Equipment Manual, 03/2007 Edition

SINAMICS S120
Booksize cold-plate power units

sinamics

SIEMENS

SIEMENS

SINAMICS

S120
SINAMICS S120 Booksize cold-plate power units

Manual

(GH4), 03.2007
6SL3097-2AJ00-0BP4

Safety Guidelines

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.

Prescribed Usage

Note the following:

⚠WARNING
This device may only be used for the applications described in the catalog or the technical description and only in connection with devices or components from other manufacturers which have been approved or recommended by Siemens. Correct, reliable operation of the product requires proper transport, storage, positioning and assembly as well as careful operation and maintenance.

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.

Siemens AG
Automation and Drives
Postfach 48 48
90437 NÜRNBERG
GERMANY

Ordernumber: 6SL3097-2AJ00-0BP4
℗ 05/2007

Foreword

SINAMICS Documentation

The SINAMICS documentation is organized in 2 parts:

- General Documentation / Catalogs
- Manufacturer/Service Documentation

An overview of publications, which is updated on a monthly and also provides information about the language versions available, can be found on the Internet at:

http://www.siemens.com/motioncontrol

Select the menu items "Support" → "Technical Documentation" → "Overview of Publications".

The Internet version of DOConCD (DOConWEB) is available under:

http://www.automation.siemens.com/doconweb

Information about training courses and FAQs (Frequently Asked Questions) can be found at the following website:

http://www.siemens.com/motioncontrol under menu option "Support"

Usage phases

Table 1 Usage phase and the available documents/tools

Usage phase	Tools
Orientation	SINAMICS S Sales Documentation
Planning/configuration	SIZER configuration tool
Decision/ordering	SINAMICS S Catalogs
Installation/assembly	• SINAMICS S120 Equipment Manual for Control Units and Supplementary System Components • SINAMICS S120 Equipment Manual Power Modules Booksize • SINAMICS S120 Equipment Manual Power Modules Chassis • SINAMICS S150 Operating Instructions
Commissioning	• STARTER parameterization and commissioning tool • SINAMICS S120 Getting Started • SINAMICS S120 Commissioning Manual • SINAMICS S120 CANopen Commissioning Manual • SINAMICS S List Manual • SINAMICS S150 Operating Instructions

Usage phase	Tools
Usage/operation	• SINAMICS S120 Commissioning Manual • SINAMICS S List Manual • SINAMICS S150 Operating Instructions
Maintenance/servicing	• SINAMICS S120 Commissioning Manual • SINAMICS S List Manual • SINAMICS S150 Operating Instructions

Target group

This Manual addresses planners, installation technicians, design engineers.

Benefits

This manual provides information on the components and functions of devices so that the target group is capable of installing, setting up, testing, operating, and troubleshooting the devices safely and correctly.

Standard scope

This documentation only describes the functionality of the standard version. Extensions or changes made by the machine tool manufacturer are documented by the machine tool manufacturer.
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.

Further, for the sake of simplicity, this documentation does not contain all detailed information about all types of the product and cannot cover every conceivable case of installation, operation or maintenance.

Technical Support

If you have any technical questions, please contact our hotline:

	Europe/Africa	Asia/Australia	America
Phone	+49 (0) 180 5050 - 222	+86 1064 719 990	+1 423 262 2522
Fax	+49 (0) 180 5050 - 223	+86 1064 747 474	+1 423 262 2289
Internet	http://www.siemens.com/automation/support-request		
E-mail	mailto:adsupport@siemens.com		

Note

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

Questions about the documentation

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

Fax	+49 9131 98 63315
E-mail	E-mail to: docu.motioncontrol@siemens.com

A fax form is available in the appendix 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
- with the responsible branch office of the A&D MC Business Division of Siemens AG.

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

- on 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. 6FC 5297-□AD30-0AP□.

ESD information

> ⚠ CAUTION
>
> Electrostatic sensitive devices (ESDs) are individual components, integrated circuits, or boards that may be damaged by either electrostatic fields or electrostatic discharge.
>
> 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 Machine Directive 98/37/EEC.
>
> Only appropriately qualified personnel may install, commission and maintain the SINAMICS S devices.
>
> 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 may cause serious injuries or death when touched.
>
> All work on the electrical system must be carried out when the system has been disconnected from the power supply.

⚠ DANGER

Correct and safe operation of SINAMICS S 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.

According to EN 61800-5-1 and UL 508, only protective extra-low voltages (DVC A) up to 30 V AC or 42.4 V DC may be connected to all connections and terminals.

⚠ DANGER

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

⚠ 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 to EN 60204-1, Section 19.4, all connections of SINAMICS units must be disconnected/unplugged to prevent them from being damaged.

Motors should be connected-up corresponding to the circuit diagram supplied with the motor (refer to the connection examples of Motor 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 and ≤ 5 W may cause the equipment to malfunction.

Explanation of symbols

The symbols are in accordance with IEC 617-2.

Table 2 Symbols

Symbol	Description
	Protective earth (PE)
	Ground (e.g. M 24 V)
	Functional ground (e.g. shield) 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. Electrical, magnetic, and electromagnetic fields that can pose a risk to people with a pacemaker and/or implants if they are too close.
5. Emission of pollutants if components or packaging are not disposed of properly.

An assessment of the residual risks of PDS components (see points 1 to 5 above) established that these risks do not exceed the specified limit values (risk priority number to EN 60812 RPZ ≤ 125).

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

Table of contents

Description 1

1.1 Cold-plate cooling

Cold-plate cooling is a cooling method for SINAMICS S120 booksize power sections. On the rear of the device is a flat aluminum cold plate, which acts as a thermal interface.

There are three methods of cooling the SINAMICS power sections:

1. Cold plate with internal liquid cooling (in preparation)

Liquid cooling via a connection adapter, whereby the liquid is conveyed through integrated channels in the cold plate.

2. Cold plate with external air heat sink

The components in the drive line-up are normally all screwed onto heat sink fins outside the cabinet.

3. Cold plate with external liquid heat sink

The components in the drive line-up are normally all screwed onto a liquid heat sink outside the cabinet.

Benefits of cold-plate cooling

1. Particularly suitable for machine configurations involving a high degree of contamination in the vicinity of the machine (e.g. in the textiles or timber industry). Reducing cabinet-internal thermal losses facilitates cooling within a sealed cabinet (IP54).
2. Particularly suitable for machine configurations in which liquid is already used for in-process cooling. This cooling method is also suitable for internal/external cold-plate cooling for the power components. The cooling liquid must have certain properties (see Chapter: "Cooling medium").

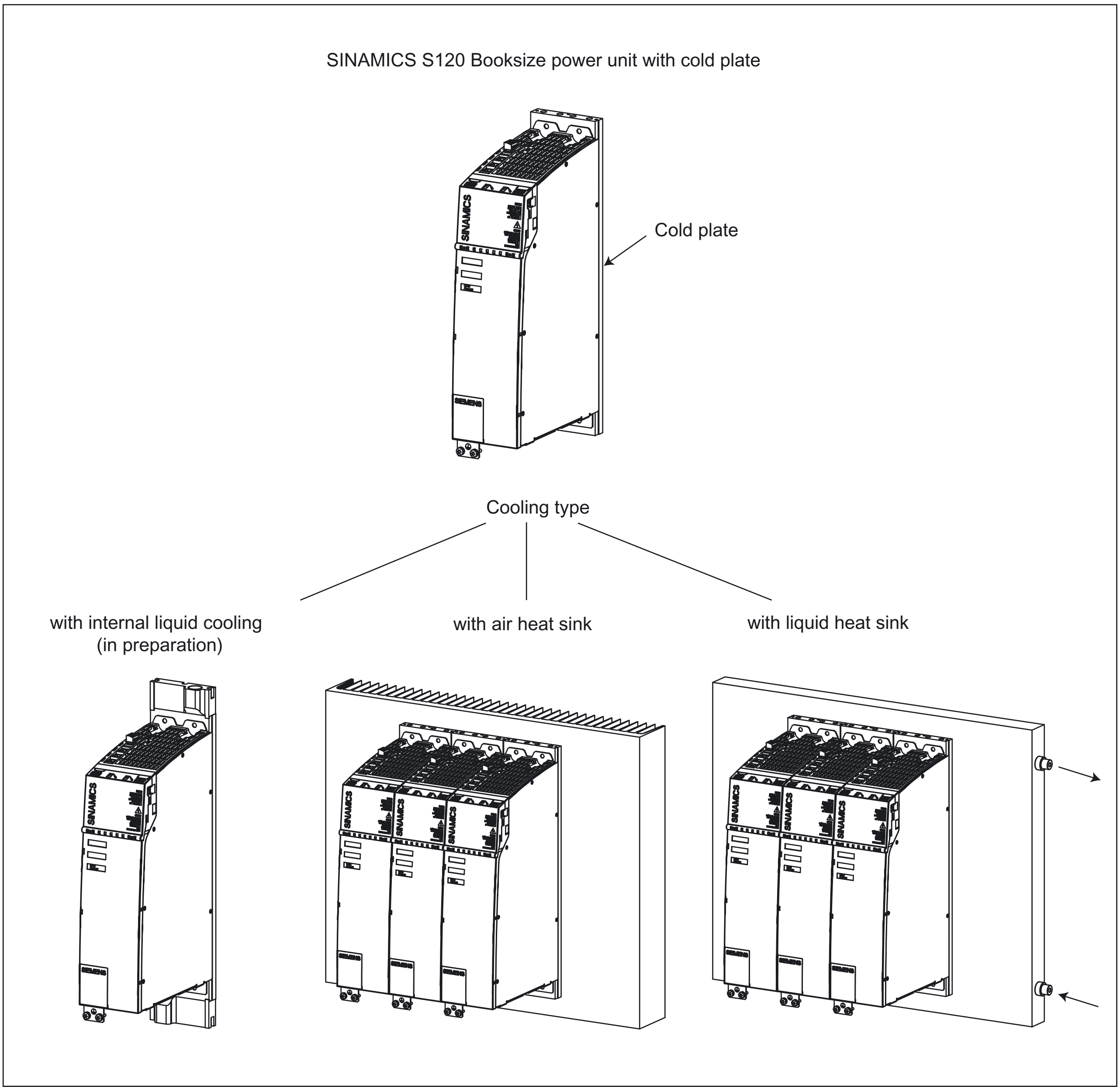


Figure 1-1 Overview: Cold-Plate

1.2 System Data

Technical data

Unless explicitly specified otherwise, the following technical data are valid for components of the SINAMICS S120 booksize drive system.

Electrical data	
Line connection voltage	3-ph. 380 V to 480 V AC ±10 % (-15 % < 1 min)
Line frequency	47 Hz to 63 Hz
Electronics power supply	24 V DC -15/+20 %*, protective extra low voltage (DVC A)
Rated short-circuit current SCCR to UL508C	42 kA
Interference suppression to EN 61800-3	Category C3 (standard) Category C2 (optional) for system designs conforming to the documentation
Overvoltage category	III acc. to EN 60664-1
Degree of contamination	2 to EN 60664-1

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

Modules	
Line Modules in booksize format • Rated supply voltage • Rated pulse frequency (for Active Line Modules in booksize format only)	 480 V 3 AC For intallation altitudes above 2000 m see the characteristic for voltage derating 8 kHz
Motor Modules in booksize format • DC link connection voltage • Rated pulse frequency	 510 V DC up to 720 V 4 kHz For higher pulse frequencies the corresponding characteristic for current derating must be taken into consideration.

Environmental conditions	
The Safety-Integrated safety function: 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 to EN 60529, open type to UL508
Protection class for network current circuits Protection class for electronic circuits	I (with protective conductor connection) and III (protective extra low voltage DVC A) acc. to EN 61 800-5-1

Environmental conditions	
Permissible coolant temperature (air) and installation altitude during operation	0 °C to +40 °C and an installation altitude of up to 1000 m without derating, >40 °C to +55 °C see the characteristic for current derating. Installation altitude >1000 m up to 4000 m see characteristic for current derating or reduction of 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 • Long-term 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 to EN 60721-3-1 Class 2M3 to EN 60721-3-2 Test values: Frequency range: 10 Hz to 58 Hz With constant deflection of 0.075 mm Frequency range: 58 Hz to 200 Hz With constant acceleration of 1 g
Shock load • Long-term storage in the transport packaging • Transport in the transport packaging • Operation	 Class 1M2 to EN 60721-3-1 Class 2M3 to EN 60721-3-2 Test values: 15 g / 11 ms
Climatic environmental conditions • Long-term storage in the transport packaging • Transport in the transport packaging • Operation	 Class 1K4 to EN 60721-3-1 Temperature -25 °C to +55 °C Class 2K4 to EN 60721-3-2 Temperature -40 °C to +70 °C Class 3K3 to EN 60721-3-3 Temperature +0 °C to +40 °C Relative / absolute humidity 5 % to 90 % / 25 g/m^3. Oil mist saline fog, icing, condensation, dripping water, spray water, splash water and jet water not permissible.

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

2 Cold plate with external air heat sinks

2.1 Overview

This chapter provides a number of examples to illustrate various cooling methods with external heat sinks that are screwed onto the cold plate.

The following cooling methods are available:

- Air cooling by means of ribbed heat sink
- Liquid cooling by means of liquid heat sink

2.2 Example: cold plate with external air heat sink

2.2.1 Setup

This chapter describes the conditions that you must take into account when setting up the cold plate and external air heat sink.

General conditions to be observed:

1. The maximum temperature within the cabinet is 40°C (inlet air temperature of the power sections). The maximum temperature in the cabinet for derating is 55°C. For the specifications, see the "Technical data".
2. The maximum permissible heat sink temperature is module dependent. See the "Technical data". A temperature sensor in the power unit measures the temperature and can be read via parameter r0037.

Note

If the components are installed in a sealed cabinet, an internal fan must be installed to prevent hot spots. It is best to install the fan above the modules to optimize the air flow (suction).

If the conditions in the plant do not allow the temperature in the cabinet to be limited to a maximum of 40°C, further measures must be taken. Please contact the hotline for more information (see the Foreword).

The power sections must be arranged in such a way that the power (loss) is distributed equally. (The permissible current carrying capacities of the DC link busbars in the different modules must be taken into account; see "Technical data".)

2.2.2 Sample setup: cold plate with external air heat sink

This chapter provides an example to illustrate the arrangement of a drive group in a cabinet in which the power units are cooled by means of a cold plate with an external air heat sink.

Example:

Four single motor modules and a control supply module are installed next to a line module with 36 kW. Each power section and its cold plate are screwed onto the external air heat sink.

Front view of cabinet

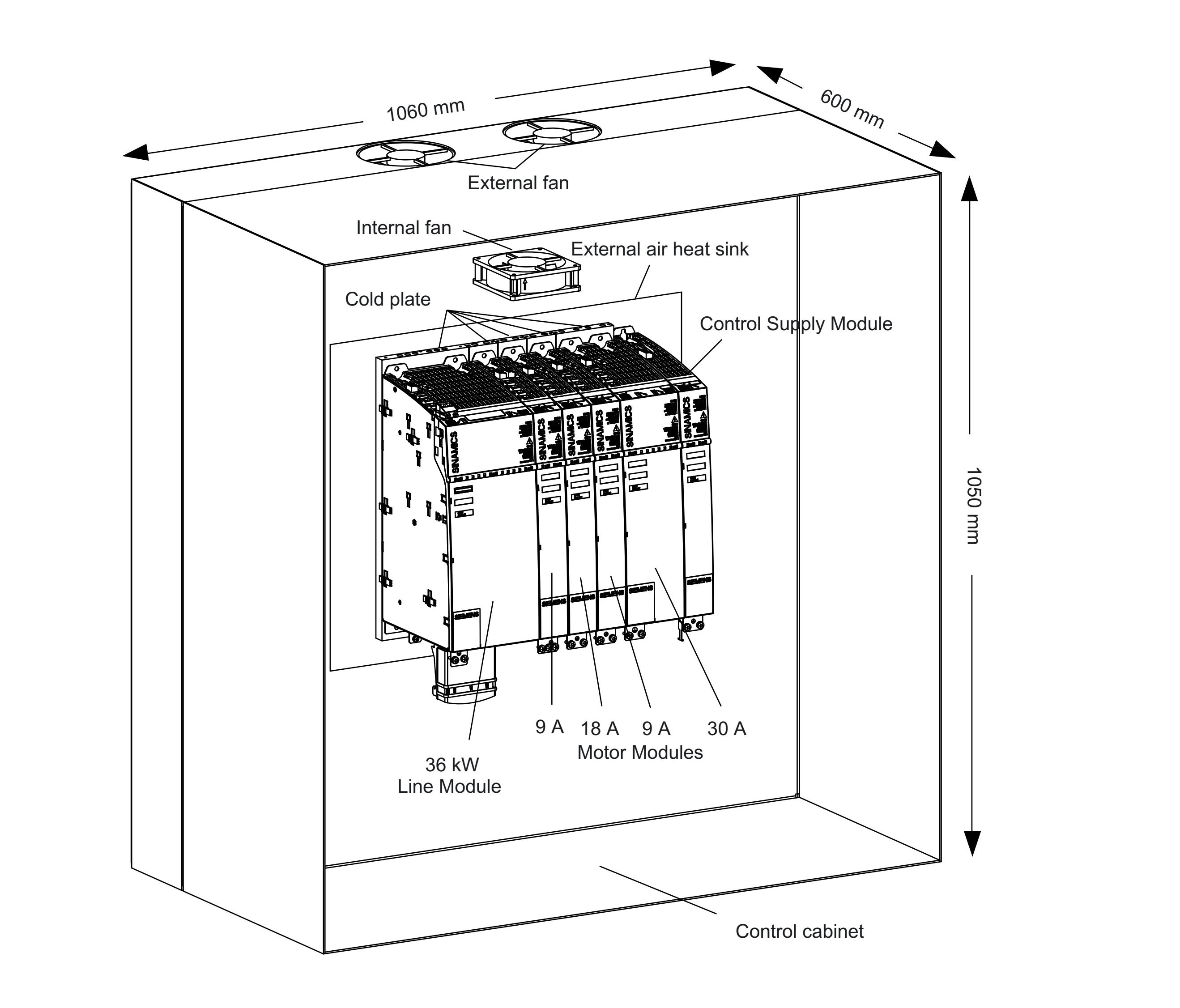


Figure 2-1 Example: cabinet setup with powers ections, cold plate, and external air heat sink

In the cabinet, a fan is installed above the power sections.

To optimize usage of the external air heat sink, it is best to arrange the components in such a way that the heat is dissipated equally over the surface of the external heat sink. This means that, if possible, a large power section should be situated next to a smaller one. The current carrying capacity of the DC link busbars must be taken into account here.

Rear view of cabinet

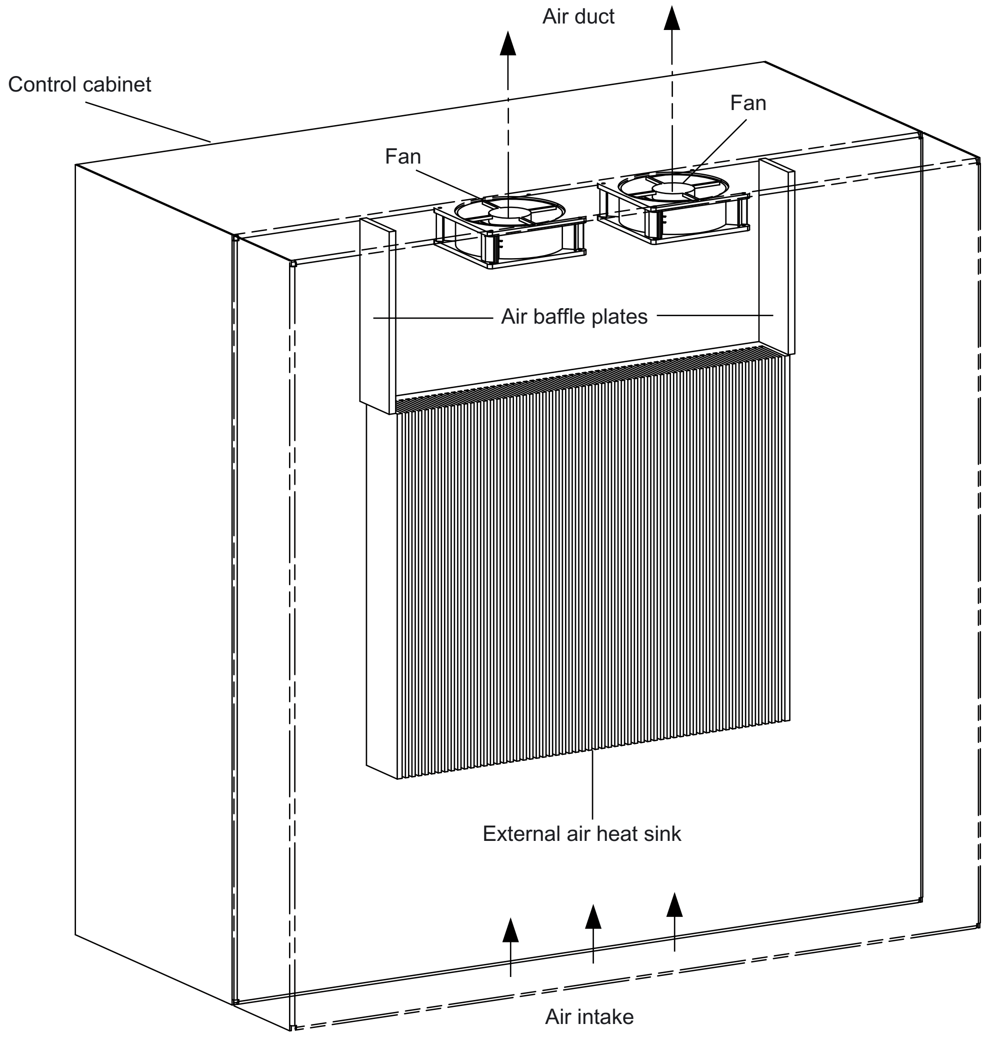


Figure 2-2 Rear view of cabinet

In this example, two axial fans with a diameter of 150 mm ensure forced convection. The ribbed heat sink, which is attached to the rear, is located in an air duct (approx. 150 mm deep). Additional air guides on the sides improve air guidance and significantly optimize the cooling process for the power sections.

Example: external air heat sink

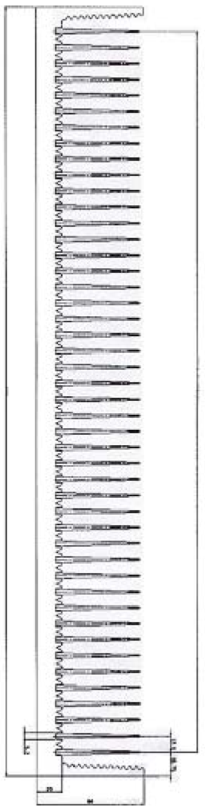


Figure 2-3 Example of an air heat sink

Aluminum air heat sinks are recommended.
The heat sinks and fans must be dimensioned for the power loss to be dissipated. For the component-specific power loss in rated operation, refer to "Technical data". (Mean power loss in periodic duty is lower.)
The heat sinks and fans are not part of the scope of supply.
Recommended suppliers for heat sinks include:

Alcan, Singen: http://www.alcan.com

Sykatec, Erlangen: http://www.sykatec.de

Note

The mounting surface for the heat sink (roughness, evenness) must fulfill the requirements described in "Installing External Heat Sinks".

2.3 Example: cold plate with external liquid heat sink

2.3.1 Design

When an external liquid heat sink is used, the power sections are all mounted on a plate through which cooling water flows to cool the power sections. The size of the liquid heat sink can be adjusted in line with the size of the drive line-up.

General conditions to be observed

1. The maximum temperature within the cabinet is 40°C
   (inlet air temperature of the power sections). The maximum temperature in the cabinet for derating is 55°C. For the specifications, see the "Technical data".
2. The maximum permissible heat sink temperature is module dependent. See the "Technical data". A temperature sensor in the power unit measures the temperature and can be read via parameter r0037.

2.3.2 Sample setup: cold plate with external liquid heat sink

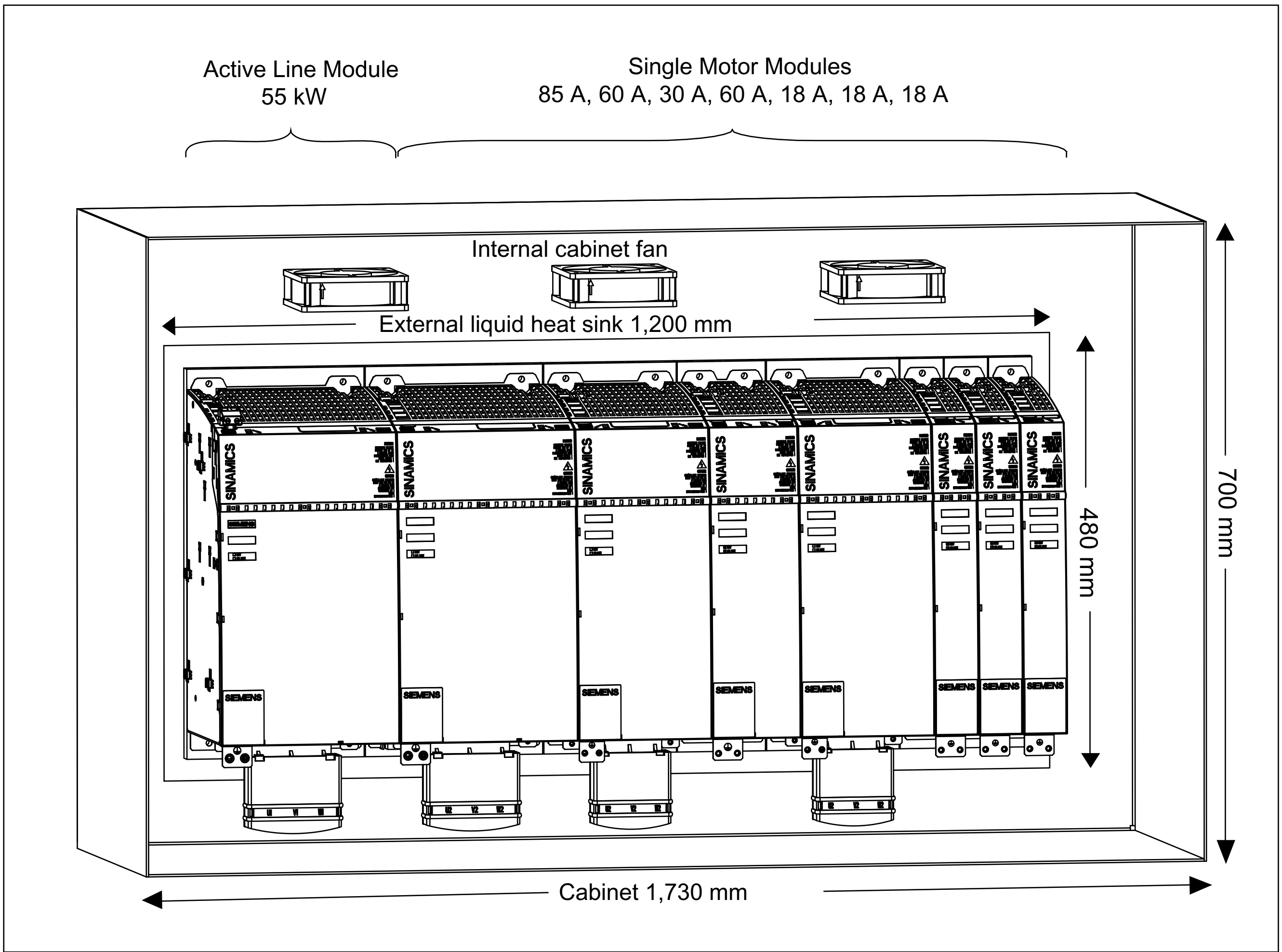


Figure 2-4 Example: cold plate drive line-up with external liquid cooling

Setup:

- Supply: Active line module 55 kW
- 7 single motor modules
- 3 internal fans at the top of the cabinet
- A joint external liquid heat sink (1200 mm x 480 mm)

The heat sinks and fans are not part of the scope of supply.
Recommended suppliers of liquid heat sinks include:
DAU Ges.m.b.H & CO.KG., Ligist: http://www.dau-at.com

Rittal: http://www.rittal.de/dcp

Cold plate with internal liquid cooling 3

3.1 Principle of internal liquid cooling

With internal cold-plate liquid cooling, connectors ("connection adapters") are required directly on the cold plate for connecting the water supply. These connection adapters are available for 300 mm wide power units (see section "Connection adapters").

The following principle applies:

Inlet below, outlet above

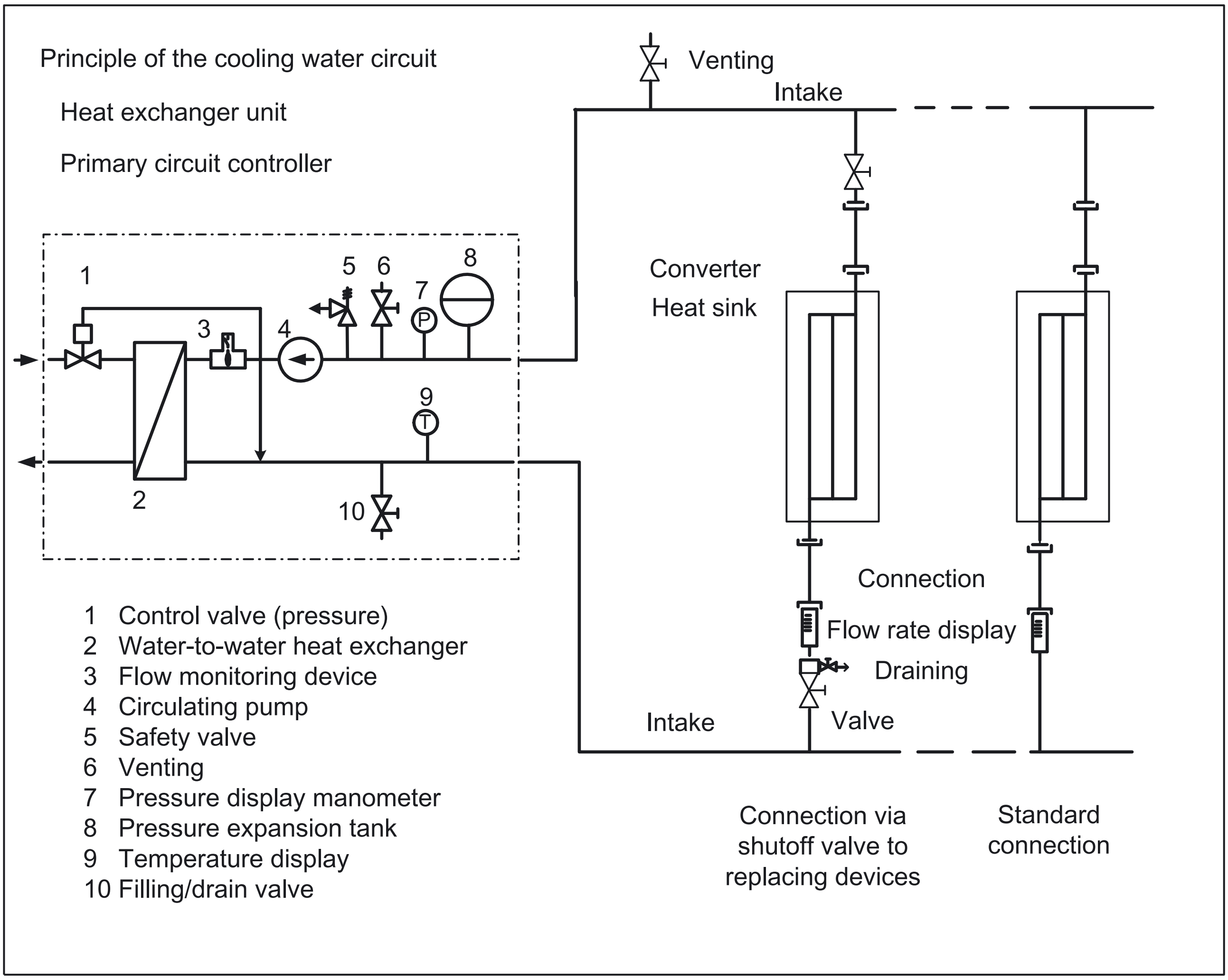


Figure 3-1 Principle of the cooling water circuit

4 Line connection

4.1 Introduction

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

- Line filter variants:
  - Basic Line Filter for Active Line Modules with line reactor
  - Basic Line Filter for Active Line Modules with Active Interface Module
  - Wideband Line Filter for Active Line Modules
  - Basic Line Filter for Basic Line Modules
  - Basic Line Filter for Smart Line Modules
- Line reactor variants:
  - Line reactors for Active Line Modules
  - Line reactors for Smart Line Modules
  - Line reactor for Basic Line Modules

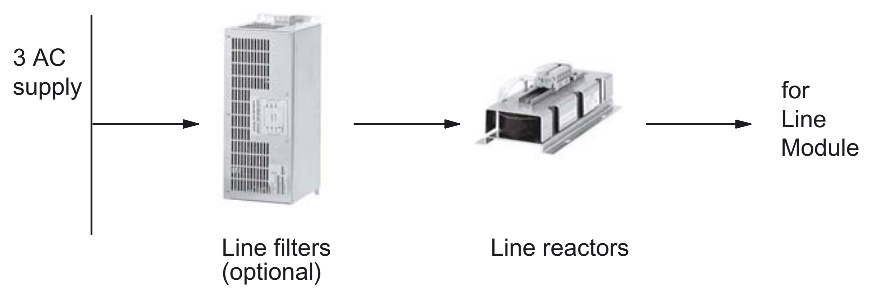


Figure 4-1 Overview: line connection

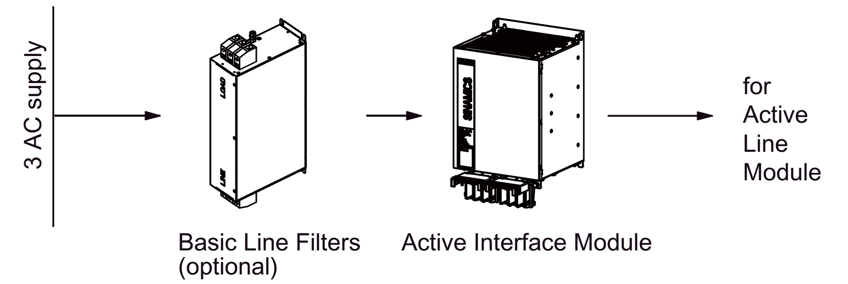


Figure 4-2 Overview: line connection with Active Interface Module

Using line filters not approved by SIEMENS for SINAMICS can lead to damage/interference to the Line Modules and line-side harmonics that can interfere with or damage other loads operated by the network.

4.2 Overview: line filter

A separate line filter (see catalog) must be used for the SINAMICS S120 drive line-up. 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 a line reactor and an EMC-compliant system configuration, line filters limit the electromagnetic emissions from the Power Modules to the limit values of category C2 to EN 61800-3.

Line filter series that are matched to the power range are also available. These line filters differ with regard to the frequency range in which they reduce the conducted emissions.

Various line filter versions are available when Line Modules are used.

Basic Line Filter for Active Line Modules with line reactor

Basic Line Filters are mainly effective in the frequency range from 150 kHz to 30 MHz; this is the range relevant to ensure compliance with the appropriate standard. They are designed for use with systems and equipment with a maximum total cable length of 150 m (shielded) of category C2 to EN 61800-3.

Basic Line Filter for Active Line Modules with Active Interface Module

Basic Line Filters are mainly effective in the frequency range from 150 kHz to 30 MHz; this is the range relevant to ensure compliance with the appropriate standard. In conjunction with an Active Interface Module, they are designed for use in systems with a maximum total cable length of 350 m (shielded) in category C2 to EN 61800-3 and 1000 m (shielded) in category C3 to EN 61800-3.

Wideband Line Filter for Active Line Modules

Wideband Line Filters are mainly effective in the frequency range from 150 kHz to 30 MHz; this is the range relevant to ensure compliance with the appropriate standard. These filters can also effectively limit low-frequency line harmonics from 2 kHz and above; this protects additional loads connected to the same line supply against disturbances and damage. The maximum total cable length is 350 m (shielded) of category C2 to EN 61800-3.

Basic Line Filter for Basic Line Modules

Basic Line Filters are mainly effective in the frequency range from 150 kHz to 30 MHz; this is the range relevant to ensure compliance with the appropriate standard. They are designed for use with systems and equipment with a maximum total cable length of 350 m (shielded) of category C2 to EN 61800-3.

Basic Line Filter for Smart Line Modules

Basic Line Filters for Smart Line Modules are specified for total cable lengths of up to 150 m (shielded) of category C2 to EN 61800-3. Basic Line Filters 16 kW and 36 kW for Smart Line Modules are specified for total cable lengths of up to 350 m (shielded) of category C2 to EN 61800-3.

Note

The acceptance of machines with EPCOS components has to be charged for.

Table 4-1 Overview

	Order No.
Basic Line Filter for Active Line Modules with line reactor	
16 kW	6SL3000-0BE21-6DAx
36 kW	6SL3000-0BE23-6DAx
55 kW	6SL3000-0BE25-5DAx
Basic Line Filter for Active Line Modules with Active Interface Modules	
55 kW	6SL3000-0BE25-5DAx
80 kW	6SL3000-0BE28-0DAx
120 kW	6SL3000-0BE31-2DAx
Wideband Line Filter for Active Line Modules	
16 kW	3SL3000-0BE21-6AAx
36 kW	3SL3000-0BE23-6AAx
55 kW	3SL3000-0BE25-5AAx
80 kW	3SL3000-0BE28-0AAx
120 kW	3SL3000-0BE31-2AAx
Basic Line Filter for Basic Line Modules	
20 kW	6SL3000-0BE21-6DAx
40 kW	6SL3000-0BE23-6DA1
100 kW	6SL3000-0BE31-2DAx
Basic Line Filter for Smart Line Modules	
5 kW	6SL3000-0HE15-0AAx
10 kW	6SL3000-0HE21-0AAx
16 kW	6SL3000-0BE21-6DAx
36 kW	6SL3000-0BE23-6DAx

4.3 Combining line reactors and line filters

Selected combinations								Achievable properties						Available for									
Active Line Module	Smart Line Module	Basic Line Module	Basic Line Filter	Wideband line filter	HF line reactor	Fe line reactor	Active Interface Module	DC link Step-up factor or rectifier value B6	Interference suppression to EN 61800-3-C2 total cable shielded	Interference suppression to EN 61800-3-C3 total cable shielded	Clock frequency filter (8kHz)	operable on IT systems	5 kW	10 kW	16 kW	20 kW	36 kW	40 kW	55 kW	80 kW	100 kW	120 kW
X					X			1,4 - 1,6	no	no	no	yes			X		X		X	X		X
X			X		X			1,4 - 1,6	150 m	150 m	no	no			X		X		X			
X				X	X			1,4 - 1,6	350 m	350 m	yes	no			X		X		X	X		X
X							X	1,4 - 2	no	350 m	yes	yes 1)							X	X		X
X			X				X	1,4 - 2	350 m	1000 m	yes	no							X	X		X
	X					X		1,35	no	no	Not relevant	yes	X	X	X		X					
	X		X			X		1,35	350 m	350 m	Not relevant	no	X	X	X		X					
		X				X		1,35	no	350 m	Not relevant	yes 1)				X		X			X	
		X	X			X		1,35	350 m	350 m	Not relevant	no				X		X			X	

1) Remove connection bracket

Figure 4-3 Combining line reactors and line filters

4.4 Basic Line Filter for Active Line Modules with line reactor

4.4.1 Description

The Basic Line Filters for Active Line Modules are designed for limiting the cable-borne interference in accordance with the specifications of the EMC legislation.
The machine manufacturer must certify the machines that he plans to launch on the market in accordance with the EU EMC Directive.

General conditions regarding Basic Line Filters and line reactors for Active Line Modules

The Basic Line Filters can be used in accordance with the following general conditions for ensuring CE conformity with regard to cable-borne interference:

- The machine/system must only be used in industrial networks.
- No. of axes ≤12.
- Total cable lengths ≤150 m (motor cables, power supply cable between line filter and Line Module).

The Basic Line Filters are only suitable for connection to TN systems; otherwise an isolating transformer will be required.

4.4.2 Safety information

⚠ WARNING

The 100 mm clearances for circulating air above and below the filter must be observed. This prevents thermal overloading of the filter.

⚠ WARNING

The input and output connections/terminals must not be interchanged:

Incoming line cable to LINE L1, L2, L3

Outgoing cable to line reactor at LOAD L1´, L2´, L3´

The line filter may be damaged if this is not observed.

⚠ CAUTION

The Line Module must only be connected to the SINAMICS line filter via the associated line reactor. Additional loads must be connected upstream of the SINAMICS line filter (if required, via a separate line filter). If this is not observed, other loads could be damaged or destroyed.

⚠ DANGER

The line filters listed conduct a high leakage current via the PE conductor. A permanent PE connection for the line filter or control cabinet is required due to the high leakage current of the line filters.

Furthermore, the following measures must be taken according to EN 61800-5-1:
Either protective ground conductor cross-sections ≥ 10 mm² Cu or installation of a second protective ground conductor of the same cross-section as the first one.

⚠ DANGER

Risk of electric shock. Dangerous voltages are still present for up to 5 minutes after the power supply has been switched off.

Note

If a high-voltage test is conducted with alternating voltage in the system, the line filters must be disconnected in order to obtain accurate measurements.

CAUTION

Only the line filters described in this Manual must be used. Other line filters can cause line harmonics that can interfere with or damage other loads powered from the line supply.

4.4.3 Interface description

4.4.3.1 Overview

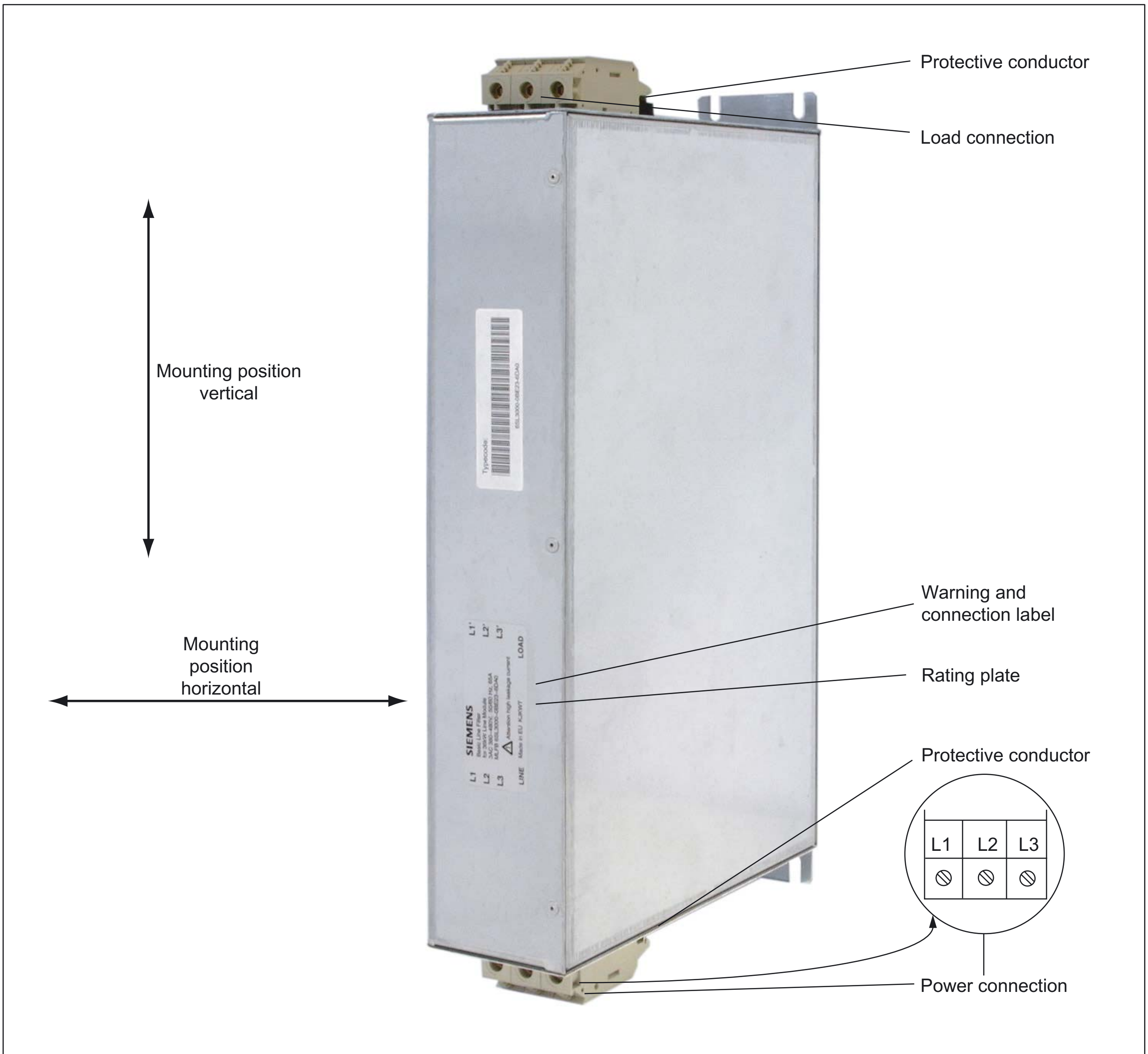


Figure 4-4 Basic Line Filter for Active Line Modules (example: 36 kW)

NOTICE
The line/load connection must not be interchanged.

4.4.3.2 Line/load connection

Table 4-2 Type of connection

Terminals	Designations
Line supply connection (line supply)	L1, L2, L3, PE
Load connection (load)	L1´, L2´, L3´, PE
Basic Line Filter for Active Line Modules	
16 kW	Screw terminal: 10 mm² 3-pin/1.5 -1.8 Nm (see Screw Terminals chapter) PE connection: M6/6 Nm[1)]
36 kW	Screw terminal: 35 mm² PE connection: M6/6 Nm[1)]
55 kW	Screw terminal: 50 mm²/6 - 8 Nm PE connection: M6/6 Nm[1)]
1) for ring cable lugs to DIN 46234	

4.4.4 Dimension Drawing

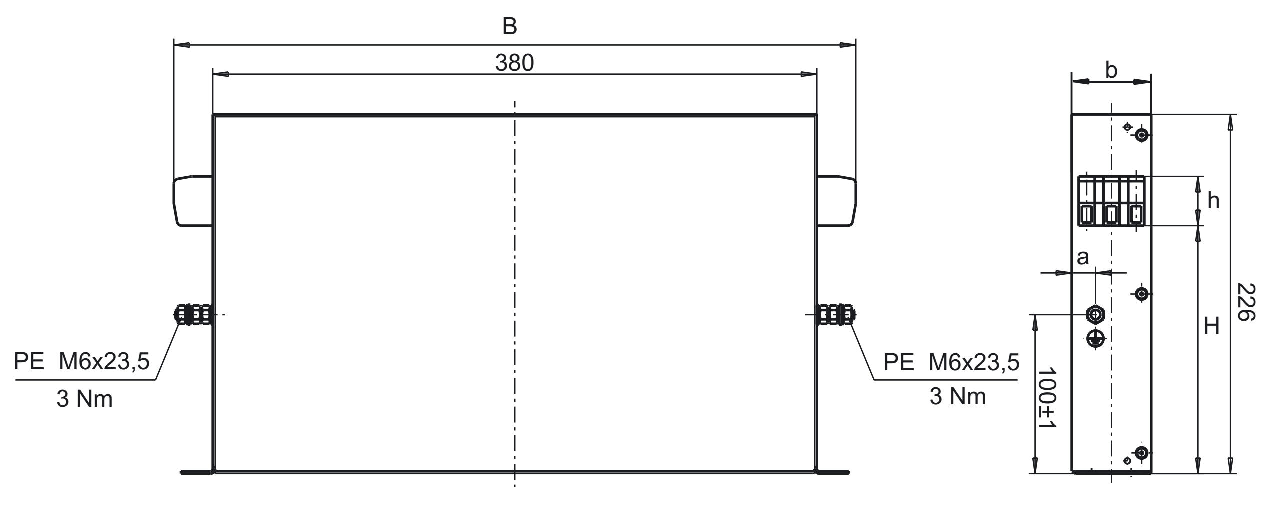


Figure 4-5 Dimension drawing: Basic Line Filter for Active Line Modules (16 kW to 55 kW)

Table 4-3 Dimensions: Basic Line Filter for Active Line Modules

Basic Line Filter	Order number	W [mm] (inches)	w [mm] (inches)	a [mm] (inches)	H [mm] (inches)	h [mm] (inches)
16 kW	6SL3000-0BE21-6DAx	429 (16.88)	50 (1.96)	15 (0.59)	156 (6.14)	31 (1.22)
36 kW	6SL3000-0BE23-6DAx	433 (17.07)	75 (2.95)	15 (0.59)	135 (5.31)	68 (2.67)
55 kW	6SL3000-0BE25-5DAx	466 (18.34)	100 (3.93)	15 (0.59)	148 (5.82)	54 (2.12)

4.4.5 Technical Specifications

Table 4-4 Technical data of Basic Line Filter for Active Line Modules with line reactor

	6SL3000 unit	0BE21-6DAx	0BE23-6DAx	0BE25-5DAx
Rated power	kW	16	36	55
Connection voltage: Supply voltage Line frequency	 V_{AC} Hz	 380 3 AC -10% (-15% < 1 min) to 480 3 AC +10% 47 to 63 Hz		
Rated current	A_{AC}	36	65	105
Power loss[1]	W	16	28	41
Weight	kg	5	6,5	11,5

[1]For an overview, see the power loss tables in Cabinet Design.

4.5 Basic Line Filter for Active Line Modules with Active Interface Module

4.5.1 Description

Basic Line Filters are mainly effective in the frequency range from 150 kHz to 30 MHz; this is the range relevant to ensure compliance with the appropriate standard.

Boundary conditions of Basic Line Filters for Active Line Modules with Active Interface Module:

The Basic Line Filters can be used in accordance with the following general conditions for ensuring CE conformity with regard to cable-borne interference:

- The machine/system must only be used in industrial networks.
- No. of axes ≤12.
- In conjunction with an Active Interface Module, they are designed for use in systems with a maximum total cable length of 350 m (shielded) in category C2 and 1000 m (shielded) in category C3.
- The Basic Line Filters are only suitable for connection to TN systems; otherwise an isolating transformer will be required.

4.5.2 Safety information

⚠ CAUTION

Line filters are only suitable for direct connection to TN systems.

⚠ WARNING

Basic Line Filters 55 kW, 80 kW and 120 kW must only be used in conjunction with an Active Interface Module.

⚠ WARNING

A ventilation clearance of 100 mm above and below the components must be observed. This prevents thermal overloading of the filter.

⚠ WARNING

The input and output connections/terminals must not be interchanged:

Incoming line cable to LINE L1, L2, L3 and

outgoing cable to line reactor at LOAD L1´, L2´, L3´

The line filter may be damaged if this is not observed.

NOTICE

The associated Line Module must only be connected to the SINAMICS line filter via the associated line reactor. Additional loads must be connected upstream of the SINAMICS line filter (if required, via a separate line filter). If this is not observed, other loads could be damaged or destroyed.

⚠ DANGER

The line filters listed conduct a high leakage current via the protective ground conductor. A permanent PE connection for the line filter or control cabinet is required due to the high leakage current of the line filters.

Furthermore, the following measures must be taken according to EN 61800-5-1:
Either protective ground conductor cross-sections ≥ 10 mm^2 Cu or installation of a second protective ground conductor of the same cross-section as the first one.

⚠ DANGER

Risk of electric shock. Dangerous voltages are still present for up to 5 minutes after the power supply has been switched off.

Note

If a high-voltage test is conducted with alternating voltage in the system, the existing line filters must be disconnected in order to obtain accurate measurements.

CAUTION

Only the line filters described in this Manual must be used. Other line filters can cause line harmonics that can interfere with or damage other loads powered from the line supply.

4.5.3 Interface description

4.5.3.1 Overview

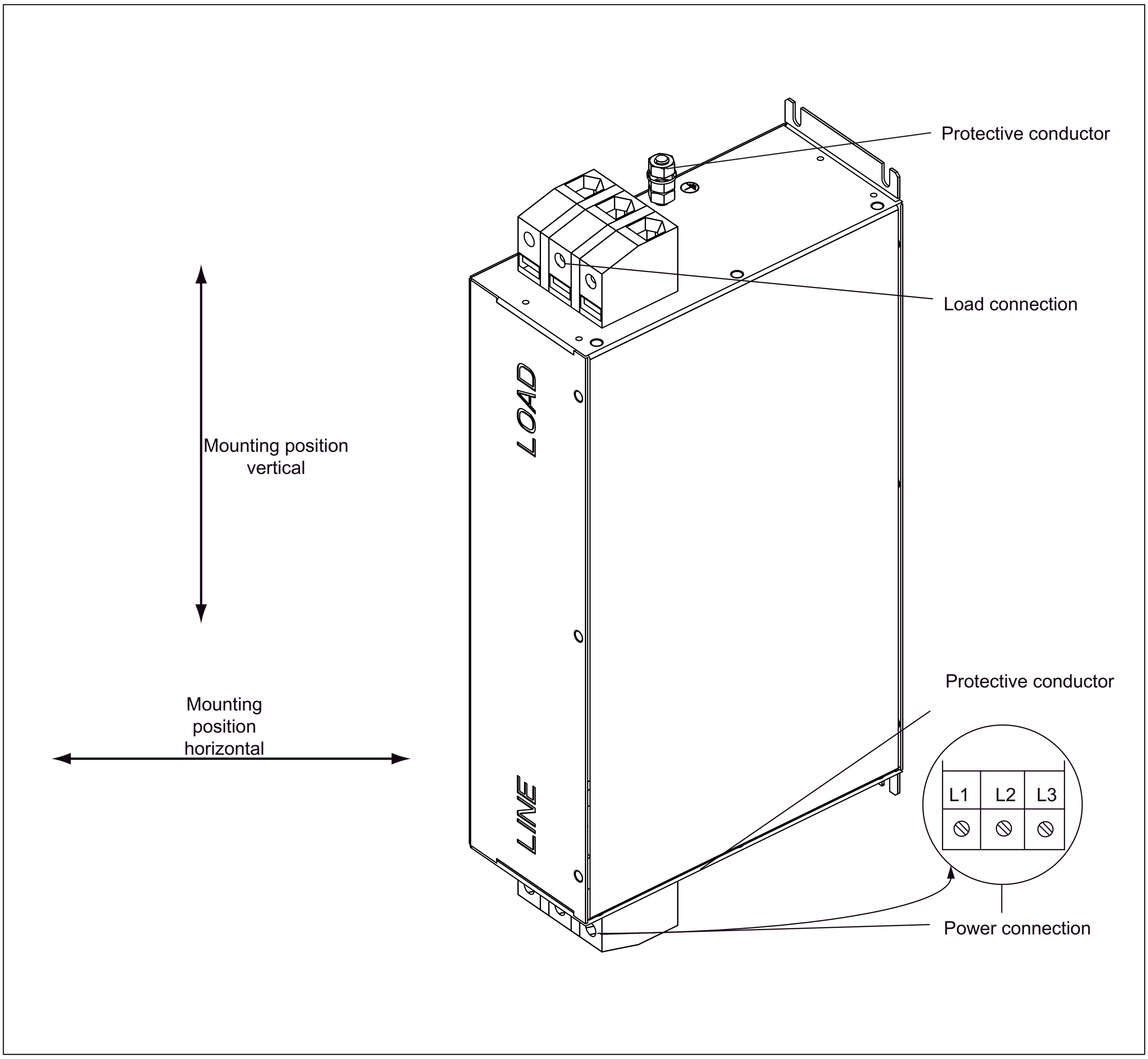


Figure 4-6 Interface description: Basic Line Filter 55 kW

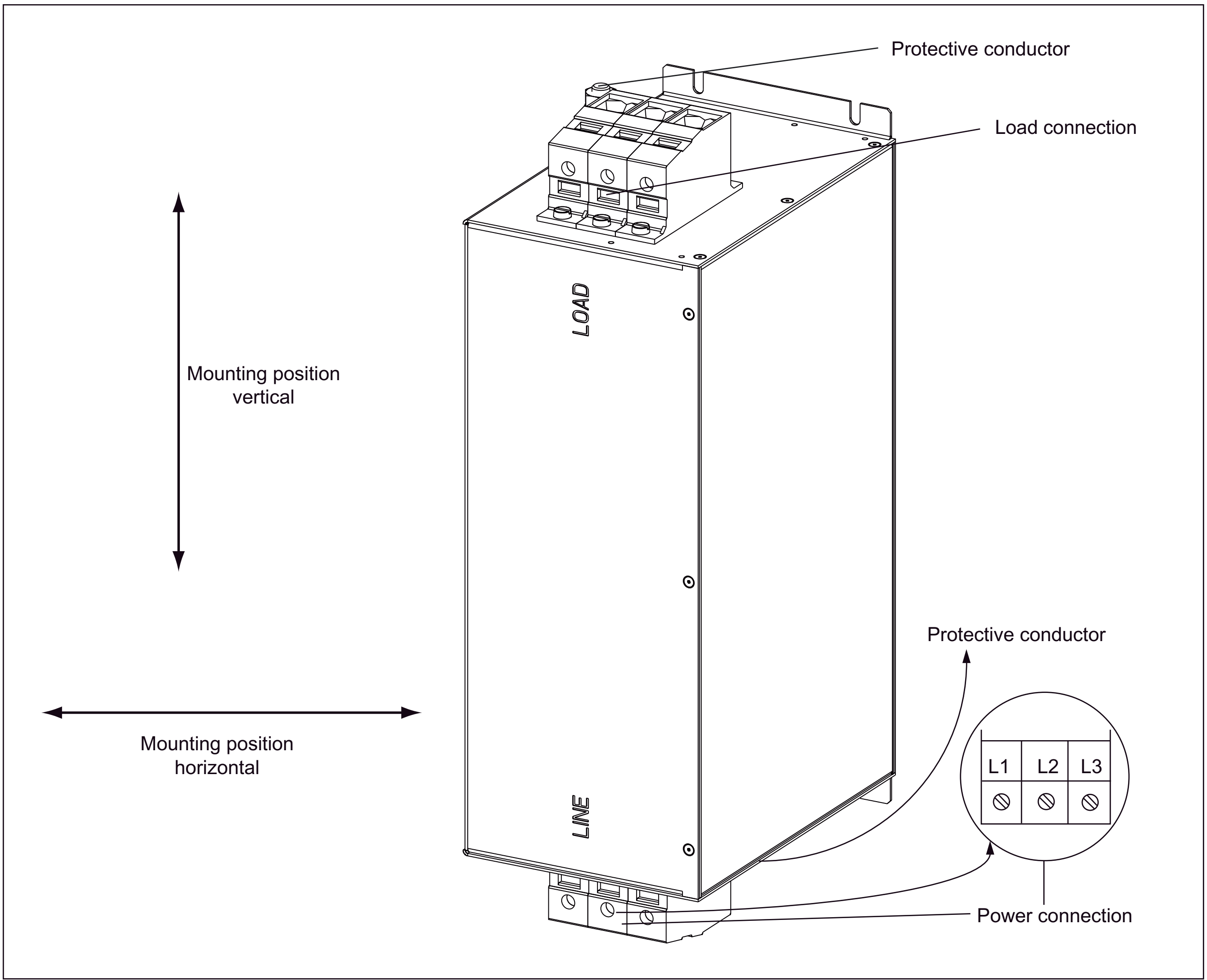


Figure 4-7 Interface description: 80 kW and 120 kW Basic Line Filter

NOTICE
The line/load connection must not be interchanged.

4.5.3.2 Line/load connection

Table 4-5 Connection type

Terminals	Designations
Line supply connection (line supply)	L1, L2, L3, PE
Load connection (load)	L1´, L2´, L3´, PE
Basic Line Filter for Active Line Module with Active Interface Module	
55 kW	Screw terminal: 95 mm² PE connection: M6/6 Nm 1)
80 kW	Screw terminal: 95 mm² PE connection: M10 / 10 Nm 1)
120 kW	
1) for ring cable lugs to DIN 46234	

4.5.4 Dimension drawing

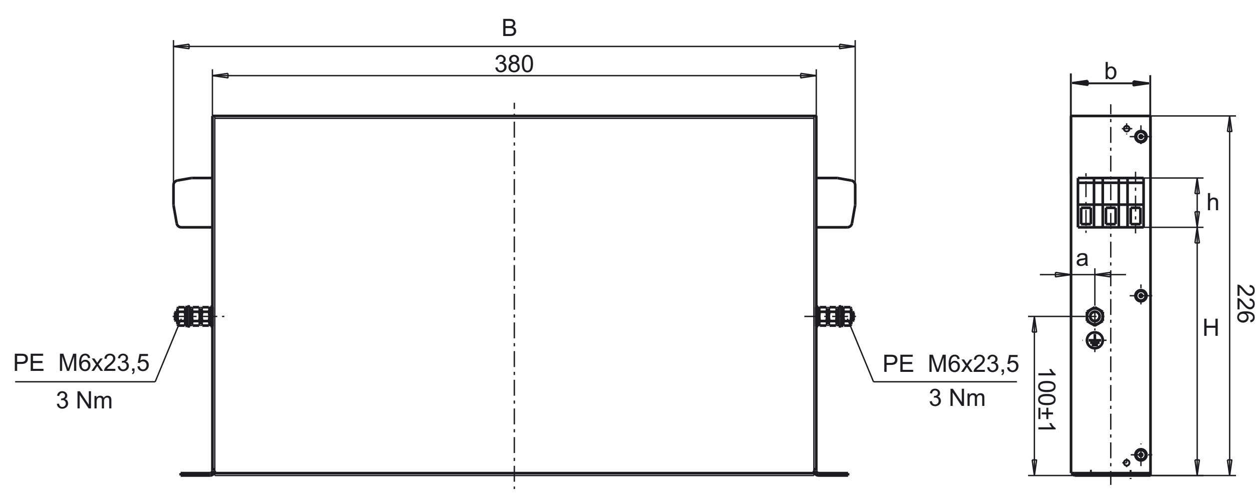


Figure 4-8 Dimension drawing: Basic Line Filter 55 kW

Table 4-6 Dimensions: Basic Line Filter for Active Line Modules

Basic Line Filter	Order No.	W [mm] (inches)	w [mm] (inches)	a [mm] (inches)	H [mm] (inches)	h [mm] (inches)
55 kW	6SL3000-0BE25-5DAx	466 (18.34)	100 (3.93)	15 (0.59)	148 (5.82)	54 (2.12)

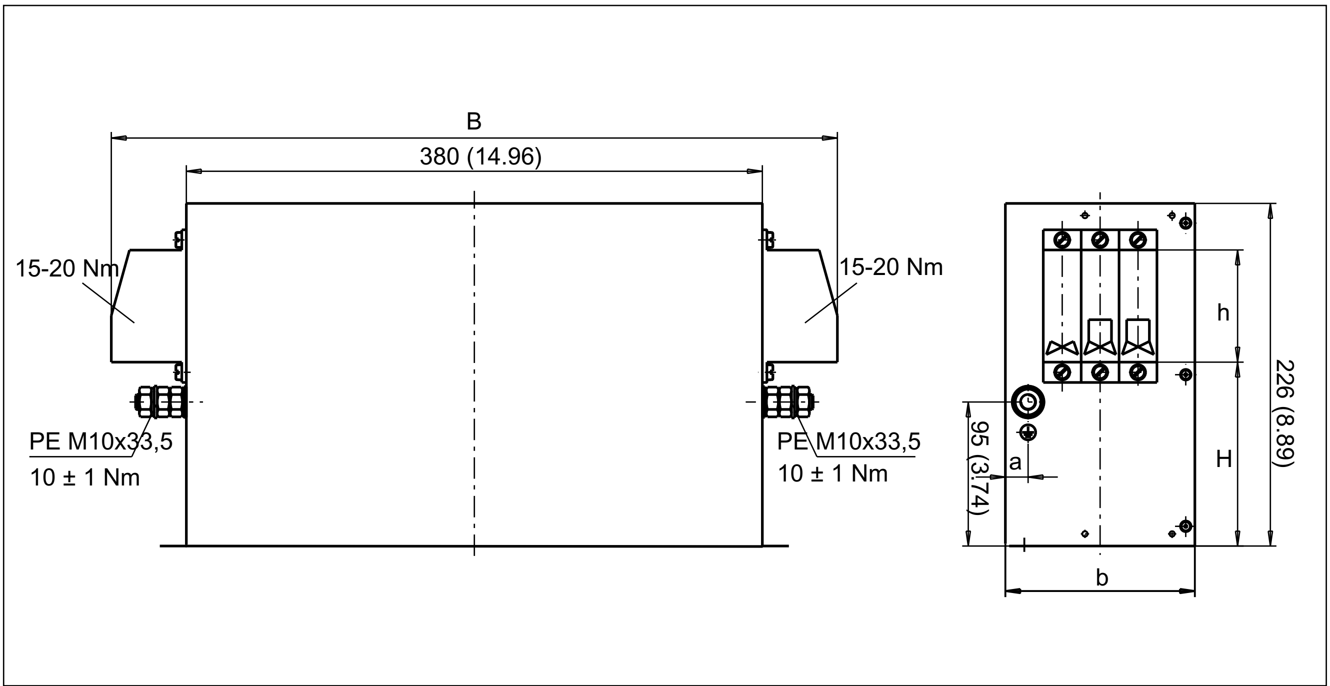


Figure 4-9 Dimension drawing: 80 kW and 120 kW Basic Line Filter

Table 4-7 Dimensions: Basic Line Filter for Active Line Modules

Basic Line Filter	Order number	W [mm] (inches)	w [mm] (inches)	a [mm] (inches)	H [mm] (inches)	h [mm] (inches)
80 kW	6SL3000-0BE28-0DAx	479 (18.85)	150 (5.90)	15 (0.59)	121,3 (4.77)	74 (2.91)
120 kW	6SL3000-0BE31-2DAx					

4.5.5 Technical specifications

Table 4-8 Technical data of the Basic Line Filter for Active Line Modules with Active Interface Module

	6SL3000- Unit	0BE25-5DA0	0BE28-0DAx	0BE31-2DAx
Rated power	kW	55	80	120
Connection voltage: Supply voltage Line frequency	 V_{AC} Hz	 380 3 AC -10% (-15% < 1 min) to 480 3 AC +10% 47 to 63 Hz		
Rated current	A_{AC}	105	132	192
Power loss [1)]	W	41	48	86
Weight	kg	11,5	18,2	18,8

[1]For an overview, see the power loss tables in Cabinet Design.

4.6 Wideband Line Filter for Active Line Modules

4.6.1 Description

The damping characteristics of Wideband Line Filters for Active Line Modules not only conform with the requirements of EMC standards for the frequency range of 150 kHz to 30 MHz but also include low frequencies as of 2 kHz. As a result, these line filters have an extended function area, which means that they can, to a certain extent, be used regardless of the machine installation location and any unknown line properties (e.g. line impedance).

Wideband Line Filters must always be used in conjunction with line reactors for Active Line Modules.

The maximum total cable length (motor cables, mains supply conductor line filter to Line Module) is 350 m (shielded) of category C2 to EN 61800-3.

4.6.2 Safety information

⚠ CAUTION
Line filters are only suitable for direct connection to TN line supplies.

⚠ WARNING
A ventilation clearance of 100 mm above and below the components must be observed. The mounting position must ensure that cool air flows vertically through the filter. This prevents thermal overloading of the filter.

⚠ WARNING
The input and output connections/terminals must not be interchanged: Incoming line cable to LINE L1, L2, L3 and outgoing cable to the line reactor to LOAD/LAST U, V, W The line filter may be damaged if this is not observed.

NOTICE
The associated Line Module must only be connected to the SINAMICS line filter via the associated line reactor. Additional loads must be connected upstream of the SINAMICS line filter (if required, via a separate line filter). If this is not observed, other loads could be damaged or destroyed.

⚠ DANGER

The line filters listed conduct a high leakage current via the protective ground conductor. A permanent PE connection for the line filter or control cabinet is required due to the high leakage current of the line filters.

Furthermore, the following measures must be taken according to EN 61800-5-1:
Either protective ground conductor cross-sections ≥ 10 mm^2 Cu or installation of a second protective ground conductor of the same cross-section as the first one.

⚠ DANGER

Risk of electric shock. Dangerous voltages are still present for up to 5 minutes after the power supply has been switched off.

Note

If a high-voltage test is conducted with alternating voltage in the system, the existing line filters must be disconnected in order to obtain accurate measurements.

CAUTION

Only the line filters described in this Manual must be used. Other line filters can lead to line harmonics that can interfere with or damage other loads powered from the line supply.

NOTICE

The air intake for the external heatsinks may not be drawn from heavily polluted machining/processing areas. The reason for this is that substances, for example, cooling and lubricating medium, can destroy the fan.

4.6.3 Interface description

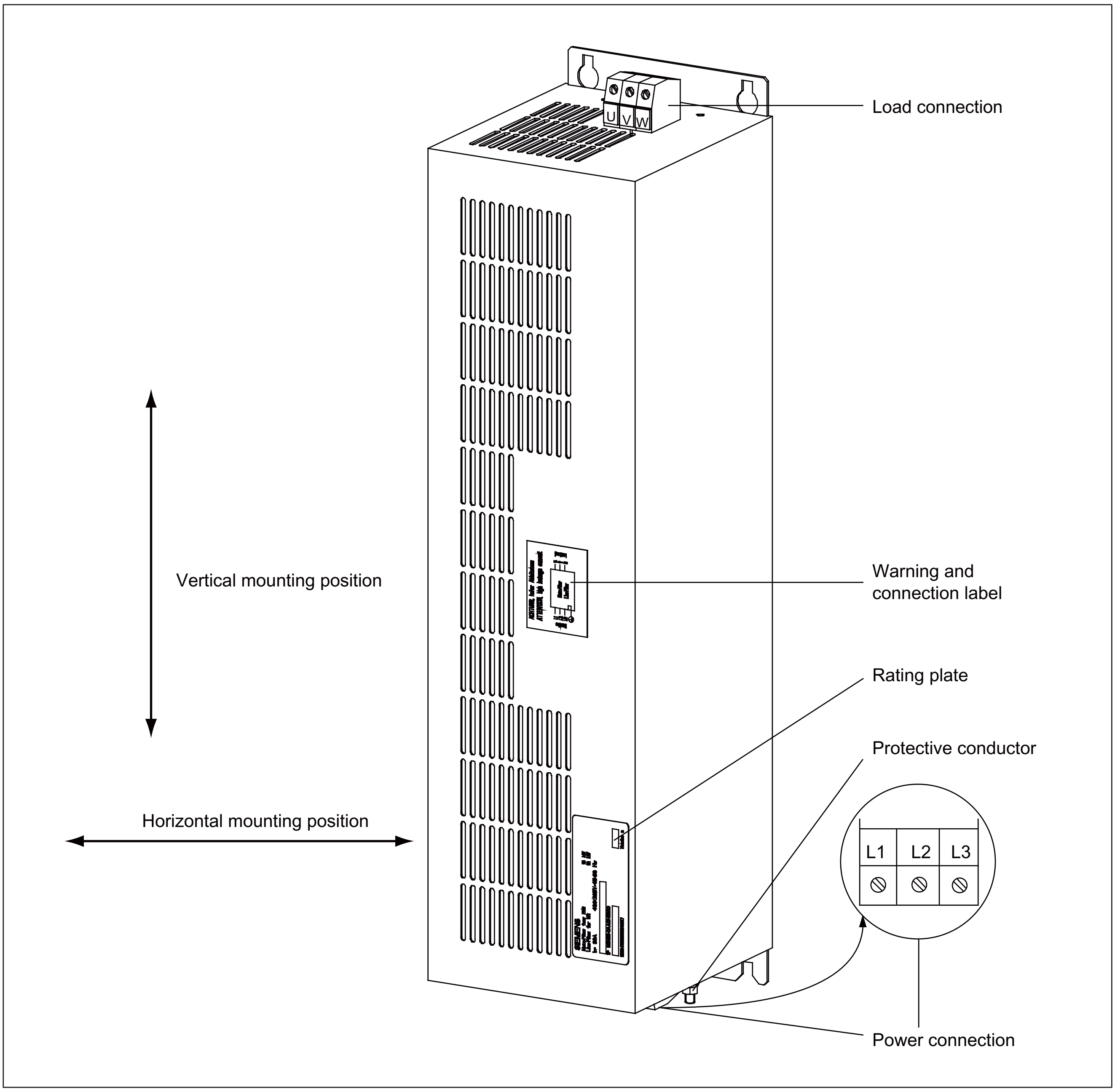


Figure 4-10 Wideband Line Filter for Active Line Module (example: 16 kW)

NOTICE
The line/load connection must not be interchanged.

4.6.3.1 Line/load connection

Table 4-9 Type of connection

Terminals	Designations
Line supply connection (line supply)	L1, L2, L3, PE
Load connection (load)	U, V, W
Wideband Line Filter for Active Line Modules	
16 kW	Screw terminal: 10 mm² 3-pin/1.5 -1.8 Nm (see Screw Terminals chapter) Grounding stud: M5/3 Nm 1)
36 and 55 kW	Screw terminal: 50 mm² 3-pin/6 - 8 Nm (see Screw Terminals chapter) Grounding stud: M8/13 Nm 1)
80 kW	Screw terminal: 95 mm² 3–pin/15 - 20 Nm (see Screw Terminals chapter) Grounding stud: M8/13 Nm 1)
120 kW	Connection strap: d = 11 mm (M10/25 Nm) Grounding stud: M8/13 Nm 1) **Note: No shock-hazard protection (IP00B acc. to 60529)**
1) for ring cable lugs to DIN 46234	

4.6.4 Dimension drawings

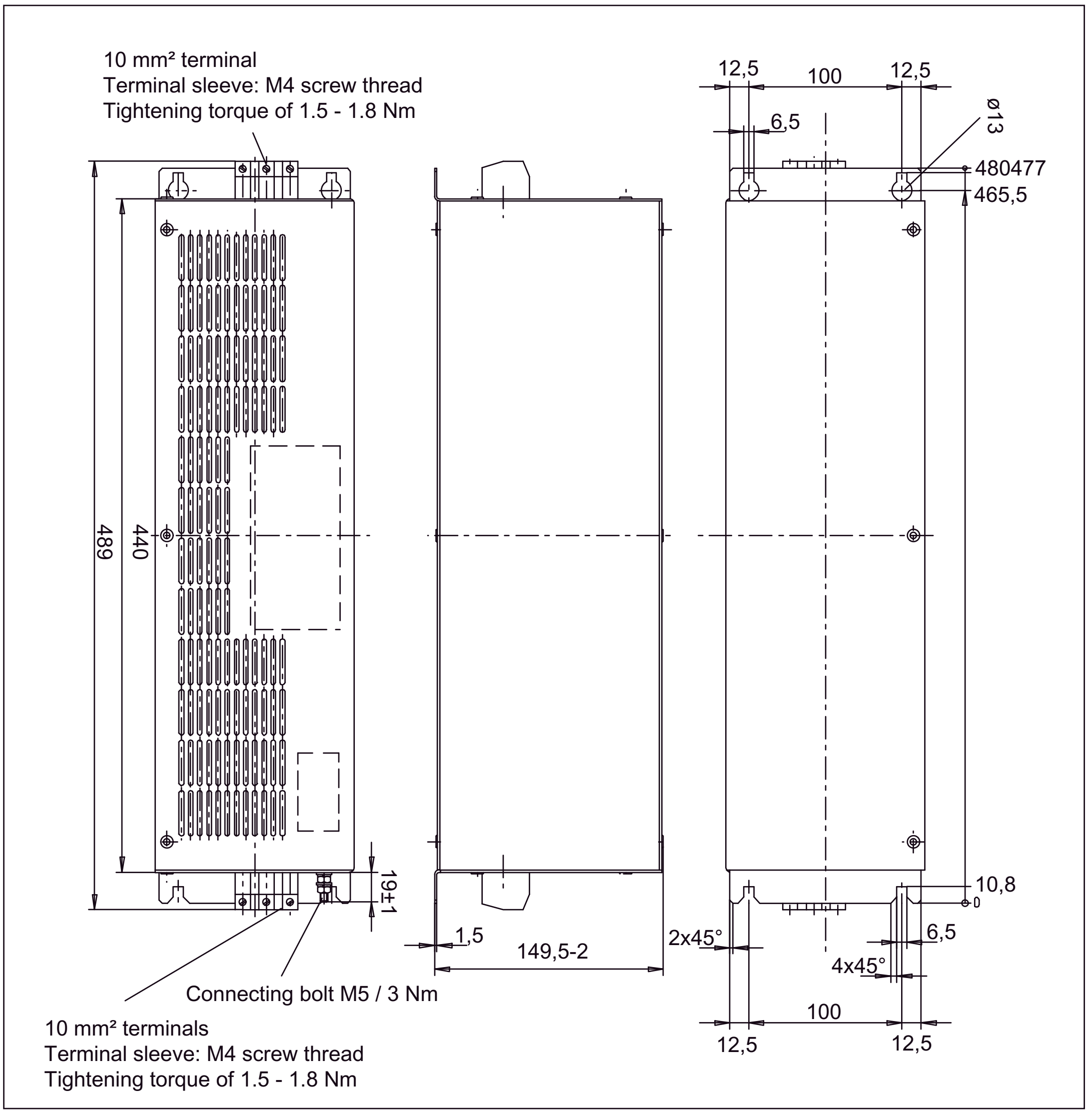


Figure 4-11 Dimension drawing: 16 kW Wideband Line Filter for Active Line Modules

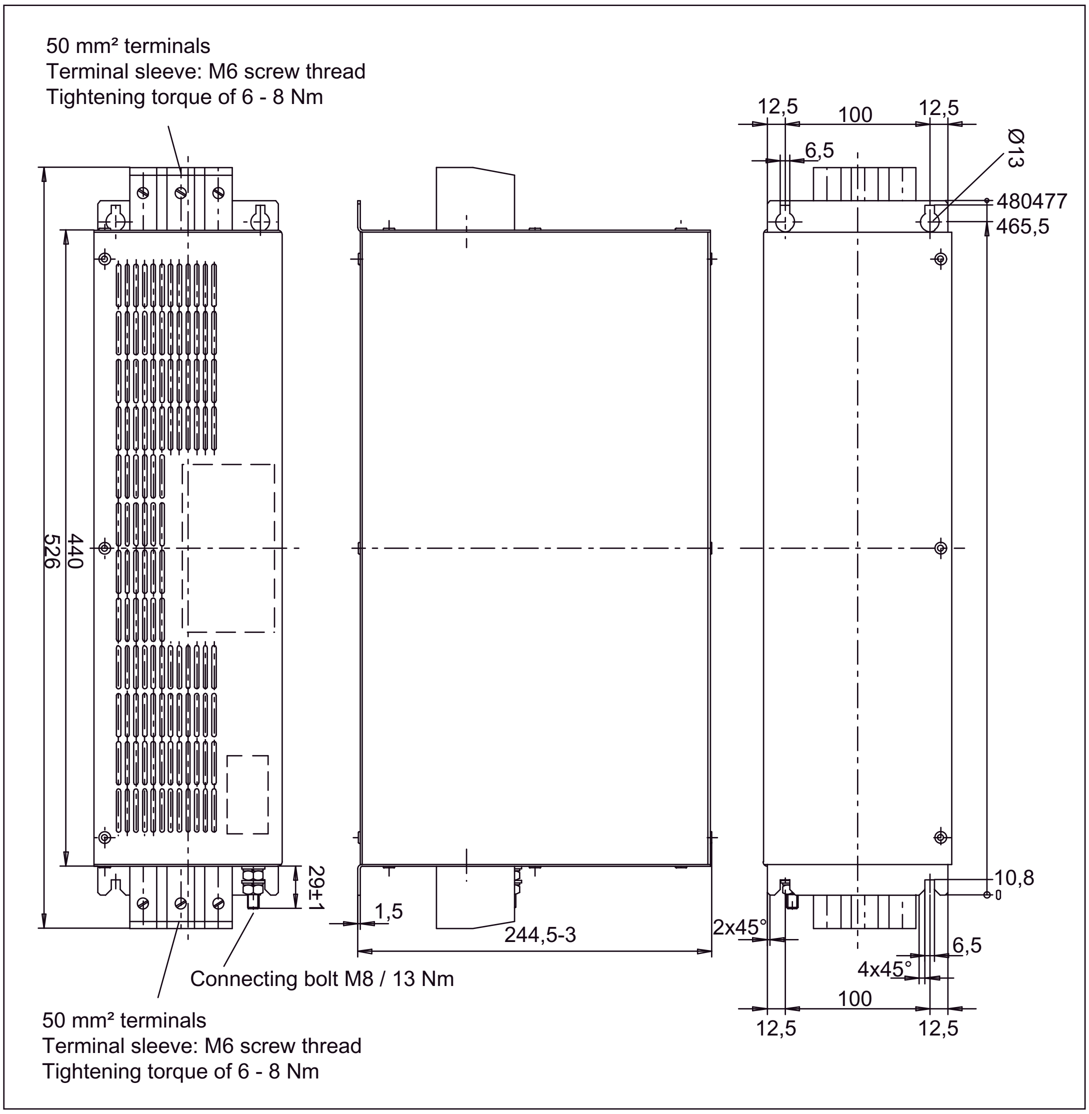


Figure 4-12 Dimension drawing: 36 kW Wideband Line Filter for Active Line Modules

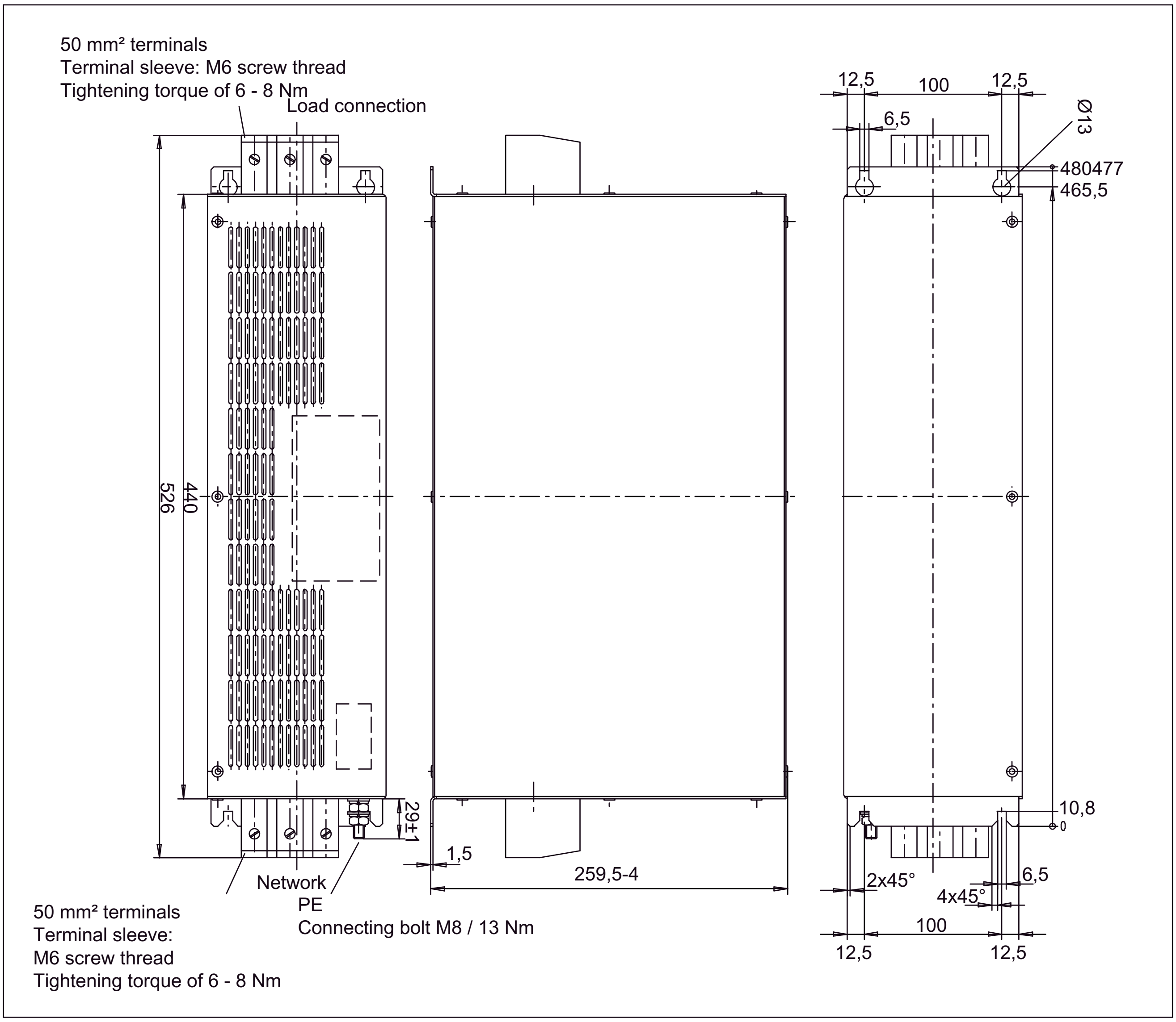


Figure 4-13 Dimension drawing: 55 kW Wideband Line Filter for Active Line Modules

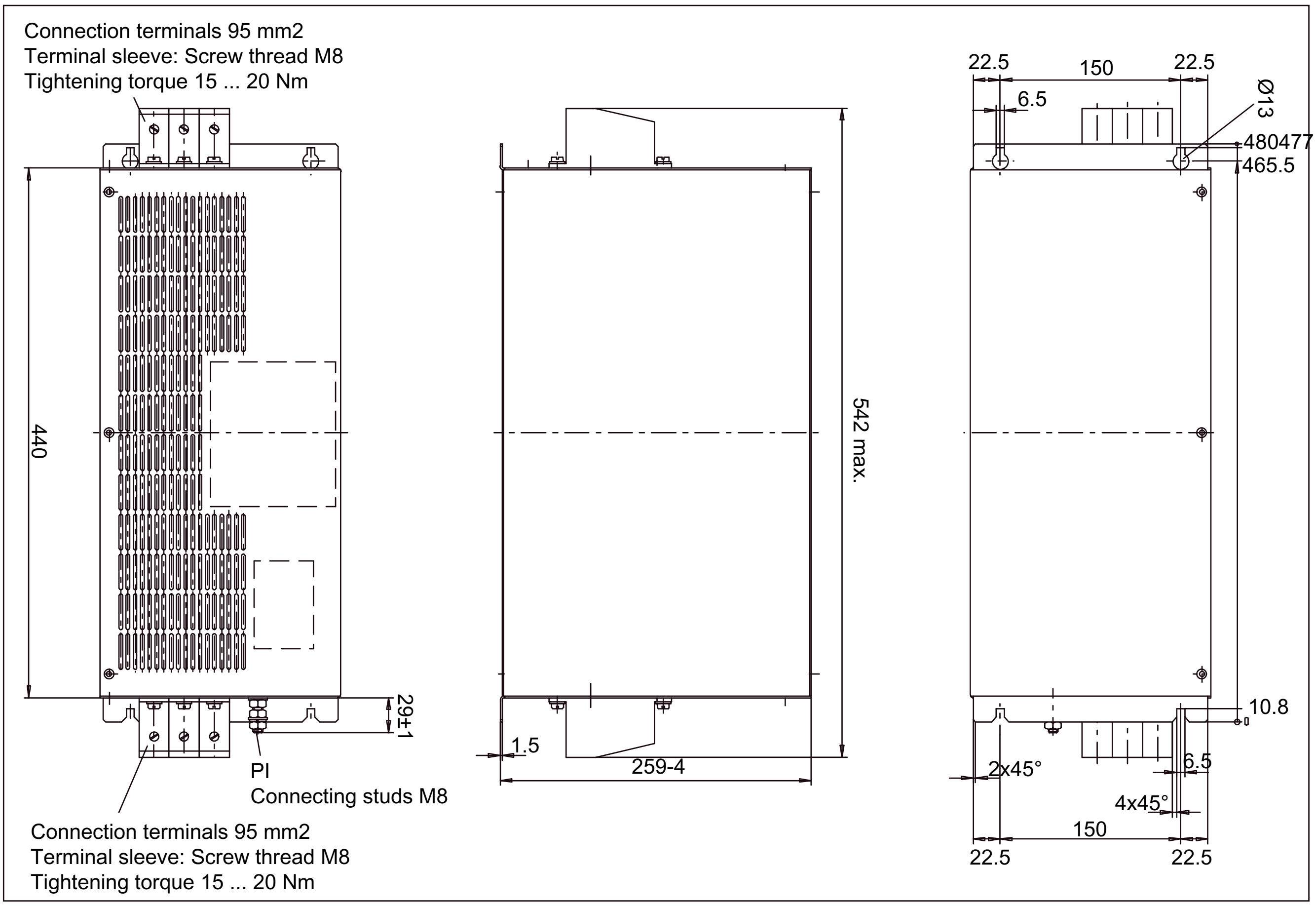


Figure 4-14 Dimension drawing: 80 kW Wideband Line Filter for Active Line Modules

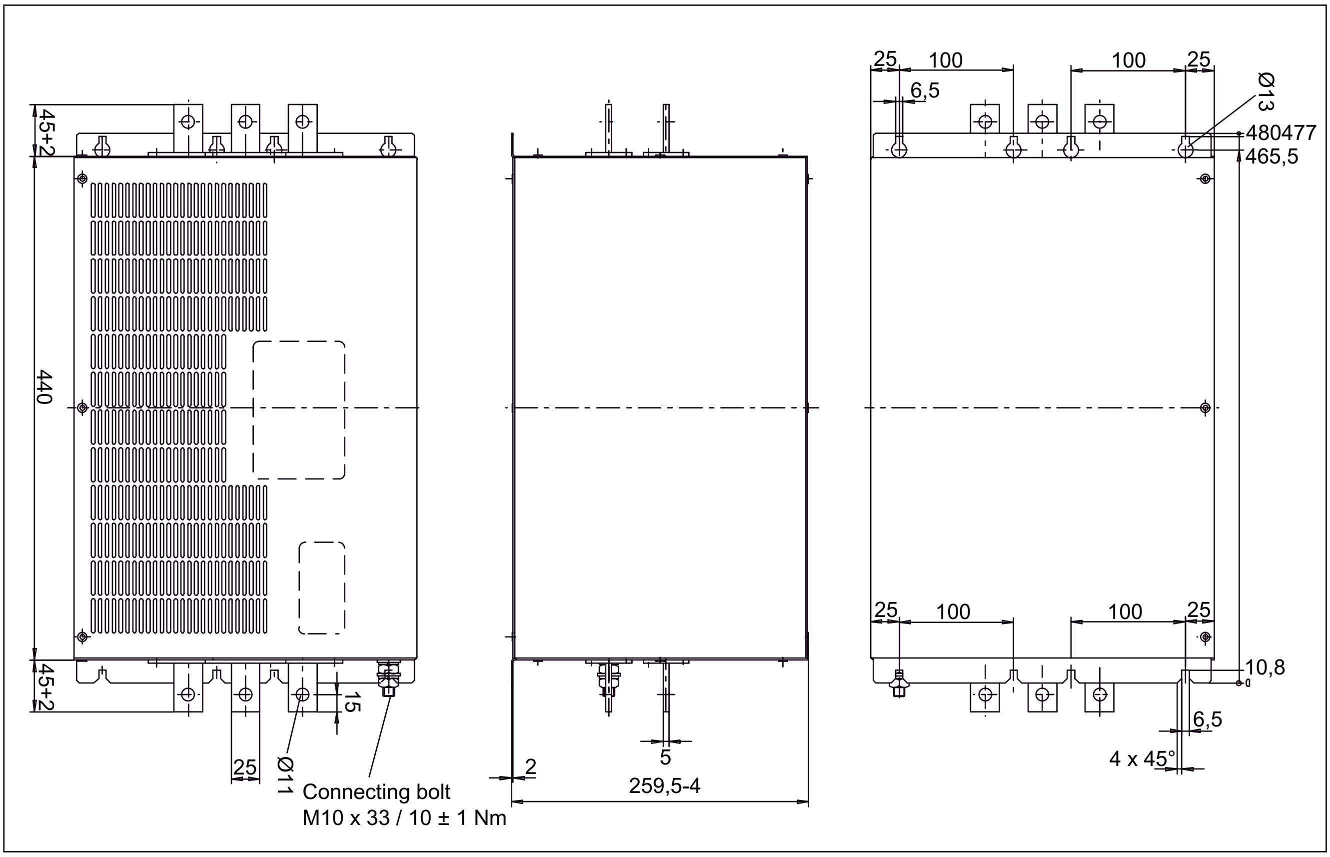


Figure 4-15 Dimension drawing: 120 kW Wideband Line Filter for Active Line Modules

Table 4-10 Wideband Line Filter

For Active Line Modules	Order no.
16 kW	6SL3000-0BE-21-6AAx
36 kW	6SL3000-0BE-23-6AAx
55 kW	6SL3000-0BE-25-5AAx
80 kW	6SL3000-0BE-28-0AAx
120 kW	6SL3000-0BE-31-2AAx

4.6.5 Technical Specifications

Table 4-11 Technical data: Wideband Line Filter for Active Line Modules

	6SL3000 unit	0BE21-6AAx	0BE23-6AAx	0BE25-5AAx	0BE28-0AAx	0BE31-2AAx
Rated power	kW	16	36	55	80	120
Connection voltages: Supply voltage Line frequency	 V_{AC} Hz	 3-ph. 380 V AC -10 % (-15 % < 1 min) up to 3-ph. 480 V AC +10 % 47 to 63 Hz				
Rated current	A_{AC}	30	67	103	150	225
Power loss[1]	W	70	90	110	150	200
Weight	kg	8,5	14,5	15,5	26	34,5

[1] For an overview, see the power loss tables in chapter Cabinet Design

4.7 Basic Line Filter for Basic Line Modules

4.7.1 Description

The Basic Line Filters for Basic Line Modules are designed for limiting the cable-borne interference in the frequency range in accordance with the specifications of the EMC legislation.
The machine manufacturer must certify the machines that he plans to launch on the market in accordance with the EU EMC Directive.

Basic Line Filters are mainly effective in the frequency range from 150 kHz to 30 MHz; this is the range relevant to ensure compliance with the appropriate standard. They are designed for use with systems and equipment with a maximum total cable length of 350 m (shielded) of category C2 to EN 61800-3.

4.7.2 Safety information

⚠ CAUTION
Line filters are only suitable for direct connection to TN line supplies.

⚠ WARNING
A ventilation clearance of 100 mm above and below the components must be observed. This prevents thermal overloading of the filter.

⚠ WARNING
The input and output connections/terminals must not be interchanged: Incoming line cable to LINE L1, L2, L3 and outgoing cable to line reactor at LOAD L1´, L2´, L3´ The line filter may be damaged if this is not observed.

NOTICE
The associated Line Module must only be connected to the SINAMICS line filter via the associated line reactor. Additional loads must be connected upstream of the SINAMICS line filter (if required, via a separate line filter). If this is not observed, other loads could be damaged or destroyed.

DANGER

The line filters listed conduct a high leakage current via the protective ground conductor. A permanent PE connection for the line filter or control cabinet is required due to the high leakage current of the line filters.

Furthermore, the following measures must be taken according to EN 61800-5-1:
Either protective ground conductor cross-sections ≥ 10 mm^2 Cu or installation of a second protective ground conductor of the same cross-section as the first one.

DANGER

Risk of electric shock. Dangerous voltages are still present for up to 5 minutes after the power supply has been switched off.

Note

If a high-voltage test is conducted with alternating voltage in the system, the existing line filters must be disconnected in order to obtain accurate measurements.

CAUTION

Only the line filters described in this Manual must be used. Other line filters can cause line harmonics that can interfere with or damage other loads powered from the line supply.

4.7.3 Interface description

4.7.3.1 Overview

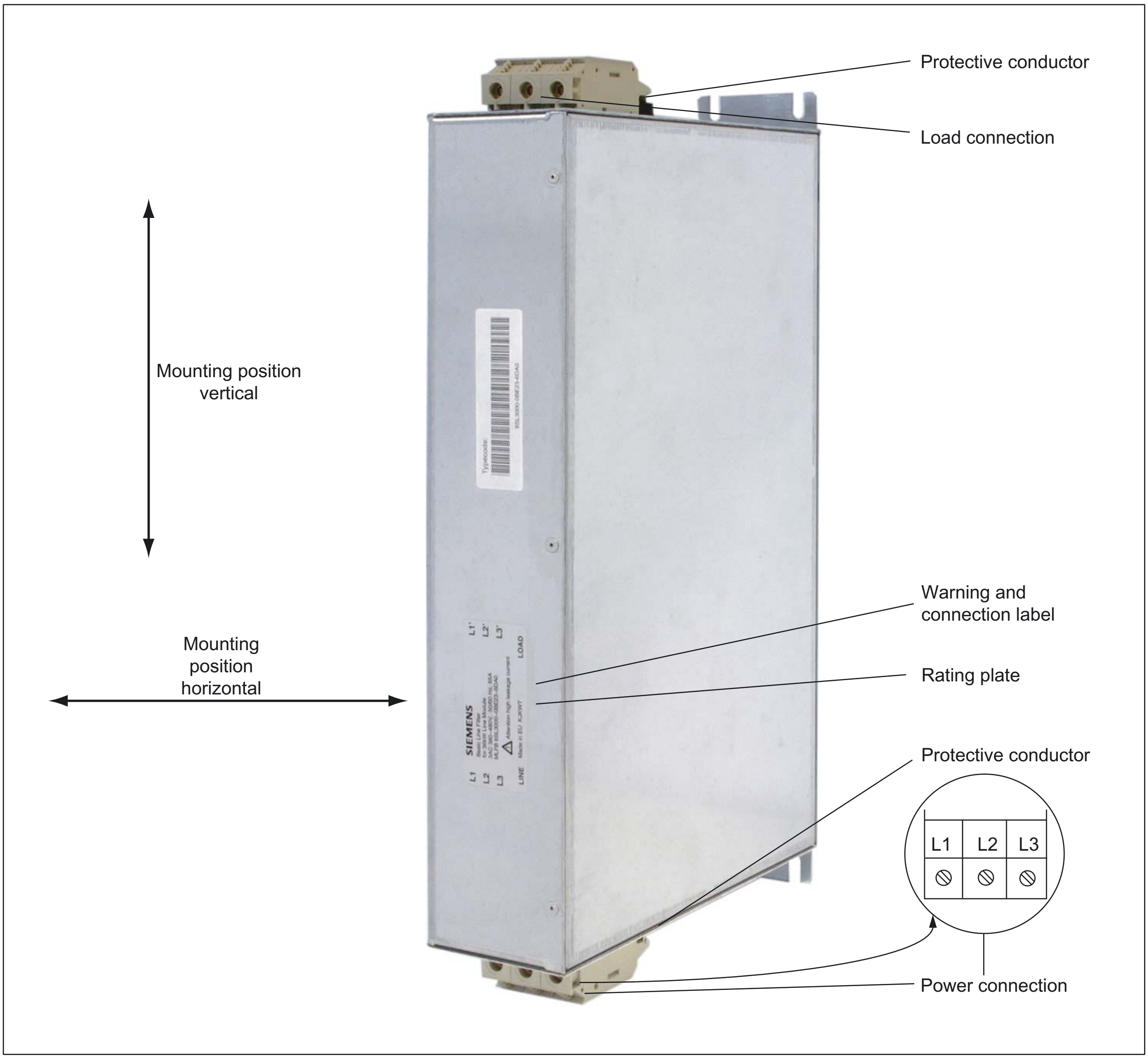


Figure 4-16 Line filters for Basic Line Modules (example: 40 kW)

NOTICE
The line/load connection must not be interchanged.

4.7.3.2 Line supply/load connection

Table 4-12 Connection type

Terminals	Designations
Line supply connection (line supply)	L1, L2, L3, PE
Load connection (load)	L1´, L2´, L3´, PE
Basic Line Filter for Basic Line Modules	
20 kW	Screw terminal: 10 mm² 3-pin / 1.5 - 1.8 Nm (see Screw Terminals chapter) PE connection: M6/6 Nm1)
40 kW	Screw terminal: 35 mm² PE connection: M6/6 Nm1)
100 kW	Screw terminal: 95 mm² PE connection: M6/6 Nm1)
1) for ring cable lugs to DIN 46234	

4.7.4 Dimension drawing

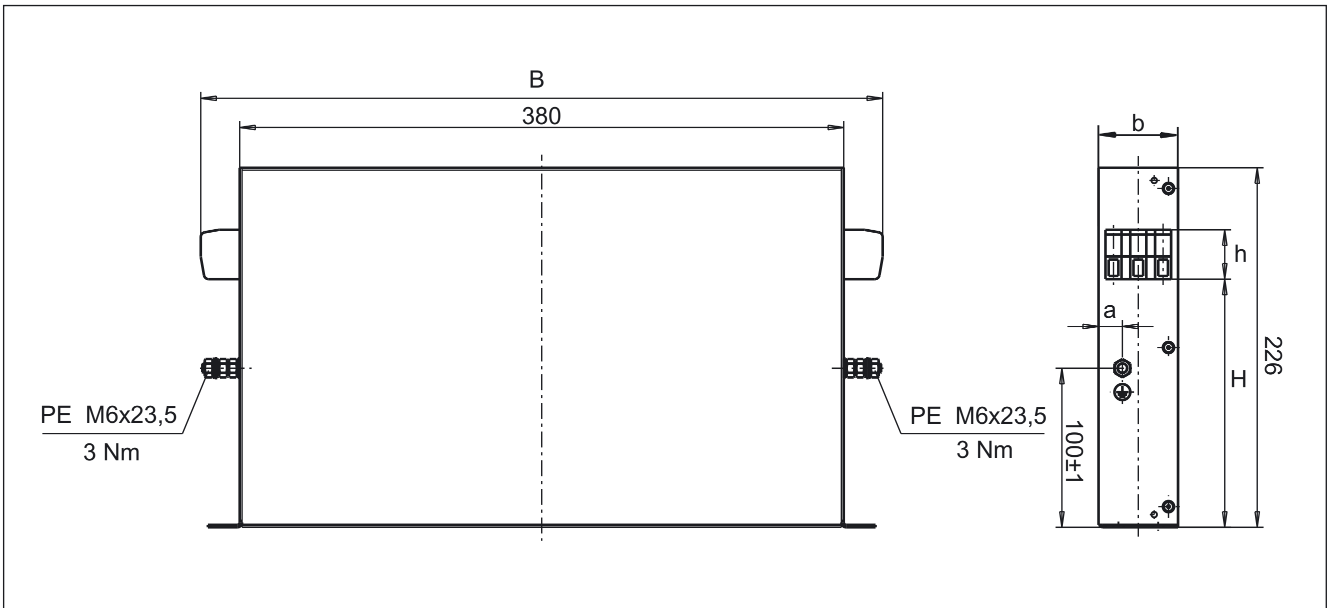


Figure 4-17 Dimension drawing: Basic Line Filter for Basic Line Modules (20 kW and 40 kW)

Table 4-13 Dimensions of Basic Line Filter for Basic Line Modules

Basic Line Filters	Order number	B [mm] (inches)	w [mm] (inches)	a [mm] (inches)	H [mm] (inches)	h [mm] (inches)
20 kW	6SL3000-0BE21-6DAx	429 (16.88)	50 (1.96)	15 (0.59)	156 (6.14)	31 (1.22)
40 kW	6SL3000-0BE23-6DA1	433 (17.07)	75 (2.95)	15 (0.59)	135 (5.31)	68 (2.67)

4.7.5 Technical Specifications

Table 4-14 Technical data for Basic Line Filter for Basic Line Modules

	6SL3000 unit	0BE21-6DAx	0BE23-6DA1	0BE31-2DAx
Rated power	kW	20	40	100
Connection voltage: Supply voltage Line frequency	 V_{AC} Hz	 380 3 AC -10% (-15% < 1 min) to 480 3 AC +10% 47 to 63 Hz		
Rated current	A_{AC}	36	65	192
Power loss[1]	W	16	28	86
Weight	kg	5	6,5	18,5

[1] For an overview, see the power loss tables in chapter Cabinet Design

4.8 Basic Line Filter for Smart Line Modules

4.8.1 Description

In conjunction with the associated line reactors, the Basic Line Filters for Smart Line Modules limit the cable-borne interference to a level in compliance with EN61800-3 category C2.

In conjunction with the line filters and the associated line reactors, drive line-ups with Smart Line Modules fulfill the requirements of category C2 to EN 61800-3.

The 16 kW and 36 kW Basic Line Filters for the Smart Line Modules are designed for total cable lengths of up to 350 m (shielded).

Basic Line Filters are suitable for direct connection to TN systems; otherwise an isolating transformer will be required.

4.8.2 Safety information

⚠ WARNING
The 100 mm clearances for circulating air above and below the filter must be observed. This prevents thermal overloading of the filter.

⚠ WARNING
The input and output connections/terminals must not be interchanged: Incoming line cable to LINE L1, L2, L3 Outgoing cable to line reactor at LOAD L1´, L2´, L3´ The line filter may be damaged if this is not observed.

⚠ CAUTION
The Line Module must only be connected to the SINAMICS line filter via the associated line reactor. Additional loads must be connected upstream of the SINAMICS line filter (if required, via a separate line filter). If this is not observed, other loads could be damaged or destroyed.

⚠ DANGER
The line filters listed conduct a high leakage current via the PE conductor. A permanent PE connection for the line filter or control cabinet is required due to the high leakage current of the line filters. Furthermore, the following measures must be taken according to EN 61800-5-1: Either protective ground conductor cross-sections ≥ 10 mm^2 Cu or installation of a second protective ground conductor of the same cross-section as the first one.

⚠ DANGER

Risk of electric shock. Dangerous voltages are still present for up to 5 minutes after the power supply has been switched off.

Note

If a high-voltage test is conducted with alternating voltage in the system, the line filters must be disconnected in order to obtain accurate measurements.

CAUTION

Only the line filters described in this Manual must be used. Other line filters can cause line harmonics that can interfere with or damage other loads powered from the line supply.

4.8.3 Interface description

4.8.3.1 Overview

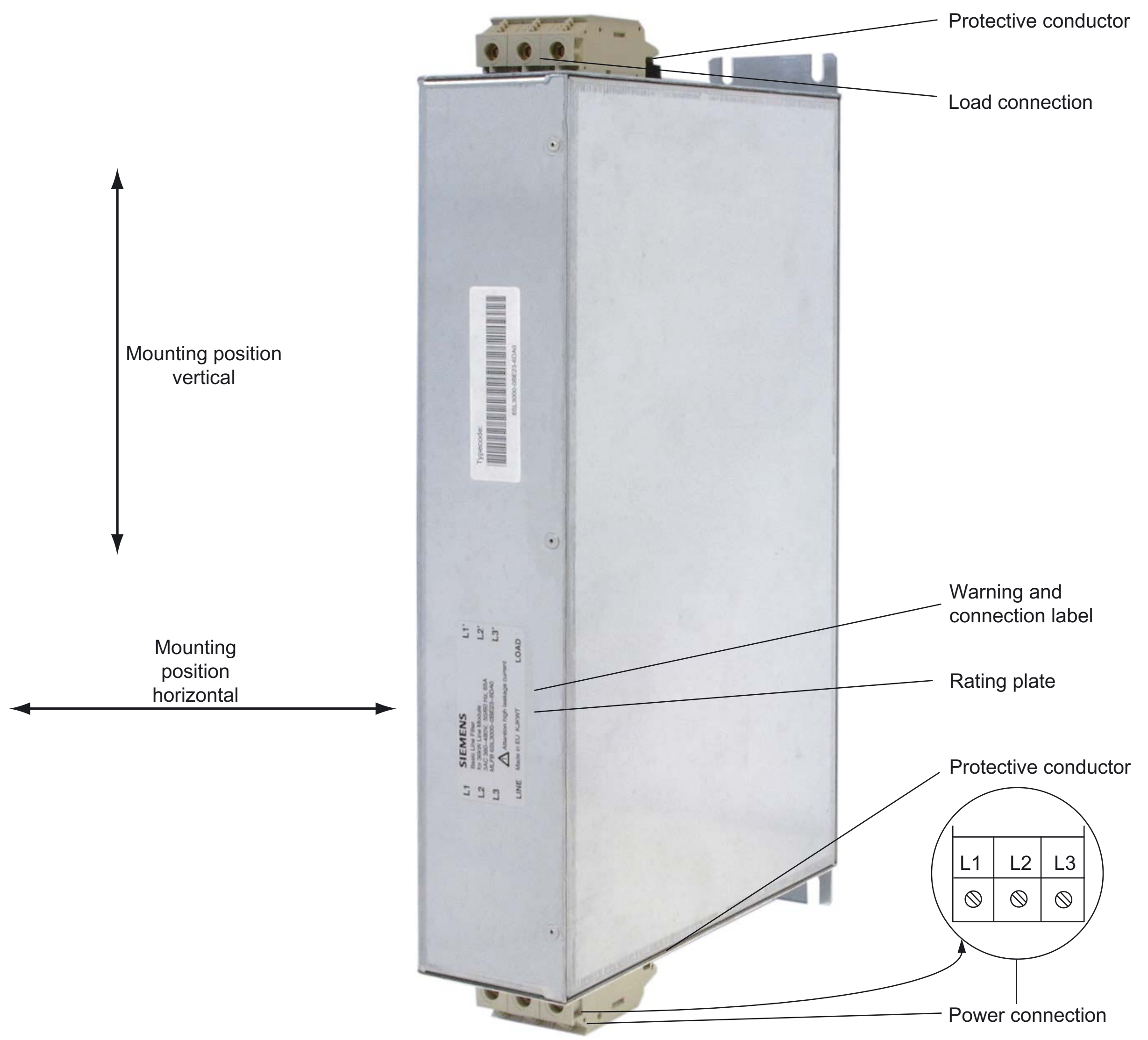


Figure 4-18 Basic Line Filter for Smart Line Modules (example: 36 kW)

NOTICE
The line/load connection must not be interchanged.

Line voltage 415 V 3 AC to 480 V AC + 10 %

- Controlled DC link voltage required, or
- limitation of the DC link voltage required due to motor isolation

4.8.3.2 Line/load connection

Table 4-15 Type of connection

Terminals	Designations
Line supply connection (line supply)	L1, L2, L3, PE
Load connection (load)	L1´, L2´, L3´, PE
Basic Line Filter for Smart Line Modules	
5 kW	Screw terminal: 10 mm² 3-pin/1.5 -1.8 Nm (see Screw Terminals chapter) Grounding bolt: M6/6 Nm 1)
10 kW	
16 kW	
36 kW	Screw terminal: 35 mm² Grounding bolt: : M6/6 Nm 1)
1) for ring cable lugs to DIN 46234	

4.8.4 Dimension Drawings

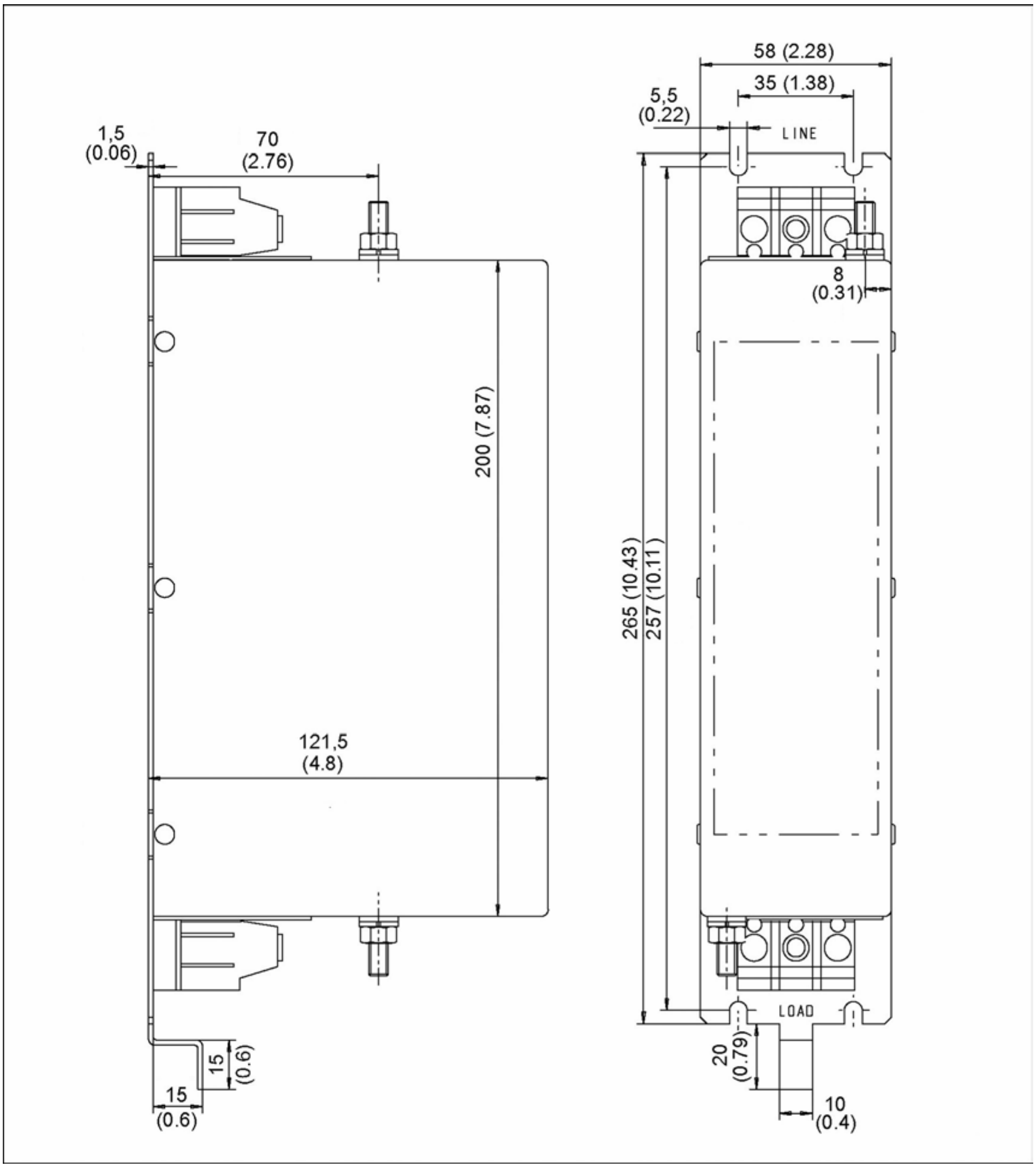


Figure 4-19 Dimension drawing: Basic Line Filter for Smart Line Modules (5 and 10 kW)

Table 4-16 Basic Line Filter for Smart Line Modules

Basic Line Filter for Smart Line Modules	Order number
5 kW	6SL3000-0HE15-0AAx
10 kW	6SL3000-0HE21-0AAx

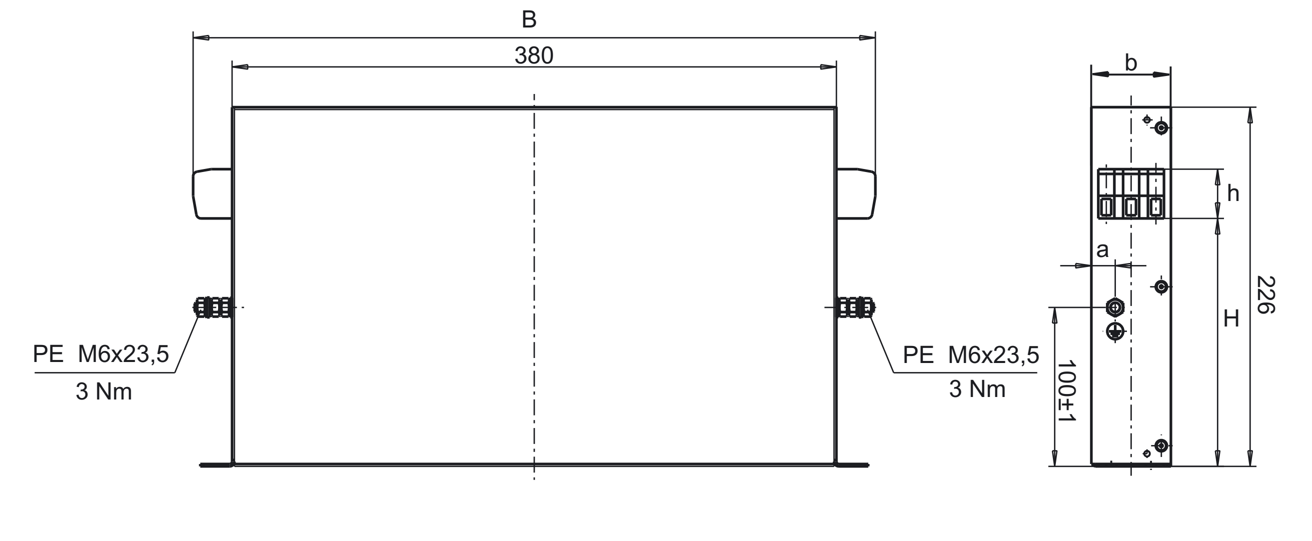


Figure 4-20 Dimension drawing: Basic Line Filter for Smart Line Modules (16 kW and 36 kW)

Table 4-17 Dimensions of Basic Line Filter for Smart Line Modules

Basic Line Filter for Smart Line Modules	Order number	W [mm] (inches)	b [mm] (inches)	a [mm] (inches)	H [mm] (inches)	h [mm] (inches)
16 kW	6SL3000-0BE21-6DAx	429 (16.88)	50 (1.96)	15 (0.59)	156 (6.14)	31 (1.22)
36 kW	6SL3000-0BE23-6DAx	433 (17.07)	75 (2.95)	15 (0.59)	135 (5.31)	68 (2.67)

4.8.5 Technical Specifications

Table 4-18 Technical data for: Basic Line Filter for Smart Line Modules

	6SL3000- Unit	0HE15-0AAx	0HE21-0AAx	0BE21-6DAx	0BE23-6DAx
Rated power	kW	5	10	16	36
Connection voltage: Supply voltage Line frequency	 V_{AC} Hz	 380 3 AC -10% (-15% < 1 min) to 480 3 AC +10% 47 to 63 Hz			
Rated current	A_{AC}	16	25	36	65
Power loss	W	20	20	16	28
Weight	kg	2,1	2,3	5	6,5

4.9 Active Interface Module

4.9.1 Description

Active Interface Modules are line-side interfaces for the Active Line Modules.

They contain the following functional units:

- Line reactors
- Low-frequency/switching frequency filters
- Line filters to EN61800-3, category C3, max. total motor cable length 350 m (shielded)

In conjunction with the associated Basic Line Filter and an EMC-compliant design, the following voltage interference limit values are observed:

- EN 61800-3, category C3, max. total cable length 1000 m
- EN 61800-3, category C2, max. total cable length 350 m

The Active Interface Module is fitted with a fan. The 24 V supply is essential for operating the component. Connection of the temperature signaling contact to the Active Line Module is also required.

4.9.2 Safety information

CAUTION
Active Interface Modules must only be operated if the option "Line filter available" has been set for the Active Line Module in the commissioning wizard, and if "AIM 400 V xxkW (6SL3100-0BE-*AB*)" has been selected as the line filter. Alternatively the parameter for line filter adjustment can also be set manually: p0220 = 4*.** **If this is not observed, the Active Interface Modules may overheat.**

⚠ DANGER
The Active Interface Modules conduct a high leakage current via the PE conductor. A permanent PE connection for the Active Interface Module or control cabinet is required due to the high leakage current of the Active Interface Module. Furthermore, the following measures must be taken according to EN 61800-5-1: Either protective ground conductor cross-sections ≥ 10 mm² Cu or installation of a second protective ground conductor of the same cross-section as the first one.

⚠ DANGER
A ventilation clearance of 80 mm above and below the components must be observed.

Note

The Active Interface Modules must only be operated in a vertical position ("hanging").

4.9.3 Interface description

4.9.3.1 Overview

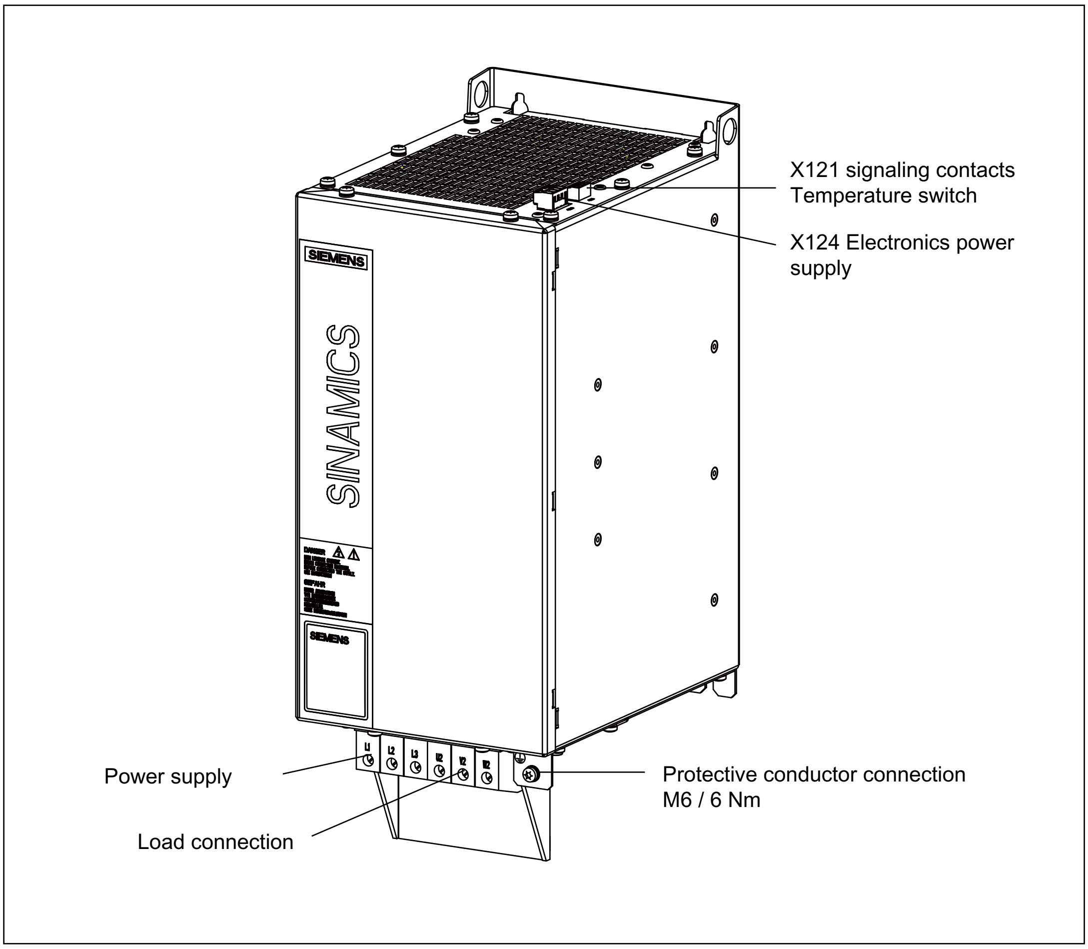


Figure 4-21 Interface description: Active Interface Module 55 kW

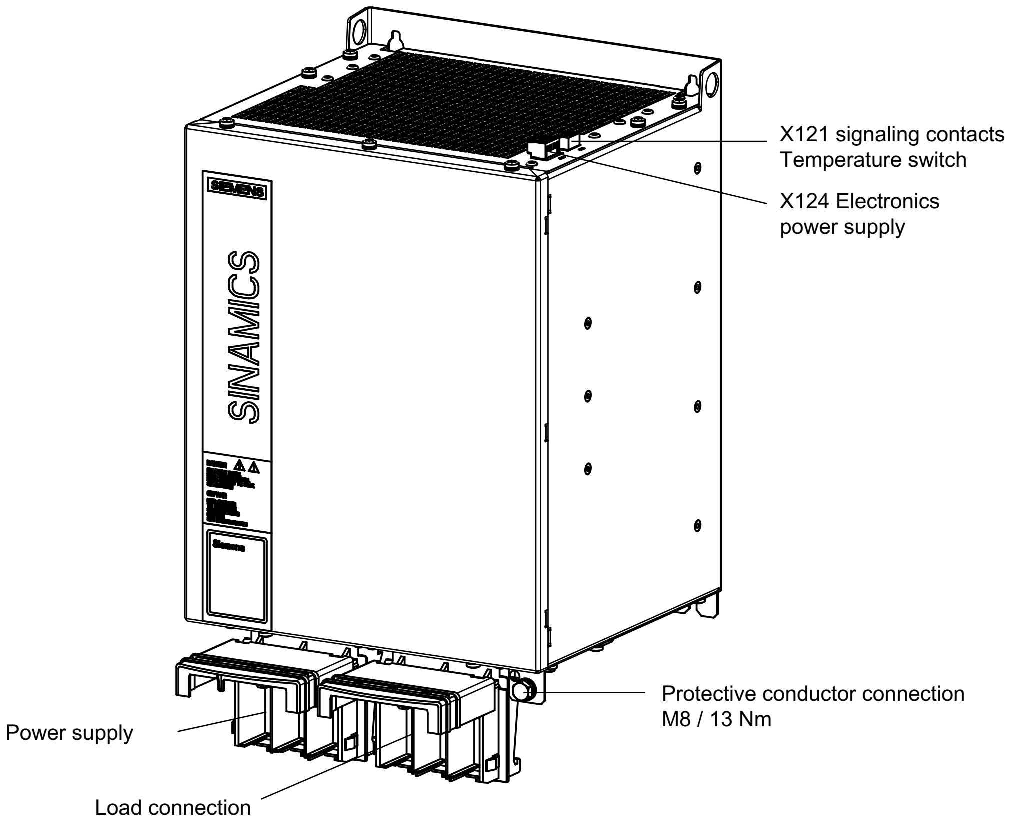


Figure 4-22 Interface description: Active Interface Module (80 kW and 120 kW)

4.9.3.2 Connection example

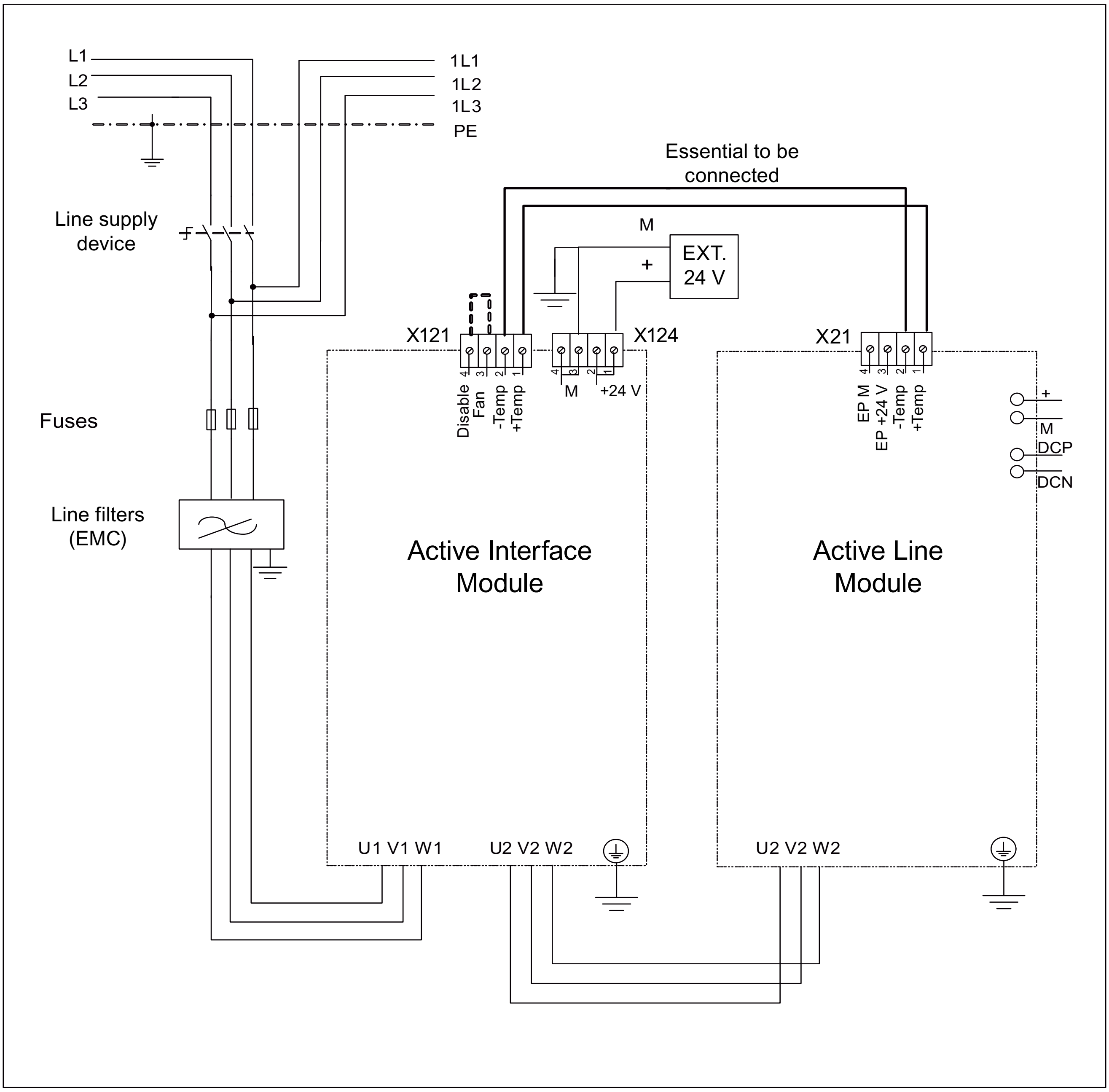
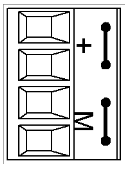


Figure 4-23 Connection example: Active Interface Module

4.9.3.3 Electronics power supply X124

Table 4-19 Terminal block X124

	Terminal	Function	Technical specifications
	+	Electronics power supply	Voltage: 24 V DC (20.4 V - 28.8 V)
	+	Electronics power supply	Current consumption: max. 1.6 A
	M	Electronic ground	Max. current via jumper in connector: 20 A at 55 °C
	M	Electronic ground	
Max. connectable cross-section: 2.5 mm²			

Note

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

4.9.3.4 Line supply/load connection

Table 4-20 Type of connection

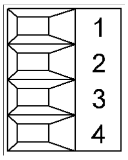
Terminals	Designations
Line supply connection (line supply)	L1, L2, L3
Load connection (load)	U2, V2, W2
Active Interface Module	
55 kW	Terminal type HDFK 50 , 25 mm² cross-section, ferrule Tightening torque min. 6 Nm
80 / 120 kW	Threaded bolt M8, max. cross-section 120 / 2 x 50 mm², tightening torque 13 Nm 1)
1) for ring cable lugs to DIN 46234	

Note

The 55 kW Active Interface Module provides the IP20 degree of protection only with insulated ferrule and a cross-section > 25 mm².

4.9.3.5 X121 alarm contacts for temperature switch

Table 4-21 Plug-in screw terminal X121

	Terminal	Designation	Technical specifications
	1	+Temp	Rated current at cosφ 1: 2.5 A (max. 5 A) Voltage: 12 - 250 V_{AC} (12 - 100 V_{DC}) Temperature switch output
	2	-Temp	Temperature switch output
	3	Disable Fan +24V	The fan can be disabled. The fan should only be switched off while the Active Line Module is disabled.
	4	Disable Fan M	
Max. connectable cross-section: 1.5 mm²			

Note

If the terminals are not connected (or connected with low level), the fan will run in continuous mode. The fan can be switched off by applying 24 V (against M).

4.9.4 Dimension drawings

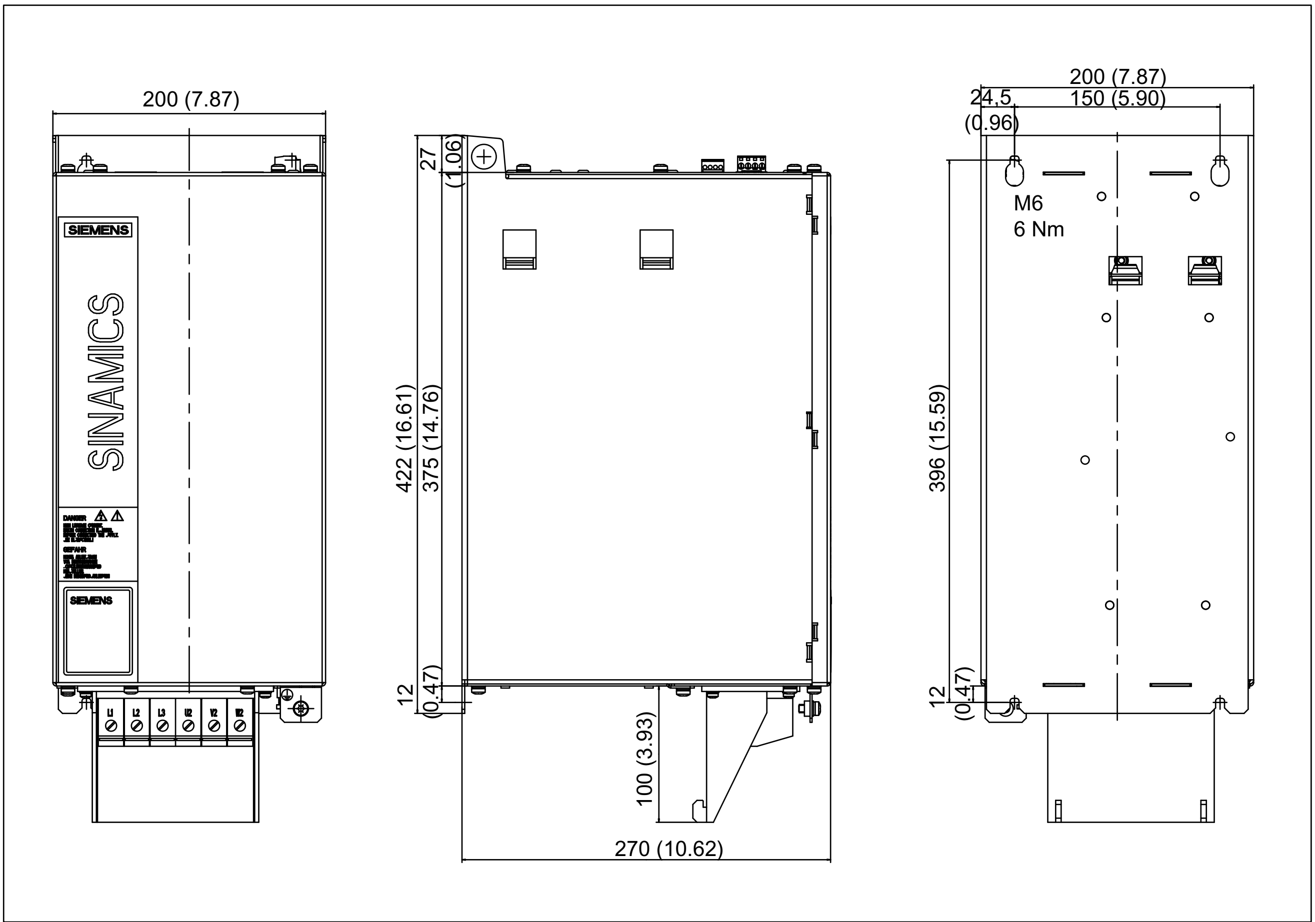


Figure 4-24 Dimension drawing: Active Interface Module 55 kW

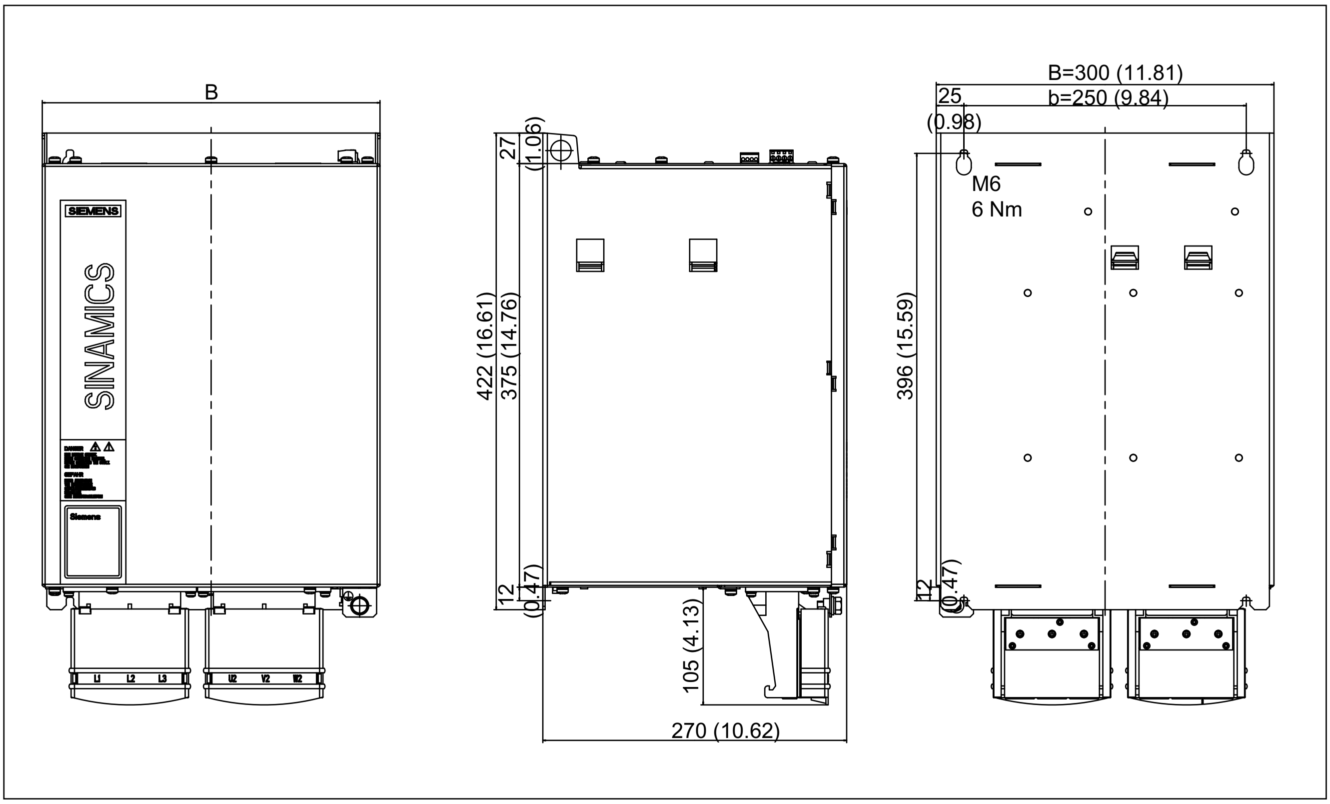


Figure 4-25 Dimension drawing: Active Interface Module (80 kW and 120 kW)

Table 4-22 Active Interface Modules

Active Interface Module	6SL3100-0BE25-5ABx	6SL3100-0BE28-0ABx	6SL3100-0BE31-2ABx
	55 kW	80 kW	120 kW

Table 4-23 Shield connecting plates for Active Interface Modules

Shield connecting plate	6SL3163-1AH00-0AAx	6SL3163-1AM00-0AAx	6SL3163-1AM00-0AAx
Active Interface Module	55 kW	80 kW	120 kW

4.9.5 Installation

The Active Interface Modules are designed for installation in the control cabinet. The components are secured onto the control cabinet installation panel next to the line filter using four M6 screws (not hexagon-head screws).

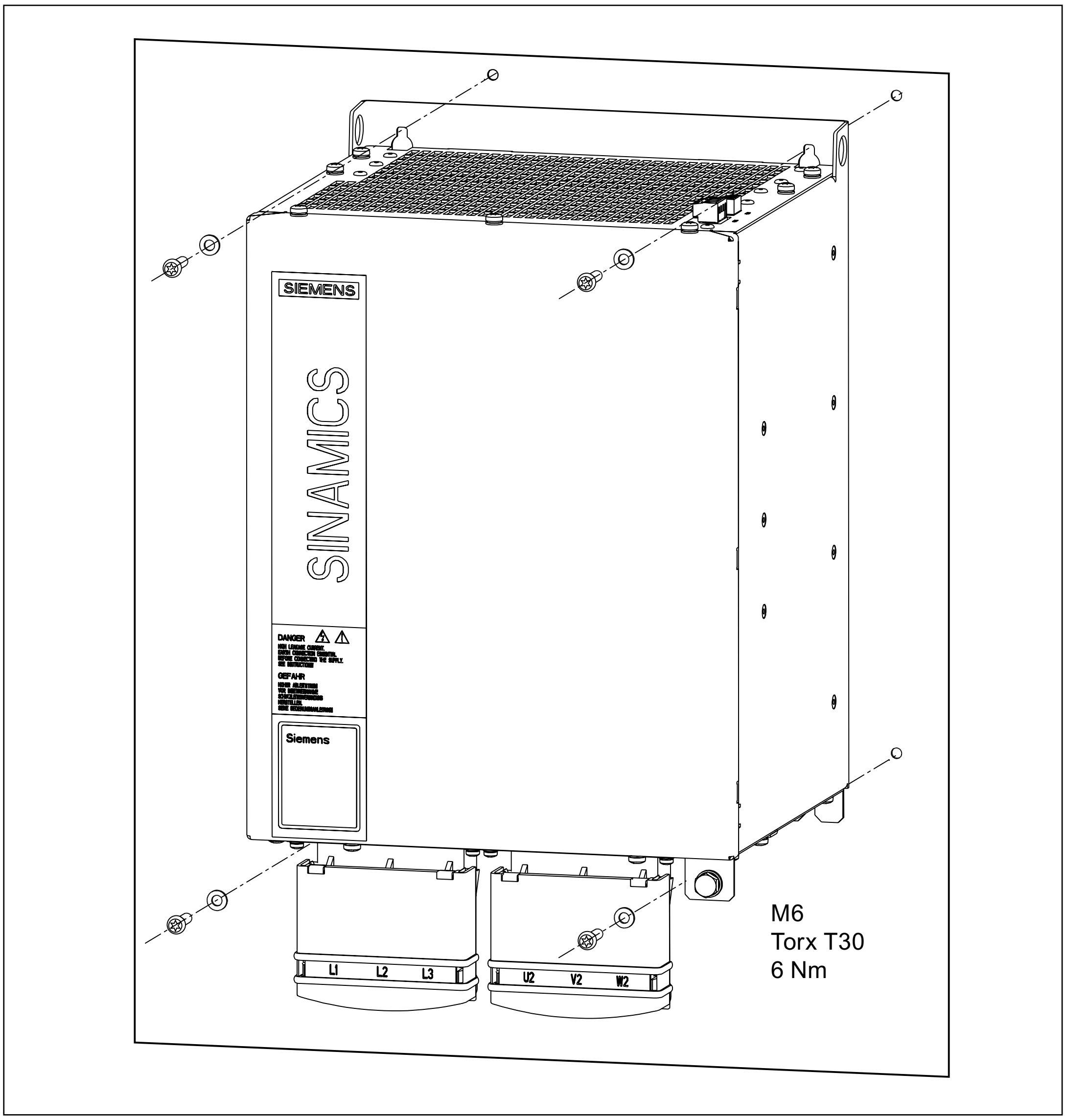


Figure 4-26 Mounting: Active Interface Module

Table 4-24 Protective conductor connection

Active Interface Module	
55 kW	Threaded hole M6 / 6 Nm
80 / 120 kW	Threaded hole M8 / 13 Nm

Operating an Active Interface Module from an insulated network (IT system)

When a 55 kW, 80 kW and 120 kW Active Interface Module is operated from an insulated supply (IT system), the connection bracket for the interference-suppression capacitor must be removed. The connection bracket for the interference-suppression capacitor is located on the lower side of the component.

⚠ DANGER
The connecting bracket may only be removed in the de-energized state. Risk of electric shock. Dangerous voltages are still present for up to 5 minutes after the power supply has been switched off.

CAUTION
If the connection bracket for the interference-suppression capacitor is not removed, an insulated supply will be grounded and may cause destruction of the isolation monitor in the case of failure.

		
Remove the connection bracket for the interference-suppression capacitor with a Tx25 screwdriver.	Remove the connection bracket.	Connection bracket for the interference-suppression capacitor

Replacing the fan in an Active Interface Module

⚠ DANGER
Before replacing the fan, you must switch off the power supplies (24 V DC and 400 V AC). Risk of electric shock. Dangerous voltages are still present for up to 5 minutes after the power supply has been switched off. The fan cover must not be opened until this time has elapsed.

Table 4-25 Replacing the fan in an Active Interface Module (120 kW)

		
Open the fan cover. Unscrew the combination screws (M5 / 3 Nm)	Open the fan cover.	Remove the connector.
		
Unscrew the screws M3 / 1.8 Nm	Release the connection cables	Remove the fan.

To install, carry out the above steps in reverse order.

4.9.6 Technical specifications

Table 4-26 Technical data

Active Interface Module	6SL3100-	0BE25-5ABx	0BE28-0ABx	0BE31-2ABx
		55 kW	80 kW	120 kW
P_{max}	kW	137	131	175
I_{rated}	A	85	132	200
I_{max}	A	170	218	292
Current requirements of the 24 V DC electronics power supply	A	1,2	1,2	1,2
Mains voltage	V	380 V 3 AC to 480 V 3 AC ±10%		
Line frequency	Hz	47 - 63		
Cooling air requirement	m³/h	300	600	600
Power loss	W	450	575	800
Weight	kg	21	29	33
Connection cross-section	mm²	50	120	120
PE connecting studs		M6	M8	M8

4.10 Line reactors for Active Line Modules

4.10.1 Description

Line reactors limit low-frequency line harmonics to permissible values. For this reason, line reactors should always be used. In conjunction with Active Line Modules, they are also used to store energy.

4.10.2 Safety information

CAUTION
A clearance of 100 mm must be maintained around the reactor in order to minimize the influence of magnetic fields in other components and cables.

Note

The connection lines between line reactor and Line Module must be kept as short as possible (max. 10 m).

If at all possible, shielded connecting cables should be used.

Do not route any cables near the line reactor. If this cannot be avoided, observe a minimum distance of 150 mm.

CAUTION
Only the line reactors or Active Interface Modules described in this Manual should be used. The following can occur if line reactors are used that have not been approved for SINAMICS S120 by SIEMENS: - The Line Modules may become damaged/faulty. - Line reactions can occur that can damage or interfere with other loads powered from the same network.

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

4.10.3 Connection description

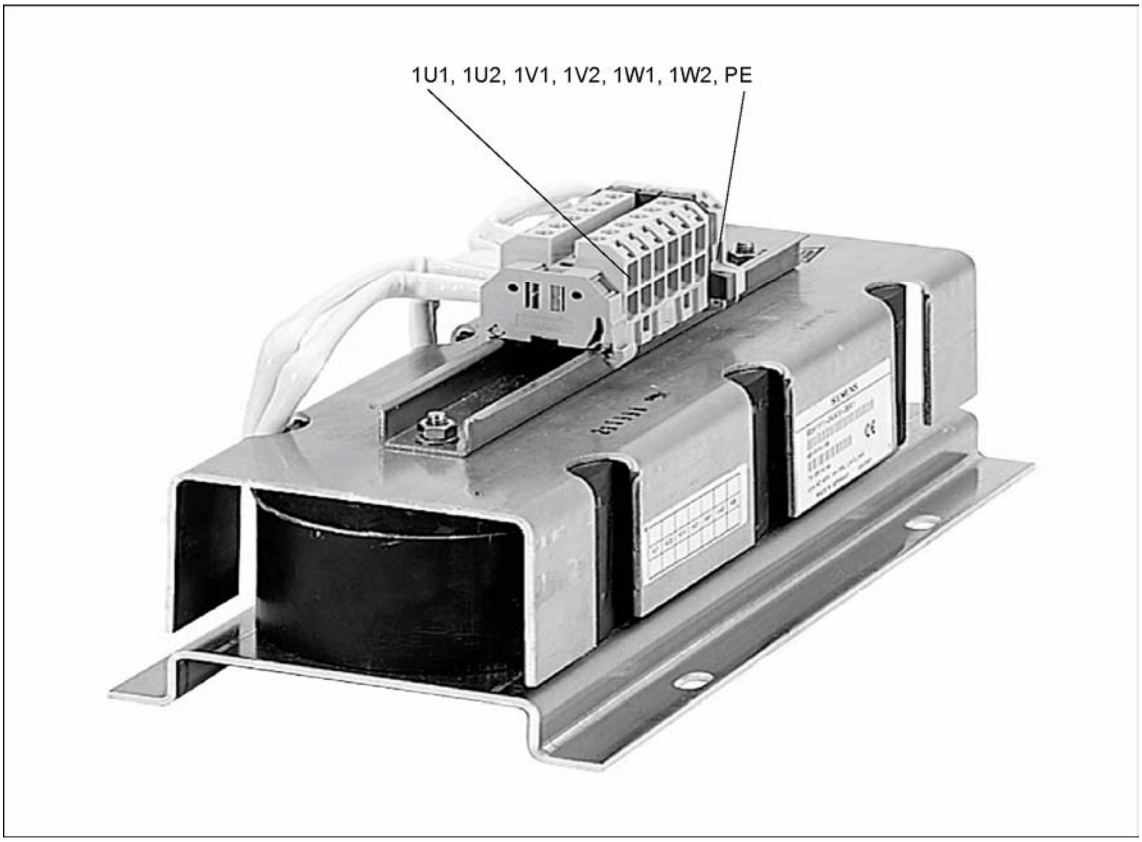


Figure 4-27 Line reactor (example: 16 kW)

4.10.3.1 Line/load connection

Table 4-27 Connection types for line reactors

Terminals	Designations
Line supply connection	1U1, 1V1, 1W1, PE
Load connection	1U2, 1V2, 1W2
Line reactors for Active Line Modules	
16 kW	Screw terminal 16 mm^2 3–pin / 6 Nm*
36 kW	Screw terminal 35 mm^2 3–pin / 6 Nm*
55 kW	Screw terminal 70 mm^2 3–pin / 6 Nm*
80 kW	Connecting lug d = 9 mm (M10/25 Nm) for ring cable lug acc. to DIN 46234 **Note: No shock-hazard protection (IP00B acc. to 60529)**
120 kW	Connecting lug d = 10 mm (M10/25 Nm) for ring cable lug acc. to DIN 46234 **Note: No shock-hazard protection (IP00B acc. to 60529)**

* See Chapter Screw terminals

4.10.4 Dimension drawings

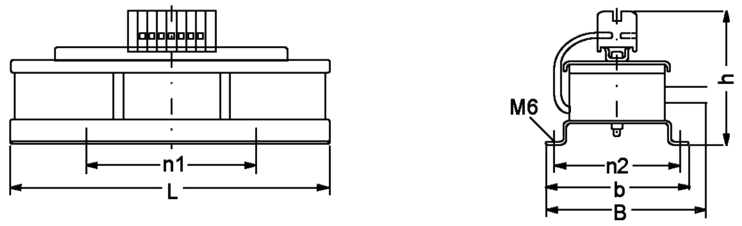


Figure 4-28 Dimension drawing: line reactor for Active Line Modules (up to 55 kW)

Table 4-28 Dimensions of the line reactor for Active Line Modules

	Order number 6SN1111-	L [mm] (inches)	W [mm] (inches)	h [mm] (inches)	w [mm] (inches)	n_1 [mm] 1) (inches)	n_2 [mm] 1) (inches)
16 kW	0AA00-0BA1	330 (12.99)	150 (5.91)	145 (5.71)	150 (5.91)	175 (6.89)	136 (5.35)
36 kW	0AA00-0CA1	330 (12.99)	150 (5.91)	230 (9.06)	150 (5.91)	175 (6.89)	136 (5.35)
55 kW	0AA00-0DA1	330 (12.99)	150 (5.91)	280 (11.02)	150 (5.91)	175 (6.89)	136 (5.35)
1) Dimensions n1 and n2 correspond to the hole spacing							

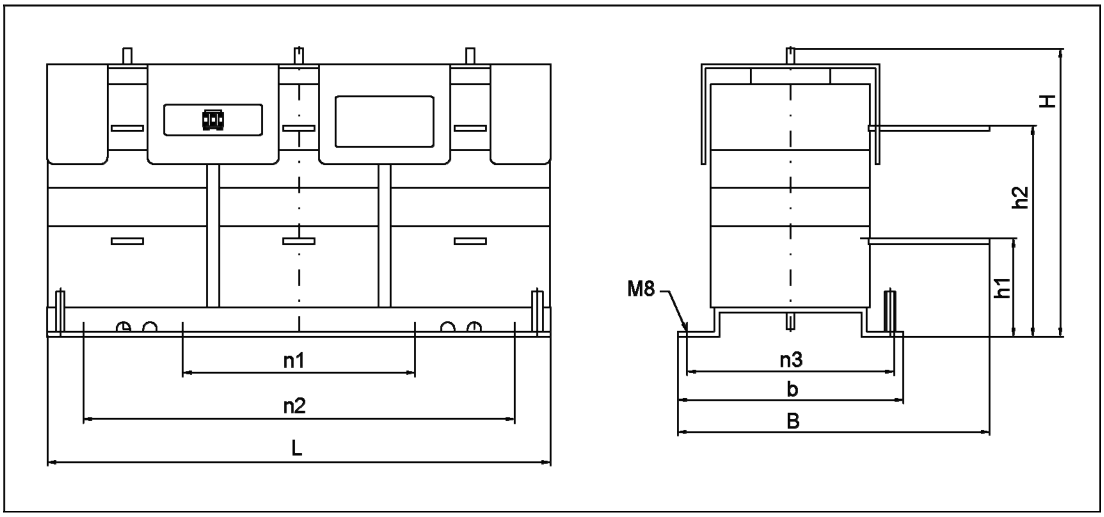


Figure 4-29 Dimension drawing: line reactor for Active Line Modules (as of 80 kW)

Table 4-29 Dimensions of the line reactor for Active Line Modules

	Order number	L [mm] (inches)	W [mm] (inches)	h1 [mm] (inches)	h2 [mm] (inches)	H [mm] (inches)	w [mm] (inches)	n_1 [mm] 1) (inches)	n_2 [mm] 1) (inches)	n_3 [mm] 1) (inches)
80 kW	6SN1111-0AA00-1EAx	380 (14.96)	225 (8.86)	50 (1.70)	170 (6.69)	220 (8.66)	170 (6.69)	175 (6.89)	325 (12.80)	156 (6.14)
120 kW	6SL3000-0DE31-2BAx	476 (18.74)	275 (10.82)	80 (3.14)	215 (8.46)	265 (10.43)	230 (9.05)	175 (6.89)	325 (12.80)	206 (8.11)
1) Dimensions n1, n2 and n3 correspond to the hole spacing										

4.10.5 Technical specifications

Table 4-30 Technical data of line reactors for the Active Line Module

	Unit	6SN1111–0AA00-0BA1	6SN1111–0AA00-0CA1	6SN1111–0AA00-0DA1	6SN1111–0AA00-1EAx	6SL3000-0DE31-2BAx
Power	kW	16	36	55	80	120
Rated current	A_{rms}	30	67	103	150	225
Power loss[1]	W	170	250	350	450	590
Weight	Weight[kg]	8,5	13	18	40	64

[1] For an overview, see the power loss tables in chapter Cabinet Design

4.11 Line reactors for Smart Line Modules

4.11.1 Description

Line reactors for Smart Line Modules limit low-frequency line harmonics to permissible values. For this reason, line reactors should always be used.

4.11.2 Safety information

CAUTION
A clearance of 100 mm must be maintained around the reactor in order to minimize the influence of magnetic fields in other components and cables.

Note

The connection lines between line reactor and Line Module must be kept as short as possible (max. 10 m).

If at all possible, shielded connecting cables should be used.

Do not route any cables near the line reactor. If this cannot be avoided, observe a minimum distance of 150 mm.

CAUTION
Only the line reactors or Active Interface Modules described in this Manual should be used. The following can occur if line reactors are used that have not been approved for SINAMICS S120 by SIEMENS: - The Line Modules may become damaged/faulty. - Line reactions can occur that can damage or interfere with other loads powered from the same network.

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

4.11.3 Connection description

4.11.3.1 Overview

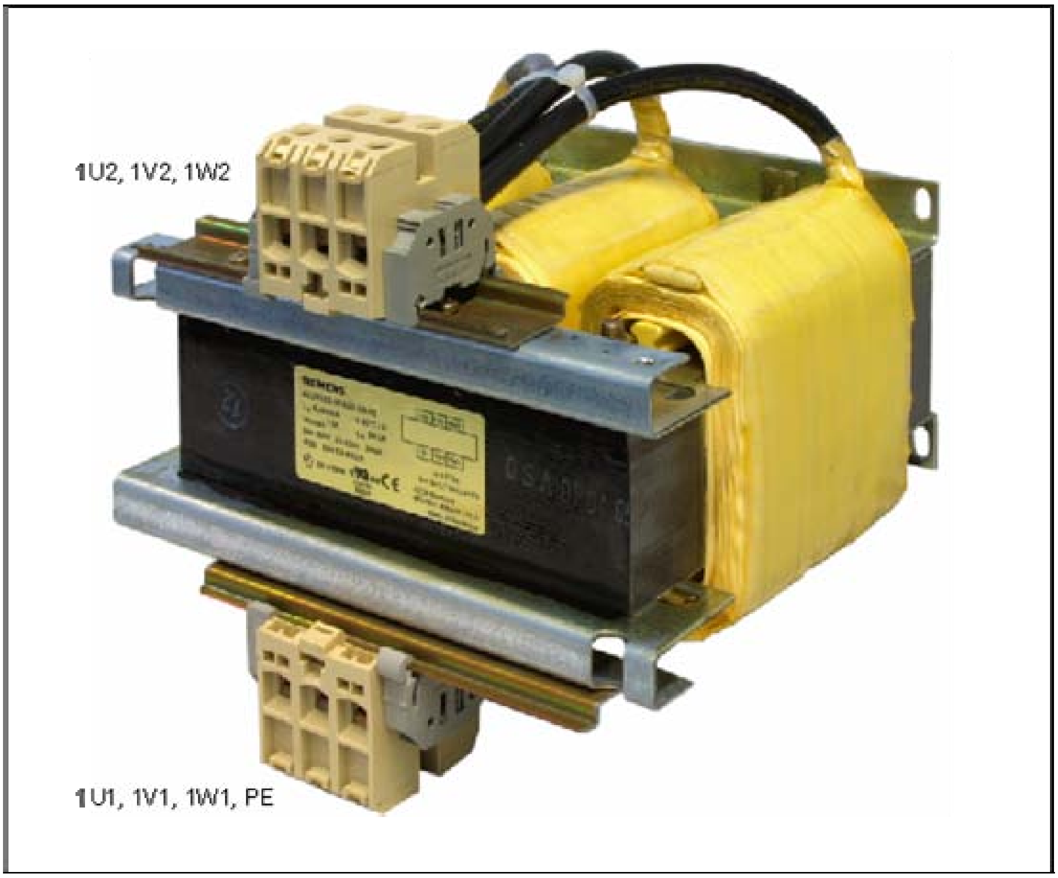


Figure 4-30 Line reactors for Smart Line Modules (example: 36 kW)

4.11.3.2 Line supply/load connection

Table 4-31 Connection types for line reactors

Terminals	Designations
Line supply connection	1U1, 1V1, 1W1, PE
Load connection	1U2, 1V2, 1W2
Line reactors for Smart Line Modules	
5 kW	Screw terminal 4 mm² 3-pin*
10 kW	Screw terminal 10 mm² 3-pin*
16 kW	Screw terminal 10 mm² 3-pin* with PE connection for ring cable lug M5 to DIN 46234
36 kW	Screw terminal 16 mm² 3-pin* with PE connection for ring cable lug M6 to DIN 46234

* See Chapter Screw terminals

4.11.4 Dimension Drawings

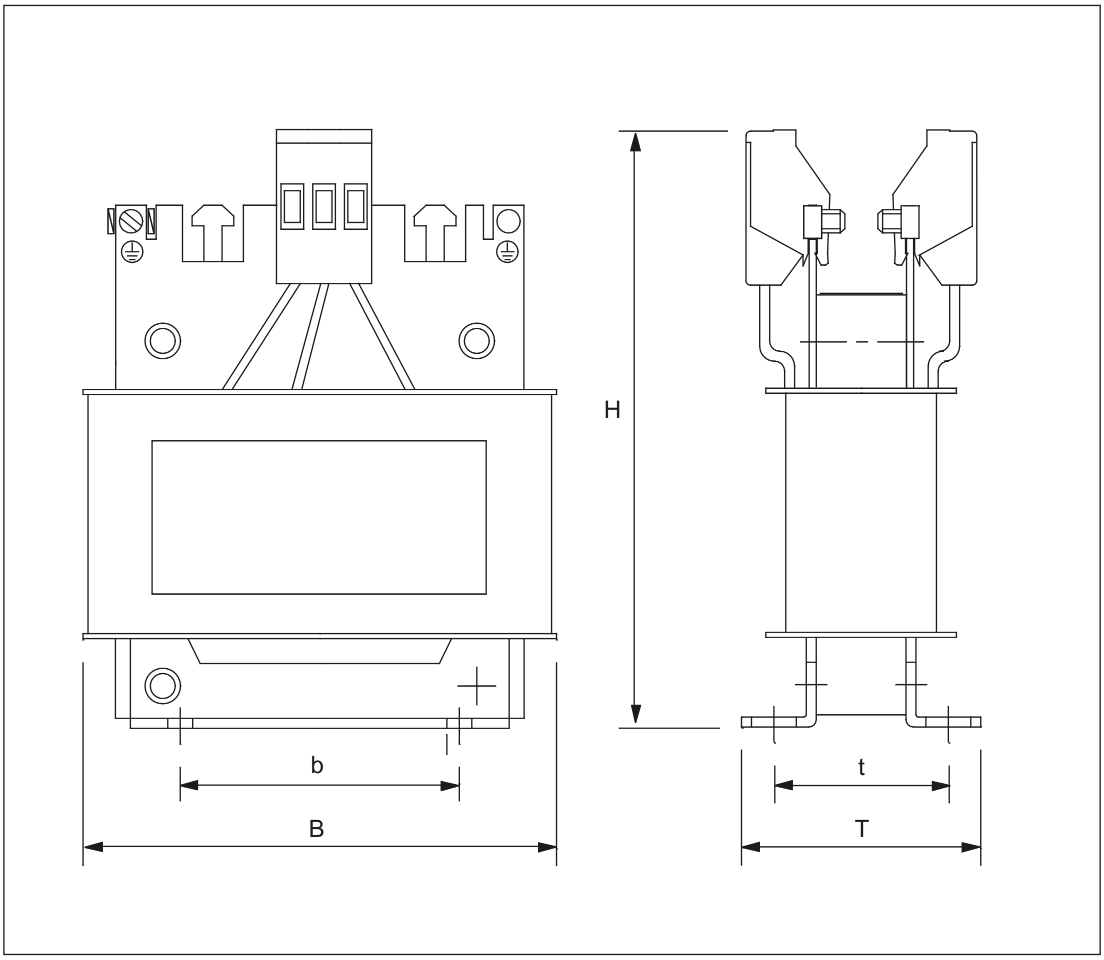


Figure 4-31 Dimension drawing: line reactor for Smart Line Modules (5 and 10 KW)

Table 4-32 Dimensions of the line filter for Smart Line Modules

	Order number 6SL3000-	W [mm] (inches)	b [mm] 1) (inches)	H [mm] (inches)	D [mm] (inches)	t [mm] 1) (inches)
5 kW	0CE-15-0AAx	150 (5.91)	113 (4.53)	175 (6.89)	66,5 (2.62)	49,5 (1.95)
10 kW	0CE-21-0AAx	177 (6.97)	136 (5.35)	196 (7.72)	86 (3.39)	67 (2.64)
1) The lengths b and t correspond to the hole spacing						

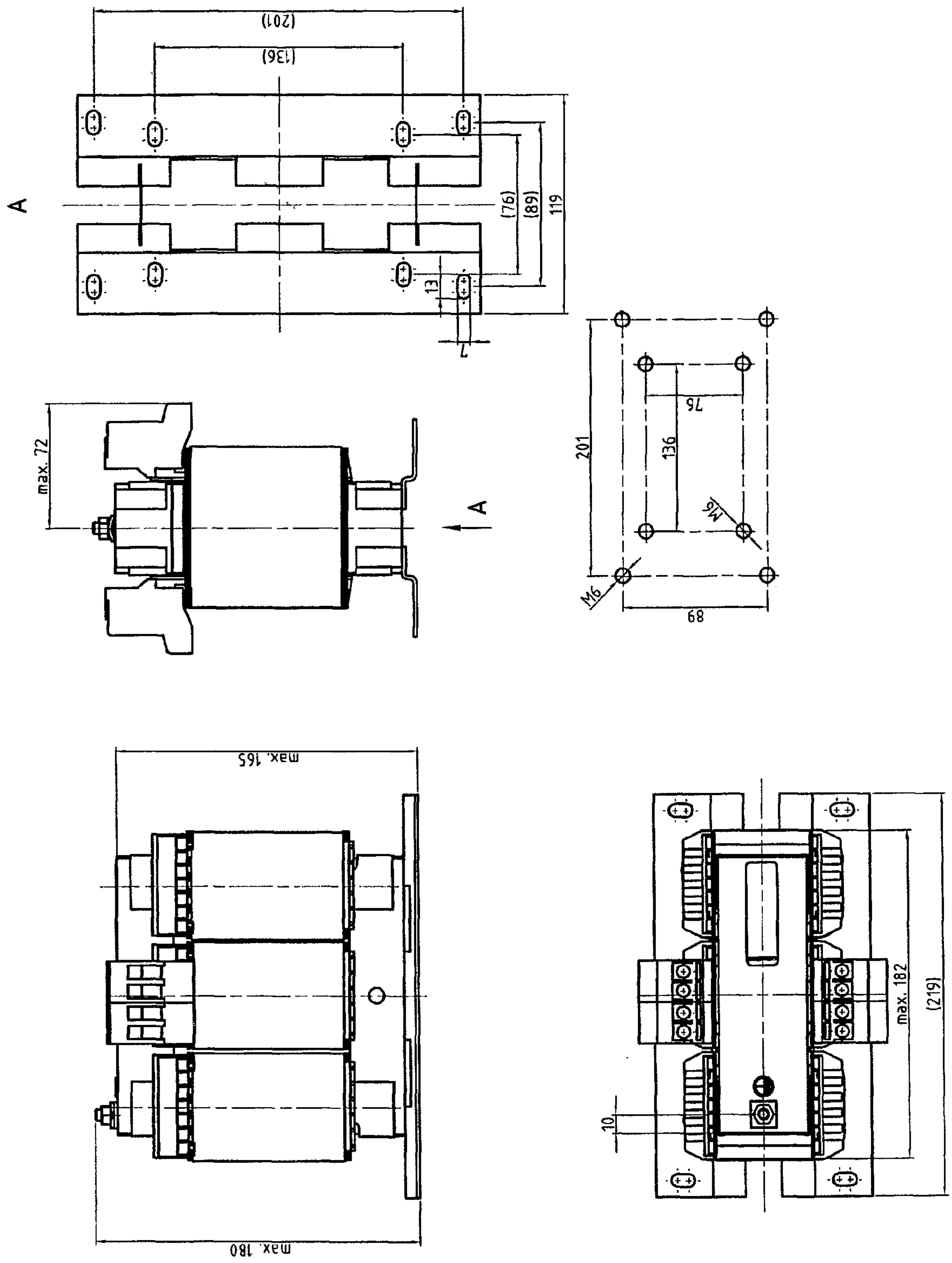
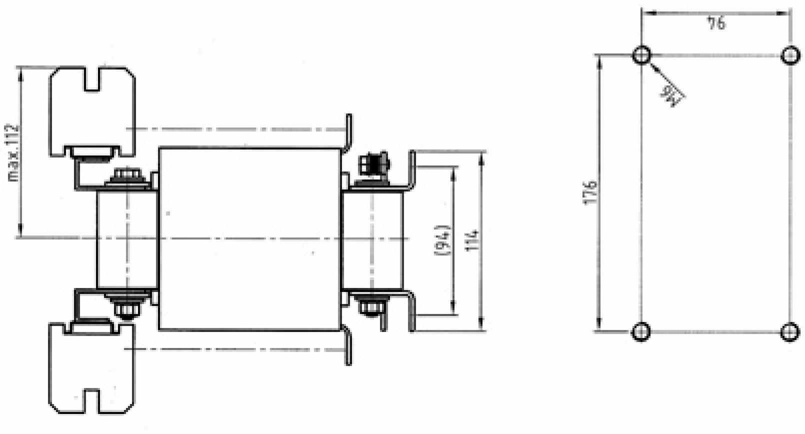


Figure 4-32 Dimension drawing of line reactor for the Smart Line Module 16 kW



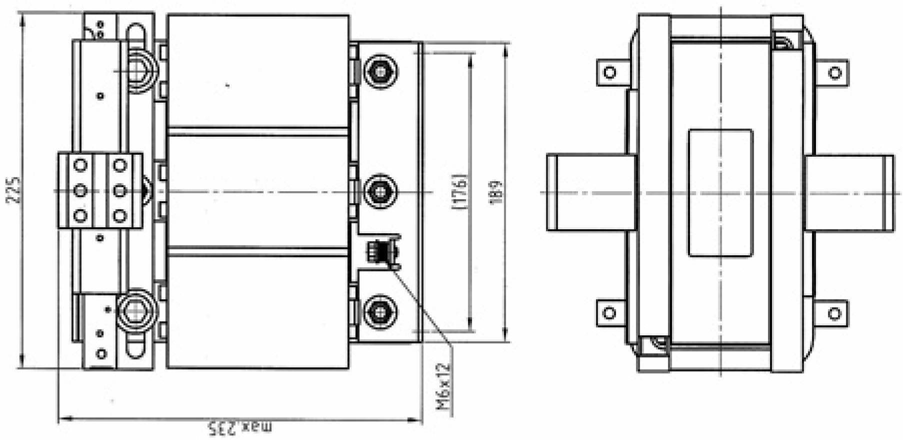


Figure 4-33 Dimension drawing of the line reactor for the Smart Line Module 36 kW

Table 4-33 Line reactor for the Smart Line Modules 16 kW and 36 kW

	Order No.
16 kW	6SL3000-0CE-21-6AAx
36 KW	6SL3000-0CE-23-6AAx

4.11.5 Technical specifications

Table 4-34 Technical data of line reactors for the Smart Line Module

	6SL3000 unit	0CE15-0AAx	0CE21-0AAx	0CE22-0AAx	0CE24-0AAx
Power	kW	5	10	16	36
Rated current	A_{rms}	14	28	35	69
Power loss[1]	W	62	116	110	170
Weight	kg	3,7	7,5	9,5	17

[1] For an overview, see the power loss tables in chapter Cabinet Design

4.12 Line reactors for Basic Line Modules

4.12.1 Description

Line reactors for Basic Line Modules limit low-frequency line harmonics to permissible values. For this reason, line reactors should always be used.

4.12.2 Safety information

CAUTION
A clearance of 100 mm must be maintained around the reactor to minimize the influence of magnetic fields in other components and cables.

Note

The connection cables to the Line Module must be as short as possible (max. 10 m).
If possible, they should be shielded.
Unless it can otherwise be avoided, cables must be routed past the line reactor at a minimum distance of 150 mm.

CAUTION
Only the line reactors described in this Manual must be used. The following can occur if line reactors are used that have not been approved for SINAMICS S120 by SIEMENS: - The Line Modules may become damaged/faulty. - Line reactions can occur that can damage or interfere with other loads powered from the same network.

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

4.12.3 Connection description

4.12.3.1 Overview

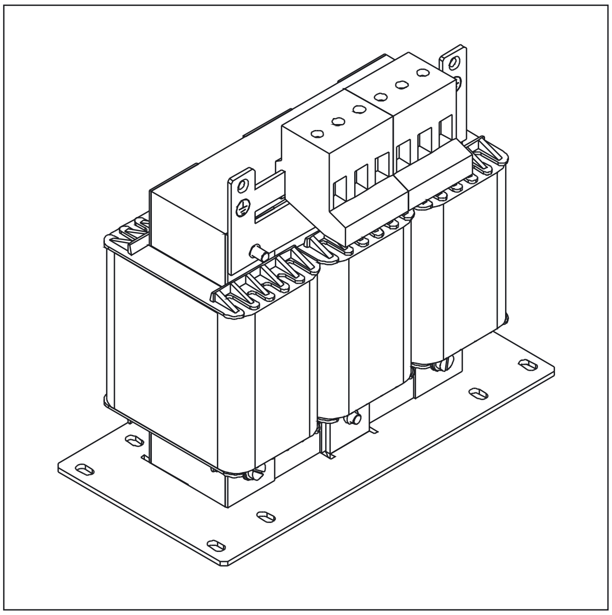


Figure 4-34 Line reactor for Basic Line Module (20 kW)

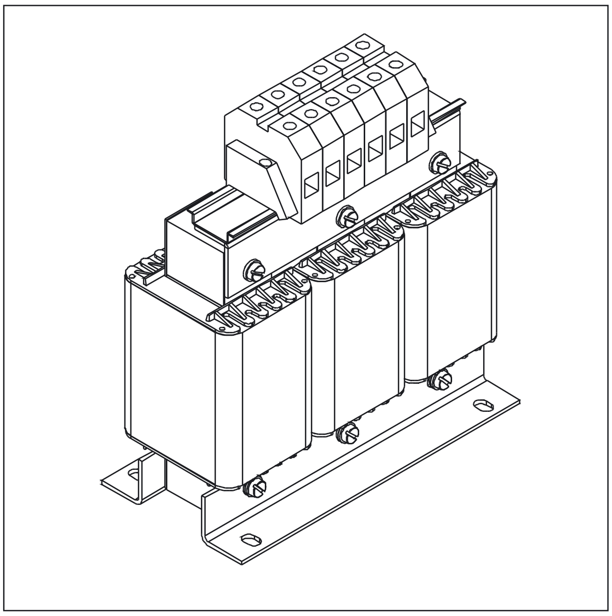


Figure 4-35 Line reactor for Basic Line Module (40 kW)

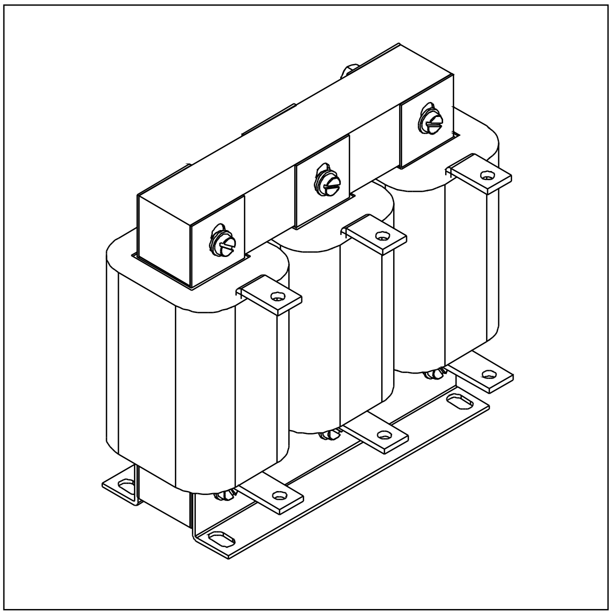


Figure 4-36 Line reactor for Basic Line Module (100 kW)

4.12.3.2 Line/power connection

Table 4-35 Connection types for line reactors

Terminals	Designations
Power connection	L1, L2, L3
Load connection	1L1, 1L2, 1L3
Line reactors for Basic Line Modules	
20 kW	Max. conductor cross-section 16 mm²/0.6 - 0.8 Nm
40 kW	Max. conductor cross-section 35 mm²/2.5 - 5.0 Nm
100 kW	Copper rails with 8.5 mm holes

4.12.4 Dimension drawings

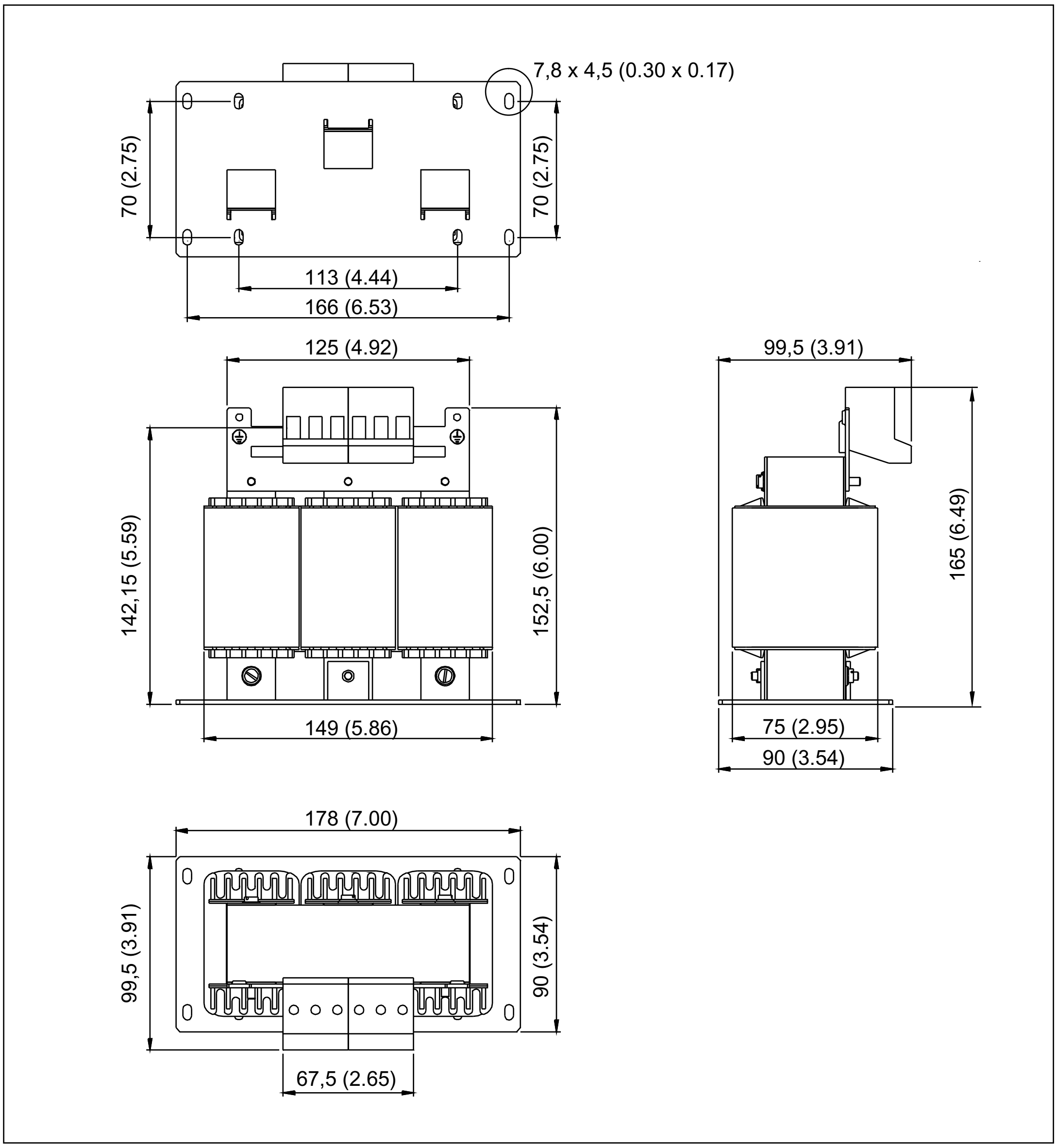


Figure 4-37 Dimension drawing: Line reactor for Basic Line Module (20 kW)

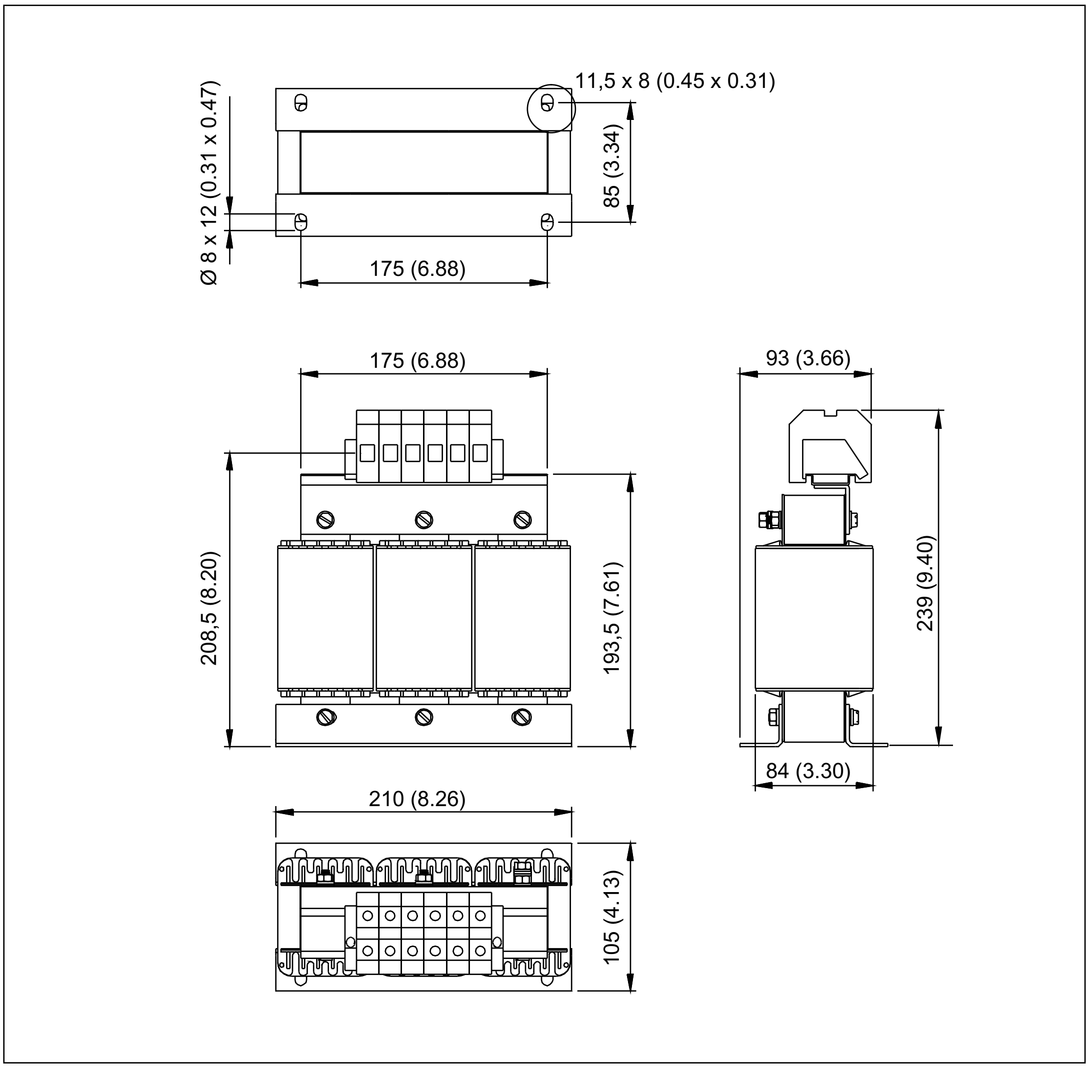


Figure 4-38 Dimension drawing: Line reactor for Basic Line Module (40 kW)

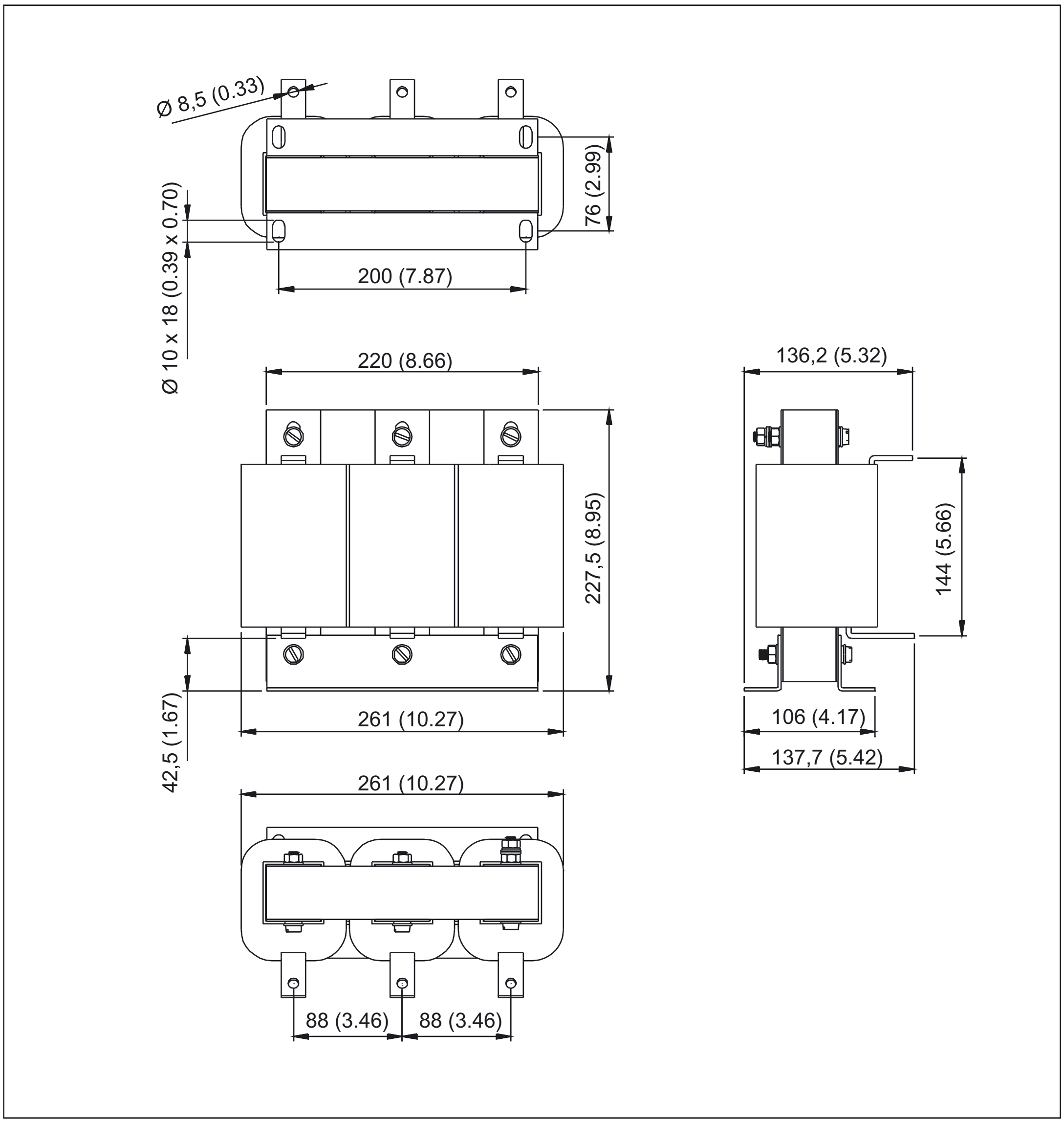


Figure 4-39 Dimension drawing: Line reactor for Basic Line Module (100 kW)

4.12.5 Technical specifications

Table 4-36 Technical specifications of line reactors for the Basic Line Modules

	6SL3000 unit	0CE22-0AAx	0CE24-0AAx	0CE31-0AAx
Power	kW	20	40	100
Rated current	A_{rms}	37	74	185
Power loss	W	130	270	480
Weight	kg	5,2	11,2	21,7

4.13 Line connection variants

4.13.1 Methods of line connection

A distinction is made between:

- Direct operation of the line connection components on the supply
- Operating line connection components via an autotransformer
- Operating line connection components via an isolating transformer

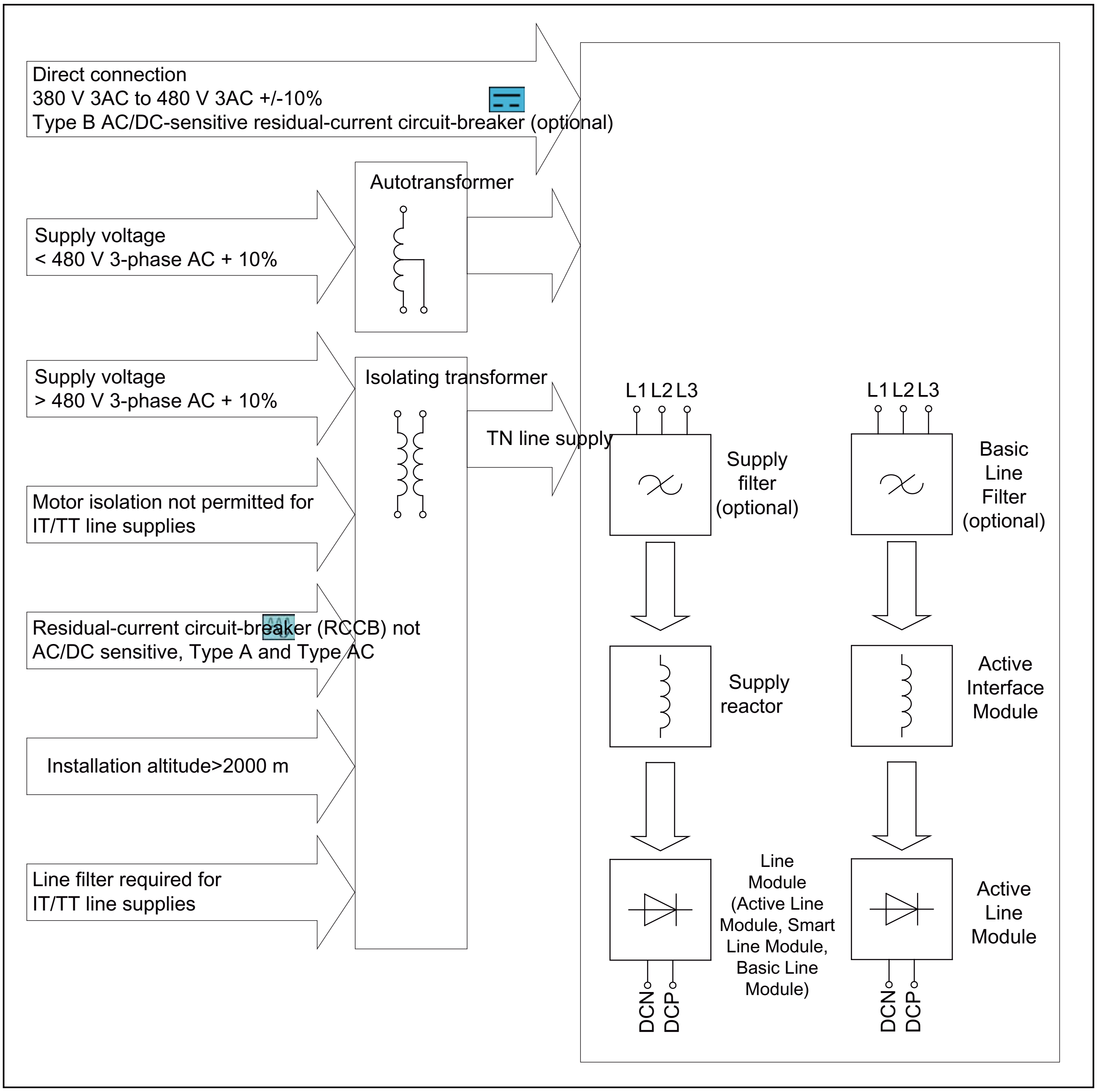


Figure 4-40 Overview of line connection versions

4.13.2 Operation of the line connection components on the supply network

The SINAMICS S Booksize converter system is rated for direct operation on TN, TT, and IT line supply systems with a rated voltage of 380 V 3 AC to 480 V 3 AC.

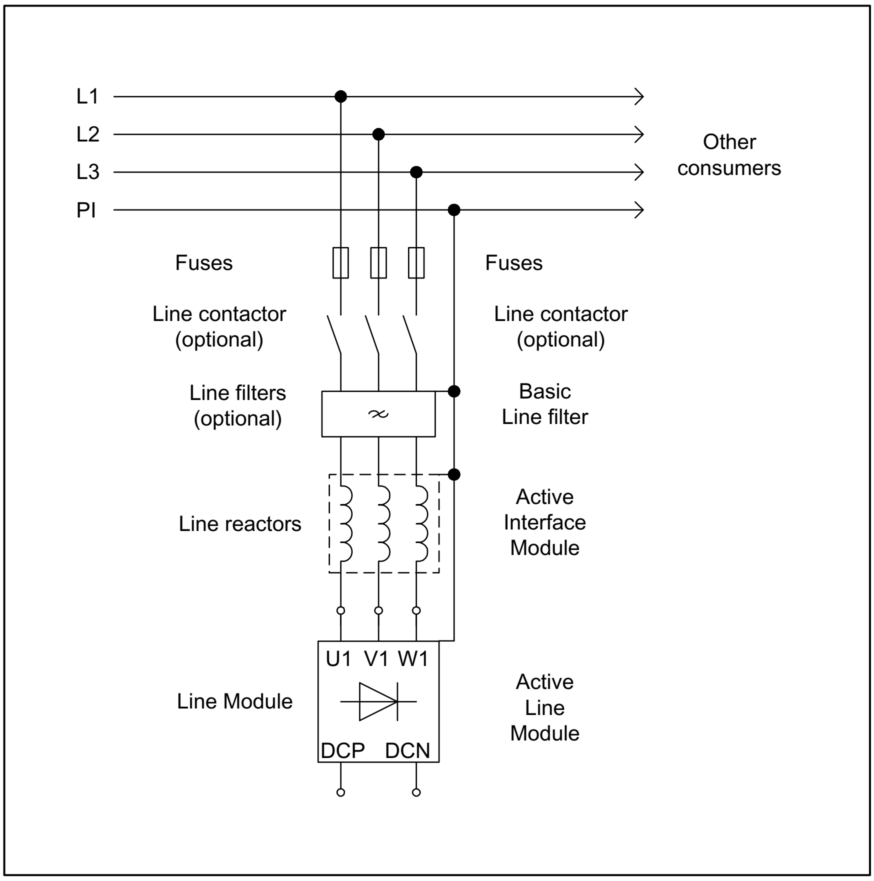


Figure 4-41 Direct operation on the line supply

4.13.3 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 %.

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

Applications:

- The motor insulation must be protected from excessive voltages.
- The active line module must provide a stabilized DC link voltage. This is possible with a rated voltage of 380 V to 415 V.
  A combination with motors that may be operated with a DC link voltage of up to 660 V, and a line voltage > 415 V requires a controlled DC link voltage.

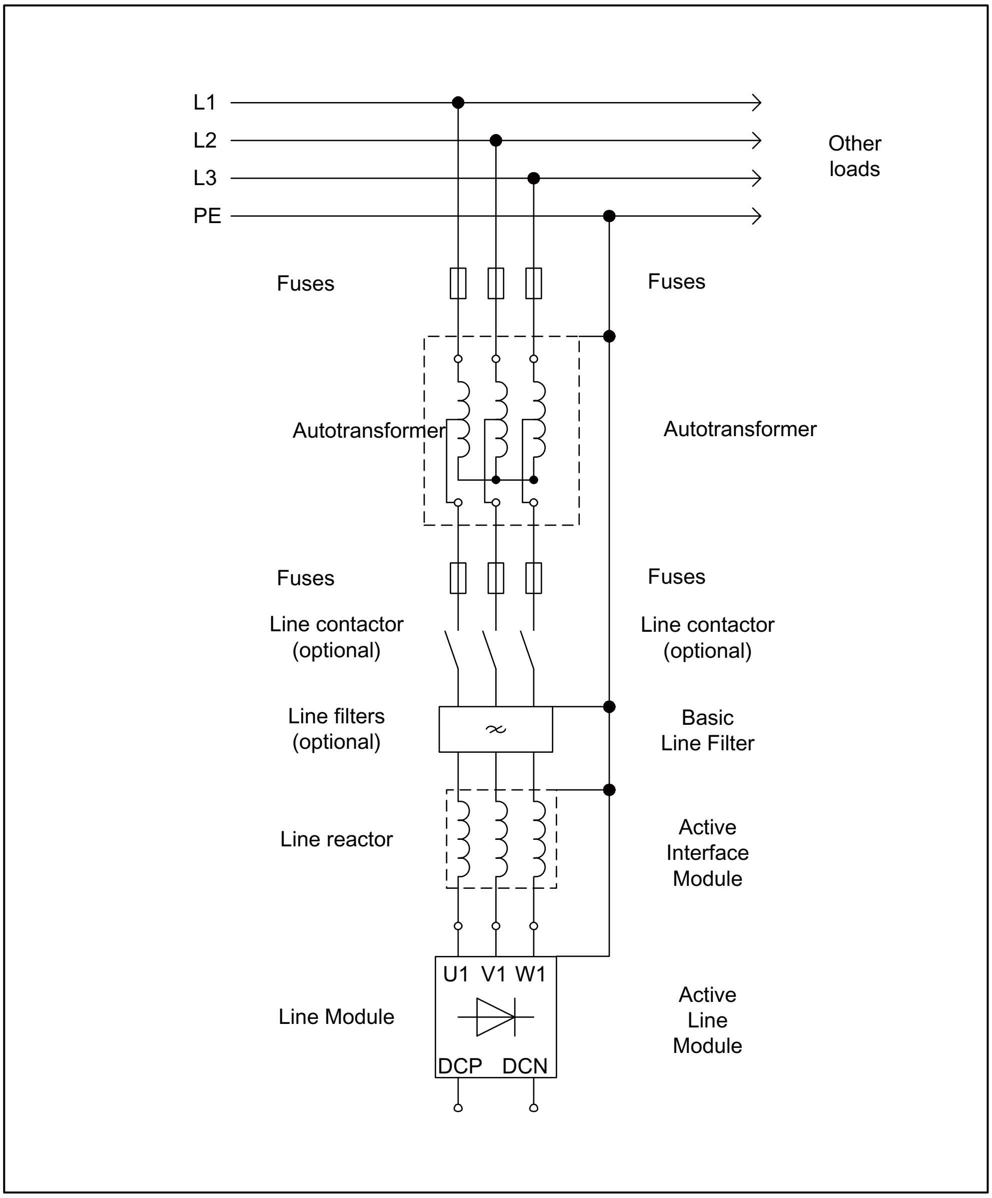


Figure 4-42 Autotransformer

4.13.4 Operation of the line connection components via an isolating transformer

The isolating transformer converts the network configuration of the system (e.g. IT/TT system) to a TN system. 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 Motor Module and/or the motor is not suitable for the voltages that occur.
- There is no compatibility with an existing residual-current protective device.
- The installation altitude is higher than 2000 m above sea level.
- A line filter should be used in a line supply system that is not a TN line supply system with grounded neutral conductor.

Note

In IT systems and when a Basic Line Filter is used, the connection bracket for the interference-suppression capacitor must be removed when a 80 kW or 120 kW Active Interface Module is used.

CAUTION
If the supply voltage is greater than 480 V +10 %, it is not permissible to use an autotransformer. An isolating transformer must be used to ensure protective separation.

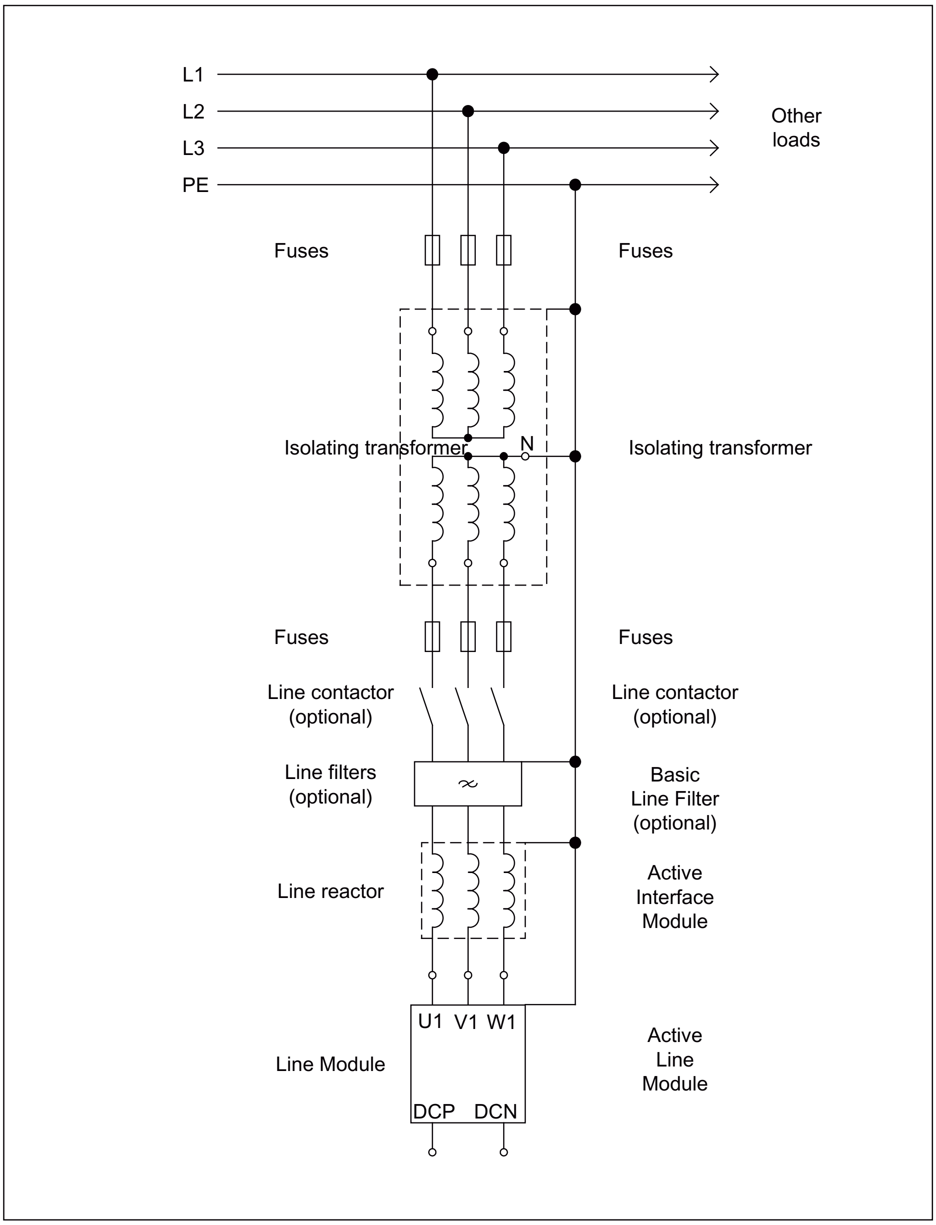


Figure 4-43 Isolating transformer

4.13.5 Line connection via a ground-fault circuit interrupter

In addition to the implemented protective measures against direct and indirect contact, selectively tripping AC/DC-sensitive residual-current circuit-breakers (Type B) can be used.

⚠ DANGER

Residual-current circuit-breakers alone are not permissible to provide protection against direct and indirect contact.

Note

Operation behind residual-current circuit-breakers is currently only possible with the 5 kW, 10 kW, 16 kW, 20 kW and 36 kW Line Modules.

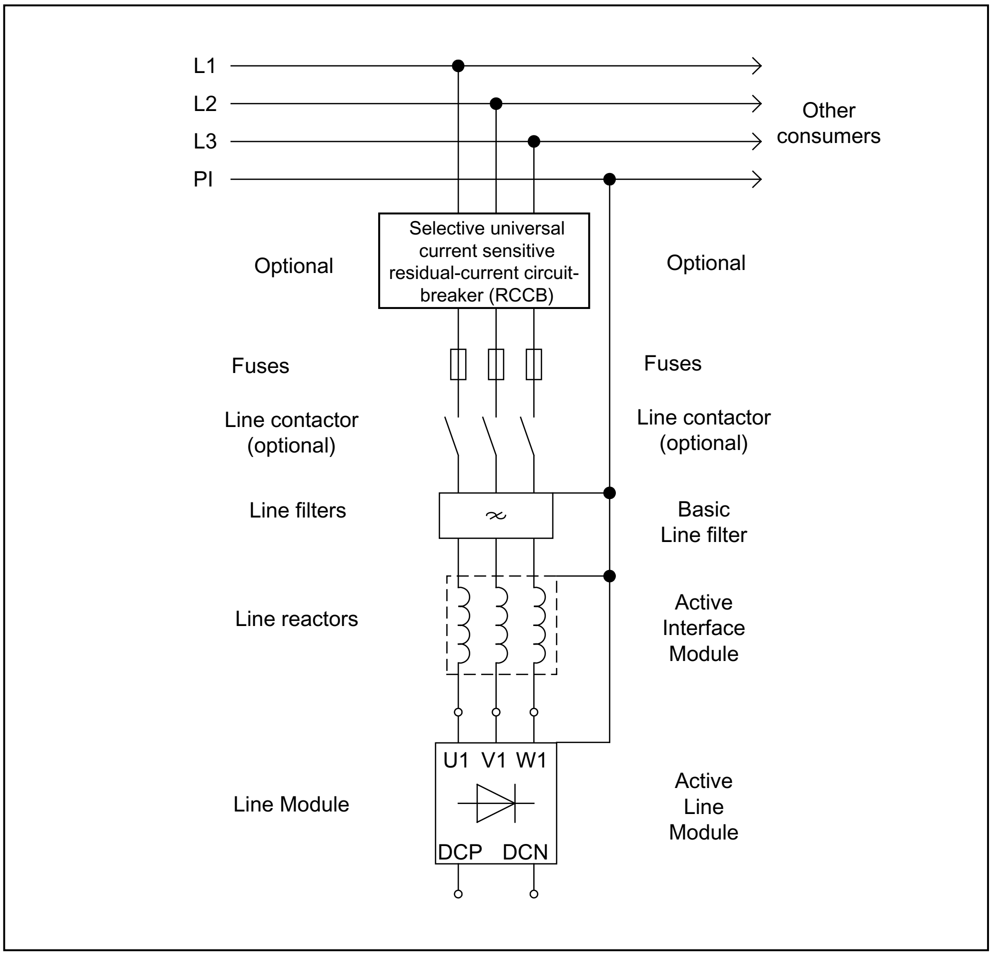


Figure 4-44 Residual-current circuit-breaker (RCCB)

Please note the following:

- It is only permissible to use a delayed tripping, selective AC/DC-sensitive residual-current circuit-breakers, Type B.
- The max. permitted grounding resistance of the "selective protective equipment" is included (83 Ω max. for residual-current circuit-breakers with 0.3 A rated differential current).
- Accessible parts of the Power Drive System and the machine are connected to the system's protective ground conductor.
- The total length of the shielded power cables in the drive line-up (motor cables incl. line supply cables from line filters to the connecting terminals of the line module) must be less than 350 m.
- Only recommended line filters must be used during operation.
- Only one residual-current circuit-breaker may be connected in series (cascading is not possible).
- Switching elements (main power switch, contactor) for connecting and disconnecting the drive group have max. 35 ms delay time time between the closing/opening of the individual main contacts.

Recommendation

SIEMENS selectively switching AC/DC-sensitive residual-current circuit-breakers in accordance with EN 61009-1 of the 5SM series (e.g. 5SM3646-4 or 5SM3646-4+5SW3300 with an auxiliary disconnector (1 NC contact / 1 NO contact) for a rated current of 63 A and rated fault current of 0.3 A (see catalog "BETA Modular Installation Devices - ET B1")).

NOTICE
AC or pulse-sensitive RCCBs are not suitable.

5 Active line modules with cold plate

5.1 Description

Active Line Modules generate a constant, regulated DC voltage in the DC link from the three-phase line supply voltage that supplies the connected Motor Modules with power.

This ensures that they are not influenced by network fluctuations.

When the motors are in feedback mode, Active Line Modules supply power back to the network. The regenerative feedback capability of the modules can be deactivated by parameterization.

The DC link starts precharging as soon as the supply voltage is applied and is independent of its phase sequence direction. Load can be applied to the DC link after the modules have been enabled. An optional main contactor is required for disconnecting the voltage.

Active Line Modules can be directly connected to TN and TT line supplies - both with grounded neutral point and also with grounded protective conductor; they can also be connected to IT line supplies. The Line Modules have an integrated overvoltage protection function.

5.2 Safety information

⚠ DANGER
Risk of electric shock. A hazardous voltage is present for up to 5 minutes after the supply has been disconnected. The protective cover may only be opened after this time has expired.

⚠ WARNING
When opening the protective cover for the DC link, you must press the release catch. A suitable tool (e.g. screwdriver) must be used for this purpose. The components must only be operated when the protective cover of the DC link is closed. Damaged components must not be used further. If this is not carefully observed, it can result in subsequent damage and accidents.

⚠ WARNING

A sufficiently high short-circuit power is required for tripping the fuses within the predefined time in the event of a ground fault. Insufficient short-circuit power increases the time to trip beyond permissible levels (e.g. fire possible).

⚠ DANGER

The Active Line Modules conduct a high leakage current via the PE conductor. Because of the high leakage current of the Active Line Modules, a permanent PE connection of the Active Line Module or control cabinet is required. Because of the high leakage current of the Motor Modules, a permanent PE connection of the Motor Module or control cabinet is required.

EN 61800-5-1 also stipulates the following precautions:
Either protective conductor cross-sections of ≥ 10 mm^2 Cu or installation of a second protective conductor of the same size as the first protective conductor.

⚠ DANGER

The DC link discharge voltage hazard warning in the local language must be attached to all of the components.
A set of labels in 16 languages is supplied with the component.

⚠ WARNING

The cooling clearances of 80 mm above and below the components must be observed.

⚠ DANGER

It is only permissible to establish connections to the DC link using the adapters that SIEMENS has recommended (DC link adapter and DC link rectifier adapter).

CAUTION

The tightening torque of the DC link busbar screws (1.8 Nm, tolerance +30%) must be checked before commissioning. After being transported the screws must be tightened.

For line supplies without regenerative feedback capability (e.g. diesel generator), the regenerative feedback capability of the Active Line Module must be deactivated using a parameter (see Description of Functions). The braking energy must then be dissipated via an additional Braking Module with a braking resistor in the drive line-up.

⚠ DANGER

If, at the lefthand end of the drive line-up, there is a 50 mm wide Motor Module or a DC link component of the appropriate width (e.g. Braking Module, CSM, VCM), then the DC link bridge and all of the associated screws must be removed completely. It is not permissible to insert the screws without a DC link bridge.

For all other power units and DC link components (e.g. Capacitor Module) that are wider than 50 mm, the DC link bridge must be moved as far as possible to the right and secured with screws; it must not be moved to the left or removed.

If this is not carefully observed, this can result in damage and accidents.

CAUTION

The total length of the power cables (motor supply cables and DC link cables) must not exceed 350 m in active mode.

The total length of the power cables (motor supply cables and DC link cables) must not exceed 1000 m in active mode in conjunction with the Active Interface Module and Basic Line Filter.

CAUTION

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

CAUTION

The DC link peripheral covers are supplied as standard with the components; they can also be ordered separately, if required (order no.: 6SL3162-5AA00-0AA0).

5.3 Interface description

5.3.1 Overview

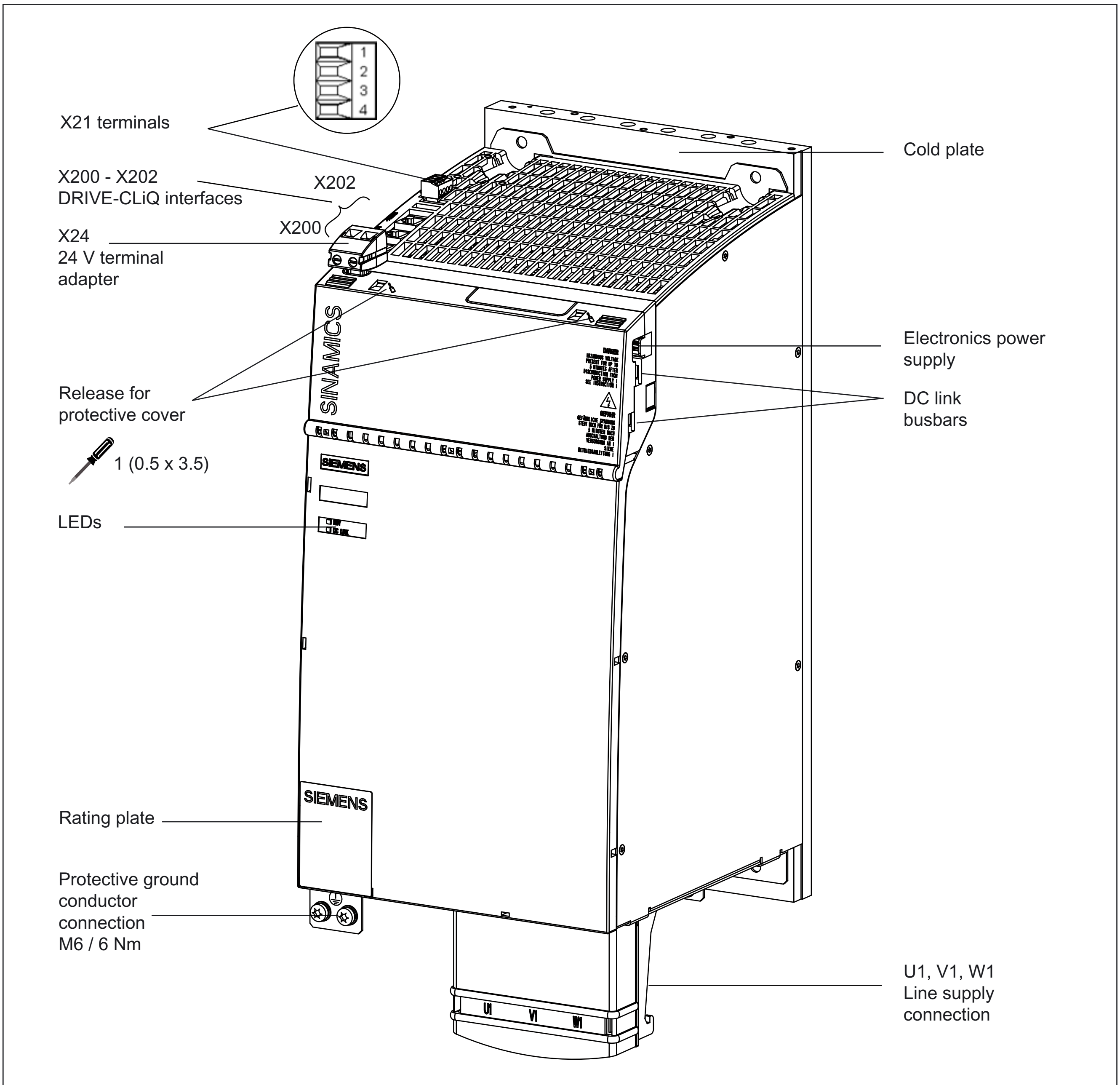
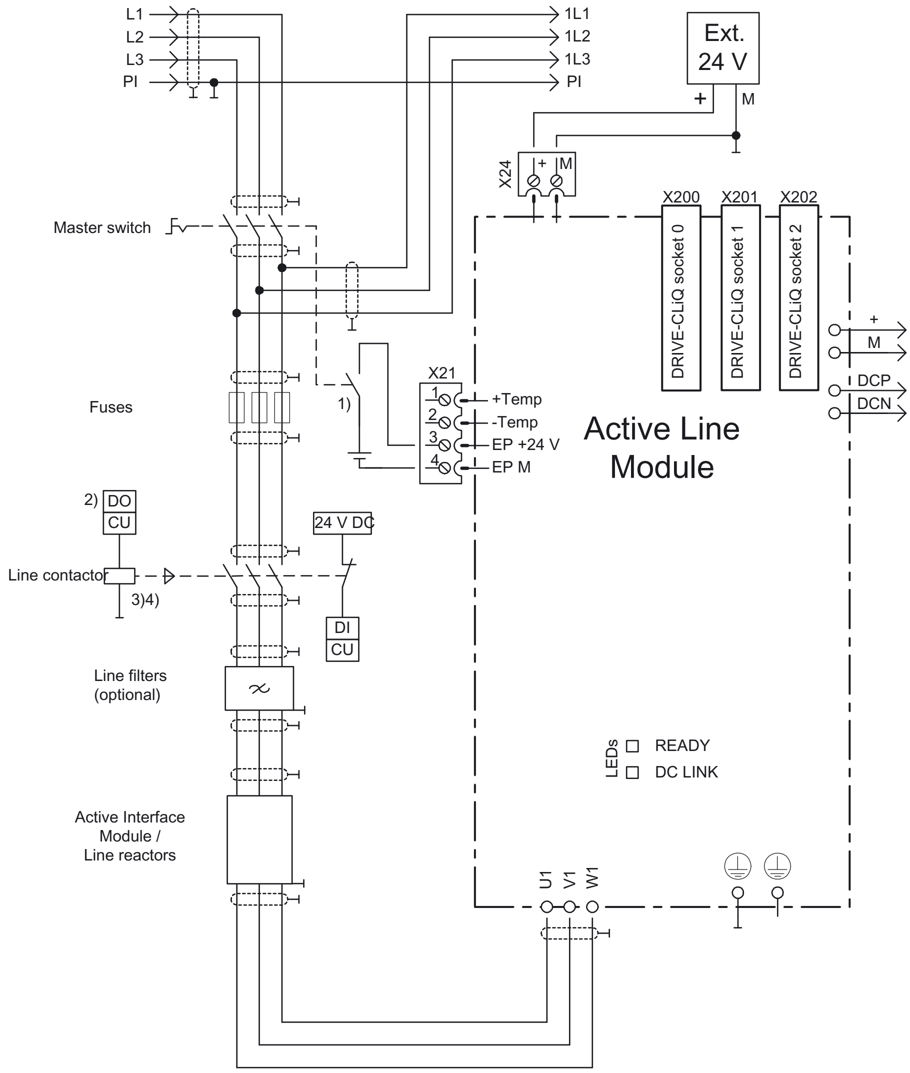


Figure 5-1 Active line module With cold plate (example: 55 kW)

5.3.2 Connection example

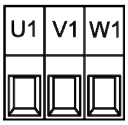
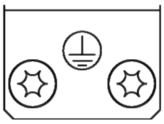


1) Leading opening contact t >10 ms
2) DI/DO (controlled by Control Unit)
3) No additional consumer permitted downstream of line contactor
4) Note the current carrying capacity of the DO.
An output interface element may have to be used.

Figure 5-2 Connection example: active line module with cold plate

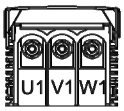
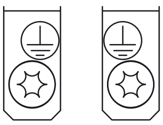
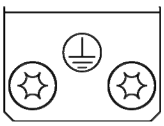
5.3.3 X1 line connection

Table 5-1 Terminal block X1 Active Line Module 16 kW

	Terminal	Technical specifications
	U1 V1 W1	Max. connectable cross-section: 10 mm^2 Type: Screw terminal 6 (see Connection Methods) Tightening torque: 1.5 - 1.8 Nm
	PE connection	Threaded hole M5/3 Nm [1]

[1] for ring cable lugs to DIN 46234

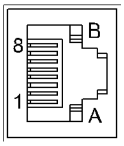
Table 5-2 Terminal block for the Active Line Module (36 kW to 120 kW)

	Terminals	Technical specifications
	U1 V1 W1	Max. connection voltage: 3-ph. 480 V AC +10 % at 47 Hz to 63 Hz **36 kW:** Threaded bolt M6/6 Nm [1)] **55 kW, 80 kW and 120 kW** Threaded bolt M8/13 Nm [1)]
	PE connection	**36 kW:** Threaded hole M6/6 Nm [1)]
		**55 kW:** Threaded hole M6/6 Nm [1)] **80 kW and 120 kW:** Threaded hole M8/13 Nm [1]

[1] for ring cable lugs to DIN 46234

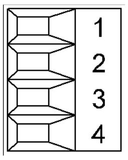
5.3.4 X200-X202 DRIVE-CLiQ interfaces

Table 5-3 DRIVE-CLiQ interface X200-X202

	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)	24 V power supply
	B	M (0 V)	Electronics ground
Blanking plate for DRIVE-CLiQ interface: Fa. Yamaichi, Bestellnummer: Y-ConAS-13			

5.3.5 EP terminals X21

Table 5-4 Terminal block X21

	Terminal	Designation	Technical specifications
	1	+Temp	Temperature sensor connection KTY84–1C130 / PTC
	2	-Temp	
	2	EP +24 V (enable pulses)	Voltage 24 V DC Current consumption: 10 mA Isolated input Signal propagation times: L → H: 100 µs H → L: 1000 µs
	4	EP M (enable pulses)	
Max. connectable cross-section: 1.5 mm² Type: Screw terminal 1 (see Appendix A)			

Note

For operation, 24 V DC must be connected to terminal 3 and ground to terminal 4. When removed, pulse inhibit is activated (if this has been parameterized).

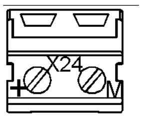
If the Line Module is not disconnected from the network (e.g. with a main contactor), the DC link remains charged.

NOTICE

Before the drive line-up is switched off by means of the line disconnecting device, the voltage at terminals 3 (EP +24 V) and 4 (EP M) must be interrupted. This can be carried out using a leading breaking auxiliary contact (≥ 10 ms), for example.

5.3.6 X24 24 V terminal adapter

Table 5-5 Terminal block X24

	Terminal	Designation	Technical specifications
	+	24 V power supply	24 V DC supply voltage
	M	Ground	Electronics ground
The 24 V terminal adapter is supplied as standard Max. connectable cross-section: 6 mm^2 Type: Screw terminal 5 (see Appendix A)			

5.3.7 Meaning of the LEDs on the Active Line Module

Table 5-6 Meaning of the LEDs on the Line Module

LED	Color	State	Description
READY	-	Off	Electronics power supply outside the permissible tolerance range.
	Green	Steady light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	Steady light	DRIVE-CLiQ communication is being established.
	Red	Steady light	At least one fault is present in this component.
	Green Red	Flashing 2 Hz	Firmware is being downloaded.
	Green/ Orange or Red/ Orange	Flashing 2 Hz	Component recognition via LED is activated (p0124). Note: Both options depend on the LED status when module recognition is activated via p0124 = 1.
DC LINK	-	Off	Electronics power supply outside the permissible tolerance range.
	Orange	Steady light	DC link voltage within permissible tolerance range (only when ready for operation)
	Red	Steady light	DC link voltage outside the permissible tolerance range (only when Active Line Module is ready for operation).

WARNING

Hazardous DC link voltages may be present at any time regardless of the status of the "DC link" LED.

The warning information on the components must be carefully observed!

Cause and rectification of faults

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

Reference: /IH1/ SINAMICS S120, Commissioning Manual.

5.4 Dimension Drawing

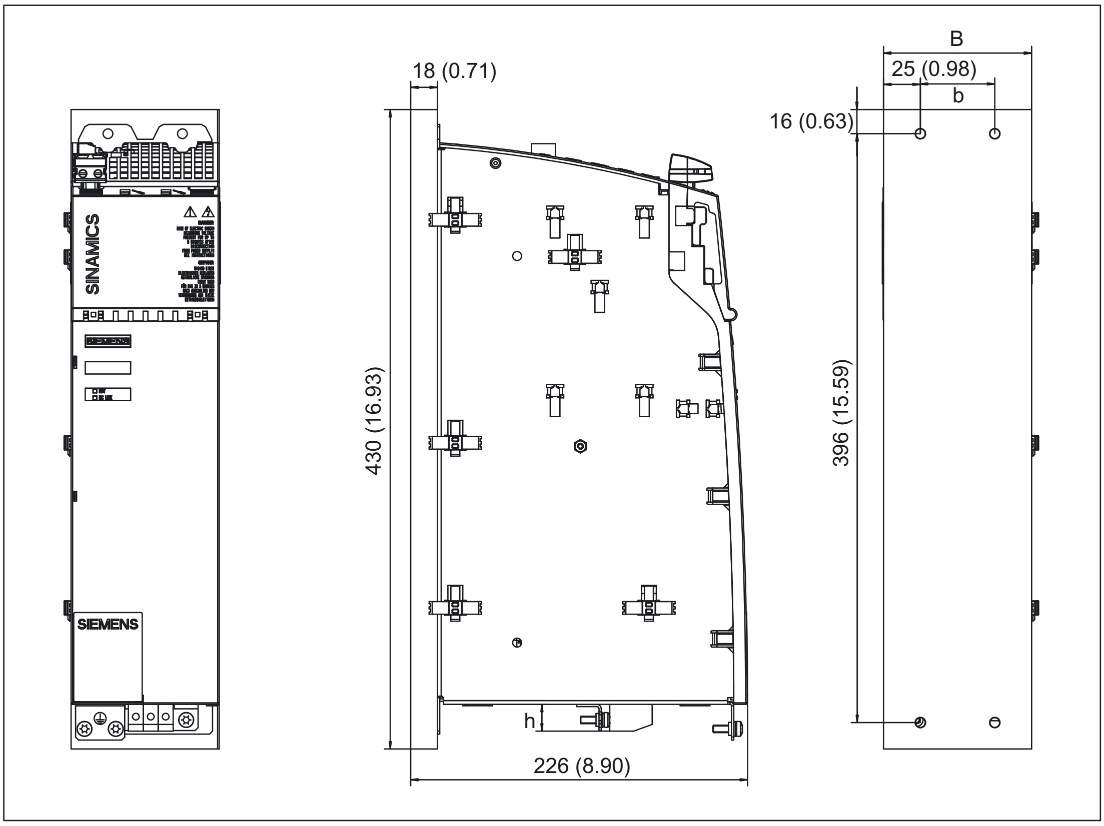


Figure 5-3 Dimension drawing, Active Line Module with cold plate (16 kW)

Table 5-7 Dimension drawing, Active Line Module with cold plate (16 kW)

Line module type	Order number	W [mm] (inches)	b [mm] (inches)	h [mm] (inches)
16 kW	6SL3136-7TE21-6AAx	100 (3.94)	50 (1.97)	18 (0.71)

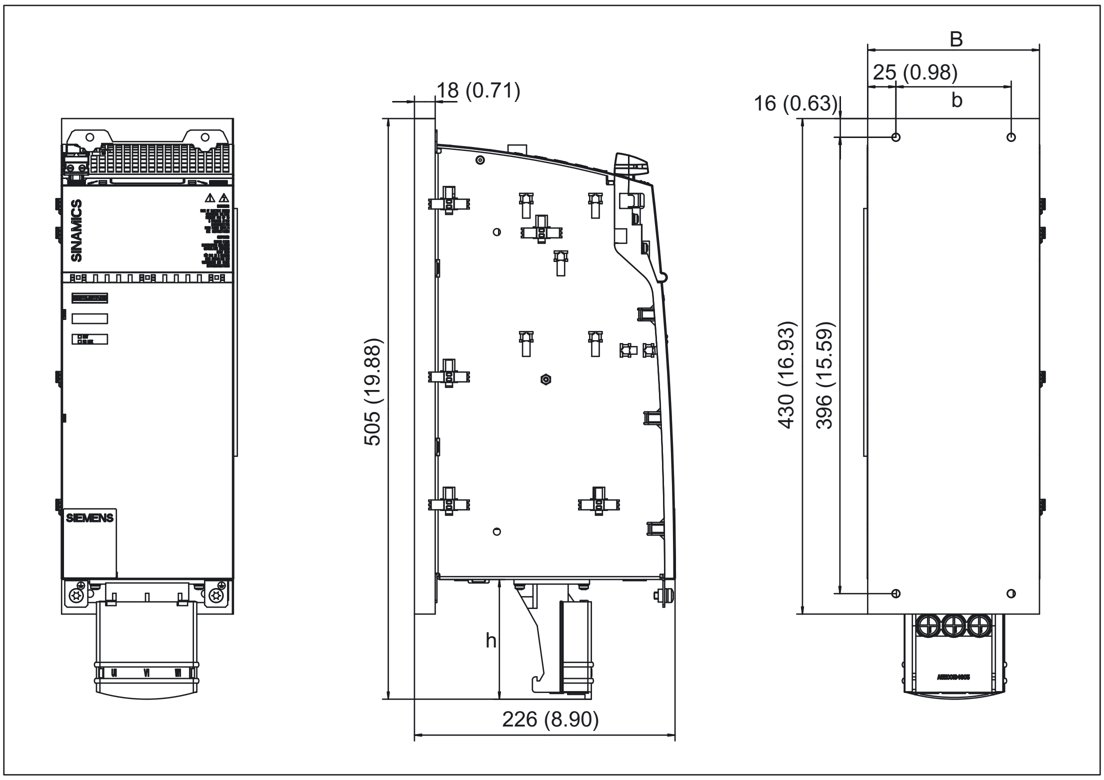


Figure 5-4 Dimension drawing, Active Line Module with cold plate (36 kW, 55 kW, 80 kW, and 120 kW)

Table 5-8 Dimensions, Active Line Modules with cold plate (36 kW, 55 kW, 80 kW, and 120 kW)

Line module type	Order number	W [mm] (inches)	b [mm] (inches)	h [mm] (inches)
36 kW	6SL3136-7TE23-6AAx	150 (5.91)	100 (3.94)	78 (3.07)
55 kW	6SL3136-7TE25-5AAx	200 (7.87)	150 (5.91)	78 (3.07)
80 kW	6SL3136-7TE28-0AAx	300 (11.81)	250 (9.84)	78 (3.07)
120 kW	6SL3136-7TE31-2AAx	300 (11.81)	250 (9.84)	78 (3.07)

5.5 Installing the Cold-Plate Modules on Customer-Specific Heat Sinks

Mounting the cold plate component on customer-specific heat sinks

Note the following before installation:

- Before mounting, check the surface of the heat sink to ensure that it is not damaged.
- To facilitate installation, M6 screw bolts and hexagon nuts/threaded pins (ISO 7436-M6x40-14 H, strength class 8.8) are recommended.
- To improve heat transfer, a heat-conducting medium must be used. Special spherical-indented heat-conducting film must be used for this purpose. Every cold plate power unit is supplied with heat-conducting film cut to the right size. Note the installation position of the heat-conducting film (see diagram below).

Note

When a component is replaced, the heat-conducting film must also be replaced.
Only heat-conducting film approved or supplied by Siemens can be used.

	Order No.
Heat-conducting foil, 50 mm	6SL3162-6FB00-0AA0
Heat-conducting foil, 100 mm	6SL3162-6FD00-0AA0
Heat-conducting foil, 150 mm	6SL3162-6FF00-0AA0
Heat-conducting foil, 200 mm	6SL3162-6FH00-0AA0
Heat-conducting foil, 300 mm	6SL3162-6FM00-0AA0

Installation

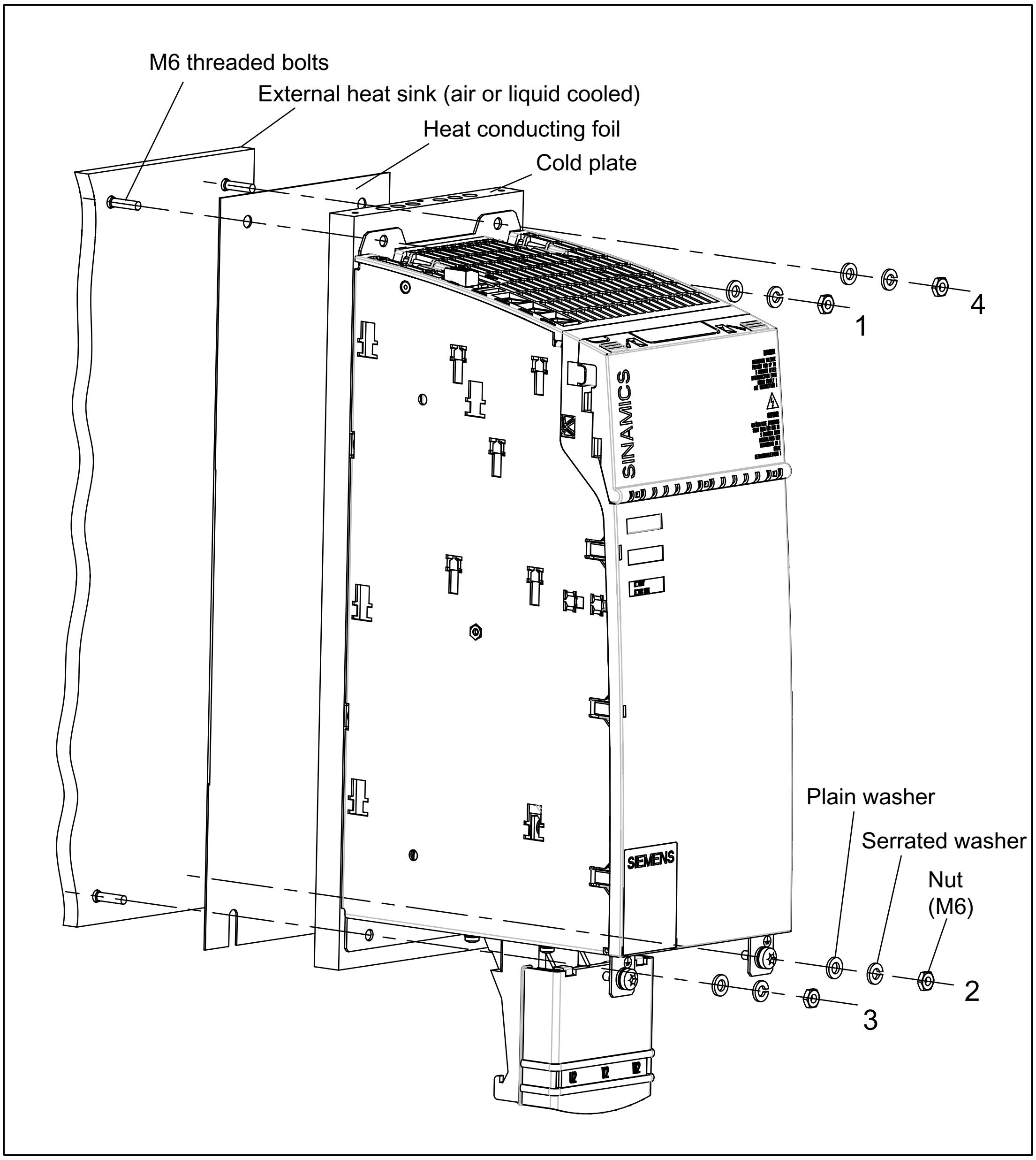


Figure 5-5 Installing a cold-plate power section with an external heat sink and heat-conducting film

To begin, tighten the screws by hand (approx. 0.5 Nm) in the sequence shown (steps 1 to 4) and then secure them (10 Nm).

Help with the mechanical cabinet design is available from:
Siemens AG
A&D SE WKC
CoC CabinetCooling
P.O. Box 1124
09070 Chemnitz, Germany
E-mail: cc.cabinetcooling@siemens.com

Properties of the heat sink

AlMgSi 0.5 is recommended as the heat sink material.
The roughness of the external heat sink surface should be at least Rz 16 and the contact surface between the heat sink and cold plate should have an evenness of 0.2 mm (applicable to a height of 450 mm and width of 300 mm).

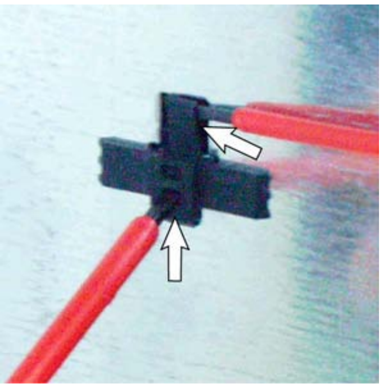
Note

The machine manufacturer can adapt the heat sink version to his special requirements. The specified rated data for the Power Modules can only be achieved if the power losses can be dissipated by the external heat sink under the specified general conditions.

NOTICE
When mounting, you must ensure that the threaded bolts do not damage the cold plate.

Remove the holder for securing the Control Unit.

If an additional component is to be flush-mounted to the left of the component, the holders for securing the Control Unit must be removed.

		
Use suitable tools to lift the latching device and push up the holder	Remove the holder	Holder removed

5.6 Technical Specifications

Table 5-9 Technical data for Active Line Modules with cold-plate cooling

	6SL3136-7TE	21-6AAx	23-6AAx	25-5AAx	28-0AAx 2)	31-2AAx 2)
Rated power	kW	16	36	55	80	120
Connection voltages: Line voltage Line frequency Electronics power supply	 V_{ACrms} Hz V_{DC}	 3-ph. 380 V AC – 10% (-15% < 1 min) up to 3-ph. 480 V AC + 10% 47 to 63 24 (20.4 – 28.8)				
DC link voltage Overvoltage tripping Undervoltage tripping	V_{DC} V_{DC} V_{DC}	510 – 720 820 ± 2 % 360 ± 2 %				
DC link busbar current carrying capacity	A_{ACrms}	100	100	200	200	200
24 V busbar current carrying capacity	A_{ACrms}	20	20	20	20	20
Electronics current consumption	A_{DC}	See Chapter Cabinet design and EMC				
Infeed: Rated power (S1) Infeed power (S6-40%) Peak infeed power	 kW (Pn) kW (Ps6) kW (Pmax)	 16 21 35	 36 47 70	 55 71 91	 80 106 131	 80 158 175
Regenerative feedback: Continuous regenerative feedback powerPeak regenerative feedback power	 kW kW	 16 35	 36 70	 55 91	 80 131	 120 175
Line currents: at 380 V_{AC} at 480 V_{AC} / 528 V_{AC} at 480 V; S6-40% Peak current (at 400 V_{AC} / 480 V_{AC})	 A_{AC} A_{AC} A_{AC} A_{AC}	 26 21 / 19 27 54 / 45	 58 46 / 42 60 107 / 89	 88 70 / 64 92 139 / 116	 128 102 / 93 134 200 / 222	 192 152 / 139 201 267 / 222
DC link current: Rated current with S6-40% peak current	 A_{DC} A_{DC} A_{DC}	 27 35 59	 60 79 117	 92 121 152	 134 176 195	 200 244 292
Max. permissible heat sink temperature	°C	70	70	78	70	75
Max. ambient temperature without derating	°C	40	40	40	40	40
Max. ambient temperature with derating	°C	55	55	55	55	55
DC link capacitance	µF	710	1410	1880	2820	3760

	6SL3136-7TE	21-6AAx	23-6AAx	25-5AAx	28-0AAx [2)]	31-2AAx [2)]
Maximum permissible DC link capacitance	µF	20 000	20 000	20 000	20 000	20 000
Power factor	cosφ	1	1	1	1	1
Weight	kg	6,1	10,2	13,8	20,3	20,4
Power loss		See Chapter Cabinet design and EMC				

1) The specified values apply for 380 V

2) The specified rated power values/currents can only be achieved if direct liquid cooling is used. When mounting on an external heat sink, derating must be applied. At a temperature of 40 °C at the interface to the power section, 80% derating occurs for
6SL3136-7TE 28-0AAx
and 70% for 6SL3136-7TE 31-2AAx

Rated duty cycles of Active Line Modules

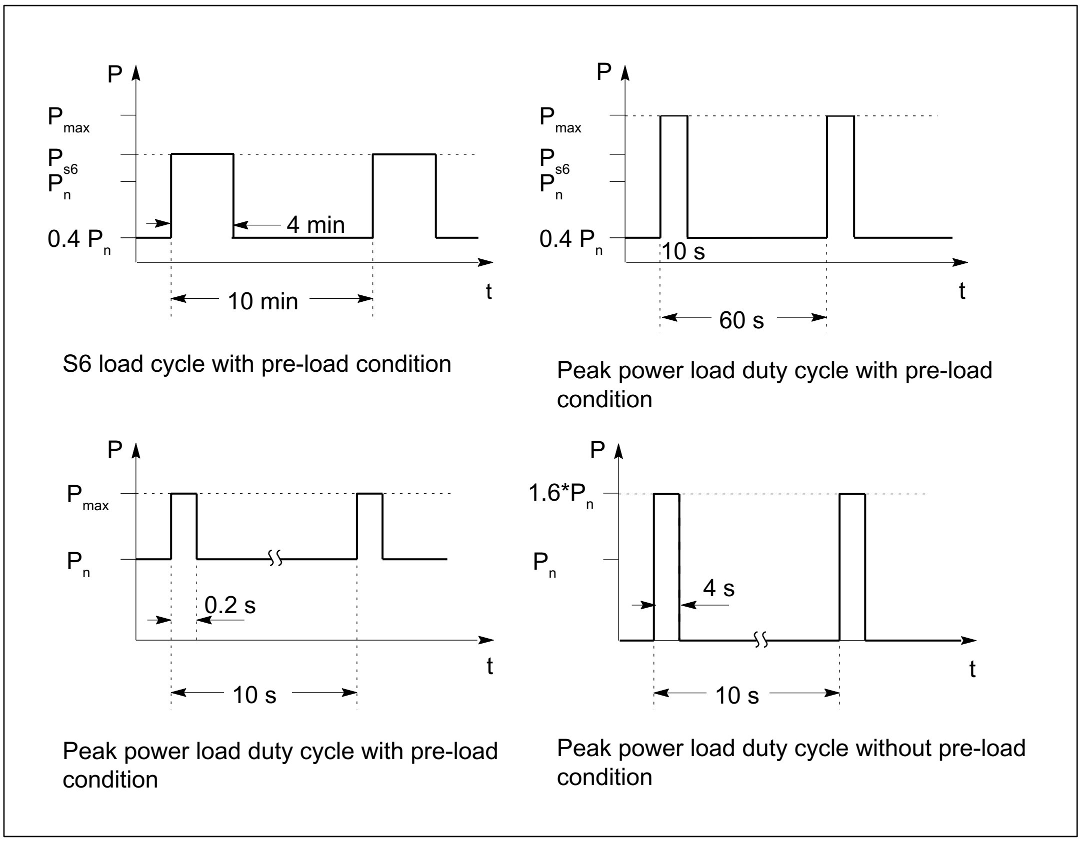


Figure 5-6 Rated duty cycles of Active Line Modules

Derating as a function of the ambient temperature

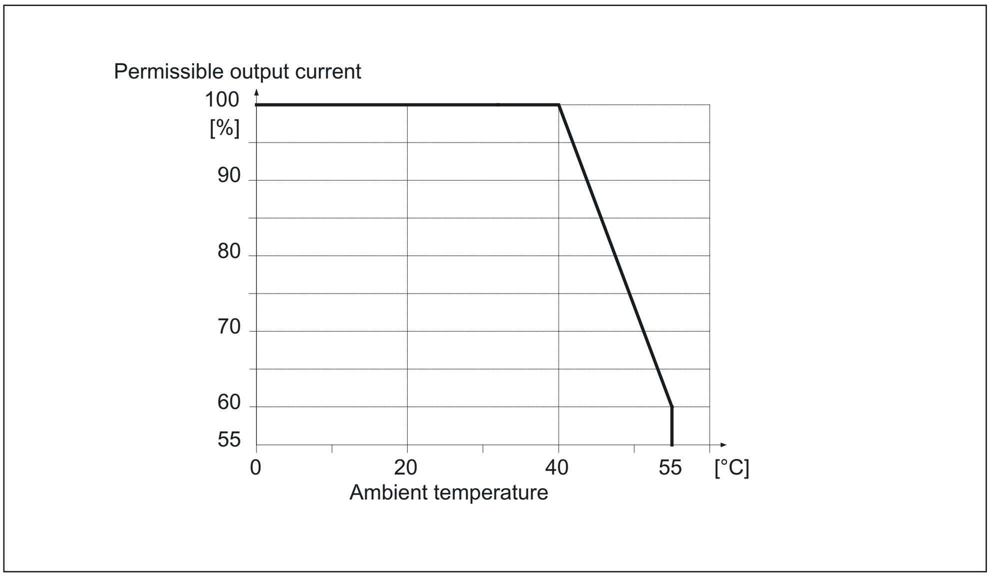


Figure 5-7 Derating as a function of the ambient temperature

Derating as a function of the site altitude

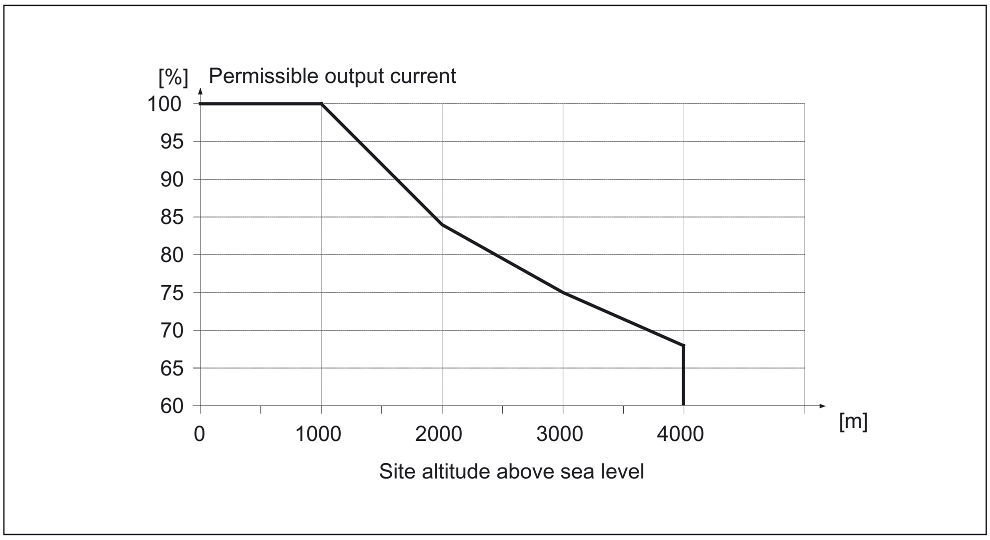


Figure 5-8 Derating as a function of the site altitude

Voltage derating as a function of the installation altitude

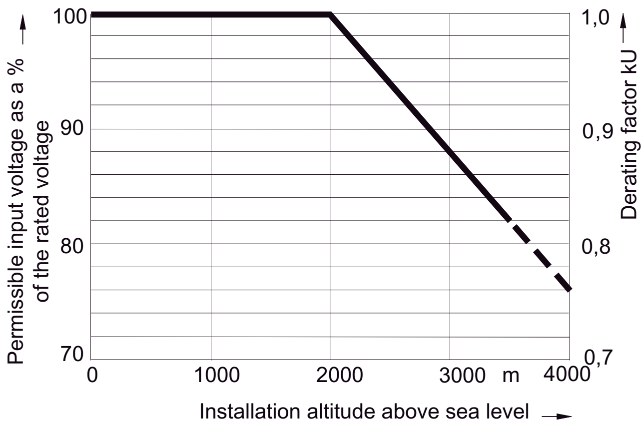


Figure 5-9 Voltage derating as a function of the installation altitude

Output power as a function of total cable length

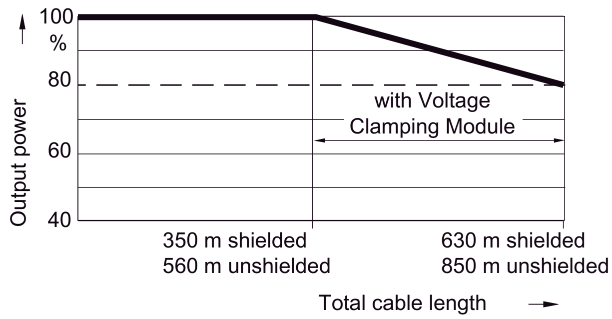


Figure 5-10 Output power as a function of total cable length

Basic Line Modules with cold plate 6

6.1 Description

The Basic Line Modules provide an unregulated DC link voltage that matches the rectified line input voltage.

One or more Motor Modules can be connected to the power supply network via the Basic Line Module. The Basic Line Module provides the DC link voltage for the Motor Modules.

To reduce the energy (e.g. for emergency retraction), a controller for an external braking resistor has been integrated in the 20 kW and 40 kW Basic Line Modules. An external Braking Module must be used for 100 kW Basic Line Modules.

The Basic Line Module is suitable for direct operation on TN, IT, and TT systems.

The 100 kW Basic Line Module includes a basic interference suppression, but the 20 kW and 40 kW Basic Line Modules do not include it.

The ratio of line short-circuit power to rated power must be ≥ 30.

The maximum total cable length for 20 kW and 40 kW Basic Line Modules (interference voltage category C2) is 350 m (shielded) with an upstream EMC filter (see Possible Line Reactor and Line Filter Combinations chapter)
500 m shielded and 750 m unshielded if the limit values are not observed.

The maximum total cable length for 100 kW Basic Line Modules (interference voltage category C2) is 350 m (shielded) with an upstream EMC filter and the same without an EMC filter for interference voltage category C3
(or 500 m shielded and 750 m unshielded if the limit values are not observed)

6.2 Safety information

⚠ DANGER
Risk of electric shock. Dangerous voltages are still present for up to 5 minutes after the power supply has been switched off. The protective cover must not be opened until this time has elapsed. When opening the protective cover for the DC link, you must activate the release. A suitable tool (e.g. screwdriver) must be used for this purpose. The components must only be operated when the protective cover of the DC link is closed. Damaged components must not be used further, as this could result in secondary damage or accidents.

⚠ DANGER
The DC link discharge time warning in the local language must be attached to all of the components. A set of labels in 16 languages is supplied with the component.

⚠ DANGER
A sufficiently high supply short circuit power is required for tripping the fuses within the predefined time in the event of a ground fault. The ratio between the line short-circuit power and the rated power of the Line Module must be ≥ 30. Low system fault values increase the time to trip beyond permissible levels (e.g. fire possible).

⚠ WARNING
A ventilation clearance of 80 mm above and below the components must be observed.

⚠ DANGER
The Basic Line Modules conduct a high leakage current via the PE conductor. A permanent PE connection for the Basic Line Module or control cabinet is required due to the high leakage current of the Basic Line Modules. Furthermore, the following measures must be taken according to EN 61800-5-1: Either protective ground conductor cross-sections ≥ 10 mm^2 Cu or installation of a second protective ground conductor of the same cross-section as the first one.

⚠ DANGER
It is only permissible to establish connections to the DC link using the adapters that SIEMENS has recommended (DC link adapter and DC link rectifier adapter).

⚠ CAUTION
The tightening torque of the DC link busbar screws (1.8 Nm, tolerance: +30 %) must be checked before commissioning is carried out when the system is disconnected from the power supply and the DC link is discharged. The screws must be tightened after transportation.

CAUTION
The DC link side covers are supplied as standard with the components; they can also be ordered separately, if required (order no.: 6SL3162-5AA00-0AA0).

Note

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

NOTICE
If a drive line-up is switched off by means of the line disconnecting device, the voltage at terminals 3 (EP +24 V) and 4 (EP M) must be interrupted beforehand. This can be achieved through e.g. an auxiliary contact.

6.3 Interface description

6.3.1 Overview

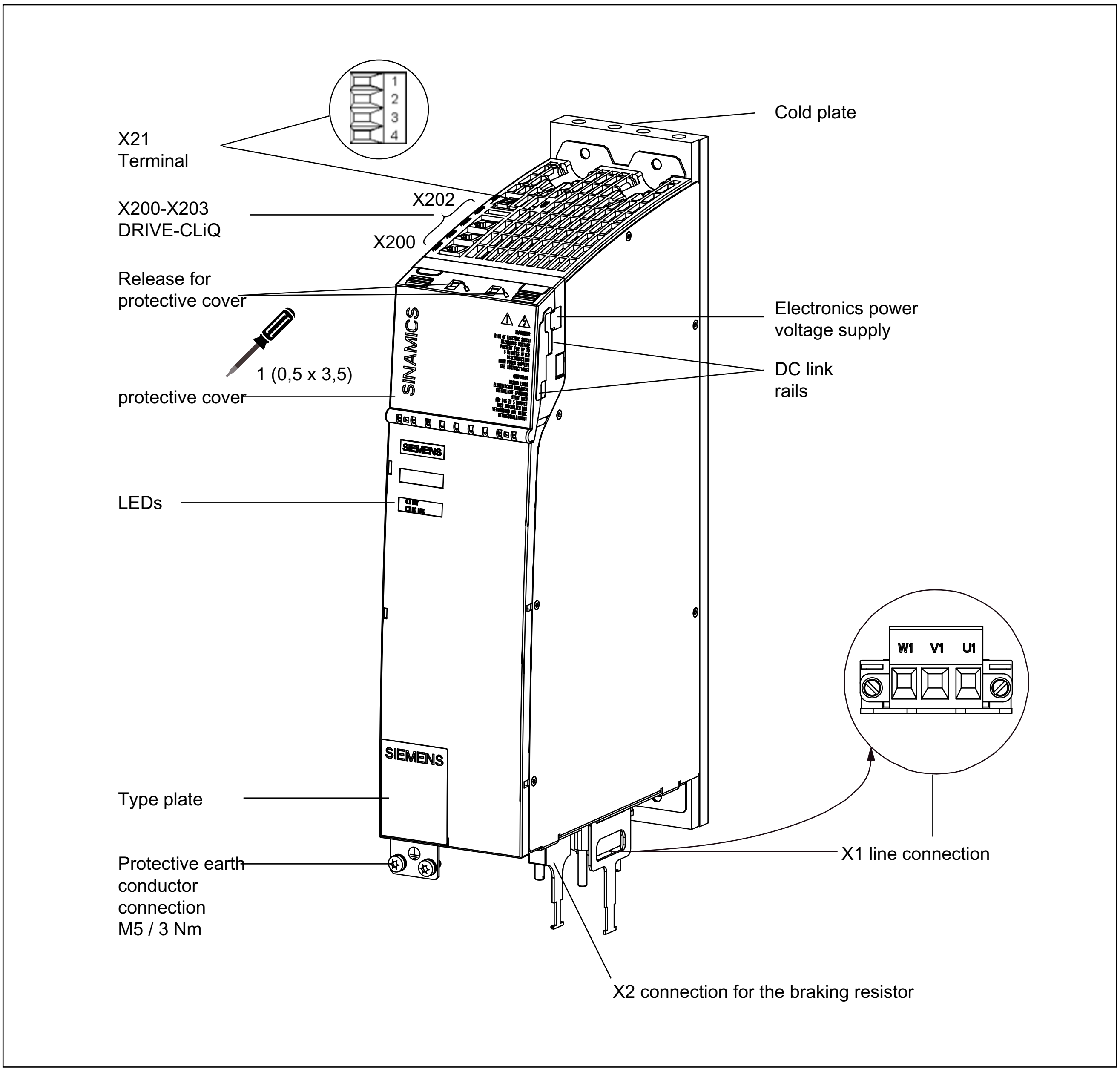


Figure 6-1 Interface description: Basic Line Module with cold-plate cooling (20 kW)

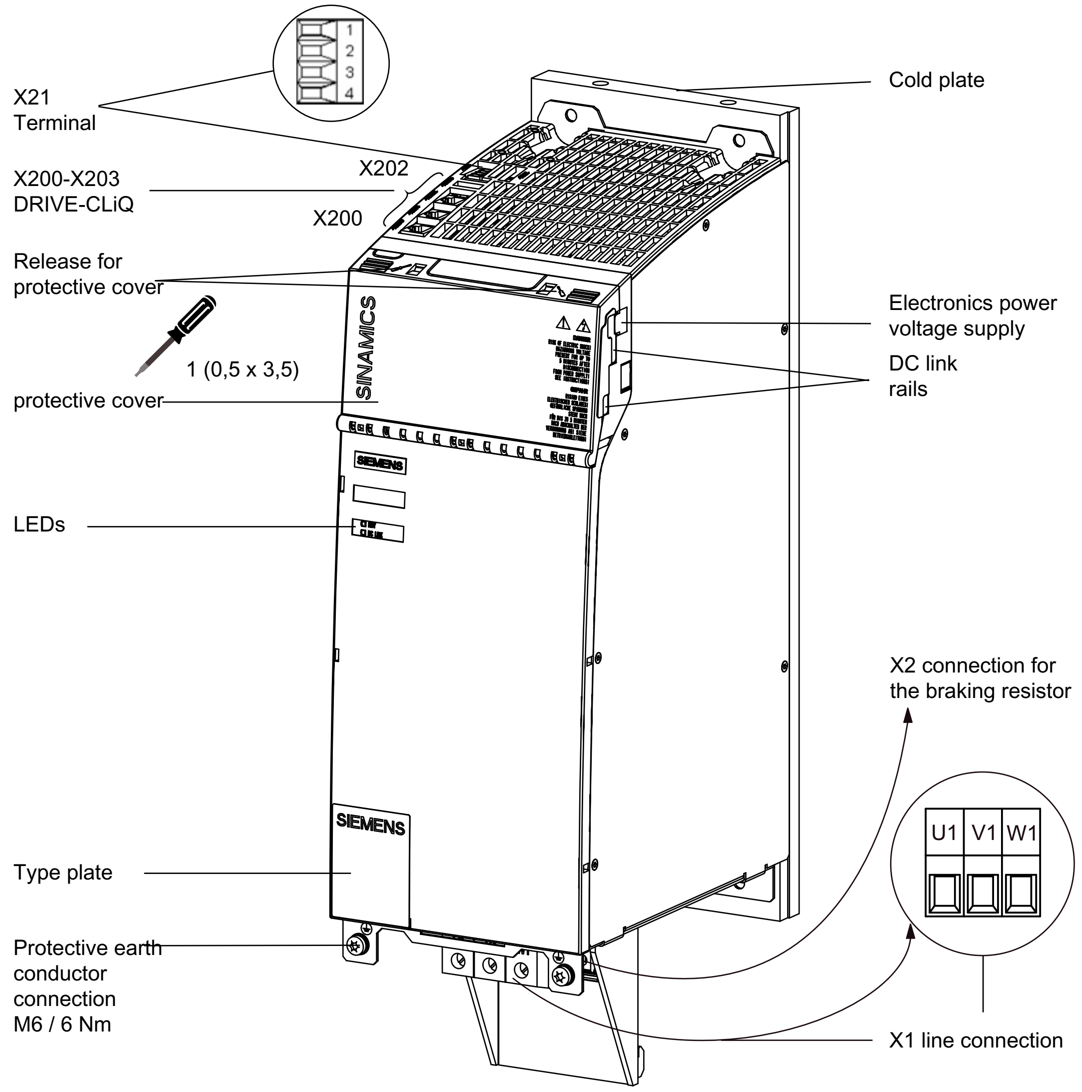


Figure 6-2 Interface description: Basic Line Module with cold-plate cooling (40 kW)

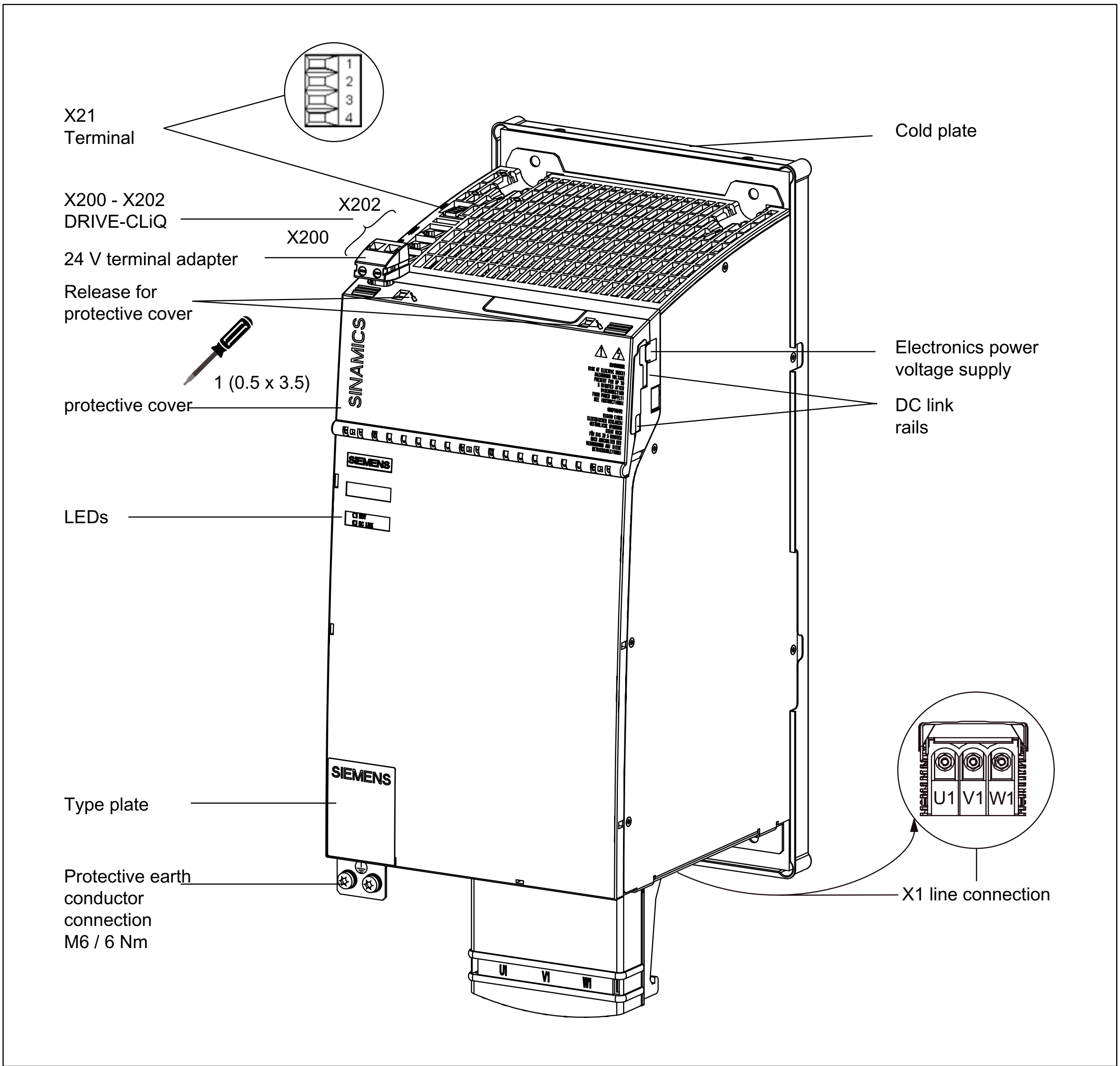
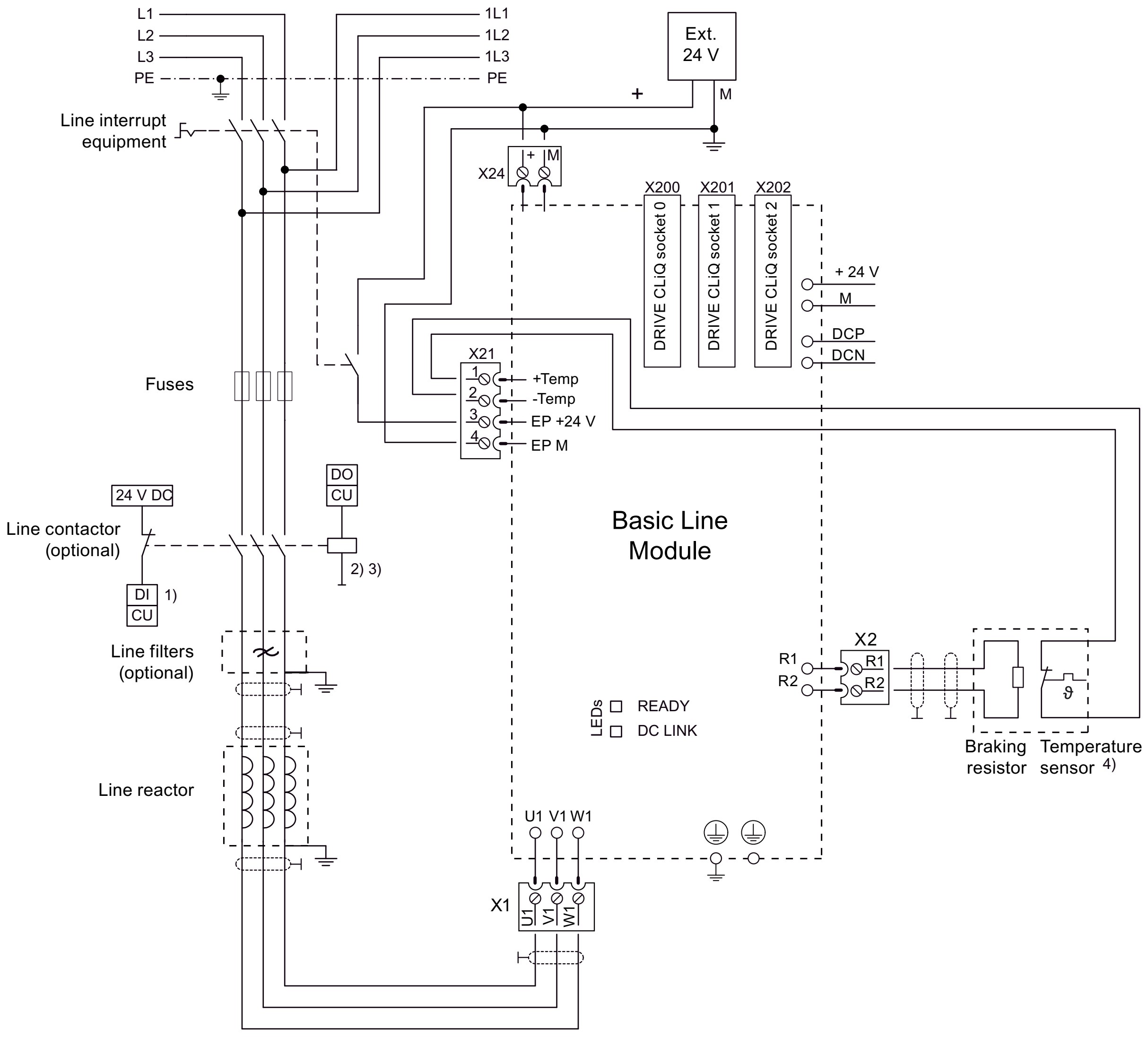


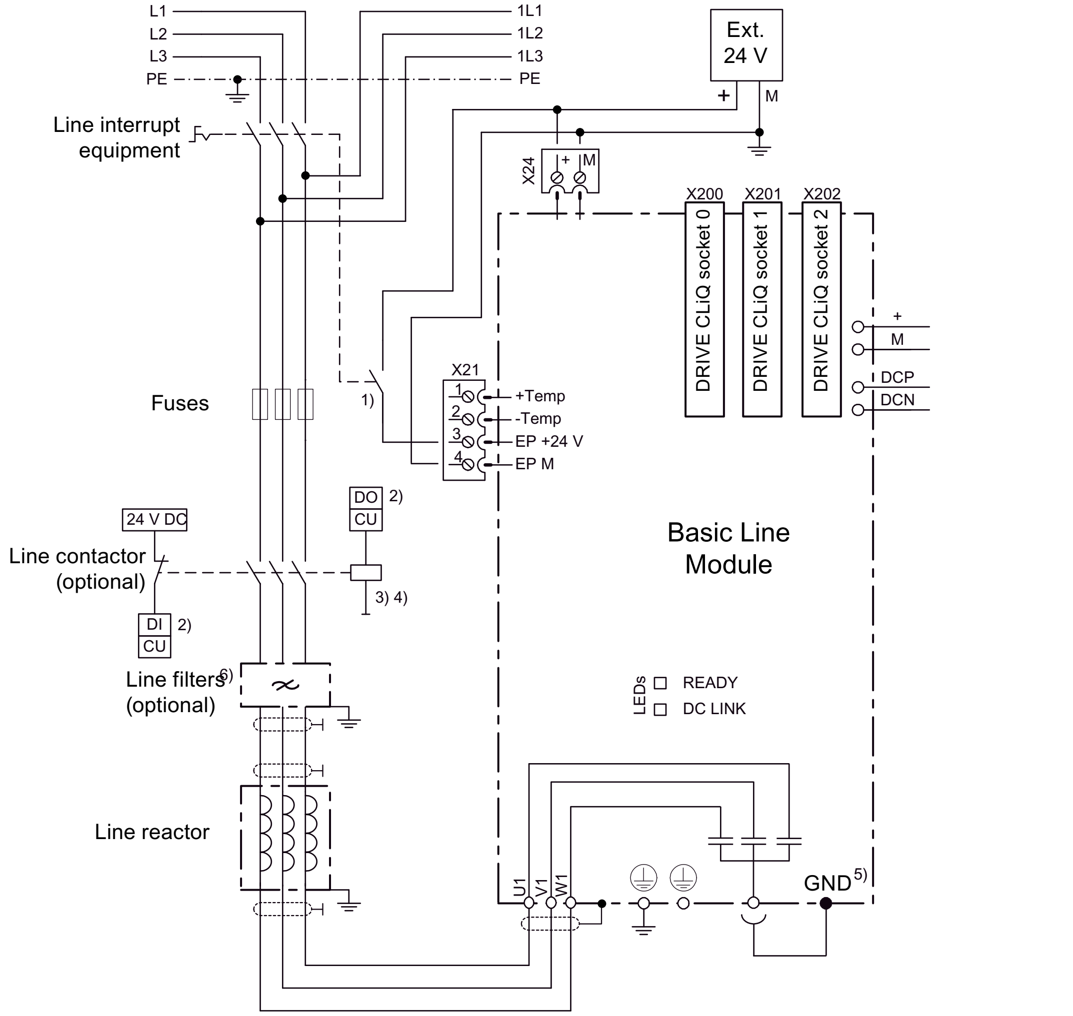
Figure 6-3 Interface description: Basic Line Module with cold-plate cooling (100 kW)

6.3.2 Connection example



1) DI/DO (controlled by Control Unit).
2) No additional load permitted downstream of line contactor!
3) The current carrying capacity of the digital output (DO) must be observed; an output interface must be used if required.
4) The bimetallic-element switch with wiring must not exceed a resistance value of 100 Ohm in the closed position.

Figure 6-4 Connection example: Basic Line Module (20 kW and 40 kW)

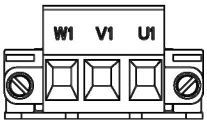
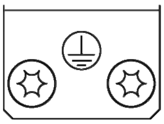


1) 24 V DC and ground must be applied for operation.
2) DI/DO (controlled by Control Unit).
3) No additional load permitted downstream of line contactor!
4) The current carrying capacity of the DO must be observed; an output interface must be used if required.
5) The connection bracket must be removed during operation of the component on the IT system.
6) Line filter is required to maintain the interference voltage according to category C2.

Figure 6-5 Connection example: Basic Line Module (100 kW)

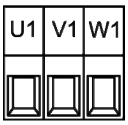
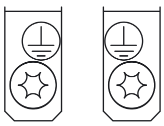
6.3.3 X1 line connection

Table 6-1 Terminal block X1 Basic Line Module 20 kW

	Terminal	Technical specifications
	U1	Max. connection voltage: 480 V 3 AC +10 % at 47 Hz to 63 Hz Max. connectable cross-section: 16 mm² Type: Screw terminal 5 (see Connection Methods) Tightening torque: 1.5 - 1.7 Nm
	V1	
	W1	
	PE connection	Threaded hole M5/3 Nm [1]

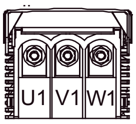
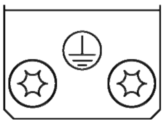
[1)] for ring cable lugs to DIN 46234

Table 6-2 Terminal block X1 Basic Line Module 40 kW

	Terminal	Technical specifications
	U1	Max. connection voltage: 480 V 3 AC +10 % at 47 Hz to 63 Hz Terminal type HDFK 50, 25 mm² cross-section, ferrules Tightening torque min. 6 Nm
	V1	
	W1	
	PE connection	Threaded hole M6/6 Nm [1)]

[1)] for ring cable lugs to DIN 46234

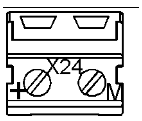
Table 6-3 Terminal block X1 Basic Line Module 100 kW

	Terminal	Technical specifications
	U1 V1 W1	Max. connection voltage: 480 V 3 AC +10 % at 47 Hz to 63 Hz Max. connectable cross-section: 120 mm² Type: Threaded bolt M8 1) (see Connection Methods) Tightening torque: 13 Nm
	PE connection	Threaded hole M6/6 Nm 1)

1) for ring cable lugs to DIN 46234

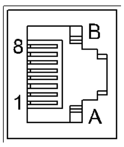
6.3.4 X24 24 V terminal adapter

Table 6-4 Terminal block X24

	Terminal	Designation	Technical specifications
	+	24 V power supply	24 V DC supply voltage
	M	Ground	Electronic ground
The 24 V terminal adapter is supplied as standard Max. connectable cross-section: 6 mm² Type: Screw terminal 5 (see Connection Methods)			

6.3.5 X200-X202 DRIVE-CLiQ interfaces

Table 6-5 DRIVE-CLiQ interface X200-X202

	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)	24 V power supply
	B	M (0 V)	Electronics ground
Blanking plate for DRIVE-CLiQ interface: Fa. Yamaichi, Bestellnummer: Y-ConAS-13			

6.3.6 X2 braking resistor connection

Table 6-6 Terminal block X2 on Basic Line Module (20 kW)

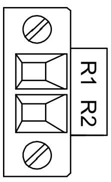
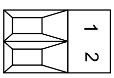
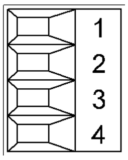
	Terminal	Designation	Technical specifications
	1	Braking resistor connection R	Max. connection voltage: 480 V 3 AC +10 % at 47 Hz to 63 Hz Max. connectable cross-section: 4 mm^2 Type: Screw terminal 5 (see Connection Methods) Tightening torque: 0.5 - 0.6 Nm
	2		

Table 6-7 Terminal block X2 on Basic Line Module (40 kW)

	Terminal	Designation	Technical specifications
	1	Braking resistor connection R	Max. connection voltage: 480 V 3 AC +10 % at 47 Hz to 63 Hz Max. connectable cross-section: 10 mm^2 Type: Screw terminal 6 (see Connection Methods) Tightening torque: min 1.5 - 1.8 Nm
	2		

6.3.7 X21 EP terminals

Table 6-8 Terminal block X21

	Terminal	Designation	Technical specifications
	1	+ Temp	Temperature switch type: Bimetallic-element switch with NC contact Response threshold of the temperature input: Temperature at the braking resistor in the operating range → Resistance value ≤ 100 ohm Overtemperature at the braking resistor → Resistance value > 100 ohm Fault reactions: Output of an error warning and deactivation of the Basic Line Module after one minute, if overtemperature is still present at the braking resistor. It is impermissible to apply a voltage at this input.[1)]
	2	- Temp	
	3	EP +24 V (enable pulses)	Voltage 24 V DC Current consumption: 10 mA Isolated input Signal propagation times: L → H 100 µs H → L: 1000 µs
	4	EP M (Enable Pulses)	
Max. connectable cross-section: 1.5 mm^2 Type: Screw terminal 1 (see Connection Methods)			

[1] only applies to 20 kW and 40 kW Basic Line Modules

⚠ WARNING

For operation, 24 V DC must be connected to terminal 3 and ground to terminal 4. When removed, the bypass relay drops out. If the Line Module is not disconnected from the line supply when the EP terminal is deactivated (e.g. a main contactor is not installed), the DC link remains charged.

⚠ DANGER

If the temperature switch is not connected, this can cause the resistor to overheat.

NOTICE

If a drive line-up is switched off by means of the line disconnecting device, the voltage at terminals 3 (EP +24 V) and 4 (EP M) must be interrupted beforehand. This can be carried out using a leading breaking auxiliary contact (≥ 10 ms), for example.

This protects external loads located parallel to the drive on the same switching component.

6.3.8 Meaning of the LEDs on the Basic Line Module

Table 6-9 Meaning of the LEDs on the Basic Line Module

LED	Color	State	Description
READY	-	Off	Electronics power supply outside the permissible tolerance range.
	Green	Continuously lit	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	Continuously lit	DRIVE-CLiQ communication is being established.
	Red	Continuously lit	At least one fault is present in this component.
	Green Red	Flashing light 2 Hz	Firmware is being downloaded.
	Green/orange or red/orange	Flashing light 2 Hz	Component detection via LED is activated (p0124). Note: Both options depend on the LED status when component detection is activated via p0124 = 1.
DC LINK	-	Off	Electronics power supply outside the permissible tolerance range.
	Orange	Flashing light 2 Hz	Braking chopper active.
		Continuously lit	DC link voltage within permissible tolerance range (only when ready for operation)
	Red	Continuously lit	DC link voltage outside the permissible tolerance range (only when Active Line Module is ready for operation).

6.4 Dimension drawings

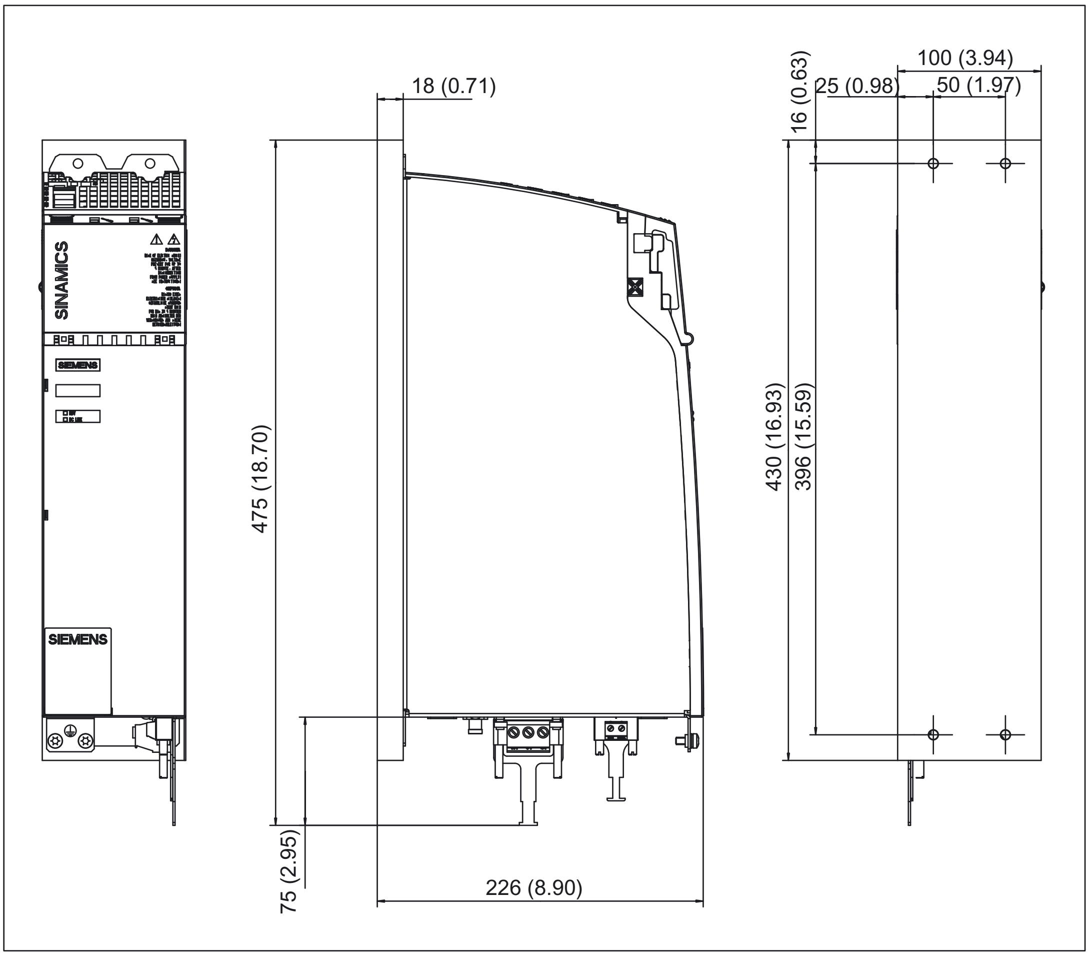


Figure 6-6 Dimension drawing: Basic Line Module with cold plate 20 kW

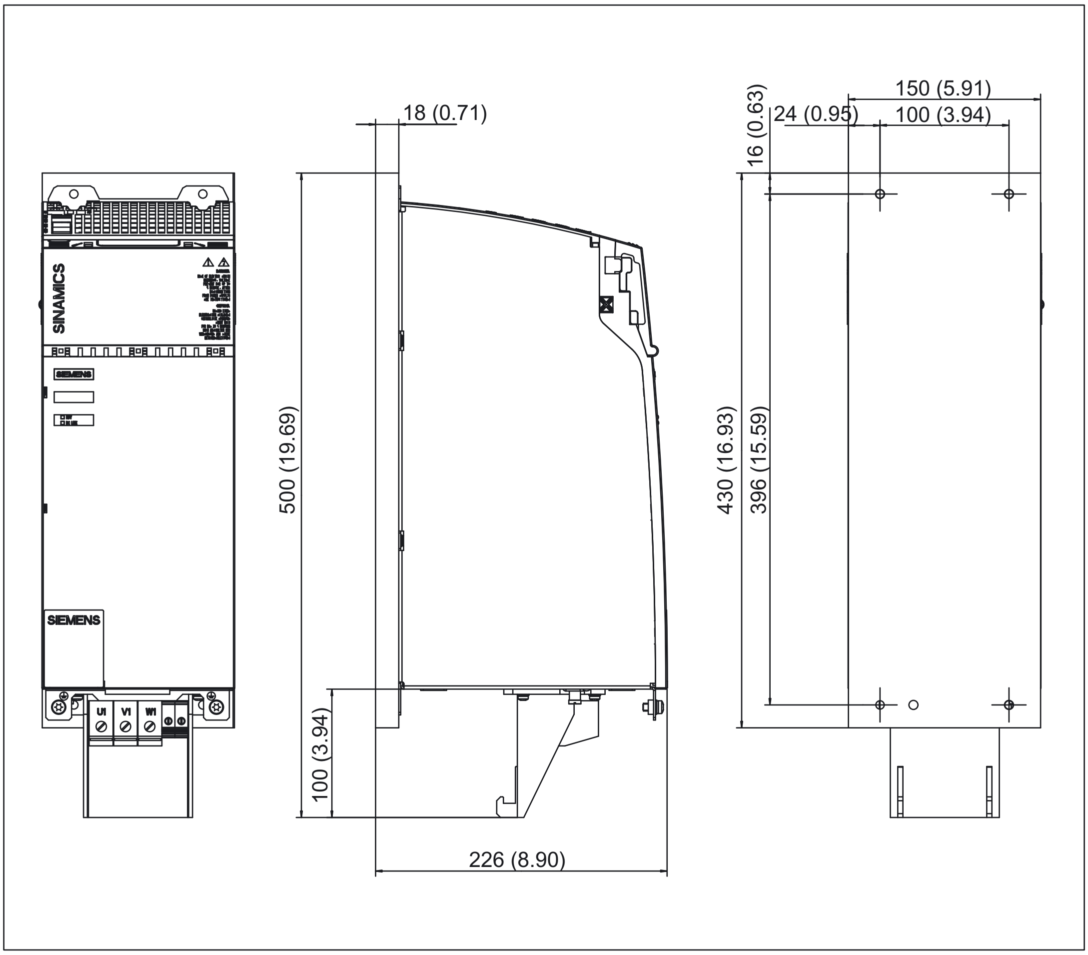


Figure 6-7 Dimension drawing: Basic Line Module with cold plate 40 kW

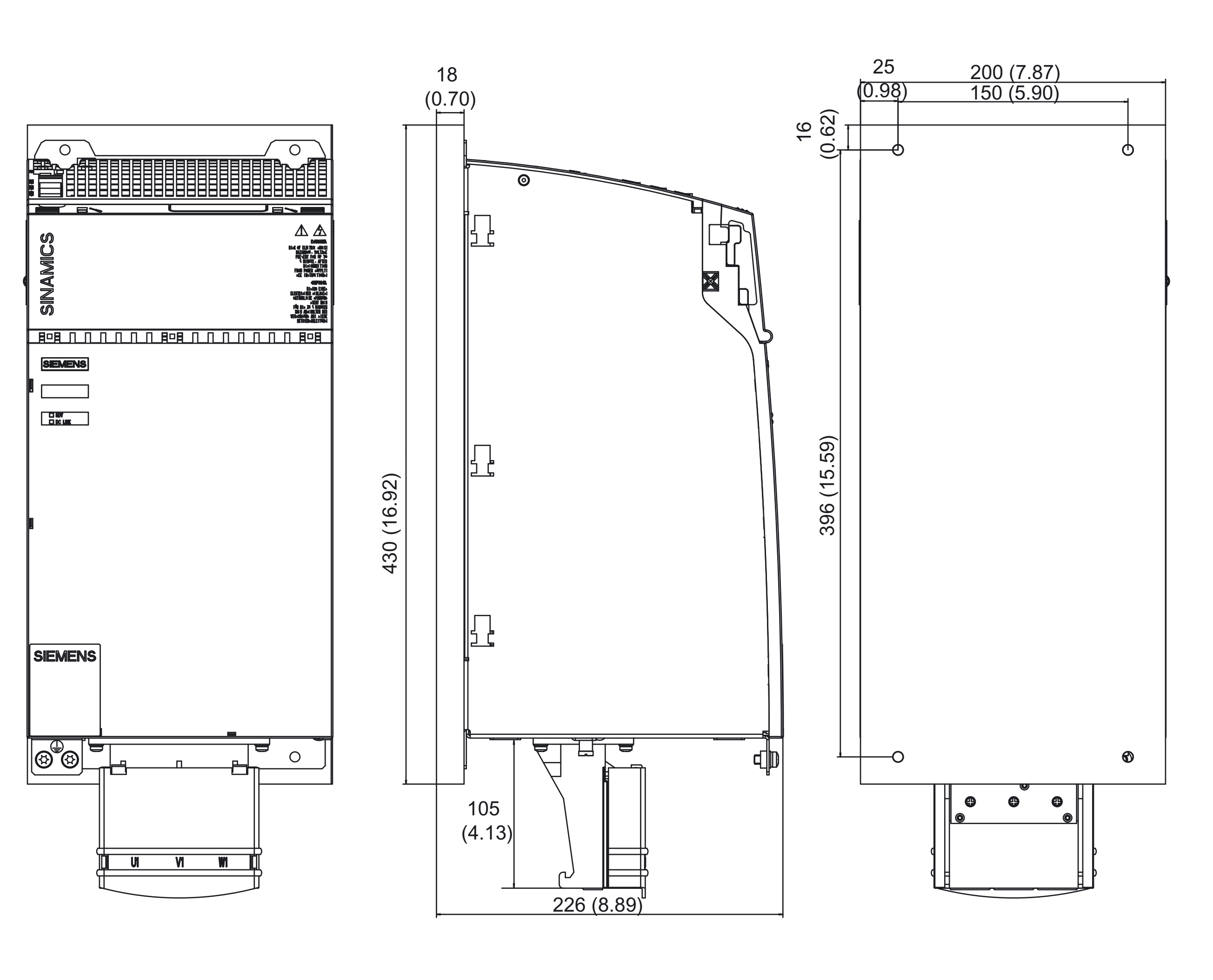


Figure 6-8 Dimension drawing: Basic Line Module with cold plate 100 kW

6.5 Installation

Mounting the cold plate component on customer-specific heat sinks

Note the following before installation:

- Before mounting, check the surface of the heat sink to ensure that it is not damaged.
- To facilitate installation, M6 screw bolts and hexagon nuts/threaded pins (ISO 7436-M6x40-14 H, strength class 8.8) are recommended.
- To improve heat transfer, a heat-conducting medium must be used. Special spherical-indented heat-conducting film must be used for this purpose. Every cold plate power unit is supplied with heat-conducting film cut to the right size. Note the installation position of the heat-conducting film (see diagrams below).

Note

When a component is replaced, the heat-conducting film must also be replaced! Only heat-conducting film approved or supplied by Siemens may be used.

	Order No.
Heat-conducting foil, 50 mm	6SL3162-6FB00-0AA0
Heat-conducting foil, 100 mm	6SL3162-6FD00-0AA0
Heat-conducting foil, 150 mm	6SL3162-6FF00-0AA0
Heat-conducting foil, 200 mm	6SL3162-6FH00-0AA0
Heat-conducting foil, 300 mm	6SL3162-6FM00-0AA0

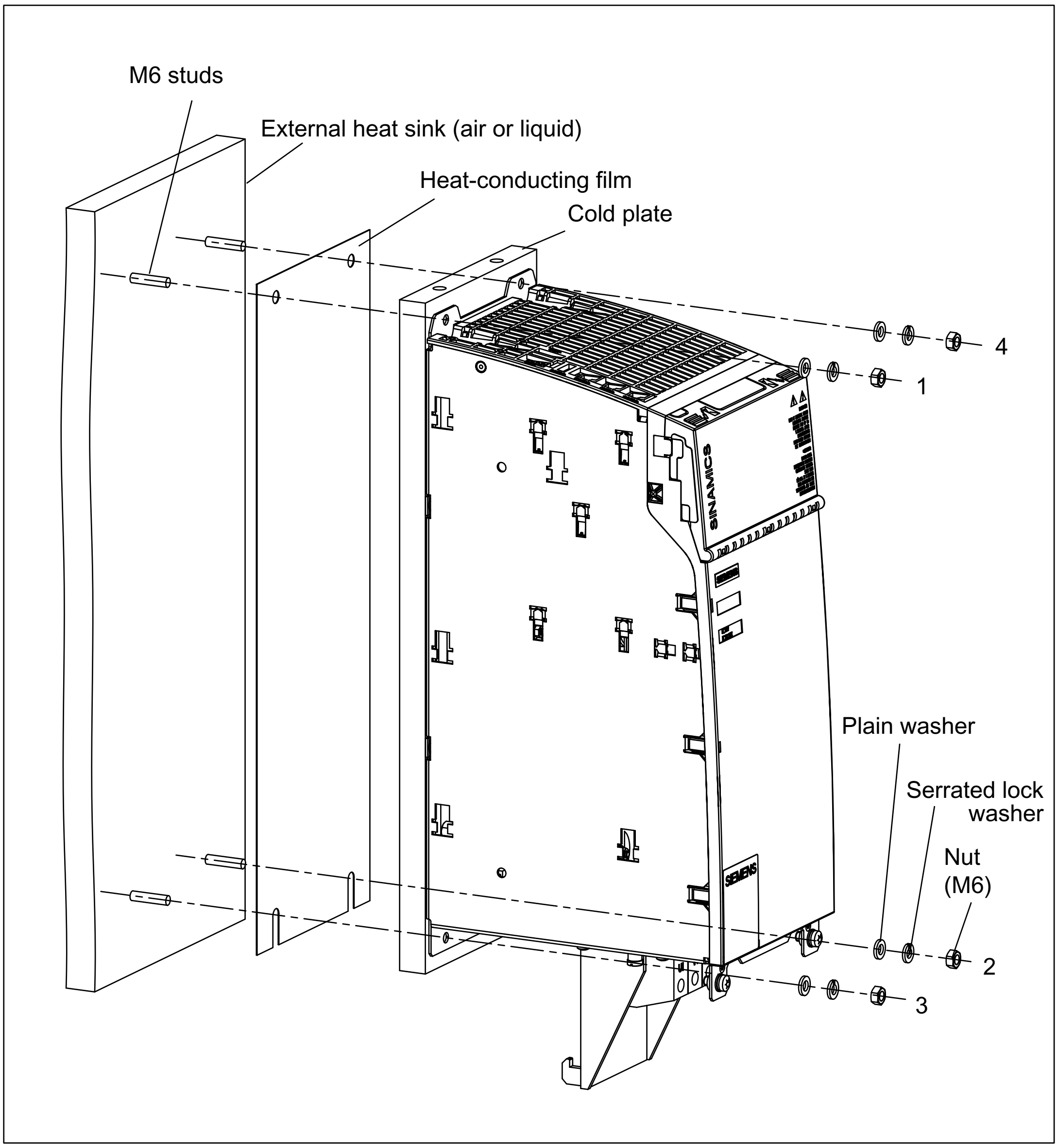


Figure 6-9 Installation of Basic Line Module 40 kW with external heat sink and heat-conducting film

To begin, tighten the screws by hand (approx. 0.5 Nm) in the sequence shown (steps 1 to 4) and then secure them (10 Nm).

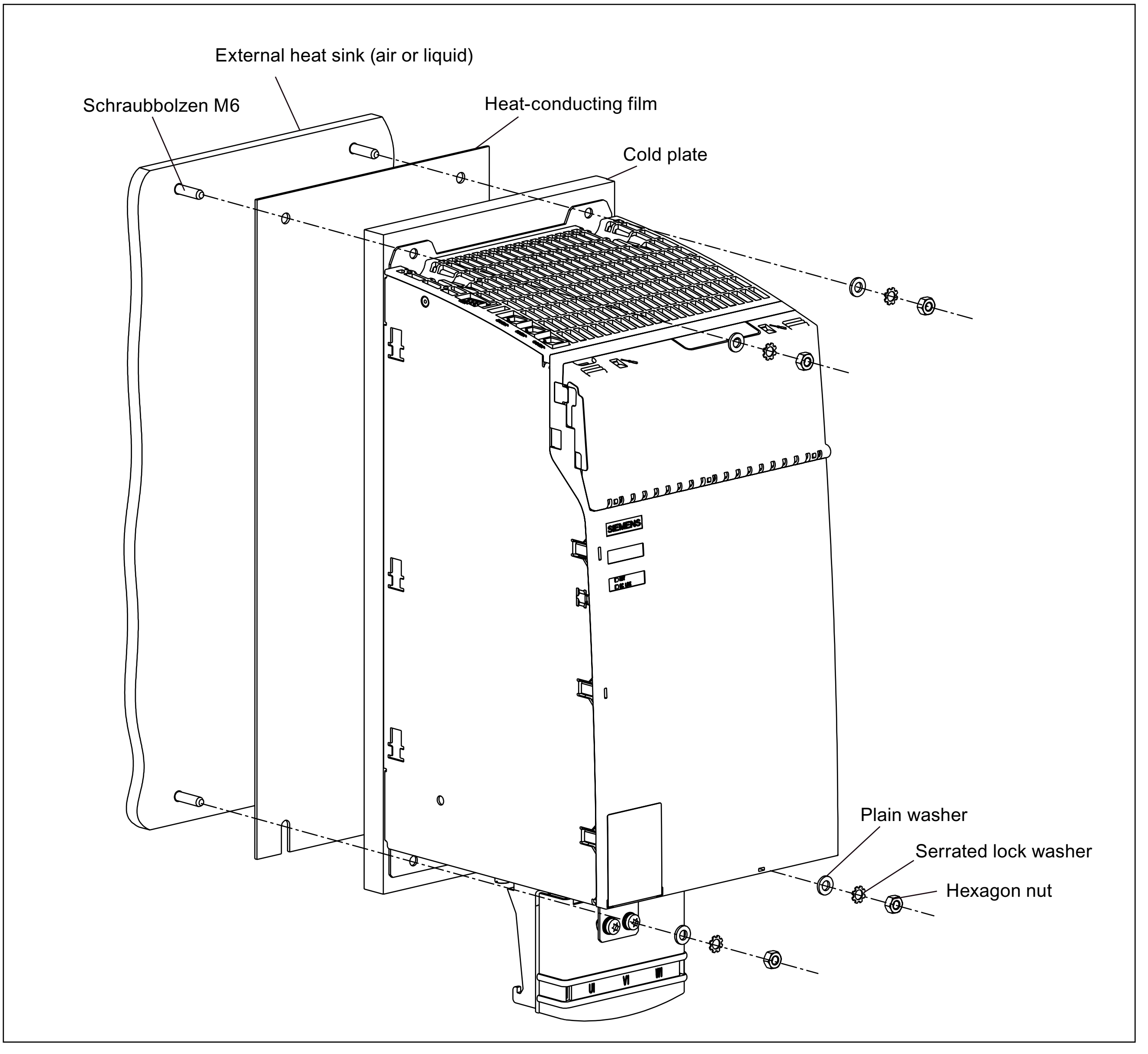


Figure 6-10 Installation of Basic Line Module 100 kW with external heat sink and heat-conducting film

Help with the mechanical cabinet design is available from:

Siemens AG
A&D SE WKC
CoC CabinetCooling
P.O. Box 1124
09070 Chemnitz, Germany

E-mail: cc.cabinetcooling@siemens.com

Properties of the heat sink

AlMgSi 0.5 is recommended as the heat sink material.
The roughness of the external heat sink surface should be at least Rz 16 and the contact surface between the heat sink and cold plate should have an evenness of 0.2 mm (applicable to a height of 450 mm and width of 300 mm).

Note

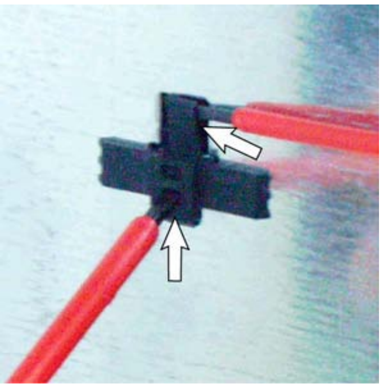
The machine manufacturer can adapt the heat sink version to his special requirements. The specified rated data for the Power Modules can only be achieved if the power losses can be dissipated by the external heat sink under the specified general conditions.

NOTICE
When mounting, you must ensure that the threaded bolts do not damage the cold plate.

Remove the holder for securing the Control Unit.

The plastic retaining element must be removed due to the different expansion variants:

- If the component to be installed comes into contact with the left-hand cabinet panel
- using center feed via the Basic Line Module

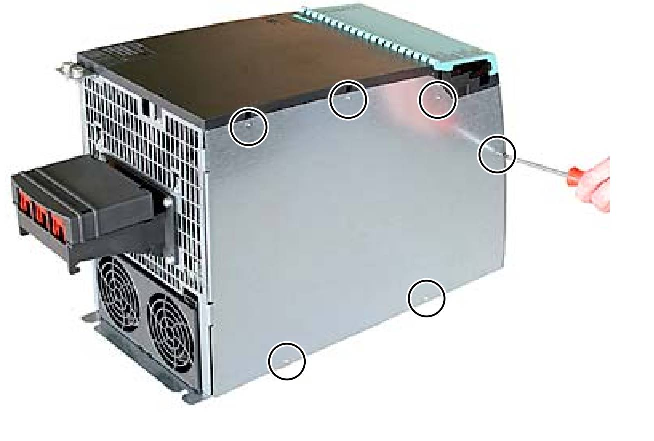
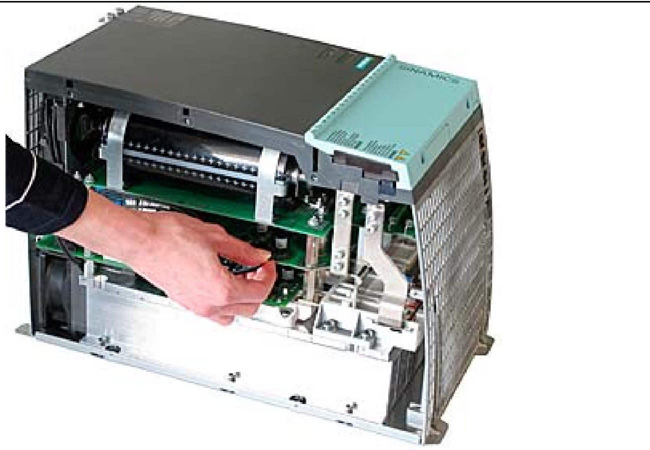
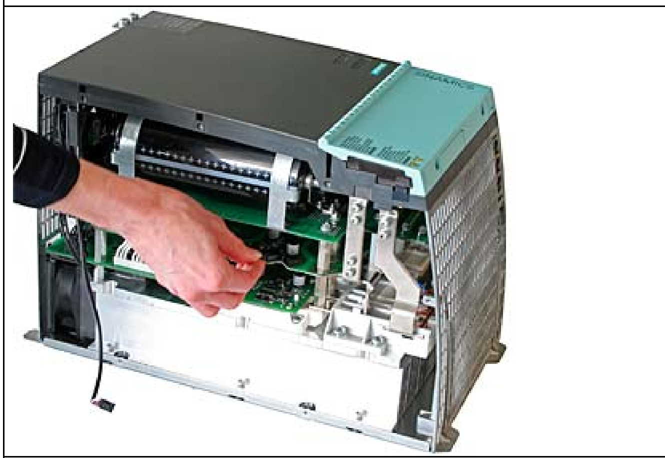
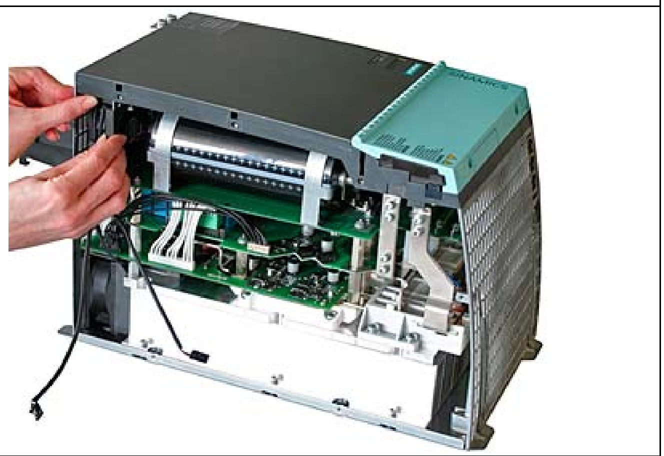
		
Use suitable tools to lift the latching device and push up the holder	Remove the holder	After the removing the holder

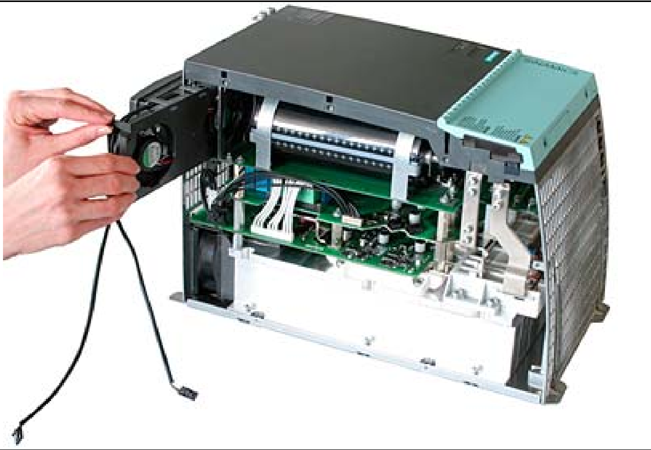
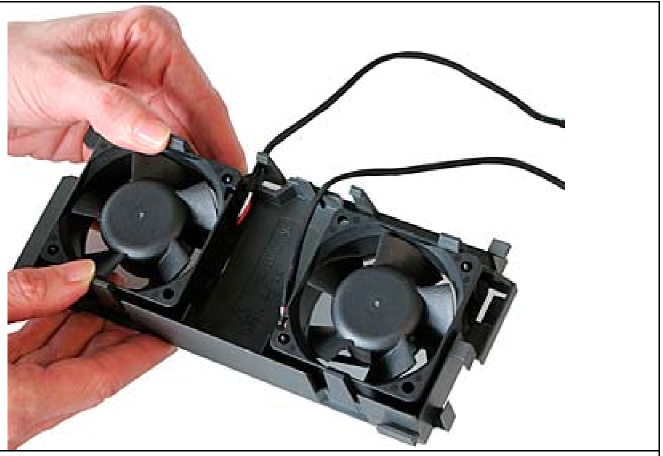
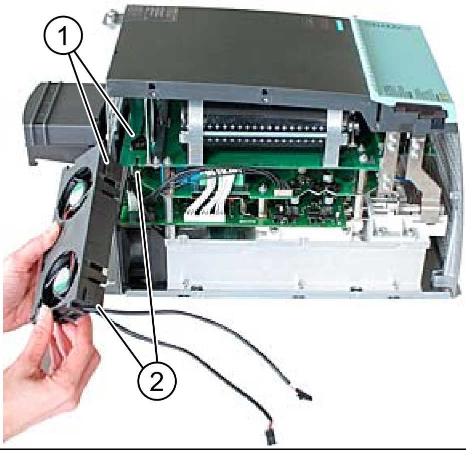
6.6 Replacing the fan for capacitor cooling

Replacing the fan for capacitor cooling of a 100 kW Basic Line Module

⚠ DANGER
Before replacing the fan, you must switch off the power supplies (24 V DC and 400 V AC). Risk of electric shock. Dangerous voltages are still present for up to 5 minutes after the power supply has been switched off. The device cover must not be opened until this time has elapsed.

NOTICE
When replacing the fan, you must observe the ESD regulations. Parts must only be replaced by trained personnel (danger of damage to sensitive components due to static electricity)!

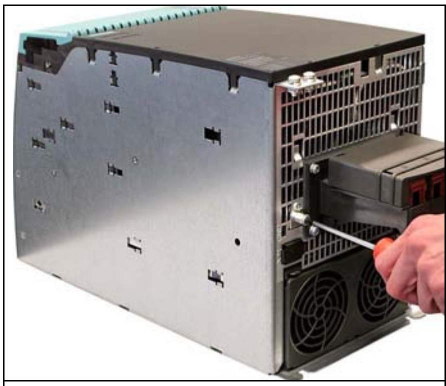
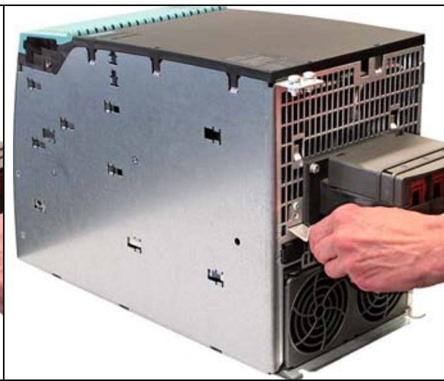
	
Open the right device cover by loosening the six marked screws	Pull the first fan cable by pressing it slightly
	
Pull the second fan cable	Unlatch the fan module

	
Completely pull out the fan module	Slightly push the fan holder apart and pull out the fan
	
Observe the air flow direction markings when inserting the new fan	Observe the cable guide
	
Push in the fan in guide rails 1 and 2. Connect the two fan cables. Close the device cover and tighten the six screws with 0.8 Nm	

Operating a 100 kW Basic Line Module from an insulated network (IT system)

When a 100 kW Basic Line Module is operated from an insulated network (IT system), the connecting bracket to the interference-suppression capacitor must be removed. The connecting bracket to the interference-suppression capacitor is located on the underside of the component.

CAUTION
If the connecting bracket to the interference-suppression capacitor is not removed, an error message might be output via the insulation monitor in the system.

		
Remove the connecting bracket to the interference-suppression capacitor with a screwdriver Tx25	Remove the connecting bracket	Connecting bracket to the interference-suppression capacitor

6.7 Electrical connection

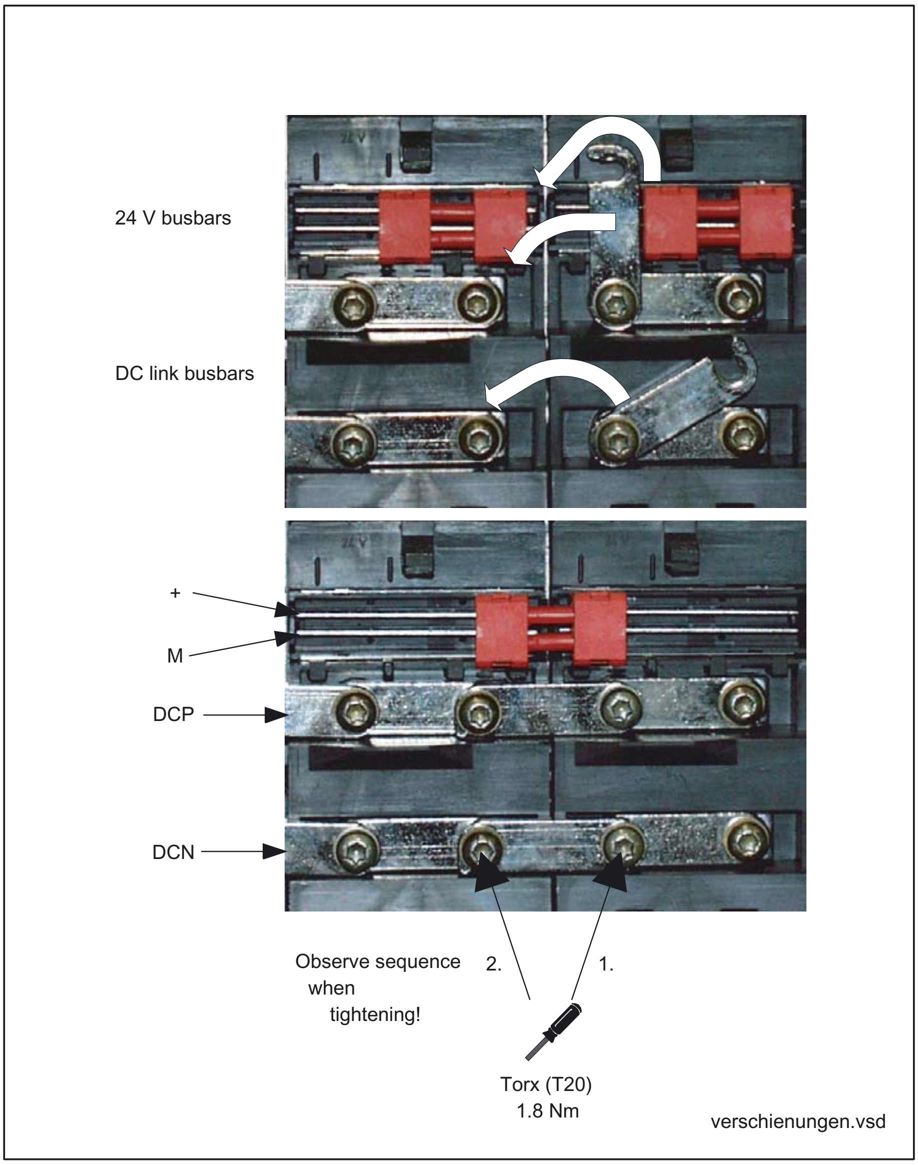


Figure 6-11 Busbar connections for booksize components

⚠ DANGER
The 24 V terminal adapter must not be removed or plugged in with 24 V applied.

NOTICE
The 24 V terminal adapter may only be withdrawn vertically to the front panel (i.e. not at an angle)!

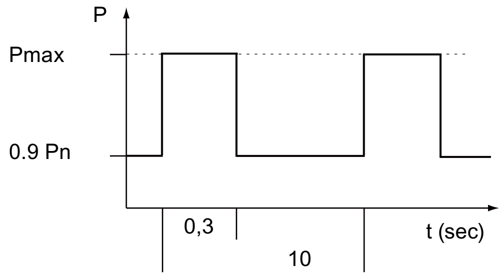
6.8 Technical data

Table 6-10 Technical data for Basic Line Modules with cold-plate cooling

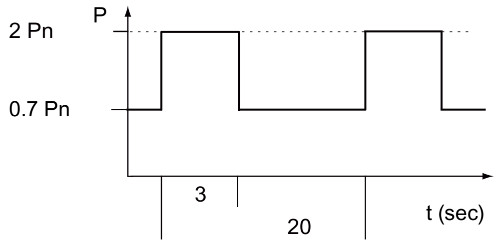
	6SL3136-	1TE22-0AA0	1TE24-0AA0	1TE31-0AA0
Rated power	kW	20	40	100
Connection voltages: Line voltage Line frequency Electronics power supply	 V_{ACrms} Hz V_{DC}	 3-ph. 380 V AC – 10% (-15% < 1 min) up to 3-ph. 480 V AC + 10% 47 to 63 24 (20.4 – 28.8)		
DC link voltage Overvoltage tripping Undervoltage tripping	V_{DC} V_{DC} V_{DC}	510 – 720 820 ± 2 % 360 ± 2 %		
DC link busbar current carrying capacity	A_{ACrms}	100	100	200
24 V busbar current carrying capacity	A_{ACrms}	20	20	20
Electronics current consumption	A_{DC}	0,9	1,1	1,6
Infeed: Rated power (S1) Infeed power (S6-40%) Peak infeed power	 kW (Pn) kW (Ps6) kW (Pmax)	 20 26 60	 40 52 120	 100 130 175
Braking power: Continuous power Peak power	 kW kW	 5 40	 10 80	 - -
Line currents: at 380 V_{AC} at 480 V_{AC} / 528 V_{AC} at 480 V; S6-40% Peak current (at 400 V_{AC} / 480 V_{AC})	 A_{AC} A_{AC} A_{AC} A_{AC}	 34,5 31 / 29 38 113 / 91	 69 62 / 58 78 208 / 172	 172 154 / 145 193 265 / 252
DC link current: Rated current with S6-40% peak current	 A_{DC} A_{DC} A_{DC}	 33,5 43 100	 67 87 200	 167 217 292
Power loss	W	See Chapter Cabinet design and EMC		
Max. permissible heat sink temperature	°C	65	70	70
Max. ambient temperature without derating	°C	40	40	40
Max. ambient temperature with derating	°C	55	55	55
DC link capacitance	µF	940	1880	4100
Maximum permissible DC link capacitance	µF	20 000	20 000	20 000
Power factor[1)]	cosφ	approx. 0.98	approx. 0.98	approx. 0.98
Weight	kg	6,4	10,9	16,4

[1)]only fundamental frequency component

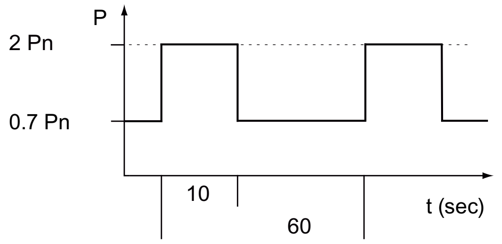
Infeed duty cycles for Basic Line Modules



Peak load duty cycle with pre-load condition



Peak load duty cycle with pre-load condition



Peak load duty cycle with pre-load condition

Figure 6-12 Infeed duty cycles for 20 kW and 40 kW Basic Line Modules

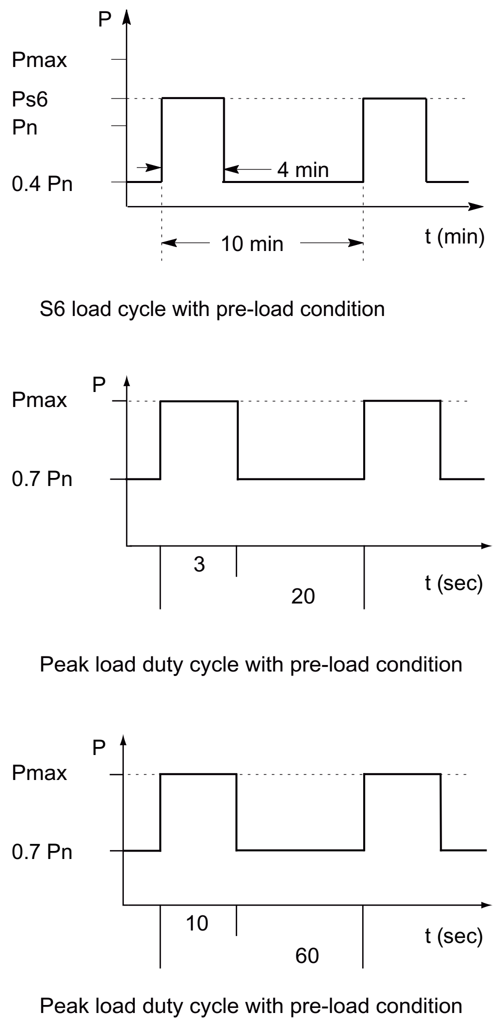


Figure 6-13 Infeed duty cycles for 100 kW Basic Line Module

Braking duty cycle for Basic Line Modules

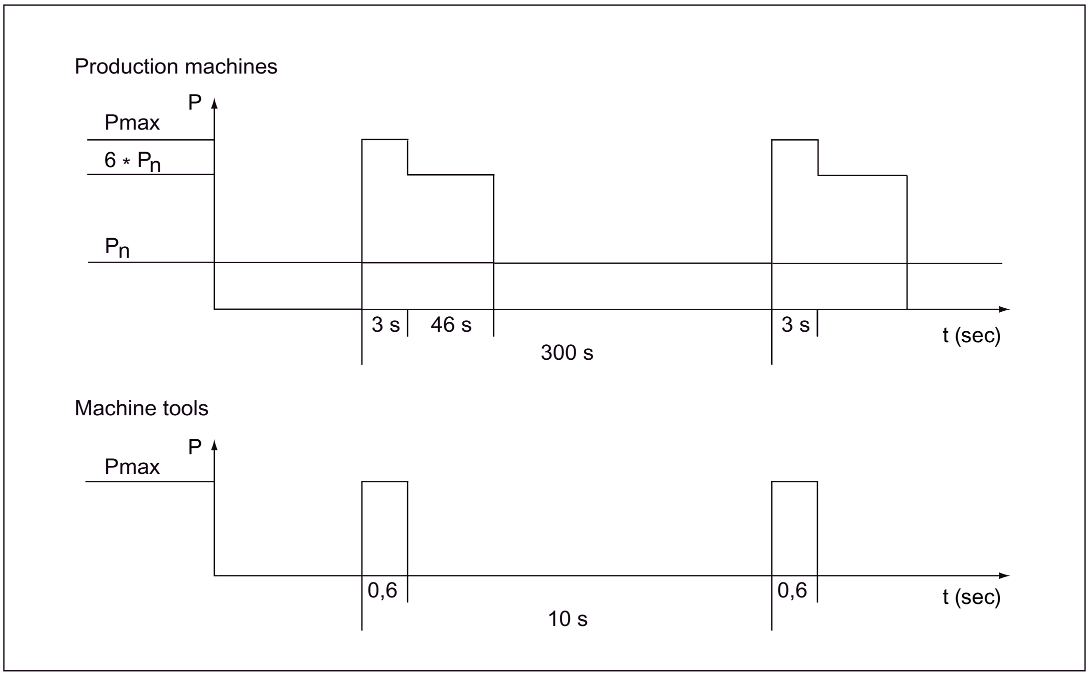


Figure 6-14 Braking duty cycle for 20 kW and 40 kW Basic Line Modules

Derating as a function of the ambient temperature

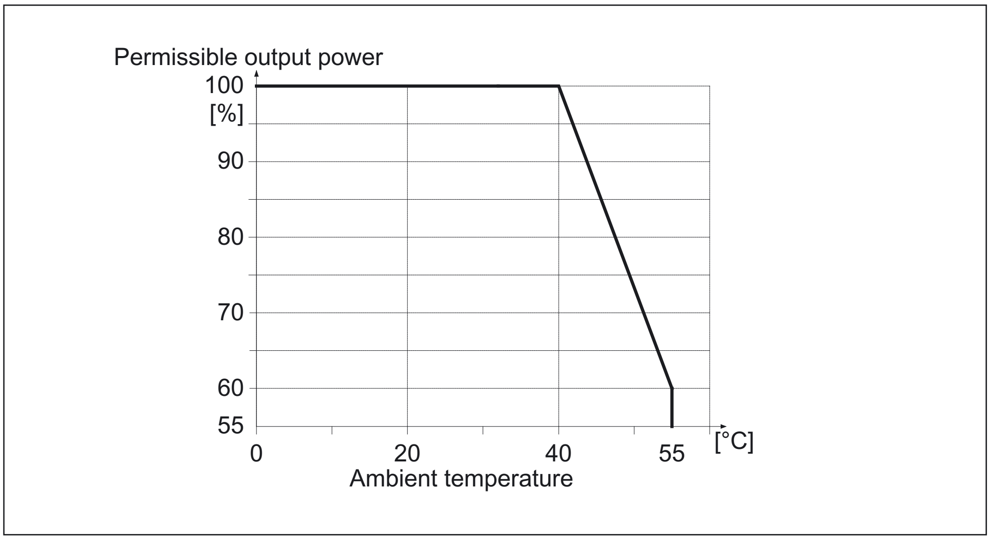


Figure 6-15 Derating as a function of the ambient temperature

Derating as a function of the site altitude

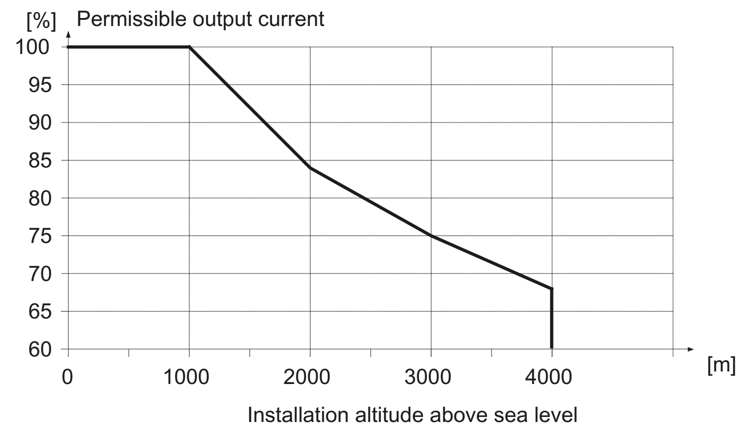


Figure 6-16 Derating as a function of the site altitude

Voltage derating as a function of the installation altitude

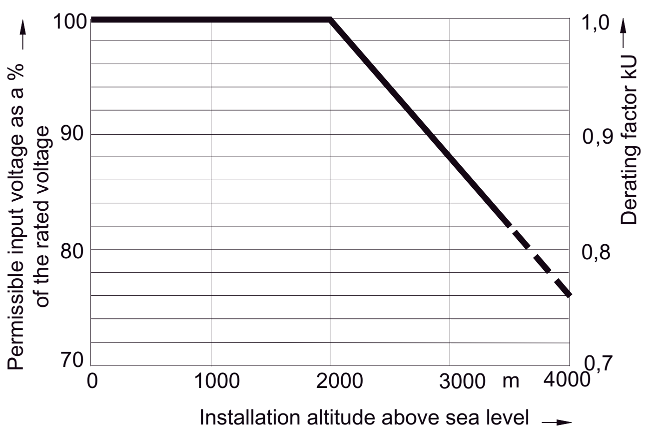


Figure 6-17 Voltage derating as a function of the installation altitude

Output power as a function of total cable length

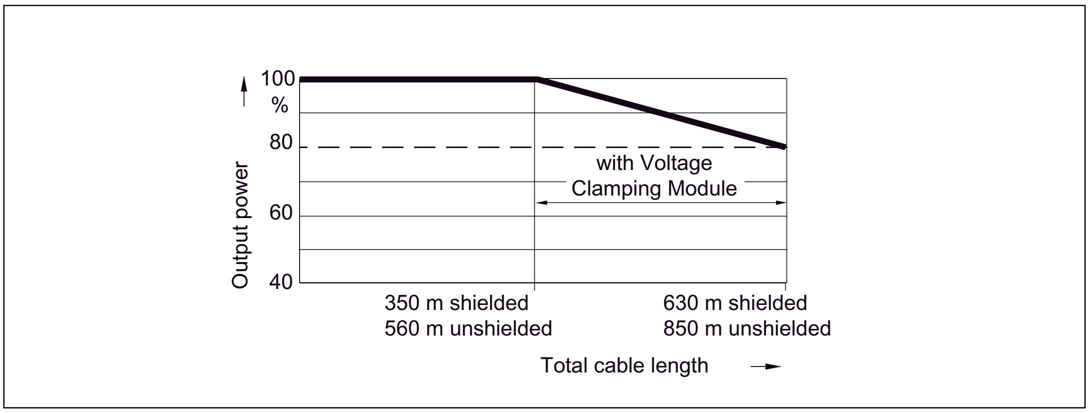


Figure 6-18 Output power as a function of total cable length

6.9 Braking resistors for Basic Line Modules

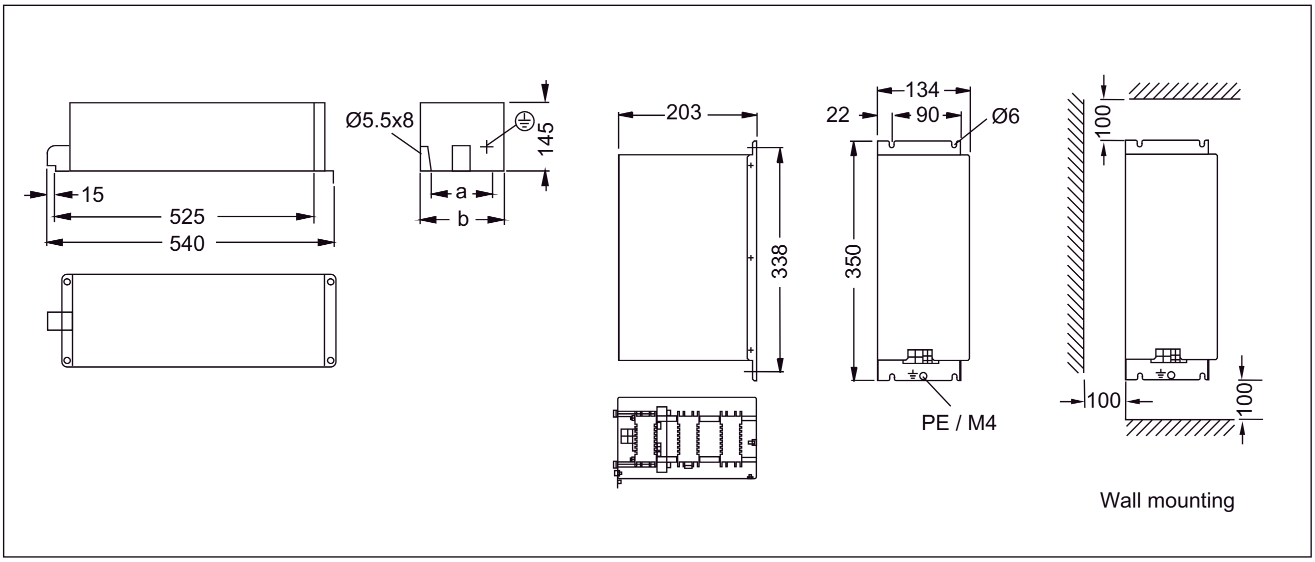


Figure 6-19 Dimension drawing: Braking resistor 7.5 kW and 15 kW

Table 6-11 Dimensions of braking resistor 7.5 kW and 15 kW

Order No.	6SE7018-0ES87-2DC0	6SE7021-6ES87-2DC0
a	150 (5.90)	330 (12.99)
b	180 (7.08)	360 (14.17)

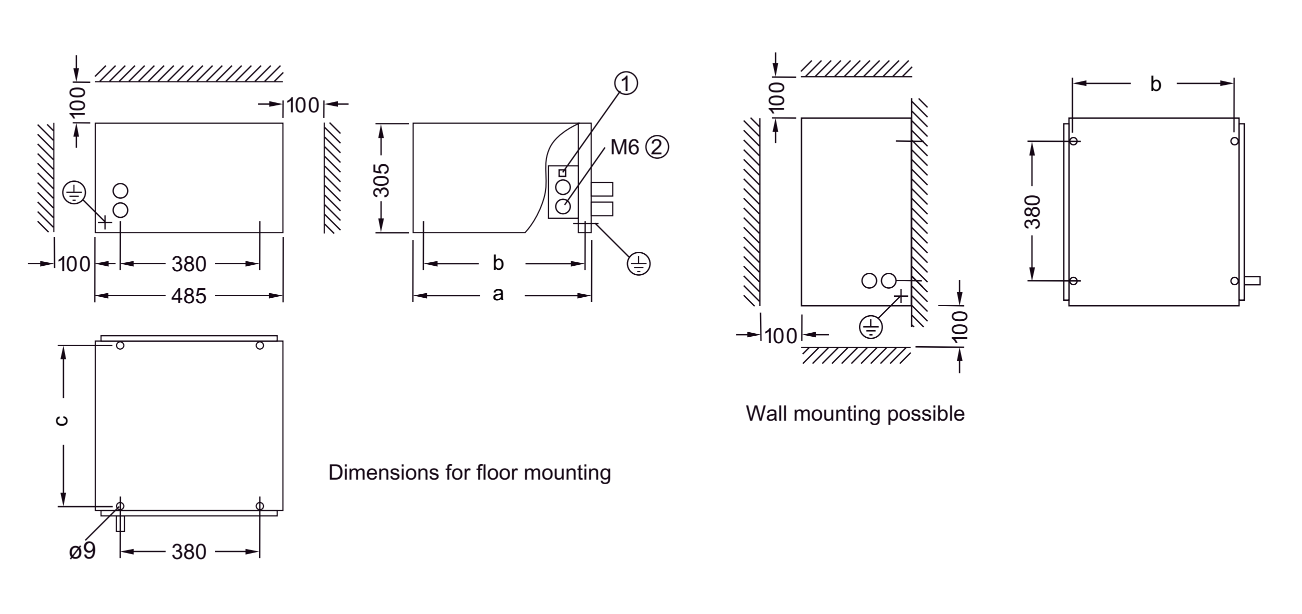


Figure 6-20 Dimension drawing: Braking resistor 30 kW and 75 kW

① T1 / T2 tunnel terminals
② Stud terminals

Table 6-12 Dimensions of braking resistor 30 kW and 75 kW

Order No.	6SE7023-2ES87-2DC0	6SE7028-0ES87-2DC0
a	430 (16.92)	740 (29.13)
b	400 (15.74)	710 (27.95)
c	400 (15.74)	710 (27.95)

⚠ CAUTION

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

Table 6-13 Technical data of braking resistors for the Basic Line Modules

Brake resistor	Unit	6SE7018-0ES87-2DC0	6SE7021-6ES87-2DC0	6SE7023-2ES87-2DC0	6SE7028-0ES87-2DC0
	Ω	80	40	20	8
Peak power[1)](Pmax)	kW	7,5	15	30	75
Rated power [1)] (Pn)	kW	1,25	2,5	5	12,5
Can be used for Basic Line Modules 20 kW		Yes	Yes	Yes	--
Can be used for Basic Line Modules 40 kW		Yes	Yes	Yes	Yes
Weight	kg	6	11,5	17	27

[1)]Applies to a DC link voltage of 760 V

Braking duty cycles for braking resistors

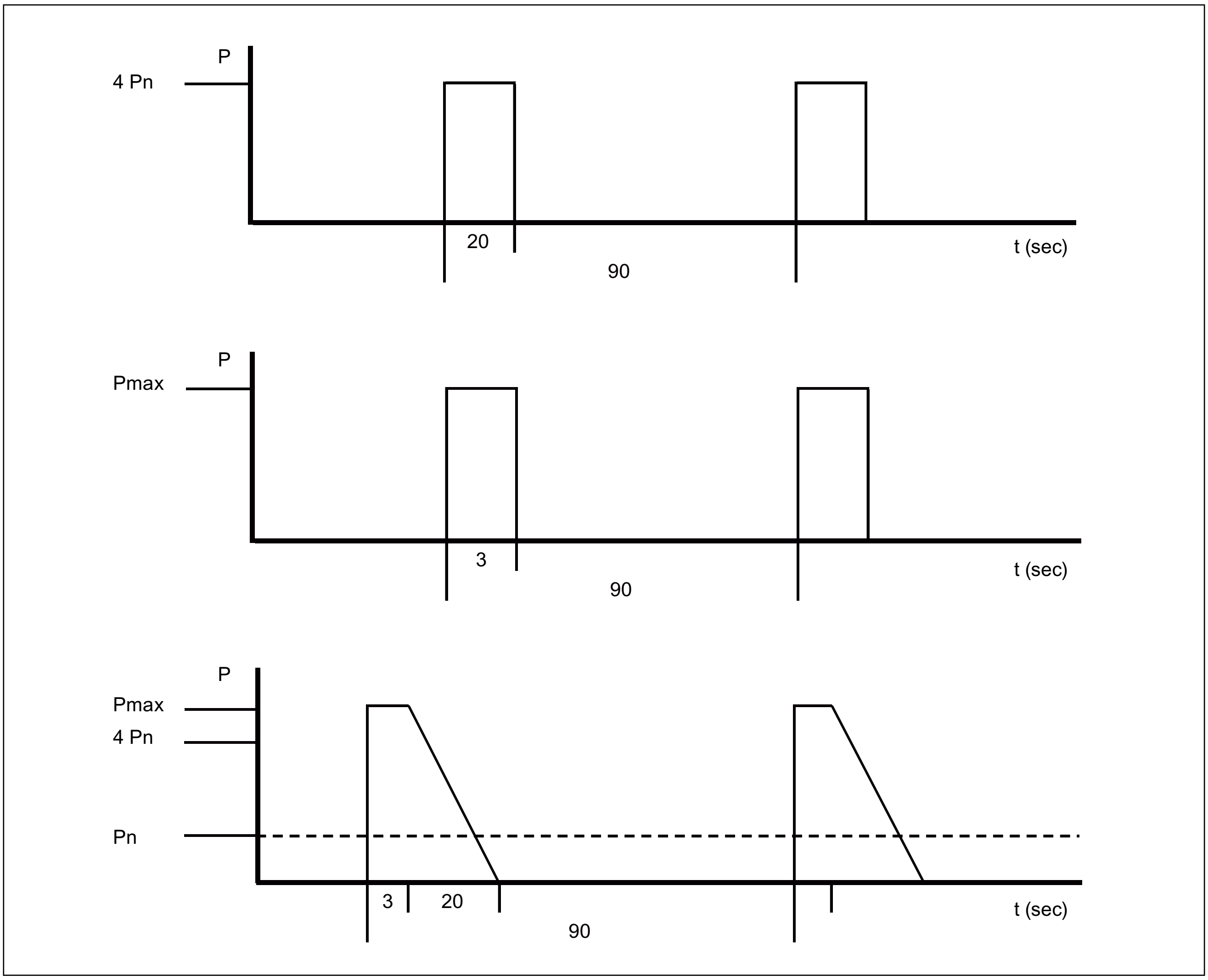


Figure 6-21 Braking duty cycles for braking resistors

7 Smart Line Modules (5 kW and 10 kW) with cold plate

7.1 Description

The Smart Line Module is an unregulated infeed/regenerative feedback unit. The Smart Line Module supplies the Motor Module(s) with an unregulated DC voltage at the DC output. In the infeed mode the Smart Line Module exhibits the typical current and voltage waveforms of a 6-pulse diode rectifier bridge.

In feedback mode, the current waveform is square waved. Feedback can be deactivated by means of a terminal because these Smart Lines Modules are not equipped with a DRIVE-CLiQ connection.

The DC link starts precharging as soon as the supply voltage is applied and is independent of its phase sequence direction. Load can be applied to the DC link after the modules have been enabled. An optional main contactor is required for disconnecting the voltage.

Smart Line Modules are suitable for direct operation in TN, IT, and TT systems. The Line Modules have an integrated overvoltage protection function.

7.2 Safety Information

⚠ DANGER
Risk of electric shock. A hazardous voltage is present for up to 5 minutes after the power supply has been disconnected. The protective cover may only be opened after this time has expired.

⚠ WARNING
When opening the protective cover for the DC link, you must activate the release. A suitable tool (e.g. screwdriver) must be used for this purpose. The components must only be operated when the protective cover of the DC link is closed. Damaged components must not be further used otherwise this could result in secondary damage or accidents.

⚠ WARNING
A sufficiently high supply short circuit power is required for tripping the fuses within the predefined time in the event of a ground fault. The ratio of line short-circuit power to rated power must be ≧ 70. If the line short-circuit power is too low, the tripping times increase to an unacceptable level (e.g. fire is possible).

⚠ DANGER
The DC link discharge voltage hazard warning in the local language must be attached to all of the components. A set of labels in 16 languages is supplied with the component.

⚠ WARNING
A ventilation clearance of 80 mm above and below the components must be observed.

⚠ DANGER
It is only permissible to establish connections to the DC link using the adapters that SIEMENS has recommended (DC link adapter and DC link rectifier adapter).

CAUTION
The tightening torque of the DC link busbar screws (1.8 Nm, tolerance +30 %) must be checked before commissioning and with the complete system in a no-voltage condition (powered-down) and with the DC link discharged. After being transported, the screws must be tightened.

⚠ DANGER
If a 50 mm wide Motor Module or if a DC link component with the appropriate width (e.g. Braking Module, Control Supply Module, Voltage Clamping Module) is located at the lefthand end of the drive line-up, then the DC link bridge including all of the screws must be removed. It is not permissible to insert the screws without a DC link bridge. For all other power units and DC link components (e.g. Capacitor Module) that are wider than 50 mm, it is neither permissible to move the DC link bridge to the left nor remove it. If this is not carefully observed, this can result in damage and accidents.

⚠ DANGER
In a supply system without regenerative feedback capability (e.g. diesel generator), the regenerative feedback capability of the Smart Line Module must be deactivated by means of a jumper between terminals X22.1 and X22.2. The braking energy must then be dissipated via an additional Braking Module with a braking resistor in the drive line-up.

CAUTION
The total length of the power cables (motor supply cables and DC link cables) must not exceed 350 m.

NOTICE
Operation without the line reactor is not permissible.

CAUTION
The DC link side covers are supplied as standard with the components; they can also be ordered separately, if required (order no.: 6SL3162-5AA00-0AA0).

⚠ WARNING
If the Line Module is not disconnected from the network (e.g. via the main contactor or main circuit-breaker), the DC link remains charged.

7.3 Interface description

7.3.1 Overview

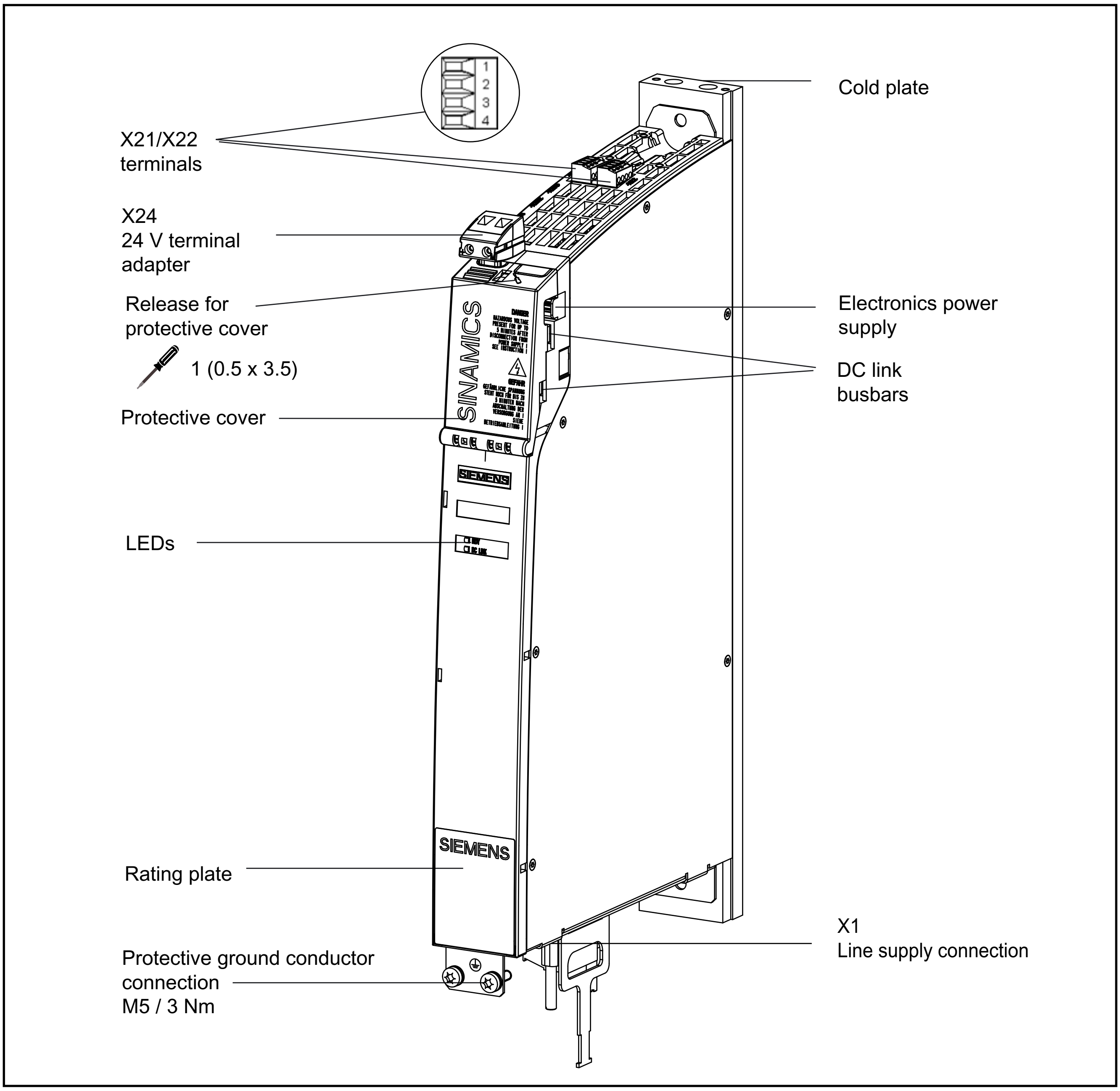
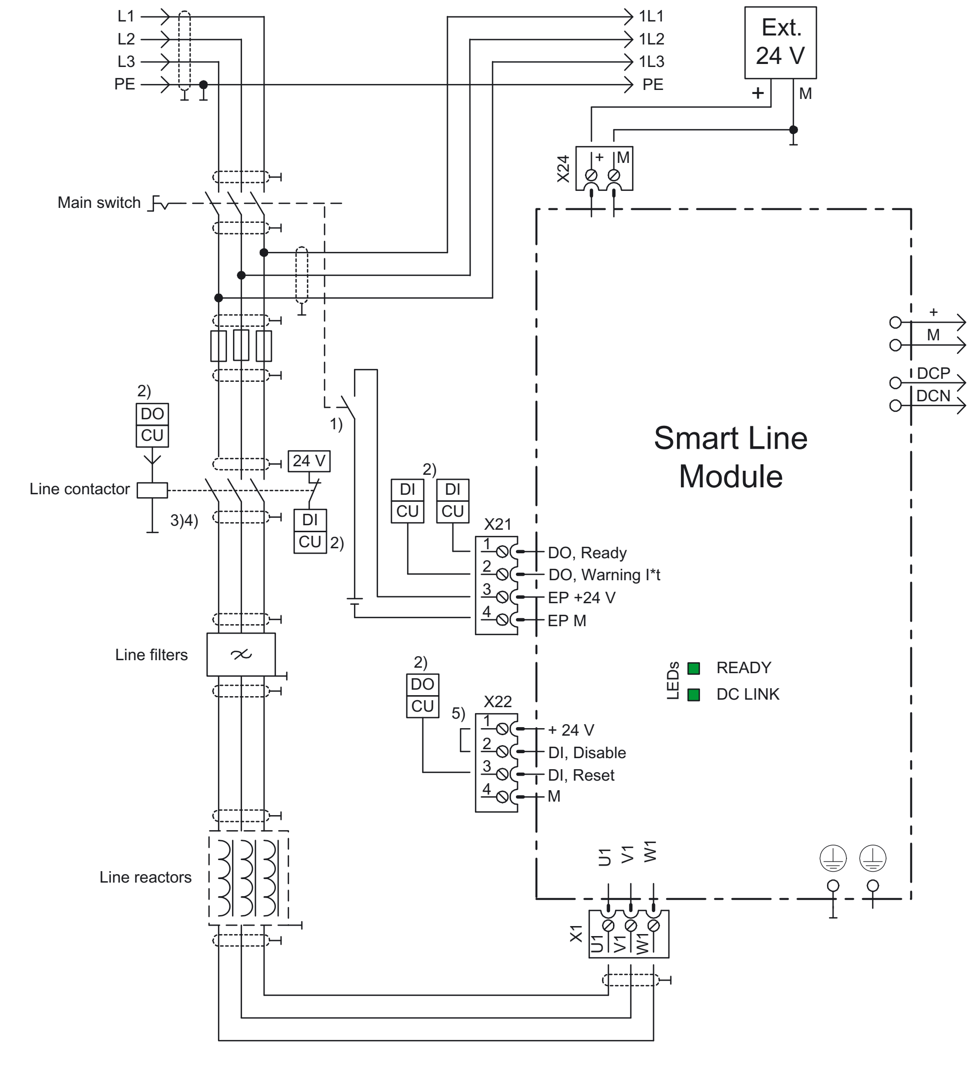


Figure 7-1 Smart line module with cold plate (10 kW)

7.3.2 Connection example

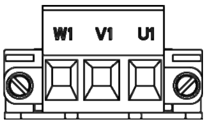
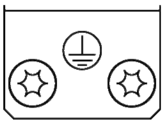


1) Leading opening contact t>10ms
2) DI/DO (controlled by Control Unit)
3) No additional load permitted downstream of line contactor
4) Note the current carrying capacity of the DO.
   An output interface element may have to be used.
5) Jumper closed, feedback deactivated

Figure 7-2 Connection example: smart line module with cold plate

7.3.3 X1 line connection

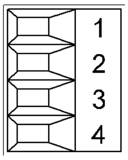
Table 7-1 Terminal block X1 of Smart Line Module (5 kW and 10 kW)

	Terminal	Technical data
	U1	Max. connection voltage: 3 AC 480 V +10% at 47 Hz to 63 Hz Max. connectable cross-section: 6 mm^2 Type: Screw terminal 5 (see Connection Engineering section) Tightening torque: 1,2 - 1,5 Nm
	V1	
	W1	
	PE connection	Threaded hole M5/3 Nm [1]

1) for ring terminal end in accordance with DIN 46234

7.3.4 X21 terminals: smart line module

Table 7-2 Terminal block X21

	Terminal	Designation	Technical specifications
	1	DO: Ready	Checkback: Smart Line Module ready The signal switches to high level when the following conditions have been met: • Electronics power supply (X24) OK • DC link is pre-charged • Pulses enabled (X21.3/.4) • No overtemperature • No overcurrent switch-off
	2	DO: Prewarning	DO: Prewarning High = no prewarning Low = prewarning • Alarm threshold overtemperature / I x t • No regenerative feedback capability due to a line fault [only monitored when feedback is activated (see terminal X22.2)]
	3	DI: Enable pulses	Voltage 24 V DC Current consumption: 10 mA Isolated input
	4	DI: Enable pulses ground	
Max. connectable cross-section: 1.5 mm^2 Type: Screw terminal 1 (see Spring-Loaded Terminals/Screw Terminals)			

Note

For operation, 24 V DC must be connected to terminal 3 and ground to terminal 4. When removed, pulse inhibit is activated, feedback is deactivated and the bypass relay drops out. If the Line Module is not disconnected from the line supply when the EP terminal is deactivated (e.g. a main contactor is not installed), the DC link remains charged.

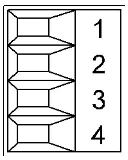
NOTICE

If a drive line-up is switched off by means of the line disconnecting device, the voltage at terminals 3 (EP +24 V) and 4 (EP M) must be interrupted beforehand. This can be carried out using a leading breaking auxiliary contact (≥ 10 ms), for example.

This protects external loads located parallel to the drive on the same switching component.

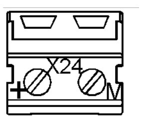
7.3.5 X22 terminals: smart line module

Table 7-3 Terminal block X22

	Terminal	Designation	Technical specifications
	1	24 V power supply	Electronics power supply for controlling digital inputs X22.2 and 3.
	2	DI: Disable Regeneration	Deactivate feedback (high active). No power is supplied back to the network from the DC link. The regenerative energy of the motors may have to be reduced using a combination of the Braking Module and braking resistor.
	3	DI: Reset	Reset faults (positive edge)
	4	Ground	Electronics ground
Max. connectable cross-section: 1.5 mm² Type: Screw terminal 1 (see Connection Engineering section)			

7.3.6 X24 24 V terminal adapter

Table 7-4 Terminal block X24

	Terminal	Designation	Technical specifications
	+	24 V power supply	24 V DC supply voltage
	M	Ground	Electronics ground
The 24 V terminal adapter is supplied as standard Max. connectable cross-section: 6 mm²			

7.3.7 Meaning of the LEDs on the smart line module with cold plate

Table 7-5 Meaning of the LEDs on a Smart Line Module with cold plate

LED	Color	State	Description
READY	Green	Steady light	Ready
	Orange	Steady light	Precharging not yet complete
	Red	Steady light	Overtemperature/overcurrent switchoff, or electronics power supply outside the permissible tolerance range, or DC link outside the permissible tolerance range
DC LINK	---	OFF	Electronics power supply outside permissible tolerance range
	Orange	Steady light	DC link voltage within permissible tolerance range
	Red	Steady light	DC link voltage outside permissible tolerance range

WARNING

Hazard DC link voltages may be present at any time regardless of the status of the "DC link" LED.

The warning information on the components must be carefully observed!

Cause and rectification of faults

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

Reference: /IH1/ SINAMICS S120, Commissioning Manual.

7.4 Dimension drawing

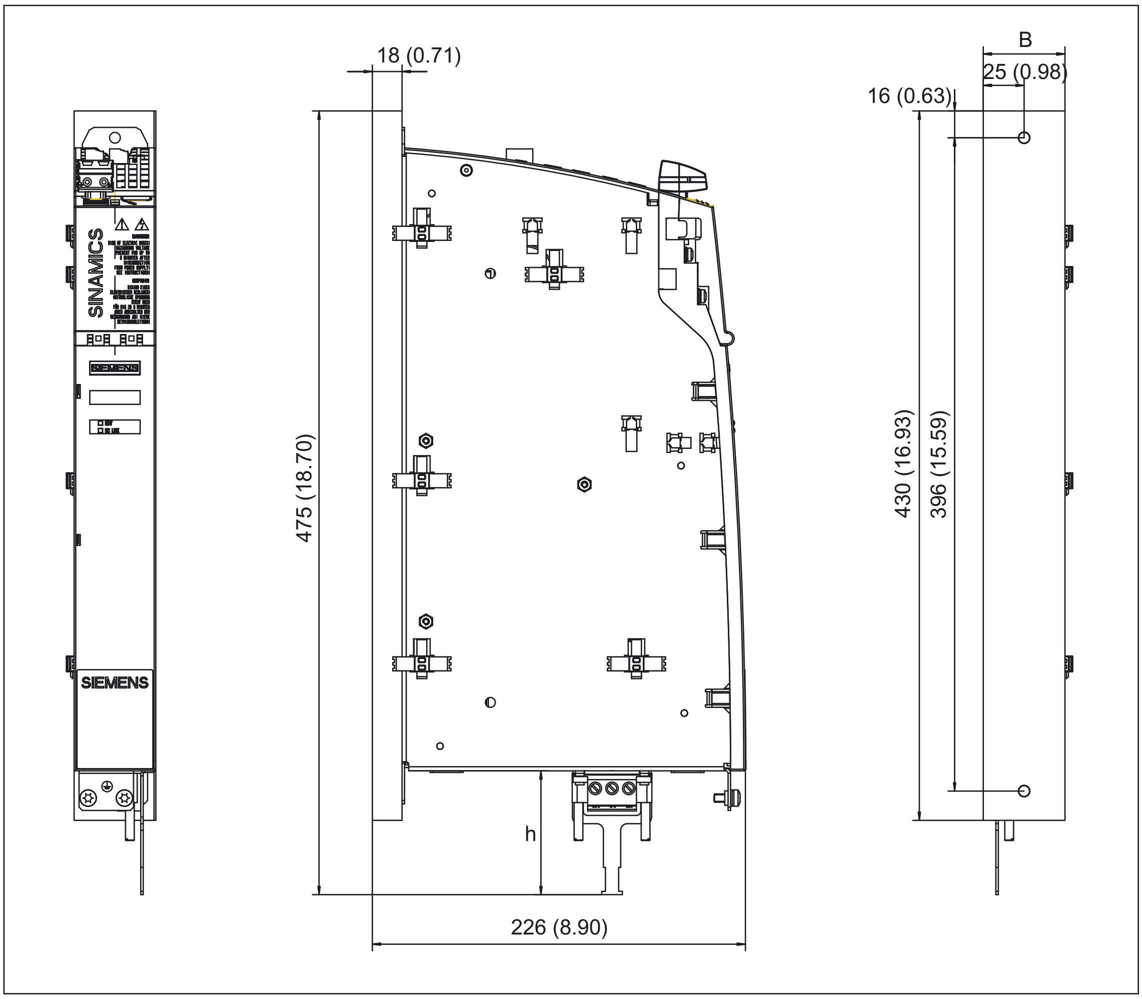


Figure 7-3 Dimension drawing, Smart Line Module with cold plate (5 kW and 10 kW)

Table 7-6 Dimension, Smart Line Module with cold plate (5 kW and 10 kW)

Line module type	Order number	W [mm] (inches)	H [mm] (inches)
5 kW	6SL3136-6AE15-0AAx	50 (1.97)	75 (2.95)
10 kW	6SL3136-6AE21-0AAx	50 (1.97)	75 (2.95)

7.5 Installing the Cold-Plate Modules on Customer-Specific Heat Sinks

Mounting the cold plate module on customer-specific heat sinks

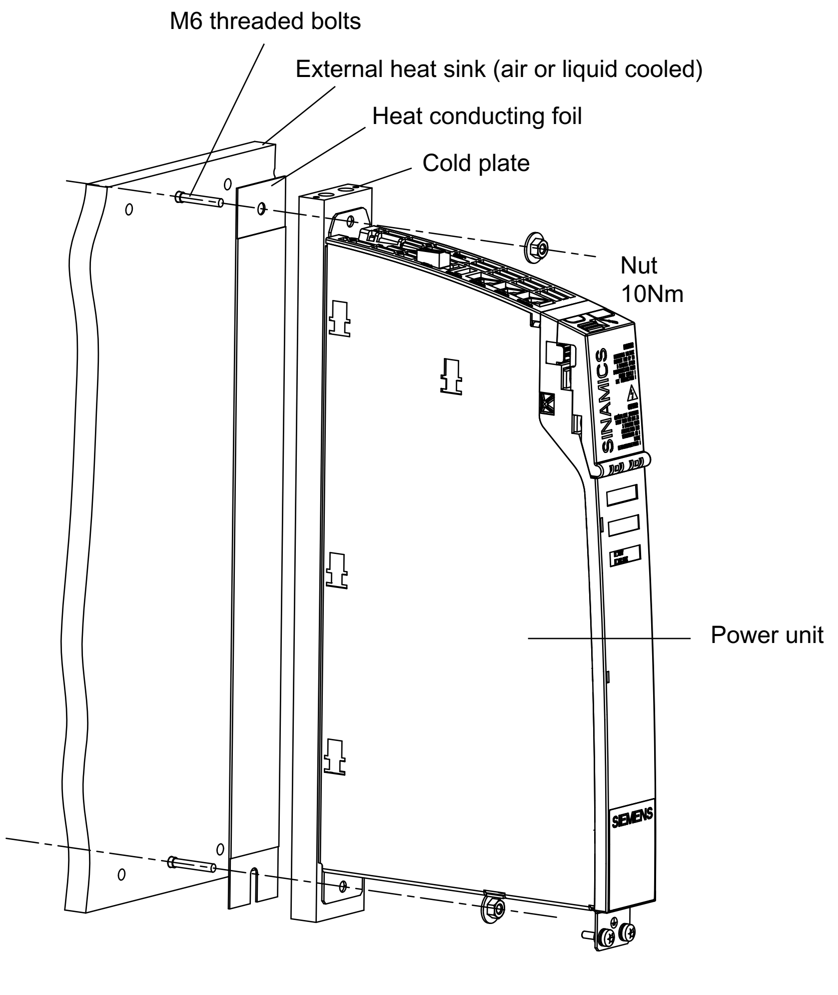


Figure 7-4 Installing a cold-plate power section with an external heat sink

Help with the mechanical cabinet design is available from:

Siemens AG
A&D SE WKC
CoC CabinetCooling
P.O. Box 1124
09070 Chemnitz, Germany

E-mail: cc.cabinetcooling@siemens.com

Properties of the heat sink

AlMgSi 0.5 is recommended as the heat sink material.
The roughness of the external heat sink surface should be at least Rz 16 and the contact surface between the heat sink and cold plate should have an evenness of 0.2 mm.

Note

The machine manufacturer can adapt the heat sink version to his special requirements. The specified rated data for the Power Modules can only be achieved if the power losses can be dissipated by the external heat sink under the specified general conditions.

NOTICE

When mounting, you must ensure that the threaded bolts do not damage the cold plate.

Installation instructions

1. Before mounting, check the surface of the heat sink to ensure that it is not damaged.
2. For installation, M6 screw bolts and hexagon nuts/threaded pins (ISO 7436-M6x40-14 H) are recommended.
3. To improve heat transfer, a heat-conducting medium must be used. Special spherical-indented heat-conducting film must be used for this purpose. Every cold plate power unit is supplied with heat-conducting film cut to the right size. Note the installation position of the heat-conducting film (see diagram above). To make it easier to attach the heat-conducting film, the screw bolts/threaded pins should already be inserted in the holes provided on the heat sink.
4. The component is then mounted onto the external heat sink.
5. The tightening torque for the screw connection is 10 Nm.

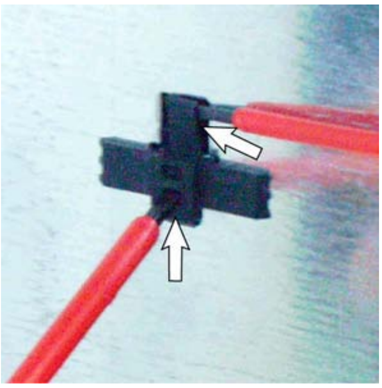
   Note

   When a component is replaced, the heat-conducting film must also be replaced.
   Only heat-conducting film approved or supplied by Siemens can be used.

	Order No.
Heat-conducting foil, 50 mm	6SL3162-6FB00-0AA0
Heat-conducting foil, 100 mm	6SL3162-6FD00-0AA0
Heat-conducting foil, 150 mm	6SL3162-6FF00-0AA0
Heat-conducting foil, 200 mm	6SL3162-6FH00-0AA0
Heat-conducting foil, 300 mm	6SL3162-6FM00-0AA0

Remove the holder for securing the Control Unit.

If an additional component is to be flush-mounted to the left of the component, the holders for securing the Control Unit must be removed.

		
Use suitable tools to lift the latching device and push up the holder	Remove the holder	Holder removed

7.6 Technical Specifications

Table 7-7 Technical data for Smart Line Modules with cold-plate cooling

	6SL3135-6AE	15-0AAx	21-0AAx
Connection voltages: Line voltage Line frequency Electronics power supply	 V_{AC} Hz V_{DC}	3-ph. 380 V AC – 10% (-15% < 1 min) up to 3-ph. 480 V AC + 10% 47 to 63 24 (20.4 – 28.8)	
DC link voltage Overvoltage trip threshold Undervoltage trip threshold	V_{DC} V_{DC} V_{DC}	510 – 720 820 ± 2 % 360 ± 2 %	
DC link busbar current carrying capacity	A_{DC}	100	100
24 V busbar current carrying capacity	A_{DC}	20	20
Rated power	kW	5	10
Infeed: Rated power (S1)[1] Infeed power (S6-40%)[1] Infeed peak power[1]	 kW (Pn) kW (Ps6) kW (Pmax)	 5 10	 10 20
Regenerative feedback: Continuous regenerative power rating Peak regenerative power rating	 kW kW	 5 10	 10 20
Line currents: at 380 V_{AC} at 480 V_{AC} / 528 V_{AC} at 480 V; S6-40% Peak current (at 400 V_{AC} / 480 V_{AC})	 A_{AC} A_{AC} A_{AC} A_{AC}	 12 9,3 / 8,5 12 22 / 18,5	 24 18 / 16,5 24 44 / 37
DC link current Rated current with S6-40% peak current	 A_{DC} A_{DC} A_{DC}	 8,3 11 16,6	 16,6 22 33,2
Max. permissible heat sink temperature	°C	60	65
Max. ambient temperature without derating	°C	40	40
Max. ambient temperature with derating	°C	55	55
DC link capacitance	µF	220	330
Maximum permissible DC link capacitance	µF	6000	6000
Power factor	cosϕ	1	1
Weight	kg	4,0	4,0

[1] The specified values are valid for 380 V

Rated duty cycles of Smart Line Modules

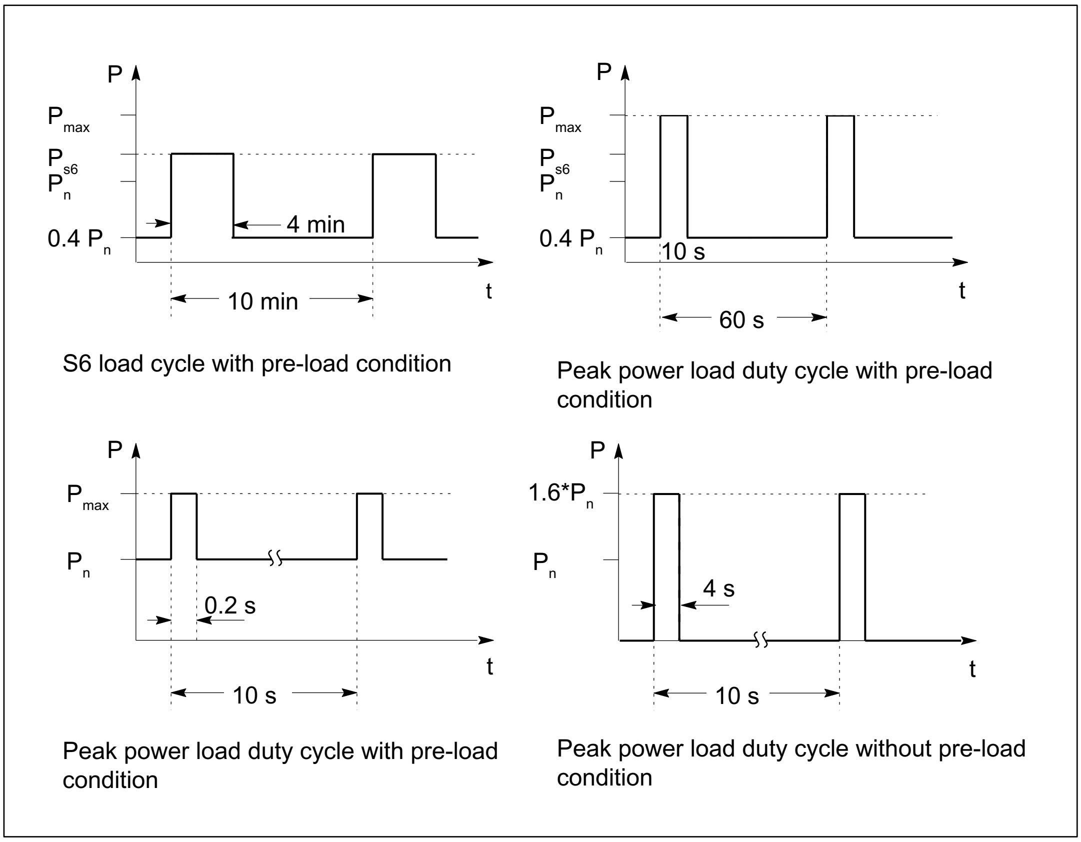


Figure 7-5 Rated duty cycles of Smart Line Modules

Derating as a function of the ambient temperature

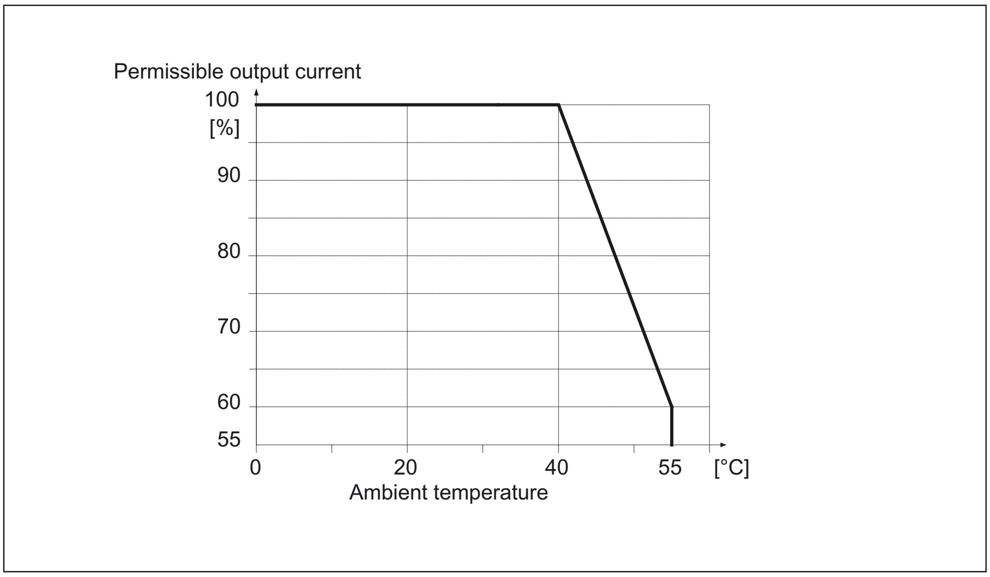


Figure 7-6 Derating as a function of the ambient temperature

Derating as a function of the site altitude

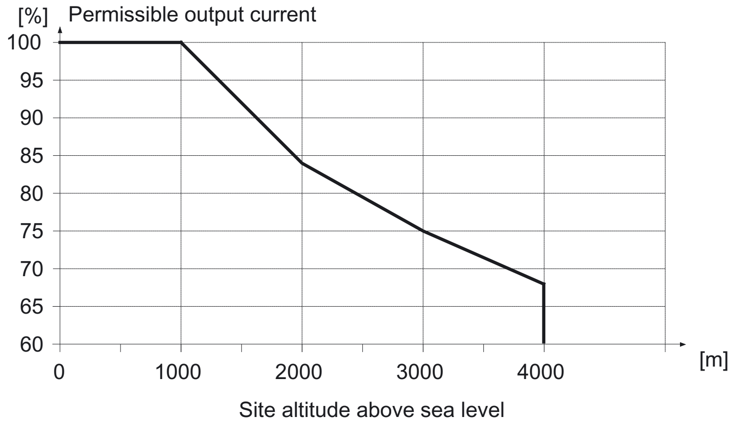


Figure 7-7 Derating as a function of the site altitude

Voltage derating as a function of the installation altitude

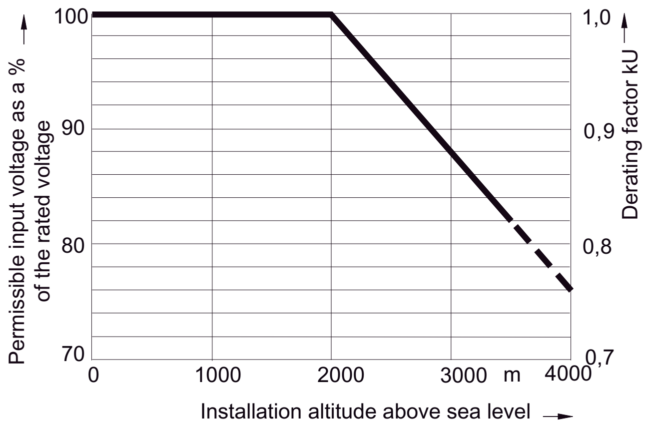


Figure 7-8 Voltage derating as a function of the installation altitude

Output power as a function of total cable length

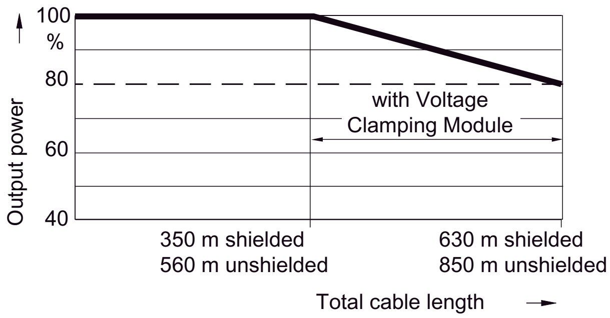


Figure 7-9 Output power as a function of total cable length

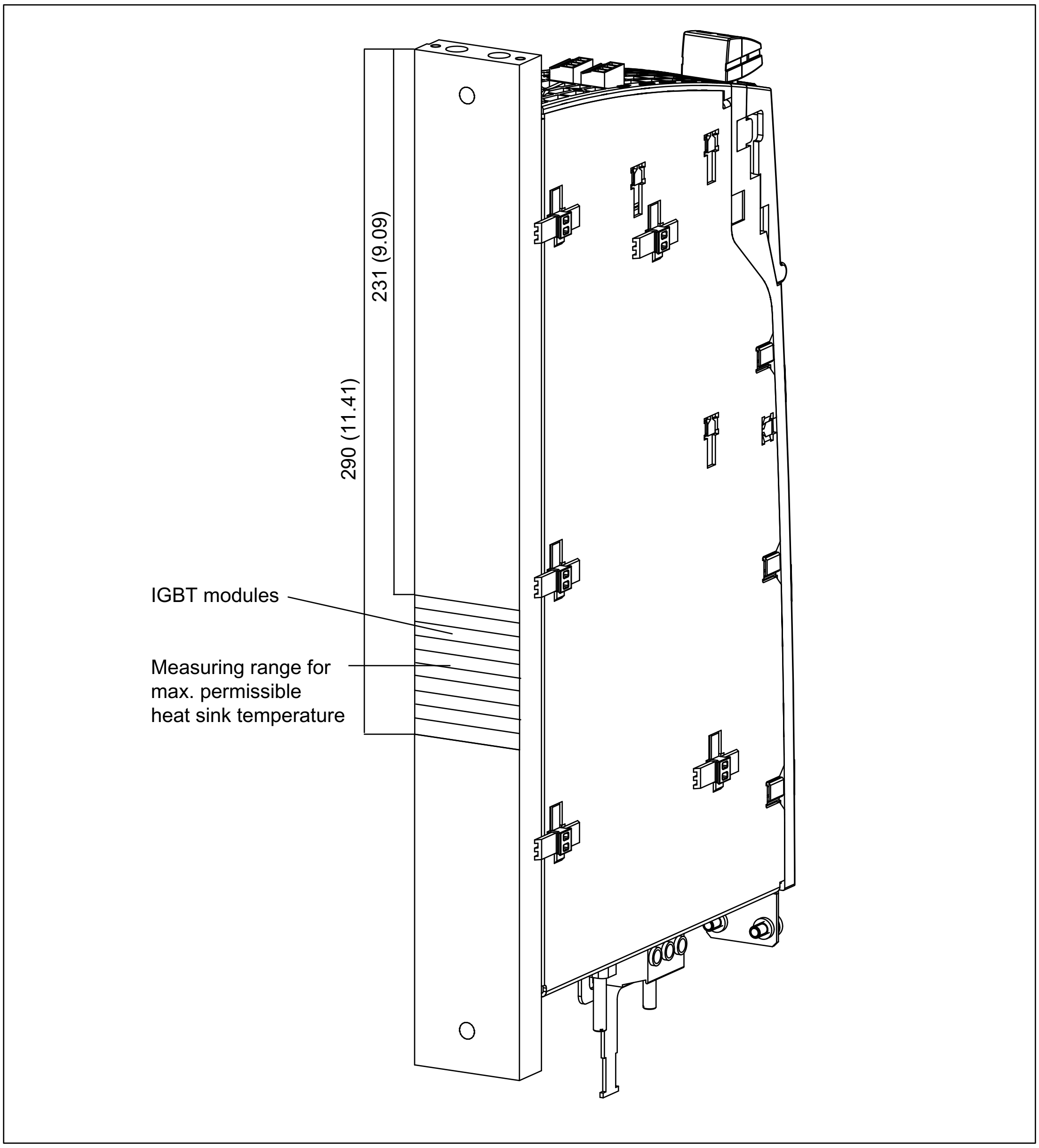


Figure 7-10 Measuring range for max. permissible heat sink temperature for a Smart Line Module

8 Motor Modules with Cold Plate

8.1 Description

A motor module is a power unit (inverter) that provides the power supply for the connected motor(s). Energy is supplied from the Infeed Module. A Motor Module must be connected to a Control Unit via DRIVE-CLiQ. The open-loop and closed-loop control functions for the Motor Module are stored in the Control Unit.

One motor can be connected to single motor modules and two motors can be connected to double motor modules.

8.2 Safety information

⚠ DANGER

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).

⚠ DANGER

Risk of electric shock. A hazardous voltage is present for up to 5 minutes after the supply has been disconnected.
The protective cover may only be opened after this time has expired.

⚠ WARNING

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

The components must only be operated when the protective cover of the DC link is closed. Damaged components must not be used further. If this is not carefully observed, it can result in subsequent damage and accidents.

⚠ DANGER
Motor Modules with a rated current of 18 A and all Double Motor Modules conduct a high leakage current via the PE conductor. Because of the high leakage current of the Motor Modules, a permanent PE connection of the Motor Module or control cabinet is required. EN 61800-5-1 also stipulates the following precautions: Either protective conductor cross-sections of ≥ 10 mm^2 Cu or installation of a second protective conductor of the same size as the first protective conductor.

⚠ DANGER
The DC link discharge voltage hazard warning in the local language must be attached to all of the components. A set of labels in 16 languages is supplied with the component.

⚠ WARNING
The cooling clearances of 80 mm above and below the components must be observed.

⚠ DANGER
It is only permissible to establish connections to the DC link using the adapters that SIEMENS has recommended (DC link adapter and DC link rectifier adapter).

CAUTION
The tightening torque of the DC link busbar screws (1.8 Nm, tolerance +30%) must be checked before commissioning. After being transported the screws must be tightened.

⚠ DANGER
If, at the lefthand end of the drive line-up, there is a 50 mm wide Motor Module or a DC link component of the appropriate width (e.g. Braking Module, CSM, VCM), then the DC link bridge and all of the associated screws must be removed completely. It is not permissible to insert the screws without a DC link bridge. For all of the other power units and DC link components (e.g. Capacitor Module) that are wider than 50 mm, then it is neither permissible to move the DC link bridge to the left nor remove it. If this is not carefully observed, this can result in damage and accidents.

⚠ WARNING
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.

DANGER

It is essential to connect the shield for the motor holding brake. Furthermore, Motion-Connect cables must be used for units with an integrated motor holding brake to ensure that the core insulation is effective. Risk of electric shock.

CAUTION

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

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.

Note

A regulated DC power supply is required to operate motors with a built-in holding brake. The voltage is supplied via the internal 24 V busbars. 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 voltage 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

CAUTION

The DC link peripheral covers are supplied as standard with the components; they can also be ordered separately, if required (order no.: 6SL3162-5AA00-0AA0).

8.3 Interface description

8.3.1 Overview

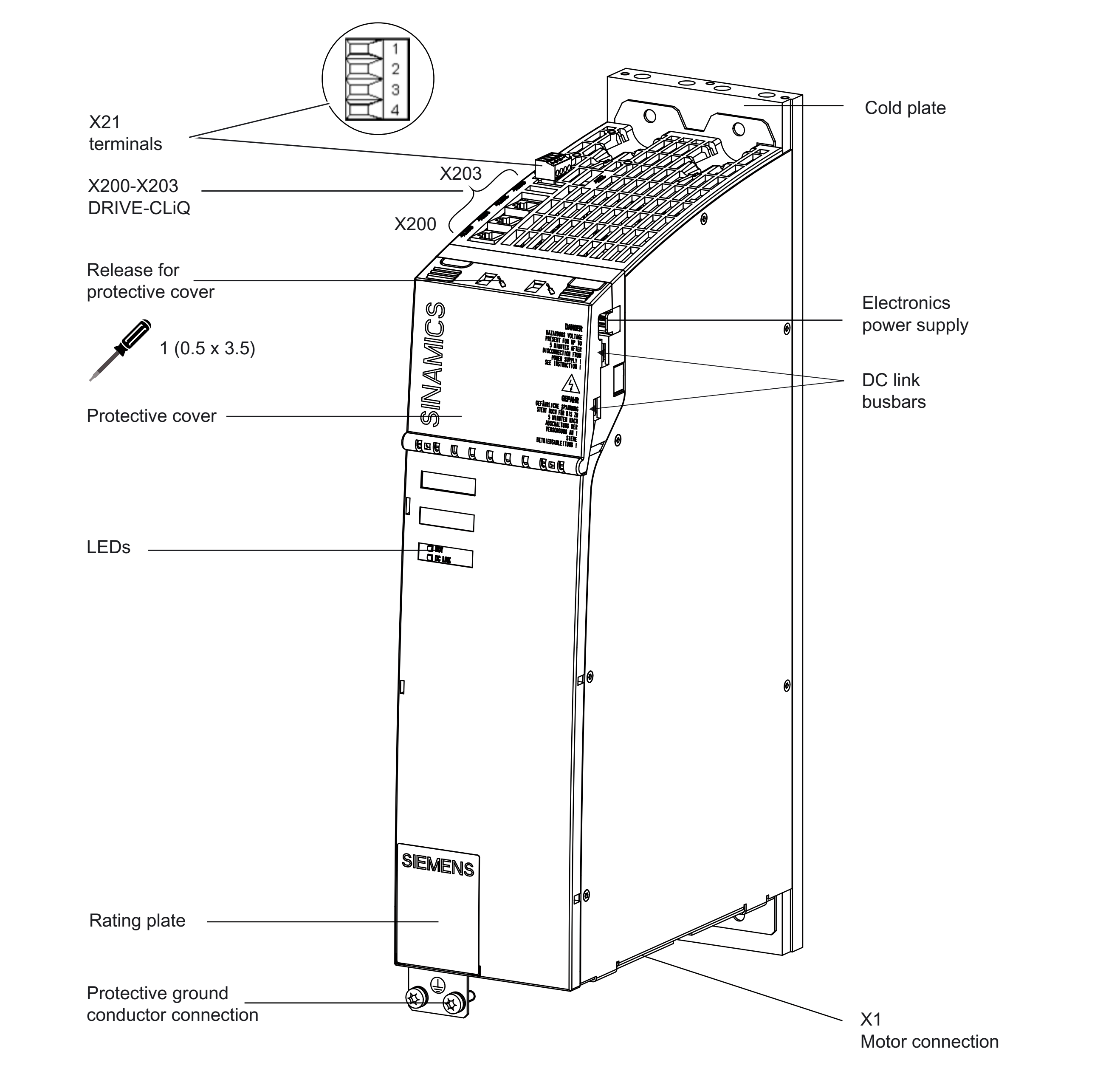
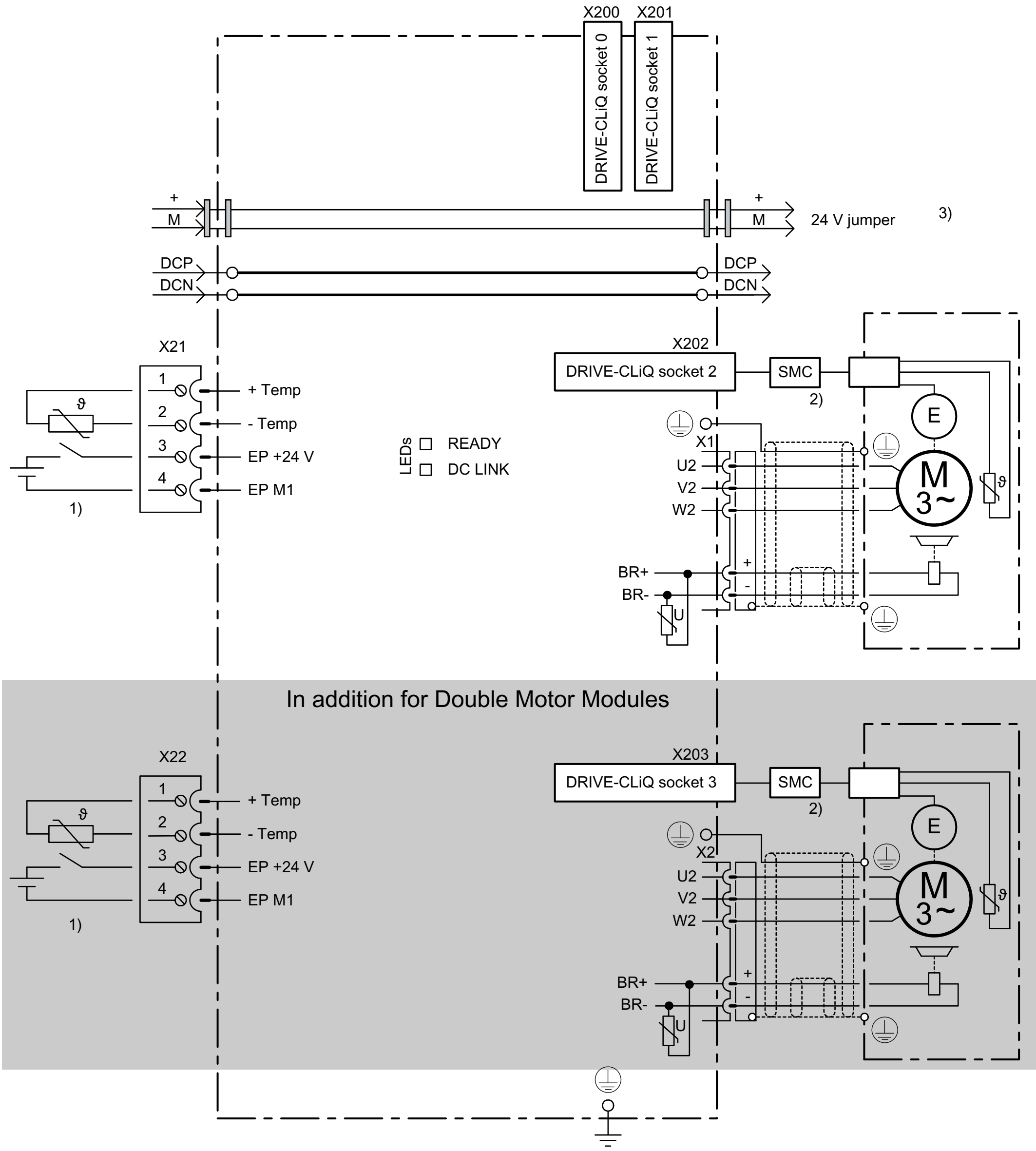


Figure 8-1 Single motor module with cold plate (example 30 A)

8.3.2 Connection Examples



1) Required for Safety
2) SMC required for motors without DRIVE-CLiQ interface
3) 24 V to the next module

Figure 8-2 Connection example of Motor Modules 3 A to 30 A and Double Motor Modules 3 A to 18 A

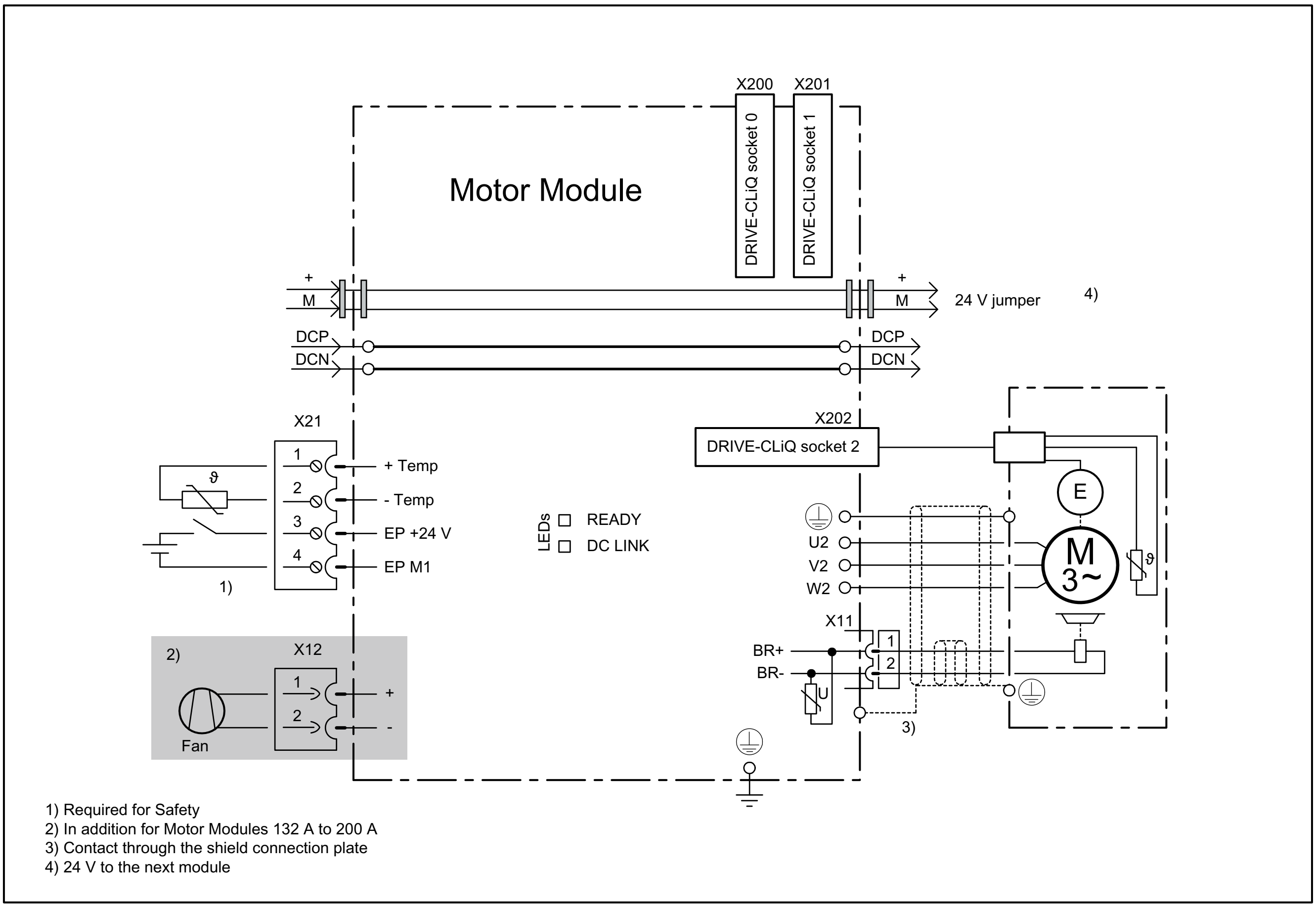
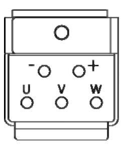
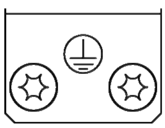


Figure 8-3 Example connection of Single Motor Modules 45 A to 200 A

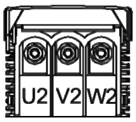
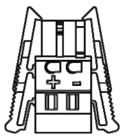
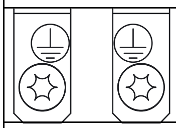
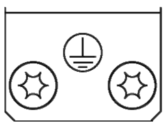
8.3.3 Motor/brake connection

Table 8-1 Terminal block X1/X2 Motor Modules 3 A to 30 A and Double Motor Modules 3 A to 18 A

	Terminal	Technical specifications
	U (U2)	Motor connection
	V (V2)	
	W (W2)	
	+ (BR+)	Brake connection
	- (BR-)	
	PE connection	Threaded hole M5/3 Nm [1]

[1] for ring cable lugs to DIN 46234

Table 8-2 Terminal block Single Motor Module 45 A to 200 A

	Terminals	Technical specifications
	U2 V2 W2	**45 A to 60 A:** Threaded bolt M6/6 Nm [1)] **85 A:** Threaded bolt M8/13 Nm [1)] **132 A to 200 A:** Threaded bolt M8/13 Nm [1)]
	+ (BR+) - (BR-)	X11 brake connector [2]: Voltage 24 V DC Max. load current 2 A Min. load current 0.1 A Max. connectable cross-section 2.5 mm^2 Type: Spring-loaded terminal 2 (see Connection Methods) Manufacturer: Wago; Order No.: 721-102/026-000/56-000 The brake connector is part of the prefabricated cable.
	PE connection	**Single Motor Module with a rated output current of 45 A to 60:** Threaded bolt for motor cables: M6/6 Nm [1)]Threaded hole for PE: M6/6 Nm[1)]
		**Single Motor Module with a rated output current of 85 A** Threaded bolt for motor cables: M8/13 Nm [1)] Threaded hole for PE: M6/6 Nm[1)] **Single Motor Module with a rated output current of 132 A to 200 A** Threaded bolt for motor cables: M8/13 Nm [1)] Threaded hole for PE: M8/13 Nm [1)]

[1] For ring cable lugs to DIN 46234

[2] The circuit for protecting the brakes against overvoltage is in the Motor Module and does not need to be installed externally. The max. load current is 2 A, the min. load current 0.1 A.

Note

The total length of the shielded power cables (motor supply cables and DC link cables) must not exceed 350 m.

Note

The motor brake must be connected via connector X11. The BR - cable must not be connected directly to electronic ground (M).

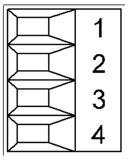
⚠ WARNING

Only protective extra-low voltages (DVC A) that comply with EN60204-1 must be connected to all connections and terminals between 0 and 48 V DC.

The voltage tolerances of the motor holding brakes must be taken into account.

8.3.4 X21/X22 EP terminals / temperature sensor connection for motor module with cold plate

Table 8-3 Terminal block X21/X22

	Terminal	Function	Technical specifications
	1	+Temp	Temperature sensor connection KTY84–1C130
	2	-Temp	
	3	EP +24 V (Enable Pulses)	Supply voltage: 24 V DC (20.4 V - 28.8 V) Current consumption: 10 mA Isolated input Signal propagation times: L → H: 100 µs H → L: 1000 µs
	4	EP M1 (Enable Pulses)	
Max. connectable cross-section 1.5 mm^2 Type: Screw terminal 1 (see Appendix A)			

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

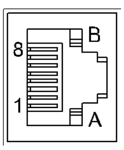
Note

The temperature sensor connection is required for motors where the temperature value is not transmitted via DRIVE-CLiQ.

If the Safety function is active, 24 V DC must be connected to terminal 3 and ground to terminal 4. When removed, pulse inhibit is activated (if this has been parameterized).

8.3.5 X200-X203 DRIVE-CLiQ interface

Table 8-4 DRIVE-CLiQ interface X200-X202: single motor module
DRIVE-CLiQ interface X200-X203: double motor module

	Pin	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	M (0 V)	Electronics ground
Blanking plate for DRIVE-CLiQ interface: Yamaichi, order no.: Y-ConAS-13			

8.3.6 Meaning of the LEDs on the Motor Module

Table 8-5 Meaning of the LEDs on the Motor Module

LED	Color	State	Description
READY	-	Off	Electronics power supply outside the permissible tolerance range.
	Green	Steady light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	Steady light	DRIVE-CLiQ communication is being established.
	Red	Steady light	At least one fault is present in this component.
	Green Red	Flashing 2 Hz	Firmware is being downloaded.
	Green/ Orange or Red/Orange	Flashing 2 Hz	Component recognition via LED is activated (p0124). Note: Both options depend on the LED status when module recognition is activated via p0124 = 1.
DC LINK	-	Off	Electronics power supply outside the permissible tolerance range.
	Orange	Steady light	DC link voltage within permissible tolerance range (only when ready for operation)
	Red	Steady light	DC link voltage outside permissible tolerance range (only when ready for operation)

⚠ WARNING

Hazardous DC link voltages may be present at any time regardless of the status of the "DC link" LED.

The warning information on the components must be carefully observed!

Cause and rectification of faults

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

Reference: /IH1/ SINAMICS S120, Commissioning Manual.

8.4 Dimension drawings

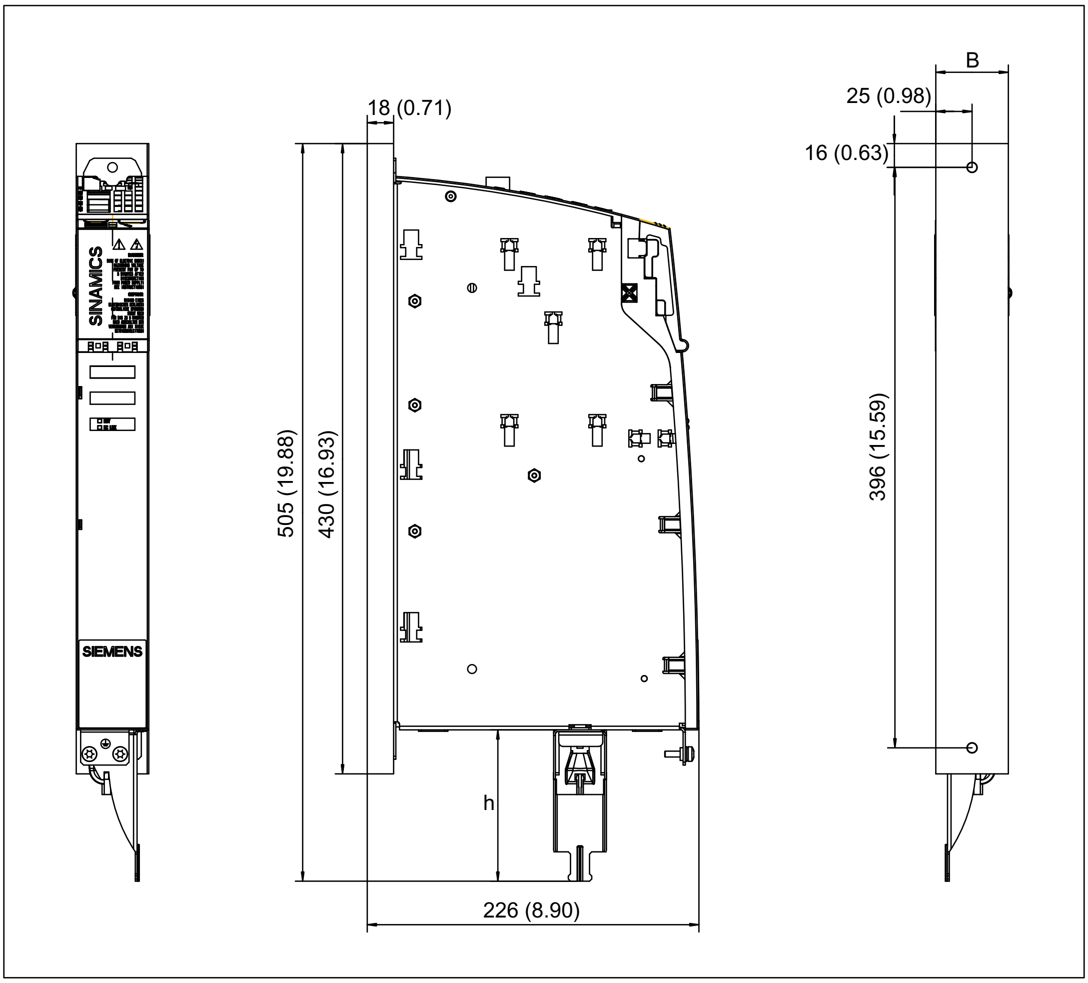


Figure 8-4 Dimension drawing of Motor Module with cold plate 3 A to 18 A and 2 x 3 A to 2 x 9 A

Table 8-6 Dimensions of Motor Module with cold plate 3 A to 18 A and 2 x 3 A to 2 x 9 A

Motor Module type	Order number	W [mm] (inches)	h [mm] (inches)
LT Compact 1 axis 400 V DC 3 A 50 mm	6SL3126-1TE13-0AAx	50 (1.97)	105 (4.13)
LT Compact 1 axis 400 V DC 5 A 50 mm	6SL3126-1TE15-0AAx	50 (1.97)	105 (4.13)
LT Compact 1 axis 400 V DC 9 A 50 mm	6SL3126-1TE21-0AAx	50 (1.97)	105 (4.13)
LT Compact 1 axis 400 V DC 18 A 50 mm	6SL3126-1TE21-8AAx	50 (1.97)	105 (4.13)
LT Compact 2 axis 400 V DC 3 A 50 mm	6SL3126-2TE13-0AAx	50 (1.97)	105 (4.13)
LT Compact 2 axis 400 V DC 5 A 50 mm	6SL3126-2TE15-0AAx	50 (1.97)	105 (4.13)
LT Compact 2 axis 400 V DC 9 A 50 mm	6SL3126-2TE21-0AAx	50 (1.97)	105 (4.13)

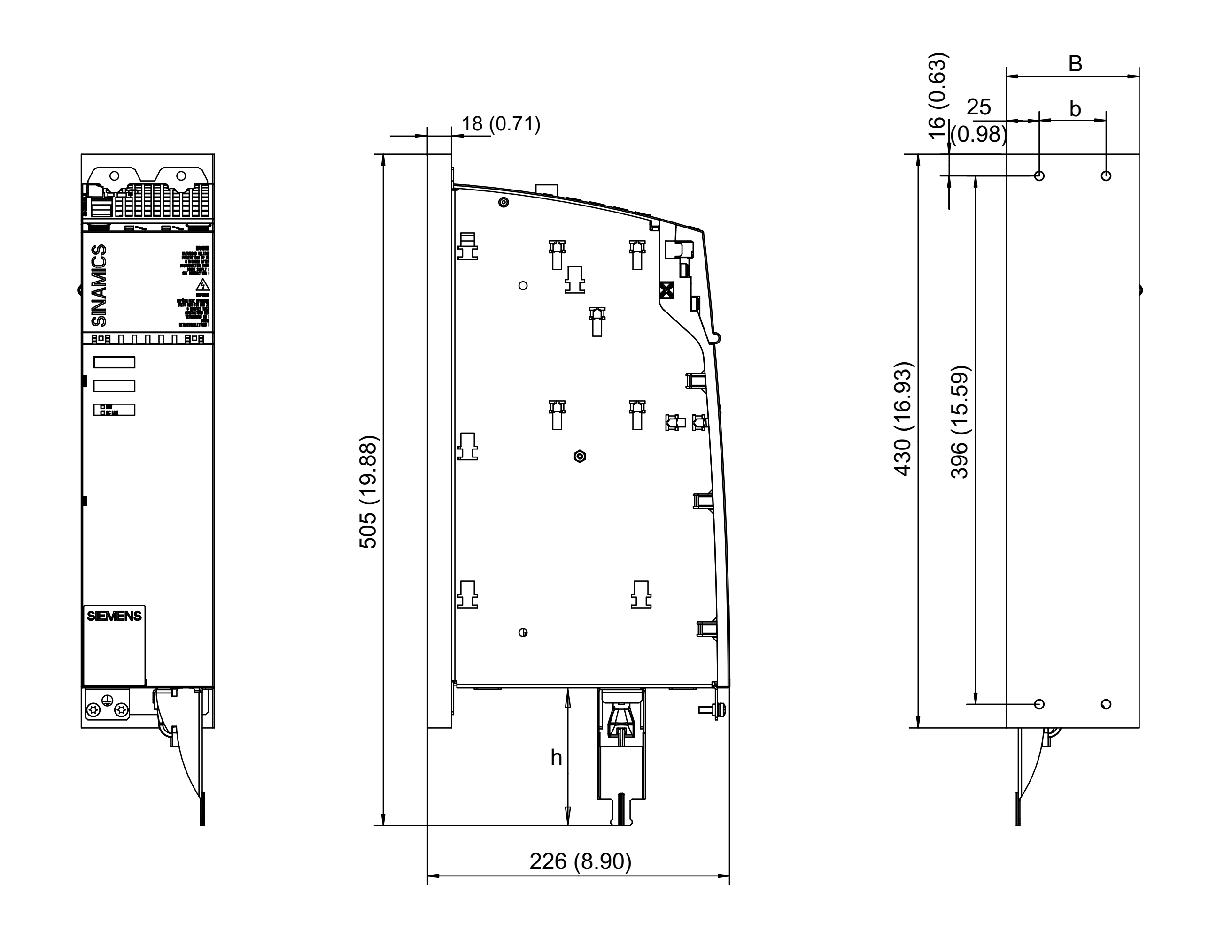


Figure 8-5 Dimension drawing of Motor Module with cold plate 30 A and 2 x 18 A

Table 8-7 Dimensions of Motor Module with cold plate 30 A and 2 x 18 A

Motor Module type	Order number	W [mm] (inches)	b [mm] (inches)	h [mm] (inches)
LT Compact 1 axis 400 V DC 30 A 100 mm	6SL3126-1TE23-0AAx	100 (3.94)	50 (1.97)	105 (4.13)
LT Compact 2 axis 400 V DC 18 A 100 mm	6SL3126-2TE21-8AAx	100 (3.94)	50 (1.97)	105 (4.13)

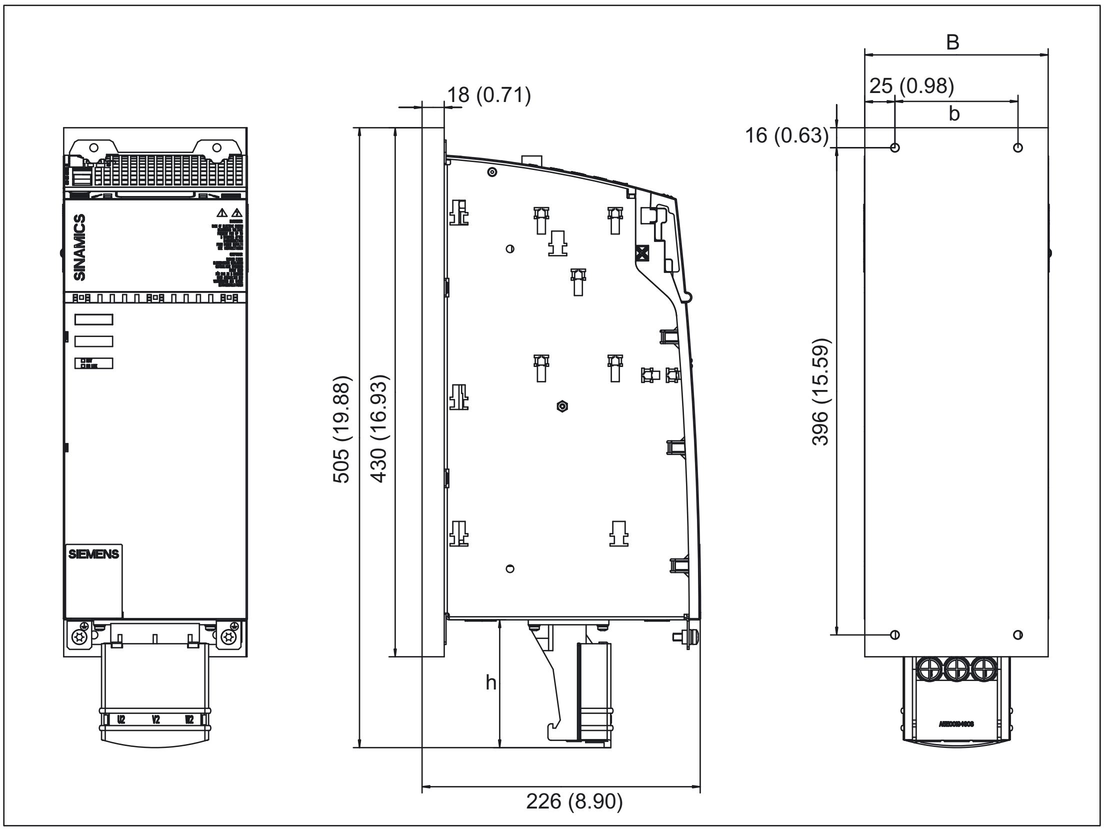


Figure 8-6 Dimension drawing, Motor Module with cold plate 45 A, 60 A and 85 A

Table 8-8 Dimensions, Motor Module with cold plate 45 A, 60 A and 85 A

Motor Module type	Order number	W [mm] (inches)	b [mm] (inches)	h [mm] (inches)
LT Compact 1 axis 400 V DC 45 A 150 mm	6SL3126-1TE24-5AAx	150 (5.91)	100 (3.94)	105 (4.13)
LT Compact 1 axis 400 V DC 60 A 150 mm	6SL3126-1TE26-0AAx	150 (5.91)	100 (3.94)	105 (4.13)
LT Compact 1 axis 400 V DC 85 A 200 mm	6SL3126-1TE28-5AAx	200 (7.87)	150 (5.91)	105 (4.13)

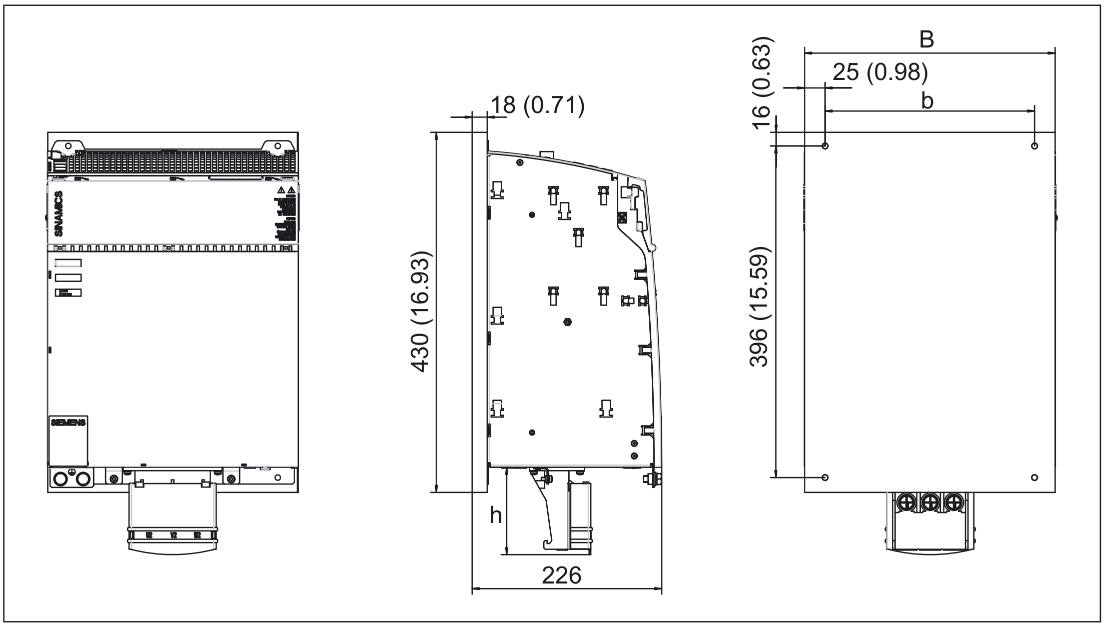


Figure 8-7 Dimension drawing of Motor Module with cold plate (132 A and 200 A)

Table 8-9 Dimensions of Motor Module with cold plate (132 A and 200 A)

Motor Module type	Order number	W [mm] (inches)	b [mm] (inches)	h [mm] (inches)
LT Compact 1 axis 400 V DC 132 A 300 mm	6SL3126-1TE31-3AAx	299 (11.77)	250 (9.84)	105 (4.13)
LT Compact 1 axis 400 V DC 200 A 300 mm	6SL3126-1TE32-0AAx	299 (11.77)	250 (9.84)	105 (4.13)

8.5 Installing the Cold-Plate Modules on Customer-Specific Heat Sinks

Mounting the cold plate component on customer-specific heat sinks

Note the following before installation:

- Before mounting, check the surface of the heat sink to ensure that it is not damaged.
- To facilitate installation, M6 screw bolts and hexagon nuts/threaded pins (ISO 7436-M6x40-14 H, strength class 8.8) are recommended.
- To improve heat transfer, a heat-conducting medium must be used. Special spherical-indented heat-conducting film must be used for this purpose. Every cold plate power unit is supplied with heat-conducting film cut to the right size. Note the installation position of the heat-conducting film (see diagram below).

Note

When a component is replaced, the heat-conducting film must also be replaced.
Only heat-conducting film approved or supplied by Siemens can be used.

	Order No.
Heat-conducting foil, 50 mm	6SL3162-6FB00-0AA0
Heat-conducting foil, 100 mm	6SL3162-6FD00-0AA0
Heat-conducting foil, 150 mm	6SL3162-6FF00-0AA0
Heat-conducting foil, 200 mm	6SL3162-6FH00-0AA0
Heat-conducting foil, 300 mm	6SL3162-6FM00-0AA0

Installation

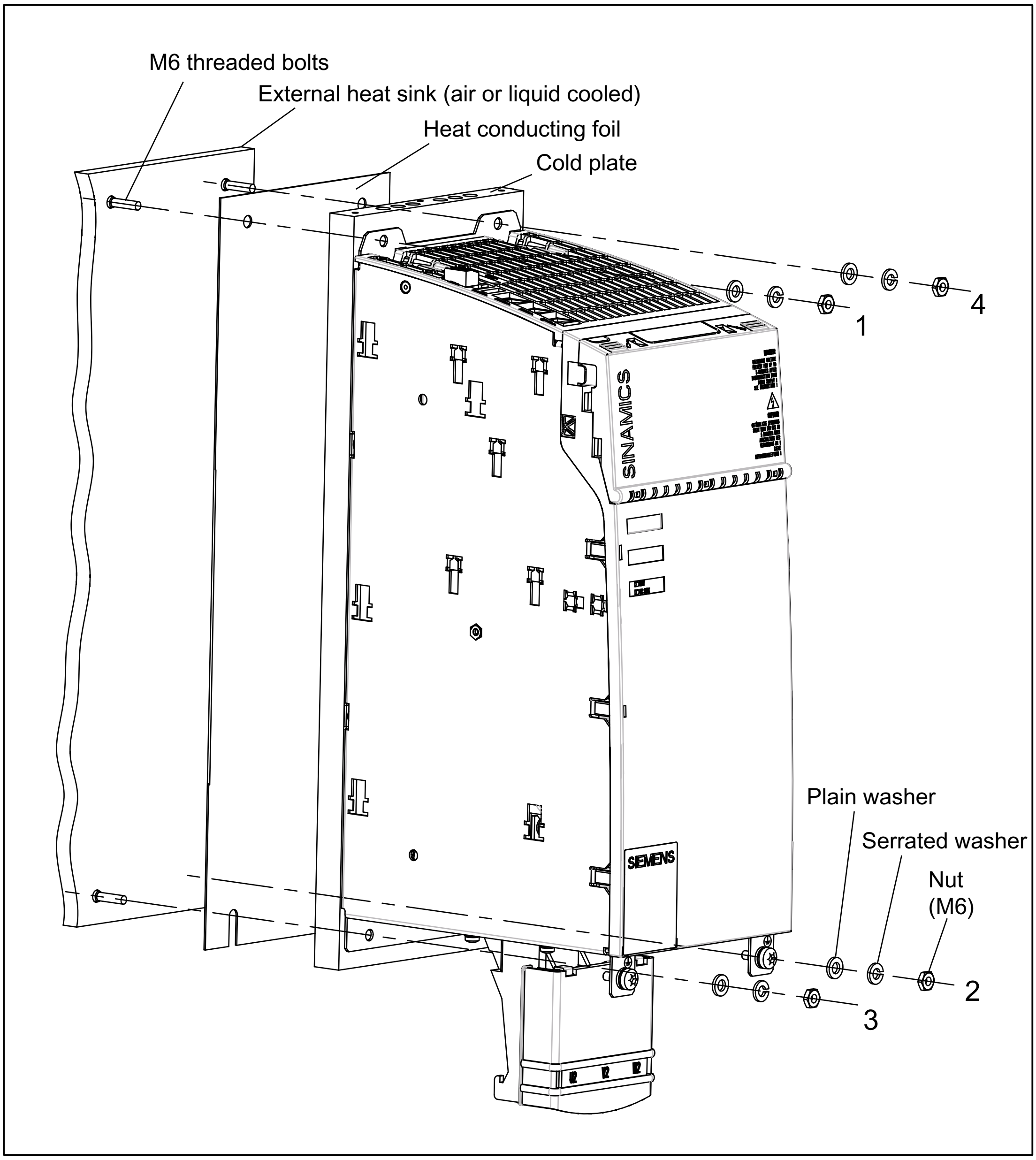


Figure 8-8 Installing a cold-plate power section with an external heat sink and heat-conducting film

To begin, tighten the screws by hand (approx. 0.5 Nm) in the sequence shown (steps 1 to 4) and then secure them (10 Nm).

Help with the mechanical cabinet design is available from:
Siemens AG
A&D SE WKC
CoC CabinetCooling
P.O. Box 1124
09070 Chemnitz, Germany
E-mail: cc.cabinetcooling@siemens.com

Properties of the heat sink

AlMgSi 0.5 is recommended as the heat sink material.
The roughness of the external heat sink surface should be at least Rz 16 and the contact surface between the heat sink and cold plate should have an evenness of 0.2 mm (applicable to a height of 450 mm and width of 300 mm).

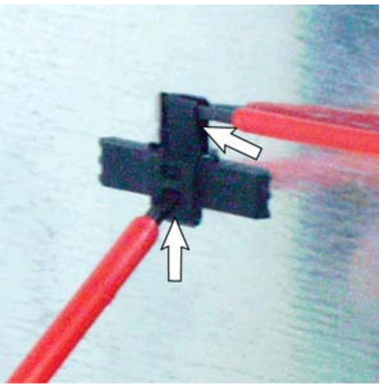
Note

The machine manufacturer can adapt the heat sink version to his special requirements. The specified rated data for the Power Modules can only be achieved if the power losses can be dissipated by the external heat sink under the specified general conditions.

NOTICE
When mounting, you must ensure that the threaded bolts do not damage the cold plate.

Remove the holder for securing the Control Unit.

If an additional component is to be flush-mounted to the left of the component, the holders for securing the Control Unit must be removed.

		
Use suitable tools to lift the latching device and push up the holder	Remove the holder	Holder removed

8.6 Technical Specifications

Table 8-10 Technical data of Motor Modules with cold plate cooling (3 A - 30 A)

	6SL3126-1TE	13-0AA0	15-0AA0	21-0AA0	21-8AA0	23-0AA0
Voltage						
Infeed: DC link voltage Electronics power supply Output voltage	 V_{DC} V_{DC} V_{ACrms}	 510 –720 24 (20.4 – 28.8) 0 - 0.67 x DC link voltage				
Overvoltage tripping Undervoltage tripping	V_{DC} V_{DC}	820 ± 2 % 380				
Electronics current consumption at 24 V	A_{DC}	See Chapter Cabinet design and EMC				
DC link busbar current carrying capacity	A_{DC}	100	100	100	100	100
24 V busbar current carrying capacity	A_{DC}	20	20	20	20	20
Rated output current	$A_{ACrms(In)}$	3	5	9	18	30
Base load current I_{base}	A	2,6	4,3	7,7	15,3	25,5
Intermittent duty current I_{S6} 40%	$A_{ACrms(Is6)}$	3,5	6	10	24	40
Peak current	$A_{ACrms(Imax)}$	6	10	18	36	56
Rated power (with DC link voltage of 600 V_{DC} and clock frequency of 4 kHz)	kW	1,6	2,7	4,8	9,7	16
Max. pulse frequency without derating	kHz	4				
Max. pulse frequency with derating	kHz	16				
Max. permissible heat sink temperature	°C	70	70	70	75	70
Max. ambient temperature without derating	°C	40				
Max. ambient temperature with derating	°C	55				
DC link capacitance	µF	110	110	110	220	710
Weight	kg	4,2	4,2	4,5	4,5	6,1

Table 8-11 Technical data of Motor Modules with cold plate cooling (45 A - 200 A)

	6SL3126-1TE	24-5AA0	26-0AA0	28-5AA0	31-3AA0[1)]	32-0AA0[1)]
Voltage						
Infeed: DC link voltage Electronics power supply Output voltage	 V_{DC} V_{DC} V_{ACrms}	 510 –720 24 (20,4 – 28,8) 0 - 480				
Overvoltage tripping Undervoltage tripping	V_{DC} V_{DC}	820 ± 2 % 380				
Electronics current consumption at 24 V	A_{DC}	See Chapter Cabinet design, Booksize.				
DC link busbar current carrying capacity	A_{DC}	100	100	200	200	200
24 V busbar current carrying capacity	A_{DC}	20	20	20	20	20
Rated output current	$A_{ACrms(In)}$	45	60	85	132	200
Base load current I_{base}	A	38	51	68	105	141
Intermittent duty current I_{S6} 40%	$A_{ACrms(Is6)}$	60	80	110	150	250
Peak current	$A_{ACrms(Imax)}$	85	113	141	210	282
Rated power (with DC link voltage of 600 V_{DC} and clock frequency of 4 kHz)	kW	24	32	46	71	107
Max. pulse frequency without derating	kHz	4				
Max. pulse frequency with derating	kHz	16				
Max. permissible heat sink temperature	°C	75	70	78	70	75
Max. ambient temperature without derating	°C	40				
Max. ambient temperature with derating	°C	55				
DC link capacitance	µF	1175	1410	1880	2820	3995
Weight	kg	9,1	9,1	12,5	18,0	18,0

[1)]The specified rated power values/currents can only be achieved if direct liquid cooling is used. When mounting on an external heat sink, derating must be applied. At a temperature of 40°C at the interface to the power section,
80% derating occurs for 6SL3126-1TE31-3AA0
and 70% for 6SL3126-1TE32-0AA0.

Table 8-12 Technical data of Double Motor Modules with cold plate cooling (2 x 3 to 2 x18 A)

	6SL3126-2TE	13-0AA0	15-0AA0	21-0AA0	21-8AA0
Voltage					
Infeed: DC link voltage Electronics power supply Output voltage	 V_{DC} V_{DC} V_{ACrms}	 510 –720 24 (20,4 – 28,8) 0 - 480			
Overvoltage tripping Undervoltage tripping	V_{DC} V_{DC}	820 ± 2% 380			
Electronics current consumption at 24 V	A_{DC}	See Chapter Cabinet design, Booksize.			
DC link busbar current carrying capacity	A_{DC}	100	100	100	100
24 V busbar current carrying capacity	A_{DC}	20	20	20	20
Rated output current	$A_{ACrms(In)}$	2x3	2x5	2x9	2x18
Base load current I_{base}	A	2x2.6	2x4.3	2x7.7	2x15.3
Intermittent duty current I_{S6} 40%	$A_{ACrms(Is6)}$	2x3.5	2x6	2x10	2x24
Peak current	$A_{ACrms(Imax)}$	2x6	2x10	2x18	2x36
Rated power (with DC link voltage of 600 V_{DC} and clock frequency of 4 kHz)	kW	1,6	2,7	4,8	9,7
Max. pulse frequency without derating	kHz	4			
Max. pulse frequency with derating	kHz	16			
Max. permissible heat sink temperature	°C	75	75	85	80
Max. ambient temperature without derating	°C	40			
Max. ambient temperature with derating	°C	55			
DC link capacitance	µF	110	220	220	705
Weight	kg	4,5	4,5	4,5	5,9

Rated duty cycles of Motor Modules booksize

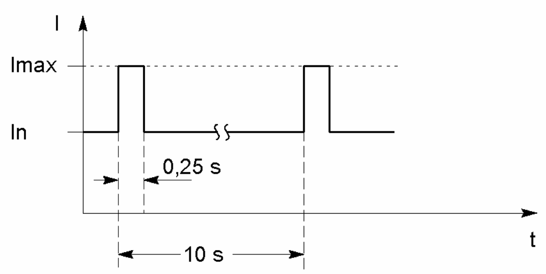


Figure 8-9 Peak current duty cycle with prior loading

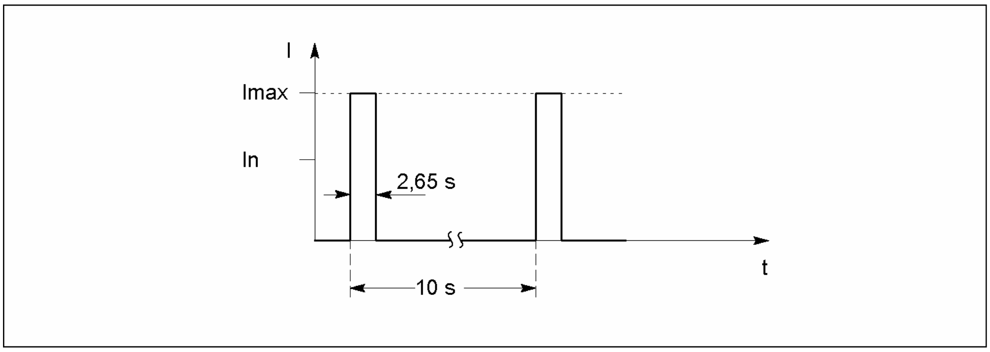


Figure 8-10 Peak current duty cycle without prior loading

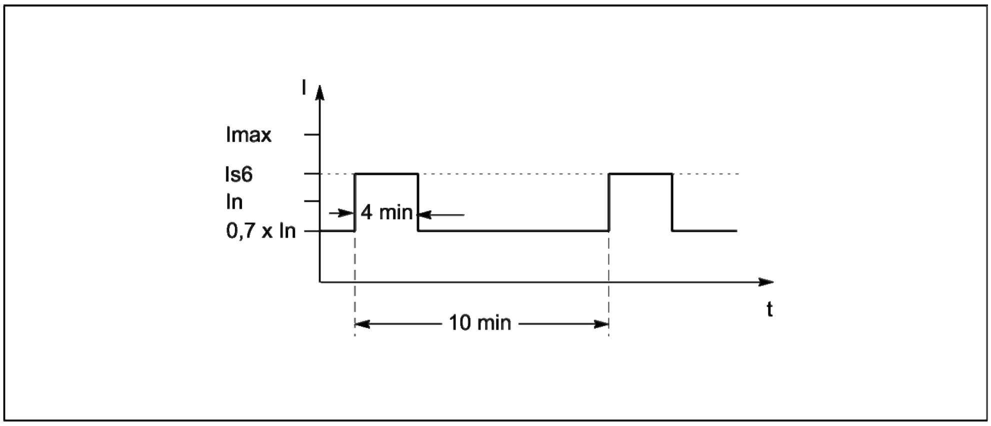


Figure 8-11 S6 current duty cycle with prior loading

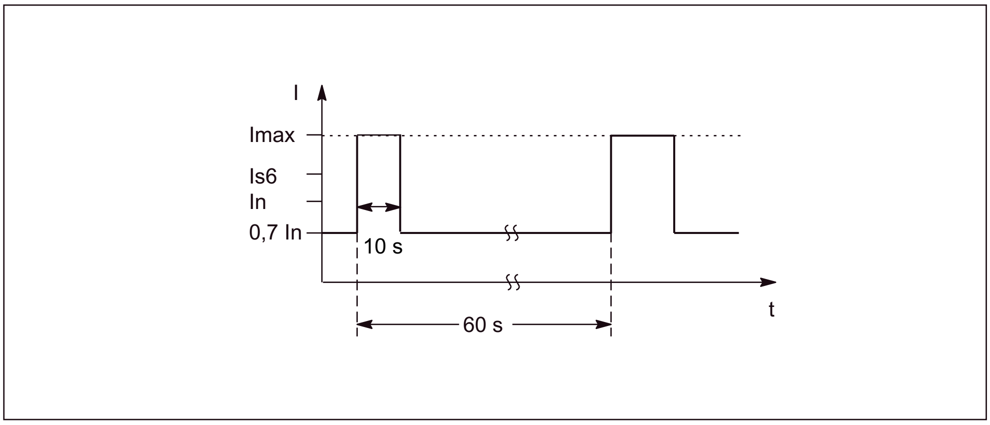


Figure 8-12 S6 peak current duty cycle with prior loading

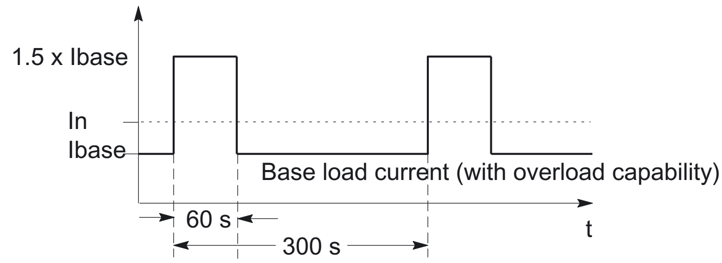


Figure 8-13 Current duty cycle with pre-loading

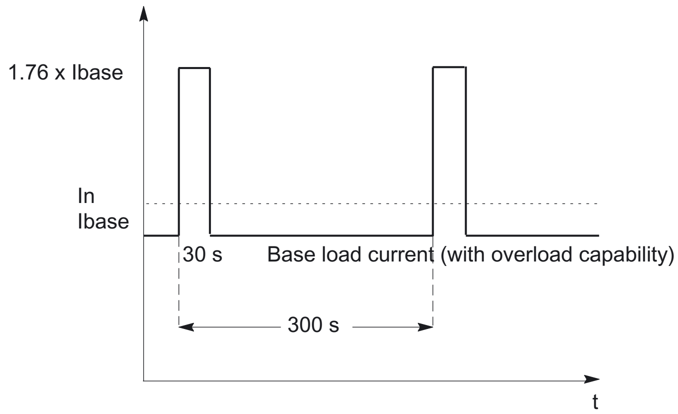


Figure 8-14 Current duty cycle with pre-loading

Derating as a function of the ambient temperature

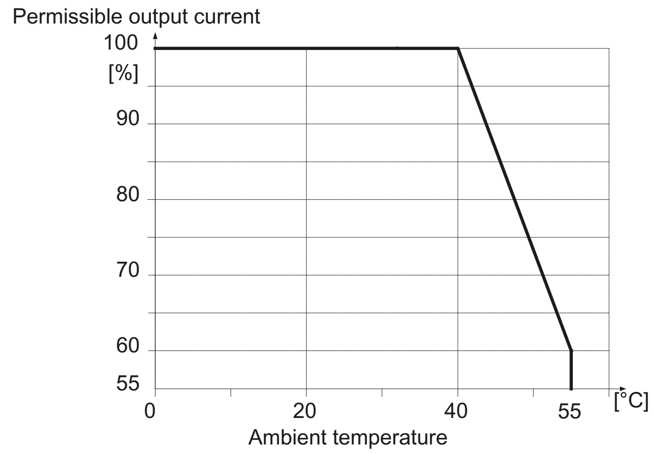


Figure 8-15 Derating as a function of the ambient temperature

Derating as a function of the pulse frequency

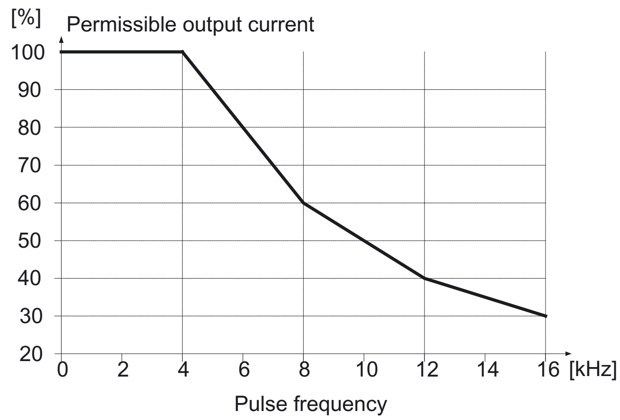


Figure 8-16 Derating as a function of the pulse frequency

Derating as a function of the site altitude

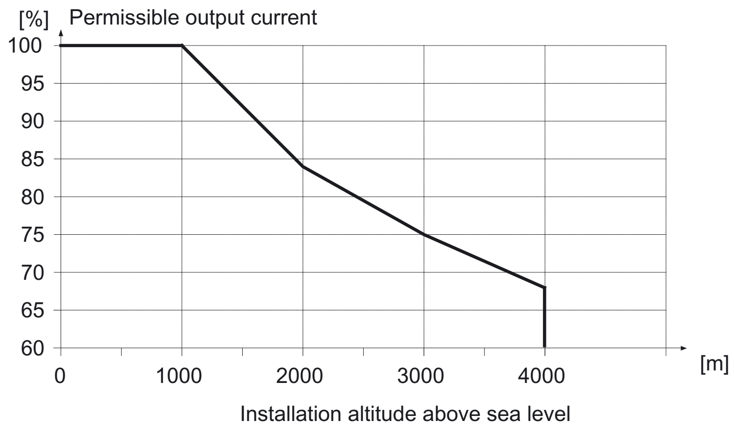


Figure 8-17 Derating as a function of the site altitude

Voltage derating as a function of the installation altitude

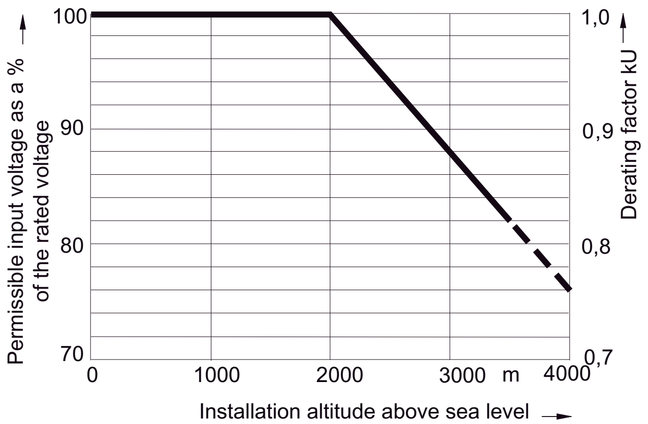


Figure 8-18 Voltage derating as a function of the installation altitude

9 Connection adapter

9.1 Description

Connection adapter allow cooling water hoses to be attached to the cold plate. A connection adapter with a molded seal is attached to the top and bottom of the cold plate. The connection adapter is made of aluminum and has threads for attaching conventional hose connections.

9.2 Safety information

⚠ CAUTION
The component with a cold plate cannot be operated without internal liquid cooling or external cooling.

Note

The information provided in "Cabinet Design" about connecting the water must be taken into account.

9.3 Dimension drawing

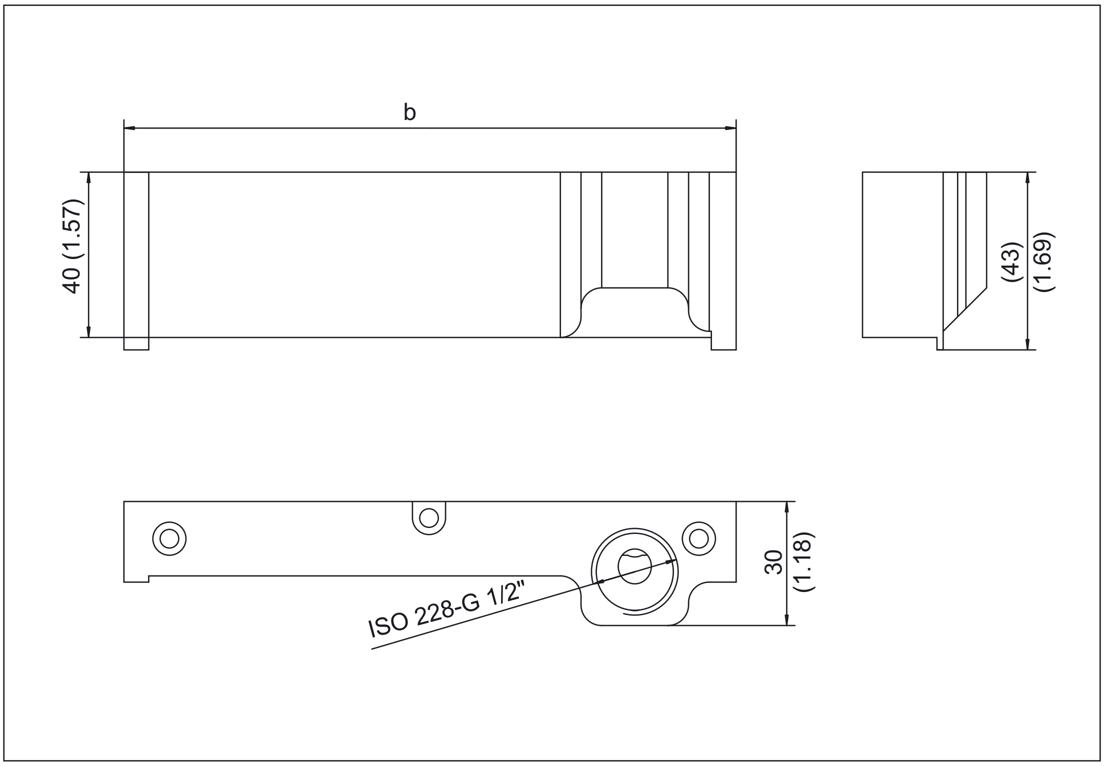


Figure 9-1 Dimension drawing of connection adapter

Table 9-1 Dimensions

Width of the power section [mm] (inches)	b [mm] (inches) of associated connection adapter
300 (11.81)	298 (11.73)

Space requirements for connection adapter

The connection adapter requires approx. 100 mm (3.94 inches) above and below the component. This does not, however, include the bending radius for the water hose, which means that extra space must be provided for the water supply lines.

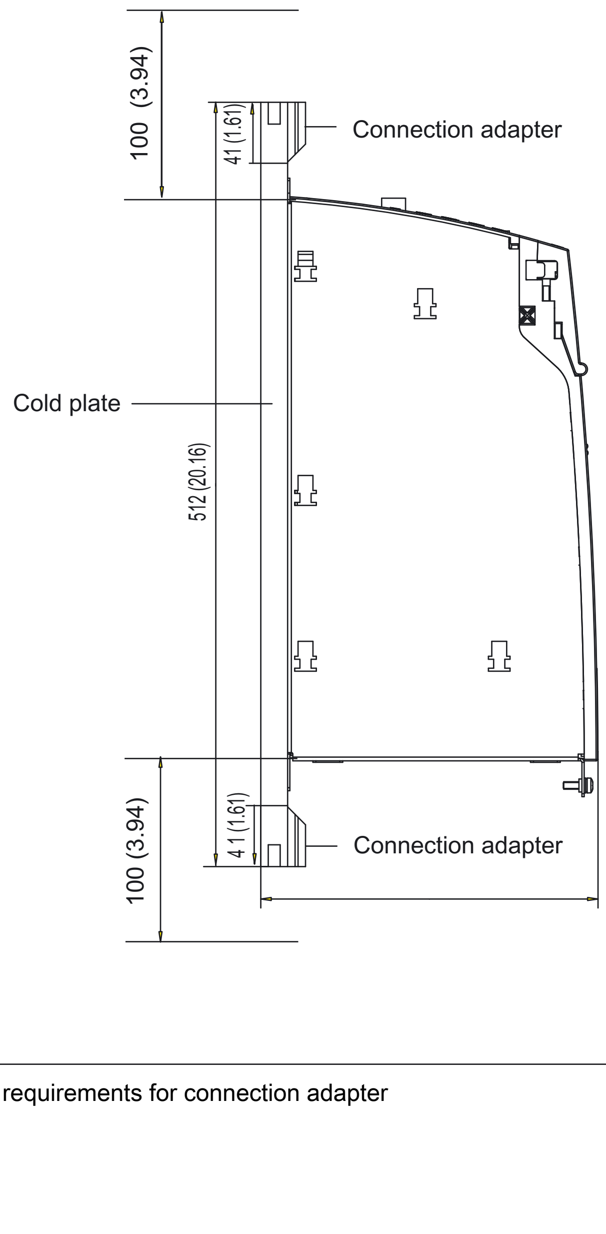


Figure 9-2 Space requirements for connection adapter

9.4 Installation

The connectors must be secured on site.
The hose connections must be made of stainless steel. The water connection can be up to ½".

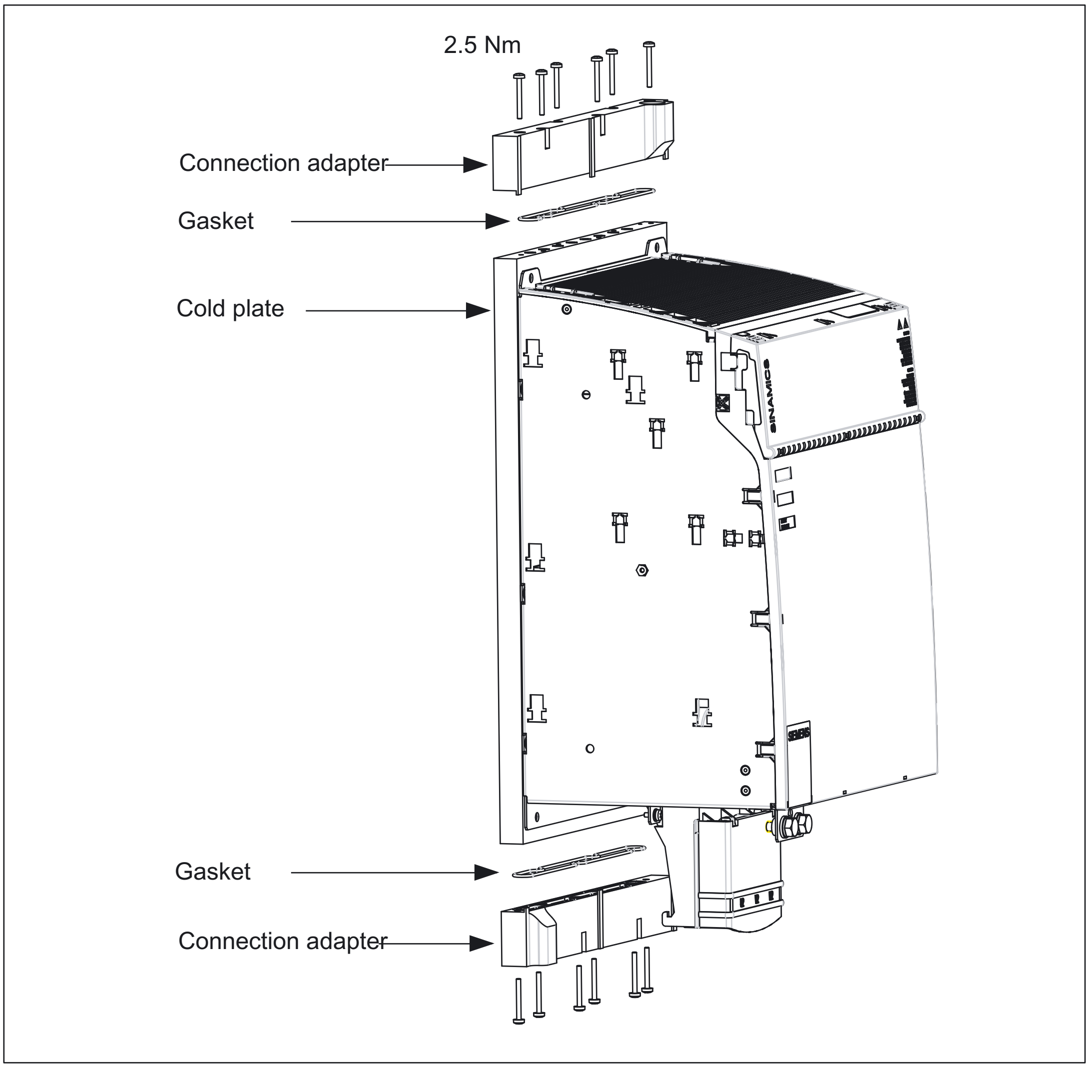


Figure 9-3 Connection method

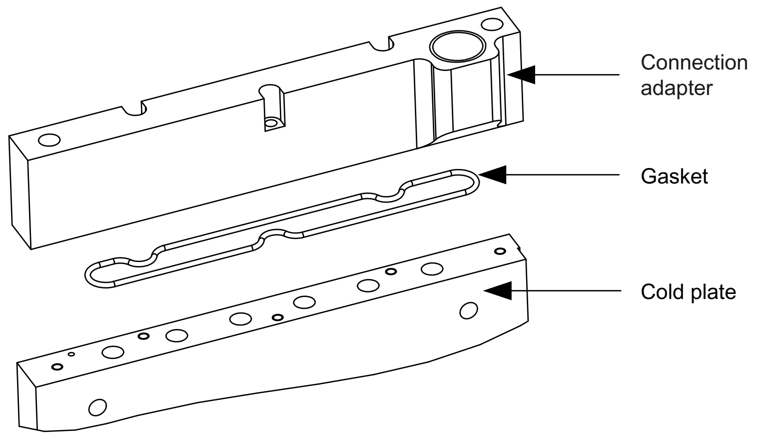


Figure 9-4 Example: connection adapter with seal

Internal Liquid Cooling

10

10.1 Cooling system requirements

Open cooling systems must never be used. Only closed cooling systems - preferably with a mechanism for monitoring the quality of the cooling water - must be installed.

The electrochemical processes that take place in a cooling system must be minimized by choosing the right materials. For this reason, mixed installations (i.e. a combination of different materials, such as copper, brass, iron, or halogenated plastic (PVC hoses and seals)) should not be used.

The fittings and connections required in the cooling system must be made of stainless steel (V2A or V4A steel; NIROSTA austenite).

The following materials can be used for the cooling system piping:

- Pipes and corrugated piping made of stainless steel (V2A or V4A steel; NIROSTA austenite)
- Hoses made of EPDM / EPDM with an electrical conductivity >109 ohm (e.g. Semperflex FKD; Semperit; http://www.semperit.at)
- DEMITEL® hoses made of PE / EPDM (Telle; http://www.telle.de)

Note

When non-conductive hoses are used, particular attention must be paid to the equipotential bonding of all the components. See Corrosion Inhibitor Additive (Inhibiting).

NOTICE
The sealing materials must be free of chlorides, graphite and carbon (Viton® or EPDM)

Note

Once installed, the cooling system must be checked to ensure that it is properly sealed.

10.2 Cooling water requirements

Properties of the cooling medium

Water or a water/anti-freeze mixture that meets the relevant requirements can be used as a cooling medium. The cooling medium must be chemically neutral, clean, and not contain any solids.

The cooling water must fulfill the following requirements over the long term:

- Chemically neutral, clean, and free of solids
- Max. inlet temperature: 40°C
- Max. outlet temperature: 50°C
- Operating pressure: 1 bar to 6 bar
- Max. size of any conveyed particles: 0.1 mm
- pH value: 6.0 to 8.0
- Chlorides < 40 ppm
- Sulfates < 50 ppm
- Loose materials < 340 ppm
- Total hardness < 170 ppm
- Conductivity value < 500 µs/cm

Note

Normal tap water does not generally fulfill these requirements, although it can be mixed with de-ionized water. Losses must always be replenished with de-ionized water.

The operating pressure must not exceed 6 bar.

NOTICE
The heat sink is made of non-seawater-proof material, which means that it must not be cooled directly with seawater.

NOTICE
Condensation must not be allowed to form on the SINAMICS S120 equipment as a result of supercooling. The temperature of the cooling water may have to be regulated.

A particle filter (particle size < 100 µm) must be installed in the cooling water circuit.

If there is a risk of frost, preventive measures must be taken during operation, storage, and transportation (e.g. emptying and blowing out with air, additional heating).

The cooling water should be checked 3 months after the cooling circuit is filled for the first time and, subsequently, once a year. If the cooling water becomes cloudy, is colored, or becomes contaminated by mould spores, the cooling circuit must be cleaned and refilled.

An inspection glass should be provided in the cooling circuit to make it easier to check the cooling water.

10.3 Anti-Freeze Additive

Antifrogen N (Clariant; http://www.clariant.com) is recommended as an antifreeze. The proportion of anti-freeze must be between 20 % and 30 %. This ensures frost protection in temperatures of at least –10°C.

NOTICE
If the proportion of anti-freeze is greater than 30 %, this can inhibit the transfer of heat and prevent the equipment from functioning correctly.

Note

You must always bear in mind that the kinematic viscosity of the cooling water changes when anti-freeze is added, which means that the pump power must be adjusted accordingly.

NOTICE
Cooling water mixtures with Antifrogen N are highly conductive. In the event of leakage, the insulating systems must be cleaned.

NOTICE
When EPDM hoses are used, oily corrosion inhibitor additives must not be used because additives can corrode and destroy EPDM.

10.4 Corrosion Inhibitor Additive (Inhibiting)

Nalco 00GE056 (ONDEO Nalco; http://www.ondeonalco.com) is recommended as a corrosion inhibitor. The concentration of corrosion inhibitor in the cooling water must be at least 2500 ppm (250 ml/100 liters KW).
The water quality must be in accordance with Chapter 9.3 or de-ionized water.

NOTICE
Corrosion inhibitor does not need to be added if the anti-freeze Antifrogen N is used in the right concentration (see Anti-Freeze Additive).

10.5 Biocide Additive (If Required)

- Adding Nalco N 77352 (ONDEO Nalco; http://www.ondeonalco.com) intermittently is recommended twice a month.
  Required amount: 5 – 15 mg / 100 liter of cooling water. This product does not impair the effectiveness of the corrosion inhibitor with Nalco 00GE056.
- When Antifrogen N anti-freeze is used with a concentration of 20% and higher, it can be assumed that there is an adequate biocide effect.

10.6 Equipotential Bonding

Equipotential bonding between the components in the cooling system is required (SINAMICS S120, heat exchanger, piping, pump, etc.). This must be effected using a copper bar or stranded copper with the appropriate conductor cross-sections to prevent the electrochemical processes.

All cabinets must be bolted together in such a way as to ensure good conductivity (e.g. cabinet beams directly connected to ensure conductivity) to prevent potential differences and, in turn, avoid the risk of electrochemical corrosion. For this reason, a PE bar must also be installed in all the cabinets, including the re-cooling system.

10.7 Water-to-water heat exchanger

If a cooling circuit that does not exceed 35°C but does not fulfill the cooling water requirements is already installed in the system, the two cooling circuits can be linked via a water-to-water heat exchanger.

The coolers for the frequency converters are attached via a distributor in such a way as to ensure the required flow without exceeding the required pressure. Conditions, such as height differences and distances, must be taken into account here.

For devices without frost protection, we recommend you use VARIDOS TOP from Schilling Chemie. VARIDOS TOP is an organic corrosion inhibitor that has been specially developed for half-open and closed cooling systems. It prevents corrosion by creating an organic protective film on the surface of the metal.

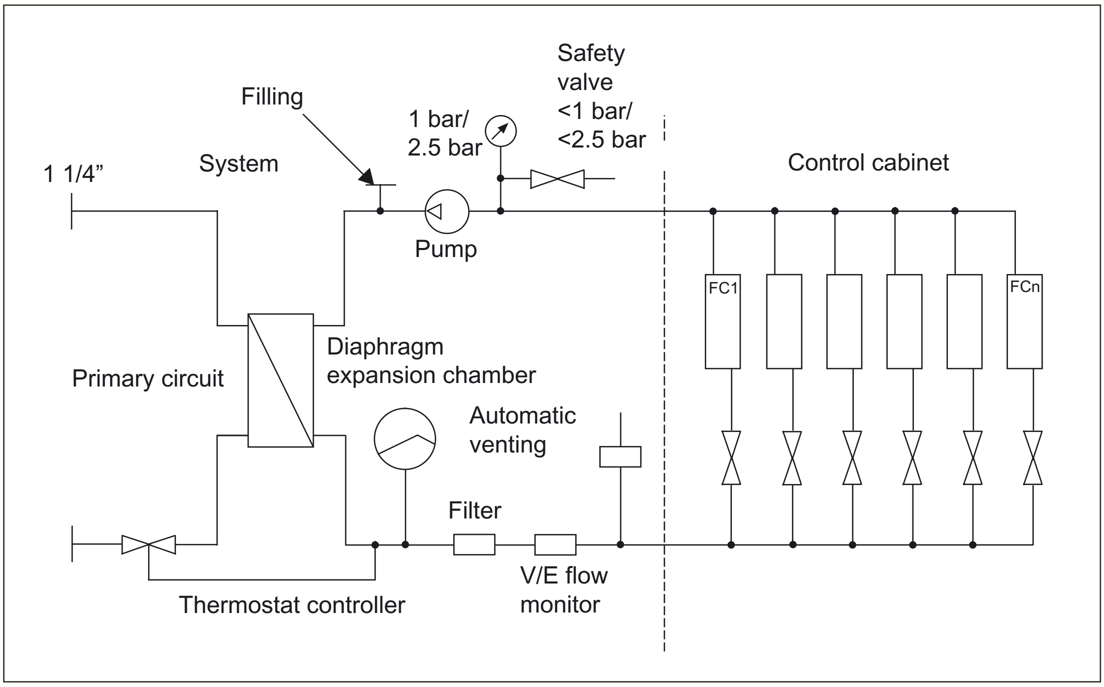


Figure 10-1 Water-to-water heat exchanger

10.8 Air-to-water heat exchanger

If a process water network is not installed but it is nonetheless best to use water-cooled frequency converters, an air-to-water cooling system can be used. The temperature of the ambient air must not be excessively high (e.g. > 35°C) (in accordance with the technical data for the air-to-water heat exchanger).

During setup, you must ensure that a primary air cooling circuit and not a process water circuit is installed.

Measures to prevent supercooling must only be taken on the secondary side by means of temperature closed-loop control, a thermostat, or a solenoid valve.

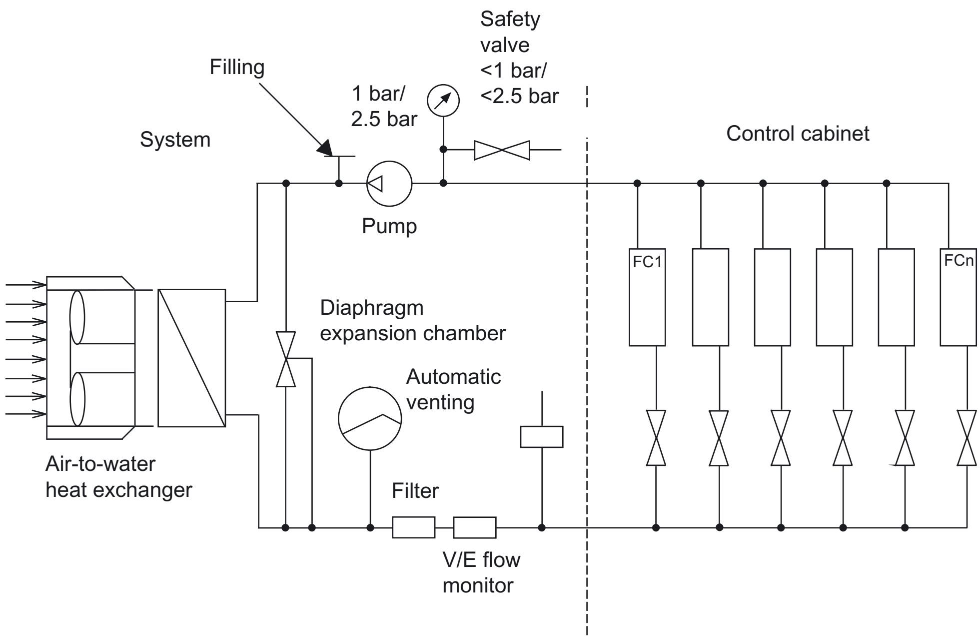


Figure 10-2 Air-to-water heat exchanger

10.9 Active Cooling Unit

If a process water network has not been installed and the ambient air is > 35°C (35°C < τ < 40°C), an active cooling unit can be used. This works in the same way as a refrigerator, whereby higher discharge air temperatures can be generated.

The following diagram shows the converter-side configuration of the cooling circuit.

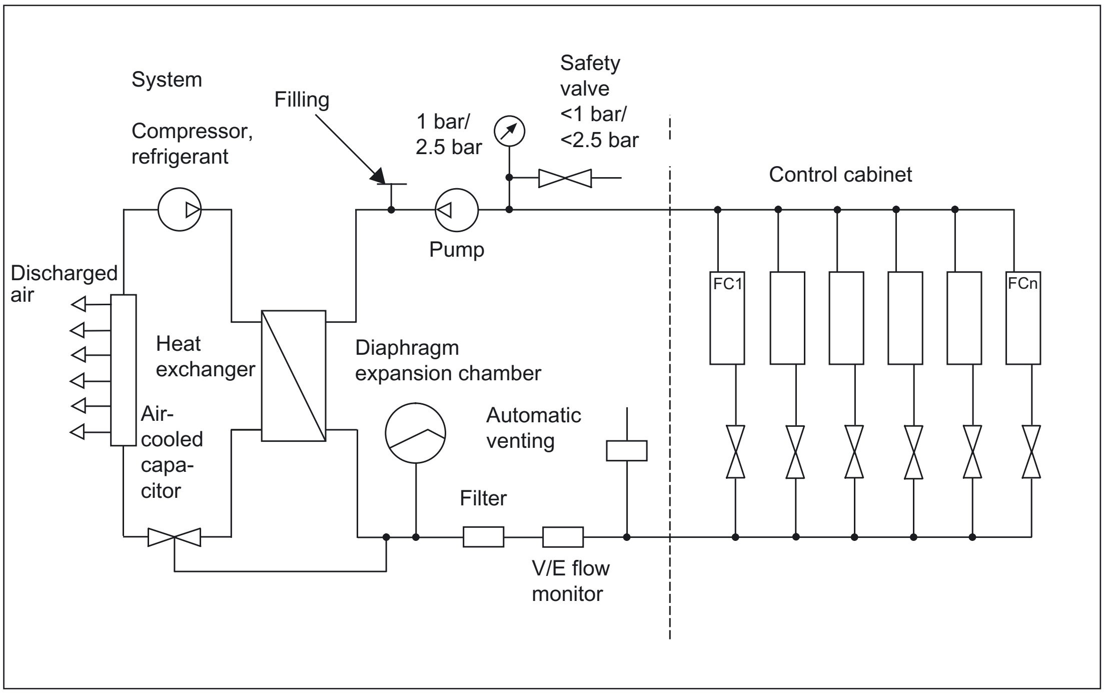


Figure 10-3 Active cooling unit

DC link components 11

11.1 Braking Module

11.1.1 Description

A Braking Module (and an external braking resistor) are required for a controlled shutdown of drives during power failure (e.g. emergency retraction or EMERGENCY STOP Category 1) or to limit the DC link voltage during temporary regenerative operation when, for example, the regenerative capability of the Line Module is deactivated or not appropriately dimensioned.
The Braking Module includes the necessary power electronics together with its control. The Braking Module is operational, the regenerative energy is dissipated as thermal energy in an external braking resistor.

Further, the Braking Module can also be used with a braking resistor to quickly discharge the DC link. The DC link is discharged in a controlled manner via the braking resistor once the rectifier unit has been switched off and the line-up has been disconnected from the power supply (e.g. main circuit-breaker, line contactor). The function can be activated via a digital input on the braking module.

To operate the braking modules, a minimum capacitance is required in the DC link.
Depending on the braking resistor used, this is:
braking resistor 25 kW, DC link capacitance 440 µF;
braking resistor 100 kW, DC link capacitance 440 µF.
The capacitance of the braking modules of 110 µF is included in the total capacitance.
When the braking modules are connected in parallel, the above-mentioned minimum capacitance must be available for each braking module.

Note

The fast discharge function is used for discharging the capacitors in the DC link after interruption of the mains supply. This makes sense, for example, when maintenance tasks are to be performed at the Motor Module and/or motor installation (reduction of the discharge time). For this purpose, the drive system must be completely disconnected from the supply and the motors must be in standstill position.

Note

Only the components that are connected to each other via the DC link busbar can be included in the total capacitance.

The cable between the braking module and the braking resistor is limited to 10 m.

11.1.2 Safety information

DANGER

Risk of electric shock. A hazardous voltage is present for up to 5 minutes after the power supply has been switched-off.
It is only permissible to open the protective cover after this time has expired.

WARNING

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

The components must only be operated when the protective cover of the DC link is closed. Damaged components must not be further used. If this is not carefully observed, it can result in subsequent damage and accidents.

DANGER

The DC link discharge voltage hazard warning in the local language must be attached to all of the components.
A set of labels in 16 languages is supplied with the component.

With a connected braking resistor, the Braking Module is ground-fault proof.

WARNING

A ventilation clearance of 80 mm above and below the components must be observed.

DANGER

It is only permissible to establish connections to the DC link using the adapters that SIEMENS has recommended (DC link adapter and DC link rectifier adapter).

CAUTION

The connection to the braking resistors must be made using a shielded cable.

The tightening torque of the DC link busbar screws (1.8 Nm, tolerance +30 %) must be checked before commissioning. After being transported the screws must be tightened.

Note

If braking resistors that are not listed in catalog D21.1 are used, they can be destroyed.

CAUTION

The DC link side covers are supplied as standard with the components; they can also be ordered separately, if required (order no.: 6SL3162-5AA00-0AA0).

11.1.3 Interface description

11.1.3.1 Overview

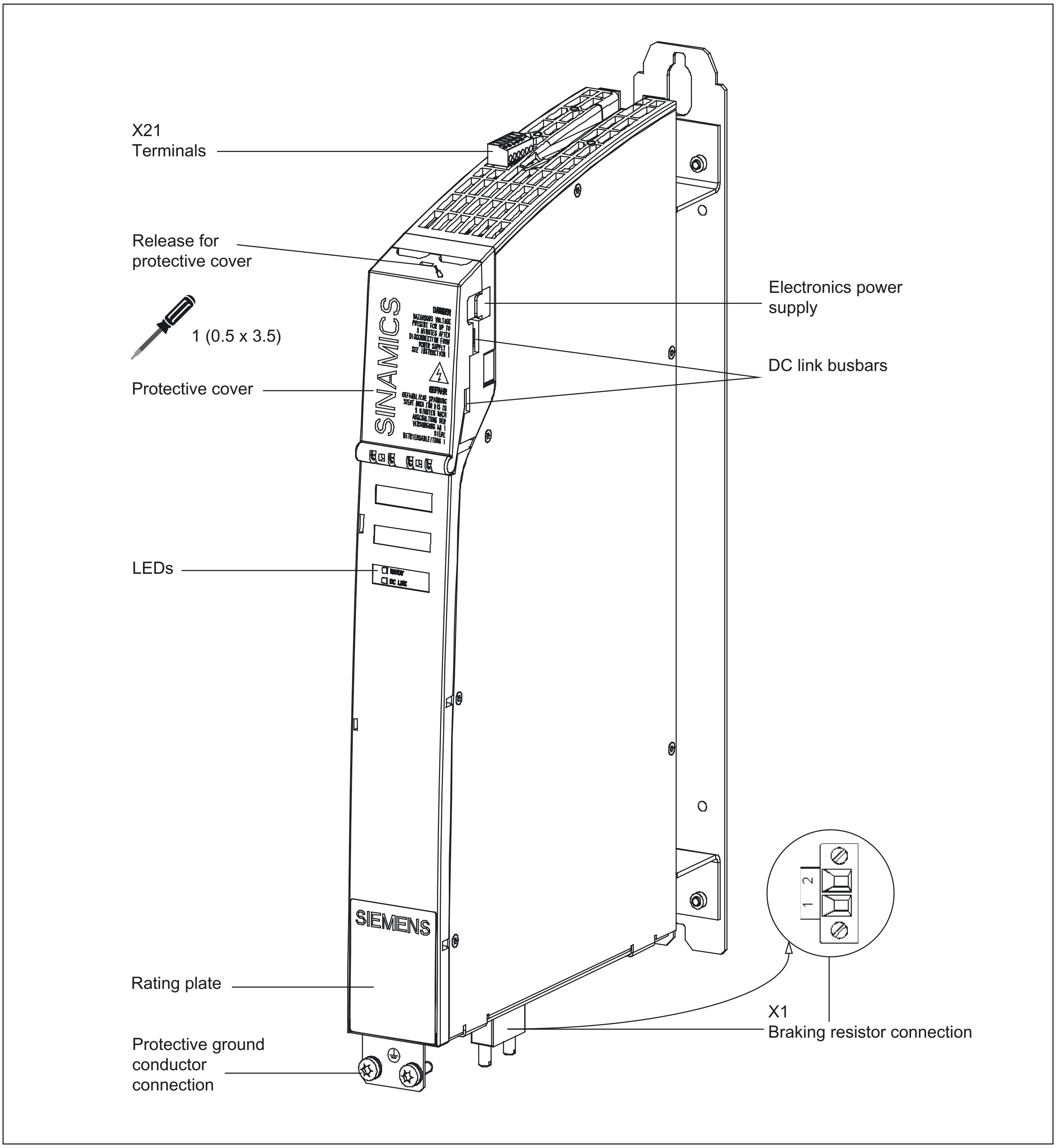


Figure 11-1 Interface description of braking module

11.1.3.2 Connection example

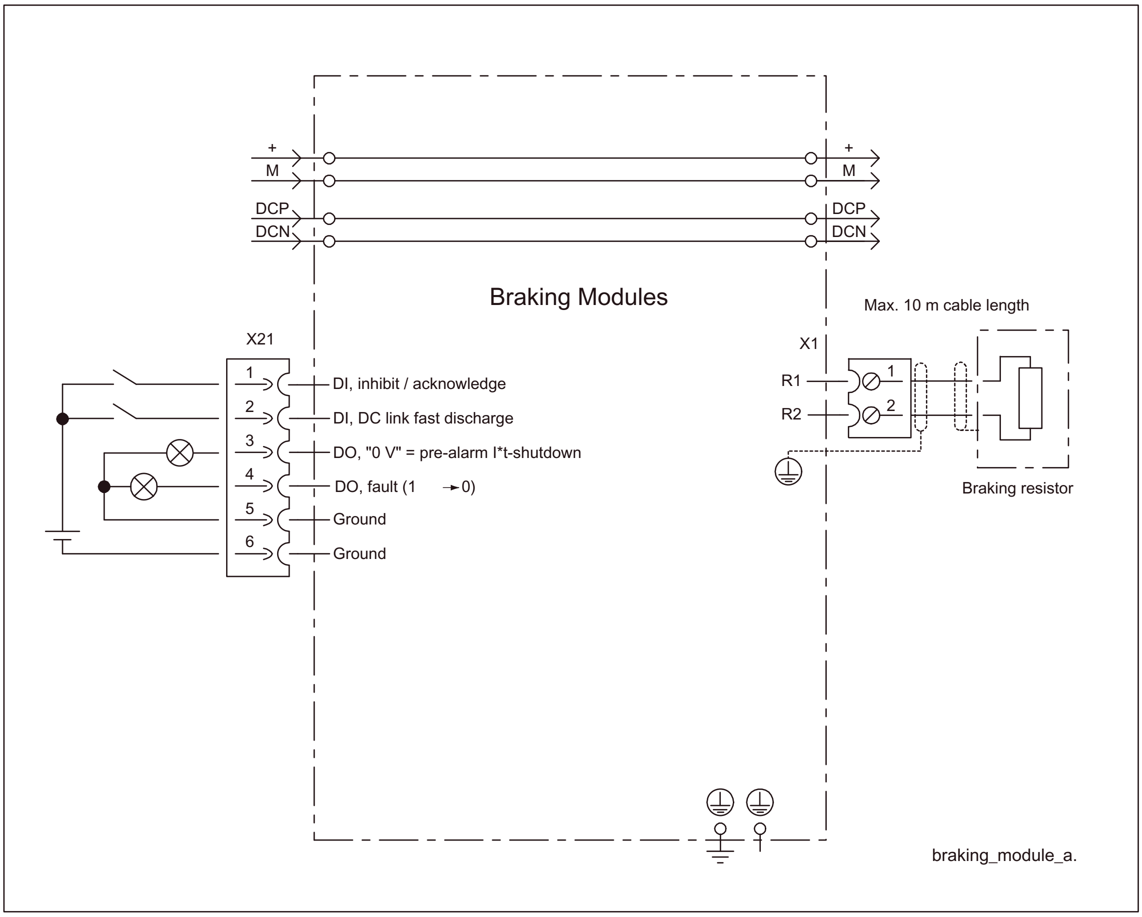
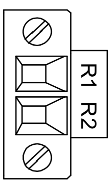


Figure 11-2 Example connection of Braking Module

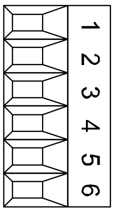
11.1.3.3 Braking resistor connection X1

Table 11-1 Terminal block X1

	Terminal	Designation	Technical specifications
	1	Braking resistor connection R1	Continued-short-circuit-proof
	2	Braking resistor connection R2	
Max. connectable cross-section: 4 mm² Type: Screw terminal 4 (see Connection Methods)			

11.1.3.4 X21 digital inputs/outputs

Table 11-2 Terminal block X21

	Terminal	Designation[1)]	Technical specifications
	1	DI low: enable Braking Module DI high: inhibit / acknowledge Edge change high -> low: fault acknowledgement	Voltage: -3 V to 30 V Typical current consumption: 10 mA at 24 V DC Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to 5 V
	2	DI low: braking resistor not activated manually DI high: braking resistor activated manually (fast discharge)[2)] Safety functions remain active, I*t protection remains active	
		If X21.1 and 2 are activated simultaneously, the Braking Module inhibit has priority.	
	3	DO high: no pre-warning for I*t shutdown DO low: pre-warning for I*t shutdown (80% of max. ON time reached)	Max. load current per output: 100 mA Continued-short-circuit-proof Voltage: 24 V DC
	4	DO high: ready for operation, no fault DO low: Fault (1→0)	
	5	Ground	
	6		
Max. connectable cross-section 1.5 mm² Type: Screw terminal 1 (see Connection Methods)			

1) DI: digital input; DO: digital output; M: Electronic ground

2) The fast discharge function is used for discharging the capacitors in the DC link after interruption of the mains supply. This functions may be used 1 to 2 times per week at the most. This makes sense, for example, when maintenance tasks are to be performed at the Motor Module and/or motor installation (reduction of the discharge time). For this purpose, the drive system must be completely disconnected from the supply and the motors must be in standstill position.

NOTICE

Prior to performing maintenance task at the drive system, the following tasks must be performed:

1. Disconnect the system.
2. Protect against reconnection.
3. Make sure that the equipment is de-energized.
4. Ground and short-circuit.
5. Cover or enclose adjacent components that are still live

These tasks must be performed in the above mentioned order prior to maintenance. After maintenance proceed in the reverse order.

Note

Applying a high signal to terminal X21.1 inhibits the Braking Module. On a falling edge, pending error signals are acknowledged.

The pre-warning for I*t monitoring is output as a high level on reaching 80% of the maximum braking resistor ON time.
Only braking resistors approved by Siemens for this component are identified automatically.

11.1.3.5 Meaning of the LEDs on the braking module

Table 11-3 Meaning of the LEDs on the Braking Module

LED	Color	State	Description
READY	-	Off	Electronics power supply outside the permissible tolerance range.
	Green	Steady light	The component is ready for operation.
	Red	Steady light	• Braking Module inhibited via DI X21.1 • Braking Module shutdown Possible reasons: – Overcurrent – Overtemperature heat sink – Braking resistor overload (I*t shutdown)
DC LINK	-	Off	Braking resistor switched off (DC link discharge not active)
	Green	Flashing	Braking resistor switched on (DC link discharge active)

Note

To protect the braking resistor, the current fault cannot be acknowledged until after a waiting period of approx. 3 min after an I*t shutdown of the braking module.

11.1.4 Dimension drawing

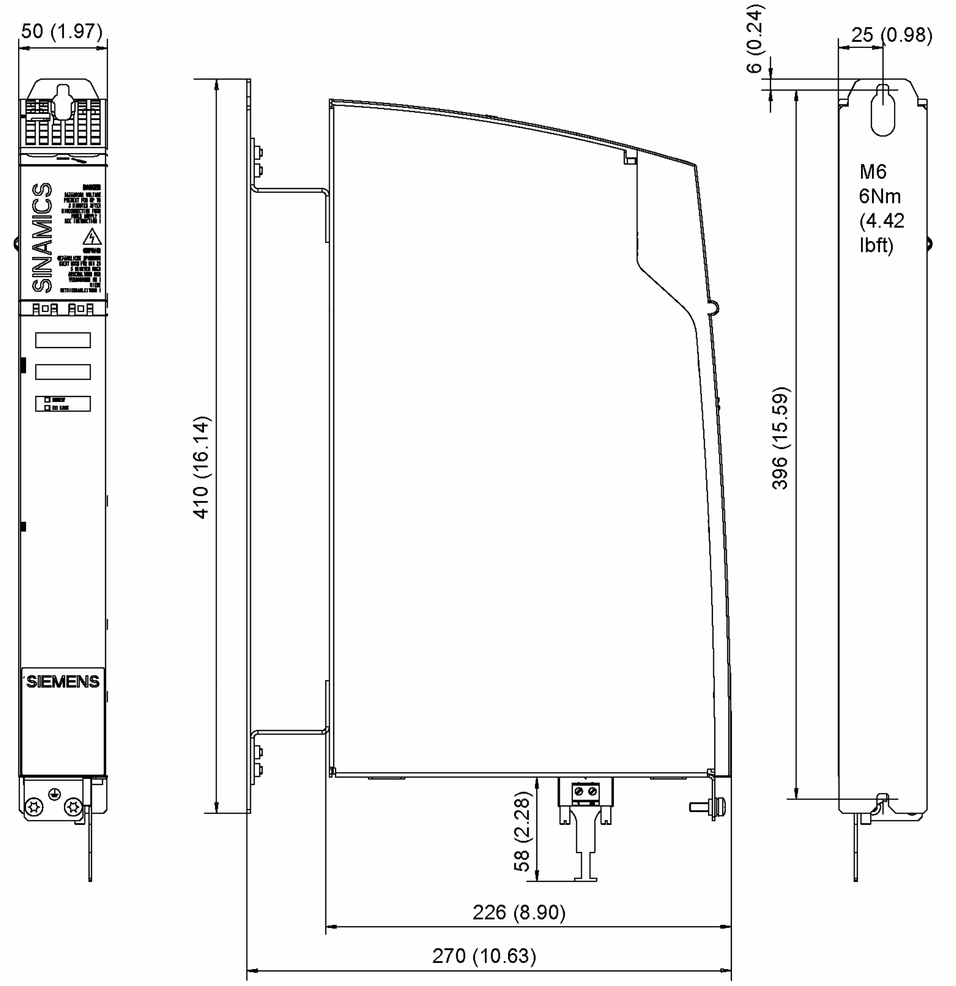


Figure 11-3 Dimension drawing of the Braking Module

11.1.5 Installation

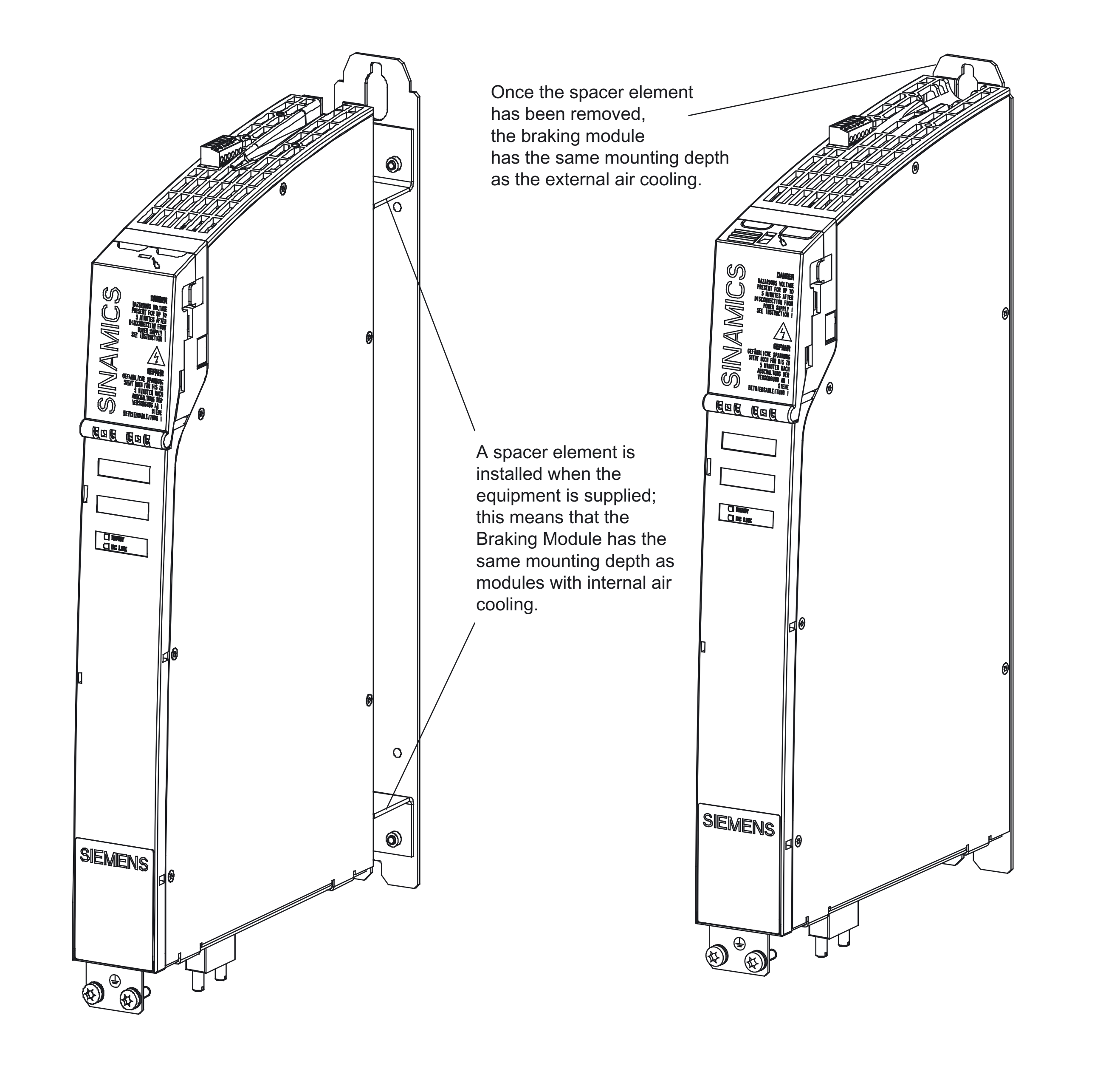


Figure 11-4 Methods of installing Braking Modules with/without spacer elements

11.1.6 Technical specifications

Table 11-4 Technical data

Braking Module Booksize		
Voltages		
Supply: DC link voltage	V_{DC}	510 - 720
ON threshold	V	770
Electronics power supply	V_{DC}	24 (20,4 - 28,8)
Electronics current consumption (at 24 V DC)	A_{DC}	0.5
Strombelastbarkeit DC link busbar	A_{DC}	100
Current carrying capacity 24 V busbar	A_{DC}	20
Max. braking power	kW	100
Continuous braking power	kW	1.5
Power loss[1]	W	20
Cooling type		Natural convection
Weight	kg	4.1

[1] For an overview, see the power loss tables in Chapter Cabinet design

11.1.7 Braking resistors for Braking Module

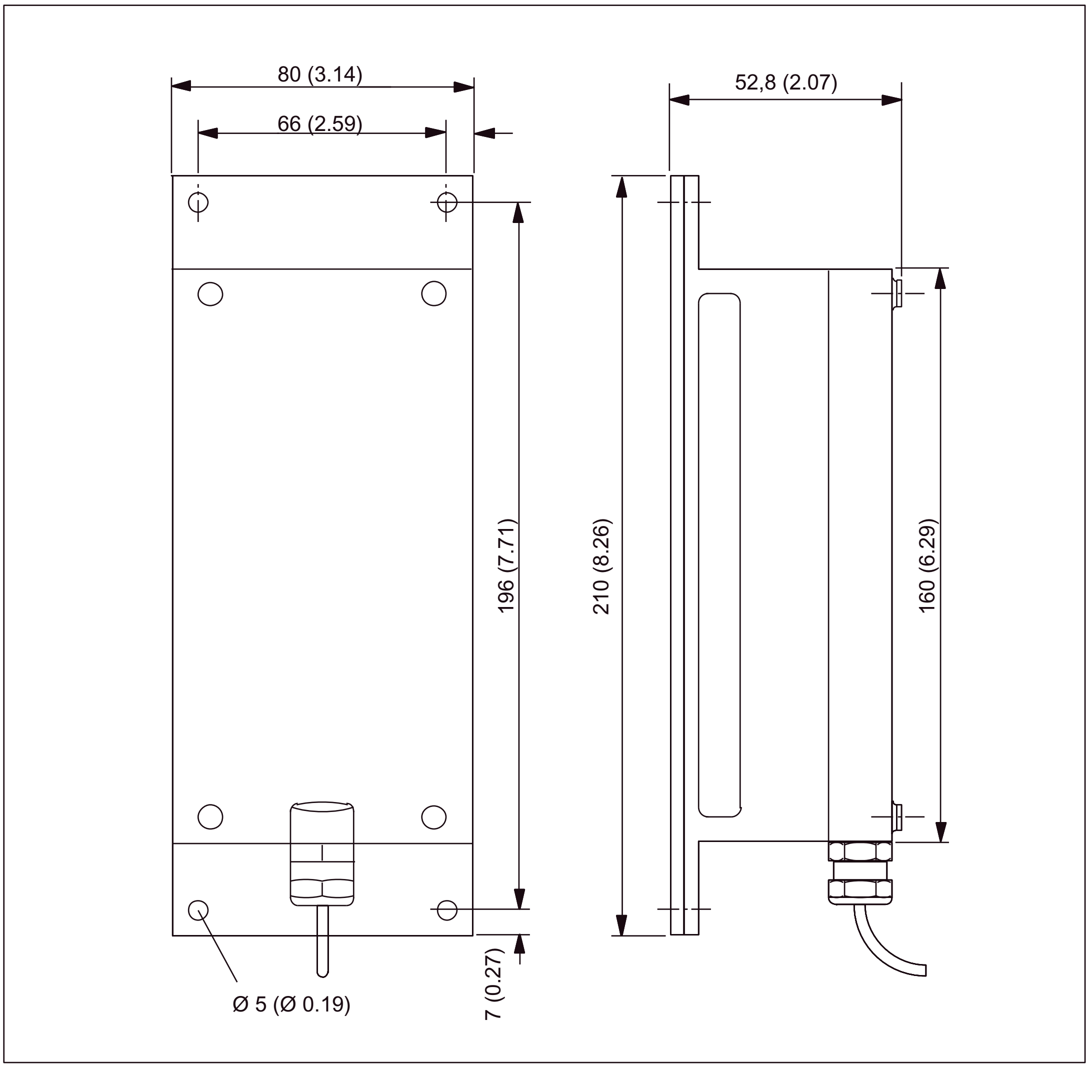


Figure 11-5 Dimension drawing: Braking resistor 0.3 kW / 25 kW

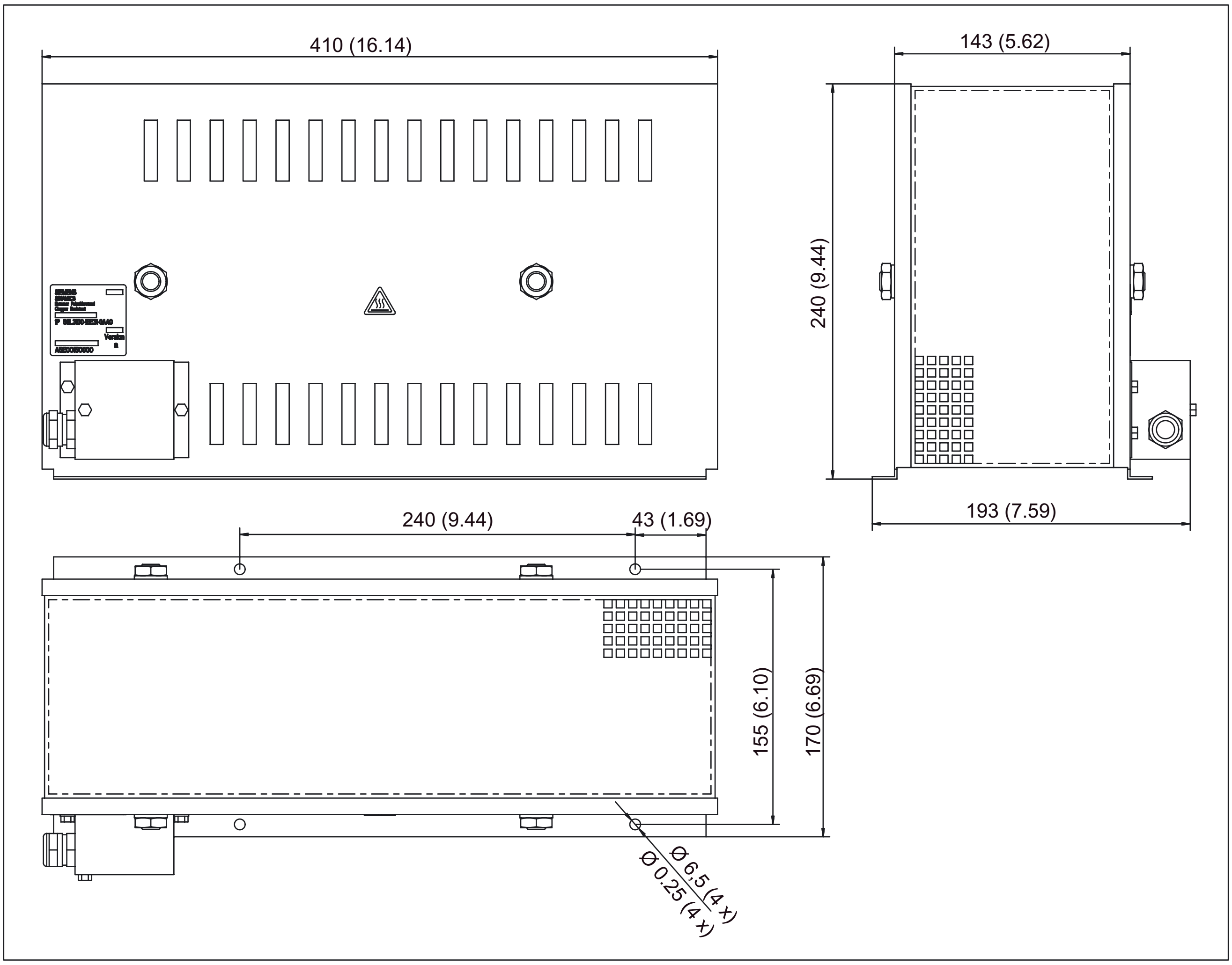


Figure 11-6 Dimension drawing: Braking resistor 1.5 kW / 100 kW

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

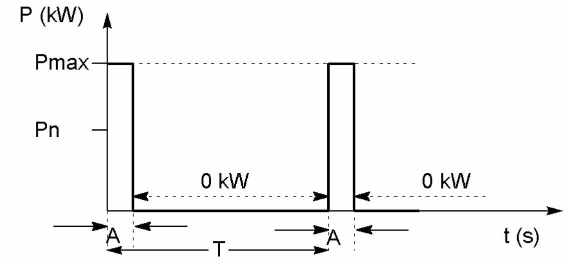


Figure 11-7 Duty cycle for braking resistors

T [s] period duration of braking duty cycle

A [s] load duration

P_n [W] continuous braking power of braking resistor

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

Table 11-5 Example of duty cycles

	Unit	R 25 kW		R 100 kW	
		Short duty cycle	Long duty cycle	Short duty cycle	Long duty cycle
A	s	0.1	0.4	1	2
T	s	11.5	210	68	460

Table 11-6 Technical data

	Unit	Braking resistor 6SN1113–1AA00–0DA0	Braking resistor 6SL3100–1BE31–0AAx
P_{max}	kW	25	100
P_n	kW	0.3	1.5
Weight	kg	3.4	5.6
Degree of protection		IP54B acc. to EN 60529	IP20 to EN 60529

Connection cables

A shielded connection cable (3 m long; 1.5 mm^2) is supplied with braking resistor 6SN1113-1AA00-0DA0.

Braking resistor 6SL3100-1BE31-0AA0 is supplied without a connection cable (4 mm^2).

The maximum cable length for both braking resistors is 10 m.

11.2 Capacitor Module

11.2.1 Description

Capacitor modules are used to increase the DC link capacitance to bridge momentary power losses.

Capacitor modules are connected to the DC link voltage via the integrated DC link busbars. Capacitor modules function autonomously.

Several capacitor modules can be operated in parallel.

11.2.2 Safety Information

⚠DANGER
Risk of electric shock. A hazardous voltage is present for up to 5 minutes after the power supply has been switched-off. It is only permissible to open the protective cover after this time has expired.

⚠WARNING
When opening the protective cover for the DC link, you must activate the release. A suitable tool (e.g. screwdriver) must be used for this purpose. The components must only be operated when the protective cover of the DC link is closed. Damaged components must not be used further, as this could result in secondary damage or accidents.

⚠DANGER
The DC link discharge voltage hazard warning in the local language must be attached to all of the components. A set of labels in 16 languages is supplied with the component.

⚠WARNING
A ventilation clearance of 80 mm above and below the components must be observed.

NOTICE
The capacitor module is precharged by the line module. The applicable maximum permissible DC link capacitances of the Line Modules must be taken into account.

DANGER
It is only permissible to establish connections to the DC link using the adapters that SIEMENS has recommended (DC link adapter and DC link rectifier adapter).

CAUTION
The DC link side covers are supplied as standard with the components; they can also be ordered separately, if required (order no.: 6SL3162-5AA00-0AA0).

11.2.3 Interface description

11.2.3.1 Overview

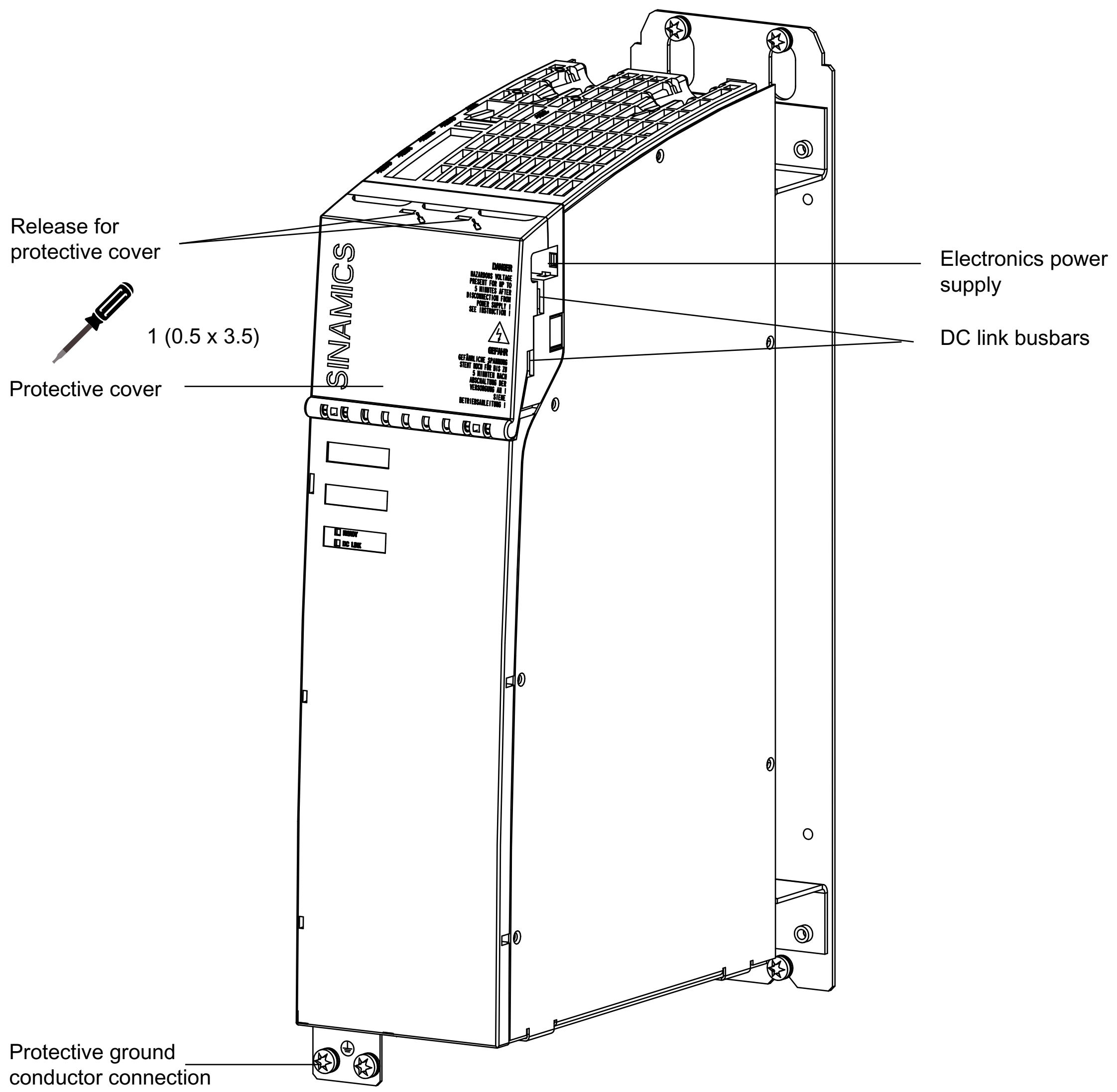


Figure 11-8 Interface description of the capacitor module

11.2.4 Dimension drawing

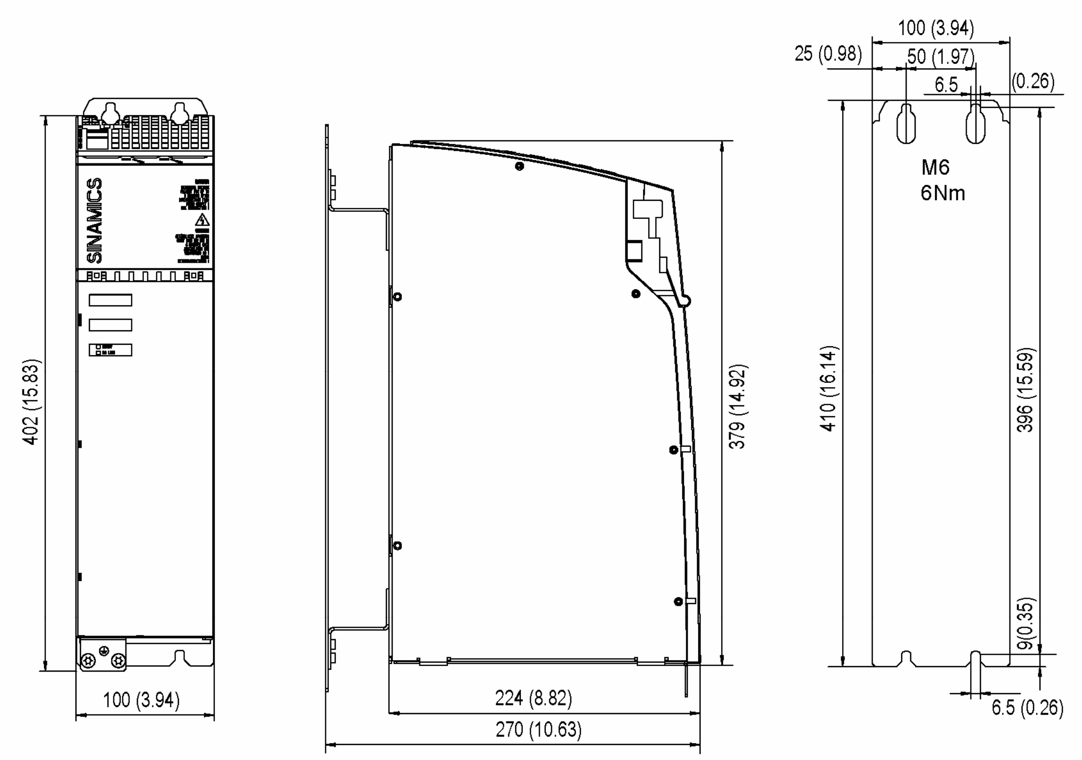


Figure 11-9 Dimension drawing of the capacitor module

11.2.5 Installation

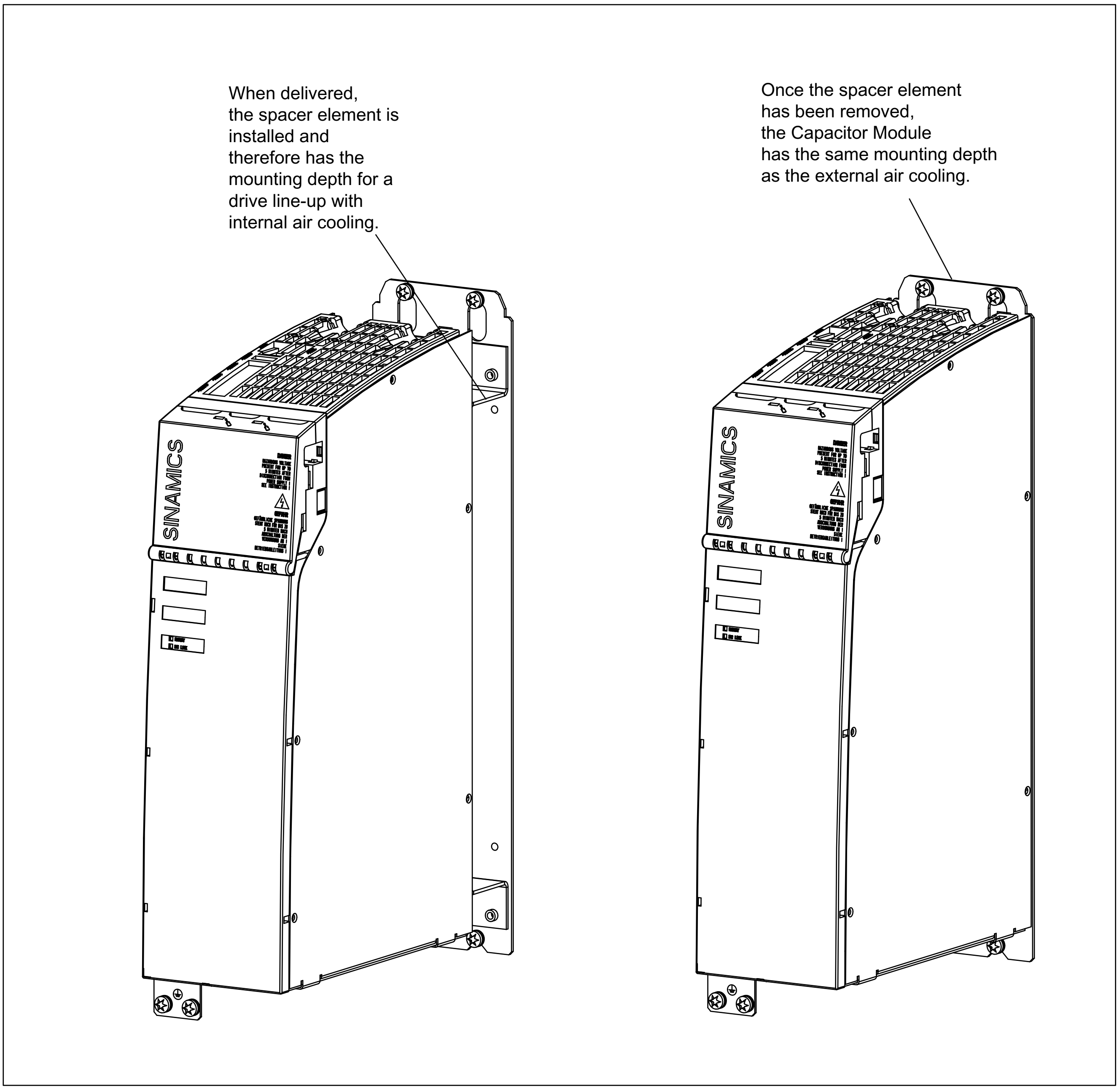


Figure 11-10 Installing a Capacitor Module with/without spacer elements

The Capacitor Module can be attached to the cabinet panel with or without spacer elements.

11.2.6 Technical Specifications

Table 11-7 Technical data

Capacitor Module		
Electronics power supply	V_{DC}	24 (20,4 - 28,8)
DC link voltage	V_{DC}	510 - 720
Capacitance	µF	4000
24 V DC busbar current carrying capacity	A	20
DC link busbar current carrying capacity	A	100
Power loss[1]	W	25
Weight	kg	7.2

[1] For an overview, see the power loss tables in Cabinet Design.

11.3 Control Supply Module

11.3.1 Description

The Control Supply Module is a 24 V power supply with 20 A output current.
The output voltage corresponds to protective extra low voltage (DVC A) with grounded frame.

The power is either supplied via the line supply connection or the integrated DC link connection. For example, this means that it is possible to maintain the 24 V power supply voltage when the power fails for coordinated retraction motion.
Input voltage range: 320 - 550 V_{AC}, 430-800 V_{DC}, (300-430 V_{DC} for <1 min).

When the Control Supply Module is first operated, then the power is always taken from the line supply. When the power fails, the module automatically changes-over to supply from the DC link.

11.3.2 Safety Information

⚠ DANGER

This component is equipped with two supply circuits!
Risk of electric shock. A hazardous voltage is present for up to 5 minutes after the power supply has been switched-off.
It is only permissible to open the protective cover after this time has expired.

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

The components must only be operated when the protective cover of the DC link is closed. Damaged components (e.g. with a defective lock on the protective cover) must not be operated further.

Failure to comply with these instructions can result in death or severe injury.

⚠ DANGER

The DC link discharge voltage hazard warning in the local language must be attached to all of the components.
A set of labels in 16 languages is supplied with the component.

⚠ WARNING

A ventilation clearance of 80 mm above and below the components must be observed.

⚠ DANGER
It is only permissible to establish connections to the DC link using the adapters that SIEMENS has recommended (DC link adapter and DC link rectifier adapter).

CAUTION
The tightening torque of the DC link busbar screws (1.8 Nm, tolerance +30 %) must be checked before commissioning. After being transported the screws must be tightened.

CAUTION
The DC link side covers are supplied as standard with the components; they can also be ordered separately, if required (order no.: 6SL3162-5AA00-0AA0).

CAUTION
If used, the 24 V terminal adapter must be screwed into place. The following screw must be used: EJOT-PT screw K30 x 16. Tightening torque 0.5 Nm.

11.3.3 Interface description

11.3.3.1 Overview

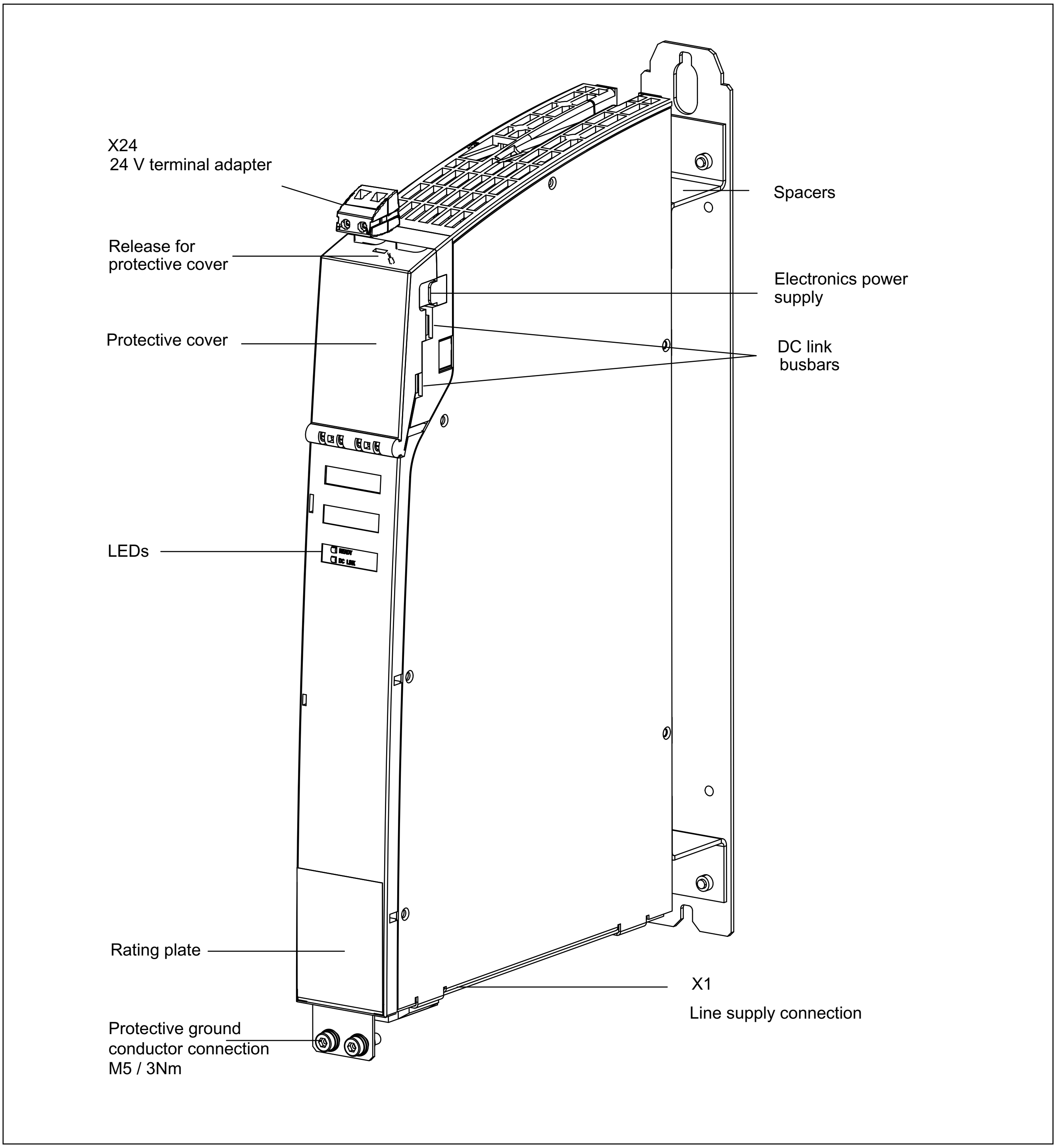
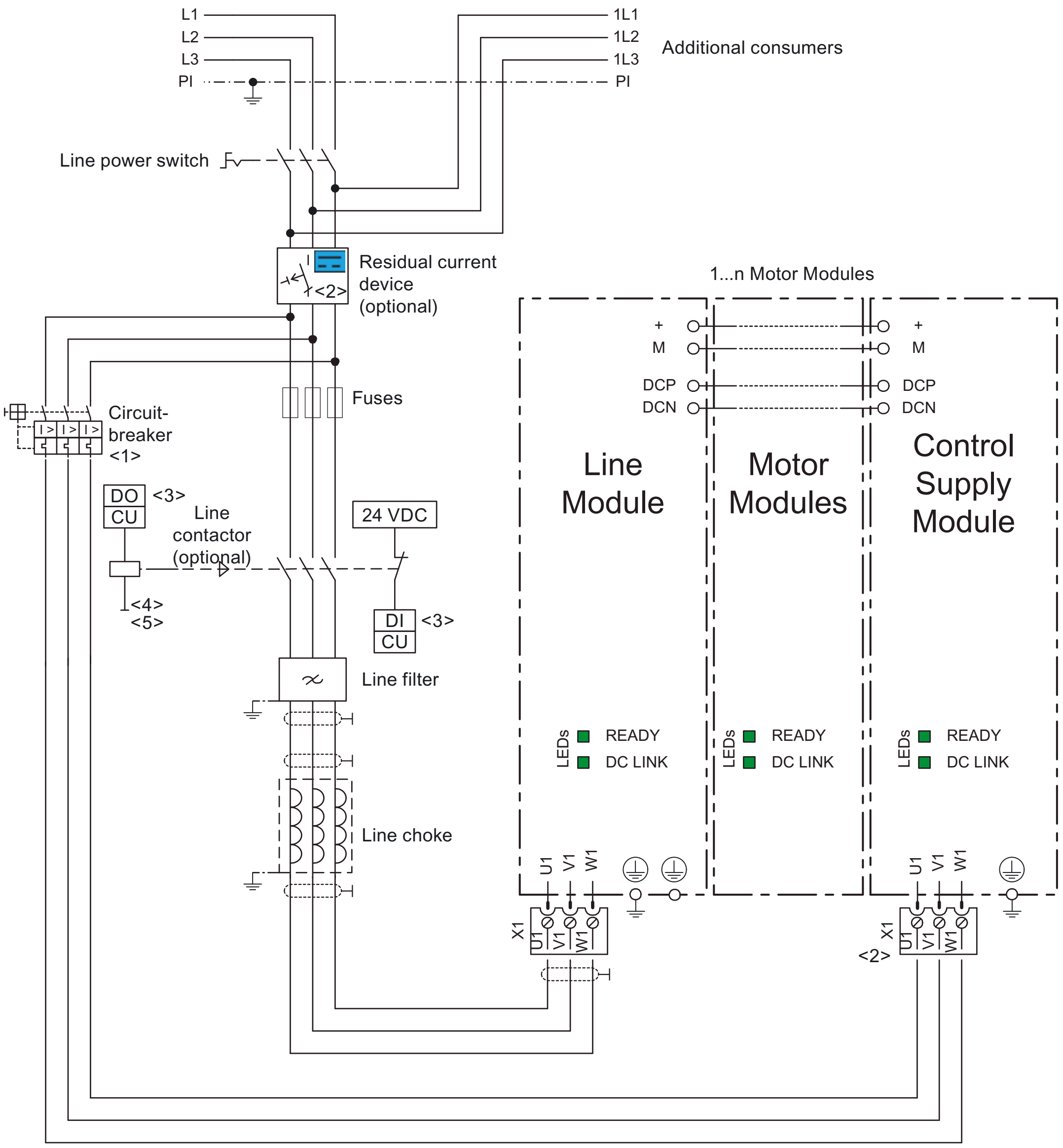


Figure 11-11 Interface description: control supply module

11.3.3.2 Connection example



<1> Permitted types:
a) circuit-breaker type SIRIUS, 3RV 1021 1DA10, setting 3A
b) branch circuit fuse type KTS-R-6 (class RK1)

<2> The power line connection must always be present

<3> DI/DO, controlled from the Control Unit.

<4> No additional consumer after the line contactor permitted!

<5> The current carrying capacity of the DO must be observed; an output interface element may need to be used.

Figure 11-12 Example connection of Control Supply Module

The Control Supply Module (CSM) is connected to the line supply (3-ph. 380 V AC –10 % up to 480 V +10 %) via the appropriate screw terminals (0.2 to 4 mm^2). This connection should preferably be made without using an isolating device (e.g. contactor).

The CSM is protected corresponding to the data provided in the Equipment Manual for Booksize power units. The CSM has an internal line filter (Class A for TN line supplies), and the pre-charging circuit for the DC link inside the unit is electrically isolated from the 24 V supply.

Note

When engineering the line supply of the CSM, it should be noted that the CSM may not be connected to the line supply after the line module is connected to the line supply. When charging, this prevents the DC link from being immediately loaded by the CSM.

NOTICE

If a selectively tripping AC/DC-sensitive residual-current circuit-breaker is used, the Control Supply Module must be connected downstream of this.

11.3.3.3 Meaning of the LEDs on the Control Supply Module

Table 11-8 Control Supply Module - Description of the LEDs

LED	Color	State	Description
READY	-	Off	Electronics power supply outside the permissible tolerance range.
	Green	Steady light	Ready for operation. Output voltage within tolerance range.
DC LINK	-	Off	DC input voltage < 290 V_{DC}, floating operation not possible
	Yellow	Steady light	DC input voltage in the range 370 < Ue < 820 V_{DC} Floating operation possible
	Red	Steady light	DC input voltage outside the tolerance range. DC input voltage 290 V< Ue < 370 V or Ue > 820 V_{DC}

11.3.4 Dimension drawing

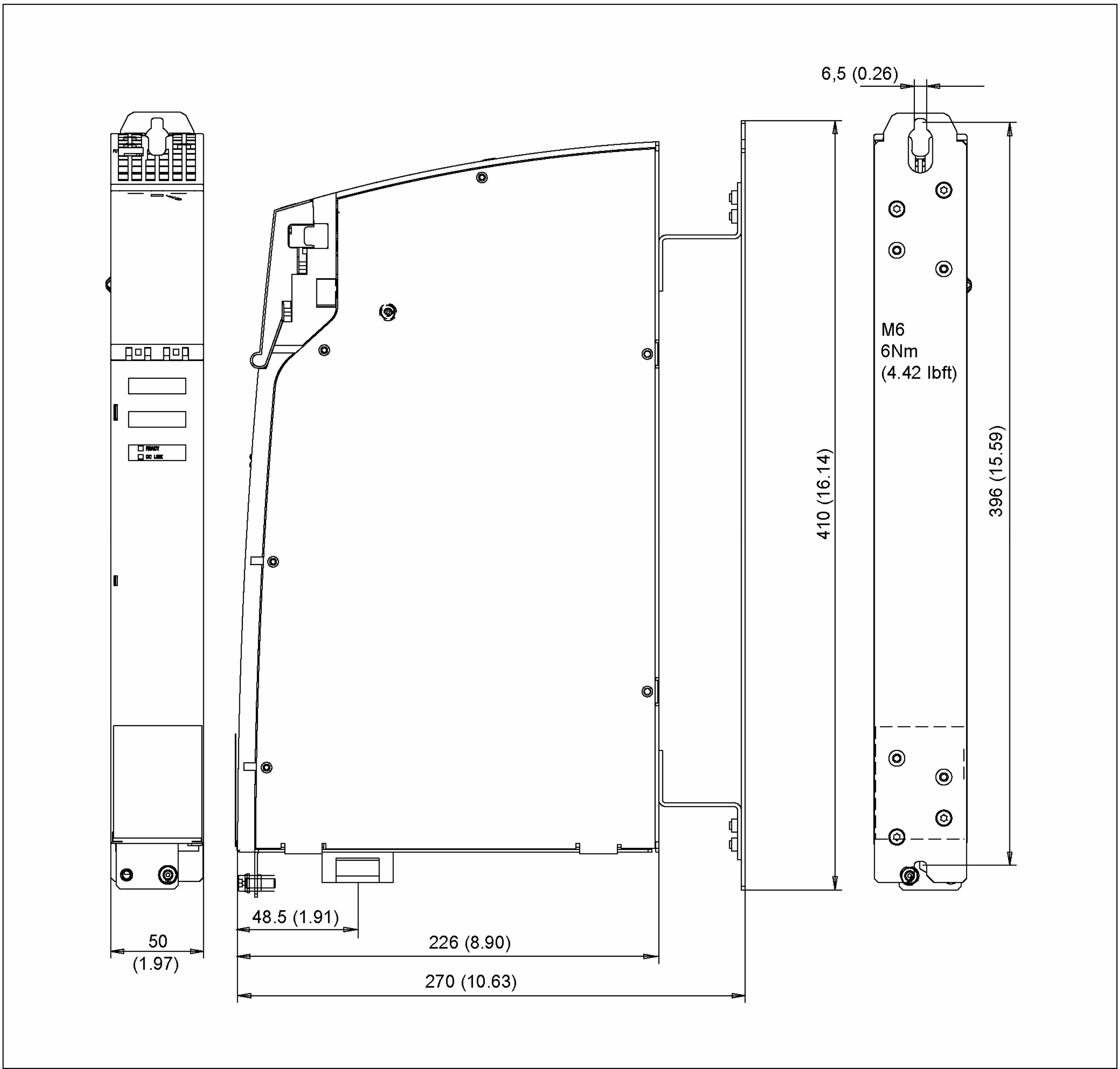


Figure 11-13 Dimension drawing of the Control Supply Module

11.3.5 Technical Specifications

Table 11-9 Technical data

Control Supply Module	Unit	Value
Input data		
Line voltage Line frequency	V_{AC} Hz	3-ph. 380 - 480 V_{AC} ± 15 % 47 to 63
Rated input current Rated value (at U_{eRated})	 A_{AC}	 approx. 2
Starting current inrush	A_{AC}	Max. 80
Power loss ride-through (at 400 V_{AC})	ms	5
DC link voltage	V_{DC}	430 to 882 (300 to 430 < 1 min)
Supply current (at 600 V)	A_{DC}	1,1
Output data		
Output voltage	V_{DC}	26 +/- 2 %
Rated output current	A_{DC}	20
Startup to short-circuit Short-circuit during operation	A_{DC} A_{DC}	≤ 24 Normally 23 (continuous)
24 V DC busbar current carrying capacity	 A_{DC}	 20
Residual ripple (clock frequency approx. 50 kHz)	mV_{pp}	< 100
Cycle peaks (bandwidth 20 MHz)	mV_{pp}	< 200
Power loss[1]	W	< 105
Weight	kg	4,8

[1] For an overview, see the power loss tables in chapter Cabinet Design

11.4 Voltage Clamping Module (VCM)

11.4.1 Description

Under certain unfavorable conditions, voltage rises can occur in extended drive line-ups due to the stimulation of the system resonance frequency. This can be particularly damaging for the insulation systems of the connected motors since partial discharges can occur.

The Voltage Clamping Module ensures that the motor voltages are limited to permissible values even when resonance occurs. The Voltage Clamping Module must always be used if the total lengths of all the motor and DC link cables exceed the following value:

- 350 m for shielded cables.
- 560 m for unshielded cables.

In conjunction with the Voltage Clamping Module, the following total cable lengths are permitted:

- 630 m for shielded cables
- 850 m for unshielded cables

Limitations/secondary conditions

The following secondary conditions must be observed:

- Power derating for Line Module to 80 %.
- Max. step-up factor (rectification factor V_{dc}/V_{line}) with controlled infeed: 150 %.
- No built-in motors must be connected (torque motors, linear motors).
- Can only be connected to TN line supply systems with grounded neutral point.
- The EMC limit values (radio interference voltage) are no longer observed, which means that special measures have to be taken to ensure CE conformity (on-site measurement (subject to charge) and adjusted filter). Contact: EPCOS, e-mail: emv.labor@epcos.com

Compatibility

The Voltage Clamping Module can be integrated in the drive line-up with:

- Internal air cooling with mounting brackets (included in the scope of supply)
- External air cooling

11.4.2 Safety information

DANGER

Risk of electric shock. A hazardous voltage is present for up to 5 minutes after the power supply has been switched-off.
It is only permissible to open the protective cover after this time has expired.

WARNING

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

The components must only be operated when the protective cover of the DC link is closed. Damaged components must not be used further, as this could result in secondary damage or accidents.

DANGER

The Voltage Clamping Module conducts a high leakage current via the functional ground. This means that a permanent PE connection must be provided for the cabinet (PE) rail.

Other than that the following measures must be taken in accordance with EN 61800-5-1: Either protective ground conductor cross-sections ≥ 10 mm^2 Cu or installation of a second protective ground conductor of the same cross-section as the first one.

NOTICE

It is not permissible to use a green/yellow cable for the functional ground of the Voltage Clamping Module.

The Voltage Clamping Module includes capacitors that are connected with respect to the functional ground. This is the reason that when carrying-out a high-voltage test in the system, the components must be disconnected from the functional ground.

DANGER

The DC link discharge voltage hazard warning in the local language must be attached to all of the components.
A set of labels in 16 languages is supplied with the component.

WARNING

A ventilation clearance of 80 mm above and below the components must be observed.

DANGER

It is only permissible to establish connections to the DC link using the adapters that SIEMENS has recommended (DC link adapter and DC link rectifier adapter).

CAUTION
After being transported the screws must be tightened. The tightening torque of the DC link busbar screws (1.8 Nm, tolerance +30 %) must be checked before commissioning.

CAUTION
The DC link side covers are supplied as standard with the components; they can also be ordered separately, if required (order no.: 6SL3162-5AA00-0AA0).

11.4.3 Interface description

11.4.3.1 Overview

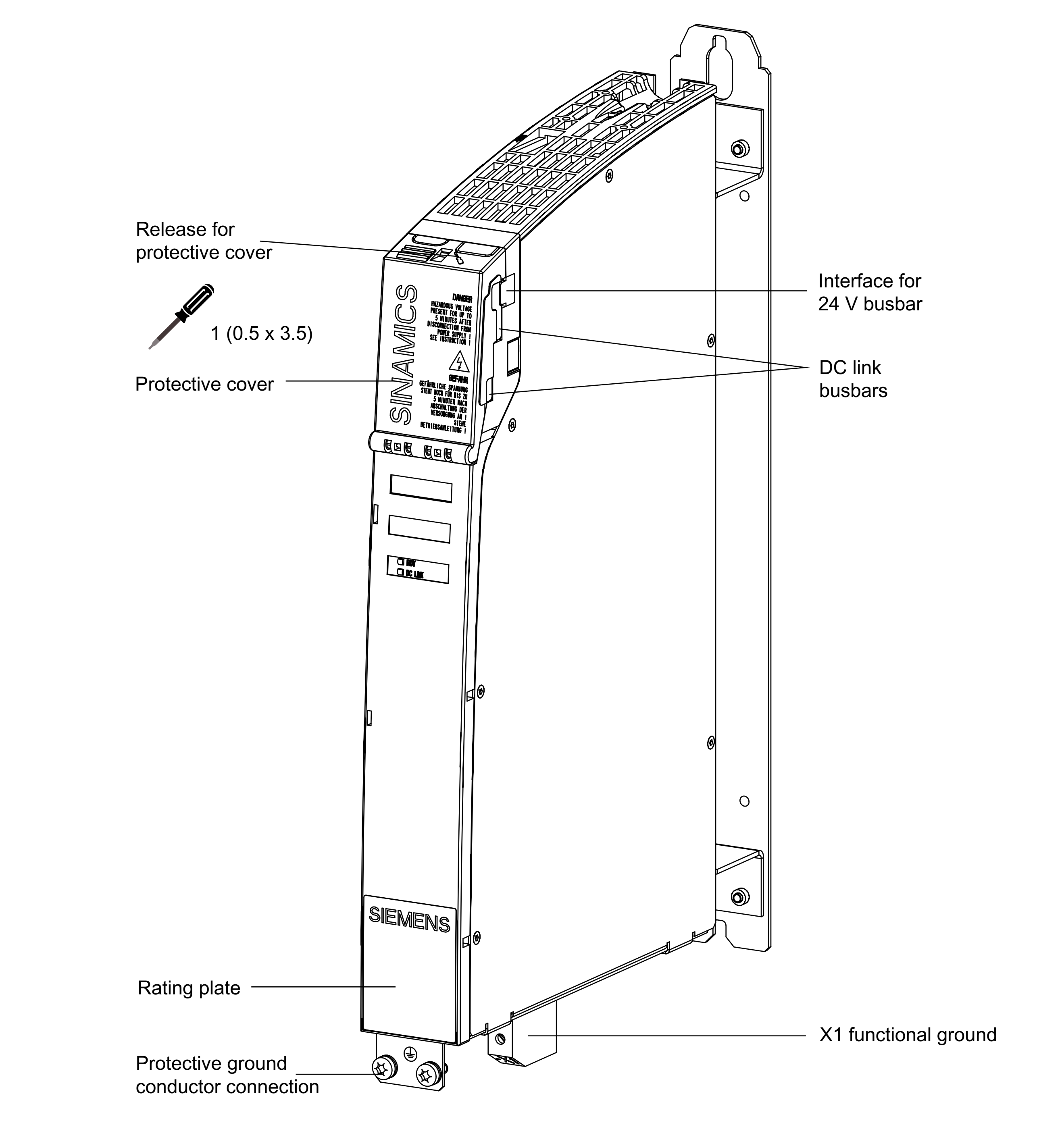


Figure 11-14 Interface description: Voltage Clamping Module

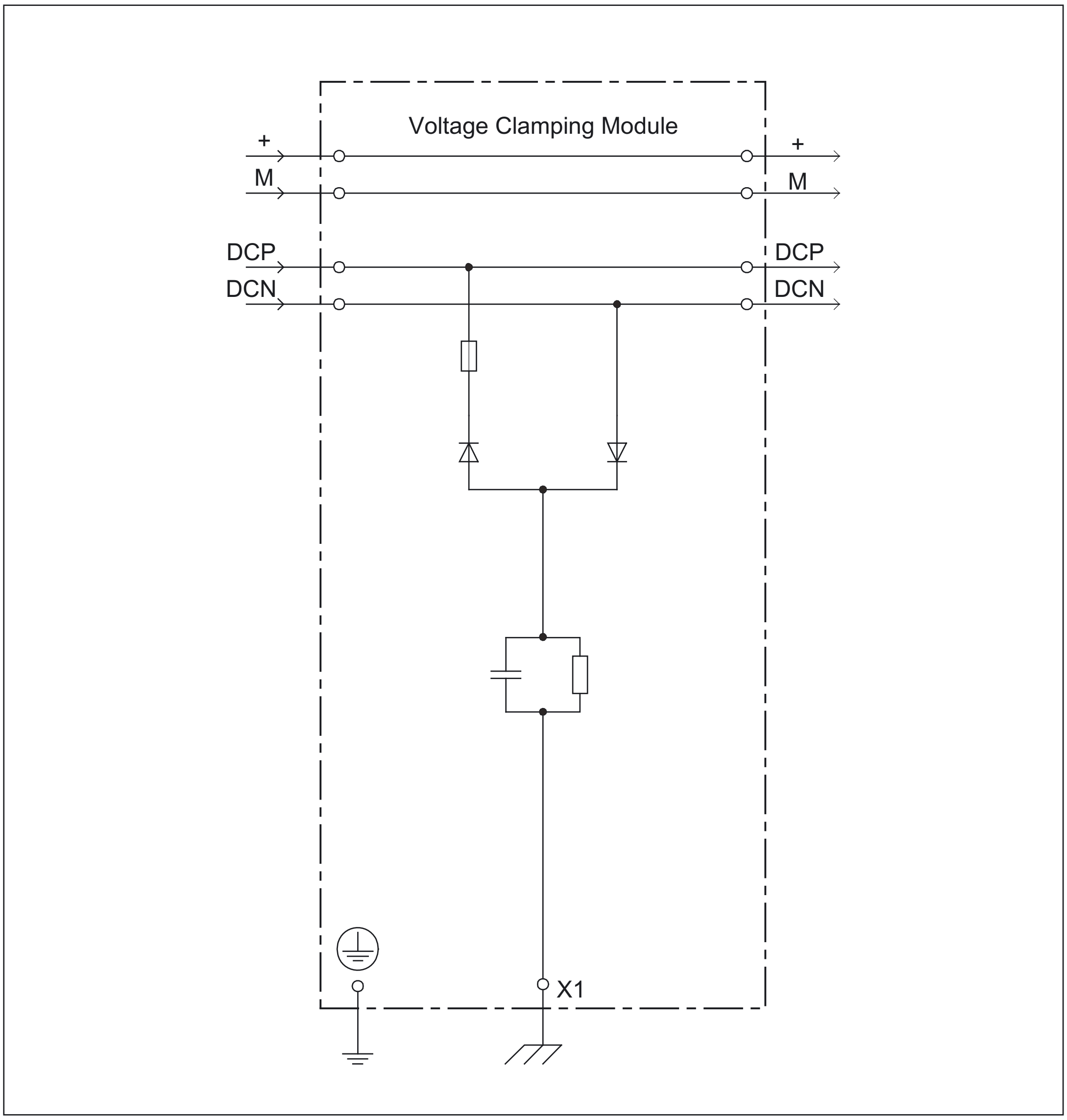


Figure 11-15 Circuit diagram: Voltage Clamping Module

11.4.3.2 X1 functional ground

X1 functional ground

To ensure that the Voltage Clamping Module functions properly, a functional ground must be connected to X1. Please note:

- The cables must be routed via the shortest possible path
- Cross-section: 4 mm² to 16 mm²
- When a line filter is used, the functional ground should be located on the metallic installation panel in the immediate vicinity of the line filter.
- In systems without a line filter, it should be connected on the PE busbar.

11.4.4 Dimension drawing

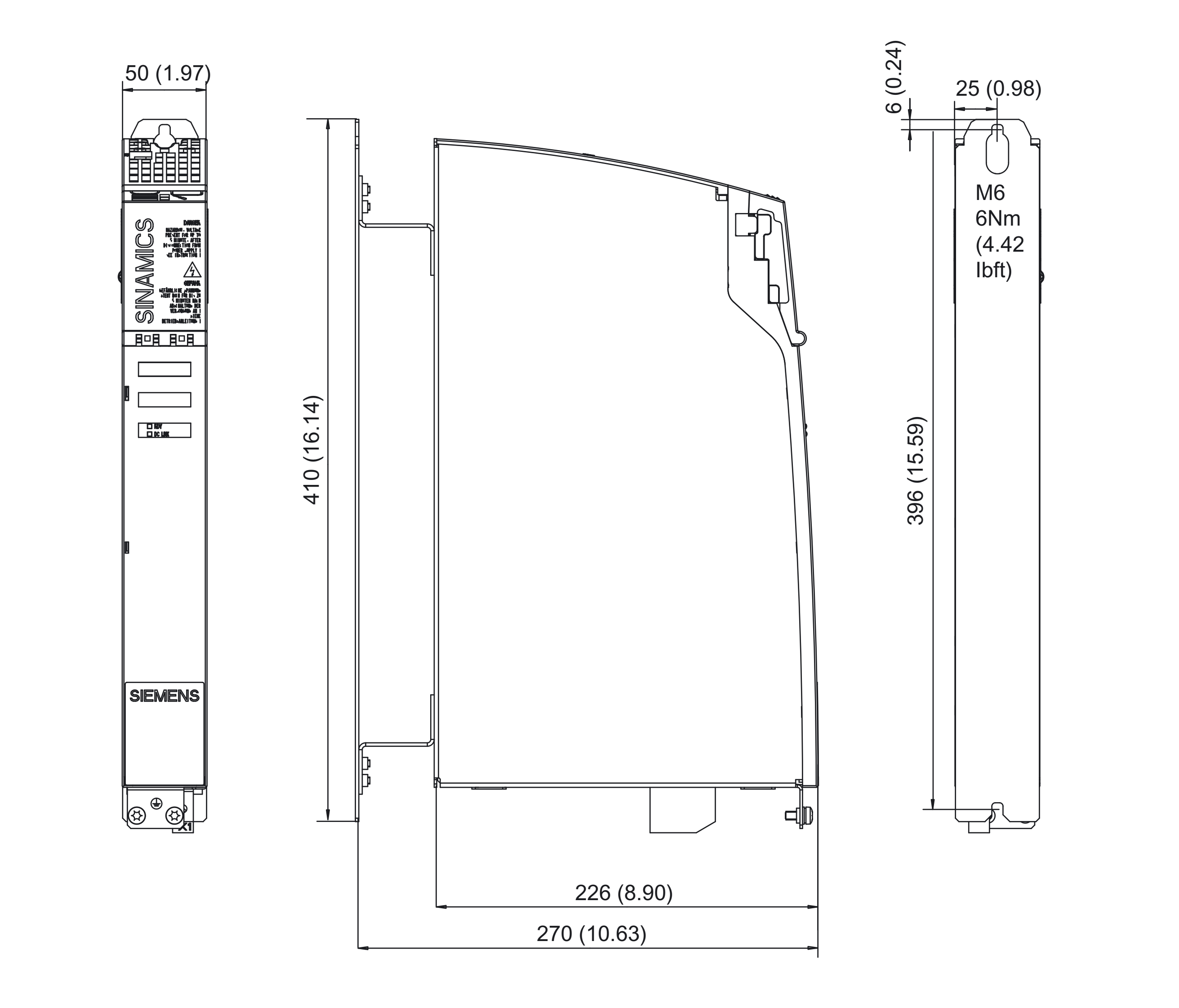


Figure 11-16 Dimension drawing of the Voltage Clamping Module

11.4.5 Installation

See the instructions for installing other DC link components (e.g. Braking Module, Capacitor Module).

Arrangement of the Voltage Clamping Module:

The Voltage Clamping Module should ideally be placed directly next to the Line Module.

- For Line Modules up to and including 36 kW, it should be placed to the right of the Line Module.
- For Active Line Modules as of 55 kW, it should be placed to the left of the Line Module due to the current-carrying capacity of the DC link busbars.
- If the Voltage Clamping Module is to be installed in an existing drive line-up, it can also be placed at the end.

11.4.6 Technical specifications

Table 11-10 Technical data

Voltage Clamping Module		
Electronics power supply	V_{DC}	24 (20,4 - 28,8)
DC link voltage	V_{DC}	510 - 720
DC link busbar current carrying capacity	A	100
24 V busbar current carrying capacity	A	20
Power loss[1]	W	50
Weight	kg	3,1

[1] For an overview, see the power loss tables in Chapter Cabinet design

Power components on the motor side 12

12.1 Motor reactors

12.1.1 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.

Prerequisites

- Ambient temperature 40 °C.
- Pulse frequency f_{max}=4 kHz.
- Output frequency f_{max}=120 kHz.
- If the total shielded cable length in the drive line-up is more than 350 m, a Voltage Clamping Module must be used.
- If the total unshielded cable length in the drive line-up is more than 560 m, a Voltage Clamping Module must be used.
- Only valid for vector operating mode.
- Supported in Starter from Version 2.4 up to 1 motor reactor.
- Supported in Starter from Version 2.5 up to 3 motor reactors.

12.1.2 Safety information

⚠ WARNING
A ventilation clearance of 100 mm above and below the components must be observed.

Note

The connecting cables to the Motor 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 120 Hz.

12.1.3 Dimension drawings

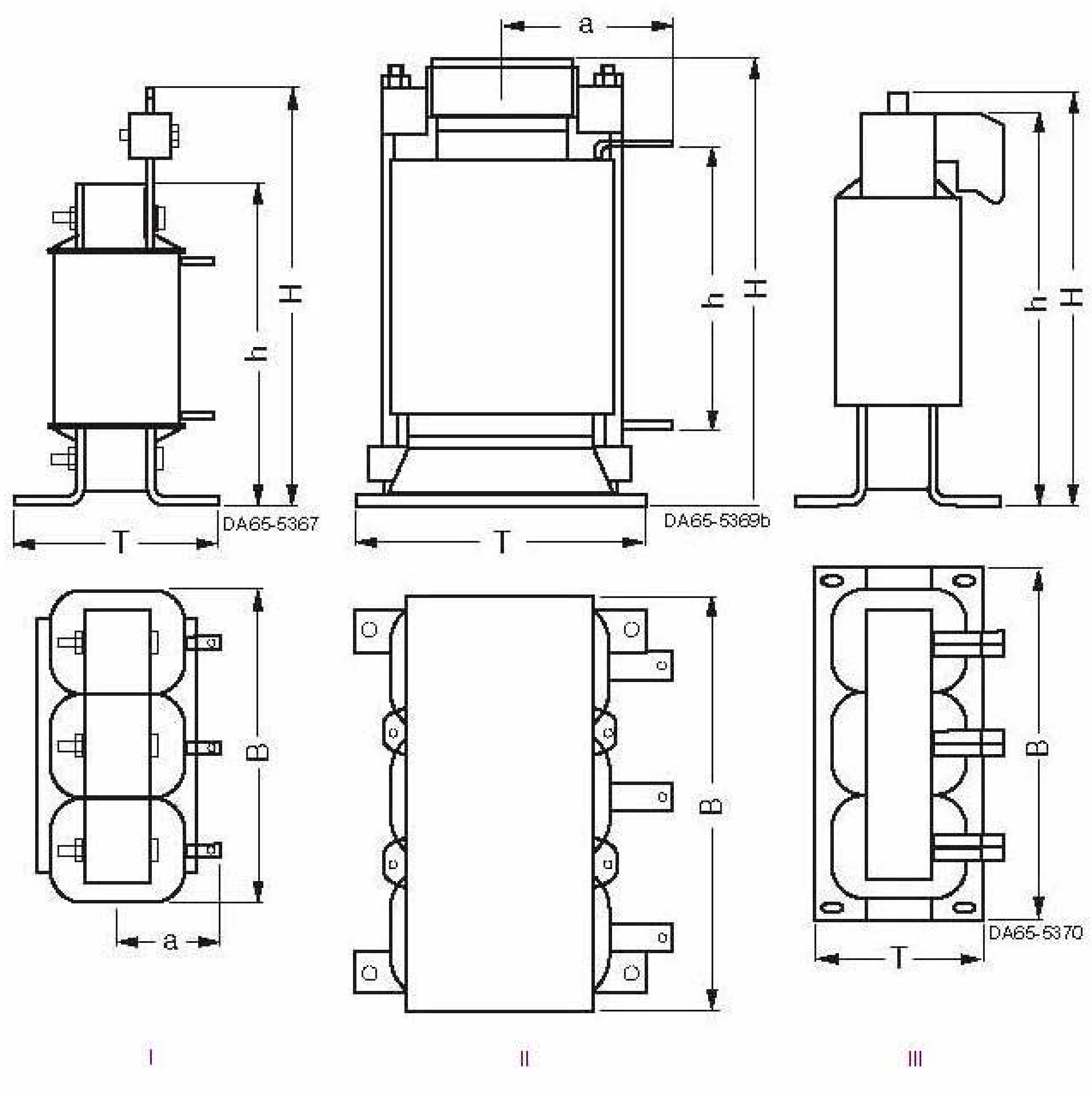


Figure 12-1 Dimension drawings: Motor reactors

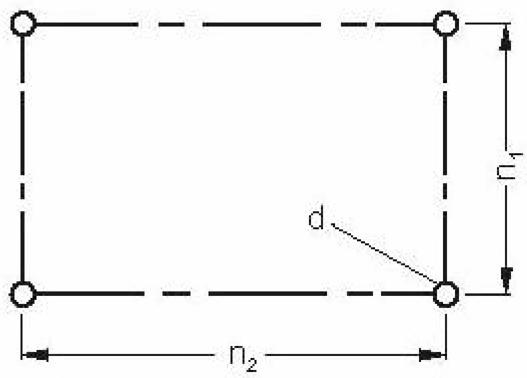


Figure 12-2 Mounting hole

Table 12-1 Dimensions of motor reactors, all data in mm and (inches)

	6SE7021-0ES87-1FE0	6SE7022-6ES87-1FE0	6SE7024-7ES87-1FE0	6SE7027-2ES87-1FE0
	Fig. III	Fig. III	Fig. II	Fig. I
B	178 (7,00)	219 (8,62)	197 (7,75)	267 (10,51)
H	153 (6,02)	180 (7,08)	220 (8,66)	221 (8,70)
D	88 (3,46)	119 (4,68)	104 (4,09)	107 (4,21)
a	-	-	69 (2,71)	77 (3,03)
h	146 (5,74)	181 (7,12)	103 (4,05)	206 (8,11)
n1	68 (2,67)	89 (3,50)	70 (2,75)	77 (3,03)
n2	166 (6,53)	201 (7,91)	176 (6,92)	249 (9,80)
d	M5	M6	M6	M6
1) Dimensions n1 and n2 correspond to the hole spacing				

Table 12-2 Dimensions of motor reactors, all data in mm and (inches)

	6SE7031-5ES87-1FE0	6SE7031-8ES87-1FE0	6SE7032-6ES87-1FE0
	Fig. II	Fig. II	Fig. II
B	197 (7,75)	281 (11,06)	281 (11,06)
H	220 (8,66)	250 (9,84)	250 (9,84)
D	128 (5,03)	146 (5,74)	146 (5,74)
a	81 (3,18)	98 (3,85)	111 (4,37)
h	100 (3,93)	119 (4,68)	121 (4,76)
n1	94 (3,70)	101 (3,97)	101 (3,97)
n2	176 (6,92)	200 (7,87)	200 (7,87)
d	M6	M8	M8
1) Dimensions n1 and n2 correspond to the hole spacing			

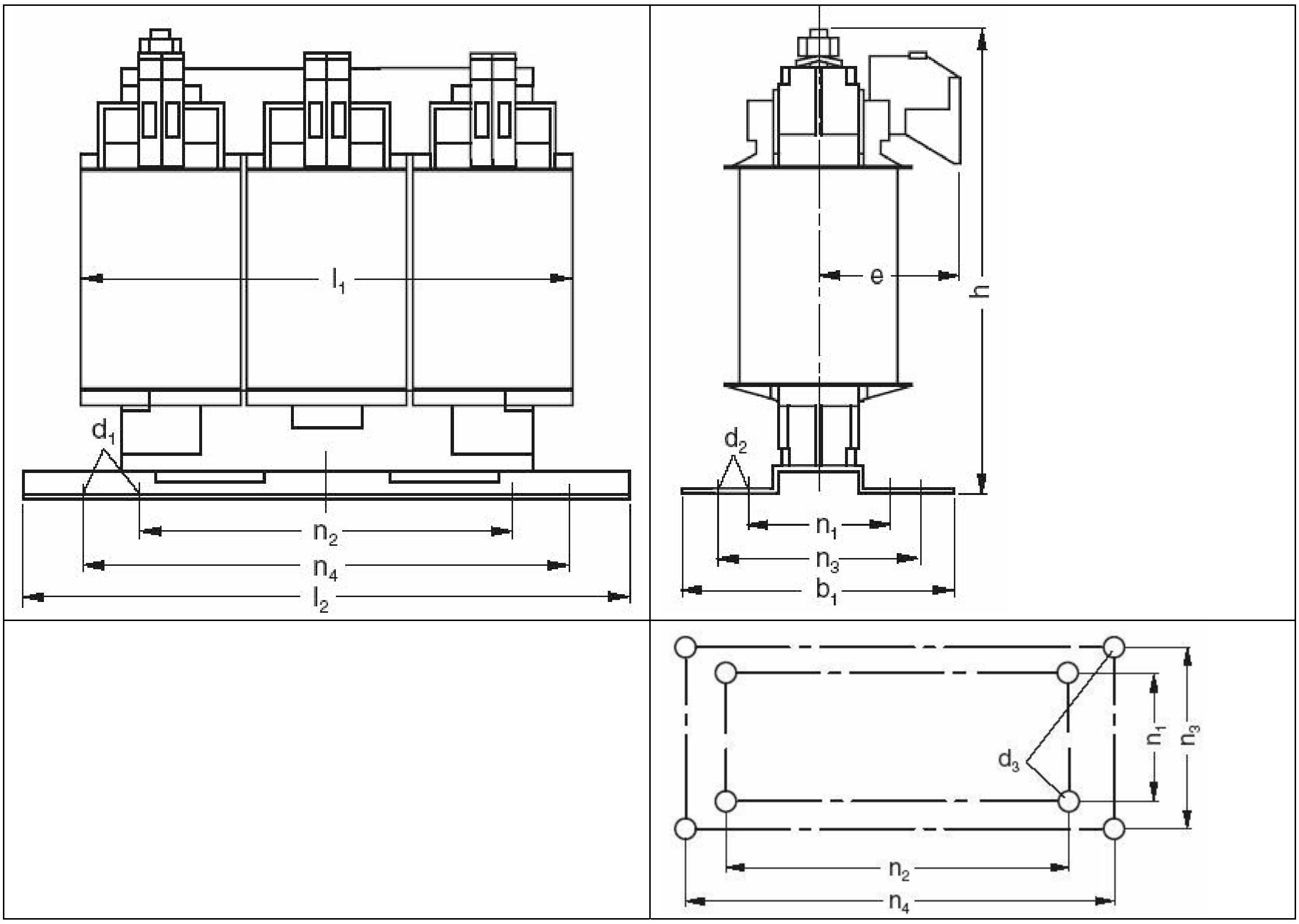
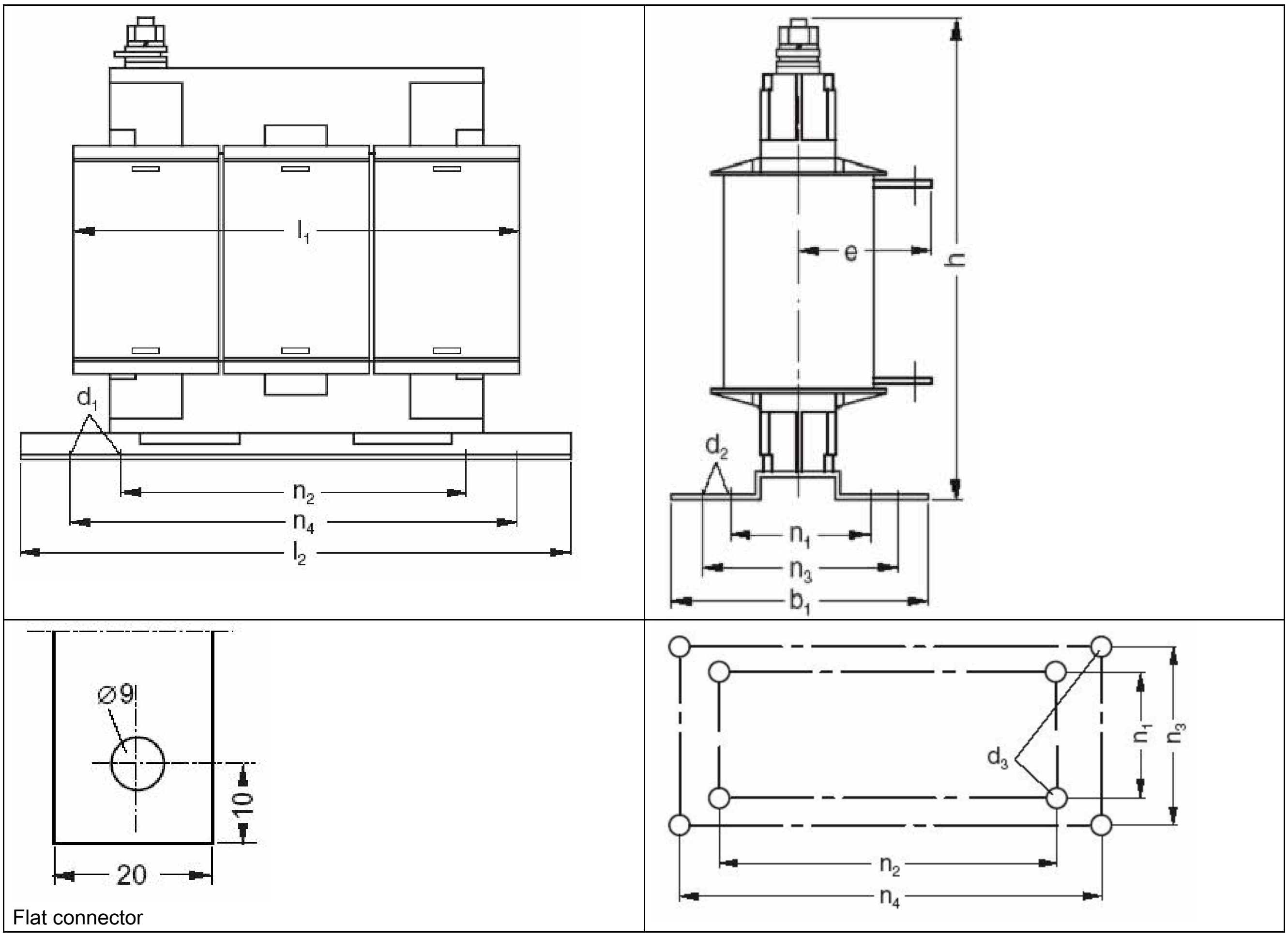


Table 12-3 Dimensions of motor reactors, all data in mm and (inches)

6SL3000-	2BE21-0AA0
l_1	150 (5,90)
l_2	178 (7,00)
b_1	88 (3,46)
b_{max}	111 (4,37)
e	67 (2,63)
h	159 (6,25)
n_1	64 (2,51)
n_2	113 (4,44)
n_3	68 (2,67)
n_4	166 (6,53)
d_1	5,8 (0,22)
d_2	11 (0,43)
d_3	M5
PI	M6
Lengths n_1, n_2, n_3 and n_4 corresponds to the distance between holes	



Flat connector

Table 12-4 Dimensions of motor reactors, all data in mm and (inches)

6SL3000-	2BE26-0AA0
l_1	max. 228 (8.97)
l_2	267 (10,51)
b_1	107 (4,21)
b_{max}	125,5 (4,94)
e	72 (2,83)
h	220 (8,66)
h_1	56 (2,20)
h_2	100 (3,93)
n_1	70 (2,75)
n_2	176 (6,92)
n_3	77 (3,03)
n_4	249 (9,80)
d_1	36 (1,41)
d_2	3,5 (0,13)

6SL3000-	2BE26-0AA0
d_3	M6
PI	M6
Lengths n_1, n_2, n_3 and n_4 corresponds to the distance between holes	

12.1.4 Technical Data

Table 12-5 Technical data, motor reactors, part 1

Order No.		6SE7021-0ES87-1FE0	6SL3000-2BE21-0AA0	6SE7022-6ES87-1FE0	6SE7024-7ES87-1FE0	6SE7027-2ES87-1FE0
Matching the Motor Module		6SL312x-1TE13-0AAx 6SL312x-2TE13-0AAx 6SL312x-1TE15-0AAx 6SL312x-2TE15-0AAx	6SL312x-1TE21-0AAx 6SL312x-2TE21-0AAx	6SL312x-1TE21-8AAx 6SL312x-2TE21-8AAx	6SL312x-1TE23-0AAx	6SL312x-1TE24-5AAx
Rated current	A	5	9	18	30	45
Induktivität	µH	1243	1000	332	180	59
Power loss	W	80	90	110	190	130
Connections - to the Motor Module - to the load - PE		 4 mm² 4 mm² M6	 10 mm² 10 mm² M6	 10 mm² 10 mm² M6	 M8 M8 M6	 M8 M8 M6
Degree of protection		IP00	IP00	IP00	IP00	IP00
Weight	kg	5.5	4.83	9.2	20	11

Table 12-6 Technical data, motor reactors, part 2

Order No.		6SL3000-2BE26-0AA0	6SE7031-5ES87-1FE0	6SE7031-8ES87-1FE0	6SE7032-6ES87-1FE0
Matching the Motor Module		6SL312x-1TE26-0AAx	6SL312x-1TE28-5AAx	6SL312x-1TE31-3AAx	6SL312x-1TE32-0AAx
Rated current	A	60	85	132	200
Inductance	µH	59	29	23	16
Power loss	W	105	220	300	300
Connections - to the Motor Module - to the load - PE		 M8 M8 M6	 M8 M8 M6	 M10 M10 M6	 M10 M10 M6
Degree of protection		IP00	IP00	IP00	IP00
Weight	kg	10.5	25	30	30

Table 12-7 Cable lengths, Part 1

Order No.	6SE7021-0ES87-1FE0	6SL3000-2BE21-0AA0	6SE7022-6ES87-1FE0	6SE7024-7ES87-1FE0	6SE7027-2ES87-1FE0
Rated current [A]	5	9	18	30	45
Shielded cables					
Maximum motor cable length, 1 reactor	100	135	160	190	200
Maximum motor cable length, 2 reactors	-	-	320	375	400
Maximum motor cable length, 3 reactors	-	-	-	-	600
Unshielded cables					
Maximum motor cable length, 1 reactor	150	200	240	280	300
Maximum motor cable length, 2 reactors	-	-	480	560	600
Maximum motor cable length, 3 reactors	-	-	-	-	900

Table 12-8 Cable lengths, Part 2

Order No.	6SL3000-2BE26-0AA0	6SE7031-5ES87-1FE0	6SE7031-8ES87-1FE0	6SE7032-6ES87-1FE0
Rated current [A]	60	85	132	200
Shielded cables				
Maximum motor cable length, 1 reactor	200	200	200	200
Maximum motor cable length, 2 reactors	400	400	400	400
Maximum motor cable length, 3 reactors	600	600	600	600
Unshielded cables				
Maximum motor cable length, 1 reactor	300	300	300	300
Maximum motor cable length, 2 reactors	600	600	600	600
Maximum motor cable length, 3 reactors	900	900	900	900

Accessories 13

13.1 Shield connecting plates

13.1.1 Description

The line and motor cable shields are connected to the shield connecting plates.
This ensures EMC compliance.

13.1.2 Overview

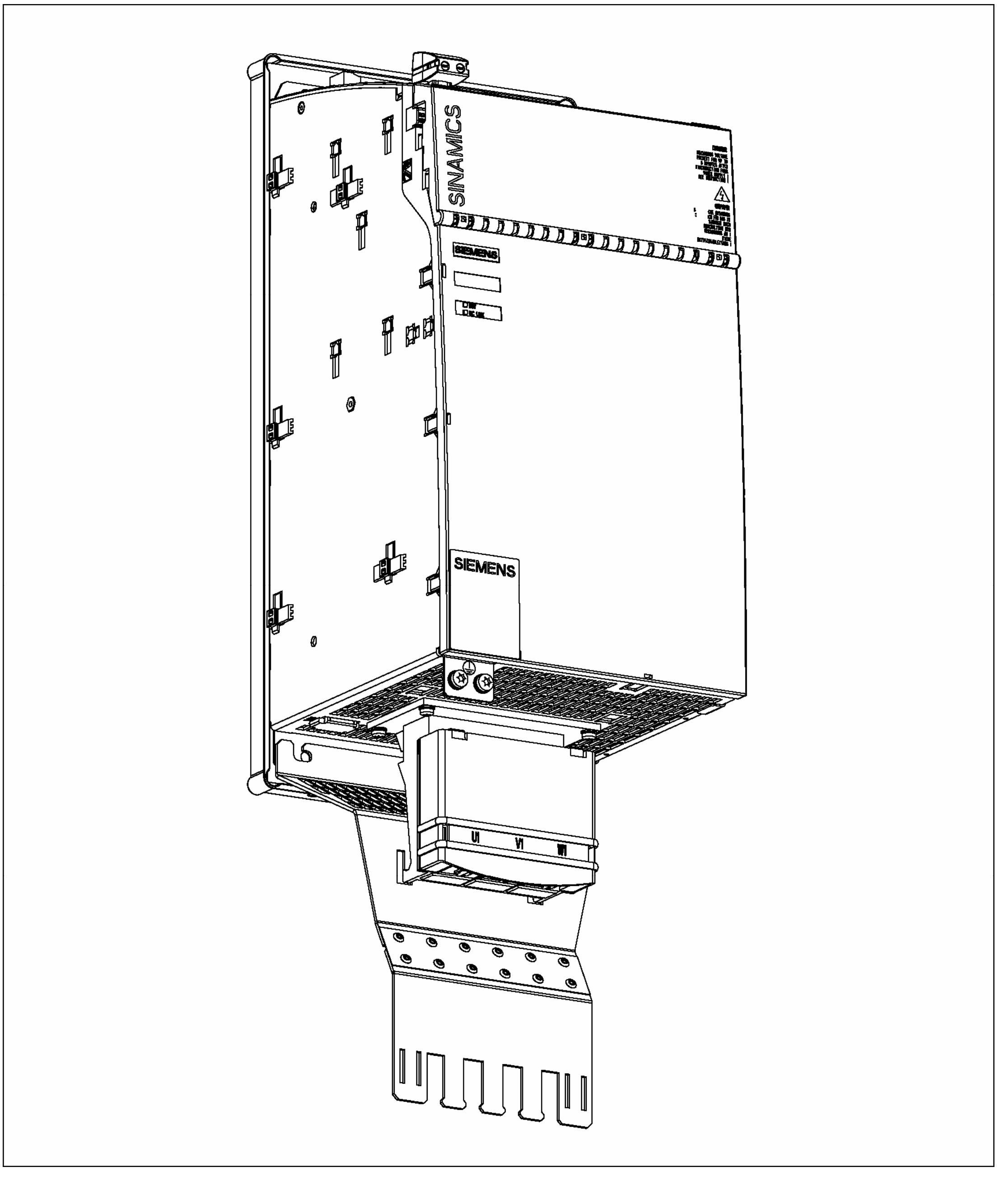


Figure 13-1 Shield connecting plate for a 200 mm module with with a cold plate

13.1.3 Dimension drawings

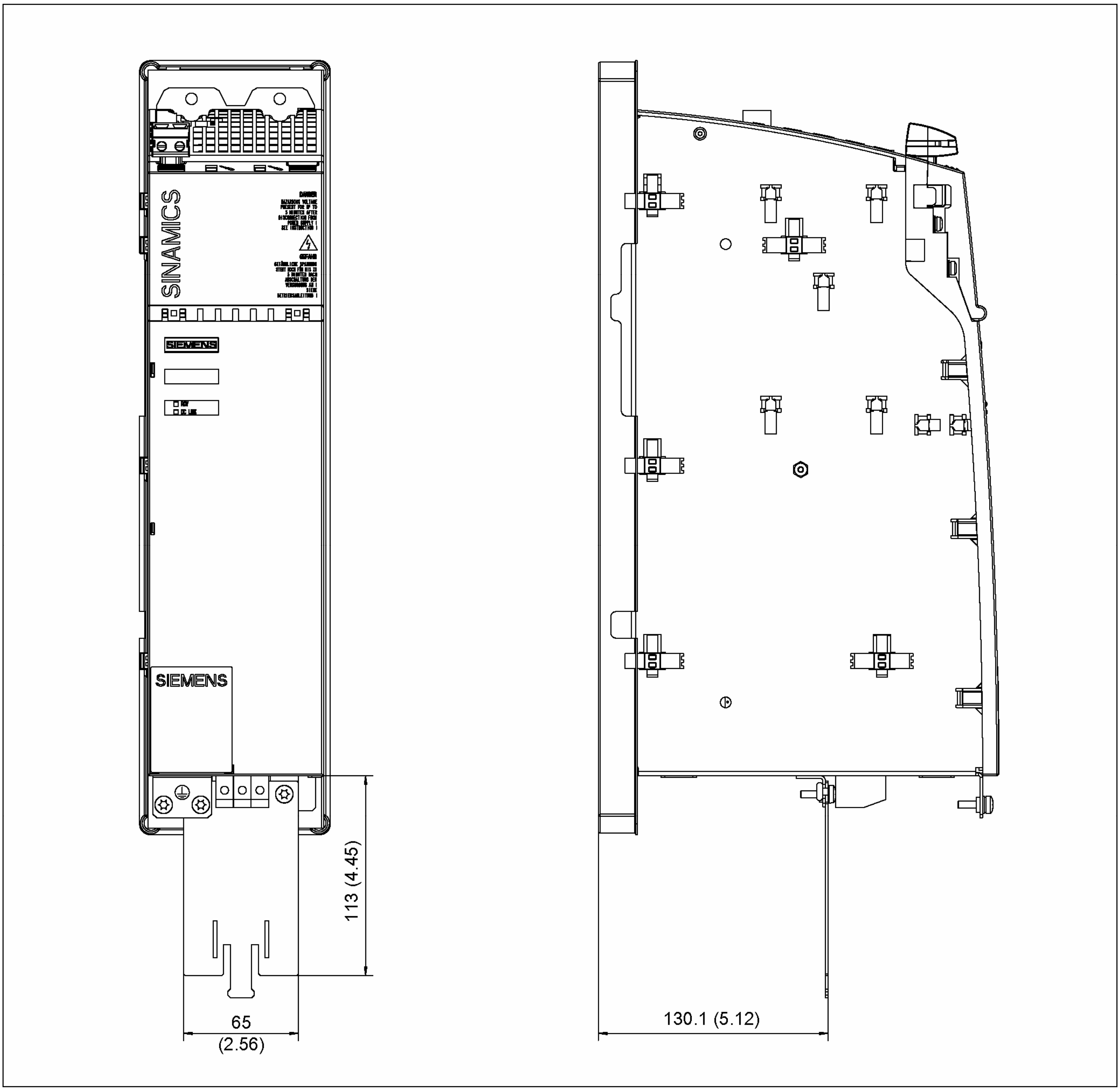


Figure 13-2 Dimension drawing, shield connecting plate on a 100 mm component with cold plate

Note

The shield connecting plate is part of the scope of supply for a 100 mm Line Module.

Recommended shield connections: from Weidmüller, order no. KLBÜ CO4

Weidmüller: http://www.weidmueller.com

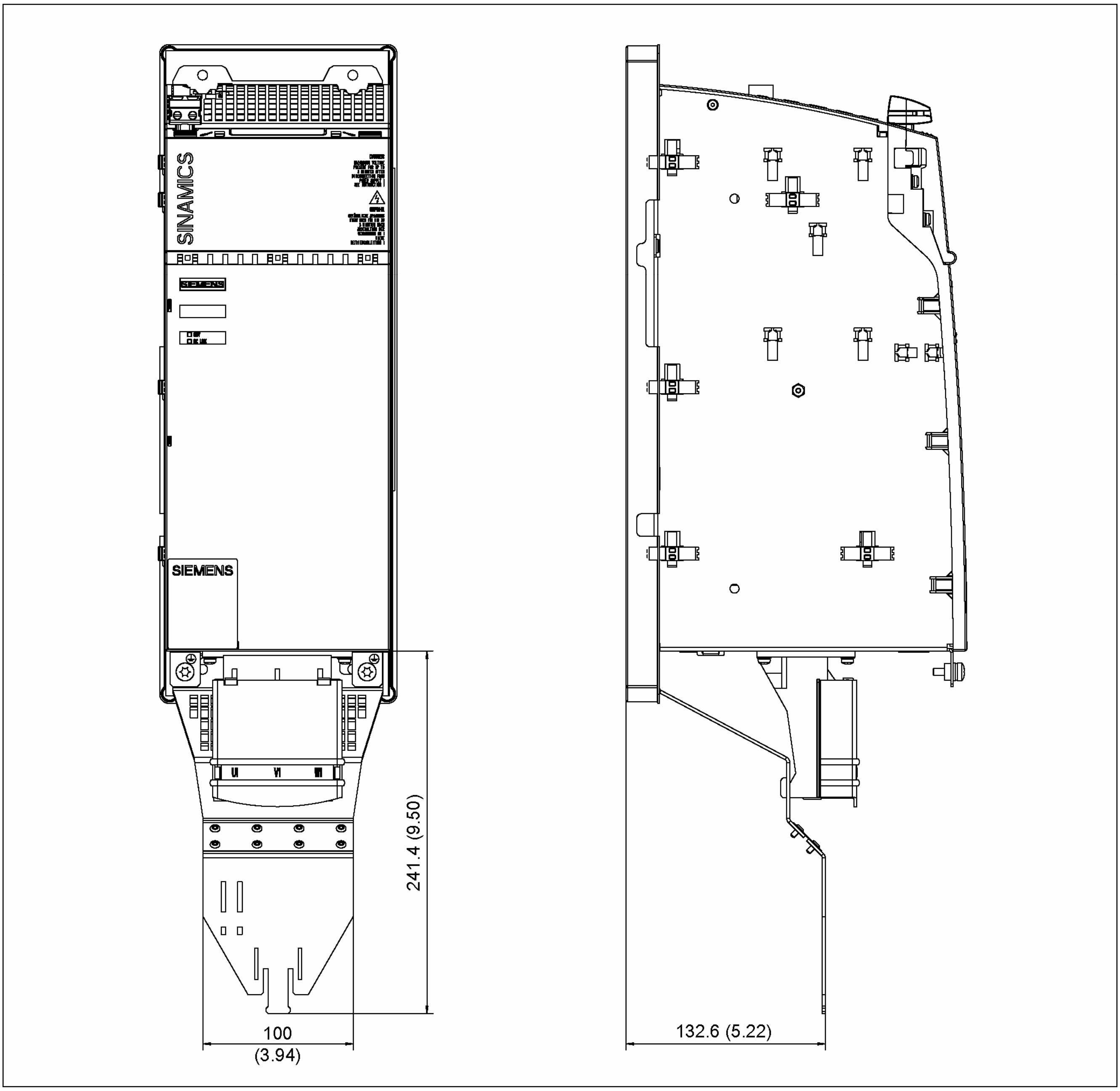


Figure 13-3 Dimension drawing, shield connecting plate on a 150 mm component with cold plate

Note

Recommended shield connections: from Weidmüller, order no. KLBÜ CO1 and KLBÜ CO4

Weidmüller: http://www.weidmueller.com

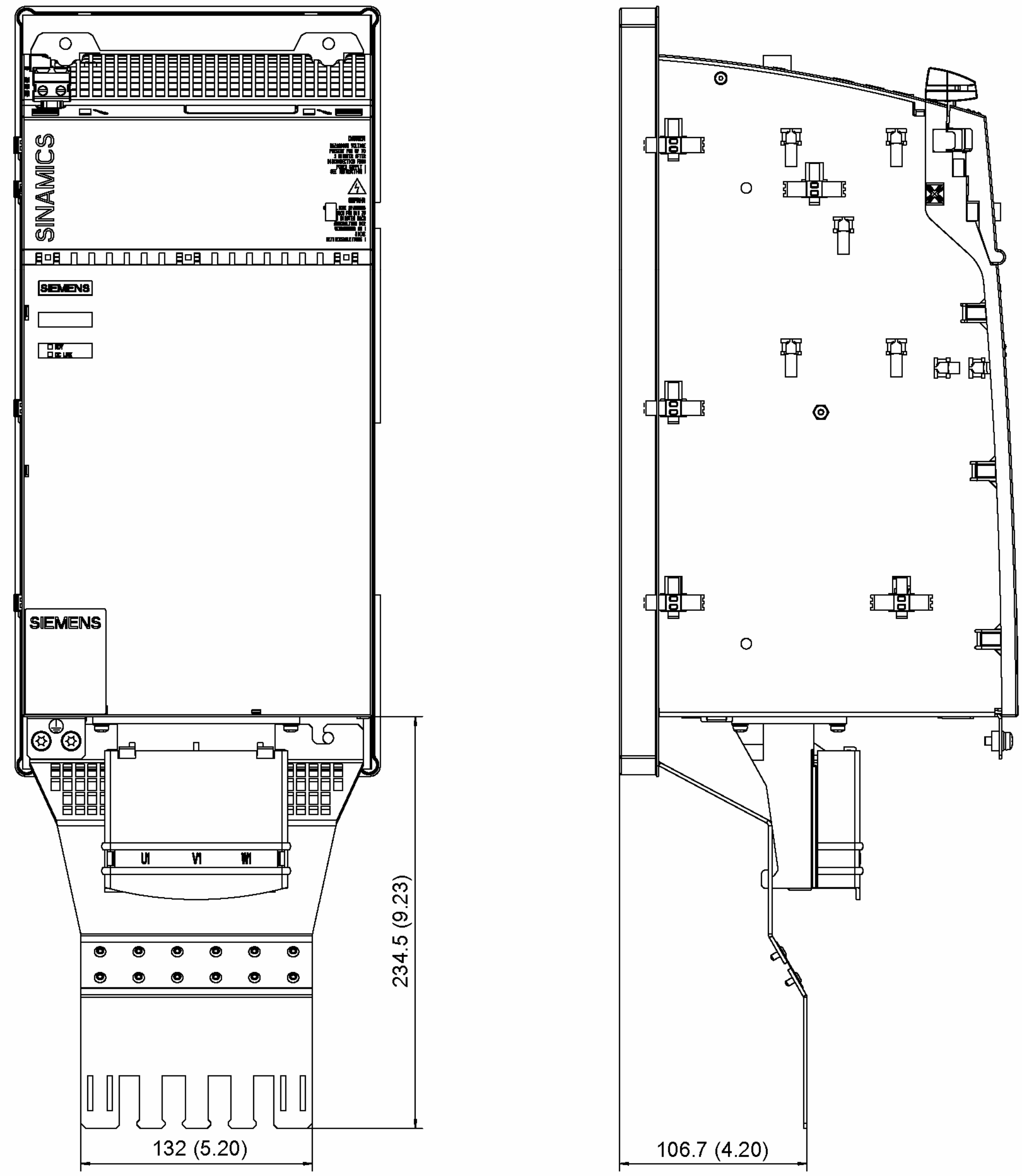


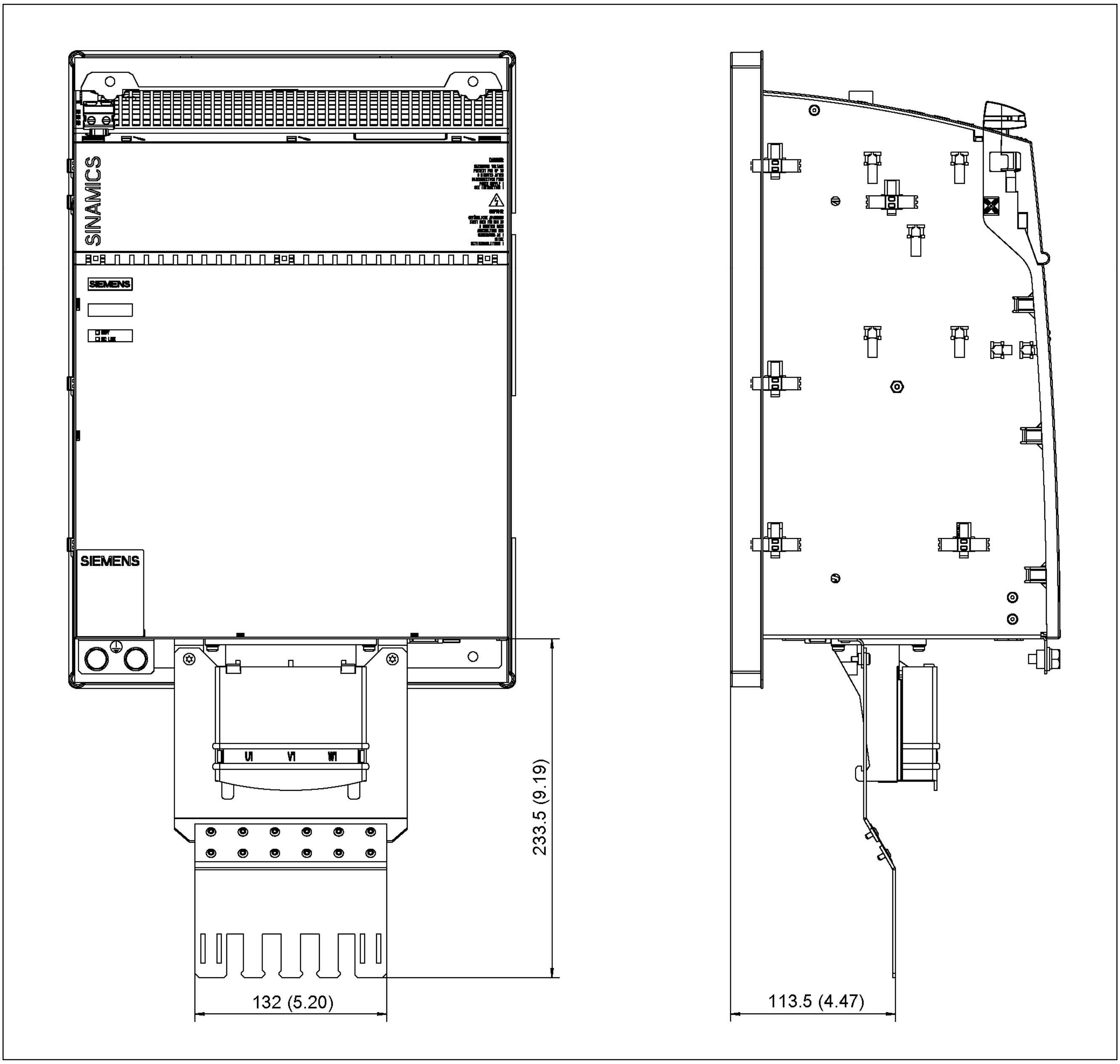
Figure 13-4 Dimension drawing, shield connecting plate on a 200 mm component with cold plate

---

Note

Recommended shield connections: Weidmüller, Order No. KLBÜ CO1

Weidmüller: http://www.weidmueller.com



Dimension drawing, shield connecting plate on a 300 mm component with cold plate

Note

Recommended shield connections: Weidmüller, Order No. KLBÜ CO1

Weidmüller: http://www.weidmueller.com

13.1.4 Mounting

Table 13-1 Mounting the shield connecting plate to a 100 mm component using as an example, internal air cooling

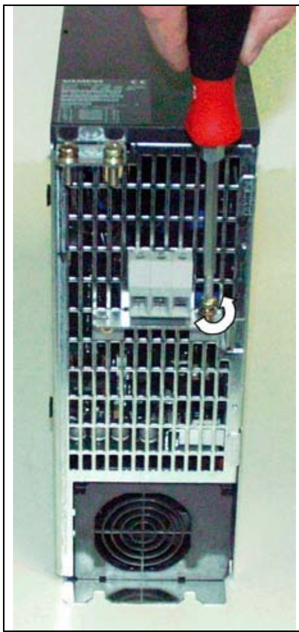
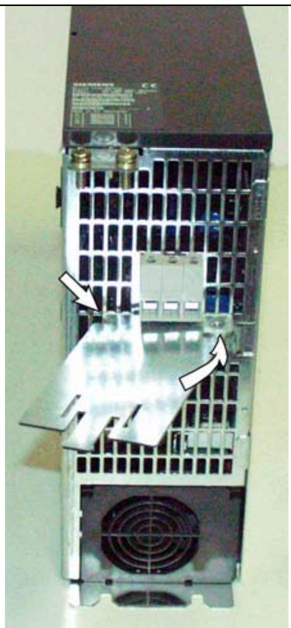
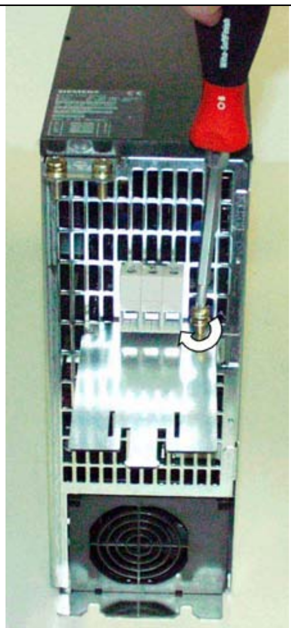
			
Remove the screw with screwdriver T25	Hook in the shielded plate.	Secure the shield connecting plate with screwdriver T25/3 Nm.	Mounted shield connecting plate

Table 13-2 Mounting the shield connecting plate to a 200 mm component using as an example, internal air cooling

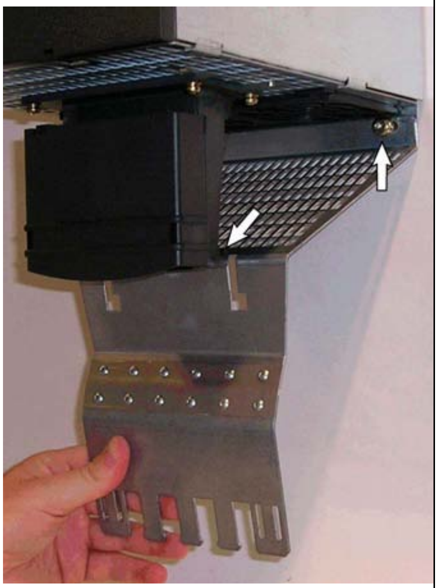
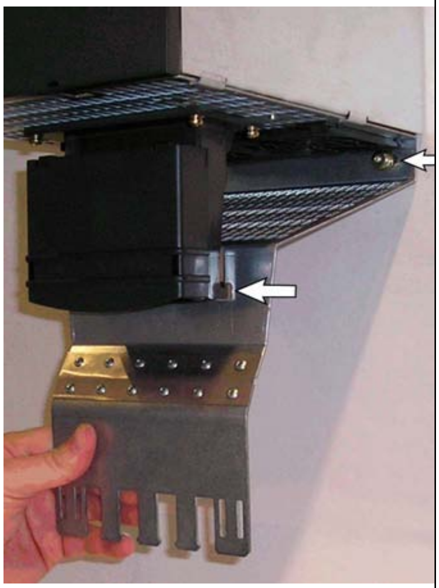
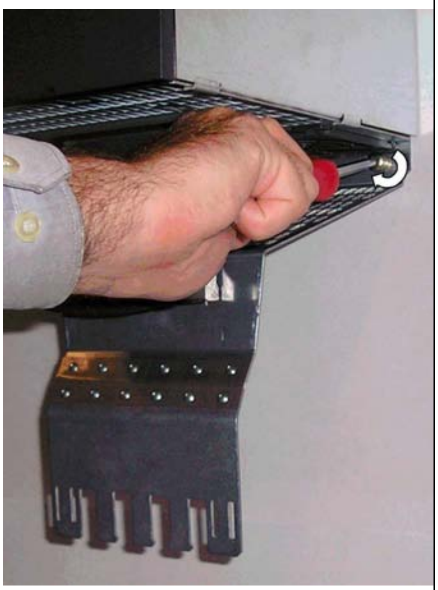
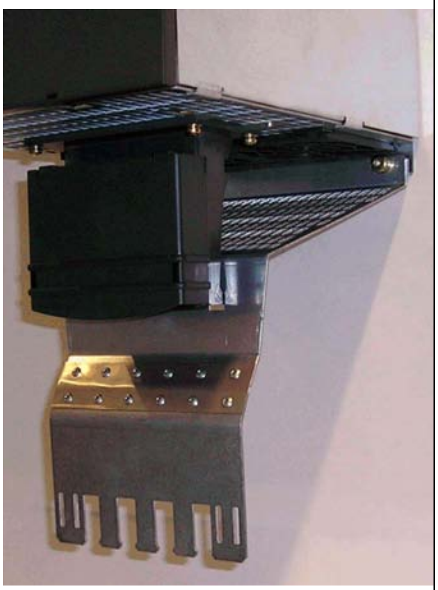
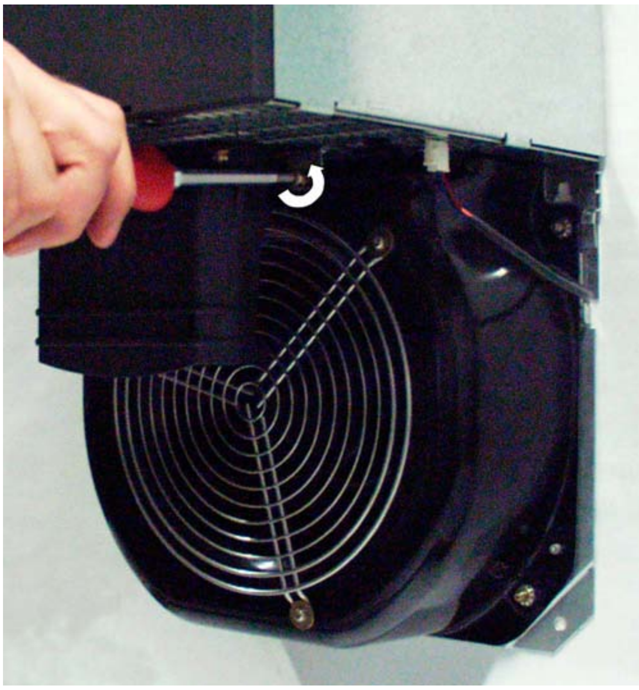
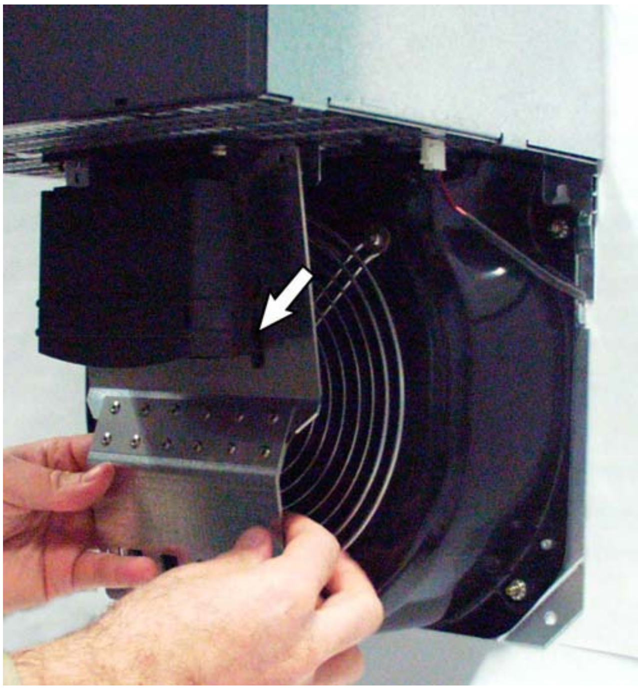
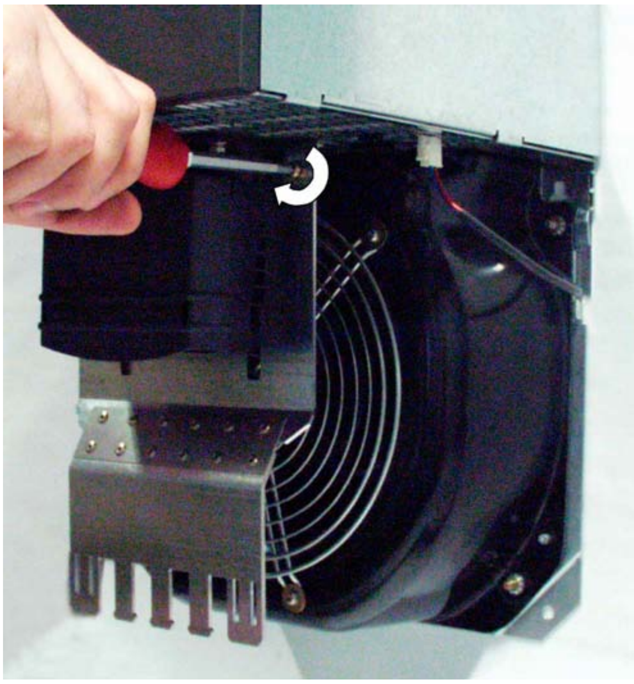
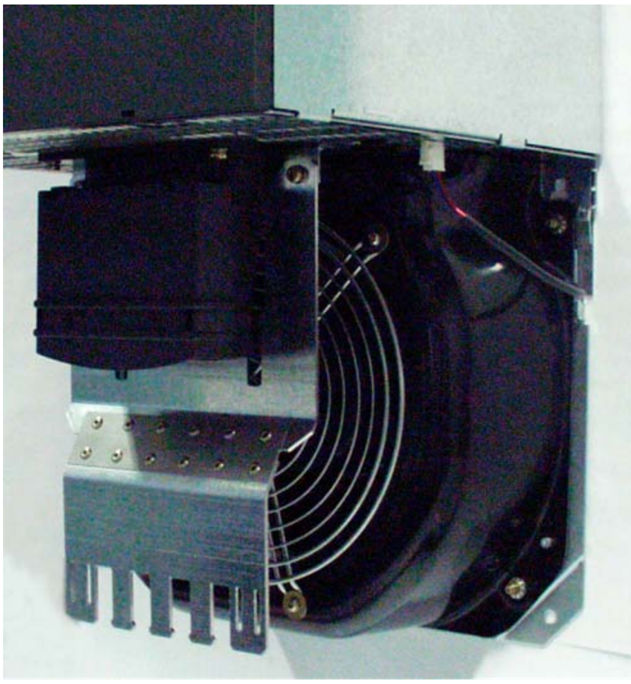
		
Loosen the lower mounting screws using a screwdriver	Hook the shield connecting plate into the screws and on the line/motor connection	Secure the shield connecting plate by shifting it to the left
		
Secure the shield connecting plate with screwdriver 6 Nm	Mounted shield connecting plate	

Table 13-3 Mounting the shield connecting plate to a 300 mm component using as an example, internal air cooling

	
Remove the screw with screwdriver T25	Hook the shield connecting plate into the line/motor connection
	
Secure the shield connecting plate with screwdriver T25/3 Nm	Mounted shield connecting plate

13.1.5 Electrical Connection

Table 13-4 Electrical connection at the shield connecting plate for 100 mm component using as an example, internal air cooling

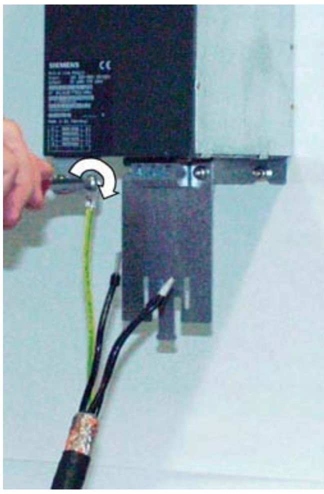
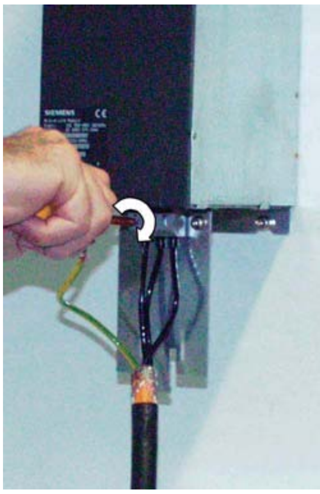
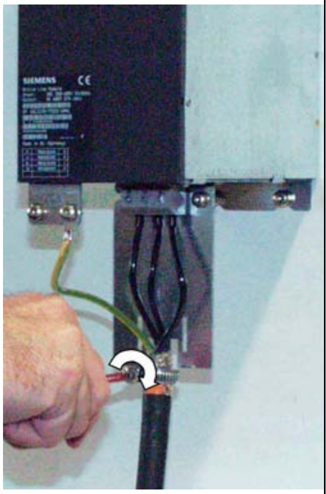
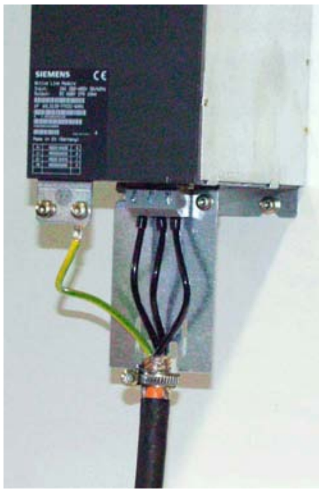
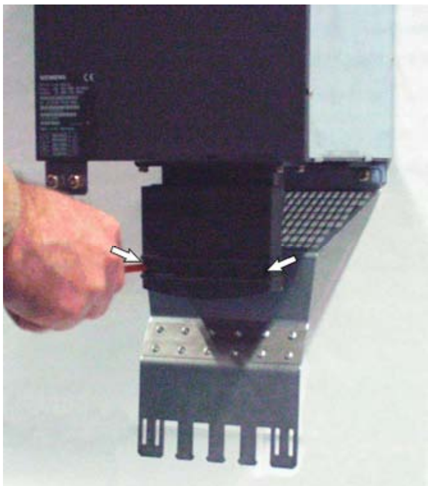
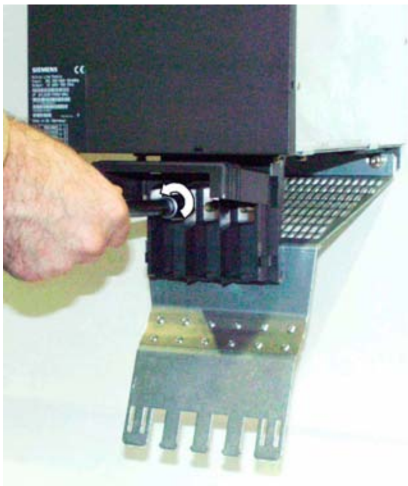
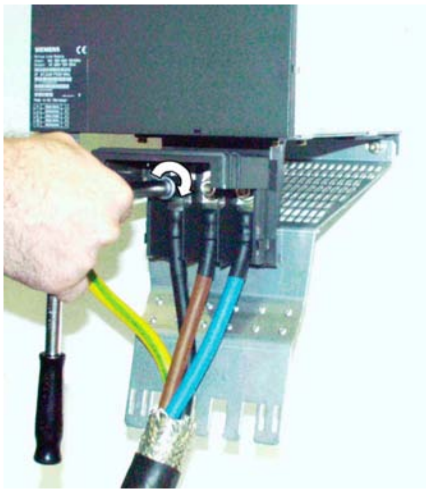
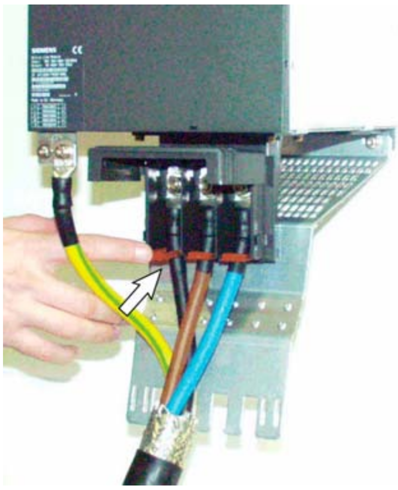
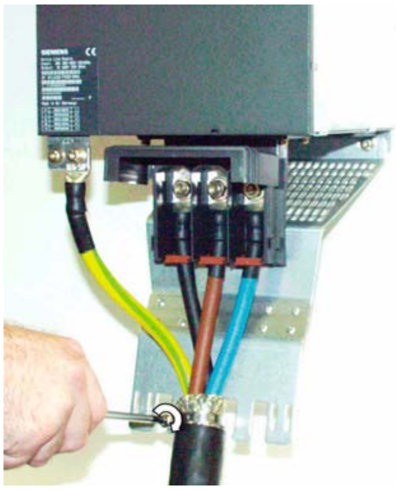
			
Attach the protective conductor (PE) using a screwdriver T25/3 Nm	Secure the power cable with flat-bladed screwdriver 4/1.8 Nm	Secure the shield clamp to the shield connecting plate using a suitable tool	The power cable is connected.

Table 13-5 Electrical connection at the shield connecting plate for 200 mm component using as an example, internal air cooling

		
Unlock and remove the cover of the terminal block.	Remove nuts M8 using a suitable tool.	Secure the earthing cable with screwdriver T25 and the power cable with torque spanner M8/13 Nm.
		
Adjust the shock-hazard protection using a suitable tool.	Attach the shock-hazard protection.	Secure the shield clamp to the shield connecting plate using a suitable tool

		
Close the cover of the terminal block.		

13.2 DC link rectifier adapter

13.2.1 Description

The DC link rectifier adapter supplies the DC link voltage directly. With a direct supply, each component is connected to the DC link separately. The internal DC link busbar is not used here.

The connection cables must be fused accordingly.

Note

When a DC link supply adapter and DC busbars are used, the limit values for radio interference emission of category C2 to EN 61800-3 cannot be observed.

It is not possible to use the DC link rectifier adapter in conjunction with internal DC link busbars.

Table 13-6 The DC link rectifier adapter is available in two sizes.

for Line/Motor Modules with a width of 50 mm and 100 mm	for Line/Motor Modules with a width of 150 mm, 200 mm, 300 mm
Screw terminals (4 to 10 mm²)	Screw terminals (35 to 95 mm²)

13.2.2 Safety Information

⚠DANGER
Risk of electric shock. A hazardous voltage is present for up to 5 minutes after the power supply has been disconnected. This time must elapse before any work may be carried-out on the adapter (e.g. mounting/installation). When opening the protective cover for the DC link, you must activate the release. A suitable tool (e.g. screwdriver) must be used for this purpose. The components must only be operated when the protective cover of the DC link is closed. Damaged components must not be used further, as this could result in secondary damage or accidents.

⚠DANGER
It is only permissible to establish connections to the DC link using the adapters that SIEMENS has recommended (DC link adapter and DC link rectifier adapter).

⚠DANGER
Components for which the recesses for the DC link rectifier adapter have been removed must no longer be operated without them. If components need to be operated without the recess and without DC link rectifier adapter, the DC link cover must be replaced.

⚠DANGER
The DC link discharge voltage hazard warning on the components on which the adapter is installed must be in the local language. A set of labels in 16 languages is supplied with the component.

CAUTION
The screw tightening torque (1.8 Nm, tolerance +30 %) for securing components to the module-side DC link busbar must be checked before commissioning to ensure that it is correct. After transportation, the screws must be tightened.

DANGER

If a 50 mm wide module or if a DC link component with the appropriate width (e.g. Braking Module, Control Supply Module, Voltage Clamping Module) is located at the lefthand end of the drive line-up, then the DC link bridge including all of the screws must be removed. It is not permissible to insert the screws without a DC link bridge.

For all other power units and DC link components (e.g. Capacitor Module) that are wider than 50 mm, it is not permissible to remove the DC link bridge.

If this is not carefully observed, this can result in damage and accidents.

CAUTION

To ensure safe electrical separation, the 24 V supply cables and those for the DC link connection cables must be physically separated (> 100 mm), or the 24 V cables must be doubly insulated (e.g. light plastic-sheathed cable).

WARNING

The DC link connection cables must be routed in such a way as to ensure that they are ground-fault and short-circuit proof in accordance with DIN/VDE 0100 or suitable fuse protection must be provided.

CAUTION

The total length of the DC link (including the connection cables) must not exceed 10 m.

13.2.3 Interface description

13.2.3.1 Overview

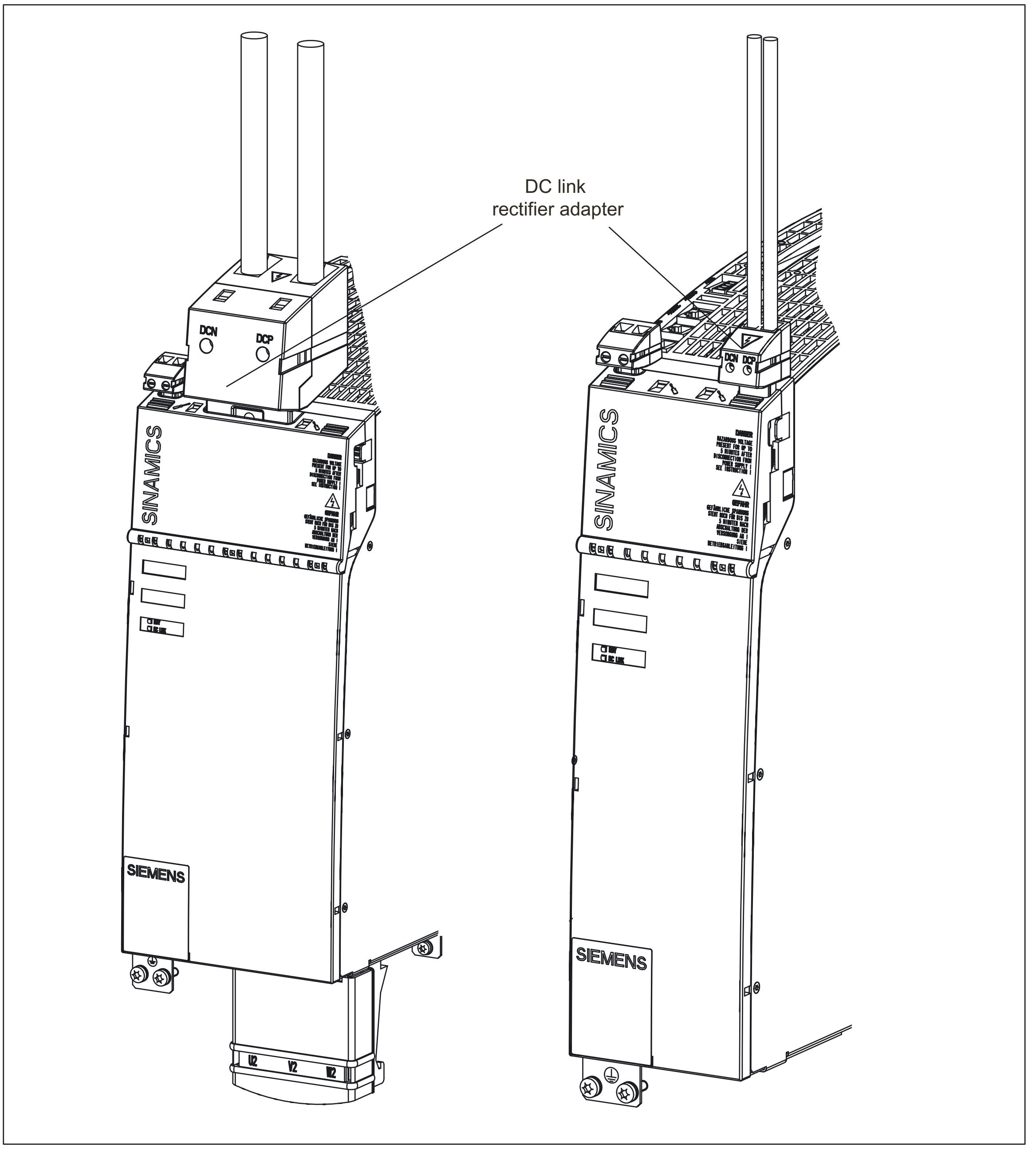


Figure 13-5 150 mm components with DC link rectifier adapter for 35 mm² to 95 mm² and 100 mm components with DC link rectifier adapter for 4 mm² to 10 mm²

13.2.3.2 DC link connection

Table 13-7 DC link rectifier adapter – description of the terminals

Terminal	Function	Technical specifications
DCP	DC link positive	**Supply voltage:** 720 V-VDE/600 V-UL **Direct supply 4 – 10 mm²** Current carrying capacity: 36 A connection cross-section: 4 – 10 mm² Stripped length: 11 mm **Direct supply 35 – 95 mm²** Current carrying capacity: 200 A connection cross-section: 35 – 95 mm² Stripped length: 27 mm
DCN	DC link negative	

13.2.4 Dimension drawings

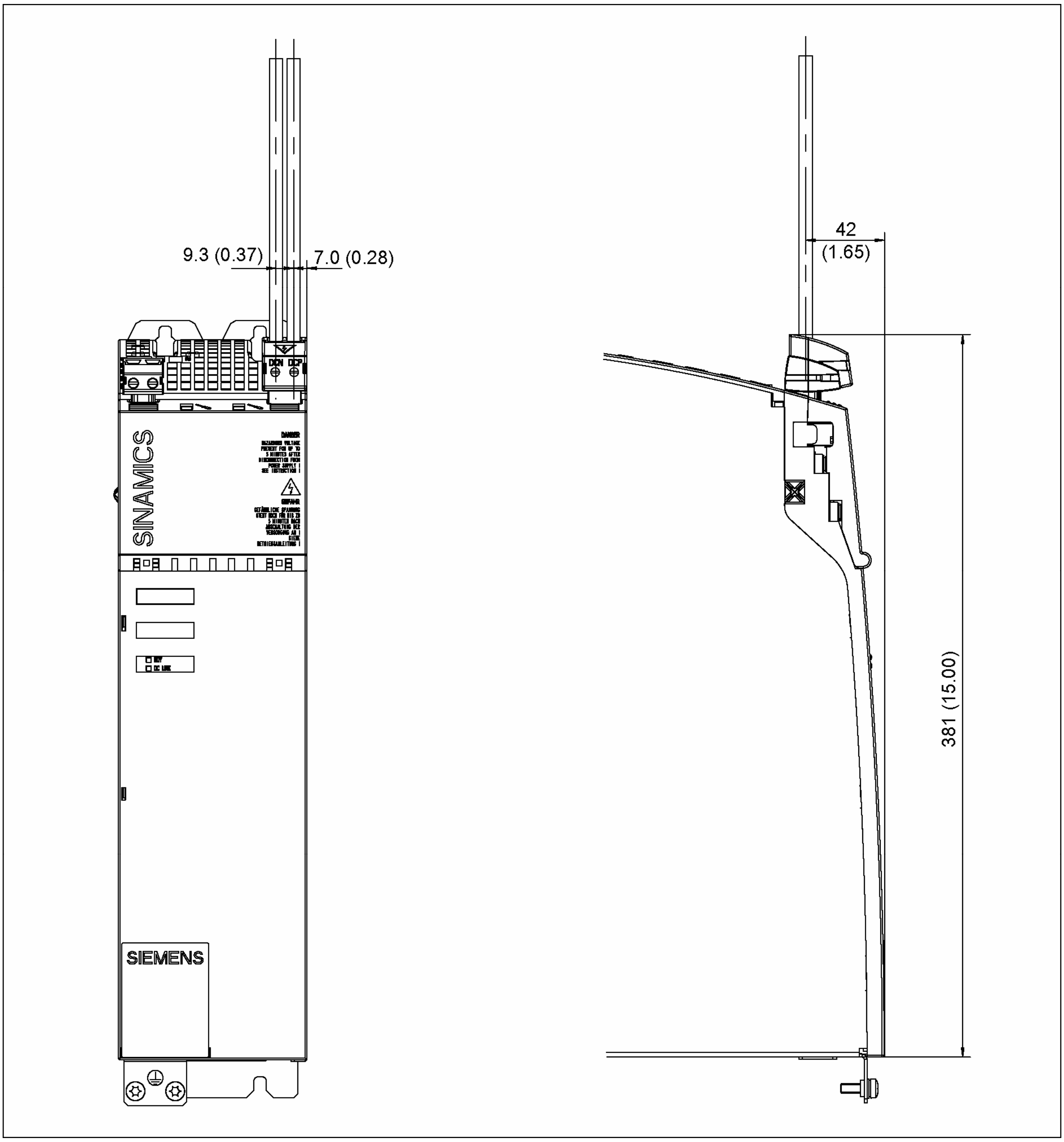


Figure 13-6 Dimension drawing, 100 mm components with DC link rectifier adapter for 0.5 mm² to 10 mm²

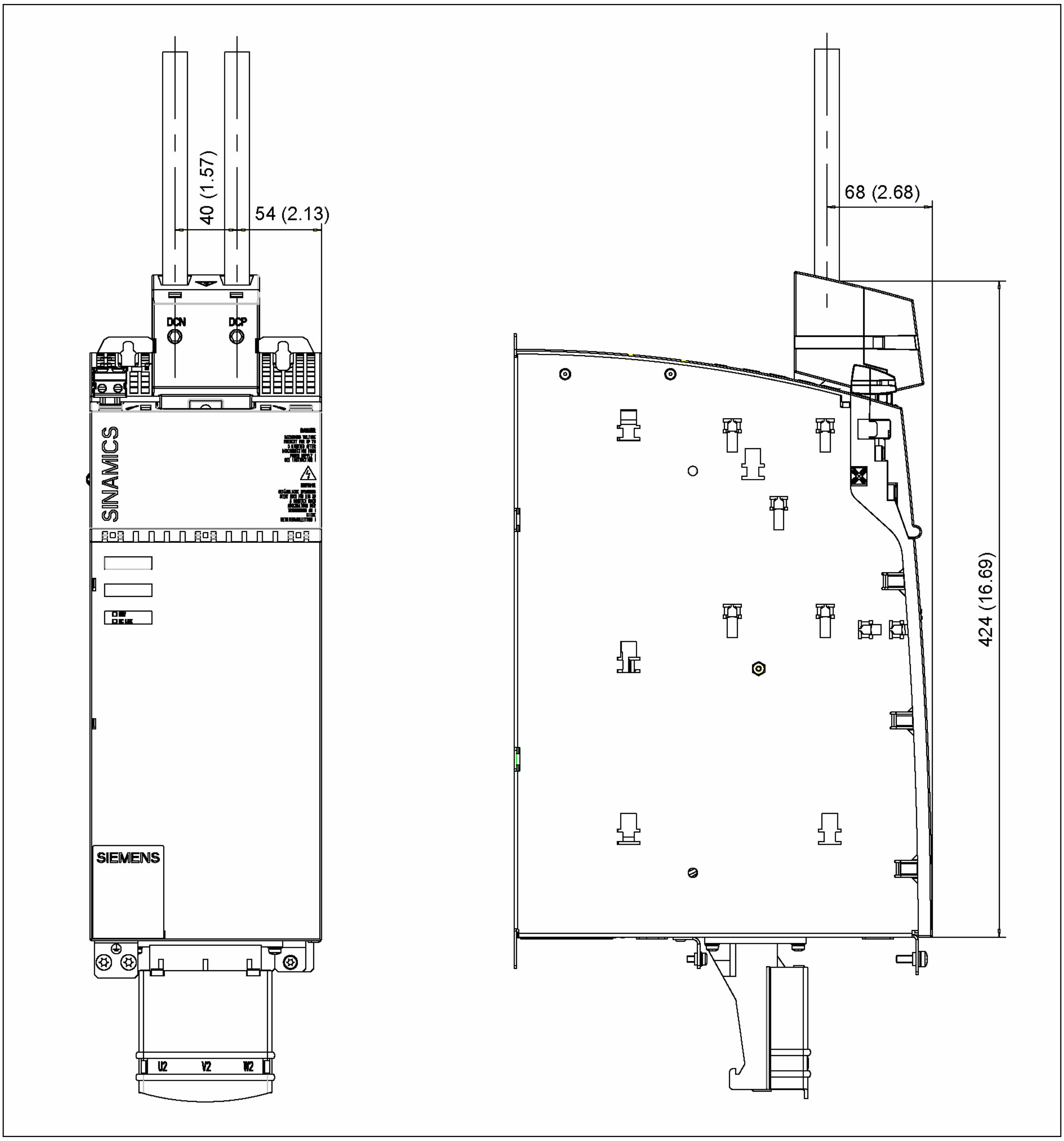


Figure 13-7 Dimension drawing, 150 mm components with DC link rectifier adapter for 35 mm² to 95 mm²

13.2.5 Installation

⚠ DANGER
If a 50 mm wide component or if a DC link component with the appropriate width (e.g. Braking Module, CSM, VCM) is located on the left-hand side of the drive line-up, the DC link bridge including all of the screws must be removed. The screws must not be inserted without a DC link bridge. For all other power units and DC link components (e.g. Capacitor Module) that are wider than 50 mm, it is not permissible to remove the DC link bridge. If this is not carefully observed, this can result in damage and accidents.

Required tools:

- Flat-bladed screwdriver 1 (0.5 x 3.5)
- Torx screwdriver T10
- Torx screwdriver T20

Table 13-8 Installing the DC link rectifier adapter for 50 mm and 100 mm components

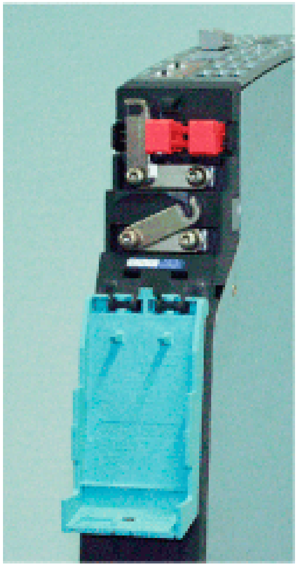
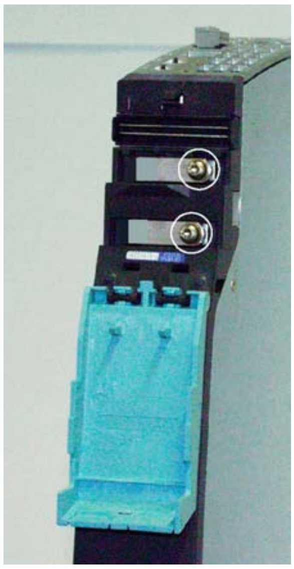
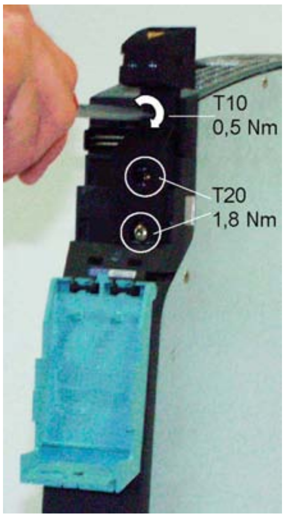
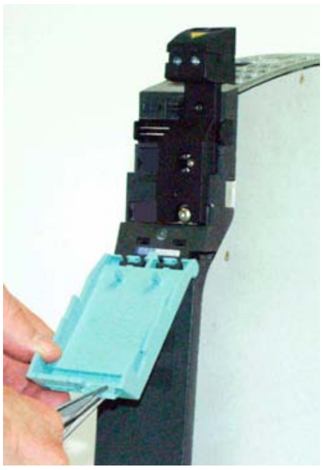
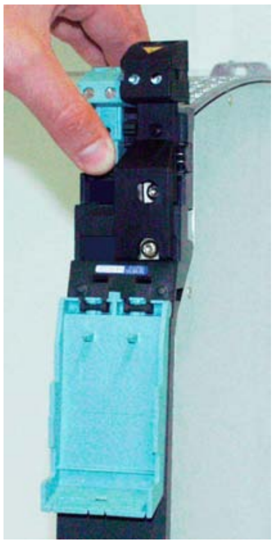
			
Unlock and open the protective cover	Opened cover with 24 V jumper and DC link bridge	The DC link bridge and 24 V jumper have been removed.	Removed DC link bridge and screws
			
Secure the adapter	Break-out the recess using suitable pliers	Attach the 24 V adapter.	Close the protective cover

Table 13-9 Installing the DC link rectifier adapter for 150 mm, 200 mm, and 300 mm components

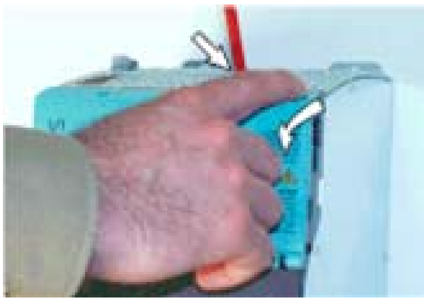
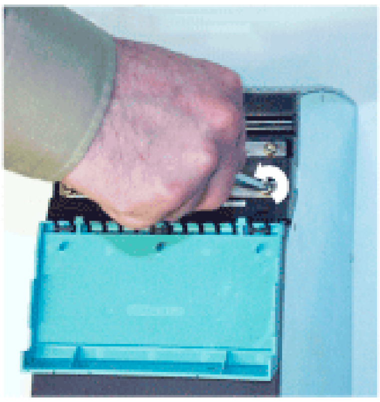
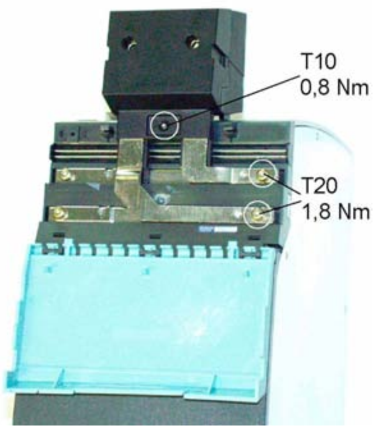
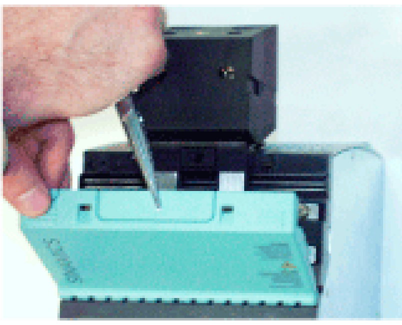
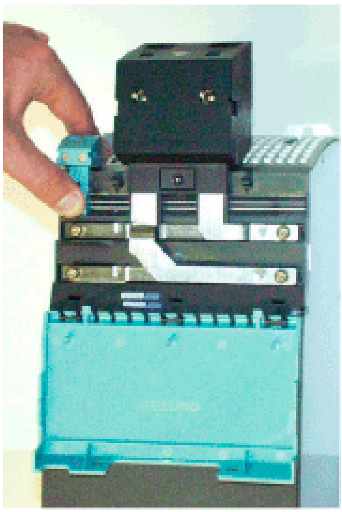
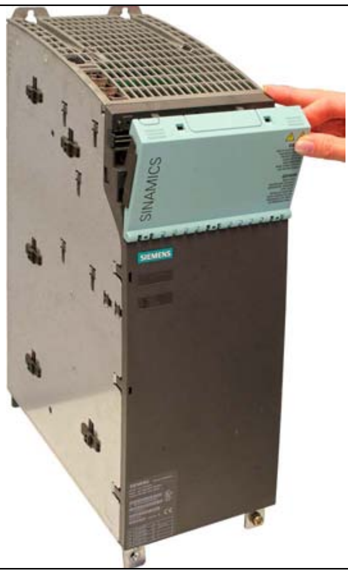
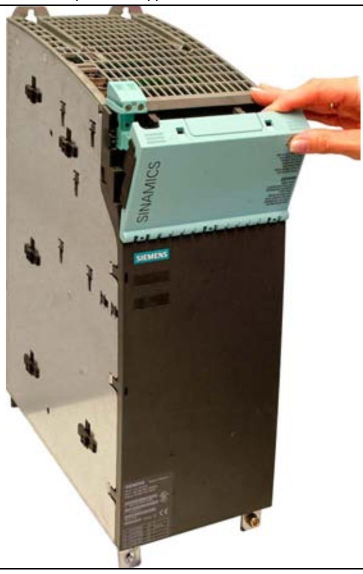
		
Unlock and open the protective cover	Opened cover with 24 V jumper	Remove the 24 V jumper and unscrew the DC link screws.
		
Hook in the adapter.	Secure the adapter	The adapter has been screwed in.
		
Break-out the recess using suitable pliers	Attach the 24 V adapter.	Close the protective cover

Table 13-10 Installing the 24 V adapter for 150 mm wide components

	
Unlock and open the protective cover (example: Active Line Module (36 kW))	Break out the recess using suitable pliers
	
Attach the 24 V adapter.	Close the protective cover

13.2.6 Electrical Connection

Table 13-11 Connecting the DC link rectifier adapter for 50 mm and 100 mm components

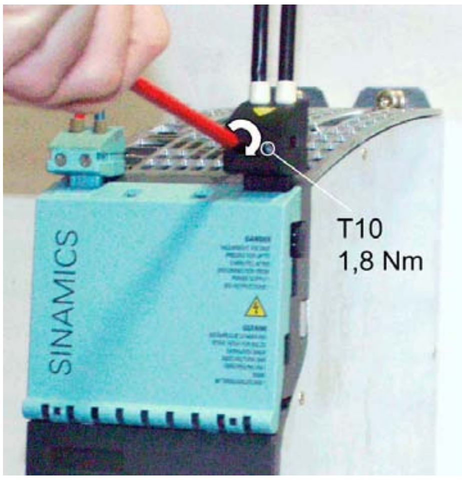
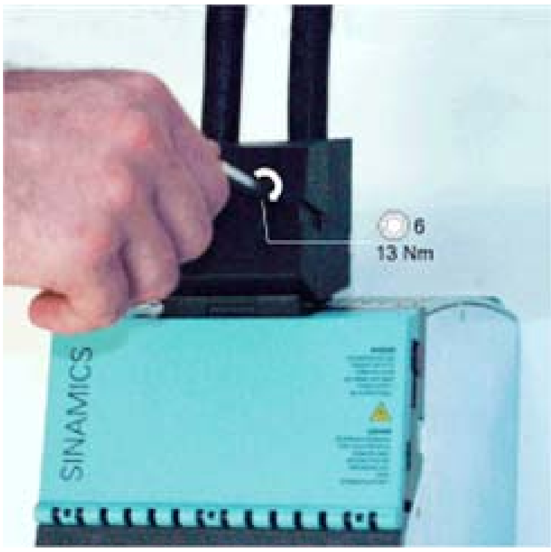
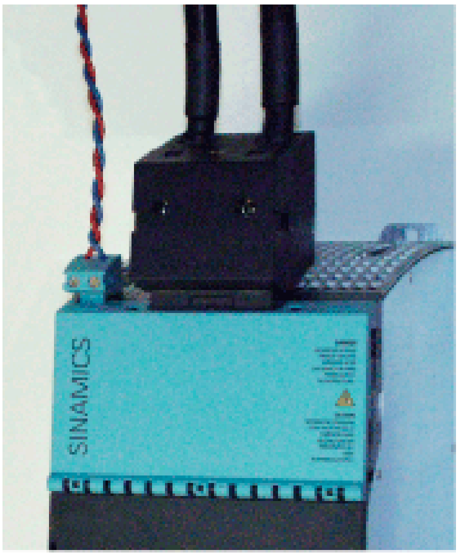
	
Connect the cable to the DC link rectifier adapter	Electrical connection of the DC link rectifier adapter

Table 13-12 Connecting the DC link rectifier adapter for 150 mm, 200 mm, and 300 mm components

	
Connect the cable to the DC link rectifier adapter	Electrical connection of the DC link rectifier adapter

13.3 DC link adapter

13.3.1 Description

The DC link adapter is required when the drive line-up needs to be divided up (e.g. into two rows). The sub-line-ups are connected using cables (35 $mm^2$to 95 mm^2). Shielded individual cores are recommended.

The DC link adapter can be used for all line modules/motor modules in booksize format.

13.3.2 Safety Information

⚠DANGER
Risk of electric shock. A hazardous voltage is present for up to 5 minutes after the power supply has been disconnected. This time must elapse before any work may be carried-out on the adapter (e.g. mounting/installation). The components must only be operated when the protective cover of the DC link is closed. Damaged components must not be used further, as this could result in secondary damage or accidents.

⚠DANGER
It is only permissible to establish connections to the DC link using the adapters that SIEMENS has recommended (DC link adapter and DC link rectifier adapter).

⚠DANGER
The DC link discharge voltage hazard warning on the components on which the adapter is installed must be in the local language. A set of labels in 16 languages is supplied with the component.

CAUTION
The screw tightening torque (1.8 Nm, tolerance +30 %) for securing components to the module-side DC link busbar must be checked before commissioning to ensure that it is correct. After transportation, the screws must be tightened.

⚠ DANGER
If a 50 mm wide module or if a DC link component with the appropriate width (e.g. Braking Module, Control Supply Module, Voltage Clamping Module) is located at the left-hand end of the drive line-up, then the DC link bridge including all of the screws must be removed. The screws must not be inserted without a DC link bridge. For all other power units and DC link components (e.g. Capacitor Module) that are wider than 50 mm, it is not permissible to remove the DC link bridge. If this is not carefully observed, this can result in damage and accidents.

⚠ DANGER
The DC link connection cables must be routed in such a way that they are ground-fault and short-circuit proof in accordance with EN 60204-1.

CAUTION
The total length of the DC link (including the connection cables) must not exceed 10 m.

13.3.3 Interface description

13.3.3.1 Overview

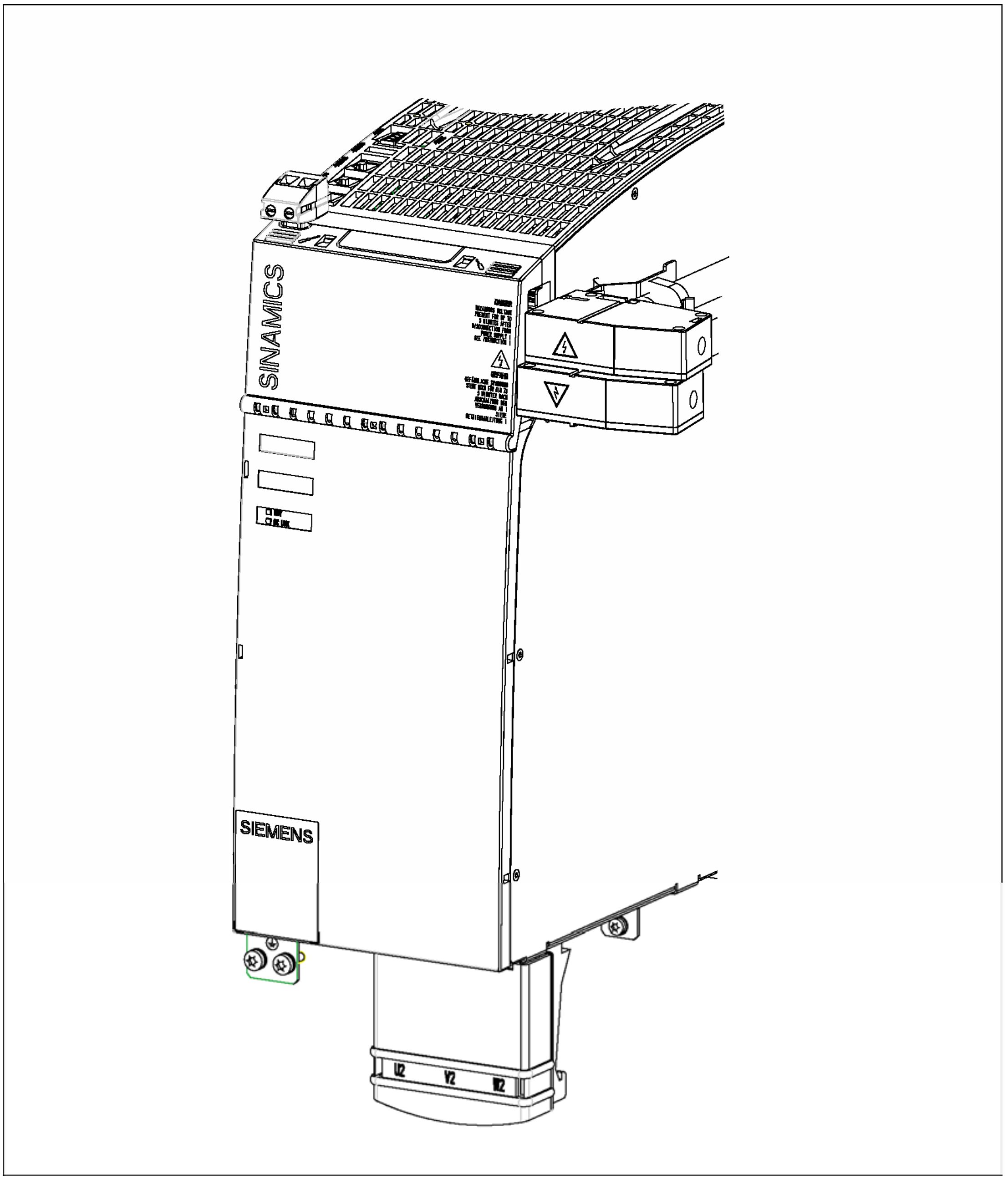


Figure 13-8 150 mm components with DC link adapter for two-row configuration 35 mm² to 95 mm²

13.3.3.2 DC link connection

Table 13-13 DC link adapter – description of the terminals

Terminal	Function	Technical specifications
DCP	DC link positive	**Two-row configuration of adapter 35 – 95 mm²** Current carrying capacity: 200 A Voltage: 720 V-VDE/600 V AC Connection cross-section: 35 – 95 mm² Stripped length: 27 mm
DCN	DC link negative	

13.3.4 Dimension drawing

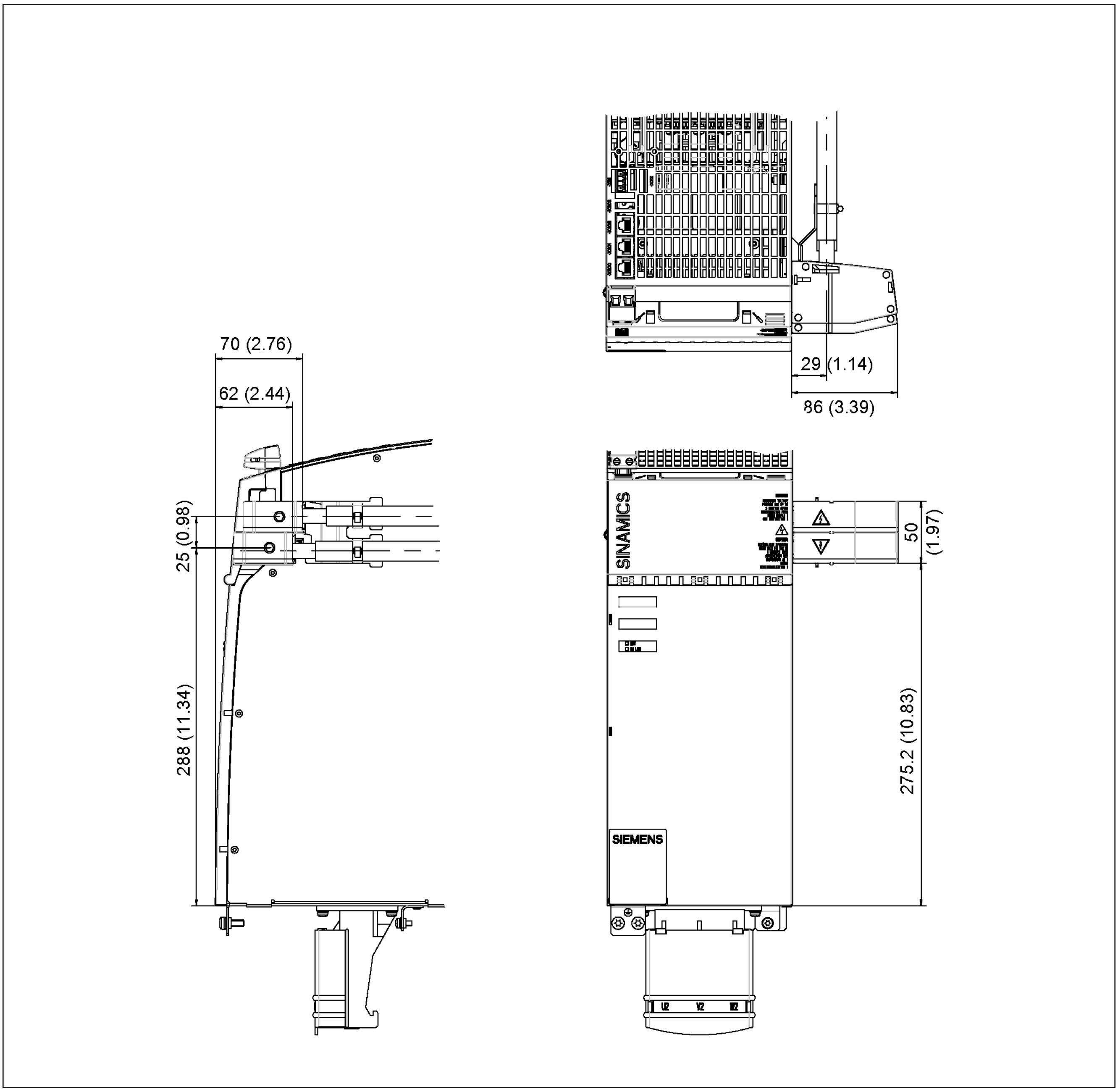


Figure 13-9 Dimension drawing, 150 mm components with DC link adapter for two-row configuration 35 mm² to 95 mm²

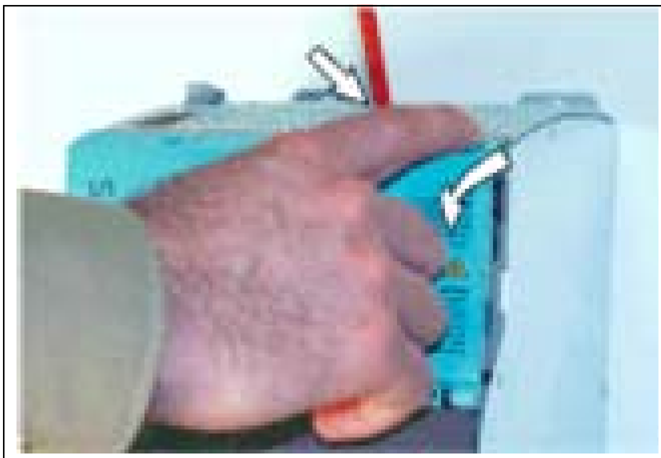
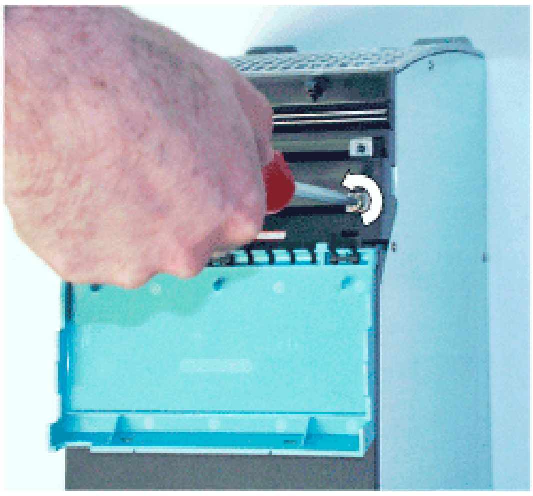
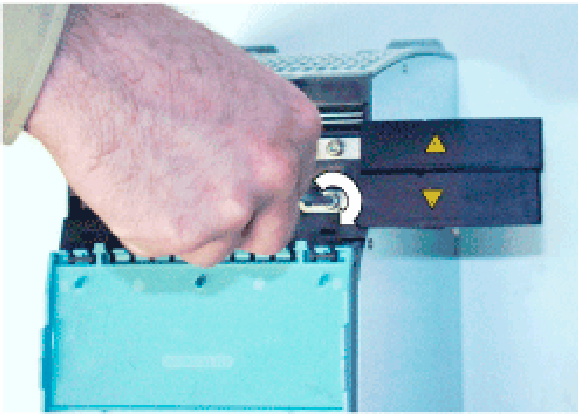
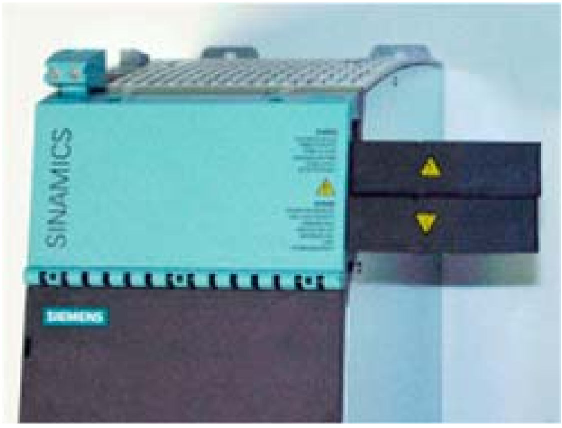
13.3.5 Installation

⚠ DANGER
If a 50 mm wide module or if a DC link component with the appropriate width (e.g. Braking Module, Control Supply Module, Voltage Clamping Module) is located at the left-hand end of the drive line-up, then the DC link bridge including all of the screws must be removed. The screws must not be inserted without a DC link bridge. For all other power units and DC link components (e.g. Capacitor Module) that are wider than 50 mm, it is not permissible to remove the DC link bridge. If this is not carefully observed, this can result in damage and accidents.

Required tools:

- Torx screwdriver T20
- Flat-bladed screwdriver 1 (0.5 – 3.5)

Table 13-14 Installing the DC link adapter for a 150 mm component

<table>
<tr><td></td><td></td></tr>
<tr><td>Unlock and open the protective cover</td><td>Unscrew the screws.</td></tr>
<tr><td></td><td>
</td></tr>
<tr><td>Secure the adapter (1.8 Nm).</td><td>The 24 V adapter is installed
and the protective cover is closed.</td></tr>
</table>

Note:

By moving the adapter housing, the DC link adapter can be fitted on either the left-hand or right-hand side of the module. This is possible with Active Line Modules as of 55 kW; refer to the overview below.

Table 13-15 Overview

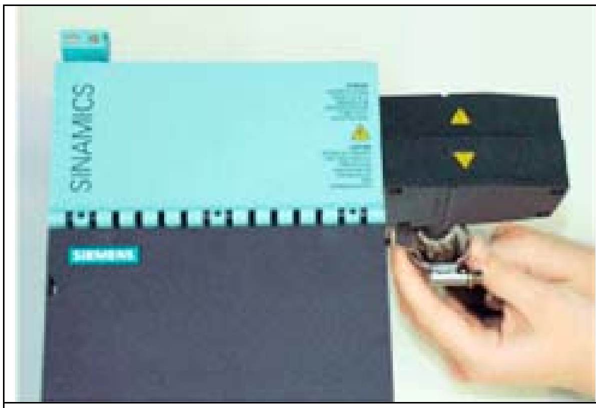
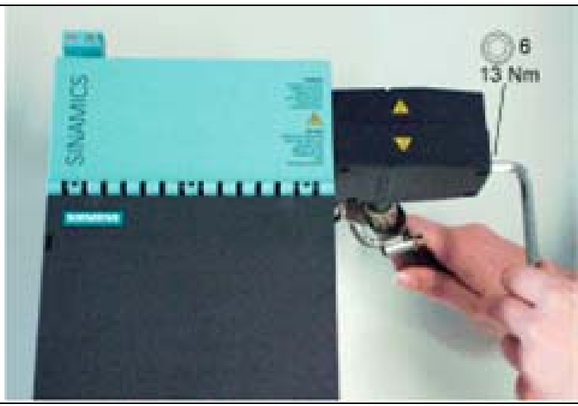
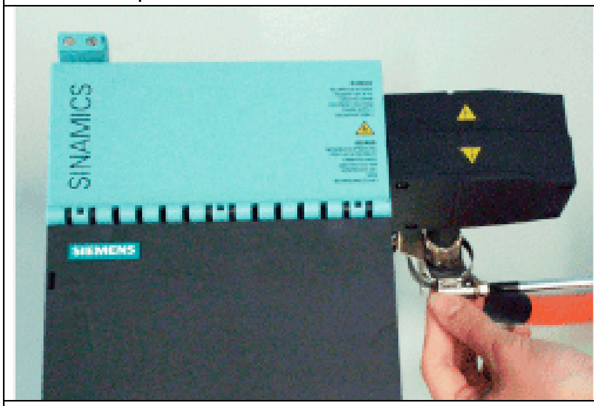
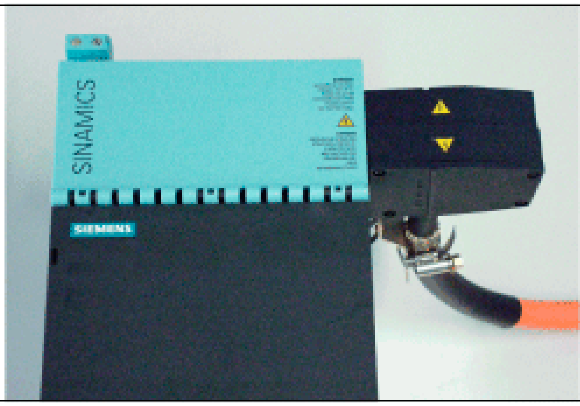
Active Line Module	With cold-plate cooling
55 kW	6SL3136-7TE25-5AA1
80 kW	6SL3136-7TE25-5AA1
120 kW	6SL3136-7TE31-2AA1

13.3.6 Electrical connection

Required tools:

- Hexagon-socket spanner (size 6)
- Suitable tool for tube clips (e.g. flat-bladed screwdriver)

Table 13-16 Electrical connection of the DC link adapter for a 150 mm component

	
Route the cable through the tube clip and insert it into the DC link adapter.	Secure the cable.
	
Secure the tube clip.	The cable is connected.

Only shielded connection cables should be used.

The DC link adapter can be fitted on the right or left.

13.4 Reinforced DC-link busbars

13.4.1 Description

Reinforced DC link busbars (optional) are available for 50 mm and 100 mm wide components.

	Order number
Reinforced DC link busbars for 50 mm components	6SL3162-2DB00-0AA☐
Reinforced DC link busbars for 100 mm components	6SL3162-2DD00-0AA☐

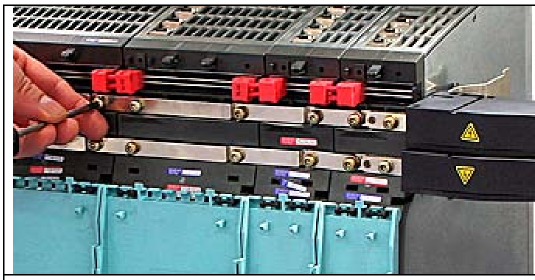
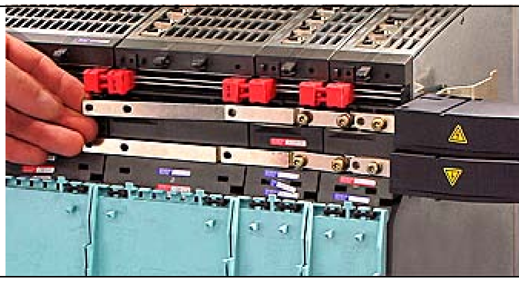
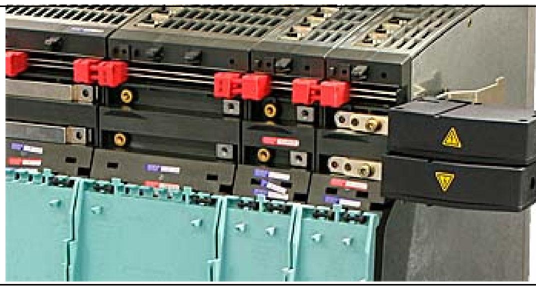
13.4.2 Safety information

⚠ DANGER
Risk of electric shock. Dangerous voltages are still present for up to 5 minutes after the power supply has been switched off. The protective cover for the DC link must not be opened until this time has elapsed. The components must only be operated when the protective cover of the DC link is closed. Damaged components must not be used further. The DC link discharge time hazard warning in the local language must be attached to all of the components. A set of labels in 16 languages is provided with the component. If this is not carefully observed, it can result in subsequent damage and accidents. If a 50 mm wide Motor Module or if a DC link component with the appropriate width (e.g. Braking Module, Control Supply Module, Voltage Clamping Module) is located at the left-hand end of the drive line-up, the DC link bridge (including the screws) must be removed. The screws must not be inserted without a DC link bridge. For all of the other power units and DC link components (e.g. Capacitor Module) that are wider than 50 mm, the DC link bridge must not be moved to the left or removed. If this is not carefully observed, it can result in subsequent damage and accidents. The left and right ends of the DC link busbar of a drive line-up must be closed using lateral covers (Order No.: 6SL3162-5AA00-0AA0). The protective cover for the DC link must be closed for all components before the voltage supply is switched on. The interlocks must audibly engage. The tightening torque of the DC link busbar screws (1.8 Nm +30%) must be checked after transportation and before commissioning when the system is disconnected from the power supply and the DC link is discharged.

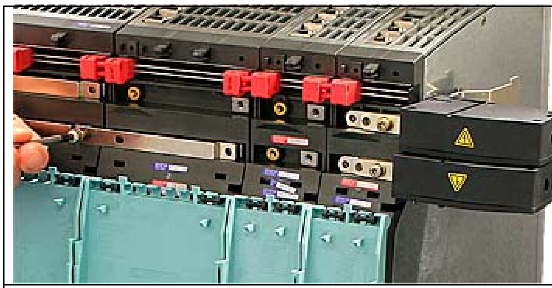
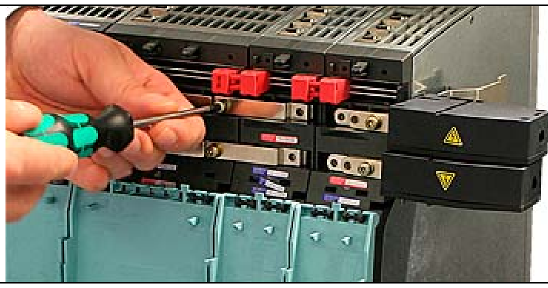
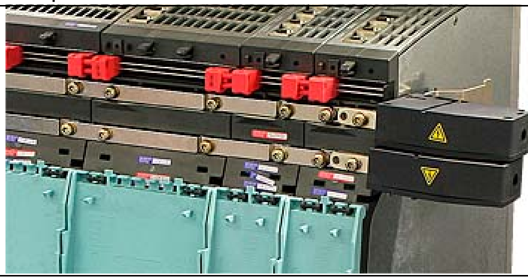
Note

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

13.4.3 Removing the DC link busbars

	
Unscrew the screws for the DC link busbar	Remove the DC link busbars
	
Remove the DC link busbars on the adjacent components too.	View once the DC link busbars have been removed

13.4.4 Mounting the reinforced DC link busbars

	
Secure the reinforced DC link busbars Do not secure M4 screws tightly yet.	Secure the reinforced DC link busbars on the adjacent components too.
	
Tightly secure all the M4 screws, 1.8 Nm +30 %	With installed reinforced DC link busbars

13.5 DRIVE-CLiQ cabinet gland

13.5.1 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 panel 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.

13.5.2 Safety Information

Note

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

13.5.3 Interface description

13.5.3.1 Overview

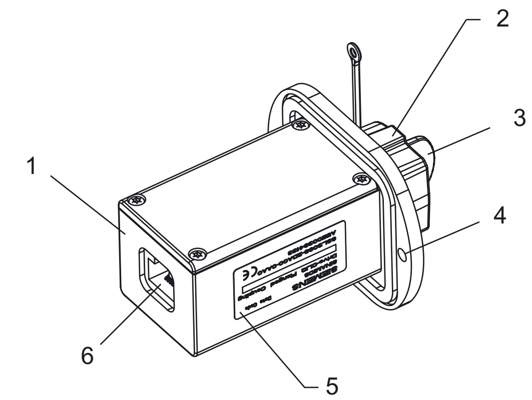


Figure 13-10 DRIVE-CLiQ cabinet gland

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

13.5.4 Dimension drawing

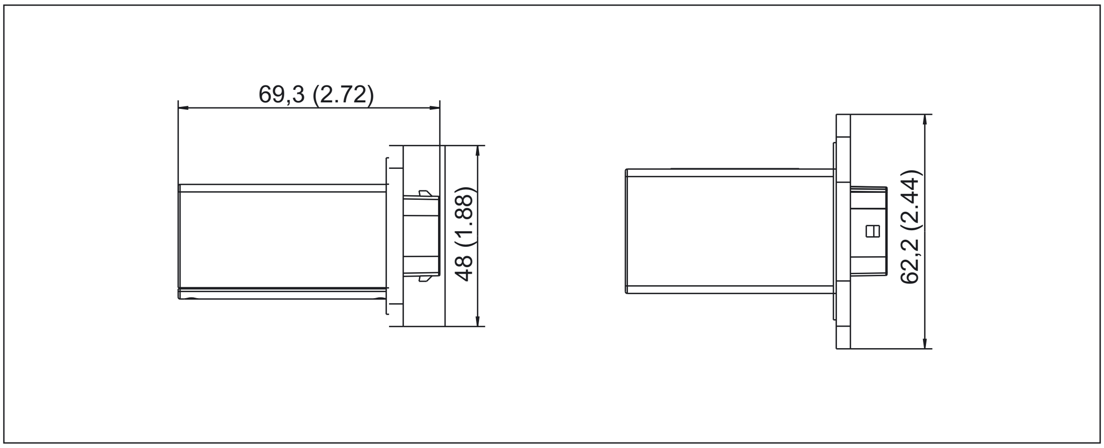


Figure 13-11 Dimension drawing, DRIVE-CLiQ cabinet gland

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

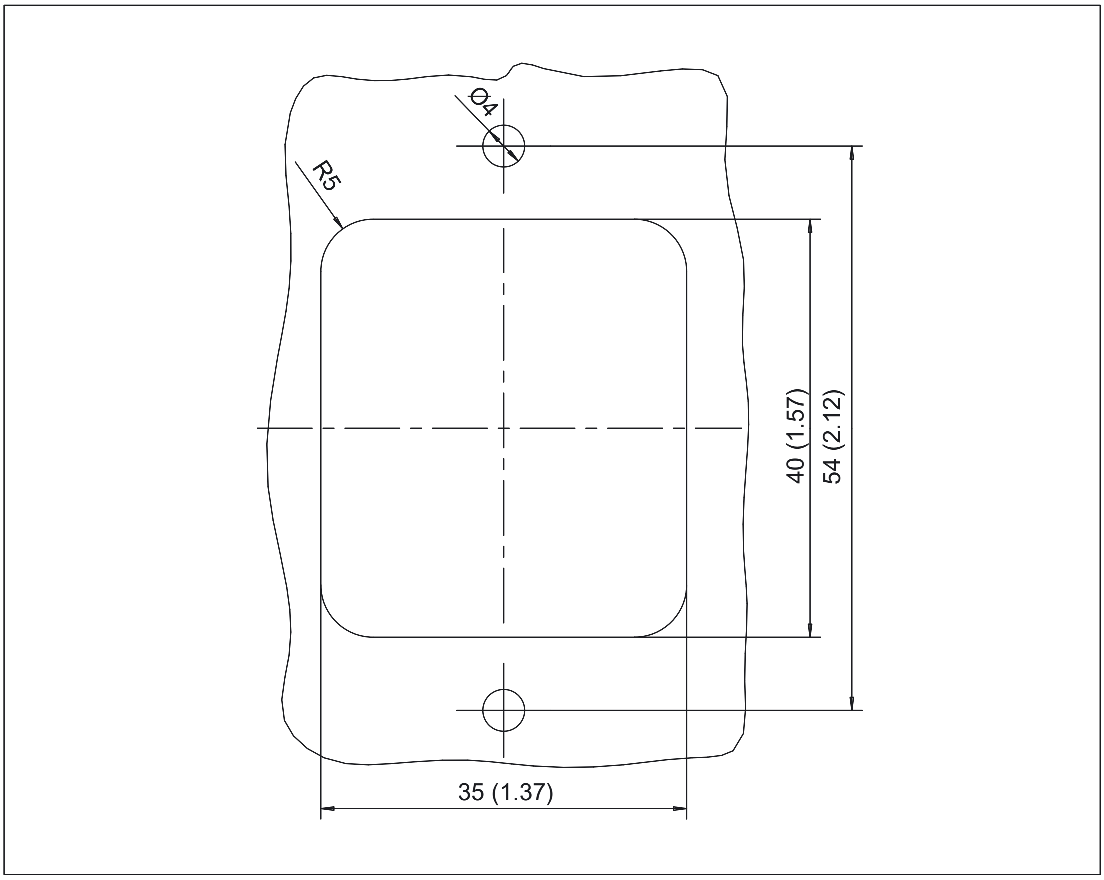


Figure 13-12 Cut-out for the cabinet

13.5.5 Installation

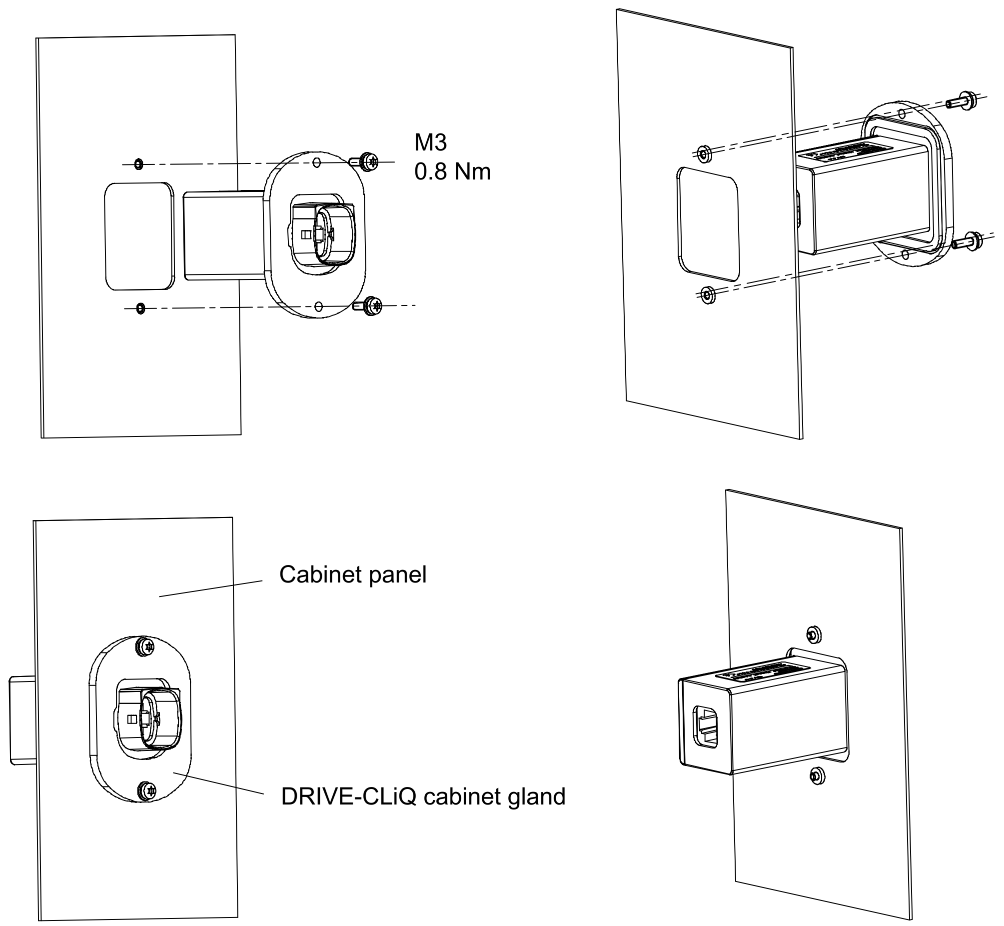


Figure 13-13 DRIVE-CLiQ cabinet gland

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.

13.5.6 Technical data

Table 13-17 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	

13.6 DRIVE-CLiQ coupling

13.6.1 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.

13.6.2 Safety Information

Note

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

13.6.3 Interface description

13.6.3.1 Overview

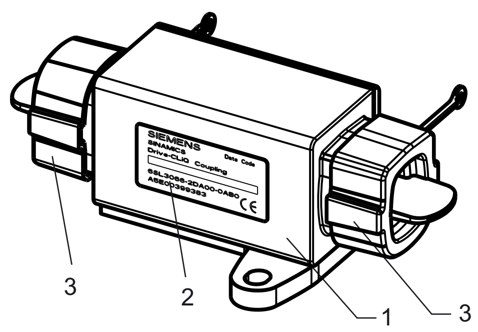


Figure 13-14 DRIVE-CLiQ coupling

1	DRIVE-CLiQ coupling
2	Rating plate
3	Centering caps, Yamaichi, order no.: Y-ConAS-24-S

13.6.4 Dimension drawing

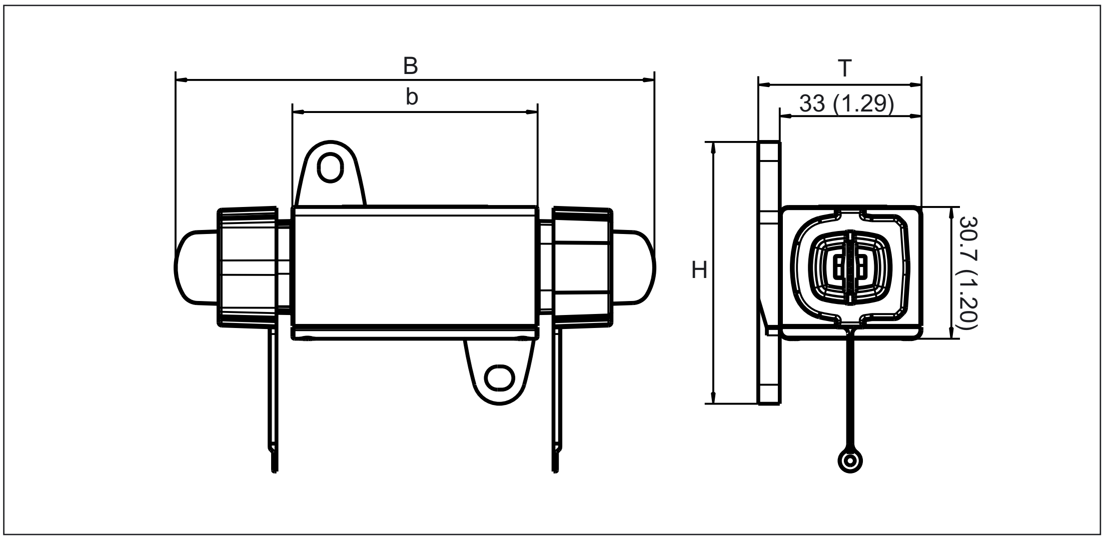


Figure 13-15 Dimension drawing, DRIVE-CLiQ coupling

Table 13-18 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)

13.6.5 Installation

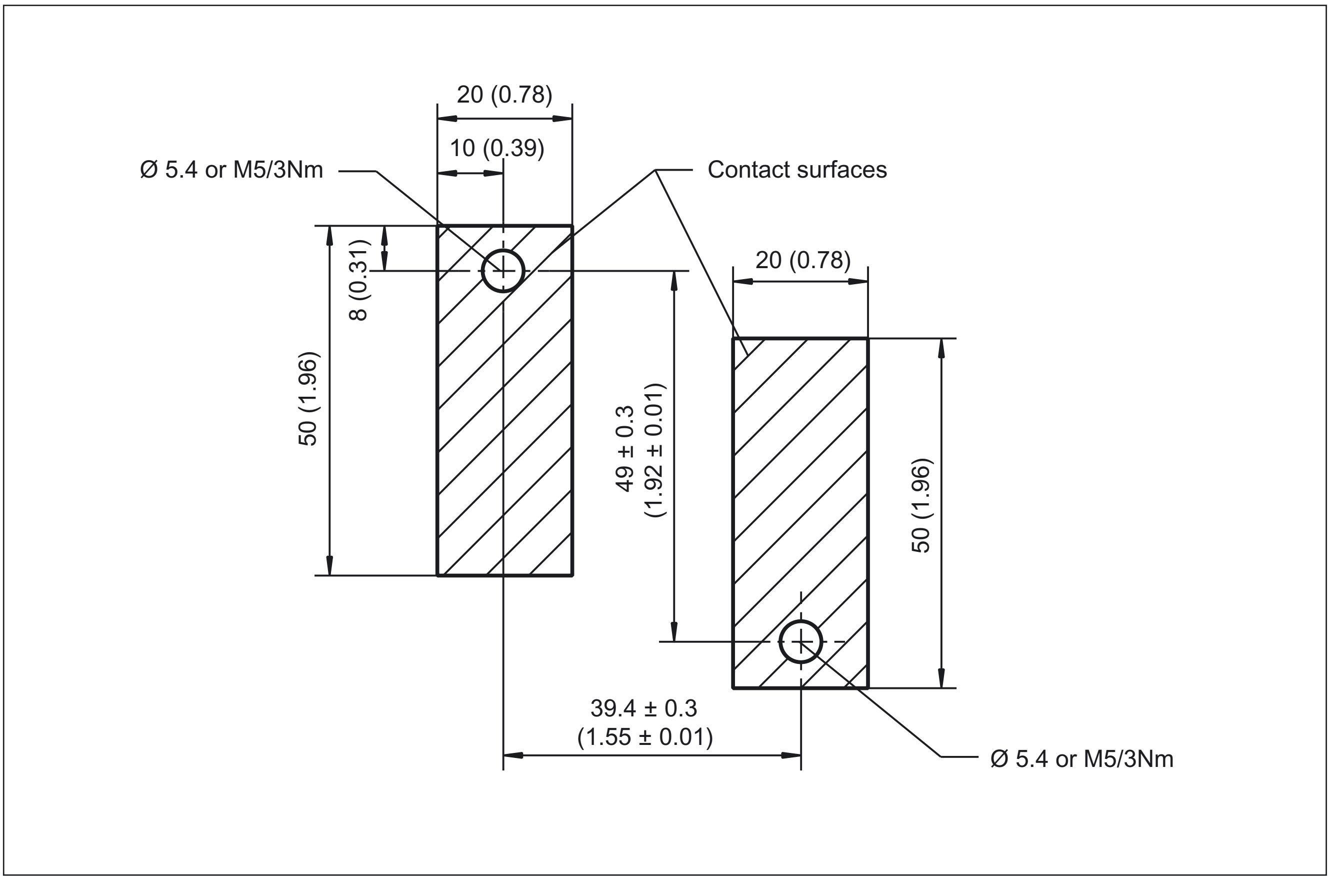


Figure 13-16 Hole drilling template for installation

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.

13.6.6 Technical data

Table 13-19 Technical data

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

Cabinet Design and EMC 14

14.1 Information

14.1.1 General

SINAMICS S components fulfill the requirements according to degree of protection IP20 in compliance with EN 60529. This provides protection against electric shock for chassis units. As far as UL 50 is concerned, the components are classified and certified as open type. Protection against mechanical and climatic stressing must be ensured by mounting the components in housings, cabinets or electrical rooms that can be closed and locked. Higher-level housings must, as a minimum, have degree of protection IP54 according to EN 60529 be classified as enclosure type 12 in compliance with UL 50.

Prefabricated MOTION-CONNECT cables are recommended.

The Safety-Integrated safety function:

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.

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

All information for device selection in this section applies to

- Connected to TN and TT line supply systems with grounded neutral point and grounded protective conductor as well as to IT line supply systems.
- Operating voltage range from 3-ph. 360 V AC to 3-ph. 440 V AC

14.1.2 Safety Information

⚠ DANGER
When installing the cabinet, you must cover the ventilation slots to prevent drill swarf, wire end ferrules, and so on from falling into the housing, which could result in short-circuits or damage the insulation. Safety regulations governing shock protection must be observed. See also EN 60204–1.

⚠ DANGER
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).

⚠ 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.

⚠ WARNING
If static discharge occurs on surfaces or interfaces that cannot be easily accessed, this can cause malfunctions and/or defects.

CAUTION
The tightening torque of the DC link busbar screws (1.8 Nm) must be checked before startup. To ensure that the encoder system works properly, you are advised to use the original Siemens accessories from catalog D21.1.

14.1.3 Directives and Standards

The following directives and standards apply within the European Union:

Table 14-1 EC Directives

Directive	Description
73/23/EEC	Directive of the Council of February 19, 1973, on the approximation of the laws of the member states relating to electrical equipment designed for use within certain voltage limits Low-Voltage Directive
98/37/EC	Directive of the Council of August 12, 1998, on the approximation of laws of the member states relating to machinery Machine Directive
89/336/EEC	Directive of the Council on the approximation of laws of the member states relating to electromagnetic compatibility EMC Directive

Conformance with the harmonized standards is an indication of conformance with the basic requirements of these laws.

The following table lists some application-relevant Standards:

Table 14-2 Standards

Standard	Description
EN 292–1	Safety of machinery General design principles Part 1: Basic terminology, methodology
EN 292–2	Safety of machinery General design principles Part 2: General requirements
EN 418	Safety of machinery Emergency stop equipment Functional aspects; principles for design
EN 563	Safety of machinery Temperatures of touchable surfaces Ergonomics data to establish temperature limit values for hot surfaces
EN 894-1	Safety of machinery Ergonomic requirements for the design of displays and control actuators Part 1: General principles for human interactions with displays and control actuators
EN 894-2	Safety of machinery Ergonomic requirements for the design of displays and control actuators Part 2: Displays
EN 954–1 and BGL. 1	Safety of machinery General design principles Part 1: Safety-related parts of control systems and supplement 1

Standard	Description
EN 1037	Safety of machinery Prevention of unexpected startup
EN 1050	Safety of machinery Principles for risk assessment
EN 1921	Safety of integrated manufacturing systems
EN 12417	Safety of machine tools Machining centres
EN 50178	Electronic equipment for use in power installations
EN 60073	Basic and safety rules for the man-machine interface marking and identification – Coding principles for indicators and actuators
EN 60204–1	Safety of machinery Electrical equipment of machines Part 1: General requirements
EN 60417-1	Graphic symbols for equipment Part 1: Overview and application
EN 60417-2	Graphic symbols for equipment Part 2: Symbol originals
EN 60439–1	Low-voltage switchgear and controlgear assemblies Part 1: Type-tested and partially type-tested assemblies
EN 60446	Basic and safety rules for the man-machine interface Identification of conductors by colours or numerals
EN 60447	Man-machine interface Actuating principles
EN 60529	Degrees of protection provided by enclosures (IP code)
EN 60695-1-1	Fire hazard testing Part 1-1: Guidance for assessing the fire hazard of electrotechnical products General guidelines
EN 61000-6-2	Electromagnetic compatibility (EMC) Generic standards: Immunity for industrial environments
EN 61000-6-4	Electromagnetic compatibility (EMC) Generic standards: Emission standard for industrial environments
EN 61310-1	Safety of machinery – displays, identification and operation Part 1: Requirements for visual, auditory and tactile signals
EN 61310-2	Safety of machinery – displays, identification and operation Part 2: Requirements for marking
EN 61310-3	Safety of machinery – displays, identification and operation Part 3: Requirements for the location and operation of actuators
EN 61800–3	Adjustable speed electrical power drive systems Part 3: EMC product standard including specific test methods
UL 508A	Industrial control panels
UL 508C	Industrial Control Equipment Standard for safety for power conversion equipment

14.2 Selection of Devices Required for Operating SINAMICS

14.2.1 General

The following components are required for connection to the power supply network:

- Line disconnecting device
- Line fuse
- Line contactor (required with electrical isolation)
- Line filter (see Line Connection)
- Line reactor (see Line Connection)

14.2.2 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 data 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 line disconnecting device must be equipped with a leading auxiliary switch ($t \geq 10$ ms), which must be integrated in the switching-off path of the active line modules (EP terminals).

The accessories required for the line disconnecting device must be selected from the manufacturer catalogs. See also catalog D21.1.

14.2.3 Overcurrent Protection by Means of Line Fuses or Circuit-Breakers

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

Note

The units can be connected to line supplies up to 480 V_{AC} that 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.

⚠ WARNING

Fuses that can operate across the maximum cable length within a circuit must be rated in accordance with the requirements for:

1. Short circuit protection (IEC 60364-4-43 and -5-52, EN 60204-1, and EN 61800-5-1)
2. The maximum permissible break time for protection against electric shock in the event of indirect contact (IEC 60364-4-41 and -4–43, IEC 61200-413, EN 61800-5-1, and EN 60204-1)
3. The maximum permissible voltage drop during operation

The maximum cable length depends on the cable cross-section, material, and insulation, as well as the type and size of the upstream overcurrent protection device.

The minimum value, which is derived from the three requirements, must generally be observed. This means that 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.

The following tables list the requirements regarding line fuses and circuit-breakers for the Active Line Modules and Smart Line Modules.

Table 14-3 Requirements regarding line fuses and circuit-breakers for the Active Line Modules

	16 kW	36 kW	55 kW	80 kW	120 kW
I_{rated} fuse	35 A	80 A	125 A	160 A	250 A
I_{fuse} 0.2s	>180 A	>360 A	>450 A	>650 A	>865 A
I_{fuse} 4s	>130 A	>260 A	>350 A	>505 A	>675 A
I_{fuse} 10 s	>100 A	>200 A	>250 A	>360 A	>480 A
I_{fuse} 240 s	>60 A	>135 A	>200 A	>280 A	>380 A

Table 14-4 Requirements regarding line fuses and circuit-breakers for the Smart Line Modules

	5 kW	10 kW	16 kW	36 kW
I_{rated} fuse	16 A	35 A	35 A	80 A
I_{fuse} 0.2s	>70 A	>100 A	>180 A	>360 A
I_{fuse}4s	>50 A	>80 A	>130 A	>260 A
I_{fuse} 10 s	>42 A	>65 A	>100 A	>200 A
I_{fuse} 240 s	>30 A	>45 A	>60 A	>135 A

See catalog D21.1

14.2.4 Line filter

A separate line filter (see catalog) must be used for the SINAMICS S120 drive line-up. 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.

Optional line filter ranges that are coordinated with the power range are available for the SINAMICS S120 drive system:

- Basic Line Filter for Active Line Modules with line reactor
- Basic Line Filter for Active Line Modules with Active Interface Module
- Wideband Line Filter for Active Line Modules
- Basic Line Filter for Basic Line Modules
- Basic Line Filter for Smart Line Modules

These line filters differ with regard to the frequency range in which they reduce the conducted emissions.

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.

14.2.5 Line Contactors

Line contactors are required for electrical isolation of the drive line-up from the power supply network.

For selection of the 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 in rating the conductors to be connected.

⚠ CAUTION
Line contactors must not be switched under load.

When the digital output is used to control the line contactor, the make/break capacity must be taken into account.

You are advised to connect overvoltage limiters to the contactor coils to limit the opening overvoltage. See catalog D21.1.

14.3 24 V DC Supply Voltage

14.3.1 General

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

1. the electronics of the SINAMICS components via the integrated 24 V busbar
2. The electronics of the Control Units, Option Boards, Sensor Modules, and Terminal Modules, as well as the process voltage of their digital inputs
3. The load voltage of the digital outputs
4. The motor holding brakes

A separate 24 V supply is recommended for a drive line-up.

Note

The electronics power supply must be provided by the user as described in section "System data" of this document.

When the system is connected to a "DC supply" as defined in EN 60204-1:1997, Sect. 4.3.3, malfunctions may occur as a result of the voltage interruptions permitted in supplies of this type.

NOTICE

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

NOTICE

The tolerances of the motor holding brakes and the voltage drops of the connection cables must be taken into account. The electronics power supply may have to be increased.

⚠ DANGER

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).

⚠ DANGER

Only safety extra-low voltages (DVC A) that comply with EN61800-5-1 must be connected to the connections and terminals between 0 and 48 V DC.

The voltage tolerances of the motor holding brakes must be taken into account.

Note

A regulated DC power supply is required to operate motors with a built-in holding brake. The voltage is supplied via the internal 24 V busbars. 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. The CSM supplies 26 V. This ensures that the supply voltage 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

14.3.2 Selecting Power Supply Units

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

Table 14-5 Recommended SITOP Power

Rated output current [A]	Input voltage range [V]	Short-circuit current [A]
5	2-ph. 85-132/170 – 550 AC	5,5
10	2-ph. 85-132/176 – 550 AC	30 for 25 ms
20	320 – 550 V 3 AC	23
40	320 – 550 V 3 AC	46

Table 14-6 Recommendation for control supply module

Rated output current [A]	Input voltage range [V]	Short-circuit current [A]
20	3-ph. 380 V AC -10% (-15% < 1 min) to 3-ph. 480 V AC +10% DC 300 – 800	< 24

See catalog D21.1.

14.3.3 Typical 24 V Component Current Consumption

The following table can be used to calculate the 24 V DC power supply.

Table 14-7 Overview: 24 V DC current consumption with cold-plate cooling

Component	Current consumption [A_{DC}]
CU320 without load for each digital output PROFIBUS Teleservice	0,8 max. 0.5 (typ. 0,4) max. 0.15
TB30 (without digital outputs) for each digital output	< 0,05 max. 0.5 (typ. 0.1)
CBC10	0,05
Active Line Modules	
16 kW	0,9
36 kW	1,0
55 kW	1,4
80 kW	1,7
120 kW	2,1
Smart Line Modules	
5 kW	0,7
10 kW	0,8
DRIVE-CLiQ and brake	
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
Single Motor Modules	
3 A (+1 x DRIVE–CLiQ; +1 x brake)	0,7
5 A (+1 x DRIVE–CLiQ; +1 x brake)	0,7
9 A (+1 x DRIVE–CLiQ; +1 x brake)	0,7
18 A (+1 x DRIVE–CLiQ; +1 x brake)	0,7
30 A (+1 x DRIVE–CLiQ; +1 x brake)	0,7
45 A (+1 x DRIVE–CLiQ; +1 x brake)	0,8
60 A (+1 x DRIVE-CLiQ; +1 x brake)	0,8
85 A (+1 x DRIVE–CLiQ; +1 x brake)	1,0
132 A (+1 x DRIVE–CLiQ; +1 x brake)	1,2
200 A (+1 x DRIVE–CLiQ + 1 x brake)	1,2
Double Motor Modules	
2 x 3 A (+2 x DRIVE–CLiQ; +2 x brake)	1,0
2 x 5 A (+2 x DRIVE–CLiQ; +2 x brake)	1,0
2 x 9 A (+2 x DRIVE–CLiQ; +2 x brake)	1,0
2 x 18 A (+2 x DRIVE–CLiQ; +2 x brake)	1,15

Component	Current consumption [A_{DC}]
Braking Modules	0,5
Sensor Modules Cabinet	
SMC10	0,25
SMC20	0,25
SMC30	0,33
Sensor Modules External	
SME20	0,19
SME 25	0,19
SME120	0,24
SME125	0,24
Additional system components	
TM15 (without digital outputs) for each digital output	0,15 0,1
TM31 (without digital outputs) for each digital output	typ. 0.12 max. 0.5 (typ.0.1)
DMC20 (+ 5 x DRIVE-CLiQ)	0,15
VSM10	0,15
CBC10	
CBE20	

14.3.4 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
- Bundling of the cables in a one duct
- Cable laying method to EN 60204-1

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

The recommended overcurrent protection devices on the primary side are circuit-breakers as specified in Siemens catalog NSK. Miniature circuit-breakers are recommended as overcurrent protection devices on the secondary side. The MCBs can be selected according to Siemens catalog "BETA Modular Installation Devices - ET B1".

The 24 V DC supply for the following booksize components:

- Line Modules
- Motor Modules
- Braking Modules
- Capacitor Modules
- Control Supply Modules

is implemented in the components by means of a 24 V busbar for 24 V DC and reference potential. The current carrying capacity of these bars is 20 A. The power supply is connected via a 24 V terminal adapter. MCBs are recommended to protect the cables from overcurrent. These overcurrent protection devices also protect the 24 V busbars. To protect against ground faults, the ground potential must be connected to the protective conductor system.

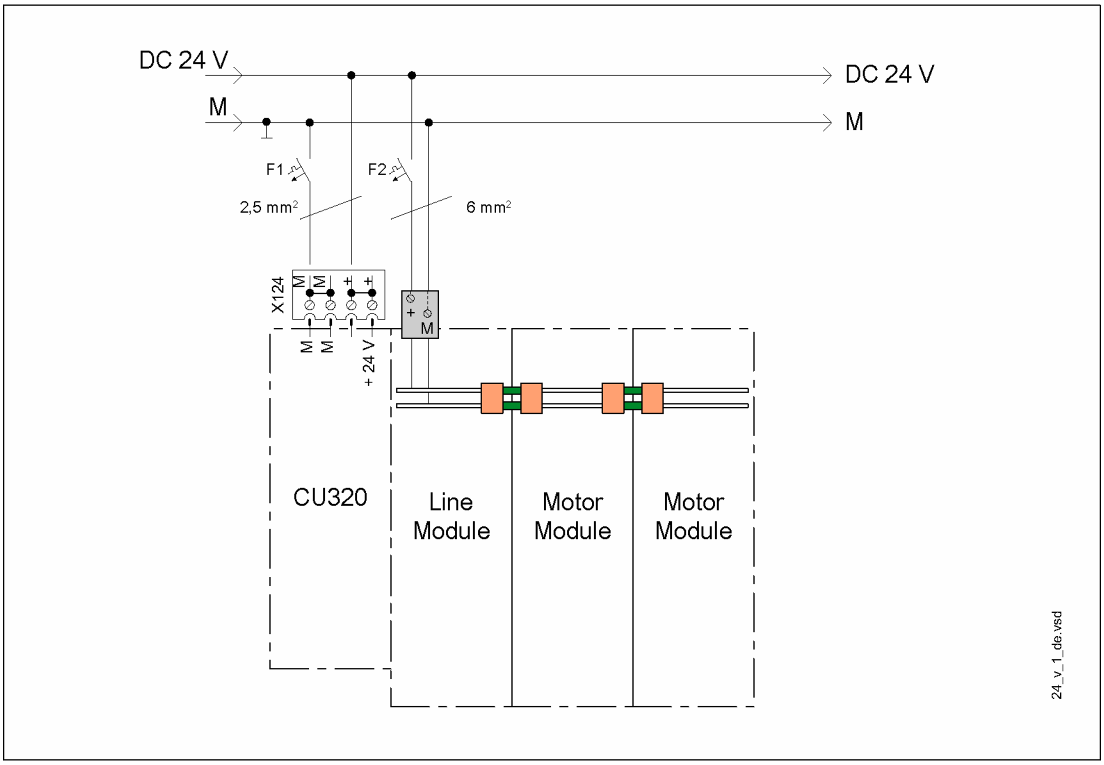


Figure 14-1 Example of 24 V DC fuse protection

The following conditions apply to the cables when the MCBs are selected from the following table:

- Ambient temperature 40°C or 55°C
- Max. 1 conductor pair, bundled
- Conductor limit temperature 70°C for normal operation
- Cable length max.:
  - 10 m for the supply cables
  - 30 m for signal lines
- To be routed separately from other cables and conductors carrying operating current.
- Cable type: PVC conductor cable

Table 14-8 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	10 A
2.5 mm^2	20 A	10 A
4 mm^2	25 A	16 A
6 mm^2	32 A	25 A
24 V busbar	20 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.

Example: calculating the 24 V DC current requirements with cold-plate cooling

Table 14-9 Example: 24 V DC current requirements with cold-plate cooling

Component	Number	Current consumption [A]	Total current consumption [A]
CU320 8 digital outputs	1 8	0,4 0,1	0,4 0,8
Active Line Module 36 kW	1	1,0	1,0
Motor Module 18 A	2	0,6	1,2
Motor Module 30 A	3	0,6	1,8
SMC20	10	0,25	2,5
Brake	5	1,1	5,5
Total:			**13,2**

14.4 Arrangement of Components and Equipment

14.4.1 General

The arrangement of the components and equipment takes account of

- Space requirements
- Cable routing
- Cooling
- EMC

Components are usually located centrally in a cabinet.

14.4.2 Drive Line-Up

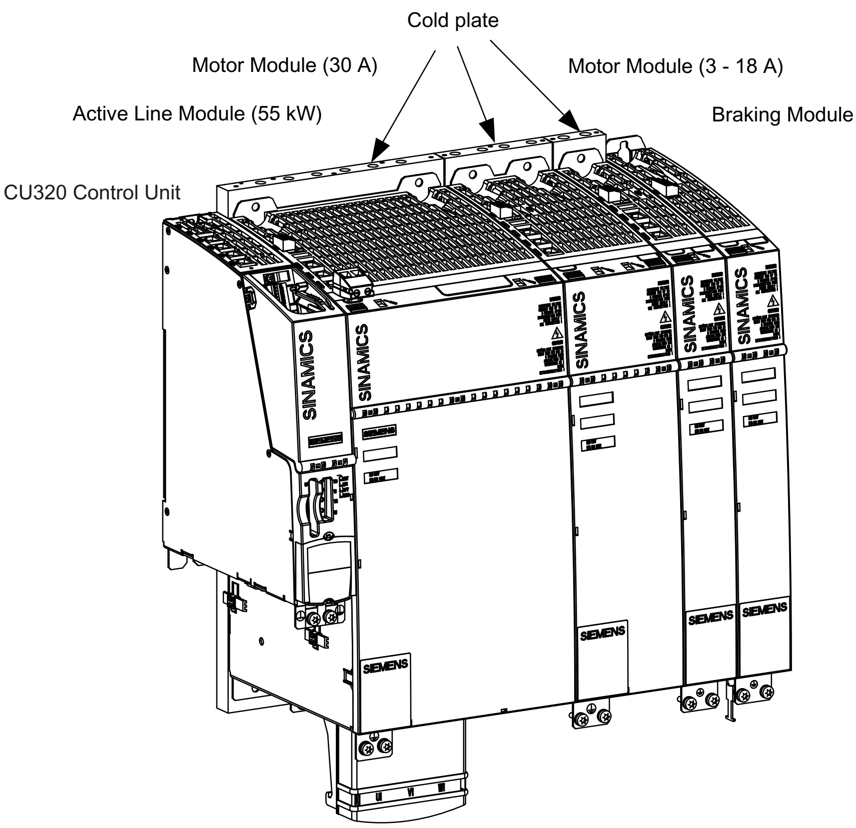


Figure 14-2 Example of a drive line-up

The components in the drive line-up must be properly connected to the external heat sink.

In the case of Active Line Modules above 55 kW, the Motor Modules can be mounted at the right or left. This applies only to Active Line Modules with order numbers ending in 0, 1 or 2.

The Motor Modules can be mounted on the right and / or left with Smart / Active Line Modules of 16 kW and higher with order numbers ending in 3 (6SL xxxxxxx 3) and with all Basic Line Modules.

The components can be arranged in one or more tiers. In a multiple-tier arrangement, vertical installation or, in a cabinet row, side-by-side installation in different cabinet sections is possible.

To determine the cross-section, use the DC link busbar current carrying capacity given in the relevant technical data.

We recommend that a minimum clearance of 150 mm is maintained between the line filter and line reactor.

Multiple-tier configuration

Figure 14-3 Removing the DC link bridges (multi-tier configuration)

The DC link bridges must be removed by unscrewing the M4 screws.

⚠ DANGER
If, at the lefthand end of the drive line-up, there is a 50 mm wide Motor Module or a DC link component of the appropriate width (e.g. Braking Module, CSM, VCM), then the DC link bridge and all of the associated screws must be removed completely. It is not permissible to insert the screws without a DC link bridge. For all other power units and DC link components (e.g. Capacitor Module) that are wider than 50 mm, it is not permissible to remove the DC link bridge. If this is not carefully observed, this can result in damage and accidents.

Continuation of the DC link with the DC link adapter external to the components is achieved using single-core, finely-stranded and shielded cables that are laid so as to ensure they are short-circuit and ground-fault proof.

Two-tier configuration

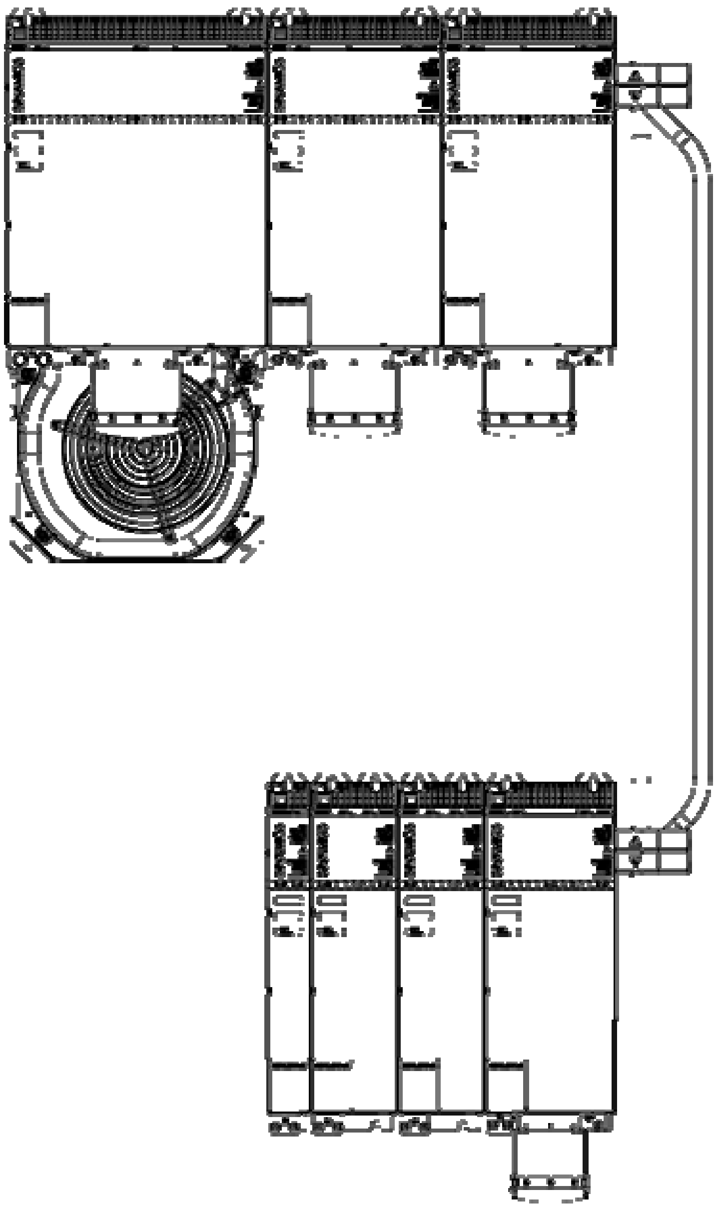


Figure 14-4 Example of a multi-tier configuration with components between 200 and 300 mm wide

The distance between the two module rows depends on the wiring and cable cross-section.

For modules with a width of between 50 and 100 mm, the distance between the upper and lower module row must be at least 300 mm.

For modules with a width of between 150 and 300 mm, the distance between the upper and lower module row must be at least 500 mm (see Cooling).

CAUTION
Signal cables must not be routed parallel to power cables.

Overview of the DC link rectifier adapter and DC link adapter

	Suitable for module width:	Max. connectable cross-section	Max. current carrying capacity
DC link rectifier adapter (cable outlet on top)			
6SL3162-2BD00-0AAx	50 mm, 100 mm	10 mm²	36 A
6SL3162-2BM00-0AAx	150 mm, 200 mm, 300 mm	95 mm²	240 A
DC link adapter (cable outlet on side)			
6SL3162-2BM01-0AAx	all	95 mm²	240 A

Note

The current carrying capacity of the DC link busbars must be taken into account. For the specifications, see the technical specifications for the components.

14.4.3 Three-tier configuration

Multiple-tier configuration

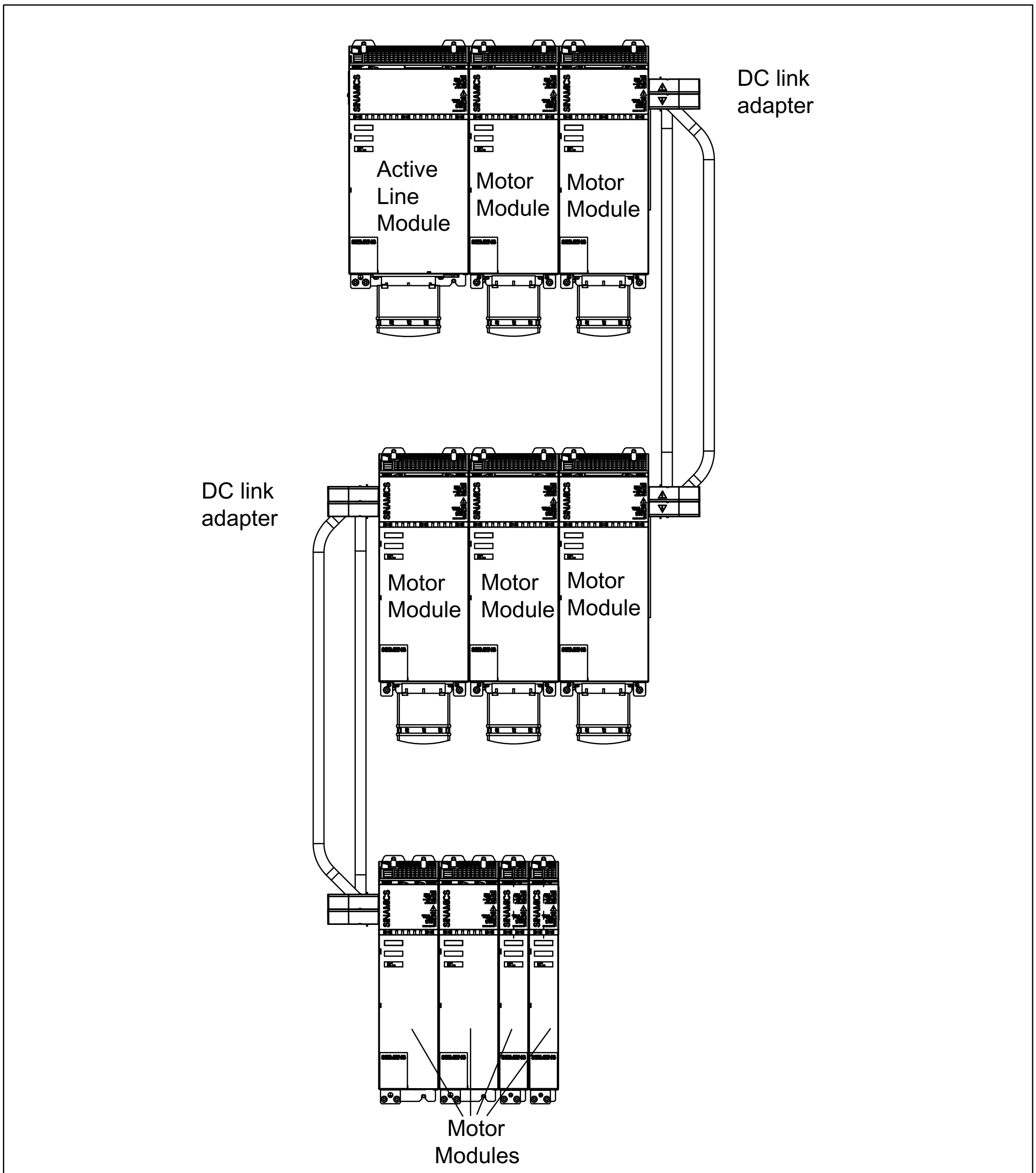


Figure 14-5 Example of a three-tier configuration with components between 50 and 200 mm wide

Note

When the power supply input is on the right-hand side of the drive line-up (e.g. in a multiple-tier configuration), the above rules apply in reverse.

This means that: The Motor Modules are arranged in order of power from the highest power to the lowest power followed by the DC link components, such as the Braking Module.

14.4.4 Information on connecting the cooling water

Cooling system/circuit requirements

CAUTION
You must take great care when laying the water pipes. The pipes must be secure and checked for leaks. The water cables must never come into contact with live parts.

- The components for connecting the water to the equipment are made of stainless steel or thick aluminum. A G 1/2“ internal thread is provided for the water connection. The connection is flat sealing.
- The cooling water infeed line (blue) and return line (red) must be connected in accordance with their color markings. The color markings are located next to the water connection.
- Open cooling systems must never be used. Only closed cooling systems - preferably with a mechanism for monitoring the quality of the cooling water - must be installed.
- The electrochemical processes that take place in a cooling system must be minimized by choosing the right materials. For this reason, mixed installations (i.e. a combination of different materials, such as copper, brass, iron, or halogenated plastic (PVC hoses and seals)) should not be used.
- Stainless steel (V2A or V4A steel; NIROSTA austenite) and non-conductive EPDM/NBR hoses (EPDM on the water side) are recommended for the cooling system piping.
- Equipotential bonding between the components in the cooling system (converter, heat exchanger, piping, pump, etc.) must be ensured using conductive construction elements with a copper bar or stranded copper with the appropriate conductor cross-sections.
- Requirements regarding the quality of the cooling water must also be observed.
- Corrosion inhibitor must be added to the cooling water.

Commissioning

CAUTION
The system must only be vented once it has been disconnected from the power supply.

- When the equipment is filled for the first time, the heat sinks must be vented.
- Remove the safety seal screws in front of the vent valve.
- Vent the system.
- Close the vent valve.
- Replace the safety seal screws.
- Ensure that they are tight.
- The operating pressure must be set in accordance with the flow conditions of the cooling water network in the infeed and return line.
- The required cooling quantity per time unit must be set.

14.5 Electromagnetic Compatibility

14.5.1 General

EMC requirements can be found in EN 60439-1 and recommendations in EN 60204-1. For installation of components in cabinets, the following conditions must be ensured to comply with the EMC Directive:

- Operation in TN systems with SINAMICS line filters
- Observance of information about cable shielding and equipotential bonding
- Use of recommended Siemens power and signal cables.
- Only Siemens cables may be used for DRIVE-CLiQ connections.

For MOTION-CONNECT cables see catalog D21.1.

CAUTION
For DRIVE-CLiQ connections it is not permissible to use cables and couplings (connectors) that you have configured yourself.

14.5.2 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 Line 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.

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 unshielded 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. For Siemens power cables in which the shield is connected to the connector shell (see relevant catalog), this is a sufficiently good shield contact.

With components that do not have any special shield connection or where the shield connection is not sufficient, the cable shields can be connected to the metal mounting plate using hose clamps and toothed rails. The cable length between the shield contact point and the terminals for cable conductors must be kept as short as possible.

Shield contact plates with pre-prepared clip contacts are available for contacting the shields for power cables of Line Modules and Motor Modules. Up to a module width of 100 mm, these plates are part of the scope of supply of the components, or they are integrated in the connector.

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 unshielded cables, connected to the drive line-up, in the immediate vicinity of noise sources, e.g. transformers. Signal lines (shielded and unshielded) connected to the drive line-up, must be routed as far as possible away from strong external magnetic fields (e.g. transformers, line reactors). In both cases, a distance of ≥ 300 mm is usually sufficient.

DANGER

The Voltage Clamping Module conducts a high leakage current via the functional ground. This means that a permanent PE connection must be provided for the cabinet (PE) rail.

Other than that the following measures must be taken in accordance with EN 61800-5-1: Either protective ground conductor cross-sections ≥ 10 mm^2 Cu or installation of a second protective ground conductor of the same cross-section as the first one.

Signal and DC power supply cables

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

- Direct current supply cables: Max. permissible length: 10 m
- Unshielded 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 14-10 Recommendations for overvoltage protection

DC 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	

NOTICE

The connected signal and power cables must be routed to the components in such a way that they do not cover the ventilation slots.

CAUTION

Unshielded signal cables must not be routed parallel to power cables.

Table 14-11 Maximum cable lengths

Type	Maximum length [m]
24 V DC power cables [2]	10
24 V signal cables [2]	30
DC link, including extensions	10
Total length of power cables in the drive line-up comprising the following: Motor power cables, DC link cable(s) and line feeder cable from the line filter output	350 (shielded) 560 (unshielded)
Total length: Motor cables, line feeder cable from the Basic Line Filter to the Active Line Module	< 150 (shielded)
Total cable length with Voltage Clamping Module (limitations/constraints, refer to the Chapter, Voltage Clamping Module)	630 (shielded) 850 (unshielded)
Power cable between line filter and line reactor	10 (shielded/unshielded) [1]
Power cable between line reactor and Line Module	10 (shielded/unshielded) [1]
Power cable between Motor and Motor Module to In = 9 A	50 (shielded) 75 (unshielded)
Power cable between Motor and Motor Module In = 18 A	70 (shielded) 100 (unshielded)
Power cable between Motor and Motor Module In ≥ 30 A	100 (shielded) 150 (unshielded)
DRIVE-CLiQ signal cables MC500	100
DRIVE-CLiQ signal cables MC800	50
DRIVE-CLiQ signal cables FIX	70
Cable between the Braking Module and braking resistor	10

[1] To comply with EMC limit values, shielded cables (preferably Motion-Connect cables) must be used.

[2] For greater lengths, suitable wiring must be connected by the user to provide overvoltage protection.

14.5.3 Equipotential Bonding

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

The machine manufacturer is responsible for ensuring that the technical user/manufacturer documentation clearly specifies all conditions relating to the connection and terminal assignments of ground cables, ground connection cables, protective conductors and equipotential bonding conductors (this is particularly important when the device features multiple protective conductor/equipotential bonding conductor connections/terminals). It must be particularly clearly stated that the terminals for equipotential bonding connections located in parallel to the terminals for protective connecting cables must not be used to loop through the protective connection.

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. As of 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.

Equipotential bonding must also be provided for the back wall. If, for example, the PROFIBUS or DRIVE-CLiQ cable is routed through several cabinets, the control unit interface PROFIBUS equipotential bonding conductor connection must be used for connecting the equipotential bonding conductor.

⚠ 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 at a 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.

14.6 Connection Methods

14.6.1 Spring-Loaded Terminals/Screw Terminals

Connectable conductor cross-sections of spring-loaded terminals

Table 14-12 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 mm² to 1.5 mm² 0.25 mm² to 1.5 mm² 0.25 mm² to 0.5 mm²
	Insulation stripping length	7 mm	
	Tool	Screwdriver 0.4 x 2.0 mm	
2	Connectable conductor cross-sections	Flexible	0.08 mm² to 2.5 mm²
	Insulation stripping length	8 to 9 mm	
	Tool	Screwdriver 0.4 x 2.0 mm	

Connectable conductor cross-sections of screw terminals

Table 14-13 Screw terminals

Screw terminal type			
1	Connectable conductor cross-sections	Rigid, flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.08 mm² to 1.5 mm² 0.25 mm² to 1.5 mm² 0.25 mm² to 0.5 mm²
	Insulation stripping length	7 mm	
	Tool	Screwdriver 0.4 x 2.0 mm	
	Tightening torque	0.22 to 0.25 Nm	
2	Connectable conductor cross-sections	Rigid, flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.08 mm² to 2.5 mm² 0.5 mm² to 2.5 mm² 0.5 mm² to 1.5 mm²
	Insulation stripping length	7 mm	
	Tool	Screwdriver 0.6 x 3.5 mm	
	Tightening torque	0.5 to 0.6 Nm	
3	Connectable conductor cross-sections	Flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.2 mm² to 2.5 mm² 0.25 mm² to 1 mm² 0.25 mm² to 1 mm²
	Insulation stripping length	9 mm	
	Tool	Screwdriver 0.6 x 3.5 mm	
	Tightening torque	0.5 to 0.6 Nm	
4	Connectable conductor cross-sections	Flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.2 mm² to 4 mm² 0.25 mm² to 4 mm² 0.25 mm² to 4 mm²
	Insulation stripping length	7 mm	
	Tool	Screwdriver 0.6 x 3.5 mm	
	Tightening torque	0.5 to 0.6 Nm	

Screw terminal type			
5	Connectable conductor cross-sections	Flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.5 mm² to 6 mm² 0.5 mm² to 6 mm² 0.5 mm² to 6 mm²
	Insulation stripping length	12 mm	
	Tool	Screwdriver 1.0 x 4.0 mm	
	Tightening torque	1.2 to 1.5 Nm	
6	Connectable conductor cross-sections	Flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.5 mm² to 10 mm² 0.5 mm² to 10 mm² 0.5 mm² to 10 mm²
	Insulation stripping length	11 mm	
	Tool	Screwdriver 1.0 x 4.0 mm	
	Tightening torque	1.5 to 1.8 Nm	

14.6.2 Connectable cable cross-sections

Table 14-14 Connectable cable cross-sections: Power supply cable / motor cable, part 1

		Connection cross-section [mm²]					
Component	**Terminal type**	**1,5**	**2,5**	**4**	**6**	**10**	**16**
Motor Module 3 A to 30 A 2 x 3 A to 2 x 18 A	Motor connector 30 A 3+2 pin	X	X	X	X	X	
Motor Module 45 A to 60 A	Threaded bolt M6/6 Nm 1)		X	X	X	X	X
Motor Module 85 A	Threaded bolt M8 / 13 Nm		X	X	X	X	X
Motor Module 132 A to 200 A	Threaded bolt M8 / 13 Nm		X	X	X	X	X
Smart Line Module 5 kW to 10 kW	Screw-type terminal	X	X	X	X		
Acitve Line Module 16 kW Smart Line Module 16 kW	Screw-type terminal	X	X	X	X	X	
Acitve Line Module 36 kW Smart Line Module 36 kW	Threaded bolt M6 / 6 Nm		X	X	X	X	X
Acitve Line Module 55 kW	Threaded bolt M8 / 13 Nm		X	X	X	X	X
Active Line Module 80 kW to 120 kW	Threaded bolt M8 / 13 Nm		X	X	X	X	X

1) for ring cable lugs to DIN 46234

Terminal area for flexible cable with wire end ferrule

Terminal area for flexible cable with ring cable lug M6

Terminal area for flexible cable with ring cable lug M8

IP2xB to EN 60529 ensured; note: the shock-hazard protection installed as standard must be used or adjusted as appropriate.

Table 14-15 Connectable cable cross-sections: Power supply cable / motor cable, part 2

		Connection cross-section [mm²]					
Component	**Terminal type**	**25**	**35**	**50**	**70**	**95**	**120**
Motor Module 3 A to 30 A 2 x 3 A to 2 x 18 A	Motor connector 30 A 3+2 pin						
Motor Module 45 A to 60 A	Threaded bolt M6/6 Nm [1)]	X	X	X			
Motor Module 85 A	Threaded bolt M8 / 13 Nm	X	X	X	X	X	X
Motor Module 132 A to 200 A	Threaded bolt M8 / 13 Nm	X	X	X	X	X	X
Smart Line Module 5 kW to 10 kW	Screw-type terminal						
Acitve Line Module 16 kW Smart Line Module 16 kW	Screw-type terminal						
Acitve Line Module 36 kW Smart Line Module 36 kW	Threaded bolt M6 / 6 Nm	X	X	X			
Acitve Line Module 55 kW	Threaded bolt M8 / 13 Nm	X	X	X	X	X	X
Active Line Module 80 kW to 120 kW	Threaded bolt M8 / 13 Nm	X	X	X	X	X	X

[1)]for ring cable lug to DIN 46234

Terminal area for flexible cable with wire end ferrule

Terminal area for flexible cable with ring cable lug M6

Terminal area for flexible cable with ring cable lug M8

IP2xB to EN 60529 ensured; note: the shock-hazard protection installed as standard must be used or adjusted as appropriate.

Table 14-16 Connectable cable cross-sections: Power supply cable / connection for braking resistor, part 3

		Connection cross-section [mm²]					
Component	**Terminal type**	**1,5**	**2,5**	**4**	**6**	**10**	**16**
Basic Line Module 20 kW line connection	Screw-type terminal	x	x	x	x	x	x
Basic Line Module 20 kW Connection for braking resistor	Screw-type terminal	x	x	x			
Basic Line Module 40 kW line connection	Screw-type terminal					x	x
Basic Line Module 40 kW Connection for braking resistor	Screw-type terminal			x	x	x	x
Basic Line Module 100 kW line connection	Threaded bolt M8 / 13 Nm		x	x	x	x	x

Table 14-17 Connectable cable cross-sections: Power supply cable / connection for braking resistor, part 4

		Connection cross-section [mm²]					
Component	Terminal type	25	35	50	70	95	120
Basic Line Module 20 kW line connection	Screw-type terminal						
Basic Line Module 20 kW Connection for braking resistor	Screw-type terminal						
Basic Line Module 40 kW line connection	Screw-type terminal	x	x	x			
Basic Line Module 40 kW Connection for braking resistor	Screw-type terminal	x					
Basic Line Module 100 kW line connection	Threaded bolt M8 / 13 Nm	x	x	x	x	x	x

Note

The 40 kW Basic Line Module provides the IP20 degree of protection only with insulated ferrule and a cross-section > 25 mm^2.

Note

The cross-section of the PE conductor must be selected in accordance with DIN EN 60204-1, DIN EN 61800-5-1, and VDE 0100-540 (IEC 60364-5-54). When doing so, note that certain components conduct a high leakage current, which means that the relevant guidelines must be observed (EN 61800-5-1).

When selecting the power supply cable, note the loop resistance so that the relevant protective components (line fuse, RCCB, etc.) function properly and that no hazardous shock currents or voltages occur in the event of a fault.

⚠ WARNING

The internal overload monitoring function of the power module only protects the cable if this is dimensioned/selected corresponding to the power module currents. If smaller cross-sections are selected, the user must ensure that the appropriate level of cable protection is provided (e.g. by setting the control parameters to suitable values).

14.6.3 Motor connector

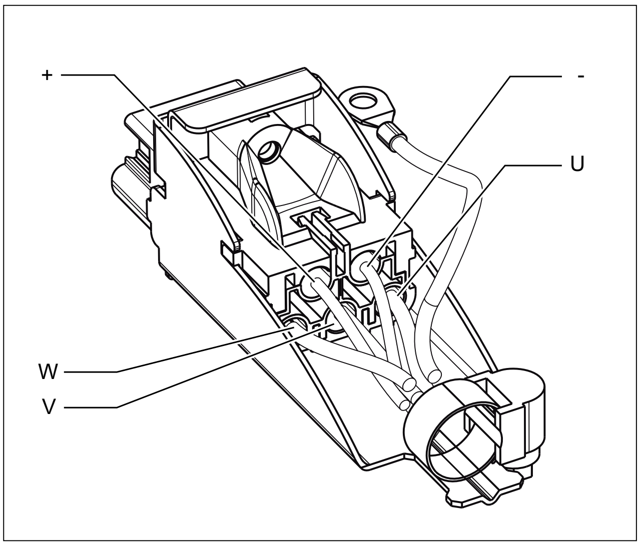


Figure 14-6 Motor connector

The figure below shows how to remove the motor connector using a pair of engineer's pliers, for example, to pull the cable through narrow cable bushings.

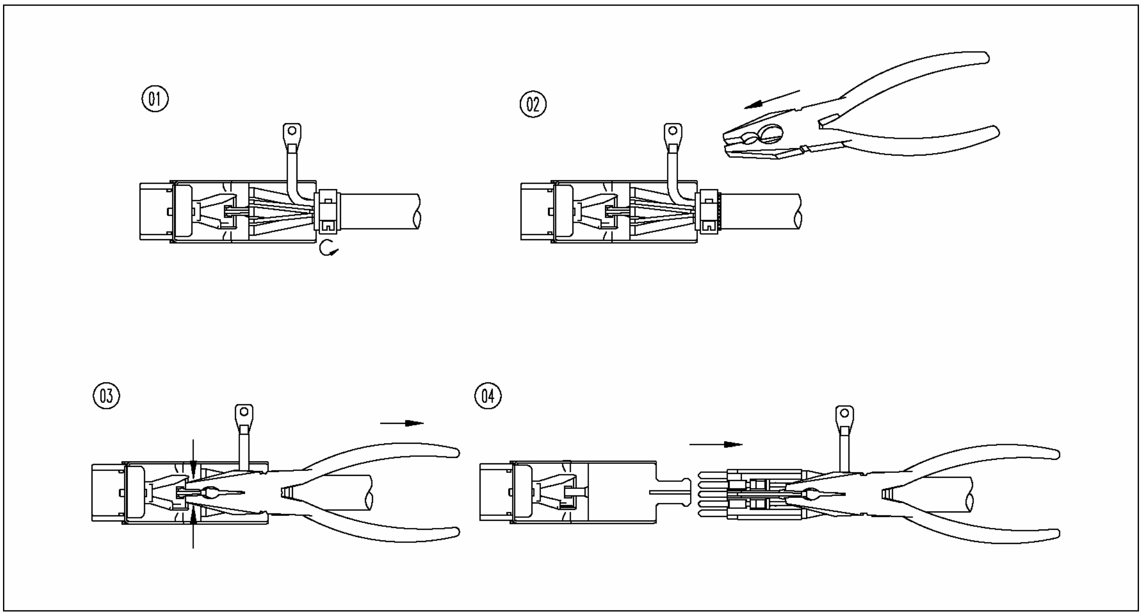


Figure 14-7 Removing the motor connector

The following figure shows how the motor connector is coded to prevent incorrect connection (especially relevant for Double Motor Modules).

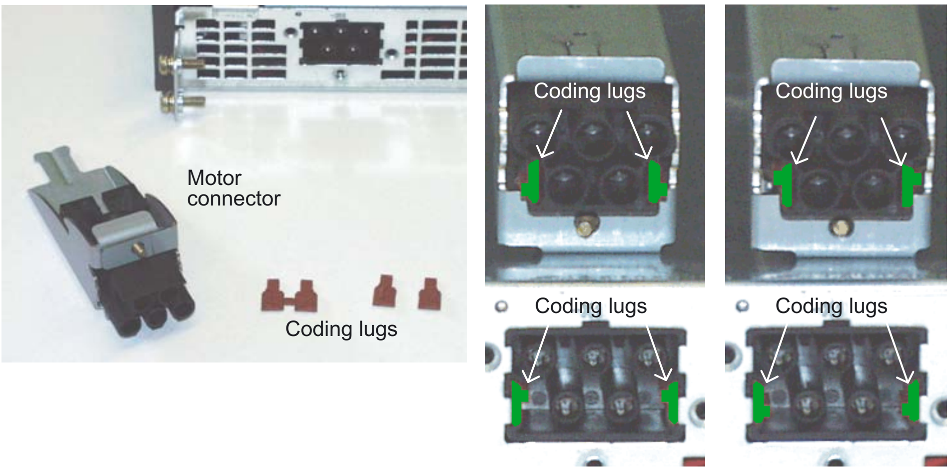


Figure 14-8 Coding the motor connector

The coding plugs are supplied with the motor cables.

14.6.4 Power connector (X1/X2)

with screw terminals

Structure and assembly

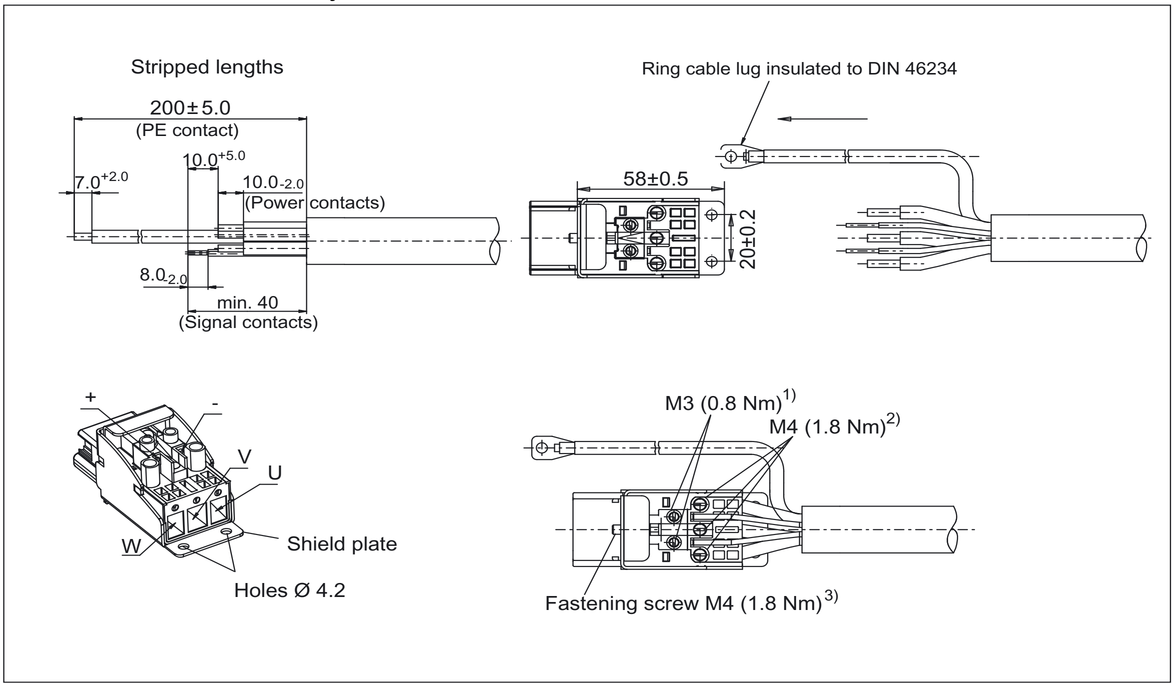


Figure 14-9 Setting up and installing the power supply connector (X1/X2)

Screwdriver

1) SZS 0.6 x 3.5

2) SZS 1.0 x 4.0

3) Torx TX20

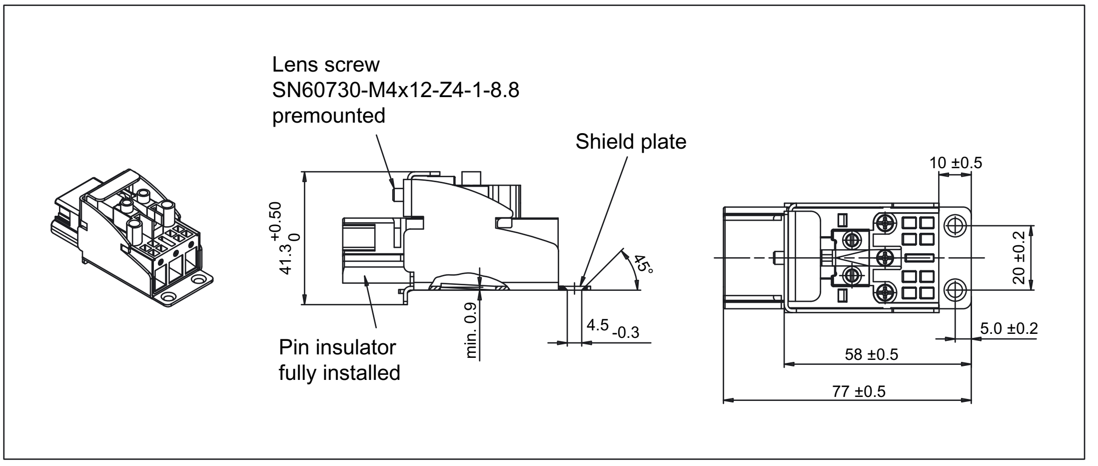


Figure 14-10 Dimensions: Power connector

Various options are available for the shield contact:

1. Shield contact with shield plate supplied.
   This type of shield contact should be preferred.

Table 14-18 Installing the shield plate

	
Shield plate supplied for power connectors	Frontal alignment of the shield plate
	
Lateral alignment of the shield plate	Lateral alignment of the shield plate

The shield plate can be installed at a number of angles using the two screws provided (M4) (tightening torque 1.8 Nm).

1. Shield contact on a toothed rail
   The toothed rail should be fitted at a distance of ≤ 150 mm below the drive line-up with the greatest possible surface area. Wherever possible, the brake conductors must be kept physically separate from U/V/W.

Note

Measures must be taken on site to relieve strain on the cables.
Max. permissible cable tension in the connection direction: 100 N

With these variants, the shield for the brake connection wires must be laid with the cable shield.

3. Securing a shield contact constructed by the customer on the shield plate.

14.6.5 24 V terminal adapter

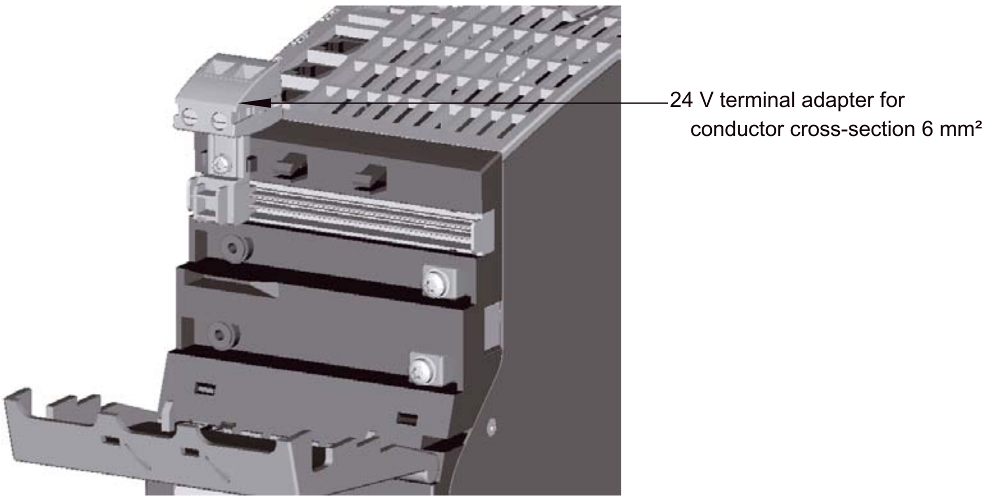


Figure 14-11 24 V terminal adapter

The terminal adapter can be fitted to any power unit. A recess must be provided for this purpose on the protective cover of the DC link using suitable pliers. The terminal adapter is snapped on and secured with a screw SHR, PT-TORX K 30-3, 0X16-ST-A2F WN1452 / EJOT / 0.5 Nm.

EJOT: http://www.ejot.de/

Note

The 24 V terminal adapter can only be installed on the component on the far left because all other areas are occupied by the red jumpers.

24 V terminal adapter for a conductor cross-section of 6 mm^2
Terminal adapter and screw are supplied with the Line Modules and Control Supply Modules.

14.7 Cooling

14.7.1 General

The following devices are available as cooling equipment:

- Internal liquid cooling (in preparation)
- External air cooling
- External liquid cooling

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

The ventilation clearances stated 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 significantly reduce the service life of the equipment and result in premature component failure.

Note

When the line reactor is being installed, it is best not to install it in the same cabinet (max. distance approx. 0.5 m). If necessary, it can be installed on the heat sink.

You must take into account the following specifications when installing a SINAMICS drive line-up:

- Ventilation clearance
- Cable routing
- Air guidance

Table 14-19 Ventilation clearances above and below the components

Component	Order No.	Clearance [mm]
Line filter for line module 5 kW - 120 kW	6SL3000-0BExx-xAAx	100
Line reactor for active line module 16 kW – 120 kW	6SN1111-0AA00-xxAx	100
Line reactor for Basic Line Module 20 kW – 100 kW	6SL3000-0CExx-0AAx	100
Line reactor for smart line module 5 kW – 10 kW	6SL3000-0CExx-0AAx	100
Active line module 16 kW – 55 kW 80 kW – 120 kW	 6SL3130-7TExx-xAAx 6SL3130-7TExx-xAAx	 80 80 (additional 50 in front of fan)
Smart line module 5 kW – 10 kW	6SL3130-6AExx-0AAx	80
Basic Line Module 20 kW - 100 kW	6SL3130-1TExx-xAAx	80
Motor module < 132 A	6SL312x-1TExx-xAAx	80
Motor module 132 A and 200 A	6SL312x-1TE3x-xAAx	80 (additional 50 in front of fan)
Braking Module	6SL3100-1AE31-0AAx	80
Control supply module	6SL3100-1DE22-0AAx	80
Capacitor Module	6SL3100-1CE14-0AAx	80

14.7.2 Ventilation

With cold-plate cooling, the SINAMICS devices must always be ventilated separately by means of a fan in the cabinet or by some other means.

When an external air heat sink is used, ventilation must also be provided outside the cabinet or by some other means.

Temperature measurement

The temperature of the power sections can be read via parameter r0037.

Temperature limits

1. For the maximum heat sink temperature, see the "Technical data" for the power sections.
2. For the maximum internal cabinet temperature, see the "Technical data" for the power sections.

Measures for remaining within temperature limits

1. Install one or more fans.
2. If necessary, the drive line-up can be operated with derating.

14.7.3 Anti-condensation measures

Special measures must be taken to prevent condensation.

Condensation occurs when the inlet temperature of the cooling medium is significantly lower than room temperature (ambient temperature).

The table below shows the dew points (in °C) for an atmospheric pressure of 1 bar (≈ installation altitude: 0...500 m). If the temperature of the cooling medium is below the specified value, condensation may occur (i.e. the temperature of the cooling medium must always be ≧ the dew point temperature).

Table 14-20 Dew point temperature as a function of the relative air humidity (Φ) and the room temperature at an installation altitude of between 0 m and 500 m

T room °C	Φ=20%	Φ=30%	Φ=40%	Φ=50%	Φ=60%	Φ=70%	Φ=80%	Φ=85%	Φ=90%	Φ=90%	Φ=100 %
10	<0	<0	<0	0.2	2.7	4.8	6.7	7.6	8.4	9.2	10
20	<0	2	6	9.3	12	14.3	16.4	17.4	18.3	19.1	20
25	0.6	6.3	10.5	13.8	16.7	19.1	21.2	22.2	23.2	24.1	24.9
30	4.7	10.5	14.9	18.4	21.3	23.8	26.1	27.1	28.1	29	29.9
35	8.7	14.8	19.3	22.9	26	28.6	30.9	32	33	34	34.9
38	11.1	17.4	22	25.7	28.8	31.5	33.8	34.9	36	36.9	37.9
40	12.8	19.1	23.7	27.5	30.6	33.4	35.8	36.9	37.9	38.9	39.9
45	16.8	23.3	28.2	32	35.3	38.1	40.6	41.8	42.9	43.9	44.9
50	20.8	27.5	32.6	36.6	40	42.9	45.5	46.6	47.8	48.9	49.9

The dew point also depends on the absolute pressure (i.e. the installation altitude).

Various measures can be taken to prevent condensation:

1. Temperature-controlled valves in the supply line.
   In the cooling circuit, a temperature-controlled valve must be provided in the supply line.
2. Water temperature control.
   The water temperature is adjusted in line with the room temperature. This is the preferred method with high room temperatures, low water temperatures, and high air humidity.
3. Physical dehumidification.
   This is only effective in closed spaces. This method involves condensing the air humidity in an air-to-water heat exchanger, which is continuously operated using the cold cooling water.
4. Installing a heater with a sufficient capacity in the cabinet.

To prevent condensation, a humidity detector can be used to monitor the air humidity. The humidity detector is not included in the scope of supply.

14.7.4 Power Loss of Components in Rated Operation

With cold-plate cooling, only part of the power loss remains in the cabinet.
The table below shows the internal and external power loss of the components. The characteristic values apply for the following conditions:

- Line voltage for Line Modules 400 V
- Pulse frequency of the Motor Modules 4 kHz
- Rated pulse frequency of the Active Line Modules 8 kHz
- Operation of components with rated power

Overview: power loss in cold-plate cooling

Table 14-21 Overview: power loss in cold-plate cooling

	Unit	Internal power loss	External power loss	Total power loss
Active Line Modules				
16 kW	W	50	210	260
36 kW	W	110	520	630
55 kW	W	160	740	900
80 kW	W	250	1100	1350
120 kW	W	400	1800	2200
Smart Line Modules				
5 kW	W	35	54	89
10 kW	W	60	110	170
Basic Line Modules				
20 kW	W	25	95	120
40 kW	W	45	205	250
100 kW	W	130	450	580
Single Motor Modules				
3 A	W	12	18	30
5 A	W	20	35	55
9 A	W	30	50	80
18 A	W	65	100	165
30 A	W	70	220	290
45 A	W	90	340	430
60 A	W	110	480	590
85 A	W	130	620	750
132 A	W	200	1050	1250
200 A	W	350	1700	2050
Double Motor Modules				
2x3 A	W	34	36	70
2x5 A	W	40	65	105
2x9 A	W	60	100	160
2x18 A	W	70	250	320

Mean power loss in periodic duty is lower.

Electronic losses of Motor Modules/Line Modules

Table 14-22 Electronic losses of Motor Modules/Line Modules

Component		Cold plate	
		Current consumption [A]	Power loss [W]
Motor Modules	3 A	0,6	14,4
	5 A	0,6	14,4
	9 A	0,6	14,4
	18 A	0,6	14,4
	30 A	0,6	14,4
	45 A	0,7	16,8
	60 A	0,7	16,8
	85 A	1	24,0
	132 A	1,5	36,0
	200 A	1,5	36,0
	2x3 A	0,85	20,4
	2x5 A	0,85	20,4
	2x9 A	0,85	20,4
	2x18 A	0,95	22,8
Active Line Modules	16 kW	0,8	19,2
	36 kW	1	24,0
	55 kW	1,4	33,6
	80 kW	2	48,0
	120 kW	2,5	60,0
Smart Line Module	5 kW	0,65	15,6
	10 kW	0,7	16,8
Basic Line Modules	20 kW	0,9	21,6
	40 kW	1,1	26,4
	100 kW	1,6	38,4

15 Service and Maintenance

15.1 Replacing Components with Internal Liquid Cooling (in Preparation)

Replacing components essentially depends on the design of the liquid installation. With a serial connection system, the entire circuit is interrupted when components are replaced. With a parallel connection system, appropriate valves in the cooling pipes (not included in the component) mean that individual components can be removed from the line-up without the need to interrupt the cooling circuit.

To make it easier to replace components, we recommend that every component is connected through self-closing valves.

Note

If the connectors are removed from the component, you must make sure that you use a new seal.

15.2 Reforming the DC link capacitors

⚠ CAUTION
If the Active Line Module, Smart Line Module and Motor Module have not been used for more than two years, the DC link capacitors must be re-formed. If this is not carried-out, the units could be damaged when the power supply voltage is connected.

If the cabinet is commissioned within two years of its date of manufacture, the DC link capacitors do not need to be reformed. The date of manufacture can be taken from the serial number on the rating plate.

Note

It is important that the storage period is calculated from the date of manufacture and not from the date that the equipment was shipped.

Procedure

The DC link capacitors are re-formed by applying the rated voltage without load for at least 30 minutes at room temperature.

Date of manufacture

The date of manufacture can be determined from the following assignment to the serial number (e.g. T-**S9**2067000015):

Table 15-1 Production year and month

Character	Year of manufacture	Character	Month of manufacture
S	2004	1 to 9	January to September
T	2005	O	October
U	2006	N	November
V	2007	D	December

The serial number is found on the rating plate.

When DC link capacitors are formed, a defined voltage is connected to them and a defined current flows so that the appropriate capacitor characteristics are re-established for them to be re-used as DC link capacitors.

Components for the forming circuit (recommendation)

- 1 fuse switch 3-phase 400 V / 10 A
- 3 incandescent lamps 230 V / 100 W
- Various small components, such as lamp socket, cable 1.5 mm^2, etc.

DANGER

Dangerously high voltage levels are still present in the cabinet up to 5 minutes after it has been disconnected due to the DC link capacitors. It is only permissible to work on the equipment or at the DC link terminals after this time has expired.

Note

Line Modules must be enabled from the connected Motor Module.

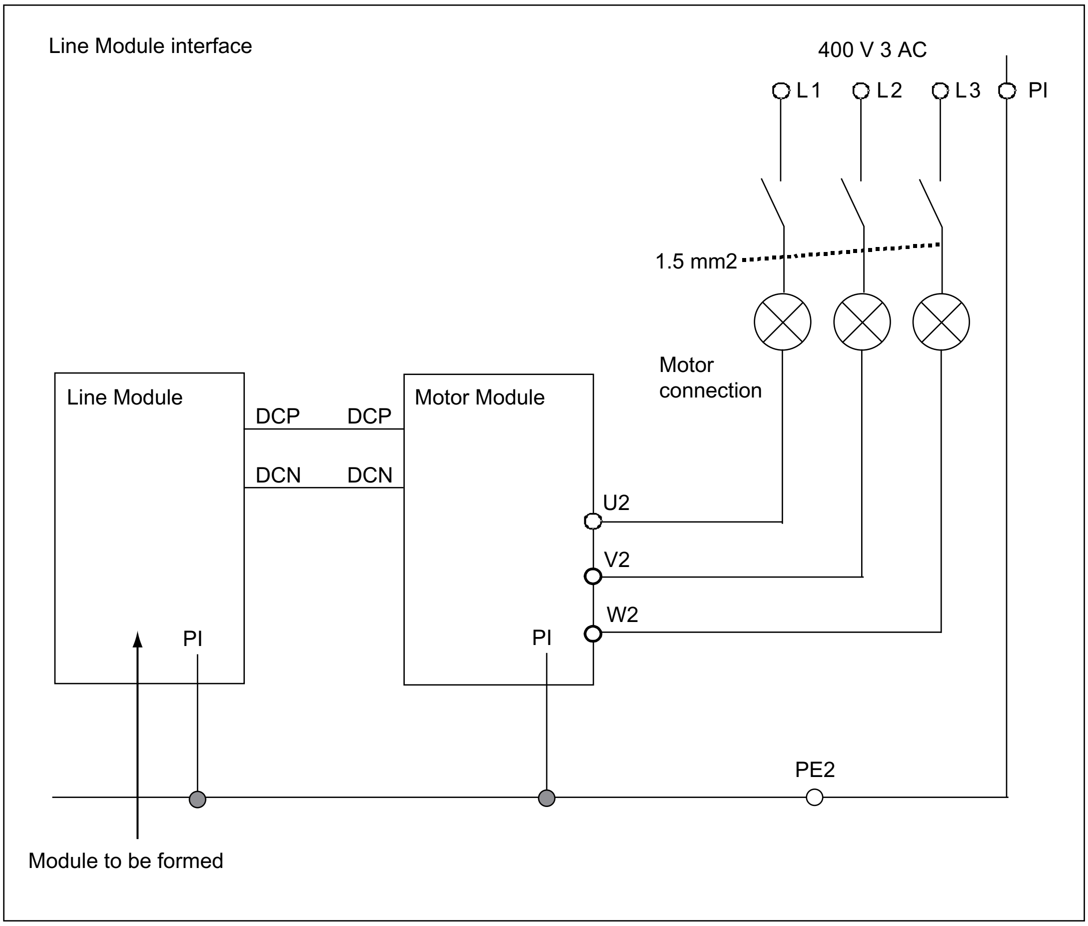


Figure 15-1 Line Module interface

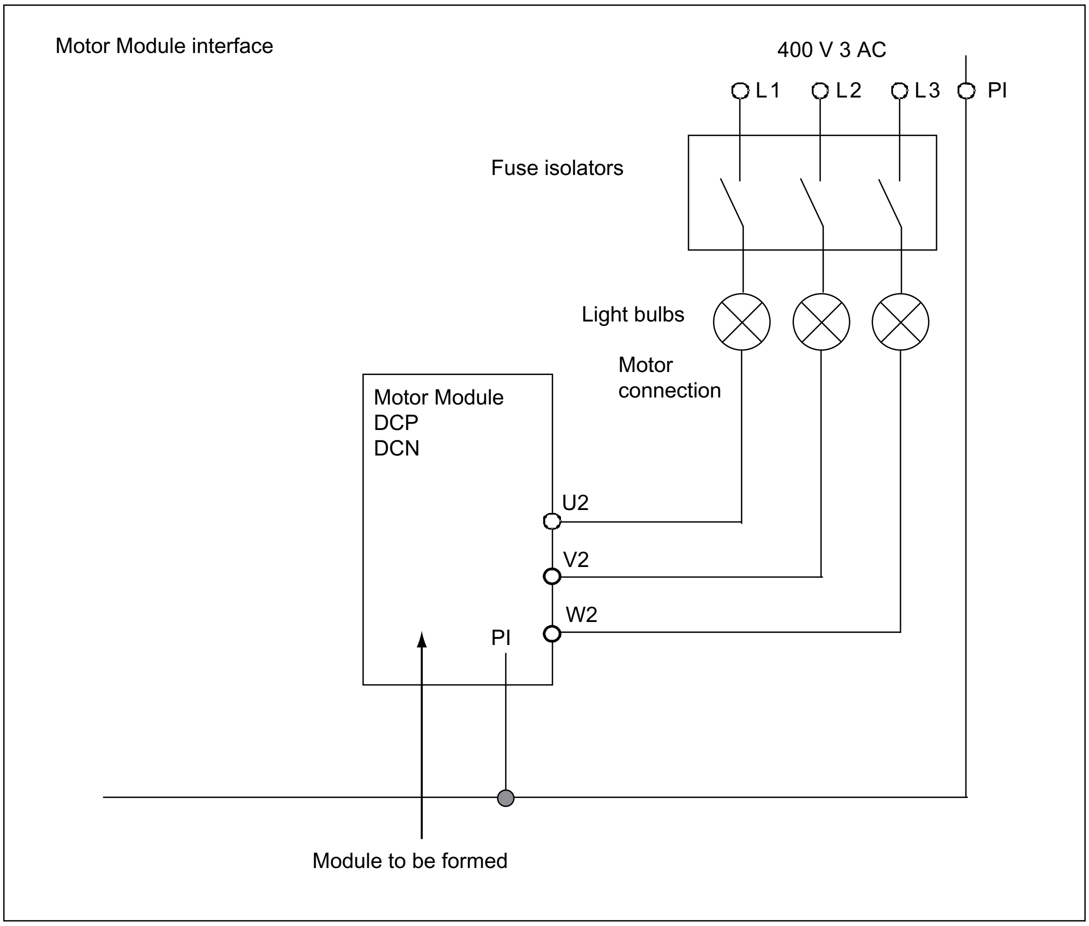


Figure 15-2 Motor Module interface

Procedure

- Before you form the DC link capacitors, the DC link bridge must be removed.
- It is not permissible that the drive unit receives a power-on command (e.g. from the keyboard, BOP20 or terminal strip).
- Connect the forming circuit.
- During the forming process, the incandescent lamps must become less bright or go completely dark. If the incandescent lamps continue to be brightly lit, a fault has occurred in the drive unit or in the wiring.

Spring-Loaded Terminals/Screw Terminals

A

A.1 Spring-Loaded Terminals/Screw Terminals

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 mm² to 1.5 mm² 0.25 mm² to 1.5 mm² 0.25 mm² to 0.5 mm²
	Insulation stripping length	7 mm	
	Tool	Screwdriver 0.4 x 2.0 mm	
2	Connectable conductor cross-sections	Flexible	0.08 mm² to 2.5 mm²
	Insulation stripping length	8 to 9 mm	
	Tool	Screwdriver 0.4 x 2.0 mm	

Connectable conductor cross-sections of screw terminals

Table A-2 Screw terminals

Screw terminal type			
1	Connectable conductor cross-sections	Rigid, flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.08 mm² to 1.5 mm² 0.25 mm² to 1.5 mm² 0.25 mm² to 0.5 mm²
	Insulation stripping length	7 mm	
	Tool	Screwdriver 0.4 x 2.0 mm	
	Tightening torque	0.22 to 0.25 Nm	
2	Connectable conductor cross-sections	Rigid, flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.08 mm² to 2.5 mm² 0.5 mm² to 2.5 mm² 0.5 mm² to 1.5 mm²
	Insulation stripping length	7 mm	
	Tool	Screwdriver 0.6 x 3.5 mm	
	Tightening torque	0.5 to 0.6 Nm	
3	Connectable conductor cross-sections	Flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.2 mm² to 2.5 mm² 0.25 mm² to 1 mm² 0.25 mm² to 1 mm²

Screw terminal type			
	Insulation stripping length	9 mm	
	Tool	Screwdriver 0.6 x 3.5 mm	
	Tightening torque	0.5 to 0.6 Nm	
4	Connectable conductor cross-sections	Flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.2 mm² to 4 mm² 0.25 mm² to 4 mm² 0.25 mm² to 4 mm²
	Insulation stripping length	7 mm	
	Tool	Screwdriver 0.6 x 3.5 mm	
	Tightening torque	0.5 to 0.6 Nm	
5	Connectable conductor cross-sections	Flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.5 mm² to 6 mm² 0.5 mm² to 6 mm² 0.5 mm² to 6 mm²
	Insulation stripping length	12 mm	
	Tool	Screwdriver 1.0 x 4.0 mm	
	Tightening torque	1.2 to 1.5 Nm	
6	Connectable conductor cross-sections	Flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.5 mm² to 10 mm² 0.5 mm² to 10 mm² 0.5 mm² to 10 mm²
	Insulation stripping length	11 mm	
	Tool	Screwdriver 1.0 x 4.0 mm	
	Tightening torque	1.5 to 1.8 Nm	

List of abbreviations

B

B.1 List of Abbreviations

Table B-1 List of abbreviations

Abbreviation	German	English
A		
A...	Warnung	Alarm
AC	Wechselstrom	Alternating Current
ADC	Analog-Digital-Konverter	Analog Digital Converter
AI	Analogeingang	Analog Input
AIM	Active Interface Module	Active Interface Module
ALM	Active Line Module	Active Line Module
AO	Analogausgang	Analog Output
AOP	Advanced Operator Panel	Advanced Operator Panel
APC	Advanced Positioning Control	Advanced Positioning Control
ASC	Ankerkurzschluss	Armature Short-Circuit
ASCII	Amerikanische Code-Norm für den Informationsaustausch	American Standard Code for Information Interchange
ASM	Asynchronmotor	Induction motor
B		
BB	Betriebsbedingung	Operating condition
BERO	Firmenname für einen Näherungsschalter	Tradename for a type of proximity switch
BI	Binektoreingang	Binector Input
BIA	Berufsgenossenschaftliches Institut für Arbeitssicherheit	German Institute for Occupational Safety
BICO	Binektor-Konnektor-Technologie	Binector Connector Technology
BLM	Basic Line Module	Basic Line Module
BO	Binektorausgang	Binector output
BOP	Basic Operator Panel	Basic Operator Panel
C		
C	Kapazität	Capacitance
C...	Safety-Meldung	Safety message
CAN	Serielles Bussystem	Controller Area Network
CBC	Kommunikationsbaugruppe CAN	Communication Board CAN
CD	Compact Disc	Compact Disc

Abbreviation	German	English
CDS	Befehlsdatensatz	Command Data Set
CF	CompactFlash	CompactFlash
CI	Konnektoreingang	Connector Input
CNC	Computerunterstützte numerische Steuerung	Computer Numerical Control
CO	Konnektorausgang	Connector Output
CO/BO	Konnektor-/Binektorausgang	Connector Output/Binector Output
COB-ID	CAN Object-Identification	CAN Object-Identification
COM	Mittelkontakt eines Wechselkontaktes	Common contact of a change-over relay
CP	Kommunikationsprozessor	Communications Processor
CPU	Zentrale Recheneinheit	Central Processing Unit
CRC	Checksummenprüfung	Cyclic Redundancy Check
CSM	Control Supply Module	Control Supply Module
CU	Control Unit	Control Unit
D		
DAC	Digital-Analog-Konverter	Digital Analog Converter
DC	Gleichstrom	Direct Current
DCN	Gleichstrom negativ	Direct Current Negative
DCP	Gleichstrom positiv	Direct Current Positive
DDS	Antriebsdatensatz	Drive Data Set
DI	Digitaleingang	Digital Input
DI/DO	Digitaleingang/-ausgang bidirektional	Bidirectional Digital Input/Output
DMC	DRIVE-CLiQ Module Cabinet (Hub)	DRIVE-CLiQ Module Cabinet (Hub)
DO	Digitalausgang	Digital Output
DO	Antriebsobjekt	Drive Object
DP	Dezentrale Peripherie	Decentralized Peripherals
DPRAM	Speicher mit beidseitigem Zugriff	Dual-Port Random Access Memory
DRAM	Dynamischer Speicher	Dynamic Random Access Memory
DRIVE-CLiQ	Drive Component Link with IQ	Drive Component Link with IQ
DSC	Dynamic Servo Control	Dynamic Servo Control
E		
EDS	Geberdatensatz	Encoder Data Set
EGB	Elektrostatisch gefährdete Baugruppen	Electrostatic Sensitive Devices (ESD)
ELP	Erdschlussüberwachung	Earth Leakage Protection
EMK	Elektromagnetische Kraft	Electromagnetic Force
EMC	Elektromagnetische Verträglichkeit	Electromagnetic Compatibility (EMC)
EN	Europäische Norm	European Standard
EnDat	Geber-Schnittstelle	Encoder-Data-Interface
EP	Impulsfreigabe	Enable Pulses
EPOS	Einfachpositionierer	Basic positioner
ES	Engineering System	Engineering System
ESB	Ersatzschaltbild	Equivalent circuit diagram
ESR	Erweitertes Stillsetzen und Rückziehen	Extended Stop and Retract

Abbreviation	German	English
F		
F…	Störung	Fault
FAQ	Häufig gestellte Fragen	Frequently Asked Questions
FBL	Freie Funktionsblöcke	Free Blocks
FCC	Function Control Chart	Function Control Chart
FCC	Flussstromregelung	Flux Current Control
F-DI	Fehlersicherer Digitaleingang	Failsafe Digital Input
F-DO	Fehlersicherer Digitalausgang	Failsafe Digital Output
FEM	Fremderregter Synchronmotor	Separately excited synchronous motor
FEPROM	Schreib- und Lesespeicher nichtflüchtig	Flash-EPROM
FG	Funktionsgenerator	Function Generator
FI	Fehlerstrom-Schutzschalter	Residual-Current Circuit-Breaker (RCCB)
FP	Funktionsplan	Function diagram
FPGA	Field Programmable Gate Away	Field Programmable Gate Away
FW	Firmware	Firmware
G		
GB	Gigabyte	Gigabyte
GC	Global-Control-Telegramm (Broadcast-Telegramm)	Global Control Telegram (broadcast telegram)
GSD	Gerätestammdatei: beschreibt die Merkmale eines PROFIBUS-Slaves	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	Hochfrequenz	High Frequency
HFD	Hochfrequenzdrossel	High frequency reactor
HLG	Hochlaufgeber	Ramp-function generator
HMI	Mensch-Maschine-Schnittstelle	Human Machine Interface
HTL	Logik mit hoher Störschwelle	High-Threshold Logic
HW	Hardware	Hardware
I		
i. V.	in Vorbereitung: diese Eigenschaft steht zur Zeit nicht zur Verfügung	In preparation: this feature is currently not available
IBN	Inbetriebnahme	Commissioning
I/O	Eingang/Ausgang	Input/Output
ID	Identifizierung	Identifier
IEC	Internationale Norm in der Elektrotechnik	International Electrotechnical Commission
IF	Interface	Interface
IGBT	Bipolartransistor mit isolierter Steuerelektrode	Insulated Gate Bipolar Transistor
IL	Impulslöschung	Pulse suppression
IP	Internet Protokoll	Internet Protocol
IPO	Interpolatortakt	Interpolator clock

Abbreviation	German	English
IT	Drehstromversorgungsnetz ungeerdet	Insulated three-phase supply network
IVP	Interner Spannungsschutz	Internal Voltage Protection
J		
JOG	Tippen	Jogging
K		
KDV	Kreuzweiser Datenvergleich	Data cross-checking
KIP	Kinetische Pufferung	Kinetic buffering
Kp	Proportionalverstärkung	Proportional gain
KTY	Spezieller Temperatursensor	Special temperature sensor
L		
L	Induktivität	Inductance
LED	Leuchtdiode	Light Emitting Diode
LIN	Linear motor	Linear motor
LR	Lageregler	Position controller
LSB	Niederwertigstes Bit	Least Significant Bit
LSS	Netzschalter	Line Side Switch
LU	Längeneinheit	Length Unit
LWL	Lichtwellenleiter	Fiber-optic cable
M		
M	Masse	Reference potential, zero potential
MB	Megabyte	Megabyte
MCC	Motion Control Chart	Motion Control Chart
MDS	Motordatensatz	Motor Data Set
MLFB	Maschinenlesbare Fabrikatebezeichnung	Machine-readable product designation
MMC	Mensch Maschine Kommunikation	Man-Machine Communication
MSB	Höchstwertigstes Bit	Most Significant Bit
MSCY_C1	Zyklische Kommunikation zwischen Master (Klasse 1) und Slave	Master Slave Cycle Class 1
MSR	Motorstromrichter	Motor side converter (MSC)
MT	Messtaster	Measuring probe
N		
N. C.	Nicht angeschlossen	Not Connected
N...	Keine Meldung oder Interne Meldung	No Report
NAMUR	Normenarbeitsgemeinschaft für Mess- und Regeltechnik in der chemischen Industrie	Standardization association for instrumentation and control in the chemical industry
NC	Öffner	Normally Closed contact
NC	Numerische Steuerung	Numerical Control
NEMA	Normengremium in USA (United States of America)	National Electrical Manufacturers Association
NM	Nullmarke	Zero Mark
NO	Schließer	Normally Open contact
NSR	Netzstromrichter	Line side converter (LSC)

Abbreviation	German	English
O		
OA	Open Architecture	Open Architecture
OEM	Original Equipment Manufacturer	Original Equipment Manufacturer
OLP	Busstecker für Lichtleiter	Optical Link Plug
OMI	Option Module Interface	Option Module Interface
P		
p…	Einstellparameter	Adjustable parameter
PB	PROFIBUS	PROFIBUS
PcCtrl	Steuerungshoheit	Master Control
PD	PROFIdrive	PROFIdrive
PDS	Leistungsteildatensatz	Power unit Data Set
PE	Schutzerde	Protective Earth
PEM	Permanenterregter Synchronmotor	Permanent-magnet synchronous motor
PG	Programmiergerät	Programming terminal
PI	Proportional Integral	Proportional Integral
PID	Proportional Integral Differential	Proportional Integral Differential
PLC	Speicherprogrammierbare Steuerung (SPS)	Programmable Logic Controller
PLL	Phase-Locked Loop	Phase Locked Loop
PN	PROFINET	PROFINET
PNO	PROFIBUS Nutzerorganisation	PROFIBUS user organisation
PPI	Punkt zu Punkt Schnittstelle	Point to Point Interface
PRBS	Weißes Rauschen	Pseudo Random Binary Signal
PROFIBUS	Serieller Datenbus	Process Field Bus
PS	Stromversorgung	Power Supply
PSA	Power Stack Adapter	Power Stack Adapter
PTC	Positiver Temperaturkoeffizient	Positive Temperature Coefficient
PTP	Punkt zu Punkt	Point To Point
PWM	Pulsweitenmodulation	Pulse Width Modulation
PZD	PROFIBUS Prozessdaten	PROFIBUS process data
Q		
R		
r …	Beobachtungsparameter (nur lesbar)	Display parameter (read only)
RAM	Speicher zum Lesen und Schreiben	Random Access Memory
RCCB	Fehlerstrom-Schutzschalter	Residual Current Circuit Breaker
RCD	Fehlerstrom-Schutzschalter	Residual Current Device
RJ45	Norm. Beschreibt eine 8-polige Steckverbindung mit Twisted-Pair Ethernet.	Standard. Describes an 8-pole plug connector with twisted pair Ethernet.
RKA	Rückkühlanlage	Cooling system
RO	Nur lesbar	Read Only
RPDO	Receive Process Data Object	Receive Process Data Object
RS232	Serielle Schnittstelle	Serial Interface
RS485	Norm. Beschreibt die Physik einer digitalen seriellen Schnittstelle.	Standard. Describes the physical characteristics of a digital serial interface.

Abbreviation	German	English
RTC	Echtzeituhr	Real Time Clock
RZA	Raumzeigerapproximation	Space vector approximation (SVA)
S		
S1	Dauerbetrieb	Continuous operation
S3	Aussetzbetrieb	Periodic duty
SBC	Sichere Bremsenansteuerung	Safe Brake Control
SBH	Sicherer Betriebshalt	Safe operating stop
SBR	Sichere Bremsrampe	Safe Brake Ramp
SBT	Sicherer Bremsentest	Safe Brake Test
SCA	Sicherer Nocken	Safe Cam
SDI	Sichere Richtung	Safe Direction
SE	Sicherer Software-Endschalter	Safe software limit switch
SG	Safely Limited Speed	Safely reduced speed
SGA	Sicherheitsgerichteter Ausgang	Safety-relevant output
SGE	Sicherheitsgerichteter Eingang	Safety-related input
SH	Sicherer Halt	Safe standstill
SI	Safety integrated	Safety integrated
SIL	Sicherheitsintegritätsgrad	Safety Integrity Level
SLI	Sicheres Schrittmaß	Safely Limited Increment
SLM	Smart Line Module	Smart Line Module
SLP	Sicher begrenzte Position	Safely-Limited Position
SLS	Sicher begrenzte Geschwindigkeit	Safely-Limited Speed
SLVC	Geberlose Vektorregelung	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	Sicherer Betriebshalt	Safe Operating Stop
SPC	Sollwertkanal	Setpoint Channel
SPS	Speicherprogrammierbare Steuerung	Programmable Logic Controller (PLC)
SS1	Safe Stop 1	Sicherer Stop 1
SS2	Safe Stop 2	Sicherer Stop 2
SSI	Synchron Serielle Schnittstelle	Synchronous Serial Interface
SSM	Sichere Rückmeldung der Geschwindigkeitsüberwachung (n < nx)	Safe Speed Monitor
SSR	Sichere Bremsrampe	Safe Stop Ramp
STO	Sicher abgeschaltetes Moment	Safe Torque Off
STW	PROFIBUS Steuerwort	PROFIBUS control word
T		
TB	Terminal Board	Terminal Board
TIA	Totally Integrated Automation	Totally Integrated Automation
TM	Terminal Module	Terminal Module

Abbreviation	German	English
TN	Drehstromversorgungsnetz geerdet	Grounded three-phase supply network
Tn	Nachstellzeit	Integral time
TPDO	Transmit Process Data Object	Transmit Process Data Object
TT	Drehstromversorgungsnetz geerdet	Grounded three-phase supply network
TTL	Transistor-Transistor-Logik	Transistor-Transistor Logic
U		
UL	Underwriters Laboratories Inc.	Underwriters Laboratories Inc.
USV	Unterbrechungsfreie Stromversorgung	Uninterruptible Power Supply (UPS)
V		
VC	Vektorregelung	Vector Control
Vdc	Zwischenkreisspannung	DC link voltage
VdcN	Teilzwischenkreisspannung negativ	Partial DC link voltage negative
VdcP	Teilzwischenkreisspannung positiv	Partial DC link voltage positive
VDE	Verband Deutscher Elektrotechniker	Association of German Electrical Engineers
VDI	Verein Deutscher Ingenieure	Association of German Engineers
Vpp	Volt Spitze zu Spitze	Volt peak to peak
VSM	Voltage Sensing Module	Voltage Sensing Module
W		
WEA	Wiedereinschaltautomatik	Automatic restart
WZM	Werkzeugmaschine	Machine tool
X		
XML	Erweiterbare Auszeichnungssprache (Standardsprache für Web-Publishing und Dokumentenmanagement)	Extensible Markup Language
Y		
Z		
ZK	Zwischenkreis	DC Link
ZSW	PROFIBUS Zustandswort	PROFIBUS status word

SINAMICS documentation overview (03/2007)

General documentation/Catalogs

SINUMERIK G110	SINAMICS G130 G150	SINAMICS S120	SINAMICS S150
D11.1 Inverter chassis units 0.12 kW to 3 kW	D11 Inverter chassis units Drive converter cabinet units	D21.1 Inverter chassis units 0.12 kW to 1200 kW	D21.3 Drive converter cabinet units 75 kW to 1200 kW

Manufacturer/service documentation

SINAMICS G110	SINAMICS G120	SINAMICS G130	SINAMICS G150	SINAMICS GM150 SM150 GL150
– Getting Started – Operating instructions – List Manual	– Operating instructions – List Manual	– Operating instructions – List Manual	– Operating instructions – List Manual	– Operating instructions – List Manual

Manufacturer/service documentation

SINAMCIS S120	SINAMCIS S120	SINAMICS S150
– Equipment Manual for Control Units and additional system components – Equipment Manual for LT Booksize Power Units – Equipment Manual for Booksize Cold-Plate Power Units – Equipment Manual for LT Chassis Power Units – Equipment Manual for LT Chassis Liquid Cooled Power Units – Equipment Manual Cabinet Modules – Equipment Manual AC Drive	– Getting Started – Commissioning Manual – Commissioning Manual for CANopen – Function Manual Drive Functions – Function Manual Safety Integrated – Operating/Programming Manual DCC – Function Manual DCC – List Manual	– Operating instructions – List Manual

Manufacturer/service documentation

SINAMICS G110/G120/ S120 Motors		
DOCONCD	Configuration Manual Motors	EMC Configuration guidelines

If you come across any misprints in this document, please let us know using this form.
Suggestions for improvement are also welcome.

<table>
<tr><td rowspan="4">On:
SIEMENS AG
A&D MC MS1
Postfach 3180

D-91050 Erlangen, Germany</td><td>From
Name:</td></tr>
<tr><td>Company/dept.</td></tr>
<tr><td>Street:</td></tr>
<tr><td>Zip code: Location:</td></tr>
<tr><td rowspan="2">Telefax.: +49 (0) 9131 / 98 - 63315 (documentation)
mailto:docu.motioncontrol@siemens.com
http://www.siemens.com/automation/service&support</td><td>Telephone: /</td></tr>
<tr><td>Telefax: /</td></tr>
</table>

Suggestions and/or corrections

Index

6SL3097-2AJ00-0BP4

Siemens AG

Automation and Drives
Motion Control Systems
Postfach 3180
91050 ERLANGEN
GERMANY

www.siemens.com/motioncontrol