

Equipment Manual 06/2005 Edition

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SINAMICS S120
Booksize Power Modules

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SINAMICS S120 Equipment Manual for Booksize Power Modules

Manual

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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

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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.

Preface

Information on the SINAMICS S Documentation

The SINAMICS S documentation is divided into the following areas:

- General documentation/catalogs
- Manufacturer/service documentation
- Electronic documentation

This documentation is an integral part of the manufacturer/service documentation developed for SINAMICS. All documents can be obtained separately.

You can obtain detailed information about the documents named in the documentation overview and other documents available for SINAMICS from your local Siemens office.

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.

The contents of this documentation are not part of an earlier or existing agreement, a promise, or a legal agreement, nor do they change this. All obligations entered into by Siemens result from the respective contract of sale that contains the complete and sole valid warranty arrangements. These contractual warranty provisions are neither extended nor curbed as a result of the statements made in this documentation.

Audience

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

Objective

This manual describes the hardware components of the SINAMICS S system. It provides information about installation, electrical connection, and cabinet design.

Technical Information

Hotline

If you have any further questions, please call our hotline:

A&D Technical Support

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Fax: +49 (0) 180 5050 - 223

E-mail: adsupport@siemens.com

Internet: <http://www.siemens.com/automation/support-request>

Please send any questions about the documentation (suggestions for improvement, corrections, and so on) to the following fax number or e-mail address:

Fax: +49 (0) 9131 98 - 63315

E-mail: motioncontrol.docu@erf.siemens.com

Fax form: See feedback page at the end of this publication

Internet Address

Up-to-date information about our products can be found on the Internet at the following address:

<http://www.siemens.com/motioncontrol>

You can find information on SINAMICS S120 at:

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

ESD Notices



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 in ESD areas with conductive flooring may only handle electronic components if:

They are grounded with an ESD wrist band

They are wearing ESD shoes or ESD shoe 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 Guidelines



Danger

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

SINAMICS S equipment must only be commissioned by suitably qualified personnel.

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.

When electrical equipment and motors are operated, the electrical circuits automatically conduct a dangerous voltage.

Dangerous mechanical movements may occur in the system during operation.

All work on the electrical system must be performed after the system has been switched off and disconnected from the power supply.

SINAMICS S equipment with three-phase motors may only be connected to the line system via residual current devices (RCDs) if compatibility of the SINAMICS equipment with the RCD has been ensured as specified in EN 50178, Subsection 5.2.11.2.



Warning

Correct and safe operation of SINAMICS S equipment assumes correct transportation, storage, 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.

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

Caution

As part of routine tests, SINAMICS equipment with three-phase motors will undergo a voltage test in accordance with EN 50178. Before the voltage test is performed on the electrical equipment of industrial machines to EN 60204-1, Section 19.4, all connectors of SINAMICS equipment must be disconnected/unplugged to prevent the equipment from being damaged.

Motors must be connected in accordance with the circuit diagram provided. They must not be connected directly to the three-phase supply because this will damage them.

Note

When operated in dry operating areas, SINAMICS equipment with three-phase motors conforms to low-voltage Directive 73/23/EEC.

SINAMICS equipment with three-phase motors conforms to EMC Directive 89/336/EEC in the configurations specified in the associated EC Certificate of Conformity.

Caution

Operating the equipment in the immediate vicinity (< 1.5 m) of mobile telephones with a transmitter power of > 1 W may lead to incorrect operation.

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System overview

1.1 Field of application

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

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

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

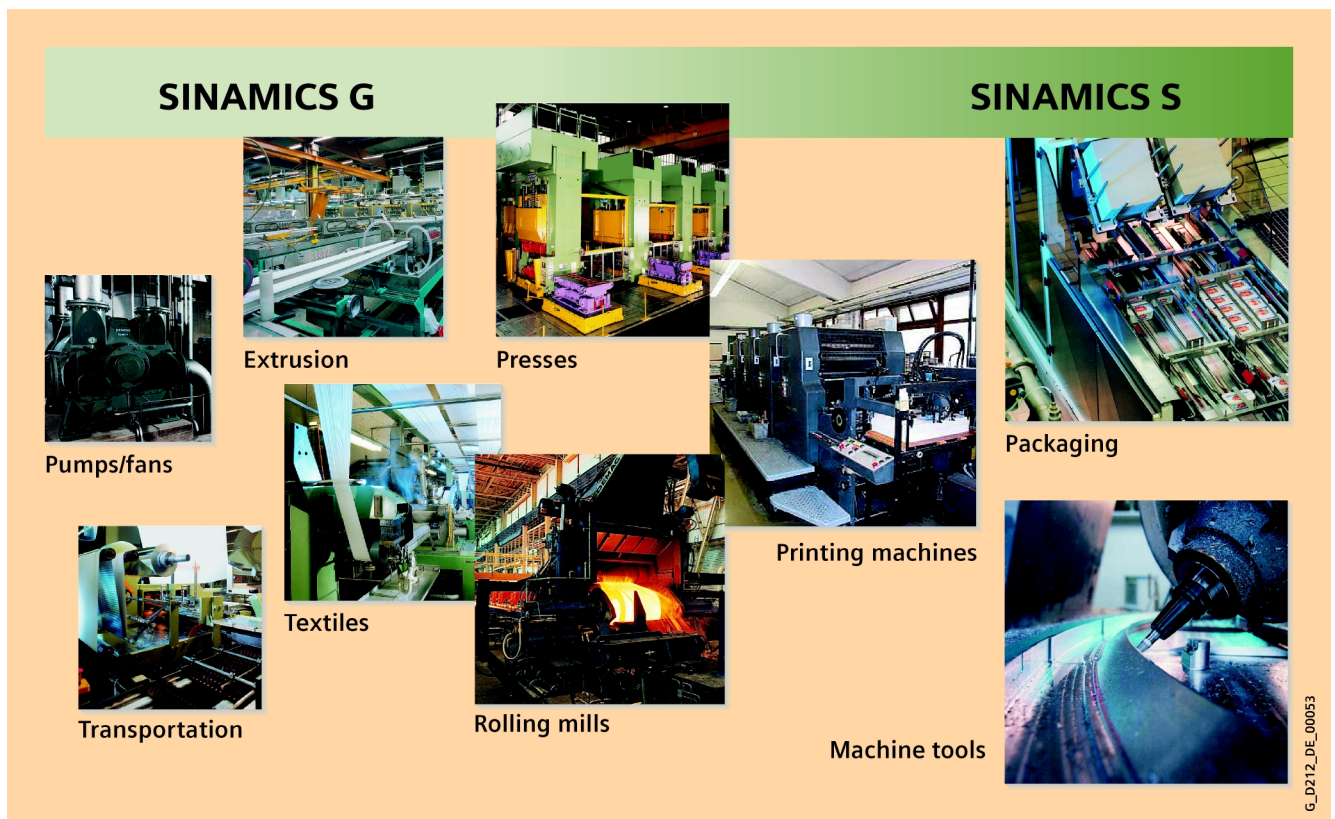


Figure 1-1 SINAMICS applications

1.2 Product variants

SINAMICS offers different versions designed to meet a range of requirements:

- SINAMICS G is designed for standard applications with asynchronous motors. These applications have less stringent requirements regarding the dynamics and accuracy of the motor speed.
- SINAMICS S handles complex drive tasks with synchronous/asynchronous motors and fulfills stringent requirements regarding:
 - Dynamics and accuracy
 - Integration of extensive technological functions in the drive control system

1.3 Platform Concept and Totally Integrated Automation

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

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

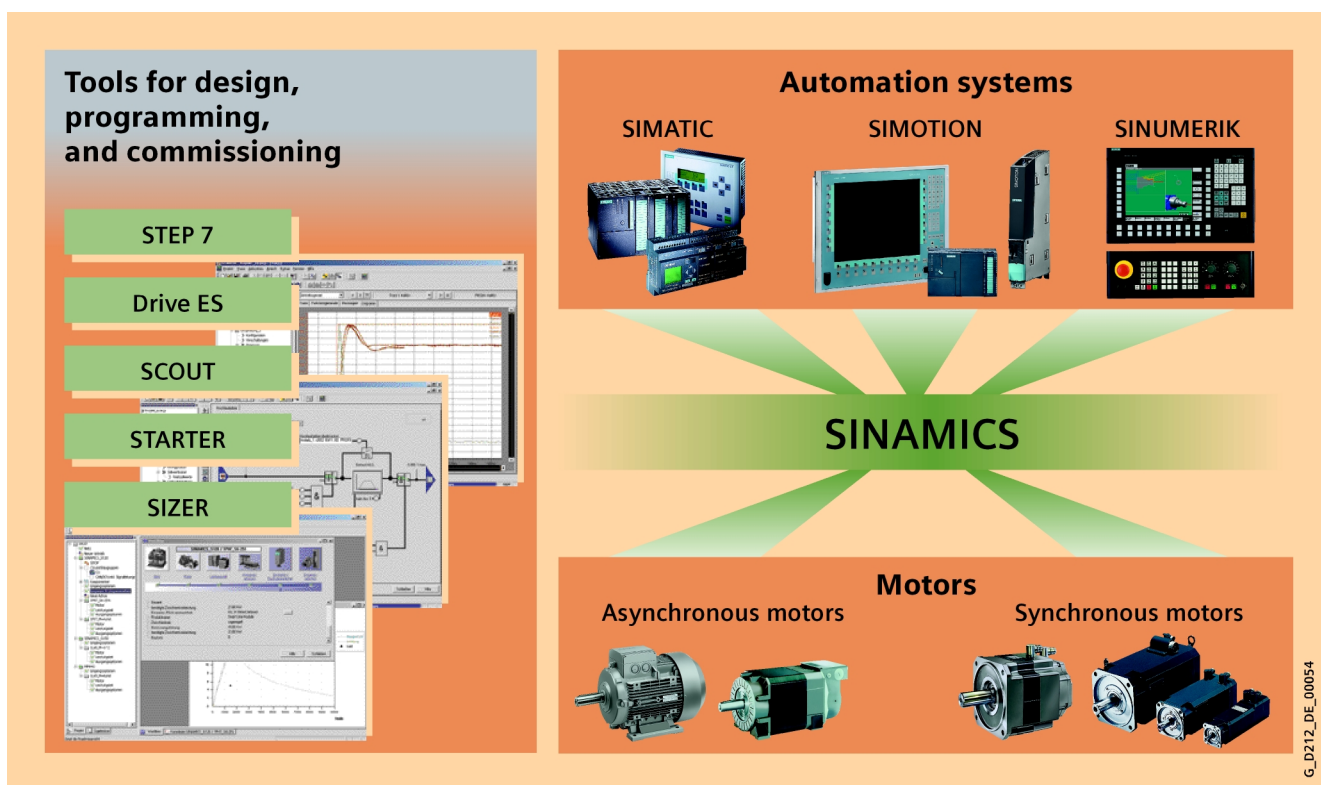


Figure 1-2 SINAMICS as part of the Siemens modular automation system

1.4 Introduction

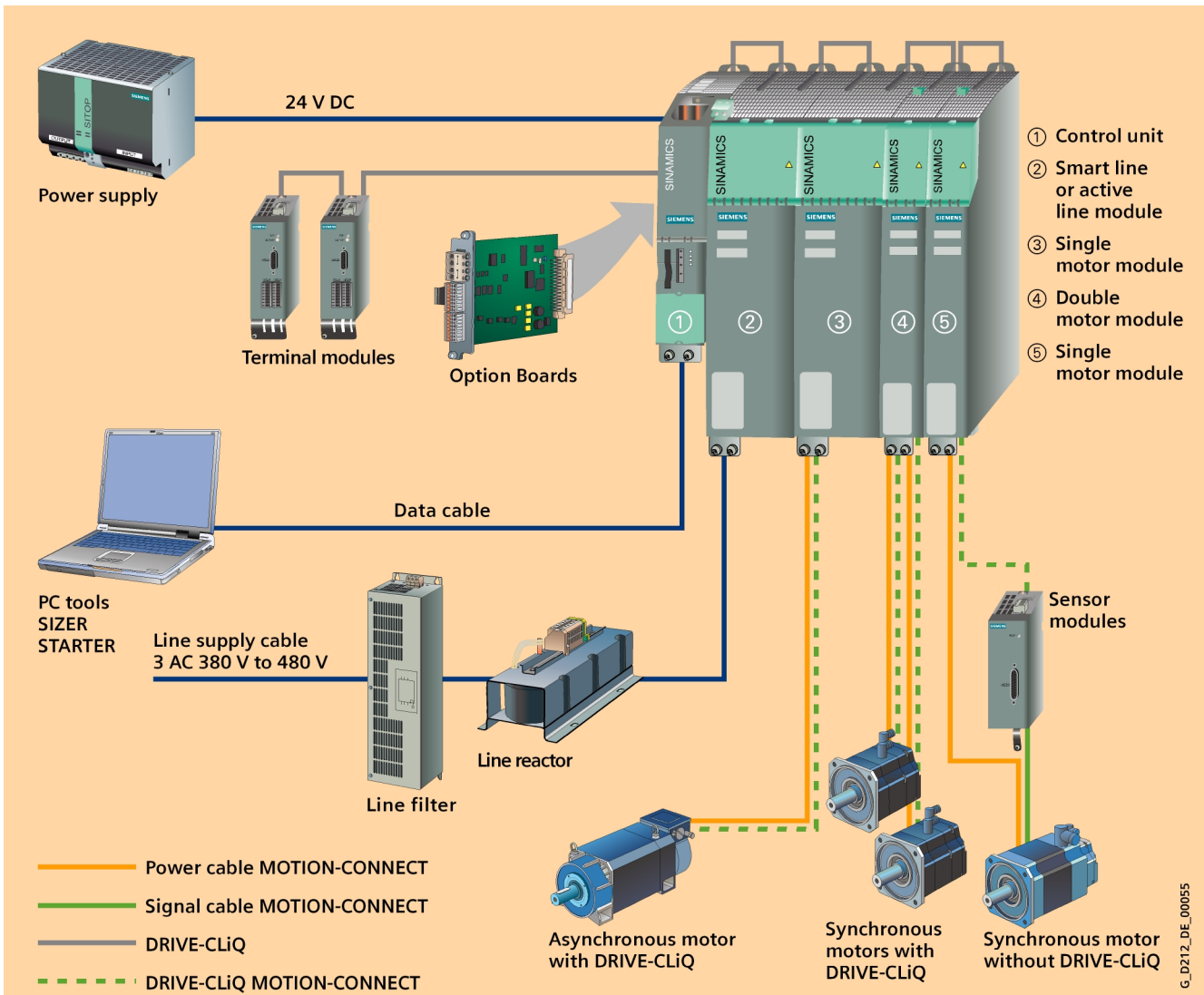


Figure 1-3 SINAMICS S120 System Overview

Modular system for complex drive tasks

SINAMICS S120 solves complex drive tasks for a wide range of industrial applications and is, therefore, designed as a modular system. Users can choose from many different harmonized components and functions to create a solution that best meets their requirements. SIZER, a high-performance configuration tool, makes it easier to choose and determine the optimum drive configuration.

SINAMICS S120 is enhanced by a wide range of motors. Whether synchronous or asynchronous, all motor types are supported by SINAMICS S120.

Drive for multi-axis applications

The trend towards separate axes in mechanical engineering is growing all the time. Where possible, central drives are being replaced by electronically coordinated servo drives. These require drives with a connected DC link, which allows cost-saving energy balancing between braking and driving axes.

SINAMICS S120 features infeeds and inverters that cover a large power range, are designed for seamless integration, and enable space-saving, multi-axis drive configurations.

New system architecture with a central control unit

Electronically coordinated individual drives work together to perform your drive tasks. Higher-level controllers operate the drives to achieve the required coordinated movement. This requires cyclic data exchange between the controller and all the drives. This exchange always had to take place via a field bus, which required a great deal of time and effort for installation and configuration. SINAMICS S120 takes a different approach. A central control unit controls the drive for all connected axes and also establishes the technological links between the axes. Since all the required data is stored in the central control unit, it does not need to be transferred. Cross-axis connections can be established within a control unit and easily configured in the STARTER commissioning tool using a mouse.

Simple technological tasks can be carried out automatically by the SINAMICS S120 control unit. For complex numerical or motion-control tasks, high-performance SINUMERIK or SIMOTION D modules are used instead.

DRIVE-CLiQ – a digital interface between all components

All SINAMICS S120 components, including the motors and encoders, are interconnected via a joint serial interface called DRIVE-CLiQ. The standardized cables and connectors reduce the variety of different parts and cut storage costs.

Converter boards for converting standard encoder signals to DRIVE-CLiQ are available for third-party motors or retrofit applications.

Electronic type plates in all components

All SINAMICS S120 components have an electronic type plate that contains all the relevant data about that particular component. In the motors, for example, this data includes the parameters of the electric equivalent circuit diagram and characteristic values for the in-built motor encoder. The control unit records this data automatically via DRIVE-CLiQ so that it does not need to be entered during commissioning or if the equipment is replaced.

In addition to the technical data, the type plate includes logistical data (manufacturer ID, order number, and globally unique ID). Since this data can be called up electronically on site or remotely, all the components used in a machine can always be individually identified, which helps simplify servicing.

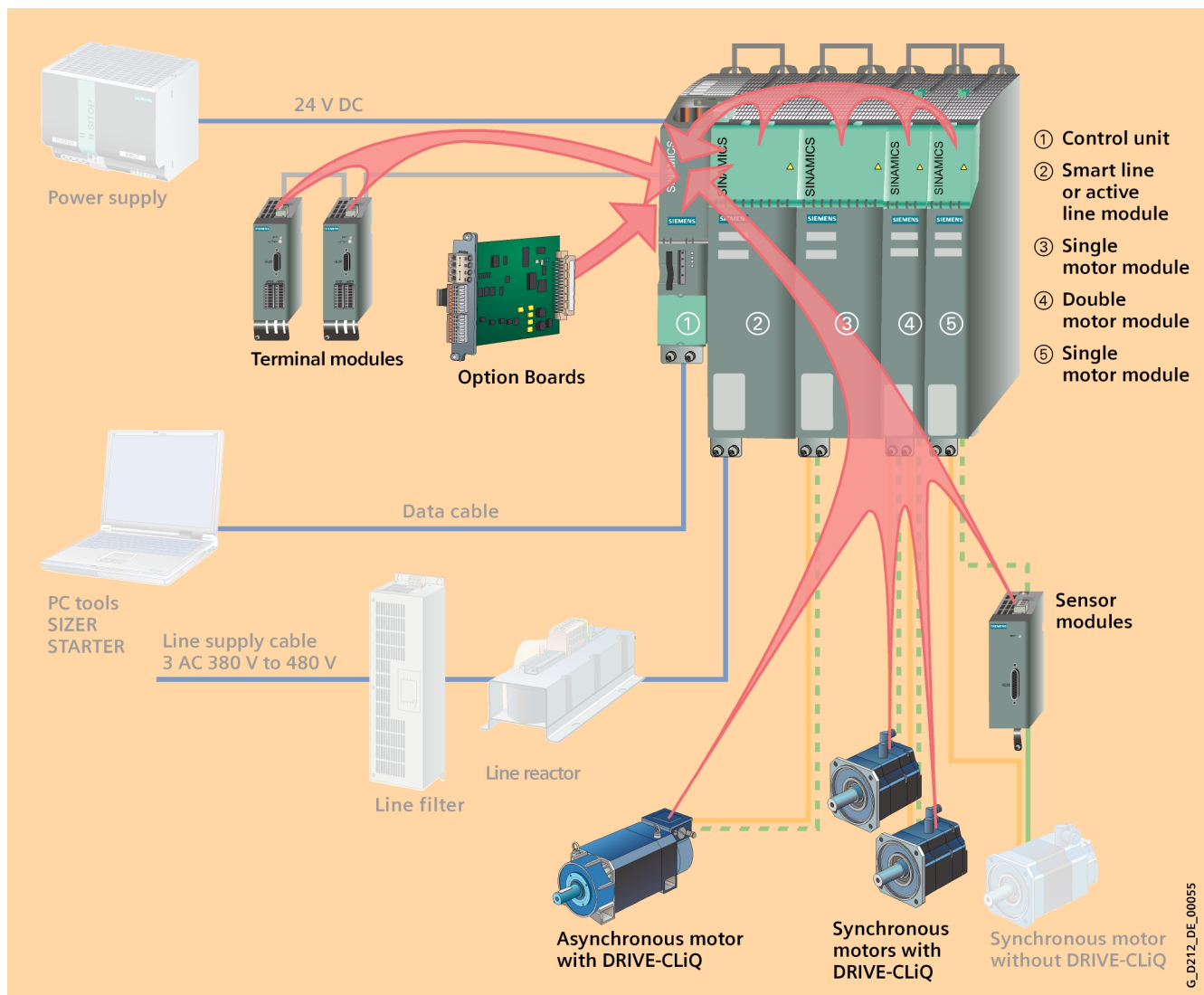
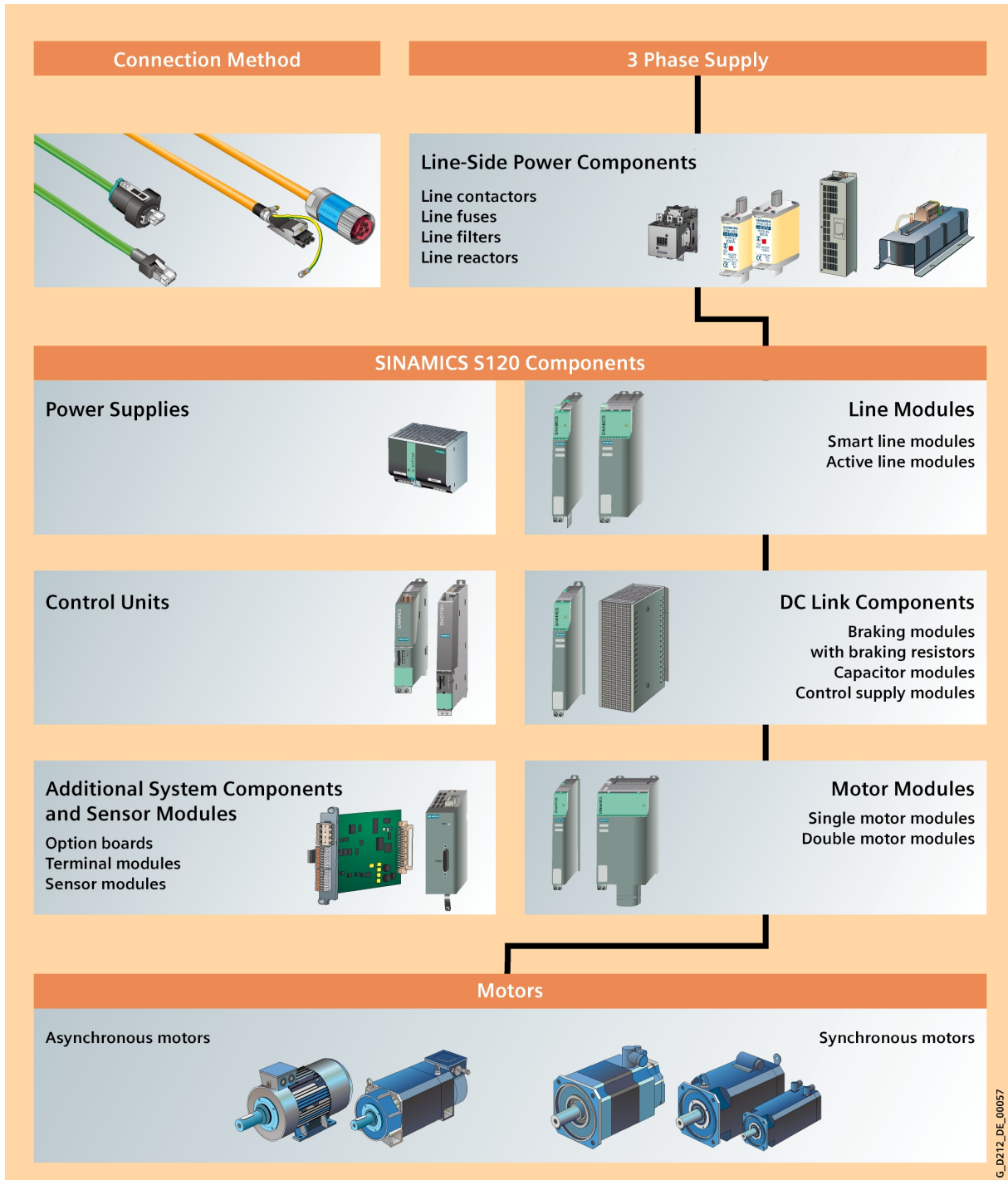


Figure 1-4 The electronic type plate for SINAMICS S120

1.5 SINAMICS S120 Components

This overview features the SINAMICS S120 components that are primarily used for multi-axis drive tasks.



G_D212_DE_00057

Figure 1-5 SINAMICS S120 component overview

The following power components are available:

- Line-side power components, such as fuses, contactors, reactors, and filters for switching the power supply and meeting EMC requirements.
- Line modules, which supply power centrally to the DC link.
- DC link components (optional), which stabilize the DC link voltage.
- Motor modules, which act as inverters, receive power from the DC link, and supply the connected motors.

To carry out the required functions, SINAMICS S120 is equipped with:

- A control unit that carries out all drive and technological functions across all axes.
- Additional system components that enhance functionality and offer different interfaces for encoders and process signals.

The SINAMICS S120 components were developed for installation in cabinets. They have the following features and characteristics:

- Easy to handle, simple installation and wiring
- Practical connection system, cable routing in accordance with EMC requirements
- Standardized design, seamless integration
- Internal ventilators (other cooling methods available on request).

1.6 Power Sections

Line modules

Convert the three-phase supply into a DC voltage for the DC link.

- Smart line modules

The smart line modules generate a non-stabilized DC link voltage and are capable of regenerative feedback.

- Active line modules

The active line modules generate a stabilized DC link voltage and are capable of regenerative feedback.

Motor modules

- Convert energy from the DC link for the connected motors with variable voltage and variable frequency.

1.7 System Data

Technical Specifications

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

Electrical specifications	
Line connection voltage	3 AC 380 V to 480 V $\pm 10\%$ (-15 % < 1 min)
Line frequency	47 – 63 Hz
Electronics power supply	24 V DC, -15/+20 %*
Conducted radio interference	No conducted radio interference Class A1 to EN 55011
<ul style="list-style-type: none"> • Standard • With line filter 	
Overvoltage category	Class III to EN 60 664-1

* If a motor holding brake is used, restricted voltage tolerances may have to be taken into account.

Modules	
Line Modules in booksize format	
<ul style="list-style-type: none"> • Rated supply voltage 	3AC 380 V
Active Line Modules in booksize format	
<ul style="list-style-type: none"> • Rated pulse frequency 	8 kHz
Motor Modules in booksize format	
<ul style="list-style-type: none"> • DC link connection voltage • Rated pulse frequency 	510 V DC to 750 V DC 4 kHz

Ambient conditions	
The Safety-Integrated safety function:	
The components must be protected against conducted contamination (e.g. by installing them in a cabinet with degree of protection IP54). Provided that conducted interference can be prevented at the installation site, the degree of protection for the cabinet can be decreased accordingly.	
Degree of protection	IP20 to EN 60 529
Protection class	Class I (with protective conductor system) and Class III (PELV) to EN 61 800-5-1
Permissible ambient and coolant temperature (air) during operation for line-side components, Line Modules and Motor Modules	0°C to 40 °C without derating, >40°C to +55 °C (see derating characteristics)
Permissible ambient and coolant temperature (air) during operation for DC link components	0 °C to +55 °C

Information on storage, transportation and operation:	
Environmental class <ul style="list-style-type: none"> • Storage • Transportation • Operation 	Class 1C2 to EN 60 721-3-1 Class 2C2 to EN 60 721-3-2 Class 3C2 to EN 60 721-3-3
Organic/biological influences <ul style="list-style-type: none"> • Storage • Transportation • Operation 	Class 1B1 to EN 60 721-3-1 Class 2B1 to EN 60 721-3-2 Class 3B1 to EN 60 721-3-3
Vibratory load <ul style="list-style-type: none"> • Transportation • Operation 	EN 60 721-3-2, class 2M3 EN 60 721-3-3, class 3M4
Shock load <ul style="list-style-type: none"> • Transportation • Operation 	EN 60 721-3-2, class 2M3 EN 60 721-3-3, class 3M3
Climatic ambient conditions <ul style="list-style-type: none"> • Storage • Transportation • Operation 	Class 1K3 to EN 60 721-3-1 Temperature: -40 °C to +70 °C Class 2K4 to EN 60 721-3-2 Temperature: -40 °C to +70 °C Max. humidity: 95 % at 40 °C Class 3K3 to EN 60 721-3-3 Relative air humidity 5 to 65 % (annual average, ≤ 80 % above the maximum for 2 months a year. Avoid splashing water and do not allow condensation or ice to form (EN 60 204, Part 1)
Degree of contamination	2 to EN 60 664-1
Installation altitude	Up to 1,000 m above sea level without derating, >1,000 m to 5,000 m above sea level (see derating characteristics)

Approbation	
Certification	CE (low-voltage and EMC Directives), cULus (file pos.: E192450, E164110, E70122, and E214113)

Line Connection Booksize

2.1 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
 - Wideband Line Filter for Active Line Modules
 - Line filters for Smart Line Modules
- Line reactor variants:
 - Line reactors for Active Line Modules
 - Line reactors for Smart Line Modules

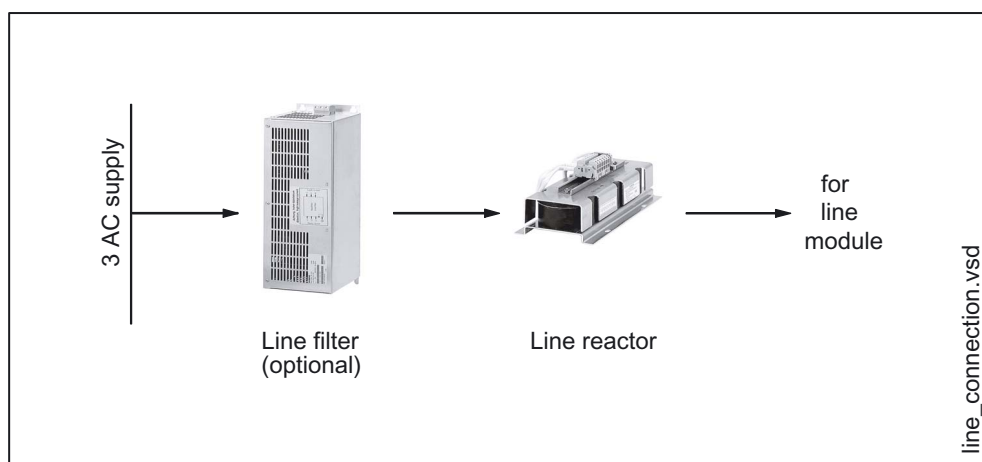


Figure 2-1 Overview diagram: line connection

Note

The limit values for the radio interference voltage are only observed when the line filter is used (class A1 to EN 55011).

Caution

The following can occur if line filters are used that have not been approved for SINAMICS 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.
-

2.2 Overview: line filters

In conjunction with a line reactor and an EMC-compliant plant configuration, line filters limit the electromagnetic emissions from the Power Modules to the limit values of class A1 to EN 55011.

Optional line filter rows that are coordinated with the power range are also available with the SINAMICS S120 converter system. These line filters differ with regard to the frequency range in which they reduce the conducted emissions.

Basic Line Filter for Active Line Modules

Basic Line Filters function in the frequency range from 150 kHz to 30 MHz. Above all, this protects the radio services.

Wideband Line Filter for Active Line Modules

Wideband Line Filters also function in the frequency range from 2 kHz to 150 kHz. They help reduce low-frequency line reactions, which protects consumers (e.g. electronic devices) against functional impairments and damage when they are operated on the same network.

Line filters for Smart Line Modules

Line filters for Smart Line Modules function in the frequency range from 150 kHz to 30 MHz. Above all, this protects the radio services.

Table 2-1 Overview

	Order number
Basic Line Filter for Active Line Modules	
16 kW	6SL3000-0BE21-6DAx
36 kW	6SL3000-0BE23-6DAx
55 kW	6SL3000-0BE25-5DA0
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
Line filters for Smart Line Modules	
5 kW	6SL3000-0HE15-0AAx
10 kW	6SL3000-0HE21-0AAx
16 kW	6SL3000-0BE21-6DAx
36 kW	6SL3000-0BE23-6DAx

2.3 Basic Line Filter for Active Line Modules

2.3.1 Description

The Basic Line Filter for Active Line Modules are designed for use in machines in which the conducted interference in the frequency range is to be reduced in accordance with EMC regulations. The machine manufacturer must carry out EMC-compliant CE certification for the product before it is implemented.

General conditions regarding Basic Line Filters for Active Line Modules

The firm that puts the machine on the market takes full responsibility for ensuring CE EMC conformity and that the Basic Line Filter is used correctly. The machine manufacturer (OEM) must have the machine conformity confirmed.

The Basic Line Filters can be used in accordance with the following general conditions for ensuring CE conformity with regard to conducted 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).

2.3.2 Safety information



Caution

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



Danger

The 100 mm clearances above and below the components must be observed. The mounting position must ensure that cool air flows vertically through the filter. This measure prevents thermal overloading of the filter.

Caution

The terminals must be correctly connected:

Incoming line cable to LINE/NETZ L1, L2, L3

Outgoing cable to line reactor on LOAD/LAST L1', L2', L3'.

Non-observance may damage the line filter.



Caution

The line filters listed conduct a high leakage current via the PE conductor. Because of the high leakage current of the line filters, a permanent PE connection of the line filter or switching cabinet is required.

Measures according to EN 61800-5-1 must be taken (e.g. PE conductor ($\geq 10\text{mm}^2$ Cu) or fit an additional connection terminal for a PE conductor with the same cross-section as the original PE conductor).



Warning

A hazardous voltage will be present at the terminals for a further 5 minutes after the system has been shutdown.

Note

If a high-potential test is conducted with alternating voltage in the system, the line filters must be disconnected to obtain correct measurement results.

Caution

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

2.3.3 Interface Description

2.3.3.1 Overview

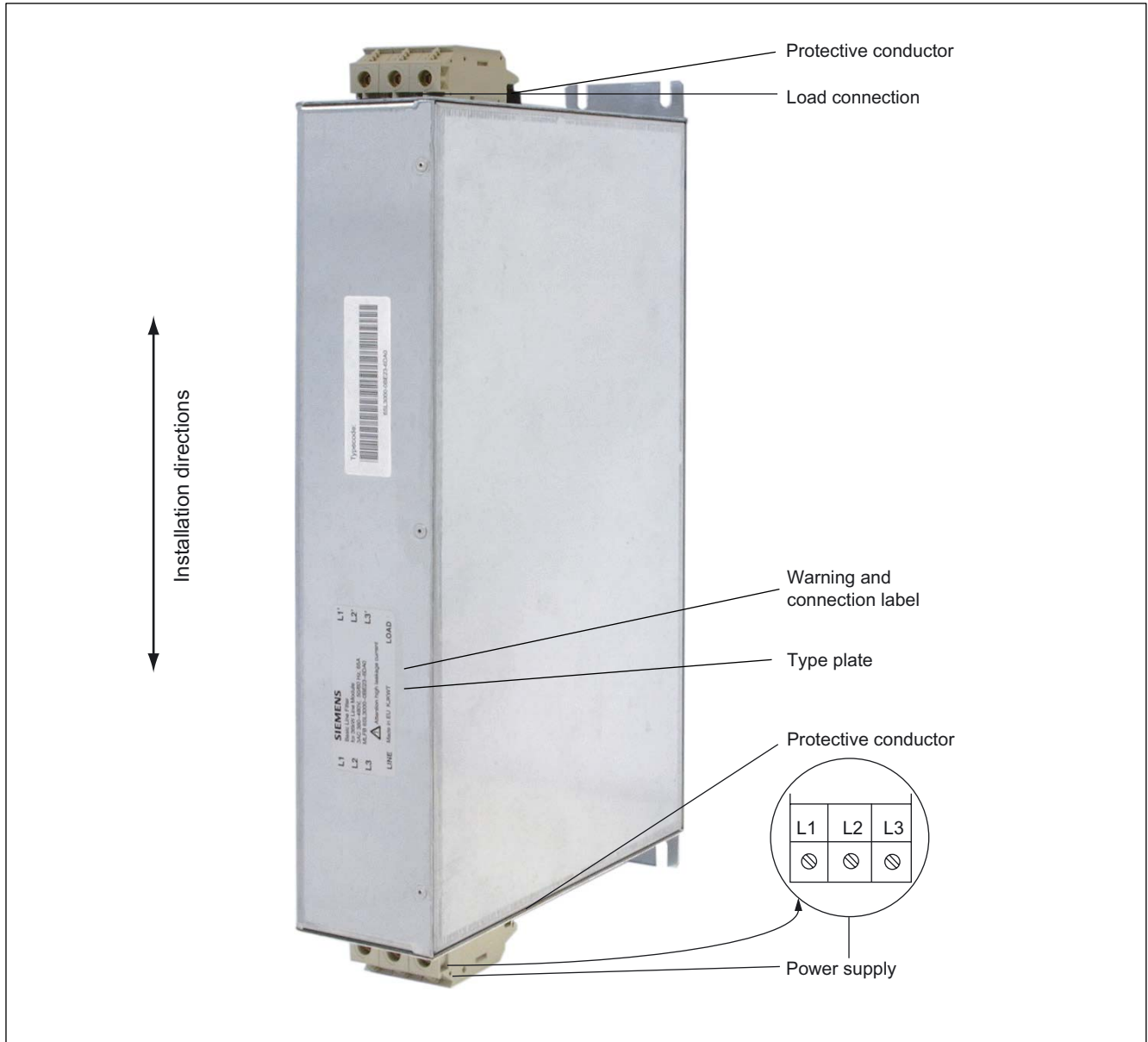


Figure 2-2 Basic Line Filter for Active Line Modules (example: 36 kW)

2.3.3.2 Line/load connection

The Basic Line Filter for Active Line Modules is rated for a voltage range of 380 V 3AC -10% to 480 V 3AC +10% (-15% <1 min) at 47 Hz to 63 Hz.

Table 2-2 Type of connection

Terminals	Designations
Line connection (line)	L1, L2, L3, PE
Load connection (load)	L1', L2', L3', PE
Basic Line Filter for Active Line Modules	
16 kW	Screw terminal: 10 mm ² 3-pin/1.5 Nm (see Screw Terminals) PE connection: M6/3 Nm ¹⁾
36 kW	Screw terminal: 35 mm ² PE connection: M6/3 Nm ¹⁾
55 kW	Screw terminal: 50 mm ² PE connection: M6/3 Nm ¹⁾
1) for ring cable lugs to DIN 46234	

2.3.4 Dimension Drawing

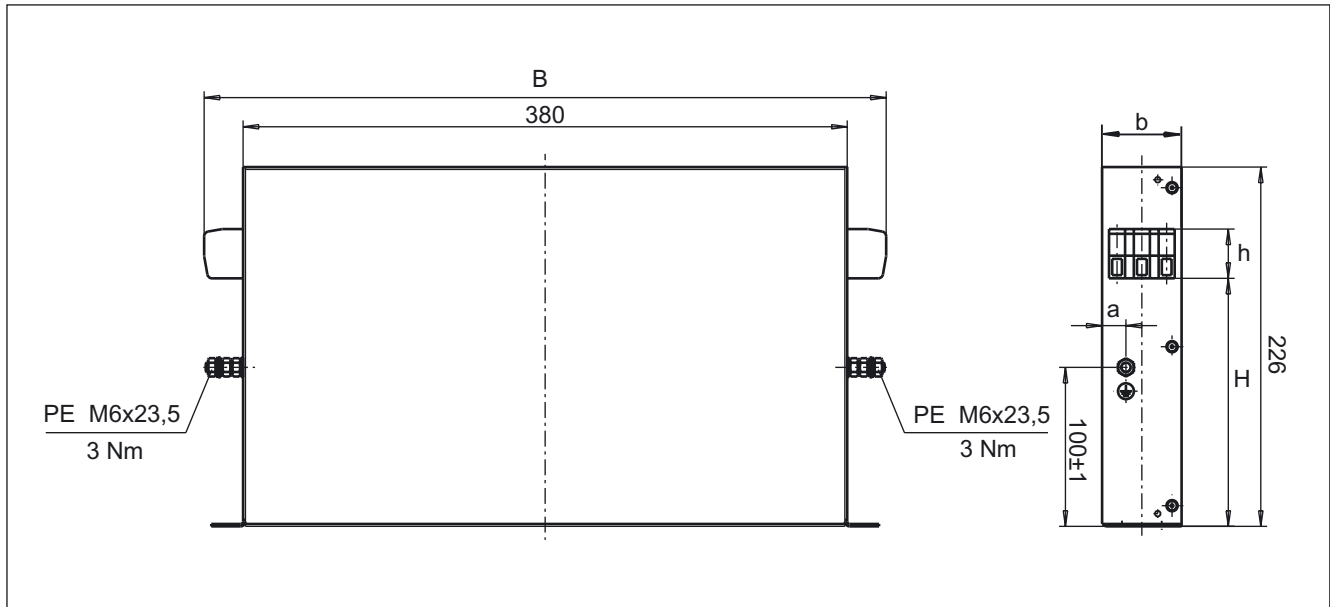


Figure 2-3 Dimension drawing: Basic Line Filter for Active Line Modules (16 kW to 55 kW)

Table 2-3 Dimensions: Basic Line Filter for Active Line Modules

Basic Line Filter	Order number	B [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)
55 kW	6SL3000-0BE25-5DA0	466 (18.34)	100 (3.93)	15 (0.59)	148 (5.82)	54 (2.12)

2.3.5 Technical Specifications

Table 2-4 Technical specifications: Basic Line Filter for Active Line Modules

	6SL3000 unit	0BE21-6DA0	0BE23-6DA0	0BE25-5DA0
Rated power	kW	16	36	55
Connection voltage: Supply voltage Line frequency	V _{AC} Hz	3AC 380 -10% to 3AC 480 +10% (-15% < 1 min) 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.

2.4 Wideband Line Filter for Active Line Modules

2.4.1 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).

With these line filters, the limit values in accordance with EN 55011, Class A for devices in group 1 are observed.

The total cable length must be less than 350 m (motor cables, power supply cable between line filter and Line Module).

2.4.2 Safety information



Caution

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



Danger

The 100 mm clearances above and below the components must be observed. The mounting position must ensure that cool air flows vertically through the filter. This measure prevents thermal overloading of the filter.

Caution

The terminals must be correctly connected:

Incoming line cable to LINE/NETZ L1, L2, L3

Outgoing cable to the line reactor to LOAD/LAST U, V, W

Non-observance may damage the line filter.



Caution

The line filters listed conduct a high leakage current via the PE conductor. Because of the high leakage current of the line filters, a permanent PE connection of the line filter or switching cabinet is required.

Measures according to EN 61800-5-1 must be taken (e.g. PE conductor ($\geq 10\text{mm}^2$ Cu) or fit an additional connection terminal for a PE conductor with the same cross-section as the original PE conductor).



Warning

A hazardous voltage will be present at the terminals for a further 5 minutes after the system has been shutdown.

Note

If a high-potential test is conducted with alternating voltage in the system, the line filters must be disconnected to obtain correct measurement results.

Caution

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

2.4.3 Interface description

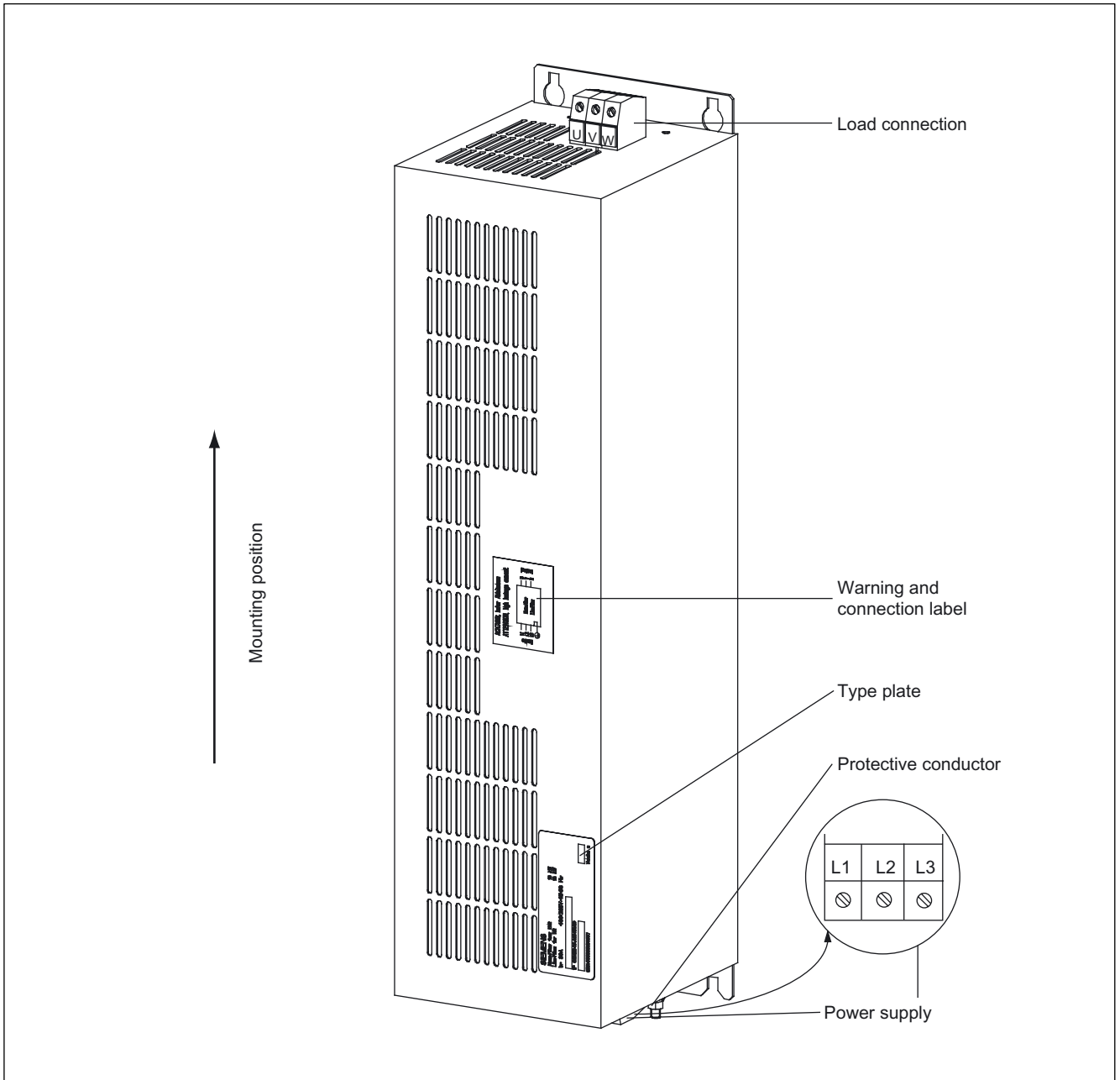


Figure 2-4 Wideband Line Filters for Active Line Module (example: 16kW)

2.4 Wideband Line Filter for Active Line Modules

2.4.3.1 Line/load connection

A Wideband Line Filter for Active Line Modules is rated for a voltage range of 380 V 3AC -10% to 480 V 3AC +10% (-15% <1 min) at 47 Hz to 63 Hz.

Table 2-5 Type of connection

Terminals	Designations
Line connection (line)	L1, L2, L3, PE
Load connection (load)	U, V, W
Wideband Line Filter for Active Line Modules	
16 kW	Screw terminal: 10 mm ² 3-pin/1.5 Nm (see Screw Terminals) Ground stud: M5/3 Nm ¹⁾
36 and 55 kW	Screw terminal: 50 mm ² 3-pin/6 Nm (see Screw Terminals) Ground stud: M8/13 Nm ¹⁾
80 kW	Screw terminal: 95 mm ² 3-pin/15 Nm (see Screw Terminals) Ground stud: M8/13 Nm ¹⁾
120 kW	Connection strap: d = 11 mm (M10/25 Nm) Ground stud: M8/13 Nm ¹⁾ Note: No shock-hazard protection (IP00)
1) for ring cable lugs to DIN 46234	

2.4.4 Dimension drawing

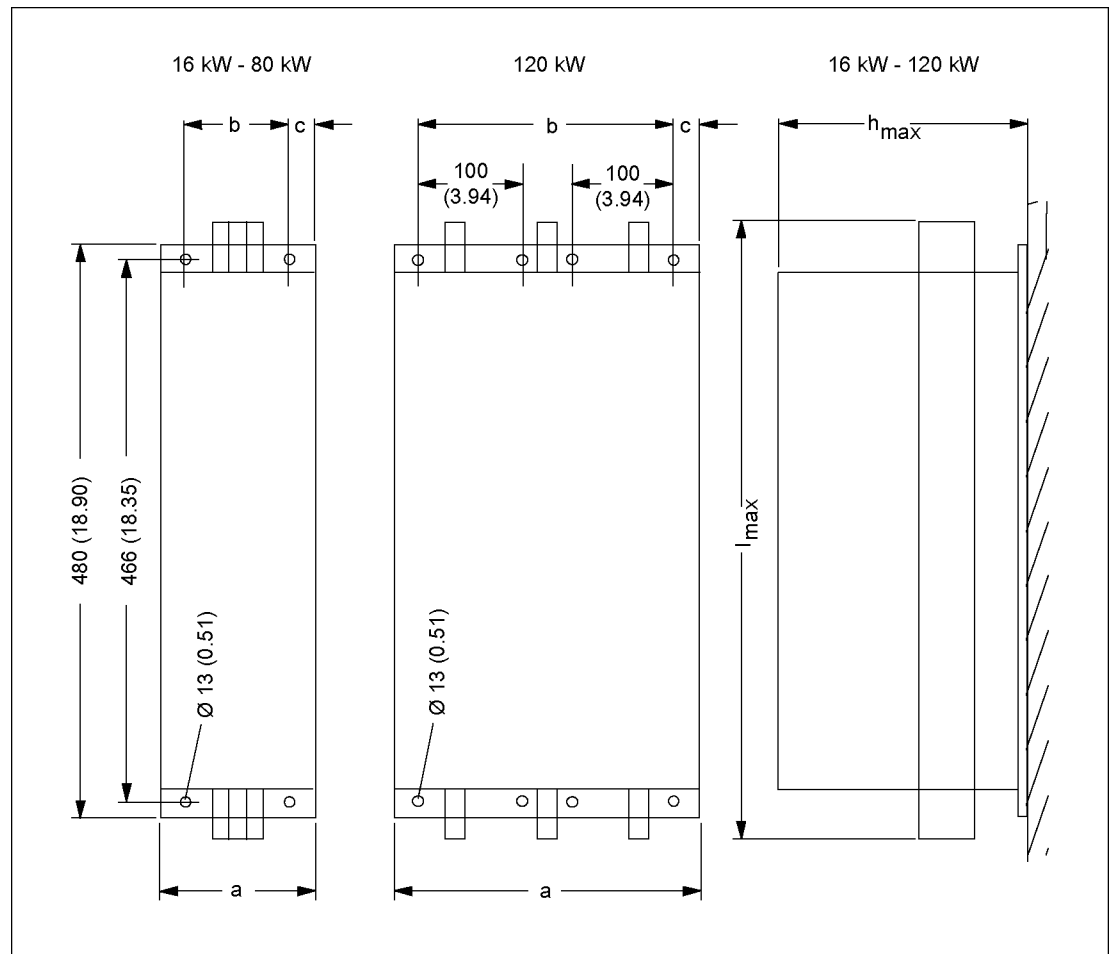


Figure 2-5 Dimension drawing: Wideband Line Filter for Active Line Modules

Table 2-6 Dimensions: Wideband Line Filter

For Active Line Modules	Order number 6SL3000-	a [mm] (inches)	b [mm] (inches)	c [mm] (inches)	h _{max} [mm] (inches)	l _{max} [mm] (inches)
16 kW	0BE-21-6AAx	130 (5.12)	100 (3.94)	15 (0.59)	150 (5.91)	489 (19.25)
36 kW	0BE-23-6AAx	130 (5.12)	100 (3.94)	15 (0.59)	245 (9.65)	526 (20.71)
55 kW	0BE-25-5AAx	130 (5.12)	100 (3.94)	15 (0.59)	260 (10.24)	526 (20.71)
80 kW	0BE-28-0AAx	200 (7.87)	150 (5.91)	25 (0.98)	260 (10.24)	539 (21.22)
120 kW	0BE-31-2AAx	300 (11.81)	250 (9.84)	25 (0.98)	260 (10.24)	530 (20.87)

2.4.5 Technical Specifications

Table 2-7 Technical specifications: Wideband Line Filter for Active Line Modules

	6SL3000 unit	0BE21-6AA0	0BE23-6AA0	0BE25-5AA0	0BE28-0AA0	0BE31-2AA0
Rated power	kW	16	36	55	80	120
Connection voltages: Supply voltage Line frequency	V _{AC} Hz	3AC 380 -10% to 3AC 480 +10% (-15% < 1 min) 47 to 63 Hz				
Rated current	A _{AC}	30	67	103	150	225
Power loss ¹	W	70	90	110	150	200
Weight	kg	9	16	19	22	32

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

2.5 Line filters for Smart Line Modules

2.5.1 Description

The line filters for Smart Line Modules are designed for use in machines in which the conducted interference in the frequency range is to be reduced in accordance with EMC regulations. The machine manufacturer must carry out EMC-compliant CE certification for the product before it is implemented.

General conditions regarding line filters for Smart Line Modules

- In conjunction with the line filters and the associated line reactors, drive line-ups with Basic Line Modules fulfill the requirements of limit value class A1 to EN55011.
- The total cable length is ≤ 350 m.

2.5.2 Safety information



Caution

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



Danger

The 100 mm clearances above and below the components must be observed. The mounting position must ensure that cool air flows vertically through the filter. This measure prevents thermal overloading of the filter.

Caution

The terminals must be correctly connected:

Incoming line cable to LINE/NETZ L1, L2, L3

Outgoing cable to line reactor on LOAD/LAST L1', L2', L3'.

Non-observance may damage the line filter.



Caution

The line filters listed conduct a high leakage current via the PE conductor. Because of the high leakage current of the line filters, a permanent PE connection of the line filter or switching cabinet is required.

Measures according to EN 61800-5-1 must be taken (e.g. PE conductor ($\geq 10\text{mm}^2$ Cu) or fit an additional connection terminal for a PE conductor with the same cross-section as the original PE conductor).



Warning

A hazardous voltage will be present at the terminals for a further 5 minutes after the system has been shutdown.

Note

If a high-potential test is conducted with alternating voltage in the system, the line filters must be disconnected to obtain correct measurement results.

Caution

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

2.5.3 Interface description

2.5.3.1 Overview

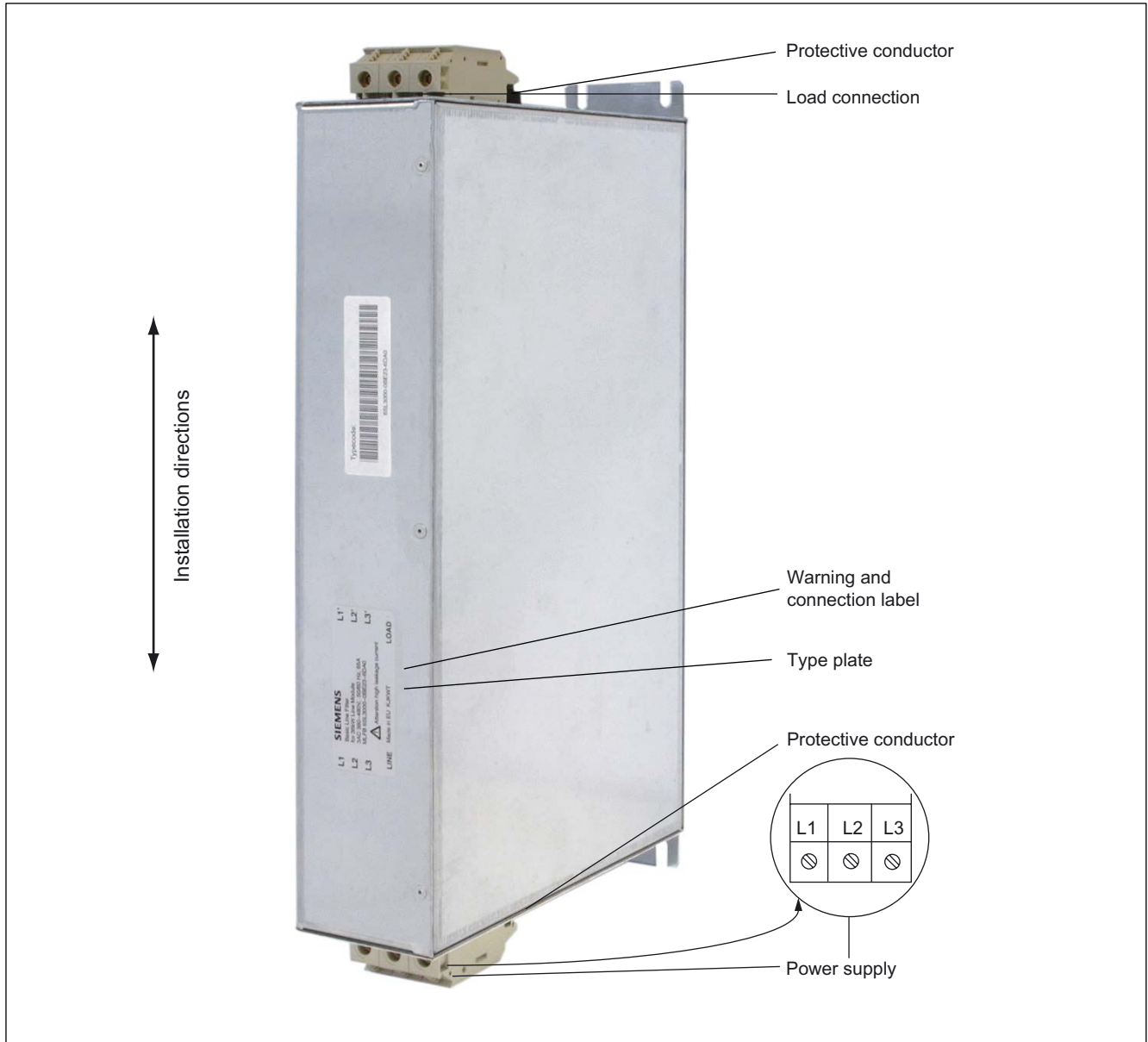


Figure 2-6 Line filters for Smart Line Modules (example: 36 kW)

2.5.3.2 Line/load connection

Line filters for Smart Line Modules are rated for a voltage range from 380 V 3AC -10% to 480 V 3AC +10% (-15% <1 min) at 47 Hz to 63 Hz.

Table 2-8 Type of connection

Terminals	Designations
Line connection (line)	L1, L2, L3, PE
Load connection (load)	L1', L2', L3', PE
Line filters for Smart Line Modules	
5 kW	Screw terminal: 10 mm ² 3-pin/1.5 Nm (see Screw Terminals) Ground stud: M6/4.8 Nm ¹⁾
10 kW	Screw terminal: 10 mm ² 3-pin/1.5 Nm (see Screw Terminals) Ground stud: M6/4.8 Nm ¹⁾
16 kW	Screw terminal: 10 mm ² 3-pin/1.5 Nm (see Screw Terminals) Ground stud: M6/3 Nm ¹⁾
36 kW	Screw terminal: 35 mm ² Ground stud: : M6/3 Nm ¹⁾
1) for ring cable lugs to DIN 46234	

2.5.4 Dimension Drawings

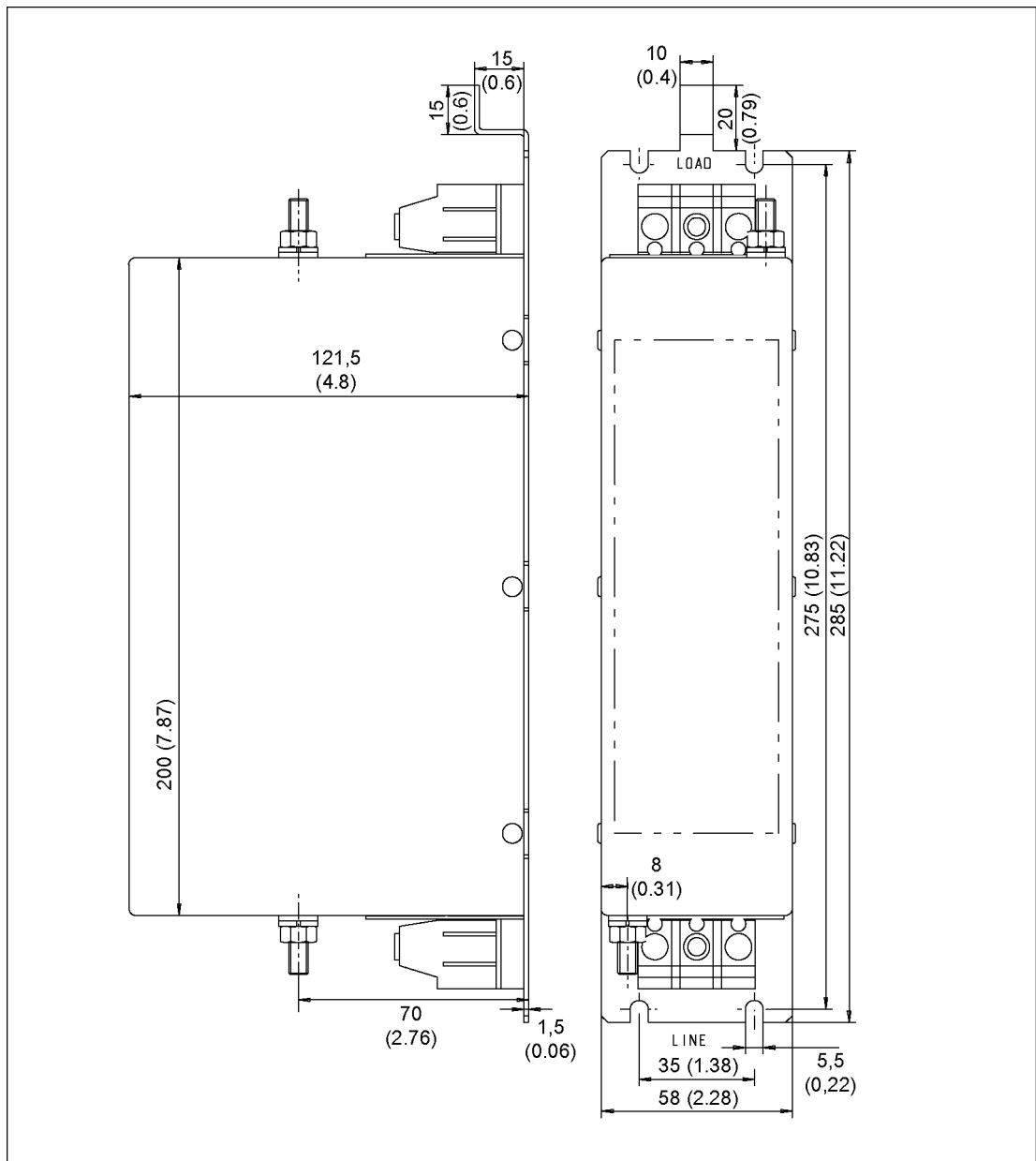


Figure 2-7 Dimension drawing: line filter for Smart Line Modules (5 and 10 kW)

Table 2-9 Line filters for Smart Line Modules

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

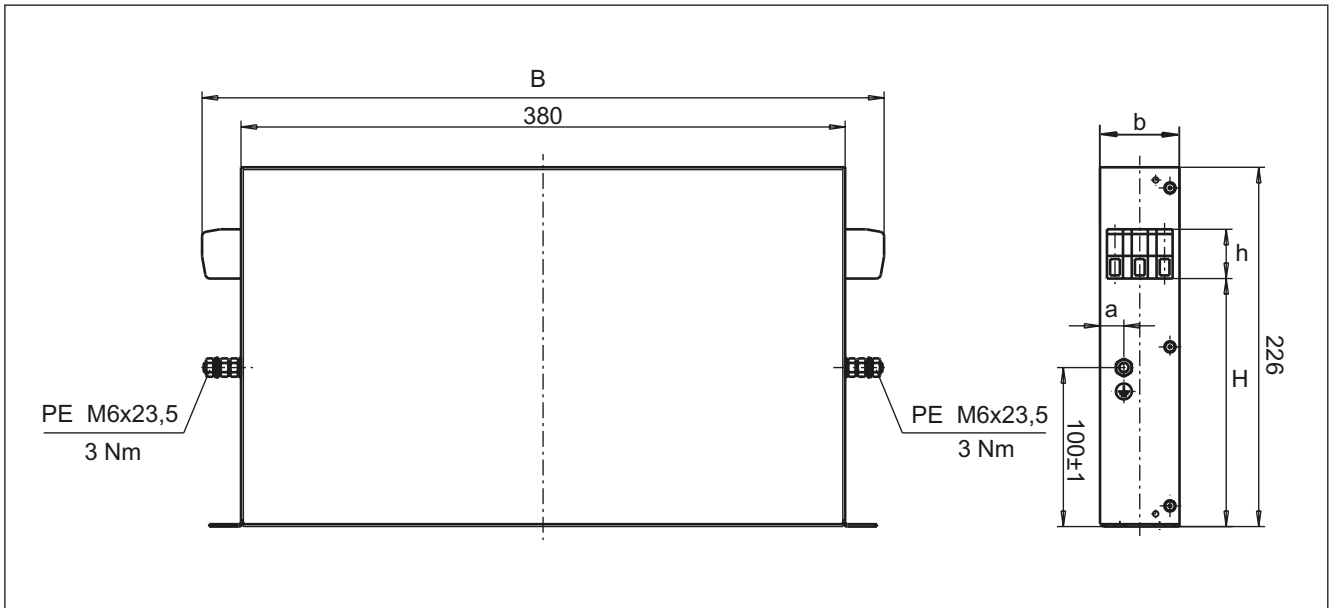


Figure 2-8 Dimension drawing: line filters for Smart Line Modules (16 kW and 36 kW)

Table 2-10 Dimension: line filters for Smart Line Modules

Line filters for Smart Line Modules	Order number	B [mm] (inches)	b [mm] (inches)	a [mm] (inches)	H [mm] (inches)	h [mm] (inches)
16 kW	6SL3000-0BE21-6DAx	429 (16.88)	41,3 (1.62)	15 (0.59)	156 (6.14)	31 (1.22)
36 kW	6SL3000-0BE23-6DAx	433 (17.07)	48 (1.88)	15 (0.59)	135 (5.31)	68 (2.67)

2.5.5 Technical Specifications

Table 2-11 Technical specifications of line filters for Smart Line Modules

	6SL3000-unit	0HE15-0AA0	0HE21-0AA0	0BE21-6DA0	0BE23-6DA0
Rated power	kW	5	10	16	36
Connection voltage: Supply voltage Line frequency	V _{AC} Hz	3AC 380 -10% to 3AC 480 +10% (-15% < 1 min) 47 to 63 Hz			
Rated current	A _{AC}	16	25	36	65
Power loss ¹	W	20	20	16	28
Weight	kg	2.1	2.3	5	6.5

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

2.6 Line reactors for Active Line Modules

2.6.1 Description

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

2.6.2 Safety information

Caution

A ventilation clearance of 100 mm must be maintained around the component (not including the mounting surface).

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 Equipment Manual must be used.

Using line reactors not approved by SIEMENS for SINAMICS 6SL31:

- The Line Modules may become damaged/faulty.
 - cause line reactions that can damage or destroy other loads powered from the same network.
-



Caution

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

2.6.3 Connection description

The line reactor is rated for a voltage range from 380 V 3AC -10% to 480 V 3AC +10% at 47 Hz to 63 Hz.

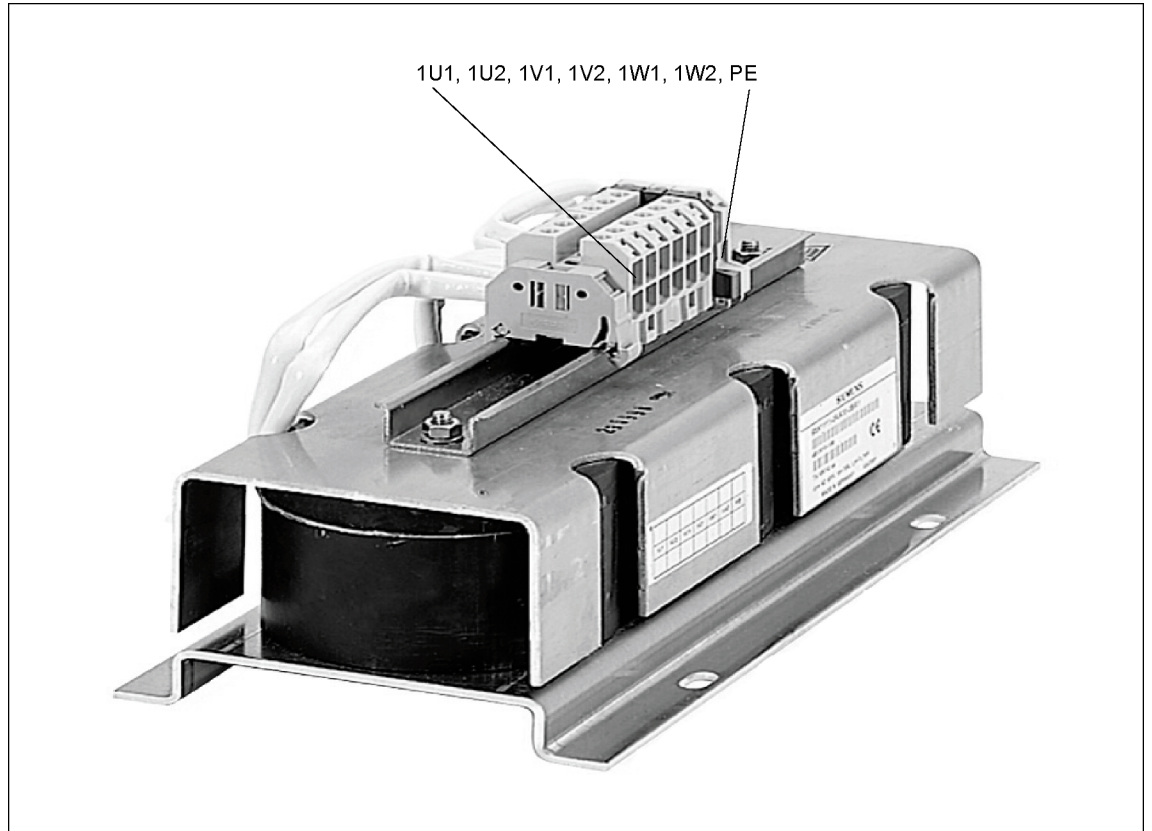


Figure 2-9 Line reactor (example: 16 kW)

2.6.3.1 Line/load connection

Table 2-12 Connection methods for line reactor

Terminals	Designations
Line 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	Connection strap d = 9 mm ² (M10/25 Nm) for ring cable lugs to DIN 46234 Note: No shock-hazard protection (IP00)
120 kW	Connection strap d = 10 mm ² (M10/25 Nm) for ring cable lugs to DIN 46234 Note: No shock-hazard protection (IP00)

* See Screw Terminals

2.6.4 Dimension drawing

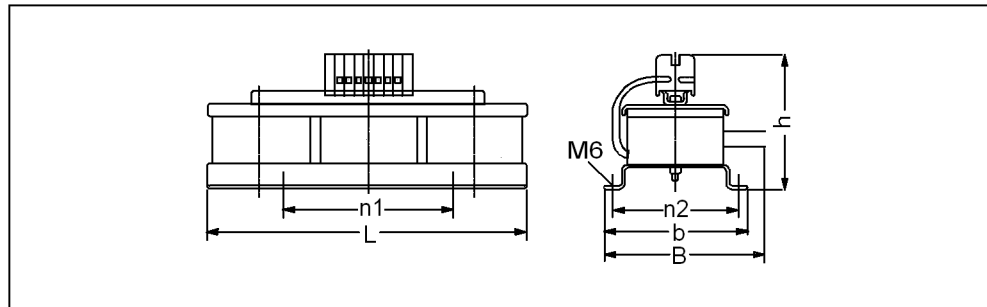


Figure 2-10 Dimension drawing: line reactor for Active Line Modules up to 55 kW

Table 2-13 Dimensions of the line reactor for Active Line Modules

	Order number 6SN1111-	L [mm] (inches)	W [mm] (inches)	h [mm] (inches)	b [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 drill hole spacing

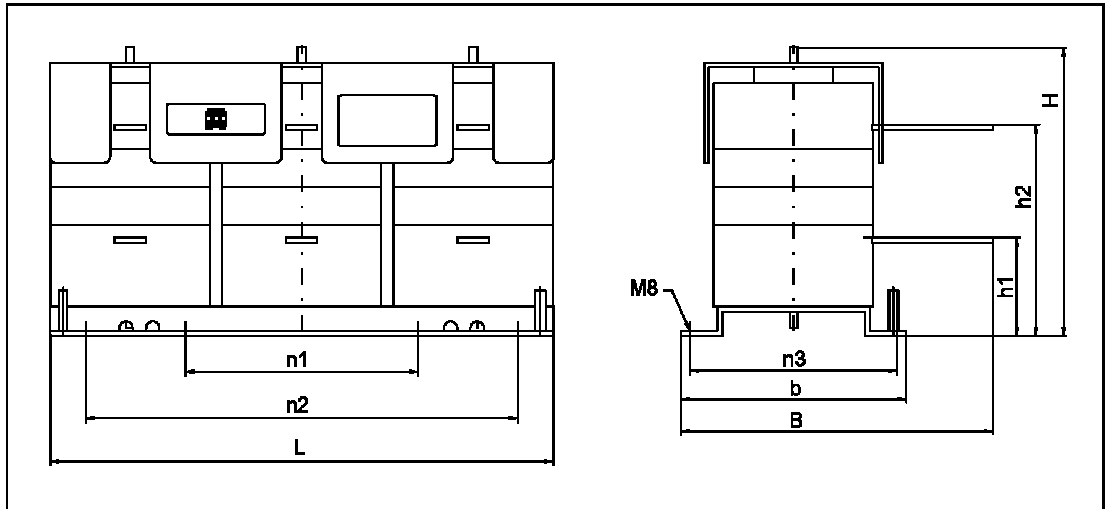


Figure 2-11 Dimension drawing: line reactor for Active Line Modules as of 80 kW

Table 2-14 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)	b [mm] (inches)	n1 [mm] 1) (inches)	n2 [mm] 1) (inches)	n3 [mm] 1) (inches)
80 kW	6SN1111-0AA00-1EA0	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	6SL3000-0DE31-2BA0	490 (19.29)	225 (8.86)	60 (2.36)	220 (8.66)	250 (9.84)	170 (6.69)	175 (6.89)	325 (12.80)	156 (6.14)

1) The lengths n1, n2 and n3 correspond to the drill hole spacing

2.6.5 Technical specifications

Table 2-15 Technical specifications of line reactors for the Active Line Module

	6SN1111- Unit	0BA1	0CA1	0DA1	1EA0	1FA0
Output	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	[kg]	8.5	13	18	40	50

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

2.7 Line reactors for Smart Line Modules

2.7.1 Description

The line reactors for Smart Line Modules limit low-frequency line reactions to permissible values.

2.7.2 Safety information

Caution

A ventilation clearance of 100 mm must be maintained around the component (not including the mounting surface).

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 Equipment Manual must be used.

Using line reactors not approved by SIEMENS for SINAMICS 6SL31:

- The Line Modules may become damaged/faulty.
 - cause line reactions that can damage or destroy other loads powered from the same network.
-



Caution

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

2.7.3.1 Line/load connection

Table 2-16 Connection methods for line reactor

Terminals	Designations
Line connection	1U1, 1V1, 1W1, PE
Load connection	1U2, 1V2, 1W2
Line reactors for Smart Line Modules	
5 kW	Screw terminal 4 mm ² 3-pin*
10 kW	Screw terminal 10 mm ² 3-pin*
16 kW	Screw terminal 10 mm ² 3-pin* with PE connection for ring cable lug M5 to DIN 46234
36 kW	Screw terminal 16 mm ² 3-pin* with PE connection for ring cable lug M6 to DIN 46234

* See Screw Terminals

2.7.4 Dimension Drawings

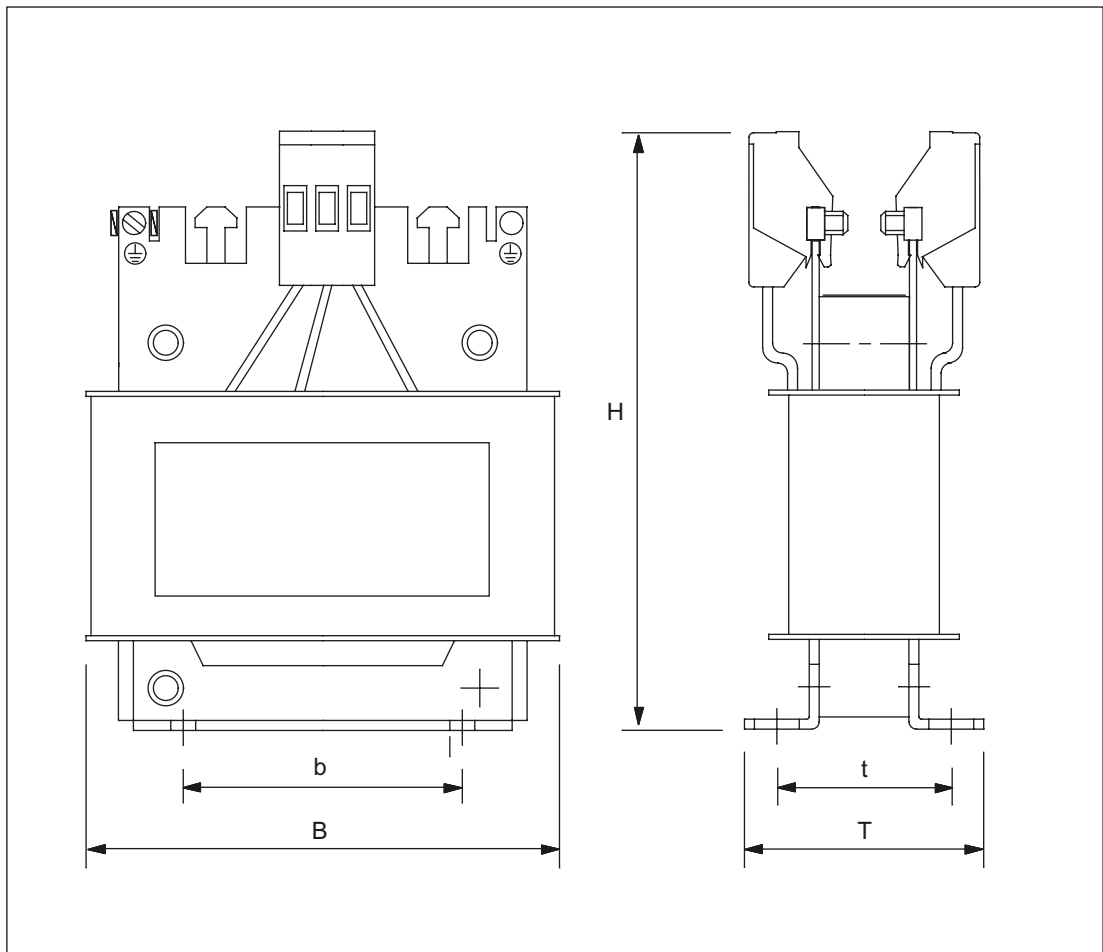


Figure 2-13 Dimension drawing: line reactor for Smart Line Modules (5 and 10 kW)

Table 2-17 Dimensions of the line filter for Smart Line Modules

	Order number 6SL3000-	W [mm] (inches)	w [mm] ¹⁾ (inches)	H [mm] (inches)	T [mm] (inches)	t [mm] ¹⁾ (inches)
5 kW	0CE-15-0AA0	150 (5.91)	113 (4.53)	175 (6.89)	66.5 (2.62)	49.5 (1.95)
10 kW	0CE-21-0AA0	177 (6.97)	136 (5.35)	196 (7.72)	86 (3.39)	67 (2.64)

1) Dimensions w and t correspond to the drill hole spacing

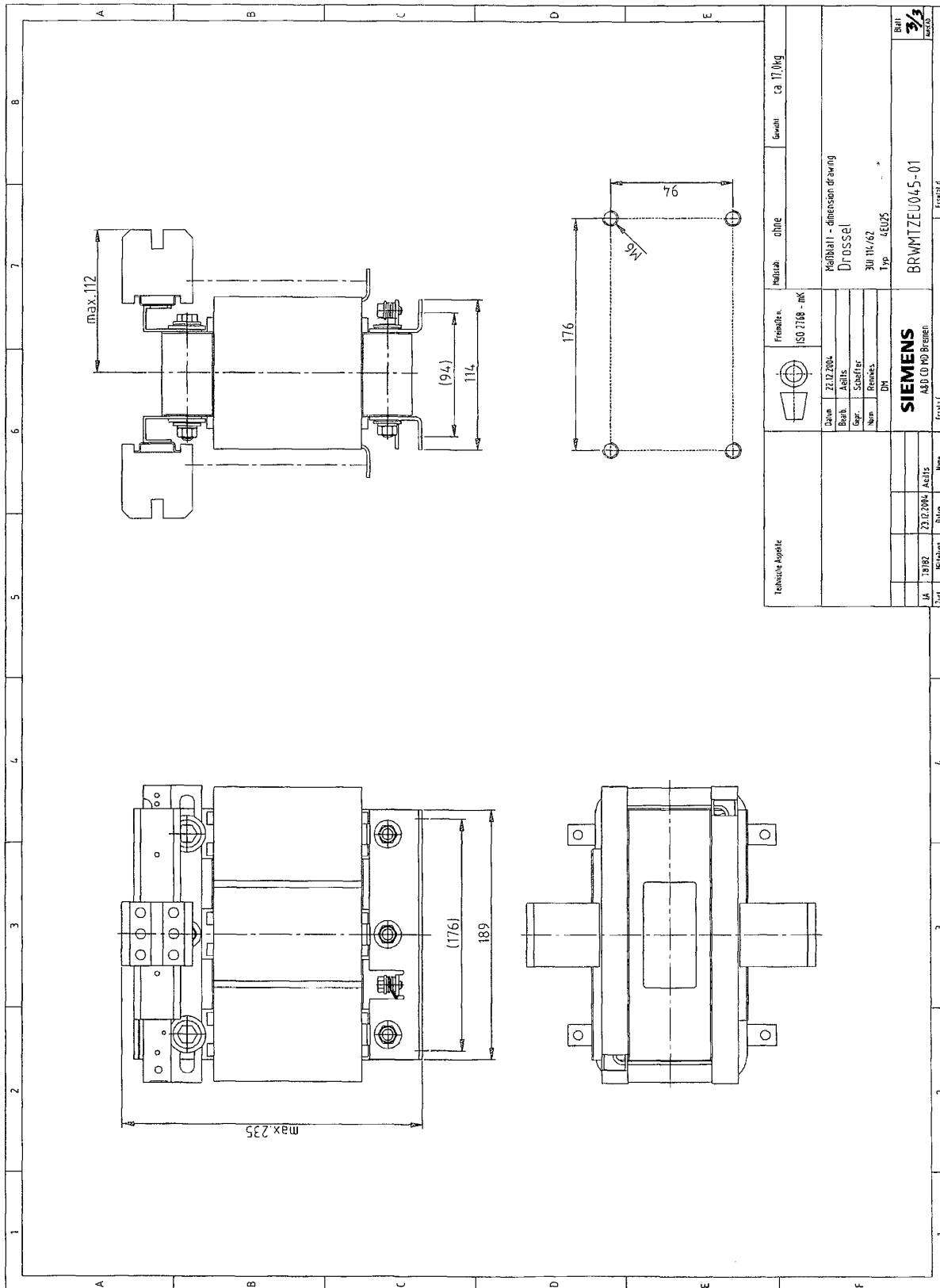


Figure 2-15 Dimension drawing of the line reactor for the Smart Line Module 36 kW

Table 2-18 Line reactor for the Smart Line Modules 16 kW and 36 kW

	Order number 6SL3000-
16 kW	0CE-21-6AA0
36 kW	0CE-23-6AA0

2.7.5 Technical specifications

Table 2-19 Technical specifications of line reactors for Smart Line Modules

	6SL3000 unit	0CE15-0AA0	0CE21-0AA0	0CE22-0AA0	0CE24-0AA0
Output	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 Cabinet Design.

2.8 Line connection variations

2.8.1 Methods of line connection

A distinction is made between:

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

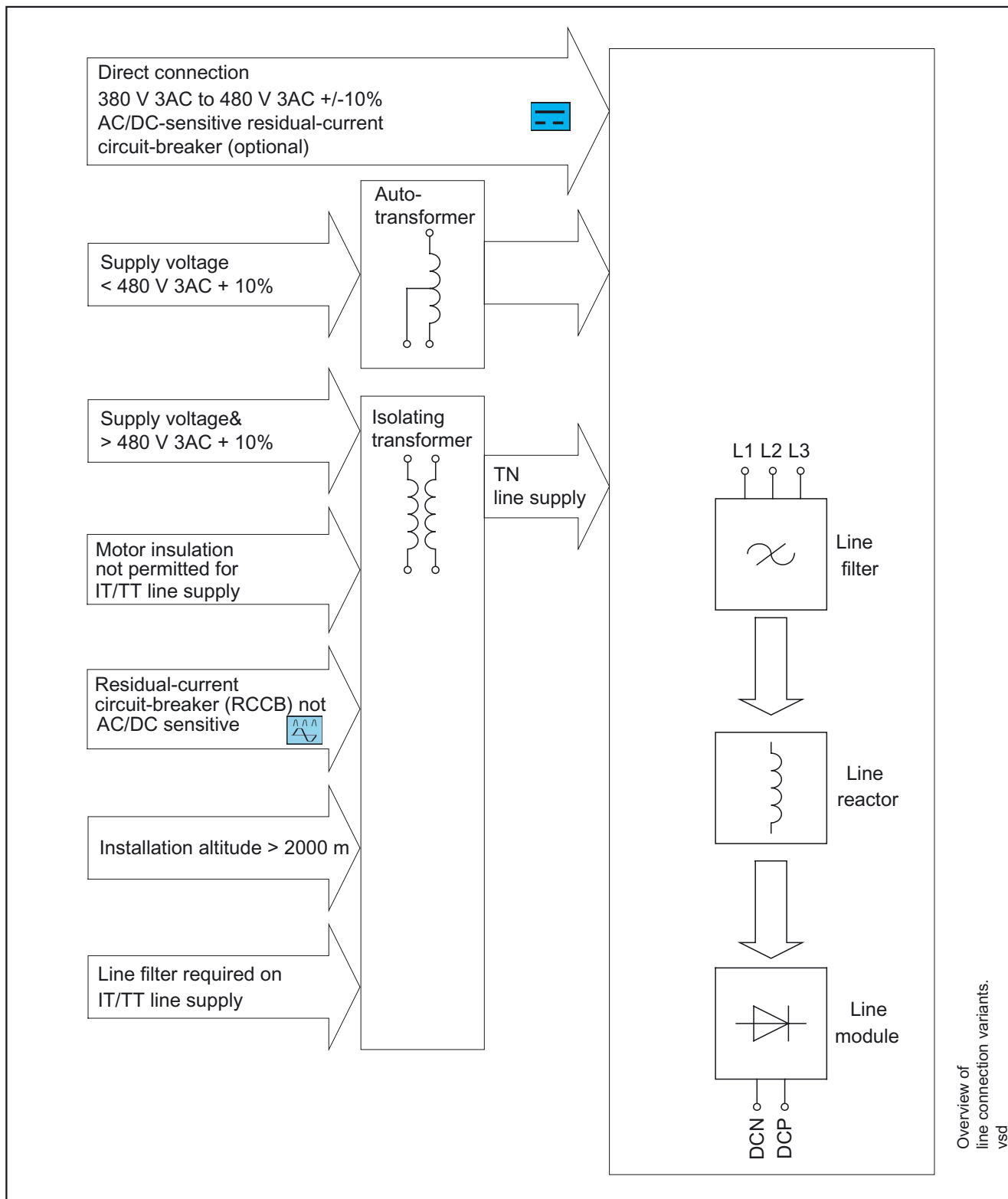


Figure 2-16 Overview of line connection variants

2.8.2 Operation of the line connection components on the supply network

The SINAMICS S booksize drive system is rated for direct operation on TN, TT, and IT supply systems with a nominal voltage of 3AC 380 V to 3AC 480 V. Operation with a line filter is only permitted for a TN supply system.

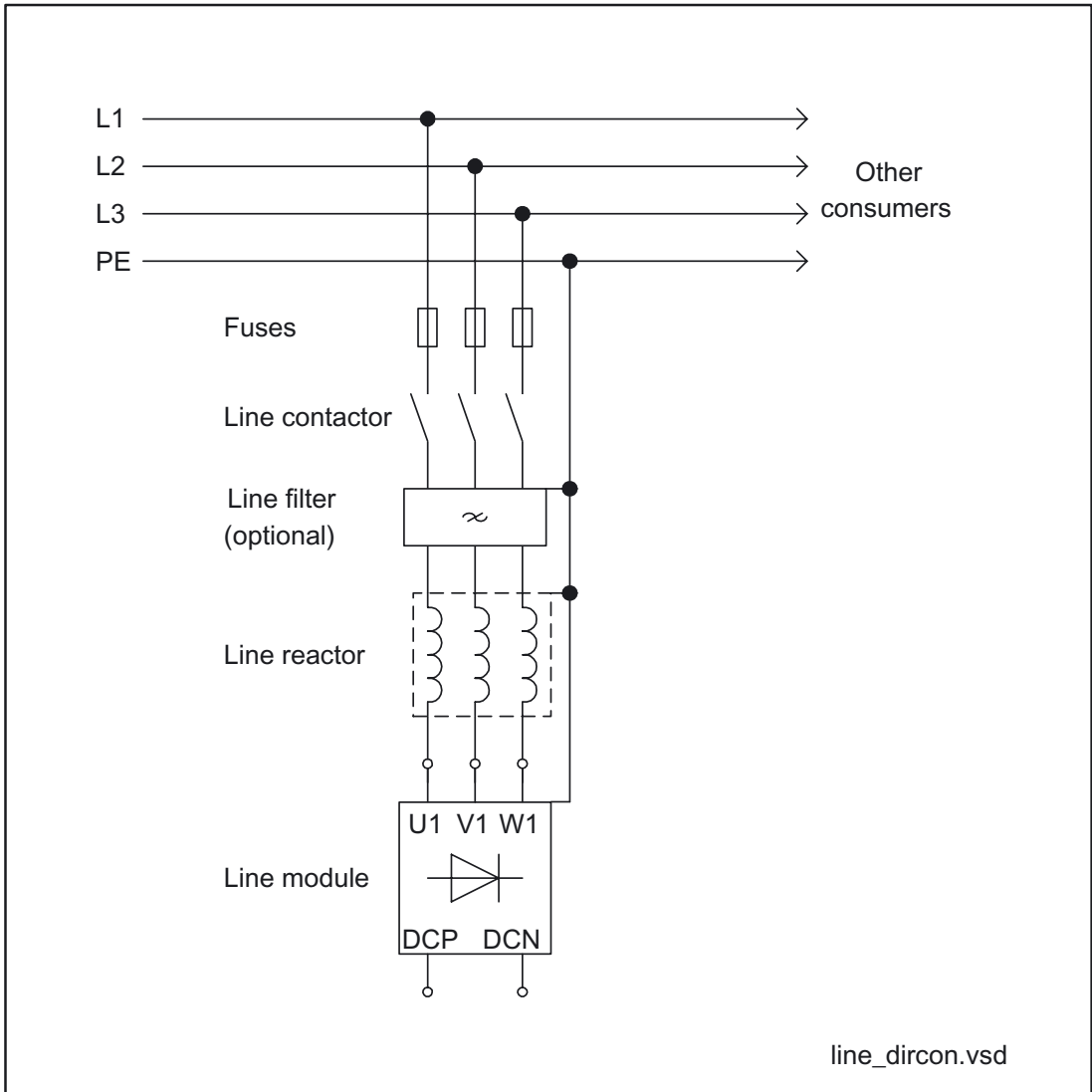


Figure 2-17 Direct operation on the supply network

2.8.3 Operation of the line connection components via an autotransformer

An autotransformer can be used for voltage adaptation in the range up to 3AC 480 V +10%.



Caution

To ensure safe electrical separation, an isolating transformer must be installed with voltages greater than 3AC 480 V +10%.

Applications:

- The motor insulation must be protected from excessive voltages.
- The active line module must provide a stabilized DC link voltage. It can be in the range 380 V to 415 V.

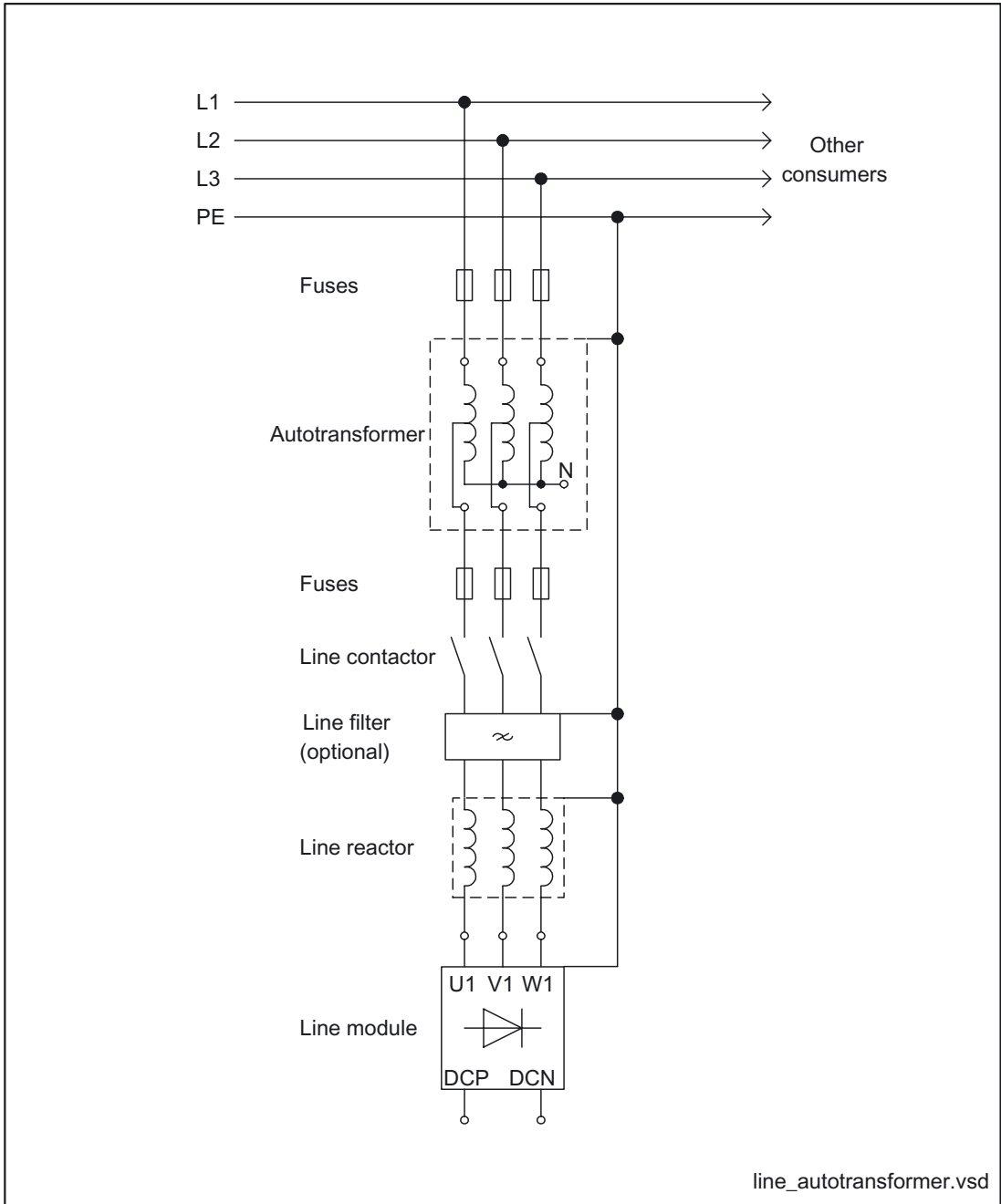


Figure 2-18 Autotransformer

2.8.4 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 motors are not approved for use in IT/TT systems.
- A residual-current circuit-breaker is required.
- The installation altitude is higher than 2000 m.
- A line filter is envisaged in an IT/TT system.

Caution

If the supply voltage is greater than 480 V +10%, an autotransformer must not be used. An isolating transformer must be used to ensure safe electrical separation.

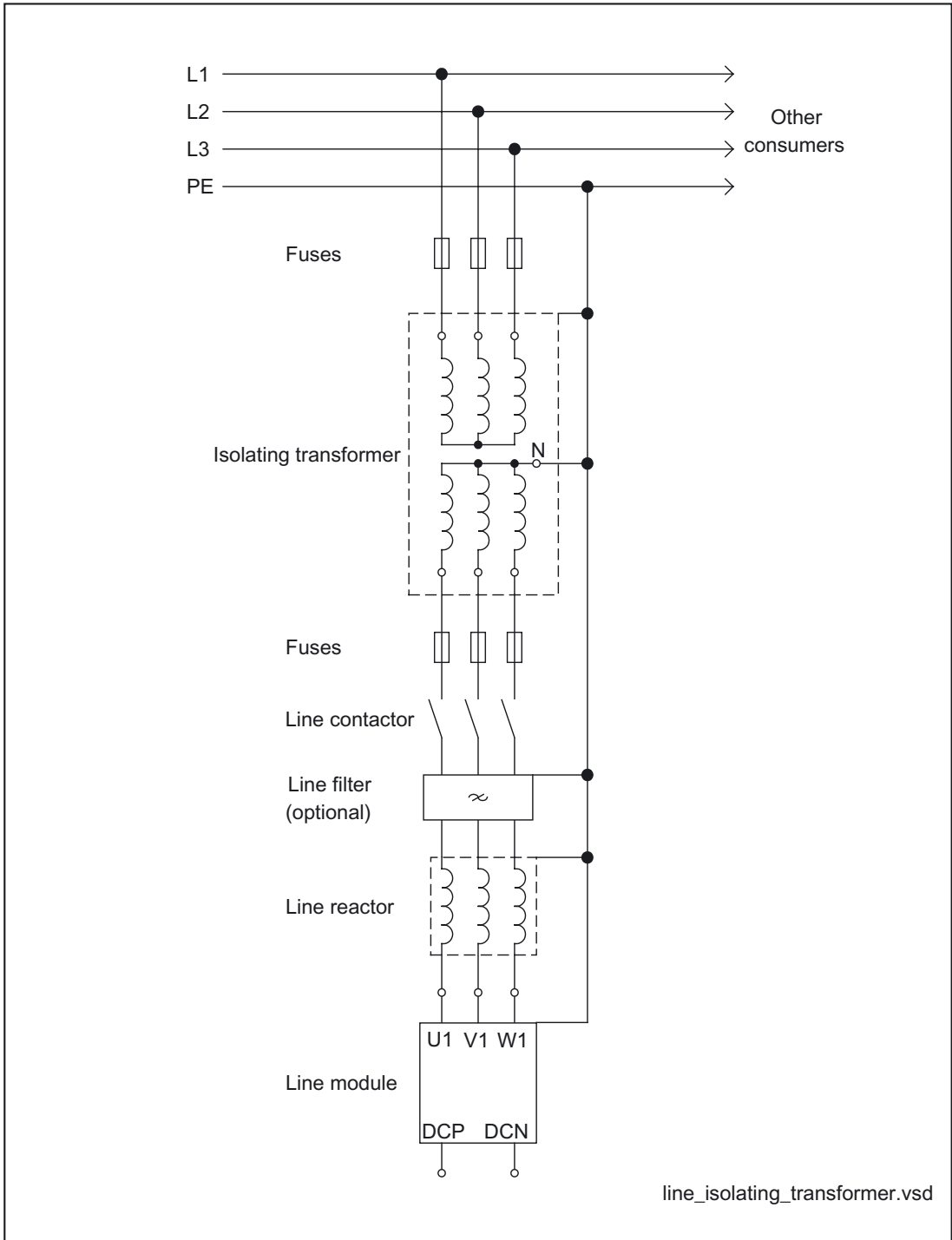


Figure 2-19 Isolating transformer

2.8.5 Line connection via a ground-fault circuit interrupter

In addition to protection measures against hazardous shock current (e.g. overcurrent trip), selectively tripping AC/DC-sensitive residual-current circuit-breakers can be used.

Note

A direct connection to a power system with selectively tripping AC/DC-sensitive residual-current circuit-breakers is only possible with the 5 kW, 10 kW, 16 kW and 36 kW Line Modules because suitable residual-current devices with higher ratings are not available as qualified products.

Selectively tripping AC/DC-sensitive residual-current circuit-breakers can be used without restriction in the event of a fault as a protective measure against hazardous shock currents.

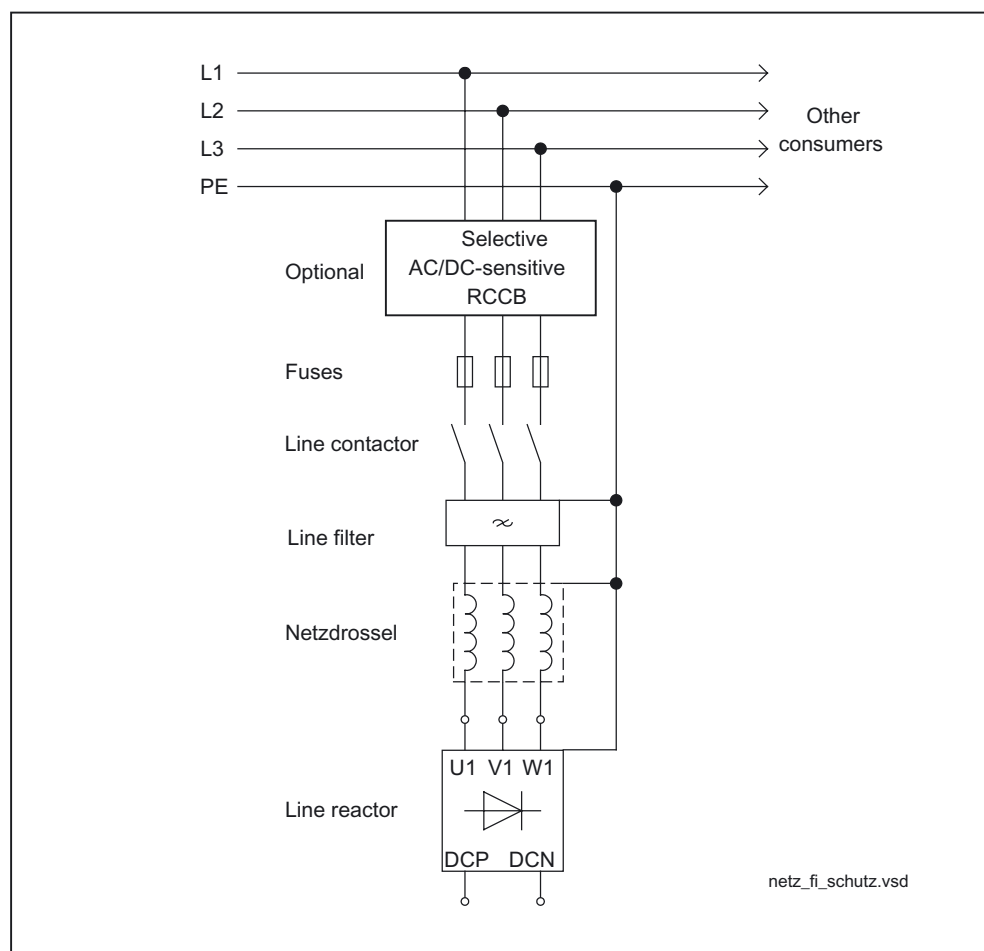


Figure 2-20 Residual-current circuit-breaker (RCCB)

Please note the following:

- Only the use of a delayed-tripping (selective) AC/DC-sensitive RCCB is permitted.
- The maximum permissible ground resistance of the "selective protection device" must be observed (max. 83 Ω for residual-current circuit-breakers with a rated differential current of 0.3 A).
- Parts of the electrical equipment and machine that can be touched are integrated in a protective grounding system.
- The total length of the shielded power cables used in the drive line-up (motor cable incl. line supply cables from line filters to line feed terminals) 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 circuit-breakers, contactors) for connecting and disconnecting the drive line-up must feature a max. 35ms delay time between closing and opening individual main contacts.

Recommendation

SIEMENS selectively switching AC/DC-sensitive residual-current circuit-breakers to EN 50178, type 5SZ (e.g. 5SZ6 468-0KG00 or 5SZ6468-0KG30 with auxiliary disconnecter (1NC/1NO) for rated current 63 A, rated fault current 0.3 A) (see also catalog CA01).

Notice

AC or pulse-sensitive RCCBs are not suitable.

Line Modules Booksize

3.1 Introduction

Line Modules generate a DC voltage that is used to power the Motor Modules from the connected supply voltage.

The Active Line Modules and Smart Line Modules (16 and 36 kW) are equipped with DRIVE-CLiQ interfaces so that they can be connected to the Control Unit. The Smart Line Modules (5 and 10 kW) must be connected to the Control Unit via terminals.

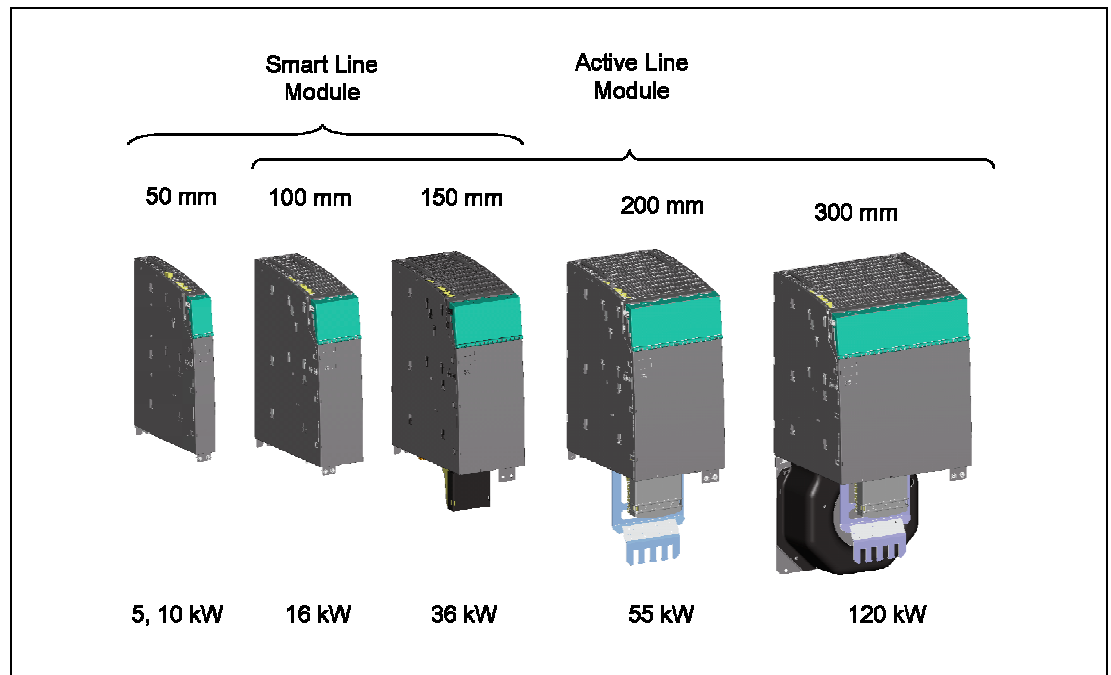


Figure 3-1 Overview of Line Modules

General characteristics of the Line Modules

- Connection voltage: 3AC 380 V -10% to 3AC 480 V +10% (-15% <1 min) (47 to 63 Hz)
- Suitable for TN, TT, and IT supply systems
- 100% regenerative feedback capability
- Internal/external air cooling
- Short-circuit/ground-fault-proof during the precharge phase
- Integrated DC link and electronics current busbar connection
- LEDs for indicating statuses and for diagnostic purposes

Characteristics of the Active Line Modules

- Regulated DC link voltage
- Regenerative feedback capability
- Sinusoidal line currents
- Electronic type plate
- DRIVE-CLiQ interface for communication with the Control Unit and/or other components in the drive line-up.
 - Integration in system diagnostics

Characteristics of the Smart Line Modules

- Unregulated DC link voltage
- Regenerative feedback capability
- Square-wave line currents

Frequency with which the DC link is precharged

The frequency with which the DC link is precharged via the Line Module is determined using the following formula:

$$\text{No. of pre-charges within 8 mins} = \frac{\text{Max. permissible DC link capacity of Line Module in } \mu\text{F}}{\Sigma\text{DC link capacity of configured drive line-up in } \mu\text{F}}$$

The maximum permissible DC link capacitance is specified in the technical specifications for the Line Modules.

3.2 Active Line Modules with Internal Air Cooling

3.2.1 Description

The Motor Modules are connected to the power supply network via the Active Line Modules which provide the Motor Modules with a constant DC link voltage.

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.

The Active Line Modules are suitable for direct operation on TN, IT, and TT systems.

3.2.2 Safety information



Warning

After disconnecting all the supply voltages, a hazardous voltage will be present in all components for another 5 minutes. 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, otherwise this could result in secondary damage or 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).



Caution

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

Measures according to EN 61800-5-1 must be taken (e.g. PE conductor ($\geq 10\text{mm}^2$ Cu) or fit an additional connection terminal for a PE conductor with the same cross-section as the original PE conductor).

Caution

The DC link discharge time hazard warning must be affixed to the modules in the local language.

A set of labels in 12 languages is available using order number: 6SL3166-3AB00-0AAx.

Notice

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

For the 80 kW and 120 kW Active Line Modules, a ventilation clearance of 50 mm must be observed in front of the fan.

Caution

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

In a supply system without regenerative feedback capability (e.g. diesel generator), the regenerative feedback capability of the Active Line Module must be deactivated via 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.

Caution

The total length of all the power cables (motor supply cables and DC link cables) must not exceed 350 m in Active mode and 560 m in Smart mode.

Caution

Only cables from Siemens must be used for DRIVE-CLiQ connections.

Caution

The ratio of the short-circuit power to the rated power of the Line Module must be ≥ 70 .

Caution

The left and right ends of the DC link busbar of a drive line-up must be fitted with peripheral covers (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.

3.2.3 Interface description

3.2.3.1 Overview

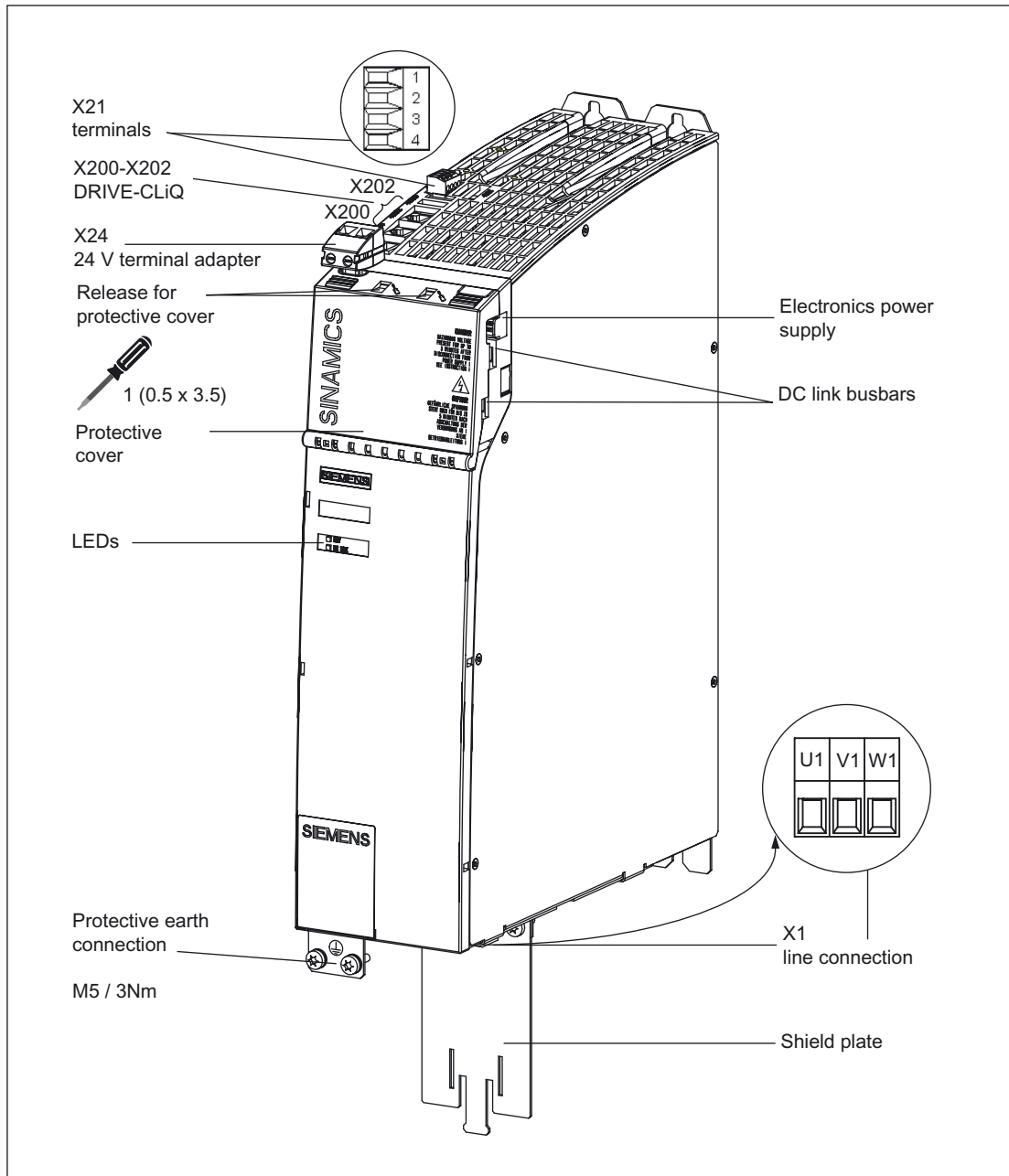


Figure 3-2 Active line module with internal air cooling (example: 16 kW)

3.2.3.2 Connection example

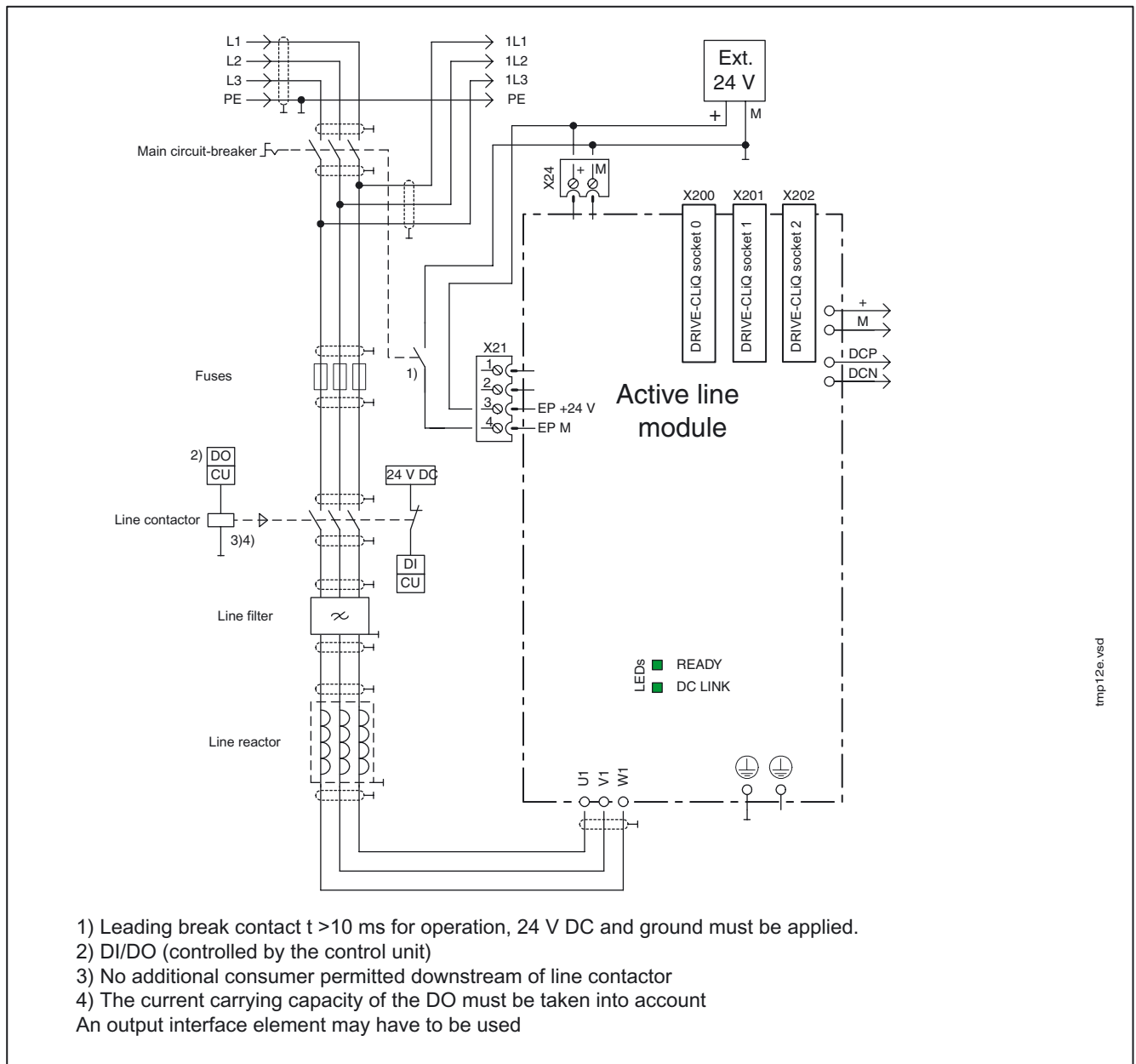
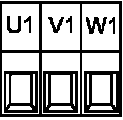
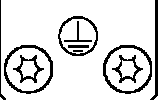


Figure 3-3 Connection example of Active Line Module


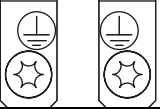
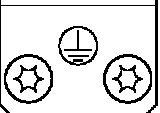
3.2.3.3 X1 line connection

Table 3-1 Terminal block X1 Active Line Module 16 kW

	Terminal	Technical specifications
	U1	Max. connection voltage: 3AC 480 V +10 at 47 Hz to 63 Hz Max. connectable cross-section: 10 mm ² Type: Screw terminal 6 (see Connection Methods)
	V1	
	W1	
	PE connection	Threaded hole M5/3 Nm ¹

¹ for ring cable lugs to DIN 46234

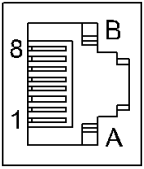
Table 3-2 Terminal block for the Active Line Module (36 kW to 120 kW)

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

¹ for ring cable lugs to DIN 46234

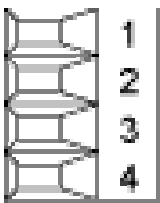
3.2.3.4 X200-X202 DRIVE-CLiQ interfaces

Table 3-3 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	GND (0 V)	Electronic ground	
	Blanking plate for DRIVE-CLiQ interface: Molex, order number: 85999-3255			

3.2.3.5 EP terminals X21

Table 3-4 Terminal block X21

	Terminal	Name	Technical specifications
	1	Reserved, do not use	Voltage 24 V DC Current consumption: 10 mA Isolated input Signal propagation times: L → H 100 µs H → L: 1000 µs
	2	Reserved, do not use	
	3	EP +24 V (Enable Pulses)	
	4	EP M (Enable Pulses)	
Max. connectable cross-section: 1.5 mm ² Type: Screw terminal 1 (see Connection Methods)			



Warning

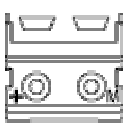
For operation, 24 V DC must be connected to terminal 3 and ground to terminal 4. Upon removal, pulse inhibit is activated. Feedback is deactivated and the bypass relay drops out. If the Line Module is not disconnected from the network when the EP terminal is deactivated (e.g. a main contactor is not 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.

3.2.3.6 X24 24 V terminal adapter

Table 3-5 Terminal block X24

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

3.2.3.7 Meaning of the LEDs on the active line module

Table 3-6 Meaning of the LEDs on the Line Module

LED	Color	State	Description
READY	-	OFF	Electronics power supply outside permissible tolerance range.
	Green	Continuous	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	Continuous	DRIVE-CLiQ communication is being established.
	Red	Continuous	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 permissible tolerance range.
	Orange	Continuous	DC link voltage within permissible tolerance range (only when ready for operation)
	Red	Continuous	DC link voltage outside the permissible tolerance range (only when Active Line Module is ready for operation).

Cause and rectification of faults

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

Reference: /IH1/ SINAMICS S120 Commissioning Manual

3.2.4 Dimension drawing

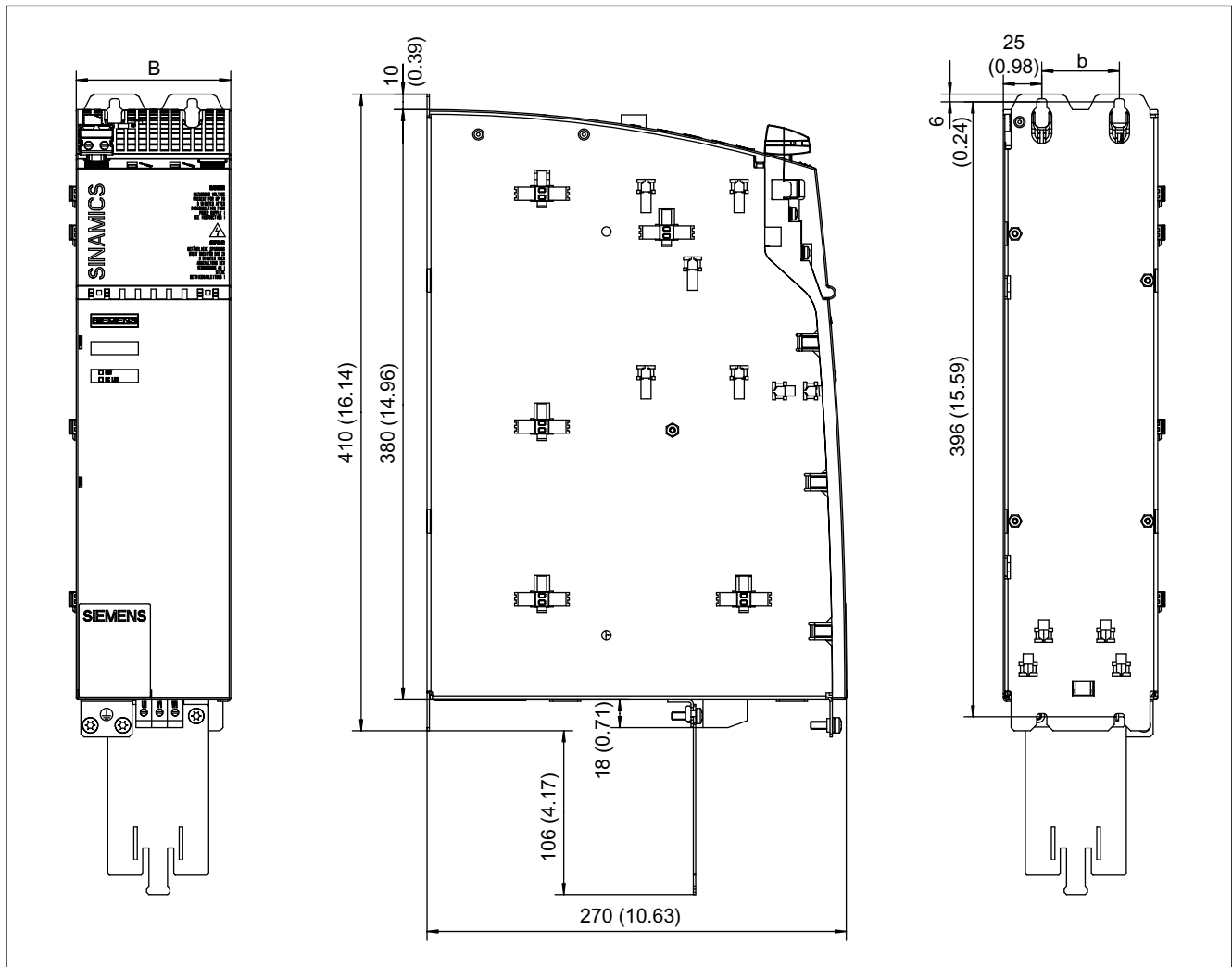


Figure 3-4 Dimension drawing of Active Line Module with internal air cooling (16 kW)

Table 3-7 Dimensions of Active Line Module with internal air cooling

Active Line Module type	Order number	W [mm] (inches)	w [mm] (inches)	h [mm] (inches)
16 kW	6SL3130-7TE21-6AAx	100 (3.94)	50 (1.97)	18 (0.71)

Note

The shielded terminal plate is part of the scope of supply of a 100 mm Line Module.
 More information can be found in "Accessories".

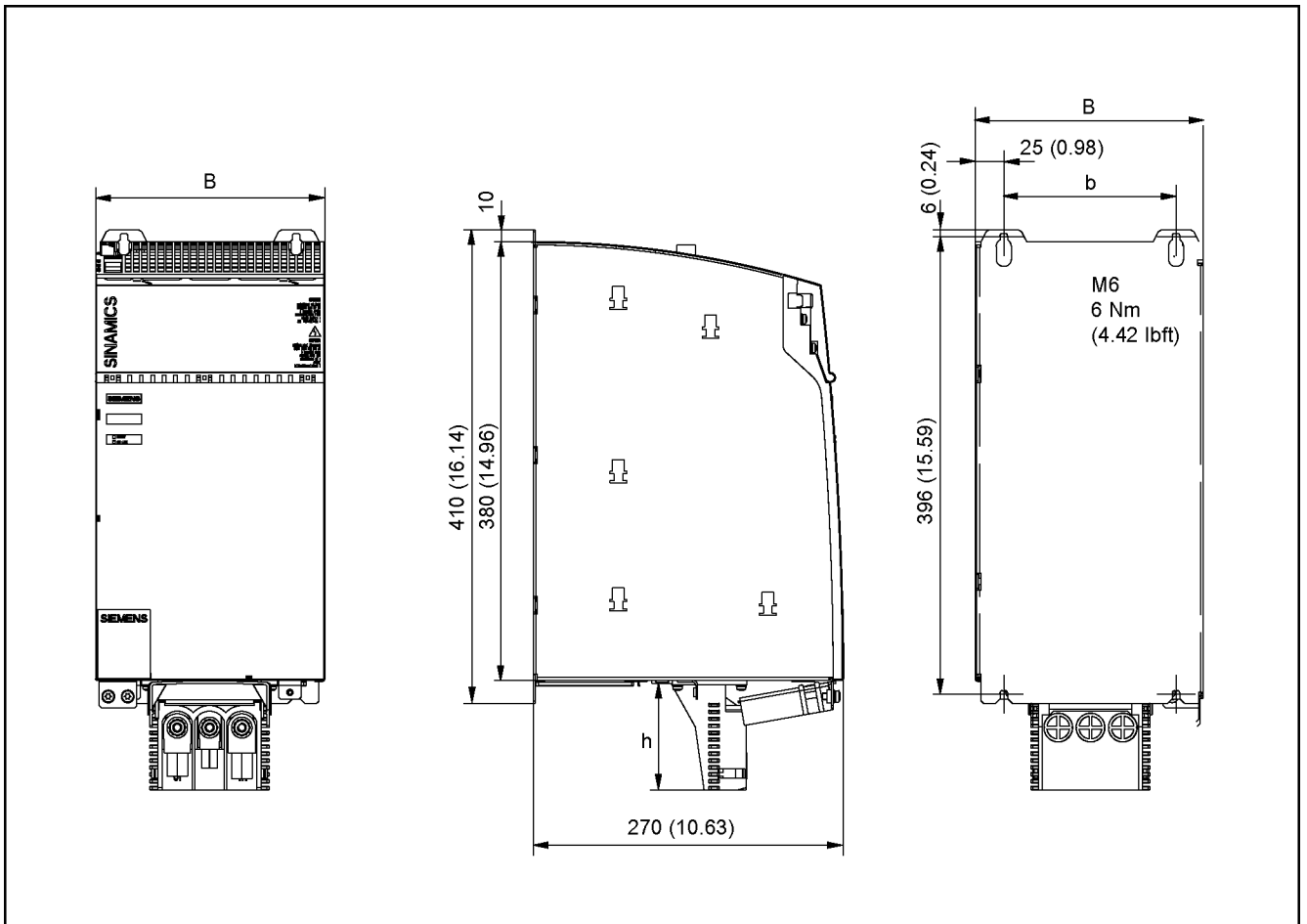


Figure 3-5 Dimension drawing of Active Line Module with internal air cooling (36 kW and 55 kW)

Table 3-8 Dimensions of Active Line Module with internal air cooling

Active Line Module type	Order number	W [mm] (inches)	w [mm] (inches)	h [mm] (inches)
36 kW	6SL3130-7TE23-6AAx	150 (5.91)	100 (3.94)	105 (4.13)
55 kW	6SL3130-7TE25-5AAx	200 (7.87)	150 (5.91)	105 (4.13)

3.2 Active Line Modules with Internal Air Cooling

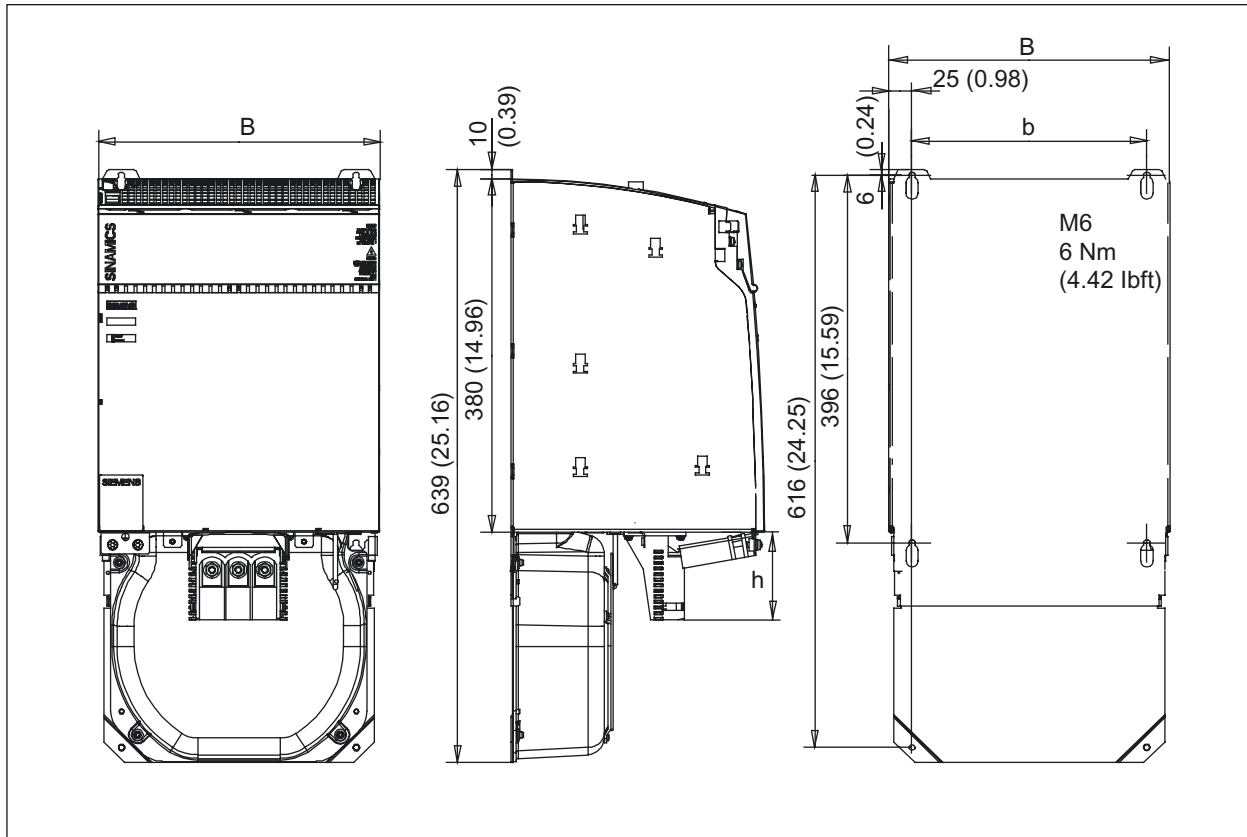


Figure 3-6 Dimension drawing of Active Line Modules with internal air cooling (80 kW and 120 kW)

Table 3-9 Dimensions of Active Line Module with internal air cooling

Active Line Module type	Order number	W [mm] (inches)	w [mm] (inches)	h [mm] (inches)
80 kW	6SL3130-7TE28-0AAx	300 (11.81)	250 (9.84)	105 (4.13)
120 kW	6SL3130-7TE31-2AAx	300 (11.81)	250 (9.84)	105 (4.13)

3.2.5 Installation

Installing the fan on Active Line Modules (80 kW and 120 kW)

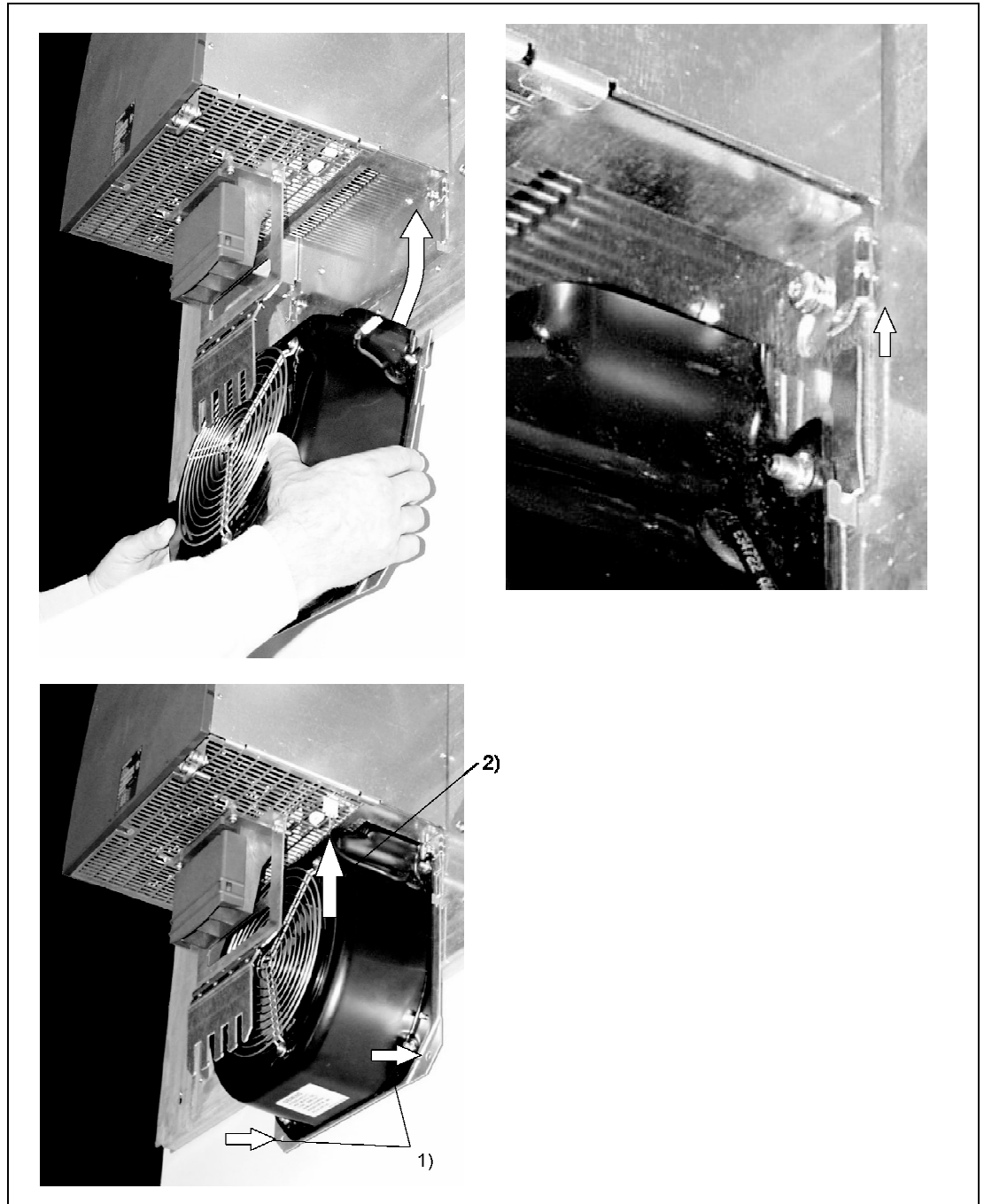
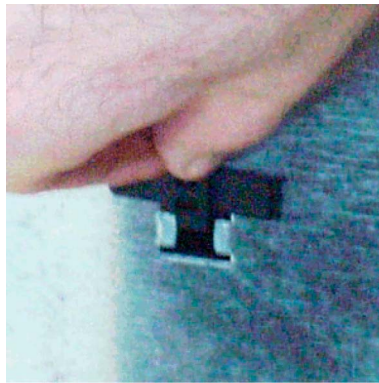
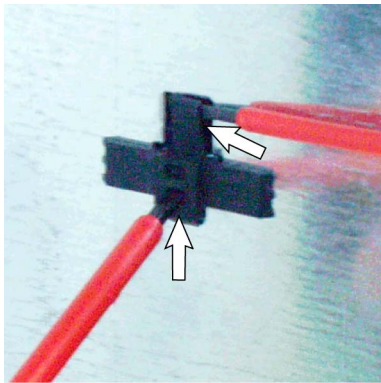


Figure 3-7 Installing the fan for 300 mm modules

- 1) Secure with M6 / 6 Nm screws
- 2) Connect the power supply for the fan

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.

The holder removed

3.2.6 Electrical connection

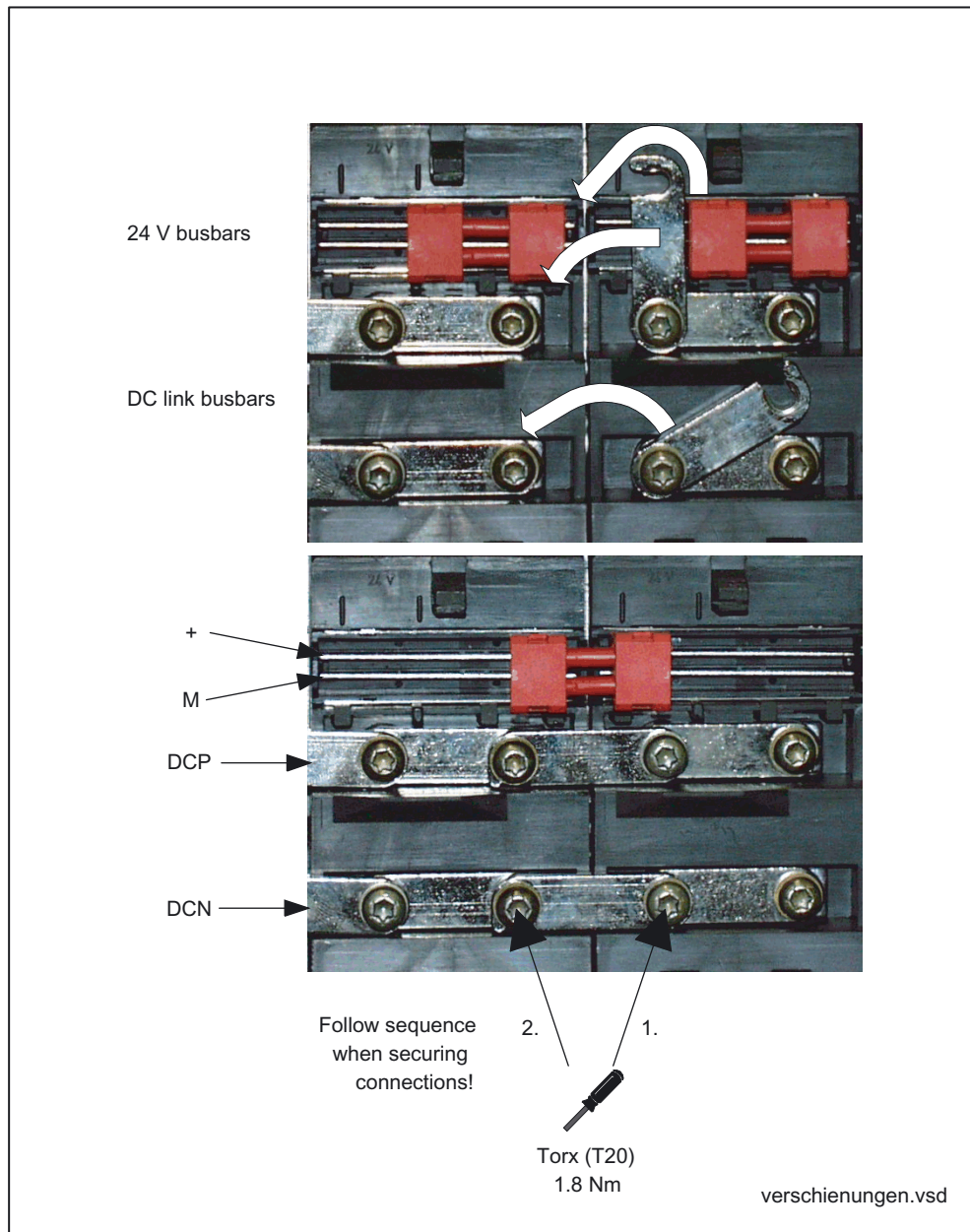


Figure 3-8 Busbar connections for booksize components

3.2.7 Technical specifications

Table 3-10 Technical specifications of Active Line Modules

Internal air cooling	6SL3130–	7TE21– 6AAx	7TE23– 6AAx	7TE25– 5AAx	7TE28– 0AAx	7TE31– 2AAx
Rated power	kW	16	36	55	80	120
Supply:						
Rated power (S1) ¹	kW (Pn)	16	36	55	80	120
Power rating (S6-40%) ¹	kW (Ps6)	21	47	71	106	145
Peak power rating ¹	kW (Pmax)	35	70	91	131	175
Regenerative feedback:						
Continuous regenerative power rating	kW	16	36	55	80	120
Peak regenerative power rating	kW	35	70	91	131	175
Connection voltages:						
Supply voltage	V _{ACrms}	3AC 380 -10% to 3AC 480 +10% (-15% < 1 min)				
Line frequency	Hz	47 to 63				
Electronics power supply	V _{DC}	24 (20.4 - 28.8)				
DC link voltage	V _{DC}	510 - 750				
Overvoltage trip threshold	V _{DC}	820 ± 2%				
Undervoltage trip threshold	V _{DC}	360 ± 2%				
Supply currents:						
at 380 V _{AC}	A _{AC}	26	58	88	128	192
at 480 V _{AC} /528 V _{AC}	A _{AC}	21 / 19	46 / 42	70 / 64	102 / 93	152 / 139
at 480 V; S6-40%)	A _{AC}	27	60	92	134	201
Peak current (at 400 V _{AC} /480 V _{AC})	A _{AC}	54 / 45	107 / 89	139 / 116	200 / 166	267 / 222
Output currents at 600 V _{DC} :						
Rated current	A _{DC}	27	60	92	134	200
at S6-40%	A _{DC}	35	79	121	176	244
peak current	A _{DC}	59	117	152	218	292
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
Electronics current consumption	A _{DC}	1.1	1.5	1.9	2	2.5
Total power loss (including electronic losses) ²	W	286.4	666	945.6	1386	2260
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	705	1 410	1 880	2 820	3 995
Charging limit	µF	20 000	20 000	20 000	20 000	20 000
Power factor	cosφ	1	1	1	1	1
Efficiency	η	0.98	0.98	0.98	0.98	0.98
Cooling method		Internal fan	Internal fan	Internal fan	Separate mounted fan	Separate mounted fan
Sound pressure level	dB(A)	<60	<65	<60	<73	<73
Cooling air requirement	m ³ /h	56	112	160	520	520

Internal air cooling	6SL3130-	7TE21-6AAx	7TE23-6AAx	7TE25-5AAx	7TE28-0AAx	7TE31-2AAx
Rated power	kW	16	36	55	80	120
Rated voltage for rated data 3 AC 380 V						
Weight	kg	7	10	17	23	23

¹ The specified values apply to 380 V

² For an overview, see the power loss tables in Cabinet Design.

Rated duty cycles of Active Line Modules

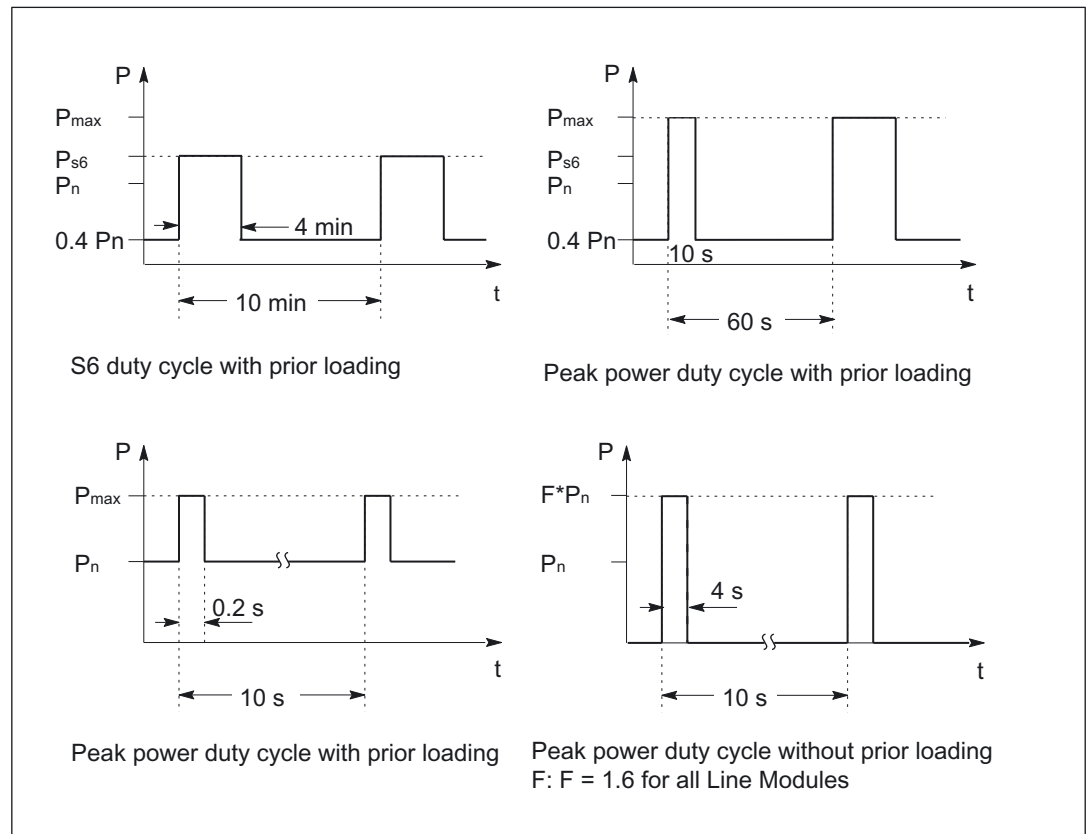


Figure 3-9 Rated duty cycles of Active Line Modules

Derating as a function of the ambient temperature

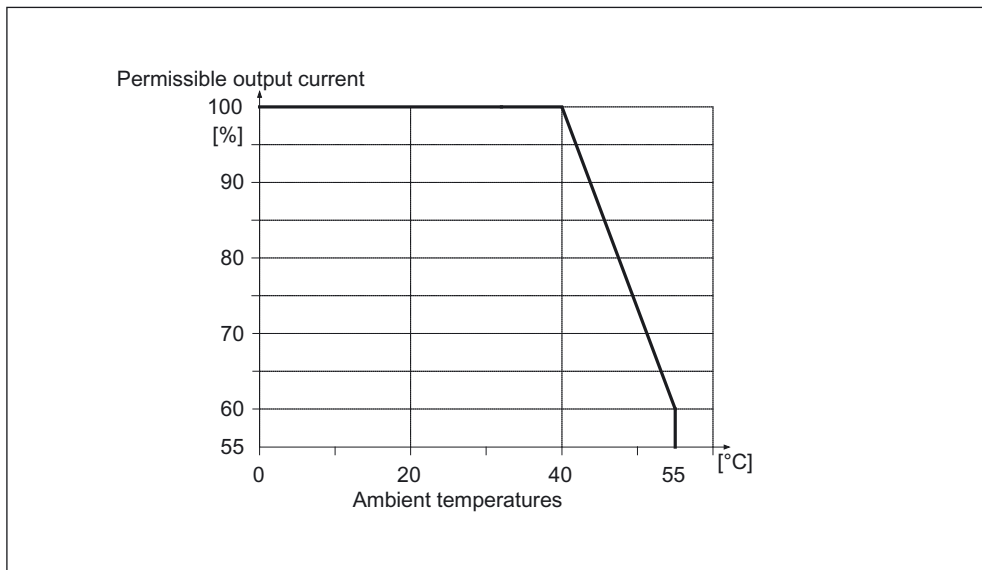


Figure 3-10 Derating as a function of the ambient temperature

Derating as a function of the installation altitude

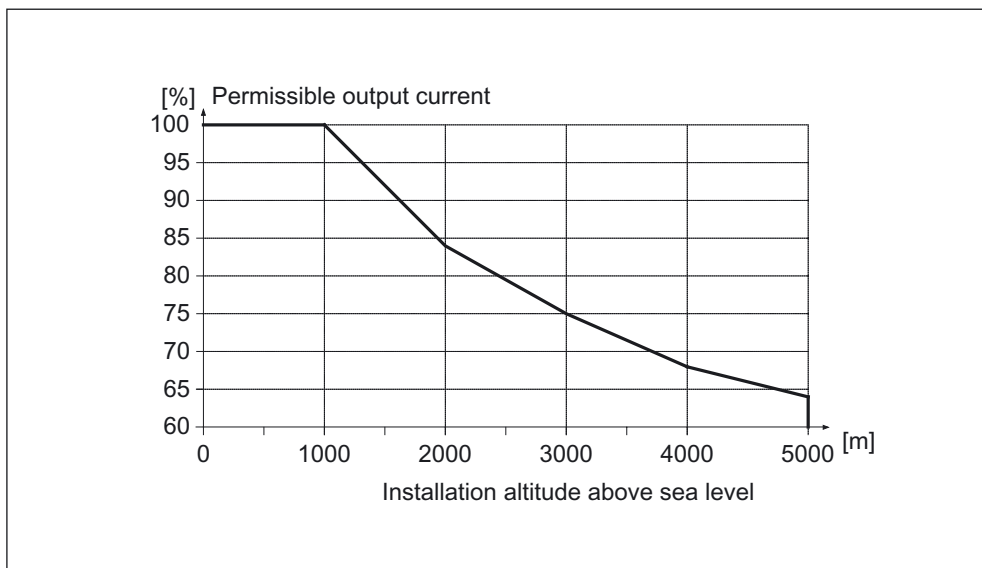


Figure 3-11 Derating as a function of the installation altitude

3.3 Active Line Modules with External Air Cooling

3.3.1 Description

The Motor Modules are connected to the power supply network via the Active Line Modules with external air cooling, which provide the Motor Modules with a constant DC link voltage.

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.

The Active Line Modules are suitable for direct operation on TN, IT, and TT systems.

External air cooling uses the "through-hole" method. This is a cooling method for SINAMICS power units that is only available for booksize devices. The power unit and its heat sink can be inserted in a rectangular knockout at the rear of the switching cabinet and mounted with a seal. The heat sink and the fan (included in the scope of supply) project beyond the rear of the switching cabinet and the heat is dissipated outside the switching cabinet or in a separate air duct.

3.3.2 Safety Information



Warning

After disconnecting all the supply voltages, a hazardous voltage will be present in all components for another 5 minutes. 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, otherwise this could result in secondary damage or 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).



Caution

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

Measures according to EN 61800-5-1 must be taken (e.g. PE conductor ($\geq 10\text{mm}^2$ Cu) or fit an additional connection terminal for a PE conductor with the same cross-section as the original PE conductor).

Caution

The DC link discharge time hazard warning must be affixed to the modules in the local language.

A set of labels in 12 languages is available using order number: 6SL3166-3AB00-0AAx.

Notice

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

Caution

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

In a supply system without regenerative feedback capability (e.g. diesel generator), the regenerative feedback capability of the Active Line Module must be deactivated via 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.

Caution

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

Caution

Only cables from Siemens must be used for DRIVE-CLiQ connections.

Notice

The external air cooling can cause the fans and the heat sink to become heavily contaminated, which may trigger the temperature monitor in the power section. The fans and heat sink must be checked for contamination at regular intervals and, if necessary, cleaned.

Note

After installation, the seal on the rear of the device must be checked to ensure that it is tight. Additional sealing can be used, if necessary.

Caution

The ratio of the short-circuit power to the rated power of the Line Module must be ≥ 70 .

Caution

The left and right ends of the DC link busbar of a drive line-up must be fitted with peripheral covers (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.

3.3.3 Interface description

3.3.3.1 Overview

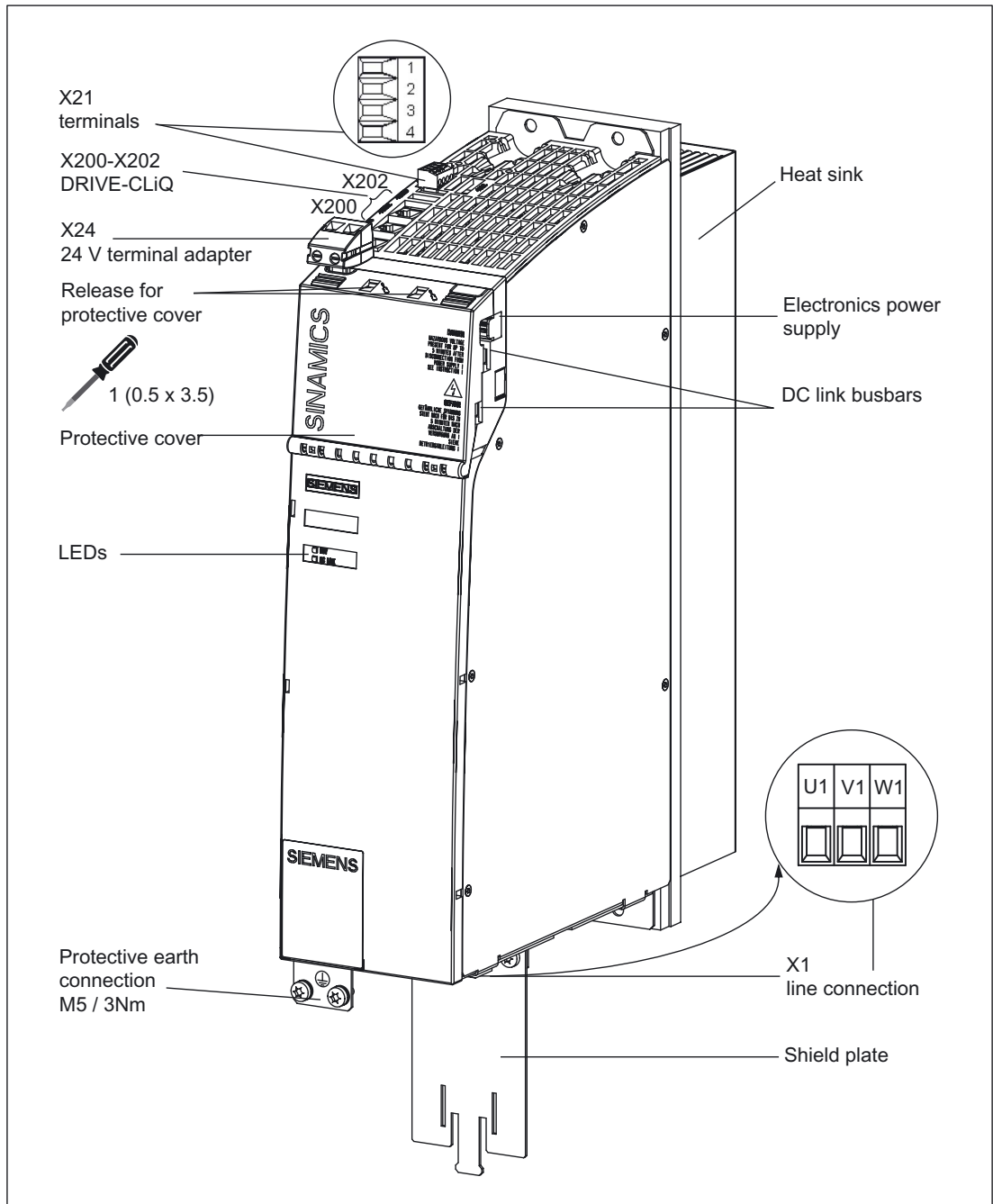


Figure 3-12 Active line module with external air cooling (example: 16 kW)

3.3.3.2 Connection example

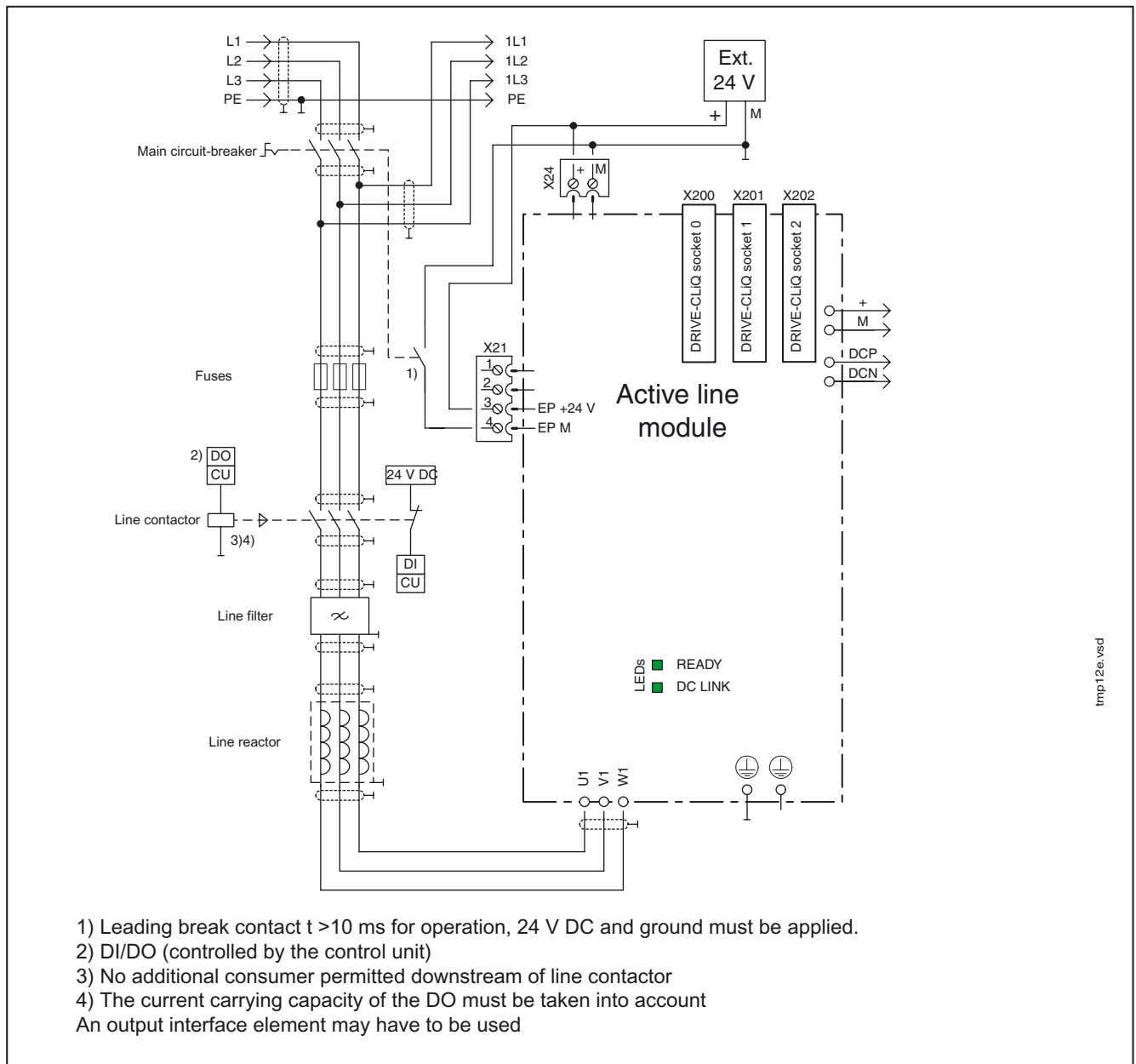
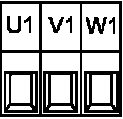
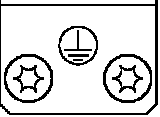


Figure 3-13 Connection example of Active Line Module

3.3 Active Line Modules with External Air Cooling

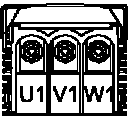
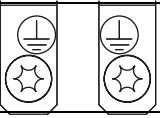
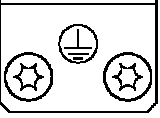
3.3.3.3 Line connection

Table 3-11 Terminal block X1 Active Line Module 16 kW

	Terminal	Technical specifications
	U1	Supply voltage: 3AC 480 V +10% (-15% < 1 min) at 47 Hz to 63 Hz Max. connectable cross-section: 10 mm ² Type: Screw terminal 6 (see Connection Methods)
	V1	
	W1	
	PE connection	Threaded hole M5/3 Nm ¹

¹ for ring cable lugs to DIN 46234

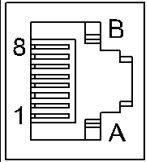
Table 3-12 Terminal block for the Active Line Module (36 kW to 120 kW)

	Terminals	Technical specifications
	U1	Supply voltage: 3AC 480 V +10% (-15% < 1 min) at 47 Hz to 63 Hz 36kW: Threaded bolt M6/6 Nm ¹ 55 kW: Threaded bolt M8/13 Nm ¹ 80 kW to 120 kW: Threaded bolt M8/13 Nm ¹
	V1	
	W1	
	PE connection	36kW: Threaded hole M6/6 Nm ¹
		55 kW: Threaded hole M6/6 Nm ¹ 80 kW to 120 kW: Threaded hole M8/13 Nm ¹

¹ for ring cable lugs to DIN 46234

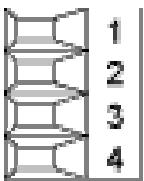
3.3.3.4 X200-X202 DRIVE-CLiQ interfaces

Table 3-13 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	GND (0 V)	Electronic ground	
	Blanking plate for DRIVE-CLiQ interface: Molex, order number: 85999-3255			

3.3.3.5 EP terminals X21

Table 3-14 Terminal block X21

	Terminal	Name	Technical specifications
	1	Reserved, do not use	
	2	Reserved, do not use	
	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)			



Warning

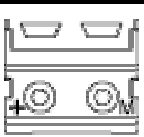
For operation, 24 V DC must be connected to terminal 3 and ground to terminal 4. Upon removal, pulse inhibit is activated. Feedback is deactivated and the bypass relay drops out. If the Line Module is not disconnected from the network when the EP terminal is deactivated (e.g. a main contactor is not 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.

3.3.3.6 X24 24 V terminal adapter

Table 3-15 Terminal block X24

	Terminal	Name	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 mm ² Type: Screw terminal 5 (see Connection Methods)			

3.3.3.7 Meaning of the LEDs on the active line module

Table 3-16 Meaning of the LEDs on the Line Module

LED	Color	State	Description
READY	-	OFF	Electronics power supply outside permissible tolerance range.
	Green	Continuous	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	Continuous	DRIVE-CLiQ communication is being established.
	Red	Continuous	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 permissible tolerance range.
	Orange	Continuous	DC link voltage within permissible tolerance range (only when ready for operation)
	Red	Continuous	DC link voltage outside the permissible tolerance range (only when Active Line Module is ready for operation).

Cause and rectification of faults

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

Reference: /IH1/ SINAMICS S120 Commissioning Manual

3.3.4 Dimension Drawings

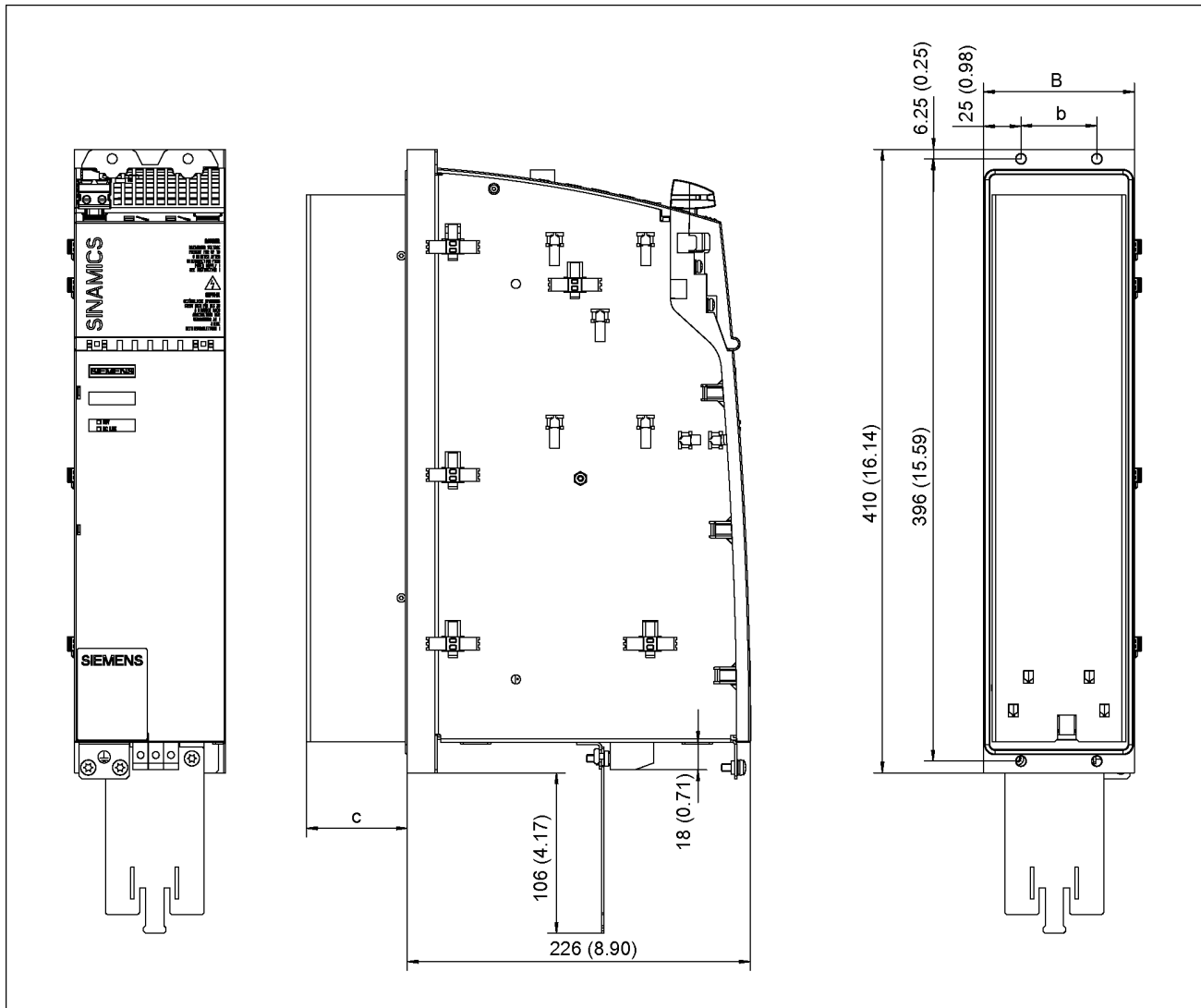


Figure 3-14 Dimension drawing of Active Line Module with external air cooling (16 kW)

Table 3-17 Dimensions of Active Line Module with external air cooling (16 kW)

Line Module type	Order number	W [mm] (inches)	w [mm] (inches)	c [mm] (inches)	h [mm] (inches)
16 kW	6SL3130-7TE21-6AAx	100 (3.94)	50 (1.97)	66.5 (2.62)	18 (0.71)

Note

The shielded terminal plate is part of the scope of supply of a 100 mm Line Module. More information can be found in "Accessories".

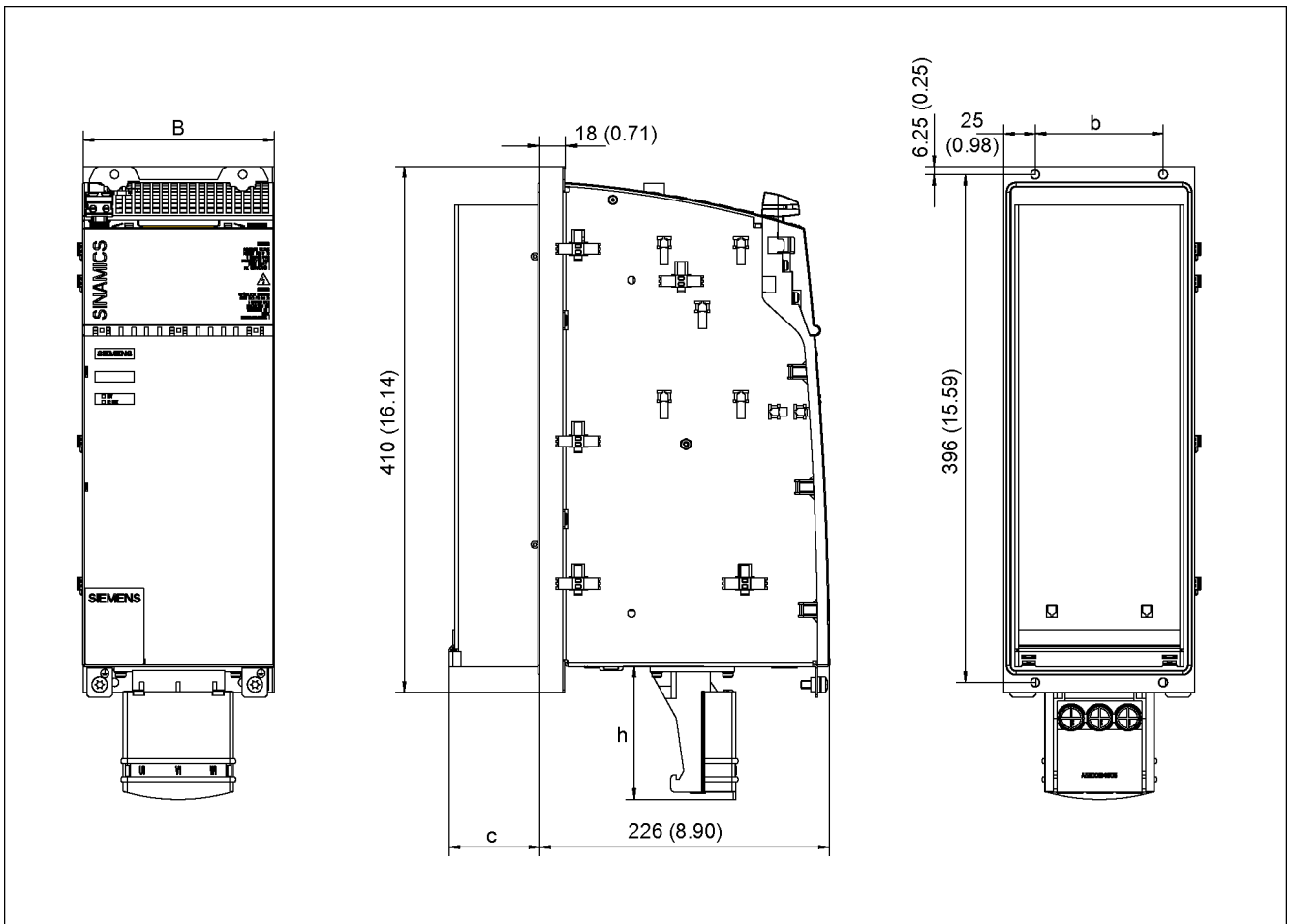


Figure 3-15 Dimension drawing of active line with external air cooling (36 kW, 55 kW, 80 kW, and 120 kW)

Table 3-18 Dimensions of Active Line Modules with external air cooling (36 kW, 55 kW, 80 kW, and 120 kW)

Line Module type	Order number	W [mm] (inches)	w [mm] (inches)	h [mm] (inches)	c [mm] (inches)
36 kW	6SL3131-7TE23-6AAx	150 (5.91)	100 (3.94)	105 (4.13)	71 (2.80)
55 kW	6SL3131-7TE25-5AAx	200 (7.87)	150 (5.91)	105 (4.13)	92 (3.62)
80 kW	6SL3131-7TE28-0AAx	300 (11.81)	250 (9.84)	105 (4.13)	82 (3.23)
120 kW	6SL3131-7TE31-2AAx	300 (11.81)	250 (9.84)	105 (4.13)	82 (3.23)

3.3.5 Installation

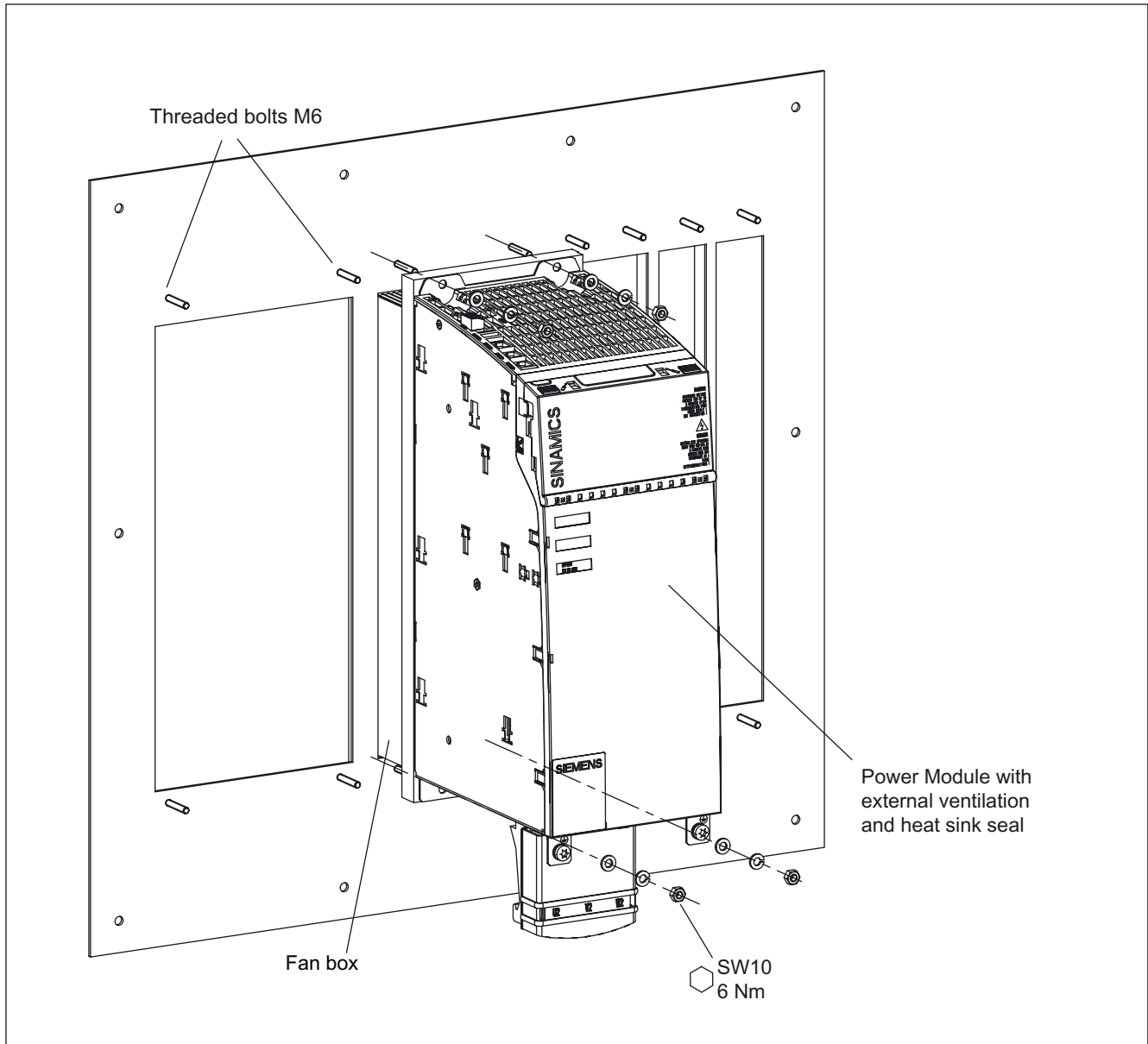


Figure 3-16 Example: installing the Power Module with external air cooling

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

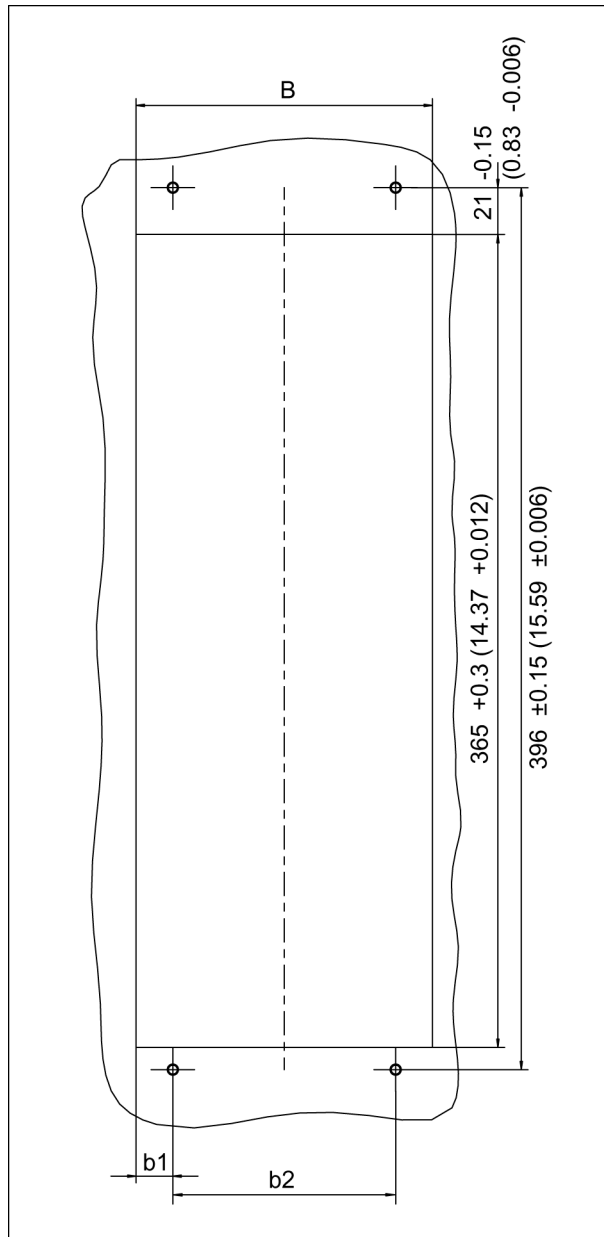


Figure 3-17 Installation openings for the Power Module with external air cooling (50 mm to 200 mm)

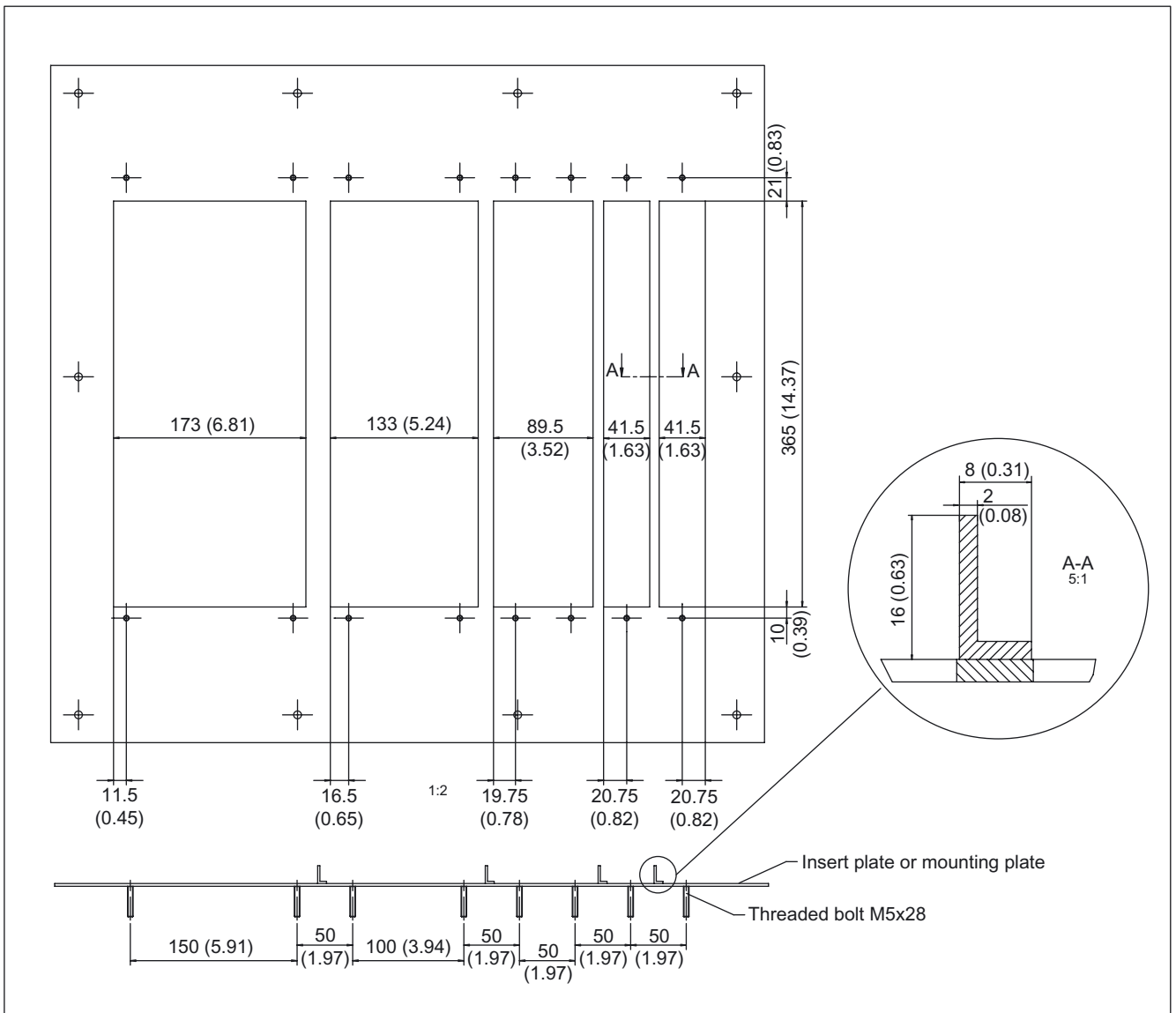


Figure 3-19 Example: mounting plate with a drive line-up

When installing the module, you must ensure that the module seal is tight all round. The cross-pieces must be sufficiently stable.

If required, we recommend that you reinforce the cross-pieces for the recesses.

In our example, the cross-pieces have been reinforced using brackets to EN 755-9.

Any means necessary can be used to secure the bracket to the insert plate.

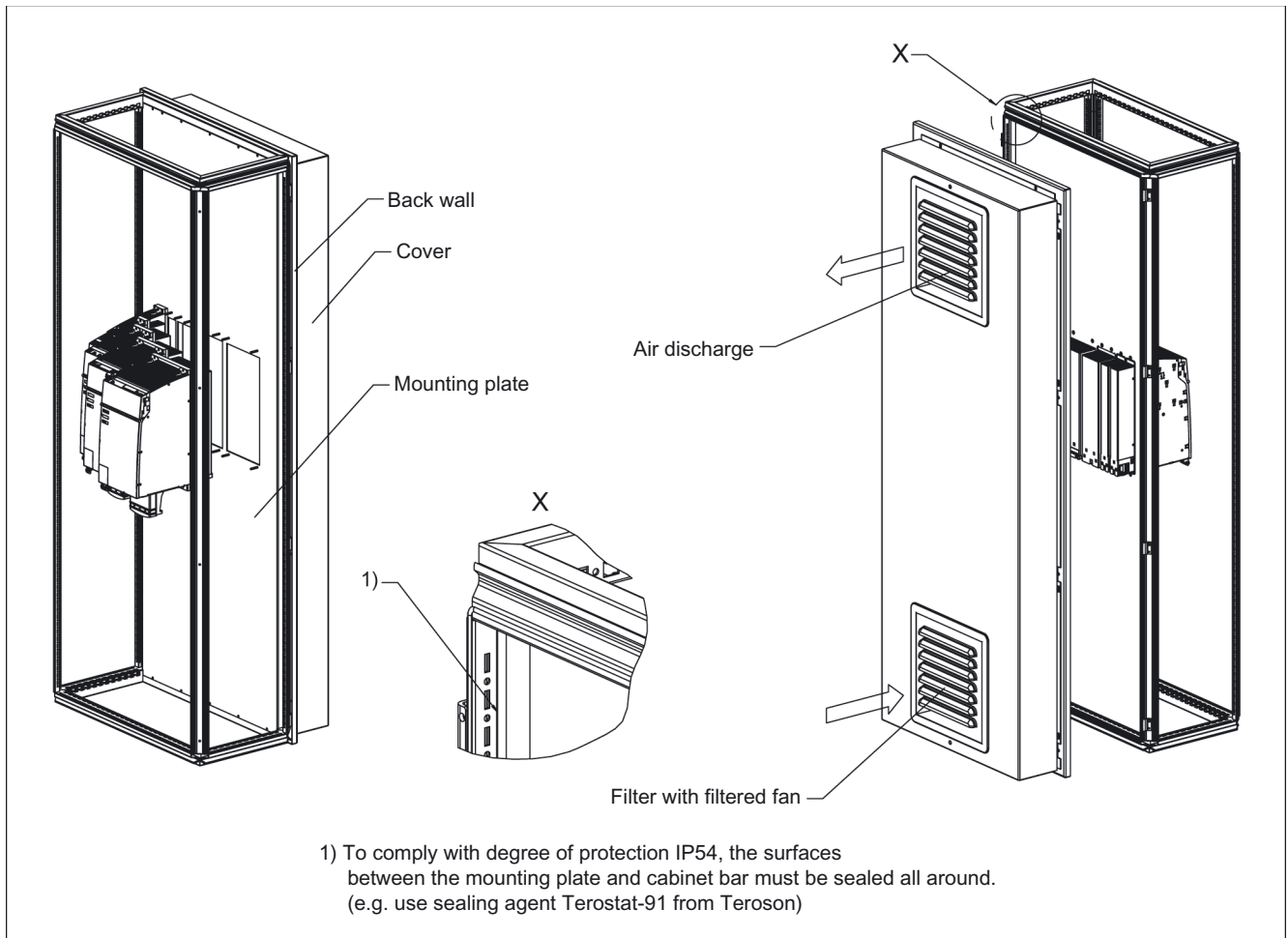


Figure 3-20 Example 1: installation in cabinet with mounting plate

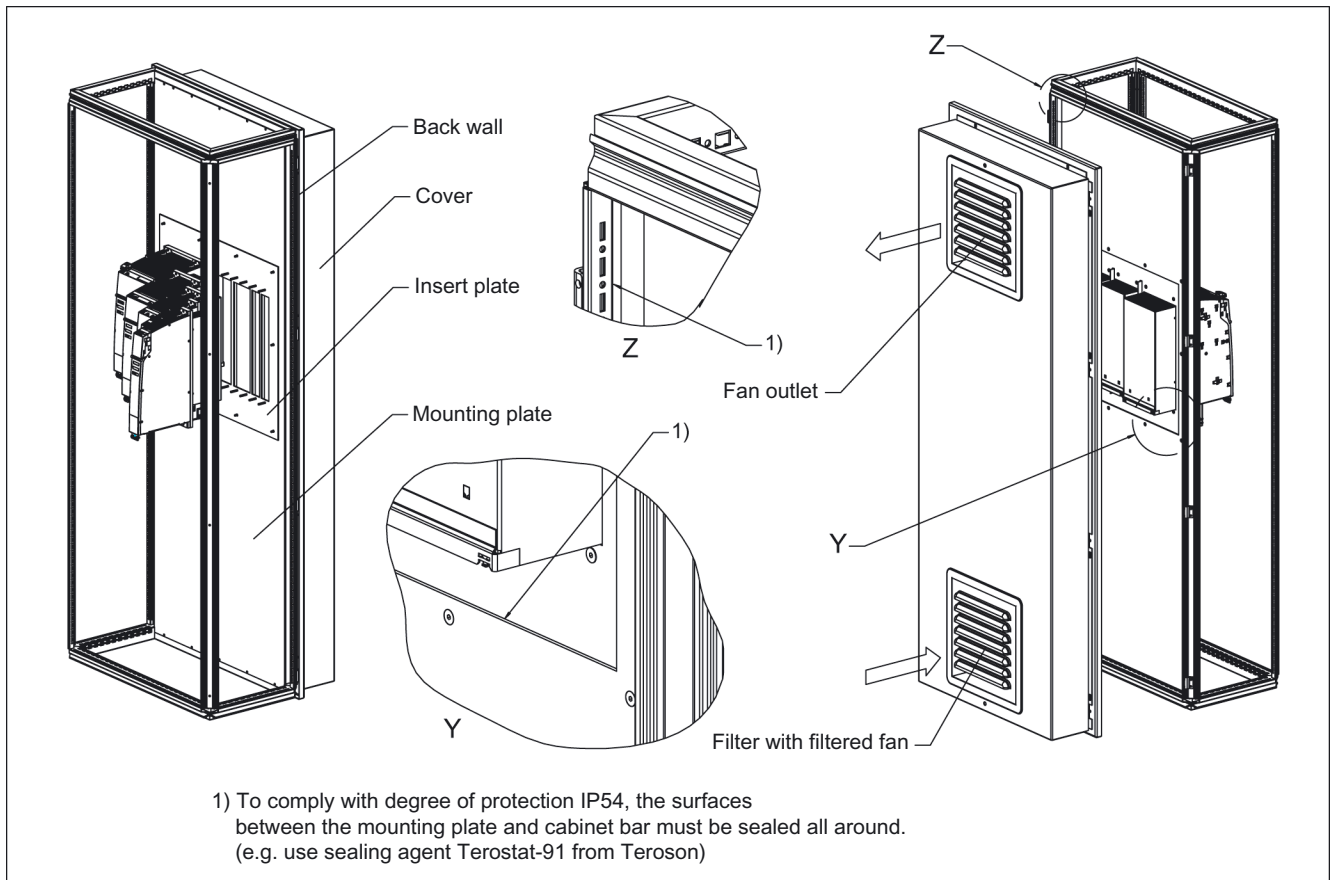


Figure 3-21 Example 2: installation in cabinet with mounting plate

We recommend that you attach a cover and filtered fan to the cabinet.

The filtered fan must be fitted in such a way that the cooling air required by the drive line-up is not restricted. This can be determined by establishing the total cooling air required by the individual components. This information is available in the technical specifications.

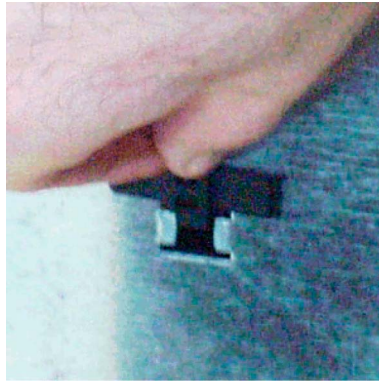
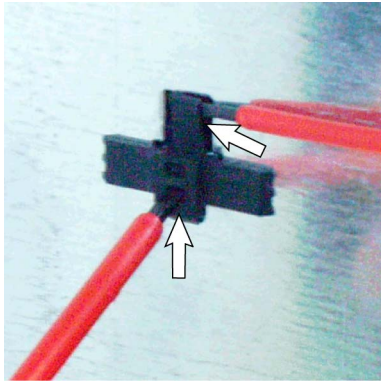
Note

If the cooling air requirement is not covered by the filtered fan, the components cannot output their specified power.

The filters with a filtered fan must be regularly checked for dirt and cleaned if necessary.

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.

The holder removed

3.3.6 Electrical connection

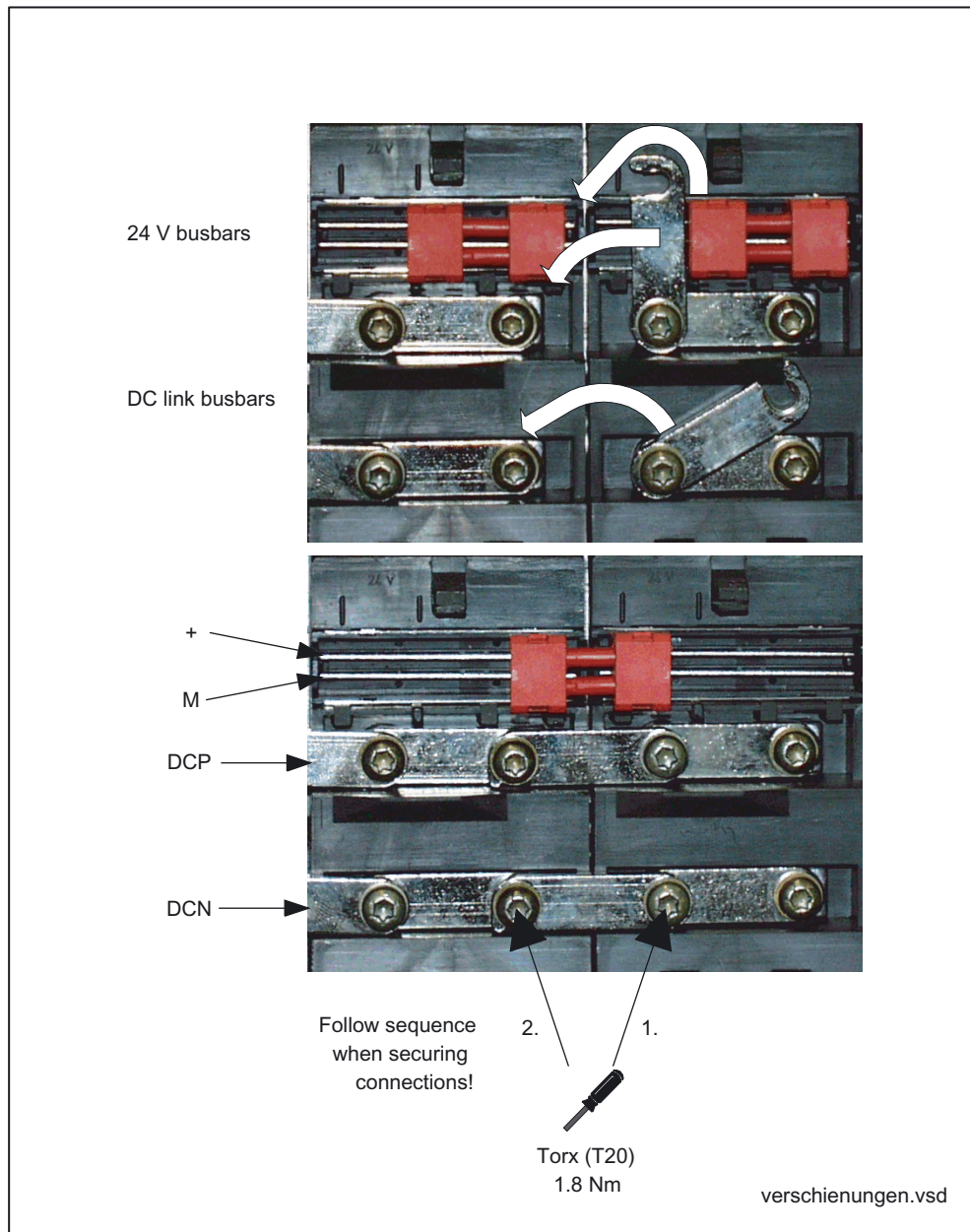


Figure 3-22 Busbar connections for booksize components

3.3.7 Technical specifications

Table 3-20 Technical specifications for Active Line Modules with external air cooling

Internal air cooling	6SL3131–	7TE21– 6AAx	7TE23– 6AAx	7TE25– 5AAx	7TE28– 0AAx	7TE31– 2AAx
Rated power	kW	16	36	55	80	120
Supply:						
Rated power (S1) ¹	kW (Pn)	16	36	55	80	120
Power rating (S6-40%) ¹	kW (Ps6)	21	47	71	106	145
Peak power rating ¹	kW (Pmax)	35	70	91	131	175
Regenerative feedback:						
Continuous regenerative power rating	kW	16	36	55	80	120
Peak regenerative power rating	kW	35	70	91	131	175
Connection voltages:						
Supply voltage	V _{ACrms}	3AC 380 -10% to 3AC 480 +10% (-15% < 1 min)				
Line frequency	Hz	47 to 63 Hz				
Electronics power supply	V _{DC}	24 (20.4 - 28.8)				
DC link voltage	V _{DC}	510 - 750				
Overvoltage trip threshold	V _{DC}	820 ± 2%				
Undervoltage trip threshold	V _{DC}	360 ± 2%				
Supply currents:						
at 380 V _{AC}	A _{AC}	26	58	88	128	192
at 480 V _{AC} /528 V _{AC}	A _{AC}	21 / 19	46 / 42	70 / 64	102 / 93	152 / 139
at 480 V (S6-40%)	A _{AC}	27	60	92	134	201
Peak current (at 400 V _{AC} /480 V _{AC})	A _{AC}	54 / 45	107 / 89	139 / 116	200 / 166	267 / 222
Output currents at 600 V _{DC} :						
Rated current	A _{DC}	27	60	92	134	200
at S6-40%	A _{DC}	35	79	121	176	244
peak current	A _{DC}	59	117	152	218	292
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
Electronics current consumption	A _{DC}	1.1	1.5	1.9	2	2.5
Total power loss (including electronic losses) ²	W	226.4	531	745.6	1081	1770
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	705	1 410	1 880	2 820	3 995
Charging limit	µF	20 000	20 000	20 000	20 000	20 000
Power factor	cosφ	1	1	1	1	1
Efficiency	η	0.98	0.98	0.98	0.98	0.98
Sound pressure level	dB(A)	<60	<65	<60	<73	<73
Cooling air requirement	m ³ /h	56	112	160	520	520
Rated voltage for rated data 3 AC 380 V						
Weight	kg	8.78	13.77	18.5	27.66	30.74

¹ The specified values apply to 380 V² For an overview, see the power loss tables in Cabinet Design.

Rated duty cycles of Active Line Modules

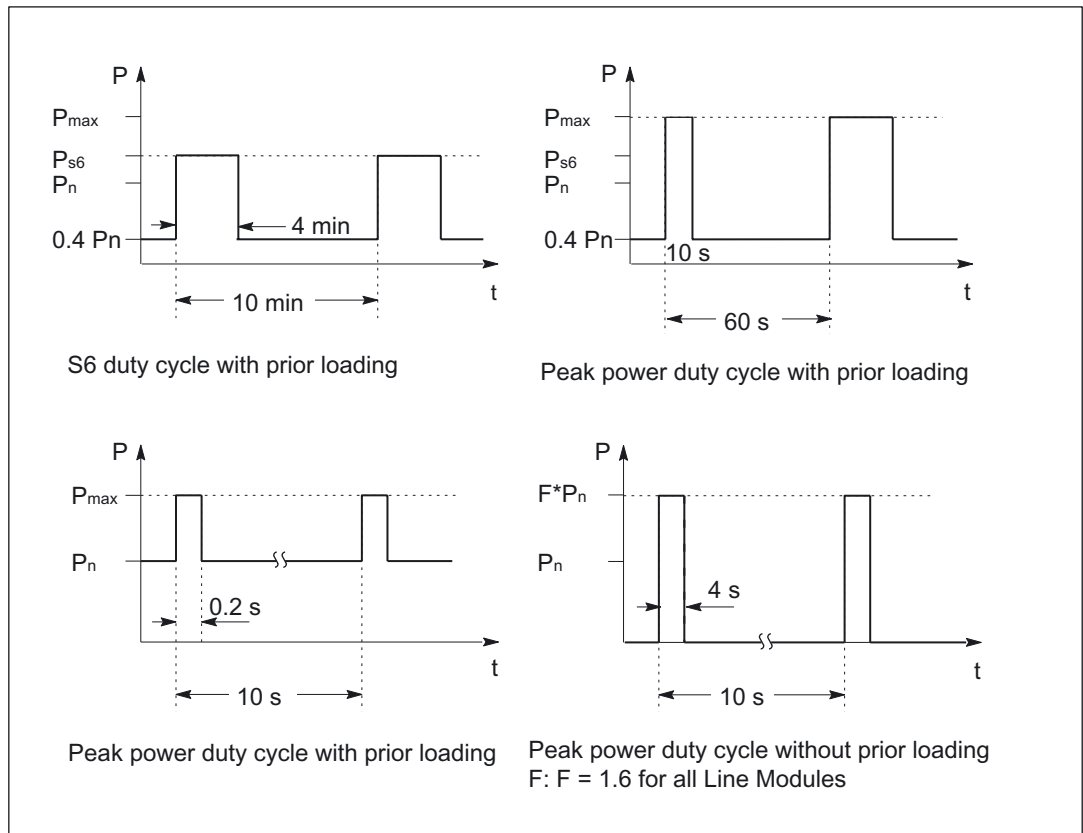


Figure 3-23 Rated duty cycles of Active Line Modules

Derating as a function of the ambient temperature

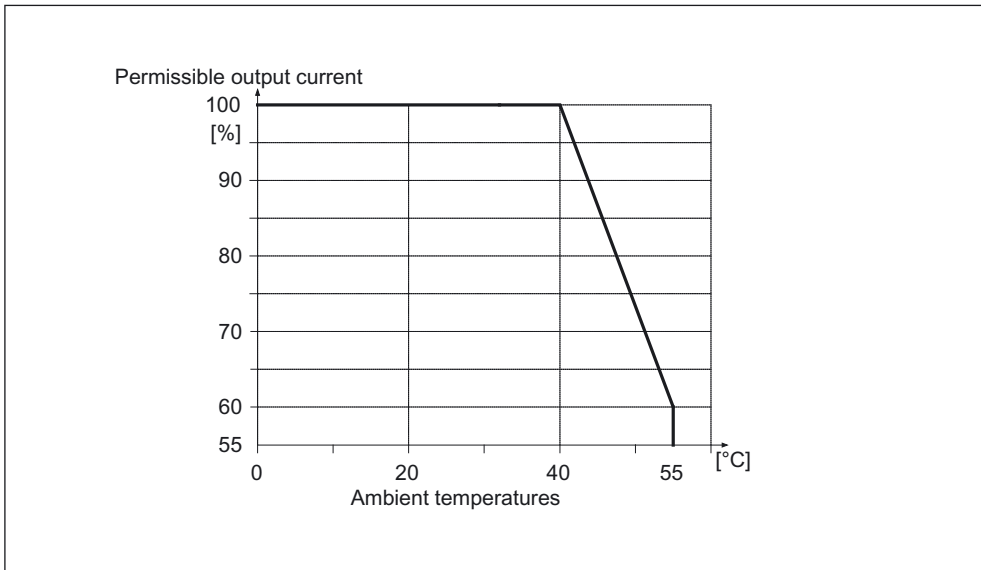


Figure 3-24 Derating as a function of the ambient temperature

Derating as a function of the installation altitude

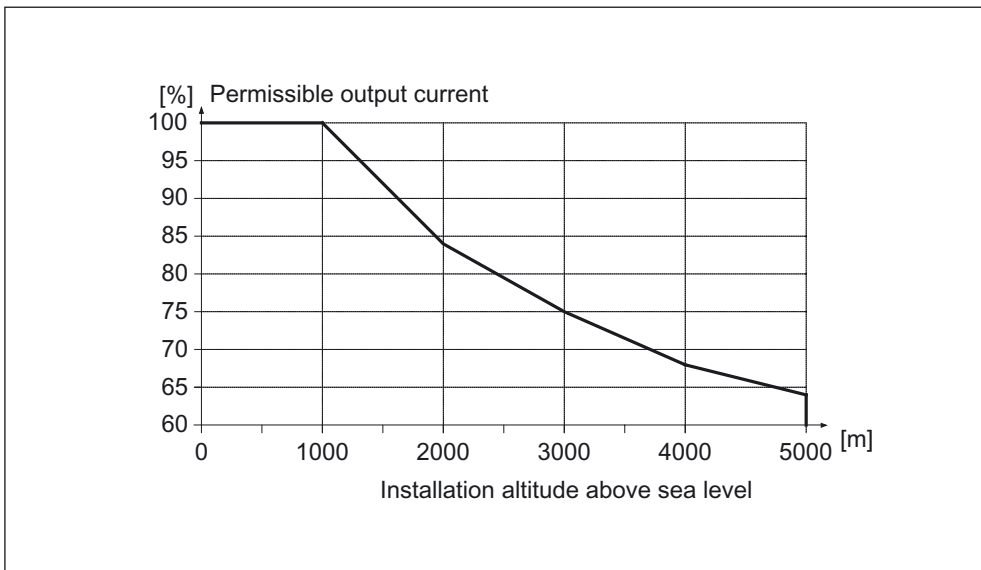


Figure 3-25 Derating as a function of the installation altitude

3.4 Smart Line Modules (5 kW and 10 kW) with internal air cooling

3.4.1 Description

The Smart Line Module (SLM) is an unregulated line infeed/feedback unit. The SLM supplies the Motor Module(s) with an unregulated DC voltage at the DC output. As regards the current and voltage waveform, the SLM in infeed mode exhibits the typical characteristic of a 6-pulse diode rectifier jumper.

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.

3.4.2 Safety Information



Warning

After disconnecting all the supply voltages, a hazardous voltage will be present in all components for another 5 minutes. 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, otherwise this could result in secondary damage or 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).



Caution

The DC link discharge time hazard warning must be affixed to the modules in the local language.

A set of labels in 12 languages is available using order number: 6SL3166-3AB00-0AAx.

Notice

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

Caution

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



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 ratio of line short-circuit power to rated power must be ≥ 70 .

Caution

The left and right ends of the DC link busbar of a drive line-up must be fitted with peripheral covers (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.

3.4.3 Interface Description

3.4.3.1 Overview

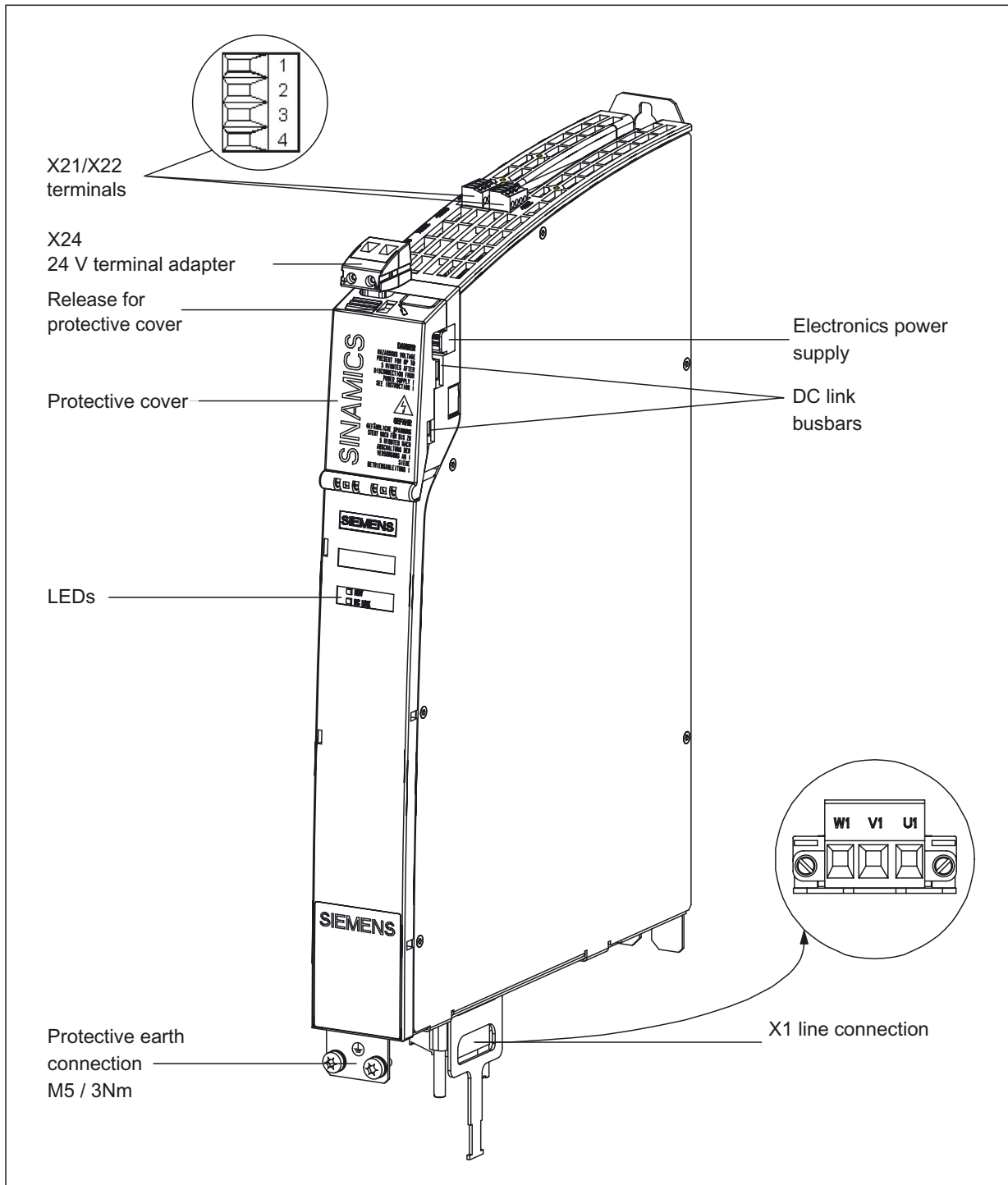


Figure 3-26 Smart line module with internal air cooling (example 5 kW)

3.4.3.2 Connection example

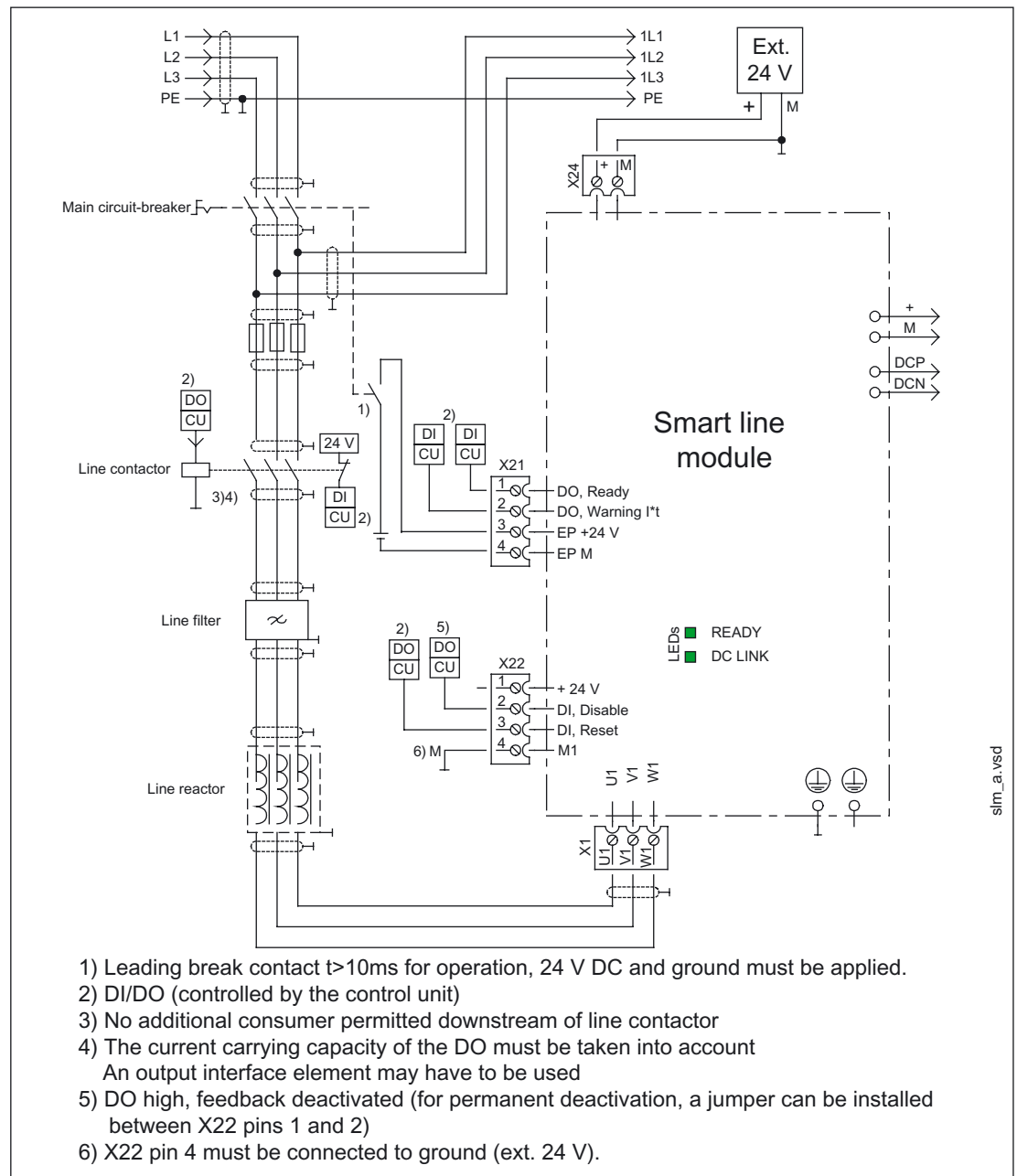
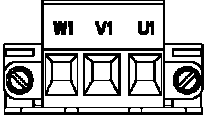
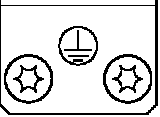


Figure 3-27 Connection example of Smart Line Module

3.4.3.3 X1 line connection

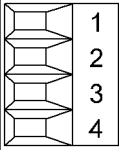
Table 3-21 Terminal block X1 of Smart Line Module (5 kW and 10 kW)

	Terminal	Technical specifications
	U1	Max. connection voltage: 3AC 480 V +10 at 47 Hz to 63 Hz Max. connectable cross-section: 6 mm ² Type: Screw terminal 5 (see Connection Methods)
	V1	
	W1	
	PE connection	Threaded hole M5/3 Nm ¹

¹ for ring cable lugs to DIN 46234

3.4.3.4 X21 terminals: smart line module

Table 3-22 Terminal block X21

	Terminal	Name	Technical specifications
	1	DO: Ready	Checkback: Smart Line Module ready The signal switches to high level when the following conditions have been met: <ul style="list-style-type: none"> • Electronics power supply (X24) OK • DC link is pre-charged • Pulses enabled (X21.3/.4) • No overtemperature • No overcurrent switch-off
	2	DO: Pre Warning	Prewarning threshold overtemperature / I x t When 80% of the maximum temperature of the Smart Line Module is exceeded, a high signal is output.
	3	DI: Enable pulses	Voltage 24 V DC Current consumption: 10 mA
	4	DI: Enable pulses ground	Isolated input
Max. connectable cross-section: 1.5 mm ² Type: Screw terminal 1 (see Spring-Loaded Terminals/Screw Terminals)			

Note

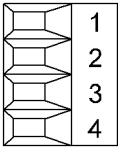
For operation, 24 V DC must be connected to terminal 3 and ground to terminal 4. When removed, pulse inhibit is activated, feedback is deactivated and the bypass relay drops out. If the Line Module is not disconnected from the network when the EP terminal is deactivated (e.g. a main contactor is not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

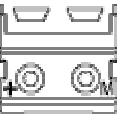
3.4.3.5 X22 terminals: smart line module

Table 3-23 Terminal block X22

	Terminal	Name	Technical specifications
	1	24 V power supply	Electronics power supply for controlling digital inputs X22.2 and 3.
	2	DI: Disable Regeneration	Deactivate feedback 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	Electronic ground
Max. connectable cross-section: 1.5 mm ² Type: Screw terminal 1 (see Connection Methods)			

3.4.3.6 X24 24 V terminal adapter

Table 3-24 Terminal block X24

	Terminal	Name	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 mm ² Type: Screw terminal 5 (see Connection Methods)			

3.4.3.7 Meaning of the LEDs on the smart line module

Table 3-25 Meaning of the LEDs on the Smart Line Module

LED	Color	State	Description
READY	Green	Continuous	Operation
	Yellow	Continuous	Pre-charging not yet complete; bypass relay dropped out
	Red	Continuous	Overtemperature/overcurrent switch-off, or Electronics power supply outside permissible tolerance range
DC LINK		OFF	Electronics power supply outside permissible tolerance range
	Yellow	Continuous	DC link voltage within permissible tolerance range
	Red	Continuous	DC link voltage outside permissible tolerance range

Cause and rectification of faults

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

Reference: /IH1/ SINAMICS S120 Commissioning Manual

3.4.4 Dimension Drawing

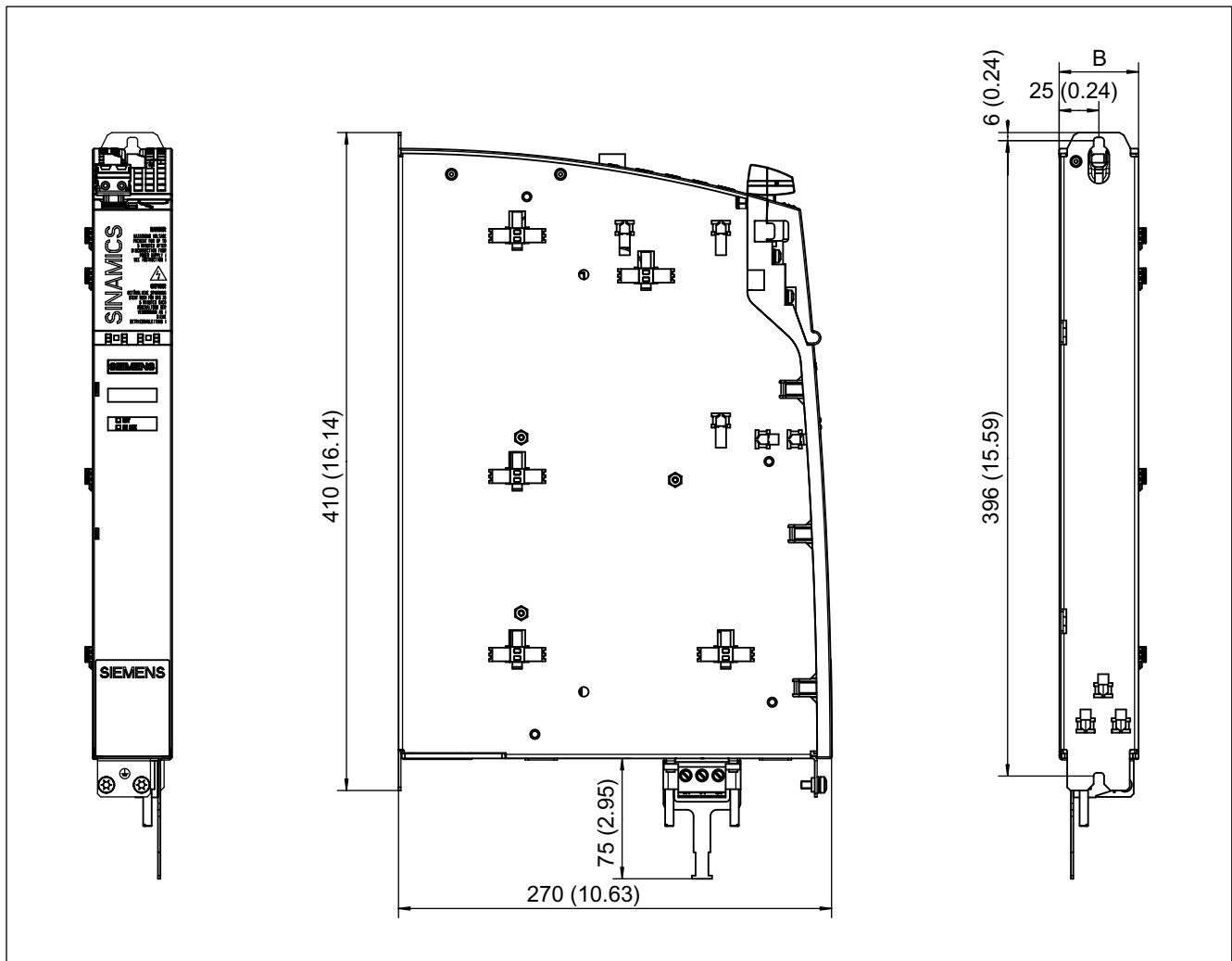


Figure 3-28 Dimension drawing of Smart Line Module (5 kW und 10 kW) with internal air cooling

Table 3-26 Dimensions of Smart Line Module (5 kW und 10 kW) with internal air cooling

Line Module type	Order number	W [mm] (inches)
5 kW	6SL3130-6AE15-0AAx	50 (1.97)
10 kW	6SL3130-6AE21-0AAx	50 (1.97)

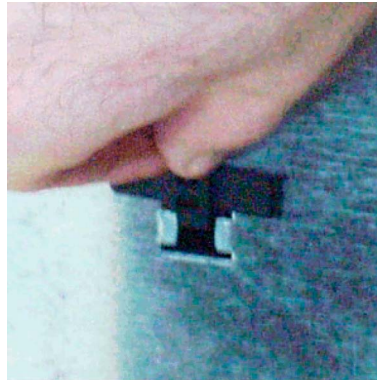
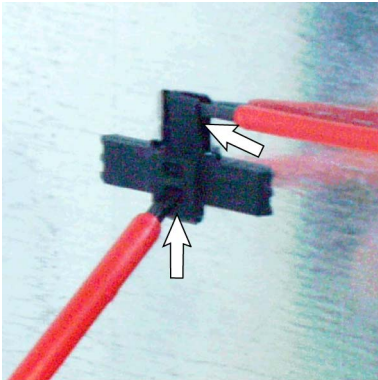
Note

The shielded terminal plate is part of the scope of supply of the 50 mm Smart Line Module.

3.4.5 Installation

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.

The holder removed

3.4.6 Electrical Connection

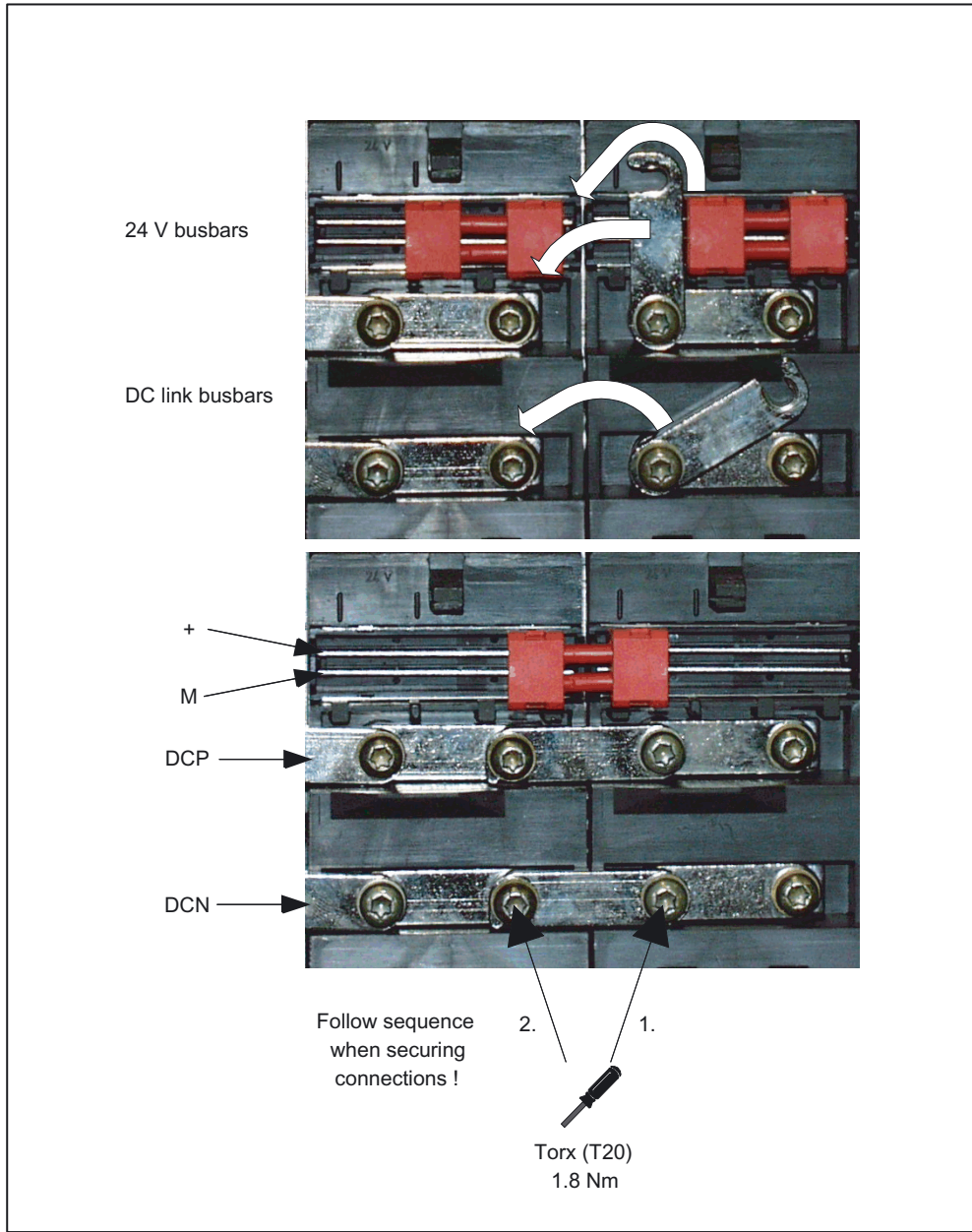


Figure 3-29 Busbar connections for booksize components

3.4.7 Technical Specifications

Table 3-27 Technical specifications for Smart Line Modules in booksize format with internal air cooling

Internal air cooling	6SL3130-	6AE15-0AAx	6AE21-0AAx
Rated power	kW	5	10
Supply:			
Rated power (S1) ¹	kW (Pn)	5	10
S6 infeed			
Power rating (S6-40%) ¹	kW (Ps6)	6.5	13
Peak power rating ¹	kW (Pmax)	10	20
Regenerative feedback:			
Continuous regenerative power rating	kW	5	10
Peak regenerative power rating	kW	10	20
Connection voltages:			
Line voltage	V _{AC}	3AC 380 -10% to 3AC 480 +10% (-15% < 1 min)	
Line frequency	Hz	47 to 63	
Electronics power supply	V _{DC}	24 (20.4 - 28.8)	
DC link voltage	V _{DC}	510 – 750	
Overvoltage trip threshold	V _{DC}	820 ± 2%	
Undervoltage trip threshold	V _{DC}	360 ± 2%	
Supply currents:			
at 380 V _{AC}	A _{AC}	12	24
at 480 V _{AC} /528 V _{AC}	A _{AC}	9.3/8.5	18/16.5
at 480 V; S6-40%)	A _{AC}	12	24
Peak current (at 400 V _{AC} /480 V _{AC})	A _{AC}	22/18.5	44/37
Output currents at 600 V _{DC} :			
Rated current	A _{DC}	8.3	16.6
at S6-40%	A _{DC}	11	22
peak current	A _{DC}	16.6	33.2
DC link busbar current carrying capacity	A _{DC}	100	100
24 V busbar current carrying capacity	A _{DC}	20	20
Electronics current consumption	A _{DC}	1.0	1.3
Total power loss (including electronic losses) ²	W	113	201.2
Max. ambient temperature without derating	°C	40	40
Max. ambient temperature with derating	°C	55	55
DC link capacitance	µF	220	330
Charging limit	µF	6000	6000
Power factor	cos φ	1	1
Efficiency	η	0.98	0.98
Cooling method		Internal fan	Internal fan
Sound pressure level	dB(A)	<60	<60
Cooling air requirement	m ³ /h	29.6	29.6
Rated voltage for rated data 3 AC 380 V			
Weight	kg	4.68	4.78

¹ The specified values apply to 380 V

² For an overview, see the power loss tables in Cabinet Design.

Rated duty cycles of Smart Line Modules

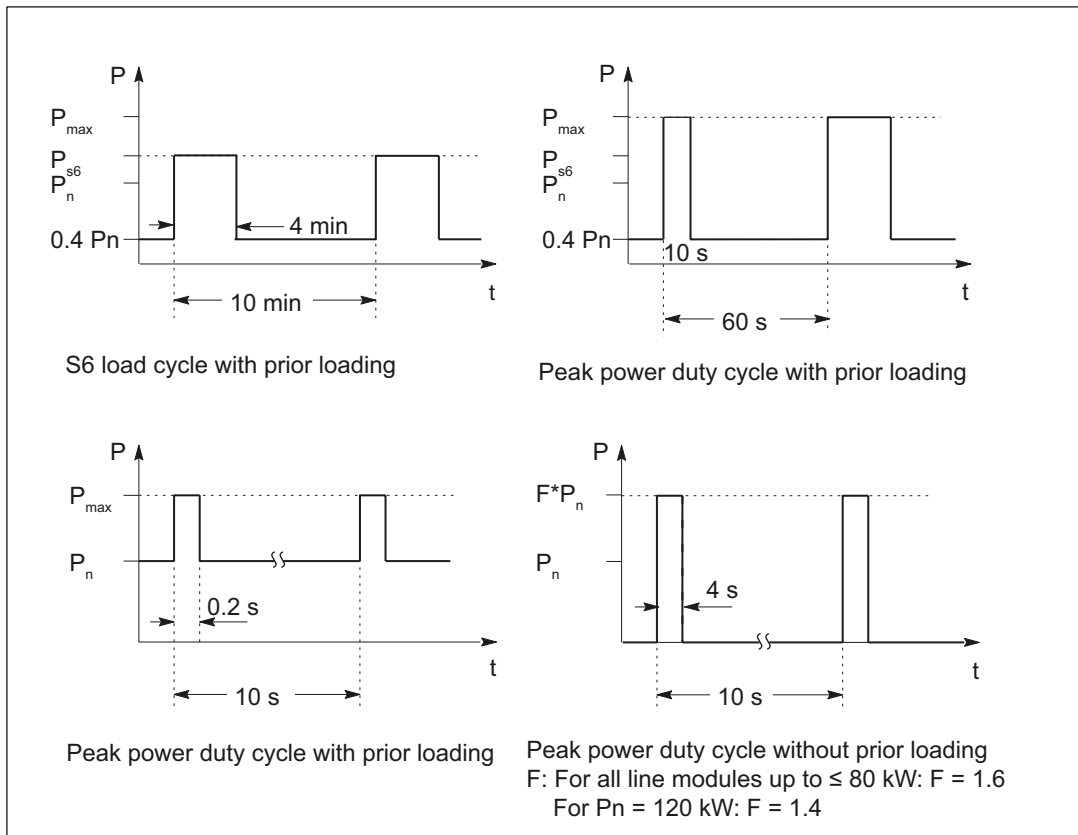


Figure 3-30 Rated duty cycles of Smart Line Modules

Derating as a function of the ambient temperature

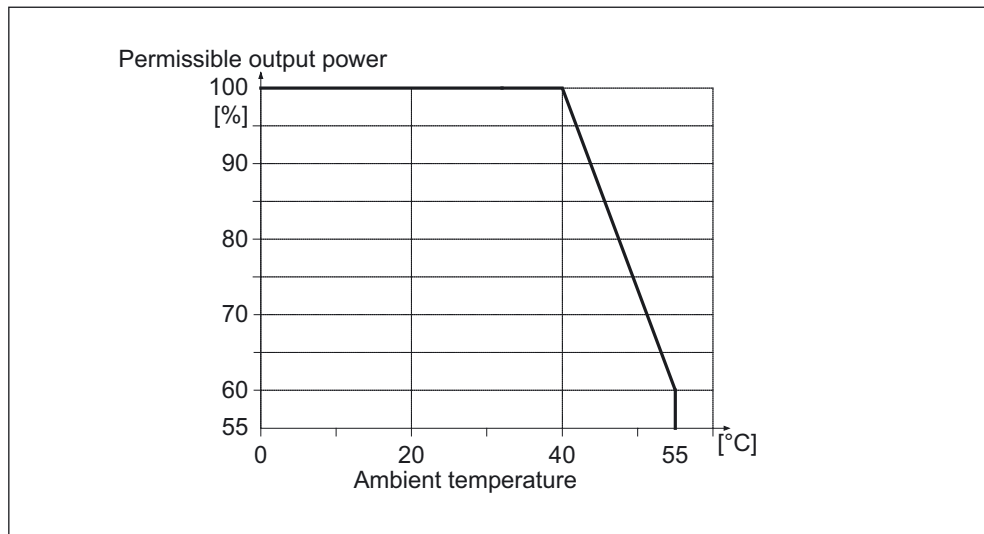


Figure 3-31 Derating as a function of the ambient temperature

Derating as a function of the installation altitude

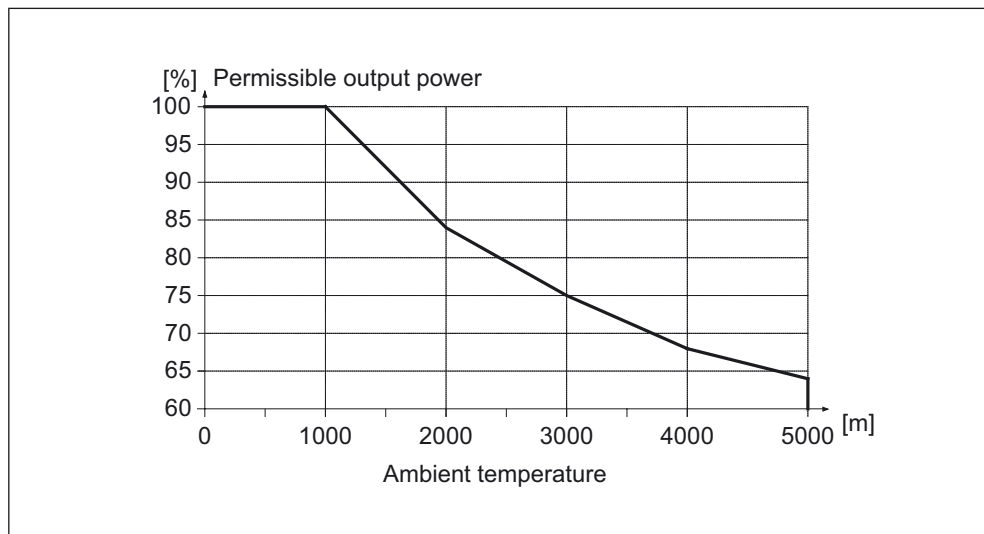


Figure 3-32 Derating as a function of the installation altitude

3.5 Smart Line Modules (16 kW and 36 kW) with internal air cooling

3.5.1 Description

The Smart Line Module (SLM) is an unregulated line infeed/feedback unit. The SLM supplies the Motor Module(s) with an unregulated DC voltage at the DC output. As regards the current and voltage waveform, the SLM in infeed mode exhibits the typical characteristic of a 6-pulse diode rectifier jumper.

In feedback mode, the current waveform is square waved. Feedback can be deactivated by means of parameterization because like the Active Line Modules, these Smart Lines Modules are 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.

3.5.2 Safety Information



Warning

After disconnecting all the supply voltages, a hazardous voltage will be present in all components for another 5 minutes. 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, otherwise this could result in secondary damage or 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).



Caution

The DC link discharge time hazard warning must be affixed to the modules in the local language.

A set of labels in 12 languages is available using order number: 6SL3166-3AB00-0AAx.

Notice

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

Caution

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



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 ratio of line short-circuit power to rated power must be ≥ 70 .

Caution

The left and right ends of the DC link busbar of a drive line-up must be fitted with peripheral covers (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.

3.5.3 Interface description

3.5.3.1 Overview

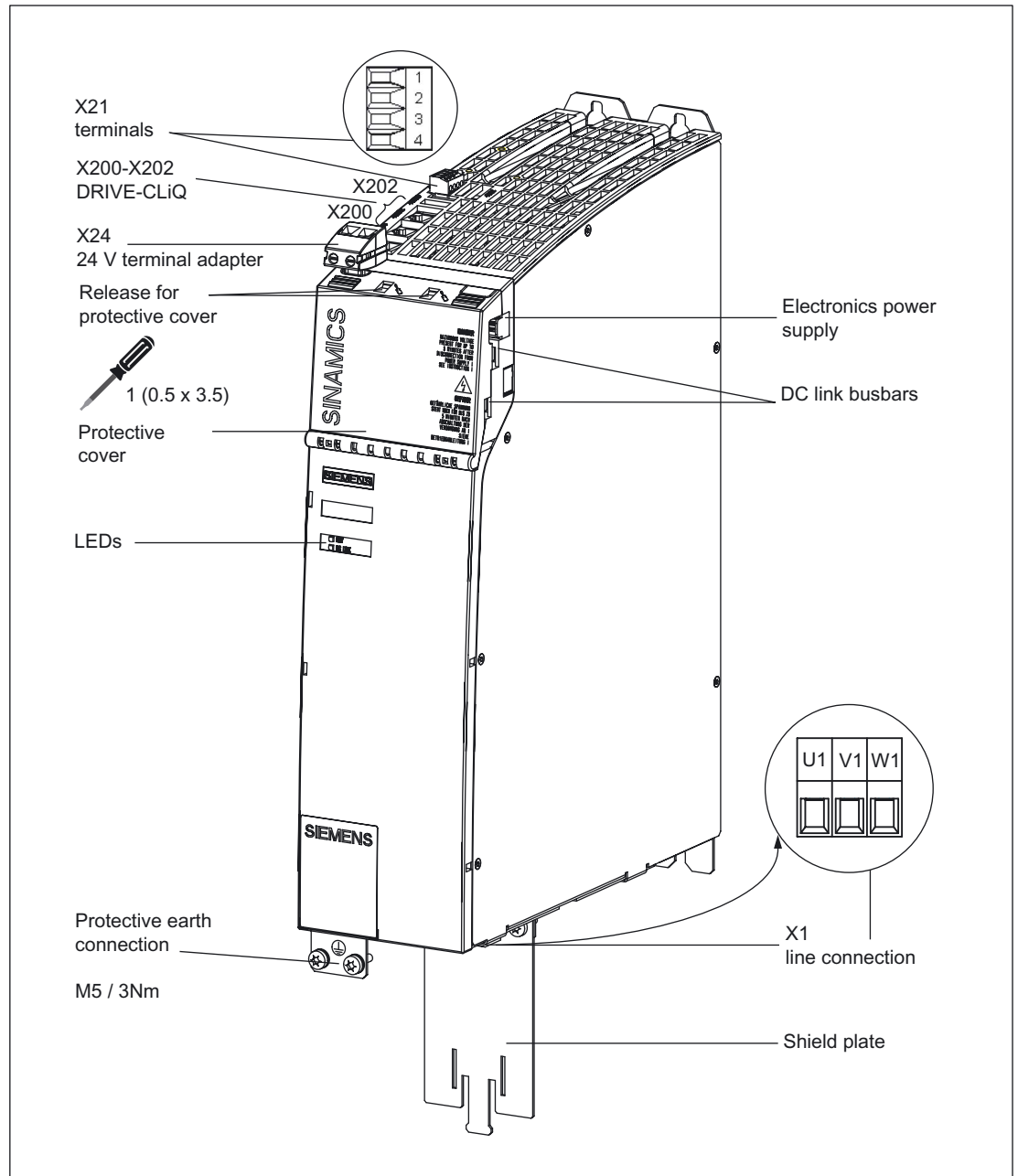


Figure 3-33 Smart Line Module with internal air cooling (example 16 kW)

3.5 Smart Line Modules (16 kW and 36 kW) with internal air cooling

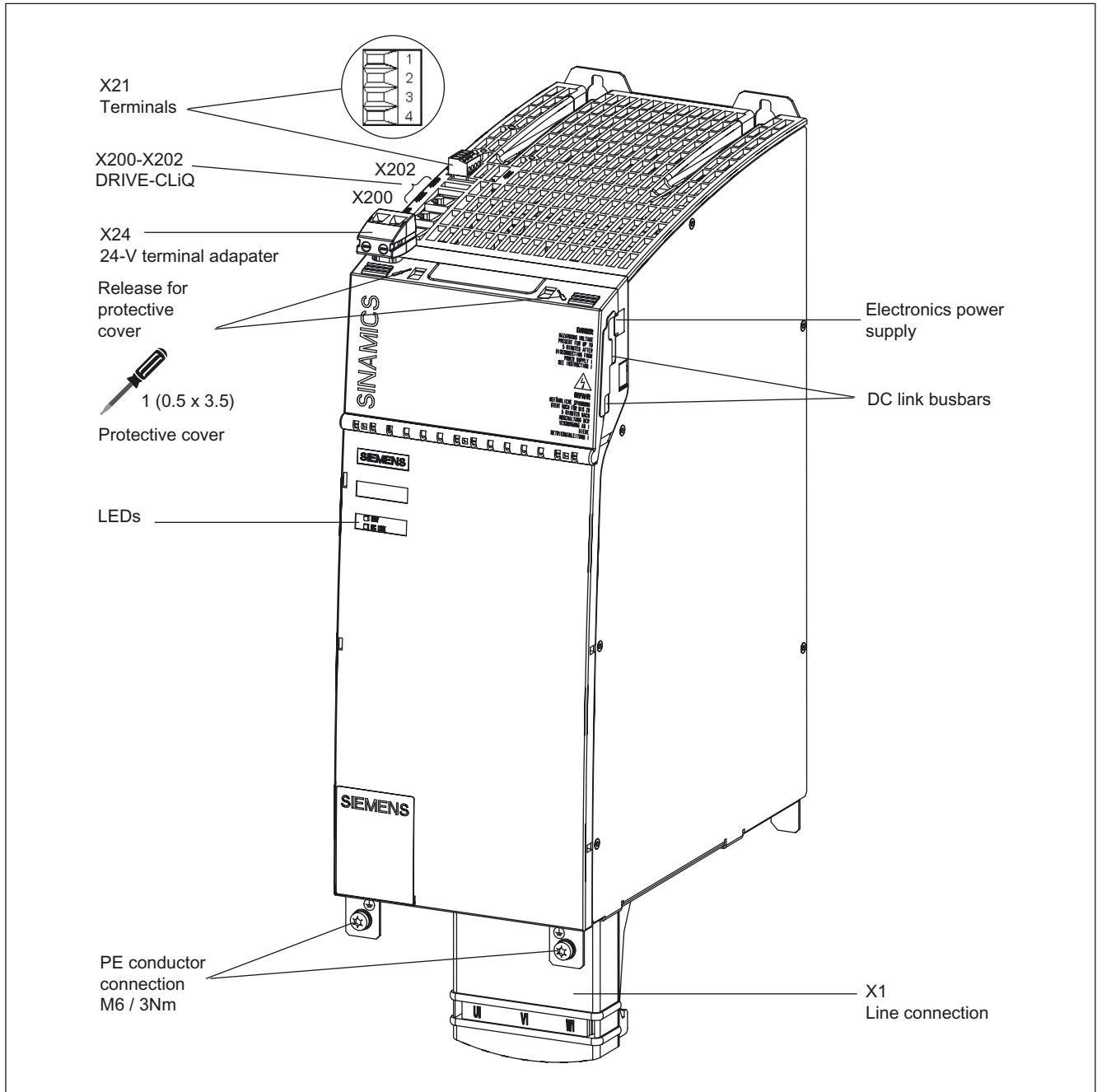


Figure 3-34 Smart Line Module with internal air cooling (example 36 kW)

3.5.3.2 Connection example

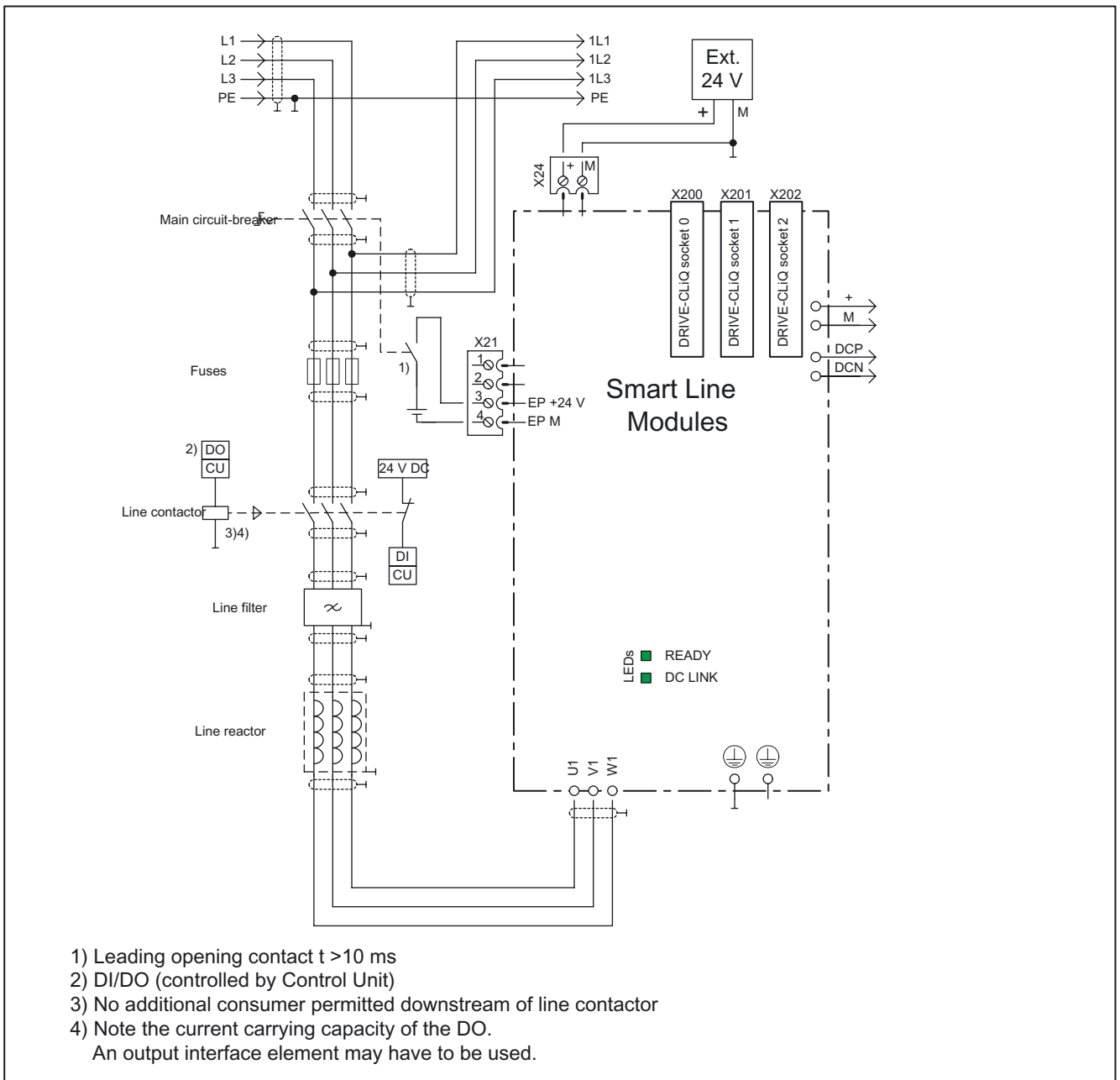
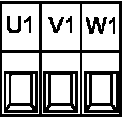
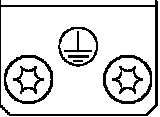


Figure 3-35 Connection example: Smart Line Module (16 kW and 36 kW)

3.5 Smart Line Modules (16 kW and 36 kW) with internal air cooling

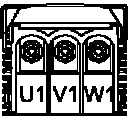
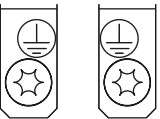
3.5.3.3 X1 line connection

Table 3-28 Terminal block X1 Smart Line Module 16 kW

	Terminal	Technical specifications
	U1	Supply voltage: 3AC 480 V +10% (-15% < 1 min) at 47 Hz to 63 Hz Max. connectable cross-section: 10 mm ² Type: Screw terminal 6 (see Connection Methods)
	V1	
	W1	
	PE connection	Threaded hole M5/3 Nm ¹

¹ for ring cable lugs to DIN 46234

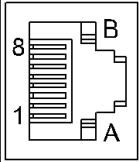
Table 3-29 Terminal block Smart Line Module 36 kW

	Terminals	Technical specifications
	U1	Supply voltage: 3AC 480 V +10% (-15% < 1 min) at 47 Hz to 63 Hz 36kW: Threaded bolt M6/6 Nm ¹
	V1	
	W1	
	PE connection	36kW: Threaded hole M6/6 Nm ¹

¹ for ring cable lugs to DIN 46234

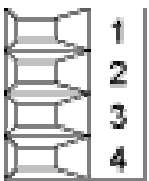
3.5.3.4 X200-X202 DRIVE-CLiQ interfaces

Table 3-30 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	GND (0 V)	Electronic ground	
	Blanking plate for DRIVE-CLiQ interface: Molex, order number: 85999-3255			

3.5.3.5 EP terminals X21

Table 3-31 Terminal block X21

	Terminal	Name	Technical specifications
	1	Reserved, do not use	Voltage 24 V DC Current consumption: 10 mA Isolated input Signal propagation times: L → H 100 µs H → L: 1000 µs
	2	Reserved, do not use	
	3	EP +24 V (Enable Pulses)	
	4	EP M (Enable Pulses)	
Max. connectable cross-section: 1.5 mm ² Type: Screw terminal 1 (see Connection Methods)			



Warning

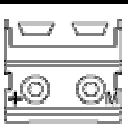
For operation, 24 V DC must be connected to terminal 3 and ground to terminal 4. Upon removal, pulse inhibit is activated. Feedback is deactivated and the bypass relay drops out. If the Line Module is not disconnected from the network when the EP terminal is deactivated (e.g. a main contactor is not 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.

3.5.3.6 X24 24 V terminal adapter

Table 3-32 Terminal block X24

	Terminal	Name	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 mm ² Type: Screw terminal 5 (see Connection Methods)			

3.5.3.7 Meaning of the LEDs on the Smart Line Module

Table 3-33 Meaning of the LEDs on the Line Module

LED	Color	State	Description
READY	-	OFF	Electronics power supply outside permissible tolerance range.
	Green	Continuous	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	Continuous	DRIVE-CLiQ communication is being established.
	Red	Continuous	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 permissible tolerance range.
	Orange	Continuous	DC link voltage within permissible tolerance range (only when ready for operation)
	Red	Continuous	DC link voltage outside the permissible tolerance range (only when Active Line Module is ready for operation).

Cause and rectification of faults

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

Reference: /IH1/ SINAMICS S120 Commissioning Manual

3.5.4 Dimension Drawings

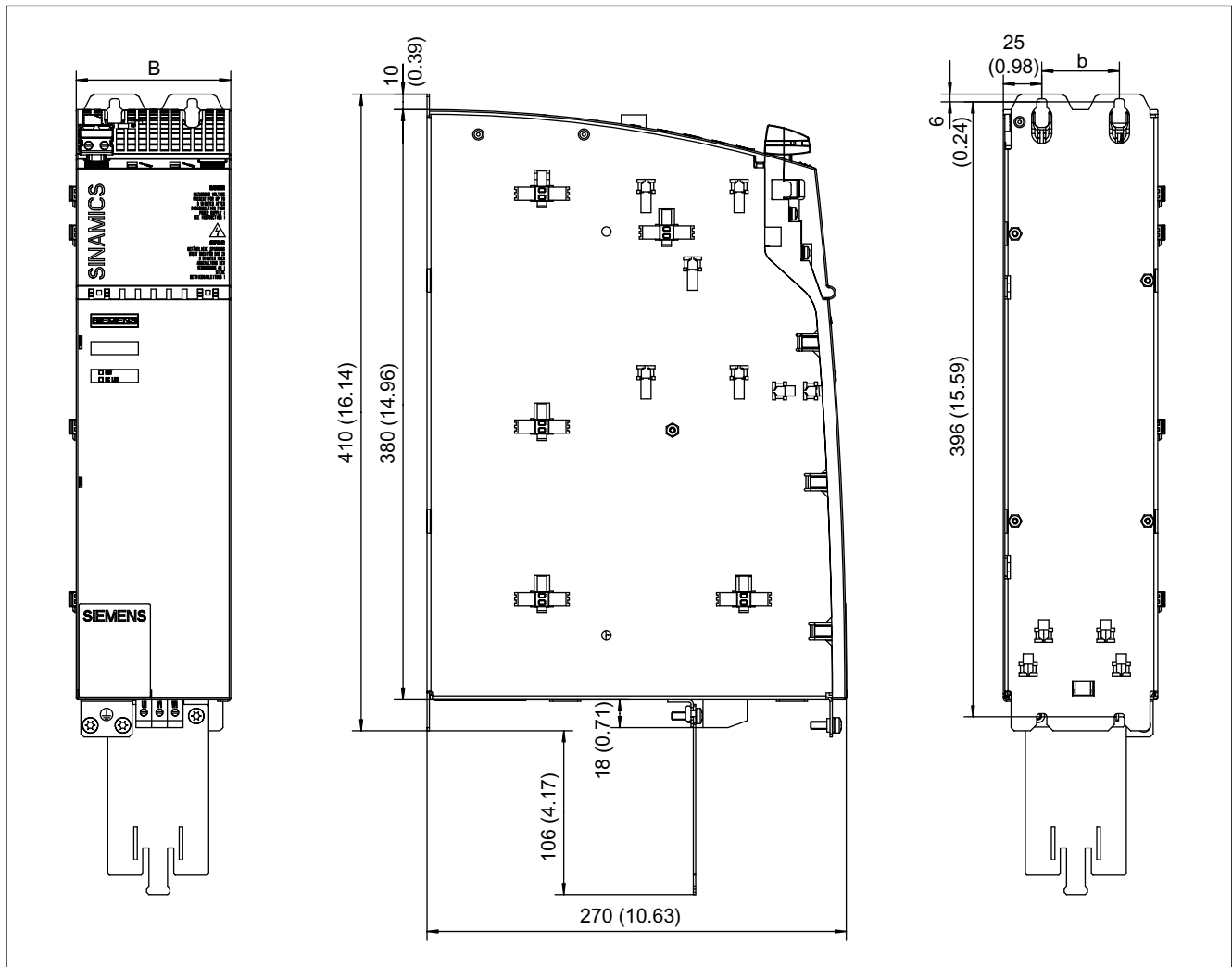


Figure 3-36 Dimension drawing of the Smart Line Module (16 kW) with internal air cooling

Table 3-34 Dimensions of Smart Line Module with internal air cooling

Smart Line Module type	Order number	W [mm] (inches)	w [mm] (inches)	h [mm] (inches)
16 kW	6SL3130-6TE21-6ABx	100 (3.94)	50 (1.97)	18 (0.71)

Note

The shielded terminal plate is part of the scope of supply of a 100 mm Line Module. Further details can be found in "Accessories".

3.5 Smart Line Modules (16 kW and 36 kW) with internal air cooling

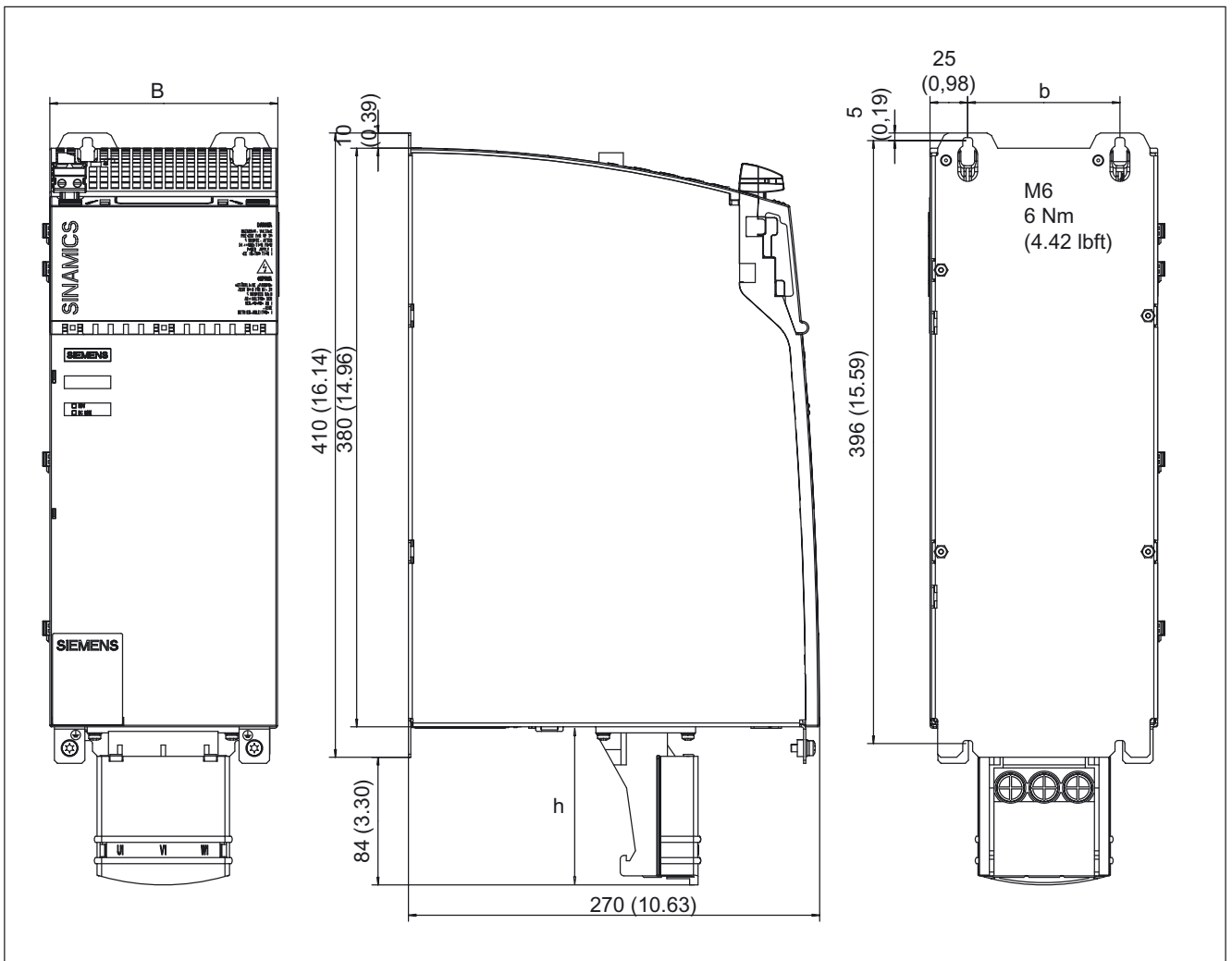


Figure 3-37 Dimension drawing of the Smart Line Module (36 kW) with internal air cooling

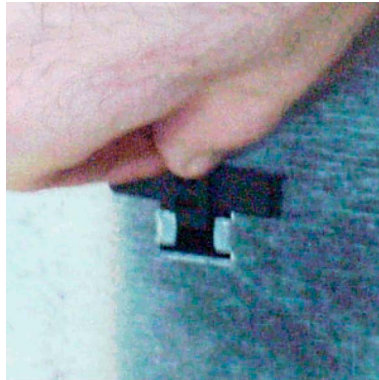
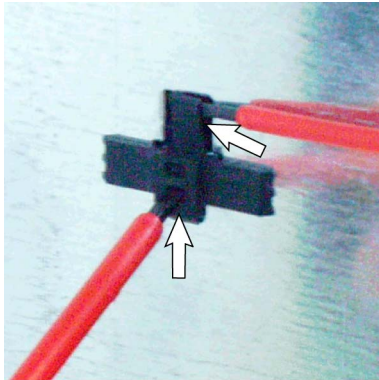
Table 3-35 Dimensions of Smart Line Module with internal air cooling

Smart Line Module type	Order number	W [mm] (inches)	w [mm] (inches)	h [mm] (inches)
36 kW	6SL3130-6TE23-6ABx	150 (5.91)	100 (3.94)	105 (4.13)

3.5.5 Installation

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.

The holder removed

3.5.6 Electrical Connection

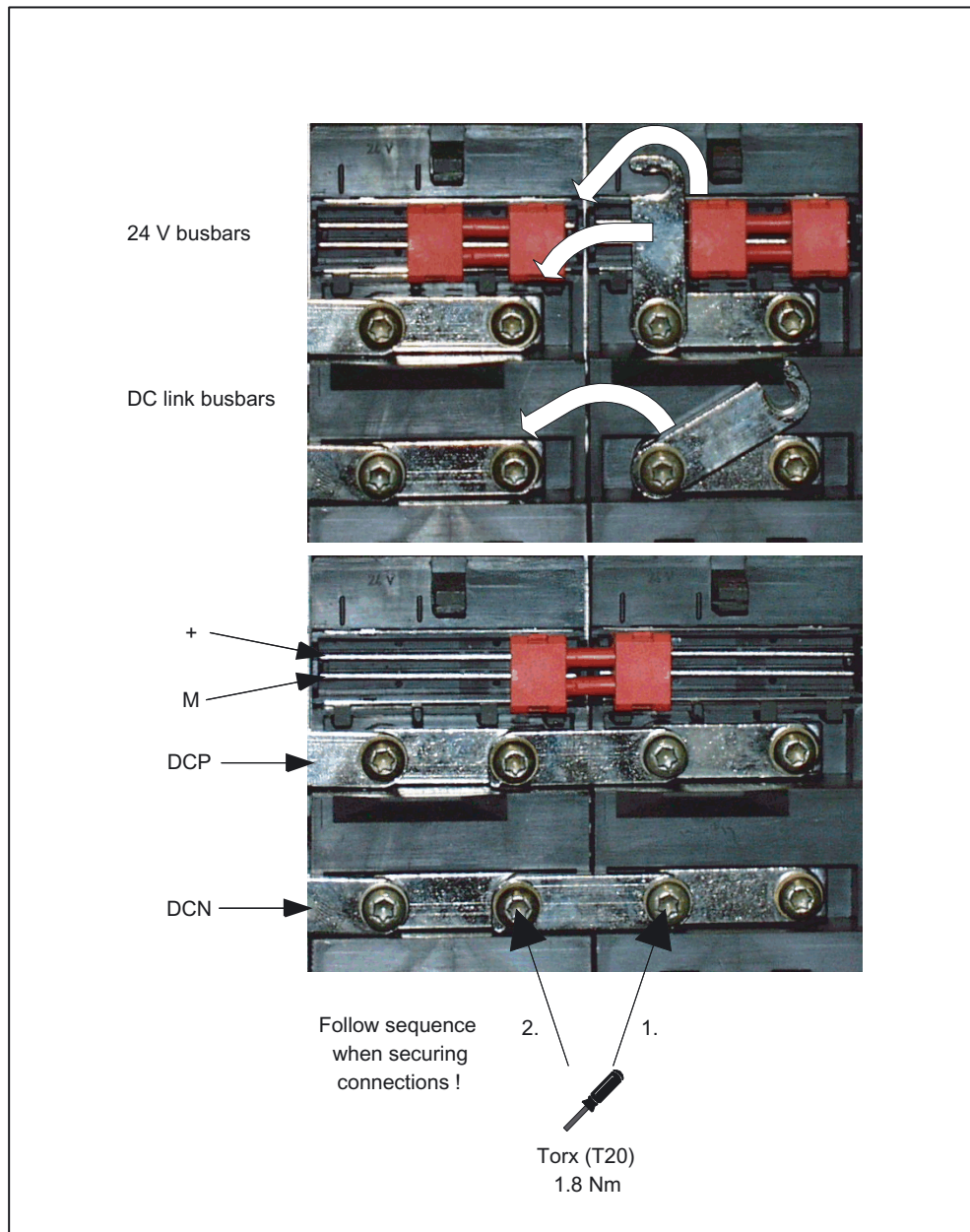


Figure 3-38 Busbar connections for booksize components

3.5.7 Technical specifications

Table 3-36 Technical specifications for Smart Line Modules in booksize format with internal air cooling

Internal air cooling	6SL3130–	6TE21-6ABx	6TE23-6ABx
Rated power	kW	16	36
Supply:			
Rated power (S1) ¹	kW (P _n)	16	36
S6 infeed			
Power rating (S6-40%) ¹	kW (P _{s6})	21	47
Peak power rating ¹	kW (P _{max})	35	70
Regenerative feedback:			
Continuous regenerative power rating	kW	16	36
Peak regenerative power rating	kW	35	70
Connection voltages:			
Line voltage	V _{AC}	3AC 380 -10% to 3AC 480 +10% (-15% < 1 min)	
Line frequency	Hz	47 to 63	
Electronics power supply	V _{DC}	24 (20.4 - 28.8)	
DC link voltage	V _{DC}	510 – 750	
Overvoltage trip threshold	V _{DC}	820 ± 2%	
Undervoltage trip threshold	V _{DC}	360 ± 2%	
Supply currents:			
at 380 V _{AC}	A _{AC}	26	58
at 480 V _{AC} /528 V _{AC}	A _{AC}	21 / 19	46 / 42
at 480 V; S6-40%	A _{AC}	27	60
Peak current (at 400 V _{AC} /480 V _{AC})	A _{AC}	54 /45	107 / 89
Output currents at 600 V _{DC} :			
Rated current	A _{DC}	27	60
at S6-40%	A _{DC}	35	79
peak current	A _{DC}	59	117
DC link busbar current carrying capacity	A _{DC}	100	100
24 V busbar current carrying capacity	A _{DC}	20	20
Electronics current consumption	A _{DC}	1.1	1.5
Total power loss (including electronic losses) ²	W	191.4	406
Max. ambient temperature without derating	°C	40	40
Max. ambient temperature with derating	°C	55	55
DC link capacitance	µF	705	1410
Charging limit	µF	20 000	20 000
Power factor	cos φ	1	1
Efficiency	η	0.99	0.99
Cooling method		Internal fan	Internal fan
Sound pressure level	dB(A)	<60	<65
Cooling air requirement	m ³ /h	56	112
Rated voltage for rated data 3 AC 380 V			
Weight	kg	7	10

¹ The specified values apply for 380 V

² For an overview, see the power loss tables in Cabinet Design

Rated duty cycles of Smart Line Modules

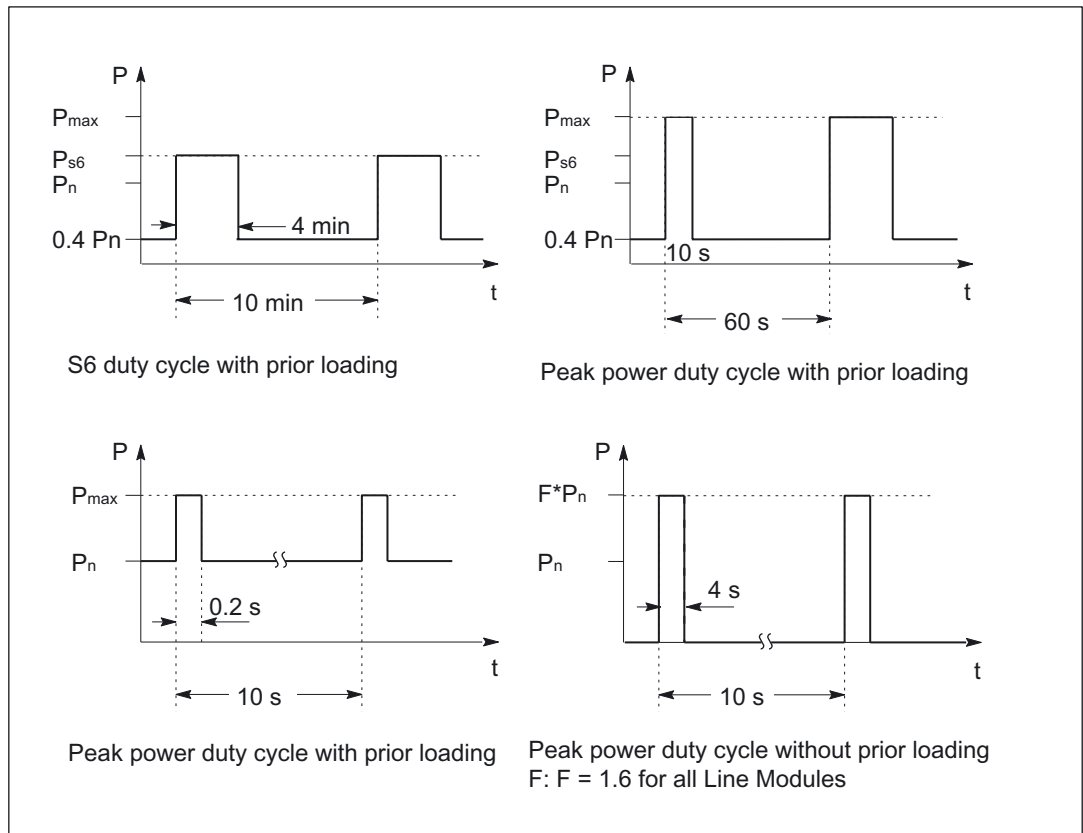


Figure 3-39 Rated duty cycles of Smart Line Modules

Derating as a function of the ambient temperature

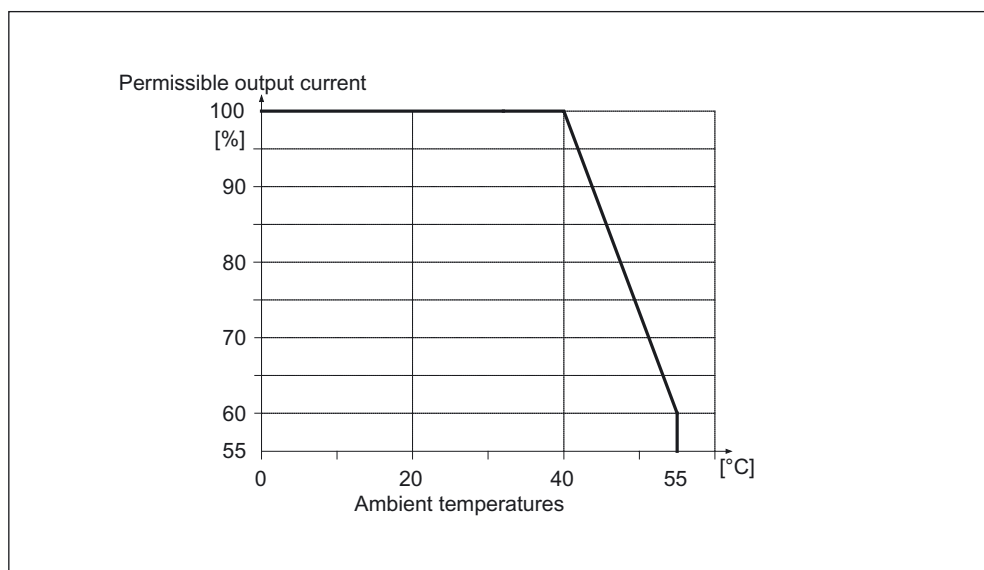


Figure 3-40 Derating as a function of the ambient temperature

Derating as a function of the installation altitude

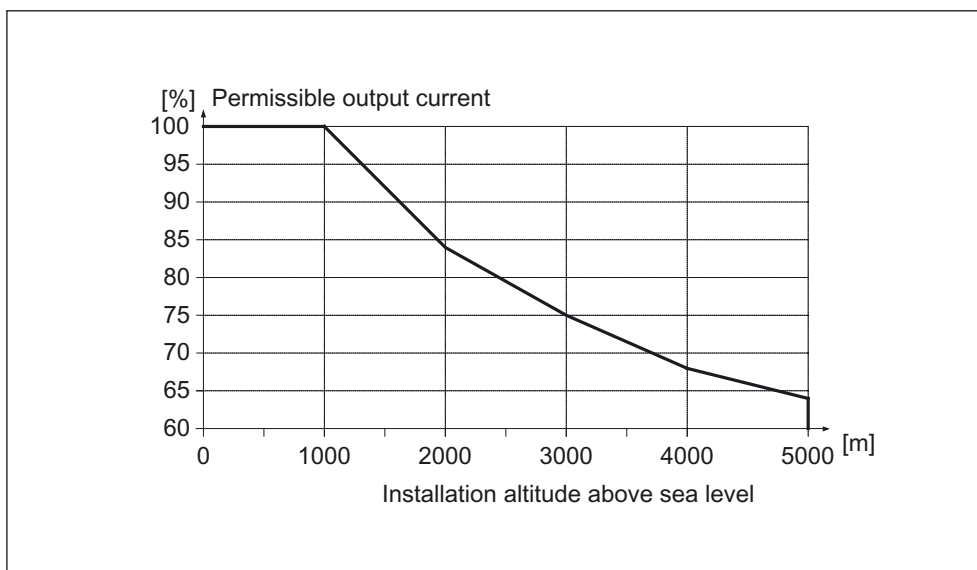


Figure 3-41 Derating as a function of the installation altitude

3.6 Smart Line Modules (5 kW and 10 kW) with external air cooling

3.6.1 Description

The Smart Line Module (SLM) is an unregulated line infeed/feedback unit. The SLM supplies the Motor Module(s) with an unregulated DC voltage at the DC output. As regards the current and voltage waveform, the SLM in infeed mode exhibits the typical characteristic of a 6-pulse diode rectifier jumper.

In feedback mode, the current waveform is square waved. Feedback can be deactivated by means of a terminal because these Smart Line 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.

External air cooling uses the "through-hole" method. This is a cooling method for SINAMICS power units that is only available for booksize devices. The power unit and its heat sink can be inserted in a rectangular knockout at the rear of the switching cabinet and mounted with a seal. The heat sink and the fan (included in the scope of supply) project beyond the rear of the switching cabinet and the heat is dissipated outside the switching cabinet or in a separate air duct.

3.6.2 Safety Information



Warning

After disconnecting all the supply voltages, a hazardous voltage will be present in all components for another 5 minutes. 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, otherwise this could result in secondary damage or 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).



Caution

The DC link discharge time hazard warning must be affixed to the modules in the local language.

A set of labels in 12 languages is available using order number: 6SL3166-3AB00-0AAx.

Notice

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

Caution

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

**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 jumper is only effective if X22.4 is also connected to ground. 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

The external air cooling can cause the fans and the heat sink to become heavily contaminated, which may trigger the temperature monitor in the power section. The fans and heat sink must be checked for contamination at regular intervals and, if necessary, cleaned.

Note

After installation, the seal on the rear of the device must be checked to ensure that it is tight. Additional sealing can be used, if necessary.

Note

The mounting frames can only be used if the cabinet has an unpainted metal surface.

Notice

Operation without the line reactor is not permissible.

Caution

The ratio of line short-circuit power to rated power must be ≥ 70 .

Caution

The left and right ends of the DC link busbar of a drive line-up must be fitted with peripheral covers (order no.: 6SL3162-5AA00-0AA0).

3.6.3 Interface description

3.6.3.1 Overview

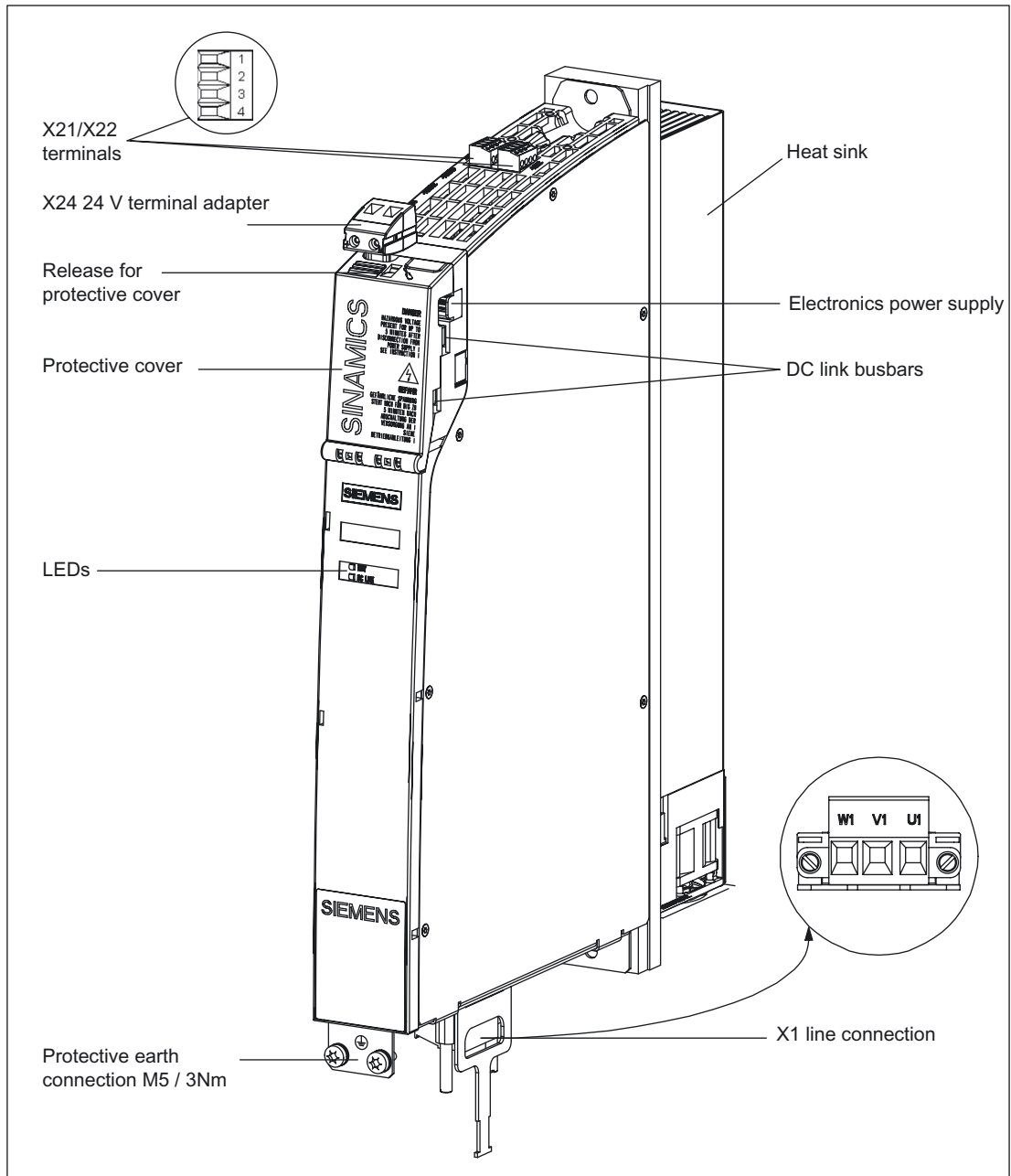


Figure 3-42 Smart Line Module with external air cooling (example 5 kW)

3.6.3.2 Connection example

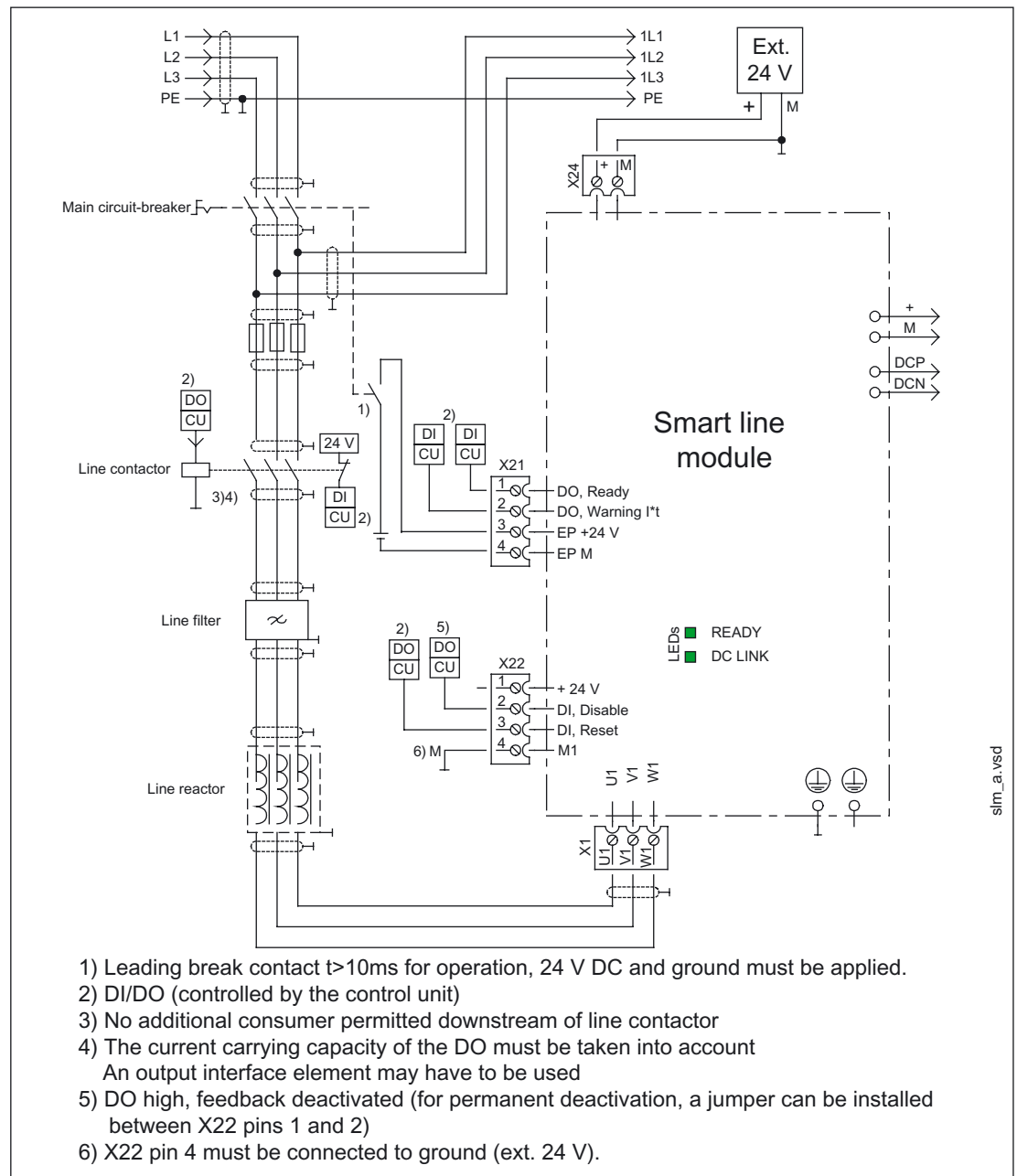
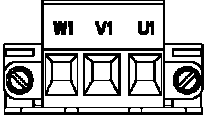
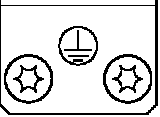


Figure 3-43 Connection example of Smart Line Module

3.6.3.3 X1 line connection

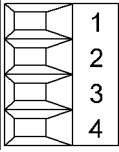
Table 3-37 Terminal block X1 of Smart Line Module (5 kW and 10 kW)

	Terminal	Technical specifications
	U1	Max. connection voltage: 3AC 480 V +10 at 47 Hz to 63 Hz Max. connectable cross-section: 6 mm ² Type: Screw terminal 5 (see Connection Methods)
	V1	
	W1	
	PE connection	Threaded hole M5/3 Nm ¹

¹ for ring cable lugs to DIN 46234

3.6.3.4 X21 terminals: smart line module

Table 3-38 Terminal block X21

	Terminal	Name	Technical specifications
	1	DO: Ready	Checkback: Smart Line Module ready The signal switches to high level when the following conditions have been met: <ul style="list-style-type: none"> • Electronics power supply (X24) OK • DC link is pre-charged • Pulses enabled (X21.3/.4) • No overtemperature • No overcurrent switch-off
	2	DO: Pre Warning	Prewarning threshold overtemperature / I x t When 80% of the maximum temperature of the Smart Line Module is exceeded, a high signal is output.
	3	DI: Enable pulses	Voltage 24 V DC Current consumption: 10 mA
	4	DI: Enable pulses ground	Isolated input
Max. connectable cross-section: 1.5 mm ² Type: Screw terminal 1 (see Spring-Loaded Terminals/Screw Terminals)			

Note

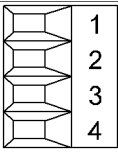
For operation, 24 V DC must be connected to terminal 3 and ground to terminal 4. When removed, pulse inhibit is activated, feedback is deactivated and the bypass relay drops out. If the Line Module is not disconnected from the network when the EP terminal is deactivated (e.g. a main contactor is not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

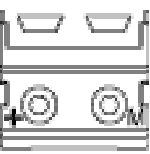
3.6.3.5 X22 terminals: smart line module

Table 3-39 Terminal block X22

	Terminal	Name	Technical specifications
	1	24 V power supply	Electronics power supply for controlling digital inputs X22.2 and 3.
	2	DI: Disable Regeneration	Deactivate feedback 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	Electronic ground
Max. connectable cross-section: 1.5 mm ² Type: Screw terminal 1 (see Connection Methods)			

3.6.3.6 X24 24 V terminal adapter

Table 3-40 Terminal block X24

	Terminal	Name	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 mm ² Type: Screw terminal 5 (see Connection Methods)			

3.6.3.7 Meaning of the LEDs on the smart line module

Table 3-41 Meaning of the LEDs on the Smart Line Module

LED	Color	State	Description
READY	Green	Continuous	Operation
	Yellow	Continuous	Pre-charging not yet complete; bypass relay dropped out
	Red	Continuous	Overtemperature/overcurrent switch-off, or Electronics power supply outside permissible tolerance range
DC LINK		OFF	Electronics power supply outside permissible tolerance range
	Yellow	Continuous	DC link voltage within permissible tolerance range
	Red	Continuous	DC link voltage outside permissible tolerance range

Cause and rectification of faults

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

Reference: /IH1/ SINAMICS S120 Commissioning Manual

3.6.4 Dimension Drawing

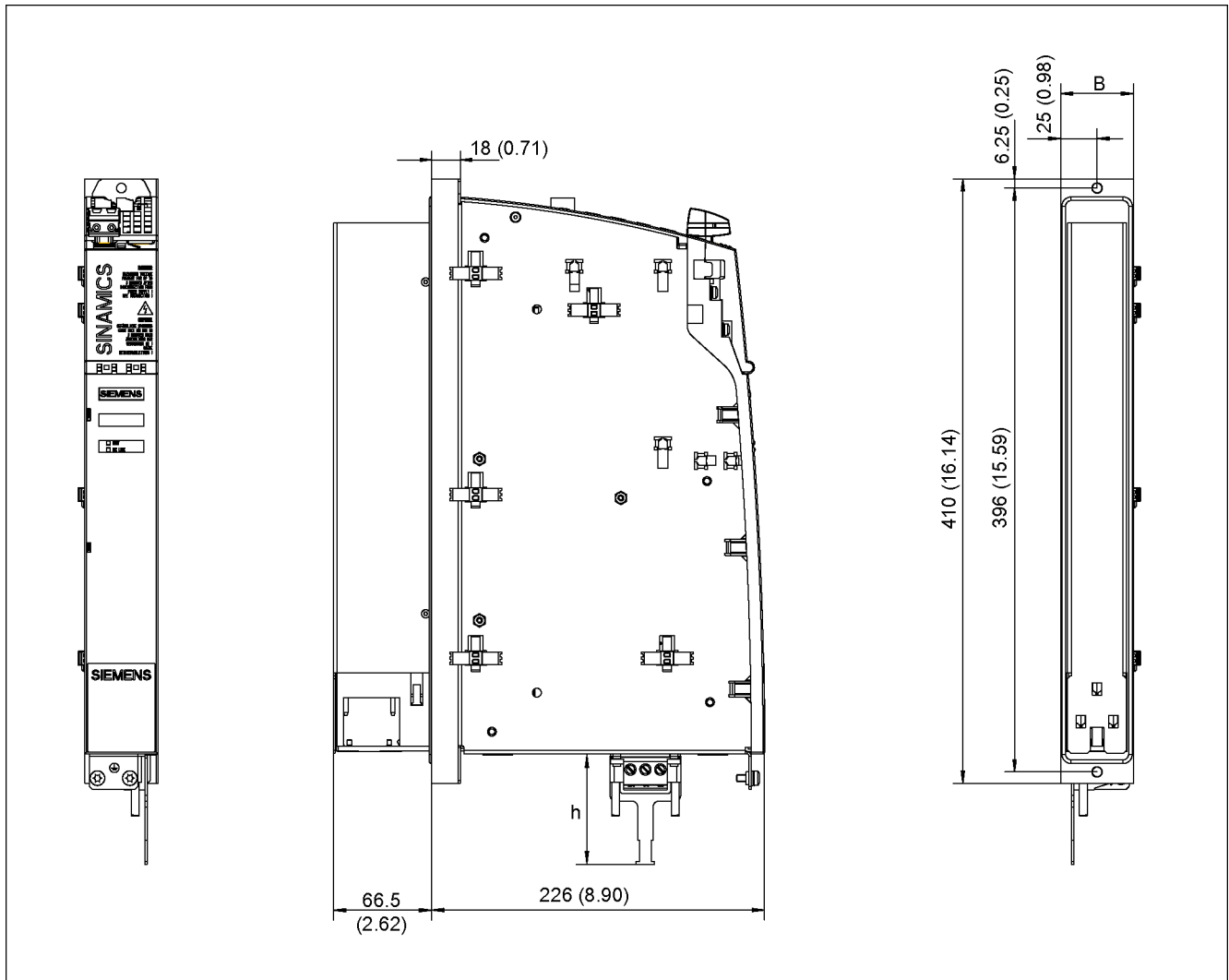


Figure 3-44 Dimension drawing of Smart Line Module (5 kW und 10 kW) with external air cooling

Table 3-42 Dimensions of Smart Line Module (5 kW und 10 kW) with external air cooling

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)

Note

The shielded terminal plate is part of the scope of supply of the 50 mm Smart Line Module.

3.6.5 Installation

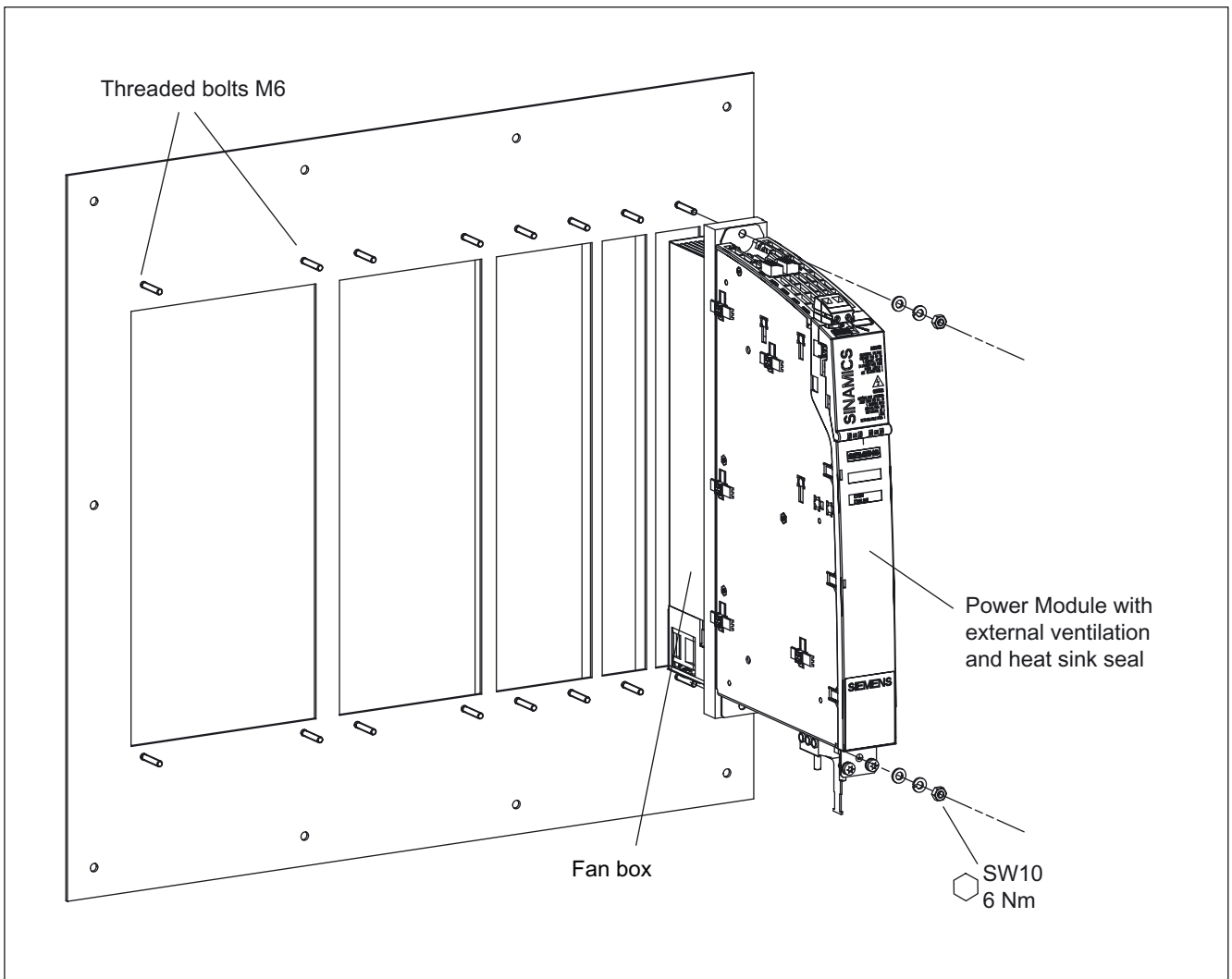


Figure 3-45 Example: installing the Power Module with external air cooling

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

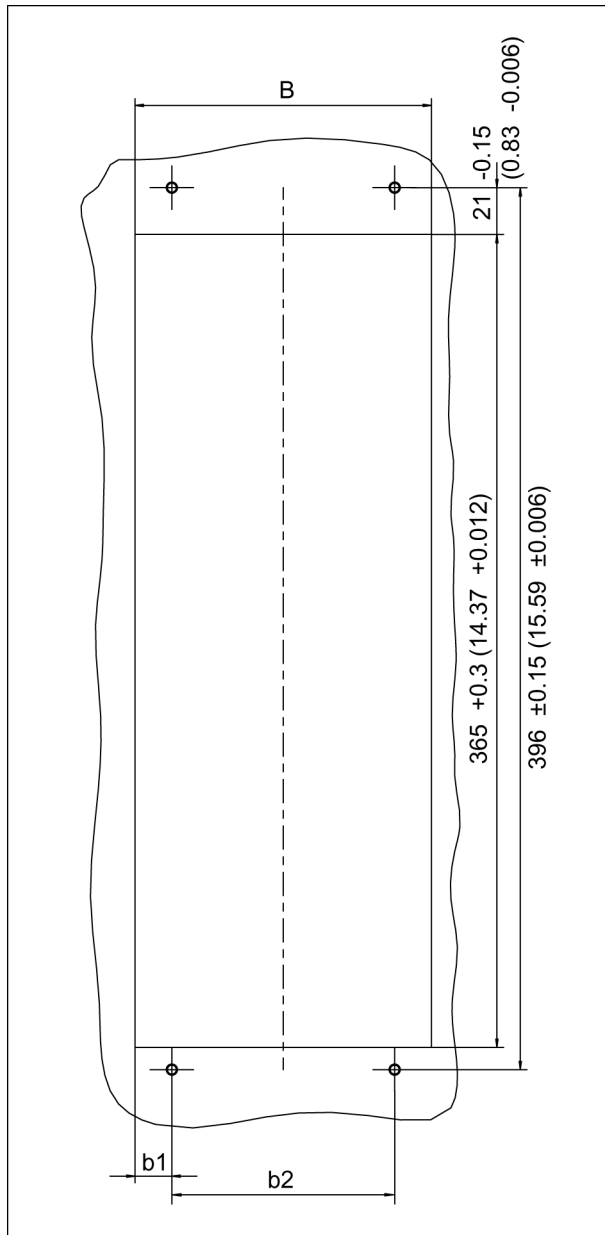


Figure 3-46 Installation openings for the Power Module with external air cooling (50 mm to 200 mm)

Table 3-43 Dimensions of the installation openings for the Power Module with external air cooling

Module width	W [mm] (inches)	w1 [mm] (inches)	w2 [mm] (inches)
50 mm	41.5 + 0.3 (1.63 + 0.012)	20.75 + 0.15 (0.82 + 0.006)	0
100 mm	89.5 + 0.3 (3.52 + 0.012)	19.75 + 0.15 (0.78 + 0.006)	50 ± 0.15 (1.97 ± 0.006)
150 mm	133 + 0.3 (5.24 + 0.012)	16.5 + 0.15 (0.65 + 0.006)	100 ± 0.15 (3.94 ± 0.006)
200 mm	173 + 0.3 (6.81 + 0.012)	11.5 + 0.15 (0.45 + 0.006)	150 ± 0.15 (5.91 ± 0.006)
300 mm	278 + 0.3 (10.94 + 0.012)	14.0 ± 0.15 (0.55 ± 0.006)	250 + 0.15 (9.84 + 0.006)

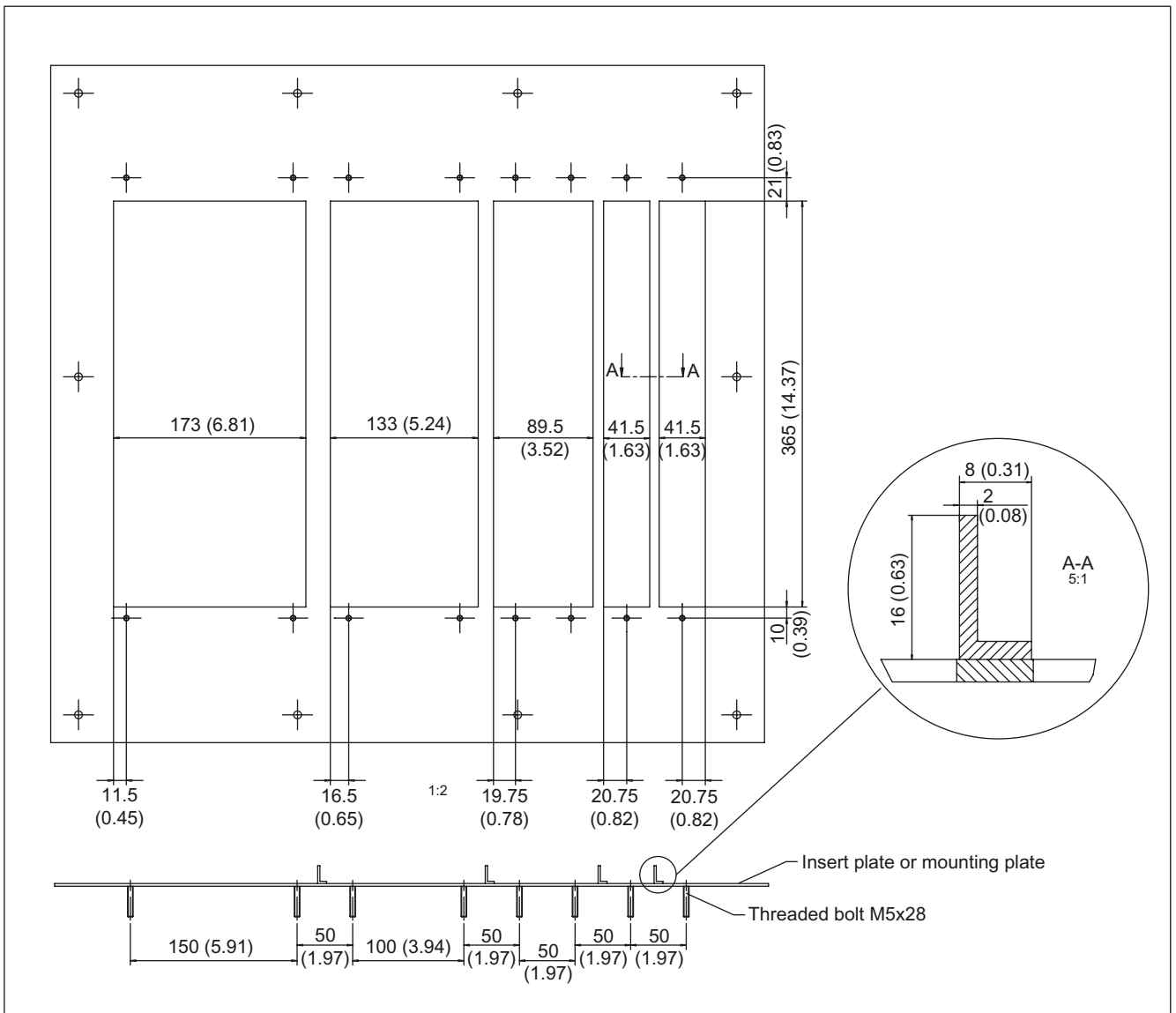


Figure 3-47 Example: mounting plate with a drive line-up

When installing the module, you must ensure that the module seal is tight all round. The cross-pieces must be sufficiently stable.

If required, we recommend that you reinforce the cross-pieces for the recesses.

In our example, the cross-pieces have been reinforced using brackets to EN 755-9.

Any means necessary can be used to secure the bracket to the insert plate.

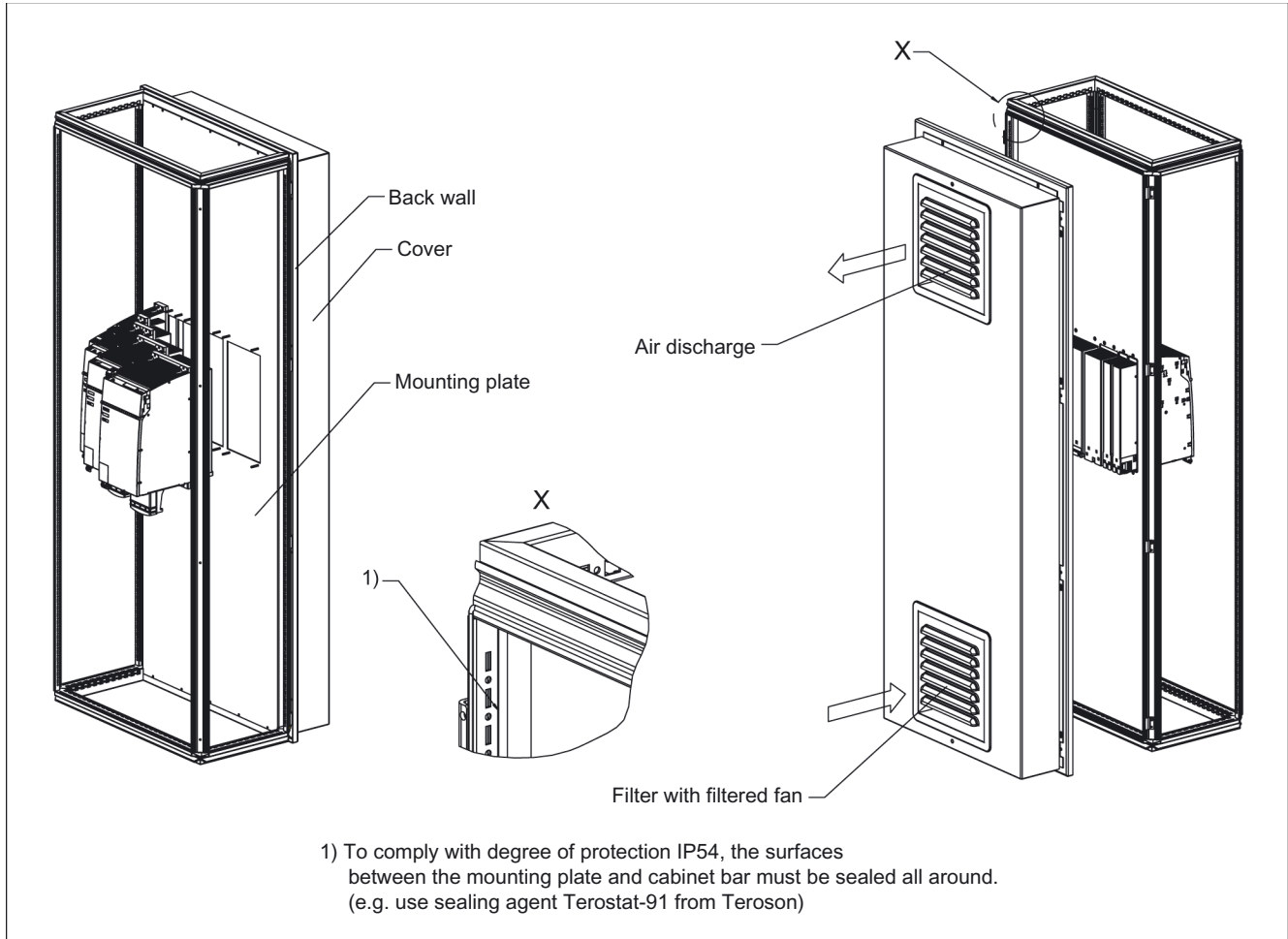


Figure 3-48 Example 1: installation in cabinet with mounting plate

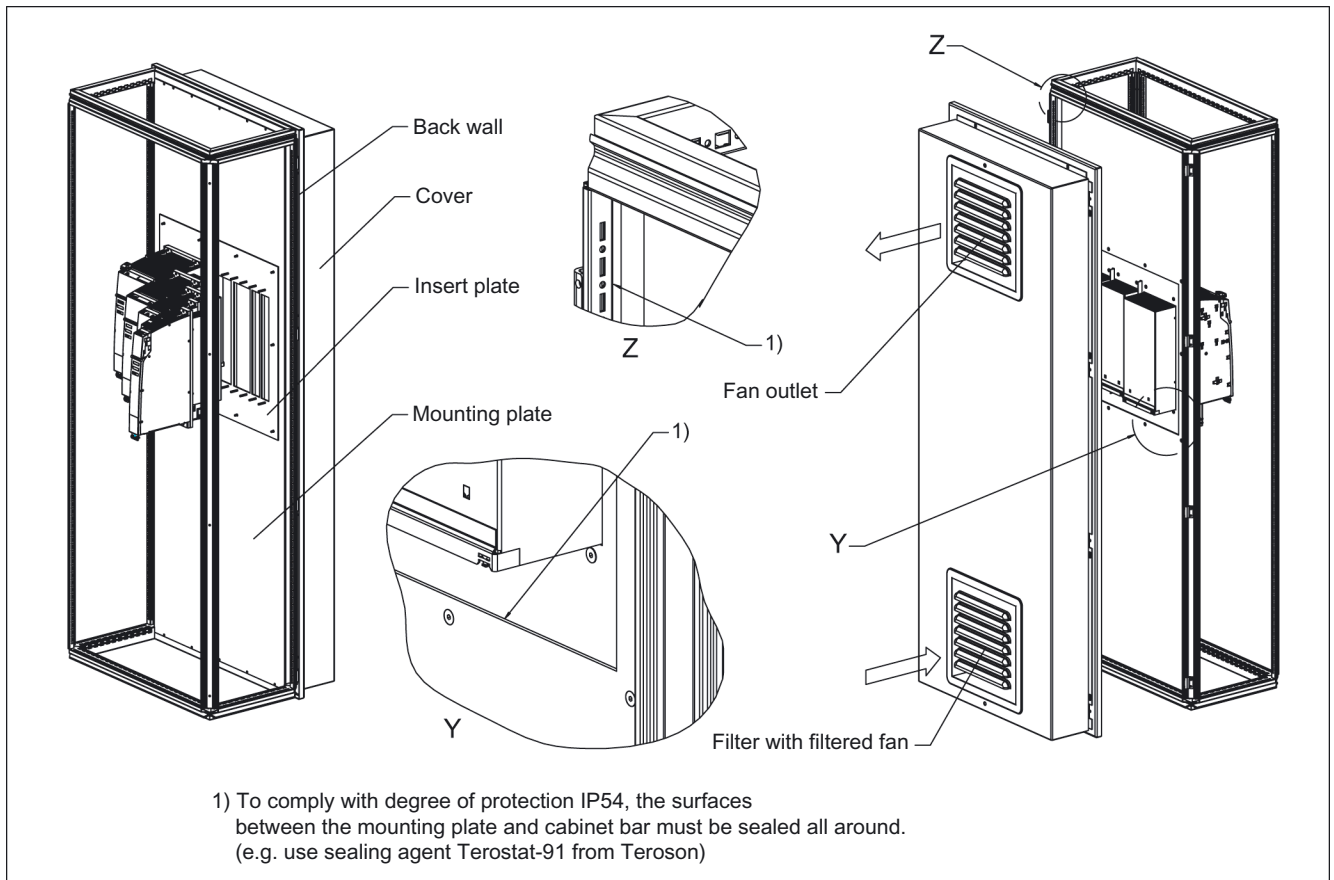


Figure 3-49 Example 2: installation in cabinet with mounting plate

We recommend that you attach a cover and filtered fan to the cabinet.

The filtered fan must be fitted in such a way that the cooling air required by the drive line-up is not restricted. This can be determined by establishing the total cooling air required by the individual components. This information is available in the technical specifications.

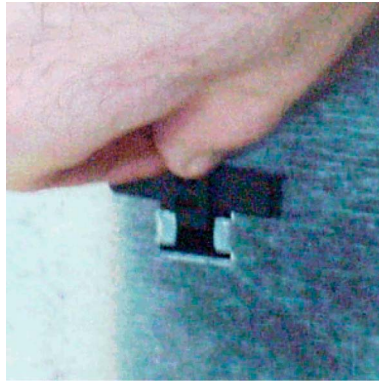
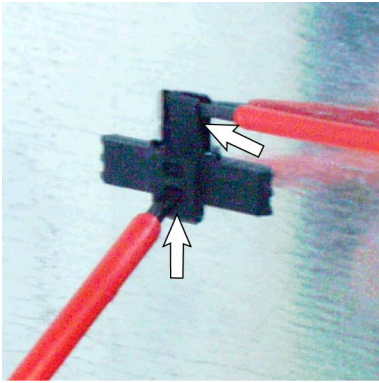
Note

If the cooling air requirement is not covered by the filtered fan, the components cannot output their specified power.

The filters with a filtered fan must be regularly checked for dirt and cleaned if necessary.

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.

The holder removed

3.6.6 Electrical Connection

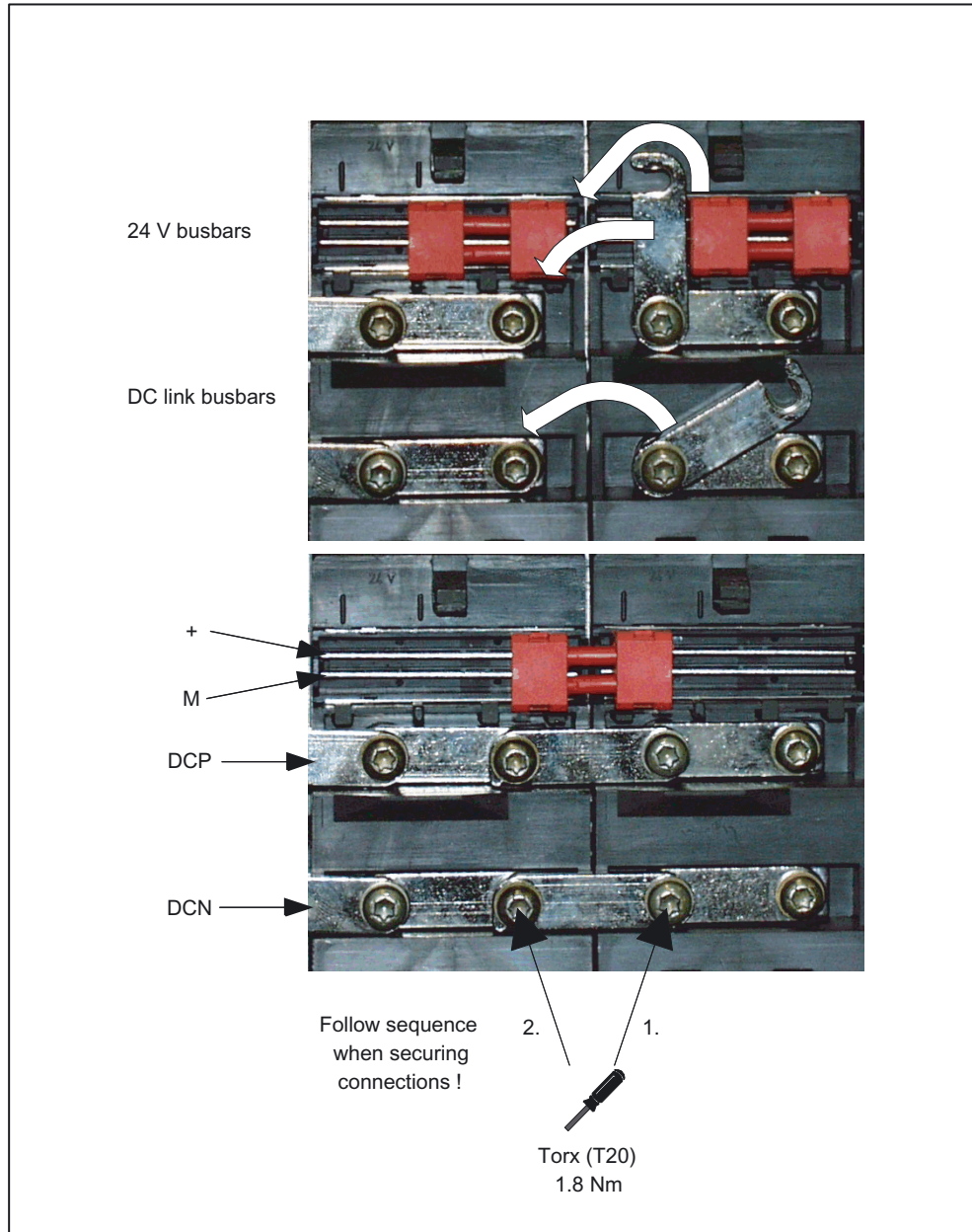


Figure 3-50 Busbar connections for booksize components

3.6.7 Technical Specifications

Table 3-44 Technical specifications for Smart Line Modules in booksize format with external air cooling

Internal air cooling	6SL3131-	6AE15-0AAx	6AE21-0AAx
Rated power	kW	5	10
Supply:			
Rated power (S1) ¹	kW (Pn)	5	10
S6 infeed			
Power rating (S6-40%) ¹	kW (Ps6)	6.5	13
Peak power rating ¹	kW (Pmax)	10	20
Regenerative feedback:			
Continuous regenerative power rating	kW	5	10
Peak regenerative power rating	kW	10	20
Connection voltages:			
Line voltage	V _{AC}	3AC 380 -10% to 3AC 480 +10% (-15% < 1 min)	
Line frequency	Hz	47 to 63	
Electronics power supply	V _{DC}	24 (20.4 - 28.8)	
DC link voltage	V _{DC}	510 – 750	
Overvoltage trip threshold	V _{DC}	820 ± 2%	
Undervoltage trip threshold	V _{DC}	360 ± 2%	
Supply currents:			
at 380 V _{AC}	A _{AC}	12	24
at 480 V _{AC} /528 V _{AC}	A _{AC}	9.3/8.5	18/16.5
at 480 V; S6-40%	A _{AC}	12	24
Peak current (at 400 V _{AC} /480 V _{AC})	A _{AC}	22/18.5	44/37
Output currents at 600 V _{DC} :			
Rated current	A _{DC}	8.3	16.6
at S6-40%	A _{DC}	11	22
peak current	A _{DC}	16.6	33.2
DC link busbar current carrying capacity	A _{DC}	100	100
24 V busbar current carrying capacity	A _{DC}	20	20
Electronics current consumption	A _{DC}	1.0	1.3
Total power loss (including electronic losses) ²	W	74	136.2
Max. ambient temperature without derating	°C	40	40
Max. ambient temperature with derating	°C	55	55
DC link capacitance	µF	220	330
Charging limit	µF	6000	6000
Power factor	cos φ	1	1
Efficiency	η	0.98	0.98
Sound pressure level	dB(A)	<60	<60
Cooling air requirement	m ³ /h	29.6	29.6
Rated voltage for rated data 3 AC 380 V			
Weight	kg	5.3	5.4

¹ The specified values apply to 380 V² For an overview, see the power loss tables in Cabinet Design.

Rated duty cycles of Smart Line Modules

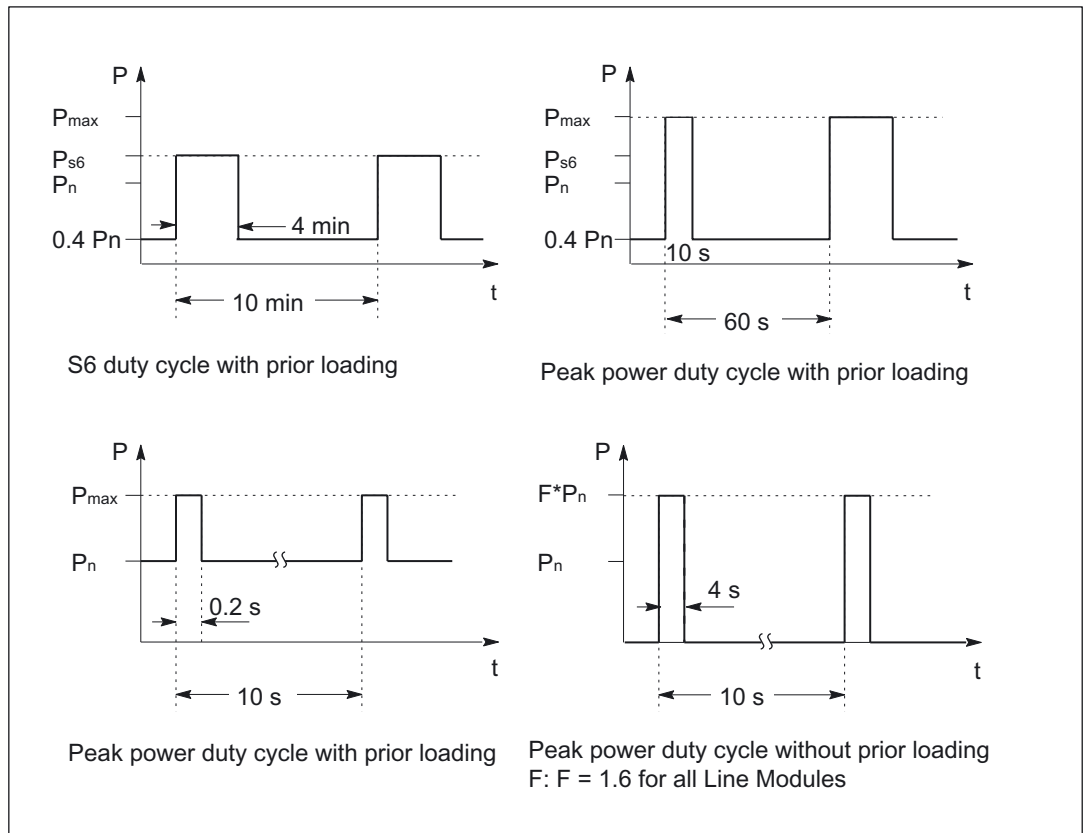


Figure 3-51 Rated duty cycles of Smart Line Modules

Derating as a function of the ambient temperature

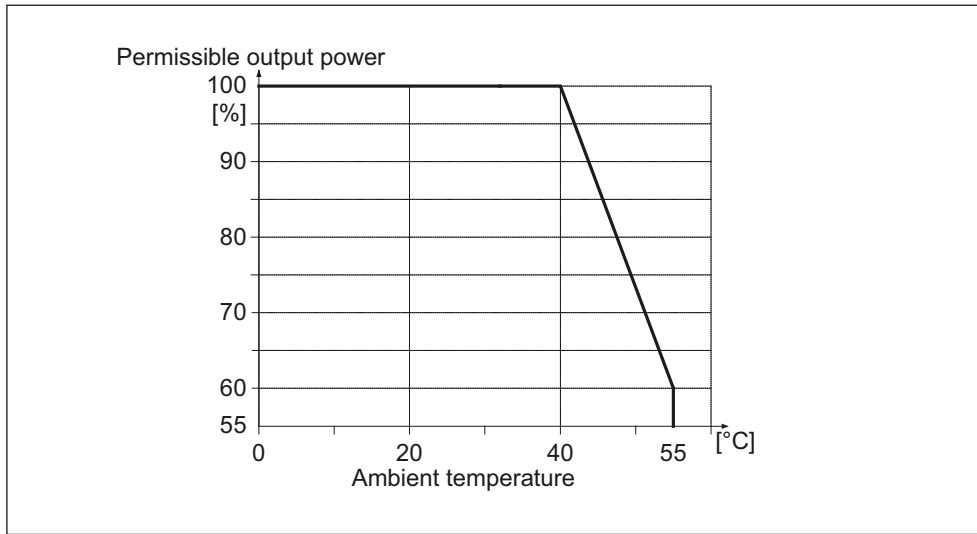


Figure 3-52 Derating as a function of the ambient temperature

Derating as a function of the installation altitude

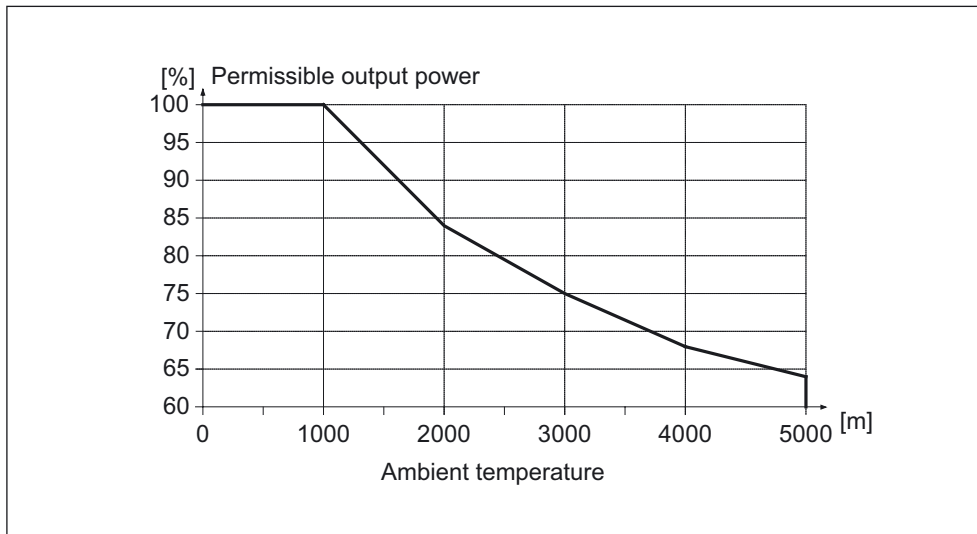


Figure 3-53 Derating as a function of the installation altitude

Motor Modules Booksize

4.1 Introduction

The motor modules in the SINAMICS S system in “booksize” format are inverters. The control information is generated in the control unit and distributed to the individual motor modules via DRIVE-CLiQ.

Depending on the type (single or double), each motor module has one or two DRIVE-CLiQ interfaces for connecting the motor encoder evaluation (sensor modules).

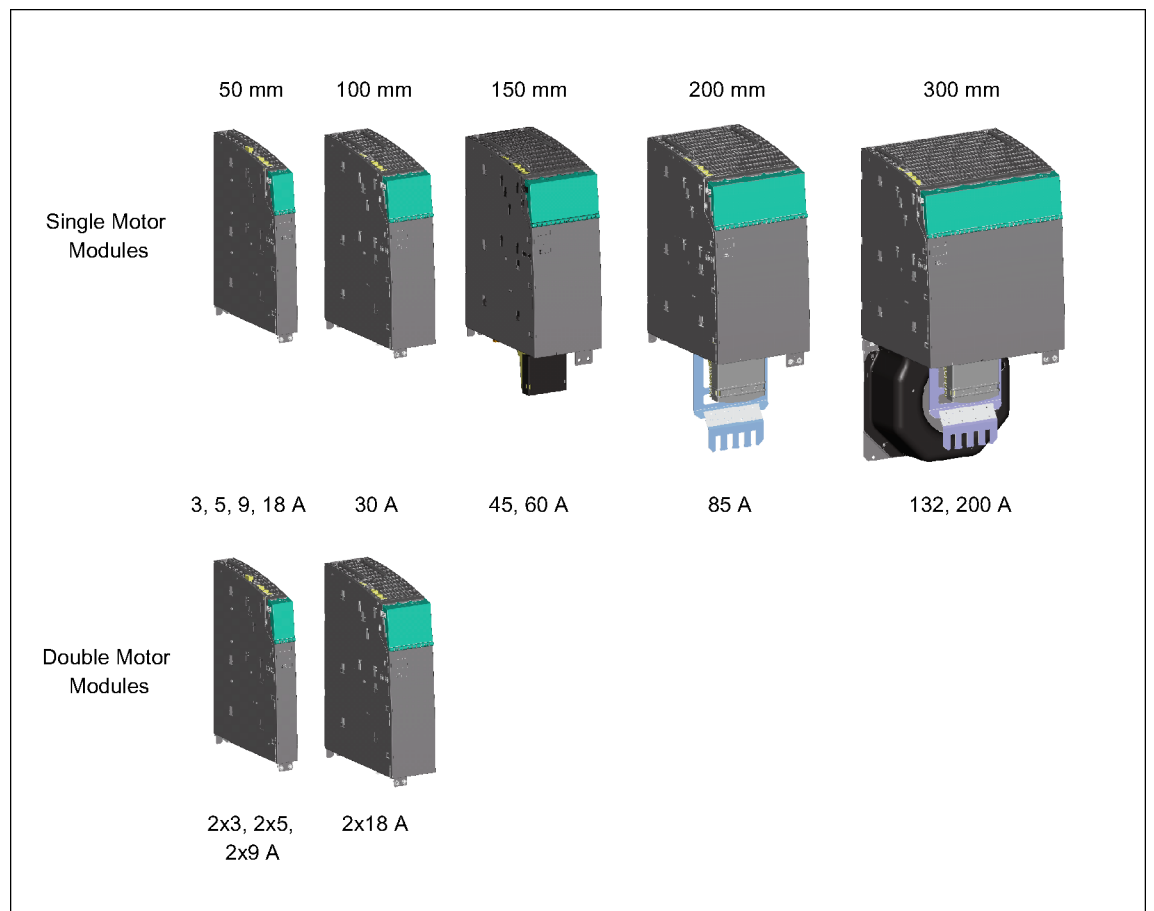


Figure 4-1 Overview of motor modules booksize (currents are continuous rms)

Characteristics of the motor modules:

- Single type from 3 A to 200 A
- Double type from 2x3 A to 2x18 A
- Internal/external air cooling
- Short-circuit/ground-fault-proof
- Integrated DC link and electronics current busbar connection
- Integrated "safe motor brake control"
- Electronic type plate
- Operating status and error status via LEDs
- DRIVE-CLiQ interface for communication with the control unit and/or other components in the drive line-up.
 - Integration in system diagnostics

4.2 Motor Modules with Internal Air Cooling

4.2.1 Description

A motor module is a power unit (inverter) that provides the power supply for the connected motor(s). Power is supplied by means of the DC link of the drive unit. 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.

4.2.2 Safety information



Warning

After disconnecting all the supply voltages, a hazardous voltage will be present in all components for another 5 minutes. 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, otherwise this could result in secondary damage or accidents.



Caution

Motor Modules with a rated current as 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 Module, a permanent PE connection of the Motor Module or switching cabinet is required.

Measures according to EN 61800-5-1 must be taken (e.g. PE conductor ($\geq 10\text{mm}^2$ Cu) or fit an additional connection terminal for a PE conductor with the same cross-section as the original PE conductor).



Caution

The DC link discharge voltage hazard warning must be affixed to the modules in the local language.

A set of labels in 12 languages is available using order number: 6SL3166-3AB00-0AAx.

Notice

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

For the 132 A and 200 A Motor Modules, a ventilation clearance of 50 mm must be observed in front of the fan.

Caution

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



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.

Caution

Only cables from Siemens must be used for DRIVE-CLiQ connections.

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 left and right ends of the DC link busbar of a drive line-up must be fitted with peripheral covers (order no.: 6SL3162-5AA00-0AA0).

4.2.3 Interface description

4.2.3.1 Overview

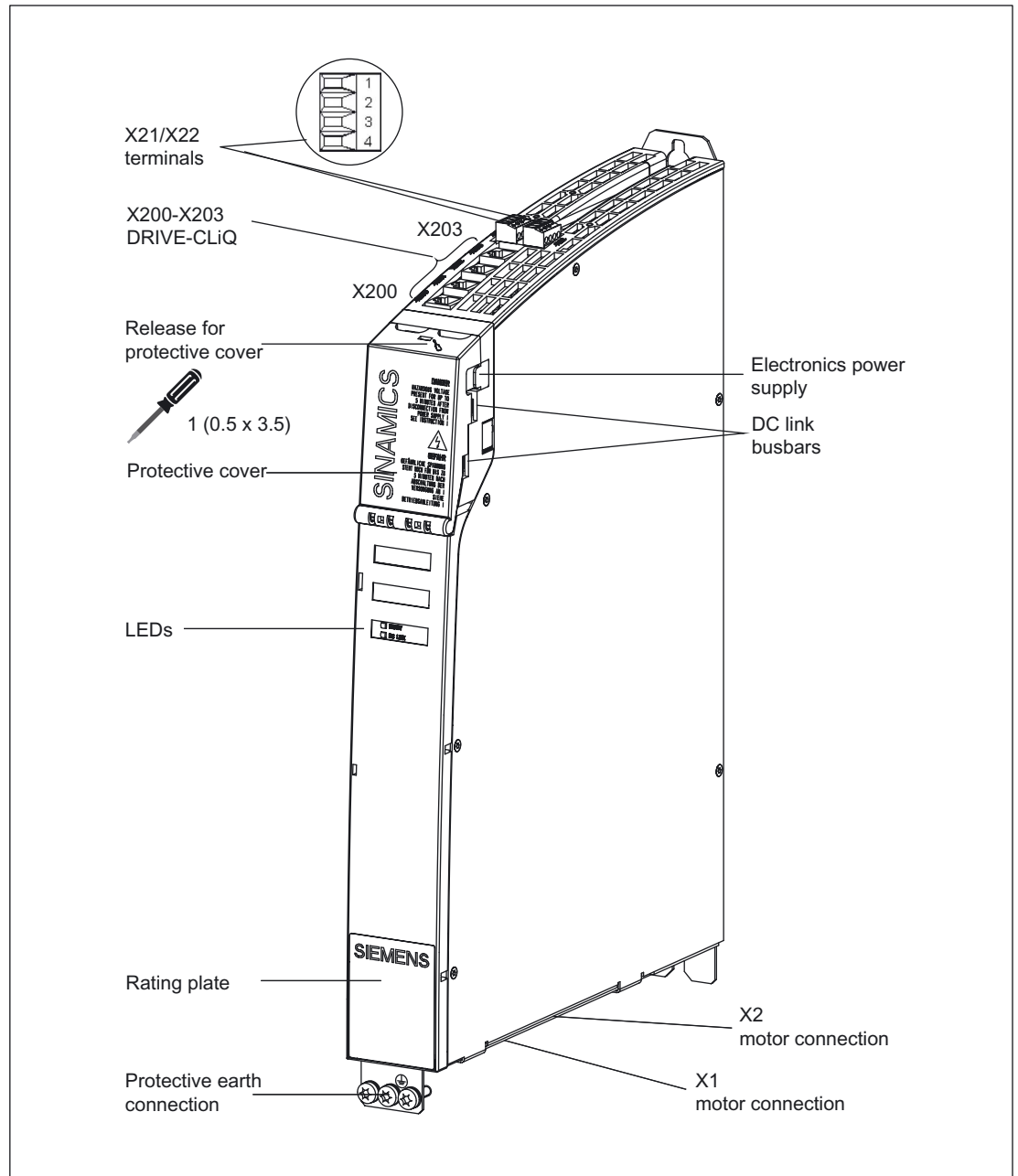


Figure 4-2 Example: double motor module with internal air cooling (2 x 3 A)

4.2.3.2 Connection Examples

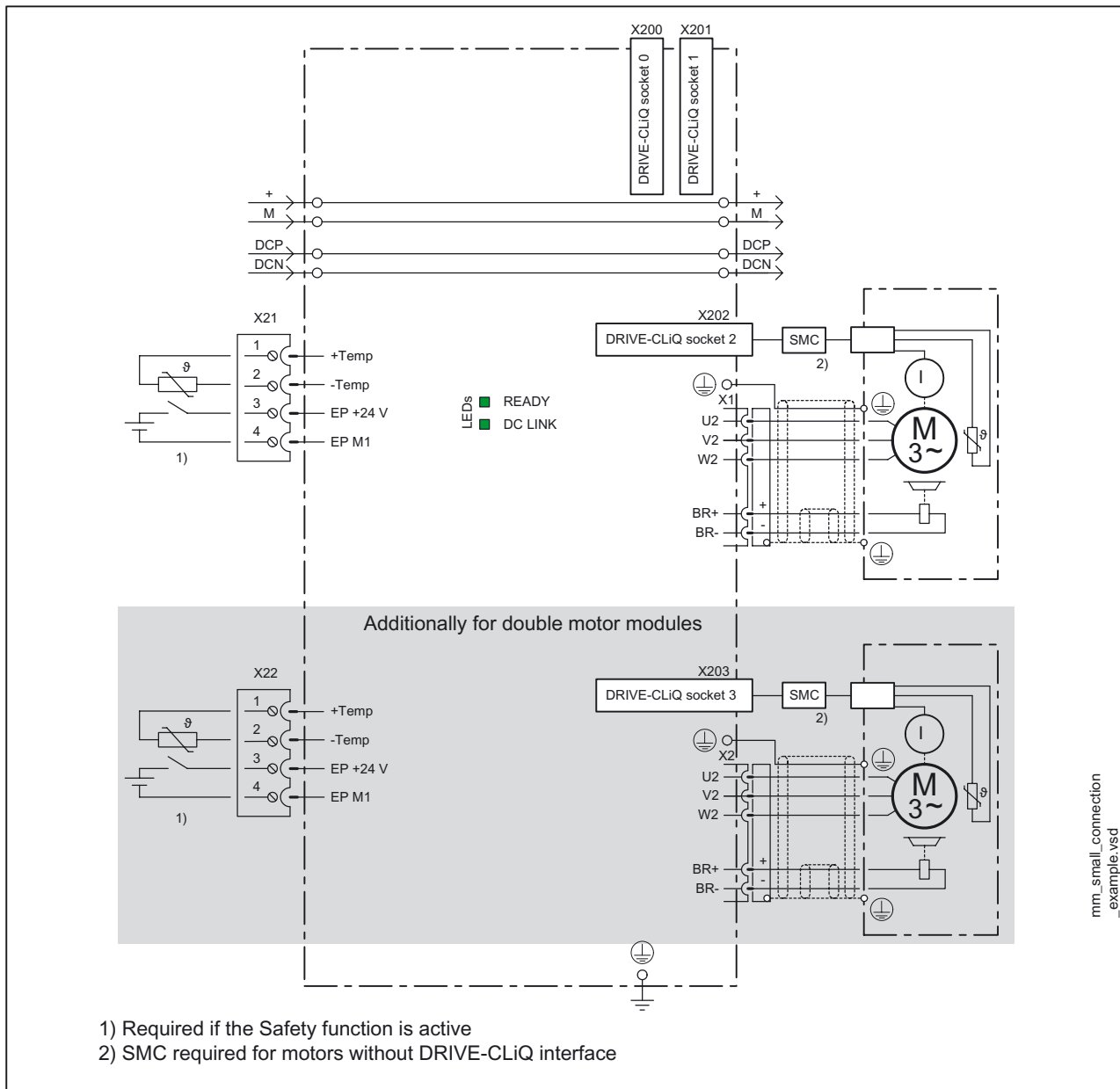


Figure 4-3 Connection example of Motor Modules 3 A to 30 A and 2x3 A to 2x18 A

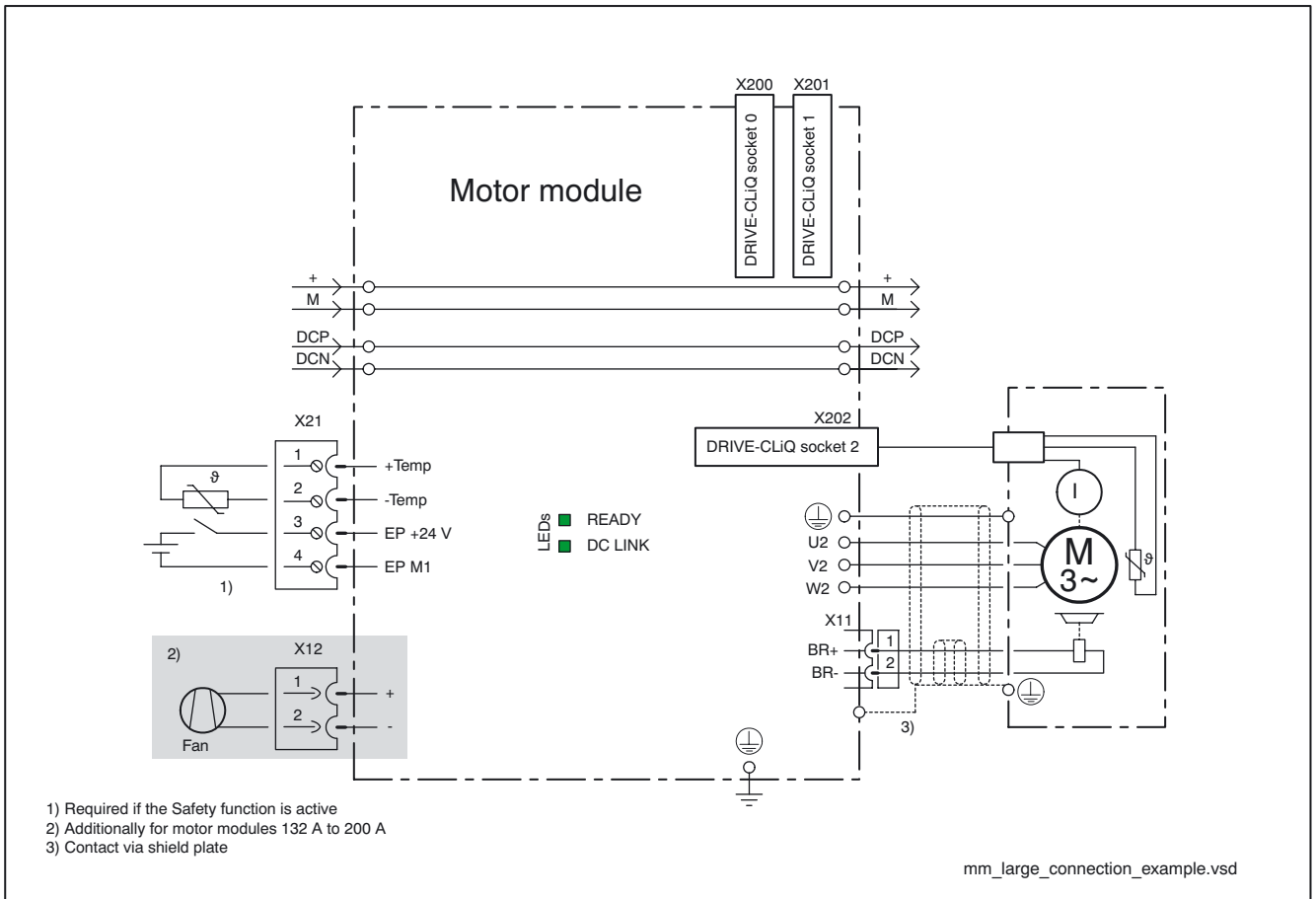
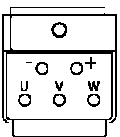
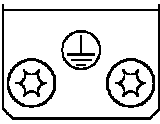


Figure 4-4 Connection example of Single Motor Modules 45 A to 200 A

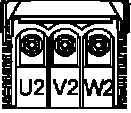
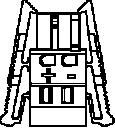
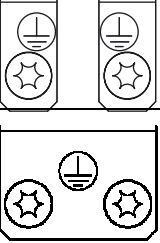
4.2.3.3 Motor/brake connection

Table 4-1 Terminal block X1/X2 Motor Modules 3 A to 30 A and 2x3 A to 2x18 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 4-2 Terminal block Single Motor Module 45 A to 200 A

	Terminals	Technical specifications
	U2	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
	V2	
	W2	
	+ (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 number: 721-102/026-000/56-000 The brake connector is part of the prefabricated cable.
	- (BR-)	
	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: M8/6 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).



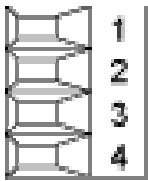
Warning

Only protective extra-low voltages (PELVs) 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.

4.2.3.4 X21/X22 EP terminals/temperature sensor connection motor module

Table 4-3 Terminal block X21/X22

	Terminal	Function	Technical specifications
	1	+Temp	Temperature sensor connection KTY84-1C130/PTC
	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 Connection Methods)			

Notice

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

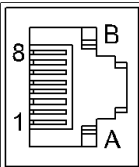
Note

The temperature sensor connection is required for motors whose temperature value is not transmitted by DRIVE-CLiQ.

To operate, 24 V DC must be applied to terminal 3 and terminal 4 must be grounded if the "Safe Standstill" function is selected. Upon removal, pulse inhibit is activated.

4.2.3.5 X200-X203 DRIVE-CLiQ interface

Table 4-4 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	GND (0 V)	Electronic ground
Blanking plate for DRIVE-CLiQ interface: Molex, order number: 85999-3255			

4.2.3.6 Meaning of the LEDs on the motor module

Table 4-5 Meaning of the LEDs on the Motor Module

LED	Color	State	Description
READY	-	OFF	Electronics power supply outside permissible tolerance range.
	Green	Continuous	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	Continuous	DRIVE-CLiQ communication is being established.
	Red	Continuous	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 permissible tolerance range.
	Orange	Continuous	DC link voltage within permissible tolerance range (only when ready for operation)
	Red	Continuous	DC link voltage outside permissible tolerance range (only when ready for operation)

Cause and rectification of faults

The following reference contains information about the cause and rectification of faults:
Reference: /IH1/ SINAMICS S120 Commissioning Manual

4.2.4 Dimension drawings

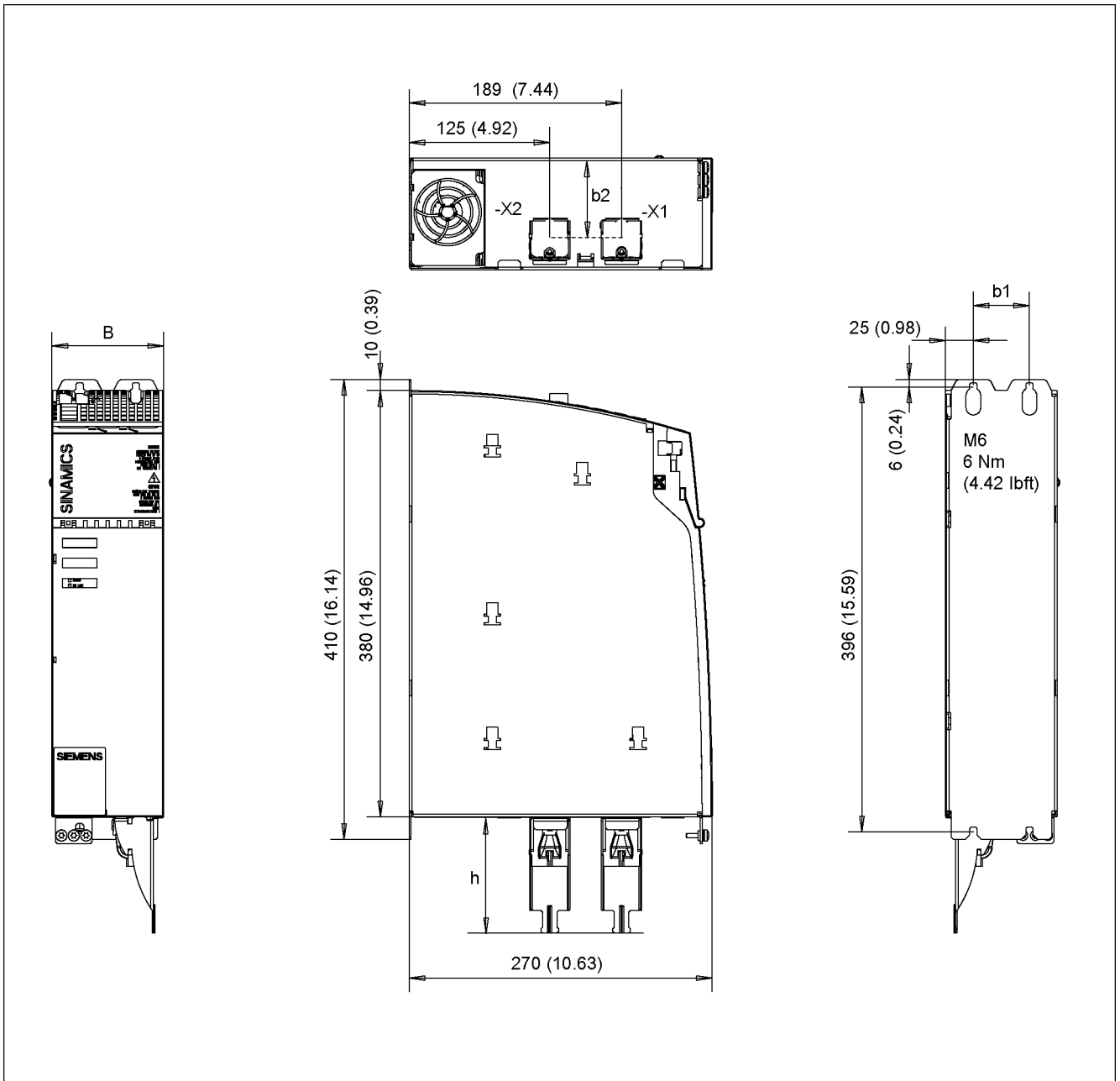


Figure 4-5 Dimension drawing of motor module with internal air cooling (3 A to 30 A and 2 x 3 A to 2 x 18 A)

4.2 Motor Modules with Internal Air Cooling

Table 4-6 Dimensions of motor module with internal air cooling (3 A to 30 A and 2 x 3 A to 2 x 18 A)

Motor module type	Order number	W [mm] (inches)	w ₁ [mm] (inches)	w ₂ [mm] (inches)	h [mm] (inches)
Single motor module 3 A	6SL3120-1TE13-0AAx	50 (1.97)	-	28 (1.10)	89 (3.50)
Single motor module 5 A	6SL3120-1TE15-0AAx	50 (1.97)	-	28 (1.10)	89 (3.50)
Single motor module 9 A	6SL3120-1TE21-0AAx	50 (1.97)	-	28 (1.10)	89 (3.50)
Single motor module 18 A	6SL3120-1TE21-8AAx	50 (1.97)	-	28 (1.10)	89 (3.50)
Single motor module 30 A	6SL3120-1TE23-0AAx	100 (3.94)	50 (1.97)	78 (3.07)	89 (3.50)
Double motor module 3 A	6SL3120-2TE13-0AAx	50 (1.97)	-	28 (1.10)	89 (3.50)
Double motor module 5 A	6SL3120-2TE15-0AAx	50 (1.97)	-	28 (1.10)	89 (3.50)
Double motor module 9 A	6SL3120-2TE21-0AAx	50 (1.97)	-	28 (1.10)	89 (3.50)
Double motor module 18 A	6SL3120-2TE21-8AAx	100 (3.94)	50 (1.97)	78 (3.07)	89 (3.50)

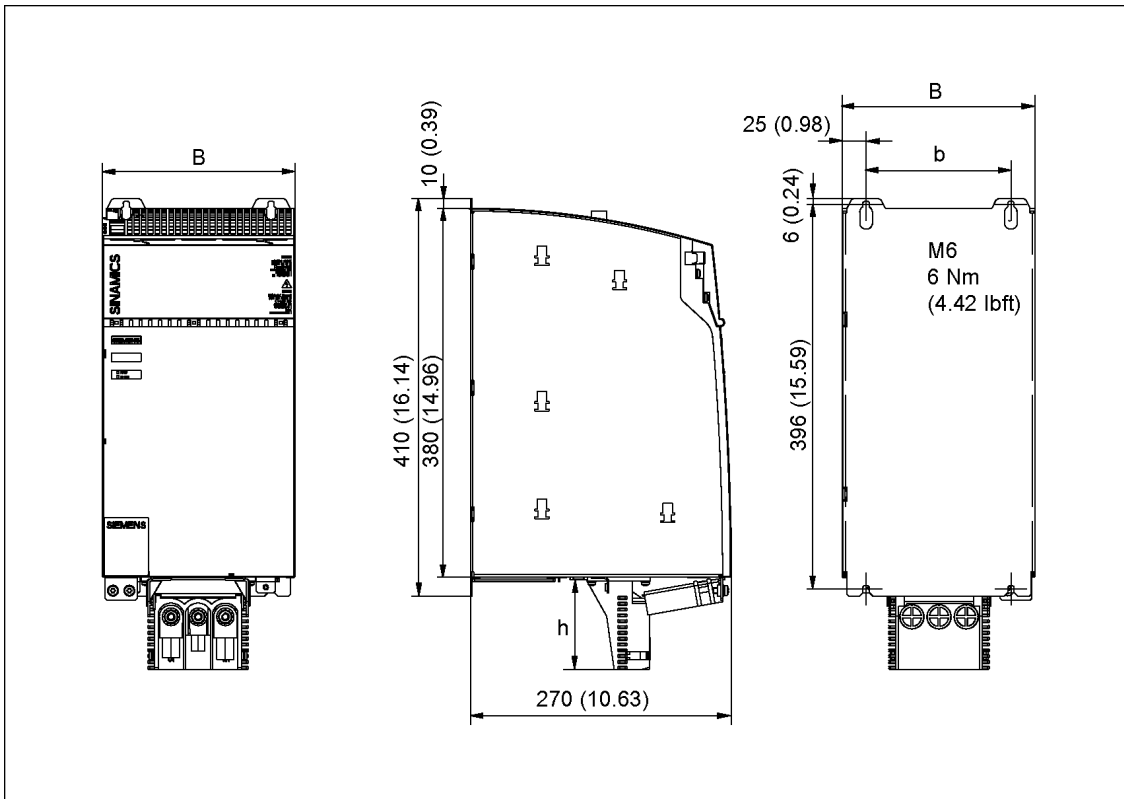


Figure 4-6 Dimension drawing of motor module with internal air cooling (45 A to 85 A)

Table 4-7 Dimensions of motor module with internal air cooling (45 A to 85 A)

Motor module type	Order number	W [mm] (inches)	w [mm] (inches)	h [mm] (inches)
Single motor module 45 A	6SL3120-1TE24-5AAx	150 (5.91)	100 (3.94)	89 (3.50)
Single motor module 60 A	6SL3120-1TE26-0AAx	150 (5.91)	100 (3.94)	89 (3.50)
Single motor module 85 A	6SL3120-1TE28-5AAx	200 (7.87)	150 (5.91)	89 (3.50)

4.2 Motor Modules with Internal Air Cooling

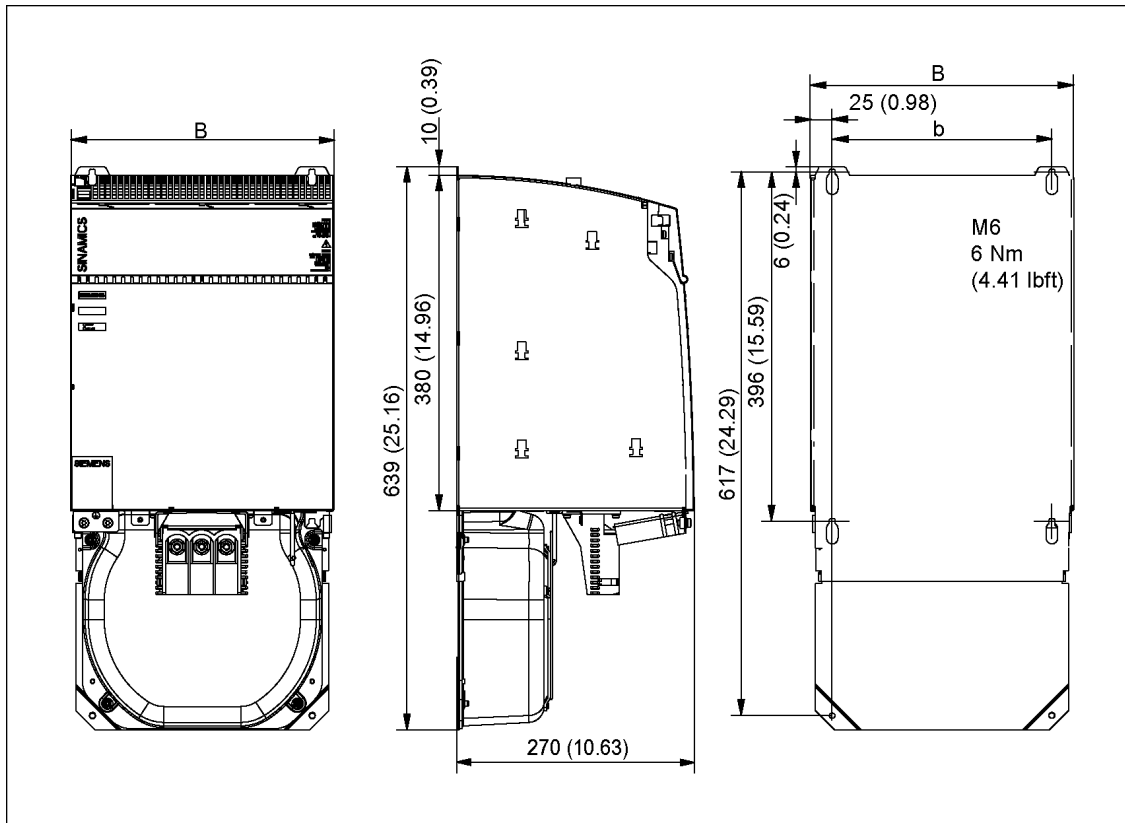


Figure 4-7 Dimension drawing of motor module with internal air cooling (132 A and 200 A)

Table 4-8 Dimensions of motor module with internal air cooling (132 A and 200 A)

Motor module type	Order number	W [mm] (inches)	w [mm] (inches)	h [mm] (inches)
Single motor module 132 A	6SL3120-1TE31-3AAx	300 (11.81)	250 (9.84)	89 (3.50)
Single motor module 200 A	6SL3120-1TE32-0AAx	300 (11.81)	250 (9.84)	89 (3.50)

4.2.5 Installation

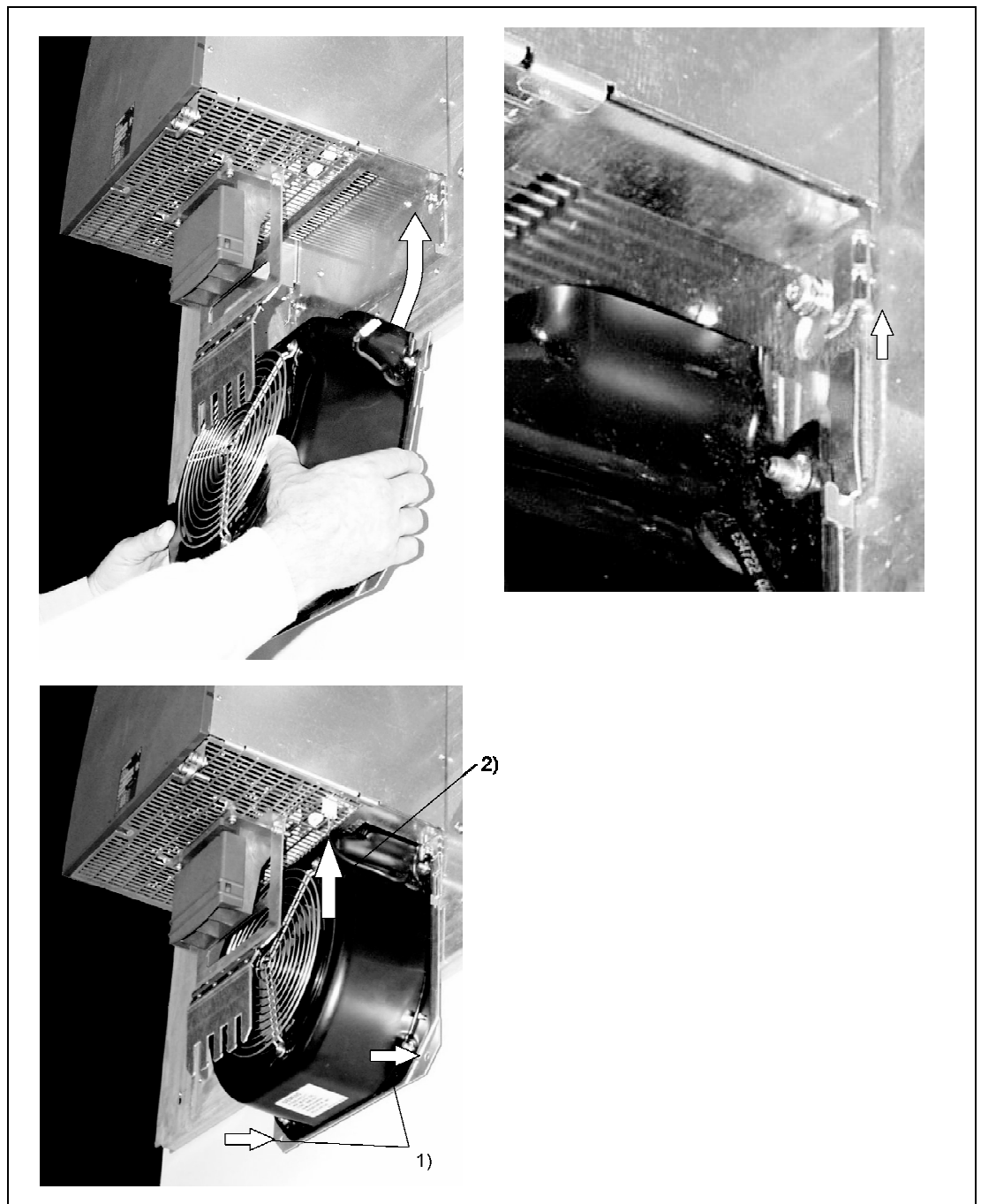


Figure 4-8 Installing the fan for 300 mm modules

- 1) Secure with M6 / 6 Nm screws
- 2) Connect the power supply for the fan

4.2.6 Electrical connection

Shield contact for the terminals

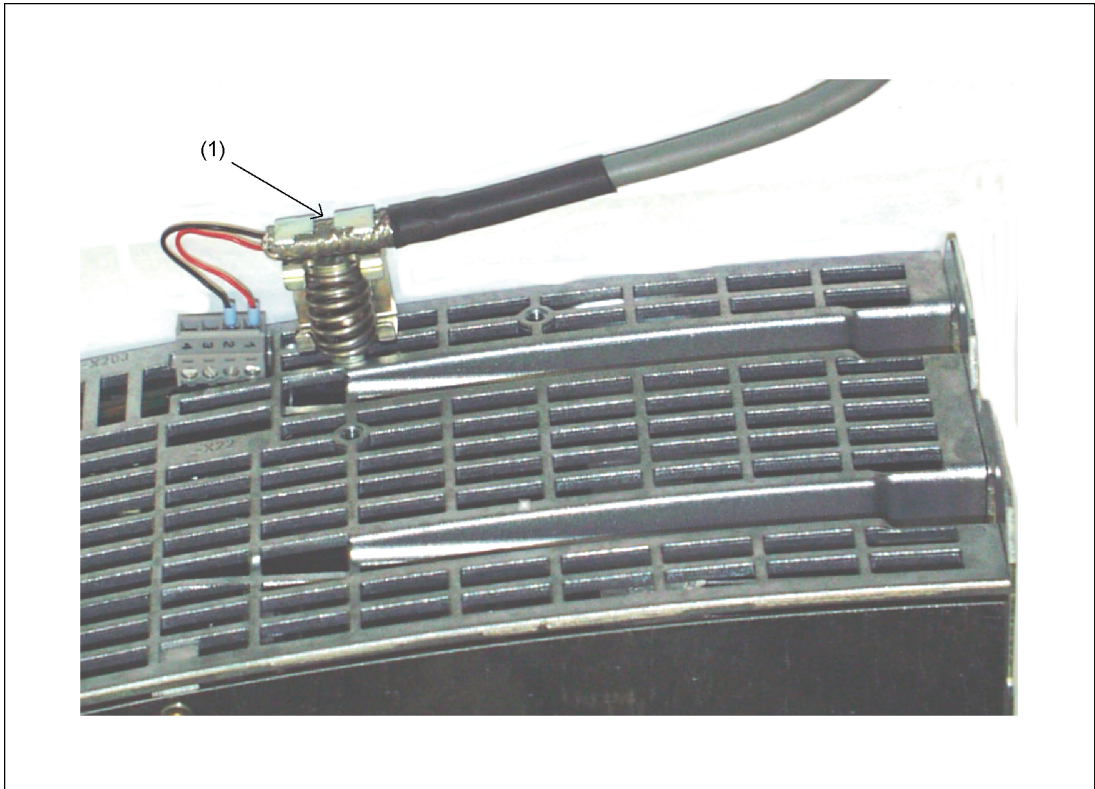


Figure 4-9 Shield contact for the terminals

(1) Shield contact: Weidmüller, order no. KLBÜ 3-8 SC

Internet address:

Weidmüller: <http://www.weidmueller.com>

4.2.7 Technical specifications

Table 4-9 Technical specifications for Single Motor Modules booksize (3 to 30 A)

Internal air cooling	6SL3120-	1TE13-0AAx	1TE15-0AAx	1TE21-0AAx	1TE21-8AAx	1TE23-0AAx
Rated current	A	3	5	9	18	30
Voltage						
Power supply: DC link voltage Electronics power supply	V _{DC} V _{DC}	510 – 750 24 (20.4 - 28.8)				
Output voltage	V _{ACrms}	0 - 0.67 x DC link voltage				
Overvoltage trip threshold Undervoltage trip threshold	V _{DC} V _{DC}	820 ± 2% 380 ± 2%				
Electronics current consumption at 24 V	A _{DC}	0.85	0.85	0.85	0.85	0.9
Total power loss (including electronic losses) ¹	W	50.4	75.4	100.4	185.4	311.6
Rated output current (I _n)	A _{ACrms}	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}	3.5	6	10	24	40
Peak current (I _{max})	A _{ACrms}	6	10	18	36	56
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 power (with DC link voltage of 600 V _{DC} and pulse frequency of 4 kHz)	kW	1.6	2.7	4.8	9.7	16
Max. pulse frequency without derating	kHz	4	4	4	4	4
Max. pulse frequency with derating	kHz	16	16	16	16	16
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	110	110	110	220	705
Efficiency (4kHz)	η	0.97	0.97	0.97	0.97	0.97
Sound pressure level	dB(A)	<60	<60	<60	<60	<60
Cooling method		Internal fan	Internal fan	Internal fan	Internal fan	Internal fan
Cooling air requirement	m ³ /h	29.6	29.6	29.6	29.6	56
Weight	kg	5.1	5.1	5	5	6.9

4.2 Motor Modules with Internal Air Cooling

Table 4-10 Technical specifications for Single Motor Modules booksize (45 to 200 A)

Internal air cooling	6SL3120-	1TE24-5AAx	1TE26-0AAx	1TE28-5AAx	1TE31-3AAx	1TE32-0AAx
Rated current	A	45	60	85	132	200
Voltage						
Power supply: DC link voltage	V _{DC}	510 – 750				
Electronics power supply	V _{DC}	24 (20.4 - 28.8)				
Output voltage	V _{ACrms}	0 - 0.67 x DC link voltage				
Overvoltage trip threshold	V _{DC}	820 ± 2%				
Undervoltage trip threshold	V _{DC}	380				
Electronics current consumption at 24 V	A _{DC}	1.2	1.2	1.5	1.5	1.5
Total power loss (including electronic losses) ¹	W	458.8	618.8	786	1286	2086
Rated output current (I _n)	A _{ACrms}	45	60	85	132	200
Base load current (I _{geund})	A	38	51	68	105	141
Intermittent duty current (I _{s6}) 40%	A _{ACrms}	60	80	110	150	230
Peak current (I _{max})	A _{ACrms}	85	113	141	210	282
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 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	4	4	4	4
Max. pulse frequency with derating	kHz	16	16	16	16	16
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	1175	1410	1880	2820	3995
Efficiency (4kHz)	η	0.97	0.97	0.97	0.97	0.97
Sound pressure level	dB(A)	<65	<65	<60	<73	<73
Cooling method (with fan)		Internal fan	Internal fan	Internal fan	Separate mounted fan	Separate mounted fan
Cooling air requirement	m ³ /h	112	112	160	520	520
Weight	kg	9	9	15	21	21

Table 4-11 Technical specifications for Double Motor Modules booksize (2x3 to 2x18A)

Internal air cooling	6SL3120-	2TE13-0AAx	2TE15-0AAx	2TE21-0AAx	2TE21-8AAx
Rated current	A	2x3	2x5	2x9	2x18
Voltage					
Power supply:					
DC link voltage	V _{DC}	510 – 750			
Electronics power supply	V _{DC}	24 (20.4 - 28.8)			
Output voltage	V _{ACrms}	0 - 0.67 x DC link voltage			
Overvoltage tripping	V _{DC}	820 ± 2%			
Undervoltage tripping	V _{DC}	380			
Electronics current consumption at 24 V	A _{DC}	1.0	1.0	1.0	1.0
Total power loss (including electronic losses) ¹	W	94	129	184	344
Rated output current (I _n)	A	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}	2x3.5	2x6	2x10	2x24
Peak current (I _{max})	A _{ACrms}	2x6	2x10	2x18	2x36
DC link busbar current carrying capacity	A	100	100	100	100
24 V busbar current carrying capacity	A	20	20	20	20
Rated power (600V, 4kHz)	kW	1.6	2.7	4.8	9.7
Max. pulse frequency without derating	kHz	4	4	4	4
Max. pulse frequency with derating	kHz	16	16	16	16
Max. ambient temperature without derating	°C	40	40	40	40
Max. ambient temperature with derating	°C	55	55	55	55
DC link capacitance	µF	110	220	220	705
Efficiency (4kHz)	η	0.97	0.97	0.97	0.97
Sound pressure level	dBA	<60	<60	<60	<60
Cooling method		Internal fan	Internal fan	Internal fan	Internal fan
Cooling air requirement	m ³ /h	29.6	29.6	29.6	56
Weight	kg	5.3	5.3	5.5	6.8

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

Rated duty cycles of Motor Modules booksize

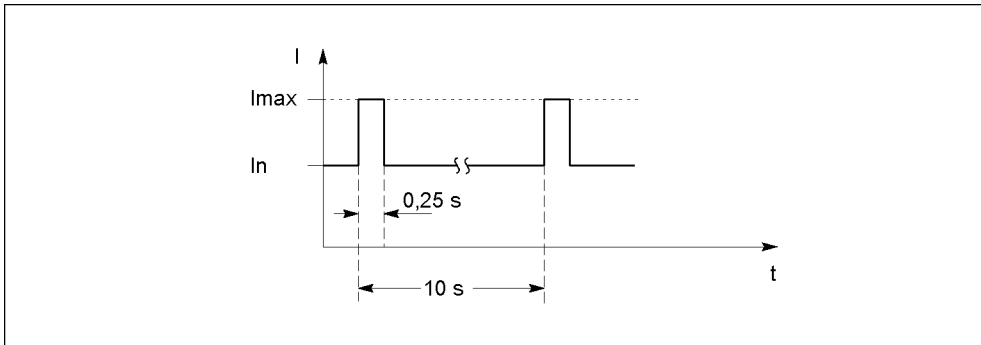


Figure 4-10 Peak current duty cycle with prior loading

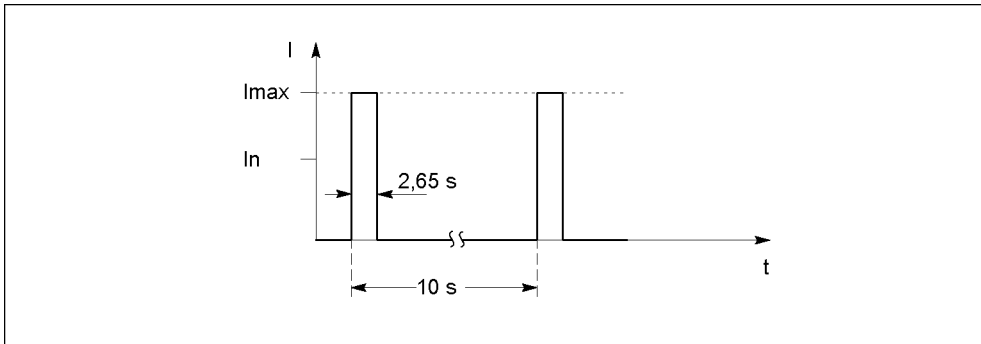


Figure 4-11 Peak current duty cycle without prior loading

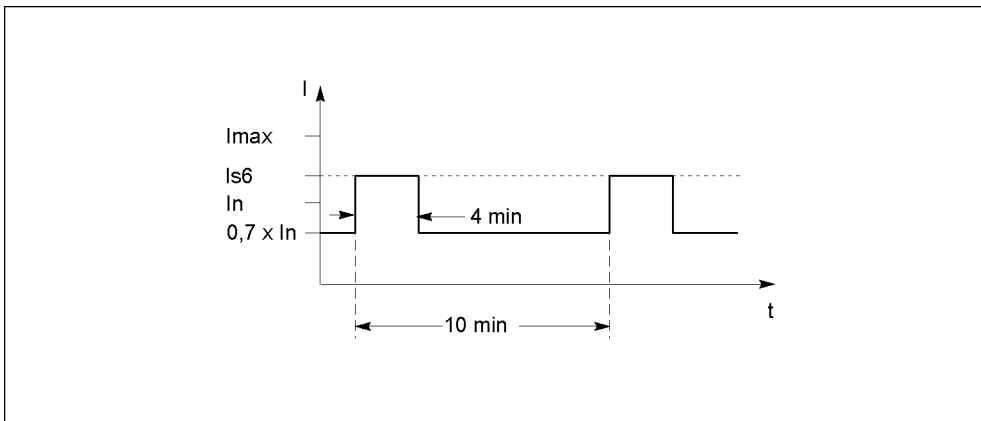


Figure 4-12 S6 current duty cycle with prior loading

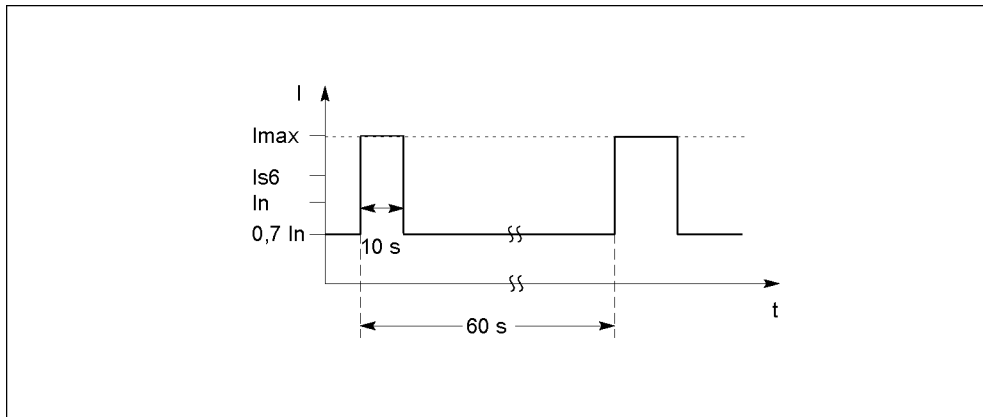


Figure 4-13 S6 peak current duty cycle with prior loading

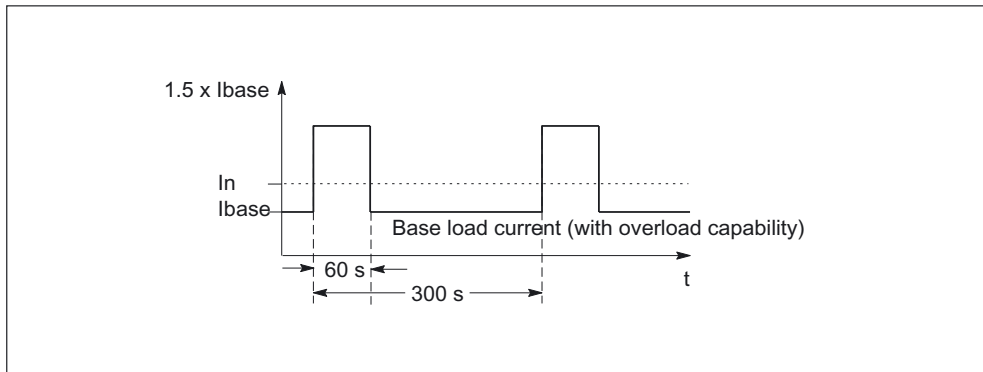


Figure 4-14 Current duty cycle with prior loading

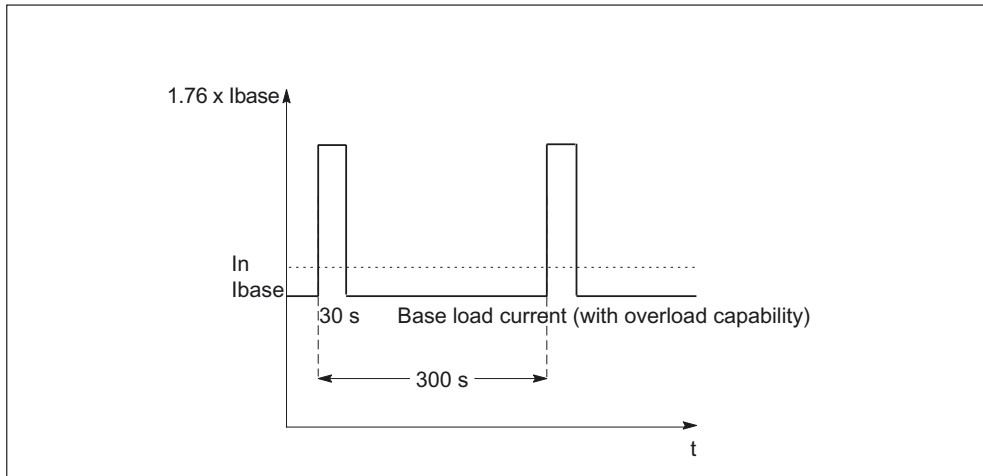


Figure 4-15 Current duty cycle with prior loading

Derating as a function of the ambient temperature

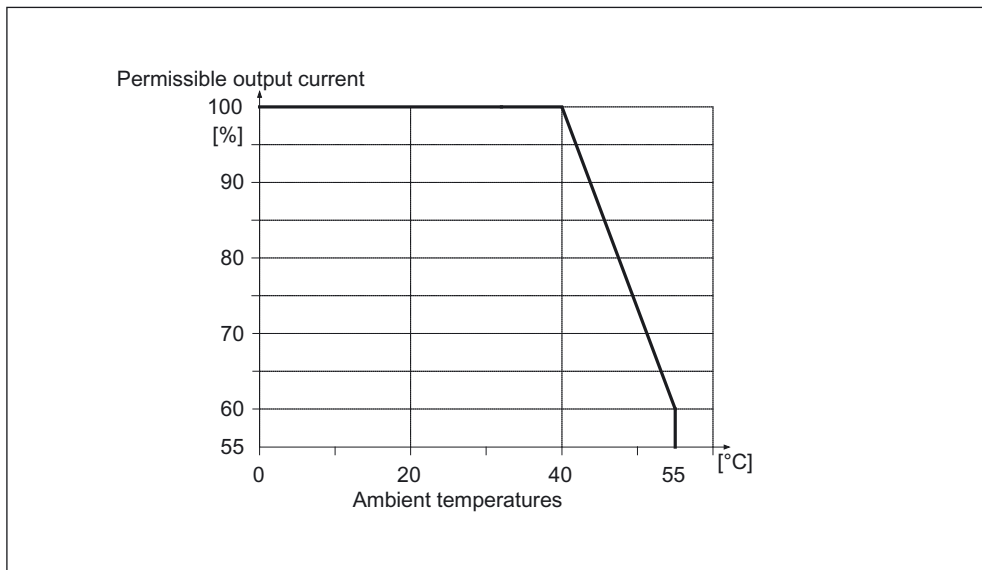


Figure 4-16 Derating as a function of the ambient temperature

Derating as a function of the pulse frequency

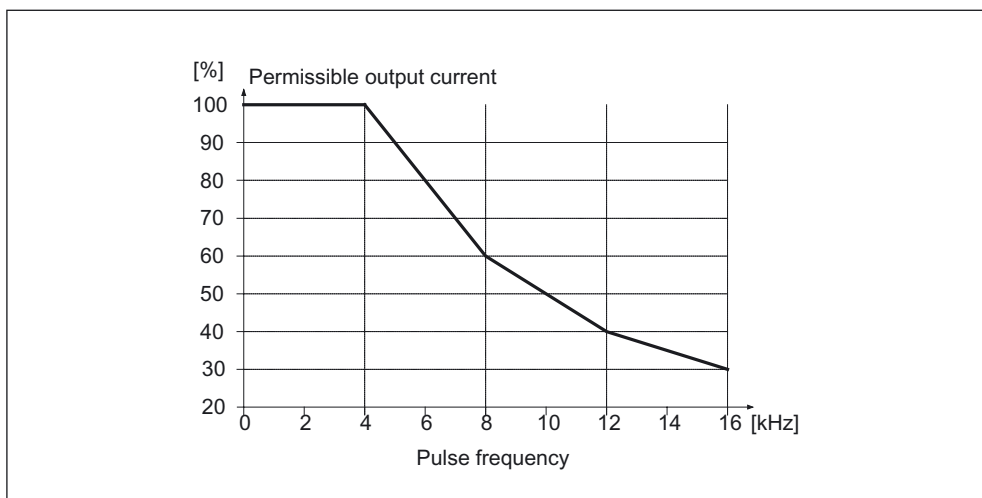


Figure 4-17 Derating as a function of the pulse frequency

Derating as a function of the installation altitude

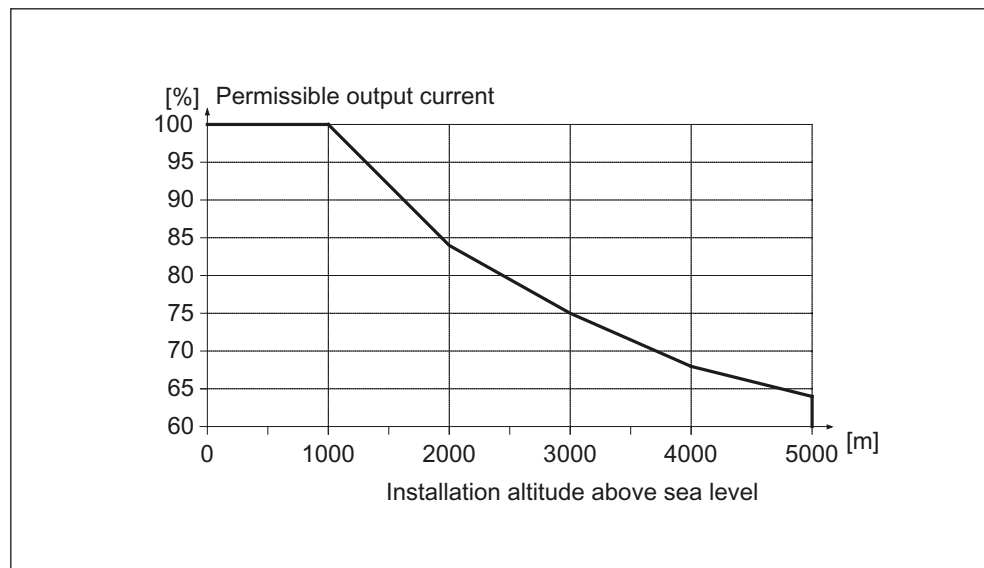


Figure 4-18 Derating as a function of the installation altitude

4.3 Motor Module with external air cooling

4.3.1 Description

A Motor Module with external air cooling is a power unit (inverter) that provides the power supply for the connected motor(s). Power is supplied by means of the DC link of the drive unit. 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.

Single Motor Modules and Double Motor Modules are available.

Just one motor can be connected to and operated using a Single Motor Module. Two motors can be connected to and operated with a Double Motor Module.

External air cooling uses the "through-hole" method. This is a cooling method for SINAMICS power units that is only available for booksize devices. The power unit and its heat sink can be inserted in a rectangular knockout at the rear of the switching cabinet and mounted with a seal. The heat sink fins and the fan (included in the scope of supply) project beyond the rear of the switching cabinet and the heat is dissipated outside the switching cabinet or in a separate air duct.

4.3.2 Safety Information



Warning

After disconnecting all the supply voltages, a hazardous voltage will be present in all components for another 5 minutes. 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, otherwise this could result in secondary damage or accidents.



Caution

Motor Modules with a rated current as 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 Module, a permanent PE connection of the Motor Module or switching cabinet is required.

Measures according to EN 61800-5-1 must be taken (e.g. PE conductor ($\geq 10\text{mm}^2$ Cu) or fit an additional connection terminal for a PE conductor with the same cross-section as the original PE conductor).



Caution

The DC link discharge voltage hazard warning must be affixed to the modules in the local language.

A set of labels in 12 languages is available using order number: 6SL3166-3AB00-0AAx.

Notice

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

Caution

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



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.

Caution

Only cables from Siemens must be used for DRIVE-CLiQ connections.

Notice

The external air cooling can cause the fans and the heat sink to become heavily contaminated, which may trigger the temperature monitor in the power section. The fans and heat sink must be checked for contamination at regular intervals and, if necessary, cleaned.

Note

After installation, the seal on the rear of the device must be checked to ensure that it is tight. Additional sealing can be used, if necessary.

Note

The mounting frames can only be used if the cabinet has an unpainted metal surface.

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 left and right ends of the DC link busbar of a drive line-up must be fitted with peripheral covers (order no.: 6SL3162-5AA00-0AA0).

4.3.3 Interface description

4.3.3.1 Overview

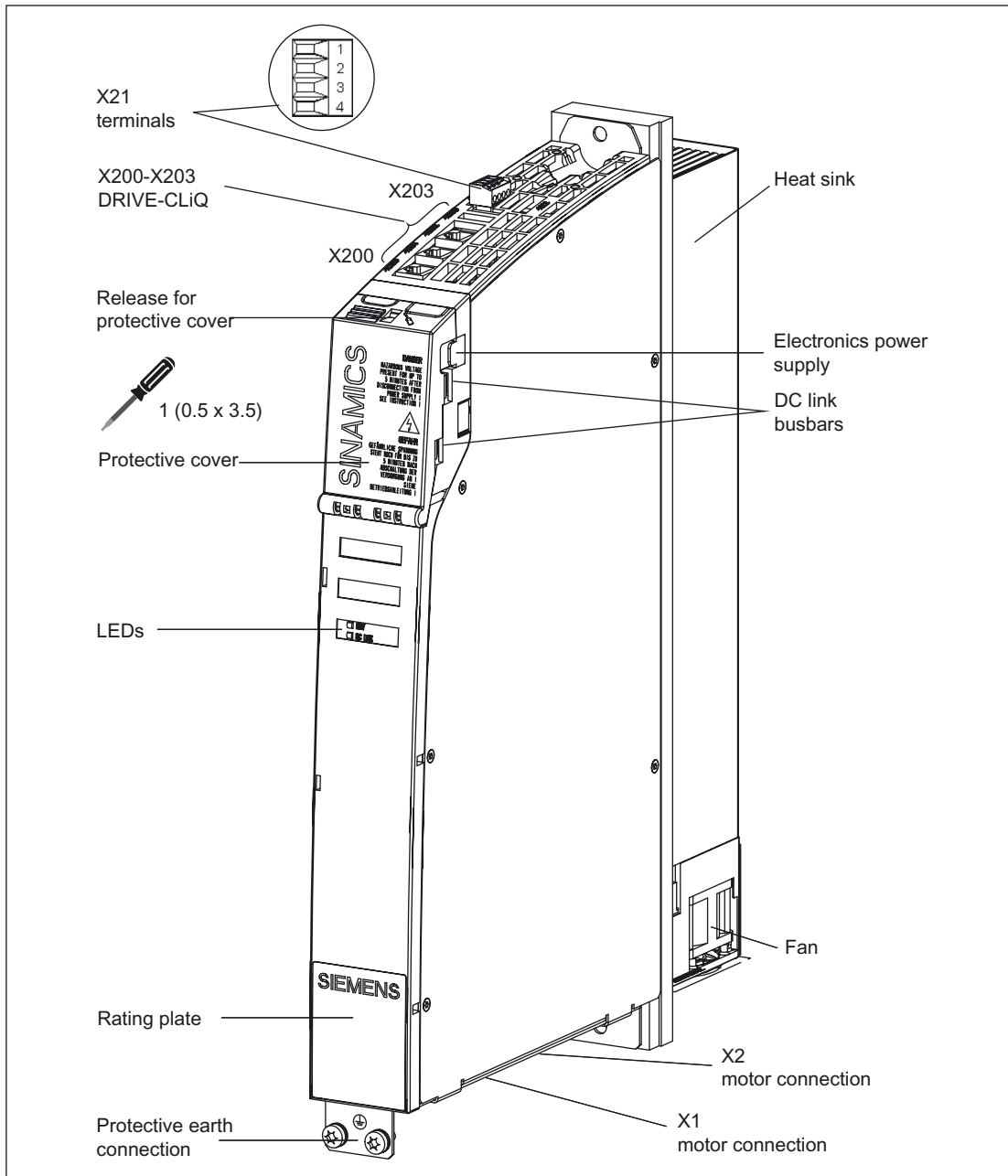


Figure 4-19 Example: single motor module with external air cooling (5 A)

4.3.3.2 Connection Examples

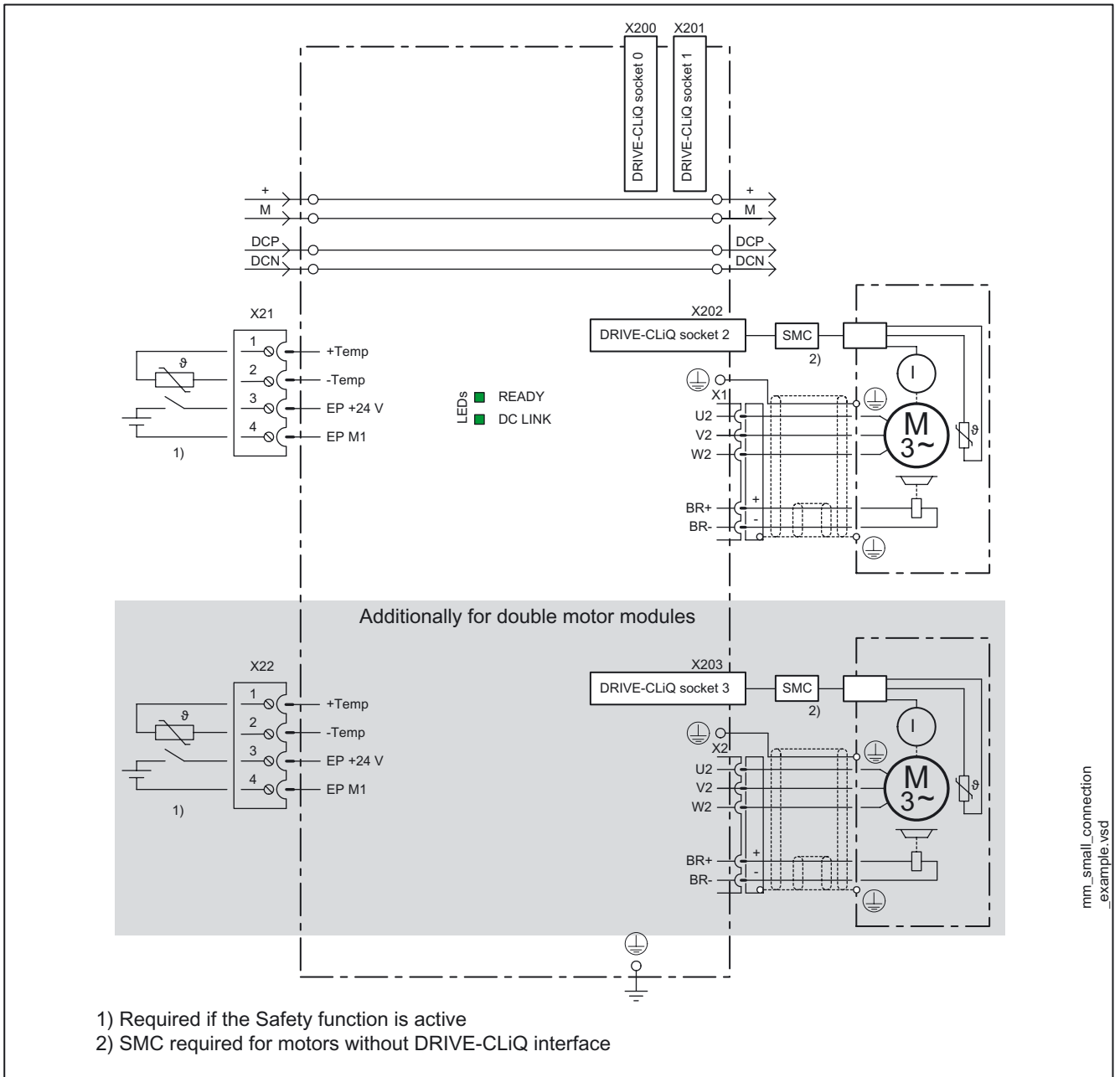


Figure 4-20 Connection example of Motor Modules 3 A to 30 A and 2x3 A to 2x18 A

4.3 Motor Module with external air cooling

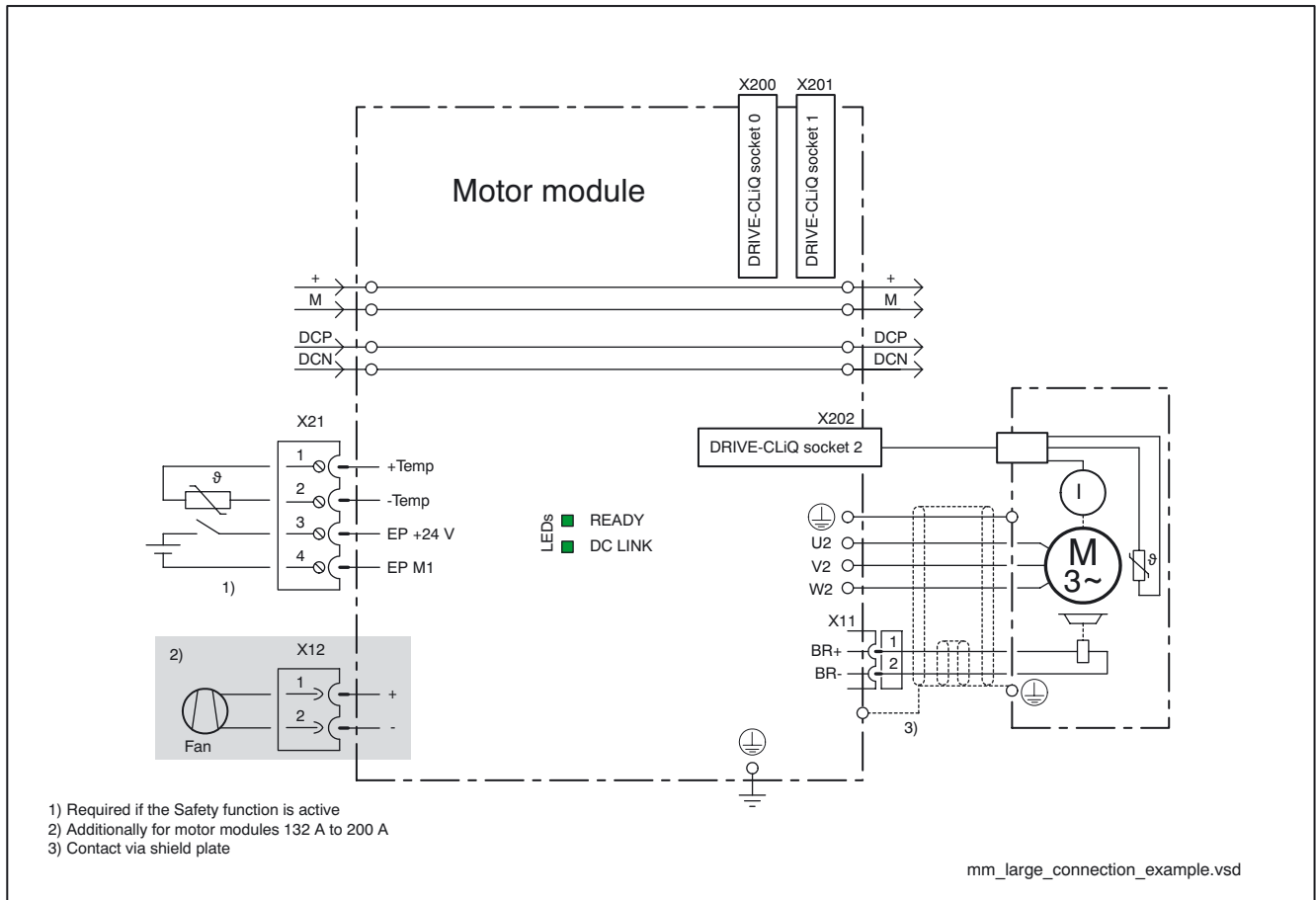
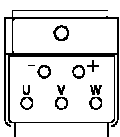
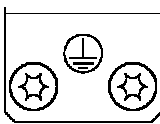


Figure 4-21 Connection example of Single Motor Modules 45 A to 200 A

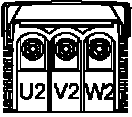
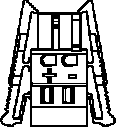
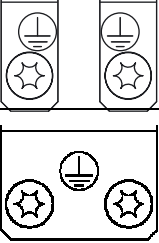
4.3.3.3 Motor/brake connection

Table 4-12 Terminal block X1/X2 Motor Modules 3 A to 30 A and 2x3 A to 2x18 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 4-13 Terminal block Single Motor Module 45 A to 200 A

	Terminals	Technical specifications
	U2	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
	V2	
	W2	
	+ (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 number: 721-102/026-000/56-000 The brake connector is part of the prefabricated cable.
	- (BR-)	
	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: M8/6 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

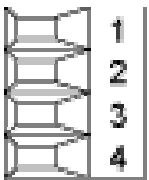
Only protective extra-low voltages (PELVs) that comply with EN60204-1 must be connected to all connections and terminals between 0 and 48 V DC.

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

4.3 Motor Module with external air cooling

4.3.3.4 X21/X22 EP terminals/temperature sensor connection motor module

Table 4-14 Terminal block X21/X22

	Terminal	Function	Technical specifications
	1	+Temp	Temperature sensor connection KTY84-1C130/PTC
	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 Connection Methods)			

Notice

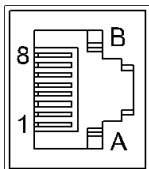
The KTY temperature sensor/the PTC must be connected with the correct polarity.

Note

The temperature sensor connection is required for motors whose temperature value is not transmitted by DRIVE-CLiQ.
 To operate, 24 V DC must be applied to terminal 3 and terminal 4 must be grounded if the "Safe Standstill" function is selected. Upon removal, pulse inhibit is activated.

4.3.3.5 X200-X203 DRIVE-CLiQ interface

Table 4-15 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	GND (0 V)	Electronic ground
Blanking plate for DRIVE-CLiQ interface: Molex, order number: 85999-3255			

4.3.3.6 Meaning of the LEDs on the motor module

Table 4-16 Meaning of the LEDs on the Motor Module

LED	Color	State	Description
READY	-	OFF	Electronics power supply outside permissible tolerance range.
	Green	Continuous	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	Continuous	DRIVE-CLiQ communication is being established.
	Red	Continuous	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 permissible tolerance range.
	Orange	Continuous	DC link voltage within permissible tolerance range (only when ready for operation)
	Red	Continuous	DC link voltage outside permissible tolerance range (only when ready for operation)

Cause and rectification of faults

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

Reference: /IH1/ SINAMICS S120 Commissioning Manual

4.3.4 Dimension Drawing

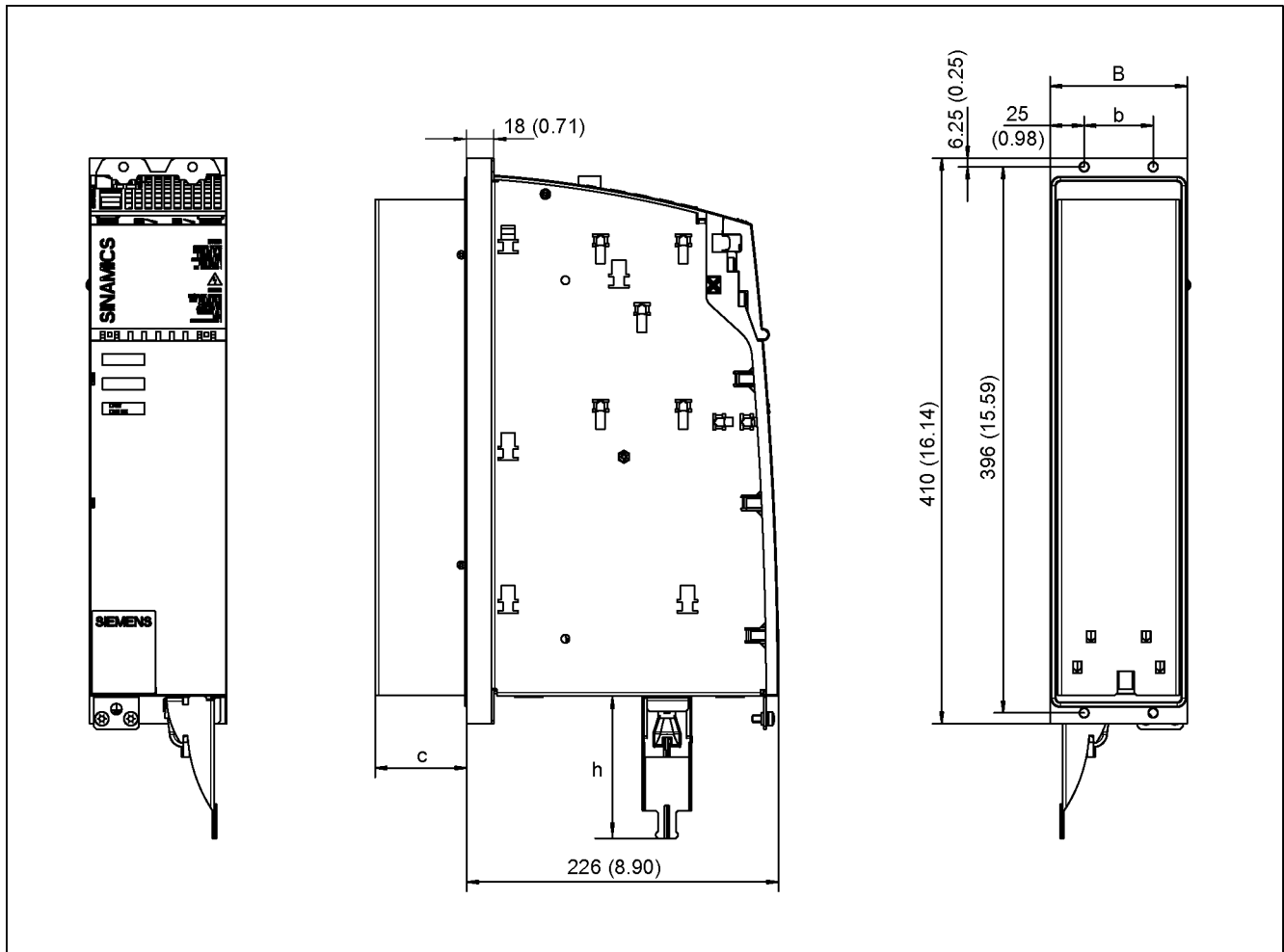


Figure 4-22 Dimension drawing of Motor Module with external air cooling (3 A to 30 A)

Table 4-17 Dimensions of Motor Module with external air cooling (3 A to 30 A)

Motor Module type	Order number	W [mm] (inches)	w [mm] (inches)	c [mm] (inches)	h [mm] (inches)
Single Motor Module 3 A	6SL3121-1TE13-0AAx	50 (1.97)	-	66.5 (2.62)	89 (3.50)
Single Motor Module 5 A	6SL3121-1TE15-0AAx	50 (1.97)	-	66.5 (2.62)	89 (3.50)
Single Motor Module 9 A	6SL3121-1TE19-0AAx	50 (1.97)	-	66.5 (2.62)	89 (3.50)
Single Motor Module 18 A	6SL3121-1TE21-8AAx	50 (1.97)	-	66.5 (2.62)	89 (3.50)
Single Motor Module 30 A	6SL3121-1TE23-0AAx	100 (3.94)	50 (1.97)	66.5 (2.62)	89 (3.50)
Double Motor Module 3 A	6SL3121-2TE13-0AAx	50 (1.97)	-	66.5 (2.62)	89 (3.50)
Double Motor Module 5 A	6SL3121-2TE15-0AAx	50 (1.97)	-	66.5 (2.62)	89 (3.50)
Double Motor Module 9 A	6SL3121-2TE19-0AAx	50 (1.97)	-	66.5 (2.62)	89 (3.50)
Double Motor Module 18 A	6SL3121-2TE21-8AAx	100 (3.94)	50 (1.97)	66.5 (2.62)	89 (3.50)

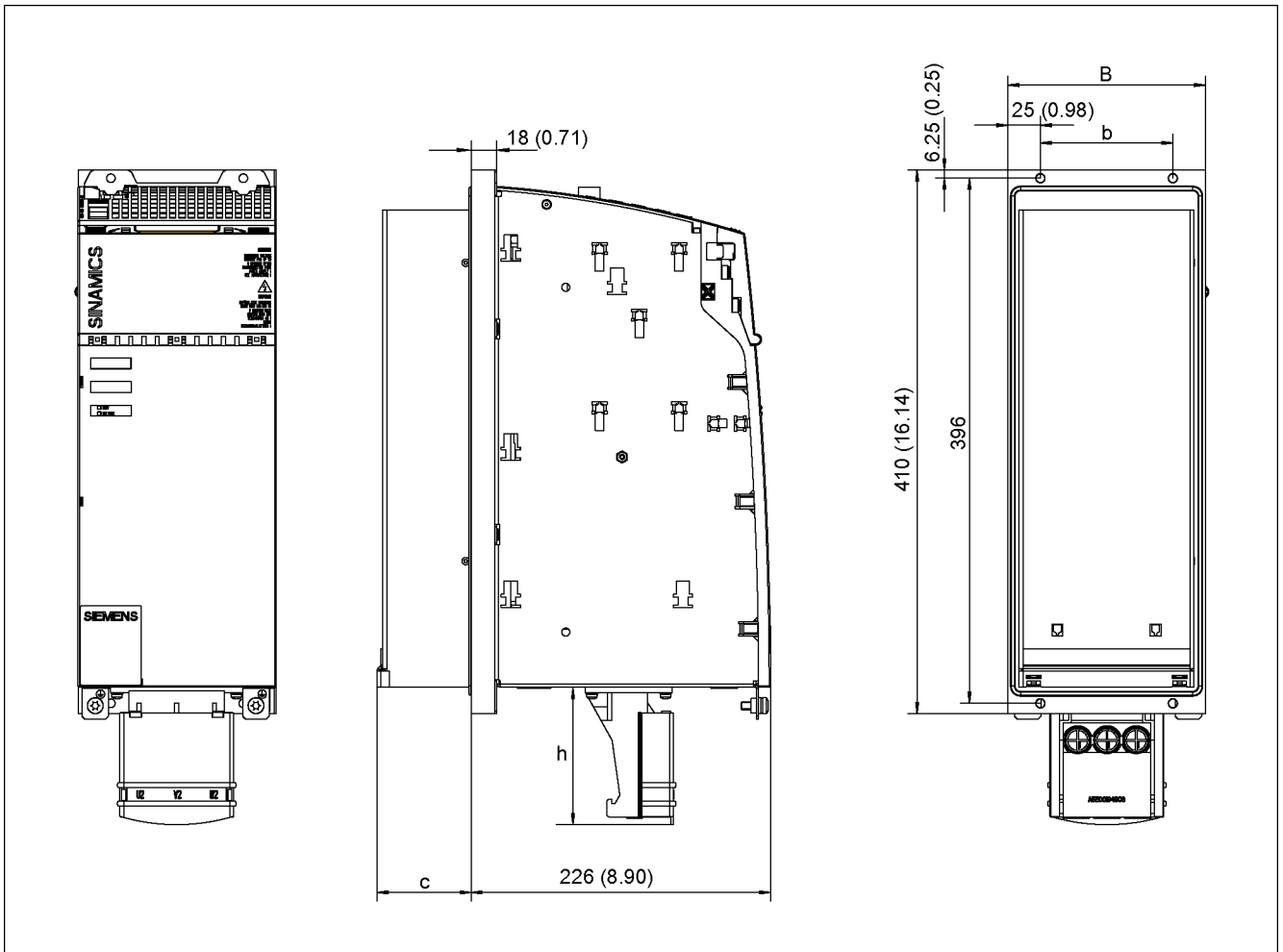


Figure 4-23 Dimension drawing of Motor Module with external air cooling (45 A, 60 A, and 85 A)

Table 4-18 Dimensions of Motor Module with external air cooling (45 A, 60 A, and 85 A)

Motor Module type	Order number	W [mm] (inches)	w [mm] (inches)	c [mm] (inches)	h [mm] (inches)
Motor Module with External Air Cooling					
Single Motor Module 45 A	6SL3121-1TE24-5AAx	150 (5.91)	100 (3.94)	71 (2.80)	105 (4.13)
Single Motor Module 60 A	6SL3121-1TE26-0AAx	150 (5.91)	100 (3.94)	71 (2.80)	105 (4.13)
Single Motor Module 85 A	6SL3121-1TE28-5AAx	200 (7.87)	150 (5.91)	92 (3.62)	105 (4.13)

4.3 Motor Module with external air cooling

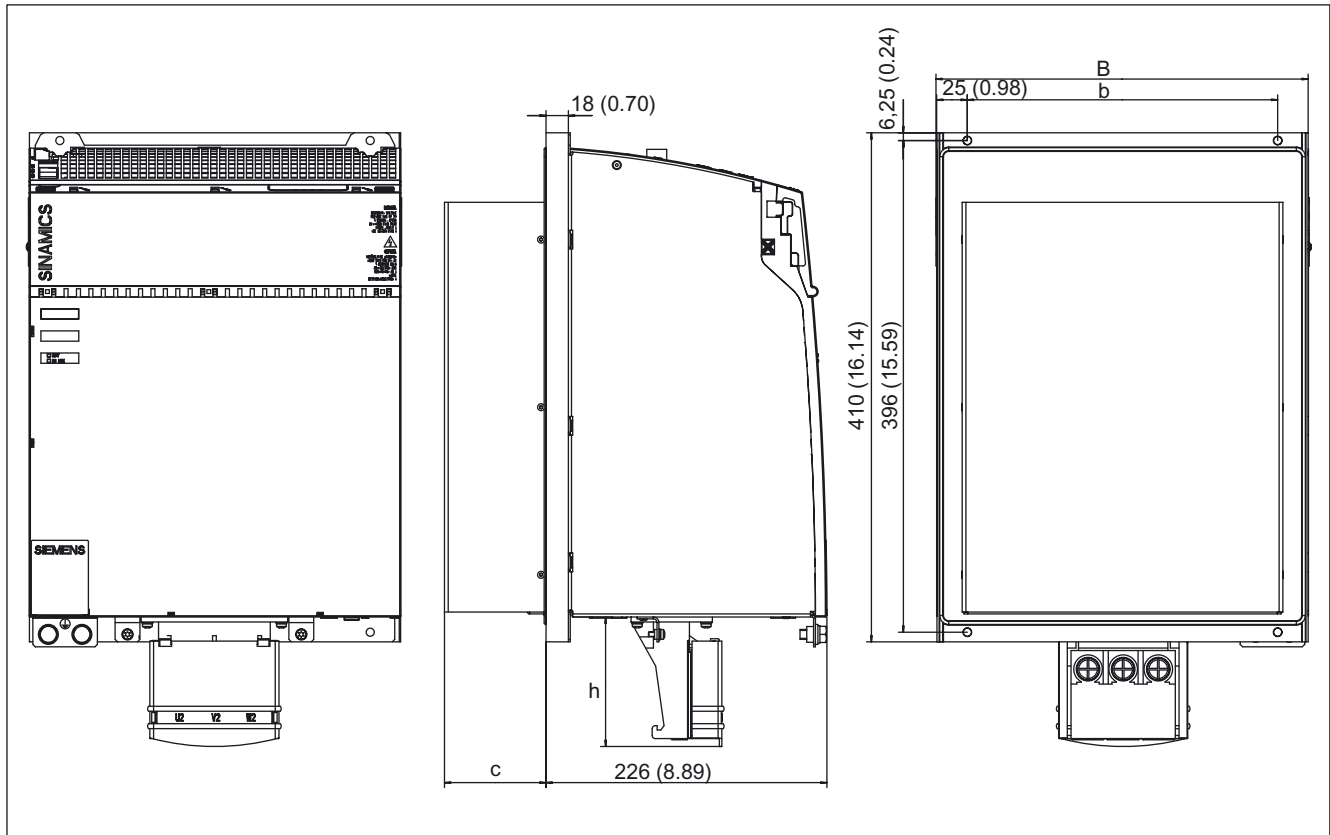


Figure 4-24 Dimension drawing of Motor Module with external air cooling (132 A and 200 A)

Table 4-19 Dimensions of Motor Module with external air cooling (132 A and 200 A)

Motor Module type	Order number	W [mm] (inches)	w [mm] (inches)	c [mm] (inches)	h [mm] (inches)
Motor Module with External Air Cooling					
Single Motor Module 132 A	6SL3121-1TE31-3AAx	300 (11.81)	250 (9.84)	82 (3.23)	105 (4.13)
Single Motor Module 200 A	6SL3121-1TE32-0AAx	300 (11.81)	250 (9.84)	82 (3.23)	105 (4.13)

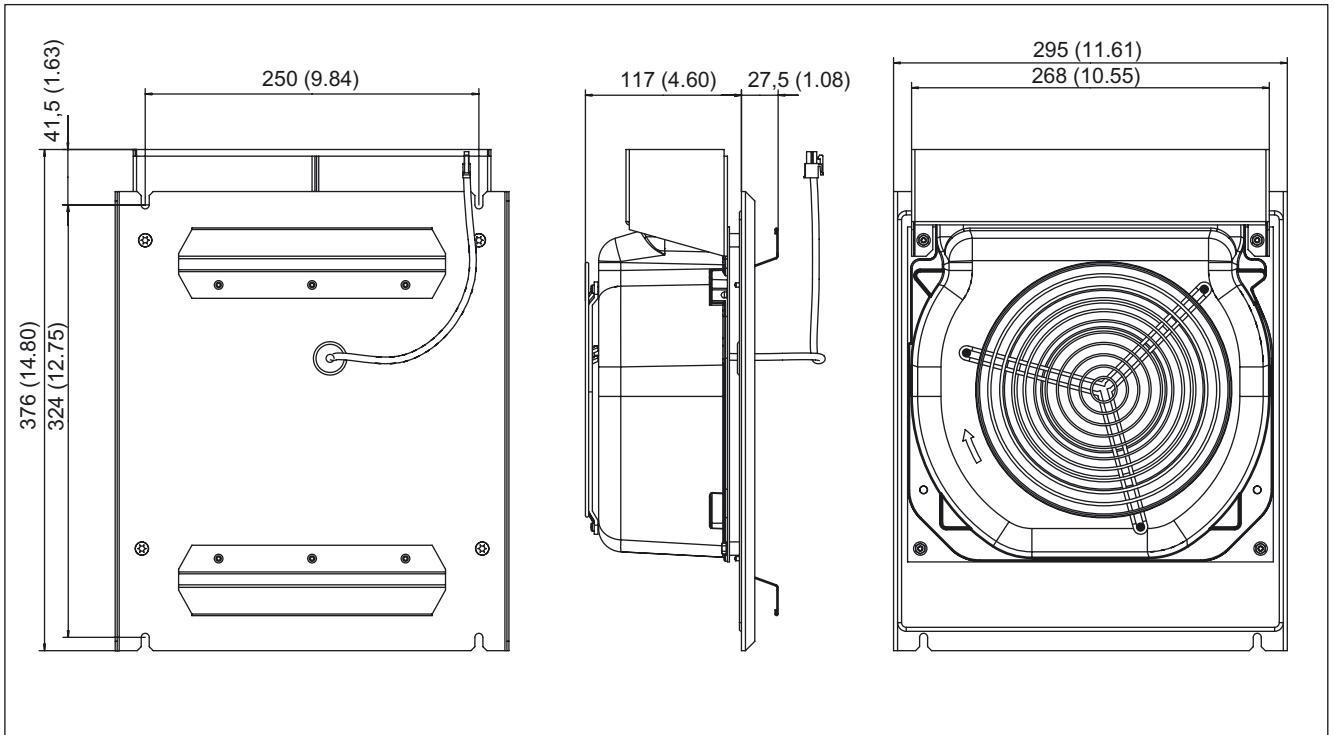


Figure 4-25 Dimension drawing of fan for Motor Modules with external air cooling (132 A and 200 A)

4.3.5 Installation

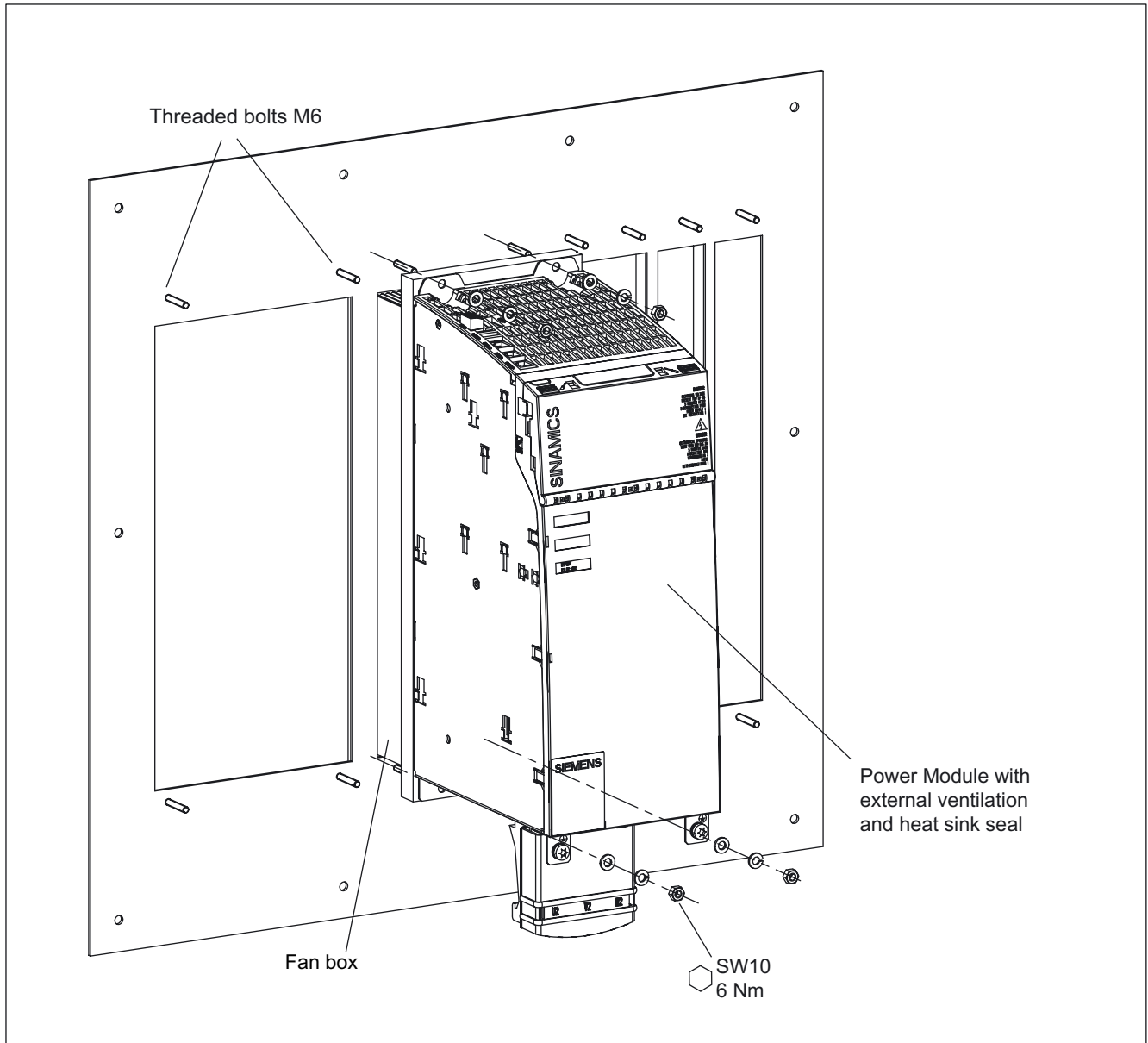


Figure 4-26 Example: installing the Power Module with external air cooling

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

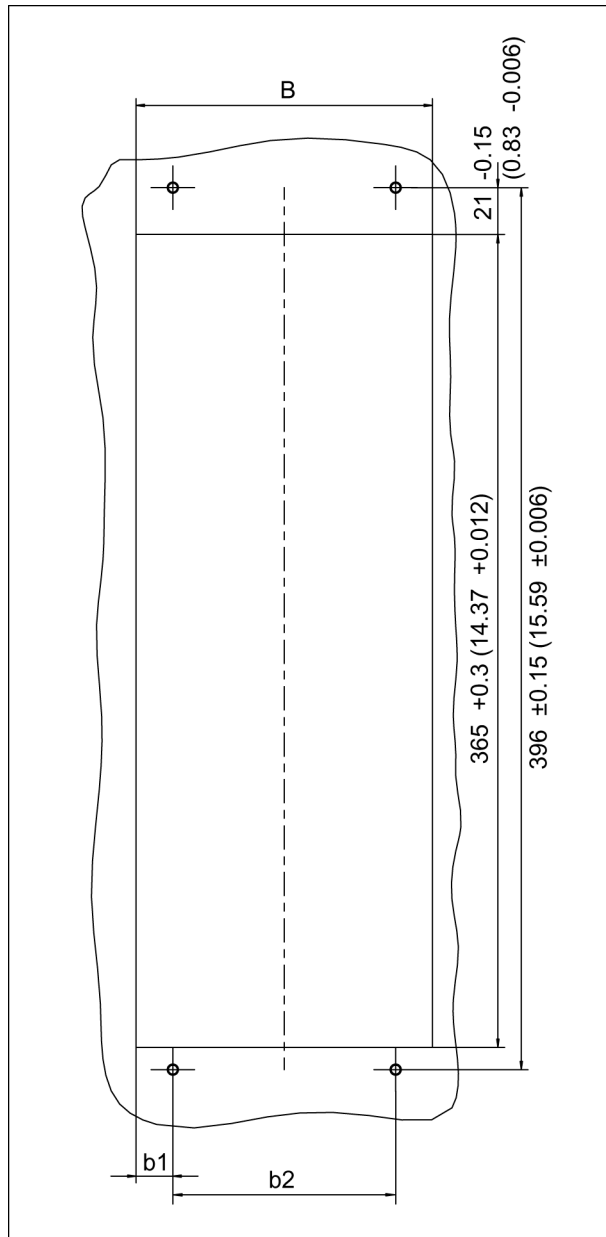


Figure 4-27 Installation openings for the Power Module with external air cooling (50 mm to 200 mm)

4.3 Motor Module with external air cooling

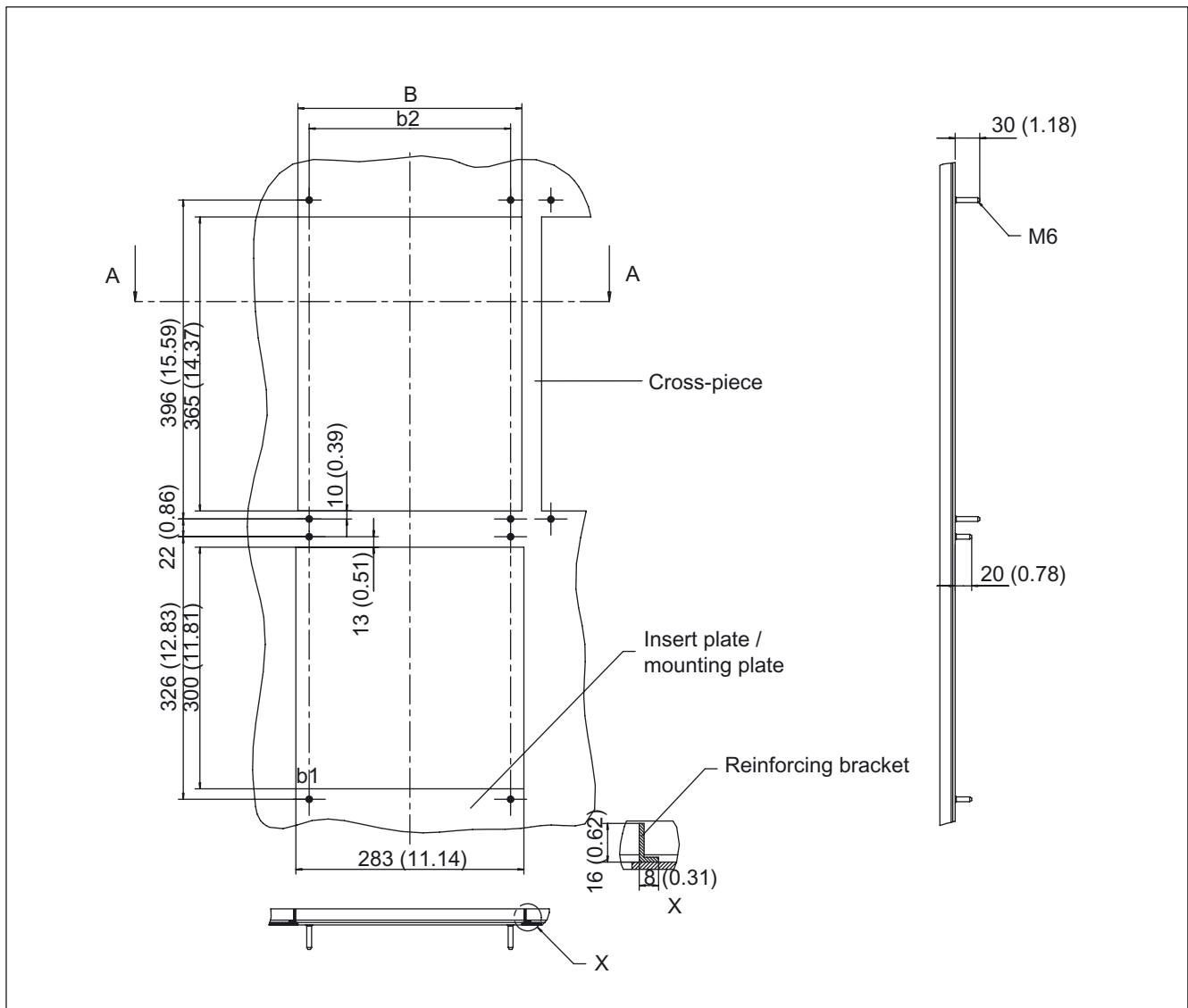


Figure 4-28 Installation openings for the Power Module with external air cooling (300 mm)

Table 4-20 Dimensions of the installation openings for the Power Module with external air cooling

Module width	W [mm] (inches)	w1 [mm] (inches)	w2 [mm] (inches)
50 mm	41.5 + 0.3 (1.63 + 0.012)	20.75 + 0.15 (0.82 + 0.006)	0
100 mm	89.5 + 0.3 (3.52 + 0.012)	19.75 + 0.15 (0.78 + 0.006)	50 ± 0.15 (1.97 ± 0.006)
150 mm	133 + 0.3 (5.24 + 0.012)	16.5 + 0.15 (0.65 + 0.006)	100 ± 0.15 (3.94 ± 0.006)
200 mm	173 + 0.3 (6.81 + 0.012)	11.5 + 0.15 (0.45 + 0.006)	150 ± 0.15 (5.91 ± 0.006)
300 mm	278 + 0.3 (10.94 + 0.012)	14.0 ± 0.15 (0.55 ± 0.006)	250 + 0.15 (9.84 + 0.006)

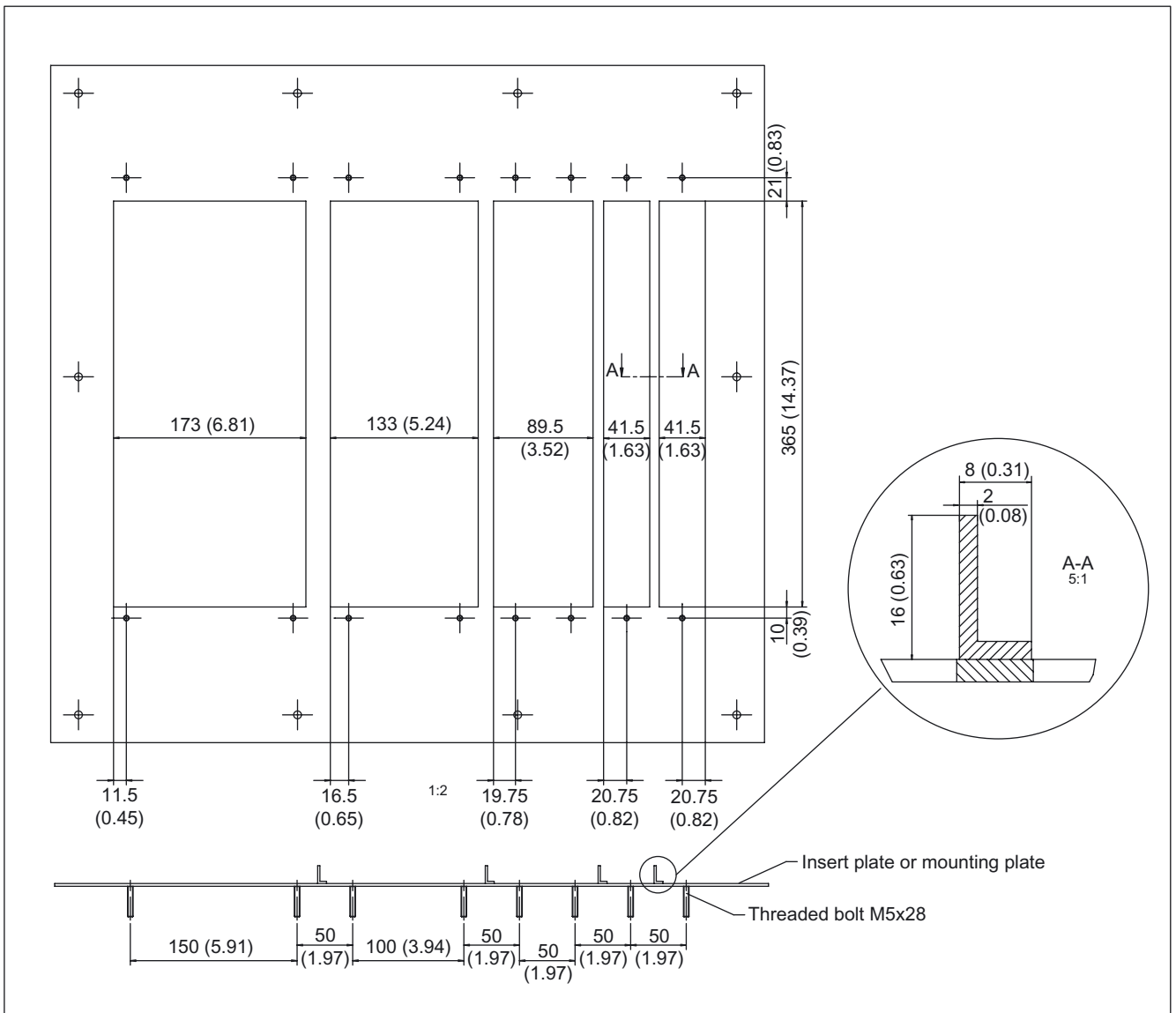


Figure 4-29 Example: mounting plate with a drive line-up

When installing the module, you must ensure that the module seal is tight all round. The cross-pieces must be sufficiently stable.

If required, we recommend that you reinforce the cross-pieces for the recesses.

In our example, the cross-pieces have been reinforced using brackets to EN 755-9.

Any means necessary can be used to secure the bracket to the insert plate.

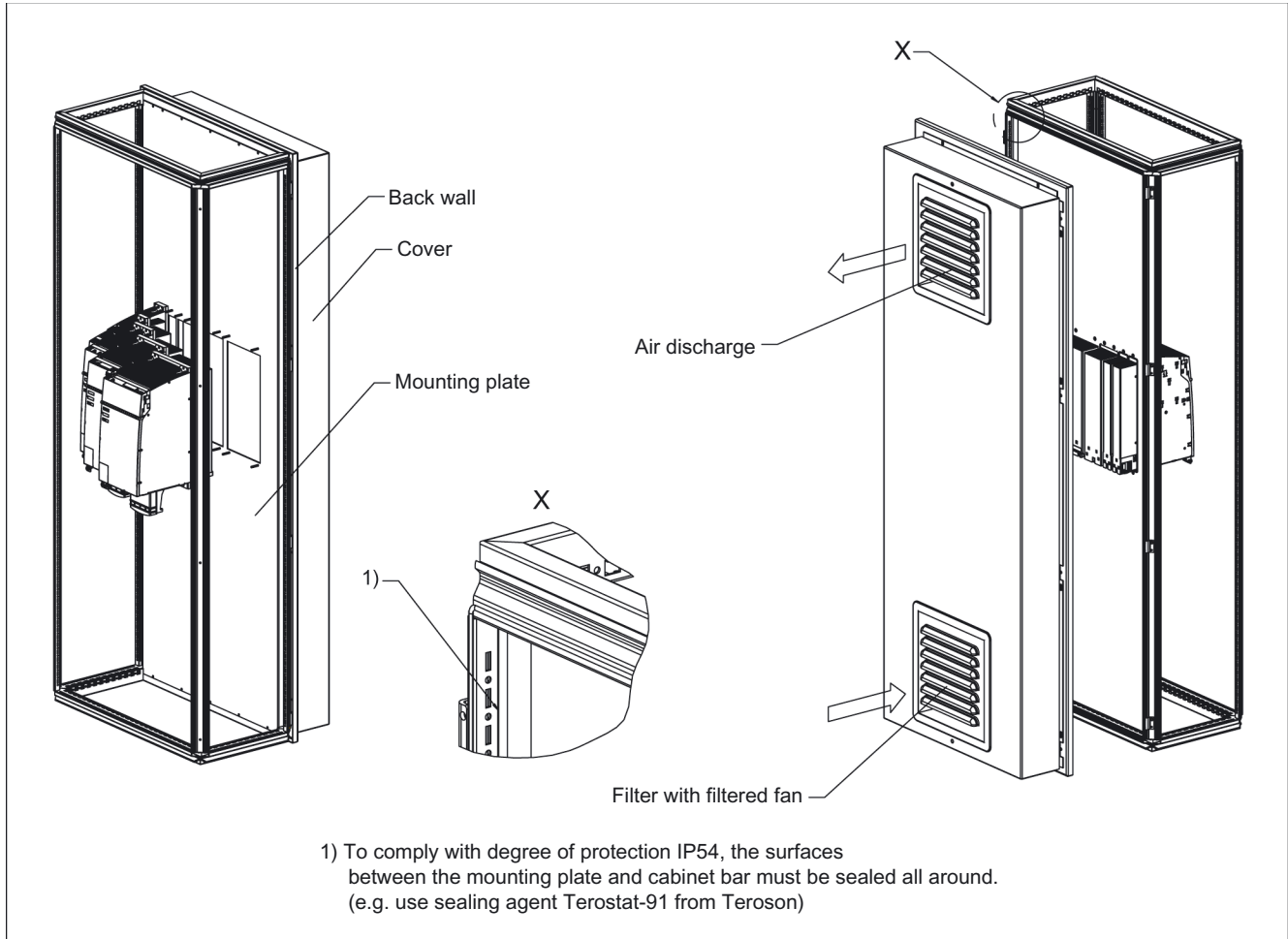


Figure 4-30 Example 1: installation in cabinet with mounting plate

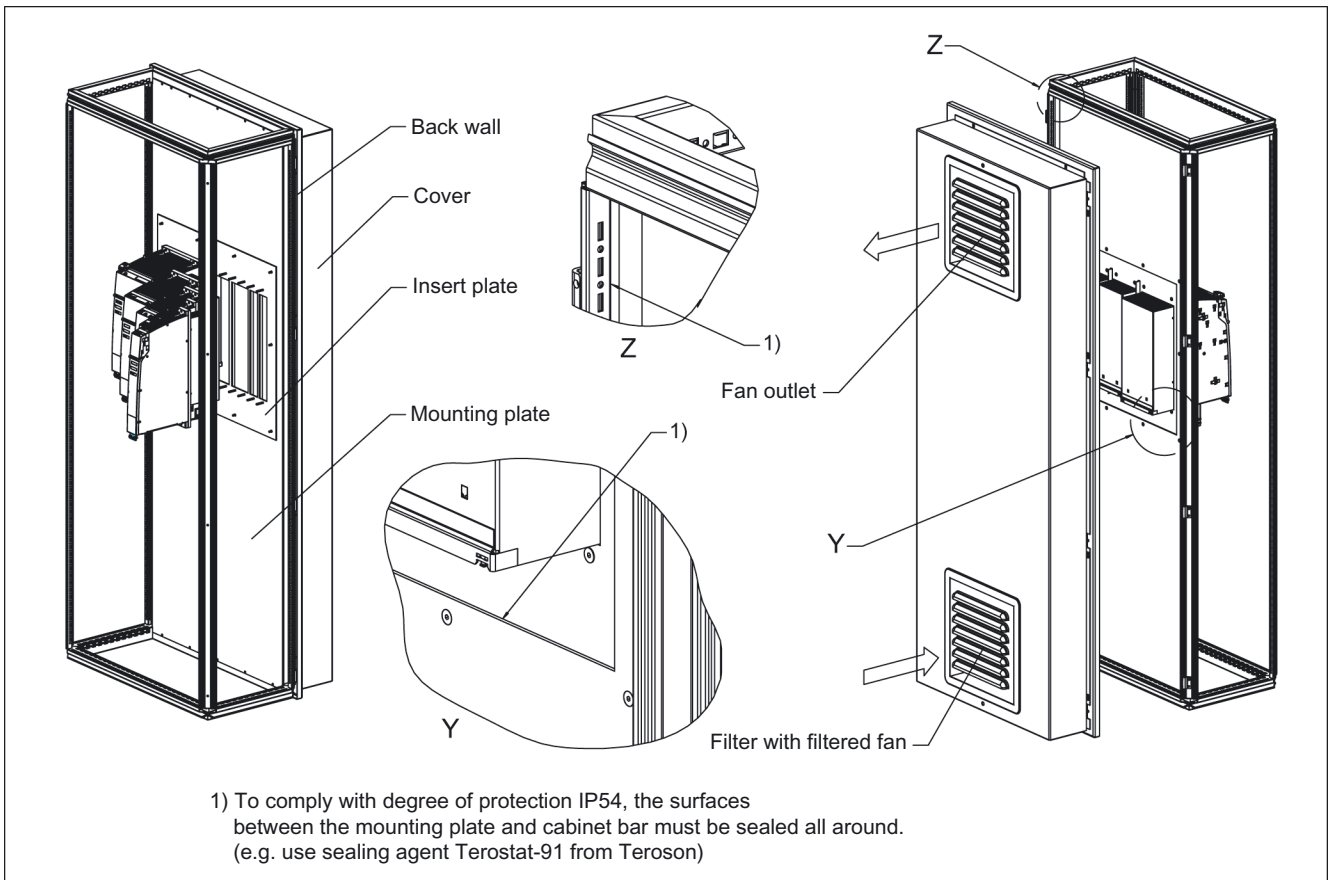


Figure 4-31 Example 2: installation in cabinet with mounting plate

We recommend that you attach a cover and filtered fan to the cabinet.

The filtered fan must be fitted in such a way that the cooling air required by the drive line-up is not restricted. This can be determined by establishing the total cooling air required by the individual components. This information is available in the technical specifications.

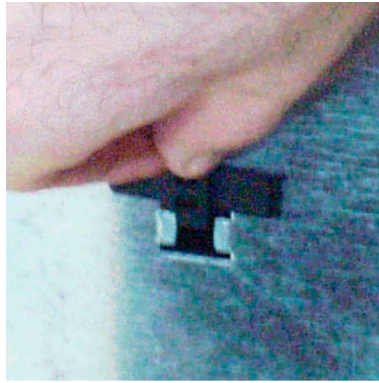
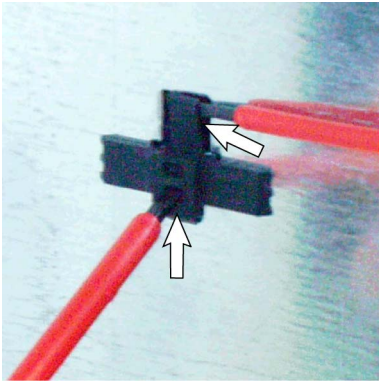
Note

If the cooling air requirement is not covered by the filtered fan, the components cannot output their specified power.

The filters with a filtered fan must be regularly checked for dirt and cleaned if necessary.

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.

The holder removed

4.3.6 Electrical connection

Shield contact for the terminals

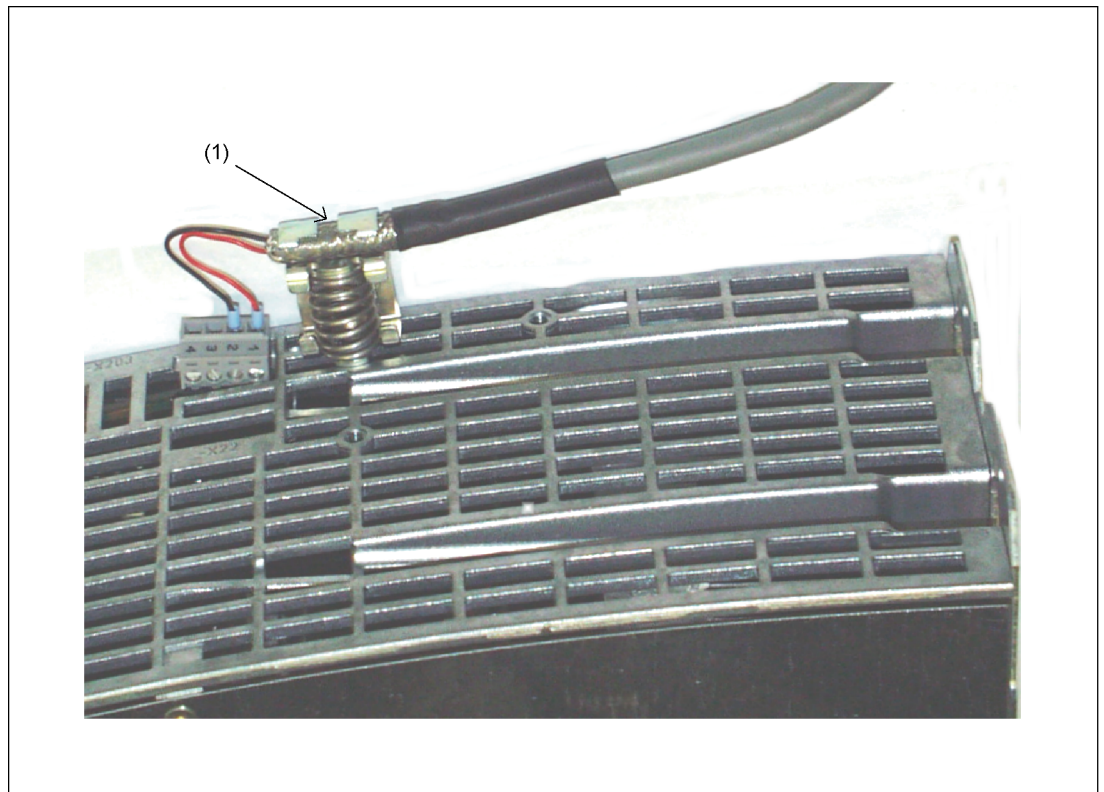


Figure 4-32 Shield contact for the terminals

(1) Shield contact: Weidmüller, order no. KLBÜ 3-8 SC

Internet address:

Weidmüller: <http://www.weidmueller.com>

4.3 Motor Module with external air cooling

4.3.7 Technical specifications

Table 4-21 Technical specifications for Single Motor Modules booksize (3 to 30 A)

External air cooling	6SL3121-	1TE13-0AAx	1TE15-0AAx	1TE21-0AAx	1TE21-8AAx	1TE23-0AAx
Rated current	A	3	5	9	18	30
Voltage						
Supply:						
DC link voltage	V _{DC}	510 – 750				
Electronics power supply	V _{DC}	24 (20.4 - 28.8)				
Output voltage	V _{ACrms}	0 - 0.67 x DC link voltage				
Overvoltage trip threshold	V _{DC}	820 ± 2%				
Undervoltage trip threshold	V _{DC}	380				
Electronics current consumption at 24 V	A _{DC}	0.85	0.85	0.85	0.85	0.9
Total power loss (including electronic losses) ¹	W	35.4	50.4	65.4	110.4	231.6
Rated output current (I _n)	A _{ACrms}	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}	3.5	6	10	24	40
Peak current (I _{max})	A _{ACrms}	6	10	18	36	56
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 power (with DC link voltage of 600 V _{DC} and pulse frequency of 4 kHz)	kW	1.6	2.7	4.8	9.7	16
Max. pulse frequency without derating	kHz	4	4	4	4	4
Max. pulse frequency with derating	kHz	16	16	16	16	16
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	110	110	110	220	705
Efficiency (4kHz)	η	0.97	0.97	0.97	0.97	0.97
Sound pressure level	dB(A)	<60	<60	<60	<60	<60
Cooling air requirement	m ³ /h	29.6	29.6	29.6	29.6	56
Weight	kg	5.69	5.69	5.7	5.7	8.43

Table 4-22 Technical specifications for Single Motor Modules booksize (45 to 200 A)

External air cooling	6SL3121-	1TE24-5AAx	1TE26-0AAx	1TE28-5AAx	1TE31-3AAx	1TE32-0AAx
Rated current	A	45	60	85	132	200
Voltage						
Supply:						
DC link voltage	V _{DC}	510 – 750				
Electronics power supply	V _{DC}	24 (20.4 - 28.8)				
Output voltage	V _{ACrms}	0 - 0.67 x DC link voltage				
Overvoltage tripping	V _{DC}	820 ± 2%				
Undervoltage tripping	V _{DC}	380				
Electronics current consumption at 24 V	A _{DC}	1.2	1.2	1.5	1.5	1.5
Total power loss (including electronic losses) ¹	W	348.8	483.8	626	1036	1696
Rated output current (I _n)	A _{ACrms}	45	60	85	132	200
Base load current (I _{geund})	A	38	51	68	105	141
Intermittent duty current (I _{s6}) 40%	A _{ACrms}	60	80	110	150	230
Peak current (I _{max})	A _{ACrms}	85	113	141	210	282
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 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	4	4	4	4
Max. pulse frequency with derating	kHz	16	16	16	16	16
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	1175	1410	1880	2820	3995
Efficiency (4kHz)	η	0.97	0.97	0.97	0.97	0.97
Sound pressure level	dB(A)	<65	<65	<60	<73	<73
Cooling air requirement	m ³ /h	112	112	160	520	520
Weight	kg	13.2	13.35	17.2	27.13	27.99

4.3 Motor Module with external air cooling

Table 4-23 Technical specifications for Double Motor Modules booksize (2x3 to 2x18A)

External air cooling	6SL3121-	2TE13-0AAx	2TE15-0AAx	2TE21-0AAx	2TE21-8AAx
Rated current	A	2x3	2x5	2x9	2x18
Voltage					
Supply:					
DC link voltage	V _{DC}	510 – 750			
Electronics power supply	V _{DC}	24 (20.4 - 28.8)			
Output voltage	V _{ACrms}	0-480			
Overvoltage tripping	V _{DC}	820 ± 2%			
Undervoltage tripping	V _{DC}	380			
Electronics current consumption at 24 V	A _{DC}	1.0	1.0	1.0	1.0
Total power loss (including electronic losses) ¹	W	59	84	119	244
Rated output current (I _n)	A	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}	2x3.5	2x6	2x10	2x24
Peak current (I _{max})	A _{ACrms}	2x6	2x10	2x18	2x36
DC link busbar current carrying capacity	A	100	100	100	100
24 V busbar current carrying capacity	A	20	20	20	20
Rated power (600V, 4kHz)	kW	1.6	2.7	4.8	9.7
Max. pulse frequency without derating	kHz	4	4	4	4
Max. pulse frequency with derating	kHz	16	16	16	16
Max. ambient temperature without derating	°C	40	40	40	40
Max. ambient temperature with derating	°C	55	55	55	55
DC link capacitance	µF	110	220	220	705
Efficiency (4kHz)	η	0.97	0.97	0.97	0.97
Sound pressure level	dBA	<60	<60	<60	<60
Cooling air requirement	m ³ /h	29.6	29.6	29.6	56
Weight	kg	5.8	5.8	5.7	8.6

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

Rated duty cycles of Motor Modules booksize

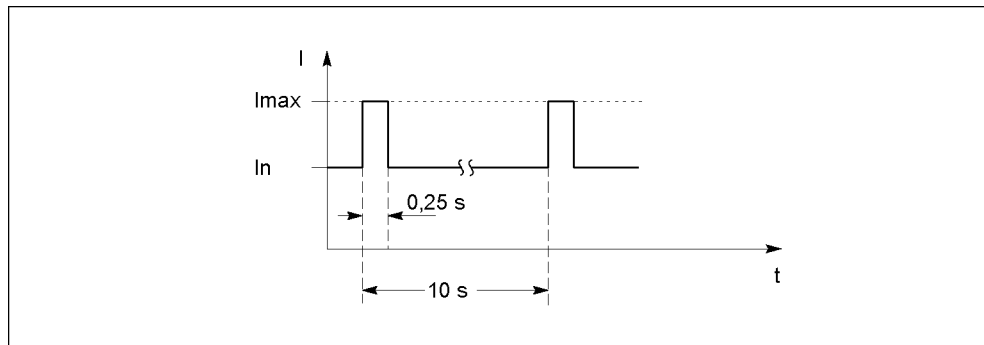


Figure 4-33 Peak current duty cycle with prior loading

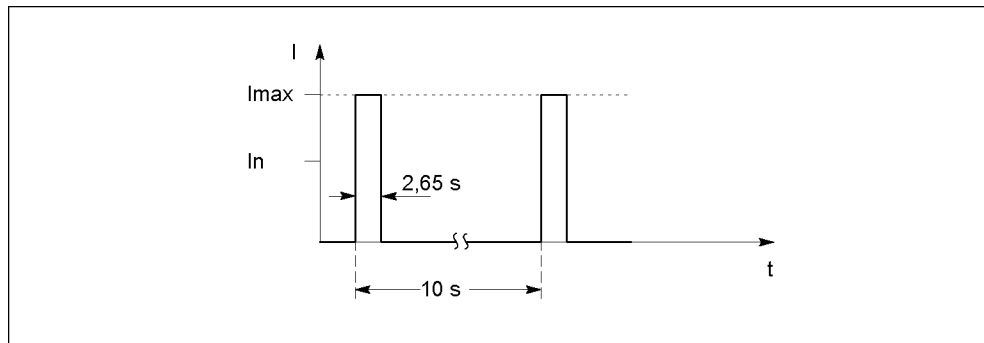


Figure 4-34 Peak current duty cycle without prior loading

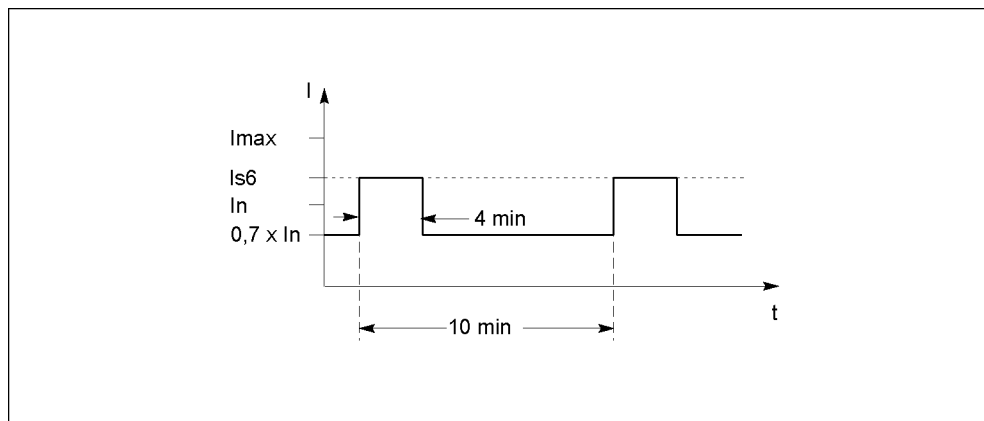


Figure 4-35 S6 current duty cycle with prior loading

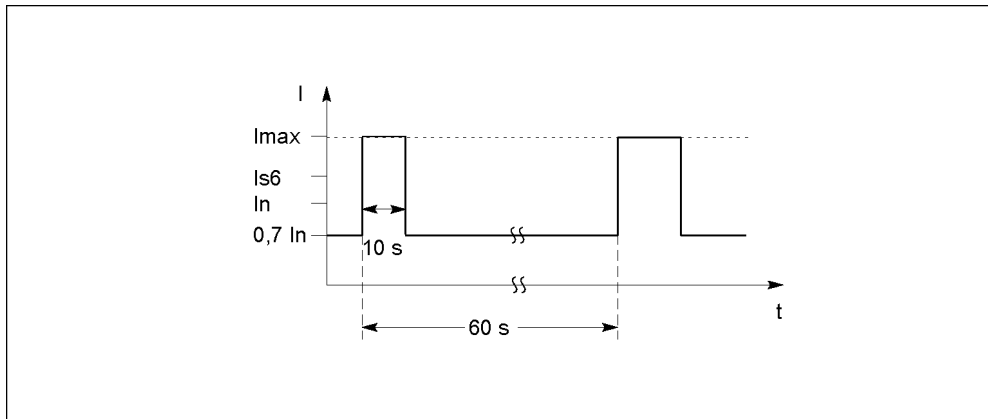


Figure 4-36 S6 peak current duty cycle with prior loading

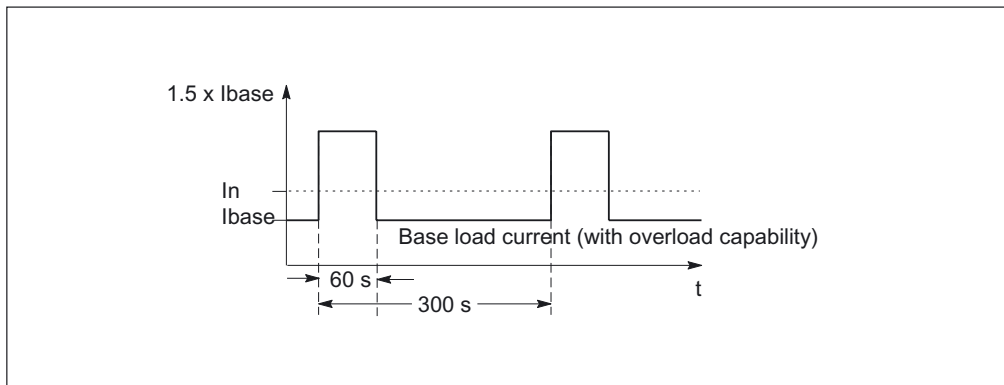


Figure 4-37 Current duty cycle with prior loading

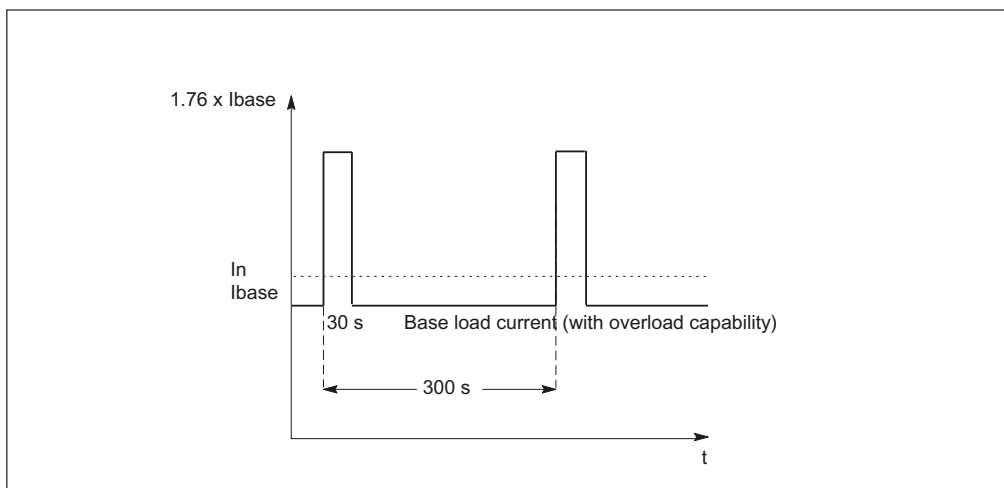


Figure 4-38 Current duty cycle with prior loading

Derating as a function of the ambient temperature

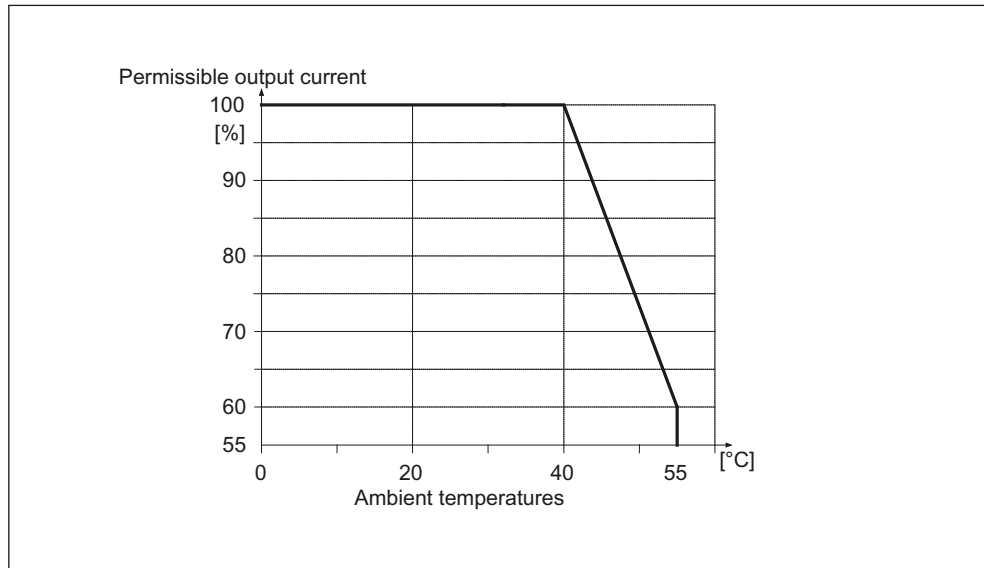


Figure 4-39 Derating as a function of the ambient temperature

Derating as a function of the pulse frequency

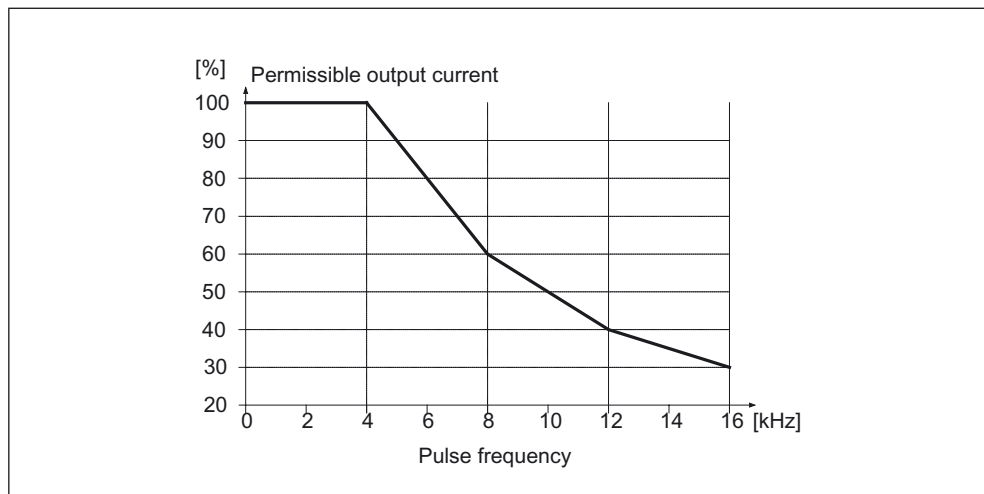


Figure 4-40 Derating as a function of the pulse frequency

Derating as a function of the installation altitude

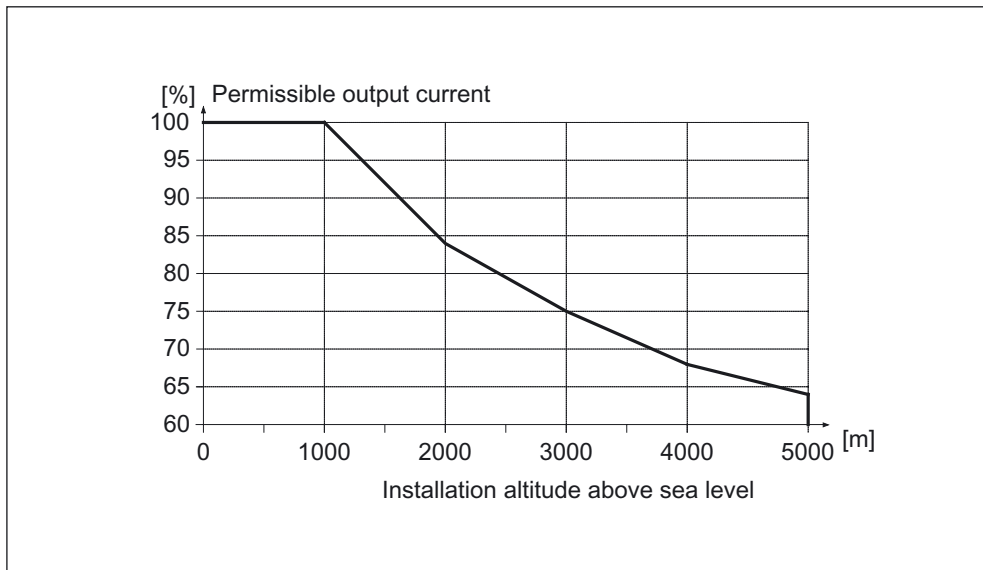


Figure 4-41 Derating as a function of the installation altitude

DC link components Booksize

5.1 Braking Module Booksize

5.1.1 Description

A braking module (and an external braking resistor) is required to bring drives to a controlled stop in the event of a line failure (e.g. emergency retraction or EMERGENCY OFF category 1) or to limit the DC link voltage during short-time regeneration if, for example, the regenerative capability of the line module has been deactivated or has not been dimensioned sufficiently.

The braking module contains the required power electronics and the associated control. When the braking module is operated, the energy supplied back is dissipated via an external braking resistor. The resistor is installed outside the cabinet.

The braking module can also be used with a braking resistor for fast discharging of 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 220 μF ;

braking resistor 100 kW, DC link capacitance 330 μF .

The capacitance of the braking module (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

Only the modules 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.

5.1.2 Safety information



Warning

After disconnecting all the supply voltages, a hazardous voltage will be present in all components for another 5 minutes. 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, otherwise this could result in secondary damage or accidents.



Caution

The DC link discharge voltage hazard warning must be affixed to the modules in the local language.

A set of labels in 12 languages is available using order number: 6SL3166-3AB00-0AAx.

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

Notice

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

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 startup. After transportation, the screws must be tightened.

Note

If braking resistors that are not listed in catalog D21.2 are used, they can be destroyed.

Caution

The left and right ends of the DC link busbar of a drive line-up must be fitted with peripheral covers (order no.: 6SL3162-5AA00-0AA0).

5.1.3 Interface description

5.1.3.1 Overview

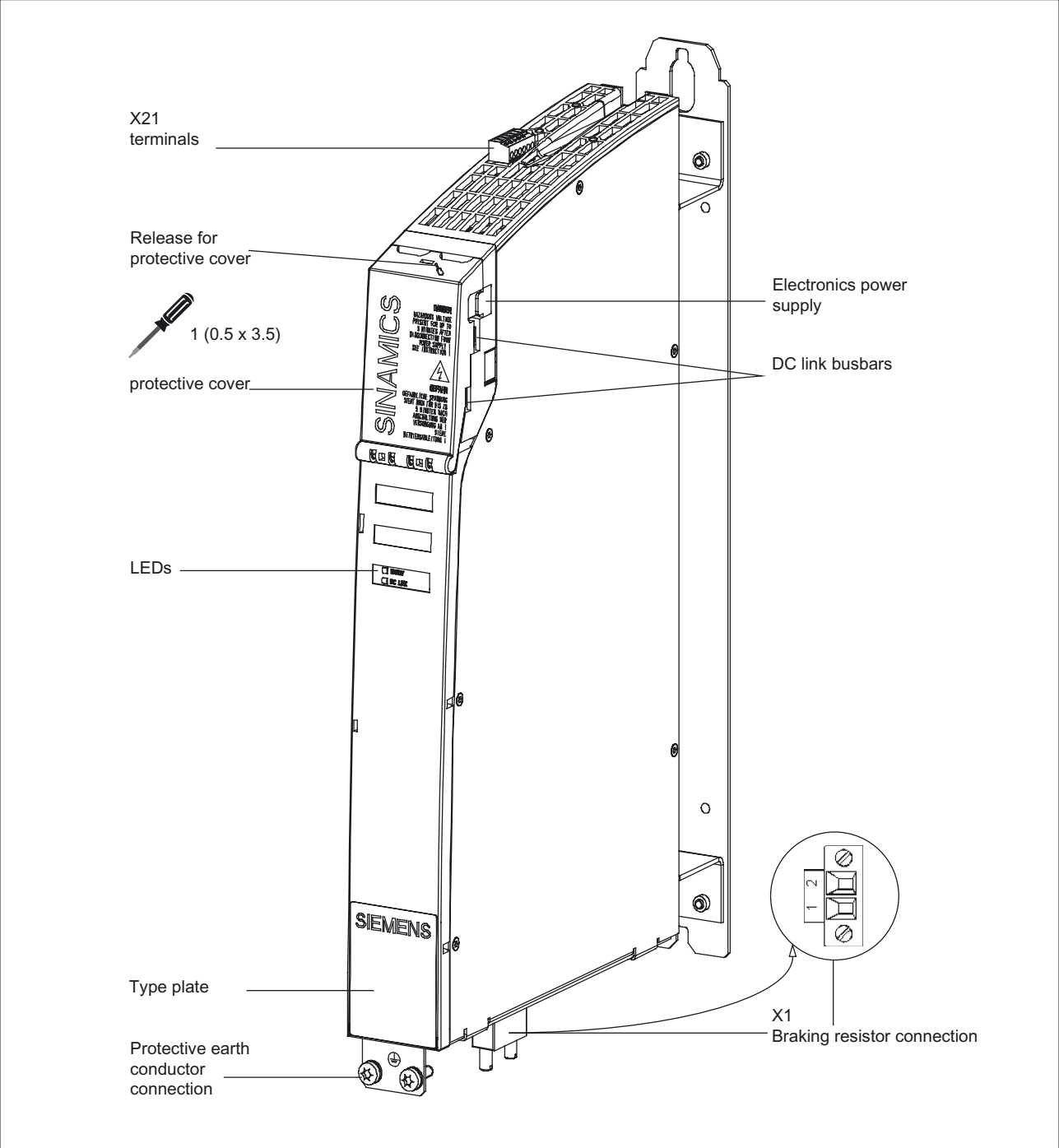


Figure 5-1 Interface description of braking module

5.1.3.2 Connection example

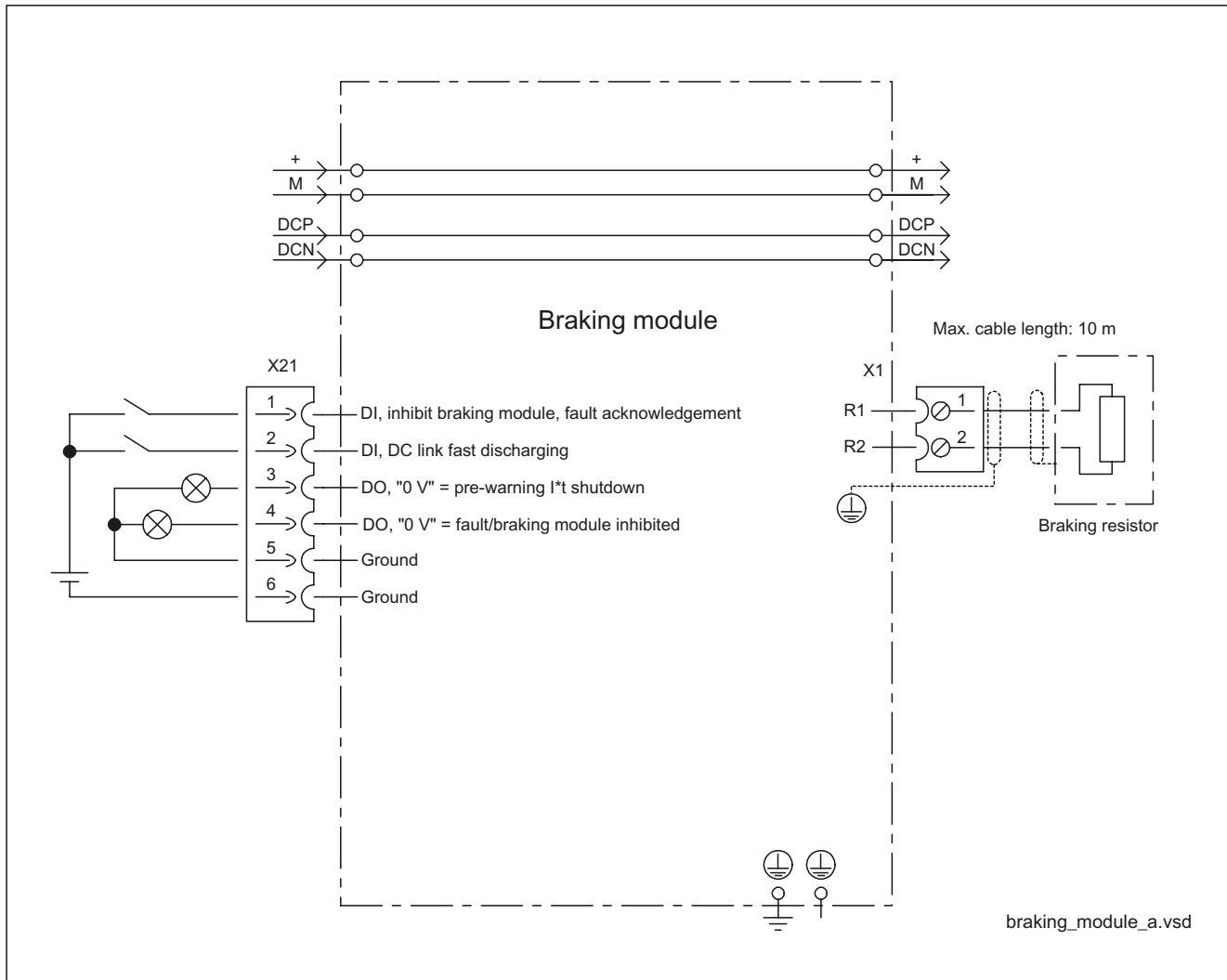
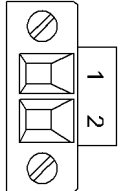


Figure 5-2 Connection example of braking module

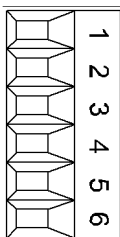
5.1.3.3 Braking resistor connection X1

Table 5-1 Terminal block X1

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

5.1.3.4 X21 digital inputs/outputs

Table 5-2 Terminal block X21

	Terminal	Name ¹⁾	Technical specifications
	1	DI low: enable braking module DI high: braking module inhibited 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) 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; braking module inhibited	
	5	Ground	
	6		
Max. connectable cross-section 1.5 mm ² Type: Screw terminal 1 (see Connection Methods)			

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

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.

5.1.3.5 Meaning of the LEDs on the braking module

Table 5-3 Meaning of the LEDs on the braking module

LED	Color	State	Description
READY	-	OFF	Electronics power supply outside permissible tolerance range.
	Green	Continuous	The component is ready for operation.
	Red	Continuous	<ul style="list-style-type: none"> • Braking module inhibited via DI X21.1 • Braking module shutdown Possible reasons: <ul style="list-style-type: none"> - 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.

5.1.4 Dimension drawing

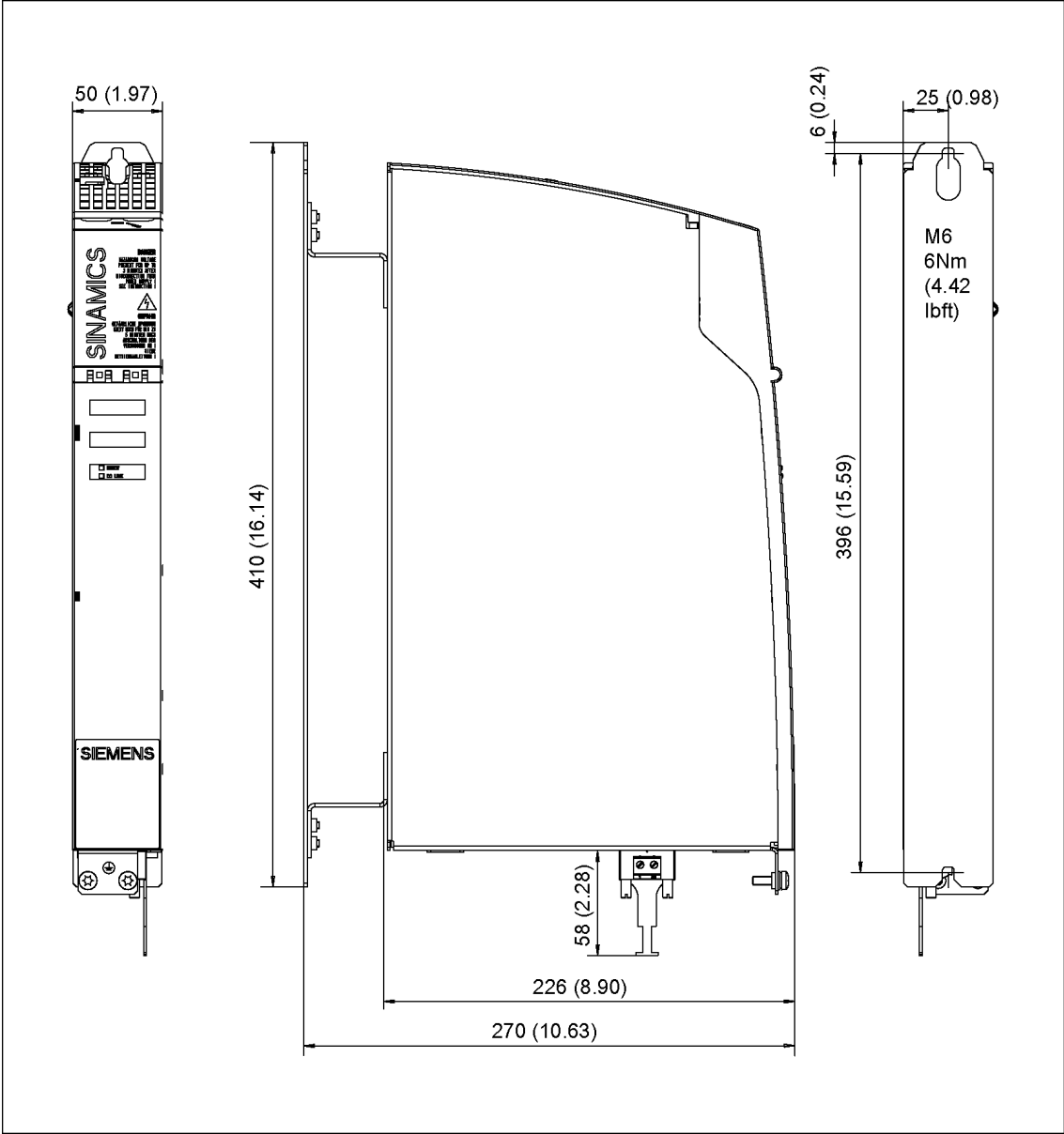


Figure 5-3 Dimension drawing of the braking module

5.1.5 Mounting

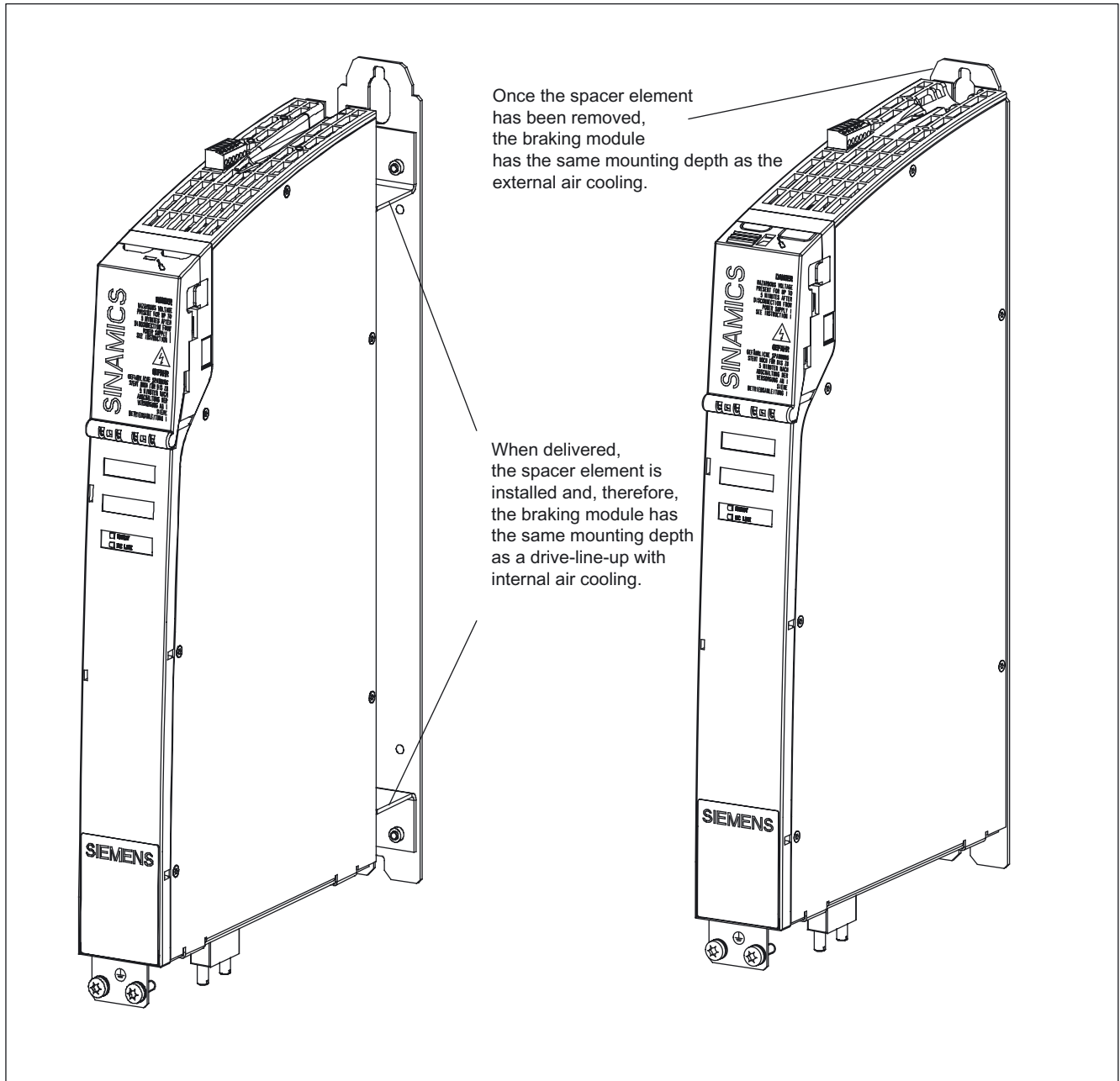


Figure 5-4 Methods of installing braking modules with/without spacer elements

5.1.6 Technical specifications

Table 5-4 Technical Specifications

Braking module booksize		
Voltages		
Supply:		
DC link voltage	V _{DC}	510 - 750
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
26 V DC busbar current carrying capacity	A _{DC}	100
26 V DC busbar current carrying capacity	A _{DC}	20
Max. braking power	kW	100
Continuous braking power	kW	1.5
Power loss ¹	W	20
• Cooling method		Natural convection
• Weight	kg	4.1

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

5.2 Braking resistors

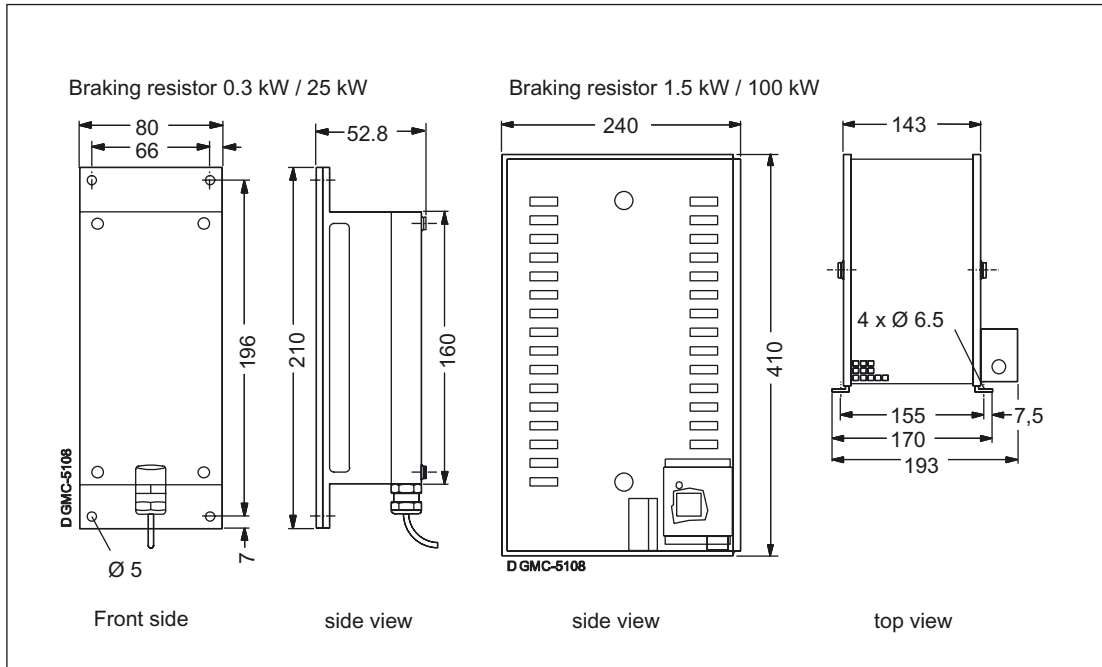


Figure 5-5 Dimension drawings of braking resistors



Caution

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

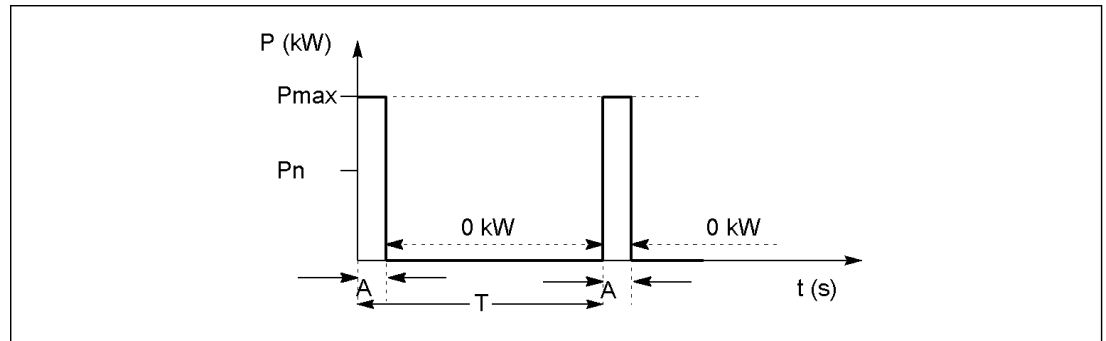


Figure 5-6 Duty cycle for braking resistors

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 5-5 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 5-6 Technical Specifications

	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		IP54	IP20

Connection cables

A shielded connection cable (3 m long; 1.5 mm²) is supplied with braking resistor 6SN1113-1AA00-0DA0.

Braking resistor 6SL3100-1BE31-0AA0 is supplied without a connection cable (4 mm²).

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

5.3 Capacitor Module

5.3.1 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.

5.3.2 Safety Information



Warning

After disconnecting all the supply voltages, a hazardous voltage will be present in all components for another 5 minutes. 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, otherwise this could result in secondary damage or accidents.



Caution

The DC link discharge voltage hazard warning must be affixed to the modules in the local language.

A set of labels in 12 languages is available using order number: 6SL3166-3AB00-0AAx.

Notice

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

Notice

The capacitor module is precharged by the line module. The relevant charging limits of the line modules must be taken into account.

Caution

The left and right ends of the DC link busbar of a drive line-up must be fitted with peripheral covers (order no.: 6SL3162-5AA00-0AA0).

5.3.3 Interface description

5.3.3.1 Overview

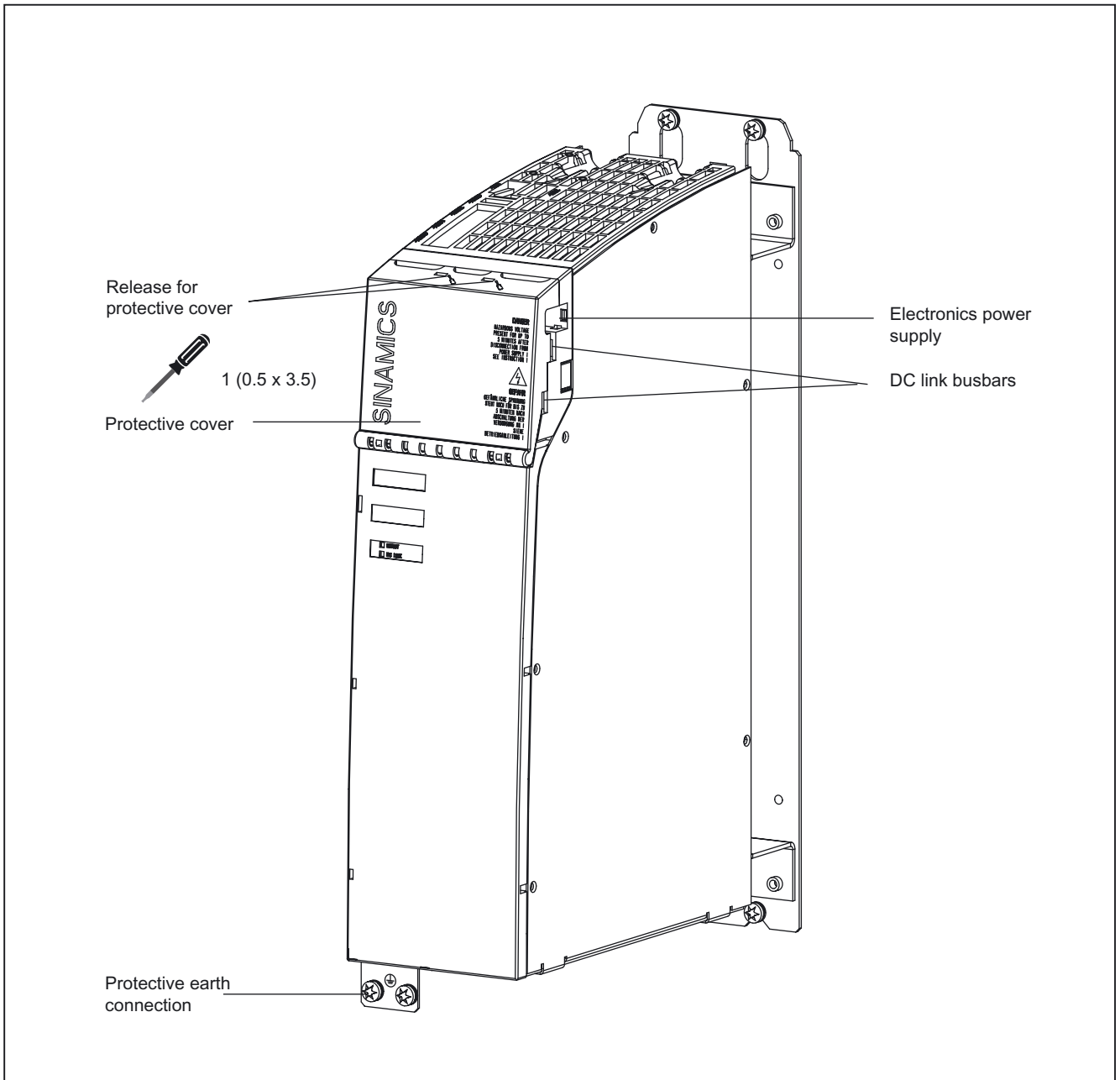


Figure 5-7 Interface description of the capacitor module

5.3.4 Dimension Drawing

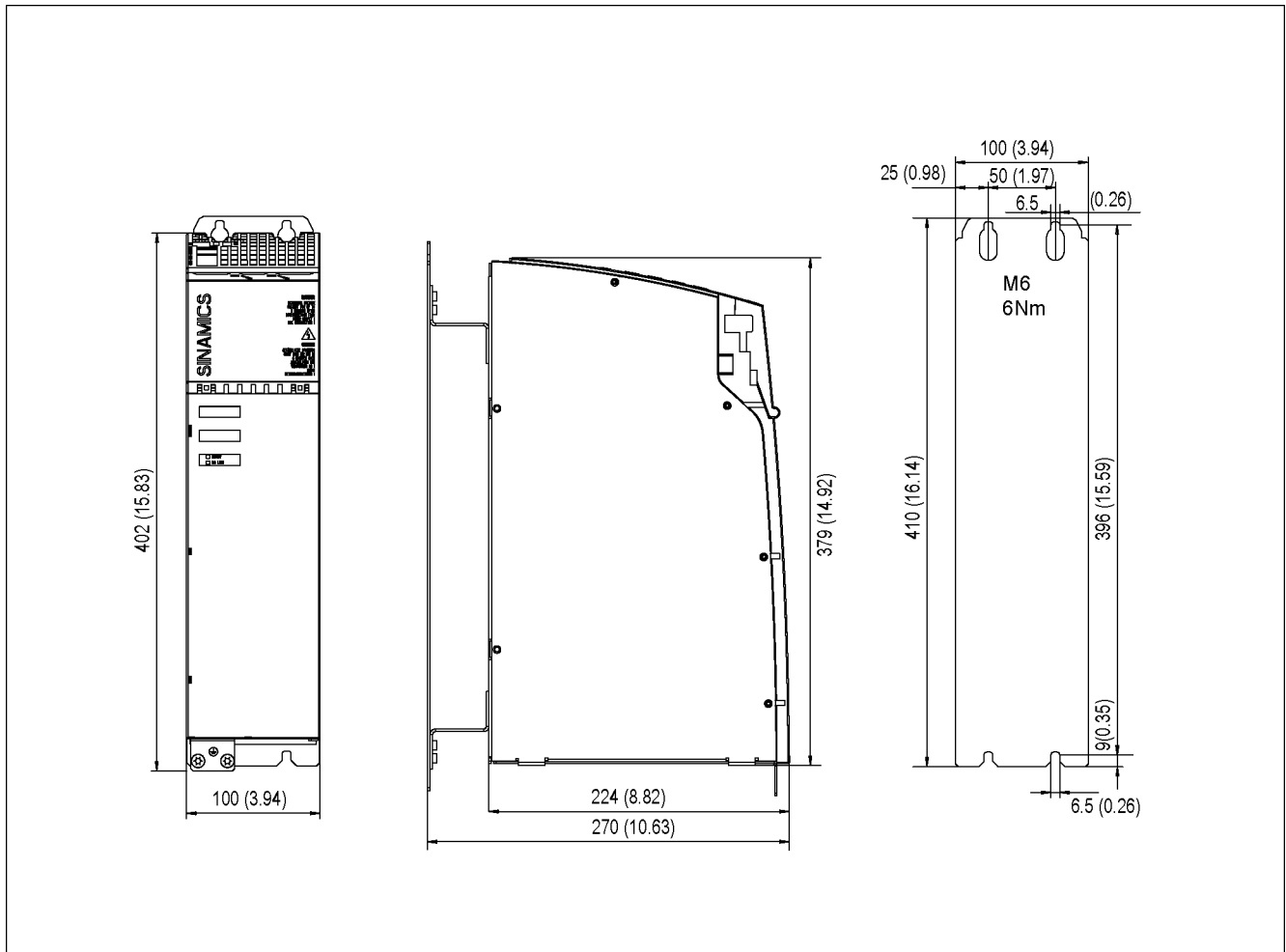


Figure 5-8 Dimension drawing of the capacitor module

5.3.5 Installation

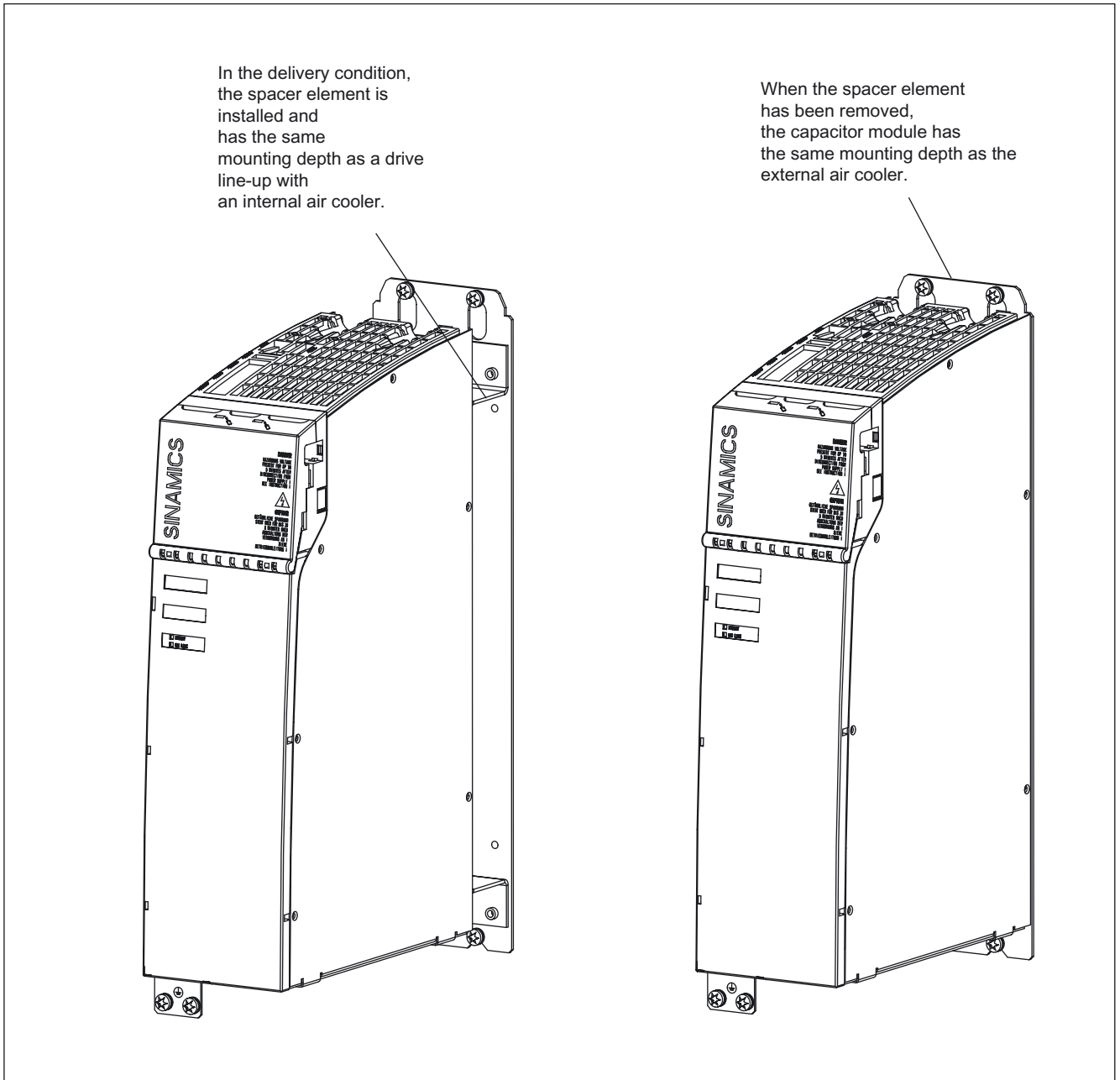


Figure 5-9 Installing a capacitor module with/without spacer elements

The capacitor module can be attached to the cabinet with or without spacer elements.

5.3.6 Technical Specifications

Table 5-7 Technical Specifications

Capacitor Module		
Electronics power supply	V _{DC}	24 (20.4 - 28.8)
DC link voltage	V _{DC}	510 - 750
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.

5.4 Control Supply Module (CSM)

5.4.1 Description

The Control Supply Module (CSM) provides a 24 V DC power supply via the power system or DC link. In this way, controlled emergency retraction movements can be made in the event of a power failure, for example, provided that the DC link voltage is available.

The supply voltage is a PELV (protective extra low voltage). The earth potential for the protective conductor system is connected in the Control Supply Module.

Input voltage range: 320-550 V_{AC}, 430-800 V_{DC}, (300-430 V_{DC} for <1min).

Startup is only possible via the power system.

5.4.2 Safety Information



Danger

This component is equipped with two supply circuits. After disconnecting all the supply circuits, a hazardous voltage will be present in all components for another 5 minutes. 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 (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.

Caution

The DC link discharge time hazard warning must be affixed to the modules in the local language.

A set of labels in 12 languages is enclosed with the module.

Notice

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

Caution

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

Caution

The left and right ends of the DC link busbar of a drive line-up must be fitted with peripheral covers (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.

5.4.3 Interface description

5.4.3.1 Overview

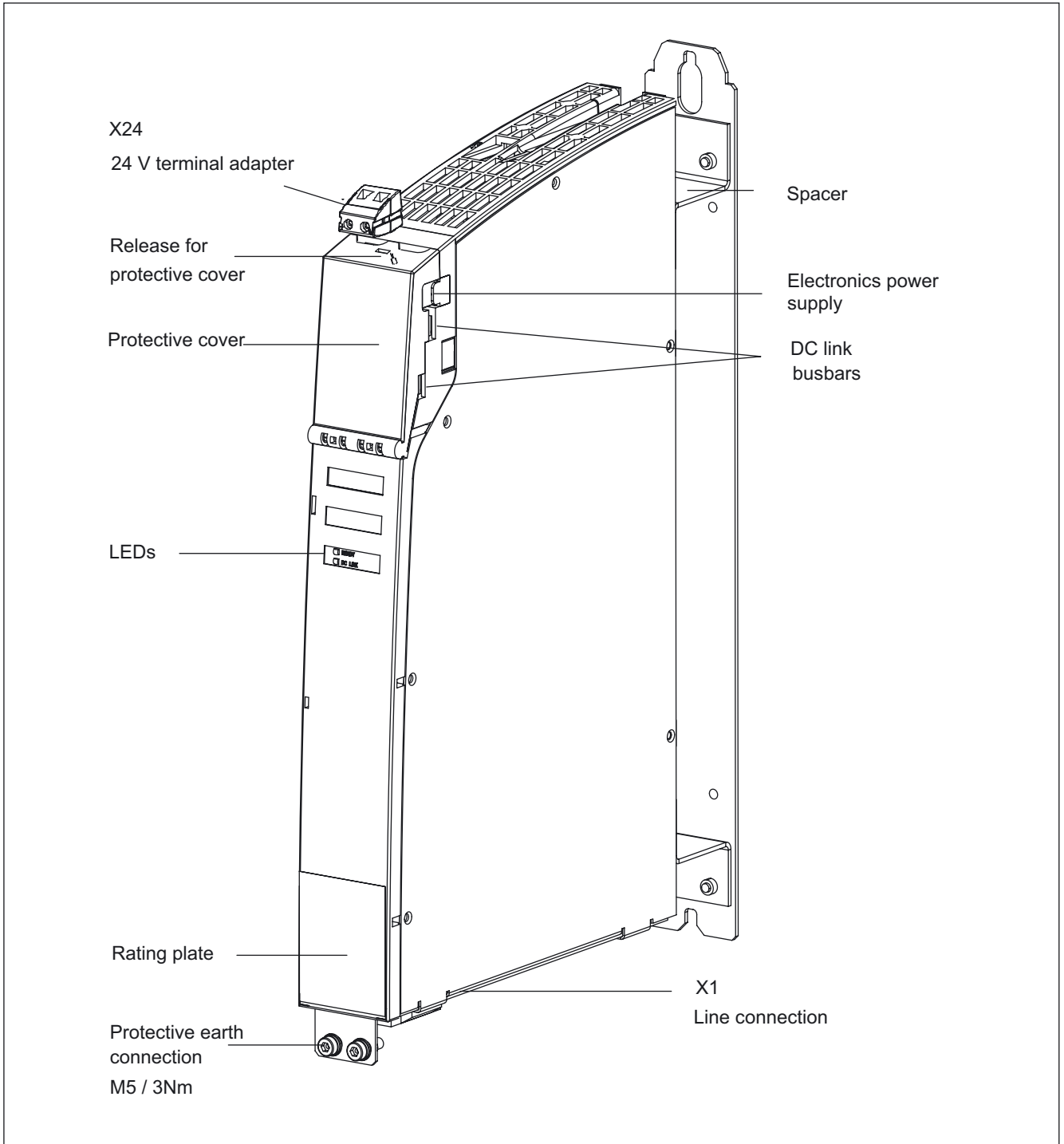


Figure 5-10 Interface description: control supply module

5.4.3.2 Connection example

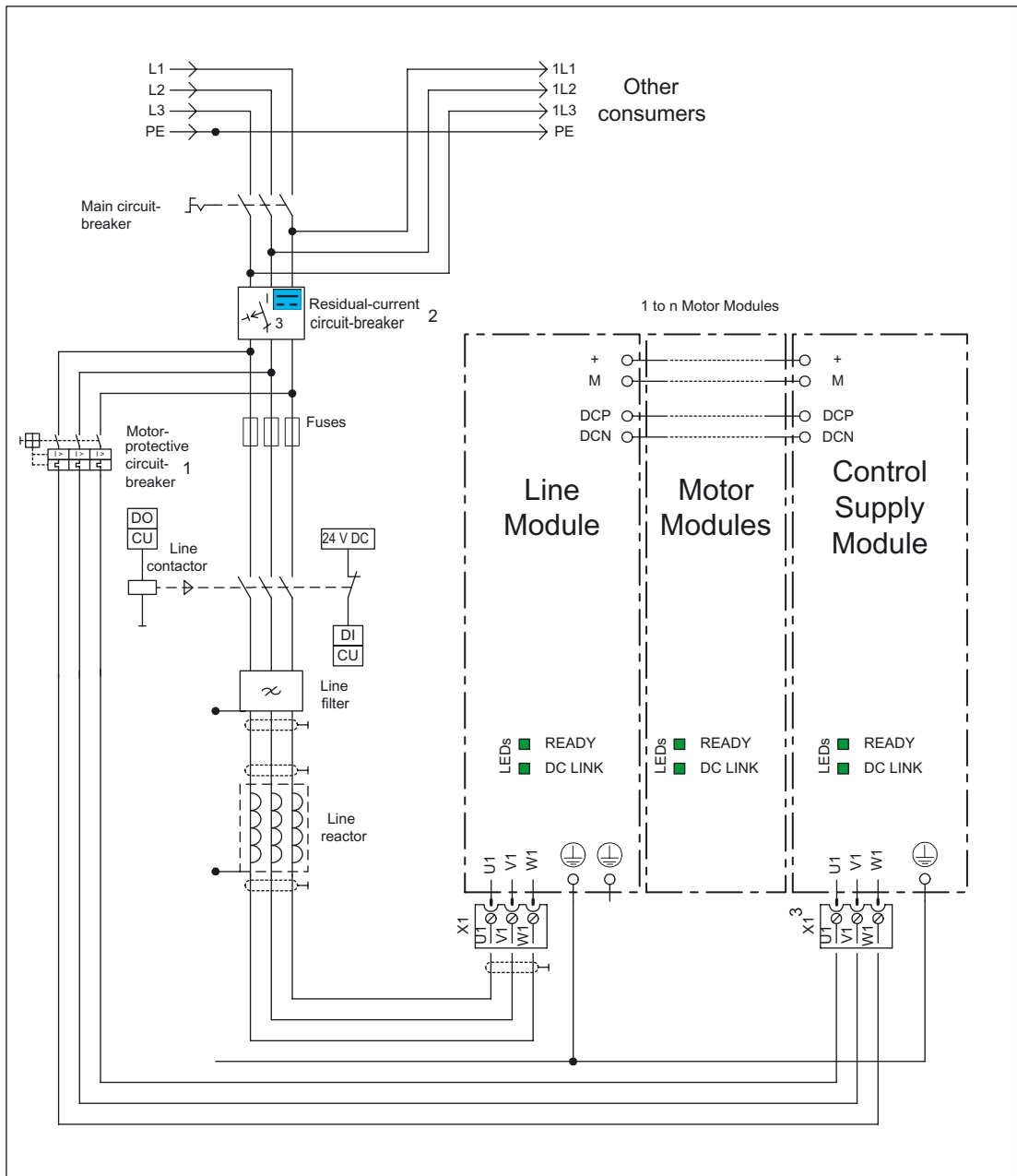


Figure 5-11 Connection example of Control Supply Module

¹ Permissible types:

- a) SIRIUS motor circuit-breaker, 3RV 1021 1DA10, set to 3A
- b) KTS-R-6-type branch circuit fuse (class RK1)

² Optional

³ The line connection must always exist

5.4.3.3 Meaning of the LEDs on the control supply module

Table 5-8 Control Supply Module - Description of the LEDs

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

5.4.4 Dimension Drawing

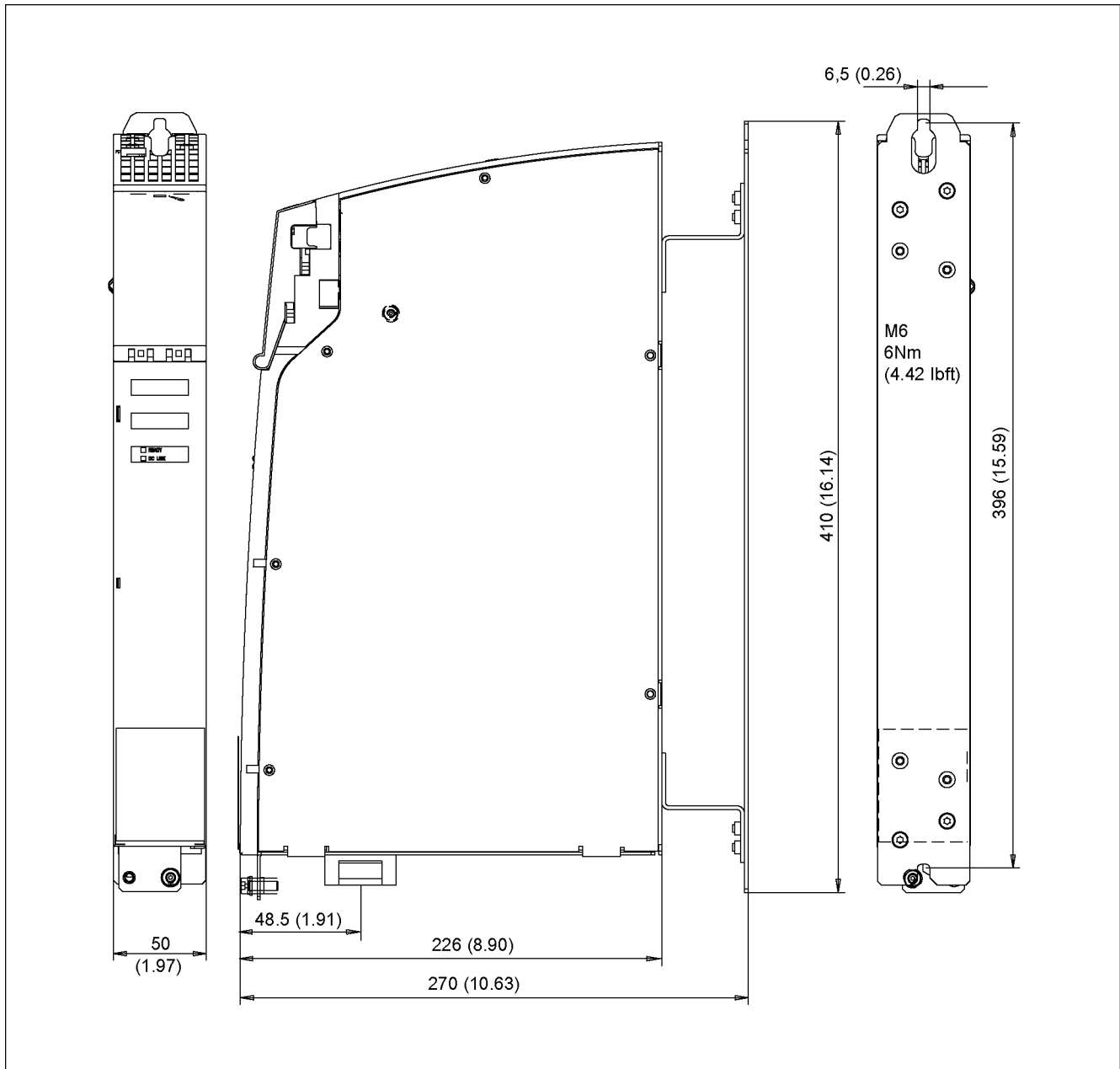


Figure 5-12 Dimension drawing of the control supply module

5.4.5 Technical Specifications

Table 5-9 Technical Specifications

Control Supply Module	Unit	Value
Input data		
Line voltage	V _{AC}	3AC 380 - 480 V _{AC} ± 15%
Line frequency	Hz	47 to 63
Connection currents		
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%
Output current	A _{DC}	20
Startup to short-circuit	A _{DC}	≤ 24
Short-circuit during operation	A _{DC}	Normally 23 (continuous)
Current carrying capacity of the 24 V DC busbars	A _{DC}	20
Efficiency U _{aRated} I _{aRated}	-	> 83%
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 Cabinet Design.

5.5 Voltage Clamping Module (VCM)

5.5.1 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 (VCM) 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 VCM, 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).
- Operation on TN networks only.
- The EMC limit values (radio interference voltage) are no longer observed, which means that special measures may have to be implemented in the system.

On request: Line filter manufactured by EPCOS, e-mail: emv.labor@epcos.com

Compatibility

The VCM can be integrated in the drive line-up with:

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

5.5.2 Safety information



Warning

After disconnecting all the supply voltages, a hazardous voltage will be present in all components for another 5 minutes. 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, otherwise this could result in secondary damage or accidents.



Caution

The VCM conducts a high leakage current via the functional ground. Because of the high leakage current of the VCM, a permanent PE connection of the VCM or switching cabinet (PE busbar) is required.

Measures according to EN 61800-5-1 must be taken (e.g. PE conductor ($\geq 10\text{mm}^2$ Cu) or fit an additional connection terminal for a PE conductor with the same cross-section as the original PE conductor).



Caution

The DC link discharge voltage hazard warning must be affixed to the modules in the local language.

A set of labels in 12 languages is available using order number: 6SL3166-3AB00-0AAx.

Notice

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

Caution

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

Caution

The left and right ends of the DC link busbar of a drive line-up must be fitted with peripheral covers (order no.: 6SL3162-5AA00-0AA0).

5.5.3 Interface Description

5.5.3.1 Overview

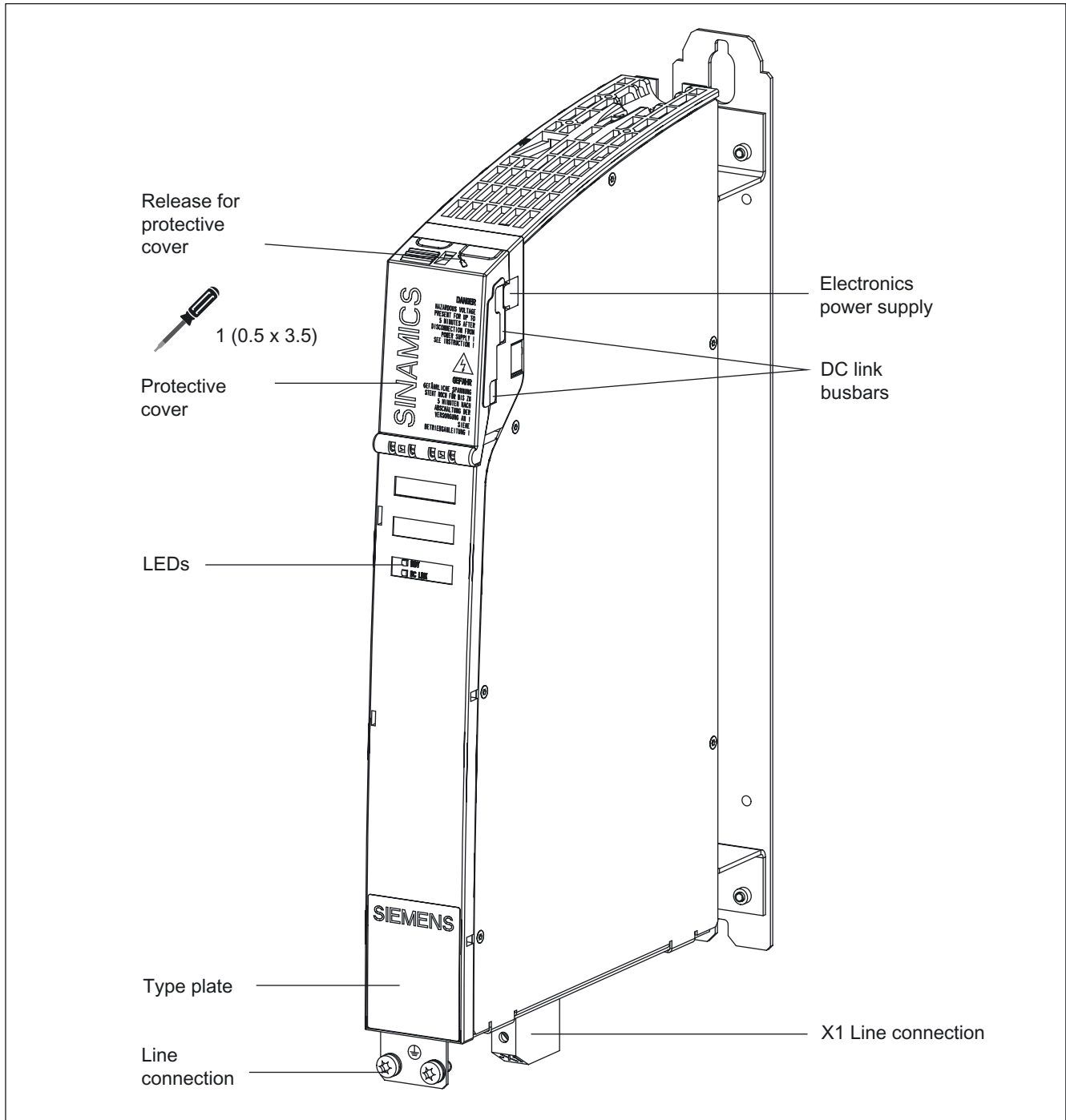


Figure 5-13 Interface description Voltage Clamping Module

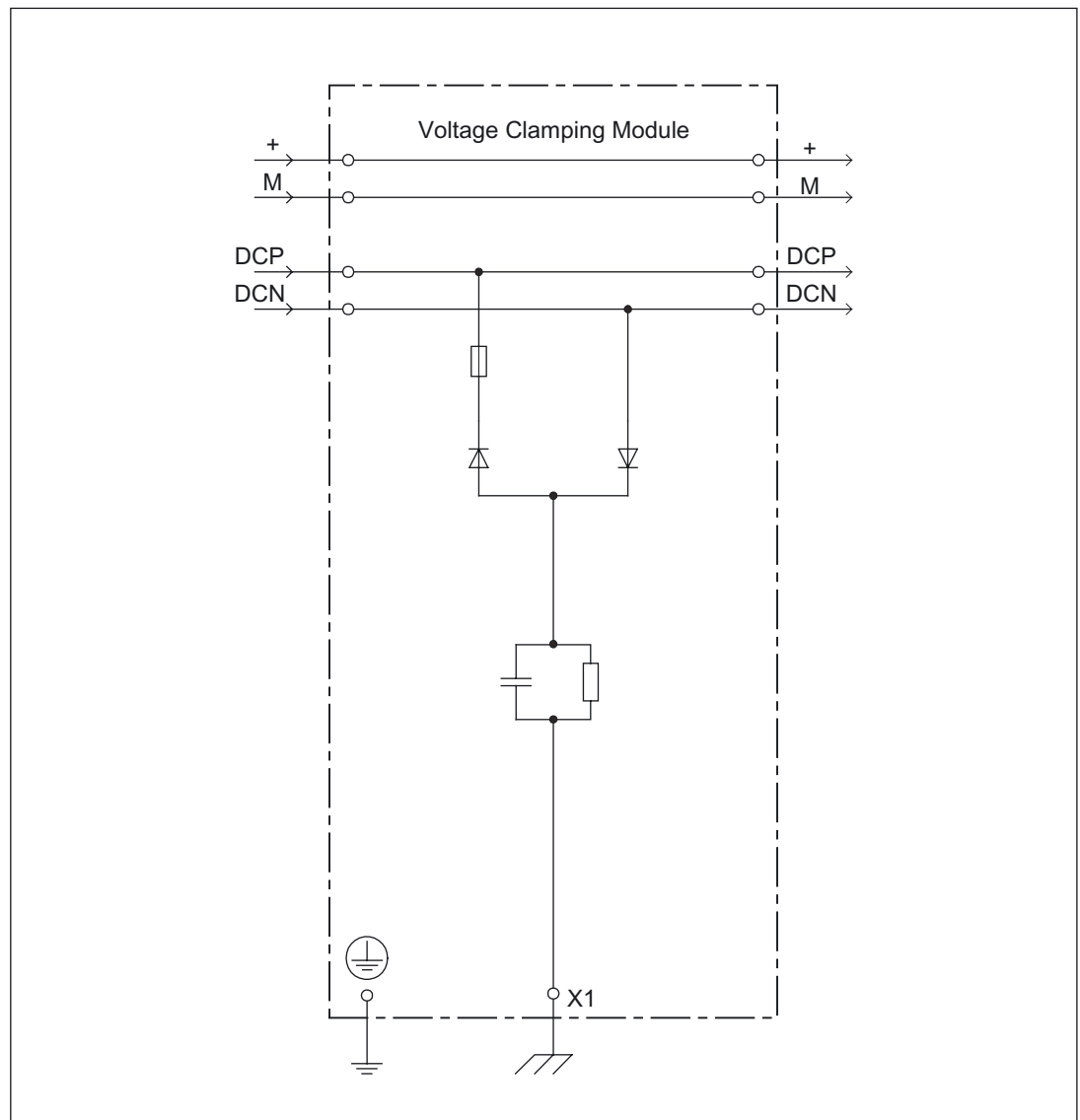


Figure 5-14 Circuit diagram: Voltage Clamping Module

5.5.3.2 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.

5.5.4 Dimension drawing

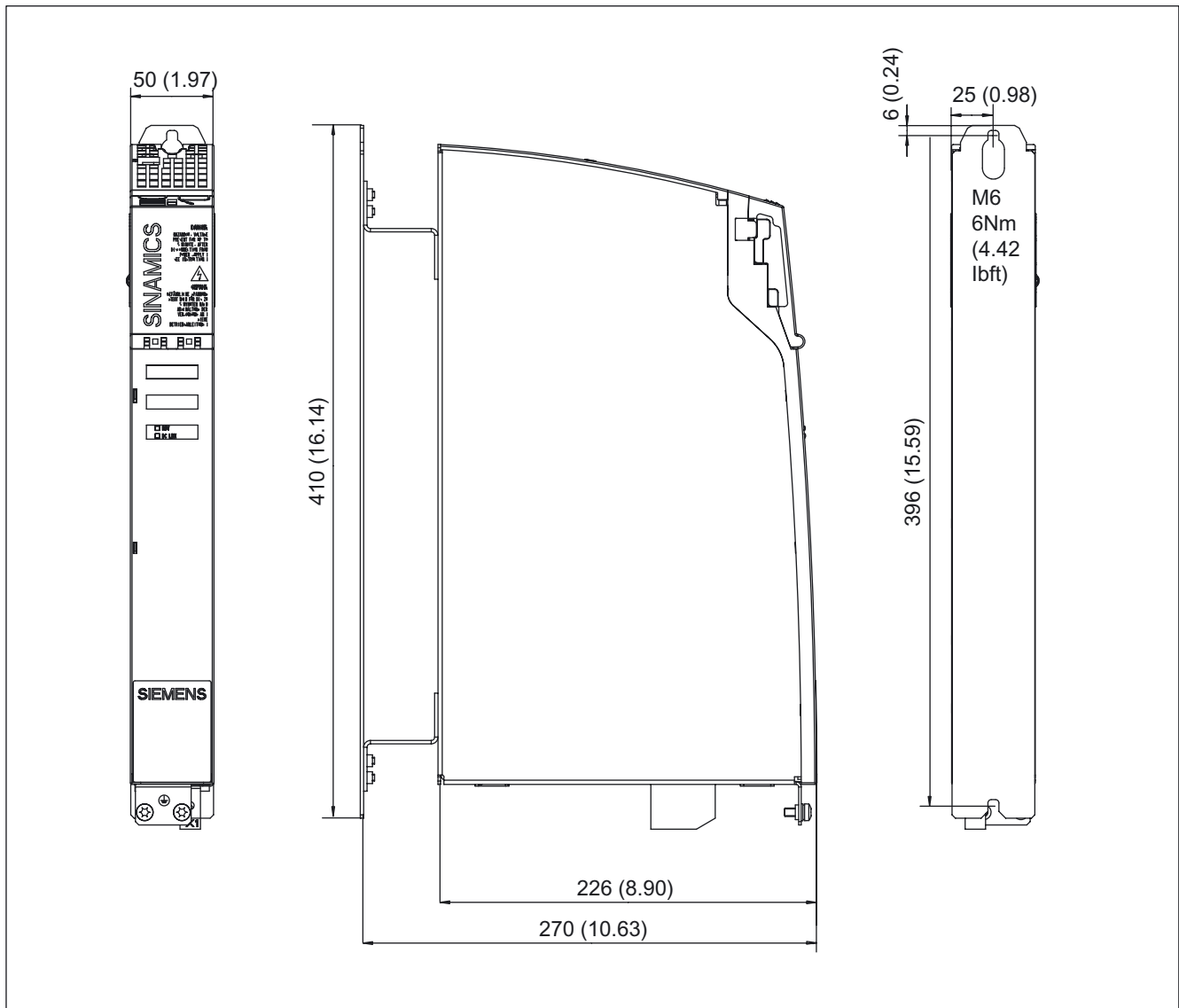


Figure 5-15 Dimension drawing of the Voltage Clamping Module

5.5.5 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.

5.5.6 Technical specifications

Table 5-10 Technical Specifications

Voltage Clamping Module		
Electronics power supply	V _{DC}	24 (20.4 - 28.8)
DC link voltage	V _{DC}	510 - 750
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 Cabinet Design.

Options

6.1 Shielded terminal plates

6.1.1 Description

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

6.1.2 Overview

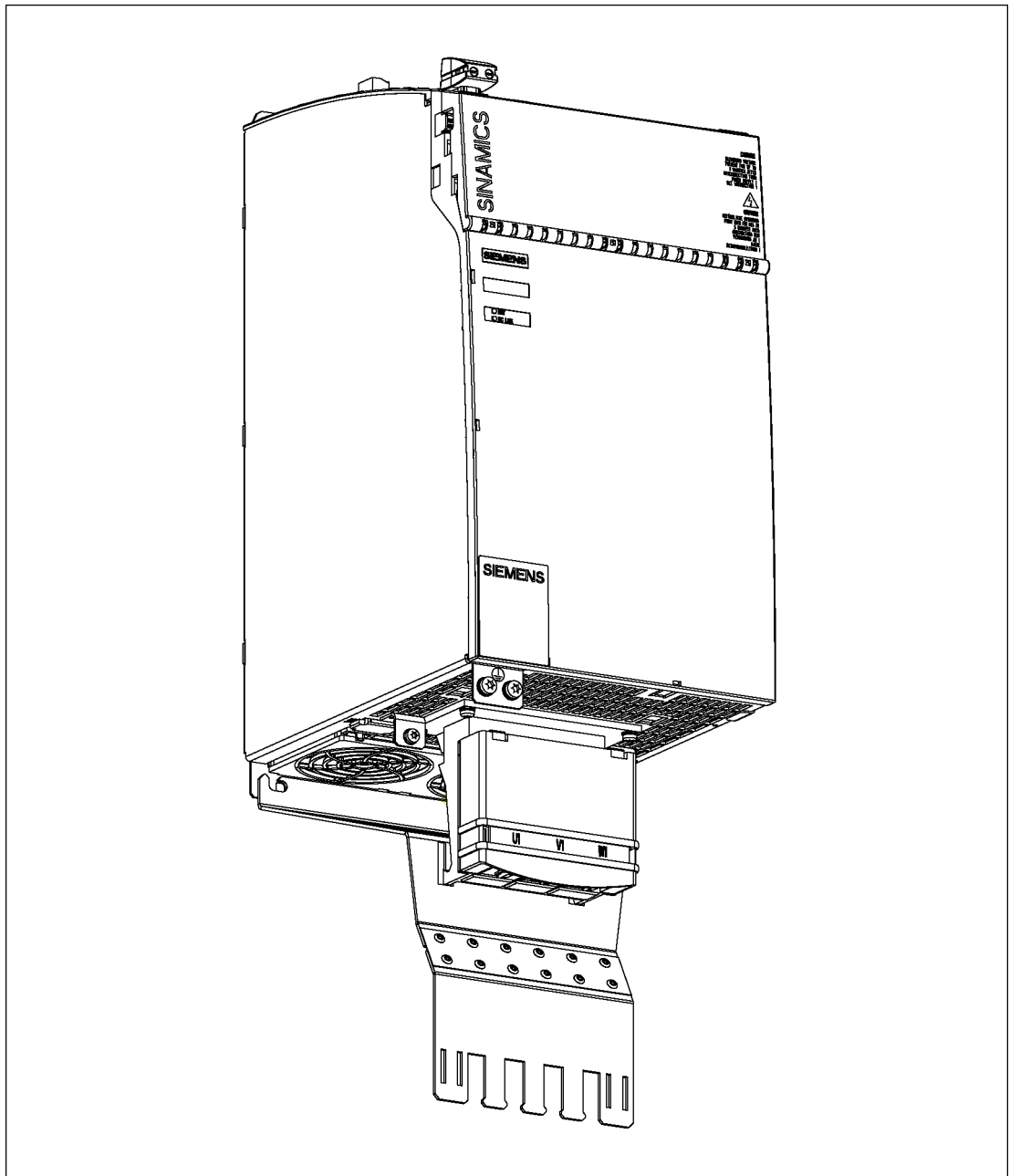


Figure 6-1 Shielded terminal plate for a 200 mm module with internal air cooling

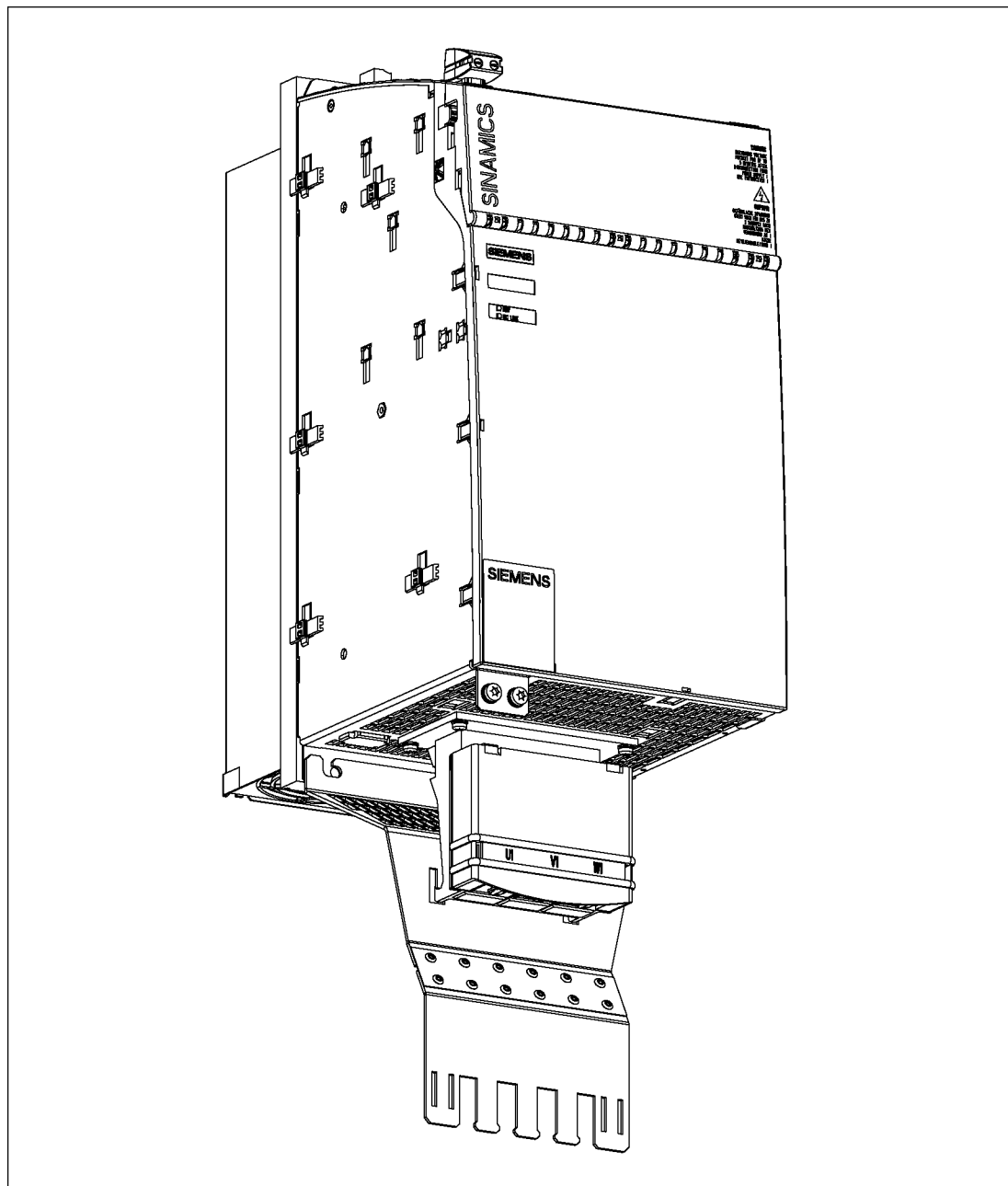


Figure 6-2 Shielded terminal plate for a 200 mm module with external air cooling

6.1.3 Dimension Drawings

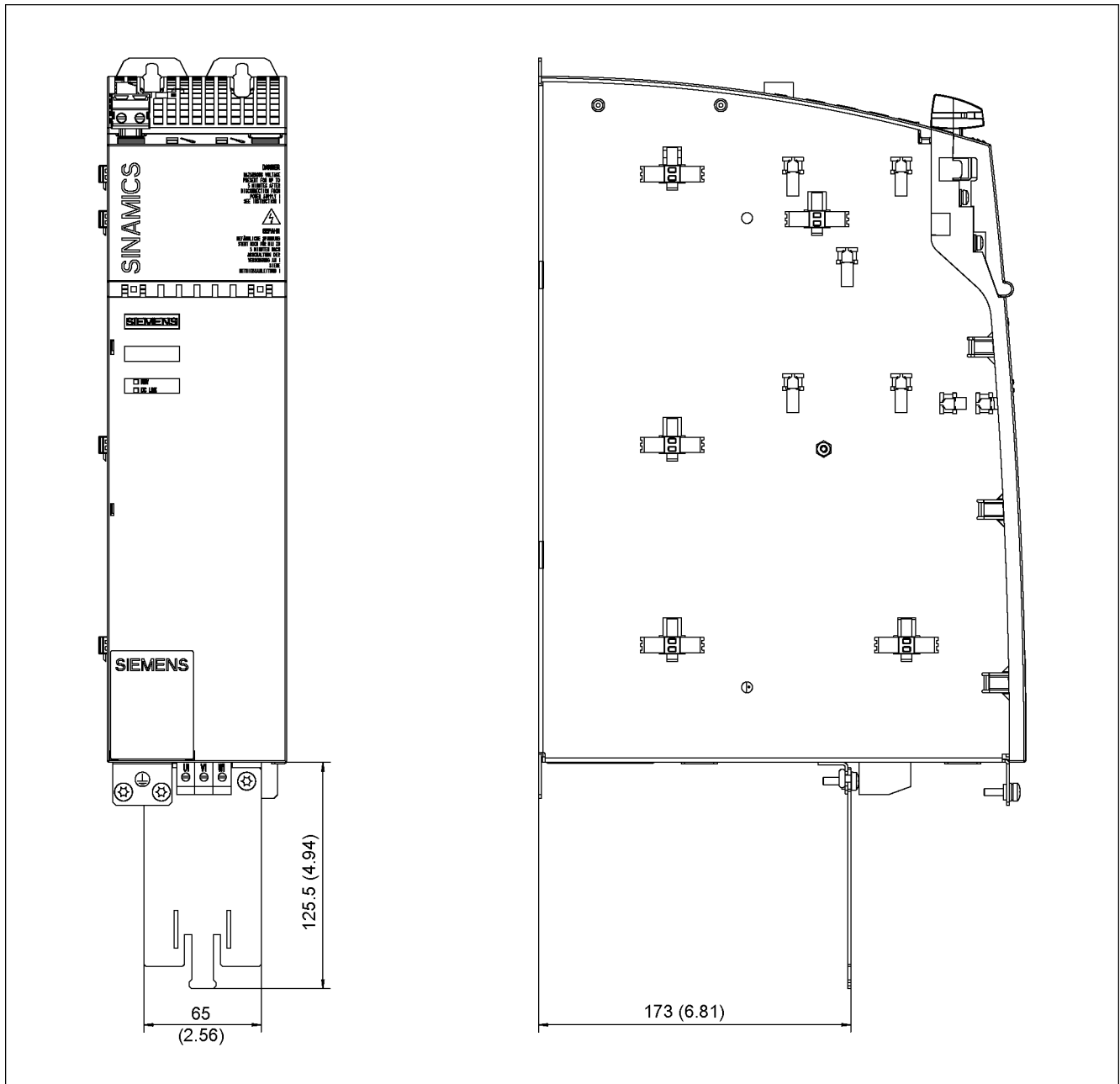


Figure 6-3 Dimension drawing of shielded terminal plate on a 100 mm module with internal air cooling

Note

The shielded terminal plate is part of the scope of supply of a 100 mm Line Module.

Recommended shield contacts: Weidmüller, order no. KLBÜ CO4

Weidmüller: <http://www.weidmueller.com>

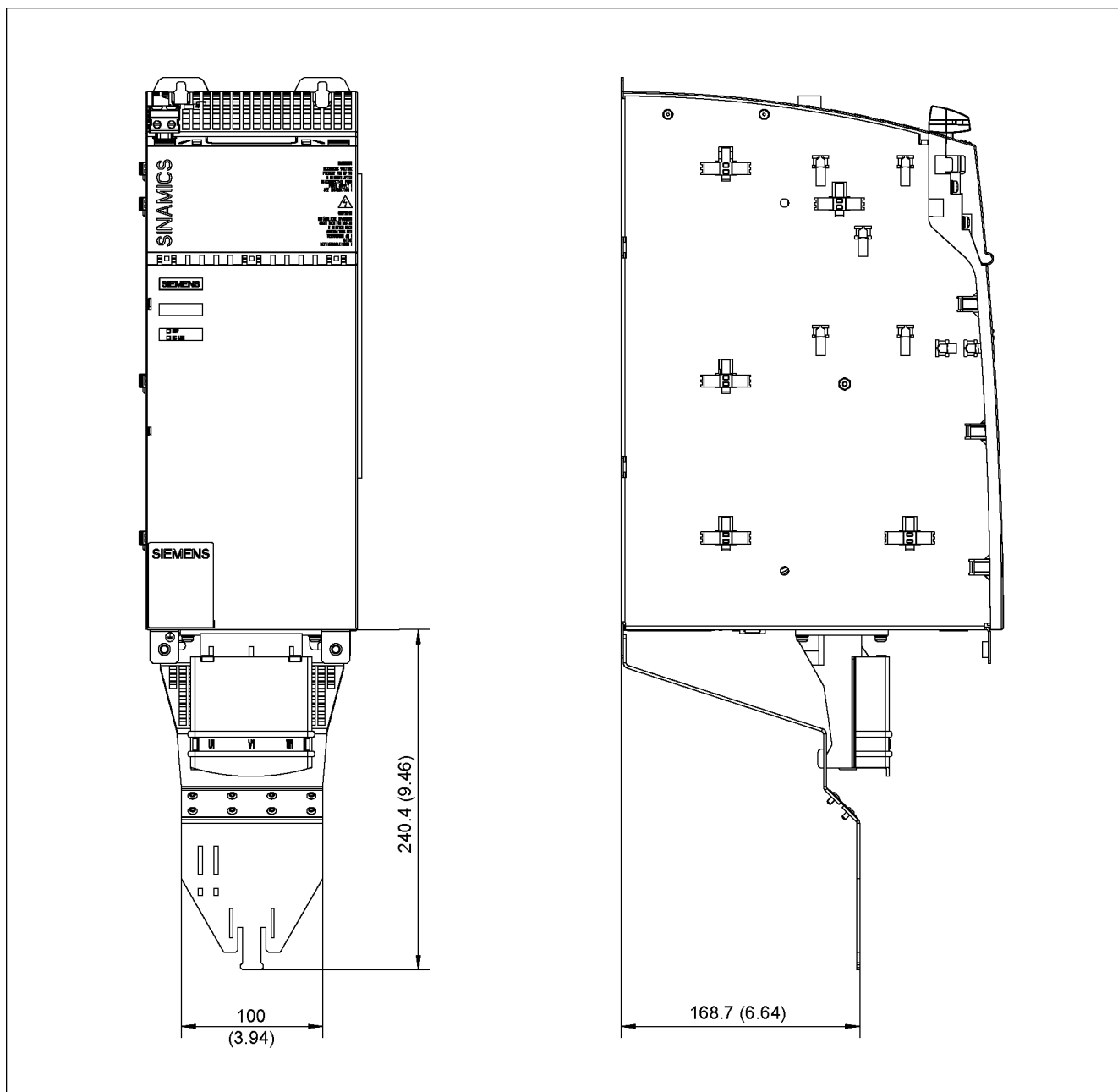


Figure 6-4 Dimension drawing of shielded terminal plate on a 150 mm module with internal air cooling

Note

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

Weidmüller: <http://www.weidmueller.com>

6.1 Shielded terminal plates

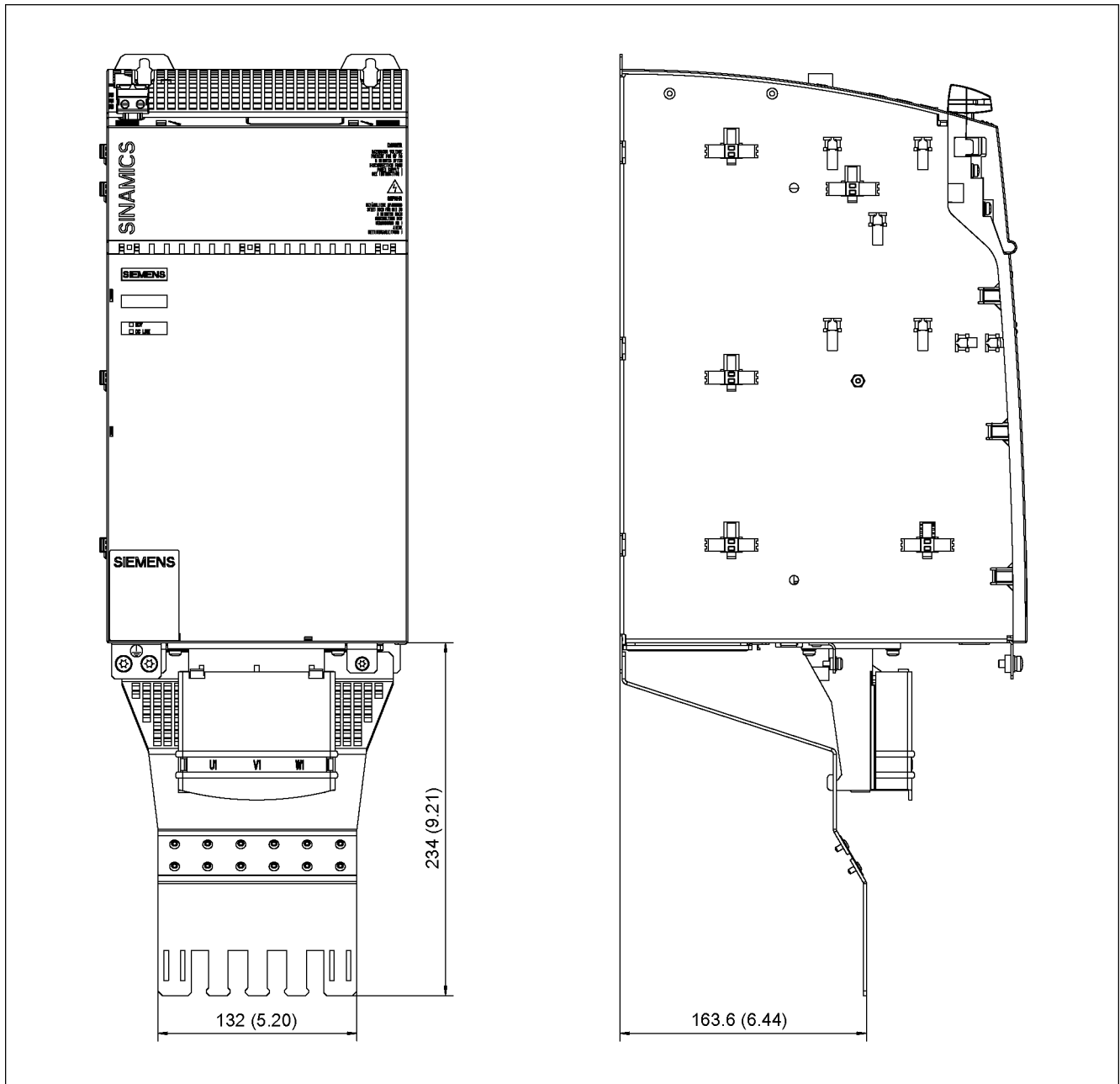


Figure 6-5 Dimension drawing of shielded terminal plate on a 200 mm module with internal air cooling

Note

Recommended shield contacts: Weidmüller, order no. KLBÜ CO1

Weidmüller: <http://www.weidmueller.com>

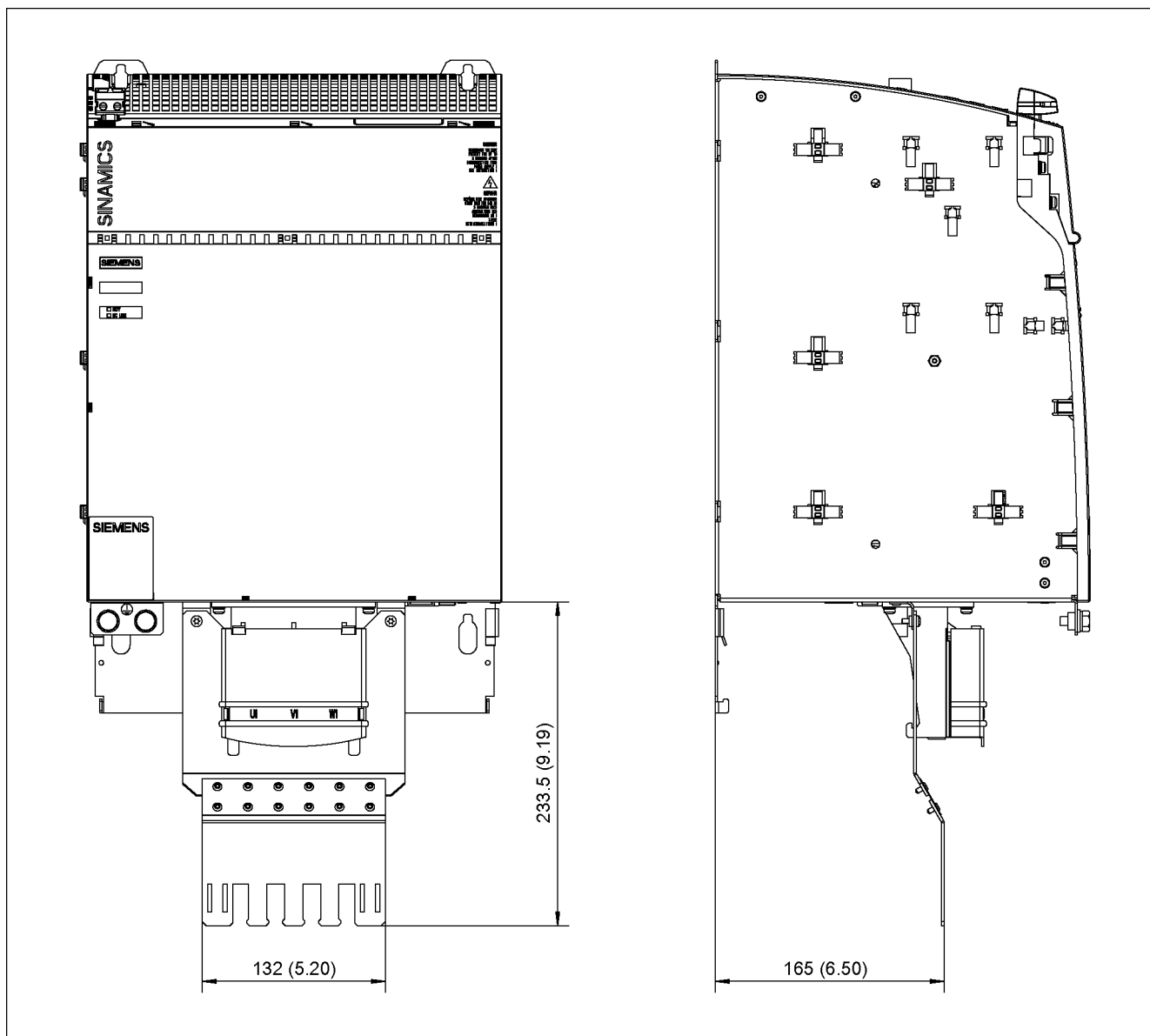


Figure 6-6 Dimension drawing of shielded terminal plate on a 300 mm module with internal air cooling

Note

Recommended shield contacts: Weidmüller, order no. KLBÜ CO1

Weidmüller: <http://www.weidmueller.com>

6.1 Shielded terminal plates

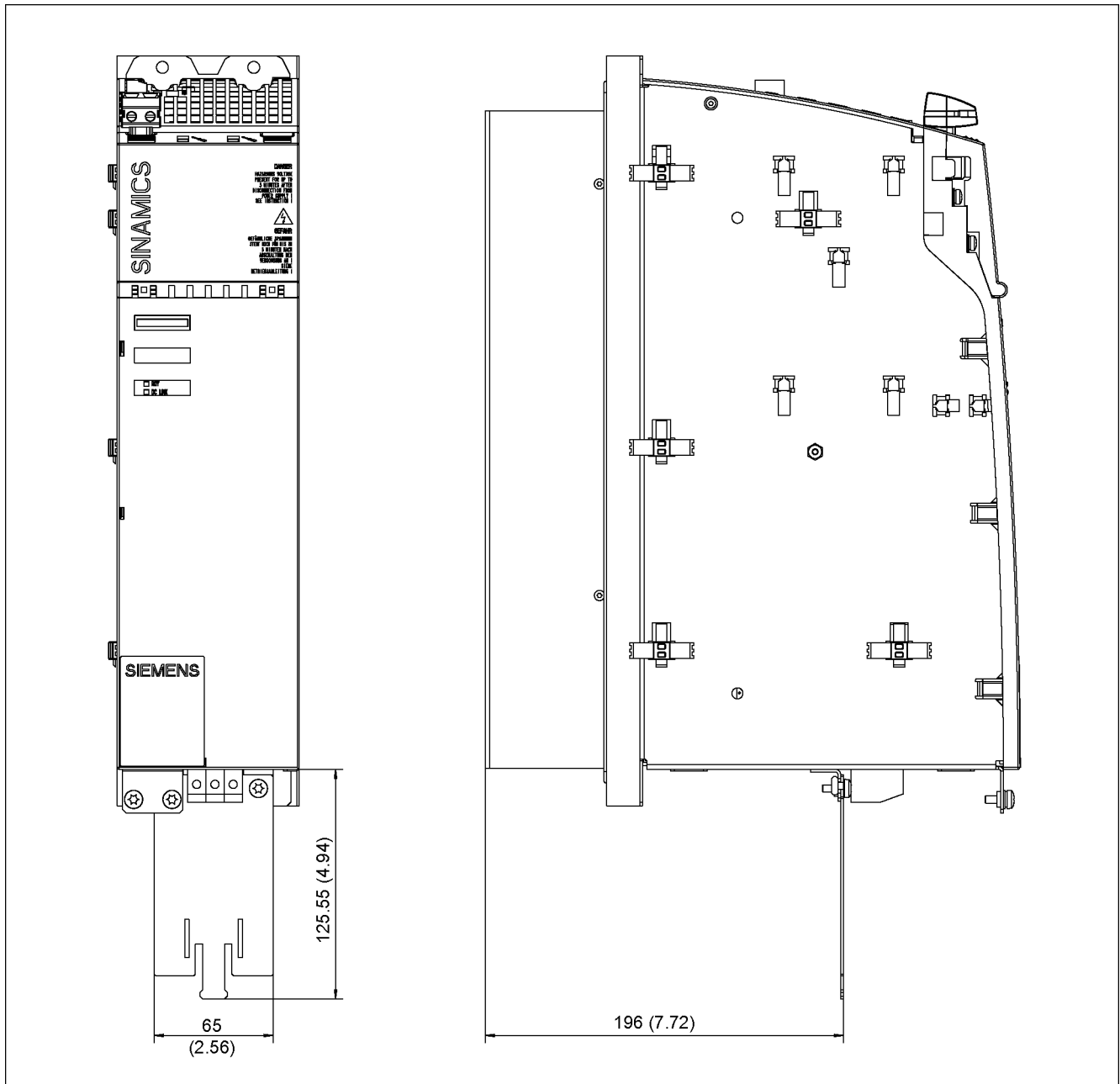


Figure 6-7 Dimension drawing of shielded terminal plate on a 100 mm module with external air cooling

Note

The shielded terminal plate is part of the scope of supply of a 100 mm Line Module.

Recommended shield contacts: Weidmüller, order no. KLBÜ CO4

Weidmüller: <http://www.weidmueller.com>

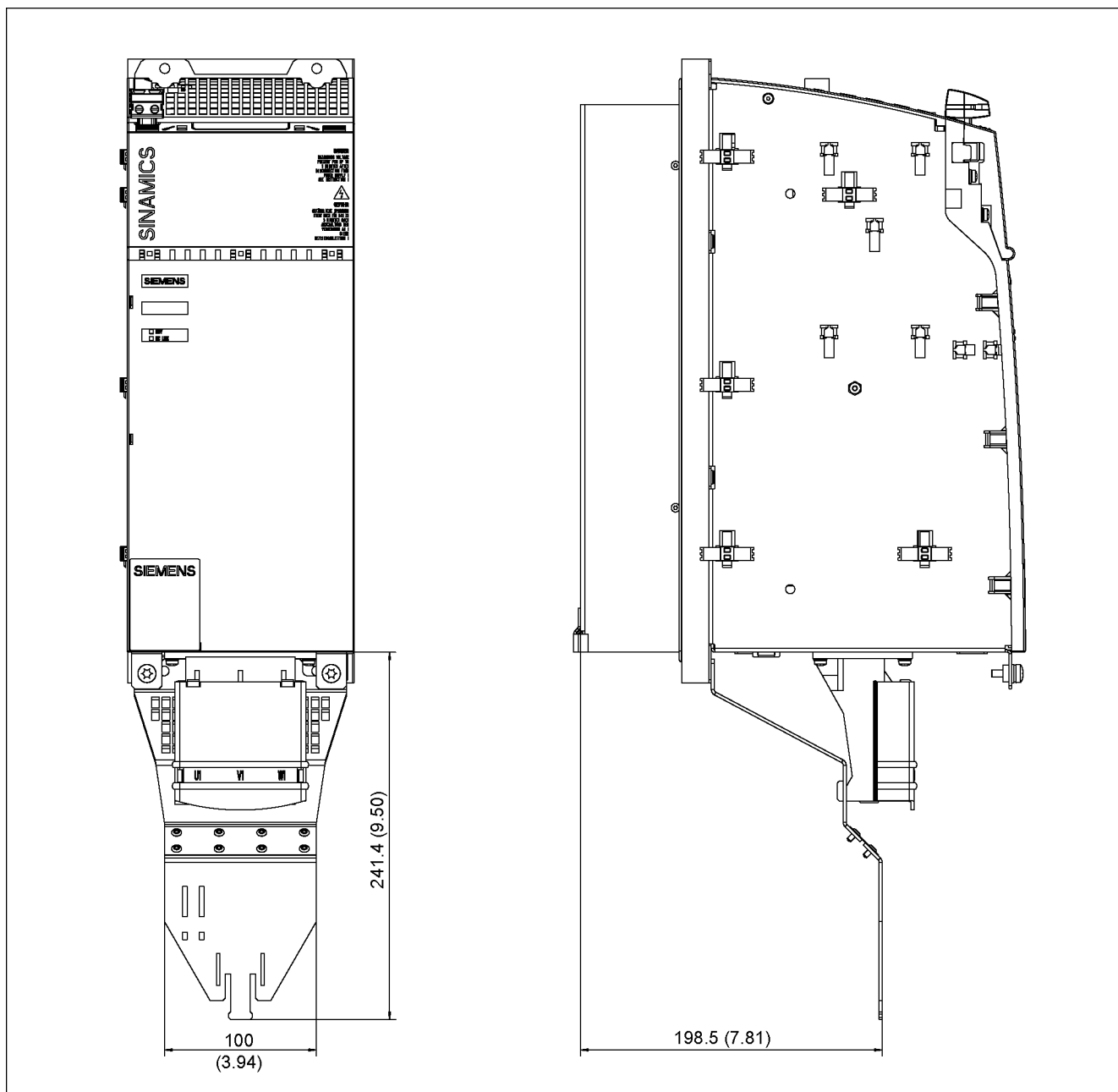


Figure 6-8 Dimension drawing of shielded terminal plate on a 150 mm module with external air cooling

Note

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

Weidmüller: <http://www.weidmueller.com>

6.1 Shielded terminal plates

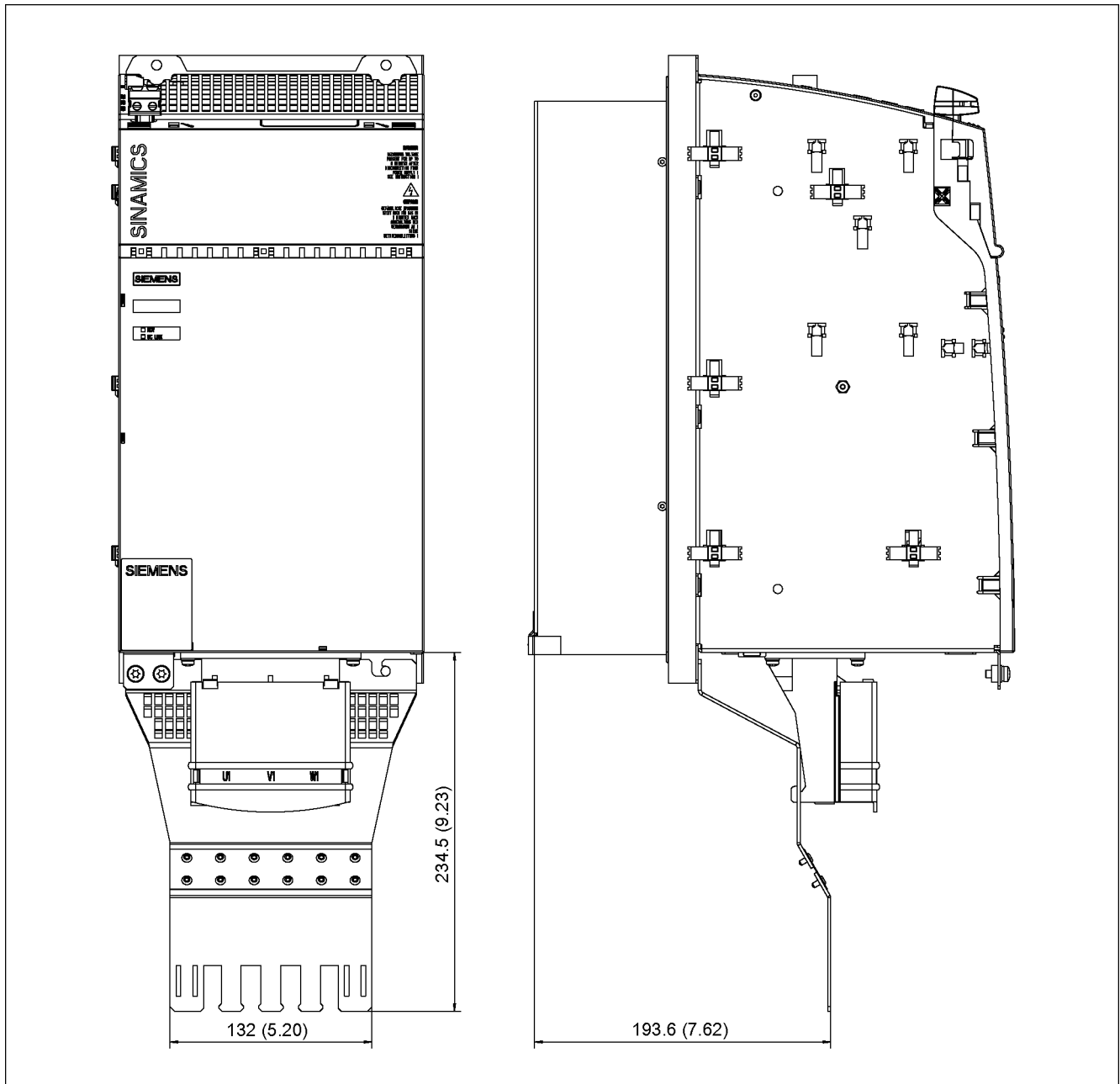


Figure 6-9 Dimension drawing of shielded terminal plate on a 200 mm module with external air cooling

Note

Recommended shield contacts: Weidmüller, order no. KLBÜ CO1

Weidmüller: <http://www.weidmueller.com>

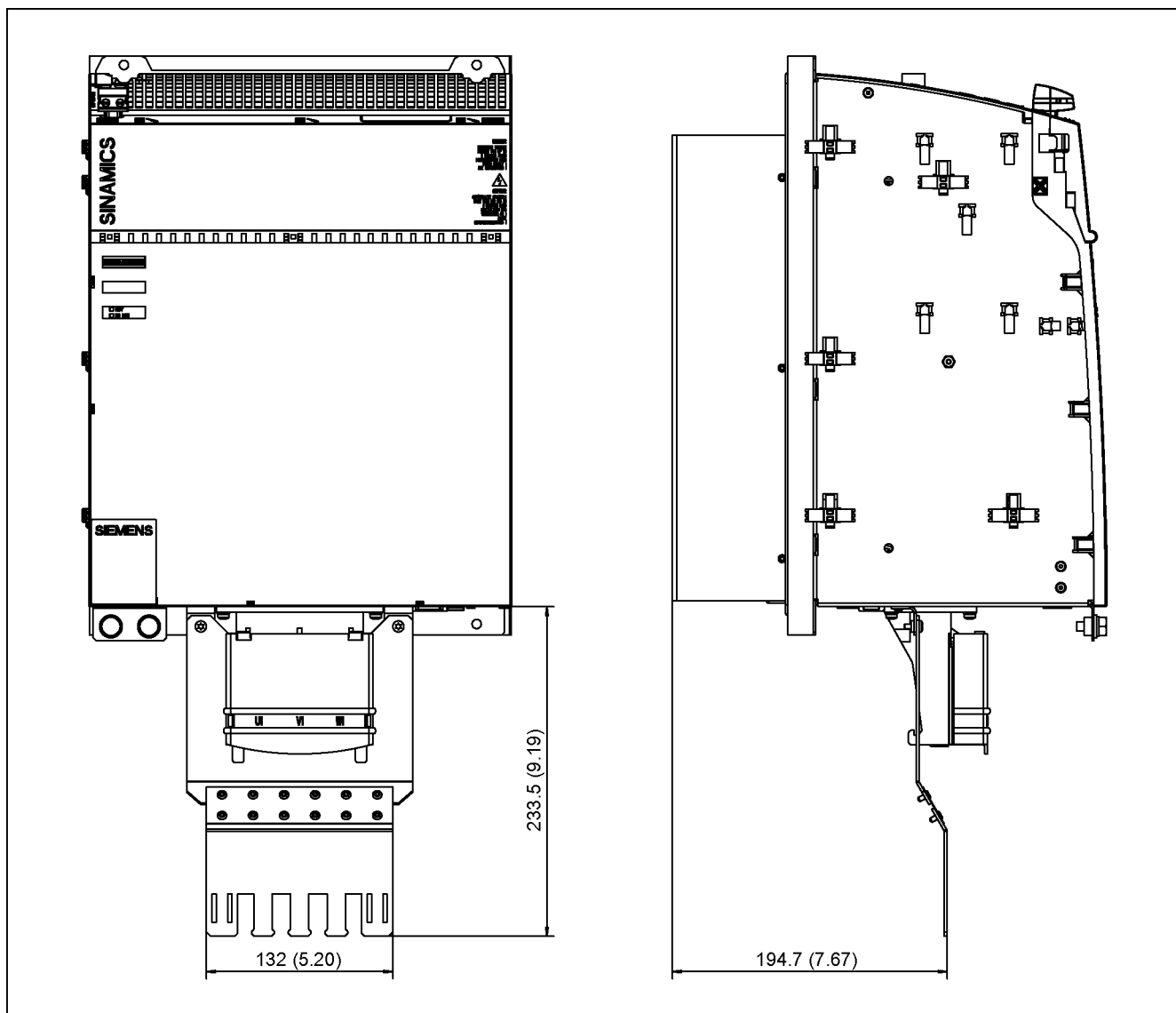


Figure 6-10 Dimension drawing of shielded terminal plate on a 300 mm module with external air cooling

Note

Recommended shield contacts: Weidmüller, order no. KLBÜ CO1

Weidmüller: <http://www.weidmueller.com>

6.1.4 Installation

Table 6-1 Installing the shielded terminal plate on a 100 mm module (e.g. with internal air cooling)

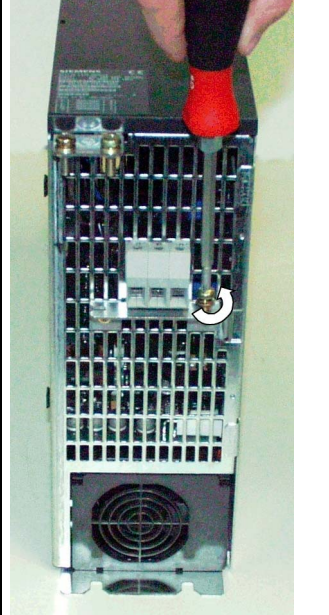

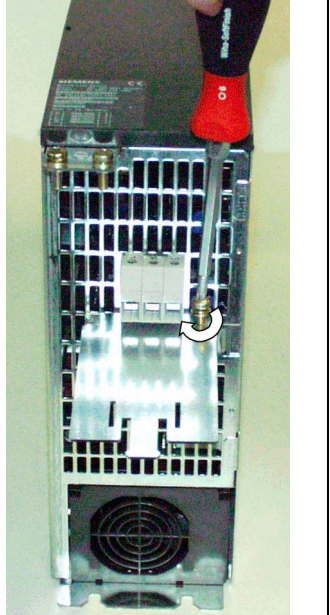



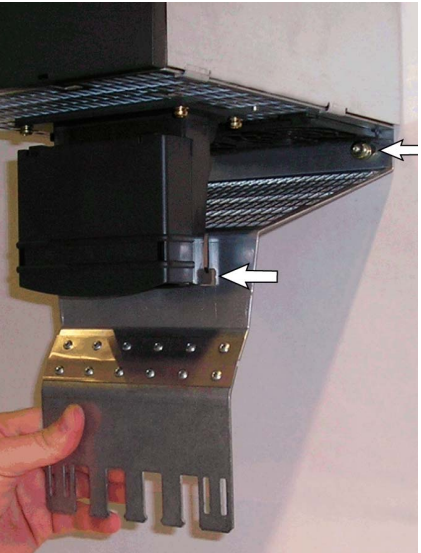

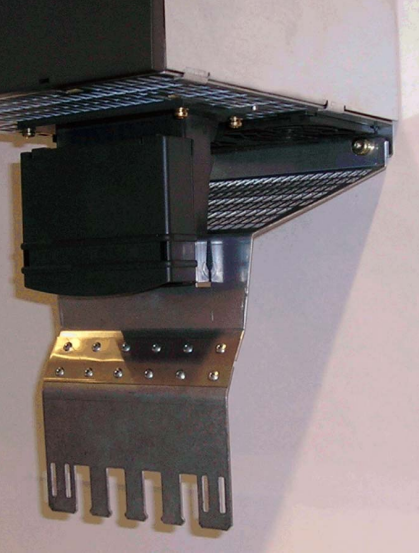
			
<p>Unscrew the screw with screwdriver T25.</p>	<p>Hook in the shielded plate.</p>	<p>Secure the shielded terminal plate with screwdriver T25/3 Nm.</p>	<p>The shielded terminal plate is installed.</p>


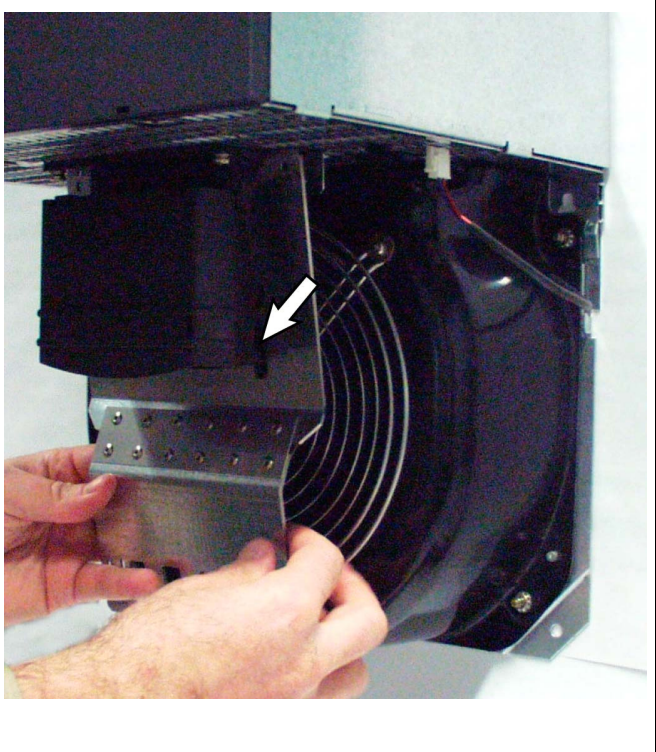
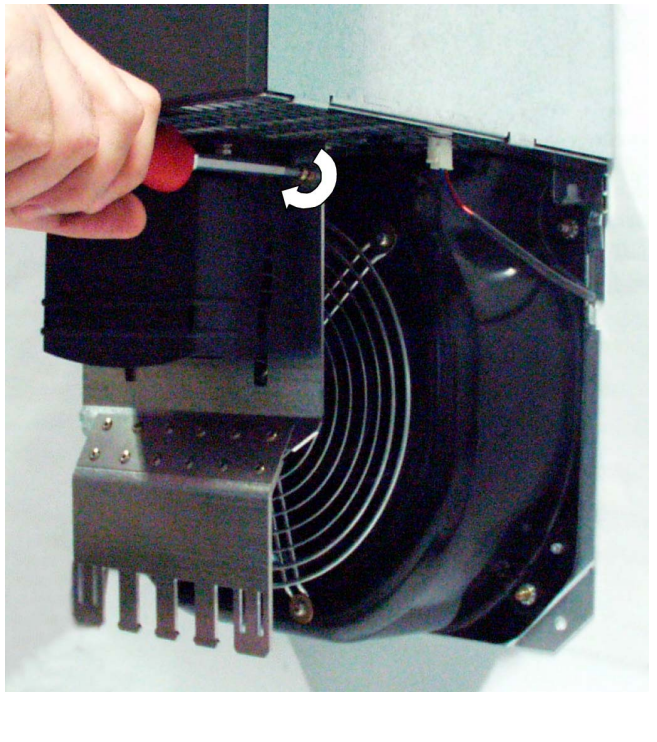
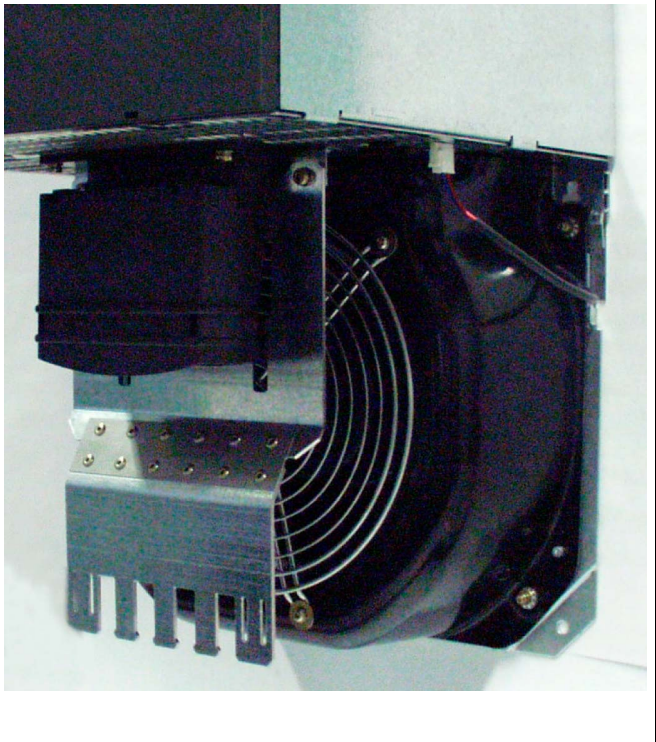
Table 6-2 Installing the shielded terminal plate on a 200 mm module (e.g. with internal air cooling)

		
<p>Loosen the lower mounting screws using a screwdriver.</p>	<p>Hook the shielded terminal plate into the screws and on the line/motor connection.</p>	<p>Secure the shielded terminal plate by shifting it to the left.</p>
		
<p>Secure the shielded terminal plate with screwdriver 6 Nm.</p>	<p>The shielded terminal plate is installed.</p>	

Options

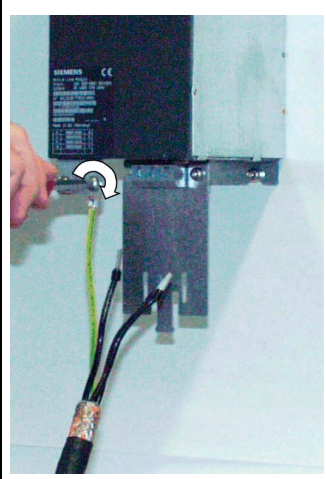
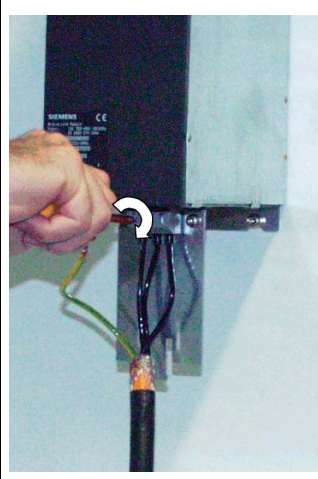
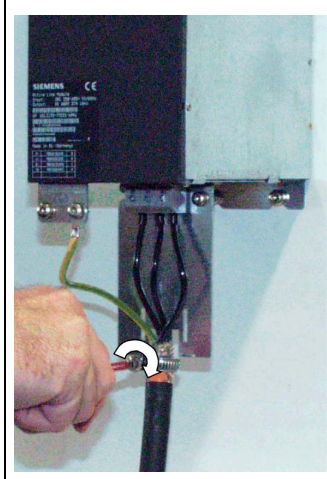
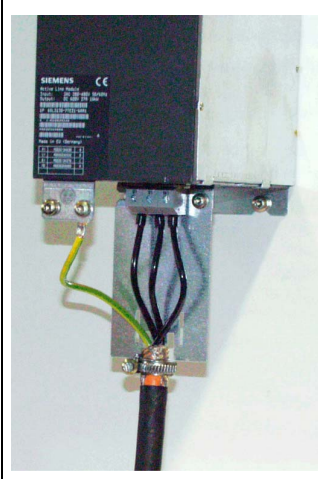
6.1 Shielded terminal plates

Table 6-3 Installing the shielded terminal plate on a 300 mm module (e.g. with internal air cooling)

	
<p>Unscrew the screw with screwdriver T25.</p>	<p>Hook the shielded terminal plate into the line/motor connection.</p>
	
<p>Secure the shielded terminal plate with screwdriver T25/3 Nm.</p>	<p>The shielded terminal plate is installed.</p>

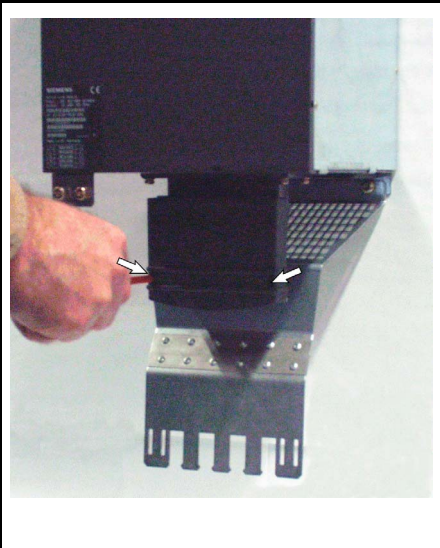
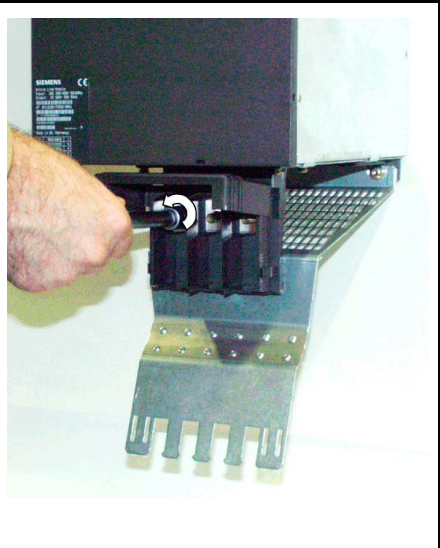
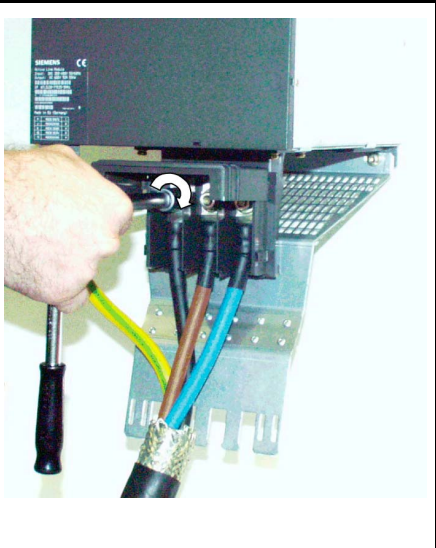
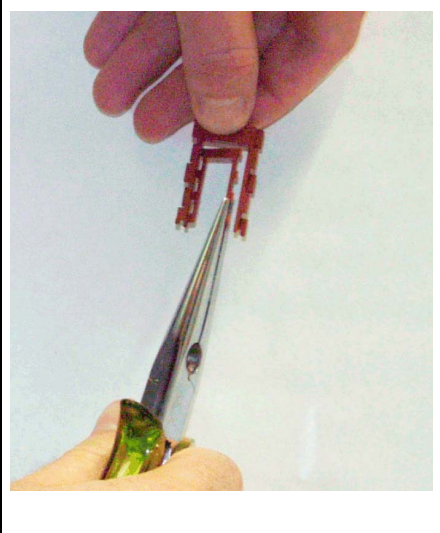
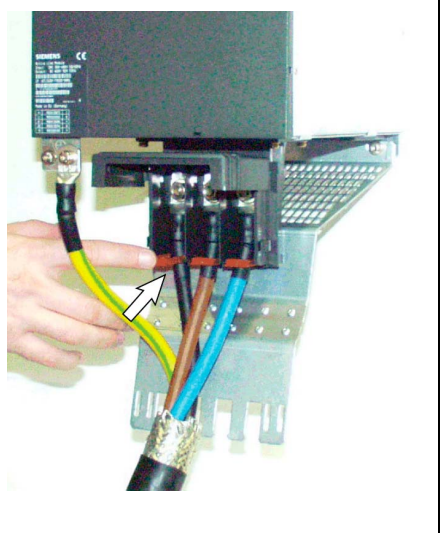
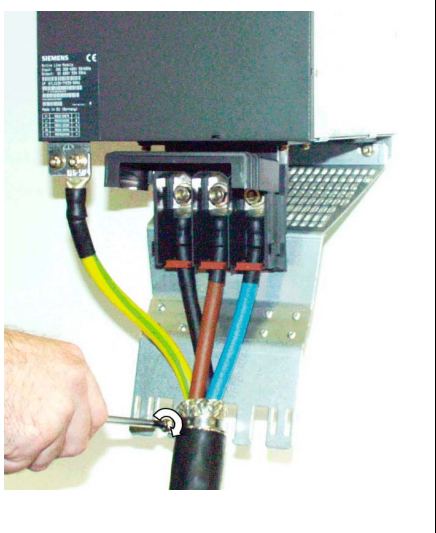
6.1.5 Electrical Connection

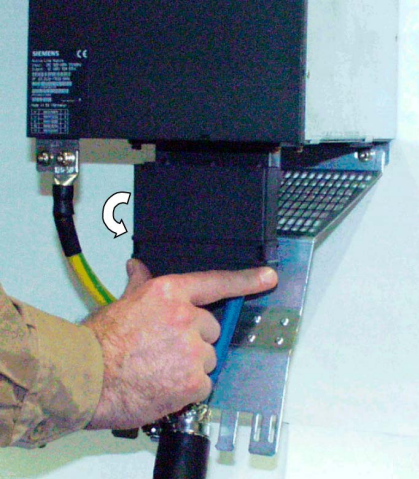
Table 6-4 Electrical connection to shielded terminal plate for 100 mm module (e.g. with internal air cooling)

			
<p>Secure the earthing cable with screwdriver T25/3 Nm.</p>	<p>Secure the power cable with flat-bladed screwdriver 4/1.8 Nm.</p>	<p>Secure the shield clip to the shielded terminal plate using a suitable tool.</p>	<p>The power cable is connected.</p>

6.1 Shielded terminal plates

Table 6-5 Electrical connection to shielded terminal plate for 200 mm module (e.g. with internal air cooling)

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

		
Close the cover of the terminal block.		

6.2 DC link supply adapter

6.2.1 Description

The DC link supply adapter supplies the DC link voltage directly. With a direct supply, each module 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 to EN 55011 cannot be observed.

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

Table 6-6 The DC link supply 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 mm ²)	Screw terminals (35 to 95 mm ²)

6.2.2 Safety Information



Danger

A hazardous voltage is present for 5 minutes after the power supply has been disconnected. The adapter cannot be installed 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, otherwise this could result in secondary damage or accidents.



Danger

Components for which the recesses for the DC link supply adapter have been removed must no longer be operated without them. If components need to be operated without either the recess nor DC link supply adapter, the DC link cover must be replaced.

Caution

The DC link discharge voltage hazard warning on the modules on which the adapter is installed must be in the local language.

A set of labels in 12 languages is available using order number: 6SL3166-3AB00-0AAx.

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.

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.

6.2.3 Interface description

6.2.3.1 Overview

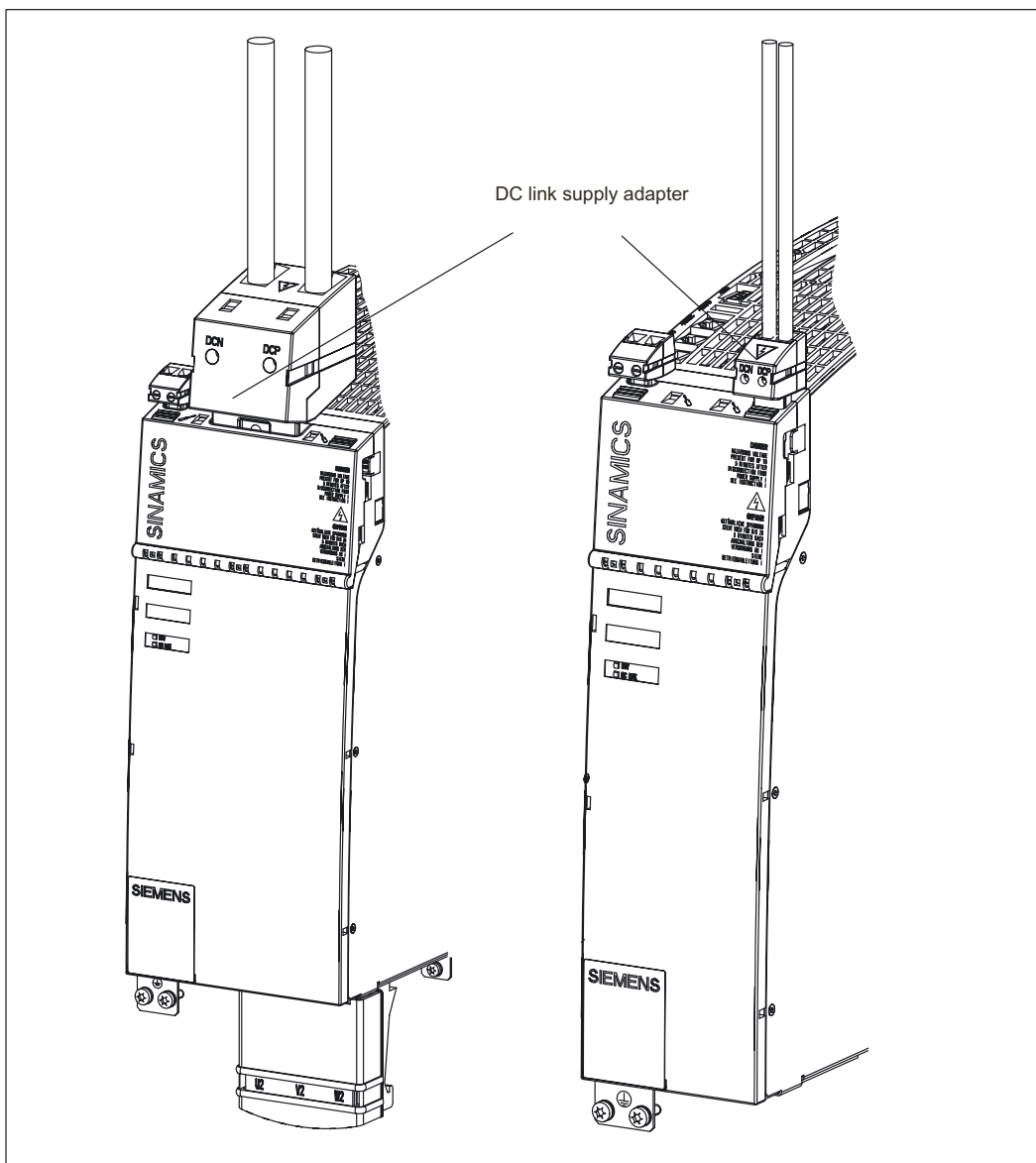


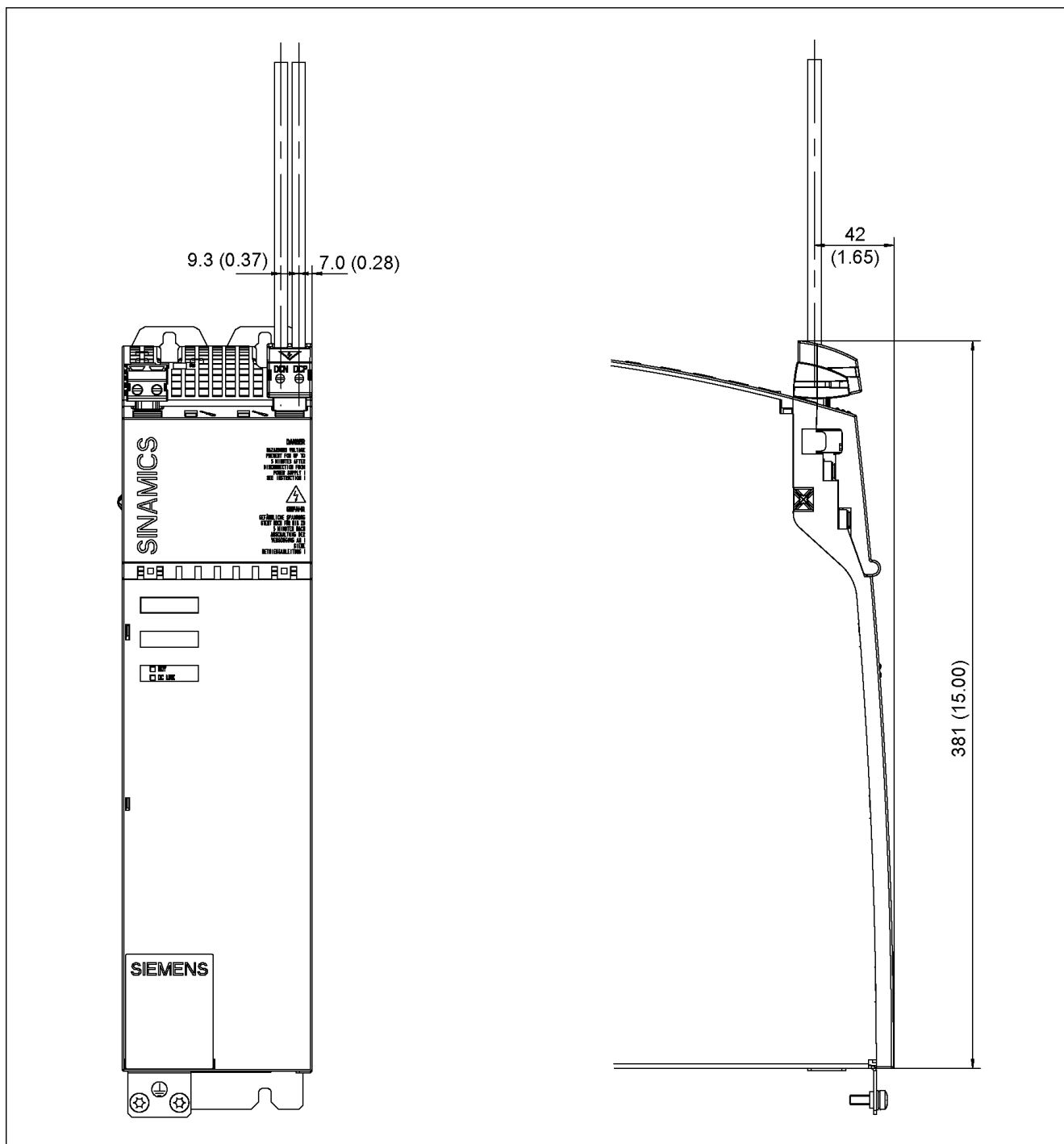
Figure 6-11 150 mm modules with DC link supply adapter for 35 mm² to 95 mm² and 100 mm modules with DC link supply adapter for 4 mm² to 10 mm²

6.2.3.2 DC link connection

Table 6-7 DC link supply adapter – description of the terminals

Terminal	Function	Technical specifications
DCP	DC link positive	Connection voltage: 750 V-VDE/600 V-UL Direct supply 4 – 10 mm² Current carrying capacity: 36 A Connection cross-section: 4 – 10 mm ² Stripped length: 11 mm Direct supply 35 – 95 mm² Current carrying capacity: 240 A Connection cross-section: 35 – 95 mm ² Stripped length: 27 mm
DCN	DC link negative	

6.2.4 Dimension Drawings

Figure 6-12 Dimension drawing of 100 mm module with DC link supply adapter for 0.5 mm² to 10 mm²

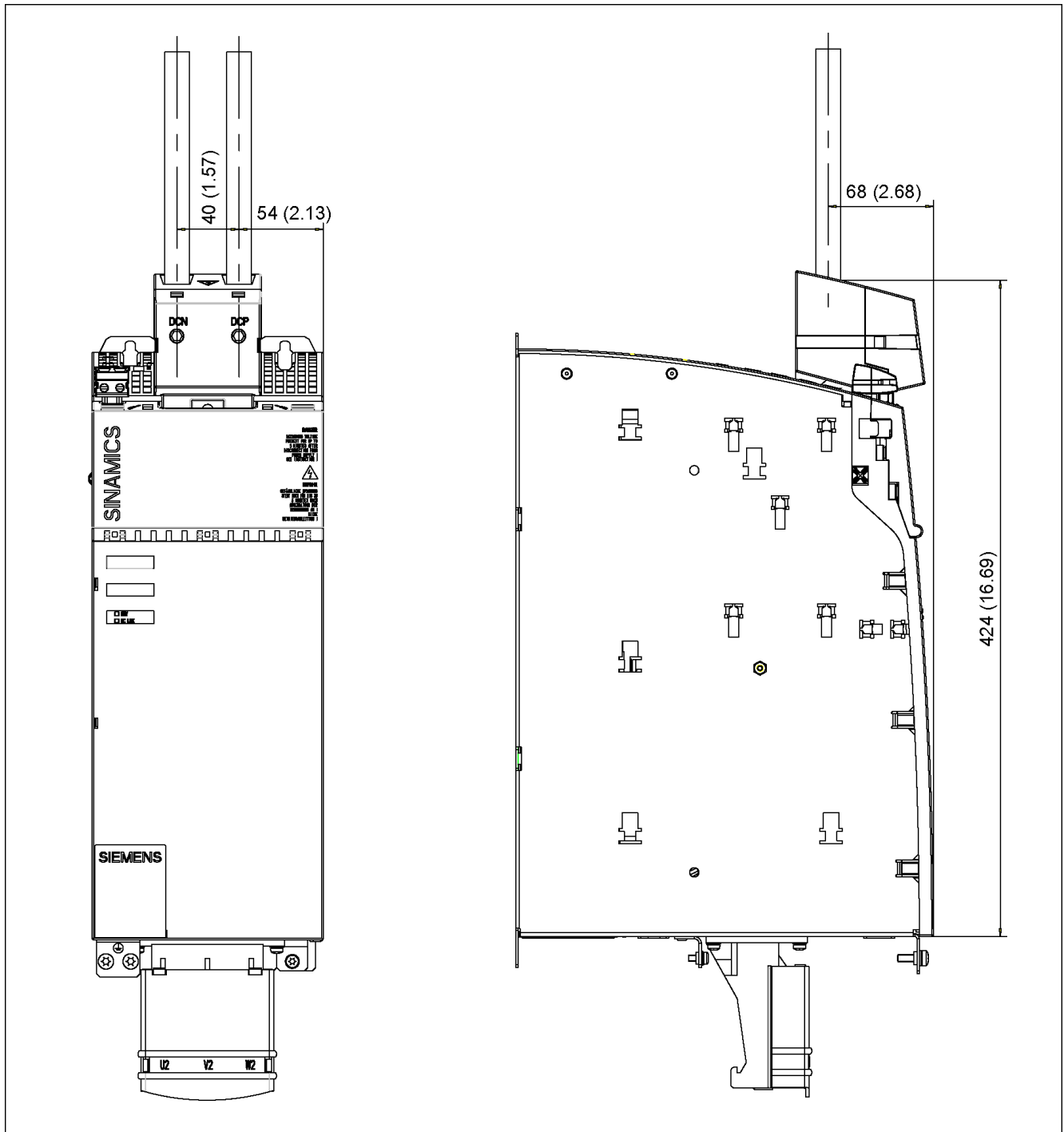



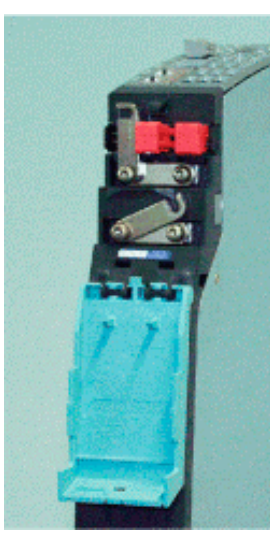
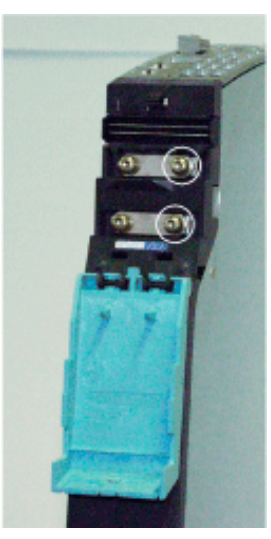
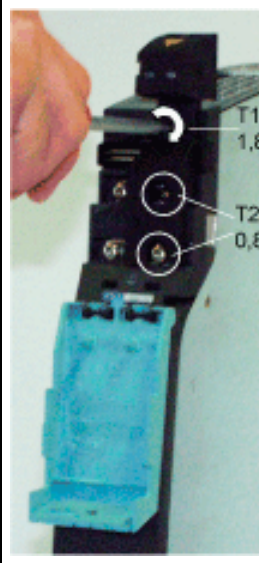
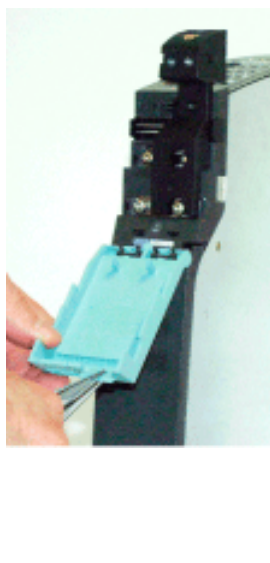
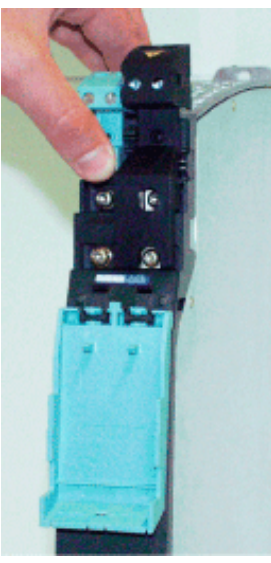

Figure 6-13 Dimension drawing of 150 mm module with DC link supply adapter for 35 mm² to 95 mm²

6.2.5 Installation

Required tools:


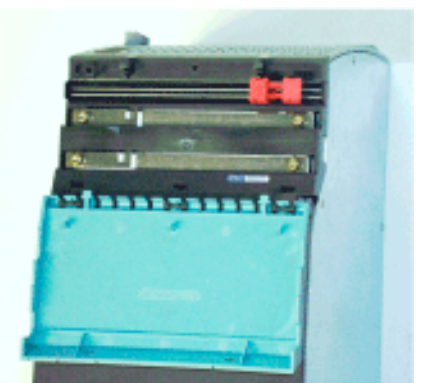
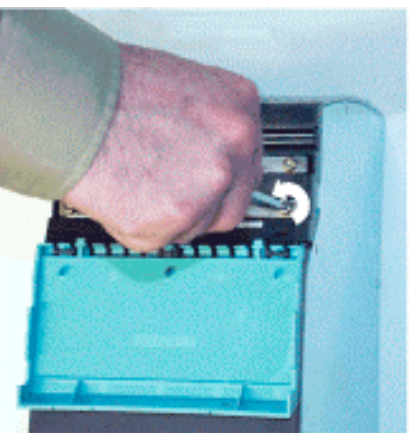


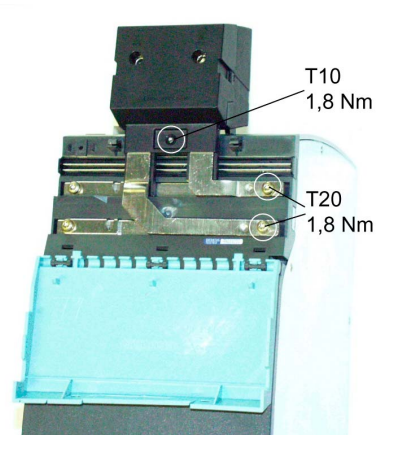
- Flat-bladed screwdriver 1 (0.5 x 3.5)
- Torx screwdriver T10
- Torx screwdriver T20

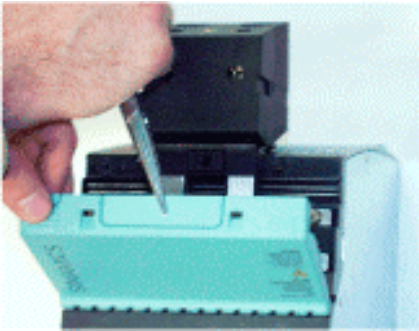
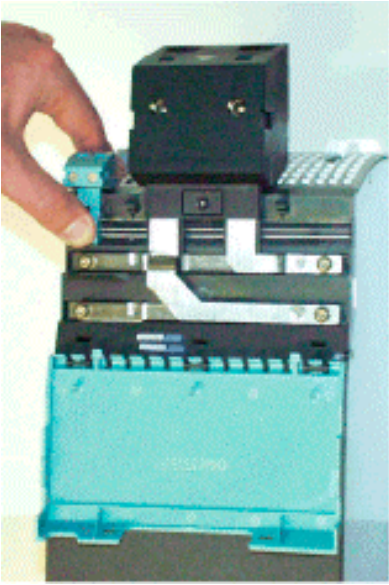

Table 6-8 Installing the DC link supply adapter for 50 mm and 100 mm modules

			
<p>Unlock and open the protective cover.</p>	<p>Opened cover with 24 V jumper and DC link bridge.</p>	<p>The DC link bridge and 24 V jumper have been removed.</p>	
			
<p>Secure the adapter.</p>	<p>Create the recess using suitable pliers.</p>	<p>Attach the 24 V adapter.</p>	<p>Close the protective cover.</p>

6.2 DC link supply adapter

Table 6-9 Installing the DC link supply adapter for 150 mm, 200 mm, and 300 mm modules

		
<p>Unlock and open the protective cover.</p>	<p>Opened cover with 24 V jumper</p>	<p>Remove the 24 V jumper and unscrew the DC link screws.</p>
		
<p>Hook in the adapter.</p>	<p>Secure the adapter.</p>	<p>The adapter has been screwed in.</p>

		
<p>Create the recess using suitable pliers.</p>	<p>Attach the 24 V adapter.</p>	<p>Close the protective cover.</p>

6.2.6 Electrical Connection

Table 6-10 Connecting the DC link supply adapter for 50 mm and 100 mm modules

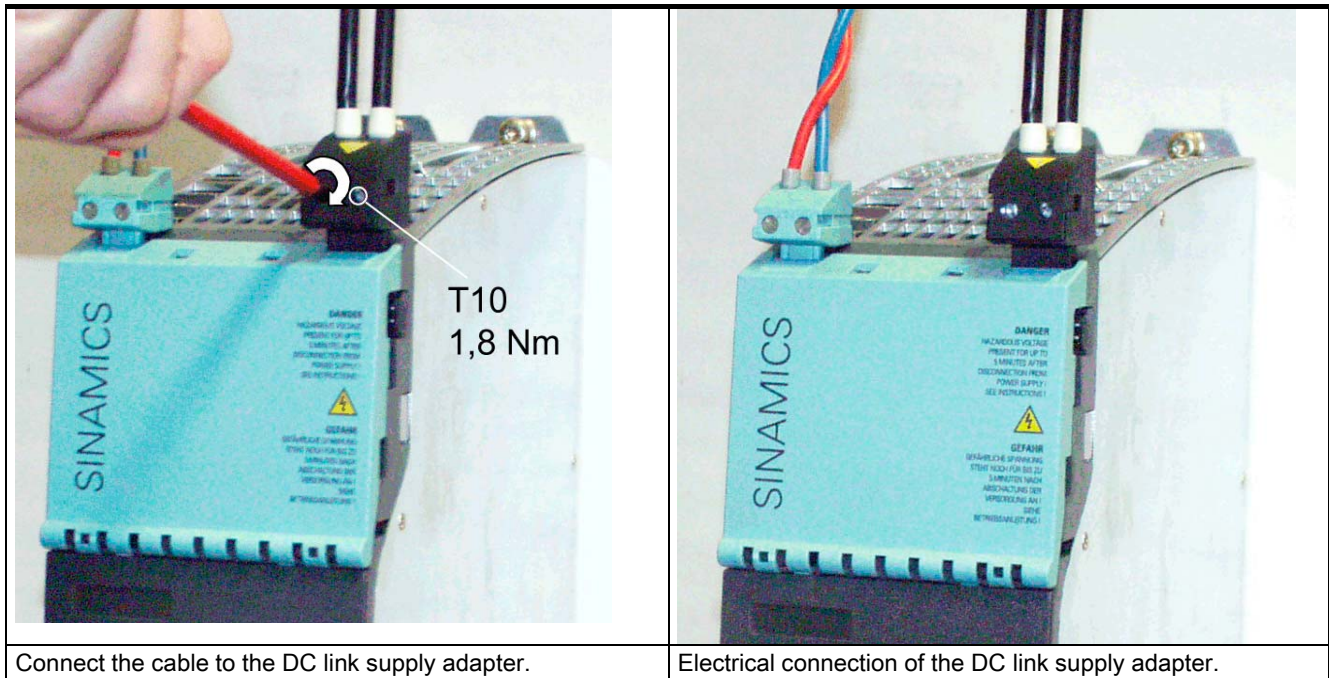
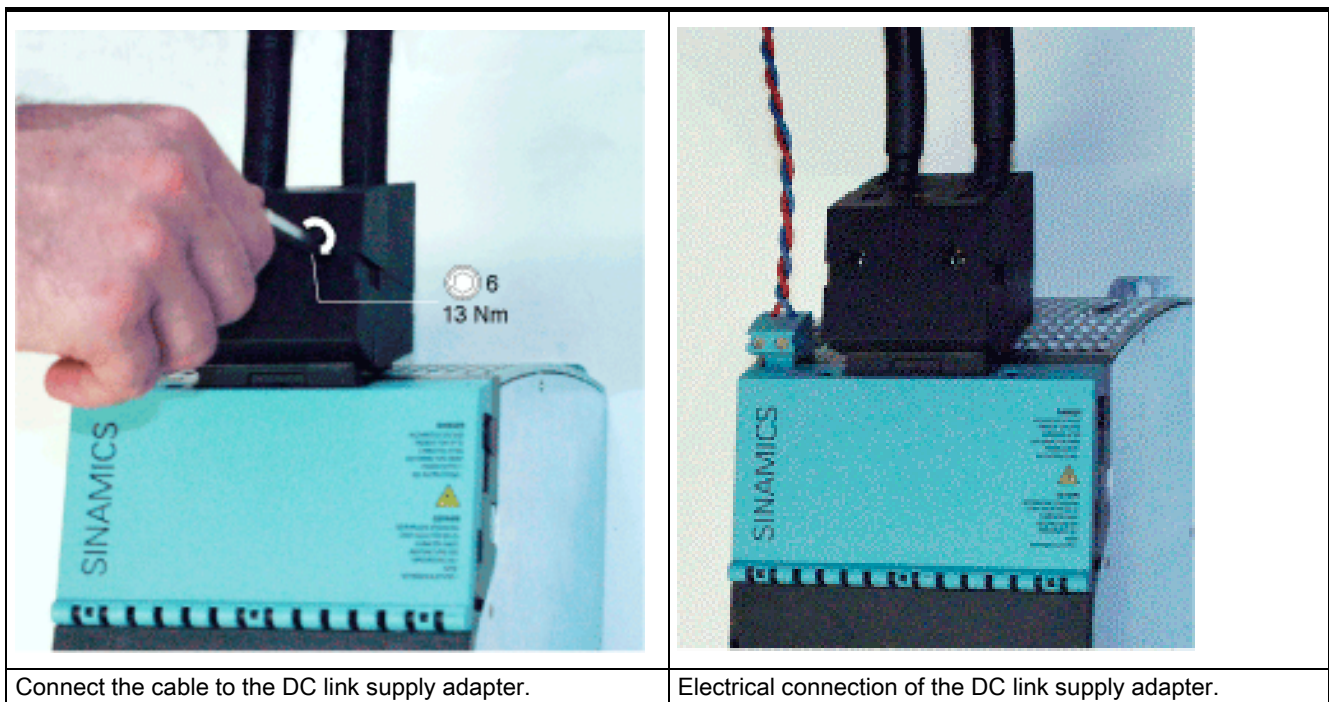


Table 6-11 Connecting the DC link supply adapter for 150 mm, 200 mm, and 300 mm modules



6.3 DC link adapter

6.3.1 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 mm² to 95 mm²). Shielded individual cores are recommended.

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

6.3.2 Safety Information



Danger

A hazardous voltage is present for 5 minutes after the power supply has been disconnected. The adapter cannot be installed 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, otherwise this could result in secondary damage or accidents.

Caution

The DC link discharge voltage hazard warning on the modules on which the adapter is installed must be in the local language.

A set of labels in 12 languages is available using order number: 6SL3166-3AB00-0AAx.

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.



Warning

The DC link connection cables must be routed in such a way that they are ground-fault and short-circuit proof in accordance with DIN/VDE 0100.

Caution

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

6.3.3 Interface description

6.3.3.1 Overview

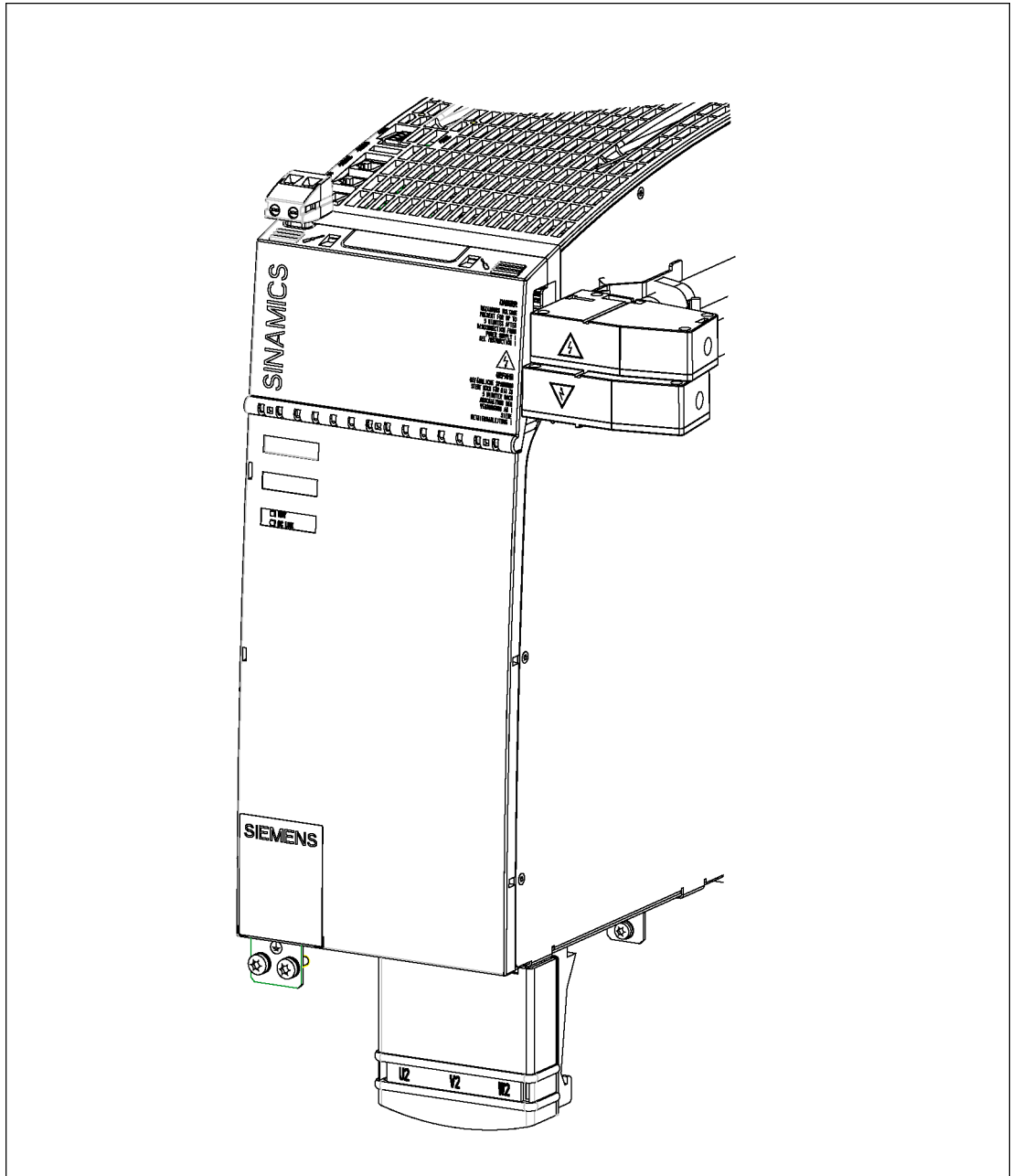


Figure 6-14 150 mm module with DC link adapter for two-row configuration (35 mm² to 95 mm²)

6.3.3.2 DC link connection

Table 6-12 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: 240 A Voltage: 750 V-VDE/600 V AC Connection cross-section: 35 – 95 mm ² Stripped length: 27 mm
DCN	DC link negative	

6.3.4 Dimension Drawing

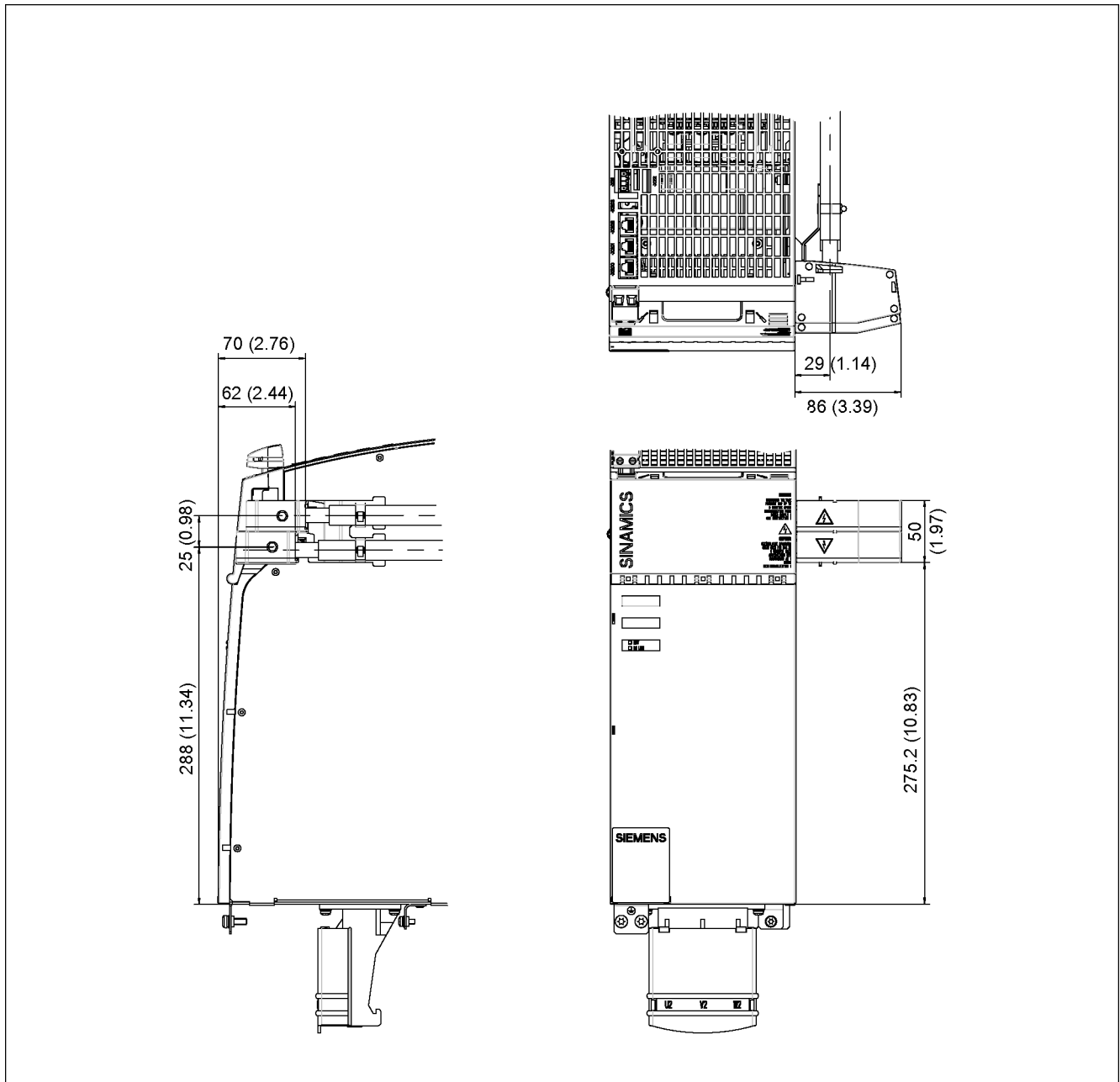


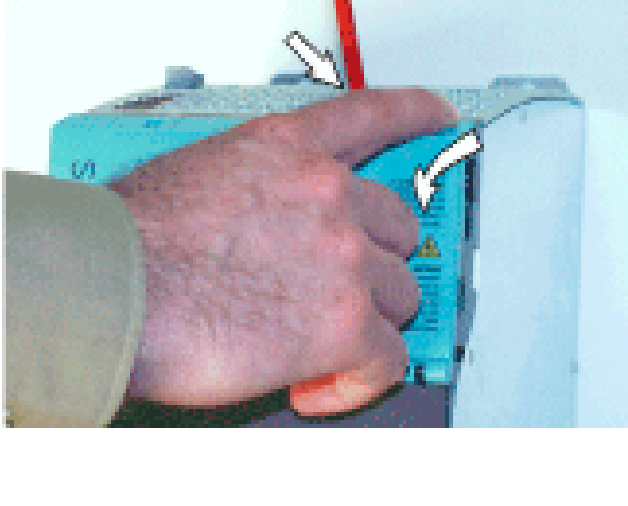
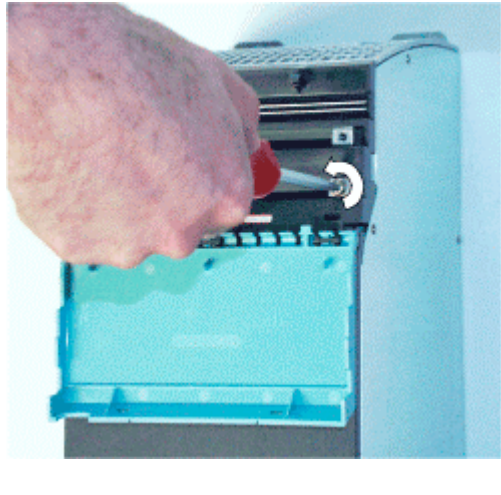
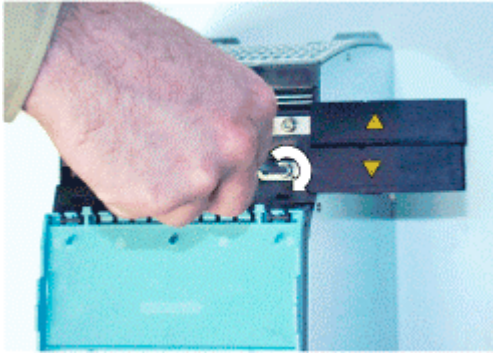
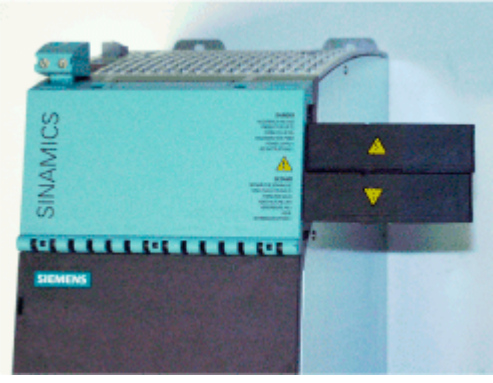
Figure 6-15 Dimension drawing of 150 mm module with DC link adapter for two-row configuration (35 mm² to 95 mm²)

6.3.5 Installation

Required tools:

- Torx screwdriver T20
- Flat-bladed screwdriver 1 (0.5 – 3.5)

Table 6-13 Installing the DC link adapter for a 150 mm module

	
<p>Unlock and open the protective cover.</p>	<p>Unscrew the screws.</p>
	
<p>Secure the adapter (1.8 Nm).</p>	<p>The 24 V adapter is installed and the protective cover is closed.</p>

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; see overview below.

6.3 DC link adapter

Table 6-14 Overview

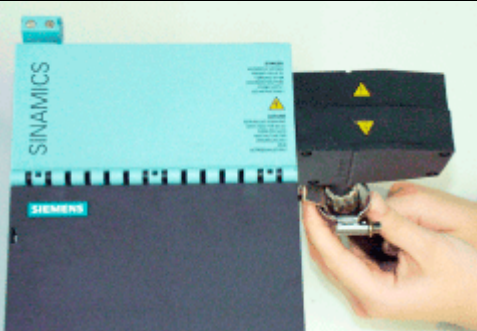
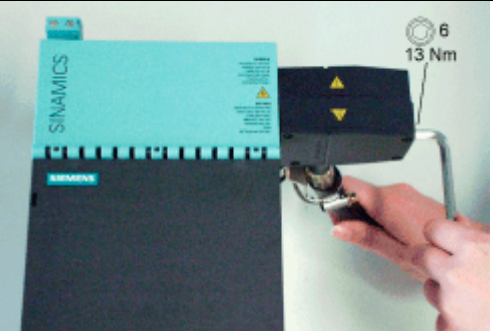
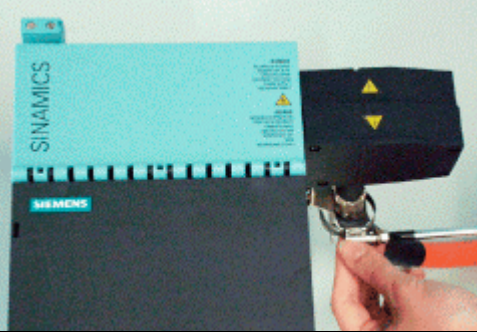
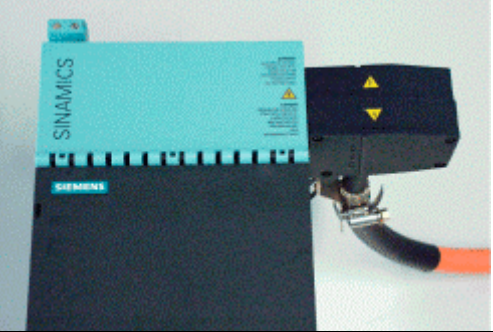
Active Line Module	Internal cooling	External cooling
55 kW	6SL3130-7TE25-5AA2	6SL3131-7TE25-5AA0 (only with DC link busbars)
80 kW	6SL3130-7TE28-0AA1	6SL3131-7TE28-0AA0 (only with DC link busbars)
120 kW	6SL3130-7TE31-2AA1	6SL3131-7TE31-2AA0 (only with DC link busbars)

6.3.6 Electrical Connection

Required tools:

- Hexagon-socket spanner (size 6)
- Suitable tool for tube clips (e.g. flat-bladed screwdriver)

Table 6-15 Electrical connection of the DC link adapter for a 150 mm module

	
<p>Route the cable through the tube clip and insert it into the DC link adapter.</p>	<p>Secure the cable.</p>
	
<p>Secure the tube clip.</p>	<p>The cable is connected.</p>

Only shielded connection cables should be used.

The DC link adapter can be fitted on the right or left.

6.4 DRIVE-CLiQ Flanged Coupling

6.4.1 Description

The DRIVE-CLiQ Flanged Coupling is used to connect two DRIVE-CLiQ cables and can be installed in a cabinet wall.

A DRIVE-CLiQ connection with degree of protection IP67 is implemented at the interface outside the cabinet. Inside the cabinet, a connection with degree of protection IP20 is implemented. The interface between the cabinet wall and the DRIVE-CLiQ Flanged Coupling satisfies degree of protection IP54.

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

6.4.2 Safety information

Caution

Only cables from Siemens must be used for DRIVE-CLiQ connections.

6.4.3 Interface Description

6.4.3.1 Overview

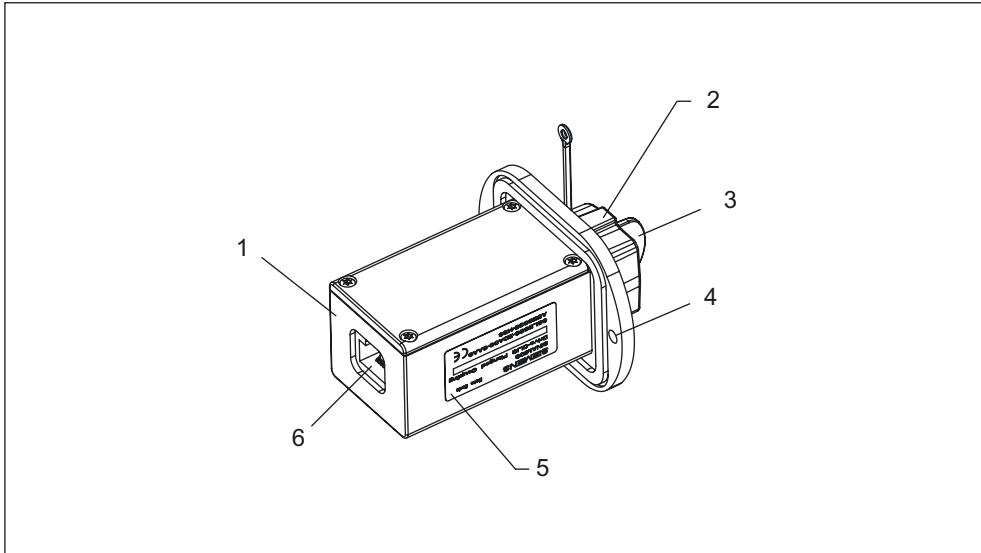


Figure 6-16 DRIVE-CLiQ Flanged Coupling

1	DRIVE-CLiQ Flanged Coupling
2	Centering cap
3	IP67 interface
4	Mounting holes
5	Type plate
6	IP20 interface

6.4.4 Dimension drawing

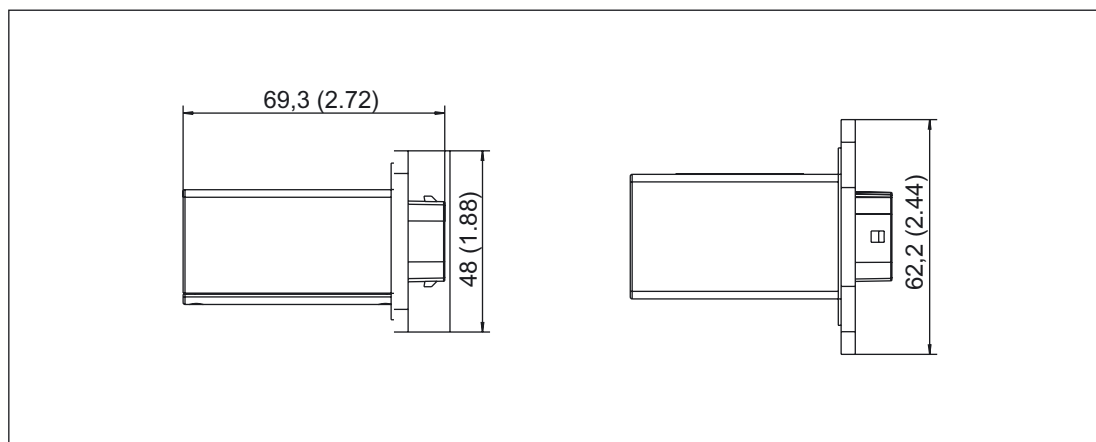


Figure 6-17 Dimension drawing of the DRIVE-CLiQ Flanged Coupling

Accessories	B [mm]	T [mm]	H [mm]
DRIVE-CLiQ Flanged Coupling (with seal)	69.3 (2.72)	62.2 (2.44)	48 (1.88)

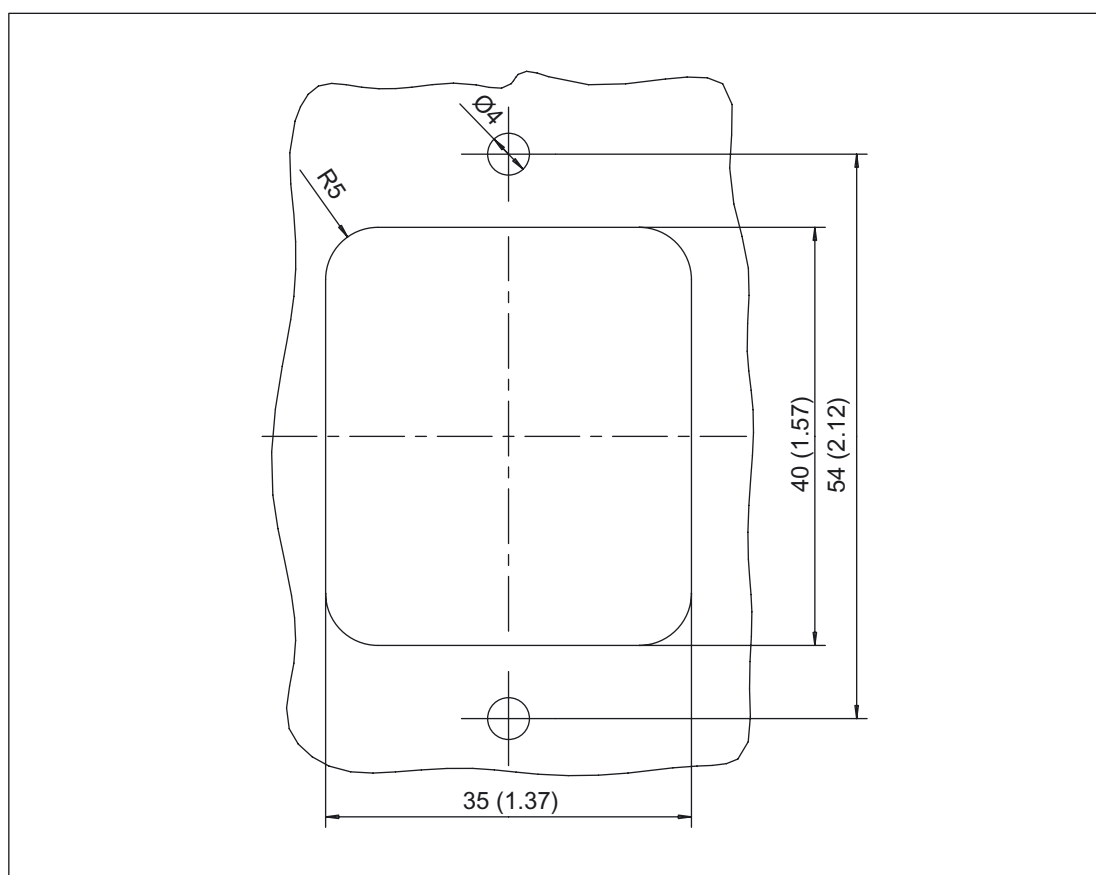


Figure 6-18 Cutout for cabinet

6.4.5 Installation

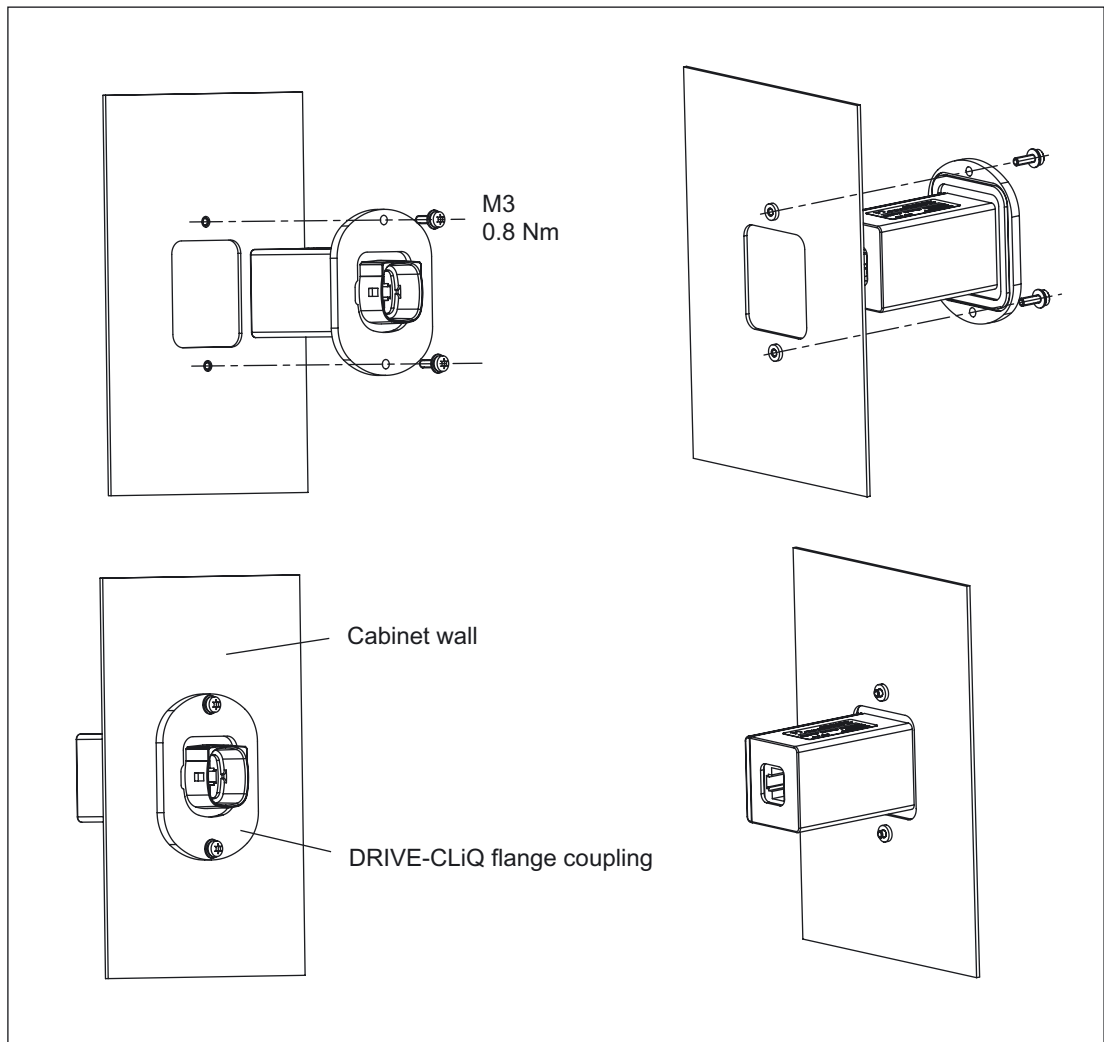


Figure 6-19 DRIVE-CLiQ Flanged Coupling

Installation

1. Create an opening for the DRIVE-CLiQ Flanged Coupling in the cabinet wall in accordance with "Dimension drawing".
2. Insert the DRIVE-CLiQ Flanged Coupling in the opening from outside the cabinet.
3. Secure the DRIVE-CLiQ Flanged Coupling to the outer cabinet wall with two bolts M3 and two nuts. In order to ensure good EMC, an electrically conductive connection should be established between the DRIVE-CLiQ Flanged Coupling and the cabinet wall.

6.4.6 Technical specifications

Table 6-16 Technical Specifications

DRIVE-CLiQ Flanged Coupling 6FX2003-0DC0x	Unit	
Weight	kg	0.135
Degree of protection	IP20 to EN 60 529 inside the cabinet IP54 to EN 60 529 outside the cabinet	

6.5 DRIVE-CLiQ Coupling

6.5.1 Description

The DRIVE-CLiQ Coupling is used to connect two DRIVE-CLiQ cables in accordance with degree of protection IP67.

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

6.5.2 Safety information

Caution

Only cables from Siemens must be used for DRIVE-CLiQ connections.

6.5.3 Interface Description

6.5.3.1 Overview

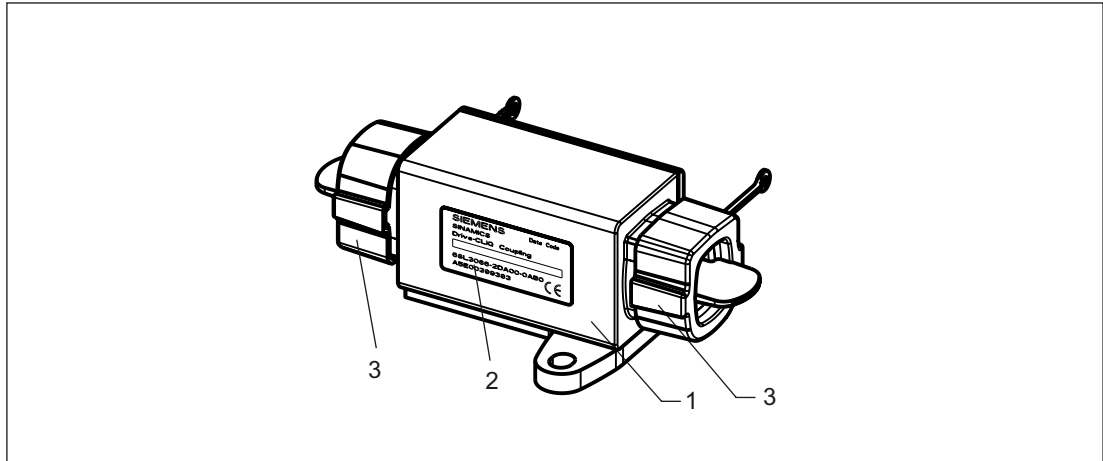


Figure 6-20 DRIVE-CLiQ Coupling

1	DRIVE-CLiQ Coupling
2	Type plate
3	Centering caps

6.5.4 Dimension drawing

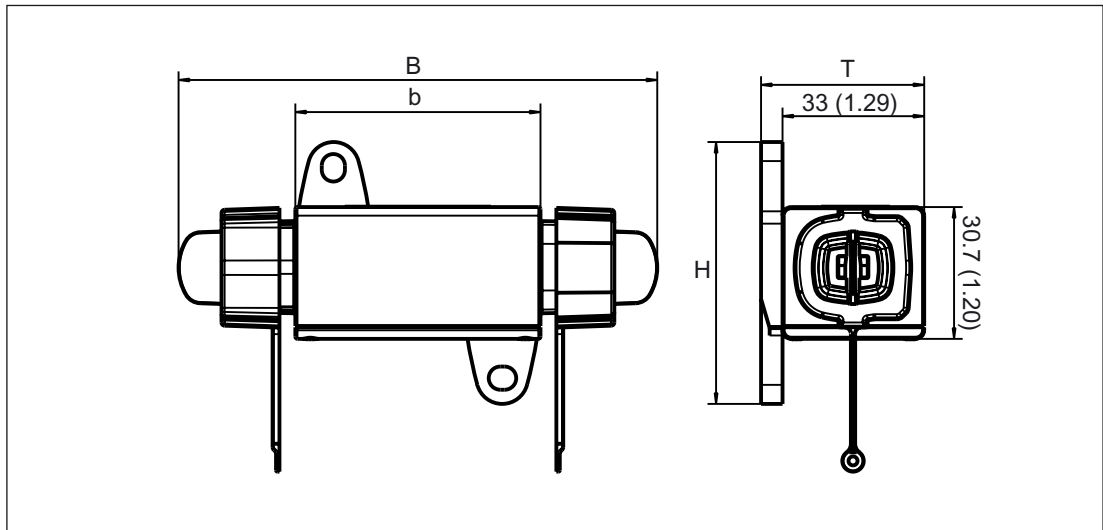


Figure 6-21 Dimension drawing of the DRIVE-CLiQ Coupling

Accessories	B [mm]	H [mm]	T [mm]
DRIVE-CLiQ Coupling	81.5 (3.20)	33 (1.29)	30.7 (1.20)

6.5.5 Installation

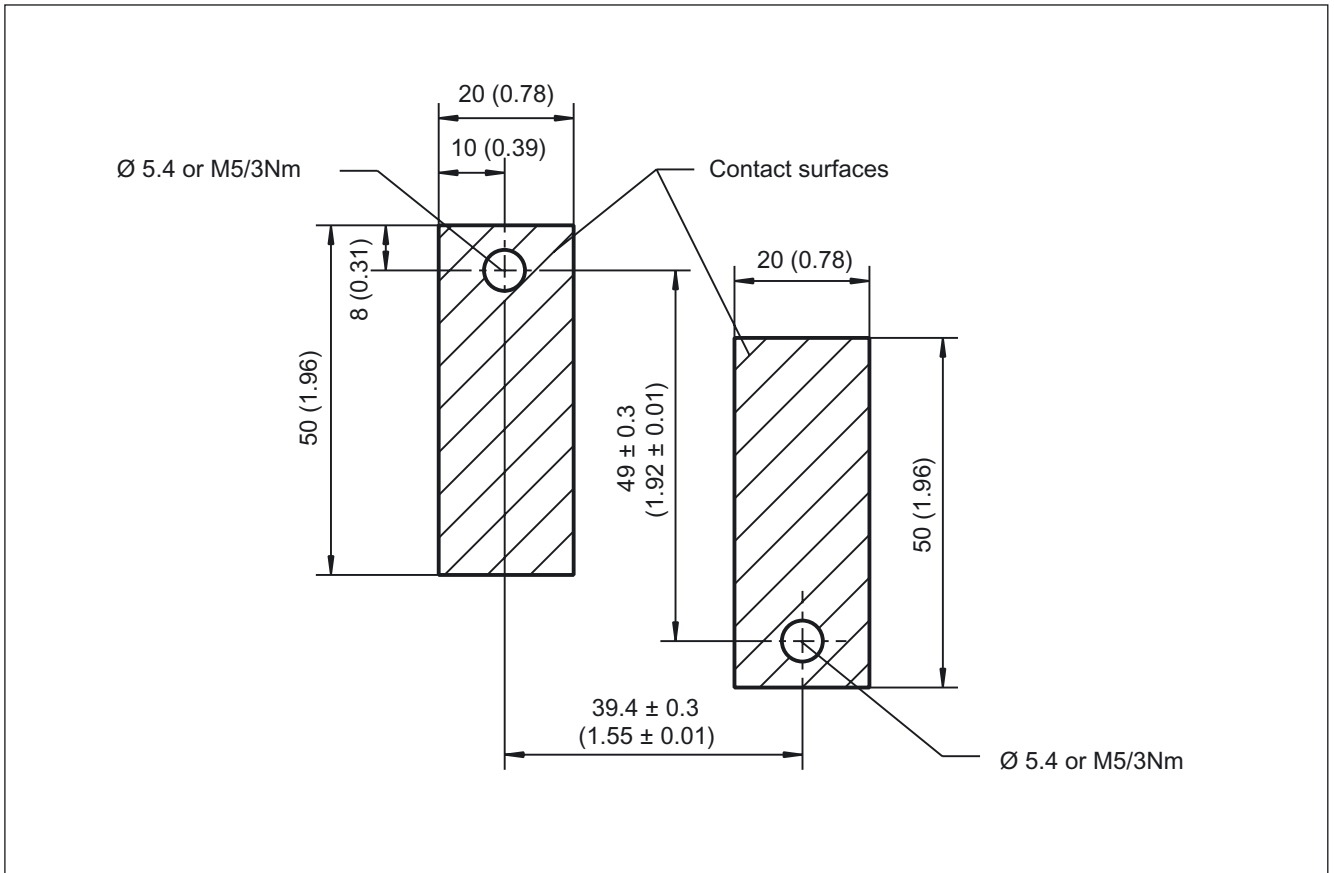


Figure 6-22 Hole drilling template for installation:

1. Fit the DRIVE-CLiQ coupling in accordance with the hole drilling template on the mounting surface.
2. Remove the protective caps on the DRIVE-CLiQ Coupling.
3. Plug the DRIVE-CLiQ connector into both ends of the DRIVE-CLiQ coupling.

6.5.6 Technical specifications

Table 6-17 Technical Specifications

DRIVE-CLiQ Coupling 6FX2003-0DC1x	Unit	
Weight	kg	0.14
Degree of protection	IP67-IP67	

Cabinet Configuration and EMC Booksize

7.1 Information

7.1.1 General

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

Prefabricated MOTION CONNECT cables are recommended.

The Safety-Integrated safety function:

The components must be protected against conducted contamination (e.g. by installing them in a cabinet with degree of protection IP54).

Provided that conducted interference can be prevented at the installation site, the degree of protection for the cabinet can be decreased accordingly.

Low-voltage switchgear and controlgear assemblies

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

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

Safety of machinery

Electrical equipment of machines

Part 1: General requirements

All information for device selection in this section applies to

- Operation in a TN system
- Operating voltage range 360 V 3AC to 440 V 3AC

7.1.2 Safety information

Note

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

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

Caution

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 catalogs D21.1 and D21.2.

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

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

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



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.

7.1.3 Directives and standards

The following directives and standards apply within the European Union:

Table 7-1 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
93/68/EEC	Directive of the Council on the approximation of laws of the member states relating to electromagnetic compatibility EMC guidelines

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 7-2 Standards

Standard	Description
EN 292-1	Safety of machinery General principles for design Part 1: Basic terminology, methodology
EN 292-2	Safety of machinery General principles for design Part 2: General requirements
EN 954-1	Safety of machinery General principles for design Part 1: Safety-related parts of control systems
EN 1037	Safety of machinery Prevention of unexpected startup
EN 1921	Safety of integrated manufacturing systems
EN 61000-6-4	Electromagnetic compatibility (EMC) Generic standard emission Part 2: Industrial environments
EN 50178	Electronic equipment for use in power installations
EN 60204-1	Safety of machinery Electrical equipment of machines Part 1: General requirements

7.2 Selection of devices required for operation of SINAMICS

Standard	Description
EN 60439-1	Low-voltage switchgear and controlgear assemblies Part 1: Type-tested and partially type-tested assemblies
EN 60529	Degrees of protection provided by enclosures
EN 61000-6-2	Electromagnetic compatibility (EMC) Part 2: Generic standard immunity, industrial environments
EN 61800-3	Adjustable speed electrical power drive systems Part 3: EMC product standard including specific test methods
UL 508C	Power conversion equipment

7.2 Selection of devices required for operation of SINAMICS

7.2.1 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)

7.2.2 Information about line isolating devices

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

The 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 Line Modules (EP terminals).

The accessories required for the line disconnecting device must be selected from the manufacturer catalogs. See also catalog D21.2.

7.2.3 Overcurrent Protection by Means of Line Fuses or Circuit-Breakers

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

Note

For use in networks capable of supplying a maximum of 36 kA rms at 480 Vac if the device is protected by means of the UL-approved (JFHR2) semiconductor safety fuse specified in the manual.

The devices have to be protected with semiconductor fuses in accordance with the Manual.

The following tables list the requirements regarding line fuses and circuit-breakers for the Active Line Modules and Smart Line Modules.

Table 7-3 Requirements regarding line fuses and circuit-breakers for Active Line Modules

	16 kW	36 kW	55 kW	80 kW	120 kW
$I_{\text{rated fuse}}$	35 A	80 A	125 A	160A	250A
$I_{\text{fuse 0.2s}}$	>180 A	>360 A	>450 A	>650 A	>865 A
$I_{\text{fuse 4s}}$	>130 A	>260 A	>350 A	>505 A	>675 A
$I_{\text{fuse 10 s}}$	>100 A	>200 A	>250 A	>360 A	>480 A
$I_{\text{fuse 240 s}}$	>60 A	>135 A	>200 A	>280 A	>380 A

Table 7-4 Requirements regarding line fuses and circuit-breakers for Smart Line Modules

	5 kW	10 kW	16 kW	36 kW
$I_{\text{rated fuse}}$	16 A	35 A	35 A	80 A
$I_{\text{fuse 0.2s}}$	>70 A	>100 A	>180 A	>360 A
$I_{\text{fuse 4s}}$	>50 A	>80 A	>130 A	>260 A
$I_{\text{fuse 10 s}}$	>42 A	>65 A	>100 A	>200 A
$I_{\text{fuse 240 s}}$	>30 A	>45 A	>60 A	>135 A

See catalog D21.2.

7.2.4 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 specifications 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 D21.2.

7.3 24 V DC supply voltage

7.3.1 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

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

Notice

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

Notice

A regulated DC power supply is required to operate motors with a built-in holding brake. The 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
-



Warning

Only protective extra-low voltages (PELVs) 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.

7.3.2 Selection of power supply units

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

Table 7-5 Recommended SITOP Power

Rated output current [A]	Input voltage range [V]	Short-circuit current [A]	Order number
5	2AC 85-132/170 – 550	5.5	6EP1333-3BA00
10	2AC 85-132/176 – 550	30 for 25 ms	6EP1334-3BA00
20	3AC 320 – 550	23	6EP1336-3BA00
40	3AC 320 – 550	46	6EP1337-3BA00

Table 7-6 Recommendation for Control Supply Module

Rated output current [A]	Input voltage range [V]	Short-circuit current [A]	Order number
20	3AC 380 -10% to 3AC 480 +10% (-15% < 1 min) DC 300 – 800	< 24	6SL3100-1DE22-0AA0

See catalog D21.2.



Warning

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

7.3.3 Typical 24-V component power consumption

A separate 24 V power supply must be used for the SINAMICS S120 drive line-up.

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

Table 7-7 Overview of 24 V DC current consumption

Component	Typical current consumption [A _{DC}]
CU320 without load	0.8
per digital output	0.1
PROFIBUS Teleservice	
TB30 (without digital outputs)	< 0.05
per digital output	0.1
CBC10	0.1
Active Line Modules	
16 kW	1.1
36 kW	1.5
55 kW	1.9
80 kW	2
120 kW	2.5
Smart Line Modules	
5 kW	1.0
10 kW	1.3
16 kW	1.1
36 kW	1.5
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)	0.85
5 A (+1 x DRIVE-CLiQ; +1 x brake)	0.85
9 A (+1 x DRIVE-CLiQ; +1 x brake)	0.85
18 A (+1 x DRIVE-CLiQ; +1 x brake)	0.85
30 A (+1 x DRIVE-CLiQ; +1 x brake)	0.9
45 A (+1 x DRIVE-CLiQ; +1 x brake)	1.2
60 A (+1 x DRIVE-CLiQ; +1 x brake)	1.2
85 A (+1 x DRIVE-CLiQ; +1 x brake)	1.5
132 A (+1 x DRIVE-CLiQ; +1 x brake)	1.5
200 A (+1 x DRIVE-CLiQ; +1 x brake)	1.5

7.3 24 V DC supply voltage

Component	Typical current consumption [A _{DC}]
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)	1.0
Braking Module	0.5
Sensor Modules	
SMC10	0.25
SMC20	0.25
SMC30	0.33
Additional system components	
TM31 (without digital outputs)	0.12
per digital output	0.1

The values specified refer to Motor Modules/Line Modules with internal/external cooling.

7.3.4 Overcurrent protection

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

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

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

Circuit-breakers from the Siemens NSK catalog are recommended as overcurrent protection devices on the primary side, and miniature circuit-breakers or SITOP select 6EP1961-2BA00 as overcurrent protection devices on the secondary side. The MCBs can be selected according to Siemens catalog "BETA Modular Installation Devices - ET B1".

The 24 V DC power supply of booksize

- Line Modules
- Motor Modules
- Braking Modules
- Capacitor 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.

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

The Control Supply Module is integrated in the drive line-up and supplies the 24 V directly to the 24 V busbars. A 24 V terminal adapter can be used to supply additional components. The earth potential for the Control Supply Module is connected to the protective conductor system inside the device.

7.3 24 V DC supply voltage

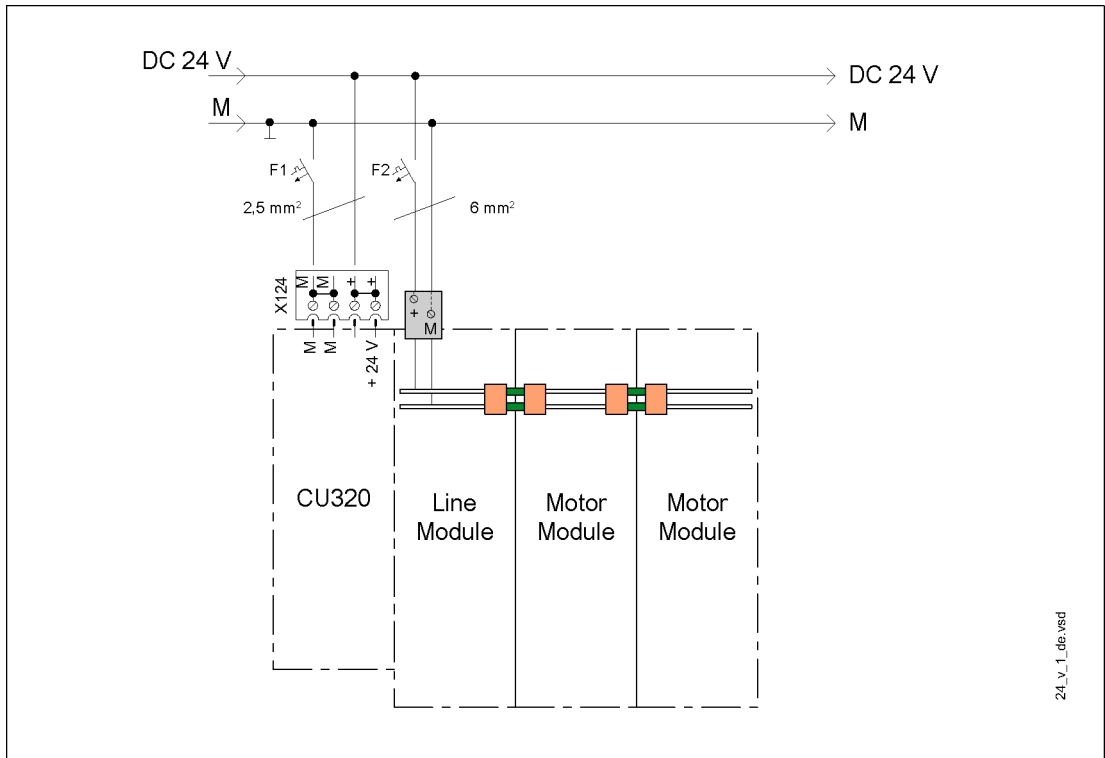


Figure 7-1 Example of 24 V DC fuse protection

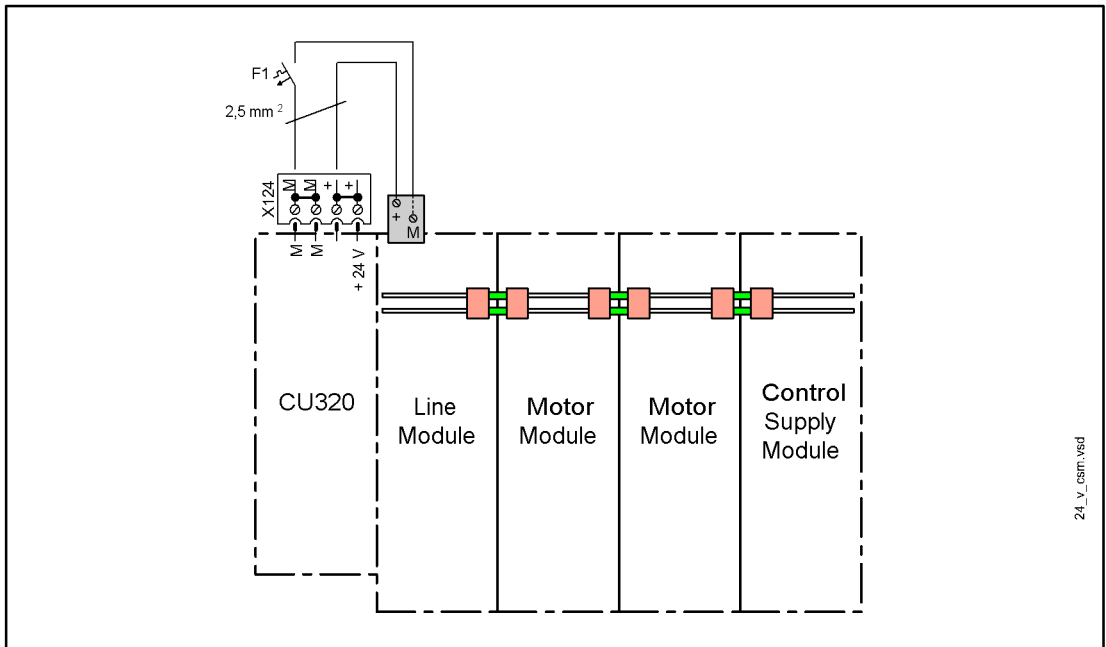


Figure 7-2 Example: 24 V supply with Control Supply Module

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 7-8 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	20 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 24 V DC current requirements

Table 7-9 Example of 24 V DC current requirements

Component	Number	Current consumption [A]	Total current consumption [A]
CU320	1	0.8	0.8
8 digital outputs	8	0.4	3.2
Active Line Module 36 kW	1	1.1	1.1
Motor Module 18 A	2	0.85	1.7
Motor Module 30 A	3	0.9	2.7
Encoders	5	0.25	1.25
Brake	5	1.1	5.5
Total:			17.5

7.4 Arrangement of components and devices

7.4.1 General

The arrangement of the components and equipment takes account of

- Space requirements
- Cable routing
- Bending radius of connection cables
For MOTION-CONNECT cables, see catalog D21.1 or D21.2.
- Heat dissipation
- EMC

Components are usually located centrally in a cabinet.

7.4.2 Drive line-up

Due to the current carrying capacity of the DC link busbars and their function, the components must be arranged according to the following rule. From left to right:

- Line Module
- Motor Modules in order of power from the highest power to the lowest power
- DC link components (e.g. Braking Module, Control Supply Module, Capacitor Module)

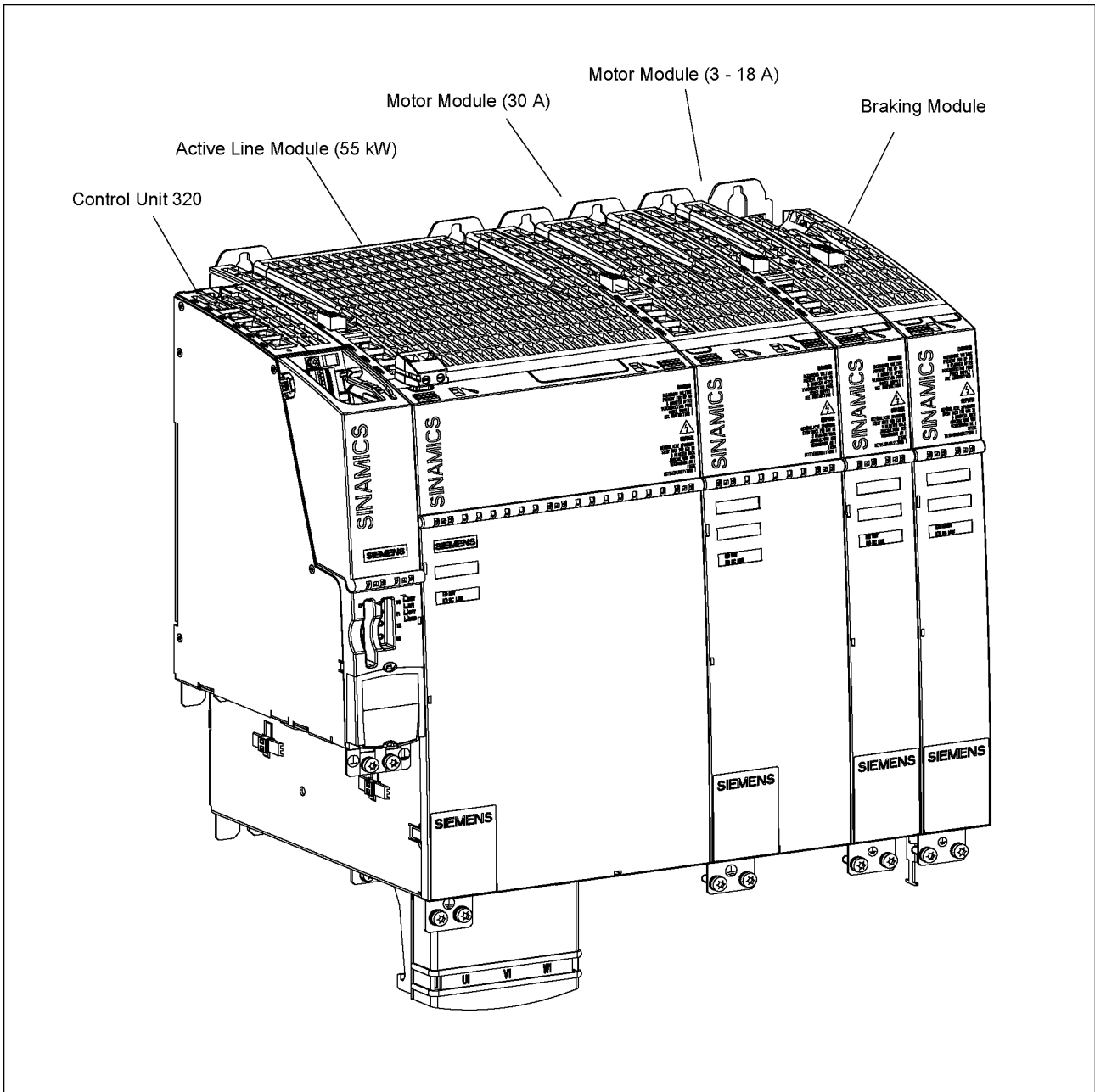


Figure 7-3 Example of a drive line-up

The components of the drive line-up should preferably be installed on a conductive mounting surface to ensure low impedance between the component and the mounting surface. Mounting plates with a galvanized surface are suitable.

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 specifications.

A distance of at least 150 mm is recommended between the line filter and the line reactor.

Arrangement of the VCM:

Power section up to 36 kW:	Preferably on the right next to the power section
Power section from 55 kW:	Preferably on the left next to the power section
In a retrofit:	At the end of the module group

Note regarding the use of modules with a width of 50 mm



Danger

If a Motor Module with a width of 50 mm or a DC link component is located on the left-hand side of the drive line-up, the bridges there must be removed. If not, this could result in damage or accidents.



Figure 7-4 Removing the DC link bridges (two-tier arrangement)

The DC link bridges must be removed by unscrewing the M4 screws.

Two-tier configuration

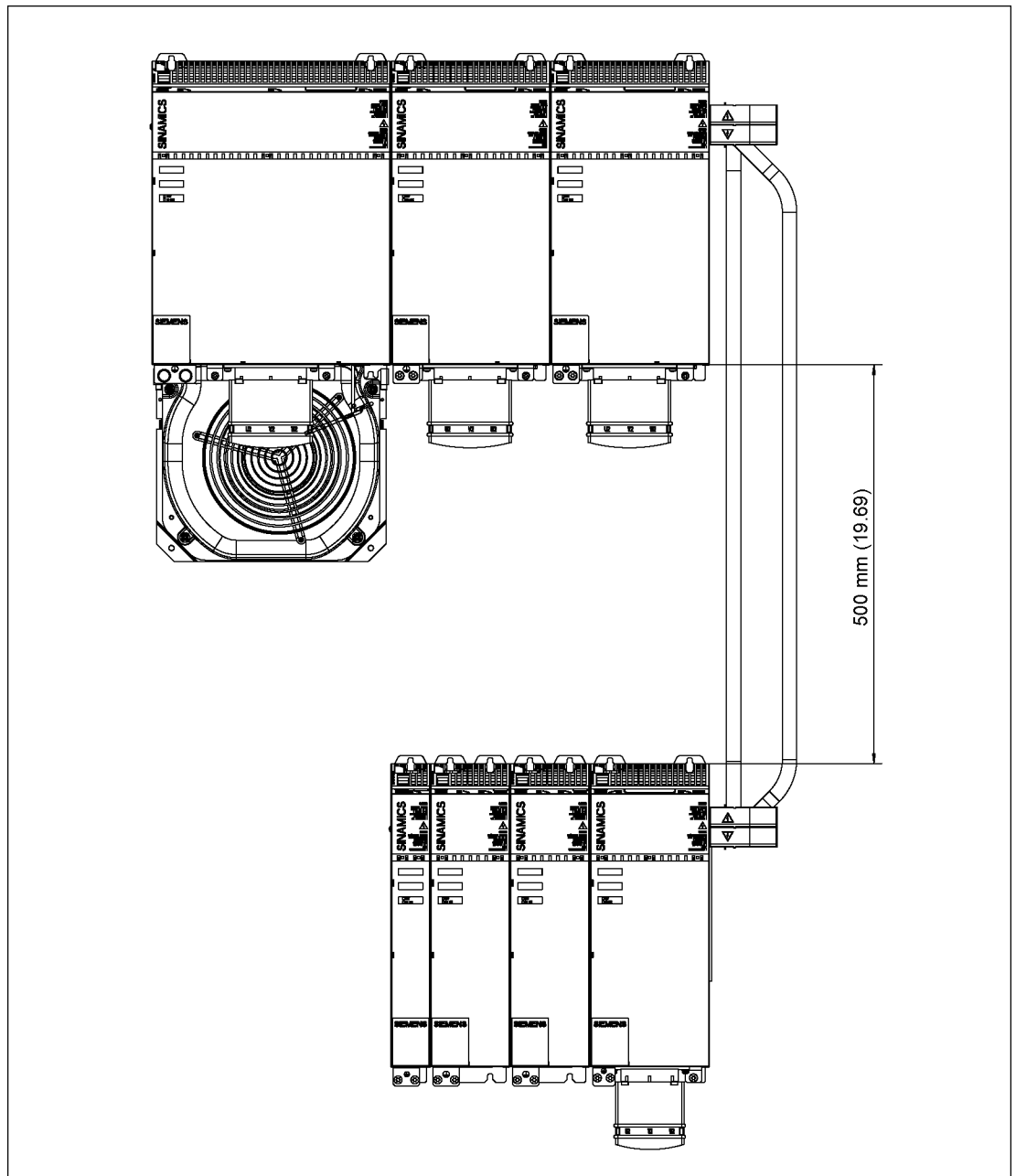


Figure 7-5 Example of a two-tier configuration with modules between 200 and 300 mm wide

Continuation of the DC link with the DC link adapter (installation above) 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.

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.

Caution

Signal cables must not be routed parallel to power cables.

Wiring rules for DRIVE-CLiQ

See the Commissioning Manual.

Overview of the DC link supply adapter and DC link adapter

	Suitable for module width:	Max. connectable cross-section	Max. current carrying capacity
DC link supply adapter (cable outlet on top)			
6SL3162-2BD00-0AAx	50 mm, 100 mm	10 mm ²	36 A
6SL3162-2BM00-0AAx	150 mm, 200 mm, 300 mm	95 mm ²	240 A
DC link adapter (cable outlet on side)			
6SL3162-2BM01-0AAx	all	95 mm ²	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 module.

Multiple-tier configuration

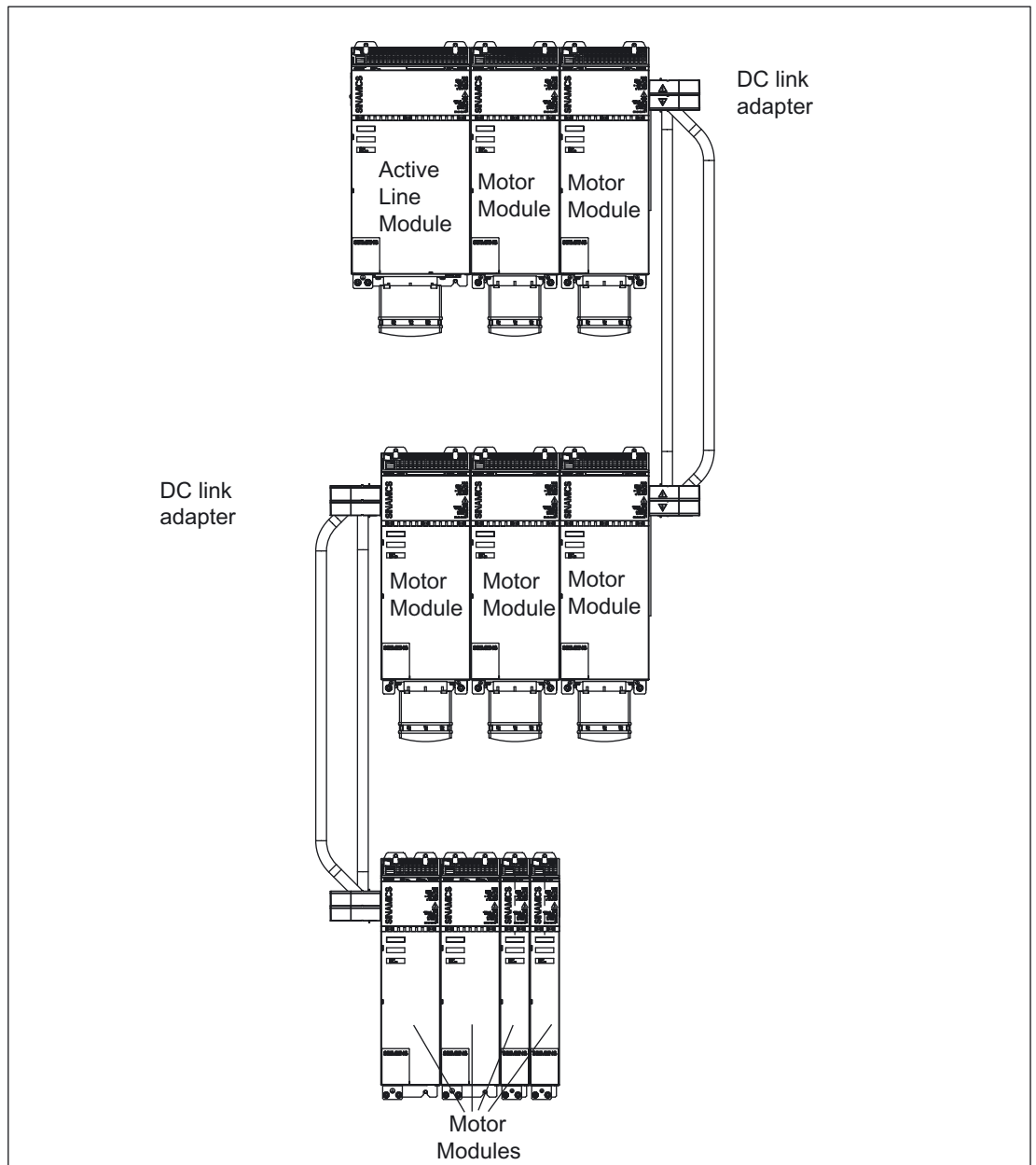


Figure 7-6 Example of a three-tier configuration with modules between 50 and 200 mm wide

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.

In the case of Active Line Modules as of 55 kW, the Motor Modules can be mounted on the right or left (see "DC link adapter").

7.5 Information about electromagnetic compatibility (EMC) and cable laying

7.5.1 General

EMC requirements can be found in EN 60439-1 and recommendations in EN60204-1. The EMC installation guide can be obtained using the order number 6FC5297-□AD30-0AP□. For installing 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
- Only the recommended Siemens power and signal cables are used
- Only cables from Siemens must be used for DRIVE-CLiQ connections.

For MOTION-CONNECT cables see catalog D21.1 or D21.2

Caution

No cables or couplings that you have prefabricated yourself must be used for DRIVE-CLiQ connections.

7.5.2 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

The EMC measures described above ensure CE compliance with the EMC Directive. 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 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.

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 7-10 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	

Caution

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

Caution

Unshielded signal cables must not be routed parallel to power cables.

Table 7-11 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 the power cables in the drive line-up comprising: motor power cables, DC link cable(s), and the power supply cable from the line filter output	350 (shielded) 560 (unshielded)
Total length: motor cables, power supply cable from the Basic Line Filter to the Active Line Module	< 150
Total cable length with VCM	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 Module and motor 18 A	70 (shielded) 100 (unshielded)
Power cable between Motor Module and motor ≤ 30 A	50 (shielded) 75 (unshielded)
Power cable between Motor Module and motor ≥ 45 A	100 (shielded) 150 (unshielded)
DRIVE-CLiQ signal cables MC500	100
DRIVE-CLiQ signal cables MC800	50
DRIVE-CLiQ signal cables FIX	100
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.

7.5.3 Equipotential bonding

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

If, for example, the PROFIBUS or DRIVE-CLiQ cable is routed through several cabinets, the "PROFIBUS equipotential bonding conductor connection" on the control unit interface must be used for connecting the equipotential bonding conductor. A finely stranded copper conductor with a 4 mm² cross-section must be used. This conductor must be routed together with the PROFIBUS cable.

Equipotential Bonding and Shielding for PROFIBUS

The cable shield must be connected over a large contact surface area.

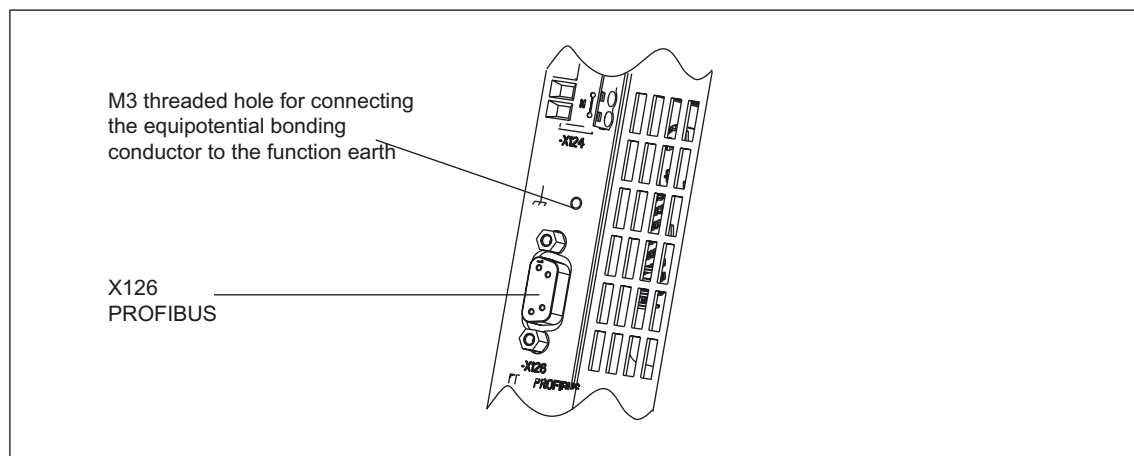


Figure 7-7 Functional ground connection for PROFIBUS

7.6 Connection methods

7.6.1 Spring-Loaded Terminals/Screw Terminals

Connectable conductor cross-sections of spring-loaded terminals

Table 7-12 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 mm ² to 1.5 mm ² 0.25 mm ² to 1.5 mm ² 0.25 mm ² to 0.5 mm ²
	Insulation stripping length	7 mm	
	Tool	Screwdriver 0.4 x 2.0 mm	
2	Connectable conductor cross-sections	Flexible	0.08 mm ² to 2.5 mm ²
	Insulation stripping length	8 to 9 mm	
	Tool	Screwdriver 0.4 x 2.0 mm	

Connectable conductor cross-sections of screw terminals

Table 7-13 Screw terminals

Screw terminal type			
1	Connectable conductor cross-sections	Flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.14 mm ² to 1.5 mm ² 0.25 mm ² to 1.5 mm ² 0.25 mm ² to 0.5 mm ²
	Insulation stripping length	7 mm	
	Tool	Screwdriver 0.4 x 2.0 mm	
	Tightening torque	0.22 to 0.25 Nm	
2	Connectable conductor cross-sections	Flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.2 mm ² to 2.5 mm ² 0.25 mm ² to 1 mm ² 0.5 mm ² to 1 mm ²
	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 mm ² to 2.5 mm ² 0.25 mm ² to 1 mm ² 0.25 mm ² to 1 mm ²
	Insulation stripping length	9 mm	
	Tool	Screwdriver 0.6 x 3.5 mm	
	Tightening torque	0.5 to 0.6 Nm	

7.6 Connection methods

Screw terminal type			
4	Connectable conductor cross-sections	Flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.2 mm ² to 4 mm ² 0.25 mm ² to 4 mm ² 0.25 mm ² to 4 mm ²
	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 mm ² to 6 mm ² 0.5 mm ² to 6 mm ² 0.5 mm ² to 6 mm ²
	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 mm ² to 10 mm ² 0.5 mm ² to 10 mm ² 0.5 mm ² to 10 mm ²
	Insulation stripping length	11 mm	
	Tool	Screwdriver 1.0 x 4.0 mm	
	Tightening torque	1.5 to 1.8 Nm	

7.6.2 Motor connector

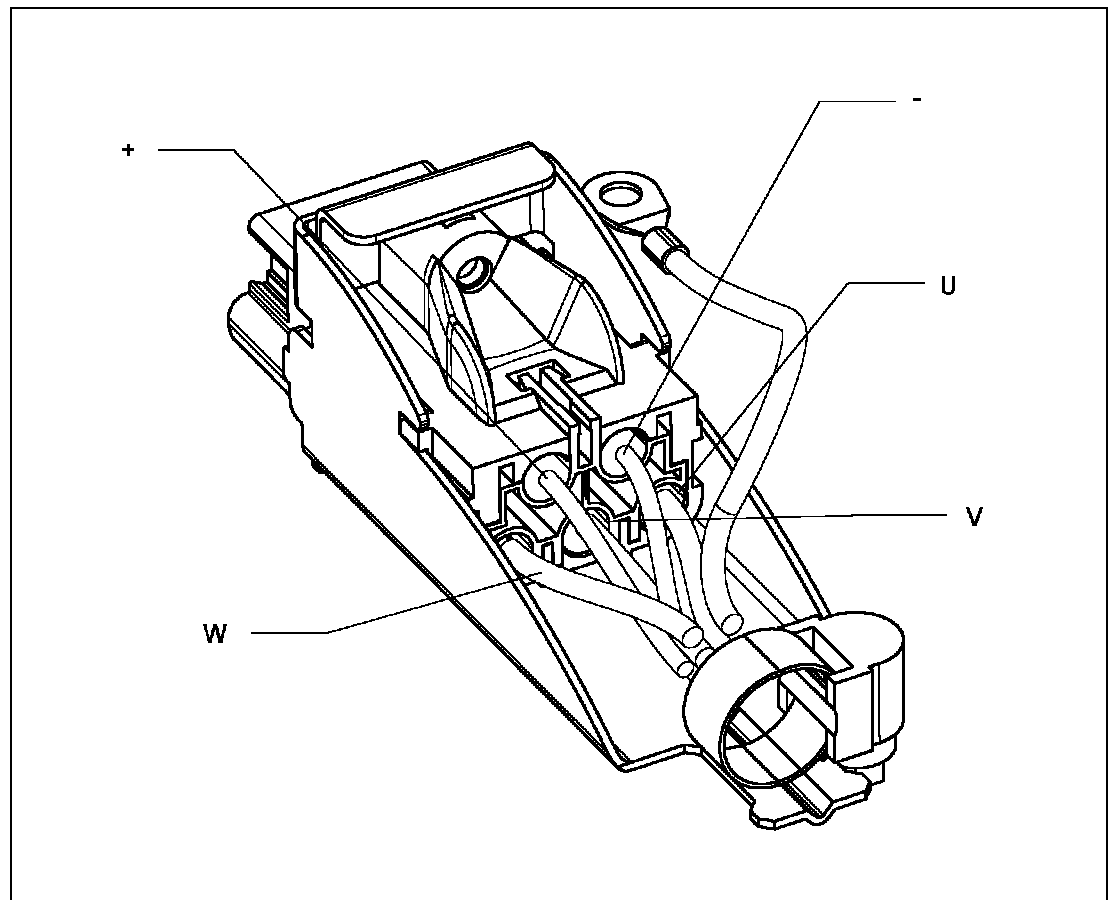


Figure 7-8 Motor Connector

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.

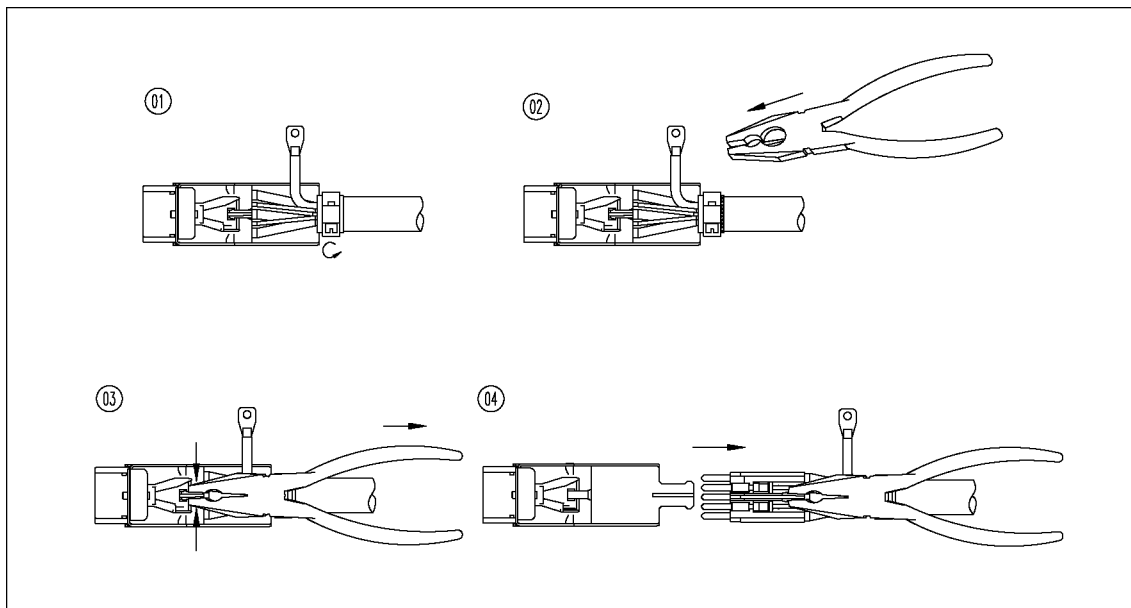


Figure 7-9 Removing the motor connector

The following figure shows how the motor connector is coded to prevent incorrect connection (especially relevant for Double Motor Modules).

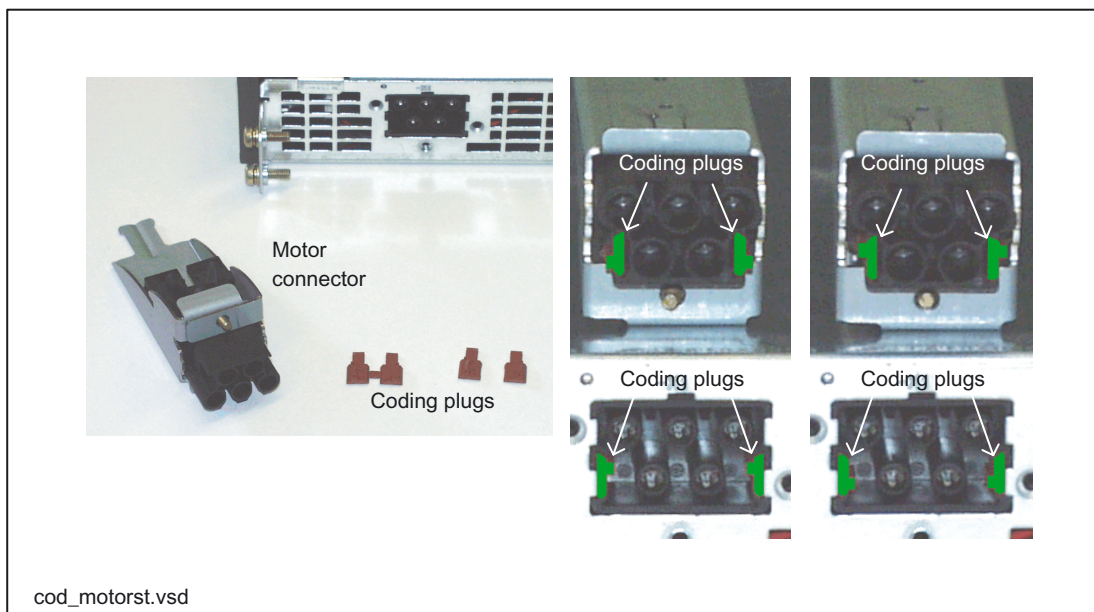


Figure 7-10 Coding the motor connector

The coding plugs are supplied with the motor cables.

7.6.3 Power connector (X1/X2)

with screw terminal

Structure and assembly

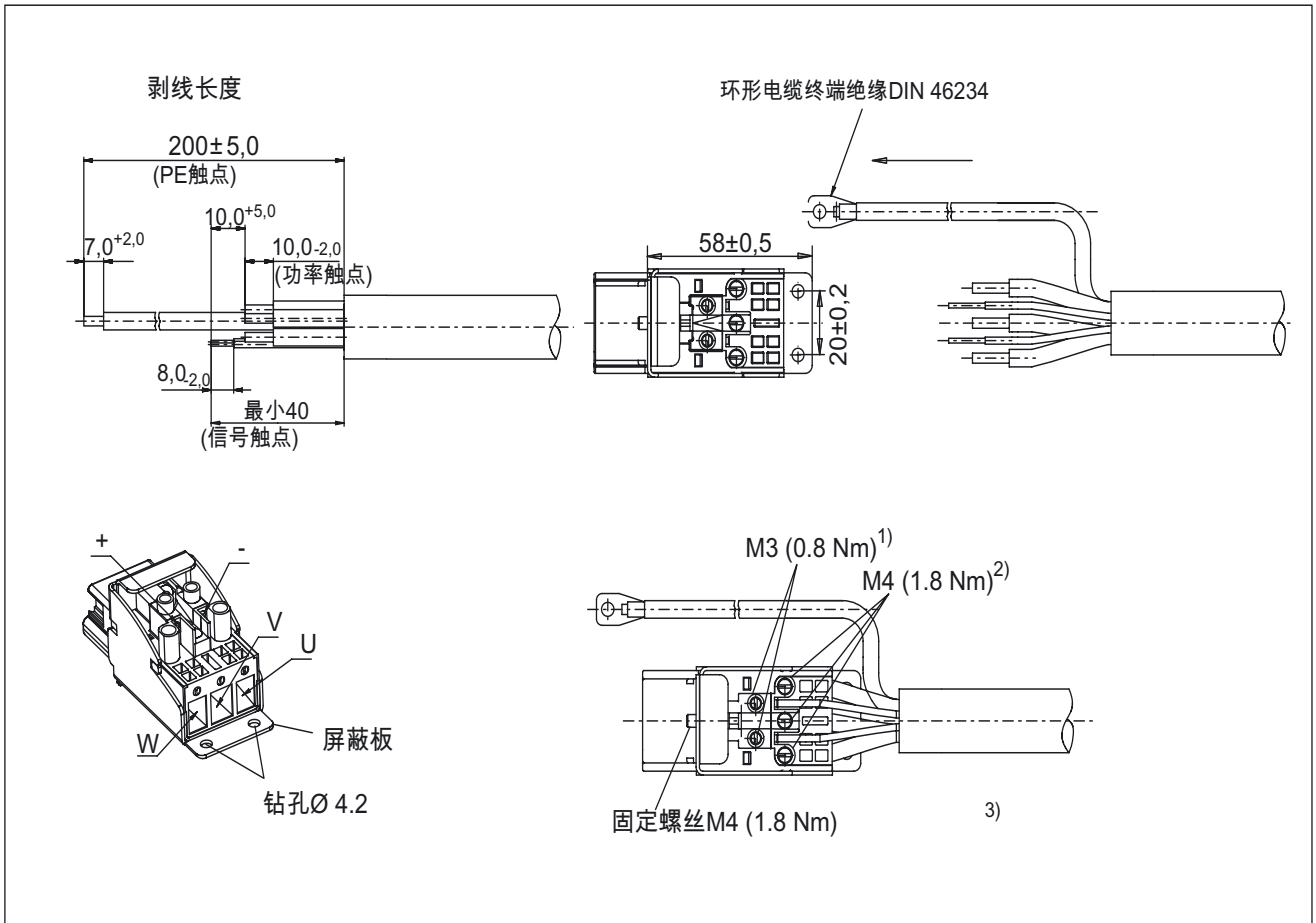


Figure 7-11 Structure and installation of the power supply connector (X1/X2)

Screwdriver

1) SZS 0.6 x 3.5

2) SZS 1.0 x 4.0

3) Torx TX20

Various options are available for the shield contact:

- 5. 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

- 6. Customer-specific shield contact

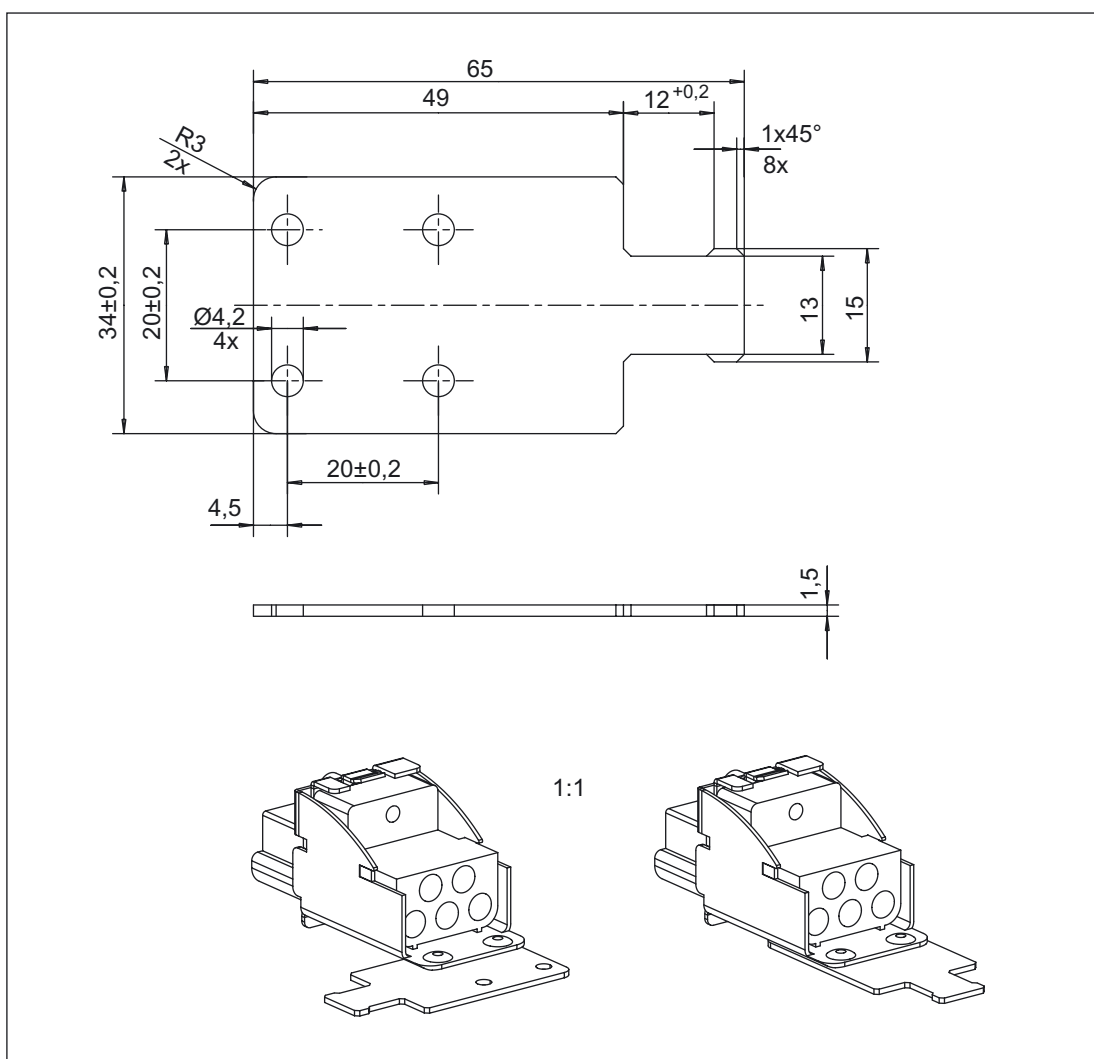


Figure 7-12 Example of a customer-specific metal shield contact
With both variants, the shield for the brake terminal wires must be applied together with the cable shield.

- 7. Securing a shield contact constructed by the customer on the shield plate.

7.6.4 24-V terminal adapter

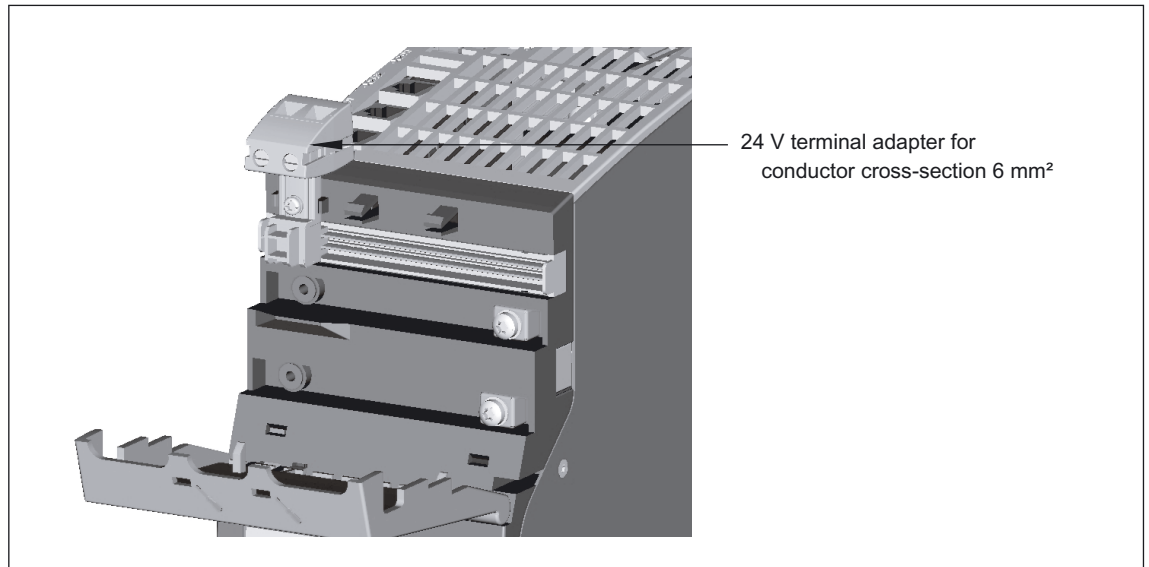


Figure 7-13 24 V terminal adapter

The terminal adapter can be fitted to any power module. To do so, a recess must be provided on the protective cover of the DC link using suitable pliers.

24 V terminal adapter for a conductor cross-section of 6 mm².
Supplied with the line modules and control supply modules.

7.7 Cooling

7.7.1 General

The following devices are available as cooling equipment:

- filtered fans
- heat exchangers or
- cooling units.

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

The 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 reduce the service life of the equipment and result in premature component failure.

You must take into account the following specifications when installing a SINAMICS drive line-up:

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

Table 7-14 Ventilation clearances above and below the components

Component	Order number	Clearance [mm]
CU320	6SL3040-0MA00-0AAx	80
SMCxx	6SL3055-0AA00-5xAx	50
TM31	6SL3055-0AA00-3AAx	50
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 Smart Line Module 5 kW – 36 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 – 36 kW	6SL3130-6AExx-0AAx	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

The specifications regarding ventilation clearances for two-tier configurations are provided in Drive Line-Up.

Note

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

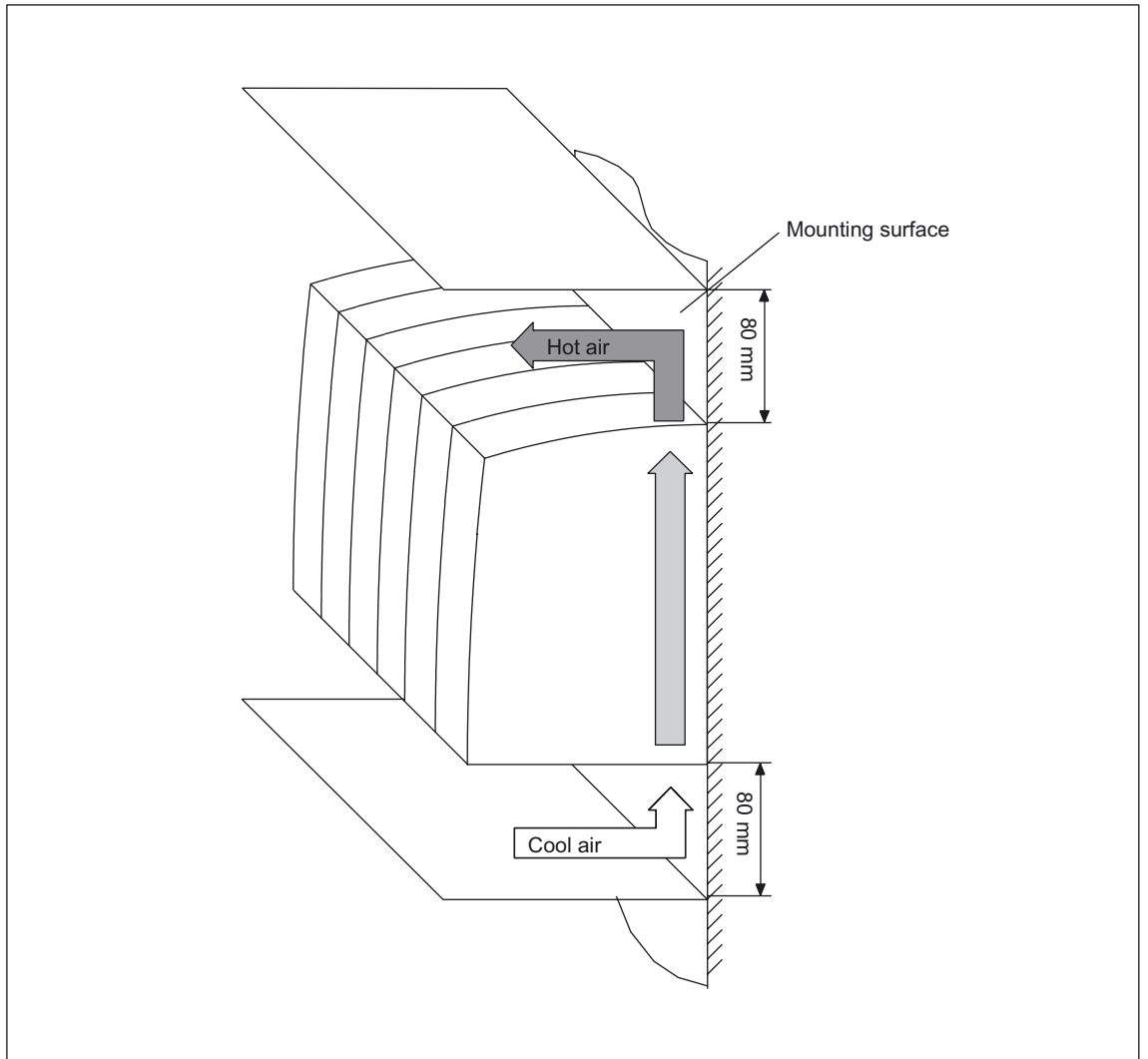


Figure 7-14 Clearances for booksize drive line-up with internal air cooling

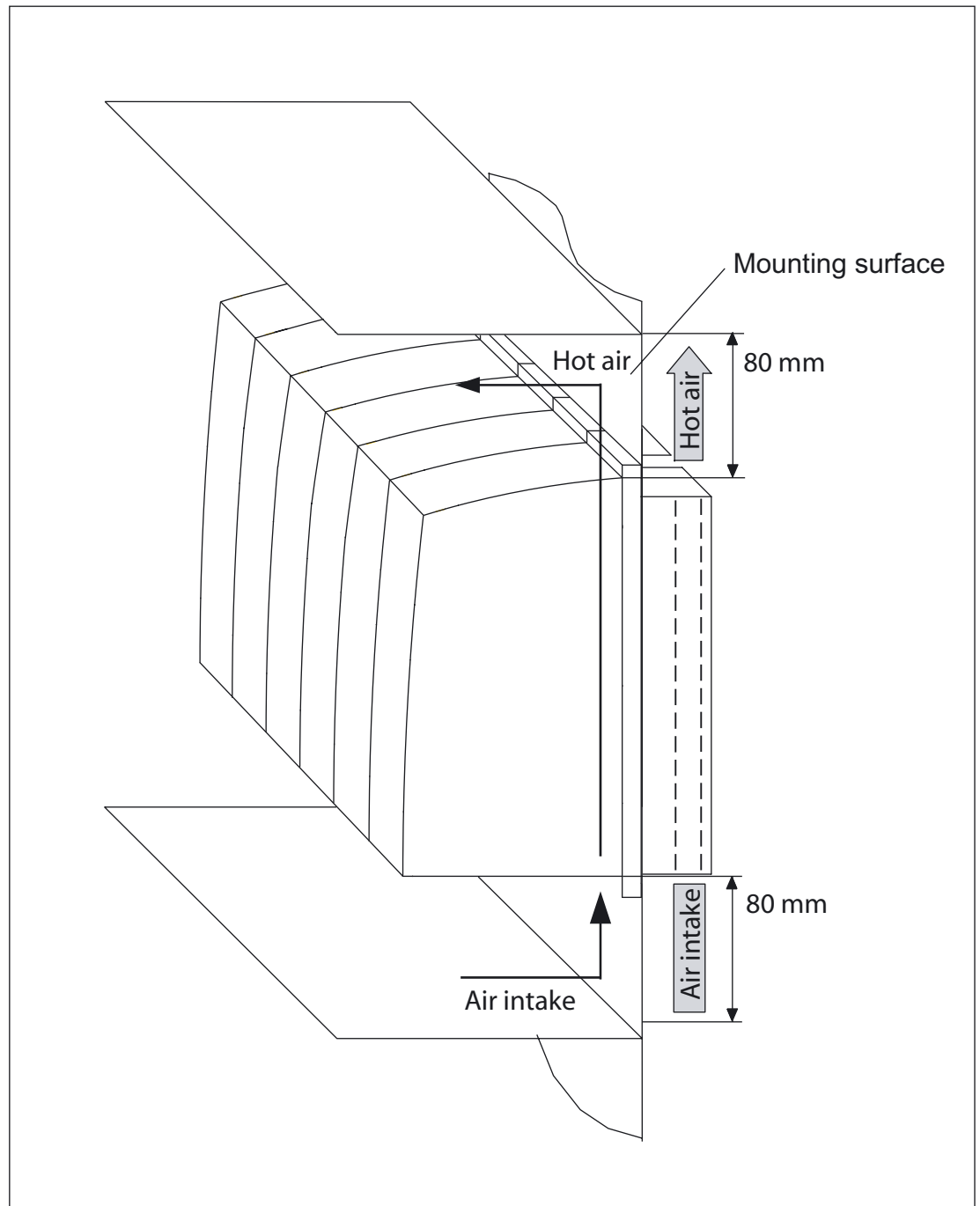


Figure 7-15 Clearances for booksize drive line-up with external air cooling

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).

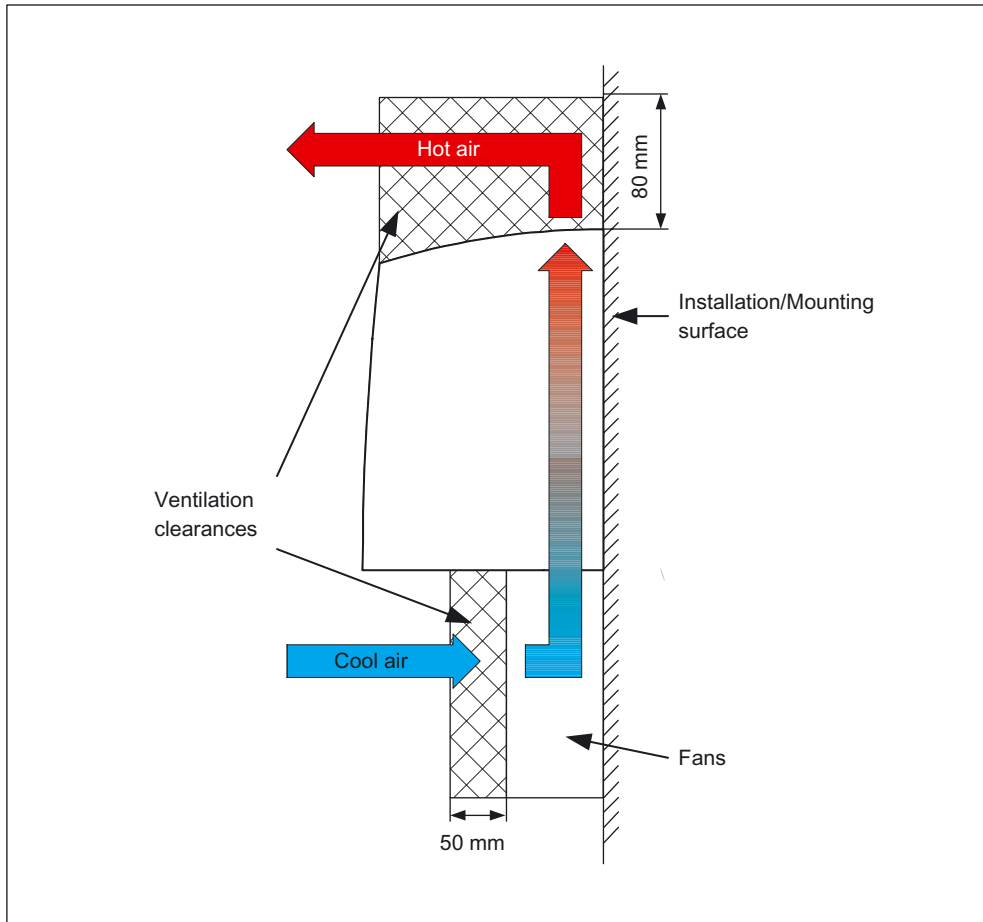


Figure 7-16 Ventilation clearances for 300 mm modules

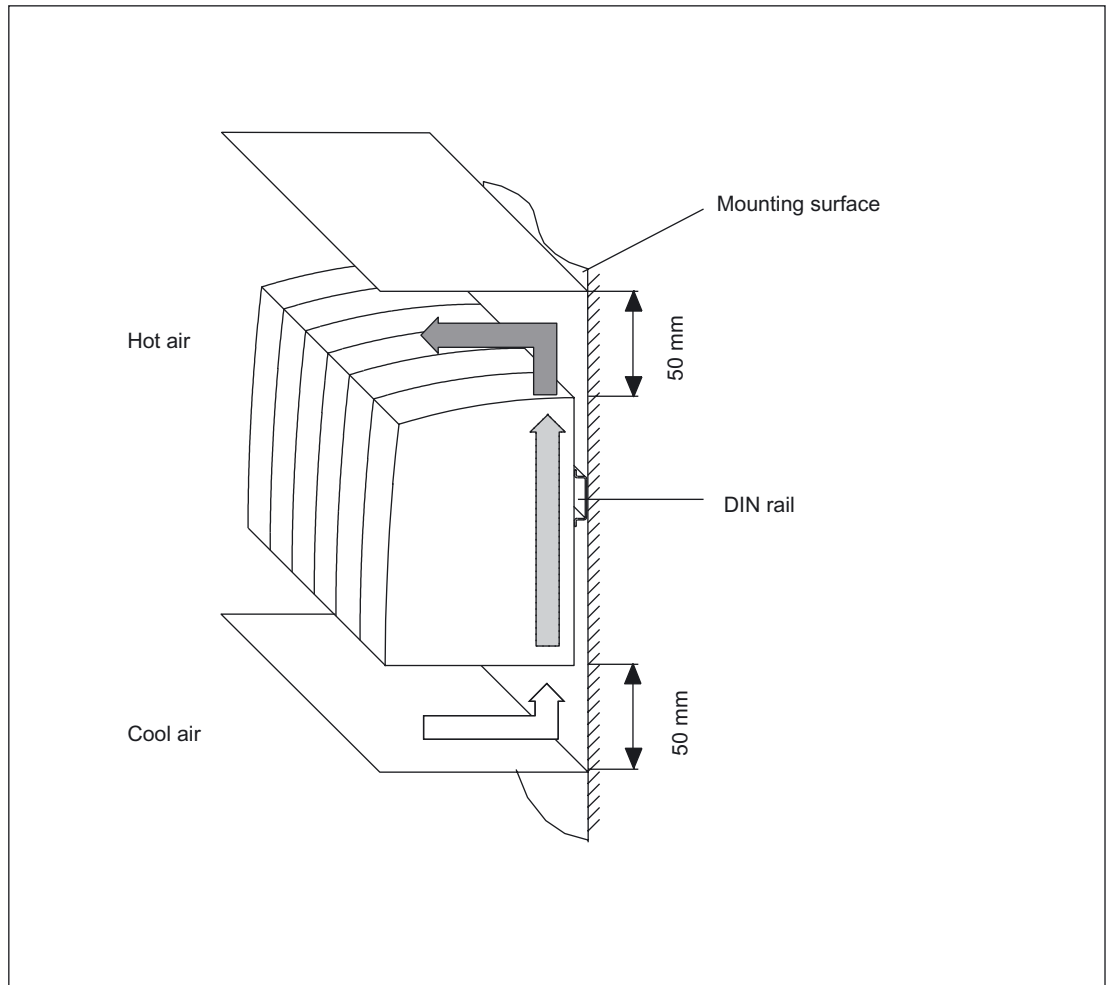


Figure 7-17 Ventilation clearances for DIN rail modules

7.7.2 Information about ventilation

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

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

If filtered fans, heat exchangers, or air conditioners are used, you must ensure that the air is flowing in the right direction. You must also ensure that the warm air can escape at the top. A ventilation clearance of at least 80 mm above and below must be observed.

Note

Cables must not be routed on the modules; the ventilation grilles must not be covered.

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

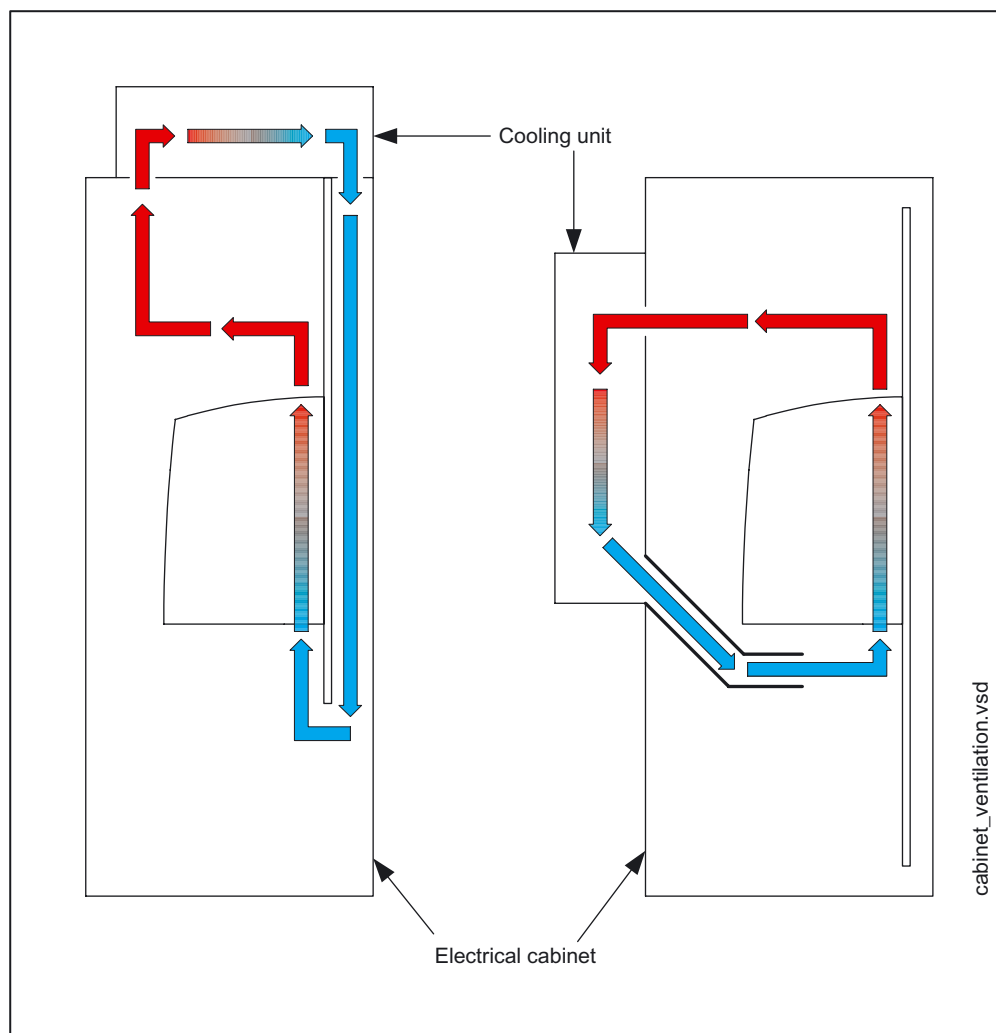


Figure 7-18 Examples of cabinet ventilation

Caution

The air guidance and arrangement of the cooling equipment must be chosen in such a way as to prevent condensation from forming.

If necessary, cabinet enclosure heating may have to be installed.

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

7.7.3 Power loss of components in rated operation

The following table shows the power loss for components with internal cooling. 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

Table 7-15 Overview of power losses

	Unit	Power loss
Control Units and Option Boards		
CU320	W	20
TB30	W	< 3
CBC10	W	< 3
CBE20	W	2.8
Basic Line Filter for Active Line Modules		
16 kW	W	16
36 kW	W	28
55 kW	W	41
80 kW	W	48
120 kW	W	95
Wideband Line Filter for Active Line Modules		
16 kW	W	70
36 kW	W	90
55 kW	W	110
80 kW	W	150
120 kW	W	200

7.7 Cooling

	Unit	Power loss
Wideband Line Filter for Smart Line Modules		
5 kW	W	5
10 kW	W	9
16 kW	W	16
36 kW	W	28
Line reactors for Active Line Modules		
16 kW	W	170
36 kW	W	250
55 kW	W	350
80 kW	W	450
120 kW	W	590
Line reactors for Smart Line Modules		
5 kW	W	62
10 kW	W	116
16 kW	W	110
36 kW	W	170
Sensor Modules		
SMC20	W	< 10
Additional system components		
TM 15	W	< 3
TM31	W	< 10
CBE20	W	2.81
DC link components		
Braking Module	W	20
Capacitor Module	W	25
Control Supply Module	W	< 105
Voltage Clamping Module	W	50

The sum of the losses of the various power components (Active Line Module, Smart Line Module, Motor Module) is calculated from the power losses (following table) and electronic losses (next table but one).

Overview: power loss with internal cooling

Table 7-16 Overview: power loss with internal cooling

	Unit	Power loss
Active Line Modules		
16 kW	W	260
36 kW	W	630
55 kW	W	900
80 kW	W	1350
120 kW	W	2200
Smart Line Modules		
5 kW	W	89
10 kW	W	170
16 kW	W	165
36 kW	W	370
Single Motor Modules		
3 A	W	30
5 A	W	55
9 A	W	80
18 A	W	165
30 A	W	290
45 A	W	430
60 A	W	590
85 A	W	750
132 A	W	1250
200 A	W	2050
Double Motor Modules		
2x3 A	W	70
2x5 A	W	105
2x9 A	W	160
2x18 A	W	320

7.7 Cooling

Overview: power loss with external cooling

Table 7-17 Overview: power loss with external cooling

	Unit	Internal power loss	External power loss	Total power loss
Active Line Modules				
16 kW	W	60	200	260
36 kW	W	135	495	630
55 kW	W	200	700	900
80 kW	W	305	1045	1350
120 kW	W	490	1710	2200
Smart Line Modules				
5 kW	W	39	50	89
10 kW	W	65	105	170
Single Motor Modules				
3 A	W	15	15	30
5 A	W	23	30	53
9 A	W	35	45	80
18 A	W	75	90	165
30 A	W	80	210	290
45 A	W	110	320	430
60 A	W	135	455	590
85 A	W	160	590	750
132 A	W	250	1000	1250
200 A	W	435	1615	2050
Double Motor Modules				
2x3 A	W	35	35	70
2x5 A	W	45	60	105
2x9 A	W	65	95	160
2x18 A	W	80	240	320

Electronic losses of Motor Modules/Line Modules

Table 7-18 Electronic losses of Motor Modules/Line Modules

Component		Internal/external cooling	
		Current consumption [A]	Power loss [W]
Motor Modules	3A	0.85	20.4
	5A	0.85	20.4
	9A	0.85	20.4
	18A	0.85	20.4
	30A	0.9	21.6
	45A	1.2	28.8
	60A	1.2	28.8
	85A	1.5	36.0
	132A	1.5	36.0
	200A	1.5	36.0
	2x3A	1	24.0
	2x5A	1	24.0
	2x9A	1	24.0
	2x18A	1	24.0
Active Line Modules	16kW	1.1	26.4
	36kW	1.5	36.0
	55kW	1.9	45.6
	80kW	1.5	36.0
	120kW	2.5	60.0
Smart Line Module	5kW	1	24.0
	10kW	1.3	31.2
	16kW	1.1	26.4
	36kW	1.5	36.0

7.7.4 Dimensioning Climate Control Equipment

Cabinet manufacturers provide calculation programs for selecting climate control equipment. It is always necessary to know the power loss of the components and equipment installed in the cabinet.

The physical relationship is shown in the following example.

$$q = \frac{Q}{\Delta T} - k * A$$

Figure 7-19 Example of dimensioning climate control equipment

q = thermal power that has to be dissipated through a cooling unit [W / K]

Q = power loss [W]

ΔT = temperature difference between the room and cabinet interior [K]

k = thermal resistance value, e.g. sheet-steel, painted 5.5 [W / (m² * K)]

A = free-standing cabinet surface area [m²]

Table 7-19 Example of a power loss calculation

Component	Number	Power loss [W]	Total power loss [W]
CU320	1	20	20
Line Filters	1	250	250
Line reactor	1	250	250
Active line module 36 kW	1	580	580
Motor module 18 A	2	165	330
Motor module 30 A	3	290	870
Encoders	5	10	50
SITOP 20	1	53	53
Line Contactor	1	12	12
Total:			2415

Assumption:

Free-standing cabinet surface area A = 5 m²

Temperature difference between the room and cabinet interior ΔT = 10 K

q = (2415 [W] / 10 [K]) - 5.5 [W / (m² * K)] * 5 [m²] = 214 [W/K]

Service and Support Booksize

8.1 Technical Support

Technical Support

If you have any further questions, please call our hotline:

A&D Technical Support
Tel.: +49 (0) 180 5050 – 222
Fax: +49 (0) 180 5050 – 223
email: adsupport@siemens.com

Please send any questions about the documentation (suggestions for improvement, corrections, and so on) to the following fax number or e-mail address:

Fax: +49 (0) 9131 98 – 2176
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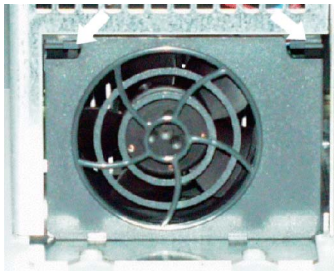
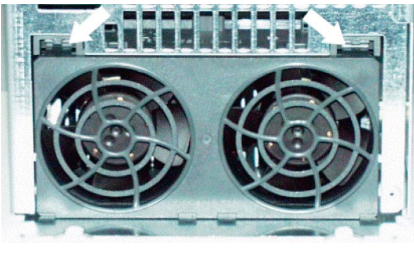

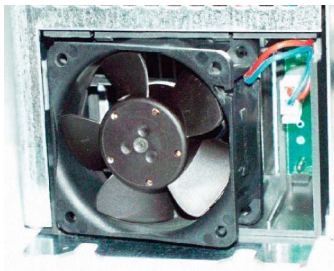
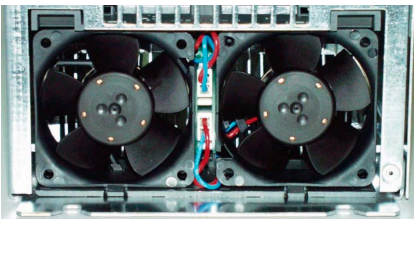
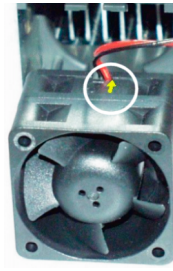
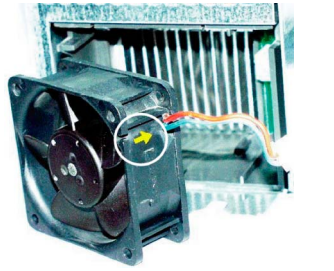
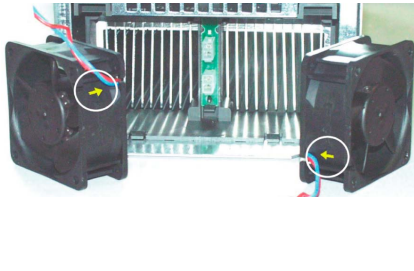
8.2 Replacing Fans

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)!

Removing the fan:

<ol style="list-style-type: none"> 1. Disconnect the power supply (24 V DC and 400 V AC) Wait 5 minutes while the DC link energy discharges! 2. Remove the component from the drive line-up. 3. Open the fan cover. 		
Module width: 50 mm	Module width: 100 mm	Module width: 150 mm and 200 mm
		
<ol style="list-style-type: none"> 4. Remove the fan. 5. Remove the connector. 		
		
		

Replacing a fan in a module with a width of 300 mm: See: Motor Modules with Internal Air Cooling – Installation

Installing the fan:

1. Before installing the fan, check the through-flow direction (the arrow on the fan must point towards the fins).
2. Insert the connector fully.
3. Insert the fan fully.
Do not squash the connection cables!
4. Close the fan cover.

8.3 Spare parts

Table 8-1 List of spare parts for SINAMICS S120 (as at: October 08, 2003)

	Order number
Control Unit 320	6SL3040-0MA00-0AA1
24 V DC 4-pin tee unit (X124)	6SL3065-2AA00-0AA0
CU320 terminals (X122 or X132)	6SL3064-2AB00-0AA0
Protective cover for CU320	6SL3064-3AB00-0AA0
Cover (CU board)	6SL3064-3BB00-0AA0
Option slot protective cover for CU320	6SL3064-3CB00-0AA0
TB30	6SL3055-0AA00-2TA0
24 V DC 4-pin tee unit (X424)	6SL3065-2AA00-0AA0
TB30 terminal block (X481, X482, and X424)	6SL3065-2BA00-0AA0
TM31	6SL3055-0AA00-3AA0
24 V DC 4-pin tee unit (X524)	6SL3065-2AA00-0AA0
TM31 terminal block (X520, X521, X522, X530, X540, X541, X542, and X524)	6SL3065-2MB00-0AA0
SMC10	6SL3055-0AA00-5AA0
24 V DC 4-pin tee unit (X524)	6SL3065-2AA00-0AA0
SMC20	6SL3055-0AA00-5BA1
24 V DC 4-pin tee unit (X524)	6SL3065-2AA00-0AA0
SMC30	6SL3055-0AA00-5CA0
24 V DC 4-pin tee unit (X524)	6SL3065-2AA00-0AA0
SMC30 terminal block (X521, X531, and X524)	6SL3065-2CB00-0AA0
Line modules	
5kW smart line module (50mm)	6SL3130-6AE15-0AA0
10kW smart line module (50mm)	6SL3130-6AE21-0AA0
Line module terminal block, 4 pole (X21)	6SL3162-2EA00-0AA0
24 V terminal adapter (X24)	6SL3162-2AA00-0AA0
Plastic inserts (CU<->line module)	6SL3064-3DB00-0AA0
Fan for 50mm line/motor module (incl. fan cover)	6SL3162-0AB00-0AA0
DC link cover for 50mm line/motor module	6SL3162-3AB00-0AA0
16kW smart line module (100mm)	6SL3130-6TE21-6AA0
16kW active line module (100mm)	6SL3130-7TE21-6AA1
Line module terminal block, 4 pole (X21)	6SL3162-2EA00-0AA0
24 V terminal adapter (X24)	6SL3162-2AA00-0AA0
Plastic inserts (CU<->line module)	6SL3064-3DB00-0AA0

8.3 Spare parts

	Order number
Fan for 100mm line/motor module (incl. fan cover)	6SL3162-0AD00-0AA0
DC link cover for 100mm line/motor module	6SL3162-3AD00-0AA0
36kW smart line module (150mm)	6SL3130-6TE23-6AA0
36kW active line module (150mm)	6SL3130-7TE23-6AA1
Line module terminal block, 4 pole (X21)	6SL3162-2EA00-0AA0
24 V terminal adapter (X24)	6SL3162-2AA00-0AA0
Plastic inserts (CU<>line module)	6SL3064-3DB00-0AA0
Fan for 150mm line/motor module (incl. fan cover)	6SL3162-0AF00-0AA0
DC link cover for 150mm line/motor module	6SL3162-3AF00-0AA0
Terminal board cover for 150mm smart/active line module	6SL3163-3CF00-0AA0
55kW active line module (200mm)	6SL3130-7TE25-5AA1
Line module terminal block, 4 pole (X21)	6SL3162-2EA00-0AA0
24 V terminal adapter (X24)	6SL3162-2AA00-0AA0
Plastic inserts (CU<>line module)	6SL3064-3DB00-0AA0
Fan for 200mm line/motor module (incl. fan cover)	6SL3162-0AH00-0AA0
DC link cover for 200mm line/motor module	6SL3162-3AH00-0AA0
Terminal board cover for 200mm/300mm smart/active line module	6SL3163-3CM00-0AA0
80kW active line module (300mm)	6SL3130-7TE28-0AA0
120kW active line module (300mm)	6SL3130-7TE31-2AA0
Line module terminal block, 4 pole (X21)	6SL3162-2EA00-0AA0
24 V terminal adapter (X24)	6SL3162-2AA00-0AA0
Plastic inserts (CU<>line module)	6SL3064-3DB00-0AA0
Fan for 300mm line/motor module	6SL3162-0AM00-0AA0
DC link cover for 300mm line/motor module	6SL3162-3AM00-0AA0
Terminal board cover for 200mm/300mm smart/active line module	6SL3163-3CM00-0AA0
Motor modules	
3A single motor module (50mm)	6SL3120-1TE13-0AA0
5A single motor module (50mm)	6SL3120-1TE15-0AA0
9A single motor module (50mm)	6SL3120-1TE21-0AA1
18A single motor module (50mm)	6SL3120-1TE21-8AA1
3A double motor module (50mm)	6SL3120-2TE13-0AA0
5A double motor module (50mm)	6SL3120-2TE15-0AA0
9A double motor module (50mm)	6SL3120-2TE21-0AA0
DRIVE-CLiQ cable, IP20/IP20, without 24 V DC, 110 mm	6SL3060-4AB00-0AA0
Safe standstill/KTY84 terminal block, 4-pin (X21 or X22)	6SL3162-2EA00-0AA0
24 V jumper	6SL3162-2AA01-0AA0
Fan for 50mm line/motor module (incl. fan cover)	6SL3162-0AB00-0AA0
DC link cover for 50mm line/motor module	6SL3162-3AB00-0AA0

	Order number
30A single motor module (100mm)	6SL3120-1TE23-0AA1
18A double motor module (100mm)	6SL3120-2TE21-8AA0
DRIVE-CLiQ cable, IP20/IP20, without 24 V DC, 160 mm	6SL3060-4AD00-0AA0
Safe standstill/KTY84 terminal block, 4-pin (X21 or X22)	6SL3162-2EA00-0AA0
24 V jumper	6SL3162-2AA01-0AA0
Fan for 100mm line/motor module (incl. fan cover)	6SL3162-0AD00-0AA0
DC link cover for 100mm line/motor module	6SL3162-3AD00-0AA0
45A single motor module (150mm)	6SL3120-1TE24-5AA1
60A single motor module (150mm)	6SL3120-1TE26-0AA1
DRIVE-CLiQ cable, IP20/IP20, without 24 V DC, 210 mm	6SL3060-4AF00-0AA0
Safe standstill/KTY84 terminal block, 4-pin (X21)	6SL3162-2EA00-0AA0
24 V jumper	6SL3162-2AA01-0AA0
Fan for 150mm line/motor module (incl. fan cover)	6SL3162-0AF00-0AA0
DC link cover for 150mm line/motor module	6SL3162-3AF00-0AA0
Terminal board cover for 150mm motor module	6SL3162-3CF00-0AA0
85A single motor module (200mm)	6SL3120-1TE28-5AA1
DRIVE-CLiQ cable, IP20/IP20, without 24 V DC, 260 mm	6SL3060-4AH00-0AA0
Safe standstill/KTY84 terminal block, 4-pin (X21)	6SL3162-2EA00-0AA0
24 V jumper	6SL3162-2AA01-0AA0
Fan for 200mm line/motor module (incl. fan cover)	6SL3162-0AH00-0AA0
DC link cover for 200mm line/motor module	6SL3162-3AH00-0AA0
Terminal board cover for 200mm/300mm motor module	6SL3162-3CM00-0AA0
132A single motor module (300mm)	6SL3120-1TE31-3AA0
200A single motor module (300mm)	6SL3120-1TE32-0AA0
DRIVE-CLiQ cable, IP20/IP20, without 24 V DC, 360 mm	6SL3060-4AM00-0AA0
Safe standstill/KTY84 terminal block, 4-pin (X21)	6SL3162-2EA00-0AA0
24 V jumper	6SL3162-2AA01-0AA0
Fan for 300mm line/motor module	6SL3162-0AM00-0AA0
DC link cover for 300mm line/motor module	6SL3162-3AM00-0AA0
Terminal board cover for 200mm/300mm motor module	6SL3162-3CM00-0AA0
Line filters	
For active line module 16 kW	6SL3000-0BE-21-6AA0
For active line module 36 kW	6SL3000-0BE-23-6AA0
For active line module 55 kW	6SL3000-0BE-25-5AA0
For active line module 80 kW	6SL3000-0BE-28-0AA0
For active line module 120 kW	6SL3000-0BE-31-2AA0
For smart line module 5 kW	6SL3000-0HE-15-0AA0
For smart line module 10 kW	6SL3000-0HE-21-0AA0

8.3 Spare parts

	Order number
Line reactors	
For active line module 16 kW	6SN1111-0AA00-0BA1
For active line module 36 kW	6SN1111-0AA00-0CA1
For active line module 55 kW	6SN1111-0AA00-0DA1
For active line module 80 kW	6SN1111-0AA00-1EA0
For active line module 120 kW	6SN1111-0AA00-1FA0
For smart line module 5 kW	6SL3000-0CE-15-0AA0
For smart line module 10 kW	6SL3000-0CE-21-0AA0
DC link components	
Braking module (50mm)	
X1	Available on request
X21	Available on request
24 V jumper	6SL3162-2AA01-0AA0
DC link cover for 50mm line/motor module	6SL3162-3AB00-0AA0
Capacitor module (100mm)	
24 V jumper	6SL3162-2AA01-0AA0
DC link cover for 100mm line/motor module	6SL3162-3AD00-0AA0
Control supply module (50mm)	
24 V terminal adapter (X24)	6SL3162-2AA00-0AA0
24 V jumper	6SL3162-2AA01-0AA0
DC link cover for 50mm line/motor module	6SL3162-3AB00-0AA0

A

List of Abbreviations

Table A-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
ALM	Active Line Module	Active Line Module
AO	Analogausgang	Analog Output
AOP	Advanced Operator Panel	Advanced Operator Panel
ASC	Ankerkurzschluss	Armature Short-Circuit
ASCII	Amerikanische Code-Norm für den Informationsaustausch	American Standard Code for Information Interchange
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	Berufsgenossenschaftliches Institut für Arbeitssicherheit (German Institute for Occupational Safety)
BICO	Binektor-Konnektor-Technologie	Binector Connector Technology
BLM	Basic Line Module	Basic Line Module
BOP	Basic Operator Panel	Basic Operator Panel
C		
C	Kapazität	Capacitance
C...	Safety-Meldung	Safety message
CAN	Controller Area Network	Controller Area Network
CBC	Kommunikationsbaugruppe CAN	Communication Board CAN
CBP	Kommunikationsbaugruppe PROFIBUS	Communication Board PROFIBUS
CD	Compact Disc	Compact Disc
CDS	Befehlsdatensatz	Command Data Set
CI	Konnektoreingang	Connector Input
CNC	Computergestützte 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

List of Abbreviations

Abbreviation	German	English
COM	Mittelkontakt eines Wechselkontaktes	Mid-position contact of a changeover contact
CP	Kommunikationsprozessor	Communications Processor
CPU	Zentralbaugruppe	Central Processing Unit
CRC	Checksummenprüfung	Cyclic Redundancy Check
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
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
I		
EDS	Geberdatensatz	Encoder Data Set
EGB	Elektrostatisch gefährdete Baugruppen	Electrostatic Sensitive Devices (ESD)
EMK	Elektromagnetische Kraft	Electromagnetic force
EMC	Elektromagnetische Verträglichkeit	Electromagnetic Compatibility
EN	Europäische Norm	European Standard
EnDat	Geber-Schnittstelle	Encoder-Data-Interface
EP	Impulsfreigabe	Enable Pulses
ES	Engineering System	Engineering System
ESR	Erweitertes Stillsetzen und Rückziehen	Extended Stop and Retract
F		
F...	Störung	Fault
FAQ	Häufig gestellte Fragen	Frequently Asked Questions
FCC	Function Control Chart	Function Control Chart
FCC	Flussstromregelung	Flux Current Control
FEPROM	Schreib- und Lesespeicher nichtflüchtig	Flash-EPROM
FG	Funktionsgenerator	Function Generator
FI	Fehlerstrom-Schutzschalter	Residual-Current Circuit-Breaker (RCCB)
FP	Funktionsplan	Function diagram
FW	Firmware	Firmware
G		
GC	Global-Control-Telegram (Broadcast-Telegramm)	Global Control Telegram (broadcast telegram)
GSD	Gerätestamdatei: beschreibt die Merkmale eines PROFIBUS-Slaves	Device master file: describes the features of a PROFIBUS slave
GSV	Gate Supply Voltage	Gate Supply Voltage

Abbreviation	German	English
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
IGBT	Bipolartransistor mit isolierter Steuerelektrode	Insulated Gate Bipolar Transistor
IL	Impulslöschung	Pulse suppression
IT	Drehstromversorgungsnetz ungeerdet	Insulated three-phase supply
J		
JOG	Tippen	Jogging
K		
KDV	Kreuzweiser Datenvergleich	Data cross-checking
KIP	Kinetische Pufferung	Kinetic buffering
Kp	Proportionalverstärkung	Proportional gain
KTY	Spezieller Temperatursensor	Positive temperature coefficient temperature sensor
L		
L	Induktivität	Inductance
LED	Leuchtdiode	Light Emitting Diode
LSB	Niederwertigstes Bit	Least Significant Bit
LSS	Netzschalter	Line Side Switch
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
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 measurement and control in chemical industries
NC	Öffner	Normally Closed contact

List of Abbreviations

Abbreviation	German	English
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
O		
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
PcCtrl	Steuerungshoheit	Master Control
PDS	Leistungssteildatensatz	Power Module Data Set
PE	Schutzerde	Protective Earth
PELV	Schutzkleinspannung	Protective Extra Low Voltage
PG	Programmiergerät	Programming device
PI	Proportional Integral	Proportional Integral
PID	Proportional Integral Differential	Proportional Integral Differential
PLC	Speicherprogrammierbare Steuerung (SPS)	Programmable Logic Controller
PLL	Baustein zur Synchronisierung	Phase Locked Loop
PNO	PROFIBUS Nutzerorganisation	PROFIBUS user organisation
PRBS	Weißes Rauschen	Pseudo Random Binary Signal
PROFIBUS	Serieller Datenbus	Process Field Bus
PS	Stromversorgung	Power Supply
PTC	Positiver Temperaturkoeffizient	Positive Temperature Coefficient
PTP	Punkt-zu-Punkt	Point To Point
PWM	Pulsweitenmodulation	Pulse Width Modulation
PZD	PROFIBUS Prozessdaten	PROFIBUS process data
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	Recooling 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
S		
S1	Dauerbetrieb	Continuous duty
S3	Aussetzbetrieb	Periodic duty
SBC	Sichere Bremsenansteuerung	Safe Brake Control
SBH	Sicherer Betriebshalt	Safe operating stop

Abbreviation	German	English
SBR	Sichere Bremsrampe	Safe braking ramp
SE	Sicherer Software-Endschalter	Safe software limit switch
SG	Sicher reduzierte Geschwindigkeit	Safely reduced speed
SGA	Sicherheitsgerichteter Ausgang	Safety-related output
SGE	Sicherheitsgerichtetes Eingangssignal	Safe input signal
SH	Sicherer Halt	Safe standstill
SI	Safety Integrated	Safety Integrated
SIL	Sicherheitsintegritätsgrad	Safety Integrity Level
SLM	Smart Line Module	Smart Line Module
SLVC	Geberlose Vektorregelung	Sensorless Vector Control
SM	Sensor Module	Sensor Module
SMC	Sensor Module Cabinet	Sensor Module Cabinet
SN	Sicherer Software-Nocken	Safe software cam
SPC	Sollwertkanal	Setpoint Channel
SPS	Speicherprogrammierbare Steuerung	Programmable Logic Controller (PLC)
STW	PROFIBUS Steuerwort	PROFIBUS Control Word
T		
TB	Terminal Board	Terminal Board
TIA	Totally Integrated Automation	Totally Integrated Automation
TM	Terminal Module	Terminal Module
TN	Drehstromversorgungsnetz geerdet	Grounded three-phase supply
Tn	Nachstellzeit	Integral time
TPDO	Transmit Process Data Object	Transmit Process Data Object
TT	Drehstromversorgungsnetz geerdet	Grounded three-phase supply
TTL	Transistor-Transistor-Logik	Transistor Transistor Logic
U		
UL	Underwriters Laboratories Inc.	Underwriters Laboratories Inc.
USV	Unterbrechungsfreie Stromversorgung	Uninterruptible power supply
V		
VC	Vektorregelung	Vector control
Vdc	Zwischenkreisspannung	DC link voltage
VDE	Verband Deutscher Elektrotechniker	Association of German Electrical Engineers
VDI	VCerband Deutscher Ingenieure	Association of German Electrical Engineers
Vpp	Volt Spitze zu Spitze	Volt peak to peak
VSM	Voltage Sensing Module	Voltage sensing module
W		
WZM	Werkzeugmaschine	Machine tool
X		
XML	Erweiterbare Auszeichnungssprache (Standardsprache für Web-Publishing und Dokumentenmanagement)	Extensible Markup Language
Z		
ZK	Zwischenkreis	DC Link
ZSW	PROFIBUS Zustandswort	PROFIBUS status word

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Order no. 2.111 (German), Version 1.0

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Note

For more information about technical documentation for Safety Integrated, visit the following address:

<http://www.siemens.com/safety>

The following list contains some of the safety-related documentation available.

/LVP/ Low-Voltage Switchgear

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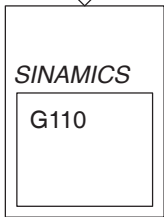
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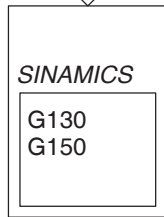
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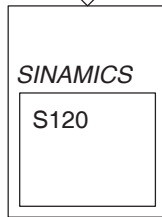
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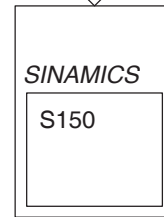
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0.12 – 3 kW



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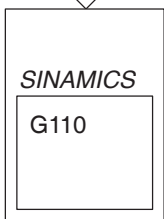


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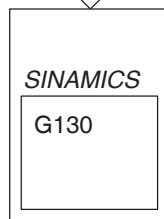


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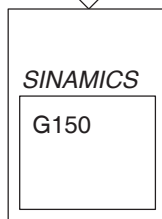
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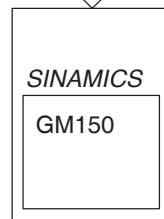
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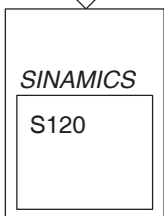


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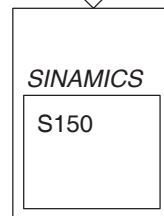


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– List Manual

Manufacturer/Service-Documentation

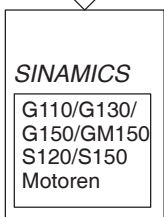


– Getting Started
– Equipment Manual Control Units and Additional System Components
– Equipment Manual Booksize Power Sections
– Equipment Manual Booksize Power Sections Cold-Plate
– Equipment Manual Chassis Power Sections
– Installation & Start-Up Manual
– Installation & Start-Up Manual CANopen
– Function Manual
– List Manual

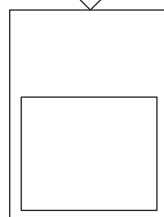


– Operating Instructions
– List Manual

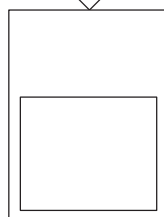
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