Equipment Manual 07/2007

SINAMICS S120
Booksize Power Units

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S120
SINAMICS S120 Booksize Power Units

Equipment 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

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

Disclaimer of Liability

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

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℗ 07/2007

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Foreword

SINAMICS Documentation

The SINAMICS documentation is organized in 2 parts:

- General Documentation / Catalogs
- Manufacturer/Service Documentation

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

http://www.siemens.com/motioncontrol

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

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

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

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

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

Usage phases

Table 1 Usage phase and the available documents/tools

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

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

Target group

This Manual addresses planners, installation technicians, design engineers.

Benefits

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

Standard scope

This documentation only describes the functionality of the standard version. Extensions or changes made by the machine tool manufacturer are documented by the machine tool manufacturer.
Other functions not described in this documentation might be able to be executed in the drive system. This does not, however, represent an obligation to supply such functions with a new control or when servicing.

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

Technical Support

If you have any questions, please get in touch with our Hotline:

	Europe/Africa
Phone	+49 180 5050 - 222
Fax	+49 180 5050 - 223
Internet	http://www.siemens.de/automation/support-request

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

	Asia/Pacific
Phone	+86 1064 719 990
Fax	+86 1064 747 474
E-mail	mailto:adsupport.asia@siemens.com

Note

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

Questions about the documentation

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

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

A fax form is available in the appendix of this document.

Internet address for SINAMICS

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

EC Declarations of Conformity

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

- in the Internet:
  http://support.automation.siemens.com
  under the Product/Order No. 15257461
- with the responsible branch office of the A&D MC Business Division of Siemens AG.

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

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

Note

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

Note

SINAMICS S devices fulfill EMC Directive 89/336/EEC or 2004/108/EEC in the configuration specified in the associated EC Declaration of Conformity and when the EMC installation guideline is implemented, Order No. 6FC 5297-□AD30-0AP□.

ESD information

⚠ CAUTION

Electrostatic sensitive devices (ESDs) are individual components, integrated circuits, or boards that may be damaged by either electrostatic fields or electrostatic discharge.

Regulations for handling ESD components:

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

Personnel may only come into contact with electronic components, if

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

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

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

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

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

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

Safety information

⚠ DANGER

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

Only appropriately qualified personnel may install, commission and maintain the SINAMICS S devices.

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

Operational electrical equipment and motors have parts and components which are at hazardous voltage levels that may cause serious injuries or death when touched.

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

⚠ DANGER

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

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

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

According to EN 61800-5-1 and UL 508 only safely isolated protective extra-low voltages of the electronic modules may be connected to all connections and terminals.

⚠ DANGER

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

⚠ DANGER

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

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

⚠ WARNING

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

Explanation of symbols

The symbols are in accordance with IEC 617-2.

Table 2 Symbols

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

Residual risks of power drive systems

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

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

An assessment of the residual risks of PDS components (see points 1 to 5 above) established that these risks do not exceed the specified limit values.

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

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System Overview

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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.

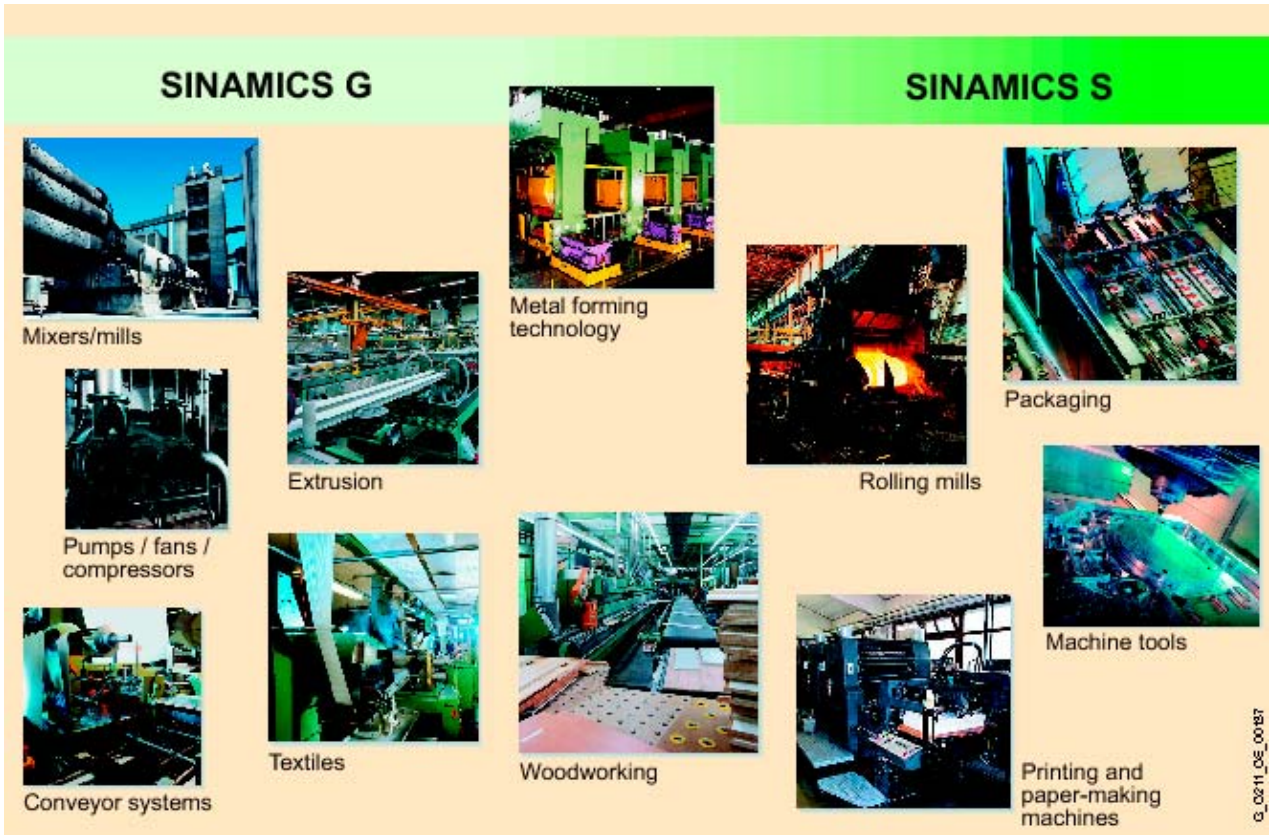


Figure 1-1 SINAMICS applications

1.2 Versions

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

- SINAMICS G is designed for standard applications with induction motors. These applications have less stringent requirements regarding the dynamics and accuracy of the motor speed.
- SINAMICS S handles complex drive tasks with synchronous/induction 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 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.

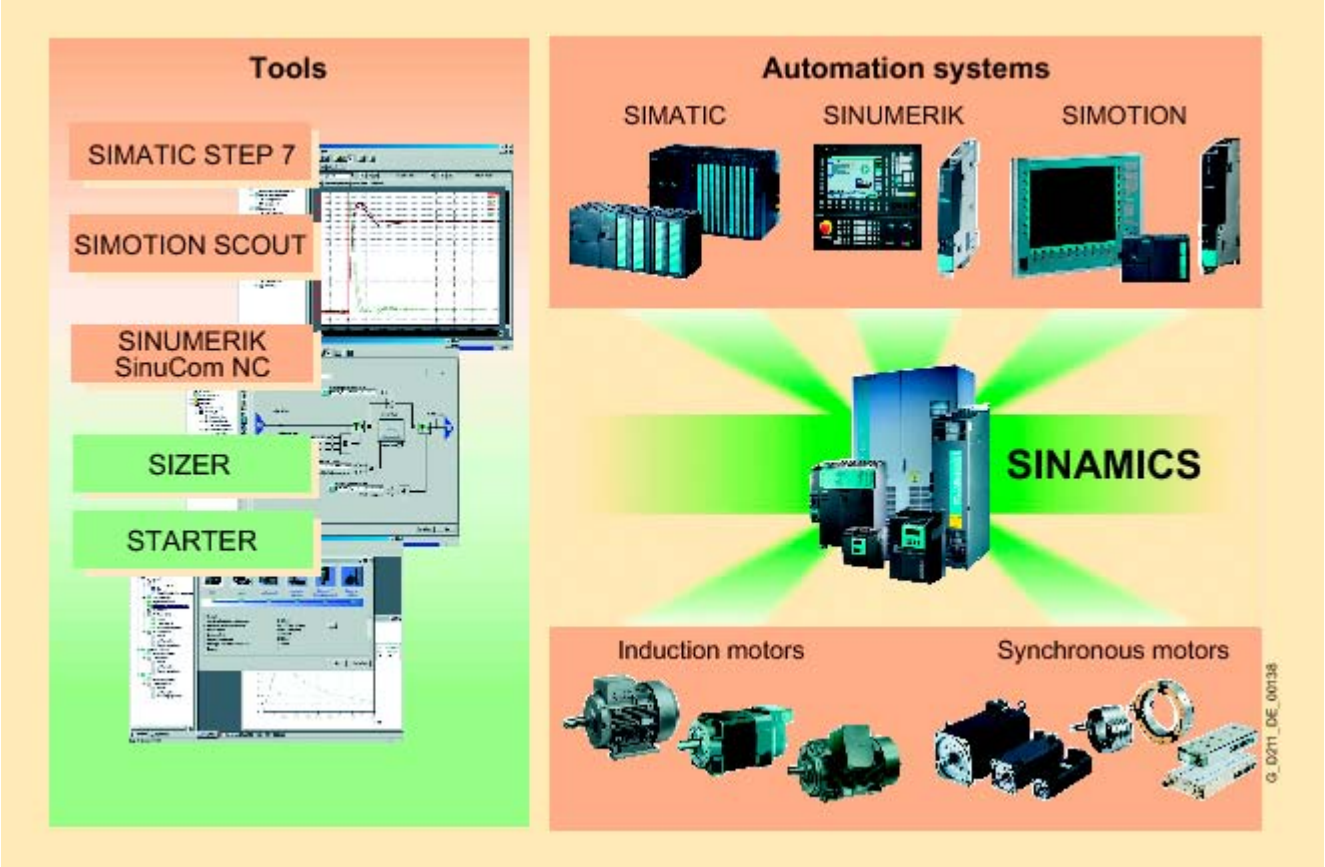


Figure 1-2 SINAMICS as part of the Siemens modular automation system

1.4 Introduction

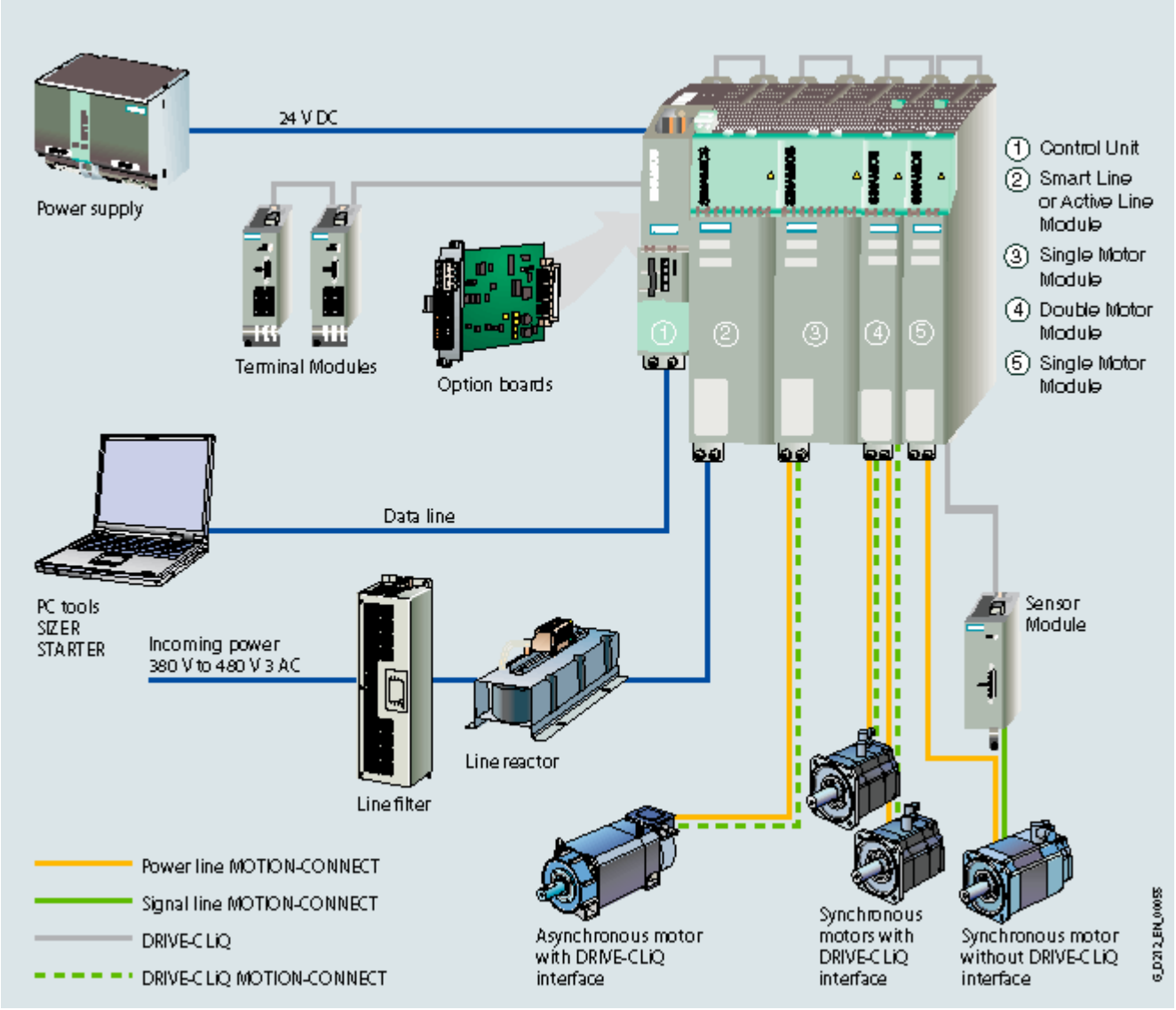


Figure 1-3 SINAMICS S120 system overview

Modular system for sophisticated 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 engineering tool, makes it easier to choose and determine the optimum drive configuration.

SINAMICS S120 is supplemented by a wide range of motors. Whether torque, synchronous or induction motors, whether rotating or linear motors, all of these motors are optimally 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 exchange between braking and driving axes.

SINAMICS S120 features infeeds and inverters that cover a broad 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 control 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. Inter-axis connections can be established within a component and easily configured in the STARTER commissioning tool using a mouse.

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

DRIVE-CLiQ – the digital interface between SINAMICS components

The 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. This electronic type plate contains all the relevant technical 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 built-in motor encoder. The Control Unit records this data automatically via DRIVE-CLiQ so that it does not need to be entered during commissioning or when 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.

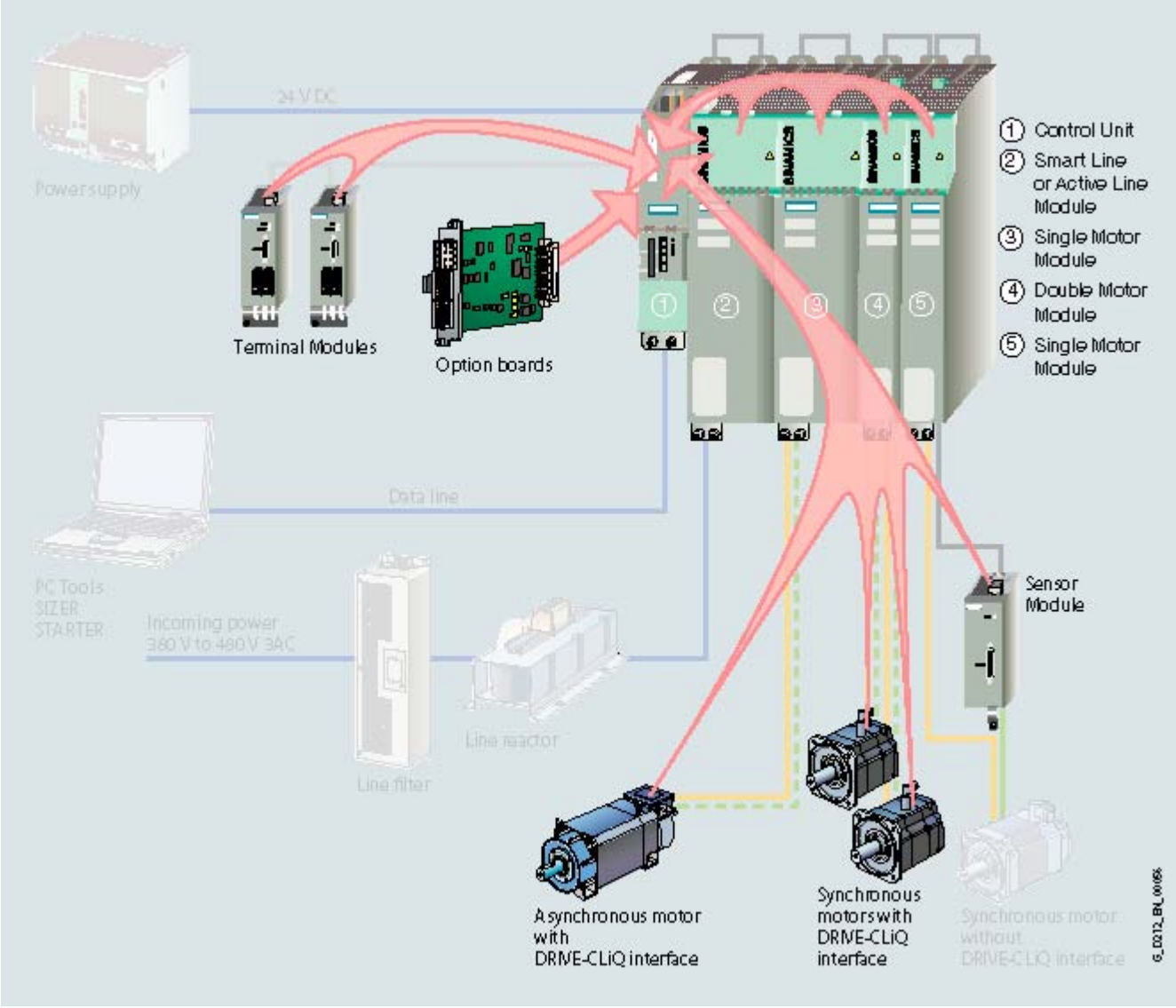


Figure 1-4 The electronic type plate for SINAMICS S120

1.5 SINAMICS S120 components

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



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.
- Supplementary system components that enhance functionality and offer different interfaces for encoders and process signals.

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 air cooling (other cooling methods available on request).

Booksize format

Booksize format units are optimized for multi-axis applications and are mounted adjacent to one another. The connection for the shared voltage-source DC link is an integral feature.

The Booksize format offers various cooling options:

- Internal air cooling
- External air cooling
- Cold-plate cooling

BooksizeCompact format

Derived from the Booksize format we developed the BooksizeCompact format for machines with particularly high requirements for the compactness of their drives. The BooksizeCompact format combines all benefits of the Booksize format providing the same performance with an even smaller overall height and an extended overload capability. The BooksizeCompact format is thus particularly well suitable for integration into machines with high dynamic requirements and confined installation conditions.

The BooksizeCompact format has the same design for the cooling methods of internal air cooling and cold-plate cooling.

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.

- Basic Line Modules
  Basic Line Modules generate an unregulated DC link voltage and are not 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 data

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

Electrical data	
Line connection voltage	380 V to 480 V 3 AC ±10 % (-15 % < 1 min)
Line frequency	47 Hz to 63 Hz
Electronics power supply	24 V DC -15/+20 %*, protective extra-low voltage DVC A (PELV)
Short-circuit current rating SCCR in accordance with UL508C (up to 600 V)	• 1.1 KW – 298 kW: 42 kA • 299 kW – 447 kW: 65 kA • 448 kW – 671 kW: 84 kA • 672 kW – 1193 kW: 170 kA • >1194 kW: 200 kA
Interference suppression to EN 61800-3	Category C3 (standard) Category C2 (optional) for system designs conforming to the documentation
Overvoltage category	III acc. to EN 60664-1
Degree of contamination	2 to EN 60664-1

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

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

Environmental conditions	
The Safety-Integrated safety function:	
The components must be protected against conductive pollution (e.g. by installing them in a cabinet with degree of protection IP54B acc. to EN 60529). Provided that conductive pollution can be prevented at the installation site, the degree of protection for the cabinet can be decreased accordingly.	

Environmental conditions	
Degree of protection	IP20 or IPXXB to EN 60529, open type to UL508
Protection class for network current circuits Protection class for electronic circuits	I (with protective conductor connection) and III (protective extra low voltage DVC A / PELV) acc. to EN 61 800-5-1
Permissible coolant temperature (air) and installation altitude during operation	0 °C to +40 °C and an installation altitude of up to 1000 m without derating, >40 °C to +55 °C see the characteristic for current derating. Installation altitude >1000 m up to 4000 m see characteristic for current derating or reduction of the ambient temperature by 3.5 K per 500 m.
Chemically active substances • Long-term storage in the transport packaging • Transport in the transport packaging • Operation	 Class 1C2 to EN 60721-3-1 Class 2C2 to EN 60721-3-2 Class 3C2 to EN 60721-3-3
Biological environmental conditions • Long-term storage in the transport packaging • Transport in the transport packaging • Operation	 Class 1B1 to EN 60721-3-1 Class 2B1 to EN 60721-3-2 Class 3B1 to EN 60721-3-3
Vibratory load • Long-term storage in the transport packaging • Transport in the transport packaging • Operation	 Class 1M2 to EN 60721-3-1 Class 2M3 to EN 60721-3-2 Test values: Frequency range: 10 Hz to 58 Hz With constant deflection of 0.075 mm Frequency range: 58 Hz to 200 Hz With constant acceleration of 1 g
Shock load • Long-term storage in the transport packaging • Transport in the transport packaging • Operation	 Class 1M2 to EN 60721-3-1 Class 2M3 to EN 60721-3-2 Test values: 15 g / 11 ms
Climatic environmental conditions • Long-term storage in the transport packaging • Transport in the transport packaging • Operation	 Class 1K4 to EN 60721-3-1 Temperature -25 °C to +55 °C Class 2K4 to EN 60721-3-2 Temperature -40 °C to +70 °C Class 3K3 to EN 60721-3-3 Temperature +0 °C to +40 °C Relative / absolute humidity 5 % to 90 % / 25 g/m^3. Oil mist saline fog, icing, condensation, dripping water, spray water, splash water and jet water not permissible.

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

1.8 Standards

Table 1-1 Essentially the application-relevant standards

Standards	Title
EN ISO 12100-1	Safety of Machinery; General Design Guidelines; Part 1: Basic terminology, methodology
EN ISO 12100-2	Safety of Machinery; General Design Guidelines; Part 2: Technical Principles and Specifications
EN 563	Safety of machinery; temperature of services that can be touched; ergonomic data to define temperature limit values for hot surfaces
EN 954-1 / ISO 13849-1	Safety of machinery; safety-related parts of control systems; Part 1: General Design Principles
EN 1037	Safety of machinery; avoiding unexpected starting
EN 60146-1-1	Semiconductor converters; general requirements and line-commutated converters; Part 1-1: Defining the basic requirements
EN 60204-1	Electrical equipment of machines; Part 1: General definitions
EN 60228	Conductors for cables and insulated conductors; guidelines for the limiting dimensions of round cables
EN 60269-1	Low-voltage fuses Part 1: General requirements
IEC 60287-1 to -3	Cables - Calculation of the current carrying capacity Part 1: Current carrying capacity equations (100 % load factor) and calculating the losses Part 2: Thermal resistance Part 3: Main sections for operating conditions
EN 60529	Degrees of protection provided by enclosures (IP code)
EN 60664-X	Insulation coordination for equipment within low-voltage systems Part 1: Principles, requirements and tests Part 3: Use of coating, potting or moulding for protection against pollution
EN 60721-3-X	Classification of environmental conditions Part 3-0: Classification of environmental parameters and their severities; Introduction Part 3-1: Classification of environmental parameters and their severities; Long-term storage Part 3-2: Classification of environmental parameters and their severities; Transport Part 3-3: Classification of environmental parameters and their severities; stationary use, weather protected
EN 61000-6-X	Electromagnetic compatibility (EMC) Part 6-1: Generic standard; Immunity for residential, commercial and light-industrial environments Part 6-2: Generic standards; Immunity for industrial environments Part 6-3: Generic standards; Generic standard emission for residential, commercial and light-industrial environments Part 6-4: Generic standards; Generic standard noise emission for industrial environments
EN 61140	Protection against electric shock; Common aspects for installation and equipment
EN 61158	Digital data communications for measurement and control - Fieldbus for use in industrial control systems
EN 61800-2	Adjustable-speed electrical power drive systems; Part 2: General requirements - Rating specifications for low-voltage adjustable frequency a.c. power drive systems
EN 61800-3	Adjustable-speed electrical power drive systems; Part 3: EMC - Requirements and specific test methods

Standards	Title
EN 61800-5-X	Adjustable-speed electrical power drive systems; Part 5: Safety requirements; Main section 1: Electrical, thermal and energy requirements Main section 2: Functional safety requirements
VDE 0100 Teil X (IEC 60364-X-X)	Erection of power installations with nominal voltages up to 1000 V; Part 200: Definitions Part 410: Protection for safety, protection against electric shock Part 420: Protection for safety, protection against thermal effects Part 430: Protection of cables and conductors for over-current Part 470: Protection for safety; use of protection for safety Part 450: Protection for safety, protection against undervoltage Part 5xx: Selecting and erecting electrical equipment Part 520: Wiring systems Part 540: Earthing, protective conductor, potential bonding conductor Part 560: Electrical equipment for safety purposes
DIN EN ISO 9001	Quality management systems - requirements
UL 50	Enclosures for Electrical Equipment
UL 508	Industrial Control Equipment
UL 508C	Safety for Power Conversion Equipment

Line Connection Booksize

2

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

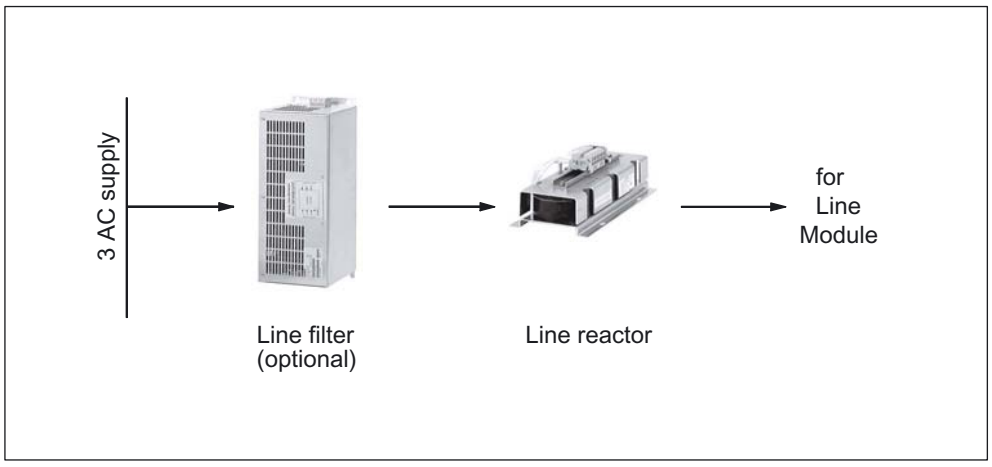


Figure 2-1 Overview: Line connection

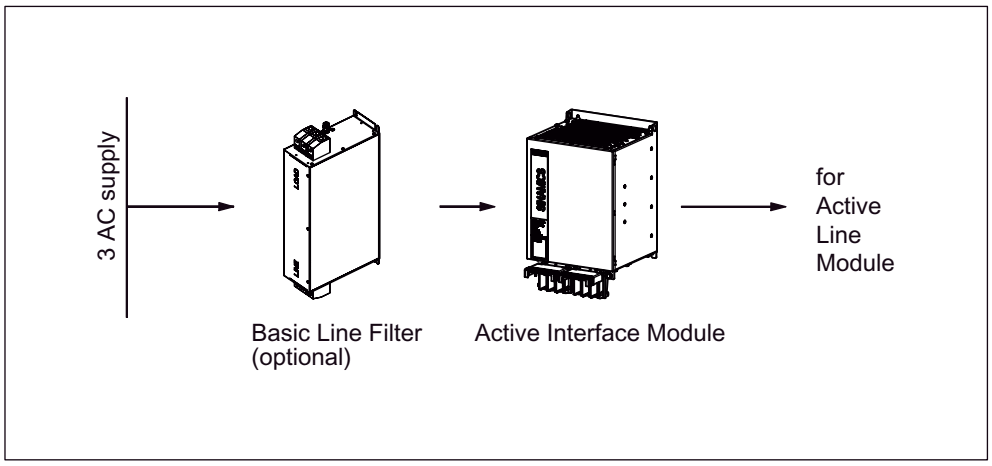


Figure 2-2 Overview: line connection with Active Interface Module

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

2.2 Overview: Line filters

A separate line filter (see catalog) must be used for the SINAMICS S120 drive line-up. An additional line filter must be used to suppress interference in other loads. To prevent mutual interference, this line filter must not be equipped with line-side capacitors with respect to ground. Filter series B84144A*R120 (EPCOS) is recommended.

In conjunction with a line reactor and an EMC-compliant system configuration, line filters limit the electromagnetic emissions from the Power Modules to the limit values of category C2 to EN 61800-3.

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

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

Basic Line Filter for Active Line Modules with line reactor

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

Basic Line Filter for Active Line Modules with Active Interface Module

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

Wideband Line Filter for Active Line Modules

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

Basic Line Filter for Basic Line Modules

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

Basic Line Filter for Smart Line Modules

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

Note

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

Table 2-1 Overview

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

2.3 Combining line reactors and line filters

Selected combinations									Achievable features				Available for											
Active Line Module	Smart Line Module	Basic Line Module	Basic Line Filter	Wideband Line Filter	HF line reactor	Fe line reactor	Active Interface Module	DC link Step-up factor or rectifier value B6	Radio interference suppression according to		Clock frequency filter (8kHz)	operable on IT systems	5 kW	10 kW	16 kW	20 kW	36 kW	40 kW	55 kW	80 kW	100 kW	120 kW
									EN 61800-3-C2 total line shielded	EN 61800-3-C3 total line shielded													
X					X			1.4 - 1.6	No	No	No	Yes			X		X		X	X		X
X			X		X			1.4 - 1.6	150 m	150 m	No	No			X		X		X			
X				X	X			1.4 - 1.6	350 m	350 m	Yes	No			X		X		X	X		X
X							X	1.4 - 2	No	350 m	Yes	Yes [1]							X	X		X
X							X	1.4 - 2	350 m	1000 m	Yes	No							X	X		X
	X					X		1.35	No	No	Not relevant	Yes	X	X	X		X					
	X		X			X		1.35	350 m	350 m	Not relevant	No	X	X	X		X					
		X				X		1.35	No	350 m	Not relevant	Yes [1]				X		X			X	
		X	X			X		1.35	350 m	350 m	Not relevant	No				X		X			X	

[1] Remove the connecting clip

Figure 2-3 Combining line reactors and line filters

2.4 Basic Line Filter for Active Line Modules with line reactor

2.4.1 Description

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

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

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

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

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

2.4.2 Safety information

⚠ WARNING

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

⚠ WARNING

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

Incoming line cable to LINE L1, L2, L3

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

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

⚠ CAUTION

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

⚠ DANGER

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

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

⚠ DANGER

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

Note

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

CAUTION

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

2.4.3 Interface description

2.4.3.1 Overview

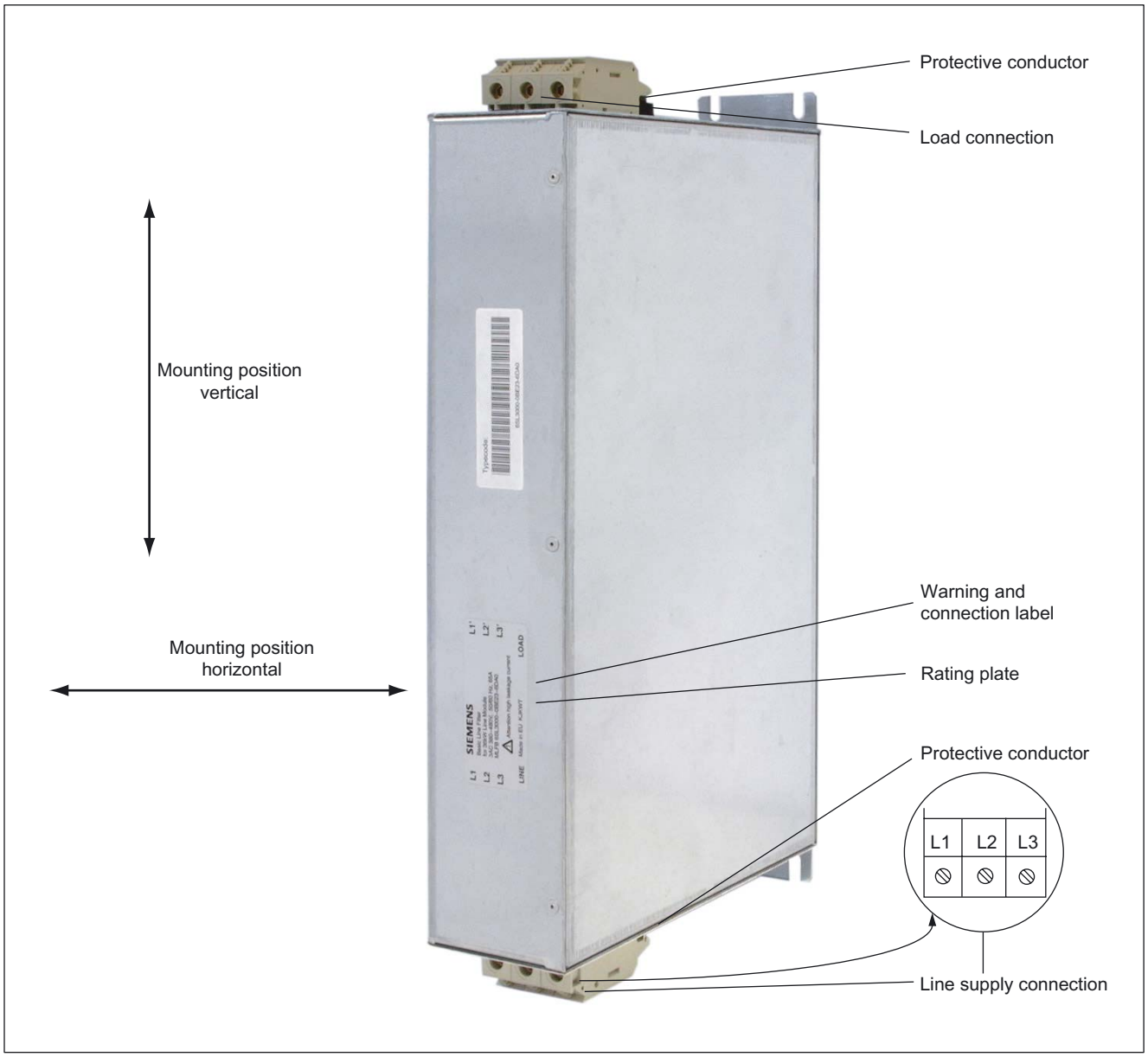


Figure 2-4 Basic Line Filter for Active Line Modules (example: 36 kW)

⚠ WARNING
The line/load connection must not be interchanged.

2.4.3.2 Line supply/load connection

Table 2-2 Type of connection

Terminals	Designations
Line supply connection (line supply)	L1, L2, L3, PE
Load connection (load)	L1´, L2´, L3´, PE
Basic Line Filter for Active Line Modules	
16 kW	Screw terminal: 10 mm^2 3-pin/1.5 -1.8 Nm (see Screw Terminals chapter) PE connection: M6/6 Nm[1)]
36 kW	Screw terminal: 35 mm^2 PE connection: M6/6 Nm[1)]
55 kW	Screw terminal: 50 mm^2/6 - 8 Nm PE connection: M6/6 Nm[1)]
1) for ring cable lugs to DIN 46234	

2.4.4 Dimension drawing

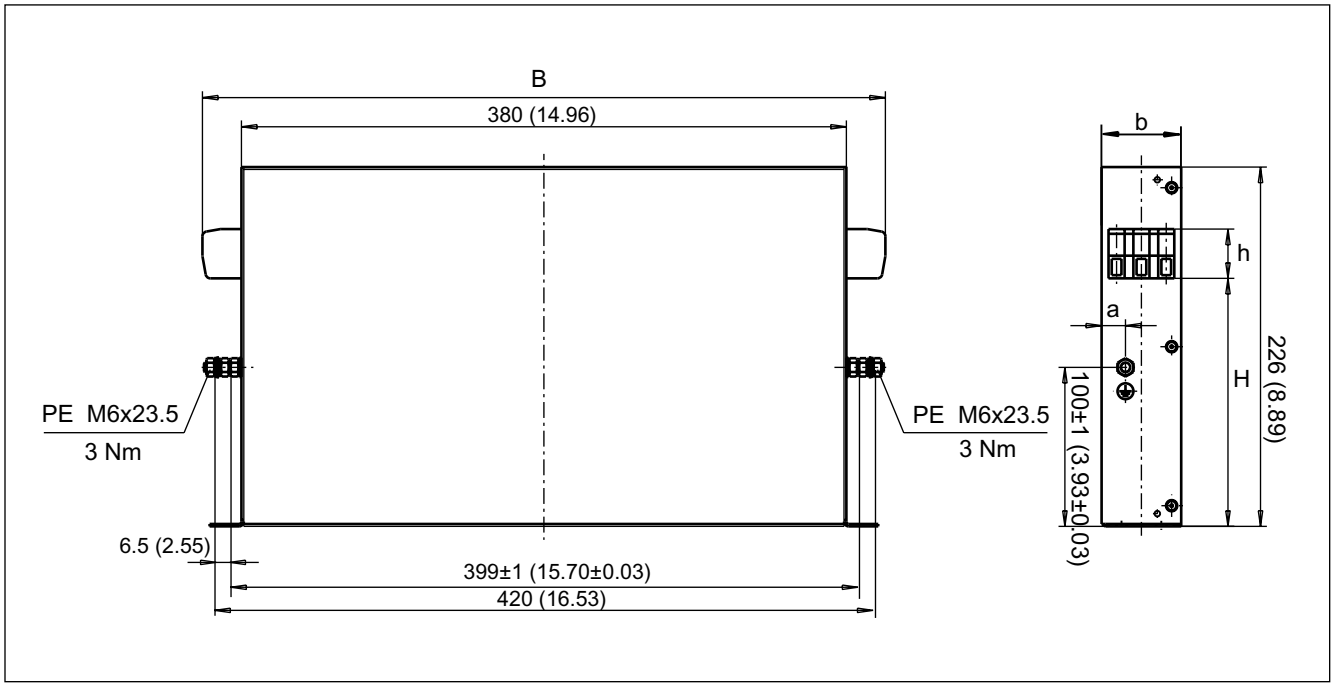


Figure 2-5 Dimension drawing: Basic Line Filter for Active Line Modules (16 kW to 55 kW)

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

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

2.4.5 Technical data

Table 2-4 Technical data of Basic Line Filter for Active Line Modules with line reactor

	6SL3000 unit	**0BE21-6DAx**	**0BE23-6DAx**	**0BE25-5DAx**
Rated power	kW	16	36	55
Connection voltage: Supply voltage Line frequency	 V_{AC} Hz	 380 V 3 AC -10 % (-15 % < 1 min) to 480 V 3 AC +10 % 47 to 63 Hz		
Rated current	A_{AC}	36	65	105
Power loss[1]	W	16	28	41
Weight	kg	5	6.5	11.5

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

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

2.5.1 Description

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

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

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

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

2.5.2 Safety information

⚠ CAUTION

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

Incoming line cable to LINE L1, L2, L3 and

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

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

NOTICE

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

⚠ DANGER

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

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

⚠ DANGER

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

Note

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

CAUTION

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

2.5.3 Interface description

2.5.3.1 Overview

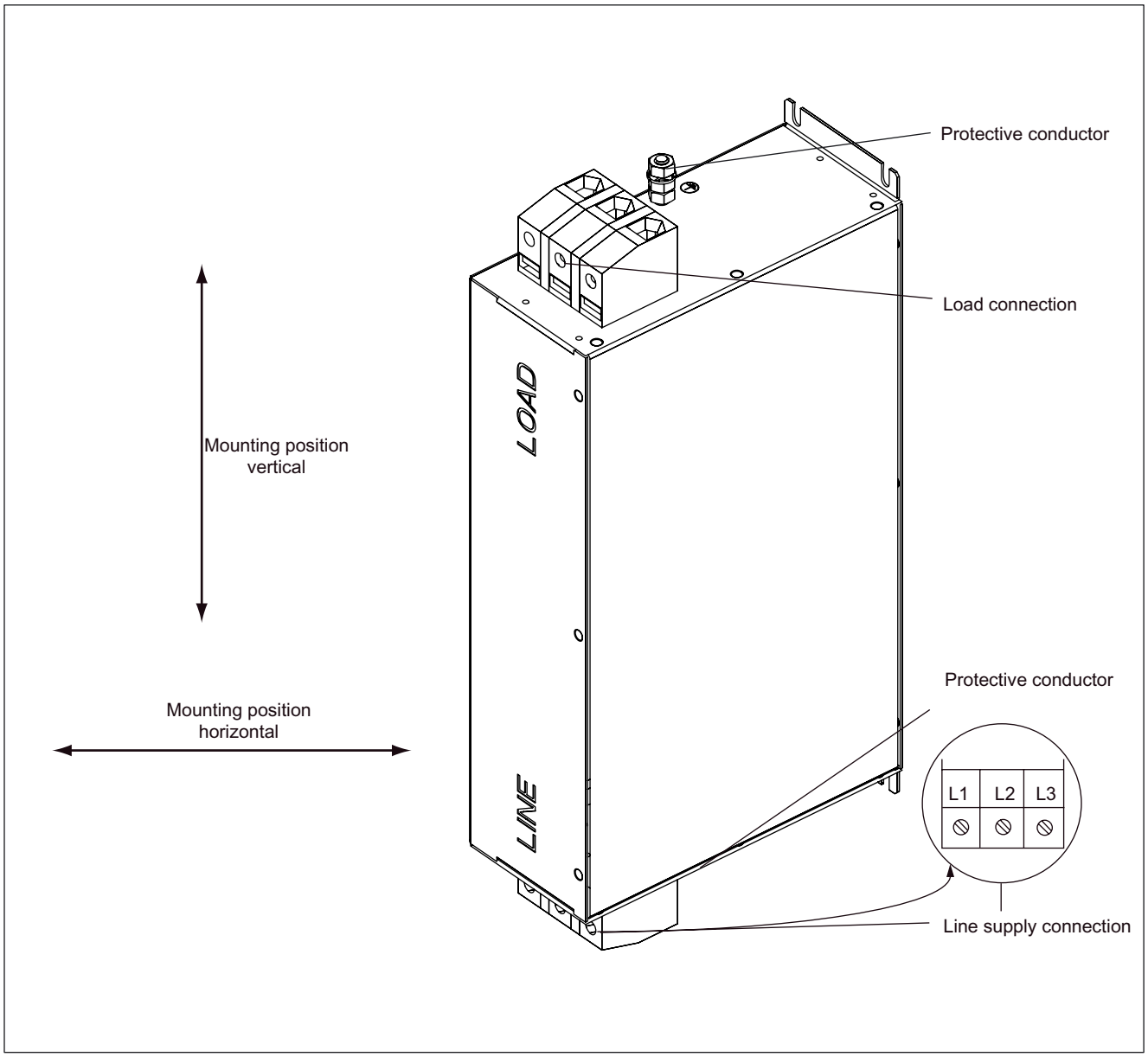


Figure 2-6 Interface description: Basic Line Filter 55 kW

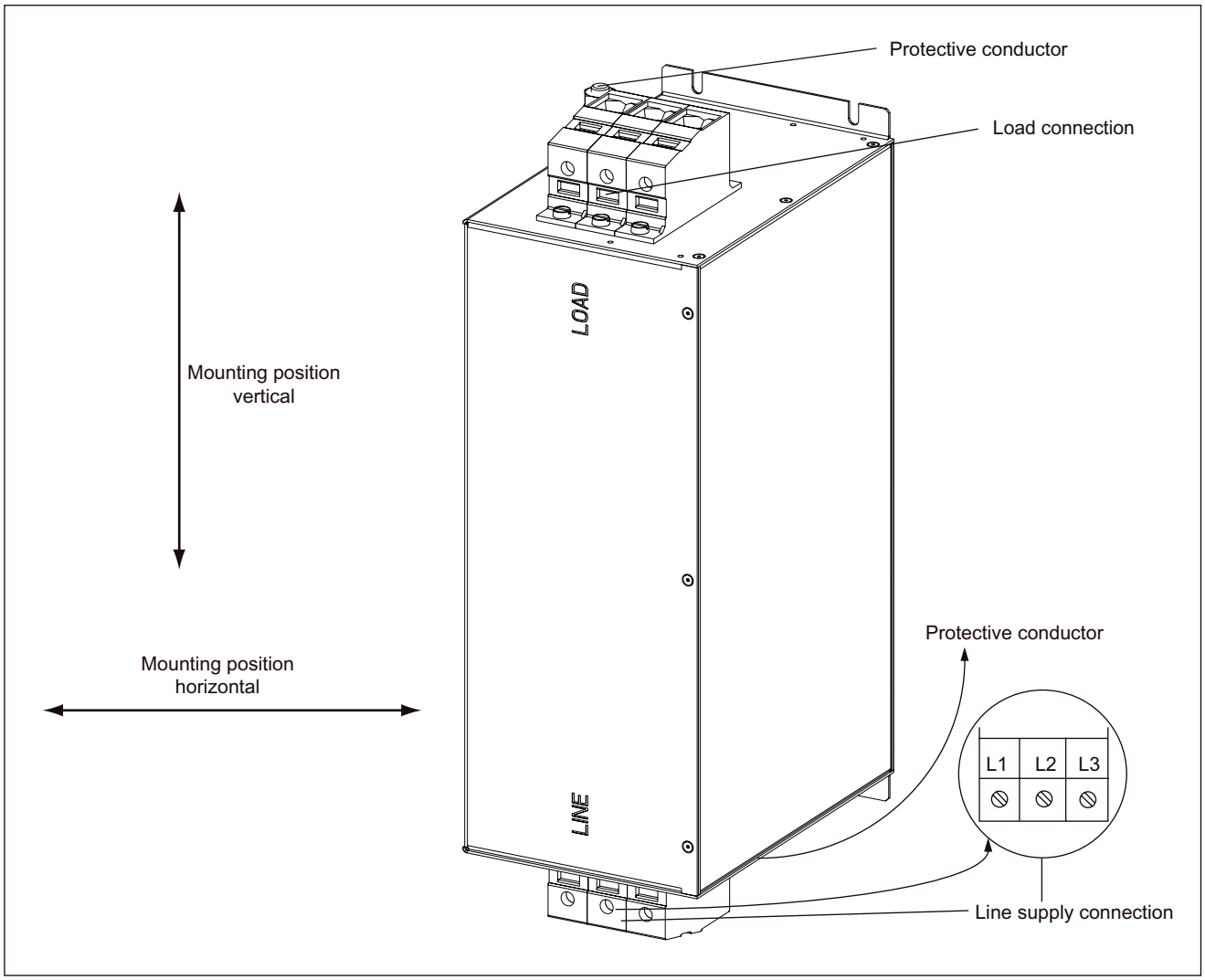


Figure 2-7 Interface description: 80 kW and 120 kW Basic Line Filter

NOTICE
The line/load connection must not be interchanged.

2.5.3.2 Line/power connection

Table 2-5 Connection type

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

2.5.4 Dimension drawing

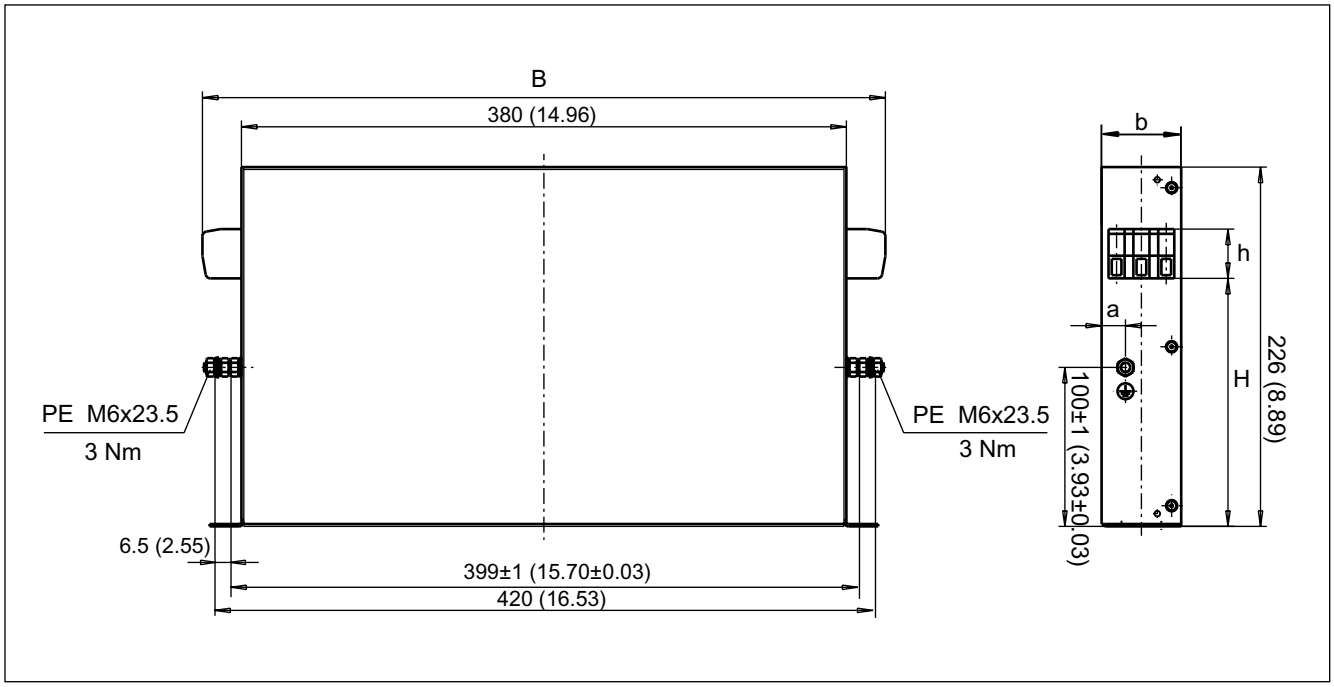


Figure 2-8 Dimension drawing: Basic Line Filter 55 kW

Table 2-6 Dimensions: Basic Line Filter for Active Line Modules

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

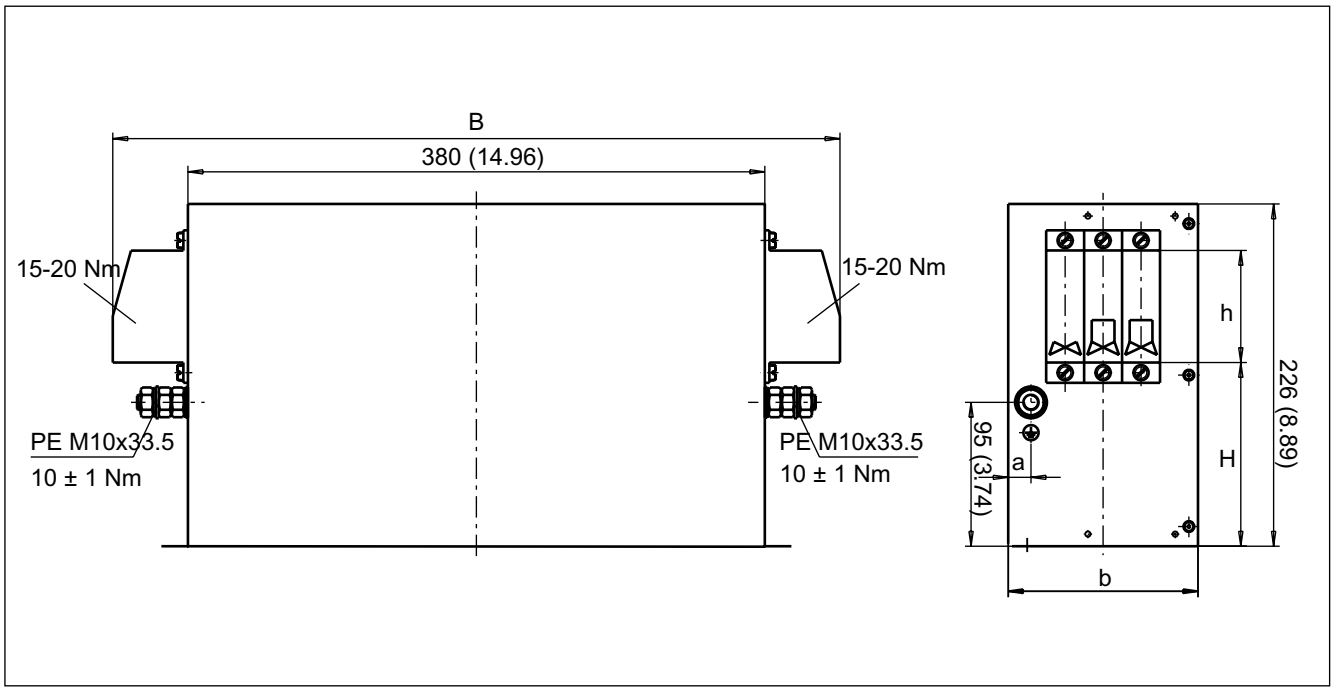


Figure 2-9 Dimension drawing: 80 kW and 120 kW Basic Line Filter

Table 2-7 Dimensions: Basic Line Filter for Active Line Modules

Basic Line Filter	Order number	W [mm] (inches)	w [mm] (inches)	a [mm] (inches)	H [mm] (inches)	h [mm] (inches)
80 kW	6SL3000-0BE28-0DAx	479 (18.85)	150 (5.90)	15 (0.59)	121.3 (4.77)	74 (2.91)
120 kW	6SL3000-0BE31-2DAx					

2.5.5 Technical data

Table 2-8 Technical data of the Basic Line Filter for Active Line Modules with Active Interface Module

	6SL3000- Unit	0BE25-5DA0	0BE28-0DAx	0BE31-2DAx
Rated power	kW	55	80	120
Connection voltage: Supply voltage Line frequency	 V_{AC} Hz	 380 V 3 AC -10 % (-15 % < 1 min) to 480 V 3 AC +10 % 47 to 63 Hz		
Rated current	A_{AC}	105	132	192
Power loss [1)]	W	41	48	86
Weight	kg	11.5	18.2	18.8

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

2.6 Wideband Line Filter for Active Line Modules

2.6.1 Description

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

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

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

2.6.2 Safety information

⚠ CAUTION

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

⚠ WARNING

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

⚠ WARNING

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

Incoming line cable to LINE L1, L2, L3 and

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

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

NOTICE

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

⚠ DANGER

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

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

⚠ DANGER

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

Note

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

CAUTION

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

NOTICE

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

2.6.3 Interface description

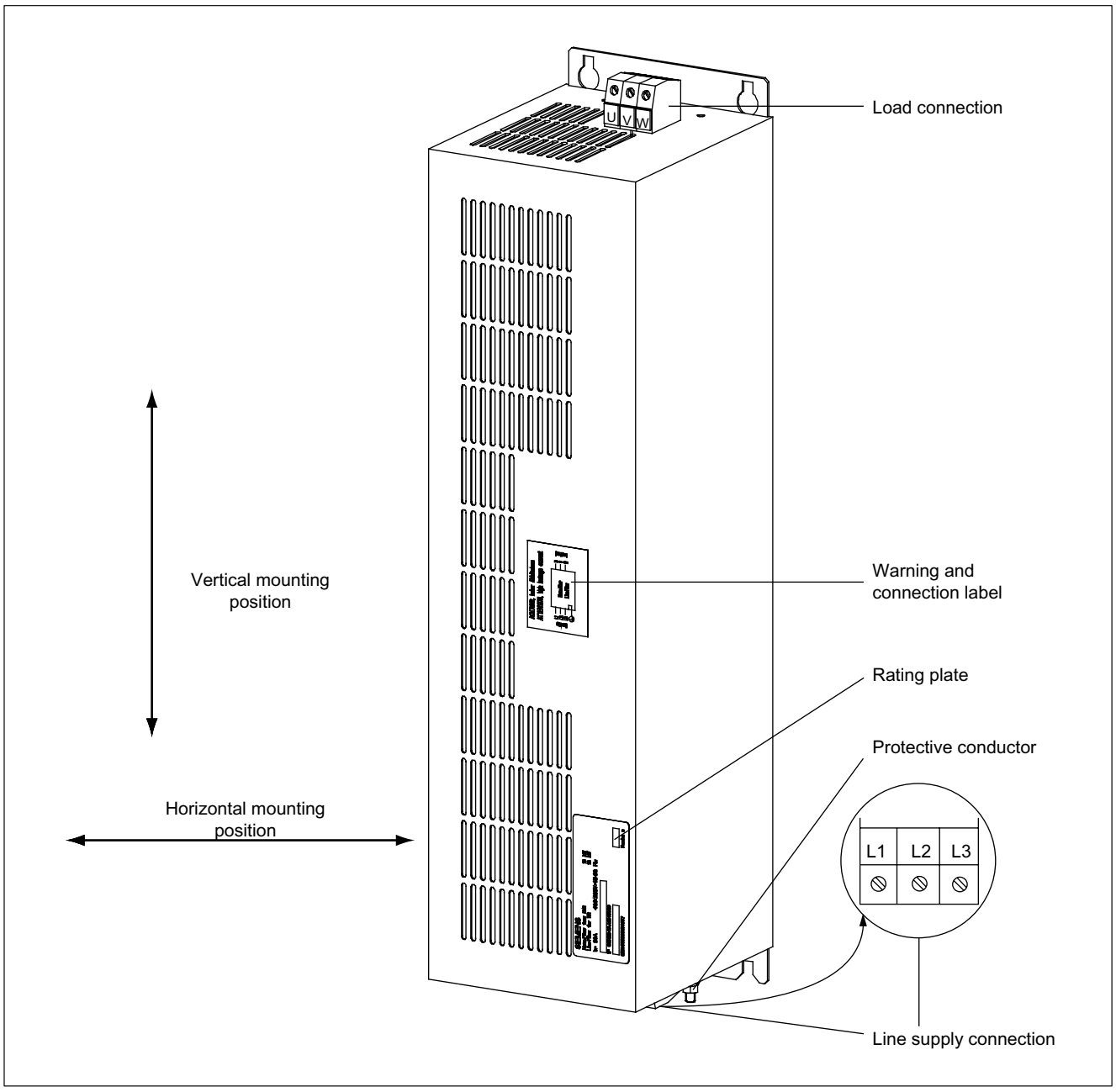


Figure 2-10 Wideband Line Filter for Active Line Module (example: 16 kW)

NOTICE
The line/load connection must not be interchanged.

2.6.3.1 Line/power connection

Table 2-9 Type of connection

Terminals	Designations
Line supply connection (line supply)	L1, L2, L3, PE
Load connection (load)	U, V, W
Wideband Line Filter for Active Line Modules	
16 kW	Screw terminal: 10 mm^2 3-pin/1.5 -1.8 Nm (see Screw Terminals chapter) Grounding stud: M5/3 Nm [1)]
36 and 55 kW	Screw terminal: 50 mm^2 3-pin/6 - 8 Nm (see Screw Terminals chapter) Grounding stud: M8/13 Nm [1)]
80 kW	Screw terminal: 95 mm^2 3–pin/15 - 20 Nm (see Screw Terminals chapter) Grounding stud: M8/13 Nm [1)]
120 kW	Connection strap: d = 11 mm (M10/25 Nm) Grounding stud: M8/13 Nm [1)] **Note: No shock-hazard protection (IP00B acc. to 60529)**
1) for ring cable lugs to DIN 46234	

2.6.4 Dimension drawings

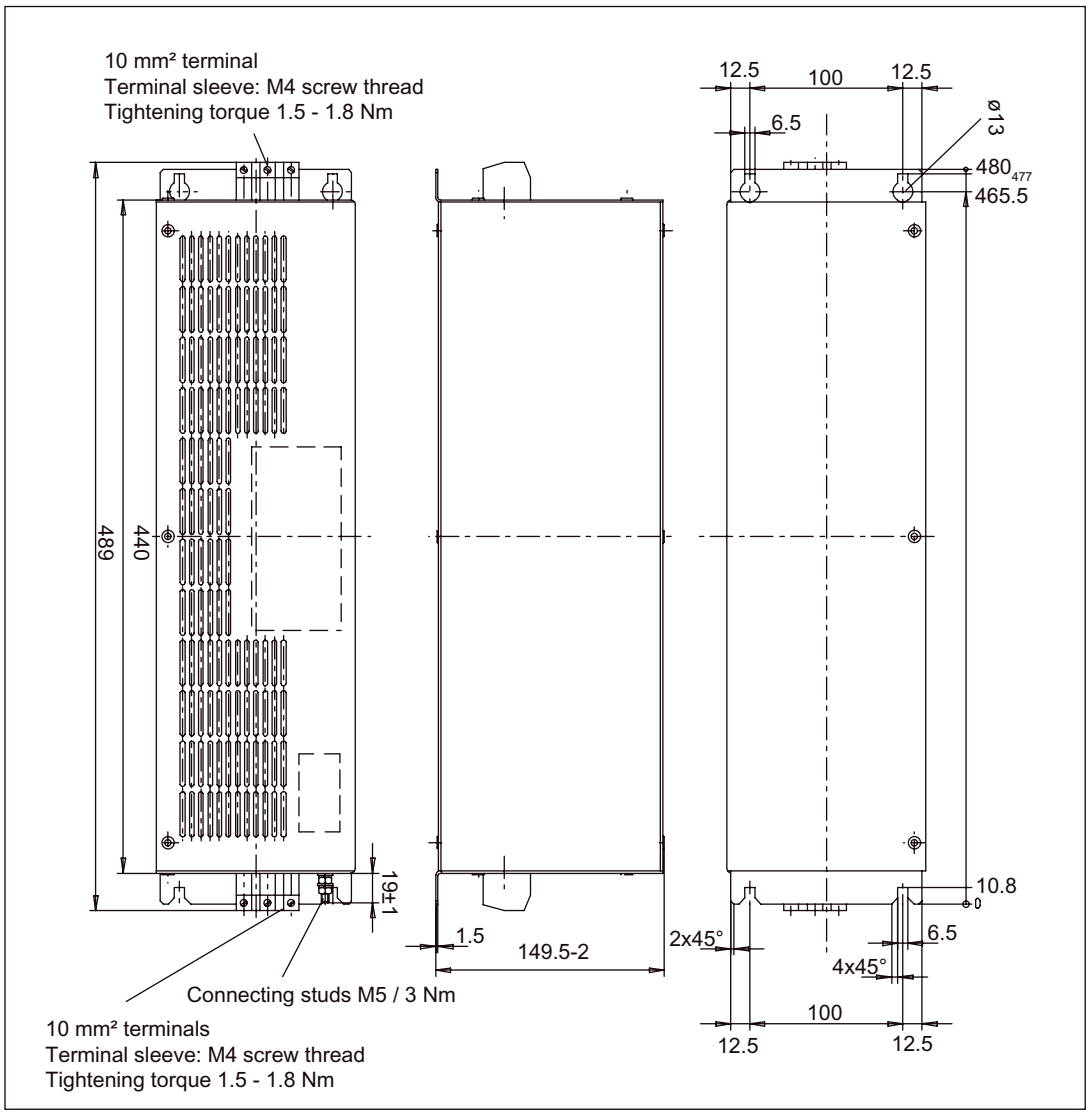


Figure 2-11 Dimension drawing: 16 kW Wideband Line Filter for Active Line Modules

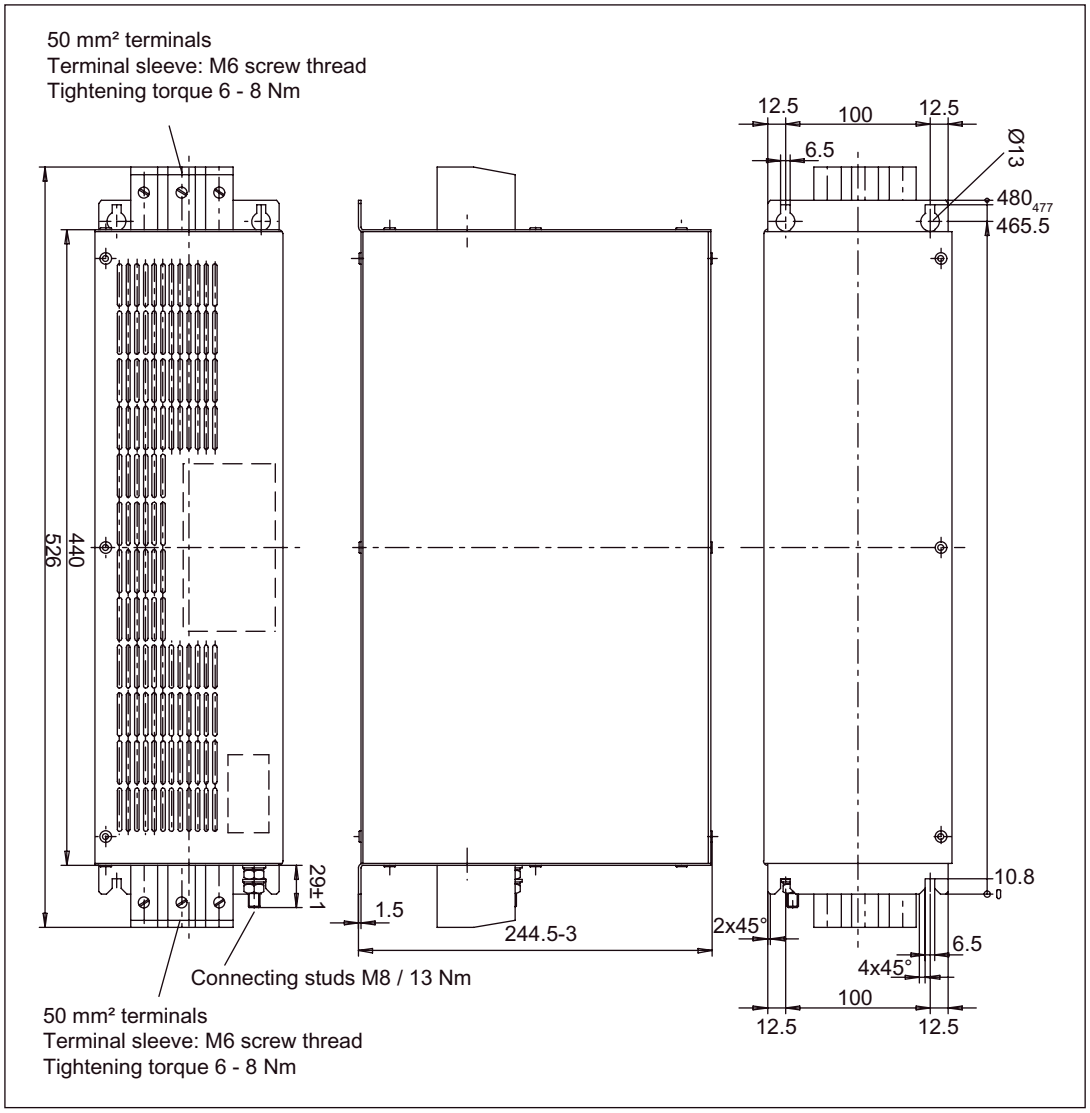


Figure 2-12 Dimension drawing: 36 kW Wideband Line Filter for Active Line Modules

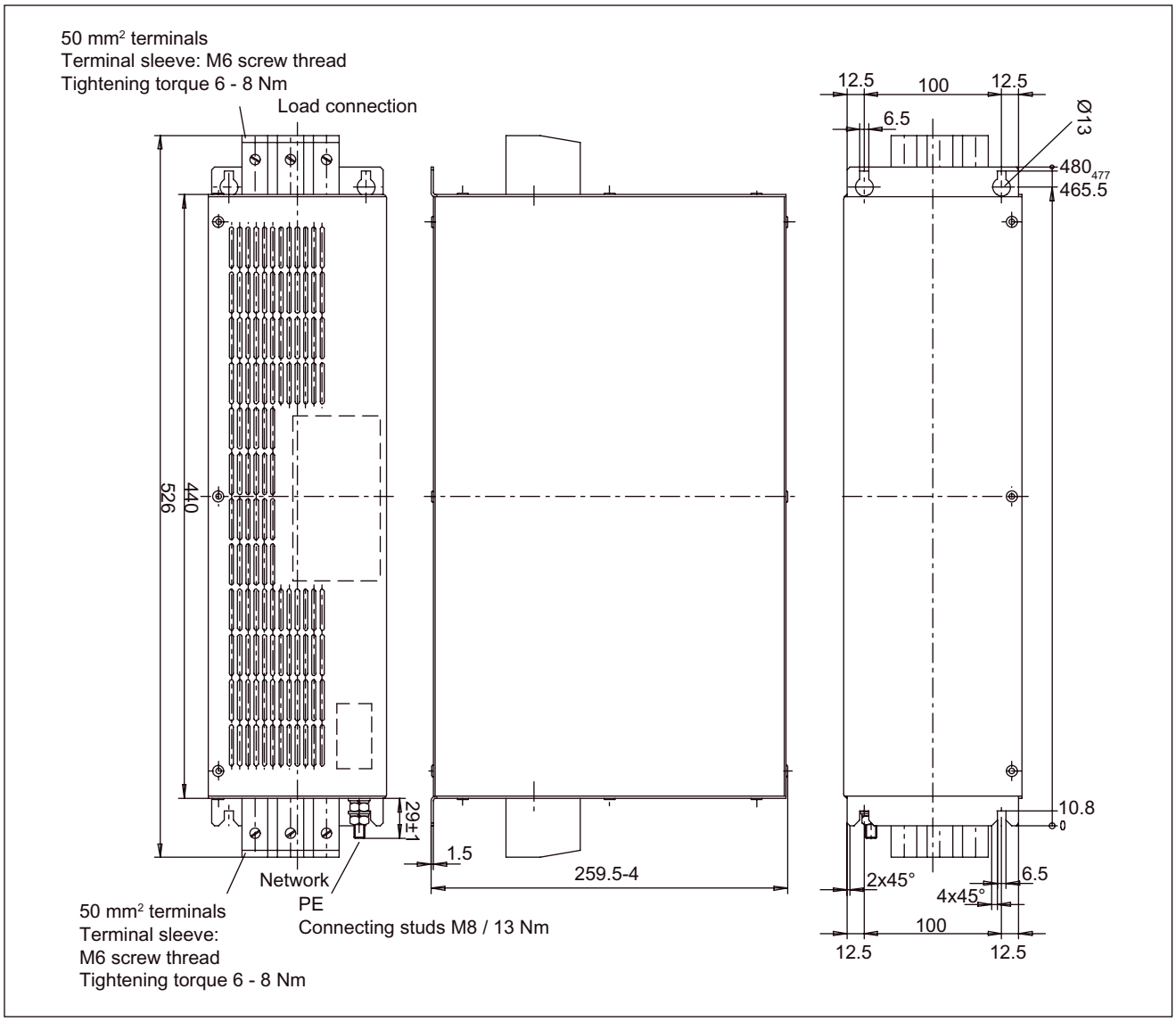


Figure 2-13 Dimension drawing: 55 kW Wideband Line Filter for Active Line Modules

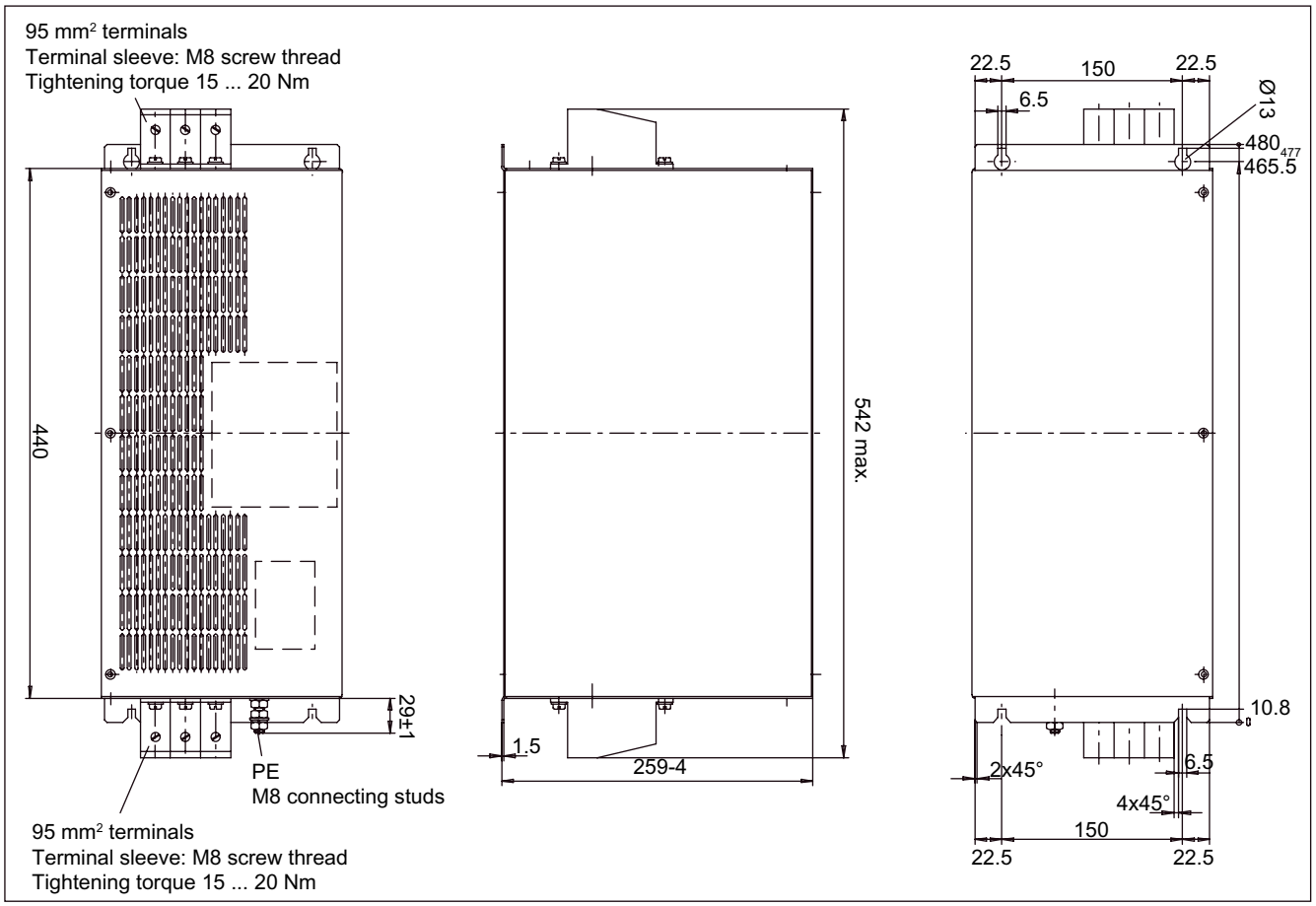


Figure 2-14 Dimension drawing: 80 kW Wideband Line Filter for Active Line Modules

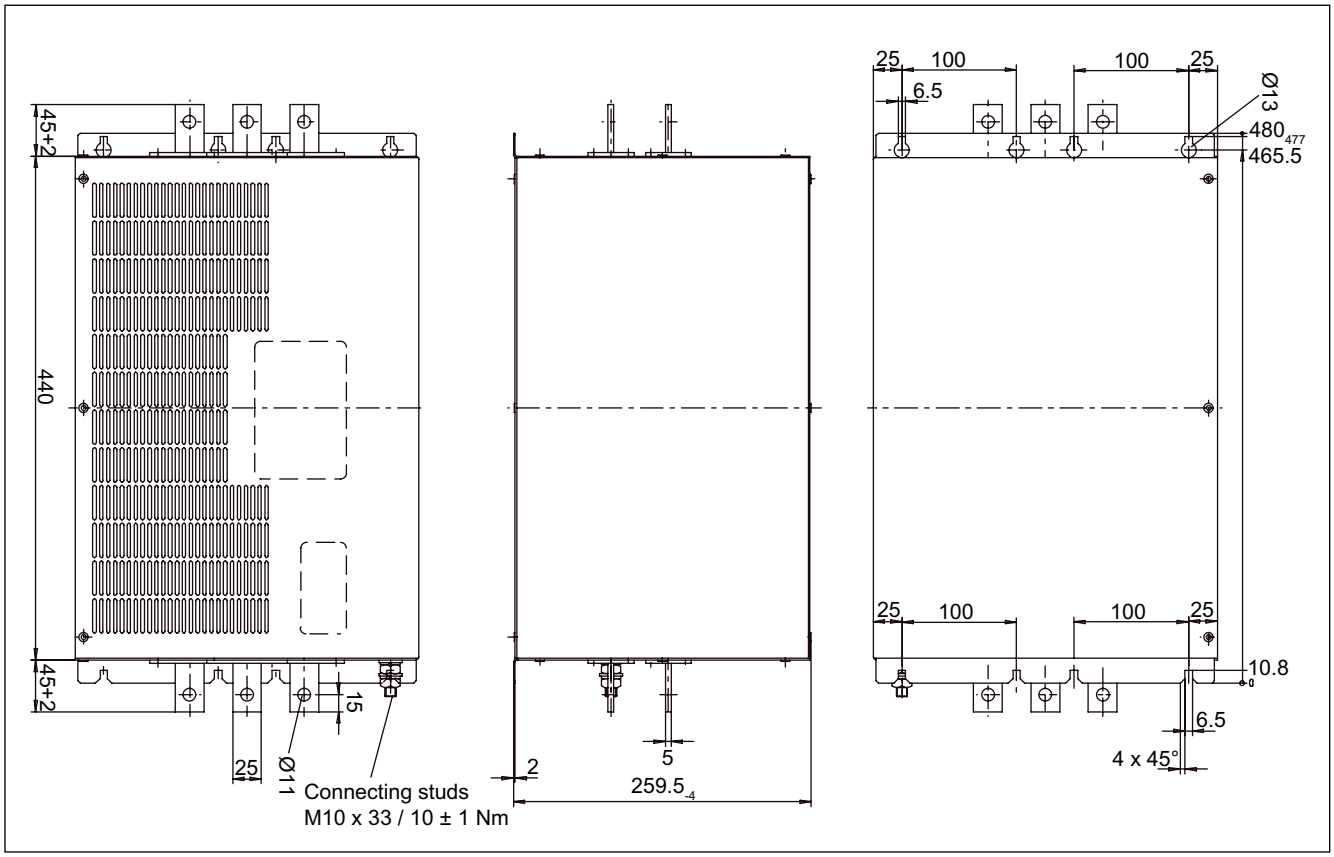


Figure 2-15 Dimension drawing: 120 kW Wideband Line Filter for Active Line Modules

Table 2-10 Wideband Line Filter

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

2.6.5 Technical data

Table 2-11 Technical data: Wideband Line Filter for Active Line Modules

	6SL3000 unit	0BE21-6AAx	0BE23-6AAx	0BE25-5AAx	0BE28-0AAx	0BE31-2AAx
Rated power	kW	16	36	55	80	120
Connection voltages: Supply voltage Line frequency	 V_{AC} Hz	 380 V 3 AC -10 % (-15 % < 1 min) up to 480 V 3 AC +10 % 47 to 63 Hz				
Rated current	A_{AC}	30	67	103	150	225
Power loss[1]	W	70	90	110	150	200
Weight	kg	8.5	14.5	15.5	26	34.5

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

2.7 Basic Line Filter for Basic Line Modules

2.7.1 Description

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

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

2.7.2 Safety information

⚠ CAUTION

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

⚠ WARNING

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

⚠ WARNING

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

Incoming line cable to LINE L1, L2, L3 and

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

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

NOTICE

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

⚠ DANGER

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

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

⚠ DANGER

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

Note

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

CAUTION

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

2.7.3 Interface description

2.7.3.1 Overview

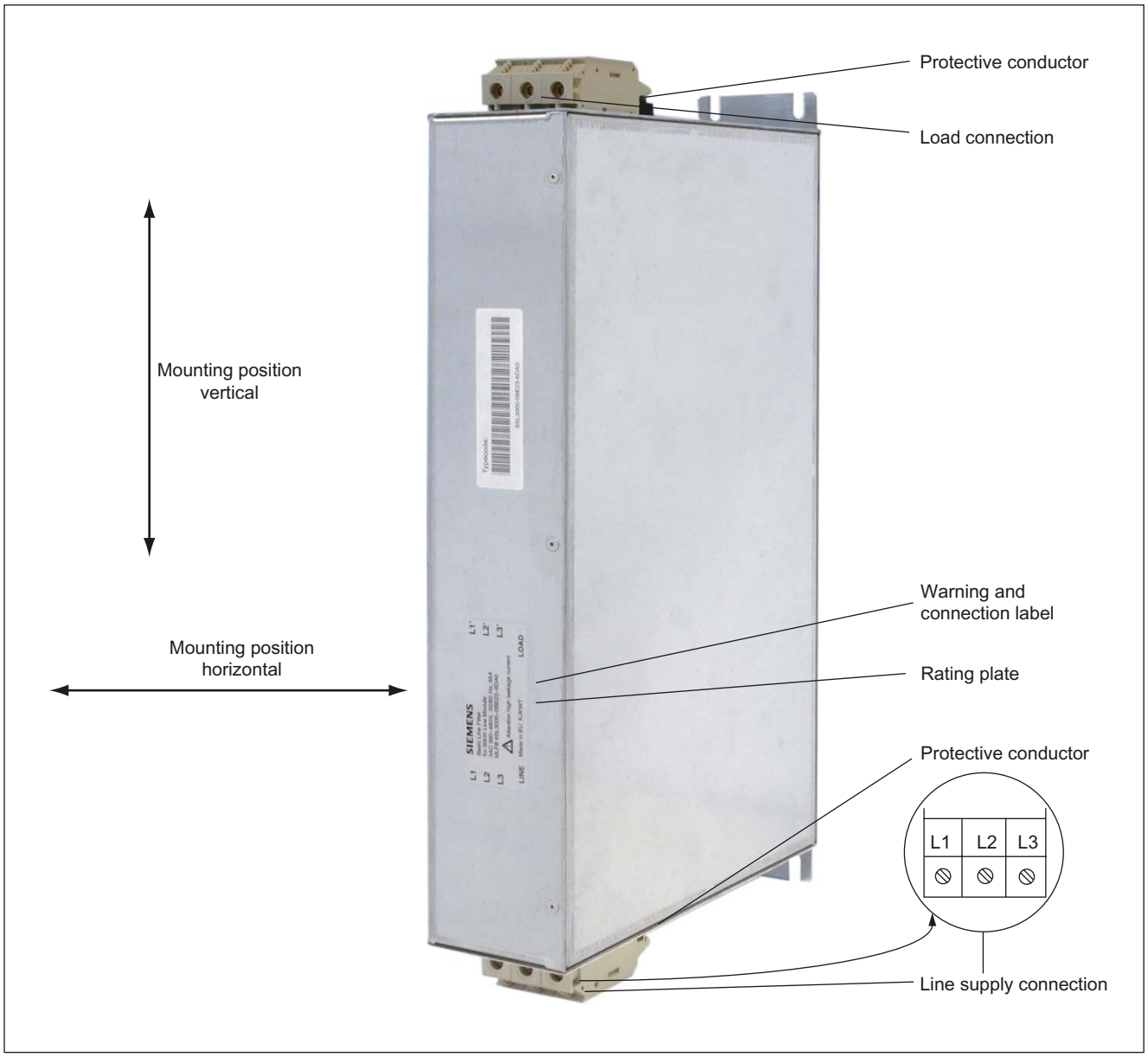


Figure 2-16 Line filters for Basic Line Modules (example: 40 kW)

NOTICE
The line/load connection must not be interchanged.

2.7.3.2 Line/power connection

Table 2-12 Connection type

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

2.7.4 Dimension drawing

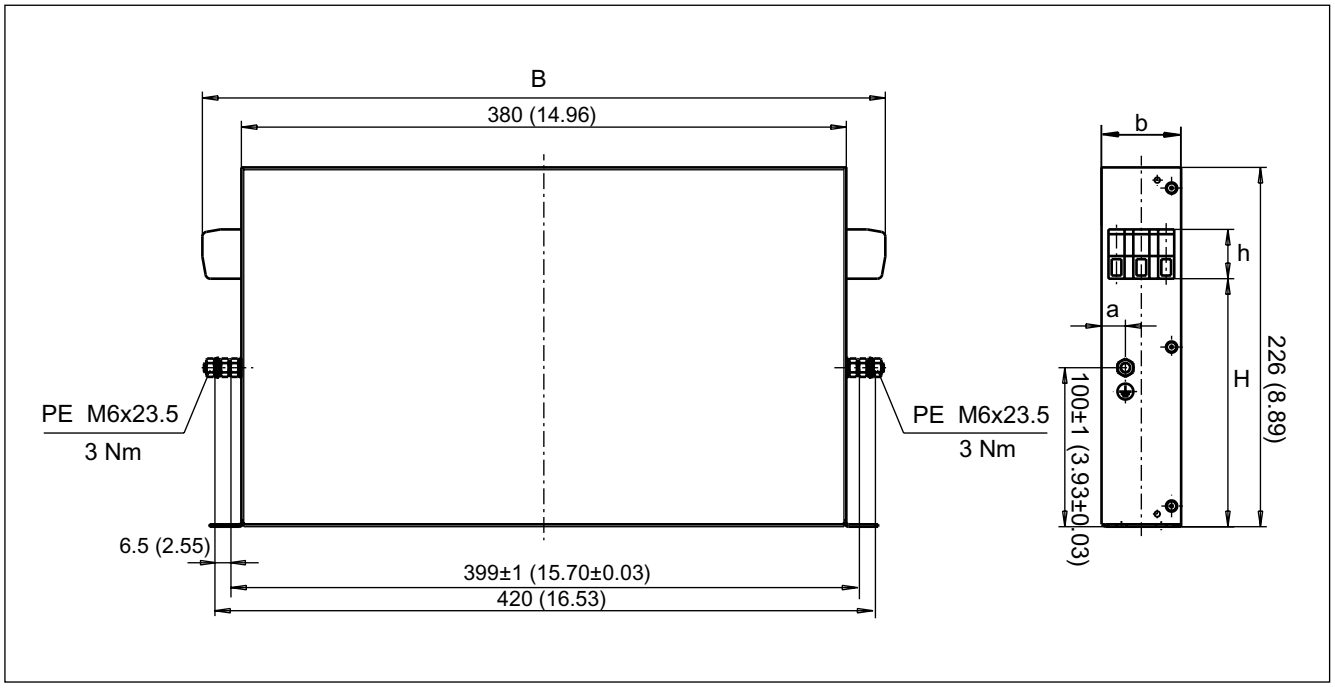


Figure 2-17 Dimension drawing: Basic Line Filter for Basic Line Modules (20 kW and 40 kW)

Table 2-13 Dimensions of Basic Line Filter for Basic Line Modules

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

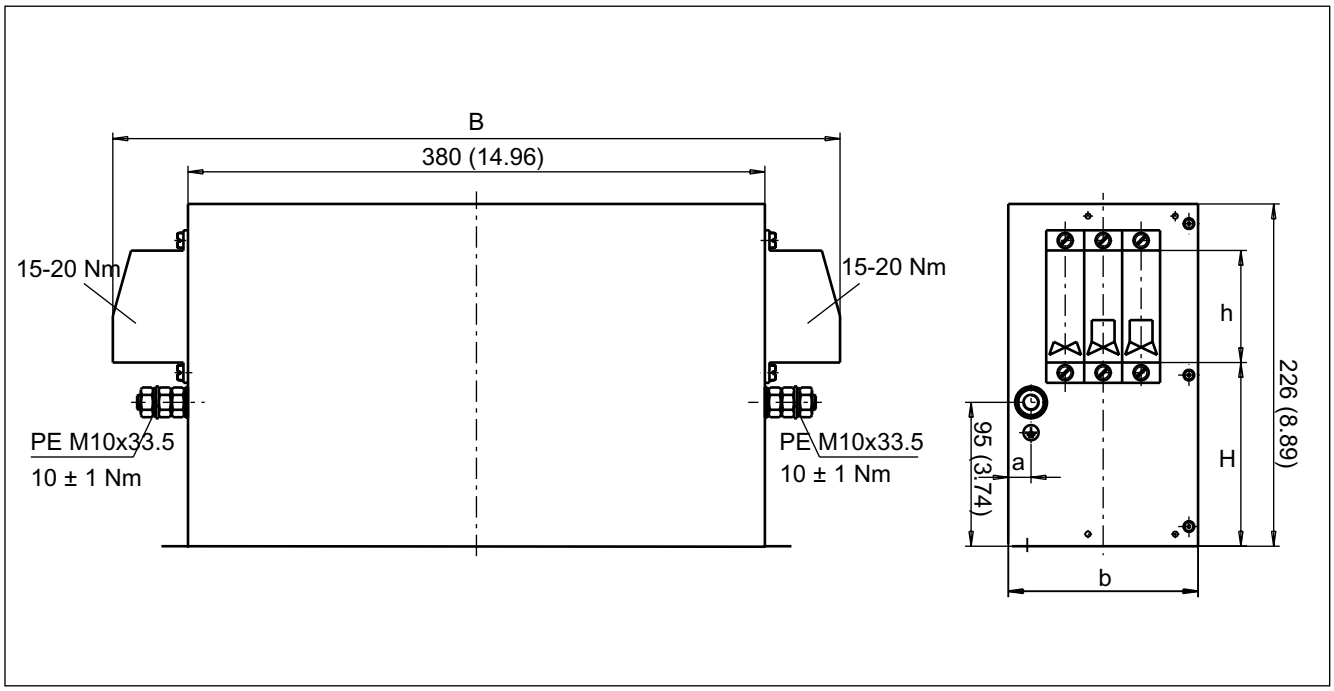


Figure 2-18 Dimension drawing of Basic Line Filter for 100 kW Basic Line Modules

Table 2-14 Dimensions of Basic Line Filter for Basic Line Modules

Basic Line Filter	Order number	B [mm] (inches)	b [mm] (inches)	a [mm] (inches)	H [mm] (inches)	h [mm] (inches)
100 kW	6SL3000-0BE31-2DAx	479 (18.85)	150 (5.90)	15 (0.59)	121.3 (4.77)	74 (2.91)

2.7.5 Technical data

Table 2-15 Technical data for Basic Line Filter for Basic Line Modules

	6SL3000 unit	0BE21-6DAx	0BE23-6DA1	0BE31-2DAx
Rated power	kW	20	40	100
Connection voltage: Supply voltage Line frequency	 V_{AC} Hz	 380 V 3 AC -10 % (-15 % < 1 min) to 480 V 3 AC +10 % 47 to 63 Hz		
Rated current	A_{AC}	36	65	192
Power loss[1]	W	16	28	86
Weight	kg	5	6.5	18.5

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

2.8 Basic Line Filter for Smart Line Modules

2.8.1 Description

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

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

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

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

2.8.2 Safety information

⚠ WARNING

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

⚠ WARNING

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

Incoming line cable to LINE L1, L2, L3

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

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

⚠ CAUTION

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

⚠ DANGER

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

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

⚠ DANGER

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

Note

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

CAUTION

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

2.8.3 Interface description

2.8.3.1 Overview

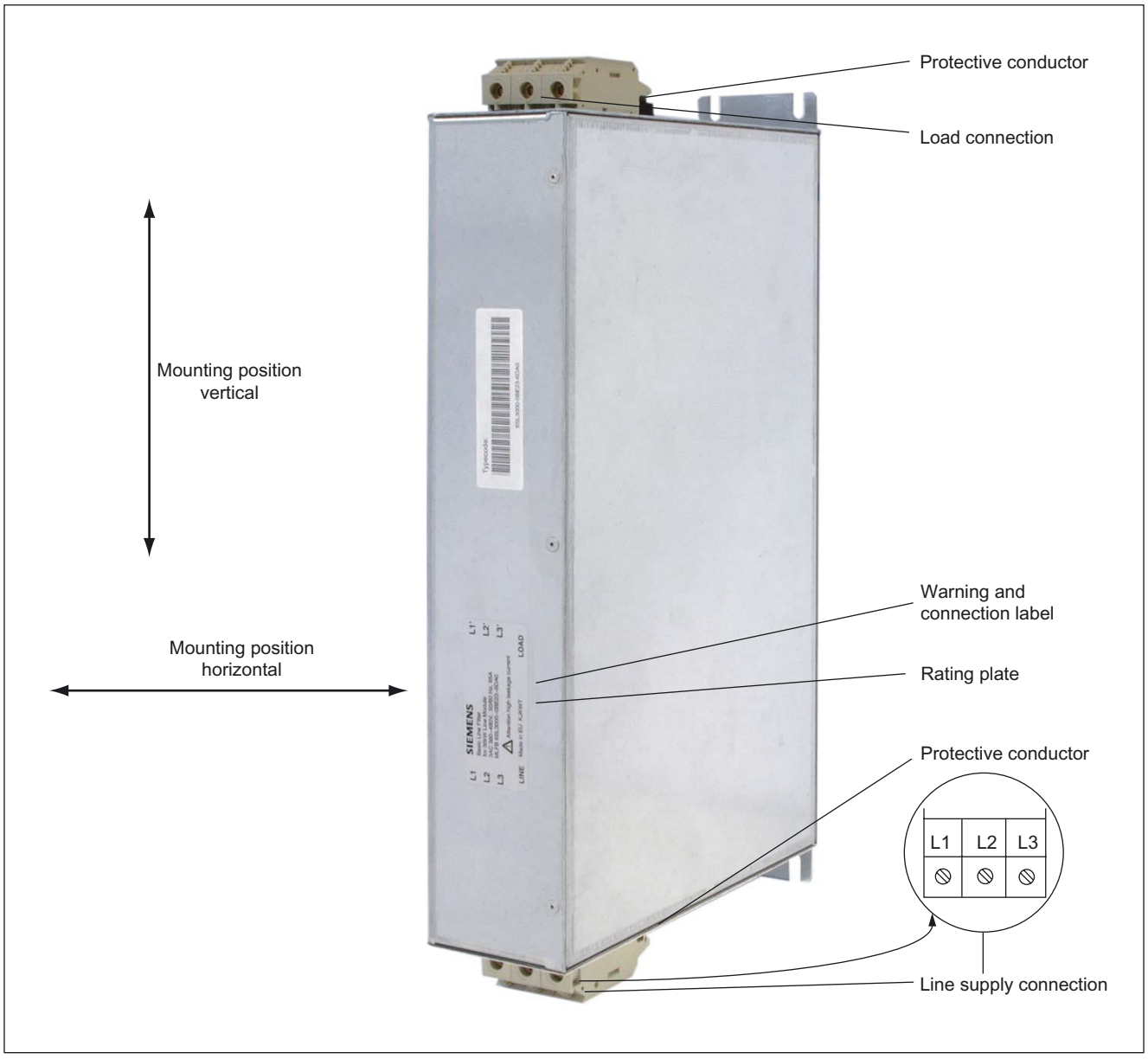


Figure 2-19 Basic Line Filter for Smart Line Modules (example: 36 kW)

NOTICE
The line/load connection must not be interchanged.

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

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

2.8.3.2 Line/power connection

Table 2-16 Type of connection

Terminals	Designations
Line supply connection (line supply)	L1, L2, L3, PE
Load connection (load)	L1´, L2´, L3´, PE
Basic Line Filter for Smart Line Modules	
5 kW	Screw terminal: 10 mm^2 3-pin/1.5 -1.8 Nm (see Screw Terminals chapter) Grounding bolt: M6/6 Nm[1)]
10 kW	
16 kW	
36 kW	Screw terminal: 35 mm^2 Grounding bolt: M6/6 Nm[1)]
1) for ring cable lugs to DIN 46234	

2.8.4 Dimension drawings

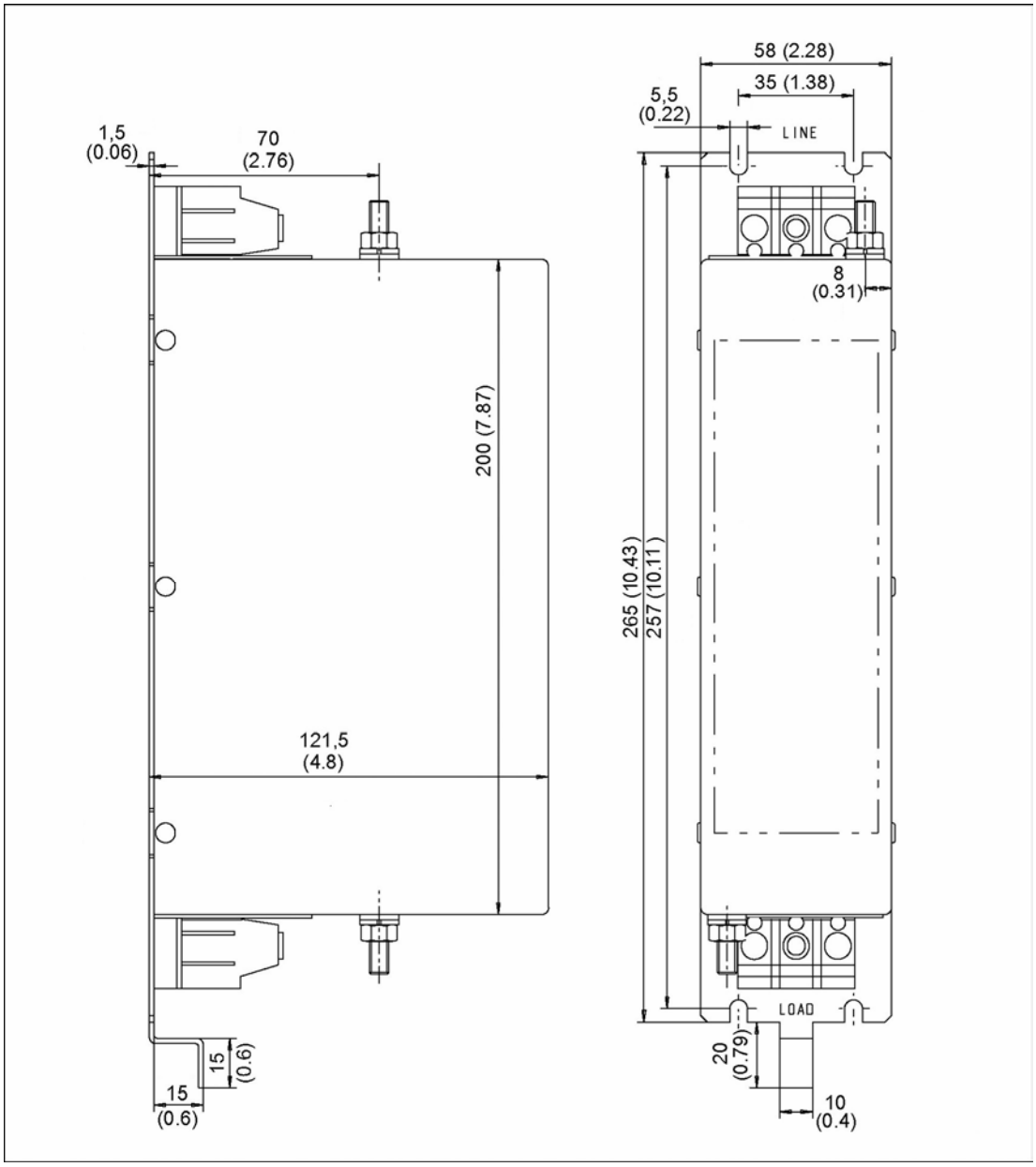


Figure 2-20 Dimension drawing: Basic Line Filter for Smart Line Modules (5 and 10 kW)

Table 2-17 Basic Line Filter for Smart Line Modules

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

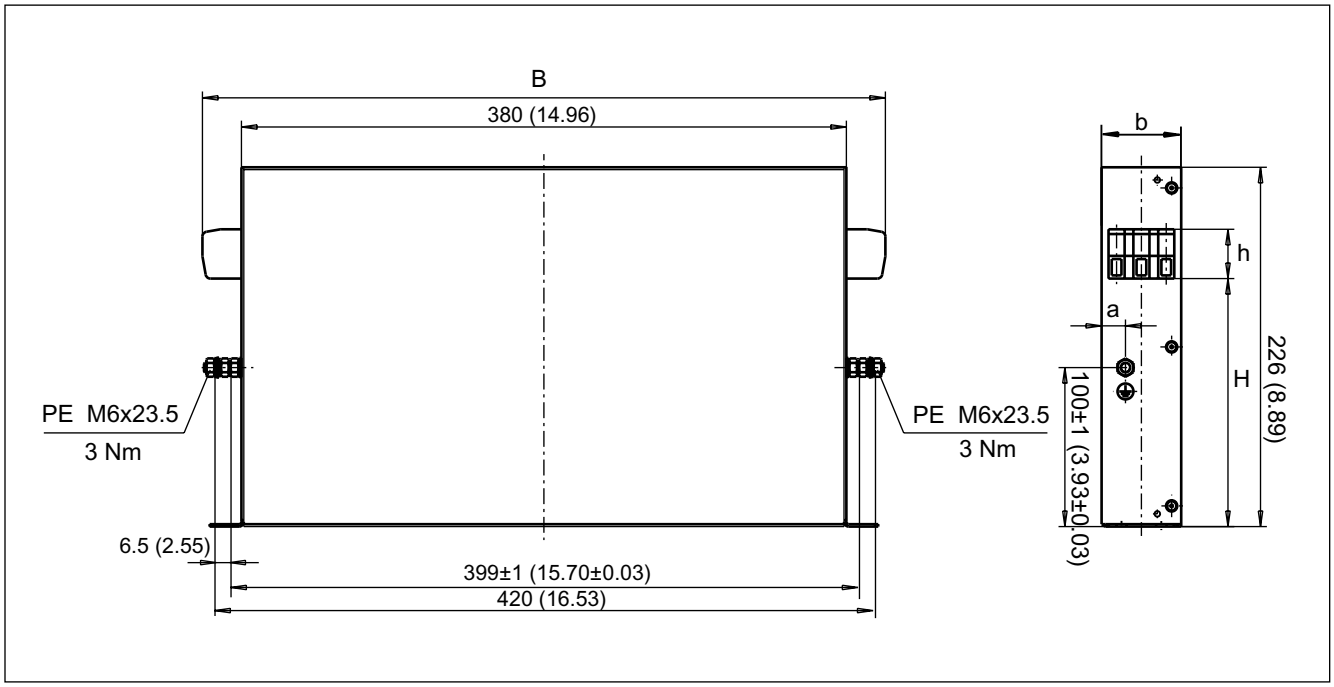


Figure 2-21 Dimension drawing: Basic Line Filter for Smart Line Modules (16 kW and 36 kW)

Table 2-18 Dimensions of Basic Line Filter for Smart Line Modules

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

2.8.5 Technical data

Table 2-19 Technical data for: Basic Line Filter for Smart Line Modules

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

2.9 Active Interface Modules (internal cooling)

2.9.1 Description

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

They contain the following functional units:

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

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

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

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

2.9.2 Safety information

CAUTION

Active Interface Modules must only be operated if the option "Line filter available" has been set for the Active Line Module in the commissioning wizard, and if "AIM 400 V xxkW (6SL3100-0BE-*AB*)" has been selected as the line filter. Alternatively the parameter for line filter adjustment can also be set manually: p0220 = 4*.**

If this is not observed, the Active Interface Modules may overheat.

⚠ DANGER

The Active Interface Modules conduct a high leakage current via the PE conductor.
A permanent PE connection for the Active Interface Module or control cabinet is required due to the high leakage current of the Active Interface Module.

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

⚠ DANGER

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

Note

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

2.9.3 Interface description

2.9.3.1 Overview

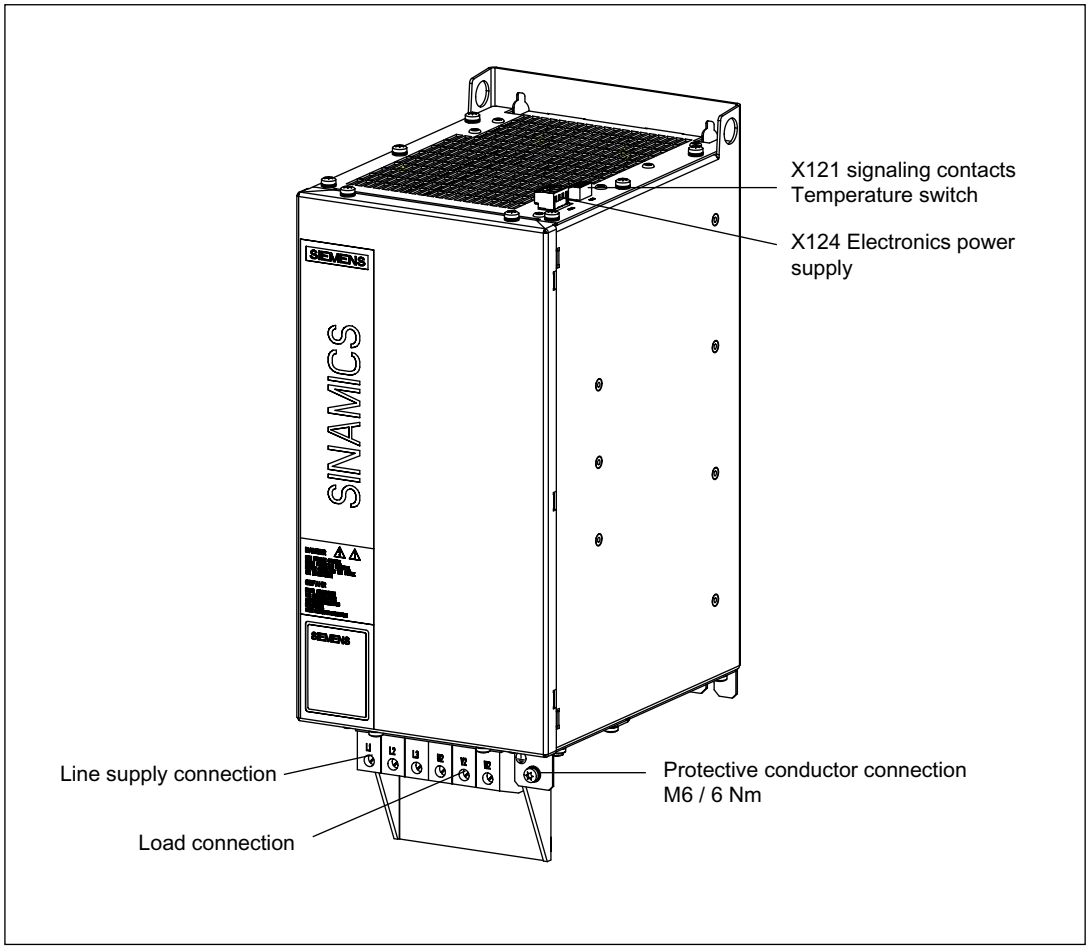


Figure 2-22 Interface description: Active Interface Module 55 kW

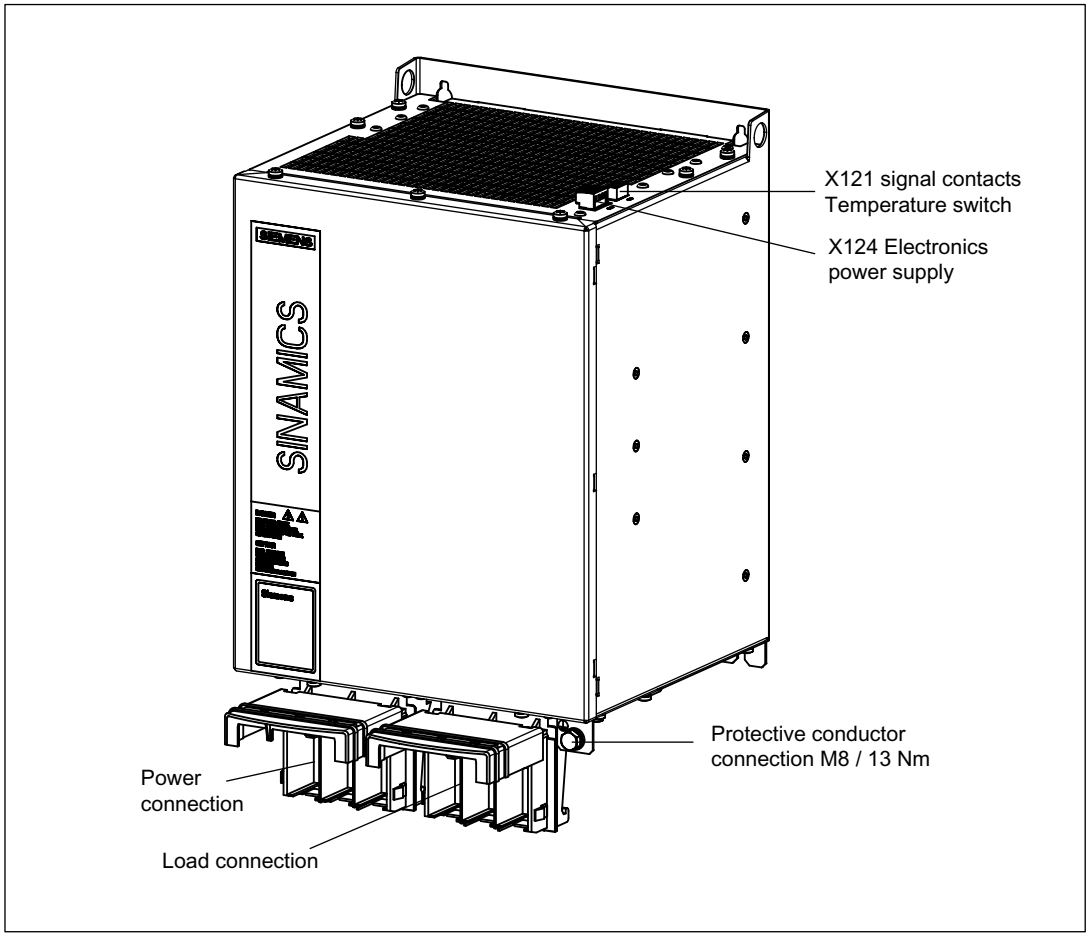


Figure 2-23 Interface description: Active Interface Module (80 kW and 120 kW)

2.9.3.2 Connection example

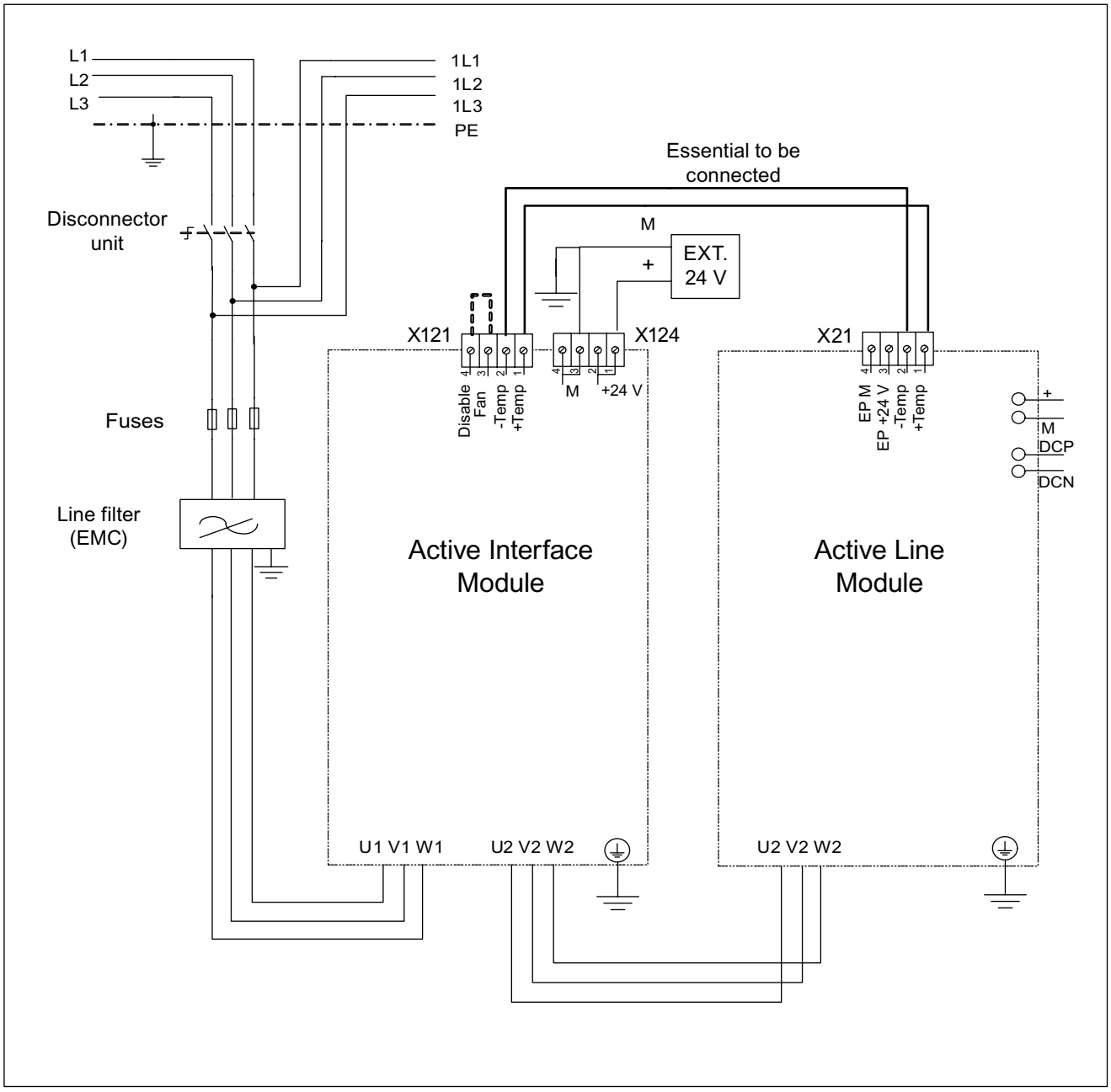
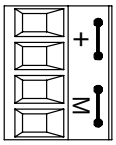


Figure 2-24 Connection example: Active Interface Module

2.9.3.3 Electronics power supply X124

Table 2-20 Terminal block X124

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

Note

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

2.9.3.4 Line/power connection

Table 2-21 Type of connection

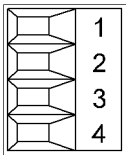
Terminals	Designations
Line supply connection (line supply)	L1, L2, L3
Load connection (load)	U2, V2, W2
Active Interface Module	
55 kW	Terminal type HDFK 50, 25 mm² cross-section, ferrule Tightening torque min. 6 Nm
80 / 120 kW	Threaded bolt M8, max. cross-section 120 / 2 x 50 mm², tightening torque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

Note

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

2.9.3.5 X121 alarm contacts for temperature switch

Table 2-22 Plug-in screw terminal X121

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

Note

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

2.9.4 Dimension drawings

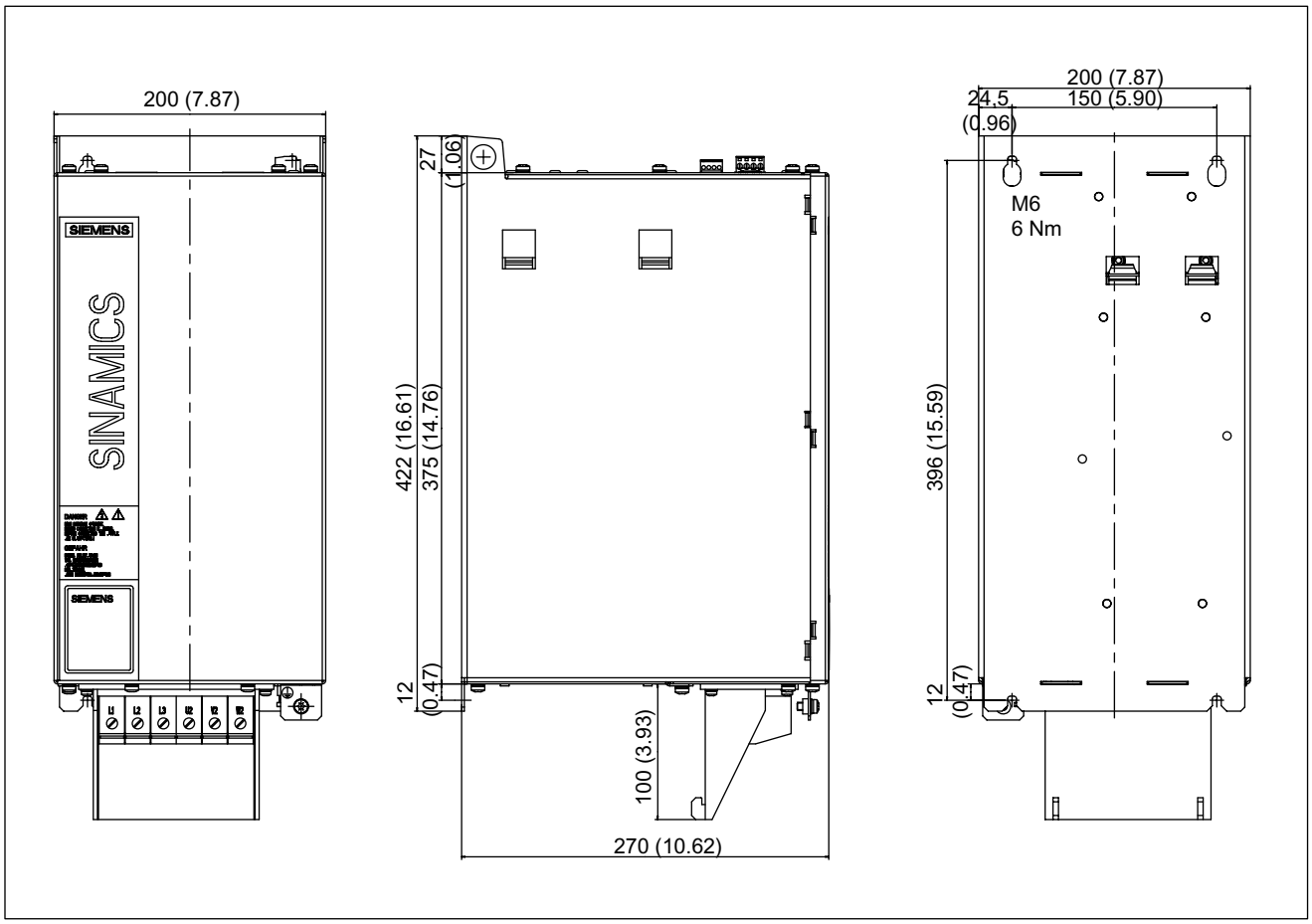


Figure 2-25 Dimension drawing: Active Interface Module 55 kW

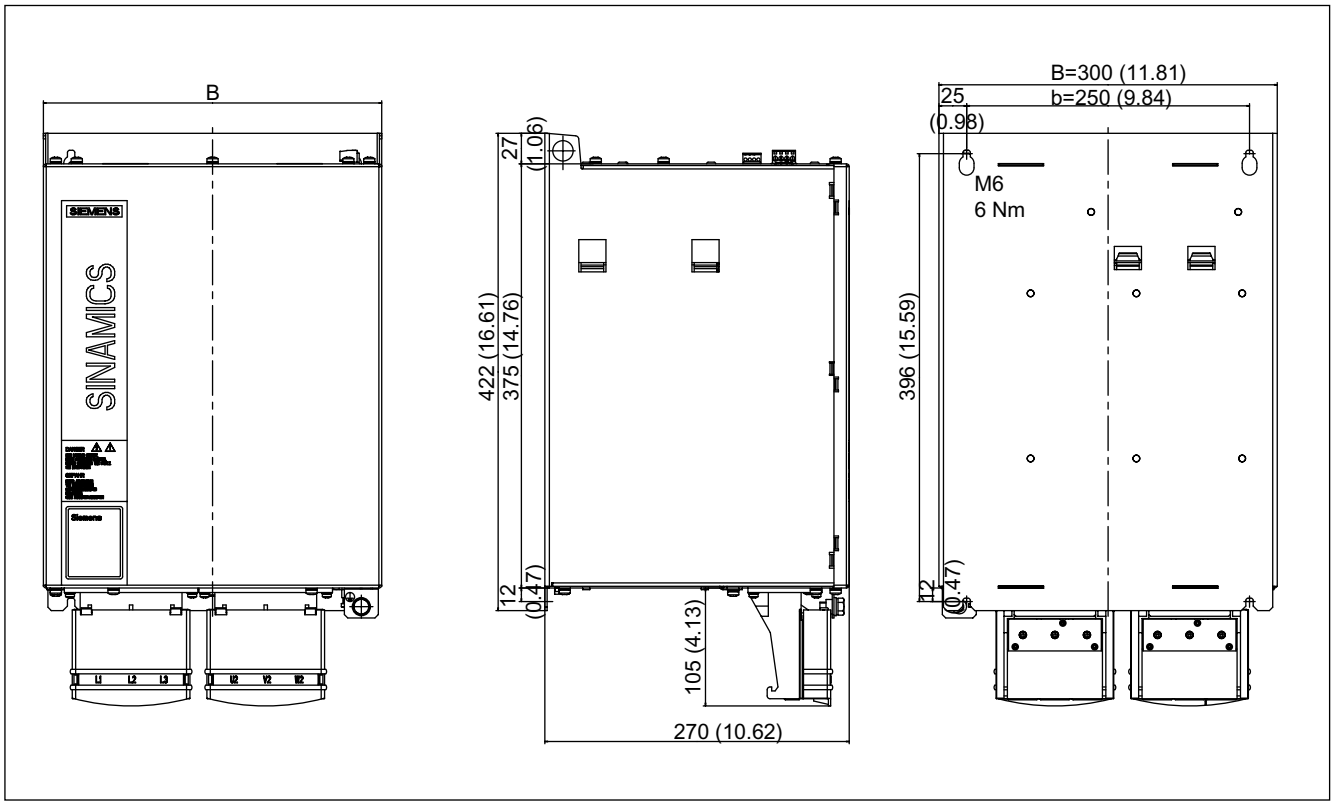


Figure 2-26 Dimension drawing: Active Interface Module (80 kW and 120 kW)

Table 2-23 Active Interface Modules

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

Table 2-24 Shield connecting plates for Active Interface Modules

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

2.9.5 Installation

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

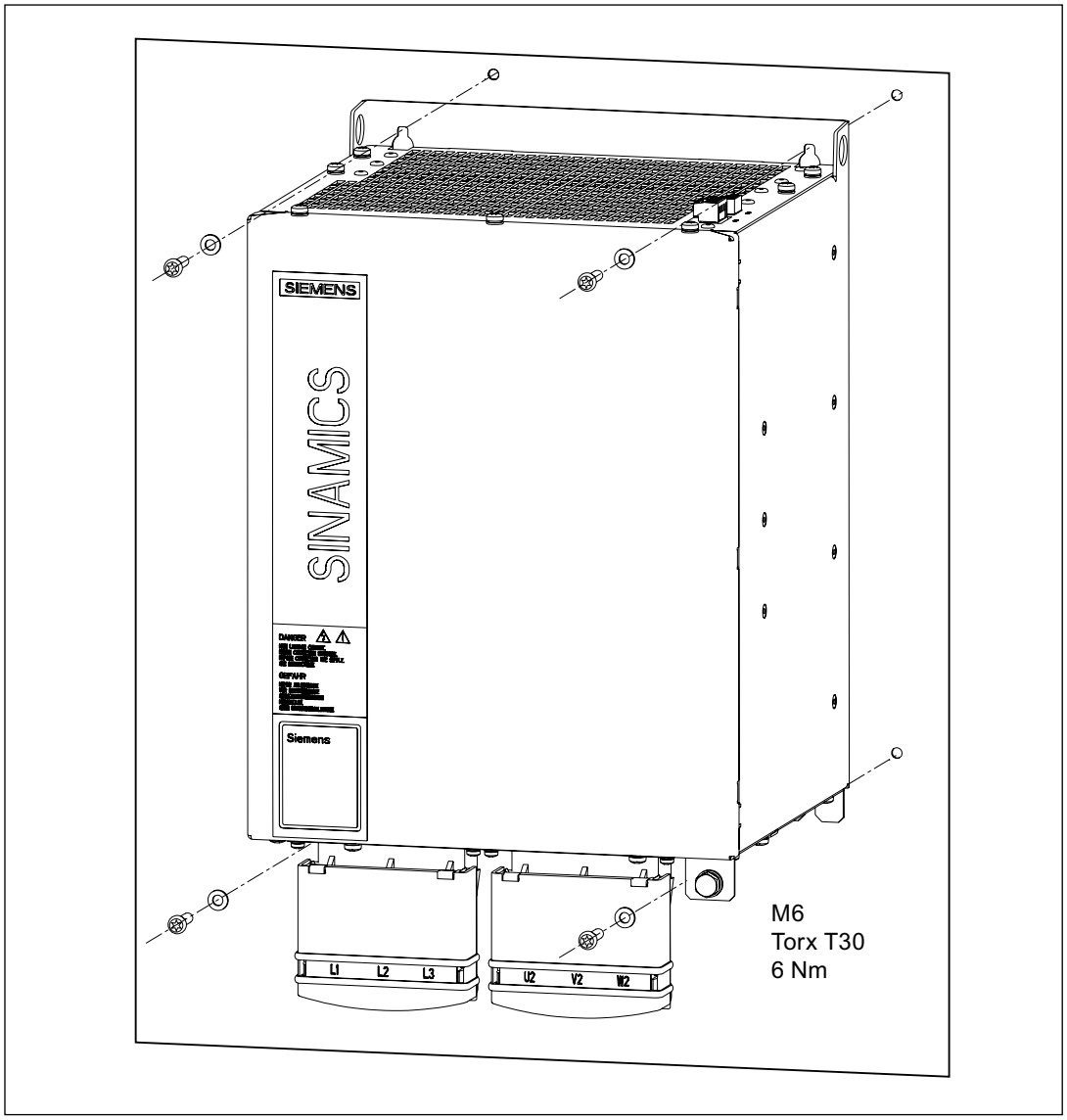


Figure 2-27 Mounting: Active Interface Module

Table 2-25 Protective conductor connection

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

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

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

⚠ DANGER

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

CAUTION

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

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

Replacing the fan in an Active Interface Module

NOTICE

When replacing the fan, you must observe the ESD regulations.

NOTICE

Parts must only be replaced by trained personnel (danger of damage to sensitive components due to static electricity)!

⚠DANGER

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

Table 2-26 Replacing the fan in an Active Interface Module, 55 kW

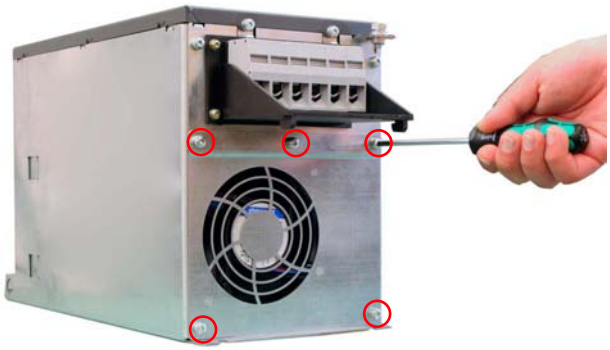
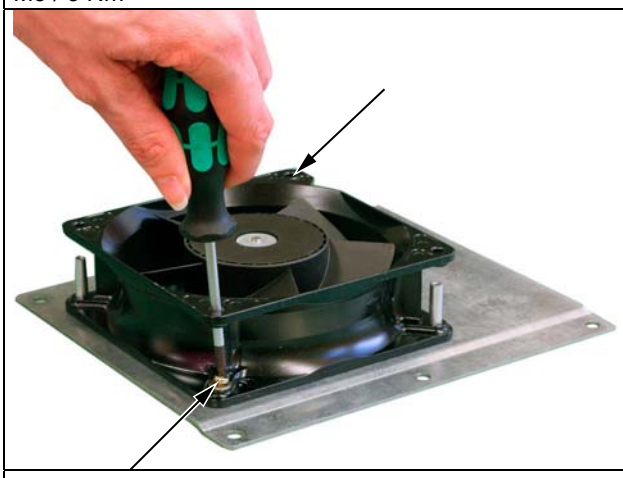
	
Open the fan cover. Unscrew the combination screws M5 / 3 Nm	Open the fan cover and remove the connector
	
Unscrew the screws M3 / 1.8 Nm	Remove the fan

Table 2-27 Replacing the fan in an Active Interface Module, 80 kW, 120 kW

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

To install, carry out the above steps in reverse order. The torques must be carefully observed.

2.9.6 Technical data

Table 2-28 Technical data

Active Interface Module	6SL3100-	0BE25-5ABx	0BE28-0ABx	0BE31-2ABx
		55 kW	80 kW	120 kW
P_{max}	kW	110	131	175
I_{rated}	A	88	132	200
I_{max}	A	176	218	292
Current requirements of the 24 V DC electronics power supply	A	1.2	1.2	1.2
Mains voltage	V		380 V to 480 V 3 AC ±10 %	
Line frequency	Hz		47 - 63	
Cooling air requirement	m^3/h	300	600	600
Power loss	W	450	575	800
Weight	kg	21	29	33
Connection cross-section	mm^2	50	120	120
PE connecting studs		M6	M8	M8

2.10 Line reactors for Active Line Modules

2.10.1 Description

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

2.10.2 Safety information

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

Note

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

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

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

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

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

2.10.3 Connection description

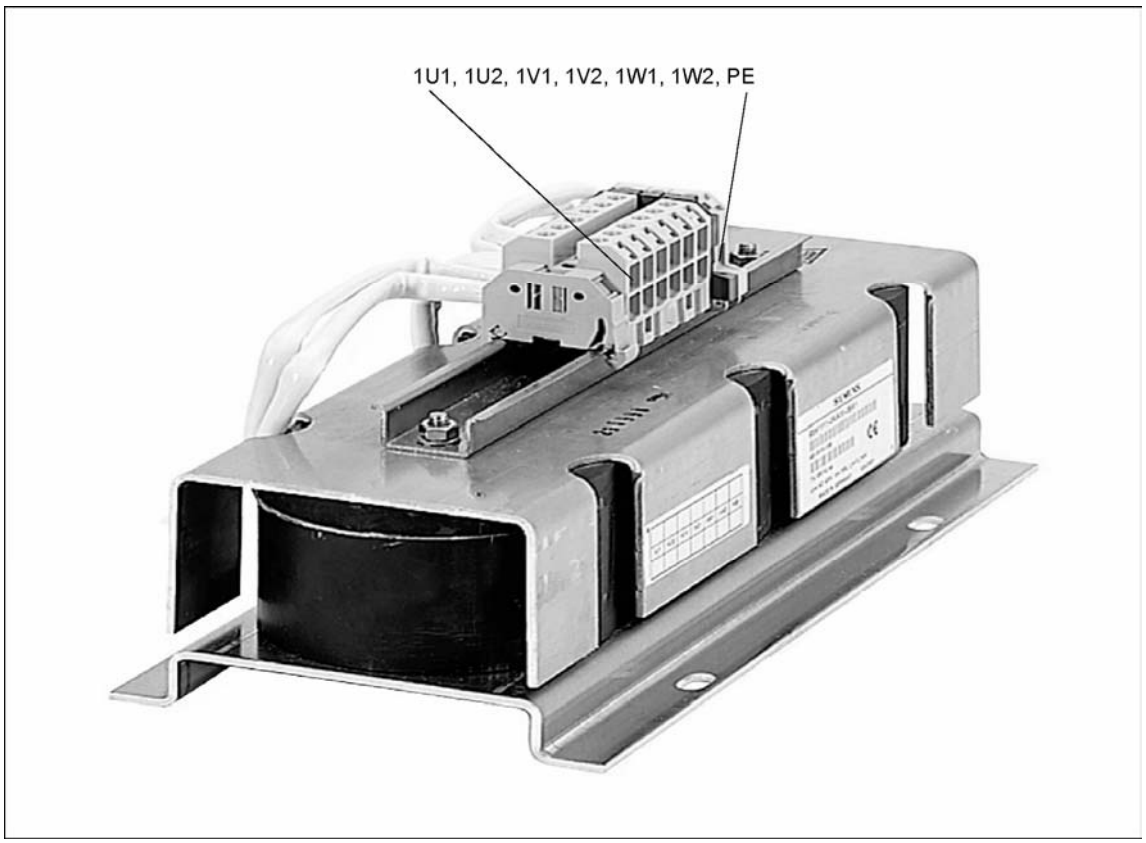


Figure 2-28 Line reactor (example: 16 kW)

2.10.3.1 Line/power connection

Table 2-29 Connection types for line reactors

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

* See Chapter Screw terminals

2.10.4 Dimension drawings

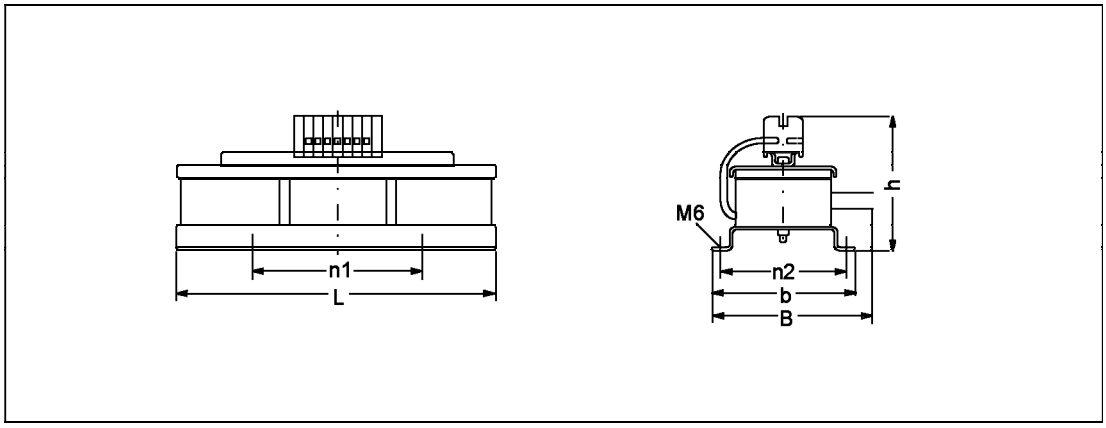


Figure 2-29 Dimension drawing: Line reactor for Active Line Modules (up to 55 kW)

Table 2-30 Dimensions of the line reactor for Active Line Modules

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

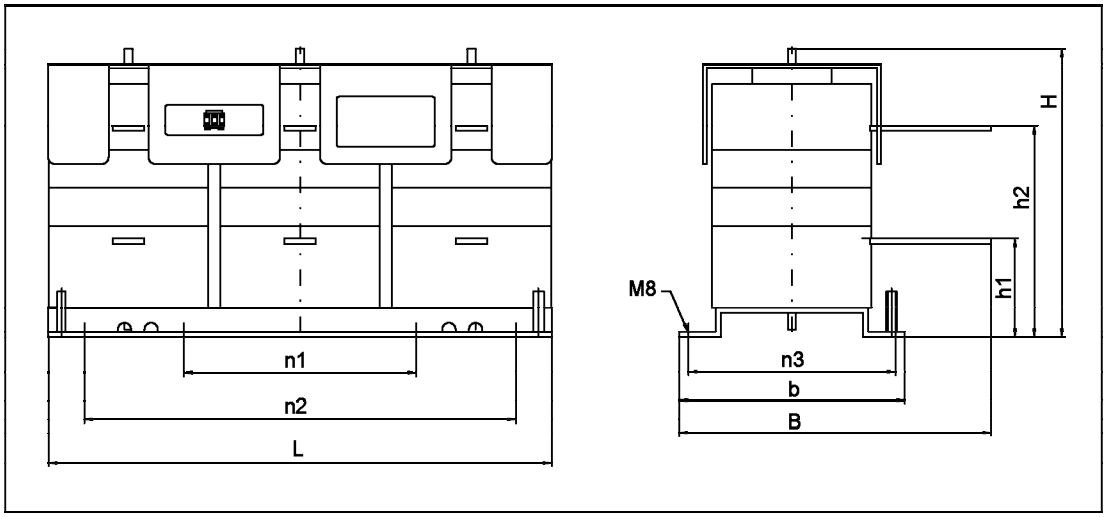


Figure 2-30 Dimension drawing: Line reactor for Active Line Modules (as of 80 kW)

Table 2-31 Dimensions of the line reactor for Active Line Modules

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

2.10.5 Technical data

Table 2-32 Technical data of line reactors for the Active Line Module

	Unit	6SN1111–0AA00-0BA1	6SN1111–0AA00-0CA1	6SN1111–0AA00-0DA1	6SN1111–0AA00-1EAx	6SL3000-0DE31-2BAx
Power	kW	16	36	55	80	120
Rated current	A_{rms}	30	67	103	150	225
Power loss[1]	W	170	250	350	450	590
Weight	Weight[kg]	8.5	13	18	40	64

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

2.11 Line reactors for Smart Line Modules

2.11.1 Description

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

2.11.2 Safety information

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

Note

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

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

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

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

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

2.11.3 Connection description

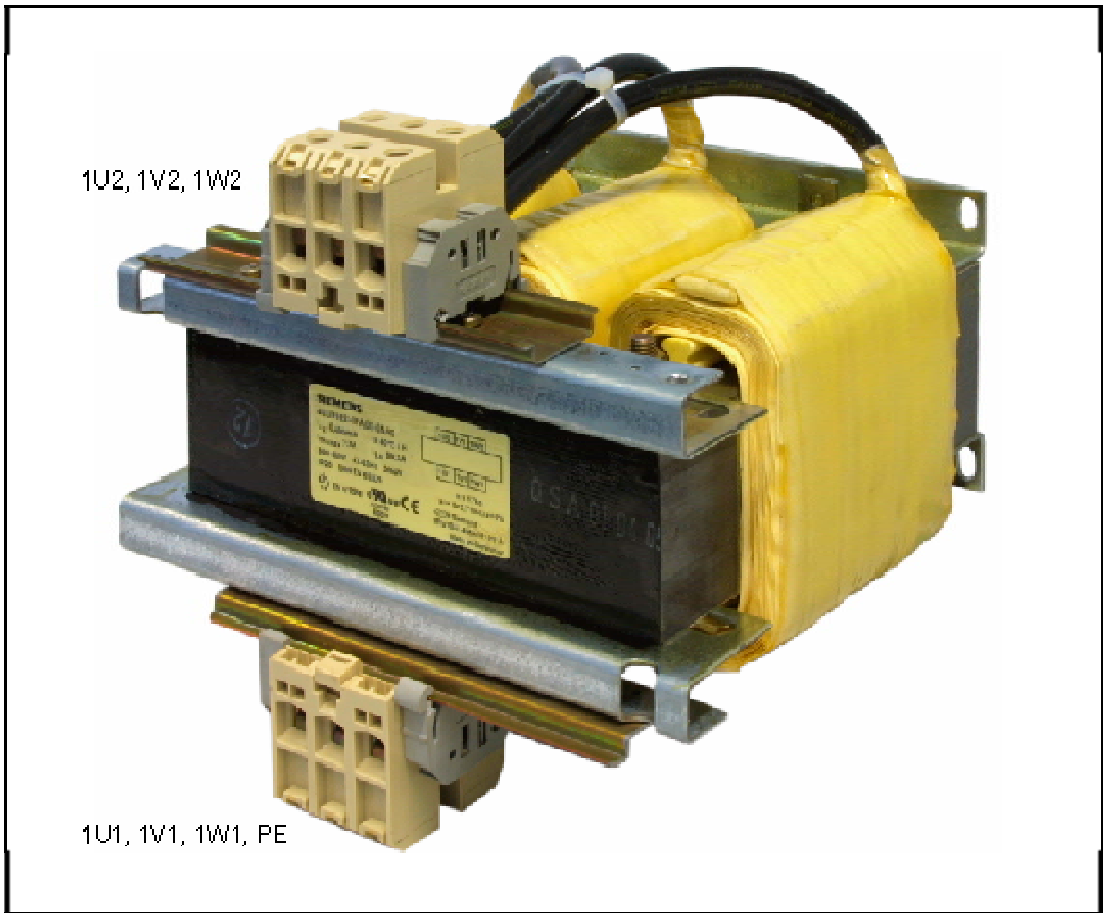


Figure 2-31 Line reactors for Smart Line Modules (example: 36 kW)

2.11.3.1 Line/power connection

Table 2-33 Connection types for line reactors

Terminals	Designations
Line supply connection	1U1, 1V1, 1W1, PE
Load connection	1U2, 1V2, 1W2
Line reactors for Smart Line Modules	
5 kW	Screw terminal 4 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 Chapter Screw terminals

2.11.4 Dimension drawings

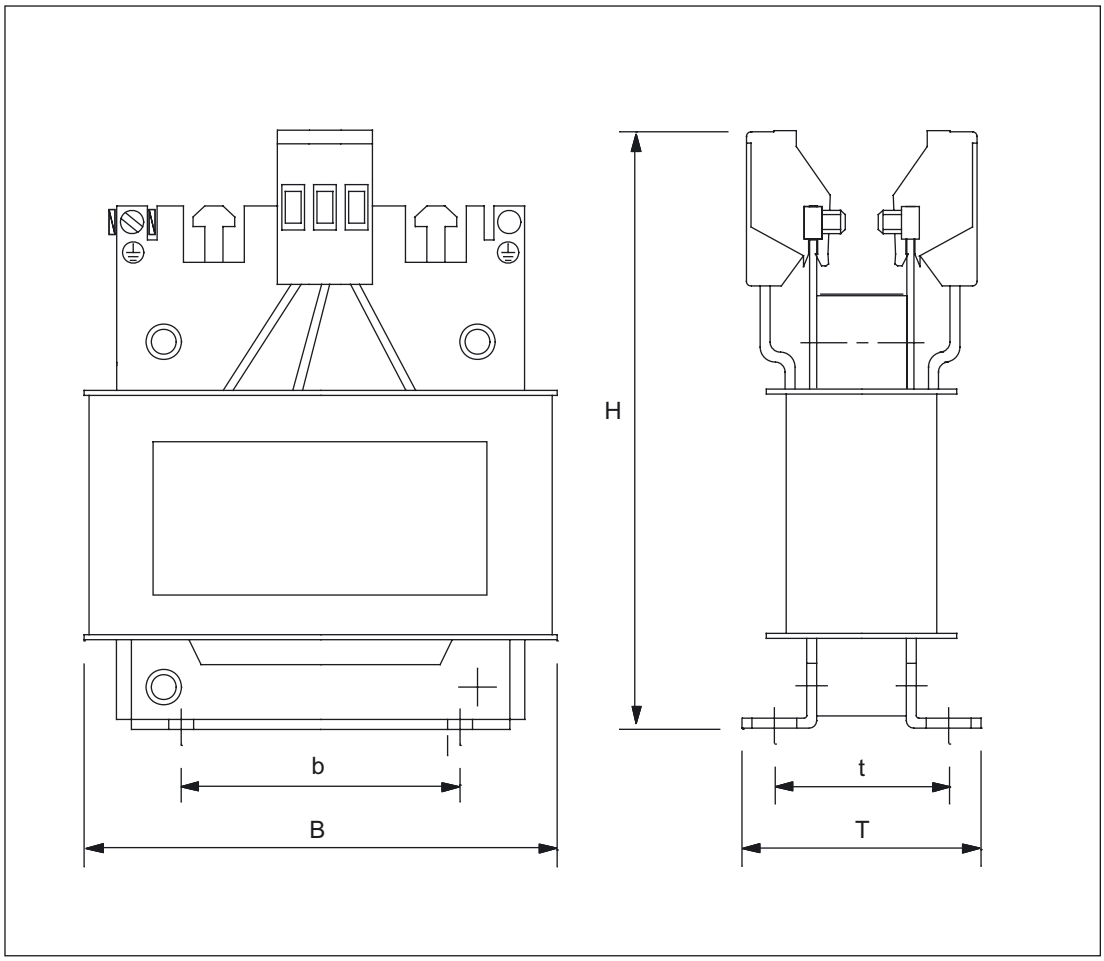


Figure 2-32 Dimension drawing: Line reactor for Smart Line Modules (5 and 10 KW)

Table 2-34 Dimensions of the line filter for Smart Line Modules

	Order number 6SL3000-	W [mm] (inches)	b [mm] 1) (inches)	H [mm] (inches)	D [mm] (inches)	t [mm] 1) (inches)
5 kW	0CE-15-0AAx	150 (5.91)	113 (4.53)	175 (6.89)	66.5 (2.62)	49.5 (1.95)
10 kW	0CE-21-0AAx	177 (6.97)	136 (5.35)	196 (7.72)	86 (3.39)	67 (2.64)
1) The lengths b and t correspond to the hole spacing						

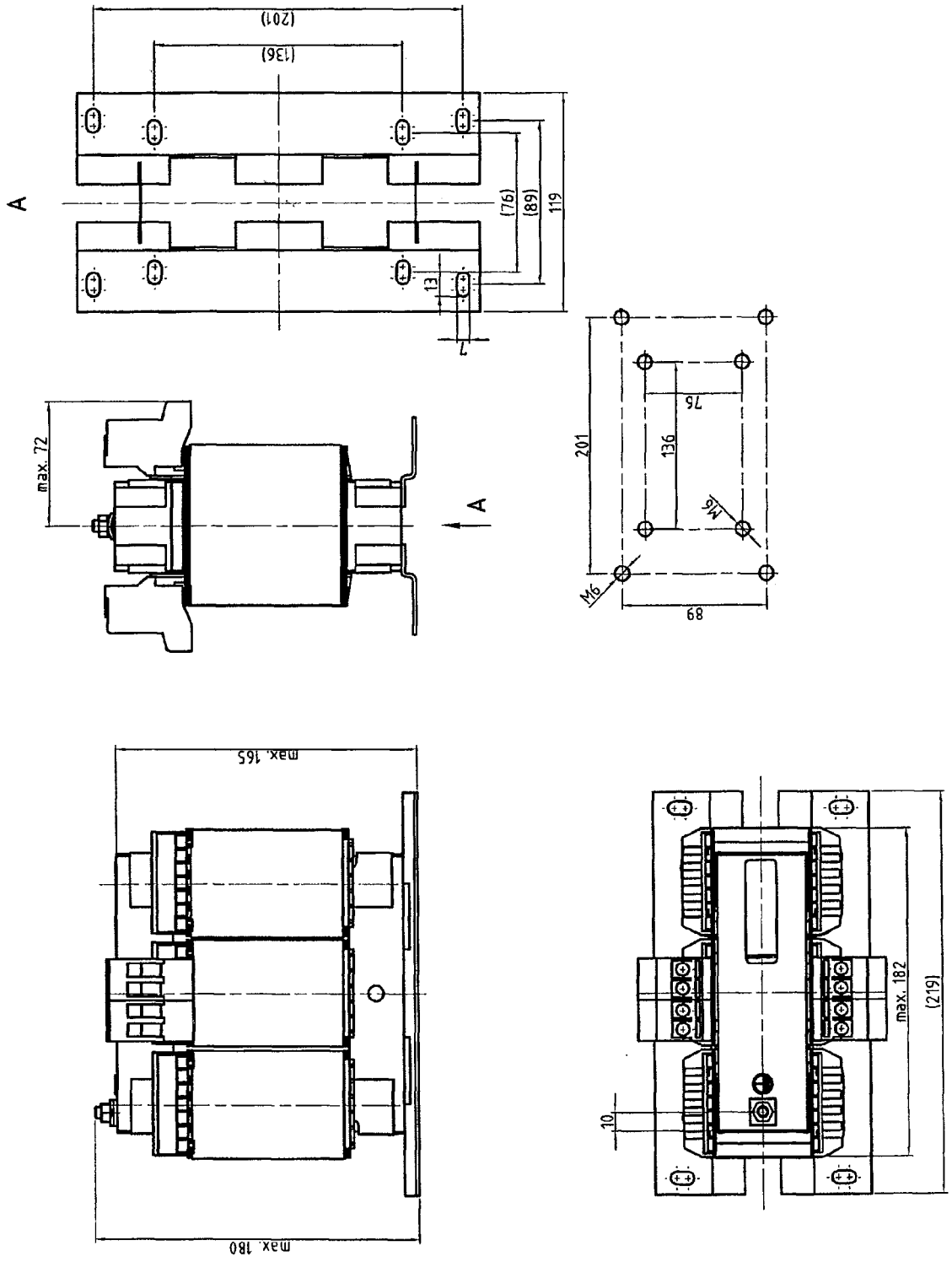


Figure 2-33 Dimension drawing of line reactor for the Smart Line Module 16 kW

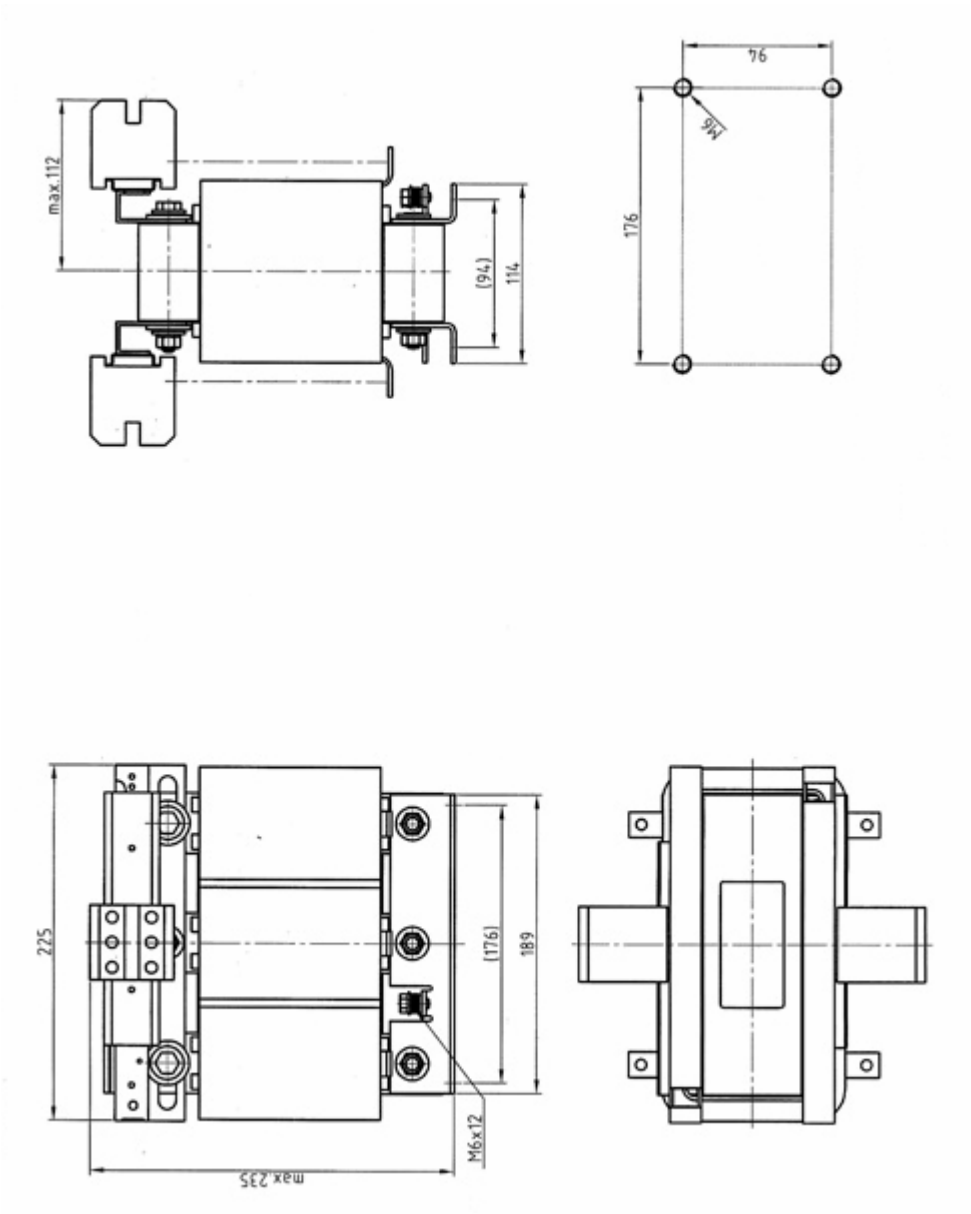


Figure 2-34 Dimension drawing of the line reactor for the Smart Line Module 36 kW

Table 2-35 Line reactor for the Smart Line Modules 16 kW and 36 kW

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

2.11.5 Technical data

Table 2-36 Technical data of line reactors for the Smart Line Module

	6SL3000 unit	0CE15-0AAx	0CE21-0AAx	0CE22-0AAx	0CE24-0AAx
Power	kW	5	10	16	36
Rated current	A_{rms}	14	28	35	69
Power loss[1]	W	62	116	110	170
Weight	kg	3.7	7.5	9.5	17

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

2.12 Line reactors for Basic Line Modules

2.12.1 Description

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

2.12.2 Safety information

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

Note

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

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

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

2.12.3 Connection description

2.12.3.1 Overview

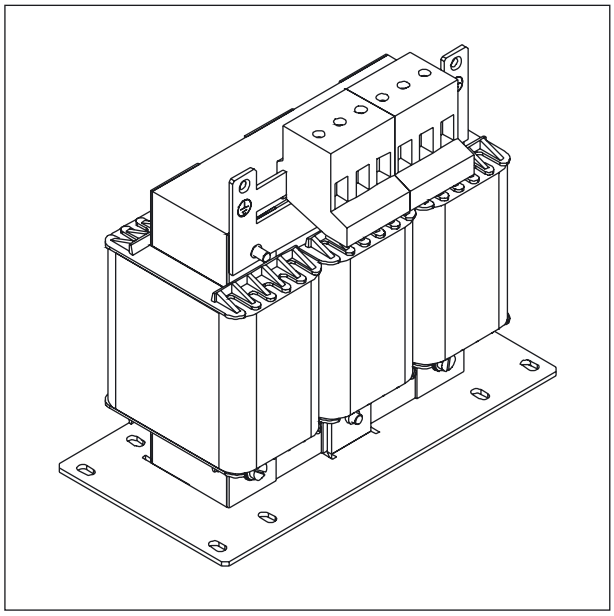


Figure 2-35 Line reactor for Basic Line Module (20 kW)

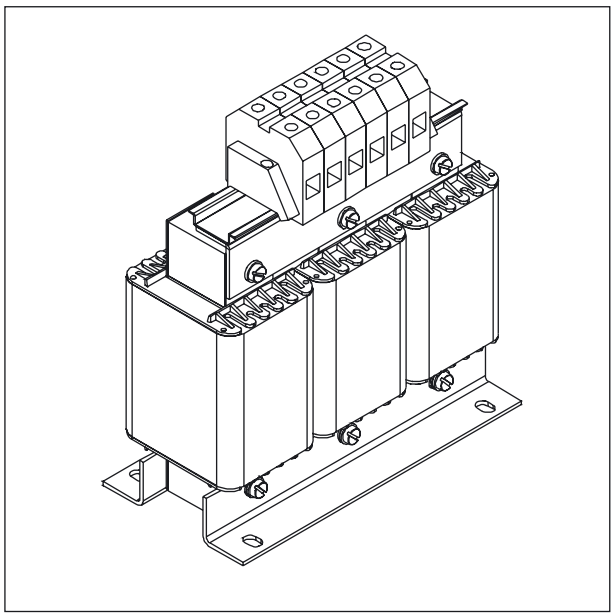


Figure 2-36 Line reactor for Basic Line Module (40 kW)

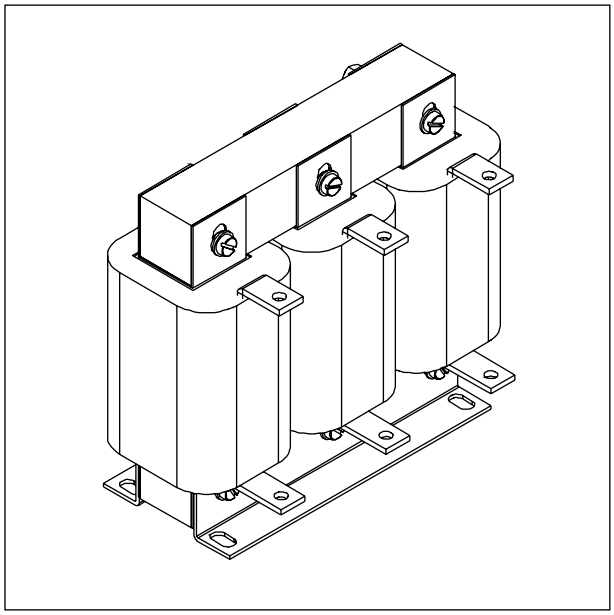


Figure 2-37 Line reactor for Basic Line Module (100 kW)

2.12.3.2 Line/power connection

Table 2-37 Connection types for line reactors

Terminals	Designations
Power connection	L1, L2, L3
Load connection	1L1, 1L2, 1L3
Line reactors for Basic Line Modules	
20 kW	Max. conductor cross-section 16 mm^2/0.6 - 0.8 Nm
40 kW	Max. conductor cross-section 35 mm^2/2.5 - 5.0 Nm
100 kW	Copper rails with 8.5 mm holes

2.12.4 Dimension drawings

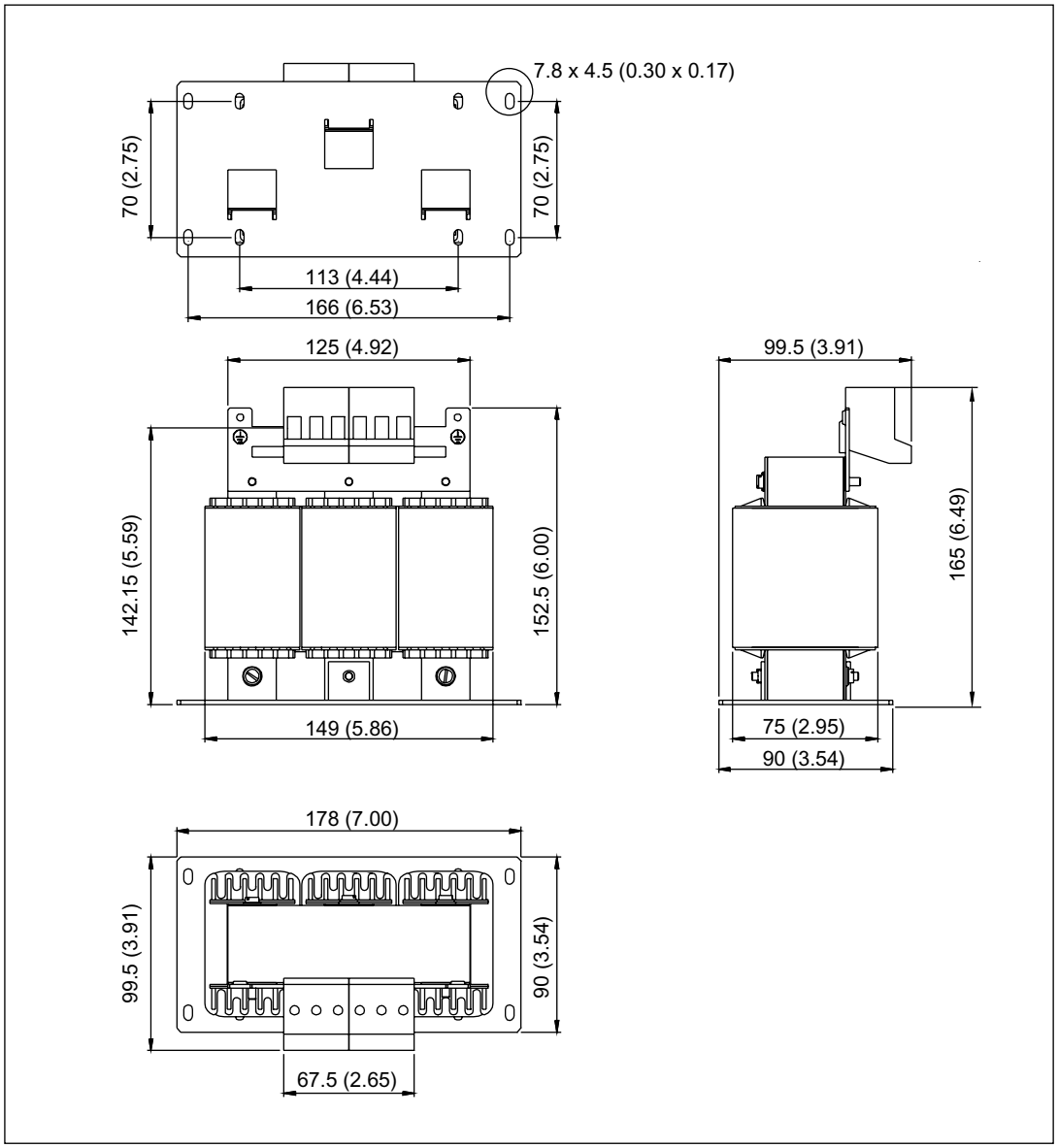


Figure 2-38 Dimension drawing: Line reactor for Basic Line Module (20 kW)

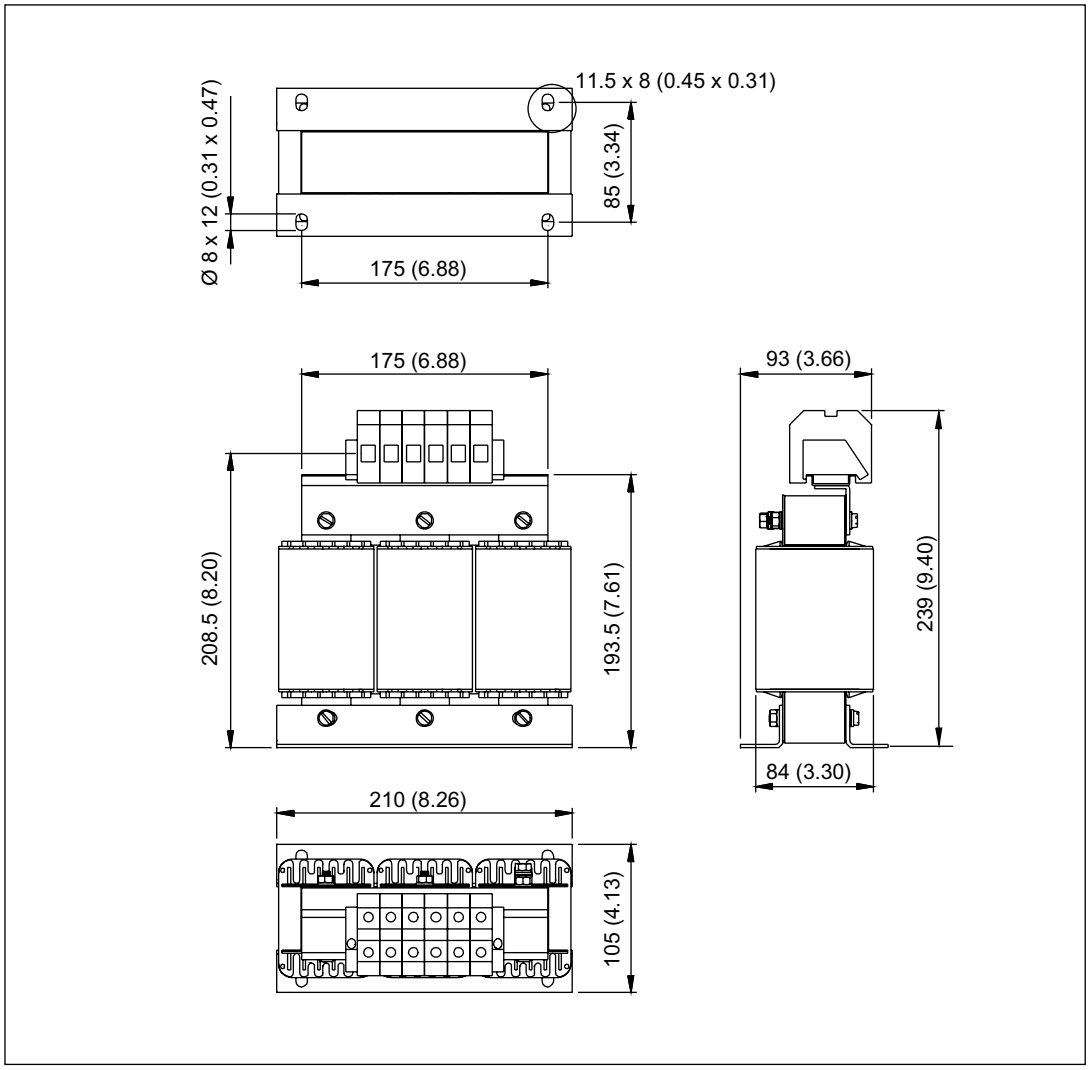


Figure 2-39 Dimension drawing: Line reactor for Basic Line Module (40 kW)

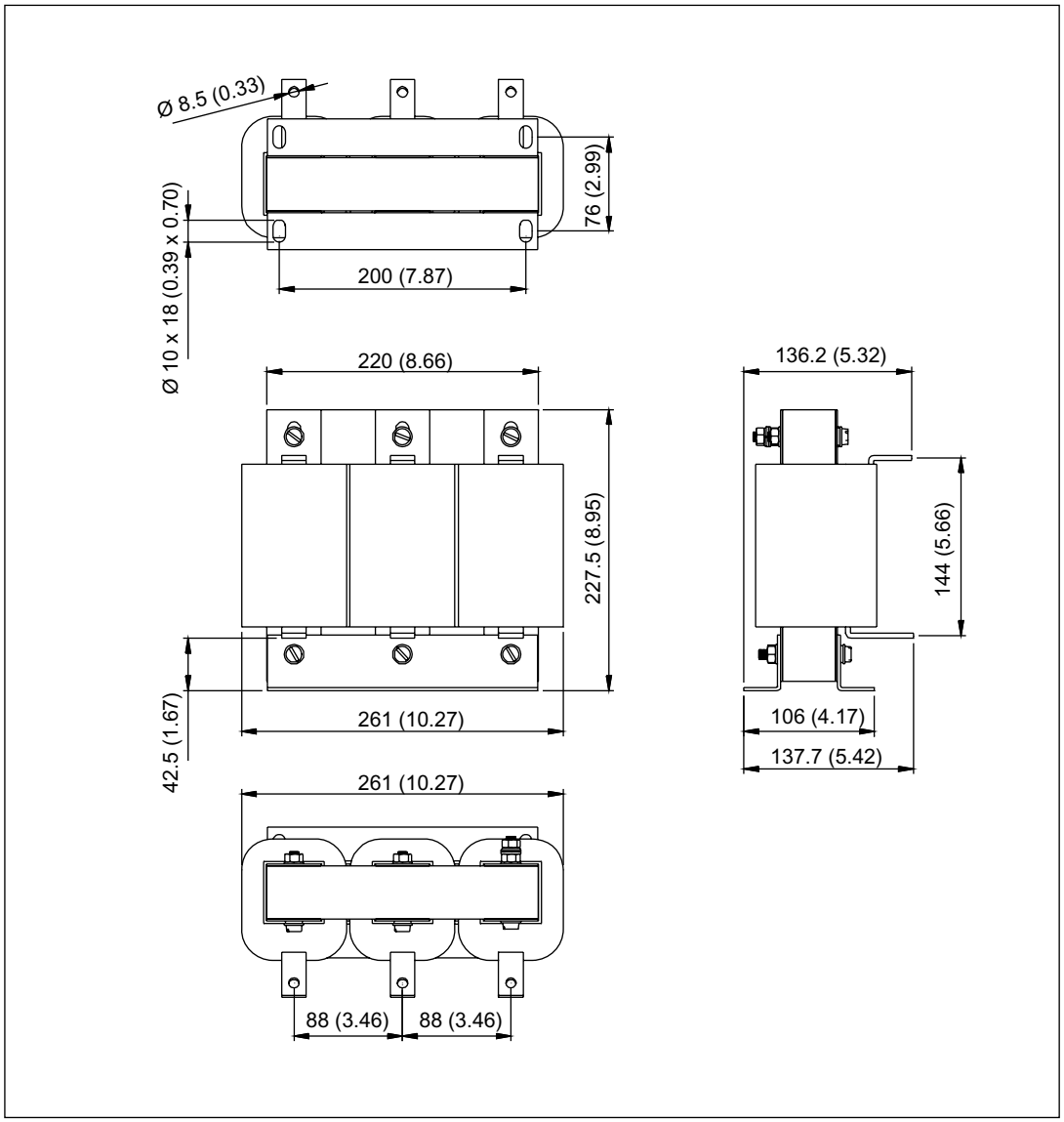


Figure 2-40 Dimension drawing: Line reactor for Basic Line Module (100 kW)

2.12.5 Technical data

Table 2-38 Technical data of line reactors for the Basic Line Modules

	6SL3000 unit	**0CE22-0AAx**	**0CE24-0AAx**	**0CE31-0AAx**
Power	kW	20	40	100
Rated current	A_{rms}	37	74	185
Power loss	W	130	270	480
Weight	kg	5.2	11.2	21.7

2.13 Line connection variants

2.13.1 Ways of connecting the line supply

A distinction is made between:

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

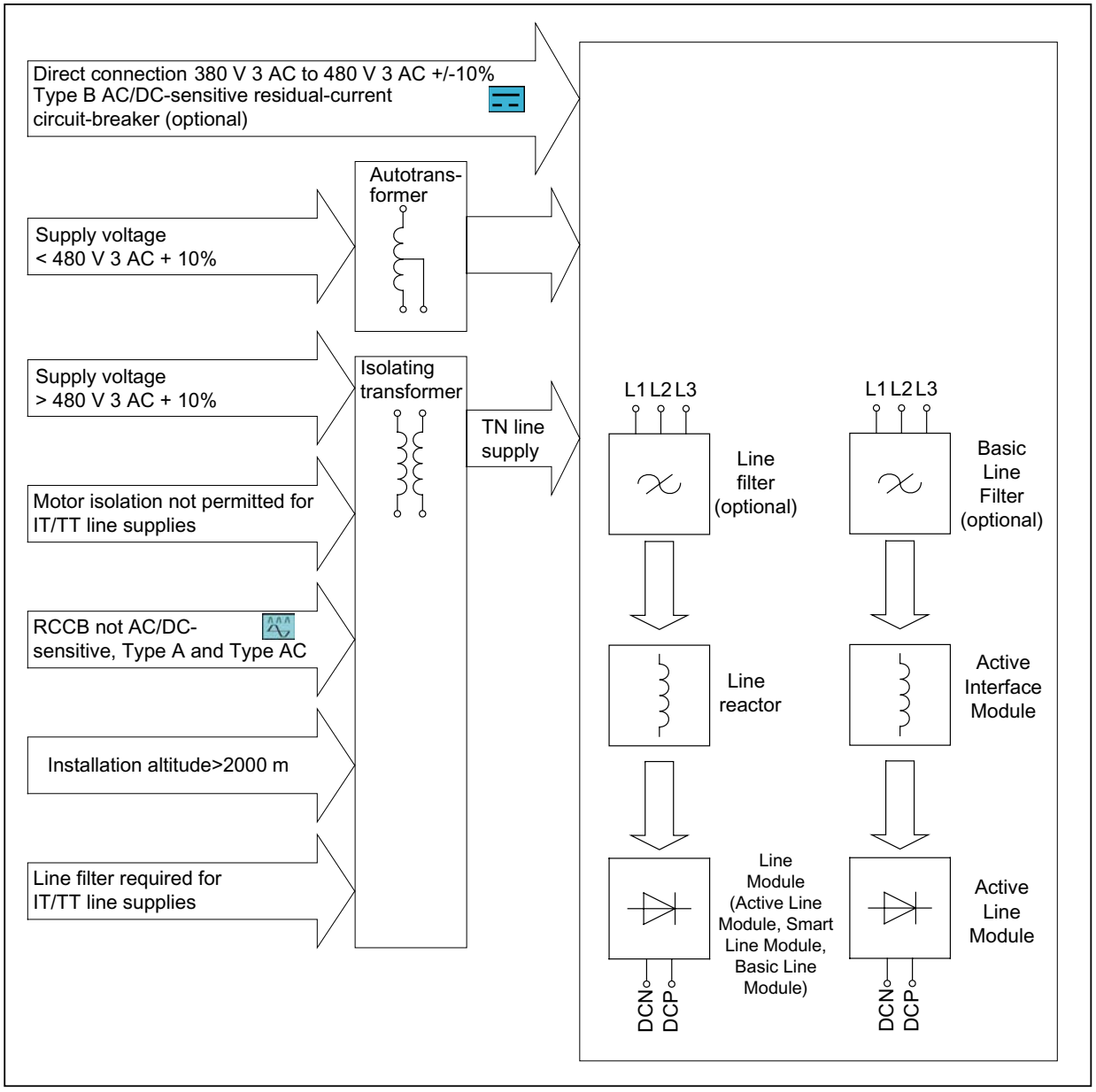


Figure 2-41 Overview of line connection versions

2.13.2 Operating line connection components on the line supply

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

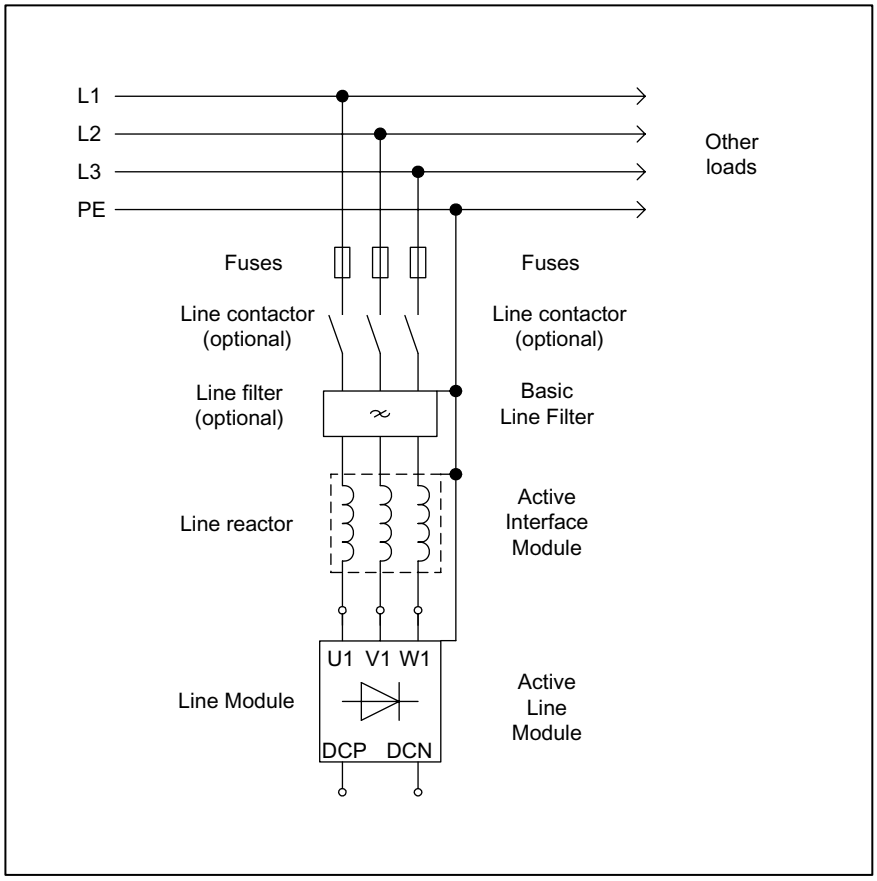


Figure 2-42 Direct operation on the line supply

2.13.3 Operating line connection components via a matching transformer

2.13.3.1 Safety information

NOTICE
If line filters are used that SIEMENS has not certified for use with SINAMICS S120, this can result in harmonics being fed back into the line supply. These harmonics can damage/disturb other equipment connected to this line supply. It is not permissible to connect other loads after the line filter.

NOTICE
If the system fault level is too low, this can result in faults/disturbances at the SINAMICS Line Module. It can also result in faults and damage to other equipment and devices that are connected at the same point of the line supply as the Line Module.

Note

If, for Line Modules, a transformer is used, this does not replace the external line reactor.

2.13.3.2 Line supply connection conditions for Line Modules

Table 2-39 Line supply connection conditions for Line Modules

Module	Description
Basic Line Module	Operation on line supplies from $S_{Kline}/Pn \geq 30$
Smart Line Module	Operation on line supplies from $S_{Kline}/Pn \geq 70$
Active Line Module	Operation on line supplies from $S_{Kline}/Pn \geq 70$

If a TN line supply is required on the secondary side, for example when using a Wideband Line Filter, a transformer with grounded neutral point must be used. However, the loop resistance must be small enough to trigger the fuses as fast as required.

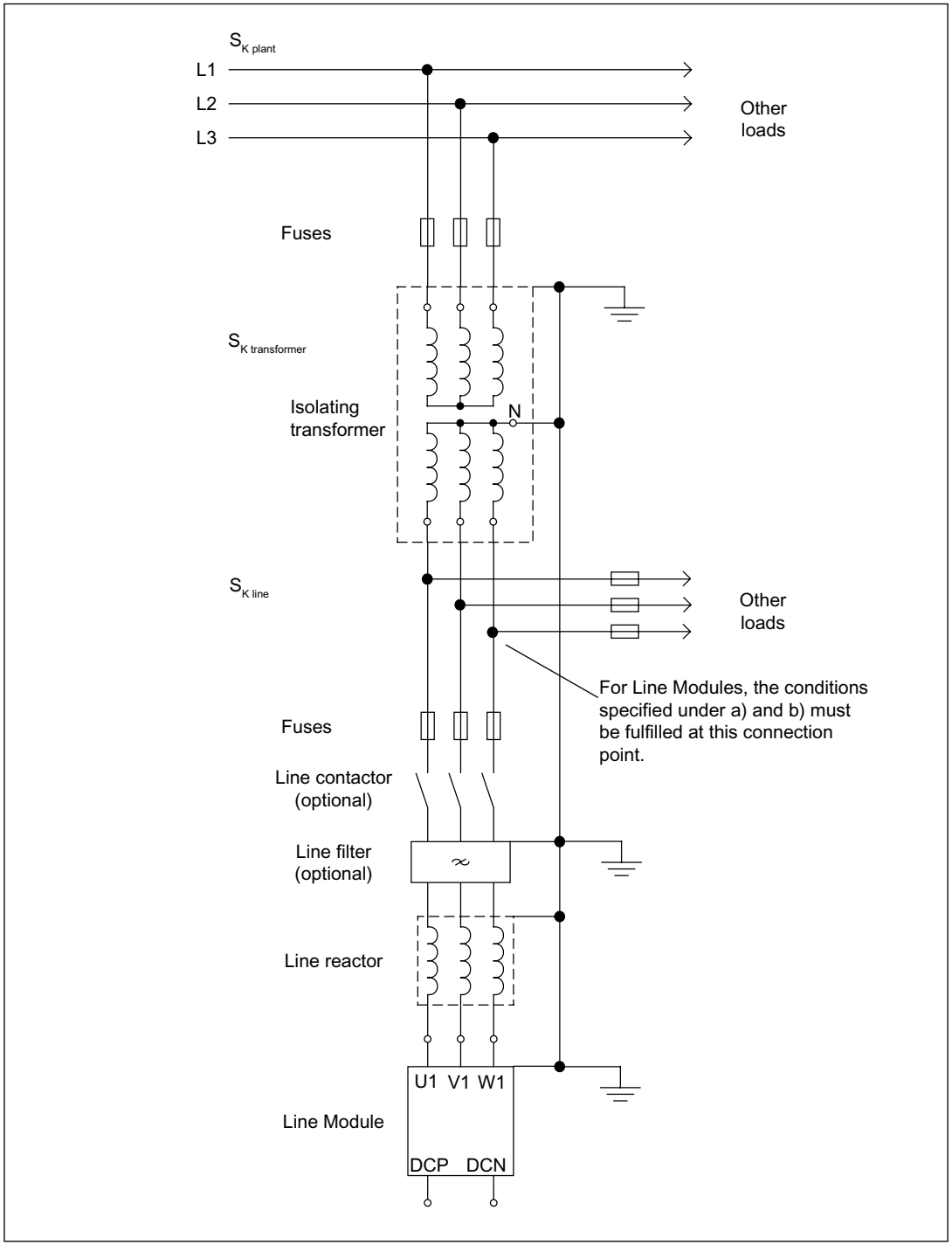
See the section entitled "Fuses".

Vector group

Suggestion: Dyn0 or Yyn0; this means either a delta or star circuit on the primary side and star circuit on the secondary side where the neutral point is brought-out.

Dimensioning and selecting the matching transformer for several loads

A SINAMICS Line Module and other loads / machines are connected to the matching transformer.



A matching transformer must be dimensioned for the total of all loads connected to it. The apparent power required for the Line Modules must be determined and added as indicated in table "Transformer configuration instructions". If the transformer S_n or S_k is too small, this can lead to increased line voltage dips and faults in the system and in other loads at this connecting point.

If other loads are connected to the secondary side of the matching transformer, the boundary conditions indicated under a) and b) must be followed when selecting the matching transformer.

S_{n1}, S_{n2} = calculated rated power of the transformer resulting from a) and b)

u_k = short-circuit voltage of the matching transformer in %
(must be between 1 % and 3 % for Active Line Modules and Smart Line Modules)

S_K = short-circuit power.

⚠WARNING

A sufficiently high system fault level (short-circuit power) is required to ensure that when a ground fault does occur, the fuses rupture in the specified time. An insufficient system fault level (short-circuit power) increases the time to trip beyond permissible levels (e.g. a fire is possible).

Boundary condition a) Rated power

The rated power (S_{n1}) of the matching transformer must always be 1.27 x P_n Line Module.

$S_{n1} \geq 1.27 \cdot P_n$

Example:

The minimum rated power of a matching transformer for 16 kW Line Modules is 21 kVA.

Boundary condition b) Short-circuit power

In order to avoid faults and disturbances at the other loads that are connected to the secondary side of the matching transformer, the sum of the system fault level (short-circuit power) of the plant connection and that of the matching transformer at the connection point must reach the following values:

$S_{K\ line} \geq 70 \cdot P_n$ (for Active Line Module and Smart Line Module)

$S_{K\ line} \geq 30 \cdot P_n$ (for Basic Line Module)

Special case:

During operation with only one supply at a transformer, the values may be reduced by the factor 0.73.

$S_{K\ line} \geq 0.73 \cdot 70 \cdot P_n$ (for Active Line Module and Smart Line Module)

$S_{K\ line} \geq 0.73 \cdot 30 \cdot P_n$ (for Basic Line Module)

For example $S_{K\ line}$ for 16 kW Active Line Module: $S_{K\ line}$ = 0.82 MVA = 820 kVA

From $S_{K\ transformer}$, the required rated power of the matching transformer can be calculated.

$$S_{n2} = \frac{S_{K\ plant}\,[kVA] \cdot S_{K\ line}\,[kVA] \cdot uk\ [\%]}{(S_{K\ plant}\,[kVA] - S_{K\ line}\,[kVA]) \cdot 100\ [\%]}\ [kVA]$$

Note:

The system fault level (short-circuit power) at the plant connection $S_{K\ plant}$ plays a decisive role in dimensioning/selecting the matching transformer.

From the rated power (S_{n1} or S_{n2}) calculated under a) and b), the higher value must be used for the matching transformer.

Table 2-40 Transformer configuration instructions

Used Active Line Module P_n	**Required rated power Sn of the isolating/autotransformer**	**Required short-circuit voltage uk**	**Required system fault level $S_{K\ line}$**
16 kW	Sn ≥ 21 kVA	uk ≤ 3 %	$S_{K\ line}$ ≥ 1.12 MVA
36 kW	Sn ≥ 46 kVA	uk ≤ 3 %	$S_{K\ line}$ ≥ 2.52 MVA
55 kW	Sn ≥ 70 kVA	uk ≤ 3 %	$S_{K\ line}$ ≥ 3.85 MVA
80 kW	Sn ≥ 102 kVA	uk ≤ 3 %	$S_{K\ line}$ ≥ 5.6 MVA
120 kW	Sn ≥ 153 kVA	uk ≤ 3 %	$S_{K\ line}$ ≥ 8.4 MVA
Used Smart Line Module Pn	**Required rated power Sn of the isolating/autotransformer**	**Required short-circuit voltage uk**	**Minimum system fault level $S_{K\ line}$** required
5 kW	Sn ≥ 6.4 kVA	uk ≤ 3 %	$S_{K\ line}$ ≥ 0.35 MVA
10 kW	Sn ≥ 13 kVA	uk ≤ 3 %	$S_{K\ line}$ ≥ 0.7 MVA
16 kW	Sn ≥ 21 kVA	uk ≤ 3 %	$S_{K\ line}$ ≥ 1.12 MVA
36 kW	Sn ≥ 46 kVA	uk ≤ 3 %	$S_{K\ line}$ ≥ 2.52 MVA
Used Basic Line Module	**Required rated power Sn of the isolating/autotransformer**	**Required short-circuit voltage uk**	**Minimum system fault level $S_{K\ line}$** required
20 kW	Sn ≥ 26 kVA	uk ≤ 10 %	$S_{K\ line}$ ≥ 1.4 MVA
40 kW	Sn ≥ 51 kVA	uk ≤ 10 %	$S_{K\ line}$ ≥ 2.8 MVA
100 kW	Sn ≥ 127 kVA	uk ≤ 10 %	$S_{K\ line}$ ≥ 7.0 MVA

Note

Ask your relevant energy provider for the system fault level $S_{K\ line}$.

Example 1

u_k matching transformer = 3 %,
$S_{K\ plant}$ = 50,000 kVA
$S_{K\ line}$ = 16 kW • 70 • 0.73 = 820 kVA

According to a)
S_{n1} = 1.27 • 16 kW = 21 kVA

According to b)

$$S_{n2} = \frac{50000\ kVA \bullet 820\ kVA \bullet 3\%}{(\ 50000\ kVA - 820\ kVA\ ) \bullet 100\%} = 25\ kVA$$

$S_{n2} > S_{n1} \Rightarrow S_{n2}$ is decisive
The matching transformer requires a rated power S_n of 25 kVA at a u_k of 3 %.

Example 2:

u_k matching transformer = 1 %,
$S_{K\ plant}$ = 50,000 kVA
$S_{K\ line}$ = 16 kW • 70 • 0.73 = 820 kVA

According to a)
S_{n1} = 1.27 • 16 kW = 21 kVA

According to b)

$$S_{n2} = \frac{50000\ kVA \bullet 820\ kVA \bullet 1\%}{(\ 50000\ kVA - 820\ kVA\ ) \bullet 100\%} = 8.3\ kVA$$

$S_{n1} > S_{n2} \Rightarrow S_{n1}$ is decisive
The matching transformer requires a rated power S_n of 21 kVA at a u_k of 1 %.

Example 3:

If $S_{K\ plant}$ is smaller, the transformer must be stronger

u_k matching transformer = 3 %,
$S_{K\ plant}$ = 3,000 kVA
$S_{K\ line}$ = 16 kW • 70 • 0.73 = 820 kVA

According to a)
S_{n1} = 1.27 • 16 kW = 21 kVA

According to b)

$$S_{n2} = \frac{3000\ kVA \bullet 820\ kVA \bullet 3\%}{(\ 3000\ kVA - 820\ kVA\ ) \bullet 100\%} = 33.9\ kVA$$

$S_{n2} > S_{n1} \Rightarrow S_{n2}$ is decisive

The matching transformer requires a rated power S_n of 34 kVA at a uk of 3 %.

Example 4:

If $S_{K\ plant}$ is smaller, you can use, alternatively to example 3, a transformer with a smaller u_k.
u_k matching transformer = 1 %,

$S_{K\ plant}$ = 3,000 kVA
$S_{K\ line}$ = 16 kW • 70 • 0.73 = 820 kVA

According to a)
S_{n1} = 1.27 • 16 kW = 21 kVA

According to b)

$$S_{n2} = \frac{3000\ kVA \bullet 820\ kVA \bullet 1\%}{(\ 3000\ kVA - 820\ kVA\ ) \bullet 100\%} = 11.3\ kVA$$

$S_{n1} > S_{n2} \Rightarrow S_{n1}$ is decisive

The matching transformer requires a rated power S_n of 21 kVA at a u_k of 1 %.

Note

S_{n2} for the matching transformer can be reduced by reducing u_k. In the examples above, the power drawn from other loads has not been taken into account.

Fuses

For timely tripping of fuses, the loop resistance as well as the vector group of the line supply transformer being fed must satisfy the requirement that the touch voltage of the devices is switched off by the provided fuses within the permissible tripping time (see figure below, in accordance with EN 61800-5-1 Ed. 2).

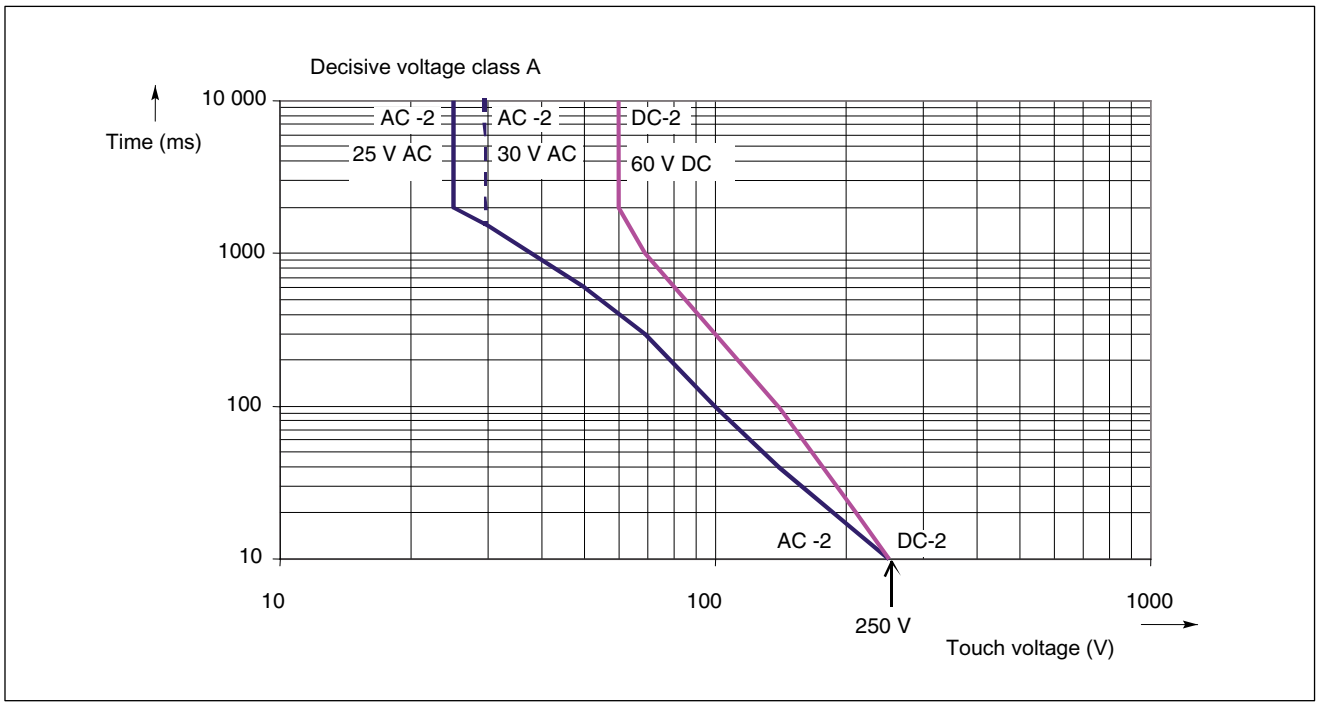


Figure 2-43 Permissible tripping time of fuses

The boundary conditions indicated above also serve to avoid a fire in case of a fault. If you do not comply with these boundary conditions, you must take additional measures, e.g., residual current transformer.

Fuse and plant conditions such as loop resistance and short-circuit power must be harmonized to one another so that the limit curve is not exceeded. This guarantees the shock-hazard protection.

2.13.3.3 Operation of the line connection components via an autotransformer

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

⚠ DANGER

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

Applications:

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

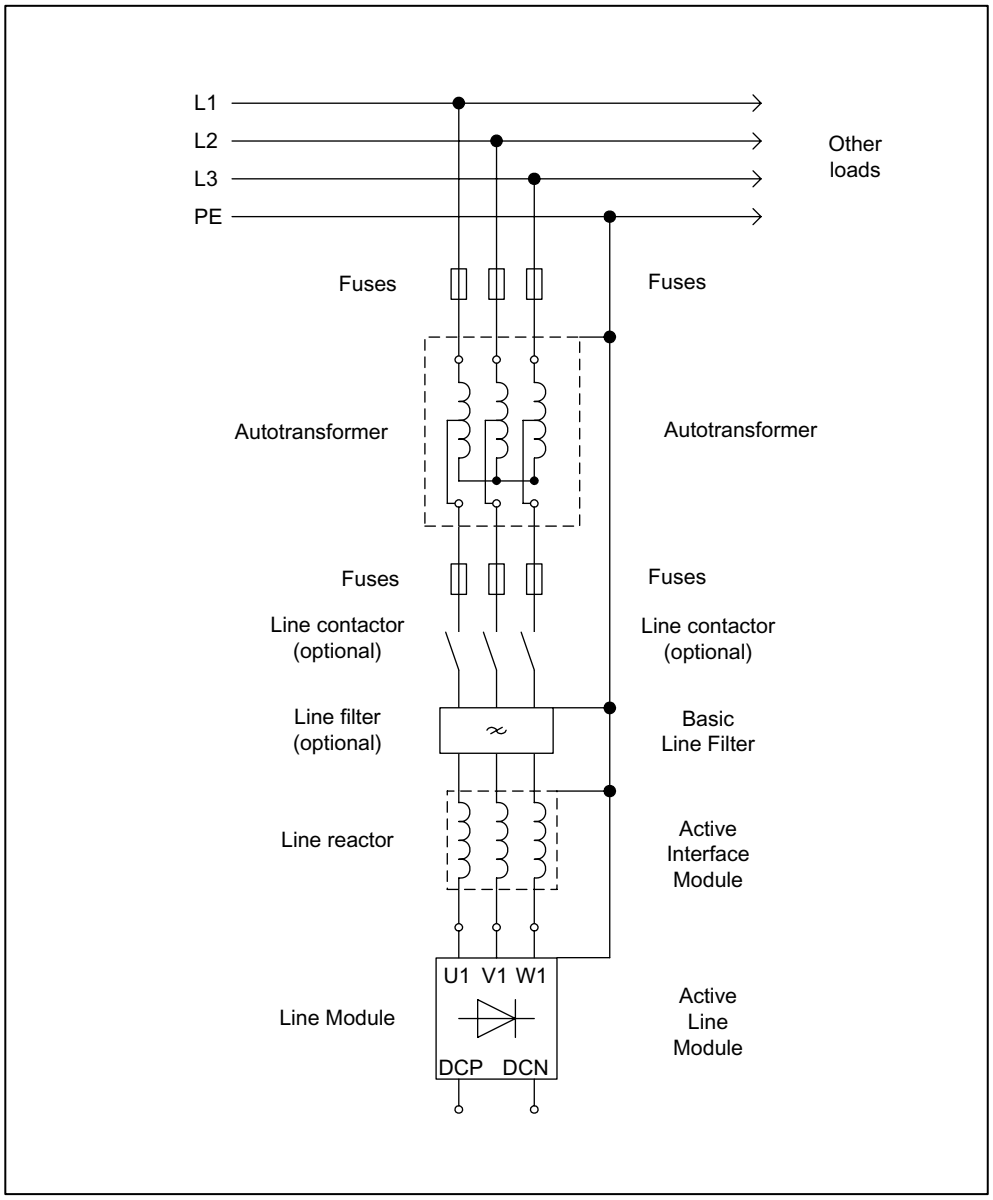


Figure 2-44 Autotransformer

2.13.3.4 Assignment of autotransformers to Active Line Modules

Table 2-41 Autotransformers for 480 / 440 V input voltage

	Active Line Module				
	16 kW	**36 kW**	**55 kW**	**80 kW**	**120 kW**
Rated power [kVA] Autotransformer IP00	21	46.5	70.3	104	155
Input voltage [V]	480 / 440 V 3 AC ± 10 %; 50 Hz - 5 % to 60 Hz + 5 %				
Output voltage [V]	400 V 3 AC				
Vector group	Yna0				
Permiss. ambient temperature • Operation [°C] • Storage / transport [°C]	-25 to +40, for power de-rating up to +55 °C, ISOKL: H, t_a = 40 -25 to +80				
Humidity classification in accordance with EN 60721-3-3	Cl. 3K5, Condensation and icing excluded Low air temperature 0 °C (+32 °F)				
Degree of protection to EN 60529 (IEC 60529) IP00	Degree of protection IP00: _ → Order No. A				
Order No.	4AP2796-0EL40-2X_0[2)]	4AU3696-0ER20-2X_0	4AU3696-2NA00-2X_0	4AU3996-0EQ80-2X_0	4BU4395-0CB50-8B
Power loss [W] Autotransformer IP00	160	430	550	700	700
Short-circuit voltage uk [%]	≤ 1.5				
Conn. cross-section, max. primary/secondary sides	16 mm²	35 mm²	70 mm²	Flat termination [1)]	
Fuse, primary side	35 A gL	80 A gL	125 A gL	160 A gL	224 A gL
Weight [kg], approx. for Degree of protection IP00	29	52	66	95	135
Terminal arrangement	1U1 / 1U3 / 1V1 / 1V3 / 1W1 / 1W3 / 2U1 / 2V1 / 2W1 / N		Flat termination connections[1)]		
	1U1 to 1W1 = 480 V input, 1U3 to 1W3 = 440 V input, 2U1 to 2W1 = 400 V output, N = neutral point				

[1)] FL = flat-type terminal, drill hole Ø 9 mm

[2)] ISOKL: B, ta = 40

Table 2-42 Autotransformers for 220 V input voltage

	Active Line Module				
	16 kW	**36 kW**	**55 kW**	**80 kW**	**120 kW**
Rated power [kVA] Autotransformer IP00	21	46.5	70.3	104	155
Input voltage [V]	220 V 3 AC ± 10 %; 50 Hz - 5 % to 60 Hz + 5 %				
Output voltage [V]	400 V 3 AC				
Vector group	Yna0				
Permiss. ambient temperature • Operation [°C] • Storage / transport [°C]	-25 to +40, for power de-rating up to +55 °C, ISOKL: H, t_a = 40 -25 to +80				
Humidity classification in accordance with EN 60721-3-3	Cl. 3K5, Condensation and icing excluded Low air temperature 0 °C (+32 °F)				
Degree of protection to EN 60529 (IEC 60529) IP00	Degree of protection IP00: _ → Order No. 0				
Order No.	4AU3696-0ER30-2XA0[2]	4BU4395-0CB6_-8B	4BU4595-0BD0_-8B	4BU5295-0AE4_-8B	4BU5495-1AA1_-8B
Power loss [W] Autotransformer IP00	550	900	980	1350	1650
Short-circuit voltage uk [%]	≤ 1.5				
Conn. cross-section, max. primary/secondary sides	16/16 mm²	70/50 mm²	95/70 mm²	Flat termination [1]	
Fuse, primary side	63 A gL	160 A gL	224 A gL	300 A gL	500 A gL
Weight [kg], approx. for Degree of protection IP00	57	110	155	215	310
Terminal arrangement	1U1 to 1W1 = 220 V input, 2U1 to 2W1 = 400 V output, N = neutral point				

[1] FL = flat-type terminal, drill hole Ø 9 mm

[2] ISOKL: B, ta = 40

2.13.3.5 Assignment of autotransformers to Smart Line Modules

Table 2-43 Autotransformers for 480 / 440 V input voltage

	Smart Line Module	
	5 kW /10 kW /16 kW	**36 kW**
Rated power [kVA] Autotransformer IP00	21	46.5
Input voltage [V]	480 / 440 V 3 AC ± 10 %; 50 Hz - 5 % to 60 Hz + 5 %	
Output voltage [V]	400 V 3 AC	
Vector group	Yna0	
Permiss. ambient temperature • Operation [°C] • Storage / transport [°C]	-25 to +40, for power de-rating up to +55 °C, ISOKL: H, t_a = 40 -25 to +80	
Humidity rating in accordance with EN 60721-3-3	Cl. 3K5, Condensation and icing excluded Low air temperature 0 °C (+32 °F)	
Degree of protection to EN 60529 (IEC 60529) IP00	Degree of protection IP00: _ → Order No. A	
Order No.	4AP2796-0EL40-2X_0	4AU3696-0ER20-2X_0
Power loss [W] Autotransformer IP00	160	430
Short-circuit voltage uk [%]	≤ 1.5	
Conn. cross-section, max. primary/secondary sides	16 mm^2	35 mm^2
Fuse, primary side	35 A gL	80A gL
Weight [kg], approx. for Degree of protection IP00	29	52
Terminal arrangement	1U1 / 1U3 / 1V1 / 1V3 / 1W1 / 1W3 / 2U1 / 2V1 / 2W1 / N	
	1U1 to 1W1 = 480 V input, 1U3 to 1W3 = 440 V input, 2U1 to 2W1 = 400 V output, N = neutral point	

Table 2-44 Autotransformers for 220 V input voltage

	Smart Line Module	
	5 kW /10 kW /16 kW	**36 kW**
Rated power [kVA] Autotransformer IP00	21	46.5
Input voltage [V]	220 V 3 AC ± 10 %; 50 Hz - 5 % to 60 Hz + 5 %	
Output voltage [V]	400 V 3 AC	
Vector group	Yna0	
Permiss. ambient temperature • Operation [°C] • Storage / transport [°C]	-25 to +40, for power de-rating up to +55 °C, ISOKL: H, t_a = 40 -25 to +80	
Humidity rating in accordance with EN 60721-3-3	Cl. 3K5, Condensation and icing excluded Low air temperature 0 °C (+32 °F)	
Degree of protection to EN 60529 (IEC 60529) IP00	Degree of protection IP00: _ → Order No. 0	
Order No.	4AU3696-0ER30-2XA0	4BU4395-0CB6_-8B
Power loss [W] Autotransformer IP00	550	900
Short-circuit voltage uk [%]	≤ 1.5	
Conn. cross-section, max. primary/secondary sides	16/16 mm^2	70/50 mm^2
Fuse, primary side	63 A gL	160 A gL
Weight [kg], approx. for Degree of protection IP00	57	110
Terminal arrangement	1U1 to 1W1 = 220 V input, 2U1 to 2W1 = 400 V output, N = neutral point	

2.13.3.6 Assignment of autotransformers to Basic Line Modules

Table 2-45 Autotransformers for 480 / 440 V input voltage

	Basic Line Modules		
	20 kW	**40 kW**	**100 kW**
Rated power [kVA] Autotransformer IP00	46.5	70.3	155
Input voltage [V]	480 / 440 V 3 AC ± 10 %; 50 Hz - 5 % to 60 Hz + 5 %		
Output voltage [V]	400 V 3 AC		
Vector group	Yna0		
Permiss. ambient temperature • Operation [°C] • Storage / transport [°C]	-25 to +40, for power de-rating up to +55 °C, ISOKL: H, t_a = 40 -25 to +80		
Humidity classification in accordance with EN 60721-3-3	Cl. 3K5, Condensation and icing excluded Low air temperature 0 °C (+32 °F)		
Degree of protection to EN 60529 (IEC 60529) IP00	Degree of protection IP00: _ → Order No. A		
Order No.	4AU3696- 0ER20-2X_0	4AU3696- 2NA00-2X_0	IP00: 4BU4395- 0CB50-8B
Power loss [W] Autotransformer IP00	430	550	700
Short-circuit voltage uk [%]	≤ 1.5		
Conn. cross-section, max. primary/secondary sides	35 mm²	70 mm²	Flat termination [1]
Fuse, primary side	80 A gL	125 A gL	224 A gL
Weight [kg], approx. for Degree of protection IP00	52	66	135
Terminal arrangement	1U1 / 1U3 / 1V1 / 1V3 / 1W1 / 1W3 / 2U1 / 2V1 / 2W1 / N		Flat termination connections
	1U1 to 1W1 = 480 V input, 1U3 to 1W3 = 440 V input, 2U1 to 2W1 = 400 V output, N = neutral point		

[1] FL = flat-type terminal, drill hole Ø 9 mm

Table 2-46 Autotransformers for 220 V input voltage

	Basic Line Modules		
	20 kW	**40 kW**	**100 kW**
Rated power [kVA] Autotransformer IP00	46.5	70.3	155
Input voltage [V]	220 V 3 AC ± 10 %; 50 Hz - 5 % to 60 Hz + 5 %		
Output voltage [V]	400 V 3 AC		
Vector group	Yna0		
Permiss. ambient temperature • Operation [°C] • Storage / transport [°C]	-25 to +40, for power de-rating up to +55 °C, ISOKL: H, t_a = 40 -25 to +80		
Humidity classification in accordance with EN 60721-3-3	Cl. 3K5, Condensation and icing excluded Low air temperature 0 °C (+32 °F)		
Degree of protection to EN 60529 (IEC 60529) IP00	Degree of protection IP00: _ --> Order No. 0		
Order No.	4BU4395- 0CB6_-8B	4BU4595- 0BD0_-8B	4BU5495- 1AA1_-8B
Power loss [W] Autotransformer IP00	900	980	1650
Short-circuit voltage uk [%]	≤ 1.5		
Conn. cross-section, max. primary/secondary sides	70/50 mm²	95/70 mm²	Flat termination [1]
Fuse, primary side	160 A gL	224 A gL	500 A gL
Weight [kg], approx. for Degree of protection IP00	110	155	310
Terminal arrangement	1U1 to 1W1 = 220 V input, 2U1 to 2W1 = 400 V output, N = neutral point		

[1] FL = flat-type terminal, drill hole Ø 9 mm

2.13.3.7 Operating line connection components via an isolating transformer

The isolating transformer converts the network configuration of the system (e.g. IT/TT system) to a TN system. Additional voltage adaptation to the permissible voltage tolerance range is possible.

An isolating transformer must be used in the following cases:

- The insulation of the Motor Module and/or the motor is not suitable for the voltages that occur.
- There is no compatibility with an existing residual-current protective device.
- The installation altitude is higher than 2000 m above sea level.
- A line filter should be used in a line supply system that is not a TN line supply system with grounded neutral conductor.

Note

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

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

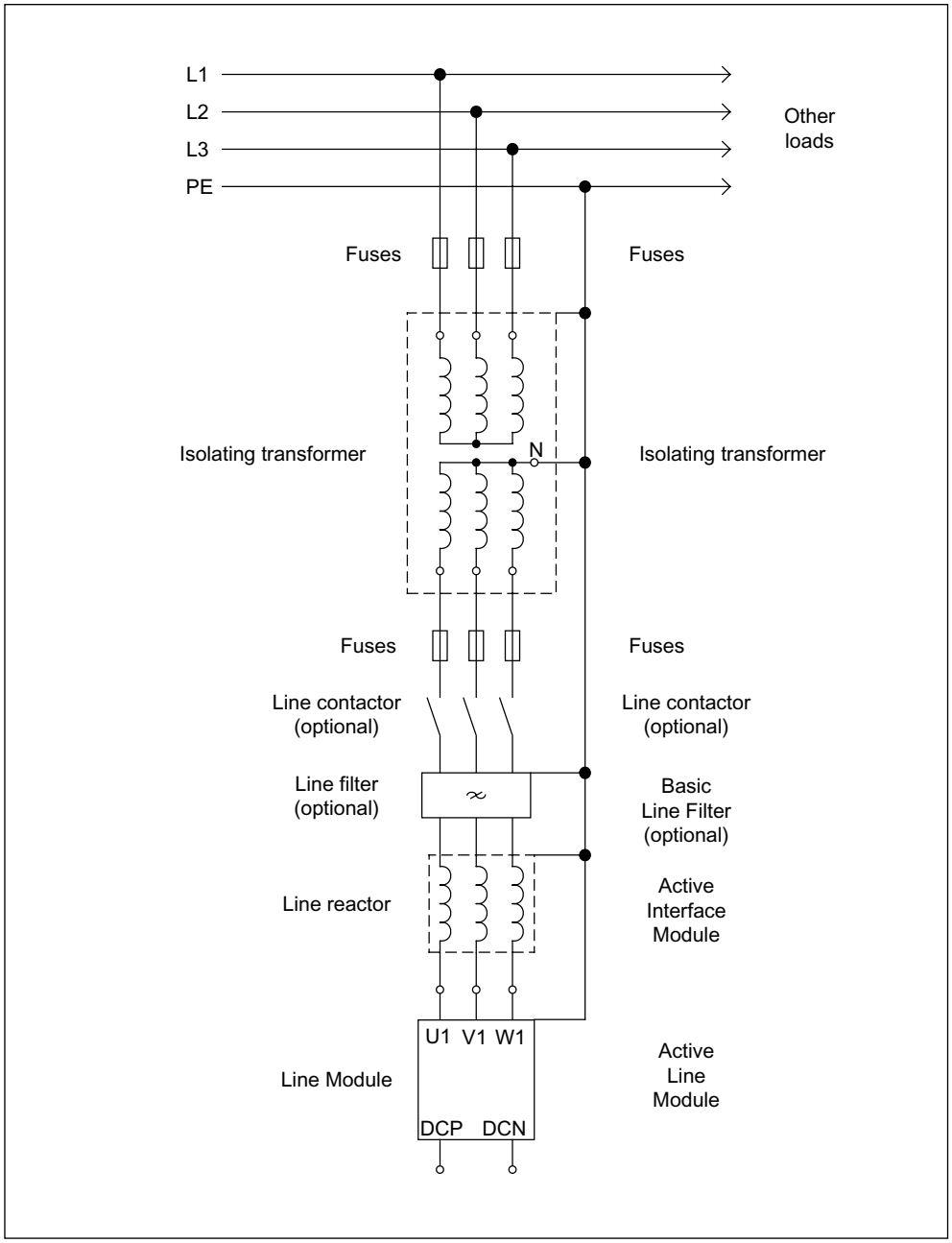


Figure 2-45 Isolating transformer

2.13.3.8 Assignment of isolating transformers to Active Line Modules

Table 2-47 Matching transformers with isolated windings for 50/60 Hz supply systems

	Active Line Module				
	16 kW	**36 kW**	**55 kW**	**80 kW**	**120 kW**
Rated power [kVA]	21	47	70	104	155
Power loss, max. [W]	650	1200	2020	2650	3050
Vector group	Yyn0				
Degree of protection acc. to DIN EN 60529 (IEC 60529)	Degree of protection IP00: _ → Order No. 0				
Humidity rating in accordance with EN 60721-3-3	Cl. 3K5, Condensation and icing excluded Low air temperature 0 °C (+32 °F)				
Permiss. ambient temperature • Operation [°C] • Storage / transport [°C]	 -25 to +40, for power de-rating up to +55, ISOKL: H, t_a = 40 -25 to +80				
Approx. weight for degree of protection IP00	120	200	300	425	600
Max. conn., secondary [mm²]	16	35	70	Cable lug according to DIN 46235	
Input voltage, 575 V 3 AC - 500 V 3 AC - 480 V 3 AC ± 10 %; 50 Hz - 5 % to 60 Hz + 5 %					
Rated input current [A]	26	58	87	127	189
Max. conn., primary [mm²]	16	35	50	70	Cable lug according to DIN 46235
Short-circuit voltage uk [%]	2.49	2.64	2.41	2.26	2.05
Order No.	4BU4395-0SA7_-0C	4BU4795-0SC3_-0C	4BU5595-0SA4_-0C	4BU5895-0SA6_-0C	4BU6095-0SA6_-0C
Input voltage, 440 V 3 AC - 415 V 3 AC - 400 V 3 AC ± 10 %; 50 Hz - 5 % to 60 Hz + 5 %					
Rated input current [A]	31	69.5	104	154	228
Max. conn., primary [mm²]	16	35	70	70	Cable lug according to DIN 46235
Short-circuit voltage uk [%]	2.47	2.63	2.4	2.24	2.09
Order No.	4BU4395-0SA8_-0C	4BU4795-0SC4_-0C	4BU5595-0SA5_-0C	4BU5895-0SA7_-0C	4BU6095-0SA7_-0C
Input voltage, 240 V 3 AC - 220 V 3 AC - 200 V 3 AC ± 10 %; 50 Hz - 5 % to 60 Hz + 5 %					
Rated input current [A]	62	138.5	210	309	450
Max. conn., primary [mm²]	35	70	Cable lug according to DIN 46235		
Short-circuit voltage uk [%]	2.43	2.59	2.61	2.2	2.16
Order No.	4BU4395-0SB0_-0C	4BU4795-0SC5_-0C	4BU5595-0SA6_-0C	4BU5895-0SA8_-0C	4BU6095-0SA8_-0C

2.13.3.9 Assignment of isolating transformers to Smart Line Modules

Table 2-48 Matching transformers with isolated windings for 50/60 Hz supply systems

	Smart Line Module			
	5 kW	**10 kW**	**16 kW**	**36 kW**
Rated power [kVA]	21			47
Power loss, max. [W]	650			1200
Vector group	Yyn0			
Degree of protection acc. to DIN EN 60529 (IEC 60529)	Degree of protection IP00: _ → Order No. 0			
Humidity rating in accordance with DIN EN 60721-3-3	Cl. 3K5, Condensation and icing excluded Low air temperature 0 °C (+32 °F)			
Permiss. ambient temperature • Operation [°C] • Storage / transport [°C]	 -25 to +40, for power de-rating up to +55, ISOKL: H, t_a = 40 -25 to +80			
Approx. weight for degree of protection IP00	120			200
Max. conn., secondary [mm²]	16			35
Input voltage, 575 V 3 AC - 500 V 3 AC - 480 V 3 AC ± 10 %; 50 Hz - 5 % to 60 Hz + 5 %				
Rated input current [A]	26			58
Max. conn., primary [mm²]	16			35
Short-circuit voltage uk [%]	2.49			2.64
Order No.	4BU4395-0SA7_-0C			4BU4795-0SC3_-0C
Input voltage, 440 V 3 AC - 415 V 3 AC - 400 V 3 AC ± 10 %; 50 Hz - 5 % to 60 Hz + 5 %				
Rated input current [A]	31			69.5
Max. conn., primary [mm²]	16			35
Short-circuit voltage uk [%]	2.47			2.63
Order No.	4BU4395-0SA8_-0C			4BU4795-0SC4_-0C
Input voltage, 240 V 3 AC - 220 V 3 AC - 200 V 3 AC ± 10 %; 50 Hz - 5 % to 60 Hz + 5 %				
Rated input current [A]	62			138.5
Max. conn., primary [mm²]	35			70
Short-circuit voltage uk [%]	2.43			2.59
Order No.	4BU4395-0SB0_-0C			4BU4795-0SC5_-0C

2.13.3.10 Assignment of isolating transformers to Basic Line Modules

Table 2-49 Matching transformers with isolated windings for 50/60 Hz supply systems

	Basic Line Modules		
	20 kW	**40 kW**	**100 kW**
Rated power [kVA]	47	70	155
Power loss, max. [W]	1200	2020	3050
Degree of protection acc. to EN 60529 (IEC 60529)	Degree of protection IP00: _ → Order No. 0		
Humidity rating in accordance with DIN EN 60721-3-3	Cl. 3K5, Condensation and icing excluded Low air temperature 0 °C (+32 °F)		
Permiss. ambient temperature • Operation [°C] • Storage / transport [°C]	 -25 to +40, for power de-rating up to +55, ISOKL: H, t_a = 40 -25 to +80		
Approx. weight for degree of protection IP00	200	300	600
Max. conn., secondary [mm²]	35	70	Cable lug according to DIN 46235
Input voltage, 575 V 3 AC - 500 V 3 AC - 480 V 3 AC ± 10 %; 50 Hz - 5 % to 60 Hz + 5 %			
Rated input current [A]	58	87	189
Max. conn., primary [mm²]	35	50	Cable lug according to DIN 46235
Short-circuit voltage uk [%]	2.64	2.41	2.05
Order No.	4BU47 95-0SC3_-0C	4BU55 95-0SA4_-0C	4BU60 95-0SA6_-0C
Input voltage, 440 V 3 AC - 415 V 3 AC - 400 V 3 AC ± 10 %; 50 Hz - 5 % to 60 Hz + 5 %			
Rated input current [A]	69.5	104	228
Max. conn., primary [mm²]	35	70	Cable lug according to DIN 46235
Short-circuit voltage uk [%]	2.63	2.4	2.09
Order No.	4BU47 95-0SC4_-0C	4BU55 95-0SA5_-0C	4BU60 95-0SA7_-0C
Input voltage, 240 V 3 AC - 220 V 3 AC - 200 V 3 AC ± 10 %; 50 Hz - 5 % to 60 Hz + 5 %			
Rated input current [A]	138.5	210	450
Max. conn., primary [mm²]	70	Cable lug according to DIN 46235	Cable lug according to DIN 46235
Short-circuit voltage uk [%]	2.59	2.61	2.16
Order No.	4BU47 95-0SC5_-0C	4BU55 95-0SA6_-0C	4BU60 95-0SA8_-0C

2.13.3.11 Technical specifications of the transformers

Basic reference conditions under which the transformers can be loaded with the rated power P_n indicated in the selection tables:

- Continuous operation P_n
- Frequency 50 Hz to 60 Hz
- Degree of protection IP00
- Installation altitude up to 1000 m above sea level
- Rated ambient temperature t_a

Installation and operating conditions that deviate from these values, influence the permissible continuous loads. For example, a lower ambient temperature of 30 °C enables a higher utilization.

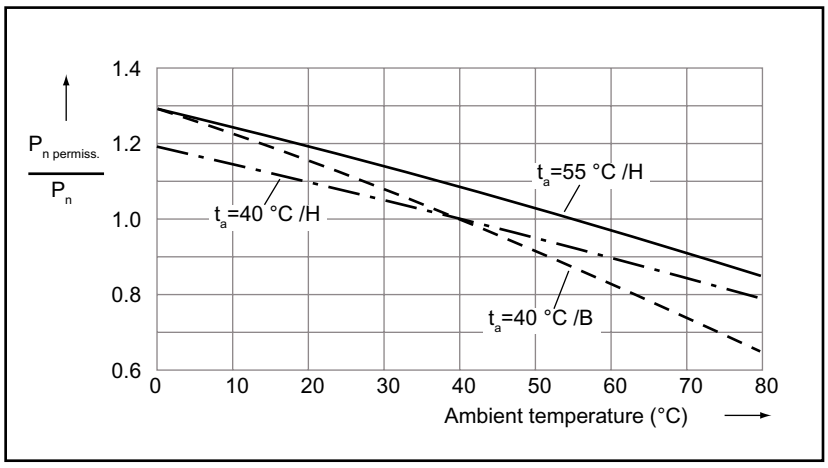


Figure 2-46 Load characteristics in relation to the ambient temperature

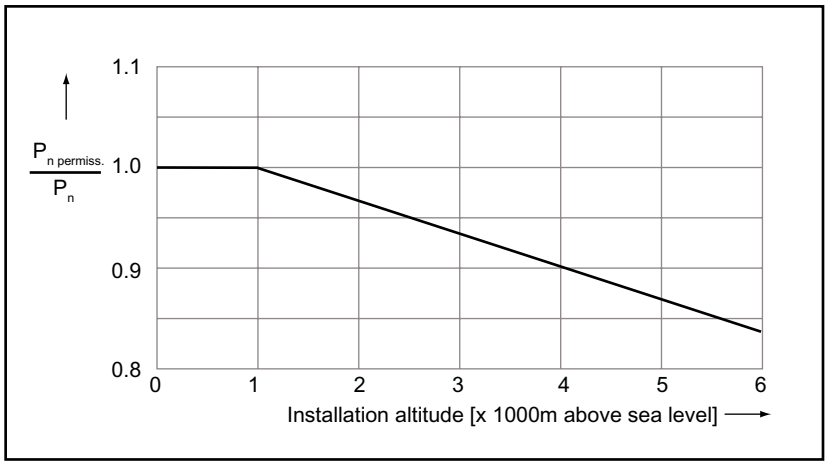


Figure 2-47 Load characteristics in relation to the installation altitude

The mentioned transformers have a neutral point that can be loaded with 10 %. They are mainly designed for secondary-side symmetrical supply systems.

2.13.3.12 Dimension drawings of the transformers

Safety, isolating, control and line transformers 4AP, 4AU

Safety, isolating, control and line transformers 4AP and
safety, isolating, control and mains transformers as well as autotransformers with selectable voltages 4AP ≤ 16 kVA

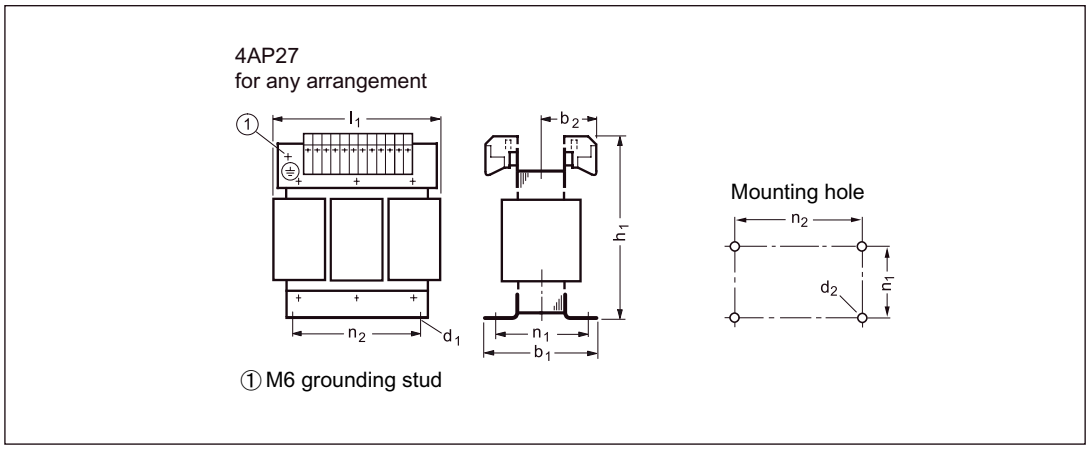


Figure 2-48 Dimension drawing: 4AP27

Table 2-50 Dimensions 4AP27, part 1

Type	Rated power kVA[1)]	Designation as per DIN 41302	b_1	b_2 max.	d_1	d_2	h1 max.	l_1
4AP27	2.5	3UI 132/70	133	103	10 x 18	M8	242	264

[1)] The rated power only applies to transformers with isolated windings (not to autotransformers).

Table 2-51 Dimensions 4AP27, part 2

Type	Fastening According to DIN 41308-4		Max. no. of terminals per side		
	n1	n2	24 A	32 A	60 A
4AP27	101	200	27	21	15

Safety, isolating, control and line transformers 4AP, 4AU ≤ 16 kVA (continued)
Safety, isolating, control and line transformers 4AU and
Safety, isolating, control and line transformers as well as autotransformers with selectable voltages 4AU ≤ 16 kVA

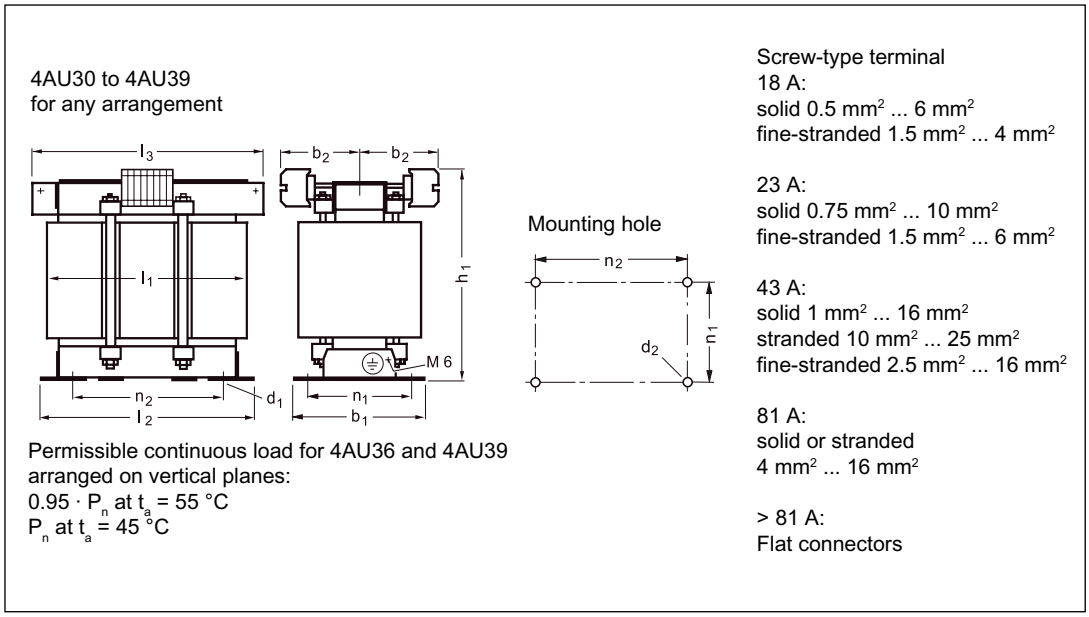


Figure 2-49 Dimension drawing: 4AU30 to 4AU39

Table 2-52 Dimensions 4AU30 to 4AU39, part 1

Type	Rated power kVA[1)]	Designation as per DIN 41302	b_1	b_2	d_1	d_2	h1	l_1
4AU36	8; 10	3UI 180/75	169	134	10 × 18	M8	320	360
4AU39	12.5; 16	3UI 210/70	174	131	12 × 18	M10	370	420

[1)] The rated power only applies to transformers with isolated windings (not to autotransformers).

Table 2-53 Dimensions 4AU30 to 4AU39, part 2

Type	l2	l3	n1	n2	Max. no. of terminals per side			
					18 A	23 A	43 A	81 A
4AU36	314	360	138	264	43	38	28	17
4AU39	366	410	141	316	50	45	33	20

Power transformers 4BU > 16 kVA
Matching transformers and transformers with selectable voltages 4BU > 16 kVA

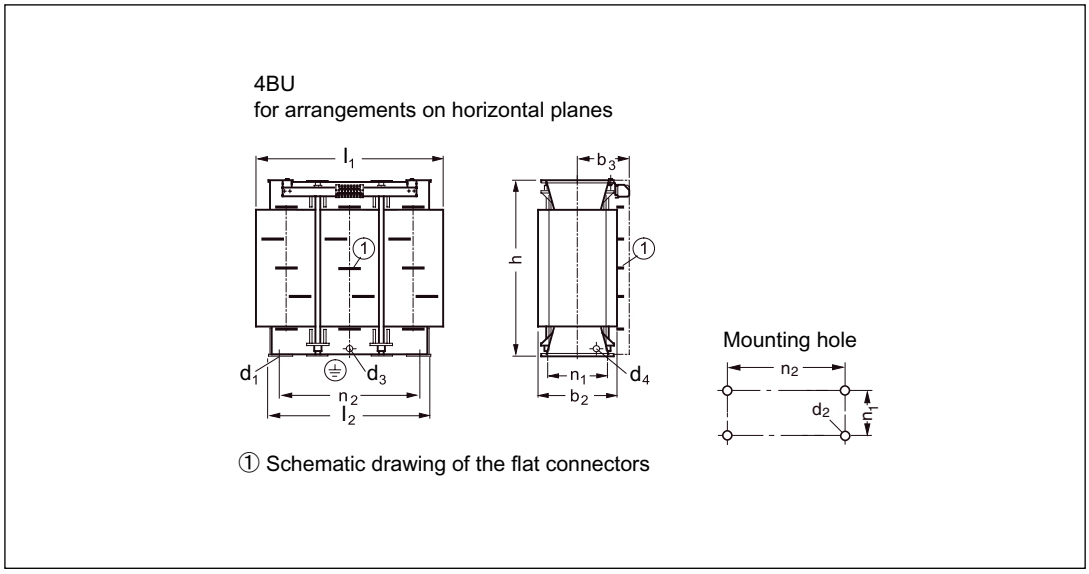


Figure 2-50 Dimension drawing: 4BU

Terminal size	Screw connection for cross section			Current capacity	
	solid mm²	stranded mm²	fine-stranded mm²	t_a = 40 °C A	t_a = 55 °C A
4	0.5 ... 6	--	1.5 ... 4	24	18
6	2.5 ... 10	--	1.5 ... 6	32	23
16	1.5 ... 16	10 ... 25	4 ... 16	60	43
35	10 ... 16	10 ... 50	10 ... 35	114	81

Table 2-54 Dimensions 4BU, part 1

Type	Rated power kVA[1)]	Type size in line with DIN 41302	b1	b2	b3 ± 3 for terminal size				d1	d2
					4	6	16	35		
4BU43	18; 20; 22.5	3UI 230/80	203	194	153	157	160	170	15	M12
4BU45	25; 28	3UI 230/107	230	221	162	166	169	179	15	M12
4BU47	31.5; 35.5; 40	3UI 230/137	260	251	182	186	189	199	15	M12
4BU52	45	3UIS 220/120	295	225	169	173	176	186	12.5	M10
4BU54	63; 71	3UIS 305/125	265	240	176	180	183	193	15	M12
4BU55	80	3UIS 305/140	280	255	184	188	191	201	15	M12
4BU58	112; 125; 140	3UIS 395/150	315	269	191	195	198	208	15	M12
4BU60	180	3UIS 395/195	360	314	213	217	220	230	15	M12

[1)] The rated power only applies to transformers with isolated windings (not to autotransformers).

Table 2-55 Dimensions 4BU, part 2

Type	d3	d4	h	l1	l2	n1	n2	Max. no. of terminals for terminal size			
								4	6	16	35
4BU43	--	M6	422	450	400	155	340	44	36	24	18
4BU45	--	M6	422	450	400	182	340	44	36	24	18
4BU47	--	M6	422	450	400	212	340	44	36	24	18
4BU52	M12	--	512	420	382	183	316	--	35	23	17
4BU54	M12	--	602	630	537	198	465	--	52	35	26
4BU55	M12	--	602	630	537	213	465	--	52	35	26
4BU58	M12	--	686	855	712	227	630	--	70	45	35
4BU60	M12	--	686	855	712	272	630	--	70	45	35

2.13.4 Line connection via a residual-current circuit-breaker

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

⚠DANGER

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

Note

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

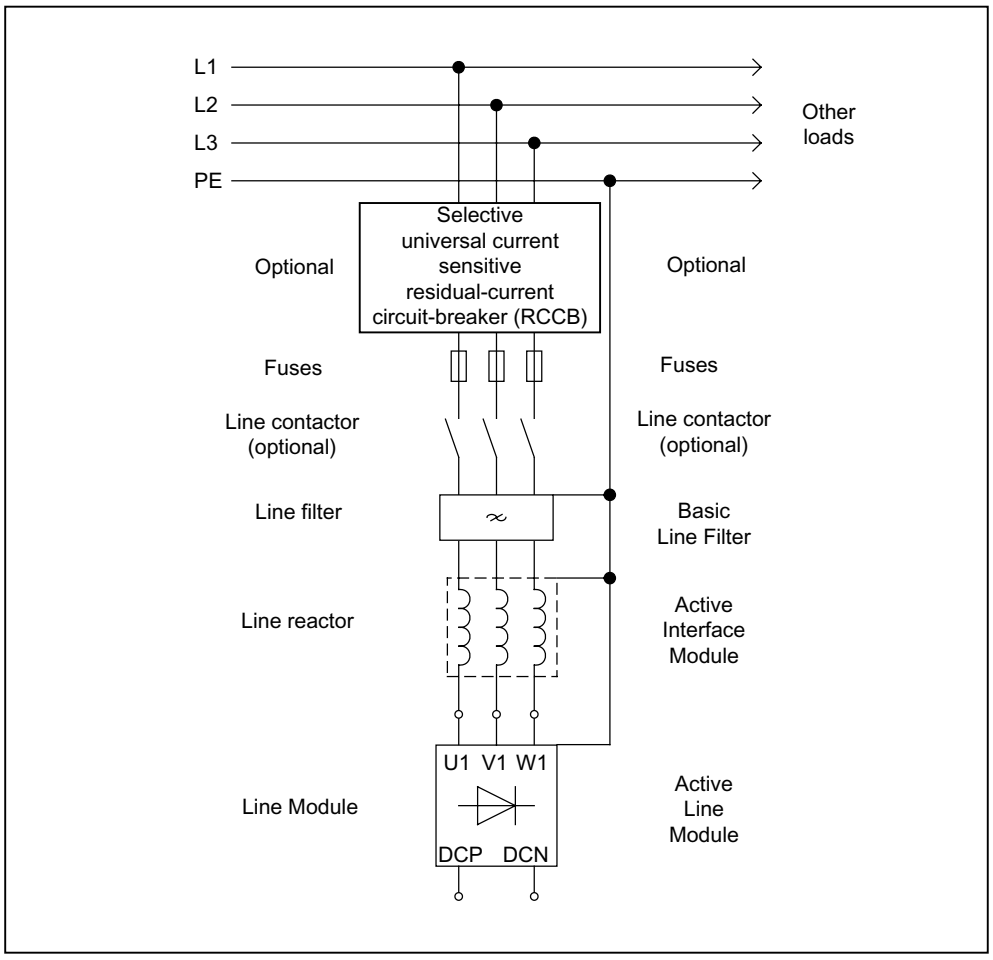


Figure 2-51 Residual-current circuit-breaker (RCCB)

Please note the following:

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

Recommendation

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

NOTICE
AC or pulse-sensitive RCCBs are not suitable.

Line Modules Booksize

3

3.1 Introduction

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

All Basic Line Modules and Active Line Modules as well as the 16 kW and 36 kW Smart Line Modules are equipped with DRIVE-CLiQ interfaces for communicating with the Control Unit. The 5 kW and 10 kW Smart Line Modules must be connected with the Control Unit via terminals.

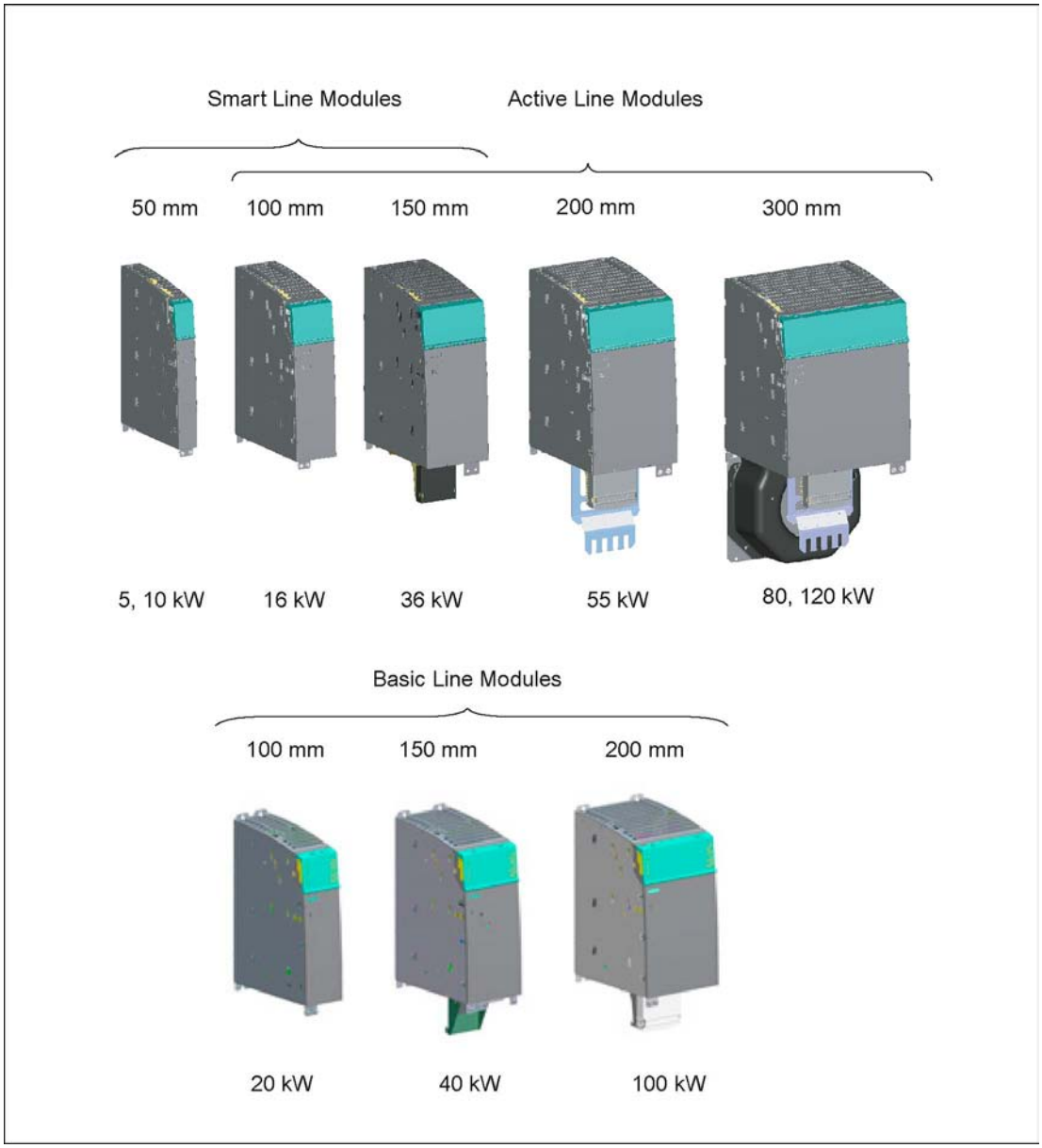


Figure 3-1 Overview of Line Modules

General characteristics of the Line Modules

- Connection voltage 380 V 3 AC -10 % (-15 % <1 min) to 480 V 3 AC +10 % (47 to 63 Hz)
- Suitable for TN, TT, and IT supply systems
- 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 diagnostics

Characteristics of the Active Line Modules

- Regulated DC link voltage
- Regenerative feedback capability
- Sinusoidal line currents
- Electronic type plate
- DRIVE-CLiQ interface for communicating with the Control Unit and/or other components in the drive line-up.
  - Integration in system diagnostics
- For Active Line Modules as of 55 kW: Outgoing circuit for DC link busbar possible on both sides
- For all Active Line Modules with order numbers ending in 3 (6SL xxxxxxx 3): Outgoing circuit for DC link busbar possible on both sides.

Characteristics of the Smart Line Modules

- Unregulated DC link voltage
- Regenerative feedback capability
- Block-type network currents in feedback direction
- For all Smart Line Modules as of 16 kW with order numbers ending in 3 (6SL xxxxxxx 3): Outgoing circuit for DC link busbar possible on both sides.

Characteristics of the Basic Line Modules

- Unregulated DC link voltage
- No regenerative feedback capability
- For all Basic Line Modules: Outgoing circuit for DC link busbar possible on both sides.

Frequency with which the DC link is precharged

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

$$\text{Number of pre-charging operations within 8 min} = \frac{\text{max. permissible DC link capacitance Line Module in µF}}{\Sigma\text{DC link capacitance of the configured drive group in µF}}$$

The DC link capacitances of the individual components can be taken from the relevant technical data.

3.2 Active Line Modules with internal air cooling

3.2.1 Description

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

This ensures that they are not influenced by network fluctuations.

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

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

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

3.2.2 Safety information

⚠ DANGER

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

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

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

⚠ DANGER

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

⚠ DANGER

A sufficiently high system fault level is required for tripping the fuses within the predefined time in the event of a ground fault. The ratio between the system fault level and the rated power of the Line Module must be ≥ 70. If the supply short circuit power is too low, the fuse rupture times increase to an unacceptable level (e.g. fire is possible).

⚠ DANGER

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

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

⚠ WARNING

A ventilation clearance of 80 mm 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.

⚠ DANGER

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

⚠ CAUTION

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

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

⚠DANGER

If a 50 mm wide Motor Module or if a DC link component with the appropriate width (e.g. Braking Module, Control Supply Module, Voltage Clamping Module) is located at the left-hand end of the drive line-up, the DC link bridge (including the screws) must be removed. The screws must not be inserted without a DC link bridge.

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

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

⚠CAUTION

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

⚠CAUTION

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.

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

⚠CAUTION

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

⚠DANGER

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

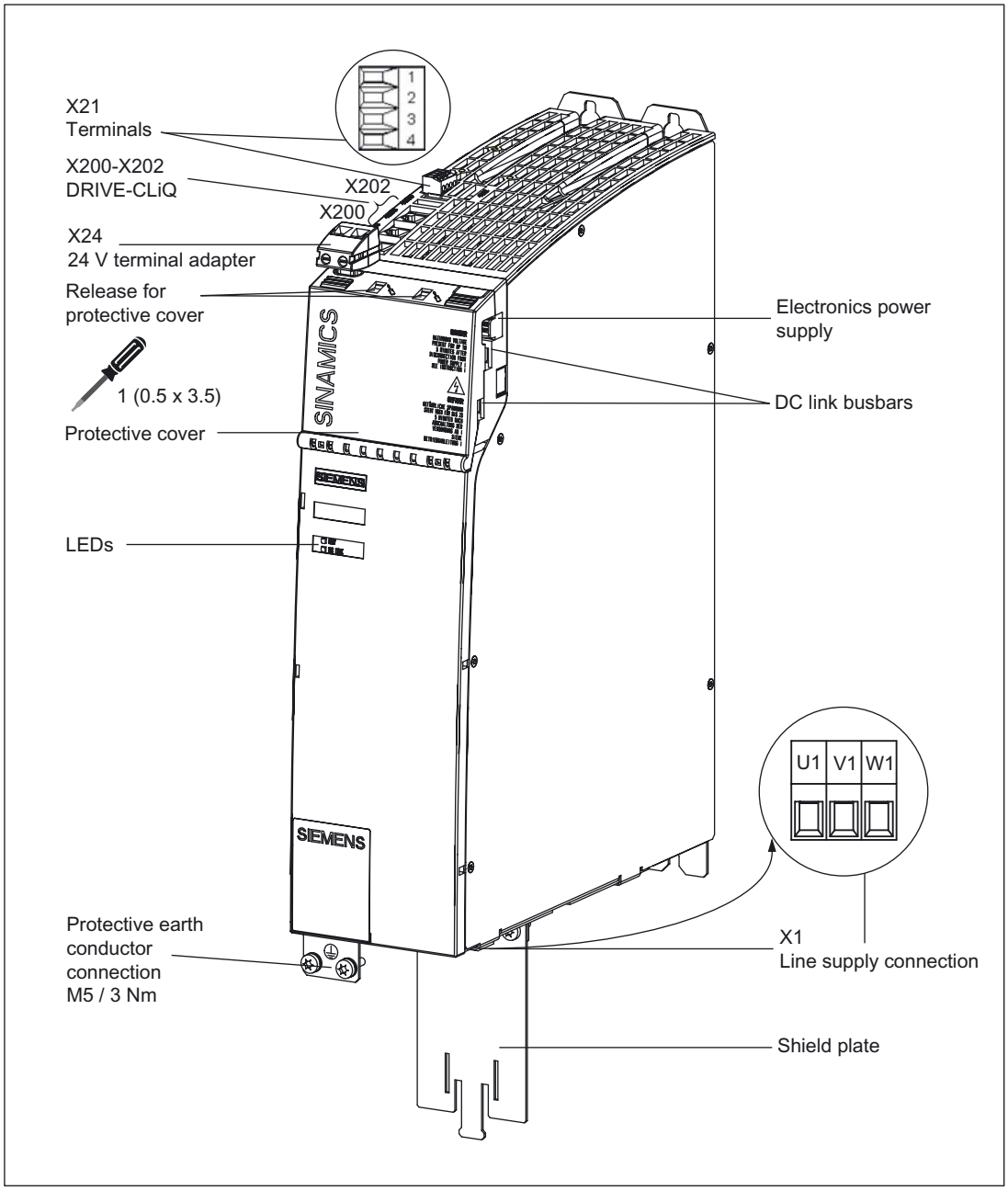
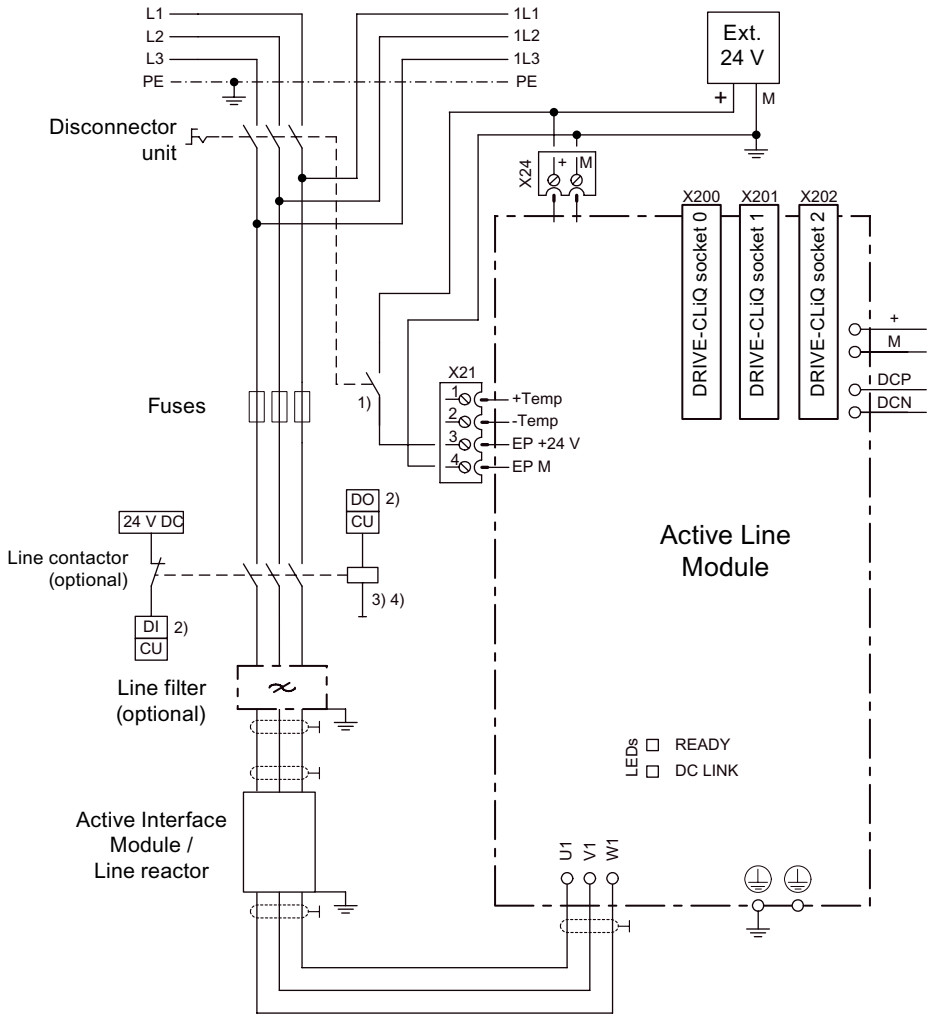


Figure 3-2 Active Line Module with internal air cooling (example: 16 kW)

3.2.3.2 Connection example

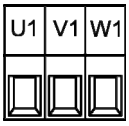
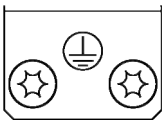


1) Leading NC contact t >10 ms, 24 V DC ground must be applied for operation.
2) DI/DO (controlled by Control Unit).
3) No additional load permitted downstream of line contactor!
4) The current carrying capacity of the DO must be observed; an output interface must be used if required.

Figure 3-3 Example connection of Active Line Module

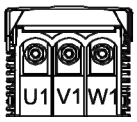
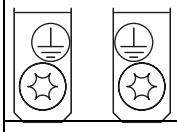
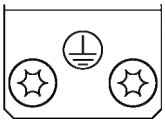
3.2.3.3 X1 line connection

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

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

[1] for ring cable lugs to DIN 46234

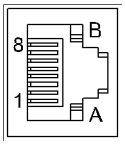
Table 3-2 Terminal block for the Active Line Module (36 kW to 120 kW)

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

[1] for ring cable lugs to DIN 46234

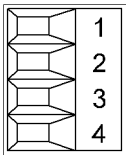
3.2.3.4 X200-X202 DRIVE-CLiQ interfaces

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

3.2.3.5 EP terminals X21

Table 3-4 Terminal block X21

	Terminal	Designation	Technical specifications
	1	+ Temp	For the temperature sensor connection on the Active Interface Module
	2	- Temp	
	3	EP +24 V (enable pulses)	Voltage 24 V DC Current consumption: 10 mA Isolated input Signal propagation times: L → H: 100 µs H → L: 1000 µs
	4	EP M (enable pulses)	
Max. connectable cross-section: 1.5 mm^2 Type: Screw terminal 1 (see Connection systems)			

⚠ CAUTION

If an Active Interface Module is connected, the temperature output of the Active Interface Module must be connected to terminals 1 and 2.

⚠ WARNING

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

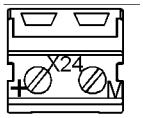
NOTICE

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

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

3.2.3.6 X24 24 V terminal adapter

Table 3-5 Terminal block X24

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

3.2.3.7 Description of the LEDs on the Active Line Module

Table 3-6 Active Line Module - description of the LEDs

Status		Description, cause	Remedy
Ready (H200)	**DC link (H201)**		
off	off	Electronics power supply is missing or outside permissible tolerance range.	–
Green	off	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.	–
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is present.	–
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is too high.	Check line voltage
Orange	Orange	DRIVE-CLiQ communication is being established.	–
Red	–	At least one fault is present in this component. **Note:** The LED is activated regardless of whether the corresponding messages have been reconfigured.	Remedy and acknowledge fault
Green/red (0.5 Hz)	-	Firmware is being downloaded.	–
Green/red (2 Hz)	-	Firmware download is complete. Wait for POWER ON.	Carry out a POWER ON
Green/orange or Red/orange	–	Component detection via LED is activated (p0124). **Note:** Both options depend on the LED status when component recognition is activated via p0124 = 1.	–

⚠ DANGER

Hazardous DC link voltages may be present at any time regardless of the status of the "DC link" LED.
The warning information on the components must be carefully observed!

3.2.4 Dimension drawing

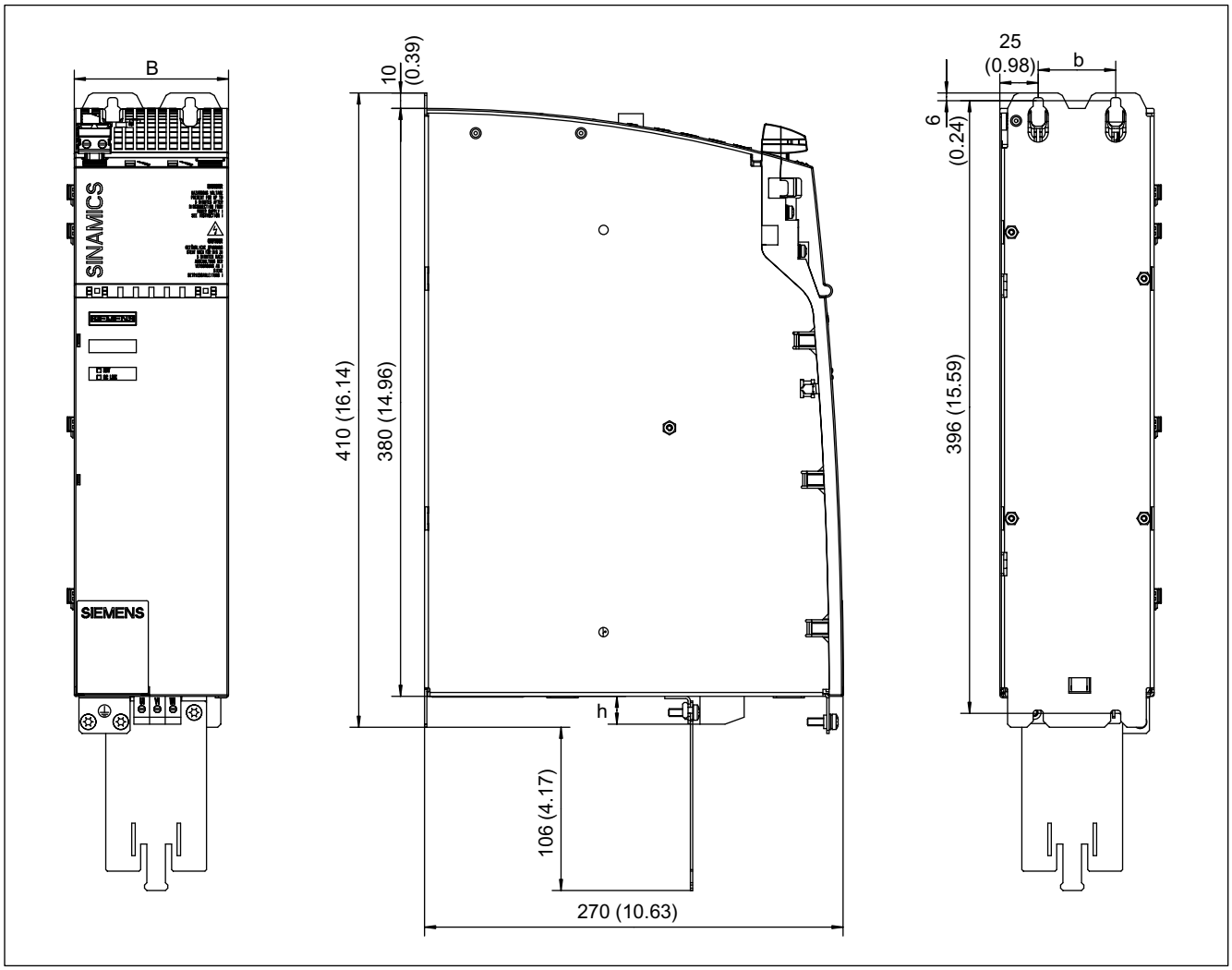


Figure 3-4 Dimension drawing of Active Line Module with internal air cooling (16 kW)

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

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

Note

The shield connecting plate is supplied with a 100 mm Line Module.

For more information, see "Accessories".

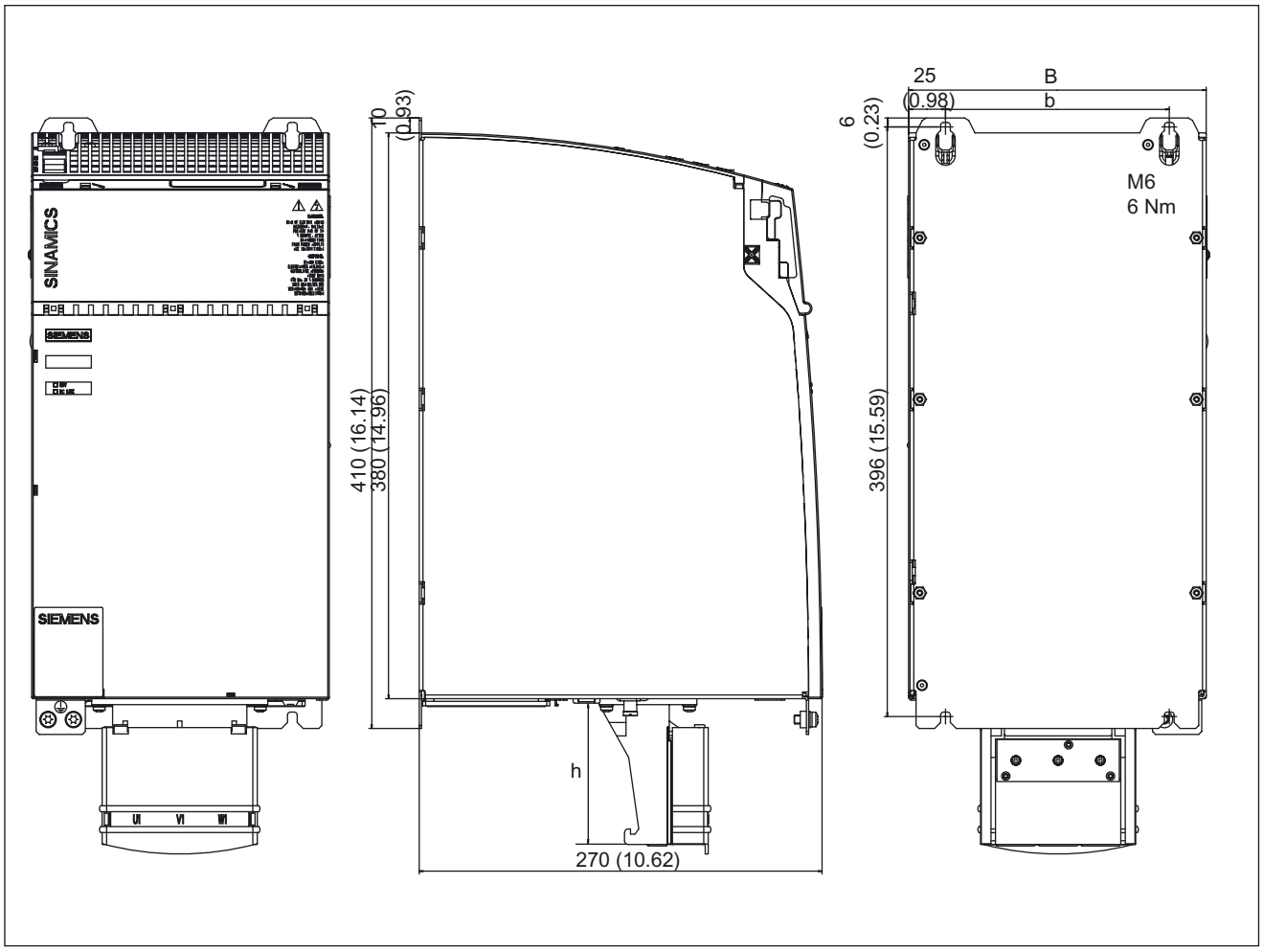


Figure 3-5 Dimension drawing of Active Line Module with internal air cooling (36 kW and 55 kW)

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

Active Line Module Type	Order number	W [mm] (inches)	b [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)

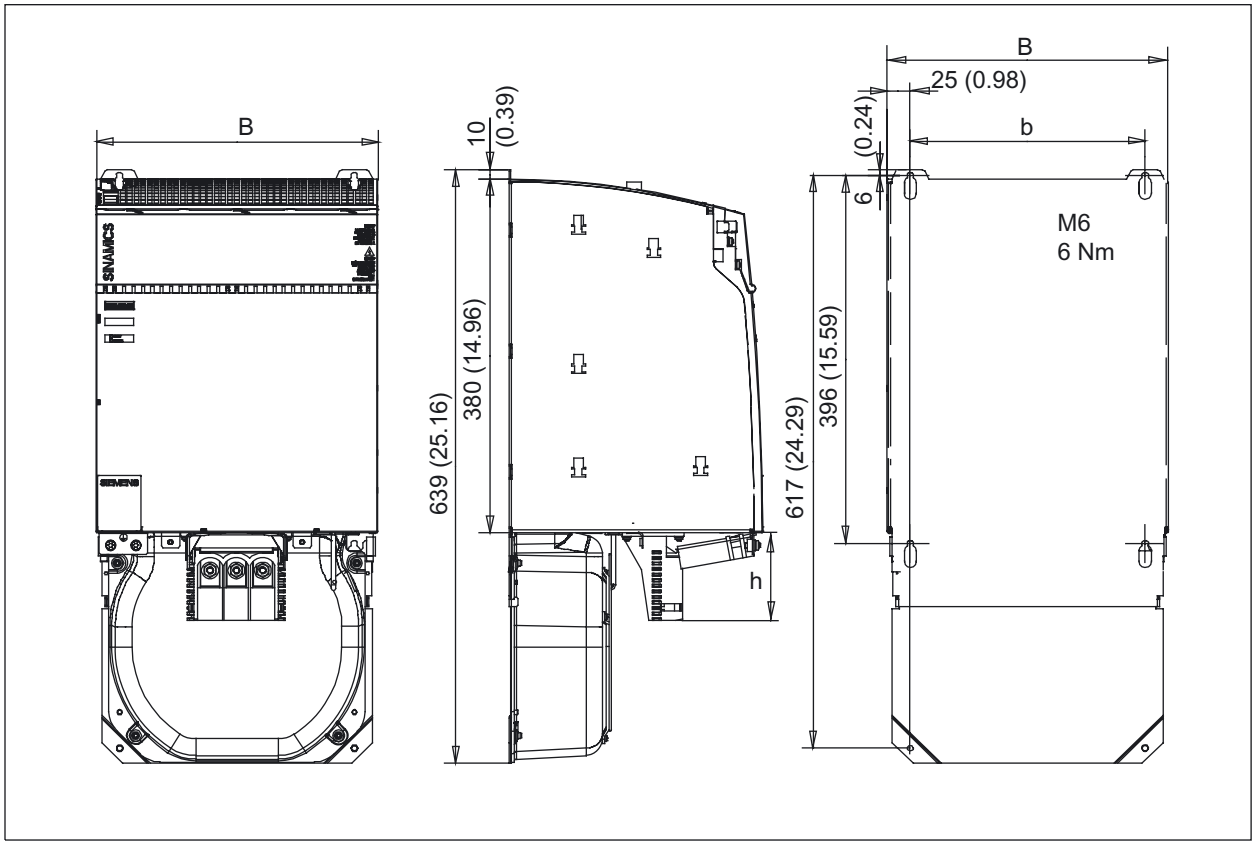


Figure 3-6 Dimension drawing of Active Line Modules with internal air cooling (80 kW and 120 kW)

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

Active Line Module Type	Order number	W [mm] (inches)	b [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 Installing

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

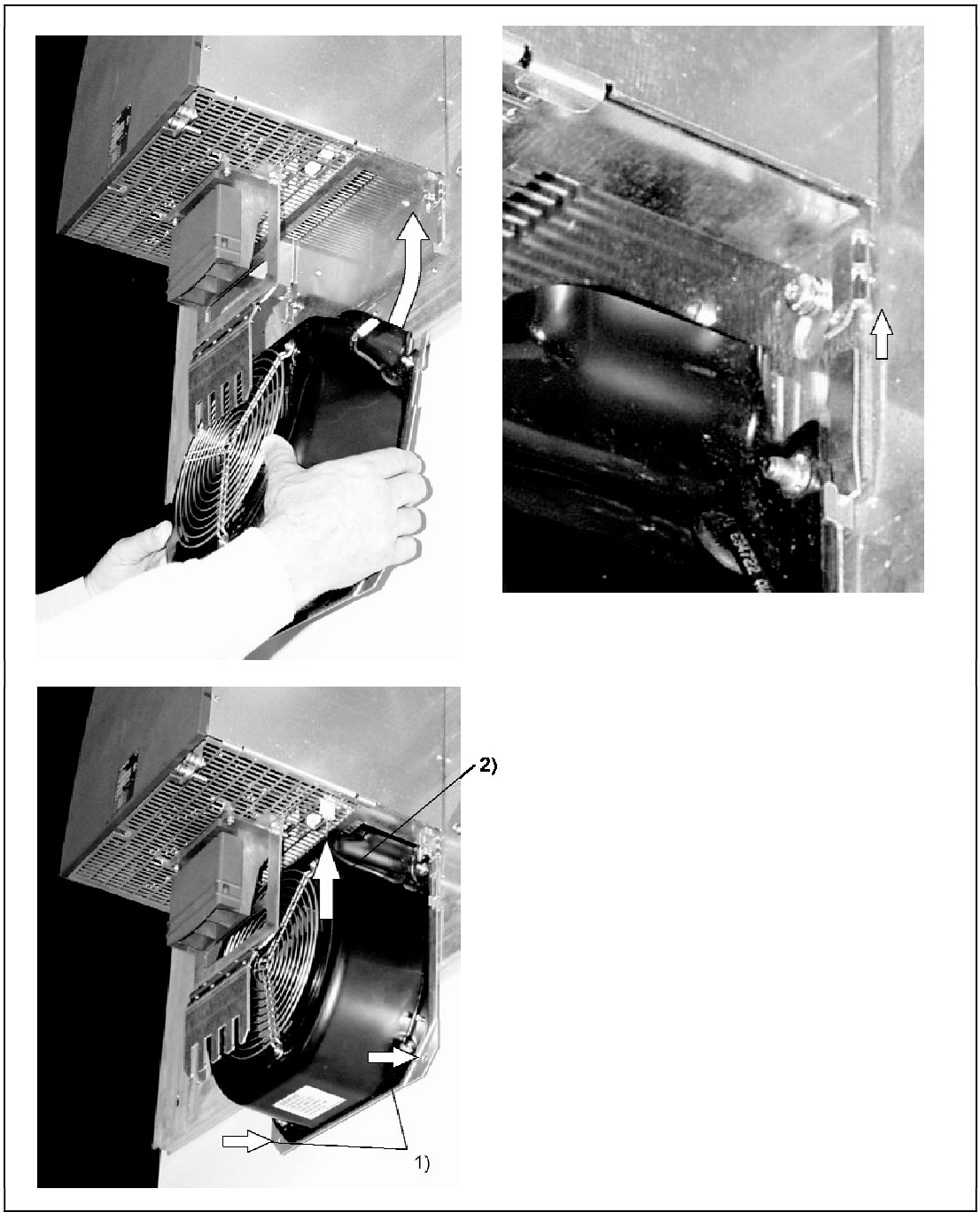


Figure 3-7 Installing the fan for 300 mm modules

1) Secure with M6 / 6 Nm screws

2) Connect the power supply for the fan

Note

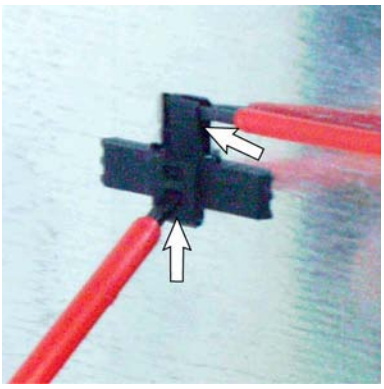
The fans are power-up and power-down as a function of the heatsink temperature.

The fans start up at the heat-sink temperature specified in the power stack data (normally 56 °C) and are switched off with a slight hysteresis when the heat-sink temperature decreases again. The length of time it takes for the fans to stop once they have been switched off depends on a number of factors (ambient temperature, output current, duty cycle, etc.) and, therefore, cannot be determined directly.

The fans are not equipped with temperature-dependent speed control; they are either ON or OFF.

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

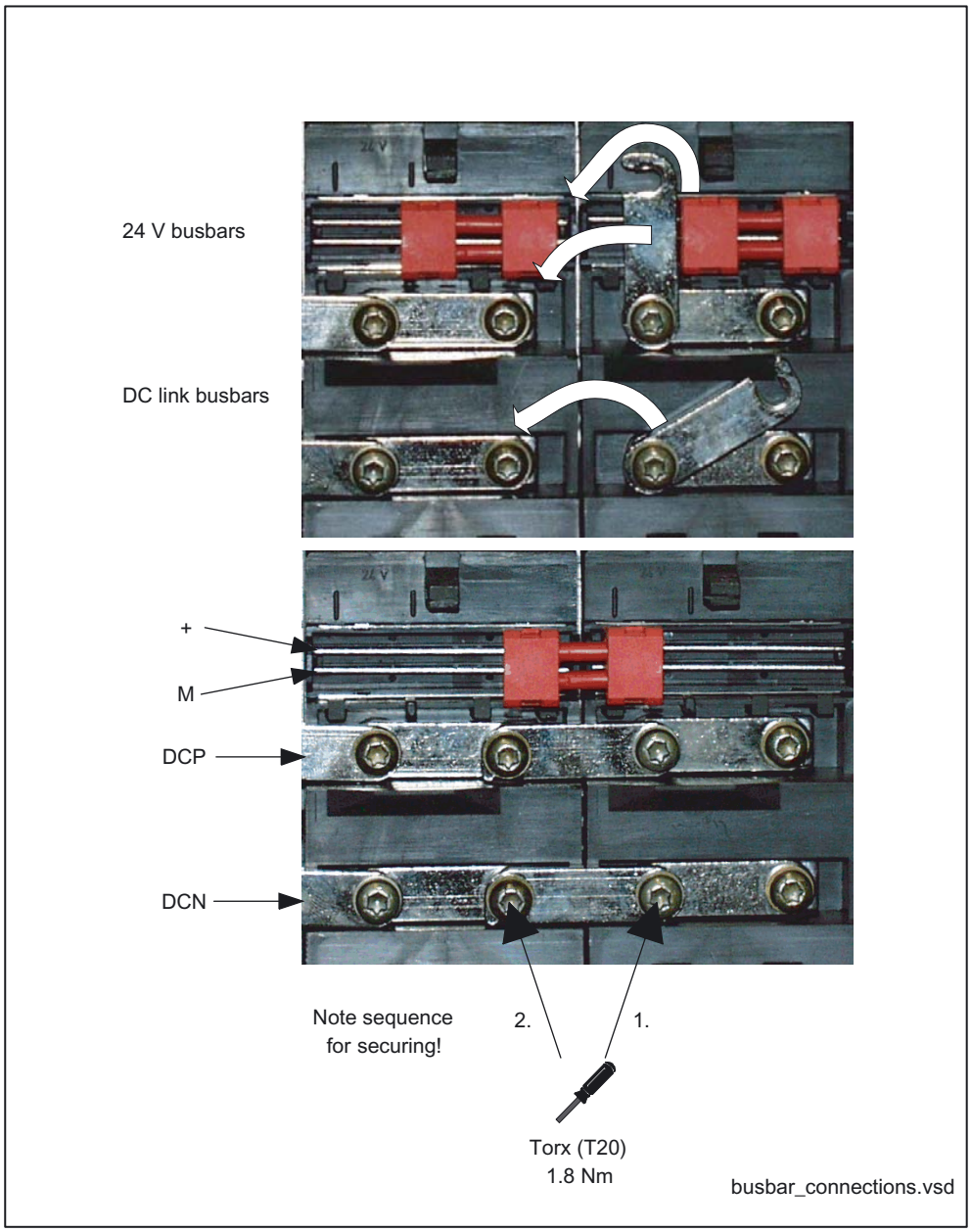


Figure 3-8 Busbar connections for booksize components

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

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

3.2.7 Technical data

Table 3-10 Technical data of Active Line Modules

Internal air cooling	6SL3130–	7TE21–6AAx	7TE23–6AAx	7TE25–5AAx	7TE25–5AA3 + Active Interface Module
Rated power	**kW**	**16**	**36**	**55**	**55**
Infeed:					
Rated power (S1)[1]	kW (Pn)	16	36	55	55
Infeed power (S6-40 %)[1]	kW (Ps6)	21	47	71	71
Peak infeed power[1]	kW (Pmax)	35	70	91	110
Regenerative feedback:					
Continuous regenerative power rating	kW	16	36	55	55
Peak regenerative power rating	kW	35	70	91	110
Line supply voltages:					
Line voltage	V_{ACrms}	380 V 3 AC -10 % (-15 % < 1 min) to 480 V 3 AC +10 %			
Line frequency	Hz	47 to 63			
Electronics power supply	V_{DC}	24 (20.4 - 28.8)			
DC link voltage	V_{DC}	510 - 720			
Overvoltage trip threshold	V_{DC}	820 ± 2 %			
Undervoltage trip threshold	V_{DC}	360 ± 2 %			
Rated input current:					
at 380 V_{AC}	A_{AC}	26	58	88	88
at 480 V_{AC}/528 V_{AC}	A_{AC}	21 / 19	46 / 42	70 / 64	70 / 64
at 480 V (S6-40 %)	A_{AC}	27	60	92	92
Peak current (at 400 V_{AC}/480 V_{AC})	A_{AC}	54 / 45	107 / 89	139 / 116	168 / 140
DC link current:					
Rated current	A_{DC}	27	60	92	92
at S6-40 %	A_{DC}	35	79	121	121
Peak current	A_{DC}	59	117	152	176
DC link busbar current carrying capacity	A_{DC}	100	200	200	200
24 V busbar current carrying capacity	A_{DC}	20	20	20	20
Electronics current consumption	A_{DC}	1.1	1.5	1.9	1.9
Total power loss (including electronic losses)[2]	W	286.4	666	945.6	945.6
Max. ambient temperature without derating	°C	40	40	40	40
Max. ambient temperature with derating	°C	55	55	55	55

Internal air cooling	6SL3130–	7TE21–6AAx	7TE23–6AAx	7TE25–5AAx	7TE25–5AA3 + Active Interface Module
Rated power	**kW**	**16**	**36**	**55**	**55**
DC link capacitance	µF	705	1 410	1 880	1 880
Maximum permissible DC link capacitance	µF	20 000	20 000	20 000	20 000
Power factor	cosϕ	1	1	1	1
Circuit-breaker type designation (status 06/2007) Rated current Short-circuit current rating SCCR at 400 V_{AC}	 A kA	3RV1031-4FA10 28 ... 40 50	3RV1041-4LA10 70 ... 90 50	3VL2712-3DC33-0AA0 125	3VL2712-3DC33-0AA0 125
Circuit-breaker type designation (status 07/2007 and later) Rated current Short-circuit current rating SCCR at 400 V_{AC} Short-circuit current rating SCCR at 480 V_{AC} Short-circuit current rating SCCR at 600 V_{AC}	 A kA kA kA	3RV1042-4FA10 28 ... 40 100	3RV1042-4LA10 70 ... 90 100	3VL2112-3KN30-0AA0 125 100 25	3VL2112-3KN30-0AA0 125 100 25
UL safety fuse type AJT Class J Rated current Short-circuit current rating SCCR at 600 V_{AC}	 A kA	AJT35 35 200	AJT80 80 200	AJT125 125 200	AJT125 125 200
Cooling method (internal air cooling)		Internal fan	Internal fan	Internal fan	Internal fan
Sound pressure level	dB(A)	<60	<65	<60	<60
Cooling air requirement	m^3/h	56	112	160	160
Rated voltage for rated data 380 V 3 AC					
Weight	kg	7	10	17	17

[1] The specified values apply to 380 V

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

Table 3-11 Technical data of Active Line Modules

Internal air cooling	6SL3130–	7TE28–0AAx	7TE31–2AAx
Rated power	**kW**	**80**	**120**
Infeed: Rated power (S1)[1] Infeed power (S6-40 %)[1] Peak infeed power[1]	 kW (Pn) kW (Ps6) kW (Pmax)	 80 106 131	 120 145 175
Regenerative feedback: Continuous regenerative power rating Peak regenerative power rating	 kW kW	 80 131	 120 175
Line supply voltages: Line voltage Line frequency Electronics power supply	 V_{ACrms} Hz V_{DC}	 380 V 3 AC -10 % (-15 % < 1 min) to 480 V 3 AC +10 % 47 to 63 24 (20.4 - 28.8)	

Internal air cooling	**6SL3130–**	**7TE28–0AAx**	**7TE31–2AAx**
Rated power	**kW**	**80**	**120**
DC link voltage Overvoltage trip threshold Undervoltage trip threshold	V_{DC} V_{DC} V_{DC}	510 - 720 820 ± 2 % 360 ± 2 %	
Rated input current: at 380 V_{AC} at 480 V_{AC}/528 V_{AC} at 480 V (S6-40 %) Peak current (at 400 V_{AC}/480 V_{AC})	 A_{AC} A_{AC} A_{AC} A_{AC}	 128 102 / 93 134 200 / 166	 192 152 / 139 201 267 / 222
DC link current: Rated current at S6-40 % Peak current	 A_{DC} A_{DC} A_{DC}	 134 176 218	 200 244 292
DC link busbar current carrying capacity	A_{DC}	200	200
24 V busbar current carrying capacity	A_{DC}	20	20
Electronics current consumption	A_{DC}	2	2.5
Total power loss (including electronic losses)[2]	W	1386	2260
Max. ambient temperature without derating	°C	40	40
Max. ambient temperature with derating	°C	55	55
DC link capacitance	µF	2 820	3 995
Maximum permissible DC link capacitance	µF	20 000	20 000
Power factor	cosϕ	1	1
Circuit-breaker type designation (status 07/2007 and later) Rated current Short-circuit current rating SCCR at 480 V_{AC} Short-circuit current rating SCCR at 600 V_{AC}	 A kA kA	3VL3117-3KN30-0AA0 175 100 25	3VL3125-3KN30-0AA0 250 100 25
UL safety fuse type AJT Class J Rated current Short-circuit current rating SCCR at 600 V_{AC}	 A kA	AJT175 175 200	AJT250 250 200
Cooling method (internal air cooling)		Mounted fan	Mounted fan
Sound pressure level	dB(A)	<73	<73
Cooling air requirement	m^3/h	520	520
Rated voltage for rated data 380 V 3 AC			
Weight	kg	23	23

[1] The specified values apply to 380 V

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

Rated duty cycles of Active Line Modules

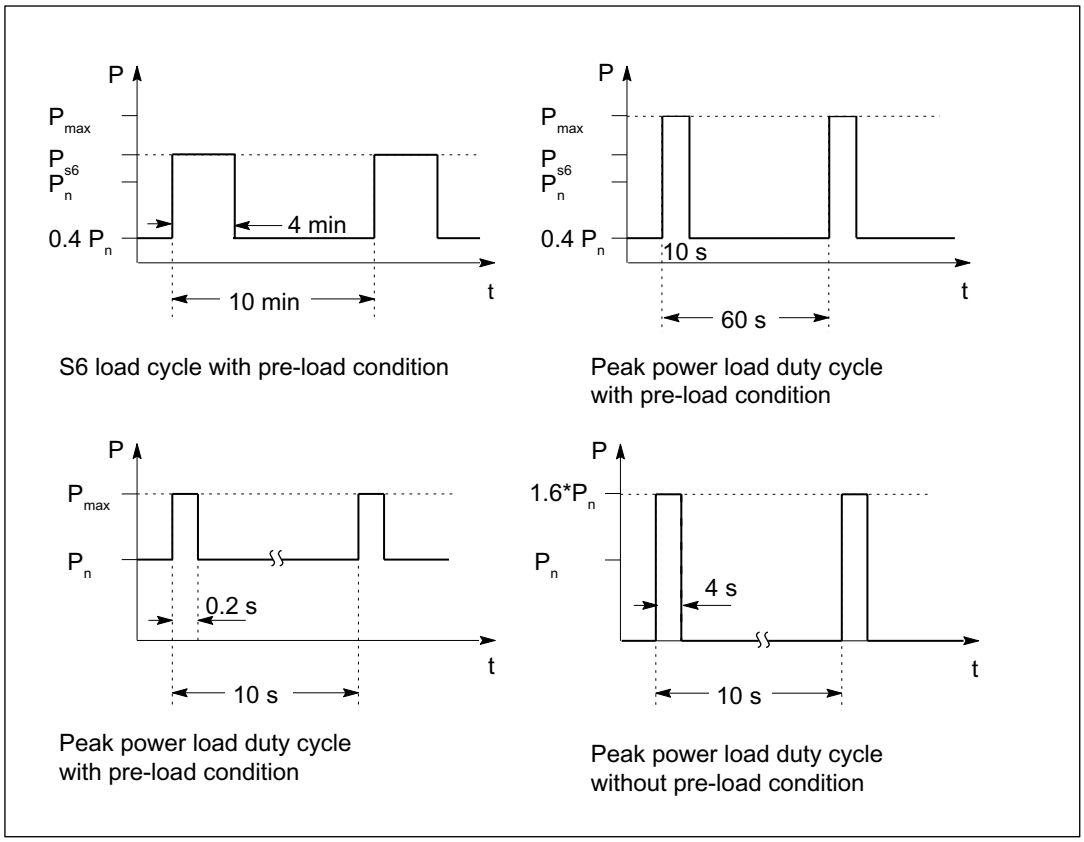


Figure 3-9 Rated duty cycles of Active Line Modules (exception: not applicable for 55 kW Active Line Module with Active Interface Module)

Rated duty cycles of 55 kW Active Line Modules with Active Interface Module

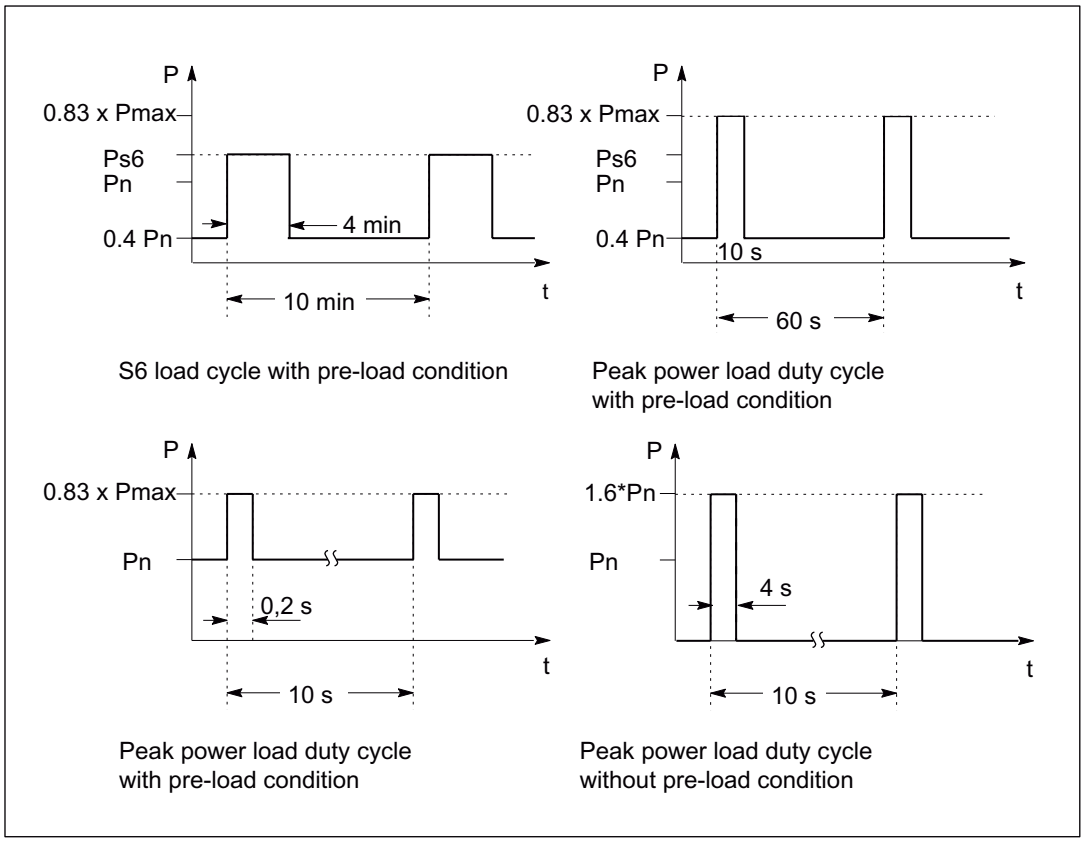


Figure 3-10 Rated duty cycles of 55 kW Active Line Modules with Active Interface Module

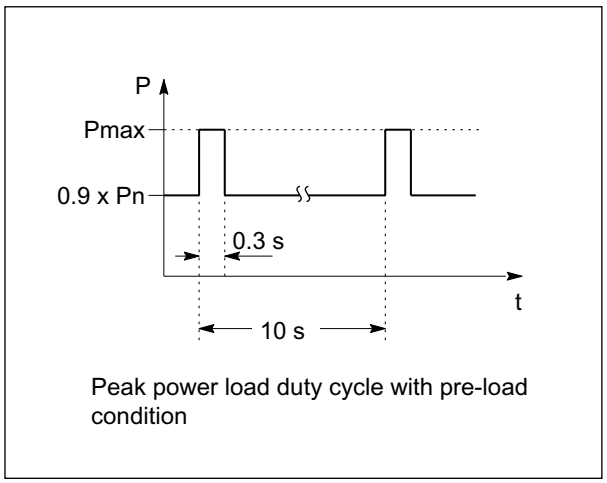


Figure 3-11 Rated duty cycle of 55 kW Active Line Modules with Active Interface Module

Derating as a function of the ambient temperature

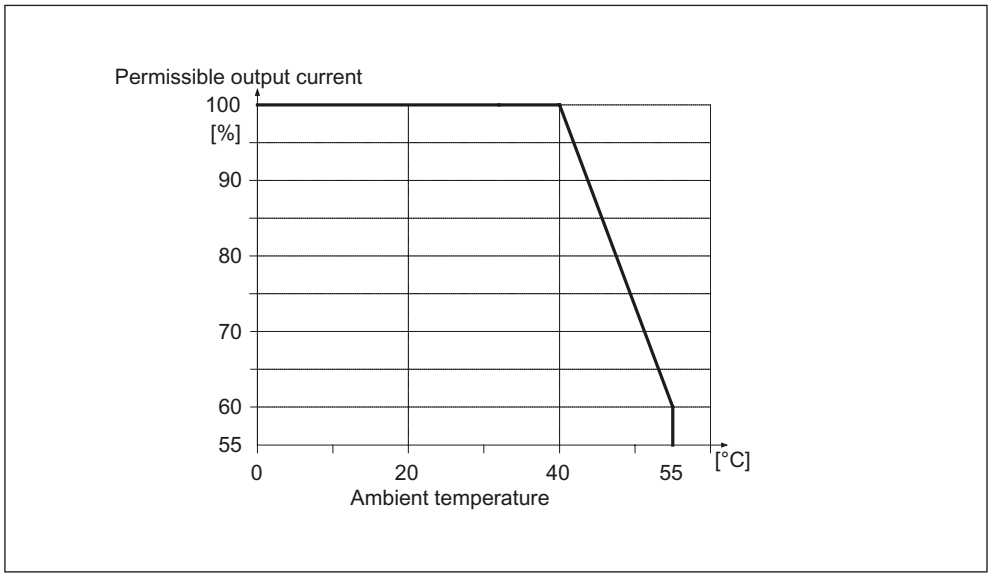


Figure 3-12 Derating as a function of the ambient temperature

Derating as a function of the installation altitude

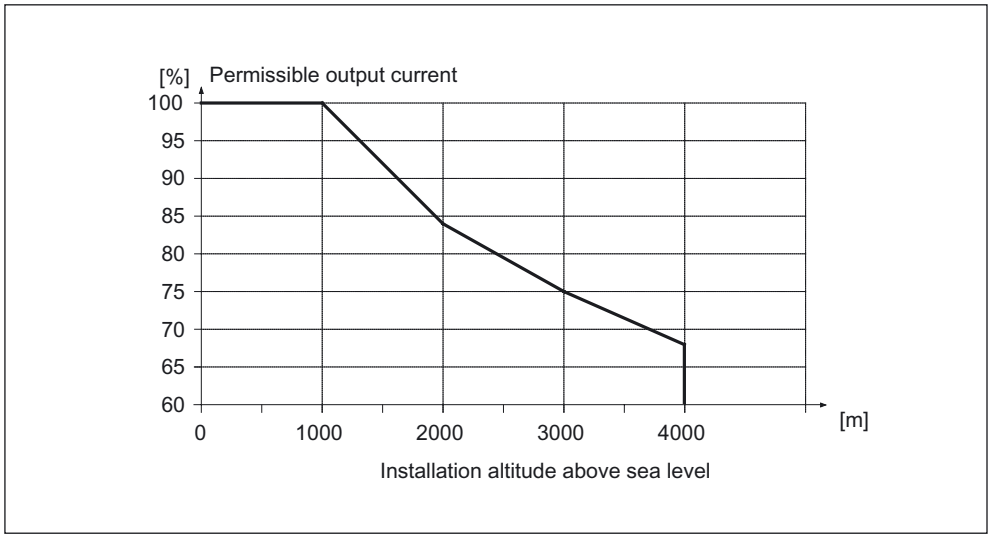


Figure 3-13 Derating as a function of the installation altitude

Voltage derating as a function of the installation altitude

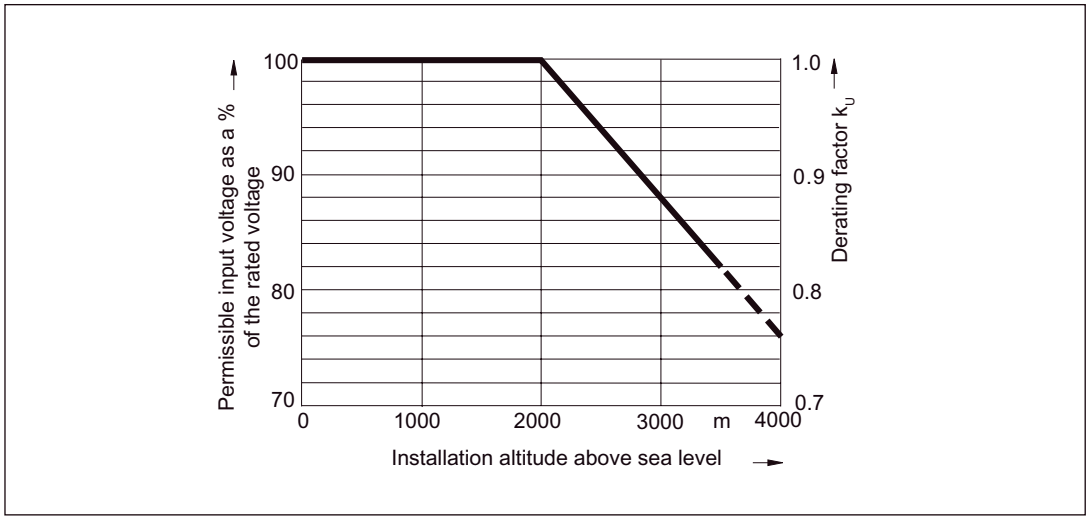


Figure 3-14 Voltage derating as a function of the installation altitude

Output power as a function of the total cable length

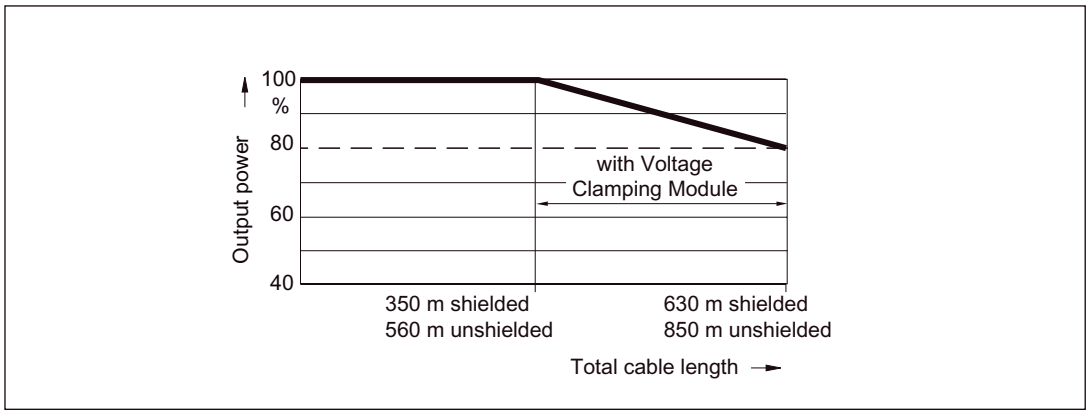


Figure 3-15 Output power as a function of the total cable length

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 system. 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. The Line Modules have an integrated overvoltage protection function.

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 control cabinet and mounted with a seal. The heat sink and the fan (included in the scope of supply) project beyond the rear of the control cabinet and the heat is dissipated outside the control cabinet or in a separate air duct.

3.3.2 Safety information

⚠ DANGER

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

⚠ WARNING

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

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

⚠ WARNING

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

⚠ DANGER

The 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 control cabinet is required. Because of the high leakage current of the Motor Module, a permanent PE connection of the Motor Module or control cabinet is required.

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

⚠ DANGER

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

⚠ WARNING

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

⚠ DANGER

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

CAUTION

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

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

⚠DANGER

If a 50 mm wide Motor Module or if a DC link component with the appropriate width (e.g. Braking Module, Control Supply Module, Voltage Clamping Module) is located at the left-hand end of the drive line-up, the DC link bridge (including the screws) must be removed. The screws must not be inserted without a DC link bridge.

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

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

CAUTION

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

⚠WARNING

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

3.3.3 Interface description

3.3.3.1 Overview

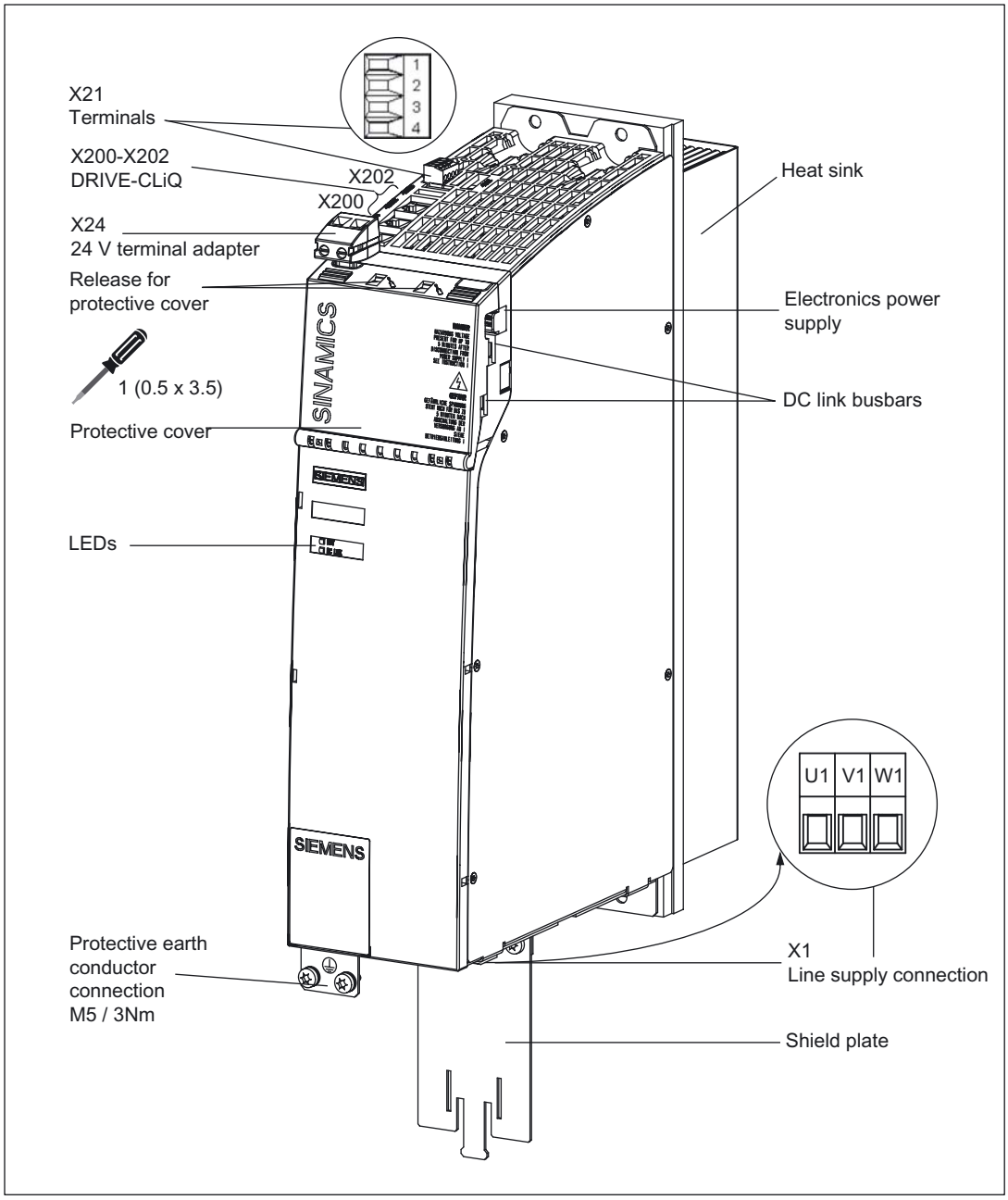
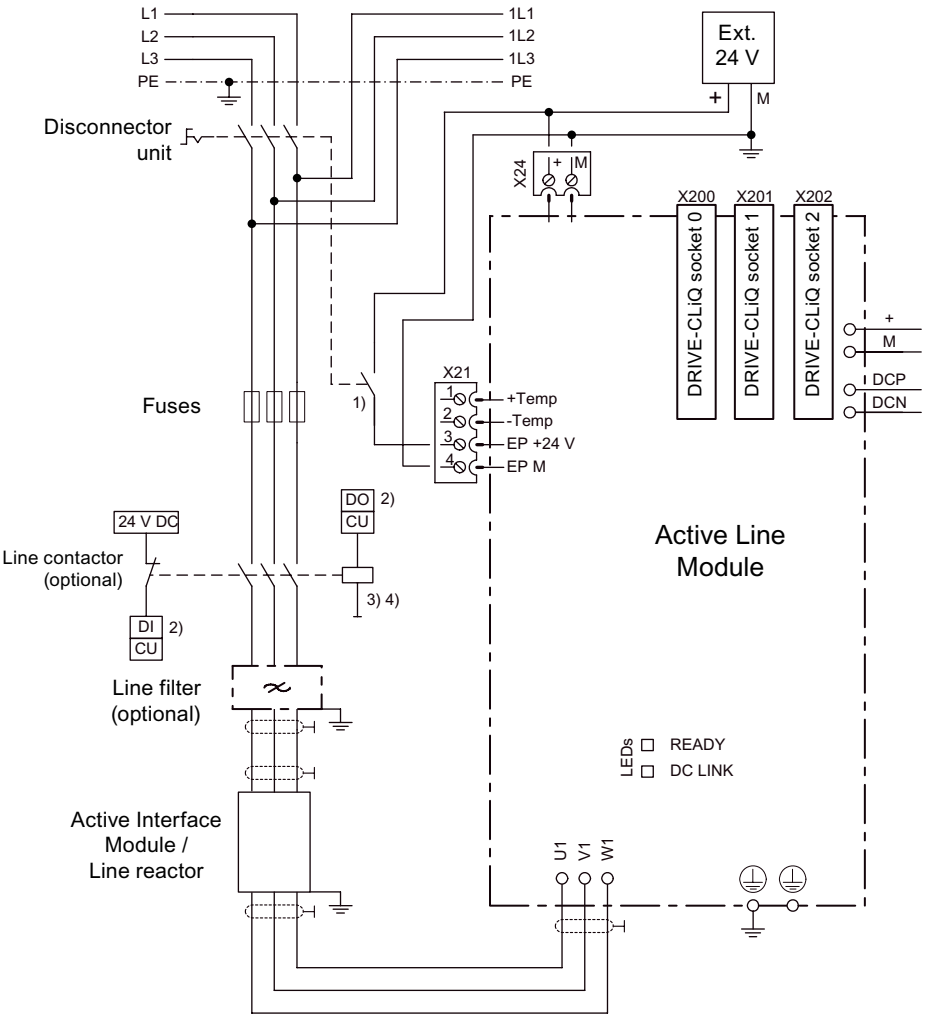


Figure 3-16 Active Line Module with external air cooling (example: 16 kW)

3.3.3.2 Connection example

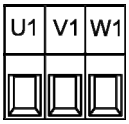
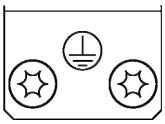


1) Leading NC contact t >10 ms, 24 V DC ground must be applied for operation.
2) DI/DO (controlled by Control Unit).
3) No additional load permitted downstream of line contactor!
4) The current carrying capacity of the DO must be observed; an output interface must be used if required.

Figure 3-17 Example connection of Active Line Module

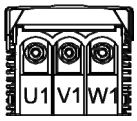
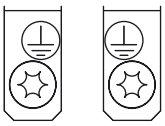
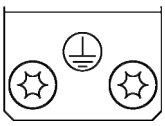
3.3.3.3 Line supply connection

Table 3-12 Terminal block X1 Active Line Module 16 kW

	Terminal	Technical specifications
	U1 V1 W1	Supply voltage: 480 V 3 AC +10 % (-15 % < 1 min) for 47 Hz to 63 Hz Max. connectable cross-section: 10 mm² Type: Screw terminal 6 (see Connection systems) Tightening torque: 1.5 - 1.8 Nm
	PE connection	Threaded hole M5/3 Nm [1]

[1] for ring cable lugs to DIN 46234

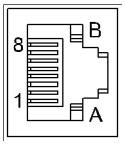
Table 3-13 Terminal block for the Active Line Module (36 kW to 120 kW)

	Terminals	Technical specifications
	U1 V1 W1	Supply voltage: 480 V 3 AC +10 % (-15 % < 1 min) for 47 Hz to 63 Hz **36 kW:** 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)]
	PE connection	**36 kW:** 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

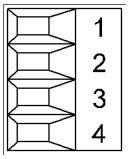
3.3.3.4 X200-X202 DRIVE-CLiQ interfaces

Table 3-14 DRIVE-CLiQ interface X200-X202

	PIN	Signal name	Technical specifications
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	24 V power supply
	B	M (0 V)	Electronics ground
Blanking plate for DRIVE-CLiQ interface: Yamaichi, order no.: Y-ConAS-13			

3.3.3.5 EP terminals X21

Table 3-15 Terminal block X21

	Terminal	Designation	Technical specifications
	1	+ Temp	For the temperature sensor connection on the Active Interface Module
	2	- Temp	
	3	EP +24 V (enable pulses)	Voltage 24 V DC Current consumption: 10 mA Isolated input Signal propagation times: L → H: 100 µs H → L: 1000 µs
	4	EP M (enable pulses)	
Max. connectable cross-section: 1.5 mm^2 Type: Screw terminal 1 (see Connection systems)			

⚠ CAUTION

If an Active Interface Module is connected, the temperature output of the Active Interface Module must be connected to terminals 1 and 2.

⚠ WARNING

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

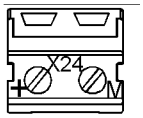
NOTICE

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

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

3.3.3.6 X24 24 V terminal adapter

Table 3-16 Terminal block X24

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

3.3.3.7 Meaning of the LEDs on the Active Line Module

Table 3-17 Active Line Module - description of the LEDs

Status		Description, cause	Remedy
Ready (H200)	**DC link (H201)**		
off	off	Electronics power supply is missing or outside permissible tolerance range.	–
Green	off	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.	–
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is present.	–
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is too high.	Check line voltage
Orange	Orange	DRIVE-CLiQ communication is being established.	–
Red	–	At least one fault is present in this component. **Note:** The LED is activated regardless of whether the corresponding messages have been reconfigured.	Remedy and acknowledge fault
Green/red (0.5 Hz)	-	Firmware is being downloaded.	–
Green/red (2 Hz)	-	Firmware download is complete. Wait for POWER ON.	Carry out a POWER ON
Green/orange or Red/orange	–	Component detection via LED is activated (p0124). **Note:** Both options depend on the LED status when component recognition is activated via p0124 = 1.	–

⚠ DANGER

Hazardous DC link voltages may be present at any time regardless of the status of the "DC link" LED.
The warning information on the components must be carefully observed!

3.3.4 Dimension drawings

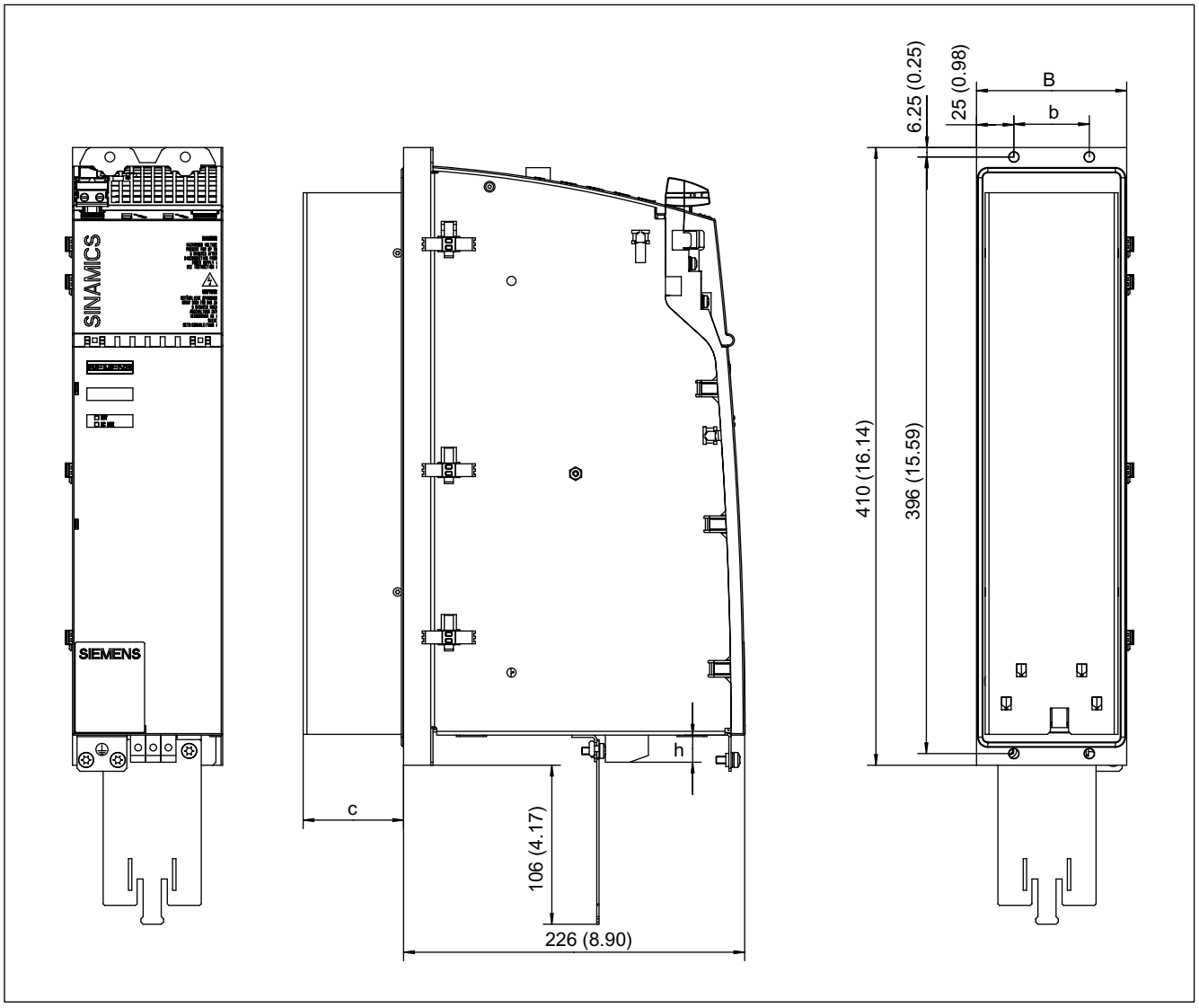


Figure 3-18 Dimension drawing of Active Line Module with external air cooling (16 kW)

Table 3-18 Dimensions of Active Line Module with external air cooling (16 kW)

Line module type	Order number	W [mm] (inches)	b [mm] (inches)	c [mm] (inches)	h [mm] (inches)
16 kW	6SL3131-7TE21-6AAx	100 (3.94)	50 (1.97)	66.5 (2.62)	18 (0.71)

Note

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

More information can be found in "Accessories".

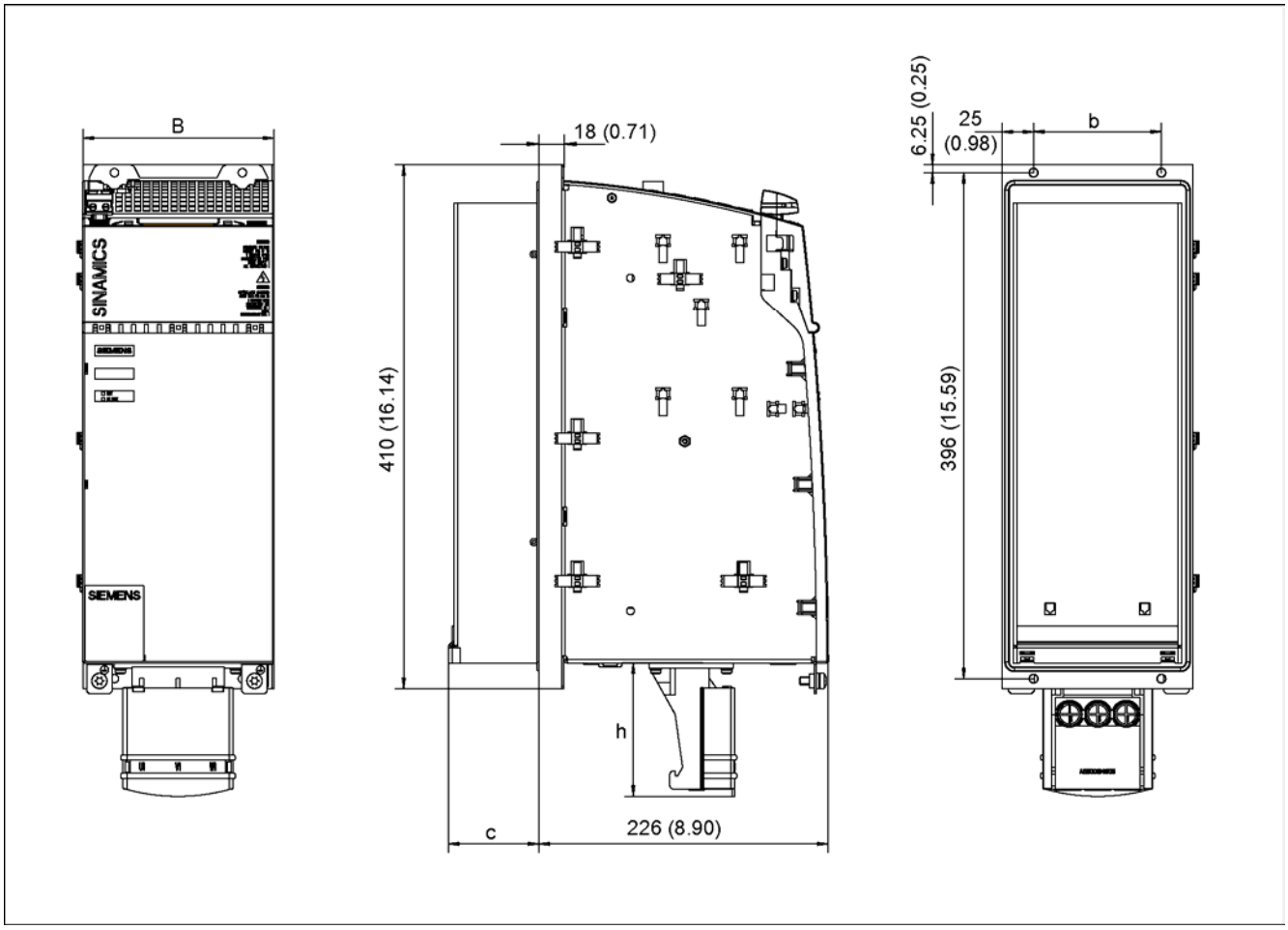


Figure 3-19 Dimension drawing of active line with external air cooling (36 kW, 55 kW, 80 kW, and 120 kW)

Table 3-19 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)	b [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

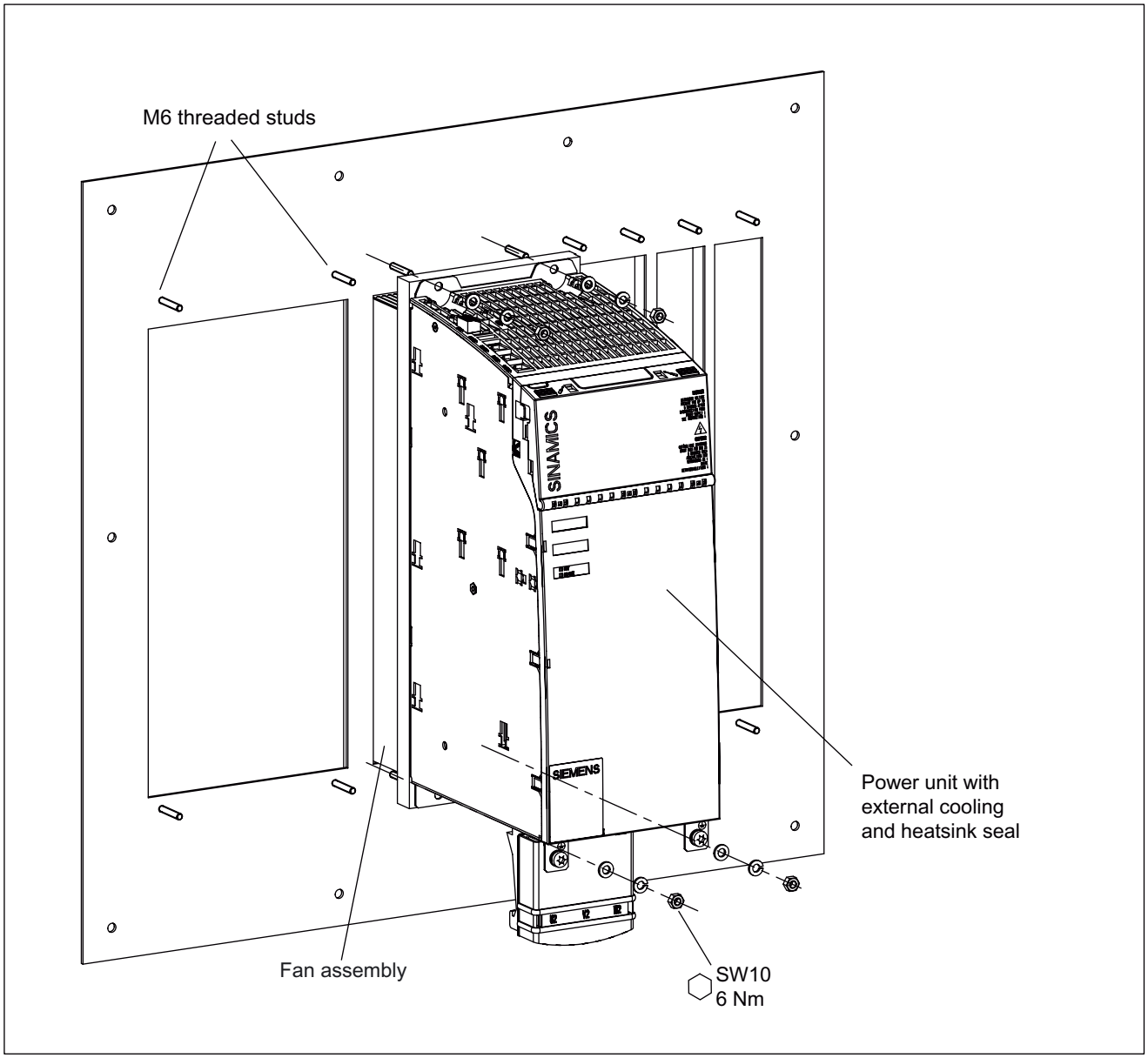


Figure 3-20 Example: Installing the power unit with external air cooling

Help with the mechanical cabinet design is available from:

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

E-mail: cc.cabinetcooling@siemens.com

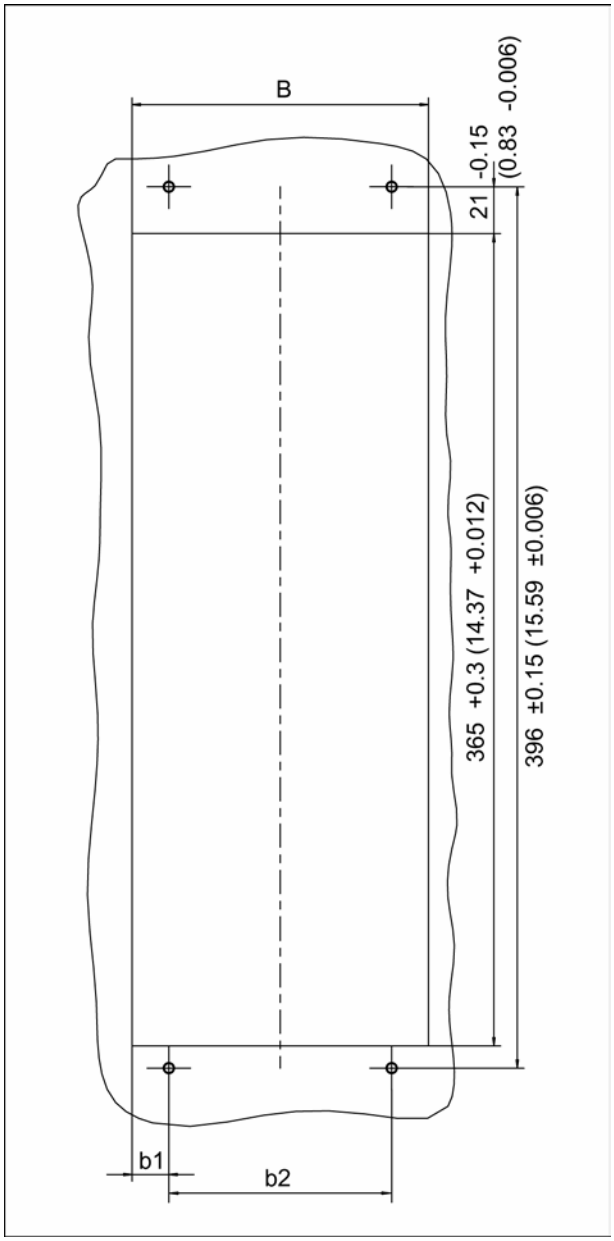


Figure 3-21 Installation openings for the power unit with external air cooling, 50 mm to 200 mm

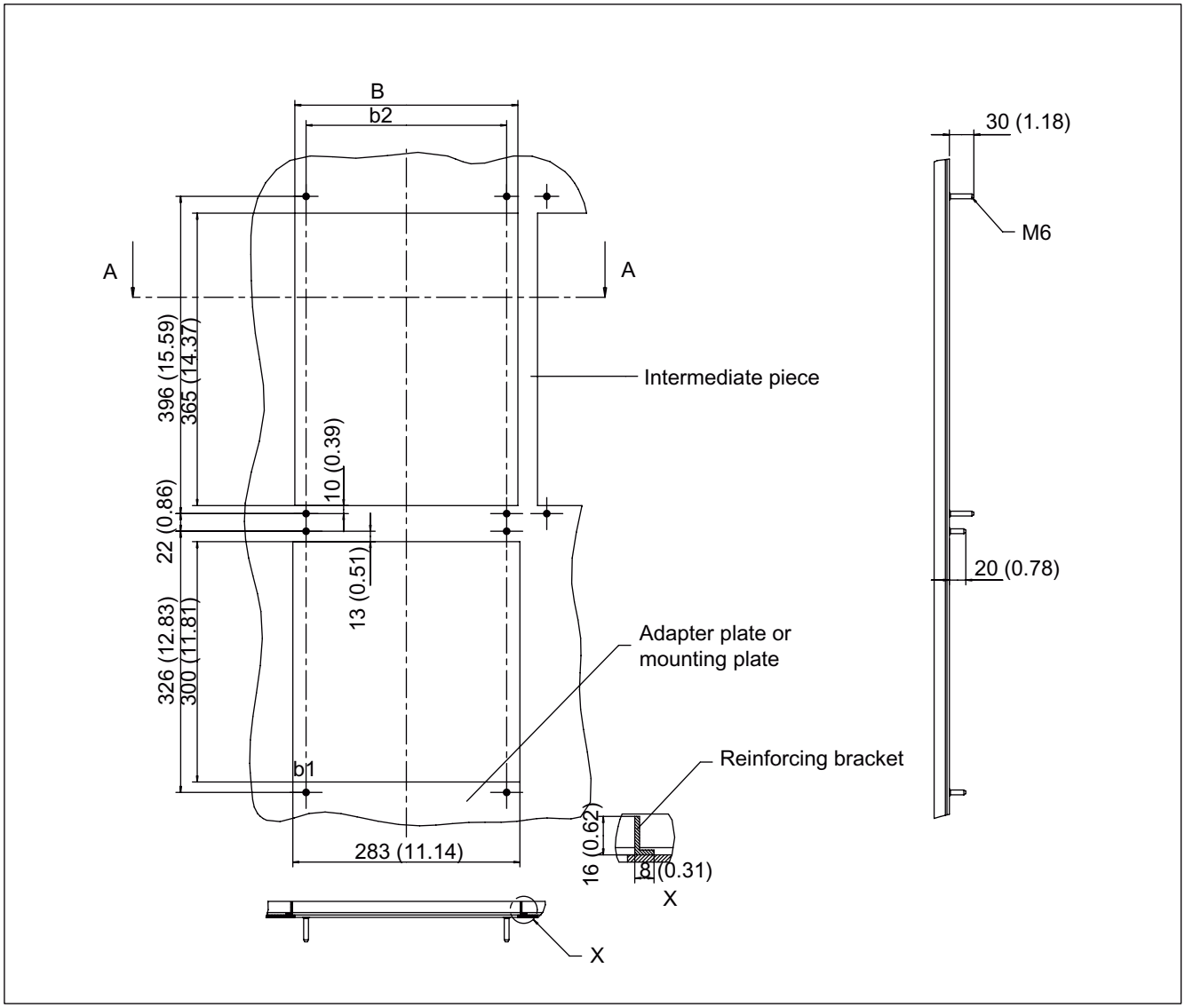


Figure 3-22 Installation openings for the power unit with external air cooling, 300 mm

Table 3-20 Dimensions of the installation openings for the power unit with external air cooling

Component 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)

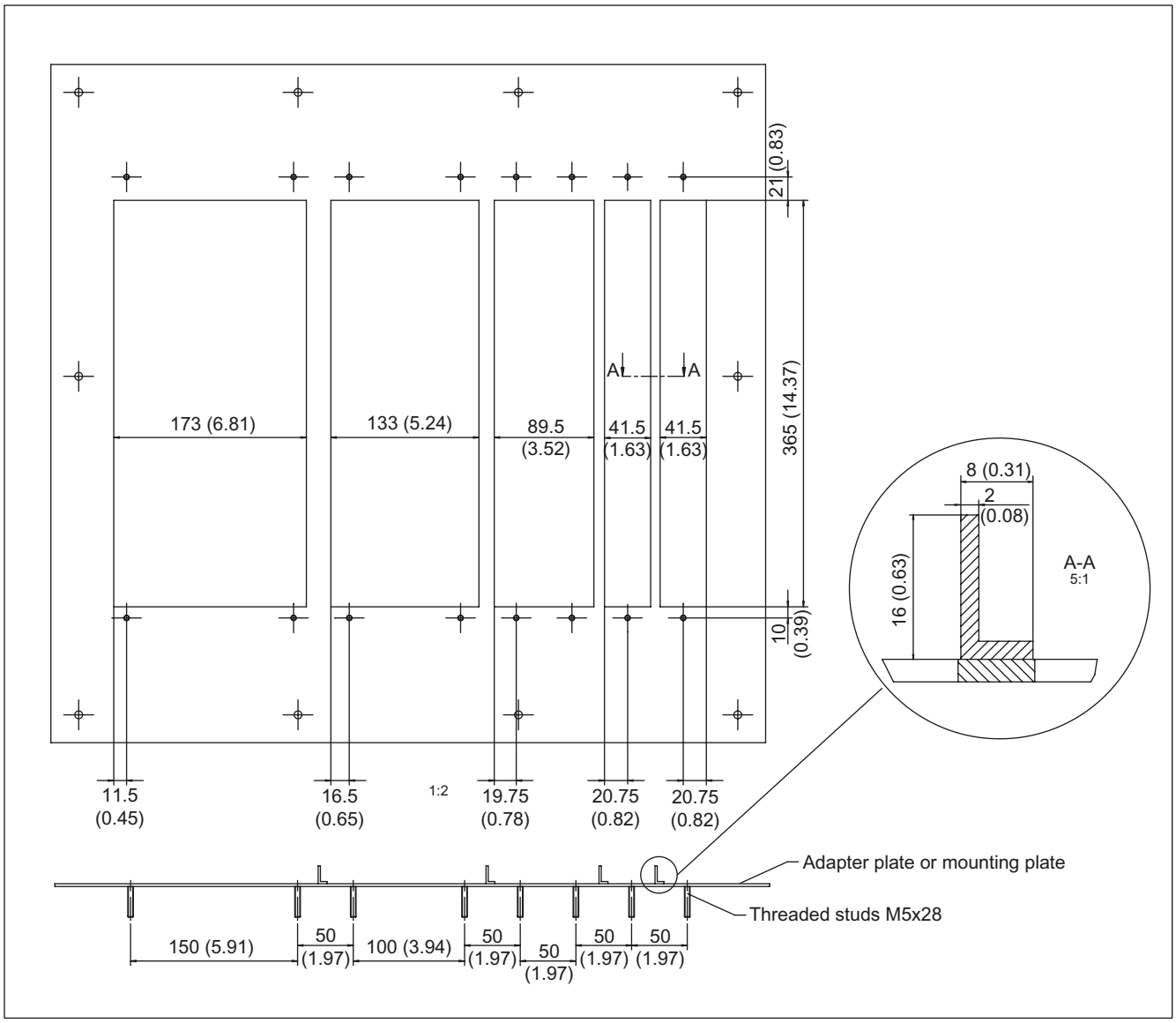


Figure 3-23 Example: Mounting plate with a drive line-up

During installation it must be ensured that the component's seal is tight throughout.

Note

A set of seals consisting of spare seals for 50 mm, 100 mm, 150 mm, 200 mm and 300 mm wide components can be ordered with order number: 6SL3162-5BU00-0AA0.

The cross-pieces must have the appropriate stability. 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.

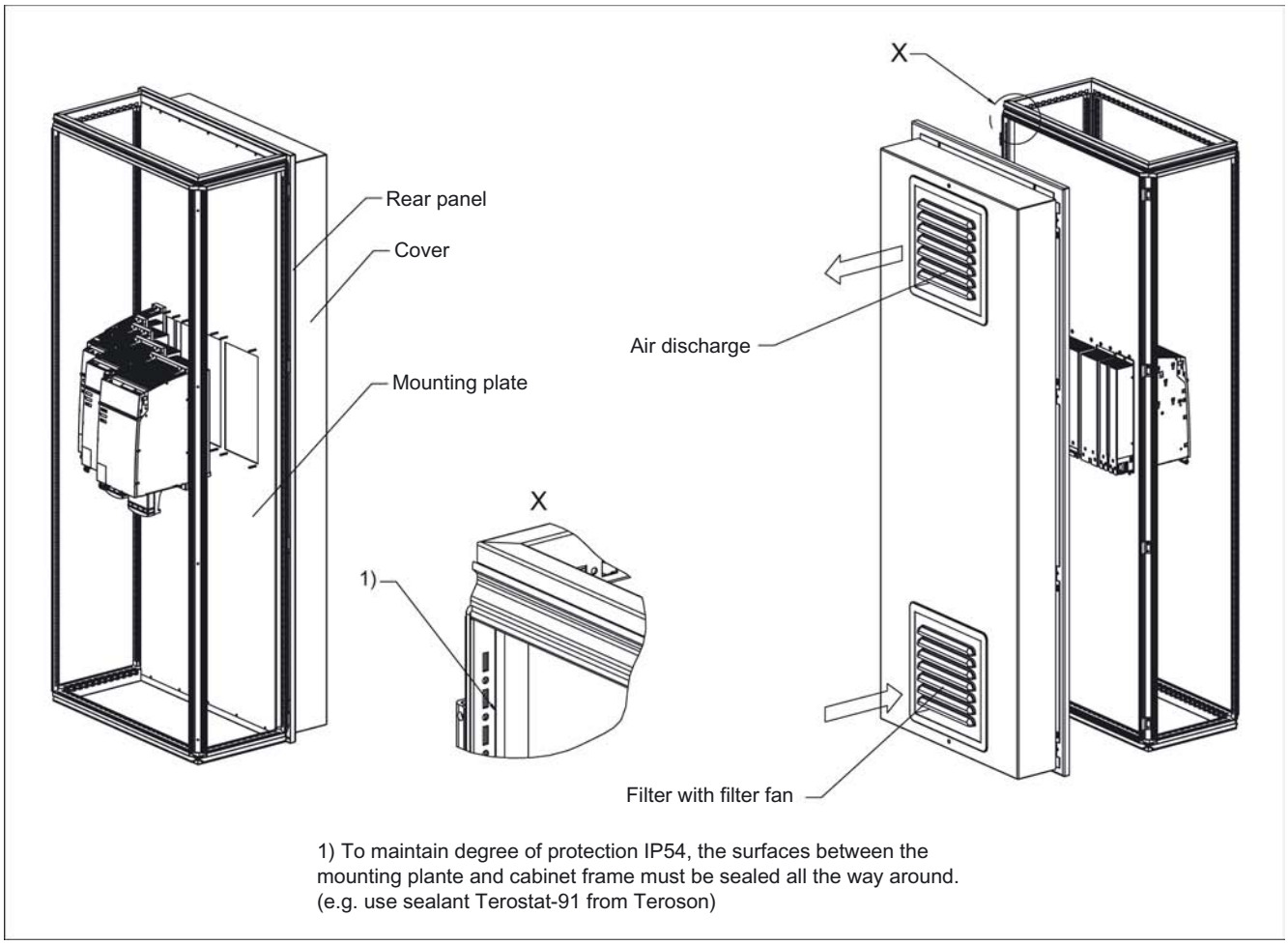
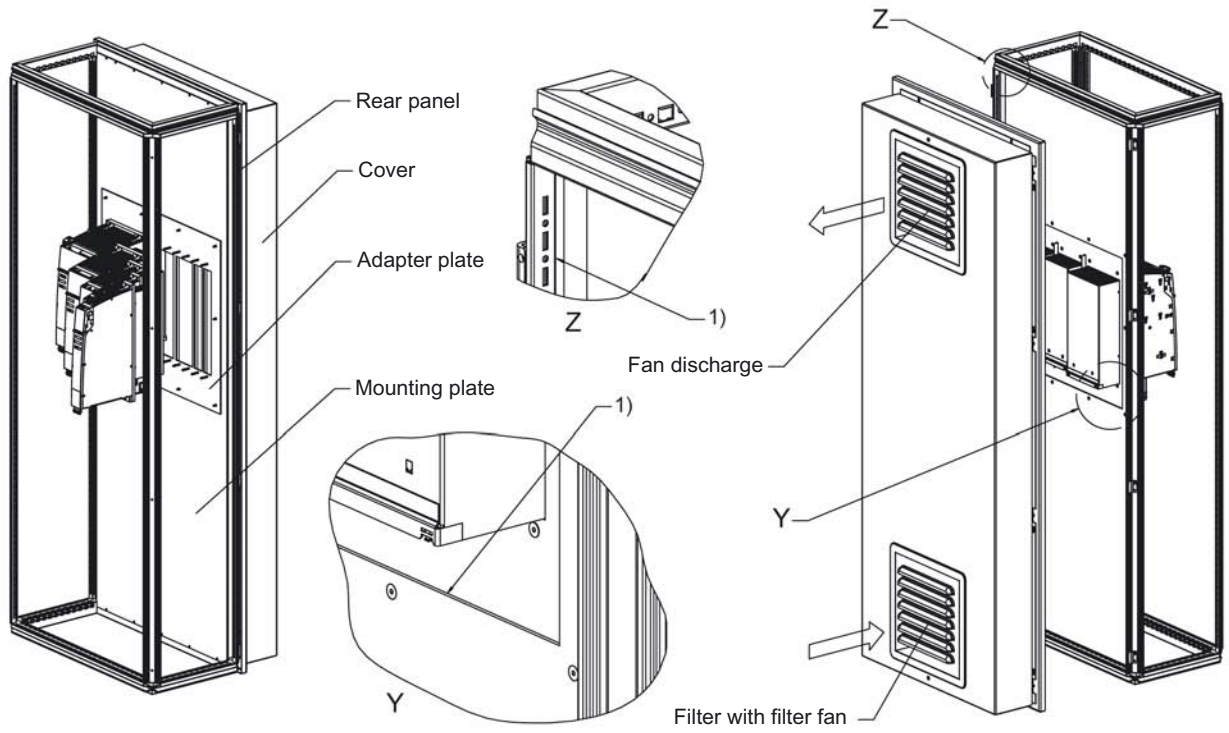


Figure 3-24 Example 1: Installation in cabinet with mounting plate



1) To maintain degree of protection IP54, the surfaces between the mounting plate and cabinet frame, as well as between the mounting plate and adapter plate, must be sealed all the way around. (e.g. use sealant Terostat-91 from Teroson)

Figure 3-25 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.

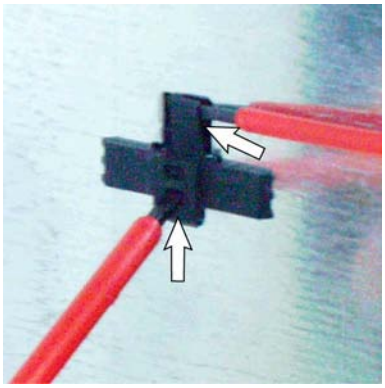
Note

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

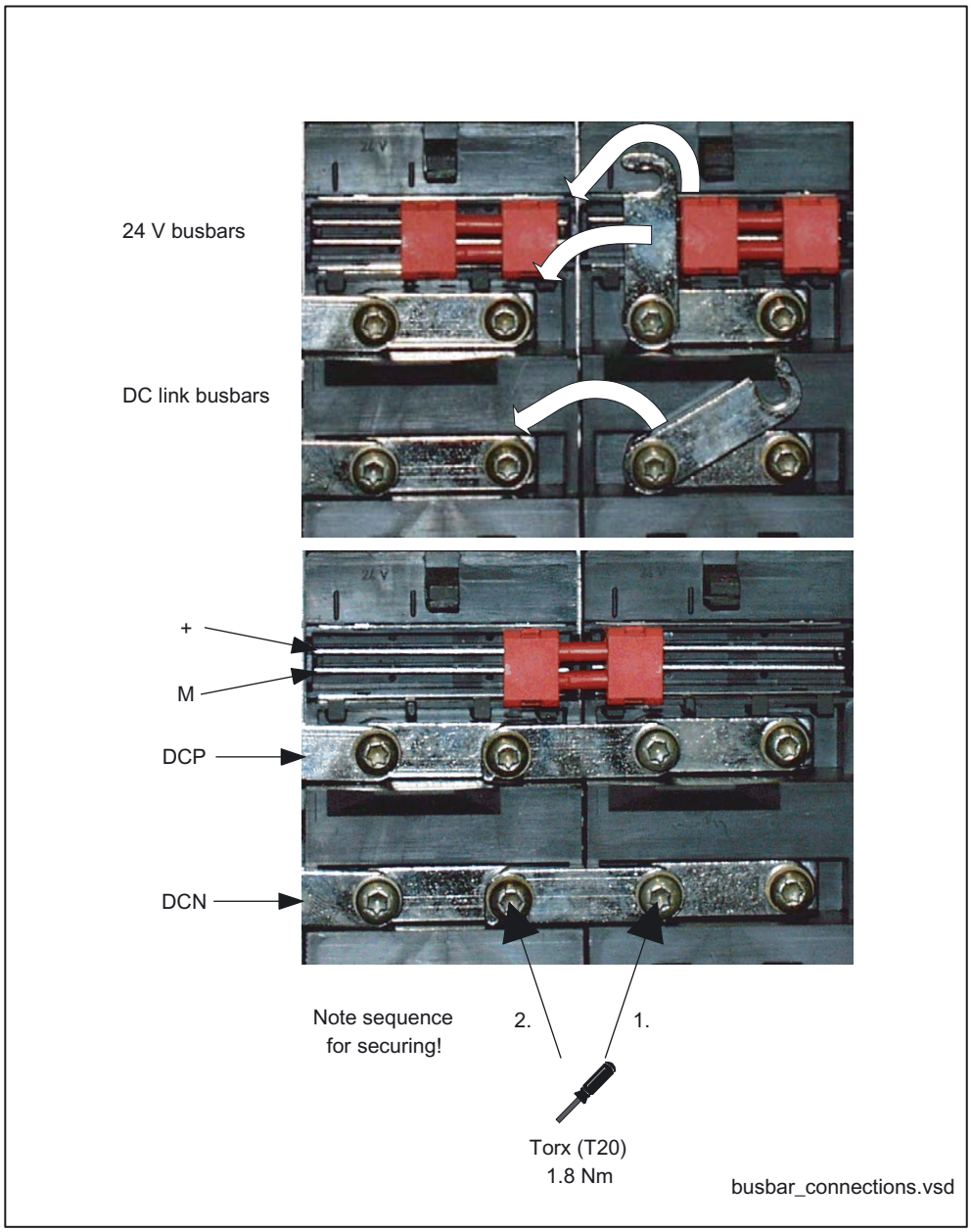


Figure 3-26 Busbar connections for booksize components

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

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

3.3.7 Technical data

Table 3-21 Technical data for Active Line Modules with external air cooling, part 1

Internal air cooling	6SL3131–	7TE21–6AAx	7TE23–6AAx	7TE25–5AAx	7TE25–5AA3 + Active Interface Module
Rated power	**kW**	**16**	**36**	**55**	**55**
Infeed:					
Rated power (S1)[1]	kW (Pn)	16	36	55	55
Infeed power (S6-40 %)[1]	kW (Ps6)	21	47	71	71
Peak infeed power[1]	kW (Pmax)	35	70	91	110
Regenerative feedback:					
Continuous regenerative power rating	kW	16	36	55	55
Peak regenerative power rating	kW	35	70	91	110
Line supply voltages:					
Line voltage	V_{ACrms}	380 V 3 AC -10 % (-15 % < 1 min) to 480 V 3 AC +10 %			
Line frequency	Hz	47 to 63 Hz			
Electronics power supply	V_{DC}	24 (20.4 - 28.8)			
DC link voltage	V_{DC}	510 - 720			
Overvoltage trip threshold	V_{DC}	820 ± 2 %			
Undervoltage trip threshold	V_{DC}	360 ± 2 %			
Rated input current:					
at 380 V_{AC}	A_{AC}	26	58	88	88
at 480 V_{AC}/528 V_{AC}	A_{AC}	21 / 19	46 / 42	70 / 64	70 / 64
at 480 V (S6-40 %)	A_{AC}	27	60	92	92
Peak current (at 400 V_{AC}/480 V_{AC})	A_{AC}	54 / 45	107 / 89	139 / 116	168 / 140
DC link current:					
Rated current	A_{DC}	27	60	92	92
at S6-40 %	A_{DC}	35	79	121	121
Peak current	A_{DC}	59	117	152	176
DC link busbar current carrying capacity	A_{DC}	100	100	200	200
24 V busbar current carrying capacity	A_{DC}	20	20	20	20
Electronics current consumption	A_{DC}	1.1	1.5	1.9	1.9
Total power loss (including electronic losses)[2]	W	286.4	666	945.6	945.6
Max. ambient temperature without derating	°C	40	40	40	40
Max. ambient temperature with derating	°C	55	55	55	55

Internal air cooling	**6SL3131–**	**7TE21–6AAx**	**7TE23–6AAx**	**7TE25–5AAx**	**7TE25–5AA3 + Active Interface Module**
Rated power	**kW**	**16**	**36**	**55**	**55**
DC link capacitance	µF	705	1 410	1 880	1 880
Maximum permissible DC link capacitance	µF	20 000	20 000	20 000	20 000
Power factor	cosϕ	1	1	1	1
Circuit-breaker type designation (status 06/2007) Rated current Short-circuit current rating SCCR at 400 V_{AC}	 A kA	3RV1031-4FA10 28 ... 40 50	3RV1041-4LA10 70 ... 90 50	3VL2712-3DC33-0AA0 125	3VL2712-3DC33-0AA0 125
Circuit-breaker type designation (status 07/2007 and later) Rated current Short-circuit current rating SCCR at 400 V_{AC} Short-circuit current rating SCCR at 480 V_{AC} Short-circuit current rating SCCR at 600 V_{AC}	 A kA kA kA	3RV1042-4FA10 28 ... 40 100	3RV1042-4LA10 70 ... 90 100	3VL2112-3KN30-0AA0 125 100 25	3VL2112-3KN30-0AA0 125 100 25
UL safety fuse type AJT Class J Rated current Short-circuit current rating SCCR at 600 V_{AC}	 A kA	AJT35 35 200	AJT80 80 200	AJT125 125 200	AJT125 125 200
Sound pressure level	dB(A)	<60	<65	<60	<60
Cooling air requirement	m^3/h	56	112	160	160
Rated voltage for rated data 380 V 3 AC					
Weight	kg	8.78	13.77	18.5	18.5

[1] The specified values apply to 380 V

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

Table 3-22 Technical data for Active Line Modules with external air cooling, part 2

Internal air cooling	6SL3131–	7TE28–0AAx	7TE31-2AAx
Rated power	**kW**	**80**	**120**
Infeed:			
Rated power (S1)[1]	kW (Pn)	80	120
Infeed power (S6-40 %)[1]	kW (Ps6)	106	145
Peak infeed power[1]	kW (Pmax)	131	175
Regenerative feedback:			
Continuous regenerative power rating	kW	80	120
Peak regenerative power rating	kW	131	175
Line supply voltages:			
Line voltage	V_{ACrms}	380 V 3 AC -10 % (-15 % < 1 min) to 480 V 3 AC +10 %	
Line frequency	Hz	47 to 63 Hz	
Electronics power supply	V_{DC}	24 (20.4 - 28.8)	
DC link voltage	V_{DC}	510 - 720	
Overvoltage trip threshold	V_{DC}	820 ± 2 %	
Undervoltage trip threshold	V_{DC}	360 ± 2 %	
Rated input current:			
at 380 V_{AC}	A_{AC}	128	192
at 480 V_{AC}/528 V_{AC}	A_{AC}	102 / 93	152 / 139
at 480 V (S6-40 %)	A_{AC}	134	201
Peak current (at 400 V_{AC}/480 V_{AC})	A_{AC}	200 / 166	267 / 222
DC link current:			
Rated current	A_{DC}	134	200
at S6-40 %	A_{DC}	176	244
Peak current	A_{DC}	218	292
DC link busbar current carrying capacity	A_{DC}	200	200
24 V busbar current carrying capacity	A_{DC}	20	20
Electronics current consumption	A_{DC}	2	2.5
Total power loss (including electronic losses)[2]	W	1386	2260
Max. ambient temperature without derating	°C	40	40
Max. ambient temperature with derating	°C	55	55
DC link capacitance	µF	2 820	3 995
Maximum permissible DC link capacitance	µF	20 000	20 000
Power factor	cosϕ	1	1
Circuit-breaker type designation (status 07/2007 and later)		3VL3117-3KN30-0AA0	3VL3125-3KN30-0AA0
Rated current	A	175	250
Short-circuit current rating SCCR at 480 V_{AC}	kA	100	100
Short-circuit current rating SCCR at 600 V_{AC}	kA	25	25

Internal air cooling	6SL3131–	7TE28–0AAx	7TE31-2AAx
Rated power	kW	80	120
UL safety fuse type AJT Class J Rated current Short-circuit current rating SCCR at 600 V_{AC}	 A kA	AJT175 175 200	AJT250 250 200
Sound pressure level	dB(A)	<73	<73
Cooling air requirement	m^3/h	520	520
Rated voltage for rated data 380 V 3 AC			
Weight	kg	27.66	30.74

[1] The specified values apply to 380 V

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

Rated duty cycles of Active Line Modules

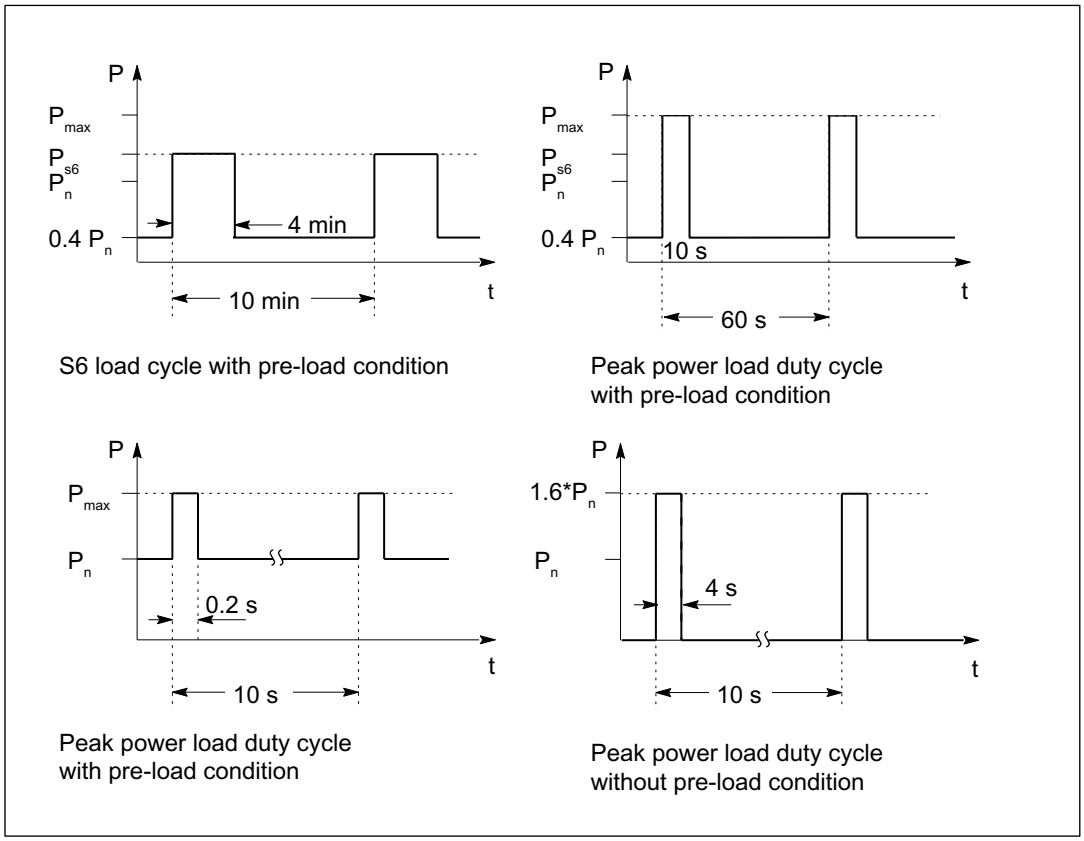


Figure 3-27 Rated duty cycles of Active Line Modules (exception: not applicable for 55 kW Active Line Module with Active Interface Module)

Rated duty cycles of 55 kW Active Line Modules with Active Interface Module

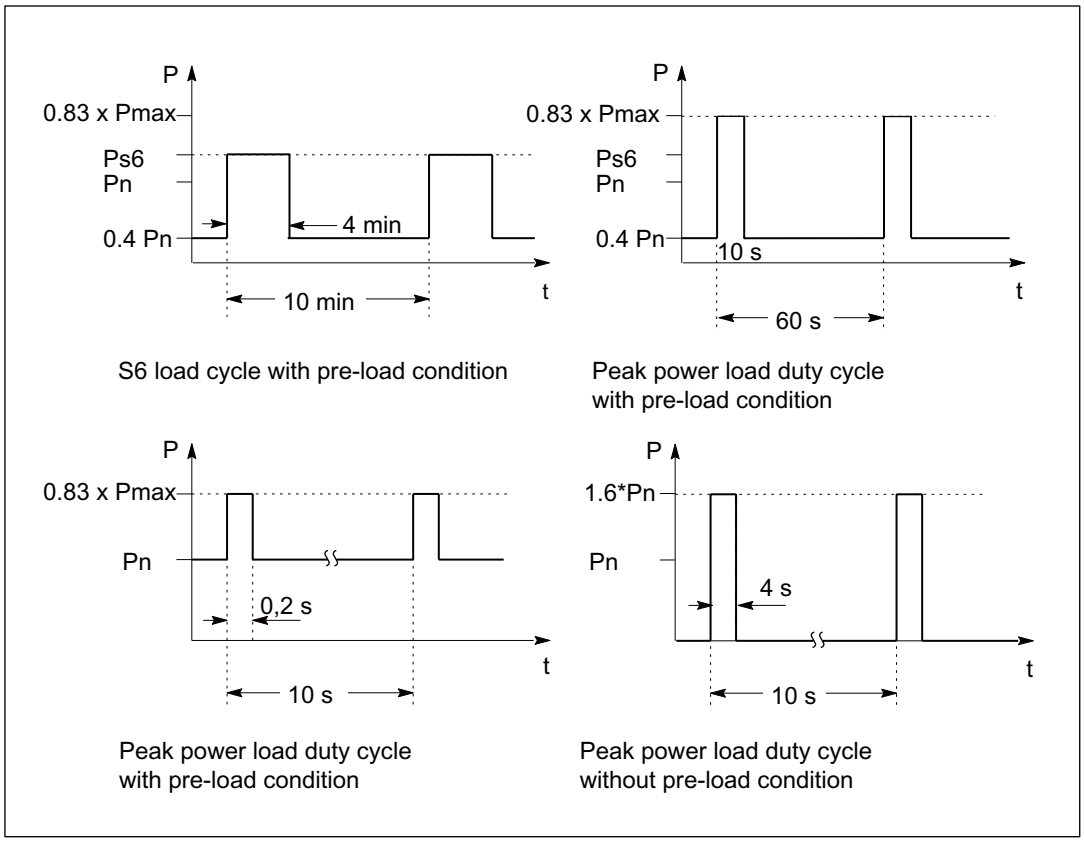


Figure 3-28 Rated duty cycles of 55 kW Active Line Modules with Active Interface Module

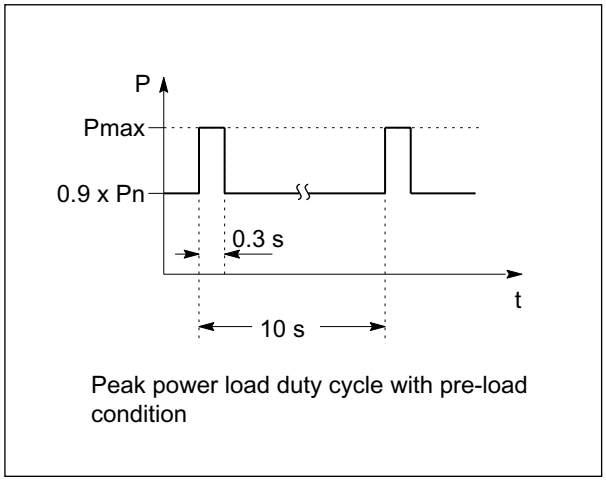


Figure 3-29 Rated duty cycle of 55 kW Active Line Modules with Active Interface Module

Derating as a function of the ambient temperature

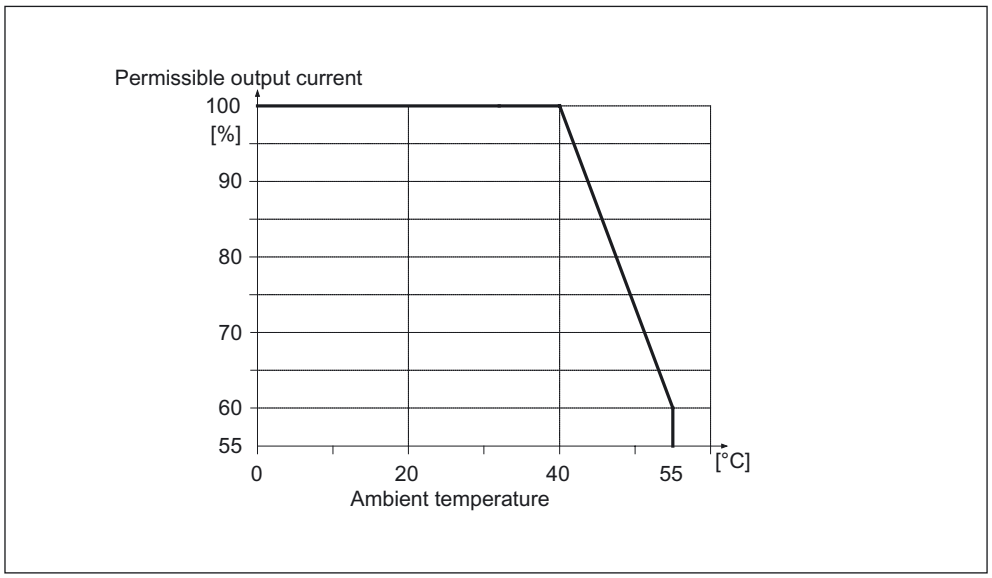


Figure 3-30 Derating as a function of the ambient temperature

Derating as a function of the installation altitude

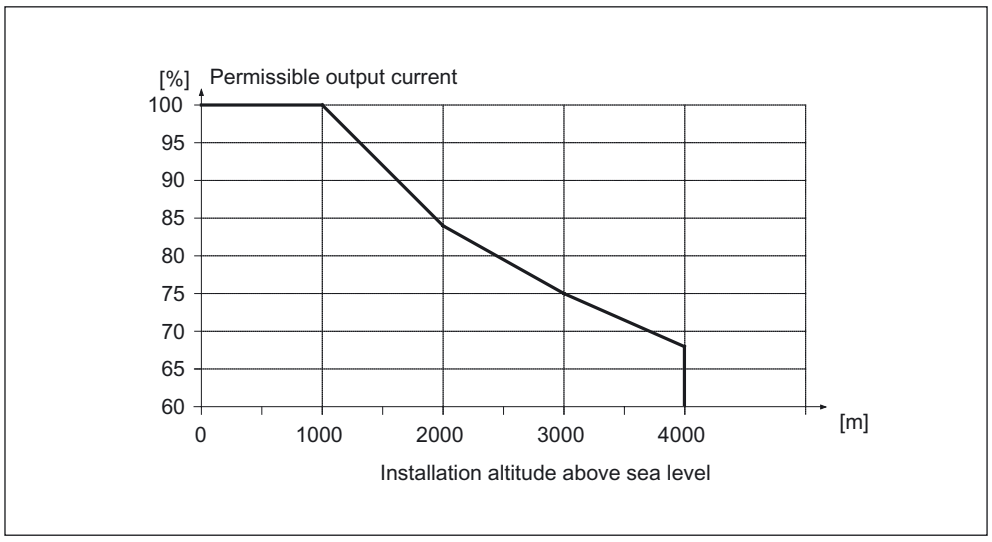


Figure 3-31 Derating as a function of the installation altitude

Voltage derating as a function of the installation altitude

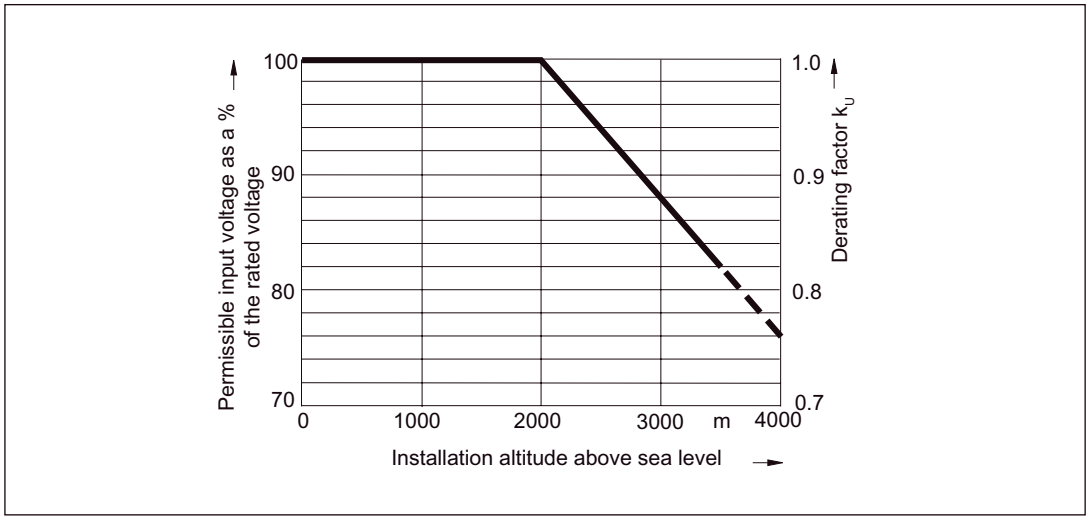


Figure 3-32 Voltage derating as a function of the installation altitude

Output power as a function of the total cable length

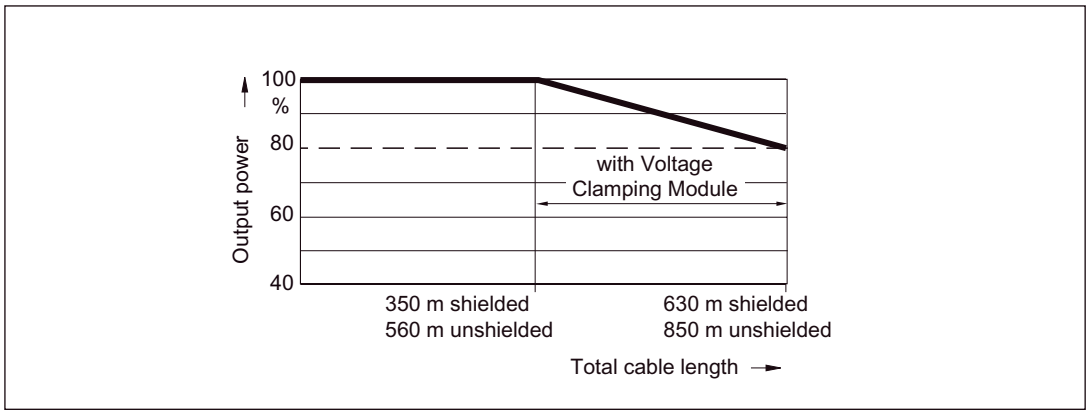


Figure 3-33 Output power as a function of the total cable length

3.4 Basic Line Modules with internal air cooling

3.4.1 Description

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

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

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

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

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

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

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

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

3.4.2 Safety information

⚠ DANGER

Risk of electric shock. Dangerous voltages are still present for up to 5 minutes after the power supply has been switched off. The protective cover must not be opened until this time has elapsed.

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

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

⚠ DANGER

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

⚠ DANGER

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

⚠ WARNING

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

⚠ DANGER

The Basic Line Modules conduct a high leakage current via the PE conductor. A permanent PE connection for the Basic Line Module or control cabinet is required due to the high leakage current of the Basic Line Modules.

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

⚠ DANGER

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

⚠ CAUTION

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

CAUTION

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

Note

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

NOTICE

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

3.4.3 Interface description

3.4.3.1 Overview

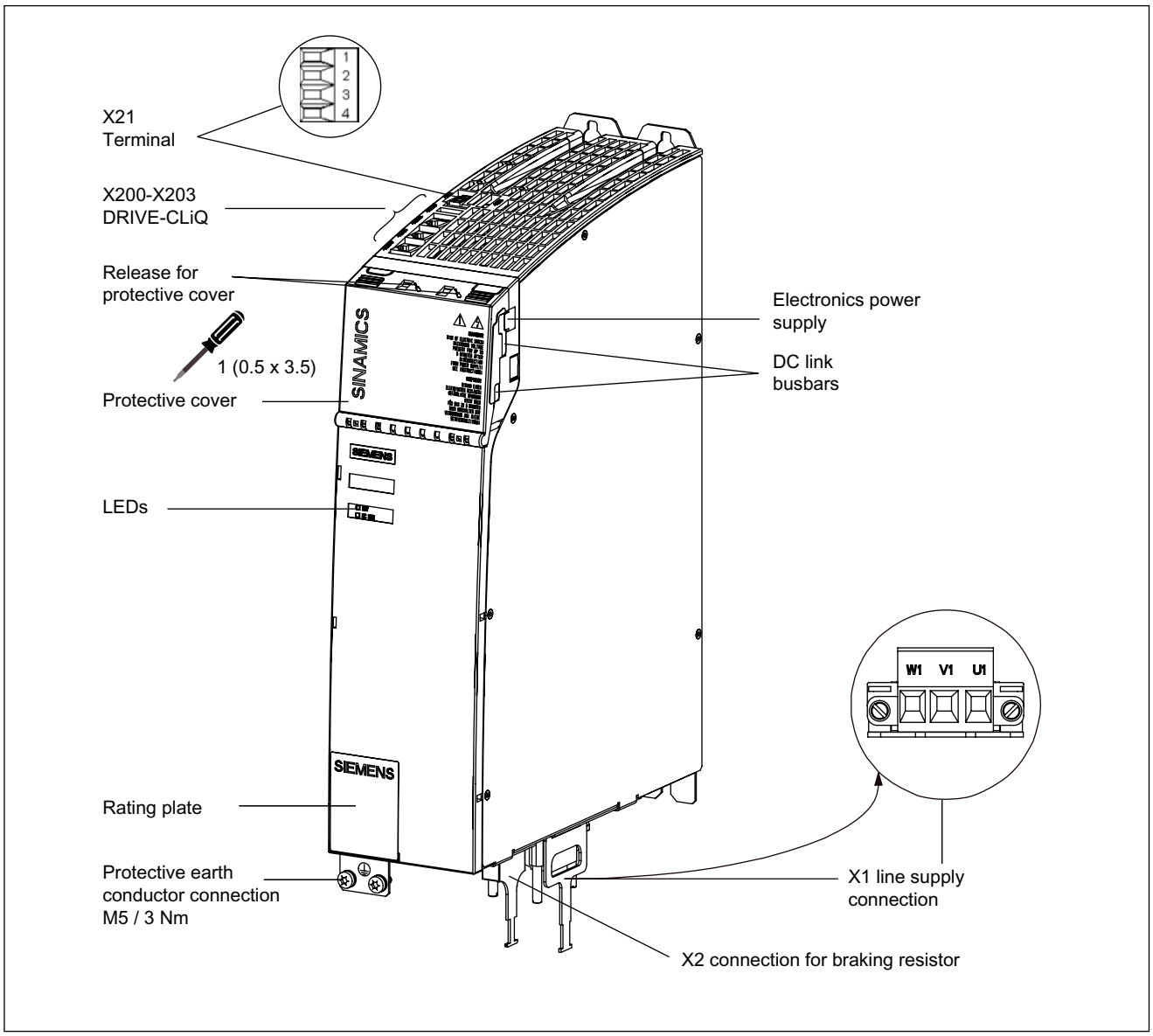


Figure 3-34 Interface description: Basic Line Module with internal air cooling (20 kW)

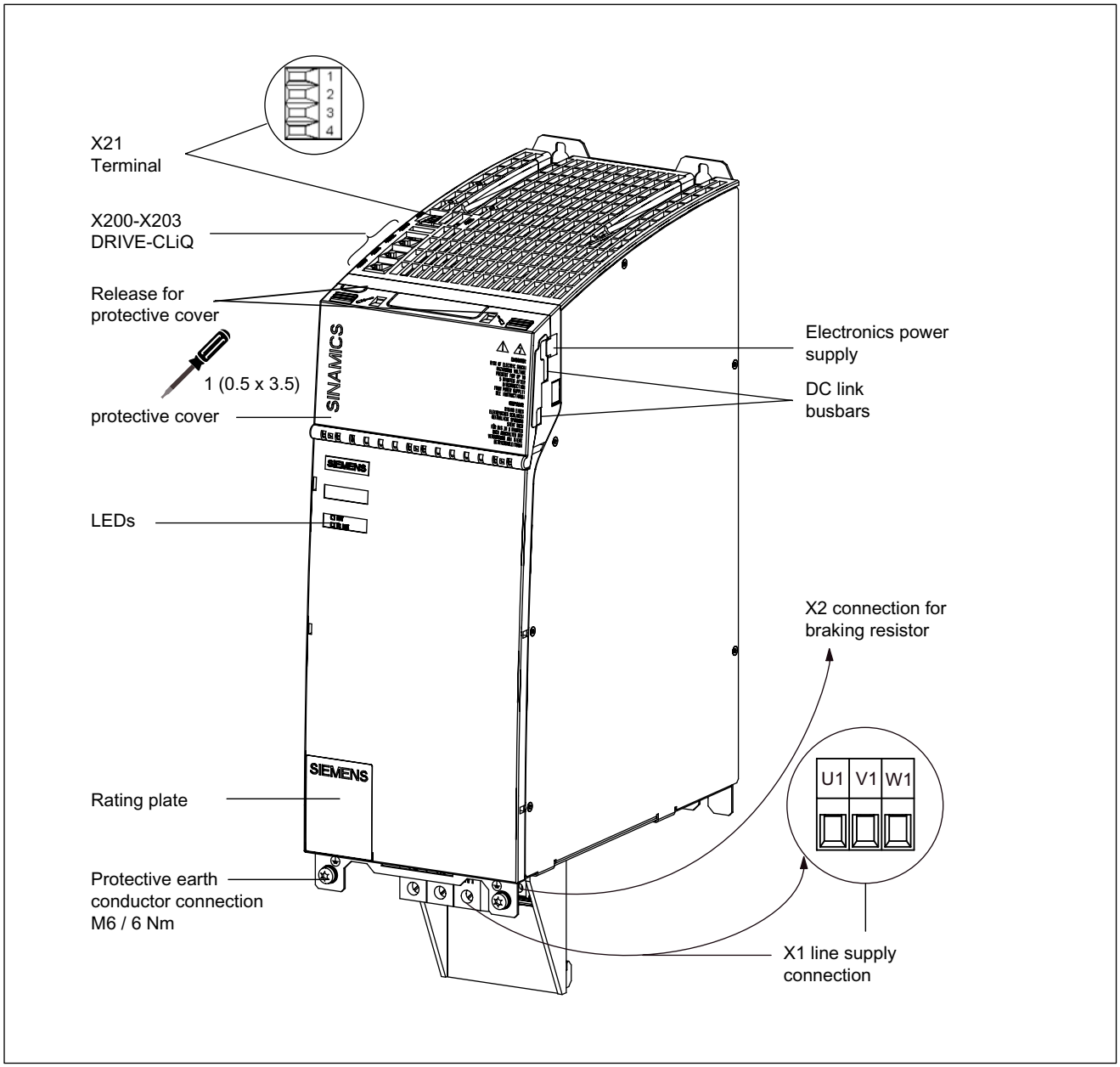


Figure 3-35 Interface description: Basic Line Module with internal air cooling (40 kW)

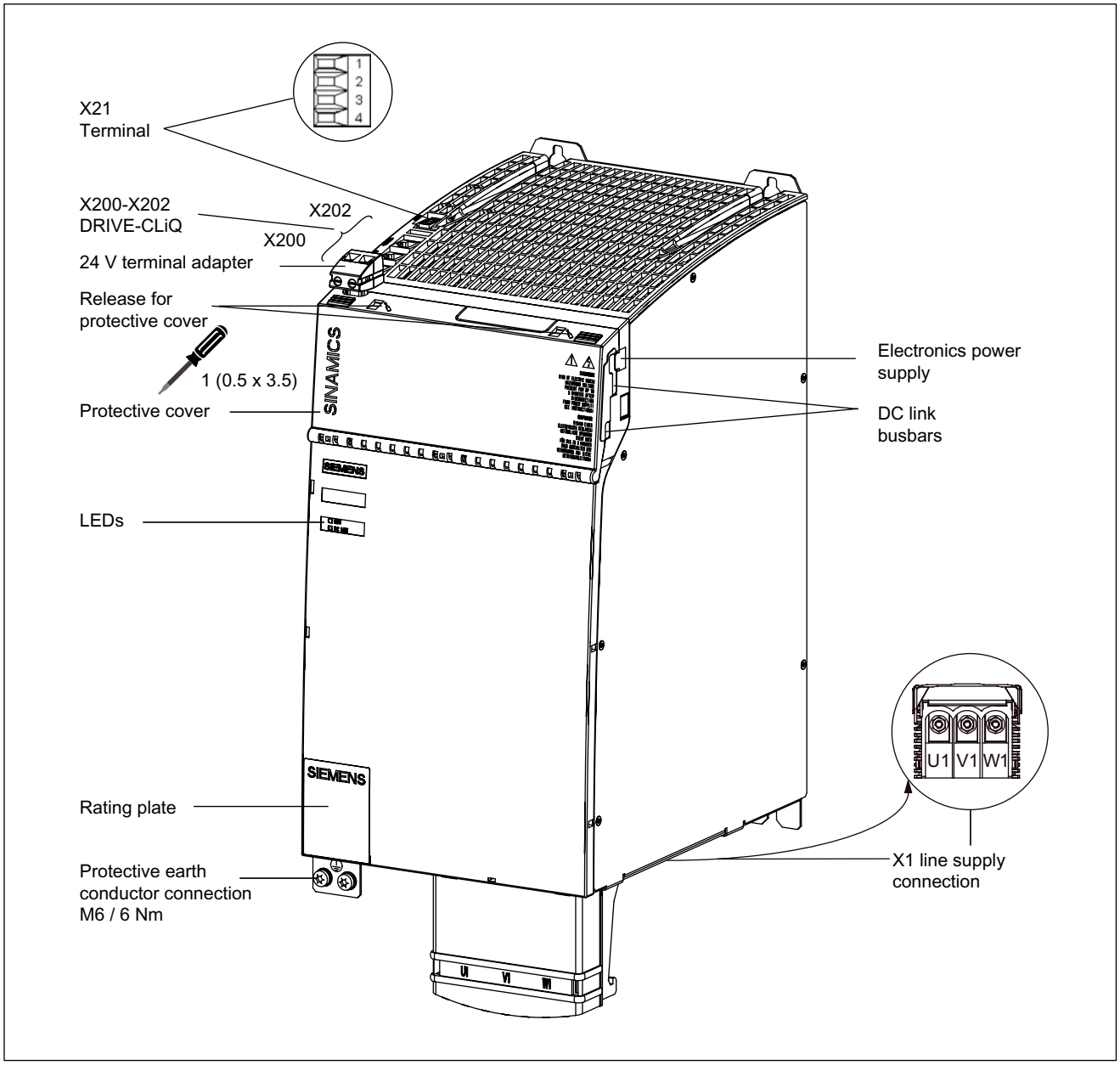
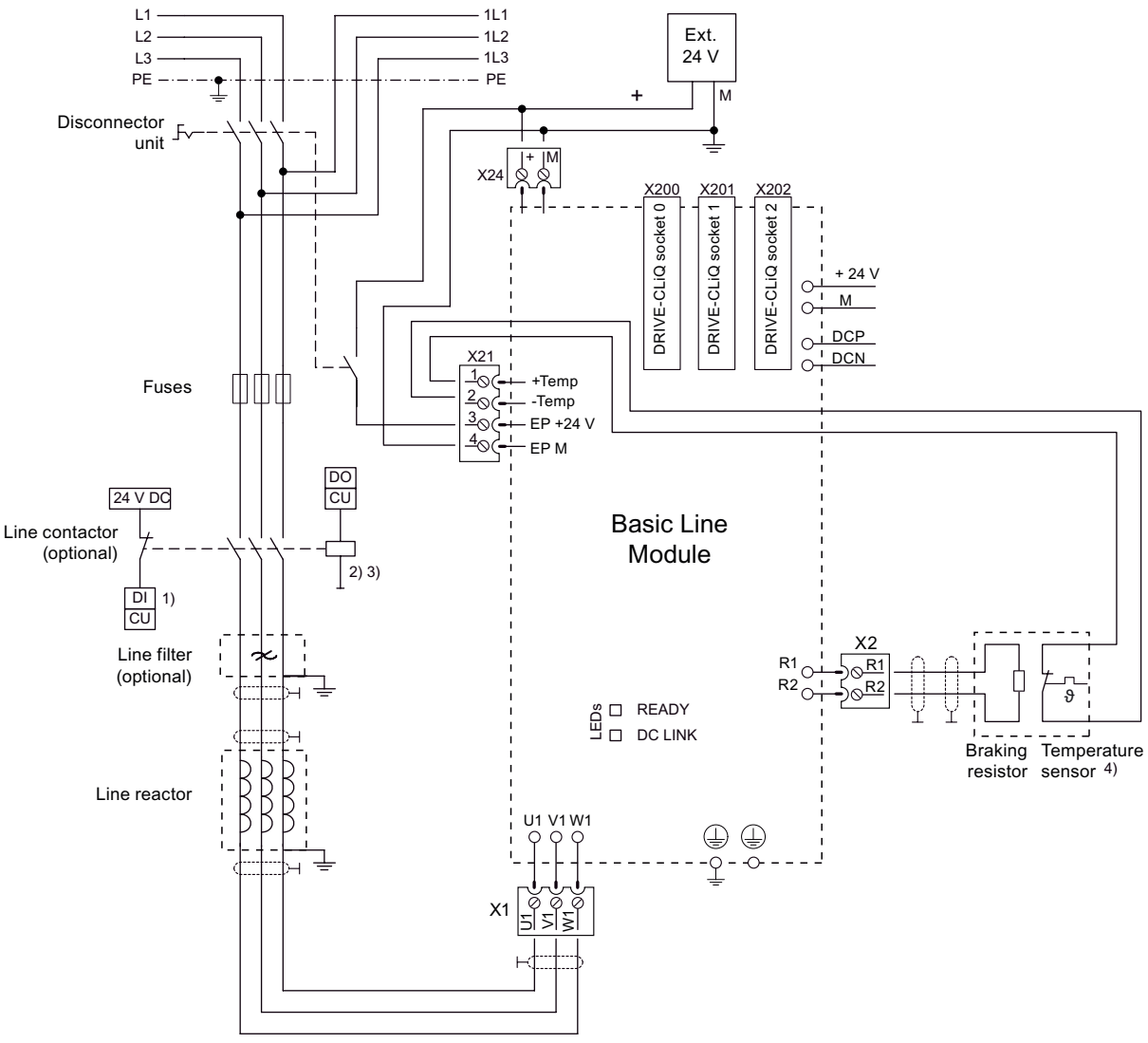


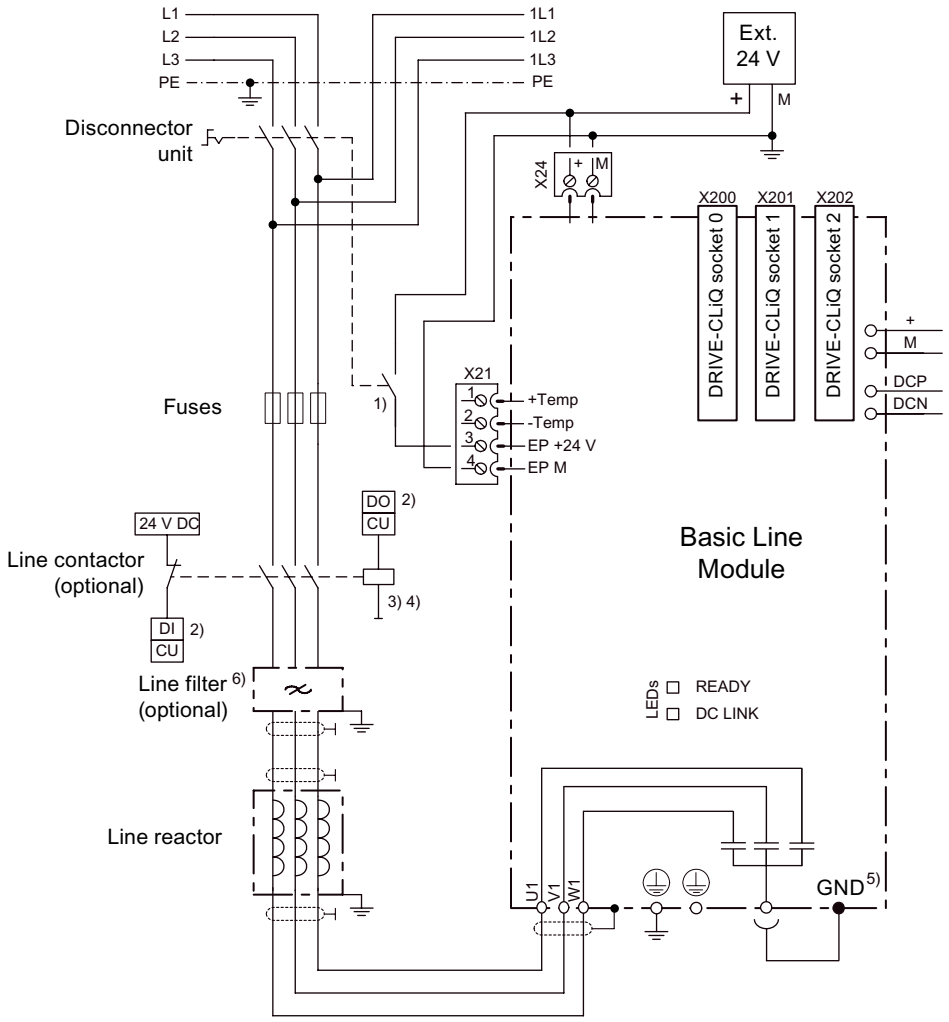
Figure 3-36 Interface description: Basic Line Module with internal air cooling (100 kW)

3.4.3.2 Connection example



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

Figure 3-37 Connection example: Basic Line Module (20 kW and 40 kW)

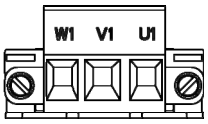
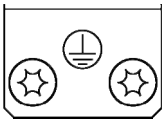


1) 24 V DC and ground must be applied for operation.
2) DI/DO (controlled by Control Unit).
3) No additional load permitted downstream of line contactor!
4) The current carrying capacity of the DO must be observed; an output interface must be used if required.
5) The connection bracket must be removed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

Figure 3-38 Connection example: Basic Line Module (100 kW)

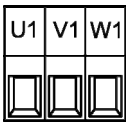
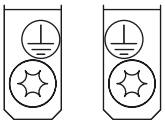
3.4.3.3 X1 line connection

Table 3-23 Terminal block X1 Basic Line Module 20 kW

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

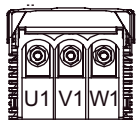
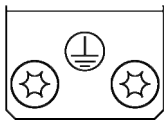
[1)] for ring cable lugs to DIN 46234

Table 3-24 Terminal block X1 Basic Line Module 40 kW

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

[1)] for ring cable lugs to DIN 46234

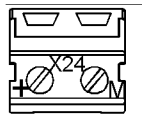
Table 3-25 Terminal block X1 Basic Line Module 100 kW

	Terminal	Technical specifications
	U1 V1 W1	Max. connection voltage: 480 V 3 AC +10 % at 47 Hz to 63 Hz Max. connectable cross-section: 120 mm^2 Type: Threaded bolt M8 1) (see Connection systems) Tightening torque: 13 Nm
	PE connection	Threaded hole M6/6 Nm 1)

1) for ring cable lugs to DIN 46234

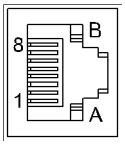
3.4.3.4 X24 24 V terminal adapter

Table 3-26 Terminal block X24

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

3.4.3.5 X200-X202 DRIVE-CLiQ interfaces

Table 3-27 DRIVE-CLiQ interface X200-X202

	PIN	Signal name	Technical specifications
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	24 V power supply
	B	M (0 V)	Electronics ground
Blanking plate for DRIVE-CLiQ interface: Yamaichi, order no.: Y-ConAS-13			

3.4.3.6 X2 braking resistor connection

Table 3-28 Terminal block X2 on Basic Line Module (20 kW)

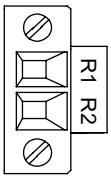
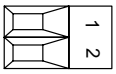
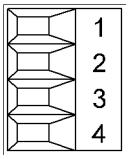
	Terminal	Designation	Technical specifications
	1	Braking resistor connection R	Max. connection voltage: 480 V 3 AC +10 % at 47 Hz to 63 Hz Max. connectable cross-section: 4 mm^2 Type: Screw terminal 5 (see Connection systems) Tightening torque: 0.5 - 0.6 Nm
	2		

Table 3-29 Terminal block X2 on Basic Line Module (40 kW)

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

3.4.3.7 X21 EP terminals

Table 3-30 Terminal block X21

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

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

⚠ WARNING

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

⚠ DANGER

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

NOTICE

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

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

3.4.3.8 Meaning of the LEDs on the Basic Line Module

Table 3-31 Basic Line Module - description of the LEDs

Status		Description, cause	Remedy
Ready (H200)	**DC link (H201)**		
off	off	Electronics power supply is missing or outside permissible tolerance range.	–
Green	off	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.	–
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is present.	–
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is too high.	Check the line voltage.
Orange	Orange	DRIVE-CLiQ communication is being established.	–
Red	–	At least one fault is present in this component. **Note:** The LED is activated regardless of whether the corresponding messages have been reconfigured.	Remedy and acknowledge fault.
Green/red (0.5 Hz)	–	Firmware is being downloaded.	–
Green/red (2 Hz)	-	Firmware download is complete. Wait for POWER ON.	Carry out a POWER ON
Green/orange or Red/orange	–	Component detection via LED is activated (p0124). **Note:** Both options depend on the LED status when component recognition is activated via p0124 = 1.	–

⚠ DANGER

Hazardous DC link voltages may be present at any time regardless of the status of the "DC link" LED.
The warning information on the components must be carefully observed!

3.4.4 Dimension drawings

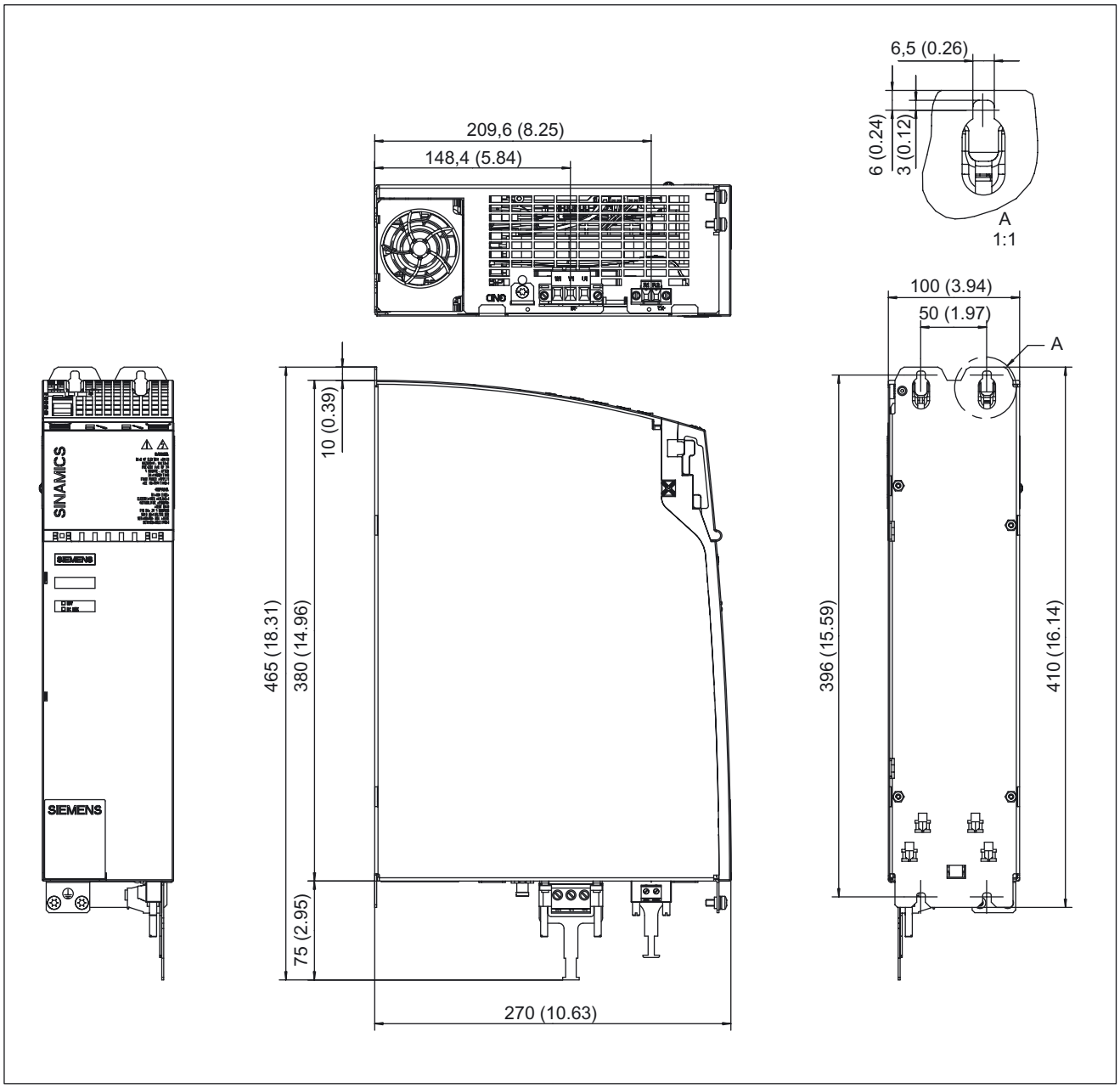


Figure 3-39 Dimension drawing: Basic Line Module with internal air cooling (20 kW)

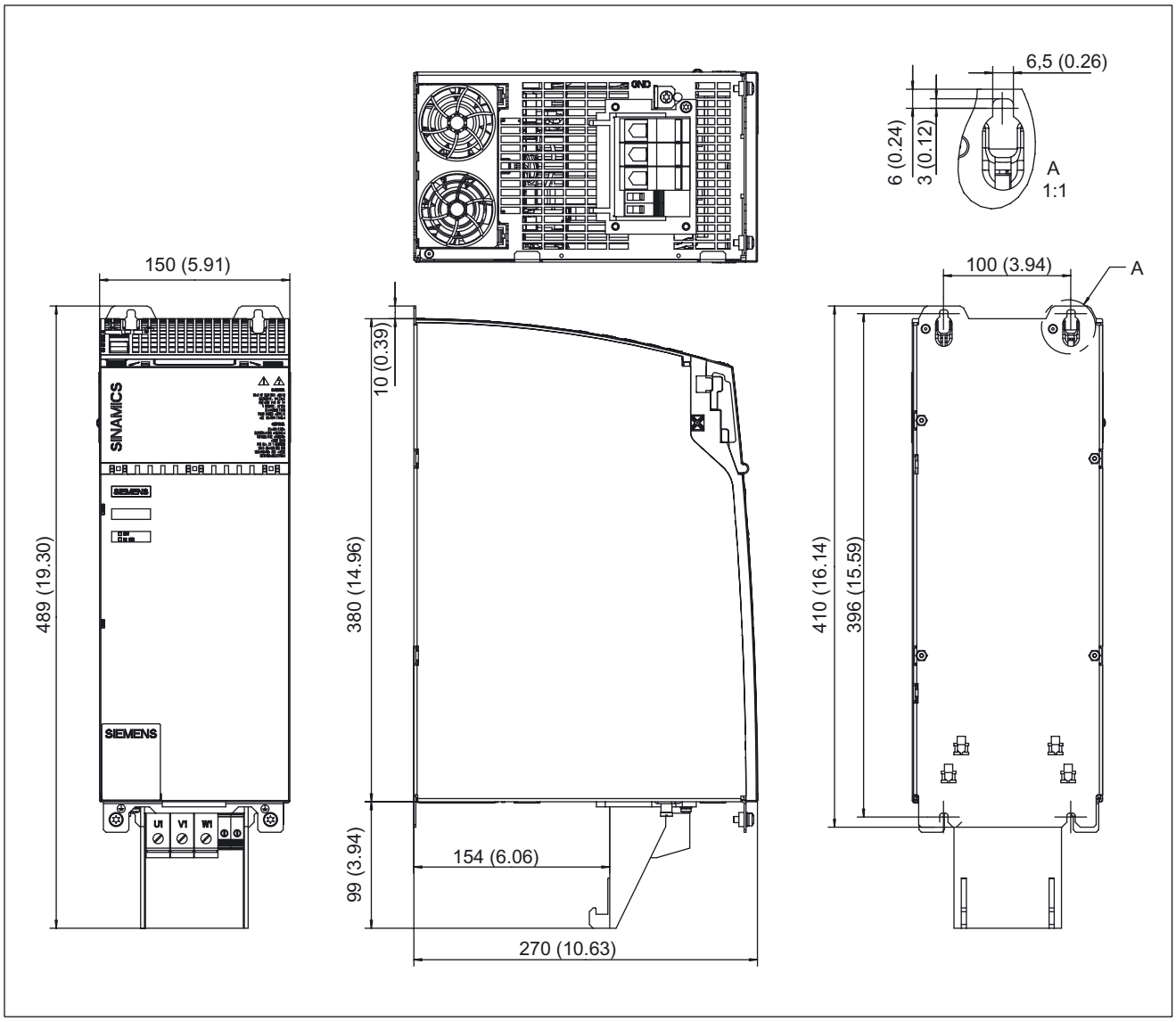


Figure 3-40 Dimension drawing: Basic Line Module with internal air cooling (40 kW)

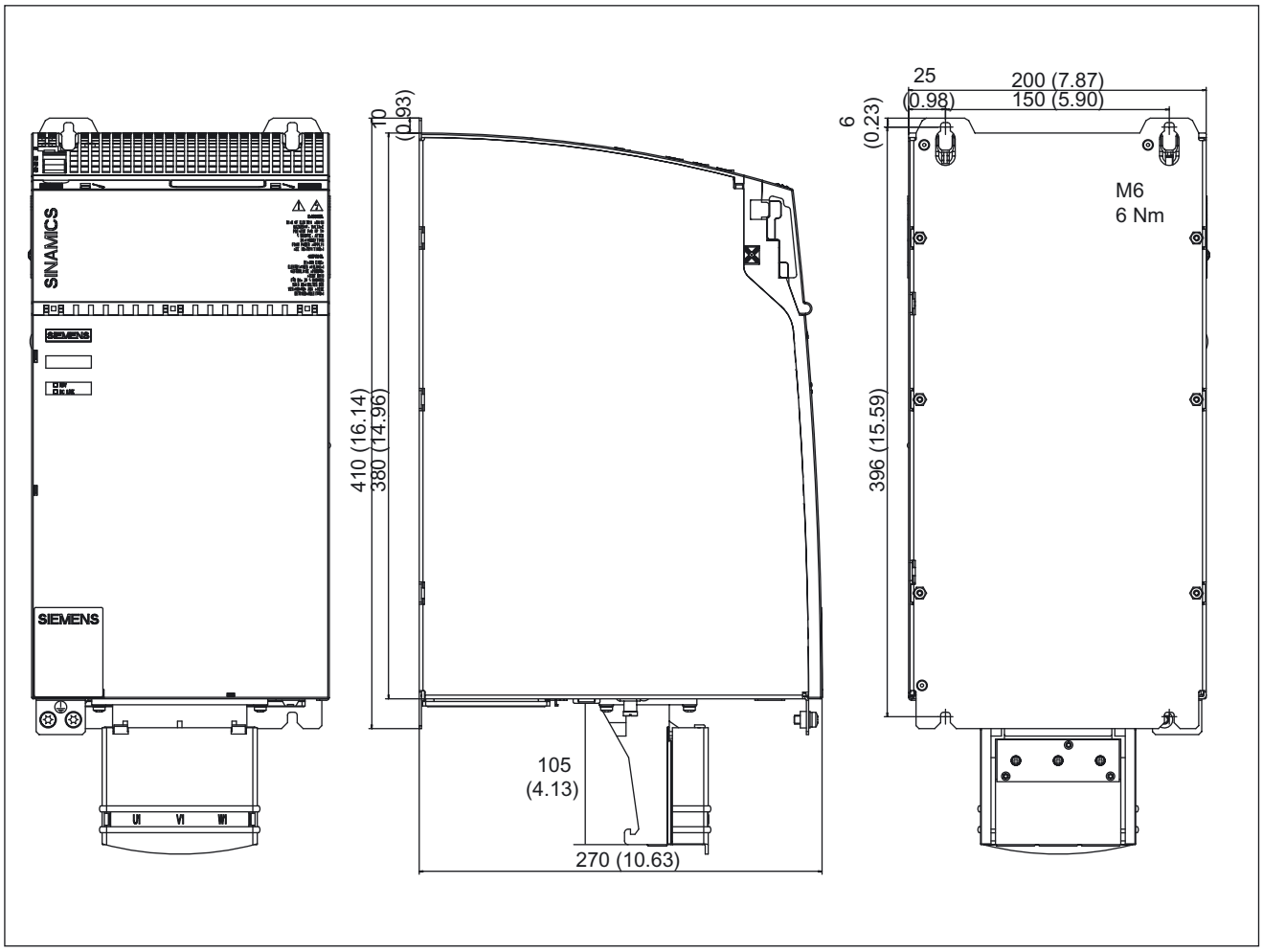


Figure 3-41 Dimension drawing: Basic Line Module with internal air cooling (100 kW)

3.4.5 Mounting

Basic Line Modules are installed in the same way as Active Line Modules and Booksize Motor Modules.

The Basic Line Modules are designed for installation in the control cabinet. The components are secured onto the control cabinet installation panel using M6 screws.

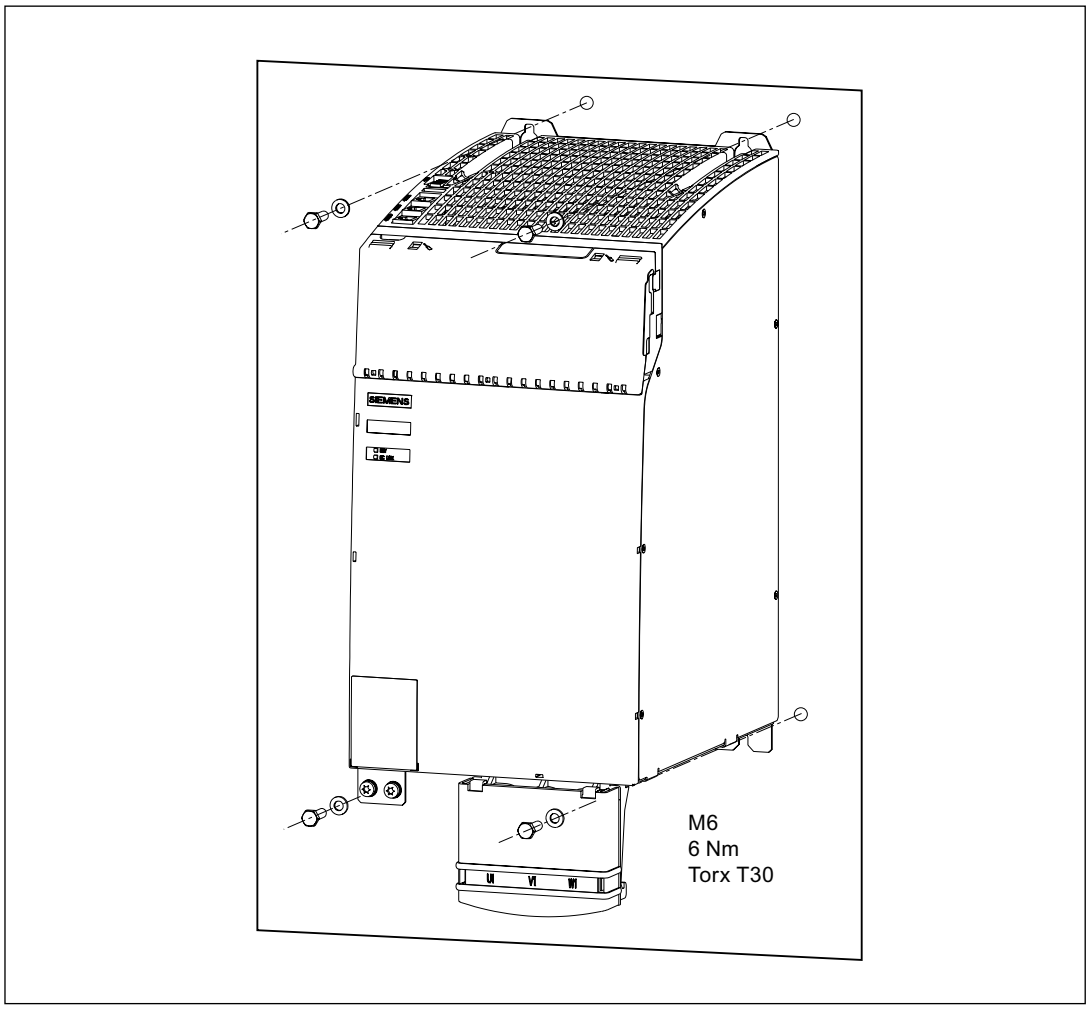
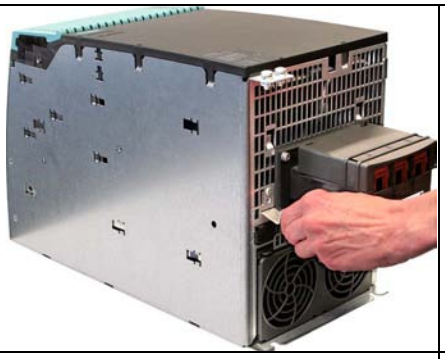


Figure 3-42 Mounting: Basic Line Module 100 kW

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

When the 100 kW Basic Line Module is operated from an insulated supply (IT system), the connection bracket for the interference-suppression capacitor must be removed. The connection bracket for the interference-suppression capacitor is located on the lower side of the component.

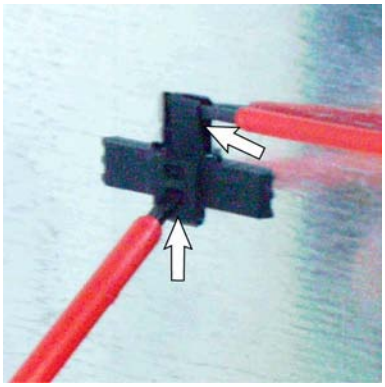
CAUTION
If the connection bracket for the interference-suppression capacitor is not removed, an error message is output via the insulation monitor in the system.

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

Remove the holder for securing the Control Unit.

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

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

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

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

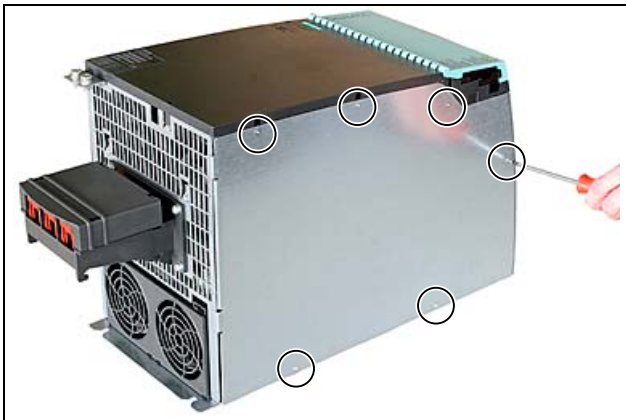
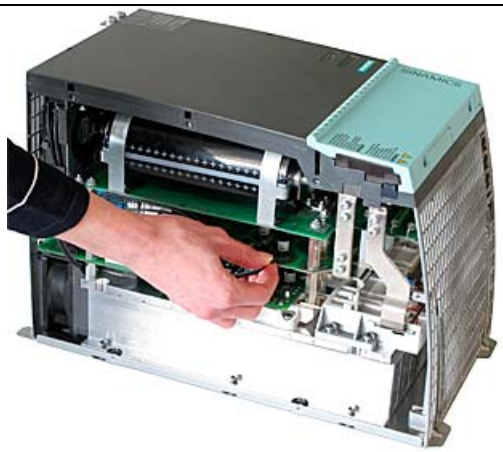
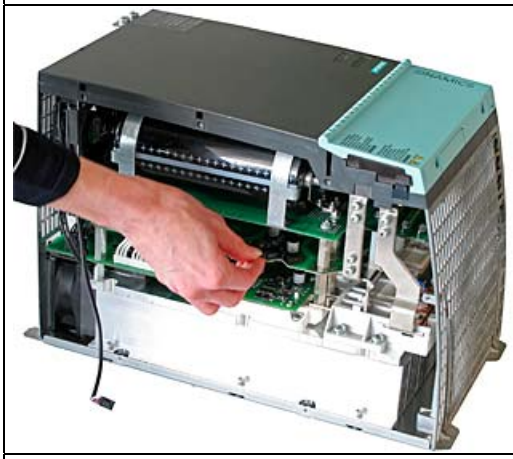
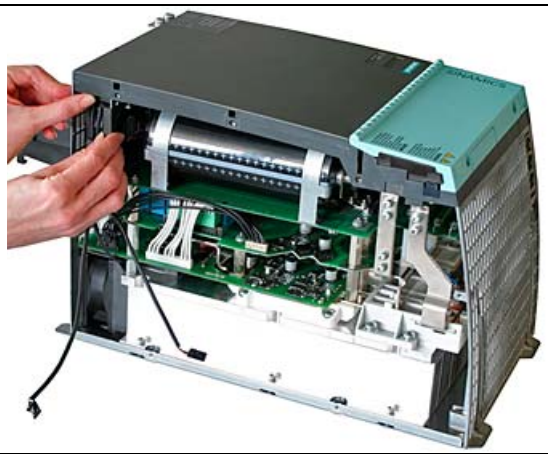
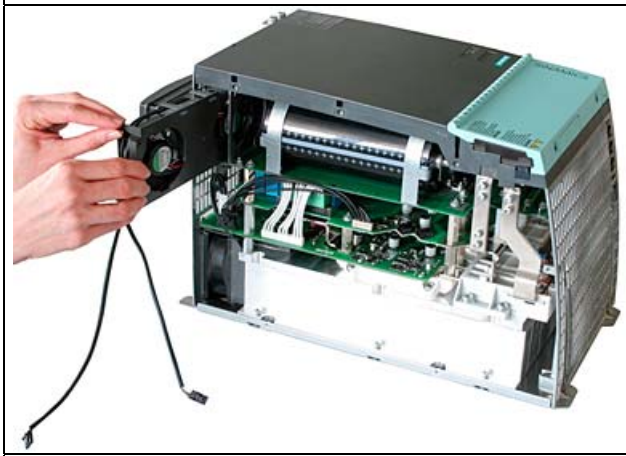
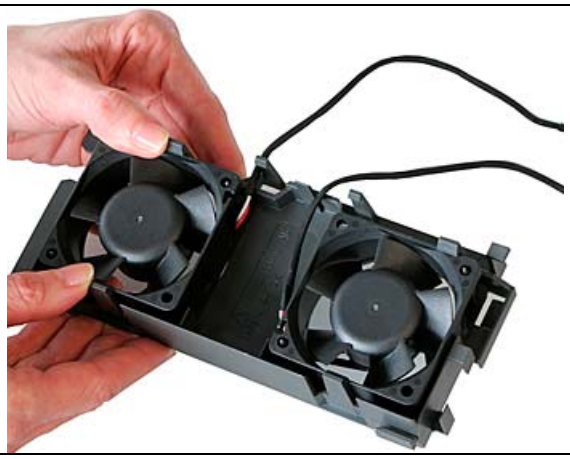
⚠ DANGER

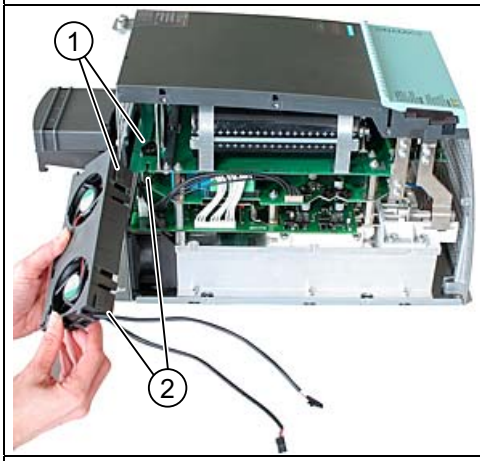
Before replacing the fan, you must switch off the power supplies (24 V DC and 400 V AC). Risk of electric shock. Dangerous voltages are still present for up to 5 minutes after the power supply has been switched off. The device cover must not be opened until this time has elapsed.

NOTICE

When replacing the fan, you must observe the ESD regulations.

Parts must only be replaced by trained personnel (danger of damage to sensitive components due to static electricity)!

	
Open the right device cover by loosening the six marked screws	Pull the first fan cable by pressing it slightly
	
Pull the second fan cable	Unlatch the fan module
	
Completely pull out the fan module	Slightly push the fan holder apart and pull out the fan

	
Observe the air flow direction markings when inserting the new fan	Observe the cable guide
	
Push in the fan in guide rails 1 and 2. Connect the two fan cables. Close the device cover and tighten the six screws with 0.8 Nm	

3.4.6 Electrical connection

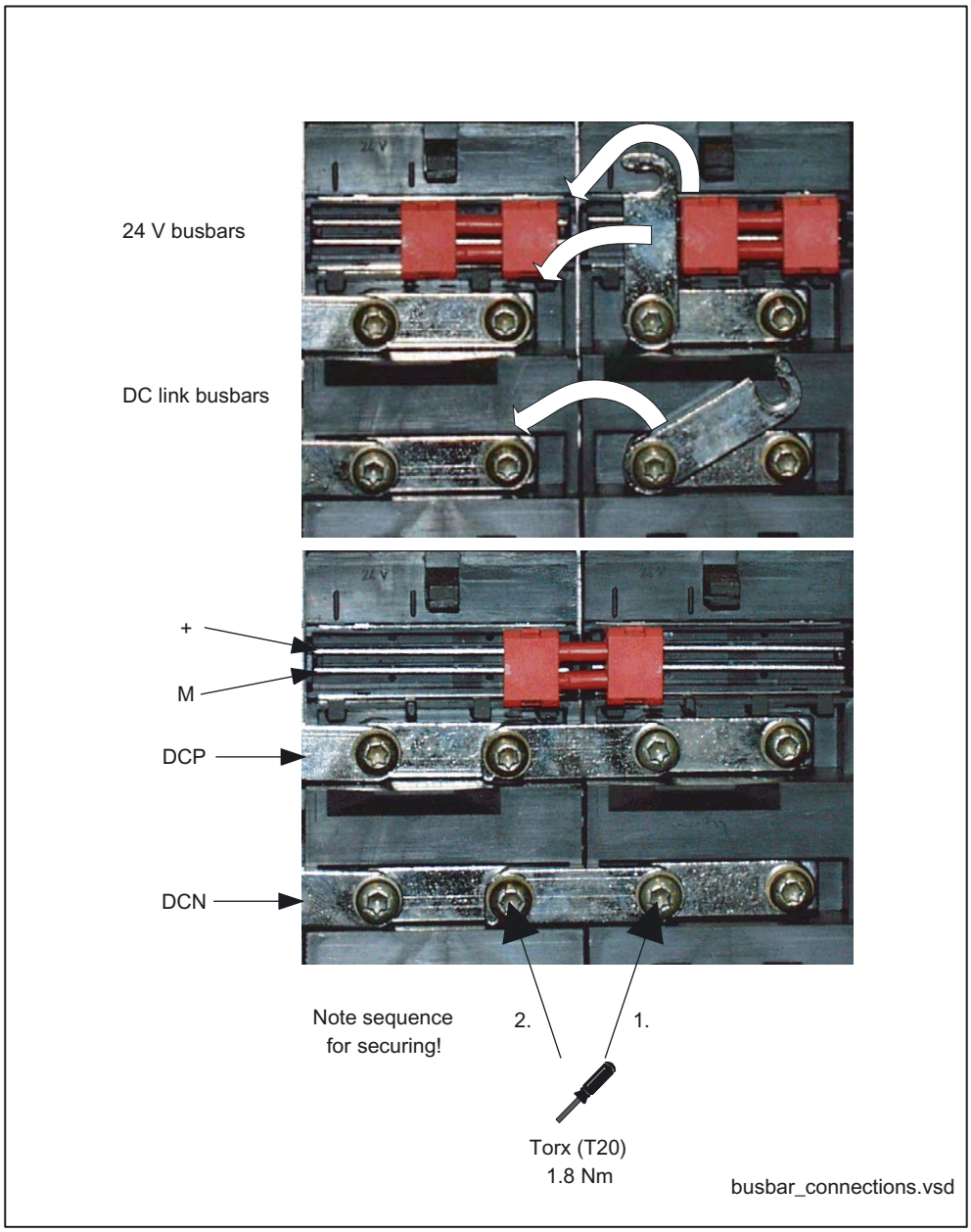


Figure 3-43 Busbar connections for booksize components

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

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

3.4.7 Technical data

Table 3-32 Technical data: Basic Line Modules

Internal air cooling	6SL3130-	1TE22-0AA0	1TE24-0AA0	1TE31-0AA0
Rated power	kW	20	40	100
Infeed:				
Rated power (S1)[1]	kW (Pn)	20	40	100
Infeed power (S6-40 %)[1]	kW (Ps6)	26	52	130
Peak infeed power[1]	kW (Pmax)	60	120	175
Braking power:				
Continuous power	kW (Pn)	5	10	-
Peak power	kW (Pmax)	40	80	-
Line supply voltages:				
Line voltage	V_{ACrms}	380 3 AC -10 % (-15 % < 1 min) to 480 3 AC +10 %		
Line frequency	Hz	47 to 63		
Electronics power supply	V_{DC}	24 (20.4 – 28.8)		
DC link voltage	V_{DC}	480 – 720		
Overvoltage trip threshold	V_{DC}	820 ± 2 %		
Undervoltage trip threshold	V_{DC}	360 ± 2 %		
Rated input current:				
at 380 V_{AC}	A_{AC}	34.5	69	172
at 480 V_{AC}/528 V_{AC}	A_{AC}	31/29	62/58	154/145
at 480 V (S6-40 %)	A_{AC}	38	78	193
Peak current (at 400 V_{AC}/480 V_{AC})	A_{AC}	113 / 91	208 / 172	265 / 252
DC link current (at 600 V_{DC}):				
Rated current	A_{DC}	33.5	67	167
at S6-40 %	A_{DC}	43	87	217
Peak current	A_{DC}	100	200	292
DC link busbar current carrying capacity	A_{DC}	100	100	200
24 V busbar current carrying capacity	A_{DC}	20	20	20
Electronics current consumption	A_{DC}	1	1.4	2.0
Total power loss (including electronic losses)[2]	W	144	283.6	628
Max. ambient temperature without derating	°C	40	40	40
Max. ambient temperature with derating	°C	55	55	55
DC link capacitance	µF	940	1880	4100

Internal air cooling	6SL3130-	1TE22-0AA0	1TE24-0AA0	1TE31-0AA0
Maximum permissible DC link capacitance	µF	20 000	20 000	50 000
Power factor[3]	cosϕ	0.98	0.98	0.98
Circuit-breaker type designation (status 07/2007 and later) Rated current Short-circuit current rating SCCR at 400 V_{AC} Short-circuit current rating SCCR at 480 V_{AC} Short-circuit current rating SCCR at 600 V_{AC}	 A kA kA kA	3RV1042-4MA10 80 ... 100 100	3VL2110-3KN30-0AA0 100 100 25	3VL3125-3KN30-0AA0 250 100 25
UL safety fuse type AJT Class J Rated current Short-circuit current rating SCCR at 600 V_{AC}	 A kA	AJT80 80 200	AJT100 100 200	AJT250 250 200
Cooling method (internal air cooling)		Internal fan	Internal fan	Internal fan
Sound pressure level	dB(A)	<60 dB	<65 dB	<65 dB
Cooling air requirement	m^3/h	56	112	180
Rated voltage for rated data 380 V 3 AC				
Weight	kg	6.8	11.3	15.8

[1] The specified values apply to 380 V

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

[3] Only basic vibration component

Rated duty cycles for Basic Line Modules

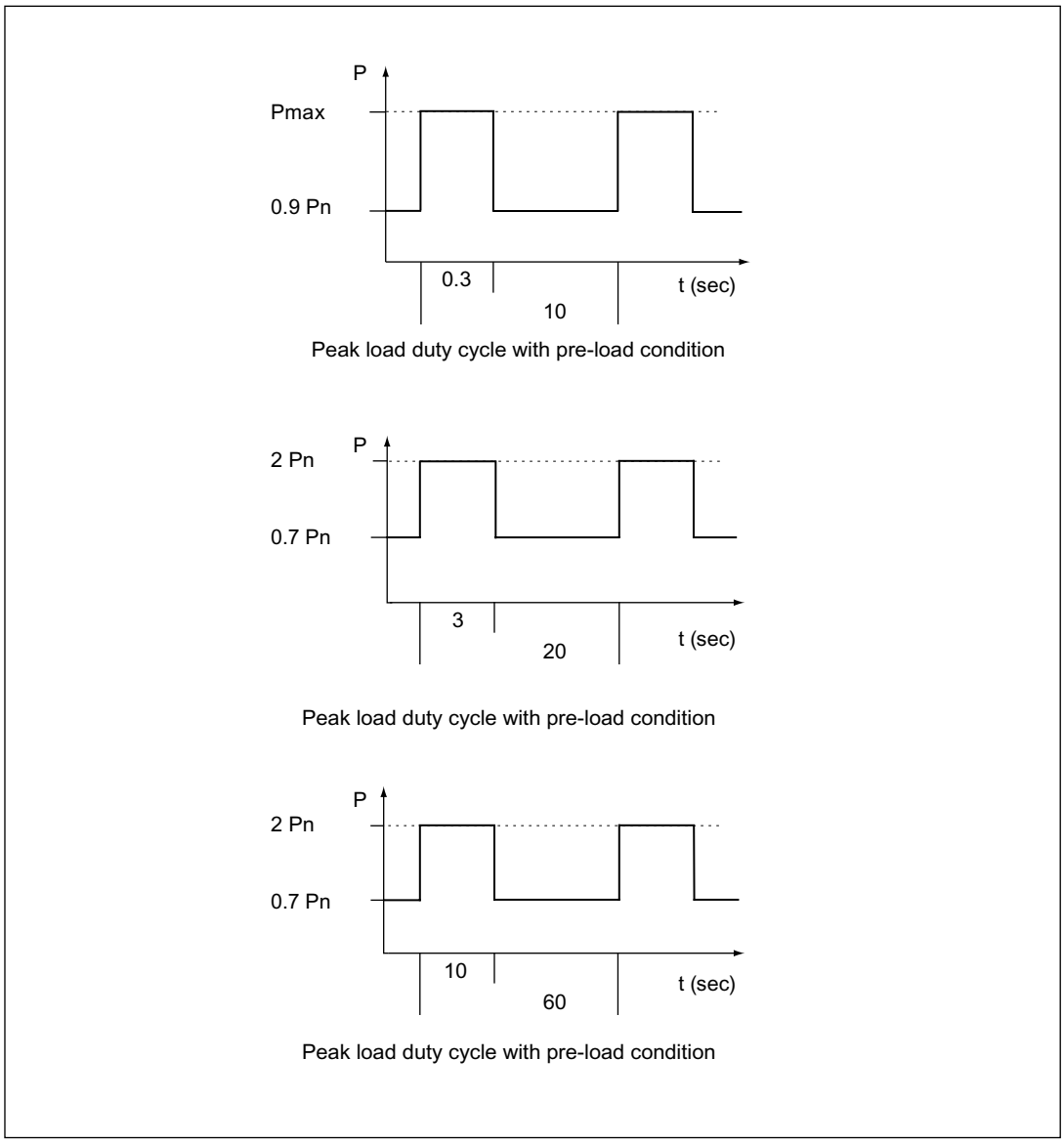


Figure 3-44 Rated duty cycles of 20 kW and 40 kW Basic Line Modules

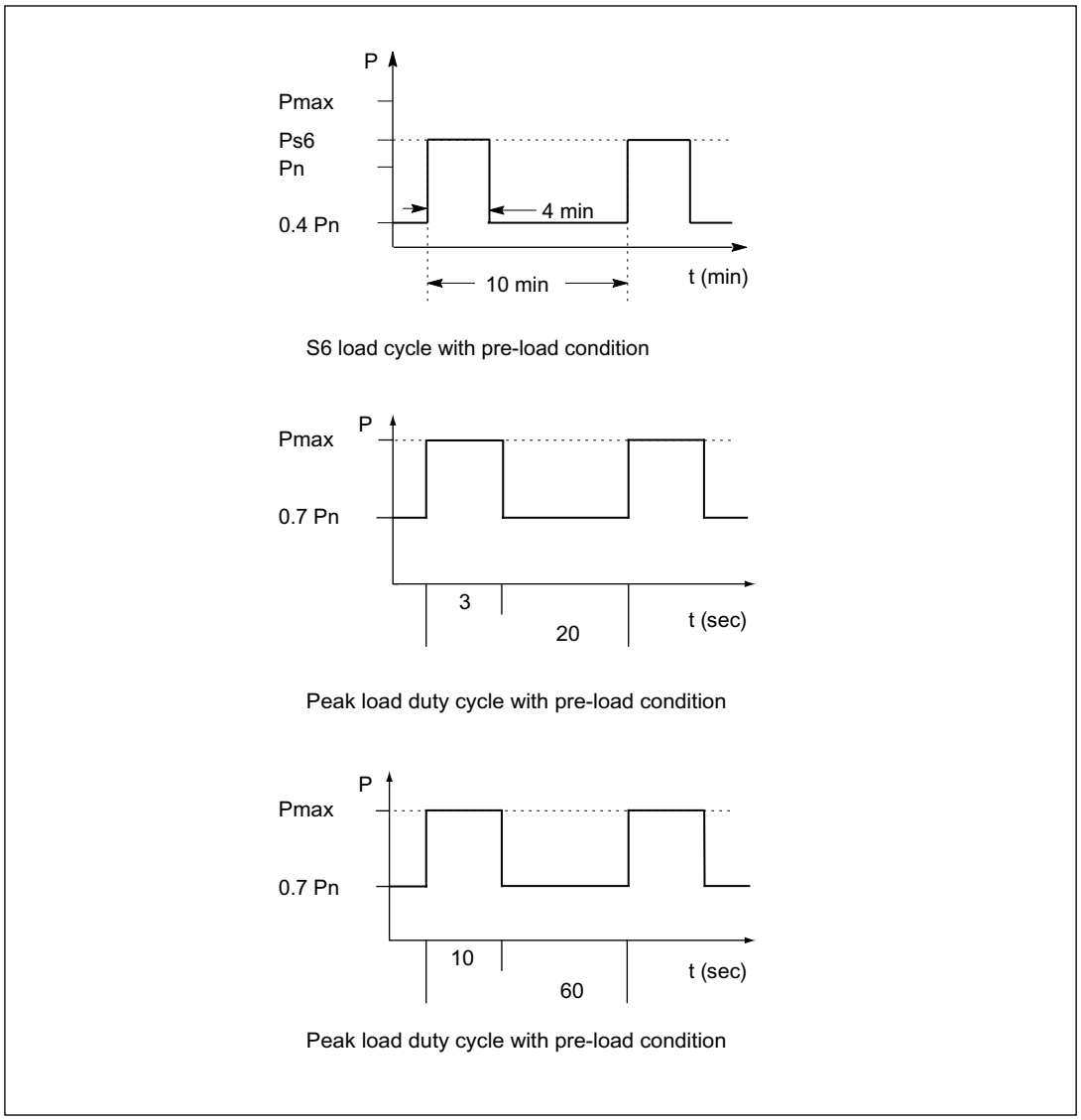


Figure 3-45 Rated duty cycles of 100 kW Basic Line Module

Braking duty cycle for Basic Line Modules

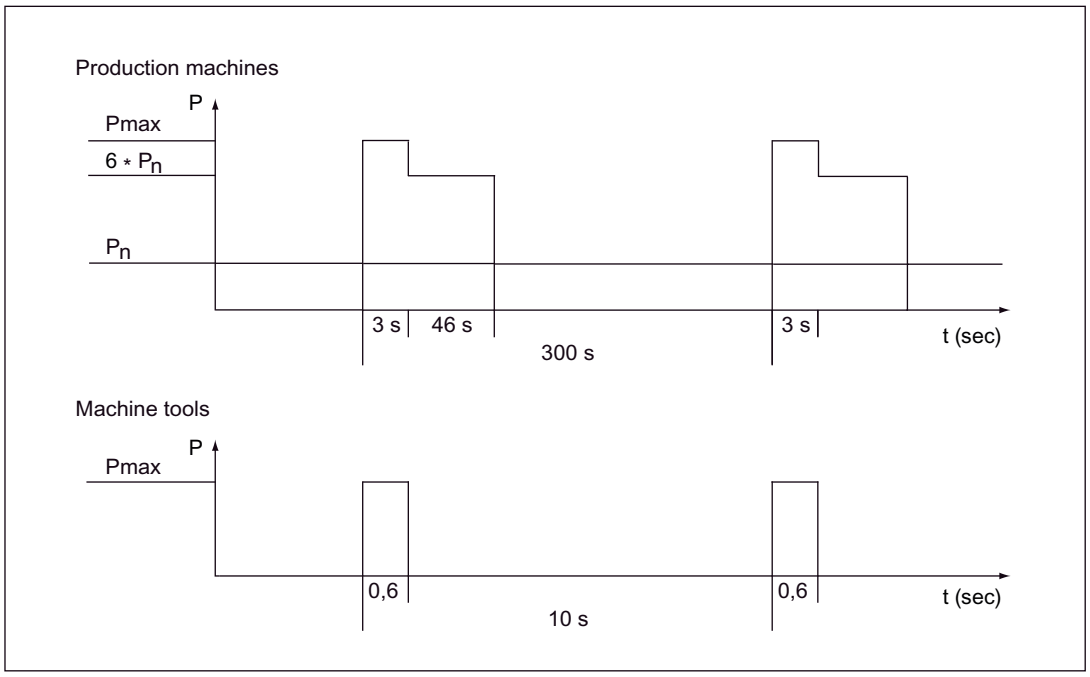


Figure 3-46 Braking duty cycle for Basic Line Modules

Derating as a function of the ambient temperature

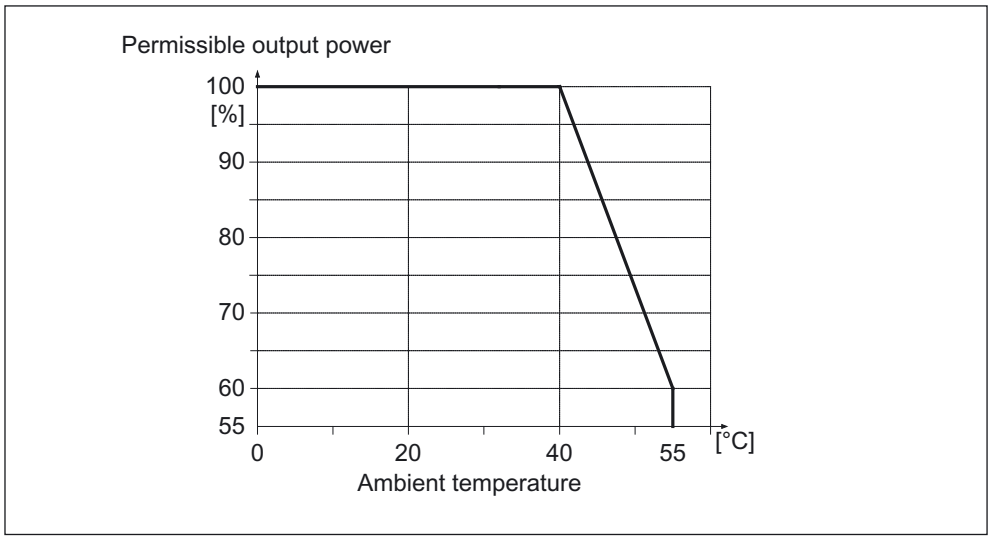


Figure 3-47 Derating as a function of the ambient temperature

Derating as a function of the installation altitude

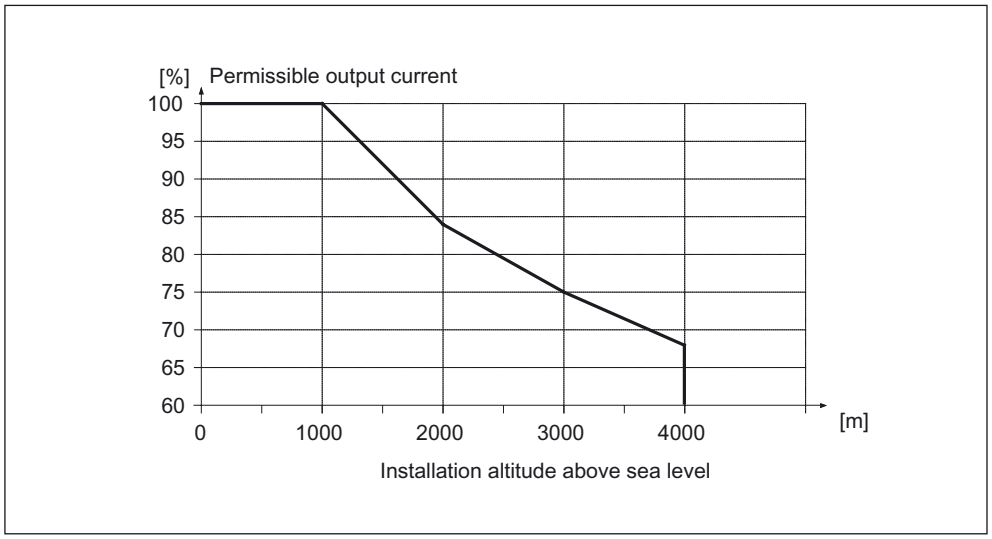


Figure 3-48 Derating as a function of the installation altitude

Voltage derating as a function of the installation altitude

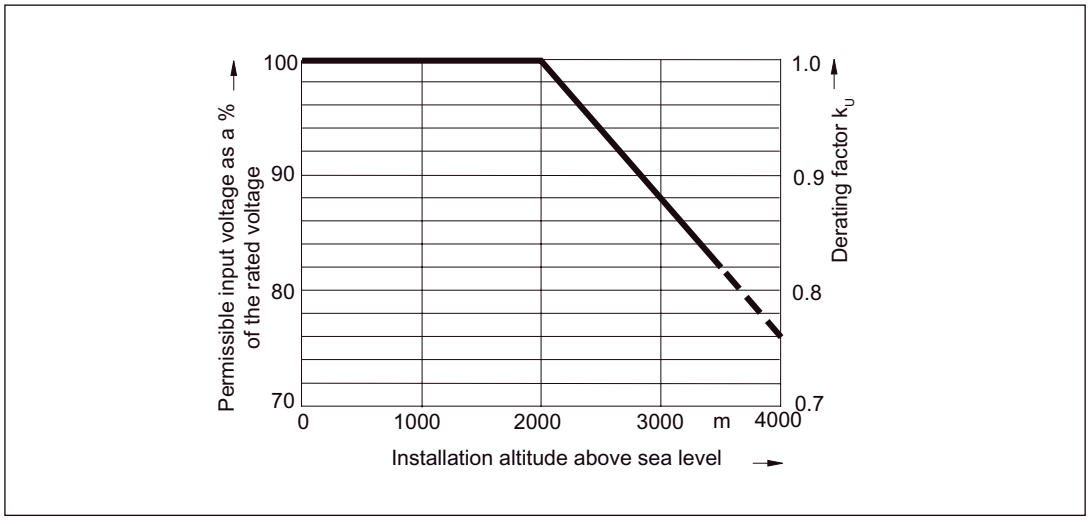


Figure 3-49 Voltage derating as a function of the installation altitude

Output power as a function of the total cable length

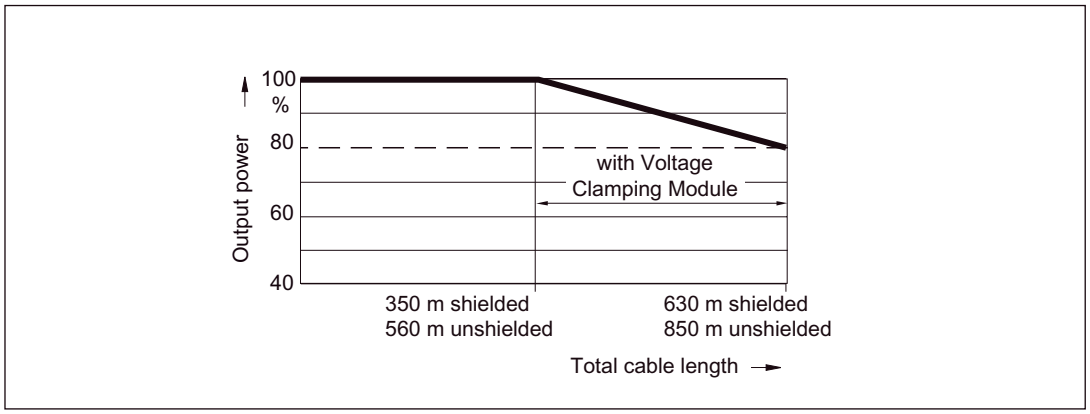


Figure 3-50 Output power as a function of the total cable length

3.4.8 Braking resistors for Basic Line Modules

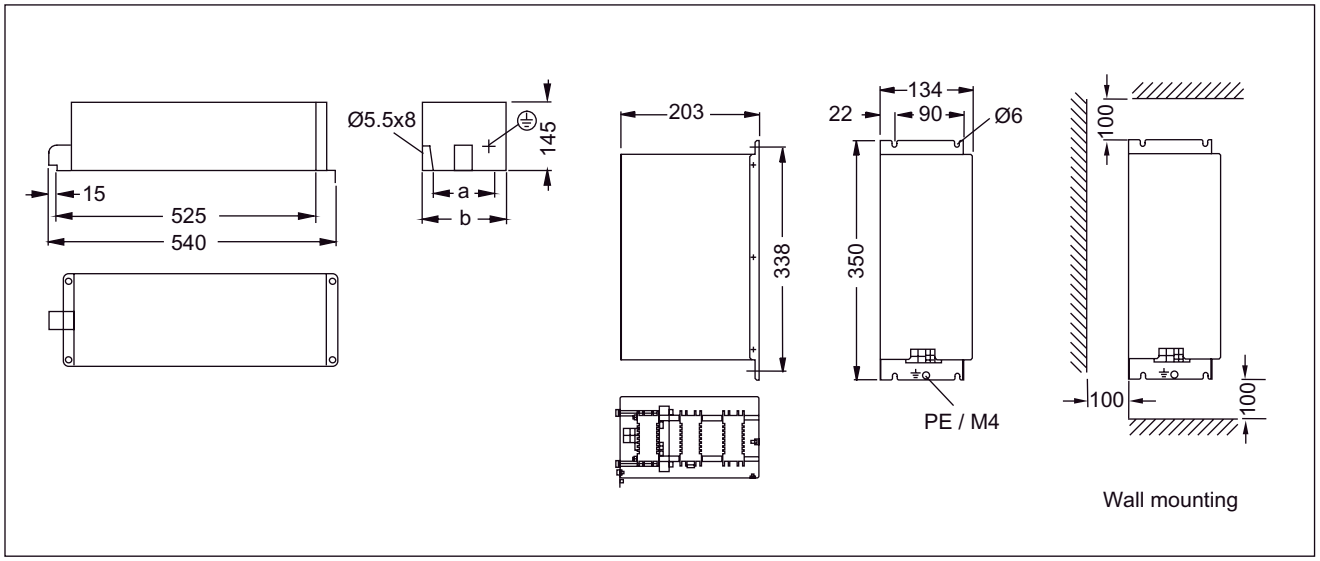


Figure 3-51 Dimension drawing: Braking resistor 7.5 kW and 15 kW

Table 3-33 Dimensions of braking resistor 7.5 kW and 15 kW

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

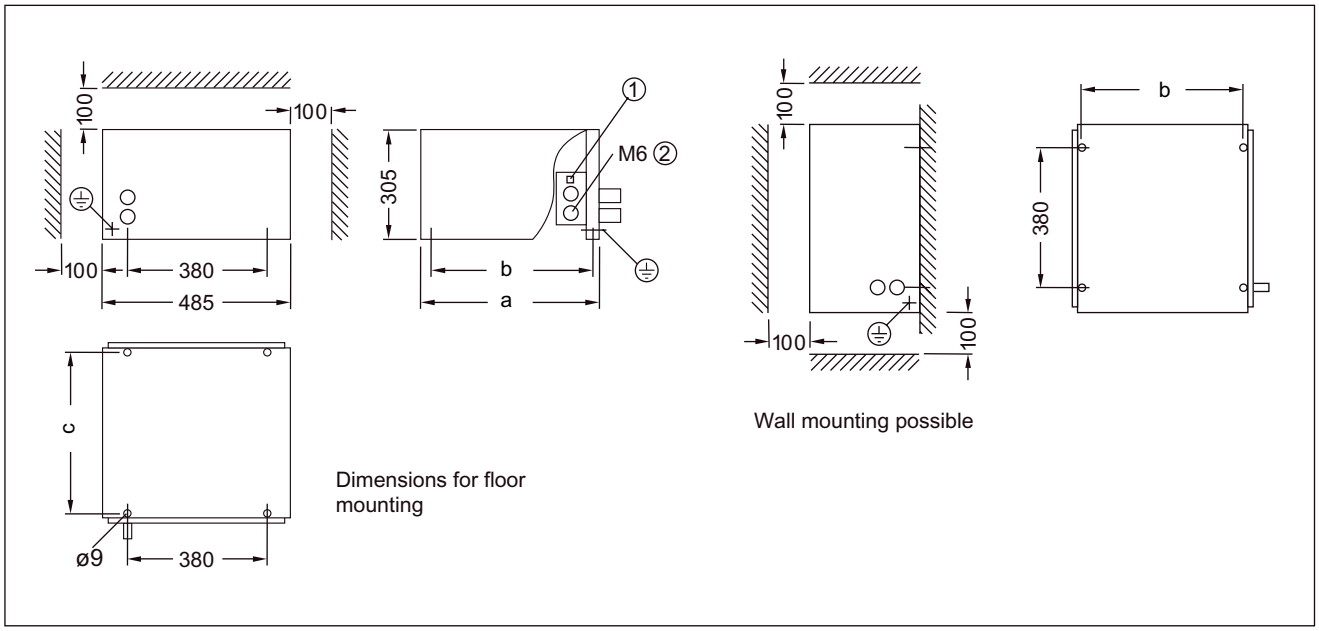


Figure 3-52 Dimension drawing: Braking resistor 30 kW and 75 kW

①T1 / T2 tunnel terminals
②Stud terminals

Table 3-34 Dimensions of braking resistor 30 kW and 75 kW

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

⚠ CAUTION

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

Table 3-35 Technical data of braking resistors for the Basic Line Modules

Brake resistor	Unit	6SE7018-0ES87-2DC0	6SE7021-6ES87-2DC0	6SE7023-2ES87-2DC0	6SE7028-0ES87-2DC0
	Ω	80	40	20	8
Peak power[1)] (Pmax)	kW	7.5	15	30	75
Rated power [1)] (Pn)	kW	1.25	2.5	5	12.5
Can be used for Basic Line Modules 20 kW		Yes	Yes	Yes	--
Can be used for Basic Line Modules 40 kW		Yes	Yes	Yes	Yes
Weight	kg	6	11.5	17	27

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

Braking duty cycles for braking resistors

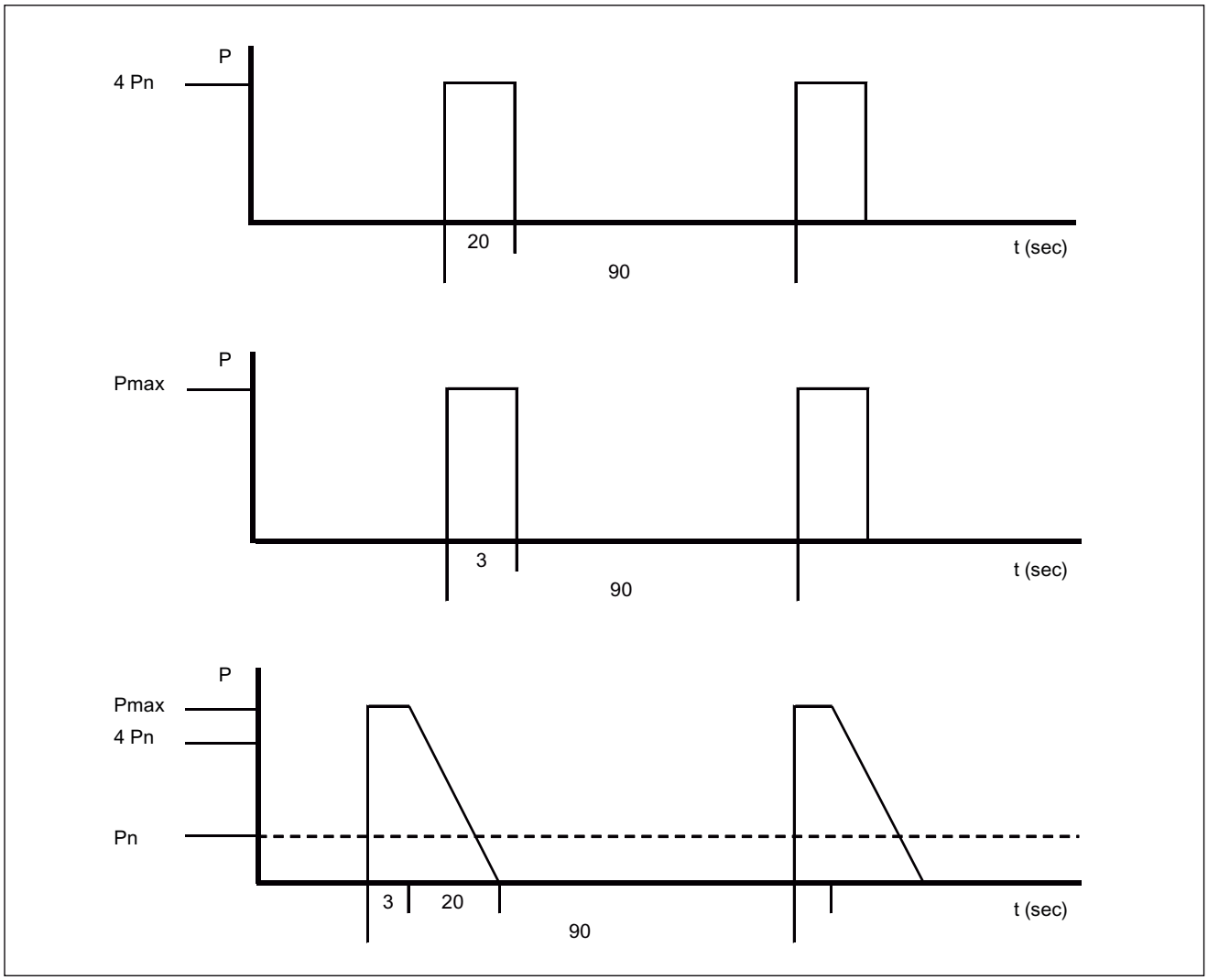


Figure 3-53 Braking duty cycles for braking resistors

3.5 Smart Line Modules (5 kW und 10 kW) with internal air cooling

3.5.1 Description

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

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

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

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

3.5.2 Safety information

⚠ DANGER

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

⚠ WARNING

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

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

⚠ WARNING

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

⚠ DANGER

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

⚠ WARNING

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

⚠ DANGER

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

CAUTION

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

⚠ DANGER

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

For all other power units and DC link components (e.g. Capacitor Module) that are wider than 50 mm, it is neither permissible to move the DC link bridge to the left nor remove it.

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

⚠ DANGER

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

CAUTION

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

NOTICE

Operation without the line reactor is not permissible.

CAUTION

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

⚠ WARNING

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

Note

With 5 kW and 10 kW Smart Line Modules, the fan runs permanently.

3.5.3 Interface description

3.5.3.1 Overview

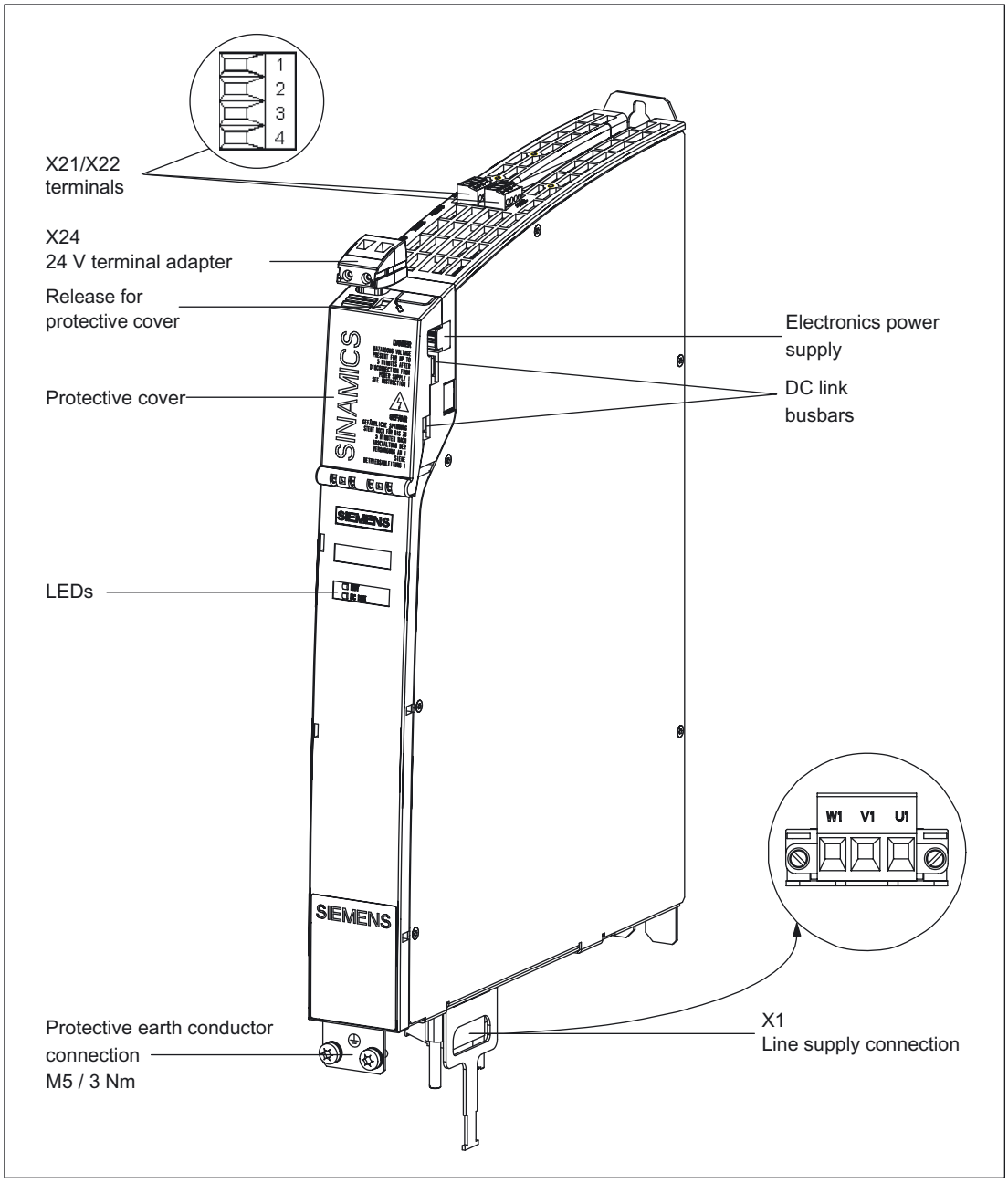
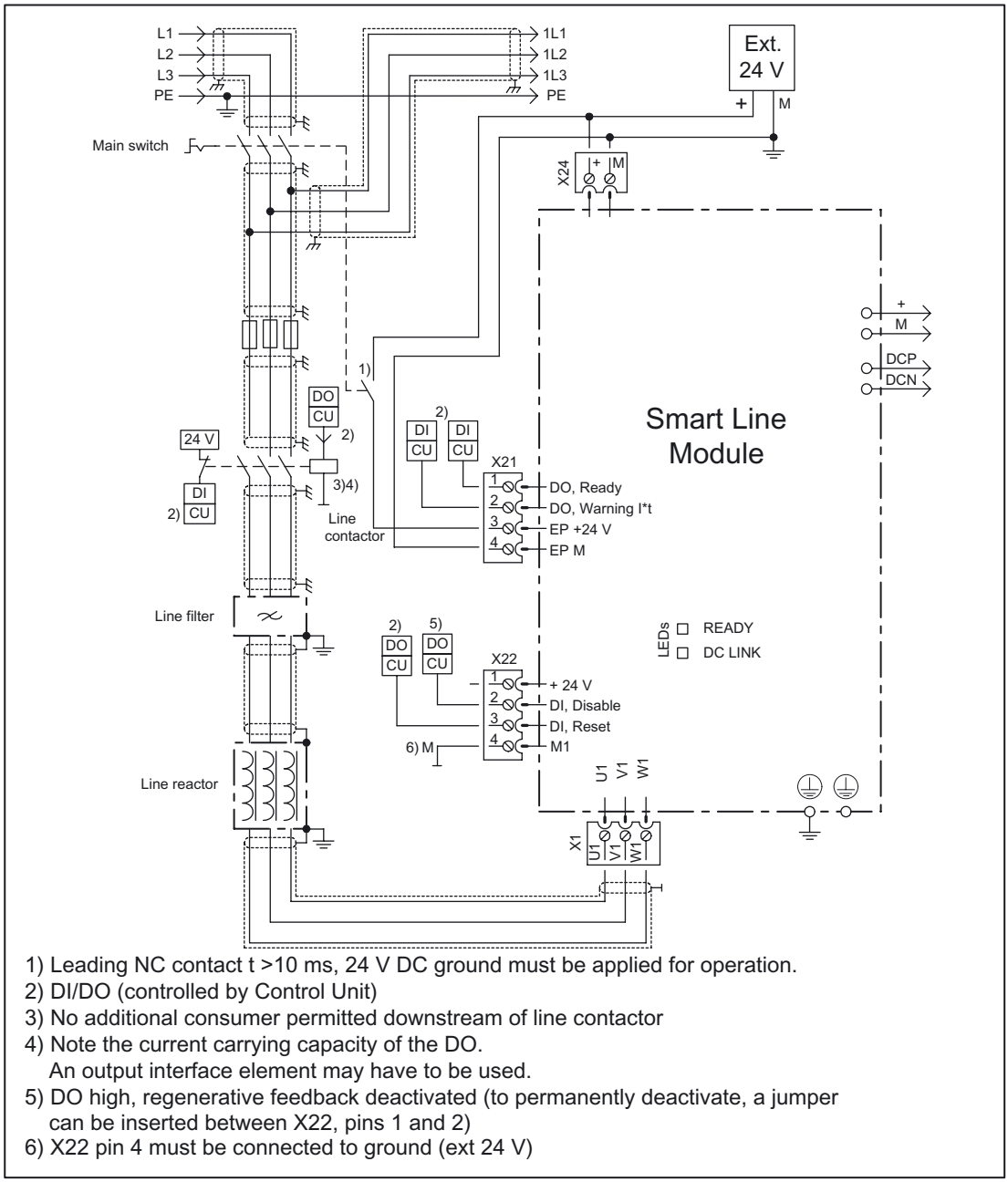


Figure 3-54 Smart line module with internal air cooling (example 5 kW)

3.5.3.2 Connection example

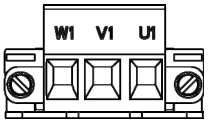
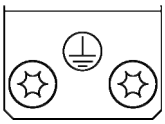


1) Leading NC contact t >10 ms, 24 V DC ground must be applied for operation.
2) DI/DO (controlled by Control Unit)
3) No additional consumer permitted downstream of line contactor
4) Note the current carrying capacity of the DO.
   An output interface element may have to be used.
5) DO high, regenerative feedback deactivated (to permanently deactivate, a jumper can be inserted between X22, pins 1 and 2)
6) X22 pin 4 must be connected to ground (ext 24 V)

Figure 3-55 Example connection of Smart Line Module

3.5.3.3 X1 line connection

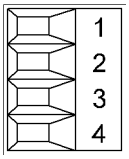
Table 3-36 Terminal block X1 of Smart Line Module (5 kW and 10 kW)

	Terminal	Technical data
	U1 V1 W1	Max. connection voltage: 3 AC 480 V +10 % at 47 Hz to 63 Hz Max. connectable cross-section: 6 mm^2 Type: Screw terminal 5 (see Connection systems) Tightening torque: 1.2 - 1.5 Nm
	PE connection	Threaded hole M5/3 Nm [1]

[1)] for ring terminal end in accordance with DIN 46234

3.5.3.4 X21 terminals: Smart Line Module

Table 3-37 Terminal block X21

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

Note

The Smart Line Module signals ready-to-operate, even though one of the external conductors is not available. In this case the feedback is deactivated and a warning message is output to X21/2 (DO, Warning I*t). If the feedback was deactivated by applying a "High" signal to terminal X22/2 (DI, Disable), no warning message will be output to X21/2 (DO, Warning I*t).

Note

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

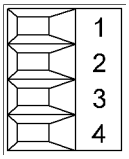
NOTICE

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

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

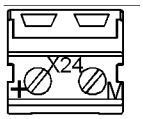
3.5.3.5 X22 terminals: Smart Line Module

Table 3-38 Terminal block X22

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

3.5.3.6 X24 24 V terminal adapter

Table 3-39 Terminal block X24

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

3.5.3.7 Meaning of the LEDs on the Smart Line Module

Table 3-40 5 kW and 10 kW Smart Line Modules – description of the LEDs

LED	Color	Status	Description, cause	Remedy
READY	–	off	Electronics power supply is missing or outside permissible tolerance range.	–
	Green	Continuous	Component is ready to operate.	–
	Yellow	Continuous	Pre-charging not yet complete. Bypass relay dropped out EP terminals not supplied with 24 V DC.	–
	Red	Continuous	Overtemperature Overcurrent switch-off	Diagnose fault (via output terminals) and acknowledge it (via input terminal)
DC LINK	–	off	Electronics power supply is missing or outside permissible tolerance range.	–
	Yellow	Continuous	DC link voltage within permissible tolerance range.	–
	Red	Continuous	DC link voltage outside permissible tolerance range. Line supply fault.	Check the supply voltage.

3.5.4 Dimension drawing

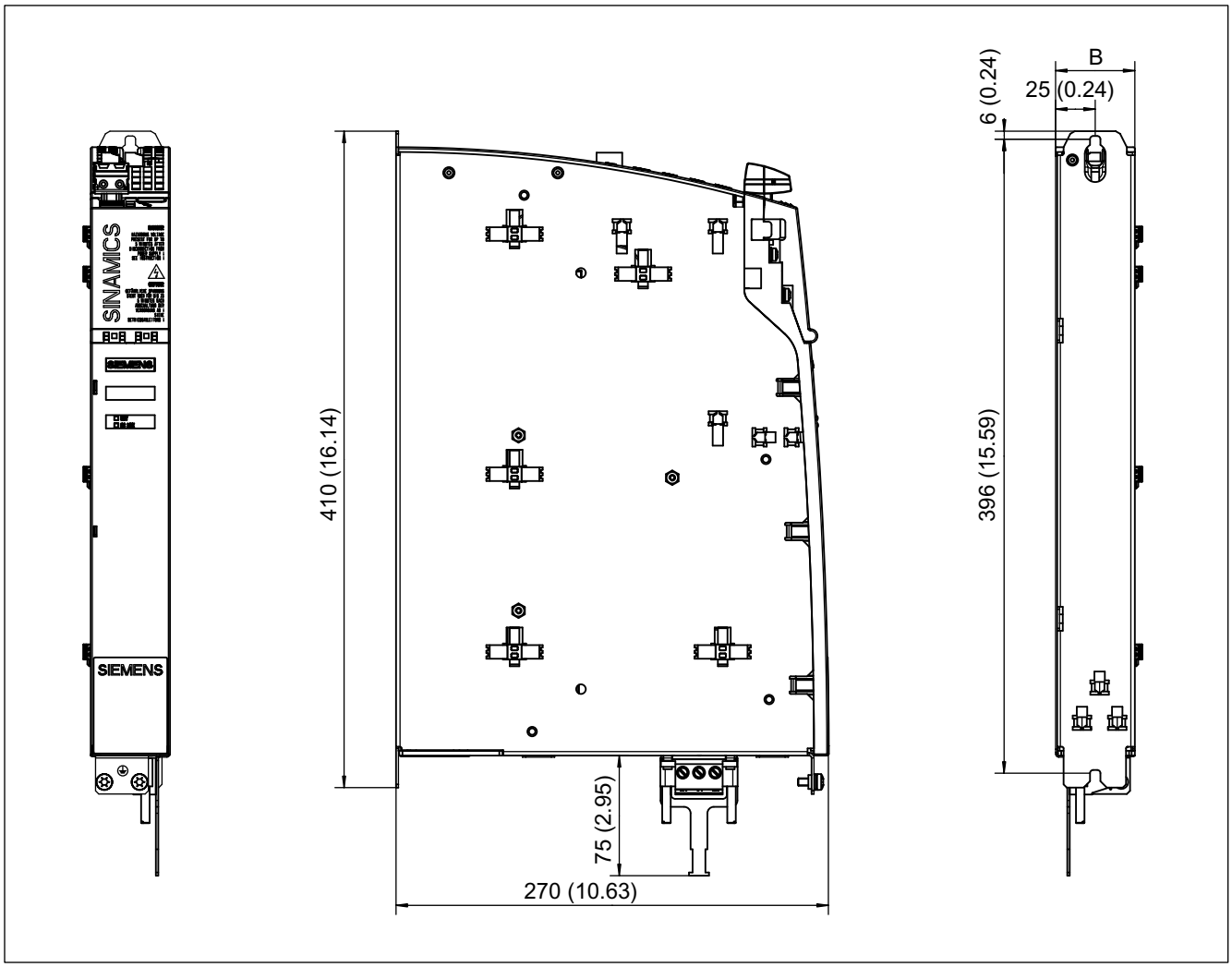


Figure 3-56 Dimension drawing of the 5 kW and 10 kW Smart Line Modules with internal air cooling

Table 3-41 Dimensions of 5 kW and 10 kW Smart Line Modules 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

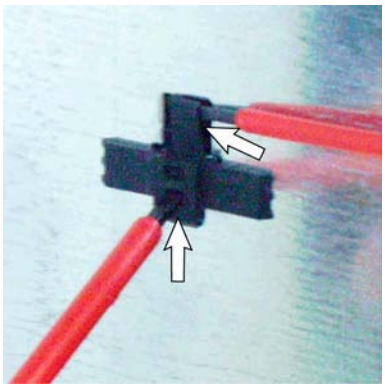
The shield connecting plate is part of the scope of supply of the 50 mm Smart Line Module.

3.5.5 Mounting

Remove the holder for securing the Control Unit.

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

- If the component to be installed comes into contact with the left-hand cabinet panel
- For a center infeed via Line Modules 55 / 80 / 120 kW

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

3.5.6 Electrical connection

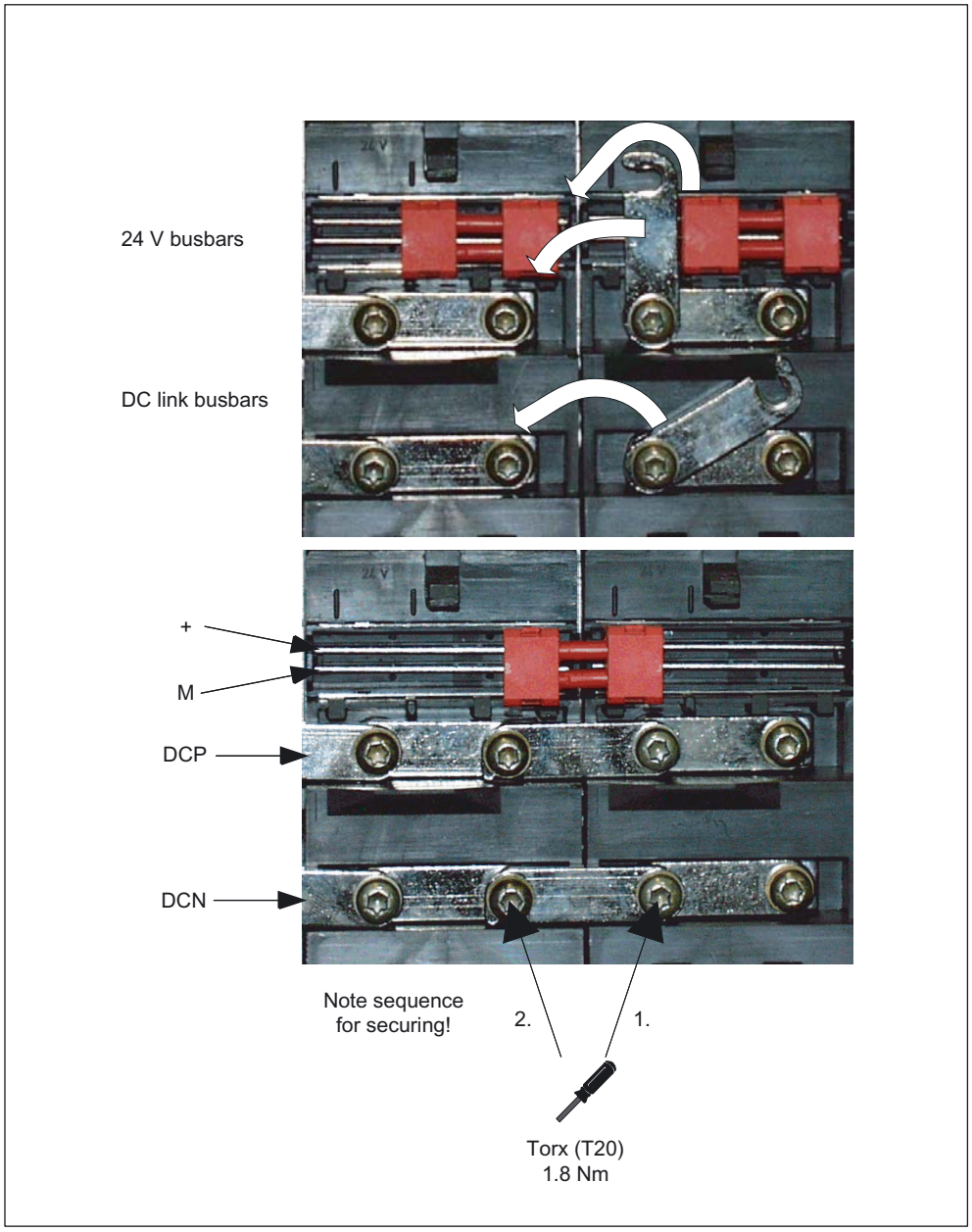


Figure 3-57 Busbar connections for booksize components

3.5.7 Technical data

Table 3-42 Technical data for Booksize Smart Line Modules with internal air cooling

Internal air cooling	**6SL3130–**	**6AE15–0AAx**	**6AE21–0AAx**
Rated power	**kW**	**5**	**10**
Infeed:			
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
Line supply voltages:			
Line voltage	V_{AC}	380 V 3 AC -10 % to 480 V 3 AC +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 – 720	
Overvoltage trip threshold	V_{DC}	820 ± 2 %	
Undervoltage trip threshold	V_{DC}	360 ± 2 %	
Rated input current:			
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
DC link current (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
Maximum permissible DC link capacitance	µF	6000	6000
Power factor	cos ϕ	0.98	0.98
Circuit-breaker type designation (status 06/2007)	3RV1031-	4BA10	4FA10
Rated current	A	14 ... 20	28 ... 40
Short-circuit current rating SCCR at 400 V_{AC}	kA	50	50

Internal air cooling	**6SL3130–**	**6AE15–0AAx**	**6AE21–0AAx**
Rated power	**kW**	**5**	**10**
Circuit-breaker type designation (status 07/2007and later) Rated current Short-circuit current rating SCCR at 400 V_{AC}	3RV1042- A kA	4BA10 14 ... 20 100	4FA10 28 ... 40 100
UL safety fuse type AJT Class J Rated current Short-circuit current rating SCCR at 600 V_{AC}	 A kA	AJT16 16 200	AJT35 35 200
Cooling method (internal air cooling)		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 380 V 3 AC			
Weight	kg	4.7	4.8

[1] The specified values apply to 380 V

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

Rated duty cycles of Smart Line Modules

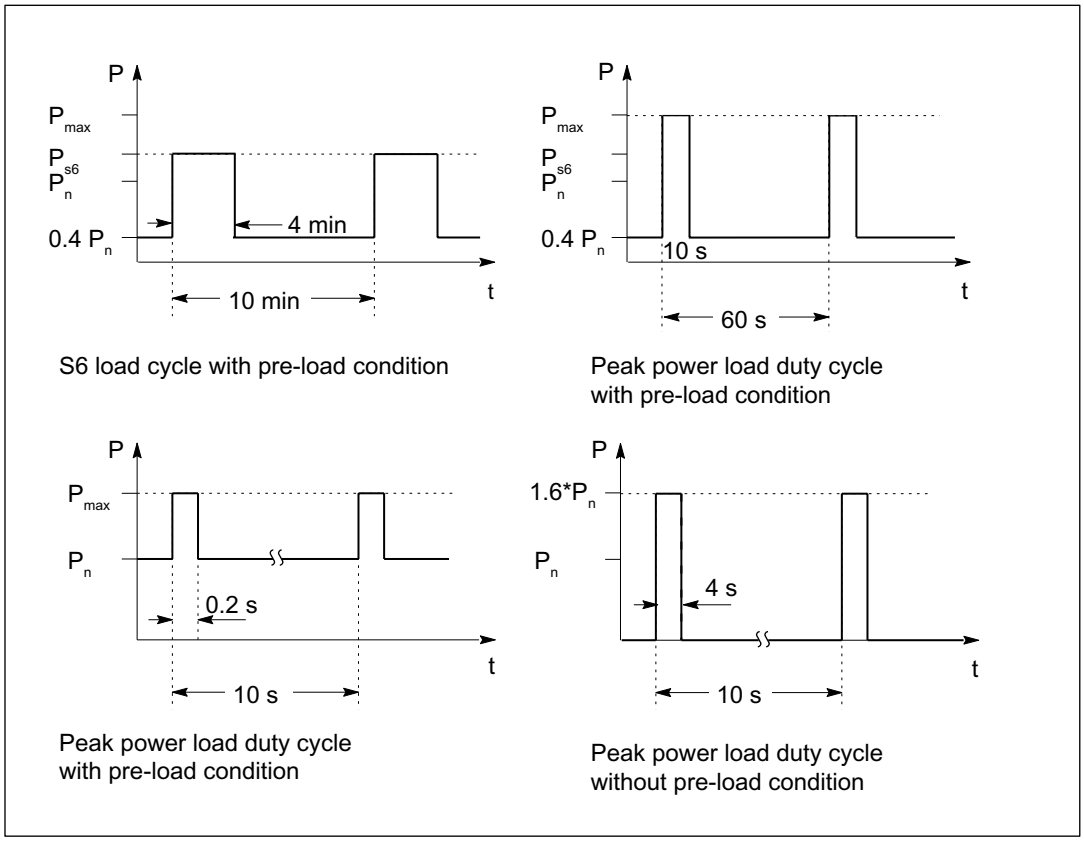


Figure 3-58 Rated duty cycles of Smart Line Modules

Derating as a function of the ambient temperature

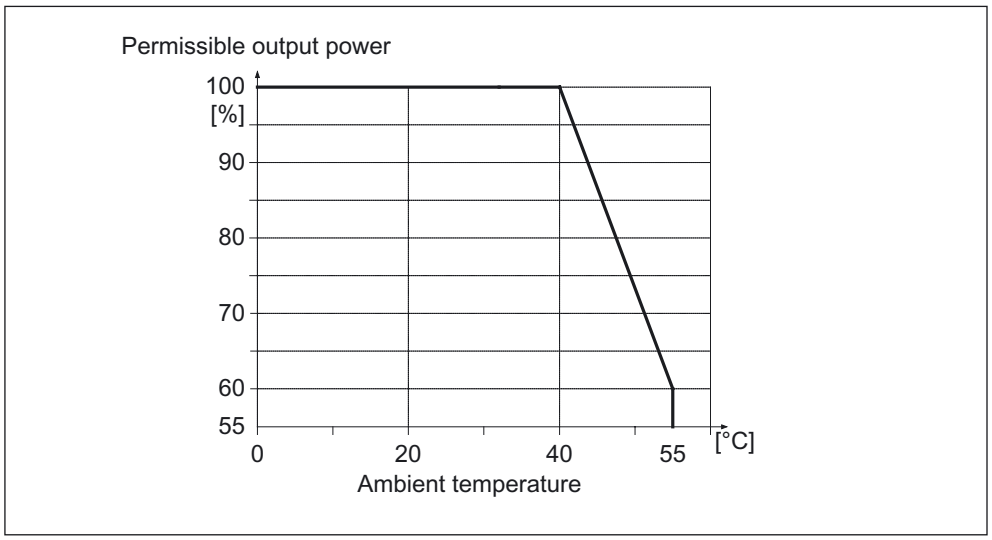


Figure 3-59 Derating as a function of the ambient temperature

Derating as a function of the installation altitude

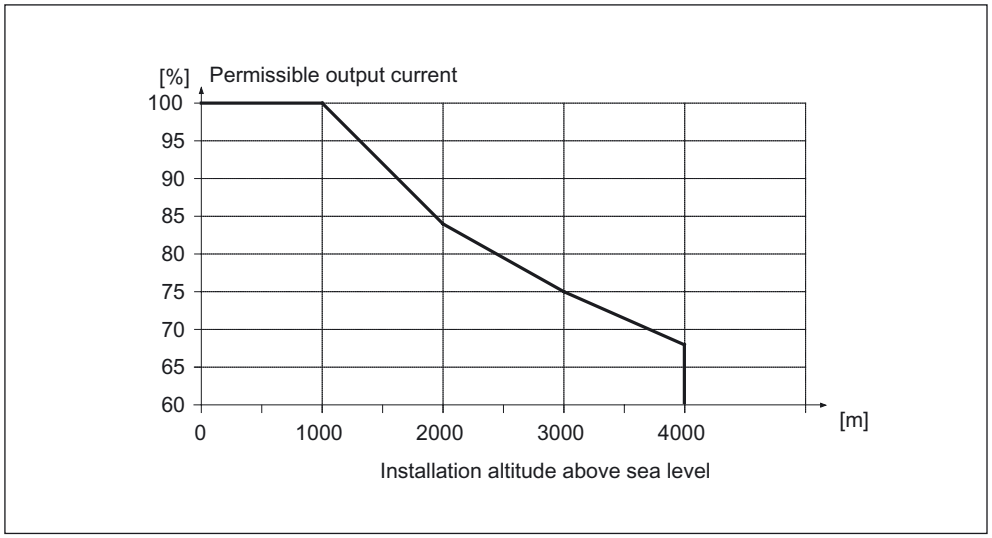


Figure 3-60 Derating as a function of the installation altitude

Voltage derating as a function of the installation altitude

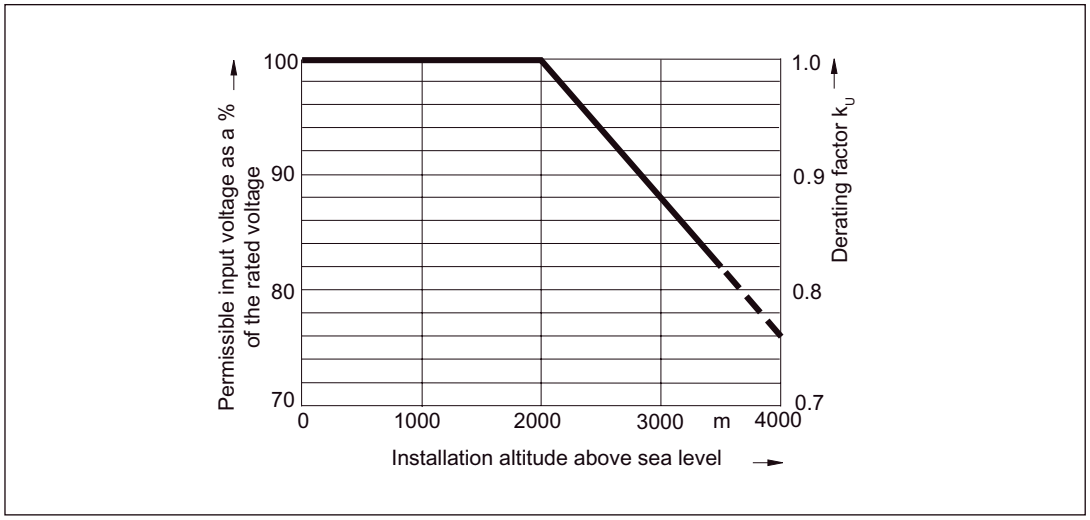


Figure 3-61 Voltage derating as a function of the installation altitude

Output power as a function of the total cable length

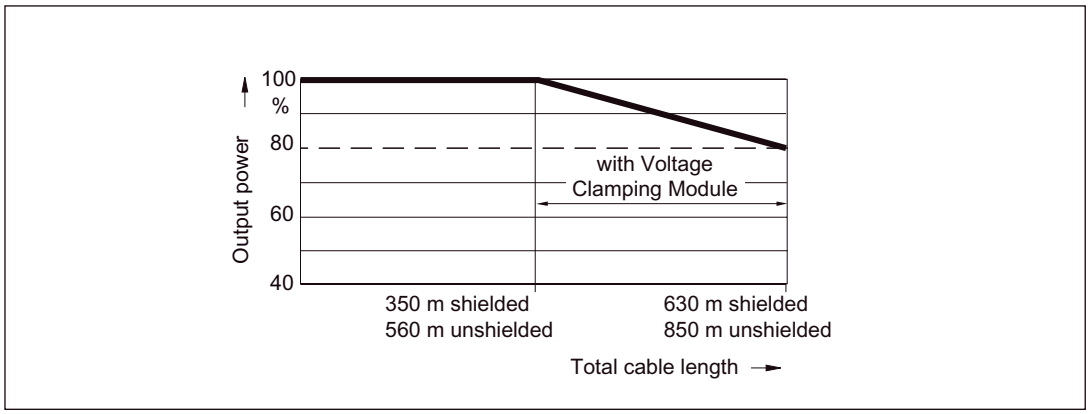


Figure 3-62 Output power as a function of the total cable length

3.6 Smart Line Modules (16 kW und 36 kW) with internal air cooling

3.6.1 Description

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

In feedback mode, the current waveform is square waved. Feedback can be deactivated by means of parameterization because like the Active Line Modules, these Smart Line 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. The Line Modules have an integrated overvoltage protection function.

3.6.2 Safety information

⚠ DANGER

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

⚠ WARNING

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

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

⚠ WARNING

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

⚠ DANGER

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

⚠ WARNING

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

⚠ DANGER

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

CAUTION

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

⚠ DANGER

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

For all other power units and DC link components (e.g. Capacitor Module) that are wider than 50 mm, it is neither permissible to move the DC link bridge to the left nor remove it.

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

⚠ DANGER

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

CAUTION

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

NOTICE

Operation without the line reactor is not permissible.

CAUTION

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

⚠ WARNING

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

Note

The fans are power-up and power-down as a function of the heatsink temperature.

The fans start up at the heat-sink temperature specified in the power stack data (normally 56 °C) and are switched off with a slight hysteresis when the heat-sink temperature decreases again. The length of time it takes for the fans to stop once they have been switched off depends on a number of factors (ambient temperature, output current, duty cycle, etc.) and, therefore, cannot be determined directly.

The fans are not equipped with temperature-dependent speed control; they are either ON or OFF.

3.6.3 Interface description

3.6.3.1 Overview

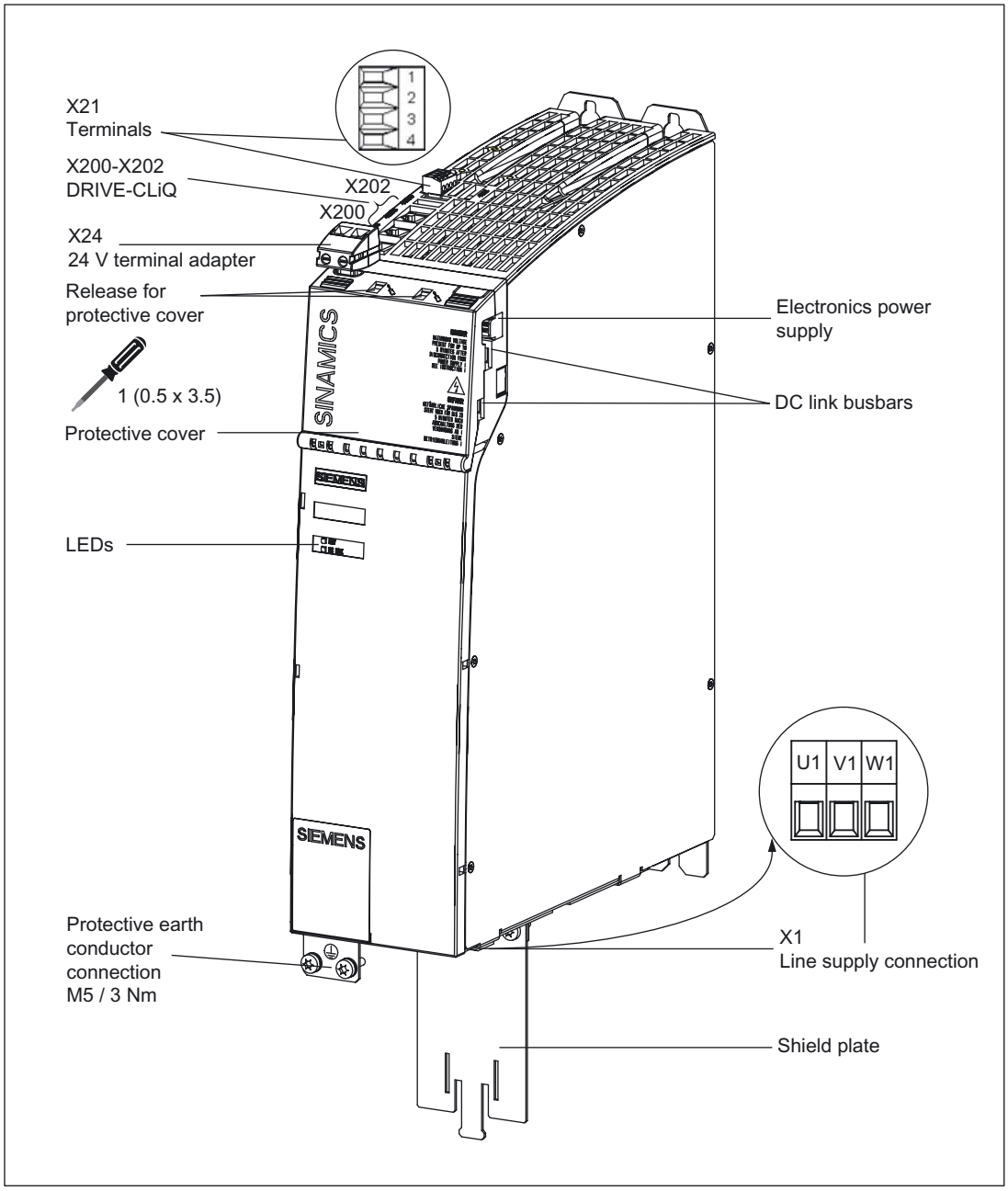


Figure 3-63 Smart Line Module Booksize format with internal air cooling (example 16 kW)

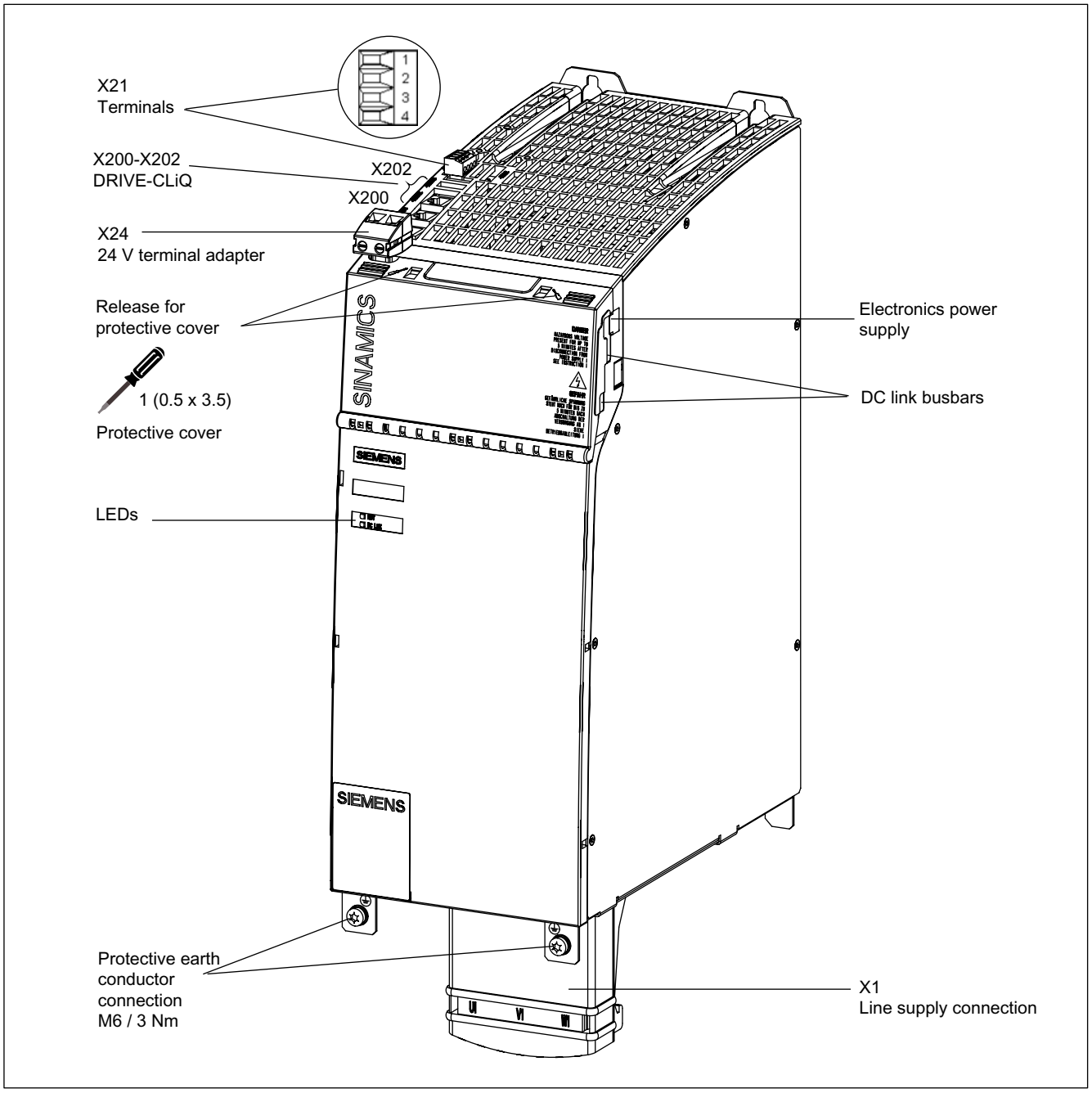
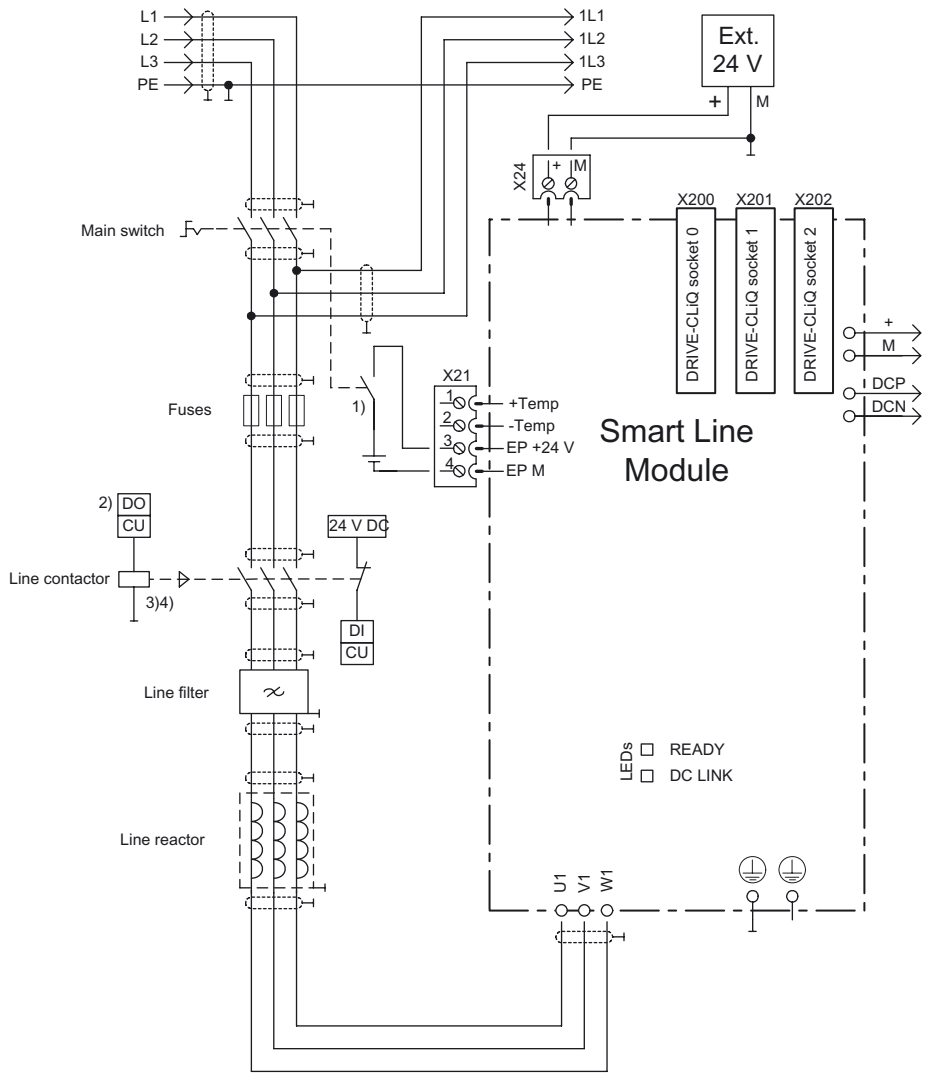


Figure 3-64 Smart Line Module Booksize format with internal air cooling (example 36 kW)

3.6.3.2 Connection example

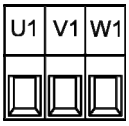
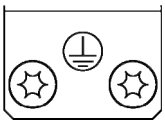


1) Leading opening contact t >10 ms
2) DI/DO (controlled by Control Unit)
3) No additional consumer permitted downstream of line contactor
4) Note the current carrying capacity of the DO.
An output interface element may have to be used.

Figure 3-65 Connection example: Smart Line Module (16 kW and 36 kW)

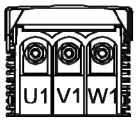
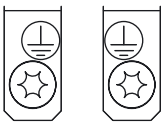
3.6.3.3 X1 line connection

Table 3-43 Terminal block X1 Smart Line Module 16 kW

	Terminal	Technical specifications
	U1 V1 W1	Supply voltage: 480 V 3 AC +10 % (-15 % < 1 min) for 47 Hz to 63 Hz Max. connectable cross-section: 10 mm^2 Type: Screw terminal 6 (see Connection systems) Tightening torque: 1.5 - 1.8 Nm
	PE connection	Threaded hole M5/3 Nm [1]

[1] for ring cable lugs to DIN 46234

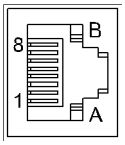
Table 3-44 Terminal block Smart Line Module 36 kW

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

[1] for ring cable lugs to DIN 46234

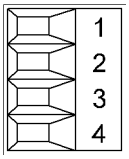
3.6.3.4 X200-X202 DRIVE-CLiQ interfaces

Table 3-45 DRIVE-CLiQ interface X200-X202

	PIN	Signal name	Technical specifications
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	24 V power supply
	B	M (0 V)	Electronics ground
Blanking plate for DRIVE-CLiQ interface: Yamaichi, order no.: Y-ConAS-13			

3.6.3.5 X21 EP terminals

Table 3-46 Terminal block X21

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

NOTICE

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

⚠ WARNING

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

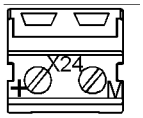
NOTICE

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

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

3.6.3.6 X24 24 V terminal adapter

Table 3-47 Terminal block X24

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

3.6.3.7 Meaning of the LEDs on the Smart Line Module

Table 3-48 Smart Line Module ≥ 16 kW - description of the LEDs

Status		Description, cause	Remedy
Ready (H200)	**DC link (H201)**		
OFF	OFF	Electronics power supply is missing or outside permissible tolerance range.	–
Green	OFF	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.	–
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is present.	–
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is too high.	Check line voltage
Orange	Orange	DRIVE-CLiQ communication is being established.	–
Red	–	At least one fault is present in this component. **Note:** The LED is activated regardless of whether the corresponding messages have been reconfigured.	Remedy and acknowledge fault
Green/red (0.5 Hz)	–	Firmware is being downloaded.	–
Green/red (2 Hz)	-	Firmware download is complete. Wait for POWER ON.	Carry out a POWER ON
Green/orange or Red/orange	–	Component detection via LED is activated (p0124). **Note:** Both options depend on the LED status when component recognition is activated via p0124 = 1.	–

⚠ DANGER

Hazardous DC link voltages may be present at any time regardless of the status of the "DC link" LED.
The warning information on the components must be carefully observed!

3.6.4 Dimension drawings

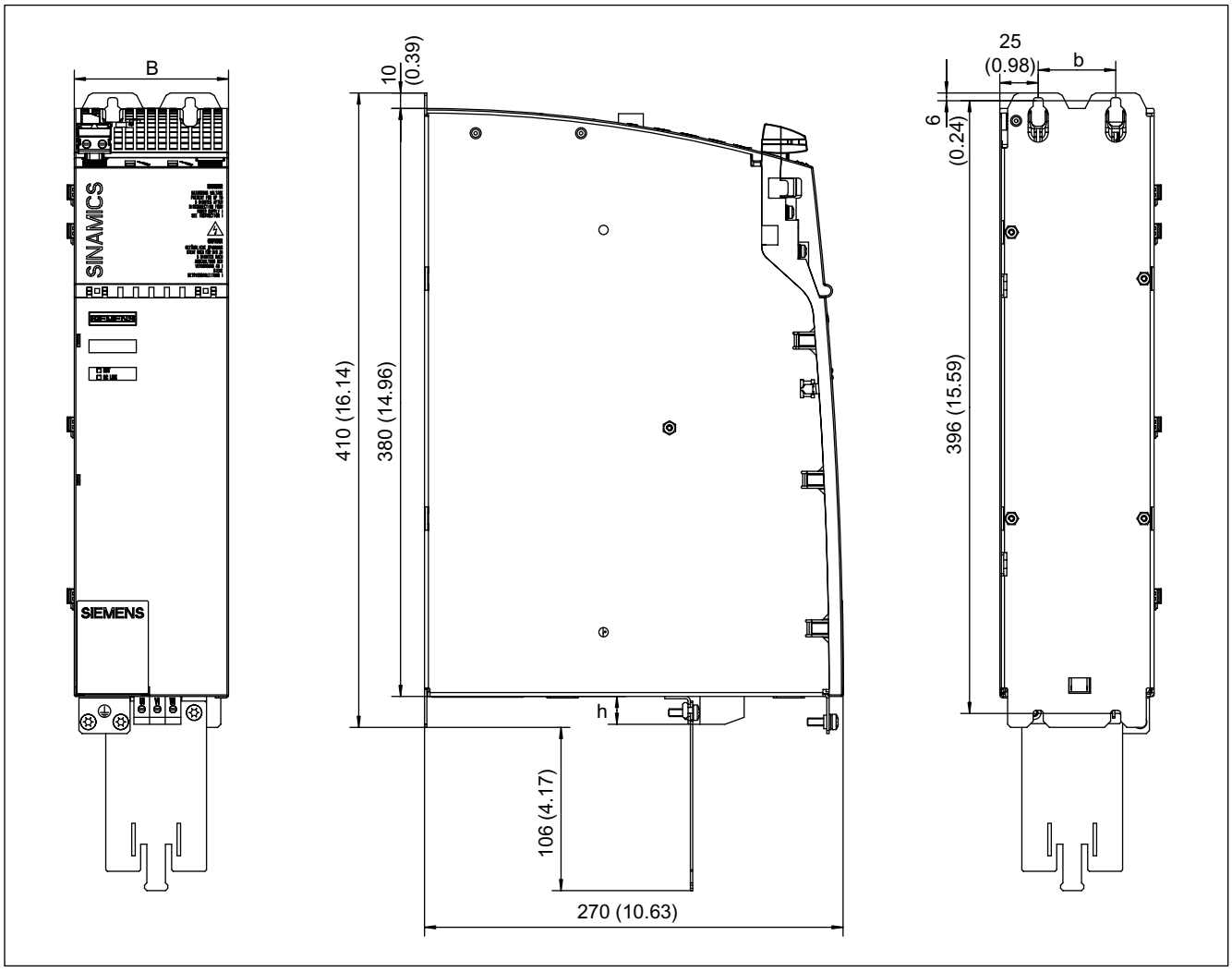


Figure 3-66 Dimension drawing: Smart Line Module Booksize format with internal air cooling (16 kW)

Table 3-49 Dimensions of Smart Line Module Booksize format with internal air cooling

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

Note

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

Further details can be found in "Accessories".

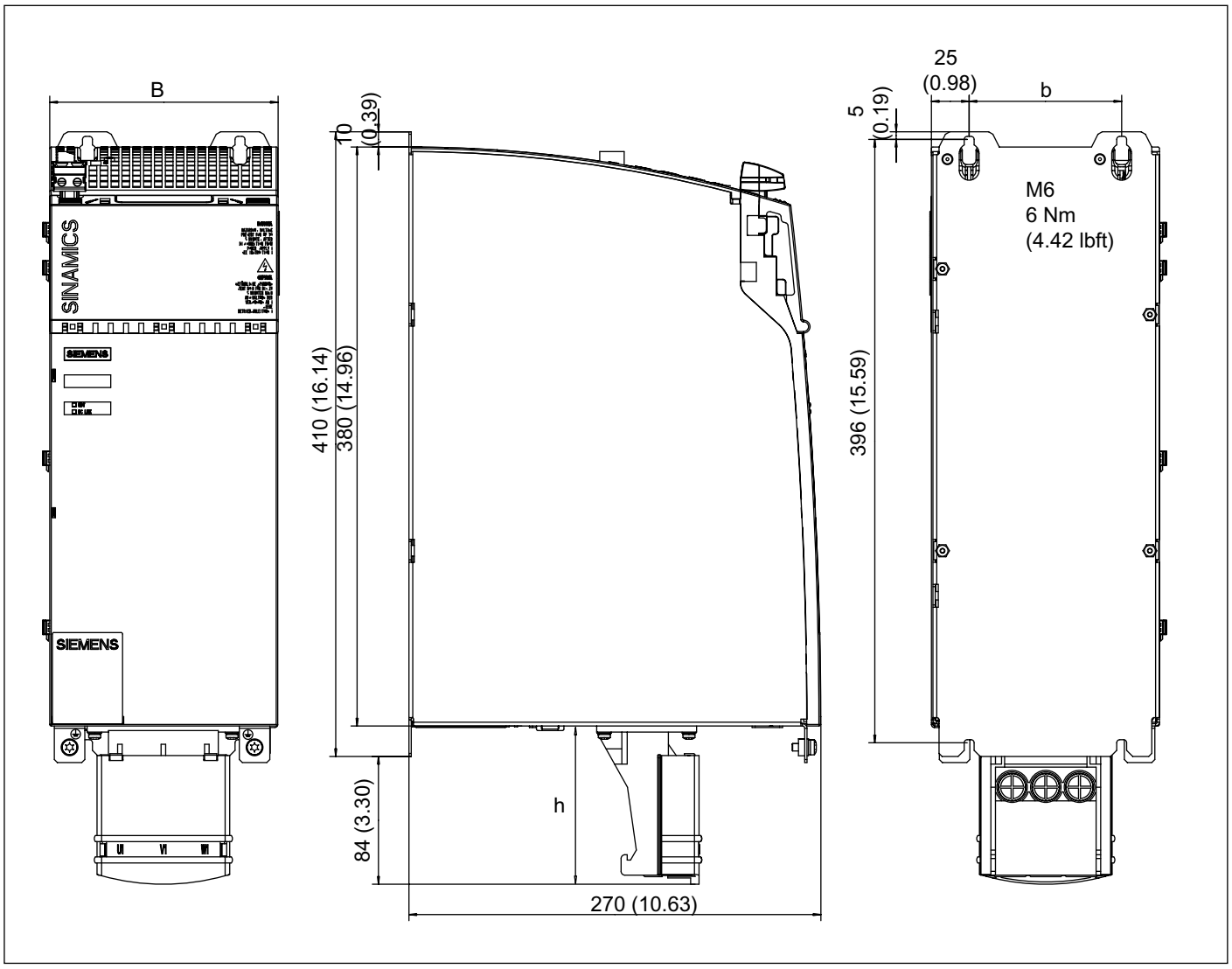


Figure 3-67 Dimension drawing: Smart Line Module Booksize format with internal air cooling (36 kW)

Table 3-50 Dimensions of Smart Line Module Booksize format with internal air cooling

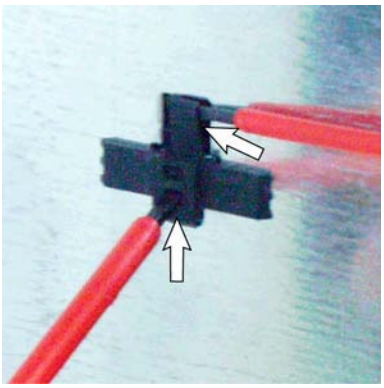
Smart Line Module Type	Order number	W [mm] (inches)	b [mm] (inches)	h [mm] (inches)
36 kW	6SL3130-6TE23-6ABx	150 (5.91)	100 (3.94)	105 (4.13)

3.6.5 Mounting

Remove the holder for securing the Control Unit

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

- If the component to be installed comes into contact with the left-hand cabinet panel
- For a center infeed via Line Modules 55 / 80 / 120 kW

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

3.6.6 Electrical connection

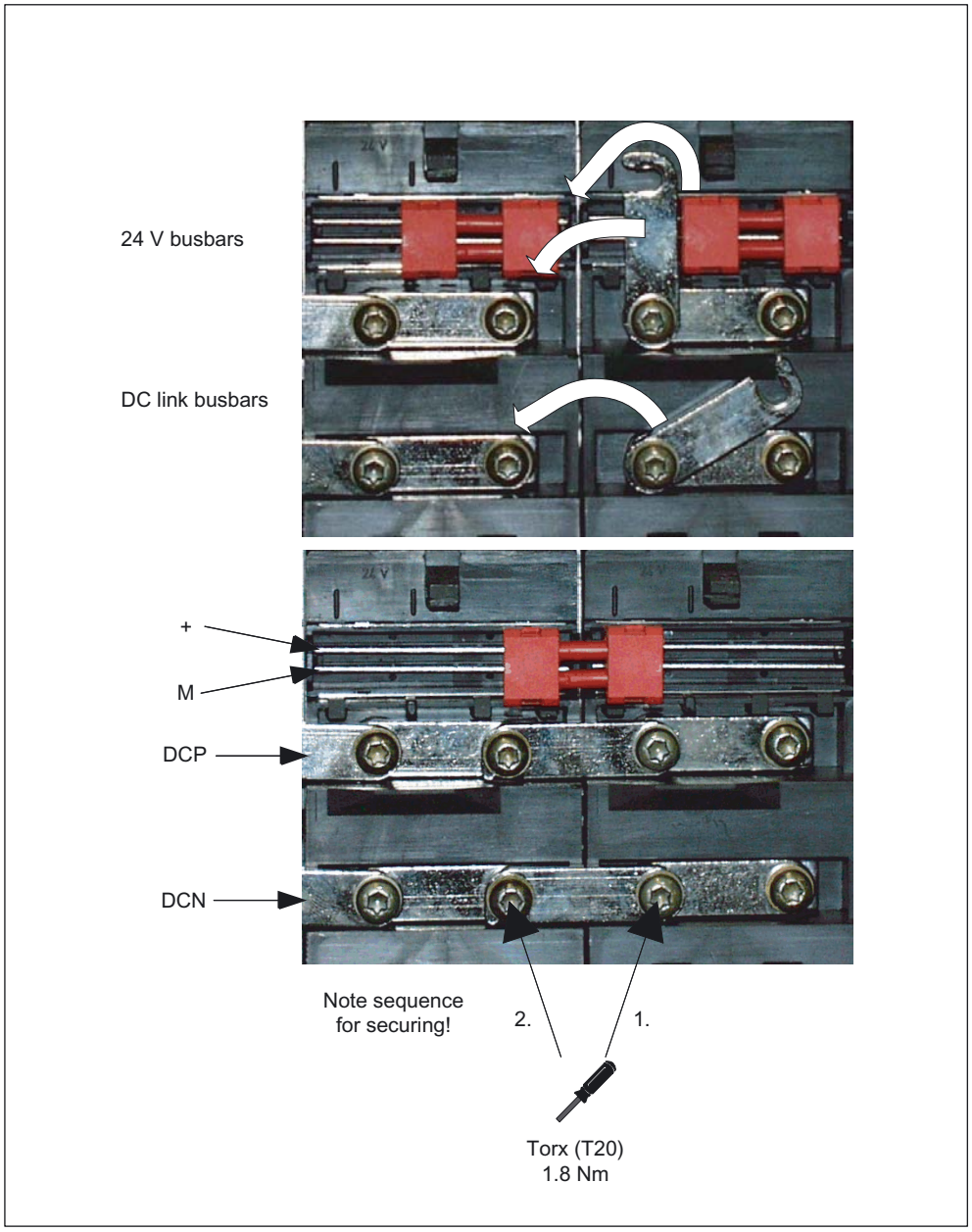


Figure 3-68 Busbar connections for booksize components

3.6.7 Technical data

Table 3-51 Technical data for Booksize Smart Line Modules with internal air cooling

Internal air cooling	**6SL3130–**	**6TE21-6ABx**	**6TE23-6ABx**
Rated power	**kW**	**16**	**36**
Infeed: Rated power (S1)[1] S6 infeed Power rating (S6-40 %)[1] Peak power rating[1]	 kW (Pn) kW (Ps6) kW (Pmax)	 16 21 35	 36 47 70
Regenerative feedback: Continuous regenerative power rating Peak regenerative power rating	 kW kW	 16 35	 36 70
Line supply voltages: Line voltage Line frequency Electronics power supply	 V_{AC} Hz V_{DC}	 380 V 3 AC -10 % (-15 % < 1 min) to 480 V 3 AC +10 % 47 to 63 24 (20.4 - 28.8)	
DC link voltage Overvoltage trip threshold Undervoltage trip threshold	V_{DC} V_{DC} V_{DC}	510 – 720 820 ± 2 % 360 ± 2 %	
Rated input current: at 380 V_{AC} at 480 V_{AC}/528 V_{AC} at 480 V (S6-40 %) Peak current (at 400 V_{AC}/480 V_{AC})	 A_{AC} A_{AC} A_{AC} A_{AC}	 26 21 / 19 27 54 /45	 58 46 / 42 60 107 / 89
DC link current: Rated current at S6-40 % Peak current	 A_{DC} A_{DC} A_{DC}	 27 35 59	 60 79 117
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
Maximum permissible DC link capacitance	µF	20 000	20 000
Power factor	cos ϕ	0.98	0.98
Circuit-breaker type designation (status 06/2007) Rated current Short-circuit current rating SCCR at 400 V_{AC}	3RV1031- A kA	4FA10 28 ... 40 50	4LA10 70 ... 90 50

Internal air cooling	6SL3130–	6TE21-6ABx	6TE23-6ABx
Rated power	**kW**	**16**	**36**
Circuit-breaker type designation (status 07/2007and later) Rated current Short-circuit current rating SCCR at 400 V_{AC}	3RV1042- A kA	4FA10 28 ... 40 100	4LA10 70 ... 90 100
UL safety fuse type AJT Class J Rated current Short-circuit current rating SCCR at 600 V_{AC}	 A kA	AJT35 35 200	AJT80 80 200
Cooling method (internal air cooling)		Internal fan	Internal fan
Sound pressure level	dB(A)	<60	<65
Cooling air requirement	m^3/h	56	112
Rated voltage for rated data 380 V 3 AC			
Weight	kg	7	10

[1] The specified values apply to 380 V

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

Rated duty cycles of Smart Line Modules

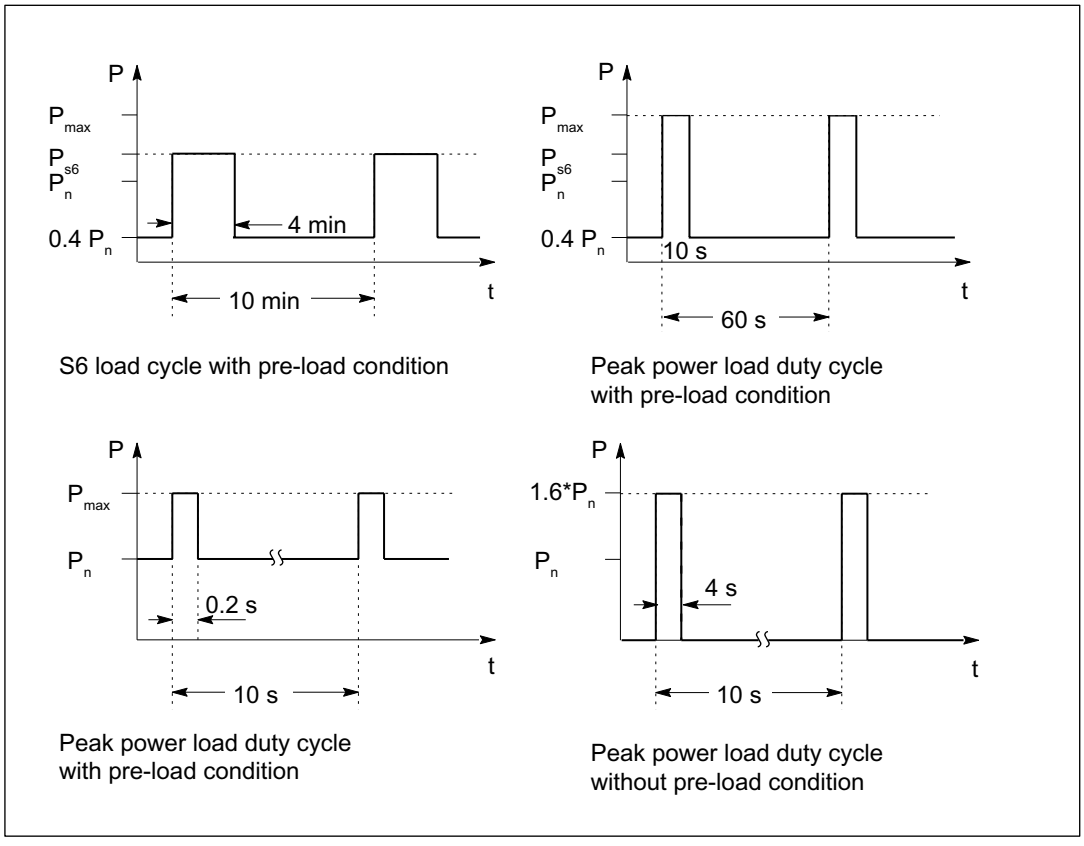


Figure 3-69 Rated duty cycles of Smart Line Modules

Derating as a function of the ambient temperature

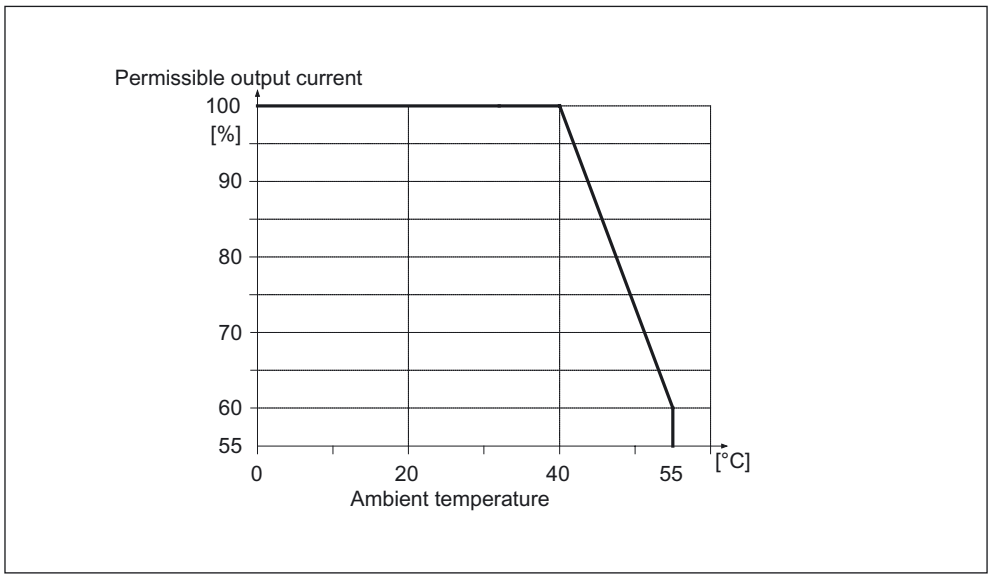


Figure 3-70 Derating as a function of the ambient temperature

Derating as a function of the installation altitude

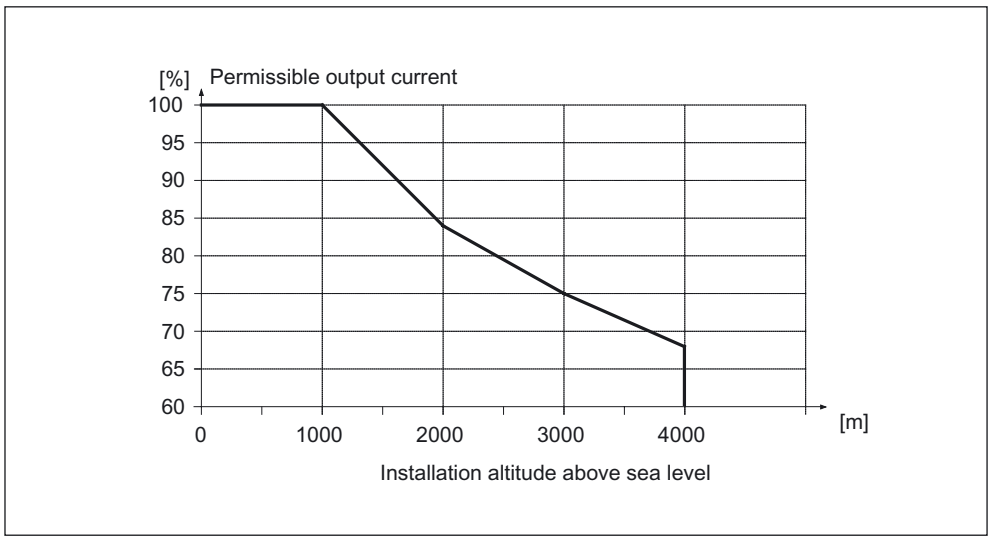


Figure 3-71 Derating as a function of the installation altitude

Voltage derating as a function of the installation altitude

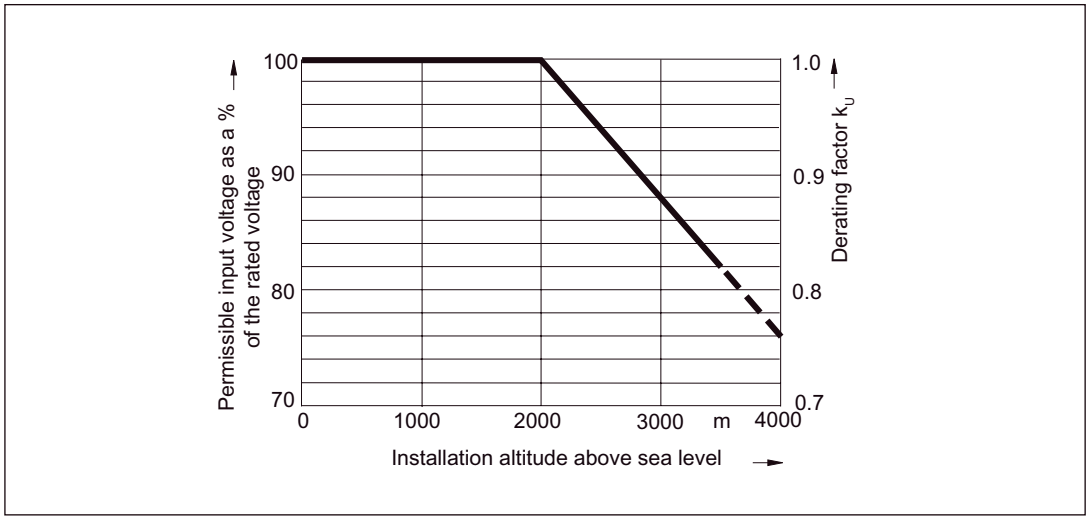


Figure 3-72 Voltage derating as a function of the installation altitude

Output power as a function of the total cable length

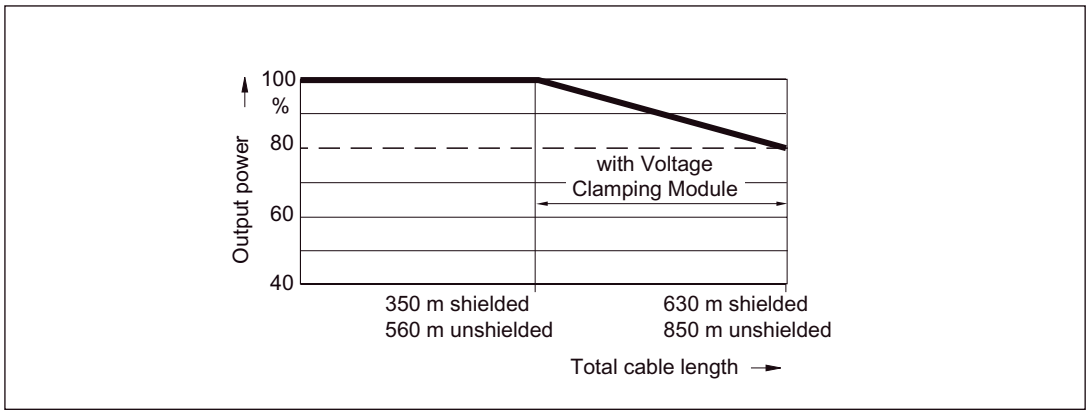


Figure 3-73 Output power as a function of the total cable length

3.7 Smart Line Modules (5 kW und 10 kW) with external air cooling

3.7.1 Description

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

In feedback mode, the current waveform is square waved. Feedback can be deactivated by means of a terminal because these Smart 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. The Line Modules have an integrated overvoltage protection function.

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 control cabinet and mounted with a seal. The heat sink and the fan (included in the scope of supply) project beyond the rear of the control cabinet and the heat is dissipated outside the control cabinet or in a separate air duct.

3.7.2 Safety information

⚠ DANGER

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

⚠ WARNING

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

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

⚠WARNING

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

⚠DANGER

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

⚠WARNING

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

⚠DANGER

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

CAUTION

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

⚠DANGER

If a 50 mm wide Motor Module or if a DC link component with the appropriate width (e.g. Braking Module, Control Supply Module, Voltage Clamping Module) is located at the left-hand end of the drive line-up, the DC link bridge (including the screws) must be removed. The screws must not be inserted without a DC link bridge.

For all other power units and DC link components (e.g. Capacitor Module) that are wider than 50 mm, it is neither permissible to move the DC link bridge to the left nor remove it.

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

⚠DANGER

In a supply system without regenerative feedback capability (e.g. diesel generator), the regenerative feedback capability of the Smart Line Module must be deactivated by means of a jumper between terminals X22.1 and X22.2. The 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 unit. 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 DC link side covers are supplied as standard with the components; they can also be ordered separately, if required (order no.: 6SL3162-5AA00-0AA0).

Note

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

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

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

3.7.3 Interface description

3.7.3.1 Overview

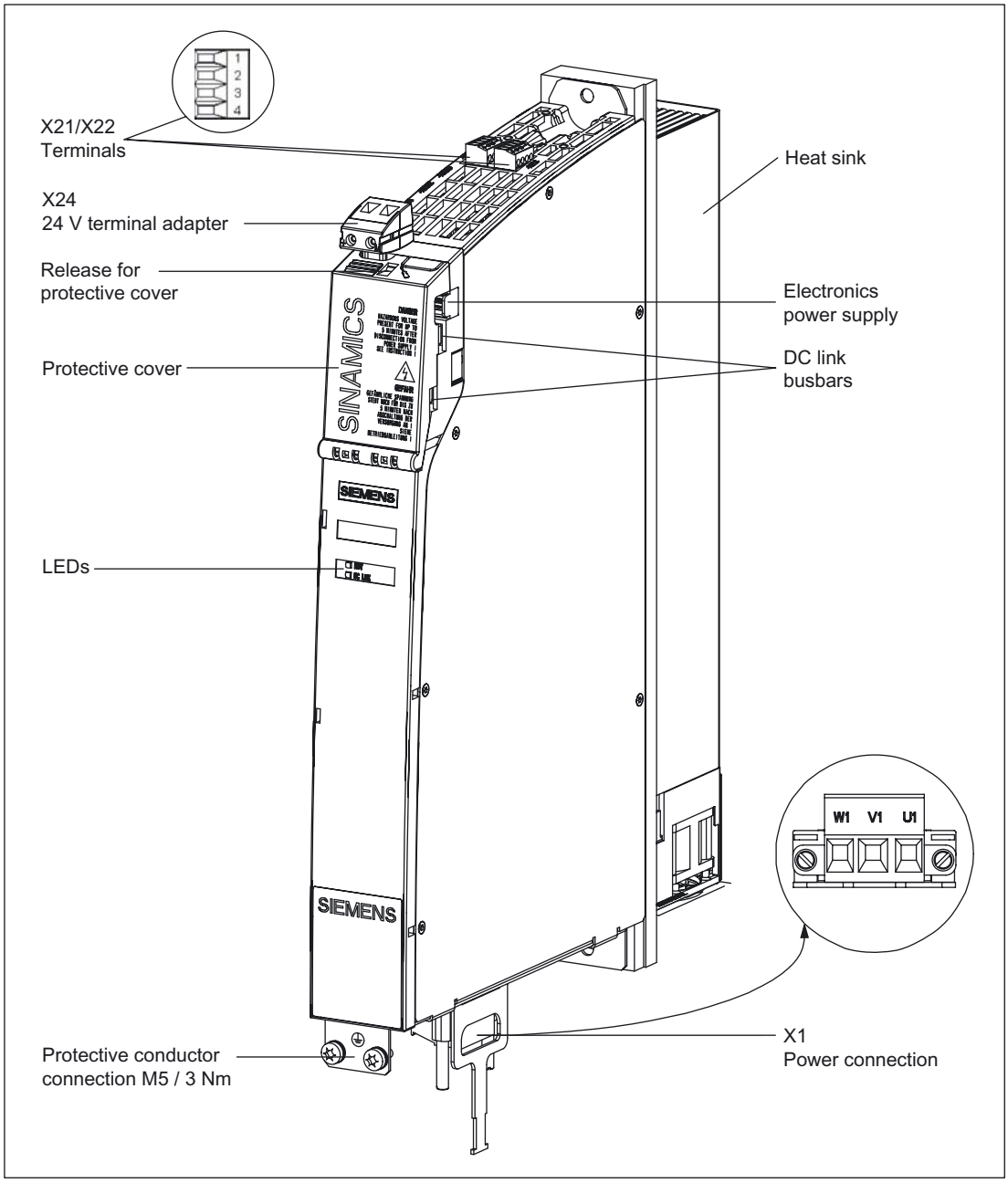
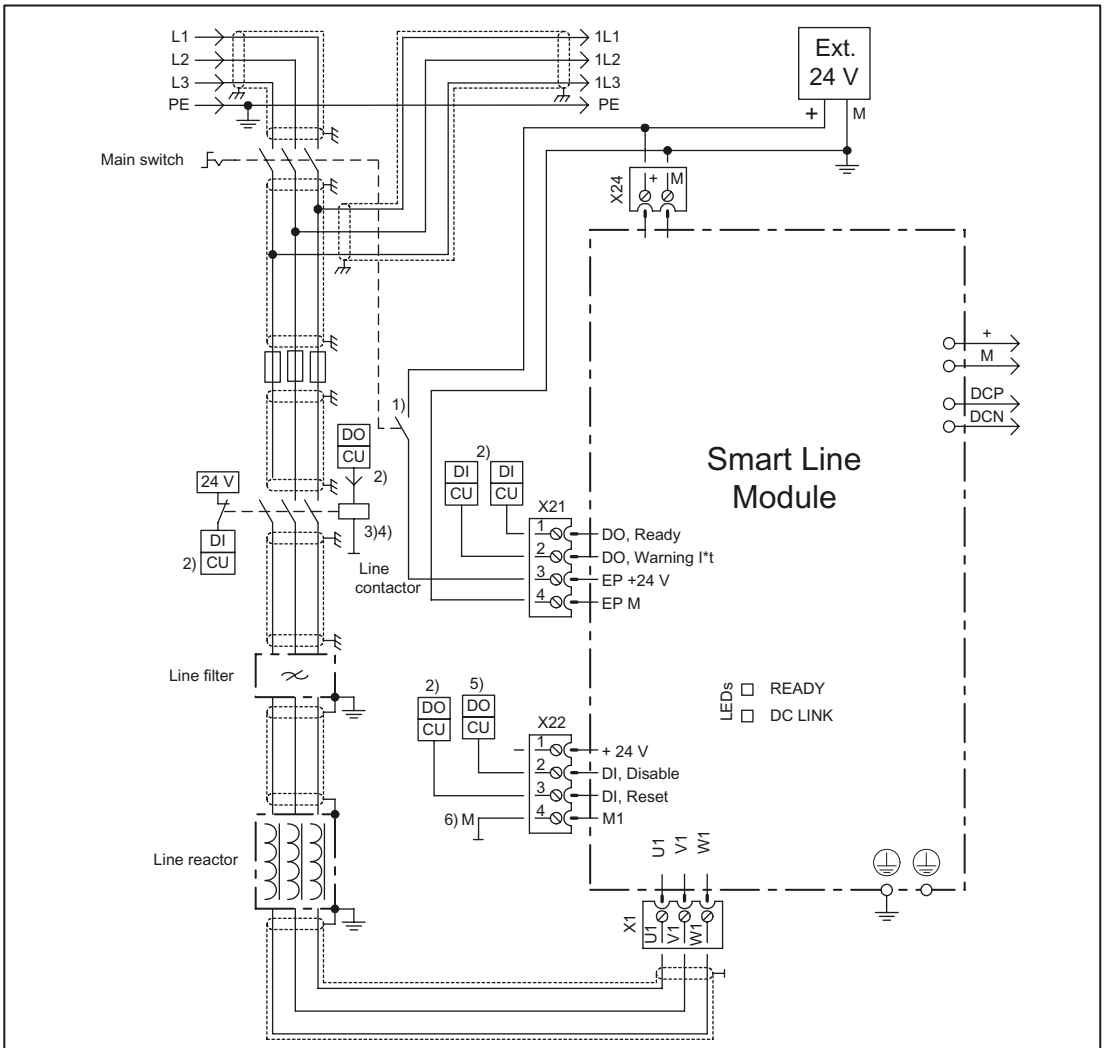


Figure 3-74 Smart Line Module with external air cooling (example 5 kW)

3.7.3.2 Connection example

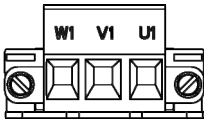
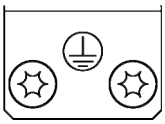


1) Leading NC contact t >10 ms, 24 V DC ground must be applied for operation.
2) DI/DO (controlled by Control Unit)
3) No additional consumer permitted downstream of line contactor
4) Note the current carrying capacity of the DO.
   An output interface element may have to be used.
5) DO high, regenerative feedback deactivated (to permanently deactivate, a jumper can be inserted between X22, pins 1 and 2)
6) X22 pin 4 must be connected to ground (ext 24 V)

Figure 3-75 Example connection of Smart Line Module

3.7.3.3 X1 line connection

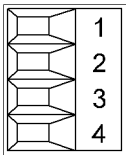
Table 3-52 Terminal block X1 of Smart Line Module (5 kW and 10 kW)

	Terminal	Technical data
	U1 V1 W1	Max. connection voltage: 3 AC 480 V +10 % at 47 Hz to 63 Hz Max. connectable cross-section: 6 mm^2 Type: Screw terminal 5 (see Connection systems) Tightening torque: 1.2 - 1.5 Nm
	PE connection	Threaded hole M5/3 Nm [1]

[1)] for ring terminal end in accordance with DIN 46234

3.7.3.4 X21 terminals: Smart Line Module

Table 3-53 Terminal block X21

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

Note

The Smart Line Module signals ready-to-operate, even though one of the external conductors is not available. In this case the feedback is deactivated and a warning message is output to X21/2 (DO, Warning I*t). If the feedback was deactivated by applying a "High" signal to terminal X22/2 (DI, Disable), no warning message will be output to X21/2 (DO, Warning I*t).

Note

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

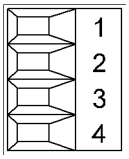
NOTICE

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

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

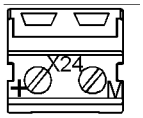
3.7.3.5 X22 terminals: Smart Line Module

Table 3-54 Terminal block X22

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

3.7.3.6 X24 24 V terminal adapter

Table 3-55 Terminal block X24

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

3.7.3.7 Meaning of the LEDs on the Smart Line Module

Table 3-56 5 kW and 10 kW Smart Line Modules – description of the LEDs

LED	Color	Status	Description, cause	Remedy
READY	–	off	Electronics power supply is missing or outside permissible tolerance range.	–
	Green	Continuous	Component is ready to operate.	–
	Yellow	Continuous	Pre-charging not yet complete. Bypass relay dropped out EP terminals not supplied with 24 V DC.	–
	Red	Continuous	Overtemperature Overcurrent switch-off	Diagnose fault (via output terminals) and acknowledge it (via input terminal)
DC LINK	–	off	Electronics power supply is missing or outside permissible tolerance range.	–
	Yellow	Continuous	DC link voltage within permissible tolerance range.	–
	Red	Continuous	DC link voltage outside permissible tolerance range. Line supply fault.	Check the supply voltage.

3.7.4 Dimension drawing

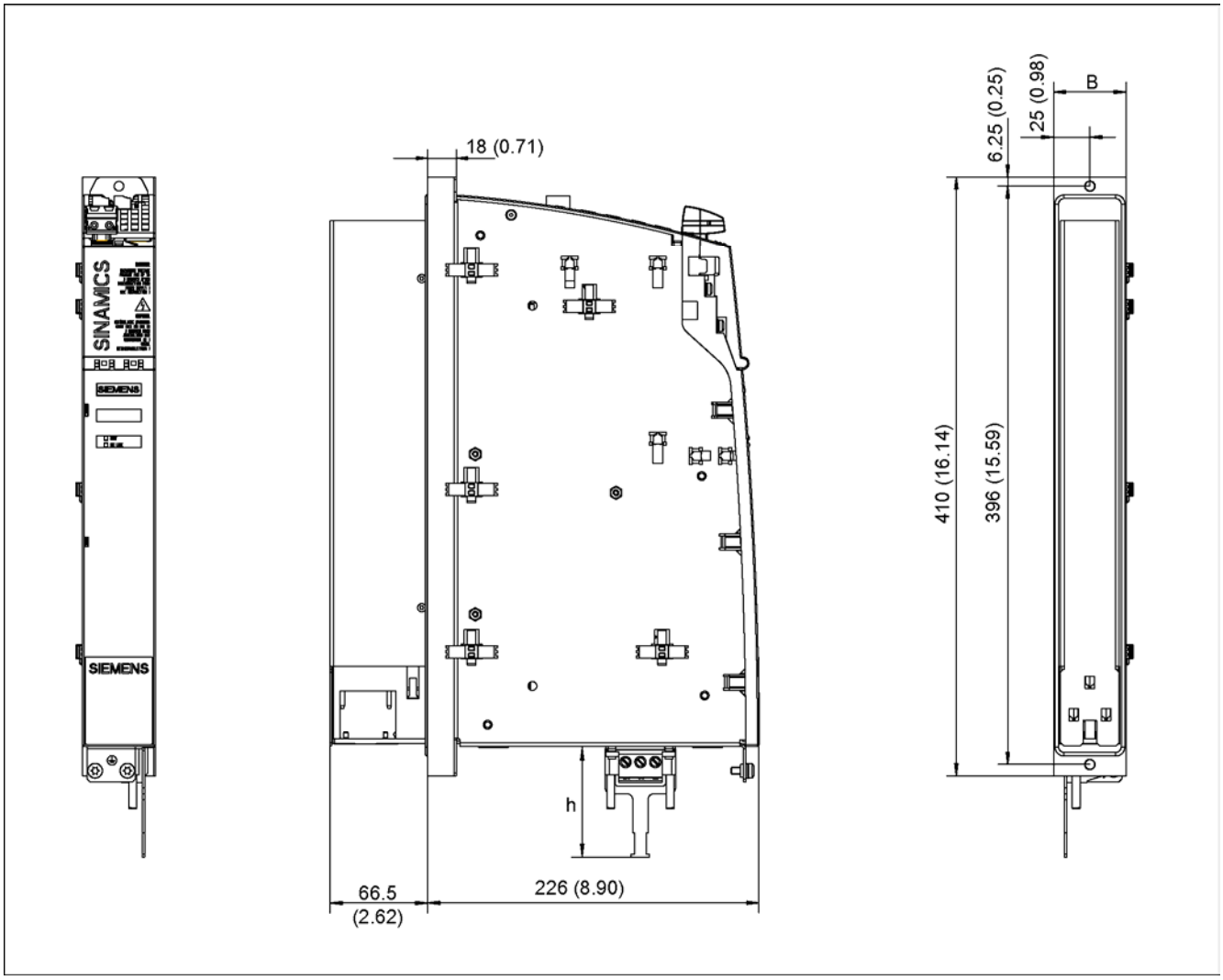


Figure 3-76 Dimension drawing of Smart Line Module (5 kW und 10 kW) with external air cooling

Table 3-57 Dimensions of Smart Line Module (5 kW and 10 kW) with external air cooling

Line module type	Order number	W [mm] (inches)	h [mm] (inches)
5 kW	6SL3131-6AE15-0AAx	50 (1.97)	75 (2.95)
10 kW	6SL3131-6AE21-0AAx	50 (1.97)	75 (2.95)

Note

The shield connecting plate is part of the scope of supply of the 50 mm Smart Line Module.

3.7.5 Installation

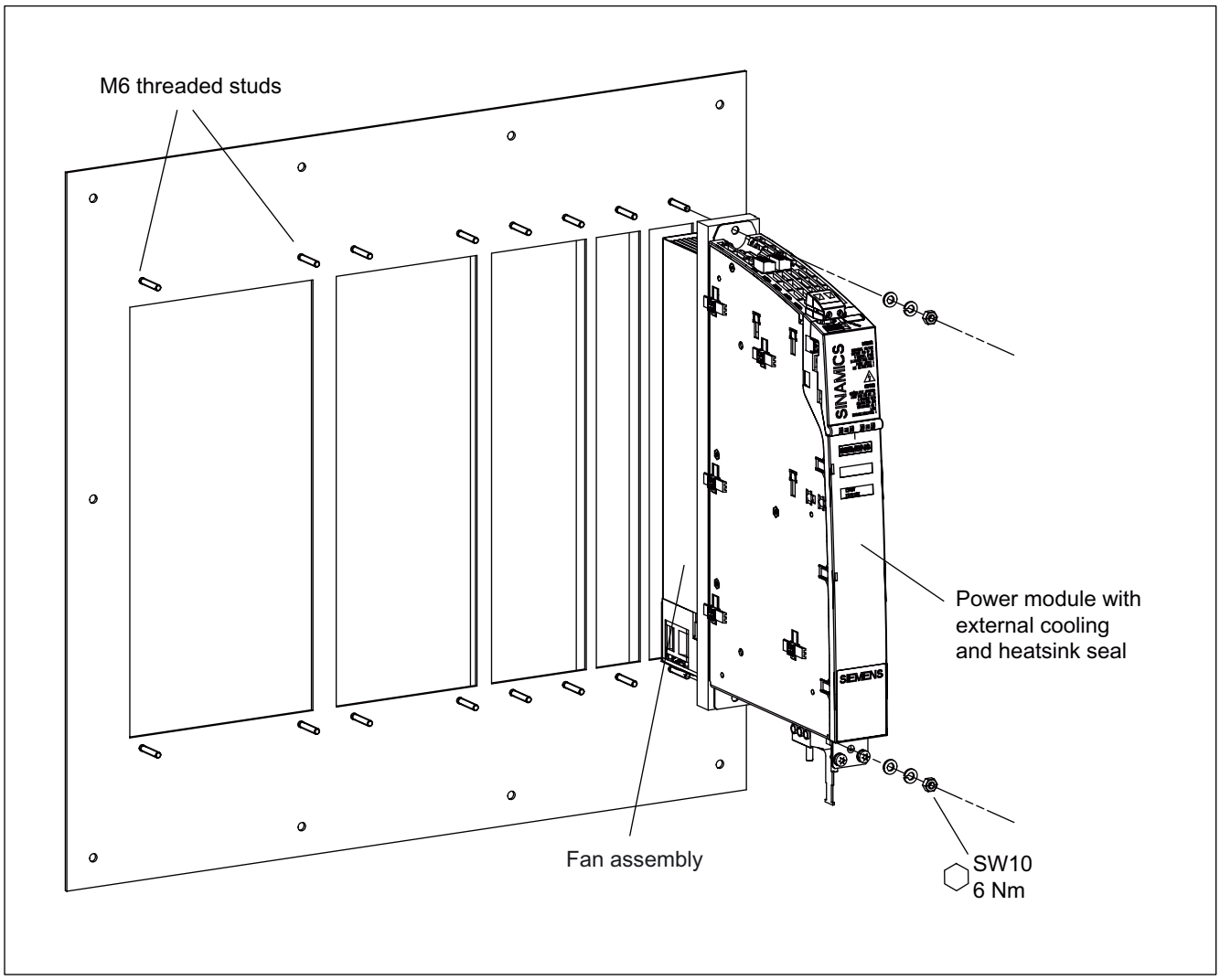


Figure 3-77 Example: Installing the Power Module with external air cooling

Help with the mechanical cabinet design is available from:

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

E-mail: cc.cabinetcooling@siemens.com

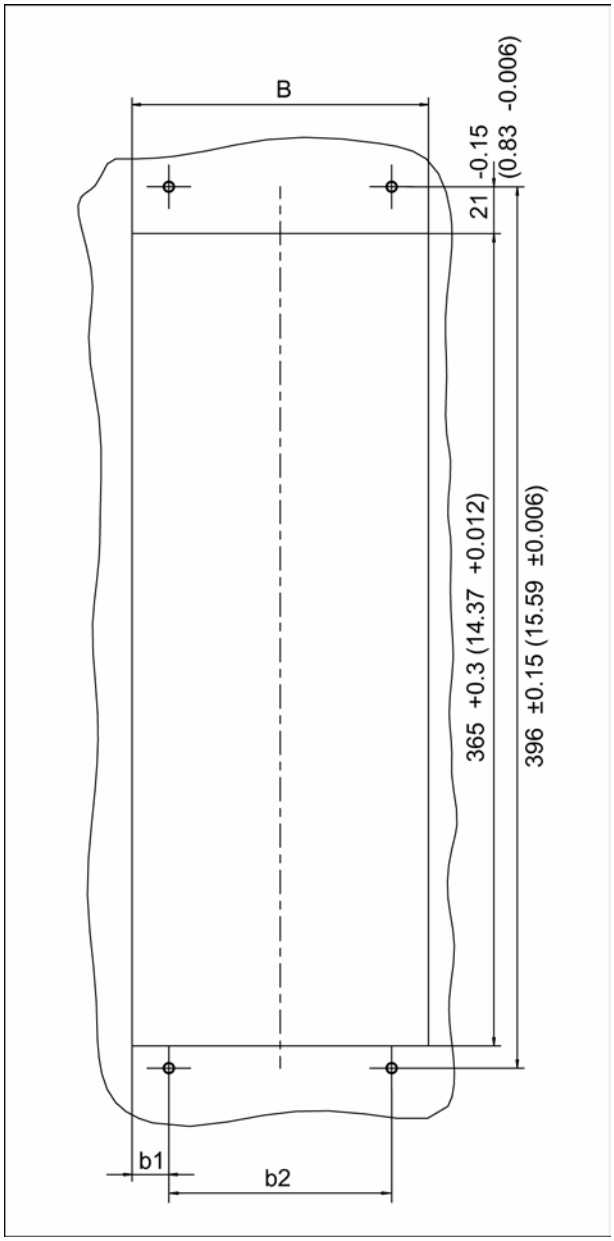


Figure 3-78 Installation openings for the Power Module with external air cooling (50 mm to 200 mm)

Table 3-58 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)

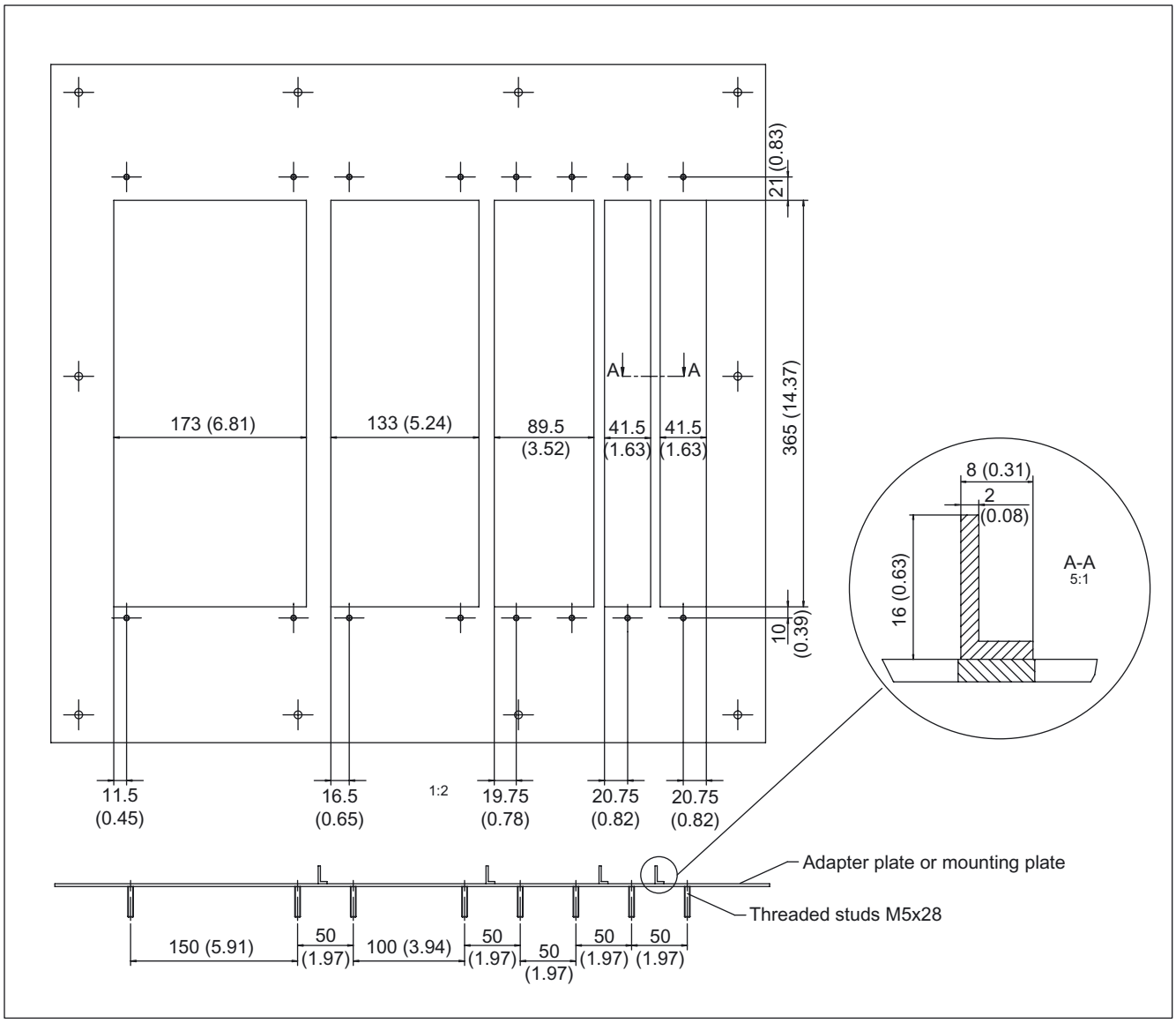


Figure 3-79 Example: Mounting plate with a drive line-up

During installation it must be ensured that the component's seal is tight throughout.

Note

A set of seals consisting of spare seals for 50 mm, 100 mm, 150 mm, 200 mm and 300 mm wide components can be ordered with order number: 6SL3162-5BU00-0AA0.

The cross-pieces must have the appropriate stability.

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.

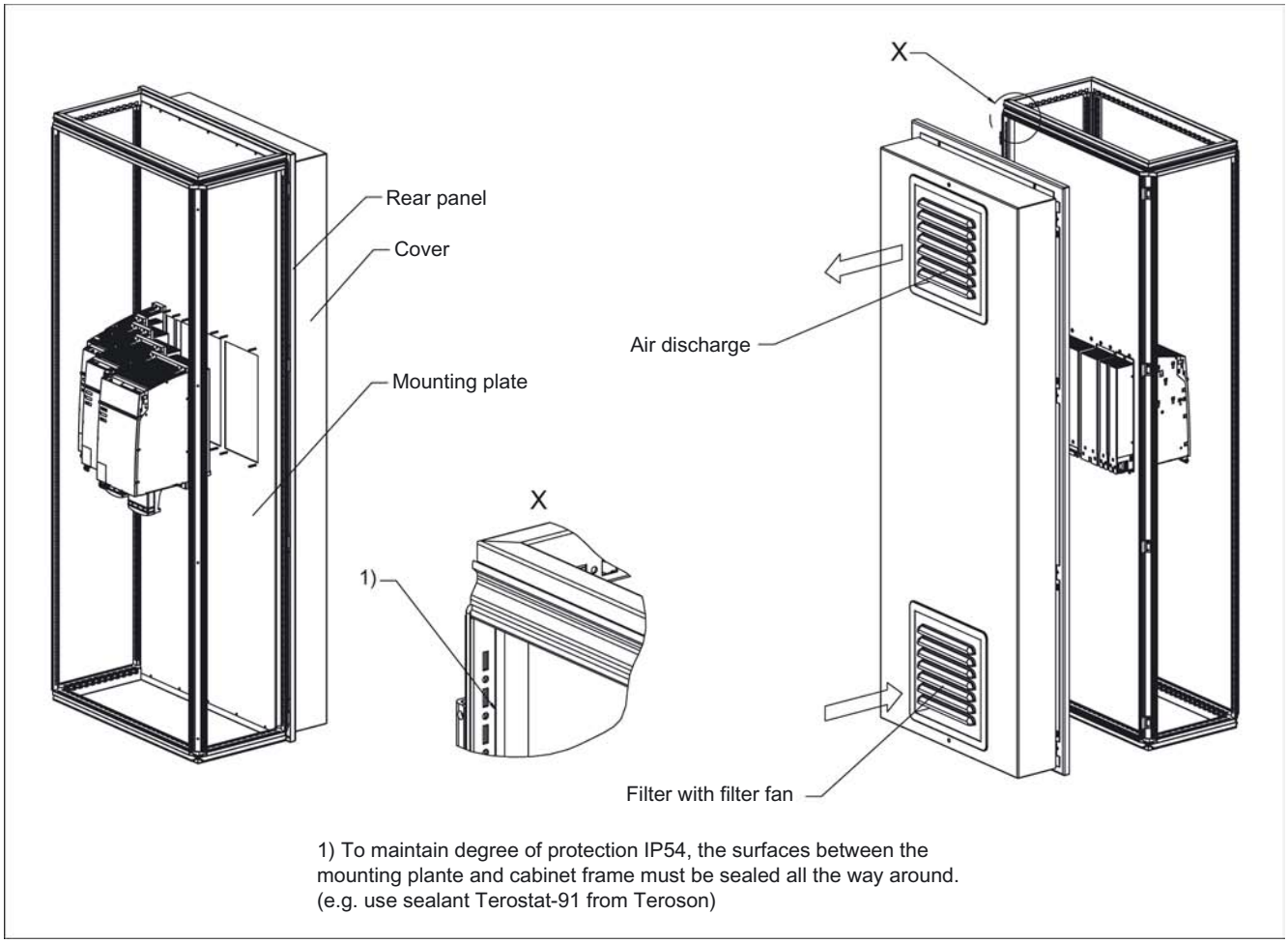


Figure 3-80 Example 1: Installation in cabinet with mounting plate

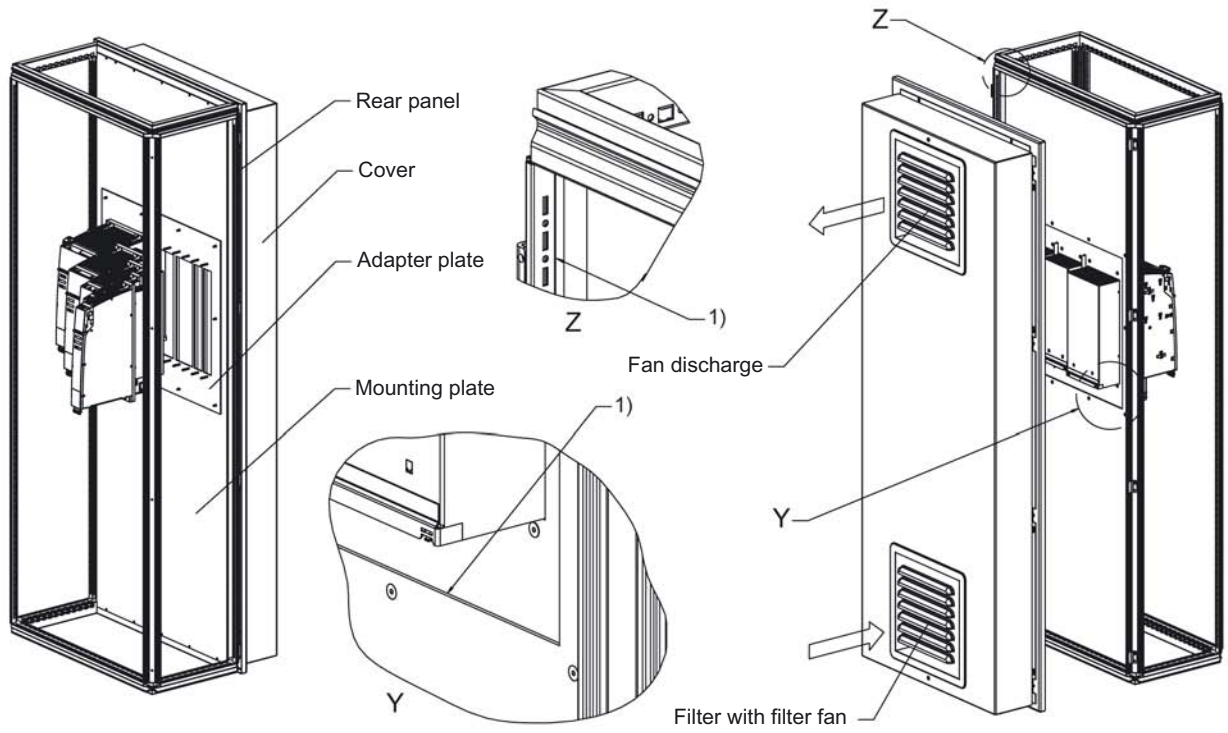


Figure 3-81 Example 2: Installation in cabinet with mounting plate

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.

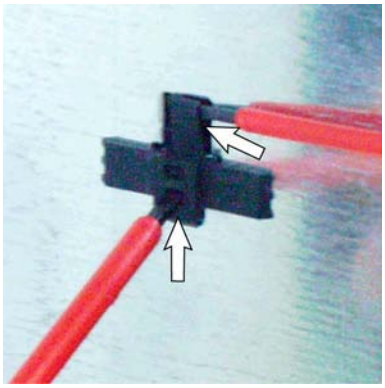
Note

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

3.7.6 Electrical connection

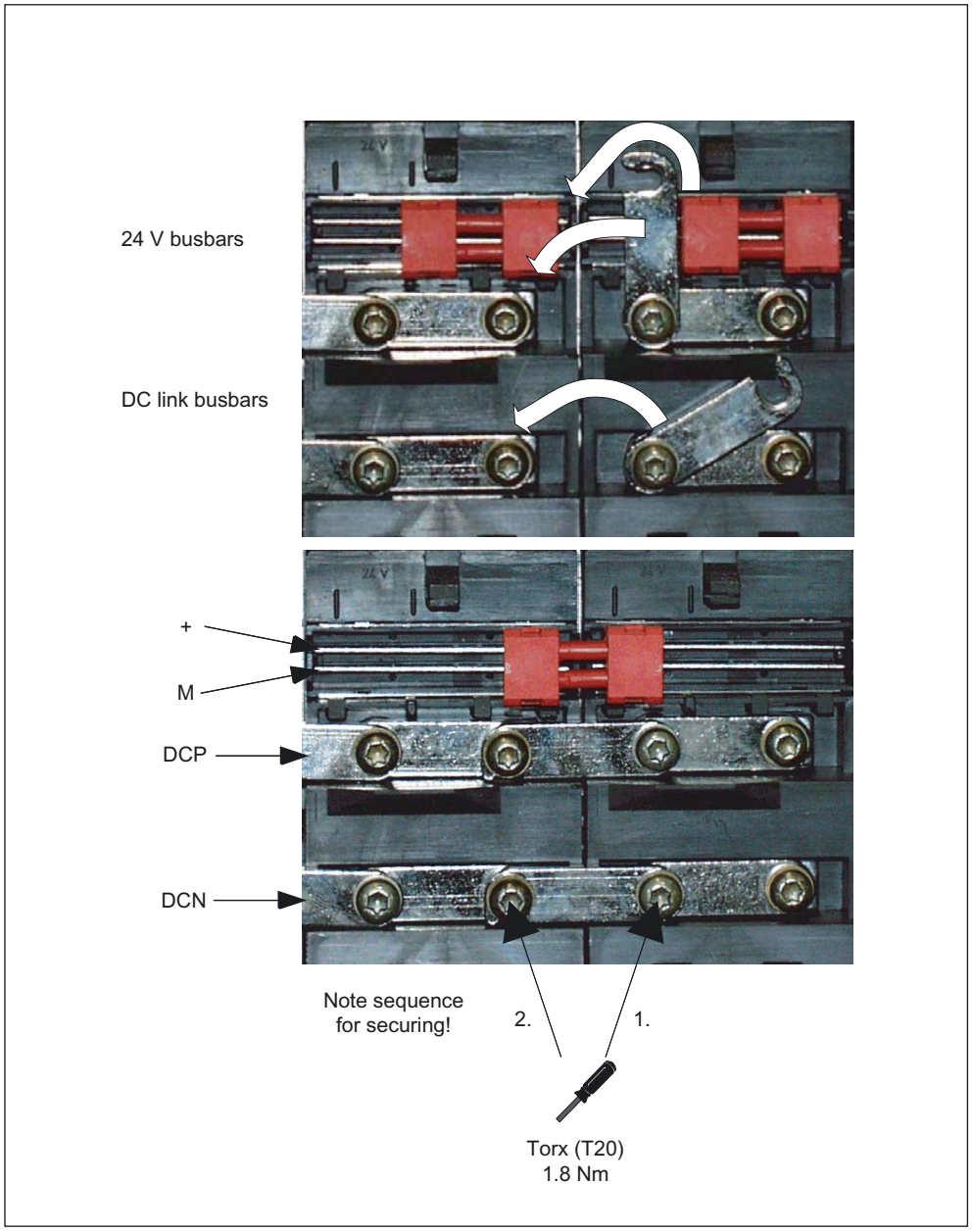


Figure 3-82 Busbar connections for booksize components

3.7.7 Technical data

Table 3-59 Technical data for Smart Line Modules in Booksize format with external air cooling

Internal air cooling	**6SL3131–**	**6AE15–0AAx**	**6AE21–0AAx**
Rated power	**kW**	**5**	**10**
Infeed:			
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
Line supply voltages:			
Line voltage	V_{AC}	380 V 3 AC -10 % (-15 % < 1 min) to 480 V 3 AC +10 %	
Line frequency	Hz	47 to 63	
Electronics power supply	V_{DC}	24 (20.4 - 28.8)	
DC link voltage	V_{DC}	510 – 720	
Overvoltage trip threshold	V_{DC}	820 ± 2 %	
Undervoltage trip threshold	V_{DC}	360 ± 2 %	
Rated input current:			
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
DC link current (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
Maximum permissible DC link capacitance	µF	6000	6000
Power factor	cos ϕ	0.98	0.98
Circuit-breaker type designation (status 06/2007)	3RV1031-	4BA10	4FA10
Rated current	A	14 ... 20	28 ... 40
Short-circuit current rating SCCR at 400 V_{AC}	kA	50	50
Circuit-breaker type designation (status 07/2007and later)	3RV1042-	4BA10	4FA10
Rated current	A	14 ... 20	28 ... 40
Short-circuit current rating SCCR at 400 V_{AC}	kA	100	100

Internal air cooling	6SL3131–	6AE15–0AAx	6AE21–0AAx
Rated power	kW	5	10
UL safety fuse type AJT Class J Rated current Short-circuit current rating SCCR at 600 V_{AC}	 A kA	AJT16 16 200	AJT35 35 200
Sound pressure level	dB(A)	< 60	< 60
Cooling air requirement	m^3/h	29.6	29.6
Rated voltage for rated data 380 V 3 AC			
Weight	kg	5.3	5.4

[1] The specified values apply to 380 V

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

Rated duty cycles of Smart Line Modules

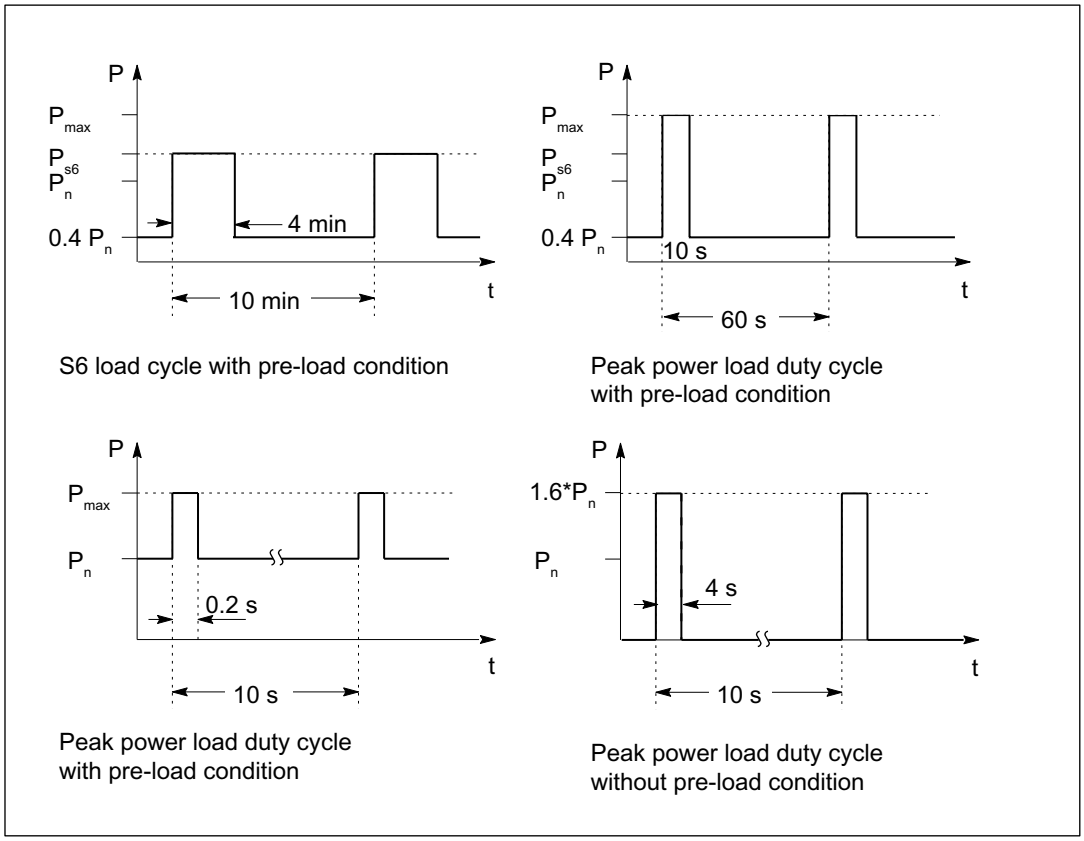


Figure 3-83 Rated duty cycles of Smart Line Modules

Derating as a function of the ambient temperature

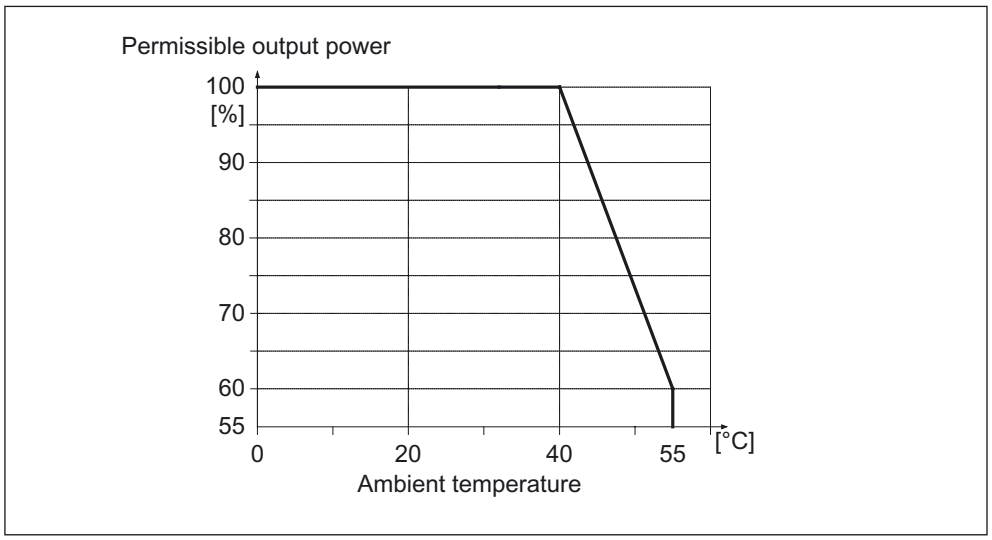


Figure 3-84 Derating as a function of the ambient temperature

Derating as a function of the installation altitude

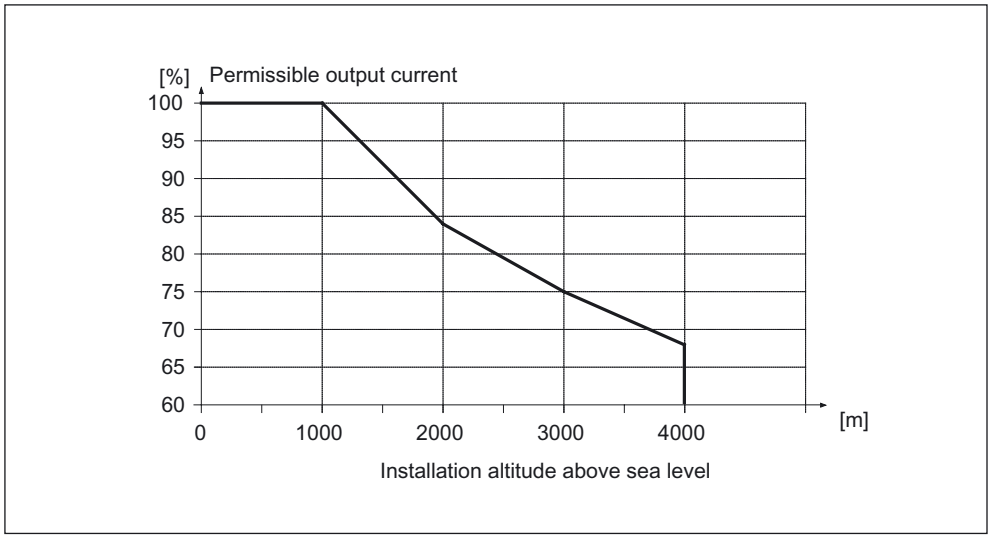


Figure 3-85 Derating as a function of the installation altitude

Voltage derating as a function of the installation altitude

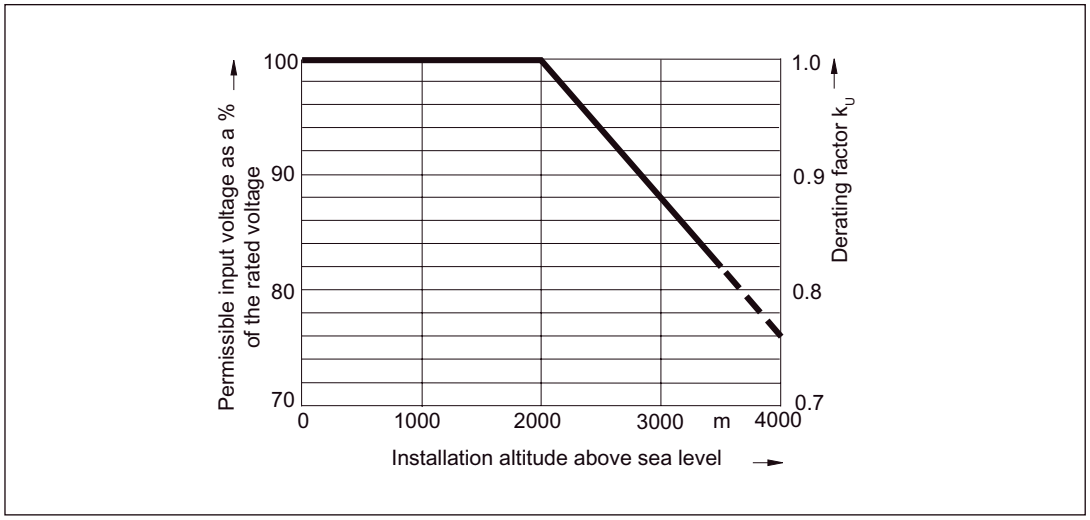


Figure 3-86 Voltage derating as a function of the installation altitude

Output power as a function of the total cable length

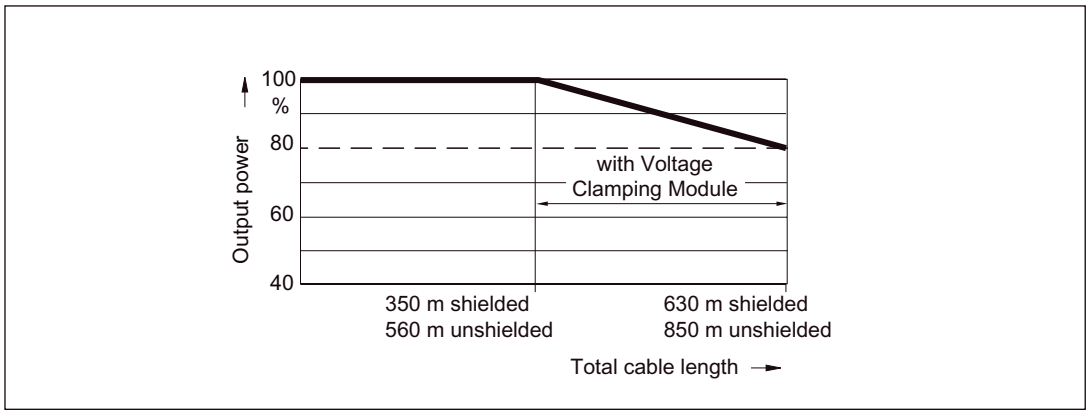


Figure 3-87 Output power as a function of the total cable length

4 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).

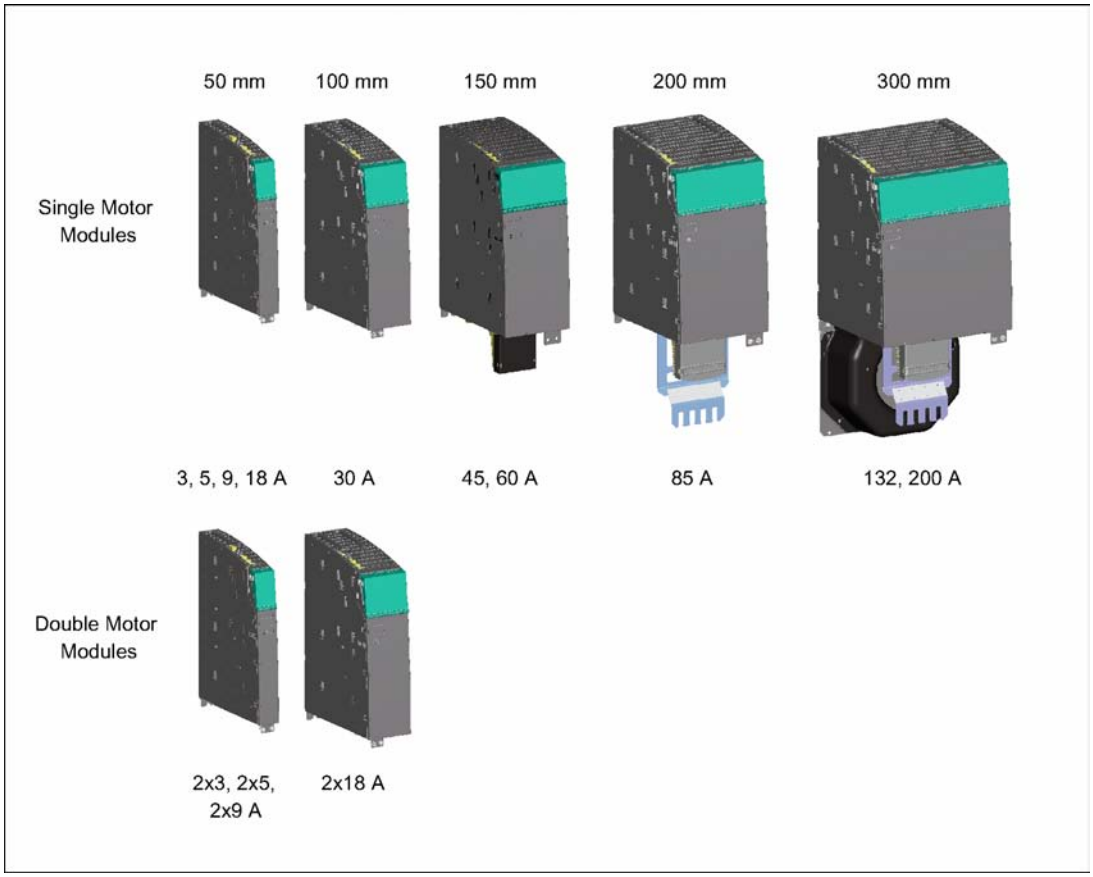


Figure 4-1 Overview of motor modules booksize (currents are continuous rms)

Characteristics of the motor modules:

- Single type from 3 A to 200 A
- Double type from 3 A to 18 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). Energy is supplied from the Infeed Module. A Motor Module must be connected to a Control Unit via DRIVE-CLiQ. The open-loop and closed-loop control functions for the Motor Module are stored in the Control Unit.

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

4.2.2 Safety information

⚠ DANGER

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

⚠ WARNING

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

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

⚠ DANGER

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 control cabinet is required.

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

⚠ DANGER

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

⚠WARNING

The 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.

⚠DANGER

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

CAUTION

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

⚠DANGER

If a 50 mm wide Motor Module or if a DC link component with the appropriate width (e.g. Braking Module, Control Supply Module, Voltage Clamping Module) is located at the left-hand end of the drive line-up, the DC link bridge (including the screws) must be removed. The screws must not be inserted without a DC link bridge.

For all other power units and DC link components (e.g. Capacitor Module) that are wider than 50 mm, it is neither permissible to move the DC link bridge to the left nor remove it.

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

⚠WARNING

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

Non-observance can cause lethal shock voltages.

⚠DANGER

It is essential to apply the shield for the motor holding brake. Furthermore, only Motion-Connect cables must be used for integrated motor holding brakes, as otherwise insulation of the wires is not guaranteed. Risk of electric shock.

CAUTION

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

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

Note

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

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

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

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

4.2.3 Interface description

4.2.3.1 Overview

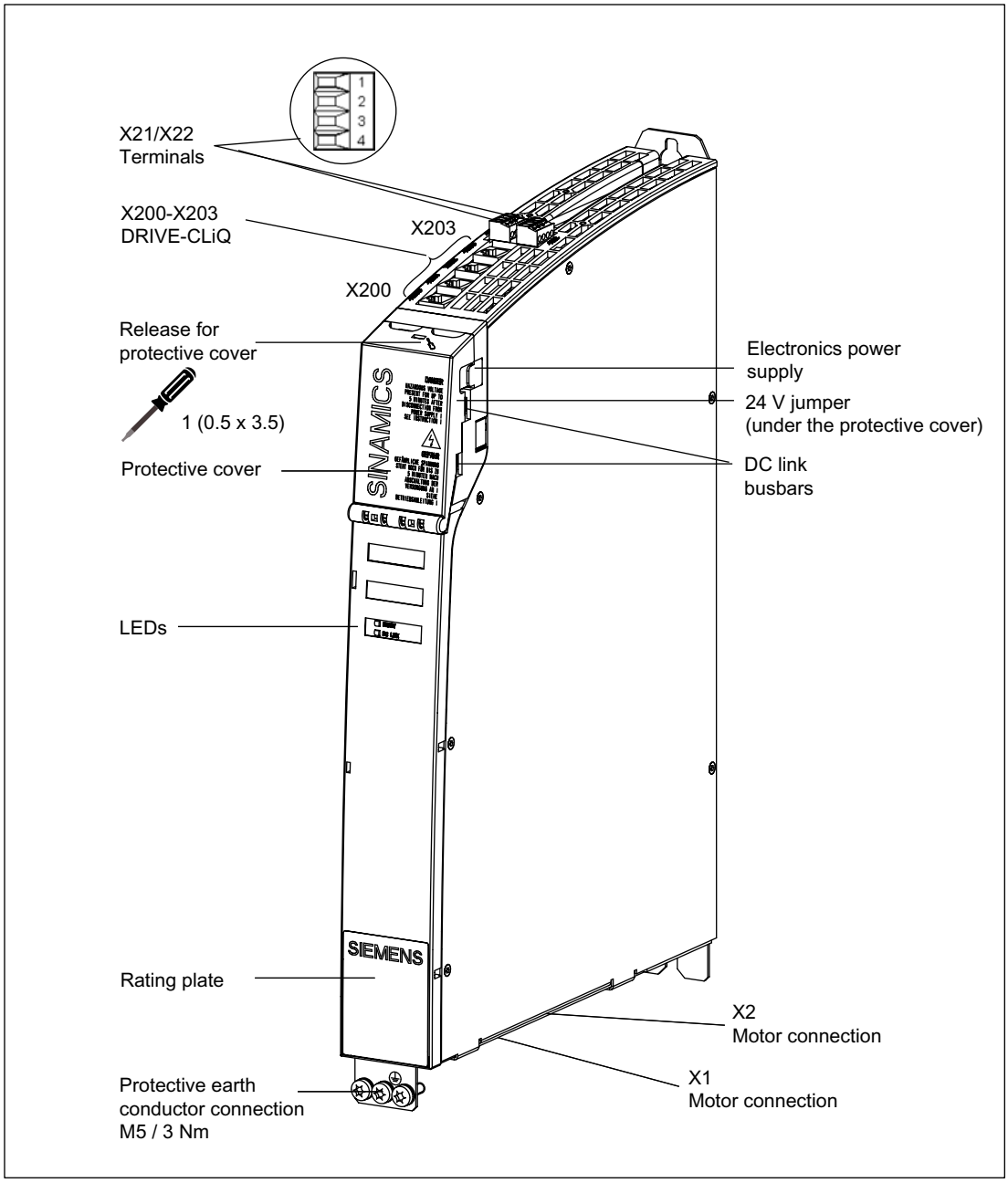
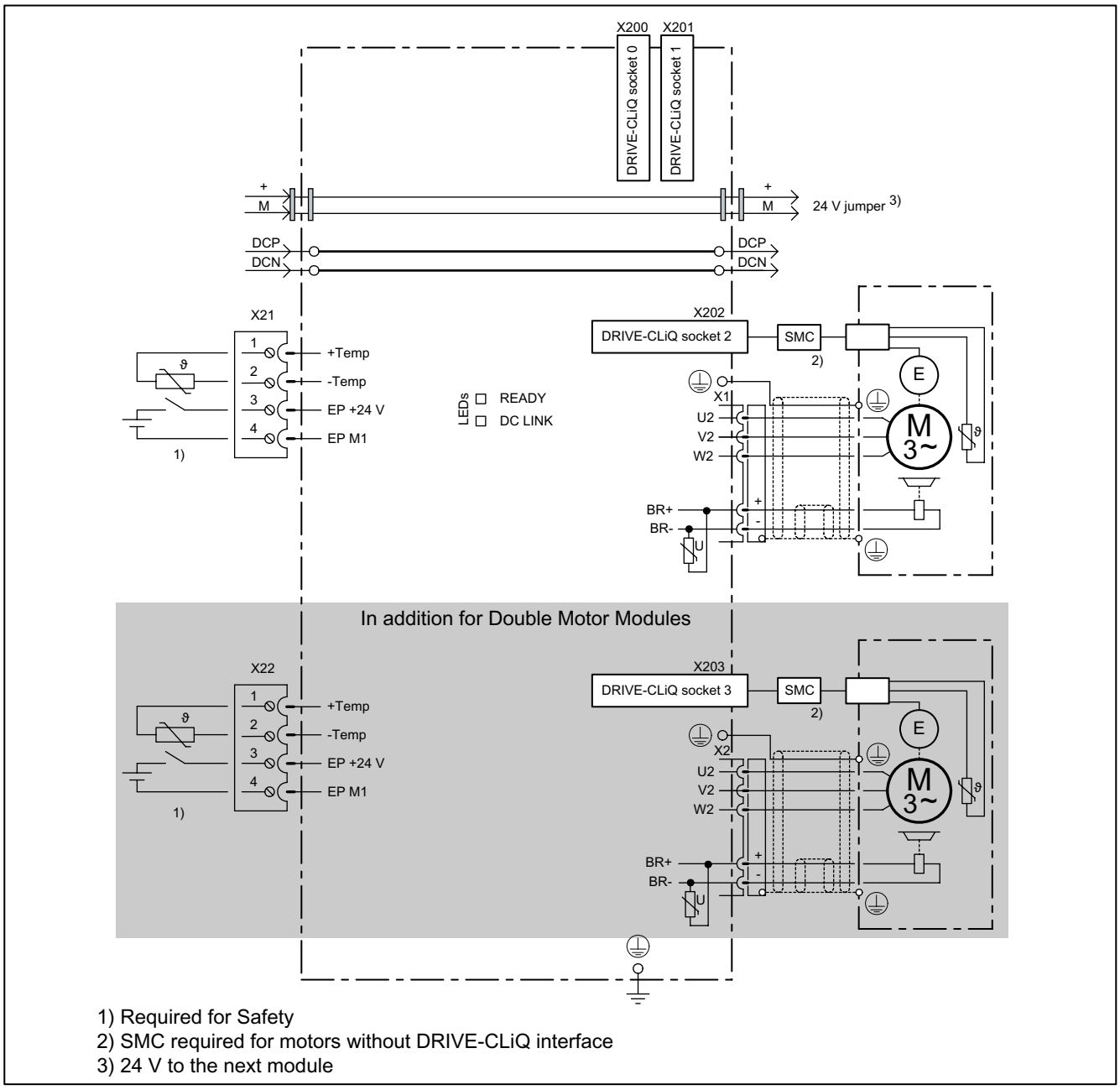


Figure 4-2 Example: Double Motor Module Booksize format with internal air cooling (2 x 3 A)

4.2.3.2 Connection examples



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

Figure 4-3 Connection example of Motor Modules 3 A to 30 A and Double Motor Modules 3 A to 18 A

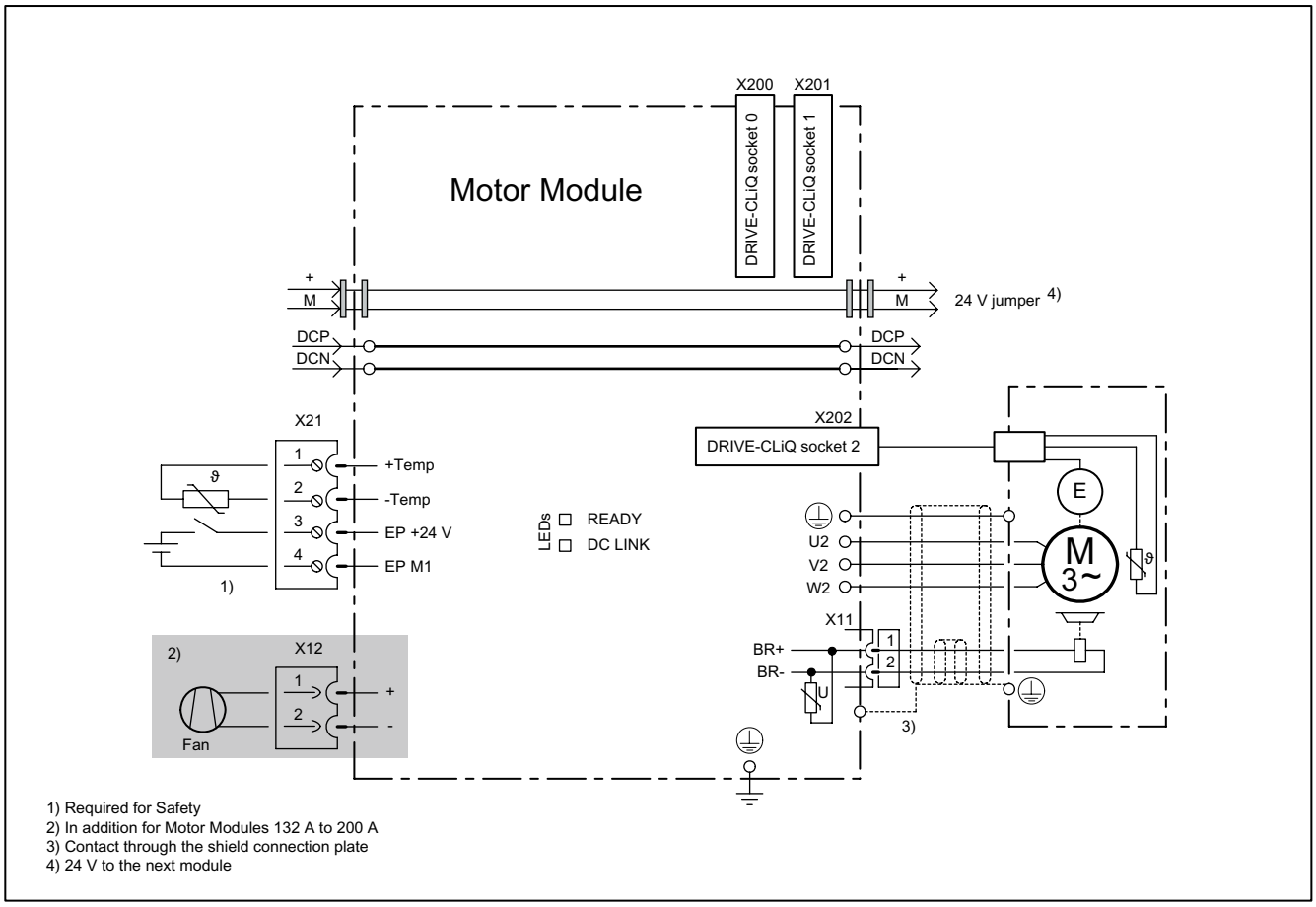
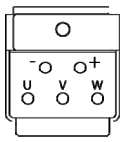
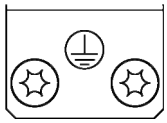


Figure 4-4 Example connection of Single Motor Modules 45 A to 200 A

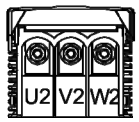
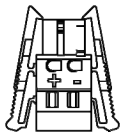
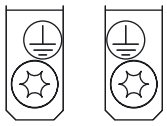
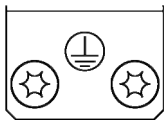
4.2.3.3 Motor/brake connection

Table 4-1 Terminal block X1/X2 Motor Modules 3 A to 30 A and Double Motor Modules 3 A to 18 A

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

[1] for ring cable lugs to DIN 46234

Table 4-2 Terminal block Single Motor Module 45 A to 200 A

	Terminals	Technical specifications
	U2 V2 W2	**45 A to 60 A:** Threaded bolt M6/6 Nm [1] **85 A:** Threaded bolt M8/13 Nm [1] **132 A to 200 A:** Threaded bolt M8/13 Nm [1]
	+ (BR+) - (BR-)	X11 brake connector [2]: Voltage 24 V DC Max. load current 2 A Min. load current 0.1 A Max. connectable cross-section 2.5 mm² Type: Spring-loaded terminal 2 (see Connection systems) Manufacturer: Wago; Order No.: 721-102/026-000/56-000 The brake connector is part of the prefabricated cable.
	PE connection	**Single Motor Module with a rated output current of 45 A to 60:** Threaded bolt for motor cables: M6/6 Nm [1] Threaded hole for PE: M6/6 Nm[1]
		**Single Motor Module with a rated output current of 85 A** Threaded bolt for motor cables: M8/13 Nm [1] Threaded hole for PE: M6/6 Nm[1] **Single Motor Module with a rated output current of 132 A to 200 A** Threaded bolt for motor cables: M8/13 Nm [1] Threaded hole for PE: M8/13 Nm [1]

[1] For ring cable lugs to DIN 46234

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

Note

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

Note

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

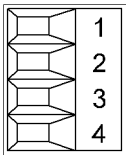
⚠ WARNING

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

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

4.2.3.4 X21/X22 EP terminals / temperature sensor connection Motor Module

Table 4-3 Terminal block X21/X22

	Terminal	Function	Technical data
	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 Optically 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 systems)			

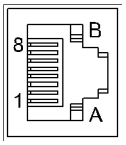
NOTICE
The KTY temperature sensor must be connected with the correct polarity.

Note

The temperature sensor connection is required for motors for which the temperature value is not transferred using DRIVE-CLiQ.
If the "Safe standstill" function is selected, for operation, ground must be placed at the -X21:3 24 V DC and the -X21:4 terminal. Upon removal, pulse suppression 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)	Electronics ground
Blanking plate for DRIVE-CLiQ interface: Yamaichi, order no.: Y-ConAS-13			

4.2.3.6 Meaning of the LEDs on the Motor Module

Table 4-5 Single Motor Module / Double Motor Module / Power Module - description of the LEDs

Status		Description, cause	Remedy
Ready (H200)	**DC link (H201)**		
OFF	OFF	Electronics power supply is missing or outside permissible tolerance range.	–
Green	OFF	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.	–
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is present.	–
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is too high.	Check supply voltage
Orange	Orange	DRIVE-CLiQ communication is being established.	–
Red	–	At least one fault is present in this component. **Note:** The LED is activated regardless of whether the corresponding messages have been reconfigured.	Remedy and acknowledge fault
Green/red (0.5 Hz)	–	Firmware is being downloaded.	–
Green/red (2 Hz)	-	Firmware download is complete. Wait for POWER ON.	Carry out a POWER ON
Green/orange or Red/orange	–	Component detection via LED is activated (p0124). **Note:** Both options depend on the LED status when component recognition is activated via p0124 = 1.	–

⚠ DANGER

Hazardous DC link voltages may be present at any time regardless of the status of the "DC link" LED.
The warning information on the components must be carefully observed!

4.2.4 Dimension drawings

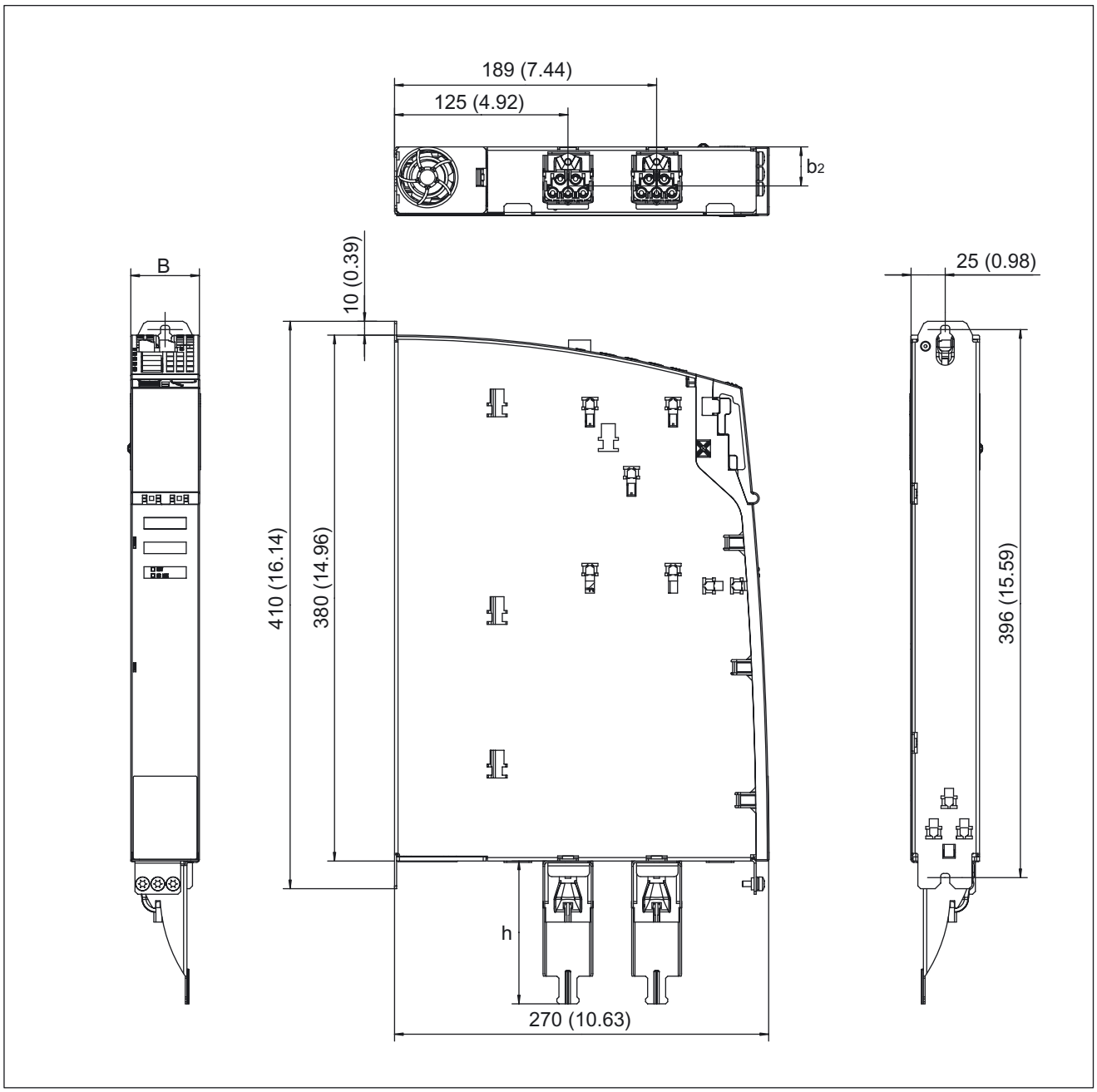


Figure 4-5 Dimension drawing: Dimensions of Motor Module Booksize format with internal air cooling 3 A to 18 A and 2 x 3 A to 2 x 9 A

Table 4-6 Dimensions: Dimensions of Motor Module Booksize format with internal air cooling 3 A to 18 A and 2 x 3 A to 2 x 9 A

Motor Module type	Order number	W [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			
Single Motor Module 9 A	6SL3120-1TE21-0AAx			
Single Motor Module 18 A	6SL3120-1TE21-8AAx			
Double Motor Module 3 A	6SL3120-2TE13-0AAx			
Double Motor Module 5 A	6SL3120-2TE15-0AAx			
Double Motor Module 9 A	6SL3120-2TE21-0AAx			

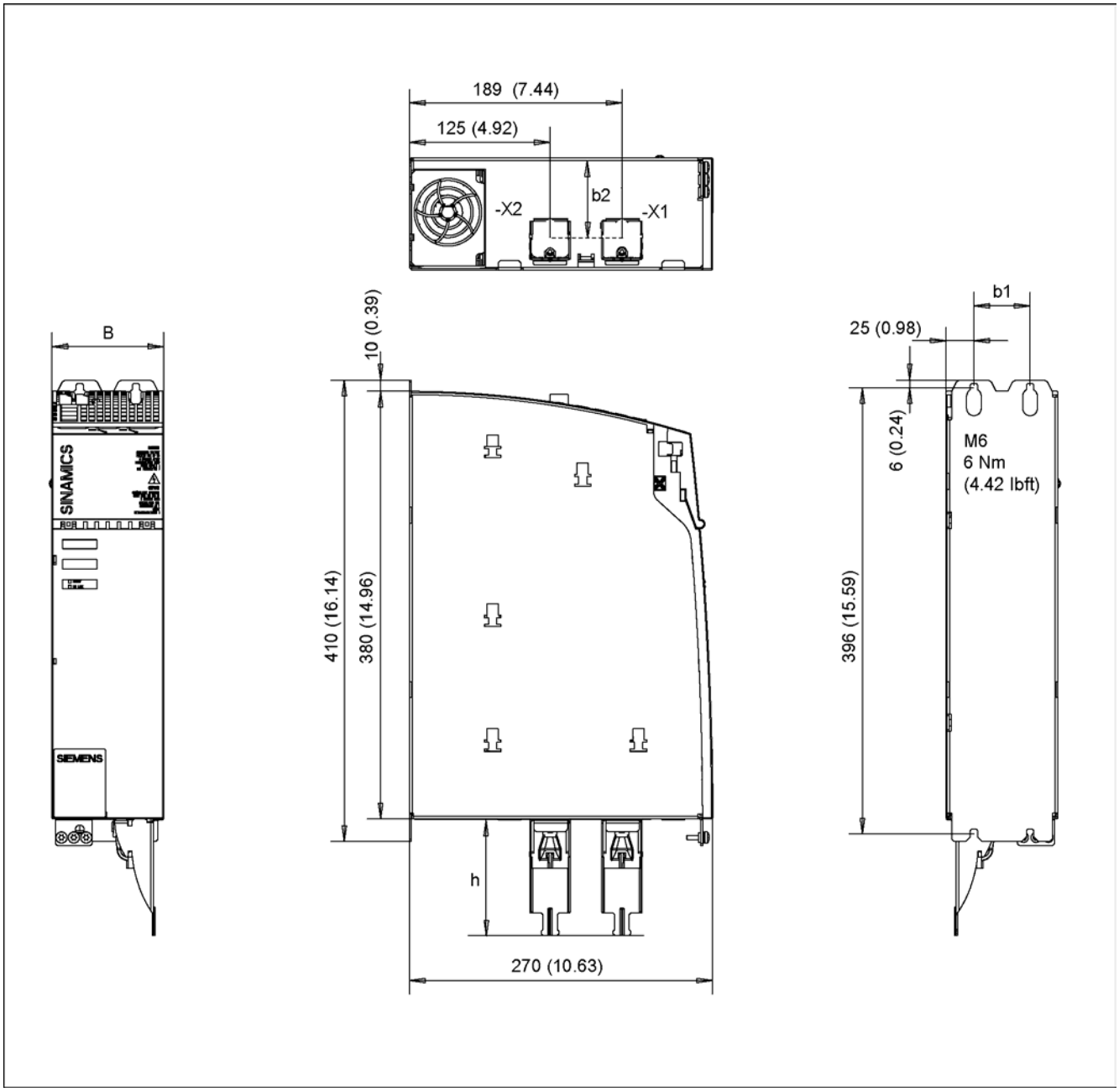


Figure 4-6 Dimension drawing: Motor Module Booksize format with internal air cooling 30 A and 2 x 18 A

Table 4-7 Dimensions: Motor Module Booksize format with internal air cooling 30 A and 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 30 A	6SL3120-1TE23-0AAx	100 (3.94)	50 (1.97)	78 (3.07)	89 (3.50)
Double Motor Module 18 A	6SL3120-2TE21-8AAx				

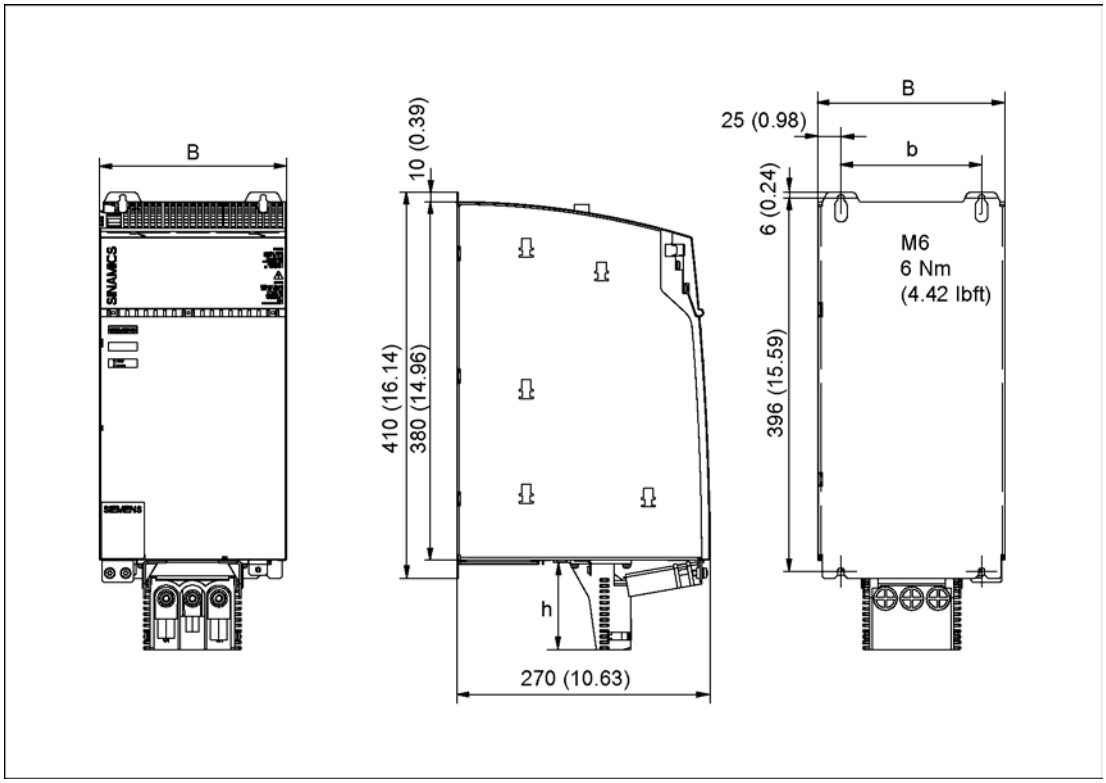


Figure 4-7 Dimension drawing: Motor Module Booksize format with internal air cooling (45 A to 85 A)

Table 4-8 Dimensions: Motor Module Booksize format with internal air cooling (45 A to 85 A)

Motor Module type	Order number	W [mm] (inches)	b [mm] (inches)	h [mm] (inches)
Single Motor Module 45 A	6SL3120-1TE24-5AAx	150 (5.91)	100 (3.94)	105 (4.13)
Single Motor Module 60 A	6SL3120-1TE26-0AAx			
Single Motor Module 85 A	6SL3120-1TE28-5AAx	200 (7.87)	150 (5.91)	105 (4.13)

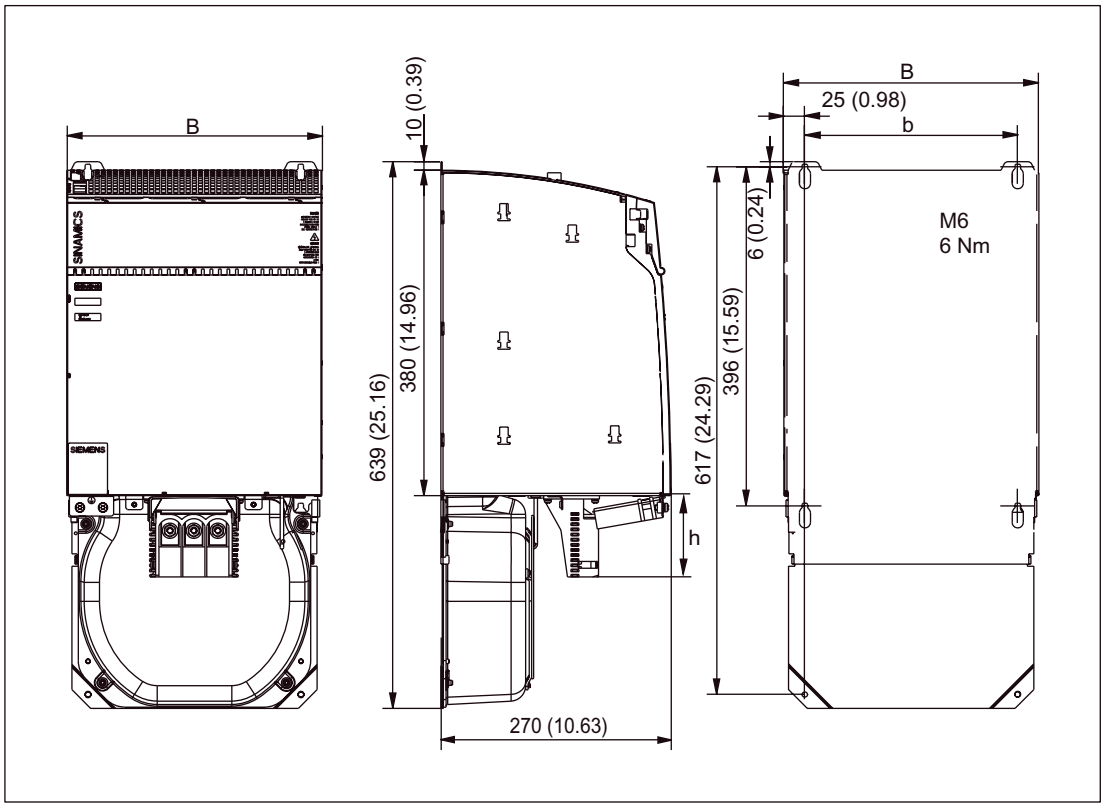


Figure 4-8 Dimension drawing: Motor Module Booksize format with internal air cooling (132 A to 200 A)

Table 4-9 Dimensions: Motor Module Booksize format with internal air cooling (132 A to 200 A)

Motor Module type	Order number	W [mm] (inches)	b [mm] (inches)	h [mm] (inches)
Single Motor Module 132 A	6SL3120-1TE31-3AAx	300 (11.81)	250 (9.84)	105 (4.13)
Single Motor Module 200 A	6SL3120-1TE32-0AAx			

4.2.5 Mounting

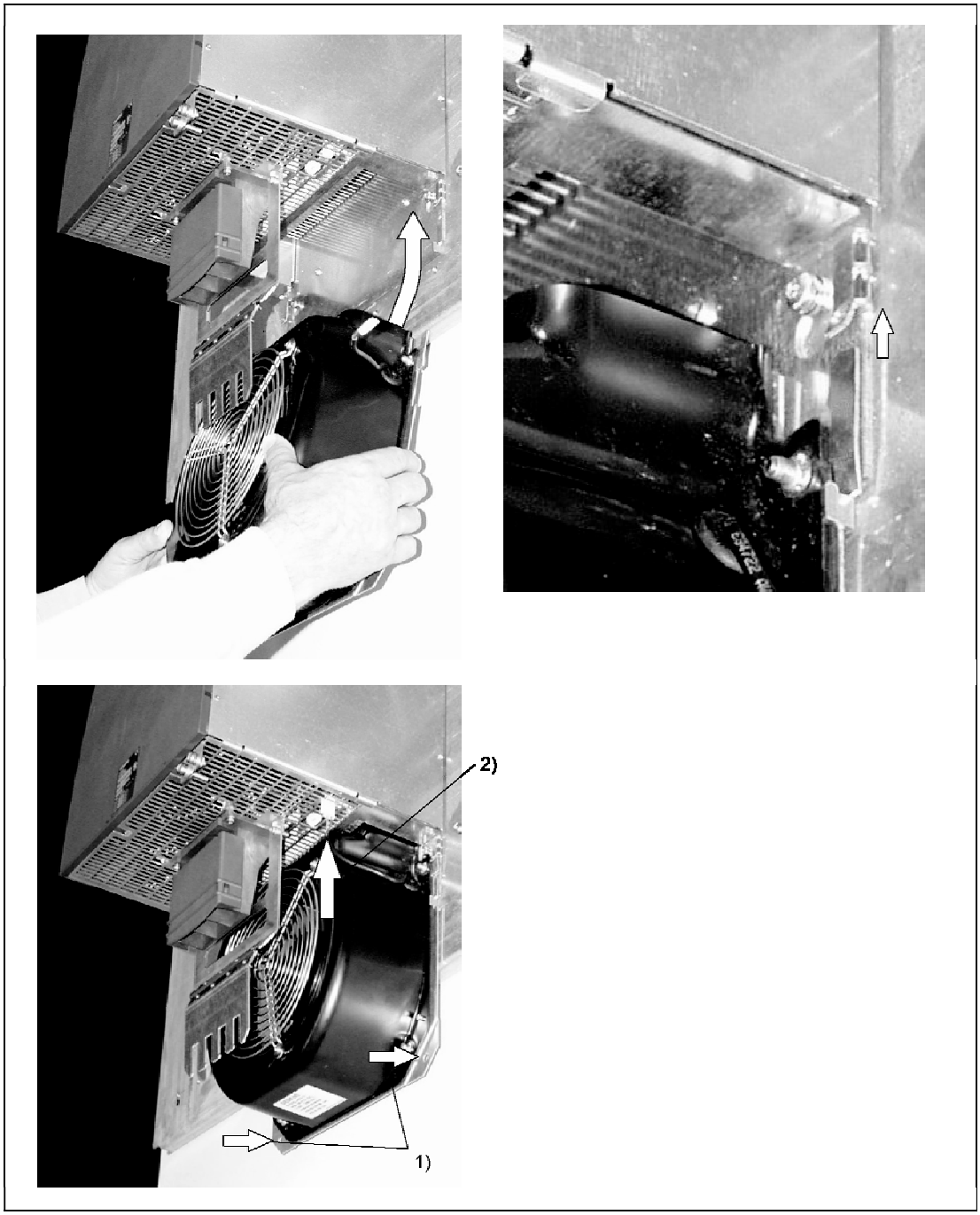


Figure 4-9 Installing the fan for 300 mm modules

1) Secure with M6 / 6 Nm screws

2) Connect the power supply for the fan

Note

The fans are power-up and power-down as a function of the heatsink temperature.

The fans start up at the heat-sink temperature specified in the power stack data (normally 56 °C) and are switched off with a slight hysteresis when the heat-sink temperature decreases again. The length of time it takes for the fans to stop once they have been switched off depends on a number of factors (ambient temperature, output current, duty cycle, etc.) and, therefore, cannot be determined directly.

The fans are not equipped with temperature-dependent speed control; they are either ON or OFF.

4.2.6 Electrical connection

Shield contact for the terminals

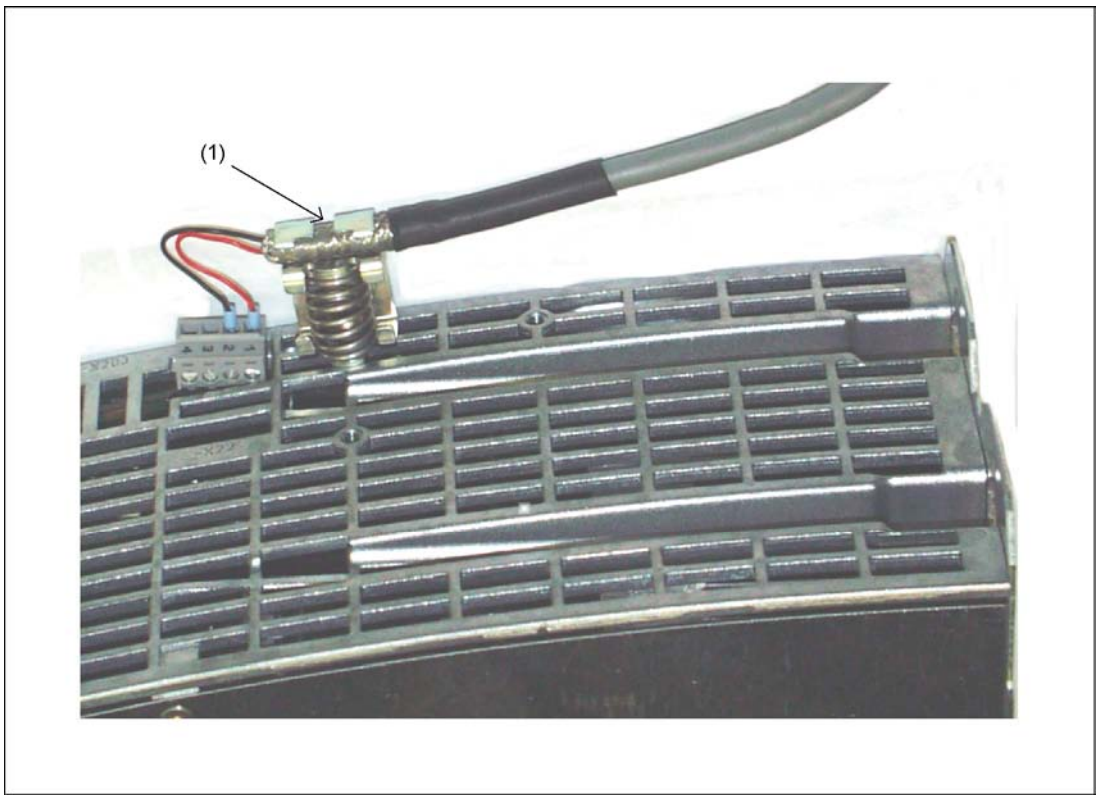


Figure 4-10 Shield contact for the terminals

(1) Shield connection: Weidmüller, Order No. KLBÜ 3-8 SC

Internet address:

Weidmüller: http://www.weidmueller.com

NOTICE
Only use screws with a permissible mounting depth of 4 - 6 mm.

4.2.7 Technical data

Table 4-10 Technical data for Booksize Single Motor Modules (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						
Infeed: DC link voltage Electronics power supply	 V_{DC} V_{DC}	 510 – 720 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
Sound pressure level	dB(A)	<60	<60	<60	<60	<60
Cooling type		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	5	5	5	6.9

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

Table 4-11 Technical data 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						
Infeed: DC link voltage Electronics power supply	 V_{DC} V_{DC}	 510 – 720 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}	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}	200	200	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 cycle 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
Sound pressure level	dB(A)	<65	<65	<60	<73	<73
Cooling method (with fan)		Internal fan	Internal fan	Internal fan	Mounted fan	Mounted fan
Cooling air requirement	m^3/h	112	112	160	520	520
Weight	kg	9	9	15	21	21

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

Table 4-12 Technical data for Double Motor Modules booksize (3 to 18A)

Internal air cooling	6SL3120-	2TE13-0AAx	2TE15-0AAx	2TE21-0AAx	2TE21-8AAx
Rated current	A	2x3	2x5	2x9	2x18
Voltage					
Infeed: DC link voltage Electronics power supply	 V_{DC} V_{DC}	 510 – 720 24 (20.4 - 28.8)			
Output voltage	V_{ACrms}	0 - 0.67 x DC link voltage			
Overvoltage tripping Undervoltage tripping	V_{DC} V_{DC}	820 ± 2 % 380 ± 2 %			
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 (600 V, 4 kHz)	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
Sound pressure level	dBA	<60	<60	<60	<60
Cooling type		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 chapter Cabinet Design

Rated duty cycles of Booksize Motor Modules

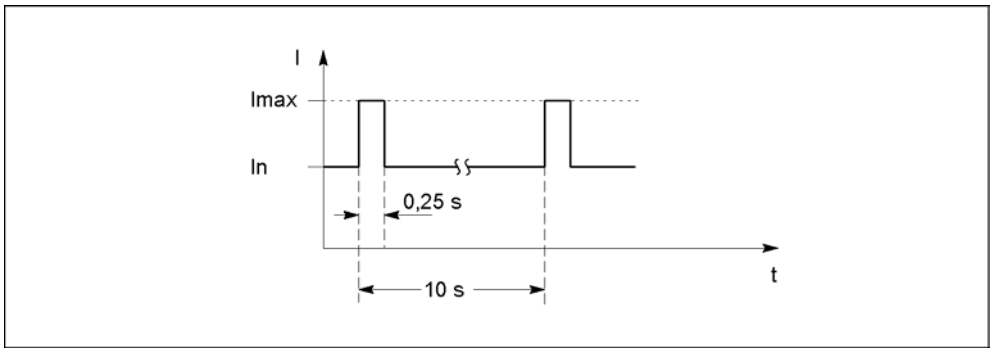


Figure 4-11 Peak current duty cycle with prior loading

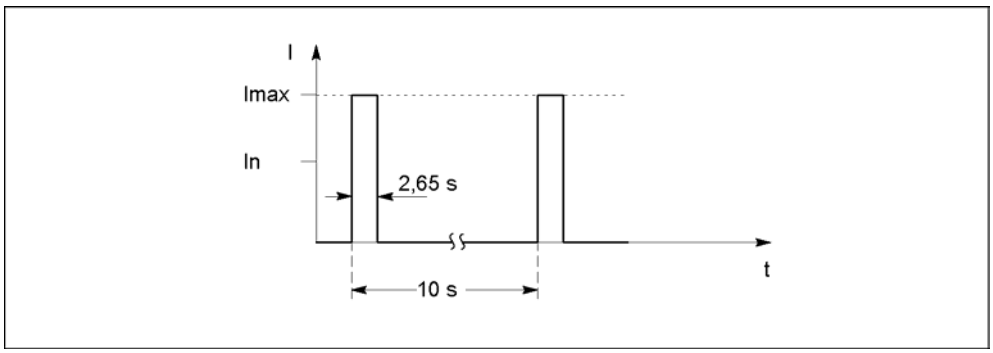


Figure 4-12 Peak current duty cycle without prior loading

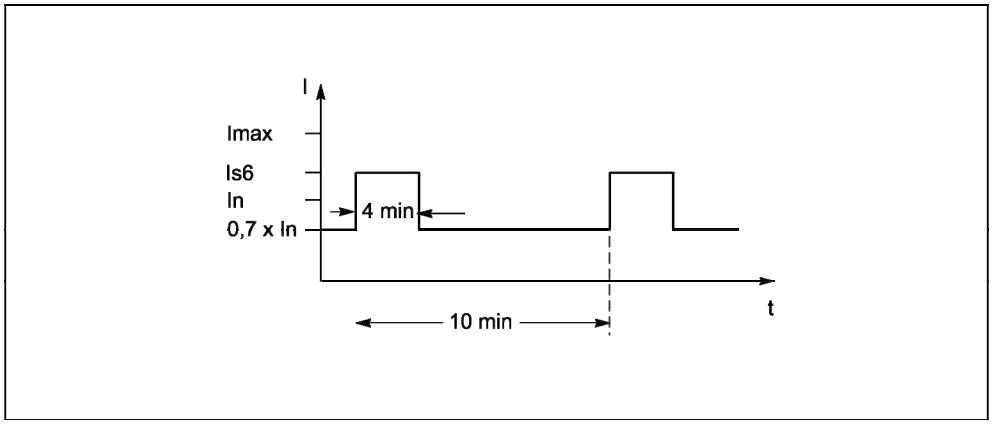


Figure 4-13 S6 current duty cycle with prior loading

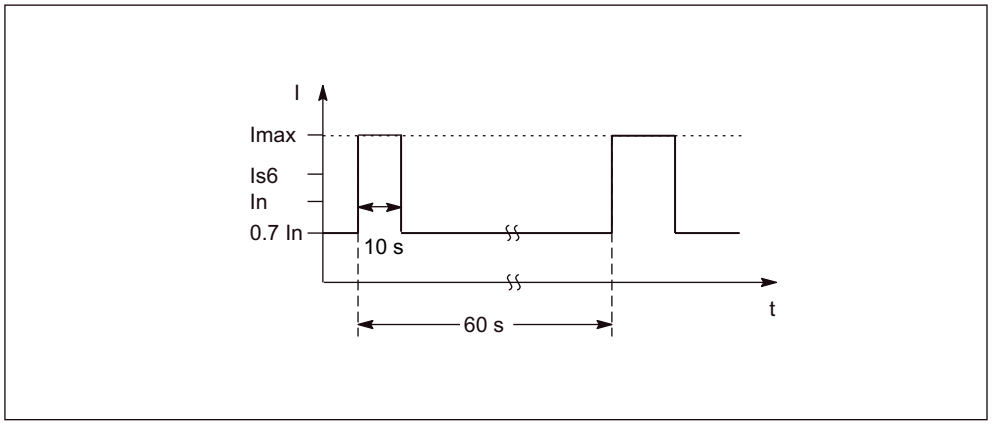


Figure 4-14 S6 peak current duty cycle with prior loading

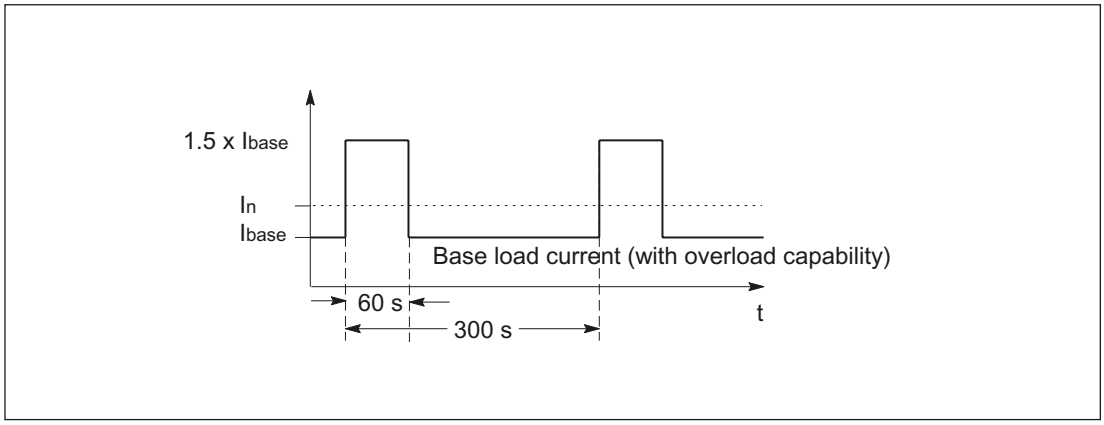


Figure 4-15 Current duty cycle with pre-loading

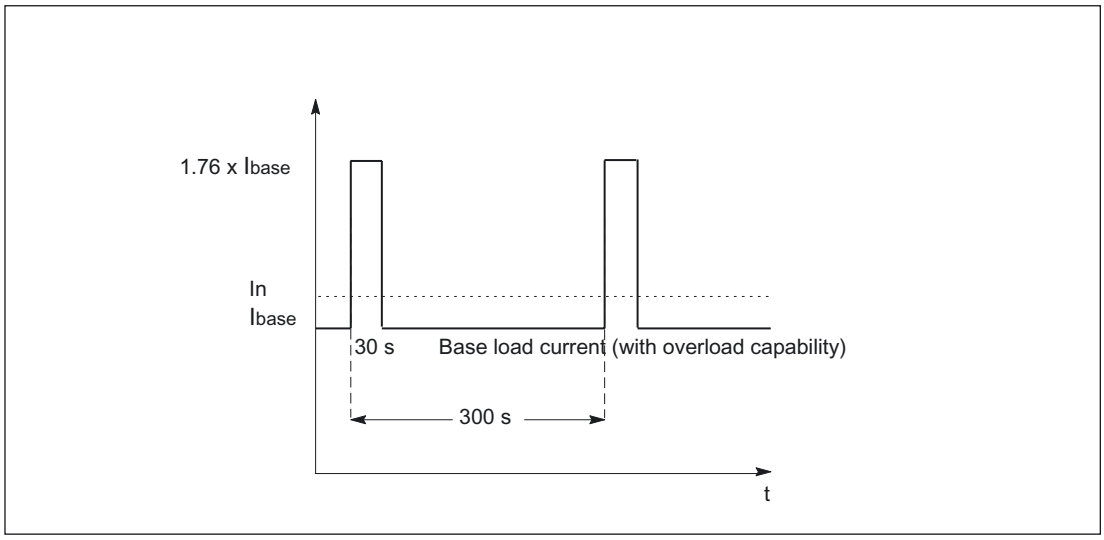


Figure 4-16 Current duty cycle with pre-loading

Derating as a function of the ambient temperature

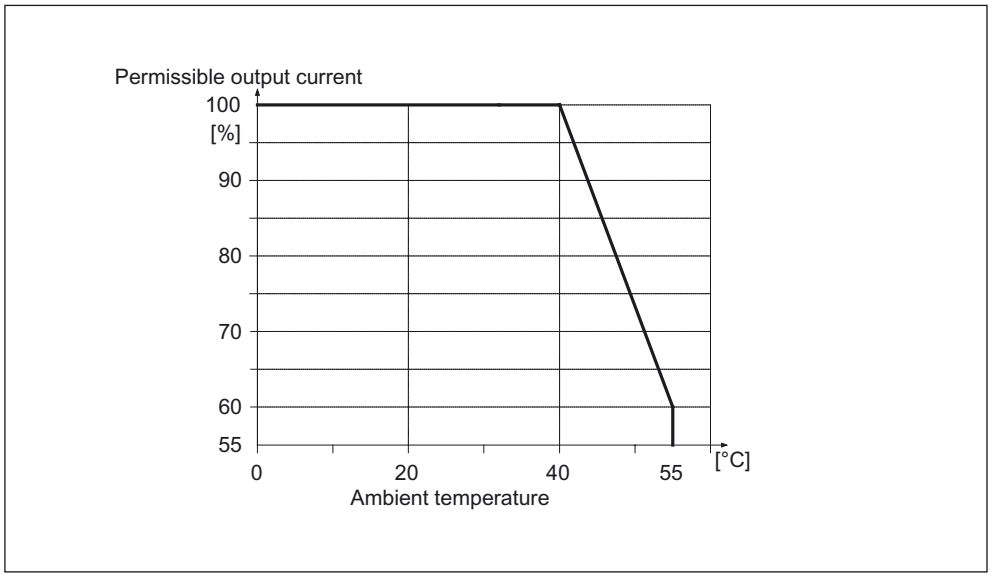


Figure 4-17 Derating as a function of the ambient temperature

Derating as a function of the pulse frequency

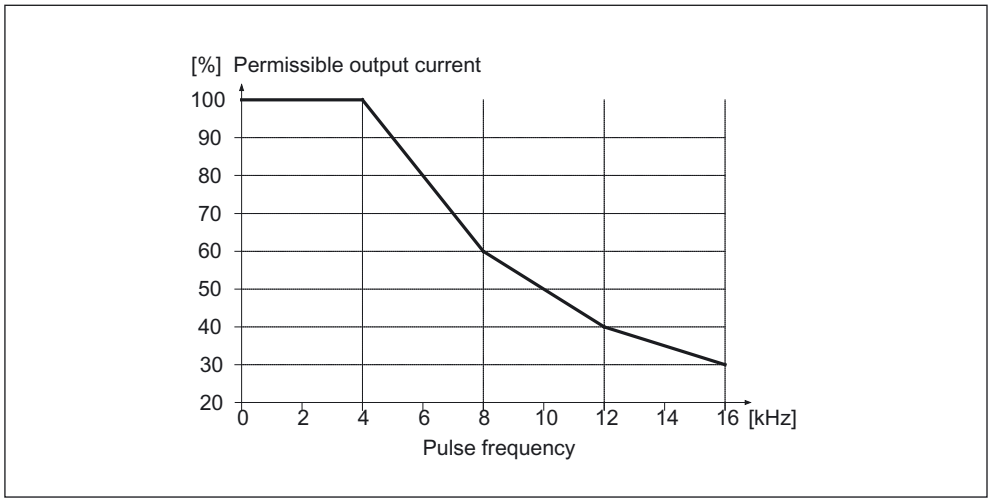


Figure 4-18 Derating as a function of the pulse frequency

Derating as a function of the installation altitude

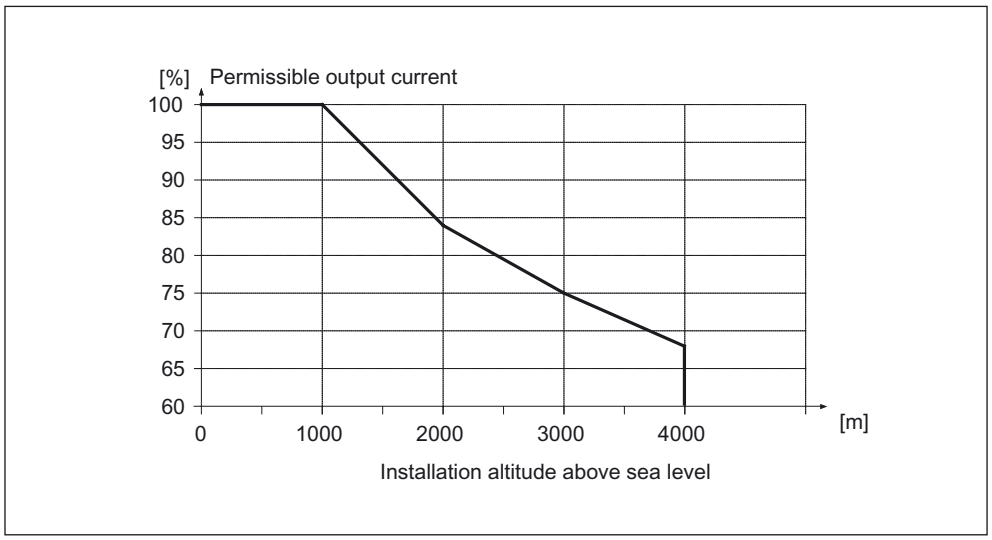


Figure 4-19 Derating as a function of the installation altitude

Voltage derating as a function of the installation altitude

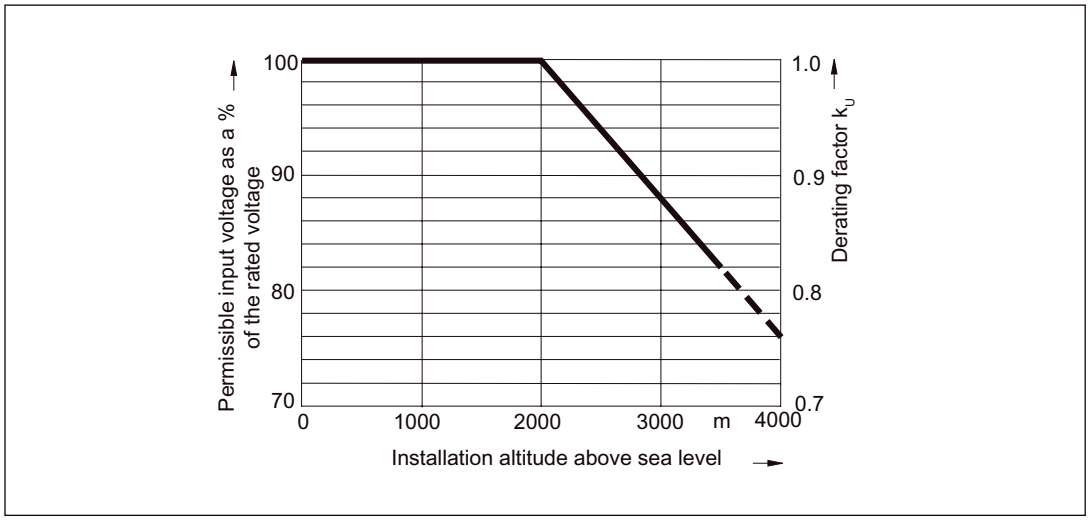


Figure 4-20 Voltage derating as a function of the installation altitude

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 control 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 control cabinet and the heat is dissipated outside the control cabinet or in a separate air duct.

4.3.2 Safety information

⚠ DANGER

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

⚠ WARNING

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

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

⚠ DANGER

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 control cabinet is required.

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

⚠ DANGER

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

⚠ WARNING

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

⚠ DANGER

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

CAUTION

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

⚠ DANGER

If a 50 mm wide Motor Module or if a DC link component with the appropriate width (e.g. Braking Module, Control Supply Module, Voltage Clamping Module) is located at the left-hand end of the drive line-up, the DC link bridge (including the screws) must be removed. The screws must not be inserted without a DC link bridge.

For all other power units and DC link components (e.g. Capacitor Module) that are wider than 50 mm, it is neither permissible to move the DC link bridge to the left nor remove it.

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

⚠WARNING

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

Non-observance can cause lethal shock voltages.

⚠DANGER

It is essential to apply the shield for the motor holding brake. Furthermore, only Motion-Connect cables must be used for integrated motor holding brakes, as otherwise insulation of the wires is not guaranteed. Risk of electric shock.

CAUTION

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

CAUTION

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

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

4.3.3 Interface description

4.3.3.1 Overview

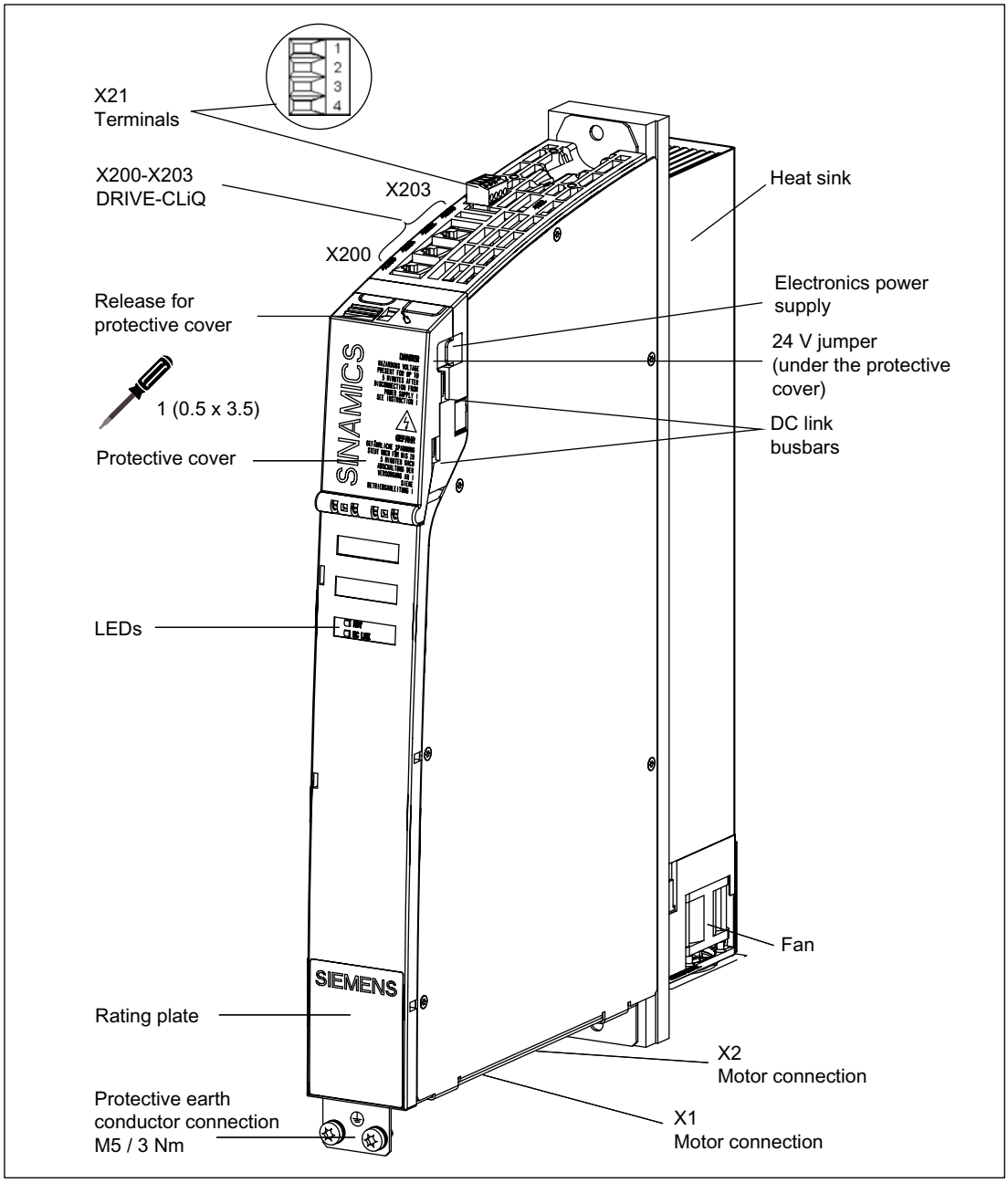
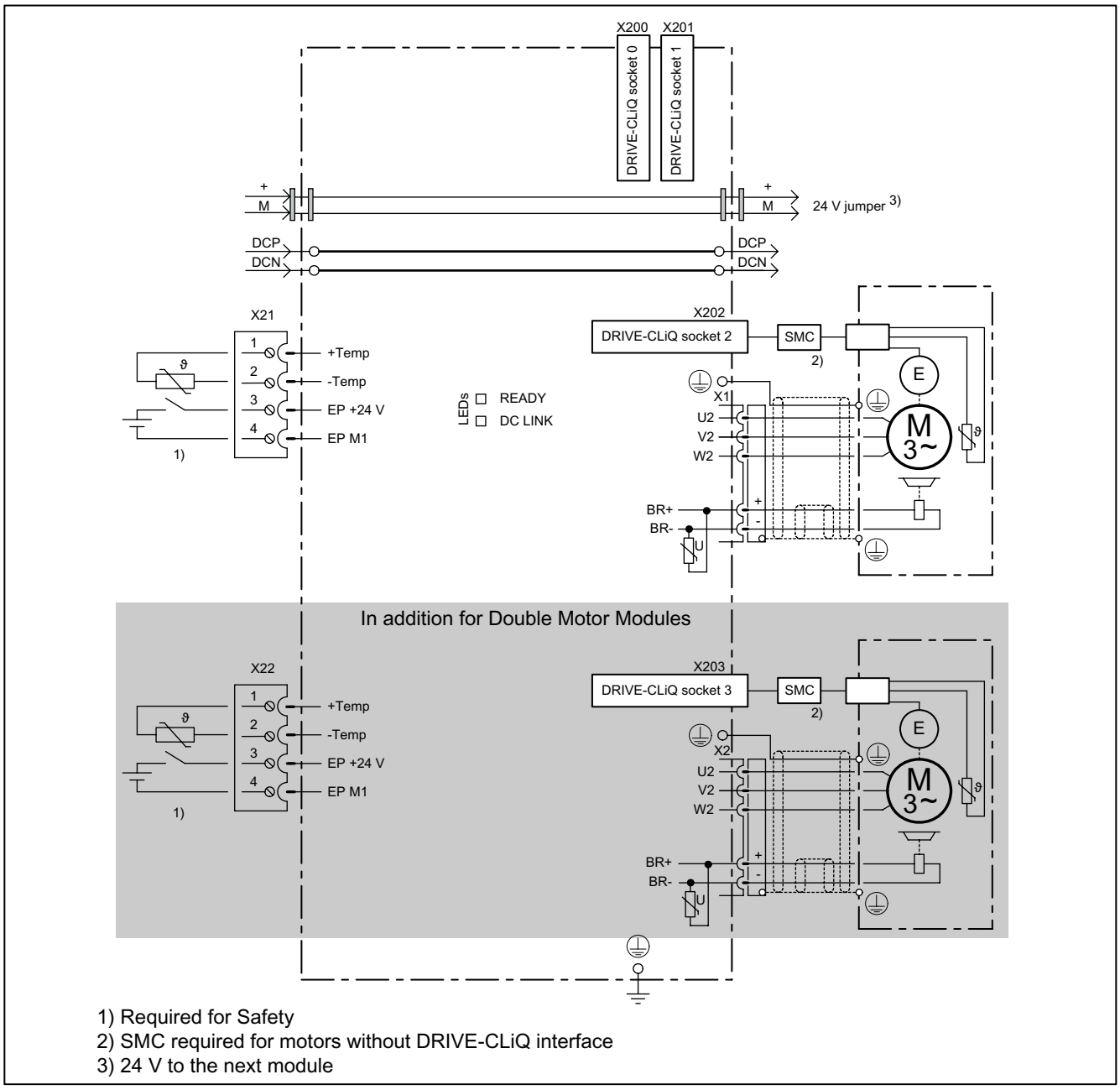


Figure 4-21 Example: Single Motor Module with external air cooling (5 A)

4.3.3.2 Connection examples



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

Figure 4-22 Connection example of Motor Modules 3 A to 30 A and Double Motor Modules 3 A to 18 A

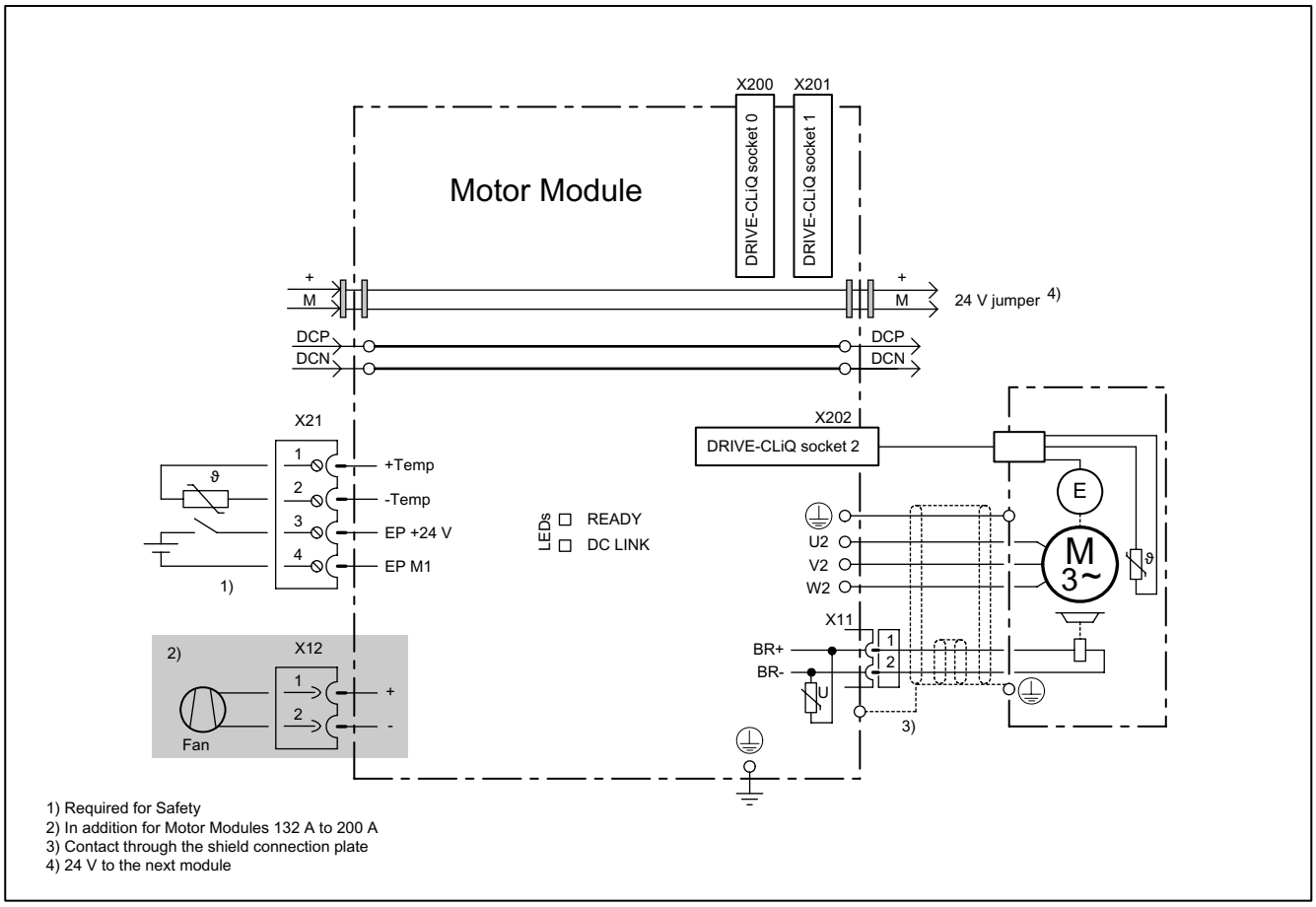
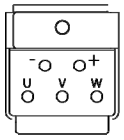
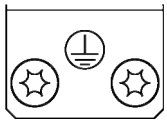


Figure 4-23 Example connection of Single Motor Modules 45 A to 200 A

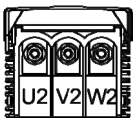
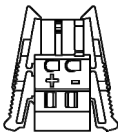
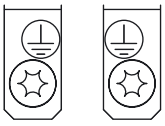
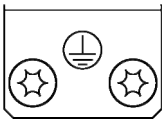
4.3.3.3 Motor/brake connection

Table 4-13 Terminal block X1/X2 Motor Modules 3 A to 30 A and Double Motor Modules 3 A to 18 A

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

[1] for ring cable lugs to DIN 46234

Table 4-14 Terminal block Single Motor Module 45 A to 200 A

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

[1] For ring cable lugs to DIN 46234

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

Note

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

Note

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

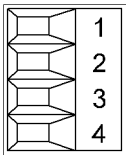
⚠ WARNING

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

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

4.3.3.4 X21/X22 EP terminals / temperature sensor connection Motor Module

Table 4-15 Terminal block X21/X22

	Terminal	Function	Technical data
	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 Optically 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 systems)			

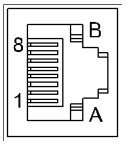
NOTICE
The KTY temperature sensor must be connected with the correct polarity.

Note

The temperature sensor connection is required for motors for which the temperature value is not transferred using DRIVE-CLiQ.
If the "Safe standstill" function is selected, for operation, ground must be placed at the -X21:3 24 V DC and the -X21:4 terminal. Upon removal, pulse suppression is activated.

4.3.3.5 X200-X203 DRIVE-CLiQ interface

Table 4-16 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)	Electronics ground
Blanking plate for DRIVE-CLiQ interface: Yamaichi, order no.: Y-ConAS-13			

4.3.3.6 Meaning of the LEDs on the Motor Module

Table 4-17 Single Motor Module / Double Motor Module / Power Module - description of the LEDs

Status		Description, cause	Remedy
Ready (H200)	**DC link (H201)**		
OFF	OFF	Electronics power supply is missing or outside permissible tolerance range.	–
Green	OFF	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.	–
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is present.	–
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is too high.	Check supply voltage
Orange	Orange	DRIVE-CLiQ communication is being established.	–
Red	–	At least one fault is present in this component. **Note:** The LED is activated regardless of whether the corresponding messages have been reconfigured.	Remedy and acknowledge fault
Green/red (0.5 Hz)	–	Firmware is being downloaded.	–
Green/red (2 Hz)	-	Firmware download is complete. Wait for POWER ON.	Carry out a POWER ON
Green/orange or Red/orange	–	Component detection via LED is activated (p0124). **Note:** Both options depend on the LED status when component recognition is activated via p0124 = 1.	–

⚠ DANGER

Hazardous DC link voltages may be present at any time regardless of the status of the "DC link" LED.
The warning information on the components must be carefully observed!

4.3.4 Dimension drawing

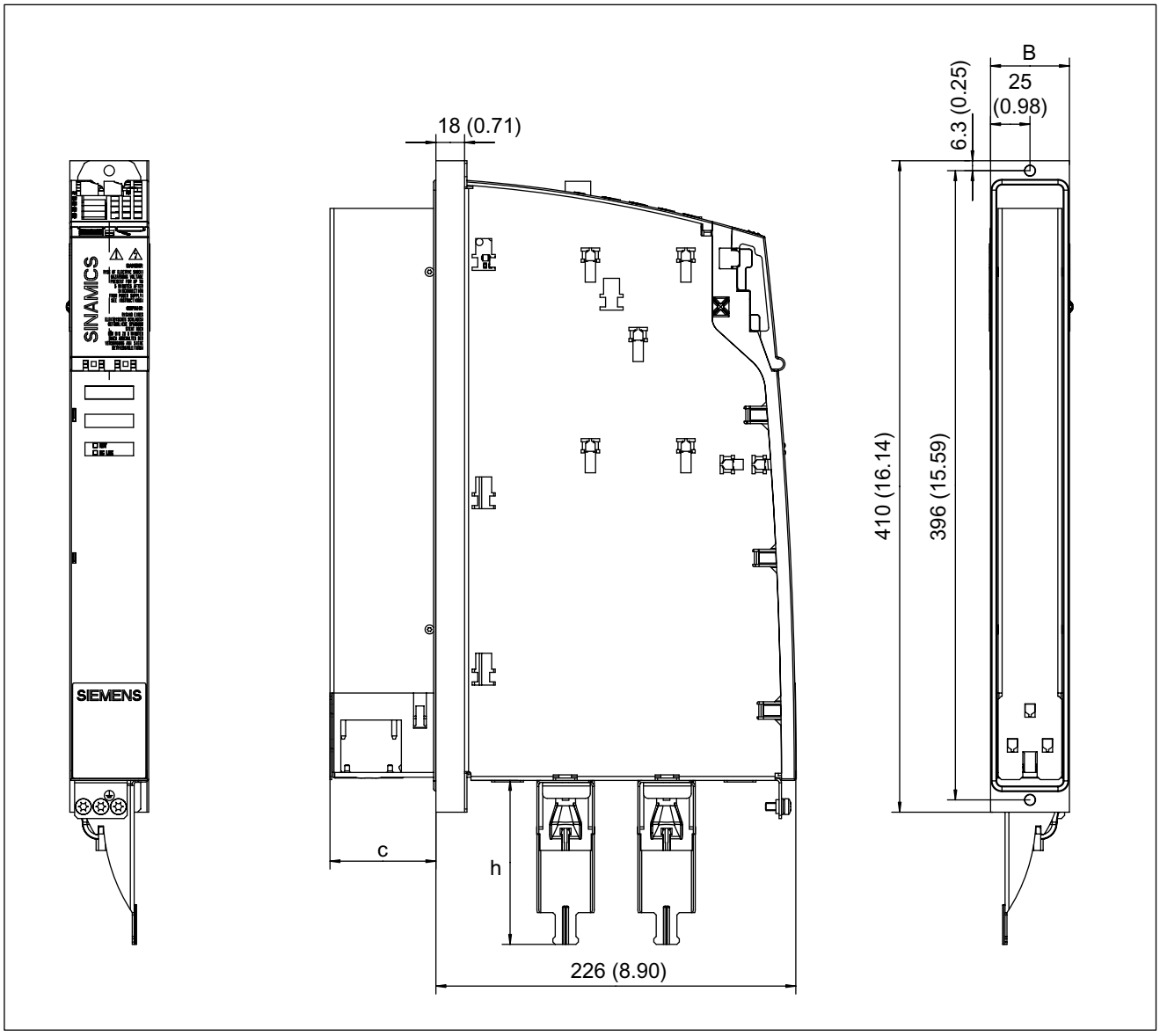


Figure 4-24 Dimension drawing of Motor Module with external air cooling 3 A to 18 A and 2 x 3 A to 2 x 9 A

Table 4-18 Dimensions of Motor Module with external air cooling 3 A to 18 A and 2 x 3 A to 2 x 9 A

Motor Module type	Order number	W [mm] (inches)	c [mm] (inches)	h [mm] (inches)
Single Motor Module 3 A	6SL3121-1TE13-0AAx	50 (1.97)	66.5 (2.62)	105 (4.13)
Single Motor Module 5 A	6SL3121-1TE15-0AAx			
Single Motor Module 9 A	6SL3121-1TE19-0AAx			
Single Motor Module 18 A	6SL3121-1TE21-8AAx			
Double Motor Module 3 A	6SL3121-2TE13-0AAx			
Double Motor Module 5 A	6SL3121-2TE15-0AAx			
Double Motor Module 9 A	6SL3121-2TE21-0AAx			

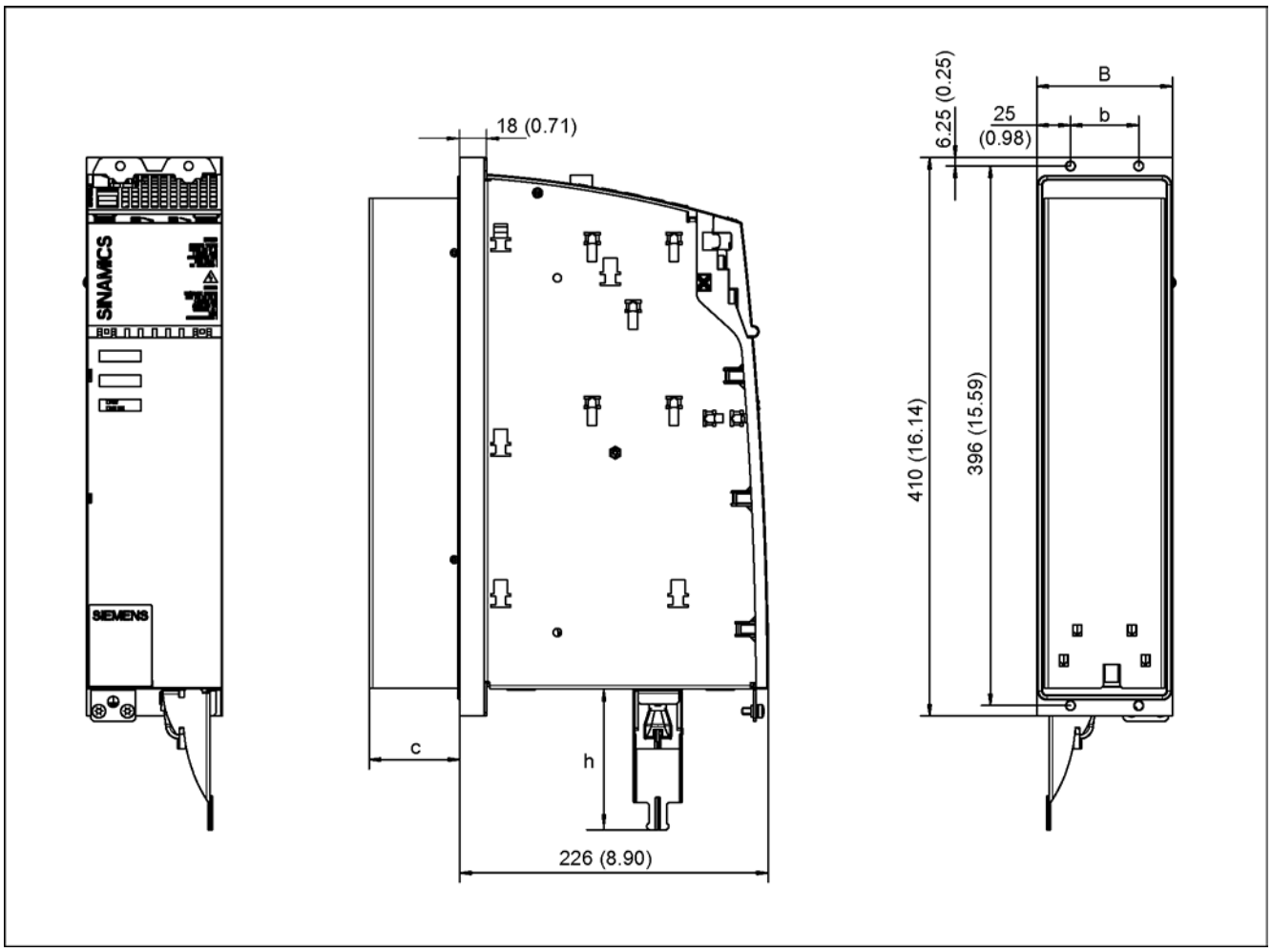


Figure 4-25 Dimension drawing of Motor Module with external air cooling 30 A and 2 x 18 A

Table 4-19 Dimensions of Motor Module with external air cooling 30 A and 2 x 18 A

Motor Module type	Order number	W [mm] (inches)	b [mm] (inches)	c [mm] (inches)	h [mm] (inches)
Single Motor Module 30 A	6SL3121-1TE23-0AAx	100 (3.94)	50 (1.97)	66.5 (2.62)	105 (4.13)
Double Motor Module 18 A	6SL3121-2TE21-8AAx				

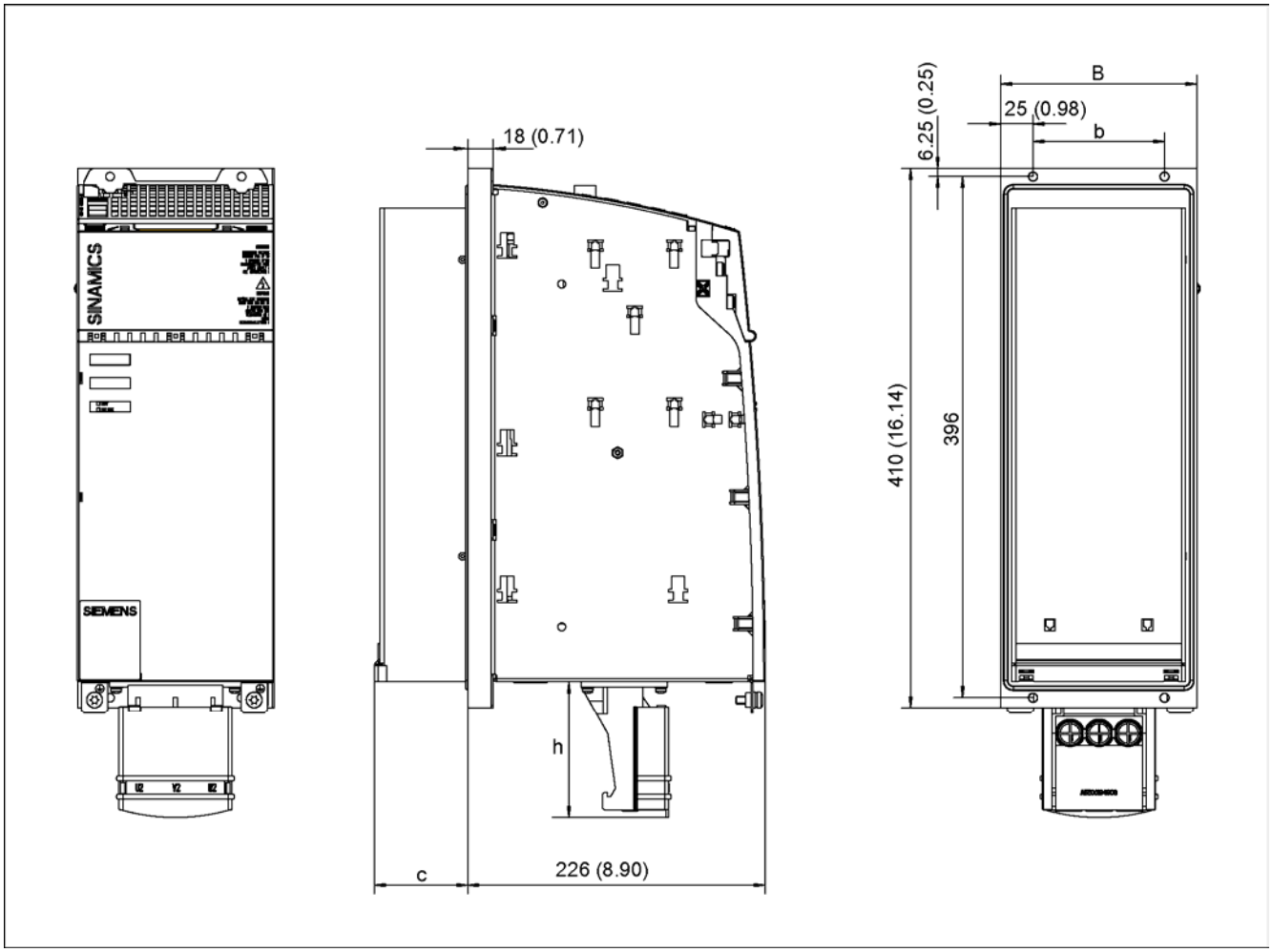


Figure 4-26 Dimension drawing of Motor Module with external air cooling (45 A, 60 A, and 85 A)

Table 4-20 Dimensions of Motor Module with external air cooling (45 A, 60 A, and 85 A)

Motor Module type	Order number	W [mm] (inches)	b [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				
Single Motor Module 85 A	6SL3121-1TE28-5AAx	200 (7.87)	150 (5.91)	92 (3.62)	105 (4.13)

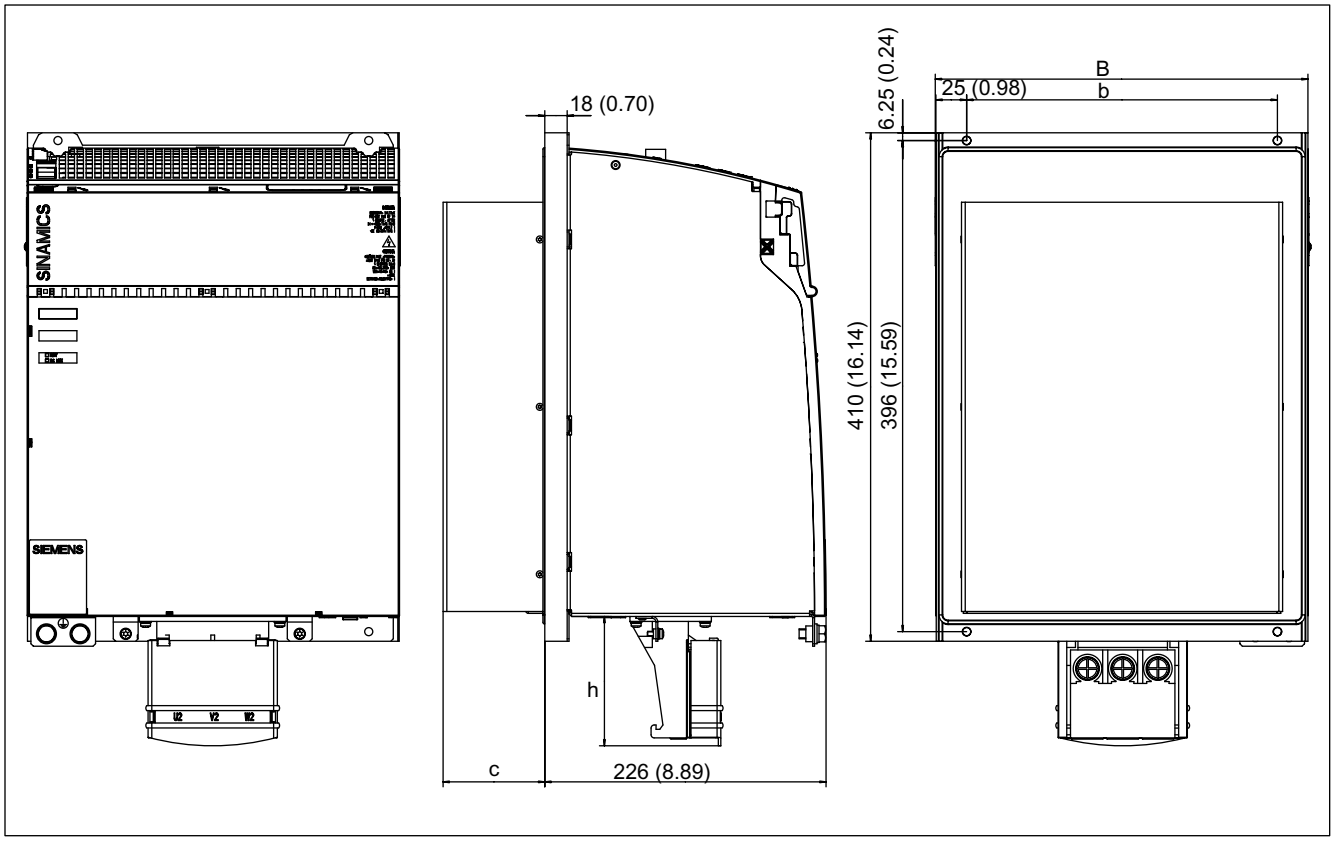


Figure 4-27 Dimension drawing of Motor Module with external air cooling (132 A and 200 A)

Table 4-21 Dimensions of Motor Module with external air cooling (132 A and 200 A)

Motor Module type	Order number	W [mm] (inches)	b [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				

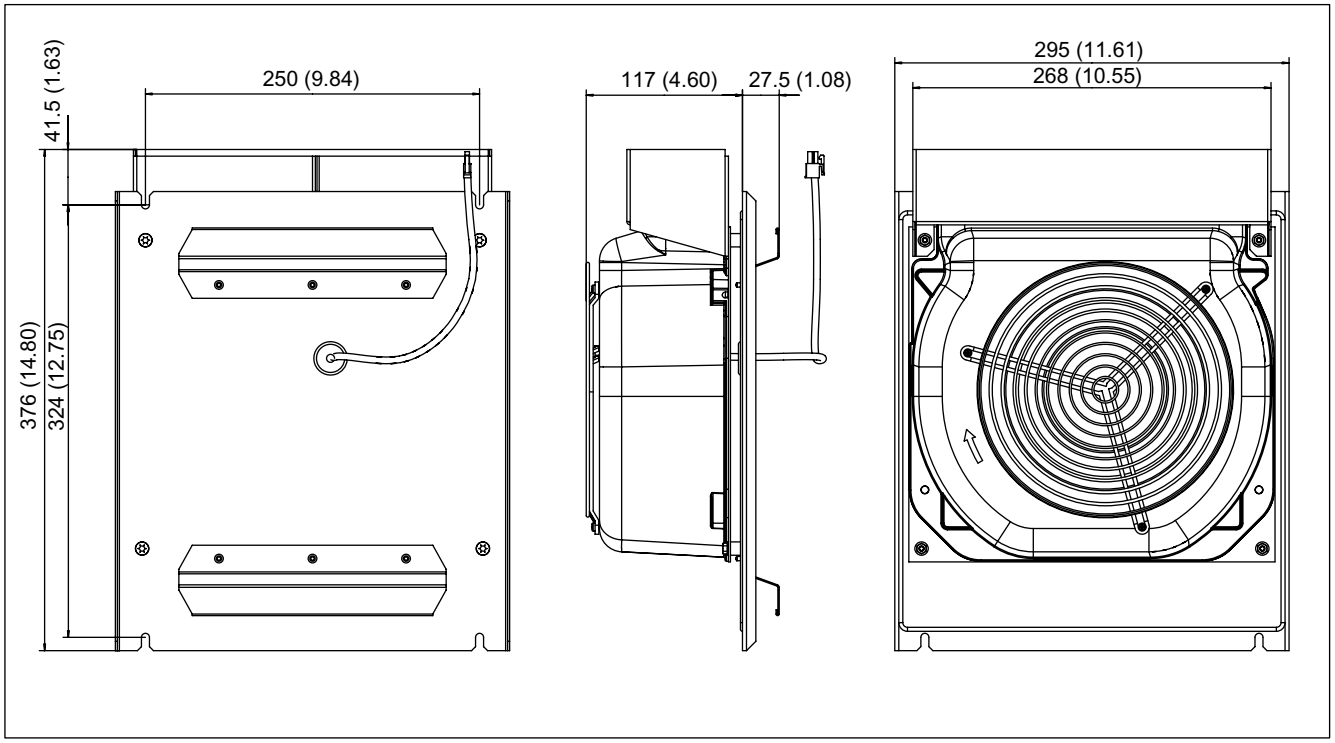


Figure 4-28 Dimension drawing of fan for Motor Modules with external air cooling (132 A and 200 A)

4.3.5 Installation

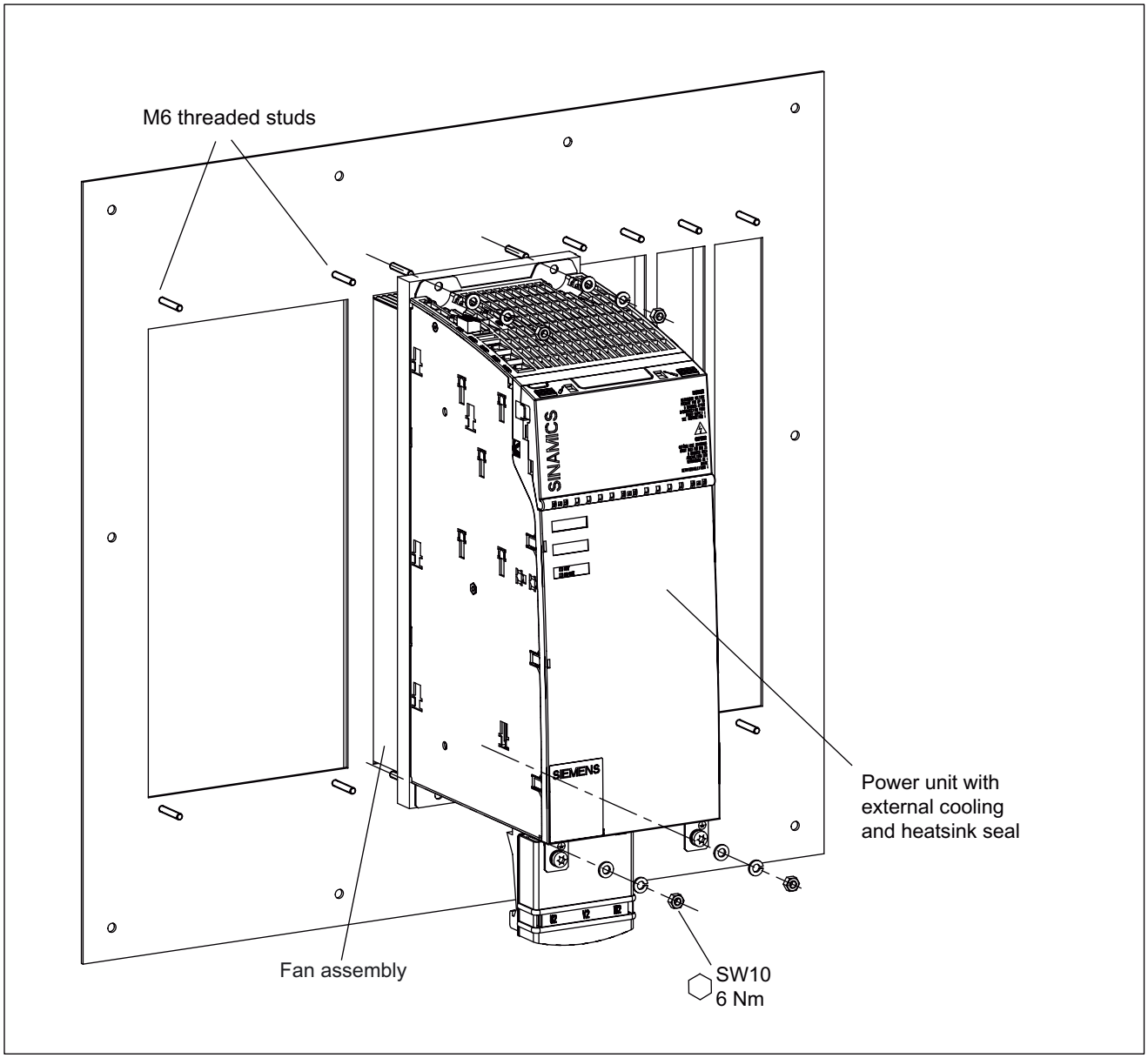


Figure 4-29 Example: Installing the power unit with external air cooling

Help with the mechanical cabinet design is available from:

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

E-mail: cc.cabinetcooling@siemens.com

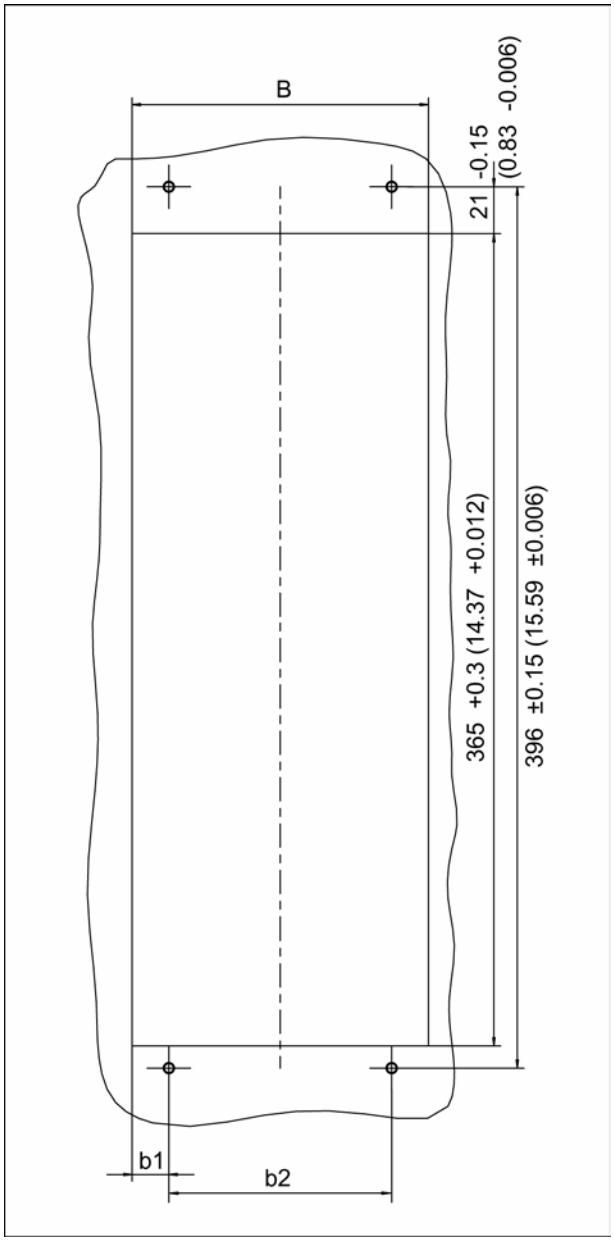


Figure 4-30 Installation openings for the power unit with external air cooling, 50 mm to 200 mm

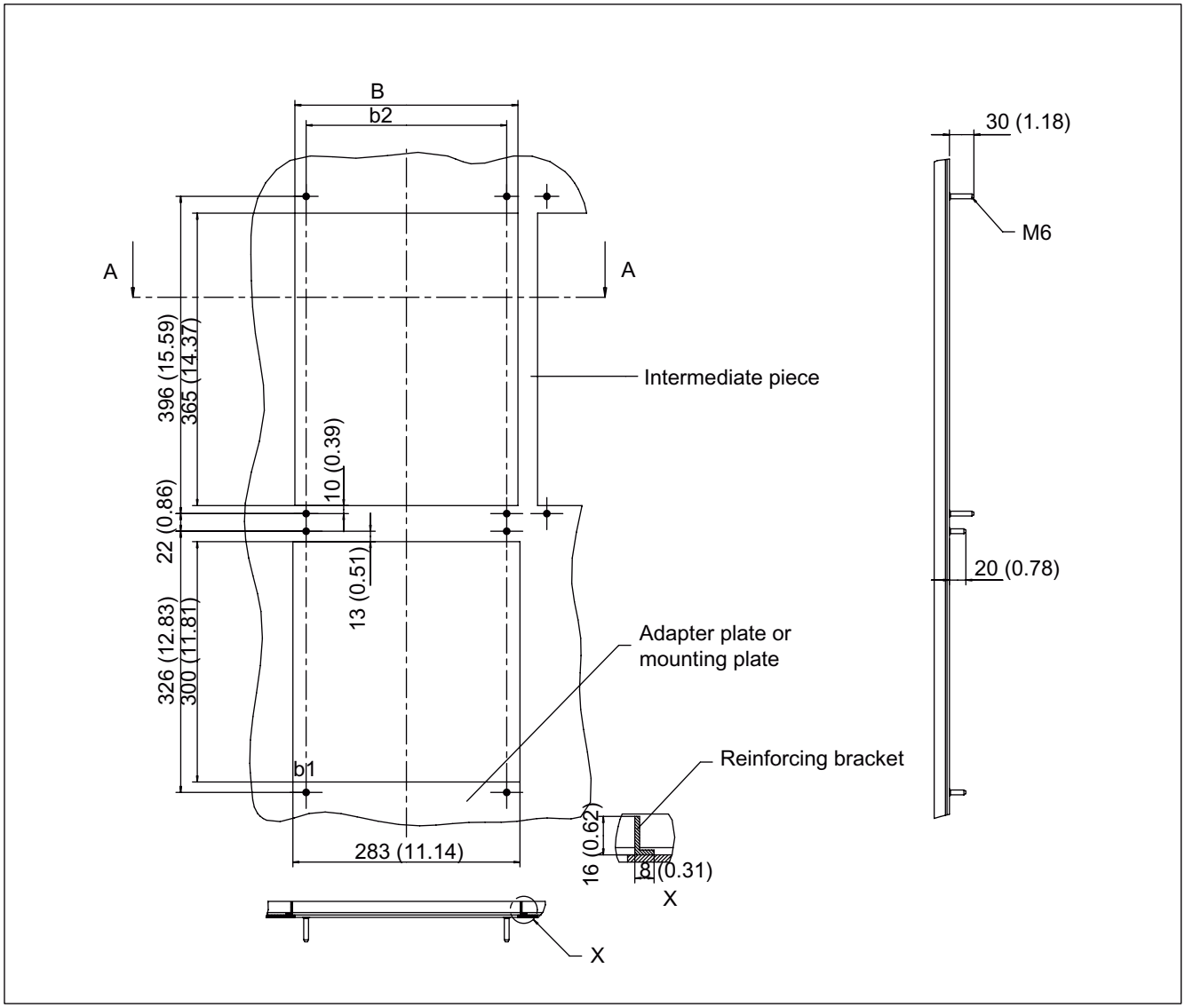


Figure 4-31 Installation openings for the power unit with external air cooling, 300 mm

Table 4-22 Dimensions of the installation openings for the power unit with external air cooling

Component 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)

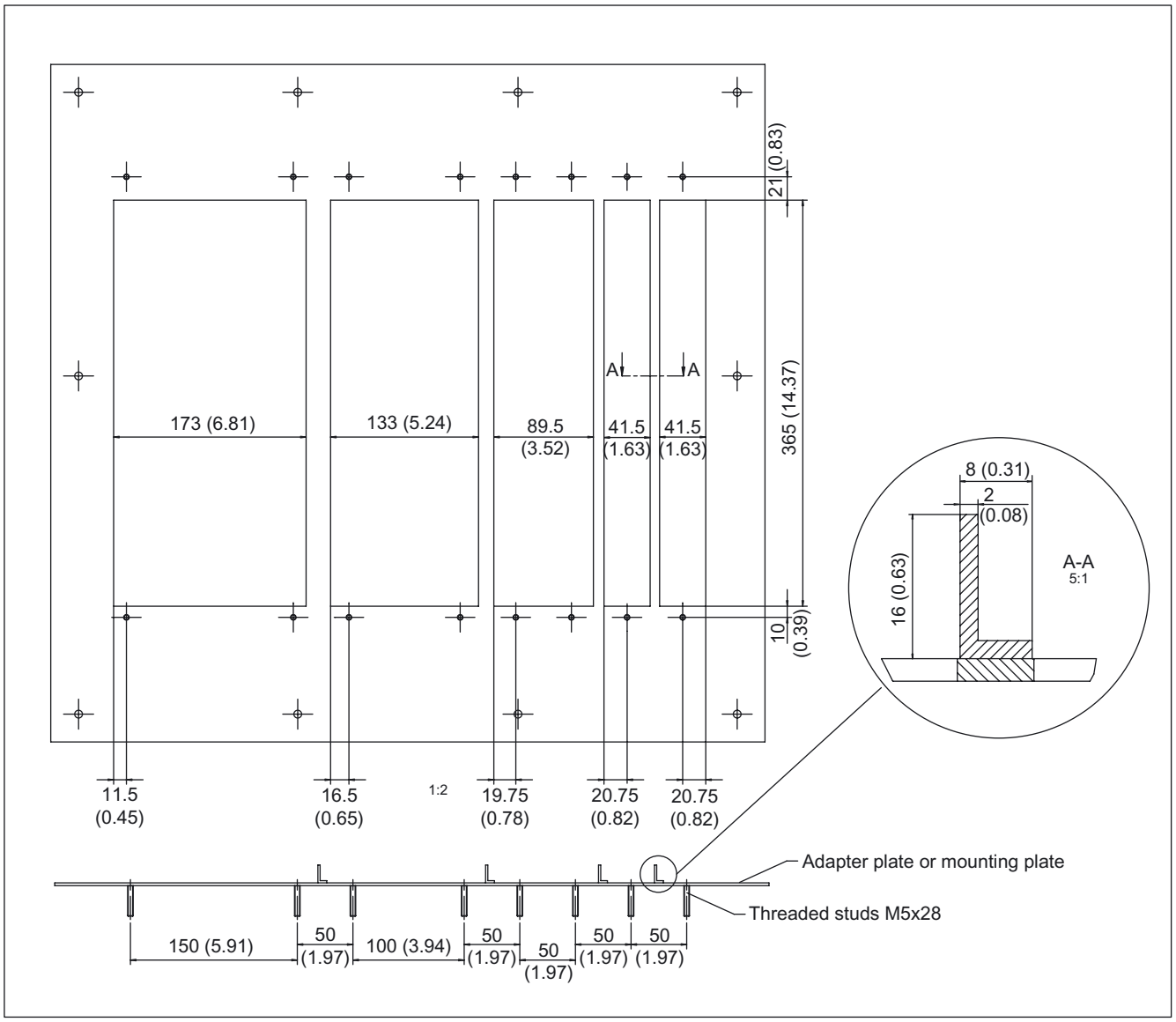


Figure 4-32 Example: Mounting plate with a drive line-up

During installation it must be ensured that the component's seal is tight throughout.

Note

A set of seals consisting of spare seals for 50 mm, 100 mm, 150 mm, 200 mm and 300 mm wide components can be ordered with order number: 6SL3162-5BU00-0AA0.

The cross-pieces must have the appropriate stability. 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.

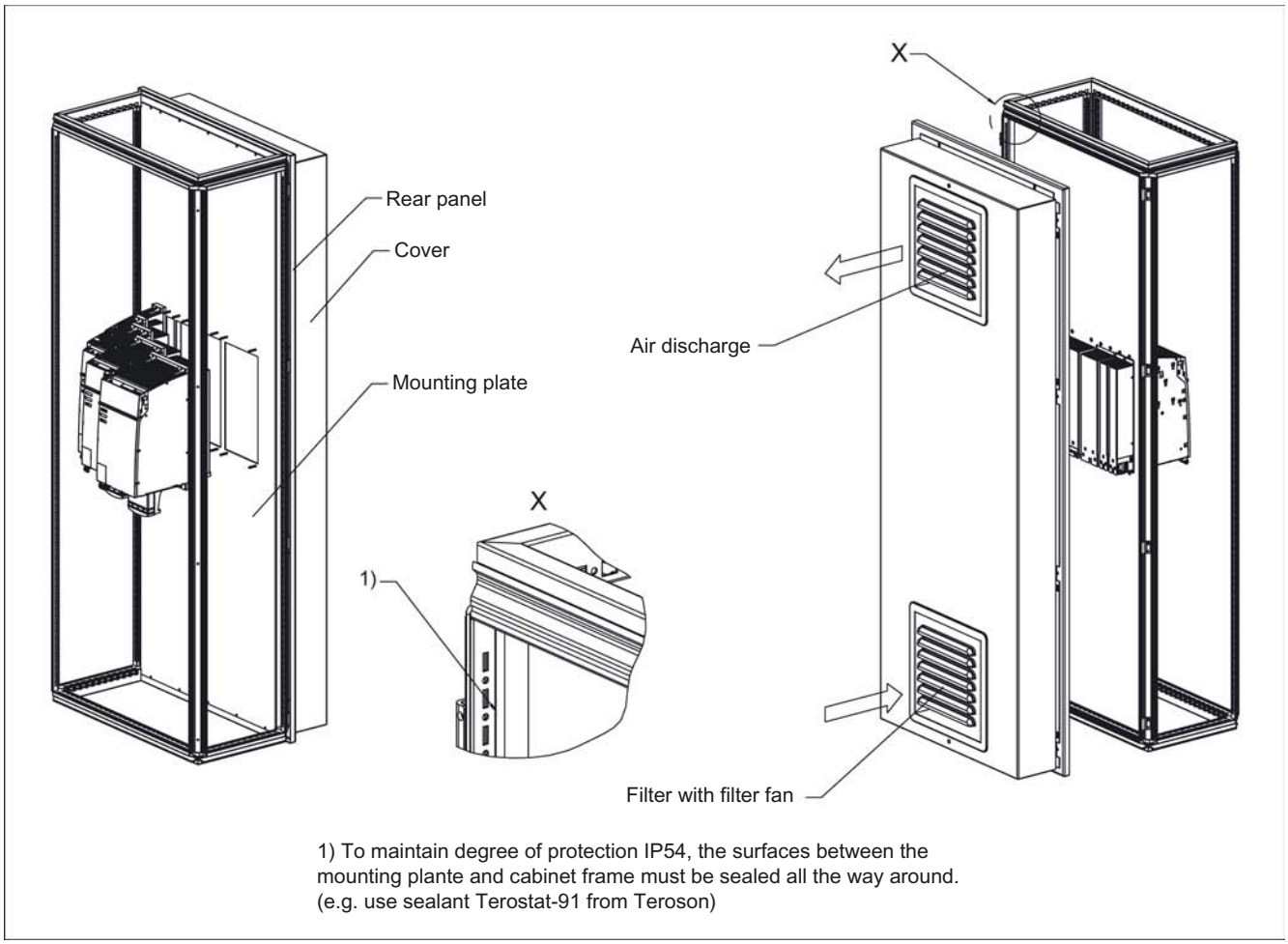
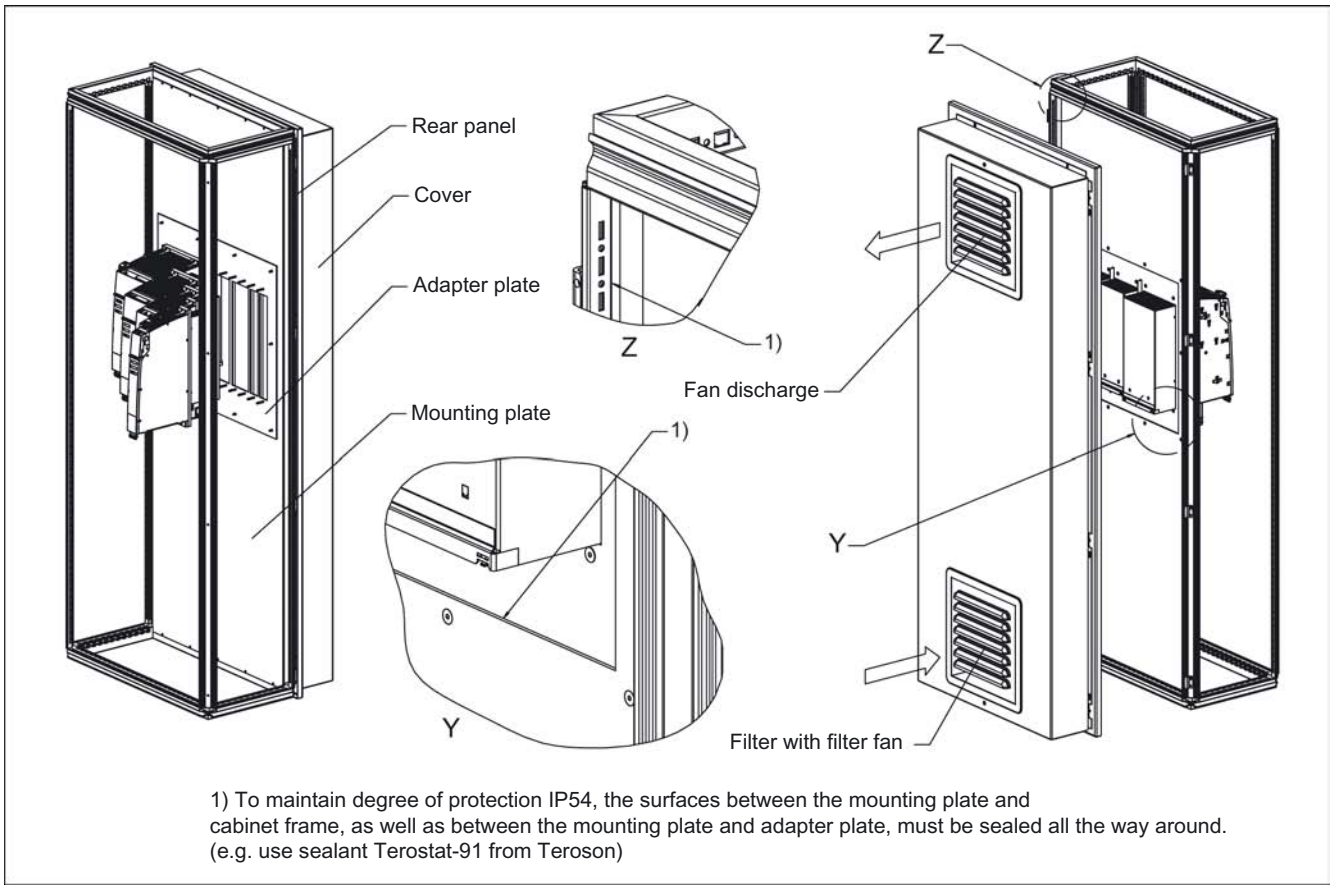


Figure 4-33 Example 1: Installation in cabinet with mounting plate



1) To maintain degree of protection IP54, the surfaces between the mounting plate and cabinet frame, as well as between the mounting plate and adapter plate, must be sealed all the way around. (e.g. use sealant Terostat-91 from Teroson)

Figure 4-34 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.

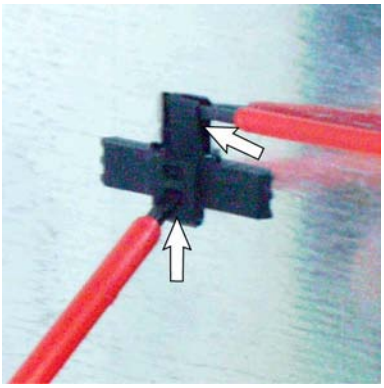
Note

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

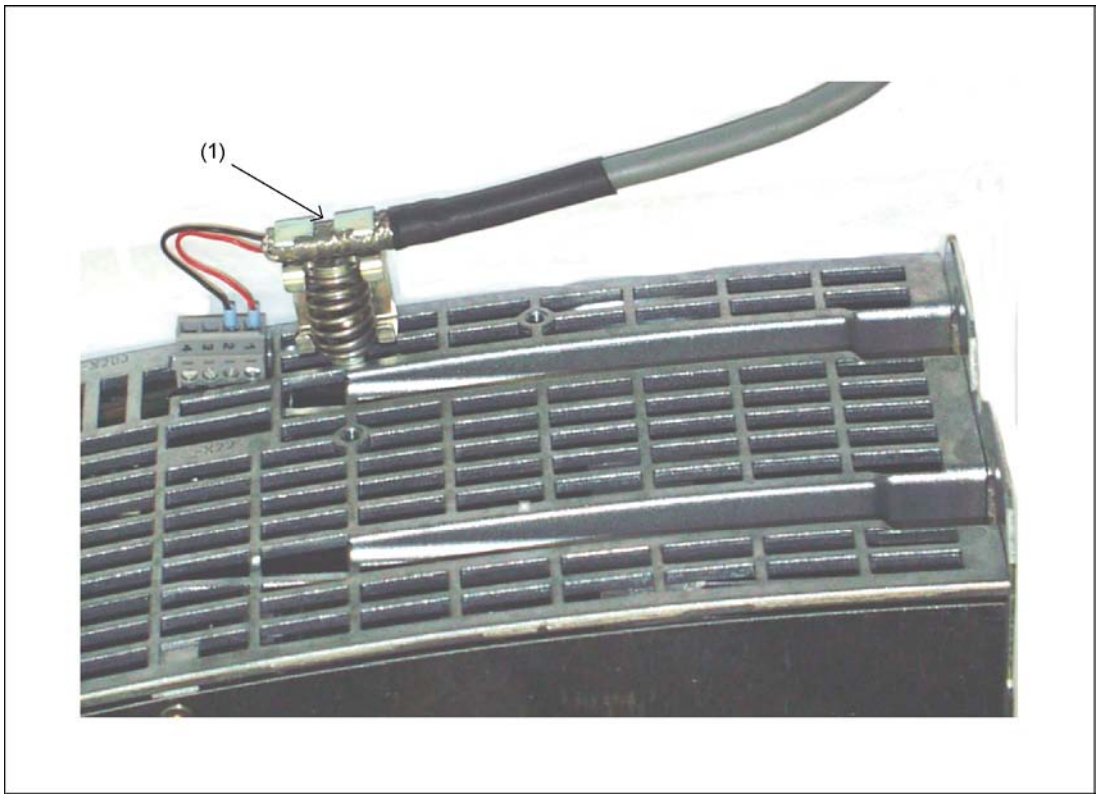


Figure 4-35 Shield contact for the terminals

(1) Shield connection: Weidmüller, Order No. KLBÜ 3-8 SC

Internet address:

Weidmüller: http://www.weidmueller.com

NOTICE
Only use screws with a permissible mounting depth of 4 - 6 mm.

4.3.7 Technical data

Table 4-23 Technical data for Booksize Single Motor Modules (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						
Infeed: DC link voltage Electronics power supply	 V_{DC} V_{DC}	 510 – 720 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
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	5.7	5.7	5.7	5.7	8.4

Table 4-24 Technical data 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						
Infeed: DC link voltage Electronics power supply	 V_{DC} V_{DC}	 510 – 720 24 (20.4 - 28.8)				
Output voltage	V_{ACrms}	0 - 0.67 x DC link voltage				
Overvoltage tripping Undervoltage tripping	V_{DC} V_{DC}	820 ± 2 % 380 ± 2 %				
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 cycle 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
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	13.3	17.2	27.1	28

Table 4-25 Technical data for Double Motor Modules Booksize (3 to 18 A)

External air cooling	6SL3121-	2TE13-0AAx	2TE15-0AAx	2TE21-0AAx	2TE21-8AAx
Rated current	A	2x3	2x5	2x9	2x18
Voltage					
Infeed: DC link voltage Electronics power supply	 V_{DC} V_{DC}	 510 – 720 24 (20.4 - 28.8)			
Output voltage	V_{ACrms}	0-480			
Overvoltage tripping Undervoltage tripping	V_{DC} V_{DC}	820 ± 2 % 380 ± 2 %			
Electronics current consumption at 24 V	A_{DC}	1.0	1.0	1.0	1.0
Total power loss (including electronic losses)[1]	W	95	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 (600 V, 4 kHz)	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
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 chapter Cabinet Design

Rated duty cycles of Booksize Motor Modules

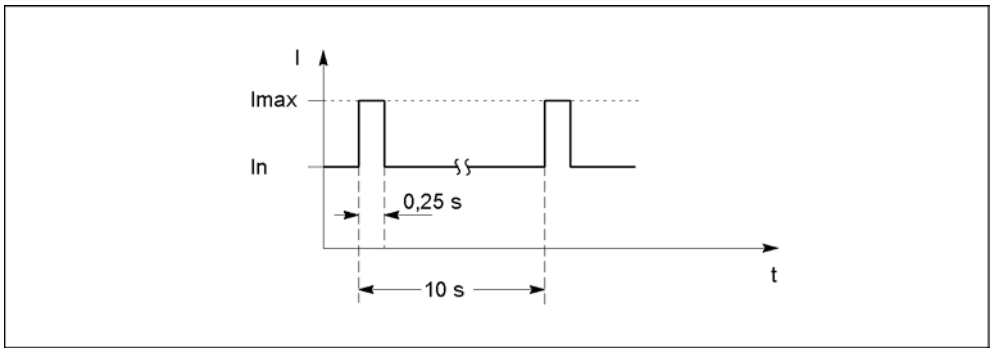


Figure 4-36 Peak current duty cycle with prior loading

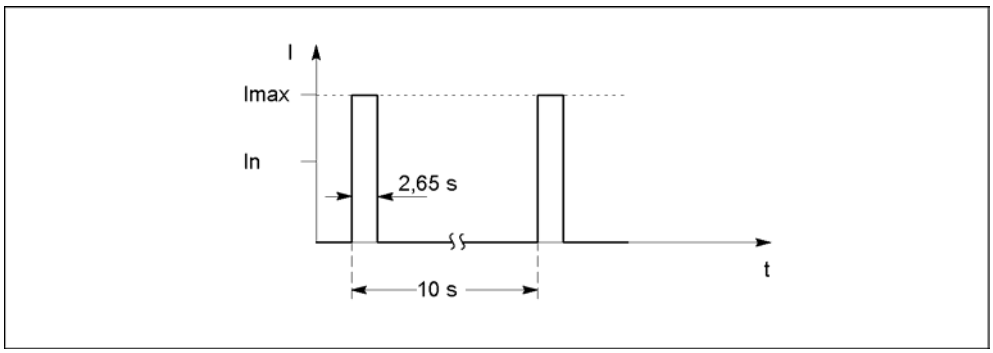


Figure 4-37 Peak current duty cycle without prior loading

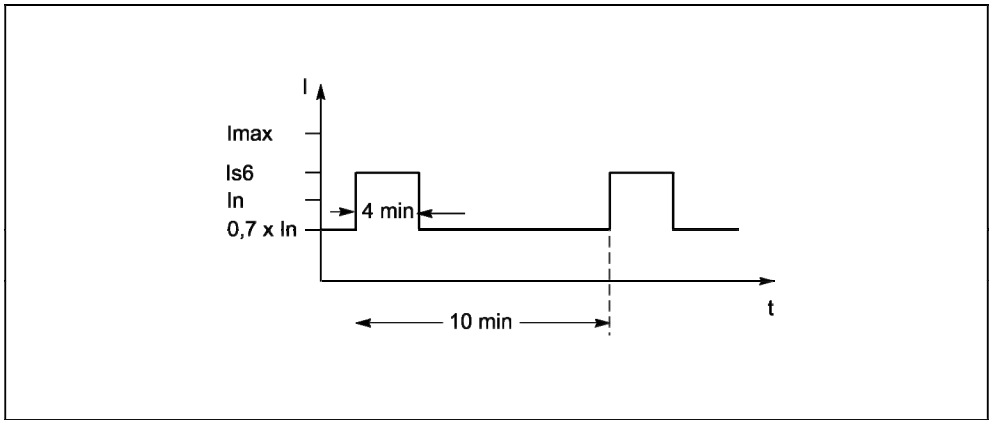


Figure 4-38 S6 current duty cycle with prior loading

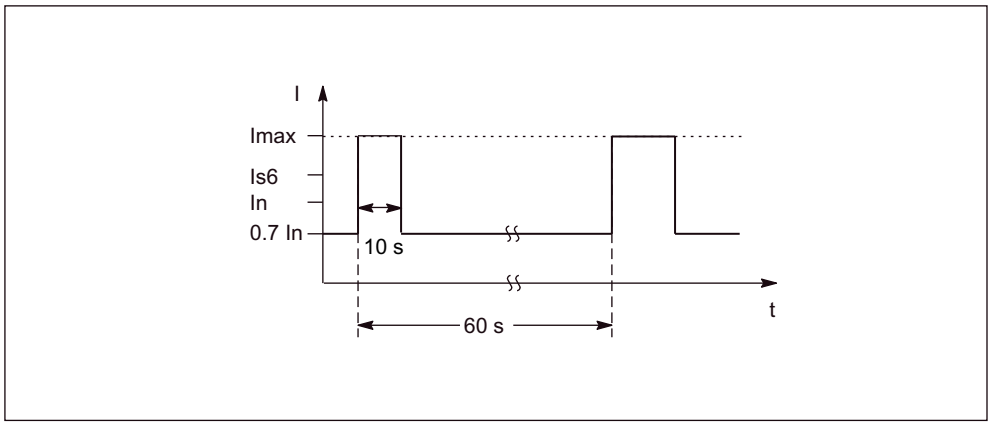


Figure 4-39 S6 peak current duty cycle with prior loading

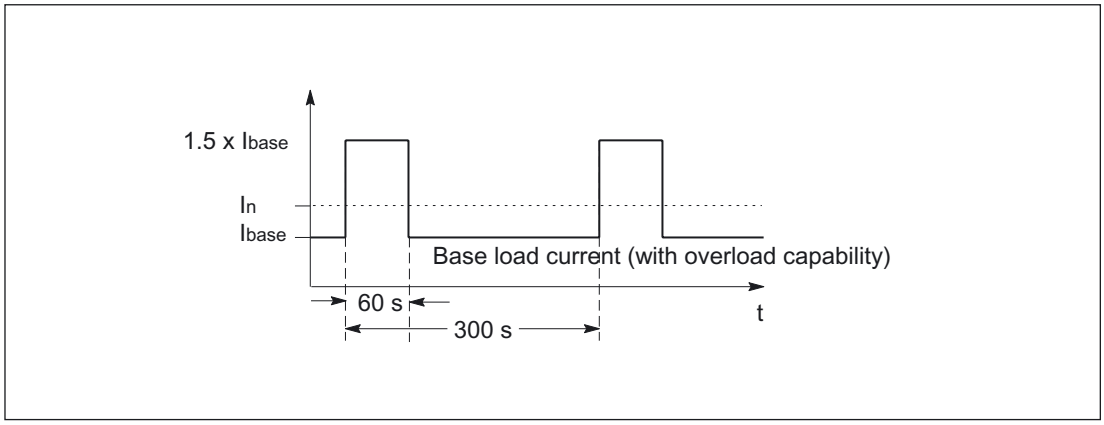


Figure 4-40 Current duty cycle with pre-loading

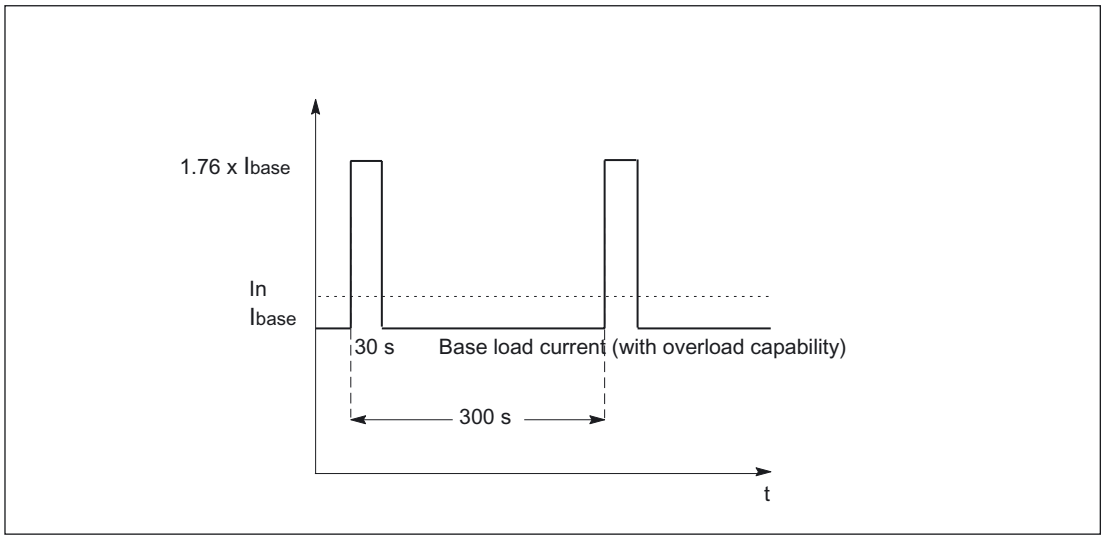


Figure 4-41 Current duty cycle with pre-loading

Derating as a function of the ambient temperature

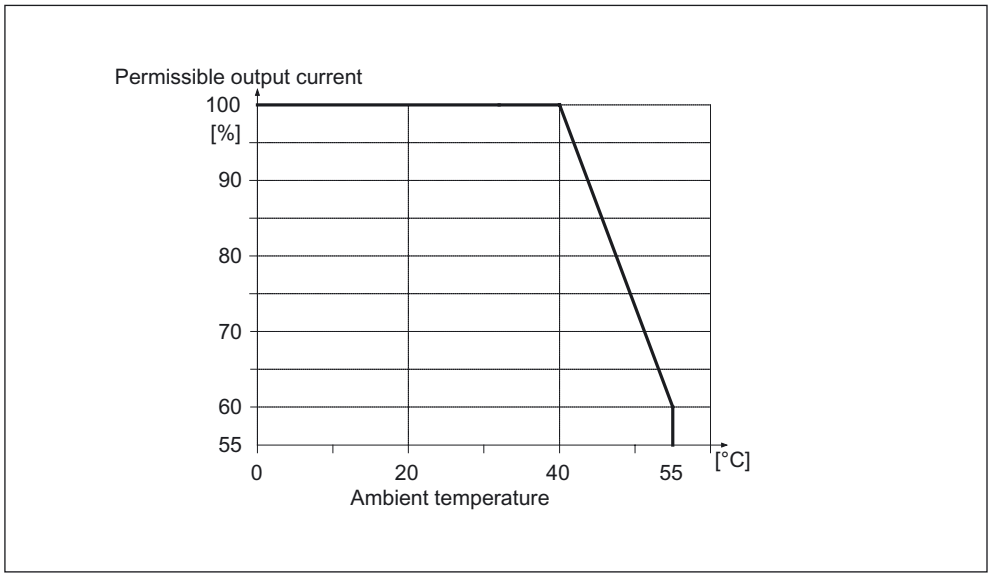


Figure 4-42 Derating as a function of the ambient temperature

Derating as a function of the pulse frequency

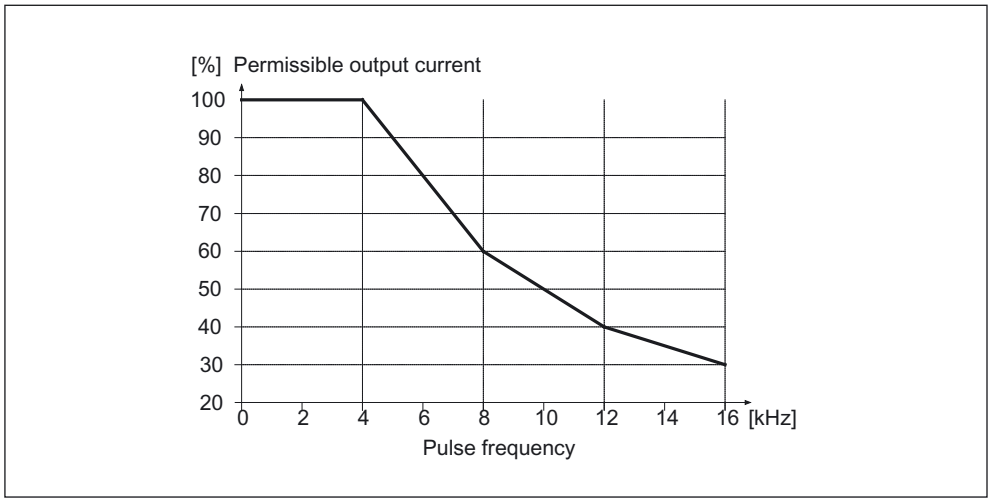


Figure 4-43 Derating as a function of the pulse frequency

Derating as a function of the installation altitude

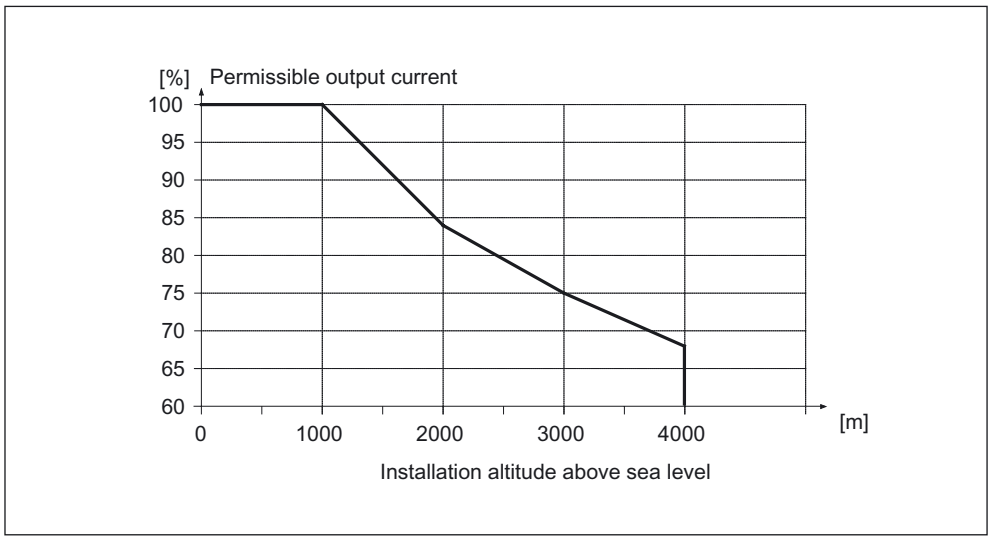


Figure 4-44 Derating as a function of the installation altitude

Voltage derating as a function of the installation altitude

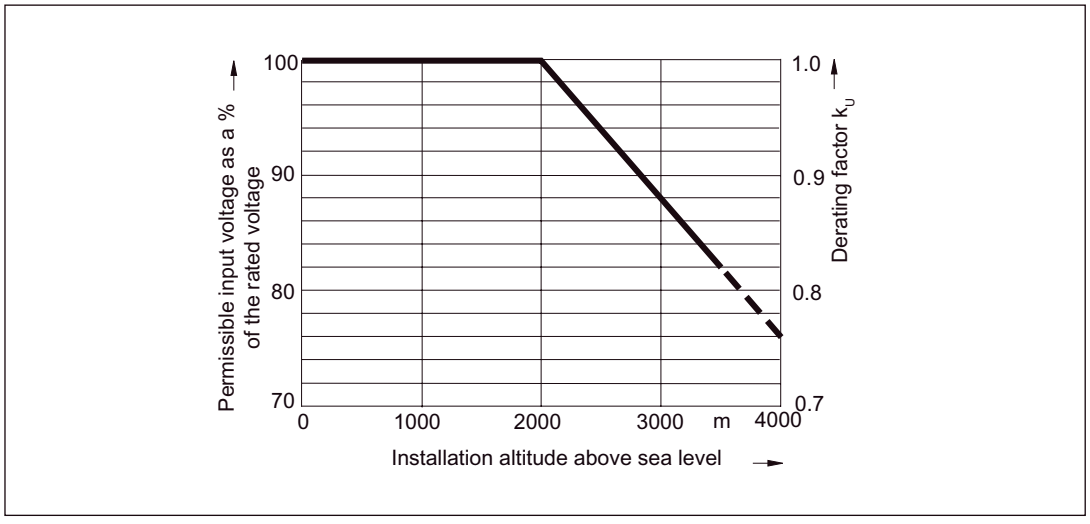


Figure 4-45 Voltage derating as a function of the installation altitude

Booksize DC Link Components

5

5.1 Braking Modules

5.1.1 Description

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

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

To operate the Braking Modules, a minimum capacitance is required in the DC link. The DC link capacitance for the 25 kW and 100 kW braking resistors is 440 µF.
The capacitance of the Braking Modules of 110 µF is included in the total capacitance.
When the Braking Modules are connected in parallel, the above-mentioned minimum DC link capacitance must be available for each Braking Module.

Note

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

Note

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

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

5.1.2 Safety information

⚠ DANGER

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

⚠ WARNING

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

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

⚠ DANGER

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

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

⚠ WARNING

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

⚠ DANGER

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

CAUTION

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

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

Note

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

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

5.1.3 Interface description

5.1.3.1 Overview

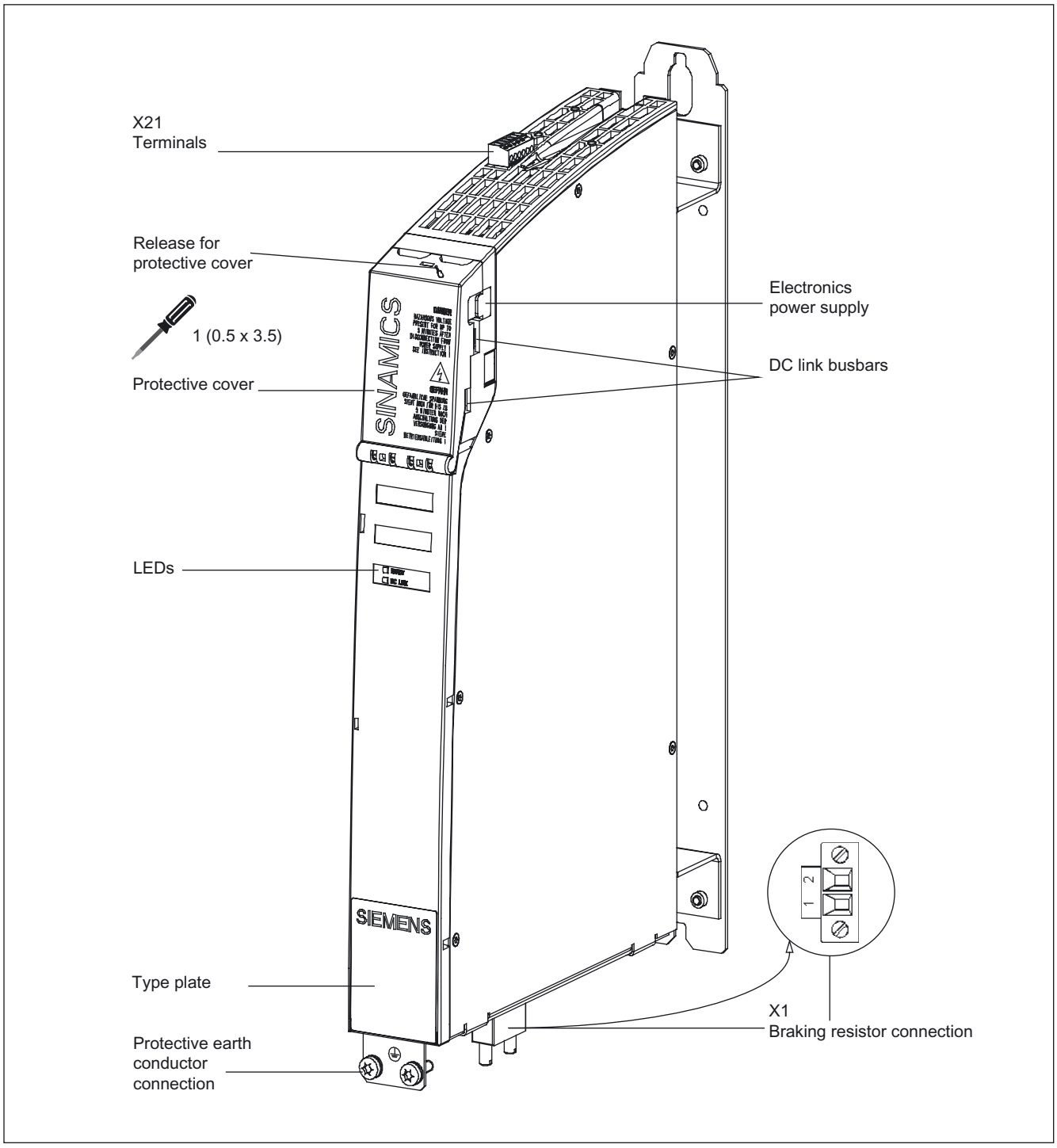


Figure 5-1 Interface description of braking module

5.1.3.2 Connection example

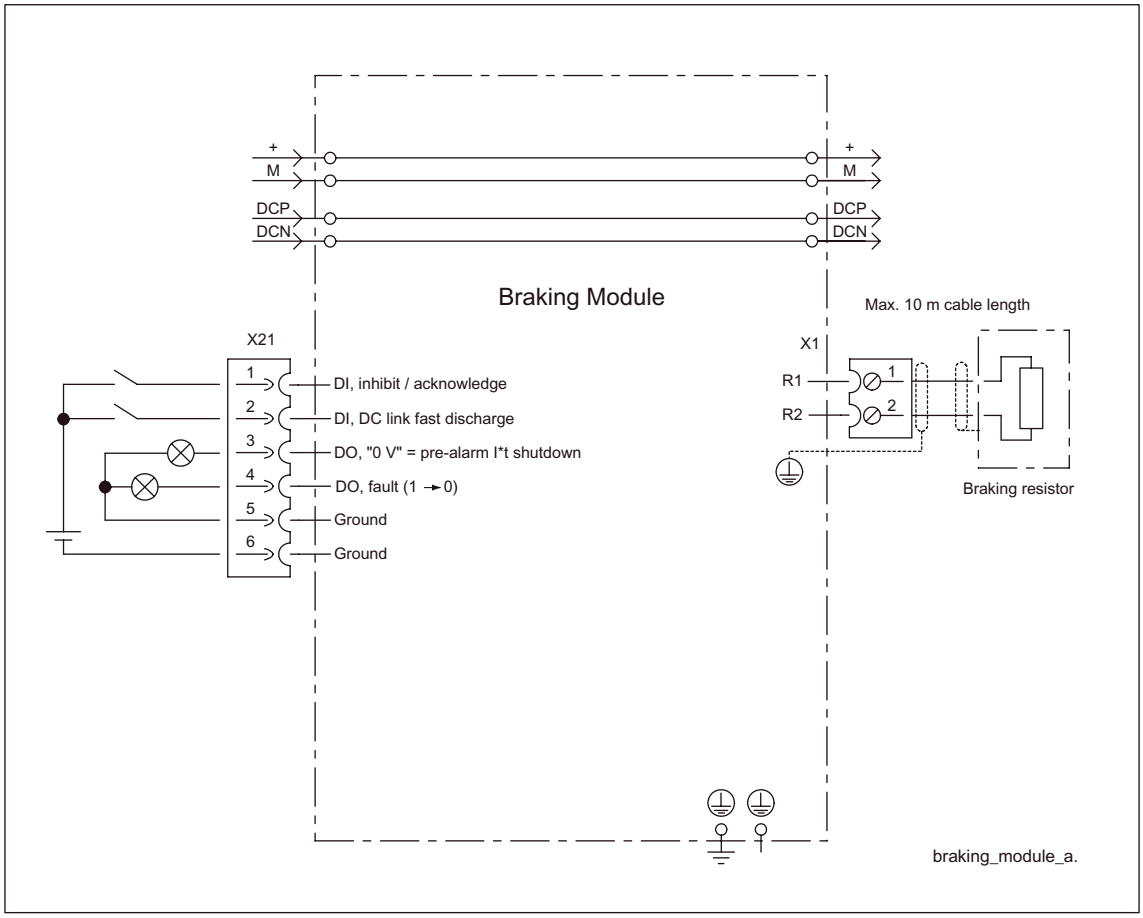
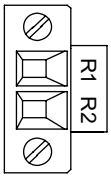


Figure 5-2 Example connection of Braking Module

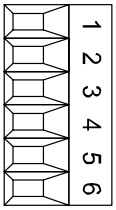
5.1.3.3 Braking resistor connection X1

Table 5-1 Terminal block X1

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

5.1.3.4 X21 digital inputs/outputs

Table 5-2 Terminal block X21

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

1) DI: Digital input; DO: Digital output; M: Electronics ground

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

⚠ DANGER

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

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

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

Note

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

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

5.1.3.5 Meaning of the LEDs on the Braking Module

Table 5-3 Braking Module Booksize – description of the LEDs

LED	Color	Status	Description, cause	Remedy
READY	-	off	Electronics power supply is missing or outside permissible tolerance range. Component deactivated via terminal.	–
	Green	Continuous	Component is ready to operate.	–
	Red	Continuous	Overtemperature. Overcurrent switch-off. I^2t monitoring activated. Ground fault/short-circuit. **Note:** In the event of an overtemperature, the error cannot be acknowledged until a cooling time has elapsed.	Diagnose fault (via output terminals) and acknowledge it (via input terminal)
DC LINK	-	off	Electronics power supply is missing or outside permissible tolerance range. Component not active.	–
	Green	Flashing	Component active (DC link discharge via braking resistor in progress).	–

5.1.4 Dimension drawing

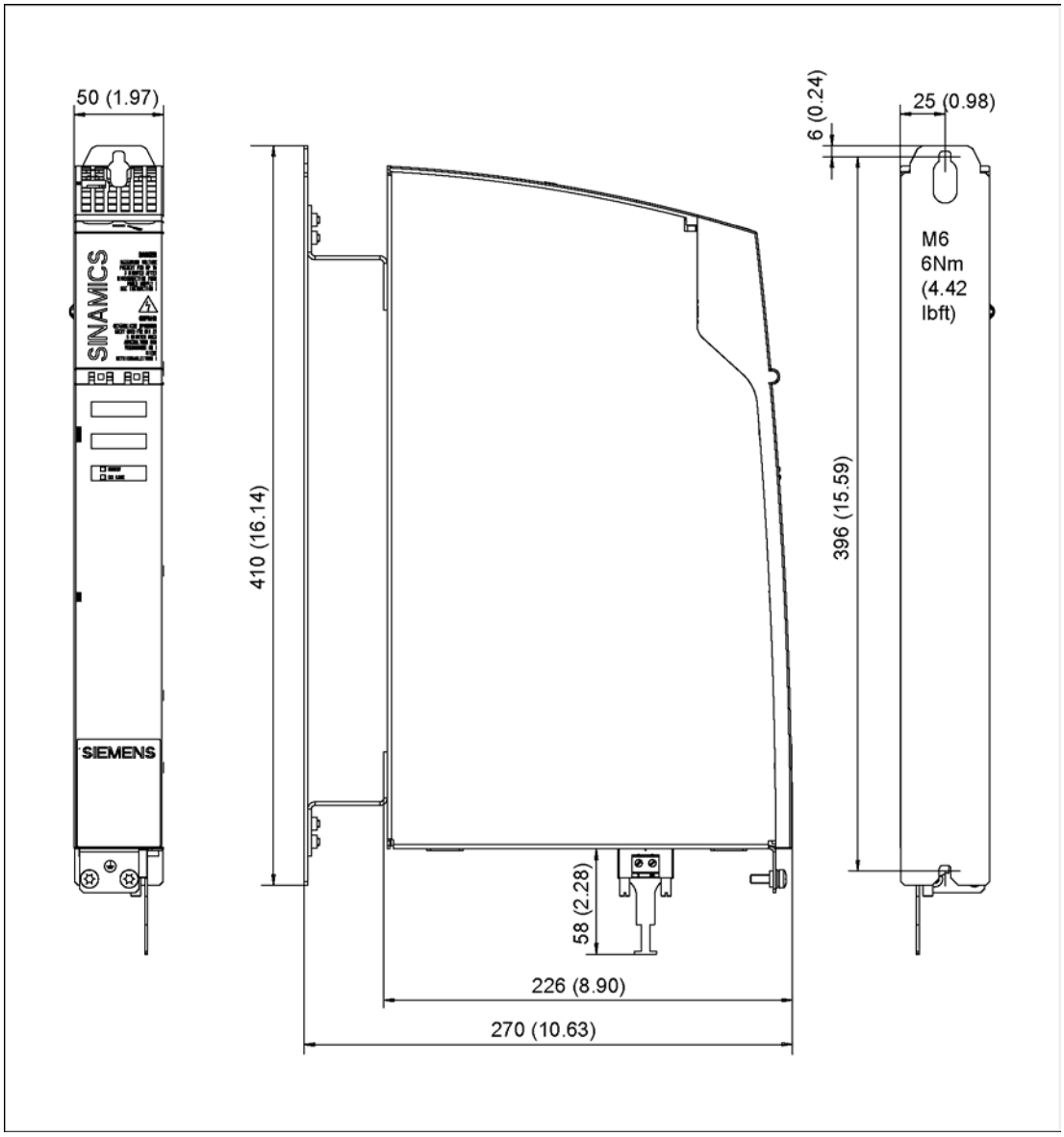


Figure 5-3 Dimension drawing of the Braking Module

5.1.5 Mounting

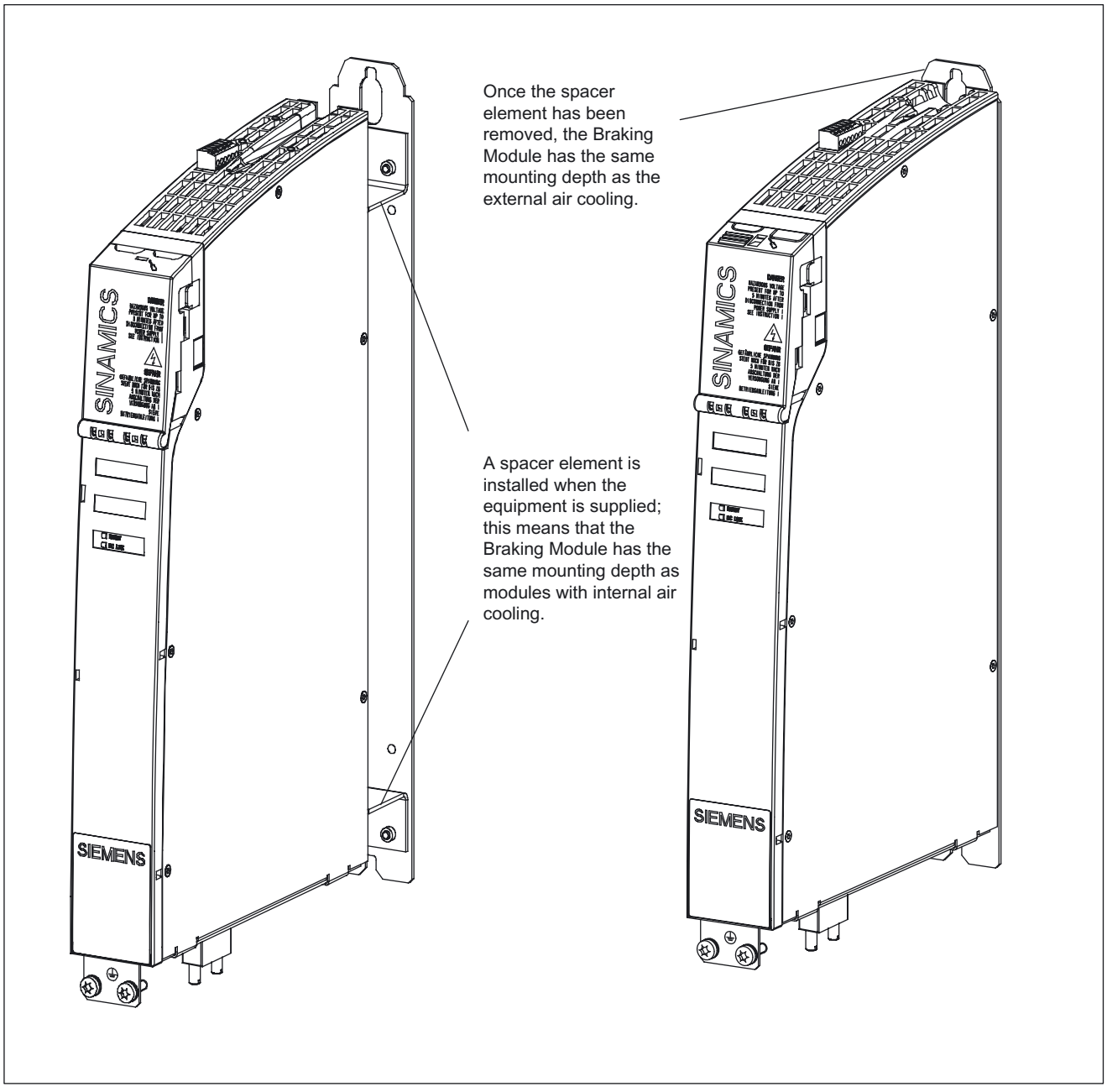


Figure 5-4 Methods of installing Braking Modules with/without spacer elements

5.1.6 Technical data

Table 5-4 Technical data

Braking Module Booksize		
Voltages		
Supply: DC link voltage	V_{DC}	510 - 720
ON threshold	V	770
Electronics power supply	V_{DC}	24 (20.4 - 28.8)
Electronics current consumption (at 24 V DC)	A_{DC}	0.5
Current carrying capacity DC link busbar	A_{DC}	100
Current carrying capacity 24 V busbar	A_{DC}	20
Max. braking power	kW	100
Continuous braking power	kW	1.5
Power loss[1]	W	20
Cooling type		Natural convection
Weight	kg	4.1

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

5.1.7 Braking resistors for Braking Module

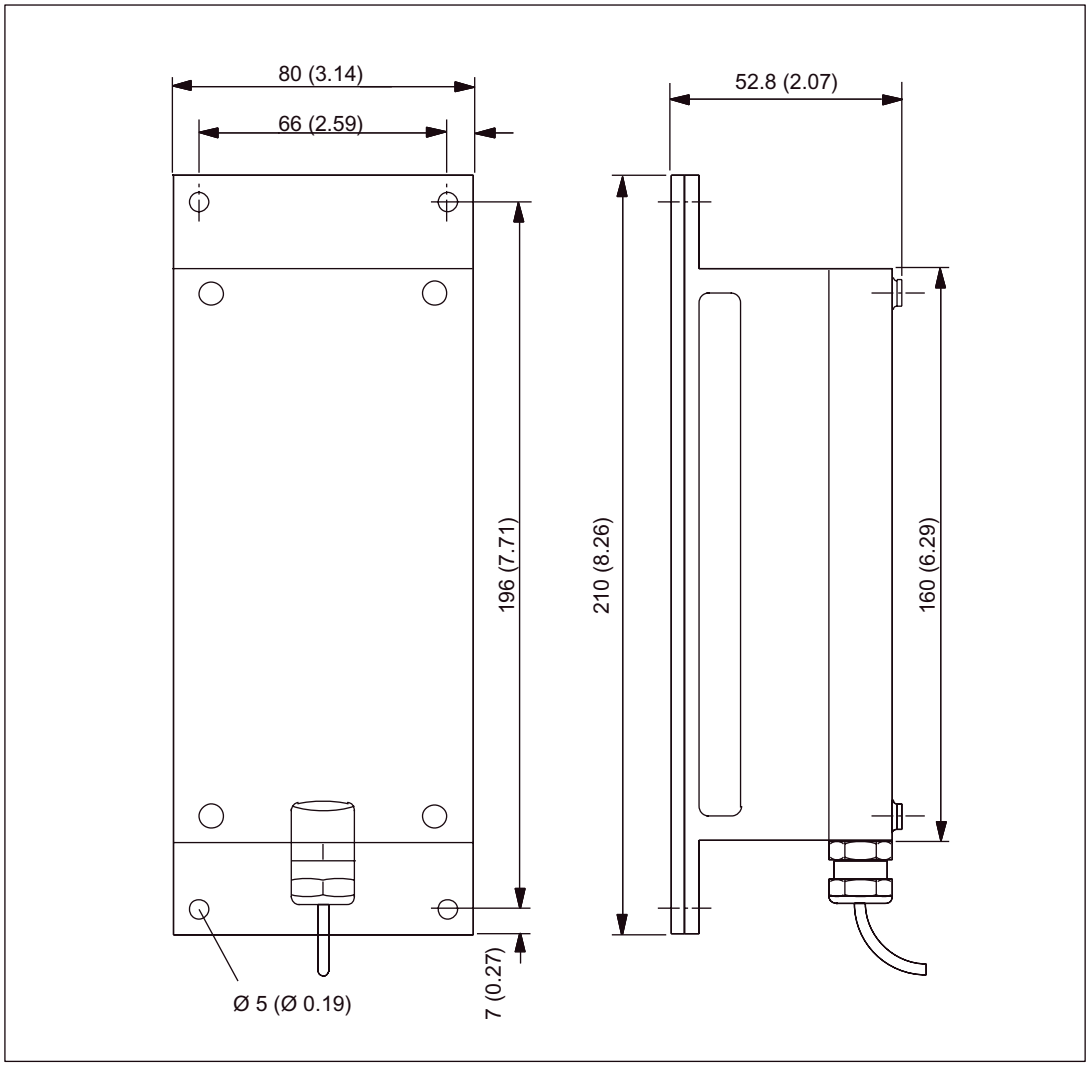


Figure 5-5 Dimension drawing: Braking resistor 0.3 kW / 25 kW

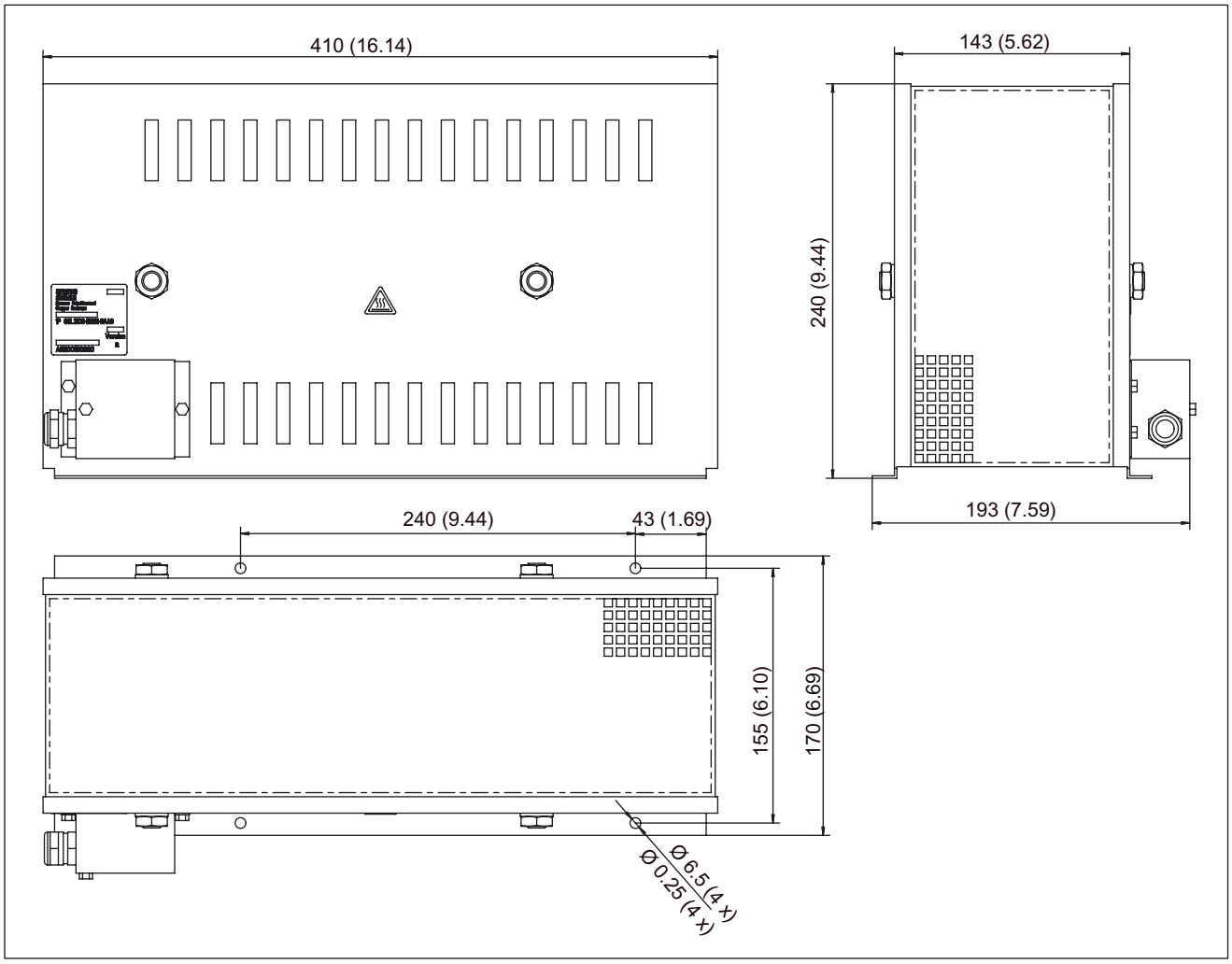


Figure 5-6 Dimension drawing: Braking resistor 1.5 kW / 100 kW

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

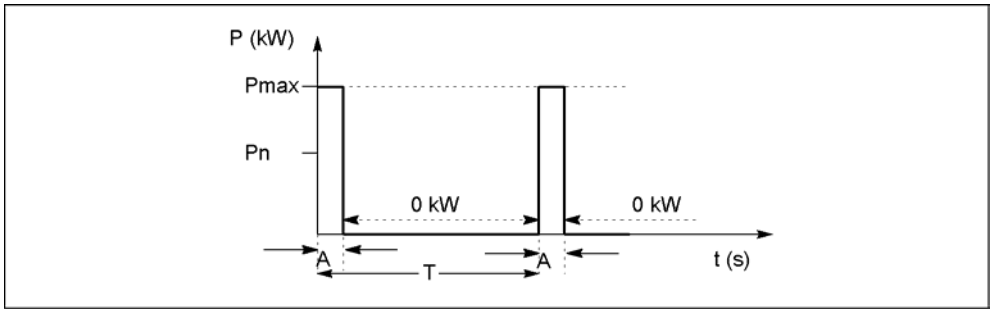


Figure 5-7 Duty cycle for braking resistors

T [s] period duration of braking duty cycle

A [s] load duration

P_n [W] continuous braking power of braking resistor

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

Table 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 data

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

Connection cables

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

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

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

5.2 Capacitor Module

5.2.1 Description

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

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

Several capacitor modules can be operated in parallel.

5.2.2 Safety information

⚠ DANGER

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

⚠ WARNING

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

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

⚠ DANGER

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

⚠ WARNING

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

NOTICE

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

⚠ DANGER

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

CAUTION

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

5.2.3 Interface description

5.2.3.1 Overview

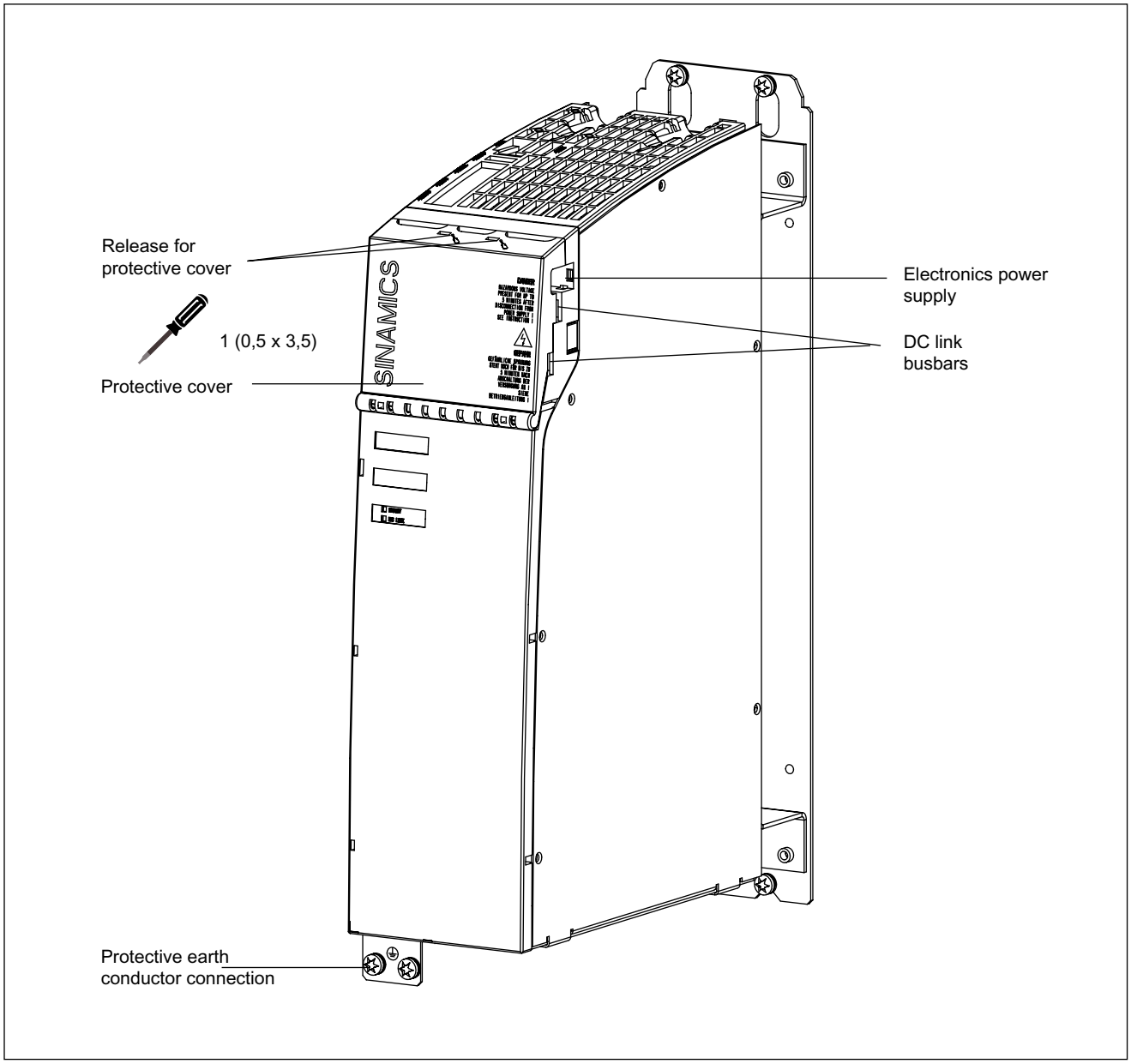


Figure 5-8 Interface description of the capacitor module

5.2.4 Dimension drawing

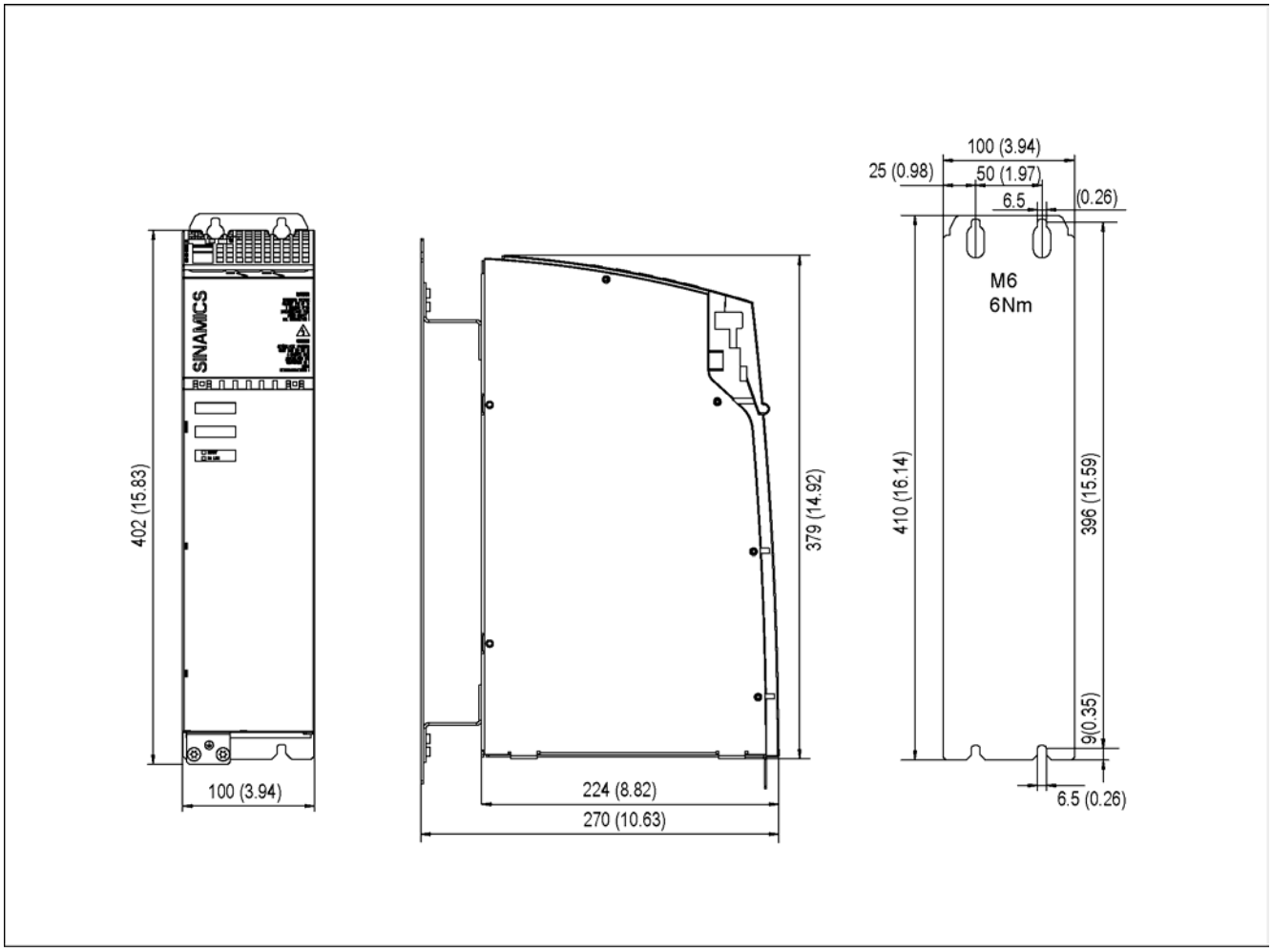


Figure 5-9 Dimension drawing of the capacitor module

5.2.5 Installation

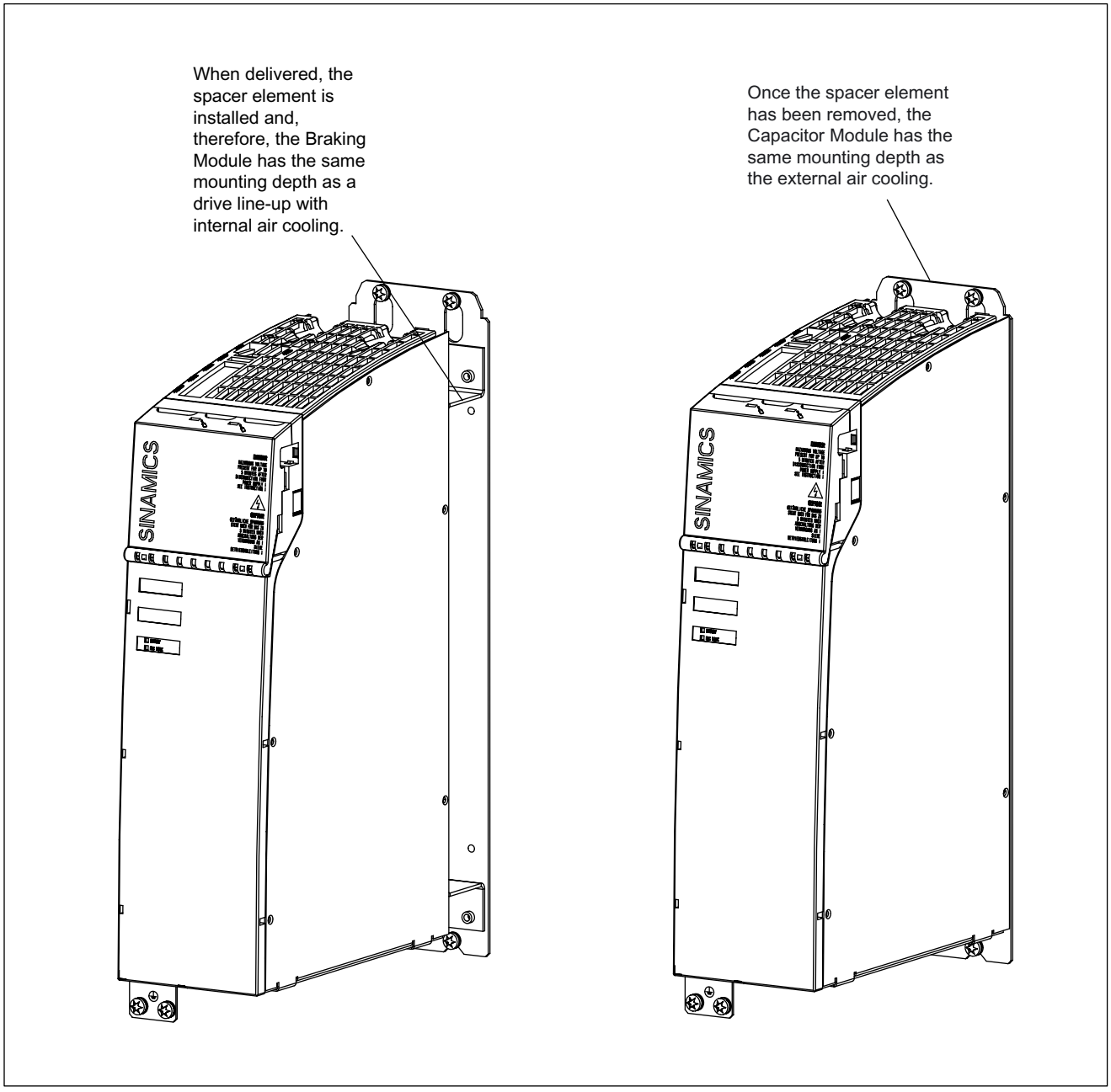


Figure 5-10 Installing a Capacitor Module with/without spacer elements

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

5.2.6 Technical data

Table 5-7 Technical data

Capacitor Module		
Electronics power supply	V_{DC}	24 (20.4 - 28.8)
DC link voltage	V_{DC}	510 - 720
Capacitance	µF	4000
24 V DC busbar current carrying capacity	A	20
DC link busbar current carrying capacity	A	100
Power loss[1]	W	25
Weight	kg	7.2

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

5.3 Control Supply Module

5.3.1 Description

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

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

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

5.3.2 Safety information

⚠ DANGER

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

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

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

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

⚠ DANGER

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

⚠ WARNING

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

⚠ DANGER

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

CAUTION

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

CAUTION

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

CAUTION

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

5.3.3 Interface description

5.3.3.1 Overview

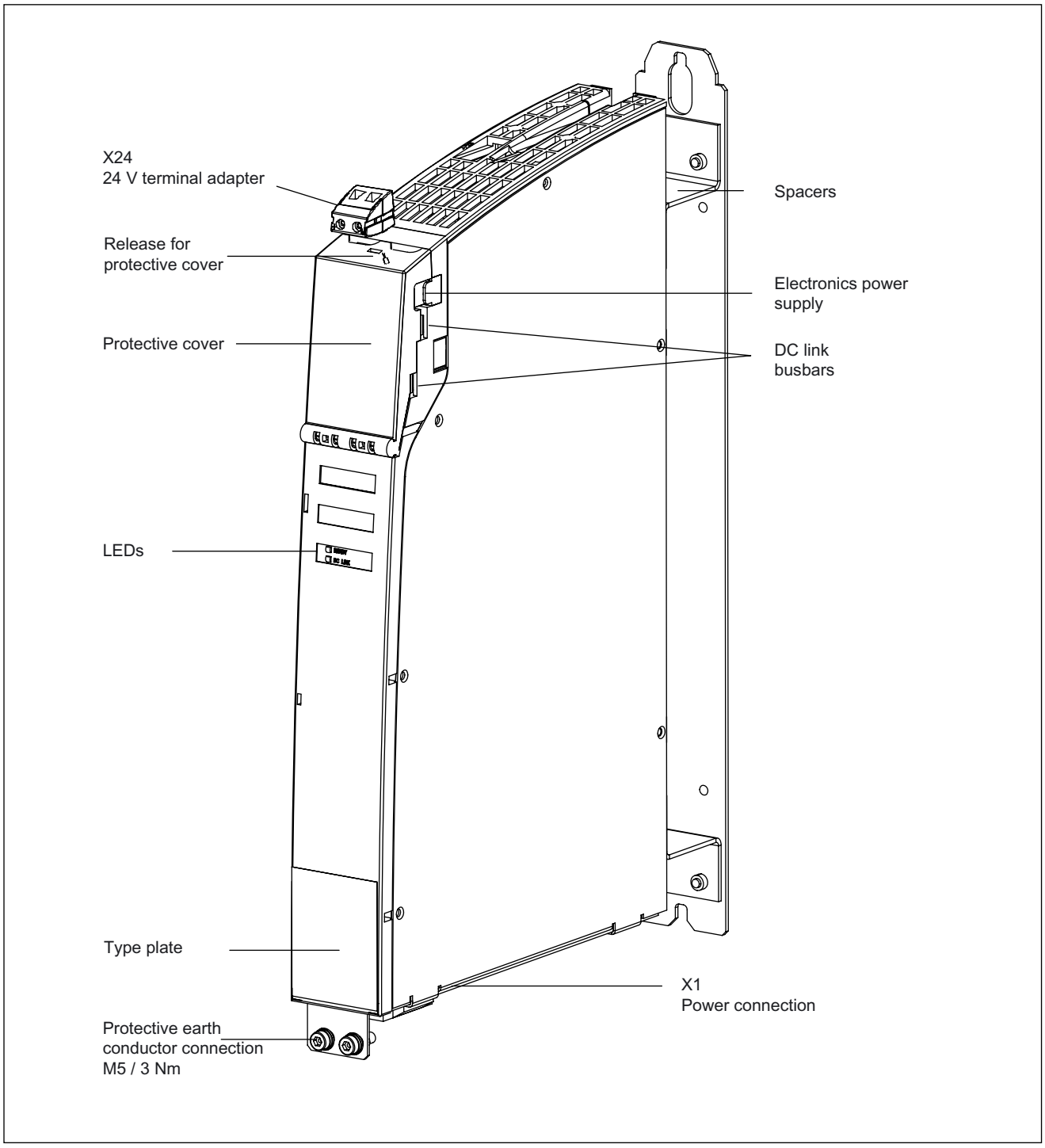
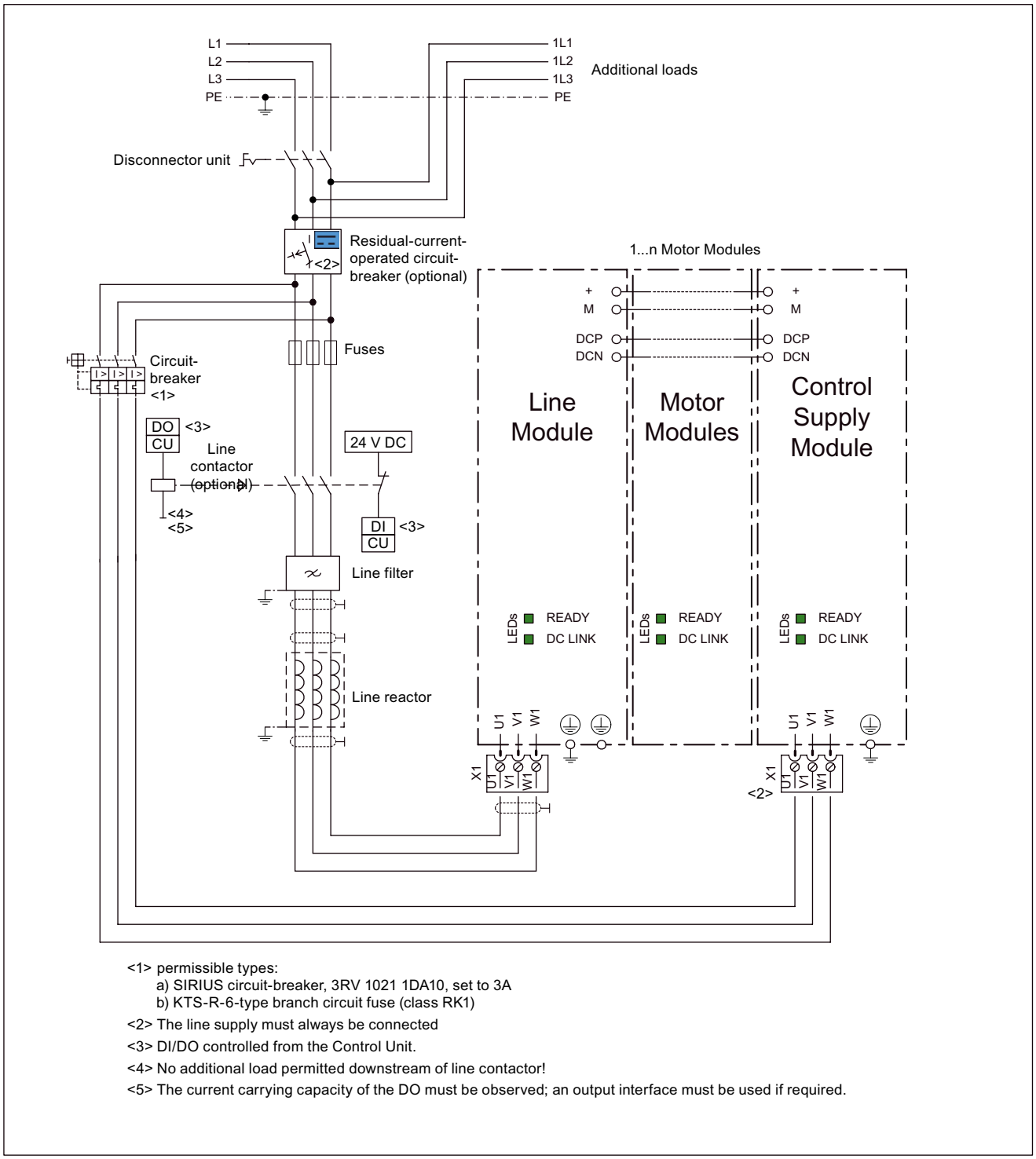


Figure 5-11 Interface description: Control supply module

5.3.3.2 Connection example



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

<2> The line supply must always be connected

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

<4> No additional load permitted downstream of line contactor!

<5> The current carrying capacity of the DO must be observed; an output interface must be used if required.

Figure 5-12 Example connection of Control Supply Module

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

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

Note

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

NOTICE

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

5.3.3.3 Meaning of the LEDs on the Control Supply Module

Table 5-8 Control Supply Module – description of the LEDs

LED	Color	Status	Description, cause	Remedy
READY	-	off	Electronics power supply is missing or outside permissible tolerance range.	–
	Green	Continuous	Component is ready to operate.	–
DC LINK	-	off	Electronics power supply is missing or outside permissible tolerance range.	–
	Orange	Continuous	DC link voltage within permissible tolerance range.	–
	Red	Continuous	DC link voltage outside permissible tolerance range.	–

5.3.4 Dimension drawing

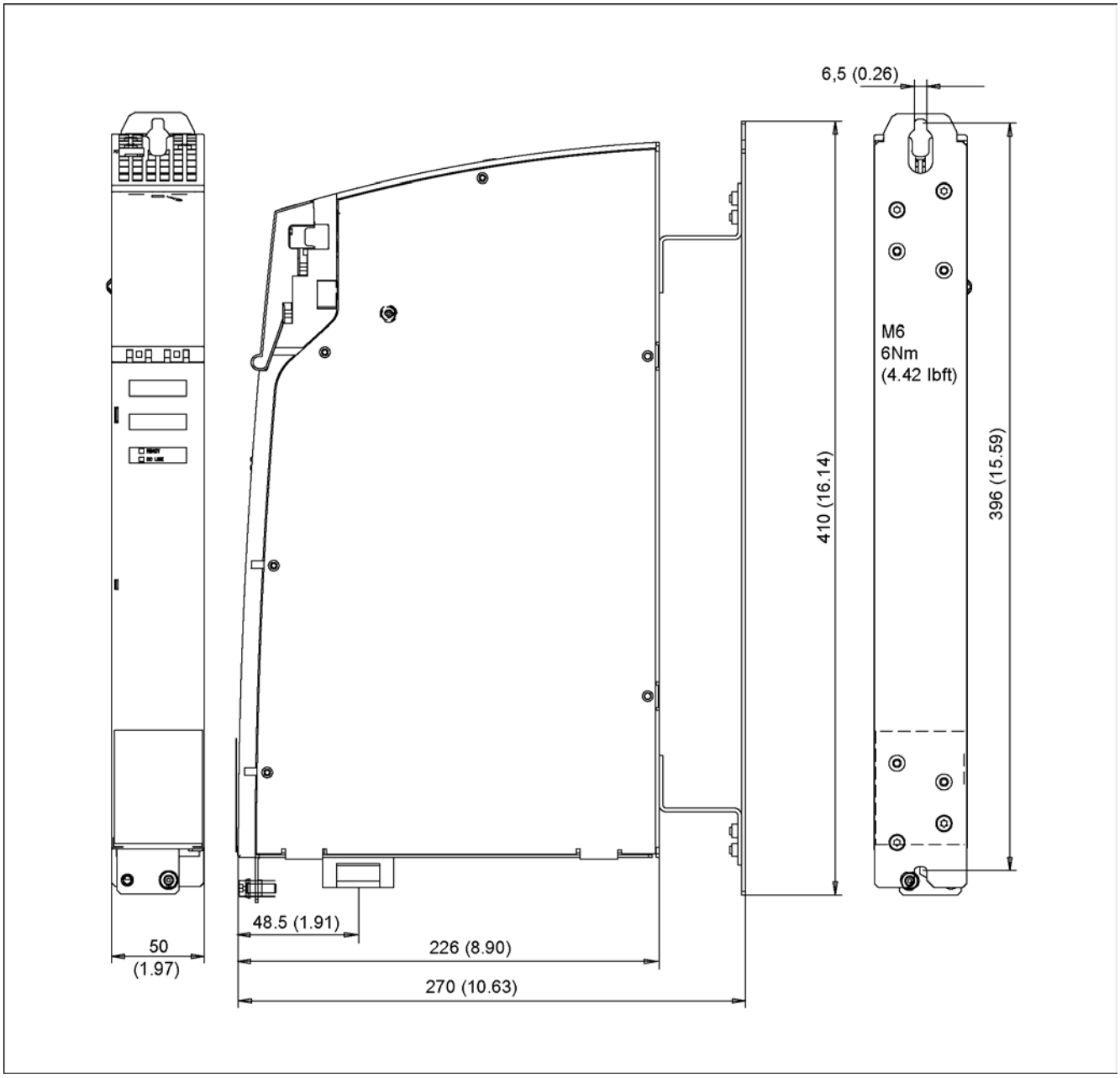


Figure 5-13 Dimension drawing of the Control Supply Module

5.3.5 Technical data

Table 5-9 Technical data

Control Supply Module	Unit	Value
Input data		
Line voltage Line frequency	V_{AC} Hz	380 - 480 V 3 AC ± 15 % 47 to 63
Rated input current Rated value (at U_{eRated})	 A_{AC}	 approx. 2
Starting current inrush	A_{AC}	Max. 80
Power loss ride-through (at 400 V_{AC})	ms	5
DC link voltage	V_{DC}	430 to 882 (300 to 430 < 1 min)
Supply current (at 600 V)	A_{DC}	1.1
Output data		
Output voltage	V_{DC}	26 +/- 2 %
Rated output current	A_{DC}	20
Startup to short-circuit Short-circuit during operation	A_{DC} A_{DC}	≤ 24 Normally 23 (continuous)
24 V DC busbar current carrying capacity	 A_{DC}	 20
Residual ripple (clock frequency approx. 50 kHz)	mV_{pp}	< 100
Cycle peaks (bandwidth 20 MHz)	mV_{pp}	< 200
Power loss[1]	W	< 105
Weight	kg	4.8

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

5.4 Voltage Clamping Module

5.4.1 Description

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

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

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

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

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

Limitations/secondary conditions

The following secondary conditions must be observed:

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

Compatibility

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

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

5.4.2 Safety information

⚠ DANGER

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

⚠ WARNING

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

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

⚠ DANGER

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

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

NOTICE

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

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

⚠ DANGER

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

⚠ WARNING

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

⚠ DANGER

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

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

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

5.4.3 Interface description

5.4.3.1 Overview

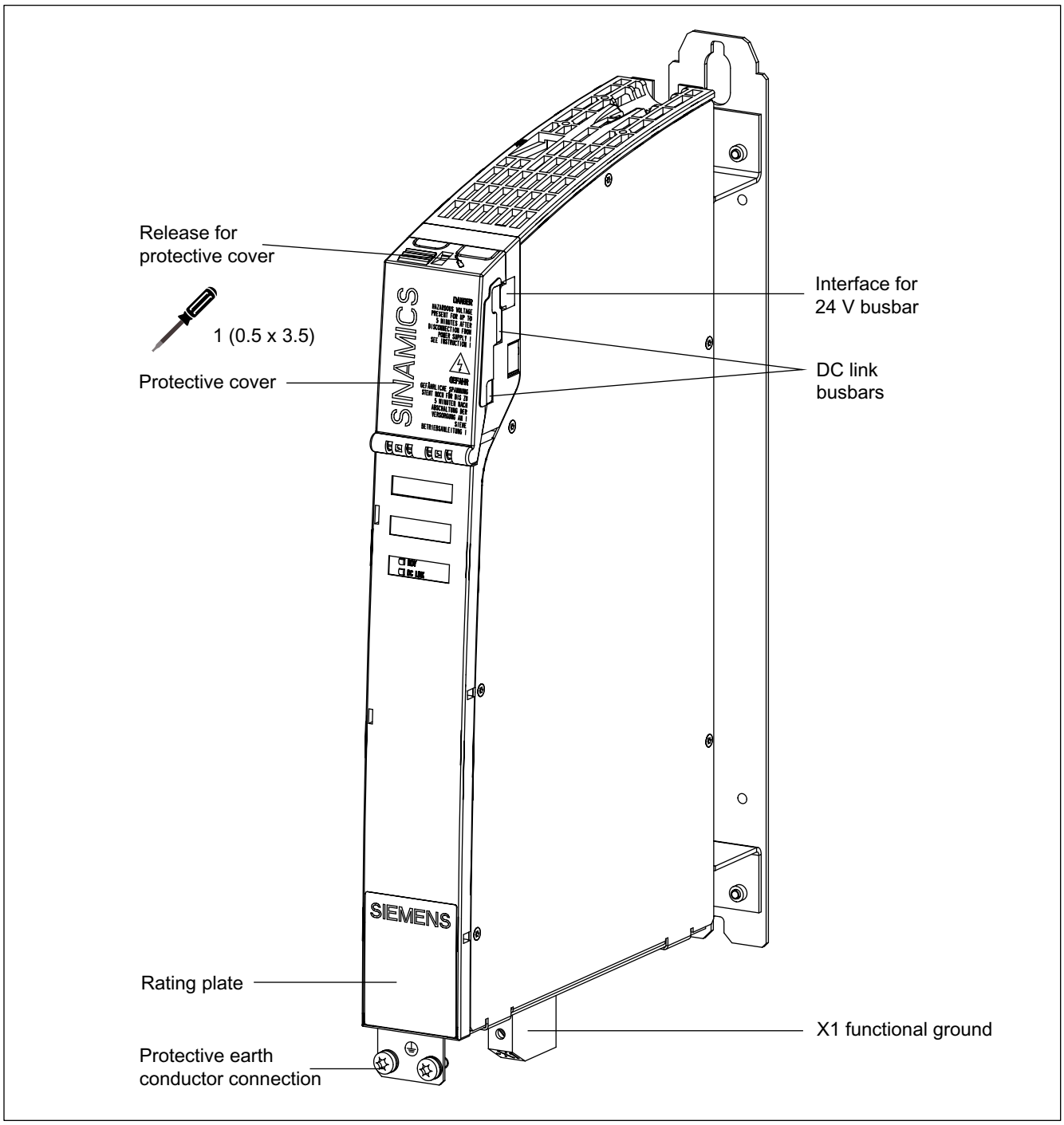


Figure 5-14 Interface description: Voltage Clamping Module

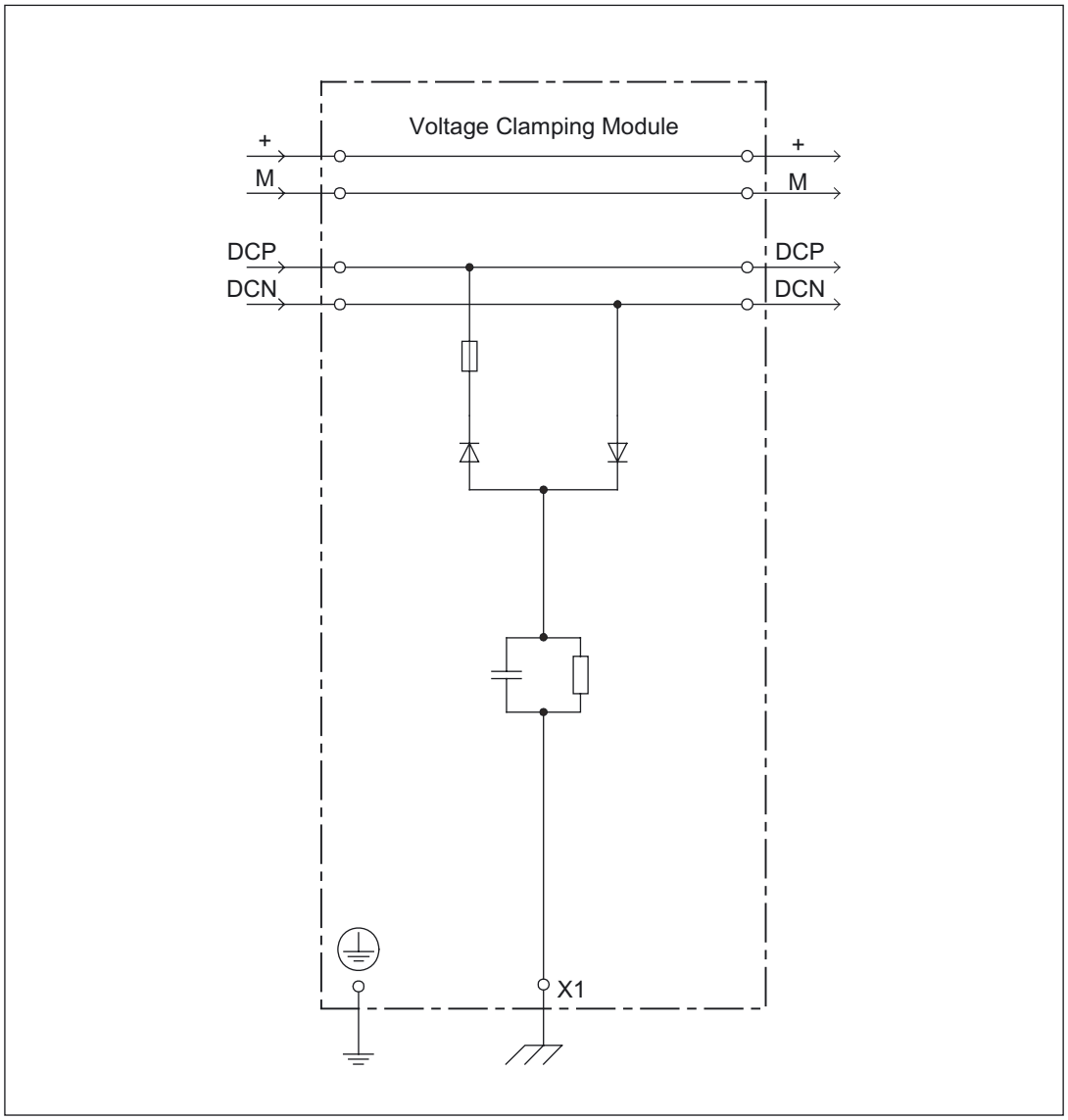


Figure 5-15 Circuit diagram: Voltage Clamping Module

5.4.3.2 X1 functional ground

X1 functional ground

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

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

5.4.4 Dimension drawing

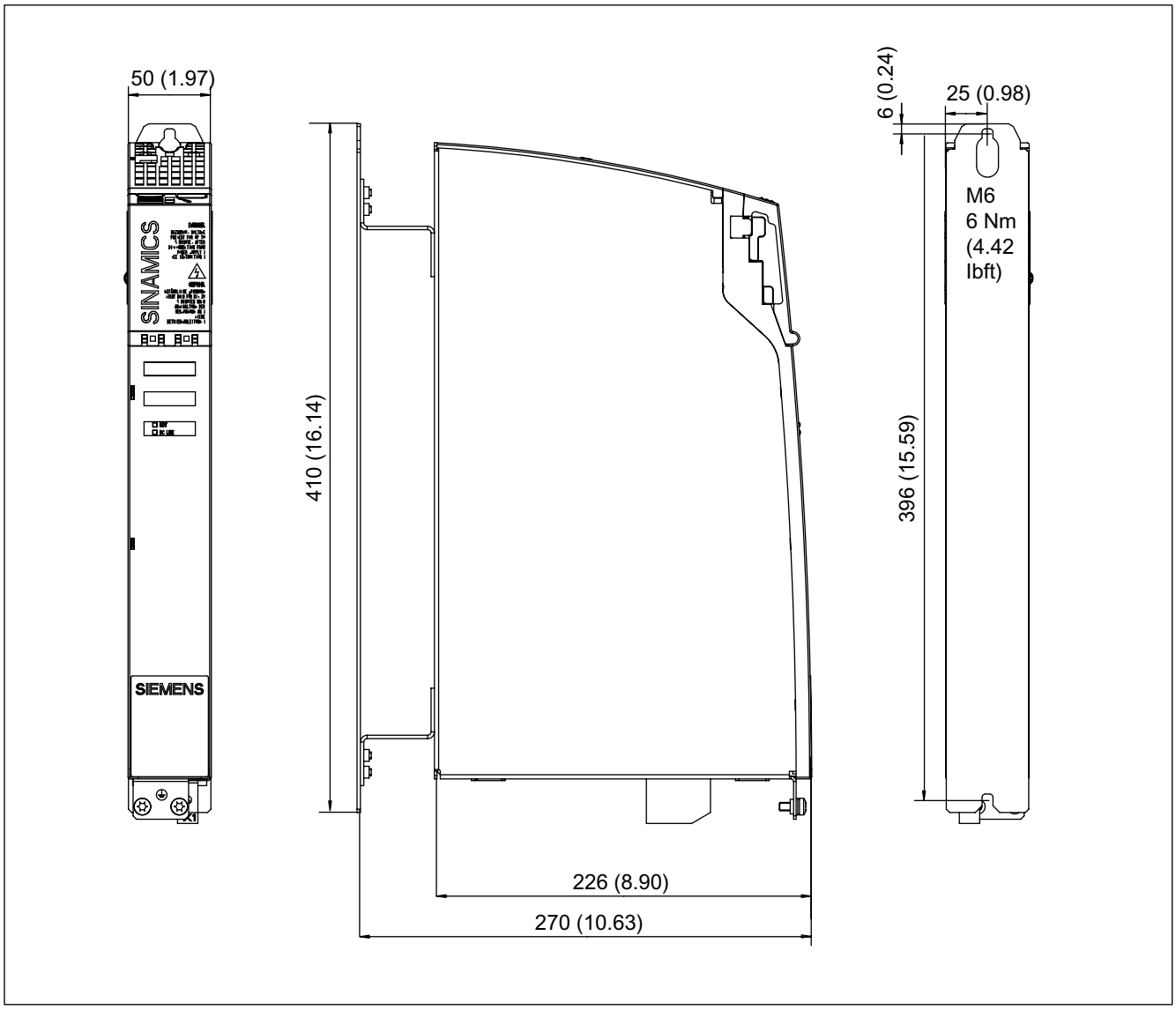


Figure 5-16 Dimension drawing of the Voltage Clamping Module

5.4.5 Mounting

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.

5.4.6 Technical data

Table 5-10 Technical data

Voltage Clamping Module		
Electronics power supply	V_{DC}	24 (20.4 - 28.8)
DC link voltage	V_{DC}	510 - 720
DC link busbar current carrying capacity	A	100
24 V busbar current carrying capacity	A	20
Power loss[1]	W	50
Weight	kg	3.1

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

Motor-Side Power Components

6

6.1 Motor reactors

6.1.1 Description

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

Prerequisites

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

6.1.2 Safety information

⚠ WARNING

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

Note

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

CAUTION

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

⚠ CAUTION

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

CAUTION

The maximum permissible output frequency when motor reactors are used is 120 Hz.

6.1.3 Dimension drawings

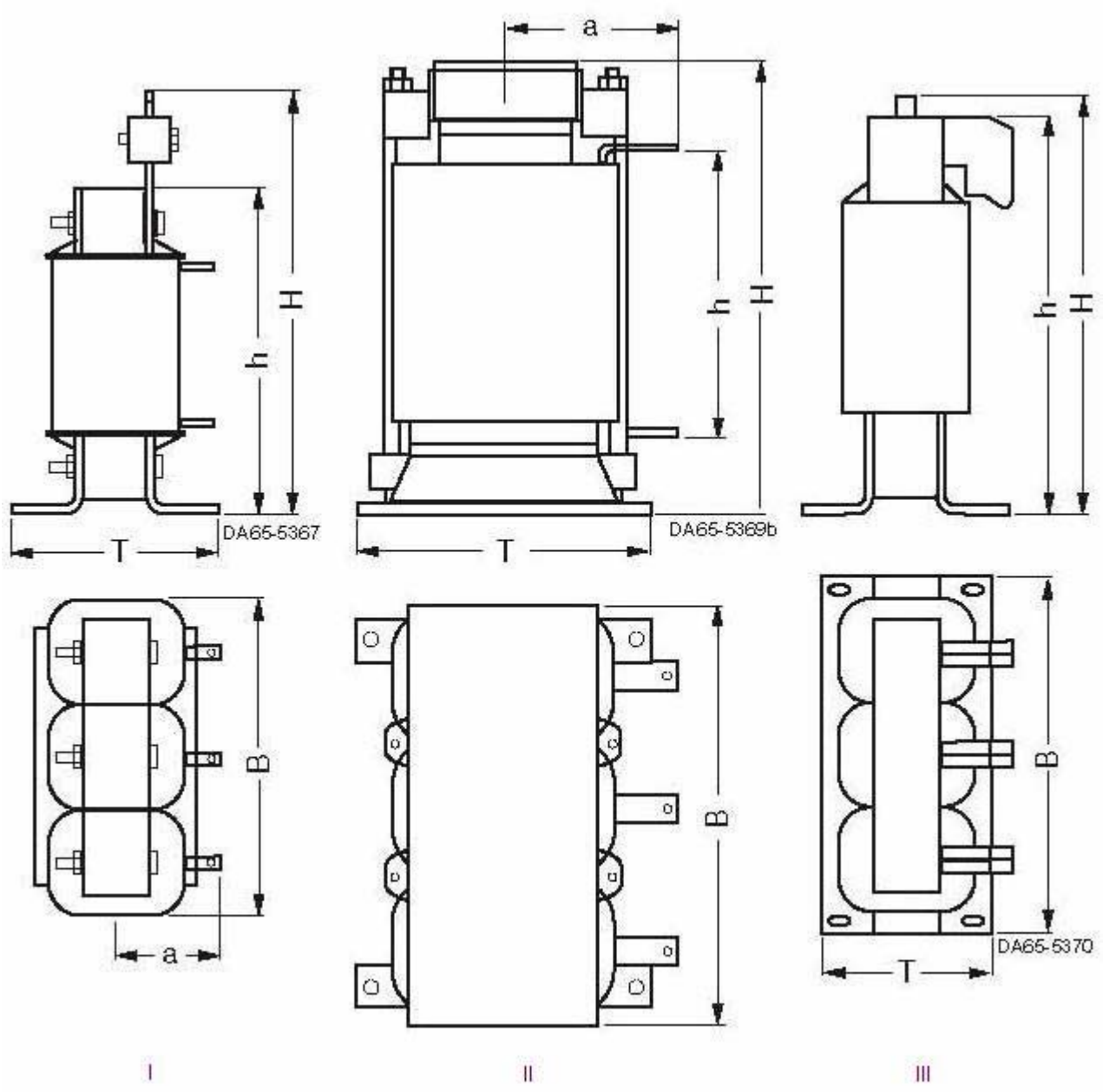


Figure 6-1 Dimension drawings: Motor reactors

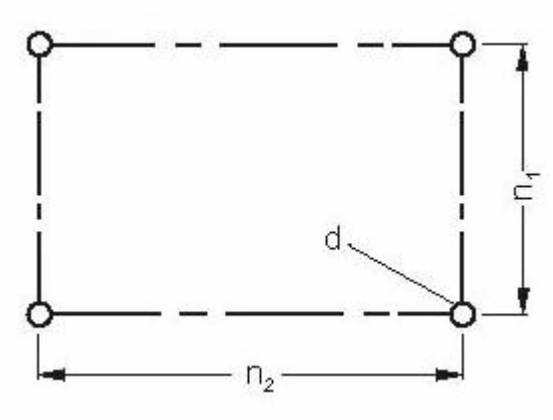


Figure 6-2 Mounting hole

Table 6-1 Dimensions of motor reactors, all data in mm and (inches)

	6SE7021-0ES87-1FE0	6SE7022-6ES87-1FE0	6SE7024-7ES87-1FE0	6SE7027-2ES87-1FE0
	Fig. III	**Fig. III**	**Fig. II**	**Fig. I**
B	178 (7.00)	219 (8.62)	197 (7.75)	267 (10.51)
H	153 (6.02)	180 (7.08)	220 (8.66)	221 (8.70)
D	88 (3.46)	119 (4.68)	104 (4.09)	107 (4.21)
a	-	-	69 (2.71)	77 (3.03)
h	146 (5.74)	181 (7.12)	103 (4.05)	206 (8.11)
n1	68 (2.67)	89 (3.50)	70 (2.75)	77 (3.03)
n2	166 (6.53)	201 (7.91)	176 (6.92)	249 (9.80)
d	M5	M6	M6	M6
1) Dimensions n1 and n2 correspond to the hole spacing				

Table 6-2 Dimensions of motor reactors, all data in mm and (inches)

	6SE7031-5ES87-1FE0	6SE7031-8ES87-1FE0	6SE7032-6ES87-1FE0
	Fig. II	**Fig. II**	**Fig. II**
B	197 (7.75)	281 (11.06)	281 (11.06)
H	220 (8.66)	250 (9.84)	250 (9.84)
T	128 (5.03)	146 (5.74)	146 (5.74)
a	81 (3.18)	98 (3.85)	111 (4.37)
h	100 (3.93)	119 (4.68)	121 (4.76)
n1	94 (3.70)	101 (3.97)	101 (3.97)
n2	176 (6.92)	200 (7.87)	200 (7.87)
d	M6	M8	M8
1) Dimensions n1 and n2 correspond to the hole spacing			

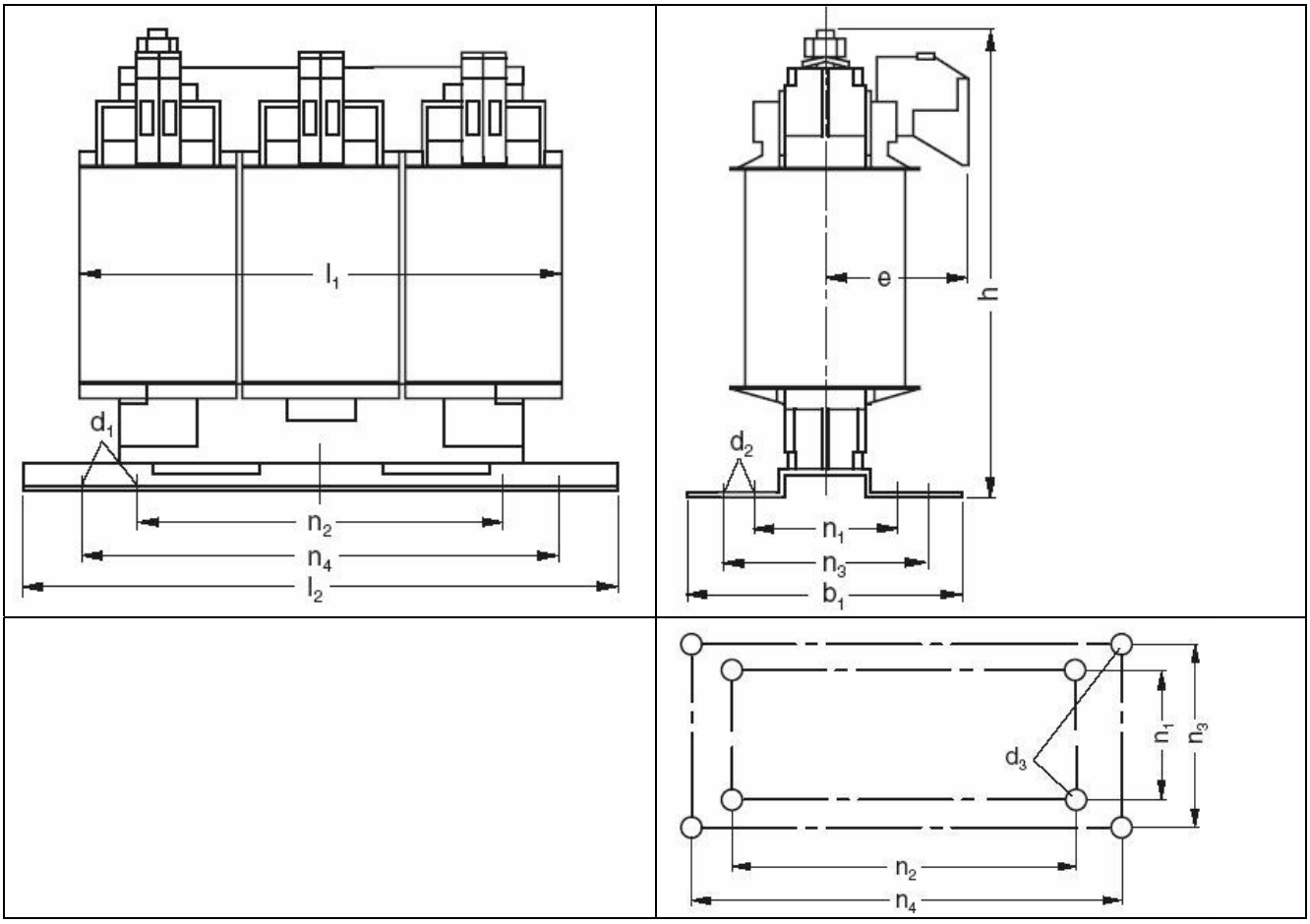
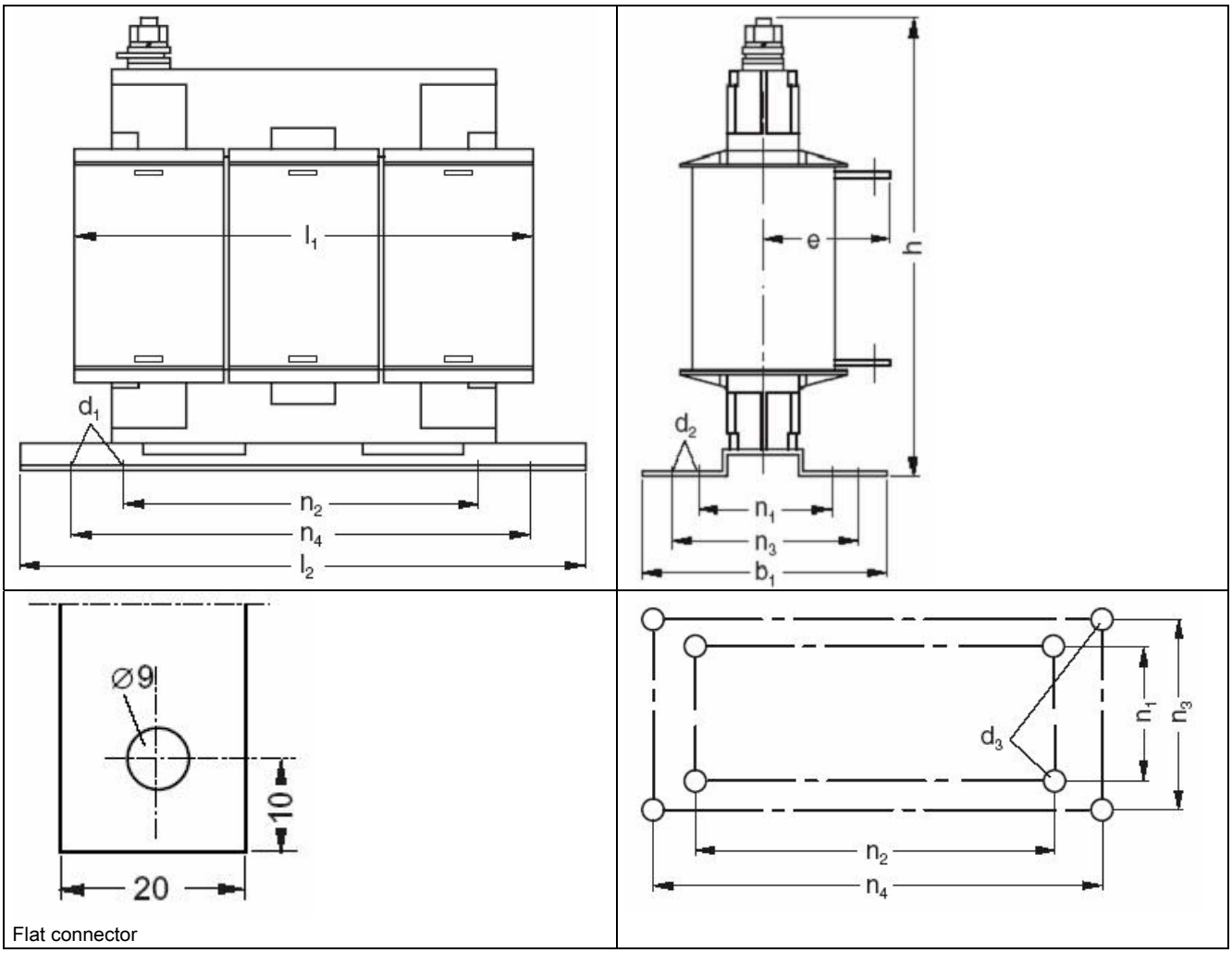


Table 6-3 Dimensions of motor reactors, all data in mm and (inches)

6SL3000-	2BE21-0AA0
l_1	150 (5.90)
l_2	178 (7.00)
b_1	88 (3.46)
b_{max}	111 (4.37)
e	67 (2.63)
h	159 (6.25)
n_1	64 (2.51)
n_2	113 (4.44)
n_3	68 (2.67)
n_4	166 (6.53)
d_1	5.8 (0.22)
d_2	11 (0.43)
d_3	M5
PI	M6
Lengths n_1, n_2, n_3 and n_4 corresponds to the distance between holes	



Flat connector

Table 6-4 Dimensions of motor reactors, all data in mm and (inches)

6SL3000-	2BE26-0AA0
l_1	max. 228 (8.97)
l_2	267 (10.51)
b_1	107 (4.21)
b_{max}	125.5 (4.94)
e	72 (2.83)
h	220 (8.66)
h_1	56 (2.20)
h_2	100 (3.93)
n_1	70 (2.75)
n_2	176 (6.92)
n_3	77 (3.03)
n_4	249 (9.80)

6SL3000-	2BE26-0AA0
d_1	36 (1.41)
d_2	3.5 (0.13)
d_3	M6
PI	M6
Lengths n_1, n_2, n_3 and n_4 corresponds to the distance between holes	

6.1.4 Technical data

Table 6-5 Technical data, motor reactors, part 1

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

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

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

Table 6-7 Cable lengths, Part 1

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

Table 6-8 Cable lengths, Part 2

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

Accessories

7

7.1 Shield connecting plates

7.1.1 Description

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

7.1.2 Overview

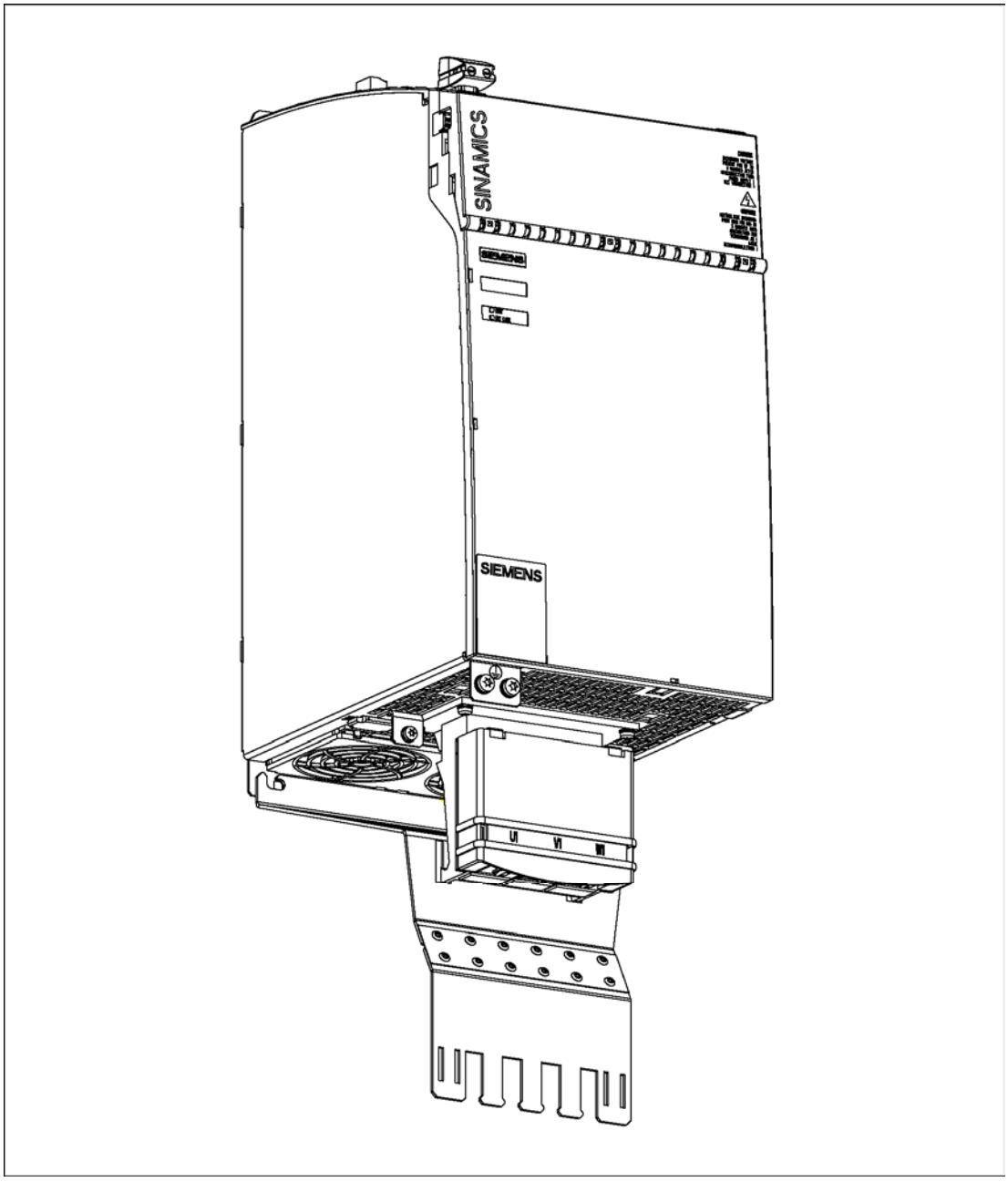


Figure 7-1 Shield connecting plate for a 200 mm module with internal air cooling

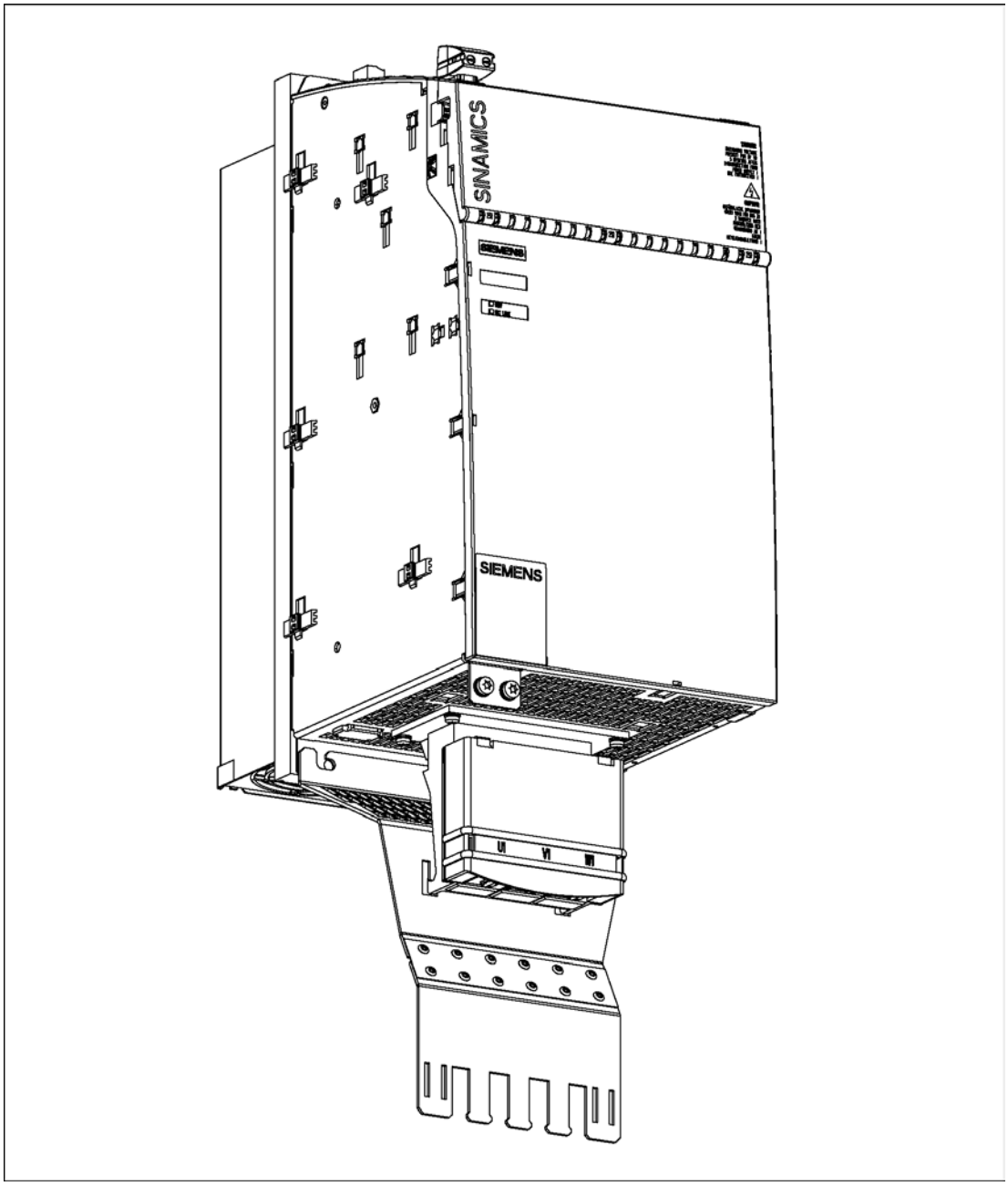


Figure 7-2 Shield connecting plate for a 200 mm module with external air cooling

7.1.3 Dimension drawings

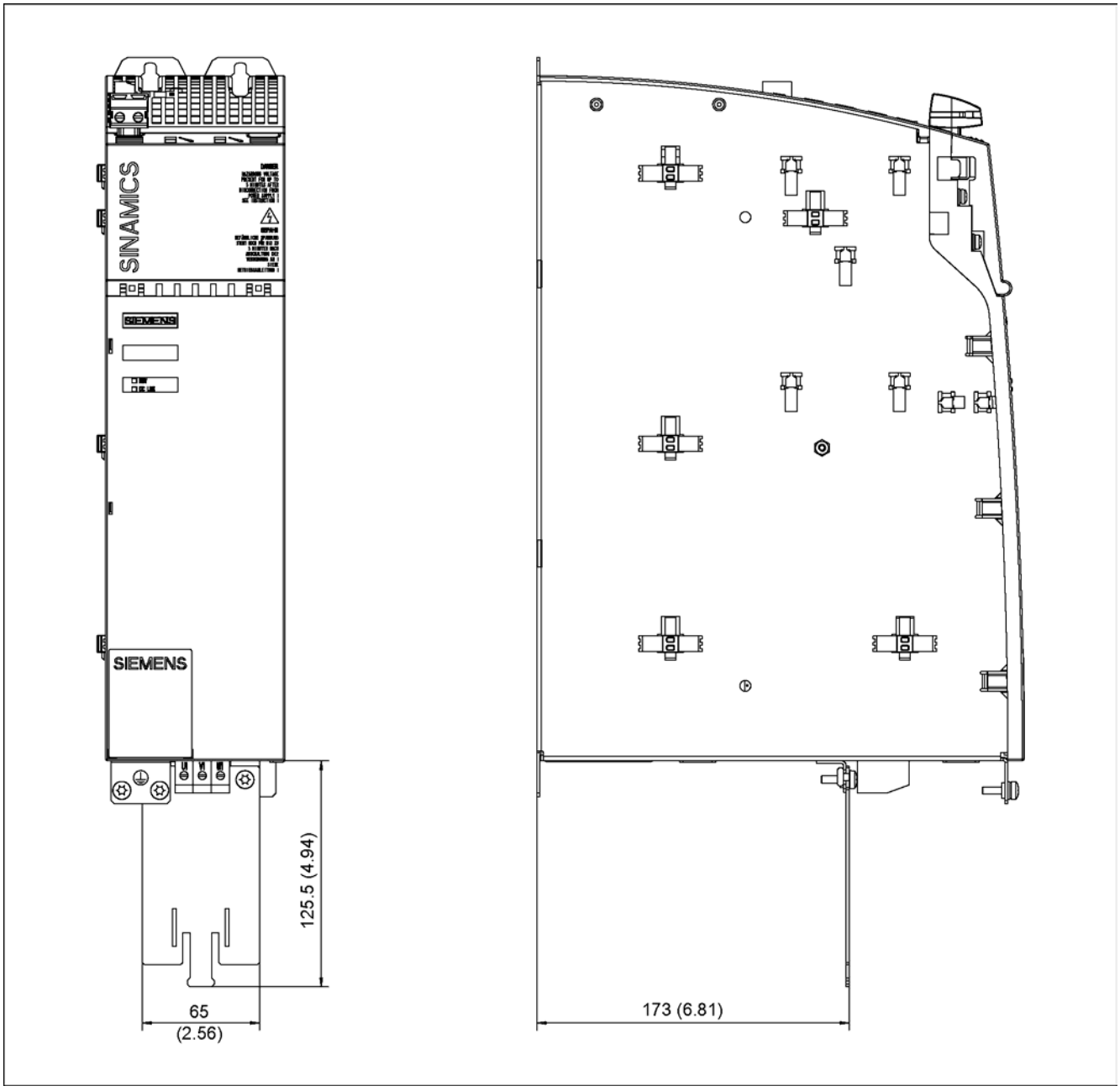


Figure 7-3 Dimension drawing of shield terminal plate on a 100 mm Line Module with internal air cooling

Note

The shield connecting plate is part of the scope of supply of a 100 mm Line Module.
Recommended shielding connection clamps: from Weidmüller, Order No. KLBÜ CO4
Weidmüller: http://www.weidmueller.com

For Motor Modules 50 mm and 100 mm wide, the motor cable shield is connected through the motor connector housing.

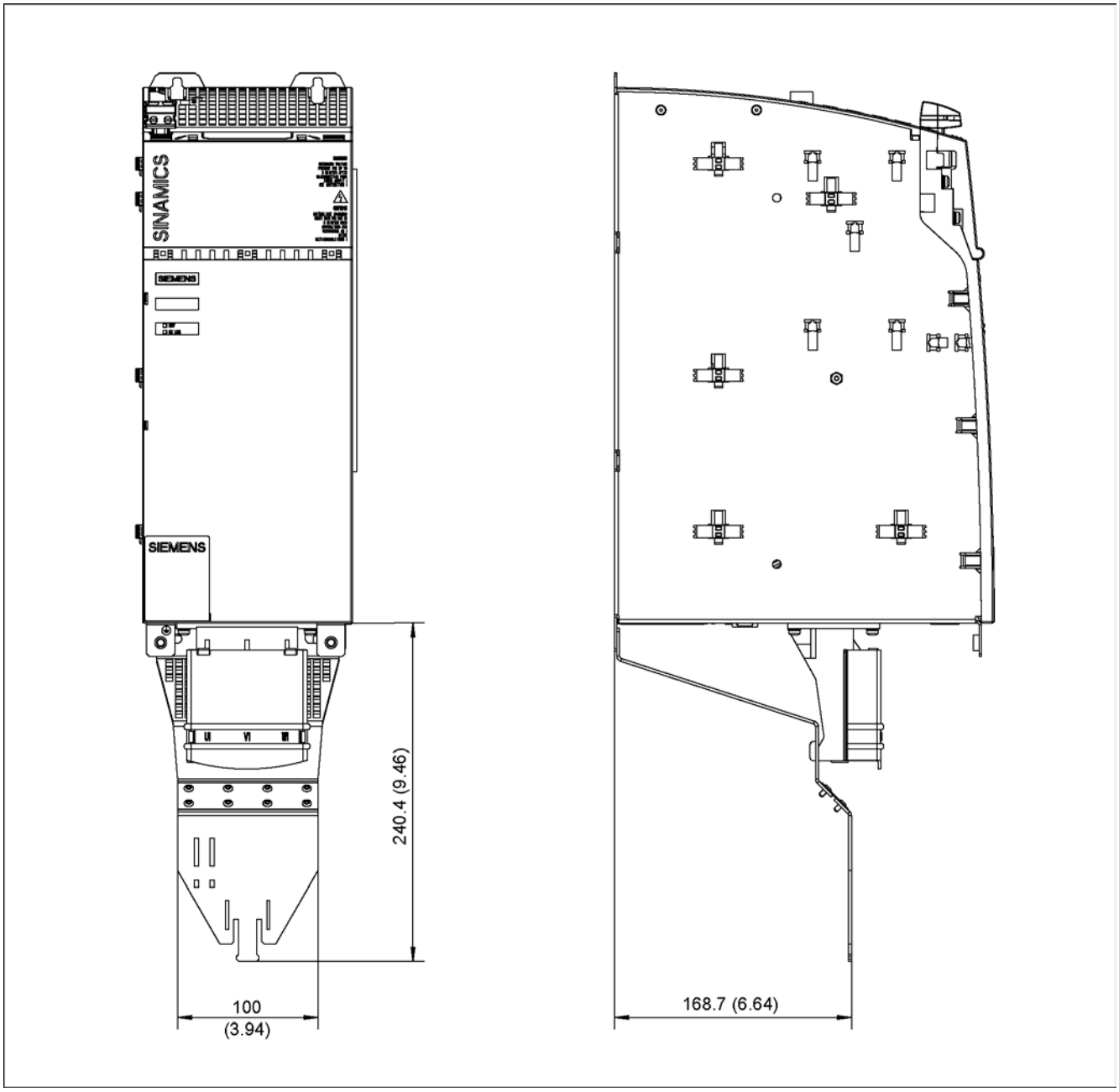


Figure 7-4 Dimension drawing of shield terminal plate on a 150 mm component (Line Module or Motor Module) with internal air cooling

Note

A shield connecting plate can be ordered as option: Siemens,
Order No. 6SL3162-1AF00-0AA1

Recommended shielding connection clamps: from Weidmüller,
Order No. KLBÜ CO1 and KLBÜ CO4

Weidmüller: http://www.weidmueller.com

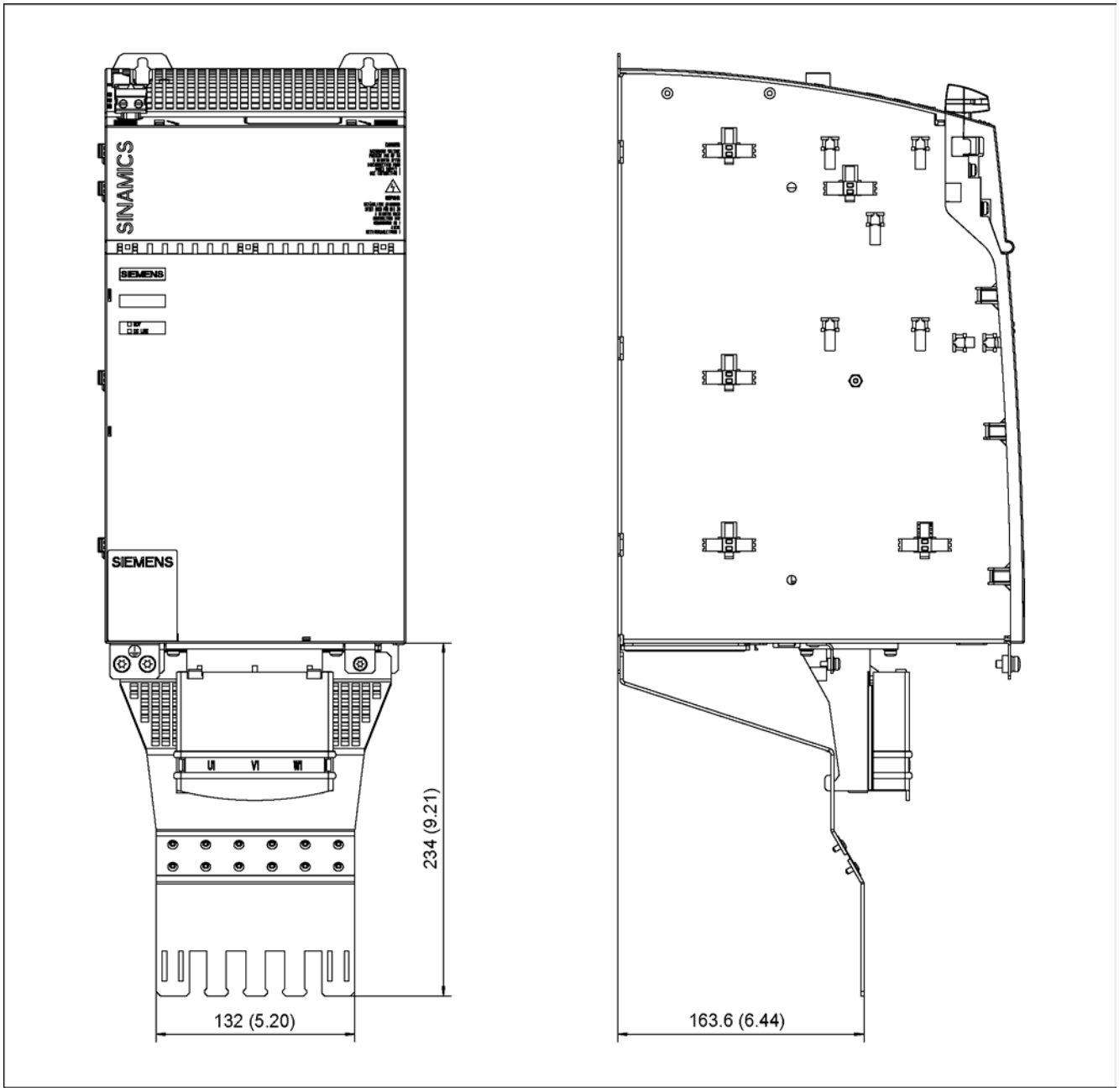


Figure 7-5 Dimension drawing of shield terminal plate on a 200 mm component (Line Module or Motor Module) with internal air cooling

Note

A shield connecting plate can be ordered as option: Siemens,
Order No. 6SL3162-1AH01-0AA0

Recommended shielding connection clamps: from Weidmüller,
Order No. KLBÜ CO1

Weidmüller: http://www.weidmueller.com

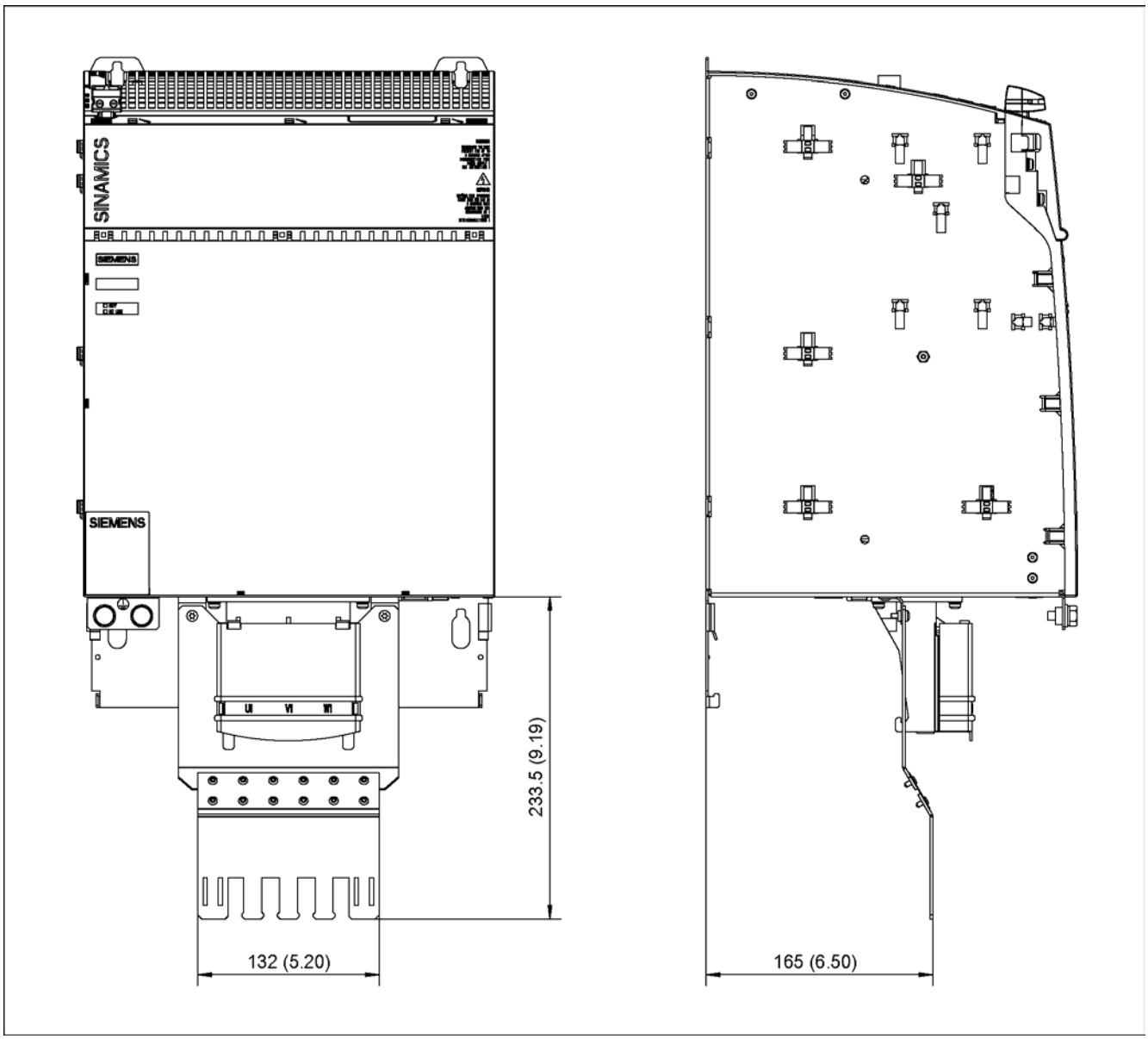


Figure 7-6 Dimension drawing of shield terminal plate on a 300 mm component (Line Module or Motor Module) with internal air cooling

Note

A shield connecting plate can be ordered as option: Siemens,
Order No. 6SL3162-1AH00-0AA0

Recommended shielding connection clamps: from Weidmüller,
Order No. KLBÜ CO1

Weidmüller: http://www.weidmueller.com

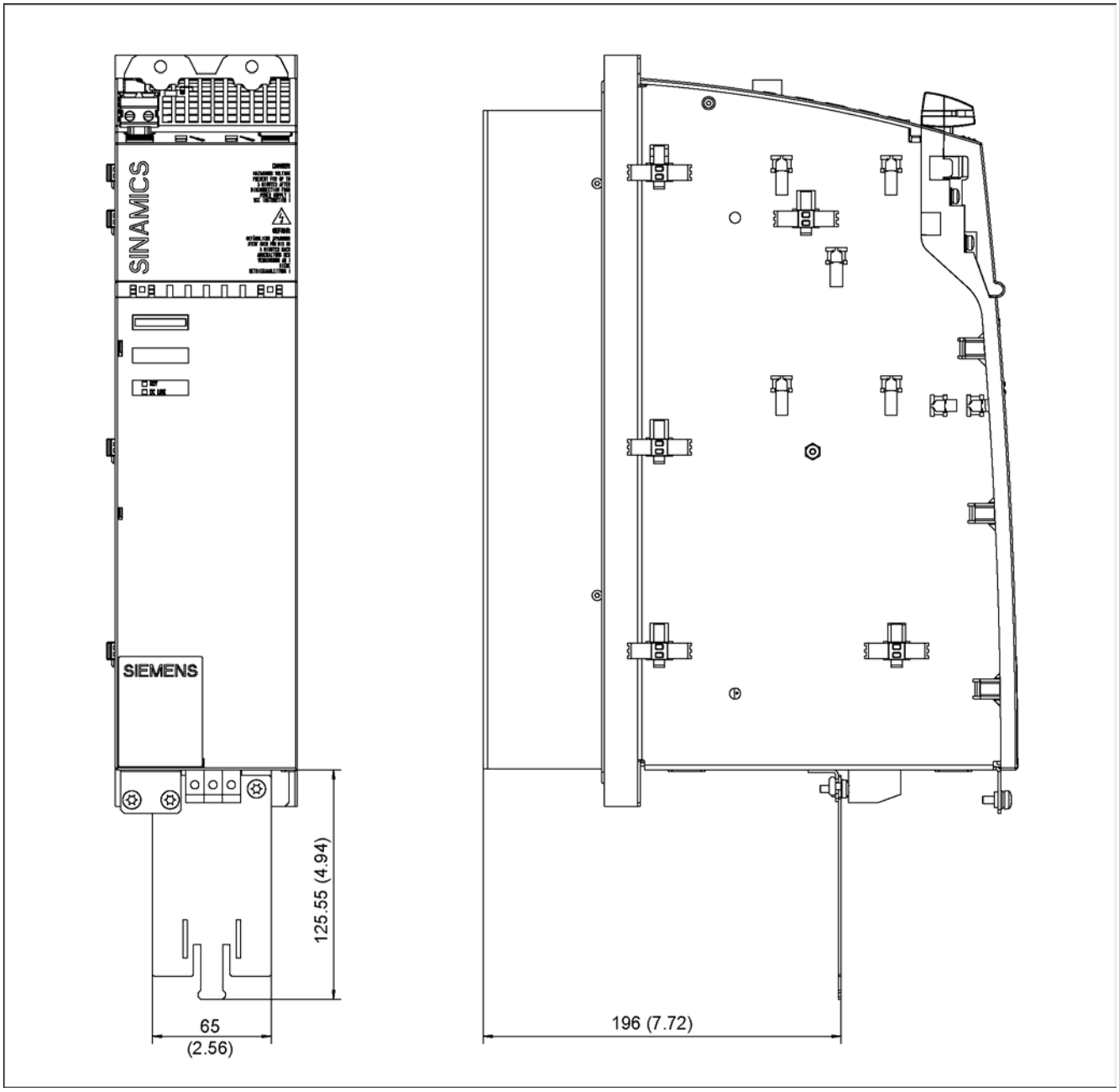


Figure 7-7 Dimension drawing of shield terminal plate on a 100 mm component (Line Module or Motor Module) with external air cooling

Note

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

Recommended shielding connection clamps: from Weidmüller, Order No. KLBÜ CO4

Weidmüller: http://www.weidmueller.com

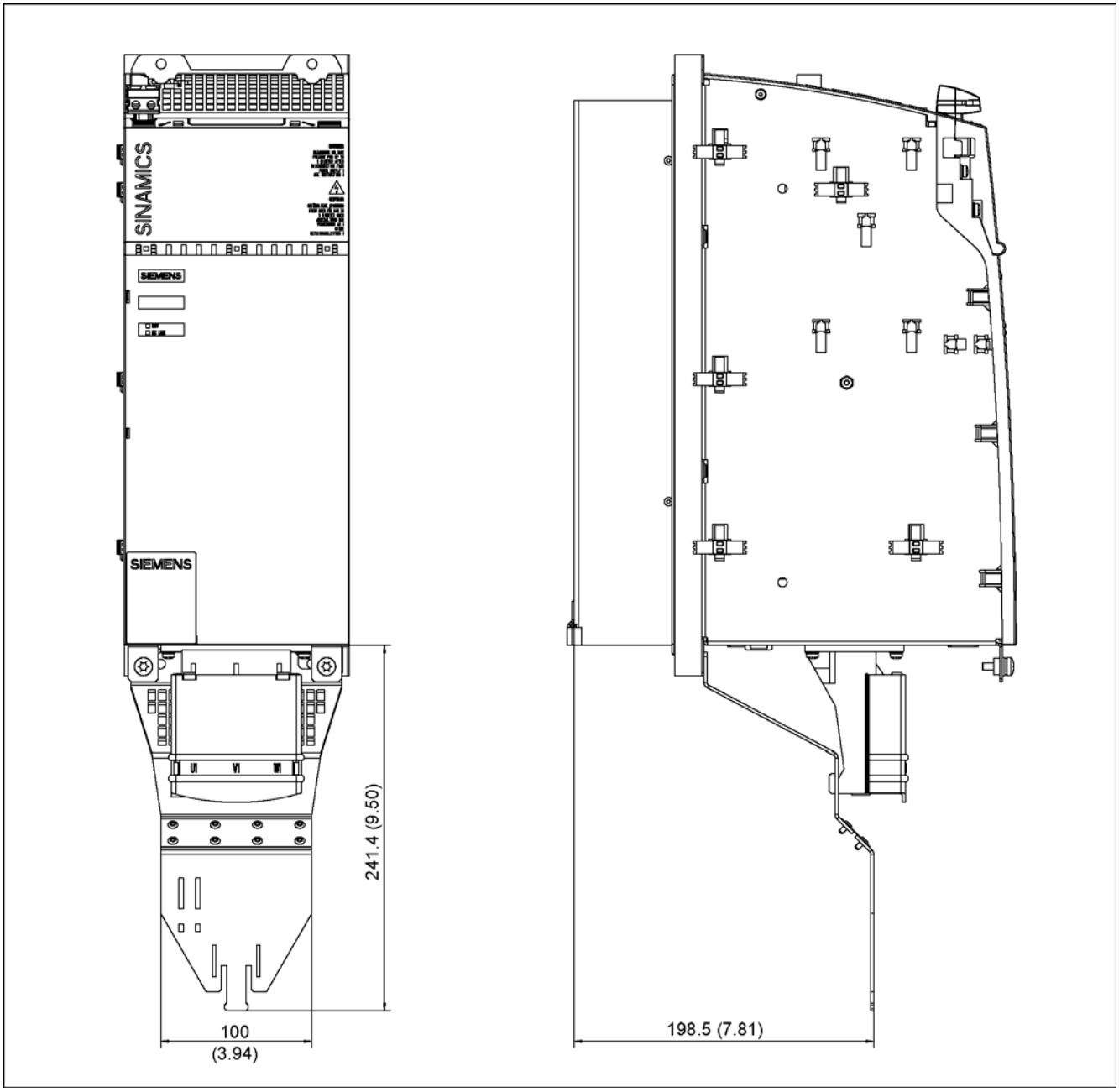


Figure 7-8 Dimension drawing of shield terminal plate on a 150 mm component (Line Module or Motor Module) with external air cooling

Note

A shield connecting plate is available as option: Siemens,
Order No. 6SL3162-1AF00-0BA5

Recommended shielding connection clamps: from Weidmüller,
Order No. KLBÜ CO1 and KLBÜ CO4

Weidmüller: http://www.weidmueller.com

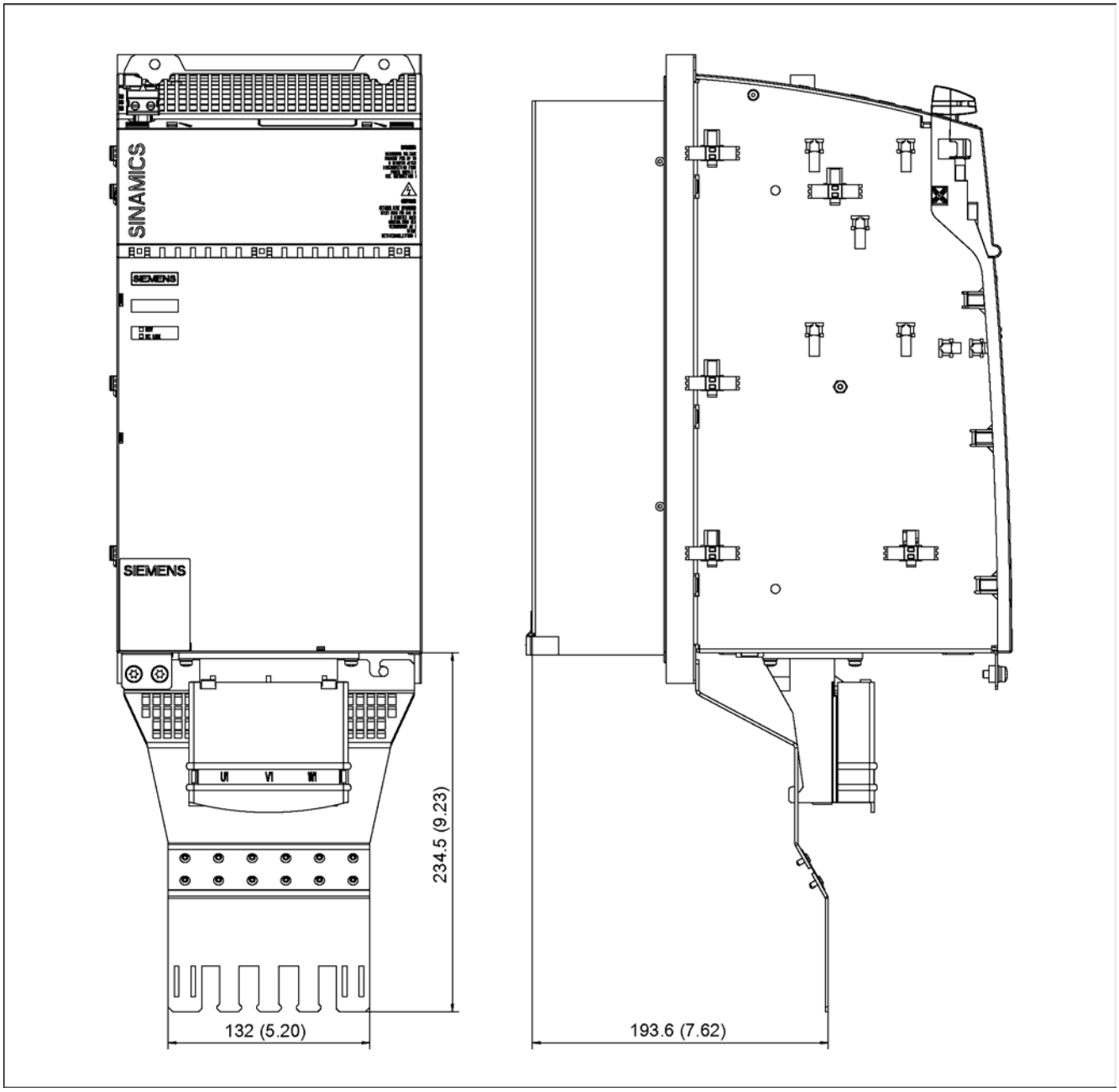


Figure 7-9 Dimension drawing of shield terminal plate on a 200 mm component (Line Module or Motor Module) with external air cooling

Note

A shield connecting plate is available as option: Siemens, Order No. 6SL3162-1AH01-0BA0

Recommended shielding connection clamps: from Weidmüller, Order No. KLBÜ CO1

Weidmüller: http://www.weidmueller.com

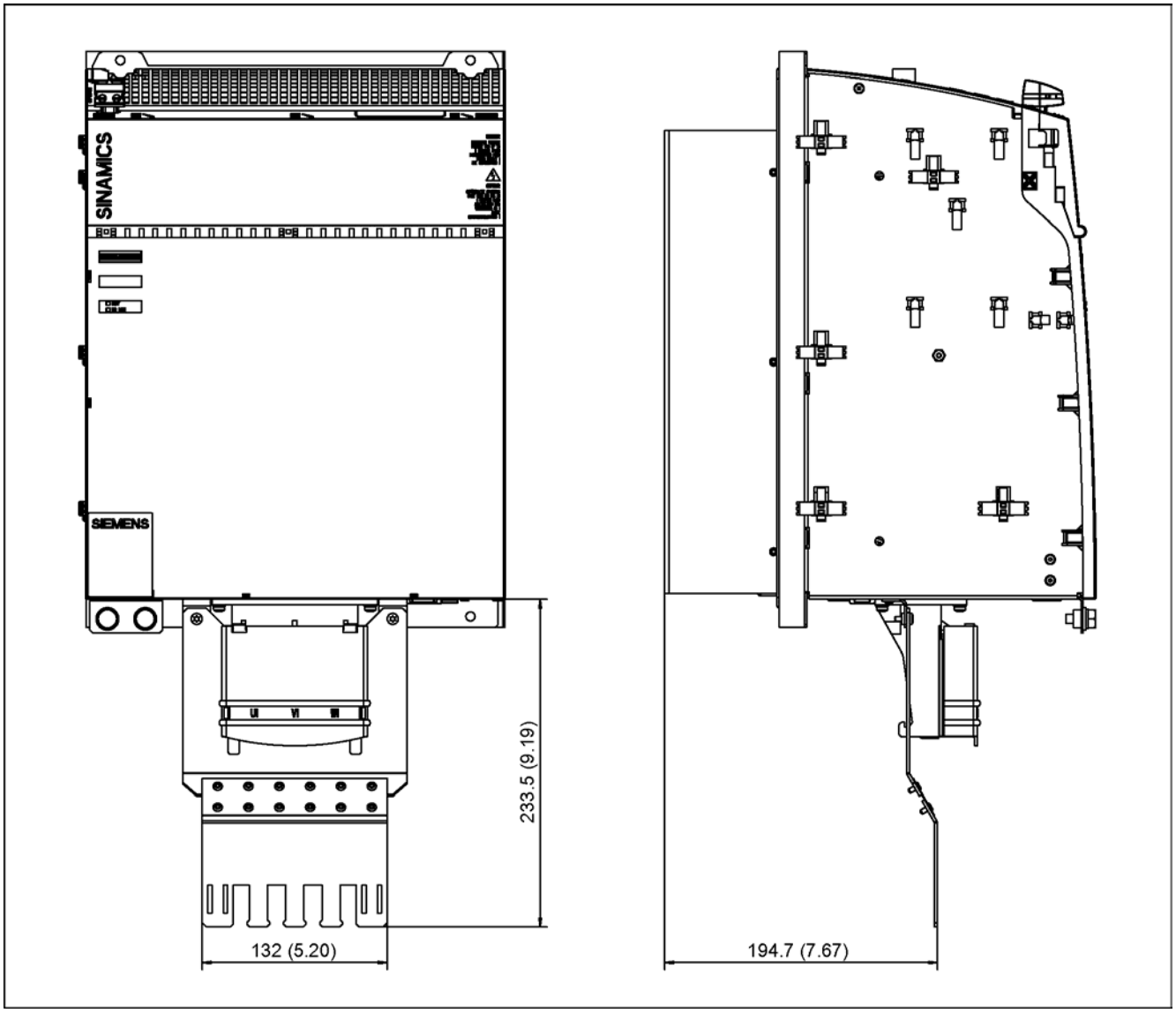


Figure 7-10 Dimension drawing of shield terminal plate on a 300 mm component (Line Module or Motor Module) with external air cooling

Note

A shield connecting plate is available as option: Siemens, Order No. 6SL3162-1AH00-0AA0

Recommended shielding connection clamps: from Weidmüller, Order No. KLBÜ CO1

Weidmüller: http://www.weidmueller.com

7.1.4 Installation

Table 7-1 Mounting the shield connecting plate to a 100 mm component using as an example, internal air cooling

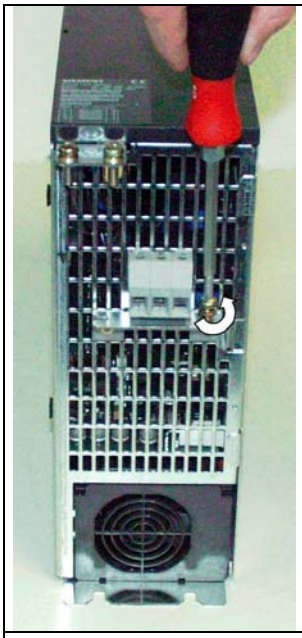
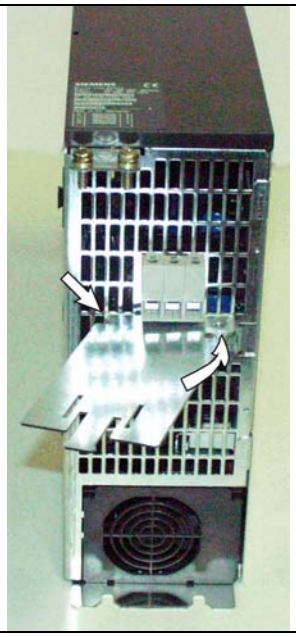
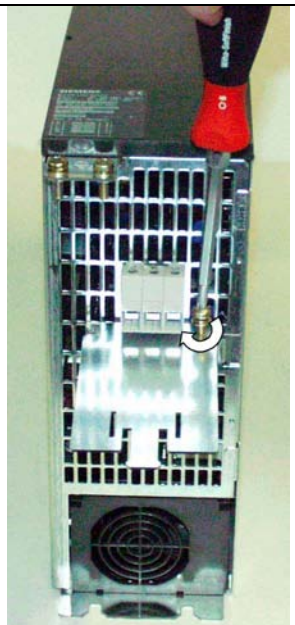
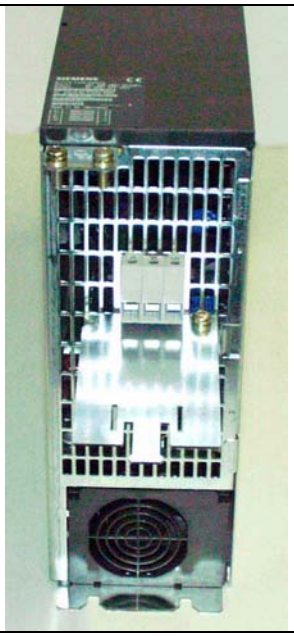
			
Remove the screw with screwdriver T25	Hook in the shielded plate.	Secure the shield connecting plate with screwdriver T25/3 Nm.	Mounted shield connecting plate

Table 7-2 Mounting the shield connecting plate to a 200 mm component using as an example, internal air cooling

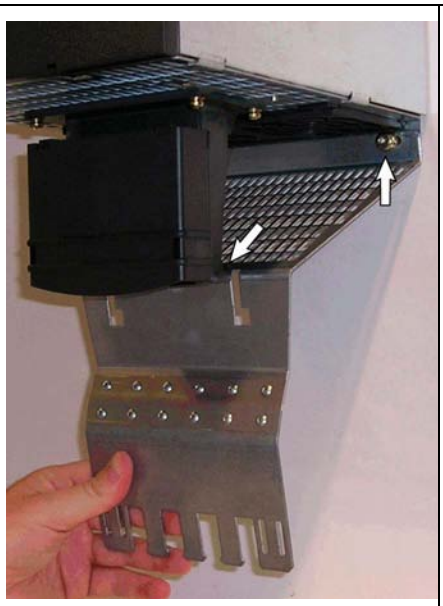
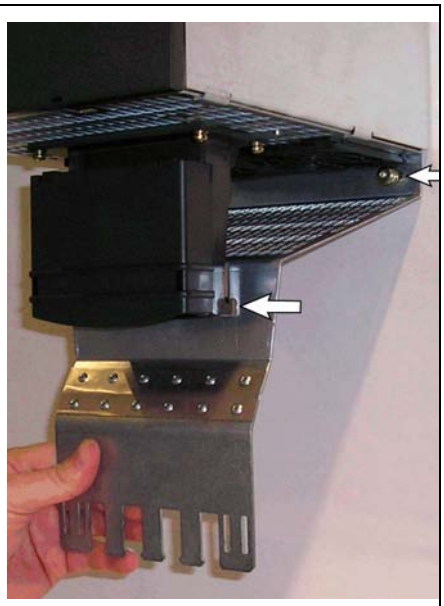
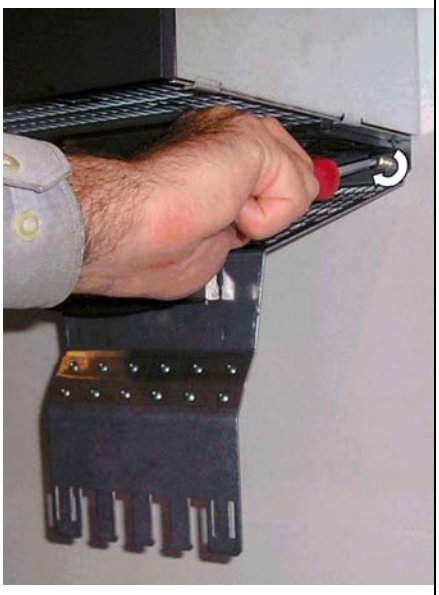
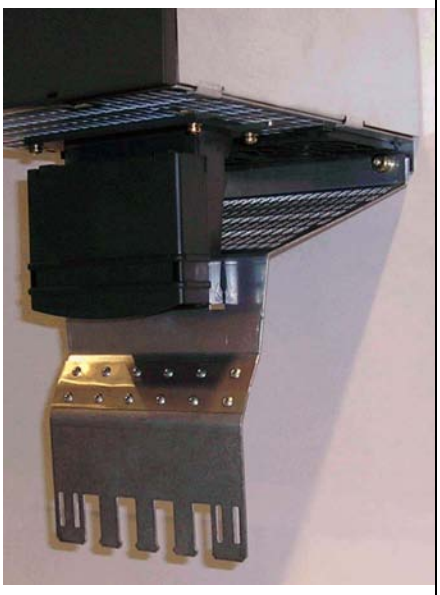
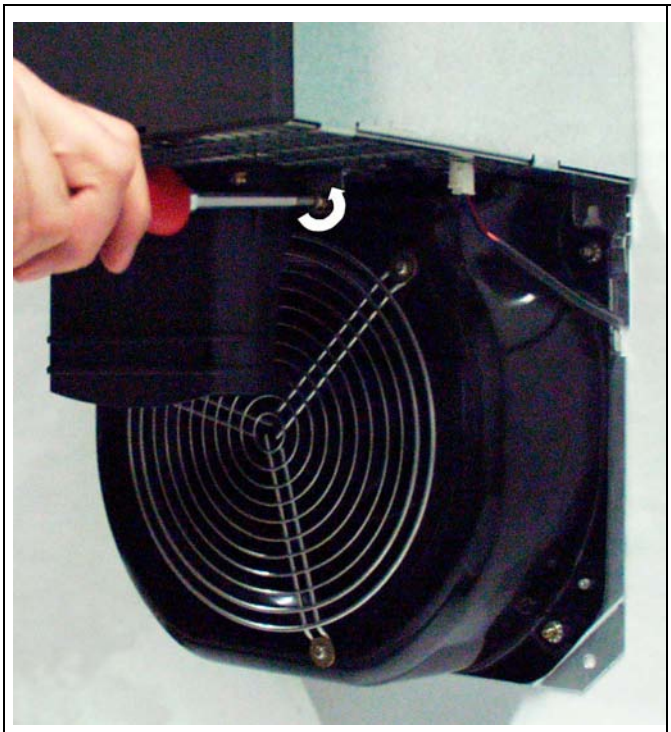
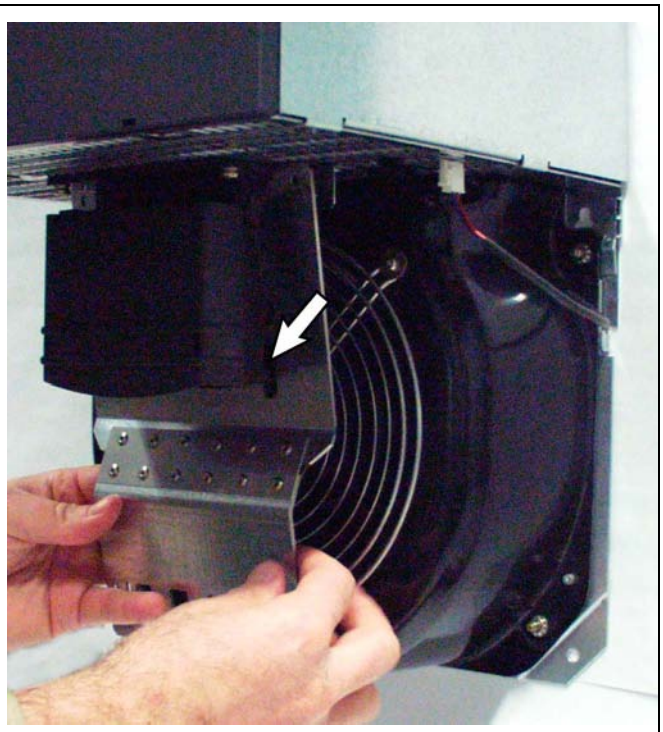
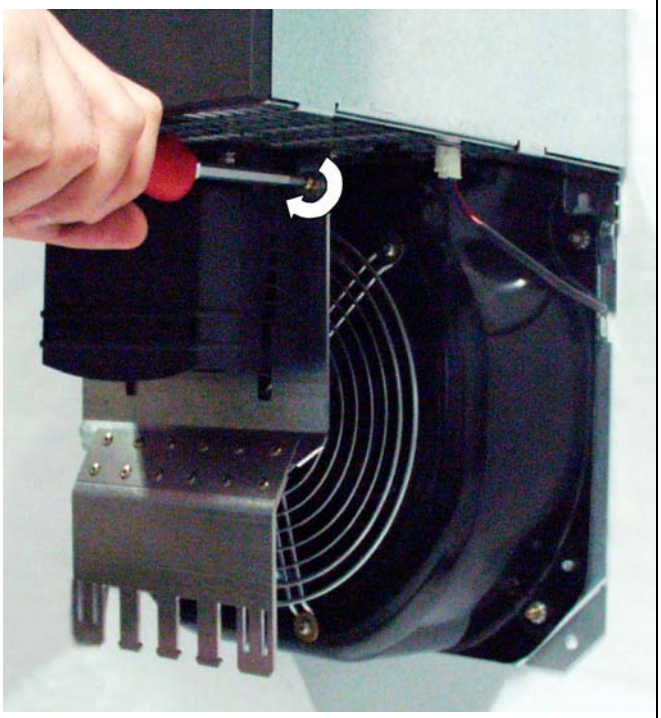
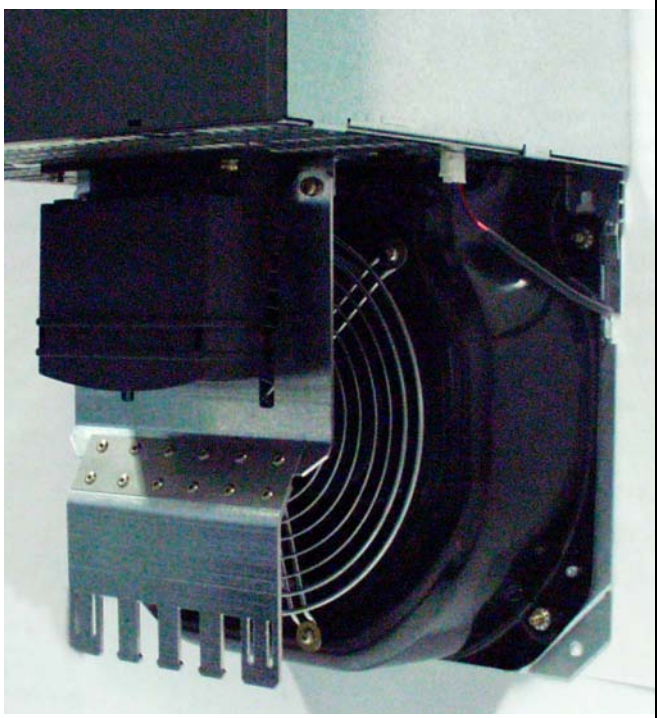
		
Loosen the lower mounting screws using a screwdriver	Hook the shield connecting plate into the screws and on the line/motor connection	Secure the shield connecting plate by shifting it to the left
		
Secure the shield connecting plate with screwdriver 6 Nm	Mounted shield connecting plate	

Table 7-3 Mounting the shield connecting plate to a 300 mm component using as an example, internal air cooling

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

7.1.5 Electrical connection

Table 7-4 Electrical connection at the shield connecting plate for 100 mm component using as an example, internal air cooling

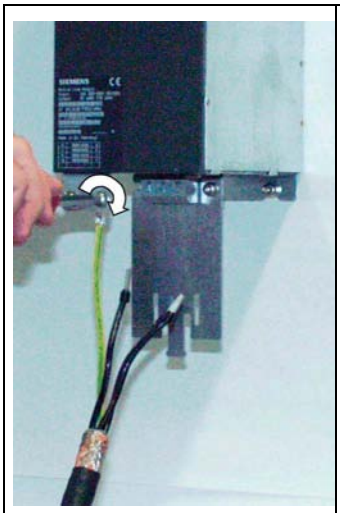
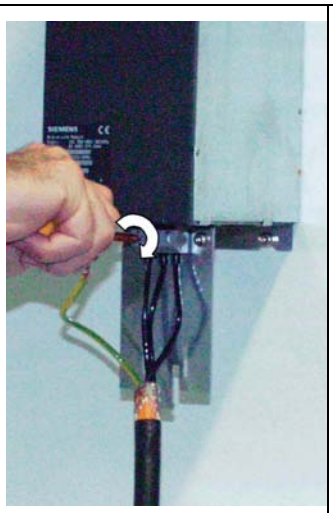
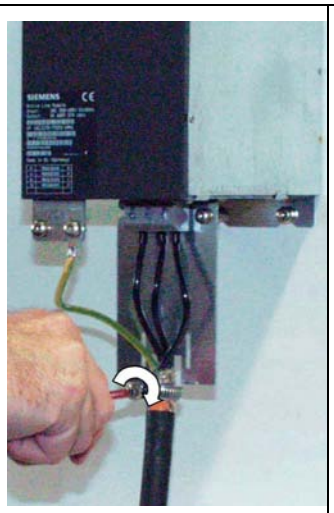
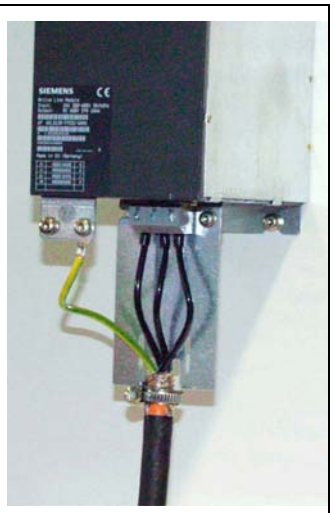
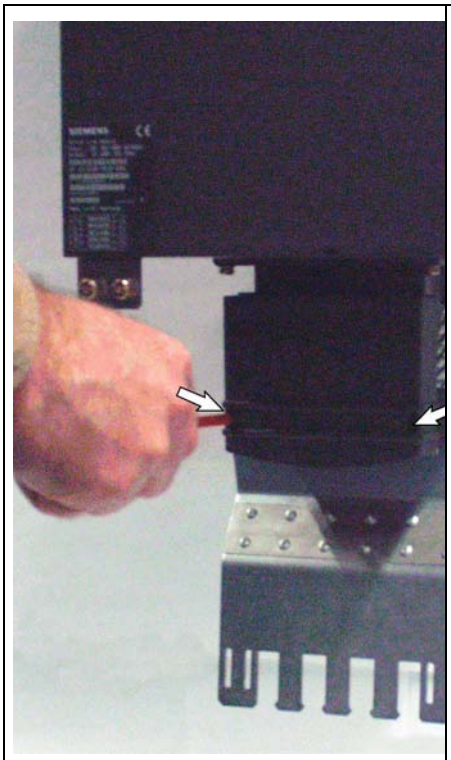
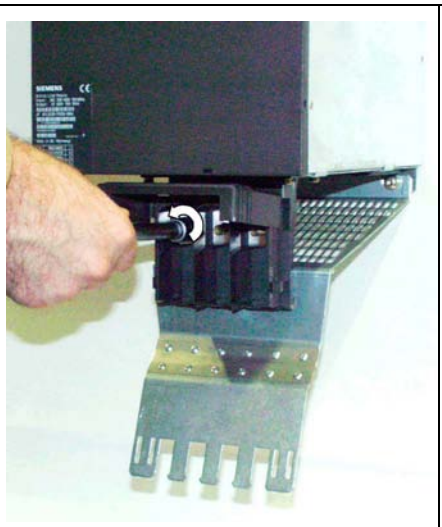
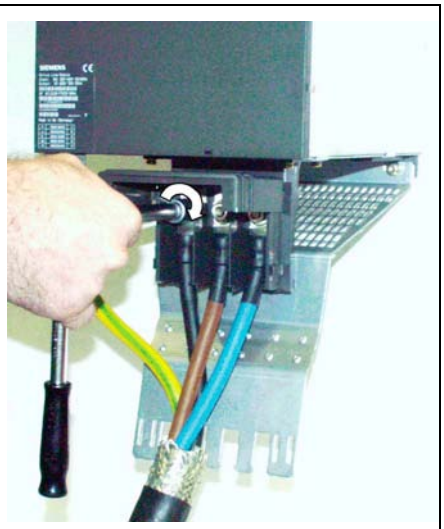
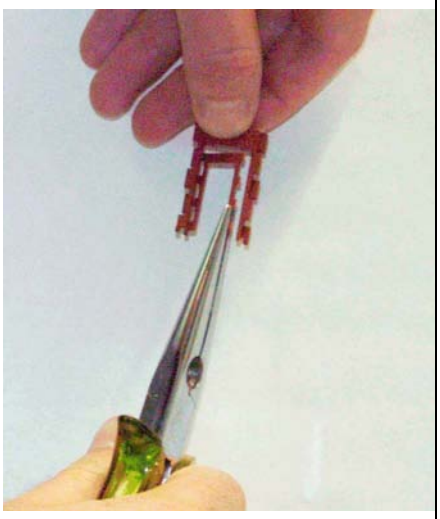
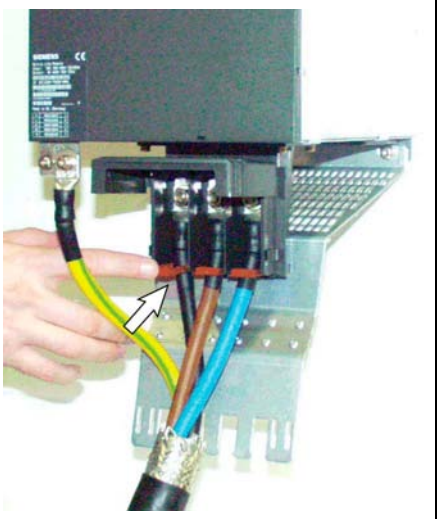
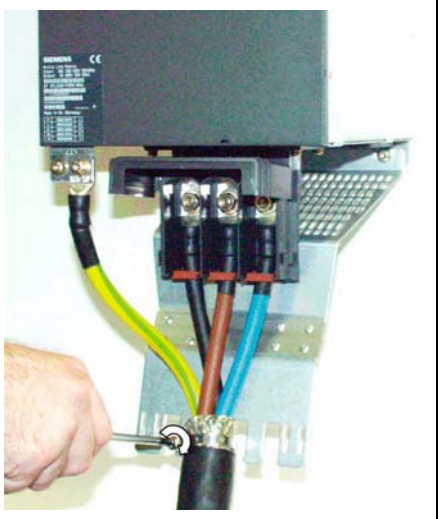
			
Attach the protective conductor (PE) using a screwdriver T25/3 Nm	Secure the power cable with flat-bladed screwdriver 4/1.8 Nm	Secure the shield clamp to the shield connecting plate using a suitable tool	The power cable is connected.

Table 7-5 Electrical connection at the shield connecting plate for 200 mm component using as an example, internal air cooling

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



Close the cover of the terminal block.

7.2 DC link rectifier adapter

7.2.1 Description

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

The connection cables must be fused accordingly.

Note

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

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

Table 7-6 The DC link rectifier adapter is available in two sizes.

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

7.2.2 Safety information

⚠DANGER

Risk of electric shock. A hazardous voltage is present for up to 5 minutes after the power supply has been disconnected.
This time must elapse before any work may be carried-out on the adapter (e.g. mounting/installation).

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

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

⚠DANGER

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

⚠DANGER

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

⚠DANGER

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

CAUTION

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

⚠DANGER

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

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

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

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

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

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

7.2.3 Interface description

7.2.3.1 Overview

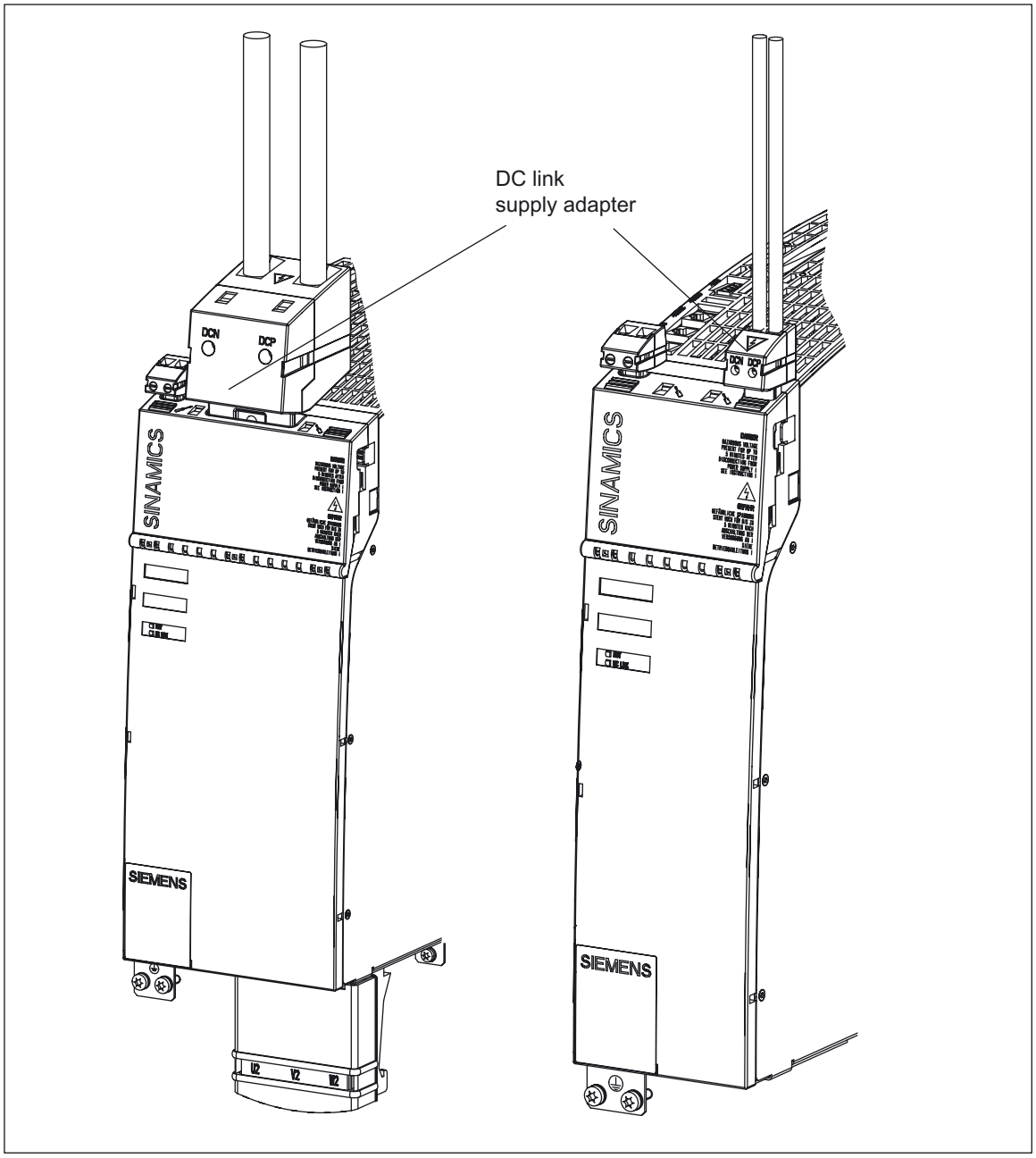


Figure 7-11 150 mm components with DC link rectifier adapter for 35 mm² to 95 mm² and 100 mm components with DC link rectifier adapter for 4 mm² to 10 mm²

7.2.3.2 DC link connection

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

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

7.2.4 Dimension drawings

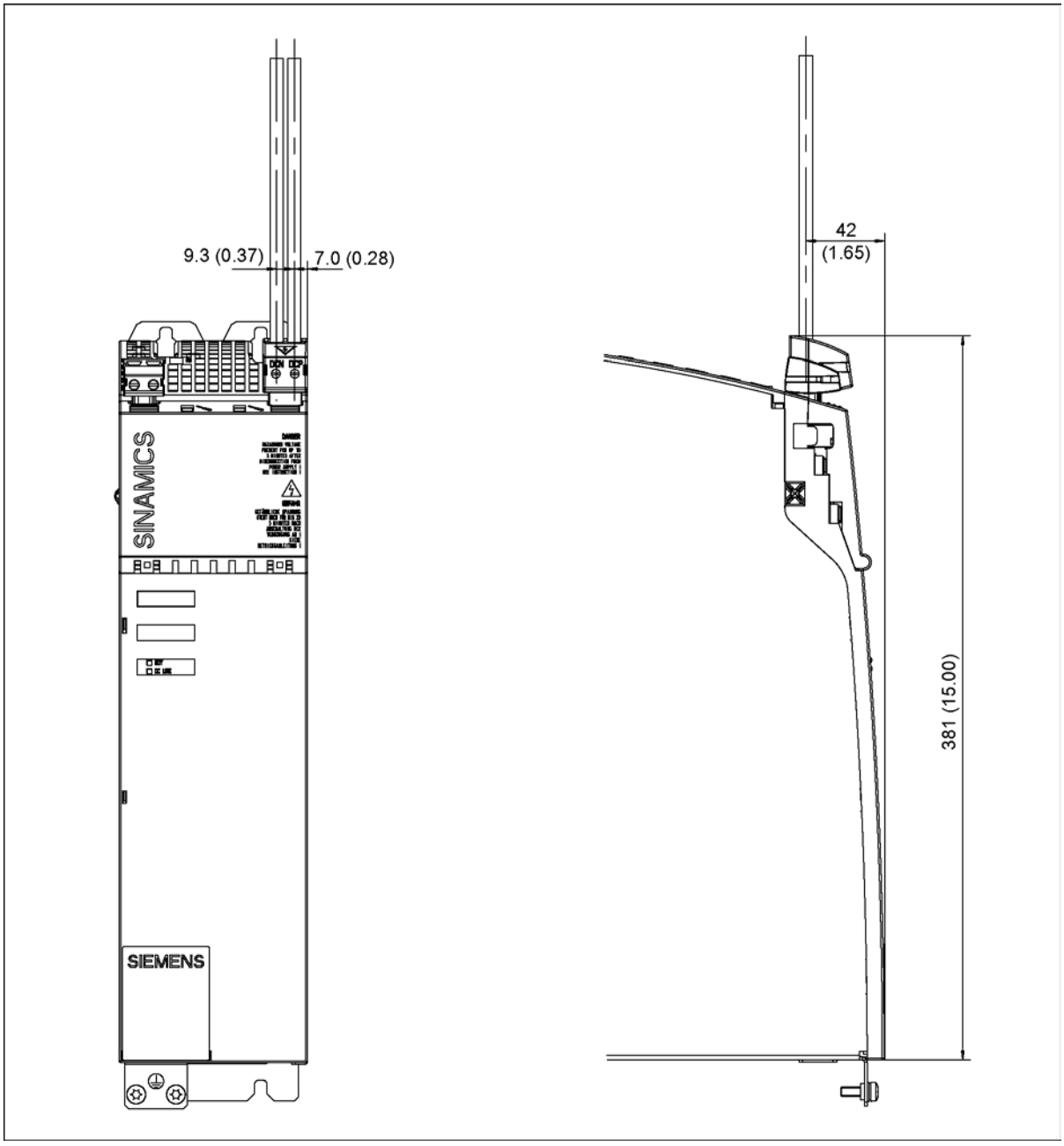


Figure 7-12 Dimension drawing, 100 mm components with DC link rectifier adapter for 0.5 mm² to 10 mm²

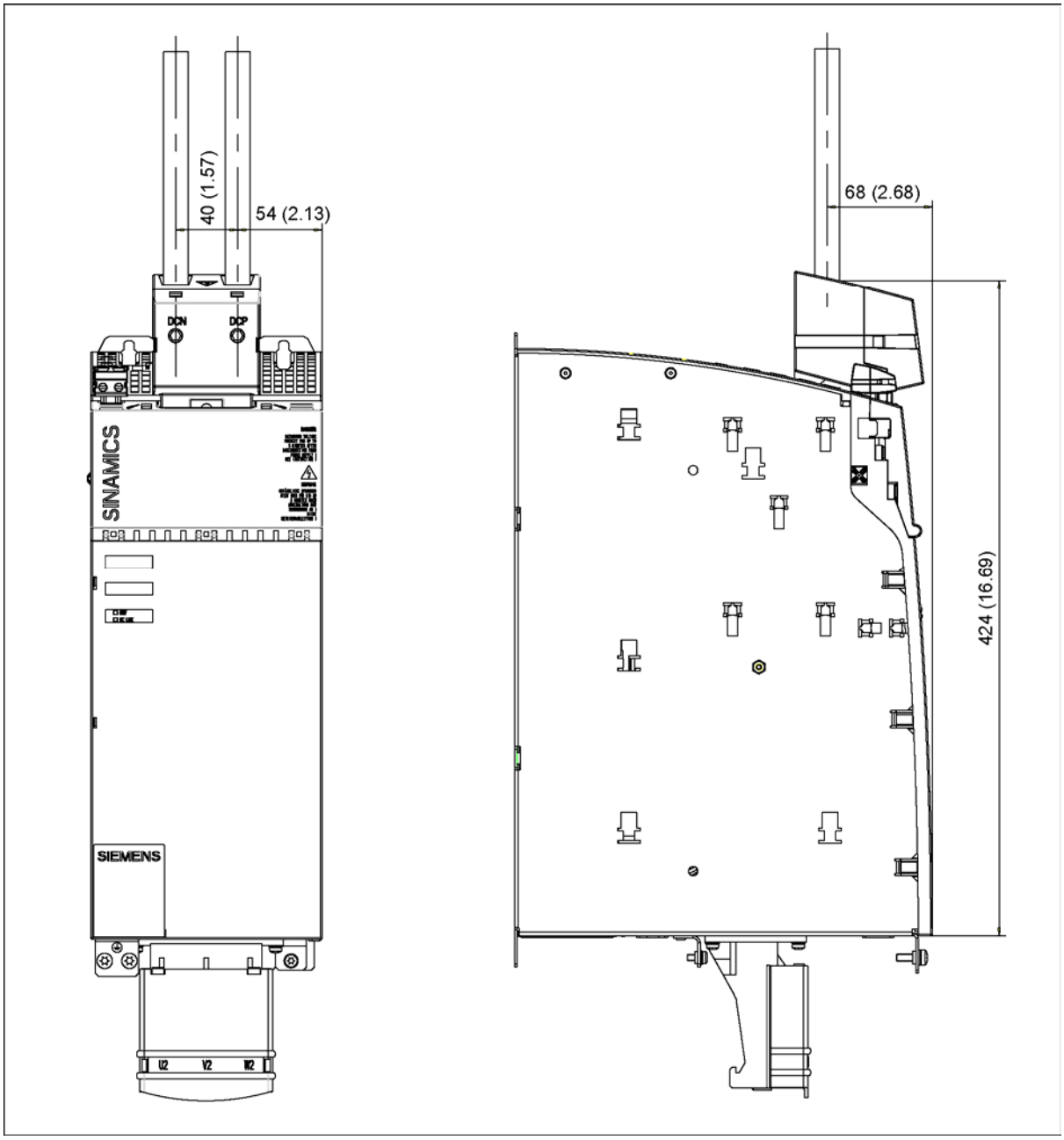


Figure 7-13 Dimension drawing, 150 mm components with DC link rectifier adapter for 35 mm² to 95 mm²

7.2.5 Mounting

⚠ DANGER

If a 50 mm wide component or if a DC link component with the appropriate width (e.g. Braking Module, CSM, VCM) is located on the left-hand side of the drive line-up, the DC link bridge including all of the screws must be removed. The screws must not be inserted without a DC link bridge.

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

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

Required tools:

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

Table 7-8 Installing the DC link rectifier adapter for 50 mm and 100 mm components

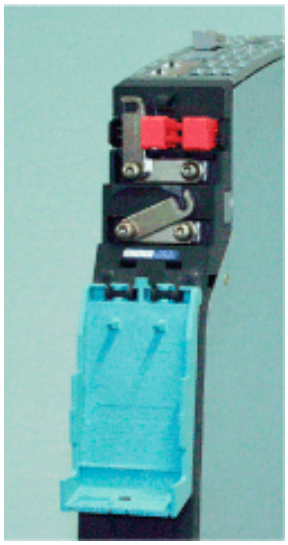
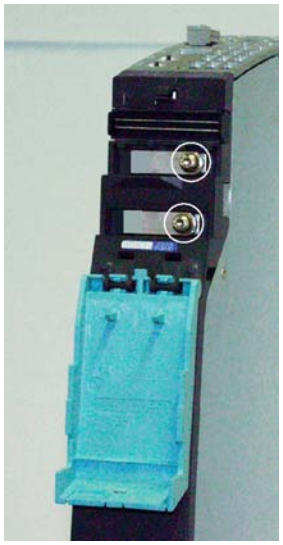
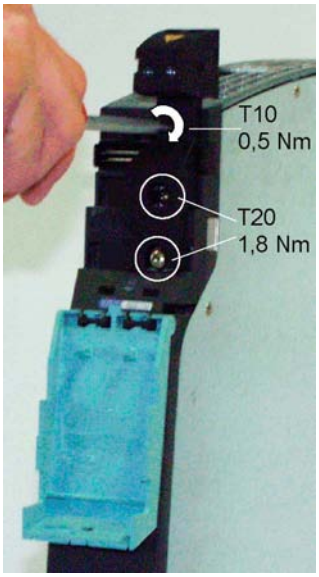
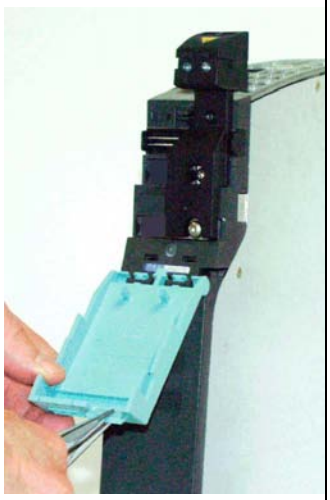
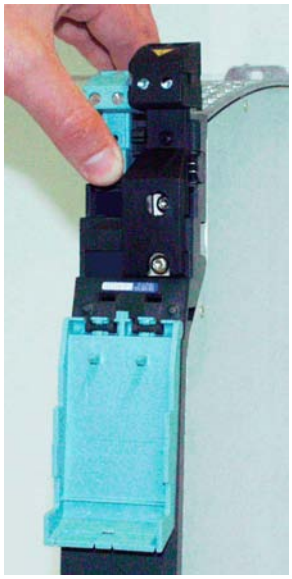
			
Unlock and open the protective cover	Opened cover with 24 V jumper and DC link bridge	The DC link bridge and 24 V jumper have been removed.	Removed DC link bridge and screws
			
Secure the adapter	Break-out the recess using suitable pliers	Attach the 24 V adapter.	Close the protective cover

Table 7-9 Installing the DC link rectifier adapter for 150 mm, 200 mm, and 300 mm components

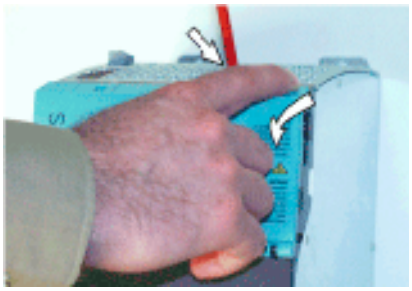
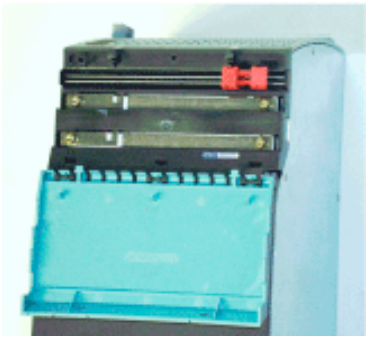
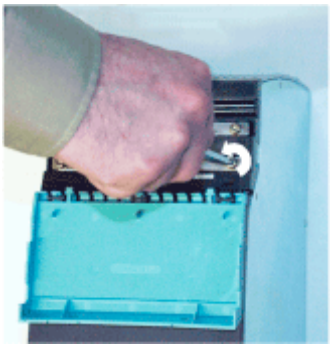
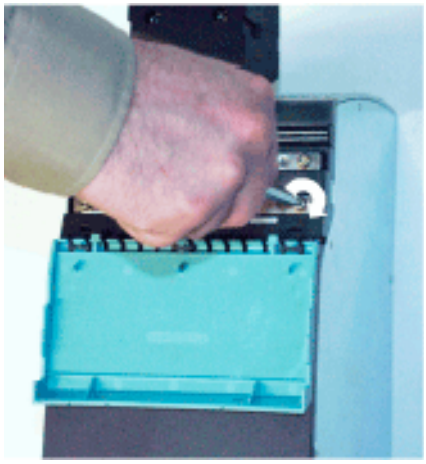
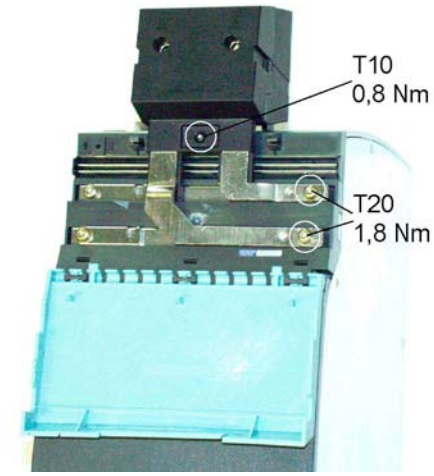
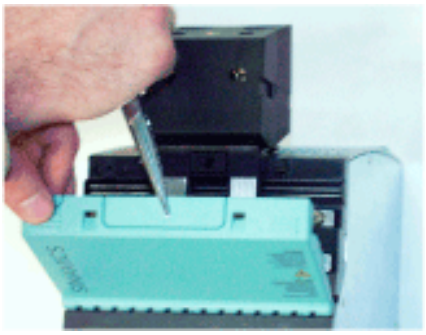
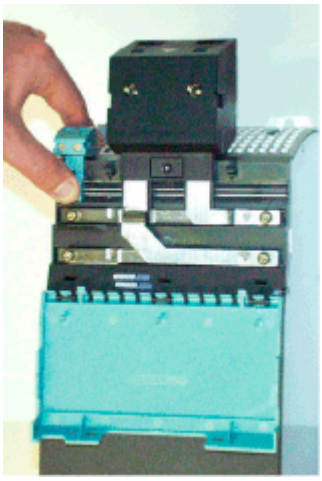
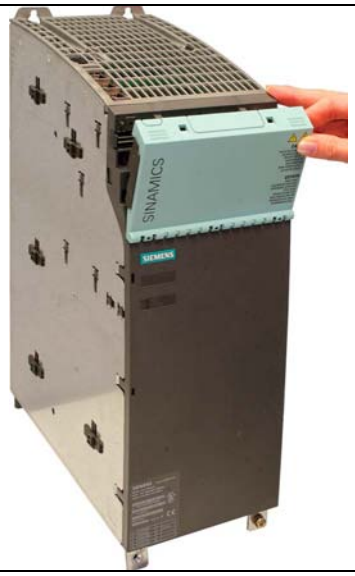
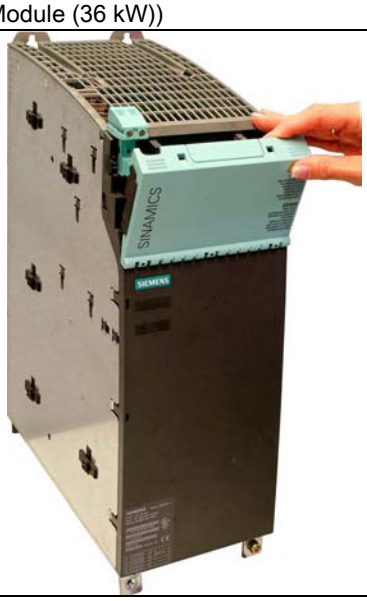
		
Unlock and open the protective cover	Opened cover with 24 V jumper	Remove the 24 V jumper and unscrew the DC link screws.
		
Hook in the adapter.	Secure the adapter	The adapter has been screwed in.
		
Break-out the recess using suitable pliers	Attach the 24 V adapter.	Close the protective cover

Table 7-10 Installing the 24 V adapter for 150 mm wide components

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

7.2.6 Electrical connection

Table 7-11 Connecting the DC link rectifier adapter for 50 mm and 100 mm components

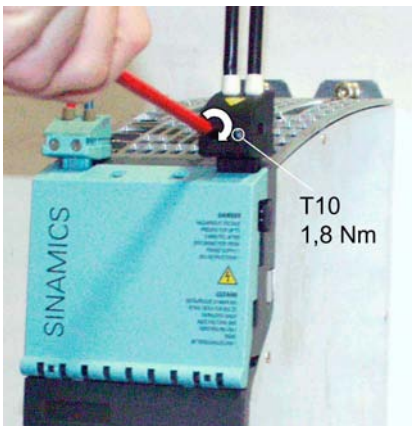
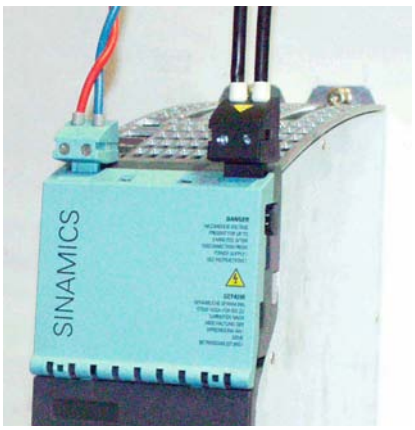
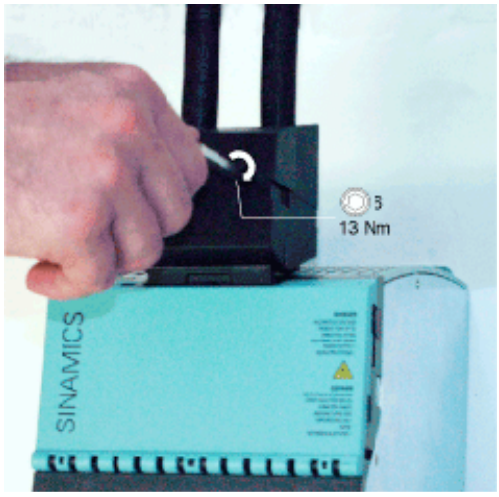
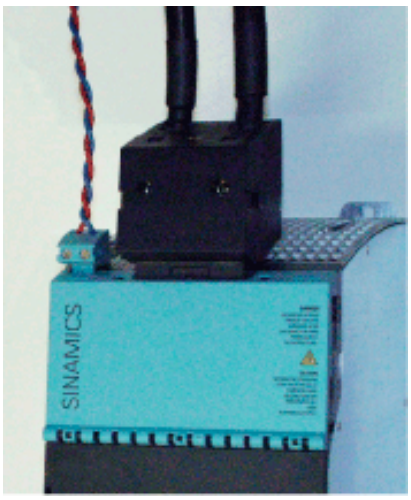
	
Connect the cable to the DC link rectifier adapter	Electrical connection of the DC link rectifier adapter

Table 7-12 Connecting the DC link rectifier adapter for 150 mm, 200 mm, and 300 mm components

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

7.3 DC link adapter

7.3.1 Description

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

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

7.3.2 Safety information

⚠DANGER

Risk of electric shock. A hazardous voltage is present for up to 5 minutes after the power supply has been disconnected.
This time must elapse before any work may be carried-out on the adapter (e.g. mounting/ installation).

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

⚠DANGER

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

⚠DANGER

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

CAUTION

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

⚠ DANGER

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

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

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

⚠ DANGER

The DC link connection cables must be routed in such a way that they are ground-fault and short-circuit proof in accordance with EN 60204-1.

CAUTION

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

7.3.3 Interface description

7.3.3.1 Overview

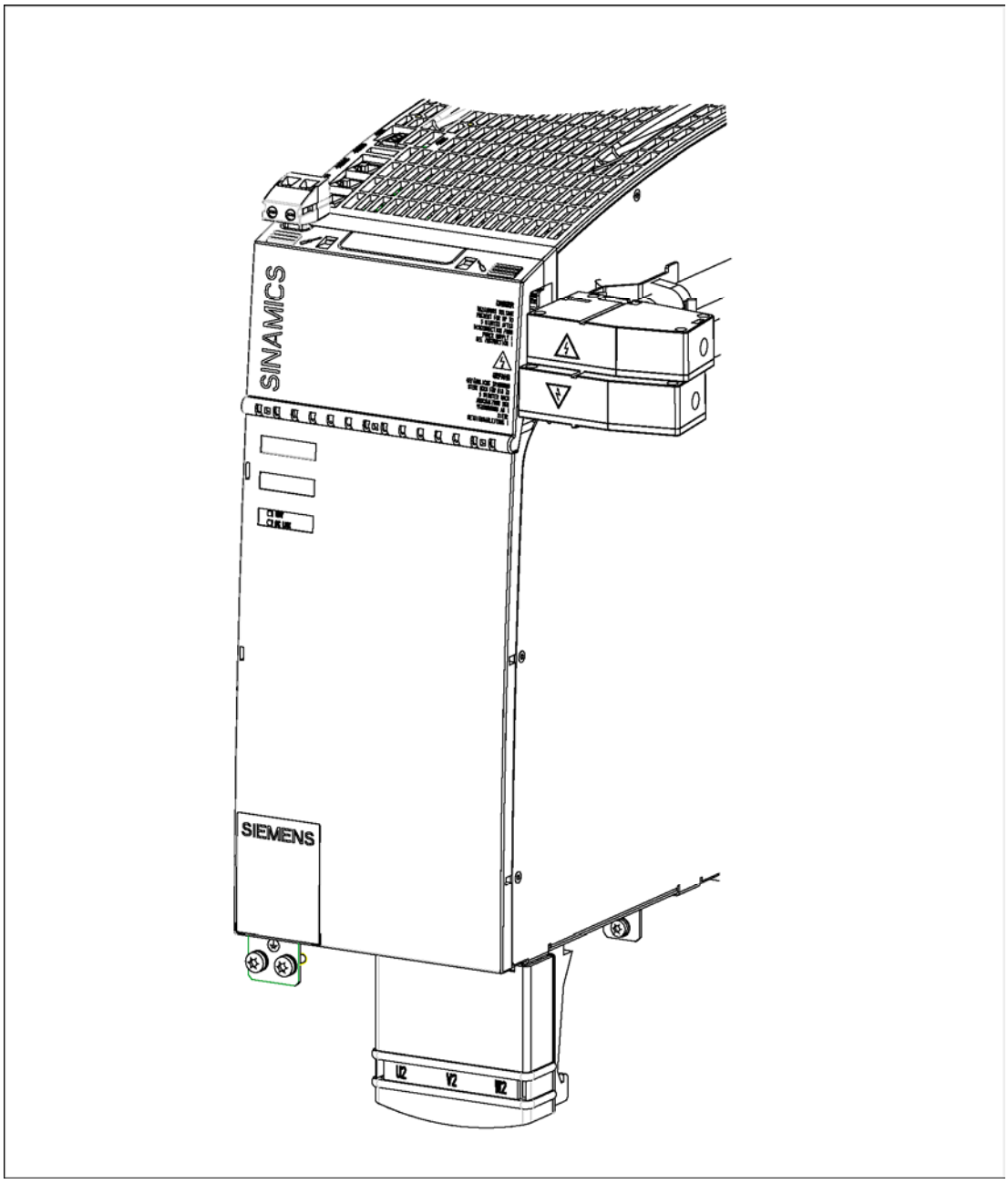


Figure 7-14 150 mm components with DC link adapter for two-row configuration 35 mm² to 95 mm²

7.3.3.2 DC link connection

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

Terminal	Function	Technical specifications
DCP	DC link positive	**Two-row configuration of adapter 35 – 95 mm²** Current carrying capacity: 200 A Voltage: 720 V-VDE/600 V AC Connection cross-section: 35 – 95 mm² Stripped length: 27 mm
DCN	DC link negative	

7.3.4 Dimension drawing

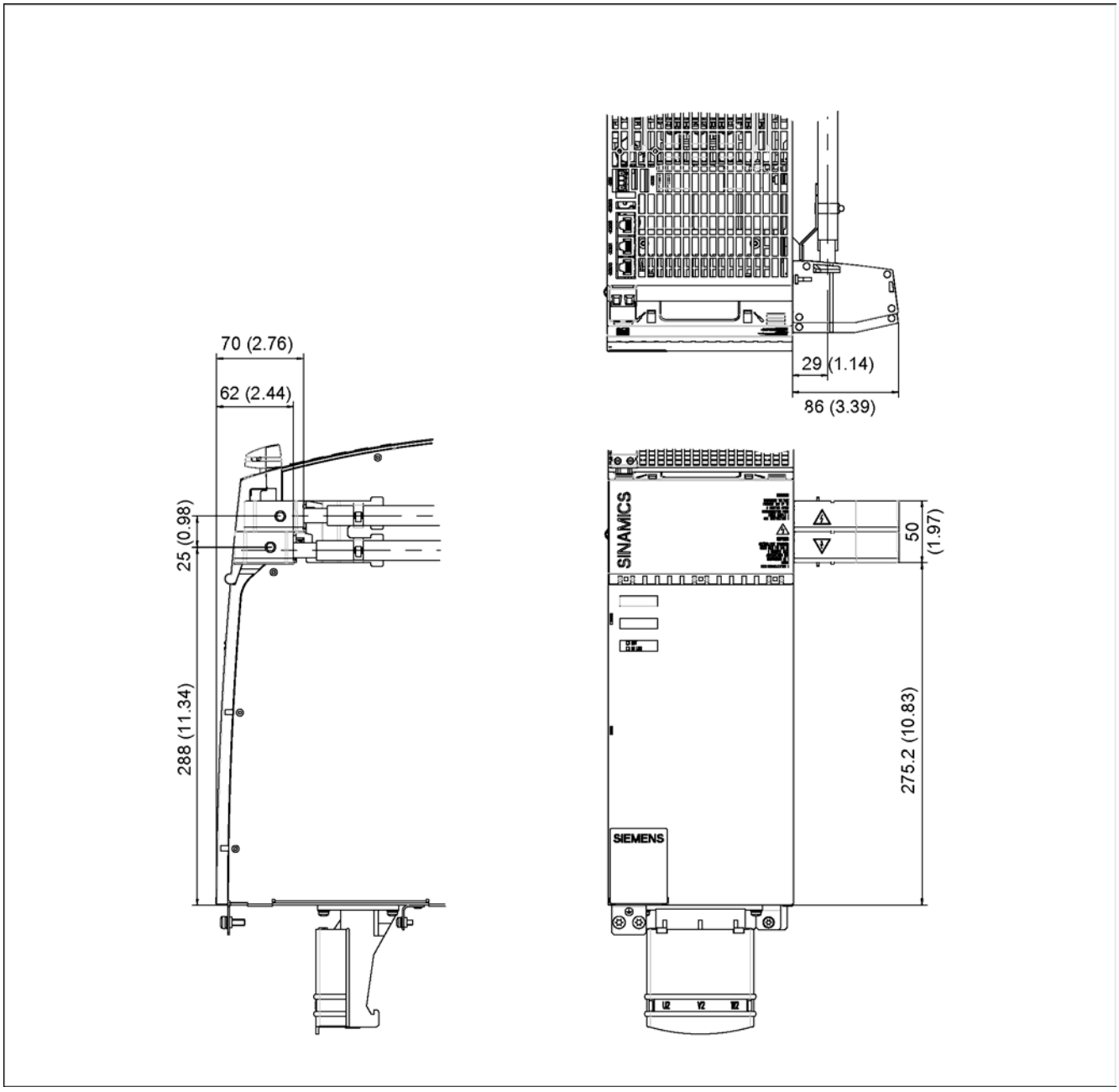


Figure 7-15 Dimension drawing, 150 mm components with DC link adapter for two-row configuration 35 mm² to 95 mm²

7.3.5 Mounting

⚠ DANGER

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

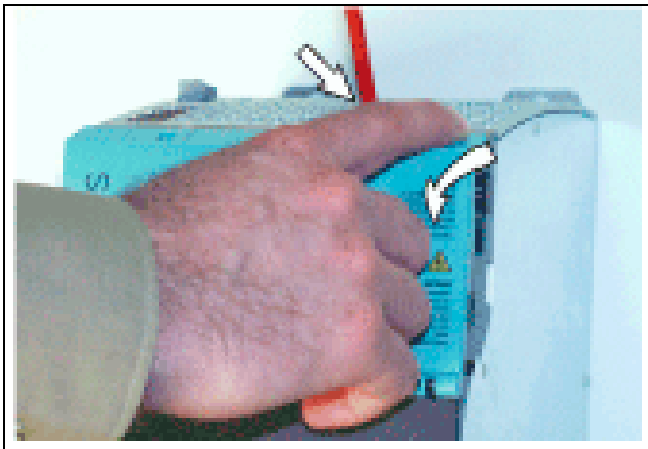
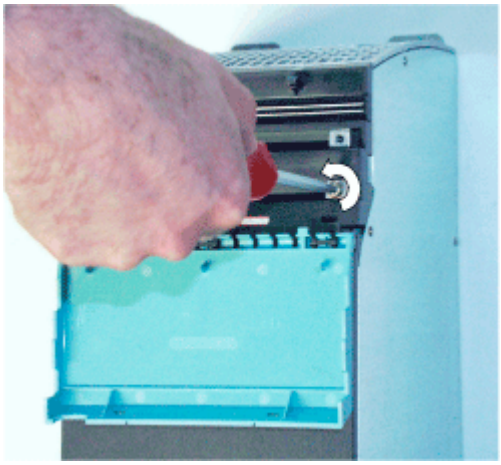
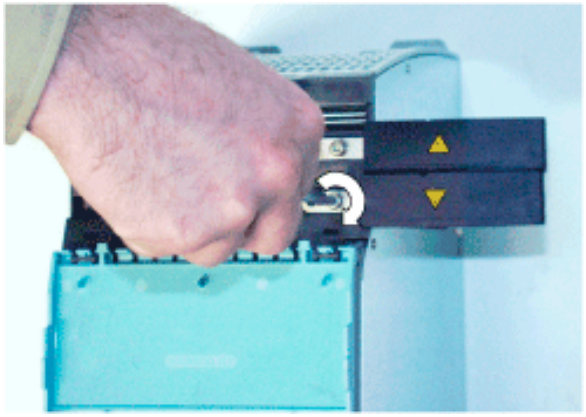
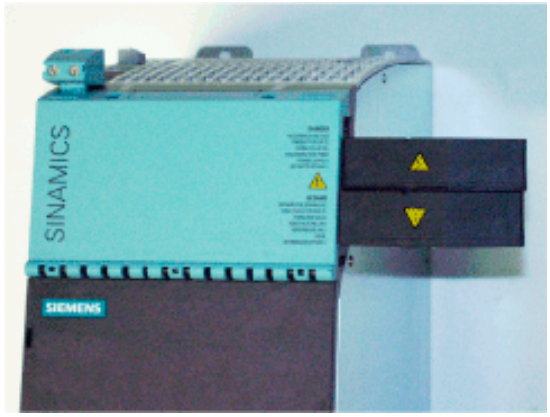
For all other power units and DC link components (e.g. Capacitor Module) that are wider than 50 mm, it is not permissible to remove the DC link bridge.

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

Required tools:

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

Table 7-14 Installing the DC link adapter for a 150 mm component

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

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.

Table 7-15 Overview

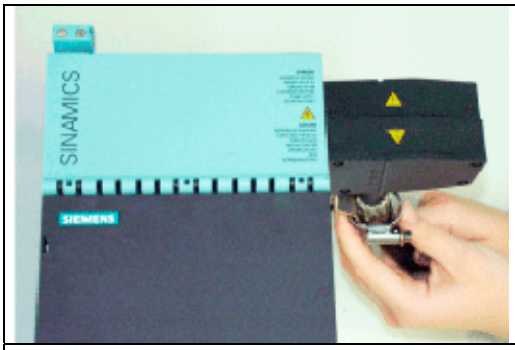
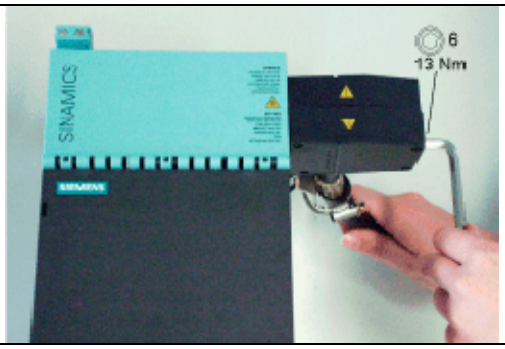
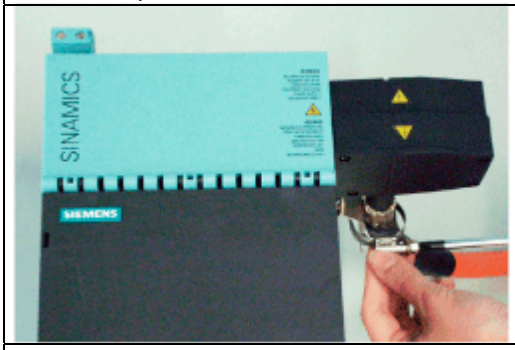
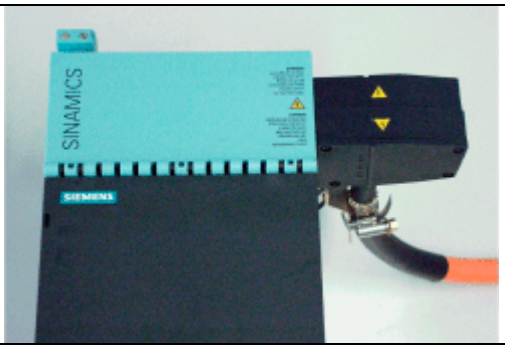
Active Line Module	Internal cooling	External cooling
55 kW	6SL3130-7TE25-5AA2	6SL3131-7TE25-5AA0 (only with DC link busbars)
80 kW	6SL3130-7TE28-0AA1	6SL3131-7TE28-0AA0 (only with DC link busbars)
120 kW	6SL3130-7TE31-2AA1	6SL3131-7TE31-2AA0 (only with DC link busbars)

7.3.6 Electrical connection

Required tools:

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

Table 7-16 Electrical connection of the DC link adapter for a 150 mm component

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

Only shielded connection cables should be used.

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

7.4 Reinforced DC-link busbars

7.4.1 Description

Reinforced DC link busbars (optional) are available for 50 mm and 100 mm wide components.

	Order number
Reinforced DC link busbars for 50 mm components	6SL3162-2DB00-0AAx
Reinforced DC link busbars for 100 mm components	6SL3162-2DD00-0AAx

7.4.2 Safety information

⚠ DANGER

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

The protective cover for the DC link must not be opened until this time has elapsed.

The components must only be operated when the protective cover of the DC link is closed. Damaged components must not be used further.

The DC link discharge time hazard warning in the local language must be attached to all of the components.

A set of labels in 16 languages is provided with the component.

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

If a 50 mm wide Motor Module or if a DC link component with the appropriate width (e.g. Braking Module, Control Supply Module, Voltage Clamping Module) is located at the left-hand end of the drive line-up, the DC link bridge (including the screws) must be removed. The screws must not be inserted without a DC link bridge.

For all of the other power units and DC link components (e.g. Capacitor Module) that are wider than 50 mm, the DC link bridge must not be moved to the left or removed.

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

The left and right ends of the DC link busbar of a drive line-up must be closed using lateral covers (Order No.: 6SL3162-5AA00-0AA0).

The protective cover for the DC link must be closed for all components before the voltage supply is switched on. The interlocks must audibly engage.

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

Note

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

7.4.3 Dimension drawings

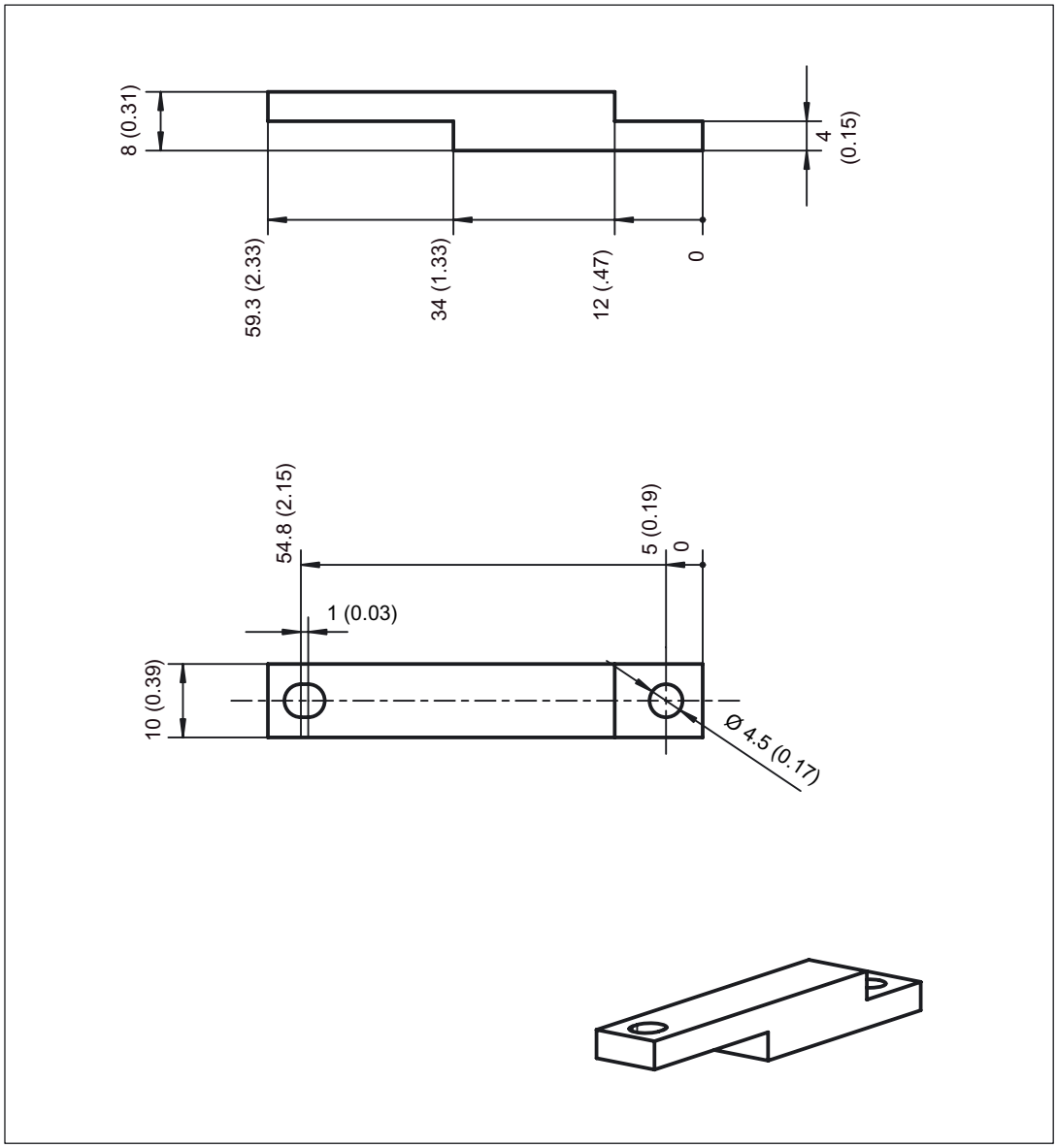


Figure 7-16 Dimension drawing: Enforced DC link busbar of 50 mm

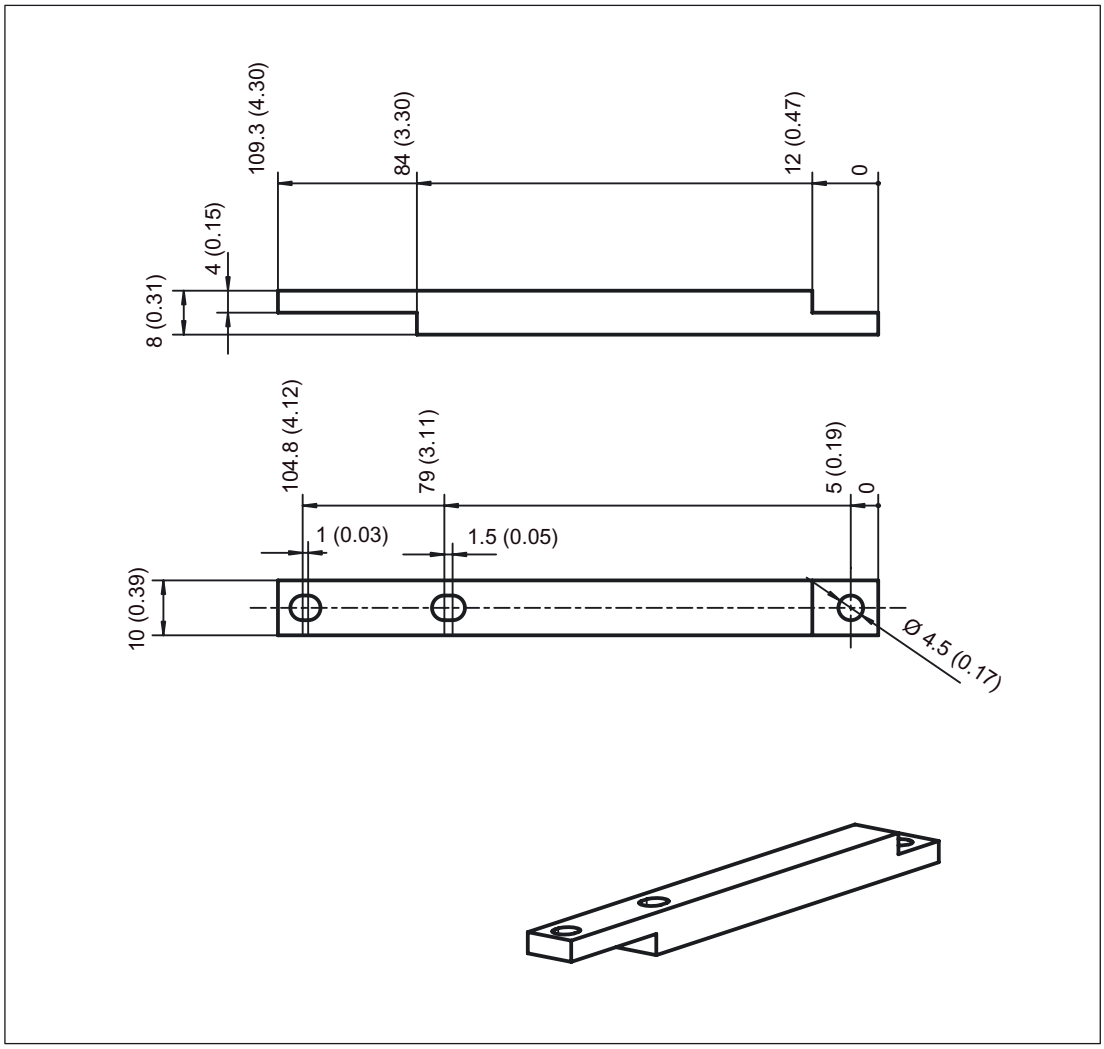
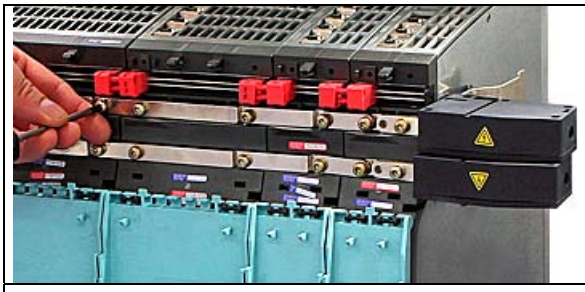
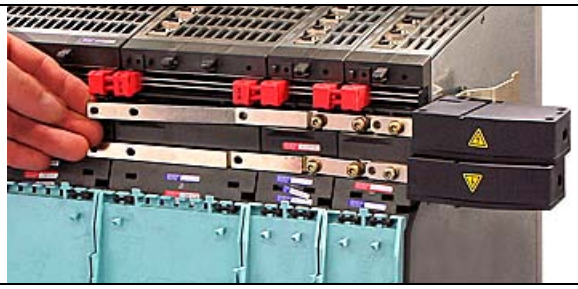
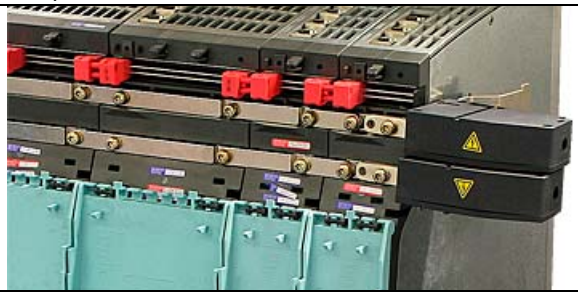


Figure 7-17 Dimension drawing: Enforced DC link busbar of 100 mm

7.4.4 Removing the DC link busbars

	
Unscrew the screws for the DC link busbar	Remove the DC link busbars
	
Remove the DC link busbars on the adjacent components too.	View once the DC link busbars have been removed

7.4.5 Mounting the reinforced DC link busbars

	
Secure the reinforced DC link busbars Do not secure M4 screws tightly yet.	Secure the reinforced DC link busbars on the adjacent components too.
	
Tightly secure all the M4 screws, 1.8 Nm +30 %	With installed reinforced DC link busbars

7.5 DRIVE-CLiQ cabinet gland

7.5.1 Description

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

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

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

7.5.2 Safety information

Note

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

7.5.3 Interface description

7.5.3.1 Overview

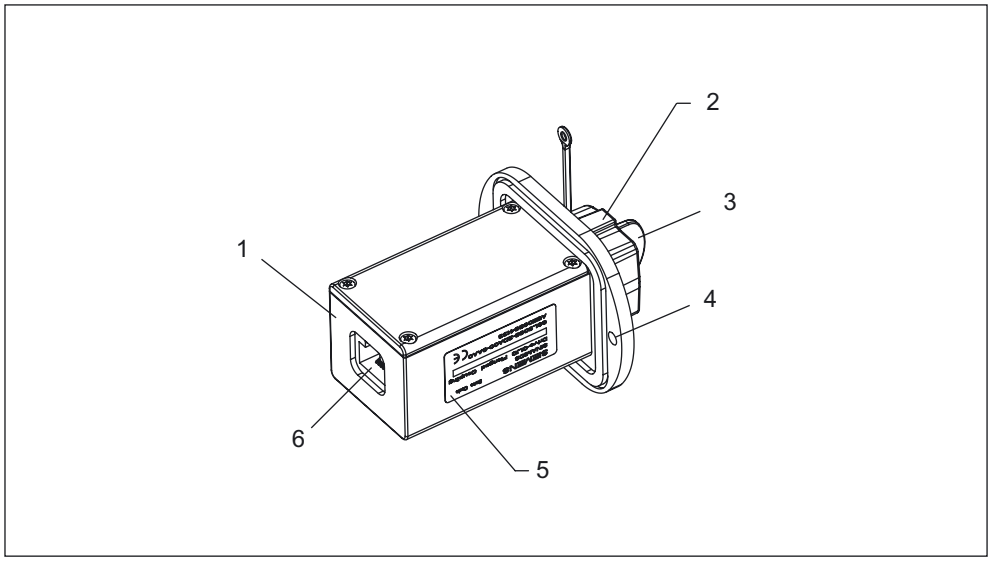


Figure 7-18 DRIVE-CLiQ cabinet gland

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

7.5.4 Dimension drawing

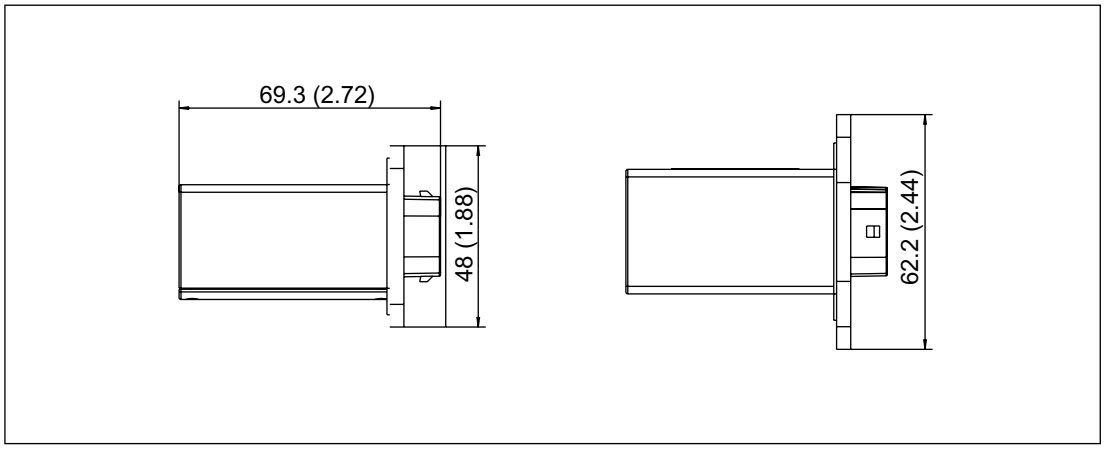


Figure 7-19 Dimension drawing, DRIVE-CLiQ cabinet gland

Accessories	W [mm]	D [mm]	H [mm]
DRIVE-CLiQ cabinet gland (with seal)	69.3 (2.72)	62.2 (2.44)	48 (1.88)

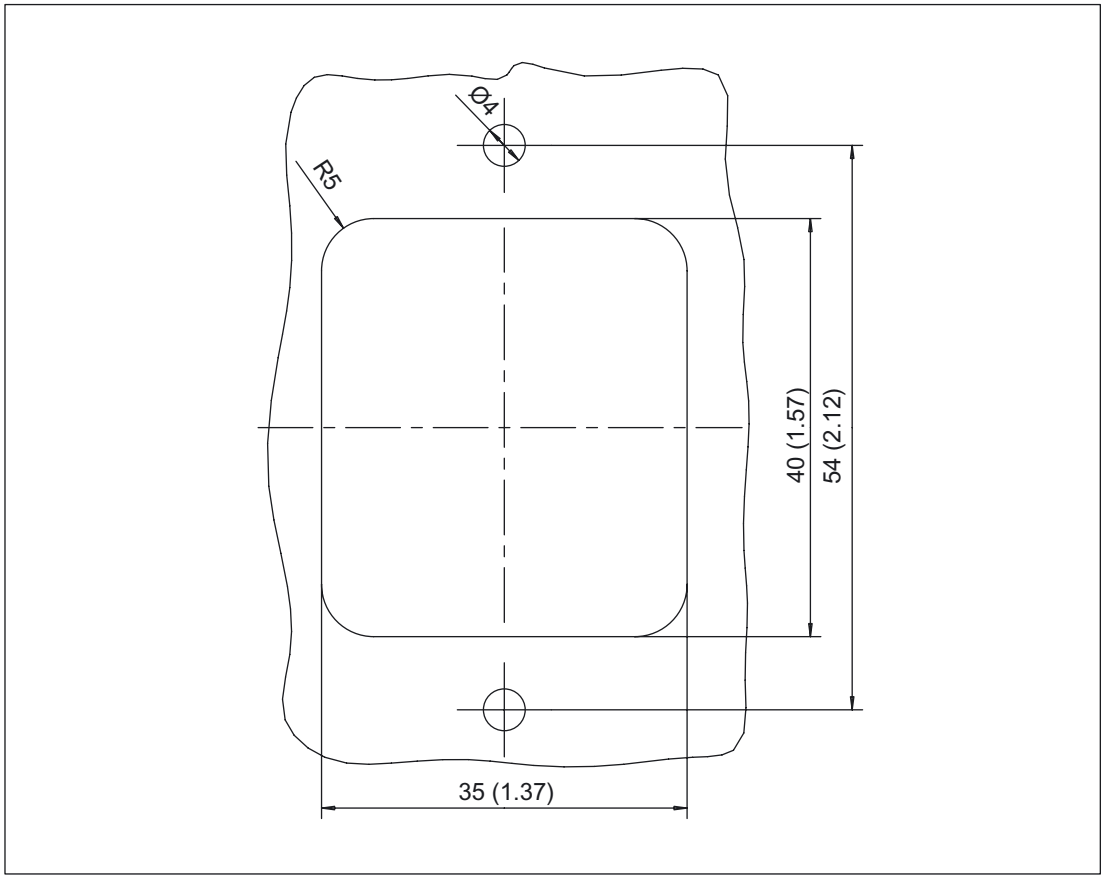


Figure 7-20 Cut-out for the cabinet

7.5.5 Mounting

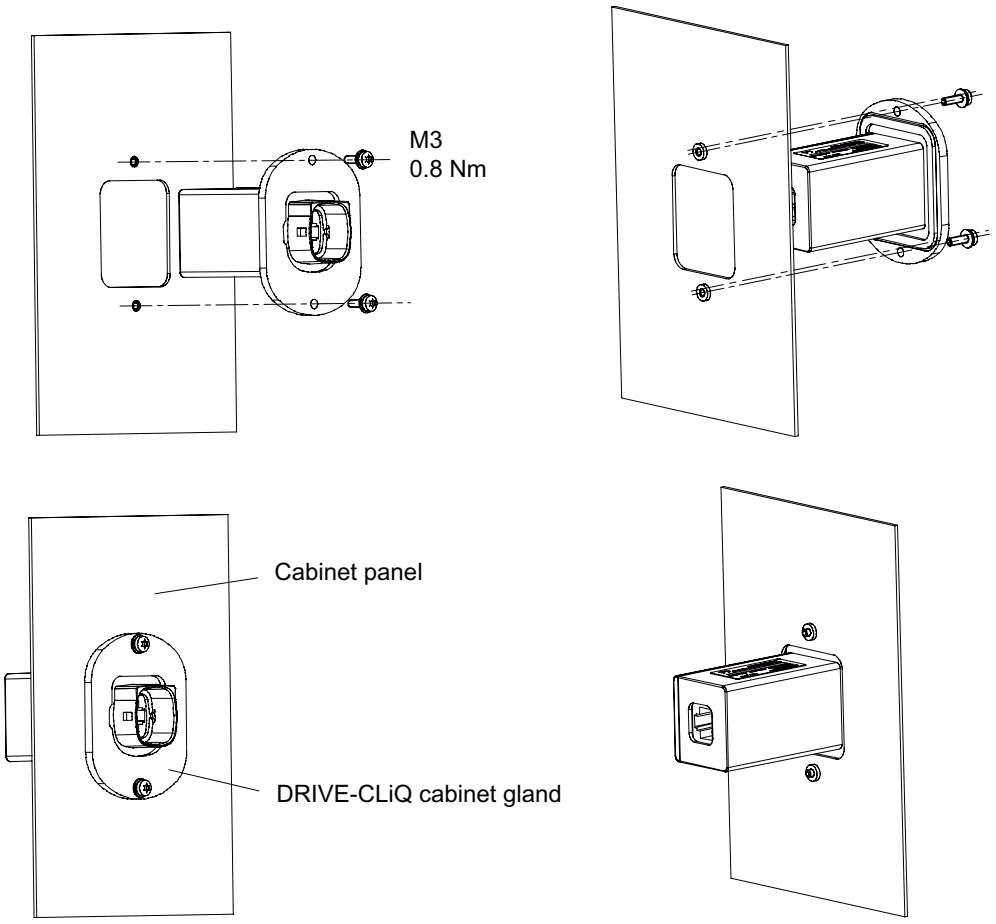


Figure 7-21 DRIVE-CLiQ cabinet gland

Installation

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

7.5.6 Technical data

Table 7-17 Technical data

DRIVE-CLiQ cabinet gland 6SL3066-2DA00-0AAx	Unit	
Weight	kg	0.135
Degree of protection	IP20 or IPXXB acc. to EN 60529 in the electrical cabinet IP54 to EN 60529 outside the electrical cabinet	

7.6 DRIVE-CLiQ coupling

7.6.1 Description

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

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

7.6.2 Safety information

Note

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

7.6.3 Interface description

7.6.3.1 Overview

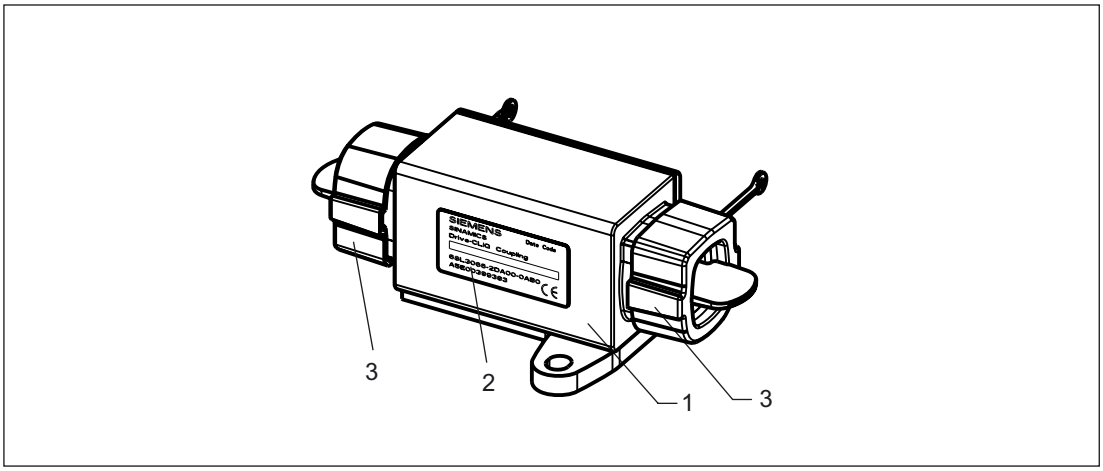


Figure 7-22 DRIVE-CLiQ coupling

1	DRIVE-CLiQ coupling
2	Rating plate
3	Centering caps, Yamaichi, order no.: Y-ConAS-24-S

7.6.4 Dimension drawing

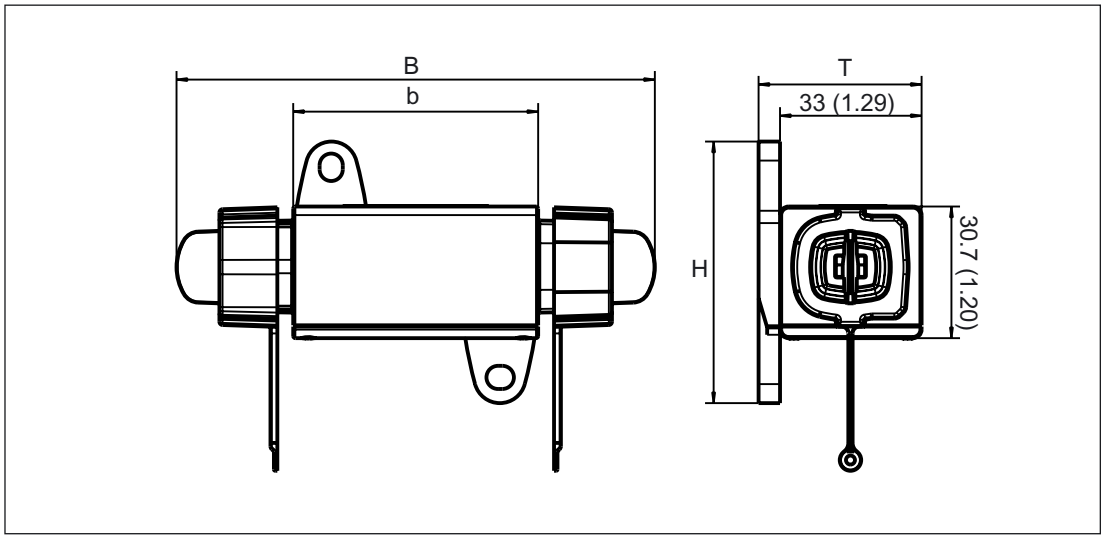


Figure 7-23 Dimension drawing, DRIVE-CLiQ coupling

Table 7-18 Dimensions of the DRIVE-CLiQ coupling, all data in mm and (inches)

Accessories	W [mm]	b [mm]	H [mm]	D [mm]
DRIVE-CLiQ coupling	111.5 (4.38)	57.1 (2.24)	61 (2.40)	38 (1.49)

7.6.5 Installation

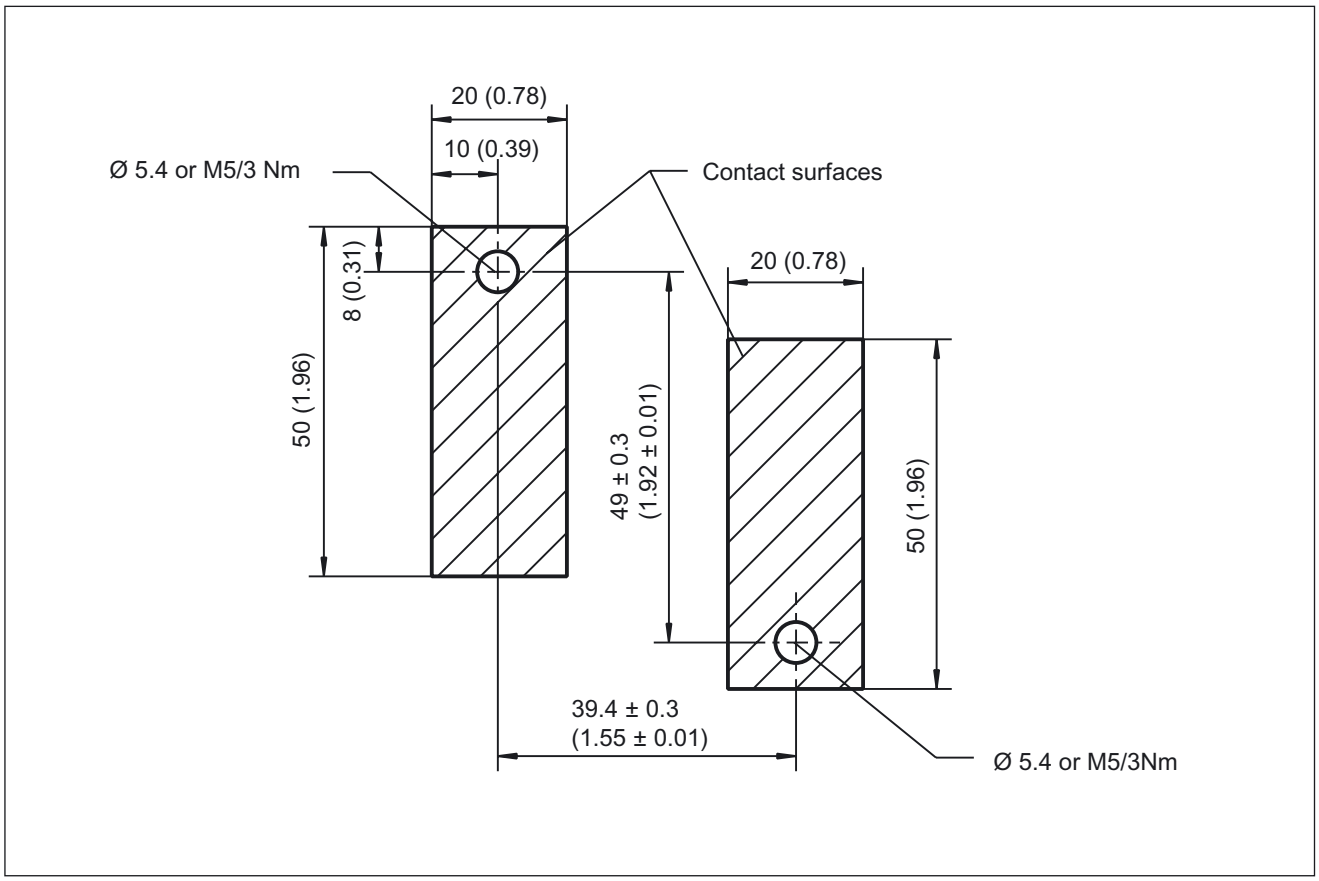


Figure 7-24 Hole drilling template for installation

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

7.6.6 Technical data

Table 7-19 Technical data

DRIVE-CLiQ coupling 6FX2003-0DC1x	**Unit**	
Weight	kg	0.14
Degree of protection	IP67 acc. to EN 60529	

Cabinet Design and EMC Booksize

8

8.1 Information

8.1.1 General information

SINAMICS S components fulfill the requirements according to degree of protection IP20 in compliance with EN 60529. This provides protection against electric shock for chassis units. As far as UL 50 is concerned, the components are classified and certified as open type. Protection against mechanical and climatic stressing must be ensured by mounting the components in housings, cabinets or electrical rooms that can be closed and locked. Higher-level housings must, as a minimum, have degree of protection IP54 according to EN 60529 be classified as enclosure type 12 in compliance with UL 50.

Prefabricated MOTION-CONNECT cables are recommended.

The Safety-Integrated safety function:

The components must be protected against conductive pollution (e.g. by installing them in a cabinet with degree of protection IP54B acc. to EN 60529).
Provided that conductive pollution can be prevented at the installation site, the degree of protection for the cabinet can be decreased accordingly.

Low-voltage switchgear and controlgear assemblies

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

Safety of machinery

Electrical equipment of machines

All information for device selection in this section applies to

- Connected to TN and TT line supply systems with grounded neutral point and grounded protective conductor as well as to IT line supply systems.
- Operating voltage range from 360 V 3 AC to 440 V 3 AC

8.1.2 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. Also refer to EN 61800-5-1 and 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 catalog D21.1.

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.

⚠ WARNING

If static discharge occurs on surfaces or interfaces that cannot be easily accessed, this can cause malfunctions and/or defects.

8.1.3 Directives

The following Directives apply within the European Union:

Table 8-1 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
89/336/EEC	Directive of the Council on the approximation of laws of the member states relating to electromagnetic compatibility EMC guidelines

8.2 Selecting devices required to operate SINAMICS

8.2.1 General

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

- Line disconnecting device (for Active Line Modules, Basic Line Modules, Smart Line Modules)
- Line fuse
- Line contactor (this is required for electrical isolation)
- Line filter (refer to Chapter Line supply connection)
- Line reactor (refer to Chapter Line supply connection)

8.2.2 Information about line isolating devices

Only valid for Active Line Modules, Basic Line Modules and Smart Line Modules

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.

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

The accessories required for the line disconnecting device must be selected from the manufacturer catalogs. See also catalog D21.1.

8.2.3 Overcurrent protection by means of line fuses or circuit-breakers

The recommended fuses are used to protect cables and when a fault occurs limit damage to the power unit. NH, D, and DO-type fuses with a gL characteristic or suitable circuit-breakers can be used for this purpose.

Note

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

⚠ WARNING

It is not permissible to overdimension fuses as this can result in significant levels of danger and also faults.

⚠ WARNING

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

⚠ WARNING

Fuses that can operate across the maximum cable length within a circuit must be rated in accordance with the requirements for:

1. Short circuit protection (IEC 60364-4-43 and -5-52, EN 60204-1, and EN 61800-5-1)
2. The maximum permissible break time for protection against electric shock in the event of indirect contact (IEC 60364-4-41 and -4–43, IEC 61200-413, EN 61800-5-1, and EN 60204-1)
3. The maximum permissible voltage drop during operation

that may have an effect with a maximum cable length for the circuits.

The maximum cable length depends on the cable cross-section, material, and insulation, as well as the type and size of the upstream overcurrent protection device.

The minimum value, which is derived from the three requirements, must generally be observed. This means that the fuses must be designed in such a way that, if a fault occurs, the line fuses trip after 0.4 s with mobile equipment and after 5 s with stationary equipment.

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

Table 8-2 Requirements regarding line fuses and circuit-breakers for Active Line Modules

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

Table 8-3 Requirements regarding line fuses and circuit-breakers for Smart Line Modules

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

See catalog D21.1

Table 8-4 Requirements regarding line fuses and circuit-breakers for the Basic Line Modules

	20 kW	**40 kW**	**100 kW**
I_{rated} fuse	50 A	80 A	200 A
I_{fuse} 0.2 s	>260 A	>360 A	>800 A
I_{fuse} 4 s	>190 A	>260 A	>600 A
I_{fuse} 10 s	>145 A	>200 A	>400 A
I_{fuse} 240 s	>90 A	>135 A	>310 A

8.2.4 Line filter

A separate line filter (see catalog) must be used for the SINAMICS S120 drive line-up. An additional line filter must be used to suppress interference in other loads. To prevent mutual interference, this line filter must not be equipped with line-side capacitors with respect to ground. Filter series B84144A*R120 (EPCOS) is recommended.

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

Optional line filter ranges that are coordinated with the power range are available for the SINAMICS S120 drive system:

- Basic Line Filter for Active Line Modules with line reactor
- Basic Line Filter for Active Line Modules with Active Interface Module
- Wideband Line Filter for Active Line Modules
- Basic Line Filter for Basic Line Modules
- Basic Line Filter for Smart Line Modules

These line filters differ with regard to the frequency range in which they reduce the conducted emissions.

Note

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

8.2.5 Line contactors

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

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

⚠ CAUTION
Line contactors must not be switched under load.

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

8.3 24 V DC supply voltage

8.3.1 General information

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.

Note

The electronic power supply has to be supplied by the user as described in the System Data chapter of this documentation.

When connecting a DC power supply as specified in EN 60204-1:1997, sect. 4.3.3, malfunctions may occur due to the voltage interruptions permitted for them.

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 Control Supply Module 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

8.3.2 Selecting power supply units

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

Table 8-5 Recommended SITOP Power

Rated output current [A]	Input voltage range [V]	Short-circuit current [A]	Order No.
5	85-132/170 – 550 2 AC	5.5	6EP1333-3BA00
10	85-132/176 – 550 2 AC	30 for 25 ms	6EP1334-3BA00
20	320-550 V 3 AC	23	6EP1336-3BA00
40	320-550 3AC	46	6EP1337-3BA00

Table 8-6 Recommendation for Control Supply Module

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

See catalog D21.1.

⚠WARNING

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

8.3.3 Typical 24 V current consumption of the components

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 8-7 Overview of 24 V DC current consumption

Component	Typical current consumption [A_{DC}]
CU320 without load per digital output PROFIBUS Teleservice	0.8 0.1
TB30 (without digital outputs) per digital output	< 0.05 0.1
CBC10	0.1
Active Line Modules	
16 kW	1.1
36 kW	1.5
55 kW	1.9
80 kW	1.7
120 kW	2.1
Smart Line Modules	
5 kW	0.9
10 kW	1.0
16 kW	1.1
36 kW	1.5
Basic Line Modules	
20 kW	1
40 kW	1.4
100 kW	2
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)	1.2
200 A (+1 x DRIVE–CLiQ + 1 x brake)	1.2

Component	Typical current consumption [A_{DC}]
Double Motor Modules	
2 x 3 A (+2 x DRIVE–CLiQ; +2 x brake)	1.15
2 x 5 A (+2 x DRIVE–CLiQ; +2 x brake)	1.15
2 x 9 A (+2 x DRIVE–CLiQ; +2 x brake)	1.15
2 x 18 A (+2 x DRIVE–CLiQ; +2 x brake)	1.3
Braking Module	0.5
Sensor Modules Cabinet	
SMC10	0.25
SMC20	0.25
SMC30	0.33
Sensor Modules External	
SME20	0.19
SME25	0.19
SME120	0.24
SME125	0.24
Additional system components	
TM15 (without digital outputs) per digital output	0.15 0.1
TM31 (without digital outputs) per digital output	0.2 0.1
TM41 (without digital outputs) per digital output	0.2 0.1
DMC20 (+ 5 x DRIVE-CLiQ)	0.15
VSM10	0.15
CBC10	-
CBE20	-

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

8.3.4 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 connection of the

- Line Modules
- Motor Modules
- DC link components

Is realized via the integrated busbars. The current carrying capacity of these busbars is 20 A. The supply can be realized in two ways:

1. When a Current Supply Module is used, the 24 V supply can be directly established through the busbars. The electronic current limiting function integrated in the Control Supply Module protects the busbar system when a fault occurs. Additional loads can be connected via the 24 V terminal adapter.

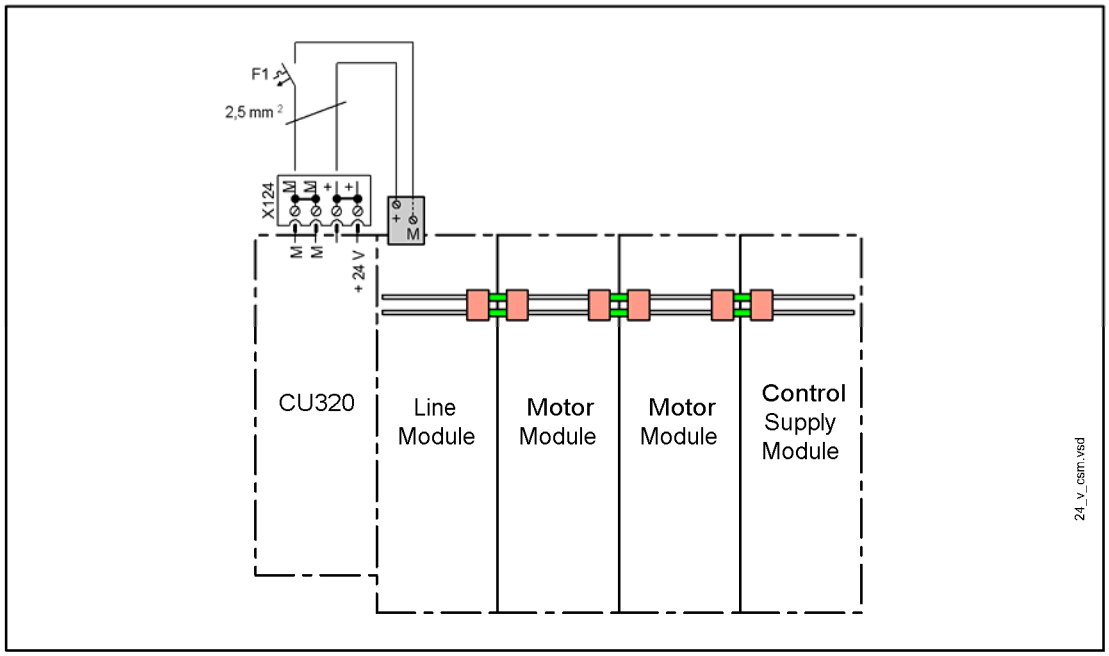


Figure 8-1 Example: 24 V supply with Control Supply Module

2. When using an external 24 V power supply, (e.g. SITOP), the 24 V terminal adapter must be used. Miniature circuit-breakers are recommended as overcurrent protective device for cables and busbars. The ground potential M must be connected to the protective conductor system (DVC A).

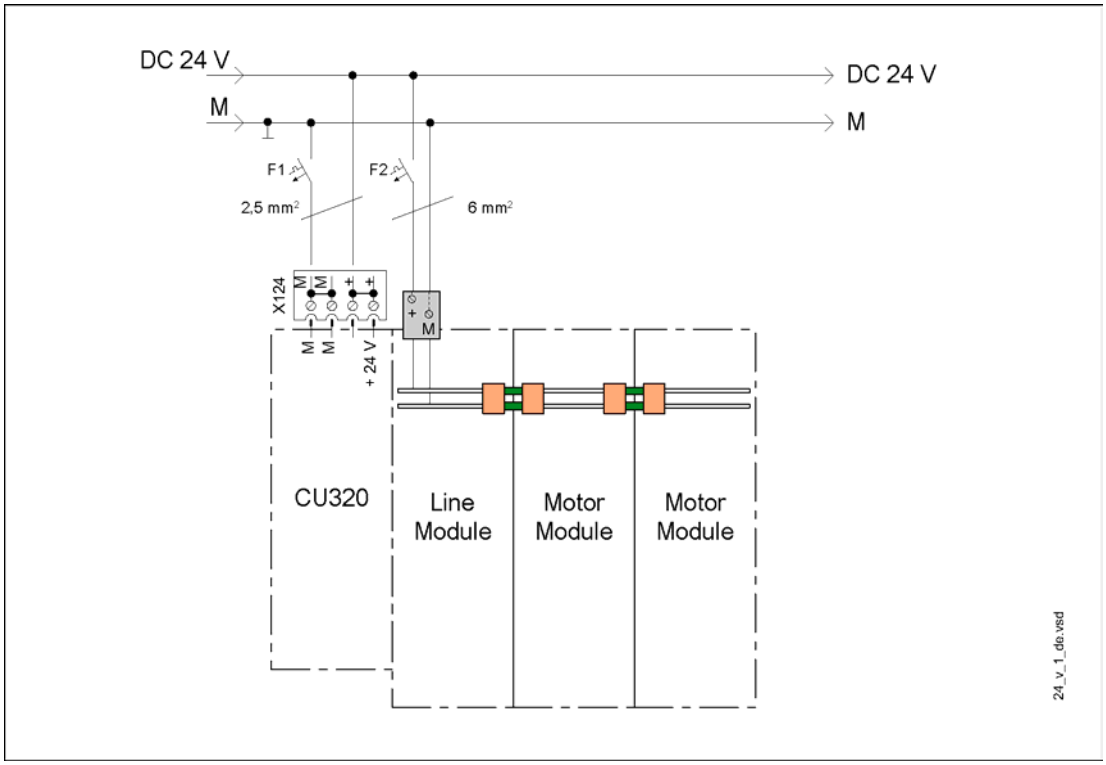


Figure 8-2 Example of 24 V DC fuse protection

When selecting the miniature circuit-breakers, you must take into account the following standards:

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

The following conditions for the conductors/cables should be used as basis:

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

Further, the conductors/cables should be routed so that

- max. 1 conductor pair, bundled and
- the 24 V conductors should be separately routed away from other cables and conductors that could conduct the operating current.

Table 8-8 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	6 A
2.5 mm^2	16 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 8-9 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	0.1	0.8
Active Line Module 36 kW	1	1.5	1.5
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:			14.25

8.4 Arrangement of components and equipment

8.4.1 General information

The arrangement of the components and equipment takes account of

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

Components are usually located centrally in a cabinet.

The necessary mounting and installation clearances above an below the components can, under certain circumstances, exceed the minimum clearances specified in the product documentation.

8.4.2 Current carrying capacity of the DC link busbar

The current carrying capacity of the DC link busbar must be observed for the configuring and the construction of the drive group.

The maximum current carrying capacity of the DC link busbar differs depending on the width of the power units.

- For power units from 3 A to 60 A (max. width 150 mm) and DC link components (Braking, Capacitor and Control Supply Module), the DC link busbar can be loaded with **100 A**.
- If the DC link busbar of 3 A to 60 A power sections (max. 150 mm wide) is replaced by a reinforced DC link busbar, the DC link busbar can carry a current of **200 A**.
- For power units from 85 A to 200 A (200 / 300 mm width), the DC link busbar can be loaded with **200 A**.

If the current carrying capacity of the DC link busbar is exceeded, two solutions are possible: Either the installation of the drive line-up with infeed from left and right (center infeed; see below) or the use of another Line Module.

Note

The following examples are based on the concurrent use and loading of the Motor Modules with the rated output current of the Motor Modules. The current values are taken from the Equipment Manual for Booksize Power Units or the NC61 catalog.

Example 1:

Connection of several Motor Modules with different current carrying capacity of the DC link busbar to a Line Module.

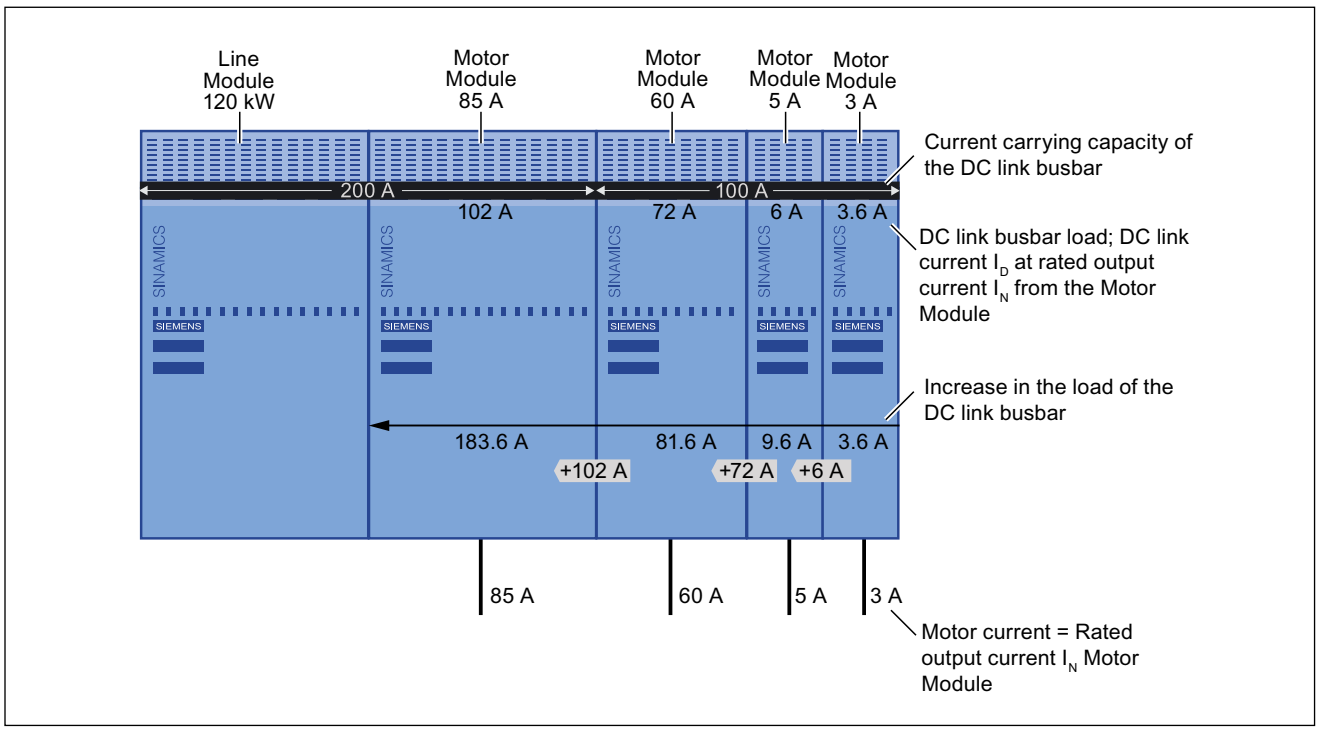


Figure 8-3 Regular installation; DC link busbar not overloaded

Example 2:

Connection of several Motor Modules with the same current carrying capacity of the DC link busbar to a Line Module with center infeed.

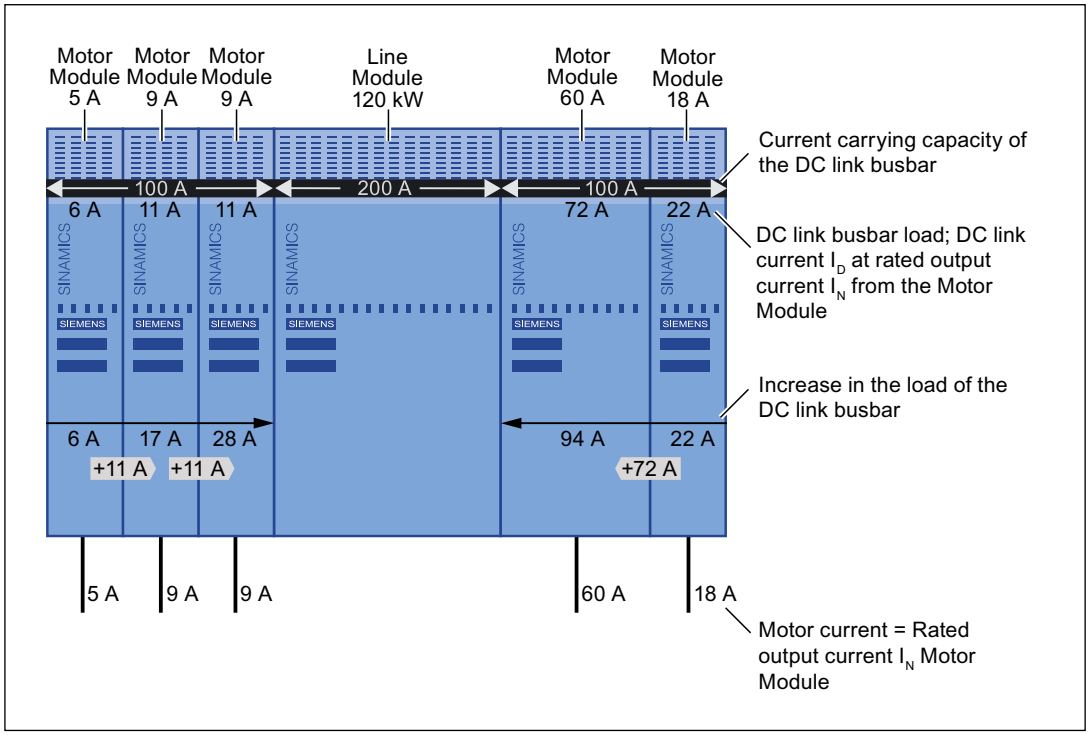


Figure 8-4 Infeed from left and right (center infeed)

In the case of Active Line Modules above 55 kW, the Motor Modules can be mounted at the right or left. This applies only to Active Line Modules with order numbers ending in 0, 1 or 2.

All Active Line Modules with order numbers ending in 3 can have the Motor Modules mounted at the right or left.

For Smart Line Modules of 16 kW or more, the order numbers of which end in 3 (6SL xxxxxxx 3), as well as for all Basic Line Modules, the Motor Modules can be mounted to the right and/or to the left.

The single side infeed would produce an overloading for a 60 A Motor Module. This construction variant is not permitted.

8.4.3 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)

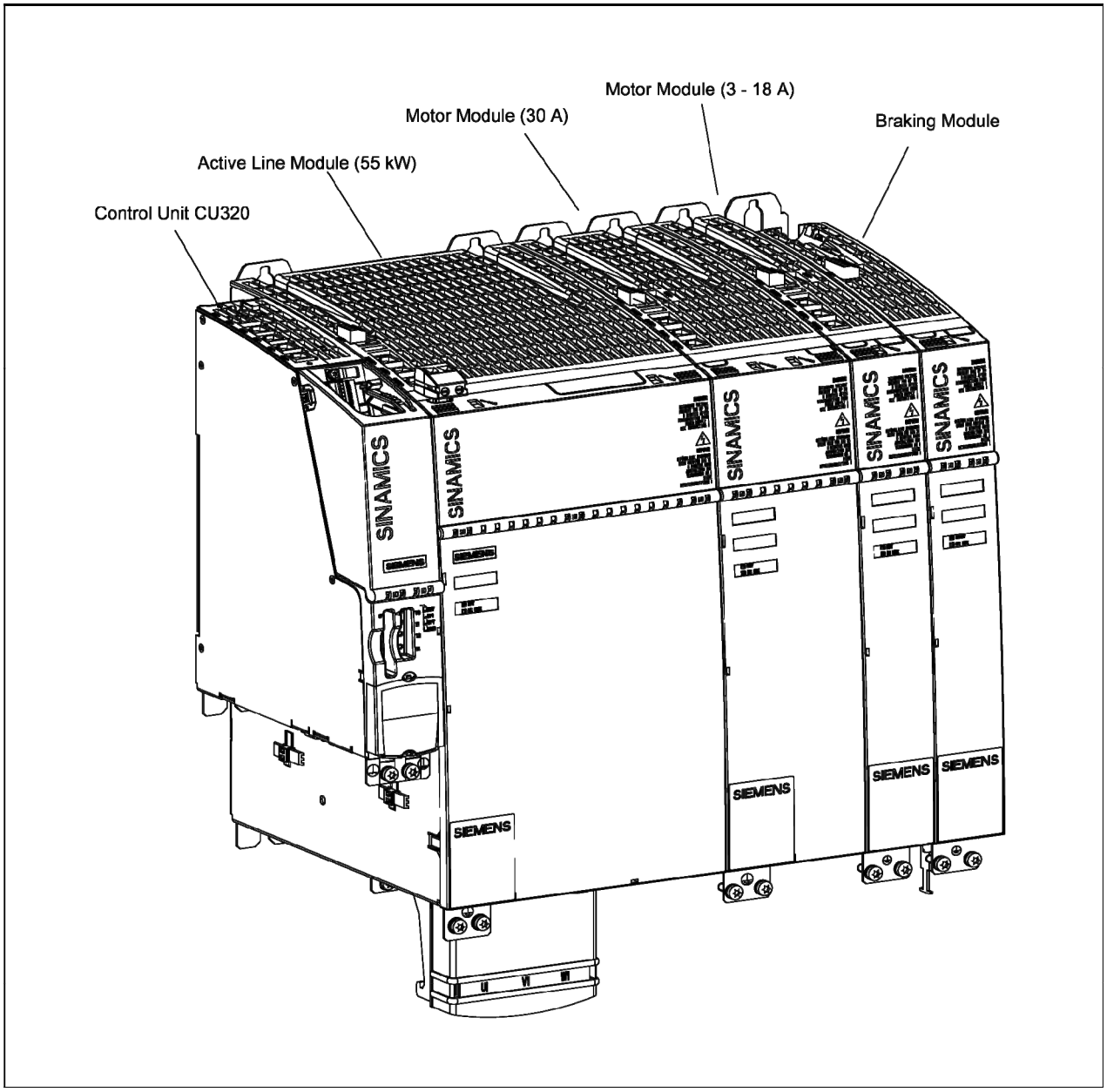


Figure 8-5 Example of a drive line-up

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 data.

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

Arrangement of the Voltage Clamping Module:

Line Modules up to 36 kW:	Preferably to the right, next to the Line Module
Line Modules above 55 kW:	Preferably to the left, next to the Line Module
When retrofitting:	At the end of the module line-up

Note concerning the use of components with a width of 50 mm

⚠DANGER

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

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

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



Figure 8-6 Removing the DC link bridges

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

Two-tier configuration

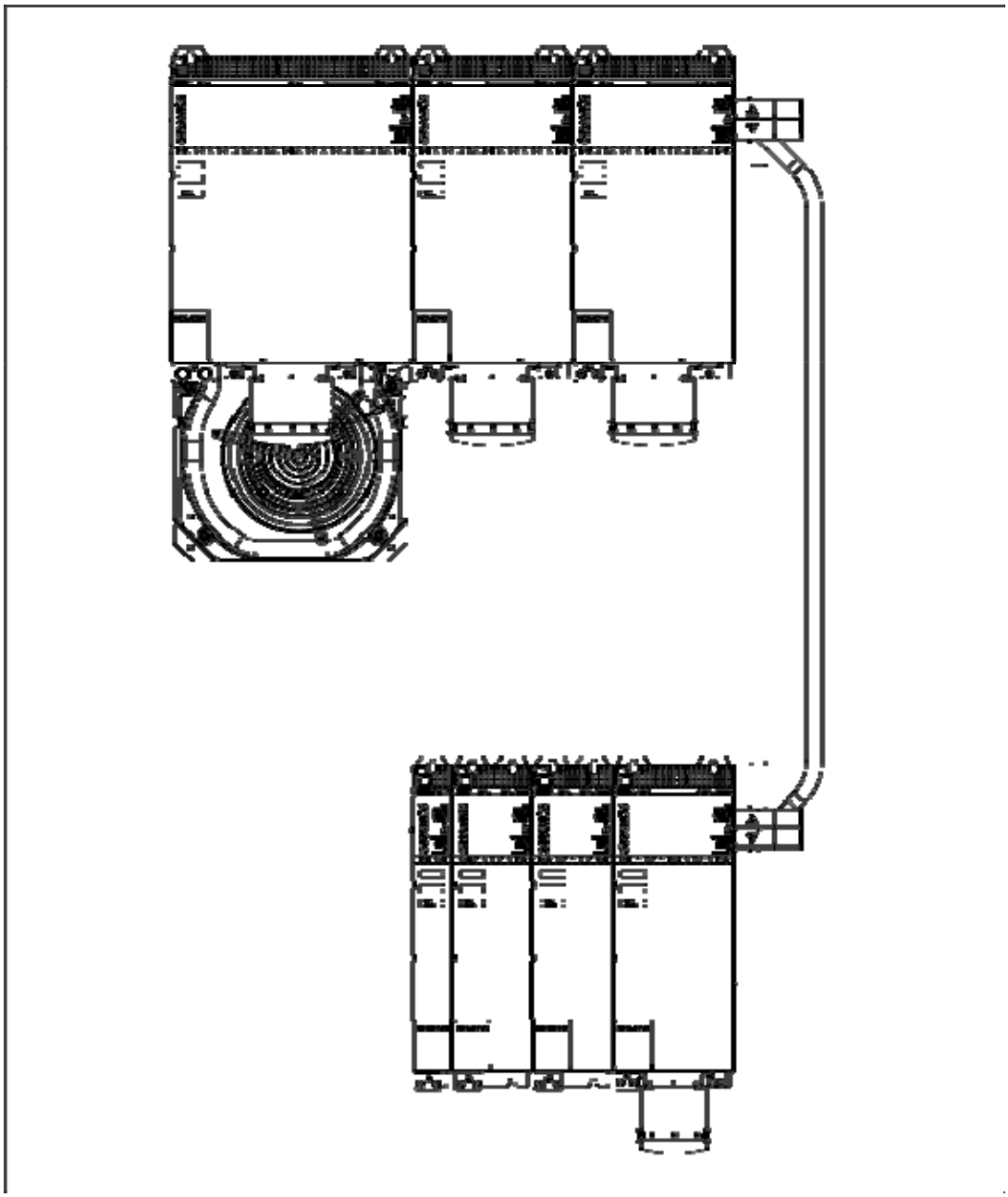


Figure 8-7 Example of a two-tier configuration with components between 200 and 300 mm wide

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 primarily depends on the wiring and cable cross-section.

The inlet temperature of the air sucked in for cooling the module must not exceed 40 °C (with derating, the inlet temperature must not exceed 55 °C). This must be ensured by means of suitable air guidance, the clearance between the module rows, or by air baffle plates.

The distance between the rows also depends on the required bending radii of the power cables to be connected.

CAUTION
Signal cables must not be routed parallel to power cables.

Wiring rules for DRIVE-CLiQ

See the Commissioning Manual.

Table 8-10 Overview of the DC link rectifier adapter and DC link adapter

	Suitable for module width	Max. connectable cross-section	Max. current carrying capacity
DC link rectifier adapter (cable outlet on top)			
6SL3162-2BD00-0AAx	50 mm, 100 mm	10 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 data for the components.

Multiple-tier configuration

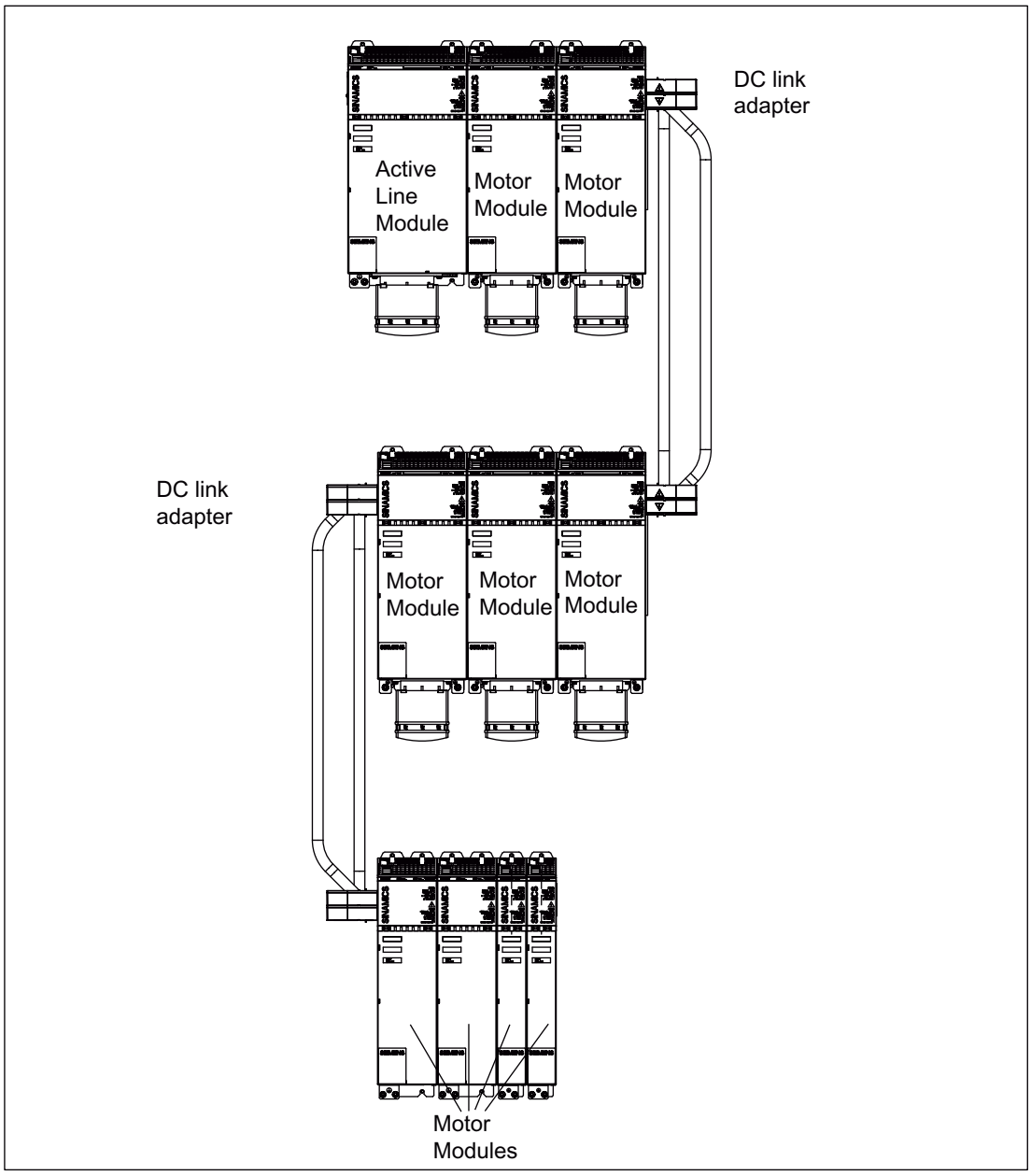


Figure 8-8 Example of a three-tier configuration with components between 50 and 200 mm wide

Note

When the power supply input is on the right-hand side of the drive line-up (e.g. in a multiple-tier configuration), the above rules apply in reverse.

This means that: The Motor Modules are arranged in order of power from the highest power to the lowest power followed by the DC link components, such as the Braking Module.

8.5 Information about electromagnetic compatibility (EMC) and cable routing

8.5.1 General information

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

8.5.2 Cable shielding and routing

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

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

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

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

The cable shields must be connected as close to the conductor terminal connections as possible to ensure a low-impedance connection with cabinet ground. For Siemens power cables in which the shield is connected to the connector shell (see relevant catalog), this is a sufficiently good shield contact.

With components that do not have any special shield connection or where the shield connection is not sufficient, the cable shields can be connected to the metal mounting plate using hose clamps and toothed rails. The cable length between the shield contact point and the terminals for cable conductors must be kept as short as possible.

Shield contact plates with pre-prepared clip contacts are available for contacting the shields for power cables of Line Modules and Motor Modules. Up to a module width of 100 mm,

these plates are part of the scope of supply of the components, or they are integrated in the connector.

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

Avoid, where possible, routing unshielded cables, connected to the drive line-up, in the immediate vicinity of noise sources, e.g. transformers. Signal lines (shielded and unshielded) connected to the drive line-up, must be routed as far as possible away from strong external magnetic fields (e.g. transformers, line reactors). In both cases, a distance of ≥ 300 mm is usually sufficient.

⚠ DANGER

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

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

Signal and DC power supply cables

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

- Direct current supply cables: Max. permissible length: 10 m
- Unshielded signal cables: Max. permissible length: 30 m (without additional wiring)

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

Table 8-11 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 D-33102 Paderborn Tel. +49 (0) 5252/960-0 Fax +49 (0) 5252/960-116 http://www.weidmueller.com	

NOTICE

The connected signal and power cables must be routed to the components in such a way that they do not cover the ventilation slots.

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

Table 8-12 Maximum cable lengths

Type	Maximum length [m]
24 V DC power cables [2]	10
24 V signal cables [2]	30
DC link, including extensions	10
Total length of power cables in the drive line-up comprising the following: Motor power cables, DC link cable(s) and line feeder cable from the line filter output	350 (shielded) 560 (unshielded)
Total length: Motor cables, line feeder cable from the Basic Line Filter to the Active Line Module	**< 150 (shielded)**
Total cable length with Voltage Clamping Module (limitations/constraints, refer to the Chapter, Voltage Clamping Module)	630 (shielded) 850 (unshielded)
Power cable between line filter and line reactor	10 (shielded/unshielded) [1]
Power cable between line reactor and Line Module	10 (shielded/unshielded) [1]
Power cable between Motor and Motor Module to In = 9 A	50 (shielded) 75 (unshielded)
Power cable between Motor and Motor Module In = 18 A	70 (shielded) 100 (unshielded)
Power cable between Motor and Motor Module In ≥ 30 A	100 (shielded) 150 (unshielded)
DRIVE-CLiQ signal cables MC500	100
DRIVE-CLiQ signal cables MC800	50
DRIVE-CLiQ signal cables FIX	70
Cable between the Braking Module and braking resistor	10

[1] To comply with EMC limit values, shielded cables (preferably Motion-Connect cables) must be used.

[2] For greater lengths, suitable wiring must be connected by the user to provide overvoltage protection.

8.5.3 Equipotential bonding

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

The machine OEM has to ensure that all conditions with regard to the assignment of ground cable connectors, protective conductor and equipotential bonding conductor connectors and terminals are indicated clearly in the Technical User Manual / Manufacturer Documentation (extremely important when several protective conductor/equipotential bonding conductor connections/terminals are available in the device). A special note must be made for connectors/terminals for equipotential bonding connections that are available in parallel with protective ground connection cables, indicating that they must not be used for looping through the protective ground 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. From a cross-section of 25 mm² copper, the outer cross-section of the finely-stranded conductor is halved.

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

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

⚠ CAUTION

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

Create a low-impedance ground connection for additional cabinets, system components, and distributed devices with the largest possible cross-section (at least 16 mm²). Other system and machine components must also be integrated in the equipotential bonding concept. The PE conductor for the motors used must be connected via a PE conductor within the motor cable.

NOTICE

If the above information about equipotential bonding is not taken into account, this can cause the field bus interfaces to malfunction or devices to malfunction.

Functional ground connection for PROFIBUS

Note

Functional ground

Ensure that grounding is carried out properly and is suitable for high frequencies to enable HF currents to flow to ground. The protective grounding provided should not be used as functional ground.

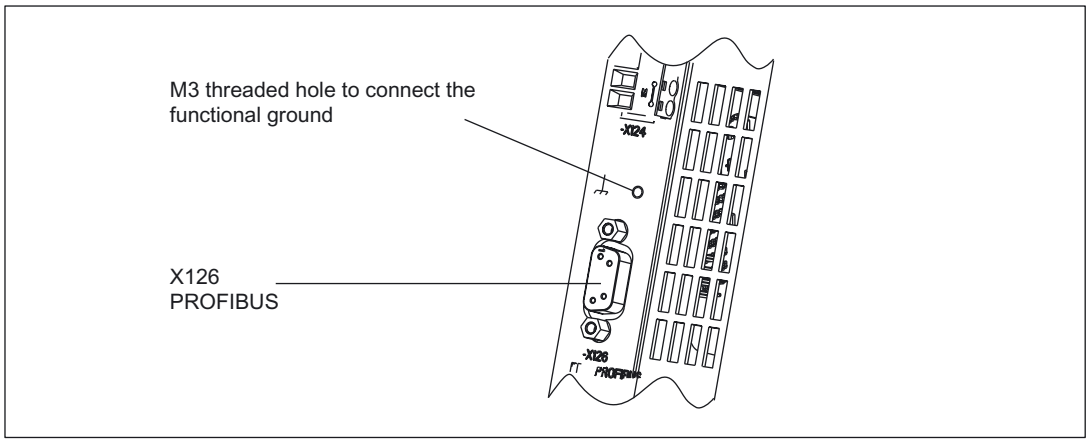


Figure 8-9 Functional ground connection for PROFIBUS

The following connectors are recommended:

- PROFIBUS connector without PG/PC connection (6ES7972-0BA41-0XA0)
- PROFIBUS connector with PG/PC connection (6ES7972-0BB41-0XA0)

8.6 Connection systems

8.6.1 Spring-loaded terminals/screw terminals

Connectable conductor cross-sections of spring-loaded terminals

Table 8-13 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 8-14 Screw terminals

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

Screw terminal type			
5	Connectable conductor cross-sections	Flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.5 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	

8.6.2 Connectable cable cross-sections

Table 8-15 Connectable cable cross-sections: Power supply cable / motor cable, part 1

		Connection cross-section [mm^2]					
Component	**Terminal type**	**1.5**	**2.5**	**4**	**6**	**10**	**16**
Motor Module 3 A to 30 A 2 x 3 A to 2 x 18 A	Motor connector 30 A 3+2 pin	X	X	X	X	X	
Motor Module 45 A to 60 A	Threaded bolt M6/6 Nm 1)		X	X	X	X	X
Motor Module 85 A	Threaded bolt M8 / 13 Nm		X	X	X	X	X
Motor Module 132 A to 200 A	Threaded bolt M8 / 13 Nm		X	X	X	X	X
Smart Line Module 5 kW to 10 kW	Screw-type terminal	X	X	X	X		
Acitve Line Module 16 kW Smart Line Module 16 kW	Screw-type terminal	X	X	X	X	X	
Acitve Line Module 36 kW Smart Line Module 36 kW	Threaded bolt M6 / 6 Nm		X	X	X	X	X
Acitve Line Module 55 kW	Threaded bolt M8 / 13 Nm		X	X	X	X	X
Active Line Module 80 kW to 120 kW	Threaded bolt M8 / 13 Nm		X	X	X	X	X

1) for ring cable lugs to DIN 46234

Terminal area for flexible cable with wire end ferrule

Terminal area for flexible cable with ring cable lug M6

Terminal area for flexible cable with ring cable lug M8

IP2xB to EN 60529 ensured. Note: The shock-hazard protection installed as standard must be used or adjusted as appropriate.

Table 8-16 Connectable cable cross-sections: Power supply cable / motor cable, part 2

		Connection cross-section [mm²]					
Component	**Terminal type**	**25**	**35**	**50**	**70**	**95**	**120**
Motor Module 3 A to 30 A 2 x 3 A to 2 x 18 A	Motor connector 30 A 3+2 pin						
Motor Module 45 A to 60 A	Threaded bolt M6/6 Nm [1]	X	X	X			
Motor Module 85 A	Threaded bolt M8 / 13 Nm	X	X	X	X	X	X
Motor Module 132 A to 200 A	Threaded bolt M8 / 13 Nm	X	X	X	X	X	X
Smart Line Module 5 kW to 10 kW	Screw-type terminal						
Acitve Line Module 16 kW Smart Line Module 16 kW	Screw-type terminal						
Acitve Line Module 36 kW Smart Line Module 36 kW	Threaded bolt M6 / 6 Nm	X	X	X			
Acitve Line Module 55 kW	Threaded bolt M8 / 13 Nm	X	X	X	X	X	X
Active Line Module 80 kW to 120 kW	Threaded bolt M8 / 13 Nm	X	X	X	X	X	X

[1] for ring cable lug to DIN 46234

Terminal area for flexible cable with wire end ferrule

Terminal area for flexible cable with ring cable lug M6

Terminal area for flexible cable with ring cable lug M8

IP2xB to EN 60529 ensured. Note: The shock-hazard protection installed as standard must be used or adjusted as appropriate.

Table 8-17 Connectable cable cross-sections: Power supply cable / connection for braking resistor, part 3

		Connection cross-section [mm²]					
Component	**Terminal type**	**1.5**	**2.5**	**4**	**6**	**10**	**16**
Basic Line Module 20 kW Line connection	Screw-type terminal	x	x	x	x	x	x
Basic Line Module 20 kW Connection for braking resistor	Screw-type terminal	x	x	x			
Basic Line Module 40 kW Line connection	Screw-type terminal					x	x
Basic Line Module 40 kW Connection for braking resistor	Screw-type terminal			x	x	x	x
Basic Line Module 100 kW Line connection	Threaded bolt M8 / 13 Nm		x	x	x	x	x

Table 8-18 Connectable cable cross-sections: Power supply cable / connection for braking resistor, part 4

		Connection cross-section [mm²]					
Component	**Terminal type**	**25**	**35**	**50**	**70**	**95**	**120**
Basic Line Module 20 kW Line connection	Screw-type terminal						
Basic Line Module 20 kW Connection for braking resistor	Screw-type terminal						
Basic Line Module 40 kW Line connection	Screw-type terminal	x	x	x			
Basic Line Module 40 kW Connection for braking resistor	Screw-type terminal	x					
Basic Line Module 100 kW Line connection	Threaded bolt M8 / 13 Nm	x	x	x	x	x	x

Note

The 40 kW Basic Line Module provides the IP20 degree of protection only with insulated ferrule and a cross-section > 25 mm².

Note

The cross-section of the PE conductor must be selected in accordance with DIN EN 60204-1, DIN EN 61800-5-1, and VDE 0100-540 (IEC 60364-5-54). When doing so, note that certain components conduct a high leakage current, which means that the relevant guidelines must be observed (EN 61800-5-1).

When selecting the power supply cable, note the loop resistance so that the relevant protective components (line fuse, RCCB, etc.) function properly and that no hazardous shock currents or voltages occur in the event of a fault.

⚠ WARNING

The internal overload monitoring function of the power module only protects the cable if this is dimensioned/selected corresponding to the power module currents. If smaller cross-sections are selected, the user must ensure that the appropriate level of cable protection is provided (e.g. by setting the control parameters to suitable values).

8.6.3 Motor connector

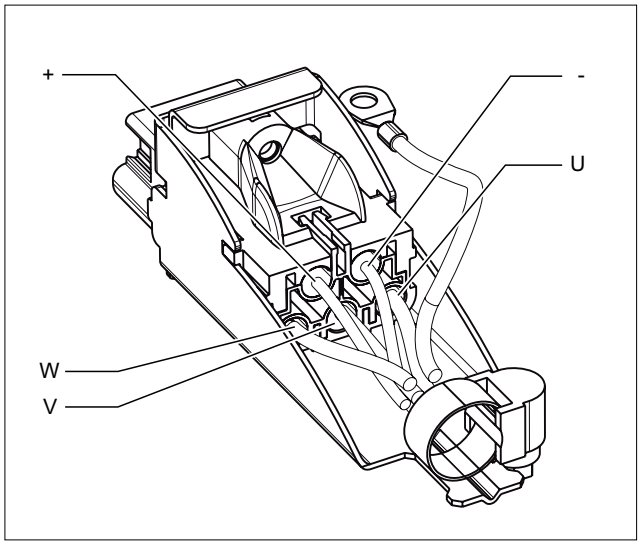


Figure 8-10 Motor connector

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.

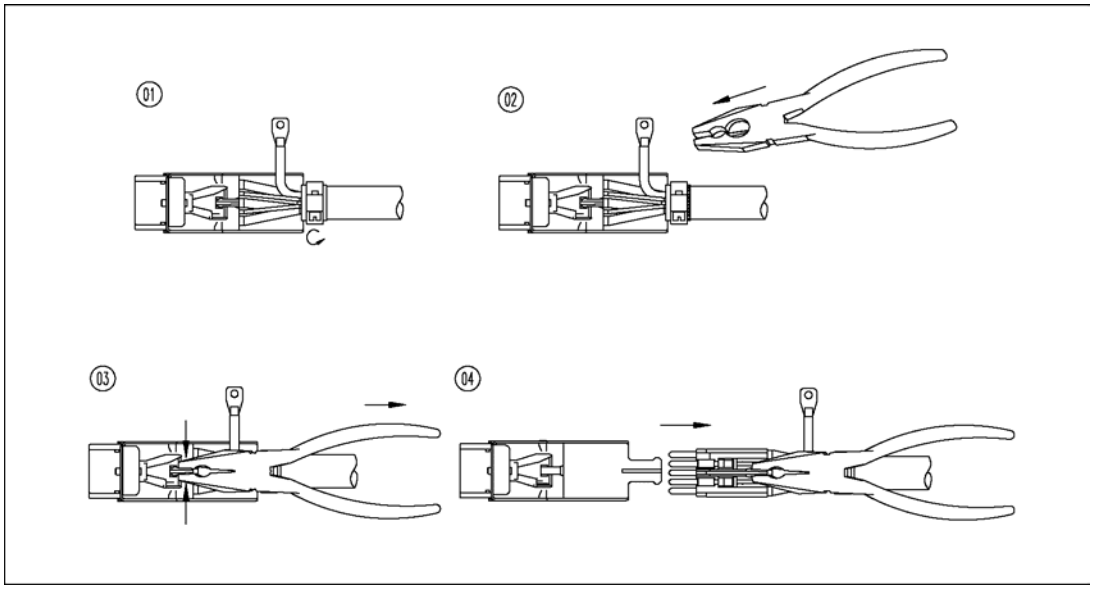


Figure 8-11 Removing the motor connector

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

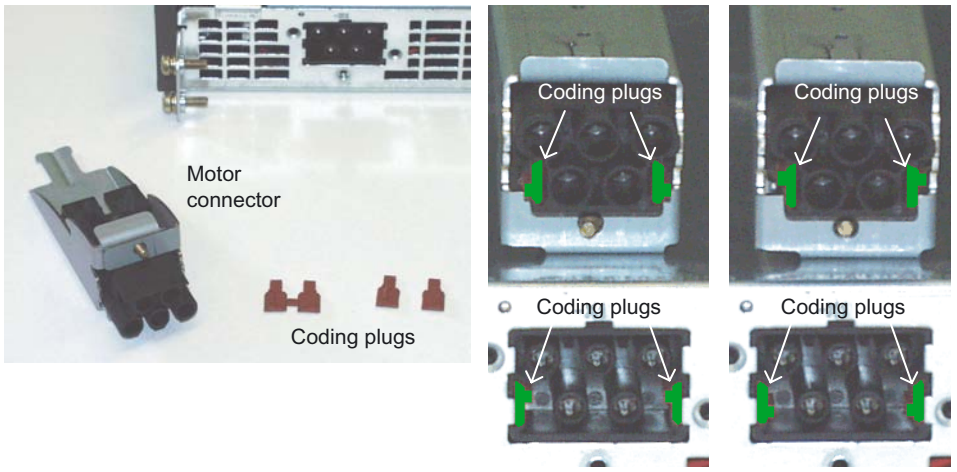


Figure 8-12 Coding the motor connector

The coding plugs are supplied with the motor cables.

8.6.4 Power connector (X1/X2)

with screw terminals

Structure and assembly

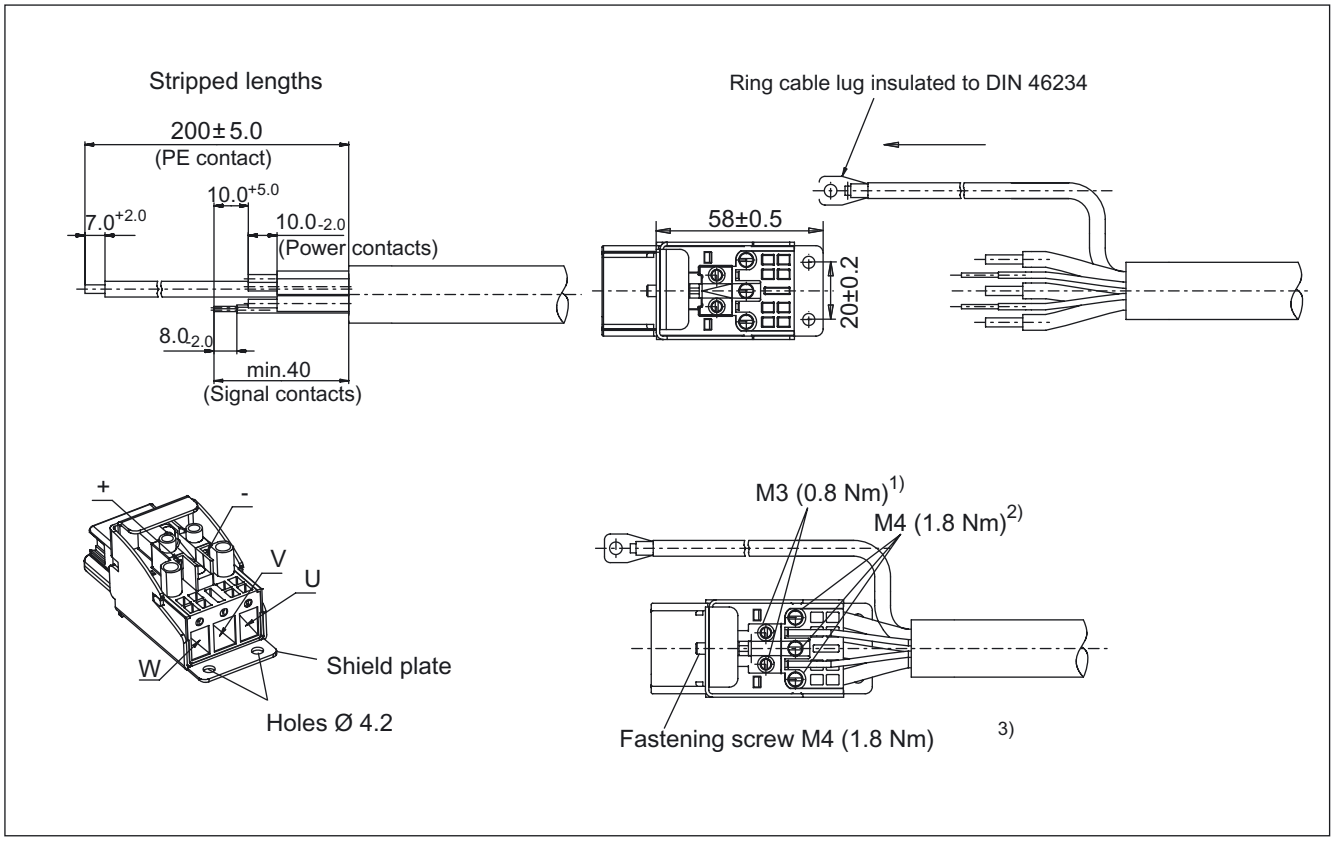


Figure 8-13 Setting up and installing the power supply connector (X1/X2)

Screwdriver

1) SZS 0.6 x 3.5

2) SZS 1.0 x 4.0

3) Torx TX20

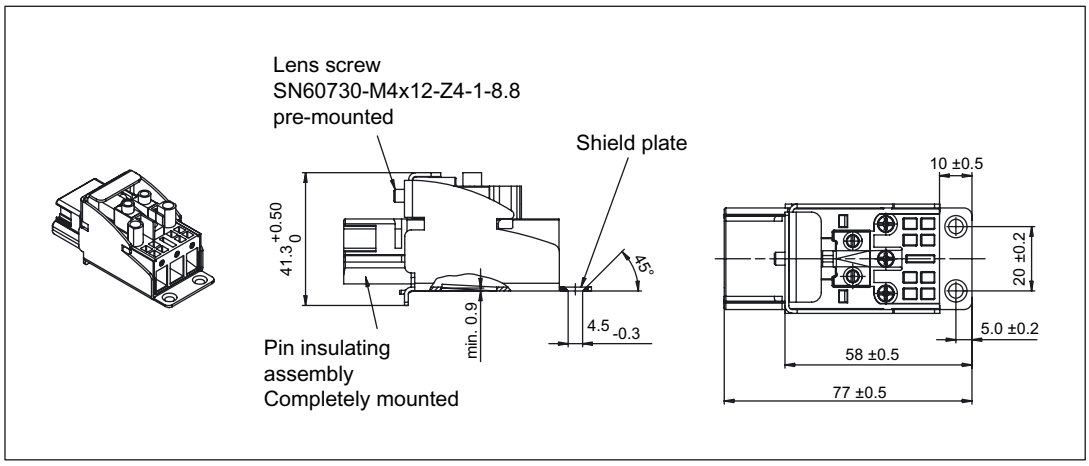


Figure 8-14 Dimensions: Power connector

Various options are available for the shield contact:

1. Shield contact with shield plate supplied.
   This type of shield contact should be preferred.

Table 8-19 Installing the shield plate

	
Shield plate supplied for power connectors	Frontal alignment of the shield plate
	
Lateral alignment of the shield plate	Lateral alignment of the shield plate

The shield plate can be installed at a number of angles using the two screws provided (M4) (tightening torque 1.8 Nm).

1. Shield contact on a toothed rail
   The toothed rail should be fitted at a distance of ≤ 150 mm below the drive line-up with the greatest possible surface area. Wherever possible, the brake conductors must be kept physically separate from U/V/W.

Note

Measures must be taken on site to relieve strain on the cables.
Max. permissible cable tension in the connection direction: 100 N

With these variants, the shield for the brake connection wires must be laid with the cable shield.

3. Securing a shield contact constructed by the customer on the shield plate.

8.6.5 24 V terminal adapter

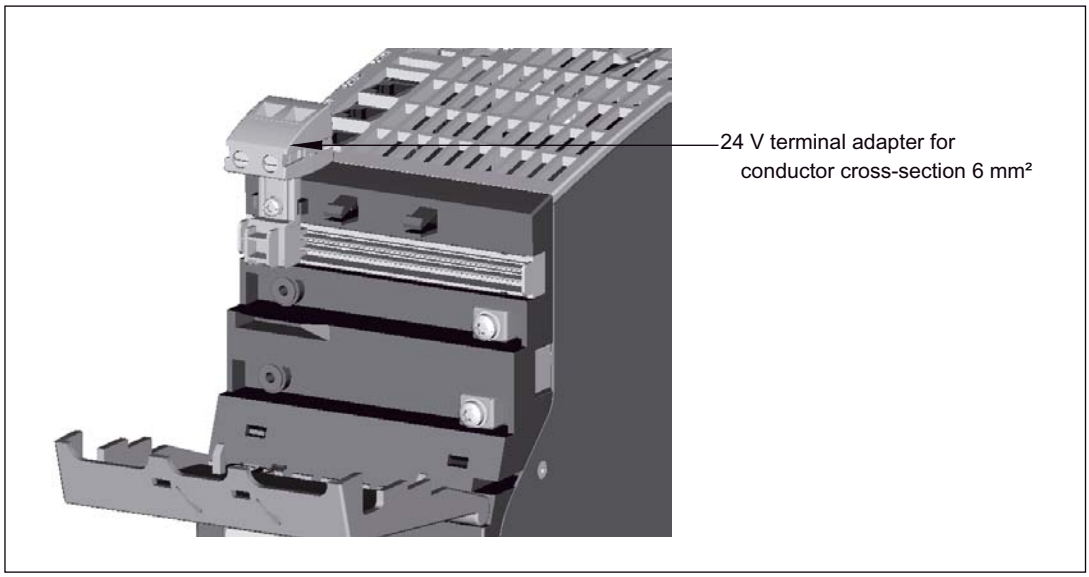


Figure 8-15 24 V terminal adapter

The terminal adapter can be fitted to any power unit. A recess must be provided for this purpose on the protective cover of the DC link using suitable pliers. The terminal adapter is snapped on and secured with a screw SHR, PT-TORX K 30-3, 0X16-ST-A2F WN1452 / EJOT / 0.5 Nm.

EJOT: http://www.ejot.de/

Note

The 24 V terminal adapter can only be installed on the component on the far left because all other areas are occupied by the red jumpers.

24 V terminal adapter for a conductor cross-section of 6 mm^2
Terminal adapter and screw are supplied with the Line Modules and Control Supply Modules.

8.7 Cooling

8.7.1 General

The cabinet can be cooled, among others, by using:

- Filtered fans
- Heat exchangers or
- Cooling units.

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

The air routing inside the control cabinet and the cooling clearances specified here, must be carefully 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
- Wiring and cabling
- Air guidance, air-conditioner

Table 8-20 Ventilation clearances above and below the components

Component	Order number	Clearance [mm]
CU320	6SL3040-0MA00-0AAx	80
SMCxx	6SL3055-0AA00-5xAx	50
TM15	6SL3055-0AA00-3FAx	50
TM31	6SL3055-0AA00-3AAx	50
TM41	6SL3055-0AA00-3PAx	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 Basic Line Module 20 kW – 100 kW	6SL3000-0CExx-0AAx	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
Basic Line Module 20 kW – 100 kW	6SL3130-1TExx-xAAx	80
Motor Module < 132 A	6SL312x-1TExx-xAAx	80
Motor Module 132 A and 200 A	6SL312x-1TE3x-xAAx	80 (additional 50 in front of fan)
Braking Module	6SL3100-1AE31-0AAx	80
Control Supply Module	6SL3100-1DE22-0AAx	80
Capacitor module	6SL3100-1CE14-0AAx	80

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

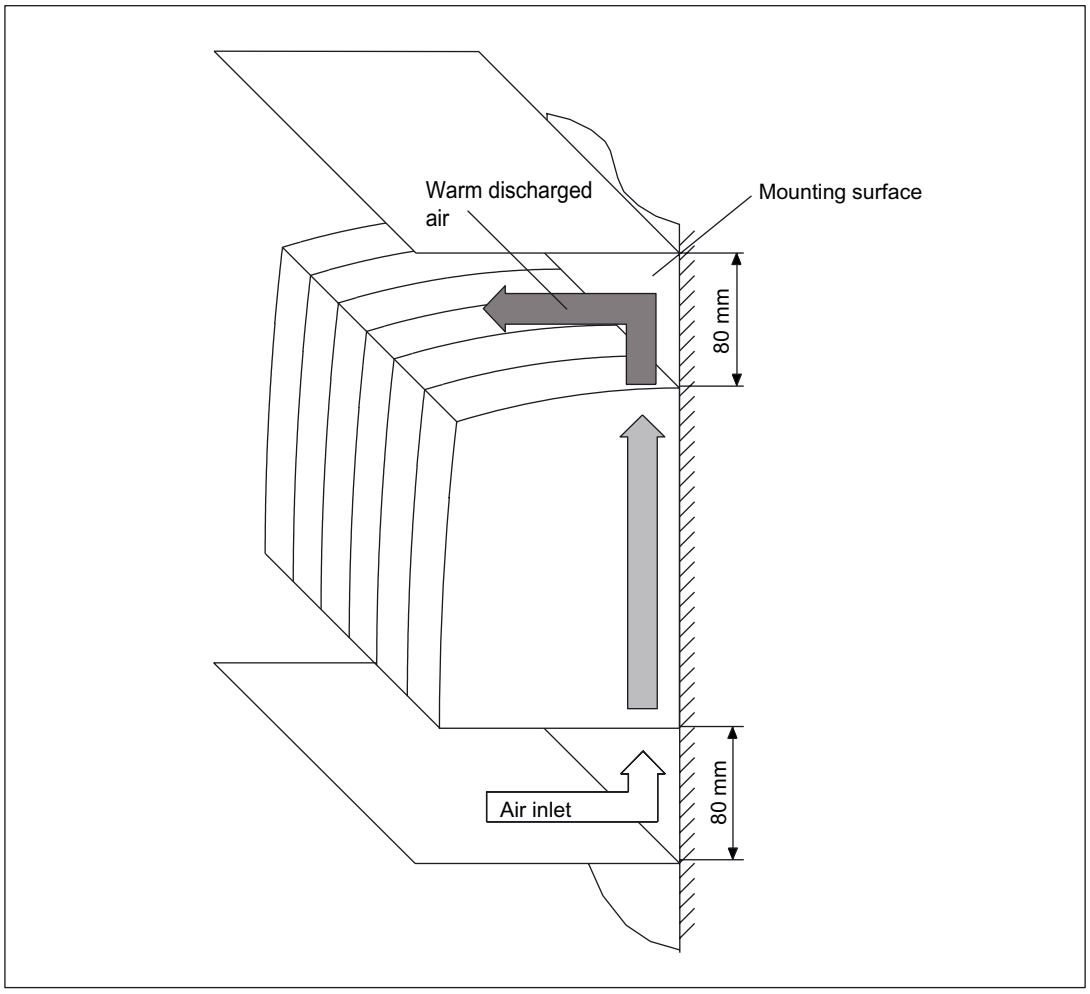


Figure 8-16 Clearances for booksize drive line-up with internal air cooling

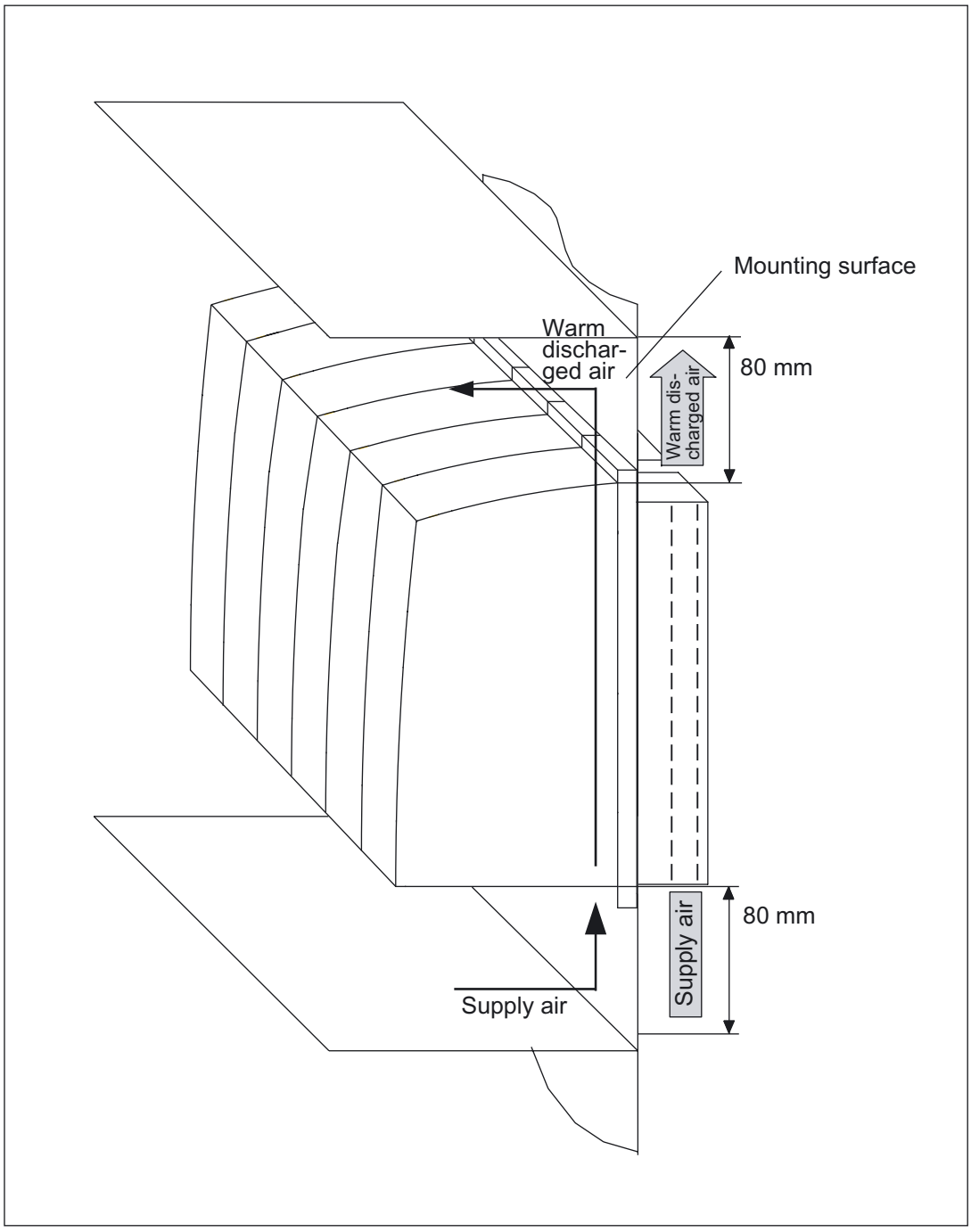


Figure 8-17 Clearances for booksize drive line-up with external air cooling

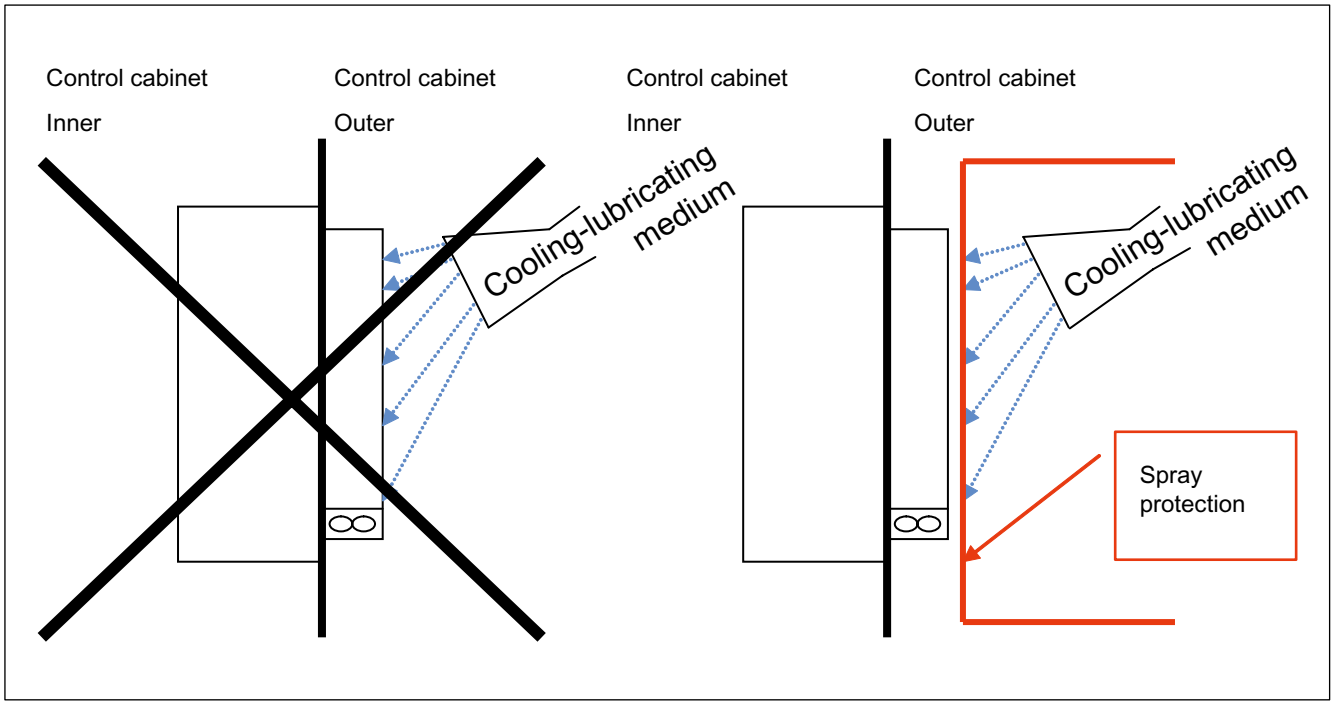


Figure 8-18 Spray protection for external cooling

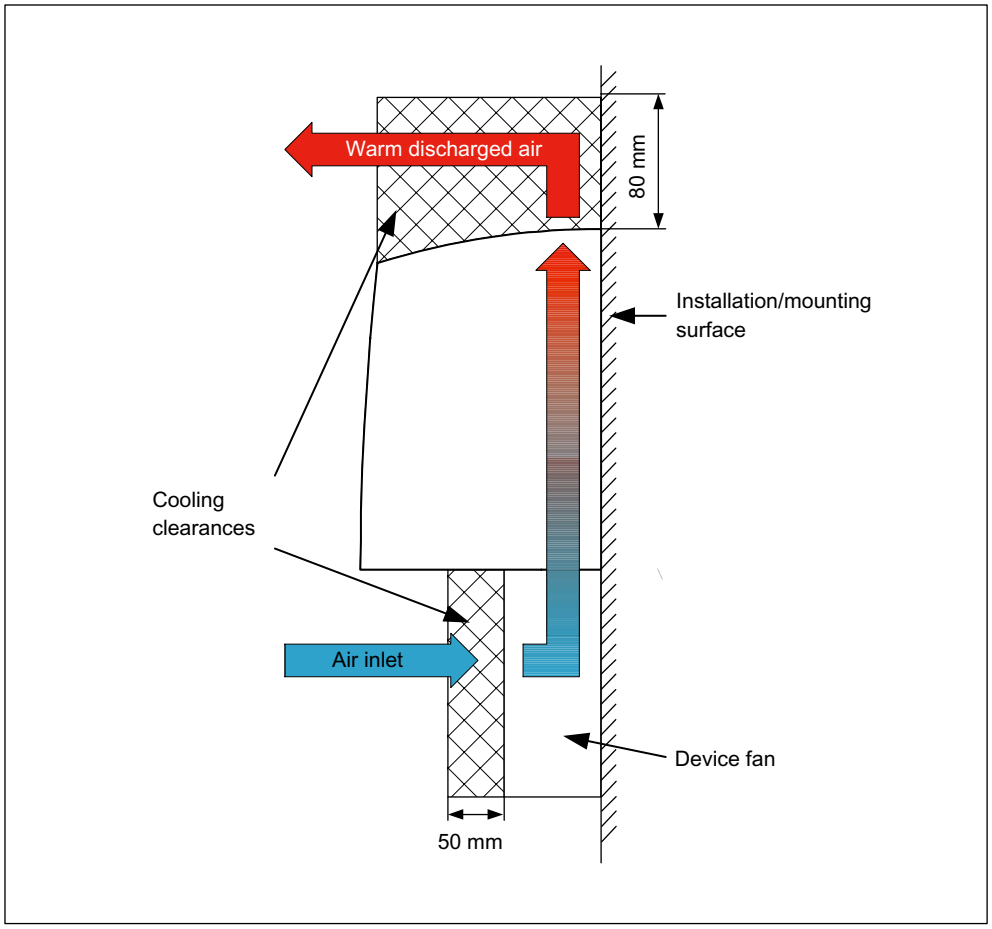


Figure 8-19 Cooling clearances for 300 mm components with mounted equipment fan

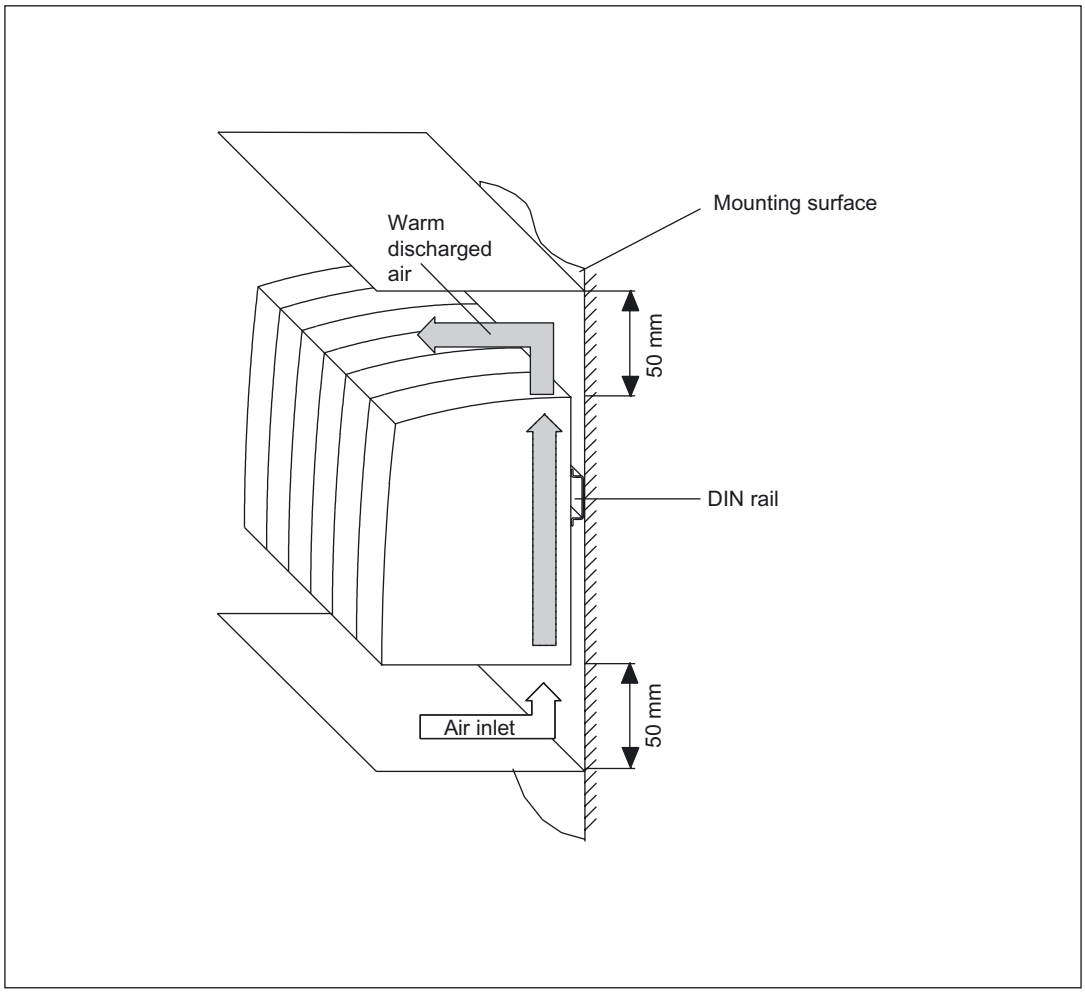


Figure 8-20 Cooling clearances, rail-mounted modules (e.g. VSM, SMC, TM, DMC)

8.7.2 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.

NOTICE
The connected signal and power cables must be routed to the components in such a way that they do not cover the ventilation slots. Cold air must not be allowed to blow directly onto electronic equipment.

Note

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

Note

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

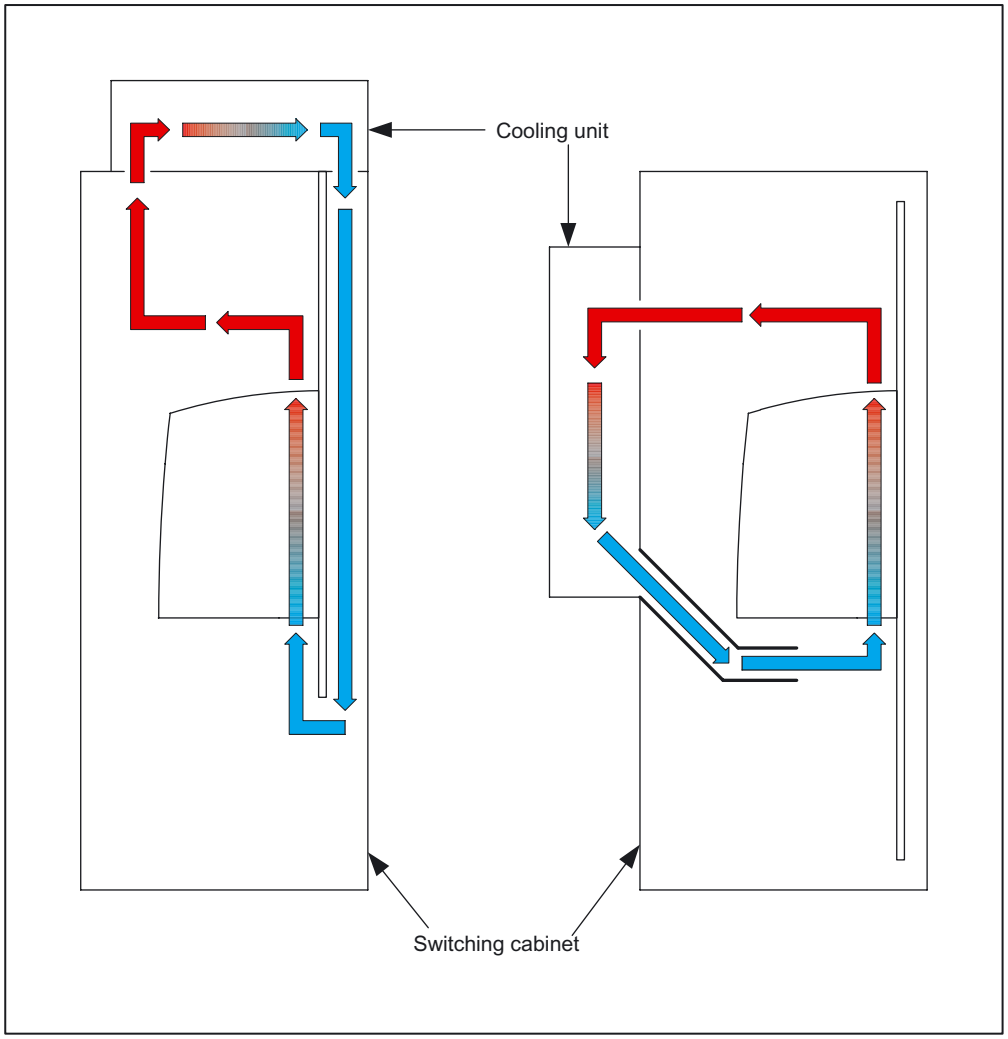


Figure 8-21 Examples of cabinet ventilation

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.

8.7.3 Power loss of components in rated operation

The following table shows the power loss for components with internal air 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
- Operating components at their rated power

Table 8-21 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
Basic Line Filter for Active Line Modules with Active Interface Module		
55 kW	W	41
80 kW	W	48
120 kW	W	86
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
Basic Line Filter for Smart Line Modules		
5 kW	W	5
10 kW	W	9
16 kW	W	16
36 kW	W	28
Basic Line Filter for Basic Line Modules		
20 kW	W	144
40 kW	W	283.6
100 kW	W	628

	Unit	Power loss
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
Line reactors for Basic Line Modules		
20 kW	W	130
40 kW	W	270
100 kW	W	480
Sensor Modules		
SMC10	W	< 10
SMC20	W	< 10
SMC30	W	< 10
Additional system components		
TM15	W	< 3
TM31	W	< 10
TM41	W	10
TM54F	W	4.5
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, internal air cooling

Table 8-22 Overview of the power loss for components with internal air 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
Basic Line Modules		
20 kW	W	144
40 kW	W	283.6
100 kW	W	628
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		
3 A	W	70
5 A	W	105
9 A	W	160
18 A	W	320

Overview, power loss, external air cooling

Table 8-23 Overview of the power loss for components with external air 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				
3 A	W	35	35	70
5 A	W	45	60	105
9 A	W	65	95	160
18 A	W	80	240	320

Electronic losses of Motor Modules/Line Modules

Table 8-24 Electronic losses of Motor Modules/Line Modules

Component		Internal/external air cooling
		Power loss [W]
Single Motor Modules	3A	20.4
	5A	20.4
	9A	20.4
	18A	20.4
	30A	21.6
	45A	28.8
	60A	28.8
	85A	36.0
	132A	36.0
	200 A	36.0
Double Motor Modules	3 A	24.0
	5 A	24.0
	9 A	24.0
	18 A	24.0
Active Line Modules	16 kW	26.4
	36 kW	36.0
	55 kW	45.6
	80 kW	36.0
	120 kW	60.0
Basic Line Modules	20 kW	144
	40 kW	283.6
	100 kW	628
Smart Line Module	5 kW	24.0
	10 kW	31.2
	16 kW	26.4
	36 kW	36.0

8.7.4 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 8-22 Formula to calculate the power loss

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 / (m^2 * K)]

A = free-standing cabinet surface area [m^2]

Table 8-25 Example, calculating the power loss of a drive configuration

Component	Number	Total power loss [W] (including electronic losses)	Total power loss [W]
CU320	1	20	20
Line filters	1	90	90
Line reactor	1	250	250
Active Line Module 36 kW	1	666	666
Motor Module 18 A	2	185.4	370.8
Motor Module 30 A	3	311.6	934.8
SMC	5	10	50
SITOP 20	1	53	53
Line Contactor	1	12	12
Total:			2446.6

Assumption:

Free-standing cabinet surface area A = 5 m^2

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

q = (2415 [W] / 10 [K]) - 5.5 [W / (m^2 * K)] * 5 [m^2] = 214 [W/K]

Service and Support Booksize

9

9.1 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
E-mail: 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
E-mail: docu.motioncontrol@siemens.com

Internet Address

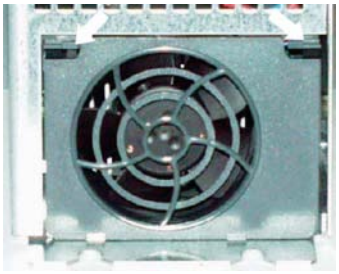
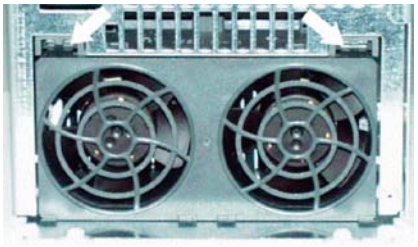
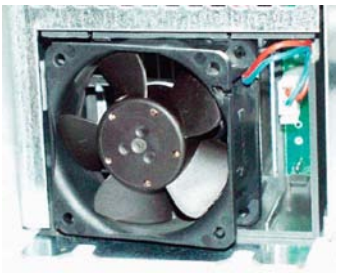
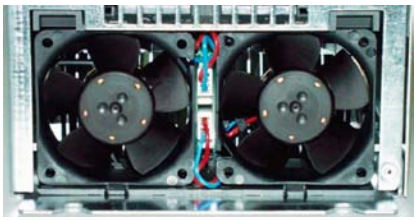
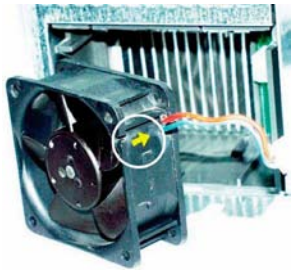
Up-to-date information about our products can be found on the Internet at the following address:

http://www.ad.siemens.de/mc

9.2 Replacing the fan

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:

<table>
<tr><td colspan="3">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.</td></tr>
<tr><td>Module width: 50 mm</td><td>Module width: 100 mm</td><td>Module width: 150 mm and 200 mm</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td colspan="3">1. Removing the fan.
2. Remove the connector.</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
</table>

Replacing a fan for a 300 mm wide component: Refer to Chapter: Motor Modules with internal air cooling – Installation

Installing the fan:

1. Before installing the fan, check the air flow direction (the arrow on the fan must point towards the cooling ribs).
2. Insert the connector until it fully engages.
3. Insert the fan until it latches into place. It is not permissible to crush the connecting cables!
4. Close the fan cover.

9.3 Forming the DC link capacitors

⚠ CAUTION

If the Active Line Module, Smart Line Module and Motor Module have not been used for more than two years, the DC link capacitors must be re-formed. If this is not carried-out, the units could be damaged when the power supply voltage is connected.

If the cabinet is commissioned within two years of its date of manufacture, the DC link capacitors do not need to be reformed. The date of manufacture can be taken from the serial number on the rating plate.

Note

It is important that the storage period is calculated from the date of manufacture and not from the date that the equipment was shipped.

Procedure

The DC link capacitors are re-formed by applying the rated voltage without load for at least 30 minutes at room temperature.

Date of manufacture

The date of manufacture can be determined from the following assignment to the serial number (e.g. T-**S9**2067000015):

Table 9-1 Production year and month

Character	Year of manufacture	Character	Month of manufacture
S	2004	1 to 9	January to September
T	2005	O	October
U	2006	N	November
V	2007	D	December

The serial number is found on the rating plate.

When DC link capacitors are formed, a defined voltage is connected to them and a defined current flows so that the appropriate capacitor characteristics are re-established for them to be re-used as DC link capacitors.

Components for the forming circuit (recommendation)

- 1 fuse switch 3-phase 400 V / 10 A
- 3 incandescent lamps 230 V / 100 W
- Various small components, such as lamp socket, cable 1.5 mm^2, etc.

⚠ DANGER

Dangerously high voltage levels are still present in the cabinet up to 5 minutes after it has been disconnected due to the DC link capacitors. It is only permissible to work on the equipment or at the DC link terminals after this time has expired.

Note

Line Modules must be enabled from the connected Motor Module.

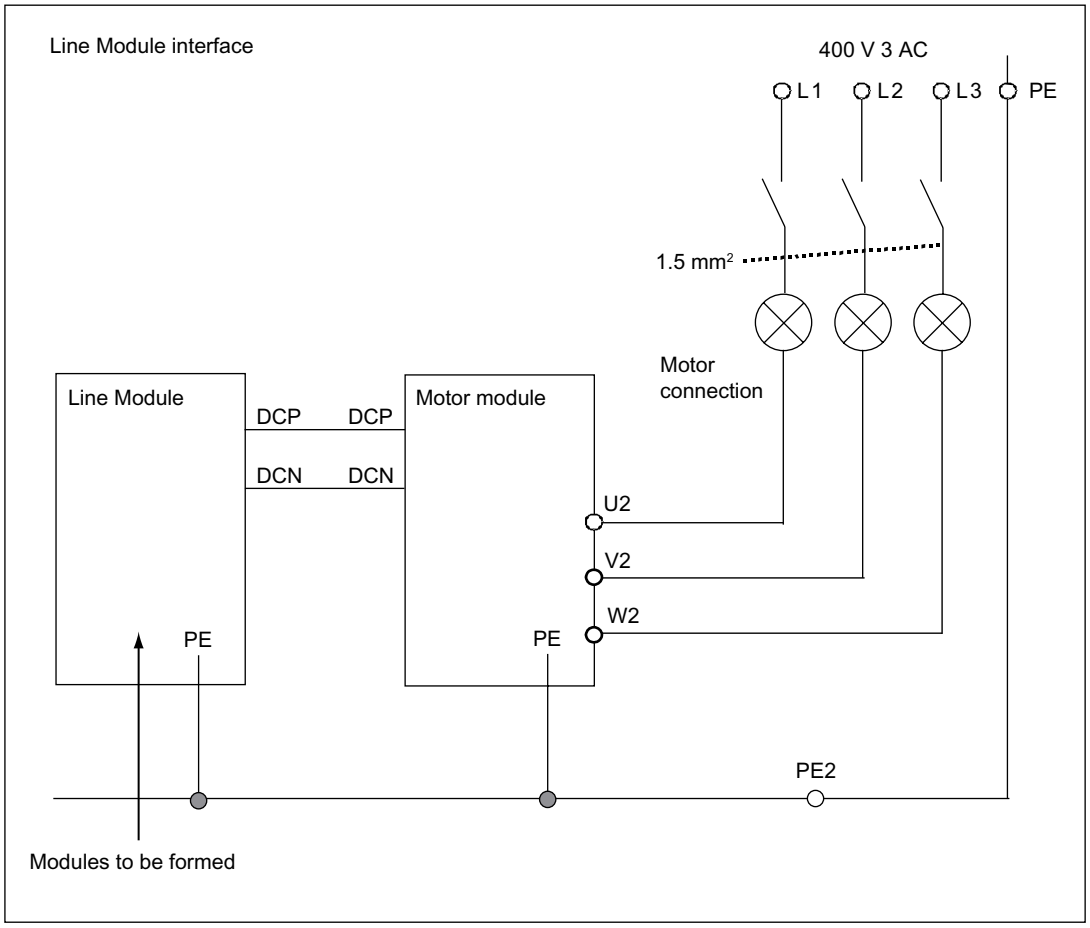


Figure 9-1 Line Module interface

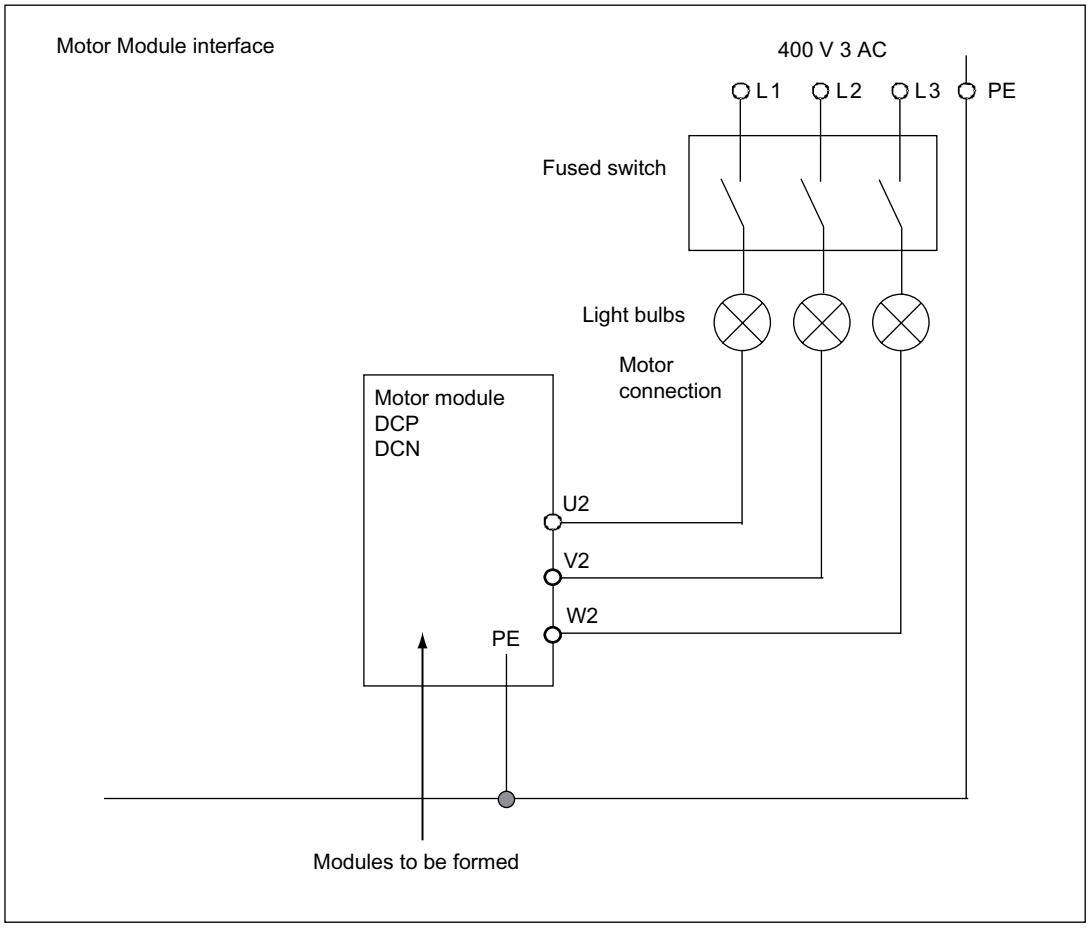


Figure 9-2 Motor Module interface

Procedure

- Before you form the DC link capacitors, the DC link bridge must be removed.
- It is not permissible that the drive unit receives a power-on command (e.g. from the keyboard, BOP20 or terminal strip).
- Connect the forming circuit.
- During the forming process, the incandescent lamps must become less bright or go completely dark. If the incandescent lamps continue to be brightly lit, a fault has occurred in the drive unit or in the wiring.

9.4 Spare parts

For a list of spare parts, see:

http://support.automation.siemens.com/WW/view/de/16612315

Appendix A

A

A.1 List of abbreviations

Note

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

Abbreviation	Meaning, German	Meaning, English
A		
A...	Warnung	Alarm
AC	Wechselstrom	Alternating Current
ADC	Analog-Digital-Konverter	Analog Digital Converter
AI	Analogeingang	Analog Input
AIM	Active Interface Module	Active Interface Module
ALM	Active Line Module	Active Line Module
AO	Analogausgang	Analog Output
AOP	Advanced Operator Panel	Advanced Operator Panel
APC	Advanced Positioning Control	Advanced Positioning Control
ASC	Ankerkurzschluss	Armature Short-Circuit
ASCII	Amerikanische Code-Norm für den Informationsaustausch	American Standard Code for Information Interchange
ASM	Asynchronmotor	Induction motor
B		
BB	Betriebsbedingung	Operating condition
BERO	Firmenname für einen Näherungsschalter	Tradename for a type of proximity switch
BI	Binektoreingang	Binector Input
BIA	Berufsgenossenschaftliches Institut für Arbeitssicherheit	German Institute for Occupational Safety
BICO	Binektor-Konnektor-Technologie	Binector Connector Technology
BLM	Basic Line Module	Basic Line Module
BOP	Basic Operator Panel	Basic Operator Panel
C		
C	Kapazität	Capacitance
C...	Safety-Meldung	Safety message

Abbreviation	Meaning, German	Meaning, English
CAN	Serielles Bussystem	Controller Area Network
CBC	Kommunikationsbaugruppe CAN	Communication Board CAN
CD	Compact Disc	Compact Disc
CDS	Befehlsdatensatz	Command Data Set
CF	CompactFlash	CompactFlash
CI	Konnektoreingang	Connector Input
CNC	Computerunterstützte numerische Steuerung	Computer Numerical Control
CO	Konnektorausgang	Connector Output
CO/BO	Konnektor-/Binektorausgang	Connector Output/Binector Output
COB-ID	CAN Object-Identification	CAN Object-Identification
COM	Mittelkontakt eines Wechselkontaktes	Common contact of a change-over relay
CP	Kommunikationsprozessor	Communications Processor
CPU	Zentrale Recheneinheit	Central Processing Unit
CRC	Checksummenprüfung	Cyclic Redundancy Check
CSM	Control Supply Module	Control Supply Module
CU	Control Unit	Control Unit
D		
DAC	Digital-Analog-Konverter	Digital Analog Converter
DC	Gleichstrom	Direct Current
DCB	Drive Control Block	Drive Control Block
DCC	Drive Control Chart	Drive Control Chart
DCN	Gleichstrom negativ	Direct Current Negative
DCP	Gleichstrom positiv	Direct Current Positive
DDS	Antriebsdatensatz	Drive Data Set
DI	Digitaleingang	Digital Input
DI/DO	Digitaleingang/-ausgang bidirektional	Bidirectional Digital Input/Output
DMC	DRIVE-CLiQ Module Cabinet (Hub)	DRIVE-CLiQ Module Cabinet (Hub)
DO	Digitalausgang	Digital Output
DO	Antriebsobjekt	Drive Object
DP	Dezentrale Peripherie	Decentralized Peripherals (Distributed I/Os)
DPRAM	Speicher mit beidseitigem Zugriff	Dual-Port Random Access Memory
DRAM	Dynamischer Speicher	Dynamic Random Access Memory
DRIVE-CLiQ	Drive Component Link with IQ	Drive Component Link with IQ
DSC	Dynamic Servo Control	Dynamic Servo Control
E		
EASC	Externer Ankerkurzschluss	External Armature Short-Circuit
EDS	Geberdatensatz	Encoder Data Set
EGB	Elektrostatisch gefährdete Baugruppen	Electrostatic Sensitive Devices (ESD)
ELP	Erdschlussüberwachung	Earth Leakage Protection
EMK	Elektromagnetische Kraft	Electromagnetic Force (EMF)
EMV	Elektromagnetische Verträglichkeit	Electromagnetic Compatibility (EMC)

Abbreviation	Meaning, German	Meaning, English
EN	Europäische Norm	European Standard
EnDat	Geber-Schnittstelle	Encoder-Data-Interface
EP	Impulsfreigabe	Enable Pulses
EPOS	Einfachpositionierer	Basic positioner
ES	Engineering System	Engineering System
ESB	Ersatzschaltbild	Equivalent circuit diagram
ESR	Erweitertes Stillsetzen und Rückziehen	Extended Stop and Retract
F		
F...	Störung	Fault
FAQ	Häufig gestellte Fragen	Frequently Asked Questions
FBL	Freie Funktionsblöcke	Free Blocks
FCC	Function Control Chart	Function Control Chart
FCC	Flussstromregelung	Flux Current Control
F-DI	Fehlersicherer Digitaleingang	Failsafe Digital Input
F-DO	Fehlersicherer Digitalausgang	Failsafe Digital Output
FEM	Fremderregter Synchronmotor	Separately excited synchronous motor
FEPROM	Schreib- und Lesespeicher nichtflüchtig	Flash-EPROM
FG	Funktionsgenerator	Function Generator
FI	Fehlerstrom-Schutzschalter	Earth Leakage Circuit-Breaker (ELCB)
FP	Funktionsplan	Function diagram
FPGA	Field Programmable Gate Array	Field Programmable Gate Array
FW	Firmware	Firmware
G		
GB	Gigabyte	Gigabyte
GC	Global-Control-Telegramm (Broadcast-Telegramm)	Global Control Telegram (Broadcast Telegram)
GSD	Gerätestammdatei: beschreibt die Merkmale eines PROFIBUS-Slaves	Device master file: Describes the features of a PROFIBUS slave
GSV	Gate Supply Voltage	Gate Supply Voltage
GUID	Globally Unique Identifier	Globally Unique Identifier
H		
HF	Hochfrequenz	High Frequency
HFD	Hochfrequenzdrossel	High frequency reactor
HLG	Hochlaufgeber	Ramp-function generator
HMI	Mensch-Maschine-Schnittstelle	Human Machine Interface
HTL	Logik mit hoher Störschwelle	High-Threshold Logic
HW	Hardware	Hardware
I		
i. V.	In Vorbereitung: diese Eigenschaft steht zur Zeit nicht zur Verfügung	In preparation: This feature is currently not available
I/O	Eingang/Ausgang	Input/Output
I2C	Serieller interner Datenbus	Inter-Integrated Circuit
IASC	Interner Ankerkurzschluss	Internal Armature Short-Circuit
IBN	Inbetriebnahme	Commissioning

Abbreviation	Meaning, German	Meaning, English
ID	Identifizierung	Identifier
IEC	Internationale Norm in der Elektrotechnik	International Electrotechnical Commission
IF	Interface	Interface
IGBT	Bipolartransistor mit isolierter Steuerelektrode	Insulated Gate Bipolar Transistor
IL	Impulslöschung	Pulse suppression
IPO	Interpolatortakt	Interpolator clock
IT	Drehstromversorgungsnetz ungeerdet	Insulated three-phase supply network
IVP	Interner Spannungsschutz	Internal Voltage Protection
J		
JOG	Tippen	Jogging
K		
KDV	Kreuzweiser Datenvergleich	Data cross-checking
KIP	Kinetische Pufferung	Kinetic buffering
Kp	Proportionalverstärkung	Proportional gain
KTY	Spezieller Temperatursensor	Special temperature sensor
L		
L	Induktivität	Inductance
LED	Leuchtdiode	Light Emitting Diode
LIN	Linearmotor	Linear motor
LR	Lageregler	Position controller
LSB	Niederstwertiges Bit	Least Significant Bit
LSS	Netzschalter	Line Side Switch
LU	Längeneinheit	Length Unit
LWL	Lichtwellenleiter	Fiber-optic cable
M		
M	Masse	Reference potential, zero potential
MB	Megabyte	Megabyte
MCC	Motion Control Chart	Motion Control Chart
MDS	Motordatensatz	Motor Data Set
MLFB	Maschinenlesbare Fabrikatebezeichnung	Machine-readable product designation
MMC	Mensch-Maschine-Kommunikation	Man-Machine Communication
MSB	Höchstwertiges Bit	Most Significant Bit
MSCY_C1	Zyklische Kommunikation zwischen Master (Klasse 1) und Slave	Master Slave Cycle Class 1
MSC	Motorstromrichter	Motor power converter
MT	Messtaster	Measuring probe
N		
N. C.	Nicht angeschlossen	Not Connected
N...	Keine Meldung oder Interne Meldung	No Report
NAMUR	Normenarbeitsgemeinschaft für Mess- und Regeltechnik in der chemischen Industrie	Standardization association for instrumentation and control in the chemical industry
NC	Öffner	Normally Closed (contact)
NC	Numerische Steuerung	Numerical Control

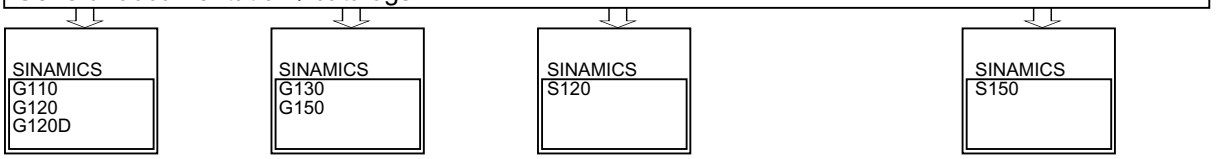
Abbreviation	Meaning, German	Meaning, English
NEMA	Normengremium in USA (United States of America)	National Electrical Manufacturers Association
NM	Nullmarke	Zero Mark
NO	Schließer	Normally Open (contact)
NSR	Netzstromrichter	Line power converter
O		
OA	Open Architecture	Open Architecture
OEM	Original Equipment Manufacturer	Original Equipment Manufacturer
OLP	Busstecker für Lichtleiter	Optical Link Plug
OMI	Option Module Interface	Option Module Interface
P		
p...	Einstellparameter	Adjustable parameter
PB	PROFIBUS	PROFIBUS
PcCtrl	Steuerungshoheit	Master Control
PD	PROFIdrive	PROFIdrive
PDS	Leistungsteildatensatz	Power Unit Data Set
PE	Schutzerde	Protective Earth
PELV	Schutzkleinspannung	Protective Extra Low Voltage
PEM	Permanenterregter Synchronmotor	Permanent-magnet synchronous motor
PG	Programmiergerät	Programming terminal
PI	Proportional Integral	Proportional Integral
PID	Proportional Integral Differential	Proportional Integral Differential
PLC	Speicherprogrammierbare Steuerung (SPS)	Programmable Logic Controller (PLC)
PLL	Phase Locked Loop	Phase Locked Loop
PNO	PROFIBUS Nutzerorganisation	PROFIBUS user organization
PPI	Punkt zu Punkt Schnittstelle	Point to Point Interface
PRBS	Weißes Rauschen	Pseudo Random Binary Signal
PROFIBUS	Serieller Datenbus	Process Field Bus
PS	Stromversorgung	Power Supply
PSA	Power Stack Adapter	Power Stack Adapter
PTC	Positiver Temperaturkoeffizient	Positive Temperature Coefficient
PTP	Punkt zu Punkt	Point-To-Point
PWM	Pulsweitenmodulation	Pulse Width Modulation
PZD	PROFIBUS Prozessdaten	PROFIBUS process data
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

Abbreviation	Meaning, German	Meaning, English
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.
RTC	Echtzeituhr	Real Time Clock
RZA	Raumzeigerapproximation	Space vector approximation (SVA)
S		
S1	Dauerbetrieb	Continuous operation
S3	Aussetzbetrieb	Periodic duty
SBC	Sichere Bremsenansteuerung	Safe Brake Control
SBH	Sicherer Betriebshalt	Safe operating stop
SBR	Sichere Bremsrampe	Safe braking ramp
SBT	Sicherer Bremsentest	Safe Brake Test
SCA	Sichere Nocke	Safe Cam
SDI	Sichere Richtung	Safe Direction
SE	Sicherer Software-Endschalter	Safe software limit switch
SG	Sicher reduzierte Geschwindigkeit	Safely reduced speed
SGA	Sicherheitsgerichteter Ausgang	Safety-related output
SGE	Sicherheitsgerichteter Eingang	Safety-related input
SH	Sicherer Halt	Safety standstill
SI	Safety Integrated	Safety Integrated
SIL	Sicherheitsintegritätsgrad	Safety Integrity Level
SLI	Sicheres Schrittmaß	Safely Limited Increment
SLM	Smart Line Module	Smart Line Module
SLP	Sicher begrenzte Position	Safely Limited Position
SLS	Sicher begrenzte Geschwindigkeit	Safely Limited Speed
SLVC	Geberlose Vektorregelung	Sensorless Vector Control
SM	Sensor Module	Sensor Module
SMC	Sensor Module Cabinet	Sensor Module Cabinet
SME	Sensor Module External	Sensor Module External
SN	Sicherer Software-Nocken	Safe software cam
SOS	Sicherer Betriebshalt	Safe Operational Stop
SPC	Sollwertkanal	Setpoint Channel
SPI	Serielle Schnittstelle für Peripherieanbindung	Serial Peripheral Interface
SPS	Speicherprogrammierbare Steuerung	Programmable Logic Controller (PLC)
SS1	Sicherer Stop 1	Safe Stop 1
SS2	Sicherer Stop 2	Safe Stop 2
SSI	Synchron Serielle Schnittstelle	Synchronous Serial Interface
SSM	Sichere Rückmeldung der Geschwindigkeitsüberwachung (n < nx)	Safe Speed Monitoring
SSR	Sichere Bremsrampe	Safe Stop Ramp
STO	Sicher abgeschaltetes Moment	Safe Torque Off
STW	PROFIBUS Steuerwort	PROFIBUS control word

Abbreviation	Meaning, German	Meaning, English
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 network
Tn	Nachstellzeit	Integral time
TPDO	Transmit Process Data Object	Transmit Process Data Object
TT	Drehstromversorgungsnetz geerdet	Grounded three-phase supply network
TTL	Transistor-Transistor-Logik	Transistor-Transistor Logic
Tv	Vorhaltezeit	Derivative-action time
U		
UL	Underwriters Laboratories Inc.	Underwriters Laboratories Inc.
USV	Unterbrechungsfreie Stromversorgung	Uninterruptible Power Supply (UPS)
V		
VC	Vektorregelung	Vector Control
Vdc	Zwischenkreisspannung	DC link voltage
VdcN	Teilzwischenkreisspannung negativ	Partial DC link voltage negative
VdcP	Teilzwischenkreisspannung positiv	Partial DC link voltage positive
VDE	Verband Deutscher Elektrotechniker	Association of German Electrical Engineers
VDI	Verein Deutscher Ingenieure	Association of German Engineers
Vpp	Volt Spitze zu Spitze	Volt peak to peak
VSM	Voltage Sensing Module	Voltage Sensing Module
W		
WEA	Wiedereinschaltautomatik	Automatic restart
WZM	Werkzeugmaschine	Machine tool
X		
XML	Erweiterbare Auszeichnungssprache (Standardsprache für Web-Publishing und Dokumentenmanagement)	Extensible Markup Language
Z		
ZK	Zwischenkreis	DC Link
ZSW	PROFIBUS Zustandswort	PROFIBUS status word

SINAMICS documentation overview (07/2007)

General documentation / catalogs



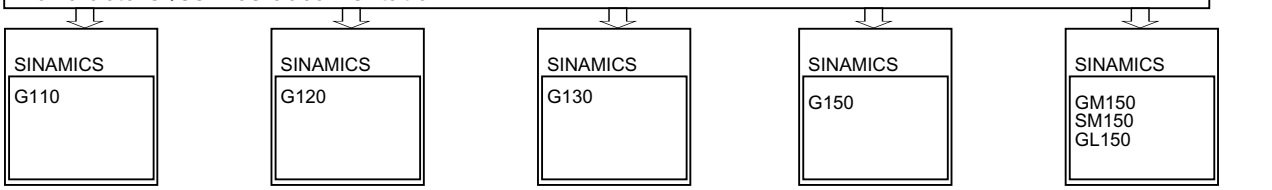
D11.1
G110/G120
Inverter chassis units
G120D
Distributed Frequency Inverters

D11
Drive Converter Chassis Units
Drive Converter Cabinet Units

D21.1
Drive Converter Chassis Units
0.12 kW to 1200 kW

D21.3
Drive Converter Cabinet Units
75 kW to 1200 kW

Manufacturer/service documentation



– Getting Started
– Operating Instructions
– List Manual

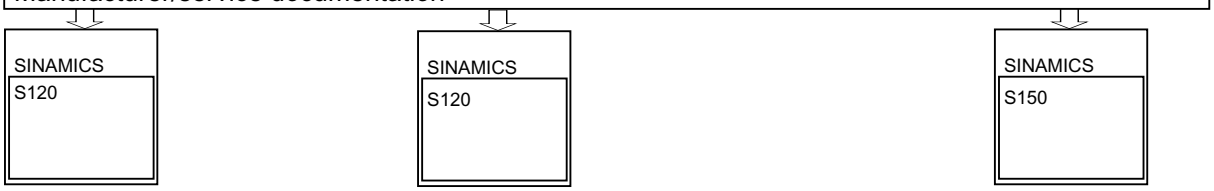
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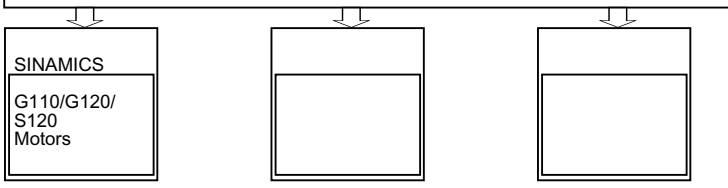


– Equipment Manual for Control Units and Additional System Components
– Equipment Manual for Booksize Power Units
– Equipment Manual for Chassis Power Units
– Equipment Manual for Booksize Cold Plate Power Units
– Equipment Manual for Cabinet Modules
– Equipment Manual for AC Drive
– Equipment Manual for Chassis Liquid-Cooled Power Units

– Getting Started
– Commissioning Manual
– Commissioning Manual CANopen
– Function Manual Drive Functions
– Function Manual Safety Integrated
– Function Manual DCC Standard Blocks
– Programming and Operating Manual DCC Editor Description
– List Manual

– Operating Instructions
– List Manual

Manufacturer/service documentation



DOCONCD

Configuration Manuals
Motors

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Installation guidelines

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Suggestions and/or corrections

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