Equipment Manual 03/2006 Edition

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SINAMICS S120
Booksize Power Units

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SINAMICS S120
Equipment Manual for Booksize Power Units

Equipment Manual

(GH2), 03.2006 Edition

6SL3097-2AC00-0BP3

Safety Guidelines

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

Danger

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

Warning

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

Caution

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

Caution

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

Notice

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

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

Qualified Personnel

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

Prescribed Usage

Note the following:

Warning

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

Trademarks

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

Disclaimer of Liability

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

Siemens AG
Automation and Drives
Postfach 48 48
90437 NÜRNBERG
GERMANY

Order No.: 6SL3097-2AC00-0BP3
03/2006 Edition

Preface

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 at:

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"

Utilization phases

Table 1 Usage phase and the available documents/tools

Usage Phase	Tools
Exploratory	SINAMICS S Sales Documentation
Planning/Configuration	SIZER Configuration Tool
Decision/Ordering	SINAMICS S Catalogs
Installation/Assembly	• SINAMICS S120 Equipment Manual for Control Units and Additional System Components • SINAMICS S120 Equipment Manual Power Modules Booksize • SINAMICS S120 Equipment Manual Power Modules Chassis • SINAMICS S150 Operating Manual
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 Manual
Usage/Operation	• SINAMICS S120 Commissioning Manual • SINAMICS S List Manual • SINAMICS S150 Operating Manual

Usage Phase	Tools
Maintenance/Servicing	• SINAMICS S120 Commissioning Manual • SINAMICS S List Manual • SINAMICS S150 Operating Manual

Target group

This manual addresses planners, installation and 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 correctly and without danger.

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

European and African time zones

A&D Technical Support

Tel.: +49 (0) 180 / 5050 - 222

Fax: +49 (0) 180 / 5050 - 223

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

E-mail: mailto:adsupport@siemens.com

Asian and Australian time zones

A&D Technical Support

Tel.: +86 1064 719 990

Fax: +86 1064 747 474

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

E-mail: mailto:adsupport@siemens.com

American time zone

A&D Technical Support

Tel.: +1 423 262 2522

Fax: +1 423 262 2289

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

E-mail: mailto:adsupport@siemens.com

Questions about the Manual

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

Fax: +49 (0) 9131 / 98 - 63315

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

Fax form: Refer to the reply form at the end of this manual

Internet address for SINAMICS

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

EC declaration of conformity

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

- in the Internet:
  http://www.ad.siemens.de/csinfo
  under the Product/Order No. 15257461
- the relevant branch office of the A&D MC group of Siemens AG.

ESD Notices

⚠ **Caution**

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

Regulations for handling ESD components:

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

Personnel may only come into contact with the electronic components, if

- they are grounded with an ESD wrist band, or
- these persons in ESD zones with conductive flooring are either wearing ESD shoes or ESD shoe grounding strips.

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

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

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

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

Dangerous mechanical movements may occur in the system during operation.

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

Danger

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

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

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

Only protective extra-low voltages (PELVs) that comply with EN 61800-5-1 and UL 508 must be connected to all connections and terminals up to 30 V AC or 42.4 V DC.

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 industrial machines to EN 60204-1, Section 19.4, all connectors of SINAMICS equipment must be disconnected/unplugged to prevent the equipment from being damaged.

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

Note

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

Note

SINAMICS equipment fulfills the EMC Directive 89/336/EEC when in the configuration specified in the associated EC Declaration of Conformance regarding EMC and when the EMC Mounting Directive is carefully observed, Order No. 6FC 5297-□AD30-0BP□.

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.

Table of contents

1 System overview

1.1 Field of application

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

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

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

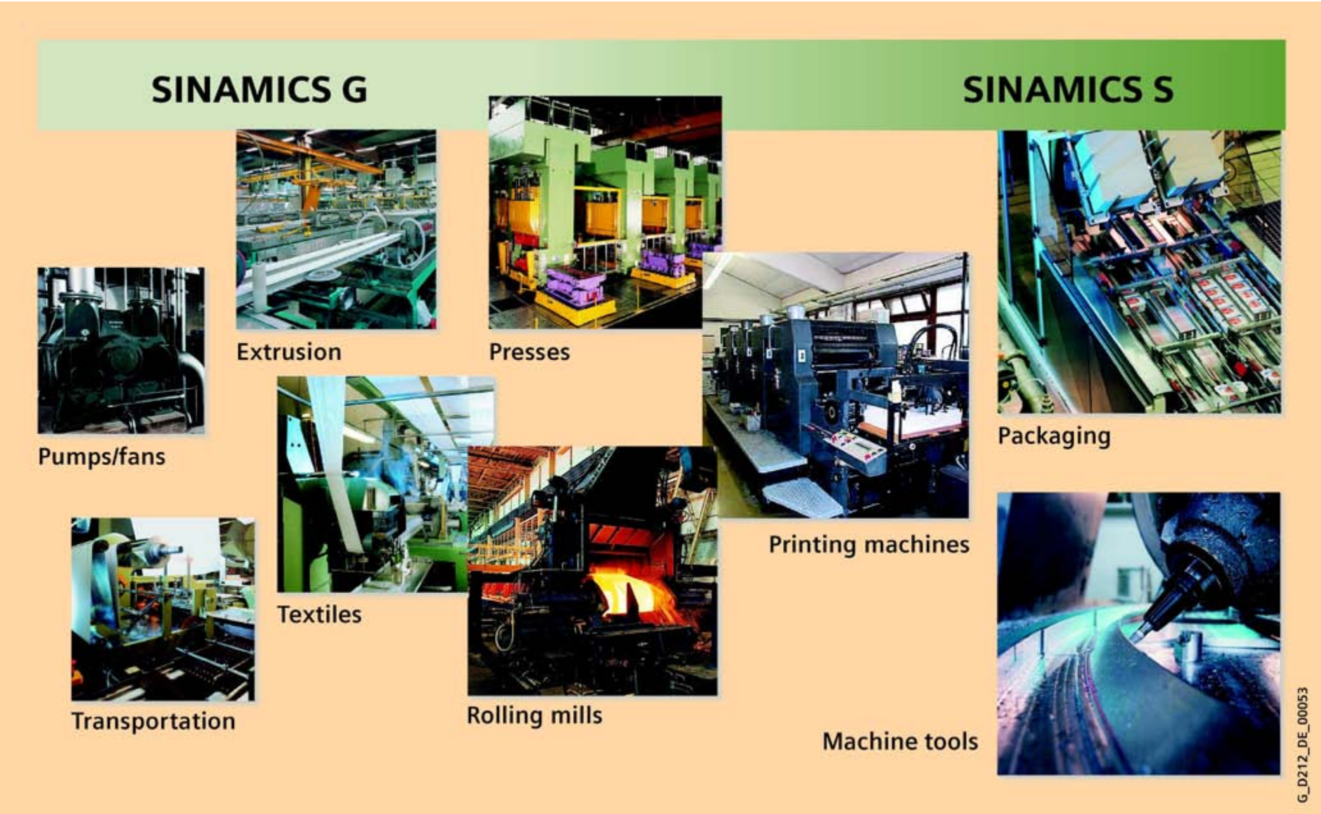


Figure 1-1 SINAMICS applications

1.2 Product variants

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

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

1.3 Platform Concept and Totally Integrated Automation

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

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

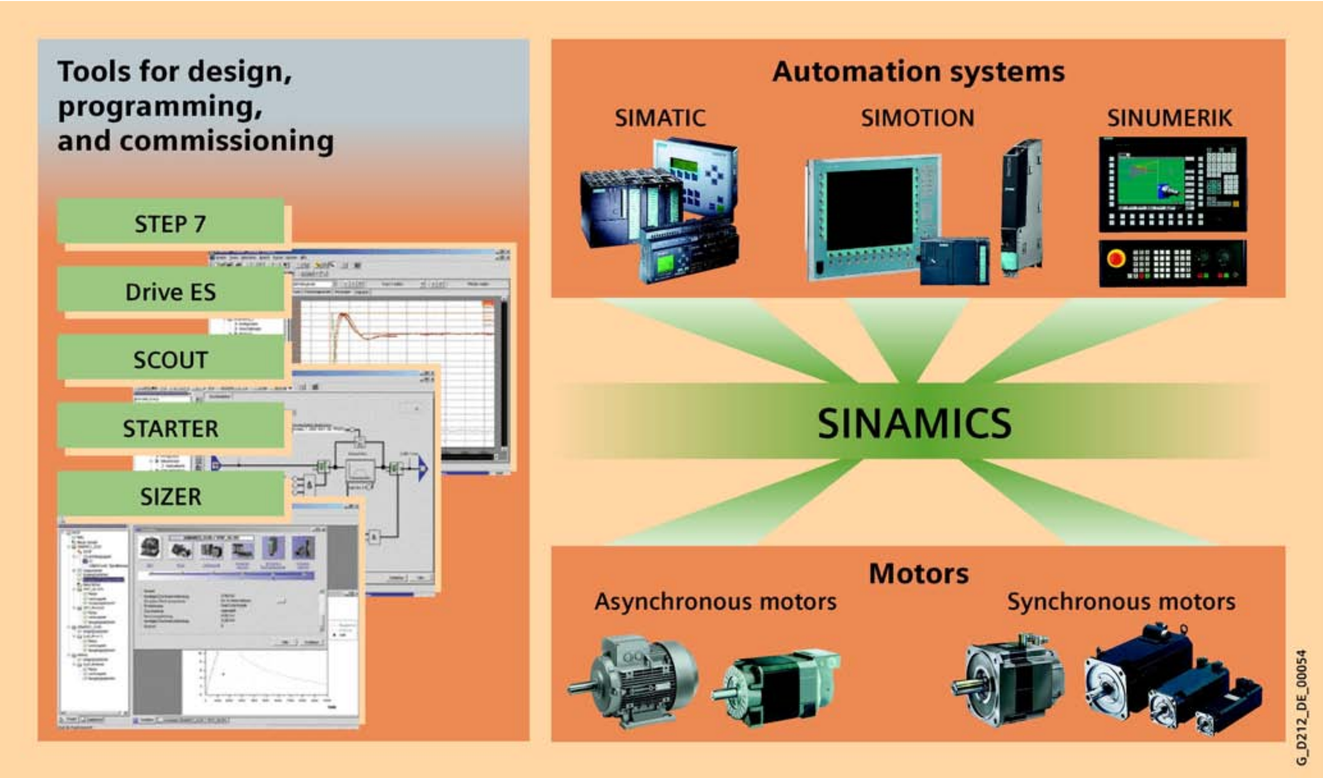


Figure 1-2 SINAMICS as part of the Siemens modular automation system

1.4 Introduction

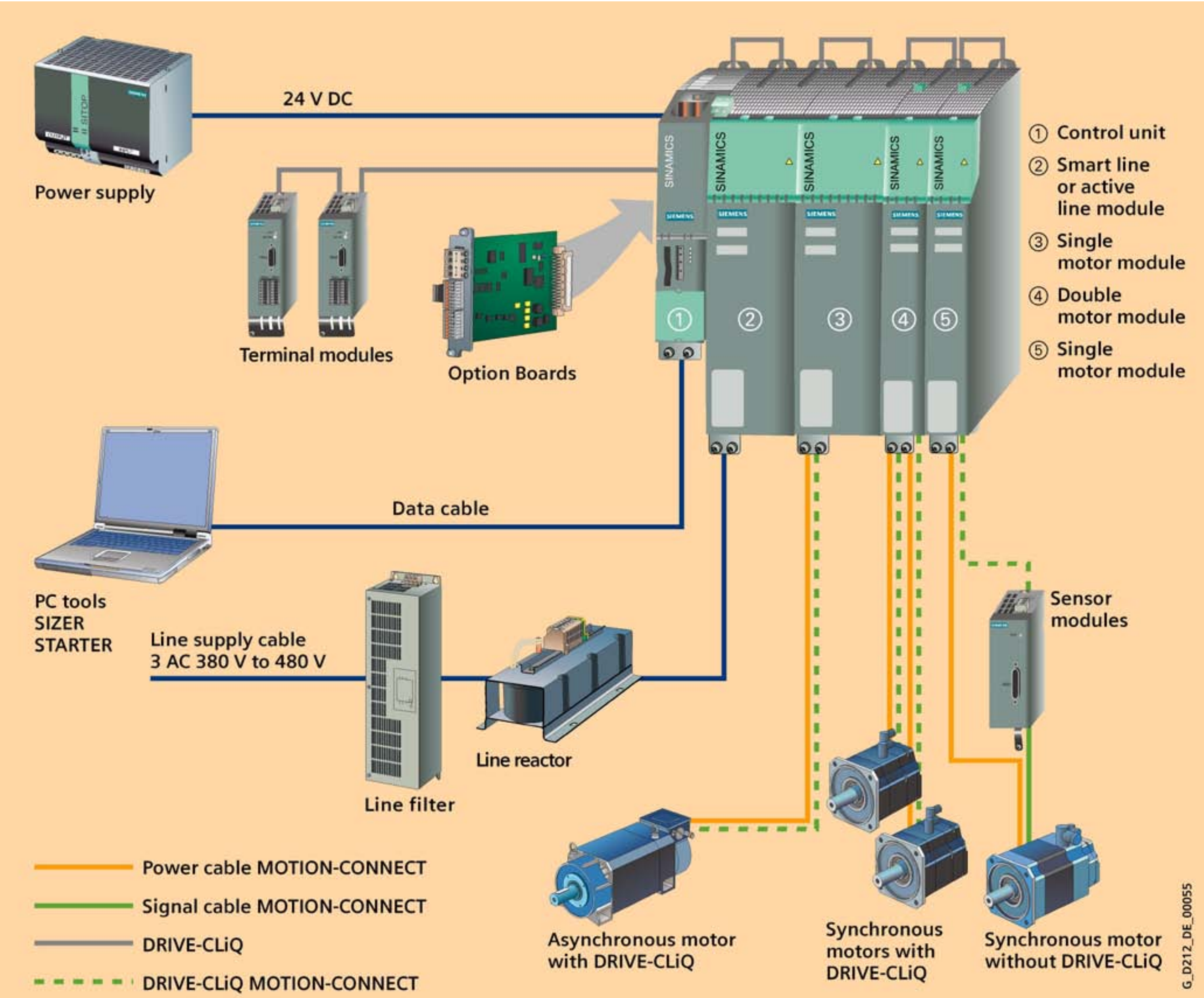


Figure 1-3 SINAMICS S120 system overview

Modular system for 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.

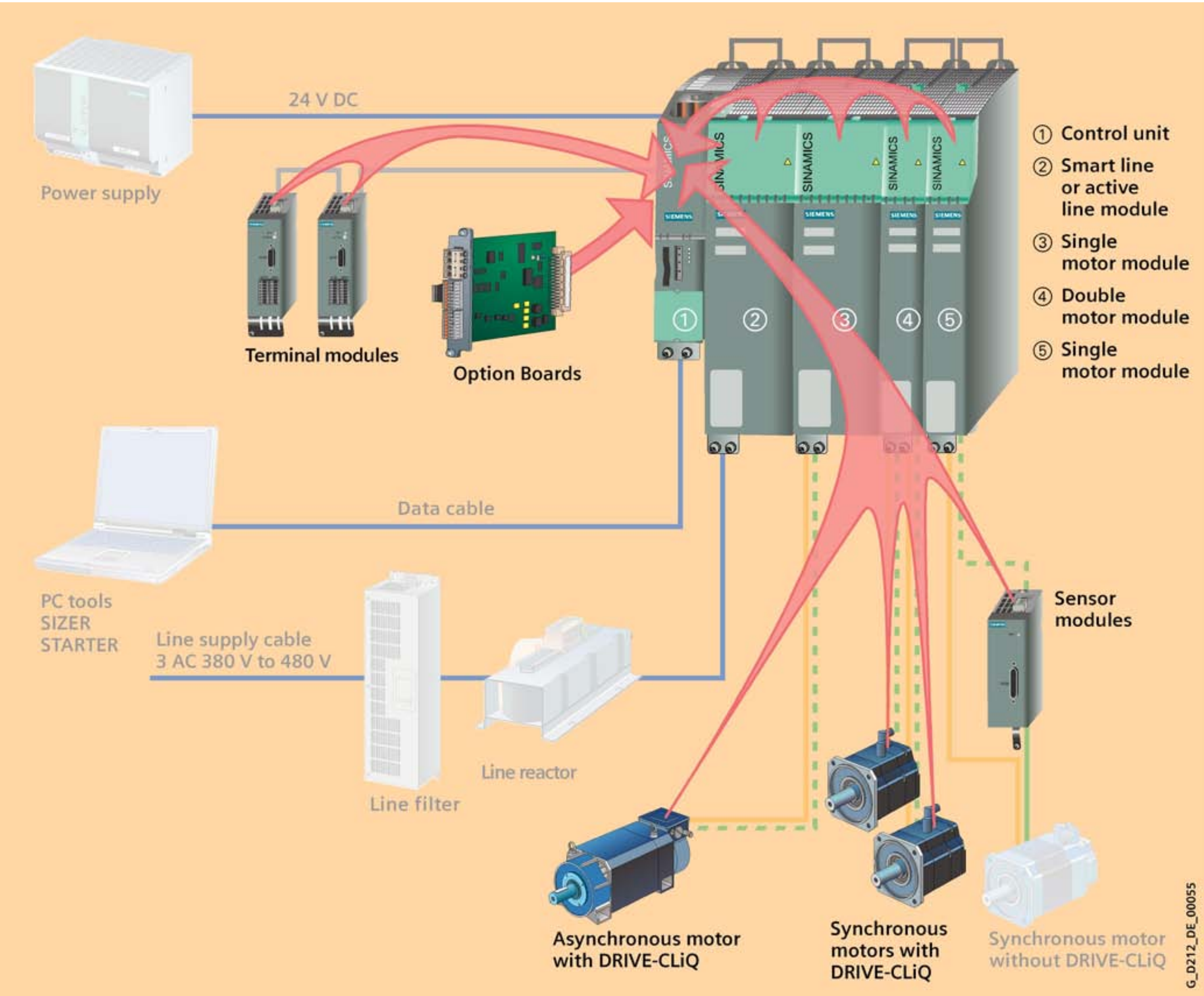


Figure 1-4 The electronic type plate for SINAMICS S120

1.5 SINAMICS S120 Components

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

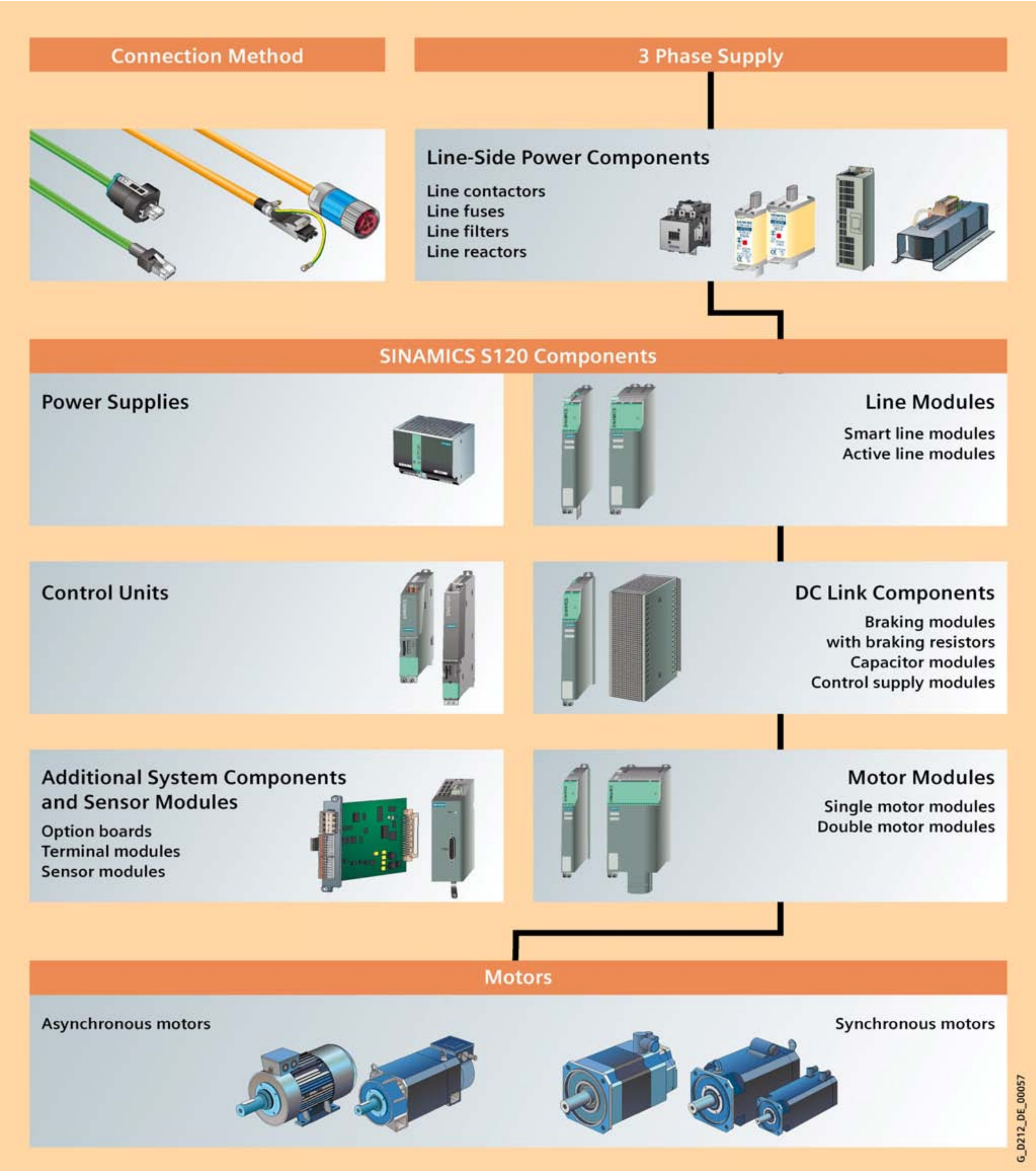


Figure 1-5 SINAMICS S120 component overview

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

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

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

1.6 Power Sections

Line modules

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

- Smart line modules

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

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

Motor modules

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

1.7 System Data

Technical Specifications

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

Electrical specifications	
Line connection voltage	3-ph. 380 V to 480 V AC ±10 % (-15 % < 1 min)
Line frequency	47 – 63 Hz
Electronics power supply	24 V DC, -15/+20 %*
Cable-borne radio interference voltage • Standard • with line filter • without line filter	 no cable-borne radio interference Class A1 acc. to EN 55011 or Category C2 acc. to EN 61800-3 Limit value classes are not complied with
Overvoltage category	III acc. to EN 60 664-1

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

Modules	
Line Modules in booksize format • Rated supply voltage	 3AC 380 V
Active Line Modules in booksize format • Rated pulse frequency	 8 kHz
Motor Modules in booksize format • DC link connection voltage • Rated pulse frequency	 510 V DC to 750 V DC 4 kHz

Ambient conditions	
The Safety-Integrated safety function: The components must be protected against conducted contamination (e.g. by installing them in a cabinet with degree of protection IP54B acc. to EN 60529). Provided that conducted interference can be prevented at the installation site, the degree of protection for the cabinet can be decreased accordingly.	
Degree of protection	IP20B acc. to EN 60529
Protection class	I (with protective conductor connection) and III (PELV) acc. to EN 61 800-5-1
Permissible ambient and coolant temperature (air) during operation for line-side components, Line Modules and Motor Modules	0 °C to 40 °C without derating, >40 °C to +55 °C (see derating characteristics)
Permissible air intake temperature (temperature in the cabinet) in operation for DC link components	0 °C to +55 °C

Information and instructions for long-term storage in the transport packaging, transport in the transport packaging and operation:	
Environmental class • Long-term storage in the transport packaging • Transport in transport packaging • Operation	Class 1C2 acc. to EN 60 721-3-1 Class 2C2 acc. to EN 60 721-3-2 Class 3C2 acc. to EN 60 721-3-3, in the transport packaging
Organic/biological effects (in the transport packaging) • Long-term storage in the transport packaging • Transport in the transport packaging • Operation	Class 1B1 to EN 60 721-3-1 Class 2B1 to EN 60 721-3-2 Class 3B1 to EN 60 721-3-3
Vibratory load • Long-term storage in the transport packaging • Transport in the transport packaging • Operation	Class 1M2 acc. to EN 60 721-3-1 Class 2M3 acc. to EN 60 721-3-2 Test values: Frequency range 10 ... 58 Hz With constant deflection = 0.075 mm Frequency range above 58 ... 150 Hz With constant acceleration = 9.81 m/s^2 (1 g)
Shock load • Long-term storage in the transport packaging • Transport in the transport packaging • Operation	EN 60 721-3-1 Class 2M2 acc. to EN 60 721-3-2 Test values: 147.15 m/s^2 (15 g) / 11 ms
Climatic ambient conditions • Long-term storage in the transport packaging • Transport in the transport packaging • Operation	Class 1K3 to EN 60 721-3-1 Temperature: -40 °C to +70 °C Class 2K4 acc. to EN 60 721-3-2 Temperature -40 °C to +70 °C Max. humidity 95 % at 40 °C Class 3K3 acc. to EN 60 721-3-3 Moisture condensation, water spray and the formation of ice are not permissible (EN 60 204, Part 1)
Degree of contamination	2 to EN 60 664-1
Installation altitude	Up to 1,000 m above sea level without derating, >1,000 m to 5,000 m above sea level (see derating characteristics)

Approbation	
Certification	CE (low-voltage and EMC Directives), cULus

1.8 Standards

Table 1-1 Essentially, standards relevant to the particular application

Standards	Title
EN 292-1	Safety of machines; general design guidelines; Part 1: General terminology, methodology:
EN 292-2	Safety of machines; general design guidelines; Part 2: Technical principles and specifications
EN 563	Safety of machines; temperature of surfaces that can be touched; ergonomic data to define the temperature limit values for hot surfaces
EN 755-9	Aluminum and aluminum alloys - extrusion-pressed bars, pipes and profiles - profiles, limiting dimensions and form tolerances
EN 954-1	Safety of machines - safety-related parts of control systems; Part 1: General principles for design
EN 1037	Safety of machines; avoiding unexpected starting
EN 55011	Industrial, scientific and medical high-frequency devices (ISM devices) - radio interference - limit values and measuring techniques
EN 60146-1-1	Power semiconductor converters; general requirements and line-commuted converters; Part 1-1: Defining the basic requirements
EN 60204-1	Electrical equipment of machines; Part 1: General definitions
IEC 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 - calculating the rated currents Part 1: Rated current 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 electrical equipment in low-voltage systems Part 1: Basics, requirements and tests Part 3: Use of coatings or encapsulation to protect against the accumulation of dirt
EN 60721-3-X	Classification of environmental conditions Part 3-0: Classes of environmental influencing quantities and their limit values; introduction Part 3-1: Classes of environmental influencing quantities and their limit values; long-time storage Part 3-2: Classes of environmental influencing quantities and their limit values; transport Part 3-3: Classes of environmental influencing quantities and their limit values; stationary use, weather-protected
EN 61000-6-X	Electromagnetic compatibility (EMC) Part 6-1: Generic standard; noise immunity for residential areas, business and trades areas as well as small facilities Part 6-2: Generic standards; noise immunity for industrial areas Part 6-3: Generic standards; generic standard noise emission for residential areas, business and trades areas as well as small facilities Part 6-4: Generic standards; generic standard noise emission for industrial areas
EN 61140	Protection against electric shock; common requirements for systems and equipment
EN 61158	Digital data communications in the process technology - fieldbus for industrial control systems

Standards	Title
EN 61800-2	Variable-speed electric drives; Part 2: General requirements - definitions for dimensioning low-voltage AC drive systems with an adjustable frequency
EN 61800-3	Variable-speed electric drives; Part 3: EMC requirements including special test procedures
EN 61800-5-X	Electrical power drive systems with an adjustable speed; Part 5: Requirements on the safety; Main section 1: Electrical, thermal and energy-related requirements Main section 2: Functional safety requirements
VDE 0100 Part X (IEC 60364-X-X)	Erecting electric power equipment with rated voltages up to 1000 V; Part 200: Terminology Part 410: Protective measures, protection against electric shock Part 420: Protective measures, protection against thermal effects Part 430: Protection of cables and conductors against over-current Part 470: Protective measures; use of protective measures Part 450: Protective measures, protection against undervoltage Part 5xx: Selecting and installing electrical equipment Part 520: Cables, conductors, busbars Part 540: Grounding, protective conductors, potential bonding conductor Part 560: Electrical equipment for safety purposes
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
  - Wideband Line Filter for Active Line Modules
  - Line filters for Smart Line Modules
- Line reactor variants:
  - Line reactors for Active Line Modules
  - Line reactors for Smart Line Modules

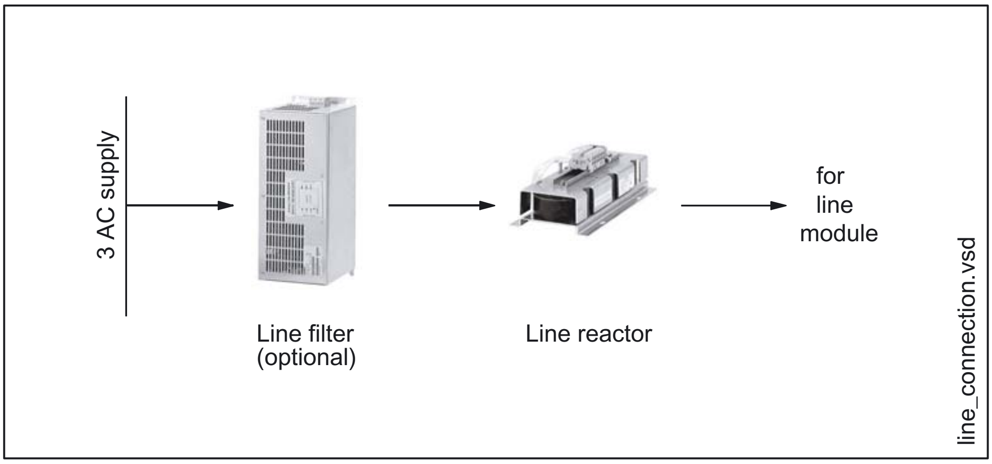


Figure 2-1 Overview diagram: line connection

Note

The limit values for the radio interference voltage are only observed when the line filter is used (class A1 to EN 55011 or Category C2 acc. to EN 61800-3).

Caution

The following can occur if line filters are used that have not been approved for SINAMICS by SIEMENS:

- The Line Modules may become damaged/faulty.

- Line reactions can occur that can damage or interfere with other loads powered from the same network.

2.2 Overview: line filters

In conjunction with a line reactor and an EMC-compliant plant configuration, line filters limit the electromagnetic emissions from the Power Modules to the limit values of Class A1 acc. to EN 55011 or Category C2 acc. to EN 61800-3.

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

There are two different line filter versions when using Active Line Modules.

Basic Line Filter for Active Line Modules

Basic Line Filters are mainly effective in the frequency range from 150 kHz to 30 MHz, which is the important range to be compliant with the Standard. They have been designed with use with systems and equipment with a maximum total cable length of 150 m (shielded).

Wideband Line Filter for Active Line Modules

Wideband Line Filters can, beyond this, also effectively limit the low-frequency harmonics from 2 kHz and above that are fed back into the line supply; this protects additional loads connected to the same line supply against disturbances and damage. The maximum total cable length is 350 m (shielded).

Line filters for Smart Line Modules

The line filters for Smart Line Modules are specified for total lengths of up to 350 m (shielded).

Table 2-1 Overview

	Order No.
Basic Line Filter for Active Line Modules	
16 kW	6SL3000-0BE21-6DAx
36 kW	6SL3000-0BE23-6DAx
55 kW	6SL3000-0BE25-5DA0
Wideband Line Filter for Active Line Modules	
16 kW	3SL3000-0BE21-6AAx
36 kW	3SL3000-0BE23-6AAx
55 kW	3SL3000-0BE25-5AAx
80 kW	3SL3000-0BE28-0AAx
120 kW	3SL3000-0BE31-2AAx
Line filters for Smart Line Modules	
5 kW	6SL3000-0HE15-0AAx
10 kW	6SL3000-0HE21-0AAx
16 kW	6SL3000-0BE21-6DAx
36 kW	6SL3000-0BE23-6DAx

2.3 Basic Line Filter for Active Line Modules

2.3.1 Description

The Basic Line Filters for Active Line Modules have the task of damping the conducted noise that is emitted in the frequency range according to that specified in the EMC legislation. The machinery construction OEM must carry-out a certification for the machines that he wishes to market according to the EC Directive EMC.

General conditions regarding Basic Line Filters 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 conducted interference:

- The machine/system must only be used in industrial line supplies.
- Number of axes ≤12.
- Total cable lengths ≤150 m (motor cables, power supply cable between line filter and Line Module).

2.3.2 Safety information

Caution

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

Danger

The 100 mm clearances above and below the components must be observed. This measure prevents thermal overloading of the filter.

Caution

The terminals must be correctly connected:

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

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

Non-observance may damage the line filter.

Notice

Only the associated line reactor for the particular line module may be connected to the SINAMICS line filter. Additional loads must be connected in front of the SINAMICS line filter (if required using a separate line filter). If this is not carefully observed, then the other loads could either be disturbed or damaged.

Caution

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

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

Danger

Risk of electric shock. Dangerous voltages are still present up to 5 minutes after the supply has been disconnected!

Note

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

Caution

Only the line filters described in this Equipment Manual may be used. If this is not observed, line harmonics can occur that disturb/damage other loads connected to the line supply.

2.3.3 Interface Description

2.3.3.1 Overview

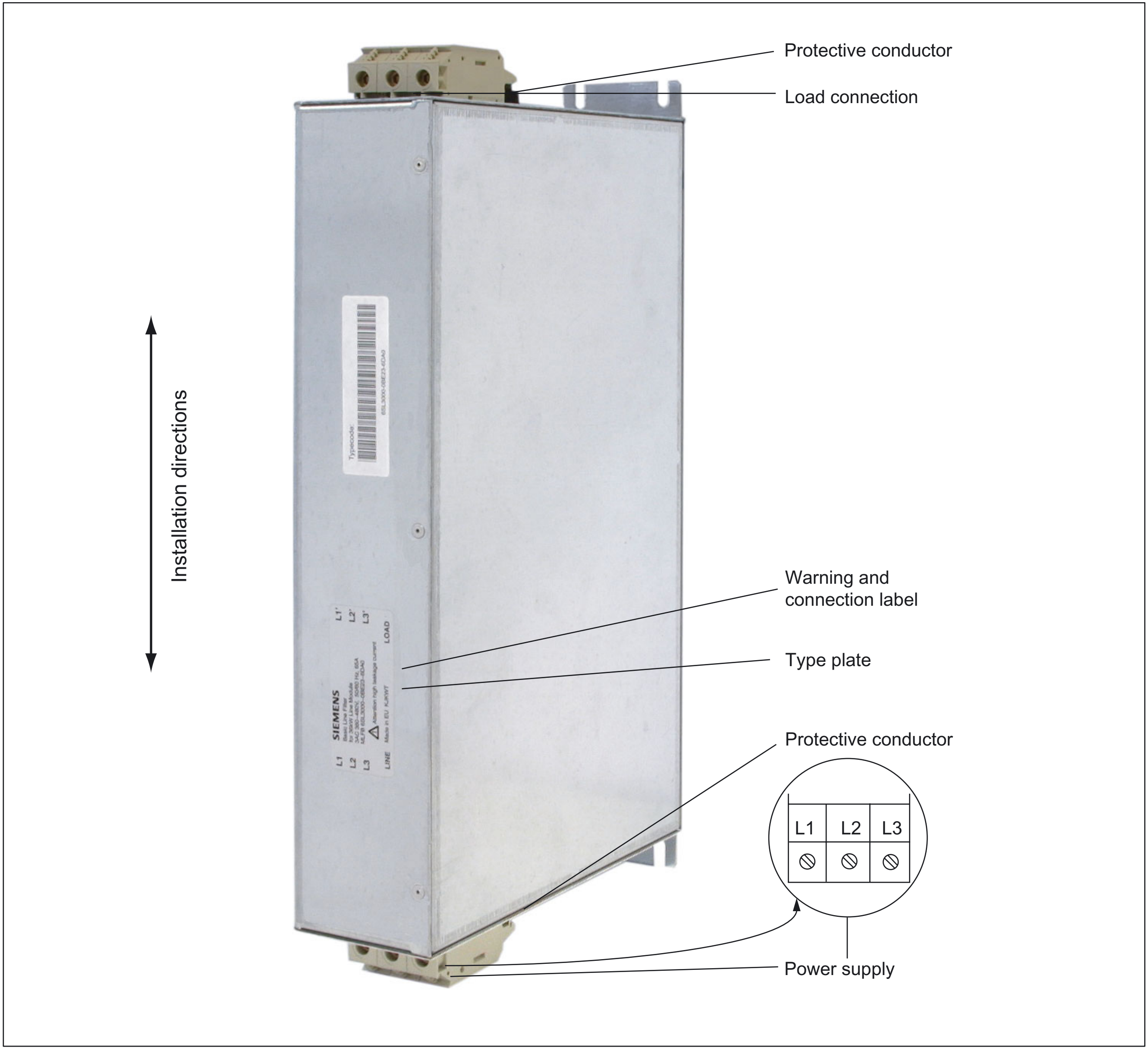


Figure 2-2 Basic Line Filter for Active Line Modules (example: 36 kW)

2.3.3.2 Line/load connection

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 mm² 3-pin/1.5 Nm (see Screw Terminals) PE connection: M6/3 Nm1)
36 kW	Screw terminal: 35 mm² PE connection: M6/3 Nm1)
55 kW	Screw terminal: 50 mm² PE connection: M6/3 Nm1)
1) for ring cable lugs to DIN 46234	

2.3.4 Dimension Drawing

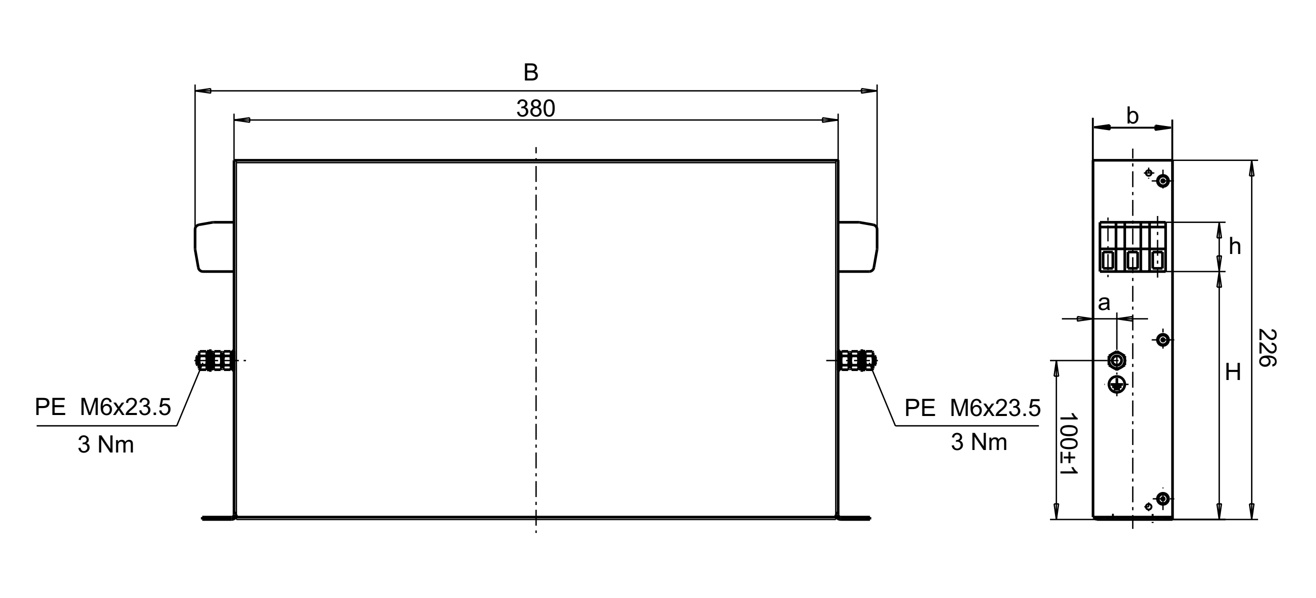


Figure 2-3 Dimension drawing: Basic Line Filter for Active Line Modules (16 kW to 55 kW)

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

Basic Line Filter	Order number	B [mm] (inches)	b [mm] (inches)	a [mm] (inches)	H [mm] (inches)	h [mm] (inches)
16 kW	6SL3000-0BE21-6DAx	429 (16.88)	50 (1.96)	15 (0.59)	156 (6.14)	31 (1.22)
36 kW	6SL3000-0BE23-6DAx	433 (17.07)	75 (2.95)	15 (0.59)	135 (5.31)	68 (2.67)
55 kW	6SL3000-0BE25-5DA0	466 (18.34)	100 (3.93)	15 (0.59)	148 (5.82)	54 (2.12)

2.3.5 Technical Specifications

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

	6SL3000 unit	0BE21-6DA0	0BE23-6DA0	0BE25-5DA0
Rated power	kW	16	36	55
Connection voltage: Supply voltage Line frequency	 V_{AC} Hz	 3-ph. 380 V AC -10% (-15% < 1 min) up to 3-ph. 480 V AC +10% 47 to 63 Hz		
Rated current	A_{AC}	36	65	105
Power loss[1]	W	16	28	41
Weight	kg	5	6.5	11.5

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

2.4 Wideband Line Filter for Active Line Modules

2.4.1 Description

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

With these line filters, the limit values in accordance with Class A1 acc. to EN 55011 or Category C2 acc. to EN 61800-3 for equipment, Group 1, are complied with.

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

2.4.2 Safety information

Caution

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

Danger

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

Caution

The terminals must be correctly connected:

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

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

Non-observance may damage the line filter.

Notice

The associated line module may only be connected to the SINAMICS line filter via the associated line reactor. Additional loads must be connected in front of the SINAMICS line filter (if required, via a separate line filter). If this is not observed, other loads could be damaged or disturbed.

Caution

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

Measures according to EN 61800-5-1 must be taken (e.g. PE conductor ($\geq$10mm² Cu) or fit an additional connection terminal for a PE conductor with the same cross-section as the original PE conductor).

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

Caution

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

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.

2.4.3 Interface description

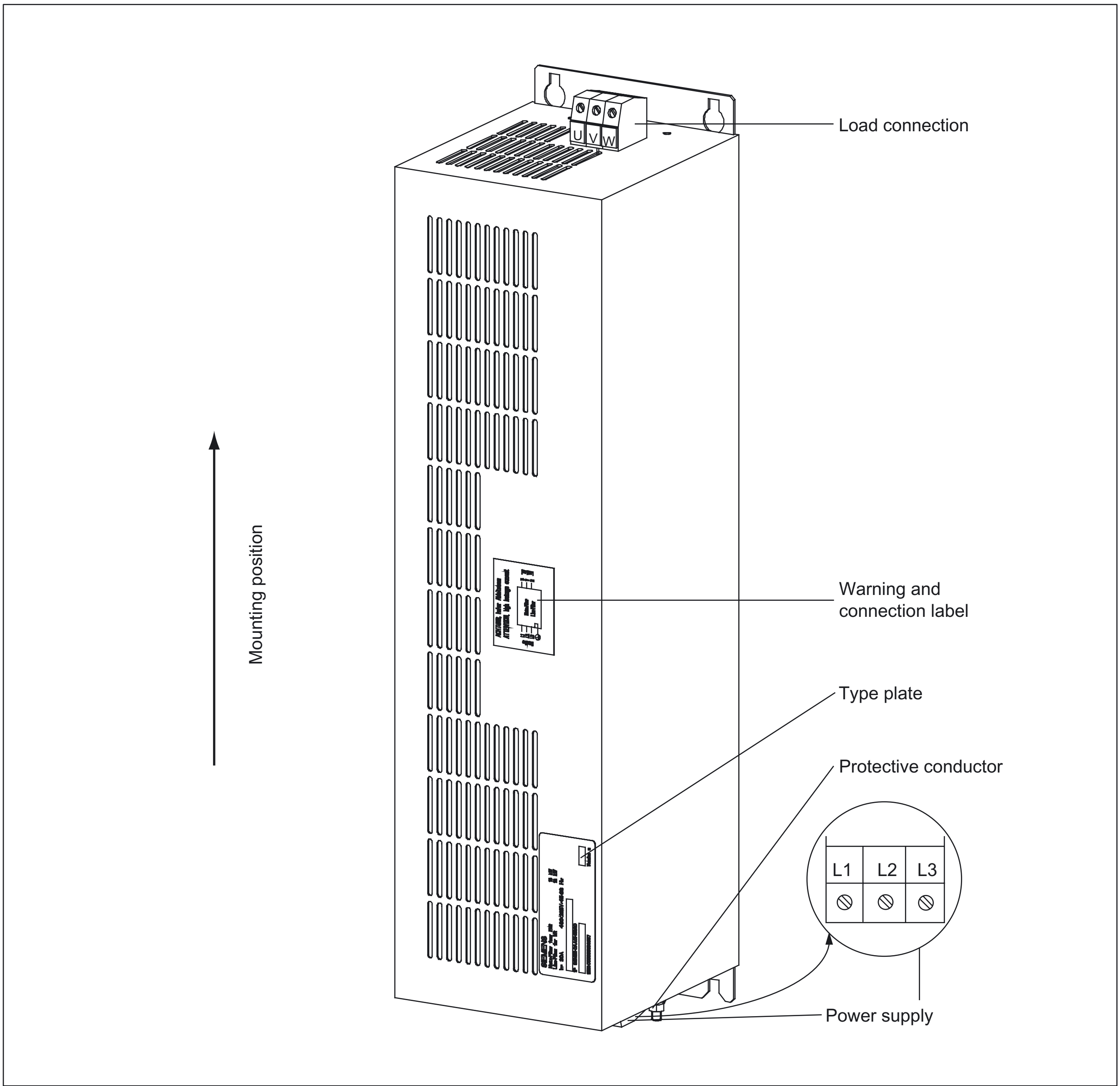


Figure 2-4 Wideband Line Filters for Active Line Module (example: 16kW)

2.4.3.1 Line/load connection

Wideband Line Filters for Active Line Modules are designed for a voltage range from 3-ph. 380 V AC -10% (-15% <1 min) up to 3-ph. 480 V AC +10% at 47 Hz to 63 Hz.

Table 2-5 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 Nm (see Screw Terminals) Ground stud: M5/3 Nm [1)]
36 and 55 kW	Screw terminal: 50 mm^2 3–pin/6 Nm (see Screw Terminals) Ground stud: M8/13 Nm [1)]
80 kW	Screw terminal: 95 mm^2 3–pin/15 Nm (see Screw Terminals) Ground stud: M8/13 Nm [1)]
120 kW	Connection strap: d = 11 mm (M10/25 Nm) Ground stud: M8/13 Nm [1)] **Note: No shock-hazard protection (IP00B acc. to 60529)**
1) for ring cable lugs to DIN 46234	

2.4.4 Dimension Drawing

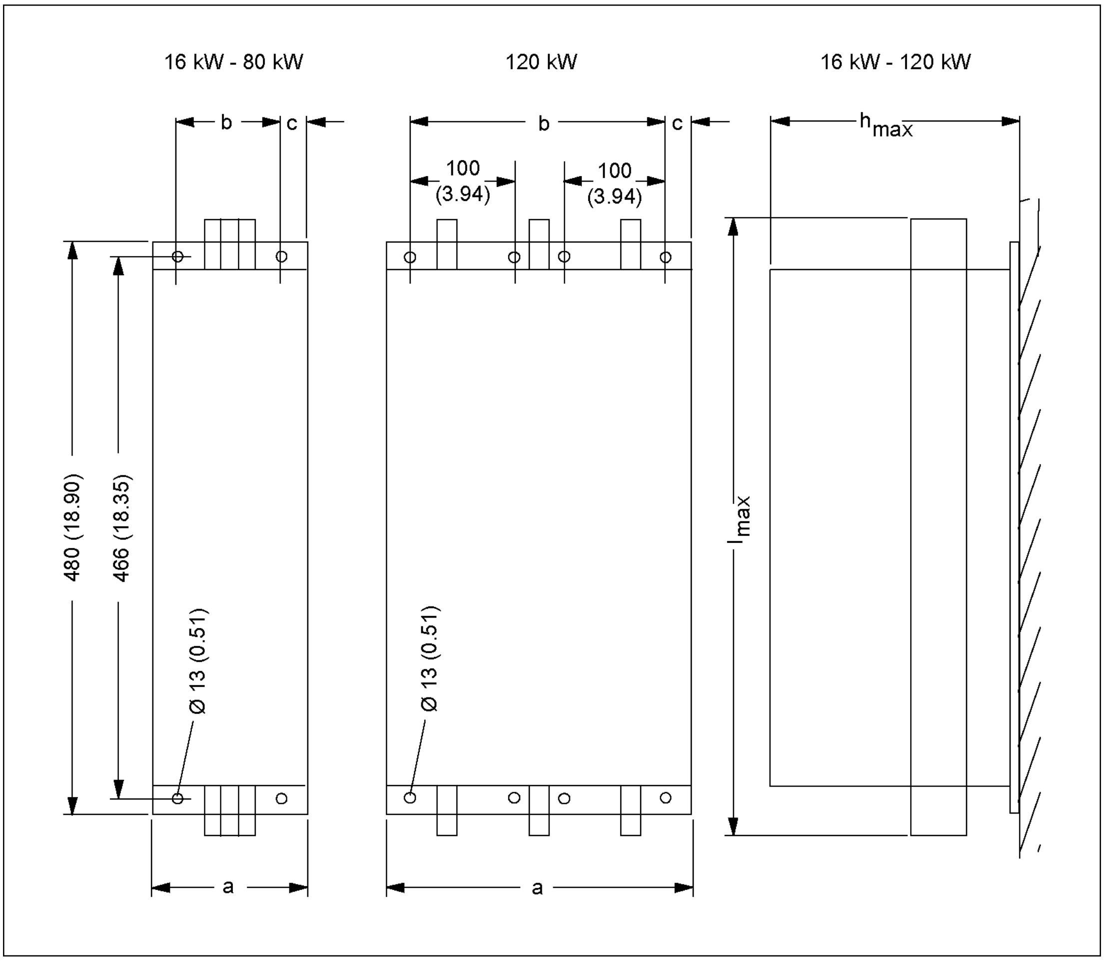


Figure 2-5 Dimension drawing: Wideband Line Filter for Active Line Modules

Table 2-6 Dimensions: Wideband Line Filter

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

2.4.5 Technical Specifications

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

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

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

2.5 Line filters for Smart Line Modules

2.5.1 Description

Line filters for Smart Line Modules, in conjunction with the associated line reactors, limit the cable-conducted noise emission to a level in conformance with E55011, Class A1.

General conditions regarding line filters for Smart Line Modules

- In conjunction with the line filters and the associated line reactors, drive line-ups with Basic Line Modules fulfill the requirements of limit value class A1 acc. to EN 55011 or Category C2 acc. to EN 61800-3.
- The total cable length is ≤ 150 m.

2.5.2 Safety information

Caution

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

Danger

The 100 mm clearances above and below the components must be observed. This measure prevents thermal overloading of the filter.

Caution

The terminals must be correctly connected:

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

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

Non-observance may damage the line filter.

Notice

Only the associated line reactor for the particular line module may be connected to the SINAMICS line filter. Additional loads must be connected in front of the SINAMICS line filter (if required using a separate line filter). If this is not carefully observed, then the other loads could either be disturbed or damaged.

Caution

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

Measures according to EN 61800-5-1 must be taken (e.g. PE conductor ($\geq$10mm² Cu) or fit an additional connection terminal for a PE conductor with the same cross-section as the original PE conductor).

Danger

Risk of electric shock. Dangerous voltages are still present up to 5 minutes after the supply has been disconnected!

Note

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

Caution

Only the line filters described in this Equipment Manual may be used. If this is not observed, line harmonics can occur that disturb/damage other loads connected to the line supply.

2.5.3 Interface description

2.5.3.1 Overview

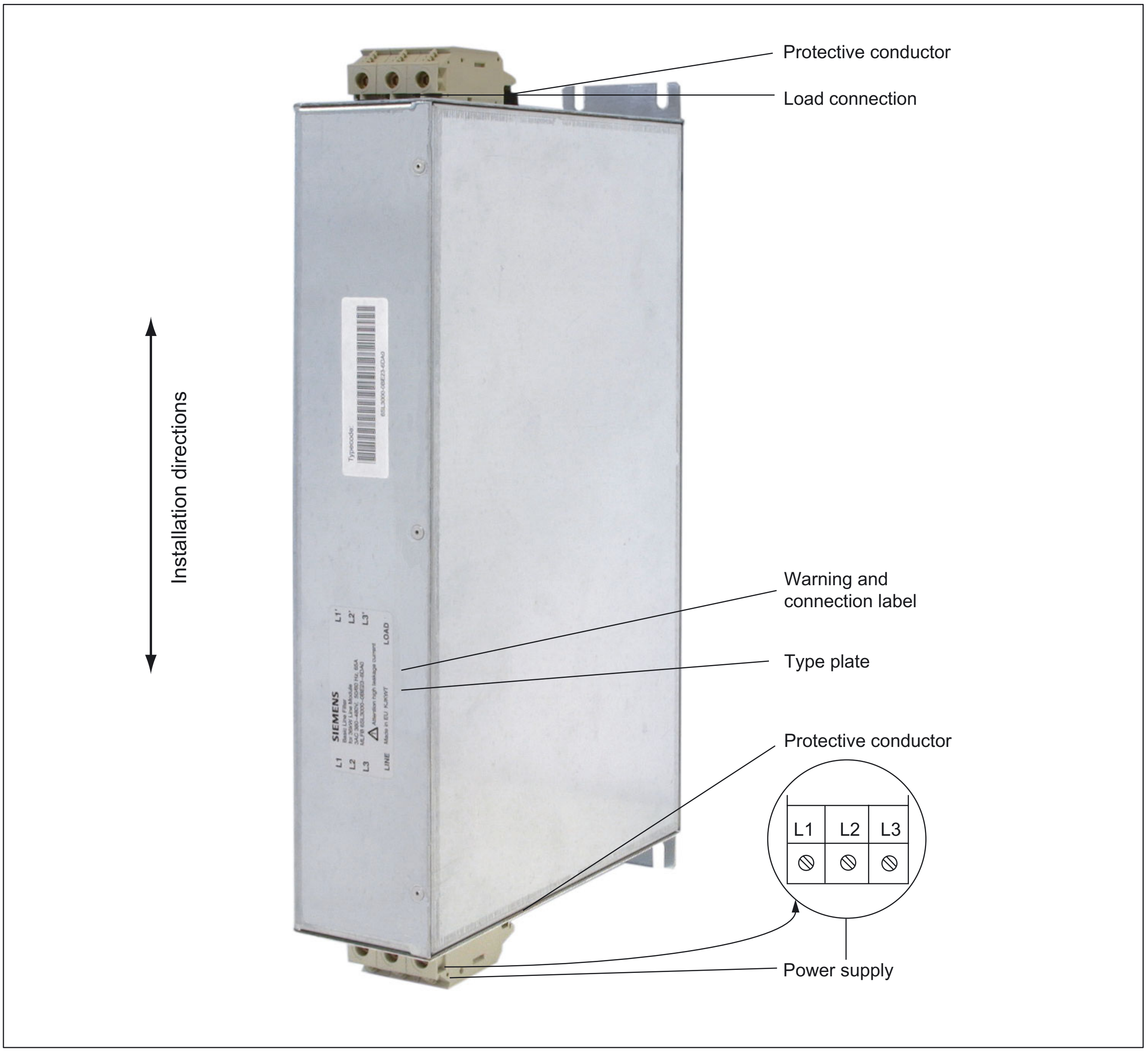


Figure 2-6 Line filters for Smart Line Modules (example: 36 kW)

2.5.3.2 Line/load connection

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

Table 2-8 Type of connection

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

2.5.4 Dimension Drawings

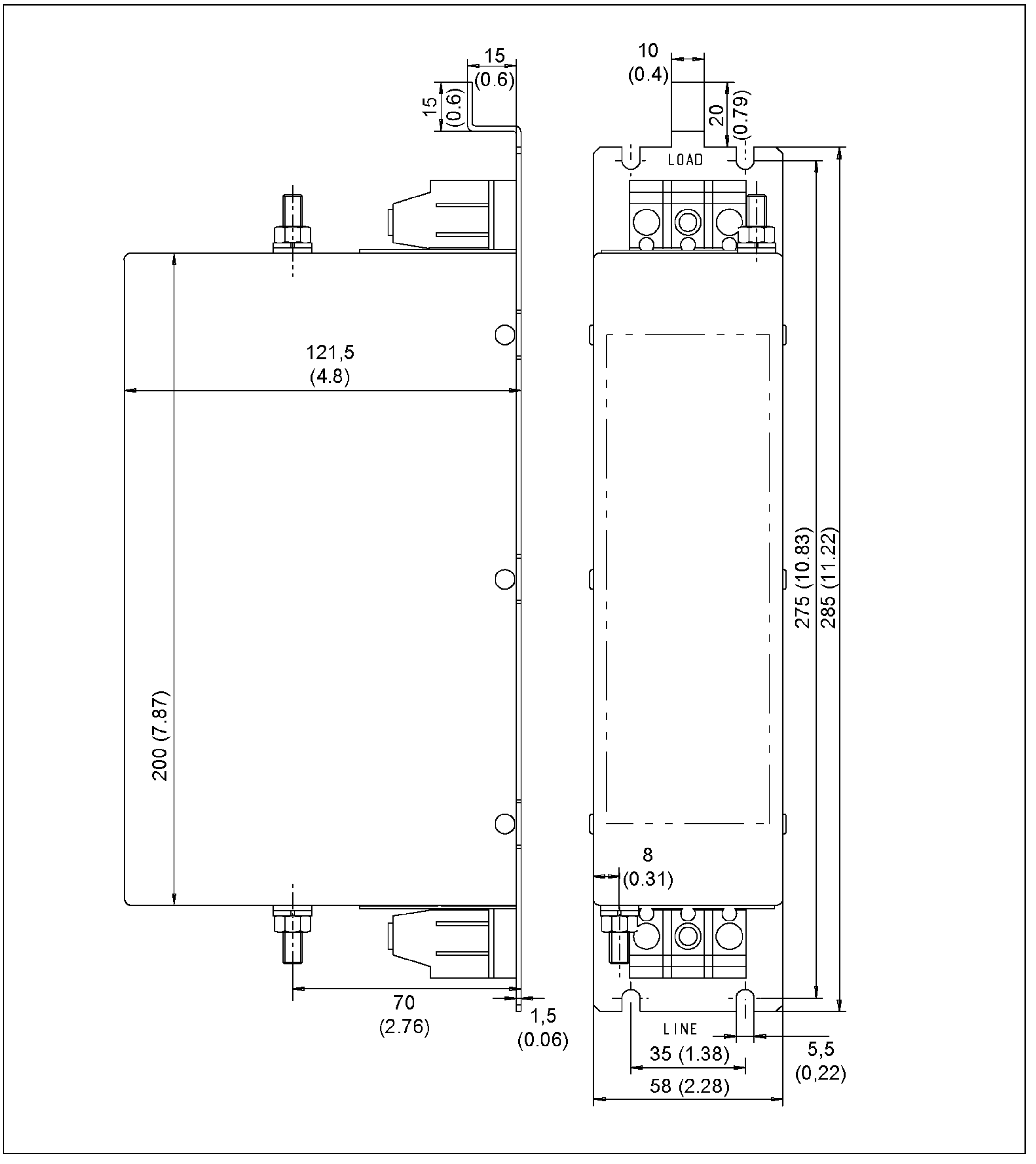


Figure 2-7 Dimension drawing: line filters for Smart Line Modules (5 and 10 kW)

Table 2-9 Line filters for Smart Line Modules

Line filters for Smart Line Modules	Order No.
5 kW	6SL3000-0HE15-0AAx
10 kW	6SL3000-0HE21-0AAx

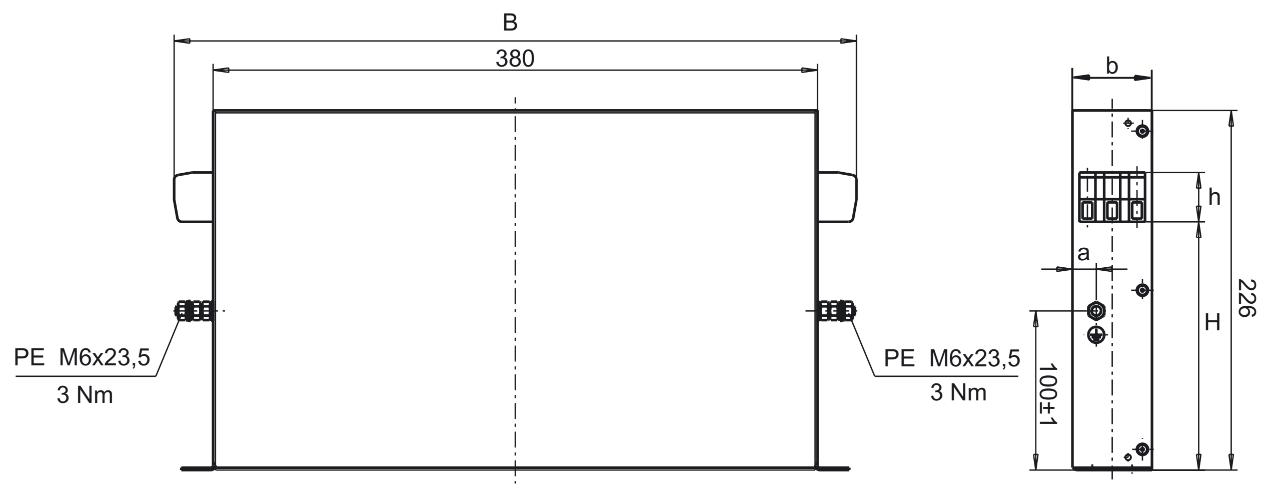


Figure 2-8 Dimension drawing: line filter for Smart Line Module (16 kW and 36 kW)

Table 2-10 Dimensions: line filter for Smart Line Module

Line filters for Smart Line Modules	Order No.	B [mm] (inches)	b [mm] (inches)	a [mm] (inches)	H [mm] (inches)	h [mm] (inches)
16 kW	6SL3000-0BE21-6DAx	429 (16.88)	50 (1.96)	15 (0.59)	156 (6.14)	31 (1.22)
36 kW	6SL3000-0BE23-6DAx	433 (17.07)	75 (2.95)	15 (0.59)	135 (5.31)	68 (2.67)

2.5.5 Technical Specifications

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

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

[1] For an overview, refer to the power loss tables in the Chapter, Cabinet Design.

2.6 Line reactors for Active Line Modules

2.6.1 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.

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

Caution

Only the line reactors described in this Equipment Manual must be used.

When using line reactors that have not been released by SIEMENS for SINAMICS S120, the following can occur:

- can damage/destroy Line Modules.

- cause line reactions that can damage or destroy other loads powered from the same network.

Caution

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

2.6.3 Connection description

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

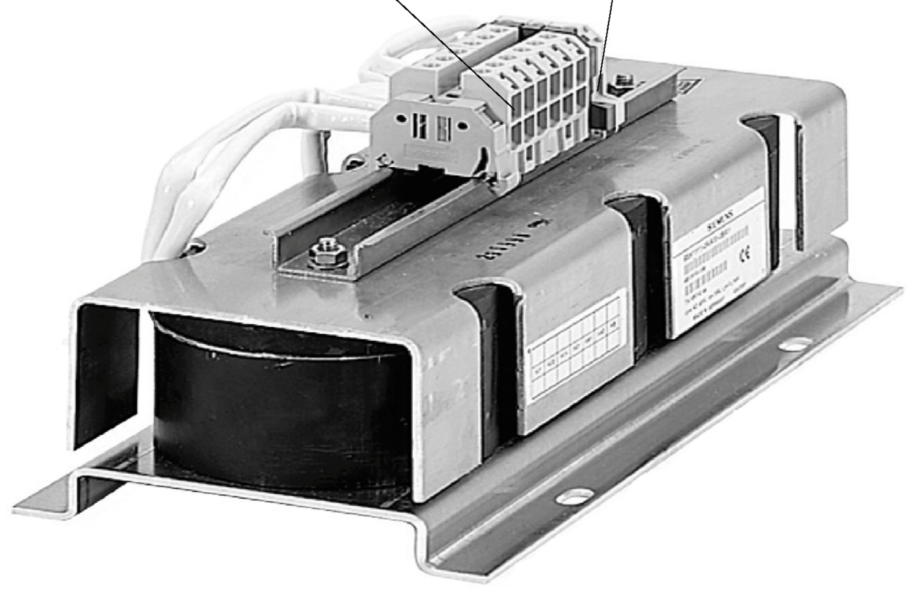


Figure 2-9 Line reactor (example: 16 kW)

2.6.3.1 Line/load connection

Table 2-12 Connection methods for line reactor

Terminals	Designations
Line supply connection	1U1, 1V1, 1W1, PE
Load connection	1U2, 1V2, 1W2
Line reactors for Active Line Modules	
16 kW	Screw terminal 16 mm² 3–pin/6 Nm*
36 kW	Screw terminal 35 mm² 3–pin/6 Nm*
55 kW	Screw terminal 70 mm² 3–pin/6 Nm*
80 kW	Connection strap d = 9 mm² (M10/25 Nm) for ring cable lugs to DIN 46234 **Note: No shock-hazard protection (IP00B acc. to 60529)**
120 kW	Connection strap d = 10 mm² (M10/25 Nm) for ring cable lugs to DIN 46234 **Note: No shock-hazard protection (IP00B acc. to 60529)**

* See Screw Terminals

2.6.4 Dimension drawing

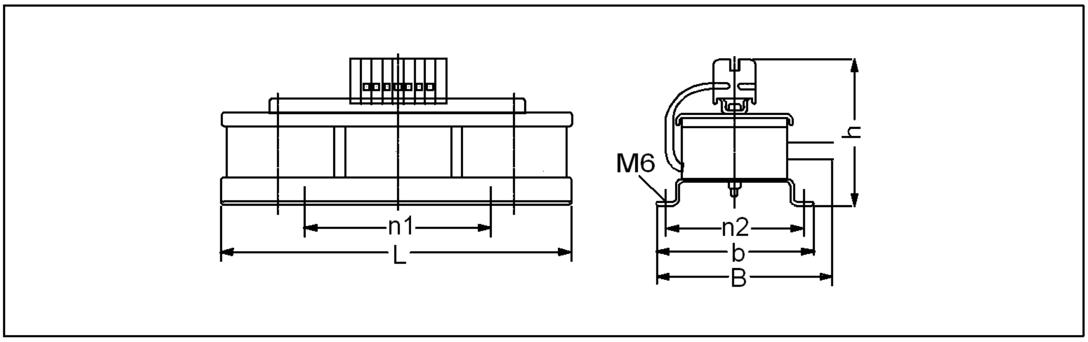


Figure 2-10 Dimension drawing: line reactor for Active Line Modules (up to 55 kW)

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

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

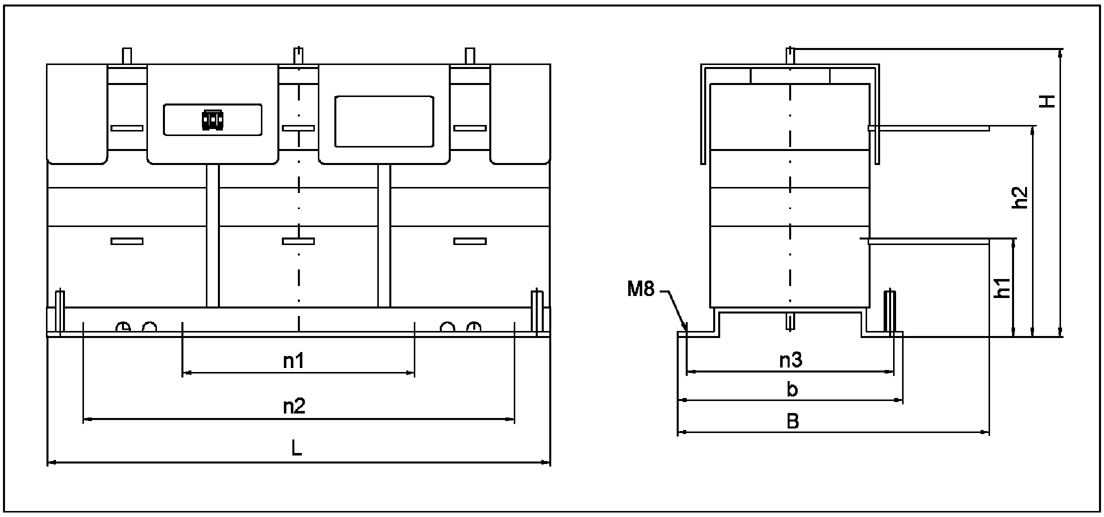


Figure 2-11 Dimension drawing: line reactor for Active Line Modules (as of 80 kW)

Table 2-14 Dimensions of the line reactor for Active Line Modules

	Order number	L [mm] (inches)	W [mm] (inches)	h1 [mm] (inches)	h2 [mm] (inches)	H [mm] (inches)	b [mm] (inches)	n_1 [mm] 1) (inches)	n_2 [mm] 1) (inches)	n_3 [mm] 1) (inches)
80 kW	6SN1111-0AA00-1EA0	380 (14.96)	225 (8.86)	50 (1.70)	170 (6.69)	220 (8.66)	170 (6.69)	175 (6.89)	325 (12.80)	156 (6.14)
120 kW	6SL3000-0DE31-2BA0	490 (19.29)	225 (8.86)	60 (2.36)	220 (8.66)	250 (9.84)	170 (6.69)	175 (6.89)	325 (12.80)	156 (6.14)
1) The lengths n1, n2 and n3 correspond to the drill hole spacing										

2.6.5 Technical specifications

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

	6SN1111– Unit	0BA1	0CA1	0DA1	1EA0	1FA0
Output	kW	16	36	55	80	120
Rated current	A_{rms}	30	67	103	150	225
Power loss[1]	W	170	250	350	450	590
Weight	Weight[kg]	8.5	13	18	40	50

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

2.7 Line reactors for Smart Line Modules

2.7.1 Description

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

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

Caution

Only the line reactors described in this Equipment Manual must be used.

When using line reactors that have not been released by SIEMENS for SINAMICS S120, the following can occur:

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

Caution

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

2.7.3 Connection description

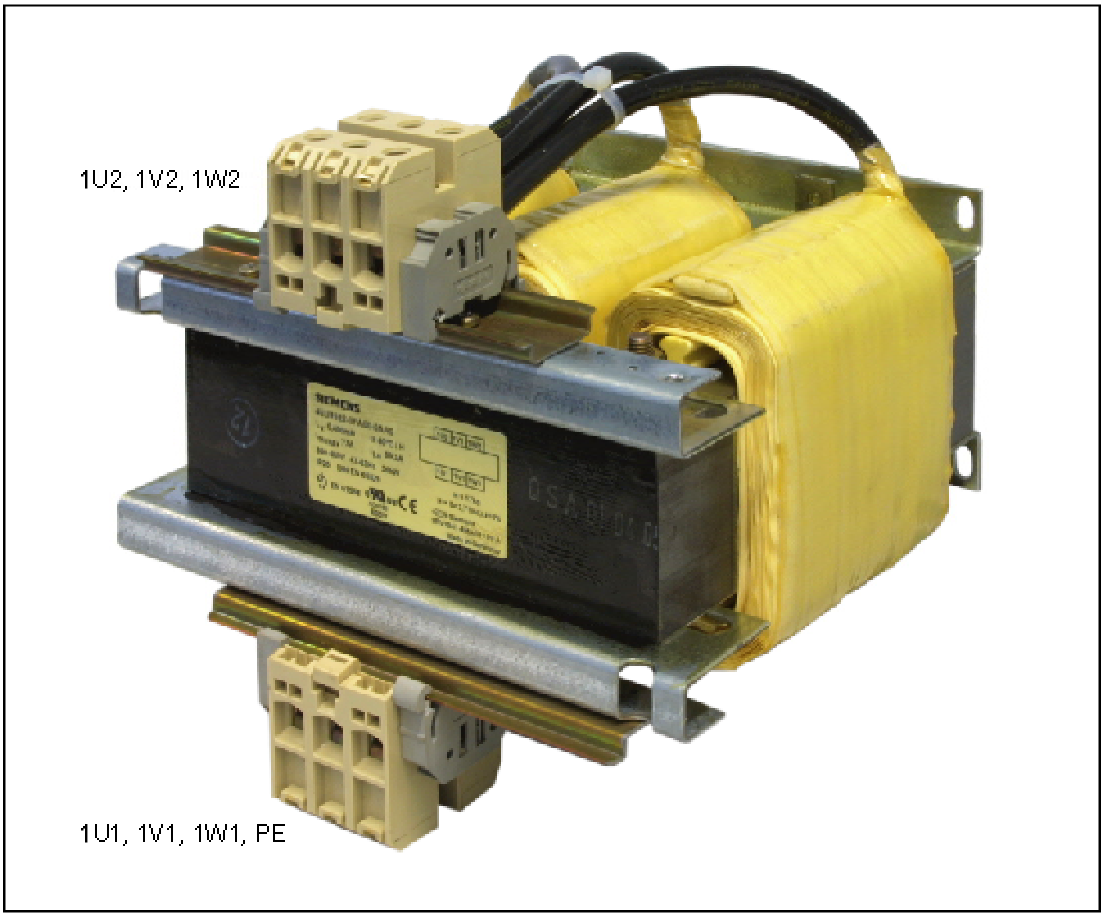


Figure 2-12 Line reactors for Smart Line Modules (example: 36 kW)

2.7.3.1 Line/load connection

Table 2-16 Connection methods for line reactor

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

* See Screw Terminals

2.7.4 Dimension Drawings

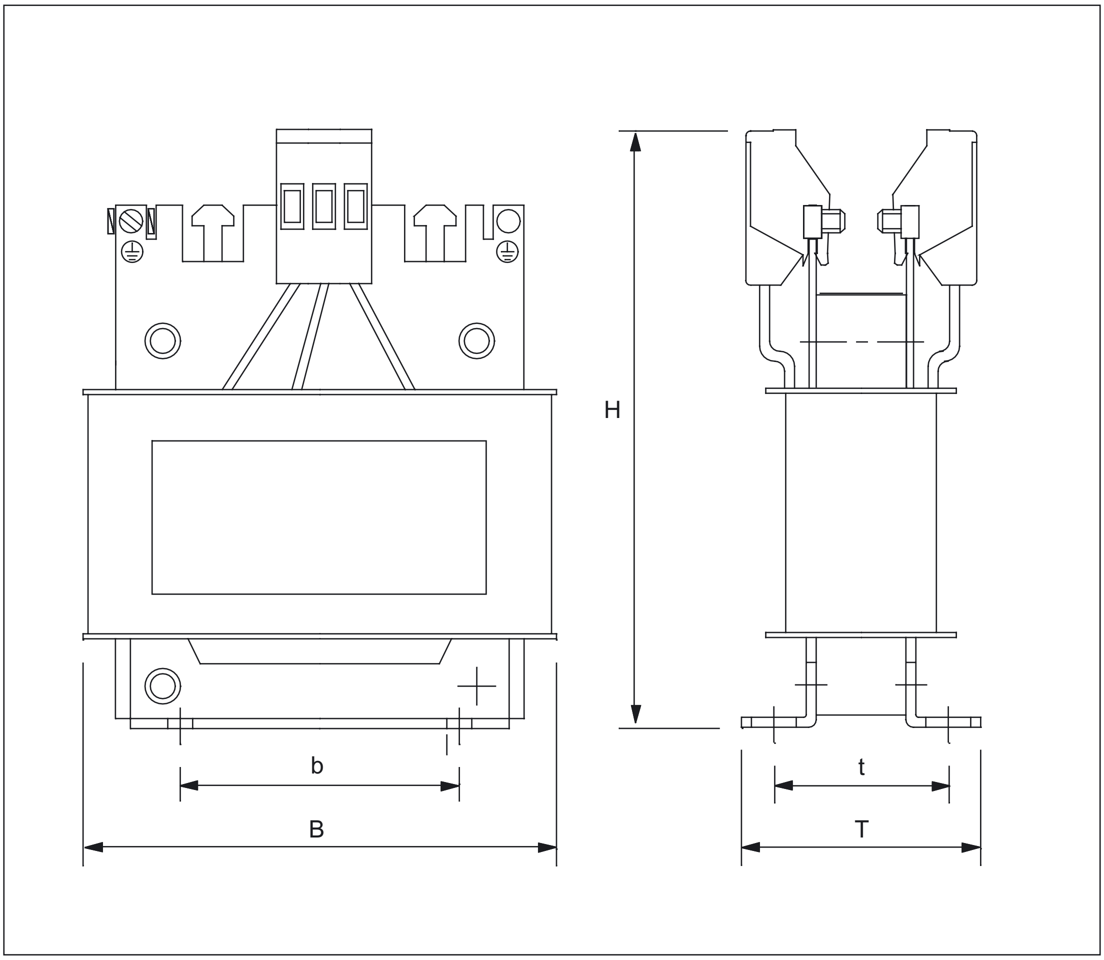


Figure 2-13 Dimension drawing: line reactor for Smart Line Modules (5 and 10 KW)

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

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

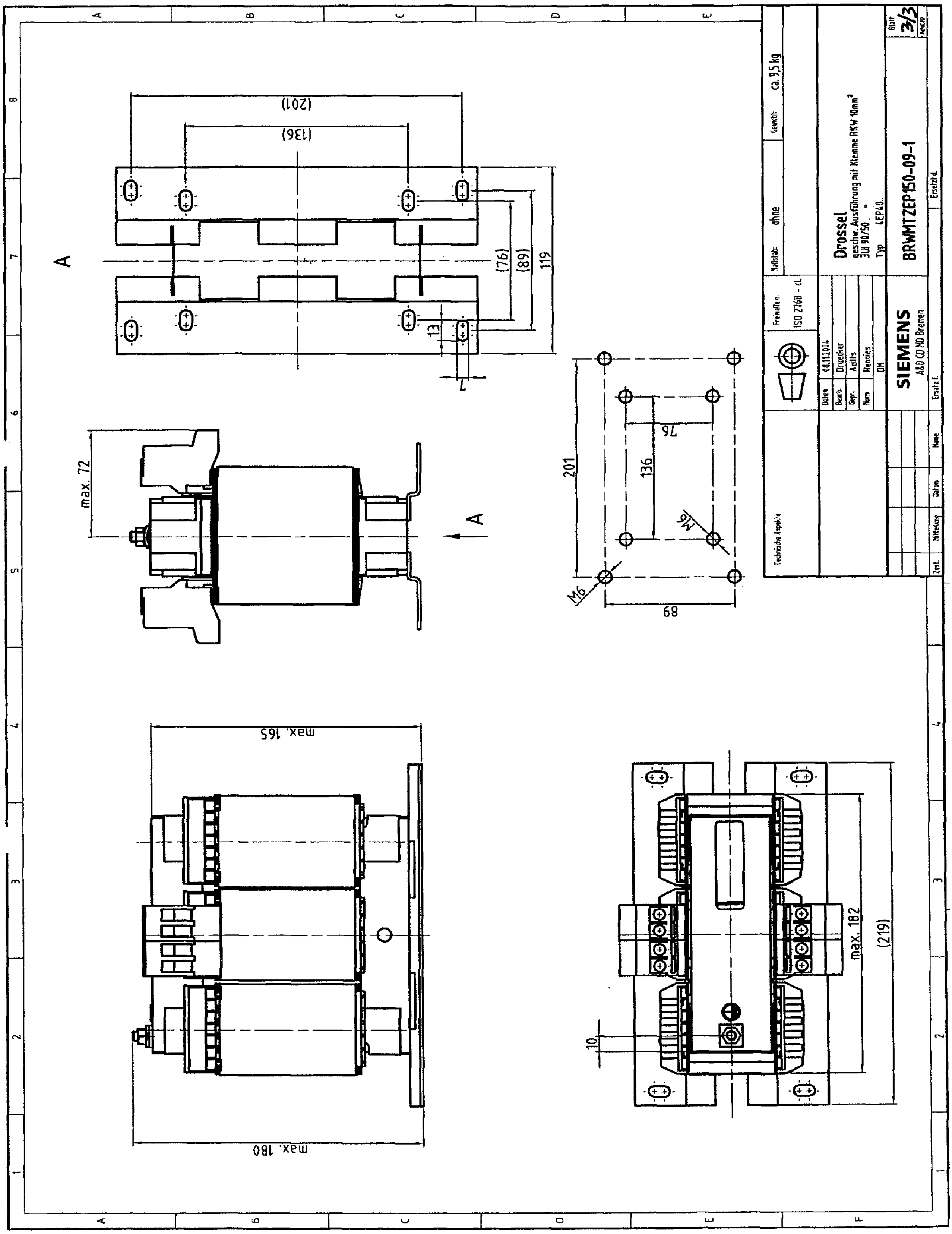


Figure 2-14 Dimension drawing of line reactor for the Smart Line Module 16 kW

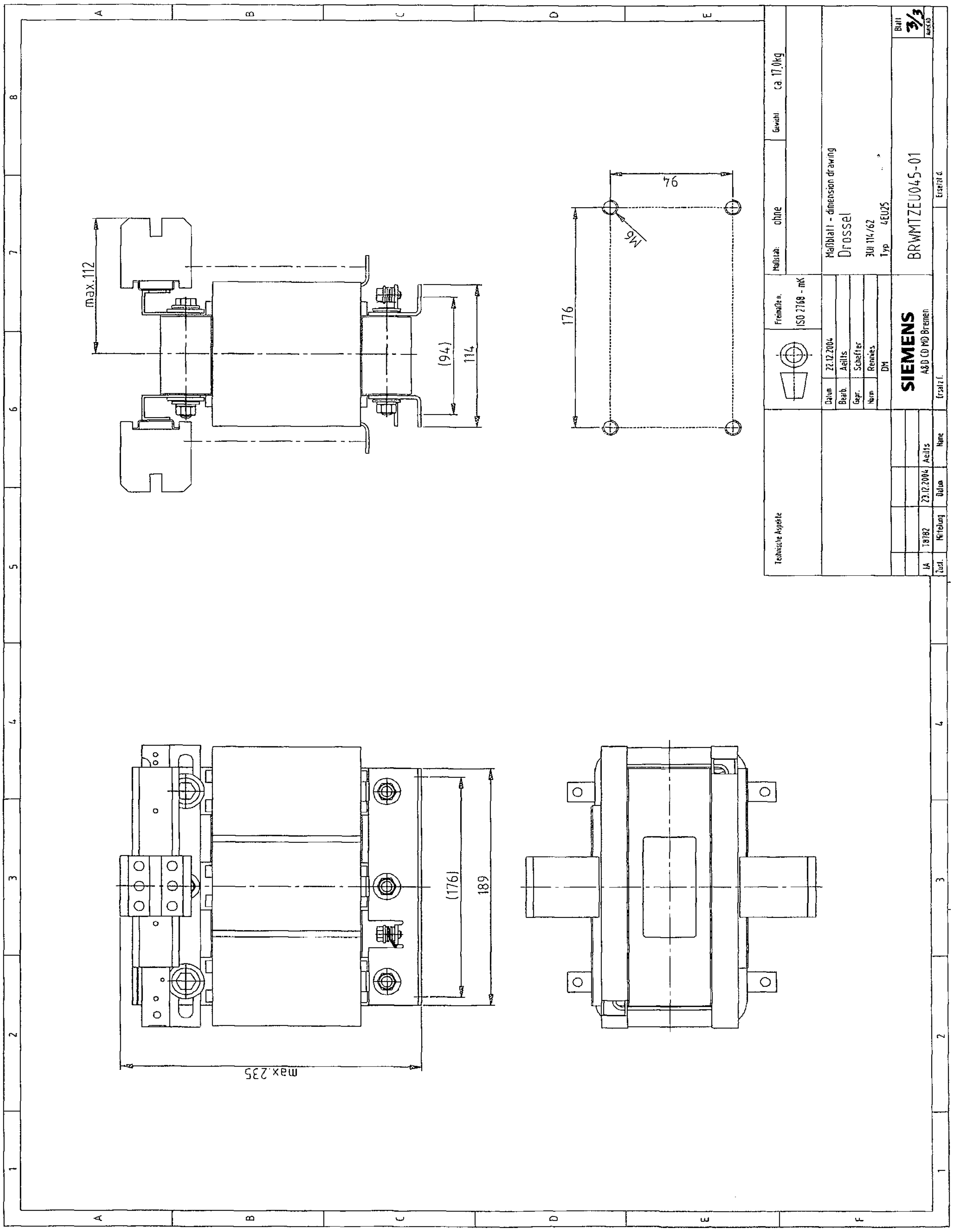


Figure 2-15 Dimension drawing of the line reactor for the Smart Line Module 36 kW

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

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

2.7.5 Technical specifications

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

	6SL3000 unit	0CE15-0AA0	0CE21-0AA0	0CE22-0AA0	0CE24-0AA0
Output	kW	5	10	16	36
Rated current	A_{rms}	14	28	35	69
Power loss[1]	W	62	116	110	170
Weight	kg	3.7	7.5	9.5	17

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

2.8 Line connection variations

2.8.1 Methods of line connection

A distinction is made between:

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

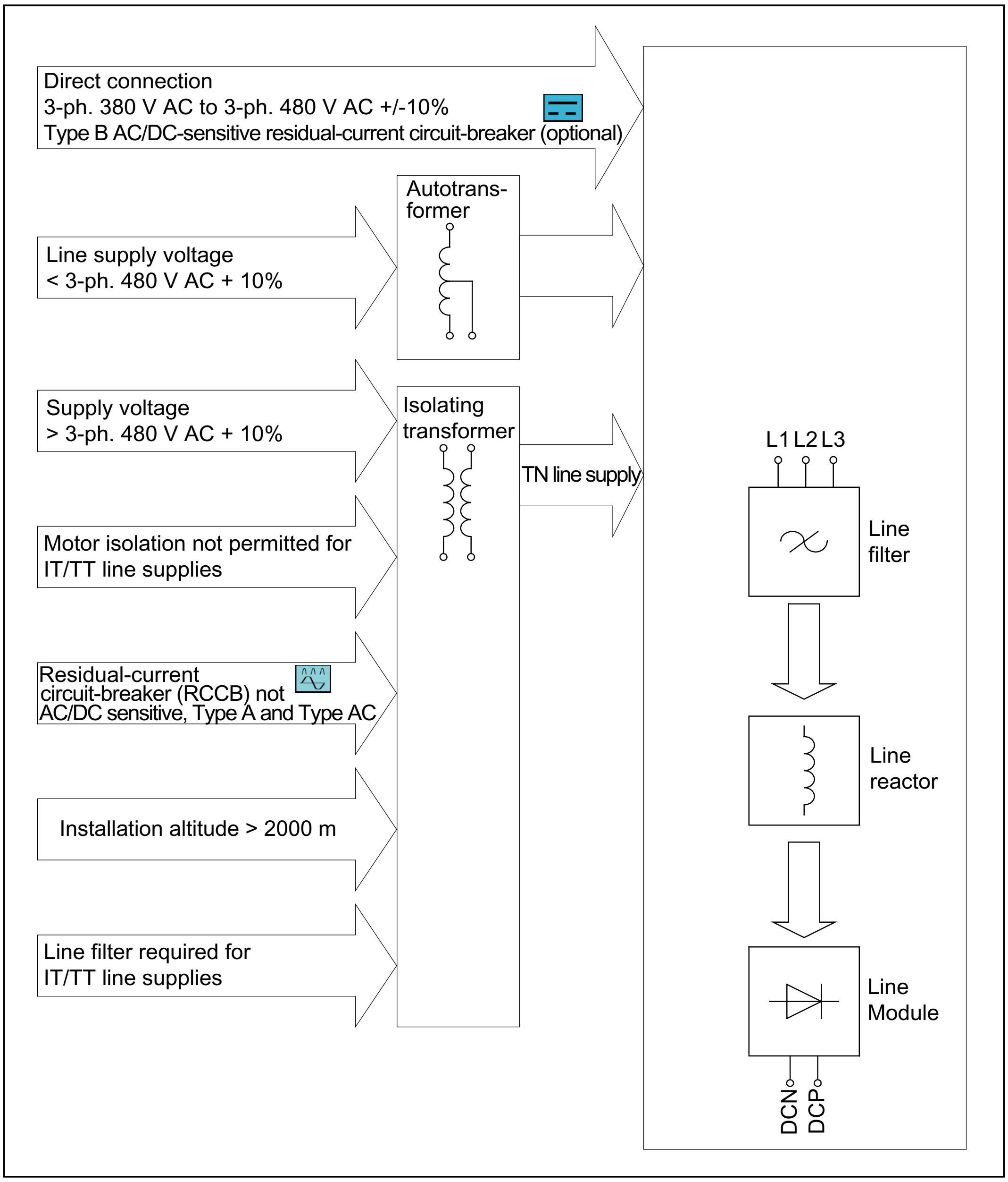


Figure 2-16 Overview of line connection variants

2.8.2 Operation of the line connection components on the supply network

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

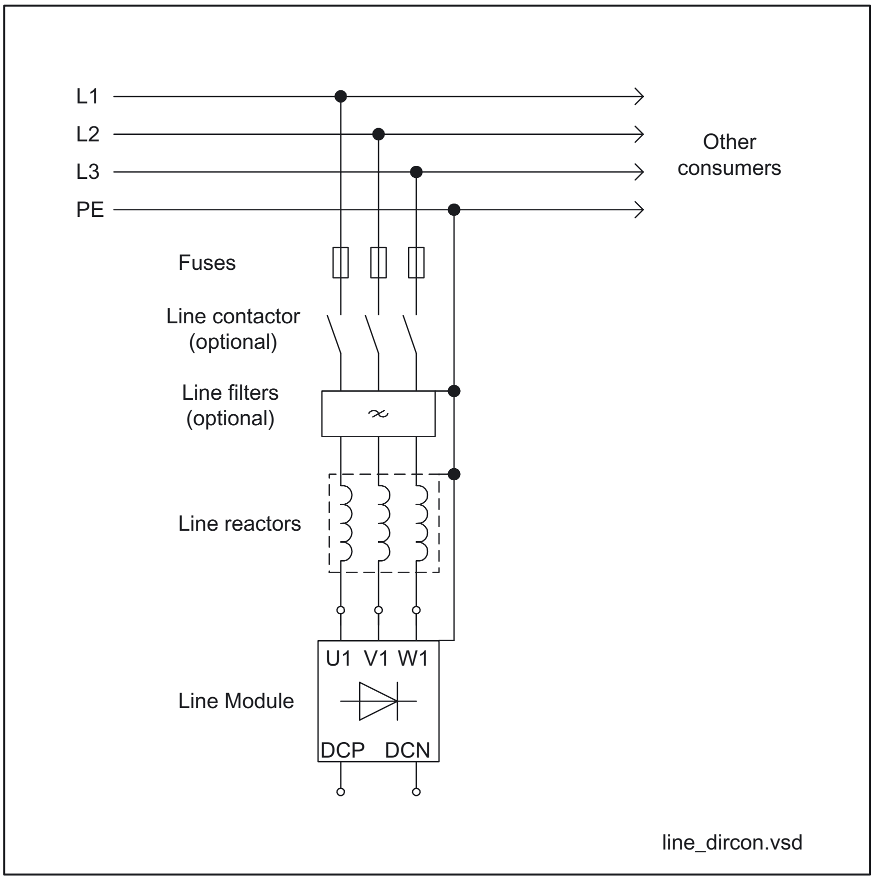


Figure 2-17 Direct operation on the line supply

2.8.3 Operation of the line connection components via an autotransformer

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

Caution

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

Applications:

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

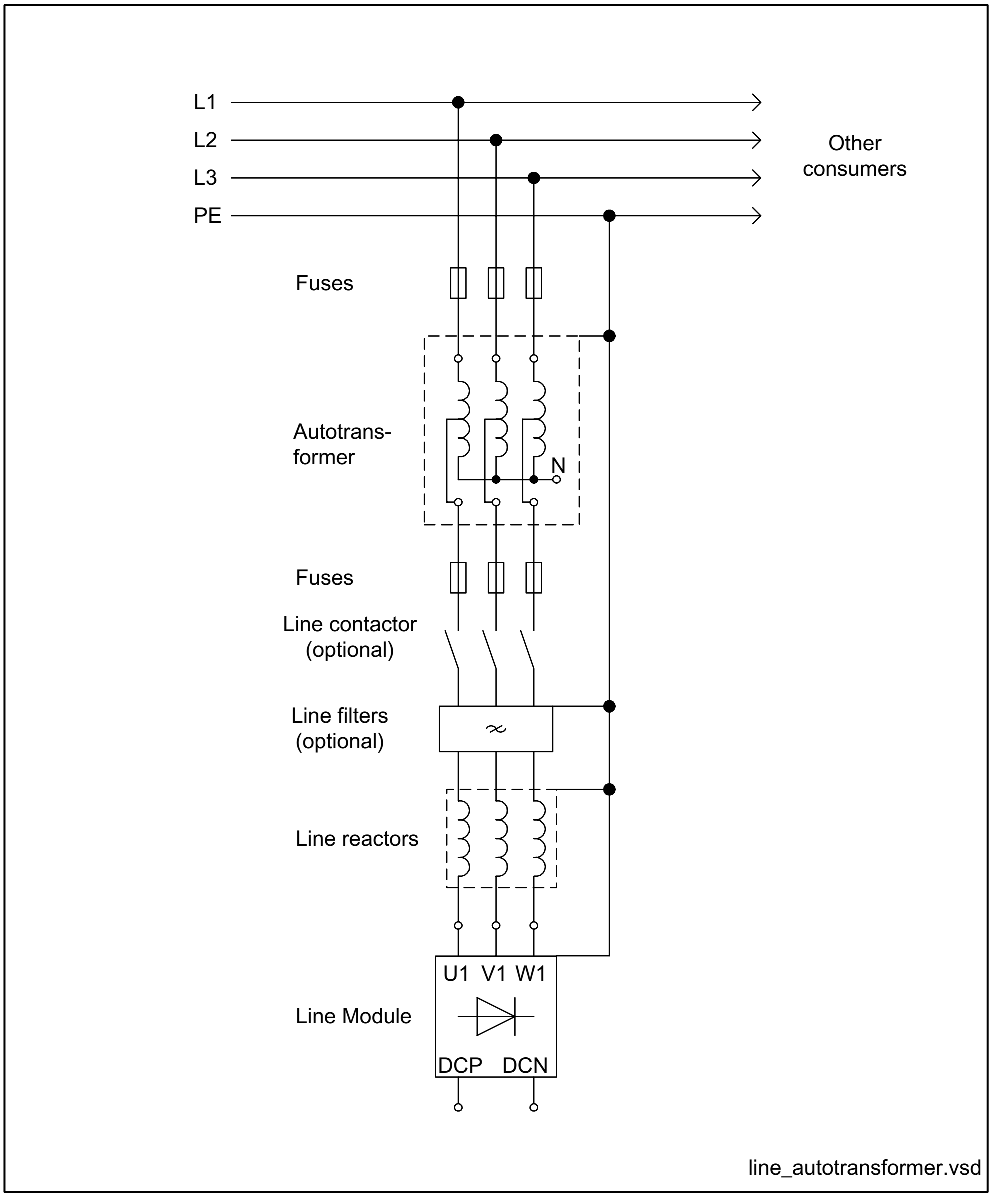


Figure 2-18 Autotransformer

2.8.4 Operation of the line connection components via an isolating transformer

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

An isolating transformer must be used in the following cases:

- The 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.

Caution

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

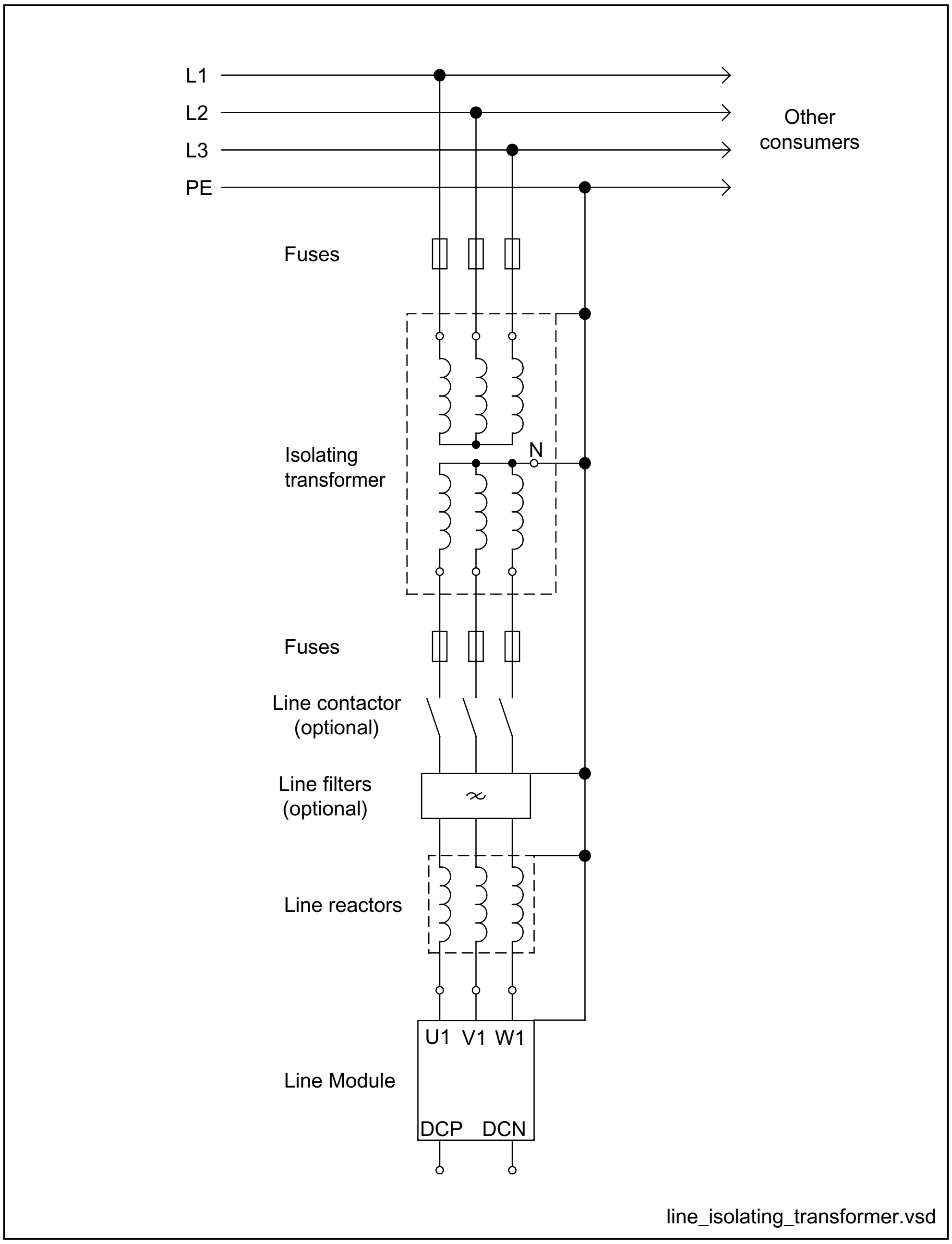


Figure 2-19 Isolating transformer

2.8.5 Line connection via a ground-fault circuit interrupter

In addition to 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

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

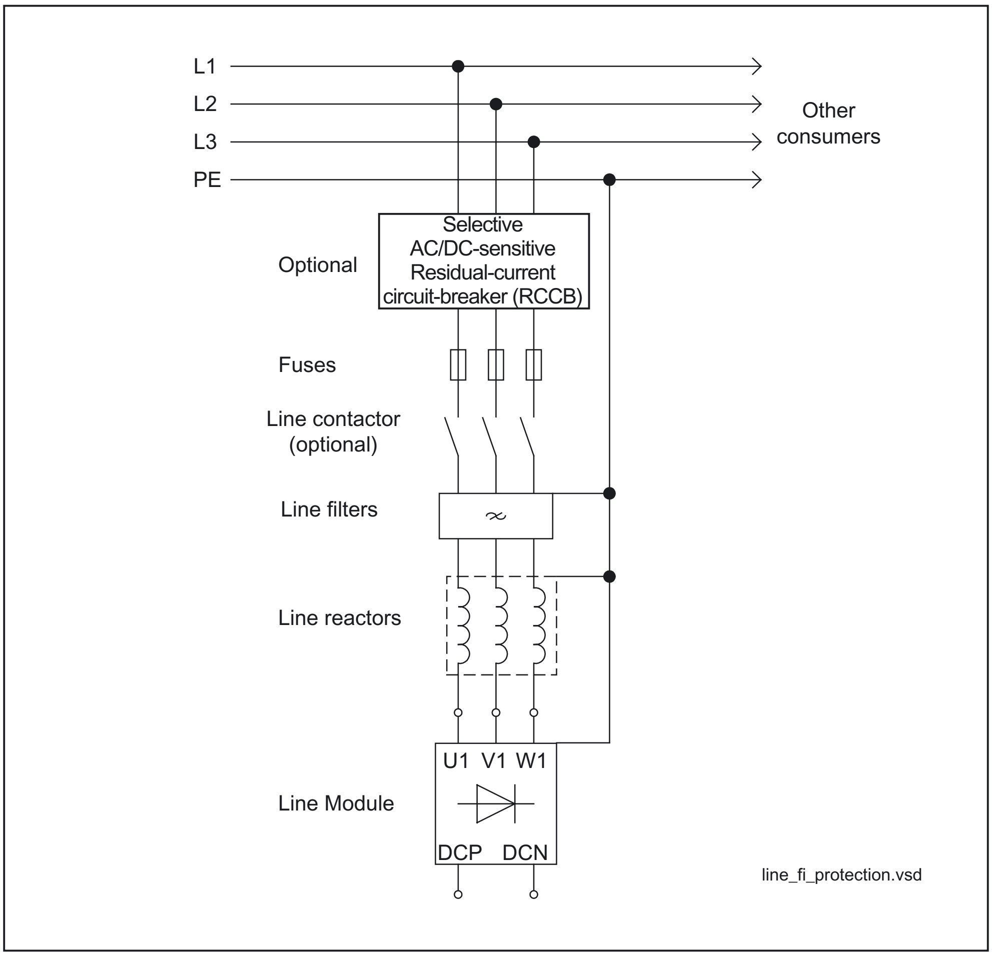


Figure 2-20 Residual-current circuit-breaker (RCCB)

Please note the following:

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

Recommendation

SIEMENS selectively tripping AC/DC-sensitive residual-current circuit-breakers to EN 61800-5-1, type 5SZ (e.g. 5SZ6 468–0KG00 or 5SZ6468–0KG30 with auxiliary disconnector (1NC/1NO) for rated current 63 A, rated fault current 0.3 A) (also refer to Catalog CA01).

Notice

AC or pulse-sensitive RCCBs are not suitable.

Line Modules Booksize 3

3.1 Introduction

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

The Active Line Modules and the Smart Line Modules 16 kW and 36 kW have DRIVE-CLiQ interfaces for communications with the Control Unit. The Smart Line Modules 5 kW and 10 kW must be connected with the Control Unit via terminals.

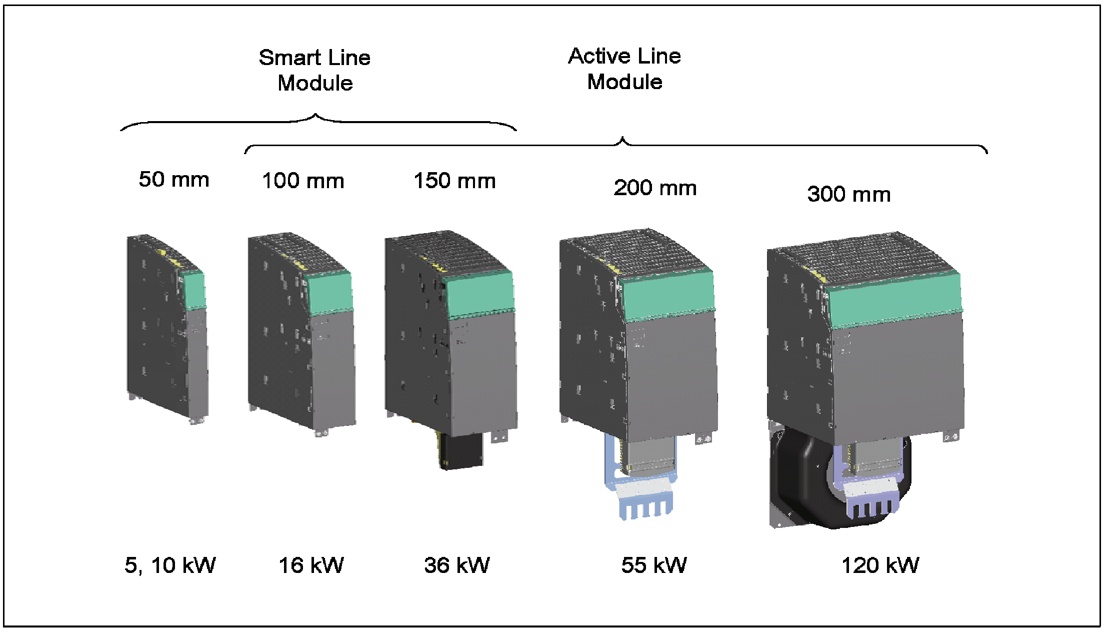


Figure 3-1 Overview of Line Modules

General characteristics of the Line Modules

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

Characteristics of the Active Line Modules

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

Characteristics of the Smart Line Modules

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

Frequency with which the DC link is precharged

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

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

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 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 protective 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, otherwise this could result in secondary damage or accidents.

Danger

A sufficiently high system fault level is required for tripping the fuses within the predefined time in the event of a ground fault. Low system fault values increase the time to trip beyond permissible levels (e.g. fire possible).

Warning

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

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

Caution

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

A set of labels in 16 languages is available under Order No.: 6SL3166-3AB00-0AAx.

Caution

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

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

Caution

It is only permissible to establish connections to the DC link using the adapters that Siemens has recommended (DC link adapter and DC link infeed 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.

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

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.

Caution

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

Caution

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

Caution

The ratio between the system fault level and the rated power of the Line Module must be $\geq$ 70.

Caution

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).

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

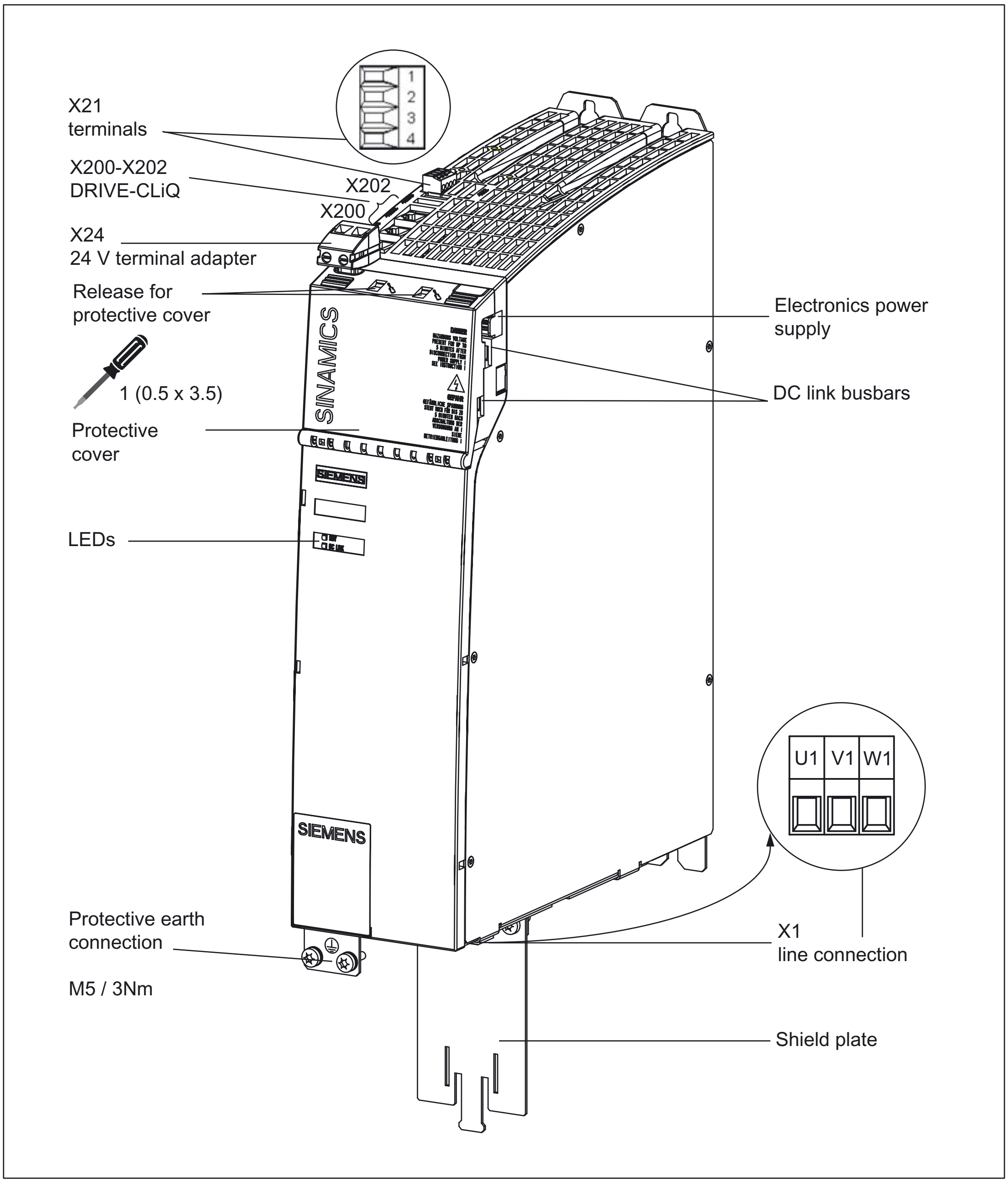
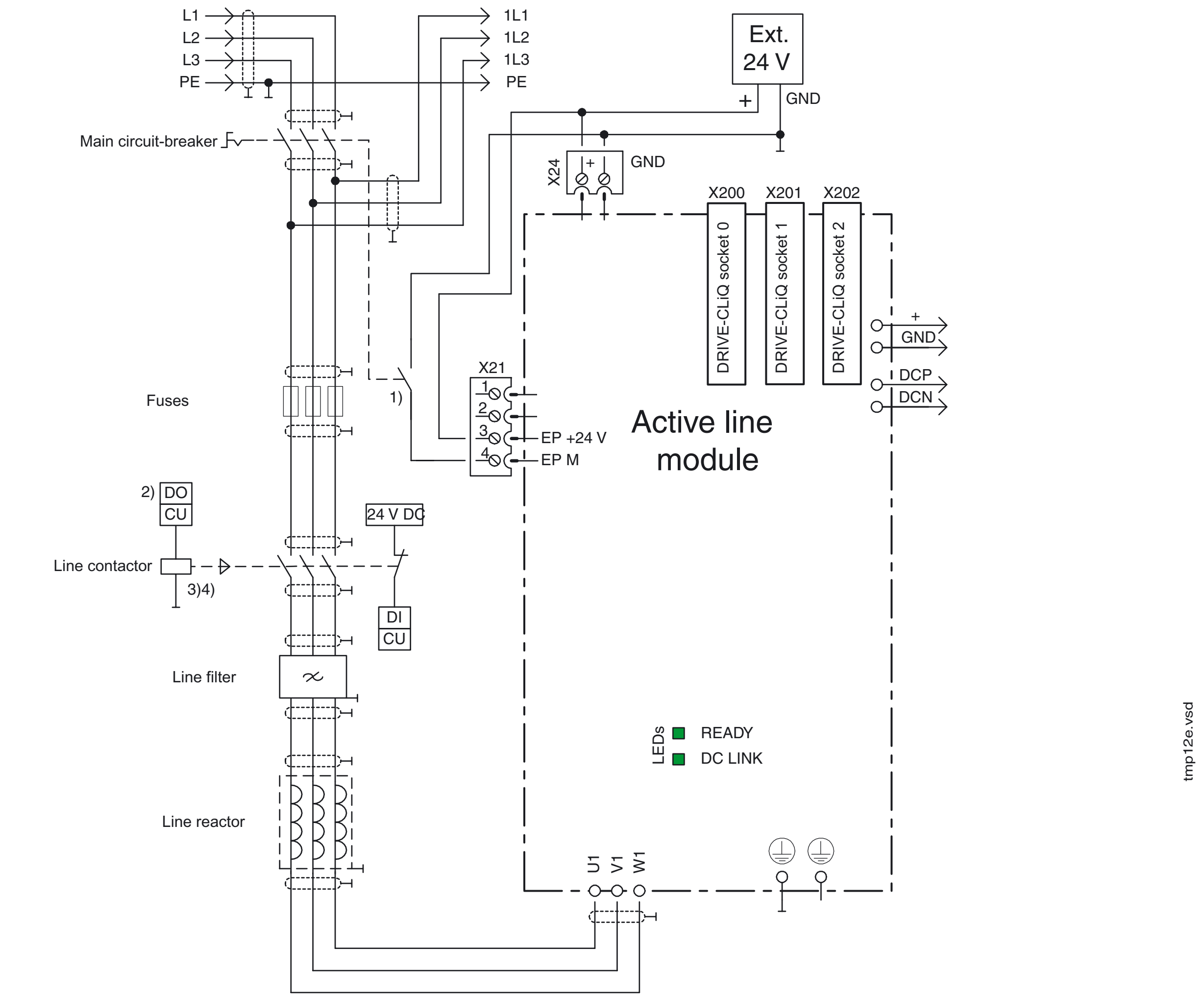


Figure 3-2 Active line module with internal air cooling (example: 16 kW)

3.2.3.2 Connection example

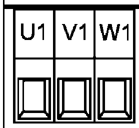
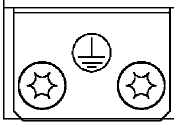


1) Leading break contact t >10 ms
2) DI/DO (controlled by the control unit)
3) No additional consumer permitted downstream of line contactor
4) The current carrying capacity of the DO must be taken into account
An output interface element may have to be used

Figure 3-3 Example connection of Active Line Module

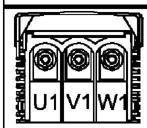
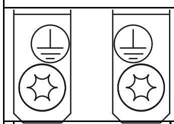
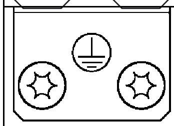
3.2.3.3 X1 line connection

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

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

[1] for ring cable lugs to DIN 46234

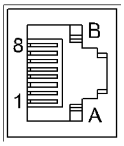
Table 3-2 Terminal block for the Active Line Module (36 kW to 120 kW)

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

[1] for ring cable lugs to DIN 46234

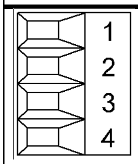
3.2.3.4 X200-X202 DRIVE-CLiQ interfaces

Table 3-3 DRIVE-CLiQ interface X200-X202

	PIN	Signal name	Technical specifications
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	24 V power supply
	B	GND (0 V)	Electronic ground
Blanking plate for DRIVE-CLiQ interface: Molex, order number: 85999-3255			

3.2.3.5 EP terminals X21

Table 3-4 Terminal block X21

	Terminal	Name	Technical specifications
	1	Reserved, do not use	
	2	Reserved, do not use	
	3	EP +24 V (Enable Pulses)	Voltage 24 V DC Current consumption: 10 mA Isolated input Signal propagation times: L → H 100 μs H → L: 1000 μs
	4	EP M (Enable Pulses)	
Max. connectable cross-section: 1.5 mm² Type: Screw terminal 1 (see Connection Methods)			

Warning

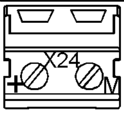
For operation, 24 V DC must be connected to terminal 3 and ground to terminal 4. Upon removal, pulse inhibit is activated. Feedback is deactivated and the bypass relay drops out. If the Line Module is not disconnected from the network when the EP terminal is deactivated (e.g. a main contactor is not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

Notice

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

3.2.3.6 X24 24 V terminal adapter

Table 3-5 Terminal block X24

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

3.2.3.7 Meaning of the LEDs on the active line module

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

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

Warning

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

The warning information on the components must be carefully observed!

Cause and rectification of faults

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

Reference: /IH1/ SINAMICS S120, Commissioning Manual.

3.2.4 Dimension drawing

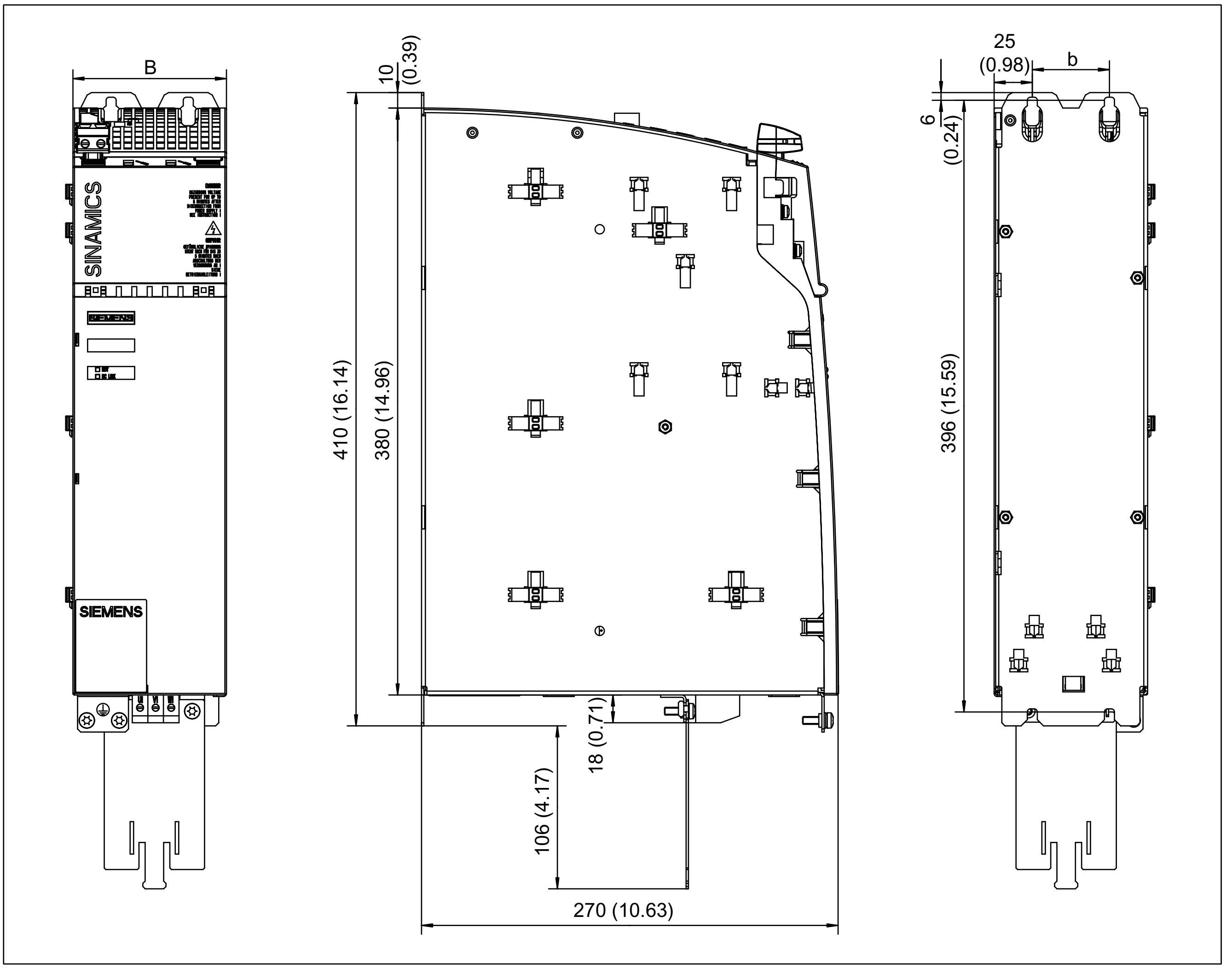


Figure 3-4 Dimension drawing of Active Line Module with internal air cooling (16 kW)

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

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

Note

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

More information can be found in "Accessories".

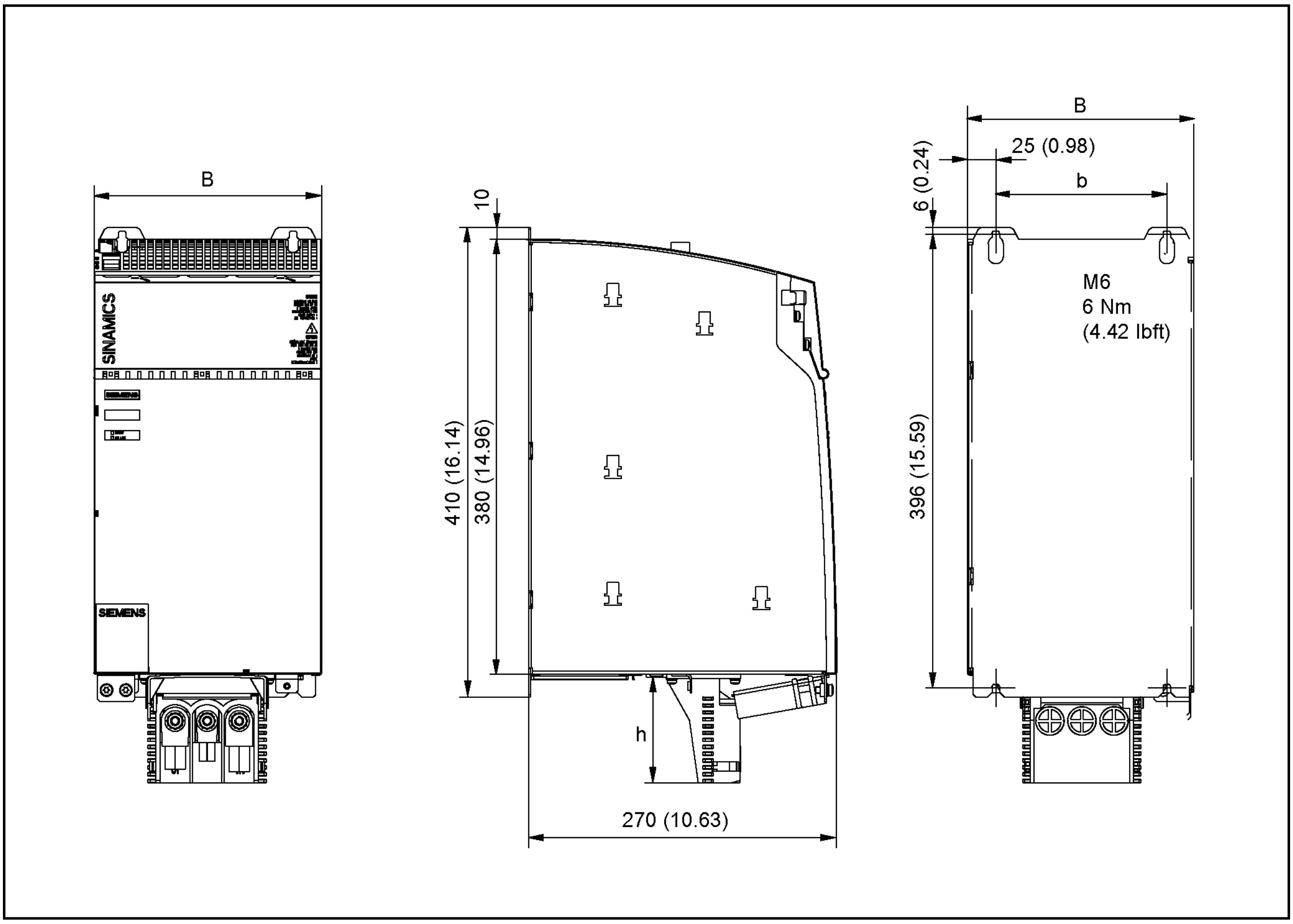


Figure 3-5 Dimension drawing of Active Line Module with internal air cooling (36 kW and 55 kW)

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

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

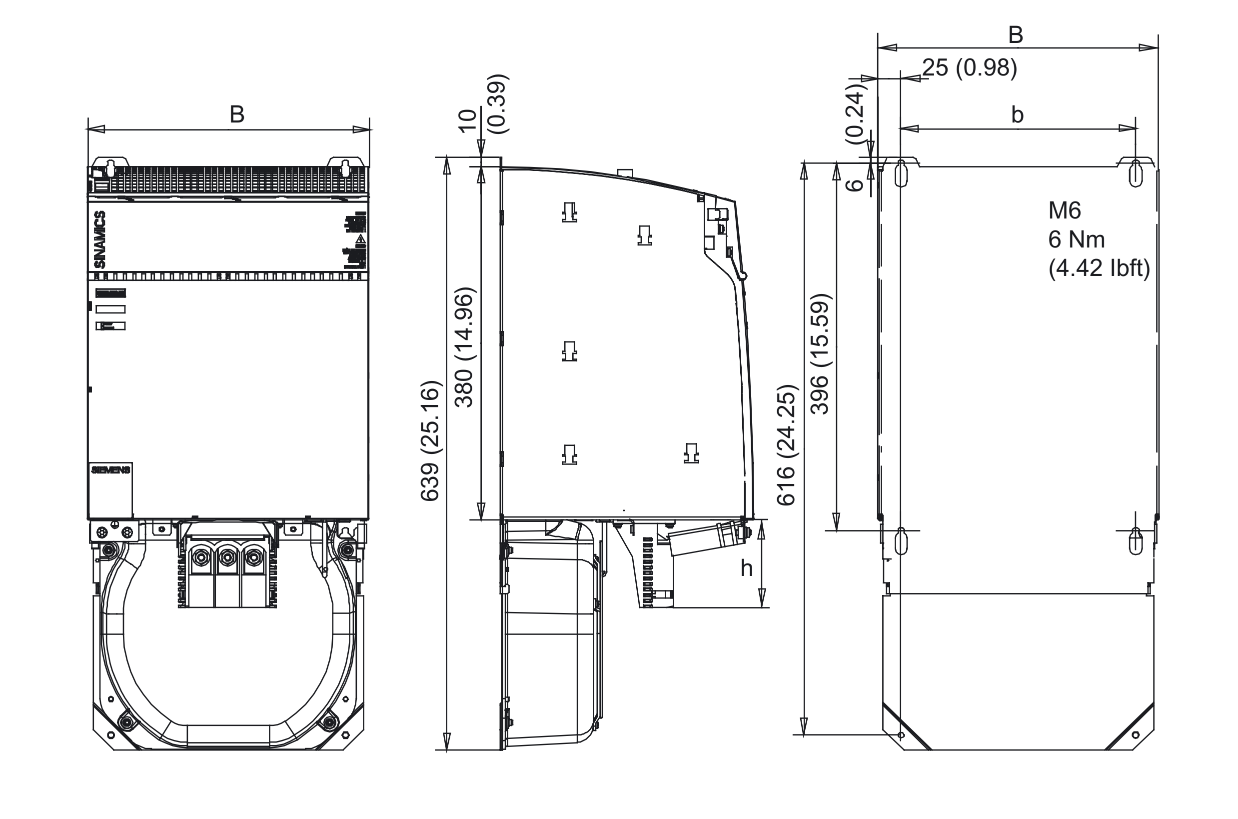


Figure 3-6 Dimension drawing of Active Line Modules with internal air cooling (80 kW and 120 kW)

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

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

3.2.5 Installation

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

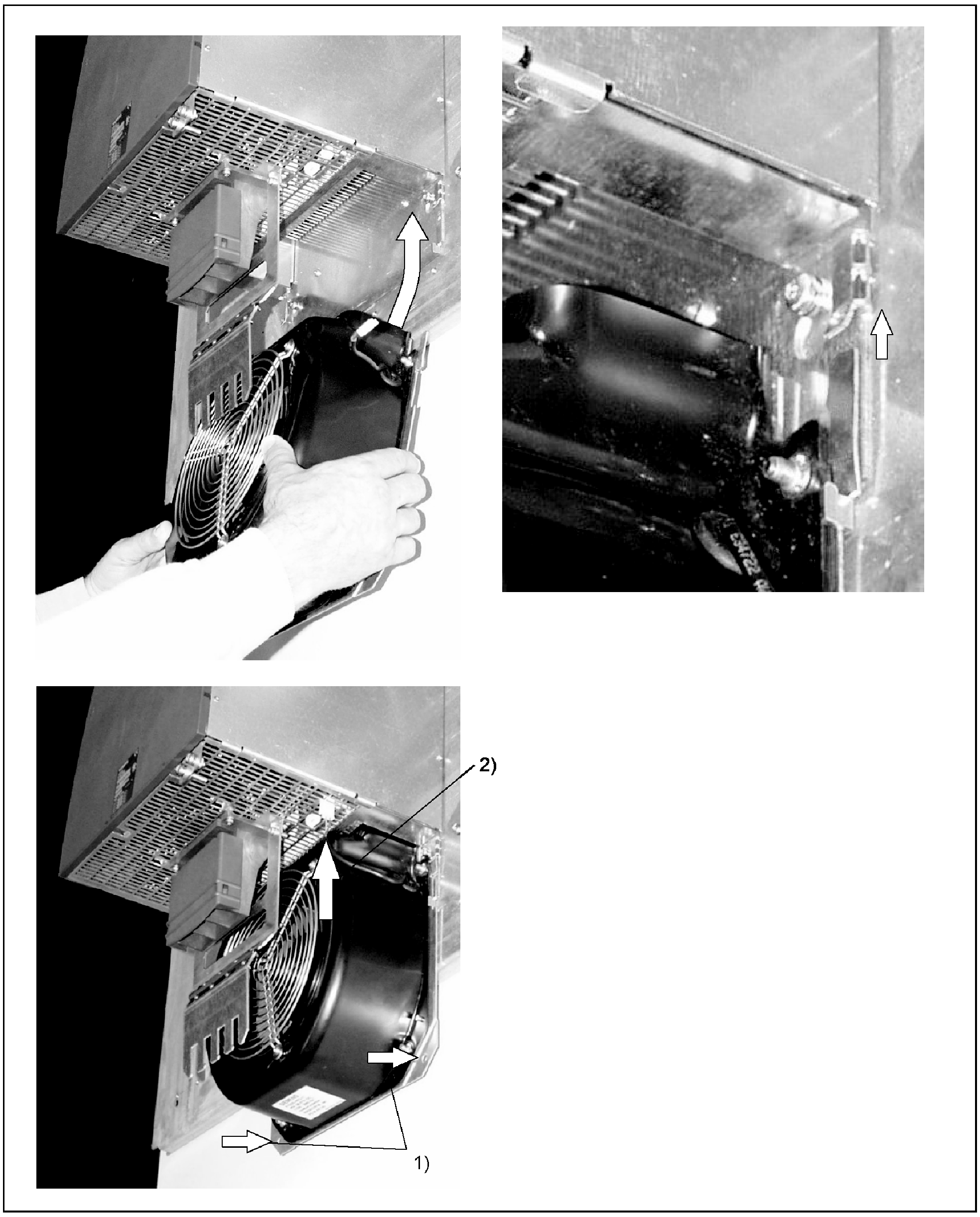


Figure 3-7 Installing the fan for 300 mm modules

1) Secure with M6/6 Nm screws

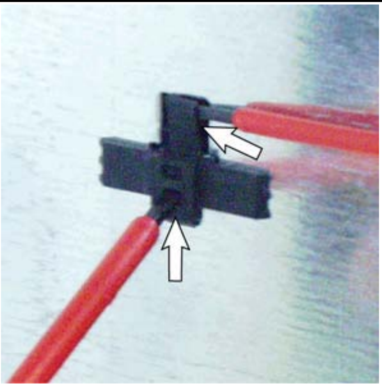
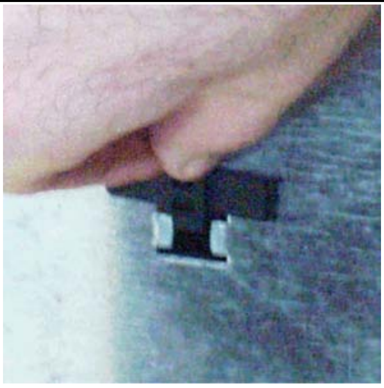
2) Connect the power supply for the fan

Note

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

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

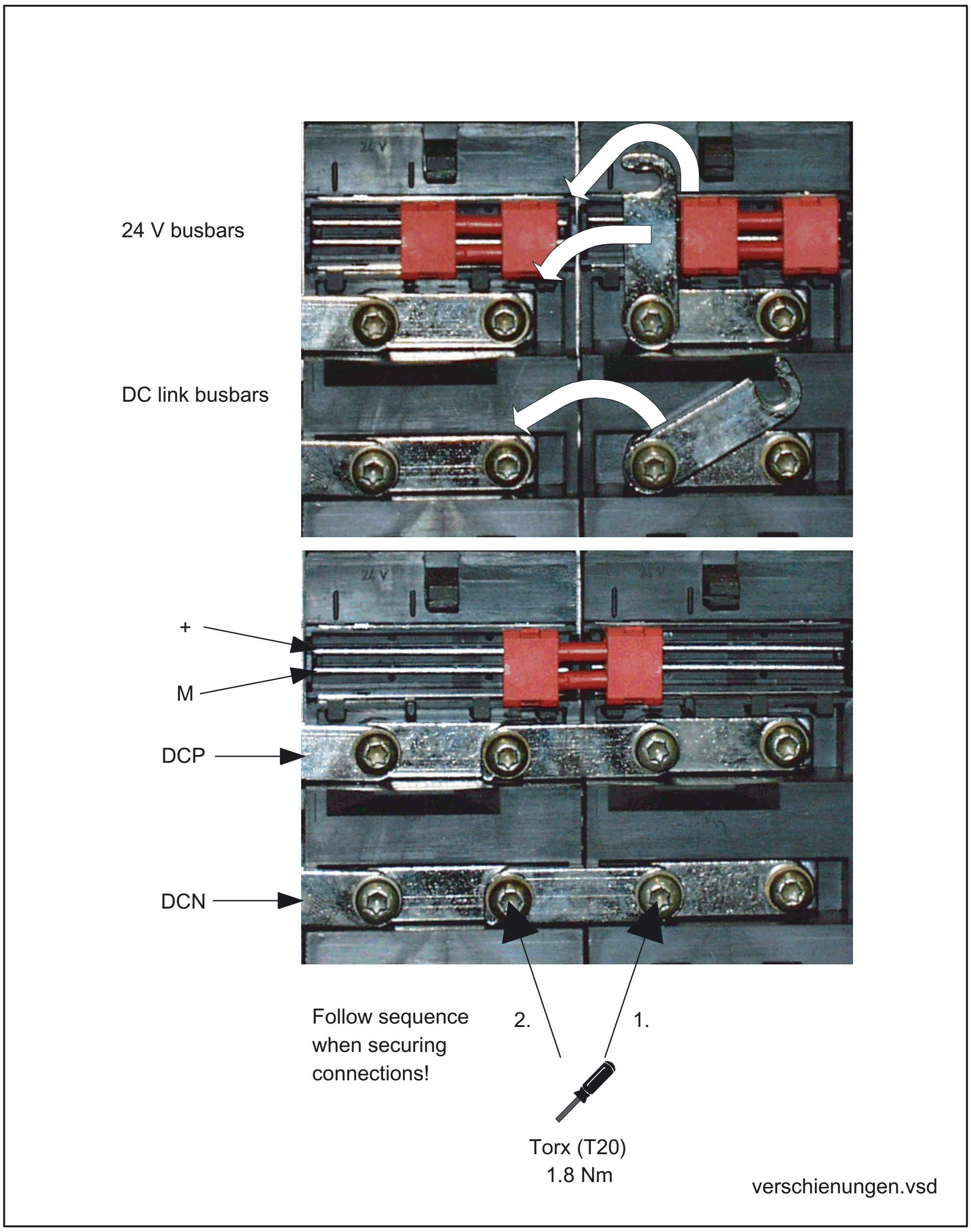


Figure 3-8 Busbar connections for booksize components

Notice

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

3.2.7 Technical specifications

Table 3-10 Technical specifications of Active Line Modules

Internal air cooling	6SL3130–	7TE21–6AAx	7TE23–6AAx	7TE25–5AAx	7TE28–0AAx	7TE31–2AAx
Rated power	**kW**	**16**	**36**	**55**	**80**	**120**
Infeed:						
Rated power (S1)[1]	kW (Pn)	16	36	55	80	120
Infeed power (S6-40%)[1]	kW (Ps6)	21	47	71	106	145
Peak infeed power[1]	kW (Pmax)	35	70	91	131	175
Regenerative feedback:						
Continuous regenerative power rating	kW	16	36	55	80	120
Peak regenerative power rating	kW	35	70	91	131	175
Connection voltages:						
Line supply voltage	V_{ACrms}	3-ph. 380 V AC -10% (-15% < 1 min) to 3-ph. 480 V AC +10%				
Line supply frequency	Hz	47 to 63				
Electronics power supply	V_{DC}	24 (20.4 - 28.8)				
DC link voltage	V_{DC}	510 - 750				
Overvoltage trip threshold	V_{DC}	820 ± 2%				
Undervoltage trip threshold	V_{DC}	360 ± 2%				
Supply currents:						
at 380 V_{AC}	A_{AC}	26	58	88	128	192
at 480 V_{AC}/528 V_{AC}	A_{AC}	21 / 19	46 / 42	70 / 64	102 / 93	152 / 139
at 480 V; S6-40%)	A_{AC}	27	60	92	134	201
Peak current (at 400 V_{AC}/480 V_{AC})	A_{AC}	54 / 45	107 / 89	139 / 116	200 / 166	267 / 222
Output currents at 600 V_{DC}:						
Rated current	A_{DC}	27	60	92	134	200
at S6-40%	A_{DC}	35	79	121	176	244
Peak current	A_{DC}	59	117	152	218	292
DC link busbar current carrying capacity	A_{DC}	100	100	200	200	200
24 V busbar current carrying capacity	A_{DC}	20	20	20	20	20
Electronics current consumption	A_{DC}	1.1	1.5	1.9	2	2.5
Total power loss (including electronic losses)[2]	W	286.4	666	945.,6	1,386	2,260
Max. ambient temperature without derating	°C	40	40	40	40	40
Max. ambient temperature with derating	°C	55	55	55	55	55
DC link capacitance	μF	705	1,410	1,880	2,820	3,995
Charge limit (DC link capacitance)	μF	20,000	20,000	20,000	20,000	20,000
Power factor	cosφ	1	1	1	1	1
Efficiency	η	0.98	0.98	0.98	0.98	0.98
Cooling method		Internal fan	Internal fan	Internal fan	Separate mounted fan	Separate mounted fan
Sound pressure level	dB(A)	<60	<65	<60	<73	<73
Cooling air requirement	m^3/h	56	112	160	520	520

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

[1] The specified values apply to 380 V

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

Rated duty cycles of Active Line Modules

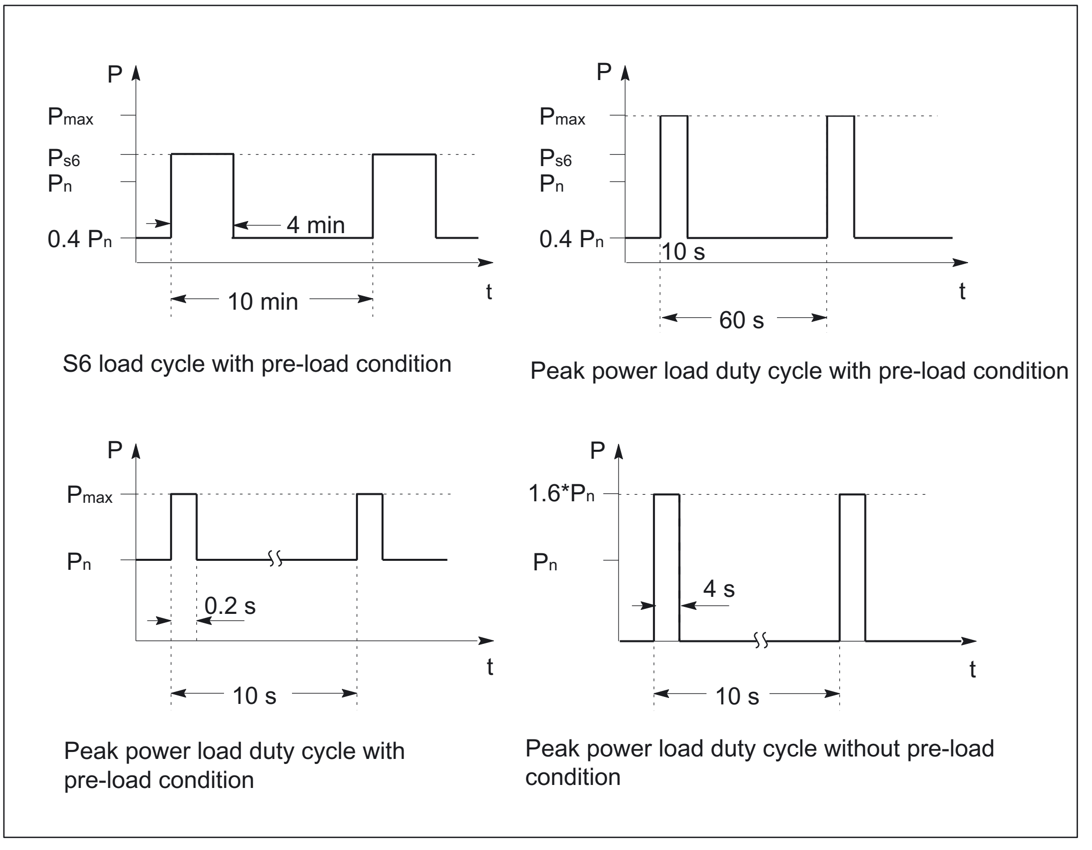


Figure 3-9 Rated duty cycles of Active Line Modules

Derating as a function of the ambient temperature

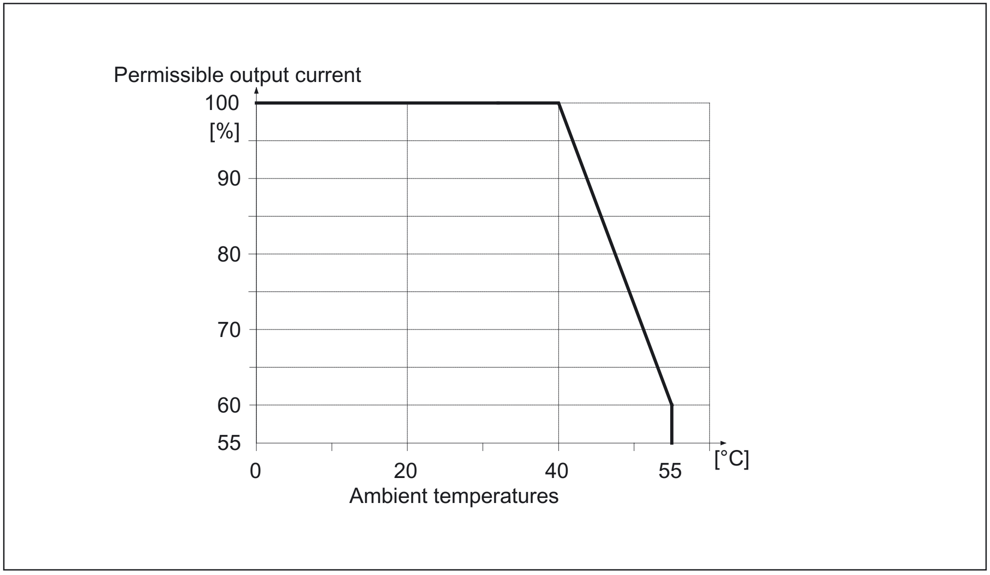


Figure 3-10 Derating as a function of the ambient temperature

Derating as a function of the installation altitude

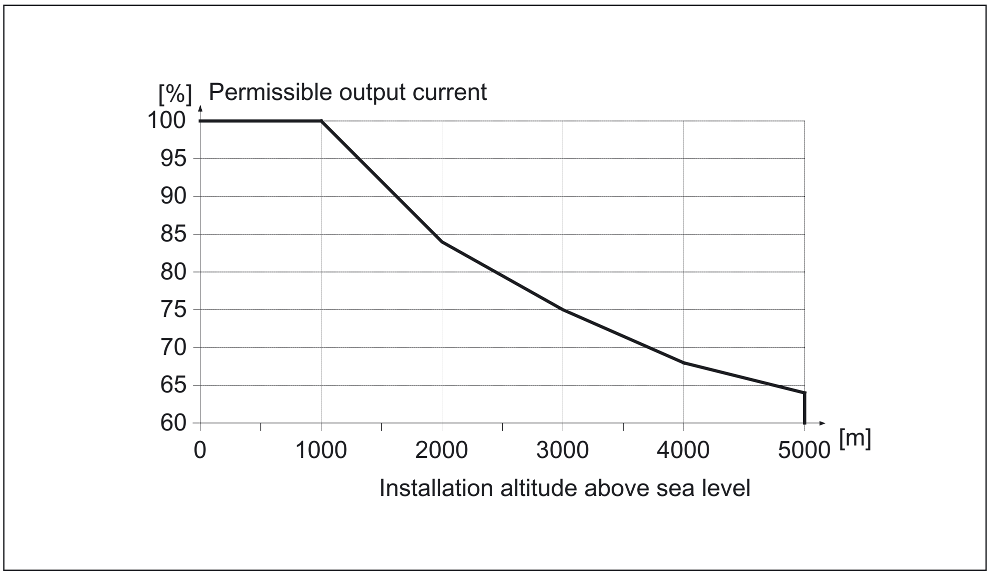


Figure 3-11 Derating as a function of the installation altitude

3.3 Active Line Modules with External Air Cooling

3.3.1 Description

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

This ensures that they are not influenced by network fluctuations.

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

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

The Active Line Modules are suitable for direct operation on TN, IT, and TT systems. 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 switching cabinet and mounted with a seal. The heat sink and the fan (included in the scope of supply) project beyond the rear of the switching cabinet and the heat is dissipated outside the switching cabinet or in a separate air duct.

3.3.2 Safety Information

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 press the release catch.
A suitable tool (e.g. screwdriver) must be used for this purpose.

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

Warning

A sufficiently high system fault level is required for tripping the fuses within the predefined time in the event of a ground fault. If the system fault level is too low, the fuse rupture times increase to an unacceptable level (e.g. fire is possible).

Caution

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

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

Caution

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

A set of labels in 16 languages is available under Order No.: 6SL3166-3AB00-0AAx.

Notice

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

Caution

It is only permissible to establish connections to the DC link using the adapters that Siemens has recommended (DC link adapter and DC link infeed 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.

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

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.

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 ratio between the system fault level and the rated power of the Line Module must be ≥ 70.

Caution

The left and right ends of the DC link busbar of a drive line-up must be closed using lateral covers (Order No.: 6SL3162-5AA00-0AA0).

Warning

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

3.3.3 Interface description

3.3.3.1 Overview

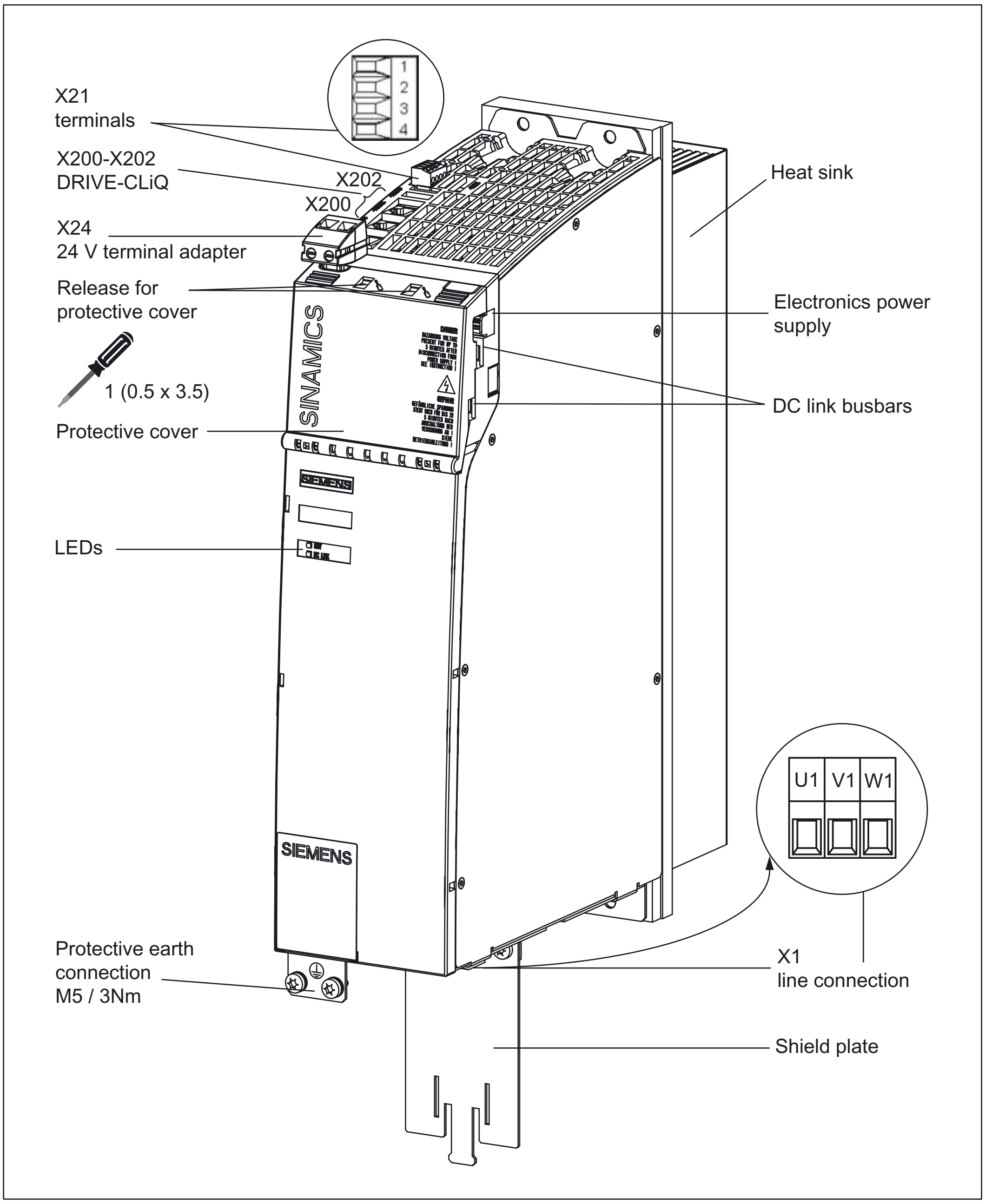
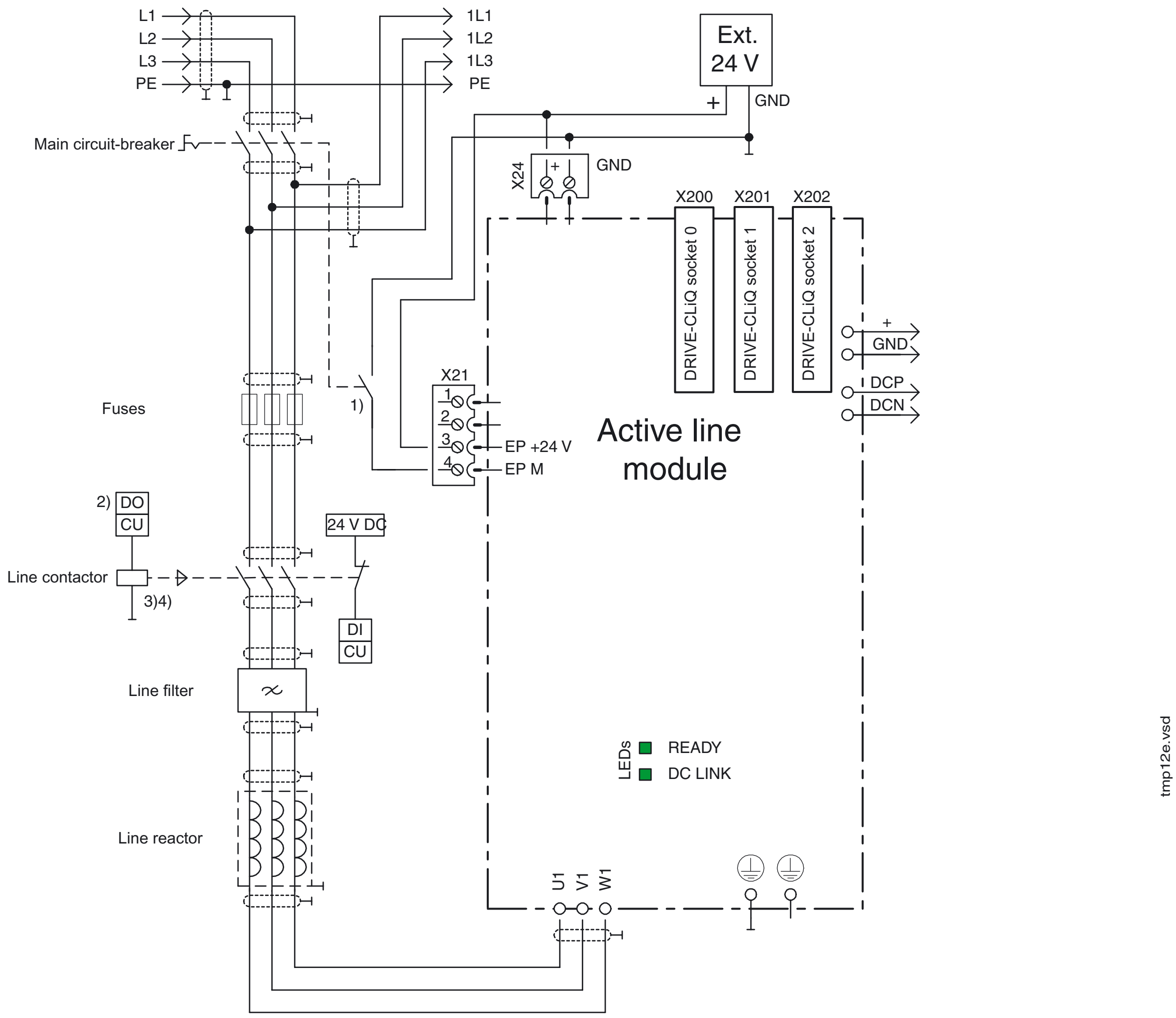


Figure 3-12 Active line module with external air cooling (example: 16 kW)

3.3.3.2 Connection example

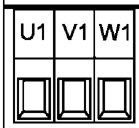
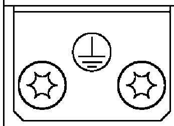


1) Leading break contact t >10 ms
2) DI/DO (controlled by the control unit)
3) No additional consumer permitted downstream of line contactor
4) The current carrying capacity of the DO must be taken into account
An output interface element may have to be used

Figure 3-13 Example connection of Active Line Module

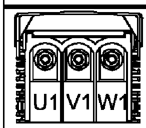
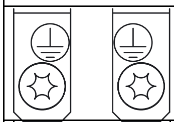
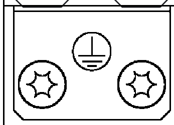
3.3.3.3 Line connection

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

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

[1] for ring cable lugs to DIN 46234

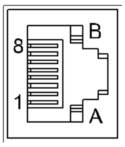
Table 3-12 Terminal block for the Active Line Module (36 kW to 120 kW)

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

[1] for ring cable lugs to DIN 46234

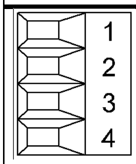
3.3.3.4 X200-X202 DRIVE-CLiQ interfaces

Table 3-13 DRIVE-CLiQ interface X200-X202

	PIN	Signal name	Technical specifications
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	24 V power supply
	B	GND (0 V)	Electronic ground
Blanking plate for DRIVE-CLiQ interface: Molex, order number: 85999-3255			

3.3.3.5 EP terminals X21

Table 3-14 Terminal block X21

	Terminal	Name	Technical specifications
	1	Reserved, do not use	
	2	Reserved, do not use	
	3	EP +24 V (Enable Pulses)	Voltage 24 V DC Current consumption: 10 mA Isolated input Signal propagation times: L → H 100 μs H → L: 1000 μs
	4	EP GND (Enable Pulses)	
Max. connectable cross-section: 1.5 mm² Type: Screw terminal 1 (see Connection Methods)			

Warning

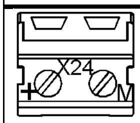
For operation, 24 V DC must be connected to terminal 3 and ground to terminal 4. Upon removal, pulse inhibit is activated. Feedback is deactivated and the bypass relay drops out. If the Line Module is not disconnected from the network when the EP terminal is deactivated (e.g. a main contactor is not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

Notice

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

3.3.3.6 X24 24 V terminal adapter

Table 3-15 Terminal block X24

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

3.3.3.7 Meaning of the LEDs on the active line module

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

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

Warning

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

The warning information on the components must be carefully observed!

Cause and rectification of faults

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

Reference: /IH1/ SINAMICS S120, Commissioning Manual.

3.3.4 Dimension Drawings

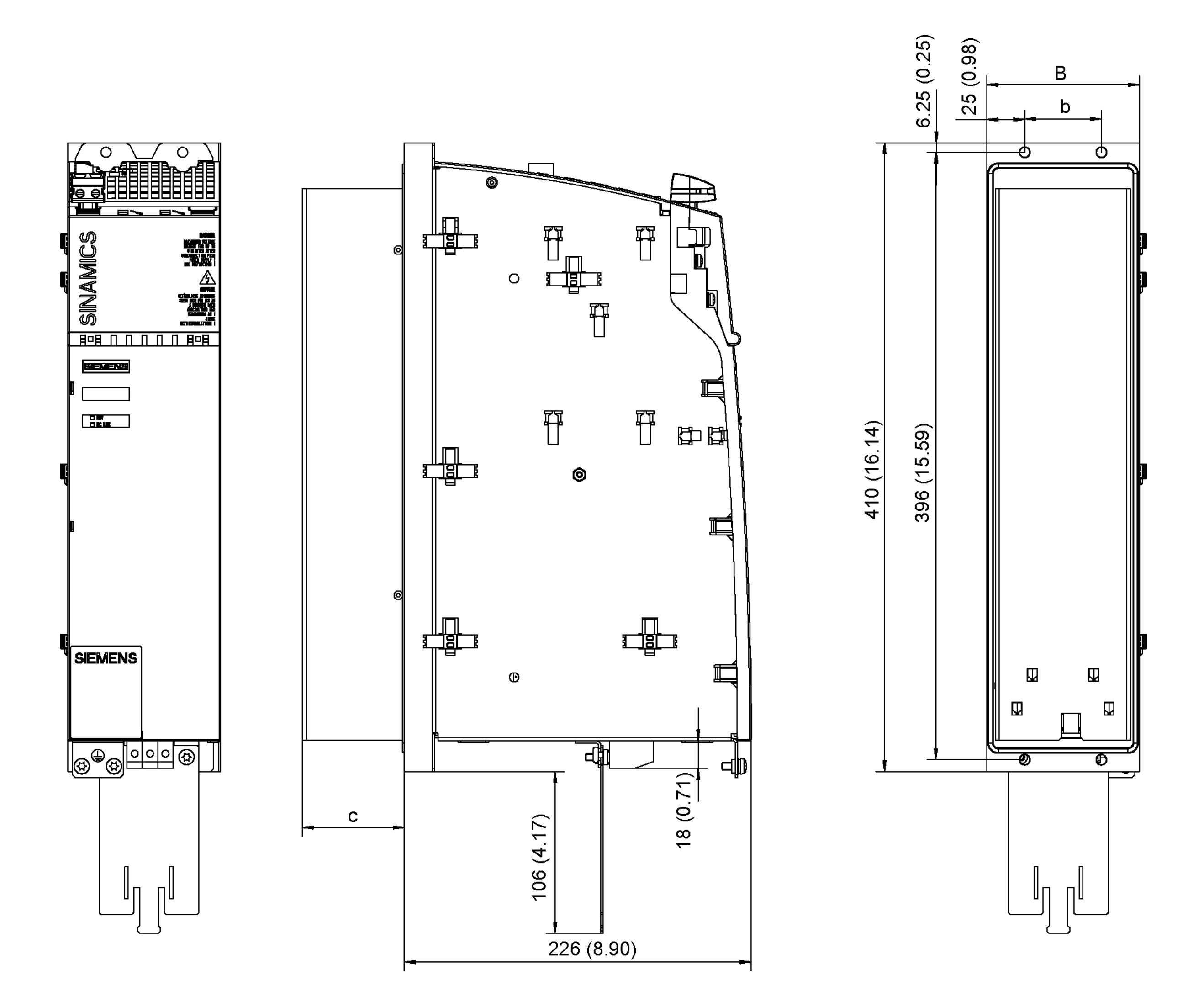


Figure 3-14 Dimension drawing of Active Line Module with external air cooling (16 kW)

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

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

Note

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

More information can be found in "Accessories".

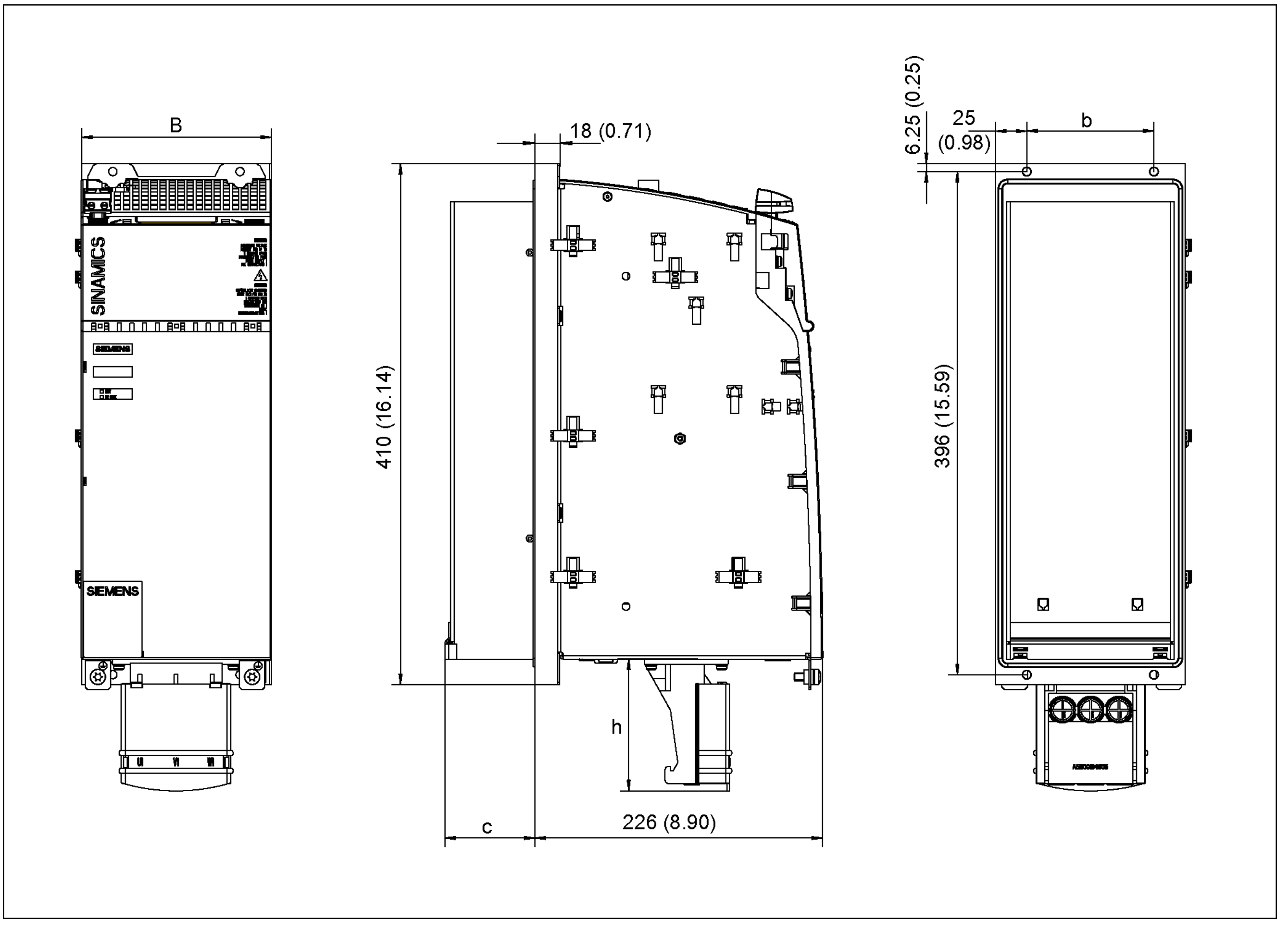


Figure 3-15 Dimension drawing of active line with external air cooling (36 kW, 55 kW, 80 kW, and 120 kW)

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

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

3.3.5 Installation

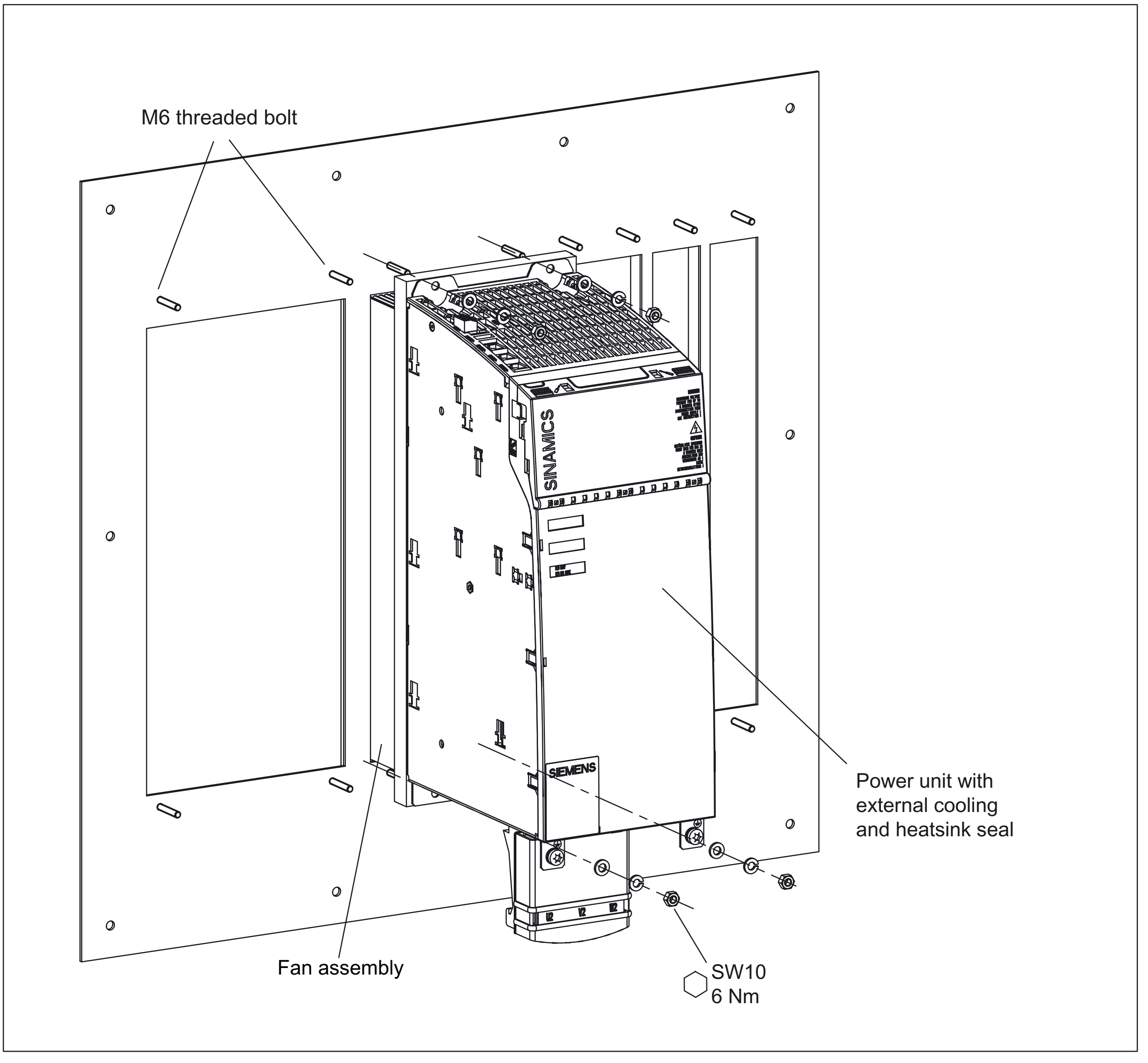


Figure 3-16 Example: installing the power unit with external air cooling

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: mailto:cc.cabinetcooling@siemens.com

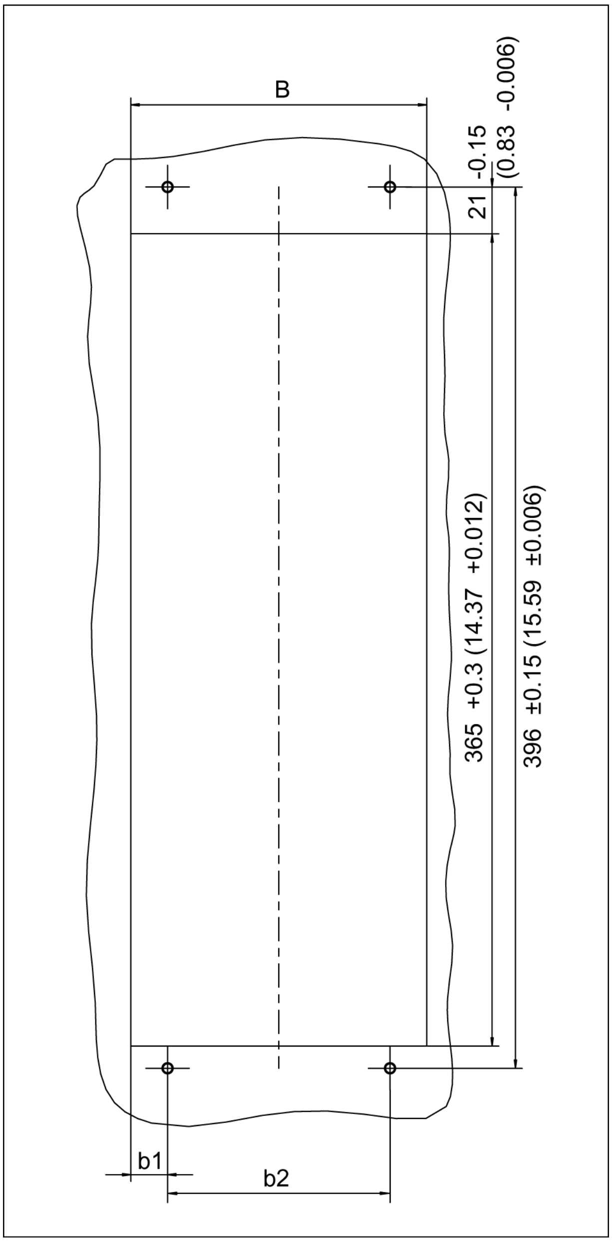


Figure 3-17 Installation openings for the power unit with external air cooling, 50 mm to 200 mm

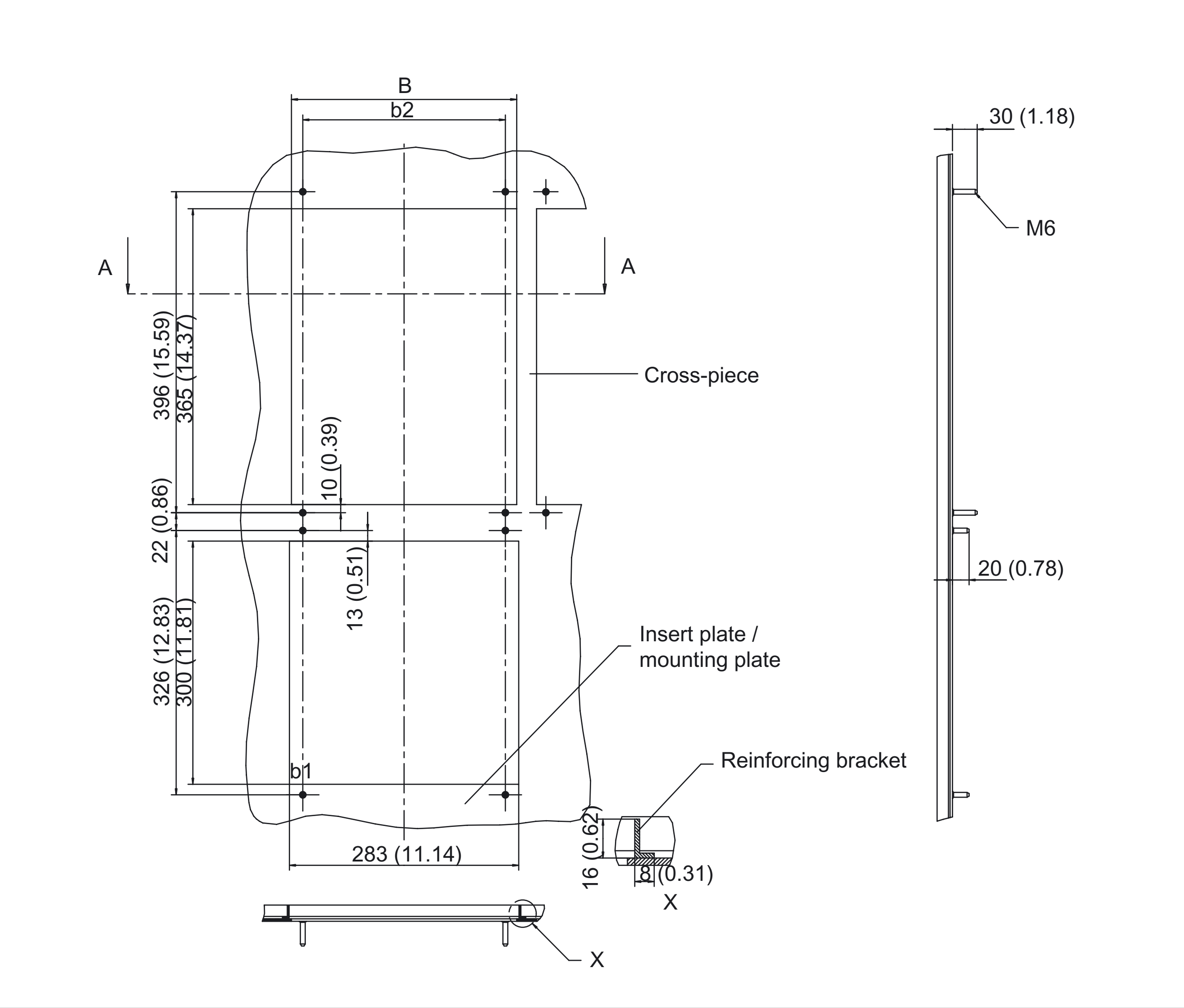


Figure 3-18 Installation openings for the power unit with external air cooling, 300 mm

Table 3-19 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)

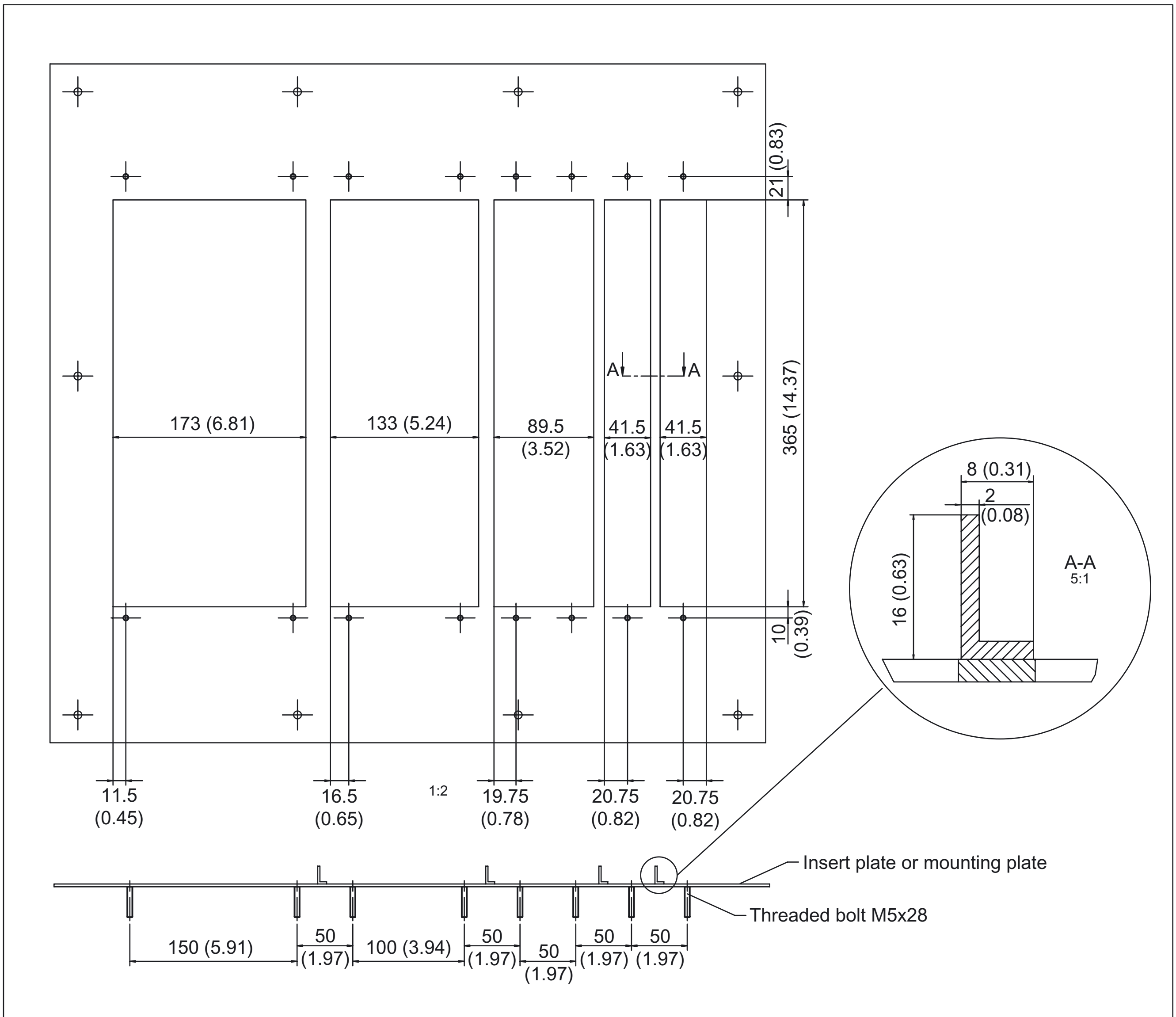


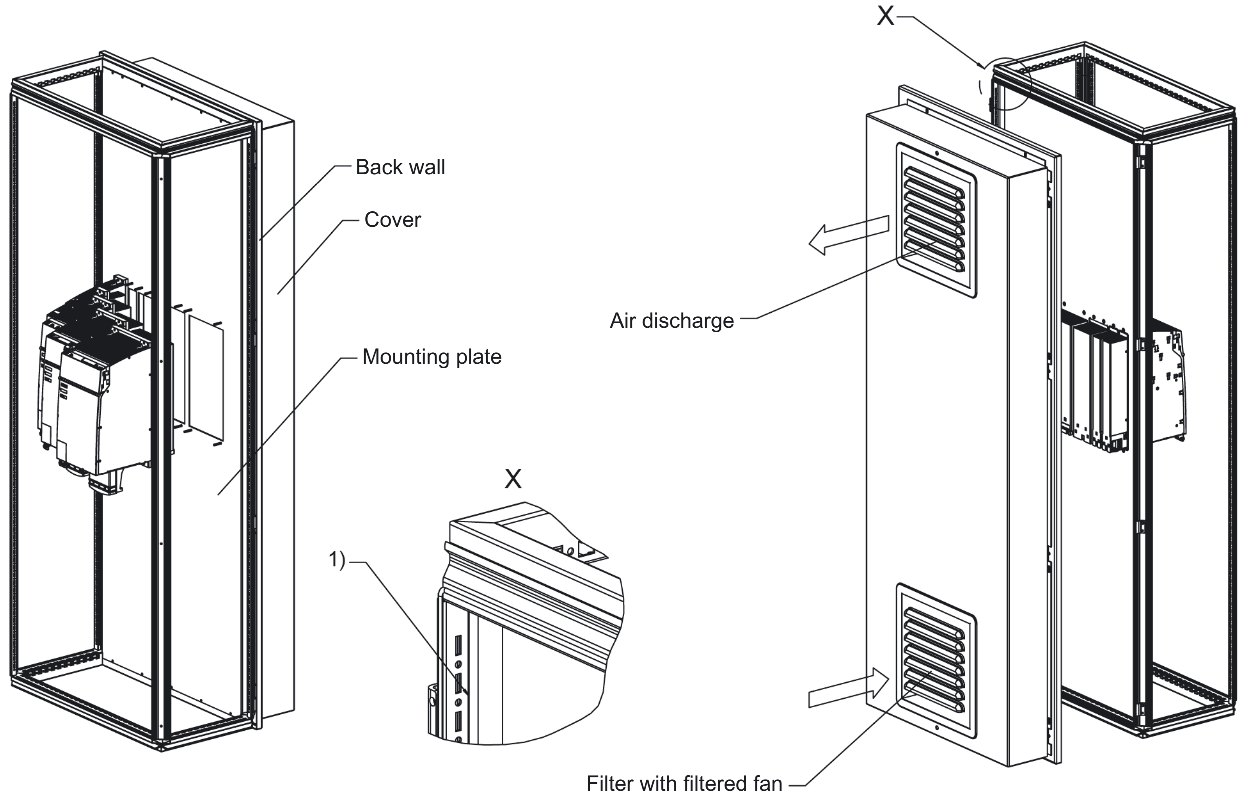
Figure 3-19 Example: mounting plate with a drive line-up

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

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

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

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



1) To comply with degree of protection IP54, the surfaces between the mounting plate and cabinet bar must be sealed all around. (e.g. use sealing agent Terostat-91 from Teroson)

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

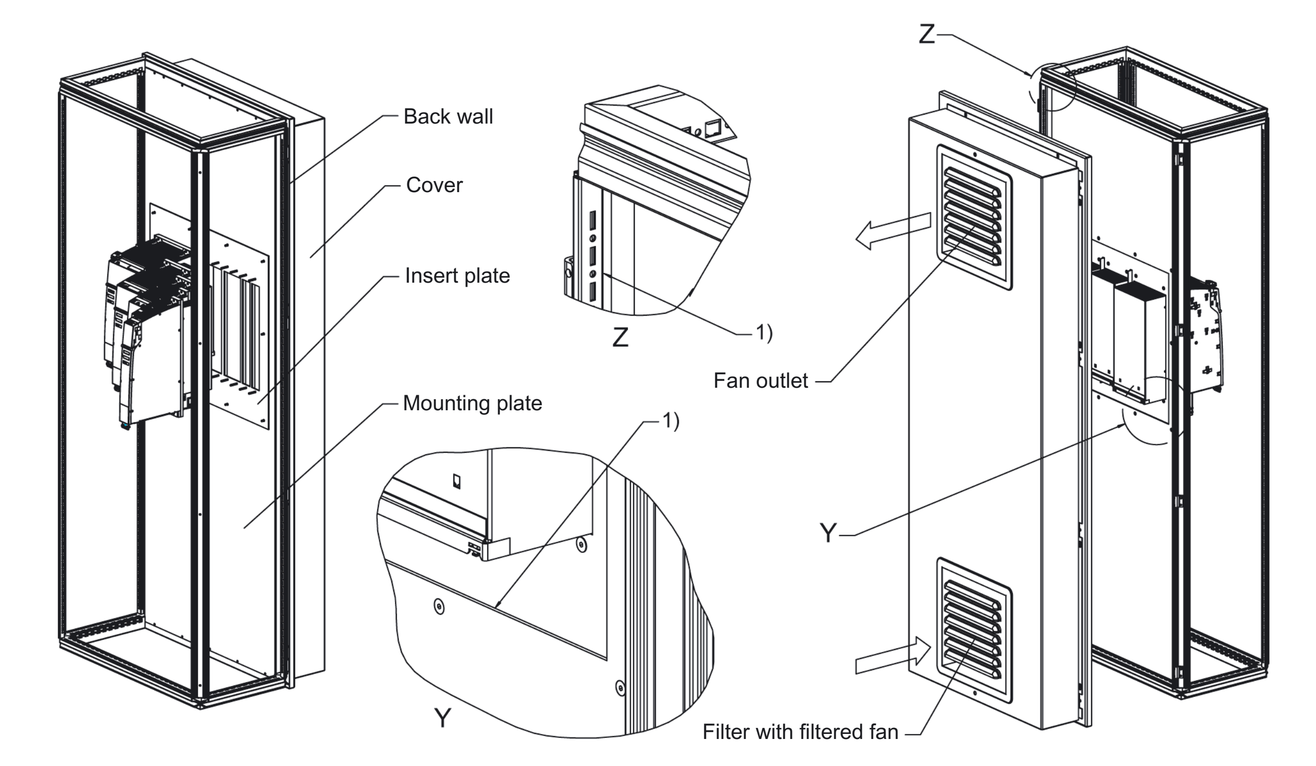


Figure 3-21 Example 2: installation in cabinet with mounting plate

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

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

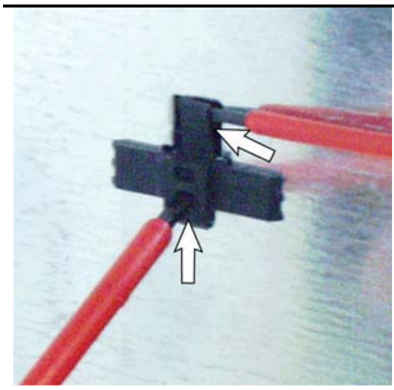
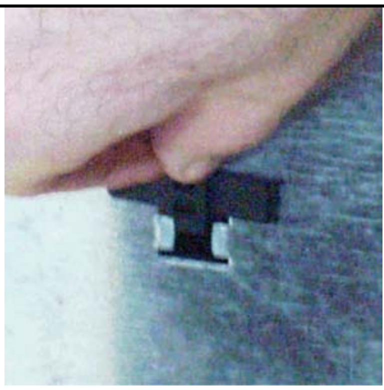
Note

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

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

Remove the holder for securing the Control Unit

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

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

3.3.6 Electrical connection

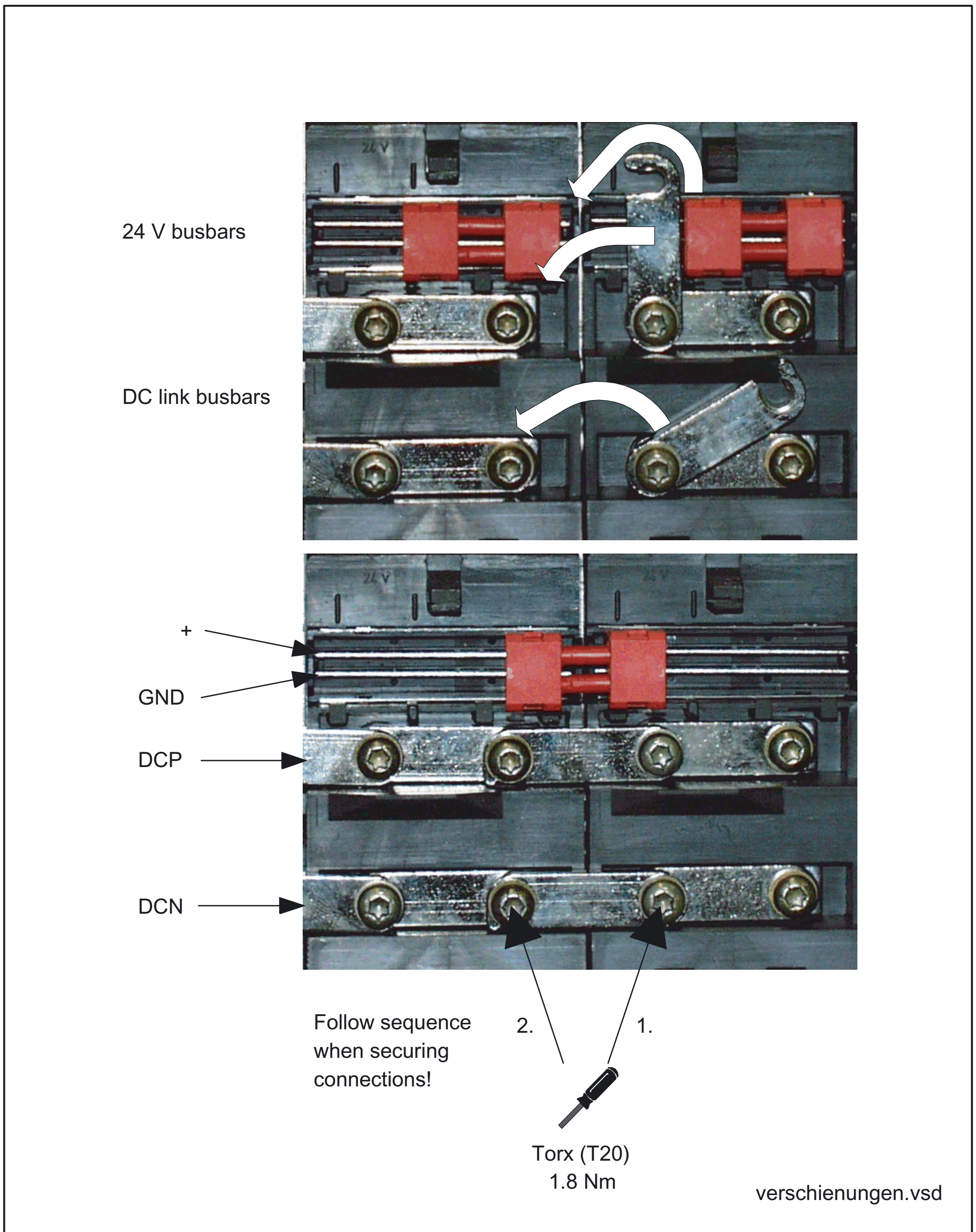


Figure 3-22 Busbar connections for booksize components

Notice

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

3.3.7 Technical specifications

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

Internal air cooling	6SL3131–	7TE21– 6AAx	7TE23– 6AAx	7TE25– 5AAx	7TE28– 0AAx	7TE31- 2AAx
Rated power	kW	16	36	55	80	120
Infeed: Rated power (S1)[1] Infeed power (S6-40%)[1] Peak infeed power[1]	 kW (Pn) kW (Ps6) kW (Pmax)	 16 21 35	 36 47 70	 55 71 91	 80 106 131	 120 145 175
Regenerative feedback: Continuous regenerative feedback power Peak regenerative feedback power	 kW kW	 16 35	 36 70	 55 91	 80 131	 120 175
Connection voltages: Line supply voltage Line supply frequency Electronics power supply	 V_{ACrms} Hz V_{DC}	 3-ph. 380 V AC -10% (-15% < 1 min) to 3-ph. 480 V AC +10% 47 to 63 Hz 24 (20.4 - 28.8)				
DC link voltage Overvoltage trip threshold Undervoltage trip threshold	V_{DC} V_{DC} V_{DC}	510 - 750 820 ± 2% 360 ± 2%				
Supply currents: at 380 V_{AC} at 480 V_{AC}/528 V_{AC} at 480 V (S6-40%) Peak current (at 400 V_{AC}/480 V_{AC})	 A_{AC} A_{AC} A_{AC} A_{AC}	 26 21 / 19 27 54 / 45	 58 46 / 42 60 107 / 89	 88 70 / 64 92 139 / 116	 128 102 / 93 134 200 / 166	 192 152 / 139 201 267 / 222
Output currents at 600 V_{DC}: Rated current at S6-40% Peak current	 A_{DC} A_{DC} A_{DC}	 27 35 59	 60 79 117	 92 121 152	 134 176 218	 200 244 292
DC link busbar current carrying capacity	A_{DC}	100	100	200	200	200
24 V busbar current carrying capacity	A_{DC}	20	20	20	20	20
Electronics current consumption	A_{DC}	1.1	1.5	1.9	2	2.5
Total power loss (including electronic losses)[2]	W	226.4	531	745.6	1,081	1,770
Max. ambient temperature without derating	°C	40	40	40	40	40
Max. ambient temperature with derating	°C	55	55	55	55	55
DC link capacitance	μF	705	1,410	1,880	2,820	3,995
Charging limit	μF	20,000	20,000	20,000	20,000	20,000
Power factor	cosφ	1	1	1	1	1
Efficiency	η	0.98	0.98	0.98	0.98	0.98
Sound pressure level	dB(A)	<60	<65	<60	<73	<73

Internal air cooling	6SL3131–	7TE21–6AAx	7TE23–6AAx	7TE25–5AAx	7TE28–0AAx	7TE31-2AAx
Rated power	**kW**	**16**	**36**	**55**	**80**	**120**
Cooling air requirement	m^3/h	56	112	160	520	520
Rated voltage for rated data, 3-ph. 380 V AC						
Weight	kg	8.78	13.77	18.5	27.66	30.74

[1] The specified values apply to 380 V

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

Rated duty cycles of Active Line Modules

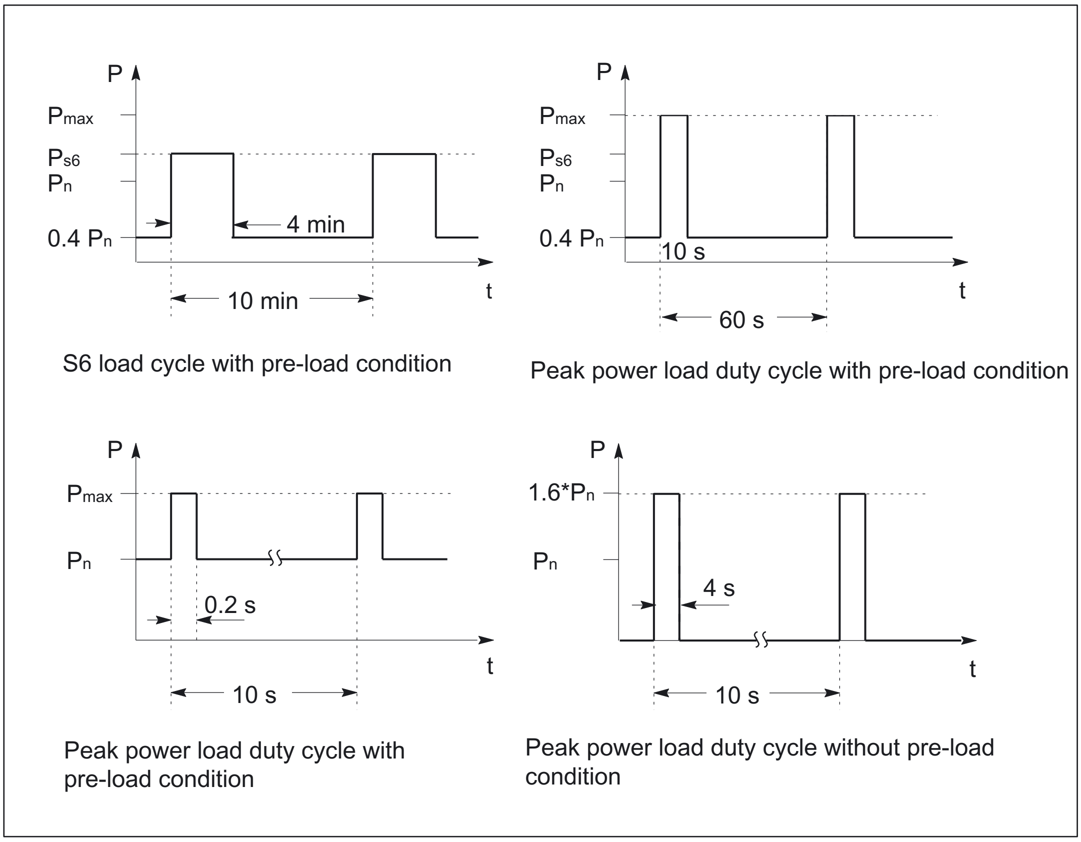


Figure 3-23 Rated duty cycles of Active Line Modules

Derating as a function of the ambient temperature

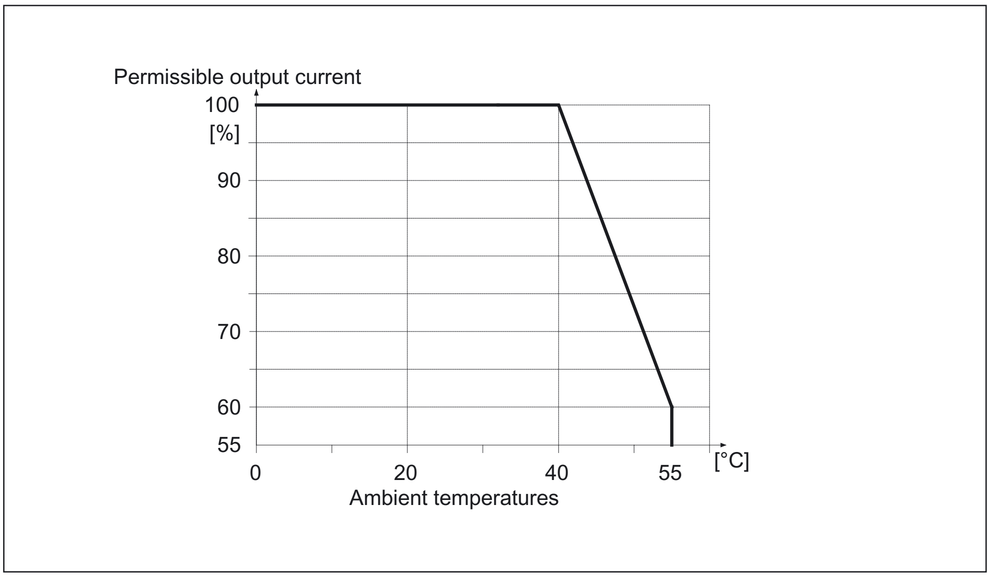


Figure 3-24 Derating as a function of the ambient temperature

Derating as a function of the installation altitude

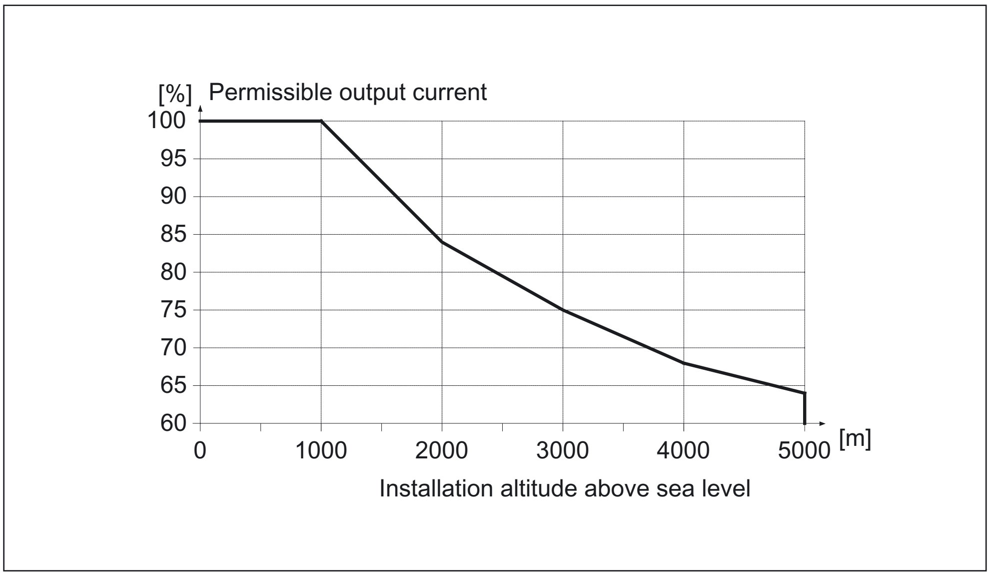


Figure 3-25 Derating as a function of the installation altitude

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

3.4.1 Description

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

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

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

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

3.4.2 Safety Information

Danger

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

Warning

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

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

Warning

A sufficiently high system fault level is required for tripping the fuses within the predefined time in the event of a ground fault. If the system fault level is too low, the fuse rupture times increase to an unacceptable level (e.g. fire is possible).

Caution

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

A set of labels in 16 languages is available under Order No.: 6SL3166-3AB00-0AAx.

Notice

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

Caution

It is only permissible to establish connections to the DC link using the adapters that Siemens has recommended (DC link adapter and DC link infeed 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 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 ratio of line short-circuit power to rated power must be ≧ 70.

Caution

The left and right ends of the DC link busbar of a drive line-up must be closed using lateral covers (Order No.: 6SL3162-5AA00-0AA0).

Warning

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

3.4.3 Interface Description

3.4.3.1 Overview

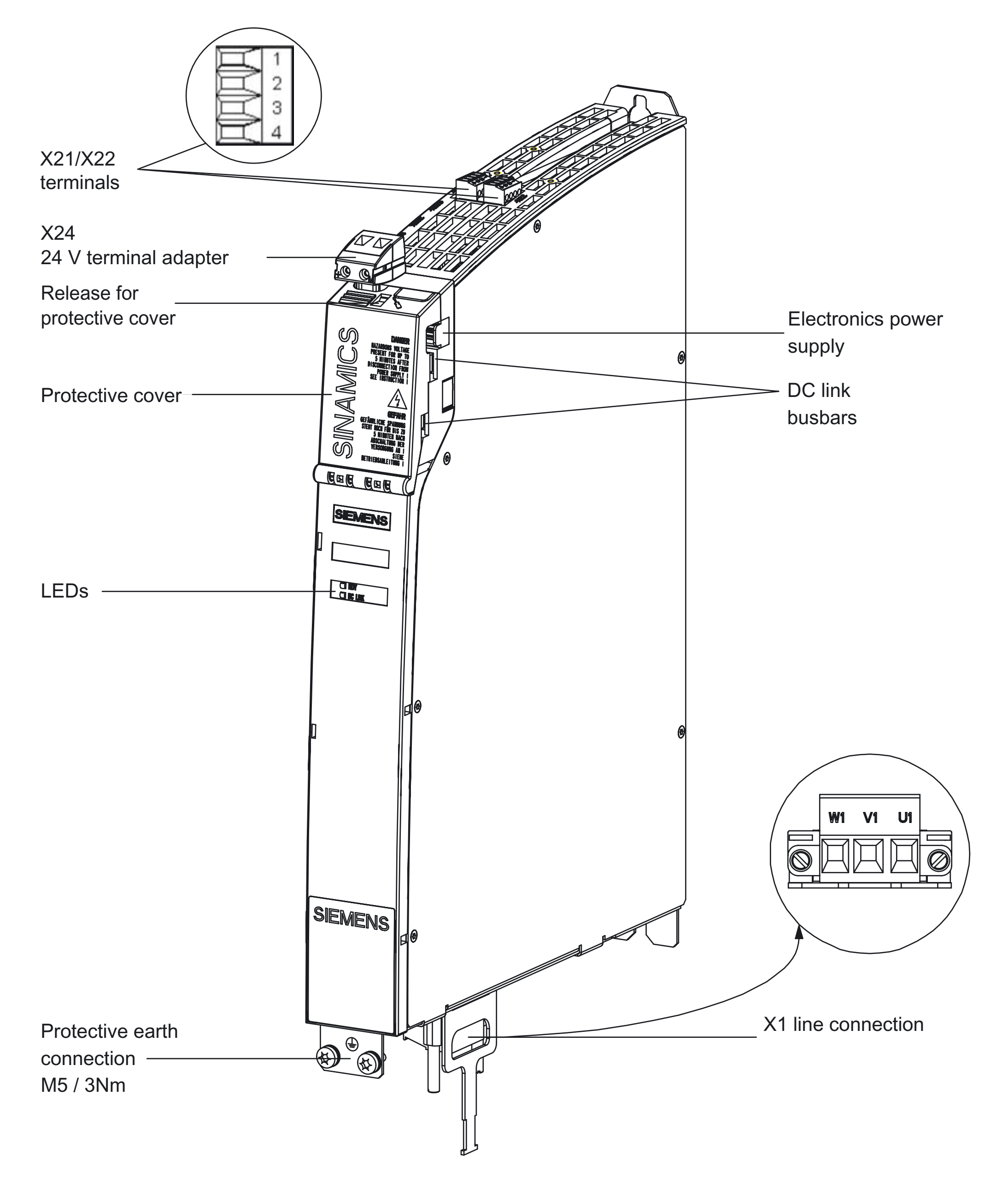
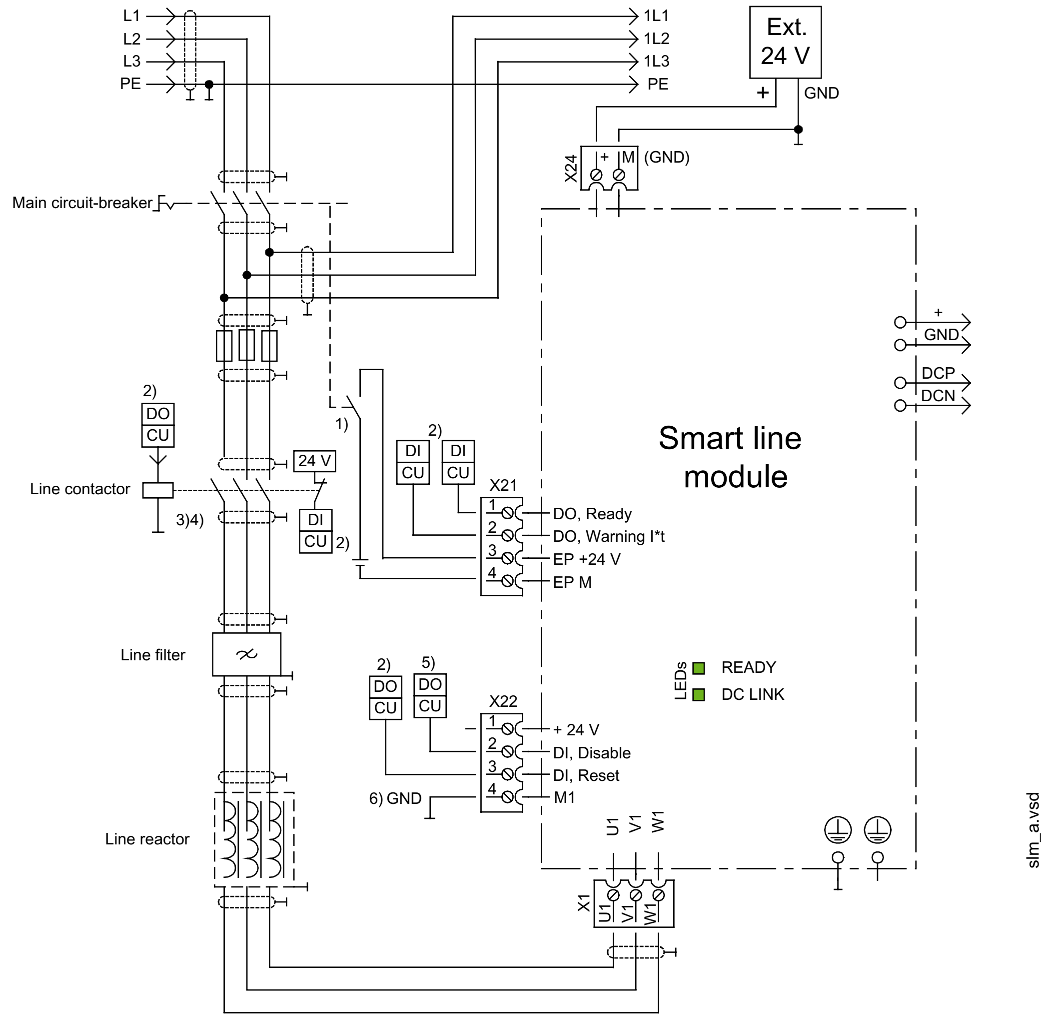


Figure 3-26 Smart line module with internal air cooling (example 5 kW)

3.4.3.2 Connection example

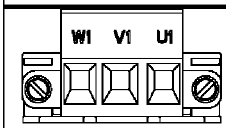
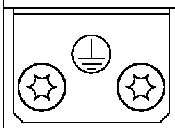


1) Leading break contact t>10ms
2) DI/DO (controlled by the control unit)
3) No additional consumer permitted downstream of line contactor
4) The current carrying capacity of the DO must be taken into account
An output interface element may have to be used
5) DO high, feedback deactivated (for permanent deactivation, a jumper can be installed between X22 pins 1 and 2)
6) X22 pin 4 must be connected to ground (ext. 24 V).

Figure 3-27 Example connection of Smart Line Module

3.4.3.3 X1 line connection

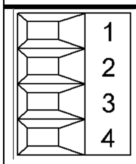
Table 3-21 Terminal block X1 of Smart Line Module (5 kW and 10 kW)

	Terminal	Technical data
	U1 V1 W1	Max. connection voltage: 3-ph. 480 V AC +10 at 47 Hz to 63 Hz Max. connectable cross-section: 6 mm² Type: Screw terminal 5 (see Connection Methods) Tightening torque: 1.2 - 1.5 Nm
	PE connection	Threaded hole M5/3 Nm [1]

[1] for ring cable lugs to DIN 46234

3.4.3.4 X21 terminals: smart line module

Table 3-22 Terminal block X21

	Terminal	Name	Technical data
	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	Pre Warning	DO: Pre-warning threshold, overtemperature / I x t High = no pre-warning Low = pre-warning
	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 mm² Type: Screw terminal 1 (see Spring-Loaded Terminals/Screw Terminals)			

Note

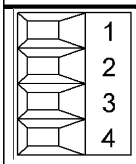
For operation, 24 V DC must be connected to terminal 3 and ground to terminal 4. When removed, pulse inhibit is activated, feedback is deactivated and the bypass relay drops out. If the Line Module is not disconnected from the network when the EP terminal is deactivated (e.g. a main contactor is not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

Notice

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

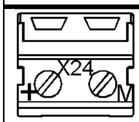
3.4.3.5 X22 terminals: smart line module

Table 3-23 Terminal block X22

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

3.4.3.6 X24 24 V terminal adapter

Table 3-24 Terminal block X24

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

3.4.3.7 Meaning of the LEDs on the smart line module

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

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

Warning

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

The warning information on the components must be carefully observed!

Cause and rectification of faults

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

Reference: /IH1/ SINAMICS S120 Commissioning Manual

3.4.4 Dimension Drawing

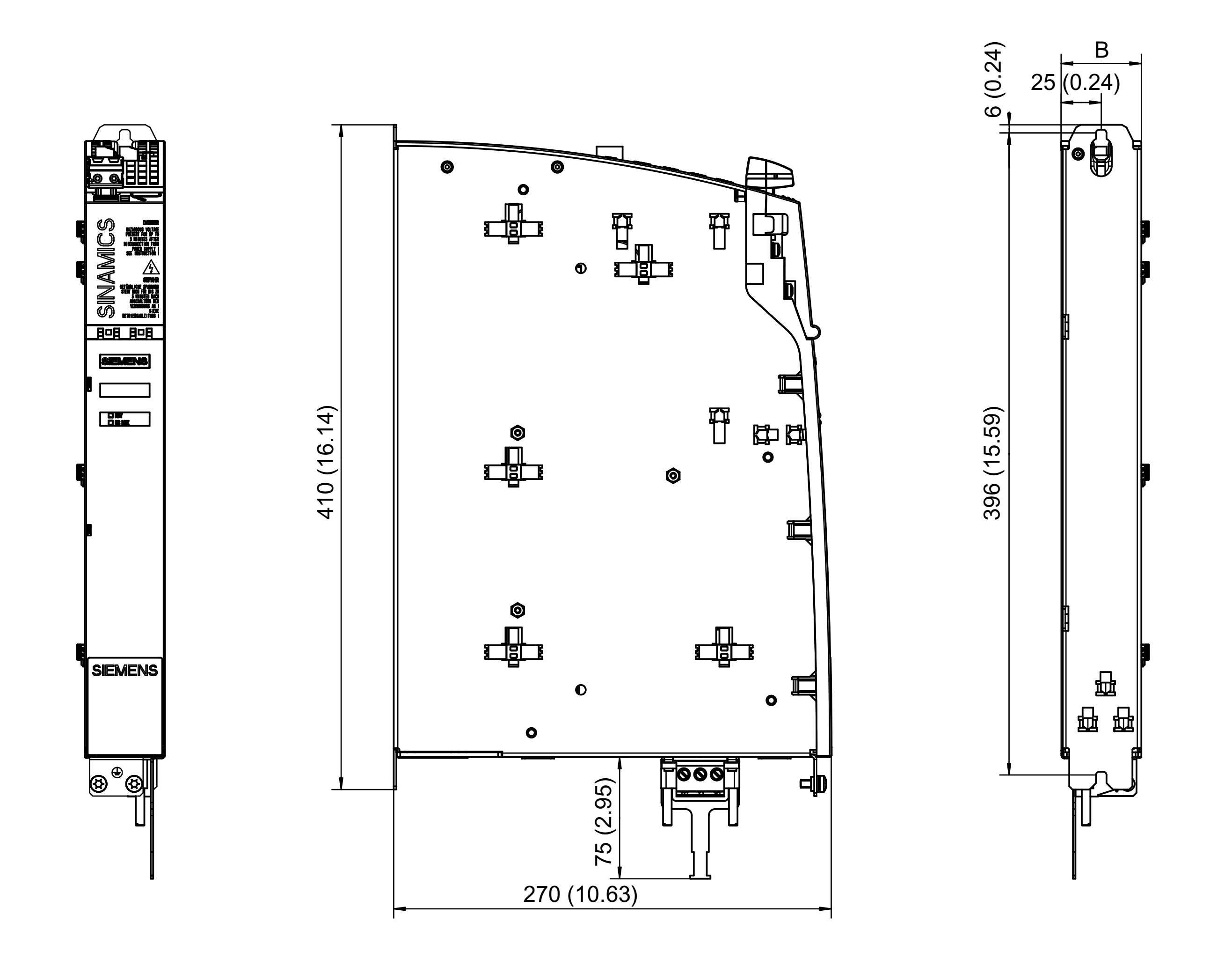


Figure 3-28 Dimension drawing of the 5 kW and 10 kW Smart Line Modules with internal air cooling

Table 3-26 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

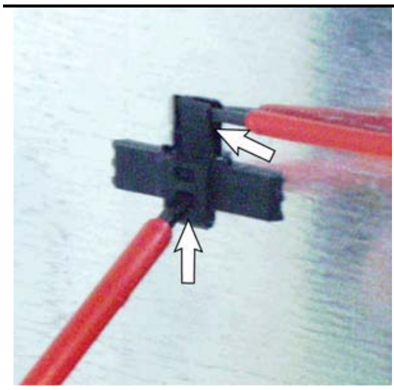
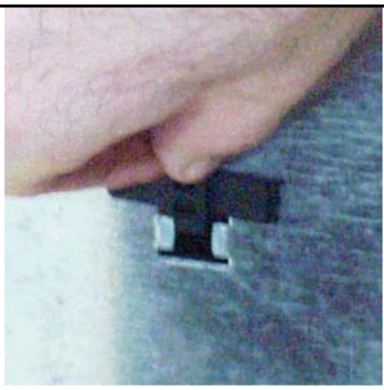
The shielded terminal plate is part of the scope of supply of the 50 mm Smart Line Module.

3.4.5 Installation

Remove the holder for securing the Control Unit

Various expansion version make it necessary to remove the plastic retaining element:

- If the component to be mounted comes into contact with the lefthand cabinet panel
- for a center infeed using 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

3.4.6 Electrical Connection

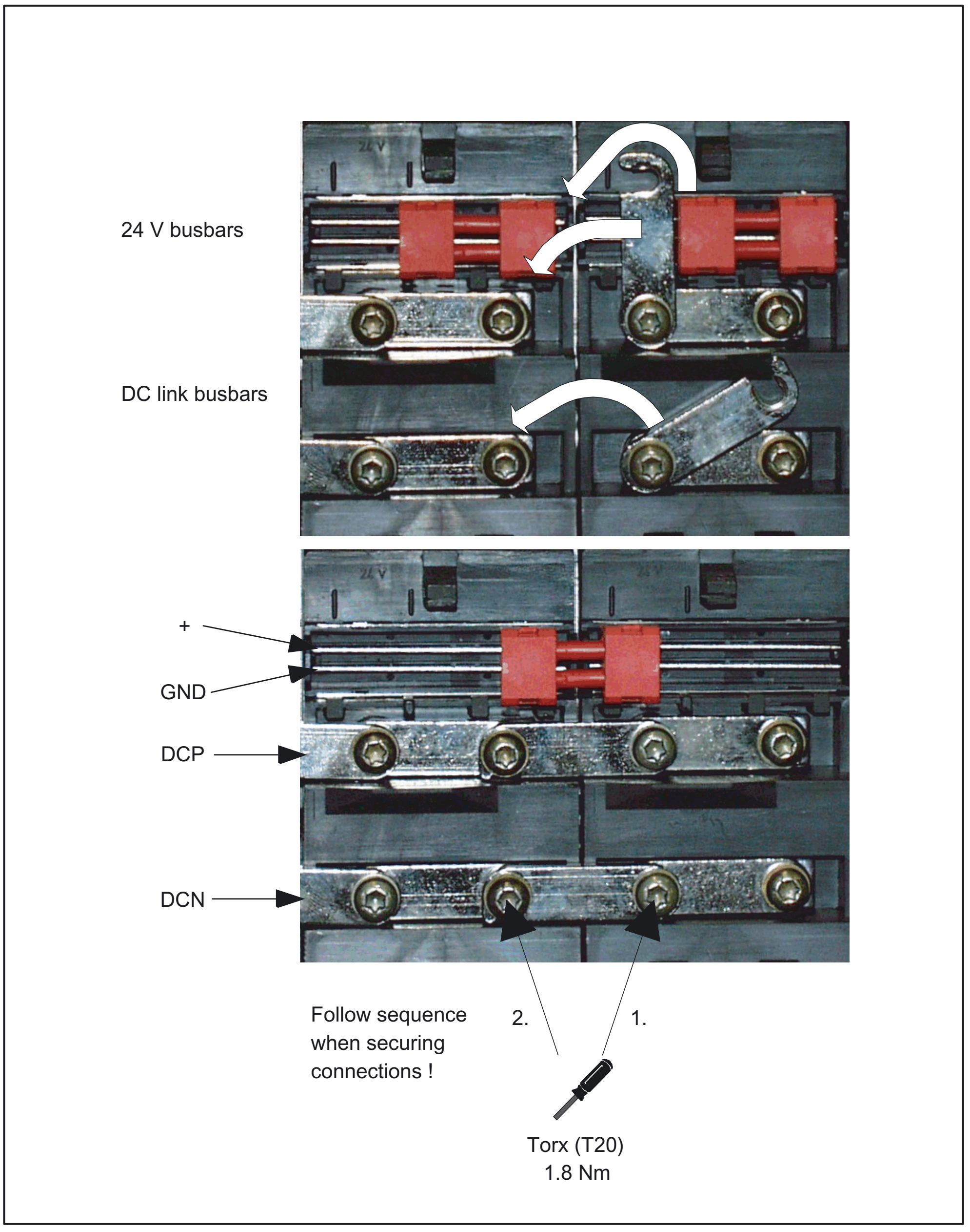


Figure 3-29 Busbar connections for booksize components

3.4.7 Technical Specifications

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

Internal air cooling	6SL3130–	6AE15–0AAx	6AE21–0AAx
Rated power	**kW**	**5**	**10**
Supply: Rated power (S1)[1] S6 infeed Power rating (S6-40%)[1] Peak power rating[1]	 kW (Pn) kW (Ps6) kW (Pmax)	 5 6.5 10	 10 13 20
Regenerative feedback: Continuous regenerative power rating Peak regenerative power rating	 kW kW	 5 10	 10 20
Connection voltages: Line voltage Line frequency Electronics power supply	 V_{AC} Hz V_{DC}	 3AC 380 -10% to 3AC 480 +10% (-15% < 1 min) 47 to 63 24 (20.4 - 28.8)	
DC link voltage Overvoltage trip threshold Undervoltage trip threshold	V_{DC} V_{DC} V_{DC}	510 – 750 820 ± 2% 360 ± 2%	
Supply currents: at 380 V_{AC} at 480 V_{AC}/528 V_{AC} at 480 V; S6-40%) Peak current (at 400 V_{AC}/480 V_{AC})	 A_{AC} A_{AC} A_{AC} A_{AC}	 12 9.3/8.5 12 22/18.5	 24 18/16.5 24 44/37
Output currents at 600 V_{DC}: Rated current at S6-40% Peak current	 A_{DC} A_{DC} A_{DC}	 8.3 11 16.6	 16.6 22 33.2
DC link busbar current carrying capacity	A_{DC}	100	100
24 V busbar current carrying capacity	A_{DC}	20	20
Electronics current consumption	A_{DC}	1.0	1.3
Total power loss (including electronic losses)[2]	W	113	201.2
Max. ambient temperature without derating	°C	40	40
Max. ambient temperature with derating	°C	55	55
DC link capacitance	μF	220	330
Charging limit	μF	6,000	6,000
Power factor	cos φ	1	1
Efficiency	η	0.98	0.98
Cooling method		Internal fan	Internal fan
Sound pressure level	dB(A)	<60	<60
Cooling air requirement	m^3/h	29.6	29.6

Internal air cooling	6SL3130–	6AE15–0AAx	6AE21–0AAx
Rated power	**kW**	**5**	**10**
Rated voltage for rated data 3 AC 380 V			
Weight	kg	4.68	4.78

[1] The specified values apply to 380 V

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

Rated duty cycles of Smart Line Modules

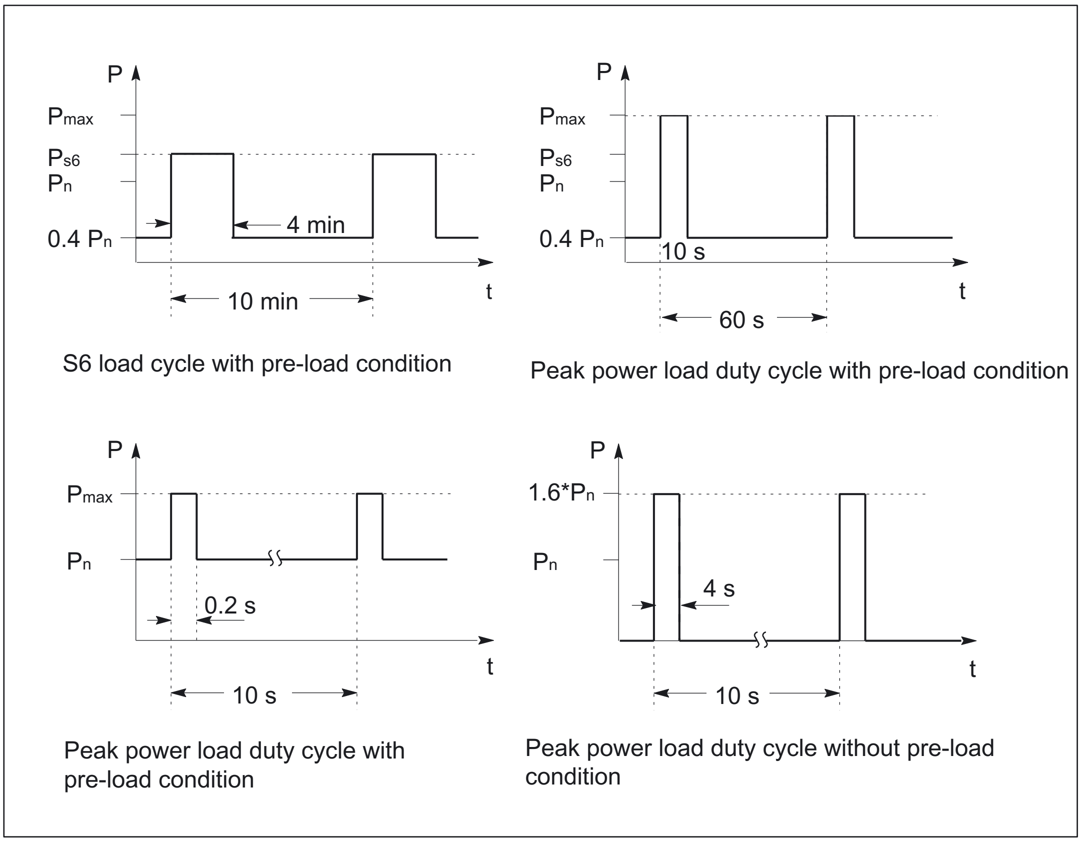


Figure 3-30 Rated duty cycles of Smart Line Modules

Derating as a function of the ambient temperature

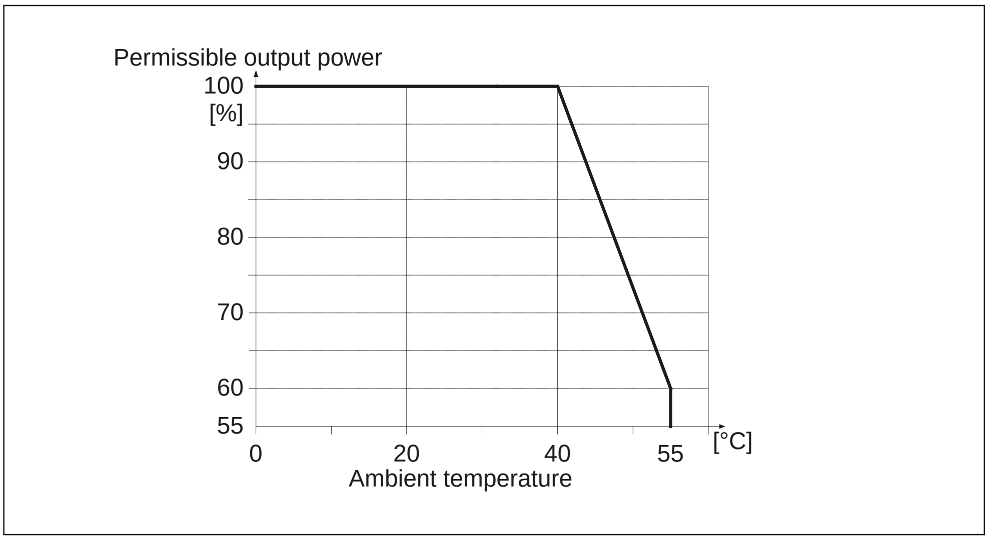


Figure 3-31 Derating as a function of the ambient temperature

Derating as a function of the installation altitude

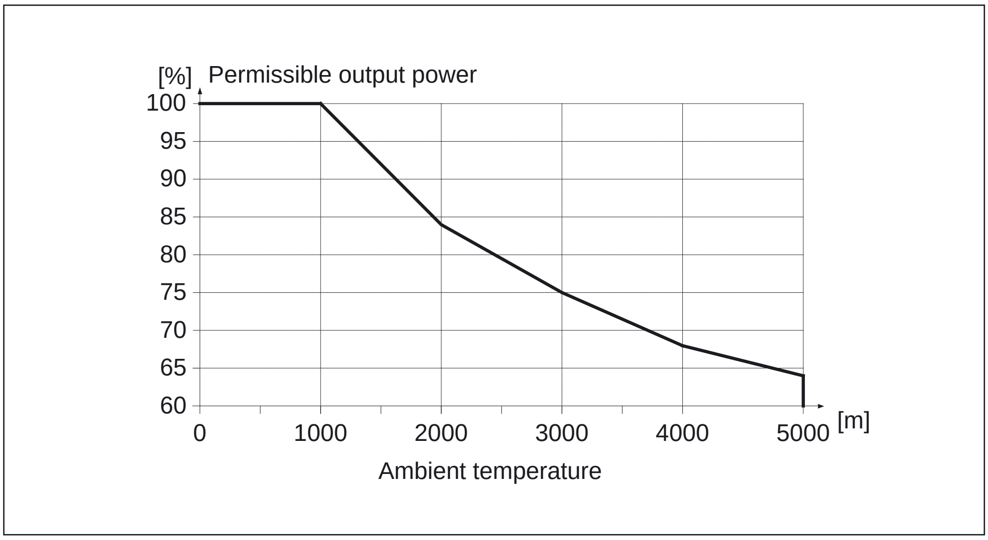


Figure 3-32 Derating as a function of the installation altitude

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

3.5.1 Description

The Smart Line Module 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 Lines Modules are equipped with a DRIVE-CLiQ connection.

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

Smart Line Modules are suitable for direct operation in TN, IT, and TT systems. 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 press the release catch.
A suitable tool (e.g. screwdriver) must be used for this purpose.

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

Warning

A sufficiently high system fault level is required for tripping the fuses within the predefined time in the event of a ground fault. If the system fault level is too low, the fuse rupture times increase to an unacceptable level (e.g. fire is possible).

Caution

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

A set of labels in 16 languages is available under Order No.: 6SL3166-3AB00-0AAx.

Notice

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

Caution

It is only permissible to establish connections to the DC link using the adapters that Siemens has recommended (DC link adapter and DC link infeed 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 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 ratio of line short-circuit power to rated power must be ≧ 70.

Caution

The left and right ends of the DC link busbar of a drive line-up must be closed using lateral covers (Order No.: 6SL3162-5AA00-0AA0).

Warning

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

Note

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

3.5.3 Interface description

3.5.3.1 Overview

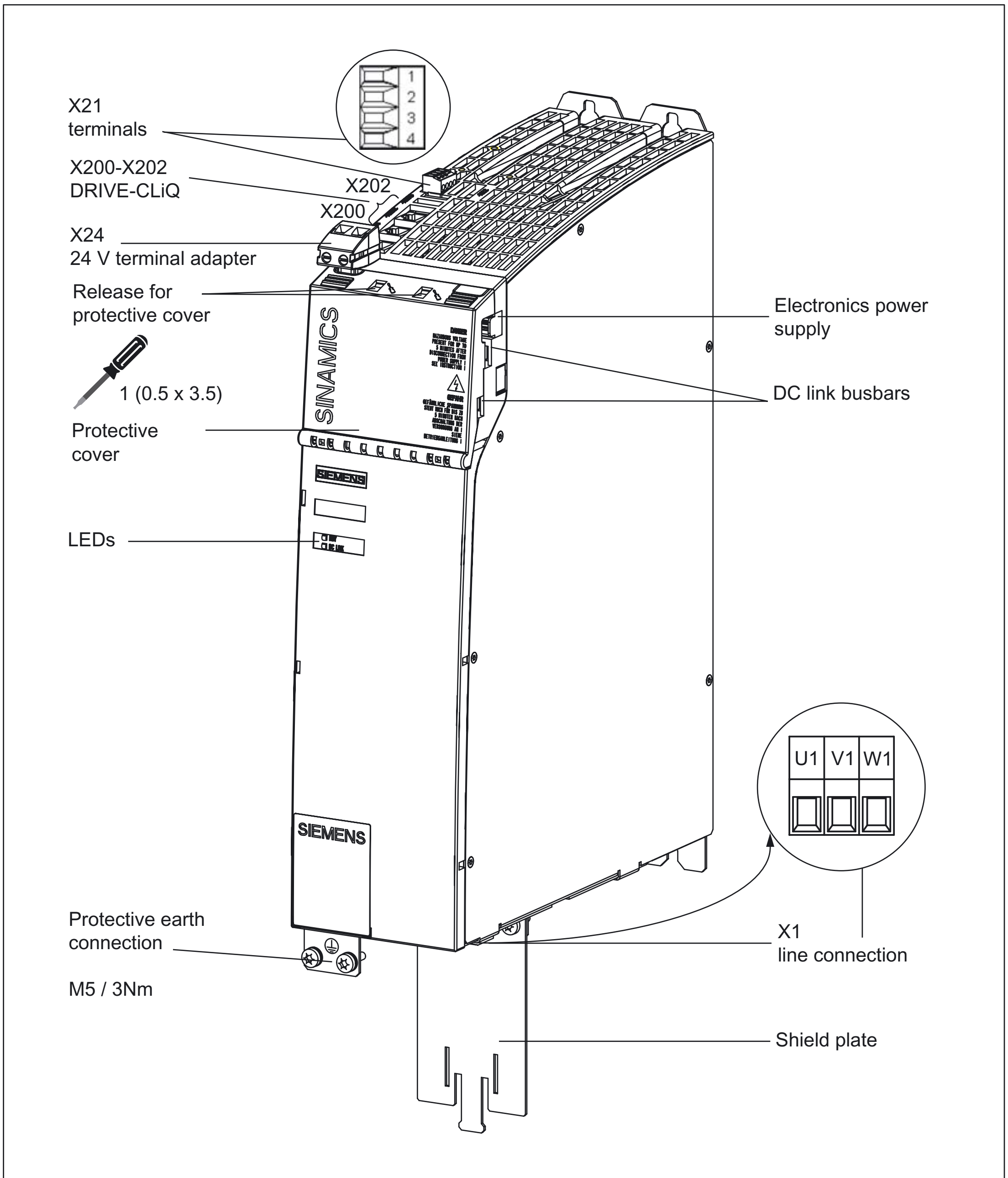


Figure 3-33 Smart Line Module with internal air cooling (example 16 kW)

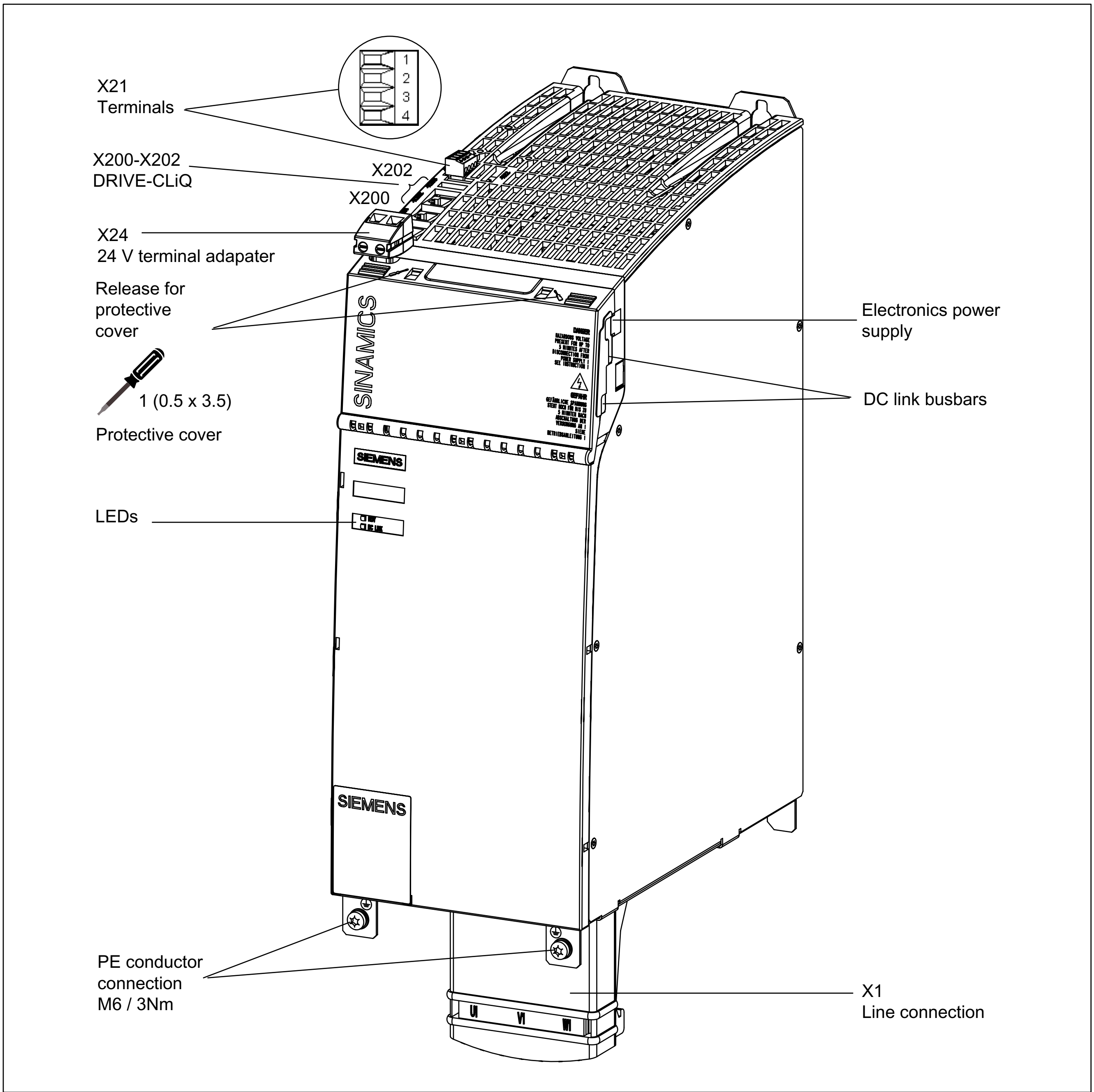
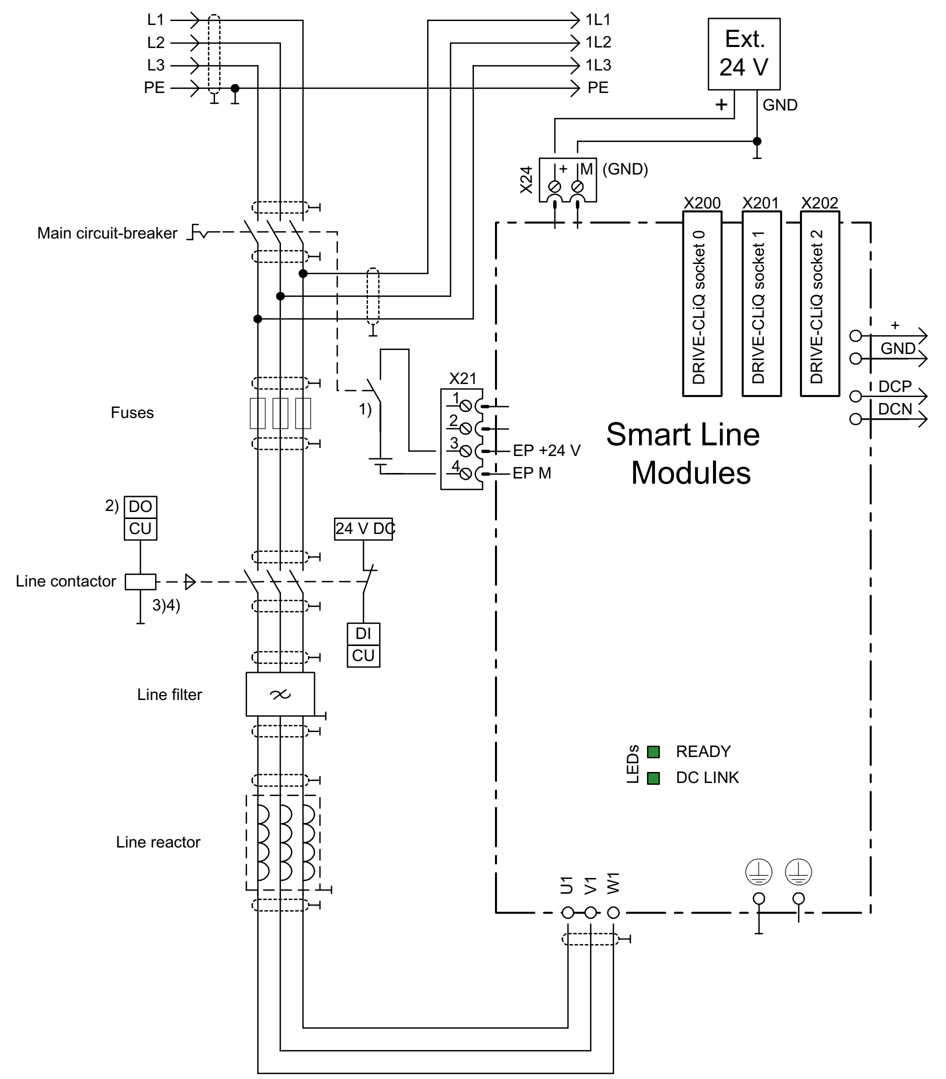


Figure 3-34 Smart Line Module with internal air cooling (example 36 kW)

3.5.3.2 Connection example

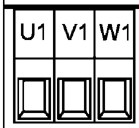
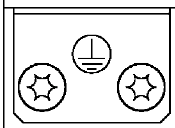


1) Leading opening contact t >10 ms
2) DI/DO (controlled by Control Unit)
3) No additional consumer permitted downstream of line contactor
4) Note the current carrying capacity of the DO.
   An output interface element may have to be used.

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

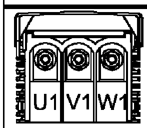
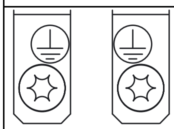
3.5.3.3 X1 line connection

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

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

[1] for ring cable lugs to DIN 46234

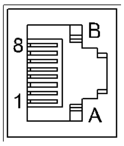
Table 3-29 Terminal block Smart Line Module 36 kW

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

[1] for ring cable lugs to DIN 46234

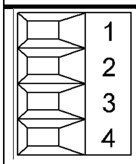
3.5.3.4 X200-X202 DRIVE-CLiQ interfaces

Table 3-30 DRIVE-CLiQ interface X200-X202

	PIN	Signal name	Technical specifications
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	24 V power supply
	B	GND (0 V)	Electronic ground
Blanking plate for DRIVE-CLiQ interface: Molex, order number: 85999-3255			

3.5.3.5 EP terminals X21

Table 3-31 Terminal block X21

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

Warning

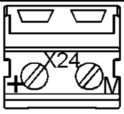
For operation, 24 V DC must be connected to terminal 3 and ground to terminal 4. Upon removal, pulse inhibit is activated. Feedback is deactivated and the bypass relay drops out. If the Line Module is not disconnected from the network when the EP terminal is deactivated (e.g. a main contactor is not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

Notice

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

3.5.3.6 X24 24 V terminal adapter

Table 3-32 Terminal block X24

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

3.5.3.7 Meaning of the LEDs on the Smart Line Module

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

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

Warning

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

The warning information on the components must be carefully observed!

Cause and rectification of faults

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

Reference: /IH1/ SINAMICS S120, Commissioning Manual.

3.5.4 Dimension Drawings

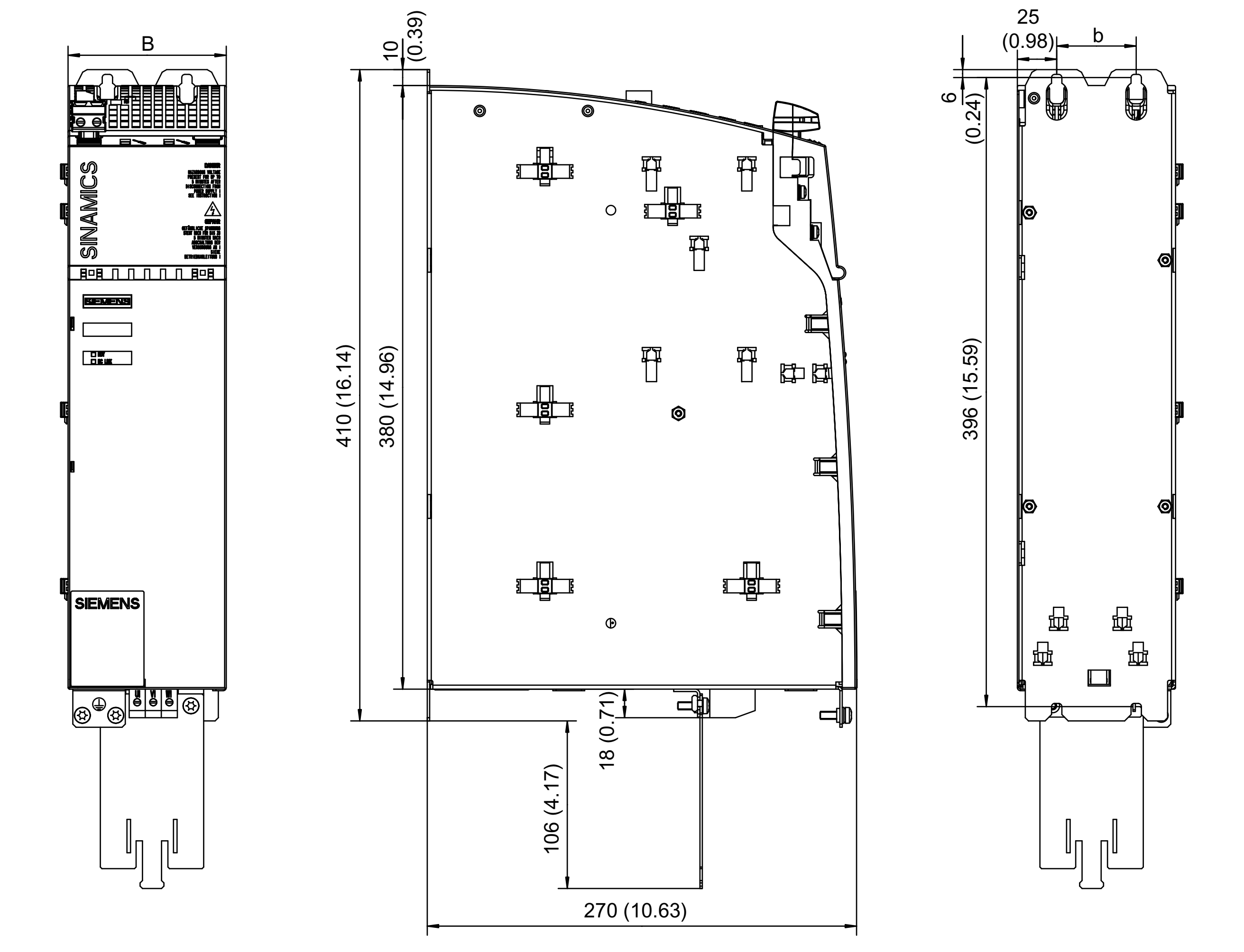


Figure 3-36 Dimension drawing of the Smart Line Module (16 kW) with internal air cooling

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

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

Note

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

Further details can be found in "Accessories".

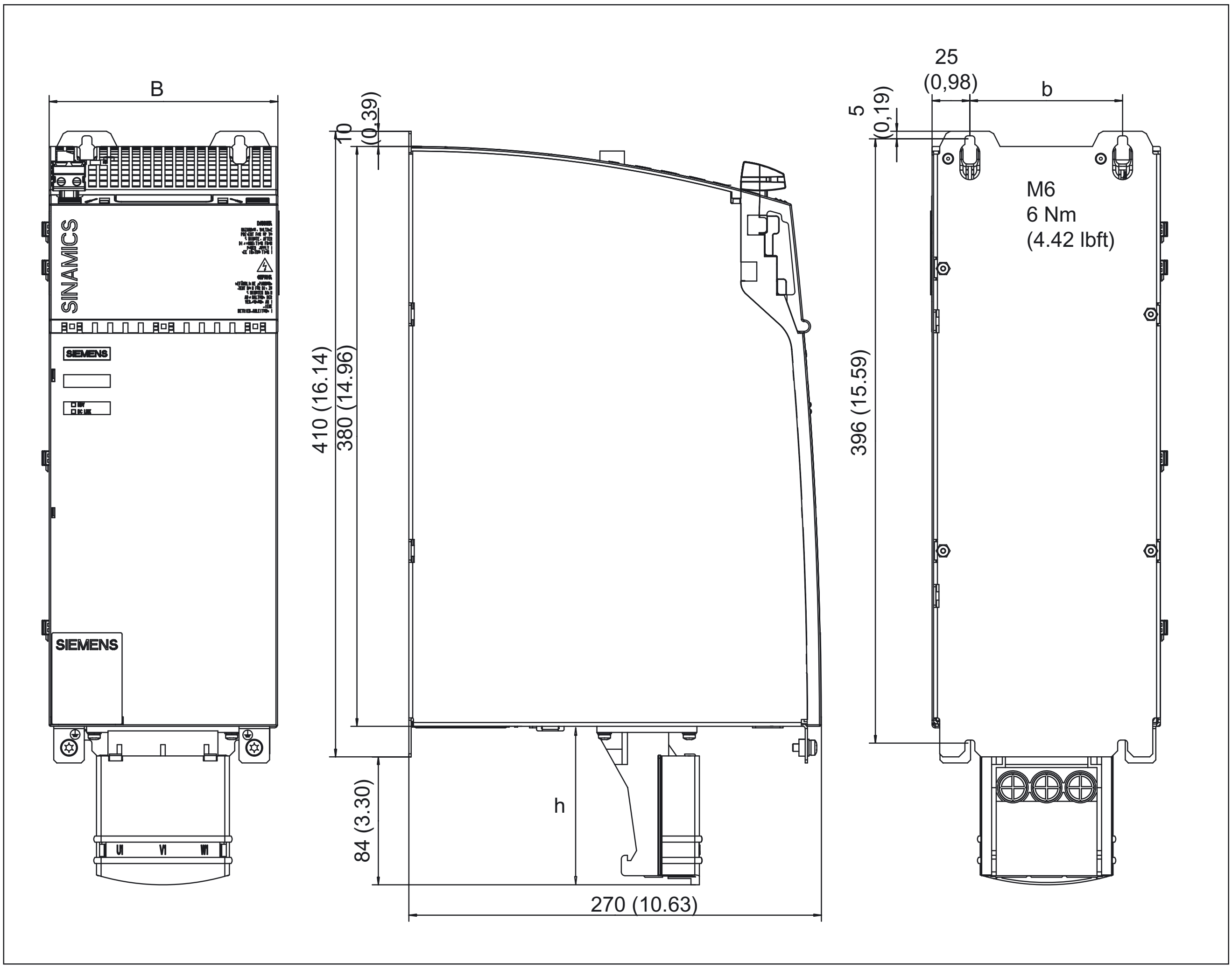


Figure 3-37 Dimension drawing of the Smart Line Module (36 kW) with internal air cooling

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

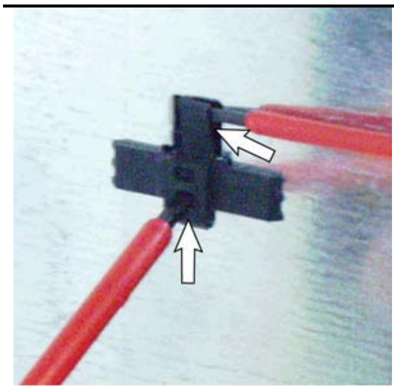
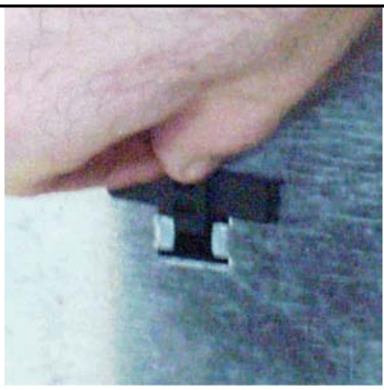
Smart Line Module Type	Order number	W [mm] (inches)	w [mm] (inches)	h [mm] (inches)
36 kW	6SL3130-6TE23-6ABx	150 (5.91)	100 (3.94)	105 (4.13)

3.5.5 Installation

Remove the holder for securing the Control Unit

Various expansion version make it necessary to remove the plastic retaining element:

- If the component to be mounted comes into contact with the lefthand cabinet panel
- for a center infeed using 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

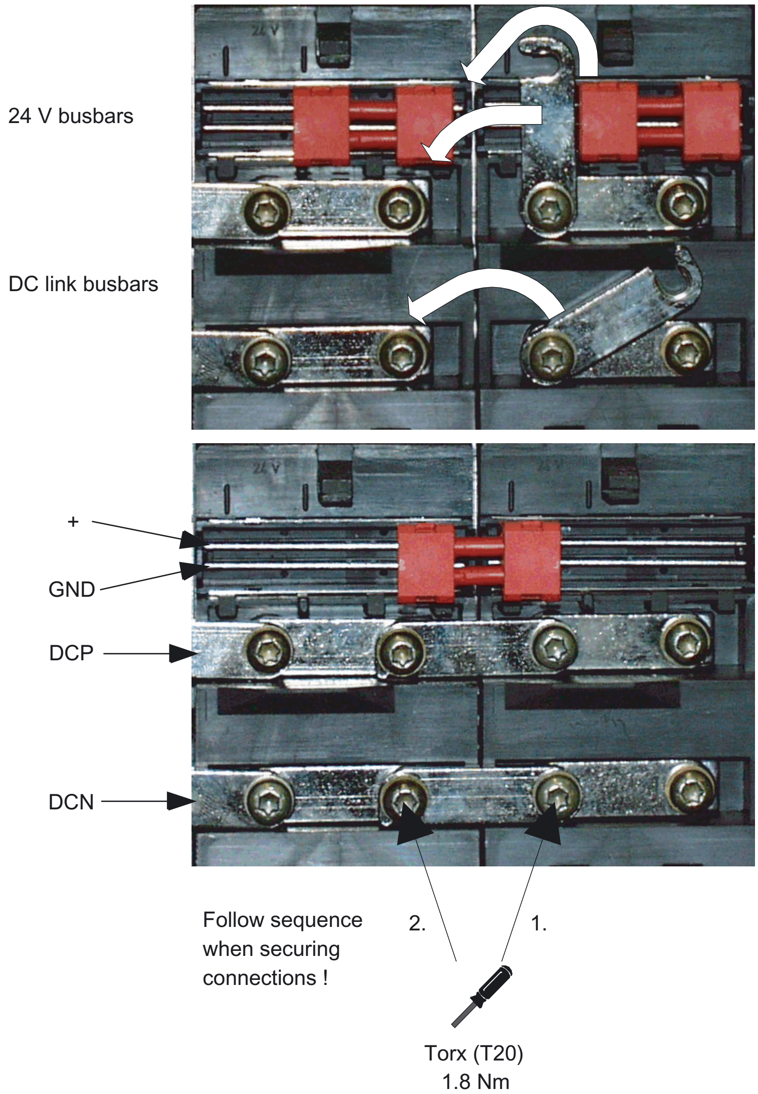


Figure 3-38 Busbar connections for booksize components

3.5.7 Technical specifications

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

Internal air cooling	**6SL3130–**	**6TE21-6ABx**	**6TE23-6ABx**
Rated power	**kW**	**16**	**36**
Supply: Rated power (S1)[1] 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
Connection voltages: Line voltage Line frequency Electronics power supply	 V_{AC} Hz V_{DC}	 3-ph. 380 V AC -10% (-15% < 1 min) to 3-ph. 480 V AC +10% 47 to 63 24 (20.4 - 28.8)	
DC link voltage Overvoltage trip threshold Undervoltage trip threshold	V_{DC} V_{DC} V_{DC}	510 – 750 820 ± 2% 360 ± 2%	
Supply currents: at 380 V_{AC} at 480 V_{AC}/528 V_{AC} at 480 V; S6-40%) Peak current (at 400 V_{AC}/480 V_{AC})	 A_{AC} A_{AC} A_{AC} A_{AC}	 26 21 / 19 27 54 /45	 58 46 / 42 60 107 / 89
Output currents at 600 V_{DC}: 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
Charging limit	μF	20,000	20,000
Power factor	cos φ	1	1
Efficiency	η	0.99	0.99
Cooling method		Internal fan	Internal fan
Sound pressure level	dB(A)	<60	<65
Cooling air requirement	m^3/h	56	112

Internal air cooling	6SL3130–	6TE21-6ABx	6TE23-6ABx
Rated power	kW	16	36
Rated voltage for rated data, 3-ph. 380 V AC			
Weight	kg	7	10

[1] The specified values apply for 380 V

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

Rated duty cycles of Smart Line Modules

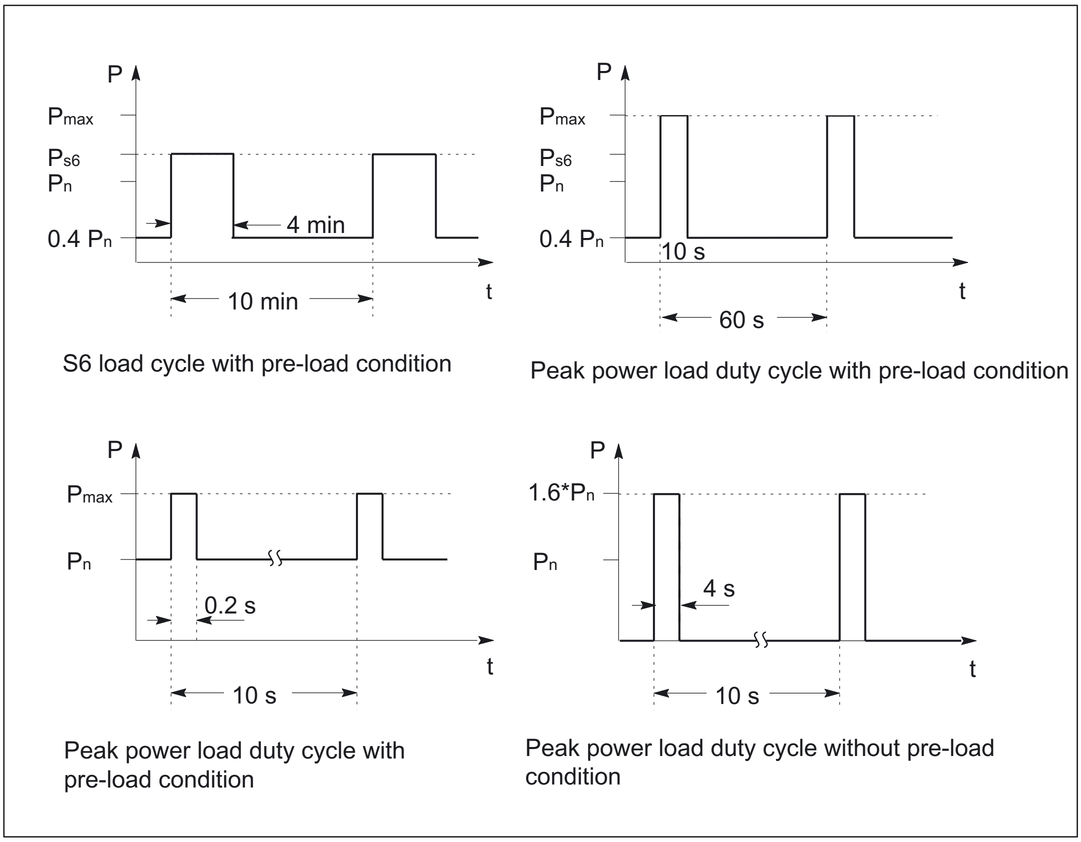


Figure 3-39 Rated duty cycles of Smart Line Modules

Derating as a function of the ambient temperature

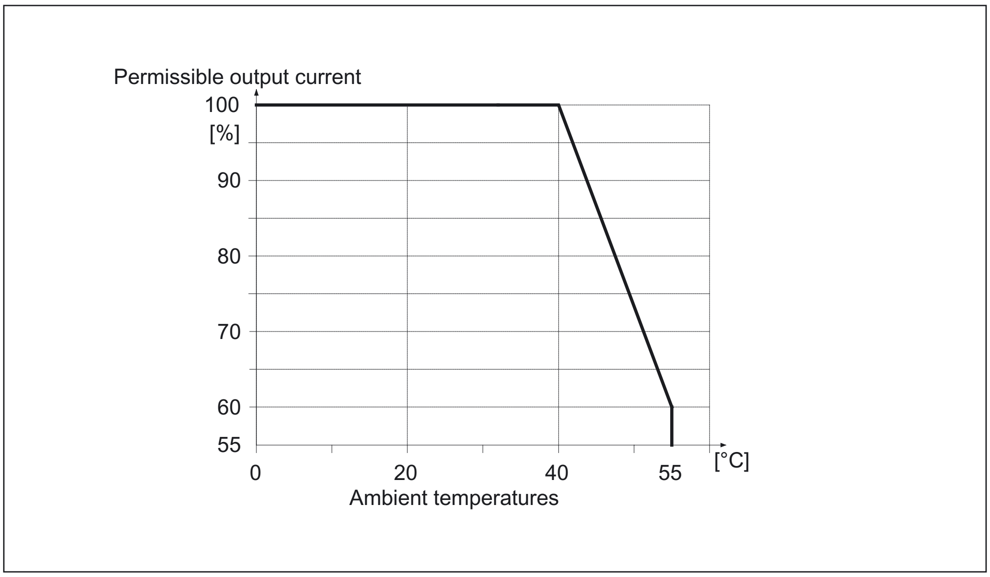


Figure 3-40 Derating as a function of the ambient temperature

Derating as a function of the installation altitude

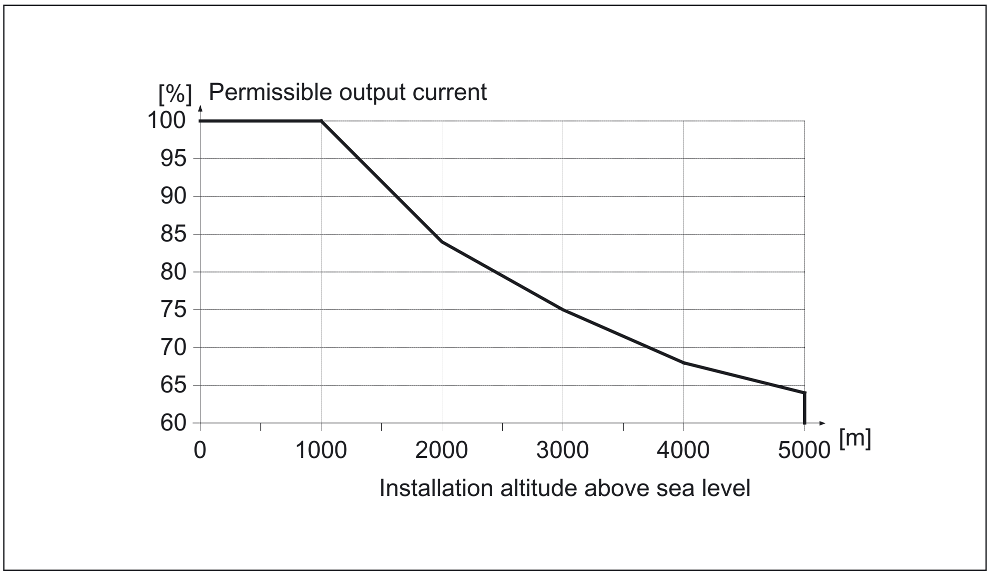


Figure 3-41 Derating as a function of the installation altitude

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

3.6.1 Description

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

3.6.2 Safety Information

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, otherwise this could result in secondary damage or accidents.

Warning

A sufficiently high system fault level is required for the fuses to rupture within the predefined time in the event of a ground fault. If the system fault level is too low, the fuse rupture times increase to an unacceptable level (e.g. fire is possible).

Caution

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

A set of labels in 16 languages is available under Order No.: 6SL3166-3AB00-0AAx.

Notice

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

Caution

It is only permissible to establish connections to the DC link using the adapters that Siemens has recommended (DC link adapter and DC link infeed 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 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 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 ratio of line short-circuit power to rated power must be $\geqq$ 70.

Caution

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).

3.6.3 Interface description

3.6.3.1 Overview

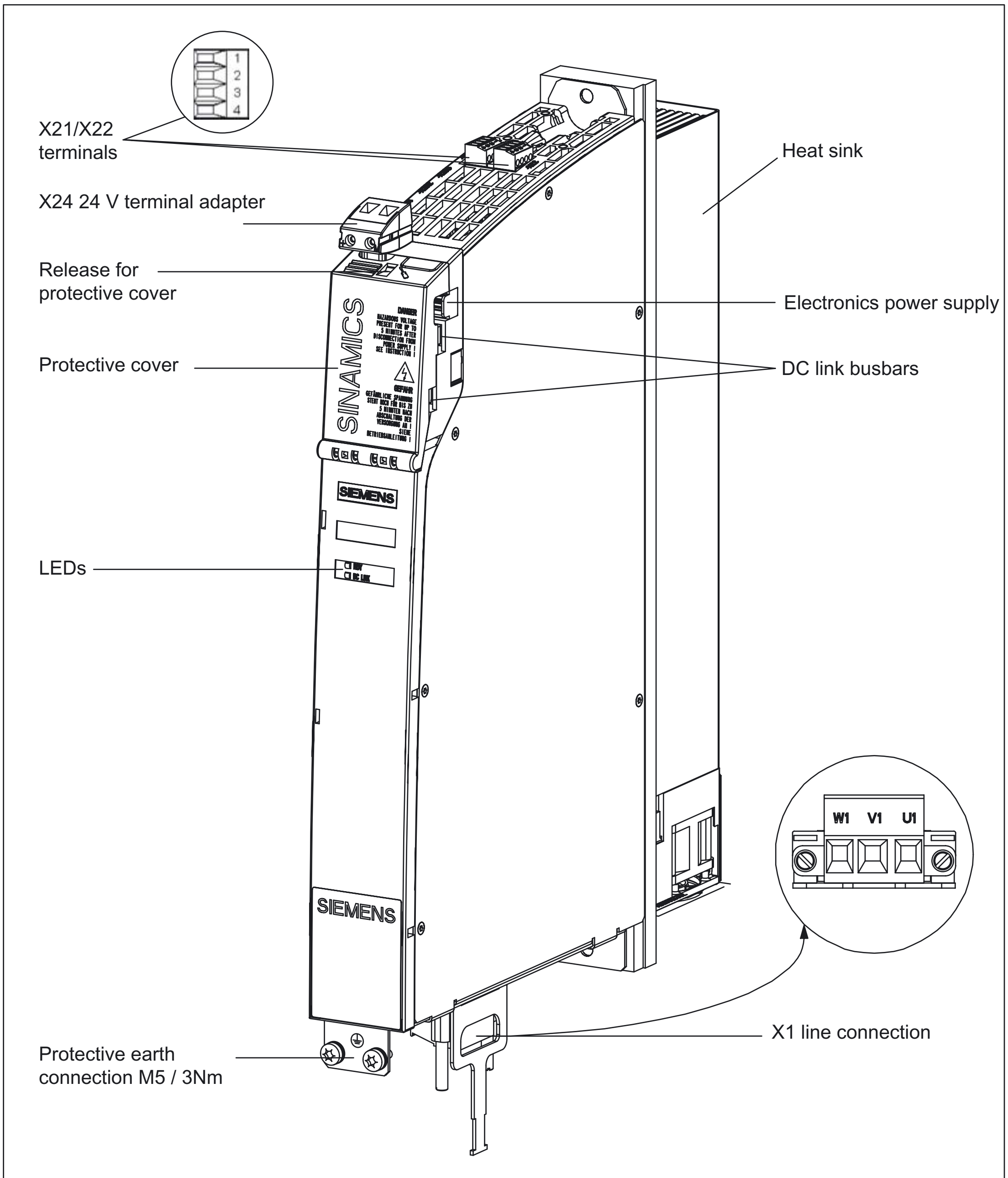
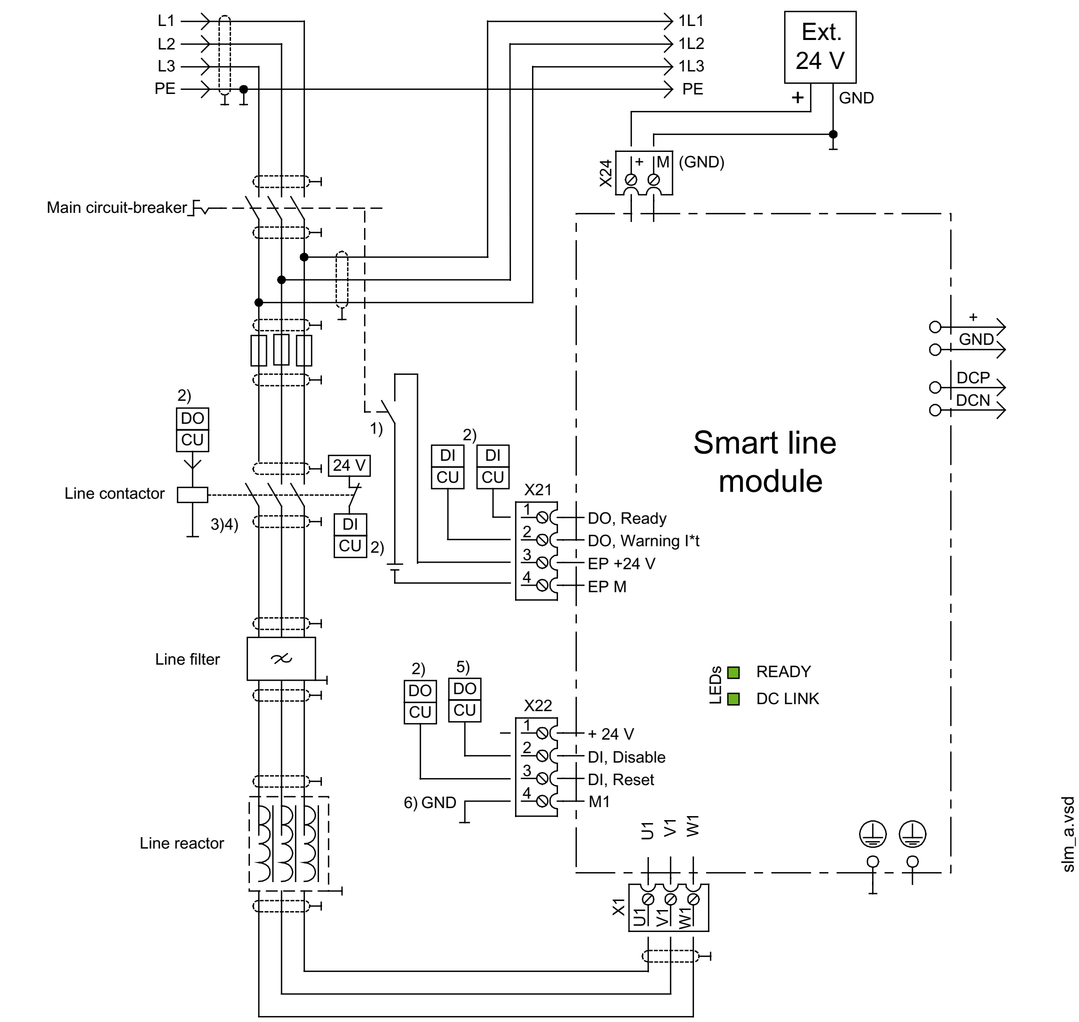


Figure 3-42 Smart Line Module with external air cooling (example 5 kW)

3.6.3.2 Connection example

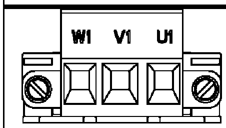
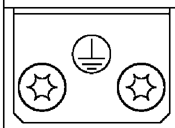


1) Leading break contact t>10ms
2) DI/DO (controlled by the control unit)
3) No additional consumer permitted downstream of line contactor
4) The current carrying capacity of the DO must be taken into account
An output interface element may have to be used
5) DO high, feedback deactivated (for permanent deactivation, a jumper can be installed between X22 pins 1 and 2)
6) X22 pin 4 must be connected to ground (ext. 24 V).

Figure 3-43 Example connection of Smart Line Module

3.6.3.3 X1 line connection

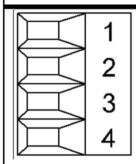
Table 3-37 Terminal block X1 of Smart Line Module (5 kW and 10 kW)

	Terminal	Technical data
	U1 V1 W1	Max. connection voltage: 3-ph. 480 V AC +10 at 47 Hz to 63 Hz Max. connectable cross-section: 6 mm² Type: Screw terminal 5 (see Connection Methods) Tightening torque: 1.2 - 1.5 Nm
	PE connection	Threaded hole M5/3 Nm [1]

[1] for ring cable lugs to DIN 46234

3.6.3.4 X21 terminals: smart line module

Table 3-38 Terminal block X21

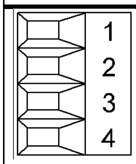
	Terminal	Name	Technical data
	1	DO: Ready	Checkback: Smart Line Module ready The signal switches to high level when the following conditions have been met: • Electronics power supply (X24) OK • DC link is pre-charged • Pulses enabled (X21.3/.4) • No overtemperature • No overcurrent switch-off
	2	Pre Warning	DO: Pre-warning threshold, overtemperature / I x t High = no pre-warning Low = pre-warning
	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 mm² Type: Screw terminal 1 (see Spring-Loaded Terminals/Screw Terminals)			

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

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

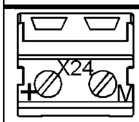
3.6.3.5 X22 terminals: smart line module

Table 3-39 Terminal block X22

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

3.6.3.6 X24 24 V terminal adapter

Table 3-40 Terminal block X24

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

3.6.3.7 Meaning of the LEDs on the smart line module

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

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

Warning

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

The warning information on the components must be carefully observed!

Cause and rectification of faults

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

Reference: /IH1/ SINAMICS S120 Commissioning Manual

3.6.4 Dimension Drawing

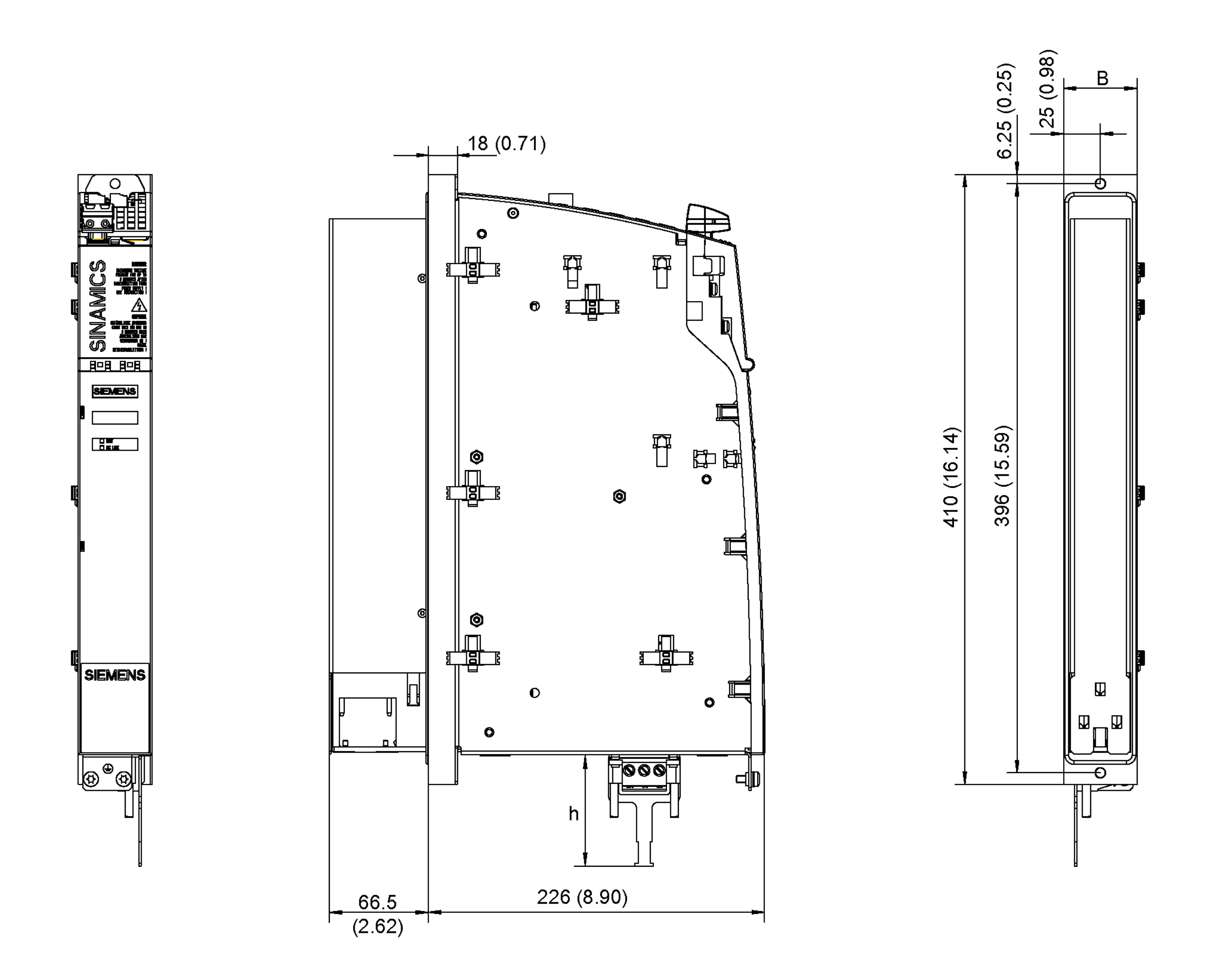


Figure 3-44 Dimension drawing of Smart Line Module (5 kW and 10 kW) with external air cooling

Table 3-42 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	6SL3136-6AE15-0AAx	50 (1.97)	75 (2.95)
10 kW	6SL3136-6AE21-0AAx	50 (1.97)	75 (2.95)

Note

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

3.6.5 Installation

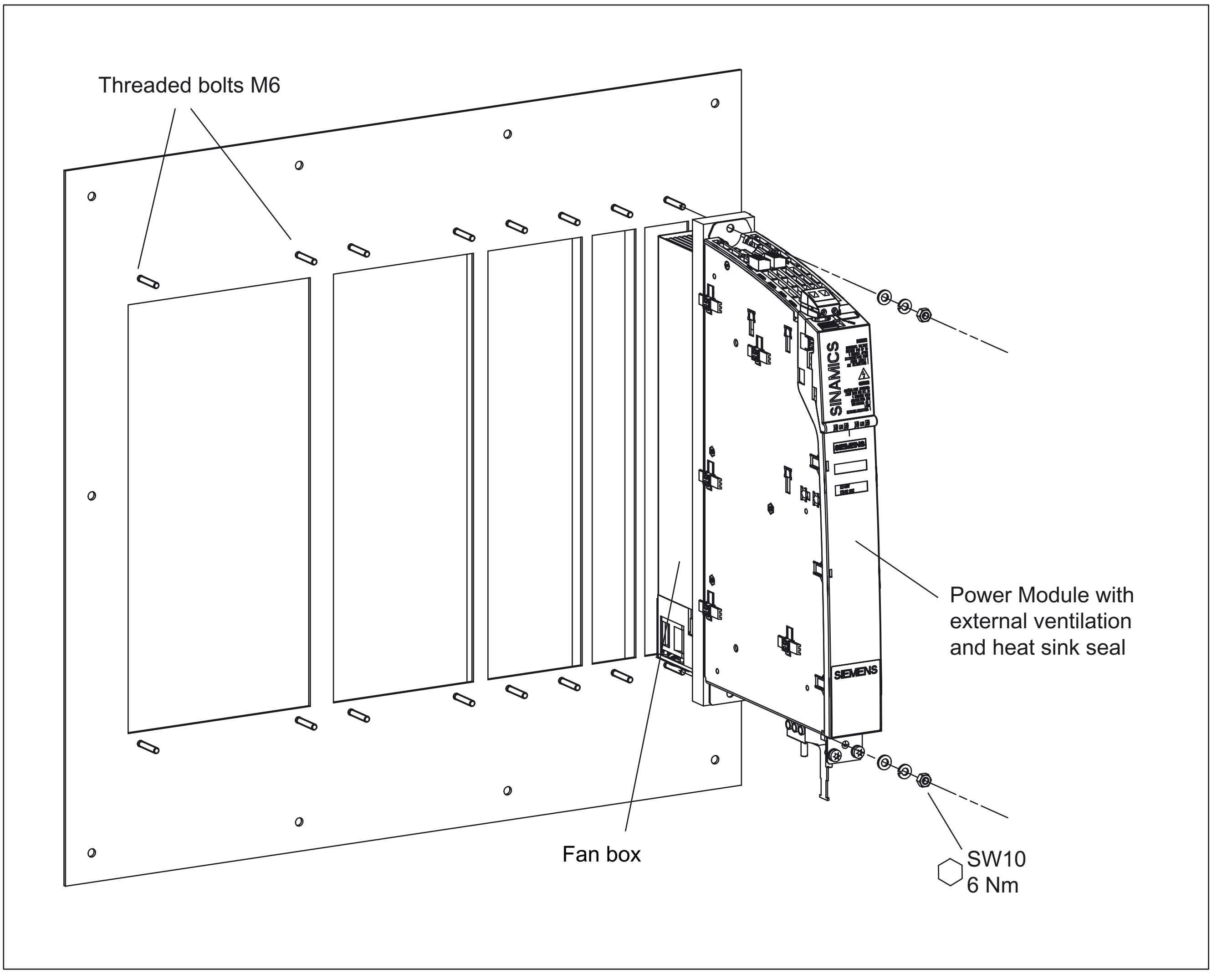


Figure 3-45 Example: installing the Power Module with external air cooling

Help with the mechanical cabinet design is available from:

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

E-mail: mailto:cc.cabinetcooling@siemens.com

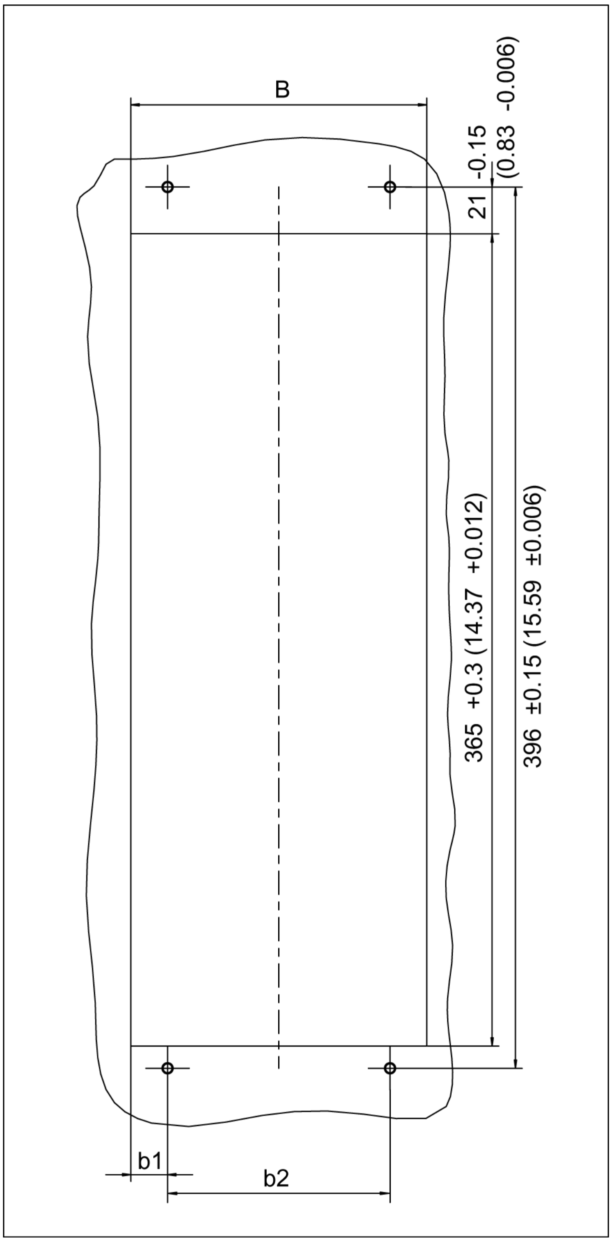


Figure 3-46 Installation openings for the Power Module with external air cooling (50 mm to 200 mm)

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

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

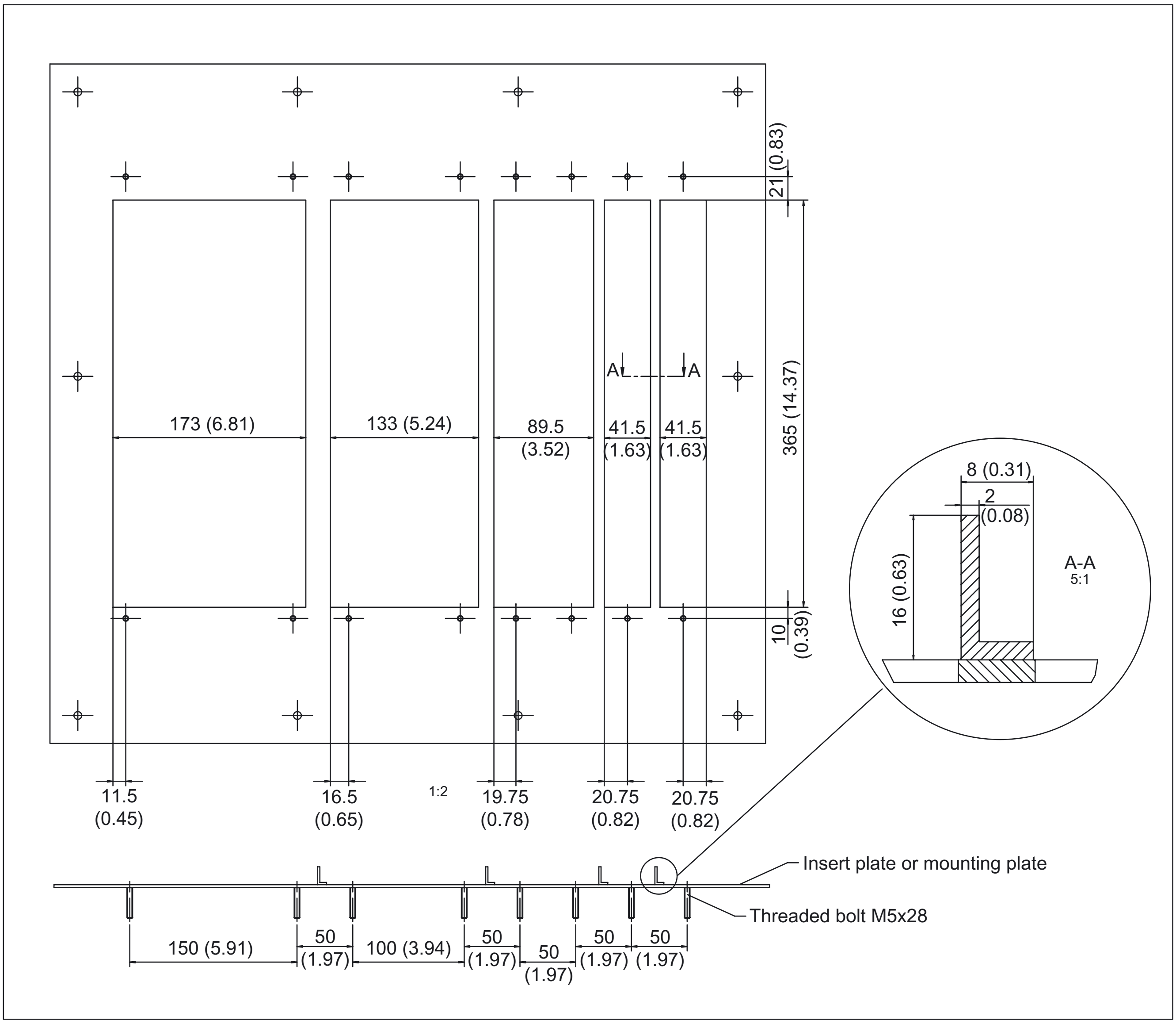


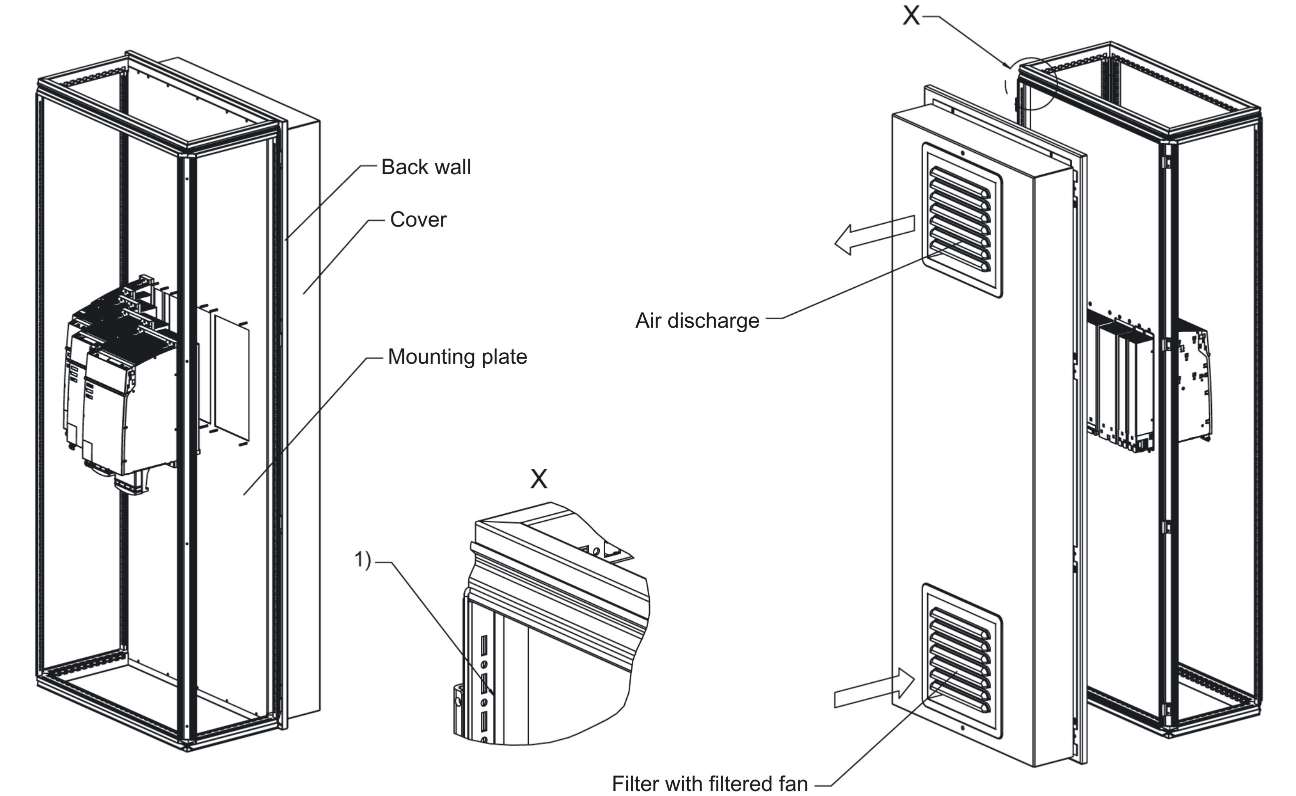
Figure 3-47 Example: mounting plate with a drive line-up

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

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

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

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



1) To comply with degree of protection IP54, the surfaces between the mounting plate and cabinet bar must be sealed all around. (e.g. use sealing agent Terostat-91 from Teroson)

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

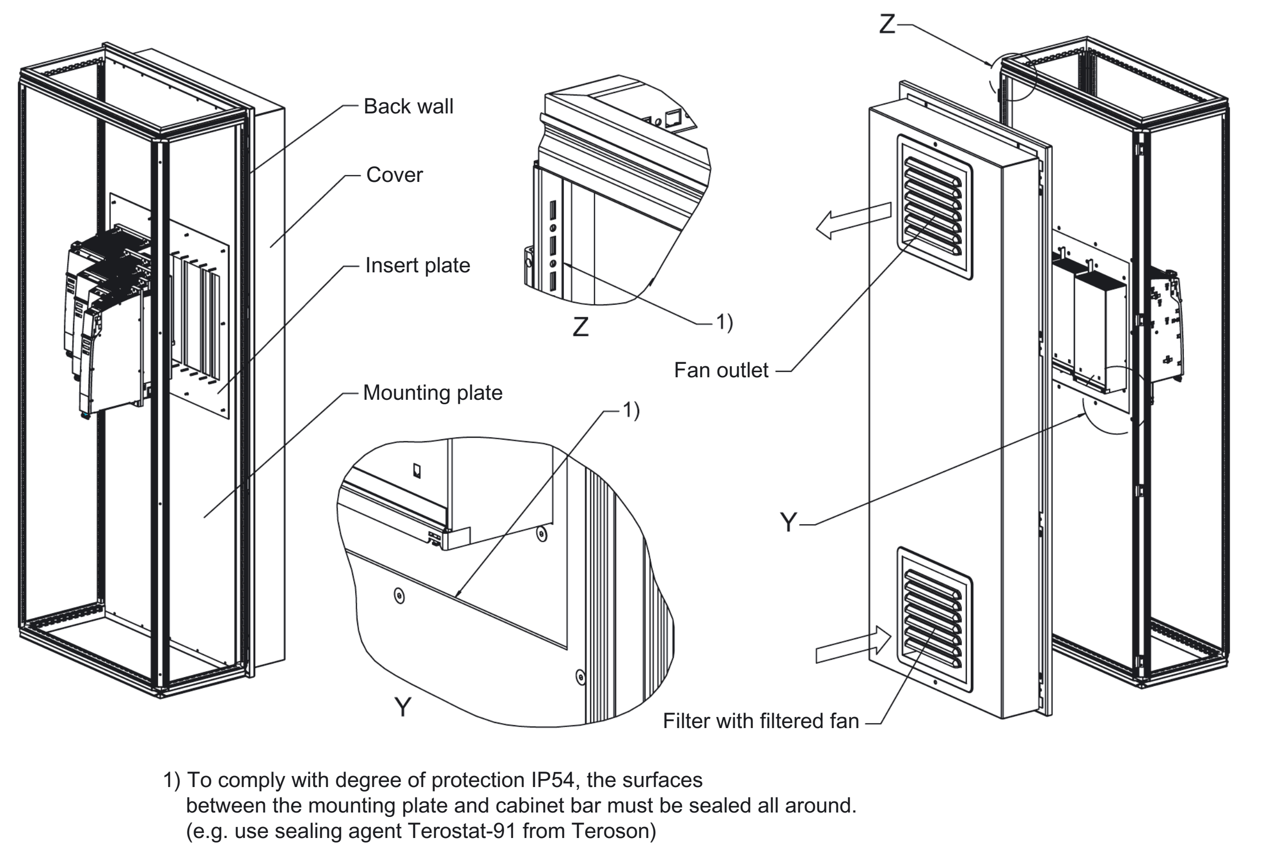


Figure 3-49 Example 2: installation in cabinet with mounting plate

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

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

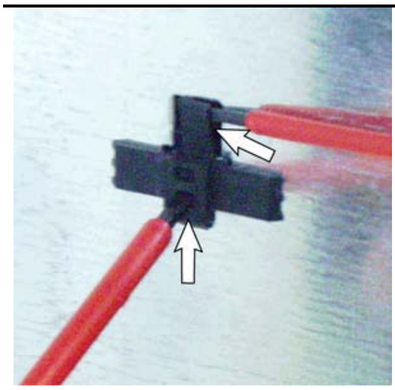
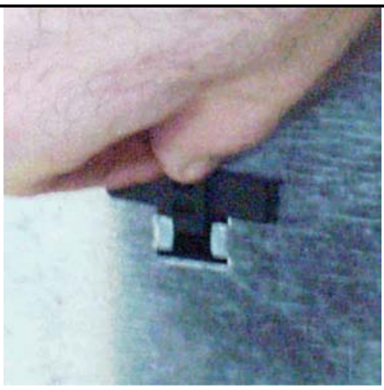
Note

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

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

Remove the holder for securing the Control Unit

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

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

3.6.6 Electrical Connection

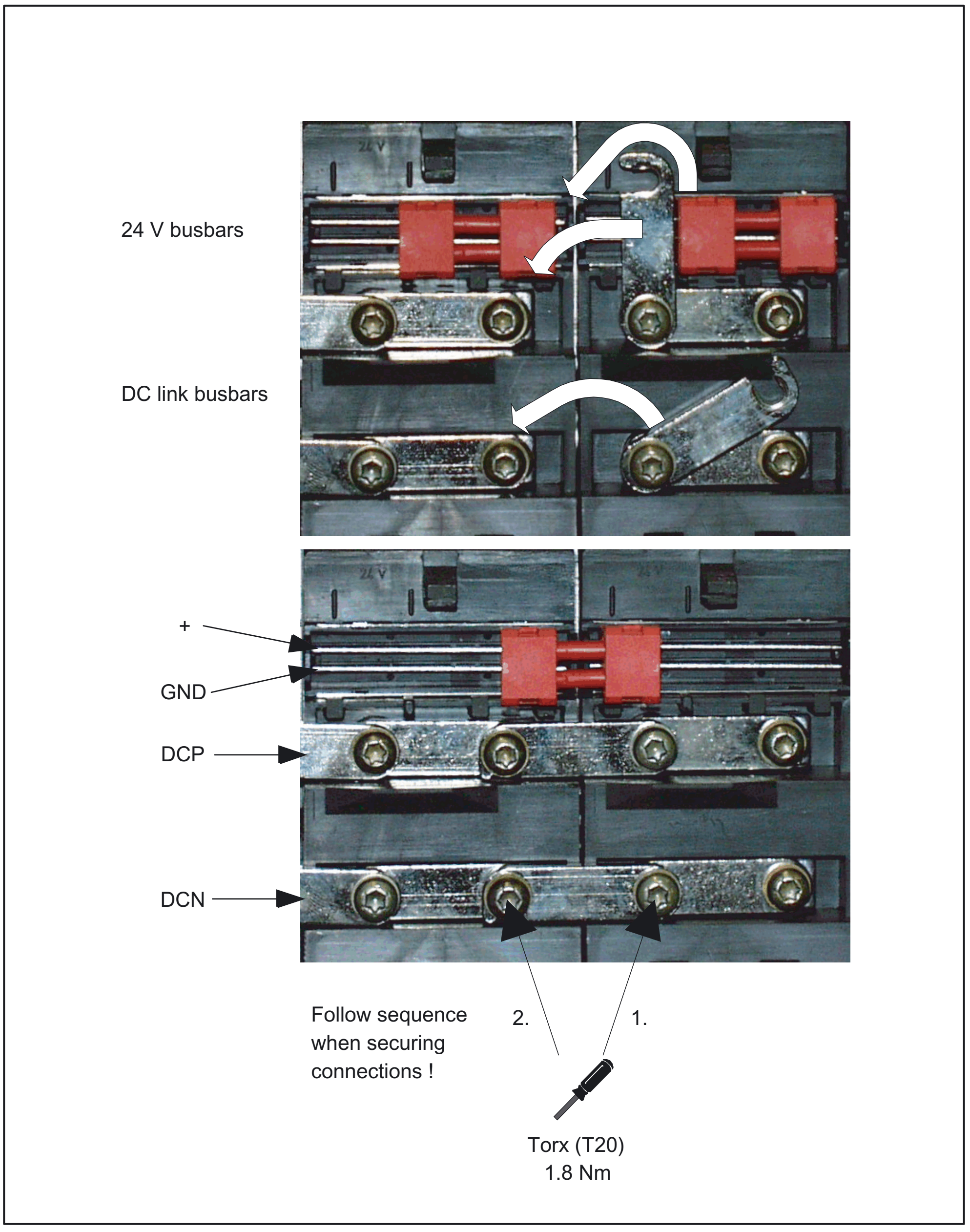


Figure 3-50 Busbar connections for booksize components

3.6.7 Technical Specifications

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

Internal air cooling	6SL3131–	6AE15–0AAx	6AE21–0AAx
Rated power	**kW**	**5**	**10**
Supply: Rated power (S1)[1] S6 infeed Power rating (S6-40%)[1] Peak power rating[1]	 kW (Pn) kW (Ps6) kW (Pmax)	 5 6.5 10	 10 13 20
Regenerative feedback: Continuous regenerative power rating Peak regenerative power rating	 kW kW	 5 10	 10 20
Connection voltages: Line voltage Line frequency Electronics power supply	 V_{AC} Hz V_{DC}	 3-ph. 380 V AC -10% (-15% < 1 min) to 3-ph. 480 V AC +10% 47 to 63 24 (20.4 - 28.8)	
DC link voltage Overvoltage trip threshold Undervoltage trip threshold	V_{DC} V_{DC} V_{DC}	510 – 750 820 ± 2% 360 ± 2%	
Supply currents: at 380 V_{AC} at 480 V_{AC}/528 V_{AC} at 480 V; S6-40%) Peak current (at 400 V_{AC}/480 V_{AC})	 A_{AC} A_{AC} A_{AC} A_{AC}	 12 9.3/8.5 12 22/18.5	 24 18/16.5 24 44/37
Output currents at 600 V_{DC}: Rated current at S6-40% Peak current	 A_{DC} A_{DC} A_{DC}	 8.3 11 16.6	 16.6 22 33.2
DC link busbar current carrying capacity	A_{DC}	100	100
24 V busbar current carrying capacity	A_{DC}	20	20
Electronics current consumption	A_{DC}	1.0	1.3
Total power loss (including electronic losses)[2]	W	74	136.2
Max. ambient temperature without derating	°C	40	40
Max. ambient temperature with derating	°C	55	55
DC link capacitance	μF	220	330
Charging limit	μF	6,000	6,000
Power factor	cos φ	1	1
Efficiency	η	0.98	0.98
Sound pressure level	dB(A)	<60	<60
Cooling air requirement	m^3/h	29.6	29.6

Internal air cooling	6SL3131–	6AE15–0AAx	6AE21–0AAx
Rated power	kW	5	10
Rated voltage for rated data, 3-ph. 380 V 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.

Rated duty cycles of Smart Line Modules

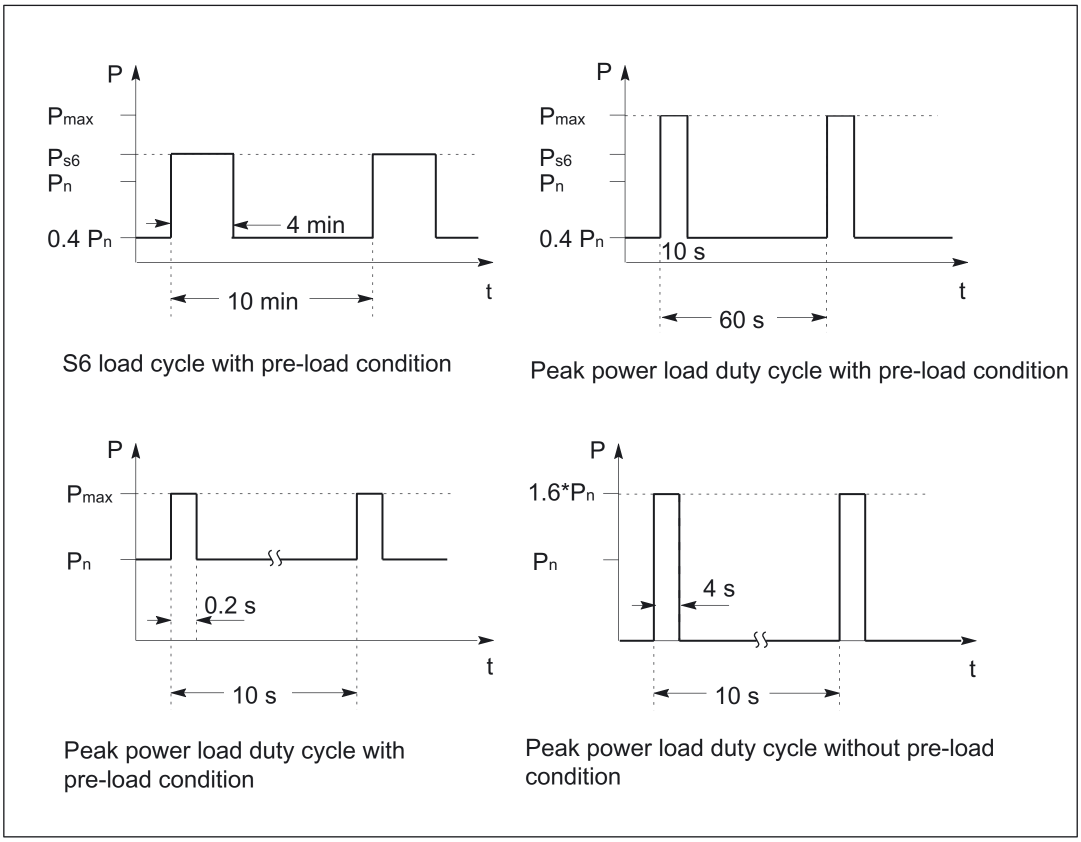


Figure 3-51 Rated duty cycles of Smart Line Modules

Derating as a function of the ambient temperature

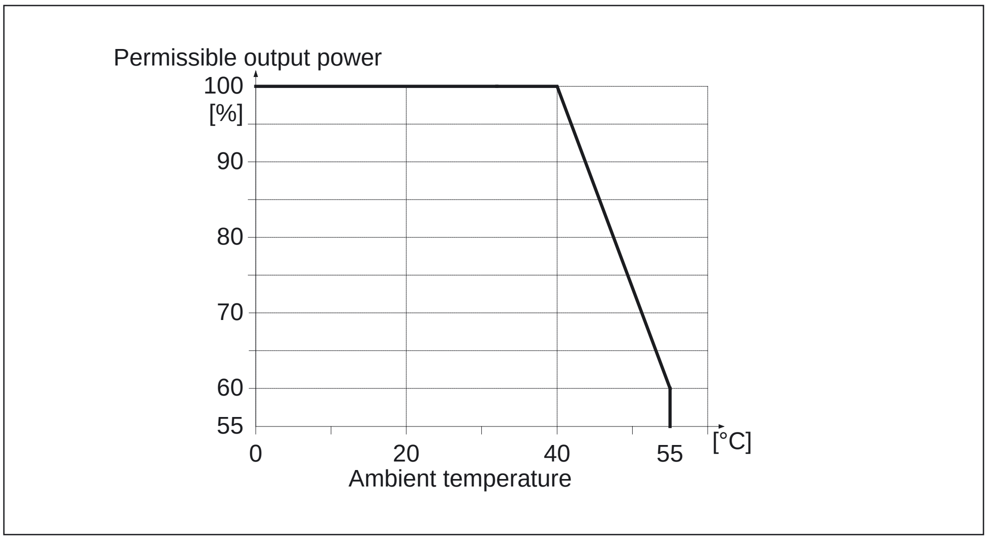


Figure 3-52 Derating as a function of the ambient temperature

Derating as a function of the installation altitude

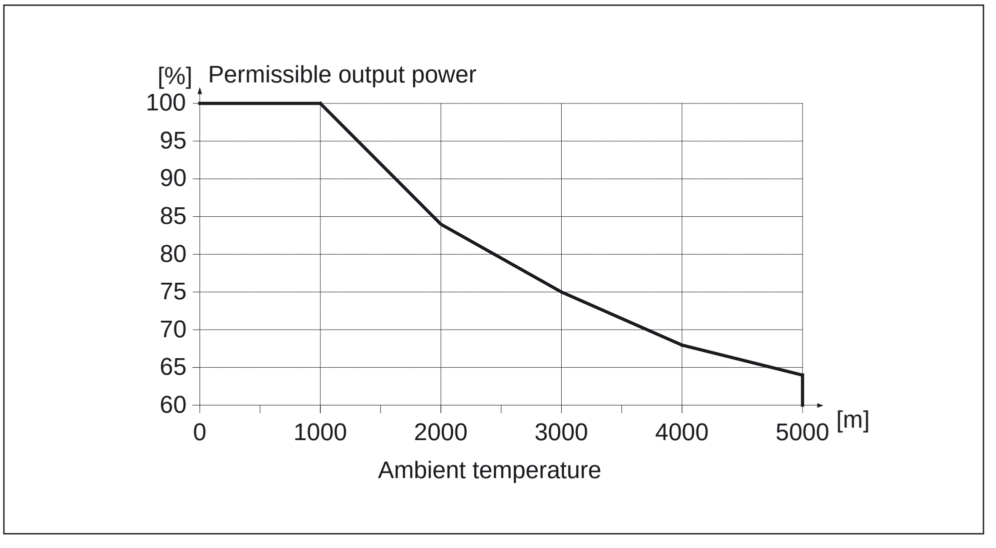


Figure 3-53 Derating as a function of the installation altitude

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).

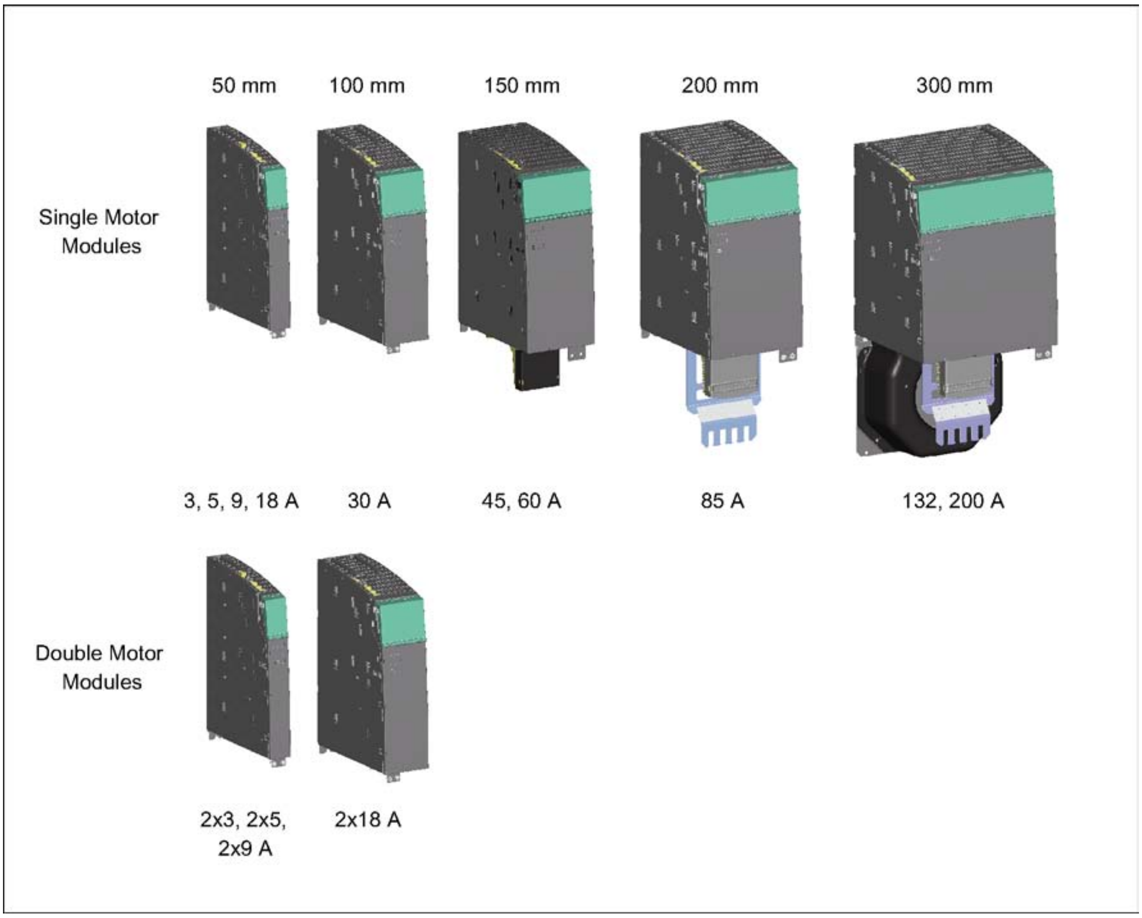


Figure 4-1 Overview of motor modules booksize (currents are continuous rms)

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). Power is supplied by means of the DC link of the drive unit. A motor module must be connected to a control unit via DRIVE-CLiQ. The open-loop and closed-loop control functions for the motor module are stored in the control unit.

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

4.2.2 Safety information

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 press the release catch.
A suitable tool (e.g. screwdriver) must be used for this purpose.

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

Caution

Motor Modules with a rated current as of 18 A and all Double Motor Modules conduct a high leakage current via the PE conductor. Because of the high leakage current of the Motor Module, a permanent PE connection of the Motor Module or control cabinet is required.

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

Caution

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

A set of labels in 16 languages is available under Order No.: 6SL3166-3AB00-0AAx.

Notice

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

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

Caution

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

Caution

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

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.

Warning

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

Non-observance can cause lethal shock voltages.

Caution

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

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 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).

4.2.3 Interface description

4.2.3.1 Overview

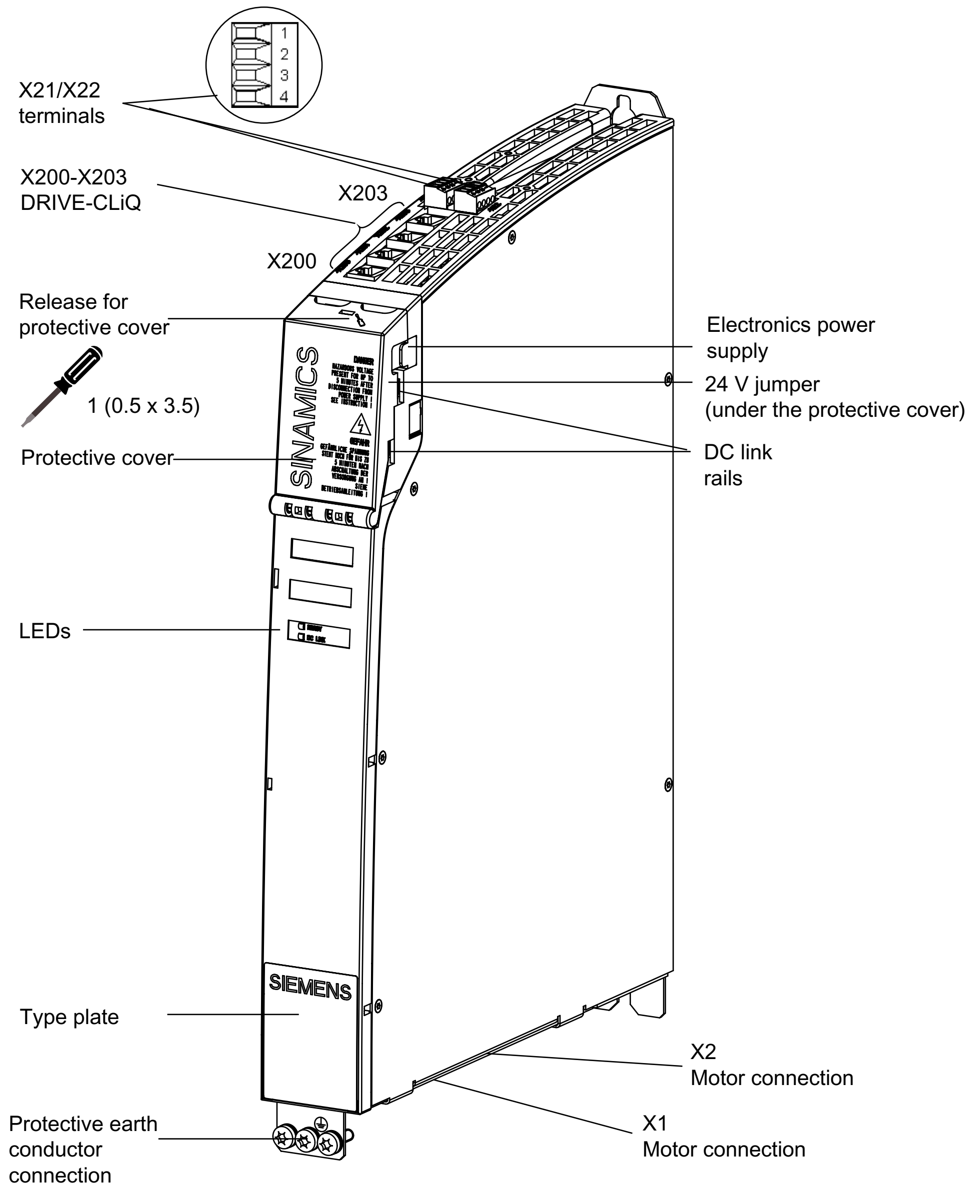
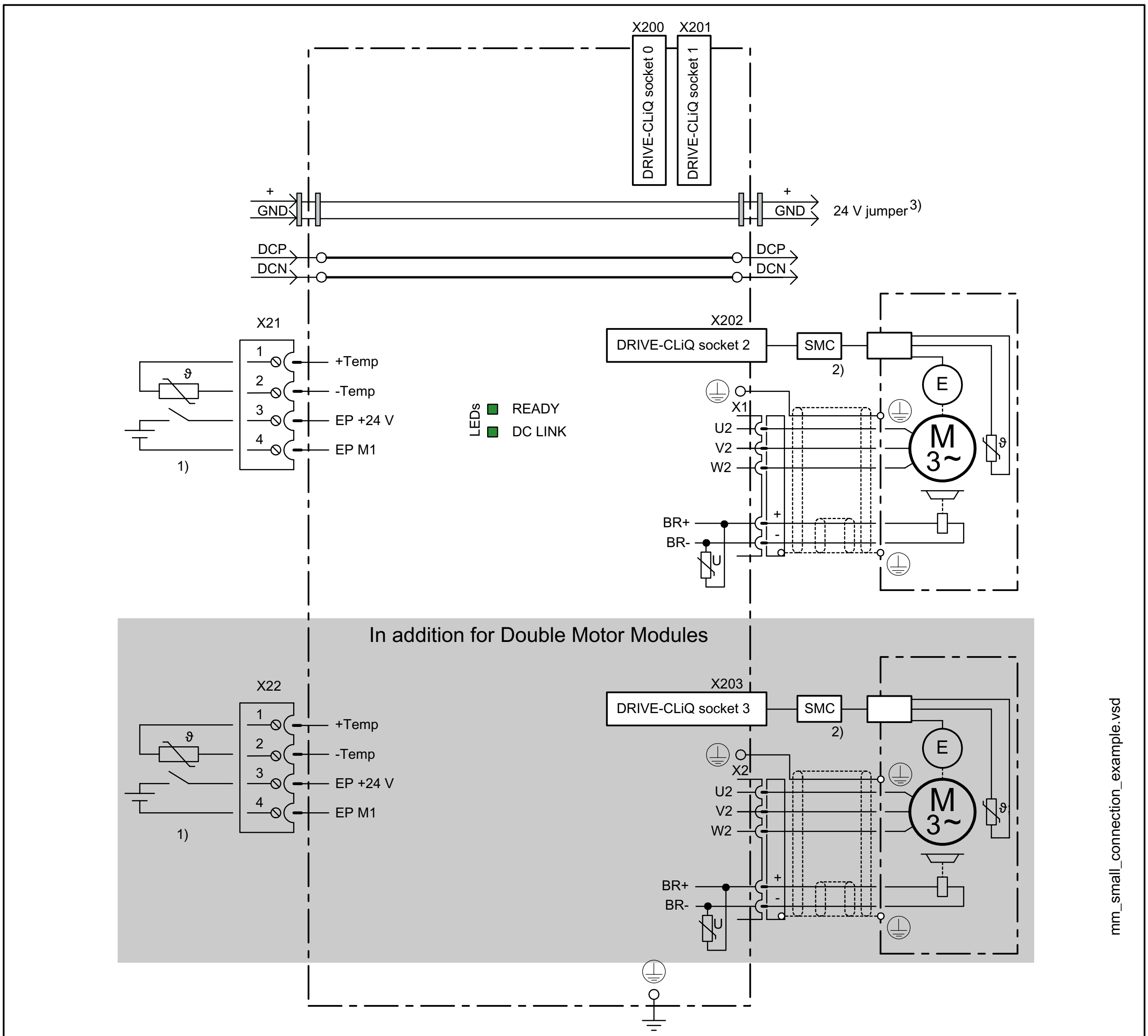


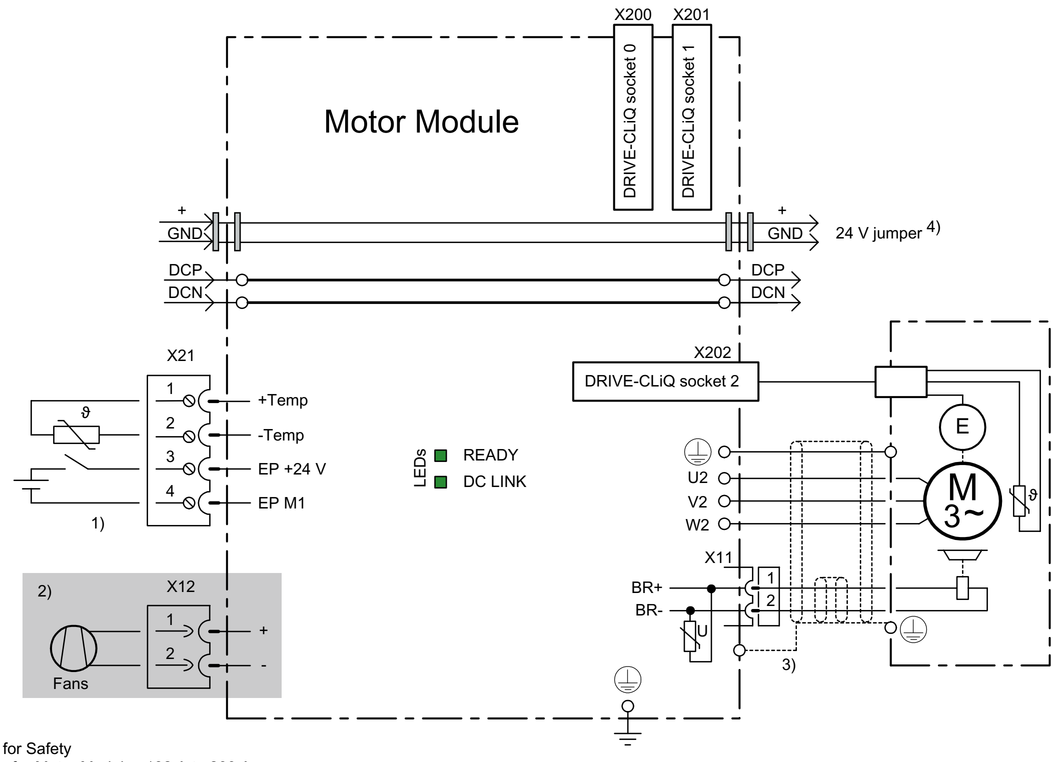
Figure 4-2 Example: double motor module with internal air cooling (2 x 3 A)

4.2.3.2 Connection Examples



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

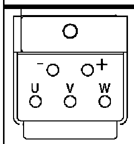
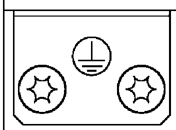


1) Required for Safety
2) In addition for Motor Modules 132 A to 200 A
3) Contact through the shield connection plate
4) 24 V to the next module

Figure 4-4 Example connection of Single Motor Modules 45 A to 200 A

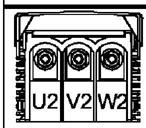
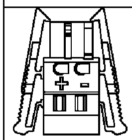
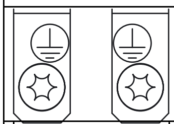
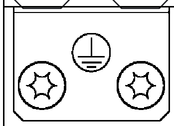
4.2.3.3 Motor/brake connection

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

1 For ring cable lugs to DIN 46234

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

Note

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

Note

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

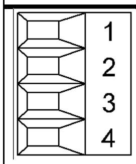
Warning

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

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

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

Table 4-3 Terminal block X21/X22

	Terminal	Function	Technical specifications
	1	+Temp	Temperature sensor connection KTY84–1C130/PTC
	2	-Temp	
	3	EP +24 V (Enable Pulses)	Supply voltage: 24 V DC (20.4 V - 28.8 V) Current consumption: 10 mA Isolated input Signal propagation times: L → H 100 μs H → L: 1000 μs
	4	EP M1 (Enable Pulses)	
Max. connectable cross-section 1.5 mm² Type: Screw terminal 1 (see Connection Methods)			

Notice

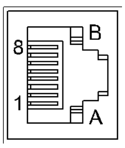
The KTY temperature sensor/the PTC must be connected with the correct polarity.

Note

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

4.2.3.5 X200-X203 DRIVE-CLiQ interface

Table 4-4 DRIVE-CLiQ interface X200-X202: Single Motor Module
DRIVE-CLiQ interface X200-X203: Double Motor Module

	Pin	Name	Technical specifications
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	Power supply
	B	GND (0 V)	Electronic ground
Blanking plate for DRIVE-CLiQ interface: Molex, order number: 85999-3255			

4.2.3.6 Meaning of the LEDs on the motor module

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

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

Warning

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

The warning information on the components must be carefully observed!

Cause and rectification of faults

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

Reference: /IH1/ SINAMICS S120, Commissioning Manual.

4.2.4 Dimension drawings

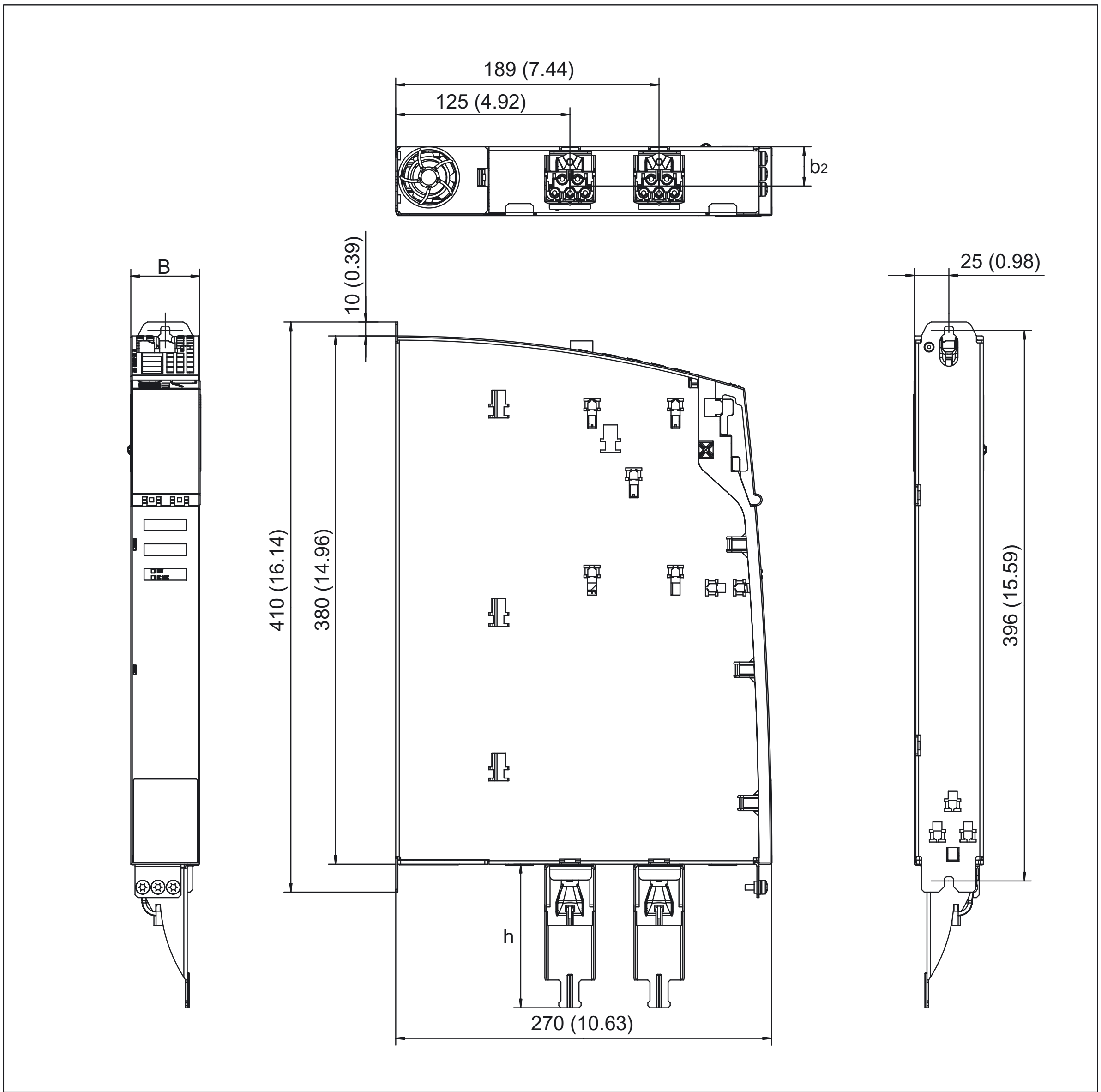


Figure 4-5 Dimension drawing of Motor Module with internal air cooling 3 A to 18 A and 2 x 3 A to 2 x 9 A

Table 4-6 Dimensions of Motor Module 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)	105 (4.13)
Single motor module 5 A	6SL3120-1TE15-0AAx	50 (1.97)	28 (1.10)	105 (4.13)
Single motor module 9 A	6SL3120-1TE21-0AAx	50 (1.97)	28 (1.10)	105 (4.13)
Single motor module 18 A	6SL3120-1TE21-8AAx	50 (1.97)	28 (1.10)	105 (4.13)
Double motor module 3 A	6SL3120-2TE13-0AAx	50 (1.97)	28 (1.10)	105 (4.13)
Double motor module 5 A	6SL3120-2TE15-0AAx	50 (1.97)	28 (1.10)	105 (4.13)
Double motor module 9 A	6SL3120-2TE21-0AAx	50 (1.97)	28 (1.10)	105 (4.13)

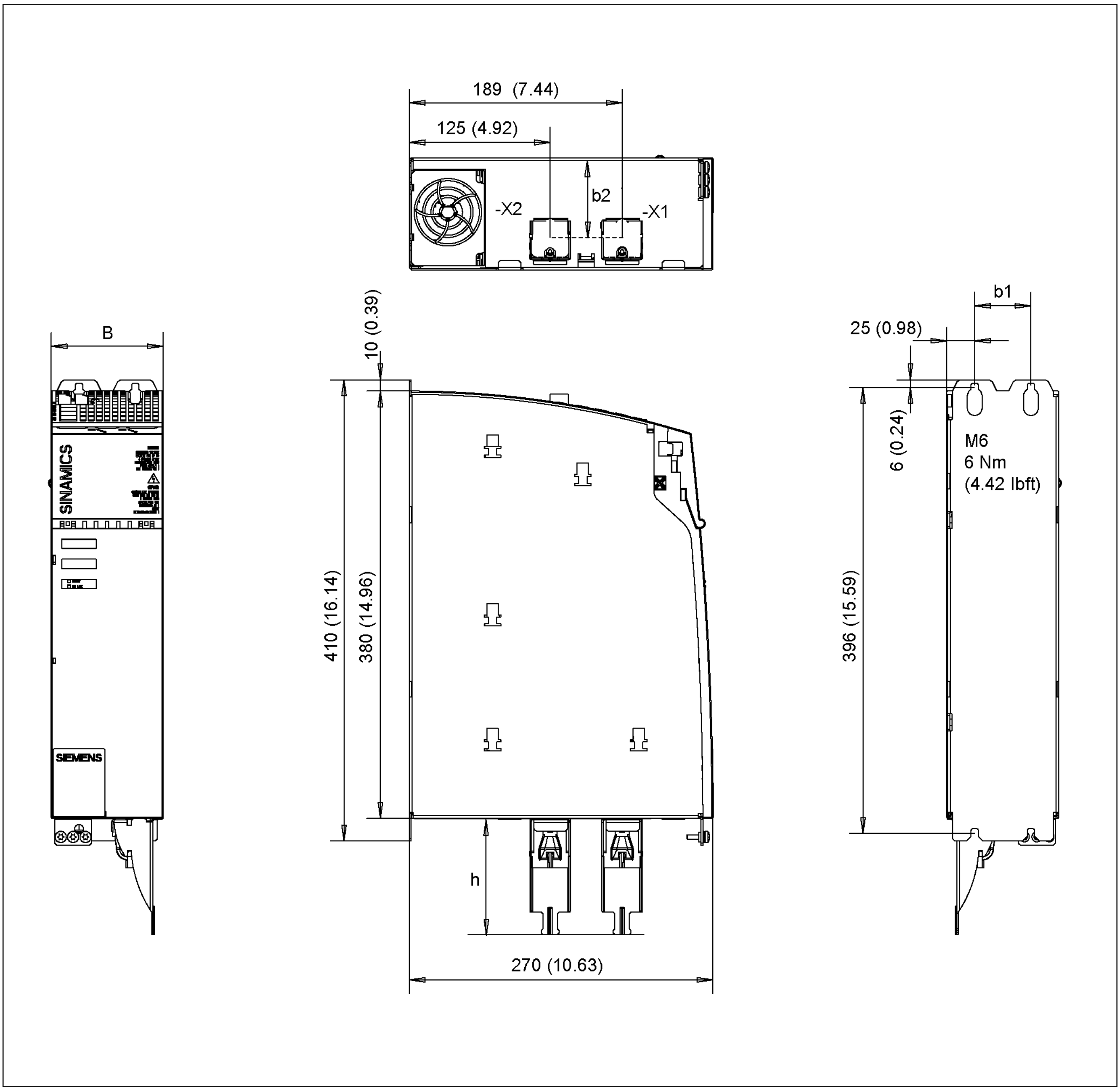


Figure 4-6 Dimension drawing of Motor Module with internal air cooling 30 A and 2 x 18 A

Table 4-7 Dimensions of Motor Module 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)	105 (4.13)
Double motor module 18 A	6SL3120-2TE21-8AAx	100 (3.94)	50 (1.97)	78 (3.07)	105 (4.13))

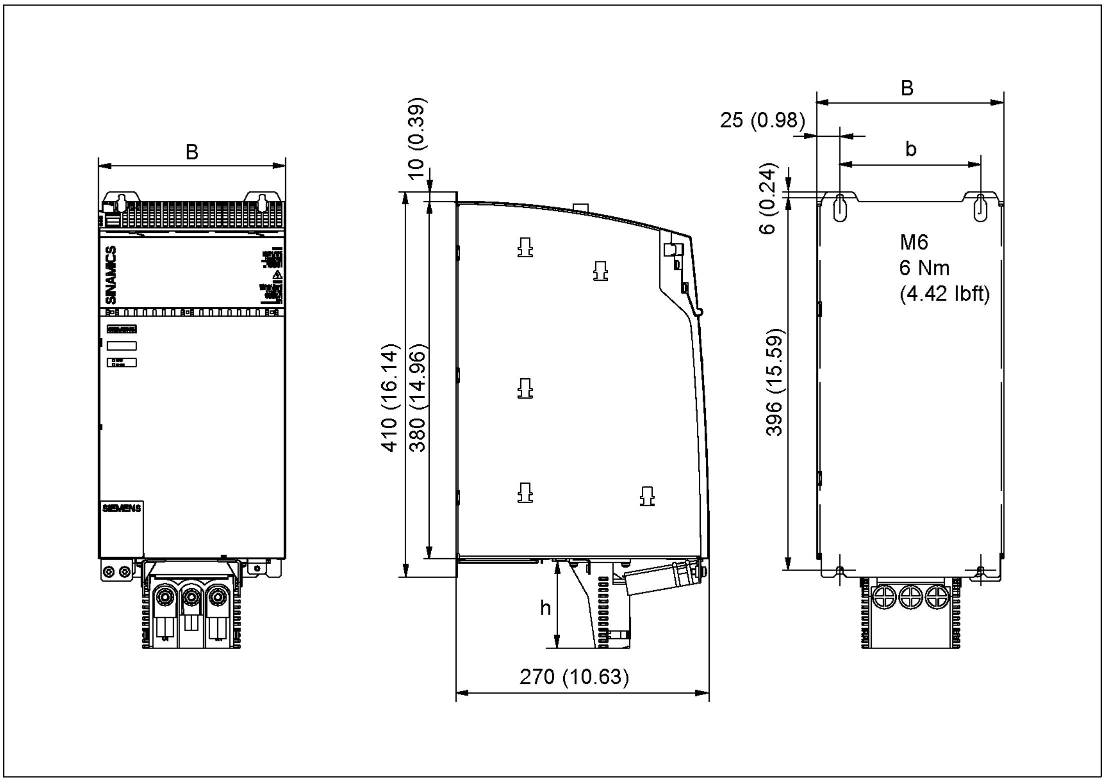


Figure 4-7 Dimension drawing of motor module with internal air cooling (45 A to 85 A)

Table 4-8 Dimensions of motor module with internal air cooling (45 A to 85 A)

Motor module type	Order number	W [mm] (inches)	w [mm] (inches)	h [mm] (inches)
Single motor module 45 A	6SL3120-1TE24-5AAx	150 (5.91)	100 (3.94)	105 (4.13)
Single motor module 60 A	6SL3120-1TE26-0AAx	150 (5.91)	100 (3.94)	105 (4.13)
Single motor module 85 A	6SL3120-1TE28-5AAx	200 (7.87)	150 (5.91)	105 (4.13)

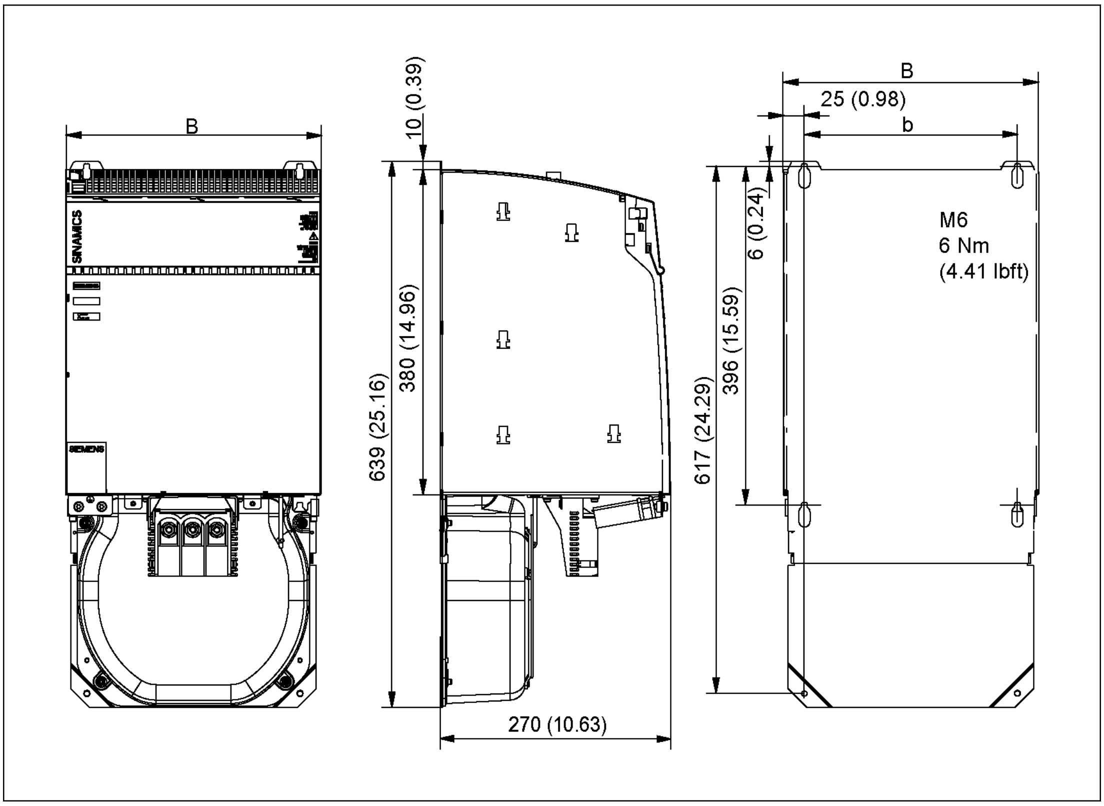


Figure 4-8 Dimension drawing of motor module with internal air cooling (132 A and 200 A)

Table 4-9 Dimensions of motor module with internal air cooling (132 A and 200 A)

Motor module type	Order number	W [mm] (inches)	w [mm] (inches)	h [mm] (inches)
Single motor module 132 A	6SL3120-1TE31-3AAx	300 (11.81)	250 (9.84)	105 (4.13)
Single motor module 200 A	6SL3120-1TE32-0AAx	300 (11.81)	250 (9.84)	105 (4.13)

4.2.5 Installation

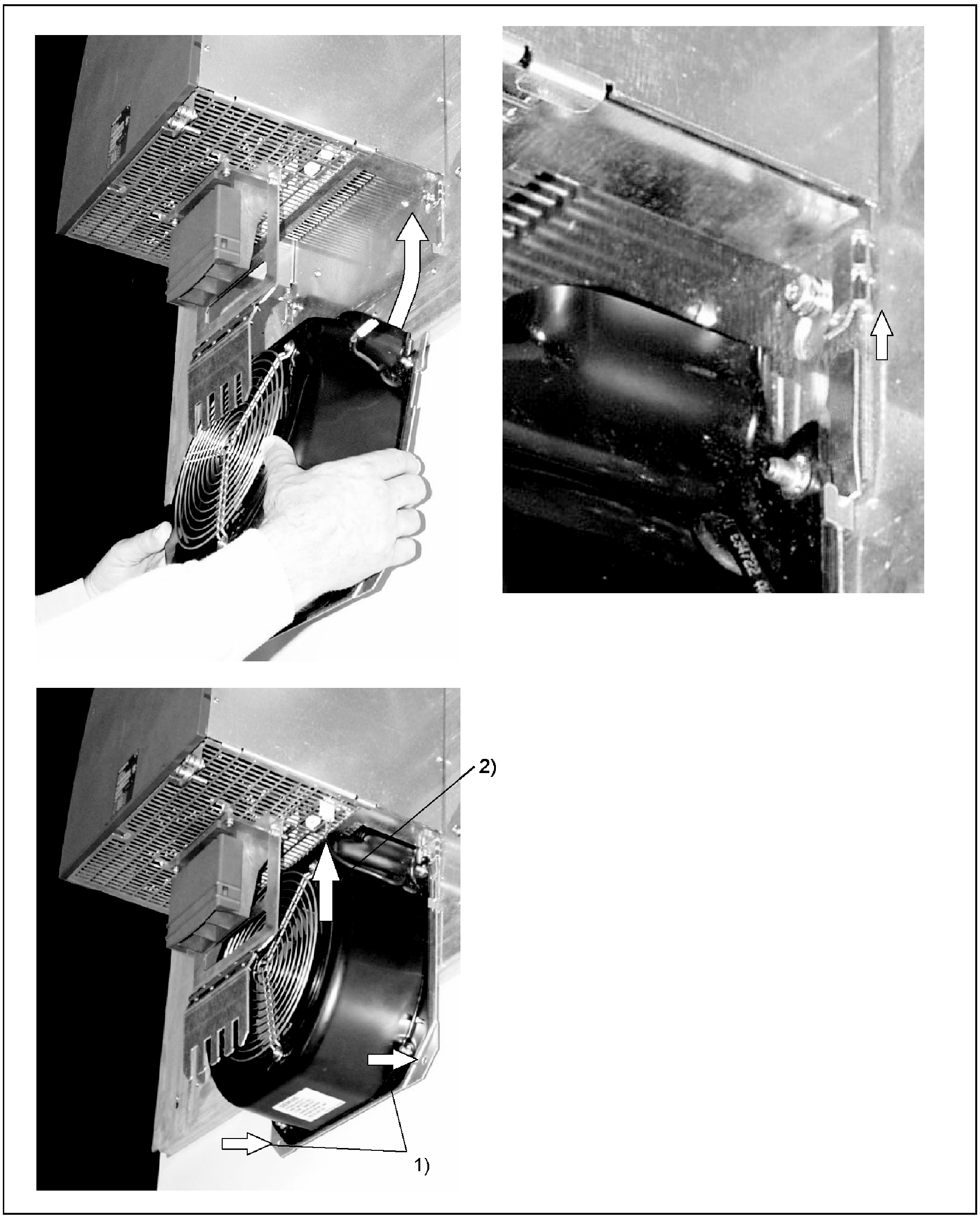


Figure 4-9 Installing the fan for 300 mm modules

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.

4.2.6 Electrical connection

Shield contact for the terminals

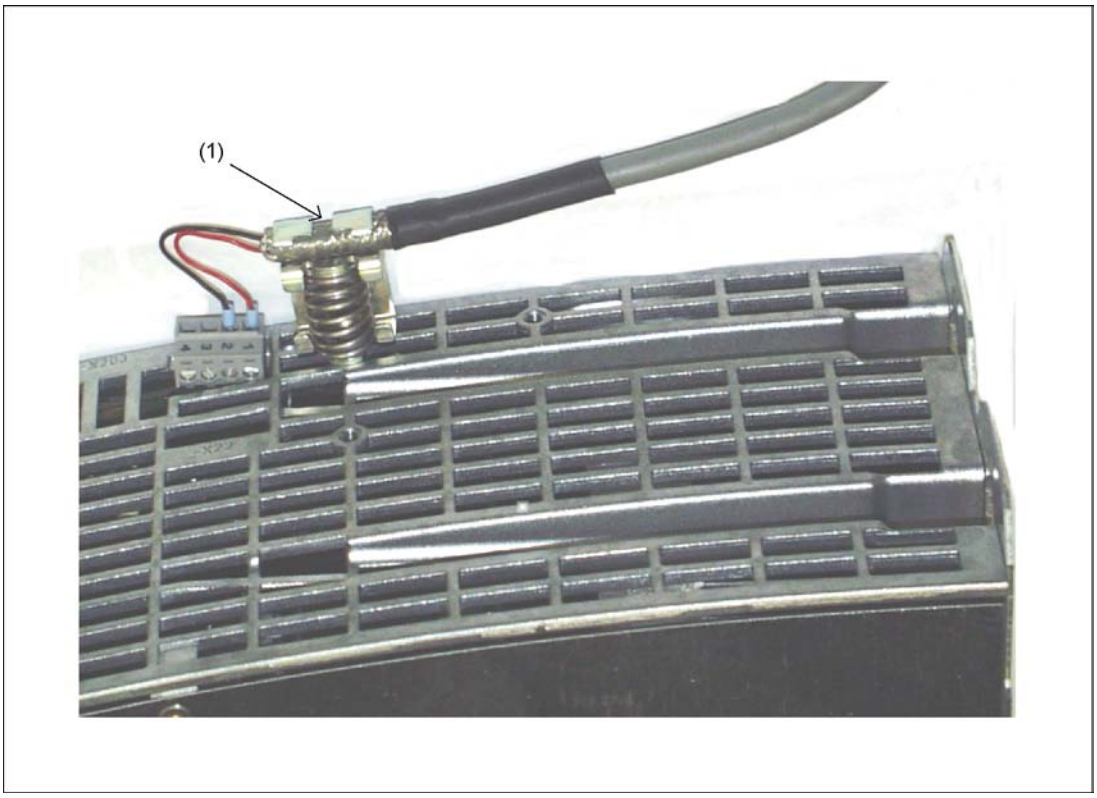


Figure 4-10 Shield contact for the terminals

(1) Shield connection: Weidmüller, Order No. KLBÜ 3-8 SC

Internet address:

Weidmüller: http://www.weidmueller.com

4.2.7 Technical specifications

Table 4-10 Technical specifications for Single Motor Modules booksize (3 to 30 A)

Internal air cooling	6SL3120–	1TE13-0AAx	1TE15-0AAx	1TE21–0AAx	1TE21–8AAx	1TE23-0AAx
Rated current	**A**	**3**	**5**	**9**	**18**	**30**
Voltage						
Power supply: DC link voltage Electronics power supply	 V_{DC} V_{DC}	 510 – 750 24 (20.4 - 28.8)				
Output voltage	V_{ACrms}	0 - 0.67 x DC link voltage				
Overvoltage trip threshold Undervoltage trip threshold	V_{DC} V_{DC}	820 ± 2% 380 ± 2%				
Electronics current consumption at 24 V	A_{DC}	0.85	0.85	0.85	0.85	0.9
Total power loss (including electronic losses)[1]	W	50.4	75.4	100.4	185.4	311.6
Rated output current (I_n)	A_{ACrms}	3	5	9	18	30
Base load current (I_{base})	A	2.6	4.3	7.7	15.3	25.5
Intermittent duty current (I_{s6}) 40%	A_{ACrms}	3.5	6	10	24	40
Peak current (I_{max})	A_{ACrms}	6	10	18	36	56
DC link busbar current carrying capacity	A_{DC}	100	100	100	100	100
24 V busbar current carrying capacity	A_{DC}	20	20	20	20	20
Rated power (with DC link voltage of 600 V_{DC} and pulse frequency of 4 kHz)	kW	1.6	2.7	4.8	9.7	16
Max. pulse frequency without derating	kHz	4	4	4	4	4
Max. pulse frequency with derating	kHz	16	16	16	16	16
Max. ambient temperature without derating	°C	40	40	40	40	40
Max. ambient temperature with derating	°C	55	55	55	55	55
DC link capacitance	μF	110	110	110	220	705
Efficiency (4kHz)	η	0.97	0.97	0.97	0.97	0.97
Sound pressure level	dB(A)	<60	<60	<60	<60	<60
Cooling method		Internal fan	Internal fan	Internal fan	Internal fan	Internal fan
Cooling air requirement	m^3/h	29.6	29.6	29.6	29.6	56
Weight	kg	5.1	5.1	5	5	6.9

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

Table 4-11 Technical specifications for Single Motor Modules booksize (45 to 200 A)

Internal air cooling	6SL3120–	1TE24-5AAx	1TE26-0AAx	1TE28-5AAx	1TE31-3AAx	1TE32-0AAx
Rated current	A	45	60	85	132	200
Voltage						
Power supply: DC link voltage Electronics power supply	 V_{DC} V_{DC}	 510 – 750 24 (20.4 - 28.8)				
Output voltage	V_{ACrms}	0 - 0.67 x DC link voltage				
Overvoltage trip threshold Undervoltage trip threshold	V_{DC} V_{DC}	820 ± 2% 380 ± 2%				
Electronics current consumption at 24 V	A_{DC}	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	1,175	1,410	1,880	2,820	3,995
Efficiency (4kHz)	η	0.97	0.97	0.97	0.97	0.97
Sound pressure level	dB(A)	<65	<65	<60	<73	<73
Cooling method (with fan)		Internal fan	Internal fan	Internal fan	Separate mounted fan	Separate mounted fan
Cooling air requirement	m^3/h	112	112	160	520	520
Weight	kg	9	9	15	21	21

[1] For an overview, see the power loss tables in 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					
Power supply: DC link voltage Electronics power supply	 V_{DC} V_{DC}	 510 – 750 24 (20.4 - 28.8)			
Output voltage	V_{ACrms}	0 - 0.67 x DC link voltage			
Overvoltage 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 (600V, 4kHz)	kW	1.6	2.7	4.8	9.7
Max. pulse frequency without derating	kHz	4	4	4	4
Max. pulse frequency with derating	kHz	16	16	16	16
Max. ambient temperature without derating	°C	40	40	40	40
Max. ambient temperature with derating	°C	55	55	55	55
DC link capacitance	µF	110	220	220	705
Efficiency (4kHz)	η	0.97	0.97	0.97	0.97
Sound pressure level	dBA	<60	<60	<60	<60
Cooling method		Internal fan	Internal fan	Internal fan	Internal fan
Cooling air requirement	m^3/h	29.6	29.6	29.6	56
Weight	kg	5.3	5.3	5.5	6.8

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

Rated duty cycles of Motor Modules booksize

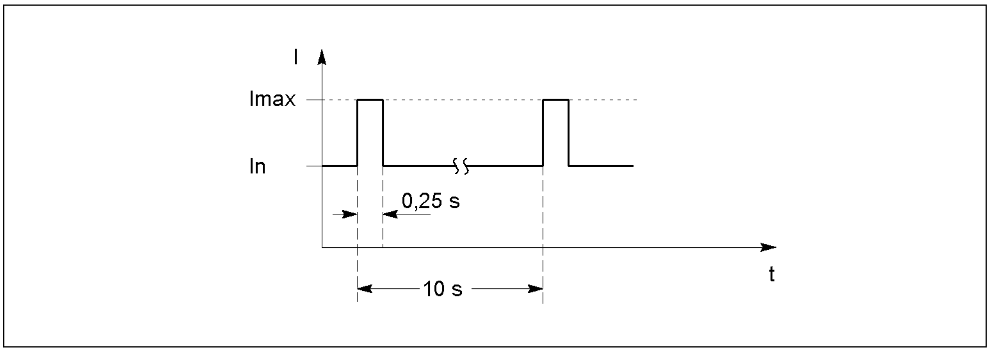


Figure 4-11 Peak current duty cycle with prior loading

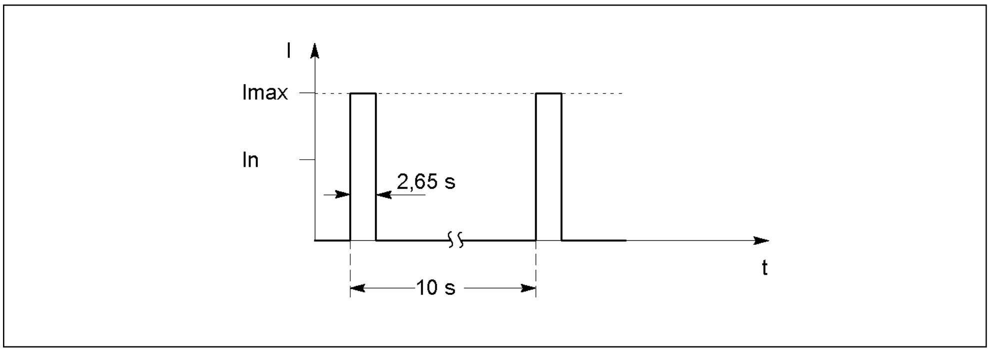


Figure 4-12 Peak current duty cycle without prior loading

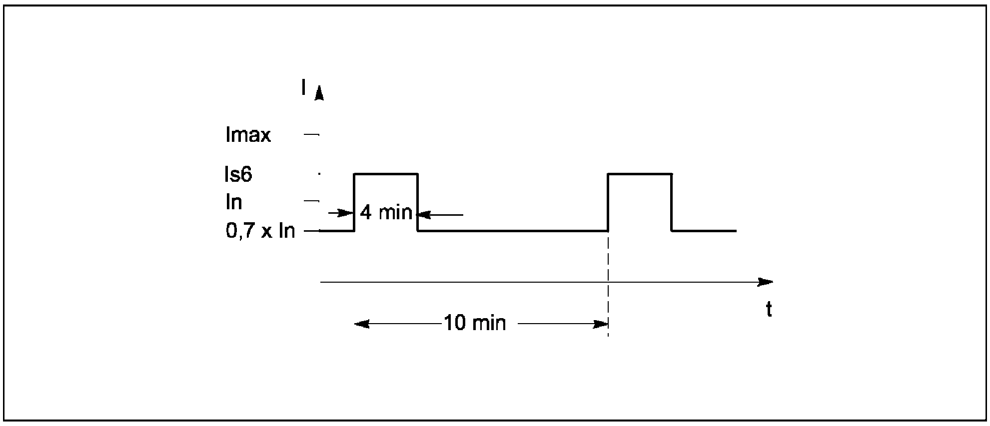


Figure 4-13 S6 current duty cycle with prior loading

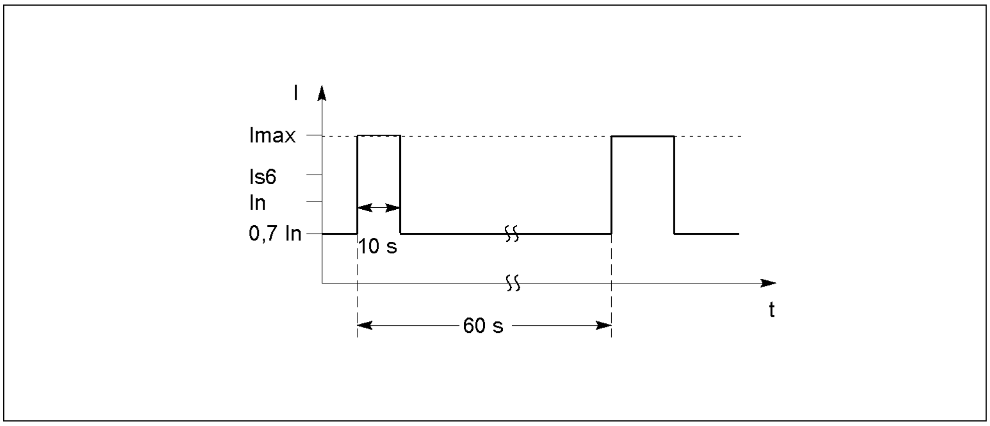


Figure 4-14 S6 peak current duty cycle with prior loading

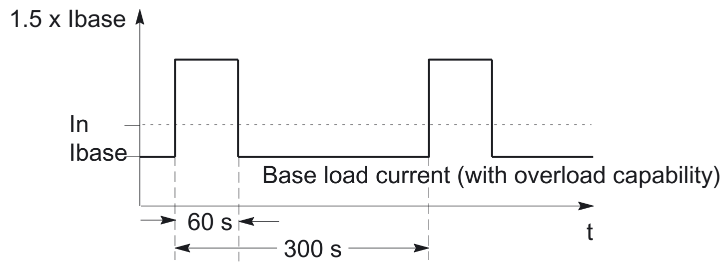


Figure 4-15 Current duty cycle with prior loading

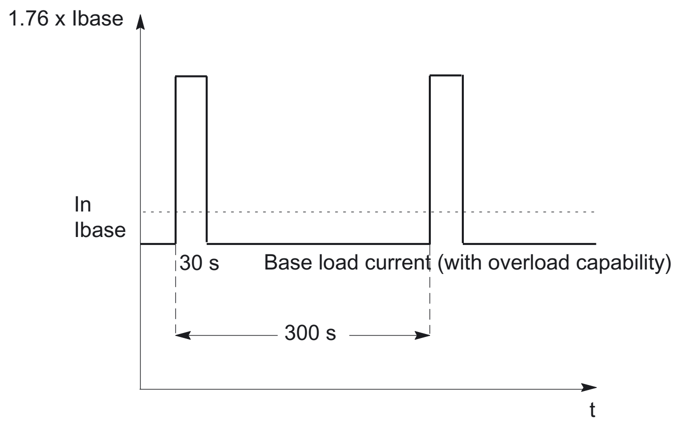


Figure 4-16 Current duty cycle with prior loading

Derating as a function of the ambient temperature

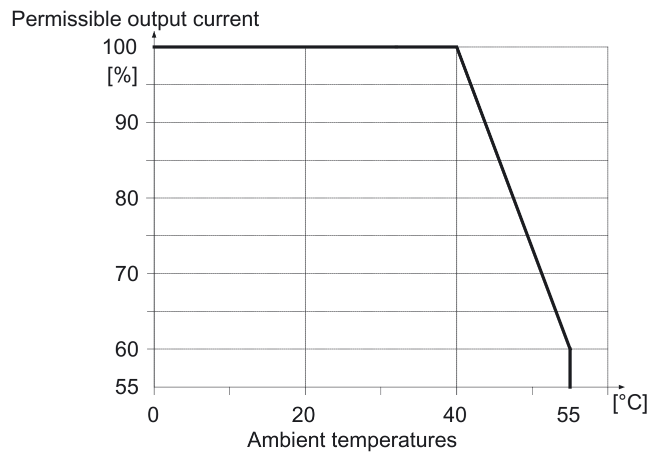


Figure 4-17 Derating as a function of the ambient temperature

Derating as a function of the pulse frequency

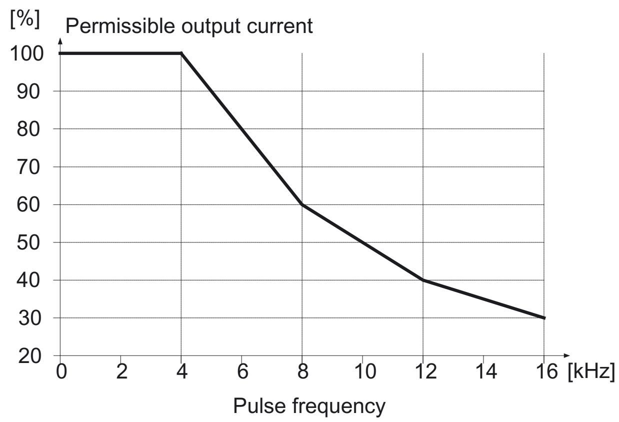


Figure 4-18 Derating as a function of the pulse frequency

Derating as a function of the installation altitude

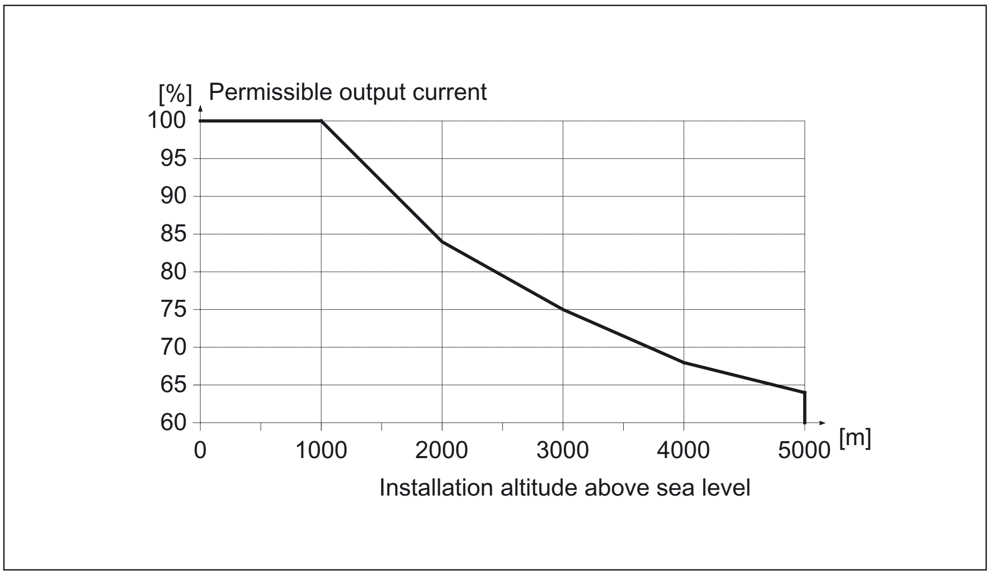


Figure 4-19 Derating as a function of the installation altitude

4.3 Motor Module with external air cooling

4.3.1 Description

A Motor Module with external air cooling is a power unit (inverter) that provides the power supply for the connected motor(s). Power is supplied by means of the DC link of the drive unit. A Motor Module must be connected to a Control Unit via DRIVE-CLiQ. The open-loop and closed-loop control functions for the Motor Module are stored in the Control Unit.

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

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

4.3.2 Safety Information

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 press the release catch.
A suitable tool (e.g. screwdriver) must be used for this purpose.

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

Caution

Motor Modules with a rated current as of 18 A and all Double Motor Modules conduct a high leakage current via the PE conductor. Because of the high leakage current of the Motor Module, a permanent PE connection of the Motor Module or control cabinet is required.

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

Caution

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

A set of labels in 16 languages is available under Order No.: 6SL3166-3AB00-0AAx.

Notice

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

Caution

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

Caution

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

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.

Warning

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

Non-observance can cause lethal shock voltages.

Caution

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

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 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).

4.3.3 Interface description

4.3.3.1 Overview

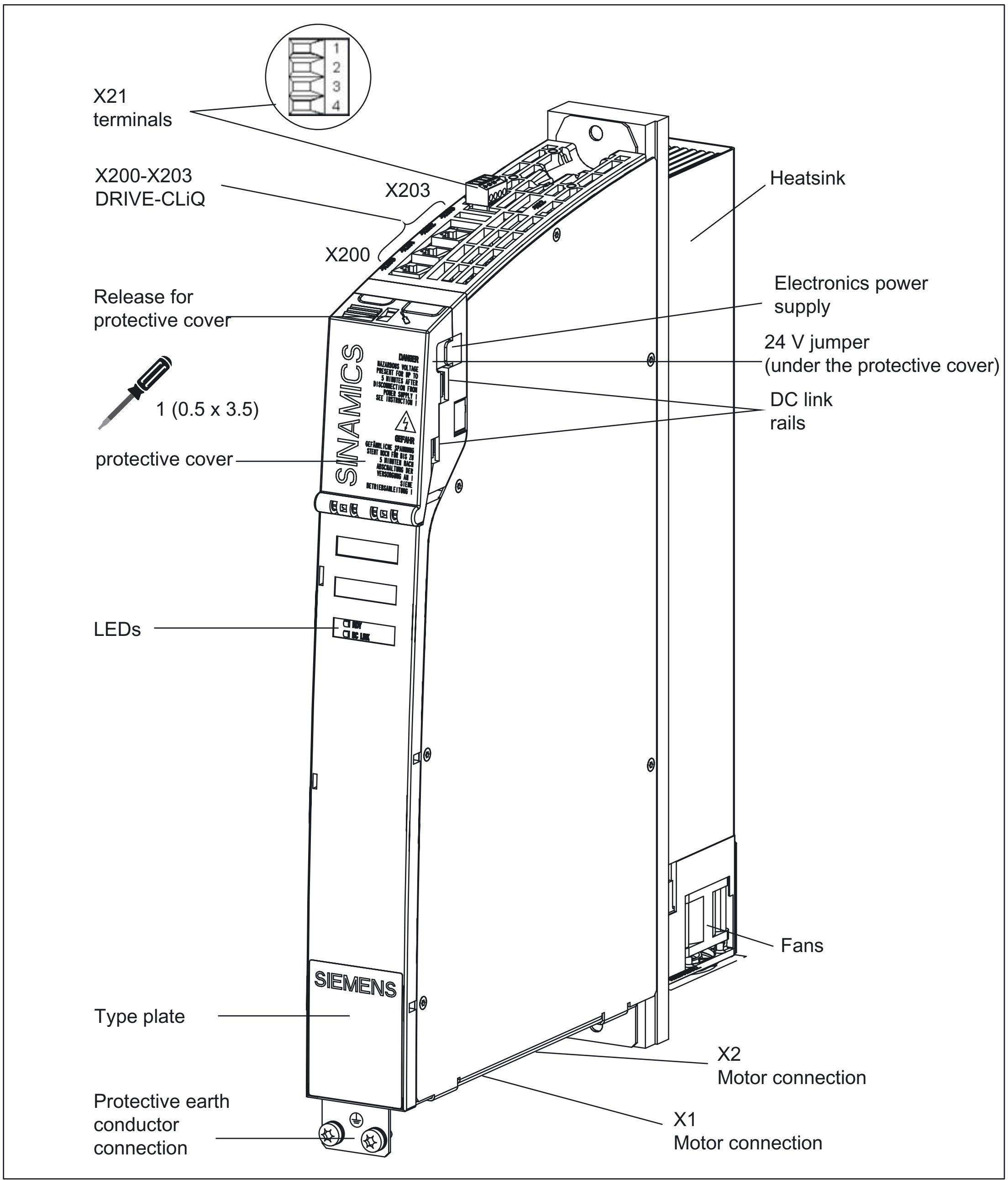
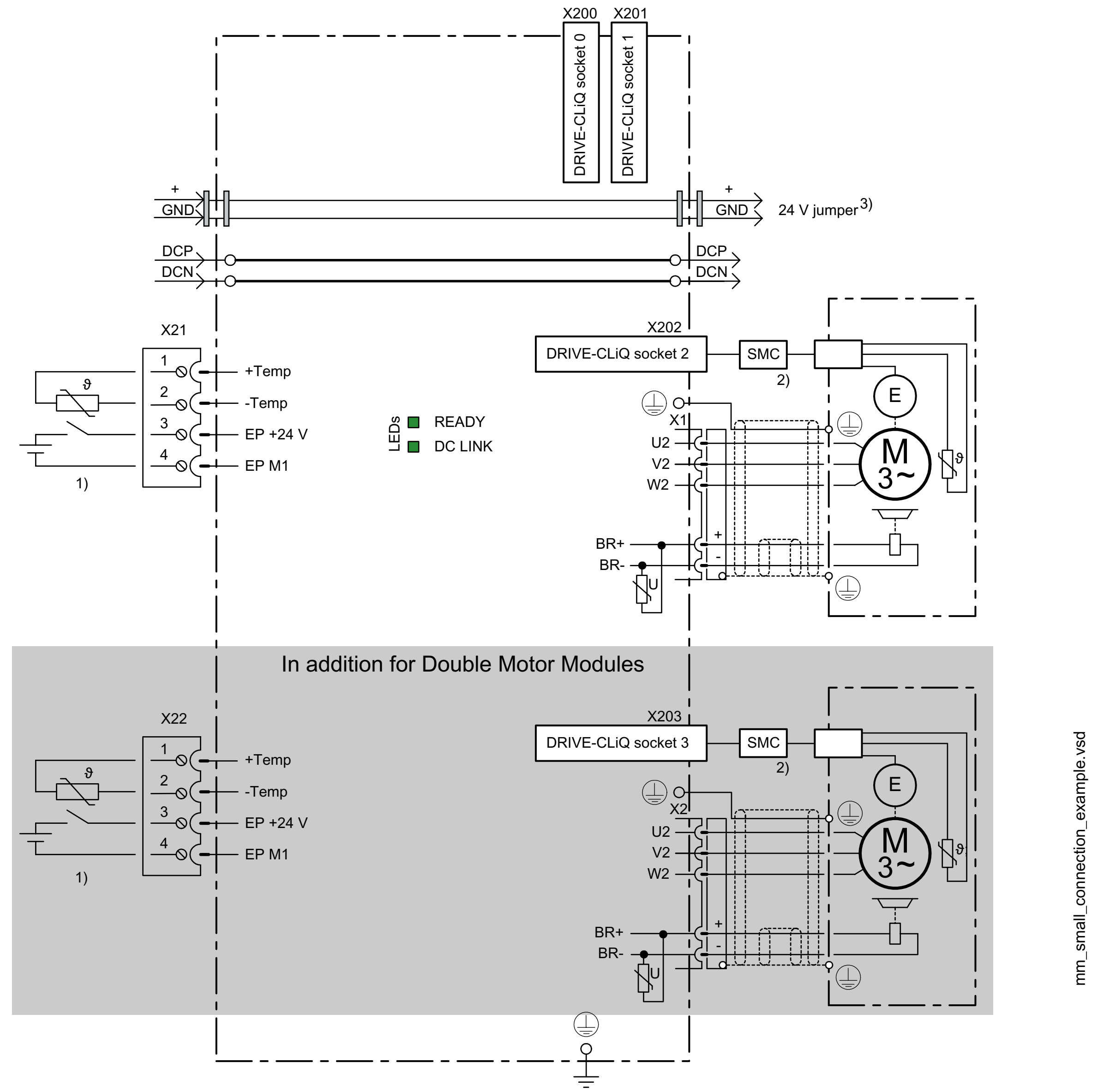


Figure 4-20 Example: Single Motor Module with external air cooling (5 A)

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 4-21 Connection example of Motor Modules 3 A to 30 A and Double Motor Modules 3 A to 18 A

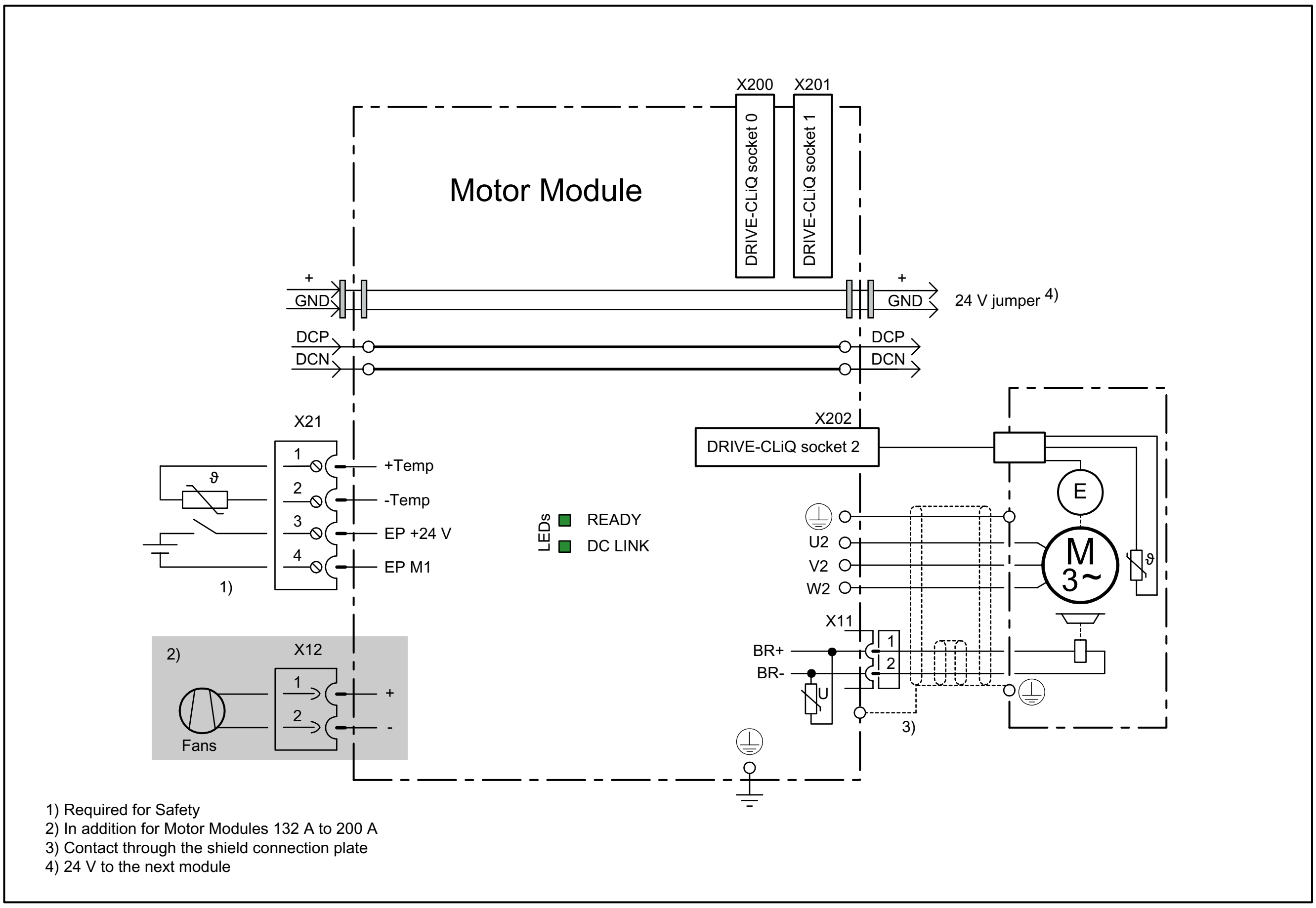
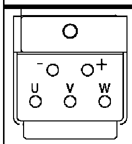
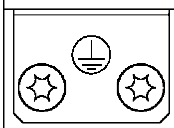


Figure 4-22 Example connection of Single Motor Modules 45 A to 200 A

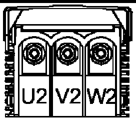
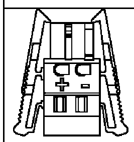
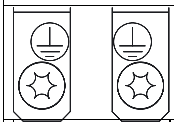
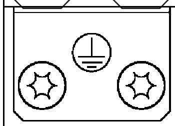
4.3.3.3 Motor/brake connection

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 data
	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 data
	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 Methods) Manufacturer: Wago; Order No.: 721-102/026-000/56-000 The brake connector is part of the prefabricated cable.
	PE connection	**Single Motor Module with a rated output current of 45 A to 60:** Threaded bolt for motor cables: M6/6 Nm [1] Threaded hole for PE: M6/6 Nm[1]
		**Single Motor Module with a rated output current of 85 A** Threaded bolt for motor cables: M8/13 Nm [1] Threaded hole for PE: M6/6 Nm[1] **Single Motor Module with a rated output current of 132 A to 200 A** Threaded bolt for motor cables: M8/13 Nm [1] Threaded hole for PE: M8/6 Nm [1]

[1] For ring cable lugs to DIN 46234

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

Note

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

Note

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

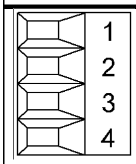
Warning

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

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

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

Table 4-15 Terminal block X21/X22

	Terminal	Function	Technical specifications
	1	+Temp	Temperature sensor connection KTY84–1C130/PTC
	2	-Temp	
	3	EP +24 V (Enable Pulses)	Supply voltage: 24 V DC (20.4 V - 28.8 V) Current consumption: 10 mA Isolated input Signal propagation times: L → H 100 μs H → L: 1000 μs
	4	EP M1 (Enable Pulses)	
Max. connectable cross-section 1.5 mm² Type: Screw terminal 1 (see Connection Methods)			

Notice

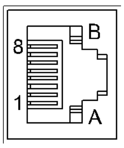
The KTY temperature sensor/the PTC must be connected with the correct polarity.

Note

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

4.3.3.5 X200-X203 DRIVE-CLiQ interface

Table 4-16 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)	Electronic ground
Blanking plate for DRIVE-CLiQ interface: Molex, order number: 85999-3255			

4.3.3.6 Meaning of the LEDs on the motor module

Table 4-17 Meaning of the LEDs on the Motor Module

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

Warning

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

The warning information on the components must be carefully observed!

Cause and rectification of faults

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

Reference: /IH1/ SINAMICS S120, Commissioning Manual.

4.3.4 Dimension Drawing

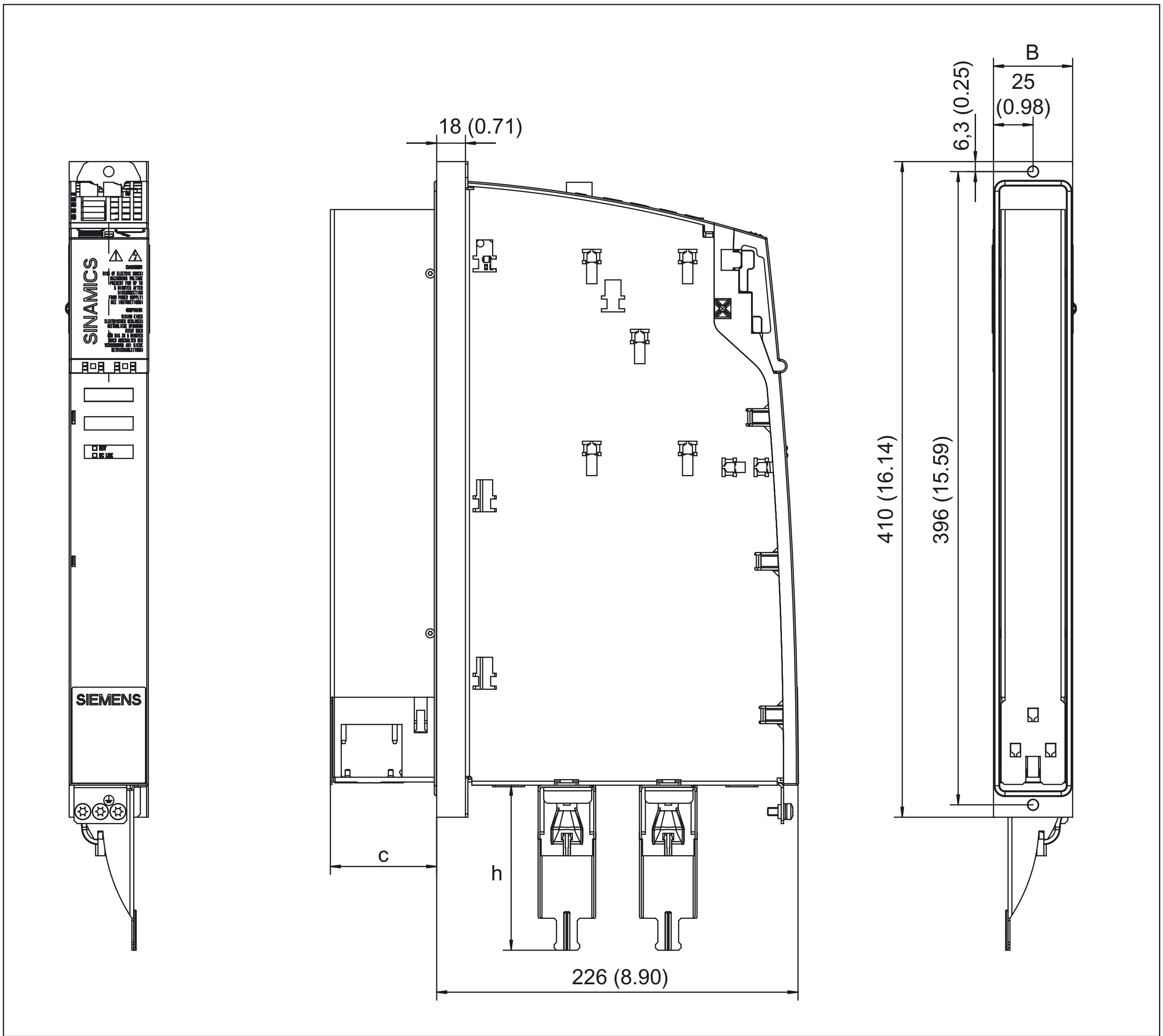


Figure 4-23 Dimension drawing of Motor Module with external air cooling 3 A to 18 A and 2 x 3 A to 2 x 9 A

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	50 (1.97)	66.5 (2.62)	105 (4.13)
Single Motor Module 9 A	6SL3121-1TE19-0AAx	50 (1.97)	66.5 (2.62)	105 (4.13)
Single Motor Module 18 A	6SL3121-1TE21-8AAx	50 (1.97)	66.5 (2.62)	105 (4.13)
Double Motor Module 3 A	6SL3121-2TE13-0AAx	50 (1.97)	66.5 (2.62)	105 (4.13)
Double Motor Module 5 A	6SL3121-2TE15-0AAx	50 (1.97)	66.5 (2.62)	105 (4.13)
Double Motor Module 9 A	6SL3121-2TE21-0AAx	50 (1.97)	66.5 (2.62)	105 (4.13)

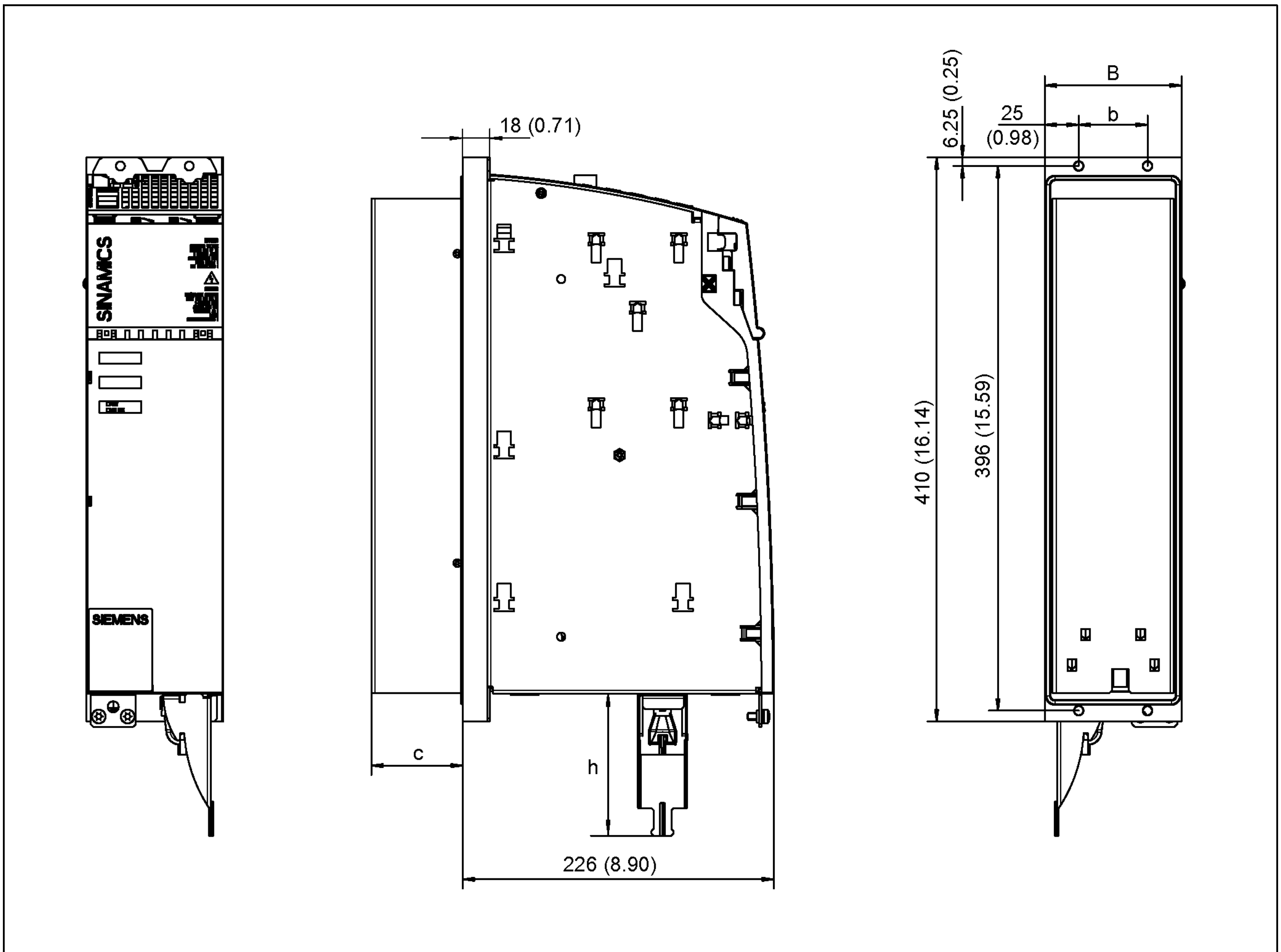


Figure 4-24 Dimension drawing of Motor Module with external air cooling 30 A and 2 x 18 A

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)	w [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	100 (3.94)	50 (1.97)	66.5 (2.62)	105 (4.13)

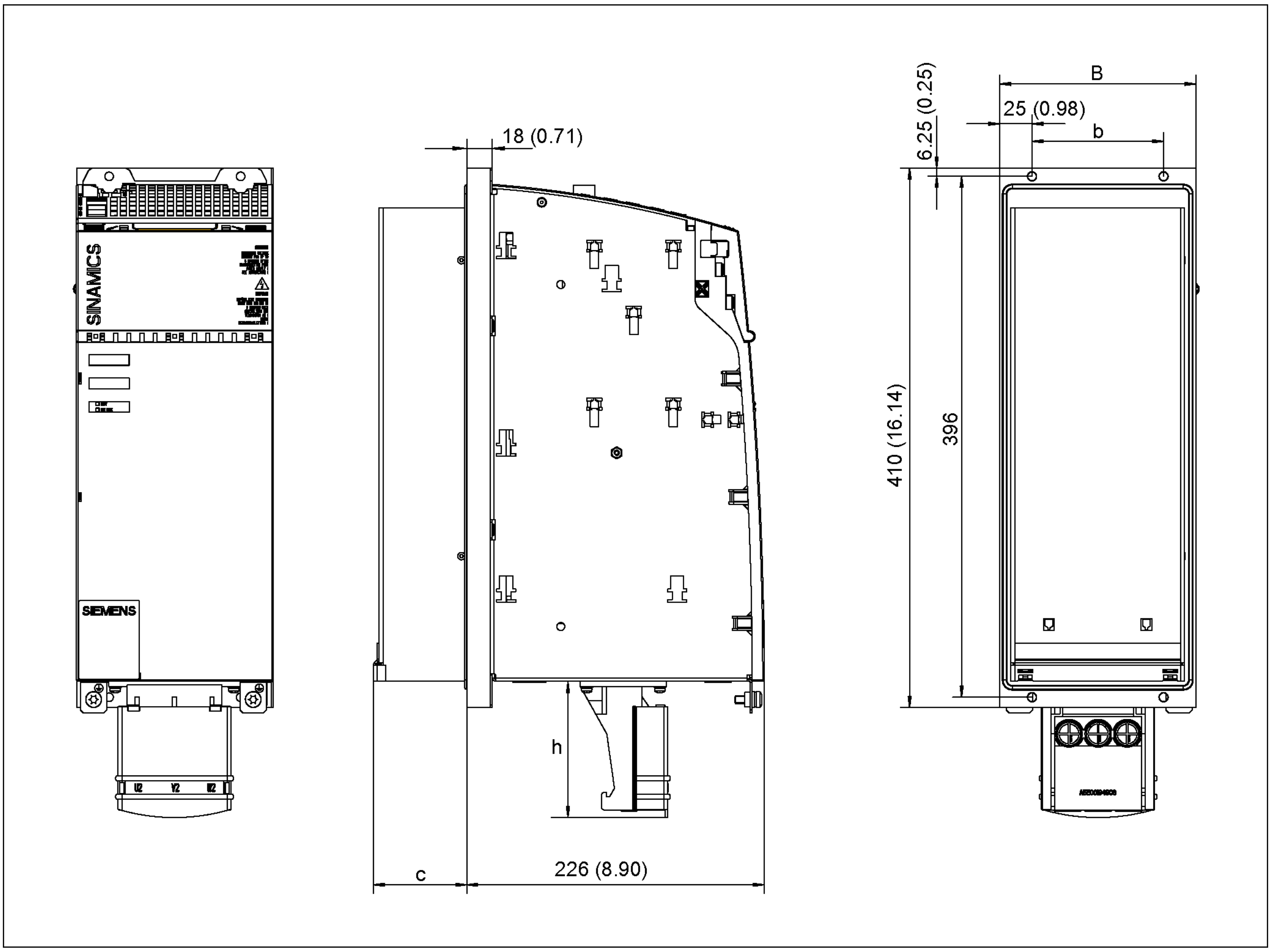


Figure 4-25 Dimension drawing of Motor Module with external air cooling (45 A, 60 A, and 85 A)

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

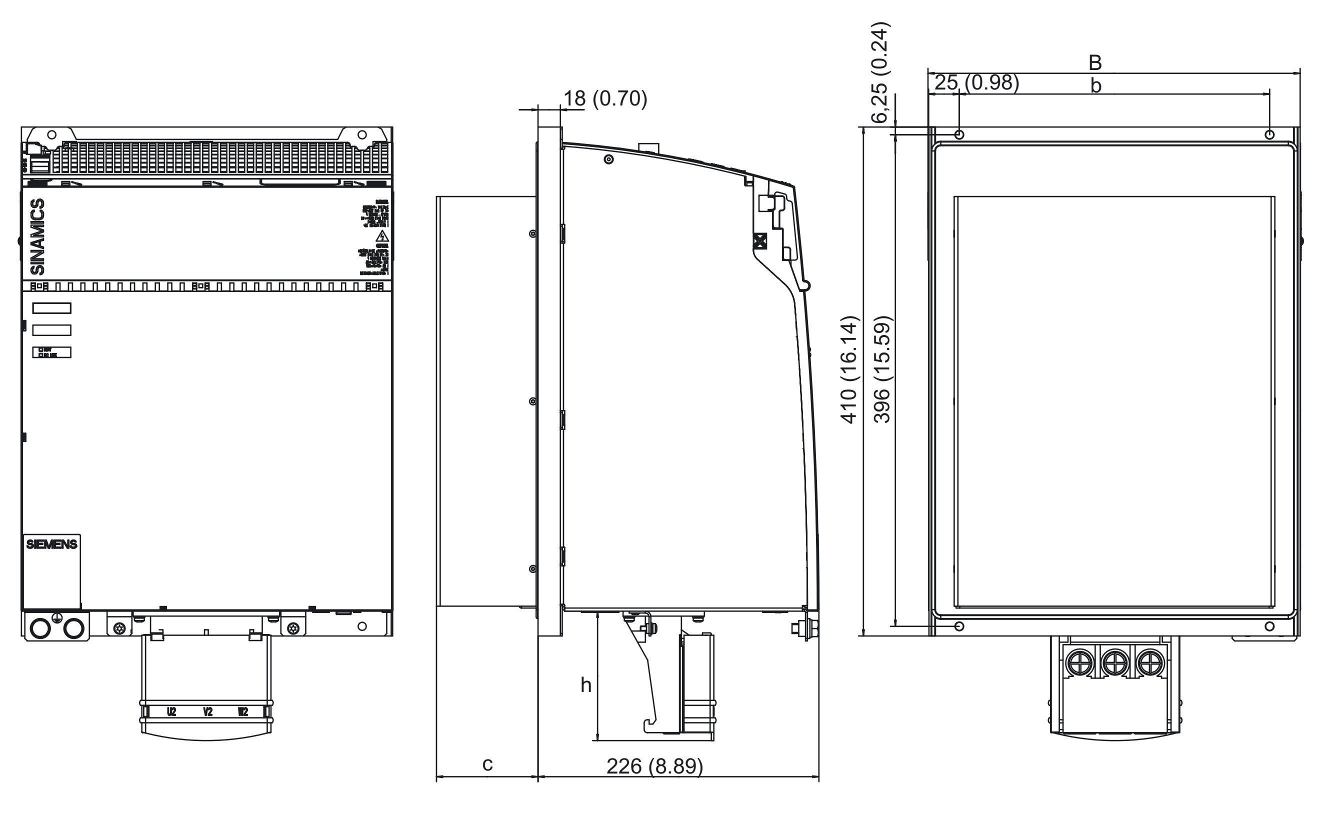


Figure 4-26 Dimension drawing of Motor Module with external air cooling (132 A and 200 A)

Table 4-21 Dimensions of Motor Module with external air cooling (132 A and 200 A)

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

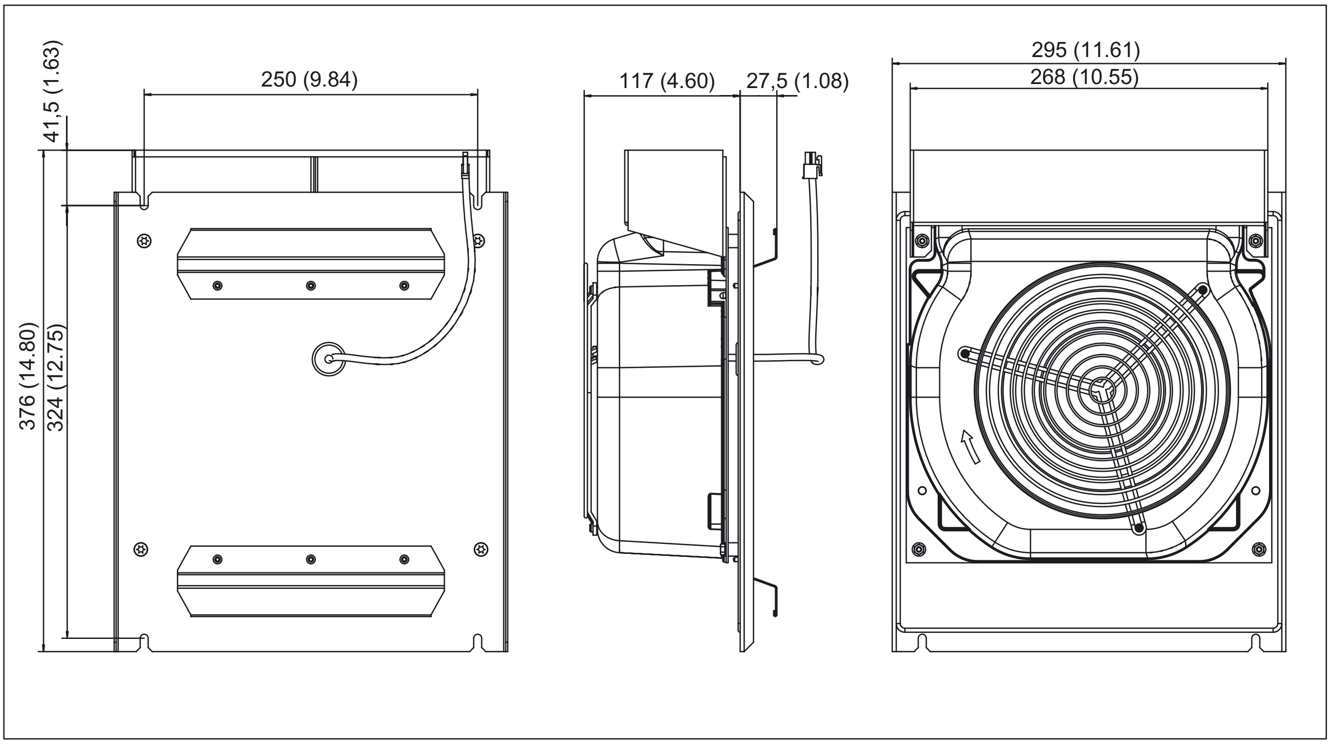


Figure 4-27 Dimension drawing of fan for Motor Modules with external air cooling (132 A and 200 A)

4.3.5 Installation

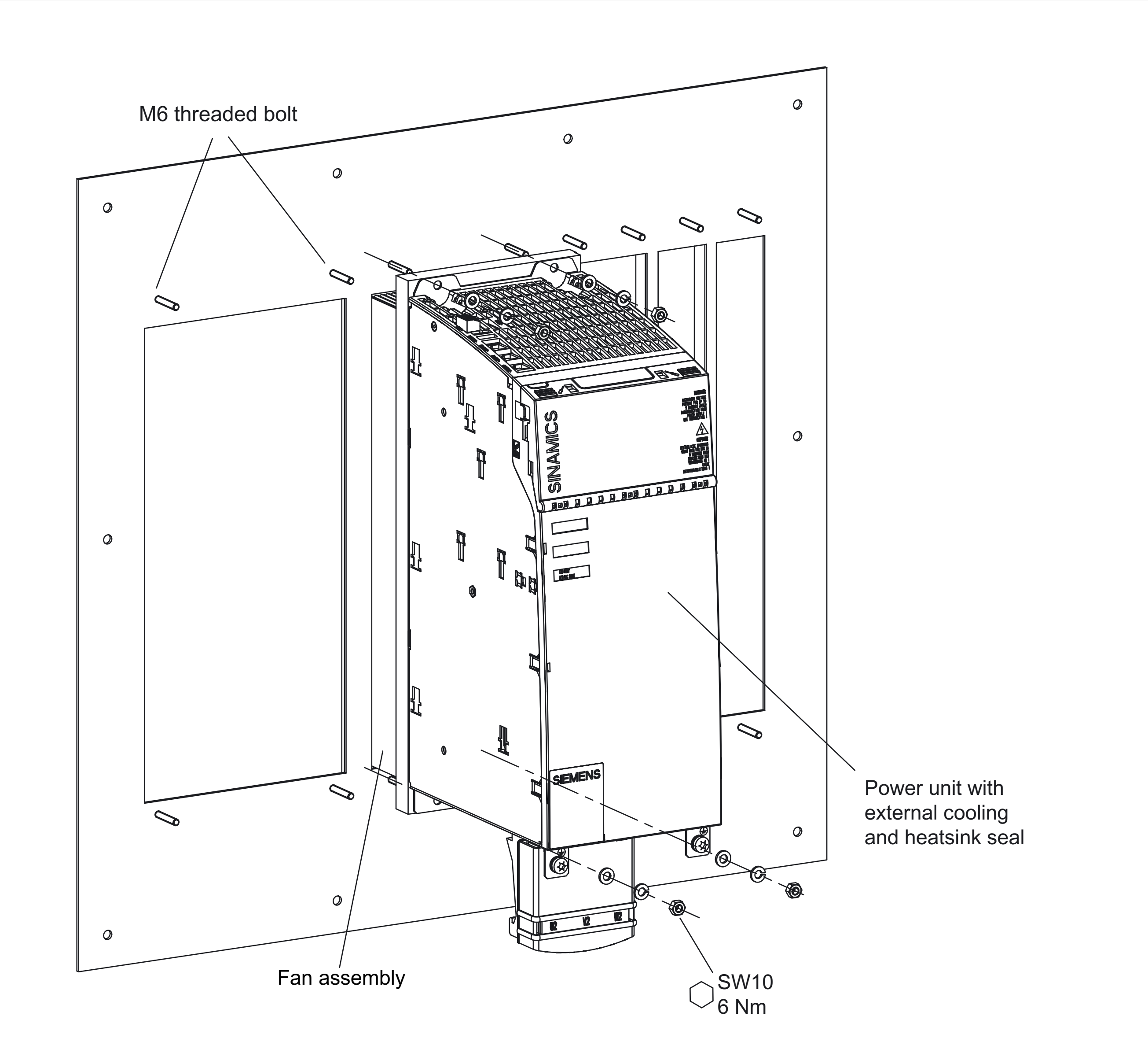


Figure 4-28 Example: Installing the power unit with external air cooling

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: mailto:cc.cabinetcooling@siemens.com

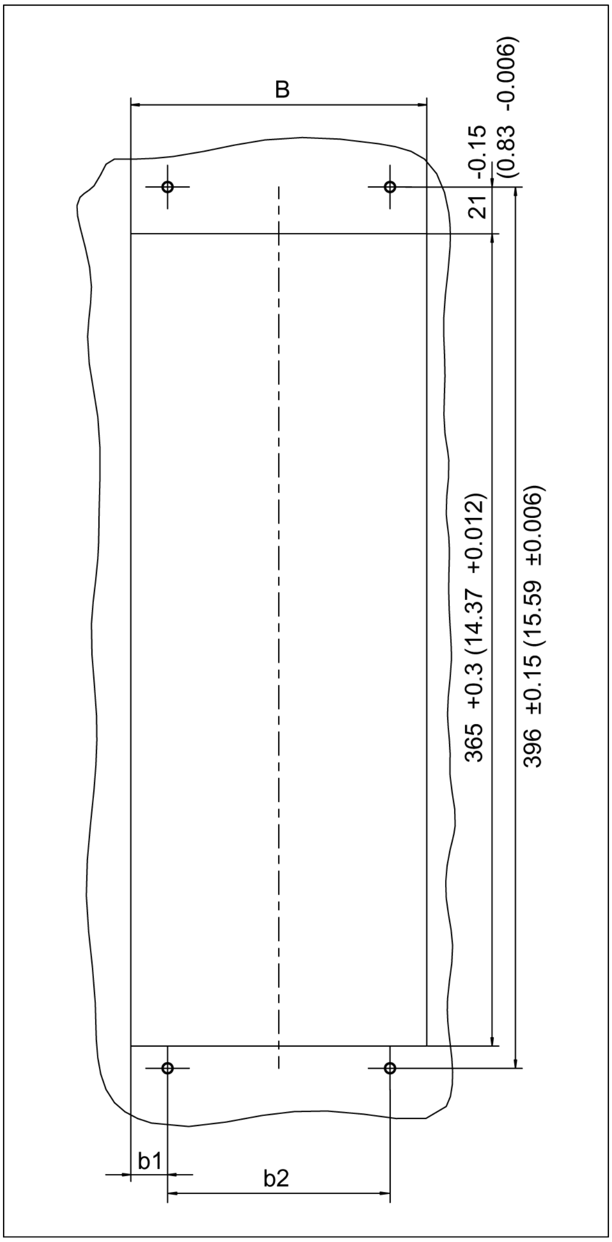


Figure 4-29 Installation openings for the power unit with external air cooling, 50 mm to 200 mm

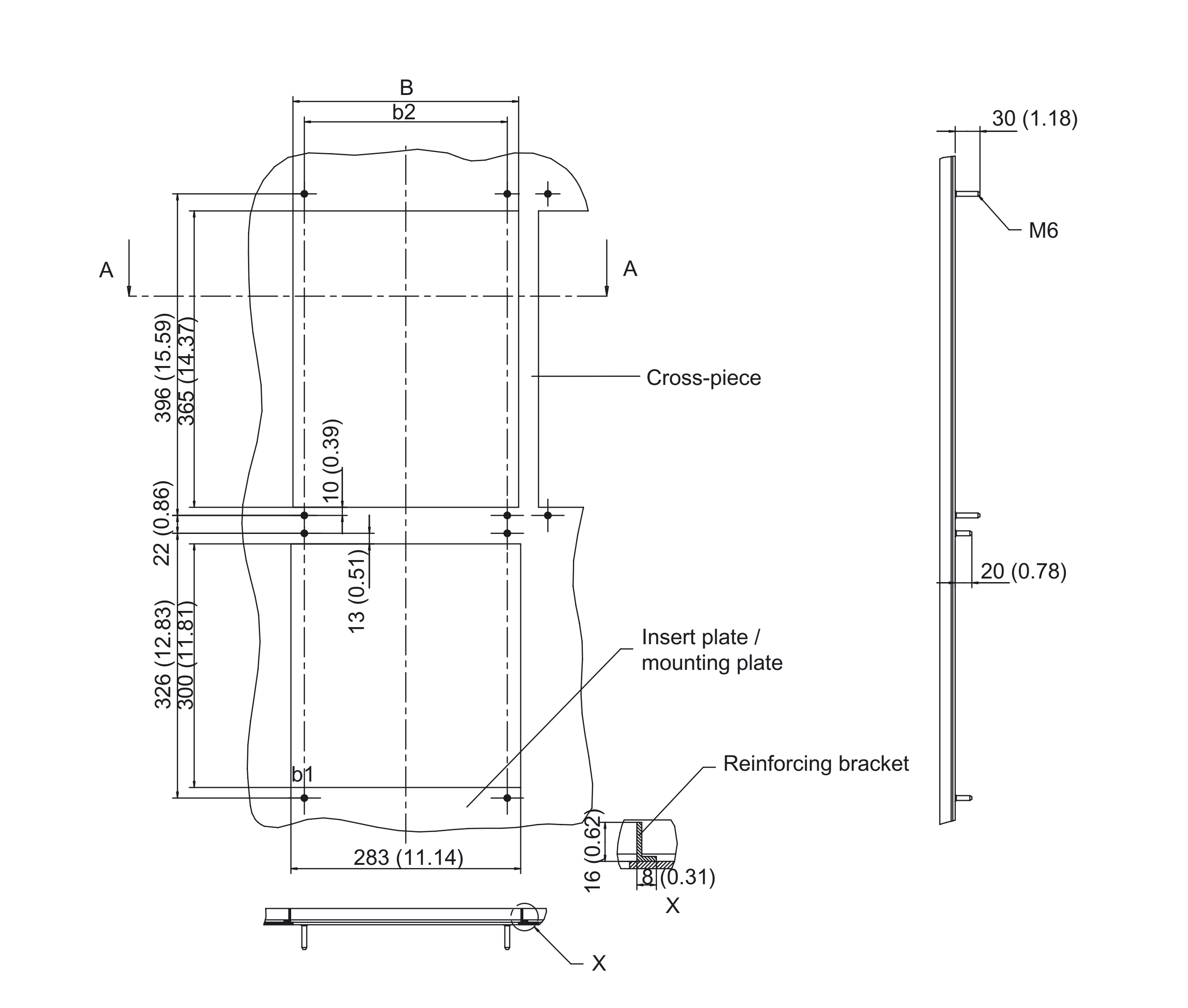


Figure 4-30 Installation openings for the power unit with external air cooling, 300 mm

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)

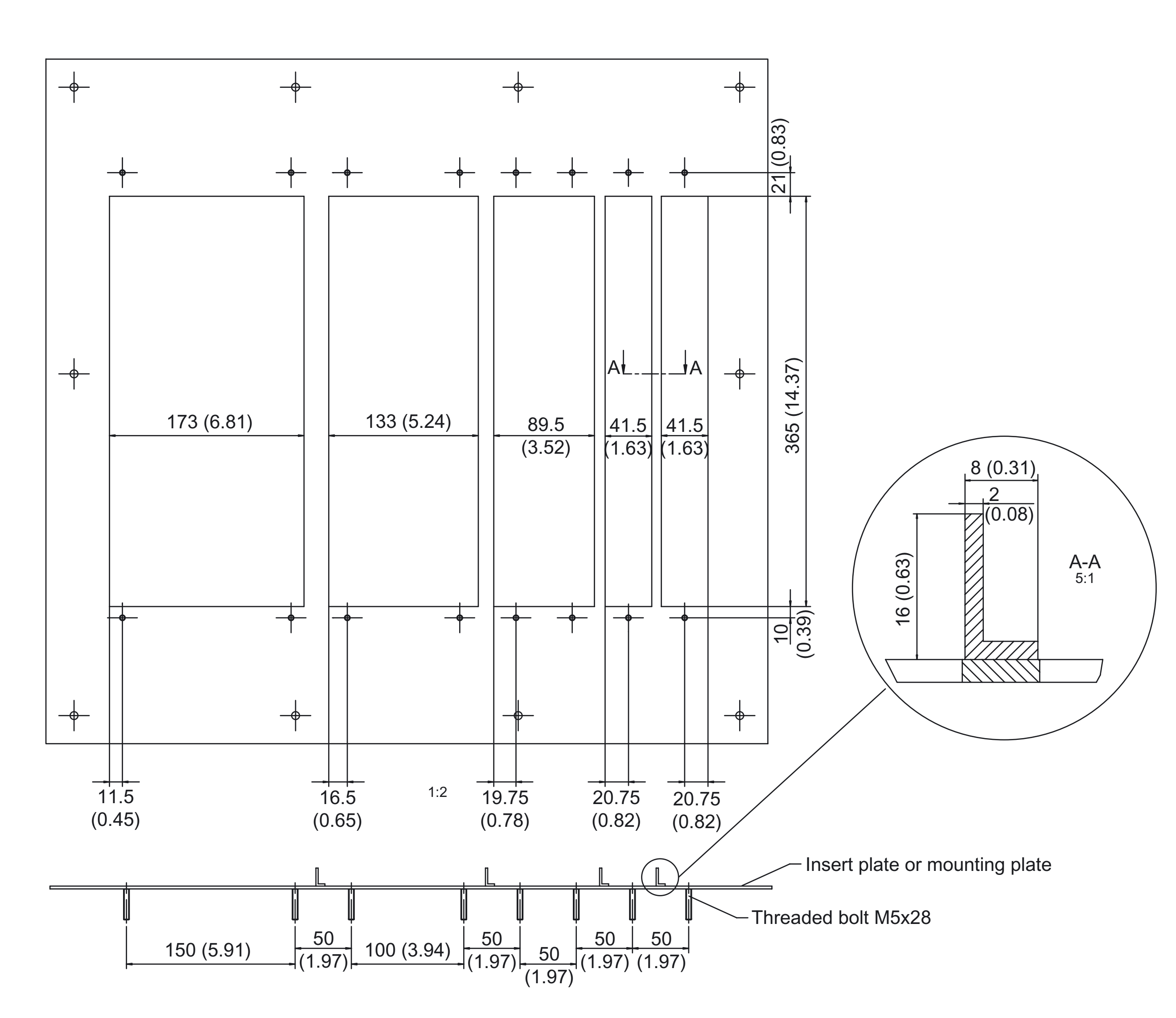


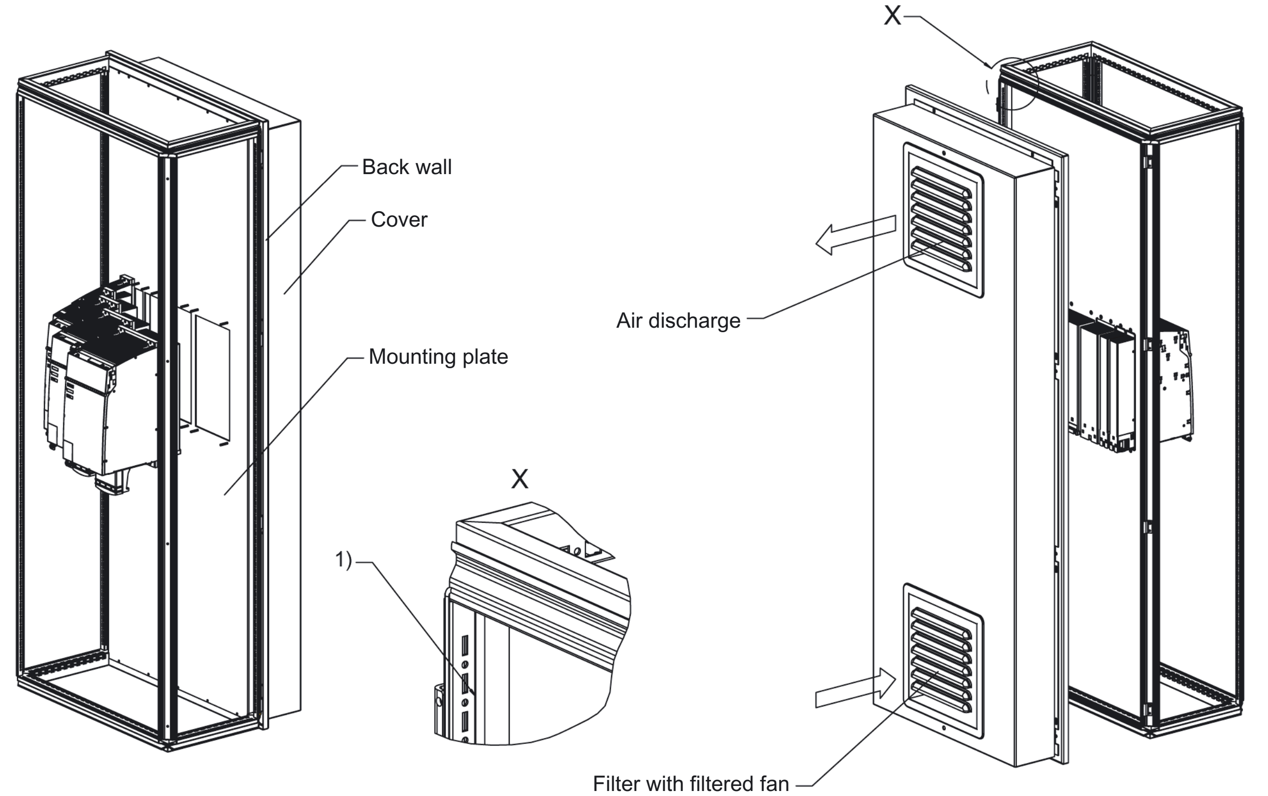
Figure 4-31 Example: mounting plate with a drive line-up

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

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

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

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



1) To comply with degree of protection IP54, the surfaces between the mounting plate and cabinet bar must be sealed all around. (e.g. use sealing agent Terostat-91 from Teroson)

Figure 4-32 Example 1: installation in cabinet with mounting plate

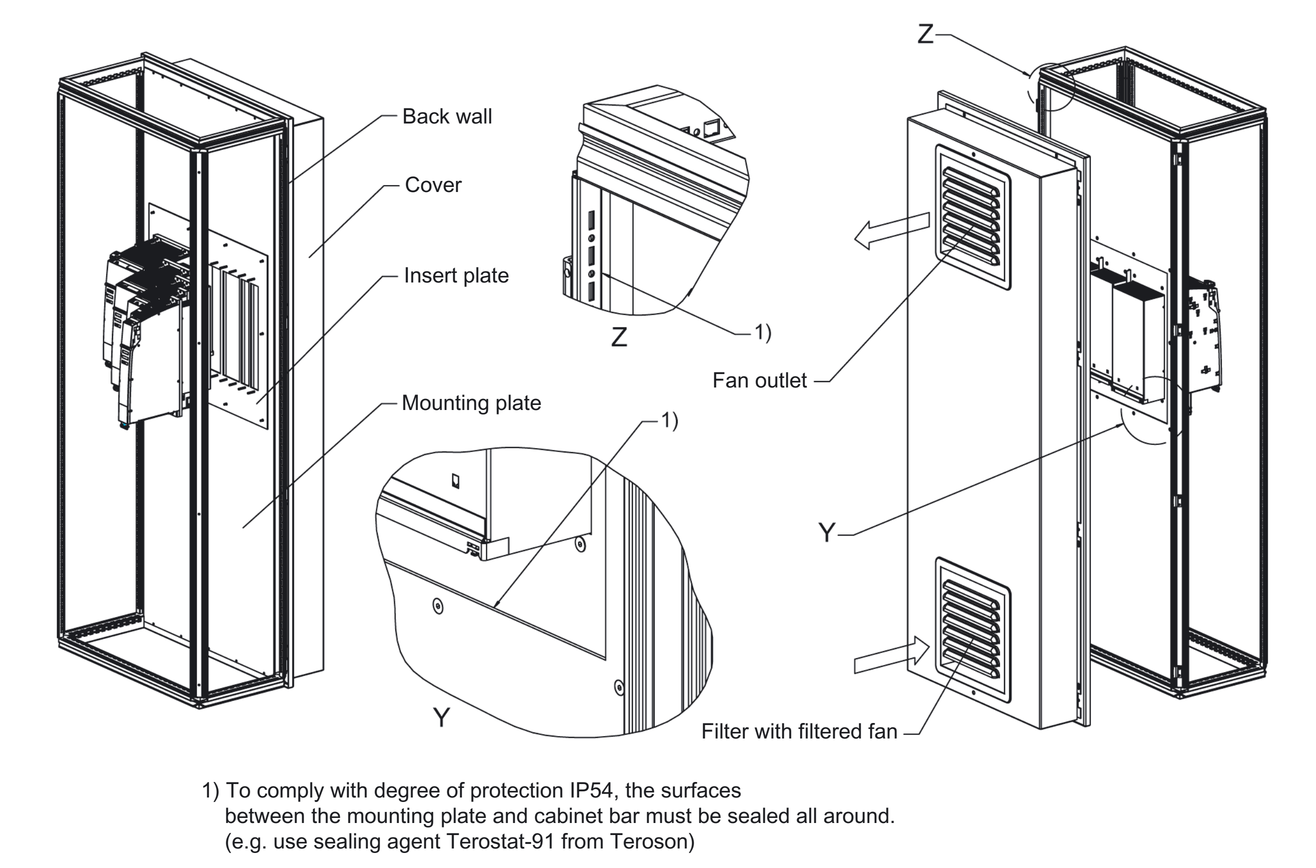


Figure 4-33 Example 2: installation in cabinet with mounting plate

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.

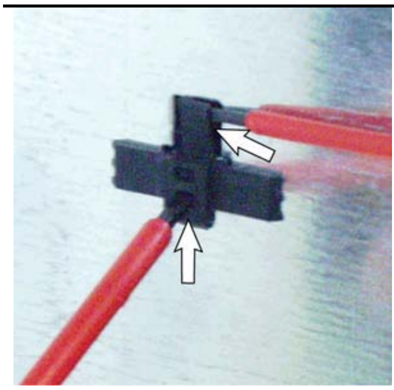
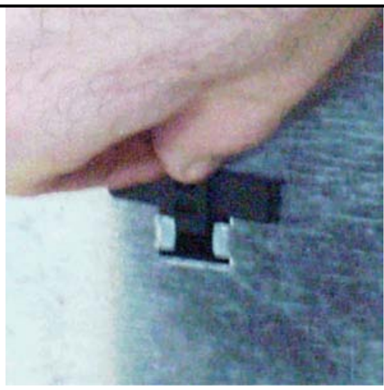
Note

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

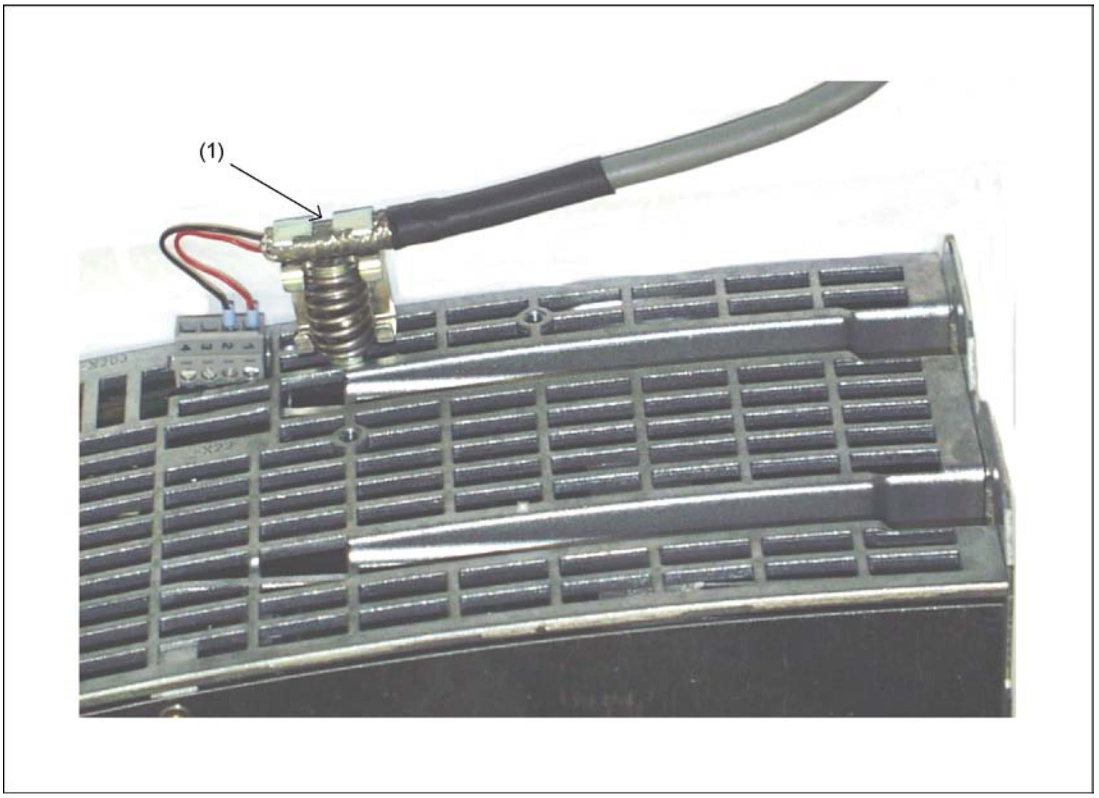


Figure 4-34 Shield contact for the terminals

(1) Shield connection: Weidmüller, Order No. KLBÜ 3-8 SC

Internet address:

Weidmüller: http://www.weidmueller.com

4.3.7 Technical specifications

Table 4-23 Technical specifications for Single Motor Modules booksize (3 to 30 A)

External air cooling	6SL3121–	1TE13-0AAx	1TE15-0AAx	1TE21–0AAx	1TE21–8AAx	1TE23-0AAx
Rated current	**A**	**3**	**5**	**9**	**18**	**30**
Voltage						
Supply: DC link voltage Electronics power supply	 V_{DC} V_{DC}	 510 – 750 24 (20.4 - 28.8)				
Output voltage	V_{ACrms}	0 - 0.67 x DC link voltage				
Overvoltage trip threshold Undervoltage trip threshold	V_{DC} V_{DC}	820 ± 2% 380 ± 2%				
Electronics current consumption at 24 V	A_{DC}	0.85	0.85	0.85	0.85	0.9
Total power loss (including electronic losses)[1]	W	35.4	50.4	65.4	110.4	231.6
Rated output current (I_n)	A_{ACrms}	3	5	9	18	30
Base load current (I_{base})	A	2.6	4.3	7.7	15.3	25.5
Intermittent duty current (I_{s6}) 40%	A_{ACrms}	3.5	6	10	24	40
Peak current (I_{max})	A_{ACrms}	6	10	18	36	56
DC link busbar current carrying capacity	A_{DC}	100	100	100	100	100
24 V busbar current carrying capacity	A_{DC}	20	20	20	20	20
Rated power (with DC link voltage of 600 V_{DC} and pulse frequency of 4 kHz)	kW	1.6	2.7	4.8	9.7	16
Max. pulse frequency without derating	kHz	4	4	4	4	4
Max. pulse frequency with derating	kHz	16	16	16	16	16
Max. ambient temperature without derating	°C	40	40	40	40	40
Max. ambient temperature with derating	°C	55	55	55	55	55
DC link capacitance	μF	110	110	110	220	705
Efficiency (4kHz)	η	0.97	0.97	0.97	0.97	0.97
Sound pressure level	dB(A)	<60	<60	<60	<60	<60
Cooling air requirement	m^3/h	29.6	29.6	29.6	29.6	56
Weight	kg	5.69	5.69	5.7	5.7	8.43

Table 4-24 Technical specifications for Single Motor Modules booksize (45 to 200 A)

External air cooling	6SL3121–	1TE24-5AAx	1TE26-0AAx	1TE28-5AAx	1TE31-3AAx	1TE32-0AAx
Rated current	**A**	**45**	**60**	**85**	**132**	**200**
Voltage						
Supply: DC link voltage Electronics power supply	 V_{DC} V_{DC}	 510 – 750 24 (20.4 - 28.8)				
Output voltage	V_{ACrms}	0 - 0.67 x DC link voltage				
Overvoltage 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	348.8	483.8	626	1036	1696
Rated output current (I_n)	A_{ACrms}	45	60	85	132	200
Base load current (I_{geund})	A	38	51	68	105	141
Intermittent duty current (I_{s6}) 40%	A_{ACrms}	60	80	110	150	230
Peak current (I_{max})	A_{ACrms}	85	113	141	210	282
DC link busbar current carrying capacity	A_{DC}	100	100	200	200	200
24 V busbar current carrying capacity	A_{DC}	20	20	20	20	20
Rated power (with DC link voltage of 600 V_{DC} and clock 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	1,175	1,410	1,880	2,820	3,995
Efficiency (4kHz)	η	0.97	0.97	0.97	0.97	0.97
Sound pressure level	dB(A)	<65	<65	<60	<73	<73
Cooling air requirement	m^3/h	112	112	160	520	520
Weight	kg	13.2	13.35	17.2	27.13	27.99

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					
Supply: DC link voltage Electronics power supply	 V_{DC} V_{DC}	 510 – 750 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	59	84	119	244
Rated output current (I_n)	A	2x3	2x5	2x9	2x18
Base load current (I_{base})	A	2x2.6	2x4.3	2x7.7	2x15.3
Intermittent duty current (I_{S6}) 40%	A_{ACrms}	2x3.5	2x6	2x10	2x24
Peak current (I_{max})	A_{ACrms}	2x6	2x10	2x18	2x36
DC link busbar current carrying capacity	A	100	100	100	100
24 V busbar current carrying capacity	A	20	20	20	20
Rated power (600V, 4kHz)	kW	1.6	2.7	4.8	9.7
Max. pulse frequency without derating	kHz	4	4	4	4
Max. pulse frequency with derating	kHz	16	16	16	16
Max. ambient temperature without derating	°C	40	40	40	40
Max. ambient temperature with derating	°C	55	55	55	55
DC link capacitance	µF	110	220	220	705
Efficiency (4kHz)	η	0.97	0.97	0.97	0.97
Sound pressure level	dBA	<60	<60	<60	<60
Cooling air requirement	m^3/h	29.6	29.6	29.6	56
Weight	kg	5.8	5.8	5.7	8.6

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

Rated duty cycles of Motor Modules booksize

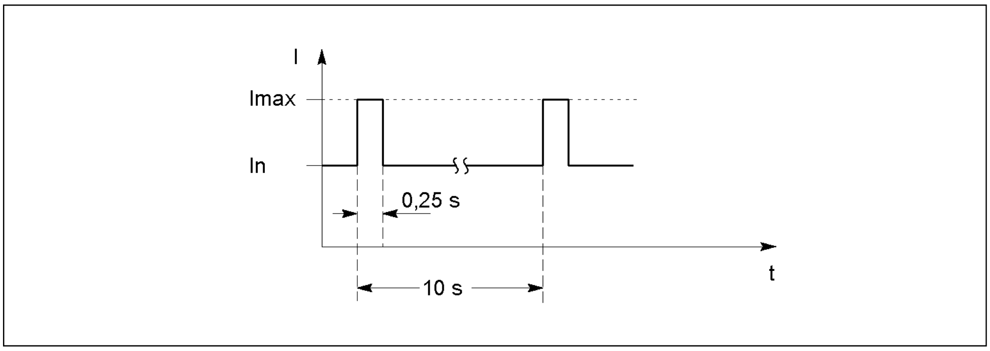


Figure 4-35 Peak current duty cycle with prior loading

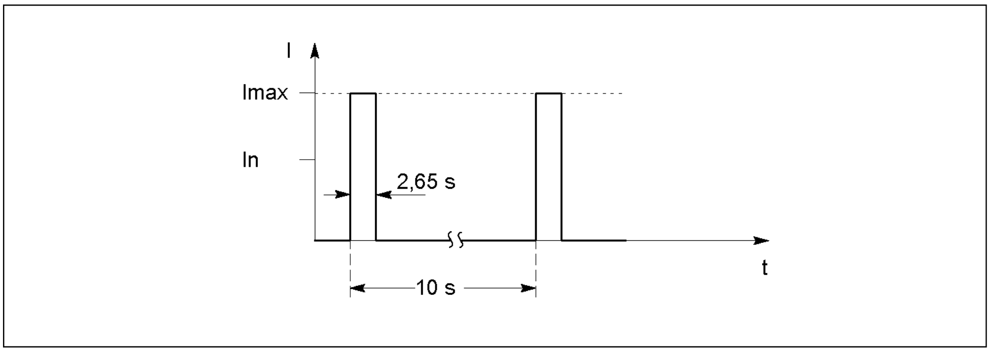


Figure 4-36 Peak current duty cycle without prior loading

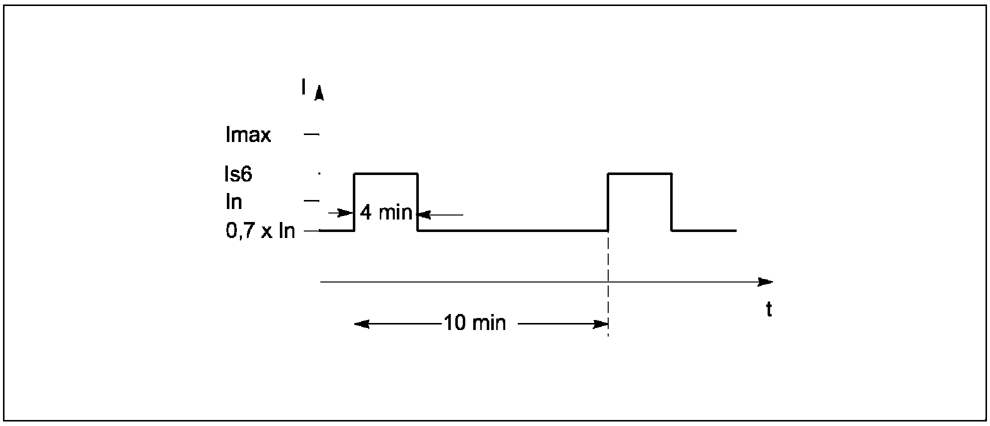


Figure 4-37 S6 current duty cycle with prior loading

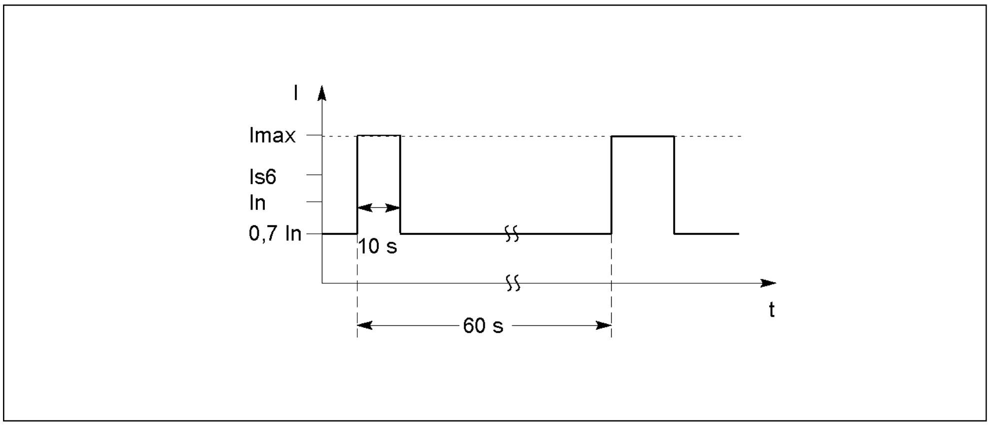


Figure 4-38 S6 peak current duty cycle with prior loading

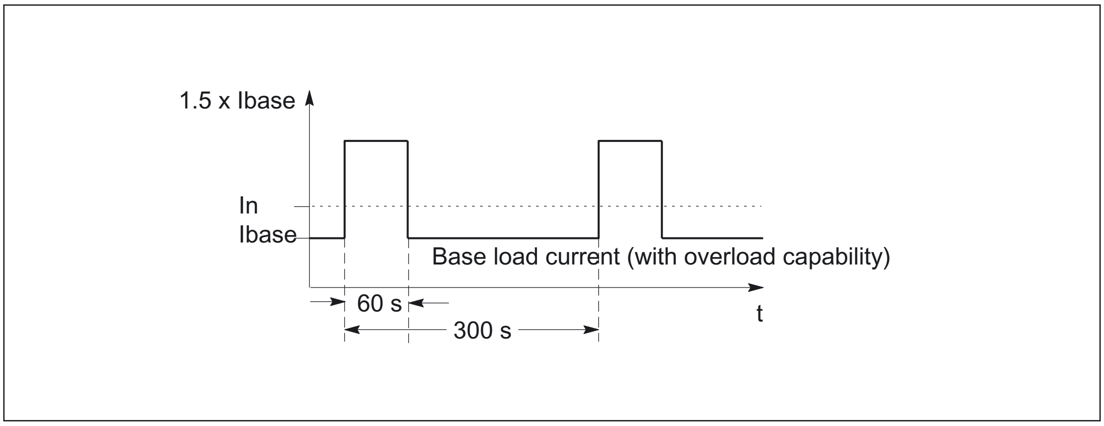


Figure 4-39 Current duty cycle with prior loading

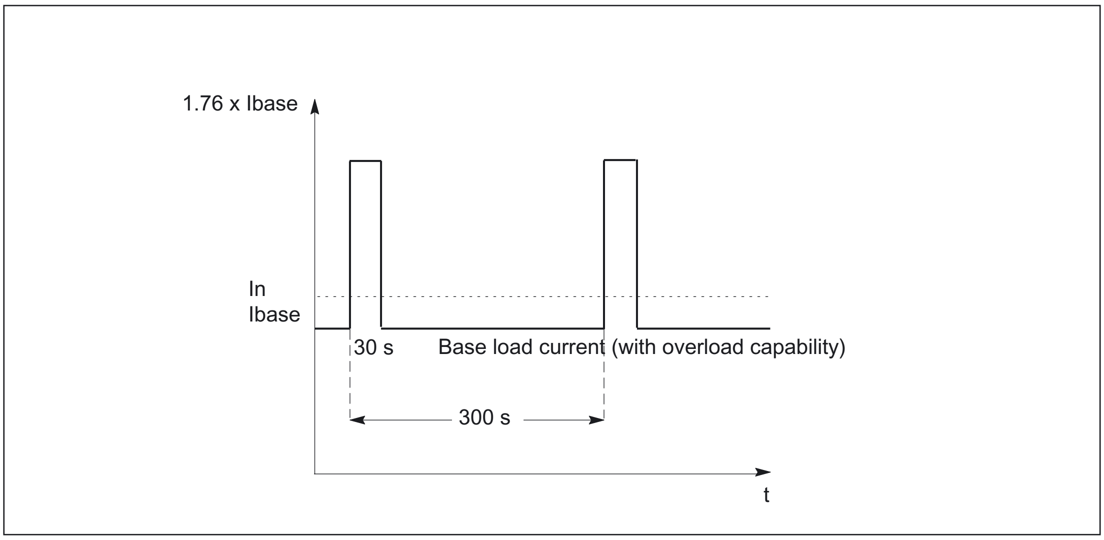


Figure 4-40 Current duty cycle with prior loading

Derating as a function of the ambient temperature

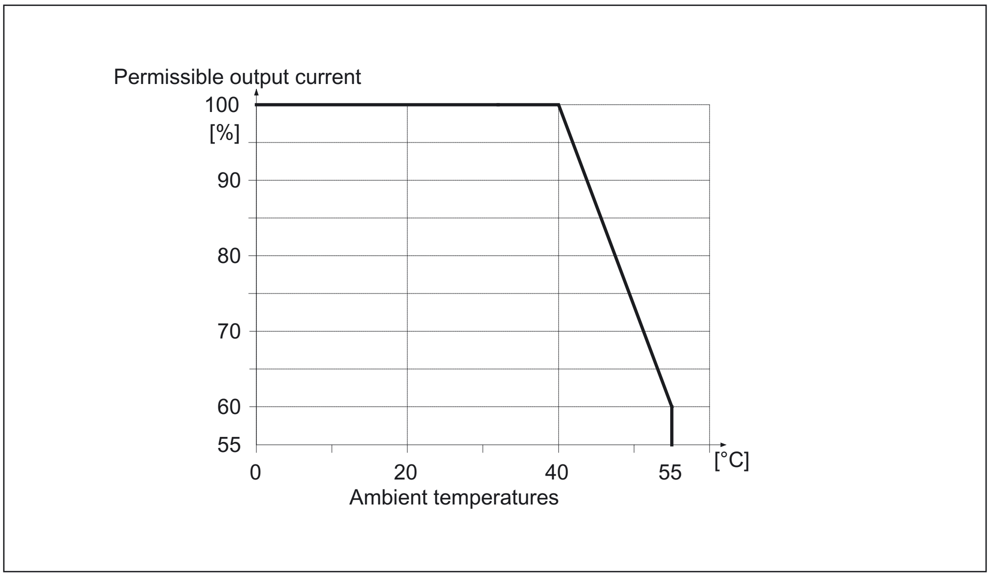


Figure 4-41 Derating as a function of the ambient temperature

Derating as a function of the pulse frequency

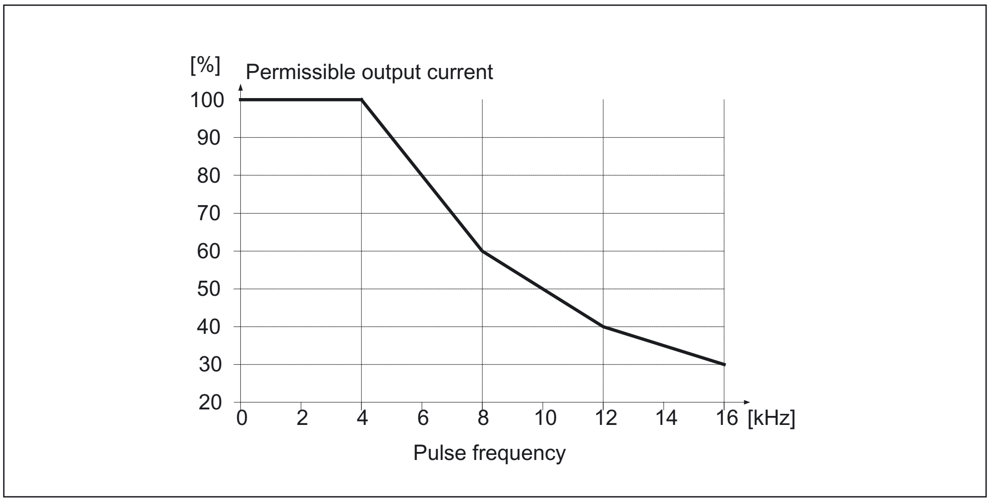


Figure 4-42 Derating as a function of the pulse frequency

Derating as a function of the installation altitude

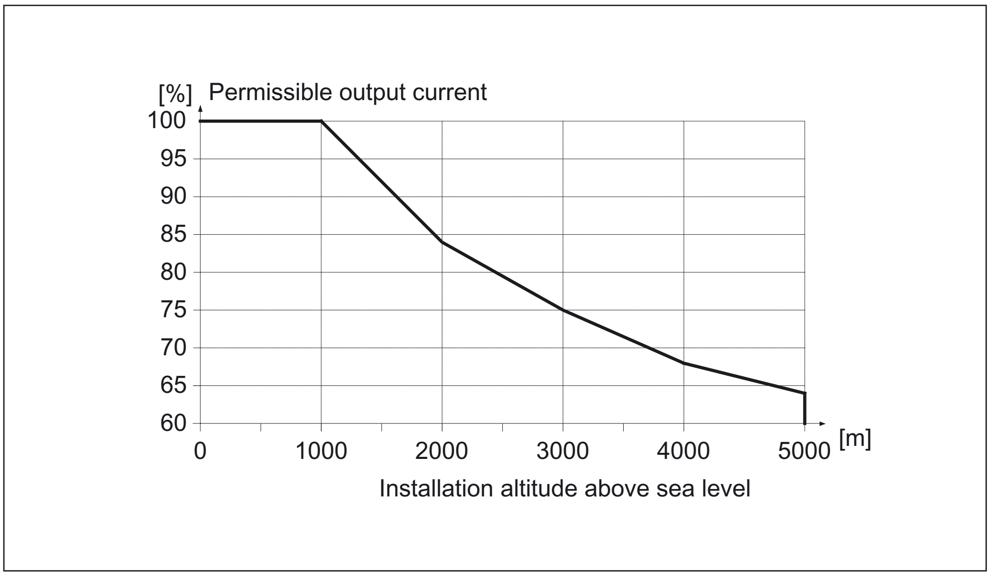


Figure 4-43 Derating as a function of the installation altitude

DC link components Booksize 5

5.1 Braking Module Booksize

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 and control. The Braking Module is operational, the regenerative energy is dissipated as thermal energy in an external braking resistor.

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

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

Note

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

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

5.1.2 Safety information

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, otherwise this could result in secondary damage or accidents.

Caution

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

A set of labels in 16 languages is available under Order No.: 6SL3166-3AB00-0AAx.

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

Notice

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

Caution

It is only permissible to establish connections to the DC link using the adapters that Siemens has recommended (DC link adapter and DC link infeed 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 startup. After transportation, the screws must be tightened.

Note

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

Caution

The left and right ends of the DC link busbar of a drive line-up must be closed using lateral covers (Order No.: 6SL3162-5AA00-0AA0).

5.1.3 Interface description

5.1.3.1 Overview

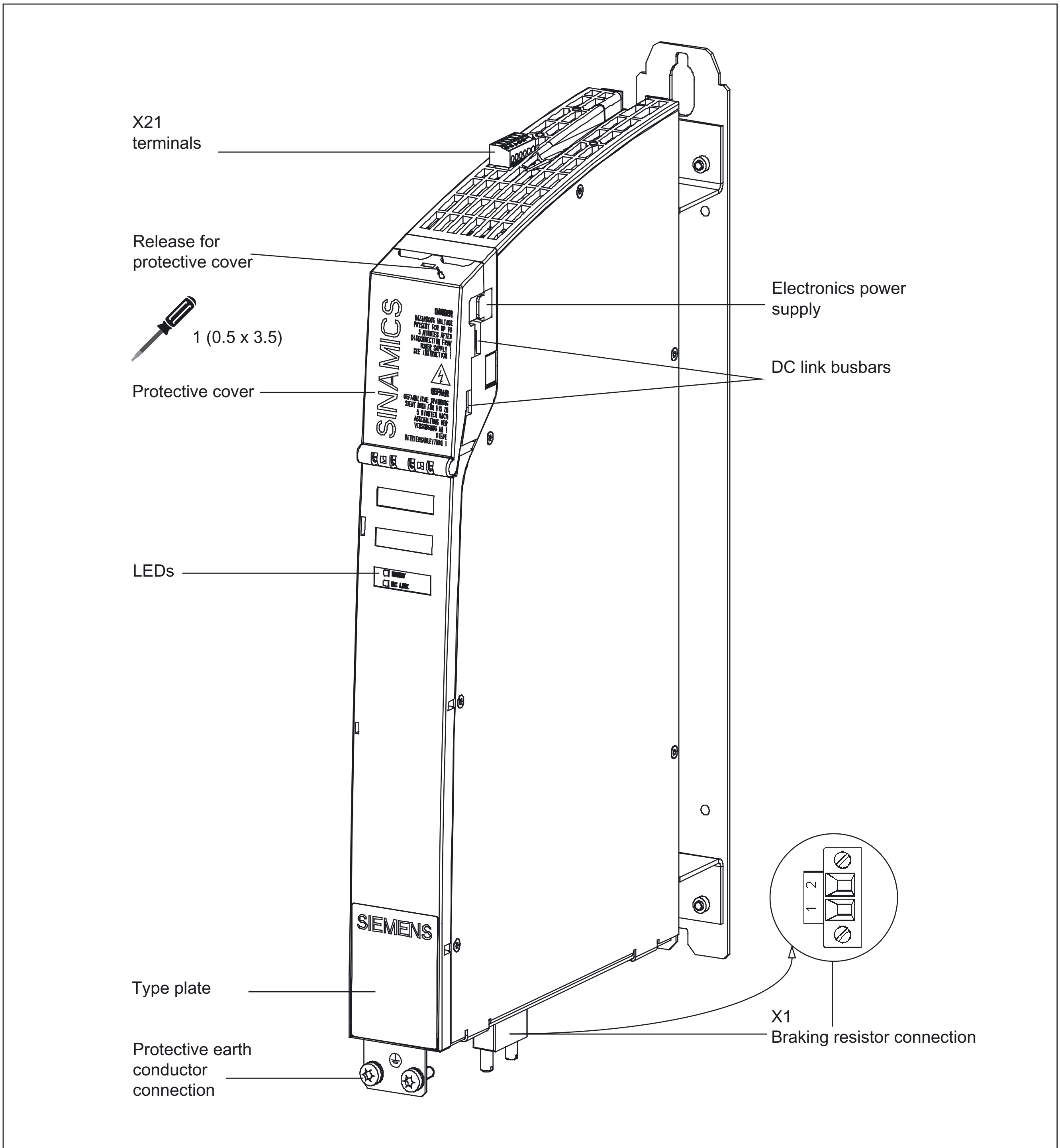


Figure 5-1 Interface description of braking module

5.1.3.2 Connection example

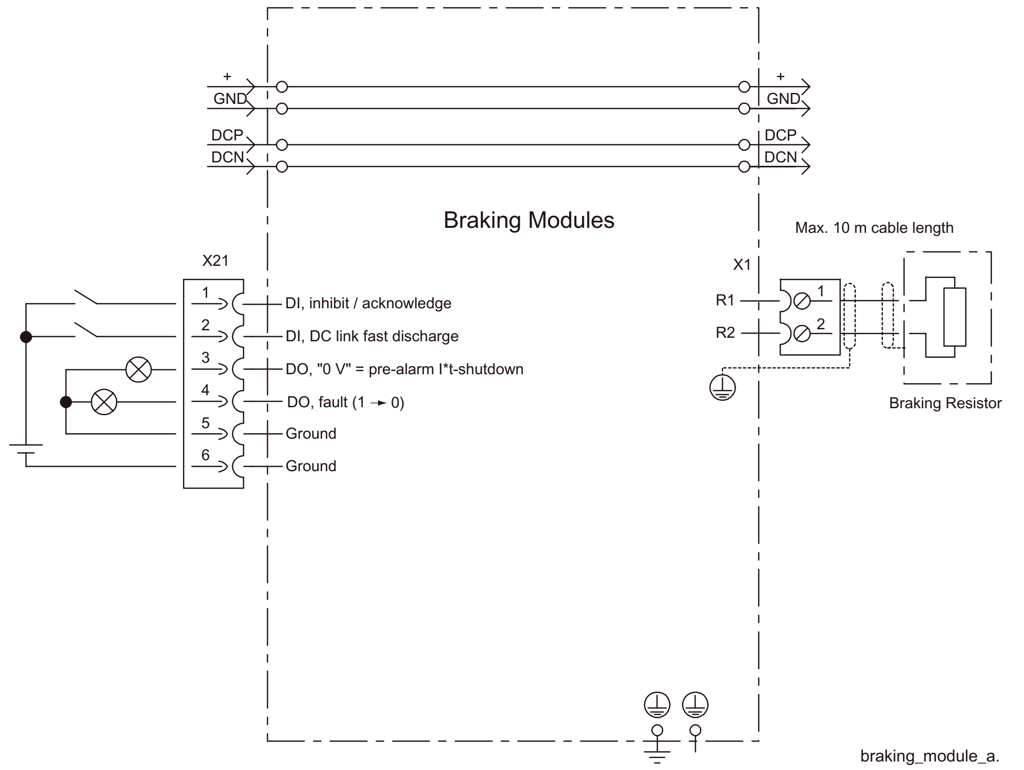
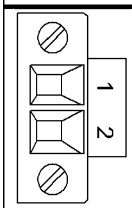


Figure 5-2 Example connection of Braking Module

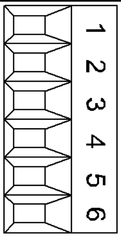
5.1.3.3 Braking resistor connection X1

Table 5-1 Terminal block X1

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

5.1.3.4 X21 digital inputs/outputs

Table 5-2 Terminal block X21

	Terminal	Name1)	Technical data
	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) 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 Methods)			

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

---

Note

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

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

5.1.3.5 Meaning of the LEDs on the braking module

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

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

Note

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

5.1.4 Dimension drawing

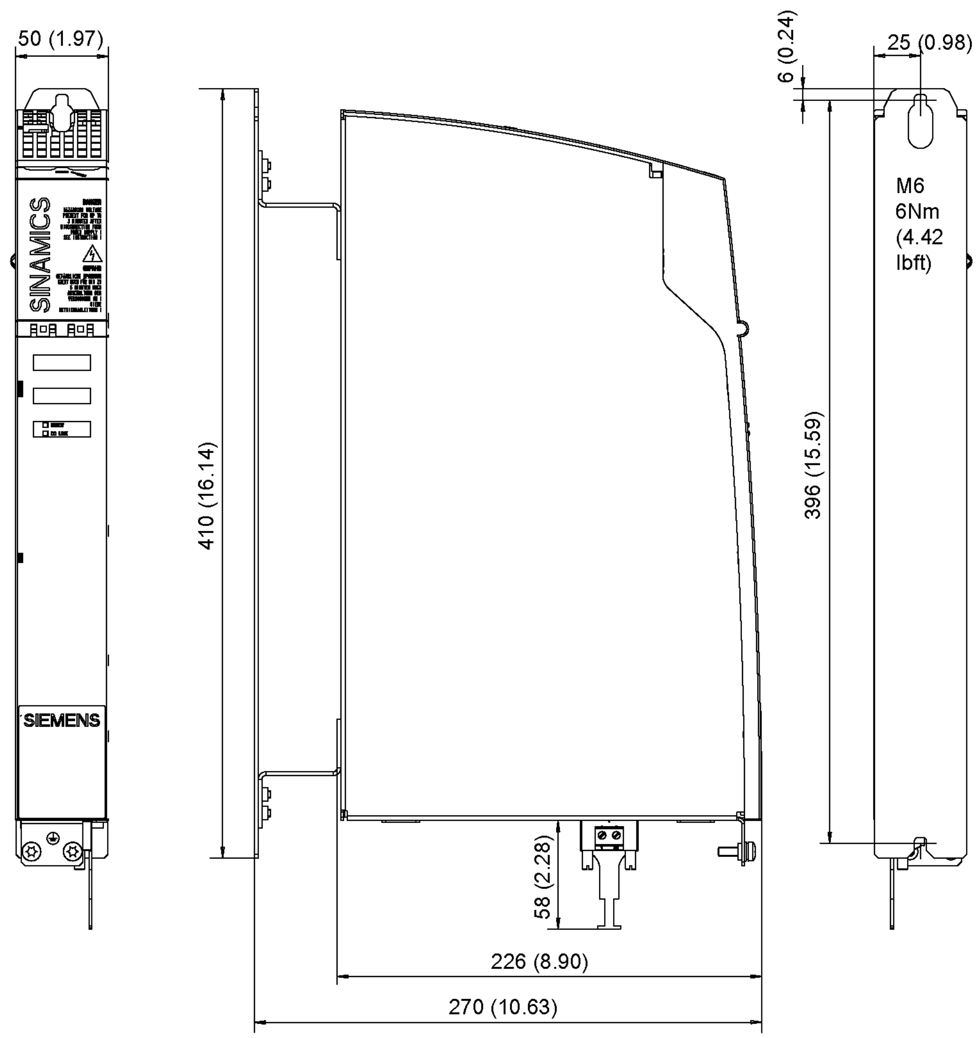


Figure 5-3 Dimension drawing of the Braking Module

5.1.5 Mounting

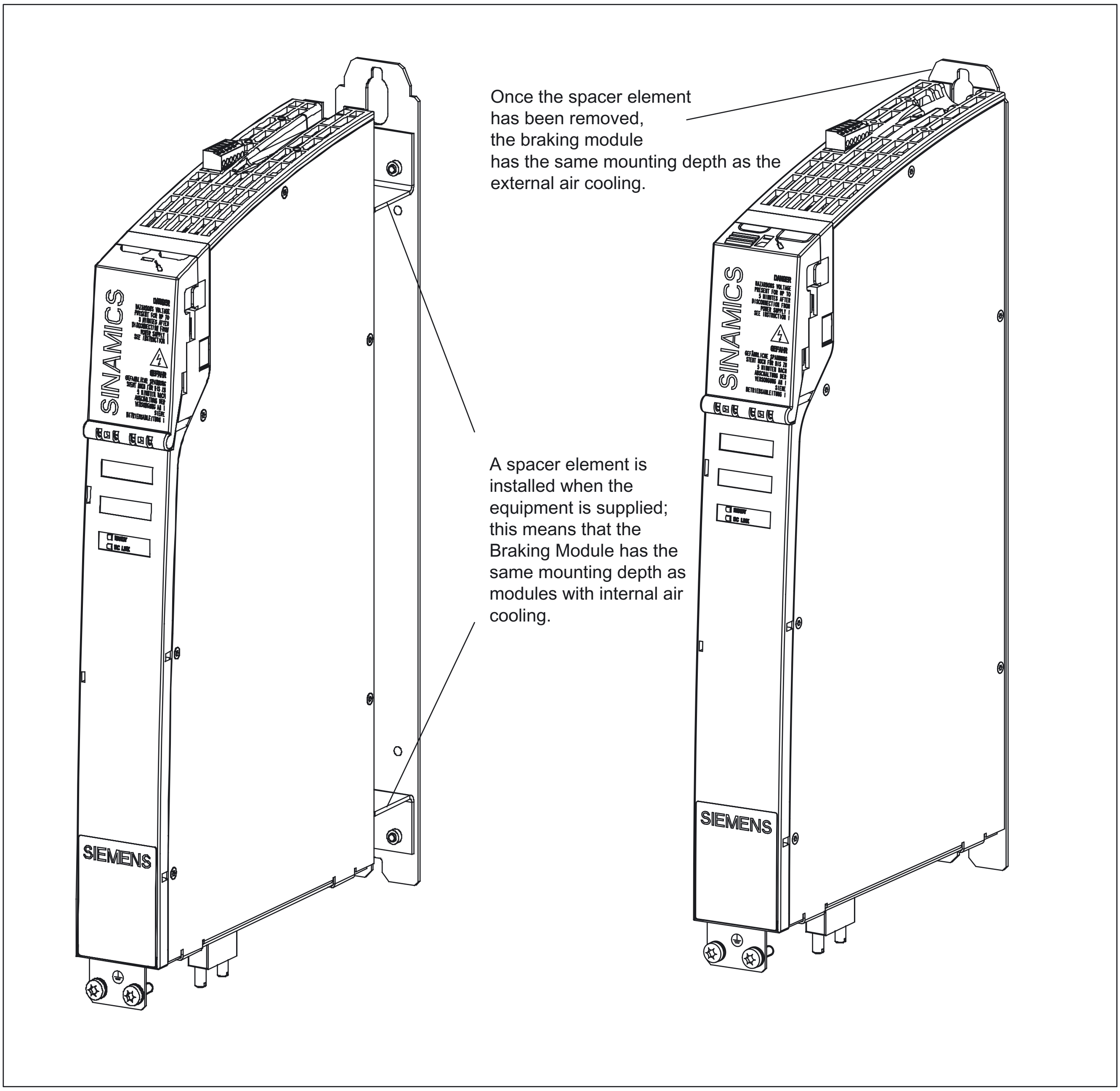


Figure 5-4 Methods of installing braking modules with/without spacer elements

5.1.6 Technical specifications

Table 5-4 Technical Specifications

Braking module booksize		
Voltages		
Supply: DC link voltage	V_{DC}	510 - 750
ON threshold	V	770
Electronics power supply	V_{DC}	24 (20.4 - 28.8)
Electronics current consumption (at 24 V DC)	A_{DC}	0.5
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 method		Natural convection
• Weight	kg	4.1

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

5.2 Braking resistors

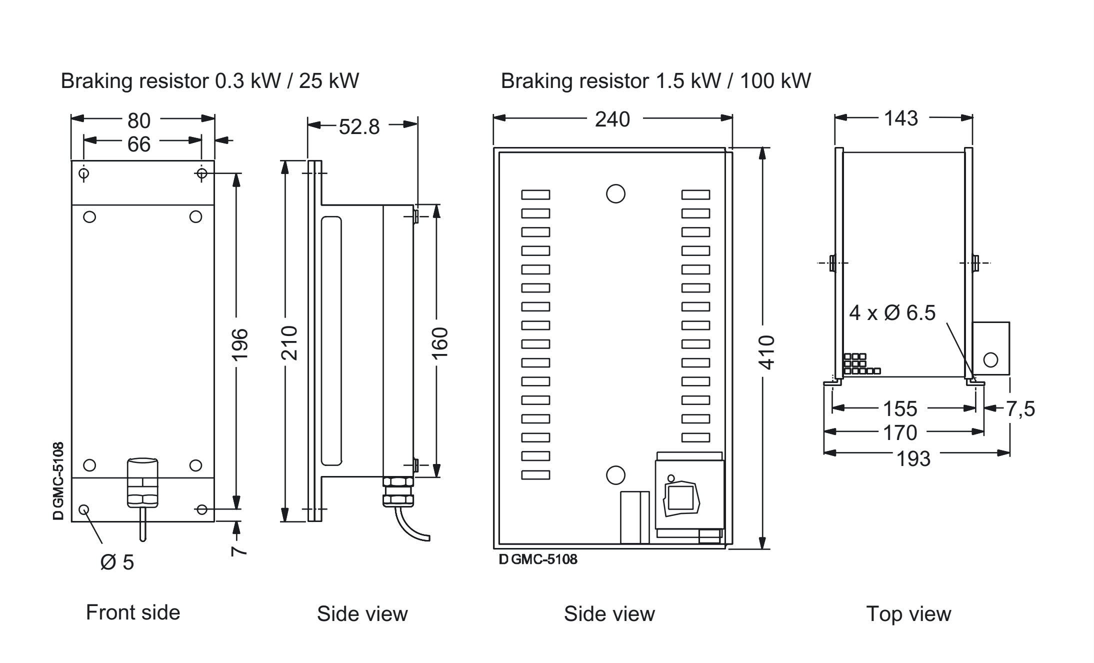


Figure 5-5 Dimension drawings of braking resistors

Caution

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

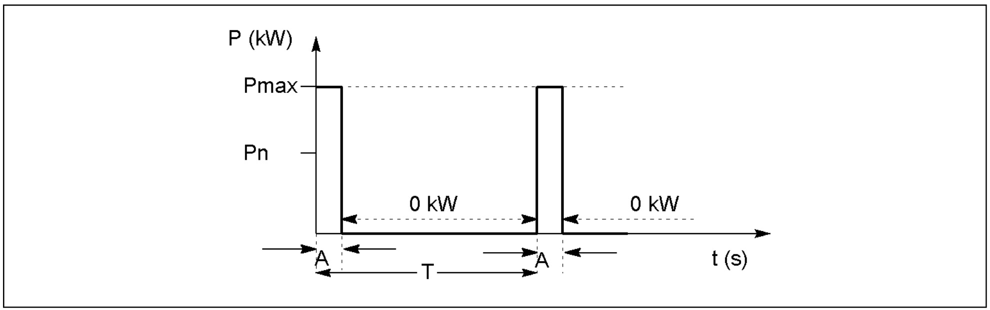


Figure 5-6 Duty cycle for braking resistors

T [s] period duration of braking duty cycle

A [s] load duration

P_n [W] continuous braking power of braking resistor

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

Table 5-5 Example of duty cycles

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

Table 5-6 Technical Specifications

	Unit	Braking resistor 6SN1113–1AA00–0DA0	Braking resistor 6SL3100–1BE31–0AAx
P_{max}	kW	25	100
P_n	kW	0.3	1.5
Weight	kg	3.4	5.6
Degree of protection		IP54B acc. to EN 60529	IP20B acc. 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.

5.3 Capacitor Module

5.3.1 Description

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

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

Several capacitor modules can be operated in parallel.

5.3.2 Safety Information

Danger

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

Warning

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

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

Caution

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

A set of labels in 16 languages is available using Order No.: 6SL3166-3AB00-0AAx.

Notice

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

Notice

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

Caution

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

Caution

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).

5.3.3 Interface description

5.3.3.1 Overview

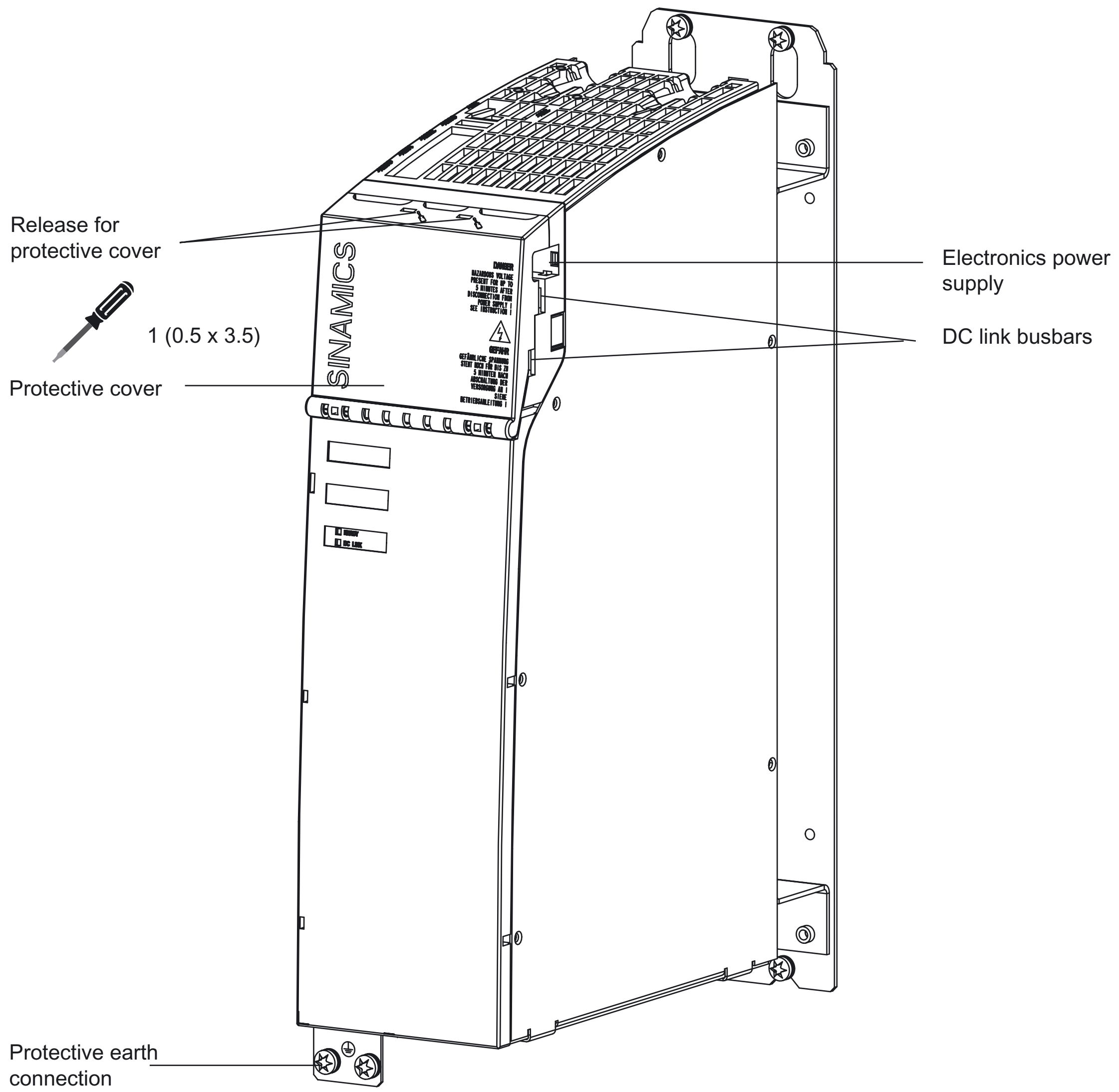


Figure 5-7 Interface description of the capacitor module

5.3.4 Dimension Drawing

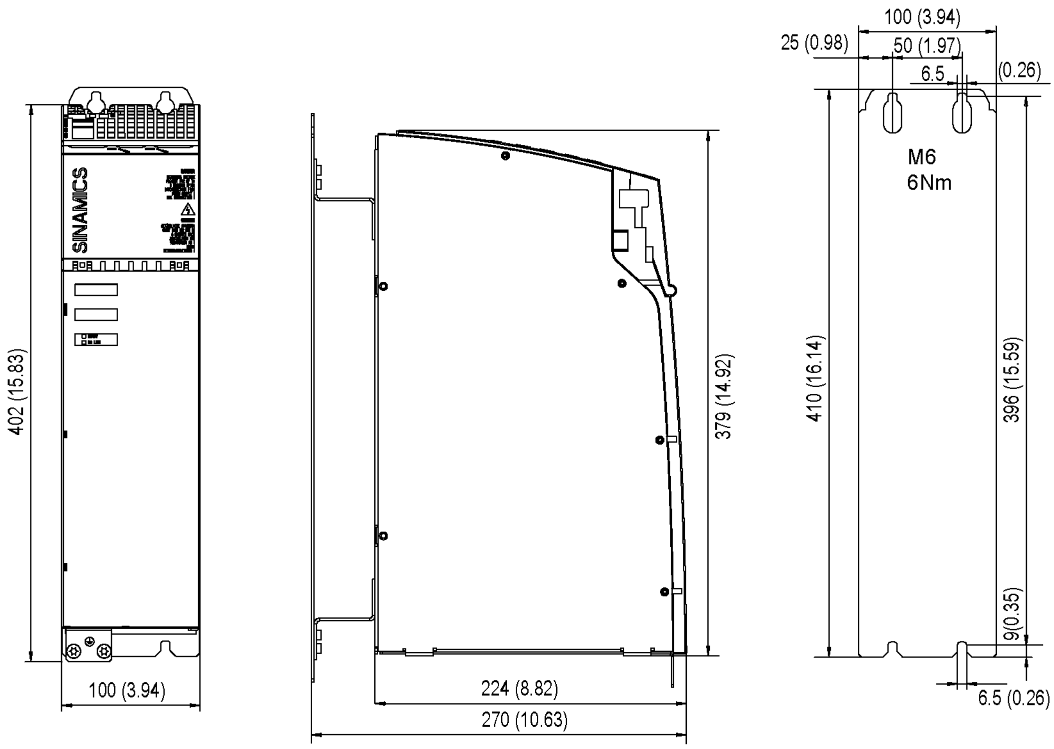


Figure 5-8 Dimension drawing of the capacitor module

5.3.5 Installation

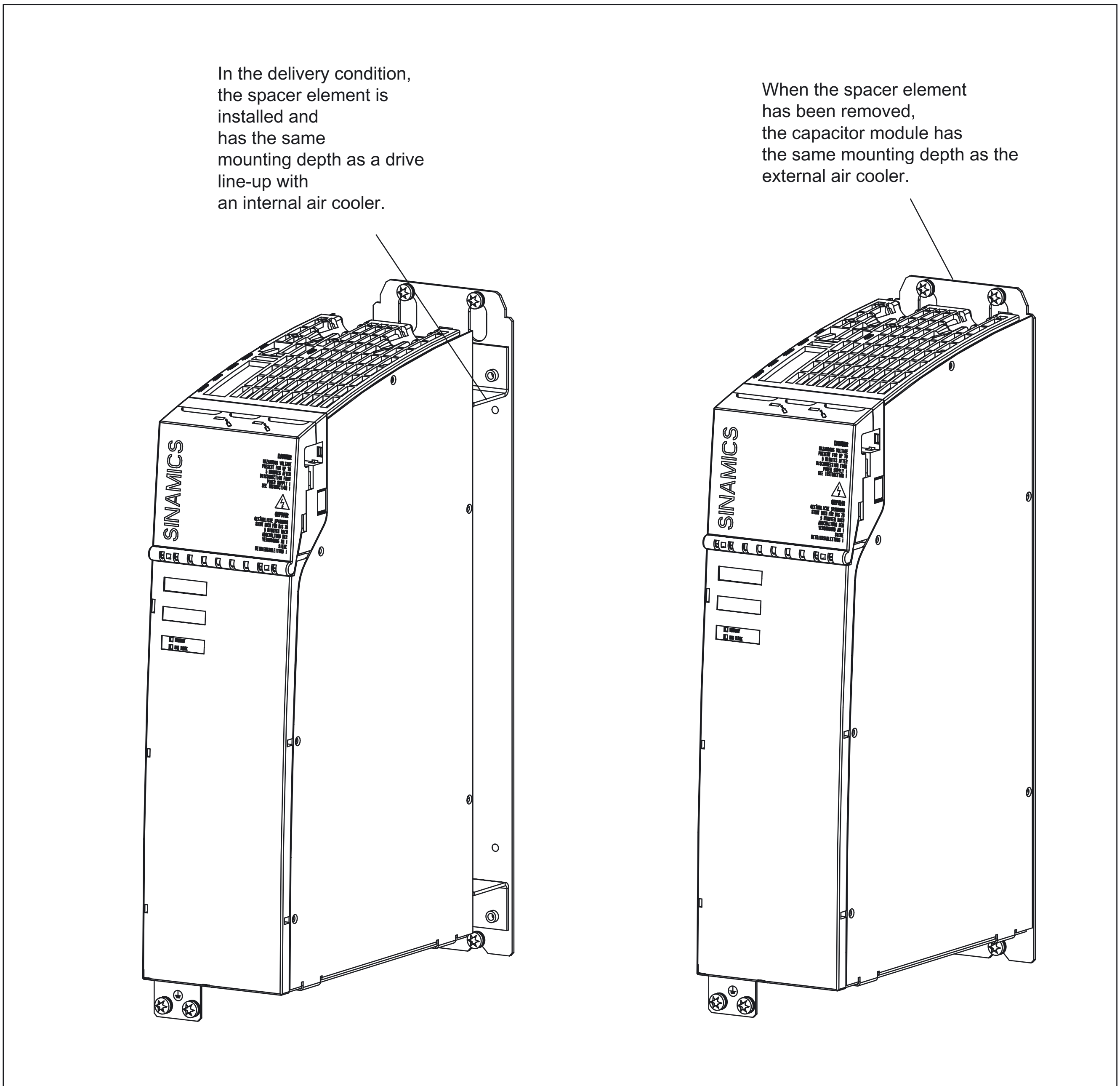


Figure 5-9 Installing a capacitor module with/without spacer elements

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

5.3.6 Technical Specifications

Table 5-7 Technical Specifications

Capacitor Module		
Electronics power supply	V_{DC}	24 (20.4 - 28.8)
DC link voltage	V_{DC}	510 - 750
Capacitance	μF	4,000
24 V DC busbar current carrying capacity	A	20
DC link busbar current carrying capacity	A	100
Power loss[1]	W	25
Weight	kg	7.2

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

5.4 Control Supply Modules

5.4.1 Description

The Control Supply Module is a 24 V power supply with 20 A output current.
The output voltage corresponds to PELV (Protective Extra Low Voltage) 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 <1min).

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.

5.4.2 Safety Information

Danger

This component is equipped with two supply circuits!
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 (e.g. with a defective lock on the protective cover) must not be operated further.

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

Caution

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

A set of labels in 16 languages is provided with the component.

Notice

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

Caution

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

Caution

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

Caution

The left and right ends of the DC link busbar of a drive line-up must be closed using lateral covers (Order No.: 6SL3162-5AA00-0AA0).

Caution

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

5.4.3 Interface description

5.4.3.1 Overview

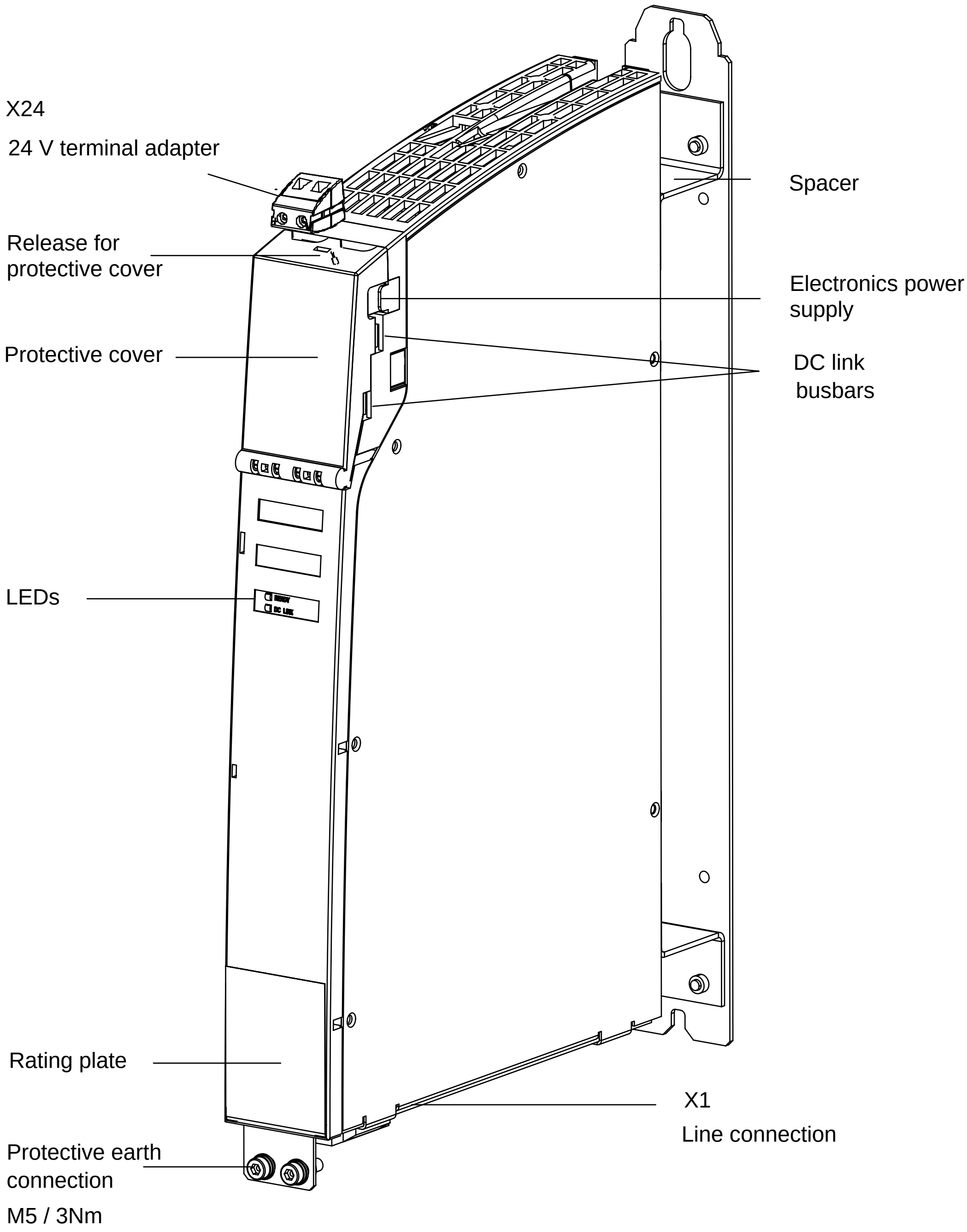


Figure 5-10 Interface description: control supply module

5.4.3.2 Connection example

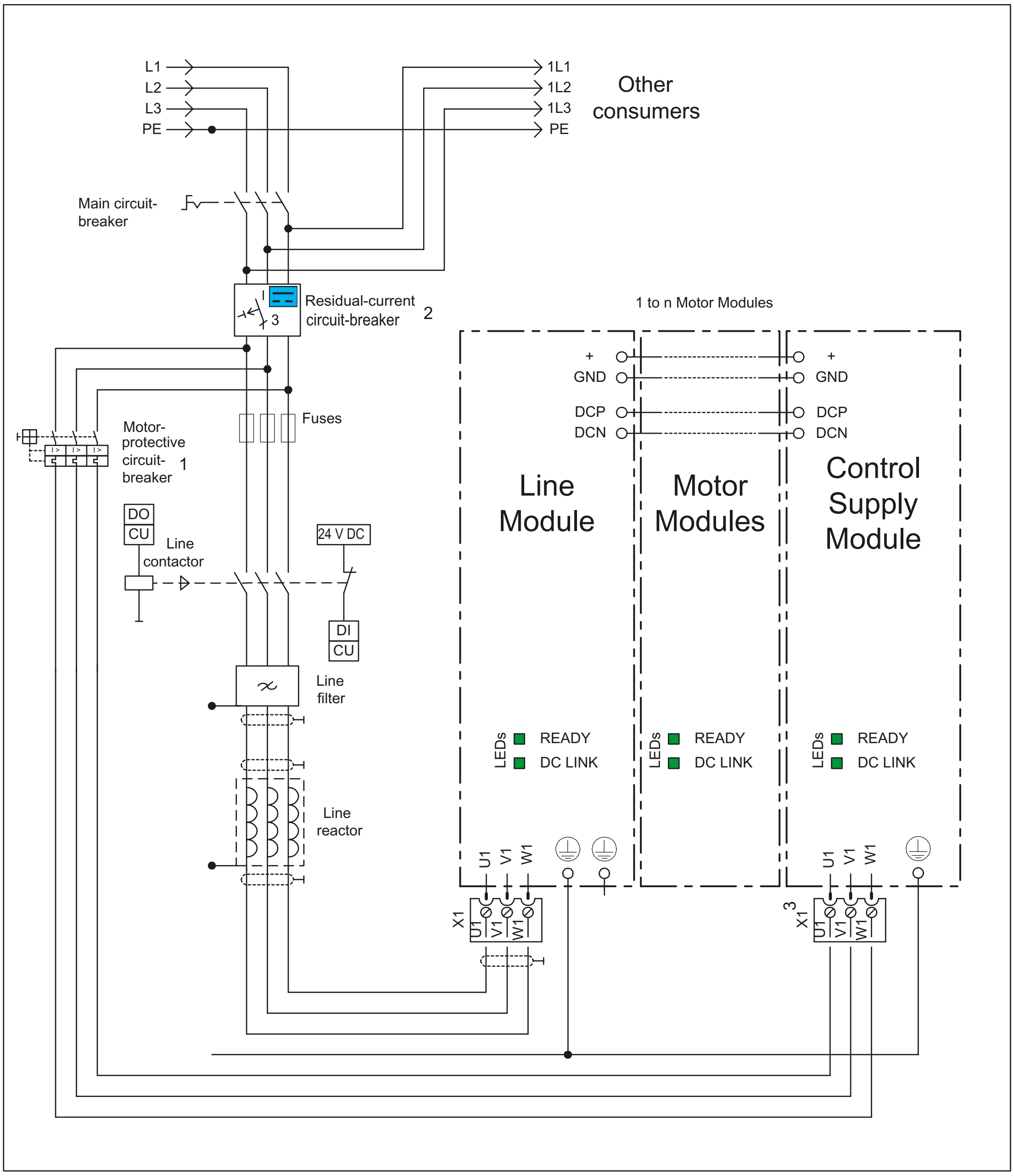


Figure 5-11 Example connection of Control Supply Module

[1] Permissible types:

a) SIRIUS motor circuit-breaker, 3RV 1021 1DA10, set to 3A

b) KTS-R-6-type branch circuit fuse (class RK1)

[2] Optional

[3] The line connection must always exist

5.4.3.3 Meaning of the LEDs on the control supply module

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

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

5.4.4 Dimension Drawing

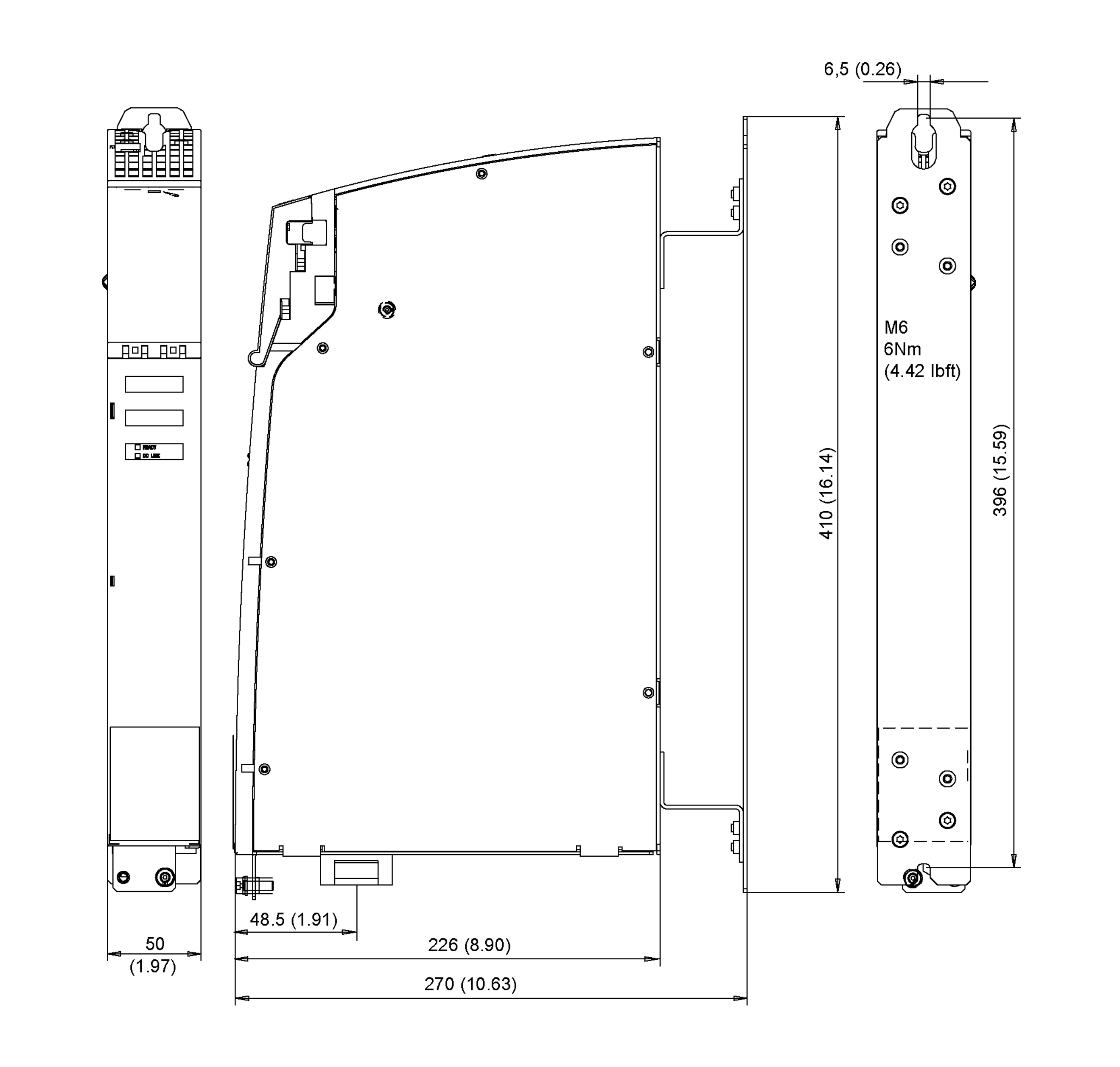


Figure 5-12 Dimension drawing of the control supply module

5.4.5 Technical Specifications

Table 5-9 Technical Specifications

Control Supply Module	Unit	Value
Input data		
Line voltage Line frequency	V_{AC} Hz	3AC 380 - 480 V_{AC} ± 15% 47 to 63
Connection currents Rated value (at U_{eRated})	 A_{AC}	 approx. 2
Starting current inrush	A_{AC}	max. 80
Power loss ride-through (at 400 V_{AC})	ms	5
DC link voltage	V_{DC}	430 to 882 (300 to 430 < 1 min)
Supply current (at 600 V)	A_{DC}	1.1
Output data		
Output voltage	V_{DC}	26 +/- 2%
Output current	A_{DC}	20
Startup to short-circuit Short-circuit during operation	A_{DC} A_{DC}	≤ 24 normally 23 (continuous)
Current carrying capacity of the 24 V DC busbars	 A_{DC}	 20
Efficiency U_{aRated} I_{aRated}	-	> 83%
Residual ripple (clock frequency approx. 50 kHz)	mV_{pp}	< 100
Cycle peaks (bandwidth 20 MHz)	mV_{pp}	< 200
Power loss[1]	W	< 105
Weight	kg	4.8

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

5.5 Voltage Clamping Module

5.5.1 Description

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

The Voltage Clamping Module 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 may have to be implemented in the system.
  On request: Line filter manufactured by, 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

5.5.2 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, otherwise this could result in secondary damage or accidents.

Caution

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.

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

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.

Caution

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

A set of labels in 16 languages is available under Order No.: 6SL3166-3AB00-0AAx.

Notice

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

Caution

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

Caution

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

Caution

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).

5.5.3 Interface Description

5.5.3.1 Overview

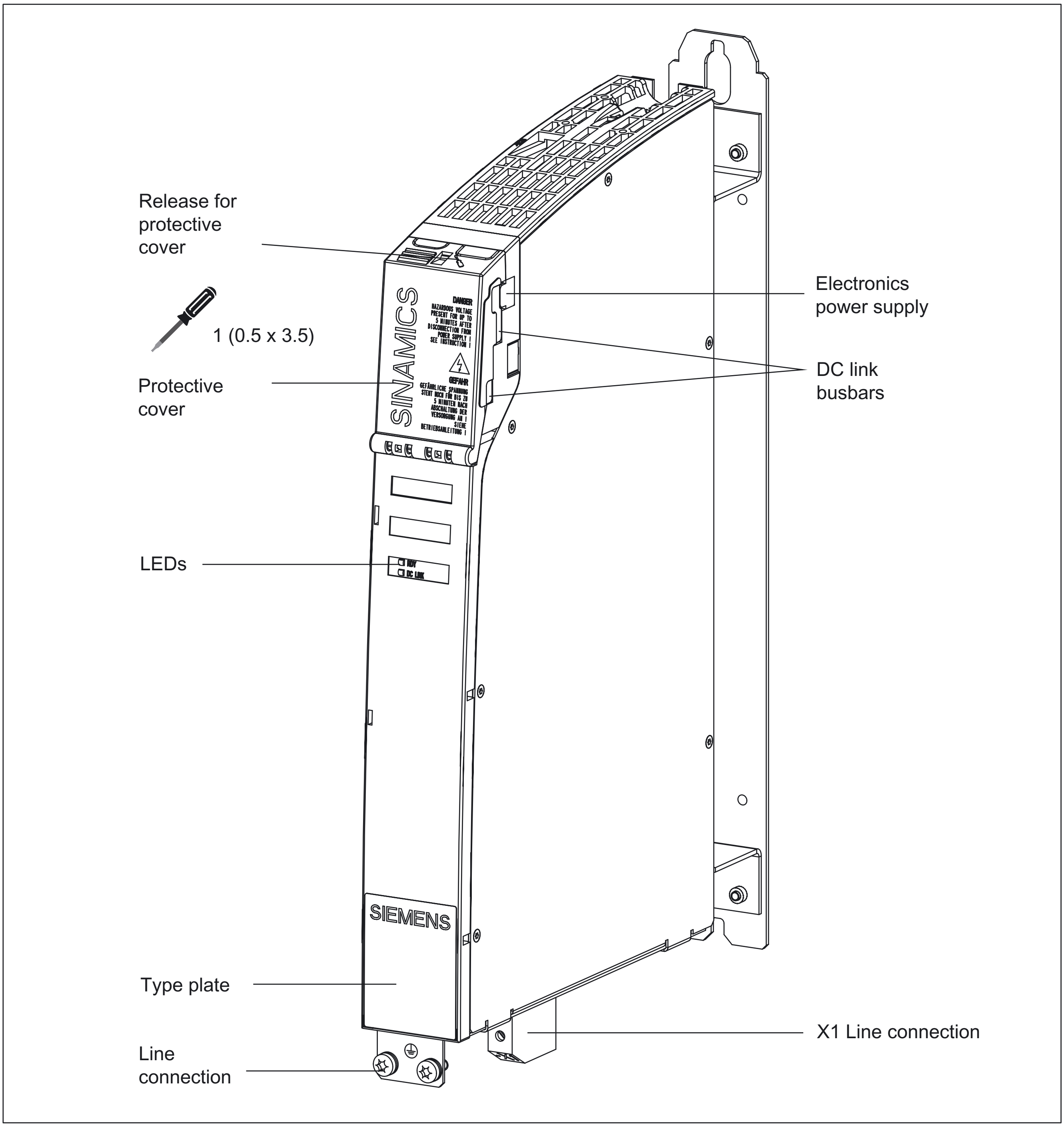


Figure 5-13 Interface description: Voltage Clamping Module

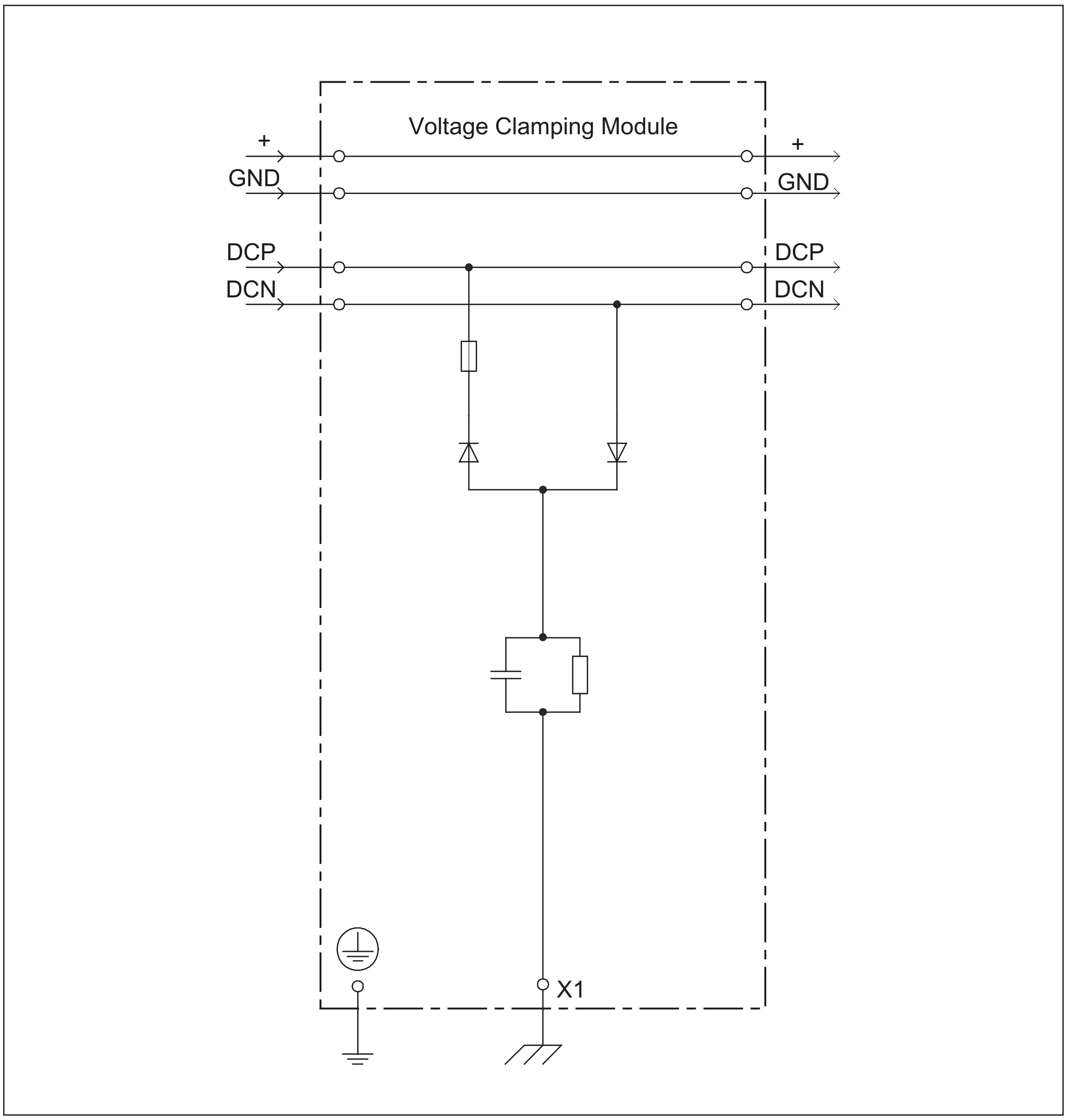


Figure 5-14 Circuit diagram: Voltage Clamping Module

5.5.3.2 X1 functional ground

X1 functional ground

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

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

5.5.4 Dimension drawing

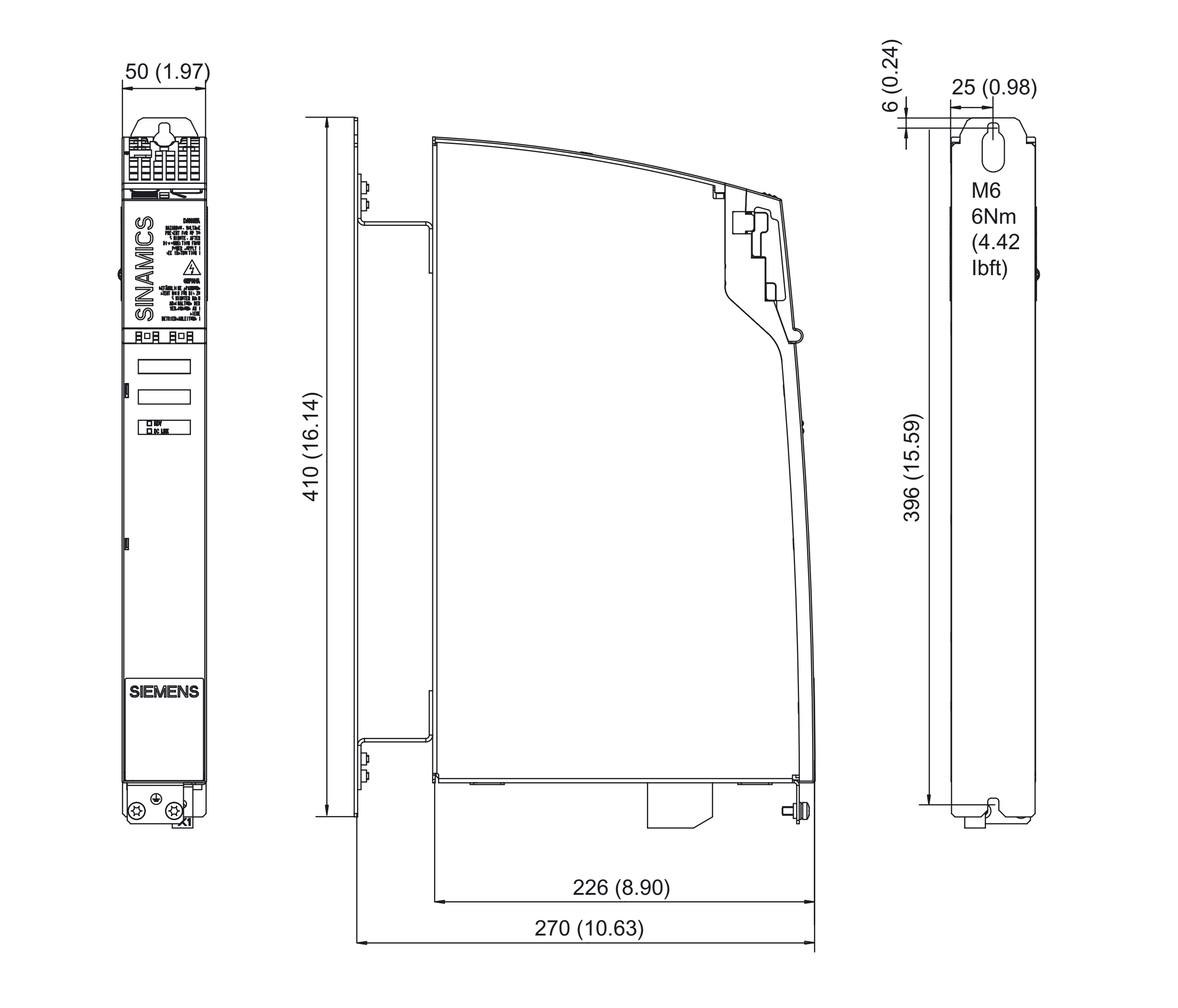


Figure 5-15 Dimension drawing of the Voltage Clamping Module

5.5.5 Installation

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

Arrangement of the Voltage Clamping Module:

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

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

5.5.6 Technical specifications

Table 5-10 Technical Specifications

Voltage Clamping Module		
Electronics power supply	V_{DC}	24 (20.4 - 28.8)
DC link voltage	V_{DC}	510 - 750
DC link busbar current carrying capacity	A	100
24 V busbar current carrying capacity	A	20
Power loss[1]	W	50
Weight	kg	3.1

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

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.

Conditions

- 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 group (drive line-up) is more than 250 m, then a Voltage Clamping Module or an HFD-R reactor must be used.
- If the total non-shielded cable length in the drive group (drive line-up) is more than 400 m, then a Voltage Clamping Module or an HFD-R reactor 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

Caution

The 100 mm clearances 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

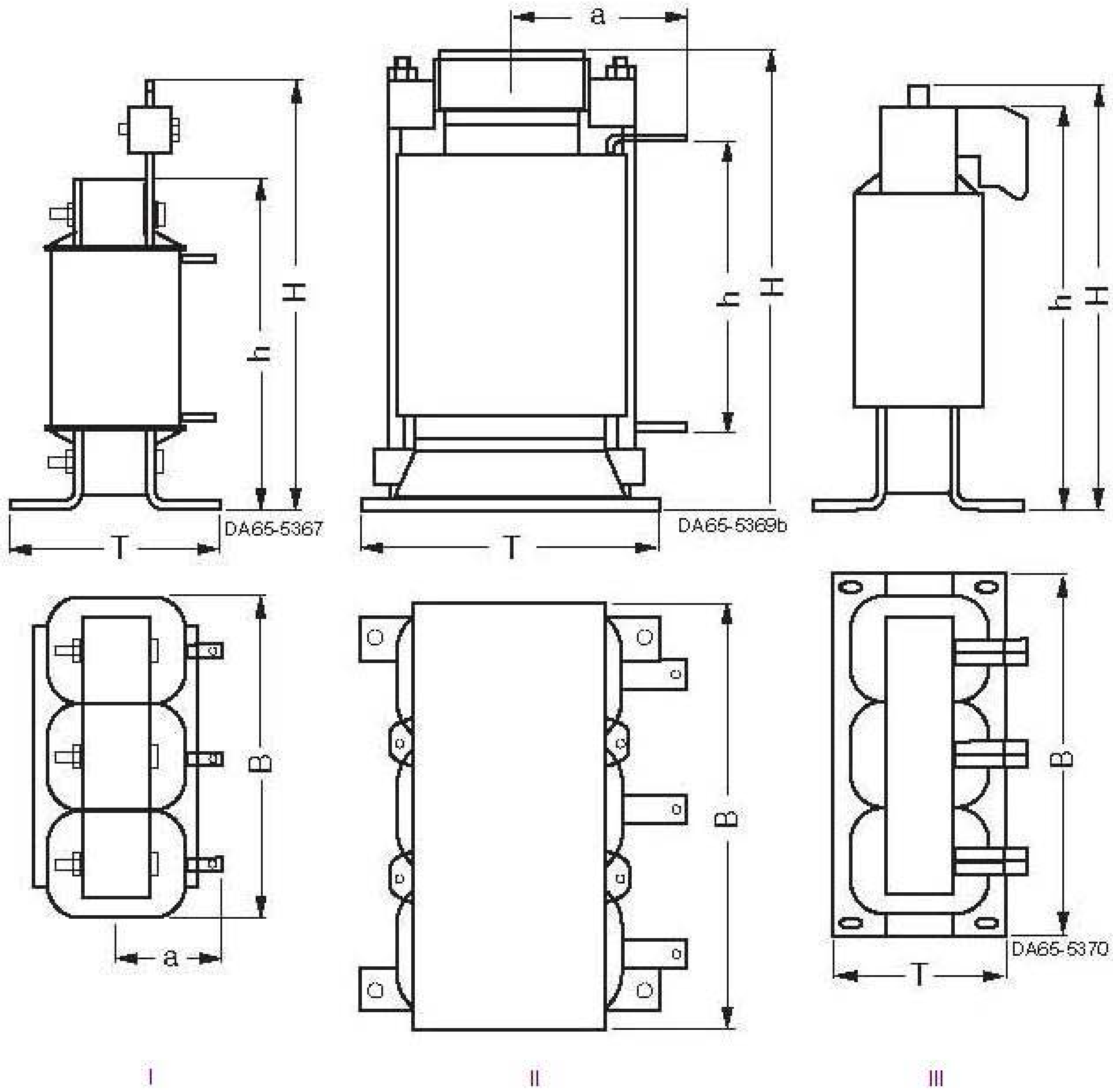


Figure 6-1 Dimension drawings: motor reactors

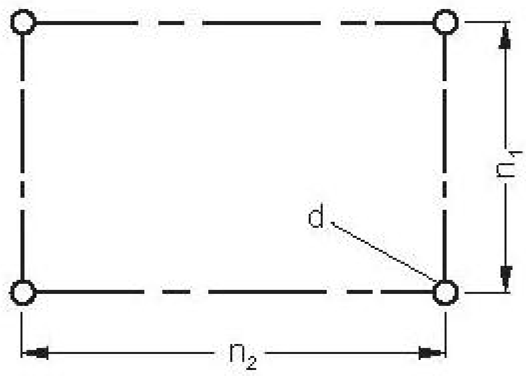


Figure 6-2 Mounting hole

Table 6-1 Dimensions of motor reactors, all data in mm and (inch)

	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) Lengths n1 and n2 correspond to the distance between holes				

Table 6-2 Dimensions of motor reactors, all data in mm and (inch)

	6SE7031-5ES87-1FE0	6SE7031-8ES87-1FE0	6SE7032-6ES87-1FE0
	Fig. II	Fig. II	Fig. II
W	197 (7.75)	281 (11.06)	281 (11.06)
H	220 (8.66)	250 (9.84)	250 (9.84)
D	128 (5.03)	146 (5.74)	146 (5.74)
a	81 (3.18)	98 (3.85)	111 (4.37)
h	100 (3.93)	119 (4.68)	121 (4.76)
n1	94 (3.70)	101 (3.97)	101 (3.97)
n2	176 (6.92)	200 (7.87)	200 (7.87)
d	M6	M8	M8
1) Lengths n1 and n2 correspond to the distance between holes			

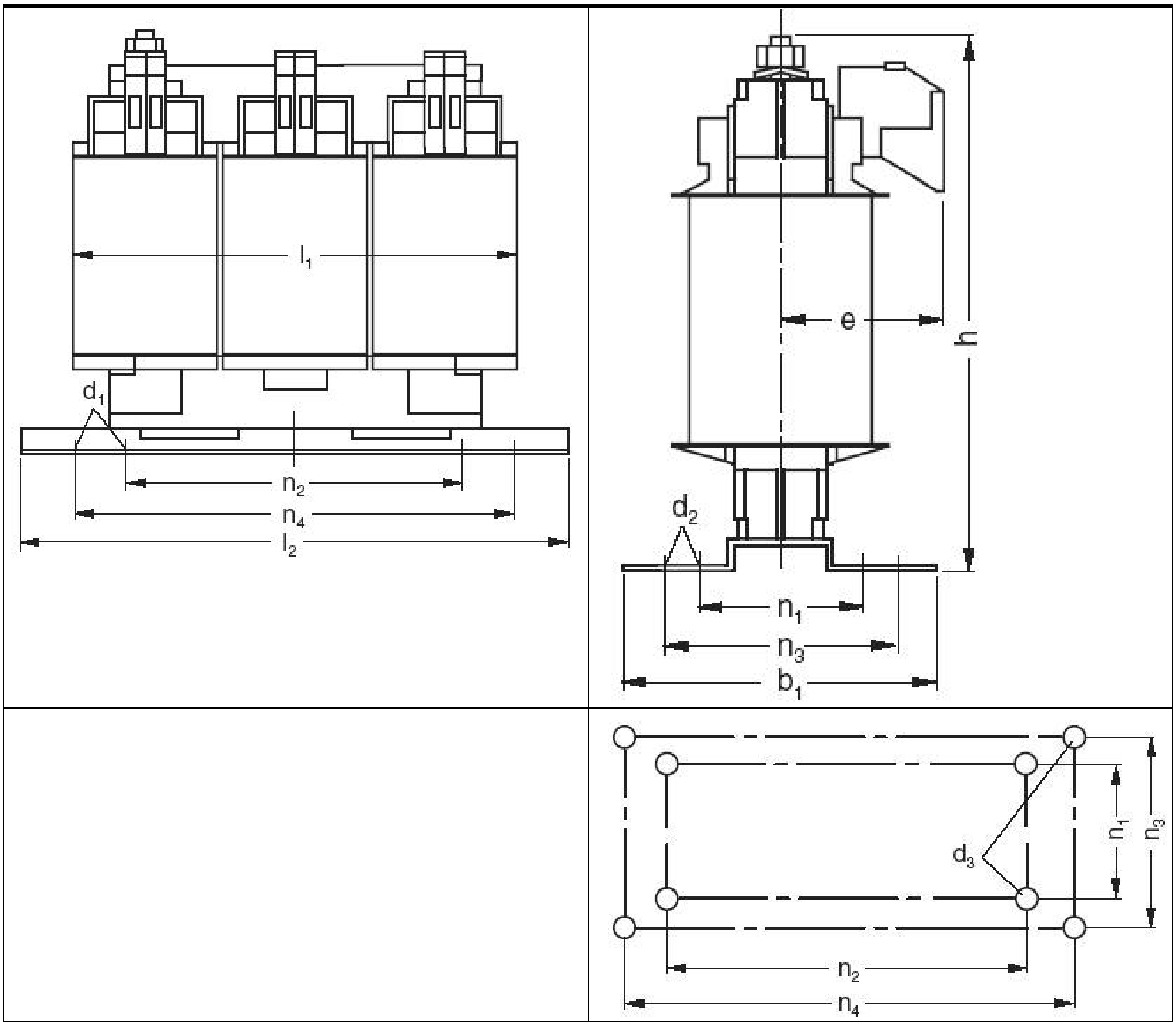
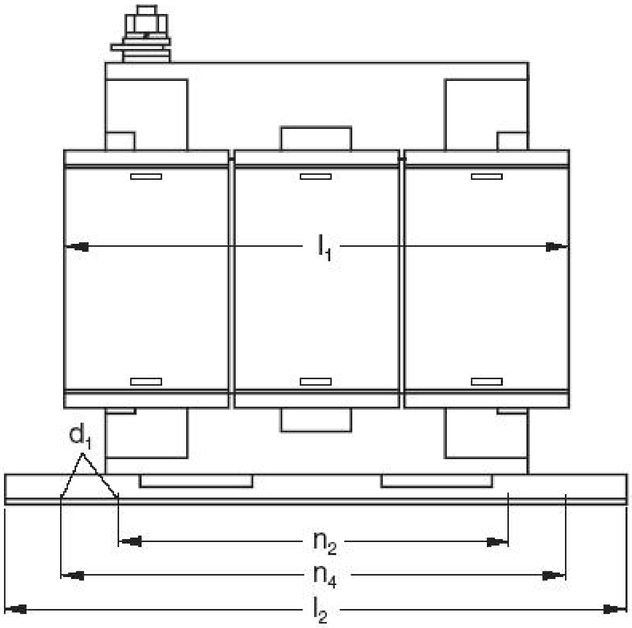
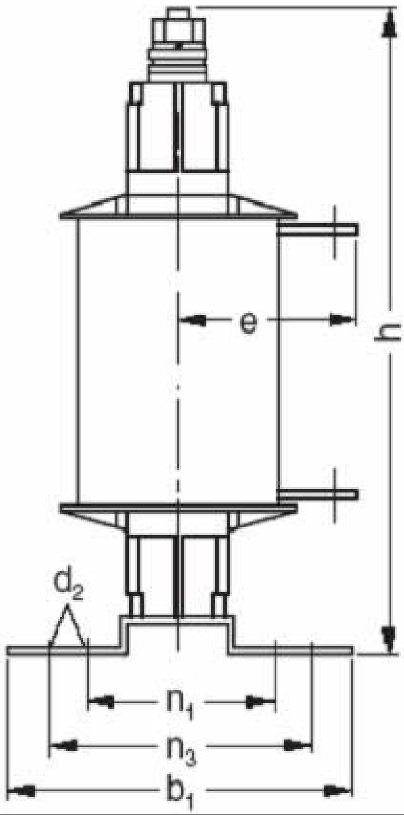


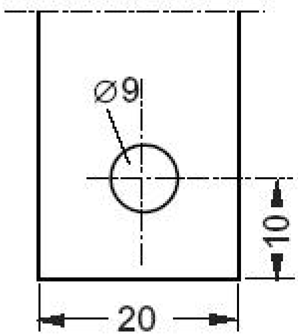
Table 6-3 Dimensions of motor reactors, all data in mm and (inch)

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)

6SL3000-	2BE21-0AA0
n_4	166 (6.53)
d_1	5.8 (0.22)
d_2	11 (0.43)
d_3	M5
PE	M6
Lengths n_1, n_2, n_3 and n_4 corresponds to the distance between holes	







Flat connector

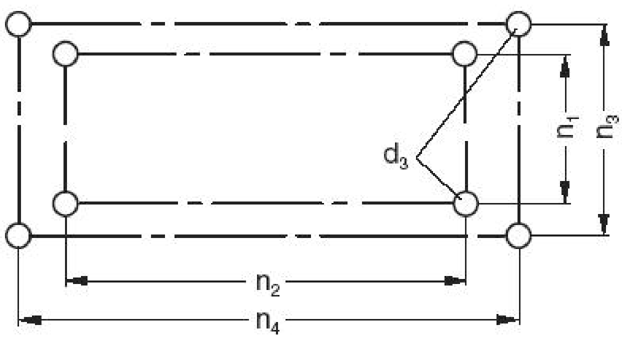


Table 6-4 Dimensions of motor reactors, all data in mm and (inch)

6SL3000-	2BE26-0AA0
l_1	max. 228 (8.97)
l_2	267 (10.51)
b_1	107 (4.21)
b_{max}	125.5 (4.94)
e	72 (2.83)
h	220 (8.66)
h_1	56 (2.20)
h_2	100 (3.93)
n_1	70 (2.75)
n_2	176 (6.92)
n_3	77 (3.03)
n_4	249 (9.80)
d_1	36 (1.41)
d_2	3.5 (0.13)
d_3	M6
PE	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
power loss	W	80	90	110	190	130
Connections - to the Motor Module - to the load - PE		 4 mm^2 4 mm^2 M6	 10 mm^2 10 mm^2 M6	 10 mm^2 10 mm^2 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
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 number:	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 number:	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

Options 7

7.1 Shielded terminal plates

7.1.1 Description

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

7.1.2 Overview

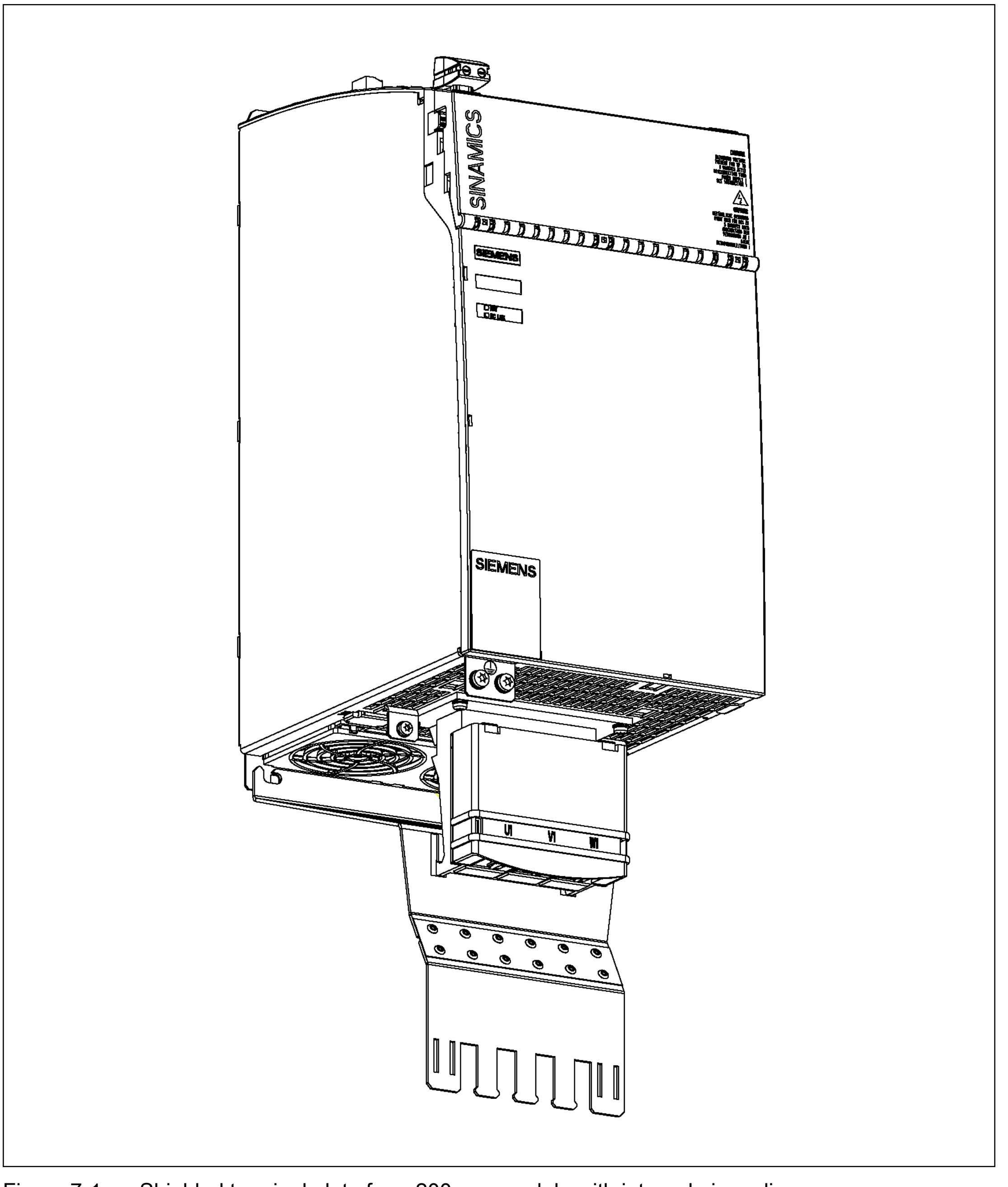


Figure 7-1 Shielded terminal plate for a 200 mm module with internal air cooling

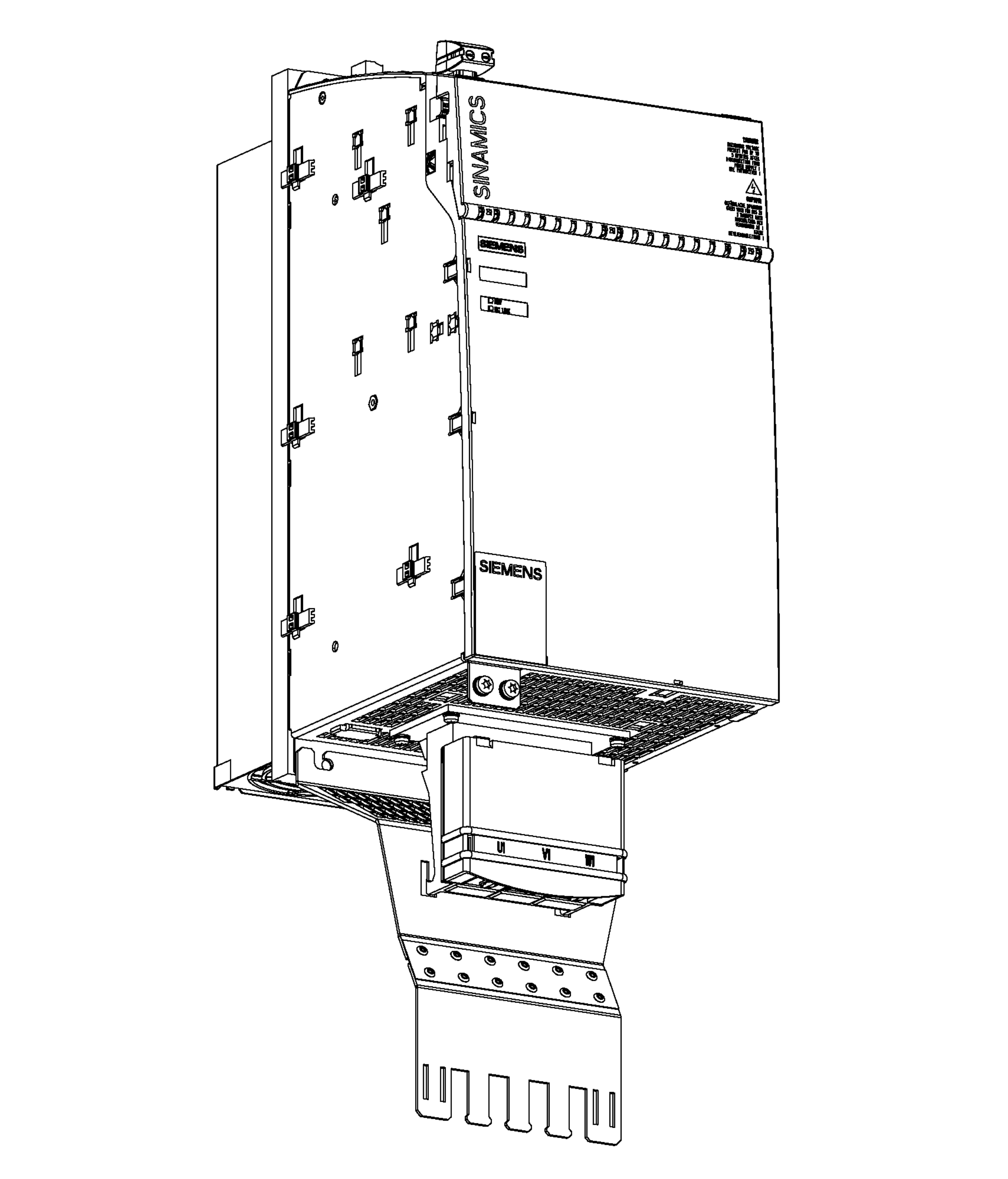


Figure 7-2 Shielded terminal plate for a 200 mm module with external air cooling

7.1.3 Dimension drawings

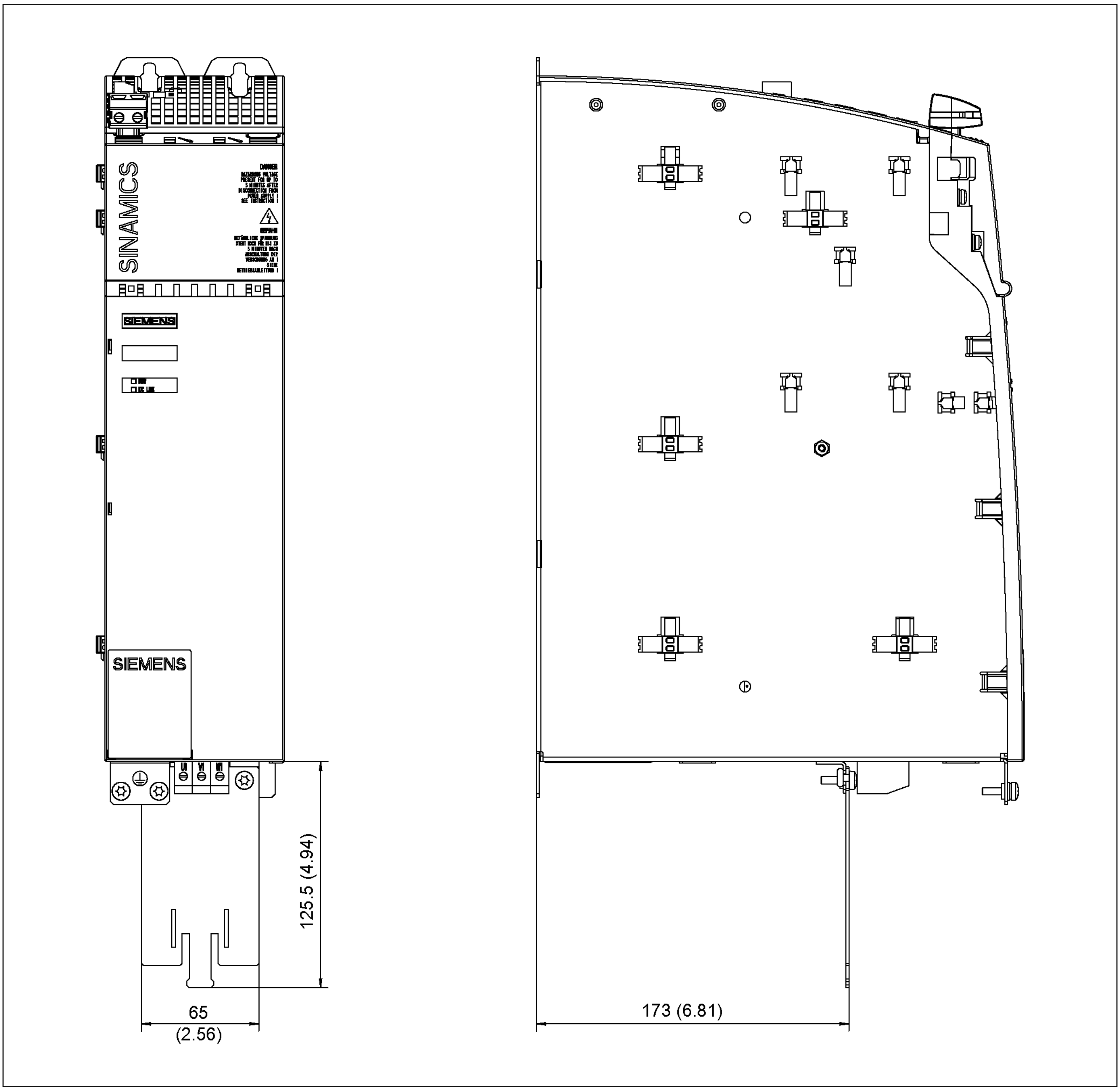


Figure 7-3 Dimension drawing of shield terminal plate on a 100 mm Line Module with internal air cooling

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Note

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

Recommended shield contacts: 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.

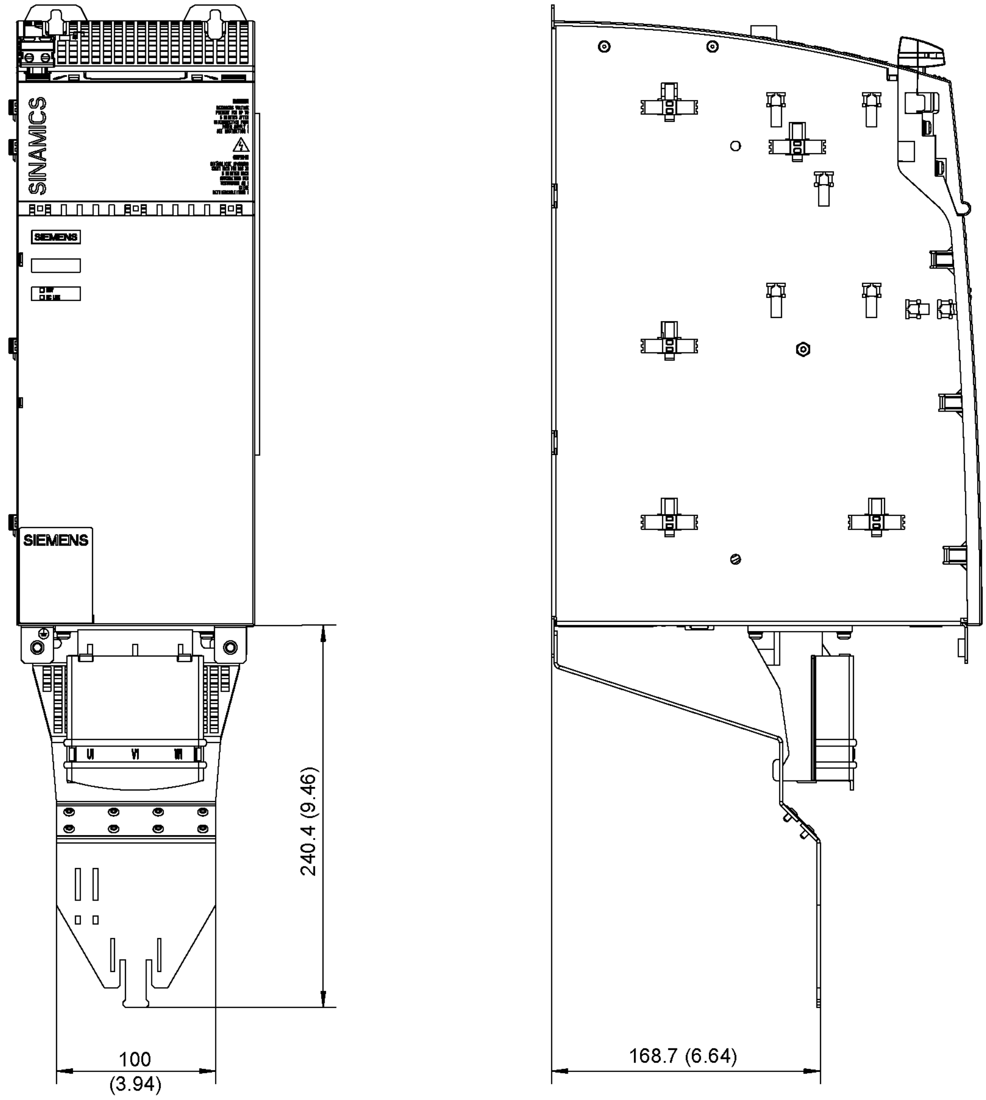

Figure 7-4 Dimension drawing of shield terminal plate on a 150 mm component (Line Module or Motor Module) with internal air cooling

Note

The shield terminal plate can be ordered as option.

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

Weidmüller: http://www.weidmueller.com

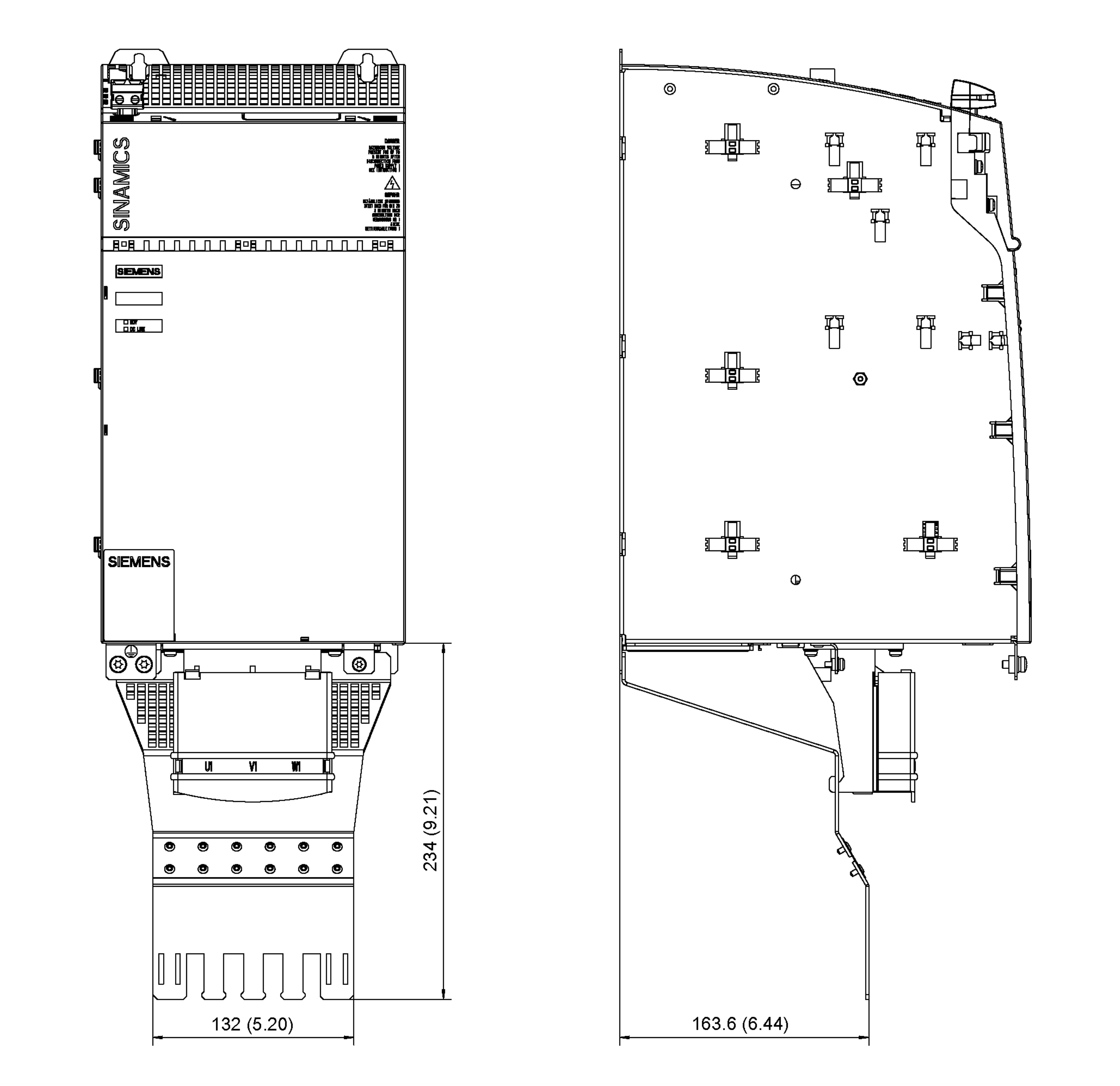

Figure 7-5 Dimension drawing of shield terminal plate on a 200 mm component (Line Module or Motor Module) with internal air cooling

Note

The shield terminal plate can be ordered as option.

Recommended shield contacts: from Weidmüller, order no. KLBÜ CO1

Weidmüller: http://www.weidmueller.com

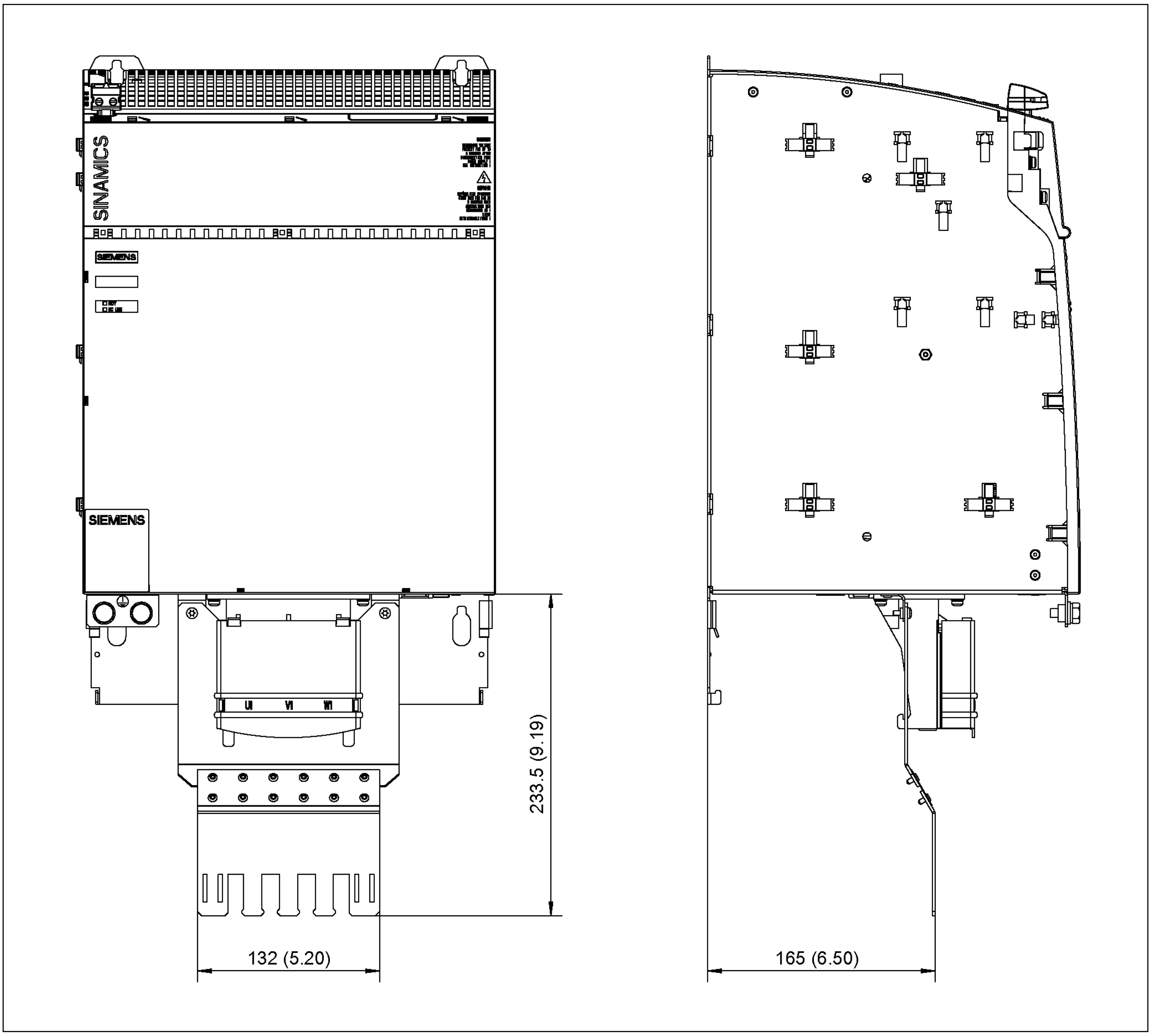

Figure 7-6 Dimension drawing of shield terminal plate on a 300 mm component (Line Module or Motor Module) with internal air cooling

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Note

The shield terminal plate can be ordered as option.

Recommended shield contacts: from Weidmüller, order no. KLBÜ CO1

Weidmüller: http://www.weidmueller.com

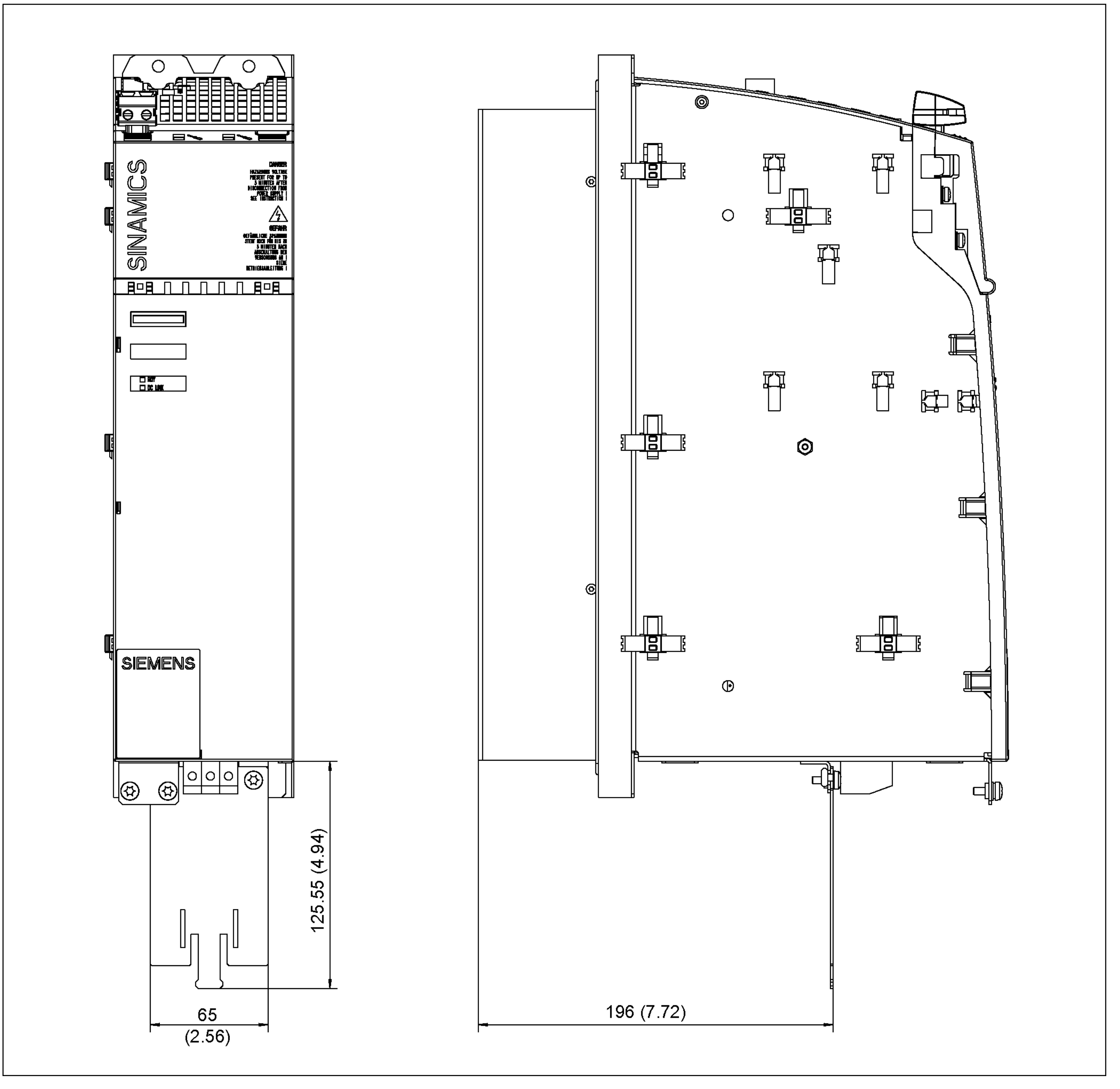

Figure 7-7 Dimension drawing of shield terminal plate on a 100 mm component (Line Module or Motor Module) with external air cooling

Note

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

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

Weidmüller: http://www.weidmueller.com

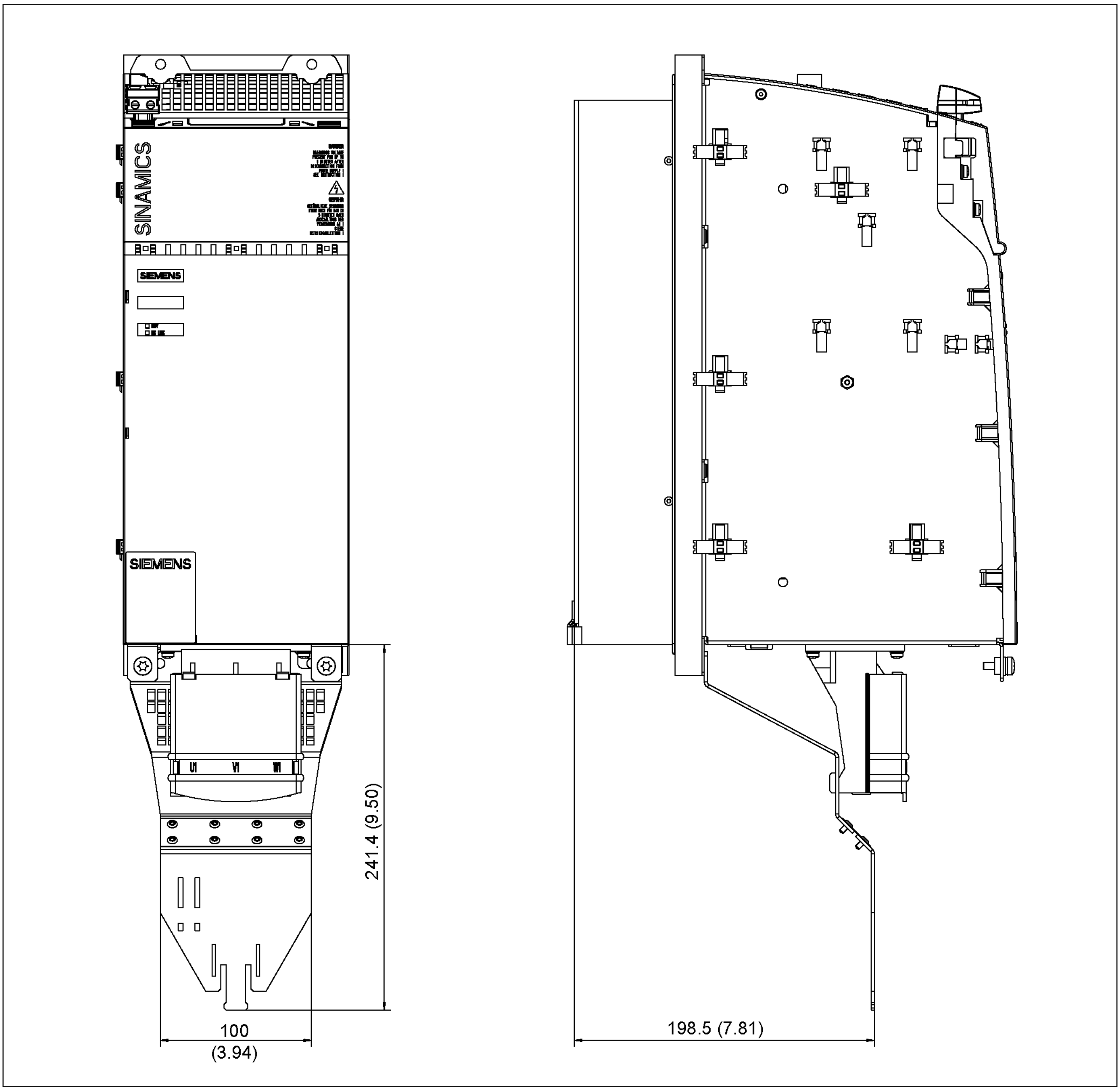

Figure 7-8 Dimension drawing of shield terminal plate on a 150 mm component (Line Module or Motor Module) with external air cooling

Note

The shield terminal plate is available as option.

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

Weidmüller: http://www.weidmueller.com

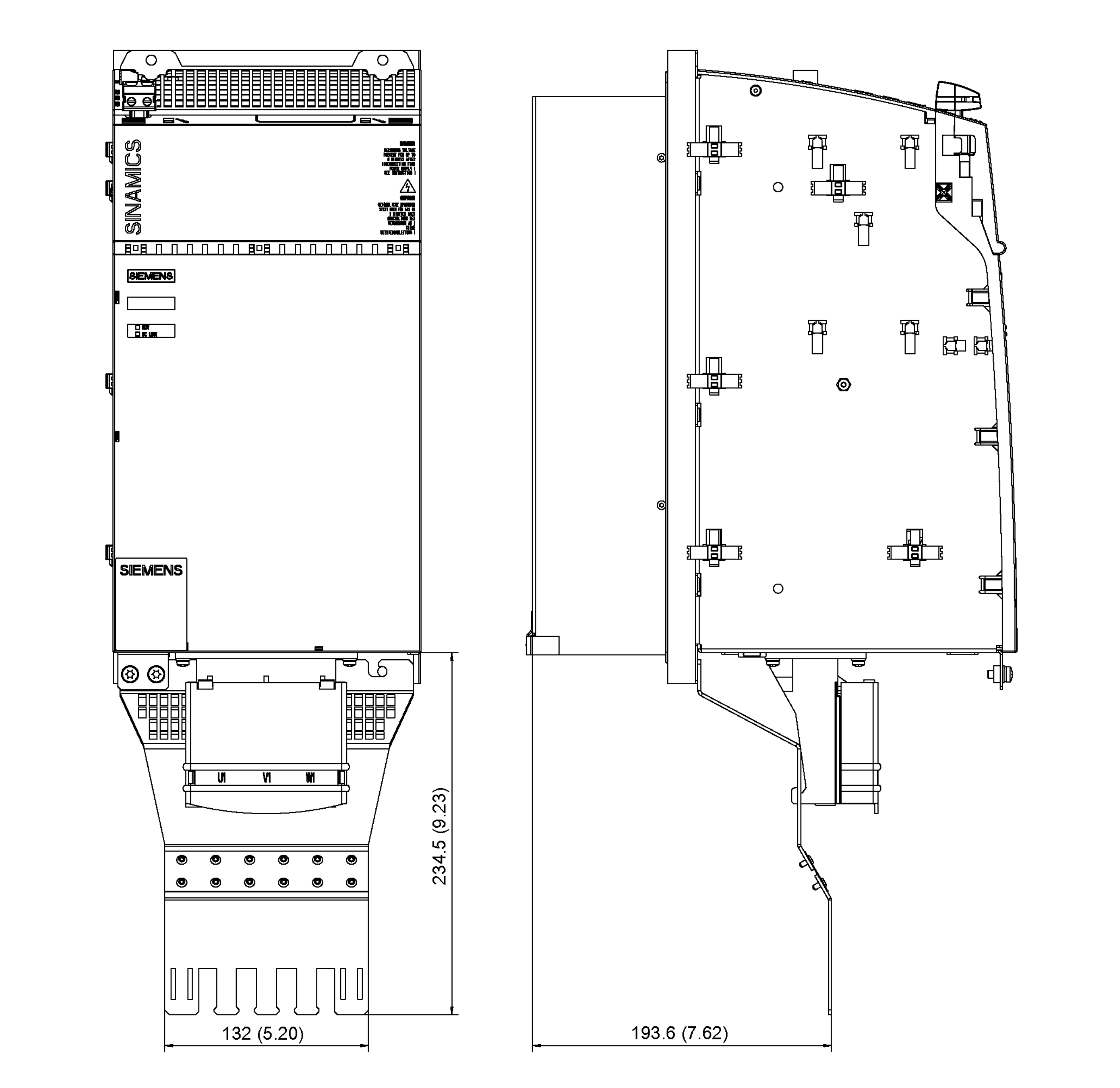

Figure 7-9 Dimension drawing of shield terminal plate on a 200 mm component (Line Module or Motor Module) with external air cooling

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Note

The shield terminal plate is available as option.

Recommended shield contacts: from Weidmüller, order no. KLBÜ CO1

Weidmüller: http://www.weidmueller.com

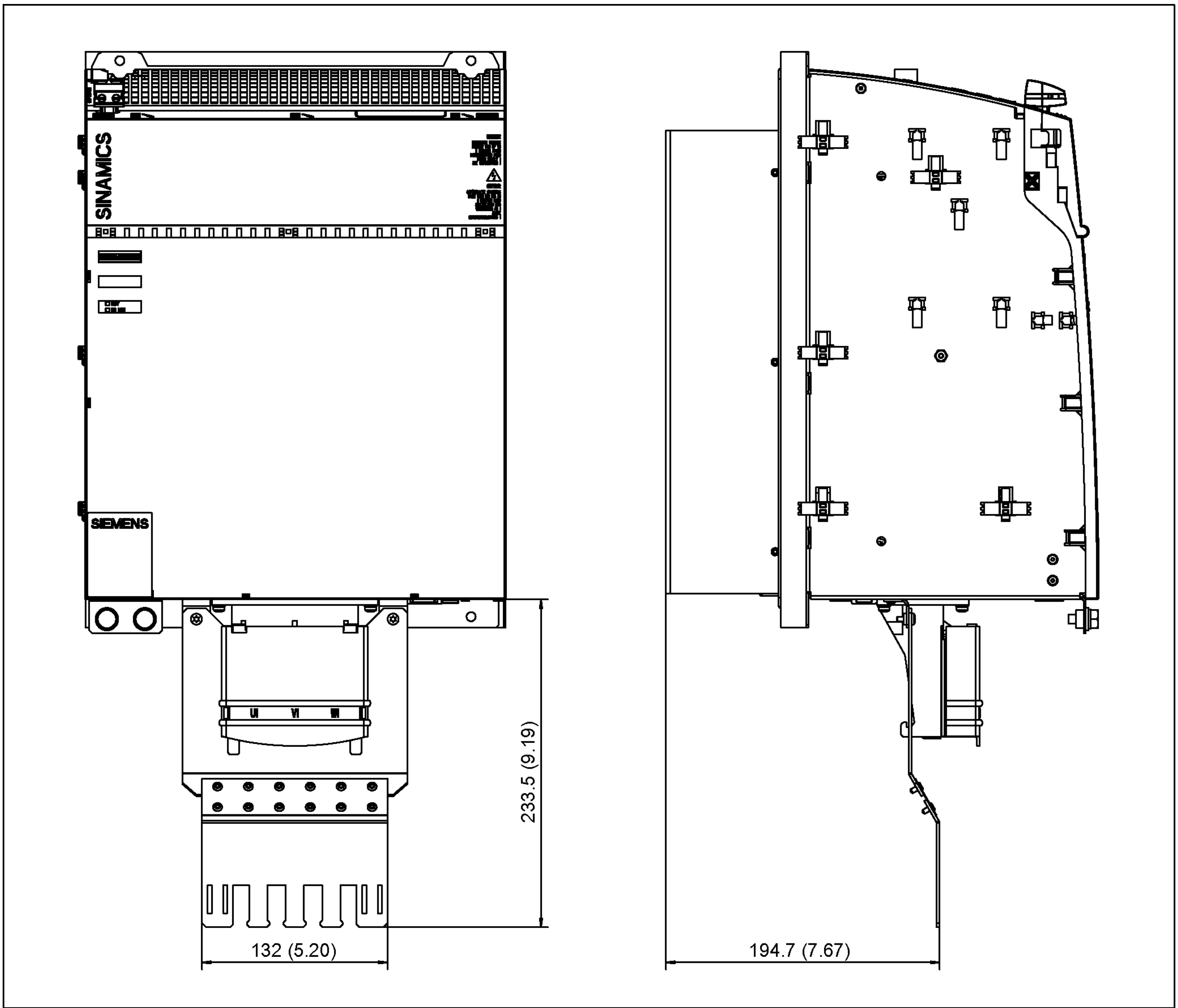


Figure 7-10 Dimension drawing of shield terminal plate on a 300 mm component (Line Module or Motor Module) with external air cooling

---

Note

The shield terminal plate is available as option.

Recommended shield contacts: from Weidmüller, order no. KLBÜ CO1

Weidmüller: http://www.weidmueller.com

7.1.4 Installation

Table 7-1 Mounting the shield connection plate to a 100 mm component using as an example, internal air cooling

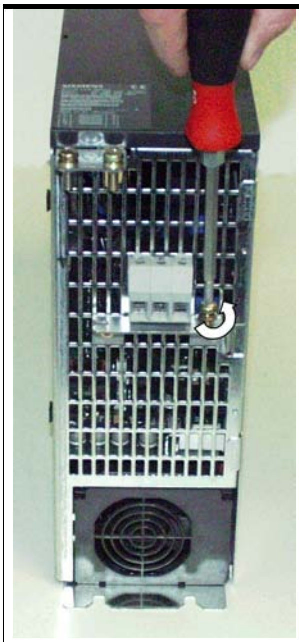
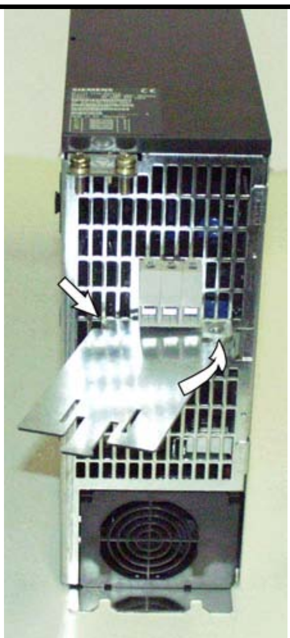
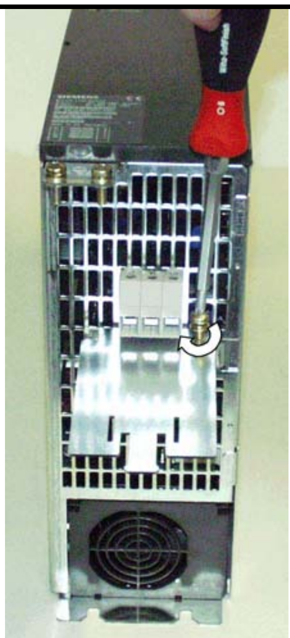
			
Unscrew the screw with screwdriver T25.	Hook in the shielded plate.	Secure the shield connection plate with screwdriver T25/3 Nm.	The shield connection plate is installed.

Table 7-2 Mounting the shield connection plate to a 200 mm component using as an example, internal air cooling

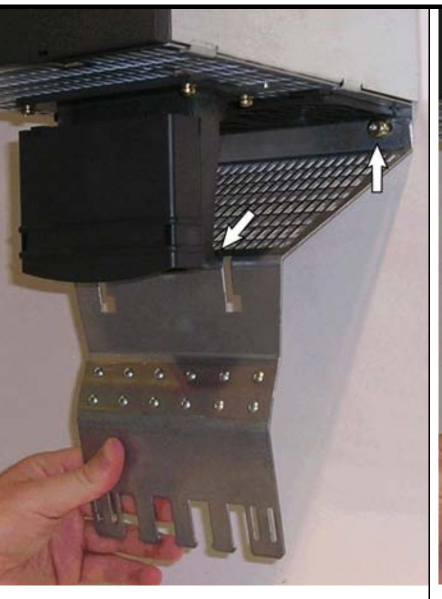
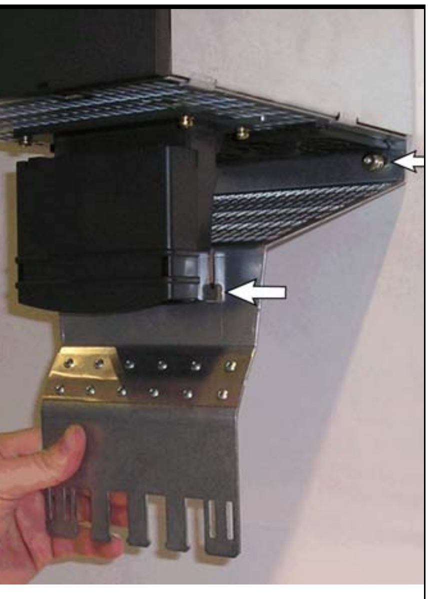
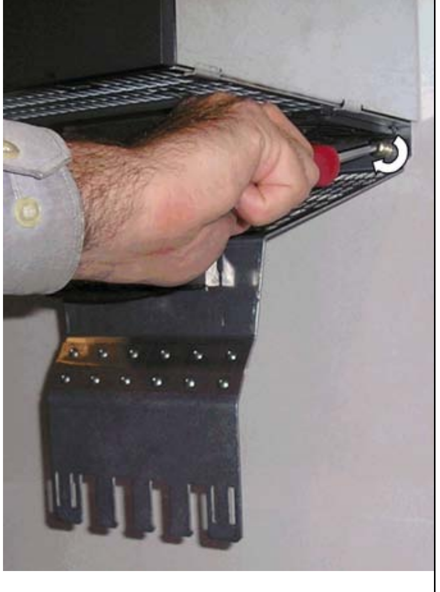
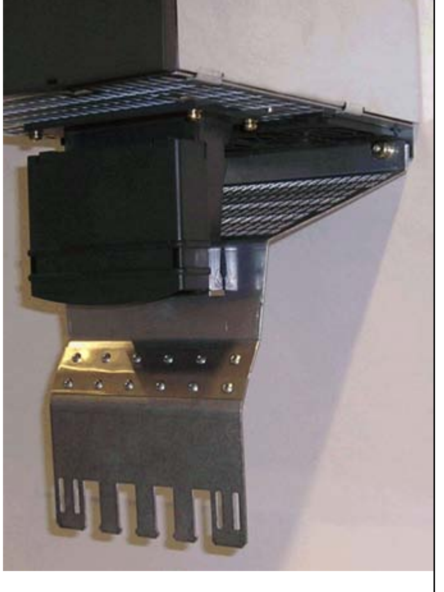
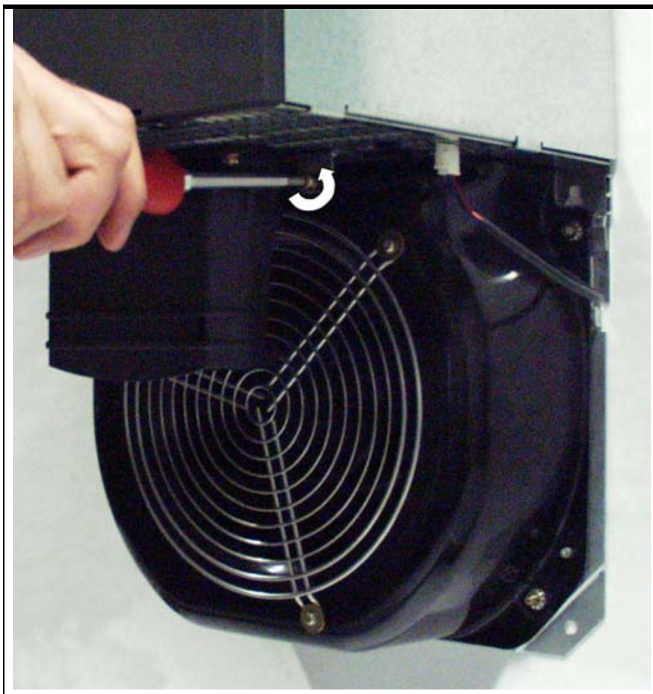
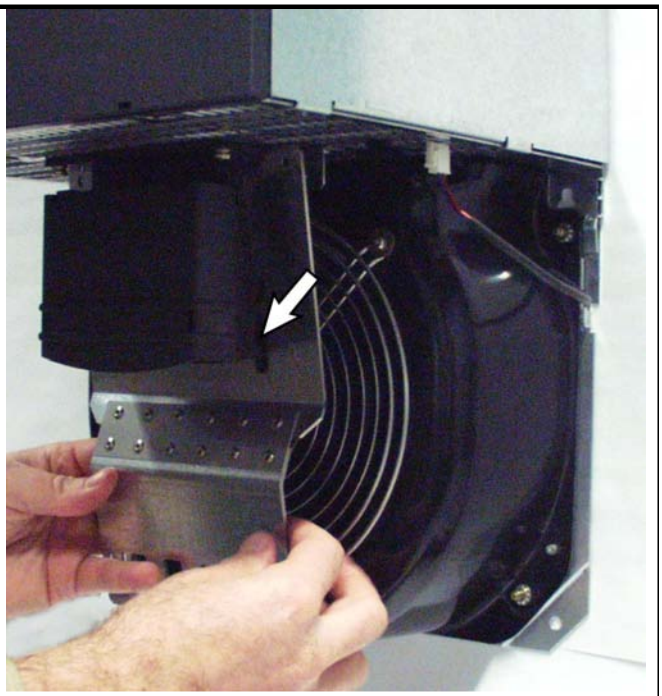
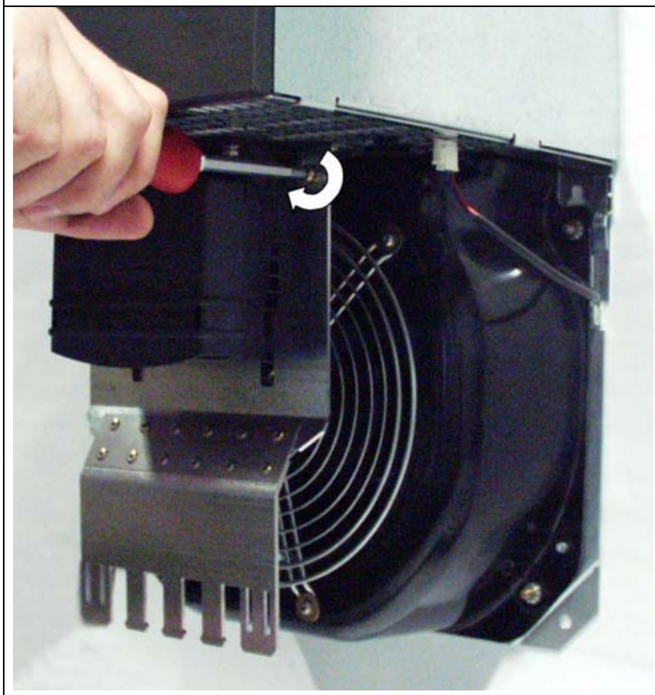
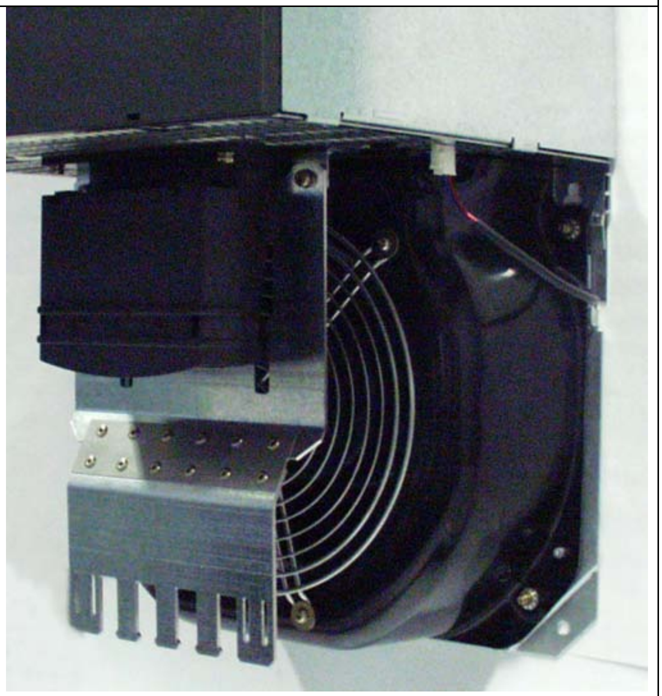
		
Loosen the lower mounting screws using a screwdriver.	Hook the shield connection plate into the screws and on the line/motor connection.	Secure the shield connection plate by shifting it to the left.
		
Secure the shield connection plate with screwdriver 6 Nm.	The shield connection plate is installed.	

Table 7-3 Mounting the shield connection plate to a 300 mm component using as an example, internal air cooling

	
Unscrew the screw with screwdriver T25.	Hook the shield connection plate into the line/motor connection.
	
Secure the shield connection plate with screwdriver T25/3 Nm.	The shield connection plate is installed.

7.1.5 Electrical Connection

Table 7-4 Electrical connection at the shielded terminal plate for 100 mm component using as an example, internal air cooling

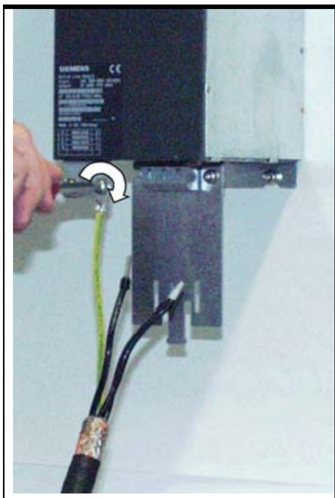
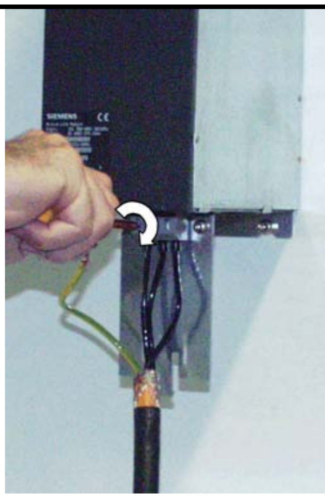
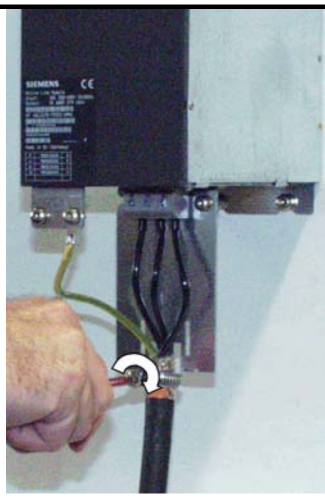
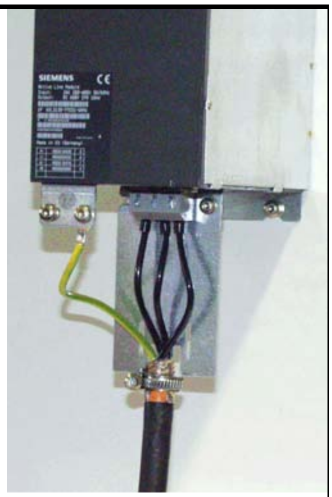
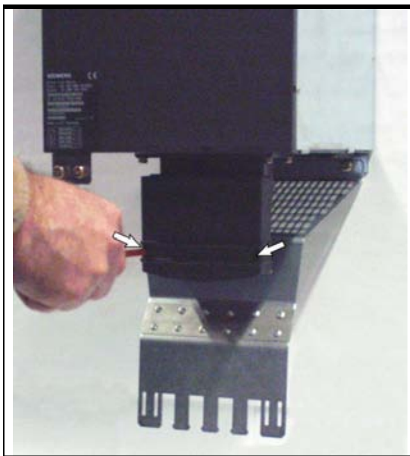
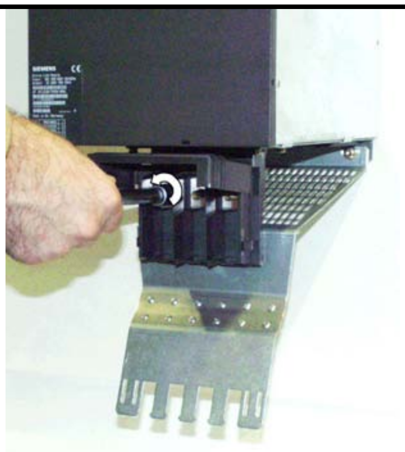
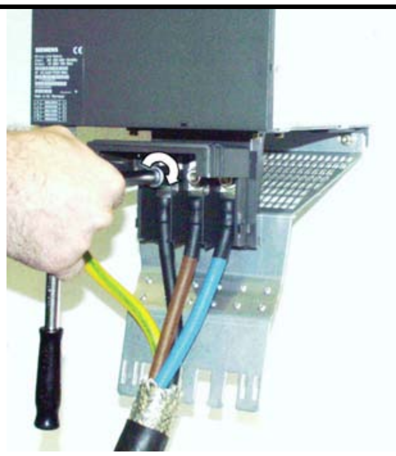
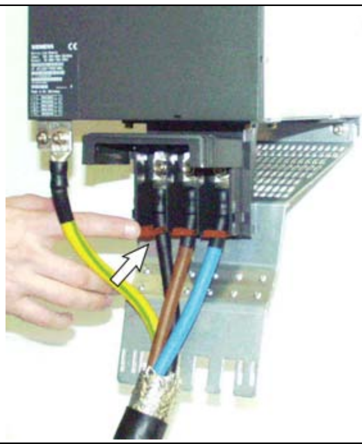
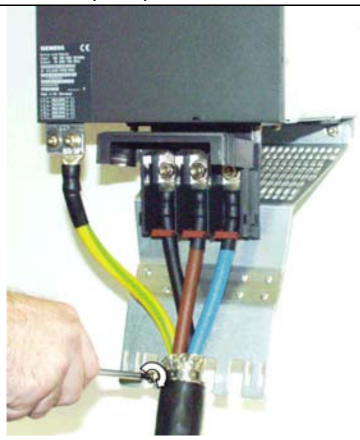
			
Attach the protective conductor (PE) using a screwdriver T25/3 Nm	Secure the power cable with flat-bladed screwdriver 4/1.8 Nm.	Secure the shield clip to the shielded terminal plate using a suitable tool.	The power cable is connected.

Table 7-5 Electrical connection at the shielded terminal 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 clip to the shielded terminal plate using a suitable tool.
		
Close the cover of the terminal block.		

7.2 DC link supply adapter

7.2.1 Description

The DC link supply 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 infeed adapter and DC busbars are used, the limit values for radio interference emission acc. to Class A1 acc. to EN 55011 or Category C2 acc. to EN 61800-3 can no longer be complied with.

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

Table 7-6 The DC link supply adapter is available in two sizes.

for Line/Motor Modules with a width of 50 mm and 100 mm	for Line/Motor Modules with a width of 150 mm, 200 mm, 300 mm
Screw terminals (4 to 10 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, otherwise this could result in secondary damage or accidents.

Caution

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

Danger

Components for which the recesses for the DC link supply adapter have been removed must no longer be operated without them. If components need to be operated without neither the recess nor DC link supply adapter, the DC link cover must be replaced.

Caution

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

A set of labels in 16 languages is available under Order No.: 6SL3166-3AB00-0AAx.

Caution

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

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

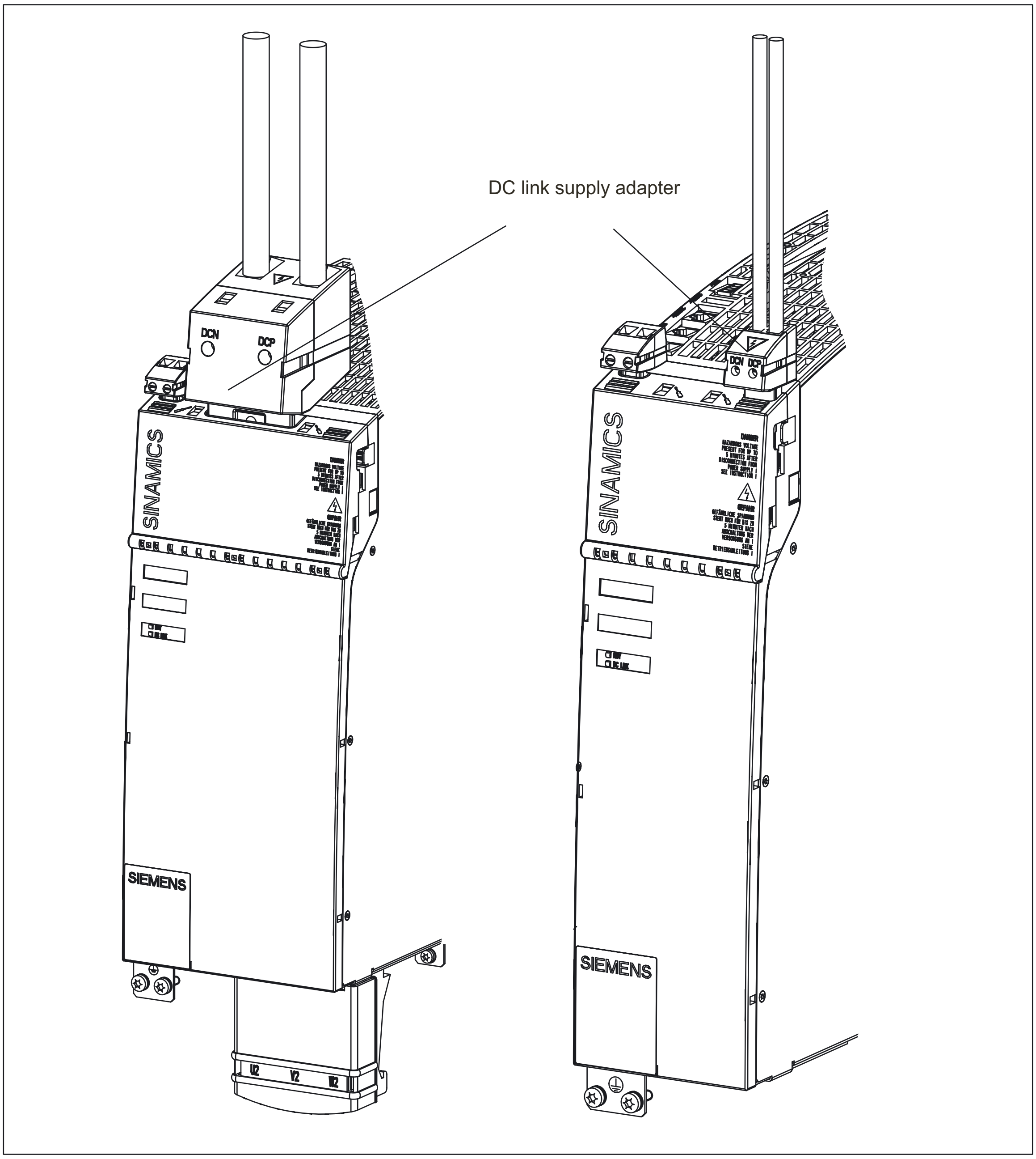


Figure 7-11 150 mm components with DC link supply adapter for 35 mm² to 95 mm² and 100 mm components with DC link infeed adapter for 4 mm² to 10 mm²

7.2.3.2 DC link connection

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

Terminal	Function	Technical specifications
DCP	DC link positive	**Supply voltage:** 750 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

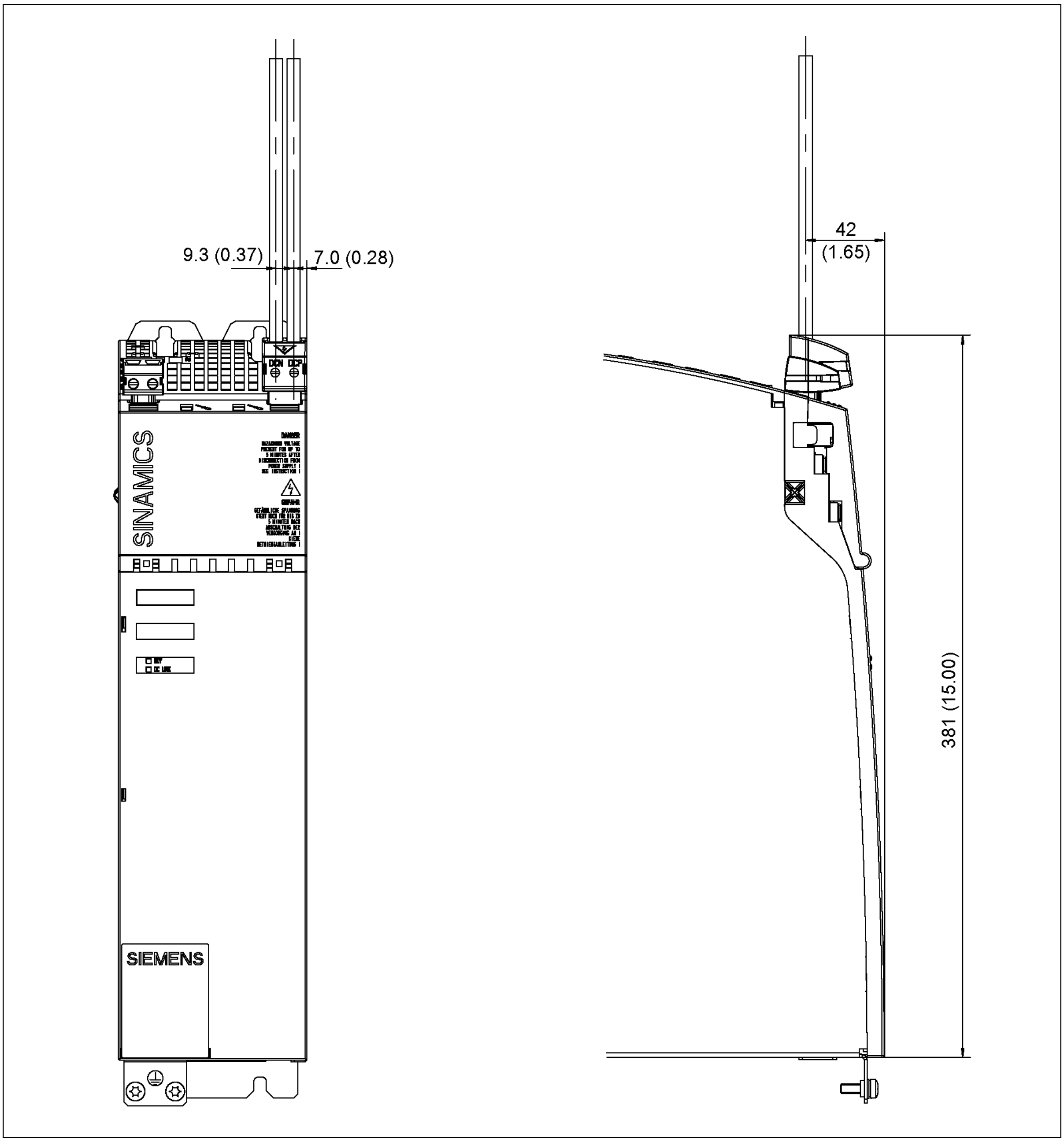


Figure 7-12 Dimension drawing, 100 mm components with DC link infeed adapter for 0.5 mm² to 10 mm²

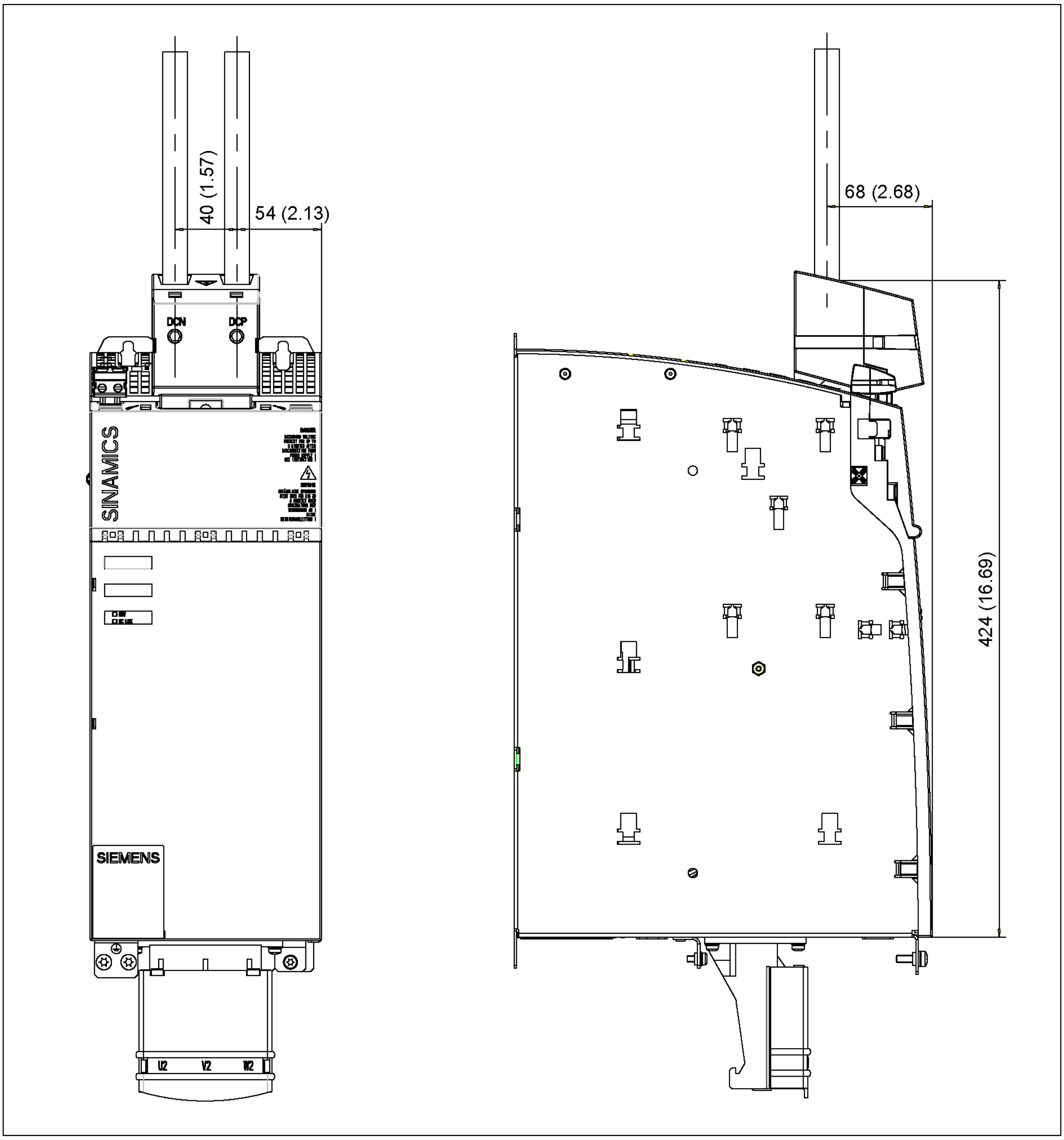


Figure 7-13 Dimension drawing, 150 mm components with DC link infeed adapter for 35 mm² to 95 mm²

7.2.5 Installation

Danger

If a 50 mm wide module or if a DC link component with the appropriate width (e.g. Braking Module, CSM, VCM) 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.

Required tools:

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

Table 7-8 Installing the DC link supply adapter for 50 mm and 100 mm modules

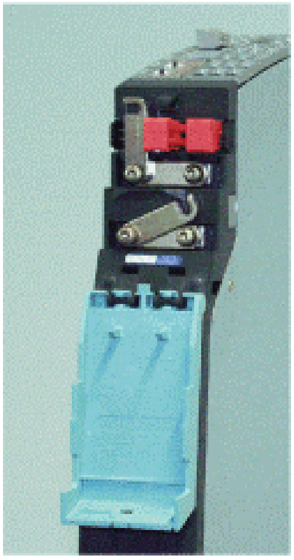
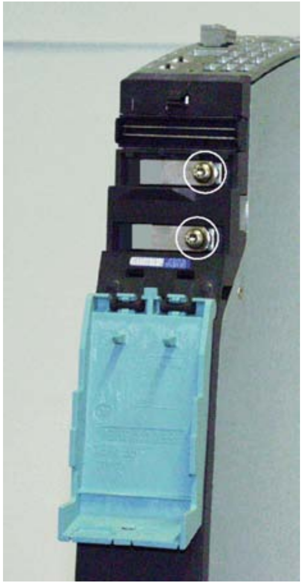
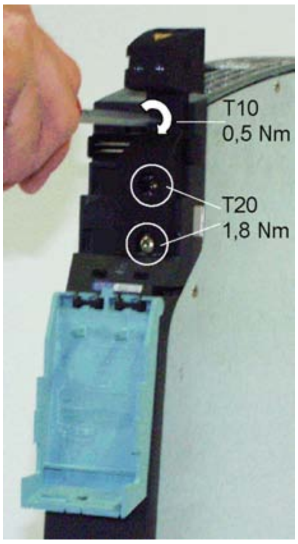
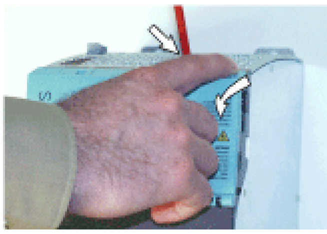
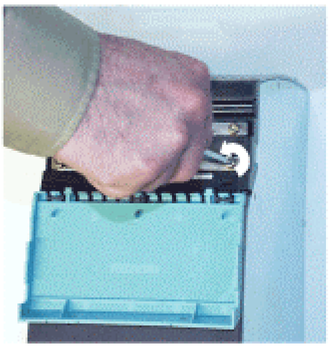
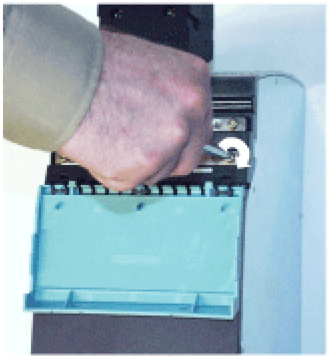
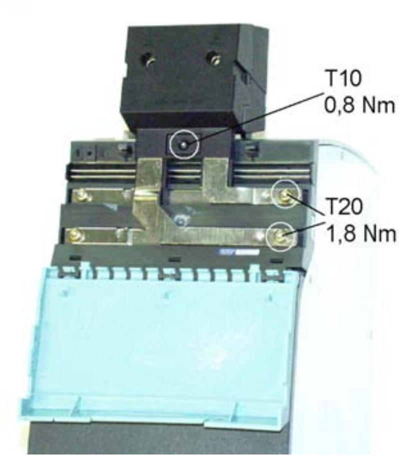
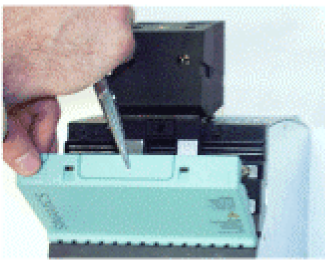
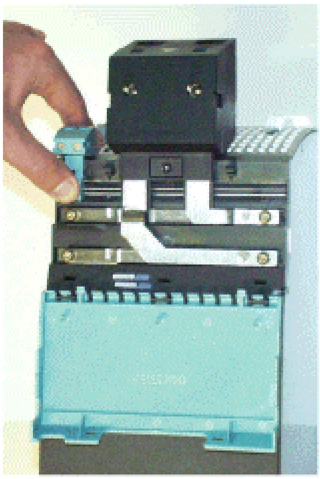
			
Unlock and open the protective cover.	Opened cover with 24 V jumper and DC link bridge	The DC link bridge and 24 V jumper have been removed.	Removed DC link bridge and screws
			
Secure the adapter.	Create the recess using suitable pliers.	Plug-on the 24 V adapter	Close the protective cover.

Table 7-9 Installing the DC link supply adapter for 150 mm, 200 mm, and 300 mm modules

		
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.
		
Create the recess using suitable pliers.	Plug-on the 24 V adapter	Close the protective cover.

7.2.6 Electrical Connection

Table 7-10 Connecting the DC link supply adapter for 50 mm and 100 mm modules

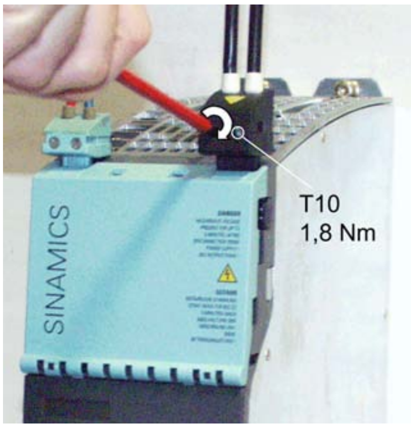
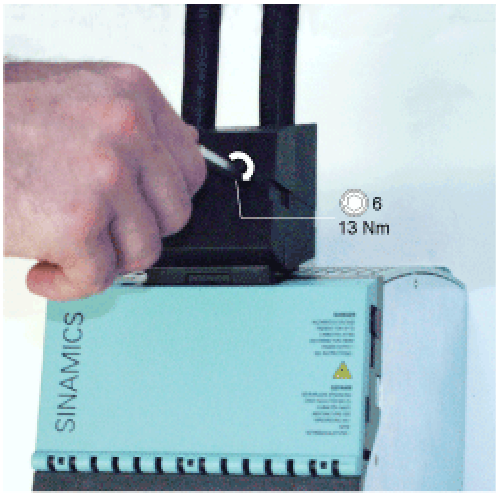
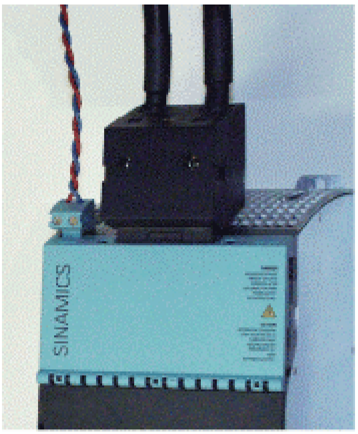
<table>
<tr><td>
</td><td>
</td></tr>
<tr><td>Connect the cable to the DC link supply adapter.</td><td>Electrical connection of the DC link supply adapter.</td></tr>
</table>

Table 7-11 Connecting the DC link supply adapter for 150 mm, 200 mm, and 300 mm modules

<table>
<tr><td>
</td><td>
</td></tr>
<tr><td>Connect the cable to the DC link supply adapter.</td><td>Electrical connection of the DC link supply adapter.</td></tr>
</table>

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, otherwise this could result in secondary damage or accidents.

Caution

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

Caution

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

A set of labels in 16 languages is available under Order No.: 6SL3166-3AB00-0AAx.

Caution

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

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.

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

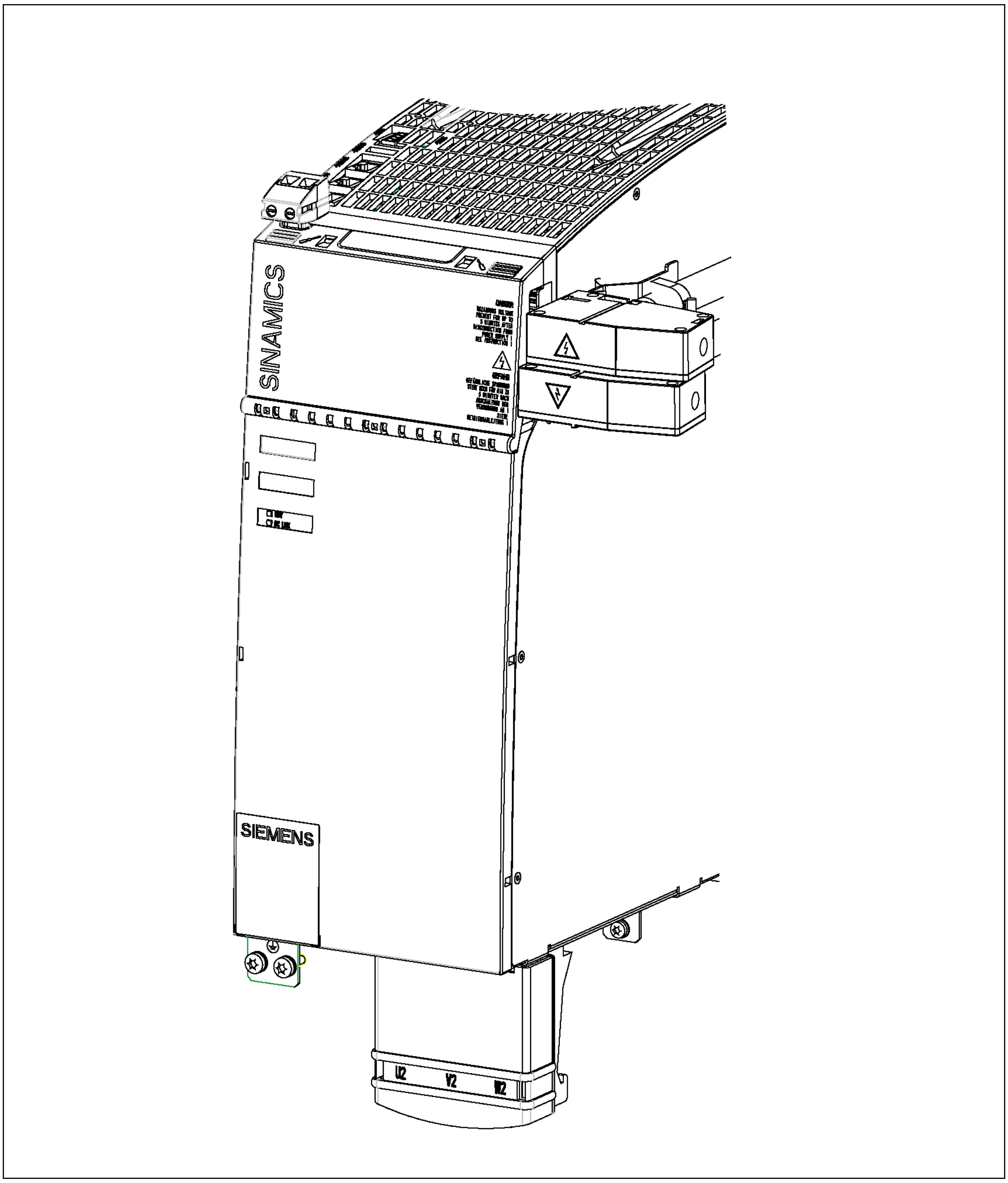


Figure 7-14 150 mm components with DC link adapter for two-row configuration 35 mm² to 95 mm²

7.3.3.2 DC link connection

Table 7-12 DC link adapter – description of the terminals

Terminal	Function	Technical specifications
DCP	DC link positive	**Two-row configuration of adapter 35 – 95 mm²** Current carrying capacity: 200 A Voltage: 750 V-VDE/600 V AC Connection cross-section: 35 – 95 mm² Stripped length: 27 mm
DCN	DC link negative	

7.3.4 Dimension Drawing

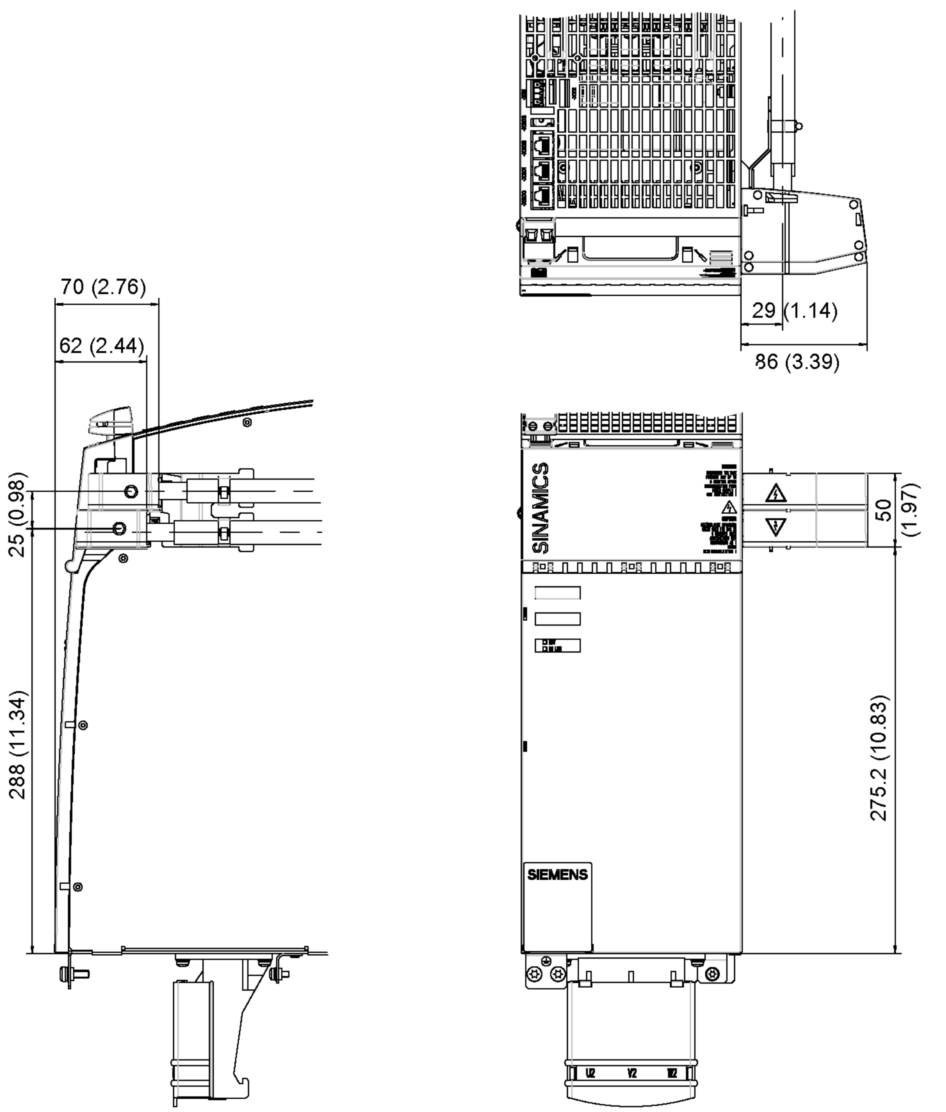


Figure 7-15 Dimension drawing, 150 mm components with DC link adapter for two-row configuration 35 mm² to 95 mm²

7.3.5 Installation

Danger

If a 50 mm wide module or if a DC link component with the appropriate width (e.g. Braking Module, Control Supply Module, Voltage Clamping Module) is located at the 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.

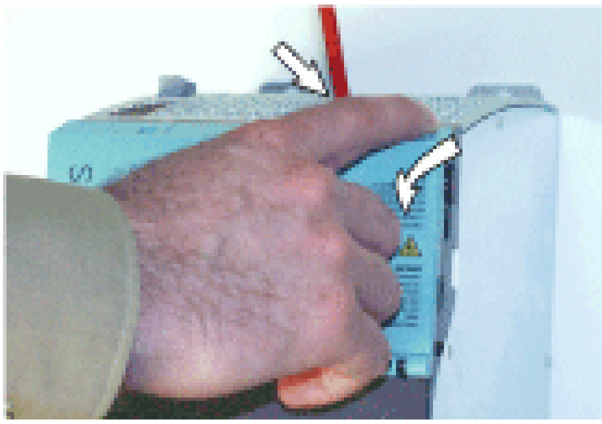
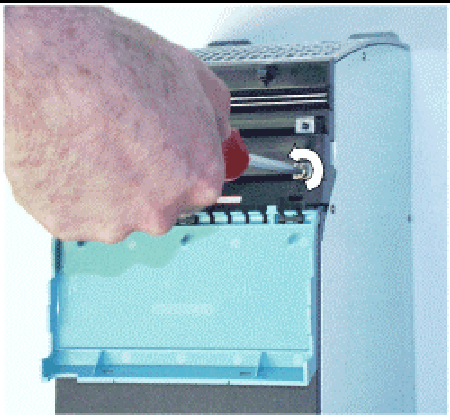
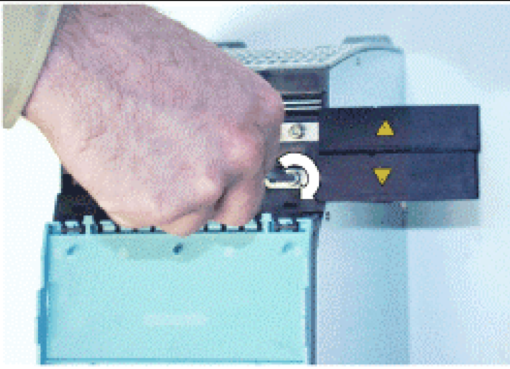
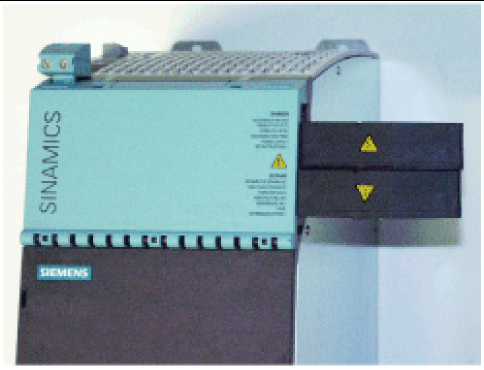
For all other power units and DC link components (e.g. Capacitor Module) that are wider than 50 mm, it is not permissible to remove the DC link bridge.

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

Required tools:

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

Table 7-13 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 plugged-on, closed protective cover

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 7-14 Overview

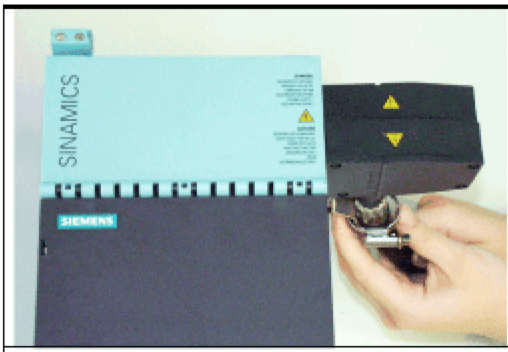
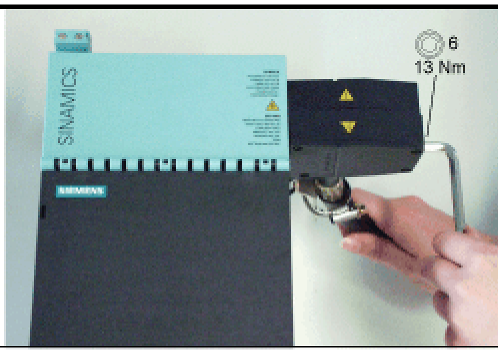
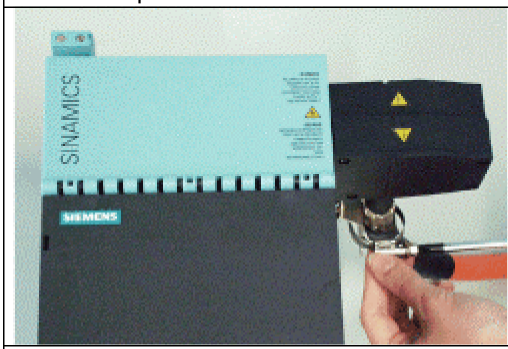
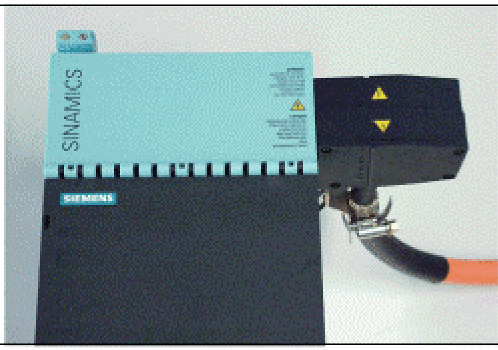
Active Line Module	Internal cooling	External cooling
55 kW	6SL3130-7TE25-5AA2	6SL3131-7TE25-5AA0 (only with DC link busbars)
80 kW	6SL3130-7TE28-0AA1	6SL3131-7TE28-0AA0 (only with DC link busbars)
120 kW	6SL3130-7TE31-2AA1	6SL3131-7TE31-2AA0 (only with DC link busbars)

7.3.6 Electrical Connection

Required tools:

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

Table 7-15 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 DRIVE-CLiQ cabinet gland

7.4.1 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.

7.4.2 Safety Information

Note

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

7.4.3 Interface Description

7.4.3.1 Overview

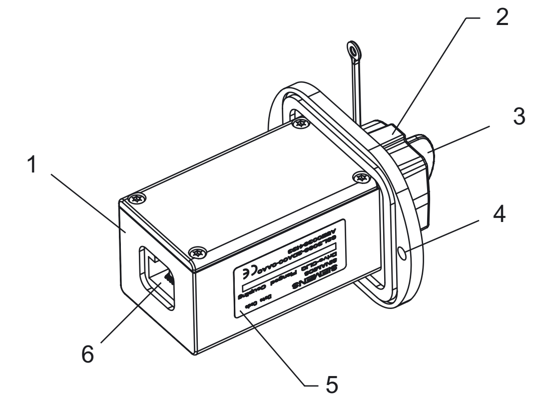


Figure 7-16 DRIVE-CLiQ cabinet gland

1	DRIVE-CLiQ cabinet gland
2	Protective cap
3	IP67 acc. to EN 60529 interface
4	Mounting holes
5	Type plate
6	IP20 or IPXXB acc. to EN 60529 interface

7.4.4 Dimension drawing

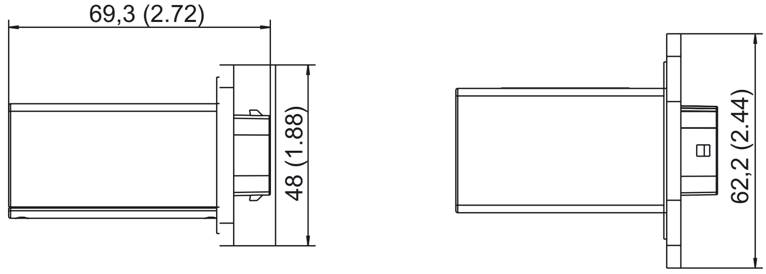


Figure 7-17 Dimension drawing, DRIVE-CLiQ cabinet gland

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

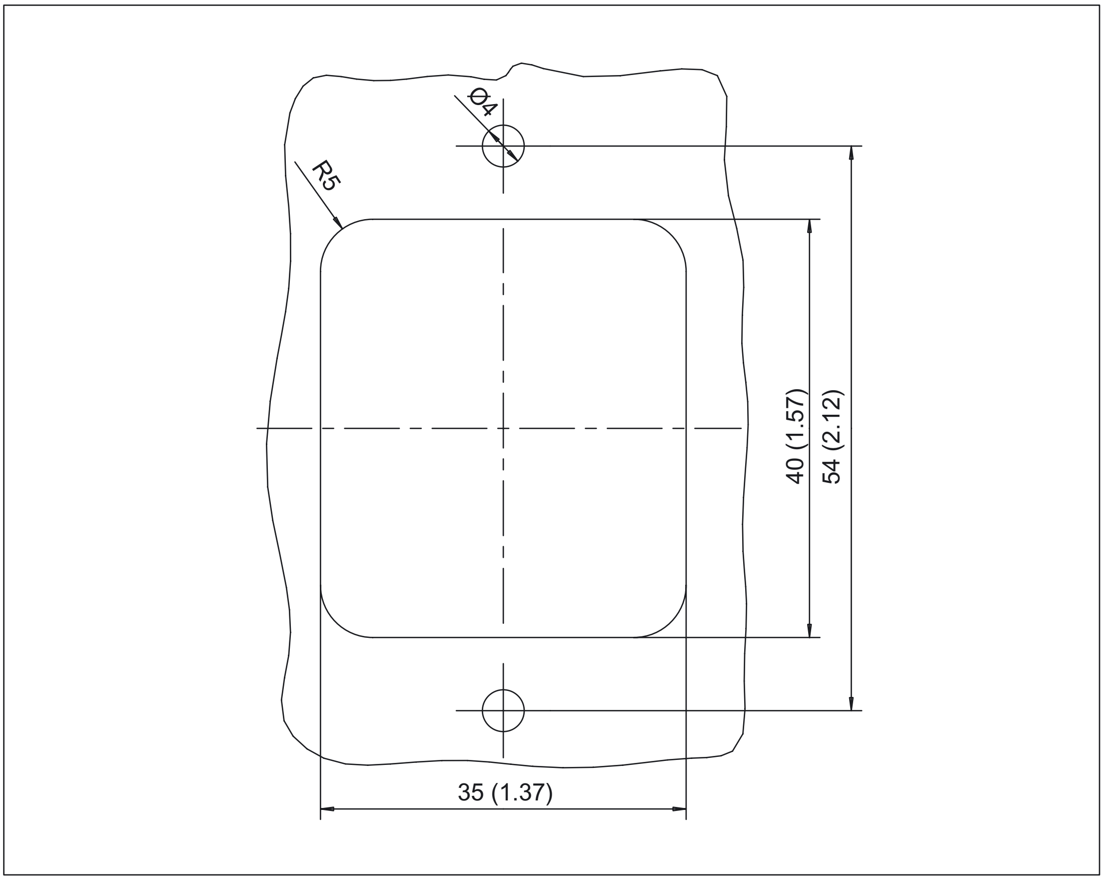


Figure 7-18 Cutout for cabinet

7.4.5 Installation

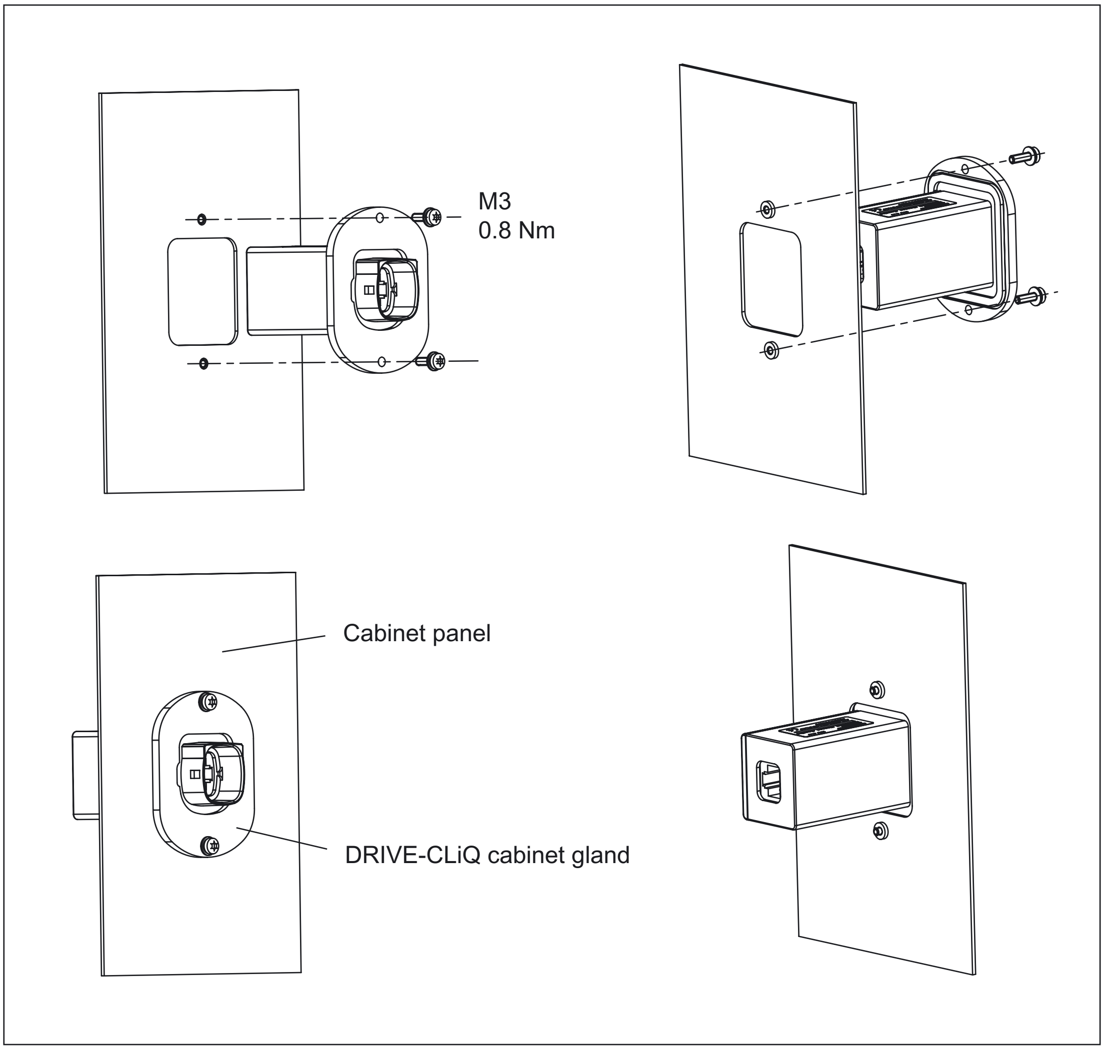


Figure 7-19 DRIVE-CLiQ cabinet gland

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.

7.4.6 Technical specifications

Table 7-16 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 cabinet IP54 to EN 60529 outside the cabinet	

7.5 DRIVE-CLiQ coupling

7.5.1 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.

7.5.2 Safety Information

Note

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

7.5.3 Interface Description

7.5.3.1 Overview

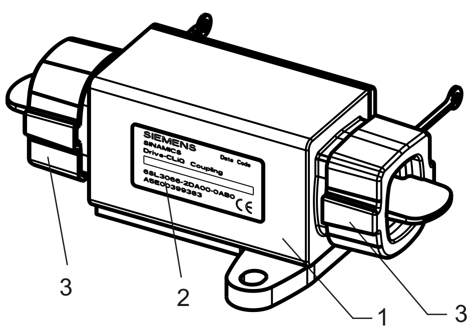


Figure 7-20 DRIVE-CLiQ coupling

1	DRIVE-CLiQ coupling
2	Type plate
3	Centering caps

7.5.4 Dimension drawing

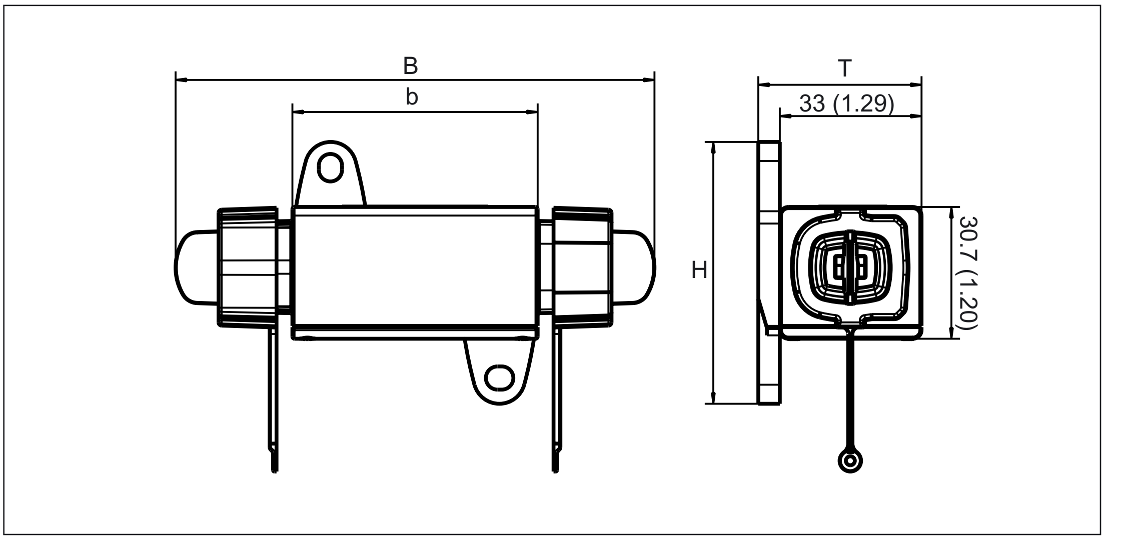


Figure 7-21 Dimension drawing, DRIVE-CLiQ coupling

Table 7-17 Dimensions of the DRIVE-CLiQ coupling, all data in mm and (inch)

Accessories	B [mm]	b [mm]	H [mm]	T [mm]
DRIVE-CLiQ coupling	111.5 (4.38)	57.1 (2.24)	61 (2.40)	38 (1.49)

7.5.5 Installation

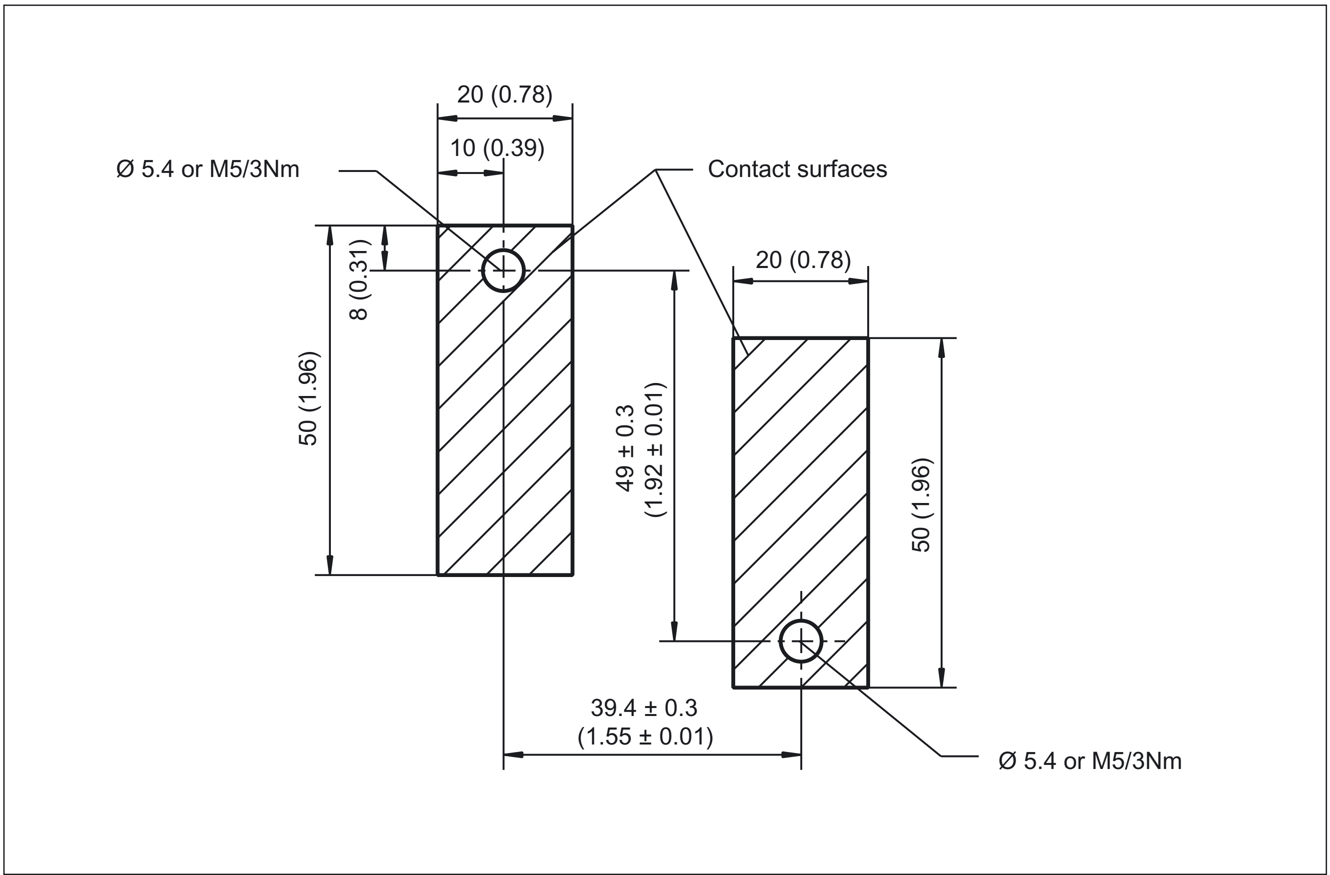


Figure 7-22 Hole drilling template for installation

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.

7.5.6 Technical specifications

Table 7-18 Technical data

DRIVE-CLiQ coupling 6FX2003-0DC1x	Unit	
Weight	kg	0.14
Degree of protection	IP67 acc. to EN 60529	

Cabinet Configuration and EMC Booksize 8

8.1 Information

8.1.1 General

SINAMICS S components fulfill the requirements according to degree of protection IP20B in compliance with EN 60529. This therefore 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 3-ph. 360 V AC to 3-ph. 440 V 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 catalogs D21.1 and D21.2.

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

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

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

Warning

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

Non-observance can cause lethal shock voltages.

8.1.3 Directives and standards

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 Selection of devices required for operation of SINAMICS

8.2.1 General

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

- Line disconnecting device
- Line fuse
- Line contactor (this is required for electrical isolation)
- Line filter (refer to Chapter Line supply connection)
- Line reactor (refer to Chapter Line supply connection)

8.2.2 Information about line isolating devices

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

The line disconnecting device must be equipped with a leading auxiliary switch ($t \geq 10$ ms), which must be integrated in the switching-off path of the Line Modules (EP terminals).

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

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

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

Note

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).

The following tables list the requirements regarding line fuses and circuit-breakers for the Active Line Modules and Smart 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	160A	250A
I_{fuse} 0.2s	>180 A	>360 A	>450 A	>650 A	>865 A
I_{fuse} 4s	>130 A	>260 A	>350 A	>505 A	>675 A
I_{fuse} 10 s	>100 A	>200 A	>250 A	>360 A	>480 A
I_{fuse} 240 s	>60 A	>135 A	>200 A	>280 A	>380 A

Table 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} 0.2s	>70 A	>100 A	>180 A	>360 A
I_{fuse}4s	>50 A	>80 A	>130 A	>260 A
I_{fuse} 10 s	>42 A	>65 A	>100 A	>200 A
I_{fuse} 240 s	>30 A	>45 A	>60 A	>135 A

See catalog D21.2.

8.2.4 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

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

1. The electronics of the SINAMICS components via the integrated 24 V busbar
2. The electronics of the Control Units, Option Boards, Sensor Modules, and Terminal Modules, as well as the process voltage of their digital inputs
3. The load voltage of the digital outputs
4. The motor holding brakes

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

Notice

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

Notice

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

The DC power supply should be set to 26 V. The 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 Selection of power supply units

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

Table 8-4 Recommended SITOP Power

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

Table 8-5 Recommendation for Control Supply Module

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

See catalog D21.2.

Warning

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

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 8-6 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
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
Double Motor Modules	
2 x 3 A (+2 x DRIVE–CLiQ; +2 x brake)	1.15

Component	Typical current consumption [A_{DC}]
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 through the 24 V terminal adapter.

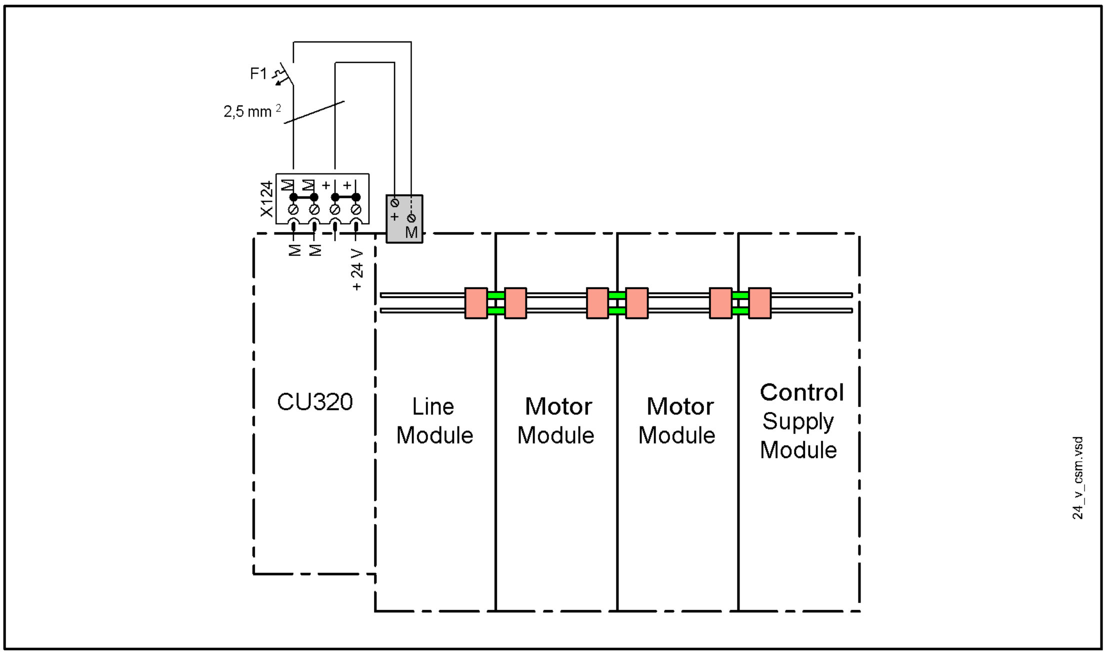


Figure 8-1 Example, 24 V supply using the Control Supply Module

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 (PELV).

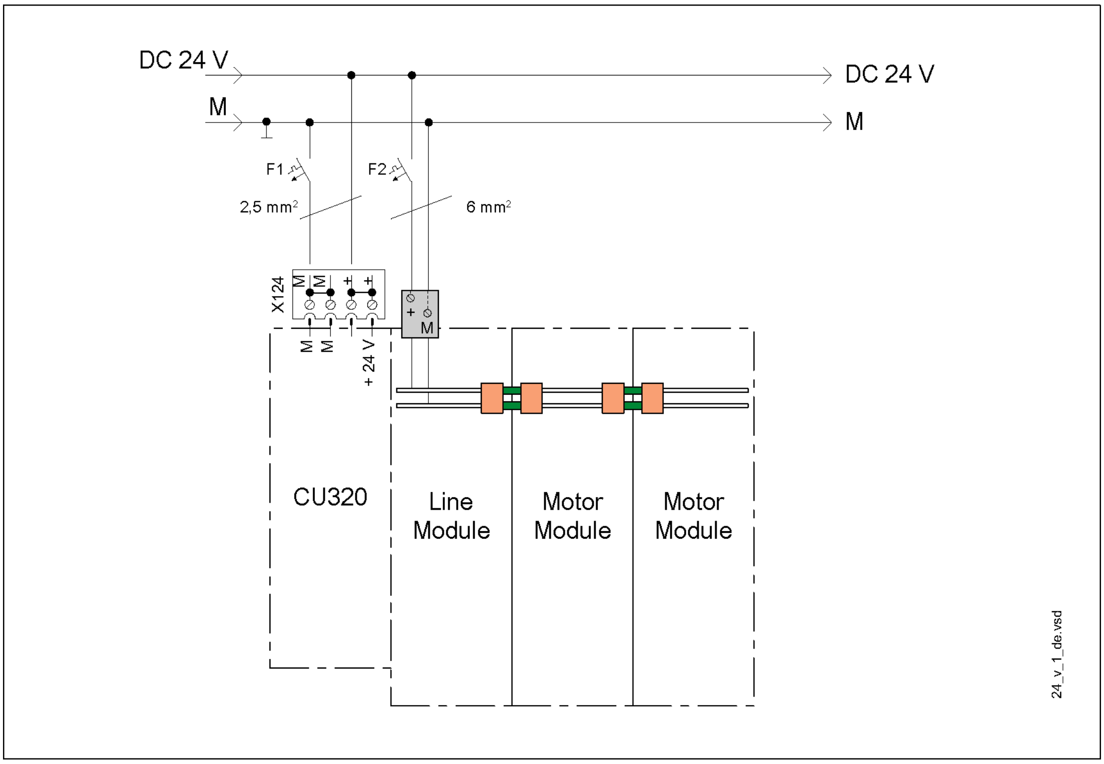


Figure 8-2 Example, 24 V DC fusing/protection

The following standards should be carefully observed when selecting the cable protection circuit-breakers:

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 8-7 MCBs by conductor cross-section and temperature

Conductor cross-section	Max. value up to 40 °C	Max. value up to 55 °C
1.5 mm²	10 A	6 A
2.5 mm²	16 A	10 A
4 mm²	25 A	16 A
6 mm²	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 the 24 V DC current requirement

Table 8-8 Example, 24 V DC current requirement

Component	Number	Current consumption [A]	Total current consumption [A]
CU320 8 digital outputs	1 8	0.8 0.1	0.8 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 devices

8.4.1 General

The arrangement of the components and equipment takes account of

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

Components are usually located centrally in a cabinet.

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 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)

In the case of Active Line Modules above 55 kW, the Motor Modules can be mounted at the right or left.

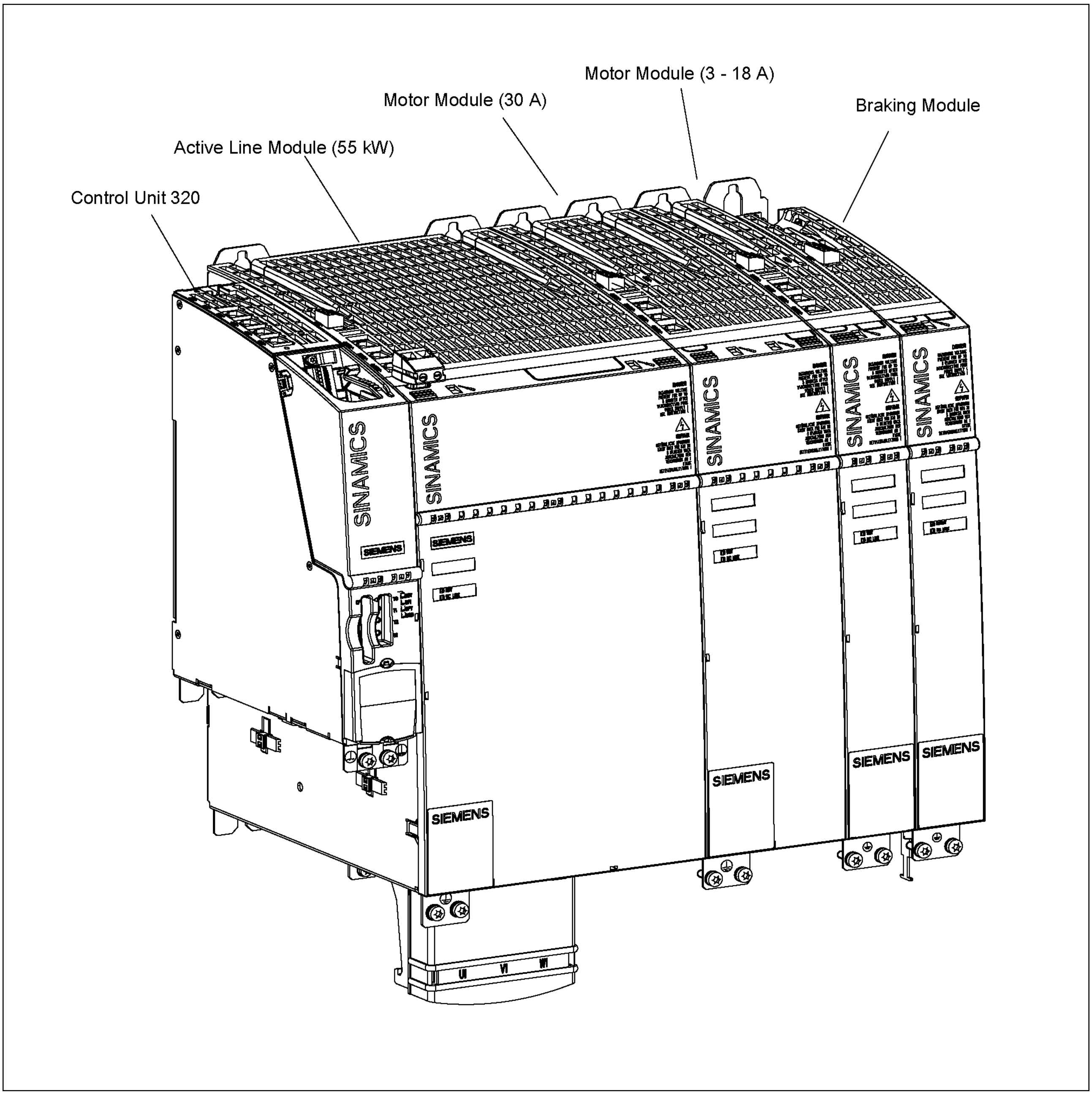


Figure 8-3 Example of a drive line-up

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

The components can be arranged in one or more tiers. In a multiple-tier arrangement, vertical installation or, in a cabinet row, side-by-side installation in different cabinet sections is possible.

To determine the cross-section, use the DC link busbar current carrying capacity given in the relevant technical specifications.

A 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 regarding the use of modules 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.

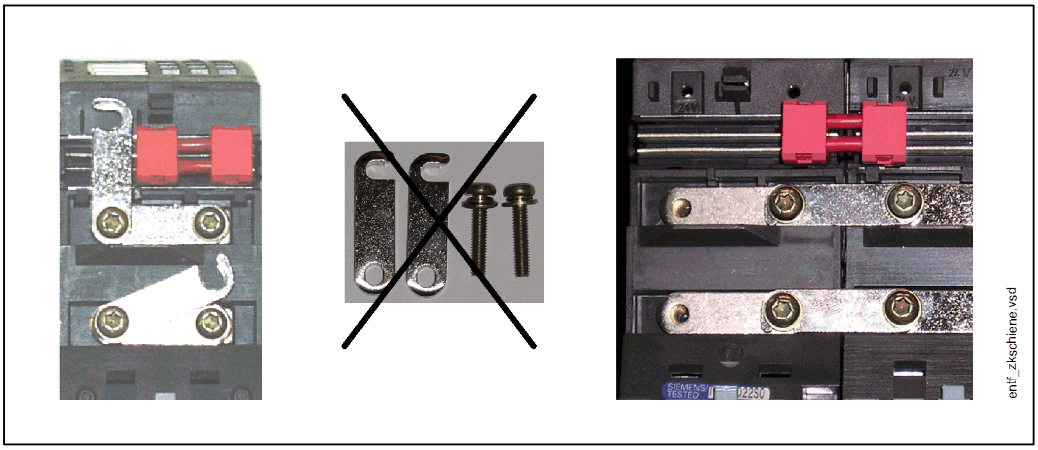


Figure 8-4 Removing the DC link bridges

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

Two-tier configuration

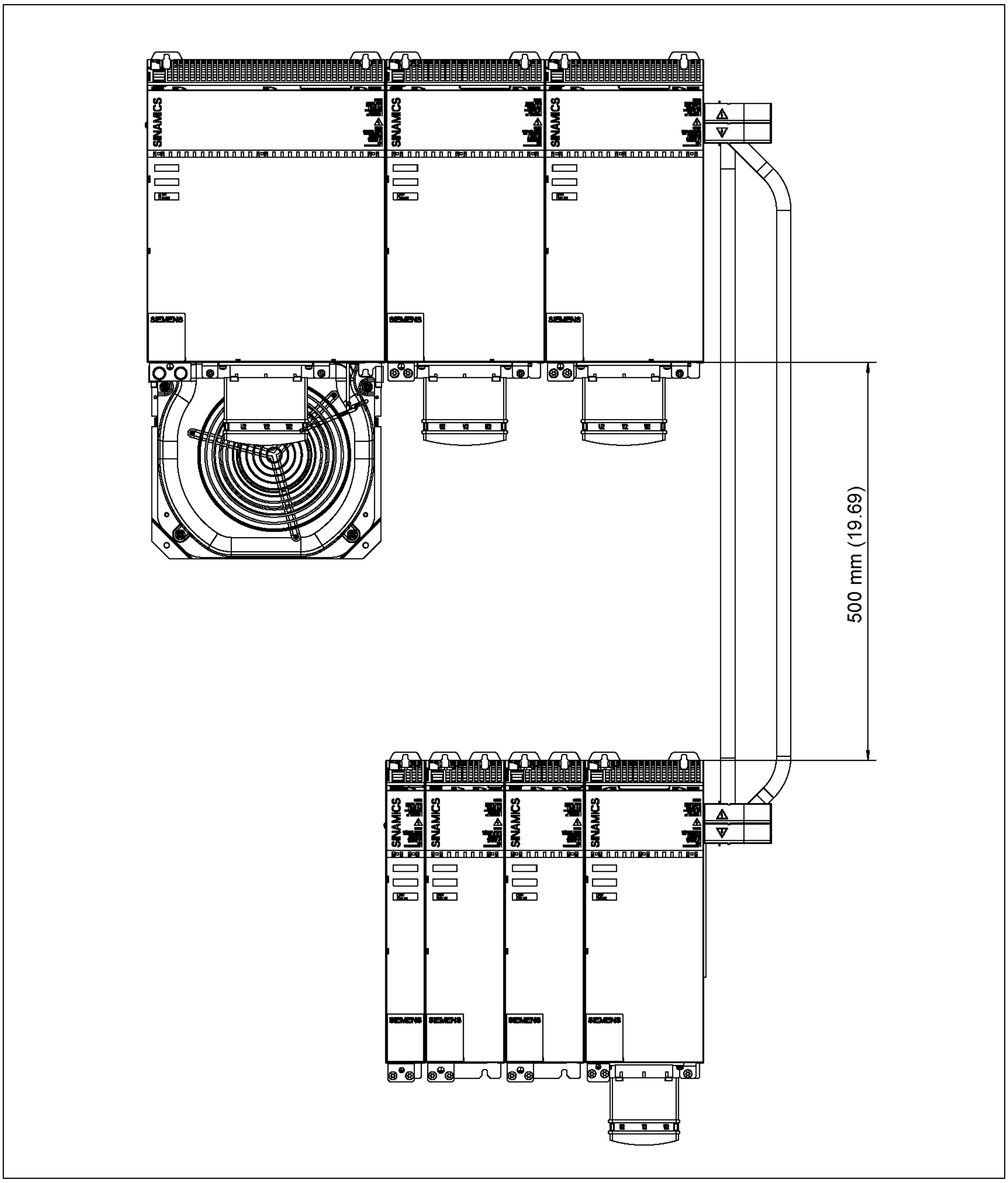


Figure 8-5 Example of a two-tier configuration with modules between 200 and 300 mm wide

Continuation of the DC link with the DC link adapter (installation above) external to the components is achieved using single-core, finely-stranded and shielded cables that are laid so as to ensure they are short-circuit and ground-fault proof.

The distance between the two module rows depends on the wiring and cable cross-section.

For components with a width of between 50 and 100 mm, the distance between the upper and lower module row must be at least 300 mm.

For components with a width of between 150 to 300 mm, the distance between the upper and lower module row must be at least 500 mm.

Caution

Signal cables must not be routed parallel to power cables.

Wiring rules for DRIVE-CLiQ

See the Commissioning Manual.

Overview of the DC link supply adapter and DC link adapter

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

Note

The current carrying capacity of the DC link busbars must be taken into account. For the specifications, see the technical specifications for the module.

Multiple-tier configuration

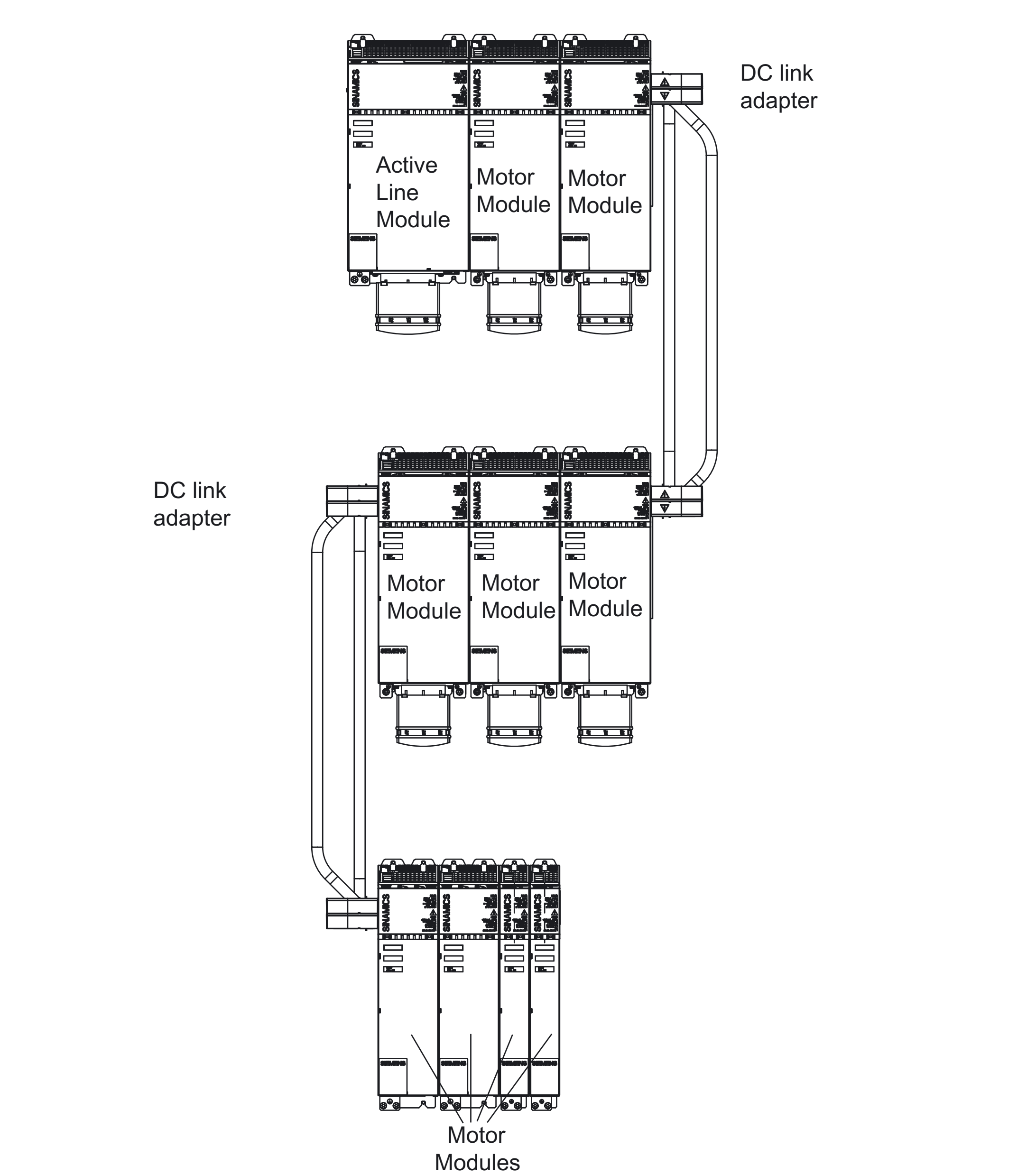


Figure 8-6 Example of a three-tier configuration with modules between 50 and 200 mm wide

Note

When the power supply input is on the right-hand side of the drive line-up (e.g. in a multiple-tier configuration), the above rules apply in reverse.

This means that: The Motor Modules are arranged in order of power from the highest power to the lowest power followed by the DC link components, such as the Braking Module.

8.5 Information about electromagnetic compatibility (EMC) and cable routing

8.5.1 General

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

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.

⚠ Caution

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.

Measures according to EN 61800-5-1 must be taken (e.g. PE conductor (≥10mm² Cu) or fit an additional connection terminal for a PE conductor with the same cross-section as the original PE conductor).

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 8-9 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)05252/960-116 http://www.weidmueller.com	

Caution

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

Caution

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

Table 8-10 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 Module and motor ≤ 18 A	70 (shielded) 100 (unshielded)
Power cable between Motor Module and motor ≤ 30 A	50 (shielded) 75 (unshielded)
Power cable between Motor Module and motor ≤ 45 A	100 (shielded) 150 (unshielded)
DRIVE-CLiQ signal cables MC500	100
DRIVE-CLiQ signal cables MC800	50
DRIVE-CLiQ signal cables FIX	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 circuitry 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.

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.

For a PROFIBUS connection between two cabinets, a finely stranded potential bonding connector should be used with a cross-section of 4 mm². The conductor must be routed together with the PROFIBUS cable and connected to the CU320 at the tapped hole provided using the cable lug.

Equipotential bonding and shielding for PROFIBUS

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

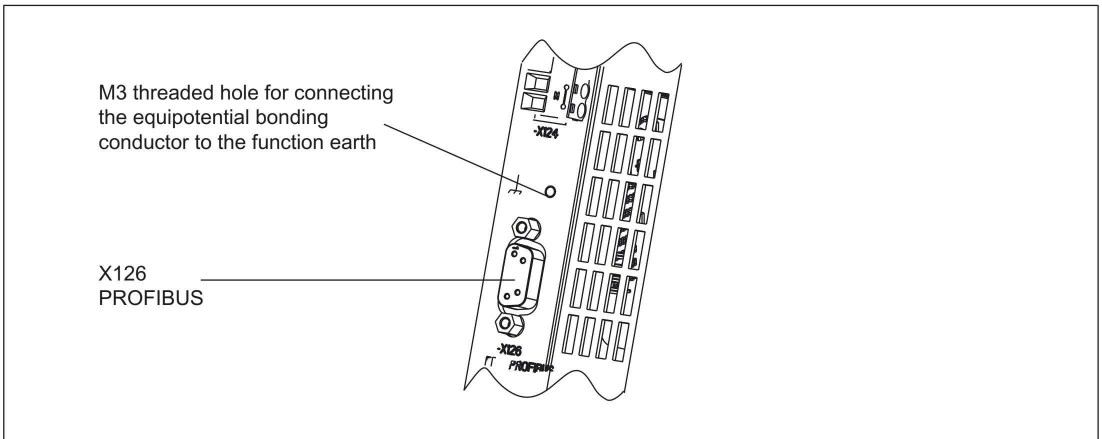


Figure 8-7 Functional ground connection for PROFIBUS

8.6 Connection methods

8.6.1 Spring-Loaded Terminals/Screw Terminals

Connectable conductor cross-sections of spring-loaded terminals

Table 8-11 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 8-12 Screw terminals

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

Screw terminal type			
4	Connectable conductor cross-sections	Flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.2 mm^2 to 4 mm^2 0.25 mm^2 to 4 mm^2 0.25 mm^2 to 4 mm^2
	Insulation stripping length	7 mm	
	Tool	Screwdriver 0.6 x 3.5 mm	
	Tightening torque	0.5 to 0.6 Nm	
5	Connectable conductor cross-sections	Flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.5 mm^2 to 6 mm^2 0.5 mm^2 to 6 mm^2 0.5 mm^2 to 6 mm^2
	Insulation stripping length	12 mm	
	Tool	Screwdriver 1.0 x 4.0 mm	
	Tightening torque	1.2 to 1.5 Nm	
6	Connectable conductor cross-sections	Flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.5 mm^2 to 10 mm^2 0.5 mm^2 to 10 mm^2 0.5 mm^2 to 10 mm^2
	Insulation stripping length	11 mm	
	Tool	Screwdriver 1.0 x 4.0 mm	
	Tightening torque	1.5 to 1.8 Nm	

8.6.2 Motor connector

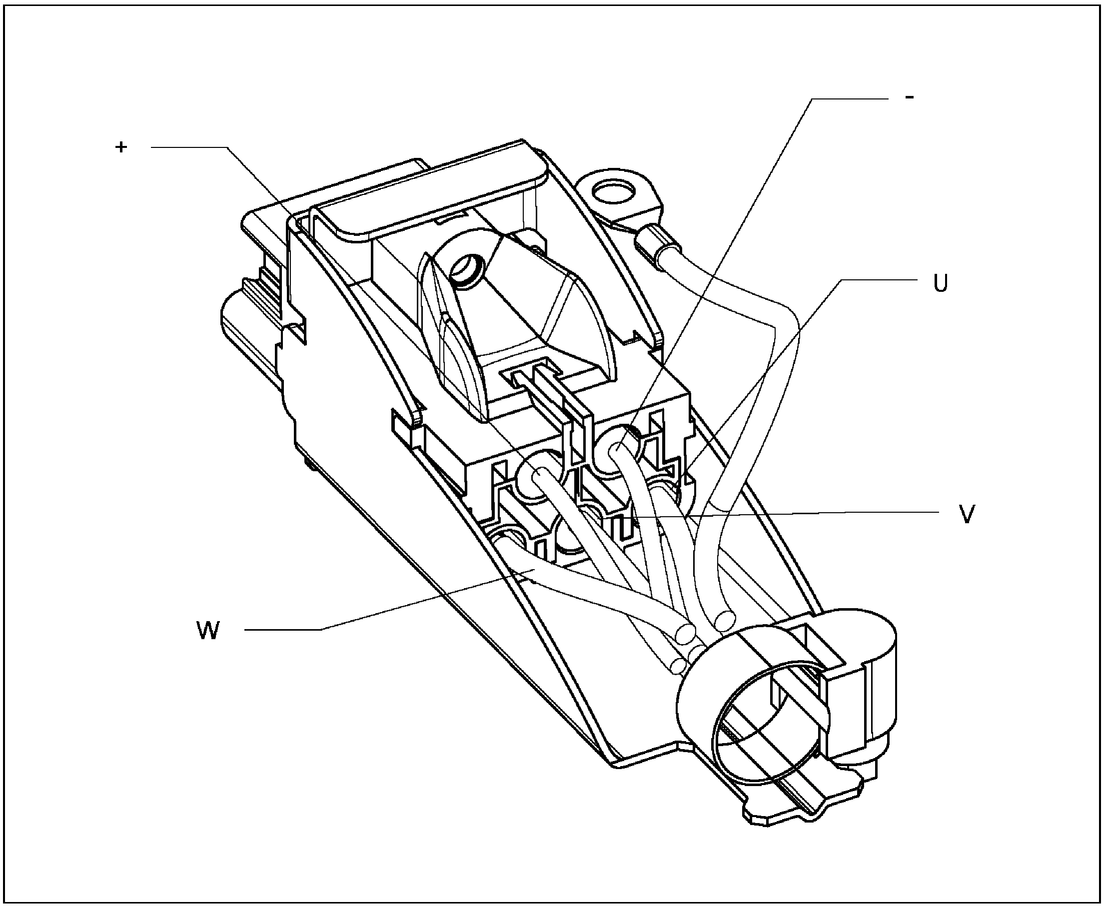


Figure 8-8 Motor Connector

The figure below shows how to remove the motor connector using a pair of engineer's pliers, for example, to pull the cable through narrow cable bushings.

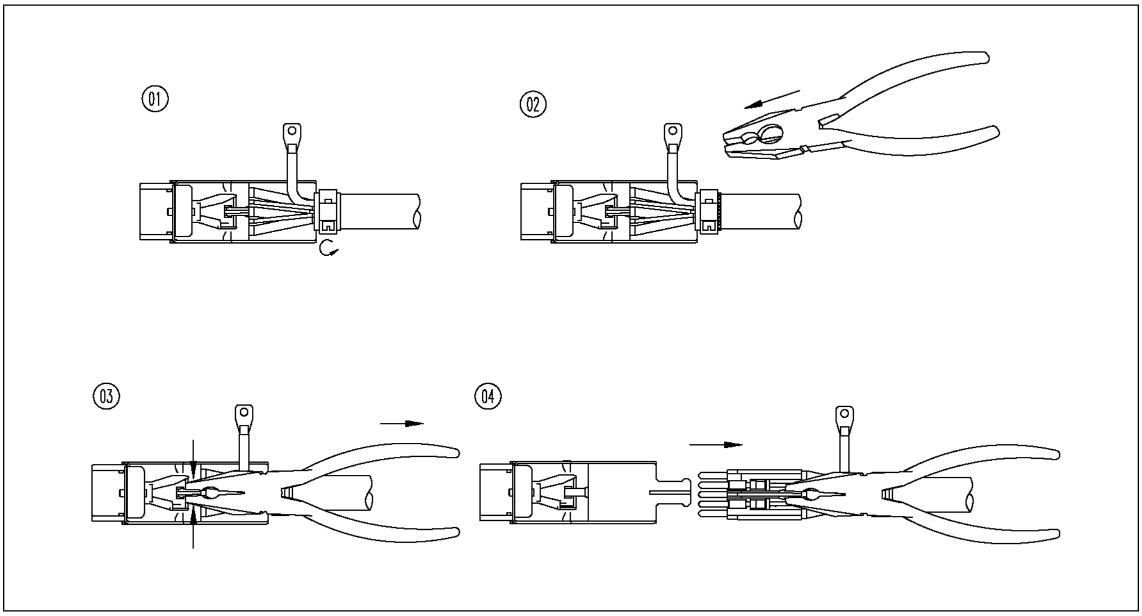


Figure 8-9 Removing the motor connector

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

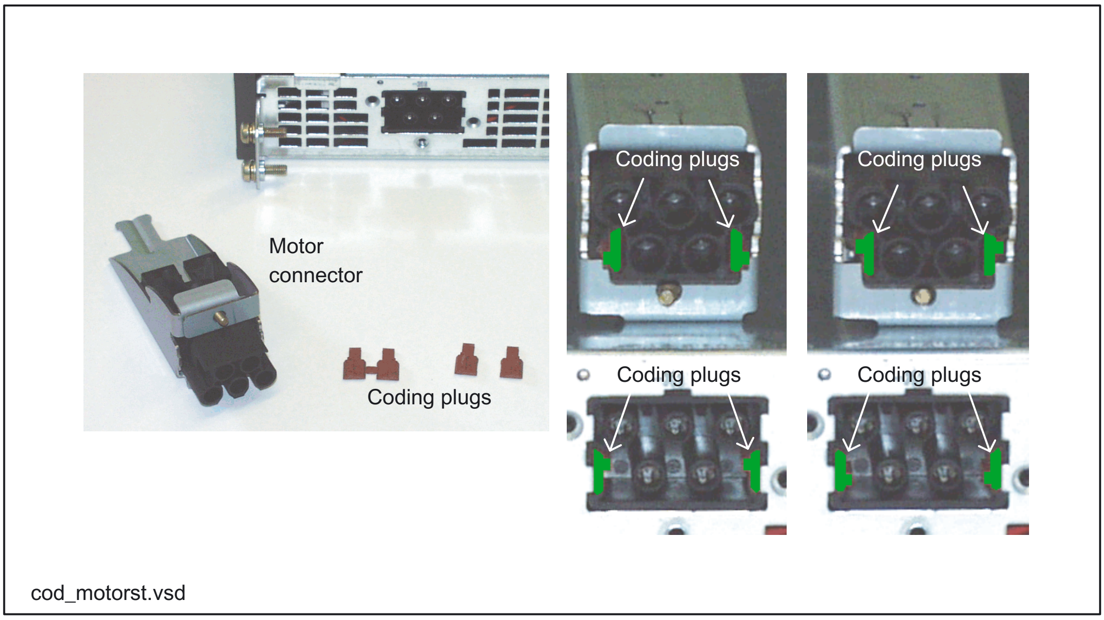


Figure 8-10 Coding the motor connector

The coding plugs are supplied with the motor cables.

8.6.3 Power connector (X1/X2)

with screw terminals

Structure and assembly

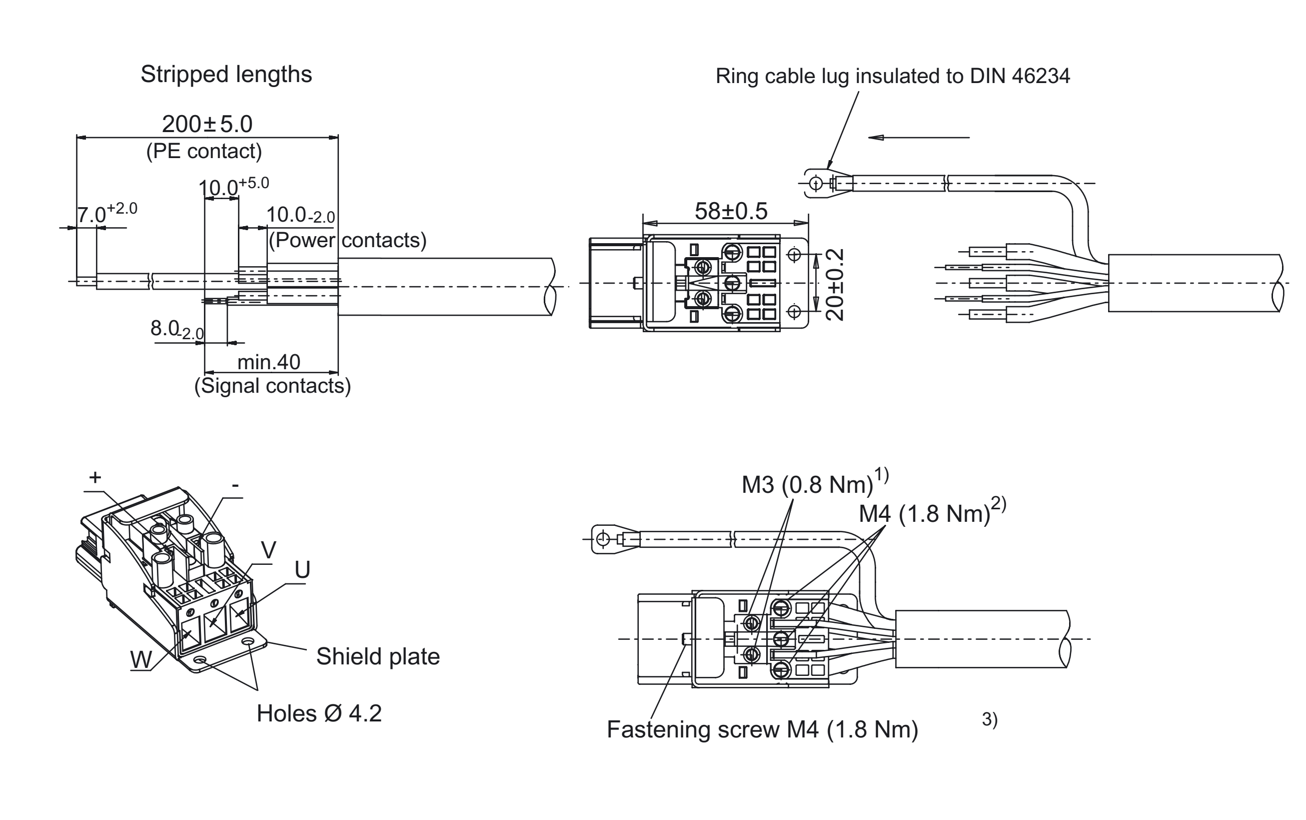


Figure 8-11 Setting up and installing the power supply connector (X1/X2)

Screwdriver

1) SZS 0.6 x 3.5

2) SZS 1.0 x 4.0

3) Torx TX20

Various options are available for the shield contact:

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

---

2. Customer-specific shield contact

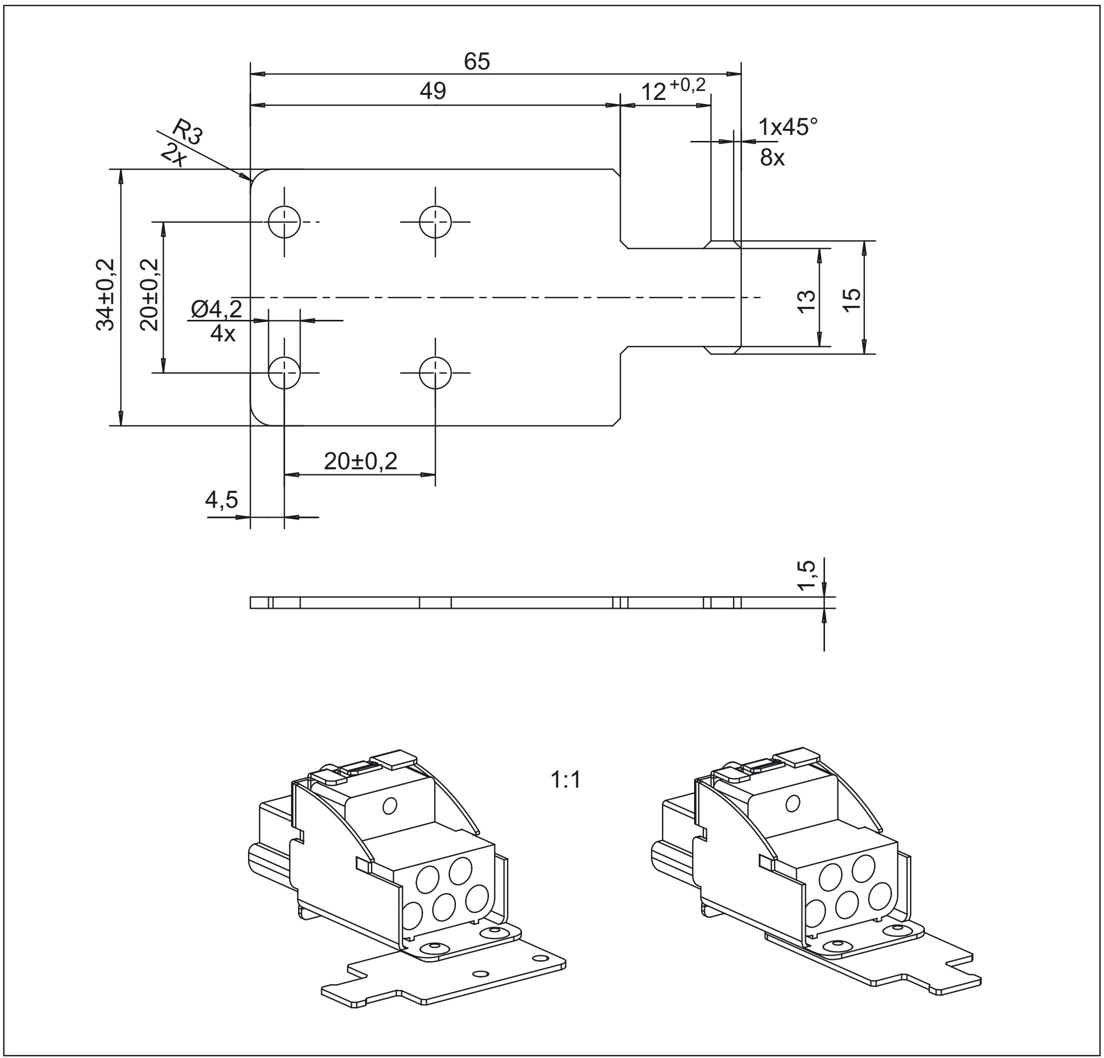


Figure 8-12 Example of a customer-specific metal shield contact
With both variants, the shield for the brake terminal wires must be applied together with the cable shield.

3. Securing a shield contact constructed by the customer on the shield plate.

8.6.4 24-V terminal adapter

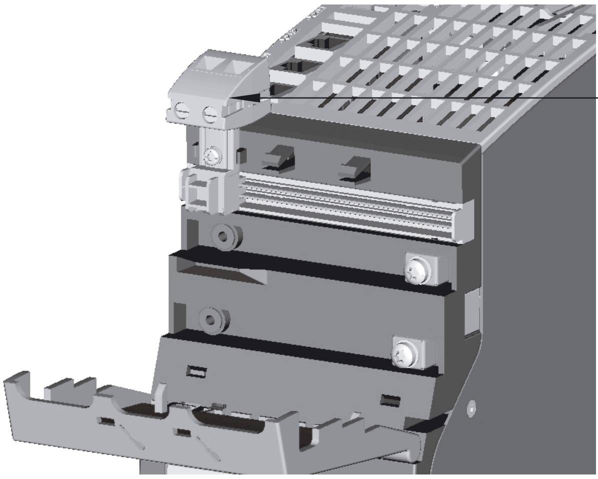


Figure 8-13 24 V terminal adapter

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

24 V terminal adapter for a conductor cross-section of 6 mm^2, supplied with the Line Modules and Control Supply Modules.

8.7 Information about cabinet 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
- cable routing
- air guidance, air-conditioner.

Table 8-13 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 Smart Line Module 5 kW – 36 kW	6SL3000-0CExx-0AAx	100
Active Line Module 16 kW – 55 kW 80 kW – 120 kW	 6SL3130-7TExx-xAAx 6SL3130-7TExx-xAAx	 80 80 (additional 50 in front of fan)
Smart Line Module 5 kW – 36 kW	6SL3130-6AExx-0AAx	80
Motor Module < 132 A	6SL312x-1TExx-xAAx	80
Motor Module 132 A and 200 A	6SL312x-1TE3x-xAAx	80 (additional 50 in front of fan)
Braking Module	6SL3100-1AE31-0AAx	80
Control Supply Module	6SL3100-1DE22-0AAx	80
Capacitor Module	6SL3100-1CE14-0AAx	80

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

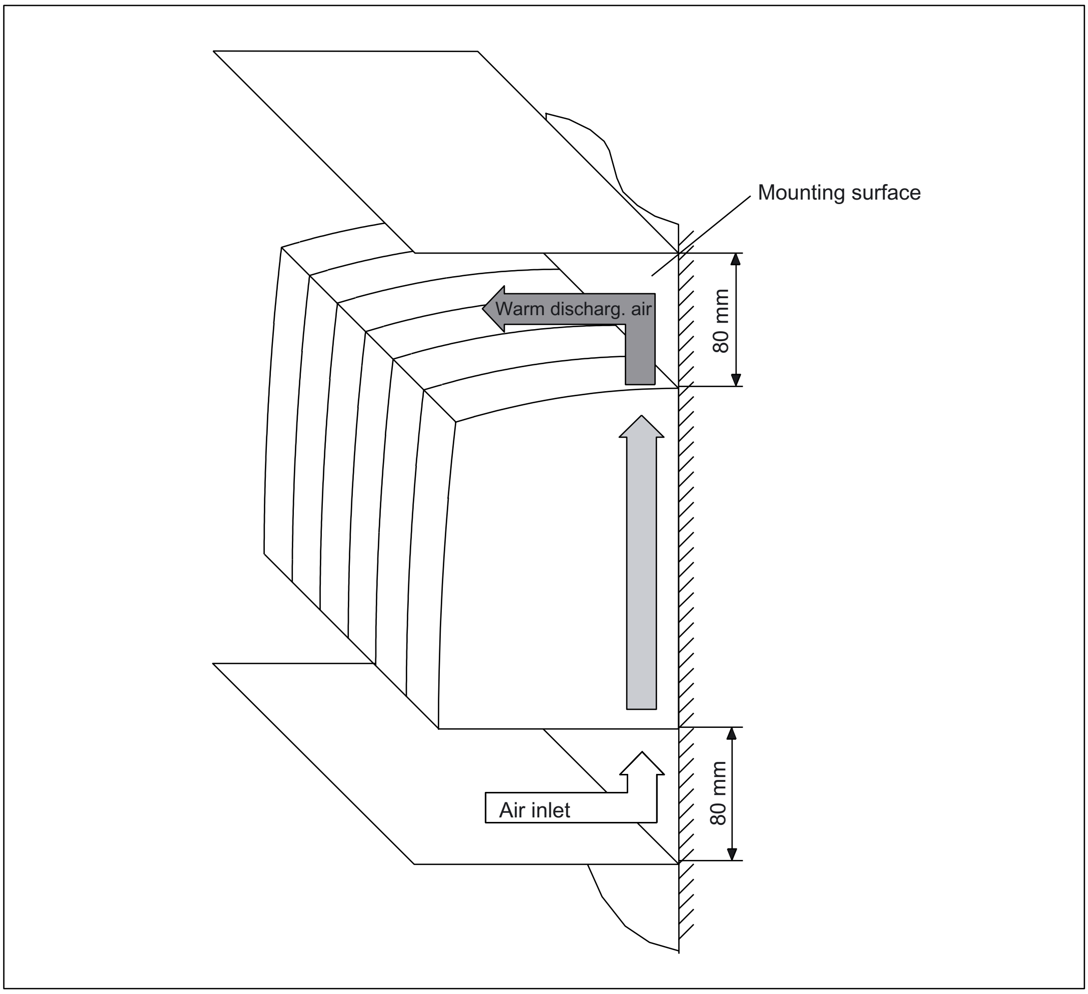


Figure 8-14 Clearances for booksize drive line-up with internal air cooling

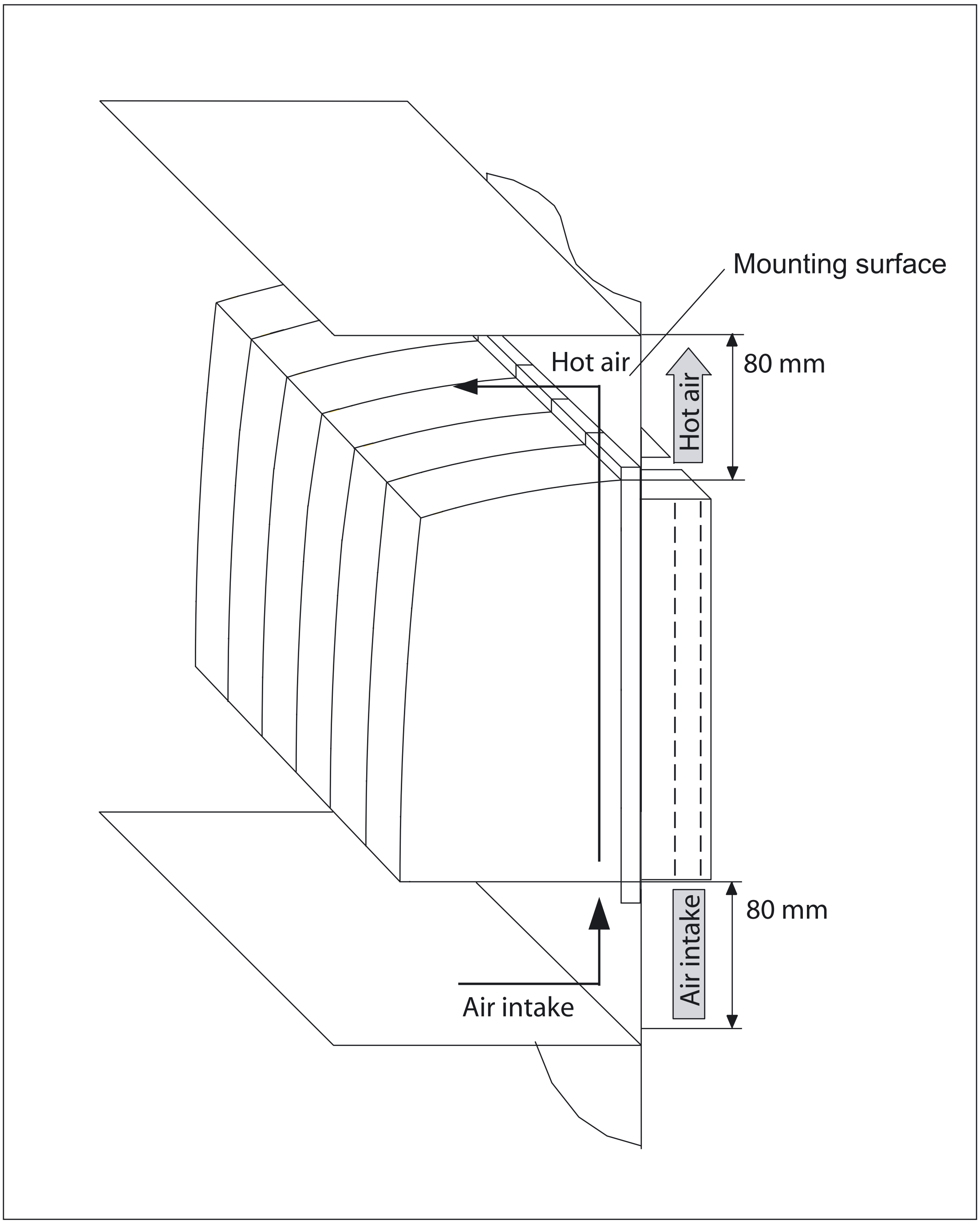


Figure 8-15 Clearances for booksize drive line-up with external air cooling

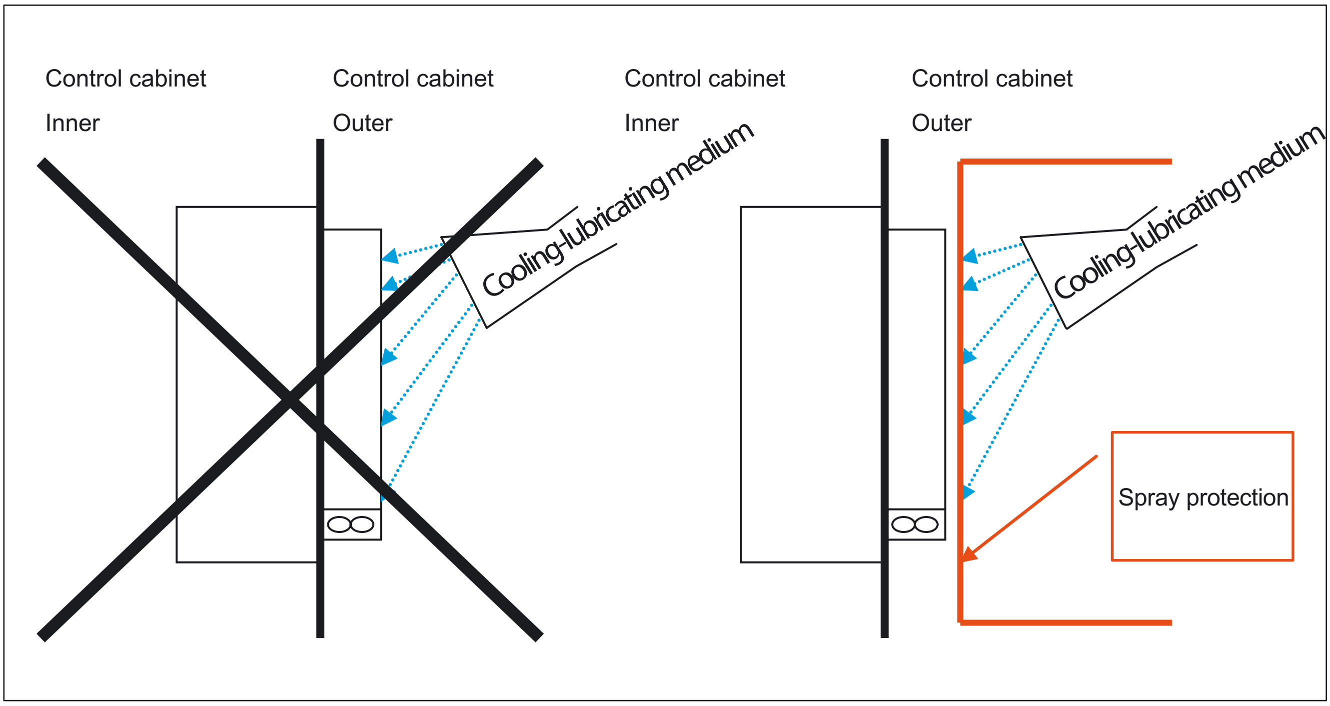


Figure 8-16 Spray protection for external cooling

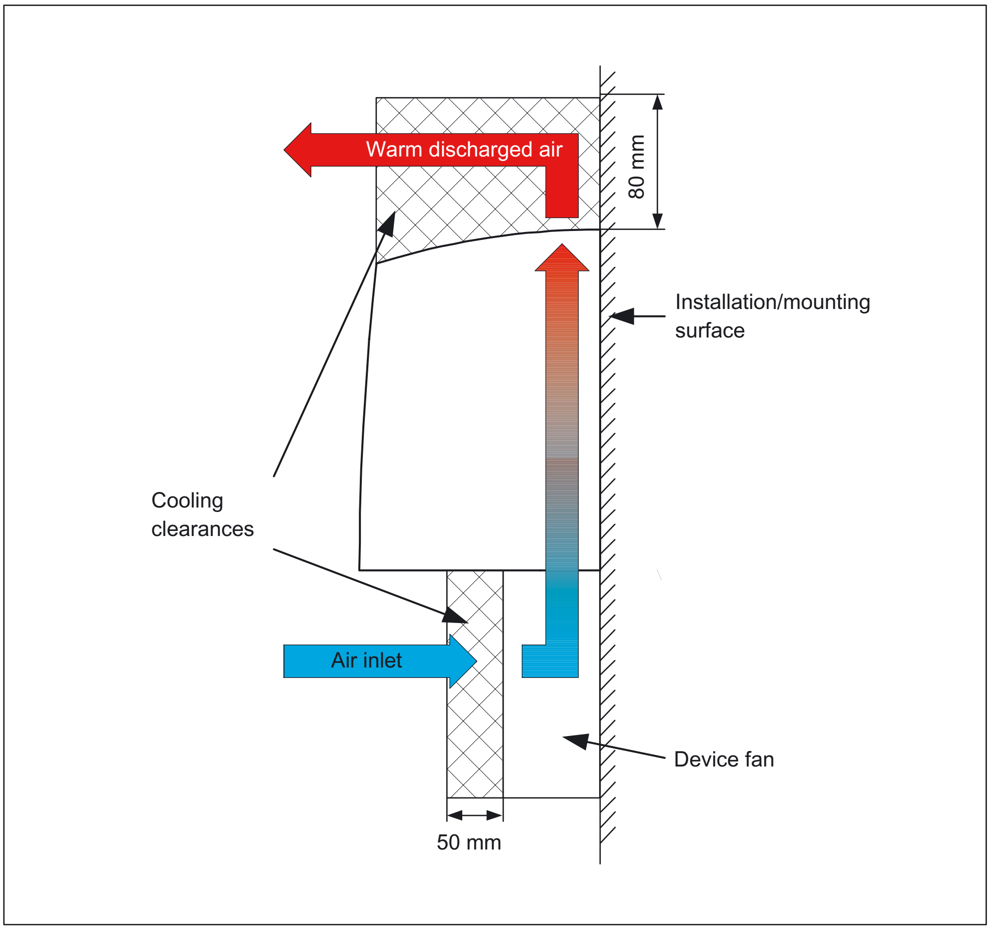


Figure 8-17 Cooling clearances for 300 mm components with mounted equipment fan

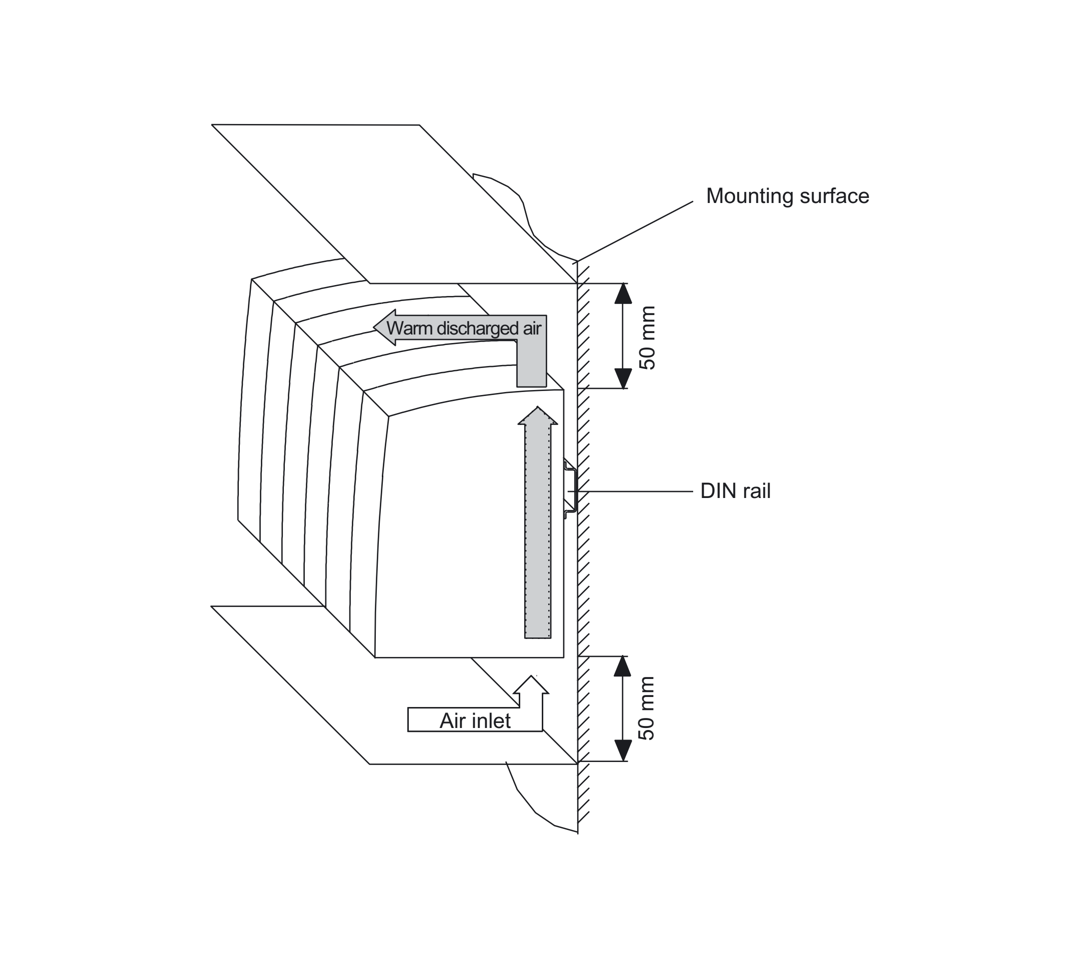


Figure 8-18 Cooling clearances, rail-mounted modules (e.g. VSM, SMC, TM, DMC)

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.

Note

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

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

Note

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

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).

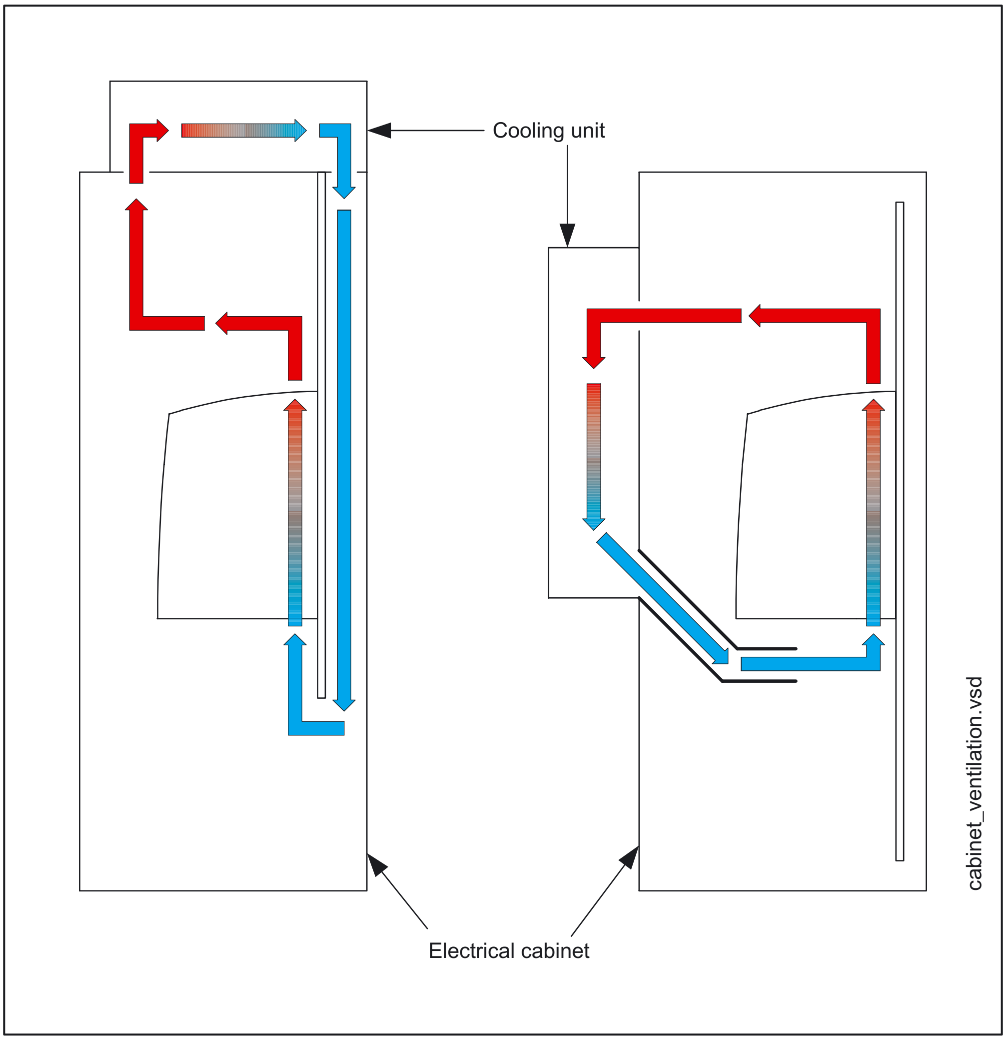


Figure 8-19 Examples of cabinet ventilation

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 8-14 Overview of power losses

	Unit	Power loss
Control Units and Option Boards		
CU320	W	20
TB30	W	< 3
CBC10	W	< 3
CBE20	W	2.8
Basic Line Filter for Active Line Modules		
16 kW	W	16
36 kW	W	28
55 kW	W	41
80 kW	W	48
120 kW	W	95
Wideband Line Filter for Active Line Modules		
16 kW	W	70
36 kW	W	90
55 kW	W	110
80 kW	W	150
120 kW	W	200
Wideband Line Filter for Smart Line Modules		
5 kW	W	5
10 kW	W	9
16 kW	W	16
36 kW	W	28
Line reactors for Active Line Modules		
16 kW	W	170
36 kW	W	250
55 kW	W	350
80 kW	W	450
120 kW	W	590
Line reactors for Smart Line Modules		
5 kW	W	62
10 kW	W	116
16 kW	W	110
36 kW	W	170

	Unit	Power loss
Sensor Modules		
SMC10	W	< 10
SMC20	W	< 10
SMC30	W	< 10
Additional system components		
TM15	W	< 3
TM31	W	< 10
TM41	W	10
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 8-15 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	1,350
120 kW	W	2,200
Smart Line Modules		
5 kW	W	89
10 kW	W	170
16 kW	W	165
36 kW	W	370
Single Motor Modules		
3 A	W	30
5 A	W	55
9 A	W	80
18 A	W	165
30 A	W	290
45 A	W	430
60 A	W	590
85 A	W	750

	Unit	Power loss
132 A	W	1,250
200 A	W	2,050
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 8-16 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	1,045	1,350
120 kW	W	490	1,710	2,200
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	1,000	1,250
200 A	W	435	1,615	2,050
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 8-17 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	16kW	26.4
	36kW	36.0
	55kW	45.6
	80kW	36.0
	120kW	60.0
Smart Line Module	5kW	24.0
	10kW	31.2
	16kW	26.4
	36kW	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 8-20 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 8-18 Example, calculating the power loss of a drive configuration

Component	Number	Power loss [W]	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	165	330
Motor module 30 A	3	290	870
Encoders	5	10	50
SITOP 20	1	53	53
Line Contactor	1	12	12
Total:			2,341

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]

9 Service and Support Booksize

9.1 Technical Support

Technical Support

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

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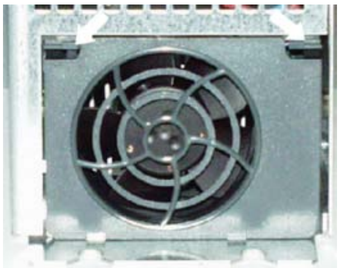
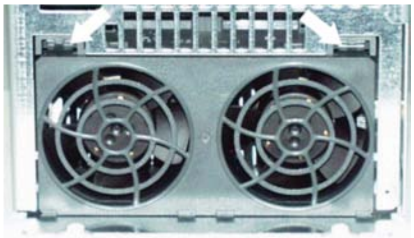
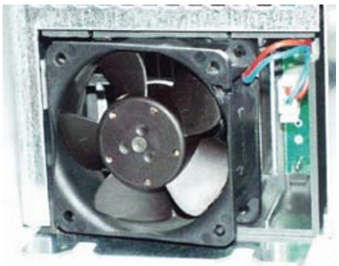
9.2 Replacing Fans

Notice

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

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

Removing the fan:

<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 Reforming the DC link capacitors

Caution

If the Active Line Module, Smart Line Module and Motor Module have not been used for more than two years, the DC link capacitors must be re-formed. If this is not carried-out, the units could be damaged when the power supply voltage is connected.

If the cabinet is commissioned within two years of its date of manufacture, the DC link capacitors do not need to be reformed. The date of manufacture can be taken from the serial number on the type 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.

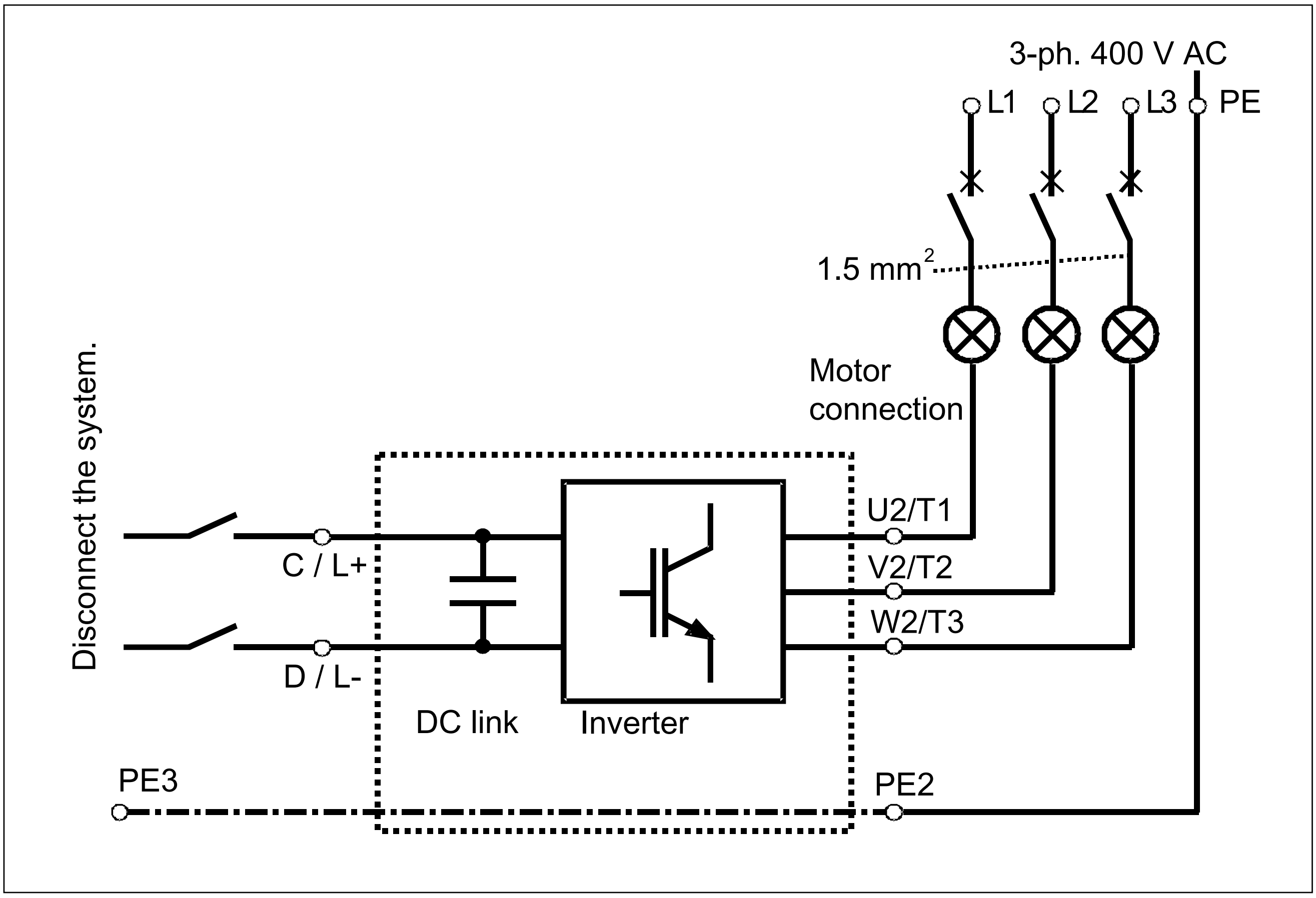


Figure 9-1 Forming circuit

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 pre-charged from the connected Motor Module.

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).
- While forming, the incandescent lamps must become less bright or go completely dark. If the incandescent lamps continue to be brightly lit, then there is either a fault in the drive unit or in the wiring.
- Connect the forming circuit; the duration depends on the time for which the Motor Module was not operational.

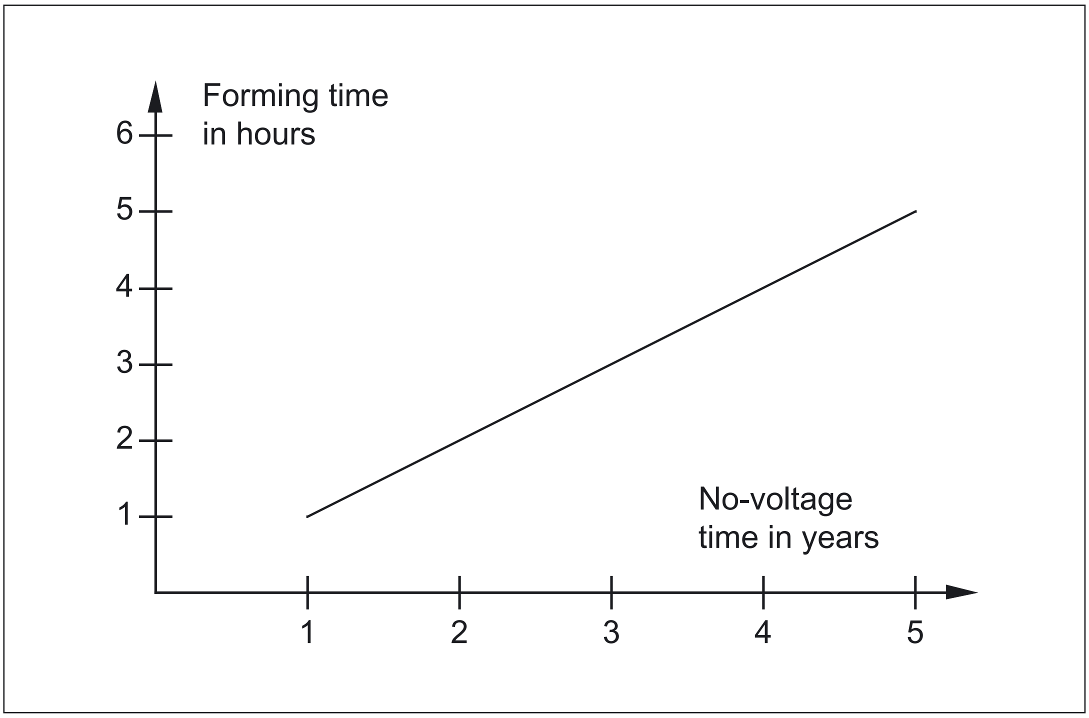


Figure 9-2 Forming depends on how long the inverter was in a non-operational state

9.4 Spare parts

Table 9-2 List of spare parts for SINAMICS S120 (as at: October 08, 2003)

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

	Order number
Fan for 100 mm line/motor module (incl. fan cover)	6SL3162-0AD00-0AA0
DC link cover for 100 mm line/motor module	6SL3162-3AD00-0AA0
36kW smart line module (150 mm)	6SL3130-6TE23-6AA0
36kW active line module (150 mm)	6SL3130-7TE23-6AA1
Line module terminal block, 4 pole (X21)	6SL3162-2EA00-0AA0
24 V terminal adapter (X24)	6SL3162-2AA00-0AA0
Plastic inserts (CU<>line module)	6SL3064-3DB00-0AA0
Fan for 150 mm line/motor module (incl. fan cover)	6SL3162-0AF00-0AA0
DC link cover for 150 mm line/motor module	6SL3162-3AF00-0AA0
Terminal board cover for 150 mm smart/active line module	6SL3163-3CF00-0AA0
55kW active line module (200 mm)	6SL3130-7TE25-5AA1
Line module terminal block, 4 pole (X21)	6SL3162-2EA00-0AA0
24 V terminal adapter (X24)	6SL3162-2AA00-0AA0
Plastic inserts (CU<>line module)	6SL3064-3DB00-0AA0
Fan for 200 mm line/motor module (incl. fan cover)	6SL3162-0AH00-0AA0
DC link cover for 200 mm line/motor module	6SL3162-3AH00-0AA0
Terminal board cover for 200 mm/300 mm smart/active line module	6SL3163-3CM00-0AA0
80kW active line module (300 mm)	6SL3130-7TE28-0AA0
120kW active line module (300 mm)	6SL3130-7TE31-2AA0
Line module terminal block, 4 pole (X21)	6SL3162-2EA00-0AA0
24 V terminal adapter (X24)	6SL3162-2AA00-0AA0
Plastic inserts (CU<>line module)	6SL3064-3DB00-0AA0
Fan for 300 mm line/motor module	6SL3162-0AM00-0AA0
DC link cover for 300 mm line/motor module	6SL3162-3AM00-0AA0
Terminal board cover for 200 mm/300 mm smart/active line module	6SL3163-3CM00-0AA0
Motor modules	
3A single motor module (50 mm)	6SL3120-1TE13-0AA0
5A single motor module (50 mm)	6SL3120-1TE15-0AA0
9A single motor module (50 mm)	6SL3120-1TE21-0AA1
18A single motor module (50 mm)	6SL3120-1TE21-8AA1
3A double motor module (50 mm)	6SL3120-2TE13-0AA0
5A double motor module (50 mm)	6SL3120-2TE15-0AA0
9A double motor module (50 mm)	6SL3120-2TE21-0AA0
DRIVE-CLiQ cable, IP20B/IP20B according to EN 60529, without 24 V DC, 110 mm	6SL3060-4AB00-0AA0
Safe standstill/KTY84 terminal block, 4-pin (X21 or X22)	6SL3162-2EA00-0AA0
24 V jumper	6SL3162-2AA01-0AA0
Fan for 50 mm line/motor module (incl. fan cover)	6SL3162-0AB00-0AA0

	Order number
DC link cover for 50 mm line/motor module	6SL3162-3AB00-0AA0
30A single motor module (100 mm)	6SL3120-1TE23-0AA1
18A double motor module (100 mm)	6SL3120-2TE21-8AA0
DRIVE-CLiQ cable, IP20B/IP20B according to EN 60529, without 24 V DC, 160 mm	6SL3060-4AD00-0AA0
Safe standstill/KTY84 terminal block, 4-pin (X21 or X22)	6SL3162-2EA00-0AA0
24 V jumper	6SL3162-2AA01-0AA0
Fan for 100 mm line/motor module (incl. fan cover)	6SL3162-0AD00-0AA0
DC link cover for 100 mm line/motor module	6SL3162-3AD00-0AA0
45A single motor module (150 mm)	6SL3120-1TE24-5AA1
60A single motor module (150 mm)	6SL3120-1TE26-0AA1
DRIVE-CLiQ cable, IP20B/IP20B according to EN 60529, without 24 V DC, 210 mm	6SL3060-4AF00-0AA0
Safe standstill/KTY84 terminal block, 4-pin (X21)	6SL3162-2EA00-0AA0
24 V jumper	6SL3162-2AA01-0AA0
Fan for 150 mm line/motor module (incl. fan cover)	6SL3162-0AF00-0AA0
DC link cover for 150 mm line/motor module	6SL3162-3AF00-0AA0
Terminal board cover for 150 mm motor module	6SL3162-3CF00-0AA0
85A single motor module (200 mm)	6SL3120-1TE28-5AA1
DRIVE-CLiQ cable, IP20B/IP20B according to EN 60529, without 24 V DC, 260 mm	6SL3060-4AH00-0AA0
Safe standstill/KTY84 terminal block, 4-pin (X21)	6SL3162-2EA00-0AA0
24 V jumper	6SL3162-2AA01-0AA0
Fan for 200 mm line/motor module (incl. fan cover)	6SL3162-0AH00-0AA0
DC link cover for 200 mm line/motor module	6SL3162-3AH00-0AA0
Terminal board cover for 200 mm/300 mm motor module	6SL3162-3CM00-0AA0
132A single motor module (300 mm)	6SL3120-1TE31-3AA0
200A single motor module (300 mm)	6SL3120-1TE32-0AA0
DRIVE-CLiQ cable, IP20B/IP20B according to EN 60529, without 24 V DC, 360 mm	6SL3060-4AM00-0AA0
Safe standstill/KTY84 terminal block, 4-pin (X21)	6SL3162-2EA00-0AA0
24 V jumper	6SL3162-2AA01-0AA0
Fan for 300 mm line/motor module	6SL3162-0AM00-0AA0
DC link cover for 300 mm line/motor module	6SL3162-3AM00-0AA0
Terminal board cover for 200 mm/300 mm motor module	6SL3162-3CM00-0AA0
Line filters	
For active line module 16 kW	6SL3000-0BE-21-6AA0
For active line module 36 kW	6SL3000-0BE-23-6AA0
For active line module 55 kW	6SL3000-0BE-25-5AA0

	Order number
For active line module 80 kW	6SL3000-0BE-28-0AA0
For active line module 120 kW	6SL3000-0BE-31-2AA0
For smart line module 5 kW	6SL3000-0HE-15-0AA0
For smart line module 10 kW	6SL3000-0HE-21-0AA0
Line reactors	
For active line module 16 kW	6SN1111-0AA00-0BA1
For active line module 36 kW	6SN1111-0AA00-0CA1
For active line module 55 kW	6SN1111-0AA00-0DA1
For active line module 80 kW	6SN1111-0AA00-1EA0
For active line module 120 kW	6SN1111-0AA00-1FA0
For smart line module 5 kW	6SL3000-0CE-15-0AA0
For smart line module 10 kW	6SL3000-0CE-21-0AA0
DC link components	
Braking module (50 mm)	
X1	Available on request
X21	Available on request
24 V jumper	6SL3162-2AA01-0AA0
DC link cover for 50 mm line/motor module	6SL3162-3AB00-0AA0
Capacitor module (100 mm)	
24 V jumper	6SL3162-2AA01-0AA0
DC link cover for 100 mm line/motor module	6SL3162-3AD00-0AA0
Control supply module (50 mm)	
24 V terminal adapter (X24)	6SL3162-2AA00-0AA0
24 V jumper	6SL3162-2AA01-0AA0
DC link cover for 50 mm line/motor module	6SL3162-3AB00-0AA0

List of Abbreviations

A

A.1 List of Abbreviations

Table A-1 List of abbreviations

Abbreviation	English
A	
A...	Alarm
AC	Alternating Current
ADC	Analog Digital Converter
AI	Analog Input
ALM	Active Line Module
AO	Analog Output
AOP	Advanced Operator Panel
ASC	Armature Short-Circuit
ASCII	American Standard Code for Information Interchange
B	
OC	Operating Condition
BERO	Tradename for a type of proximity switch
BI	Binector Input
BGIA	Berufsgenossenschaftliches Institut für Arbeitssicherheit (German Institute for Occupational Safety)
BICO	Binector Connector Technology
BLM	Basic Line Module
BOP	Basic Operator Panel
C	
C	Capacitance
C...	Safety message
CAN	Controller Area Network
CBC	Communication Board CAN
CBP	Communications Board PROFIBUS
CD	Compact Disc
CDS	Command Data Set

Abbreviation		English
CI	Connector Input	
CNC	Computer Numerical Control	
CO	Connector Output	
CO/BO	Connector Output/Binector Output	
COB-ID	CAN object identification	
COM	Mid-position contact of a changeover contact	
CP	Communications Processor	
CPU	Central Processing Unit	
CRC	Cyclic Redundancy Check	
CU	Control Unit	
D		
DAC	Digital Analog Converter	
DC	Direct Current	
DCN	Direct Current Negative	
DCP	Direct Current Positive	
DDS	Drive Data Set	
DI	Digital Input	
DI/DO	Bidirectional Digital Input/Output	
DMC	DRIVE-CLiQ Module Cabinet (Hub)	
DO	Digital Output	
DO	Drive Object	
DPRAM	Dual-Port Random Access Memory	
DRAM	Dynamic Random Access Memory	
DRIVE CLiQ	Drive Component Link with IQ	
DSC	Dynamic servo control	
I		
EDS	Encoder Data Set	
EGB	Electrostatic Sensitive Devices	
EMK	Electromagnetic force	
EMC	Electromagnetic Compatibility	
EN	European Standard	
EnDat	Encoder-Data-Interface	
EP	Enable Pulses	
ES	Engineering System	
ESR	Extended Stop and Retract	
F		
F...	Fault	
FAQ	Frequently Asked Questions	

Abbreviation		English
FCC	Function Control Chart	
FCC	Flux Current Control	
FEPROM	Flash-EPROM	
FG	Function Generator	
FI	Residual Current	
FP	Function diagram	
FW	Firmware	
G		
GC	Global Control Telegram (broadcast telegram)	
GSD	Device master file: describes the features of a PROFIBUS slave	
GSV	Gate Supply Voltage	
H		
HF	High Frequency	
HFD	High frequency reactor	
HLG	Ramp-Function Generator	
HMI	Human Machine Interface	
HTL	High threshold logic	
HW	Hardware	
I		
In preparation:	In preparation: this feature is currently not available	
IBN	Commissioning	
I/O	Input/Output	
ID	Identifier	
IEC	International Electrotechnical Commission	
IGBT	Insulated Gate Bipolar Transistor	
IL	Pulse cancellation	
IT	Insulated three-phase line supply	
J		
JOG	Jogging	
K		
KDV	Data cross-checking	
KIP	Kinetic buffering	
Kp	Proportional gain	
KTY	Positive temperature coefficient temperature sensor	
L		
L	Inductance	

Abbreviation	English
LED	Light Emitting Diode
LSB	Least Significant Bit
LSS	Line Side Switch
M	
M	Reference potential, zero potential
MB	Megabyte
MCC	Motion Control Chart
MDS	Motor Data Set
MLFB	Machine-readable product designation
MMC	Man Machine Communication
MSB	Most Significant Bit
MSCY_C1	Master Slave Cycle Class 1
N	
N. C.	Not Connected
N...	No Report
NAMUR	Standardization association for instrumentation and control in the chemical industry
NC	Normally Closed contact
NC	Numerical Control
NEMA	National Electrical Manufacturers Association
NM	Zero mark
NO	Normally Open contact
O	
OEM	Original Equipment Manufacturer
OLP	Optical Link Plug
OMI	Option Module Interface
P	
p...	Adjustable parameter
PcCtrl	Master Control
PDS	Power unit Data Set
PE	Protective Earth
PELV	Protective Extra Low Voltage
PG	Programming device
PI	Proportional Integral
PID	Proportional Integral Differential
PLC	Programmable Logic Controller

Abbreviation	English
PLL	Phase Locked Loop
PNO	PROFIBUS user organisation
PRBS	Pseudo Random Binary Signal
PROFIBUS	Process Field Bus
PS	Power Supply
PTC	Positive Temperature Coefficient
PTP	Point To Point
PWM	Pulse Width Modulation
PZD	PROFIBUS process data
Q	
R	
r …	Display parameter (read only)
RAM	Random Access Memory
RCCB	Residual-Current Circuit-Breaker
RCD	Residual Current Device
RJ45	Standard Describes an 8-pole plug connector with twisted pair Ethernet.
RKA	Cooling system
RO	Read Only
RPDO	Receive Process Data Object
RS232	Standard. Describes the physical characteristics of a serial interface.
RS485	Standard Describes the physical characteristics of a digital serial interface.
S	
S1	Continuous duty
S3	Periodic duty
SBC	Safe Brake Control
SOS	Safe Operational Stop
SSR	Safe Stop Ramp
SE	Safe software limit switch
SLS	Safely Limited Speed
SGA	Safety-relevant output
SGE	Safe input signal
SH	Safe standstill
SI	Safety Integrated
SIL	Safety Integrity Level

Abbreviation		English
SLM	Smart Line Module	
SLVC	Sensorless Vector Control	
SM	Sensor Module	
SMC	Sensor Module Cabinet	
SCA	Safe Cam	
SPC	Setpoint Channel	
SPS	Programmable Logic Controller (PLC)	
STW	PROFIBUS Control Word	
T		
TB	Terminal Board	
TIA	Totally Integrated Automation	
TM	Terminal Module	
TN	Grounded three-phase line supply	
Tn	Integral time	
TPDO	Transmit Process Data Object	
TT	Grounded three-phase line supply	
TTL	Transistor Transistor Logic	
U		
UL	Underwriters Laboratories Inc.	
UPS	Uninterruptible Power Supply	
V		
VC	Vector control	
Vdc	DC link voltage	
VDE	Association of German Electrical Engineers	
VDI	Association of German Electrical Engineers	
Vpp	Volt peak to peak	
VSM	Voltage sensing module	

Abbreviation		English
W		
WZM	Machine tool	
X		
XML	Extensible Markup Language	
Y		
Z		
ZK	DC Link	
ZSW	PROFIBUS status word	

References

B

B.1 References

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Catalogs

/D11.1/ SINAMICS G110 Inverter Chassis Units 0.12 kW to 3 kW
Order no.: E86060-K5511-A111-A2, 10.2005 edition

/D11/ SINAMICS G130 Drive Converter Chassis Units, SINAMICS G150 Drive Converter Cabinet Units
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/D21.1/ SINAMICS S120 Vector Control Drive System
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/D21.3/ SINAMICS S150 Drive Converter Cabinet Units
75 kW to 1200 kW
Order no.: E86060-K5521-A131-A1, 05.2004 edition

Related catalogs

/ST70/ SIMATIC Components for Totally Integrated Automation
Ordering information
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/CA01/ The Offline Mall of Automation and Drives
CD-ROM
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/Mall/ A&D Mall, Catalog and Online Ordering System
http://www.siemens.com/automation/mall

Electronic documentation

/CD2/ SINAMICS
The SINAMICS System
Order no.: 6SL3097-2CA00-0YG2, 05.2006 edition

User Documentation

/BA1/ SINAMICS G150
Operating Manual
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/BA2/ SINAMICS G130
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/GH1/ SINAMICS S120
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/GH4/ SINAMICS S120
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/GH5/ SINAMICS S120
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Order no.: On request, 03.2006 edition

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/GS1/ SINAMICS S120
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/LH1/ SINAMICS S
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/PFK7S/ SINAMICS Synchronous Motors 1FK7
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Basic Information, Tips and Tricks for Users
Hüthig; Manfred Popp; 2nd edition
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Haid- und Neu-Straße 7, D-76131 Karlsruhe
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/PDP/ PROFIBUS Installation Guidelines
Installation Guideline for PROFIBUS-FMS/DP
Installation and Wiring Recommendation for RS 485 Transmission
Order no. 2.111 (German), Version 1.0
Order no. 2.112 (English), Version 1.0

Documentation for Safety Equipment

Note

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

http://www.siemens.de/safety

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

/LV1/ Low-Voltage Controls and Distribution SIRIUS-SENTRON-SIVACON
Catalog
Order no.: E86060-K1002-P101-A5, 2006 edition

/MRL/ Directive 98/37/EG of the European Parliament and Council
Machinery Directive
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SINAMICS
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Converter Cabinet Units

SINAMICS
S120

D21.1
Chassis Units

SINAMICS
S150

D21.3
Vector Control Cabinet Units
75 – 1200 kW

Manufacturer/Service Documentation

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– List Manual

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