SINAMICS S120

Chassis Liquid Cooled Power Units

Equipment Manual · 01/2011

SINAMICS

SIEMENS

SIEMENS

SINAMICS

S120
Chassis Liquid Cooled Power Units

Manual

(GH7), 01/2011

6SL3097-4AM00-0BP1

Legal information

Warning notice system

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

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

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

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

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

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

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

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation for the specific task, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

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

Trademarks

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

Disclaimer of Liability

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

Siemens AG
Industry Sector
Postfach 48 48
90026 NÜRNBERG
GERMANY

order number: 6SL3097-4AM00-0BP1
℗ 02/2011

Preface

SINAMICS documentation

The SINAMICS documentation is organized in two parts:

- General documentation / catalogs
- Manufacturer / service documentation

This documentation is part of the manufacturer/service documentation for SINAMICS. All of the documents are available individually.

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

- Order documentation
  Here you can find an up-to-date overview of publications
- Download documentation
  Links to more information for downloading files from Service & Support
- Documentation online
  Information on DOConCD and direct access to the publications in DOConWeb.
- Assemble documentation individually on the basis of Siemens content with the My Documentation Manager (MDM), see http://www.siemens.com/mdm
  The My Documentation Manager offers you a range of features for creating your own machine documentation.
- Training and FAQs
  Information on the range of training courses and FAQs (frequently asked questions) are available via the page navigation.

Standard scope

The scope of the functionality described in this document can differ from the scope of the functionality of the drive system that is actually supplied. Other functions not described in this documentation might be able to be executed in the drive system. This does not, however, represent an obligation to supply such functions with a new controller or when servicing. The machinery construction OEM documents supplements or changes that he makes (the machinery construction OEM).

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.

Audience

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

Objective

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

Technical support

If you have any questions, please contact our hotline:

European and African time zone	
Telephone	+49 (0) 911 895 7222
Fax	+49 (0) 911 895 7223
Internet	http://www.siemens.com/automation/support-request

America time zone	
Telephone	+1 423 262 2522
Fax	+1 423 262 2200
Internet	techsupport.sea@siemens.com

Time zone Asia/Pacific	
Telephone	+86 1064 757 575
Fax	+86 1064 747 474
Internet	support.asia.automation@siemens.com

Note

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

---

Spare parts

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

Internet address for SINAMICS

http://www.siemens.com/sinamics

EC Declarations of Conformity

The EC Declaration of Conformity for the EMC Directive and for the Low Voltage Directive can be found/obtained from the relevant regional office of the I DT MC and I DT LD Business Units of Siemens AG.

ESD information

CAUTION

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

Regulations for handling ESD components:

- During the handling of electronic components, pay attention to the grounding of the person, workplace and packaging!
- Personnel in ESD areas with conductive flooring may only handle electronic components if:
  - They are grounded with an ESD wrist band
  - They are wearing ESD shoes or ESD shoe grounding straps
- Electronic components should be touched only when this is unavoidable. They must only be handled on the front panel or, in the case of printed circuit boards, at the edge.
- Electronic components must not be brought into contact with plastics or clothing made of artificial fibers.
- Electronic components may only be placed on conducting surfaces (table with ESD coating, conducting ESD foamed material, ESD packing bag, ESD transport container).
- Electronic components may not be placed near display units, monitors or televisions (minimum distance from the 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

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 follow the specified danger and warning notices.

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

Dangerous mechanical movements of the driven machine components are possible during system operations.

All work on the electrical system must be carried out when the system has been disconnected from the power supply and is in a no-voltage condition.

DANGER

Five safety rules

When carrying out any kind of work on electrical devices, the "five safety rules" according to EN 50110 must always be observed:

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

WARNING

Correct and safe operation of SINAMICS S units assumes correct transportation in the transport 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 plant-specific regulations and requirements must be taken into account.

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

Note

When operated in dry operating areas, SINAMICS equipment with AC motors conforms to Low-Voltage Directive 2006/95/EC.

Note

In the configuration specified in the corresponding EC Declaration of Conformity regarding EMC requirements and when the EMC installation guideline (order no. 6FC5297-0AD30-0*P2) is observed, SINAMICS devices conform to EMC Directive 89/336/EEC and 2004/108/EC.
(*A: German; *B: English)

NOTICE
For a UL-approved system use 60/75°C copper conductors only.

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

Residual risks of power drive systems

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

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

For more information about residual risks of the Power Drive System components, see the relevant chapters in the technical user documentation.

⚠ WARNING

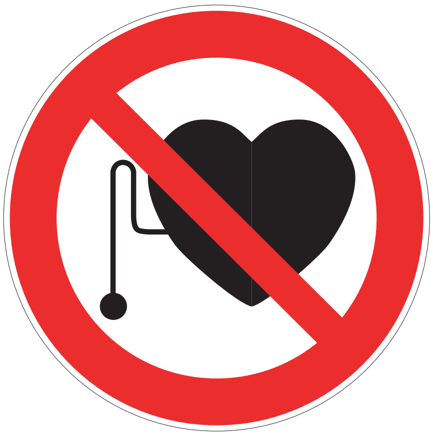
Electromagnetic fields "electro smog"

Electromagnetic fields are generated by the operation of electrical power engineering installations such as transformers, converters or motors.

Electromagnetic fields can interfere with electronic devices, which could cause them to malfunction. For example, the operation of heart pacemakers can be impaired, potentially leading to damage to a person's health or even death. It is therefore forbidden for persons with heart pacemakers to enter these areas.

The plant operator is responsible for taking appropriate measures (labels and hazard warnings) to adequately protect operating personnel and others against any possible risk.

- Observe the relevant nationally applicable health and safety regulations. In Germany, "electromagnetic fields" are subject to regulations BGV B11 and BGR B11 stipulated by the German statutory industrial accident insurance institution.
- Display adequate hazard warning notices.



- Place barriers around hazardous areas.
- Take measures, e.g. using shields, to reduce electromagnetic fields at their source.
- Make sure that personnel are wearing the appropriate protective gear.

Table of contents

1 System overview

1.1 The SINAMICS range of drives

Field of application

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

- Simple pump and fan applications in the process industry
- Complex single 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
- High-precision servo drives for the manufacture of wind turbines
- Highly dynamic servo drives for machine tools, as well as packaging and printing machines.

Figure 1-1 SINAMICS applications

Variants

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

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

Platform concept and Totally Integrated Automation

All SINAMICS versions are based on a platform concept. Common 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 without system gaps. The different SINAMICS versions can be easily combined with each other.

SINAMICS is part of the Siemens "Totally Integrated Automation" concept. Integrated SINAMICS systems covering engineering, data management and communication at the automation level, result in extremely cost-effective solutions based on SIMOTION, SINUMERIK and SIMATIC control systems.

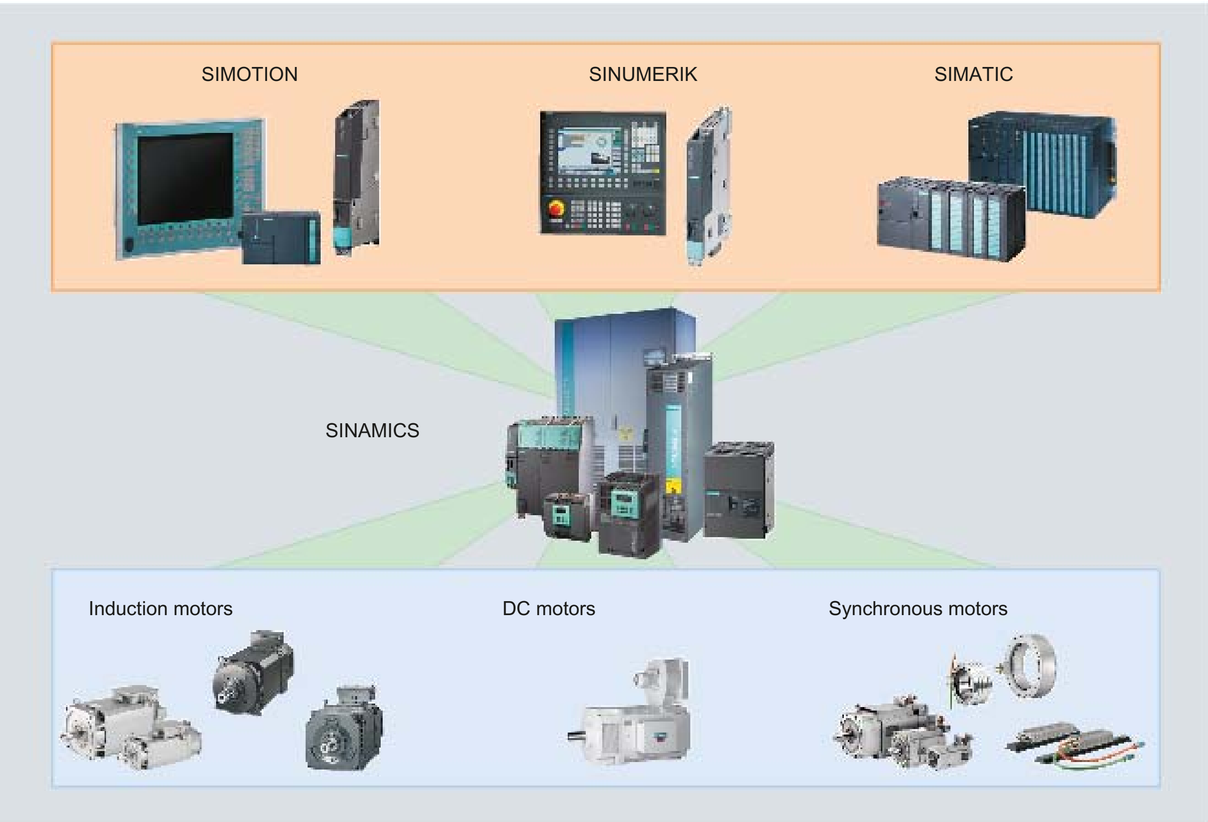


Figure 1-2 SINAMICS as part of the Siemens modular automation system

Quality management according to DIN EN ISO 9001

SINAMICS is able to meet the highest requirements in terms of quality. Comprehensive quality assurance measures in all development and production processes ensure a consistently high level of quality.

Our quality assurance system is certified by an independent authority in accordance with DIN EN ISO 9001.

Universal applications

SINAMICS meets the requirements of relevant international standards and regulations - from the EN European standards through IEC to UL and cULus.

1.2 SINAMICS S120 drive system

Modular system for sophisticated drive tasks

SINAMICS S120 solves demanding 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 enhanced by a wide range of motors. Whether synchronous or induction, all motor types are supported by SINAMICS S120.

Particularly suitable for multi-axis applications

Coordinated drives that carry out drive tasks together are used in many mechanical and plant engineering applications, including running gears in gantry cranes, stretching systems in the textile industry, or paper machines and rolling mills. These require drives with coupled DC link to provide a cost-effective energy compensation between braking and driving axes.

SINAMICS S120 features Line Modules (infeed modules) and Motor Modules (inverter modules) covering a wide power range which, having been designed for seamless integration, pave the way for compact multi-axis drive configurations.

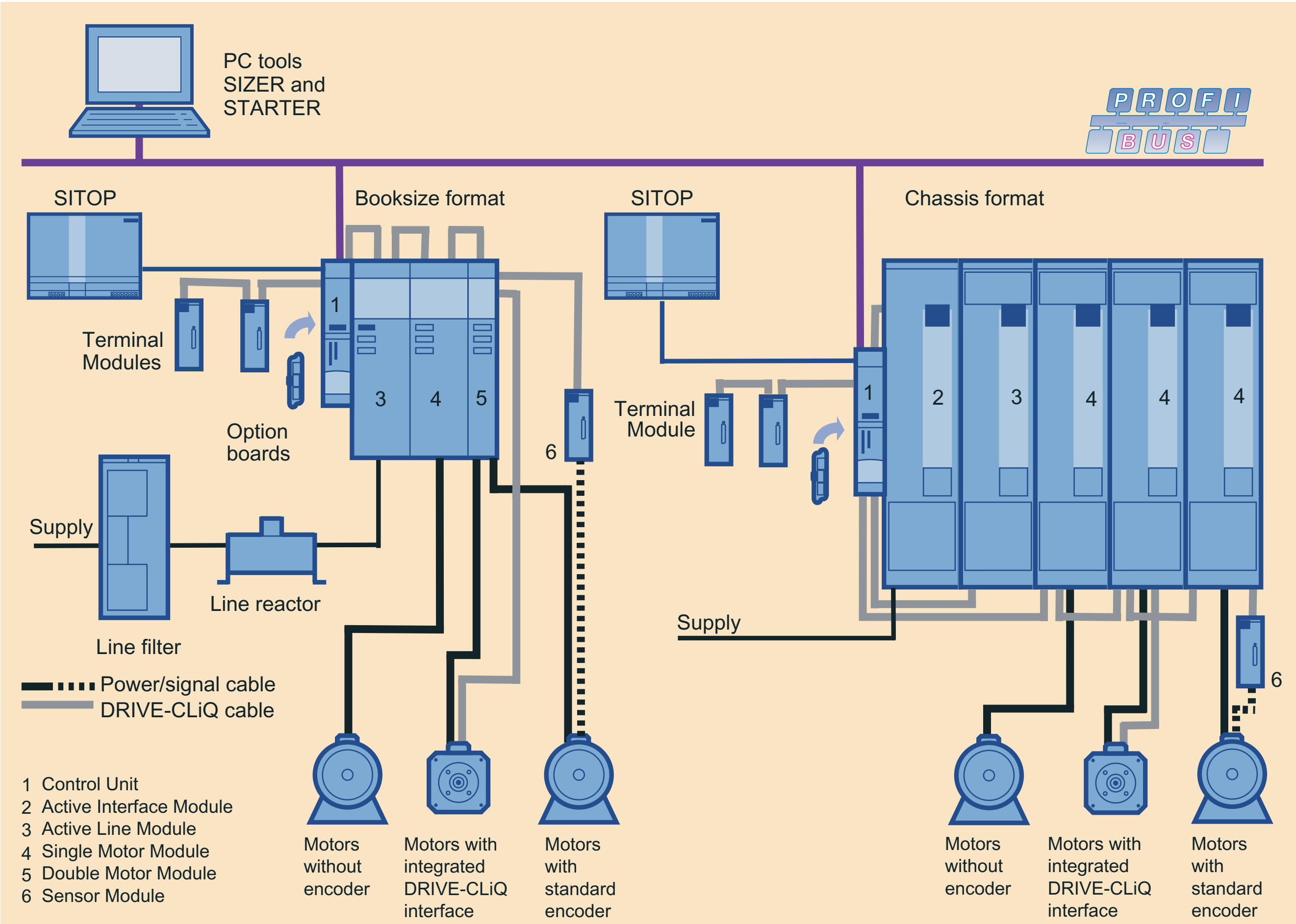


Figure 1-3 SINAMICS S120 system overview

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 usually took 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 drives and/or 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 Control Unit and easily configured in the STARTER commissioning tool using a mouse.

The SINAMICS S120 Control Unit solves basic technological tasks autonomously. For complex numerical or motion-control tasks, high-performance SIMOTION D modules are used instead.

DRIVE-CLiQ – the digital interface between all components

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

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

Electronic rating plates in all components

All SINAMICS S120 components with a DRIVE-CLiQ interface have an electronic rating plate. This electronic rating plate contains all the relevant technical data about that particular component. For motors, for example, these data include the parameters of the electric equivalent circuit diagram and characteristic values for the built-in motor encoder. The Control Unit records these data automatically via DRIVE-CLiQ so that they do not need to be entered during commissioning or when the equipment is replaced.

In addition to the technical data, the rating plate includes logistical data (manufacturer ID, order number, and globally unique ID). Since these 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.

SINAMICS S120 components

The SINAMICS S120 components are primarily used for multi-axis drive tasks.

The following power components are available:

- **Line-side power components**, such as fuses, contactors, line reactors and line filters for switching the power supply and complying with EMC regulations.
- **Power Modules,** which function as both a power infeed and an inverter.
- **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.
- **Motor-side components** such as sine-wave filters, motor reactors, and dv/dt filters for reducing the voltage loads on the motor windings.

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.

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.

Boundary conditions for use

The Power Modules, Line Modules and Motor Modules are designed for connection to a liquid coolant circuit which must be provided by the customer.

The design of this liquid coolant circuit is an important factor in determining the operational reliability and service life of the equipment and the entire installation.

The main criteria are described in the following chapters.

Advantages of liquid cooling over air cooling

Liquid cooling systems are considerably more efficient at dissipating heat losses than air cooling systems. As a result, liquid-cooled devices are much more compact than air-cooled units with the same output rating. Since the heat losses generated by the electronic components are almost completely dissipated by the liquid coolant, only very small cooling fans are required. This makes the devices extremely quiet in operation. Due to their compact dimensions and almost negligible cooling air requirement, liquid-cooled units are the preferred solution wherever installation space is restricted and/or the ambient operating conditions are rough. Control cabinets with liquid cooling are easy to implement as hermetically sealed units with degrees of protection of IP54 or above.

1.3 Technical specifications

Technical data

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

Table 1- 1 General technical data

Electrical data	
Line supply voltage	• 380 V 3 AC -10% (-15% < 1 min) to 480 V 3 AC +10% • 500 V 3 AC -10% (-15% < 1 min) to 690 V 3 AC +10%
Line frequency	47 Hz to 63 Hz
Output voltage	0 to line connection voltage, depending on the type of infeed. With an Active Line Module, it is also possible to achieve a higher output voltage.
Output frequency	Vector control: 0 Hz to 600 Hz Servo control: 0 Hz to 650 Hz U/f control: 0 Hz to 650 Hz
Electronic power supply	24 V DC (20.4 V - 28.8 V) implemented as PELV circuit in accordance with EN 61800-5-1 Ground = Negative polarity grounded via the electronics
Rated short-circuit current SCCR (Short Circuit Current Rating)) in accordance with UL508C (up to 600 V), in conjunction with the specified fuses or circuit-breakers	• 1.1 kW – 447 kW: 65 kA • 448 kW – 671 kW: 84 kA • 672 kW – 1193 kW: 170 kA • >1194 kW: 200 kA
Frequency with which the DC link is precharged	Max. 1 precharge every 3 minutes
Interference suppression	Category C3 (second environment) to EN 61800-3
Overvoltage category	Class III to EN 61800-5-1
Mechanical data	
Vibratory load • Transport [1)] • Operation	 • EN 60721-3-2, class 2M2 • Test values in accordance with EN 60068-2-6 test Fc: – 10 to 58 Hz with constant deflection = 0.075 mm – 58 to 150 Hz with constant acceleration = 9.81 m/s² (1 g)
Shock stressing • Transport [1)] • Operation	 • EN 60721-3-2, class 2M2 • Test values in accordance with EN 60068-2-27 test Ea: 98 m/s² (10 g) / 20 ms
Ambient conditions	
Degree of protection	IP00 acc. to EN 60529
Protection class	Class I (with protective conductor system) and class III (PELV) to EN 61800-5-1

Cooling method according to EN 60146-1-1:1993	• Power Modules, Basic Line Modules, Active Line Modules, Motor Modules: **WE** – W: Liquid cooling – E: Forced cooling, drive unit outside the device • Active Interface Modules: **AF** – A: Air cooling – F: Forced cooling, drive unit inside the device • Line reactors, sine-wave filters, motor reactors, dv/dt filters with Voltage Peak Limiter: **AN** – A: Air cooling – N : Natural cooling (convection)
Cooling circuit • Max. system pressure with respect to atmosphere • Pressure drop at the heat sink at rated volumetric flow • Recommended pressure range • Inlet temperature of liquid coolant	 • 600 kPa • 70 kPa • 80 kPa to 200 kPa • Dependent on ambient temperature, no condensation permitted – 0°C to + 45 °C without derating, >45 °C to + 50 °C see derating characteristics – (anti-freeze essential for temperature range between 0 °C and 5 °C; recommended anti-freeze agent: "Antifrogen N" supplied by Clariant)
Permissible ambient temperature (air) in operation	• Dependent on inlet temperature of liquid coolant, no condensation permitted: – 0 to 45 °C without derating – > 45 °C to 50 °C refer to derating characteristics
Climatic ambient conditions	
• Storage[1)] • Transport [1)] • Operation	• Class 1K3 to EN 60721-3-1, temperature: -40 °C to +70 °C • Class 2K4 to EN 60721-3-2, temperature -40 °C to +70 °C, max. air humidity 95% at +40 °C • Class 3K3 to EN 60721-3-3, condensation, splashwater and ice formation not permitted (EN 60204, Part 1)
Environmental class/harmful chemical substances	
• Storage[1)] • Transport [1)] • Operation	• Class 1C2 to EN 60721-3-1 • Class 2C2 to EN 60721-3-2 • Class 3C2 to EN 60721-3-3
Organic/biological influences	
• Storage[1)] • Transport [1)] • Operation	• Class 1B1 to EN 60721-3-1 • Class 2B1 to EN 60721-3-2 • Class 3B1 to EN 60721-3-3

Degree of pollution	2 to EN 61800-5-1 The devices may be operated only in environments with degree of pollution 2 and without condensation. On control cabinets with forced air cooling, foreign particles must be filtered out of the inflow air through filter mats. To prevent condensation, the devices can be warmed constantly by heaters.
The Safety Integrated safety function: The components must be protected against conductive contamination (e.g. by installing them in a cabinet with degree of protection IP54B 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.	
Installation altitude	• > 2000 m above sea level without derating • > 2000 m above sea level, see derating characteristics
Certificates	
Conformity	CE (Low Voltage and EMC Directives)
Standards	EN 61800-5-1, EN 60204-1, EN 61800-3, EN 60146-1-1
Approvals (only up to 600 V 3 AC)	cULus (File Nos.: E192450 and E214113), some approvals in preparation

1) In transport packaging

> **⚠ WARNING**
>
> **Storage and transport of liquid-cooled units**
>
> When liquid-cooled units are placed in storage or transported, the cooling circuit must always be completely drained, otherwise considerable damage can be caused by freezing.

1.4 Standards

Note

The standards listed in the table below are non-binding and do not in any way claim to be complete. The standards listed do not represent a guaranteed property of the product.

Only the statements made in the Declaration of Conformity shall be deemed binding.

Table 1- 2 Fundamental, application-relevant standards in succession: EN, IEC/ISO, DIN, VDE

Standards*	Title
EN 1037 ISO 14118 DIN EN 1037	Safety of machinery; avoiding unexpected starting
EN ISO 9001 ISO 9001 DIN EN ISO 9001	Quality management systems - requirements
EN ISO 12100-x ISO 12100-x DIN EN ISO 12100-x	Safety of Machinery; General Design Guidelines; Part 1: Basic terminology, methodology Part 2: Technical Principles and Specifications
EN ISO 13849-x ISO 13849-x DIN EN ISO 13849-x	Safety of machinery; safety-related parts of control systems; Part 1: General basic design principles Part 2: Validation
EN ISO 14121-1 ISO 14121-1 DIN EN ISO 14121-1	Safety of Machinery - Risk Assessment; Part 1: Guidelines
EN 55011 CISPR 11 DIN EN 55011 VDE 0875-11	Industrial, scientific and medical high-frequency devices (ISM devices) - radio interference - limit values and measuring techniques
EN 60146-1-1 IEC 60146-1-1 DIN EN 60146-1-1 VDE 0558-11	Semiconductor converters; general requirements and line-commutated converters; Part 1-1: Defining the basic requirements
EN 60204-1 IEC 60204-1 DIN EN 60204-1 VDE 0113-1	Electrical equipment of machines; Part 1: General definitions
EN 60228 IEC 60228 DIN EN 60228 VDE0295	Conductors for cables and insulated leads
EN 60269-1 IEC 60269-1 DIN EN 60269-1 VDE 0636-1	Low-voltage fuses; Part 1: General requirements

Standards*	Title
IEC 60287-1 to -3	Cables - Calculation of the current carrying capacity Part 1: Current carrying capacity equations (100 % load factor) and calculating the losses Part 2: Thermal resistance - Part 3: Main sections for operating conditions
HD 60364-x-x IEC 60364-x-x DIN VDE 0100-x-x VDE 0100-x-x	Erection of power installations with nominal voltages up to 1000 V; Part 200: Definitions Part 410: Protection for safety, protection against electric shock Part 420: Protection for safety, protection against thermal effects Part 430: Protection of cables and conductors for over-current Part 450: Protection for safety, protection against undervoltage Part 470: Protection for safety; use of protection for safety Part 5xx: Selecting and erecting electrical equipment Part 520: Wiring systems Part 540: Earthing, protective conductor, potential bonding conductor Part 560: Electrical equipment for safety purposes
EN 60439 IEC 60439 DIN EN 60439 VDE 0660-500	Low-voltage switchgear assemblies; Part 1: Type-tested and partially type-tested assemblies
EN 60529 IEC 60529 DIN EN 60529 VDE 0470-1	Degrees of protection provided by enclosures (IP code)
EN 60721-3-x IEC 60721-3-x DIN EN 60721-3-x	Classification of environmental conditions Part 3-0: Classification of environmental parameters and their severities; Introduction Part 3-1: Classification of environmental parameters and their severities; Long-term storage Part 3-2: Classification of environmental parameters and their severities; Transport Part 3-3: Classification of environmental parameters and their severities; stationary use, weather protected
EN 60947-x-x IEC 60947 -x-x DIN EN 60947-x-x VDE 0660-x	Low-voltage switchgear
EN 61000-6-x IEC 61000-6-x DIN EN 61000-6-x VDE 0839-6-x	Electromagnetic compatibility (EMC) Part 6-1: Generic standard; Immunity for residential, commercial and light-industrial environments Part 6-2: Generic standards; Immunity for industrial environments Part 6-3: Generic standards; Generic standard emission for residential, commercial and light-industrial environments Part 6-4: Generic standards; Generic standard noise emission for industrial environments
EN 61140 IEC 61140 DIN EN 61140 VDE 0140-1	Protection against electric shock; Common aspects for installation and equipment
EN 61800-2 IEC 61800-2 DIN EN 61800-2 VDE 0160-102	Adjustable-speed electrical power drive systems; Part 2: General requirements - Rating specifications for low-voltage adjustable frequency a.c. power drive systems
EN 61800-3 IEC 61800-3 DIN EN 61800-3 VDE 0160-103	Adjustable-speed electrical power drive systems; Part 3: EMC - Requirements and specific test methods

Standards*	Title
EN 61800-5-x IEC 61800-5-x DIN EN 61800-5-x VDE 0160-105-x	Adjustable-speed electrical power drive systems; Part 5: Safety requirements; Main section 1: Electrical, thermal and energy requirements Main section 2: Functional safety requirements
EN 62061 IEC 62061 DIN EN 62061 VDE 0113-50	Safety of machinery; Functional safety of safety-related electrical, electronic and programmable electronic control systems
UL 50 CSA C22.2 No. 94.1	Enclosures for Electrical Equipment
UL 508 CSA C22.2 No. 142	Industrial Control Equipment Process Control Equipment
UL 508C CSA C22.2 No. 14	Power Conversion Equipment Industrial Control Equipment

* The technical requirements in the standards listed are not necessarily identical.

1.5 Structure of a drive system with SINAMICS S120 Liquid Cooled

1.5.1 Structure of a drive system with SINAMICS S120 Liquid Cooled and Power Module

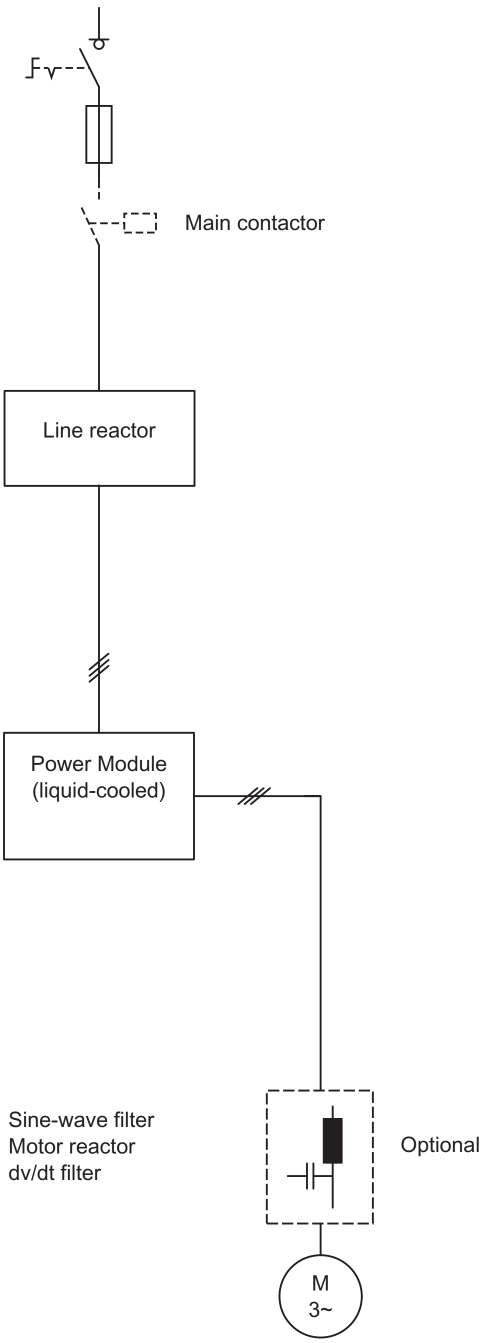


Figure 1-4 Basis structure of a drive system with SINAMICS S120 Liquid Cooled and Power Module

1.5.2 Structure of a drive system with SINAMICS S120 Liquid Cooled and regulated infeed

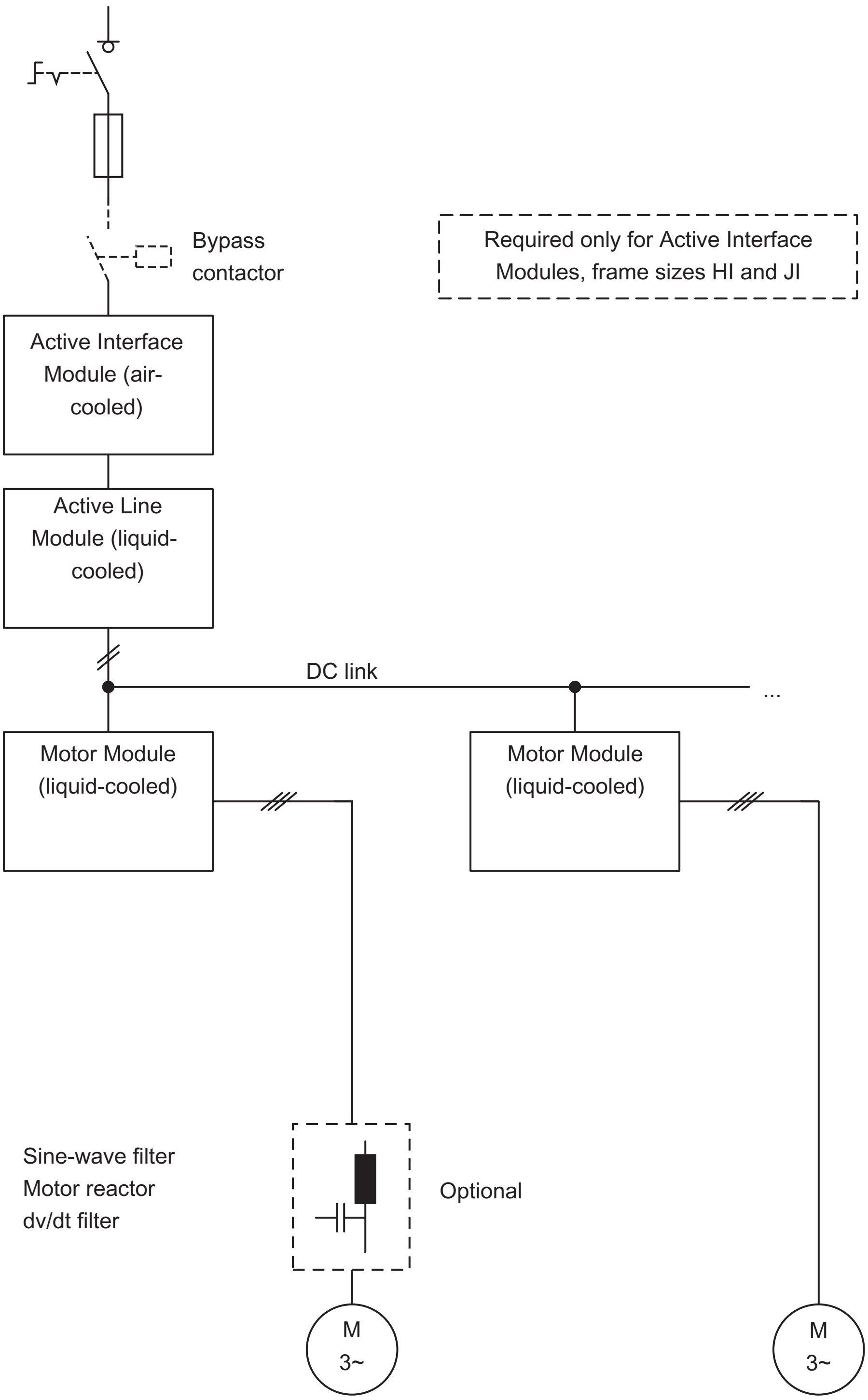


Figure 1-5 Basic structure of a drive system with SINAMICS S120 Liquid Cooled and regulated infeed

1.5.3 Structure of a drive system with SINAMICS S120 Liquid Cooled and unregulated infeed

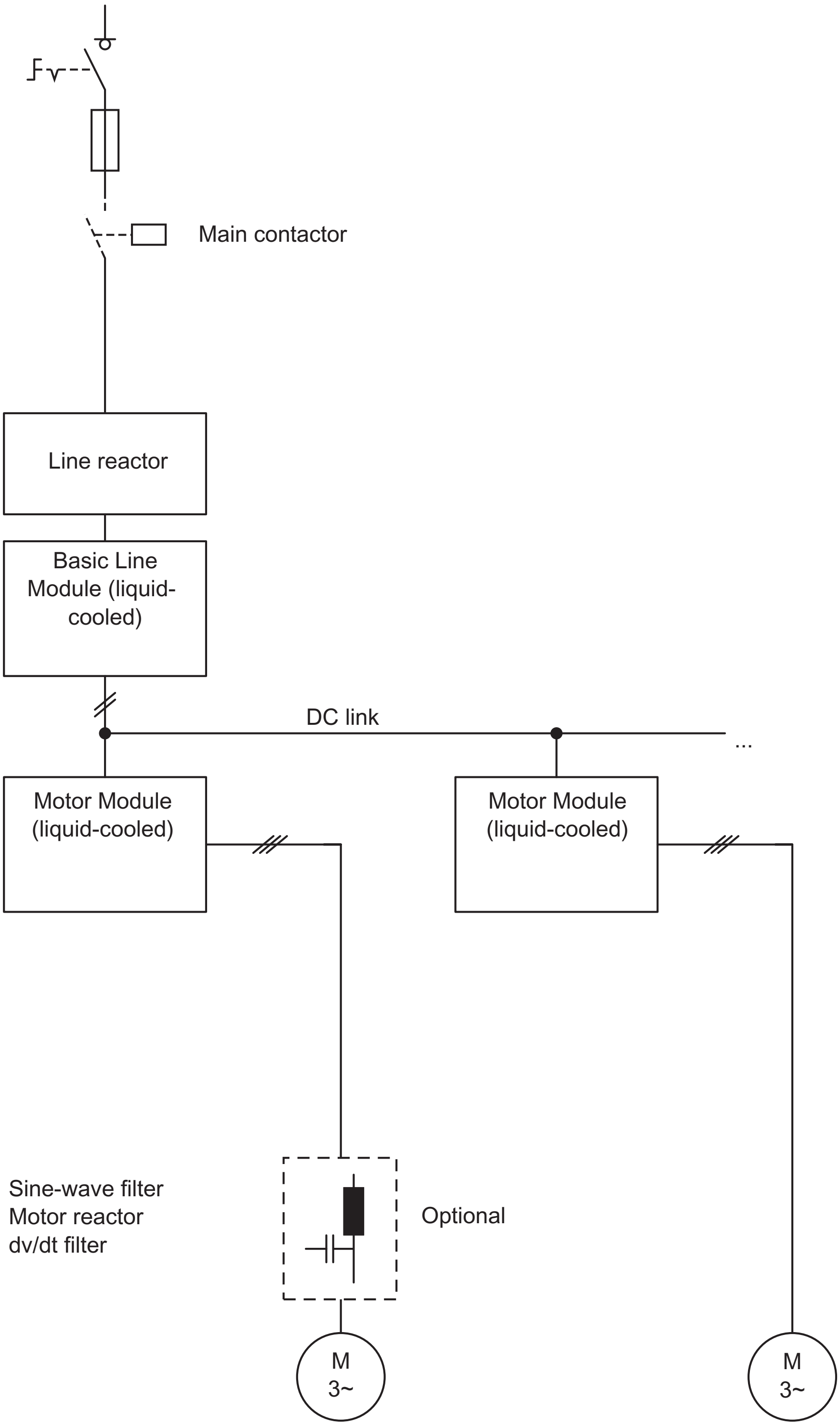


Figure 1-6 Basic structure of a drive system with SINAMICS S120 Liquid Cooled and unregulated infeed

Line-side power components 2

2.1 Line reactors for Power Modules

2.1.1 Description

The line reactors limit low-frequency line harmonics and reduce the load on the semiconductors in the Power Modules. A line reactor is not required where the effective supply impedance equals uk > 3 %.

2.1.2 Safety information

CAUTION
The 100 mm cooling clearances above and to the side of the components must be observed.

Note

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

CAUTION
When using line reactors that have not been approved by SIEMENS for SINAMICS, the following can occur: • the Power Modules could be damaged/destroyed. • Line harmonics may interfere with or damage other loads connected to the same line supply.

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

2.1.3 Dimension drawing

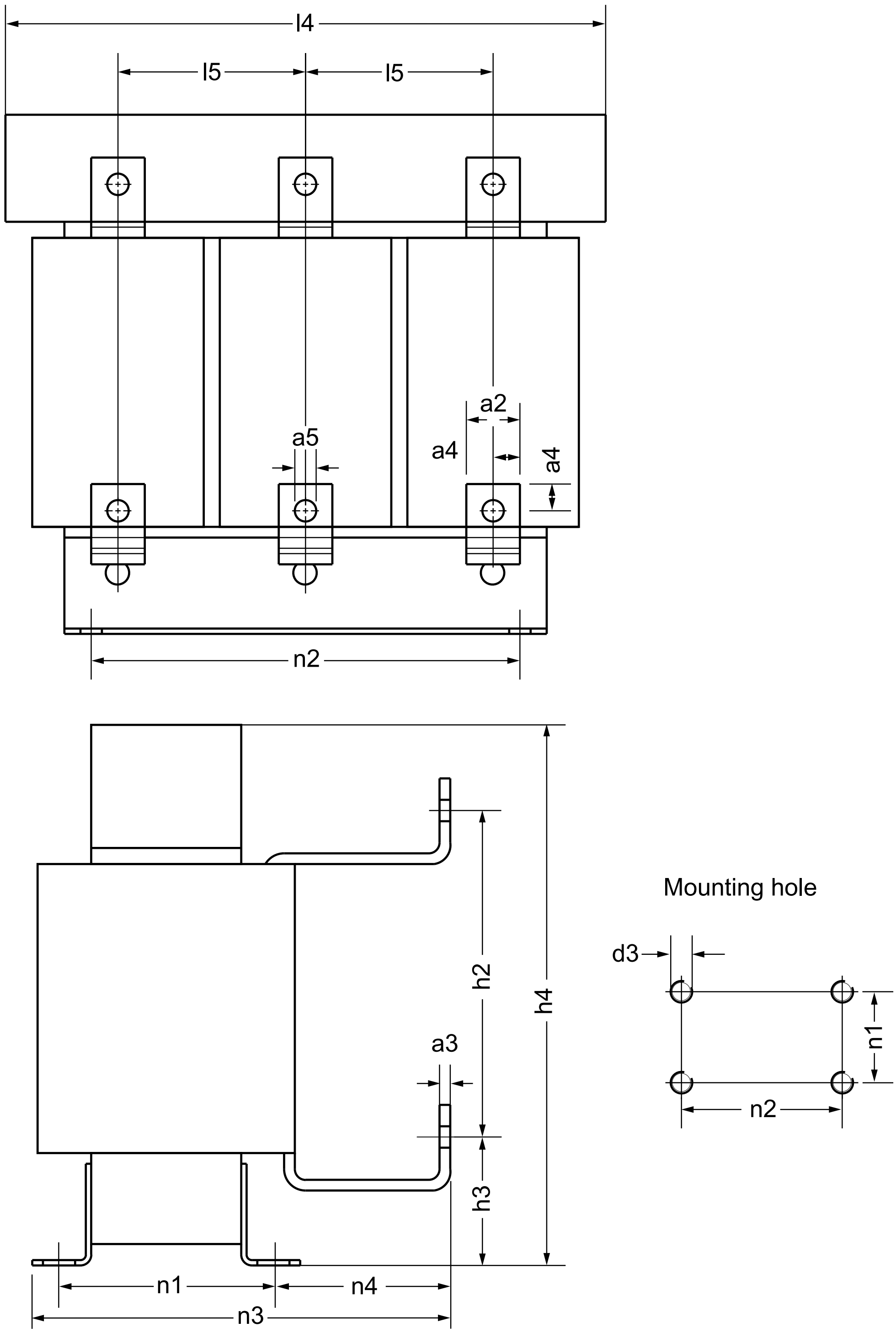


Figure 2-1 Dimension drawing of line reactor for Power Modules

Table 2- 1 Dimensions of line reactors for Power Modules (all data in mm)

6SL3000-	0CE32-3AA0	0CE32-8AA0	0CE33-3AA0	0CE35-1AA0	
a2	25	25	25	30	
a3	5	5	5	6	
a4	12.5	12.5	12.5	15	
a5	11	11	11	14	
l4	270	270	270	300	
l5	88	88	88	100	
h2	150	150	150	180	
h3	60	60	60	60	
h4	248	248	248	269	
n1 [1)]	101	101	101	118	
n2 [1)]	200	200	200	224	
n3	200	200	200	212.5	
n4	84.5	84.5	84.5	81	
d3	M8	M8	M8	M8	

[1)] Lengths n1 and n2 correspond to the distance between holes

2.1.4 Technical specifications

Table 2- 2 Technical data of line reactors for Power Modules

Order number	6SL3000-	0CE32-3AA0	0CE32-8AA0	0CE33-3AA0	0CE35-1AA0
Suitable for Power Module	6SL3315-	1TE32-1AAx	1TE32-6AAx	1TE33-1AAx	1TE35-0AAx
Unit rating of the Power Module	kW	110	132	160	250
Rated voltage	V	3 AC 380 –10% (-15% < 1 min) to 3 AC 480 +10%			
I_{thmax}	A	224	278	331	508
Power loss	kW	0.274	0.247	0.267	0.365
Line/load connection		M10 connecting lugs	M10 connecting lugs	M10 connecting lugs	M12 connecting lugs
PE connection		M6 screw	M6 screw	M6 screw	M6 screw
Degree of protection		IP00	IP00	IP00	IP00
Dimensions Width Height Depth	 mm mm mm	 270 248 200	 270 248 200	 270 248 200	 300 269 212.5
Weight	kg	24.5	26	27.8	38

2.2 Line reactors for Basic Line Modules

2.2.1 Description

Line reactors limit low-frequency line harmonics and reduce the load on the semiconductors in the Basic Line Modules.

A line reactor must be used if several Basic Line Modules are operated in parallel.

A line reactor is not required if a single Basic Line Module is used and the effective supply impedance equals uk > 3 %.

2.2.2 Safety information

CAUTION
The 100 mm cooling clearances above and to the side of the components must be observed.

Note

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

CAUTION
When using line reactors that have not been approved by SIEMENS for SINAMICS, the following can occur: • The Basic Line Modules may become damaged/faulty. • Line harmonics may interfere with or damage other loads connected to the same line supply.

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

2.2.3 Dimension drawing

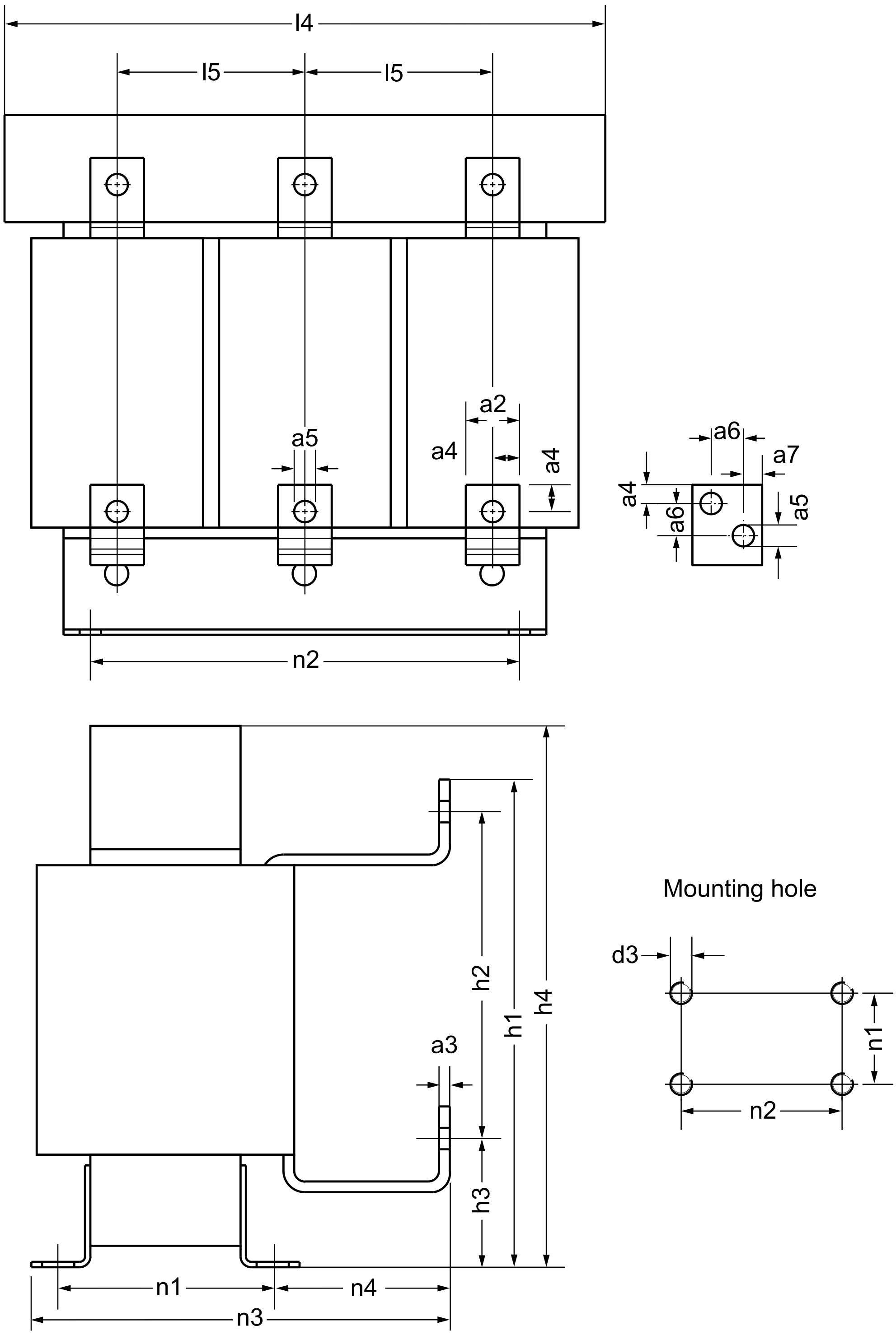


Figure 2-2 Dimension drawing of line reactors for Basic Line Modules

Table 2- 3 Dimensions of line reactors for Basic Line Modules, 380 V – 480 V 3 AC (all values in mm)

6SL3000-	0CE36-3AA0	0CE41-0AA0	0CE41-5AA0	
a2	30	50	60	
a3	6	8	12	
a4	15	25	25	
a5	14	14	18 x 14	
a6	-	-	26	
a7	-	-	17	
l4	300	350	460	
l5	100	120	152.5	
h1	-	397	-	
h2	180	252	278	
h3	60	120	120	
h4	269	321	435	
n1 1)	118	138	155	
n2 1)	224	264	356	
n3	212.5	211.5	235	
n4	81	60	60	
d3	M8	M8	M12	

1) Lengths n1 and n2 correspond to the distance between holes

Table 2- 4 Dimensions of line reactors for Basic Line Modules, 500 V – 690 V 3 AC (all values in mm)

6SL3000-	0CH33-4AA0	0CH36-0AA0	0CH41-2AA0	0CH41-6AA0
a2	25	30	60	60
a3	5	6	12	12
a4	12.5	15	25	25
a5	11	14	14	18 x 14
a6	-	-	26	26
a7	-	-	17	17
l4	270	350	460	445
l5	88	120	152.5	152.5
h1	-	-	-	-
h2	150	198	278	278
h3	60	75	120	120
h4	248	321	435	435
n1 1)	101	138	155	170
n2 1)	200	264	356	356
n3	200	232.5	235	250
n4	84.5	81	60.5	60.5
d3	M8	M8	M12	M12

1) Lengths n1 and n2 correspond to the distance between holes

2.2.4 Technical specifications

Table 2- 5 Technical data of line reactors for Basic Line Modules, 380 V – 480 V 3 AC

Order number	6SL3000-	0CE36-3AA0	0CE41-0AA0	0CE41-5AA0	
Suitable for Basic Line Module	6SL3335-	1TE37-4AAx	1TE41-2AAx	1TE41-7AAx	
Rated power of the Basic Line Module	kW	360	600	830	
Rated voltage	V	3 AC 380 –10% (-15% < 1 min) to 3 AC 480 +10%			
I_{thmax}	A	628	1022	1458	
Power loss	kW	0.368	0.498	0.776	
Line/load connection		M12 connecting lugs	M12 connecting lugs	M12 connecting lugs	
PE connection		M6 screw	M6 screw	M6 screw	
Degree of protection		IP00	IP00	IP00	
Dimensions Width Height Depth	 mm mm mm	 300 269 212.5	 350 397 211.5	 460 435 235	
Weight	kg	41.4	69.6	118	

Table 2- 6 Technical data of line reactors for Basic Line Modules, 500 V – 690 V 3 AC

Order number	6SL3000-	0CH33-4AA0	0CH36-0AA0	0CH41-2AA0	0CH41-6AA0
Suitable for Basic Line Module	6SL3335-	1TG34-2AAx	1TG37-3AAx	1TG41-3AAx	1TG41-7AAx
Rated power of the Basic Line Module	kW	355	630	1100	1370
Rated voltage	V	3 AC 500 –10% (-15% < 1 min) to 3 AC 690 +10%			
I_{thmax}	A	342	597	1167	1600
Power loss	kW	0.270	0.485	0.783	0.977
Line/load connection		M10 connecting lugs	M12 connecting lugs	M12 connecting lugs	M12 connecting lugs
PE connection		M6 screw	M6 screw	M6 screw	M6 screw
Degree of protection		IP00	IP00	IP00	IP00
Dimensions Width Height Depth	 mm mm mm	 270 248 200	 350 321 232.5	 460 435 235	 445 435 250
Weight	kg	38.9	63.8	147	134

2.3 Active Interface Modules

2.3.1 Description

Active Interface Modules are used in conjunction with the Active Line Modules in chassis format. The air-cooled Active Interface Modules contain a Clean Power Filter with basic RI suppression, the pre-charging circuit for the Active Line Module, the line voltage sensing circuit and monitoring sensors.

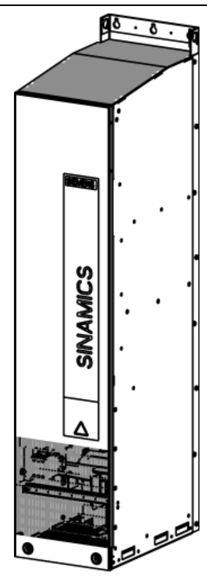
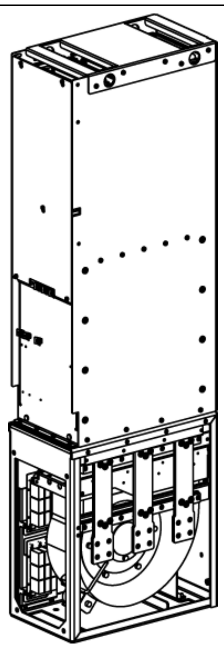
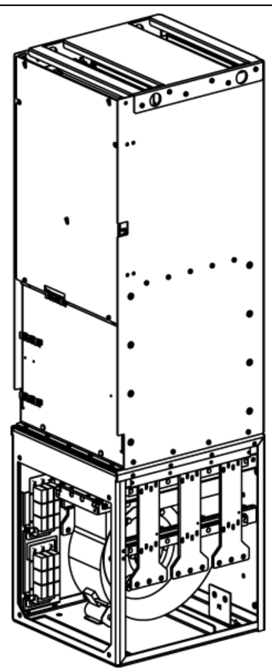
Frame size GI is equipped as standard with a bypass contactor which ensures a highly compact design. The bypass contactor must be provided separately for frame sizes HI and JI.

The vast majority of line harmonics are suppressed by the Clean Power Filter.

The Active Interface Module contains:

- Clean Power Filter
- Line reactor
- Pre-charging circuit
- Bypass contactor (for frame size GI)
- Voltage Sensing Module
- Fan

Table 2- 7 Active Interface Modules

		
Frame size GI	Frame size HI	Frame size JI

2.3.2 Safety information

⚠ CAUTION
The DC link discharge time hazard warning must be affixed to the component in the relevant local language.

NOTICE
The cooling clearances above, below, and in front of the component, which are specified in the dimension drawings, must be observed.

⚠ DANGER
Active Interface Modules discharge a high leakage current to the protective ground conductor. Due to the high leakage current associated with Active Interface Modules, they or the relevant control cabinet must be permanently connected to PE. According to EN 61800-5-1, Section. 6.3.6.7, the minimum cross-section of the protective ground conductor must conform to the local safety regulations for protective ground conductors for equipment with a high leakage current.

2.3.3 Interface description

2.3.3.1 Overview

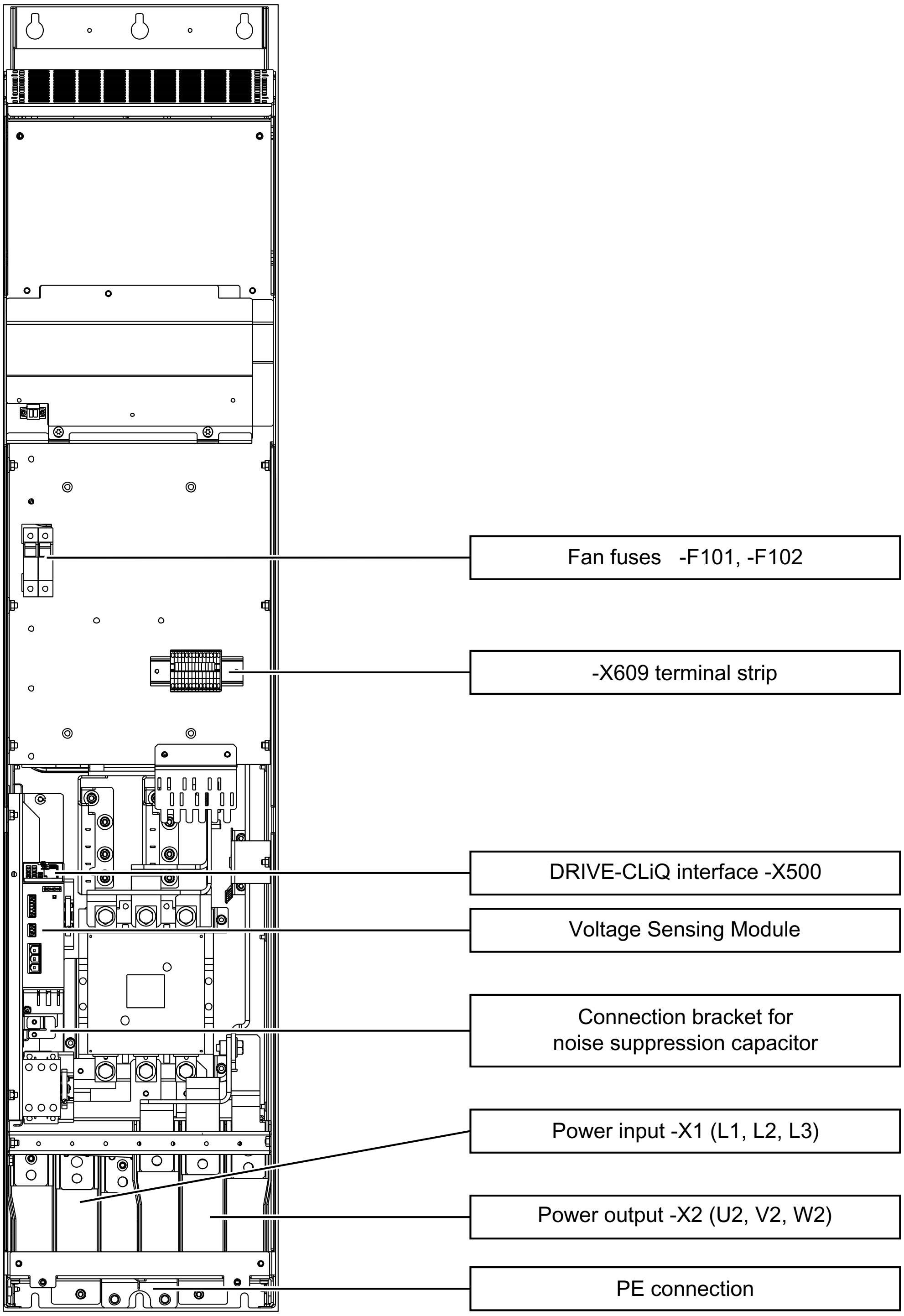


Figure 2-3 Interface overview in the Active Interface Module, frame size GI

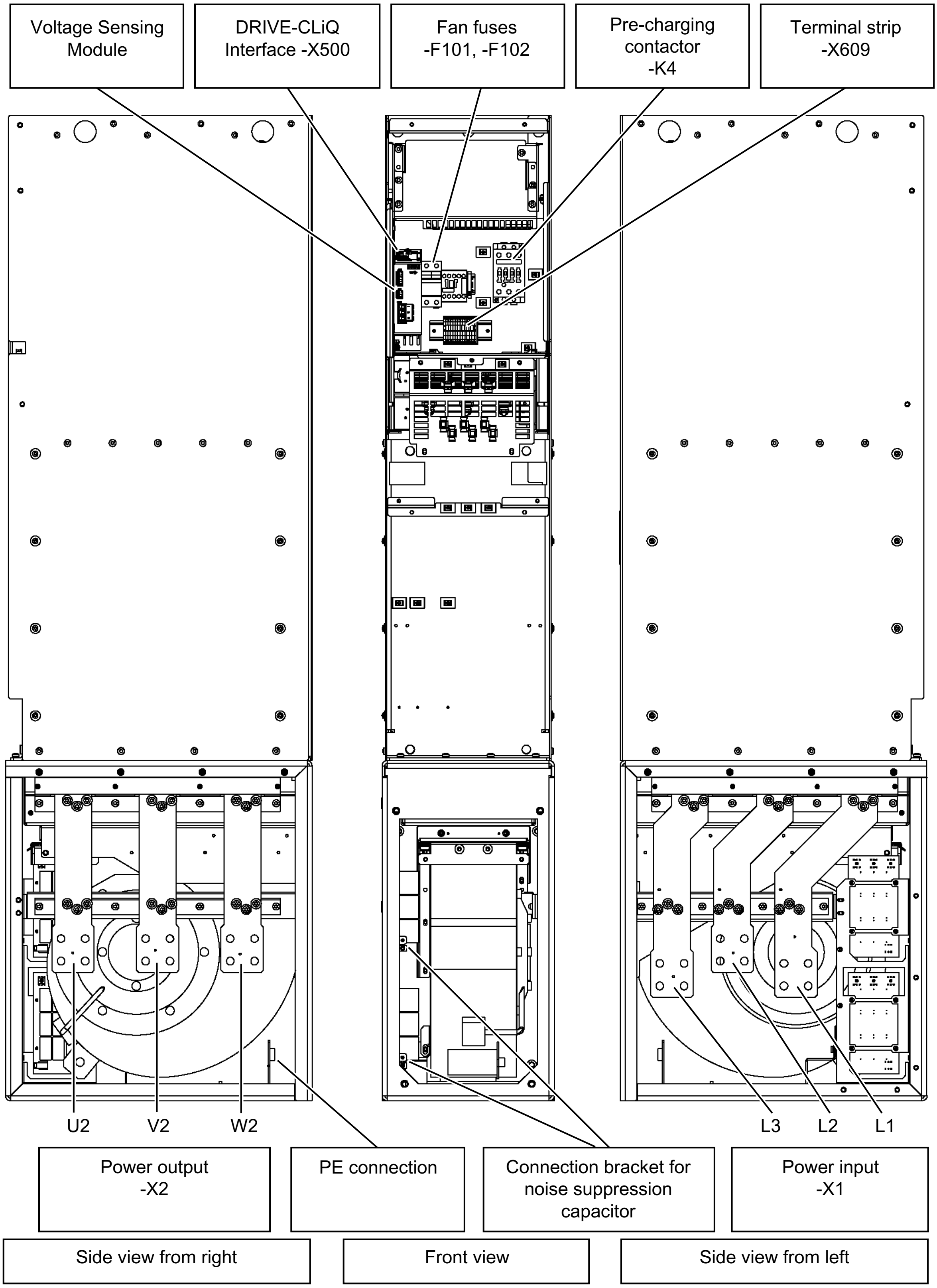


Figure 2-4 Interface overview in the Active Interface Module, frame size HI

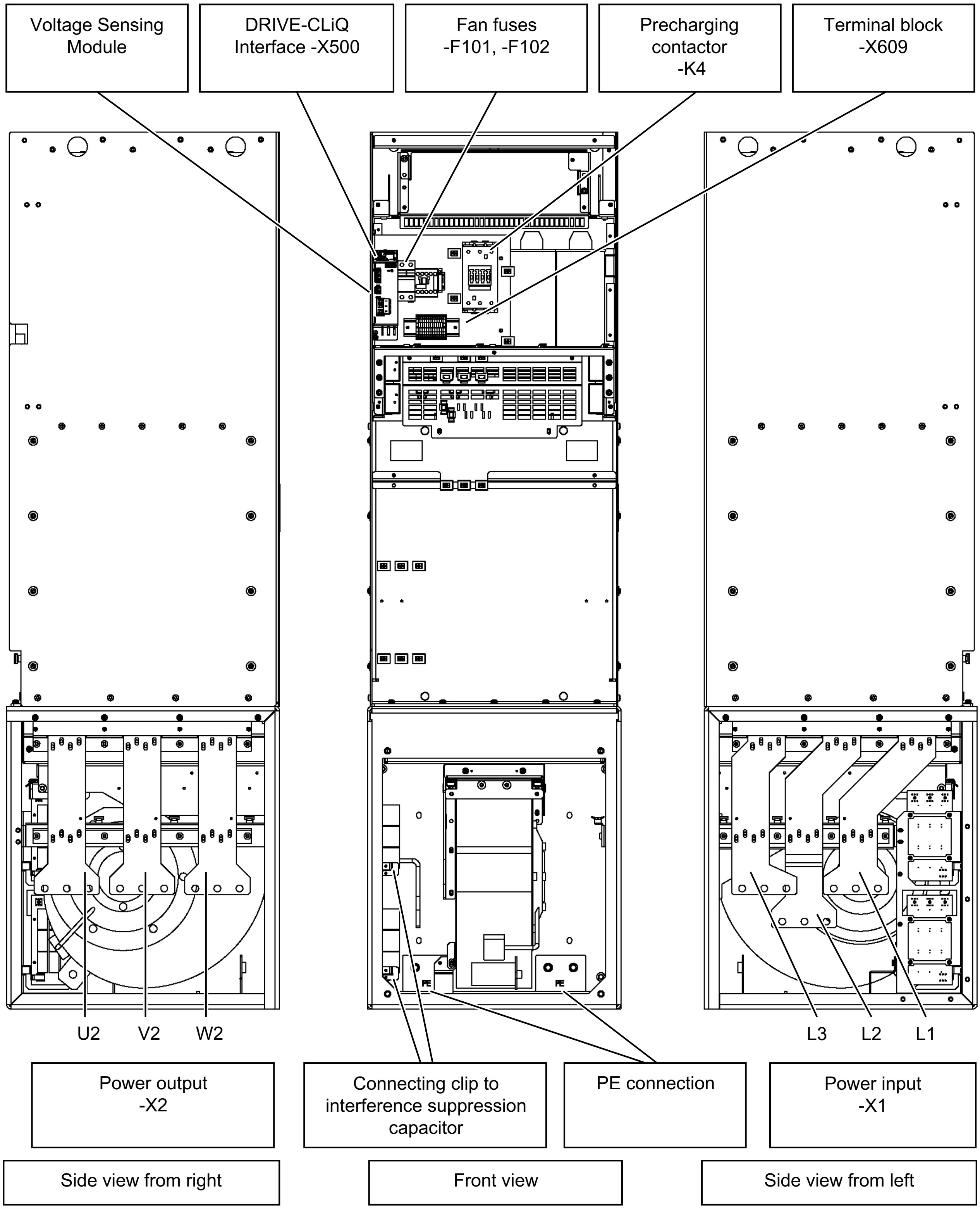


Figure 2-5 Interface overview in the Active Interface Module, frame size JI

2.3.3.2 Connection example

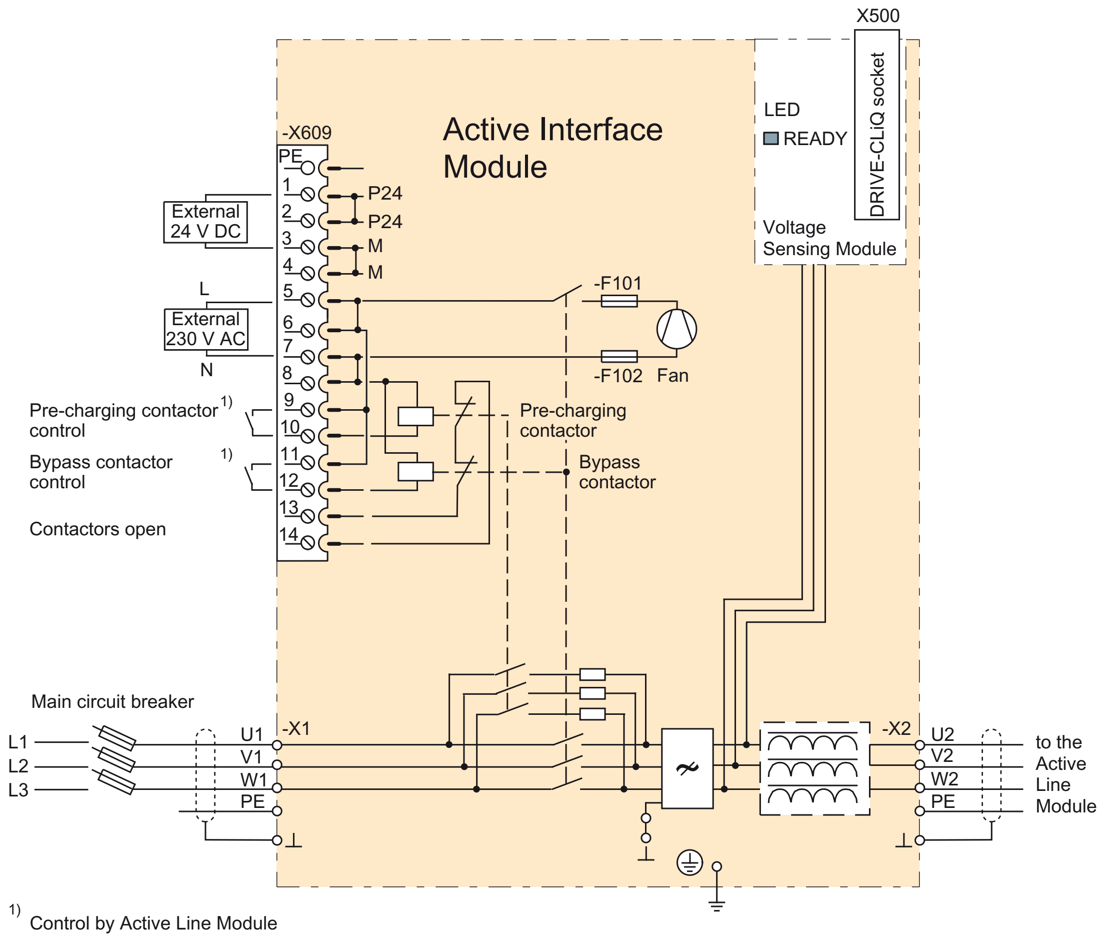


Figure 2-6 Connection example Active Interface Module, frame size GI

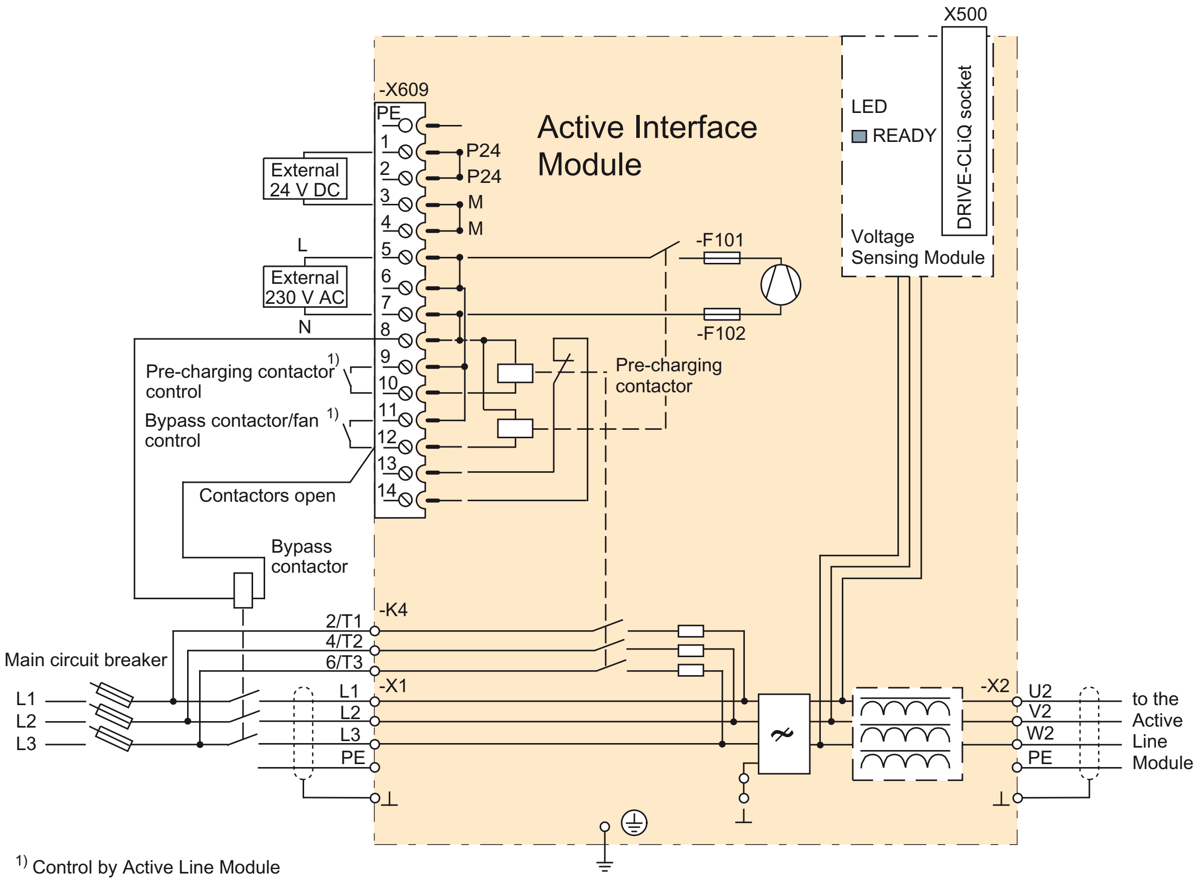


Figure 2-7 Connection example Active Interface Module, frame sizes HI / JI

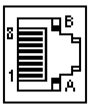
2.3.3.3 Line/load connection

Table 2- 8 Connections for the Active Interface Module

Terminals	Designations
X1: L1, L2, L3 X2: U2, V2, W2	Voltage: • 3 AC 380 V -10 % (-15 % < 1 min) to 3 AC 480 V +10 % • 3 AC 500 V -10 % (-15 % < 1 min) to 3 AC 690 V +10 % Frequency: 47 Hz to 63 Hz Connecting thread: • Frame size GI: M10 / 25 Nm for cable lugs in accordance with DIN 46234 / DIN 46235 • Frame sizes HI / JI: M12 / 50 Nm for cable lugs in accordance with DIN 46234 / DIN 46235
K4: 2/T1, 4/T2, 6/T3 (for frame sizes HI / JI only)	Connection for pre-charging circuit directly on pre-charging contactor: • Frame size HI: 2 x 16 mm² max. (3RT1034) • Frame size JI: 2 x 35mm² max. (3RT1044)
PE connection	Connecting thread: • Frame size GI: M10 / 25 Nm for cable lugs in accordance with DIN 46234 / DIN 46235 • Frame sizes HI / JI: M12 / 50 Nm for cable lugs in accordance with DIN 46234 / DIN 46235

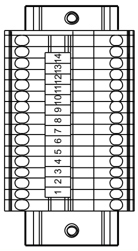
2.3.3.4 DRIVE-CLiQ interface X500

Table 2- 9 DRIVE-CLiQ interface X500

	PIN	Signal name	Technical specifications
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	24 V power supply
	B	M (0 V)	Electronics ground
Blanking plate for DRIVE-CLiQ interfaces (50 pcs.) order number: 6SL3066-4CA00-0AA0			

2.3.3.5 X609 terminal strip

Table 2- 10 X609 terminal strip

	Terminal	Designation	Technical specifications	
	1	P24	Voltage: 24 V DC (20.4 V – 28.5 V) Power consumption: max. 0.25 A	
	2	P24		
	3	M		
	4	M		
	5	L	Voltage: 230 V AC (195.5 V – 264.5 V) Power consumption: max. 10 A Fan operating currents, see "Technical data"	
	6	L		
	7	N		
	8	N		
	9	Pre-charge contactor–A1	Voltage: 230 V AC (195.5 V – 264.5 V) Power consumption: max. 4 A	To Active Line Module, X9:5
	10	Pre-charge contactor–A2		To Active Line Module, X9:6
	11	Bypass contactor–A1	Voltage: 230 V AC (195.5 V – 264.5 V) Power consumption: max. 6 A	To Active Line Module, X9:3
	12	Bypass contactor–A2		To Active Line Module, X9:4
	13	Contactor feedback 1*	Voltage: 230 V AC (195.5 V – 264.5 V) Max. permissible current: 6 A	
	14	Contactor feedback 2*		
Max. connectable cross-section 1.5 mm²				

* Series connection NO contact of pre-charge contactor and bypass contactor (only for frame size GI)

CAUTION
Active Interface Modules of frame sizes HI and JI require a signal on terminal X609:11 and 12 to control the fans. If this signal is not present during operation, the fans do not rotate and the module is shut down on overtemperature.

2.3.3.6 Meaning of the LED on the Voltage Sensing Module (VSM) in the Active Interface Module

Table 2- 11 Description of the LED on the Voltage Sensing Module (VSM) in the Active Interface Module

LED	Color	State	Description
RDY	---	Off	The electronics power supply is missing or out of tolerance
	Green	Continuously lit	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	Continuously lit	DRIVE-CLiQ communication is being established.
	Red	Continuously lit	At least one fault is present in this component. Note: LED is driven irrespective of the corresponding messages being reconfigured.
	Green / red	Flashing 0.5 Hz	Firmware is being downloaded.
		Flashing 2 Hz	Firmware download is complete. Waiting for POWER ON
	Green / orange or Red / orange	Flashing 2 Hz	Component recognition via LED is activated (p0144) Note: The two options depend on the LED status when module recognition is activated via p0144 = 1.

2.3.4 Dimension drawing

Dimension drawing, frame size GI

The mandatory cooling clearances are indicated by the dotted line.

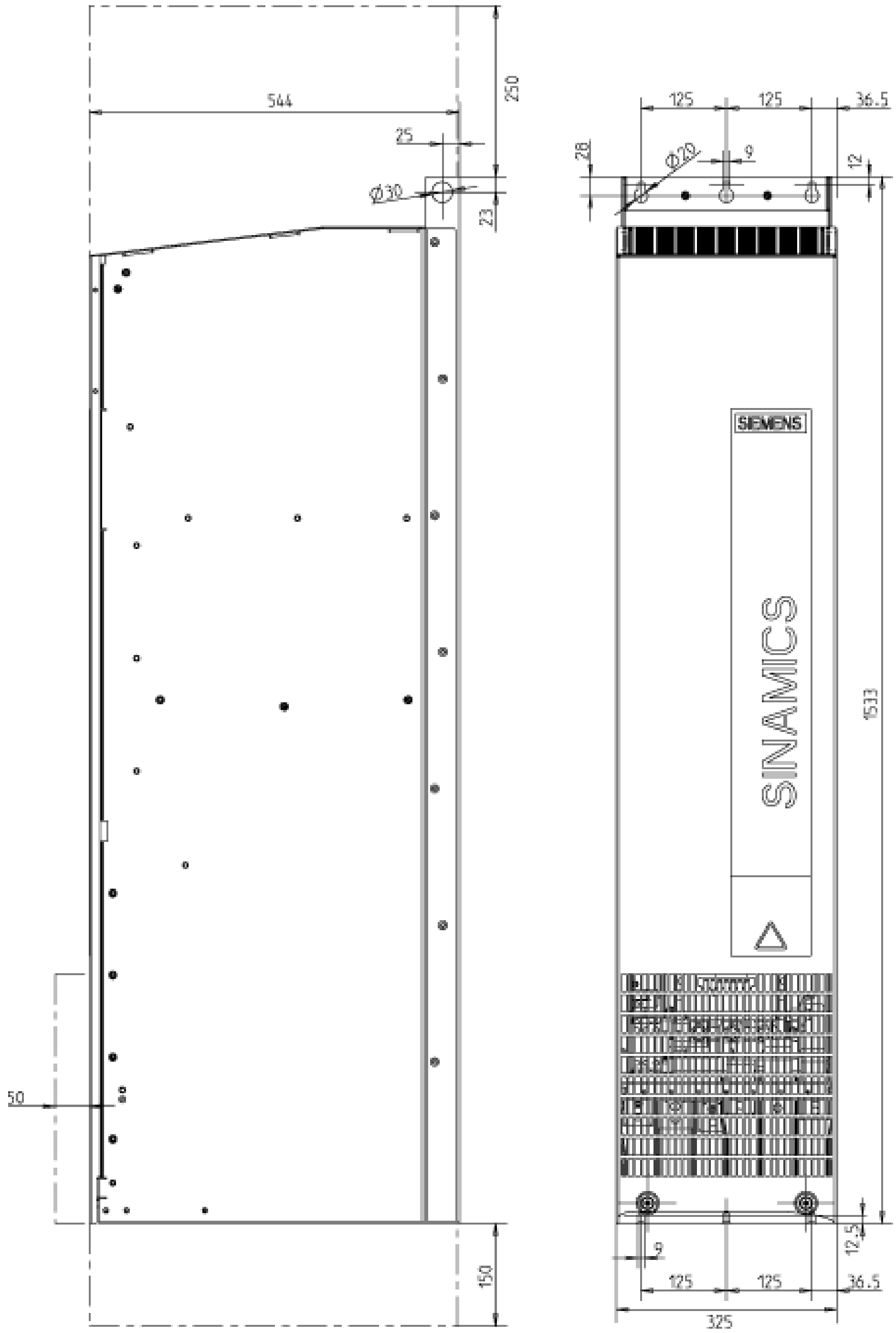


Figure 2-8 Dimension drawing for Active Interface Module, frame size GI Side view, front view

Dimension drawing, frame size HI

The mandatory cooling clearances are indicated by the dotted line.

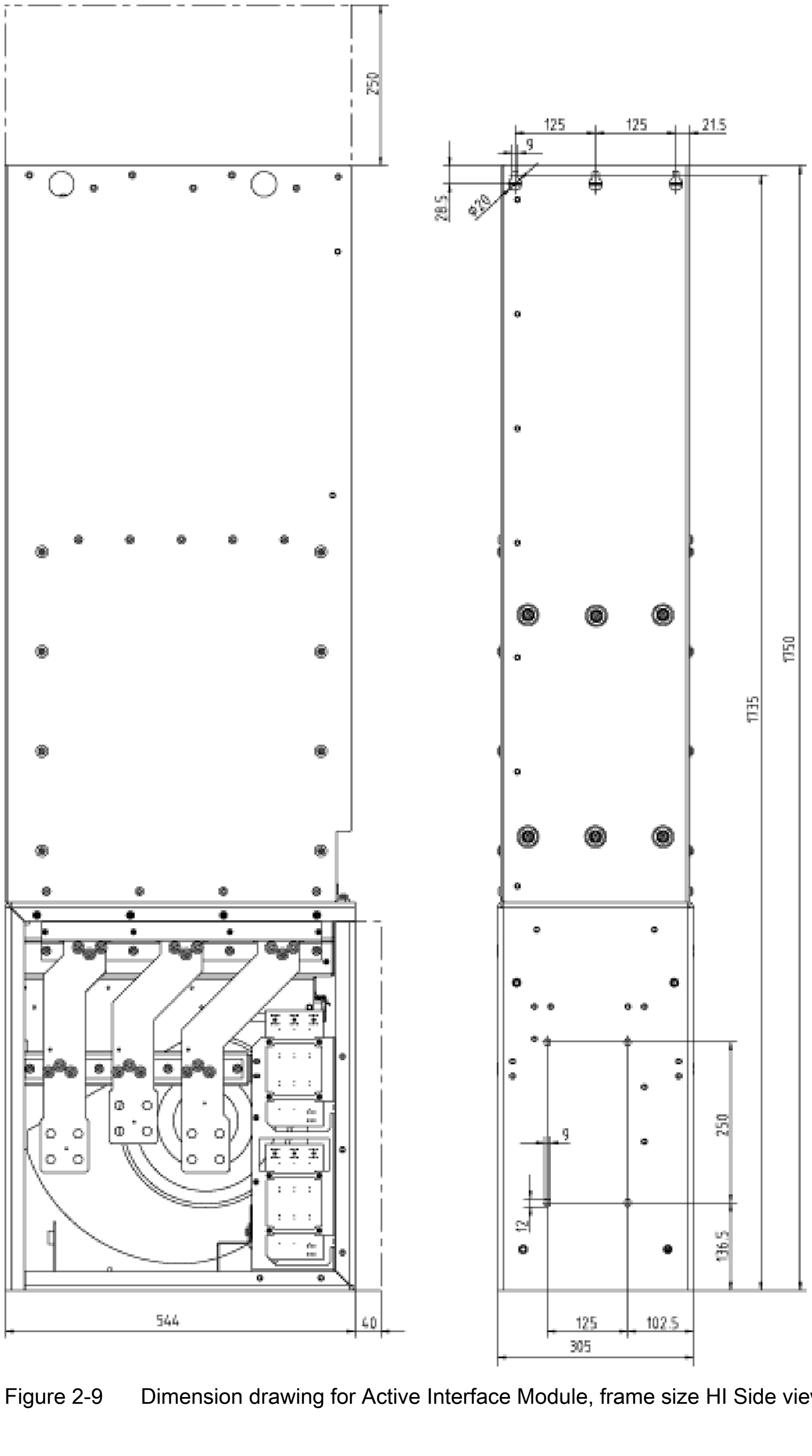


Figure 2-9 Dimension drawing for Active Interface Module, frame size HI Side view, rear view

Dimension drawing, frame size JI

The mandatory cooling clearances are indicated by the dotted line.

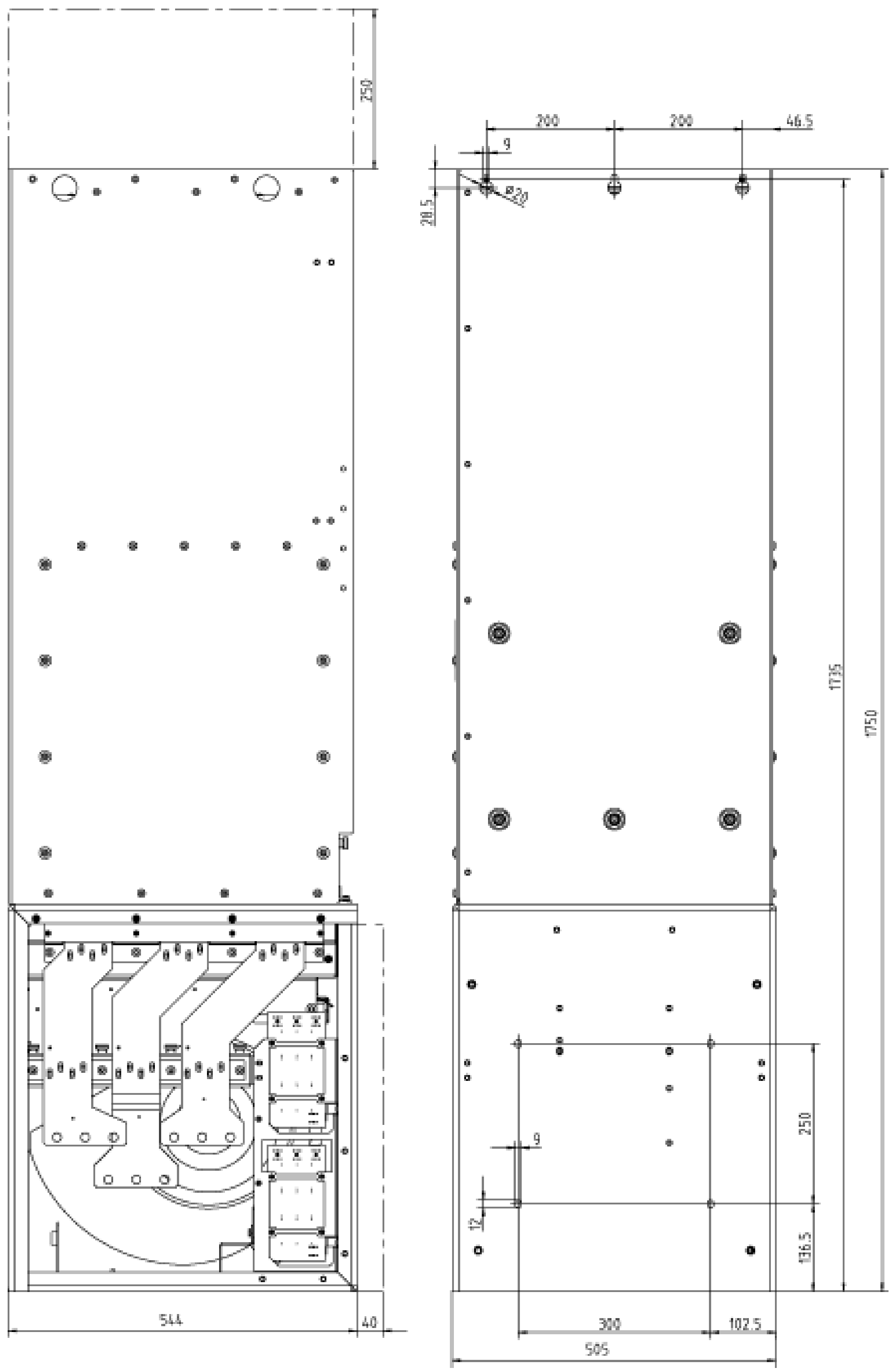


Figure 2-10 Dimension drawing for Active Interface Module, frame size JI Side view, rear view

2.3.5 Electrical connection

The Active Interface Module is electrically connected in accordance with the connection examples shown in section "Interface description".

Operating an Active Interface Module on a grounded system/IT system

When the device is operated on a non-grounded line supply/IT line supply, the connection bracket to the interference suppression capacitor must be removed (e.g.: see "1" in figure below).

The interface overview in the section "Interface description" shows the installation position of the connection bracket on the different frame sizes.

With devices of frame sizes HI and JI, two connection brackets must be removed.

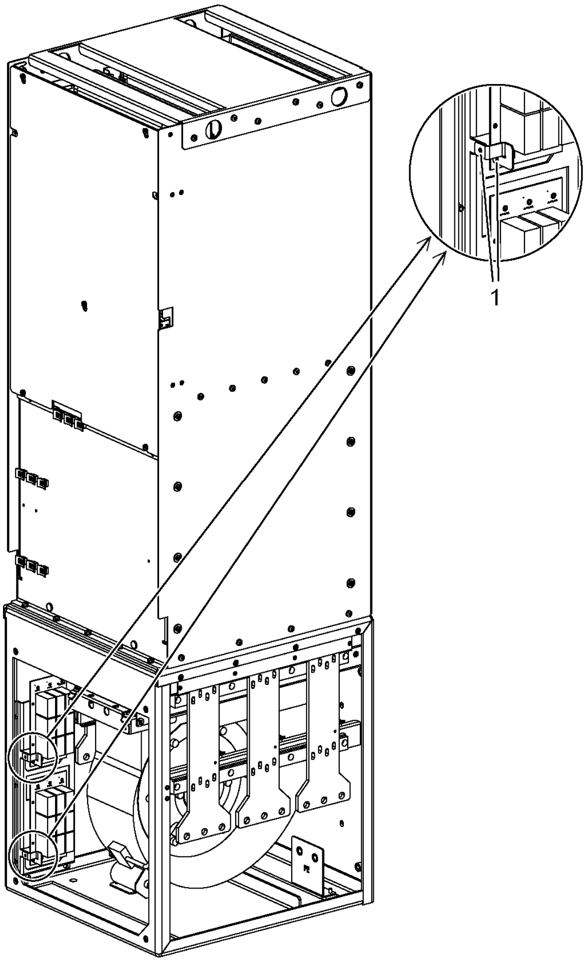


Figure 2-11 Removing the connection bracket to the noise suppression capacitor (example: frame size JI)

⚠ WARNING
Failing to remove the connection bracket for the noise suppression capacitor on a non-grounded system/IT system can cause significant damage to the unit.

2.3.6 Technical specifications

Table 2- 12 Technical data for Active Interface Modules, 380 V – 480 V 3 AC

Order number	6SL3300–	7TE35–0AA0	7TE38–4AA0		
Suitable for Active Line Module Rated power of Active Line Module	6SL3335- kW	7TE35-0AAx 300	7TE38-4AAx 500		
Rated current	A	490	840		
Supply voltages - Line voltage - Line frequency - Electronics power supply - Fan supply voltage	 V_{ACrms} Hz V_{DC} V_{AC}	 380 V 3 AC -10 % (-15 % < 1 min) to 480 V 3 AC +10 % 47 to 63 Hz 24 (20.4 - 28.8) 230 (195.5 - 264.5)			
DC link capacitance of the drive line-up, max.	µF	76800	134400		
Power requirements - Electronic power consumption (24 V DC) - Fan supply, 2 AC 230 V, 50/60 Hz, max.	 A A	 0.17 0.9 / 1.2	 0.17 3.6 / 4.6		
Bridging contactor		included	included	included	included
Power consumption bridging contactor (230 VAC) - Making current - Holding current	 A A	 2.5 1.2	 -- --		
Bridging contactor	A	Internal	3WL1110-2BB34-4AN2-Z Z=C22		
Max. ambient temperature - Without derating - With derating	 °C °C	 40 55	 40 55		
Power loss	kW	3.9	6.1		
Cooling-air requirement	m^3/s	0.47	0.40		
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	71 / 73	71 / 73		
Line/load connection L1, L2, L3 / U2, V2, W2		Flat connector for screw			
		M10	M12		
PE connection		M10 screw	M12 screw		
Line/load connection - Line connection (L1, L2, L3) - Load connection (U2, V2, W2) - PE connection	 mm² mm² mm²	 2 x 185 2 x 185 2 x 185	 4 x 240 4 x 240 2 x 240		
Degree of protection		IP20	IP00		
Dimensions - Width - Height - Depth	 mm mm mm	 325 1533 542	 305 1750 544		
Frame size		GI	HI		
Weight	kg	190	390		

Table 2- 13 Technical data for Active Interface Modules, 500 V – 690 V 3 AC

Order number	6SL3300–	7TG35–8AA0	7TG41–3AA0		
Suitable for Active Line Module Rated power of Active Line Module	6SL3335- kW	7TG35-8AAx 560	7TG41-3AAx 1400		
Rated current	A	575	1270		
Supply voltages - Line voltage - Line frequency - Electronics power supply - Fan supply voltage	 V_{ACrms} Hz V_{DC} V_{AC}	 500 V 3 AC –10 % (-15 % < 1 min) to 690 V 3 AC +10 % 47 to 63 Hz 24 (20.4 - 28.8) 230 (195.5 - 264.5)			
DC link capacitance of the drive line-up, max.	 μF	 59200	 153600		
Power requirements - Electronic power consumption (24 V DC) - Max. fan power consumption, 2 AC 230 V	 A A	 0.17 4.6	 0.17 4.9		
Bypass contactor [1]	A	3RT1476- 6AP36	3WL1216- 4BB34-4AN2-Z Z=C22		
Max. ambient temperature - Without derating - With derating	 °C °C	 40 55	 40 55		
Power loss	kW	6.8	9.6		
Cooling-air requirement	m^3/s	0.40	0.40		
Sound pressure level L_{pA} (1 m) at 50/60 Hz	 dB(A)	 71 / 73	 71 / 73		
Line/load connection L1, L2, L3 / U2, V2, W2		Flat connector for screw M12	 M12		
PE connection		M12 screw	M12 screw		
Line/load connection - Line connection (L1, L2, L3) - Load connection (U2, V2, W2) - PE connection	 mm² mm² mm²	 4 x 240 4 x 240 2 x 240	 6 x 240 6 x 240 4 x 240		
Degree of protection		IP00	IP00		
Dimensions - Width - Height - Depth	 mm mm mm	 305 1750 544	 505 1750 544		
Frame size		HI	JI		
Weight	kg	390	620		

[1] Bypass contactor is not included, must be provided separately.

2.3.7 Derating factors as a function of installation altitude and ambient temperature

The cabinet devices and the associated system components are rated for an ambient temperature of 40 °C and installation altitudes up to 2000 m above sea level.

At ambient temperatures > 40 °C, the output current must be reduced. Ambient temperatures above 55 °C are not permissible.

At installation altitudes > 2000 m above sea level, it must be taken into account that the air pressure, and therefore air density, decreases as the height increases. This reduces both the cooling effect as well as the insulating strength of the air.

As a result of the lower cooling effect, on one hand, the ambient temperature must be reduced, and on the other hand, the power loss in the chassis unit must also be reduced by decreasing the output current; whereby ambient temperatures less than 40 °C can be factored in as countermeasure for compensation.

The following table shows the permissible output currents as a function of installation altitude and ambient temperature (the permissible correction between installation altitude and ambient temperatures of < 40 °C – inlet air temperature at the air inlet of the chassis unit – is taken into account in the specified values).

The values apply under the precondition that a cooling air flow though the units as stated in the technical specifications is ensured.

As a further measure at installation altitudes of 2000 m and 5000 m, the use of an isolating transformer is required to reduce transient overvoltages in accordance with EN 60664-1.

Table 2- 14 Current derating for chassis units as a function of ambient temperature (supply air temperature at the air inlet of the chassis unit) and installation altitude

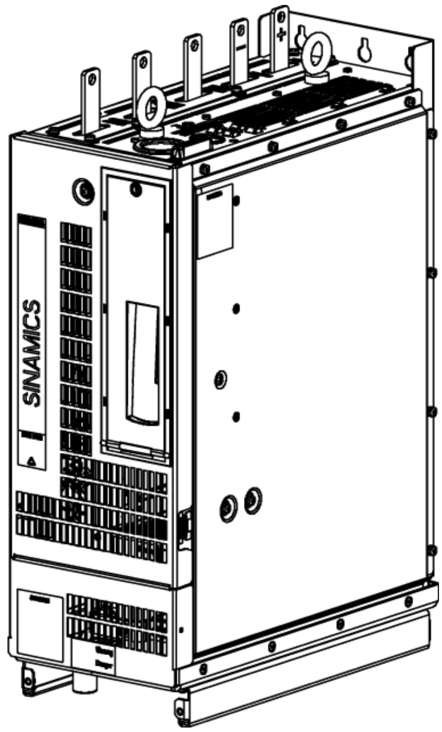
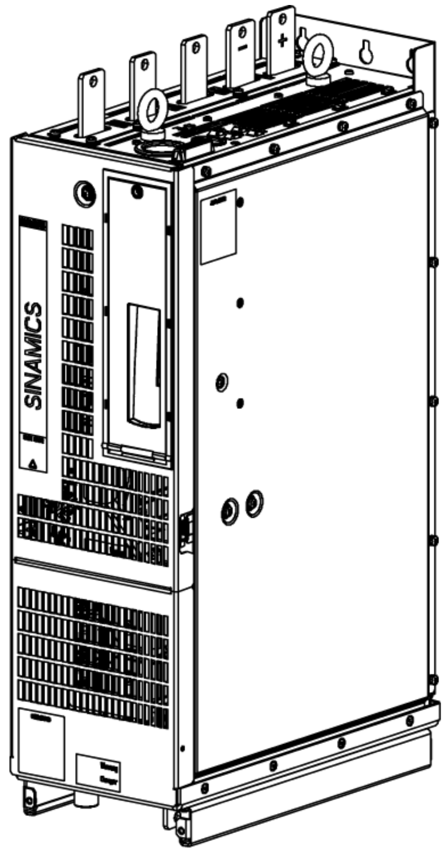
Installation altitude above sea level in m	Current derating factor (in % of rated current) at an ambient temperature (air intake temperature) of							
	20 °C	25 °C	30 °C	35 °C	40 °C	45 °C	50 °C	55 °C
0 ... 2000	100 %	100 %	100 %	100 %	100 %	93.3 %	86.7 %	80.0 %
... 2500	100 %	100 %	100 %	100 %	96.3 %			
... 3000	100 %	100 %	100 %	98.7 %				
... 3500	100 %	100 %	100 %					
... 4000	100 %	100 %	96.3 %					
... 4500	100 %	97.5 %						
... 5000	98.2 %							

Power Modules 3

3.1 Description

A Power Module is a power unit (frequency converter) that provides the power supply for the connected motor. The power from the 3-phase system is supplied via the 6-pulse rectifier. The output inverter produces a 3-phase, variable-voltage, variable-frequency system. A Power Module must be connected to a Control Unit via DRIVE-CLiQ. The open-loop and closed-loop control functions are stored in the Control Unit.

Table 3- 1 Power Modules

	
Frame size FL	Frame size GL

Characteristics of Power Modules

- Design for 380 V 3 AC to 480 V 3 AC from 210 A to 490 A
- Suitable for TN, TT, and IT supply systems
- Liquid cooling
- Short-circuit/ground-fault-proof
- Electronic rating 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
- The Power Modules communicate with the higher-level Control Unit via DRIVE-CLiQ. The Control Unit in this case could be a CU310 or CU320 or a SIMOTION D Control Unit.
- An external 24 VDC supply is required to operate liquid-cooled Power Modules.
- The correct line reactor must be connected in series to achieve category C3 EMC conformance in accordance with EN 61800.

The volumetric flow of the coolant is monitored by the software. If the volumetric flow is continuously lower than the setpoint, an alarm (A5005) is first displayed. If this alarm remains active continually for the next 5 minutes, a fault message (F30047) is activated which shuts down the unit.

The fans for the internal electronic circuitry are only switched on when required.

The fans are switched on and off as a function of several factors (e.g. heat sink temperature, ambient temperature, output current, duty cycle, ...) which means that fan operating cycles cannot be calculated directly.

3.2 Safety information

WARNING

A hazardous voltage will be present in the component for a further 5 minutes after all voltage supplies have been disconnected. Work cannot be carried out until this time has elapsed.

Before starting work, you should also measure the voltage after the 5 minutes have elapsed. The voltage can be measured on DC link terminals DCP and DCN.

CAUTION

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

NOTICE

The cooling clearances above, below, and in front of the component, which are specified in the dimension drawings, must be observed.

WARNING

Cable shields and power cable conductors which are not used must be connected to PE potential in order to discharge charges as a result of capacitive coupling.

Non-observance can cause lethal shock voltages.

CAUTION

The busbars and coolant connections which stick out of the module must never be used as handles or support surfaces when the units are transported.

DANGER

Power Modules discharge a high leakage current to the protective ground conductor.
Due to the high leakage current associated with Power Modules, they or the relevant control cabinet must be permanently connected to PE.

According to EN 61800-5-1, Section. 6.3.6.7, the minimum cross-section of the protective ground conductor must conform to the local safety regulations for protective ground conductors for equipment with a high leakage current.

3.3 Interface description

3.3.1 Overview

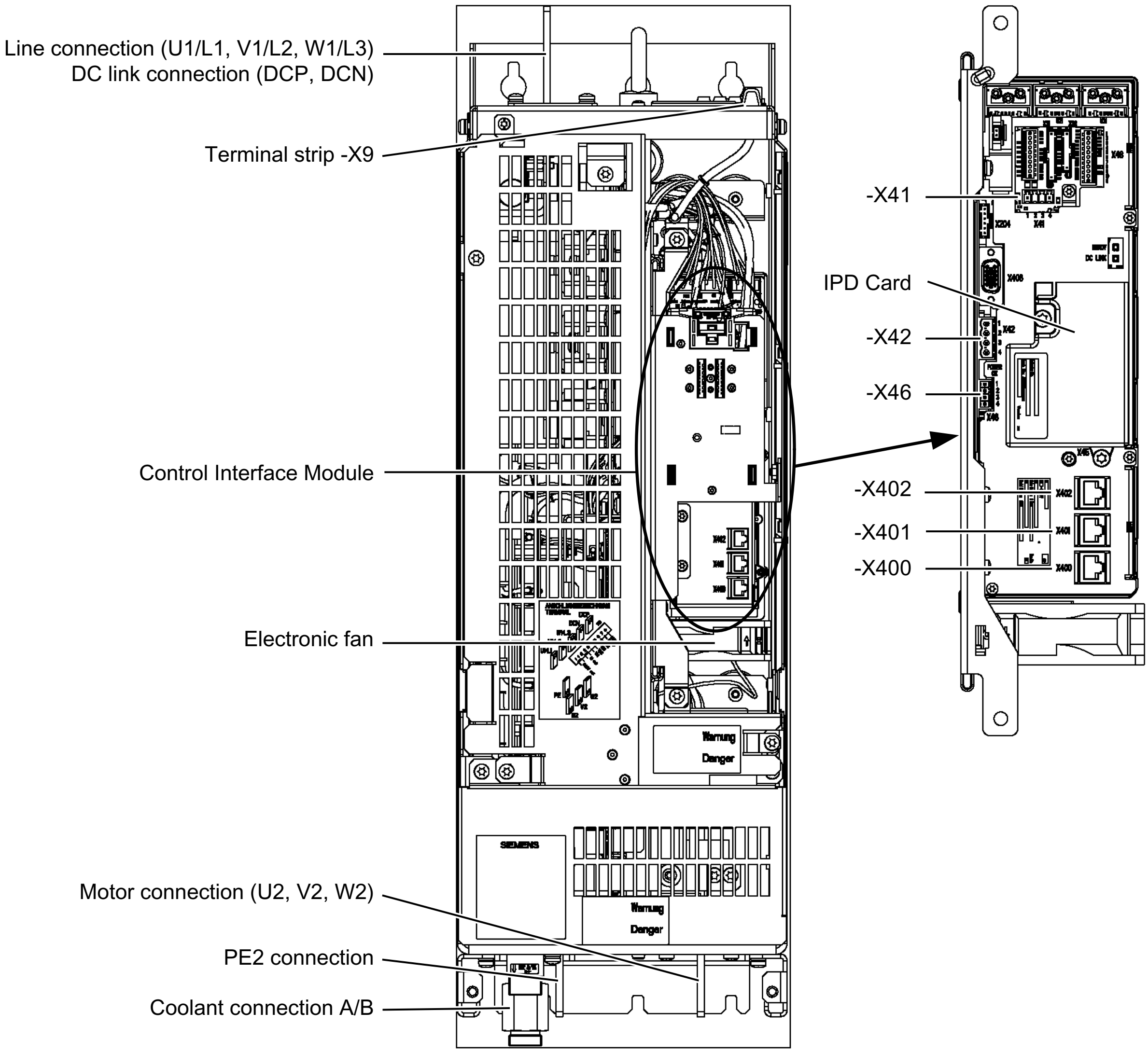


Figure 3-1 Power Module, frame size FL

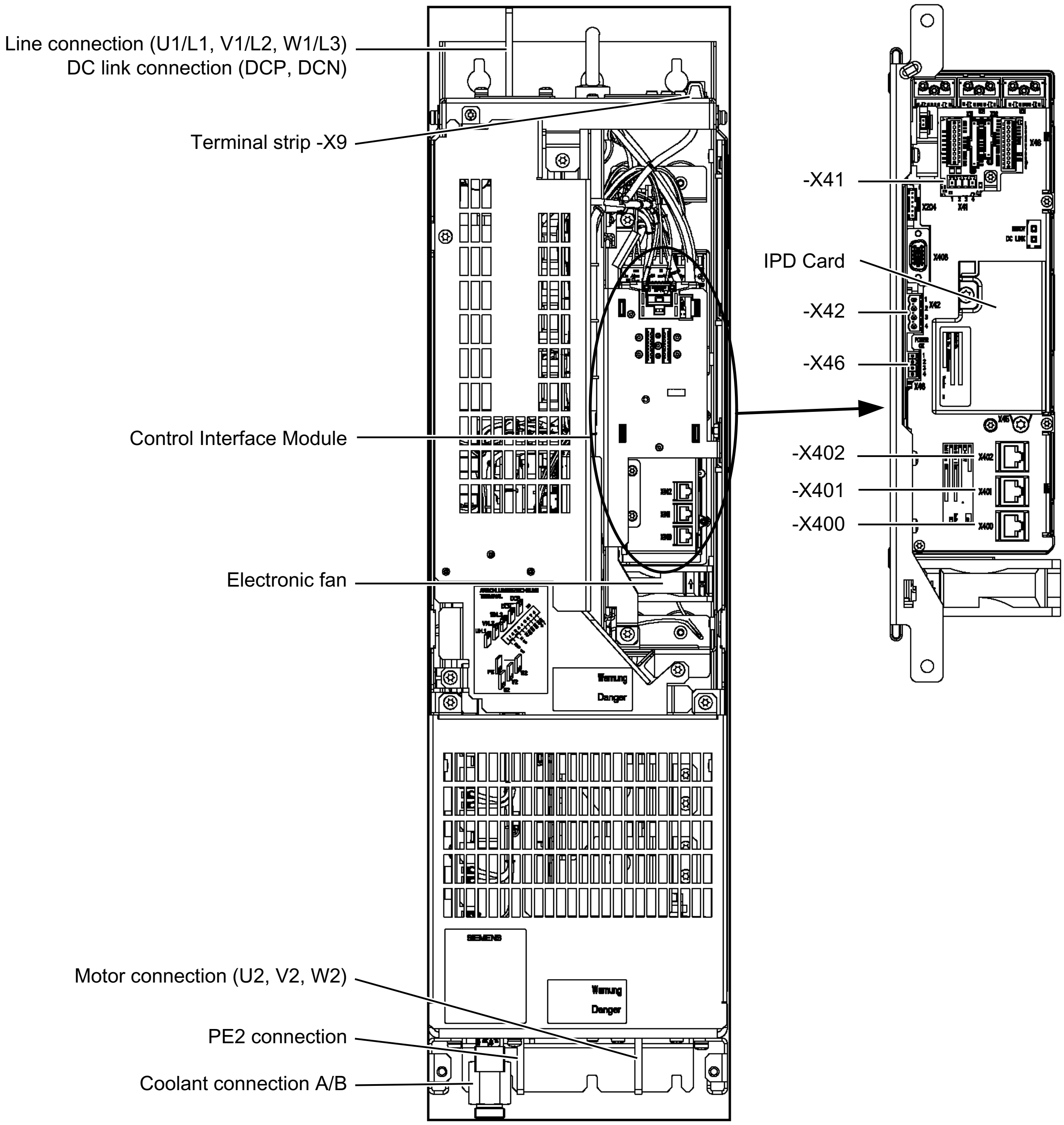


Figure 3-2 Power Module, frame size GL

3.3.2 Connection example

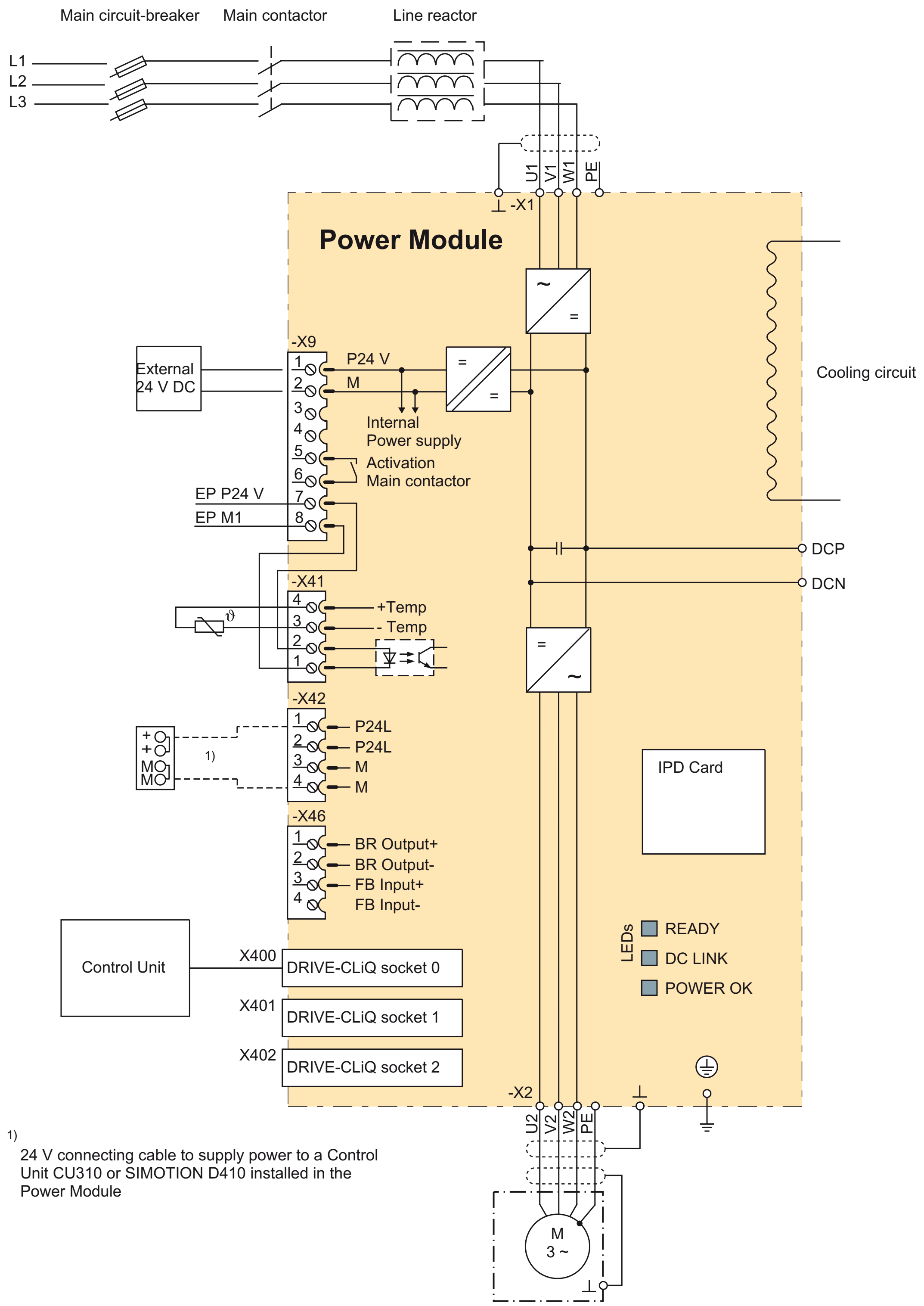


Figure 3-3 Connection example for Power module

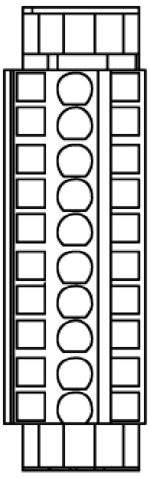
3.3.3 Line/DC link/motor connection

Table 3- 2 Line/DC link/motor connection for Power Module

Terminals	Technical specifications
U1/L1, V1/L2, W1/L3 3 AC power input	Voltage: 3 AC 380 V -10% (-15% < 1 min) to 3 AC 480 V +10% Frequency: 47 Hz to 63 Hz Connecting lugs: d = 13 mm (M12/50 Nm) for cable lugs in accordance with DIN 46234 / DIN 46235
DC link connection DCP, DCN	Voltage: 1.35 x V_{line} Connecting lugs: d = 13 mm (M12/50 Nm) for cable lugs in accordance with DIN 46234 / DIN 46235
U2, V2, W2 3 AC power output	Voltage: 0 V 3 AC to 0.72 x DC link voltage Connecting lugs: d = 13 mm (M12/50 Nm) for cable lugs in accordance with DIN 46234 / DIN 46235
PE connection	Connecting lugs: d = 13 mm (M12/50 Nm) for cable lugs in accordance with DIN 46234 / DIN 46235

3.3.4 X9 terminal strip

Table 3- 3 Terminal strip X9

	Terminal	Signal name	Technical specifications
	1	P24 V	Voltage: 24 V DC (20.4 V – 28.8 V) Power consumption: See Technical data
	1	P24 V	
	2	M	
	2	M	
	3	Reserved, do not use	
	4		
	5	Main contactor control	240 V AC: max. 8 A 30 V DC: max. 1 A isolated
	6		
	7	EP +24 V (Enable Pulses)	Supply voltage: 24 V DC (20.4 V - 28.8 V) Power consumption: 10 mA Signal propagation times: L → H: 100 μs H → L: 1000 μs The pulse disable function is only available when Safety Integrated Basic Functions are enabled.
	8	EP M1 (Enable Pulses)	
Max. connectable cross-section 1.5 mm^2			

Note

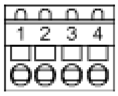
The function of the EP terminals is only available when Safety Integrated Basic Functions are enabled.

Note

The two "P24 V" or "M" terminals are jumpered in the connector. This ensures that the supply voltage is looped through, even when the connector is removed.

3.3.5 X41 EP terminal / temperature sensor connection

Table 3- 4 Terminal strip X41

	Terminal	Function	Technical specifications
	1	EP M1 (Enable Pulses)	Connected to terminal -X9:8
	2	EP +24 V (Enable Pulses)	Connected to terminal -X9:7
	3	-Temp	Temperature sensor connection KTY84-1C130 / PTC / PT100
	4	+Temp	
Max. connectable cross-section 1.5 mm^2			

DANGER

Risk of electric shock!

Only temperature sensors that meet the safety isolation specifications contained in EN 61800-5-1 may be connected to terminals "+Temp" and "-Temp". If safe electrical separation cannot be guaranteed (for linear motors or third-party motors, for example), a Sensor Module External (SME120 or SME125) must be used.

If these instructions are not complied with, there is a risk of electric shock!

Note

The following probes can be connected to the temperature sensor connection: KTY84-1C130 / PTC / PT100.

CAUTION

The temperature sensor must be connected in shielded form. The shielding must be attached to the shield support of the Power Module.

NOTICE

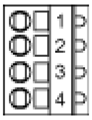
The KTY temperature sensor must be connected with the correct polarity.

Note

A cable harness is used to connect terminals -X41:1 and -X41:2 to terminals -X9:8 and -X9:7.

3.3.6 X42 terminal strip

Table 3- 5 Terminal strip X42 voltage supply for Control Unit, Sensor Module and Terminal Module

	Terminal	Function	Technical specifications
	1	P24L	Voltage supply for Control Unit, Sensor Module and Terminal Module (18 to 28.8 V) Maximum load current: 3 A
	2		
	3	M	
	4		
Max. connectable cross-section 2.5 mm²			

Note

The terminal strip supplies power to the CU310 Control Unit via a cable harness supplied with the device.

CAUTION

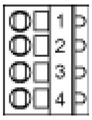
The terminal strip is not intended for free 24 V DC availability (for example for supplying further line-side components), as the voltage supply of the Control Interface Module could also be overloaded and operating capability could thus be compromised.

Note

The terminal strip supplies power to the CU310 Control Unit via a cable harness supplied with the device.

3.3.7 X46 Brake control and monitoring

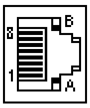
Table 3- 6 Terminal strip X46 brake control and monitoring

	Terminal	Function	Technical specifications
	1	BR output +	The interface is intended for connection of the Safe Brake Adapter.
	2	BR output -	
	3	FB input +	
	4	FB input -	
Max. connectable cross-section 1.5 mm^2			

CAUTION
The length of the connecting lead at terminal strip X46 must not exceed 10 m, and the lead must not be brought out outside the control cabinet or control cabinet group.

3.3.8 DRIVE-CLiQ interfaces X400, X401, X402

Table 3- 7 DRIVE-CLiQ interfaces X400, X401, X402

	PIN	Signal name	Technical specifications
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	24 V power supply
	B	M (0 V)	Electronics ground
Blanking plate for DRIVE-CLiQ interfaces (50 pcs.) order number: 6SL3066-4CA00-0AA0			

3.3.9 Cooling circuit connections

Table 3- 8 Cooling circuit connections

Connection	Technical data
Coolant connection A: Inlet	Pipe thread ISO 228 - G 3/4 B (external thread 3/4", flat-sealing)
Coolant connection B: Return flow	
Tightening torque	60 Nm

Note

The seals for the screwed connections can be used only once when the cooling circuit is first assembled. The seals must be replaced if the circuit is disassembled and assembled again.

A replacement seal is commercially available under the name Viton flat gasket 3/4".

3.3.10 Meaning of the LEDs on the Control Interface Module in the Power Module

Table 3- 9 Meaning of the LEDs "READY" and "DC LINK" on the Control Interface Module in the Power Module

LED state		Description
READY	DC LINK	
Off	Off	The electronics power supply is missing or out of tolerance.
Green	Off	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is present.
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is too high.
Orange	Orange	DRIVE-CLiQ communication is being established.
Red	---	At least one fault is present in this component. Note: LED is driven irrespective of the corresponding messages being reconfigured.
Flashing light 0.5 Hz: Green / red	---	Firmware is being downloaded.
2 Hz flashing: Green / red	---	Firmware download is complete. Waiting for POWER ON.
2 Hz flashing: Green / orange or red / orange	---	Component detection using LED is activated (p0124) Note: The two options depend on the LED status when module recognition is activated via p0124 = 1.

Table 3- 10 Meaning of the LED "POWER OK" on the Control Interface Module in the Power Module

LED	Color	Status	Description
POWER OK	Green	Off	DC link voltage < 100 V and voltage at -X9:1/2 less than 12 V.
		On	The component is ready for operation.
		Flashing light	There is a fault. If the LED continues to flash after you have performed a POWER ON, please contact your Siemens service center.

WARNING

Irrespective of the state of the LED "DC LINK", hazardous DC link voltages can always be present.

The warning information on the component must be carefully observed!

3.4 Dimension drawing

Dimension drawing for frame size FL

The mandatory cooling clearances are indicated by the dotted line.

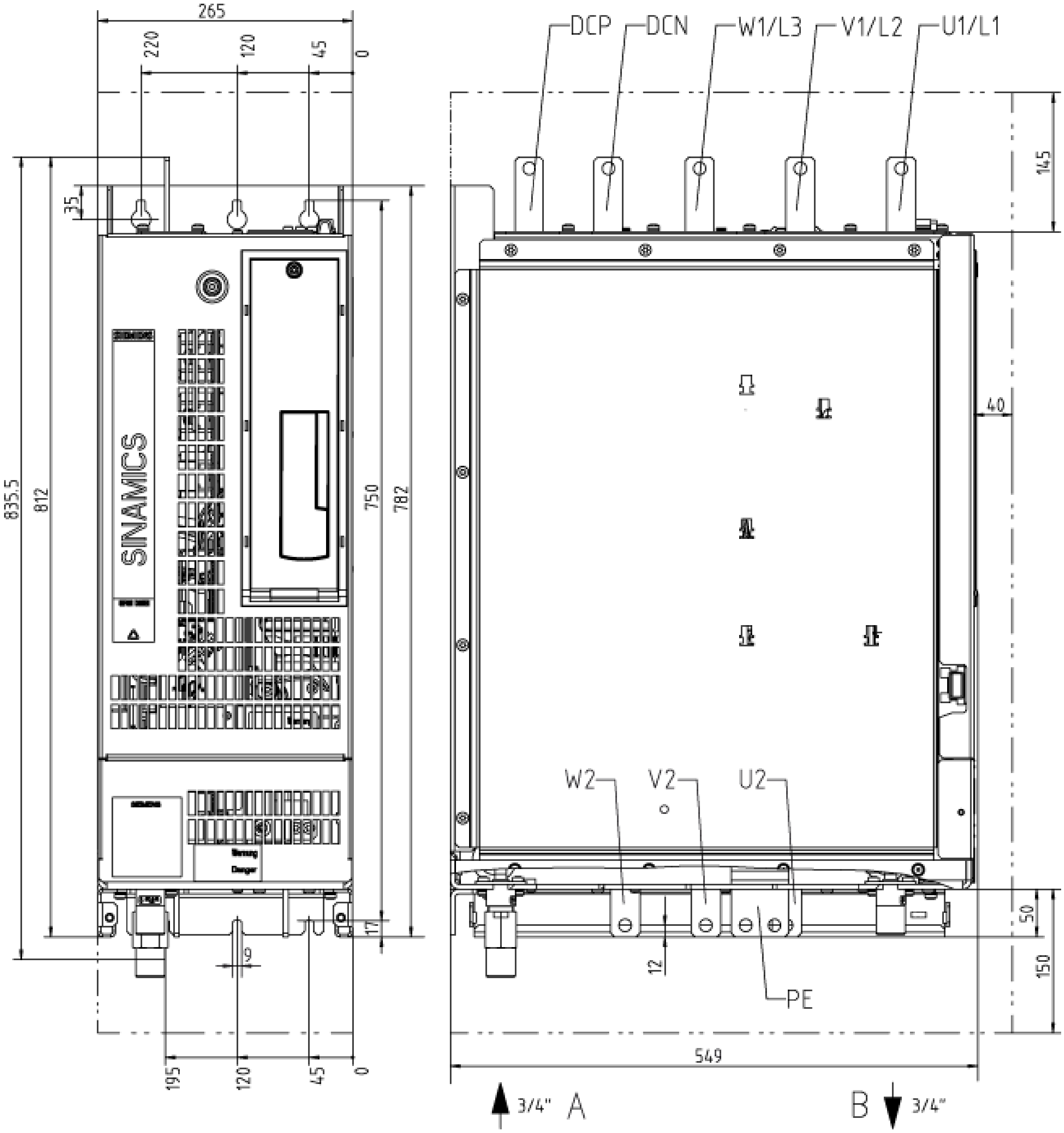


Figure 3-4 Dimension drawing Power Module, frame size FL, front view, side view

Dimension drawing for frame size GL

The mandatory cooling clearances are indicated by the dotted line.

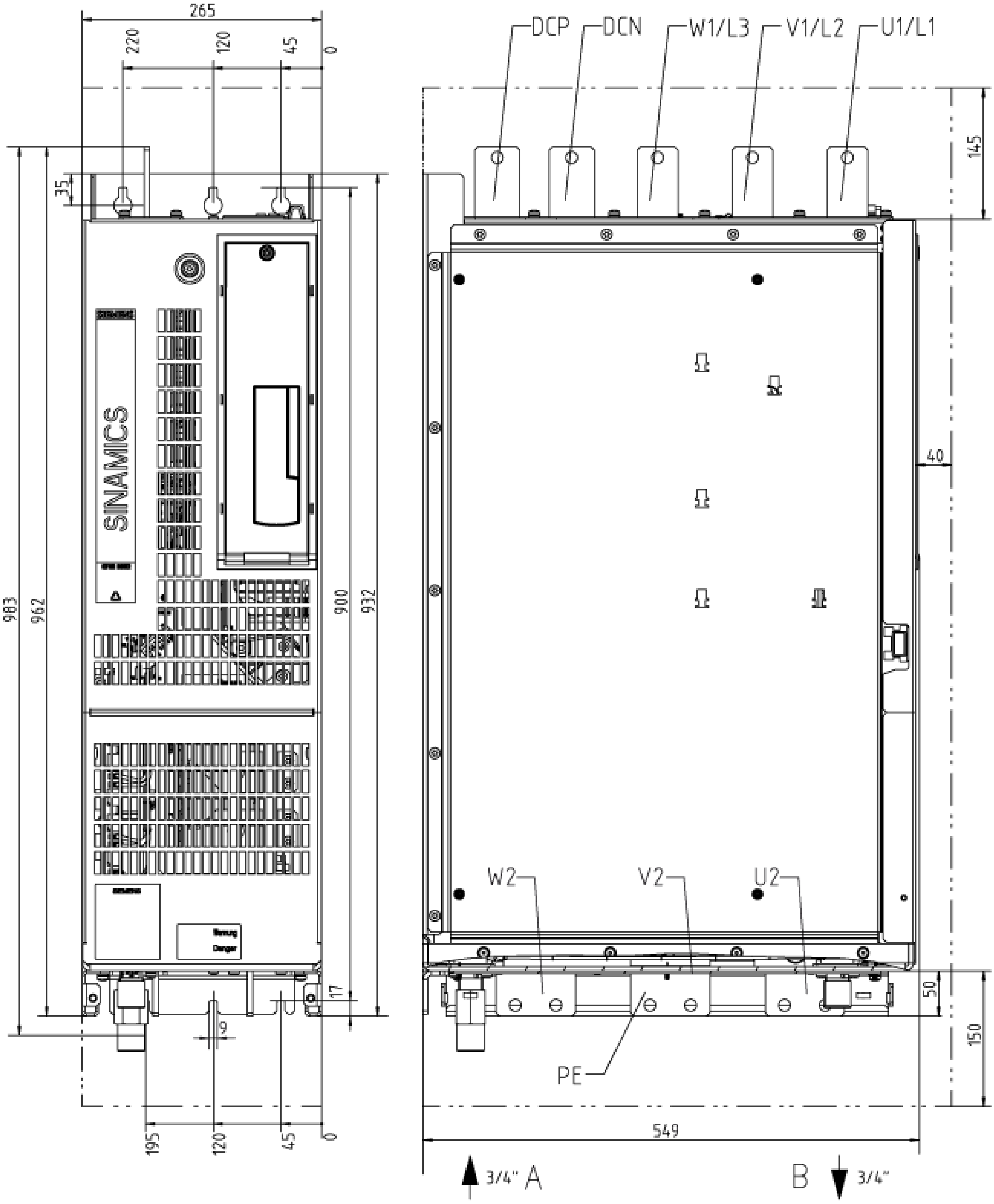


Figure 3-5 Dimension drawing Power Module, frame size GL. Front view, side view

3.5 Installation

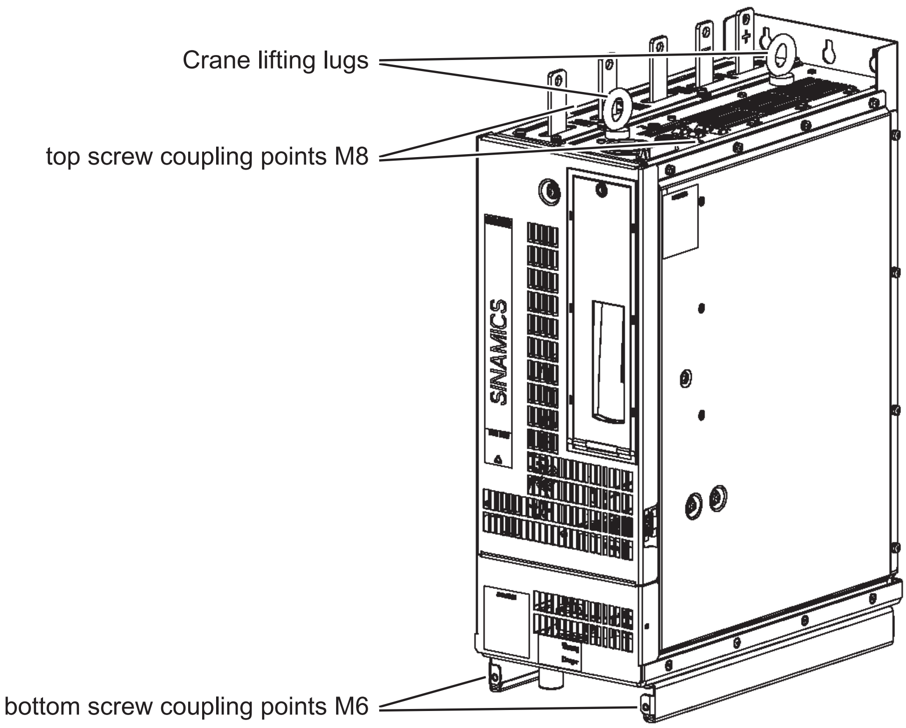


Figure 3-6 Crane lifting lugs / screw coupling points for mechanical support

Crane lifting lugs

Power Modules are fitted with crane lifting lugs as standard when shipped. The units can be hoisted from these lugs and transported from the pallet to the installation location.

Note

A thread for inserting a crane lifting lug is provided on the bottom of the Power Module. This allows the Power Module to also be transported horizontally with a lifting harness.

⚠ WARNING

A lifting harness with vertical ropes or chains must be used to prevent any risk of damage to the housing.

The crane lifting lugs must be removed after the modules have been installed. The lugs should be safely stored for future use.

Screw coupling points for mechanical support

The Power Modules are provided with screw coupling points at the top and bottom so that they can be connected to modules mounted adjacently.

Protection guard

A protection guard is mounted on the bottom of the Power Module ("1" in the diagram below) for use during transportation. The Power Module can be rested on this protection guard while it is removed from the packaging and during transportation.
Before the module is installed at its final location, this guard must be removed. To do this, remove the 4 screws ("2" in the diagram) and remove the guard.

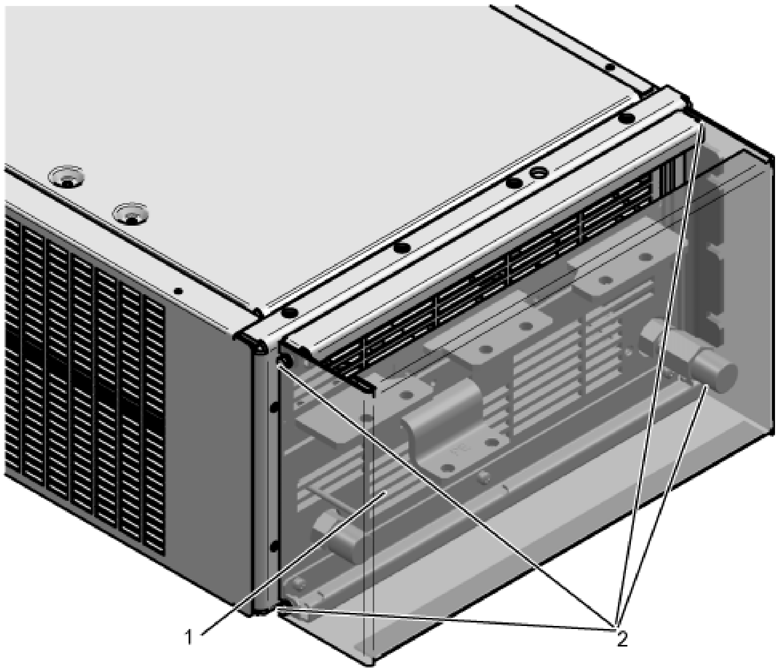


Figure 3-7 Protection guard

3.6 Electrical connection

Operating a Power Module on a non-grounded supply system/IT system

When the device is operated from a non-grounded system/IT system, the connection bracket for the interference-suppression capacitor must be removed.

To do so, loosen the two screws ("1" in the following diagram) and remove the connection bracket. Once you have loosened the screws, turn the connection bracket to the side (to the right) first and then pull it forwards out of the unit.

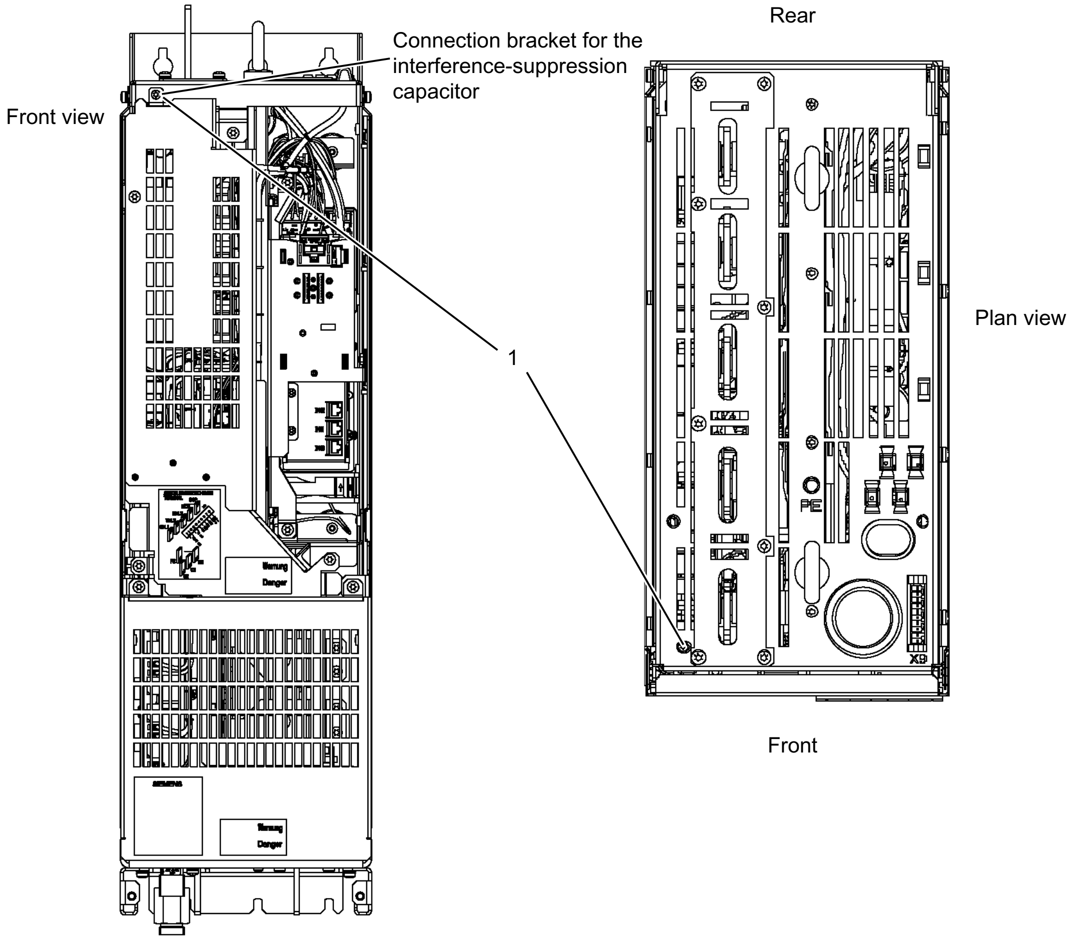


Figure 3-8 Removing the connection bracket for the interference-suppression capacitor

> ⚠ **WARNING**
>
> Failing to remove the connection bracket for the noise suppression capacitor on a non-grounded system/IT system can cause significant damage to the unit.

3.7 Technical specifications

Table 3- 11 Technical data of Power Modules, 380 V – 480 V 3 AC

Order number	6SL3315–	1TE32-1AA3	1TE32–6AA3	1TE33–1AA3	1TE35–0AA3
Output current - Rated current $I_{N\,A}$ - Base load current I_L - Base load current I_H - Max. output current $I_{max\,A}$	 A A A A	 210 205 178 307	 260 250 233 375	 310 302 277 453	 490 477 438 715
Unit rating - based on I_L (50 Hz 400 V) [1)] - based on I_H (50 Hz 400 V) [1)] - based on I_L (60 Hz 460 V) [2)] - based on I_H (60 Hz 460 V) [2)]	 kW kW hp hp	 110 90 150 150	 132 110 200 200	 160 132 250 200	 250 200 400 350
Supply voltages - Line voltage - Line frequency - Electronics power supply - DC link voltage - Output voltage	 V_{ACrms} Hz V_{DC} V_{DC} V_{ACrms}	 380 V 3 AC –10 % (-15 % < 1 min) to 480 V 3 AC +10 % 47 to 63 Hz 24 (20.4 – 28.8) 1.35 x U_{line} 0 to 0.72 x DC link voltage			
Input current - Rated current $I_{N\,E}$ - Maximum current $I_{max\,E}$	 A A	 230 336	 285 411	 340 496	 540 788
Rated pulse frequency - Max. pulse frequency without derating - Max. pulse frequency with derating	kHz kHz kHz	2 2 8	2 2 8	2 2 8	2 2 8
Electronic power consumption (24 V DC)	A	1.4	1.4	1.5	1.5
Cooling method		Liquid cooling with integrated stainless steel heat exchanger			
Power loss, max. [3)] - at 50 Hz 400 V - at 60 Hz 460 V	 kW kW	 2.42 2.6	 3.04 3.2	 3.4 3.6	 5.43 5.7
Max. coolant temperature - Without derating - With derating	 °C °C	 45 50	 45 50	 45 50	 45 50
Rated volumetric flow for water at 70 kPa pressure drop [4)]	l/min	9	9	12	12
Liquid volume of integrated heat exchanger	dm^3	0.52	0.52	0.88	0.88
Sound pressure level L_{pA} (1 m) at 50/60 Hz	 dB(A)	 52	 52	 52	 52
Line/DC link/motor connection		Flat connector for M12 screw			
Max. connection cross-section - Line connection (U1/L1, V1/L2, W1/L3) - DC link connection (DCP, DCN) - Motor connection (U2, V2, W2) - PE connection	 mm^2 mm^2 mm^2 mm^2	 2 x 95 2 x 95 2 x 95 2 x 95	 2 x 95 2 x 95 2 x 95 2 x 95	 2 x 240 2 x 240 2 x 240 2 x 240	 2 x 240 2 x 240 2 x 240 2 x 240
Max. cable length	m	300 (shielded) / 450 (unshielded)			
Degree of protection		IP00	IP00	IP00	IP00

Order number	6SL3315–	1TE32-1AA3	1TE32–6AA3	1TE33–1AA3	1TE35–0AA3
Dimensions - Width - Height - Depth	 mm mm mm	 265 836 549	 265 836 549	 265 983 549	 265 983 549
Frame size		FL	FL	GL	GL
Weight	kg	77	77	108	108
UL listed fuse [5] - Number (connected in parallel) - Rated current - Frame size acc. to IEC 60269	 A 	3NE1230-2 1 315 1	3NE1331-2 1 350 1	3NE1333-2 1 450 2	3NE1230-2 2 315 1

[1] Rated output of a typical standard induction motor based on I_L or I_H at 400 V 3 AC 50 Hz.

[2] Rated output of a typical standard induction motor based on I_L or I_H at 460 V 3 AC 60 Hz.

[3] The specified power loss is the maximum value at 100% capacity utilization. In normal operation a lower value is established.

[4] This value applies to the water coolant option; for other coolant types, see Chapter "Cooling circuit and coolant properties".

[5] To achieve a UL-approved system, it is absolutely essential to use the fuse types specified in the table.

3.7.1 Overload capability

The Power Modules are equipped with an overload reserve e.g. to handle breakaway torques.

In the case of drives with overload requirements, the appropriate base-load current must, therefore, be used as a basis for the required load.

The criterion for overload is that the Power Module is operated with its base load current before and after the overload occurs (a load duration of 300 s is used as a basis here).

Low overload

The base load current for low overload (I_L) is based on a load duty cycle of 110 % for 60 s or 150 % for 10 s.

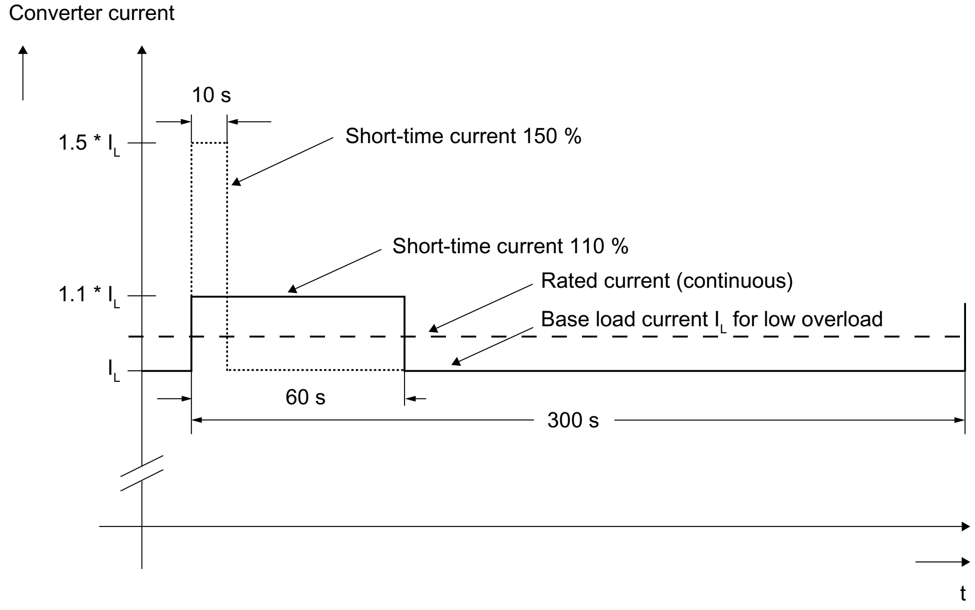


Figure 3-9 Low overload

High overload

The base load current for a high overload I_H is based on a duty cycle of 150 % for 60 s or 160 % for 10 s.

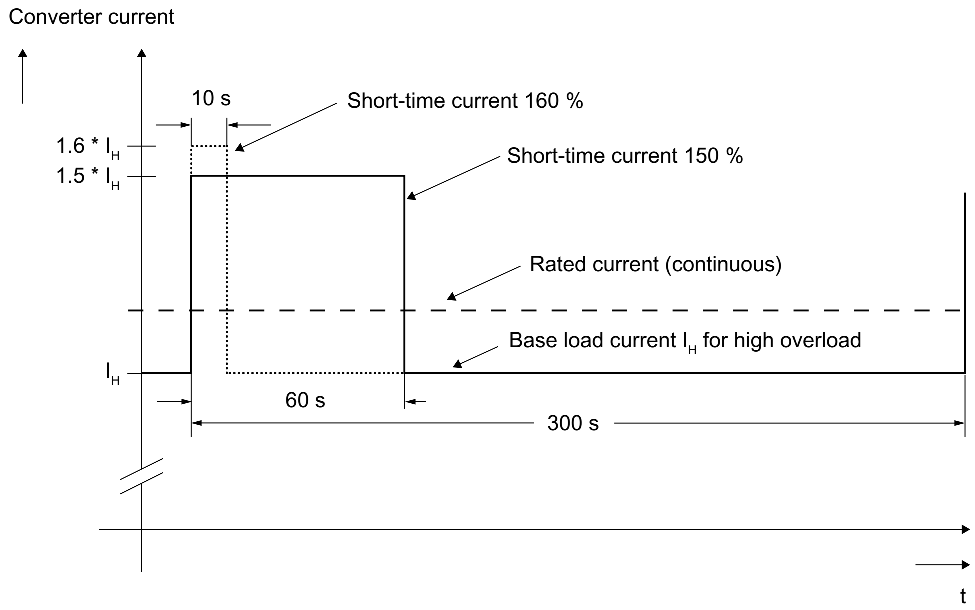


Figure 3-10 High overload

3.7.2 Derating factors as a function of coolant temperature

SINAMICS S120 Liquid Cooled units are designed for cooling by H_2O or by an H_2O Antifrogen N mixture. An H_2O Antifrogen N mixture must contain between 20 % and 45 % Antifrogen N.

When H_2O is used as a coolant, the units can supply 100 % output current at temperatures between 5 °C and 45 °C. The maximum output current decreases linearly to 90 % at temperatures between 45 °C and 50 °C.

When H_2O Antifrogen N mixture described above is used as a coolant, the units can supply 100 % output current at temperatures between 0 °C and 45 °C. The maximum output current decreases linearly to 90 % at temperatures between 45 °C and 50 °C.

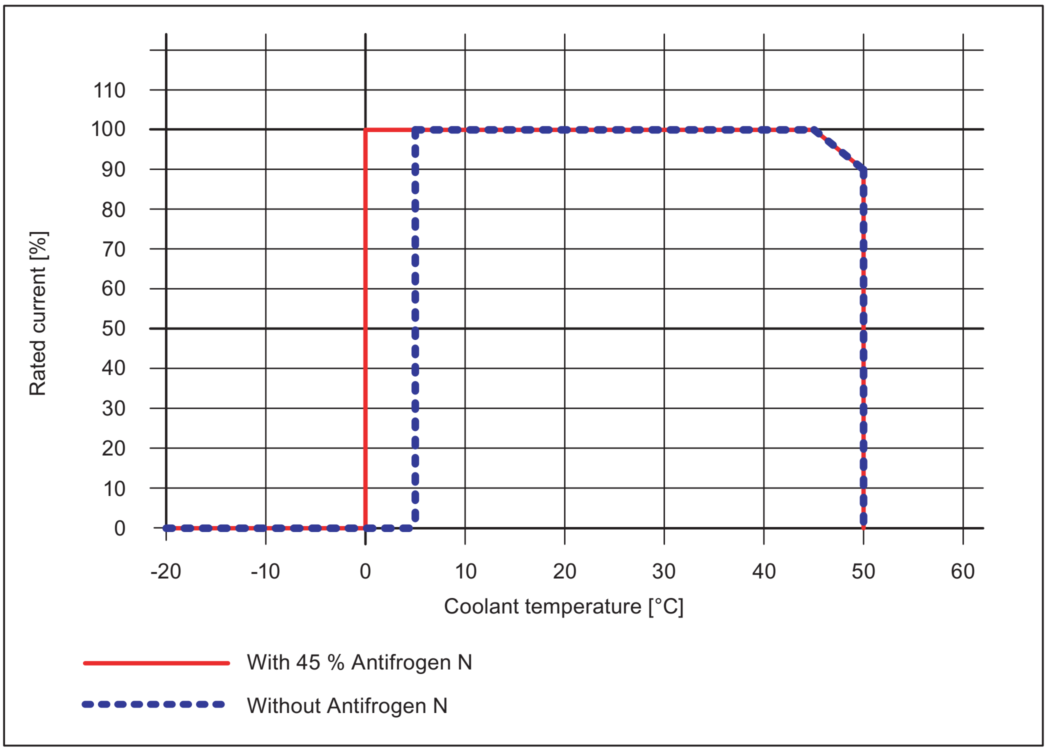


Figure 3-11 Maximum output current as a function of coolant temperature

3.7.3 Derating factors as a function of the ambient temperature

The units can supply 100 % output current at an ambient air temperature of between 0 °C and 45 °C. The maximum output current decreases linearly to 90 % at ambient air temperatures of between 45 °C and 50 °C.

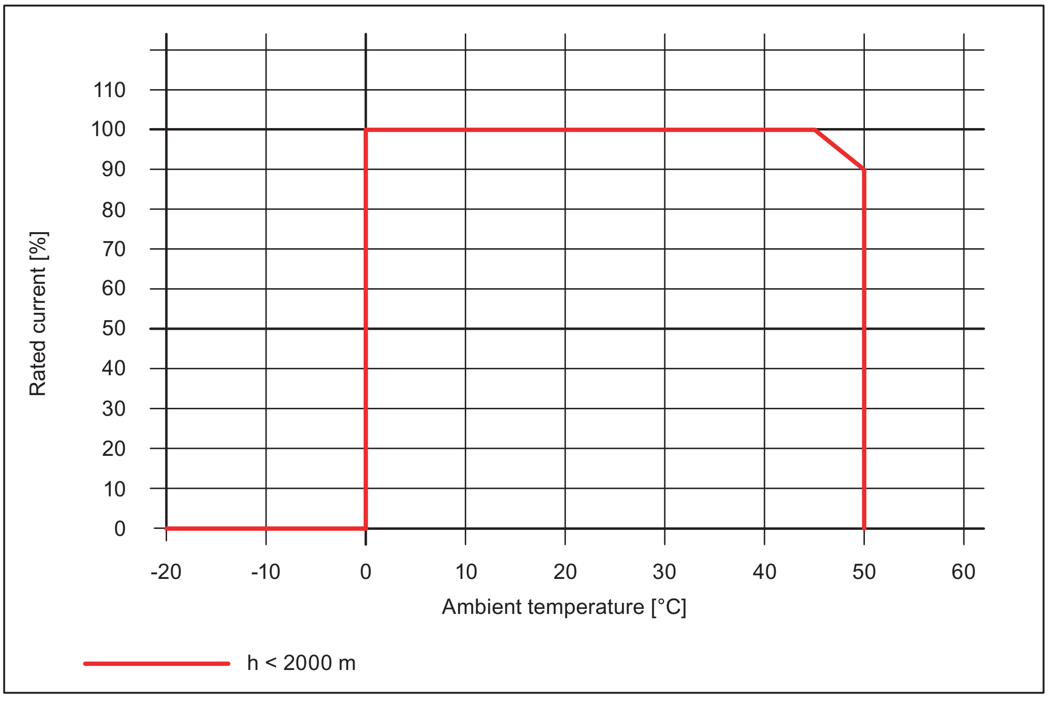


Figure 3-12 Maximum current as a function of ambient temperature

3.7.4 Derating factors as a function of installation altitude

When the units are operated at an installation altitude with reduced air pressure, the derating characteristic shown below applies to the output current or the ambient air temperature.

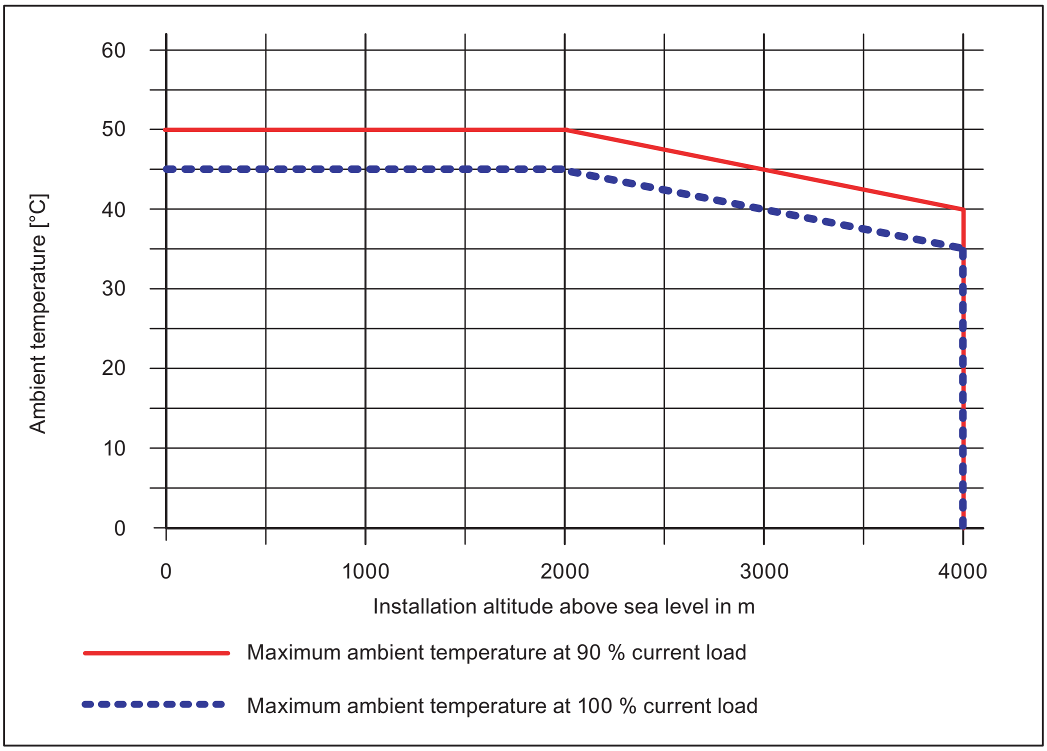


Figure 3-13 Maximum ambient temperature as a function of installation altitude

At installation altitudes above 2000 m (6562 ft), the line voltage must not exceed certain limits to ensure that surge voltages can be insulated in accordance with IEC 61800-5-1 for surge voltage category III. If the line voltage is higher than this limit at installation altitudes > 2000 m (6562 ft), measures must be taken to reduce transient category III surge voltages to category II values, e.g. equipment must be supplied via an isolating transformer.

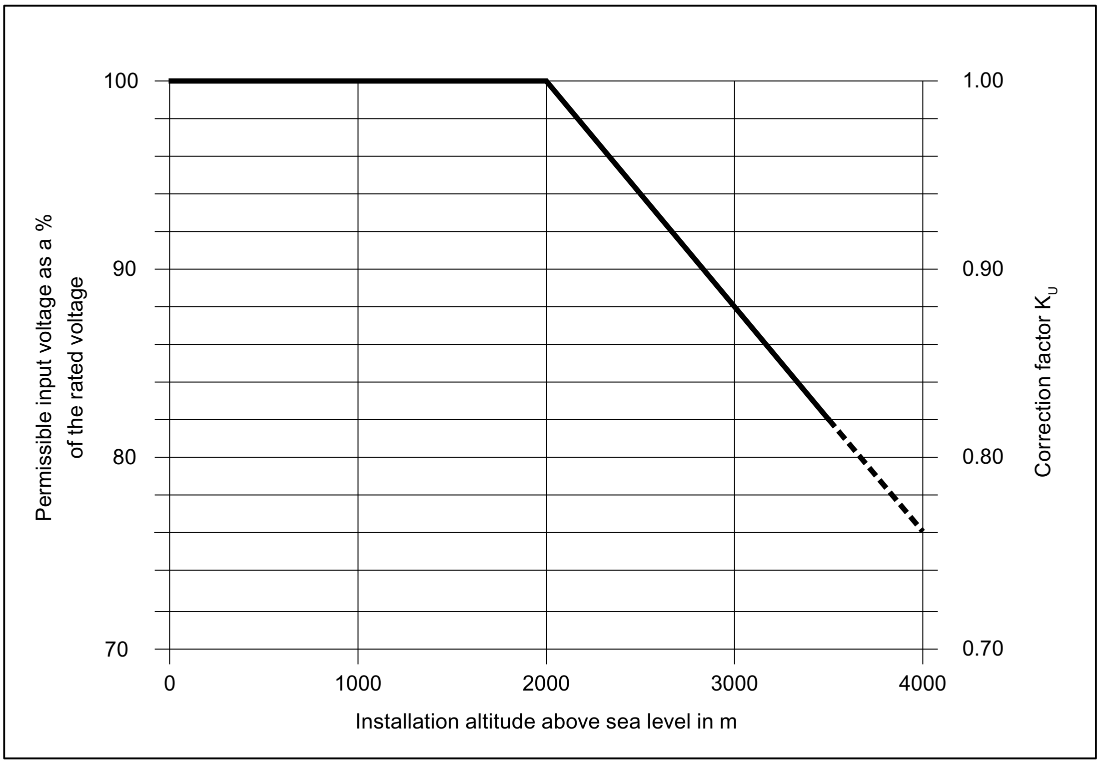


Figure 3-14 Voltage correction factor K_T as a function of the installation altitude

---

Note

Refer to the maximum line voltage under "Connection voltages" in the technical data for details of the rated voltage.

Note

The dashed line represents a theoretical characteristic of the correction factor. The devices have an undervoltage threshold, which leads to shutdown when the voltage drops below it. Consequently, the input voltage range that is actually usable has a lower limit.

3.7.5 Current derating as a function of the pulse frequency

When the pulse frequency is increased, the derating factor of the output current must be taken into account.

This derating factor must be applied to the currents specified in the technical specifications.

Table 3- 12 Derating factor of the output current as a function of the pulse frequency

Order number 6SL3315-...	Unit rating [kW]	Output current for a pulse frequency of 2 kHz [A]	Derating factor for a pulse frequency of 4 kHz
1TE32-1AAx	110	210	82 %
1TE32-6AAx	132	260	83 %
1TE33-1AAx	160	310	88 %
1TE35-0AAx	250	490	78 %

Note

For pulse frequencies in the range between the specified fixed values, the relevant derating factors can be determined by linear interpolation.

Maximum output frequencies achieved by increasing the pulse frequency

By multiplying the rated pulse frequency with a multiple integer, the following output frequencies can be achieved taking into account the derating factors:

Table 3- 13 Maximum output frequencies achieved by increasing the pulse frequency in VECTOR mode

Pulse frequency [kHz]	Maximum output frequency [Hz]
2	160
4	320

Table 3- 14 Maximum output frequencies achieved by increasing the pulse frequency in SERVO mode

Pulse frequency [kHz]	Maximum output frequency [Hz]
2	300
4	300 / 650 [1)]

[1)] The maximum output frequency of 650 Hz is can only be achieved for a current controller clock cycle of 125 µs (factory setting: 250 µs).

4 Line Modules

4.1 Introduction

The drive line-up is connected to the power supply network via the Line Modules.

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

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

General characteristics of the Line Modules

- Supply voltage:
  - 3 AC 380 V –10 % (-15 % < 1 min) to 3 AC 480 V +10 % (47 to 63 Hz)
  - 3 AC 500 V –10 % (-15 % < 1 min) to 3 AC 690 V +10 % (47 to 63 Hz)
- Suitable for TN, TT, and IT supply systems
- Operating status and error status via LEDs

4.2 Basic Line Modules

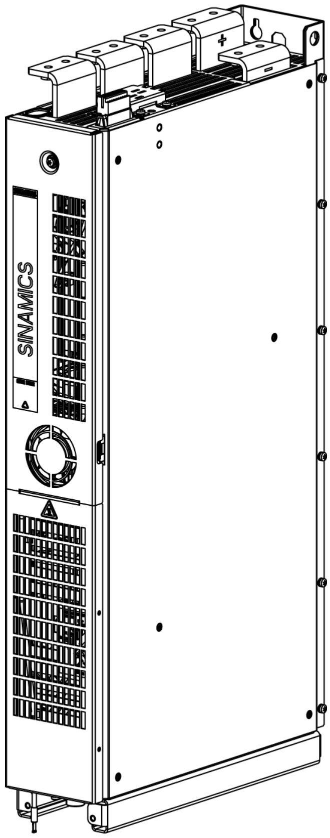
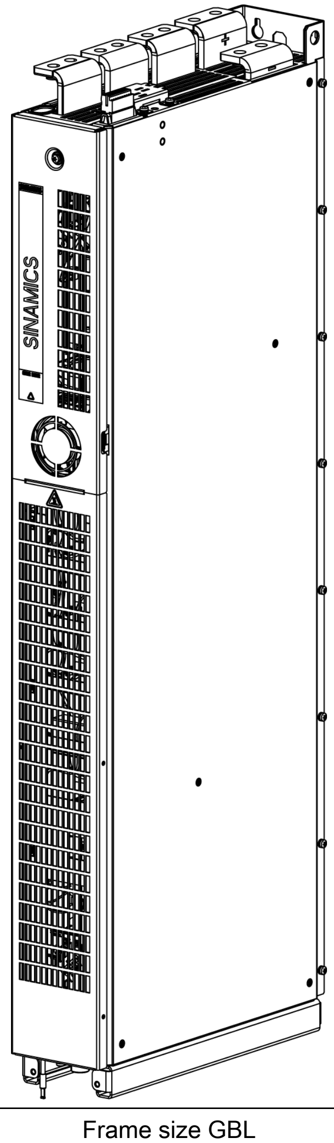
4.2.1 Description

Basic Line Modules are used for the power infeed into the DC link.

They are suitable for applications in which no regenerative energy is produced, or in which the energy exchange takes place between the motor- and the generator-driven axes in the DC link.

The DC link voltage is greater than the rms value of the line rated voltage by a factor of 1.35 (under partial load) or 1.32 (under full load).

Table 4- 1 Overview of Basic Line Modules

	
Frame size FBL	Frame size GBL

Operating principle

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

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

The volumetric flow of the coolant is monitored by the software. If the volumetric flow is continuously lower than the setpoint, an alarm (A5005) is first displayed. If this alarm remains active continually for the next 5 minutes, a fault message (F30047) is activated which shuts down the unit.

The fans for the internal electronic circuitry are only switched on when required.

The fans are switched on and off as a function of several factors (e.g. heat sink temperature, ambient temperature, output current, duty cycle, ...) which means that fan operating cycles cannot be calculated directly.

An external 24 VDC supply is required to operate liquid-cooled Basic Line Modules.

Parallel connection of Basic Line Modules to increase power rating

Up to four Basic Line Modules with the same power rating can be connected in parallel in order to increase power.

The following rules must be observed when connecting Basic Line Modules in parallel:

- Up to 4 identical Basic Line Modules can be connected in parallel.
- A common Control Unit is required whenever the modules are connected in parallel.
- With multiple infeeds, power must be supplied to the systems from a common infeed point (i.e. different supply systems are not permitted).
- A line reactor must be series-connected to every parallel-connected Basic Line Module.
- A derating factor of 7.5 % must be taken into consideration, regardless of the number of modules connected in parallel.

Note

It is only possible to connect identical power units in parallel if both power units have the same hardware version. Mixed operation between a power unit with Control Interface Module (order number 6SL33xx-xxxxx–xAA3) and a power unit with Control Interface Board (order number 6SL33xx-xxxxx–xAA0) is not possible.

4.2.2 Safety information

⚠ WARNING
A hazardous voltage will be present in the component for a further 5 minutes after all voltage supplies have been disconnected. Work cannot be carried out until this time has elapsed. Before starting work, you should also measure the voltage after the 5 minutes have elapsed. The voltage can be measured on DC link terminals DCP and DCN.

⚠ CAUTION
The DC link discharge time hazard warning must be affixed to the component in the relevant local language.

NOTICE
The cooling clearances above, below, and in front of the component, which are specified in the dimension drawings, must be observed.

CAUTION
The busbars and coolant connections which stick out of the module must never be used as handles or support surfaces when the units are transported.

⚠ DANGER
Basic Line Modules discharge a high leakage current to the protective ground conductor. Due to the high leakage current associated with Basic Line Modules, they or the relevant control cabinet must be permanently connected to PE. According to EN 61800-5-1, Section. 6.3.6.7, the minimum cross-section of the protective ground conductor must conform to the local safety regulations for protective ground conductors for equipment with a high leakage current.

4.2.3 Interface description

4.2.3.1 Overview

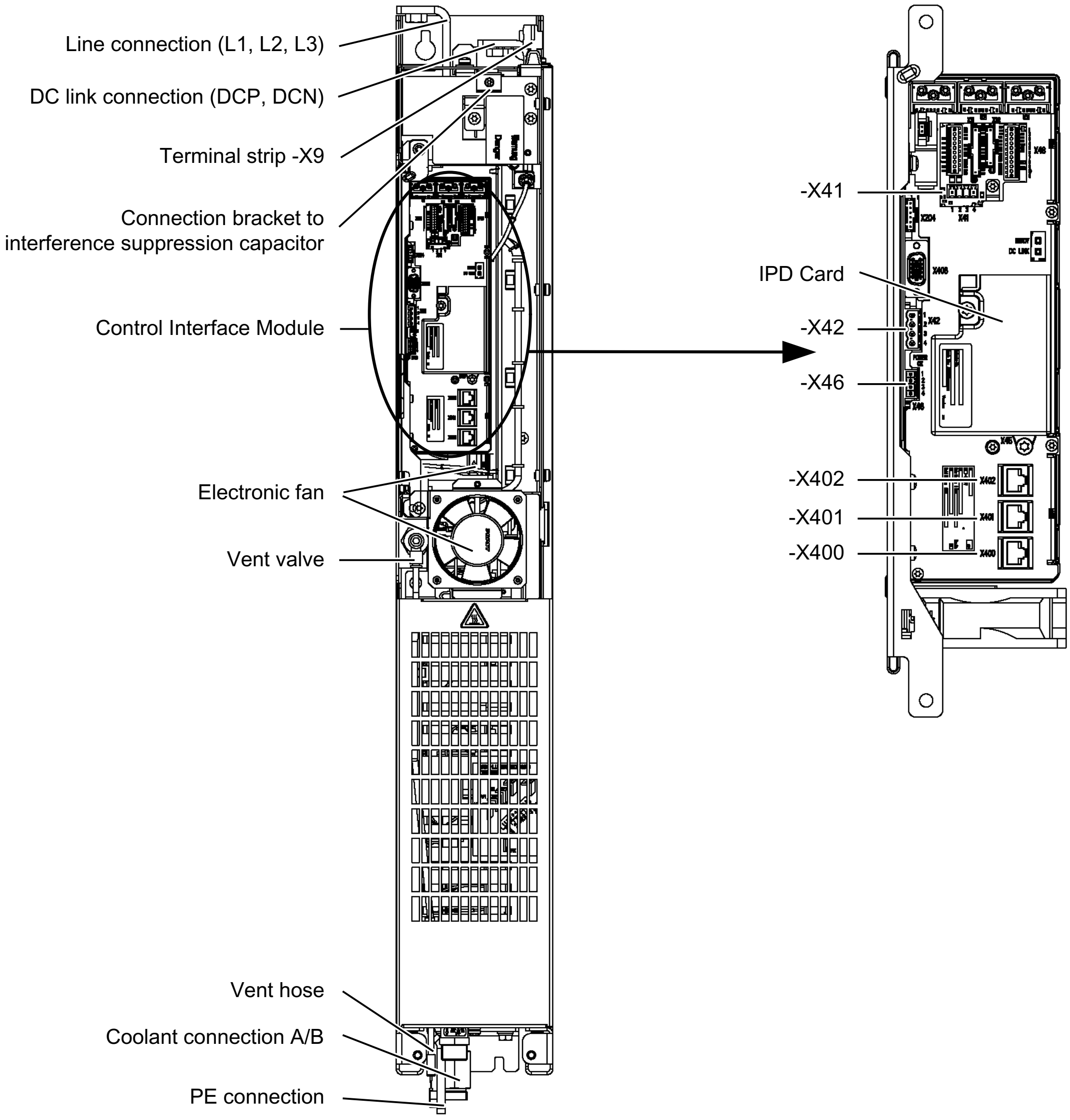


Figure 4-1 Basic Line Module, frame size FBL

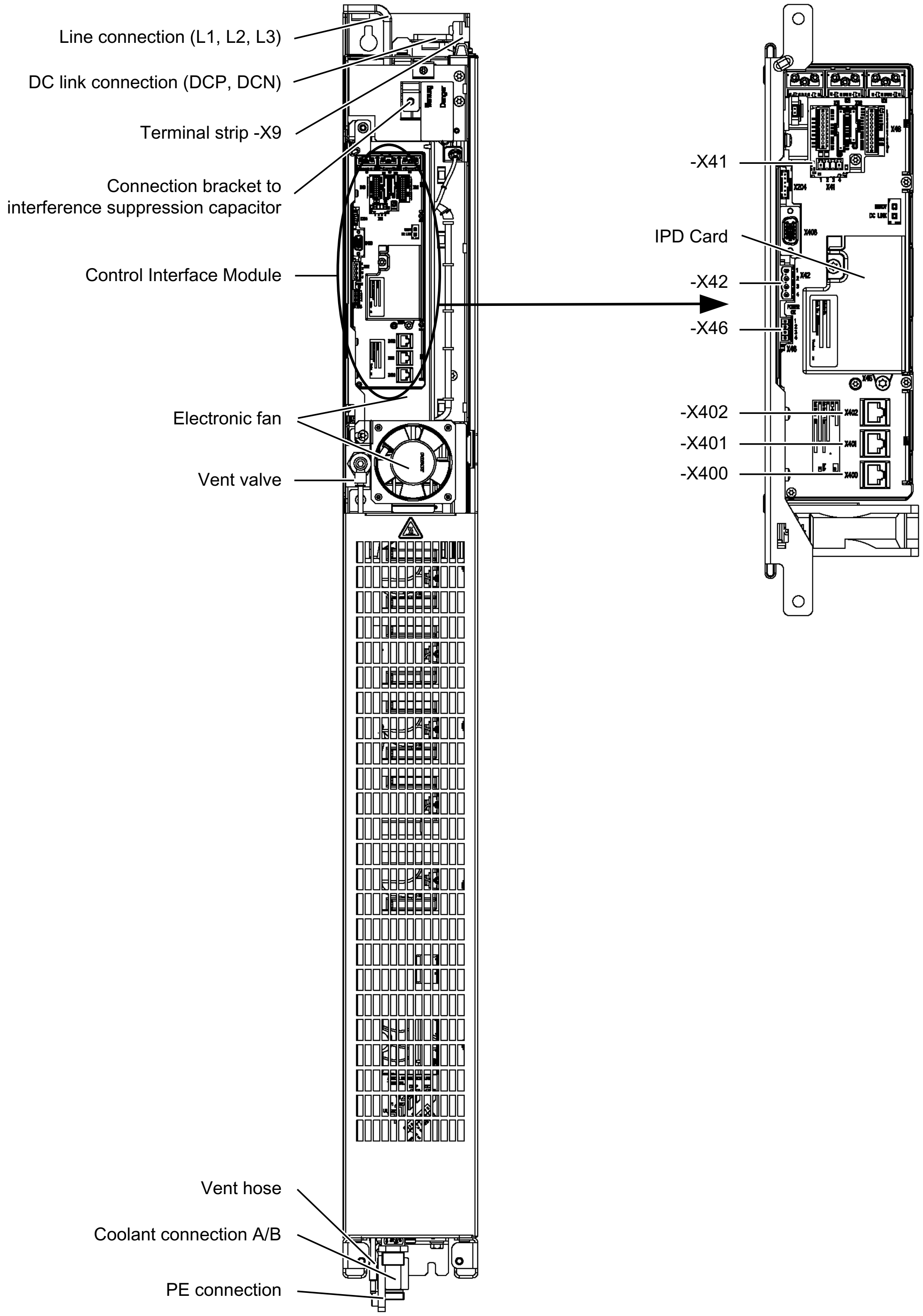


Figure 4-2 Basic Line Module, frame size GBL

4.2.3.2 Connection example

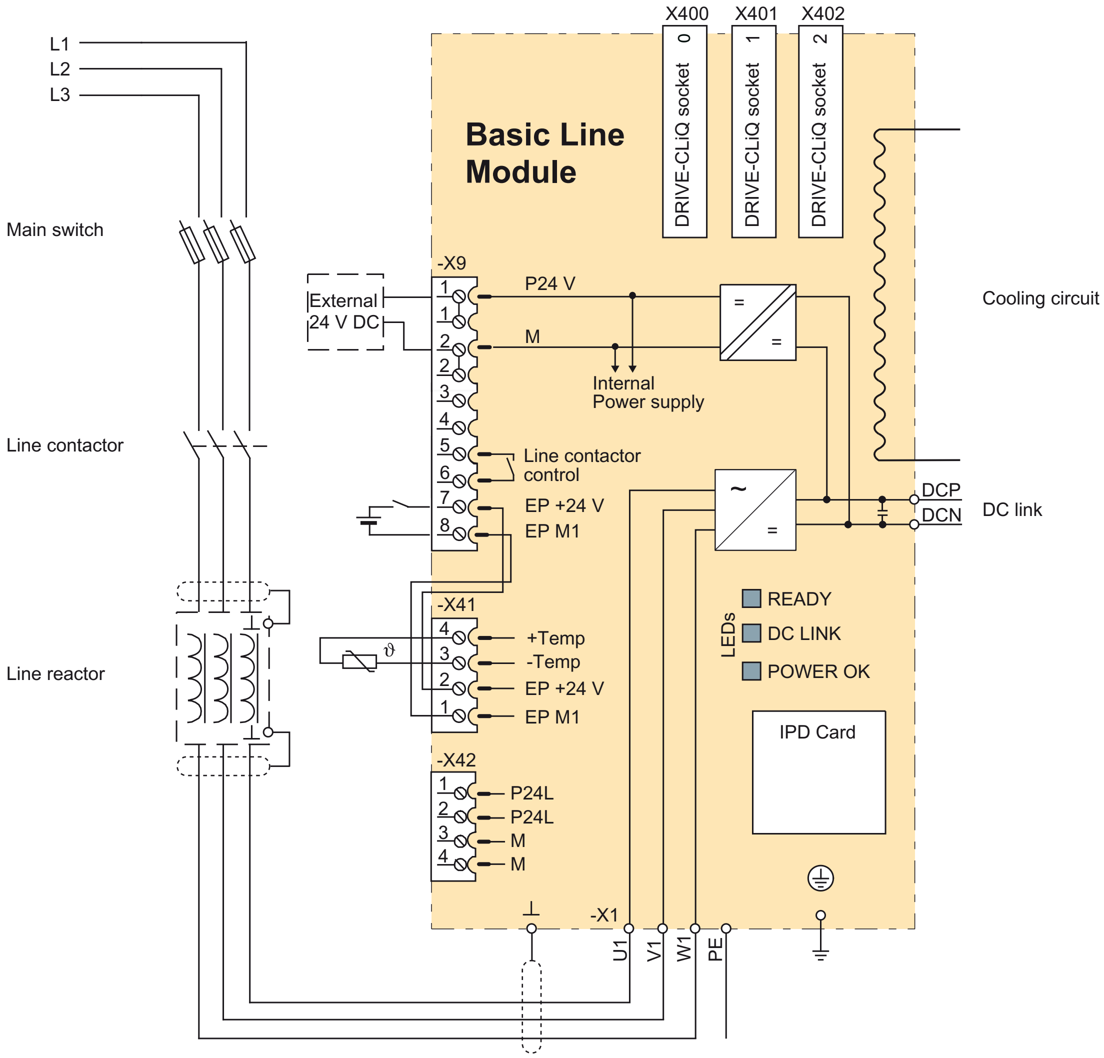


Figure 4-3 Connection example for Basic Line Modules

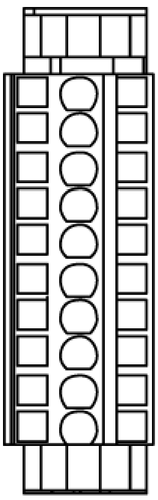
4.2.3.3 Line/load connection

Table 4- 2 Line/load connection of the Basic Line Module

Terminals	Technical specifications
U1, V1, W1 3 AC power input	Voltage: • 3 AC 380 V -10 % (-15 % < 1 min) to 3 AC 480 V +10 % • 3 AC 500 V -10 % (-15 % < 1 min) to 3 AC 690 V +10 % Frequency: 47 Hz to 63 Hz Connecting thread: M12/50 Nm for busbar connection
DCP, DCN DC power output	Voltage: • 513 V to 648 V DC • 675 to 932 VDC Connecting thread: M12/50 Nm for busbar connection
PE connection	Connecting thread: M12/50 Nm for busbar connection

4.2.3.4 X9 terminal strip

Table 4- 3 Terminal strip X9

	Terminal	Signal name	Technical specifications
	1	P24 V	Voltage: 24 V DC (20.4 V – 28.8 V) Power consumption: See Technical data
	1	P24 V	
	2	M	
	2	M	
	3	Reserved, do not use	
	4		
	5	Main contactor control	240 V AC: max. 8 A 30 V DC: max. 1 A isolated
	6		
	7	EP +24 V (Enable Pulses)	Supply voltage: 24 V DC (20.4 V - 28.8 V) Power consumption: 10 mA
	8	EP M1 (Enable Pulses)	
Max. connectable cross-section 1.5 mm²			

Note

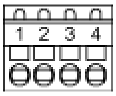
For operation, 24 V DC must be connected to terminal 7 and ground to terminal 8. Pulse suppression is activated when terminals are disconnected.

Note

The two "P24 V" or "M" terminals are jumpered in the connector. This ensures that the supply voltage is looped through, even when the connector is removed.

4.2.3.5 X41 EP terminal / temperature sensor connection

Table 4- 4 Terminal strip X41

	Terminal	Function	Technical specifications
	1	EP M1 (Enable Pulses)	Connected to terminal -X9:8
	2	EP +24 V (Enable Pulses)	Connected to terminal -X9:7
	3	- Temp	Temperature sensor connection KTY84-1C130 / PTC
	4	+ Temp	
Max. connectable cross-section 1.5 mm^2			

Note

A cable harness is used to connect terminals -X41:1 and -X41:2 to terminals -X9:8 and -X9:7.

⚠ DANGER

Risk of electric shock!

Only temperature sensors that meet the safety isolation specifications contained in EN 61800-5-1 may be connected to terminals "+Temp" and "-Temp". If safe electrical separation cannot be guaranteed (for linear motors or third-party motors, for example), a Sensor Module External (SME120 or SME125) must be used.

If these instructions are not complied with, there is a risk of electric shock!

Note

The following probes can be connected to the temperature sensor connection: KTY84-1C130 / PTC.

CAUTION

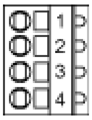
The temperature sensor connection must be shielded. The shielding must be attached to the shield support of the module.

NOTICE

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

4.2.3.6 X42 terminal strip

Table 4- 5 Terminal strip X42 voltage supply for Control Unit, Sensor Module and Terminal Module

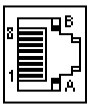
	Terminal	Function	Technical specifications
	1	P24L	Voltage supply for Control Unit, Sensor Module and Terminal Module (18 to 28.8 V) maximum load current: 3 A
	2		
	3	M	
	4		
Max. connectable cross-section 2.5 mm^2			

CAUTION

The terminal strip is not intended for free 24 V DC availability (for example for supplying further line-side components), as the voltage supply of the Control Interface Module could also be overloaded and operating capability could thus be compromised.

4.2.3.7 DRIVE-CLiQ interfaces X400, X401, X402

Table 4- 6 DRIVE-CLiQ interfaces X400, X401, X402

	PIN	Signal name	Technical specifications
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	24 V power supply
	B	M (0 V)	Electronics ground
Blanking plate for DRIVE-CLiQ interfaces (50 pcs.) order number: 6SL3066-4CA00-0AA0			

4.2.3.8 Cooling circuit connections

Table 4- 7 Cooling circuit connections

Connection	Technical data
Coolant connection A: Inlet	Pipe thread ISO 228 - G 3/4 B (external thread 3/4", flat-sealing)
Coolant connection B: Return flow	
Tightening torque	60 Nm

Note

The seals for the screwed connections can be used only once when the cooling circuit is first assembled. The seals must be replaced if the circuit is disassembled and assembled again.

A replacement seal is commercially available under the name Viton flat gasket 3/4".

4.2.3.9 Meaning of the LEDs on the Control Interface Module in the Basic Line Module

Table 4- 8 Meaning of the LEDs "READY" and "DC LINK" on the Control Interface Module in the Basic Line Module

LED state		Description
READY	**DC LINK**	
Off	Off	The electronics power supply is missing or out of tolerance.
Green	Off	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is present.
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is too high.
Orange	Orange	DRIVE-CLiQ communication is being established.
Red	---	At least one fault is present in this component. Note: LED is driven irrespective of the corresponding messages being reconfigured.
Flashing light 0.5 Hz: Green / red	---	Firmware is being downloaded.
2 Hz flashing: Green / red	---	Firmware download is complete. Waiting for POWER ON.
2 Hz flashing: Green / orange or red / orange	---	Component detection using LED is activated (p0124) Note: The two options depend on the LED status when module recognition is activated via p0124 = 1.

Table 4- 9 Meaning of the LED "POWER OK" on the Control Interface Module in the Basic Line Module

LED	Color	Status	Description
POWER OK	Green	Off	DC link voltage < 100 V and voltage at -X9:1/2 less than 12 V.
		On	The component is ready for operation.
		Flashing light	There is a fault. If the LED continues to flash after you have performed a POWER ON, please contact your Siemens service center.

⚠ WARNING

Irrespective of the state of the LED "DC LINK", hazardous DC link voltages can always be present.

The warning information on the component must be carefully observed!

4.2.4 Dimension drawing

Dimension drawing, frame size FBL

The mandatory cooling clearances are indicated by the dotted line.

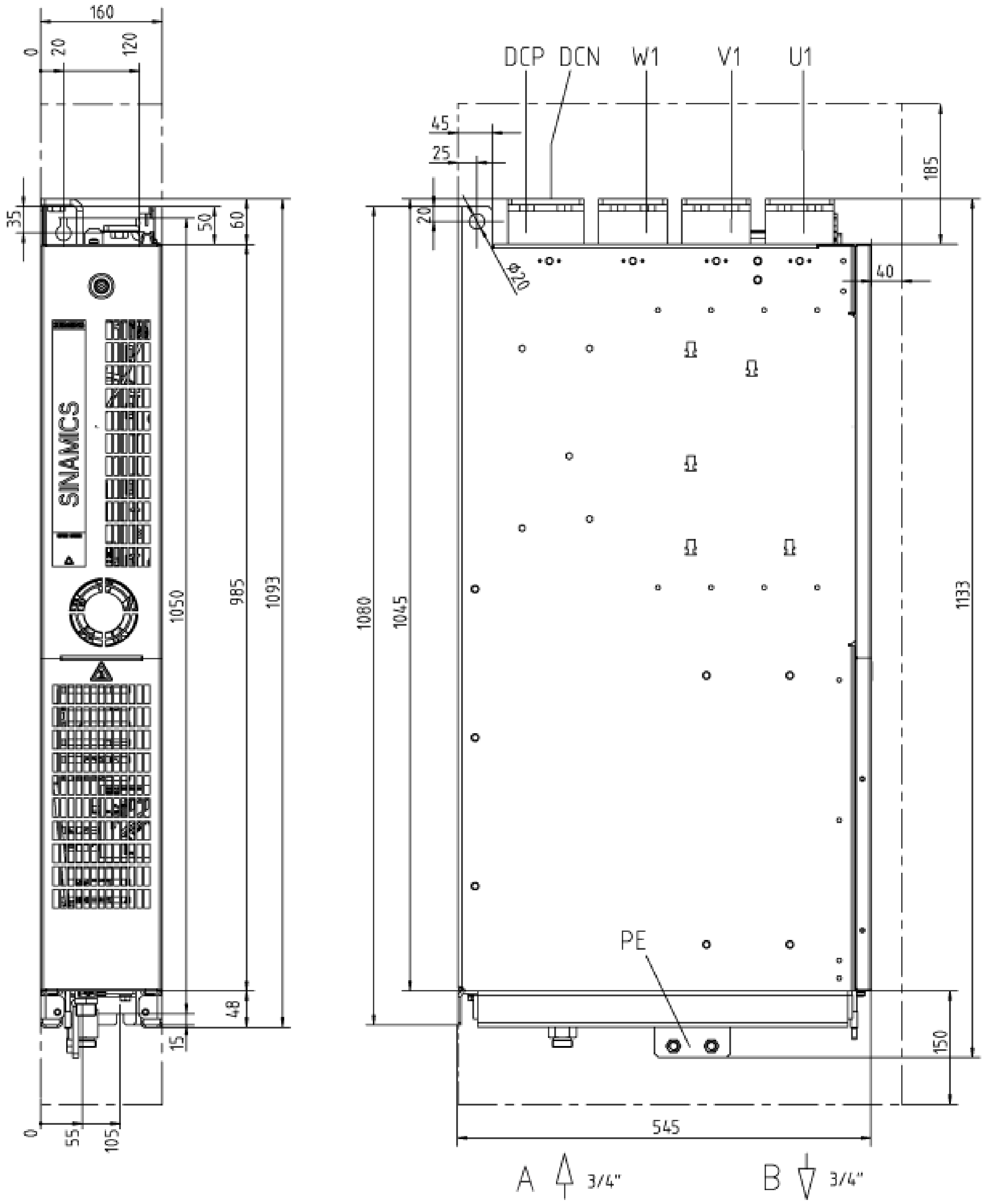


Figure 4-4 Dimension drawing, Basic Line Module, frame size GBL. Front view, side view

Dimension drawing, frame size GBL

The mandatory cooling clearances are indicated by the dotted line.

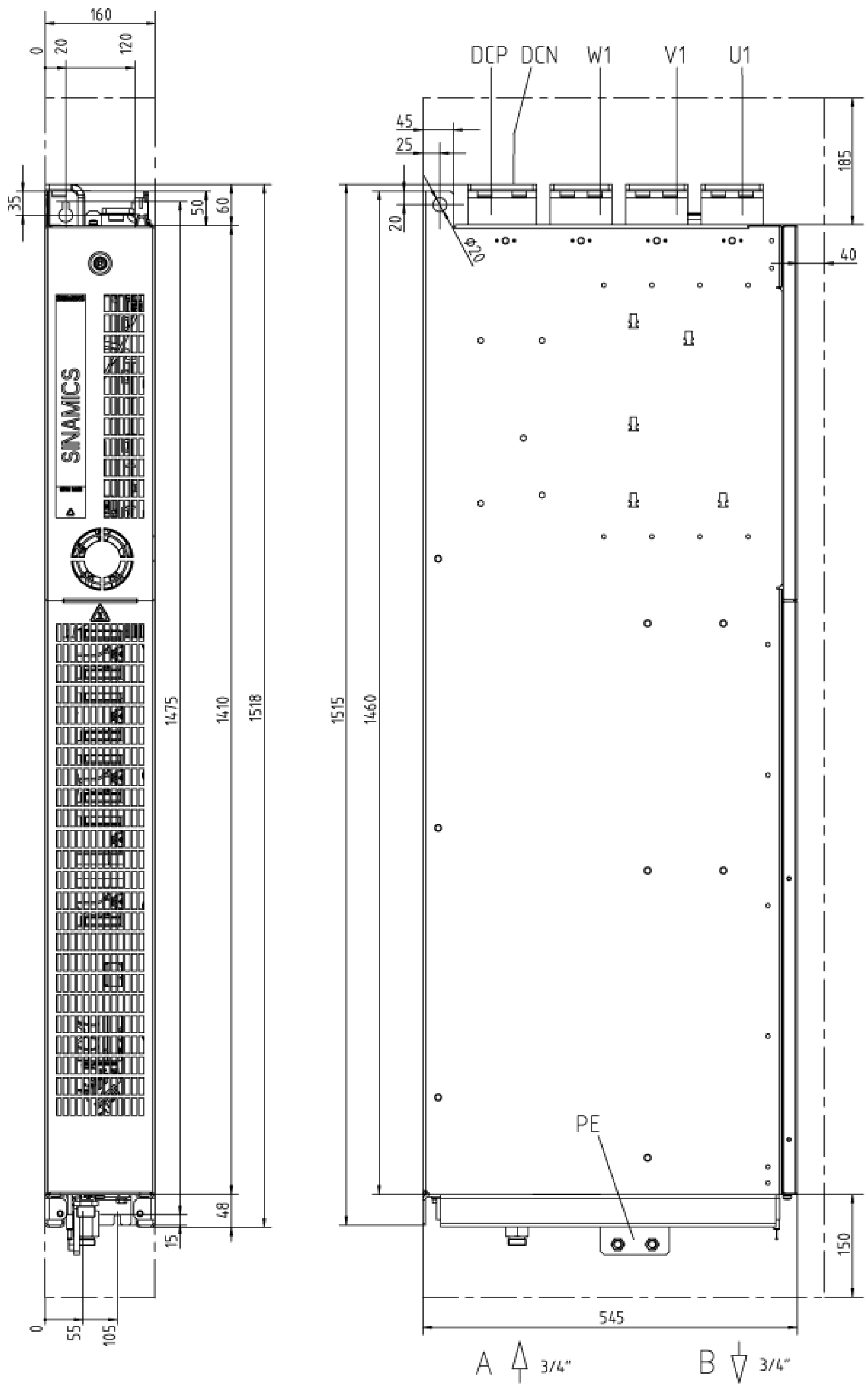


Figure 4-5 Dimension drawing, Basic Line Module, frame size GBL. Front view, side view

4.2.5 Installation

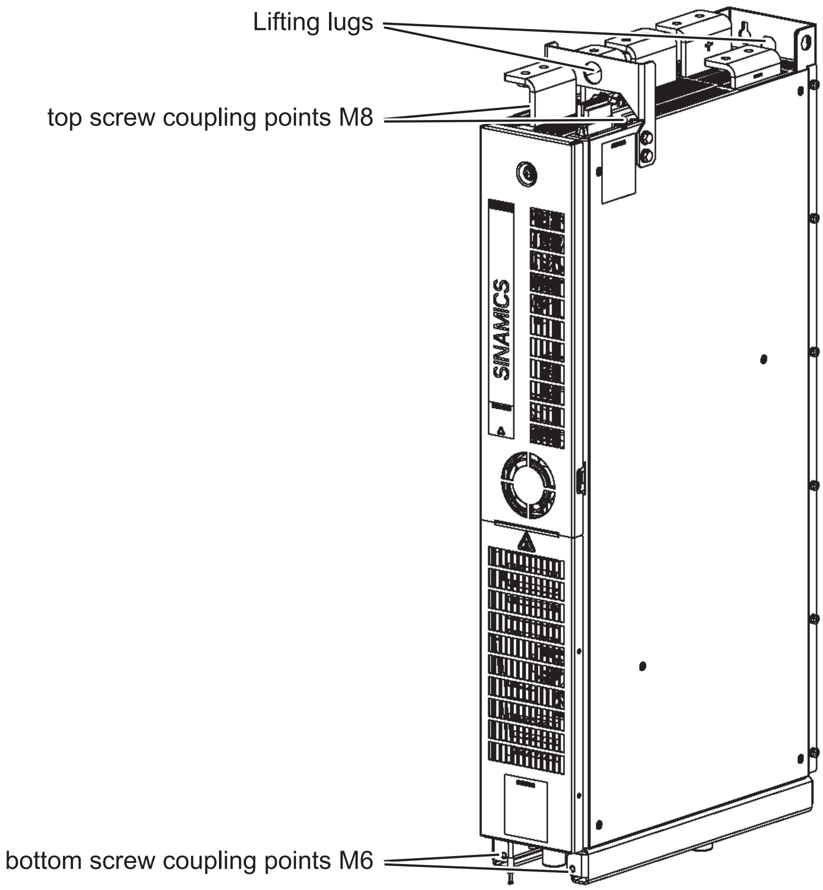


Figure 4-6 Lifting lugs / screw coupling points for mechanical support

Lifting lugs

Basic Line Modules are fitted with lifting lugs as standard when shipped. The units can be lifted from these lugs by a crane and transported from the pallet to the installation location.

⚠ WARNING
A lifting harness with vertical ropes or chains must be used to prevent any risk of damage to the housing. Once the Basic Line Modules have been installed, the lifting lugs to the front of the units must be removed. The lugs should be safely stored for future use.

Screw coupling points for mechanical support

Since the Basic Line Modules are housed in a very slim enclosure, they need to be mechanically supported against lateral movement and vibration if they are installed in a control cabinet. Screw coupling points are provided on the top and bottom of the units for this purpose.

If several modules are mounted adjacent to one another, they can be interconnected via the screw coupling points. When a single module is installed, lateral support can be provided by means of reinforcing plates inserted between the module and the cabinet.

Protection guard

A protection guard is mounted on the bottom of the Basic Line Module ("1" in the diagram below) for use during transportation. The Basic Line Module can be rested on this protection guard while it is removed from the packaging and during transportation.
Before the module is installed at its final location, this guard must be removed. To do this, remove the 4 screws ("2" in the diagram) and remove the guard.

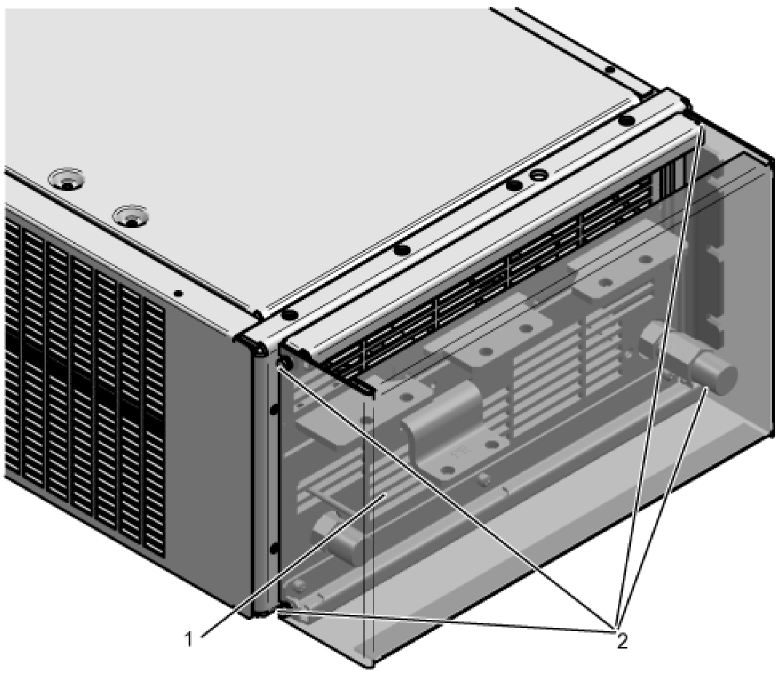


Figure 4-7 Protection guard

4.2.6 Electrical connection

Operating a Basic Line Module from a non-grounded network (IT system)

When the device is operated from a non-grounded system/IT system, the connection bracket for the interference-suppression capacitor must be removed.

To do so, loosen the two screws ("1" in the figure below) and pull the connection bracket towards you out of the device.

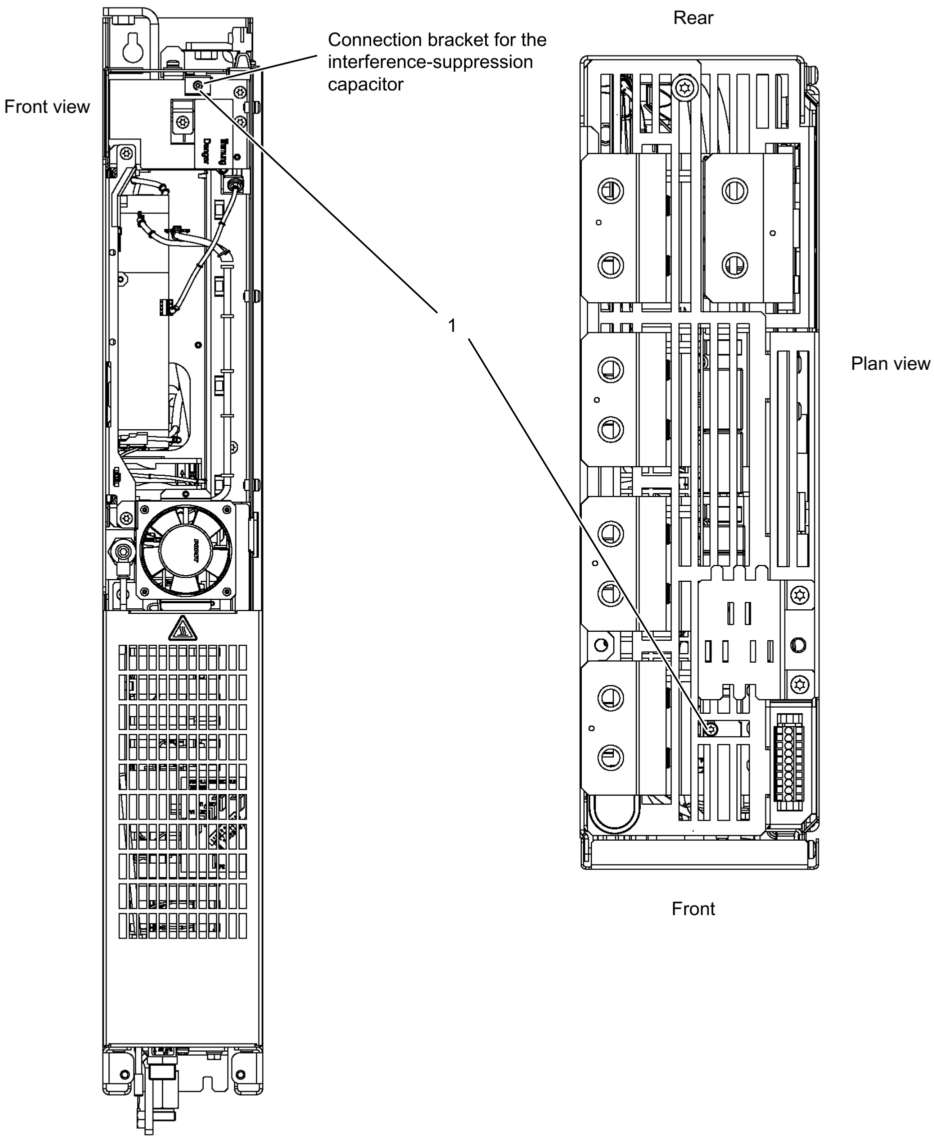


Figure 4-8 Removing the connection bracket for the interference-suppression capacitor

⚠ WARNING
Failing to remove the connection bracket for the noise suppression capacitor on a non-grounded system/IT system can cause significant damage to the unit.

4.2.7 Technical specifications

Table 4- 10 Technical data for Basic Line Modules, 3 AC 380 V – 480 V

Order number	6SL3335–	1TE37–4AA3	1TE41–2AA3	1TE41–7AA3	
Rated output - for $I_{L\ DC}$ (50 Hz 400 V) - for $I_{H\ DC}$ (50 Hz 400 V) - for $I_{L\ DC}$ (60 Hz 460 V) - for $I_{H\ DC}$ (60 Hz 460 V)	 kW kW hp hp	 360 280 555 430	 600 450 925 69	 830 650 1280 1000	
DC link current - Rated current $I_{N\ DC}$ - Rated current $I_{L\ DC}$ - Base load current $I_{H\ DC}$ - Maximum current $I_{max\ DC}$ 1)	 A A A A	 740 710 578 1110	 1220 1171 936 1830	 1730 1660 1350 2595	
Input current - Rated current $I_{N\ E}$ - Maximum current $I_{max\ E}$	 A A	 610 915	 1000 1500	 1420 2130	
Supply voltages - Line voltage - Line frequency - Electronic power supply - Fan supply voltage - DC link voltage	 V_{ACrms} Hz V_{DC} V_{AC} V_{DC}	 3 AC 380 -10 % (-15 % < 1 min) to 3 AC 480 +10 % 47 to 63 Hz 24 (20.4 – 28.8) 230 (195.5 – 264.5) 1.35 x U_{line} (partial load) / 1.32 x U_{line} (full load)			
Electronic power consumption (24 V DC)	A	0,7	0,7	0,7	
Cooling method		Liquid cooling with integrated aluminum heat exchanger			
Power loss, max. 2) - at 50 Hz 400 V - at 60 Hz 460 V	 kW kW	 2.95 2.95	 4.77 4.77	 6.39 6.39	
Max. coolant temperature - Without derating - With derating	 °C °C	 45 50	 45 50	 45 50	
Rated volumetric flow for water at 70 kPa pressure drop 3)	l/min	9	9	12	
Liquid volume of integrated heat exchanger	dm³	0.45	0.45	0.79	
DC link capacitance - Basic Line Module - Drive line-up, max.	 µF µF	 12000 96000	 20300 162400	 26100 208800	
Sound pressure level L_{pA} (1 m) at 50/60 Hz	 dB(A)	 54	 56	 56	
Line/load connection		Flat connector for M12 screw			
Max. connection cross-sections - Line connection (U1, V1, W1) - DC link connection (DCP, DCN) - PE connection	 mm² mm² mm²	 Busbar Busbar Busbar	 Busbar Busbar Busbar	 Busbar Busbar Busbar	

Order number	6SL3335–	1TE37–4AA3	1TE41–2AA3	1TE41–7AA3	
Max. cable length (total of all motor cables and DC link) - shielded - unshielded	 m m	 2600 3900	 4000 6000	 4800 7200	
Degree of protection		IP00	IP00	IP00	
Dimensions - Width - Height - Depth	 mm mm mm	 160 1137 545	 160 1137 545	 160 1562 545	
Frame size		FBL	FBL	GBL	
Weight	kg	108	108	185	
UL listed fuse [4)] - Number (connected in parallel) - Rated current - Frame size acc. to IEC 60269	 A 	3NE1333-2 2 450 2	3NE1435-2 2 560 3	3NE1438-2 2 800 3	

[1)] Valid for a 5 s duty cycle (overload duration) and a duty cycle duration of 300 s based on the base load DC link current I_{H_DC}.

[2)] The specified power loss is the maximum value at 100% capacity utilization. In normal operation a lower value is established.

[3)] This value applies to the water coolant option; for other coolant types, see Chapter "Cooling circuit and coolant properties".

[4)] To achieve a UL-approved system, it is absolutely essential to use the fuse types specified in the table.

Table 4- 11 Technical data for Basic Line Modules, 3 AC 500 V – 690 V

Order number	6SL3335–	1TG34–2AA3	1TG37–3AA3	1TG41–3AA3	1TG41–7AA3
Input power					
- for $I_{L\,DC}$ (50 Hz 690 V)	kW	355	630	1100	1370
- for $I_{H\,DC}$ (50 Hz 690 V)	kW	275	475	840	1070
- for $I_{L\,DC}$ (50 Hz 500 V)	kW	245	420	750	950
- for $I_{H\,DC}$ (50 Hz 500 V)	kW	200	345	610	775
- for $I_{L\,DC}$ (60 Hz 575 V)	hp	395	705	1230	1530
- for $I_{H\,DC}$ (60 Hz 575 V)	hp	305	530	940	1195
DC link current					
- Rated current $I_{N\,DC}$	A	420	730	1300	1650
- Rated current $I_{L\,DC}$	A	403	700	1248	1584
- Base load current $I_{H\,DC}$	A	328	570	1014	1287
- Maximum current $I_{max\,DC}$ 1)	A	630	1095	1950	2475
Input current					
- Rated current $I_{N\,E}$	A	340	600	1070	1350
- Maximum current $I_{max\,E}$	A	510	900	1605	2025
Supply voltages					
- Line voltage	V_{ACrms}	3 AC 500 -10 % (-15 % < 1 min) to 3 AC 690 +10 %			
- Line frequency	Hz	47 to 63 Hz			
- Electronic power supply	V_{DC}	24 (20.4 – 28.8)			
- Fan supply voltage	V_{AC}	230 (195.5 – 264.5)			
- DC link voltage	V_{DC}	1.35 x U_{line} (partial load) / 1.32 x U_{line} (full load)			
Electronic power consumption (24 V DC)	A	0,7	0,7	0,7	0,7
Cooling method		Liquid cooling with integrated aluminum heat exchanger			
Power loss, max. 2)					
- at 50 Hz 690 V	kW	1.76	3.09	5.09	6.25
- at 60 Hz 575 V	kW	1.76	3.09	5.09	6.25
Max. coolant temperature					
- Without derating	°C	45	45	45	45
- With derating	°C	50	50	50	50
Rated volumetric flow for water at 70 kPa pressure drop 3)	l/min	9	9	12	12
Liquid volume of integrated heat exchanger	dm³	0.45	0.45	0.79	0.79
DC link capacitance					
- Basic Line Module	µF	4800	7700	15500	19300
- Drive line-up, max.	µF	38400	61600	124000	154400
Sound pressure level					
L_{pA} (1 m) at 50/60 Hz	dB(A)	54	54	56	56
Line/load connection		Flat connector for M12 screw			
Max. connection cross-sections					
- Line connection (U1, V1, W1)	mm²	Busbar	Busbar	Busbar	Busbar
- DC link connection (DCP, DCN)	mm²	Busbar	Busbar	Busbar	Busbar
- PE connection	mm²	Busbar	Busbar	Busbar	Busbar
Max. cable length (total of all motor cables and DC link)					
- shielded	m	1500	1500	2250	2250
- unshielded	m	2250	2250	3375	3375

Order number	6SL3335–	1TG34–2AA3	1TG37–3AA3	1TG41–3AA3	1TG41–7AA3
Degree of protection		IP00	IP00	IP00	IP00
Dimensions - Width - Height - Depth	 mm mm mm	 160 1137 545	 160 1137 545	 160 1562 545	 160 1562 545
Frame size		FBL	FBL	GBL	GBL
Weight	kg	108	108	185	185
UL listed fuse [4] - Number (connected in parallel) - Rated current - Frame size acc. to IEC 60269	 A 	3NE1333-2 1 450 2	3NE1331-2 2 350 2	3NE1447-2 2 670 3	3NE1435-2 3 560 3

[1] Valid for a 5 s duty cycle (overload duration) and a duty cycle duration of 300 s based on the base load DC link current I_{H_DC}.

[2] The specified power loss is the maximum value at 100% capacity utilization. In normal operation a lower value is established.

[3] This value applies to the water coolant option; for other coolant types, see Chapter "Cooling circuit and coolant properties".

[4] To achieve a UL-approved system, it is absolutely essential to use the fuse types specified in the table.

4.2.7.1 Derating factors as a function of coolant temperature

SINAMICS S120 Liquid Cooled units are designed for cooling by H_2O or by an H_2O Antifrogen N mixture. An H_2O Antifrogen N mixture must contain between 20 % and 45 % Antifrogen N.

When H_2O is used as a coolant, the units can supply 100 % output current at temperatures between 5 °C and 45 °C. The maximum output current decreases linearly to 90 % at temperatures between 45 °C and 50 °C.

When H_2O Antifrogen N mixture described above is used as a coolant, the units can supply 100 % output current at temperatures between 0 °C and 45 °C. The maximum output current decreases linearly to 90 % at temperatures between 45 °C and 50 °C.

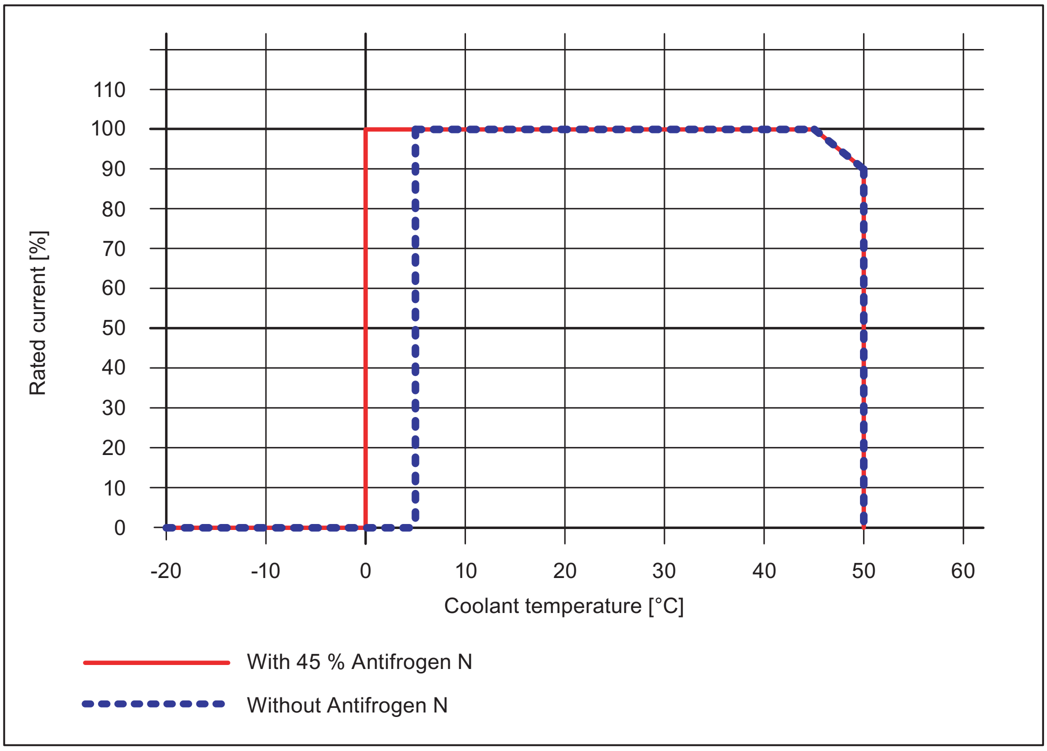


Figure 4-9 Maximum output current as a function of coolant temperature

4.2.7.2 Derating factors as a function of the ambient temperature

The units can supply 100 % output current at an ambient air temperature of between 0 °C and 45 °C. The maximum output current decreases linearly to 90 % at ambient air temperatures of between 45 °C and 50 °C.

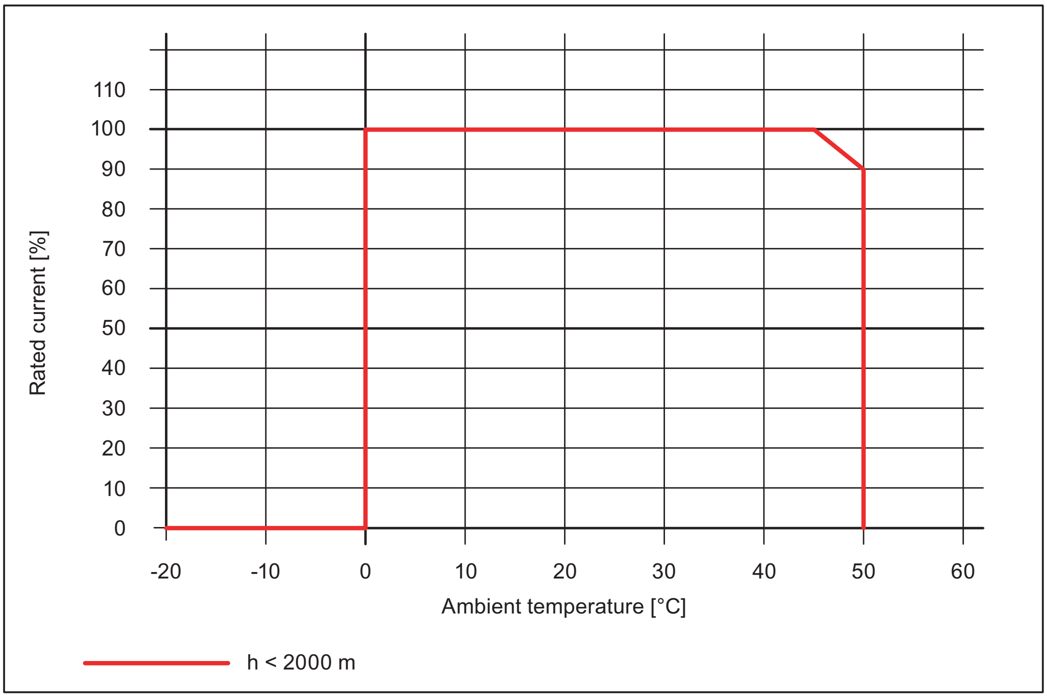


Figure 4-10 Maximum current as a function of ambient temperature

4.2.7.3 Derating factors as a function of installation altitude

When the units are operated at an installation altitude with reduced air pressure, the derating characteristic shown below applies to the output current or the ambient air temperature.

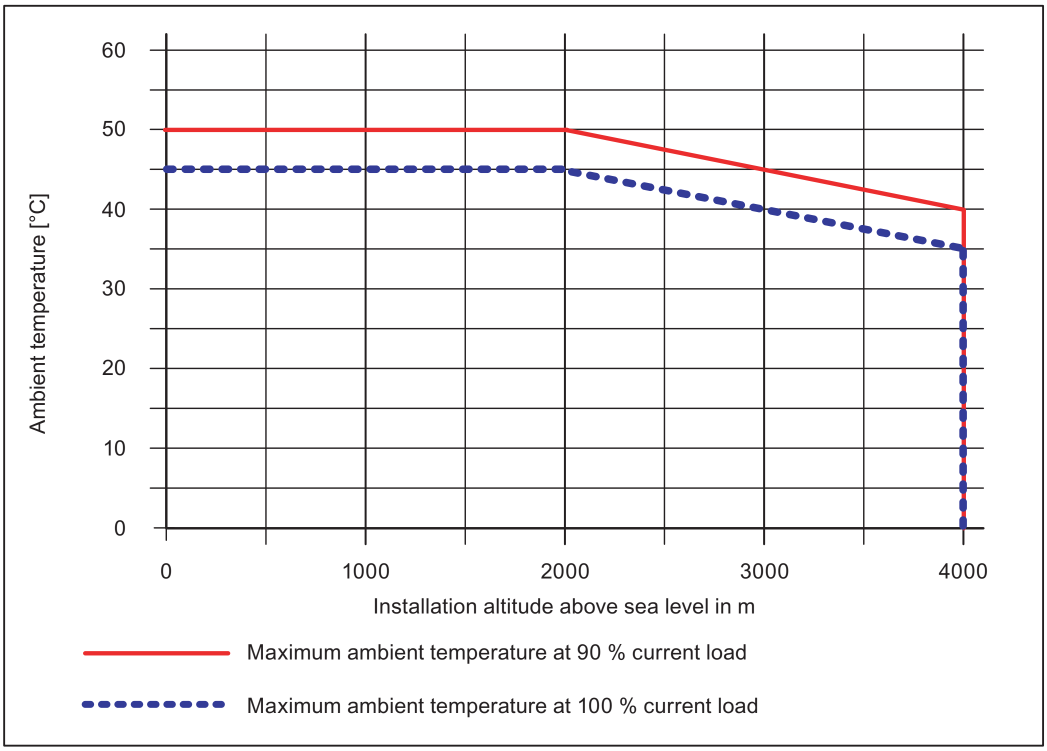


Figure 4-11 Maximum ambient temperature as a function of installation altitude

At installation altitudes above 2000 m (6562 ft), the line voltage must not exceed certain limits to ensure that surge voltages can be insulated in accordance with IEC 61800-5-1 for surge voltage category III. If the line voltage is higher than this limit at installation altitudes > 2000 m (6562 ft), measures must be taken to reduce transient category III surge voltages to category II values, e.g. equipment must be supplied via an isolating transformer.

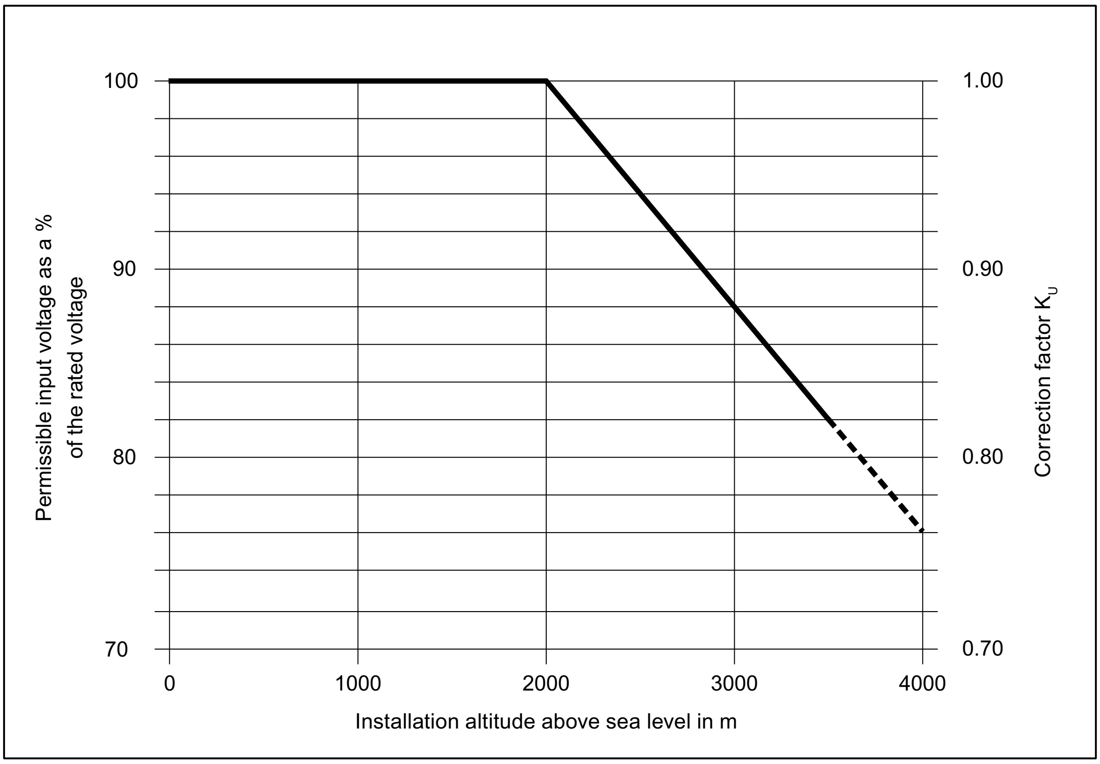


Figure 4-12 Voltage correction factor K_T as a function of the installation altitude

---

Note

Refer to the maximum line voltage under "Connection voltages" in the technical data for details of the rated voltage.

Note

The dashed line represents a theoretical characteristic of the correction factor. The devices have an undervoltage threshold, which leads to shutdown when the voltage drops below it. Consequently, the input voltage range that is actually usable has a lower limit.

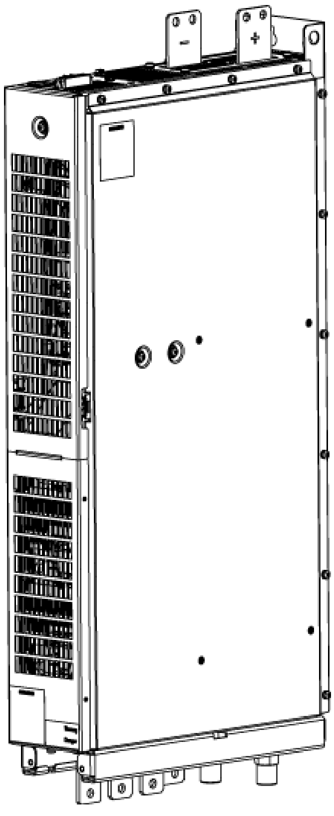
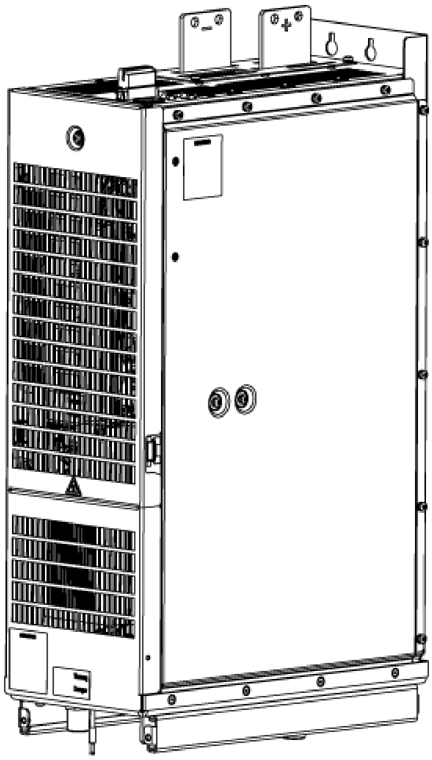
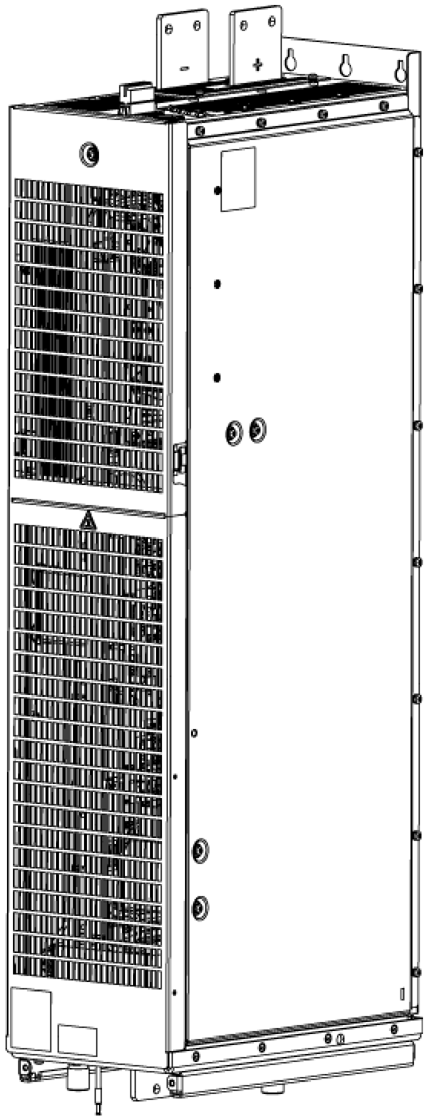
4.3 Active Line Modules

4.3.1 Description

The self-commutating infeed / regenerative feedback units act as step-up converters and generate a stabilized DC link voltage that is 1.5x greater (factory setting) than the rated line supply voltage. In this way, the connected Motor Modules are isolated from the line voltage. This improves the dynamic response and control quality because line tolerances and fluctuations do not affect the motor voltage.

If required, the Active Line Modules can also provide reactive power compensation.

Table 4- 12 Overview of Active Line Modules

		
Frame size GXL	Frame size HXL	Frame size JXL

Active Infeed components

An Active Infeed comprises an Active Interface Module and an Active Line Module.

The bypass contactor is fitted in the relevant Active Interface Module on Active Infeeds which feature an Active Line Module of frame size GXL. Active Interface Modules in these frame sizes have degree of protection IP20; Active Line Modules in these frame sizes have degree of protection IP00.

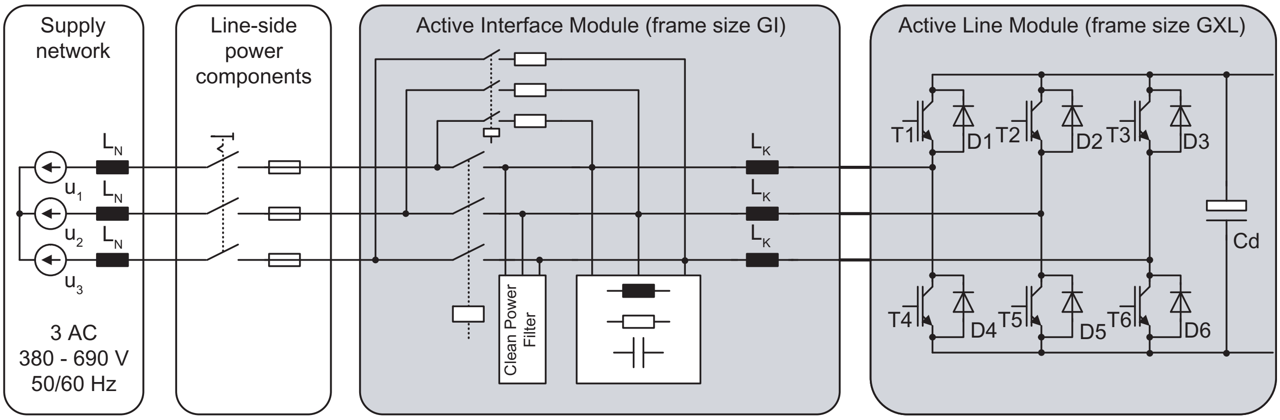


Figure 4-13 Overview of Active Infeeds, frame size GXL

In the case of an Active Infeed with an Active Line Module of frame sizes HXL or JXL, the bypass contactor is not included in the associated Active Interface Module, but must be provided separately. The Active Interface Modules and Active Line Modules of this frame size have degree of protection IP00.

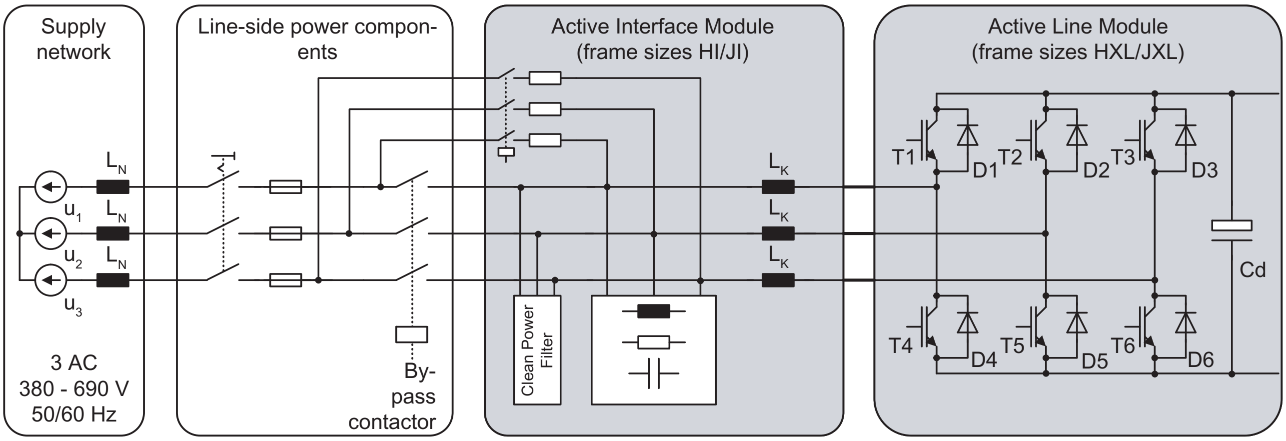


Figure 4-14 Overview of Active Infeeds, frame sizes HI/HXL and JI/JXL

Operating principle

One or more Motor Modules can be connected to the power supply network via the Active Line Module. The Active Line Module provides a constant DC link voltage for the Motor Modules. This ensures that they are not influenced by line voltage fluctuations. The regenerative feedback capability of the Active Line Module can be deactivated by parameterization.

The Active Line Module is suitable for direct operation both on TN and on IT and TT systems.

With the motors operating as generators, the Active Line Module feeds regenerative energy into the supply network.

The Active Line Module is used for:

- Machines with high dynamic drive requirements
- Frequent braking cycles and high braking energy.

The fans for the internal electronic circuitry are only switched on when required.
The fans are switched on and off as a function of several factors (e.g. heat sink temperature, ambient temperature, output current, duty cycle, ...) which means that fan operating cycles cannot be calculated directly.

An external 24 V DC supply is required to operate liquid-cooled Active Line Modules.

Parallel connection of Active Line Modules to increase power rating

Up to four Active Line Modules with the same power rating can be connected in parallel in order to increase power.

The following rules must be observed when connecting Active Line Modules in parallel:

- Up to 4 identical Active Line Modules can be connected in parallel.
- A common Control Unit is required whenever the modules are connected in parallel.
- With multiple infeeds, power must be supplied to the systems from a common infeed point (i.e. different supply systems are not permitted).
- A derating factor of 5% must be taken into consideration, regardless of the number of modules connected in parallel.

Note

It is only possible to connect identical power units in parallel if both power units have the same hardware version. Mixed operation between a power unit with Control Interface Module (order number 6SL33xx-xxxxx–xAA3) and a power unit with Control Interface Board (order number 6SL33xx-xxxxx–xAA0) is not possible.

4.3.2 Safety information

⚠ WARNING

A hazardous voltage will be present in the component for a further 5 minutes after all voltage supplies have been disconnected. Work cannot be carried out until this time has elapsed.

Before starting work, you should also measure the voltage after the 5 minutes have elapsed. The voltage can be measured on DC link terminals DCP and DCN.

⚠ CAUTION

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

NOTICE

The cooling clearances above, below, and in front of the component, which are specified in the dimension drawings, must be observed.

CAUTION

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

CAUTION

The busbars and coolant connections which stick out of the module must never be used as handles or support surfaces when the units are transported.

⚠ DANGER

Active Line Modules discharge a high leakage current to the protective ground conductor. Due to the high leakage current associated with Active Line Modules, they or the relevant control cabinet must be permanently connected to PE.

According to EN 61800-5-1, Section. 6.3.6.7, the minimum cross-section of the protective ground conductor must conform to the local safety regulations for protective ground conductors for equipment with a high leakage current.

4.3.3 Interface description

4.3.3.1 Overview

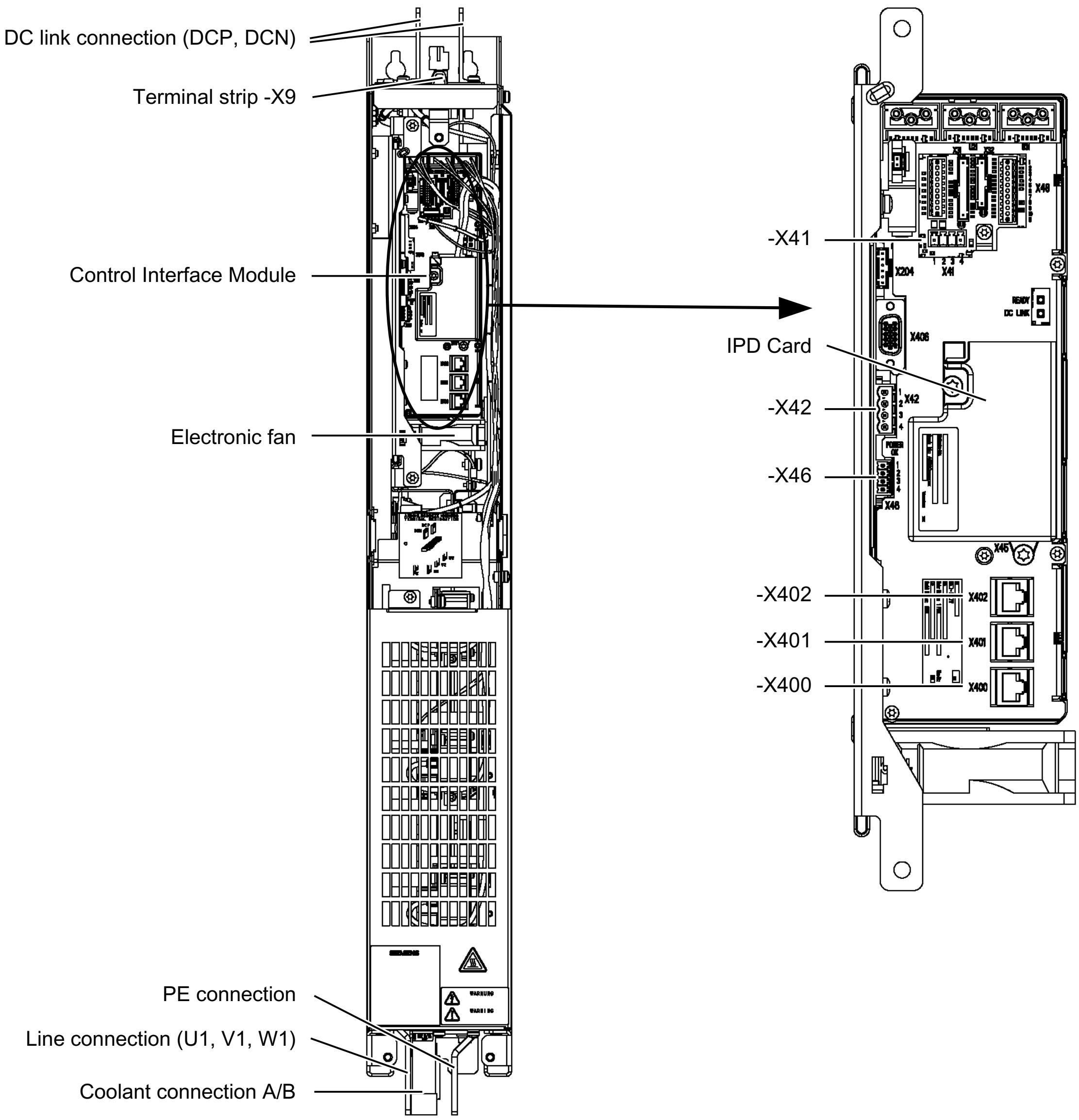


Figure 4-15 Active Line Module, frame size GXL

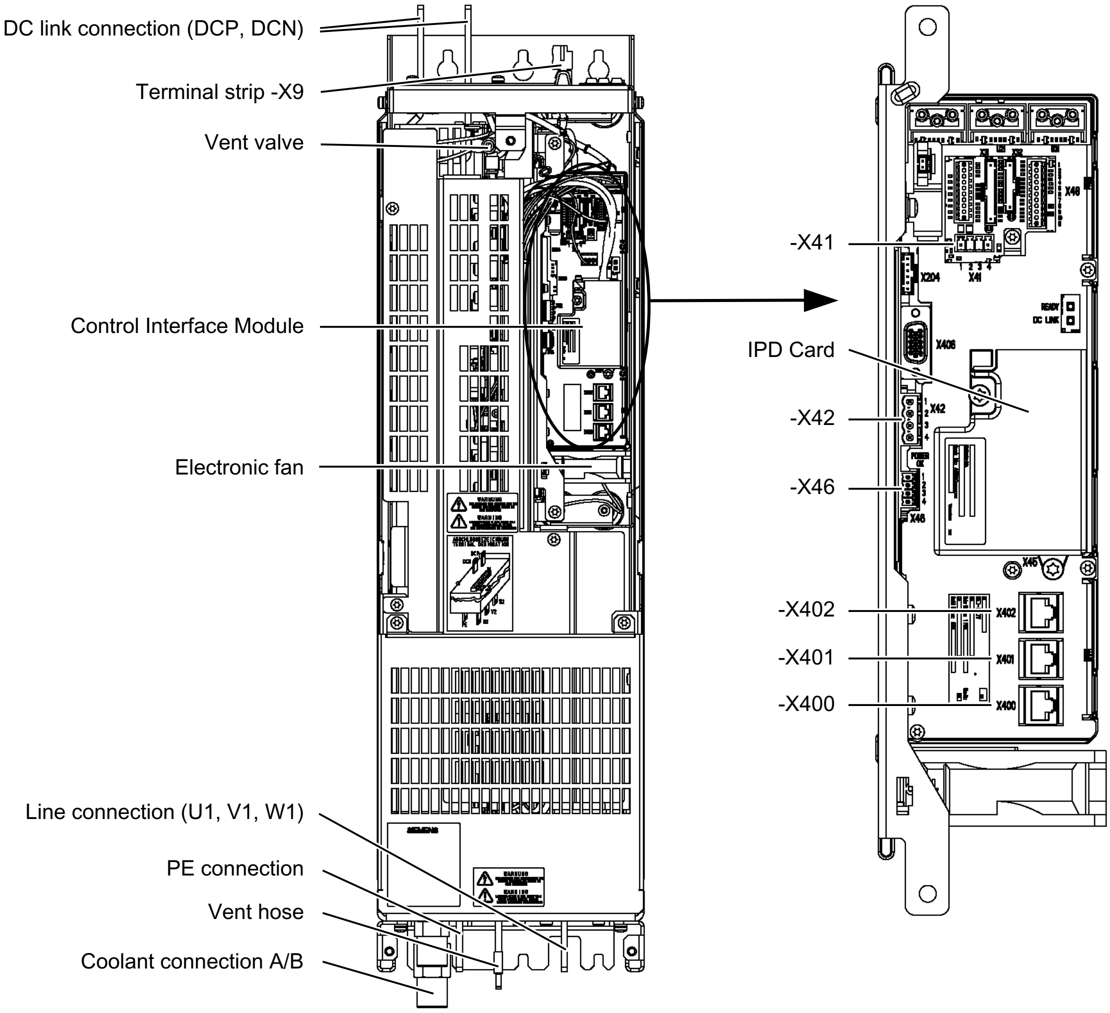


Figure 4-16 Active Line Module, frame size HXL

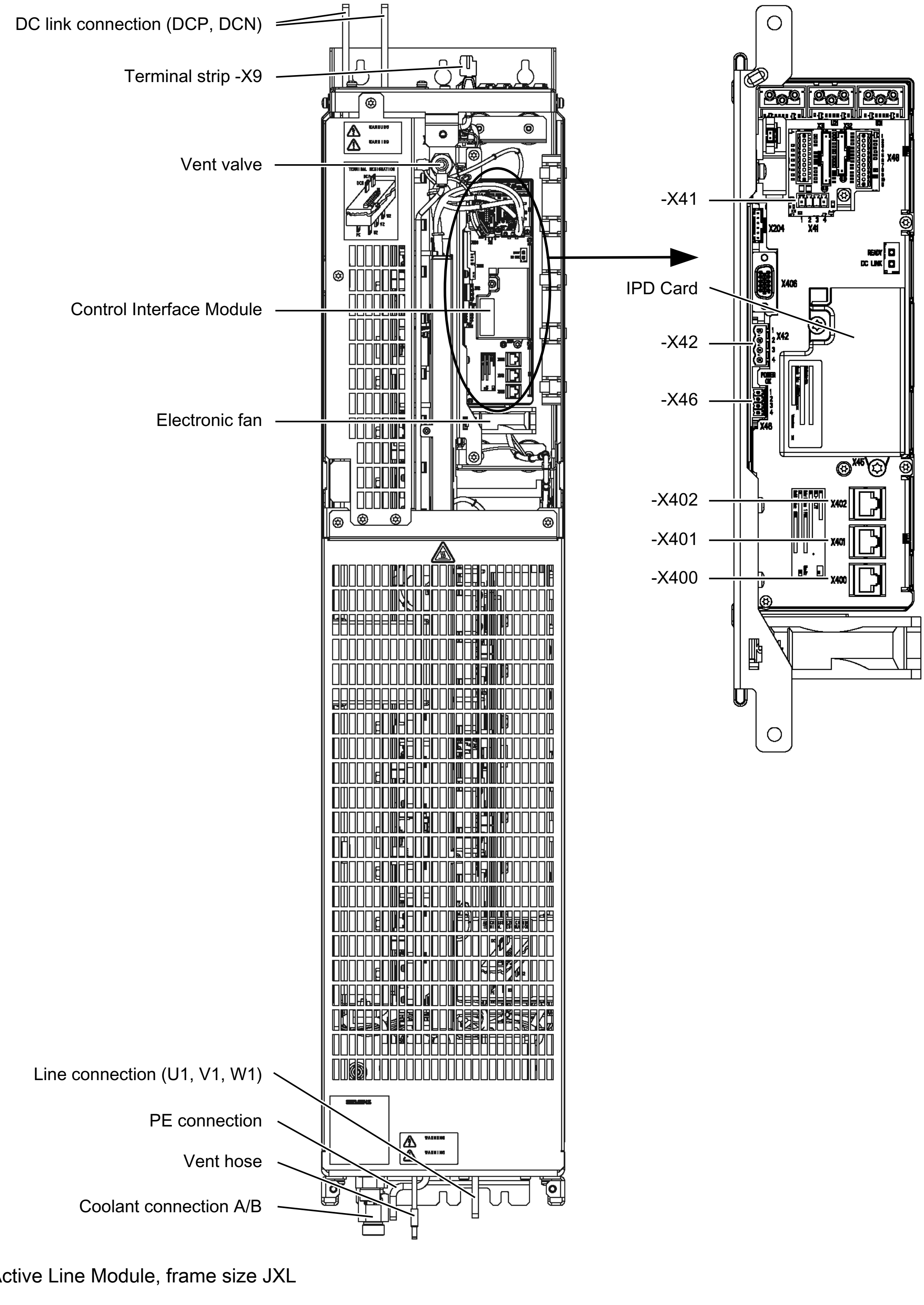


Figure 4-17 Active Line Module, frame size JXL

4.3.3.2 Connection example

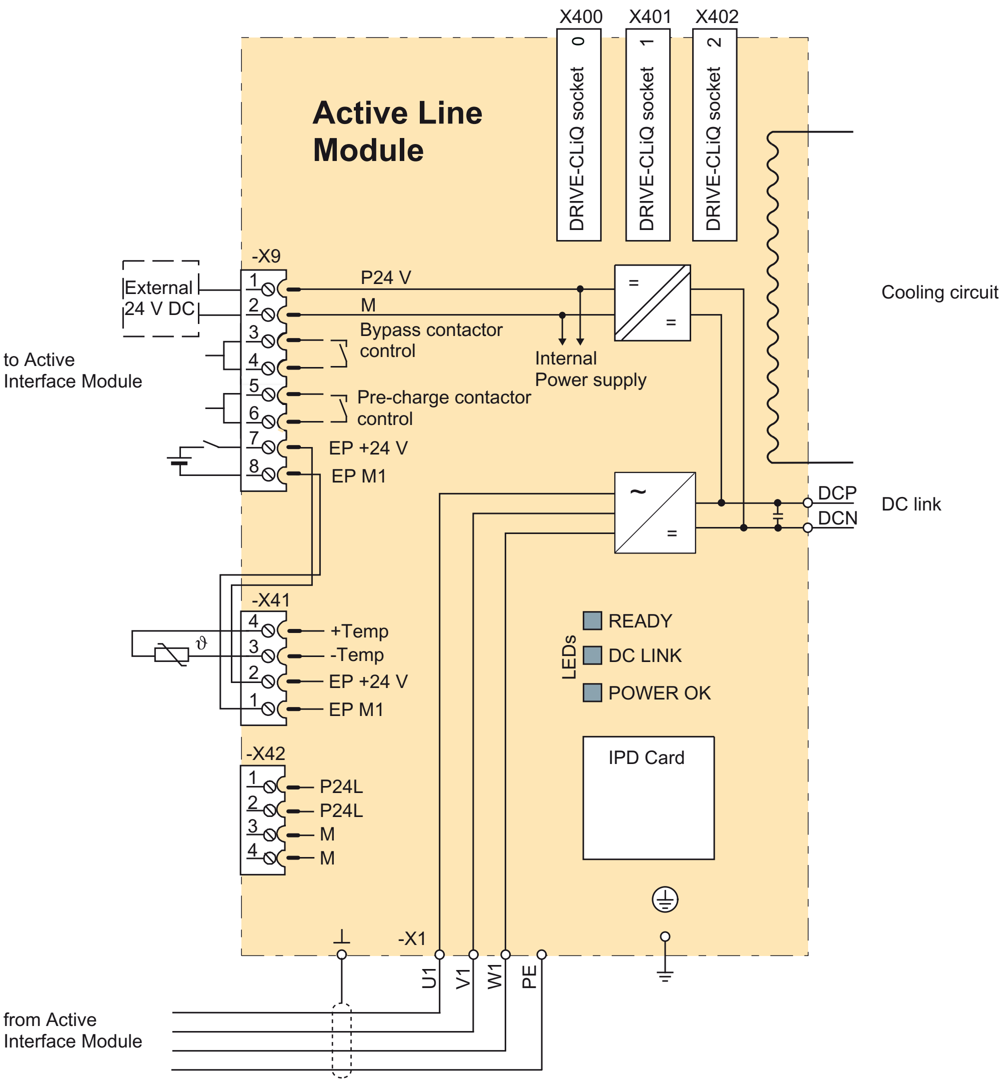


Figure 4-18 Example connection of Active Line Module

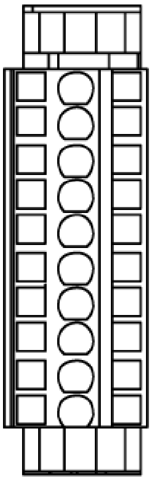
4.3.3.3 Line/load connection

Table 4- 13 Line/load connection of the Active Line Module

Terminals	Technical specifications
U1, V1, W1 3 AC power input	Voltage: • 3 AC 380 V -10 % (-15 % < 1 min) to 3 AC 480 V +10 % • 3 AC 500 V -10 % (-15 % < 1 min) to 3 AC 690 V +10 % Frequency: 47 Hz to 63 Hz Connecting lugs: • Frame sizes FXL, GXL, HXL: d = 13 mm (M10/50 Nm) for cable lugs in accordance with DIN 46234 / DIN 46235 • Frame size JXL: d = 13 mm (M10/50 Nm) for busbar connection
DCP, DCN DC power output	Voltage: • 570 to 720 VDC • 750 to 1035 VDC Connecting lugs: D = 13 mm (M10/50 Nm) for busbar connection
PE connection	Connecting lugs: • Frame sizes FXL, GXL, HXL: D = 13 mm (M10/50 Nm) for cable lugs in accordance with DIN 46234 / DIN 46235 • Frame size JXL: D = 13 mm (M10/50 Nm) for busbar connection

4.3.3.4 X9 terminal strip

Table 4- 14 Terminal strip X9

	Terminal	Signal name	Technical specifications
	1	P24 V	Voltage: 24 V DC (20.4 V – 28.8 V) Power consumption: See Technical data
	1	P24 V	
	2	M	
	2	M	
	3	Bypass contactor control	for Active Interface Module, -X609;11
	4		for Active Interface Module,-X609;12
	5	Pre-charge contactor control	for Active Interface Module, -X609;9
	6		for Active Interface Module, -X609;10
	7	EP +24 V (Enable Pulses)	Supply voltage: 24 V DC (20.4 V - 28.8 V) Power consumption: 10 mA
	8	EP M1 (Enable Pulses)	
Max. connectable cross-section 1.5 mm^2			

Note

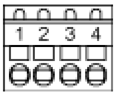
For operation, 24 V DC must be connected to terminal 7 and ground to terminal 8. Pulse suppression is activated when terminals are disconnected.

Note

The two "P24 V" or "M" terminals are jumpered in the connector. This ensures that the supply voltage is looped through, even when the connector is removed.

4.3.3.5 X41 EP terminal / temperature sensor connection

Table 4- 15 Terminal strip X41

	Terminal	Function	Technical specifications
	1	EP M1 (Enable Pulses)	Connected to terminal -X9:8
	2	EP +24 V (Enable Pulses)	Connected to terminal -X9:7
	3	- Temp	Temperature sensor connection KTY84-1C130 / PTC
	4	+ Temp	
Max. connectable cross-section 1.5 mm^2			

Note

A cable harness is used to connect terminals -X41:1 and -X41:2 to terminals -X9:8 and -X9:7.

DANGER

Risk of electric shock!

Only temperature sensors that meet the safety isolation specifications contained in EN 61800-5-1 may be connected to terminals "+Temp" and "-Temp". If safe electrical separation cannot be guaranteed (for linear motors or third-party motors, for example), a Sensor Module External (SME120 or SME125) must be used.

If these instructions are not complied with, there is a risk of electric shock!

Note

The following probes can be connected to the temperature sensor connection: KTY84-1C130 / PTC.

CAUTION

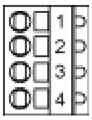
The temperature sensor connection must be shielded. The shielding must be attached to the shield support of the module.

NOTICE

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

4.3.3.6 X42 terminal strip

Table 4- 16 Terminal strip X42 voltage supply for Control Unit, Sensor Module and Terminal Module

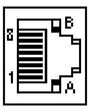
	Terminal	Function	Technical specifications
	1	P24L	Voltage supply for Control Unit, Sensor Module and Terminal Module (18 to 28.8 V) maximum load current: 3 A
	2		
	3	M	
	4		
Max. connectable cross-section 2.5 mm²			

CAUTION

The terminal strip is not intended for free 24 V DC availability (for example for supplying further line-side components), as the voltage supply of the Control Interface Module could also be overloaded and operating capability could thus be compromised.

4.3.3.7 DRIVE-CLiQ interfaces X400, X401, X402

Table 4- 17 DRIVE-CLiQ interfaces X400, X401, X402

	PIN	Signal name	Technical specifications
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	24 V power supply
	B	M (0 V)	Electronics ground
Blanking plate for DRIVE-CLiQ interfaces (50 pcs.) order number: 6SL3066-4CA00-0AA0			

4.3.3.8 Cooling circuit connections

Table 4- 18 Cooling circuit connections

Connection	Technical data
Coolant connection A: Inlet	Pipe thread ISO 228 - G 3/4 B (external thread 3/4", flat-sealing)
Coolant connection B: Return flow	
Tightening torque	60 Nm

Note

The seals for the screwed connections can be used only once when the cooling circuit is first assembled. The seals must be replaced if the circuit is disassembled and assembled again.

A replacement seal is commercially available under the name Viton flat gasket 3/4".

4.3.3.9 Meaning of the LEDs on the Control Interface Module in the Active Line Module

Table 4- 19 Meaning of the LEDs "READY" and "DC LINK" on the Control Interface Module in the Active Line Module

LED state		Description
READY	DC LINK	
Off	Off	The electronics power supply is missing or out of tolerance.
Green	Off	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is present.
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is too high.
Orange	Orange	DRIVE-CLiQ communication is being established.
Red	---	At least one fault is present in this component. Note: LED is driven irrespective of the corresponding messages being reconfigured.
Flashing light 0.5 Hz: Green / red	---	Firmware is being downloaded.
2 Hz flashing: Green / red	---	Firmware download is complete. Waiting for POWER ON.
2 Hz flashing: Green / orange or red / orange	---	Component detection using LED is activated (p0124) Note: The two options depend on the LED status when module recognition is activated via p0124 = 1.

Table 4- 20 Meaning of the LED "POWER OK" on the Control Interface Module in the Active Line Module

LED	Color	Status	Description
POWER OK	Green	Off	DC link voltage < 100 V and voltage at -X9:1/2 less than 12 V.
		On	The component is ready for operation.
		Flashing light	There is a fault. If the LED continues to flash after you have performed a POWER ON, please contact your Siemens service center.

WARNING

Irrespective of the state of the LED "DC LINK", hazardous DC link voltages can always be present.

The warning information on the component must be carefully observed!

4.3.4 Dimension drawing

Dimension drawing for frame size GXL

The mandatory cooling clearances are indicated by the dotted line.

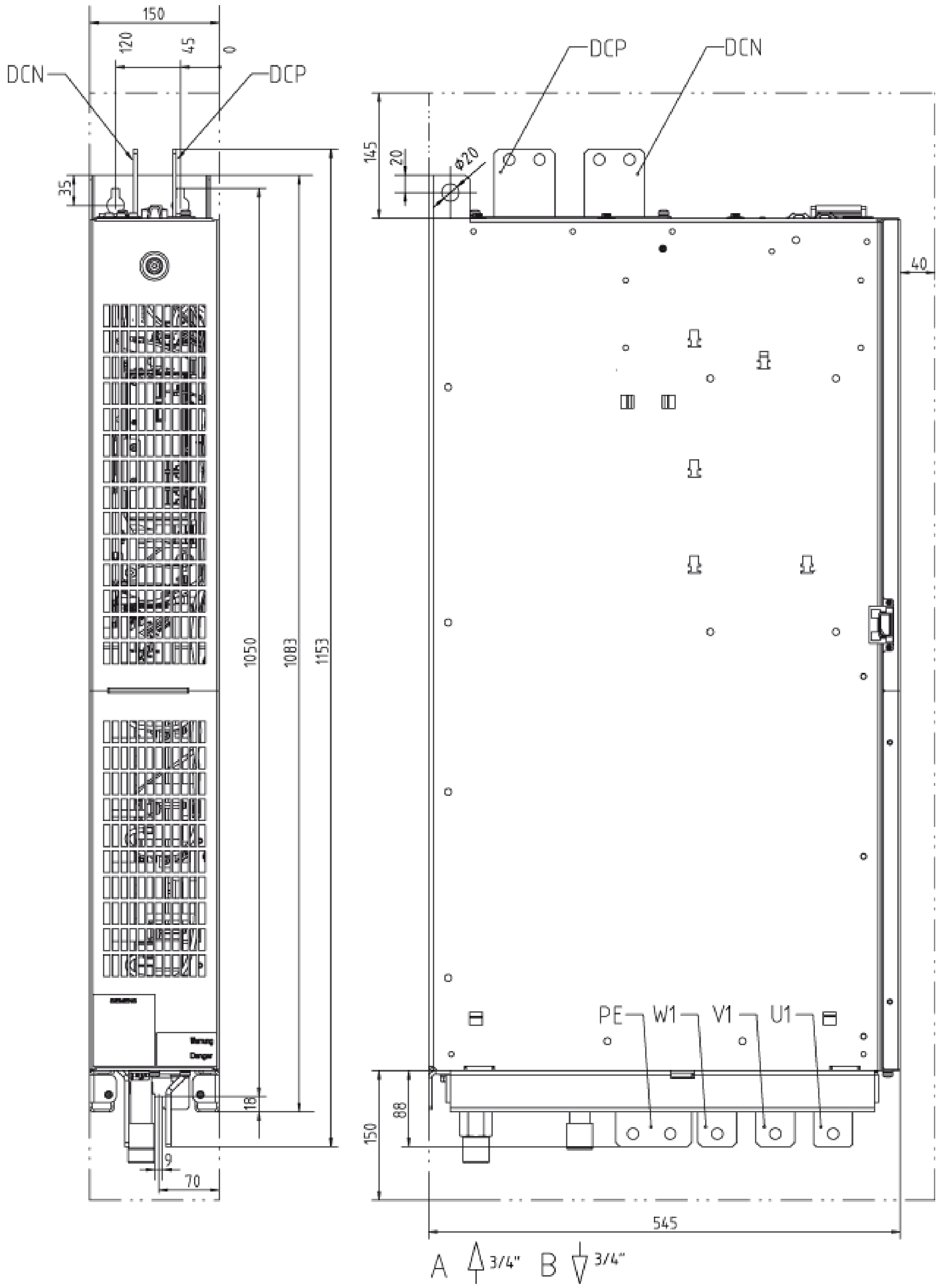


Figure 4-19 Dimension drawing Active Line Module, frame size GXL Front view, side view

Dimension drawing, frame size HXL

The mandatory cooling clearances are indicated by the dotted line.

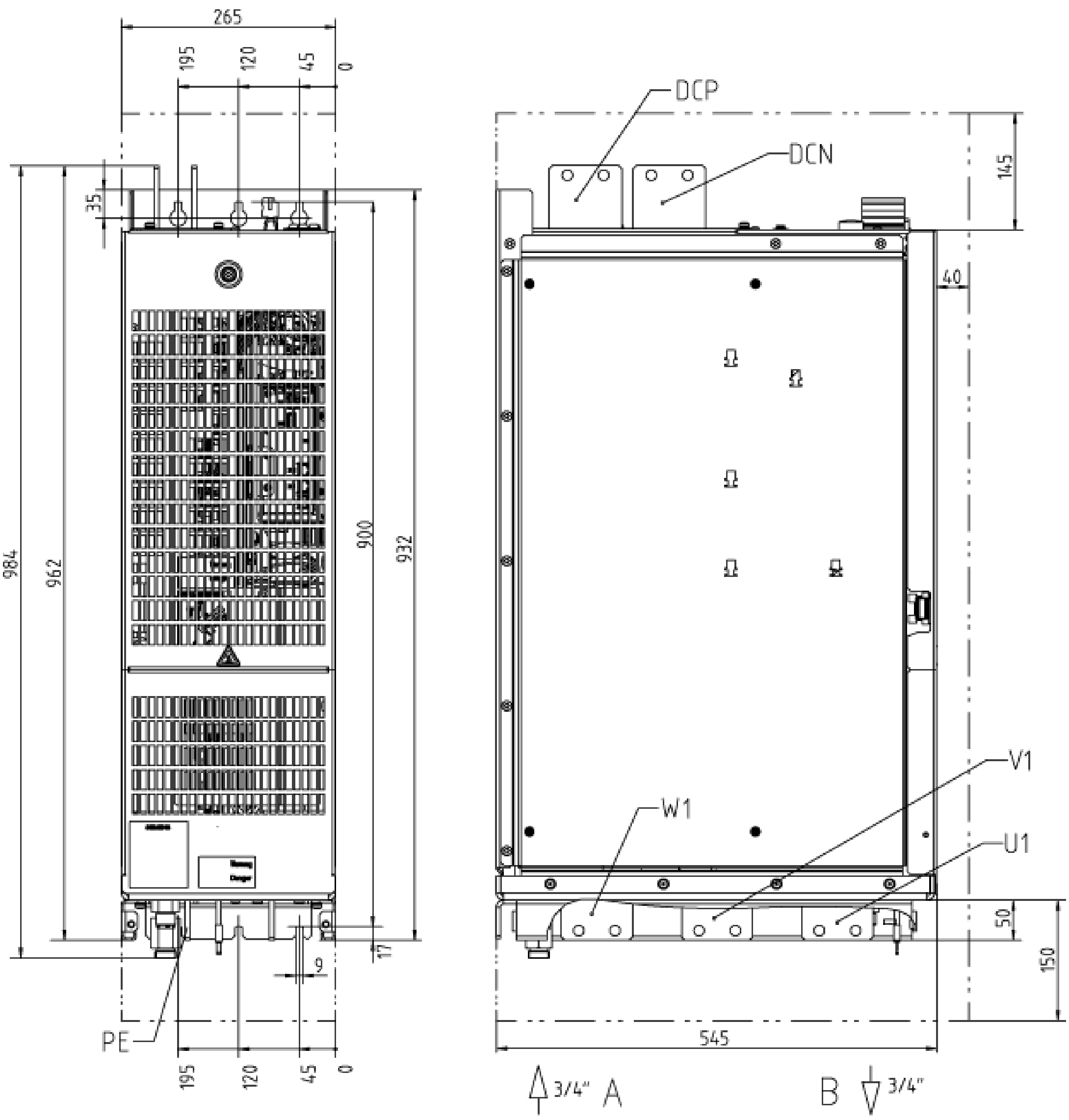


Figure 4-20 Dimension drawing Active Line Module, frame size HXL Front view, side view

Dimension drawing for frame size JXL

The mandatory cooling clearances are indicated by the dotted line.

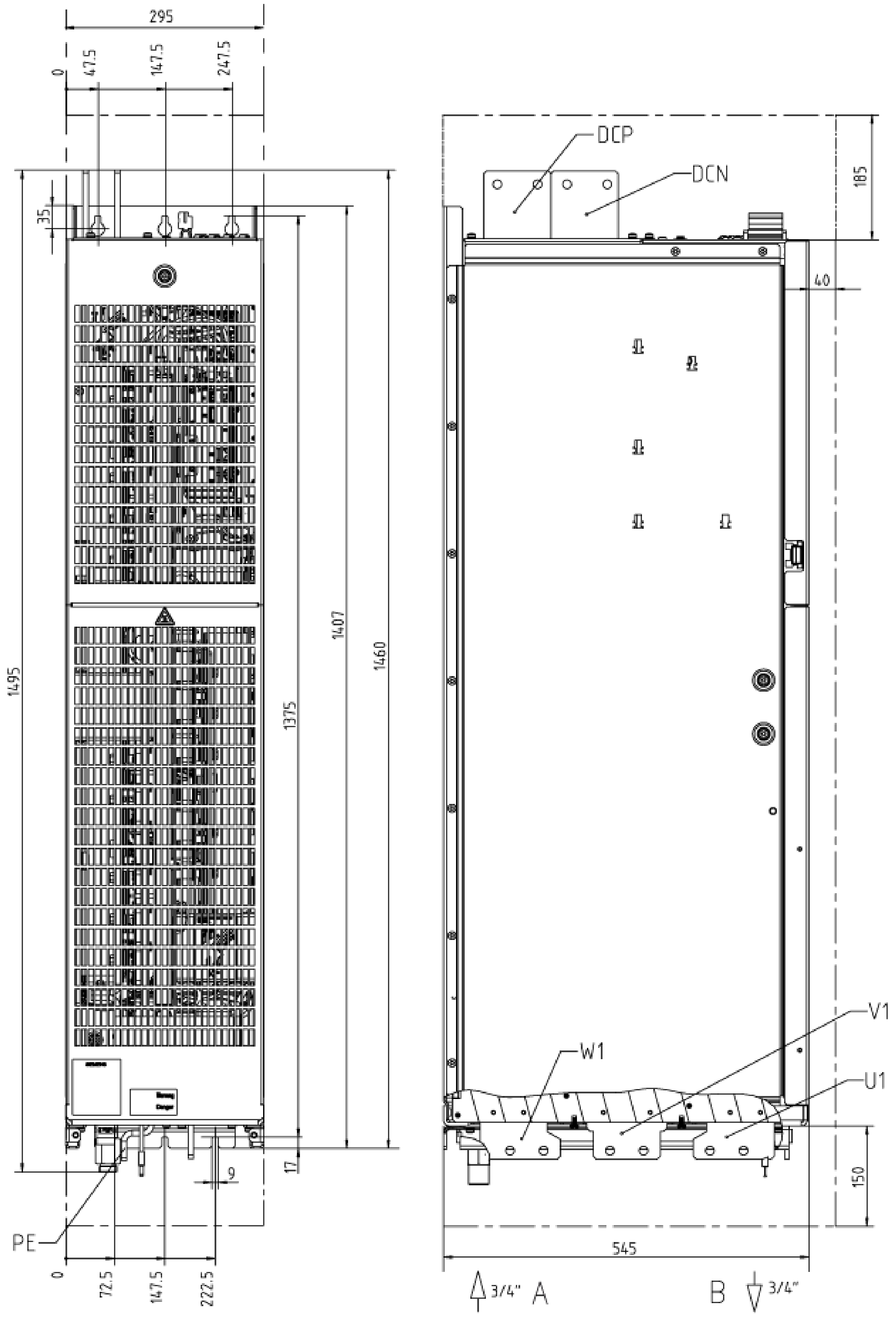


Figure 4-21 Dimension drawing Active Line Module, frame size JXL Front view, side view

4.3.5 Installation

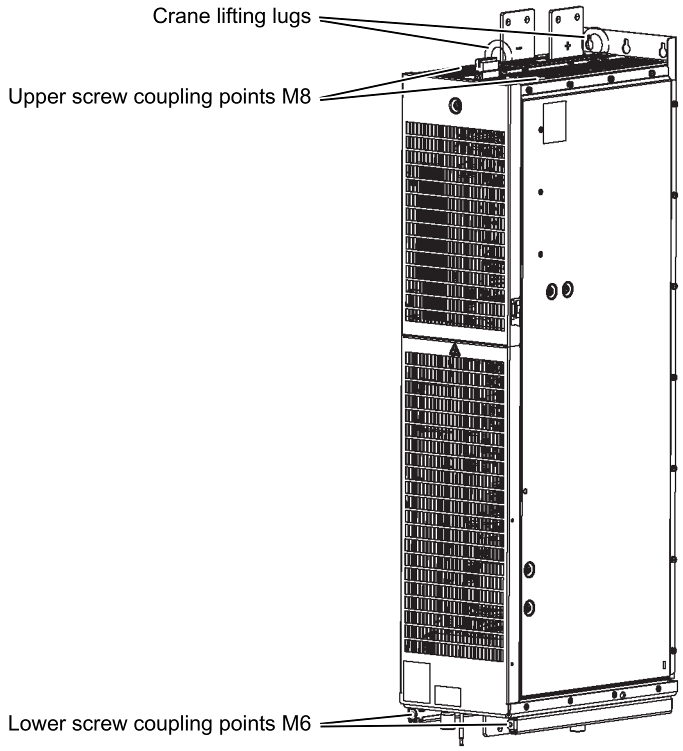


Figure 4-22 Crane lifting lugs / screw coupling points for mechanical support

Crane lifting lugs

Active Line Modules are fitted with crane lifting lugs as standard when shipped. The units can be hoisted from these lugs and transported from the pallet to the installation location.

Note

A thread for inserting a crane lifting lug is provided on the bottom of the Active Line Module. This allows the Active Line Module to also be transported horizontally with a lifting harness.

⚠ WARNING
A lifting harness with vertical ropes or chains must be used to prevent any risk of damage to the housing. The crane lifting lugs must be removed after the modules have been installed. The lugs should be safely stored for future use.

Screw coupling points for mechanical support

Since the Active Line Modules are housed in a very slim enclosure, they need to be mechanically supported against lateral movement and vibration if they are installed in a control cabinet. Screw coupling points are provided on the top and bottom of the units for this purpose.

If several modules are mounted adjacent to one another, they can be interconnected via the screw coupling points. When a single module is installed, lateral support can be provided by means of reinforcing plates inserted between the module and the cabinet.

Protection guard

A protection guard is mounted on the bottom of the Active Line Module ("1" in the diagram below) for use during transportation. The Active Line Module can be rested on this protection guard while it is removed from the packaging and during transportation.
Before the module is installed at its final location, this guard must be removed. To do this, remove the 4 screws ("2" in the diagram) and remove the guard.

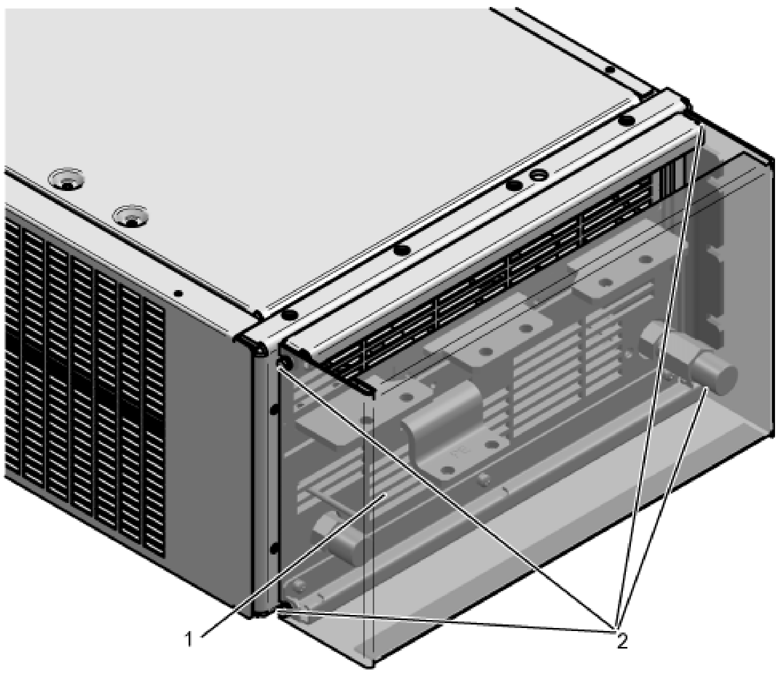


Figure 4-23 Protection guard

4.3.6 Technical specifications

Table 4- 21 Technical data for Active Line Modules, 380 V – 480 V 3 AC

Order number	6SL3335–	7TE35–0AA3	7TE38–4AA3		
Rated output - for $I_{L\ DC}$ (50 Hz 400 V) - for $I_{H\ DC}$ (50 Hz 400 V) - for $I_{L\ DC}$ (60 Hz 460 V) - for $I_{H\ DC}$ (60 Hz 460 V)	 kW kW hp hp	 300 450 500 400	 500 750 700 700		
DC link current - Rated current $I_{N\ DC}$ - Base load current $I_{L\ DC}$ - Rated current $I_{H\ DC}$ - Maximum current $I_{max\ DC}$ 1)	 A A A A	 549 535 489 823	 941 917 837 1410		
Input current - Rated current at 400 V 3 AC - maximum	 A A	 490 735	 840 1260		
Supply voltages - Line voltage - Line frequency - Electronics power supply - DC link voltage	 V_{ACrms} Hz V_{DC} V_{DC}	 380 V 3 AC -10 % (-15 % < 1 min) to 480 V 3 AC +10 % 47 to 63 Hz 24 (20.4 - 28.8) 1.5 x U_{line}			
Pulse frequency	kHz	4	2.5		
Electronic power consumption (24 V DC)	A	1.5	1.6		
Cooling method		Liquid cooling with integrated heat exchanger made of			
		Stainless steel	Aluminum		
Power loss, max. 2) - at 50 Hz 400 V - at 60 Hz 460 V	 kW kW	 3.1 3.36	 5.3 5.75		
Max. coolant temperature - Without derating - With derating	 °C °C	 45 50	 45 50		
Rated volumetric flow for water at 70 kPa pressure drop 3)	l/min	12	16		
Liquid volume of integrated heat exchanger	dm³	0,91	0.74		
DC link capacitance - Active Line Module	 µF	 9600	 17400		
Sound pressure level L_{pA} (1 m) at 50/60 Hz	 dB(A)	 52	 54		
Line/load connection		Flat connector for M12 screw			
Max. connection cross-sections - Line connection (U1, V1, W1) - DC link connection (DCP, DCN) - PE connection	 mm² mm² mm²	 2 x 240 Busbar 2 x 240	 4 x 185 Busbar 4 x 185		
Max. cable length (total of all motor cables and DC link) - shielded - unshielded	 m m	 2700 4050	 3900 5850		

Order number	6SL3335–	7TE35–0AA3	7TE38–4AA3		
Degree of protection		IP00	IP00		
Dimensions - Width - Height - Depth	 mm mm mm	 150 1172 545	 265 1002 545		
Frame size		GXL	HXL		
Weight	kg	80	110		
UL listed fuse [4)] - Number (connected in parallel) - Rated current - Frame size acc. to IEC 60269	 A 	3NE1436-2 1 630 3	3NE1334-2 2 500 3		

[1)] Valid for a 5 s duty cycle (overload duration) and a duty cycle duration of 300 s based on the base load DC link current.

[2)] The specified power loss is the maximum value at 100% capacity utilization. In normal operation a lower value is established.

[3)] This value applies to the water coolant option; for other coolant types, see Chapter "Cooling circuit and coolant properties".

[4)] To achieve a UL-approved system, it is absolutely essential to use the fuse types specified in the table.

Table 4- 22 Technical data for Active Line Modules, 500 V – 690 V 3 AC

Order number	6SL3335–	7TG35–8AA3	7TG41–3AA3		
Rated output - for $I_{L\ DC}$ (50 Hz 690 V) - for $I_{H\ DC}$ (50 Hz 690 V) - for $I_{L\ DC}$ (50 Hz 500 V) - for $I_{H\ DC}$ (50 Hz 500 V) - for $I_{L\ DC}$ (60 Hz 575 V) - for $I_{H\ DC}$ (60 Hz 575 V)	 kW kW kW kW hp hp	 560 550 435 400 600 450	 1400 1215 965 880 1500 1250		
DC link current - Rated current $I_{N\ DC}$ - Base load current $I_{L\ DC}$ - Rated current $I_{H\ DC}$ - Maximum current $I_{max\ DC}$ 1)	 A A A A	 644 627 573 966	 1422 1386 1266 2133		
Input current - Rated current at 690 V 3 AC - maximum	 A A	 575 862	 1270 1905		
Supply voltages - Line voltage - Line frequency - Electronics power supply - DC link voltage	 V_{ACrms} Hz V_{DC} V_{DC}	 500 V 3 AC -10 % (-15 % < 1 min) to 690 V 3 AC +10 % 47 to 63 Hz 24 (20.4 - 28.8) 1.5 x U_{line}			
Pulse frequency	kHz	2.5	2.5		
Electronic power consumption (24 V DC)	A	1.6	1.46		
Cooling method		Liquid cooling with integrated aluminum heat exchanger			
Power loss, max. 2) - at 50 Hz 690 V - at 60 Hz 575 V	 kW kW	 5.3 5.1	 13.5 12.6		
Max. coolant temperature - Without derating - With derating	 °C °C	 45 50	 45 50		
Rated volumetric flow for water at 70 kPa pressure drop 3)	l/min	16	27		
Liquid volume of integrated heat exchanger	dm³	0.74	1.56		
DC link capacitance - Active Line Module	 µF	 9670	 19330		
Sound pressure level L_{pA} (1 m) at 50/60 Hz	 dB(A)	 54	 56		
Line/load connection		Flat connector for M12 screw			
Max. connection cross-sections - Line connection (U1, V1, W1) - DC link connection (DCP, DCN) - PE connection	 mm² mm² mm²	 4 x 185 Busbar 2 x 185	 Busbar Busbar Busbar		
Max. cable length (total of all motor cables and DC link) - shielded - unshielded	 m m	 2250 3375	 2250 3375		

Order number	6SL3335–	7TG35–8AA3	7TG41–3AA3		
Degree of protection		IP00	IP00		
Dimensions - Width - Height - Depth	 mm mm mm	 265 1002 545	 295 1516 545		
Degree of protection		IP00	IP00		
Frame size		HXL	JXL		
Weight	kg	110	220		
UL listed fuse [4] - Number (connected in parallel) - Rated current - Frame size acc. to IEC 60269	 A 	3NE1447-2 1 670 3	3NE1438-2 2 800 3		

[1] Valid for a 5 s duty cycle (overload duration) and a duty cycle duration of 300 s based on the base load DC link current.

[2] The specified power loss is the maximum value at 100 % capacity utilization. In normal operation a lower value is established.

[3] This value applies to the water coolant option; for other coolant types, see Chapter "Cooling circuit and coolant properties".

[4] To achieve a UL-approved system, it is absolutely essential to use the fuse types specified in the table.

4.3.6.1 Derating factors as a function of coolant temperature

SINAMICS S120 Liquid Cooled units are designed for cooling by H_2O or by an H_2O Antifrogen N mixture. An H_2O Antifrogen N mixture must contain between 20 % and 45 % Antifrogen N.

When H_2O is used as a coolant, the units can supply 100 % output current at temperatures between 5 °C and 45 °C. The maximum output current decreases linearly to 90 % at temperatures between 45 °C and 50 °C.

When H_2O Antifrogen N mixture described above is used as a coolant, the units can supply 100 % output current at temperatures between 0 °C and 45 °C. The maximum output current decreases linearly to 90 % at temperatures between 45 °C and 50 °C.

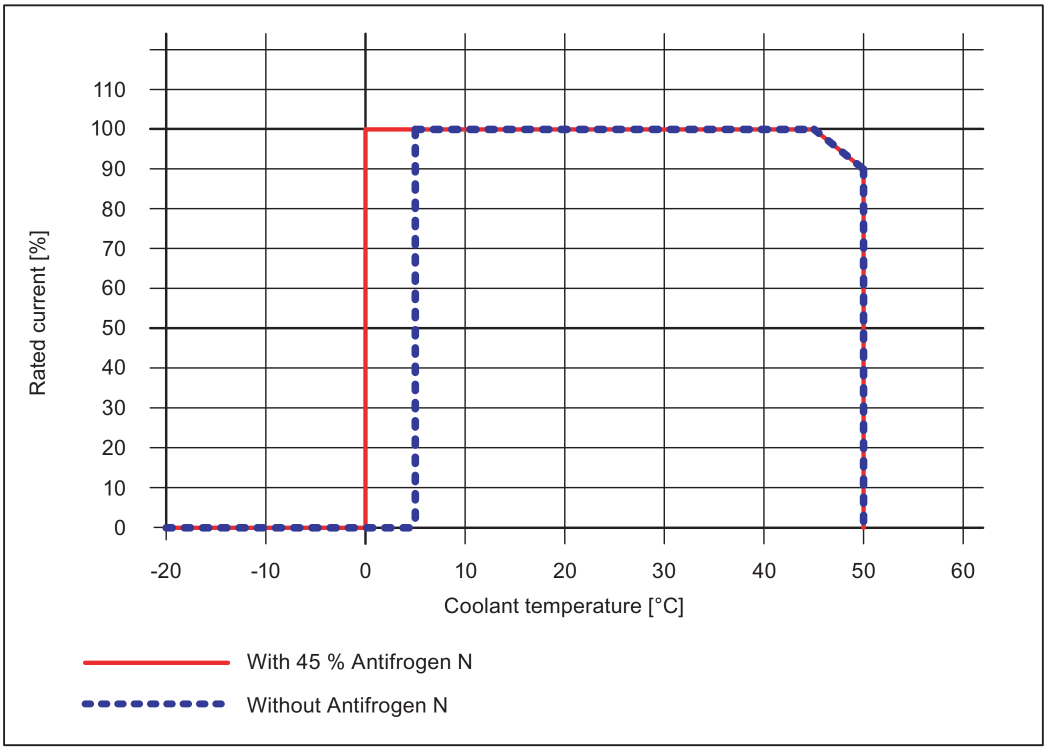


Figure 4-24 Maximum output current as a function of coolant temperature

4.3.6.2 Derating factors as a function of the ambient temperature

The units can supply 100 % output current at an ambient air temperature of between 0 °C and 45 °C. The maximum output current decreases linearly to 90 % at ambient air temperatures of between 45 °C and 50 °C.

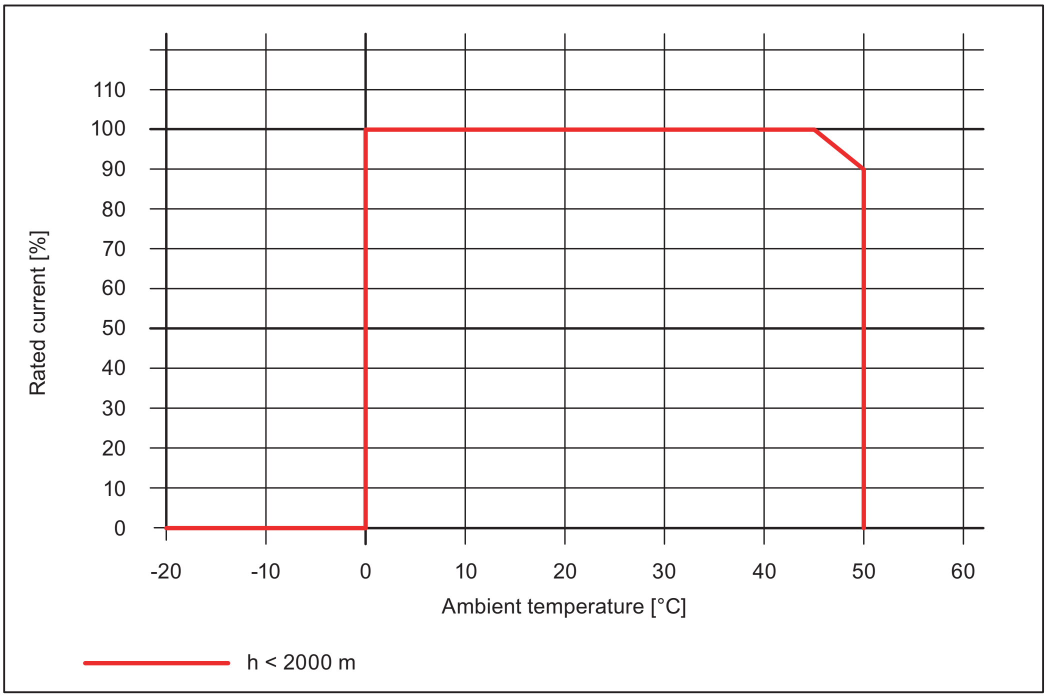


Figure 4-25 Maximum current as a function of ambient temperature

4.3.6.3 Derating factors as a function of installation altitude

When the units are operated at an installation altitude with reduced air pressure, the derating characteristic shown below applies to the output current or the ambient air temperature.

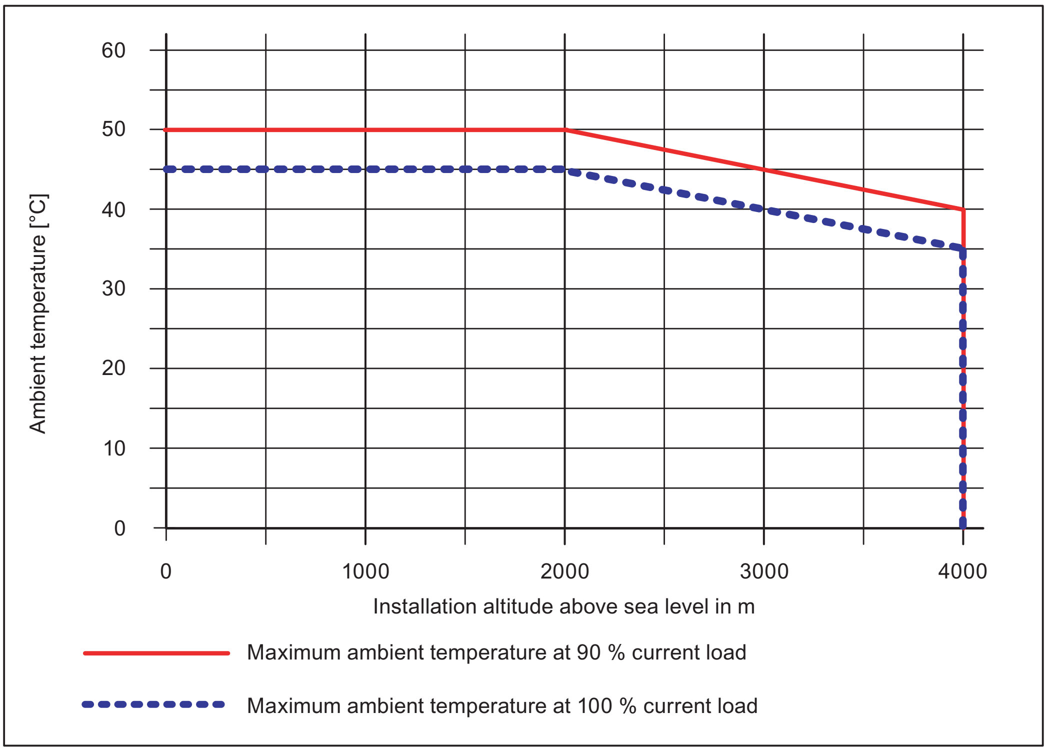


Figure 4-26 Maximum ambient temperature as a function of installation altitude

At installation altitudes above 2000 m (6562 ft), the line voltage must not exceed certain limits to ensure that surge voltages can be insulated in accordance with IEC 61800-5-1 for surge voltage category III. If the line voltage is higher than this limit at installation altitudes > 2000 m (6562 ft), measures must be taken to reduce transient category III surge voltages to category II values, e.g. equipment must be supplied via an isolating transformer.

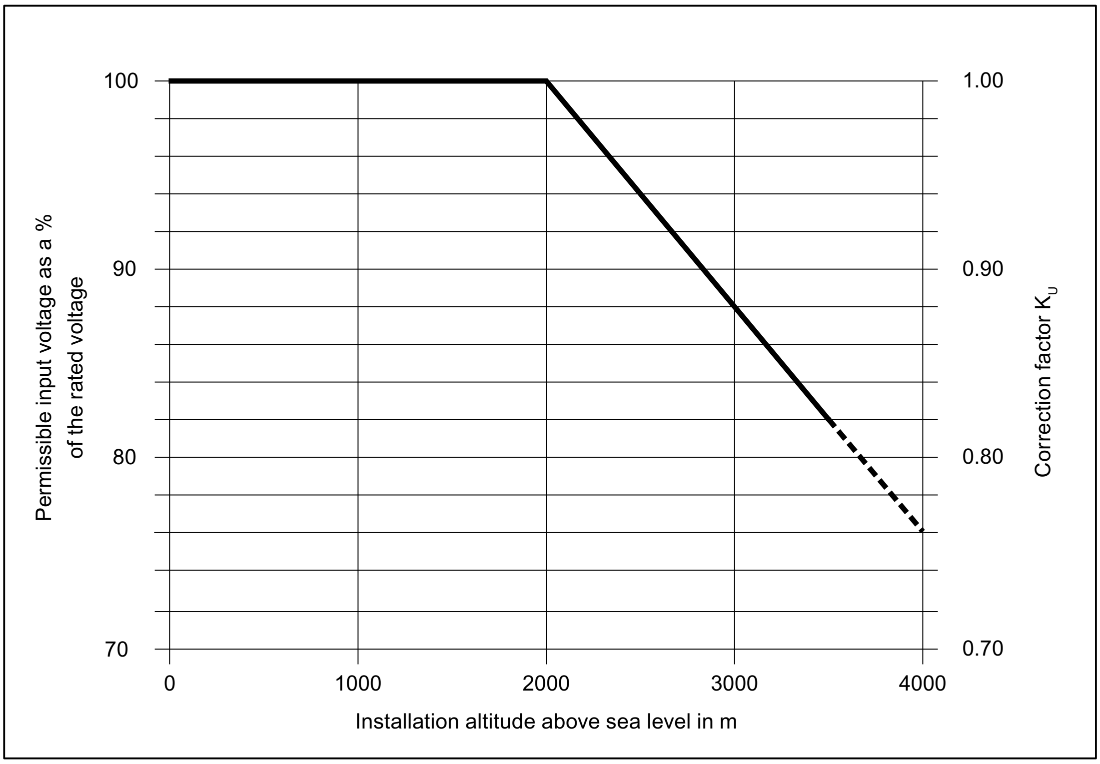


Figure 4-27 Voltage correction factor K_T as a function of the installation altitude

---

Note

Refer to the maximum line voltage under "Connection voltages" in the technical data for details of the rated voltage.

Note

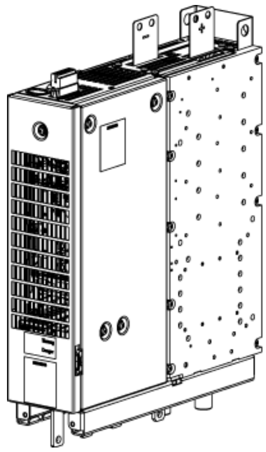
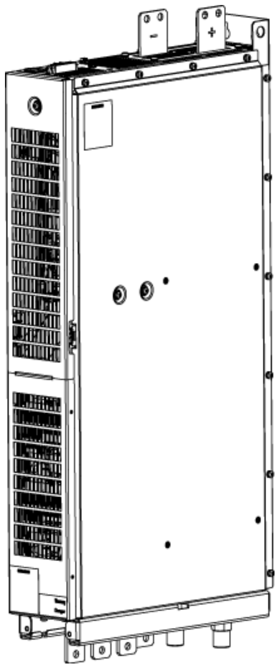
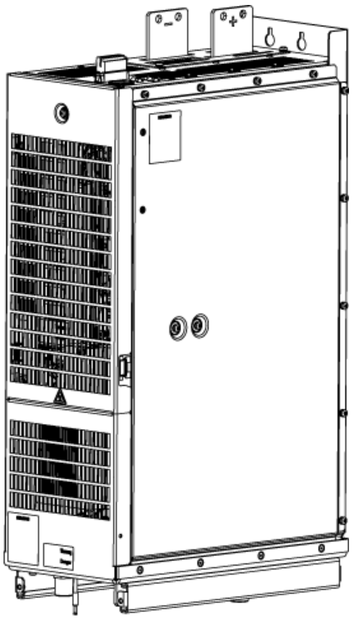
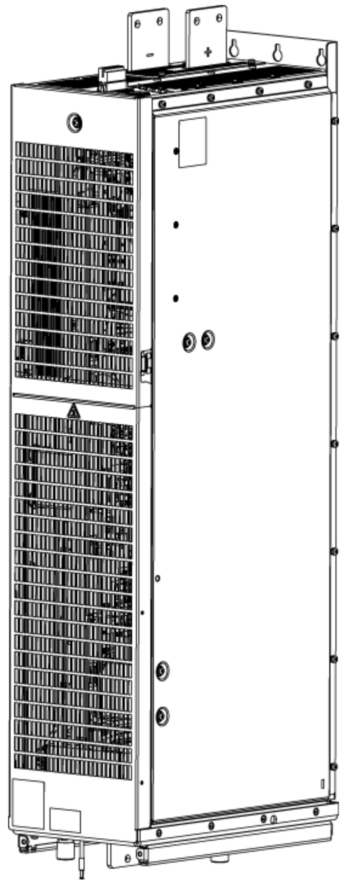
The dashed line represents a theoretical characteristic of the correction factor. The devices have an undervoltage threshold, which leads to shutdown when the voltage drops below it. Consequently, the input voltage range that is actually usable has a lower limit.

Motor Modules 5

5.1 Description

A Motor Module is a power unit (DC-AC inverter) that provides the power supply for the motor connected to it. 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 are stored in the Control Unit.

Table 5- 1 Overview of Motor Modules

			
Frame size FXL	Frame size GXL	Frame size HXL	Frame size JXL

Characteristics of the Motor Modules

- Version for 510 V DC to 750 V DC from 210 A to 1405 A
  Version for 675 V DC to 1080 V DC from 100 A to 1270 A
- Liquid cooling
- Short-circuit/ground-fault-proof
- Electronic rating 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
- An external 24 V DC supply is required to operate liquid-cooled Motor Modules.

The volumetric flow of the coolant is monitored by the software. If the volumetric flow is continuously lower than the setpoint, an alarm (A5005) is first displayed. If this alarm remains active continually for the next 5 minutes, a fault message (F30047) is activated which shuts down the unit.

The fans for the internal electronic circuitry are only switched on when required.

The fans are switched on and off as a function of several factors (e.g. heat sink temperature, ambient temperature, output current, duty cycle, ...) which means that fan operating cycles cannot be calculated directly.

5.2 Safety information

⚠ WARNING

After disconnecting all the supply voltages, a hazardous voltage will be present in all components for another 5 minutes. Work cannot be carried out until this time has elapsed.

Before starting work, you should also measure the voltage after the 5 minutes have elapsed. The voltage can be measured on DC link terminals DCP and DCN.

⚠ CAUTION

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

NOTICE

The cooling clearances above, below, and in front of the component, which are specified in the dimension drawings, must be observed.

⚠ WARNING

Cable shields and power cable conductors which are not used must be connected to PE potential in order to discharge charges as a result of capacitive coupling.

Non-observance can cause lethal shock voltages.

CAUTION

The busbars and coolant connections which stick out of the module must never be used as handles or support surfaces when the units are transported.

⚠ DANGER

Motor Modules discharge a high leakage current to the protective ground conductor.
Due to the high leakage current associated with Motor Modules, they or the relevant control cabinet must be permanently connected to PE.

According to EN 61800-5-1, Section. 6.3.6.7, the minimum cross-section of the protective ground conductor must conform to the local safety regulations for protective ground conductors for equipment with a high leakage current.

5.3 Interface description

5.3.1 Overview

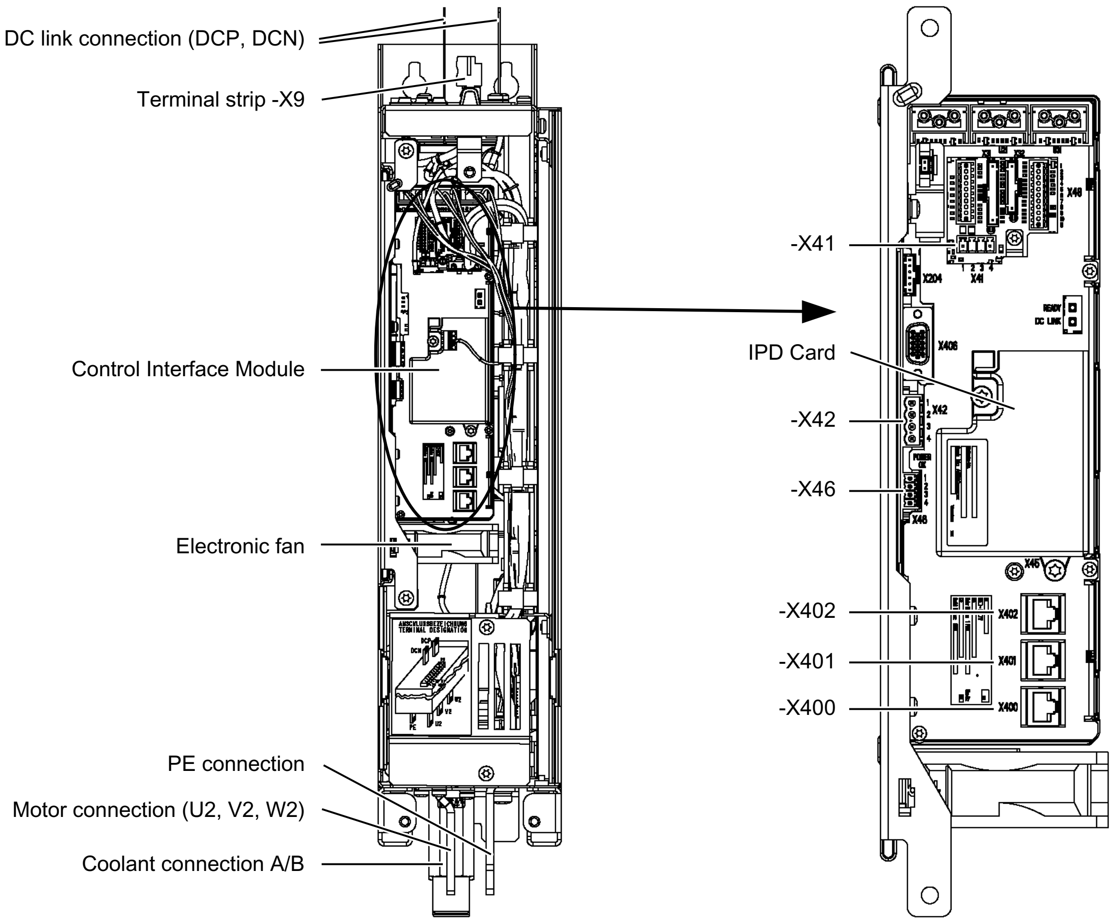


Figure 5-1 Motor Module, frame size FXL

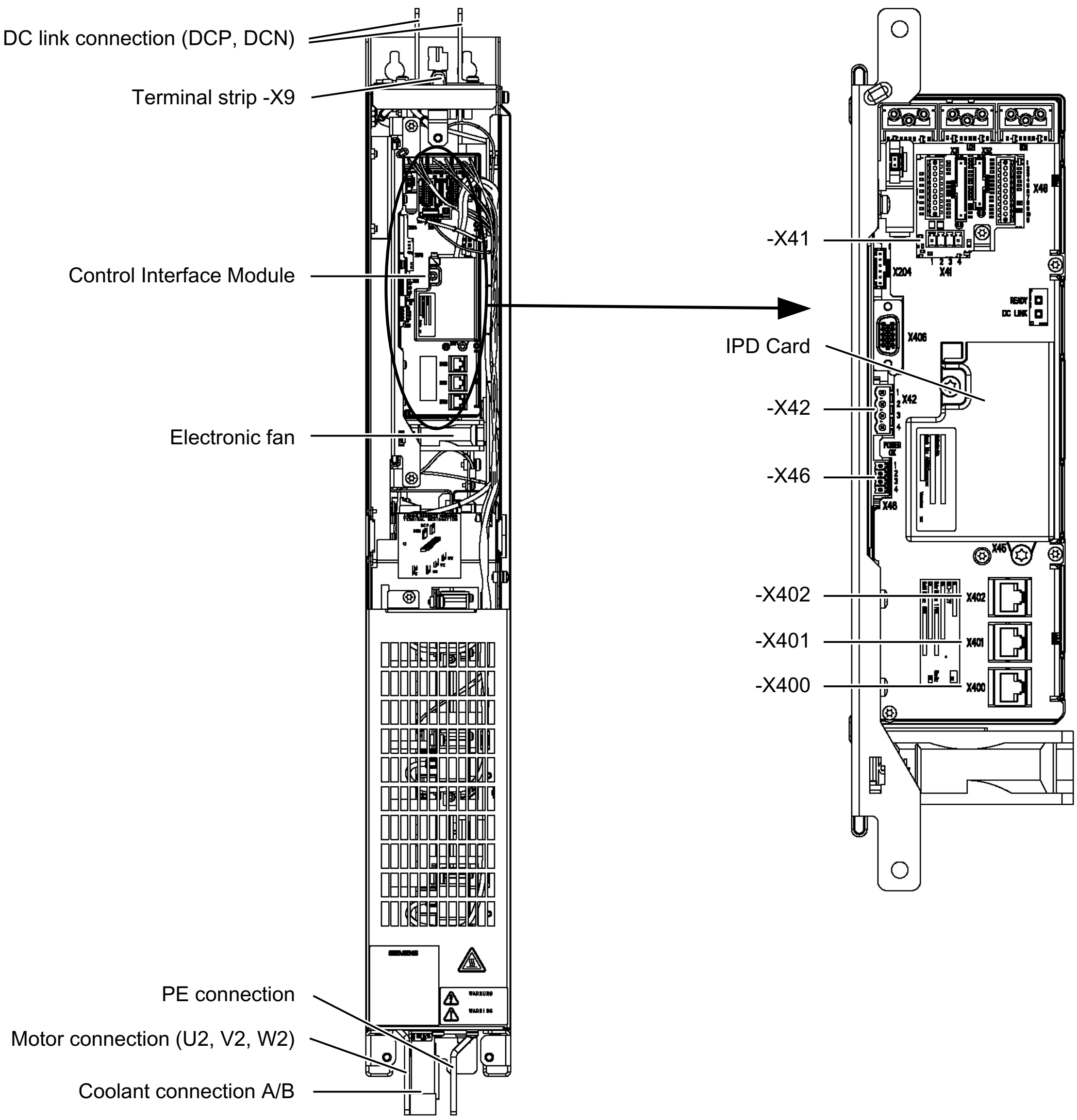


Figure 5-2 Motor Module, frame size GXL

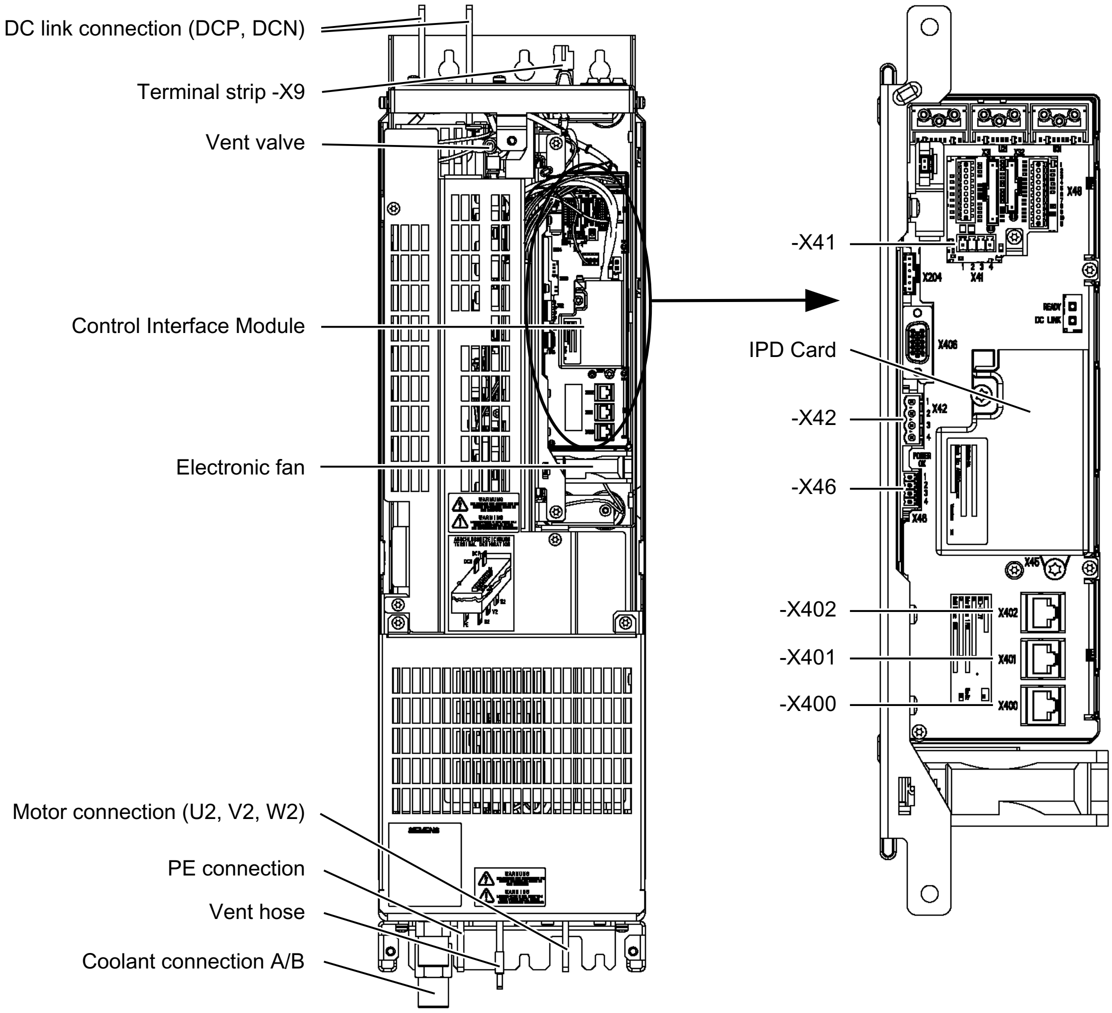


Figure 5-3 Motor Module, frame size HXL

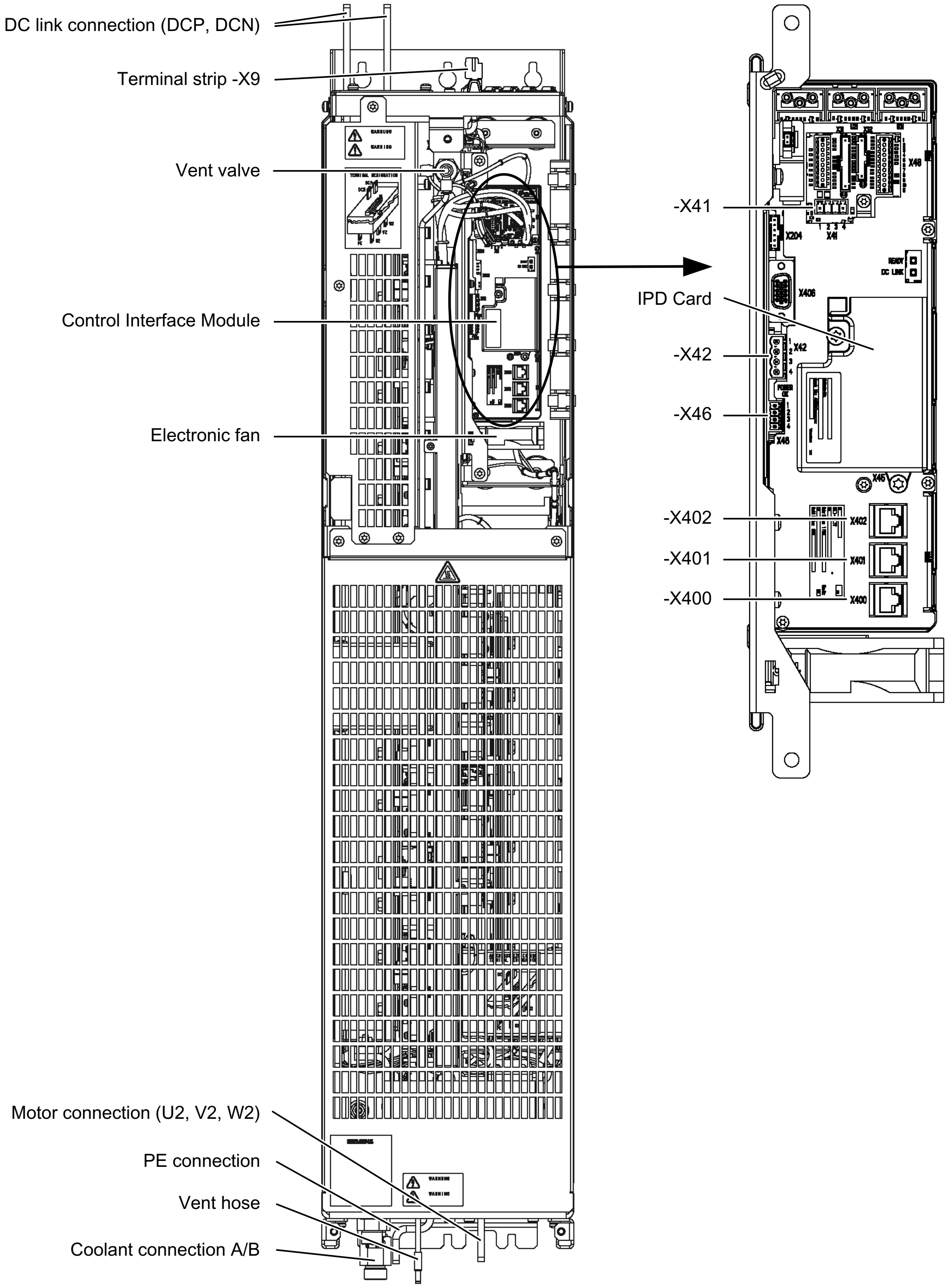


Figure 5-4 Motor Module, frame size JXL

5.3.2 Connection example

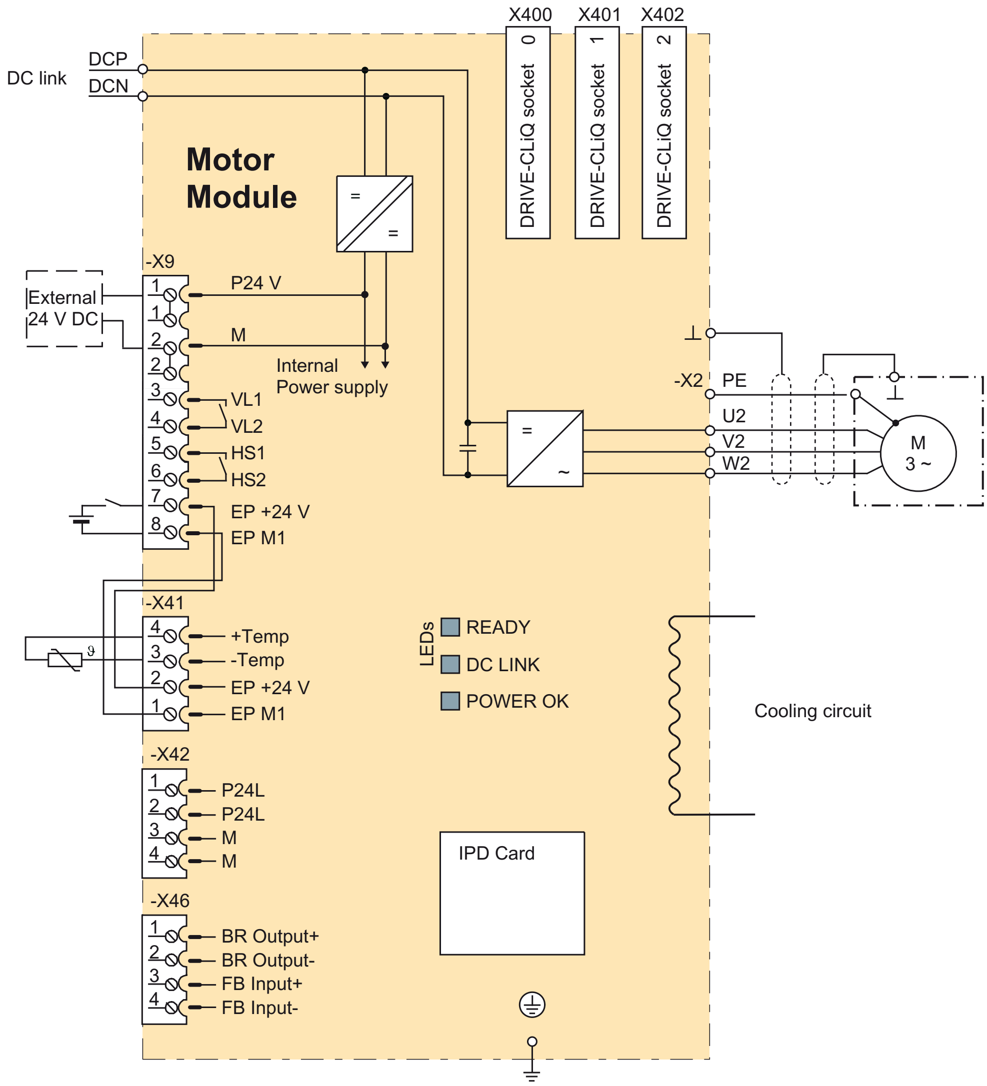


Figure 5-5 Connection example Motor Module

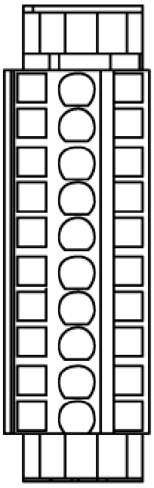
5.3.3 DC link/motor connection

Table 5- 2 DC link/motor connection of the Motor Module

Terminals	Technical specifications
DCP, DCN DC power input	Voltage: • 510 to 750 V DC • 675 to 1080 V DC Connecting lugs: d = 13 mm (M12/50 Nm) for busbar connection
U2, V2, W2 3 AC power output	Voltage: • 0 V 3 AC to 0.72 x DC link voltage Connecting lugs: • Frame sizes FXL, GXL, HXL: D = 13 mm (M10/50 Nm) for cable lugs in accordance with DIN 46234 / DIN 46235 • Frame size JXL: D = 13 mm (M10/50 Nm) for busbar connection
PE connection	Connecting lugs: • Frame sizes FXL, GXL, HXL: D = 13 mm (M10/50 Nm) for cable lugs in accordance with DIN 46234 / DIN 46235 • Frame size JXL: D = 13 mm (M10/50 Nm) for busbar connection

5.3.4 X9 terminal strip

Table 5- 3 Terminal strip X9

	Terminal	Signal name	Technical specifications
	1	P24 V	Voltage: 24 V DC (20.4 V – 28.8 V) Power consumption: See Technical data
	1	P24 V	
	2	M	
	2	M	
	3	VL1	240 V AC: 8 A max. 24 V DC: max. 1 A isolated
	4	VL2	
	5	HS1	240 V AC: 8 A max. 24 V DC: max. 1 A isolated
	6	HS2	
	7	EP +24 V (Enable Pulses)	Supply voltage: 24 V DC (20.4 V - 28.8 V) Power consumption: 10 mA Signal propagation times: L → H: 100 μs H → L: 1000 μs The pulse disable function is only available when Safety Integrated Basic Functions are enabled.
	8	EP M1 (Enable Pulses)	
Max. connectable cross-section 1.5 mm²			

NOTICE

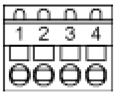
The function of the EP terminals is only available when Safety Integrated Basic Functions are enabled.

Note

The two "P24 V" or "M" terminals are jumpered in the connector. This ensures that the supply voltage is looped through, even when the connector is removed.

5.3.5 X41 EP terminal / temperature sensor connection

Table 5- 4 Terminal strip X41

	Terminal	Function	Technical specifications
	1	EP M1 (Enable Pulses)	Connected to terminal -X9:8
	2	EP +24 V (Enable Pulses)	Connected to terminal -X9:7
	3	-Temp	Temperature sensor connection KTY84-1C130 / PTC / PT100
	4	+Temp	
Max. connectable cross-section 1.5 mm²			

DANGER

Risk of electric shock!

Only temperature sensors that meet the safety isolation specifications contained in EN 61800-5-1 may be connected to terminals "+Temp" and "-Temp". If safe electrical separation cannot be guaranteed (for linear motors or third-party motors, for example), a Sensor Module External (SME120 or SME125) must be used.

If these instructions are not complied with, there is a risk of electric shock!

Note

The following probes can be connected to the temperature sensor connection: KTY84-1C130 / PTC / PT100.

CAUTION

The temperature sensor must be connected in shielded form. The shielding must be attached to the shield support of the motor module.

NOTICE

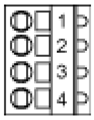
The KTY temperature sensor must be connected with the correct polarity.

Note

A cable harness is used to connect terminals -X41:1 and -X41:2 to terminals -X9:8 and -X9:7.

5.3.6 X42 terminal strip

Table 5- 5 Terminal strip X42 voltage supply for Control Unit, Sensor Module and Terminal Module

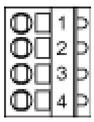
	Terminal	Function	Technical specifications
	1	P24L	Voltage supply for Control Unit, Sensor Module and Terminal Module (18 to 28.8 V) maximum load current: 3 A
	2		
	3	M	
	4		
Max. connectable cross-section 2.5 mm²			

CAUTION

The terminal strip is not intended for free 24 V DC availability (for example for supplying further line-side components), as the voltage supply of the Control Interface Module could also be overloaded and operating capability could thus be compromised.

5.3.7 X46 Brake control and monitoring

Table 5- 6 Terminal strip X46 brake control and monitoring

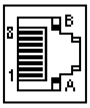
	Terminal	Function	Technical specifications
	1	BR output +	The interface is intended for connection of the Safe Brake Adapter.
	2	BR output -	
	3	FB input +	
	4	FB input -	
Max. connectable cross-section 1.5 mm²			

CAUTION

The length of the connecting lead at terminal strip X46 must not exceed 10 m, and the lead must not be brought out outside the control cabinet or control cabinet group.

5.3.8 DRIVE-CLiQ interfaces X400, X401, X402

Table 5- 7 DRIVE-CLiQ interfaces X400, X401, X402

	PIN	Signal name	Technical specifications
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	24 V power supply
	B	M (0 V)	Electronics ground
Blanking plate for DRIVE-CLiQ interfaces (50 pcs.) order number: 6SL3066-4CA00-0AA0			

5.3.9 Cooling circuit connections

Table 5- 8 Cooling circuit connections

Connection	Technical data
Coolant connection A: Inlet	Pipe thread ISO 228 - G 3/4 B (external thread 3/4", flat-sealing)
Coolant connection B: Return flow	
Tightening torque	60 Nm

Note

The seals for the screwed connections can be used only once when the cooling circuit is first assembled. The seals must be replaced if the circuit is disassembled and assembled again.

A replacement seal is commercially available under the name Viton flat gasket 3/4".

5.3.10 Meaning of the LEDs on the Control Interface Module in the Motor Module

Table 5- 9 Meaning of the LEDs "READY" and "DC LINK" on the Control Interface Module in the Motor Module

LED state		Description
READY	DC LINK	
Off	Off	The electronics power supply is missing or out of tolerance.
Green	Off	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is present.
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is too high.
Orange	Orange	DRIVE-CLiQ communication is being established.
Red	---	At least one fault is present in this component. Note: LED is driven irrespective of the corresponding messages being reconfigured.
Flashing light 0.5 Hz: Green / red	---	Firmware is being downloaded.
2 Hz flashing: Green / red	---	Firmware download is complete. Waiting for POWER ON.
2 Hz flashing: Green / orange or red / orange	---	Component detection using LED is activated (p0124) Note: The two options depend on the LED status when module recognition is activated via p0124 = 1.

Table 5- 10 Meaning of the LED "POWER OK" on the Control Interface Module in the Motor Module

LED	Color	Status	Description
POWER OK	Green	Off	DC link voltage < 100 V and voltage at -X9:1/2 less than 12 V.
		On	The component is ready for operation.
		Flashing light	There is a fault. If the LED continues to flash after you have performed a POWER ON, please contact your Siemens service center.

WARNING

Irrespective of the state of the LED "DC LINK", hazardous DC link voltages can always be present.

The warning information on the component must be carefully observed!

5.4 Dimension drawing

Dimension drawing, frame size FXL

The mandatory cooling clearances are indicated by the dotted line.

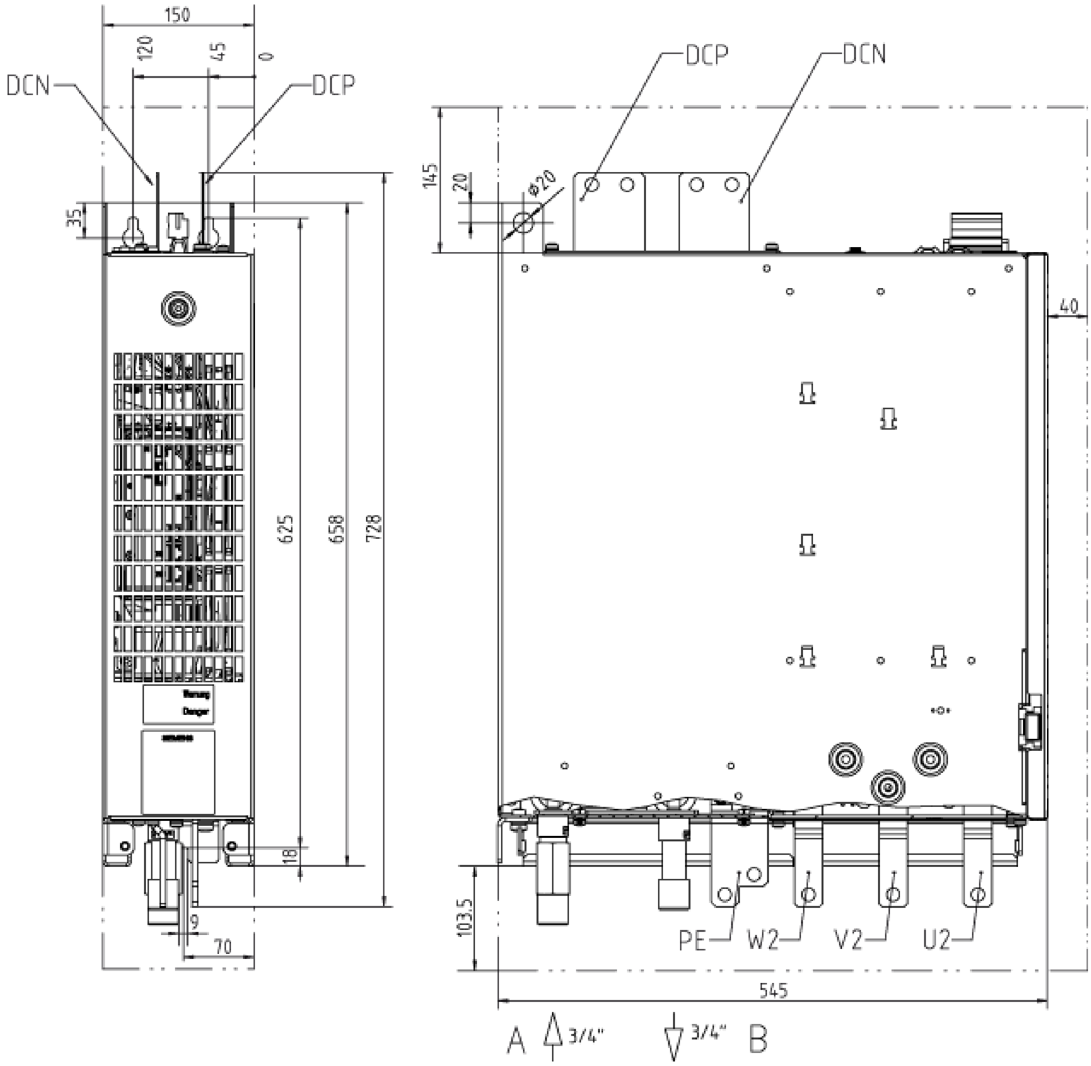


Figure 5-6 Dimension drawing Motor Module, frame size FXL. Front view, side view

Dimension drawing for frame size GXL

The mandatory cooling clearances are indicated by the dotted line.

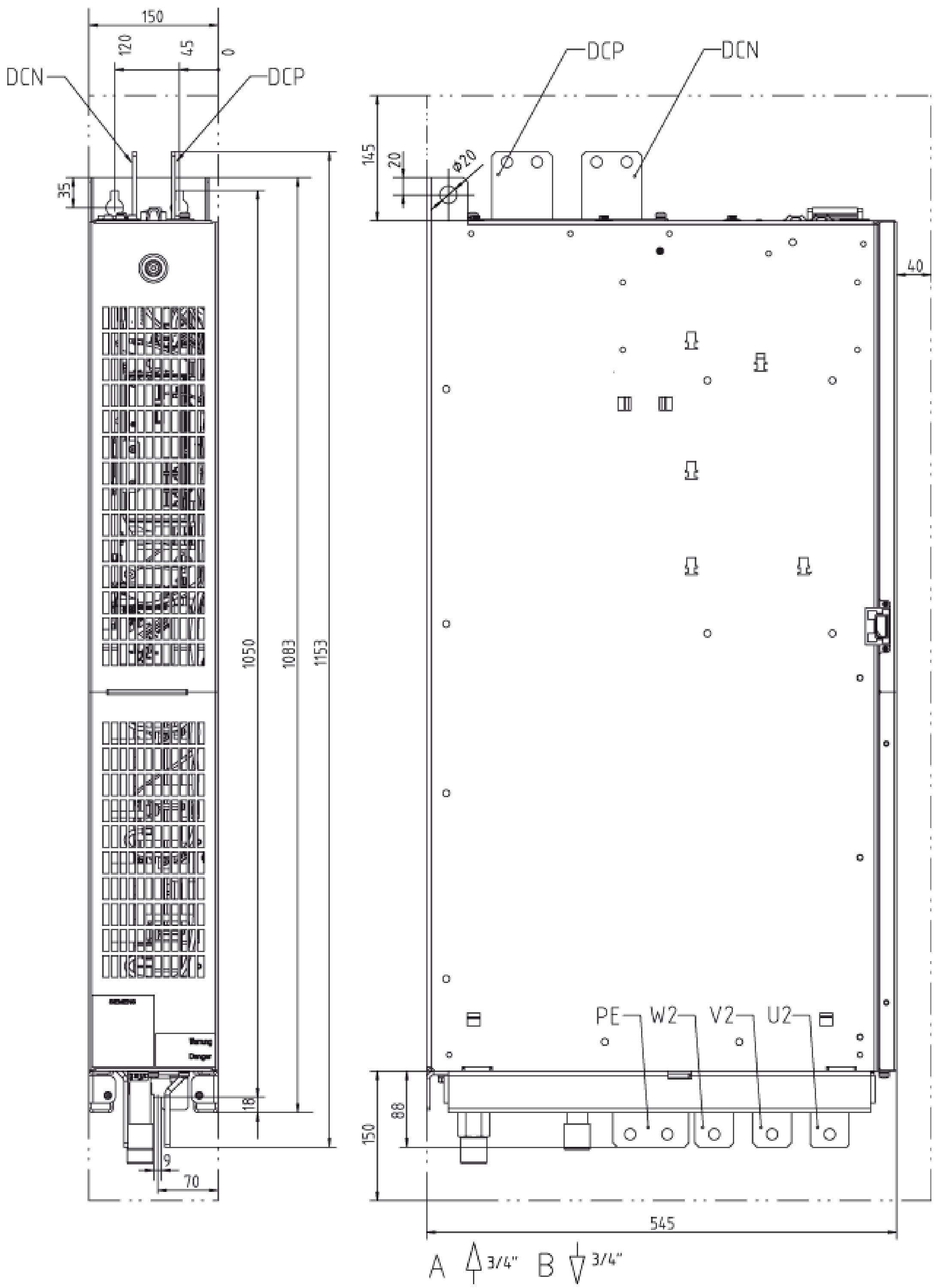


Figure 5-7 Dimension drawing Motor Module, frame size GXL. Front view, side view

Dimension drawing, frame size HXL

The mandatory cooling clearances are indicated by the dotted line.

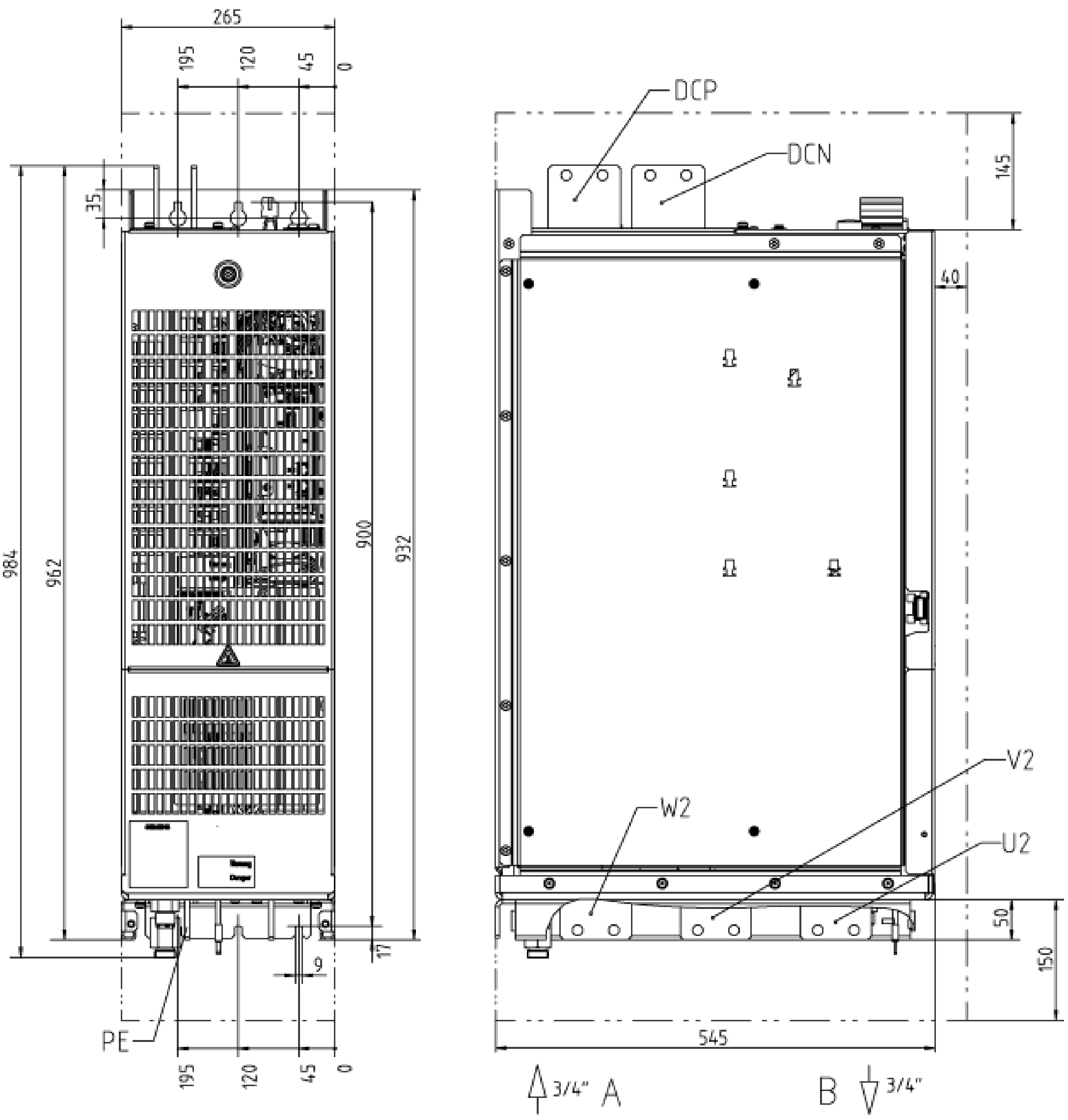


Figure 5-8 Dimension drawing Motor Module, frame size HXL. Front view, side view

Dimension drawing for frame size JXL

The mandatory cooling clearances are indicated by the dotted line.

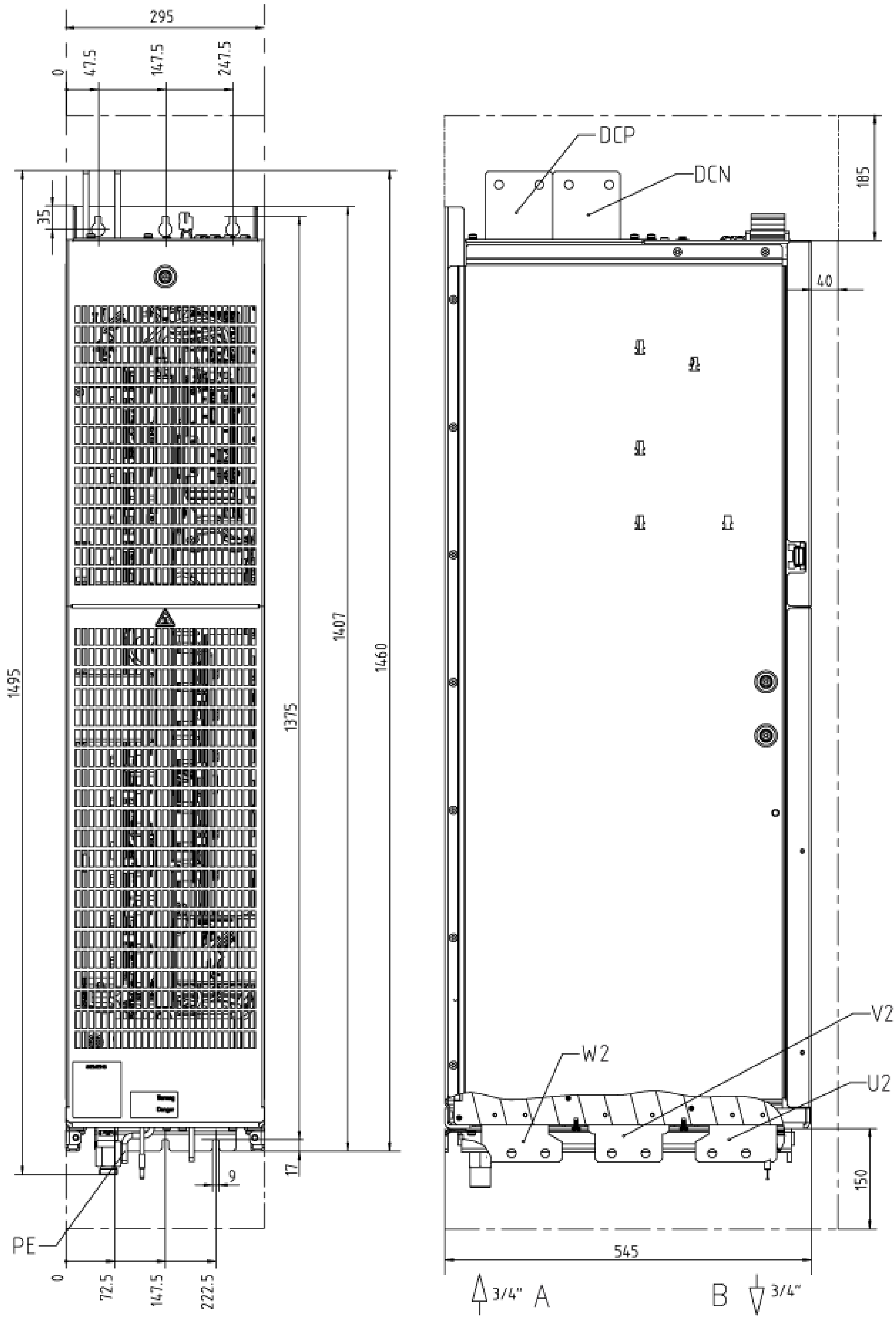


Figure 5-9 Dimension drawing Motor Module, frame size JXL. Front view, side view

5.5 Installation

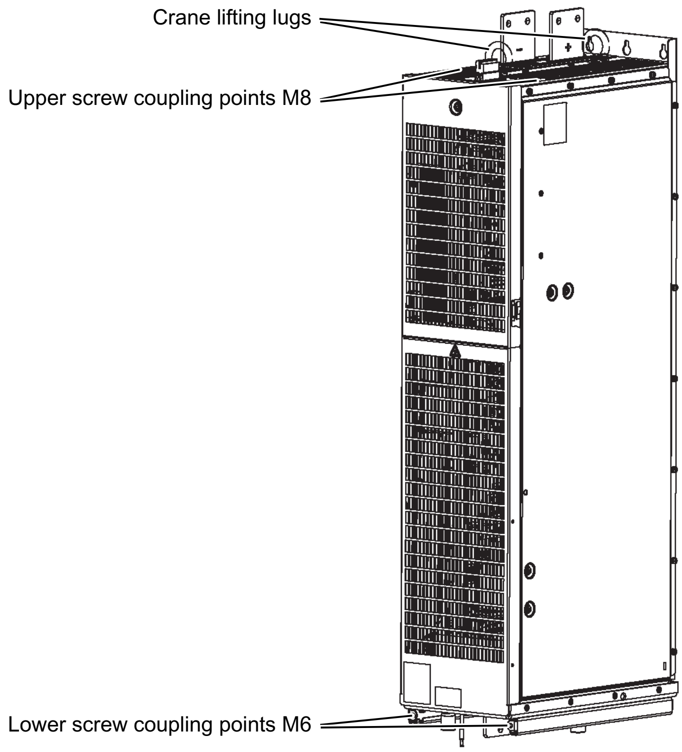


Figure 5-10 Crane lifting lugs / screw coupling points for mechanical support

Crane lifting lugs

Motor Modules are fitted with crane lifting lugs as standard when shipped. The units can be hoisted from these lugs and transported from the pallet to the installation location.

Note

A thread for inserting a crane lifting lug is provided on the bottom of the Motor Module. This allows the Motor Module to also be transported horizontally with a lifting harness.

⚠ WARNING

A lifting harness with vertical ropes or chains must be used to prevent any risk of damage to the housing.

The crane lifting lugs must be removed after the modules have been installed. The lugs should be safely stored for future use.

Screw coupling points for mechanical support

Since the Motor Modules are housed in a very slim enclosure, they need to be mechanically supported against lateral movement and vibration if they are installed in a control cabinet. Screw coupling points are provided on the top and bottom of the units for this purpose.

If several modules are mounted adjacent to one another, they can be interconnected via the screw coupling points. When a single module is installed, lateral support can be provided by means of reinforcing plates inserted between the module and the cabinet.

Protection guard

A protection guard is mounted on the bottom of the Motor Module ("1" in the diagram below) for use during transportation. The Motor Module can be rested on this protection guard while it is removed from the packaging and during transportation.
Before the module is installed at its final location, this guard must be removed. To do this, remove the 4 screws ("2" in the diagram) and remove the guard.

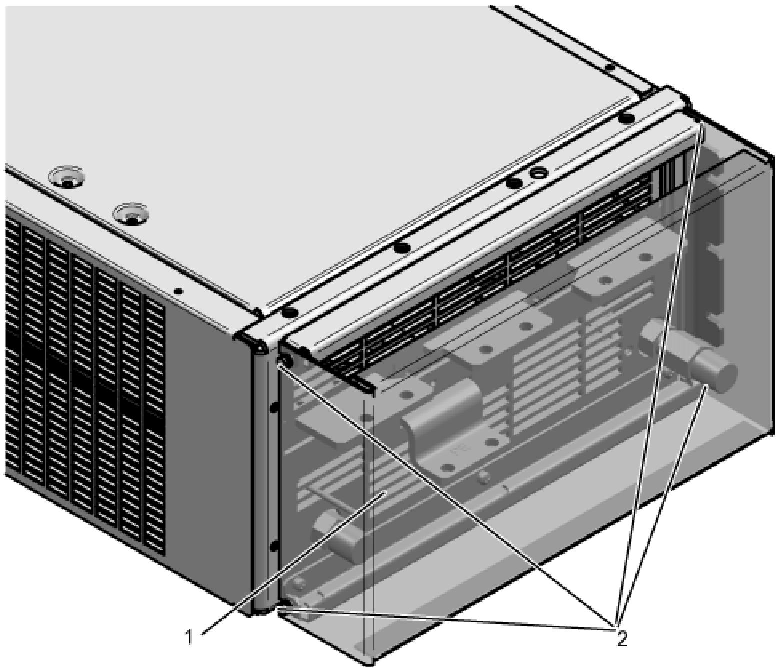


Figure 5-11 Protection guard

5.6 Technical specifications

Table 5- 11 Technical data for Motor Module, 510 – 750 V DC, part 1

Order number	6SL3325–	1TE32-1AA3	1TE32–6AA3	1TE33-1AA3	1TE35–0AA3
Output current					
- Rated current $I_{N A}$	A	210	260	310	490
- Base load current I_L	A	205	250	302	477
- Base load current I_H	A	178	233	277	438
- Max. output current $I_{max A}$	A	307	375	453	715
Unit rating					
- based on I_L (50 Hz 400 V) [1]	kW	110	132	160	250
- based on I_H (50 Hz 400 V) [1]	kW	90	110	132	200
- based on I_L (60 Hz 460 V) [2]	hp	150	200	250	400
- based on I_H (60 Hz 460 V) [2]	hp	150	200	200	350
DC link current					
- Rated current $I_{N DC}$ when fed via					
- Basic Line Module	A	256	317	380	600
- Active Line Module	A	230	287	340	538
- Base load current $I_{L DC}$ when fed via					
- Basic Line Module	A	250	305	368	581
- Active Line Module	A	225	274	331	522
- Base load current $I_{H DC}$ when fed via					
- Basic Line Module	A	227	284	338	534
- Active Line Module	A	195	255	303	480
Supply voltages					
- Electronics power supply	V_{DC}	24 (20.4 – 28.8)			
- DC link voltage	V_{DC}	510 to 750			
- Output voltage	V_{ACrms}	0 to 0.72 x DC link voltage			
DC link capacitance	μF	4800	5800	8400	9600
Rated pulse frequency	kHz	2	2	2	2
- Max. pulse frequency without derating	kHz	2	2	2	2
- Max. pulse frequency with derating	kHz	8	8	8	8
Electronic power consumption (24 V DC)	A	1.4	1.4	1.5	1.5
Cooling method		Liquid cooling with integrated stainless steel heat exchanger			
Power loss, max. [3]					
- at 50 Hz 400 V	kW	1.54	1.8	2.2	3.4
- at 60 Hz 460 V	kW	1.67	1.95	2.38	3.74
Max. coolant temperature					
- Without derating	°C	45	45	45	45
- With derating	°C	50	50	50	50
Rated volumetric flow for water at 70 kPa pressure drop [4]	l/min	9	9	12	12
Liquid volume of integrated heat exchanger	dm³	0.31	0.31	0.91	0.91
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	52	52	52	52
DC link/motor connection		Flat connector for M12 screw			

Order number	6SL3325–	1TE32-1AA3	1TE32–6AA3	1TE33-1AA3	1TE35–0AA3
Max. conductor cross-sections - DC link connection (DCP, DCN) - Motor connection (U2, V2, W2) - PE connection	 mm² mm² mm²	 Busbar 2 x 95 2 x 95	 Busbar 2 x 95 2 x 95	 Busbar 2 x 240 2 x 240	 Busbar 2 x 240 2 x 240
Max. cable length	m	300 (shielded) / 450 (unshielded)			
Degree of protection		IP00	IP00	IP00	IP00
Dimensions - Width - Height - Depth	 mm mm mm	 150 746 545	 150 746 545	 150 1172 545	 150 1172 545
Frame size		FXL	FXL	GXL	GXL
Weight	kg	41	41	80	80
UL listed fuse [5] - Number (connected in parallel) - Rated current - Frame size acc. to IEC 60269	 A 	3NE3230-0B 1 315 1	3NE3232-0B 1 400 1	3NE3233 1 450 1	3NE3336 1 650 2

[1] Rated output of a typical 6-pole standard induction motor based on I_L or I_H at 400 V 3 AC 50 Hz.

[2] Rated output of a typical 6-pole standard induction motor based on I_L or I_H at 460 V 3 AC 60 Hz.

[3] The specified power loss is the maximum value at 100% capacity utilization. In normal operation a lower value is established.

[4] This value applies to the water coolant option; for other coolant types, see Chapter "Cooling circuit and coolant properties".

[5] To achieve a UL-approved system, it is absolutely essential to use the fuse types specified in the table.

Table 5- 12 Technical data for Motor Module, 510 – 750 V DC, part 2

Order number	6SL3325–	1TE36-1AA3	1TE38–4AA3	1TE41-0AA3	1TE41–4AA3
Output current					
- Rated current $I_{N A}$	A	605	840	985	1405
- Base load current I_L	A	590	820	960	1370
- Base load current I_H	A	460	700	860	1257
- Max. output current $I_{max A}$	A	885	1230	1440	2055
Unit rating					
- based on I_L (50 Hz 400 V) [1)]	kW	315	450	560	800
- based on I_H (50 Hz 400 V) [1)]	kW	250	400	450	710
- based on I_L (60 Hz 460 V) [2)]	hp	500	700	800	1000
- based on I_H (60 Hz 460 V) [2)]	hp	350	600	700	1000
DC link current					
- Rated current $I_{N DC}$ when fed via					
- Basic Line Module	A	738	1025	1202	1714
- Active Line Module	A	664	922	1080	1544
- Base load current $I_{L DC}$ when fed via					
- Basic Line Module	A	719	1000	1170	1670
- Active Line Module	A	646	898	1051	1500
- Base load current $I_{H DC}$ when fed via					
- Basic Line Module	A	561	853	1048	1532
- Active Line Module	A	504	767	942	1377
Supply voltages					
- Electronics power supply	V_{DC}	24 (20.4 – 28.8)			
- DC link voltage	V_{DC}	510 to 750			
- Output voltage	V_{ACrms}	0 to 0.72 x DC link voltage			
DC link capacitance	μF	12600	17400	21000	29000
Rated pulse frequency	kHz	1.25	1.25	1.25	1.25
- Max. pulse frequency without derating	kHz	1.25	1.25	1.25	1.25
- Max. pulse frequency with derating	kHz	7.5	7.5	7.5	7.5
Electronic power consumption (24 V DC)	A	1.6	1.6	1.46	1.46
Cooling method		Liquid cooling with integrated aluminum heat exchanger			
Power loss, max. [3)]					
- at 50 Hz 400 V	kW	4.7	5.5	7.6	9.6
- at 60 Hz 460 V	kW	4.99	5.98	8.42	10.79
Max. coolant temperature					
- Without derating	°C	45	45	45	45
- With derating	°C	50	50	50	50
Rated volumetric flow for water at 70 kPa pressure drop [4)]	l/min	16	16	27	27
Liquid volume of integrated heat exchanger	dm³	0.74	0.74	1.56	1.56
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	54	54	56	56
DC link/motor connection		Flat connector for M12 screw			
Max. conductor cross-sections					
- DC link connection (DCP, DCN)	mm²	Busbar	Busbar	Busbar	Busbar
- Motor connection (U2, V2, W2)	mm²	4 x 185	4 x 185	Busbar	Busbar
- PE connection	mm²	4 x 185	4 x 185	Busbar	Busbar
Max. cable length	m	300 (shielded) / 450 (unshielded)			

Order number	6SL3325–	1TE36-1AA3	1TE38–4AA3	1TE41-0AA3	1TE41–4AA3
Degree of protection		IP00	IP00	IP00	IP00
Dimensions - Width - Height - Depth	 mm mm mm	 265 1002 545	 265 1002 545	 295 1516 545	 295 1516 545
Frame size		HXL	HXL	JXL	JXL
Weight	kg	110	110	220	220
UL listed fuse 5) - Number (connected in parallel) - Rated current - Frame size acc. to IEC 60269	 A 	3NE3338-8 1 800 2	3NE3335 2 560 2	3NE3336 2 630 2	3NE3340 2 900 2

1) Rated output of a typical 6-pole standard induction motor based on I_L or I_H at 400 V 3 AC 50 Hz.

2) Rated output of a typical 6-pole standard induction motor based on I_L or I_H at 460 V 3 AC 60 Hz.

3) The specified power loss is the maximum value at 100 % capacity utilization. In normal operation a lower value is established.

4) This value applies to the water coolant option; for other coolant types, see Chapter "Cooling circuit and coolant properties".

5) To achieve a UL-approved system, it is absolutely essential to use the fuse types specified in the table.

Table 5- 13 Technical data for Motor Module, 675 – 1080 V DC, part 1

Order number	6SL3325–	1TG31-0AA3	1TG31–5AA3	1TG32-2AA3	1TG33–3AA3
Output current					
- Rated current $I_{N A}$	A	100	150	215	330
- Base load current I_L	A	95	142	208	320
- Base load current I_H	A	89	134	192	280
- Max. output current $I_{max A}$	A	142	213	312	480
Unit rating					
- based on I_L (50 Hz 690 V) [1)]	kW	90	132	200	315
- based on I_H (50 Hz 690 V) [1)]	kW	75	110	160	250
- based on I_L (50 Hz 500 V) [1)]	kW	55	90	132	200
- based on I_H (50 Hz 500 V) [1)]	kW	55	90	132	200
- based on I_L (60 Hz 575 V) [2)]	hp	75	150	200	300
- based on I_H (60 Hz 575 V) [2)]	hp	75	125	200	250
DC link current					
- Rated current $I_{N DC}$ when fed via					
- Basic Line Module	A	122	183	263	403
- Active Line Module	A	110	165	237	363
- Base load current $I_{L DC}$ when fed via					
- Basic Line Module	A	116	173	253	390
- Active Line Module	A	105	156	229	352
- Base load current $I_{H DC}$ when fed via					
- Basic Line Module	A	108	163	234	341
- Active Line Module	A	98	147	211	308
Supply voltages					
- Electronics power supply	V_{DC}	24 (20.4 – 28.8)			
- DC link voltage	V_{DC}	675 to 1080			
- Output voltage	V_{ACrms}	0 to 0.72 x DC link voltage			
DC link capacitance	µF	2800	2800	4200	5800
Rated pulse frequency	kHz	1.25	1.25	1.25	1.25
- Max. pulse frequency without derating	kHz	1.25	1.25	1.25	1.25
- Max. pulse frequency with derating	kHz	7.5	7.5	7.5	7.5
Electronic power consumption (24 V DC)	A	1	1	1.5	1.5
Cooling method		Liquid cooling with integrated stainless steel heat exchanger			
Power loss, max. [3)]					
- at 50 Hz 400 V	kW	1.15	1.65	2.24	3.38
- at 60 Hz 460 V	kW	1	1.45	2	3.05
Max. coolant temperature					
- Without derating	°C	45	45	45	45
- With derating	°C	50	50	50	50
Rated volumetric flow for water at 70 kPa pressure drop [4)]	l/min	9	9	12	12
Liquid volume of integrated heat exchanger	dm³	0.31	0.31	0.91	0.91
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	52	52	52	52
DC link/motor connection		Flat connector for M12 screw			

Order number	6SL3325–	1TG31-0AA3	1TG31–5AA3	1TG32-2AA3	1TG33–3AA3
Max. conductor cross-sections - DC link connection (DCP, DCN) - Motor connection (U2, V2, W2) - PE connection	 mm² mm² mm²	 Busbar 2 x 95 2 x 95	 Busbar 2 x 95 2 x 95	 Busbar 2 x 240 2 x 240	 Busbar 2 x 240 2 x 240
Max. cable length	m	300 (shielded) / 450 (unshielded)			
Degree of protection		IP00	IP00	IP00	IP00
Dimensions - Width - Height - Depth	 mm mm mm	 150 746 545	 150 746 545	 150 1172 545	 150 1172 545
Frame size		FXL	FXL	GXL	GXL
Weight	kg	41	41	80	80
UL listed fuse [5)] - Number (connected in parallel) - Rated current - Frame size acc. to IEC 60269	 A 	3NE3230-0B 1 315 1	3NE3232-0B 1 400 1	3NE3233 1 450 1	3NE3336 1 650 2

1) Rated output of a typical 6-pole standard induction motor based on I_L or I_H at 500 or 690 V 3 AC 50 Hz.

2) Rated output of a typical 6-pole standard induction motor based on I_L or I_H at 575 V 3 AC 60 Hz.

3) The specified power loss is the maximum value at 100% capacity utilization. In normal operation a lower value is established.

4) This value applies to the water coolant option; for other coolant types, see Chapter "Cooling circuit and coolant properties".

5) To achieve a UL-approved system, it is absolutely essential to use the fuse types specified in the table.

Table 5- 14 Technical data for Motor Module, 675 – 1080 V DC, part 2

Order number	6SL3325–	1TG35-8AA3	1TG38–1AA3	1TG41–0AA3	1TG41–3AA3
Output current					
- Rated current $I_{N A}$	A	575	810	1025	1270
- Base load current I_L	A	560	790	1000	1230
- Base load current I_H	A	514	724	917	1136
- Max. output current $I_{max A}$	A	840	1185	1500	1845
Unit rating					
- based on I_L (50 Hz 690 V) 1)	kW	560	800	1000	1200
- based on I_H (50 Hz 690 V) 1)	kW	450	710	900	1000
- based on I_L (50 Hz 500 V) 1)	kW	400	560	710	900
- based on I_H (50 Hz 500 V) 1)	kW	315	560	630	800
- based on I_L (60 Hz 575 V) 2)	hp	600	800	1000	1250
- based on I_H (60 Hz 575 V) 2)	hp	500	700	900	1000
DC link current					
- Rated current $I_{N DC}$ when fed via					
- Basic Line Module	A	702	990	1250	1550
- Active Line Module	A	632	891	1125	1395
- Base load current $I_{L DC}$ when fed via					
- Basic Line Module	A	683	963	1219	1500
- Active Line Module	A	616	869	1100	1353
- Base load current $I_{H DC}$ when fed via					
- Basic Line Module	A	627	883	1118	1384
- Active Line Module	A	565	796	1009	1250
Supply voltages					
- Electronics power supply	V_{DC}	24 (20.4 – 28.8)			
- DC link voltage	V_{DC}	675 to 1080			
- Output voltage	V_{ACrms}	0 to 0.72 x DC link voltage			
DC link capacitance	µF	9670	14000	16000	19330
Rated pulse frequency	kHz	1.25	1.25	1.25	1.25
- Max. pulse frequency without derating	kHz	1.25	1.25	1.25	1.25
- Max. pulse frequency with derating	kHz	7.5	7.5	7.5	7.5
Electronic power consumption (24 V DC)	A	1.6	1.46	1.46	1.46
Cooling method		Liquid cooling with integrated aluminum heat exchanger			
Power loss, max. 3)					
- at 50 Hz 400 V	kW	5.6	9.56	10.87	13.48
- at 60 Hz 460 V	kW	5.1	9	10.1	12.6
Max. coolant temperature					
- Without derating	°C	45	45	45	45
- With derating	°C	50	50	50	50
Rated volumetric flow for water at 70 kPa pressure drop 4)	l/min	16	27	27	27
Liquid volume of integrated heat exchanger	dm³	0.74	1.56	1.56	1.56
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	54	56	56	56
DC link/motor connection		Flat connector for M12 screw			

Order number	6SL3325–	1TG35-8AA3	1TG38–1AA3	1TG41–0AA3	1TG41–3AA3
Max. conductor cross-sections - DC link connection (DCP, DCN) - Motor connection (U2, V2, W2) - PE connection	 mm² mm² mm²	 Busbar 4 x 185 4 x 185	 Busbar Busbar Busbar	 Busbar Busbar Busbar	 Busbar Busbar Busbar
Max. cable length	m	300 (shielded) / 450 (unshielded)			
Degree of protection		IP00	IP00	IP00	IP00
Dimensions - Width - Height - Depth	 mm mm mm	 265 1002 545	 295 1516 545	 295 1516 545	 295 1516 545
Frame size		HXL	JXL	JXL	JXL
Weight	kg	110	220	220	220
UL listed fuse [5] - Number (connected in parallel) - Rated current - Frame size acc. to IEC 60269	 A 	3NE3338-8 1 800 2	3NE3335 2 560 2	3NE3336 2 630 2	3NE3340 2 900 2

[1] Rated output of a typical 6-pole standard induction motor based on I_L or I_H at 500 or 690 V 3 AC 50 Hz.

[2] Rated output of a typical 6-pole standard induction motor based on I_L or I_H at 575 V 3 AC 60 Hz.

[3] The specified power loss is the maximum value at 100% capacity utilization. In normal operation a lower value is established.

[4] This value applies to the water coolant option; for other coolant types, see Chapter "Cooling circuit and coolant properties".

[5] To achieve a UL-approved system, it is absolutely essential to use the fuse types specified in the table.

5.6.1 Overload capability

The Motor Modules have an overload reserve e.g. to handle breakaway torques.

In the case of drives with overload requirements, the appropriate base-load current must, therefore, be used as a basis for the required load.

The criterion for overload is that the Motor Module is operated with its base load current before and after the overload occurs (a load duration of 300 s is used as a basis here).

Low overload

The base load current for low overload (I_L) is based on a load duty cycle of 110 % for 60 s or 150 % for 10 s.

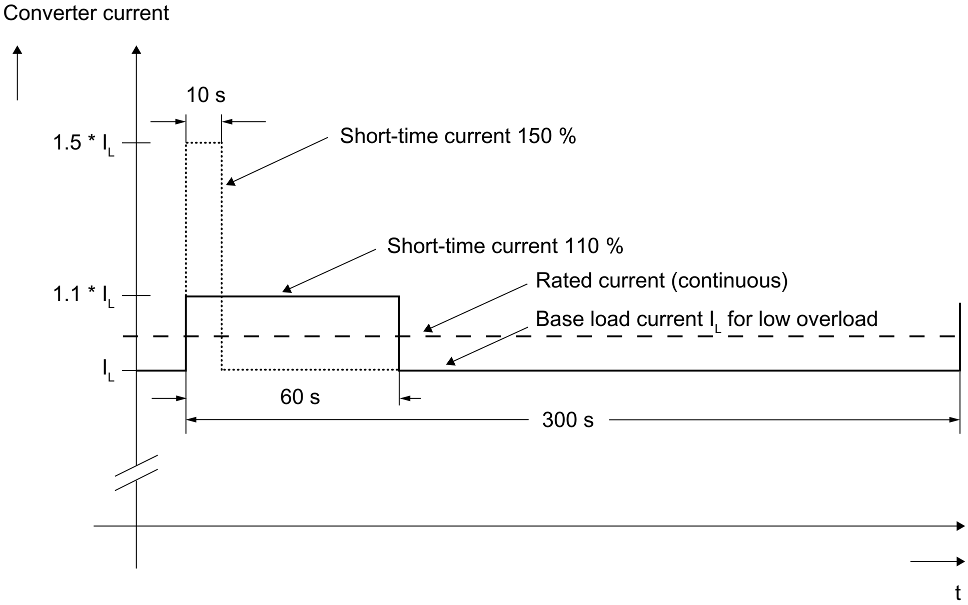


Figure 5-12 Low overload

High overload

The base load current for a high overload I_H is based on a duty cycle of 150 % for 60 s or 160 % for 10 s.

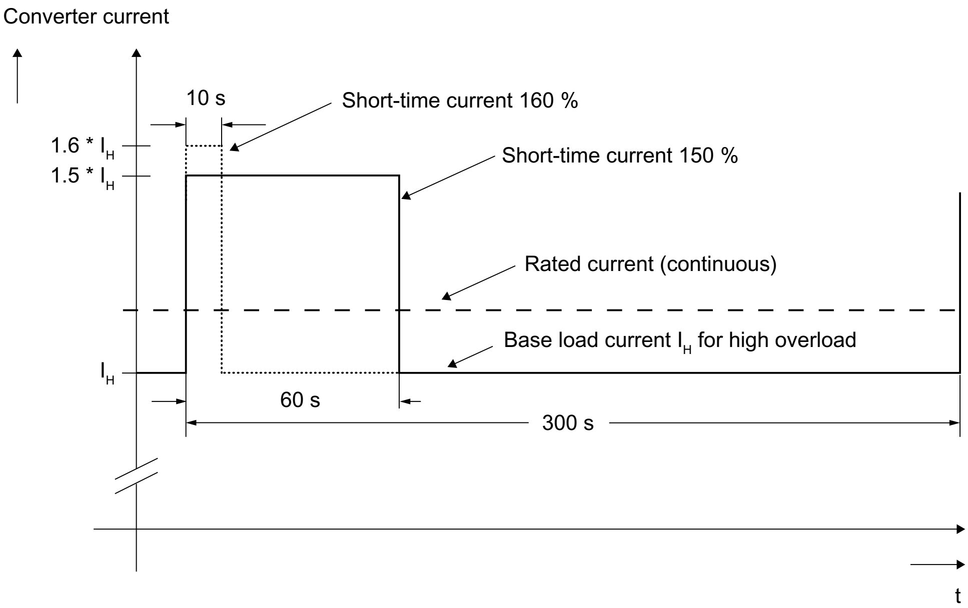


Figure 5-13 High overload

5.6.2 Derating factors

5.6.2.1 Derating factors as a function of coolant temperature

SINAMICS S120 Liquid Cooled units are designed for cooling by H_2O or by an H_2O Antifrogen N mixture. An H_2O Antifrogen N mixture must contain between 20 % and 45 % Antifrogen N.

When H_2O is used as a coolant, the units can supply 100 % output current at temperatures between 5 °C and 45 °C. The maximum output current decreases linearly to 90 % at temperatures between 45 °C and 50 °C.

When H_2O Antifrogen N mixture described above is used as a coolant, the units can supply 100 % output current at temperatures between 0 °C and 45 °C. The maximum output current decreases linearly to 90 % at temperatures between 45 °C and 50 °C.

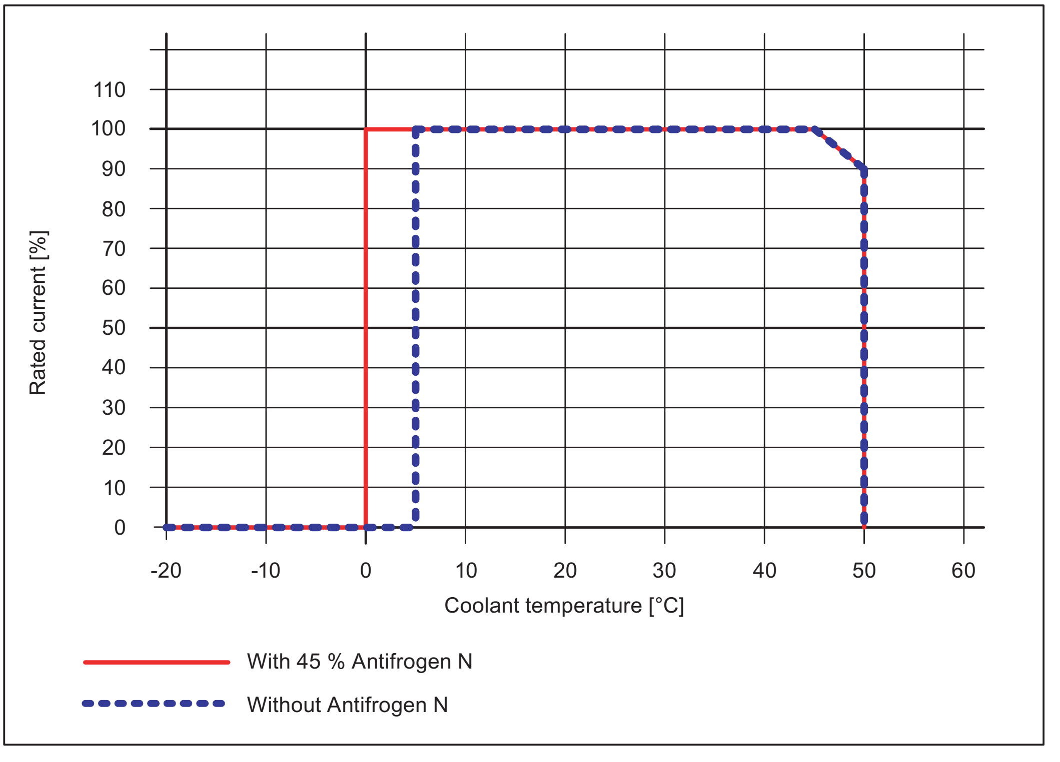


Figure 5-14 Maximum output current as a function of coolant temperature

5.6.2.2 Derating factors as a function of the ambient temperature

The units can supply 100 % output current at an ambient air temperature of between 0 °C and 45 °C. The maximum output current decreases linearly to 90 % at ambient air temperatures of between 45 °C and 50 °C.

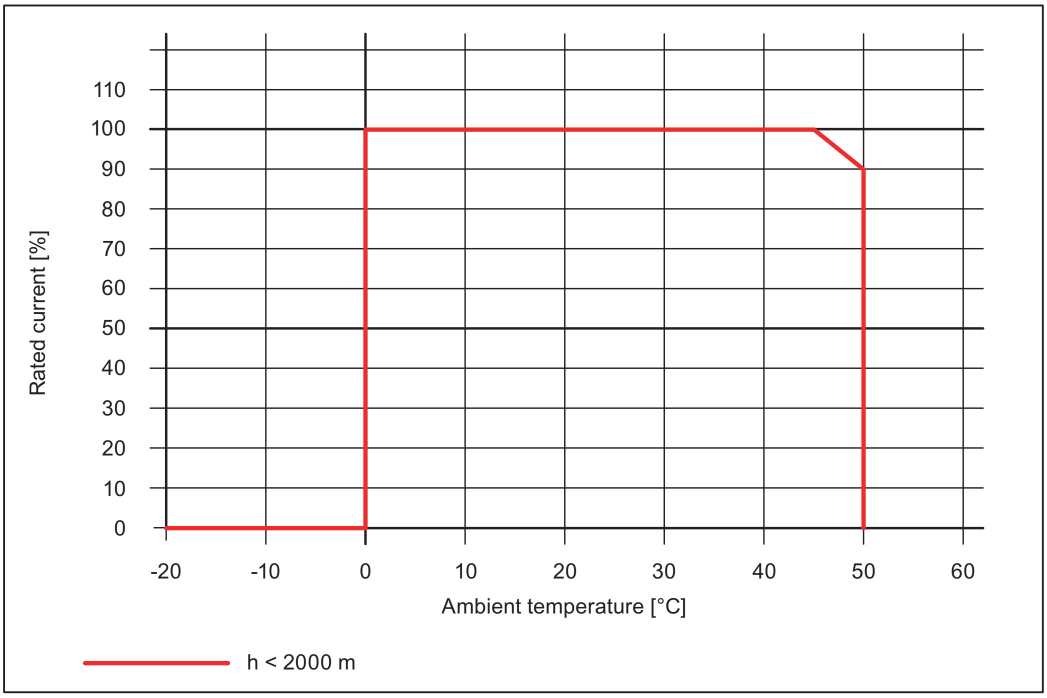


Figure 5-15 Maximum current as a function of ambient temperature

5.6.2.3 Derating factors as a function of installation altitude

When the units are operated at an installation altitude with reduced air pressure, the derating characteristic shown below applies to the output current or the ambient air temperature.

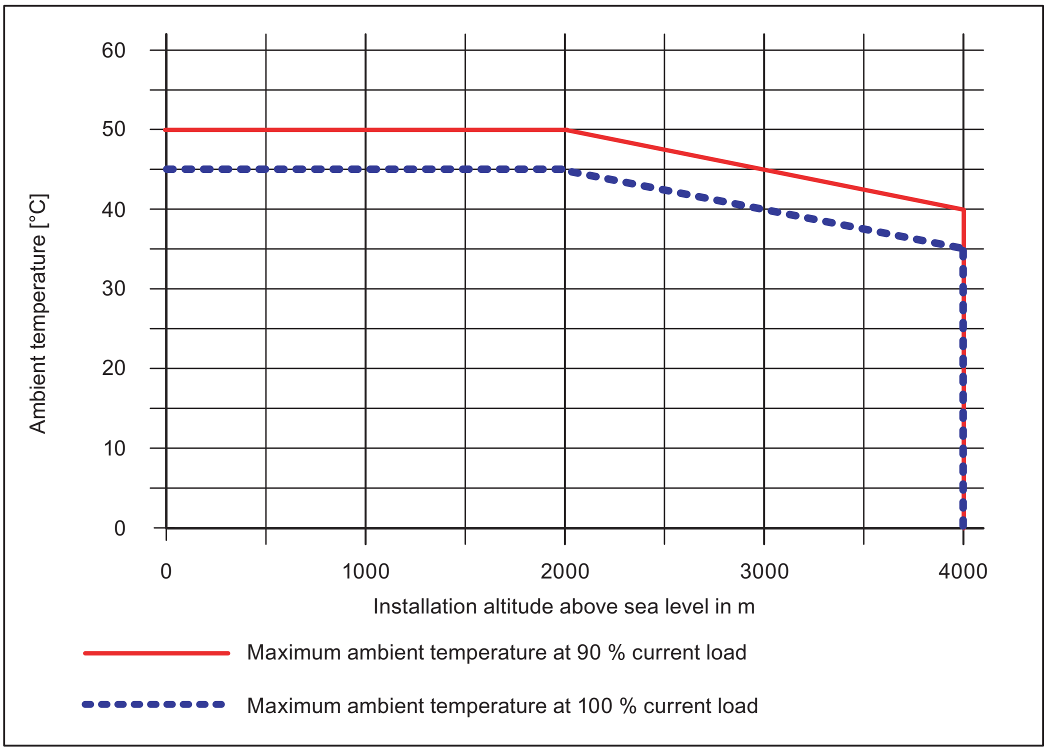


Figure 5-16 Maximum ambient temperature as a function of installation altitude

At installation altitudes above 2000 m (6562 ft), the line voltage must not exceed certain limits to ensure that surge voltages can be insulated in accordance with IEC 61800-5-1 for surge voltage category III. If the line voltage is higher than this limit at installation altitudes > 2000 m (6562 ft), measures must be taken to reduce transient category III surge voltages to category II values, e.g. equipment must be supplied via an isolating transformer.

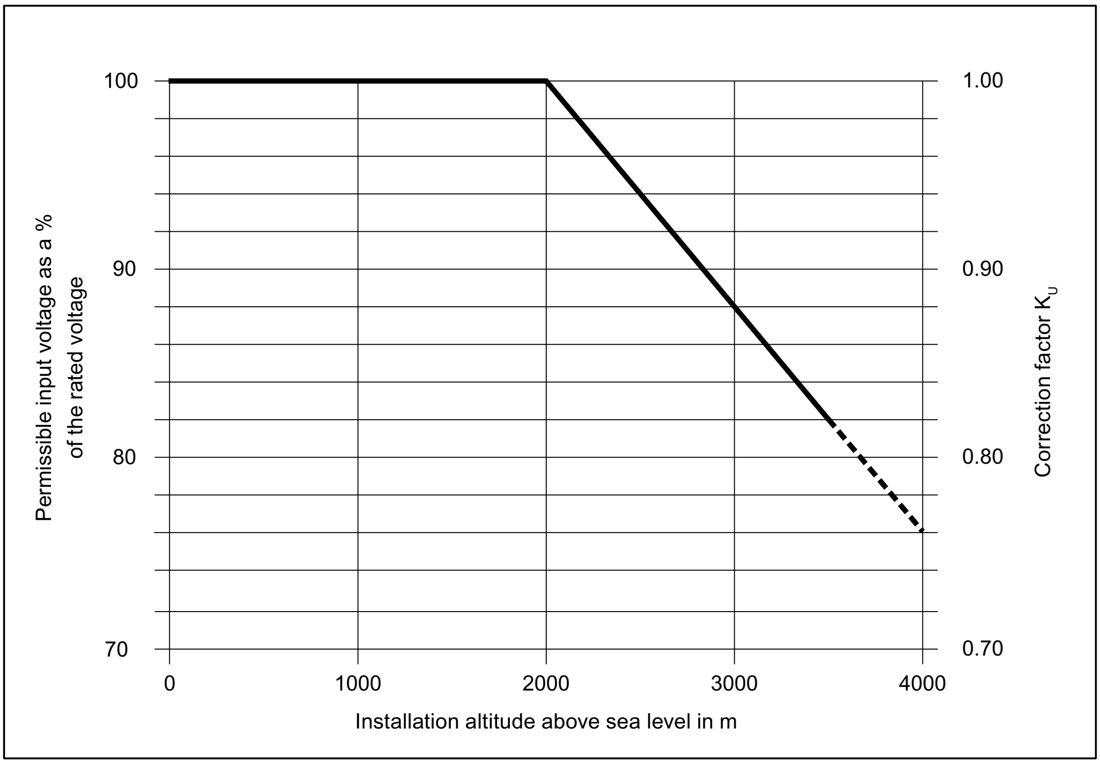


Figure 5-17 Voltage correction factor K_T as a function of the installation altitude

---

Note

Refer to the maximum line voltage under "Connection voltages" in the technical data for details of the rated voltage.

Note

The dashed line represents a theoretical characteristic of the correction factor. The devices have an undervoltage threshold, which leads to shutdown when the voltage drops below it. Consequently, the input voltage range that is actually usable has a lower limit.

5.6.2.4 Current derating as a function of the pulse frequency

When the pulse frequency is increased, the derating factor of the output current must be taken into account. This derating factor must be applied to the currents specified beforehand in the technical data.

Table 5- 15 Derating factor of the output current as a function of the pulse frequency for devices with a rated pulse frequency of 2 kHz

Order no. 6SL3325-...	Unit rating [kW]	Output current for a pulse frequency of 2 kHz [A]	Derating factor for a pulse frequency of 4 kHz
Supply voltage 510 – 750 V DC			
1TE32-1AAx	110	210	82 %
1TE32-6AAx	132	260	83 %
1TE33-1AAx	160	310	88 %
1TE35-0AAx	250	490	78 %

Table 5- 16 Derating factor of the output current as a function of the pulse frequency for devices with a rated pulse frequency of 1.25 kHz

Order no. 6SL3325-...	Unit rating [kW]	Output current for a pulse frequency of 1.25 kHz [A]	Derating factor for a pulse frequency of 2.5 kHz
Supply voltage 510 – 750 V DC			
1TE36-1AAx	315	605	72 %
1TE38-4AAx	450	840	79 %
1TE41-0AAx	560	985	87 %
1TE41-4AAx	800	1405	95 %
Supply voltage 675 – 1080 V DC			
1TG31-0AAx	90	100	88 %
1TG31-5AAx	132	150	84 %
1TG32-2AAx	200	215	87 %
1TG33-3AAx	315	330	82 %
1TG35-8AAx	560	575	85 %
1TG38-1AAx	800	810	95 %
1TG41-0AAx	1000	1025	86 %
1TG41-3AAx	1200	1270	79 %

Note

For pulse frequencies in the range between the specified fixed values, the relevant derating factors can be determined by linear interpolation.

Maximum output frequencies achieved by increasing the pulse frequency

By multiplying the rated pulse frequency with a multiple integer, the following output frequencies can be achieved taking into account the derating factors:

Table 5- 17 Maximum output frequencies achieved by increasing the pulse frequency in VECTOR mode

Pulse frequency [kHz]	Maximum output frequency [Hz]
1.25	100
2	160
2.5	200
4	320
5	400

Table 5- 18 Maximum output frequencies achieved by increasing the pulse frequency in SERVO mode

Pulse frequency [kHz]	Maximum output frequency [Hz]
2	300
4	300 / 650 [1)]

1) The maximum output frequency of 650 Hz is can only be achieved for a current controller clock cycle of 125 µs (factory setting: 250 µs).

5.6.3 Parallel connection of Motor Modules

The following rules must be observed when connecting Motor Modules in parallel:

- Up to 4 identical Motor Modules can be connected in parallel.
- A common Control Unit is required whenever the modules are connected in parallel.
- The motor supply cables must be the same length (symmetrical design).
- Power must be supplied to the Motor Modules from a common DC link.
- For motors with a single winding system, supply cables with a minimum length or motor reactors must be used. The cable lengths are listed in the following tables.
- A derating factor of 5 % must be taken into consideration, regardless of the number of modules connected in parallel.

Note

It is only possible to connect identical power units in parallel if both power units have the same hardware version. Mixed operation between a power unit with Control Interface Module (order number 6SL33xx-xxxxx–xAA3) and a power unit with Control Interface Board (order number 6SL33xx-xxxxx–xAA0) is not possible.

Minimum cable lengths for parallel connection and connection to a motor with a single-winding system

NOTICE
The minimum cable lengths specified in the tables below must be observed when two or more Motor Modules are connected in parallel and there is a connection to a motor with a single-winding system. If the cable length required for the application cannot be achieved, a motor reactor must be provided.

Table 5- 19 510 to 750 V DC Motor Modules

Order number	Unit rating [kW]	Output current [A]	Minimum cable length [m]
6SL3325-1TE32-1AAx	110	210	30
6SL3325-1TE32-6AAx	132	260	27
6SL3325-1TE33-1AAx	160	310	20
6SL3325-1TE35-0AAx	250	490	15
6SL3325-1TE36-1AAx	315	605	13
6SL3325-1TE38-4AAx	450	840	9
6SL3325-1TE41-0AAx	560	985	8
6SL3325-1TE41-4AAx	800	1405	5

Table 5- 20 675 to 1080 V DC Motor Modules

Order number	Unit rating [kW]	Output current [A]	Minimum cable length [m]
6SL3325-1TG31-0AAx	90	100	90
6SL3325-1TG31-5AAx	132	150	70
6SL3325-1TG32-2AAx	200	215	50
6SL3325-1TG33-3AAx	315	330	30
6SL3325-1TG35-8AAx	560	575	20
6SL3325-1TG38-1AAx	800	810	15
6SL3325-1TG41-0AAx	1000	1025	10
6SL3325-1TG41-3AAx	1200	1270	8

Motor-side power components 6

6.1 Sine-wave filter

6.1.1 Description

If a sine-wave filter is connected to the output of the Power Modules or Motor Modules, the voltage between the motor terminals is virtually sinusoidal. This reduces the voltage load on the motor windings and prevents motor noise that would be induced by the pulse frequency.

Sine-wave filters are available up to a converter type power rating of 250 kW (without consideration for derating).

The pulse frequency of the Power Modules or Motor Modules must be set to 4 kHz for the sine-wave filters. This reduces the output current of the Power Modules or Motor Modules.

When a sine-wave filter is used, the available output voltage decreases by 15%.

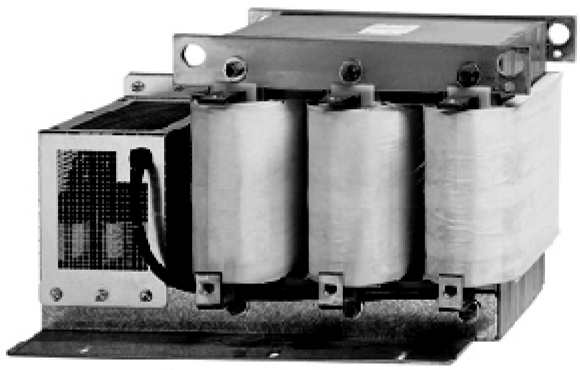


Figure 6-1 Sine-wave filter

6.1.2 Safety information

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

Note

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

CAUTION
The connections must not be interchanged: • Incoming cable from the Power Modules or Motor Modules to 1U1, 1V1, 1W1, and • Outgoing cable to the load 1U2, 1V2, 1W2. Non-observance may damage the sine-wave filter.

CAUTION
If sine-wave filters are used that have not been approved for SINAMICS by SIEMENS, the Power Modules or Motor Modules may be damaged or may malfunction.

⚠ CAUTION
The surface temperature of the sine-wave filters can exceed 80°C.

CAUTION
If a sine-wave filter is connected to the Power Modules or Motor Modules, the converter must be activated during commissioning (p0230 = 3) to prevent the filter from being destroyed. If a sine-wave filter is connected to the Power Module or Motor Module, the Power Module or Motor Module must not be operated without a connected motor because otherwise the filter can be destroyed.

CAUTION
The maximum permissible output frequency when sine-wave filters are used is 150 Hz.

⚠ DANGER
Sine-wave filters discharge a high leakage current to the protective ground conductor. Due to the high leakage current associated with sine-wave filters, they or the relevant control cabinet must be permanently connected to PE. According to EN 61800-5-1, Section. 6.3.6.7, the minimum cross-section of the protective ground conductor must conform to the local safety regulations for protective ground conductors for equipment with a high leakage current.

6.1.3 Dimension drawing

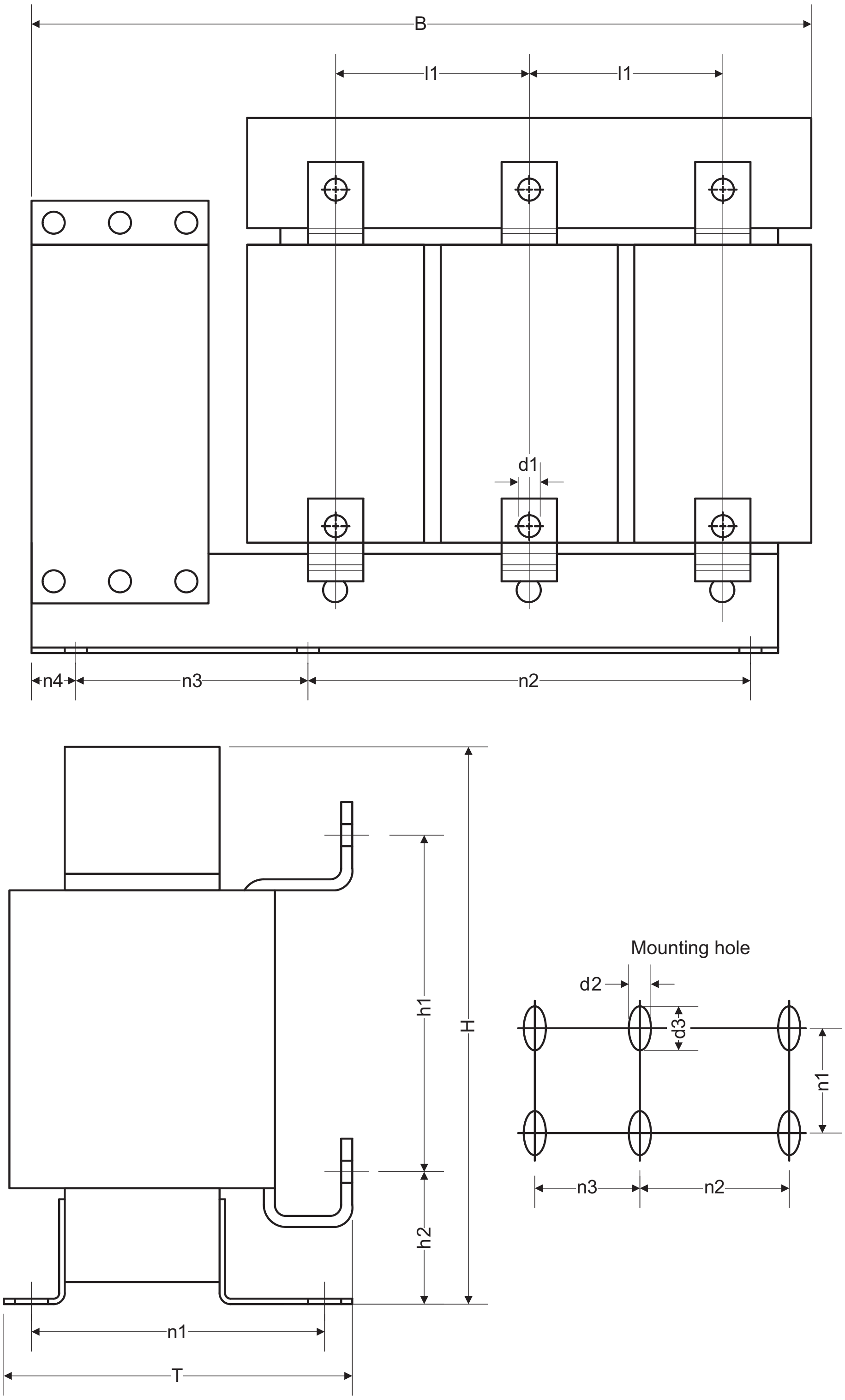


Figure 6-2 Dimension drawing, sine-wave filter

Table 6- 1 Dimensions of the sine-wave filter (all values in mm)

6SL3000-	2CE32-3AA0	2CE32-8AA0	2CE34-1AA0	
B	620	620	620	
H	300	300	370	
T	320	320	360	
l1	140	140	140	
h1	180	180	220	
h2	65	65	65	
n1 [1)]	280	280	320	
n2 [1)]	150	150	150	
n3 [1)]	225	225	225	
n4	105	105	105	
d1	12	12	12	
d2	11	11	11	
d3	22	22	22	

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

6.1.4 Technical specifications

Table 6- 2 Technical specifications of sine-wave filters 3 AC 380 V – 480 V

Order number	6SL3000-	2CE32-3AA0	2CE32-3AA0	2CE32-8AA0	2CE34-1AA0
Suitable for Power Module	6SL3315-	1TE32-1AAx	1TE32-6AAx	1TE33-1AAx	1TE35-0AAx
Suitable for Motor Module	6SL3325-	1TE32-1AAx	1TE32-6AAx	1TE33-1AAx	1TE35-0AAx
Rated current (unit rating) of the Power Modules or Motor Modules with sine-wave filter at pulse frequency of 4 kHz		170 A (90 kW)	215 A (110 kW)	270 A (132 kW)	380 A (200 kW)
Rated current	A	225	225	276	408
Maximum output frequency	Hz	150	150	150	150
Power loss - at 50 Hz - at 150 Hz	 kW kW	 0.35 0.6	 0.35 0.6	 0.4 0.69	 0.38 0.7
Connections - to the Power Module or Motor Module - load		M10 connecting lugs M10 connecting lugs			
Max. permissible cable length between sine-wave filter and motor	m	300 (shielded) 450 (unshielded)			
Degree of protection		IP00	IP00	IP00	IP00
Dimensions Width Height Depth	 mm mm mm	 620 300 320	 620 300 320	 620 300 320	 620 370 360
Weight	kg	124	124	127	198

6.2 Motor reactors

6.2.1 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 Modules or Motor Modules when longer motor cables are used are simultaneously reduced.

6.2.2 Safety information

CAUTION
The 100 mm cooling clearances above and to the side of the components must be observed.

Note

The connecting cables to the Power Modules or Motor Modules 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
If a motor reactor is connected to the Power Module or Motor Module, it must be activated during commissioning (p0230 = 1).

CAUTION
The maximum permissible output frequency when sine-wave filters are used is 150 Hz.

CAUTION
The maximum permissible pulse frequency when motor reactors are used is 2.5 Hz or 4 kHz.

6.2.3 Dimension drawing

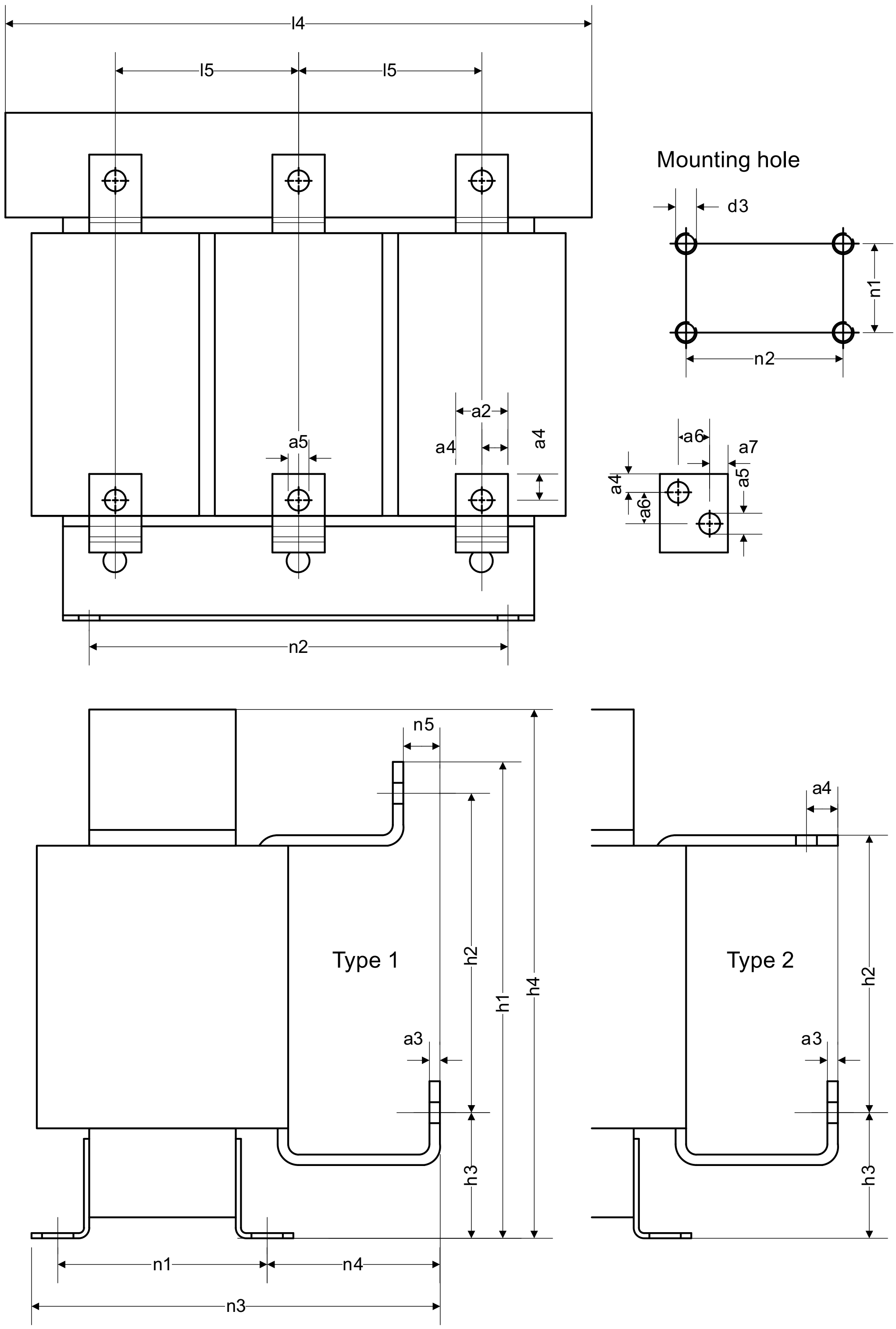


Figure 6-3 Dimension drawing, motor reactor

Table 6- 3 Dimensions of motor reactor, 3 AC 380 V – 480 V, part 1 (all specifications in mm)

6SL3000-	2BE32-1AA0	2BE32-6AA0	2BE33-2AA0	2BE35-0AA0
Connection type	Type 1	Type 1	Type 1	Type 1
a2	25	25	25	30
a3	5	5	5	6
a4	12.5	12.5	12.5	15
a5	11	11	11	14
l4	300	300	300	300
l5	100	100	100	100
h1	-	-	-	-
h2	194	227	194	245
h3	60	60	60	60
h4	285	315	285	365
n1 [1)]	163	183	163	183
n2 [1)]	224	224	224	224
n3	257	277	257	277
n4	79	79	79	79
d3	M8	M8	M8	M8

[1)] Lengths n1 and n2 correspond to the distance between holes

Table 6- 4 Dimensions of motor reactor, 3 AC 380 V – 480 V, part 2 (all specifications in mm)

6SL3000-	2AE36-1AA0	2AE38-4AA0	2AE41-0AA0	2AE41-4AA0
Connection type	Type 1	Type 1	Type 1	Type 1
a2	40	40	40	60
a3	8	8	8	11
a4	20	20	20	17
a5	14	14	14	14
a6	-	-	-	22
a7	-	-	-	19
l4	410	410	410	460
l5	140	140	140	160
h1	392	392	392	392
h2	252	252	252	255
h3	120	120	120	120
h4	385	385	385	385
n1 [1)]	191	191	206	212
n2 [1)]	316	316	316	356
n3	292	292	302	326
n4	84.5	84.5	79.5	94.5
n5	30	30	-	-
d3	M10	M10	M10	M10

[1)] Lengths n1 and n2 correspond to the distance between holes

Table 6- 5 Dimensions of motor reactor, 3 AC 500 V – 690 V, part 1 (all specifications in mm)

6SL3000-	2AH31-0AA0	2AH31-5AA0	2AH32-4AA0	2AH33-6AA0
Connection type	Type 1	Type 1	Type 1	Type 1
a2	25	25	25	25
a3	5	5	5	5
a4	12.5	12.5	12.5	12.5
a5	11	11	11	11
l4	270	270	300	300
l5	88	88	100	100
h1	-	-	-	-
h2	150	150	194	194
h3	60	60	60	60
h4	248	248	285	285
n1 1)	103	103	118	118
n2 1)	200	200	224	224
n3	200	200	212	212
n4	82	82	79	79
d3	M8	M8	M8	M8

1) Lengths n1 and n2 correspond to the distance between holes

Table 6- 6 Dimensions of motor reactor, 3 AC 500 V – 690 V, part 2 (all specifications in mm)

6SL3000-	2AH35-8AA0	2AH38-1AA0	2AH41-1AA0	2AH41-3AA0
Connection type	Type 1	Type 1	Type 1	Type 1
a2	40	40	50	60
a3	8	8	8	12
a4	20	20	14	17
a5	14	14	14	14
a6	-	-	22	22
a7	-	-	-	19
l4	410	410	410	460
l5	140	140	140	160
h1	392	392	392	392
h2	252	252	258	255
h3	120	120	120	120
h4	385	385	385	385
n1 1)	141	183	206	182
n2 1)	316	316	316	356
n3	292	279	317	296
n4	134.5	79.5	94.5	94.5
n5	30	-	-	-
d3	M10	M10	M10	M10

1) Lengths n1 and n2 correspond to the distance between holes

6.2.4 Technical specifications

Table 6- 7 Technical specifications of motor reactors, 3 AC 380 V – 480 V, Part 1

Order number	6SL3000-	2BE32-1AA0	2BE32-6AA0	2BE33-2AA0	2BE35-0AA0
Suitable for Power Module	6SL3315-	1TE32-1AAx	1TE32-6AAx	1TE33-1AAx	1TE35-0AAx
Suitable for Motor Module	6SL3325-	1TE32-1AAx	1TE32-6AAx	1TE33-1AAx	1TE35-0AAx
Unit rating of Power Module or Motor Module	kW	110	132	160	250
Rated current	A	210	260	310	490
Power loss - at 50 Hz - at 150 Hz	 kW kW	 0.436 0.486	 0.454 0.5	 0.422 0.47	 0.448 0.5
Connections - to the Power Module or Motor Module - Load - PE		 M10 M10 M8	 M10 M10 M8	 M10 M10 M8	 M12 M12 M8
Max. permissible cable length between motor reactor and motor - with 1 motor reactor - with 2 motor reactors in series	 m m	 300 (shielded) / 450 (non-shielded) 525 (shielded) / 787 (non-shielded)			
Degree of protection		IP00	IP00	IP00	IP00
Dimensions Width Height Depth	 mm mm mm	 300 285 257	 300 315 277	 300 285 257	 300 365 277
Weight, approx.	kg	66	66	66	100

Table 6- 8 Technical specifications of motor reactors, 3 AC 380 V – 480 V, Part 2

Order number	6SL3000-	2AE36-1AA0	2AE38-4AA0	2AE41-0AA0	2AE41-4AA0
Suitable for Motor Module	6SL3325-	1TE36-1AAx	1TE38-4AAx	1TE41-0AAx	1TE41-4AAx
Unit rating of the Motor Module	kW	315	450	560	800
Rated current	A	605	840	985	1405
Power loss - at 50 Hz - at 150 Hz	 kW kW	 0.798 0.9	 0.834 0.943	 0.939 1.062	 0.946 1.054
Connections - to the Motor Module - load - PE		 M12 M12 M10	 M12 M12 M10	 M12 M12 M10	 2 x M12 2 x M12 M10
Max. permissible cable length between motor reactor and motor - with 1 motor reactor - with 2 motor reactors in series	 m m	 300 (shielded) / 450 (non-shielded) 525 (shielded) / 787 (non-shielded)			
Degree of protection		IP00	IP00	IP00	IP00
Dimensions Width Height Depth	 mm mm mm	 410 392 292	 410 392 292	 410 392 302	 460 392 326
Weight, approx.	kg	130	140	146	179

Table 6- 9 Technical specifications of motor reactors, 3 AC 500 V – 690 V, Part 1

Order number	6SL3000-	2AH31-0AA0	2AH31-5AA0	2AH32-4AA0	2AH33-6AA0
Suitable for Motor Module	6SL3325-	1TG31-0AAx	1TG31-5AAx	1TG32-2AAx	1TG33-3AAx
Unit rating of the Motor Module	kW	90	132	200	315
Rated current	A	100	150	215	330
Power loss - at 50 Hz - at 150 Hz	 kW kW	 0.269 0.3	 0.296 0.332	 0.376 0.425	 0.4 0.454
Connections - to the Motor Module - load - PE		 M10 M10 M6	 M10 M10 M6	 M10 M10 M6	 M10 M10 M6
Max. permissible cable length between motor reactor and motor - with 1 motor reactor - with 2 motor reactors in series	 m m	 300 (shielded) / 450 (non-shielded) 525 (shielded) / 787 (non-shielded)			
Degree of protection		IP00	IP00	IP00	IP00
Dimensions Width Height Depth	 mm mm mm	 270 248 200	 270 248 200	 300 285 212	 300 285 212
Weight, approx.	kg	25	25.8	34	46

Table 6- 10 Technical specifications of motor reactors, 3 AC 500 V – 690 V, Part 2

Order number	6SL3000-	2AH35-8AA0	2AH38-1AA0	2AH41-1AA0	2AH41-3AA0
Suitable for Motor Module	6SL3325-	1TG35-8AAx	1TG38-1AAx	1TG41-0AAx	1TG41-3AAx
Unit rating of the Motor Module	kW	560	800	1000	1200
Rated current	A	575	810	1025	1270
Power loss - at 50 Hz - at 150 Hz	 kW kW	 0.705 0.801	 0.77 1.003	 0.927 1.052	 0.862 0.952
Connections - to the Motor Module - load - PE		 M12 M12 M8	 M12 M12 M8	 M12 M12 M8	 M12 M12 M8
Max. permissible cable length between motor reactor and motor - with 1 motor reactor - with 2 motor reactors in series	 m m	 300 (shielded) / 450 (non-shielded) 525 (shielded) / 787 (non-shielded)			
Degree of protection		IP00	IP00	IP00	IP00
Dimensions Width Height Depth	 mm mm mm	 410 392 292	 410 392 279	 410 392 317	 460 392 296
Weight, approx.	kg	80	146	163	153

6.3 dv/dt filter plus Voltage Peak Limiter

6.3.1 Description

The dv/dt filter plus Voltage Peak Limiter comprises two components: the dv/dt reactor and the voltage-limiting network (Voltage Peak Limiter), which cuts of the voltage peaks and returns energy to the DC link. The dv/dt filters plus Voltage Peak Limiter must be used for motors for which the proof voltage of the insulation system is unknown or insufficient.

Dv/dt filters plus Voltage Peak Limiters limit the rate of voltage rise to values < 500 V/µs and the typical voltage peaks with rated line voltages to the values below:

< 1000 V at U_{line} < 575 V

< 1250 V at 660 V < U_{line} < 690 V.

Components

The order numbers of the individual components (dv/dt reactor and voltage peak limiter) are listed in the following table:

Table 6- 11 dv/dt filter plus Voltage Peak Limiter, order numbers of the individual components

dv/dt filter plus Voltage Peak Limiter	dv/dt reactor	Voltage peak limiter
Line voltage 380 V – 480 V		
6SL3000-2DE32-6AA0	6SL3000-2DE32-6CA0	6SL3000-2DE32-6BA0
6SL3000-2DE35-0AA0	6SL3000-2DE35-0CA0	6SL3000-2DE35-0BA0
6SL3000-2DE38-4AA0	6SL3000-2DE38-4CA0	6SL3000-2DE38-4BA0
6SL3000-2DE41-4AA0	2 x 6SL3000-2DE41-4DA0	6SL3000-2DE41-4BA0
Line voltage 500 V – 690 V		
6SL3000-2DH31-0AA0	6SL3000-2DH31-0CA0	6SL3000-2DH31-0BA0
6SL3000-2DH31-5AA0	6SL3000-2DH31-5CA0	6SL3000-2DH31-5BA0
6SL3000-2DH32-2AA0	6SL3000-2DH32-2CA0	6SL3000-2DH32-2BA0
6SL3000-2DH33-3AA0	6SL3000-2DH33-3CA0	6SL3000-2DH33-3BA0
6SL3000-2DH35-8AA0	6SL3000-2DH35-8CA0	6SL3000-2DH35-8BA0
6SL3000-2DH38-1AA0	2 x 6SL3000-2DH38-1DA0	6SL3000-2DH38-1BA0
6SL3000-2DH41-3AA0	2 x 6SL3000-2DH41-3DA0	6SL3000-2DH41-3BA0

⚠ WARNING

When a dv/dt filter plus Voltage Peak Limiter is used, the pulse frequency of the Power Module or Motor Module must not exceed 2.5 kHz or 4 kHz respectively. If a higher pulse frequency is set, then this could destroy the dv/dt filter.

Table 6- 12 Max. pulse frequency when a dv/dt filter is used with Power Modules with a rated pulse frequency of 2 kHz

Order number	Unit rating [kW]	Output current for a pulse frequency of 2 kHz [A]	Max. pulse frequency when a dv/dt filter is used
Supply voltage 510 – 750 V DC			
6SL3315-1TE32-1AAx	110	210	4 kHz
6SL3315-1TE32-6AAx	132	260	4 kHz
6SL3315-1TE33-1AAx	160	310	4 kHz
6SL3315-1TE35-0AAx	250	490	4 kHz

Table 6- 13 Max. pulse frequency when a dv/dt filter is used with Motor Modules with a rated pulse frequency of 2 kHz

Order number	Unit rating [kW]	Output current for a pulse frequency of 2 kHz [A]	Max. pulse frequency when a dv/dt filter is used
Supply voltage 510 – 750 V DC			
6SL3325-1TE32-1AAx	110	210	4 kHz
6SL3325-1TE32-6AAx	132	260	4 kHz
6SL3325-1TE33-1AAx	160	310	4 kHz
6SL3325-1TE35-0AAx	250	490	4 kHz

Table 6- 14 Max. pulse frequency when a dv/dt filter is used with Motor Modules with a rated pulse frequency of 1.25 kHz

Order number	Unit rating [kW]	Output current for a pulse frequency of 1.25 kHz [A]	Max. pulse frequency when a dv/dt filter is used
Supply voltage 510 – 750 V DC			
6SL3325-1TE36-1AAx	315	605	2.5 kHz
6SL3325-1TE38-4AAx	450	840	2.5 kHz
6SL3325-1TE41-0AAx	560	985	2.5 kHz
6SL3325-1TE41-4AAx	800	1405	2.5 kHz
Supply voltage 675 – 1080 V DC			
6SL3325-1TG31-0AAx	90	100	2.5 kHz
6SL3325-1TG31-5AAx	132	150	2.5 kHz
6SL3325-1TG32-2AAx	200	215	2.5 kHz
6SL3325-1TG33-3AAx	315	330	2.5 kHz
6SL3325-1TG35-8AAx	560	575	2.5 kHz
6SL3325-1TG38-1AAx	800	810	2.5 kHz
6SL3325-1TG41-0AAx	1000	1025	2.5 kHz
6SL3325-1TG41-3AAx	1200	1270	2.5 kHz

6.3.2 Safety information

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

Note

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

CAUTION

The terminals on the voltage limiting network (Voltage Peak Limiter) must always be connected as follows:

- Cable from the DC link of the Power Module or Motor Module at DCP, DCN and
- Cable to the dv/dt reactor 1U2, 1V2, 1W2.

Failure to connect the terminals correctly could damage the voltage peak limiter.

CAUTION
If dv/dt filters plus Voltage Peak Limiters are used that SIEMENS has not approved for SINAMICS, these dv/dt filters may be damaged.

⚠ CAUTION
The surface temperature of the dv/dt reactors may exceed 80 °C.

CAUTION
If a dv/dt filter plus Voltage Peak Limiter is connected to the Power Module or Motor Module, it must be activated during commissioning (p0230 = 2).

CAUTION
The maximum permissible output frequency when using dv/dt filters plus Voltage Peak Limiter is 150 Hz.

⚠ DANGER

dv/dt filters plus Voltage Peak Limiter discharge a high leakage current to the protective ground conductor.
Due to the high leakage current associated with dv/dt filters, they or the relevant control cabinet must be permanently connected to PE.

According to EN 61800-5-1, Section. 6.3.6.7, the minimum cross-section of the protective ground conductor must conform to the local safety regulations for protective ground conductors for equipment with a high leakage current.

6.3.3 Interface description

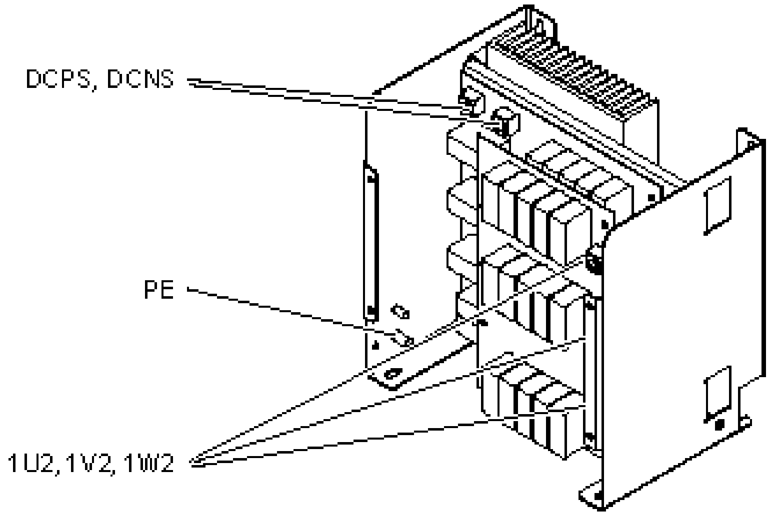


Figure 6-4 Interface overview, voltage peak limiter, type 1

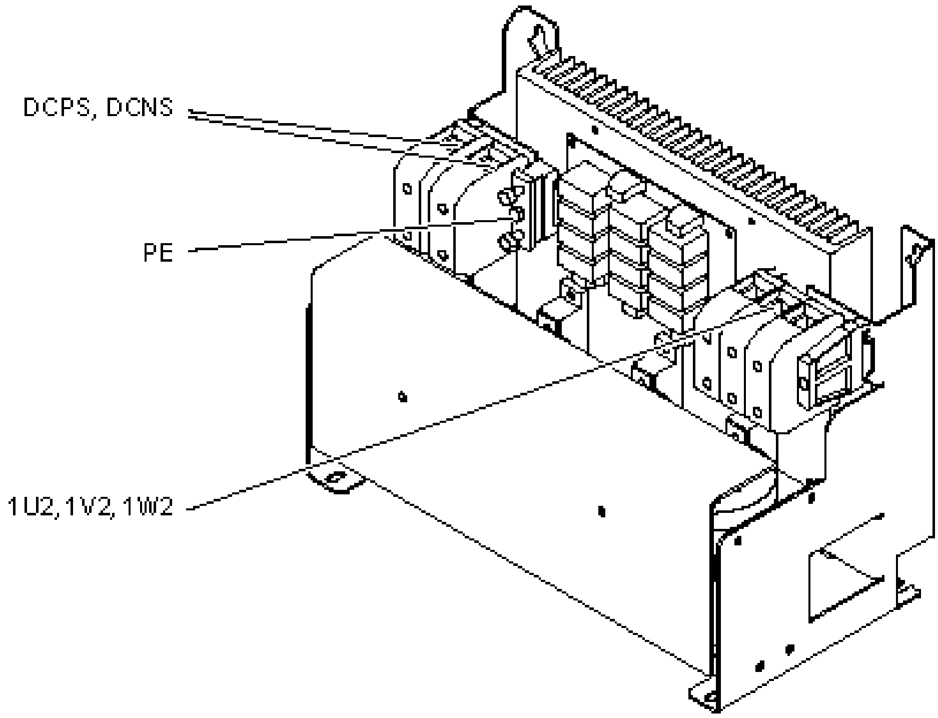


Figure 6-5 Interface overview, voltage peak limiter, type 2

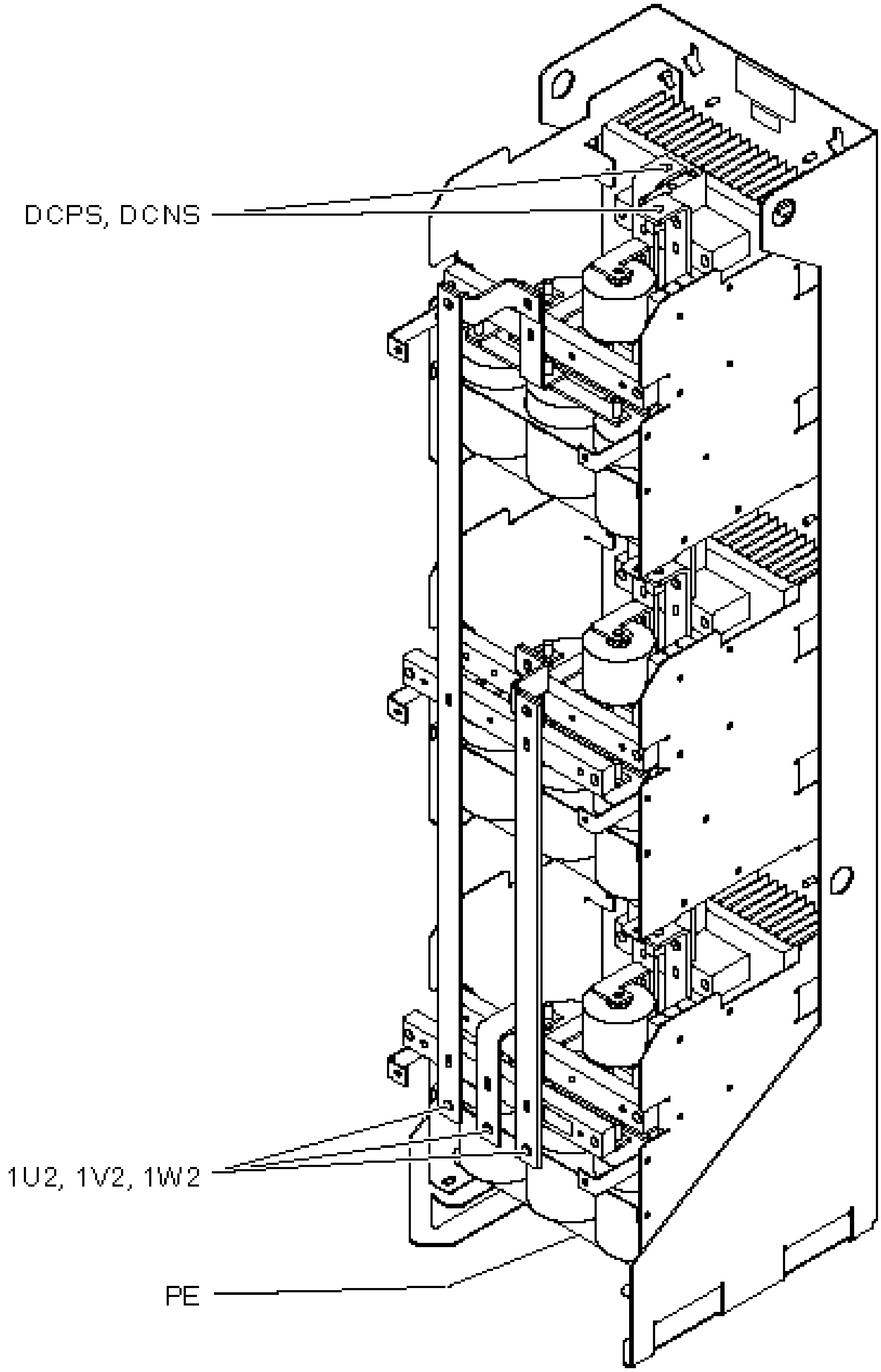


Figure 6-6 Interface overview, voltage peak limiter, type 3

6.3.4 Connecting the dv/dt filter plus Voltage Peak Limiter

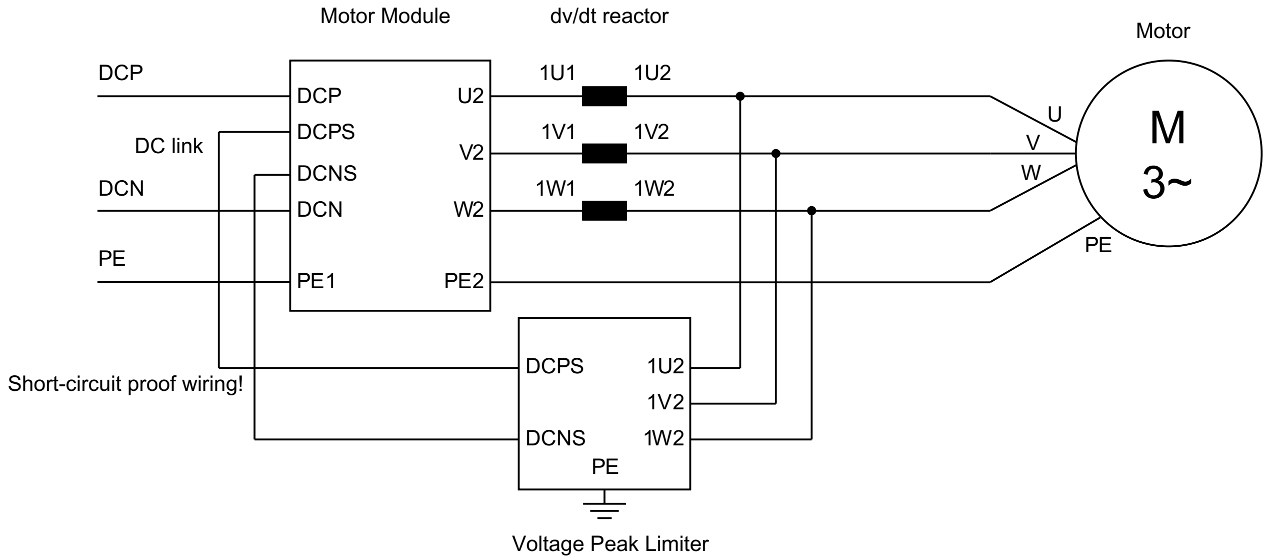


Figure 6-7 Connecting a dv/dt filter plus Voltage Peak Limiter for versions with one dv/dt reactor

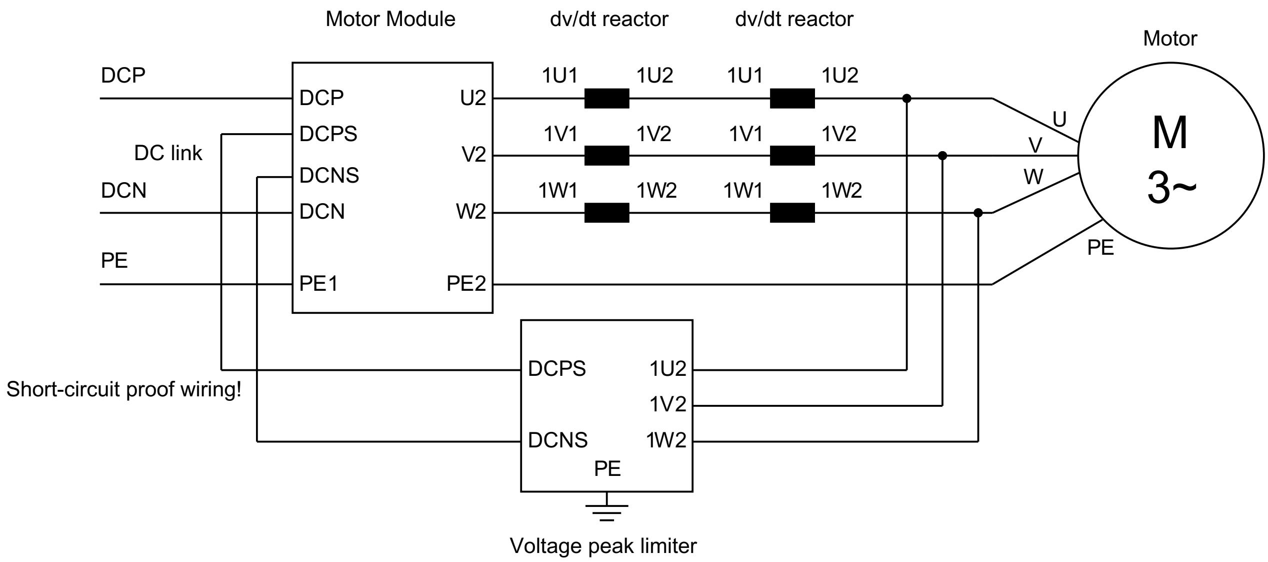


Figure 6-8 Connecting a dv/dt filter plus Voltage Peak Limiter for versions with two dv/dt reactors

Cable cross-sections

Table 6- 15 Cable cross-sections for connections between the dv/dt filter plus Voltage Peak Limiter and Power Module or Motor Module

dv/dt filter plus Voltage Peak Limiter	Connection to the DC link (DCPS / DCNS) [mm²]	Connection between dv/dt reactor and Voltage Peak Limiter (1U2, 1V2, 1W2) [mm²]
Line voltage 380 V – 480 V		
6SL3000-2DE32-6AA0	35	10
6SL3000-2DE35-0AA0	70	16
6SL3000-2DE38-4AA0	2 x 50	50
6SL3000-2DE41-4AA0	2 x 120	120
Line voltage 500 V – 690 V		
6SL3000-2DH31-0AA0	16	6
6SL3000-2DH31-5AA0	16	6
6SL3000-2DH32-2AA0	70	16
6SL3000-2DH33-3AA0	70	16
6SL3000-2DH35-8AA0	120	35
6SL3000-2DH38-1AA0	2 x 70	70
6SL3000-2DH41-3AA0	2 x 120	120

CAUTION

The connection to the DC link of the Power Module or Motor Module must be routed according to IEC 61800-5-2:2007, Table D.1 in order to rule out short-circuiting or ground faults.

This can be achieved by the following measures, for example:

- Preventing the risk of mechanical damage to cables
- Use cables with dual insulation
- Maintain sufficient clearances, using spacers for example
- Install cables in separate installation ducts or conduits

Note

The connections should be kept as short as possible.
The maximum cable length for the specified connections is 5 m in each case.

6.3.5 Dimension drawing, dv/dt reactor

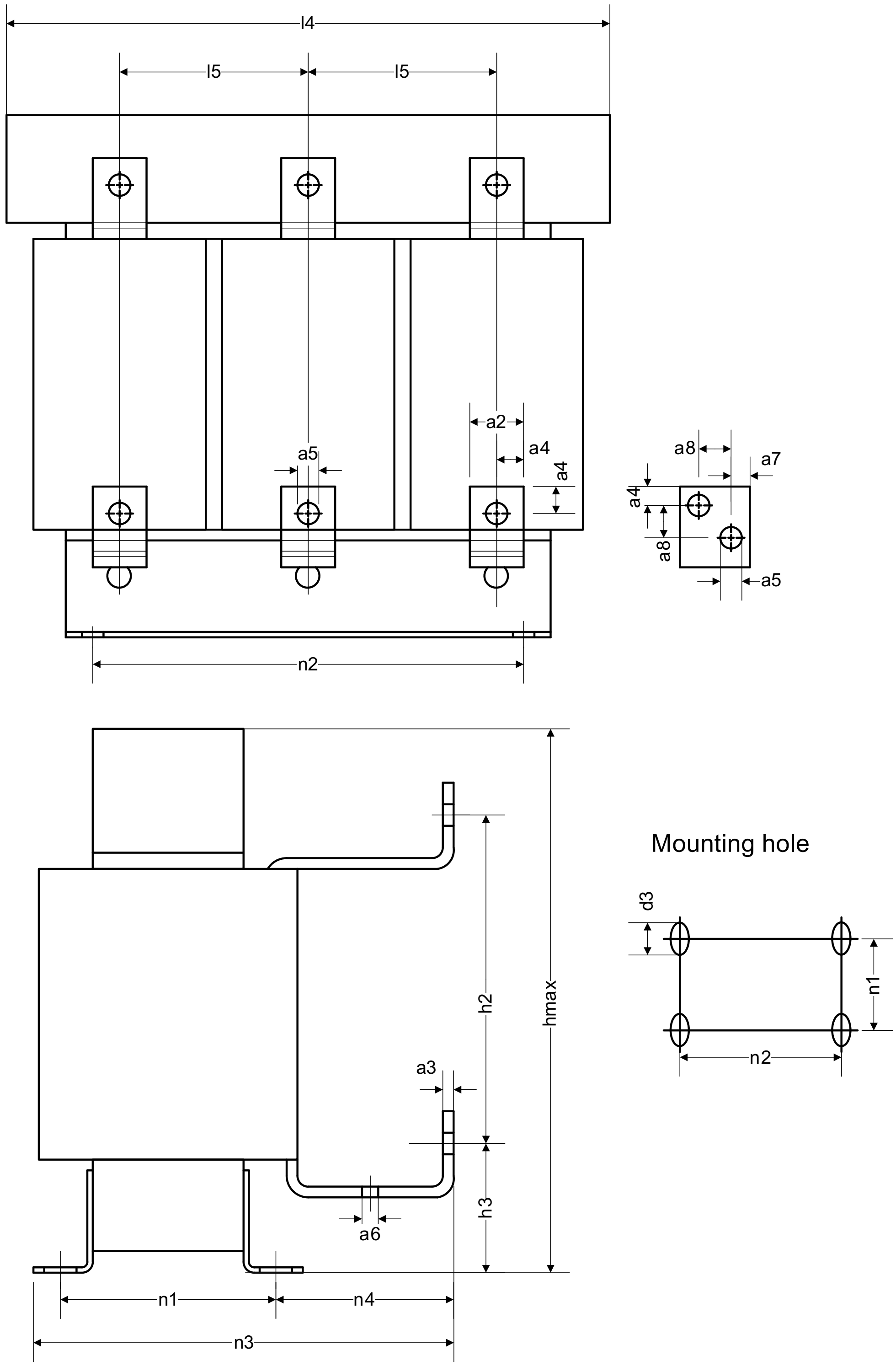


Figure 6-9 Dimension drawing, dv/dt reactor

Table 6- 16 Dimensions of dv/dt reactor, 380 V - 480 V 3 AC (all values in mm)

6SL3000-	2DE32-6CA0	2DE35-0CA0	2DE38-4CA0	2DE41-4CA0
a2	25	30	40	60
a3	5	6	8	10
a4	14	17	22	19
a5	10.5 x 14	14 x 18	14 x 18	14 x 18
a6	7	9	11	11
a7	-	-	-	17
a8	-	-	-	26
l4	410	460	460	445
l5	135	152.5	152.5	145
hmax	370	370	385	385
h2	258	240	280	250
h3	76	83	78	121
n1 [1)]	141	182	212	212
n2 [1)]	316	356	356	341
n3	229	275	312	312
n4	72	71	78	78
d3	M10 (12 x 18)	M12 (15 x 22)	M12 (15 x 22)	M12 (15 x 22)

1) Lengths n1 and n2 correspond to the distance between holes

Table 6- 17 Dimensions of dv/dt reactor, 500 V - 690 V, Part 1 (all values in mm)

6SL3000-	2DH31-0CA0	2DH31-5CA0	2DH32-2CA0	2DH33-3CA0
a2	25	25	25	25
a3	6	6	5	5
a4	14	14	14	14
a5	10.5 x 14	10.5 x 14	10.5 x 14	10.5 x 14
a6	7	7	7	9
a7	-	-	-	-
a8	-	-	-	-
l4	350	350	460	460
l5	120	120	152.5	152.5
hmax	320	320	360	360
h2	215	215	240	240
h3	70	70	86	86
n1 [1)]	138	138	155	212
n2 [1)]	264	264	356	356
n3	227	227	275	275
n4	74	74	101	42
d3	M8	M8	M12 (15 x 22)	M12 (15 x 22)

1) Lengths n1 and n2 correspond to the distance between holes

Table 6- 18 Dimensions of dv/dt reactor, 500 V - 690 V, Part 2 (all values in mm)

6SL3000-	2DH35-8CA0	2DH38-1DA0	2DH41-3DA0	
a2	40	50	60	
a3	8	8	10	
a4	22	16	19	
a5	14 x 18	14 x 18	14 x 18	
a6	11	11	11	
a7	-	14	17	
a8	-	22	26	
l4	460	445	445	
l5	152.5	145	145	
hmax	385	385	385	
h2	280	255	250	
h3	78	114	121	
n1 [1)]	212	212	212	
n2 [1)]	365	341	341	
n3	312	312	312	
n4	78	78	78	
d3	M12 (15 x 22)	M12 (15 x 22)	M12 (15 x 22)	

[1)] Lengths n1 and n2 correspond to the distance between holes

6.3.6 Dimension drawing of the voltage peak limiter

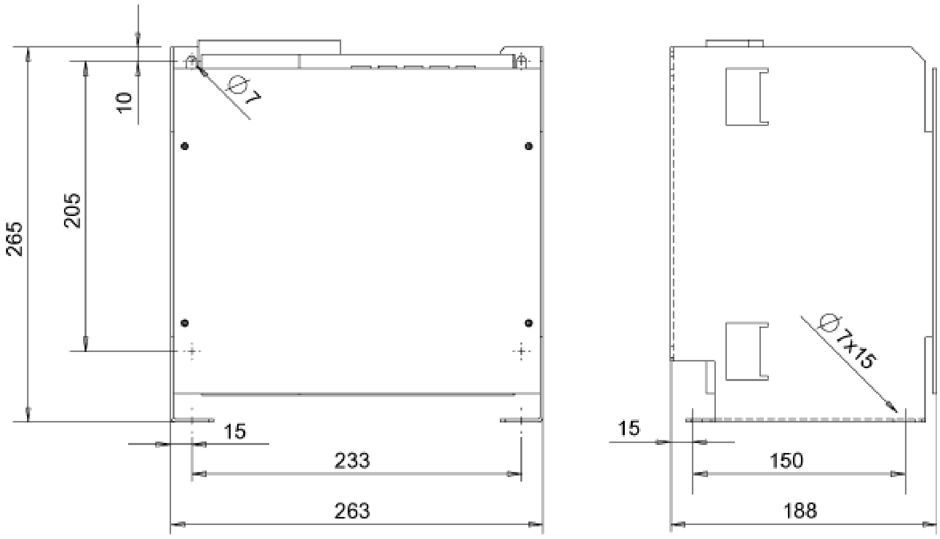


Figure 6-10 Dimension drawing of the voltage peak limiter, type 1

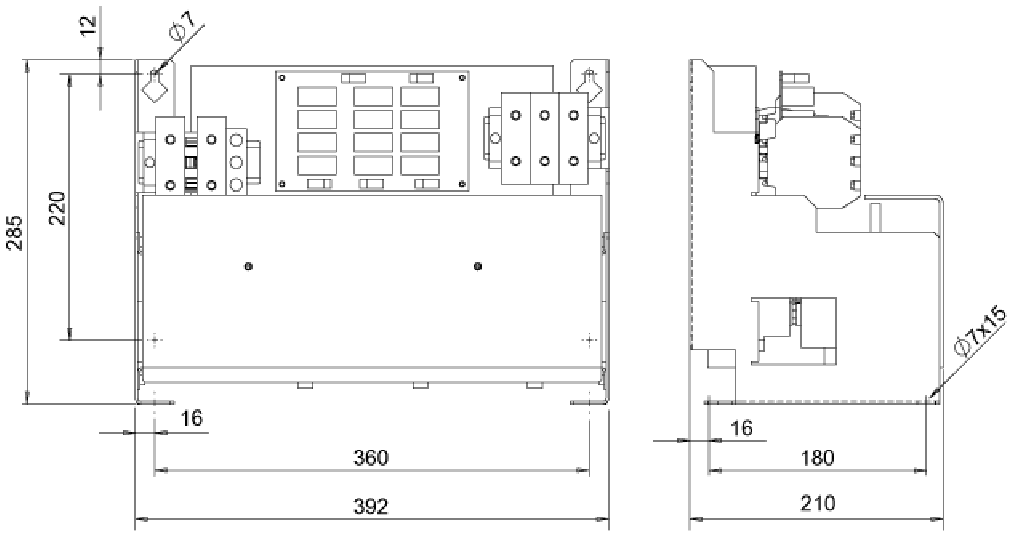


Figure 6-11 Dimension drawing of the voltage peak limiter, type 2

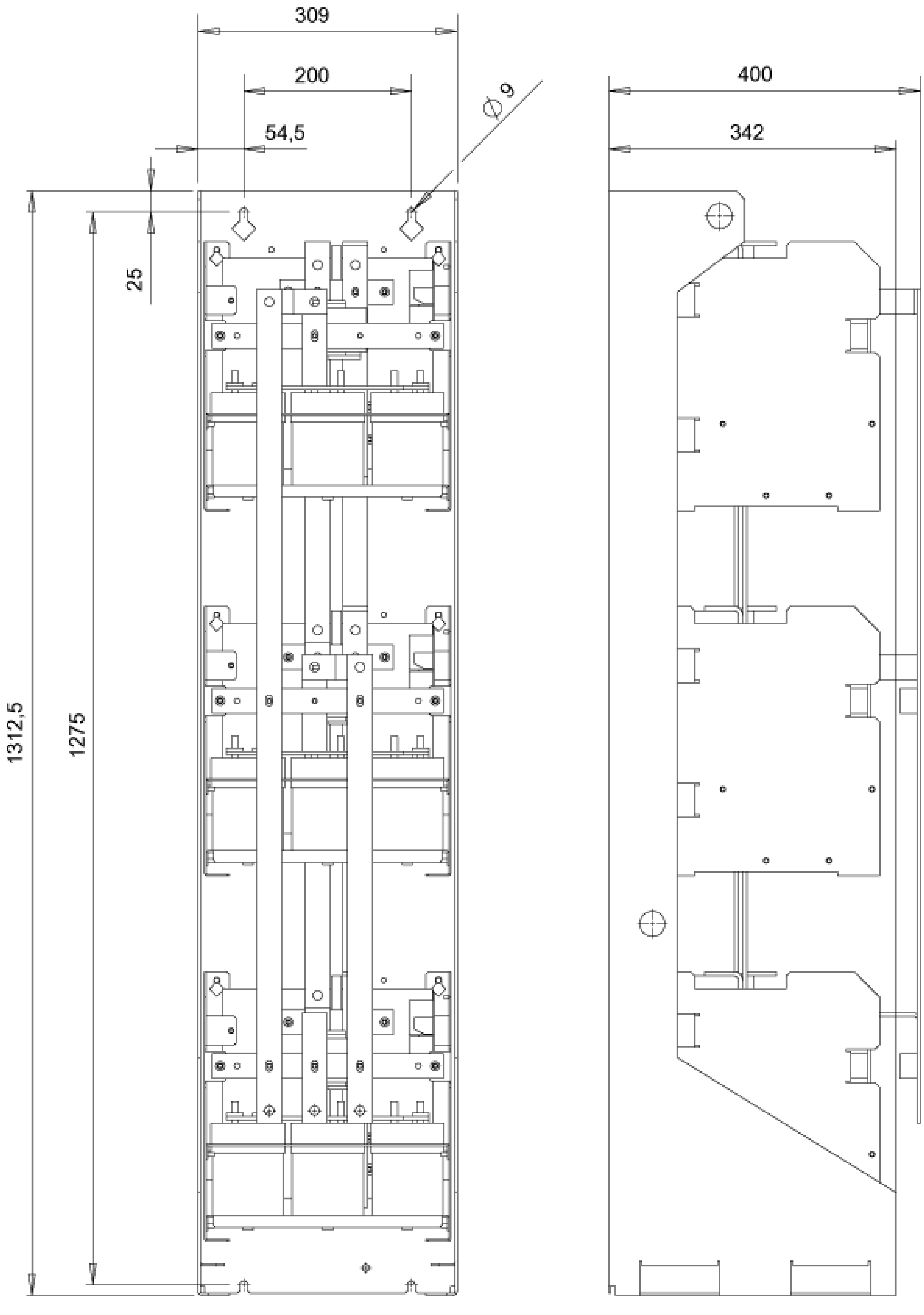


Figure 6-12 Dimension drawing of the voltage peak limiter, type 3

Table 6- 19 Assigning voltage peak limiter to dimension drawings

Voltage peak limiter	Dimension drawing type
Line voltage 380 V – 480 V	
6SL3000-2DE32-6BA0	Type 1
6SL3000-2DE35-0BA0	Type 2
6SL3000-2DE38-4BA0	Type 3
6SL3000-2DE41-4BA0	Type 3
Line voltage 500 V – 690 V	
6SL3000-2DH31-0BA0	Type 1
6SL3000-2DH31-5BA0	Type 1
6SL3000-2DH32-2BA0	Type 2
6SL3000-2DH33-3BA0	Type 2
6SL3000-2DH35-8BA0	Type 3
6SL3000-2DH38-1BA0	Type 3
6SL3000-2DH41-3BA0	Type 3

6.3.7 Technical specifications

Table 6- 20 Technical data for the dv/dt filter plus Voltage Peak Limiter, 380 V – 480 V 3 AC, part 1

Order number	6SL3000-	2DE32-6AA0	2DE32-6AA0	2DE35-0AA0	2DE35-0AA0
Suitable for Power Module	6SL3315-	1TE32-1AAx	1TE32-6AAx	1TE33-1AAx	1TE35-0AAx
Suitable for Motor Module	6SL3325-	1TE32-1AAx	1TE32-6AAx	1TE33-1AAx	1TE35-0AAx
Unit rating of Power Module or Motor Module	kW	110	132	160	250
I_{thmax}	A	260	260	490	490
Degree of protection		IP00	IP00	IP00	IP00
dv/dt reactor					
Power loss - at 50 Hz - at 60 Hz - at 150 Hz	 kW kW kW	 0.701 0.729 0.78	 0.701 0.729 0.78	 0.874 0.904 0.963	 0.874 0.904 0.963
Connections - to the Power Module or Motor Module - Load - PE		 M10 M10 M6	 M10 M10 M6	 M12 M12 M6	 M12 M12 M6
Max. permissible cable length between dv/dt reactor and motor	m	300 (shielded) 450 (unshielded)			
Dimensions Width Height Depth	 mm mm mm	 410 370 229	 410 370 229	 460 370 275	 460 370 275
Weight, approx.	kg	66	66	122	122
Voltage Peak Limiter					
Power loss - at 50 Hz - at 60 Hz - at 150 Hz	 kW kW kW	 0.029 0.027 0.025	 0.029 0.027 0.025	 0.042 0.039 0.036	 0.042 0.039 0.036
Connections - to the dv/dt reactor - DC - PE		 M8 M8 M8	 M8 M8 M8	 Terminal 70 mm² Terminal 70 mm² Terminal 35 mm²	 Terminal 70 mm² Terminal 70 mm² Terminal 35 mm²
Dimensions Width Height Depth	 mm mm mm	 263 265 188	 263 265 188	 392 285 210	 392 285 210
Weight, approx.	kg	6	6	16	16

Table 6- 21 Technical data for the dv/dt filter plus Voltage Peak Limiter, 380 V – 480 V 3 AC, part 2

Order number	6SL3000-	2DE38-4AA0	2DE38-4AA0	2DE41-4AA0 [1)]	2DE41-4AA0 [1)]
Suitable for Motor Module	6SL3325-	1TE36-1AAx	1TE38-4AAx	1TE41-0AAx	1TE41-4AAx
Unit rating of the Motor Module	kW	315	450	560	800
I_{thmax}	A	840	840	1405	1405
Degree of protection		IP00	IP00	IP00	IP00
dv/dt reactor					
Power loss - at 50 Hz - at 60 Hz - at 150 Hz	 kW kW kW	 1.106 1.115 1.226	 1.106 1.115 1.226	 1.111 1.154 1.23	 1.111 1.154 1.23
Connections - to the Motor Module - load - PE		 M12 M12 M6	 M12 M12 M6	 2 x M12 2 x M12 M6	 2 x M12 2 x M12 M6
Max. permissible cable length between dv/dt reactor and motor	m	300 (shielded) 450 (unshielded)			
Dimensions Width Height Depth	 mm mm mm	 460 385 312	 460 385 312	 445 385 312	 445 385 312
Weight, approx.	kg	149	149	158	158
Voltage Peak Limiter					
Power loss - at 50 Hz - at 60 Hz - at 150 Hz	 kW kW kW	 0.077 0.072 0.066	 0.077 0.072 0.066	 0.134 0.125 0.114	 0.134 0.125 0.114
Connections - to the dv/dt reactor - DC - PE		 M8 M8 M8	 M8 M8 M8	 M10 M10 M8	 M10 M10 M8
Dimensions Width Height Depth	 mm mm mm	 309 1312.5 400	 309 1312.5 400	 309 1312.5 400	 309 1312.5 400
Weight, approx.	kg	48	48	72	72

1) Two dv/dt reactors are required for these dv/dt filters. The technical data provided apply to one dv/dt reactor.

Note

For versions with two dv/dt reactors, the cable lengths specified in the table do not change.

Table 6- 22 Technical data for the dv/dt filter plus Voltage Peak Limiter, 500 V – 690 V 3 AC, part 1

Order number	6SL3000-	2DH31-0AA0	2DH31-5AA0	2DH32-2AA0	2DH33-3AA0
Suitable for Motor Module	6SL3325-	1TG31-0AAx	1TG31-5AAx	1TG32-2AAx	1TG33-3AAx
Unit rating of the Motor Module	kW	90	132	200	315
I_{thmax}	A	100	150	215	330
Degree of protection		IP00	IP00	IP00	IP00
dv/dt reactor					
Power loss - at 50 Hz - at 60 Hz - at 150 Hz	 kW kW kW	 0,49 0,508 0,541	 0,389 0,408 0,436	 0,578 0,604 0,645	 0,595 0,62 0,661
Connections - to the Motor Module - load - PE		 M10 M10 M6	 M10 M10 M6	 M10 M10 M6	 M10 M10 M6
Max. permissible cable length between dv/dt reactor and motor	m	300 (shielded) 450 (unshielded)			
Dimensions Width Height Depth	 mm mm mm	 350 320 227	 350 320 227	 460 360 275	 460 360 275
Weight, approx.	kg	48	50	83	135
Voltage Peak Limiter					
Power loss - at 50 Hz - at 60 Hz - at 150 Hz	 kW kW kW	 0,016 0,015 0,013	 0,020 0,019 0,018	 0,032 0,03 0,027	 0,042 0,039 0,036
Connections - to the dv/dt reactor - DC - PE		 M8 M8 M8	 M8 M8 M8	 Terminal 70 mm² Terminal 70 mm² Terminal 35 mm²	 Terminal 70 mm² Terminal 70 mm² Terminal 35 mm²
Dimensions Width Height Depth	 mm mm mm	 263 265 188	 263 265 188	 392 285 210	 392 285 210
Weight, approx.	kg	6	6	16	16

Table 6- 23 Technical data for the dv/dt filter plus Voltage Peak Limiter, 500 V – 690 V 3 AC, part 2

Order number	6SL3000-	2DH35-8AA0	2DH38-1AA0 1)	2DH41-3AA0 1)	2DH41-3AA0 1)
Suitable for Motor Module	6SL3325-	1TG35-8AAx	1TG38-1AAx	1TG41-0AAx	1TG41-3AAx
Unit rating of the Motor Module	kW	560	800	1000	1200
I_{thmax}	A	575	810	1270	1270
Degree of protection		IP00	IP00	IP00	IP00
dv/dt reactor					
Power loss - at 50 Hz - at 60 Hz - at 150 Hz	 kW kW kW	 0.862 0.902 0.964	 0.828 0.867 0.927	 0.865 0.904 0.966	 0.865 0.904 0.966
Connections - to the Motor Module - load - PE		 M12 M12 M6	 2 x M12 2 x M12 M6	 2 x M12 2 x M12 M6	 2 x M12 2 x M12 M6
Max. permissible cable length between dv/dt reactor and motor	m	300 (shielded) 450 (unshielded)			
Dimensions Width Height Depth	 mm mm mm	 460 385 312	 445 385 312	 445 385 312	 445 385 312
Weight, approx.	kg	172	160	164	164
Voltage Peak Limiter					
Power loss - at 50 Hz - at 60 Hz - at 150 Hz	 kW kW kW	 0.063 0.059 0.054	 0.106 0.1 0.091	 0.15 0.14 0.128	 0.15 0.14 0.128
Connections - to the dv/dt reactor - DC - PE		 M8 M8 M8	 M10 M10 M8	 M10 M10 M8	 M10 M10 M8
Dimensions Width Height Depth	 mm mm mm	 309 1312.5 400	 309 1312.5 400	 309 1312.5 400	 309 1312.5 400
Weight, approx.	kg	48	72	72	72

1) Two dv/dt reactors are required for these dv/dt filters. The technical data provided apply to one dv/dt reactor.

Note

For versions with two dv/dt reactors, the cable lengths specified in the table do not change.

6.4 dv/dt filter compact plus Voltage Peak Limiter

6.4.1 Description

The dv/dt filter compact plus Voltage Peak Limiter comprises two components: the dv/dt reactor and the voltage-limiting network (Voltage Peak Limiter), which cuts off the voltage peaks and feeds back the energy into the DC link. The dv/dt filter compact plus Voltage Peak Limiter is designed for use with motors for which the voltage strength of the insulation system is unknown or insufficient.

The dv/dt filters compact plus Voltage Peak Limiter limit the voltage load on the motor cables to values in accordance with the limit value curve A as per IEC/TS 60034-25:2007.

The rate of voltage rise is limited to < 1600 V/µs, the peak voltages are limited to < 1400 V.

⚠ WARNING

When a dv/dt filter compact plus Voltage Peak Limiter is used, the drive must not be operated in uninterrupted duty with an output frequency lower than 10 Hz.

A maximum load duration of 5 minutes at an output frequency lower than 10 Hz is permissible, provided that the drive is operated with an output frequency higher than 10 Hz for a period of 5 minutes thereafter.

Uninterrupted duty at an output frequency less than 10 Hz can produce thermal overload and destroy the dv/dt filter.

⚠ WARNING

When a dv/dt filter compact plus Voltage Peak Limiter is used, the pulse frequency of the Power Module or Motor Module must not exceed 2.5 kHz or 4 kHz respectively. If a higher pulse frequency is set, then this could destroy the dv/dt filter.

Note

It is permissible to set pulse frequencies in the range between the rated pulse frequency and the relevant maximum pulse frequency when a dv/dt filter compact plus Voltage Peak Limiter is used.

Note

For current derating with increased pulse frequency, the derating of the associated Motor Module is the decisive factor.

Note

The dv/dt filters compact plus Voltage Peak Limiter of Types 1 to 3 consist of one single component. Type 4 consists of two separate components, the dv/dt reactor and the Voltage Peak Limiter.

Table 6- 24 Max. pulse frequency when a dv/dt filter compact plus Voltage Peak Limiter is used in Power Modules with a rated pulse frequency of 2 kHz

Order number	Unit rating [kW]	Output current for a pulse frequency of 2 kHz [A]	Max. pulse frequency when a dv/dt filter compact plus Voltage Peak Limiter is used
Supply voltage 380 – 480 V 3 AC			
6SL3315-1TE32-1AAx	110	210	4 kHz
6SL3315-1TE32-6AAx	132	260	4 kHz
6SL3315-1TE33-1AAx	160	310	4 kHz
6SL3315-1TE35-0AAx	250	490	4 kHz

Table 6- 25 Max. pulse frequency when a dv/dt filter compact plus Voltage Peak Limiter is used in Motor Modules with a rated pulse frequency of 2 kHz

Order number	Unit rating [kW]	Output current for a pulse frequency of 2 kHz [A]	Max. pulse frequency when a dv/dt filter compact plus Voltage Peak Limiter is used
Supply voltage 510 – 750 V DC			
6SL3325-1TE32-1AAx	110	210	4 kHz
6SL3325-1TE32-6AAx	132	260	4 kHz
6SL3325-1TE33-1AAx	160	310	4 kHz
6SL3325-1TE35-0AAx	250	490	4 kHz

Table 6- 26 Max. pulse frequency when a dv/dt filter compact plus Voltage Peak Limiter is used in Motor Modules with a rated pulse frequency of 1.25 kHz

Order number	Unit rating [kW]	Output current for a pulse frequency of 1.25 kHz [A]	Max. pulse frequency when a dv/dt filter compact plus Voltage Peak Limiter is used
Supply voltage 510 – 750 V DC			
6SL3325-1TE36-1AAx	315	605	2.5 kHz
6SL3325-1TE38-4AAx	450	840	2.5 kHz
6SL3325-1TE41-0AAx	560	985	2.5 kHz
6SL3325-1TE41-4AAx	800	1405	2.5 kHz
Supply voltage 675 – 1080 V DC			
6SL3325-1TG31-0AAx	90	100	2.5 kHz
6SL3325-1TG31-5AAx	132	150	2.5 kHz
6SL3325-1TG32-2AAx	200	215	2.5 kHz
6SL3325-1TG33-3AAx	315	330	2.5 kHz
6SL3325-1TG35-8AAx	560	575	2.5 kHz
6SL3325-1TG38-1AAx	800	810	2.5 kHz
6SL3325-1TG41-0AAx	1000	1025	2.5 kHz
6SL3325-1TG41-3AAx	1200	1270	2.5 kHz

6.4.2 Safety information

CAUTION

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

The dv/dt filters compact plus Voltage Peak Limiter must only be installed upright, to ensure that cooling air flows from bottom to top through the heatsinks on the Voltage Peak Limiter.

Note

The motor cables between the Power Module or Motor Module and dv/dt filter compact, and the cables to the DC link must be kept as short as possible (max. 5 m).

CAUTION

Terminals for order numbers 6SL3000-2DE41-4EA0, 6SL3000-2DG38-1EA0 and 6SL3000-2DG41-3EA0

The terminals on the voltage limiting network (Voltage Peak Limiter) must always be connected as follows:

- Cable from the DC link to the Motor Module at DCPS, DCNS and
- Cable to the dv/dt reactor 1U2, 1V2, 1W2.

Failure to connect the terminals correctly could damage the Voltage Peak Limiter.

CAUTION

When using dv/dt filters that SIEMENS has not approved for SINAMICS, then these dv/dt filters can be thermally damaged.

CAUTION

The surface temperature of the dv/dt filters compact may exceed 80 °C.

CAUTION

If a dv/dt filter compact plus Voltage Peak Limiter is connected to the Power Module or Motor Module, it must be activated during commissioning (p0230 = 2).

CAUTION

The maximum permissible output frequency when using dv/dt filters compact plus Voltage Peak Limiter is 150 Hz.

⚠ DANGER

dv/dt filters compact plus Voltage Peak Limiter discharge a high leakage current to the protective ground conductor.
Due to the high leakage current associated with dv/dt filters, they or the relevant control cabinet must be permanently connected to PE.

According to EN 61800-5-1, Section 6.3.6.7, the minimum cross-section of the protective ground conductor must conform to the local safety regulations for protective ground conductors for equipment with a high leakage current.

⚠ DANGER

Each component must be grounded using the specially marked PE connection.

6.4.3 Interface description

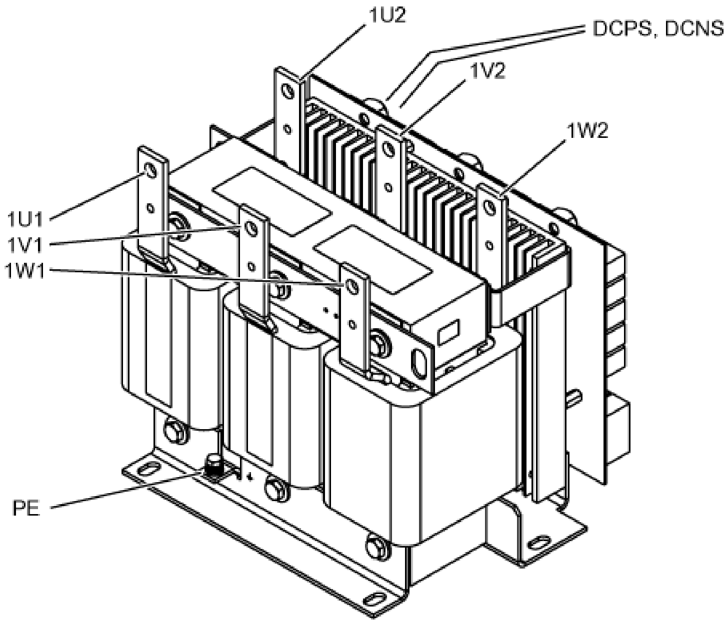


Figure 6-13 Interface overview for dv/dt filter compact plus Voltage Peak Limiter, Type 1

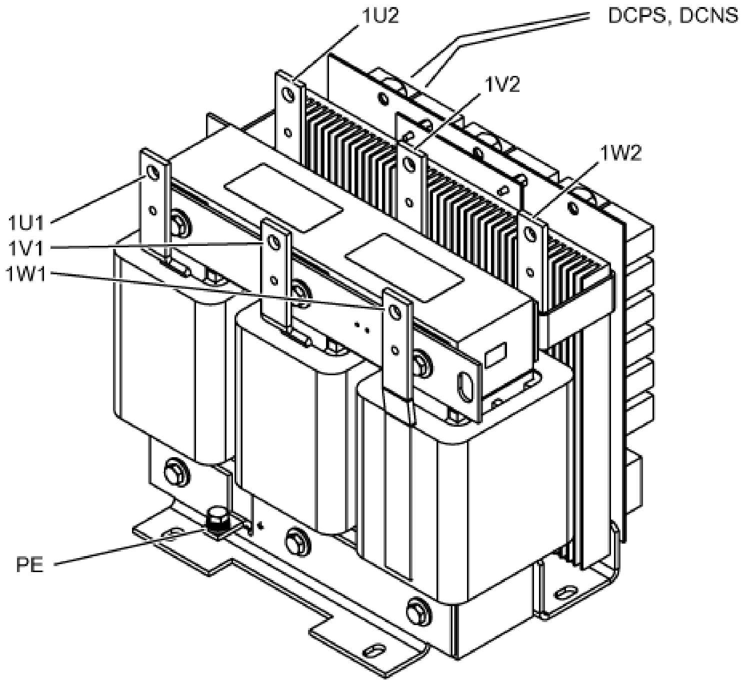


Figure 6-14 Interface overview for dv/dt filter compact plus Voltage Peak Limiter, Type 2

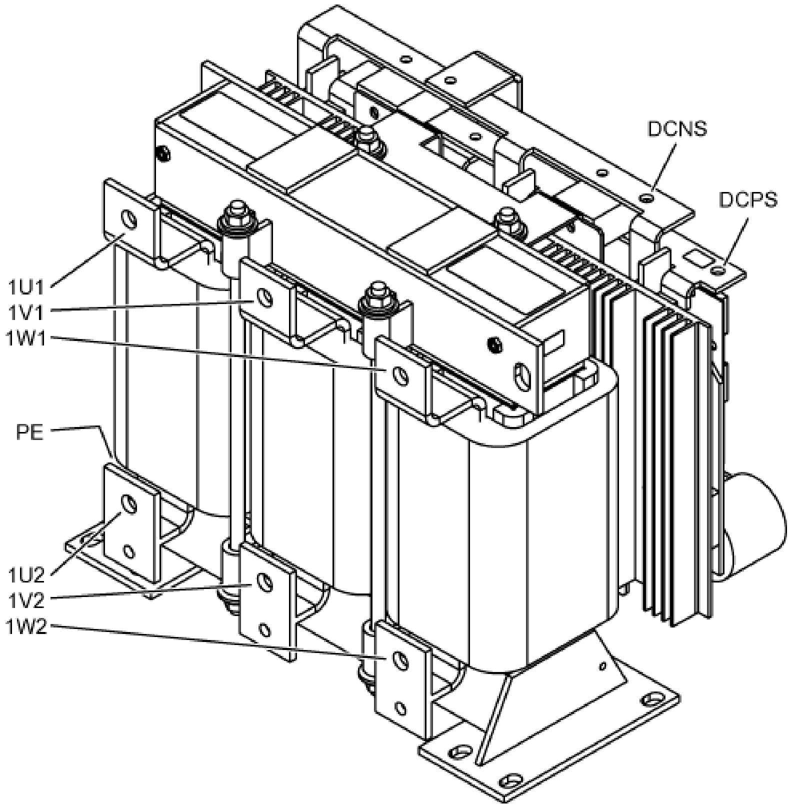


Figure 6-15 Interface overview for dv/dt filter compact plus Voltage Peak Limiter, Type 3

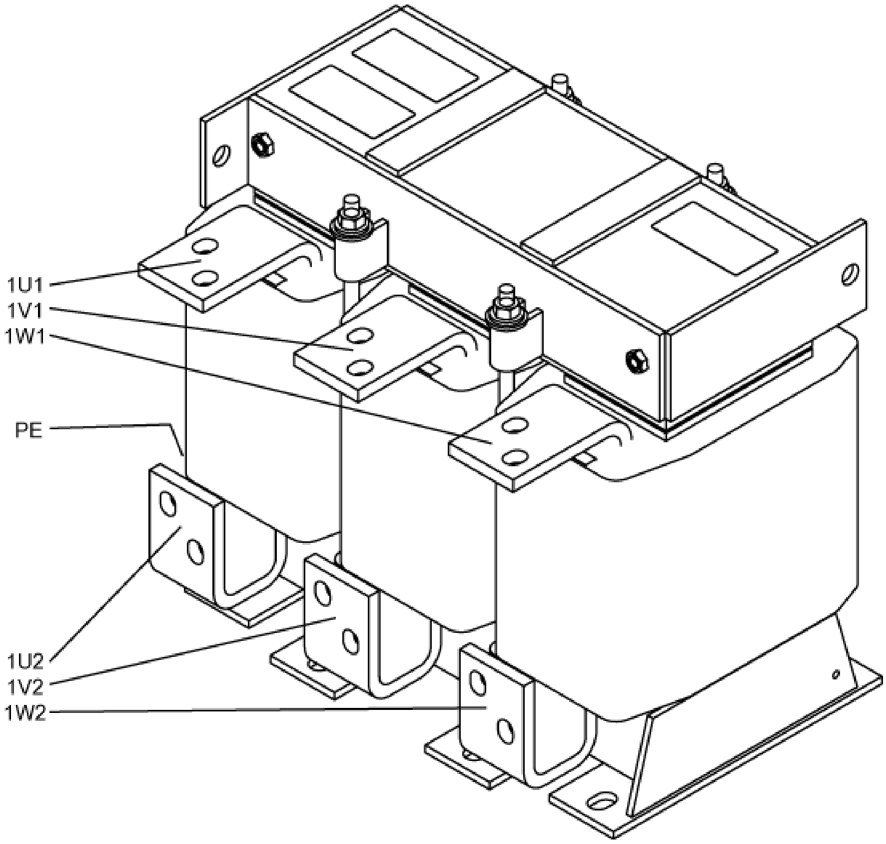


Figure 6-16 Interface overview for dv/dt filter compact plus Voltage Peak Limiter, Type 4 dv/dt reactor

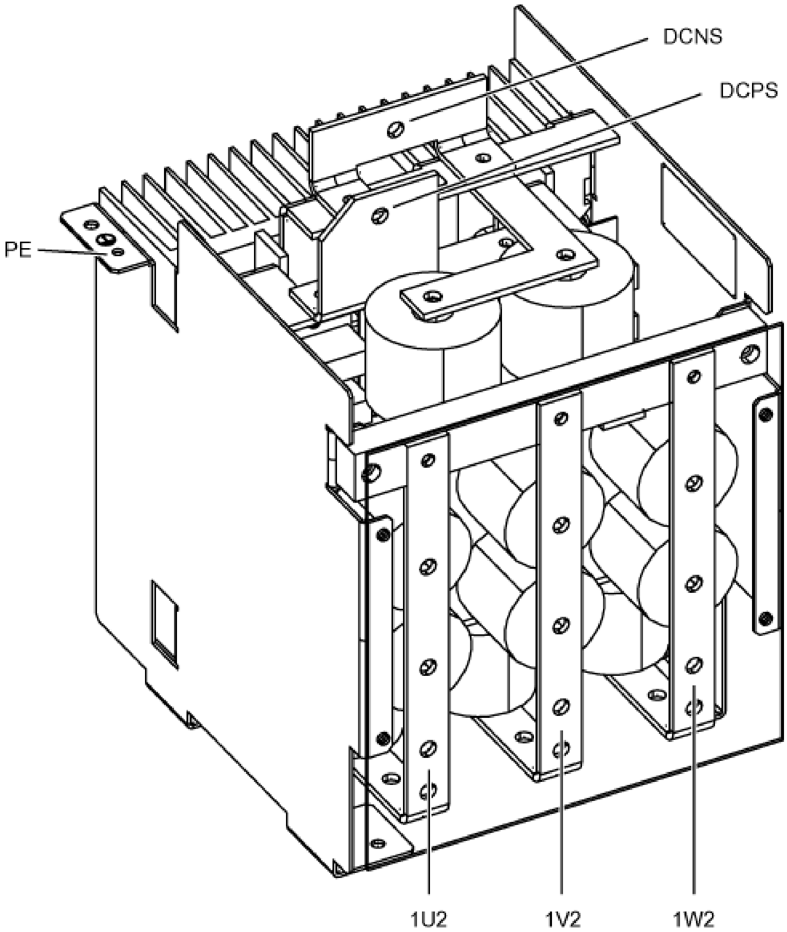


Figure 6-17 Interface overview for dv/dt filter compact plus Voltage Peak Limiter, Type 4 Voltage Peak Limiter

6.4.4 Connecting the dv/dt filter compact plus Voltage Peak Limiter

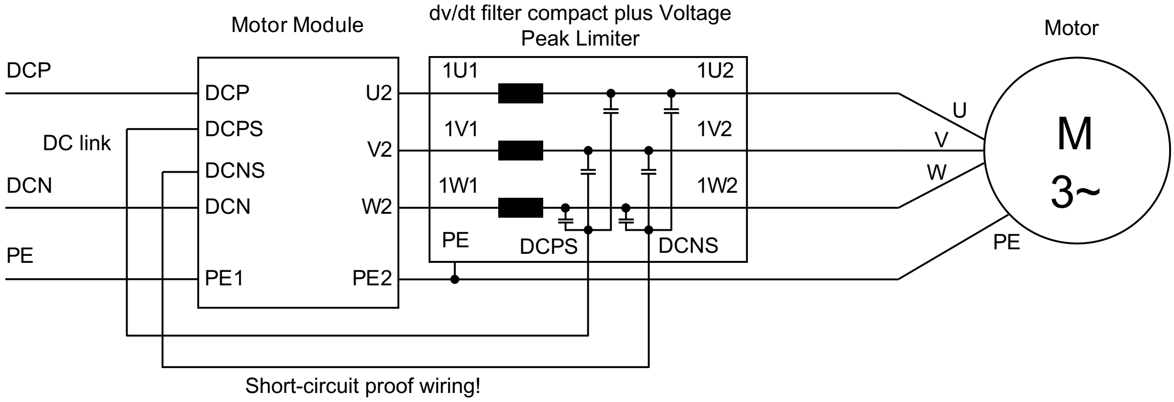


Figure 6-18 Connecting the dv/dt filter compact plus Voltage Peak Limiter - integrated unit

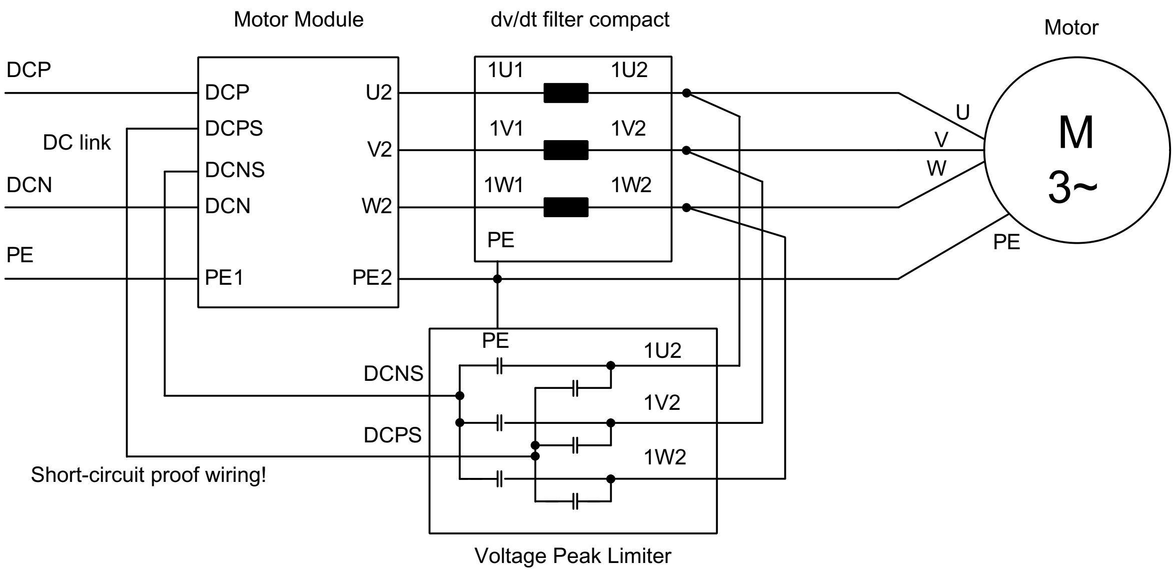


Figure 6-19 Connecting the dv/dt filter compact plus Voltage Peak Limiter - separate components

Cable cross-sections

In a dv/dt filter with separate Voltage Peak Limiter (Type 4), the connections between dv/dt reactor and Voltage Peak Limiter are already installed on the Voltage Peak Limiter.

Table 6- 27 Cable cross-sections for connections between a dv/dt filter and Motor Module

dv/dt filter compact plus Voltage Peak Limiter	Cross-section [mm²]	Connection on dv/dt filter
Type 1	16	Screw M8 / 12 Nm
Type 2	25	Screw M8 / 12 Nm
Type 3	50	Copper bar for M8 bolt / 12 Nm
Type 4	95	Copper bar for M8 bolt / 12 Nm

Table 6- 28 Connection cable enclosed for connecting dv/dt reactor and Voltage Peak Limiter

Voltage Peak Limiter	Cross-section [mm²]	Lug for connecting 1U2 / 1V2 / 1W2 on the dv/dt reactor
Type 4	70	M12

Cable type: 600 V, UL style 3271, operating temperature 125 °C

CAUTION

The connection to the DC link of the Power Module or Motor Module must be routed according to IEC 61800-5-2:2007, Table D.1 in order to rule out short-circuiting or ground faults.

This can be accomplished, for example, by:

- Eliminating the risk of mechanical damage to the cables
- Using cables with double insulation
- Maintaining adequate clearance, using spacers, for example
- Laying the cables in separate cable ducts or pipes

Note

The connections should be kept as short as possible.
The maximum cable length between Power Modules or Motor Module and dv/dt filter compact (motor cables and cables to the DC link) is 5 m.

An equivalent cable type must be used when replacing enclosed cables.

WARNING

The connections at the dv/dt filter compact are not designed for direct mechanical connection to the motor cables.

The customer is responsible for ensuring that mechanical loading caused by connected cables cannot bend the terminals.

6.4.5 Dimension drawing for dv/dt filter compact plus Voltage Peak Limiter

dv/dt filter compact plus Voltage Peak Limiter, Type 1

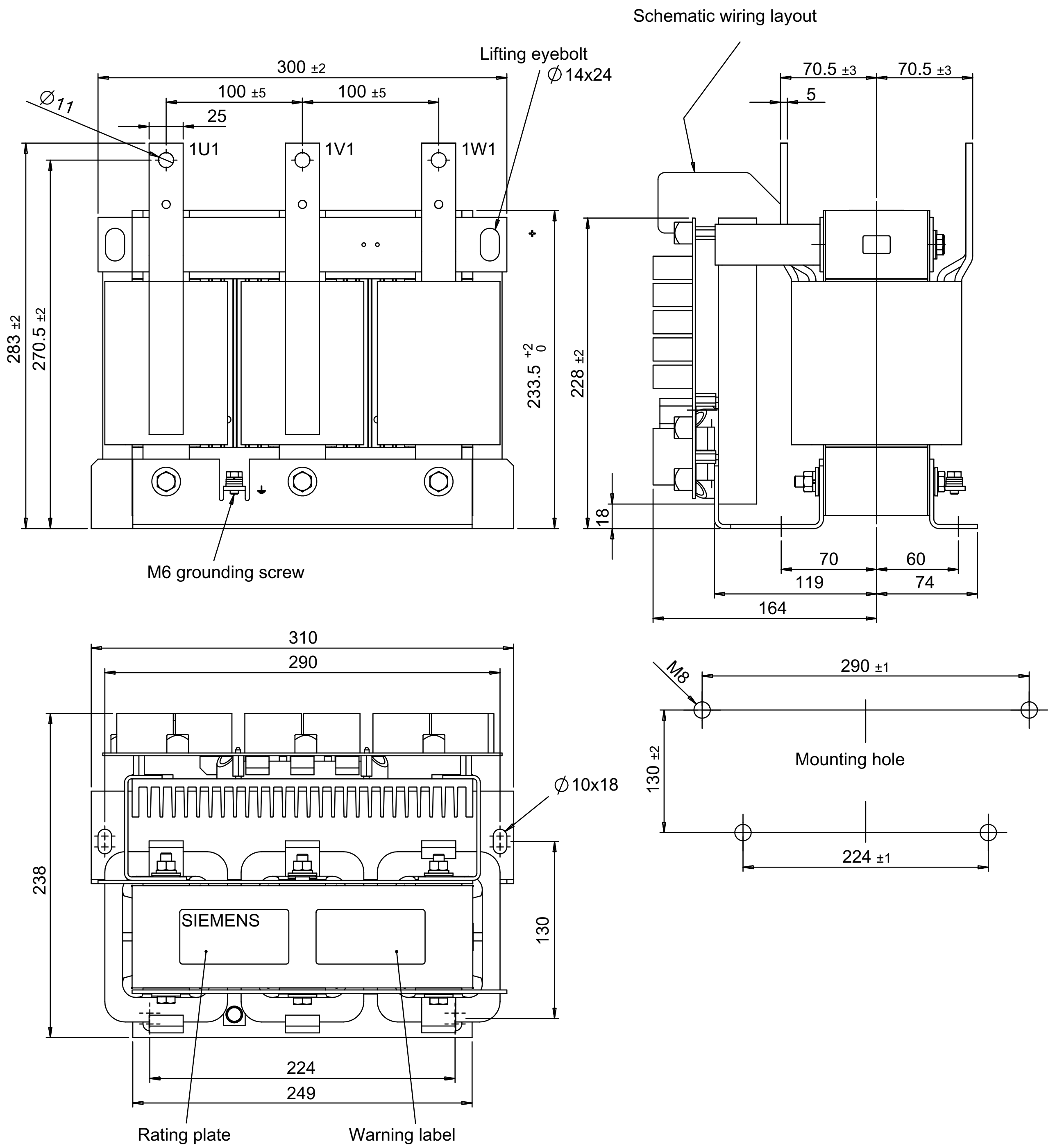


Figure 6-20 Dimension drawing for dv/dt filter compact plus Voltage Peak Limiter, Type 1

dv/dt filter compact plus Voltage Peak Limiter, Type 2

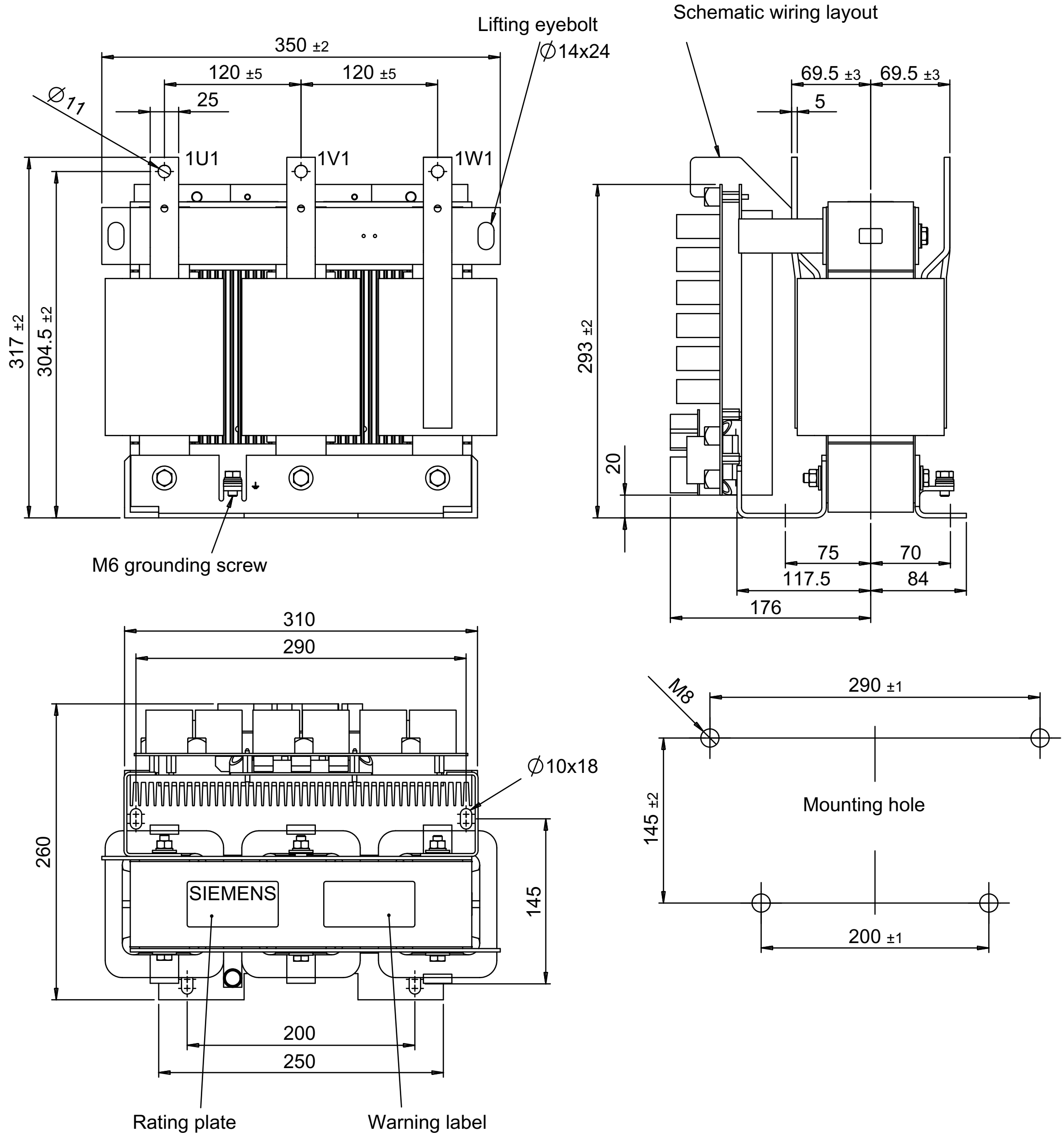


Figure 6-21 Dimension drawing for dv/dt filter compact plus Voltage Peak Limiter, Type 2

dv/dt filter compact plus Voltage Peak Limiter, Type 3

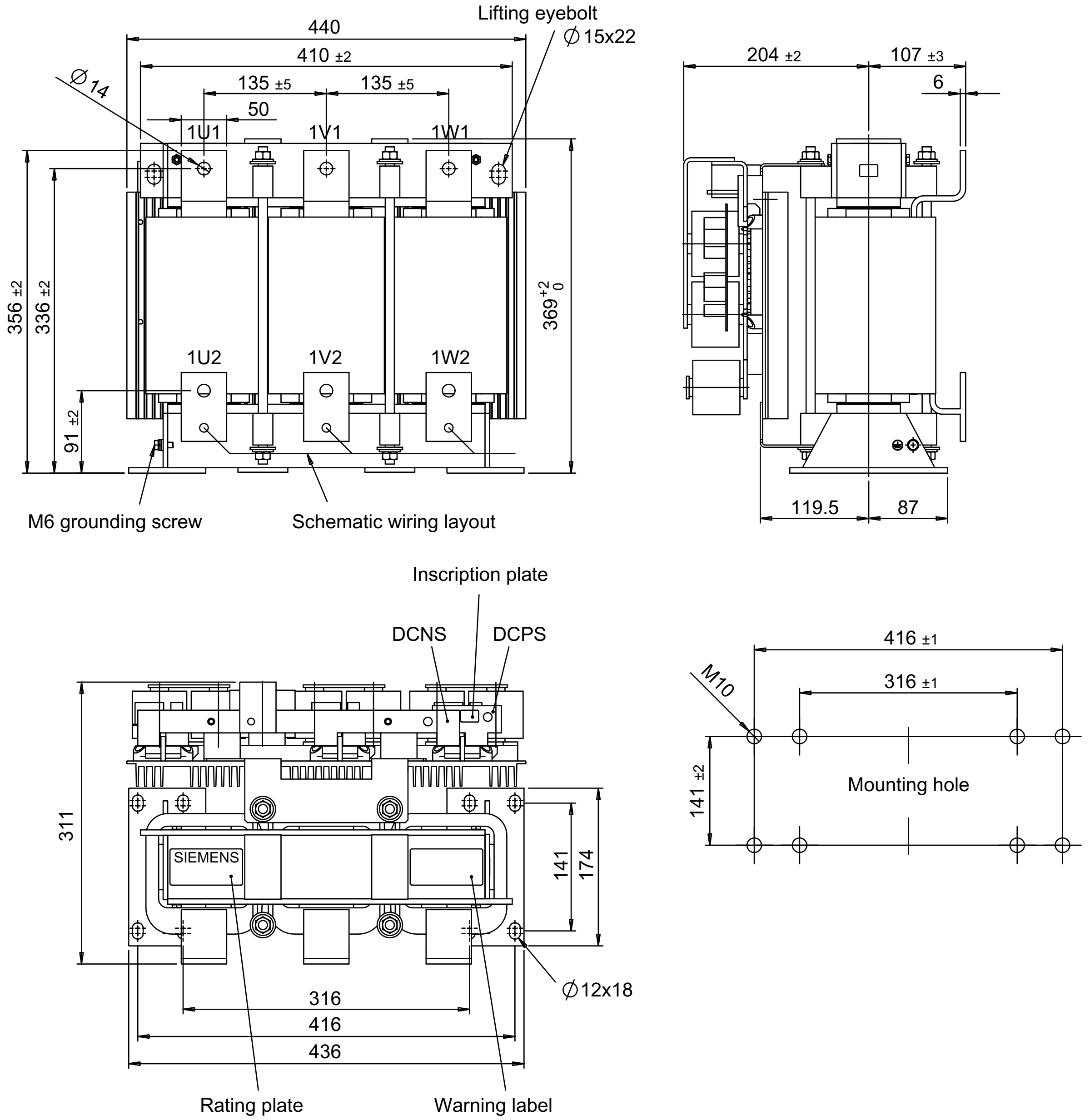


Figure 6-22 Dimension drawing for dv/dt filter compact plus Voltage Peak Limiter, Type 3

dv/dt filter compact plus Voltage Peak Limiter, Type 4

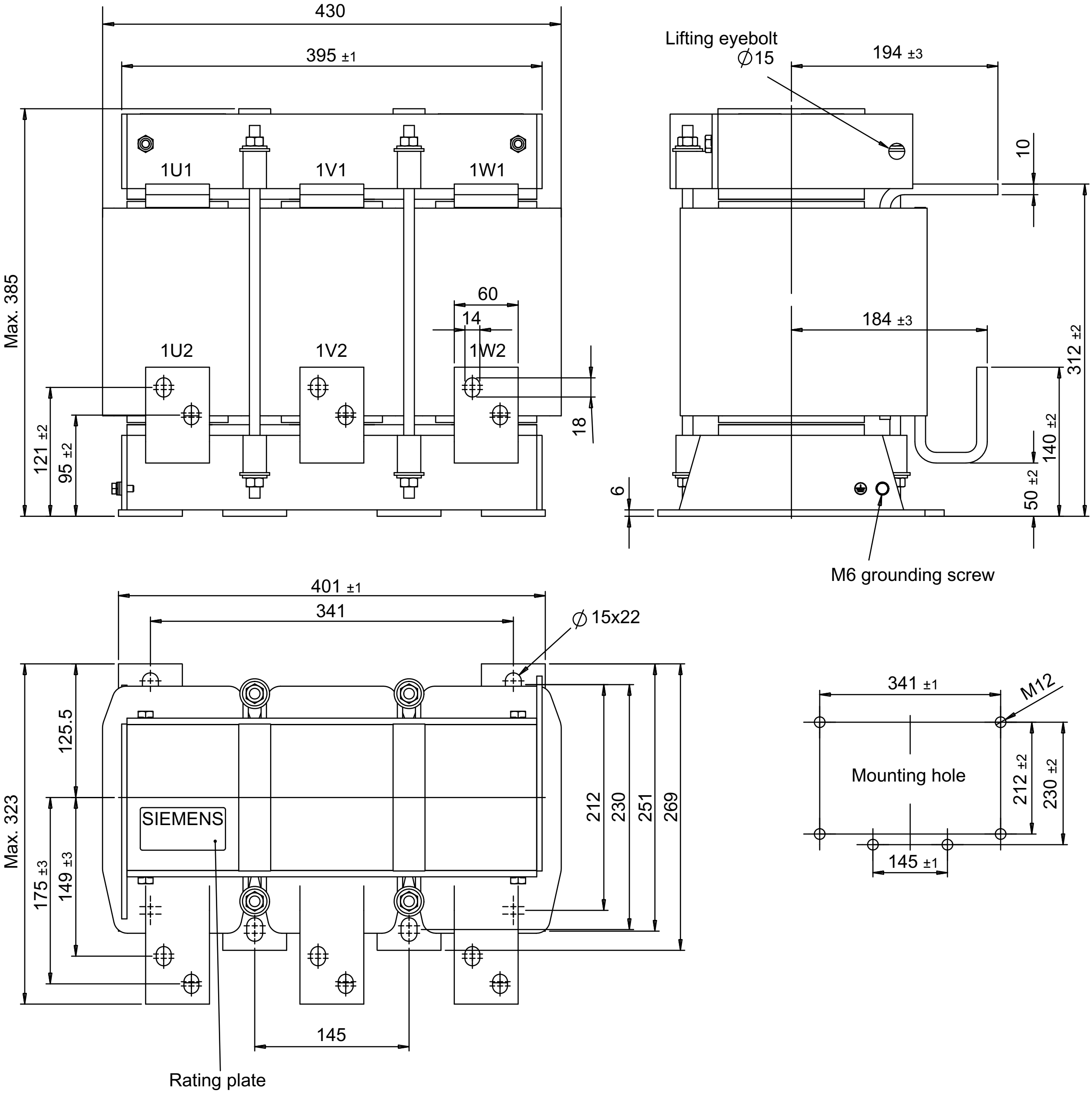


Figure 6-23 Dimension drawing for dv/dt filter compact plus Voltage Peak Limiter, Type 4 dv/dt reactor

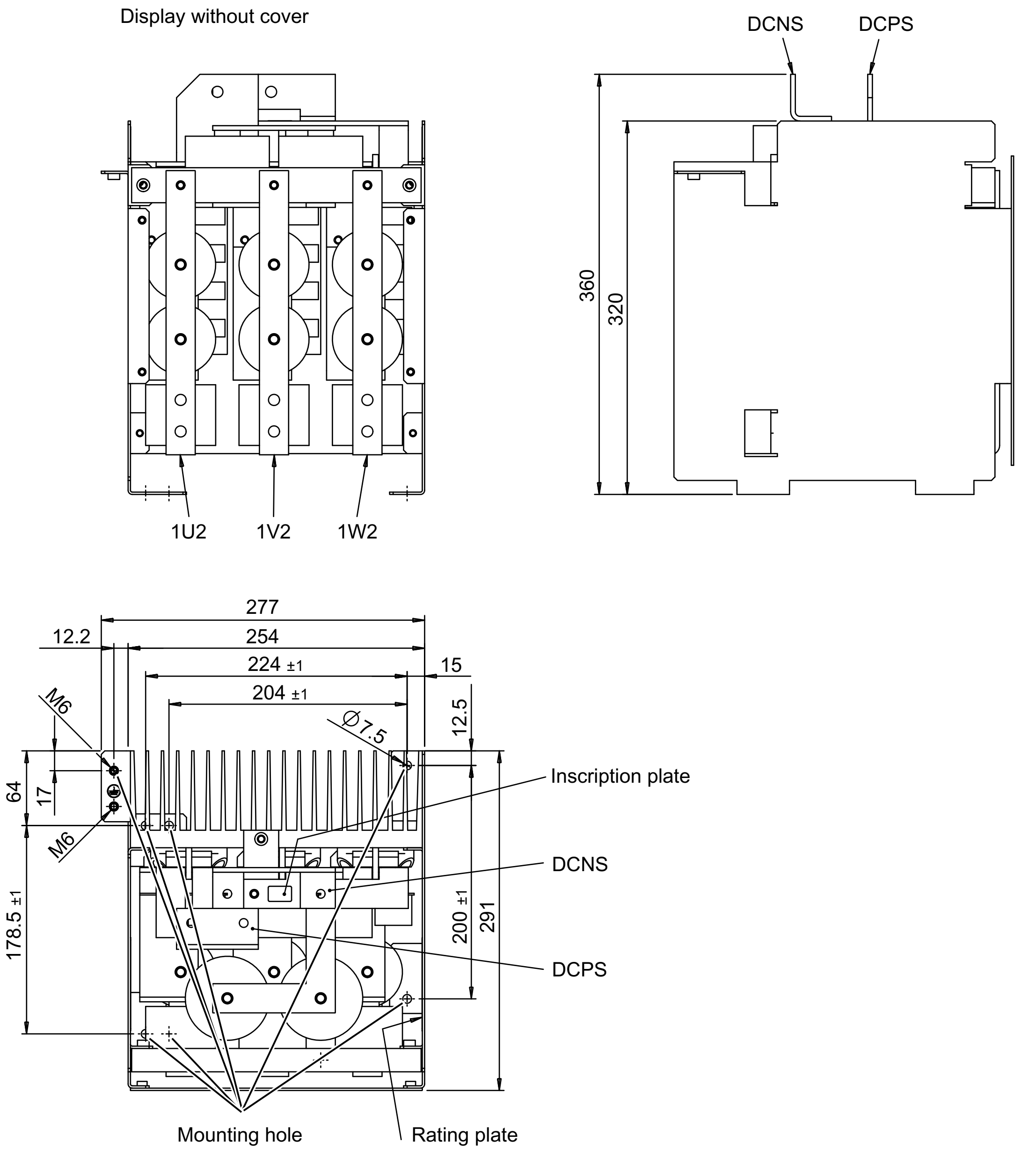


Figure 6-24 Dimension drawing for dv/dt filter compact plus Voltage Peak Limiter, Type 4 Voltage Peak Limiter

Table 6- 29 Assignment of dv/dt filters compact plus Voltage Peak Limiter to the dimension drawings

dv/dt filter compact plus Voltage Peak Limiter	Dimension drawing type
Line voltage 380 V – 480 V 3 AC	
6SL3000-2DE32-6EA0	Type 1
6SL3000-2DE35-0EA0	Type 2
6SL3000-2DE38-4EA0	Type 3
6SL3000-2DE41-4EA0	Type 4
Line voltage 500 V – 690 V 3 AC	
6SL3000-2DG31-0EA0	Type 1
6SL3000-2DG31-5EA0	Type 1
6SL3000-2DG32-2EA0	Type 2
6SL3000-2DG33-3EA0	Type 2
6SL3000-2DG34-1EA0	Type 3
6SL3000-2DG35-8EA0	Type 3
6SL3000-2DG38-1EA0	Type 4
6SL3000-2DG41-3EA0	Type 4

6.4.6 Technical specifications

Table 6- 30 Technical data for the dv/dt filter compact plus Voltage Peak Limiter, 380 V – 480 V 3 AC, part 1

Order number	6SL3000-	2DE32-6EA0	2DE35-0EA0	2DE38-4EA0
Suitable for Power Module (unit rating)	6SL3315-	1TE32-1AAx (110 kW) 1TE32-6AAx (132 kW)	1TE33-1AAx (160 kW) 1TE35-0AAx (250 kW)	1TE36-1AAx (315 kW) 1TE38-4AAx (450 kW)
Suitable for Motor Module (unit rating)	6SL3325-	1TE32-1AAx (110 kW) 1TE32-6AAx (132 kW)	1TE33-1AAx (160 kW) 1TE35-0AAx (250 kW)	
I_{thmax}	A	260	490	840
Degree of protection		IP00	IP00	IP00
Power loss - at 50 Hz - at 60 Hz - at 150 Hz	 kW kW kW	 0.210 0.215 0.255	 0.290 0.296 0.344	 0.518 0.529 0.609
Terminals - 1U1/1V1/1W1 - DCPS/DCNS - 1U2/1V2/1W2 - PE		 for M10 bolt for M8 screw for M10 bolt M6 screw	 for M10 bolt for M8 screw for M10 bolt M6 screw	 for M12 bolt for M8 bolt for M12 bolt M6 screw
Max. permissible cable length between dv/dt filter and motor	m	100 (shielded) 150 (unshielded)		
Dimensions Width Height Depth	 mm mm mm	 310 283 238	 350 317 260	 440 369 311
Weight, approx.	kg	41	61	103

Table 6- 31 Technical data for the dv/dt filter compact plus Voltage Peak Limiter, 380 V – 480 V 3 AC, part 2

Order number	6SL3000-	2DE41-4EA0		
Suitable for Motor Module (unit rating)	6SL3325-	1TE41-0AAx (560 kW) 1TE41-4AAx (800 kW)		
I_{thmax}	A	1405		
Degree of protection		IP00		
Power loss - at 50 Hz - at 60 Hz - at 150 Hz	 kW kW kW	 1.154 1.197 1.444		
Max. permissible cable length between dv/dt filter and motor	m	100 (shielded) 150 (unshielded)		
dv/dt reactor				
Terminals - 1U1/1V1/1W1 - 1U2/1V2/1W2 - PE		 for 2 x M12 bolts for 2 x M12 bolts M6 screw		
Dimensions Width Height Depth	 mm mm mm	 430 385 323		
Weight, approx.	kg	168.8		
Voltage Peak Limiter				
Terminals - DCPS/DCNS - 1U2/1V2/1W2 - PE		 for M8 bolt for M8 bolt for M6 screw		
Dimensions Width Height Depth	 mm mm mm	 277 360 291		
Weight, approx.	kg	19.2		

Table 6- 32 Technical data for the dv/dt filter compact plus Voltage Peak Limiter, 500 V – 690 V 3 AC, part 1

Order number	6SL3000-	2DG31-0EA0	2DG31-5EA0	2DG32-2EA0
Suitable for Motor Module (unit rating)	6SL3325-	1TG31-0AAx (90 kW)	1TG31-5AAx (132 kW)	1TG32-2AAx (200 kW)
I_{thmax}	A	100	150	215
Degree of protection		IP00	IP00	IP00
Power loss - at 50 Hz - at 60 Hz - at 150 Hz	 kW kW kW	 0.227 0.236 0.287	 0.270 0.279 0.335	 0.305 0.316 0.372
Terminals - 1U1/1V1/1W1 - DCPS/DCNS - 1U2/1V2/1W2 - PE		 for M10 bolt for M8 screw for M10 bolt M6 screw	 for M10 bolt for M8 screw for M10 bolt M6 screw	 for M10 bolt for M8 screw for M10 bolt M6 screw
Max. permissible cable length between dv/dt filter and motor	m	100 (shielded) 150 (unshielded)		
Dimensions Width Height Depth	 mm mm mm	 310 283 238	 310 283 238	 350 317 260
Weight, approx.	kg	34	36	51

Table 6- 33 Technical data for the dv/dt filter compact plus Voltage Peak Limiter, 500 V – 690 V 3 AC, part 2

Order number	6SL3000-	2DG33-3EA0	2DG35-8EA0	
Suitable for Motor Module (unit rating)	6SL3325-	1TG33-3AAx (315 kW)	1TG35-8AAx(560 kW)	
I_{thmax}	A	330	575	
Degree of protection		IP00	IP00	
Power loss - at 50 Hz - at 60 Hz - at 150 Hz	 kW kW kW	 0.385 0.399 0.480	 0.571 0.586 0.689	
Terminals - 1U1/1V1/1W1 - DCPS/DCNS - 1U2/1V2/1W2 - PE		 for M10 bolt for M8 screw for M10 bolt M6 screw	 for M12 bolt for M8 bolt for M12 bolt M6 screw	
Max. permissible cable length between dv/dt filter and motor	m	100 (shielded) 150 (unshielded)		
Dimensions Width Height Depth	 mm mm mm	 350 317 260	 440 369 311	
Weight, approx.	kg	60	100	

Table 6- 34 Technical data for the dv/dt filter compact plus Voltage Peak Limiter, 500 V – 690 V 3 AC, part 3

Order number	6SL3000-	2DG38-1EA0	2DG41-3EA0	
Suitable for Motor Module (unit rating)	6SL3325-	1TG38-1AAx(800 kW)	1TG41-0AAx (1000 kW) 1TG41-3AAx (1200 kW)	
I_{thmax}	A	810	1270	
Degree of protection		IP00	IP00	
Power loss - at 50 Hz - at 60 Hz - at 150 Hz	 kW kW kW	 0.964 0.998 1.196	 1.050 1.104 1.319	
Max. permissible cable length between dv/dt filter and motor	m	100 (shielded) 150 (unshielded)		
dv/dt reactor				
Terminals - 1U1/1V1/1W1 - 1U2/1V2/1W2 - PE		 for 2 x M12 bolts for 2 x M12 bolts M6 screw	 for 2 x M12 bolts for 2 x M12 bolts M6 screw	
Dimensions Width Height Depth	 mm mm mm	 430 385 323	 430 385 323	
Weight, approx.	kg	171.2	175.8	
Voltage Peak Limiter				
Terminals - DCPS/DCNS - 1U2/1V2/1W2 - PE		 for M8 bolt for M8 bolt for M6 screw	 for M8 bolt for M8 bolt for M6 screw	
Dimensions Width Height Depth	 mm mm mm	 277 360 291	 277 360 291	
Weight, approx.	kg	18.8	19.2	

Cabinet design and EMC 7

7.1 Notes

7.1.1 General Information

The modular concept of SINAMICS S120 allows a wide range of potential device combinations. For this reason, it is impossible to describe each individual combination. This section instead aims to provide some basic information and general rules on the basis of which special device combinations can be constructed and to ensure electromagnetic compatibility.

The SINAMICS S120 components are designed for installation in enclosures, which can take the form of cabinet units or control boxes made of steel that provide protection against shock and other environmental influences. They are also part of the EMC concept.

7.1.2 Safety information

WARNING

When transporting the devices and replacing components, note the following:

- Some of the devices and components are heavy or top heavy.
- Due to their weight, the devices must be handled with care by trained personnel.

Serious injury or even death and substantial material damage can occur if the devices are not lifted or transported properly.

Note

When installing the cabinet unit, make sure that no foreign bodies – especially metallic objects, such as drill swarf, wire end ferrules, or cable cut-offs – fall into the device. If necessary, cover the ventilation slots.

Note

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

CAUTION

To ensure that the entire system functions properly, you are advised to use the original Siemens accessories.

Only original DRIVE-CLiQ cables may be used for wiring the DRIVE-CLiQ nodes.

Before commissioning, check the tightening torque of all the terminal screws.

WARNING

Cable shields and unused cores/conductors of the power cables must be connected to PE potential.

Non-observance can cause lethal shock voltages.

Note

On systems with a grounded phase conductor and a line voltage > 600 V AC, line-side components should be installed to limit overvoltages to overvoltage category II in accordance with IEC 61800-5-1.

Maximum cable lengths

Table 7- 1 Maximum cable lengths

Type	Maximum length [m]
24 VDC power cables [1)]	10
24 V signal cables [1)]	30
Power cable between the Power Module or Motor Module and motor when using 2 motor reactors in series	300 (shielded) 450 (unshielded) 525 (shielded) 787 (unshielded)
DRIVE-CLiQ cables • Inside cabinet unit e.g. connection between CU320 and the first Motor Module or between the Motor Modules • DRIVE-CLiQ MOTION CONNECT connecting cables for external components	 70 100

[1)] For greater lengths, suitable wiring must be provided by the user for overvoltage protection.

Table 7- 2 Recommendations for overvoltage protection

DC supply	24 V signal cables
Weidmüller Type: PU DS 24V 16A Type no.: 868210 0000	Weidmüller Type no.: MCZ OVP TAZ
Weidmüller GmbH & Co. KG	

7.1.3 Directives

The product satisfies the protection targets of the following EU Directives applicable within the European Union:

Table 7- 3 Directives

Directive	Description
2006/95/EC	Directive of the European Parliament and Council of December 12, 2006, on the approximation of the laws of the member states relating to electrical equipment designed for use within certain voltage limits (Low-Voltage Directive)
2004/108/EC	Directive of the European Parliament and Council of December 15, 2004, which repeals directive 89/336/EEC, on the approximation of laws of the member states relating to electromagnetic compatibility (EMC Directive)

7.2 EMC-compliant design and control cabinet configuration

For detailed configuration instructions regarding the EMC-compliant design of drives and control cabinet configuration, refer to the "SINAMICS Low Voltage Configuration Manual".

7.3 Horizontal installation

SINAMICS S120 Liquid Cooled units can operate in a vertical position with the unit resting on its rear panel.

To prevent heat concentrations inside the units in this mounting position, an external fan needs to be installed which is capable of removing heated air from the devices.

A baffle (referred to below as air distribution baffle) must also be mounted above the unit. This ensures that the air is sucked through the IP20 covers in an even distribution over the entire length of the device, thereby ensuring that even components at the bottom left of the module remain within the permissible tolerance range (see Figure below).

The components required for a horizontal mounting position can be seen in the Figure below.

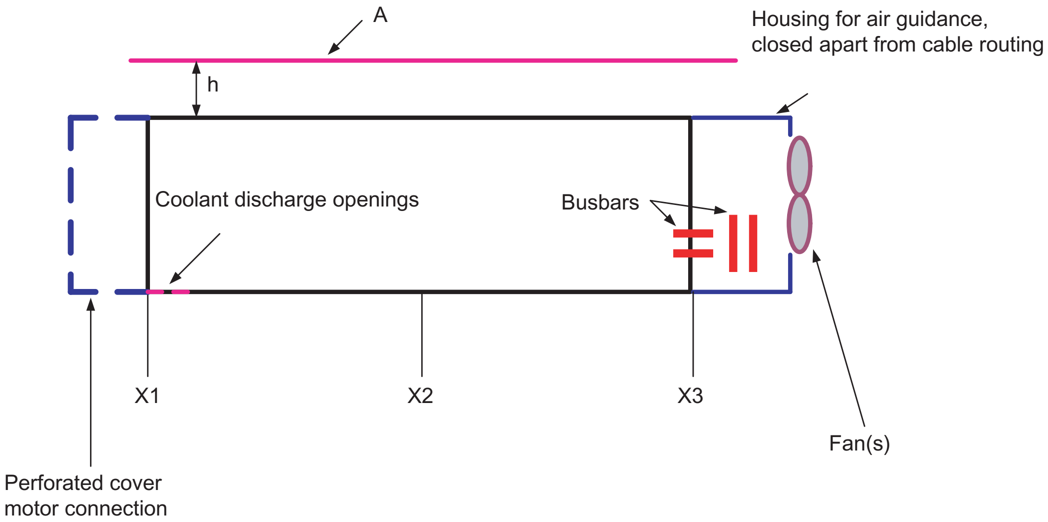


Figure 7-1 Basic layout for horizontal installation position

The height h (the distance between the module top edge (horizontal) and the air distribution baffle A) must be in the range 25 mm < h < 60 mm!

Requirement for air distribution baffle ("A")

With a single unit (Power Module, Basic Line Module, Active Line Module or Motor Module) or Motor Module with Basic Line Module / Active Line Module installed adjacent: Air distribution baffle A is closed, the side openings ensure adequate distribution of air flow.

For configurations with several modules mounted adjacently, air distribution baffle A must be perforated. The perforation must be designed such that up to 60% of the opening area is in the lower module half (in the Figure above, between X1 and X2).

Housing for air guidance

The fan(s) can suck the air out of the module only if air cannot be sucked in between the module and the fan. A housing (enclosure) must therefore be provided between the fan and the module.

Motor connection cover

The motor connection on a horizontally mounted module must be covered. This cover must be perforated. The perforations should have an opening area of 8 x 30 mm with a perforation spacing of 3 to 5 mm.

Figure 7-2 Example of a protective cover for the motor connection

Volumetric air flow and fans required

The following table lists the fans required for different module types and also specifies the volumetric flow which must be provided through the SINAMICS device. The data must be regarded as minimum values.

If the specified fan is not available, an alternative fan can be used provided that its characteristic is higher than that of the fan recommended (fan with higher air flow rate). Data sheets for the recommended minimum fan with characteristic are available on request from EBM-Papst.

Table 7- 4 Volumetric flow requirement and number of fans needed for horizontal mounting

Type	Required volumetric air flow [dm³/s]	Number of fans Papst 4114NXH or Papst 4114NHH or Papst 4184NXH (120 x 120 mm) *)
Power Module, frame sizes FL, GL	15	1
Basic Line Module FBL, 740 A (400 V), 420 A (690 V)	27	1
Basic Line Module FBL, 1220 A (400 V), 730 A (690 V)	44	2
Basic Line Module GBL	63	2
Active Line Module GXL, Motor Module FXL, GXL	15	1
Active Line Module HXL, Motor Module HXL	25	1
Active Line Module JXL, Motor Module JXL	63	2

*) Available from info2@de.ebmpapst.com

NOTICE
If the measures recommended above are not implemented, the equipment might malfunction in operation at air temperatures as low as approx. 30 °C. This is because the current transformers would be overheated!

Coolant connection

The coolant connection must be designed to prevent any coolant leakage into the unit. It is advisable to empty the coolant hoses before connecting them and to plug the heat sink before removing the coolant hoses.

8 Cooling circuit and coolant properties

⚠ WARNING
The equipment must be safely disconnected from the supply before any installation or service work is carried out on cooling circuit components. The cooling circuit must always be designed and installed by an appropriately trained engineer.

Note

The contact addresses for companies named in this section are available on request from your local Siemens sales office.

8.1 Cooling circuits

General information

The type of heat sink materials used requires two distinctly different heat exchange concepts.

Different materials are used to guide the coolant into the cooling plates of the SINAMICS S120 Liquid Cooled units, providing the user with a range of different options for the design of the cooling circuit.

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

Please read the following definitions for clarification:

1. Closed cooling circuit
   The pressure compensator is closed (no ingress of oxygen) and is fitted with a pressure-relief valve (6 bar); it is always connected on the suction side of the pump! The coolant is guided only through the SINAMICS units, the heat exchange components and possibly to a motor (for example, see Figure below). The materials used in the cooling circuit comply with the recommendations in the "Materials" section.
2. Open cooling circuit
   The coolant is guided through the SINAMICS units and the heat exchange components, as well as through components external to the cooling circuit. The materials used comply with the minimum requirements stipulated in Section "Materials".
3. Semi-open cooling circuit
   Oxygen can be transferred to the coolant only via the pressure compensator, otherwise as for 1.

Table 8- 1 Cooling circuit for SINAMICS units

SINAMICS units	Basic Line Module, frame sizes FBL, GBL Active Line Module, frame sizes HXL, JXL Motor Modules, frame sizes HXL, JXL	Power Modules, frame sizes FL, GL Active Line Module, frame size GXL Motor Modules, frame sizes FXL, GXL
Heat sink material	Aluminum	Stainless steel
Closed cooling circuit	The closed cooling circuit is the recommended standard solution!	The closed cooling circuit is the recommended standard solution!
Open cooling circuit	Not permissible!	Permissible
Semi-open cooling circuit	Permissible only with inhibitors and Antifrogen N with a proportion X of 20 % < X ≤ 45 %.	Permissible
Inhibitors required	Yes	Recommended

Print

The maximum system pressure is 600 kPa. The lowest possible pressure should be selected to allow use of pumps with a flat characteristic.

Maximum permissible differential pressure for a heat sink: 200 kPa.

The layout must be selected such that the total length of supply and drain pipe is equal for each SINAMICS unit or motor.

It is not permissible to create water cooling systems with series-connected modules and/or modules and motors as the increased volumetric flow increases the risk of cavitation and abrasion. This type of arrangement is acceptable only if the pressure difference per unit does not exceed 200 kPa.

Installation

The connection between the units and cooling system should be designed with hoses for mechanical decoupling.

The following hose types are recommended:

- EPDM hoses with an electrical conductivity >10^9 ohms, e.g. Semperflex FKD supplied by Semperit, or
- DEMITTEL made of PE / EPDM supplied by Telle
- Secured with clips conforming to DIN 2871, available, e.g. from Telle, see Table in Section "Materials".

The following information must be observed when installing the cooling circuit:

- Seals must be free of chloride, graphite and rust.
- As a result of negative experience with Teflon, Viton, AFM34 and EPDM are recommended instead.
- In order to prevent cavitation damage to the pump (but also in the heat sink), the pressure on the suction side of the pump must be a minimum of 30 kPa, or the geodesic height from the reservoir to the pump suction side must be >3 m (see Section "Preventing cavitation").
- To prevent blockages and corrosion, it is advisable also to install a flushback filter in the circuit (so that residues can be rinsed out when the system is running).

8.1.1 Cooling circuit for aluminum heat sinks

To ensure an optimum heat sink service life, please note the following recommendation for aluminum heat sinks (Basic Line Modules FBL and GBL, Active Line Modules HXL and JXL, Motor Modules HXL and JXL):

- Closed cooling circuit made of stainless steel or ABS which transfers heat to a cooling system via a
  water-to-water heat exchanger.
- Cooling circuit pipes, fittings made of stainless steel (Nirosta) or common steel (ST37).

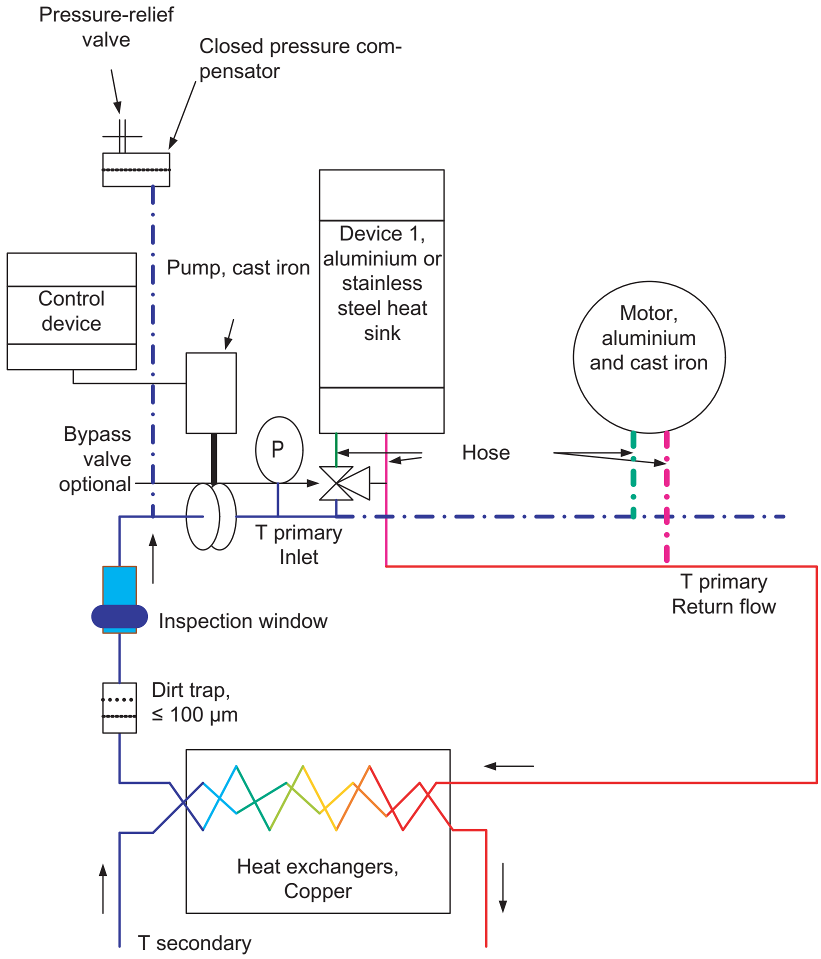


Figure 8-1 Recommendation for closed circuit

Note

When arranging the units in the cooling circuit, please note that the Basic Line Modules, Active Line Modules and Motor Modules must always be positioned upstream of the motors.

Dirt traps (strainers), at least one pressure measuring point and a service inspection window are important.

Table 8- 2 Components of the closed cooling circuit

Component	Explanation
1. Pressure-relief valve	Required in cooling circuits with aluminum owing to the hydroxide reaction with H_2 as the reaction product.
2. Pressure compensator (pressurizer)	Closed pressure compensator if possible, normal type used for heating systems suitable only for closed cooling circuits, with inhibitors or Antifrogen N.
3. Pressure-relief dP valve	Required for systems with very powerful pumps and to dissipate H_2.
4. Pump	Delivery area made of stainless steel, avoid use of grey cast iron wherever possible.
5. Connecting pipes	Stainless steel, also common steel in closed circuits with inhibitors in the coolant.
6. Inspection window	Recommended for diagnosing turbidity and discoloration of the coolant which can indicate ageing or corrosion problems.
7. Dirt traps (strainers)	Dissolved substances (reaction products) must be trapped before they cause blockages in the heat sink!
8. Pressure measuring point	Required for servicing.
9. Connection hose	EPDM hose
10. Heat exchangers	Ideally of stainless steel, but a copper heat exchanger can be used as an alternative in closed circuits.
11. Bypass valve	May be necessary to protect against condensation.
12. Coolant	See the section entitled "Coolant definition".

8.1.2 Cooling circuit for stainless steel heat sinks

To ensure an optimum heat sink service life, please note the following recommendation for stainless steel heat sinks (Power Modules FL and GL, Active Line Modules GXL, Motor Modules FXL and GXL):

- Open or semi-open cooling circuit made of stainless steel or ABS which transfers heat to a recooling system via a water-to-water heat exchanger.
- Cooling circuit pipes, fittings made of stainless steel (Nirosta) or common steel (ST37).

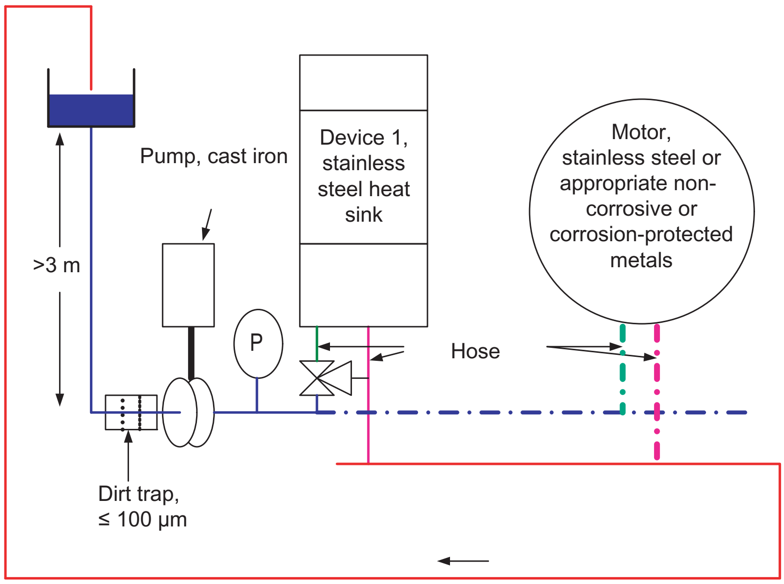


Figure 8-2 Recommendation for open circuit

8.1.3 Preventing cavitation

The following applies to all cooling circuits:

- The cooling circuit must always be designed in such a way that the pressure compensator is located on the suction side of the pump and as close as possible to the pump (see Figure below).
- The minimum pressure on the suction side of the pump must be approximately 30 kPa, or the geodesic height from the reservoir to the pump suction side must be >3 m.
- The pressure drop across a SINAMICS unit must not exceed 200 kPa in continuous operation, as the resultant increase in volumetric flow increases the risk of cavitation and/or abrasion.
- The guidelines given in the Subsection "Cooling circuit configuring information" below regarding series connections and maximum pressure must also be followed.

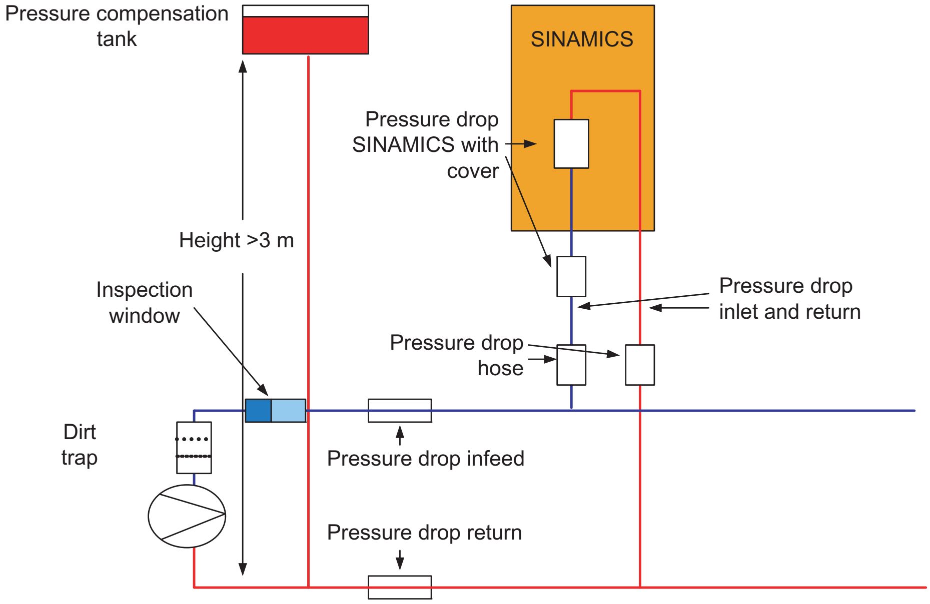


Figure 8-3 Arrangement of pressure compensator, component pressure drops

8.1.4 Cooling circuit configuring information

The operating pressure must be set according to the flow conditions in the supply and return lines of the cooling circuit. The required coolant flow rate per time unit must be set according to the technical data of the devices. The units are normalized to a rated pressure of 70 kPa (for coolant type H_2O) via an orifice.

If a mixture of Antifrogen N and H_2O is used as a coolant, the rated pressure must be calculated according to the mixing ratio. The following table specifies the pressure drop across components at different coolant temperatures for a coolant with mixing ratio 45 % Antifrogen N.

The maximum permissible pressure to atmosphere in the heat sink and thus in the cooling circuit must not exceed 6 bar. If the pump used can reach a maximum pressure in excess of this value, appropriate measures (safety valve $p \leq 6$ bar, pressure control or similar) must be implemented by the customer to ensure that the maximum pressure limit is not exceeded.

The lowest possible differential pressure between the coolant in the supply and return lines should be selected to allow use of pumps with a flat characteristic.

The maximum differential pressure across a heat sink is 200 kPa; higher differential pressures significantly increase the risk of cavitation and abrasion.

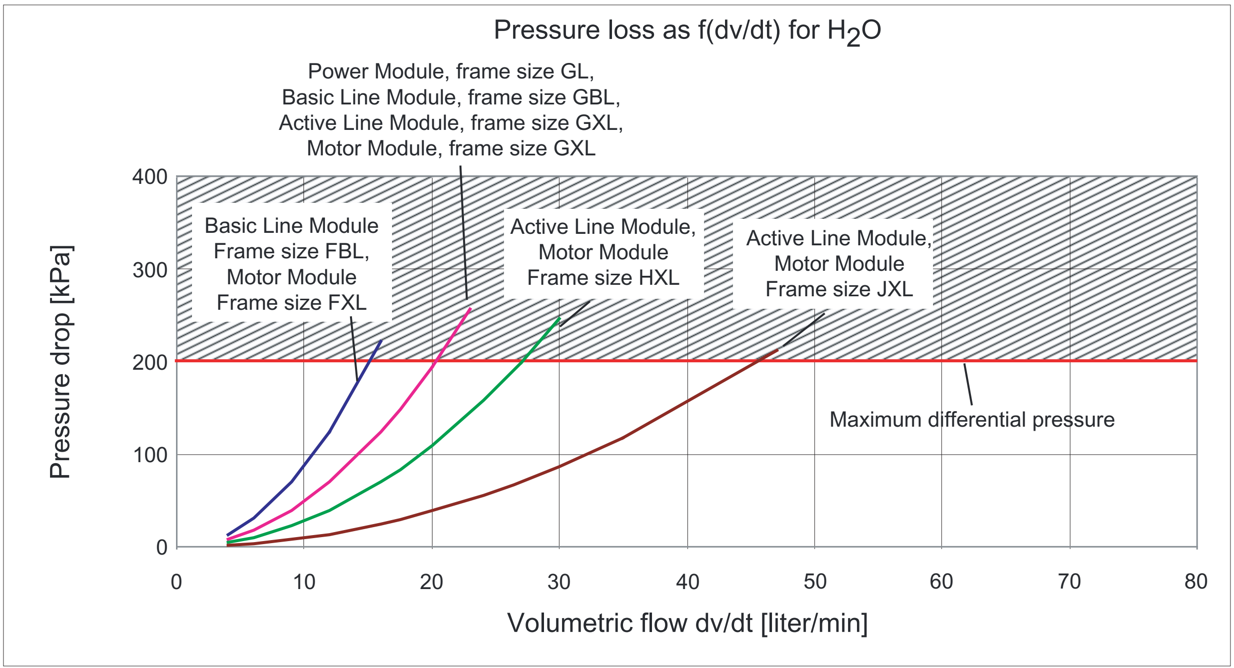


Figure 8-4 Pressure drop as a function of volumetric flow

Water cooling systems with series-connected SINAMICS units cannot be recommended for the following reasons:

- The risk of cavitation and abrasion increases as a result of the high total volumetric flow.
- It is not possible to connect SINAMICS S120 in series because the total volumetric flow inherent to any constellation of series connection requires system pressures in the 600 kPa range or above.

The characteristic curves for the pressure drop across the heat sinks as a function of the volumetric flow vary depending on the temperature and the Antifrogen N / water coolant mix, as can be seen in the following figures.

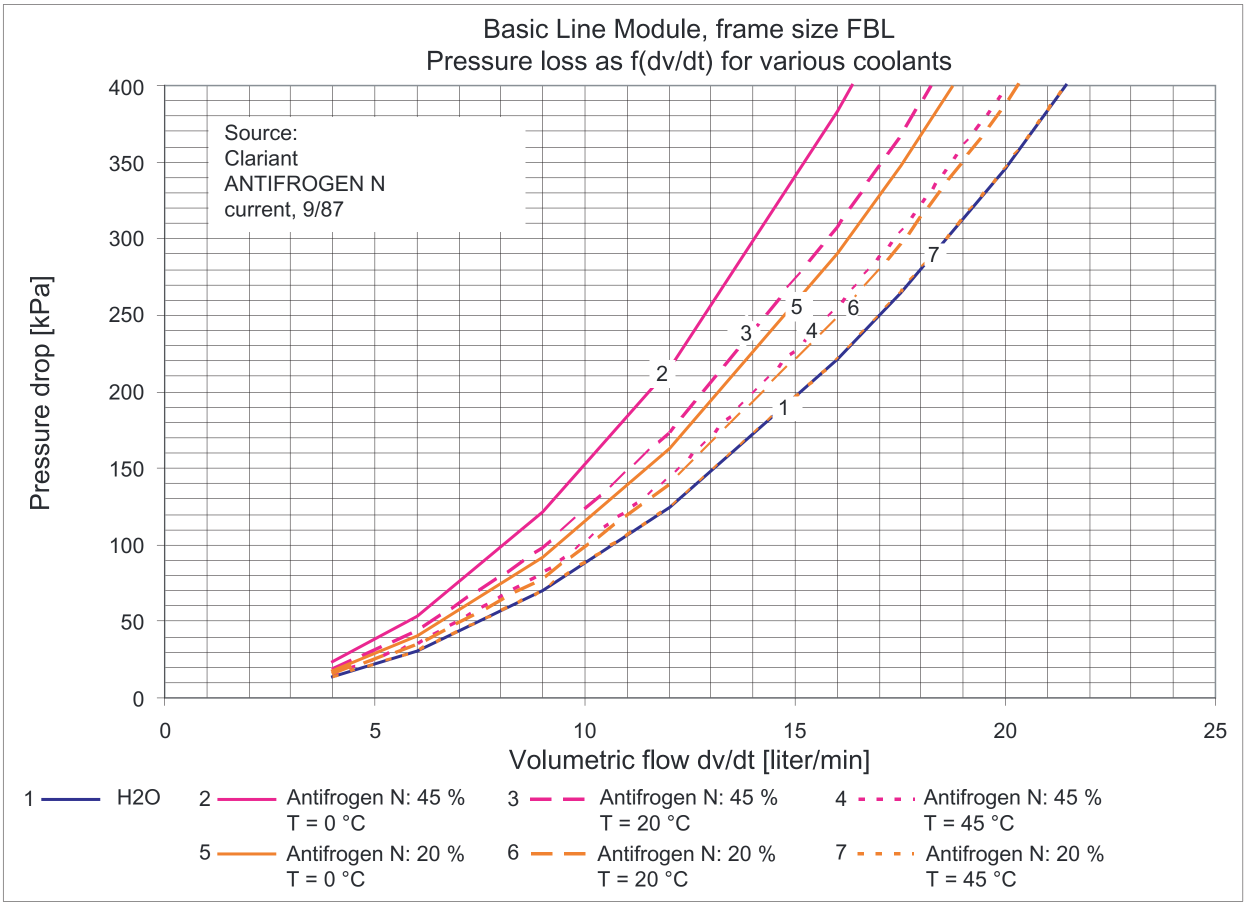


Figure 8-5 Pressure drop as a function of volumetric flow for Basic Line Module, frame size FBL

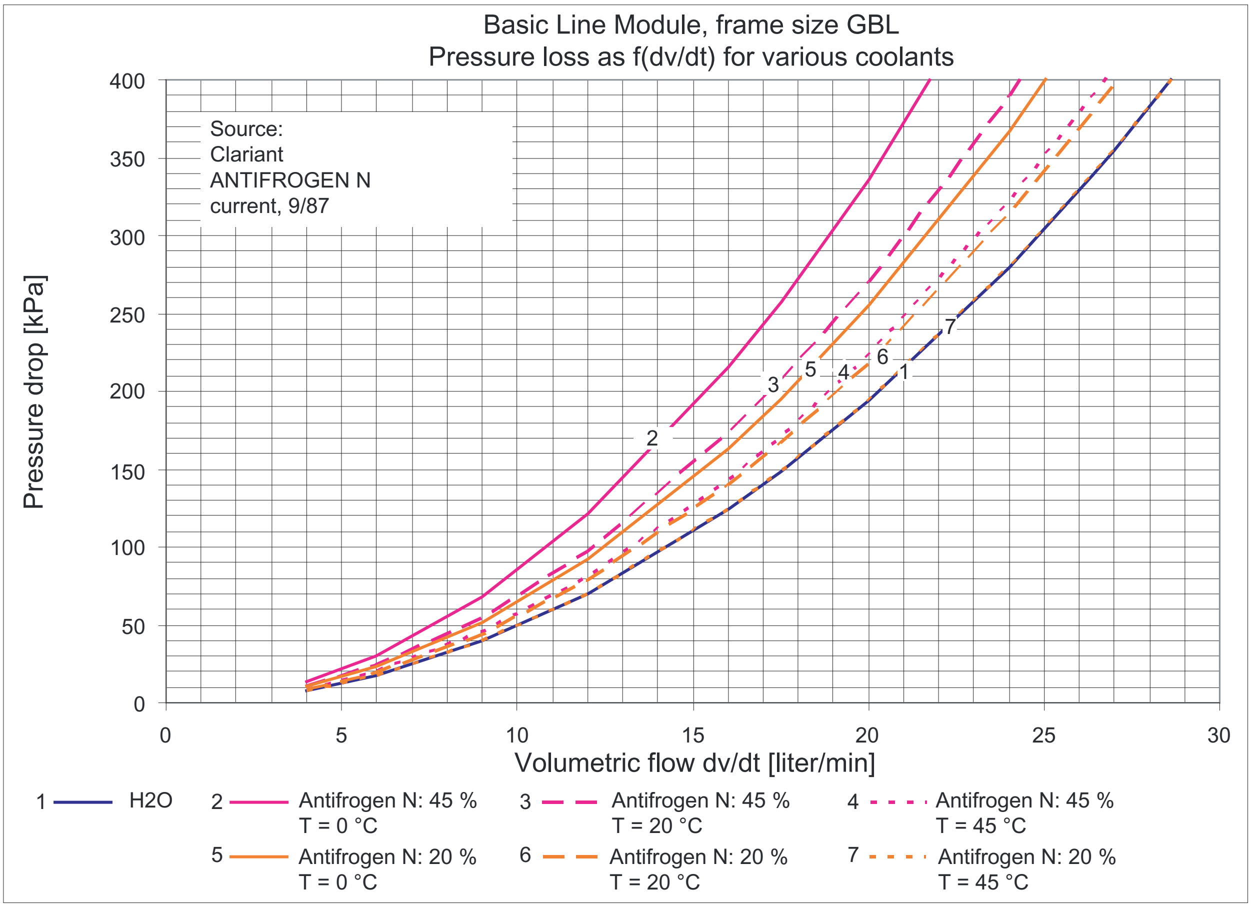


Figure 8-6 Pressure drop as a function of volumetric flow for Basic Line Module, frame size GBL

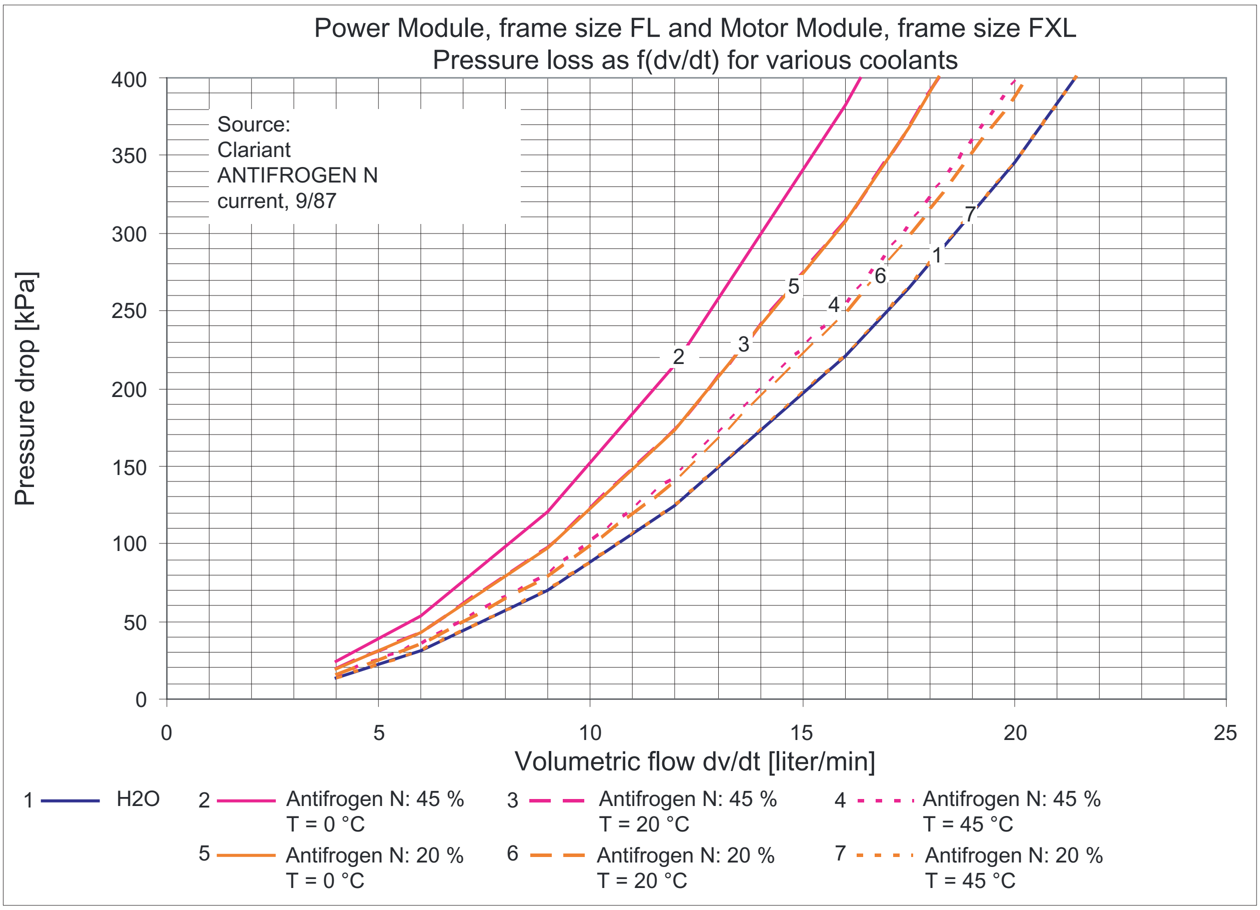


Figure 8-7 Pressure drop as a function of volumetric flow for Power Module frame size FL and Motor Module frame size FXL

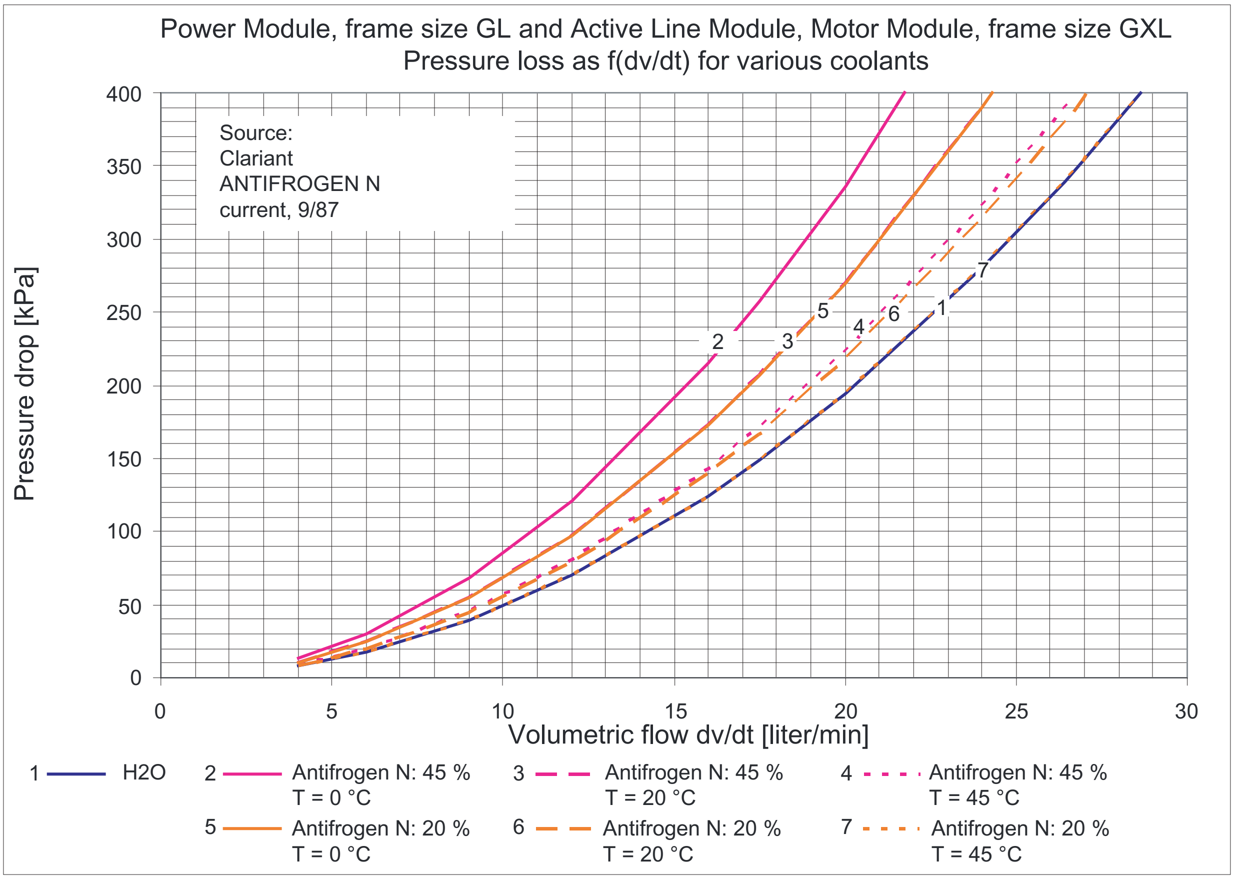


Figure 8-8 Pressure drop as a function of volumetric flow for Power Module frame size GL and Motor Module frame size GXL

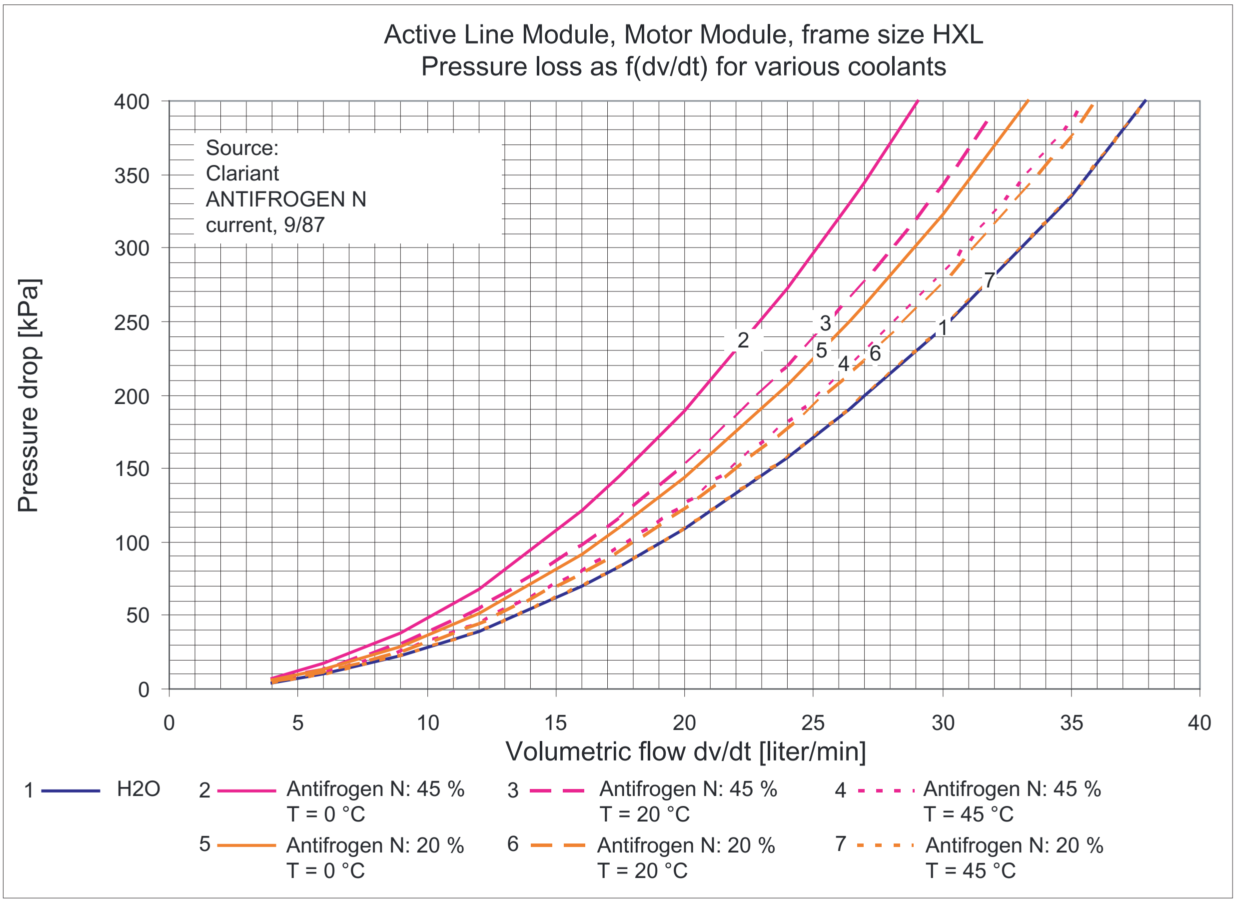


Figure 8-9 Pressure drop as a function of volumetric flow for Active Line Module and Motor Module, frame size HXL

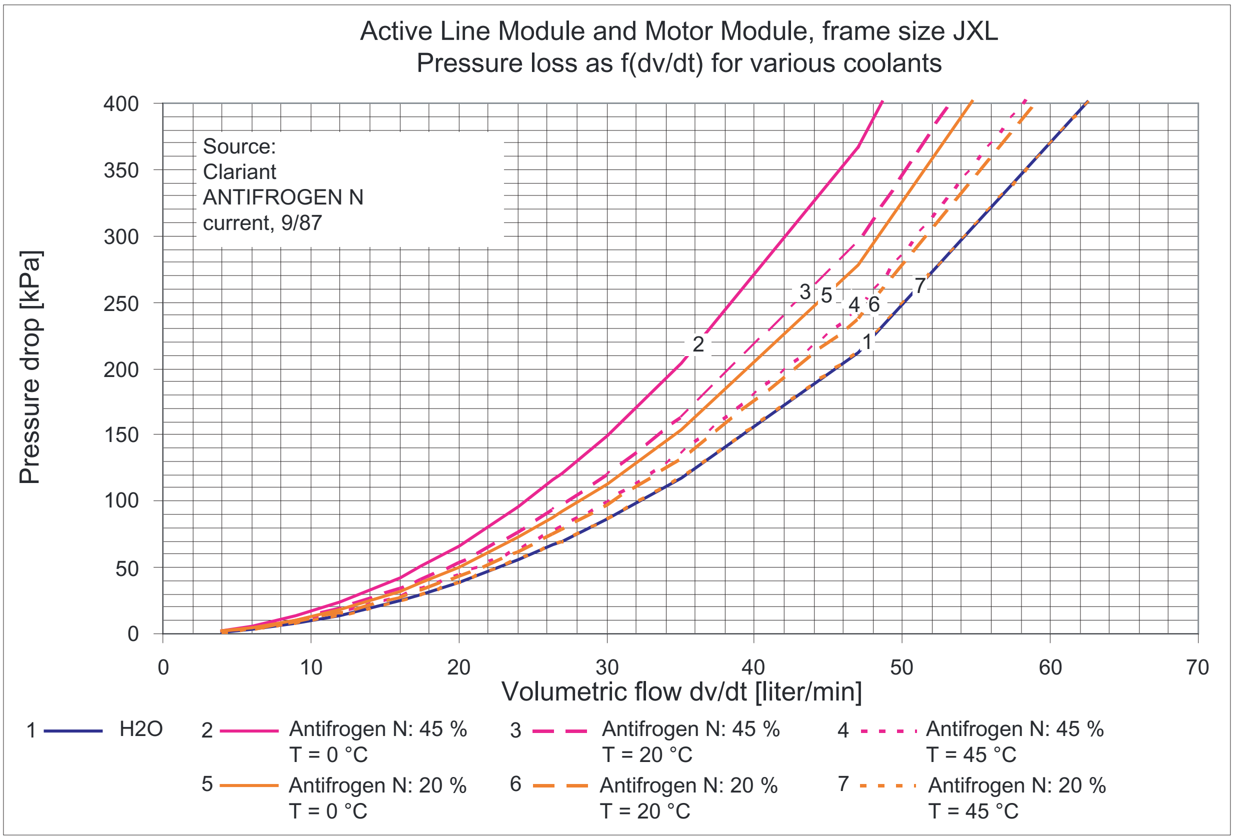


Figure 8-10 Pressure drop as a function of volumetric flow for Active Line Module and Motor Module, frame size JXL

Recommendation for dimensioning the cooling circuit:

The differential pressure between the supply and return lines should be selected such that the following applies:

$$\sum dPi < dP_{System} < \sum dPi + 0.3 \text{ bar}$$

The individual pressure drops Pi represent the pressure drops of components (heat exchanger, piping, 70 kPa for the SINAMICS units connected in parallel, valves, dirt traps, pipe bends, etc.).

The greatest care must be taken when routing pipes. The pipes must never come into contact with electrically live components; an insulation clearance of >13 mm must always be left between pipes and live parts! The pipes must be securely mounted and checked for leaks.

8.1.5 Equipotential bonding

All components in the cooling system (SINAMICS units, heat exchanger, piping system, pump, pressure compensator, etc.) must be connected to an equipotential bonding system. A copper bar or stranded copper with the appropriate conductor cross-sections must be used for this purpose to eliminate electrochemical processes.

If the installation comprises several control cabinets, these must be bolted together in a solid, conductive connection (e.g. bolt cabinet cross-beams together directly at several points to make conductive connection). This eliminates potential differences and thus the risk of electrochemical corrosion. A PE bar must be installed in every cabinet (including the recooling system) and the individual bars then interconnected.

8.2 Coolant definition

8.2.1 Coolant definition

The coolant must fulfill the following requirements over the long term.

Table 8- 3 Coolant definition

	Coolant quality for aluminum heat sink	Coolant quality for stainless steel heat sink
Basic coolant mix	Deionized water with reduced conductivity (5 ... 10 µS/cm), e.g. • "battery water" with 0.2 % Nalco inhibitor TRAC100 (made by: Nalco) or Antifrogen N with a proportion X of 20 % < X ≤ 45 % (made by: Clariant) • or filtered drinking/municipal water with 0.2 % Nalco inhibitor TRAC100 (made by: Nalco) or Antifrogen N with a proportion X of 20 % < X ≤ 45 % (made by: Clariant) of the quality specified below:	Filtered drinking/municipal water of the quality specified below:
Chloride ions	< 40 mg/l Can be obtained by adding deionized water.	< 200 mg/l
Sulfate ions	< 50 mg/l	< 240 mg/l
Nitrate ions	< 50 mg/l	< 50 mg/l
pH value	5.5 – 8.0	6.5 – 9.0
Conductivity	< 500 µS/cm	< 2000 µS/cm
Total hardness	< 1.7 mmol/l	< 1.7 mmol/l
Dissolved solids	< 340 mg/l	< 340 mg/l
Size of entrained particles	< 100 µm	< 100 µm

⚠ WARNING

According to Directive 98/83/EC, drinking water may contain up to 250 mg/l of chloride! This value is too high for the heat sinks which may sustain serious damage if inhibitors are not added!

Note

We recommend that use is made of Nalco's service for analyzing the water quality at the plant site (manufacturer: Nalco).

To better explain the coolant recommendations in this document, a number of problems which can be encountered if the recommendations are ignored are listed in the table below.

Table 8- 4 Substances which can cause irreparable heat sink damage

Coolant property or limit-value violation	Countermeasure
Sea water	Do not use sea water!
Water compliant with limit values	Use of inhibitors, Antifrogen N proportion X of 20 % < X ≤ 45 %, circuit must include a pressure-relief valve.
Oxygen transfer	Closed circuit with pressure-relief valve, use of inhibitors, Antifrogen N proportion X of 20 % < X ≤ 45 %.
Chloride	Use of inhibitors, Antifrogen N proportion X of 20 % < X ≤ 45 %.
Sulfate	Dilute with de-ionized water until the sulphate content is within tolerance.
Dissolved solids (e.g. sand)	Rinse cooling circuit without SINAMICS units. Install dirt trap (e.g. strainers, fine filters).
Total hardness	Use of inhibitors, Antifrogen N proportion X of 20 % < X ≤ 45 %.
Conductivity	Equipotential bonding of all circuit components.
Biological contamination	Use of biocides, dirt traps (e.g. strainers, fine filters).
Oil residue	Use of inhibitors or Antifrogen N proportion X of 20 % < X ≤ 45 %, rinse cooling circuit without SINAMICS units.
Mechanical contamination	Rinse cooling circuit without SINAMICS units. Install dirt trap (e.g. strainers, fine filters).
Inadequate equipotential bonding	Connect all components to equipotential bonding system.

8.2.2 Inhibitors, anti-freeze, biocides

Table 8- 5 Overview and application of coolant additives

	Application with SINAMICS S120 Liquid Cooled with aluminum heat sink	Application with SINAMICS S120 Liquid Cooled with stainless steel heat sink	Important note
Inhibitor without anti-freeze effect	Required	Not necessary	Inhibitor 0.2 % to 0.25 % of total volume!
Anti-freeze protection	Antifrogen N 20 % < X < 45 %, no additional inhibitor required	Antifrogen N 20 % < X ≤ 45 %	
Biocide	Yes	Yes	Cooling circuit with open pressurizer
Anti-freeze + biocide	An Antifrogen N anti-freeze content of >20 % provides an adequate biocidal effect.	An Antifrogen N anti-freeze content of >20 % provides an adequate biocidal effect.	

Inhibitor without anti-freeze effect

The NALCO TRAC100 inhibitor (made by: Nalco) must always be used in a mixing ratio of 0.2 % to 0.25 %.

Inhibitors can be used only in water with the properties defined in Section "Coolant definition" which must not contain any magnesium carbonate.

Control kits can be ordered from Nalco to check the inhibitor concentration.

Anti-freeze protection

Antifrogen N (Manufacturer: Clariant) with a proportion X of 20 % < X ≤ 45 % is the anti-freeze used. Coolants containing 45 % Antifrogen N are anti-freeze-protected down to -30 °C.

Antifrogen N contains anti-corrosion inhibitors which permanently protect the metal in the cooling system against corrosion.

It is particularly important to ensure that the proportion of Antifrogen N is always >20 % when a system is refilled, otherwise the mixture becomes corrosive.

Inhibitors and Antifrogen N must not be mixed.

Biocide

Closed cooling circuits with soft water (°DH>4) are susceptible to microbes. The risk of corrosion caused by microbes is virtually non-existent in chlorinated drinking water systems.

No strain of bacteria can survive if >20 % Antifrogen N is added.

The following types of bacteria are encountered in practice:

- Slime-forming bacteria
- Corrosive bacteria
- Iron-depositing bacteria

The type of bacteria determines the suitability of a biocide. At least one water analysis per annum (to determine the number of bacterial colonies) is recommended. Suitable biocides are available from the manufacturer Nalco for example.

Note

The type of bacteria determines the biocide.

The manufacturer's recommendations must be followed as regards the dosage and compatibility with any inhibitor used.

Biocides and Antifrogen N must not be mixed.

Antifrogen N has a biocidal effect even at the minimum required concentration of >20 %.

8.3 Materials

The following table lists a wide variety of materials and components which may or may not be used in a cooling circuit.

Table 8- 6 Materials and components of a cooling circuit

Material	Used as	Application with SINAMICS S120 Liquid Cooled
Zinc	Pipes, valves and fittings	Do not use zinc!
Brass	Pipes, valves and fittings	Can be used in closed circuits with inhibitor.
Copper	Pipes, valves and fittings	Can be used only in closed circuits with inhibitors in which the heat sink and copper component are separated (e.g. connection hose on units).
Common steel (e.g. St37)	Cable	Permissible in closed circuits with inhibitors or Antifrogen N, check for oxide formation, inspection window recommended.
Cast steel, cast iron	Pipes, motors	Closed circuit and use of strainers and flushback filters. Fe separator for stainless heat sink.
High-alloy steel, Group 1 (V2A)	Pipes, valves and fittings	Can be used for drinking or municipal water with a chloride content up to <250 ppm, suitable according to definition in Section "Coolant definition".
High-alloy steel, Group 2 (V4A)	Pipes, valves and fittings	Can be used for drinking or municipal water with a chloride content up to <500 ppm, suitable according to definition in Section "Coolant definition".
Installation made of different materials (mixed installation)	Pipes, valves and fittings	Do not use a mixed installation.
PVC	Pipes, valves and fittings, hoses	Do not use PVC!
Hoses		Reduce the use of hoses to a minimum (device connection). Must not be used as the main line for the whole system. Recommendation: EPDM hoses with an electrical conductivity >10^9 ohms, (e.g. Semperflex FKD supplied by Semperit, or DEMITTEL of PE/EPD supplied by Telle)
Gaskets	Pipes, valves and fittings	Use of Viton, AFM34, EPDM is recommended.
Hose connections	Pipe-hose transition	Secure with clips conforming to DIN2817, available, e.g. from Telle.

8.4 Anti-condensation measures

The customer must take measures to protect the units against condensation.

Condensation occurs when the inlet temperature of the coolant is significantly lower than room temperature (ambient temperature). The permissible temperature difference between coolant and air varies as a function of the relative humidity ϕ of the ambient air. The air temperature at which the aqueous phase drops out is referred to as the "dew point".

The table below shows the dew points (in °C) for an atmospheric pressure of 1 bar (≈ installation altitude: 0 to 500 m). If the temperature of the coolant is below the specified value, condensation may occur, i.e. the coolant temperature must always be ≥ the dew point temperature.

Table 8- 7 Dew point temperature as a function of relative air humidity ϕ and room temperature at an installation altitude of 0 m.

T room [°C]	φ=20%	φ=30%	φ=40%	φ=50%	φ=60%	φ=70%	φ=80%	φ=85%	φ=90%	φ=95%	φ=100%
10	<0	<0	<0	0.2	2.7	4.8	6.7	7.6	8.4	9.2	10
20	<0	2	6	9.3	12	14.3	16.4	17.4	18.3	19.1	20
25	0.6	6.3	10.5	13.8	16.7	19.1	21.2	22.2	23.2	24.1	24.9
30	4.7	10.5	14.9	18.4	21.3	23.8	26.1	27.1	28.1	29	29.9
35	8.7	14.8	19.3	22.9	26	28.6	30.9	32	33	34	34.9
38	11.1	17.4	22	25.7	28.8	31.5	33.8	34.9	36	36.9	37.9
40	12.8	19.1	23.7	27.5	30.6	33.4	35.8	36.9	37.9	38.9	39.9
45	16.8	23.3	28.2	32	35.3	38.1	40.6	41.8	42.9	43.9	44.9
50	20.8	27.5	32.6	36.6	40	42.9	45.5	46.6	47.8	48.9	49.9

The dew point also depends on the absolute pressure, i.e. the installation altitude.

The dew points for low atmospheric pressure are lower than those at an altitude of 0 m, i.e. it is always acceptable to calculate the coolant supply temperature for an altitude of 0 m.

8.5 Degrees of protection

SINAMICS S120 Liquid Cooled units have degree of protection IP20 with the exception of the electrical connections (overall degree of protection IP00).

The temperature ranges stated in the technical specifications also apply to units mounted in a control cabinet.

No additional measures need to be taken if the modules are mounted in a cabinet with degree of protection up to IP21.

However, if they are mounted in a cabinet with a degree of protection higher than IP21, a fan must be installed above the modules to dissipate any concentrated heat.

The table below specifies the required volumetric flows and the average rates of flow within a shrouding cover (400 mm high).

If several modules are installed in the same cabinet, then the required volumetric flow corresponds to the total volumetric flows of the individual components.

In configurations where a number of shrouding covers are interconnected, the total volumetric flow must also be calculated and a fan selected accordingly.

If a single module is installed in a cabinet with degree of protection IP54, then the fan can be dispensed with if the required volumetric flow for the module is <0.01 m³/s.

Table 8- 8 Required volumetric flows of shrouding cover fan with degree of protection >IP21

Type	Required volumetric flow dv/dt of shrouding cover fan [m³/s]	Average rate of flow [m/s]
Power Module FL, 210 A (400 V)	0.0025	0.01
Power Module FL, 260 A (400 V)	0.0030	0.02
Power Module GL, 310 A (400 V)	0.0036	0.02
Power Module GL, 490 A (400 V)	0.0057	0.03
Basic Line Module FBL, 740 A (400 V)	0.0100	0.05
Basic Line Module FBL, 1220 A (400 V)	0.0170	0.09
Basic Line Module GBL, 1420 A (400 V)	0.0239	0.12
Basic Line Module FBL, 420 A (690 V)	0.0090	0.05
Basic Line Module FBL, 730 A (690 V)	0.0160	0.08
Basic Line Module GBL, 1300 A (690 V)	0.0180	0.09
Basic Line Module GBL, 1650 A (690 V)	0.0230	0.12
Active Line Module GXL, 490 A (400 V)	0.0056	0.03
Active Line Module HXL, 840 A (400 V)	0.0100	0.05
Active Line Module HXL, 575 A (690 V)	0.0056	0.03
Active Line Module JXL, 1422 A (690 V)	0.0236	0.12
Motor Module FXL, 210 A (400 V)	0.0024	0.01
Motor Module FXL, 260 A (400 V)	0.0030	0.02
Motor Module GXL, 310 A (400 V)	0.0035	0.02
Motor Module GXL, 490 A (400 V)	0.0056	0.03
Motor Module HXL, 605 A (400 V)	0.0069	0.04
Motor Module HXL, 840 A (400 V)	0.0100	0.05
Motor Module JXL, 985 A (400 V)	0.0200	0.10
Motor Module JXL, 1405 A (400 V)	0.0260	0.14
Motor Module FXL, 100 A (690 V)	0.0024	0.01
Motor Module FXL, 150 A (690 V)	0.0029	0.02
Motor Module FXL, 215 A (690 V)	0.0038	0.02
Motor Module FXL, 330 A (690 V)	0.0049	0.03
Motor Module HXL, 575 A (690 V)	0.0065	0.03
Motor Module JXL, 810 A (690 V)	0.0187	0.10
Motor Module JXL, 1025 A (690 V)	0.0210	0.11
Motor Module JXL, 1270 A (690 V)	0.0236	0.12

Recommended fan: Supplied by EBM-Papst, type W2E200-HH38-01

8.6 Connection methods

The electrical connections on the SINAMICS S120 Liquid Cooled units must be made with cables of the cross-section stipulated in the technical specifications for the relevant device.

The coolant connection is made using 3/4" couplings.

The supply and return connections on the SINAMICS devices must be made with flexible, non-conductive hose (see Section "Materials") so as to eliminate the risk of electrochemical corrosion, to reduce transfer of vibration and to dampen pressure transients in the coolant. The hose should be about 1.5 m in length (total of supply and return lines).

The coolant hoses should be connected before the units are mounted.

8.7 Commissioning

Commissioning the cooling circuit

Once the modules have been installed in the plant, the coolant circuit must be commissioned before the electrical systems.

Venting the heat sink

In some devices the heat sink has to be vented when it is being filled, depending on the device type and the frame size.

- It is not necessary to vent the heat sinks on Power Modules of frame sizes FL and GL, Active Line Modules of frame size GXL and Motor Modules of frame size FXL and GXL before they are filled for the first time.
- The heat sinks on Basic Line Modules, frame sizes FBL, GBL, Active Line Modules, frame sizes HXL, JXL and Motor Modules, frames sizes HXL, JXL must be vented before they are filled for the first time.
  - For this purpose, the units are fitted with a vent valve at the top and a vent hose at the bottom. The air and/or coolant can be bled out of the unit via this hose and collected underneath so that it cannot leak into the module.
  - A stopper is inserted in the lower end of the vent hose at the factory. This must be removed before the heat sink is vented and inserted again afterwards.

Venting the heat sink with removal of the front electronic fan

On the following Basic Line Modules the front electronic fan must be removed in order to operate the venting lever:

- 6SL3335-1TE41-2AAx (380 - 480 V, 1220 A, 600 kW)
- 6SL3335-1TE41-7AAx (380 - 480 V, 1730 A, 830 kW)
- 6SL3335-1TG41-3AAx (500 - 690 V, 1300 A, 1100 kW)
- 6SL3335-1TG41-7AAx (500 - 690 V, 1650 A, 1370 kW)

The necessary steps following removal of the top housing cover are shown in the illustration below.

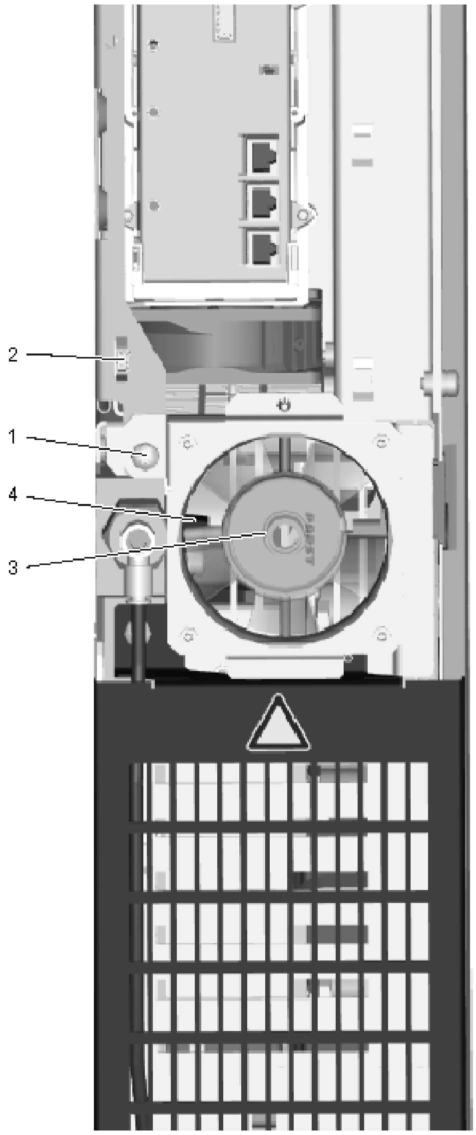


Figure 8-11 Removal of the electronic fan to operate the venting lever

The numbering below corresponds to the numbers in the figure.

1. Remove the lower fastening screw for the plug-in electronics module/the front electronic fan.
2. Detach the plug connection of the power cable for the front electronic fan.
3. Tilt the electronic fan forward and remove it.
4. The venting lever (behind the electronic fan) is now freely accessible.

WARNING
Liquid-cooled devices must be completely dry before being switched on and put into operation. Ensure that no liquid coolant is sprayed onto the devices or additionally mounted electrical components. The equipment must be shut down immediately if there any leaks causing liquid to escape (drips or pools)! Failure to observe this gives rise to a risk of short-circuits, causing damage and malfunctions.

CAUTION
For the cooling circuit to function correctly, vent the circuit to ensure that it does not contain any air bubbles.

8.8 Service

Service

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

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

Maintenance and servicing 9

9.1 Chapter content

This chapter provides information on the following:

- Maintenance and servicing procedures that have to be carried out on a regular basis to ensure the availability of the components.
- Exchanging device components when the unit is serviced
- Forming the DC link capacitors

⚠ DANGER
Before carrying out any maintenance or repair work on the de-energized unit, wait for 5 minutes after switching off the supply voltage. This allows the capacitors to discharge to a harmless level (< 25 V) after the line voltage has been switched off. Before starting work, you should also measure the voltage after the 5 minutes have elapsed. The voltage can be measured on DC link terminals DCP and DCN.

⚠ DANGER
When the external power supply or the external 230 V AC auxiliary supply is connected, dangerous voltages are still present in components even when the main circuit breaker is open.

9.2 Maintenance

The devices comprise mostly electronic components. Apart from the electronic fan(s), therefore, they contain hardly any components that are subject to mechanical wear or that require maintenance or servicing. Maintenance is intended to ensure that the equipment remains in the specified condition. Inspections must be performed regularly, but at least once a year. Where necessary, contaminants must be removed and wearing parts replaced.

The following points must generally be observed.

Cleaning

Dust deposits

Dust deposits inside the device must be removed at regular intervals (or at least once a year) by qualified personnel in line with the relevant safety regulations. The unit must be cleaned using a brush and vacuum cleaner, and dry compressed air (max. 1 bar) for areas that cannot be easily reached.

Ventilation

The ventilation openings in the devices must never be obstructed. The electronic fans must be checked to make sure that they are functioning correctly.

Cable and screw terminals

Cable and screw terminals must be checked regularly to ensure that they are secure in position, and if necessary, retightened. Cabling must be checked for defects. Defective parts must be replaced immediately.

Checking for leaks

The cooling system should be checked for leaks whenever maintenance is carried out.

Note

The actual intervals at which maintenance procedures are to be performed depend on the installation conditions (cabinet environment) and the operating conditions.

Siemens offers its customers support in the form of a service contract. For further details, contact your regional office or sales office.

9.3 Servicing

Servicing involves activities and procedures for maintaining and restoring the specified condition of the devices.

Required tools

The following tools are required for replacing components:

- Spanner or socket spanner (w/f 10)
- Spanner or socket spanner (w/f 13)
- Spanner or socket spanner (w/f 16/17)
- Spanner or socket spanner (w/f 18/19)
- Hexagon-socket spanner (size 8)
- Torque wrench from 5 Nm to 50 Nm
- Screwdriver size 1 / 2
- Screwdriver Torx T20
- Screwdriver Torx T30

Tightening torques for current-carrying parts

When securing connections for current-carrying parts (DC link/motor connections, busbars), you must observe the following tightening torques.

Table 9- 1 Tightening torques for connecting current-carrying parts

Bolt	Torque
M6	6 Nm
M8	13 Nm
M10	25 Nm
M12	50 Nm

9.4 Replacing components

9.4.1 Safety information

⚠ WARNING

When transporting the devices and replacing components, note the following:
- Some of the devices and components are heavy (e.g. > 30 kg) and top-heavy.
- Due to their weight, the devices must be handled with care by trained personnel.
- Serious injury or even death and substantial material damage can occur if the devices are not lifted or transported properly.

⚠ WARNING

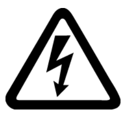
The devices are operated with high voltages.

All connection work must be carried out when the cabinet is de-energized!

All work on the device must be carried out by trained personnel only. Death, serious injury, or substantial material damage can result if these warnings are not taken into account.

Work on an open device must be carried out with extreme caution because external supply voltages may be present. The power and control terminals may be live even when the motor is not running.

Dangerously high voltage levels are still present in the device up to 5 min after it has been disconnected due to the DC link capacitors. For this reason, the cabinet should not be opened until a reasonable period of time has elapsed.



⚠ DANGER

Five safety rules

When carrying out any kind of work on electrical devices, the "five safety rules" according to EN 50110 must always be observed:
1. Isolate the equipment from the power supply
2. Protect against reconnection.
3. Make sure that the equipment is de-energized.
4. Ground and short-circuit.
5. Cover or enclose adjacent components that are still live.

CAUTION

The busbars and coolant connections which stick out of the module must never be used as handles or support surfaces when the units are transported.

9.4.2 Replacing the Control Interface Module, Power Module, frame size FL

Replacing the Control Interface Module

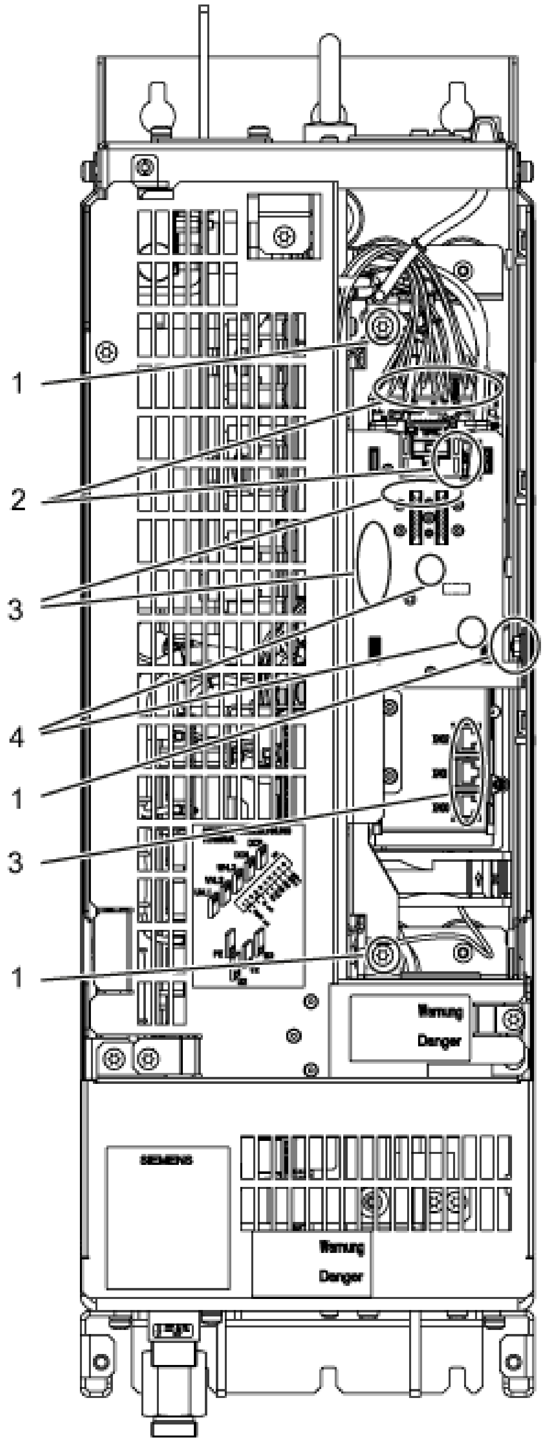


Figure 9-1 Replacing the Control Interface Module, Power Module, frame size FL

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access.
- Remove the protective cover.

Removal

The removal steps are numbered in accordance with the figure.

1. Undo the retaining screws for the control module holder and the plug-in electronics module (2 screws and one nut) and remove the control module holder.
2. Disconnect the plug-in connections for the fiber-optic cables and signal cables (5 plugs maximum).
3. Remove the DRIVE-CLiQ cables and connections on –X41 / –X42 / –X46 (6 plugs maximum).
4. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from connector –X45 on the Control Interface Module.

When removing the Control Interface Module, you have to disconnect a maximum of 5 further plugs one after the other (2 at the top, 3 below) and the PE connection (1 screw below).

CAUTION
When removing the unit, ensure that you do not damage any signal cables.

Installation

For installation, carry out the above steps in reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. Carefully establish the plug-in connections and then ensure that they are secure. When dealing with connectors with a lock, make sure that the locking lever is securely engaged once connected. The fiber-optic cable plugs must be remounted at their original slot. Fiber-optic cables and sockets are accordingly labeled for correct assignment (U11, U21, U31). The DRIVE-CLiQ cable plugs should be labeled prior to disassembly and reinstalled at their original slot, since it is necessary to re-perform system identification after changing the DRIVE-CLiQ cables. The screw connections for the protective covers must only be tightened by hand.

9.4.3 Replacing the Control Interface Module, Power Module, frame size GL

Replacing the Control Interface Module

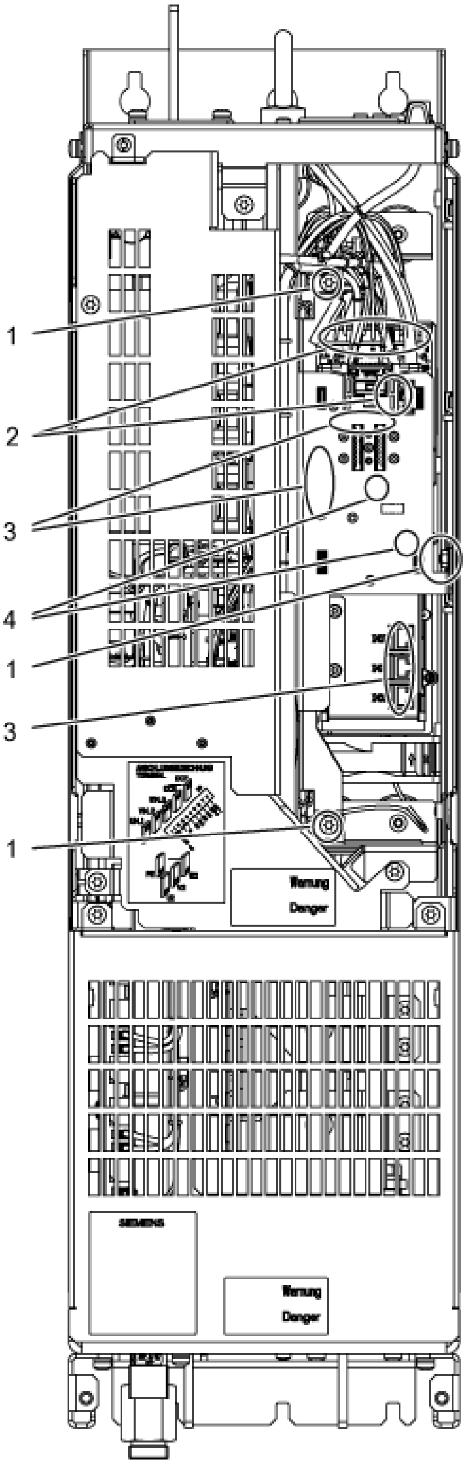


Figure 9-2 Replacing the Control Interface Module, Power Module, frame size GL

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access.
- Remove the protective cover.

Removal

The removal steps are numbered in accordance with the figure.

1. Undo the retaining screws for the control module holder and the plug-in electronics module (2 screws and one nut) and remove the control module holder.
2. Disconnect the plug-in connections for the fiber-optic cables and signal cables (5 plugs maximum).
3. Remove the DRIVE-CLiQ cables and connections on –X41 / –X42 / –X46 (6 plugs maximum).
4. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from connector –X45 on the Control Interface Module.

When removing the Control Interface Module, you have to disconnect a maximum of 5 further plugs one after the other (2 at the top, 3 below) and the PE connection (1 screw below).

CAUTION
When removing the unit, ensure that you do not damage any signal cables.

Installation

For installation, carry out the above steps in reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. Carefully establish the plug-in connections and then ensure that they are secure. When dealing with connectors with a lock, make sure that the locking lever is securely engaged once connected. The fiber-optic cable plugs must be remounted at their original slot. Fiber-optic cables and sockets are accordingly labeled for correct assignment (U11, U21, U31). The DRIVE-CLiQ cable plugs should be labeled prior to disassembly and reinstalled at their original slot, since it is necessary to re-perform system identification after changing the DRIVE-CLiQ cables. The screw connections for the protective covers must only be tightened by hand.

9.4.4 Replacing the Control Interface Module, Motor Module, frame size FXL

Replacing the Control Interface Module

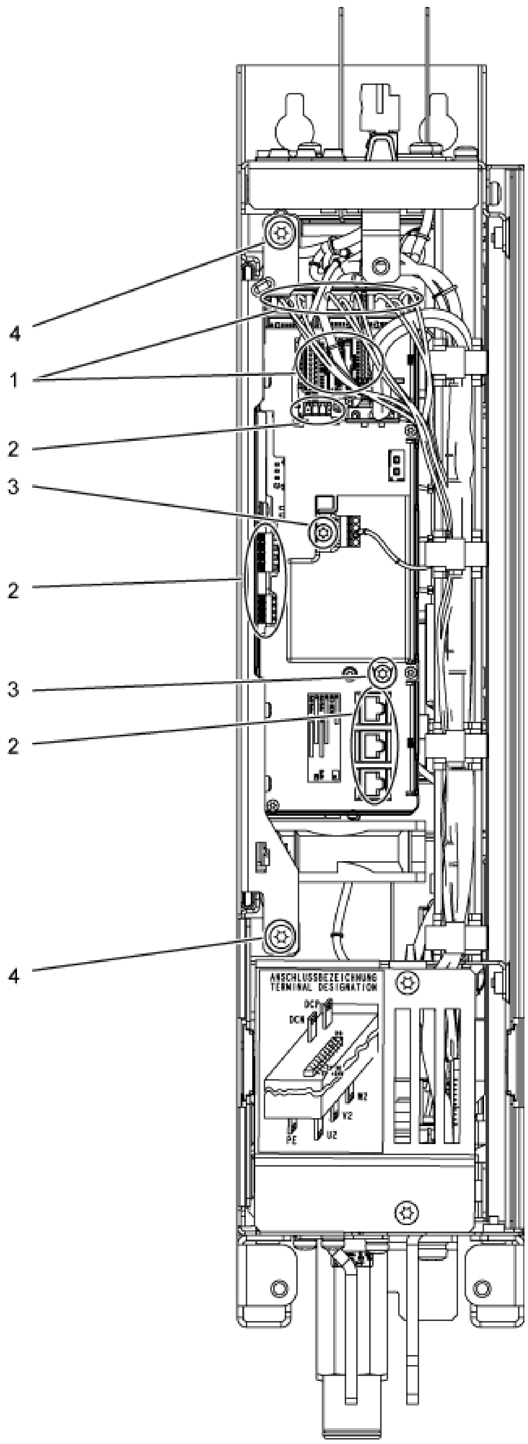


Figure 9-3 Replacing the Control Interface Module, Motor Module, frame size FXL

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access.
- Remove the protective cover.

Removal

The removal steps are numbered in accordance with the figure.

1. Disconnect the plug-in connections for the fiber-optic cables and signal cables (5 plugs maximum).
2. Remove the DRIVE-CLiQ cables and connections on –X41 / –X42 / –X46 (6 plugs maximum).
3. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from connector –X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (2 screws).

When removing the Control Interface Module, you have to disconnect a maximum of 5 further plugs one after the other (2 at the top, 3 below) and the PE connection (1 screw below).

CAUTION
When removing the unit, ensure that you do not damage any signal cables.

Installation

For installation, carry out the above steps in reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. Carefully establish the plug-in connections and then ensure that they are secure. When dealing with connectors with a lock, make sure that the locking lever is securely engaged once connected. The fiber-optic cable plugs must be remounted at their original slot. Fiber-optic cables and sockets are accordingly labeled for correct assignment (U11, U21, U31). The DRIVE-CLiQ cable plugs should be labeled prior to disassembly and reinstalled at their original slot, since it is necessary to re-perform system identification after changing the DRIVE-CLiQ cables. The screw connections for the protective covers must only be tightened by hand.

9.4.5 Replacing the Control Interface Module, Active Line Module and Motor Module, frame size GXL

Replacing the Control Interface Module

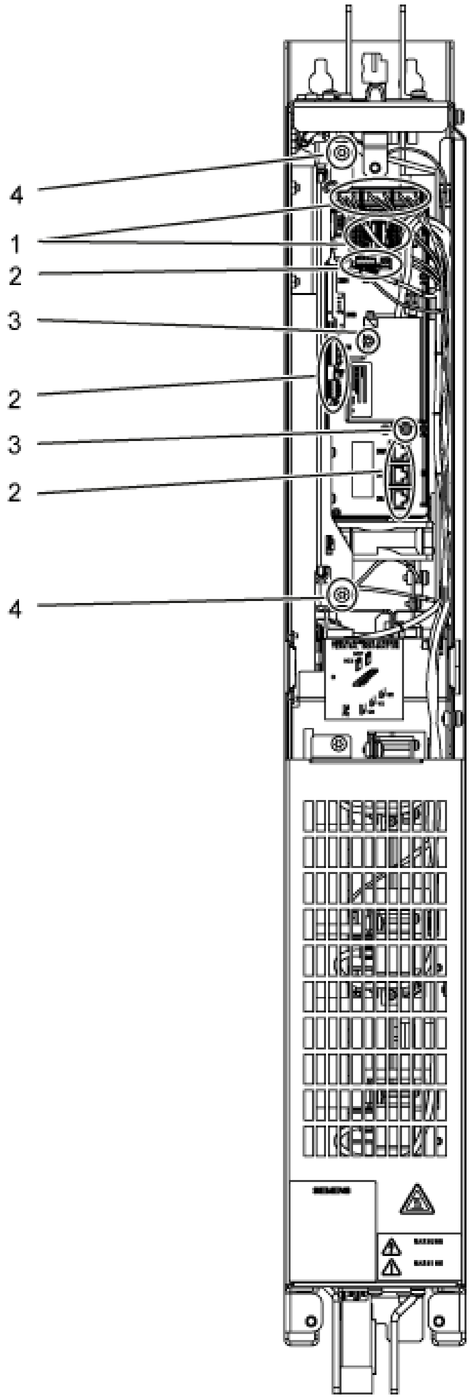


Figure 9-4 Replacing the Control Interface Module, Active Line Module and Motor Module, frame size GXL

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access.
- Remove the protective cover.

Removal

The removal steps are numbered in accordance with the figure.

1. Disconnect the plug-in connections for the fiber-optic cables and signal cables (5 plugs maximum).
2. Remove the DRIVE-CLiQ cables and connections on –X41 / –X42 / –X46 (6 plugs maximum).
3. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from connector –X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (2 screws).

When removing the Control Interface Module, you have to disconnect a maximum of 5 further plugs one after the other (2 at the top, 3 below) and the PE connection (1 screw below).

CAUTION
When removing the unit, ensure that you do not damage any signal cables.

Installation

For installation, carry out the above steps in reverse order.

> CAUTION
>
> The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed.
>
> Carefully establish the plug-in connections and then ensure that they are secure.
>
> When dealing with connectors with a lock, make sure that the locking lever is securely engaged once connected.
>
> The fiber-optic cable plugs must be remounted at their original slot. Fiber-optic cables and sockets are accordingly labeled for correct assignment (U11, U21, U31).
>
> The DRIVE-CLiQ cable plugs should be labeled prior to disassembly and reinstalled at their original slot, since it is necessary to re-perform system identification after changing the DRIVE-CLiQ cables.
>
> The screw connections for the protective covers must only be tightened by hand.

9.4.6 Replacing the Control Interface Module, Active Line Module and Motor Module, frame size HXL

Replacing the Control Interface Module

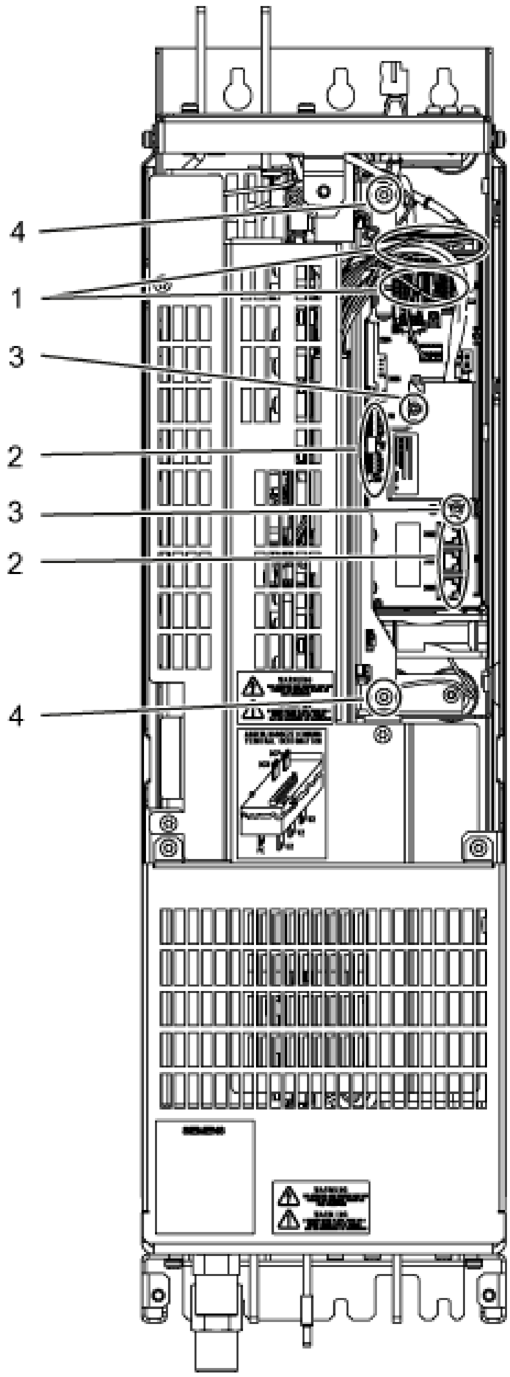


Figure 9-5 Replacing the Control Interface Module, Active Line Module and Motor Module, frame size HXL

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access.
- Remove the protective cover.

Removal

The removal steps are numbered in accordance with the figure.

1. Disconnect the plug-in connections for the fiber-optic cables and signal cables (5 plugs maximum).
2. Remove the DRIVE-CLiQ cables and connections on –X41 / –X42 / –X46 (6 plugs maximum).
3. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from connector –X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (2 screws).

When removing the Control Interface Module, you have to disconnect a maximum of 5 further plugs one after the other (2 at the top, 3 below) and the PE connection (1 screw below).

CAUTION
When removing the unit, ensure that you do not damage any signal cables.

Installation

For installation, carry out the above steps in reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. Carefully establish the plug-in connections and then ensure that they are secure. When dealing with connectors with a lock, make sure that the locking lever is securely engaged once connected. The fiber-optic cable plugs must be remounted at their original slot. Fiber-optic cables and sockets are accordingly labeled for correct assignment (U11, U21, U31). The DRIVE-CLiQ cable plugs should be labeled prior to disassembly and reinstalled at their original slot, since it is necessary to re-perform system identification after changing the DRIVE-CLiQ cables. The screw connections for the protective covers must only be tightened by hand.

9.4.7 Replacing the Control Interface Module, Active Line Module and Motor Module, frame size JXL

Replacing the Control Interface Module

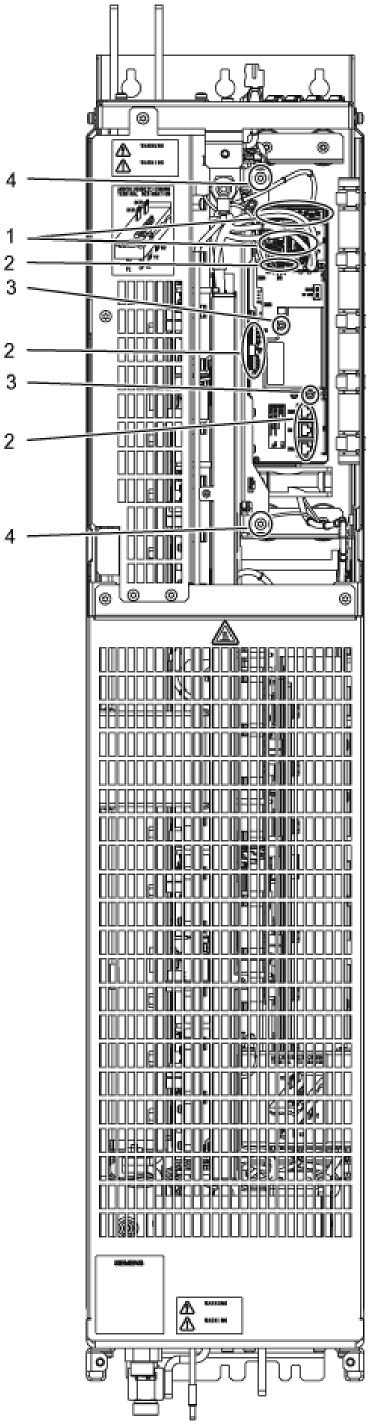


Figure 9-6 Replacing the Control Interface Module, Active Line Module and Motor Module, frame size JXL

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access.
- Remove the protective cover.

Removal

The removal steps are numbered in accordance with the figure.

1. Disconnect the plug-in connections for the fiber-optic cables and signal cables (5 plugs maximum).
2. Remove the DRIVE-CLiQ cables and connections on –X41 / –X42 / –X46 (6 plugs maximum).
3. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from connector –X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (2 screws).

When removing the Control Interface Module, you have to disconnect a maximum of 5 further plugs one after the other (2 at the top, 3 below) and the PE connection (1 screw below).

CAUTION
When removing the unit, ensure that you do not damage any signal cables.

Installation

For installation, carry out the above steps in reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. Carefully establish the plug-in connections and then ensure that they are secure. When dealing with connectors with a lock, make sure that the locking lever is securely engaged once connected. The fiber-optic cable plugs must be remounted at their original slot. Fiber-optic cables and sockets are accordingly labeled for correct assignment (U11, U21, U31). The DRIVE-CLiQ cable plugs should be labeled prior to disassembly and reinstalled at their original slot, since it is necessary to re-perform system identification after changing the DRIVE-CLiQ cables. The screw connections for the protective covers must only be tightened by hand.

9.4.8 Replacing the Control Interface Module, Basic Line Module, frame size FBL

Replacing the Control Interface Module

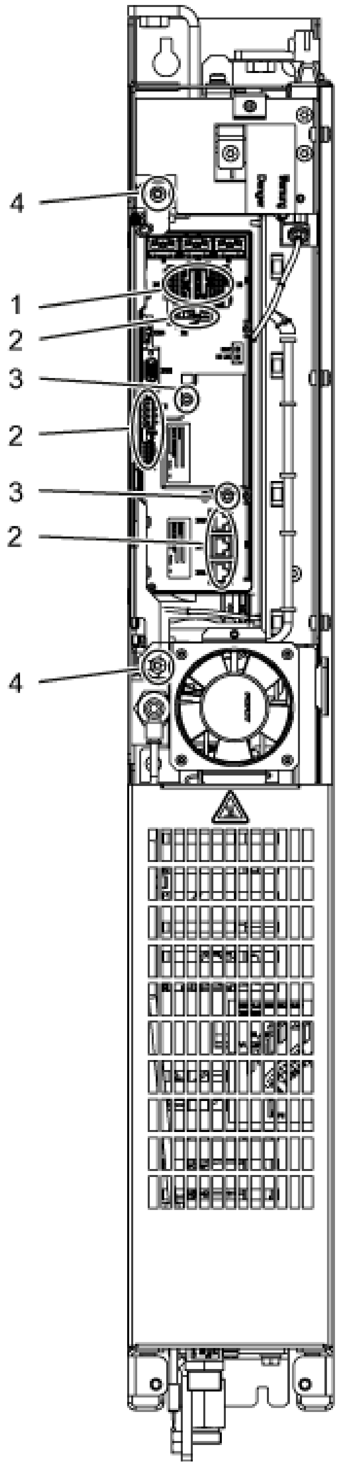


Figure 9-7 Replacing the Control Interface Module, Basic Line Module, frame size FBL

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access.
- Remove the protective cover.

Removal

The removal steps are numbered in accordance with the figure.

1. Disconnect the plugs for the signal cables (2 plugs).
2. Remove the DRIVE-CLiQ cables and connections on –X41 / –X42 (5 plugs maximum).
3. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from connector –X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (2 screws). The bottom screw also secures the front electronic fan.

When removing the Control Interface Module, you have to disconnect a maximum of 5 further plugs one after the other (2 at the top, 3 below) and the PE connection (1 screw below).

CAUTION
When removing the unit, ensure that you do not damage any signal cables.

Installation

For installation, carry out the above steps in reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. Carefully establish the plug-in connections and then ensure that they are secure. When dealing with connectors with a lock, make sure that the locking lever is securely engaged once connected. The DRIVE-CLiQ cable plugs should be labeled prior to disassembly and reinstalled at their original slot, since it is necessary to re-perform system identification after changing the DRIVE-CLiQ cables. The screw connections for the protective covers must only be tightened by hand.

9.4.9 Replacing the Control Interface Module, Basic Line Module, frame size GBL

Replacing the Control Interface Module

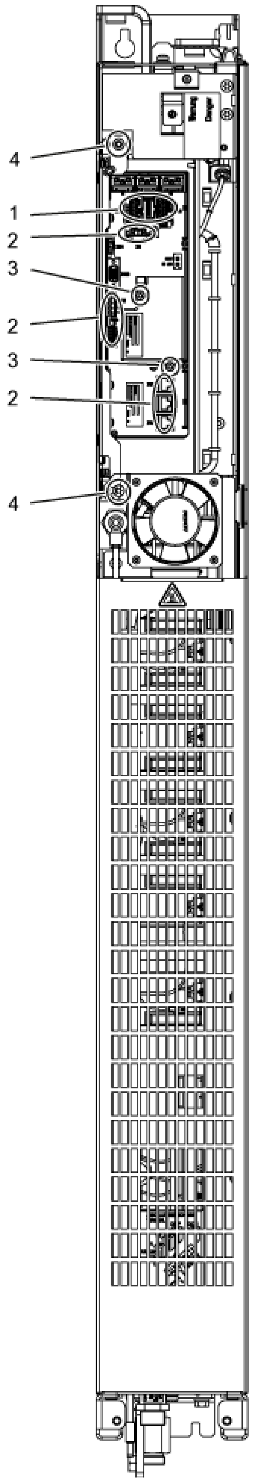


Figure 9-8 Replacing the Control Interface Module, Basic Line Module, frame size GBL

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access.
- Remove the protective cover.

Removal

The removal steps are numbered in accordance with the figure.

1. Disconnect the plugs for the signal cables (2 plugs).
2. Remove the DRIVE-CLiQ cables and connections on –X41 / –X42 (5 plugs maximum).
3. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from connector –X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (2 screws). The bottom screw also secures the front electronic fan.

When removing the Control Interface Module, you have to disconnect a maximum of 5 further plugs one after the other (2 at the top, 3 below) and the PE connection (1 screw below).

CAUTION
When removing the unit, ensure that you do not damage any signal cables.

Installation

For installation, carry out the above steps in reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. Carefully establish the plug-in connections and then ensure that they are secure. When dealing with connectors with a lock, make sure that the locking lever is securely engaged once connected. The DRIVE-CLiQ cable plugs should be labeled prior to disassembly and reinstalled at their original slot, since it is necessary to re-perform system identification after changing the DRIVE-CLiQ cables. The screw connections for the protective covers must only be tightened by hand.

9.4.10 Replacing the electronic fan, Power Module, frame size FL

Replacing the electronic fan

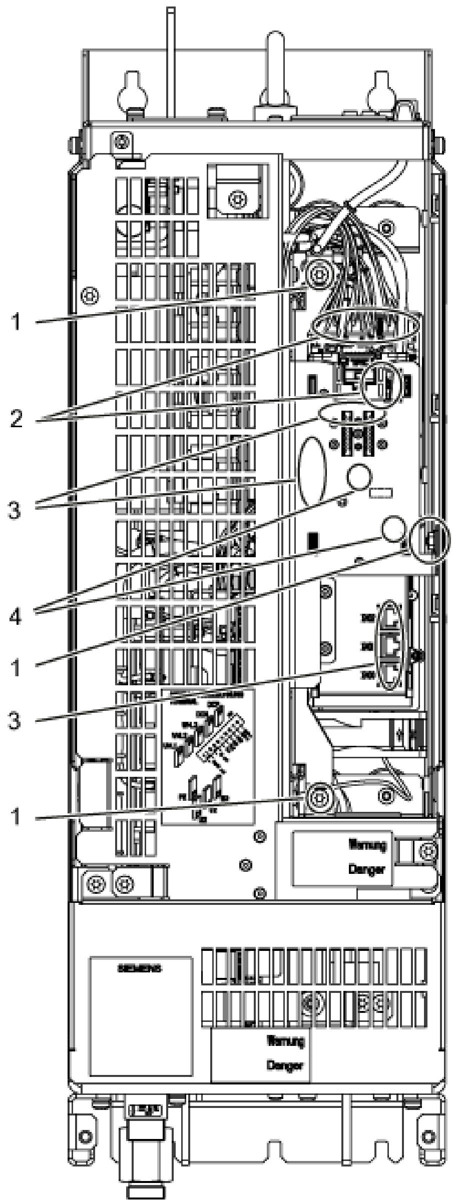


Figure 9-9 Replacing the electronic fan, Power Module, frame size FL

Description

The average service life of the electronic fans is 50,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and, therefore, may deviate from this value.

The electronic fans must be replaced in good time to ensure that the device is available.

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access.
- Remove the protective cover.

Removal

The removal steps are numbered in accordance with the figure.

1. Undo the retaining screws for the control module holder and the plug-in electronics module (2 screws and one nut) and remove the control module holder.
2. Disconnect the plug-in connections for the fiber-optic cables and signal cables (5 plugs maximum).
3. Remove the DRIVE-CLiQ cables and connections on –X41 / –X42 / –X46 (6 plugs maximum).
4. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from connector –X45 on the Control Interface Module.

When removing the Control Interface Module, you have to disconnect a maximum of 5 further plugs one after the other (2 at the top, 3 below) and the PE connection (1 screw below).

CAUTION
When removing the unit, ensure that you do not damage any signal cables.

Then, you can remove the plug for the electronic fan power supply from the Control Interface Module. Now you can remove the electronic fan for the Control Interface Module.

Installation

For installation, carry out the above steps in reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. Carefully establish the plug-in connections and then ensure that they are secure. The fiber-optic cable plugs must be remounted at their original slot. Fiber-optic cables and sockets are accordingly labeled for correct assignment (U11, U21, U31). The DRIVE-CLiQ cable plugs should be labeled prior to disassembly and reinstalled at their original slot, since it is necessary to re-perform system identification after changing the DRIVE-CLiQ cables. The screw connections for the protective covers must only be tightened by hand.

9.4.11 Replacing the electronic fan, Power Module, frame size GL

Replacing the electronic fan

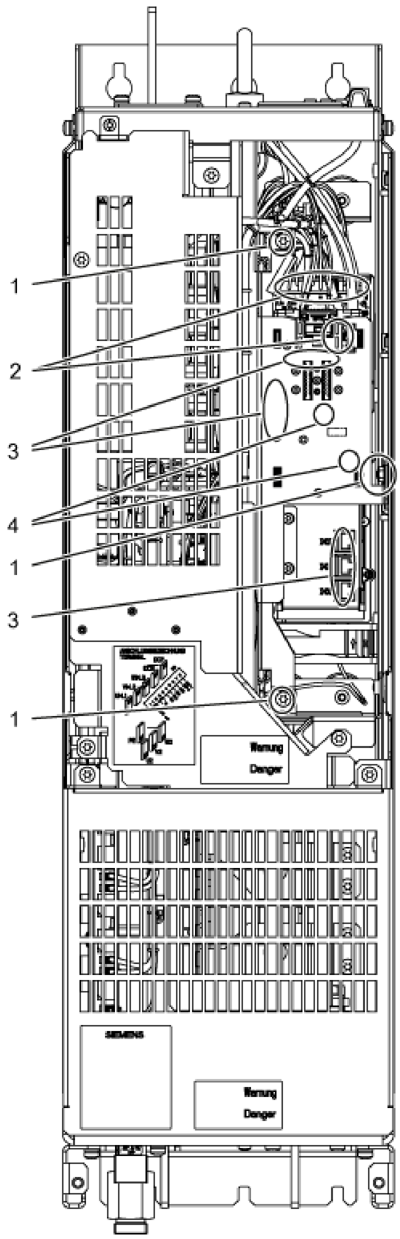


Figure 9-10 Replacing the electronic fan, Power Module, frame size GL

Description

The average service life of the electronic fans is 50,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and, therefore, may deviate from this value.

The electronic fans must be replaced in good time to ensure that the device is available.

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access.
- Remove the protective cover.

Removal

The removal steps are numbered in accordance with the figure.

1. Undo the retaining screws for the control module holder and the plug-in electronics module (2 screws and one nut) and remove the control module holder.
2. Disconnect the plug-in connections for the fiber-optic cables and signal cables (5 plugs maximum).
3. Remove the DRIVE-CLiQ cables and connections on –X41 / –X42 / –X46 (6 plugs maximum).
4. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from connector –X45 on the Control Interface Module.

When removing the Control Interface Module, you have to disconnect a maximum of 5 further plugs one after the other (2 at the top, 3 below) and the PE connection (1 screw below).

CAUTION
When removing the unit, ensure that you do not damage any signal cables.

Then, you can remove the plug for the electronic fan power supply from the Control Interface Module. Now you can remove the electronic fan for the Control Interface Module.

Installation

For installation, carry out the above steps in reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. Carefully establish the plug-in connections and then ensure that they are secure. The fiber-optic cable plugs must be remounted at their original slot. Fiber-optic cables and sockets are accordingly labeled for correct assignment (U11, U21, U31). The DRIVE-CLiQ cable plugs should be labeled prior to disassembly and reinstalled at their original slot, since it is necessary to re-perform system identification after changing the DRIVE-CLiQ cables. The screw connections for the protective covers must only be tightened by hand.

9.4.12 Replacing the electronic fan, Motor Module, frame size FXL

Replacing the electronic fan

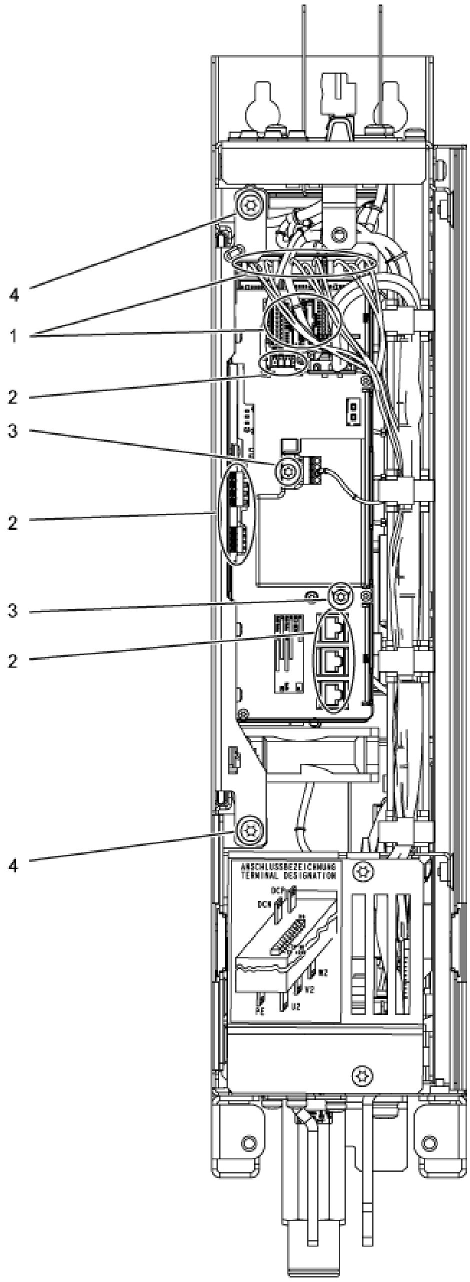


Figure 9-11 Replacing the electronic fan, Motor Module, frame size FXL

Description

The average service life of the electronic fans is 50,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and, therefore, may deviate from this value.

The electronic fans must be replaced in good time to ensure that the device is available.

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access.
- Remove the protective cover.

Removal

The removal steps are numbered in accordance with the figure.

1. Disconnect the plug-in connections for the fiber-optic cables and signal cables (5 plugs maximum).
2. Remove the DRIVE-CLiQ cables and connections on –X41 / –X42 / –X46 (6 plugs maximum).
3. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from connector –X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (2 screws).

When removing the Control Interface Module, you have to disconnect a maximum of 5 further plugs one after the other (2 at the top, 3 below) and the PE connection (1 screw below).

CAUTION
When removing the unit, ensure that you do not damage any signal cables.

Then, you can remove the plug for the electronic fan power supply from the Control Interface Module. Now you can remove the electronic fan for the Control Interface Module.

Installation

For installation, carry out the above steps in reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. Carefully establish the plug-in connections and then ensure that they are secure. The fiber-optic cable plugs must be remounted at their original slot. Fiber-optic cables and sockets are accordingly labeled for correct assignment (U11, U21, U31). The DRIVE-CLiQ cable plugs should be labeled prior to disassembly and reinstalled at their original slot, since it is necessary to re-perform system identification after changing the DRIVE-CLiQ cables. The screw connections for the protective covers must only be tightened by hand.

9.4.13 Replacing the electronic fan, Active Line Module, and Motor Module, frame size GXL

Replacing the electronic fan

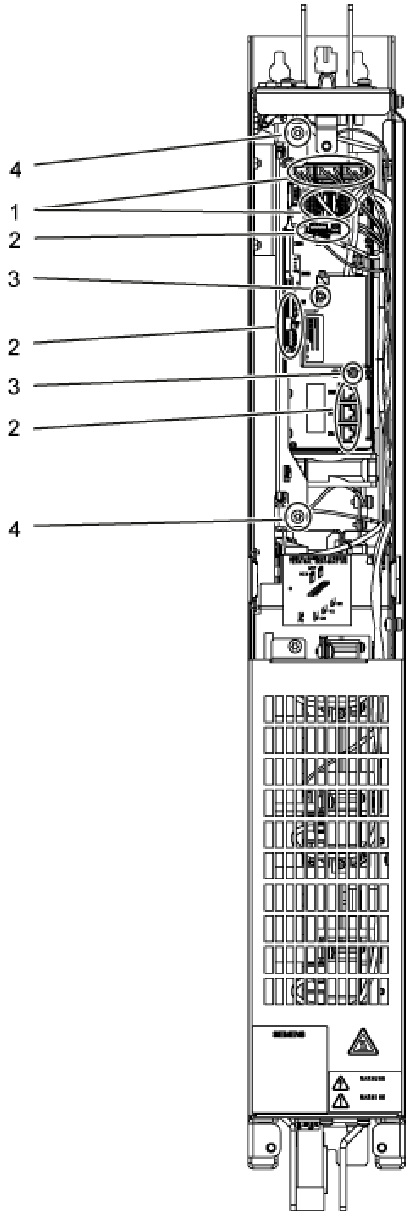


Figure 9-12 Replacing the electronic fan, Active Line Module, and Motor Module, frame size GXL

Description

The average service life of the electronic fans is 50,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and, therefore, may deviate from this value.

The electronic fans must be replaced in good time to ensure that the device is available.

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access.
- Remove the protective cover.

Removal

The removal steps are numbered in accordance with the figure.

1. Disconnect the plug-in connections for the fiber-optic cables and signal cables (5 plugs maximum).
2. Remove the DRIVE-CLiQ cables and connections on –X41 / –X42 / –X46 (6 plugs maximum).
3. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from connector –X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (2 screws).

When removing the Control Interface Module, you have to disconnect a maximum of 5 further plugs one after the other (2 at the top, 3 below) and the PE connection (1 screw below).

CAUTION
When removing the unit, ensure that you do not damage any signal cables.

Then, you can remove the plug for the electronic fan power supply from the Control Interface Module. Now you can remove the electronic fan for the Control Interface Module.

Installation

For installation, carry out the above steps in reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. Carefully establish the plug-in connections and then ensure that they are secure. The fiber-optic cable plugs must be remounted at their original slot. Fiber-optic cables and sockets are accordingly labeled for correct assignment (U11, U21, U31). The DRIVE-CLiQ cable plugs should be labeled prior to disassembly and reinstalled at their original slot, since it is necessary to re-perform system identification after changing the DRIVE-CLiQ cables. The screw connections for the protective covers must only be tightened by hand.

9.4.14 Replacing the electronic fan, Active Line Module, and Motor Module, frame size HXL

Replacing the electronic fan

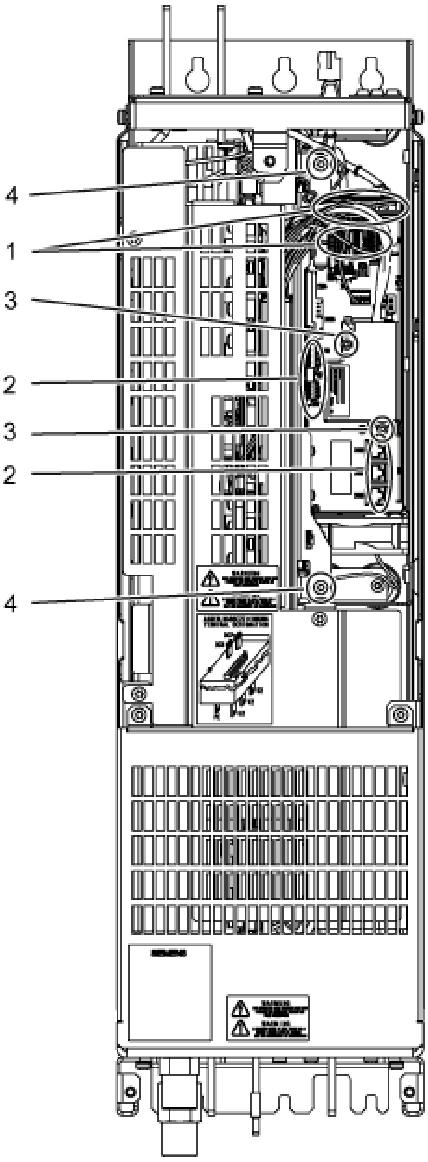


Figure 9-13 Replacing the electronic fan, Active Line Module, and Motor Module, frame size HXL

Description

The average service life of the electronic fans is 50,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and, therefore, may deviate from this value.

The electronic fans must be replaced in good time to ensure that the device is available.

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access.
- Remove the protective cover.

Removal

The removal steps are numbered in accordance with the figure.

1. Disconnect the plug-in connections for the fiber-optic cables and signal cables (5 plugs maximum).
2. Remove the DRIVE-CLiQ cables and connections on –X41 / –X42 / –X46 (6 plugs maximum).
3. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from connector –X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (2 screws).

When removing the Control Interface Module, you have to disconnect a maximum of 5 further plugs one after the other (2 at the top, 3 below) and the PE connection (1 screw below).

CAUTION
When removing the unit, ensure that you do not damage any signal cables.

Then, you can remove the plug for the electronic fan power supply from the Control Interface Module. Now you can remove the electronic fan for the Control Interface Module.

Installation

For installation, carry out the above steps in reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. Carefully establish the plug-in connections and then ensure that they are secure. The fiber-optic cable plugs must be remounted at their original slot. Fiber-optic cables and sockets are accordingly labeled for correct assignment (U11, U21, U31). The DRIVE-CLiQ cable plugs should be labeled prior to disassembly and reinstalled at their original slot, since it is necessary to re-perform system identification after changing the DRIVE-CLiQ cables. The screw connections for the protective covers must only be tightened by hand.

9.4.15 Replacing the electronic fan, Active Line Module, and Motor Module, frame size JXL

Replacing the electronic fan

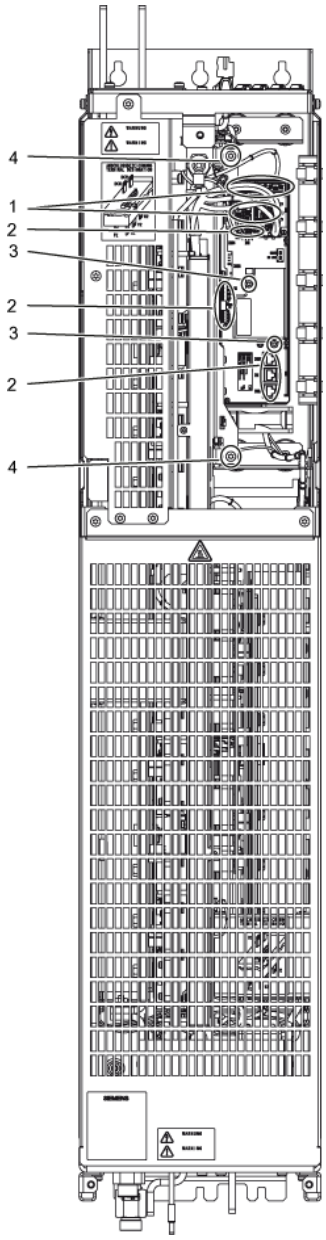


Figure 9-14 Replacing the electronic fan, Active Line Module, and Motor Module, frame size JXL

Description

The average service life of the electronic fans is 50,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and, therefore, may deviate from this value.

The electronic fans must be replaced in good time to ensure that the device is available.

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access.
- Remove the protective cover.

Removal

The removal steps are numbered in accordance with the figure.

1. Disconnect the plug-in connections for the fiber-optic cables and signal cables (5 plugs maximum).
2. Remove the DRIVE-CLiQ cables and connections on –X41 / –X42 / –X46 (6 plugs maximum).
3. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from connector –X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (2 screws).

When removing the Control Interface Module, you have to disconnect a maximum of 5 further plugs one after the other (2 at the top, 3 below) and the PE connection (1 screw below).

CAUTION
When removing the unit, ensure that you do not damage any signal cables.

Then, you can remove the plug for the electronic fan power supply from the Control Interface Module. Now you can remove the electronic fan for the Control Interface Module.

Installation

For installation, carry out the above steps in reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. Carefully establish the plug-in connections and then ensure that they are secure. The fiber-optic cable plugs must be remounted at their original slot. Fiber-optic cables and sockets are accordingly labeled for correct assignment (U11, U21, U31). The DRIVE-CLiQ cable plugs should be labeled prior to disassembly and reinstalled at their original slot, since it is necessary to re-perform system identification after changing the DRIVE-CLiQ cables. The screw connections for the protective covers must only be tightened by hand.

9.4.16 Replacing the electronic fan, Basic Line Module, frame size FBL

Replacing the electronic fan

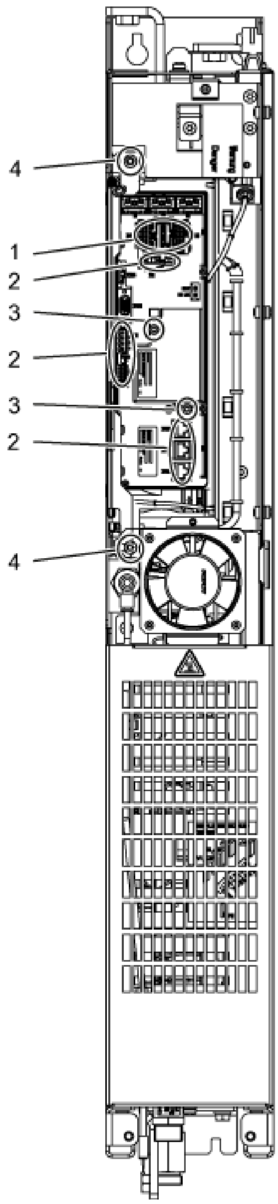


Figure 9-15 Replacing the electronic fan, Basic Line Module, frame size FBL

Description

The average service life of the electronic fans is 50,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and, therefore, may deviate from this value.

The electronic fans must be replaced in good time to ensure that the device is available.

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access.
- Remove the protective cover.

Removal

The removal steps are numbered in accordance with the figure.

1. Disconnect the plugs for the signal cables (2 plugs).
2. Remove the DRIVE-CLiQ cables and connections on –X41 / –X42 (5 plugs maximum).
3. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from connector –X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (2 screws). The bottom screw also secures the front electronic fan.

When removing the Control Interface Module, you have to disconnect a maximum of 5 further plugs one after the other (2 at the top, 3 below) and the PE connection (1 screw below).

CAUTION
When removing the unit, ensure that you do not damage any signal cables.

Then, you can remove the plug for the electronic fan power supply from the electronic Control Interface Module. Now you can remove the electronic fans for the Control Interface Module.

Installation

For installation, carry out the above steps in reverse order.

<table>
<tr><th>CAUTION</th></tr>
<tr><td>The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed.

Carefully establish the plug-in connections and then ensure that they are secure.

The DRIVE-CLiQ cable plugs should be labeled prior to disassembly and reinstalled at their original slot, since it is necessary to re-perform system identification after changing the DRIVE-CLiQ cables.

The screw connections for the protective covers must only be tightened by hand.</td></tr>
</table>

9.4.17 Replacing the electronic fan, Basic Line Module, frame size GBL

Replacing the electronic fan

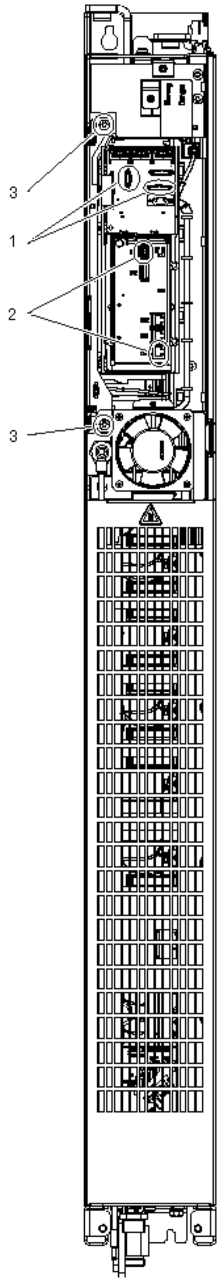


Figure 9-16 Replacing the electronic fan, Basic Line Module, frame size GBL

Description

The average service life of the electronic fans is 50,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and, therefore, may deviate from this value.

The electronic fans must be replaced in good time to ensure that the device is available.

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access.
- Remove the protective cover.

Removal

The removal steps are numbered in accordance with the figure.

1. Disconnect the plugs for the signal cables (2 plugs).
2. Remove the DRIVE-CLiQ cables and connections on –X41 / –X42 (5 plugs maximum).
3. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from connector –X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (2 screws). The bottom screw also secures the front electronic fan.

When removing the Control Interface Module, you have to disconnect a maximum of 5 further plugs one after the other (2 at the top, 3 below) and the PE connection (1 screw below).

CAUTION
When removing the unit, ensure that you do not damage any signal cables.

Then, you can remove the plug for the electronic fan power supply from the electronic Control Interface Module. Now you can remove the electronic fans for the Control Interface Module.

Installation

For installation, carry out the above steps in reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. Carefully establish the plug-in connections and then ensure that they are secure. The DRIVE-CLiQ cable plugs should be labeled prior to disassembly and reinstalled at their original slot, since it is necessary to re-perform system identification after changing the DRIVE-CLiQ cables. The screw connections for the protective covers must only be tightened by hand.

9.4.18 Replacing the fan, Active Interface Module, frame size GI

Replacing the fan

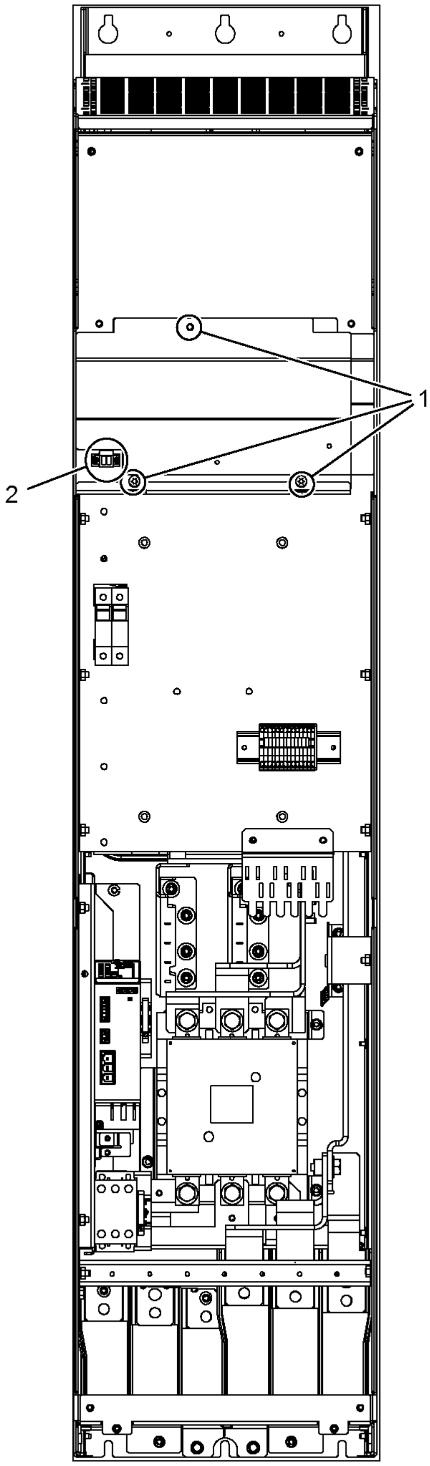


Figure 9-17 Replacing the fan, Active Interface Module, frame size GI

Description

The average service life of the device fans is 50,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and, therefore, may deviate from this value.

The fans must be replaced in good time to ensure that the device is available.

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access.
- Remove the protective cover.

Removal

The removal steps are numbered in accordance with the figure.

1. Remove the retaining screws for the fan unit (3 screws).
2. Unplug connector –X630.

CAUTION
When removing the fan, ensure that the cables are not damaged.

Installation

For installation, carry out the above steps in reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. Carefully establish the plug-in connections and then ensure that they are secure. The screw connections for the protective covers must only be tightened by hand.

9.4.19 Replacing the fan, Active Interface Module, frame size HI

Replacing the fan

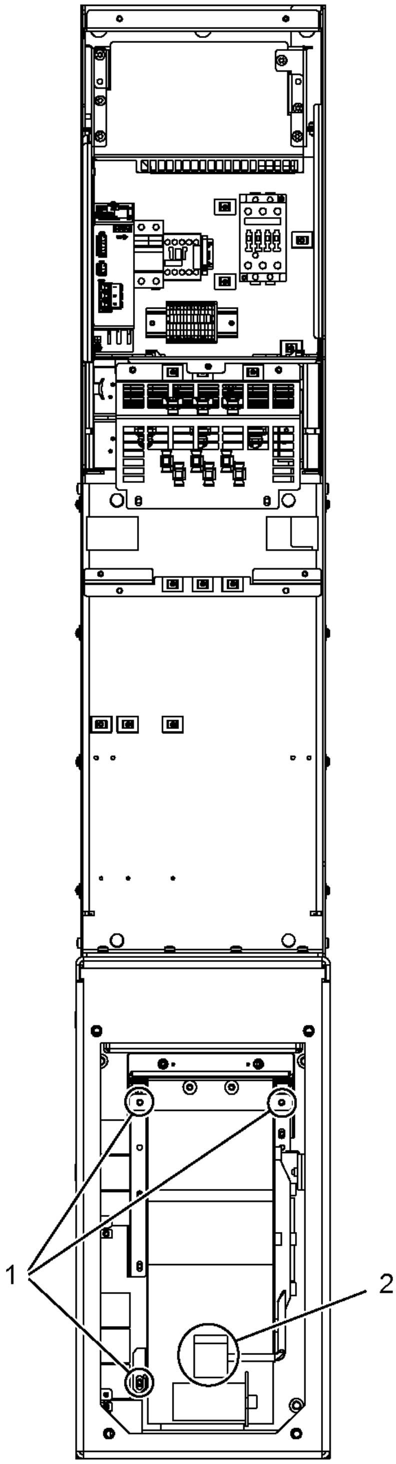


Figure 9-18 Replacing the fan, Active Interface Module, frame size HI

Description

The average service life of the device fans is 50,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and, therefore, may deviate from this value.

The fans must be replaced in good time to ensure that the device is available.

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access.
- Remove the protective cover.

Removal

The removal steps are numbered in accordance with the figure.

1. Remove the retaining screws for the fan unit (3 screws).
2. Disconnect the supply cables (1 x "L", 1 x "N").

CAUTION
When removing the fan, ensure that the cables are not damaged.

Installation

For installation, carry out the above steps in reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. Carefully establish the plug-in connections and then ensure that they are secure. The screw connections for the protective covers must only be tightened by hand.

9.4.20 Replacing the fan, Active Interface Module, frame size JI

Replacing the fan

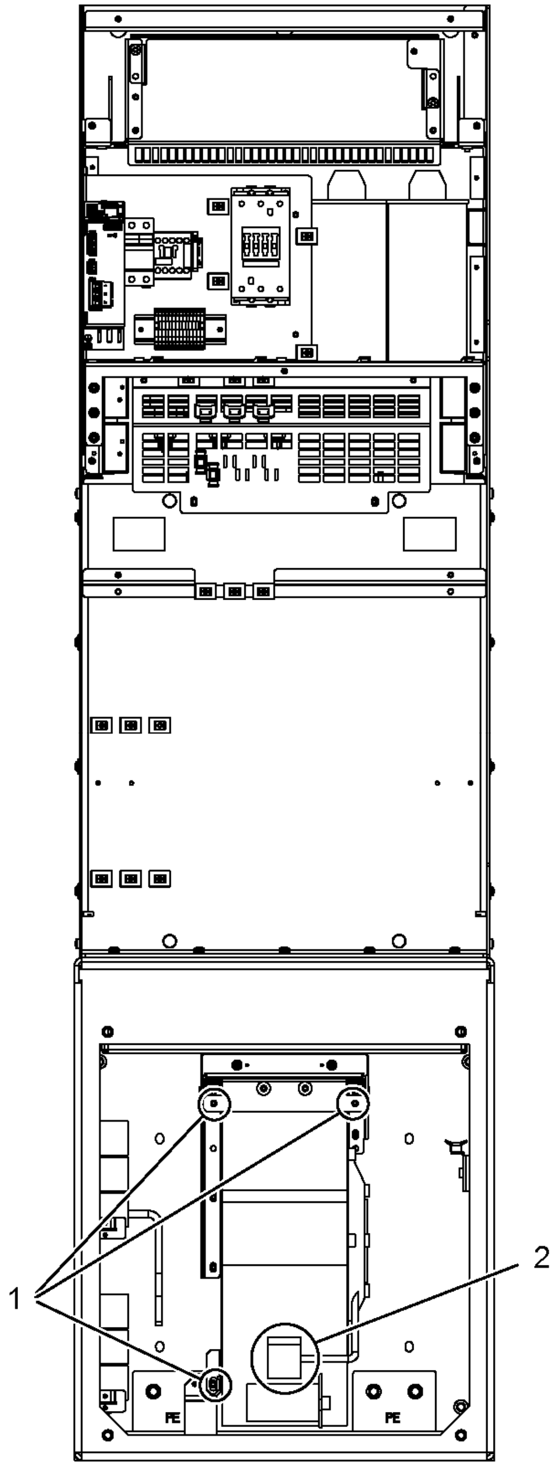


Figure 9-19 Replacing the fan, Active Interface Module, frame size JI

Description

The average service life of the device fans is 50,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and, therefore, may deviate from this value.

The fans must be replaced in good time to ensure that the device is available.

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access.
- Remove the protective cover.

Removal

The removal steps are numbered in accordance with the figure.

1. Remove the retaining screws for the fan unit (3 screws).
2. Disconnect the supply cables (1 x "L", 1 x "N").

CAUTION
When removing the fan, ensure that the cables are not damaged.

Installation

For installation, carry out the above steps in reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. Carefully establish the plug-in connections and then ensure that they are secure. The screw connections for the protective covers must only be tightened by hand.

9.5 Forming the DC link capacitors

Description

If the Power Module, Basic Line Module, Active Line Module, and Motor Module have not been used for more than two years, the DC link capacitors must be reformed. If this is not carried out, the units could be damaged when the DC link voltage is connected under load.

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

Note

It is important that the storage period is calculated from the date of manufacture and not from the date that the equipment was shipped.

Rating plate

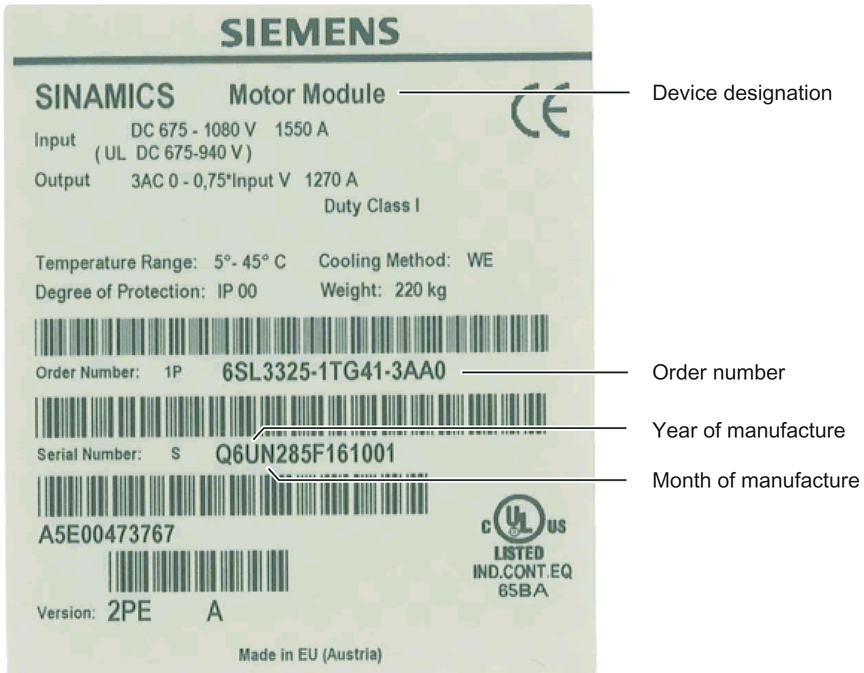


Figure 9-20 Rating plate using a Motor Module as example

Date of manufacture

The date of manufacture can be determined as follows:

Table 9- 2 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
W	2008			
X	2009			
A	2010			
B	2011			
C	2012			
D	2013			
E	2014			

Procedure in the event of repair or replacement

A replacement Line Module or Motor Module or the corresponding replacement power block has to be re-formed after being in storage for a period of more than two years.

The DC link capacitors are re-formed by applying the rated voltage without load for at least 30 minutes.
To do this, the DC link must be precharged (i.e. the Line Modules switched on), while the controller for the existing Motor Modules must not be enabled for the specified length of time.

Procedure for re-forming outside the drive line-up

Replacement power units which have to be held ready for immediate use in the event of repair or replacement can also be re-formed individually and outside the drive line-up.

For this, the equipment must be connected to the forming circuits described in the following.

Components for the forming circuit (recommendation)

- 1 fuse switch 3-phase 400 V / 10 A or 690 V / 10 A
- 3 incandescent lamps 230 V / 100 W for a line voltage of 380 to 480 V 3 AC.
  Alternatively, use 3 resistors of 1 kΩ / 100 W each (e.g. GWK150J1001KLX000 from Vishay) instead of the incandescent lamps.
- 6 incandescent lamps 230 V / 100 W for a line voltage of 500 to 690 V 3 AC, where 2 incandescent lamps must be connected in series in each supply phase.
  Alternatively, use 3 resistors of 1 kΩ / 160 W each (e.g. GWK200J1001KLX000 from Vishay) instead of the incandescent lamps.
- Various small components, such as lamp sockets, cable 1.5 mm^2, etc.

⚠ CAUTION

At a line voltage of 500 to 690 V 3 AC, the two lamp sockets connected in series must be insulated and protected from touch, because the insulation of the sockets is not designed for this high voltage.

Forming circuit for Line Modules

Note

Voltage must be supplied to Line Modules via a connected Motor Module and the associated DC link.

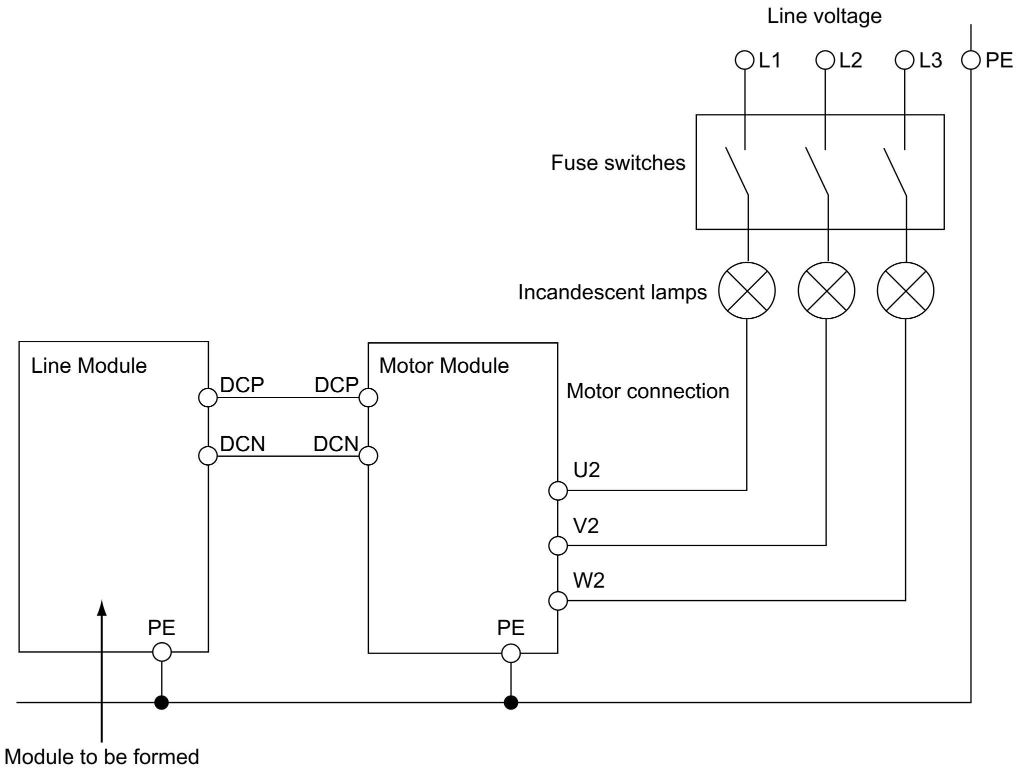


Figure 9-21 Forming circuit for Line Modules

Forming circuit for Motor Modules

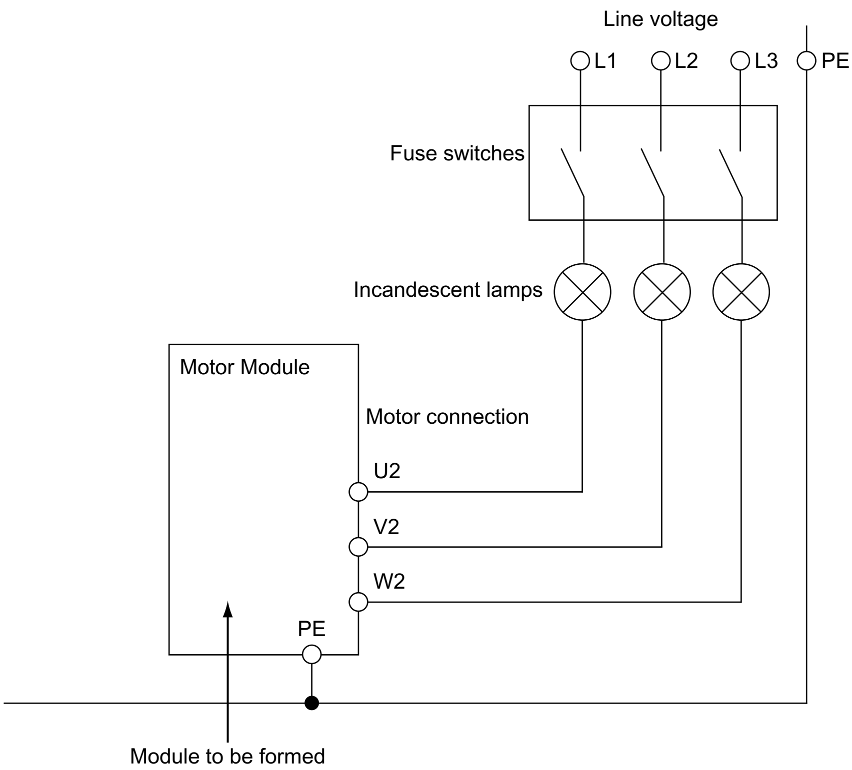


Figure 9-22 Forming circuit for Motor Modules

Procedure

- The unit being formed must not receive a power-on command (e.g. from the keyboard, BOP20 or terminal block).
- Connect the appropriate forming circuit.
- During the forming process, the incandescent lamps must become less bright or go completely dark. If the incandescent lamps continue to be brightly lit, a fault has occurred in the drive unit or in the wiring.

Maintaining the operational readiness of individual power blocks for servicing

It is recommended that during the planned downtimes, the power blocks positioned on the line side are replaced in order to guarantee the correct functioning of the power blocks during servicing.

List of abbreviations

A

A.1 List of abbreviations

Table A- 1 List of abbreviations

Abbreviation	Meaning, German	Meaning, English
A		
A...	Warnung	Alarm
AC	Wechselstrom	Alternating Current
ADC	Analog-Digital-Konverter	Analog Digital Converter
AI	Analogeingang	Analog Input
AO	Analogausgang	Analog Output
AOP	Advanced Operator Panel	Advanced Operator Panel
ASCII	Amerikanische Code-Norm für den Informationsaustausch	American Standard Code for Information Interchange
B		
BB	Betriebsbedingung	Operating condition
BERO	Firmenname für einen Näherungsschalter	Tradename for a type of proximity switch
BI	Binektoreingang	Binector Input
BIA	Berufsgenossenschaftliches Institut für Arbeitssicherheit	Berufsgenossenschaftliches Institut für Arbeitssicherheit (German Institute for Occupational Safety)
BICO	Binektor-Konnektor-Technologie	Binector Connector Technology
BOP	Basic Operator Panel	Basic Operator Panel
C		
C	Kapazität	Capacity
CAN	Serielles Bussystem	Controller Area Network
CBC	Kommunikationsbaugruppe CAN	Communication Board CAN
CBP	Kommunikationsbaugruppe PROFIBUS	Communication Board PROFIBUS
CD	Compact Disc	Compact Disc
CDS	Befehlsdatensatz	Command Data Set
CI	Konnektoreingang	Connector Input
CIB	Control Interface Board	Control Interface Board
CNC	Computerunterstützte numerische Steuerung	Computer Numerical Control
CO	Konnektorausgang	Connector Output
CO/BO	Konnektor-/Binektorausgang	Connector/Binector Output
COM	Mittelkontakt eines Wechselkontaktes	Medium contact of a change-over contact
CP	Kommunikationsprozessor	Communications Processor
CPU	Zentralbaugruppe	Central Processing Unit
CRC	Checksummenprüfung	Cyclic Redundancy Check

Abbreviation	Meaning, German	Meaning, English
CT	Konstantes Drehmoment	Constant Torque
CU	Control Unit	Control Unit
D		
DAC	Digital-Analog-Konverter	Digital Analog Converter
DC	Gleichstrom	Direct Current
DCN	Gleichstrom negativ	Direct current negative
DCNA	Gleichstrom negativ Zusatzanschluss	Direct current negative auxiliary
DCP	Gleichstrom positiv	Direct current positive
DCPA	Gleichstrom negativ Zusatzanschluss	Direct current positive auxiliary
DDS	Antriebsdatensatz	Drive Data Set
DI	Digitaleingang	Digital Input
DI / DO	Digitaleingang/-ausgang bidirektional	Bidirectional Digital Input/Output
DMC	DRIVE-CLiQ Module Cabinet (Hub)	DRIVE-CLiQ Module Cabinet (Hub)
DO	Digitalausgang	Digital Output
DO	Antriebsobjekt	Drive Object
DPRAM	Speicher mit beidseitigem Zugriff	Dual-Port Random Access Memory
DRAM	Dynamischer Speicher	Dynamic Random Access Memory
DRIVE-CLiQ	Drive Component Link with IQ	Drive Component Link with IQ
DSC	Dynamic Servo Control	Dynamic Servo Control
E		
EDS	Geberdatensatz	Encoder Data Set
ESD	Elektrostatisch gefährdete Baugruppen	Electrostatic Sensitive Devices (ESD)
EMV	Elektromagnetische Verträglichkeit	Electromagnetic Compatibility (EMC)
EN	Europäische Norm	European Standard
EnDat	Geber-Schnittstelle	Encoder-Data-Interface
EP	Impulsfreigabe	Enable Pulses
ES	Engineering System	Engineering System
F		
F ...	Störung	Fault
FAQ	Häufig gestellte Fragen	Frequently Asked Questions
FCC	Function Control Chart	Function Control Chart
FCC	Flussstromregelung	Flux Current Control
FEPROM	Schreib- und Lesespeicher nichtflüchtig	Flash-EPROM
FG	Funktionsgenerator	Function Generator
FI	Fehlerstrom-Schutzschalter	Earth Leakage Circuit-Breaker (ELCB)
Float	Gleitkommazahl	Floating point
FP	Funktionsplan	Function diagram
FW	Firmware	Firmware
G		
GCP	Global-Control-Telegramm (Broadcast-Telegramm)	Global Control Telegram (broadcast telegram)

Abbreviation	Meaning, German	Meaning, English
GSD	Gerätestammdatei: beschreibt die Merkmale eines PROFIBUS-Slaves	Device master file: describes the features of a PROFIBUS slave
H		
HLG	Hochlaufgeber	Ramp-function generator
HMI	Mensch-Maschine-Schnittstelle	Human Machine Interface
HTL	Hochpegellogik	High Threshold Logic
HW	Hardware	Hardware
I		
i. V.	in Vorbereitung: diese Eigenschaft steht zur Zeit nicht zur Verfügung	in preparation: this feature is currently not available
IBN	Inbetriebnahme	Commissioning
I/O	Eingang/Ausgang	Input/Output
ID	Identifizierung	Identifier
IEC	Internationale Norm in der Elektrotechnik	International Electrotechnical Commission
IGBT	Bipolartransistor mit isolierter Steuerelektrode	Insulated Gate Bipolar Transistor
IT	Drehstromversorgungsnetz ungeerdet	three-phase supply network, ungrounded
J		
JOG	Tippen	Jogging
K		
KDV	Kreuzweiser Datenvergleich	Data cross-checking
KIP	Kinetische Pufferung	Kinetic buffering
KTY	Spezieller Temperatursensor	Special temperature sensor
L		
L	Inductance	Inductance
LED	Leuchtdiode	Light Emitting Diode
LSB	Niederwertigstes Bit	Least Significant Bit
M		
M	Masse	reference potential, zero potential
MB	Megabyte	Megabyte
MCC	Motion Control Chart	Motion Control Chart
MDS	Motordatensatz	Motor Data Set
MLFB	Machine-readable product designation	machine-readable product designation
MMC	Mensch Maschine Kommunikation	Man-Machine Communication
MSB	Höchstwertigstes Bit	Most Significant Bit
MSCY_C1	Zyklische Kommunikation zwischen Master (Klasse 1) und Slave	Master Slave Cycle Class 1
N		
NC	Öffner	Normally Closed (contact)
NC	Numerische Steuerung	Numerical Control
NEMA	Normengremium in USA (United States of America)	National Electrical Manufacturers Association
NM	Nullmarke	Zero Mark
NO	Schließer	Normally Open (contact)

Abbreviation	Meaning, German	Meaning, English
O		
OEM	Original Equipment Manufacturer	Original Equipment Manufacturer
OLP	Busstecker für Lichtleiter	Optical Link Plug
OMI	Option Module Interface	Option Module Interface
P		
p ...	Einstellparameter	Adjustable parameter
PDS	Leistungsteildatensatz	Power Module Data Set
PE	Schutzerde	Protective Earth
PELV	Schutzkleinspannung	Protective Extra Low Voltage
PG	Programmiergerät	Programming terminal
PI	Proportional Integral	Proportional Integral
PLC	Speicherprogrammierbare Steuerung (SPS)	Programmable Logic Controller (PLC)
PLL	Baustein zur Synchronisierung	Phase Locked Loop
PNO	PROFIBUS Nutzerorganisation	PROFIBUS user organization
PRBS	Weißes Rauschen	Pseudo Random Binary Signal
PROFIBUS	Serieller Datenbus	Process Field Bus
PS	Stromversorgung	Power Supply
PTC	Positiver Temperaturkoeffizient	Positive Temperature Coefficient
PTP	Punkt zu Punkt	Point To Point
PWM	Pulsweitenmodulation	Pulse Width Modulation
PZD	PROFIBUS Prozessdaten	PROFIBUS Process data
Q		
R		
r...	Beobachtungsparameter (nur lesbar)	Display Parameter (read only)
RAM	Speicher zum lesen und schreiben	Random Access Memory
RCD	Fehlerstrom-Schutzschalter	Residual Current Device
RJ45	Norm. Beschreibt eine 8-polige Steckverbindung mit Twisted-Pair Ethernet.	Standard. Describes an 8-pole plug connector with twisted pair Ethernet.
RO	Nur lesbar	Read Only
RS232	Serielle Schnittstelle	Serial Interface
RS485	Norm. Beschreibt die Physik einer digitalen seriellen Schnittstelle.	Standard. Describes the physical characteristics of a digital serial interface.
S		
S1	Dauerbetrieb	Continuous operation
S3	Aussetzbetrieb	periodic duty
SBC	Sichere Bremsenansteuerung	Safe Brake Control
SGE	Sicherheitsgerichtetes Eingangssignal	Safe input signal
SH	Sicherer Halt	Safe Standstill
SI	Safety Integrated	Safety Integrated
SIL	Sicherheitsintegritätsgrad	Safety Integrity Level
SLVC	Geberlose Vektorregelung	Sensorless Vector Control
SM	Sensor Module	Sensor Module

Abbreviation	Meaning, German	Meaning, English
SMC	Sensor Module Cabinet	Sensor Module Cabinet
SME	Sensor Module External	Sensor Module External
SPS	Speicherprogrammierbare Steuerung	Programmable Logic Controller (PLC)
STW	PROFIBUS Steuerwort	PROFIBUS control word
T		
TB	Terminal Board	Terminal Board
TIA	Totally Integrated Automation	Totally Integrated Automation
TM	Terminal Module	Terminal Module
TN	Drehstromversorgungsnetz geerdet	Three-phase supply network, grounded
TT	Drehstromversorgungsnetz geerdet	Three-phase supply network, grounded
TTL	Transistor-Transistor-Logik	Transistor-transistor logic
U		
UL	Underwriters Laboratories Inc.	Underwriters Laboratories Inc.
V		
VC	Vektorregelung	Vector Control
Vdc	Zwischenkreisspannung	DC link voltage
VDE	Verband Deutscher Elektrotechniker	Association of German Electrical Engineers
VDI	Verein Deutscher Ingenieure	Association of German Engineers
VSM	Voltage Sensing Module	Voltage Sensing Module
VT	Variables Drehmoment	Variable Torque
W		
WZM	Werkzeugmaschine	Machine tool
X		
XML	Erweiterbare Auszeichnungssprache (Standardsprache für Web-Publishing und Dokumentenmanagement)	Extensible Markup Language
Y		
Z		
ZK	Zwischenkreis	DC Link
ZSW	PROFIBUS Zustandswort	PROFIBUS status word

Index

R

S

T

V

Siemens AG
Industry Sector
Drive Technologies
Large Drives
P.O. Box 4743
90025 NUREMBERG
GERMANY

www.siemens.com/automation