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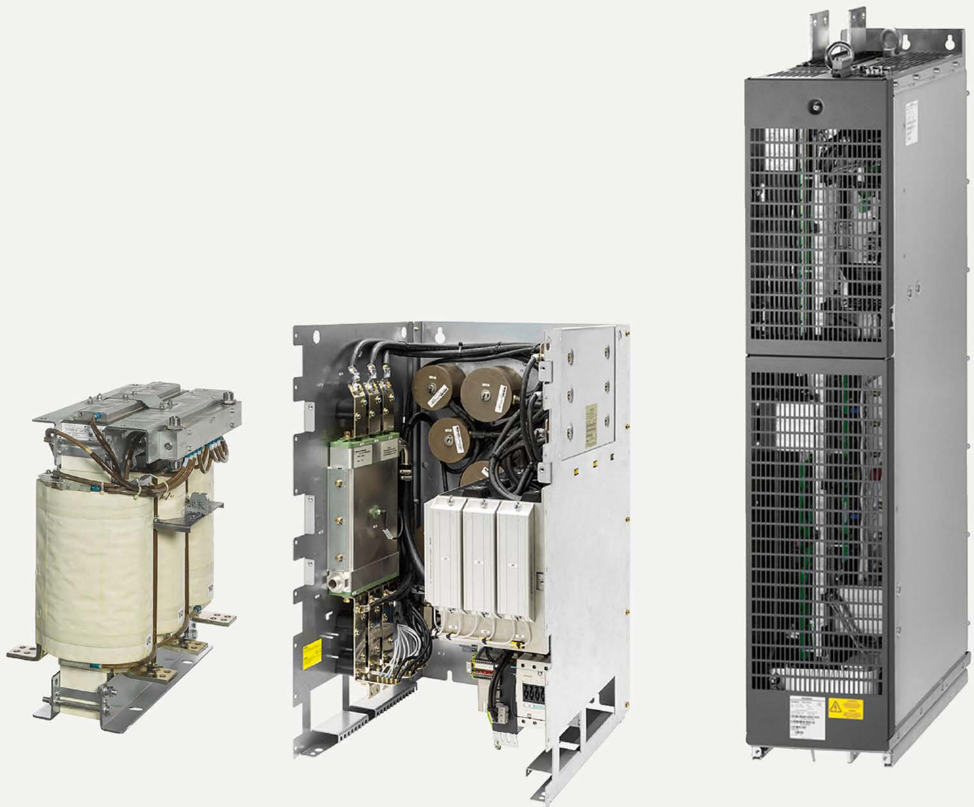

Edition 06/2024

EQUIPMENT MANUAL

SINAMICS

SINAMICS S120

Liquid-cooled chassis power units

www.siemens.com/drives

SIEMENS

SINAMICS

S120
Liquid-cooled chassis power units

Equipment Manual

06/2024

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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
indicates that minor personal injury can result if proper precautions are not taken.

NOTICE
indicates that property damage can result if proper precautions are not taken.

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, 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 complied with. The information in the relevant documentation must be observed.

Trademarks

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

Disclaimer of Liability

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

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Introduction 1

1.1 The SINAMICS converter family

With the SINAMICS converter family, you can solve any individual drive task in the low-voltage, medium-voltage and DC voltage range. From converters to motors and controllers, all Siemens drive components are perfectly matched to each other and can be easily integrated into your existing automation system. With SINAMICS you are prepared for digitization. You benefit from highly efficient engineering with a variety of tools for the entire product development and production process. And you also save space in the control cabinet – thanks to the integrated safety technology.

You can find additional information about SINAMICS at the following address (http://www.siemens.com/sinamics).

SINAMICS documentation

The SINAMICS documentation is organized in the following categories:

- General documentation/catalogs
- User documentation
- Manufacturer/service documentation

Standard scope

The scope of the functionality described in this document can differ from that 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. However, no claim can be made regarding the availability of these functions when the equipment is first supplied or in the event of service.
- The documentation can also contain descriptions of functions that are not available in a particular product version of the drive system. Please refer to the ordering documentation only for the functionality of the supplied drive system.
- Extensions or changes made by the machine manufacturer must be documented by the machine manufacturer.

For reasons of clarity, this documentation does not contain all of the detailed information about all of the product types, and cannot take into consideration every conceivable type of installation, operation and service/maintenance.

Sales law

Typical use cases are listed in this product documentation and in the online help to illustrate possible application areas for our products. These are purely exemplary and do not constitute a statement on the suitability of the respective product for applications in specific individual cases. Unless explicitly agreed as part of a contract, Siemens assumes no liability for such suitability. Suitability for a particular application in specific individual cases must be assessed by the user on a case-for-case basis, taking into account all technical, legal and other requirements. Always observe the descriptions of the technical properties and the relevant constraints of the respective product provided in the product documentation.

Target group

This documentation is intended for machine manufacturers, commissioning engineers, and service personnel who use the SINAMICS drive system.

Benefits

This manual provides all of the information, procedures and operator actions required for the particular usage phase.

Siemens MySupport/Documentation

You can find information on how to create your own individual documentation based on Siemens content and adapt it for your own machine documentation at the following address (https://support.industry.siemens.com/My/ww/en/documentation).

Additional information

You can find information on the following topics at the following address (https://support.industry.siemens.com/cs/ww/en/view/108993276):

- Ordering documentation / overview of documentation
- Additional links to download documents
- Using documentation online (find and search in manuals/information)

Siemens Product Configurator

2D dimension drawings and 3D CAD models are available in the Siemens Product Configurator at the following address (https://www.siemens.com/spc).

Questions relating to the technical documentation

Please send any questions about the technical documentation (e.g. suggestions for improvement, corrections) to the following email address (mailto:docu.motioncontrol@siemens.com).

FAQs

You can find Frequently Asked Questions under Product Support (https://support.industry.siemens.com/cs/ww/en/ps/faq).

Information on the product

You can obtain information about your product via the ID link.
The ID link is a globally unique identifier according to IEC 61406-1.

A QR code is provided on your product and the product packaging.
You can recognize the ID link by the frame with a black frame corner at the bottom right.

Scan the QR code using either a standard code scanner or the "Industry Online Support" app.

When using a standard code scanner, you open the scanned ID link in an Internet web browser that is provided on your device.

You can use the ID link to obtain product data, manuals, Declarations of Conformity, certificates and other information about your product.

Siemens Support for on the move

The "Siemens Industry Online Support" app supports you in the following areas, for example:

- Resolving problems when executing a project
- Troubleshooting when faults develop
- Expanding a system or planning a new system

Further, you have access to the Technical Forum and other articles that our experts have drawn-up:

- FAQs
- Application examples
- Manuals
- Certificates
- Product announcements and much more

There is a data matrix code or QR code on the nameplate of your product. Scan the code using the "Siemens Industry Online Support" app to obtain technical information about the device.

The app is available for Apple iOS and Android.

Web sites of third-party companies

This document includes hyperlinks to web sites of third-party companies Siemens accepts no responsibility for the content of these web sites, nor does it use these web sites and their content for its own use, as Siemens cannot check these web sites and is also not responsible for the content and information provided on them. The user uses these web sites at his own risk.

1.2 Usage phases and their documents/tools (as an example)

Usage phase	Tools
Orientation	SINAMICS S sales documentation
Planning/engineering	• SIZER engineering tool • SINAMICS Low Voltage Configuration Manual • Configuration manuals, motors
Decision making/ordering	SINAMICS S120 catalogs • SINAMICS S120 and SIMOTICS (Catalog D 21.4) • SINAMICS Converters for Single-Axis Drives – Built-In Units (D 31.1) • SINAMICS S120 Chassis Format Units and Cabinet Modules, SINAMICS S150 Converter Cabinet Units (catalog D 21.3)
Configuring/installation	• SINAMICS S120 Equipment Manual for Control Units and Supplementary System Components • SINAMICS S120 Equipment Manual for Booksize Power Units • SINAMICS S120 Equipment Manual for Air-Cooled Chassis Power Units • SINAMICS S120 Equipment Manual for Liquid-Cooled Chassis Power Units • SINAMICS S120 Equipment Manual water-cooled chassis power units for common cooling circuits • SINAMICS S120 Equipment Manual for AC Drives • SINAMICS S120M Equipment Manual for Distributed Drive Technology
Commissioning	• STARTER Commissioning Tool • SINAMICS S120 Getting Started • SINAMICS S120 Commissioning Manual • SINAMICS S120 Function Manual Drive Functions • SINAMICS S120 Safety Integrated Function Manual • SINAMICS S120 Communication Function Manual • SINAMICS S120/S150 List Manual
Using/operating	• SINAMICS S120 Commissioning Manual • SINAMICS S120 Function Manual Drive Functions • SINAMICS S120/S150 List Manual
Maintenance/Service	• SINAMICS S120 Commissioning Manual • SINAMICS S120/S150 List Manual
List of references	• SINAMICS S120/S150 List Manual

You can find SINAMICS S120 documentation on the Internet at the following address.

(https://support.industry.siemens.com/cs/ww/en/ps/13231/man)

1.3 Where can the various topics be found?

Software		Manual
Alarms	Described in order of ascending numbers	SINAMICS S120/S150 List Manual
Parameters	Described in order of ascending numbers	SINAMICS S120/S150 List Manual
Function block diagrams	Sorted according to topic	SINAMICS S120/S150 List Manual
	Described in order of ascending numbers	
Drive functions		SINAMICS S120 Function Manual Drive Functions
Communication topics		SINAMICS S120 Function Manual Communication[2]
Safety Integrated	Basic and Extended Functions	SINAMICS S120 Safety Integrated Function Manual
	Basic Functions	SINAMICS S120 Function Manual Drive Functions
Commissioning	Of a simple SINAMICS S120 drive with STARTER	Getting Started[1]
Commissioning	With STARTER	SINAMICS S120 Commissioning Manual[1]
Commissioning	Of a simple SINAMICS S120 drive with Startdrive	Getting Started[2]
Commissioning	With Startdrive	SINAMICS S120 Commissioning Manual[2]
Web server		SINAMICS S120 Function Manual Drive Functions

Hardware		Manual
Control Units and expansion components		SINAMICS S120 Equipment Manual for Control Units and Supplementary System Components
Booksize power units		SINAMICS S120 Equipment Manual for Booksize Power Units
Chassis power units		SINAMICS S120 Equipment Manual for Chassis Power Units, Air-cooled SINAMICS S120 Manual for Chassis Power Units, liquid cooled SINAMICS S120 Equipment Manual for Chassis Power Units, Water-cooled for common cooling circuits
AC drive components		SINAMICS S120 Equipment Manual for AC Drives
S120 Combi components		SINAMICS S120 Equipment Manual Combi
Diagnostics via LEDs	STARTER	SINAMICS S120 Commissioning Manual[1]
	Startdrive	SINAMICS S120 Commissioning Manual[2]
Meaning of the LEDs		Equipment Manuals
High Frequency Drive components		SINAMICS S120 System Manual High Frequency Drives

1) Up to firmware version 5.1 SP1

2) From firmware version 5.2

1.4 Training and support

Training

At the following address, you can find information about SITRAIN - Siemens training courses for products, systems and solutions for drive and automation technology: Training (http://www.siemens.com/sitrain).

Siemens Industry Online Support

You can find the following information in the Siemens Industry Online Support:

- Product support
- Global forum for information and best practice sharing between users and specialists
- Local contact persons via the contact person database (→ Contact)
- Product information
- FAQs (frequently asked questions)
- Application examples
- Manuals
- Downloads
- Compatibility tool
- Newsletter with product selection
- Catalogs/brochures
- Certificates

Address: Siemens Industry Online Support (https://support.industry.siemens.com/cs/ww/en)

1.5 Directives, standards, certificates

Relevant directives and standards

You can obtain an up-to-date list of currently certified components on request from your local Siemens office or your local sales support office. If you have any questions relating to certifications that have not yet been completed, please ask your Siemens contact person.

Certificates for download

The certificates can be downloaded from the Internet:

Certificates (https://support.industry.siemens.com/cs/ww/en/ps/13206/cert)

EC declaration of conformity

You can find the EC Declaration of Conformity for the relevant directives as well as the relevant certificates, prototype test certificates, manufacturers declarations and test certificates for functions relating to functional safety ("Safety Integrated") on the Internet at the following address (https://support.industry.siemens.com/cs/ww/en/ps/13231/cert).

The following directives and standards are relevant for SINAMICS S devices:

- **European Low Voltage Directive**

  SINAMICS S devices fulfil the requirements stipulated in the Low-Voltage Directive 2014/35/EU, insofar as they are covered by the application area of this directive.

- **European Machinery Directive**

  SINAMICS S devices fulfil the requirements stipulated in the Low-Voltage Directive 2006/42/EC, insofar as they are covered by the application area of this directive.

  The use of SINAMICS S devices in a typical machine application have been fully assessed for compliance with the main regulations relating to health and safety in this directive.

- **Directive 2011/65/EU**

  SINAMICS S devices comply with the requirements of Directive 2011/65/EU relating to the restriction of the use of certain hazardous substances in electrical and electronic devices (RoHS II).

- **European EMC Directive**

  SINAMICS S devices comply with the EMC Directive 2014/30/EU.

- **Requirements for the UK market**

  SINAMICS S devices with the UKCA marking on the nameplate satisfy the requirements for the UK market (England, Wales and Scotland).

- **Eurasian conformity**

  SINAMICS S devices comply with the requirements of the Russia/Belarus/Kazakhstan customs union (EAC).

- **North American market**

  SINAMICS S devices with one of the test symbols displayed fulfill the requirements stipulated for the North American market as a component of drive applications.

  You can find the relevant certificates on the Internet pages of the certifiers (https://productiq.ulprospector.com/en).

- **Australia and New Zealand (RCM formerly C-Tick)**

  SINAMICS S devices showing the test symbols fulfill the EMC requirements for Australia and New Zealand.

- **Quality systems**

  Siemens AG employs a quality management system that meets the requirements of ISO 9001 and ISO 14001.

Standards that are not relevant

China Compulsory Certification

SINAMICS S devices do not fall in the area of validity of the China Compulsory Certification (CCC).

You can find detailed information at: "Certificates for export to China (https://support.industry.siemens.com/cs/ww/en/view/46382761)".

For individual parts that are subject to CCC but are supplied as spare parts, negative certificates are required instead of certificates for shipment to China.

These are required anew for each individual delivery and are to be applied for by the exporter at the following address (http://www.china-certification.com).

EMC limit values for South Korea

SINAMICS S devices with the KC marking on the nameplate comply with EMC requirements for South Korea.

이 기기는 업무용(A급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.
For sellers or other user, please keep in mind that this device in an A-grade electromagnetic wave device. This device is intended to be used in areas other than home.

The mandatory EMC limits for Korea correspond to the limits of IEC 61800-3 (EMC product standard for adjustable speed electrical drive systems) for category C2 or to limit class A, Group 1 according to EN 55011.
Compliance with the limits according to category C2 or class A, group 1 is achieved with suitable additional measures. Further, additional measures may be required, such as using an additional radio interference suppression filter (EMC filter).
The measures for EMC-compliant design of the system are described in detail in this manual and in the "SINAMICS Low Voltage Engineering Manual".
The final statement regarding compliance with the standard is always specified by the respective label attached to the individual unit.

Information on product-related environmental protection

You can find additional information about product-related environmental protection at the following address (https://support.industry.siemens.com/cs/ww/en/view/39200038).

1.6 Correct and intended use

⚠WARNING

Death or serious injury if not used as intended

Not using as intended can result in hazardous states.

- Carefully observe the description of intended use

Note

It cannot be guaranteed that EMC emission limits are complied with if the products are connected to an isolated line supply grounded through a high ohmic connection, or a line supply with a grounded line conductor.

- Draw-up an EMC plan to comply with the EMC requirements of the intended application.

The products described in this manual, together with software, accessories and options, form an electric drive to supply low voltage, three-phase motors.

The products are professional devices for stationary indoor use in industrial, light-industrial and commercial applications and are intended for supply from a non-public (industrial) low-voltage grid. The products are not intended for use in residential areas and are not intended for supply from a public low-voltage grid.

The products must be transported and stored correctly and installed, commissioned and maintained by professionals who have adequate knowledge to implement the safety, security and EMC measures in accordance with the specifications described in this manual and recognized state-of-the-art engineering practice.

You may only use the products when the following requirements are complied with:

- All regulations and directives that are applicable at the place of final use, especially with regard to electrical safety, functional safety and electromagnetic compatibility (EMC).
- All instructions, notes, technical specifications, safety information, and security information provided in this manual and other supporting documentation.

The products are part of a machine or system. They must ensure the safety of persons and material assets, as well as electromagnetic compatibility, by applying suitable measures when designing the system.

A risk assessment of the complete application, including third-party products and implementation of adequate safety and security measures must be performed before you use the product.

Products without protective enclosure (IP00 or IP20) are intended for installation in control panels or control cabinets that provide the required level of protection.

Any other use that is not expressly permitted can result in malfunctions and unpredictable hazards.

1.7 Additional information

Ensuring reliable operation

The manual describes a desired state which, if maintained, ensures the required level of operational reliability and compliance with EMC limit values.

Should there be any deviation from the requirements in the equipment manual, appropriate actions (e.g. measurements) must be taken to check/prove that the required level of operational reliability and compliance with EMC limit values are ensured.

Spare parts

Spare parts are available on the Internet at the following address (https://www.sow.siemens.com/).

Product maintenance

The components are subject to continuous further development within the scope of product maintenance (improvements to robustness, discontinuations of components, etc).

These further developments are "spare parts-compatible" and do not change the article number.

In the scope of such spare parts-compatible further developments, connector/connection positions are sometimes changed slightly. This does not cause any problems with proper use of the components. Please take this fact into consideration in special installation situations (e.g. allow sufficient clearance for the cable length).

Use of third-party products

This document contains recommendations relating to third-party products. Siemens accepts the fundamental suitability of these third-party products.

You can use equivalent products from other manufacturers.

Siemens does not accept any warranty for the properties of third-party products.

Ground symbols

Table 1- 1 Symbols

Icon	Meaning
	Connection for protective conductor
	Ground (e.g. M 24 V)
	Connection for function potential bonding

1.8 General Data Protection Regulation

Compliance with the General Data Protection Regulation

Siemens respects the principles of data protection, in particular the data minimization rules (privacy by design).

For this product, this means:
The product does not process neither store any person-related data, only technical function data (e.g. time stamps). If the user links these data with other data (e.g. shift plans) or if he stores person-related data on the same data medium (e.g. hard disk), thus personalizing these data, he has to ensure compliance with the applicable data protection stipulations.

Fundamental safety instructions 2

2.1 General safety instructions

WARNING

Electric shock and danger to life due to other energy sources

Touching live components can result in death or serious injury.

- Only work on electrical devices when you are qualified for this job.
- Always observe the country-specific safety rules.

Generally, the following steps apply when establishing safety:

1. Prepare for disconnection. Notify all those who will be affected by the procedure.
2. Isolate the drive system from the power supply and take measures to prevent it being switched back on again.
3. Wait until the discharge time specified on the warning labels has elapsed.
4. Check that there is no voltage between any of the power connections, and between any of the power connections and the protective conductor connection.
5. Check whether the existing auxiliary supply circuits are de-energized.
6. Ensure that the motors cannot move.
7. Identify all other hazardous energy sources, e.g. compressed air, hydraulic systems, water. Switch the energy sources to a safe state.
8. Check that the correct drive system is completely locked.

After you have completed the work, restore the operational readiness in the inverse sequence.

WARNING

Risk of electric shock and fire from supply networks with an excessively high impedance

Excessively low short-circuit currents can lead to the protective devices not tripping or tripping too late, and thus causing electric shock or a fire.

- In the case of a conductor-conductor or conductor-ground short-circuit, ensure that the short-circuit current at the point where the converter is connected to the line supply at least meets the minimum requirements for the response of the protective device used.

WARNING

Risk of electric shock and fire from supply networks with an excessively low impedance

Excessively high short-circuit currents can lead to the protective devices not being able to interrupt these short-circuit currents and being destroyed, and thus causing electric shock or a fire.

- Ensure that the prospective short-circuit current at the line terminal of the converter does not exceed the breaking capacity (SCCR or Icc) of the protective device used.

WARNING

Electric shock if there is no ground connection

For missing or incorrectly implemented protective conductor connection for devices with protection class I, high voltages can be present at open, exposed parts, which when touched, can result in death or severe injury.

- Ground the device in compliance with the applicable regulations.

WARNING

Electric shock due to connection to an unsuitable power supply

When equipment is connected to an unsuitable power supply, exposed components may carry a hazardous voltage that might result in serious injury or death.

- Only use power supplies that provide SELV (Safety Extra Low Voltage) or PELV (Protective Extra Low Voltage) output voltages for all connections and terminals of the electronics modules.

WARNING

Electric shock due to equipment damage

Improper handling may cause damage to equipment. For damaged devices, hazardous voltages can be present at the enclosure or at exposed components; if touched, this can result in death or severe injury.

- Ensure compliance with the limit values specified in the technical data during transport, storage and operation.
- Do not use any damaged devices.

WARNING

Electric shock due to unconnected cable shield

Hazardous touch voltages can occur through capacitive cross-coupling due to unconnected cable shields.

- As a minimum, connect cable shields and the cores of power cables that are not used (e.g. brake cores) at one end at the grounded housing potential.

WARNING

Arcing when a plug connection is opened during operation

Opening a plug connection when a system is in operation can result in arcing that may cause serious injury or death.

- Only open plug connections when the equipment is in a voltage-free state, unless it has been explicitly stated that they can be opened in operation.

WARNING

Electric shock due to residual charges in power components

Because of the capacitors, a hazardous voltage is present for up to 5 minutes after the power supply has been switched off. Contact with live parts can result in death or serious injury.

- Wait for 5 minutes before you check that the unit really is in a no-voltage condition and start work.

NOTICE

Damage to equipment due to unsuitable tightening tools.

Unsuitable tightening tools or fastening methods can damage the screws of the equipment.

- Be sure to only use screwdrivers which exactly match the heads of the screws.
- Tighten the screws with the torque specified in the technical documentation.
- Use a torque wrench or a mechanical precision nut runner with a dynamic torque sensor and speed limitation system.
- Calibrate the tools used on a regular basis.

NOTICE

Property damage due to loose power connections

Insufficient tightening torques or vibration can result in loose power connections. This can result in damage due to fire, device defects, or malfunctions.

- Tighten all power connections to the prescribed torque.
- Check all power connections at regular intervals, particularly after equipment has been transported.

WARNING

Electromagnetic interference due to inadequate shield support

A lack of adequate shield support for the power cables can cause malfunctions and impermissibly high levels of interference.

- Use the shield connection plates supplied or recommended.
- Use the shield connection clamps recommended.

WARNING

Spread of fire from built-in devices

Built-in devices can cause a fire and a pressure wave in the event of a fault. The higher the power rating of a converter, the more dangerous the effects of an arc or pressure wave. Fire and smoke can escape from the control cabinet and cause serious personal injury and material damage.

- Install built-in appliances in a robust metal control cabinet that is suitable for protecting people from fire and smoke.
- Ensure that smoke can only escape via controlled and monitored paths.
- Only operate built-in devices with the control cabinet doors closed.
- When control cabinet doors are open, only qualified electrical personnel are permitted to carry out service and maintenance work.

WARNING

Active implant malfunctions due to electromagnetic fields

Converters generate electromagnetic fields (EMF) during operation. Electromagnetic fields may interfere with active implants, e.g. pacemakers. People with active implants in the immediate vicinity of systems are at risk.

- As the operator of an EMF-emitting installation, assess the individual risks of persons with active implants.
- Observe the data on EMF emission provided in the product documentation.

CAUTION

Symptomatic reactions of the respiratory tract and the skin to chemicals

A newly purchased product may contain traces of substances that were identified as sensitizers.

Sensitizers are substances that can cause pulmonary and skin sensitization after exposure.

Once sensitized, further exposure can result in severe reactions, even at low levels. In the most extreme cases, those involved can develop asthma and/or dermatitis.

- If the product has a strong smell associated with it, keep it in a well ventilated room for 14 days.

WARNING

Unexpected movement of machines caused by radio devices or mobile phones

Using radio devices, cellphones, or mobile WLAN devices in the immediate vicinity of the components can result in equipment malfunction or faults and damage to the devices. Malfunctions may impair the functional safety of machines and can therefore put people in danger or lead to property damage.

- Avoid operating radio devices, cellphones and mobile WLAN devices in the direct vicinity of converters and operating units.
- Scan the machine readable code, e.g. a QR code, from the farthest distance possible or switch off the converter power supply before scanning.
- Only operate built-in devices with the control cabinet doors closed.
- When control cabinet doors are open, only qualified electrical personnel are permitted to carry out service and maintenance work.

WARNING

Damage to motor insulation due to excessive voltages

When operated on systems with grounded line conductor or in the event of a ground fault in the IT line system, the motor insulation can be damaged by the higher voltage to ground. If you use motors that have insulation that is not designed for operation with grounded line conductors, you must perform the following measures:

- IT system: Use a ground fault monitor and eliminate the fault as quickly as possible.
- TN or TT systems with grounded line conductor: Use an isolating transformer on the line side.

WARNING

Fire due to inadequate ventilation clearances

Inadequate ventilation clearances can cause overheating of components with subsequent fire and smoke. This can cause serious injury or even death. This can also result in increased failures and shorter service lives for devices/systems.

- Ensure compliance with the specified minimum clearance as ventilation clearance for the respective component.

NOTICE

Overheating due to inadmissible mounting position

The device may overheat and therefore be damaged if mounted in an inadmissible position.

- Only operate the device in admissible mounting positions.

⚠ WARNING
Unrecognized dangers due to missing or illegible warning labels
Dangers might not be recognized if warning labels are missing or illegible. Unrecognized dangers may cause accidents resulting in serious injury or death. • Check that the warning labels are complete based on the documentation. • Attach any missing warning labels to the components, where necessary in the national language. • Replace illegible warning labels.

NOTICE
Device damage caused by incorrect insulation resistance tests
High test voltages can damage the device. • Measure the insulation resistance of low voltage circuits of machines or systems only with ≤ 500 V DC. • Measure the insulation resistance of SELV circuits of machines or systems only with ≤ 250 V DC.

NOTICE
Device damage caused by incorrect voltage tests
High test voltages can damage the device. Capacitive leakage currents can falsify the test results. • Disconnect the components before you carry out a voltage test on the machine. [1)]

[1)] The components are voltage tested in accordance with the IEC 61800-5-1 product standard and must be disconnected during testing in accordance with IEC 60204-1:2021 Section 18.4.

⚠ WARNING
Unexpected movement of machines caused by inactive safety functions
Inactive or non-adapted safety functions can trigger unexpected machine movements that may result in serious injury or death. • Observe the information in the appropriate product documentation before commissioning. • Carry out a safety inspection for functions relevant to safety on the entire system, including all safety-related components. • Ensure that the safety functions used in your drives and automation tasks are adjusted and activated through appropriate parameterizing. • Run a function test. • Only put your plant into live operation once you have guaranteed that the functions relevant to safety are running correctly.

Note

Important safety instructions for Safety Integrated functions

If you want to use Safety Integrated functions, you must observe the safety instructions in the Safety Integrated documentation.

2.2 Handling electrostatic sensitive devices (ESD)

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

NOTICE

Equipment damage due to electric fields or electrostatic discharge

Electric fields or electrostatic discharge can cause malfunctions through damaged individual components, integrated circuits, modules or devices.

- Only pack, store, transport and send electronic components, modules or devices in their original packaging or in other suitable materials, e.g. conductive foam rubber or aluminum foil.
- Only touch components, modules and devices when you are grounded by one of the following methods:
  - Wearing an ESD wrist strap
  - Wearing ESD shoes or ESD grounding straps in ESD areas with conductive flooring
- Only place electronic components, modules or devices on conductive surfaces (table with ESD surface, conductive ESD foam, ESD packaging, ESD transport container).

2.3 Warranty and liability for application examples

The application examples are not binding and do not claim to be complete regarding configuration, equipment or any eventuality which may arise. Application examples are not customer-specific solutions, but merely provide assistance with typical tasks.

As user, you are responsible for ensuring that the products described are operated correctly. Application examples do not relieve you of your responsibility for safe handling when using, installing, operating and maintaining the equipment.

2.4 Industrial cybersecurity

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Products and solutions from Siemens constitute one element of such a concept.

Customers are responsible for preventing unauthorized access to their plants, systems, machines and networks. These systems, machines and components should only be connected to an enterprise network or the Internet if and to the extent such a connection is necessary and only when appropriate security measures (e.g. firewalls and/or network segmentation) are in place.

For additional information on industrial cybersecurity measures that may be implemented, please visit:
https://www.siemens.com/cybersecurity-industry (https://www.siemens.com/cybersecurity-industry).

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends that product updates are applied as soon as they become available, and that only the latest product versions are used. Use of product versions that are no longer supported, and failure to apply latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Cybersecurity RSS Feed under:
https://www.siemens.com/cert (https://www.siemens.com/cert).

Additional information is provided on the Internet:
Industrial security Configuration Manual
(https://support.industry.siemens.com/cs/ww/en/view/108862708)

⚠ WARNING

Unsafe operating states resulting from software manipulation

Software manipulations, e.g. viruses, Trojans, or worms, can cause unsafe operating states in your system that may lead to death, serious injury, and property damage.

- Keep the software up to date.
- Incorporate the automation and drive components into a state-of-the-art, integrated industrial cybersecurity concept for the installation or machine.
- Make sure that you include all installed products in the integrated industrial cybersecurity concept.
- Protect files stored on exchangeable storage media from malicious software by with suitable protection measures, e.g. virus scanners.
- Carefully check all cybersecurity-relevant settings once commissioning has been completed.

2.5 Residual risks of power drive systems

When assessing the machine or system-related risk in accordance with the respective local regulations (e.g. EC Machinery Directive), the machine manufacturer or system integrator must take into account the following residual risks emanating from the control and drive components of a drive system:

1. Unintentional movements of the driven machine or system components during commissioning, operation, maintenance and repairs caused by, for example:
   - Hardware faults and/or software errors in the sensor technology, control system, actuator technology, and connection system
   - Response times of the controller and drive
   - Operation and/or environmental conditions outside the specification
   - Condensation/conductive pollution
   - Parameterization, programming, cabling, and installation errors
   - Use of wireless devices/mobile phones in the immediate vicinity of electronic components
   - External influence/damage
   - X-rays, ionizing radiation and cosmic radiation
2. Unusually high temperatures - including open flames - as well as the emission of light, noise, particles, gases, etc. can occur inside and outside the components under fault conditions caused by, for example:
   - Component malfunctions
   - Software errors
   - Operation and/or environmental conditions outside the specification
   - External influence/damage
   - Short circuits or ground faults in the DC link of the converter
3. Hazardous shock voltages caused by, for example:
   - Component malfunctions
   - Influence of electrostatic charging
   - Induction of voltages in moving motors
   - Operation and/or environmental conditions outside the specification
   - Condensation/conductive pollution
   - External influence/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

6. Influence on communication systems via the line supply, e.g. ripple-control transmitters or data communication via the line supply
7. Motors for use in potentially explosive areas:

   When moving components such as bearings become worn, this can cause enclosure components to exhibit unexpectedly high temperatures during operation, creating a hazard in areas with a potentially explosive atmosphere.

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

2.6 Shipping and handling indicators

Line Modules and Motor Modules are equipped with tilt and shock indicators to monitor for damage during transport.

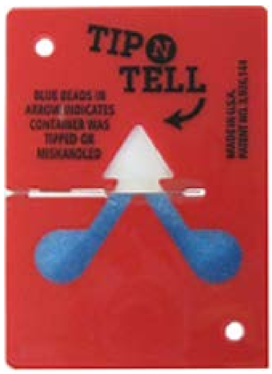


Figure 2-1 Tilt indicator

Figure 2-2 Shock indicator

Position of the shipping and handling indicators

The tilt or shock indicators are attached to the outside of the shipping crate.

Checking the transport indicators

The transport indicators must be checked before unpacking the devices.

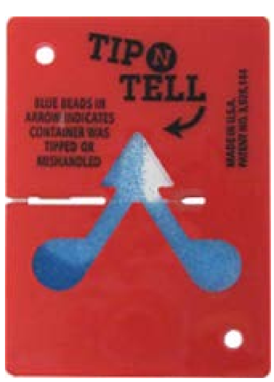


Figure 2-3 Tilt indicator tripped

The tilt indicator provides immediate visible evidence of whether the devices have been correctly transported stored upright. Blue-colored quartz sand begins to flow into the arrow-shaped indicator area. The tilt indicator has tripped when the blue color extends beyond the middle line of the arrowhead.

Figure 2-4 Shock indicator tripped

The shock indicator shows if an acceleration has exceeded 98.1 m/s^2 (10 x g) and indicates the direction of acceleration. The black color of the arrows indicates that an impermissible shock load has occurred in the direction of the arrow.

⚠ WARNING

Device damage when tilt or shock indicators have tripped

If a shock or tilt indicator has tripped, safe operation of the device cannot be guaranteed.

This can result in death, serious injury or material damage.

- Do not commission the device if one of the tilt or shock indicators has tripped during transport.
- Contact Technical Support immediately for clarification.

System overview

3

3.1 The SINAMICS range of drives

Field of application

SINAMICS is the comprehensive 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.
- Servo drives with a high dynamic performance for machine tools, as well as packaging and printing machines

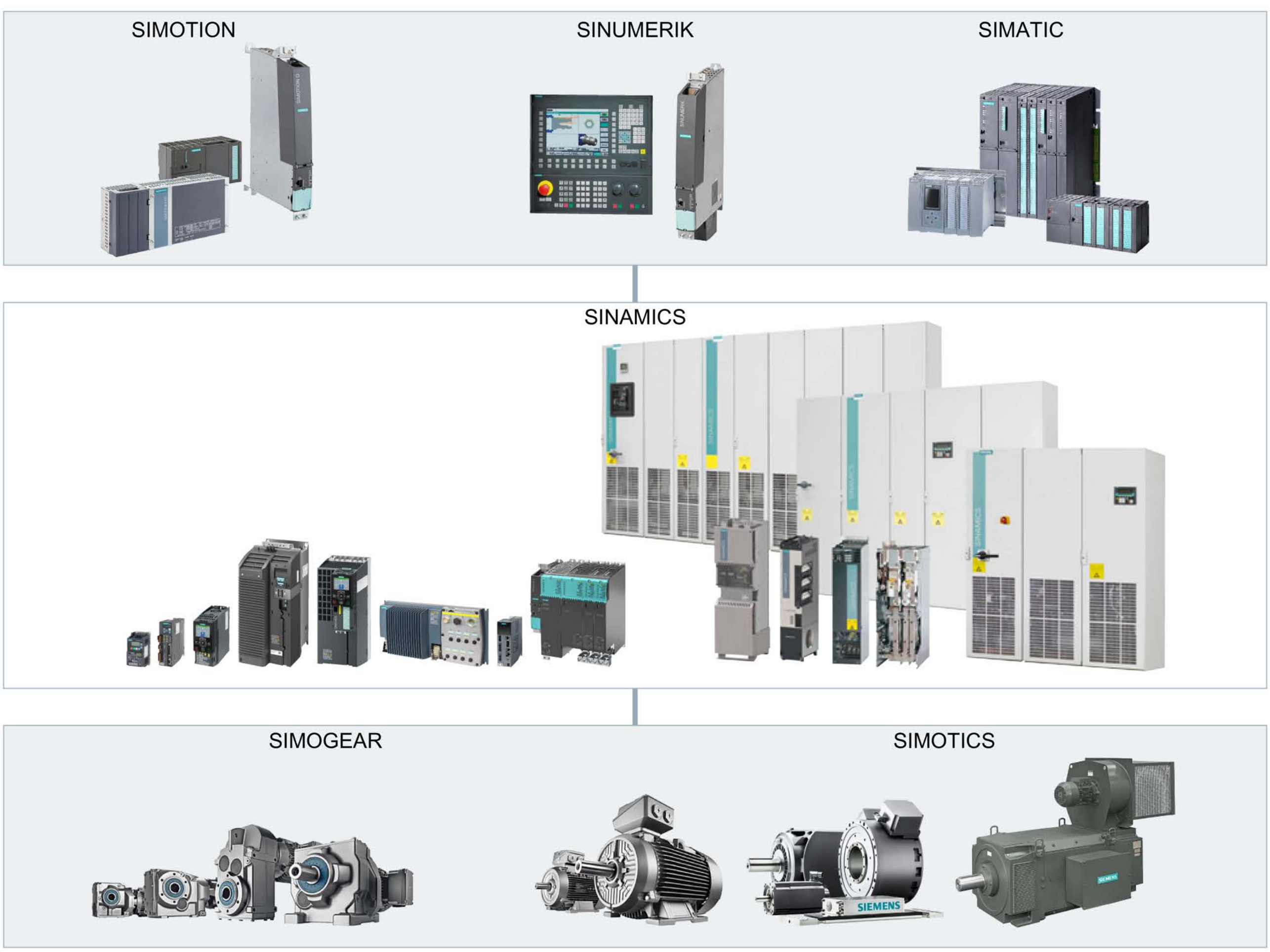


Figure 3-1 SINAMICS as part of the Siemens modular automation system

Variants

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

- SINAMICS V converters focus on the essential issues - both regarding the hardware as well as the functionality. This results in a high degree of ruggedness while at the same time reducing capital investment costs.
- SINAMICS G converters have functions that are perfect in addressing basic and medium demands relating to the dynamic response.
- SINAMICS S converters have been specially developed for use in demanding single-axis and multi-axis applications in mechanical and plant engineering and for a broad range of Motion Control tasks.

Platform concept

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.

Totally Integrated Automation and communication

SINAMICS is an integral component of Siemens Totally Integrated Automation. The integrated and seamless SINAMICS system covering engineering, data management, and communication at the automation level ensures solutions with low associated costs in conjunction with the SIMATIC, SIMOTION, and SINUMERIK control systems.

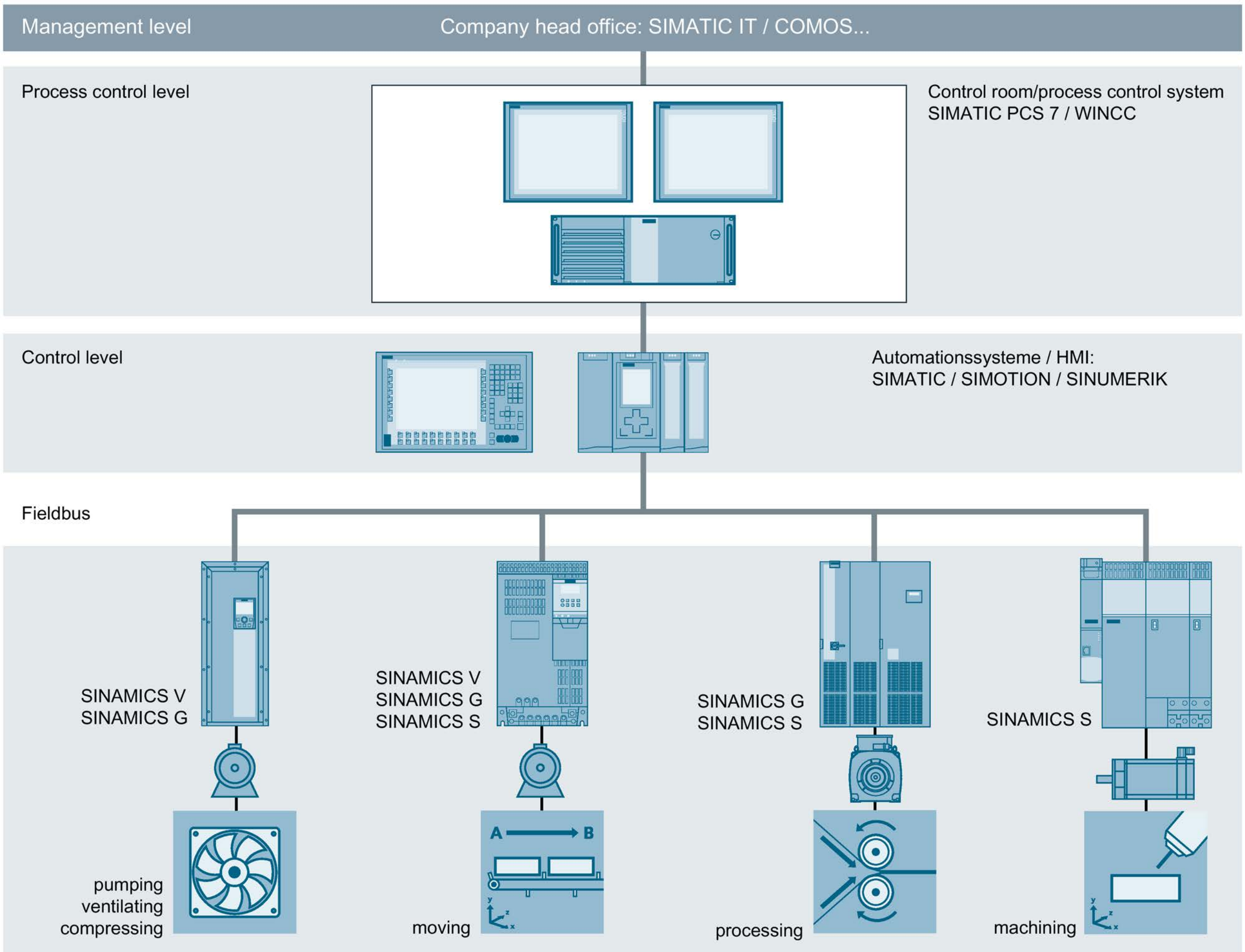


Figure 3-2 SINAMICS in the automation environment

Depending on the application, the appropriate converter can be selected and incorporated in the automation concept. With this in mind, the converters are clearly subdivided into their different applications. A wide range of communication options (depending on the drive type) are available for establishing a communication link to the automation system:

- PROFINET
- PROFIBUS
- EtherNet/IP
- Modbus TCP
- Modbus RTU
- AS-interface
- CANopen
- BacNet MS/TP

Integrated Drive System (IDS)

The Siemens Integrated Drive Systems (IDS) solution offers perfectly matched drive components with which you can meet your requirements. The drive components come into their own as Integrated Drive System, extending from engineering and commissioning through to operation.

The Drive Technology Configurator is is used to configure a seamlessly integrated system: Simply select the motor and converter and dimension them using the SIZER for Siemens Drives engineering tool.
The commissioning tools STARTER and SINAMICS Startdrive integrate the motor data at the same time, therefore simplifying efficient commissioning.
Integrated Drive Systems are integrated in the TIA Portal – which simplifies engineering, commissioning and diagnostics.

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.

It goes without saying that our quality management system is certified by an independent authority in accordance with 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.

System properties

The SINAMICS range is characterized by the following system properties:

- Standard and seamless functionality based on a platform concept
- Standardized engineering
- High degree of flexibility and combination capability
- Wide range of power ratings
- Designed for global use
- SINAMICS Safety Integrated
- Higher economic efficiency and effectiveness
- High energy efficiency
- Wide range of coupling options to higher-level control systems
- Totally Integrated Automation

3.2 SINAMICS S120 drive system

Overview

SINAMICS S120 is the modular drive system with vector and servo control for demanding drive applications in plant and machinery construction.

Multi-axis drive solutions with higher-level motion control can be implemented with the modular SINAMICS S120 system just the same as solutions for single-axis drives.

Covering a power range from 0.12 kW to 5700 kW and various control modules with a graduated range of functionality, the modular SINAMICS S120 system can be used to simply and quickly create a precisely tailored drive configuration – for almost any sophisticated drive application.

For SINAMICS S120, the drive intelligence is combined with closed-loop control functions in the Control Units.

These units are capable of controlling drives in the vector, servo and U/f control modes. They also perform the speed and torque control functions as well as other intelligent drive functions for all drive axes.

Using the closed-loop control techniques available, both synchronous as well as induction motors can be operated, and therefore the complete range of low-voltage motors from Siemens.

Integrated PROFIBUS DP or PROFINET interfaces ensure easy integration into complete automation solutions.

Benefits

SINAMICS S120 sets itself apart through:

- Can be universally used in high-performance single and multi-axis applications
- Can be freely combined to create customized solutions
- Wide range of power ratings
- Wide range of functions
- SINAMICS Safety Integrated functions
- Supports various cooling types (air/liquid-cooled)
- Supports various infeed concepts
- Can be simply integrated into higher-level automation and IT environments
- User-friendly engineering
- Ease of handling
- Simple installation
- Practical connection system
- Autoconfiguration with electronic nameplates

Control Units

The closed-loop control intelligence for all the drive axes integrated in the multi-axis group is combined in the Control Units. They also feature drive-related inputs/outputs and interfaces for communicating with higher-level control systems. Control Units are available with different functional scopes and with various performance levels.

DRIVE-CLiQ – the digital interface between components

SINAMICS S120 components, including motors and encoders, are equipped with the high-performance DRIVE-CLiQ system interface.
Line Modules and Motor Modules for example are connected to the Control Unit – and Terminal Modules and Sensor Modules to the drive system via DRIVE-CLiQ – simply and efficiently. Motors that also have this interface can be directly connected to the drive system.

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

The electronic nameplate

Electronic nameplates in every component represent a digital link to the SINAMICS S120 drive system. They allow all drive components to be automatically identified via the DRIVE-CLiQ link.

The electronic nameplate contains all the relevant technical data about that particular component. In addition to the technical data, the nameplate includes logistical data such as the manufacturer ID, article number and identification number. Since this data can be called up electronically on site or remotely, all the components used in a machine can always be individually identified, which helps simplify servicing.

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 the following components:

- A **Control Unit** that handles 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.

Constraints for use

The Power Modules, Active Interface Modules, Line Modules and Motor Modules are designed for connection to a coolant circuit that must be provided on the plant side.

The design of this 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. Only very small cooling fans for the electronics are required, as the power losses generated by the electronic components are almost completely dissipated by the liquid cooling. This means that the devices are 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. Closed control cabinets with degrees of protection up to IP55 can be easily implemented with liquid cooling.

3.3 Technical specifications

Unless specified otherwise, the following technical specifications are valid for all the following components of the SINAMICS S120 drive system, liquid-cooled.

Table 3- 1 General technical data

Electrical data	
Line supply voltage	• 3 AC 380 V -10% (-15% < 1 min) ... 3 AC 480 V +10% • 3 AC 500 V -10 % (-15 % < 1 min) ... 3 AC 690 V +10 %
Line frequency	47 ... 63 Hz
Output voltage	0 to line supply 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 ... 550 Hz 1) Servo control: 0 ... 550 Hz 1) U/f control: 0 ... 550 Hz 1)
Electronics power supply	24 V DC (20.4 ... 28.8 V) implemented as PELV circuit according to IEC 61800-5-1 Ground = negative pole grounded through the electronics
Maximum short-circuit current I_{cc} according to IEC, in conjunction with the specified fuses or circuit breakers	• 1.1 ... 447 kW: 65 kA • 448 ... 671 kW: 84 kA • 672 ... 1193 kW: 170 kA • >1194 kW: 200 kA
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 ... 447 kW: 65 kA • 448 ... 671 kW: 84 kA • 672 ... 1193 kW: 170 kA • >1194 kW: 200 kA
Frequency with which the DC link is precharged	Max. 1 precharge every 3 minutes
Overvoltage category	Class III according to IEC 61800-5-1
Electromagnetic compatibility (EMC)	
Emitted interference	Category C3 (second environment) according to IEC 61800-3
Noise immunity	Use in the first and second environments according to IEC 61800-3
Mechanical data	
Vibratory load • Transport 2) • Operation	 • IEC 60721-3-2, Class 2M2:1997 • Test values according to IEC 60068-2-6 test Fc: – 10 ... 58 Hz with constant deflection = 0.075 mm – 58 ... 150 Hz with constant acceleration = 9.81 m/s^2 (1g)
Shock load • Transport 2) • Operation	 • IEC 60721-3-2, Class 2M2:1997 • Test values according to IEC 60068-2-27 test Ea: 98 m/s^2 (10g) / 20ms

Ambient conditions	
Degree of protection	IP00 according to IEC 60529 (IP20, without taking into account the connecting busbars)
Protection class	Class I (with protective conductor system) and Class III (PELV) acc. to IEC 61800-5-1
Touch protection	EN 50274 and DGUV regulation 3 when used for the intended purpose
Cooling method according to IEC 60146-1-1	• Power Modules, Basic Line Modules, Active Line Modules, Motor Modules: **WE** – W: Liquid cooling – E: Forced cooling, drive device outside the equipment • Active Interface Modules, air-cooled: **AF** – A: Air cooling – F: Forced cooling, drive unit inside the device • Active Interface Modules, liquid-cooled: **WE** – W: Liquid cooling – E: Forced cooling, drive device outside the equipment • Line reactors, sine-wave filters, motor reactors, dv/dt filters with Voltage Peak Limiter: **AN** – A: Air cooling – N: Natural cooling (convection)
Permissible ambient temperature (air) in operation	• Dependent on inlet temperature of liquid coolant, no condensation permitted: – 0 ... 45 °C without derating – > 45 ... 50 °C, refer to derating characteristics
Cooling circuit data	
• Maximum system pressure with respect to the atmosphere	• 600 kPa
• Recommend system pressure with respect to the atmosphere	• 80 ... 150 kPa (is applicable for water as coolant)
• Differential pressure drop across the heat sink at the nominal flow rate	• 70 kPa
• Inlet temperature of liquid coolant	• Dependent on ambient temperature, no condensation permitted – 0 ... 45 °C without derating, > 45 ... 50 °C see derating characteristics – Temperature range between 0 °C and 5 °C - only with antifreeze; antifreeze: Antifrogen N, Antifrogen L and Dowcal 100
Climatic ambient conditions	
• Storage [2)]	• Class 1K4 acc. to IEC 60721-3-1:1997, temperature -25 ... +55 °C max. Air humidity 95 %
• Transport [2)]	• Class 2K4 acc. to IEC 60721-3-2:1997, temperature -25 ... +70 °C, max. air humidity 95 % at +40 °C
• Operation	• better than Class 3K3 according to IEC 60721-3-3:2002 Relative humidity: 5 ... 95 % (no condensation) Oil mist, salt mist, ice formation, condensation, dripping water, spraying water, splashing water and water jets are not permitted

Environmental class / harmful chemical substances	
• Storage [2)] • Transport [2)] • Operation	• Class 1C2 according to IEC 60721-3-1:1997 • Class 2C2 according to IEC 60721-3-2:1997 • Class 3C2 according to IEC 60721-3-3:2002
Environmental class /mechanically active substances	
• Storage [2)] • Transport [2)] • Operation	• Class 1S1 according to IEC 60721-3-1:1997 • Class 2S1 according to IEC 60721-3-2:1997 • Class 3S1 according to IEC 60721-3-3:2002
Organic/biological influences	
• Storage [2)] • Transport [2)] • Operation	• Class 1B1 according to IEC 60721-3-1:1997 • Class 2B1 according to IEC 60721-3-2:1997 • Class 3B1 according to IEC 60721-3-3:2002
Degree of pollution	2 acc. to IEC 61800-5-1 The devices may only be operated in environments with degree of pollution 2; the following guidelines should be applied, especially to avoid condensation: A ventilated enclosure equipped with filter must be used to provide forced ventilation. This means that ventilation is realized using one or several fans in the enclosure that provide a positive air intake and discharge. The other alternative is to use heating devices to constantly heat the air in the enclosure or to use heat generated by continuously energizing the equipment, with interruptions so that the air does not cool down to the point where condensation can occur.
The Safety Integrated safety function: The components must be protected against conductive pollution, e.g. by installing them in a control cabinet with degree of protection IP54B according to IEC 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
Compliance with standards	
Conformity	- EMC Directive 2014/30/EU - Low-Voltage Directive 2014/35/EU - RoHS 2 guideline 2011/65/EU - machinery directive 2006/42/EC for functional safety - UKCA
Certificates for marine classes	Type certificate for Marine Class DNV GL, valid in conjunction with the installation regulations specified on the certificate.
Standards	IEC 61800-5-1, IEC 60204-1, IEC 61800-3, IEC 60146-1-1
Approvals (only up to 3 AC 600 V)	cULus (File Nos.: E192450, E214113, E203250 and E253831) EAC, KC

1) Depending on the system configuration, higher output frequencies are possible.

2) In transport packaging

NOTICE

Damage to the device through incorrect storage and transport of liquid-cooled devices

The storage and transport of liquid-cooled devices that have not been completely emptied can result in damage to the device through freezing.

- Always empty the liquid-cooled devices completely before storage or transport.

Note on the design of a UL-approved system

Note

Design of a UL-approved system

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

3.4 Derating factors

3.4.1 Derating factors as a function of coolant temperature

Liquid-cooled SINAMICS S120 devices are suitable for water or a mixture of water and antifreeze as coolant, corresponding to Chapter "Antifreeze, biocides, inhibitors (Page 340)".

When water 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 water and an antifreeze 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.

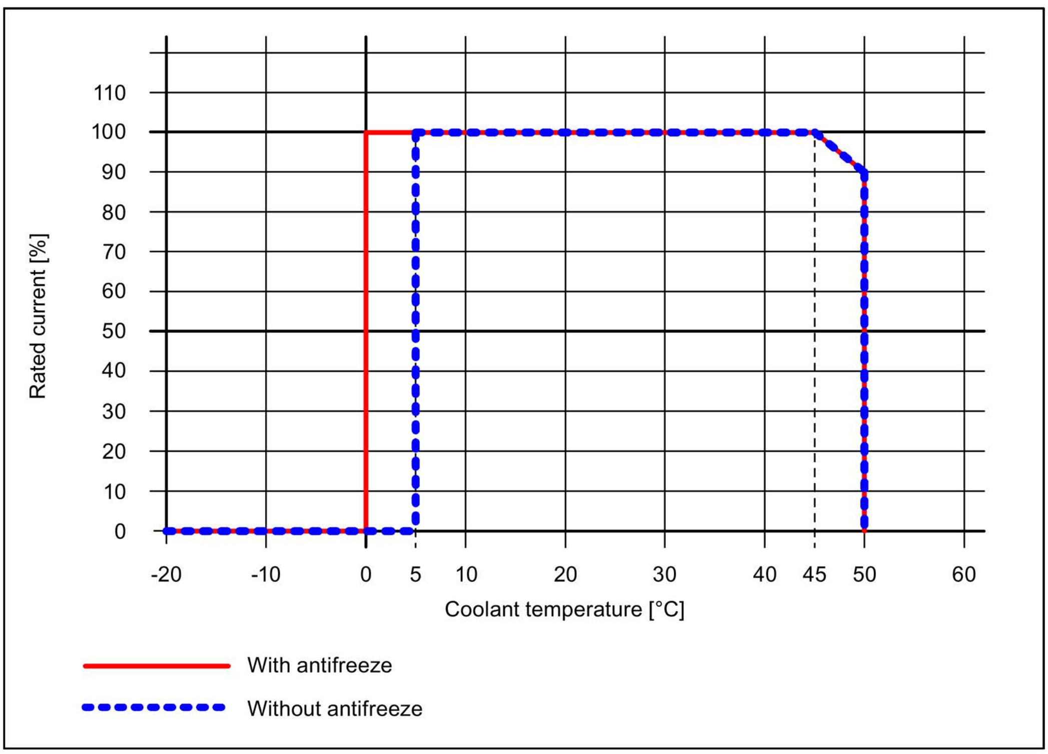


Figure 3-3 Maximum output current as a function of coolant temperature

3.4.2 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.

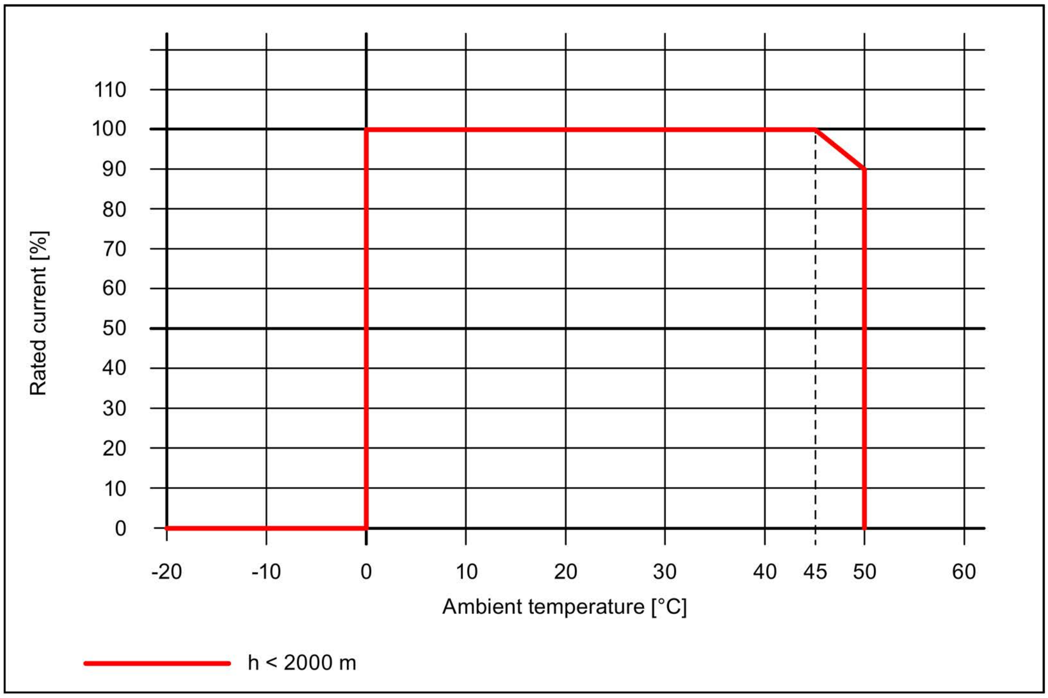


Figure 3-4 Maximum current as a function of ambient temperature

3.4.3 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.

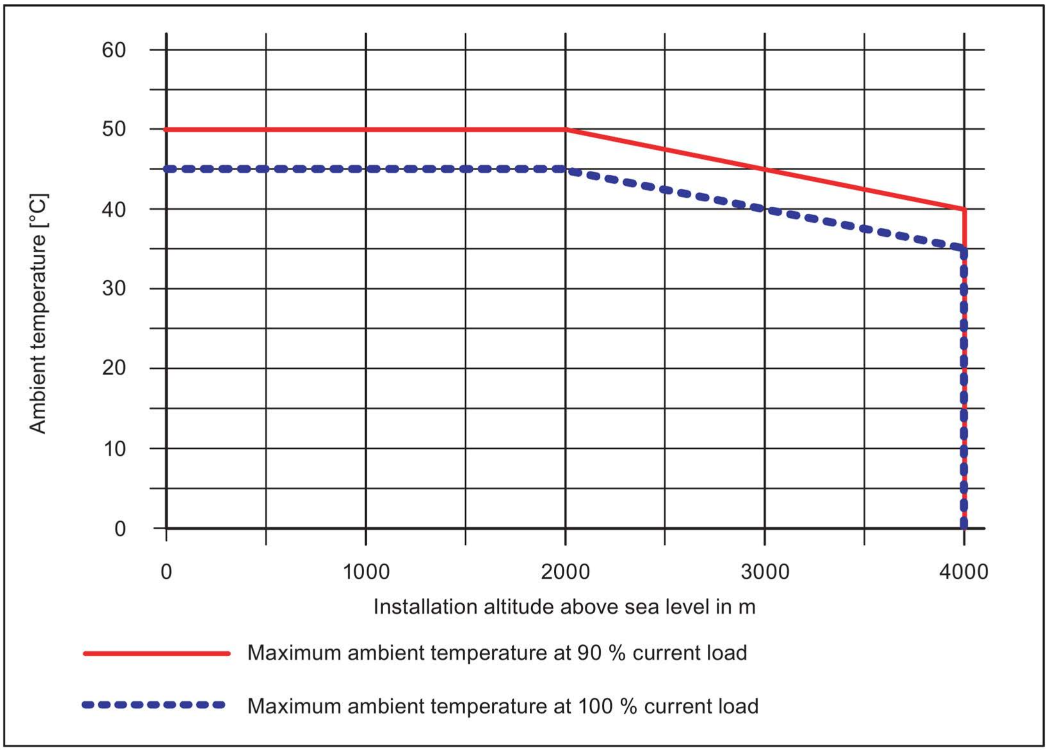


Figure 3-5 Maximum ambient temperature as a function of installation altitude

At installation altitudes above 2000 m, the line voltage must not exceed certain limits to ensure that surge voltages can be insulated in accordance with IEC 6180051 for surge voltage category III. If the line voltage is higher than this limit at installation altitudes >2000 m, measures must be taken to reduce transient category III surge voltages to category II values, e.g. equipment must be supplied via an isolation transformer.

Additional information is provided in the "SINAMICS Low Voltage Engineering Manual".

3.5 Standards

Note

Information on the listed standards

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 3- 2 Fundamental, application-relevant standards in succession: EN, IEC/ISO, DIN, VDE

Standards*	Title
EN ISO 3744	Acoustics - Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering methods for an essentially free acoustic field over a reflecting plane
ISO 14118 DIN EN ISO 14118	Safety of machinery; avoiding unexpected starting
EN ISO 9001 ISO 9001 DIN EN ISO 9001	Quality management systems - requirements
ISO 12100 DIN EN ISO 12100	Safety of Machinery – General Design Guidelines – Risk Assessment and Risk Minimization
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 14121-2 ISO 14121-2 DIN EN ISO 14121-2	Safety of Machinery - Risk Assessment; Part 2: Practical guidelines and process examples.
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
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

Standards*	Title
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 overcurrent 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: Cables, conductors, busbars Part 540: Grounding, protective conductor, potential bonding conductor Part 560: Electrical equipment for safety purposes
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 61439 IEC 61439 DIN EN 61439 VDE 0660-600	Low-voltage switchgear assemblies Part 1: General definitions
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
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

Standards*	Title
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
UL61800-5-1 CSA 22.2 No. 274-13	Standard for Adjustable Speed Electrical Power Drive Systems - Part 5-1: Safety requirements – Electrical, thermal and energy

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

3.6 Basic structure of a drive system with liquid-cooled SINAMICS S120

3.6.1 Structure of a drive system with liquid-cooled SINAMICS S120 Power Modules

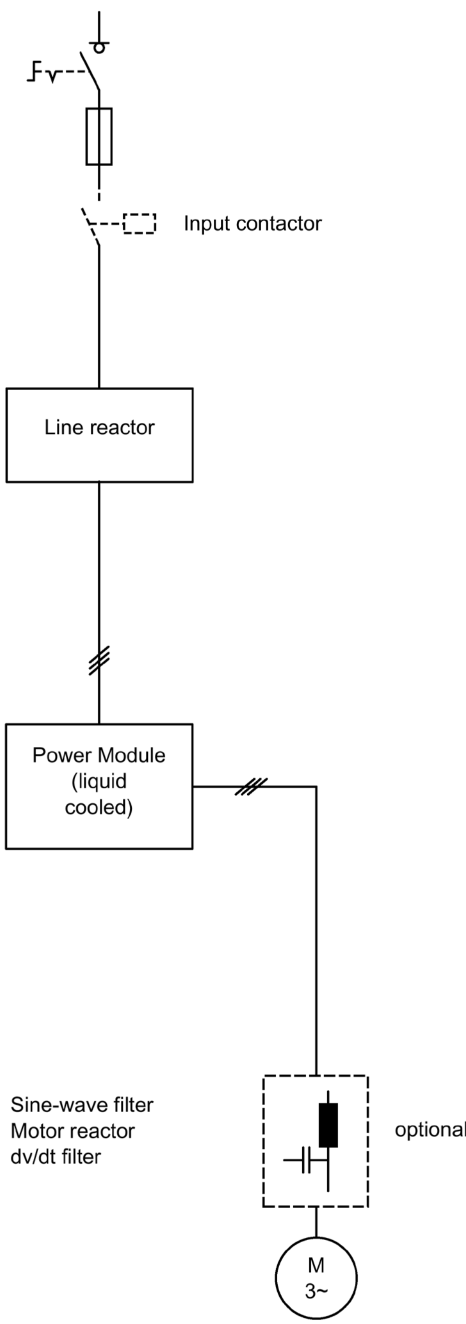


Figure 3-6 Principle structure of a drive system with liquid-cooled SINAMICS S120 Power Modules

3.6.2 Structure of a drive system with liquid-cooled SINAMICS S120 and regulated infeed

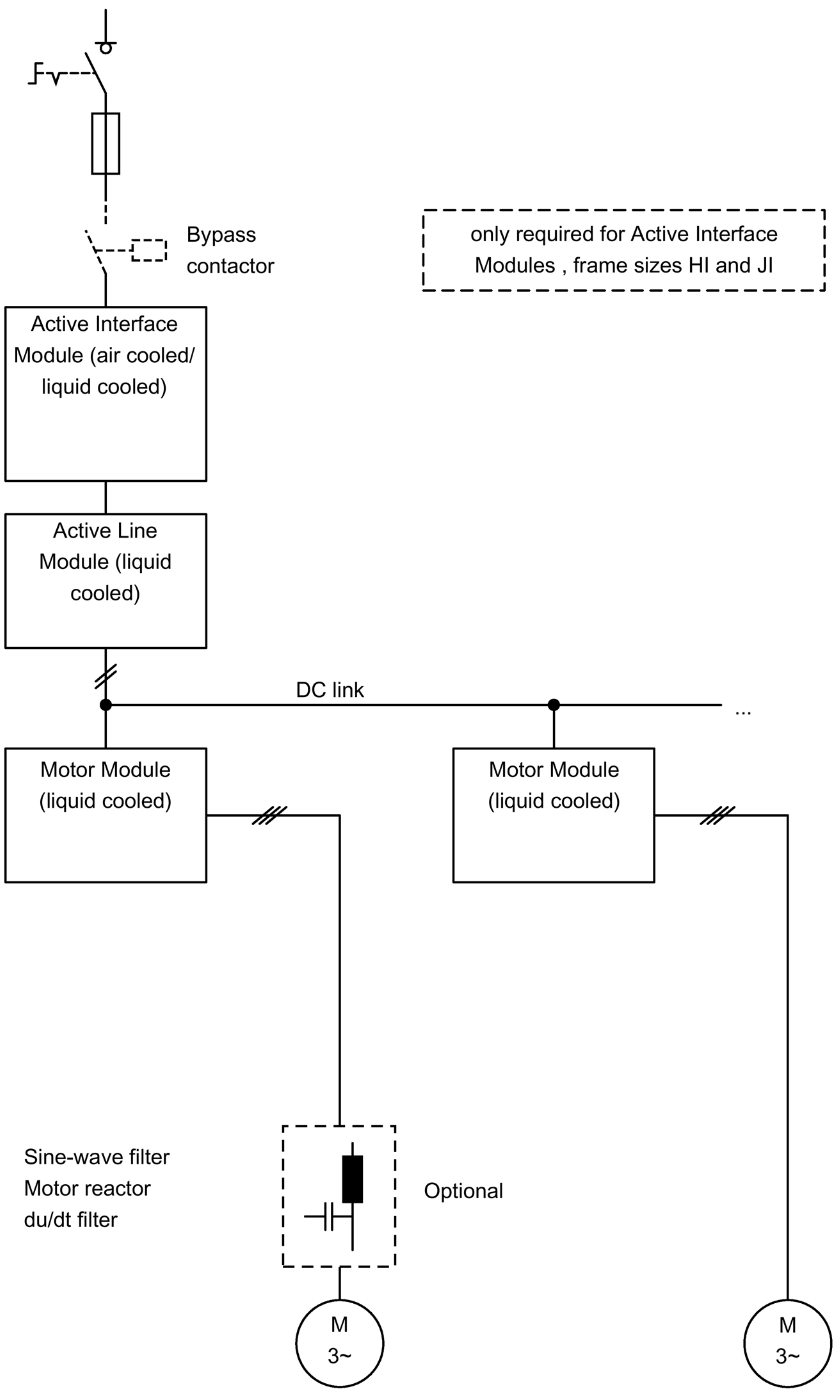


Figure 3-7 Basic structure of a drive system with liquid-cooled SINAMICS S120 and regulated infeed

3.6.3 Structure of a drive system with liquid-cooled SINAMICS S120 and unregulated infeed

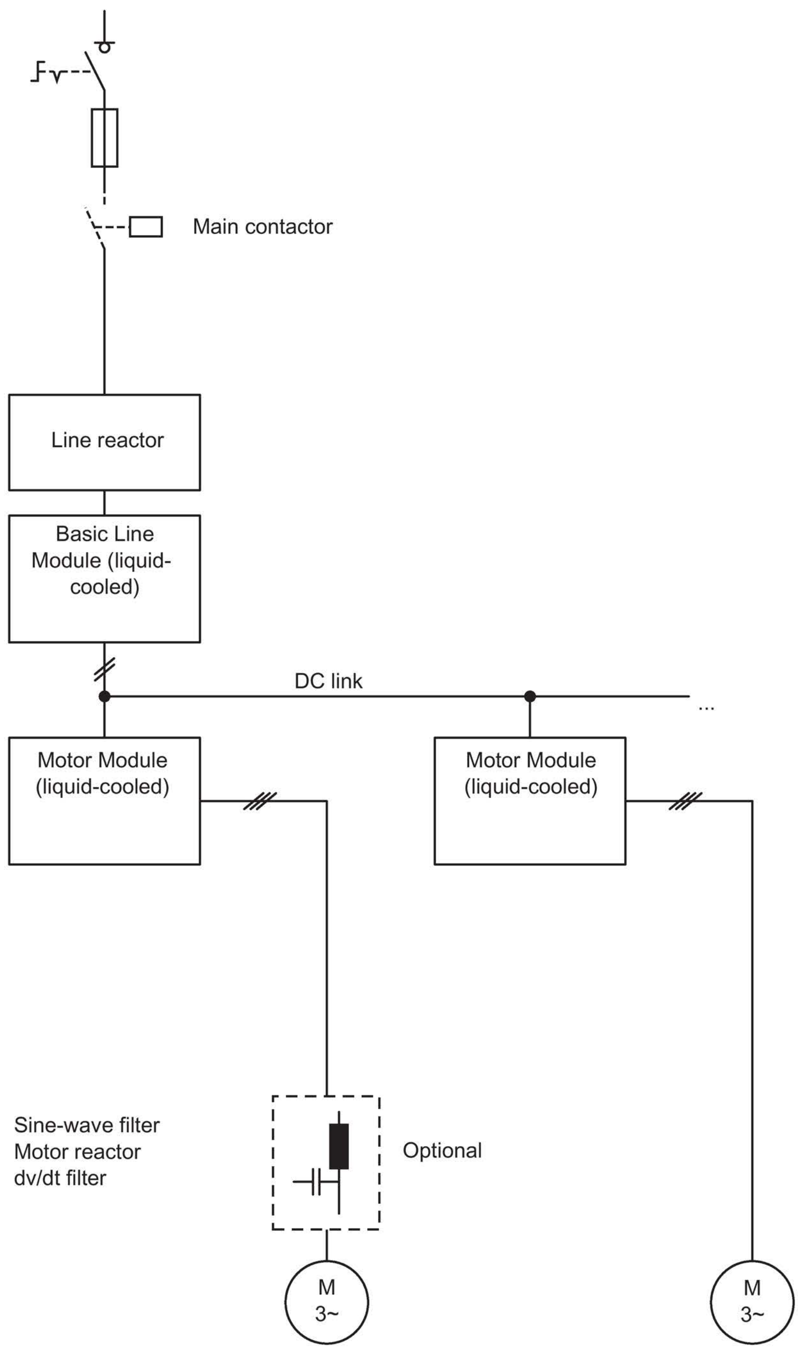


Figure 3-8 Basic structure of a drive system with liquid-cooled SINAMICS S120 and unregulated infeed

Line-side power components 4

4.1 Line reactors for Power Modules

4.1.1 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 %.

4.1.2 Safety information

⚠ WARNING

Not observing fundamental safety instructions and residual risks

Not observing fundamental safety instructions and residual risks listed in Chapter 1 can result in accidents with severe injuries or death.

- Comply with the fundamental safety instructions.
- When assessing the risk, take into account residual risks.

⚠ CAUTION

Burns resulting from high surface temperature

The line reactors can become very hot. You can get seriously burnt when touching the surface.

- Mount the line reactors so that contact is not possible. If this is not possible, attach clearly visible and understandable warning notices at hazardous positions.
- To prevent adjacent components from suffering damage due to these high temperatures, maintain a clearance of 100 mm on all sides of the line reactors.

NOTICE

Damage to the system caused by the use of inappropriate and not approved line reactors

Inappropriate and not approved line reactors can damage the Power Modules.

Line harmonics that damage/disturb other loads connected to the same line supply can also occur.

- Only use line reactors that are listed in this Manual.

Note

Malfunctions through magnetic fields

Reactors produce magnetic fields that can disturb or damage components and cables.

- Arrange the components and cables at a suitable distance (at least 200 mm) or shield the magnetic fields appropriately.

Note

Length of connecting cables

The connection lines between line reactor and Power Module must be kept as short as possible (max. 5 m).

You must use shielded connection cables, whose cable shields are attached at both ends.

Shielding can only be omitted if the following conditions are met:

- The cables do not exceed 1 m in length.
- The cables are laid flush with the rear metal wall of the control cabinet.
- The cables are laid in a way that keeps them physically separate from signal cables.

Do not route any cables near the line reactor. If this cannot be avoided, observe a minimum clearance of 200 mm.

4.1.3 Dimension drawing

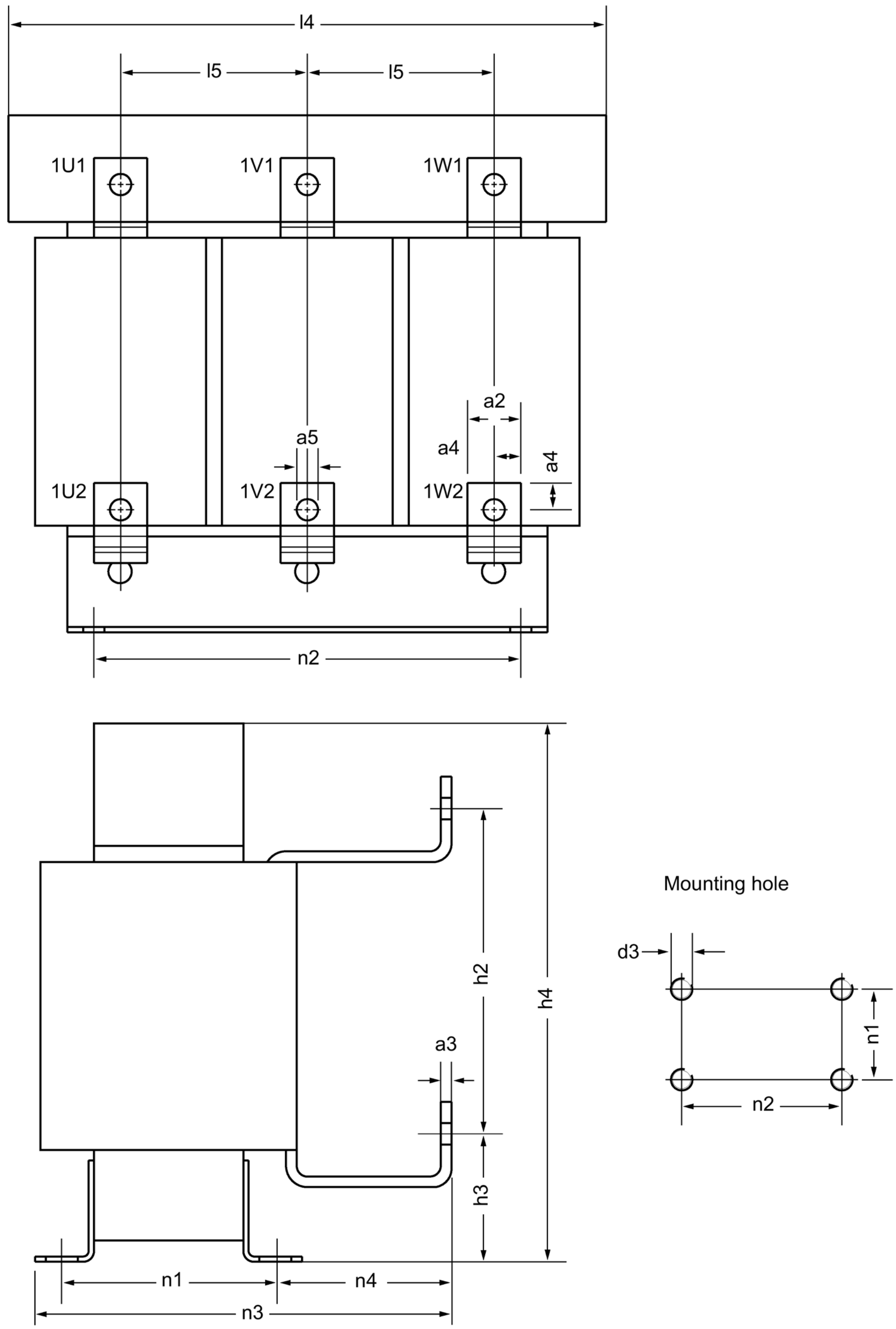


Figure 4-1 Dimension drawing of line reactor for Power Modules

Table 4- 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

4.1.4 Technical data

Table 4- 2 Technical data, line reactors for Power Modules, 3 AC 380 ... 480 V

Article number	6SL3000-	0CE32-3AA0	0CE32-8AA0	0CE33-3AA0	0CE35-1AA0
Suitable for Power Module	6SL3315-	1TE32-1AA3	1TE32-6AA3	1TE33-1AA3	1TE35-0AA3
Type 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 1U1, 1V1, 1W1, 1U2, 1V2, 1W2		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

4.2 Line reactors for Basic Line Modules

4.2.1 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 %.

4.2.2 Safety information

⚠ **WARNING**

Not observing fundamental safety instructions and residual risks

Not observing fundamental safety instructions and residual risks listed in Chapter 1 can result in accidents with severe injuries or death.

- Comply with the fundamental safety instructions.
- When assessing the risk, take into account residual risks.

⚠ **CAUTION**

Burns resulting from high surface temperature

The line reactors can become very hot. You can get seriously burnt when touching the surface.

- Mount the line reactors so that contact is not possible. If this is not possible, attach clearly visible and understandable warning notices at hazardous positions.
- To prevent adjacent components from suffering damage due to these high temperatures, maintain a clearance of 100 mm on all sides of the line reactors.

NOTICE

Damage to the system caused by the use of inappropriate and not approved line reactors

Inappropriate and not approved line reactors can damage the Line Modules.

Line harmonics that damage/disturb other loads connected to the same line supply can also occur.

- Only use line reactors that are listed in this Manual.

Note

Malfunctions through magnetic fields

Reactors produce magnetic fields that can disturb or damage components and cables.

- Arrange the components and cables at a suitable distance (at least 200 mm) or shield the magnetic fields appropriately.

Note

Length of connecting cables

The connection cables between line reactor and Line Module, as well as between line reactor and line filter, must be kept as short as possible (max. 5 m).

You must use shielded connection cables, whose cable shields are attached at both ends.

Shielding can only be omitted if the following conditions are met:

- The cables do not exceed 1 m in length.
- The cables are laid flush with the rear metal wall of the control cabinet.
- The cables are laid in a way that keeps them physically separate from signal cables.

Do not route any cables near the line reactor. If this cannot be avoided, observe a minimum clearance of 200 mm.

4.2.3 Dimension drawing

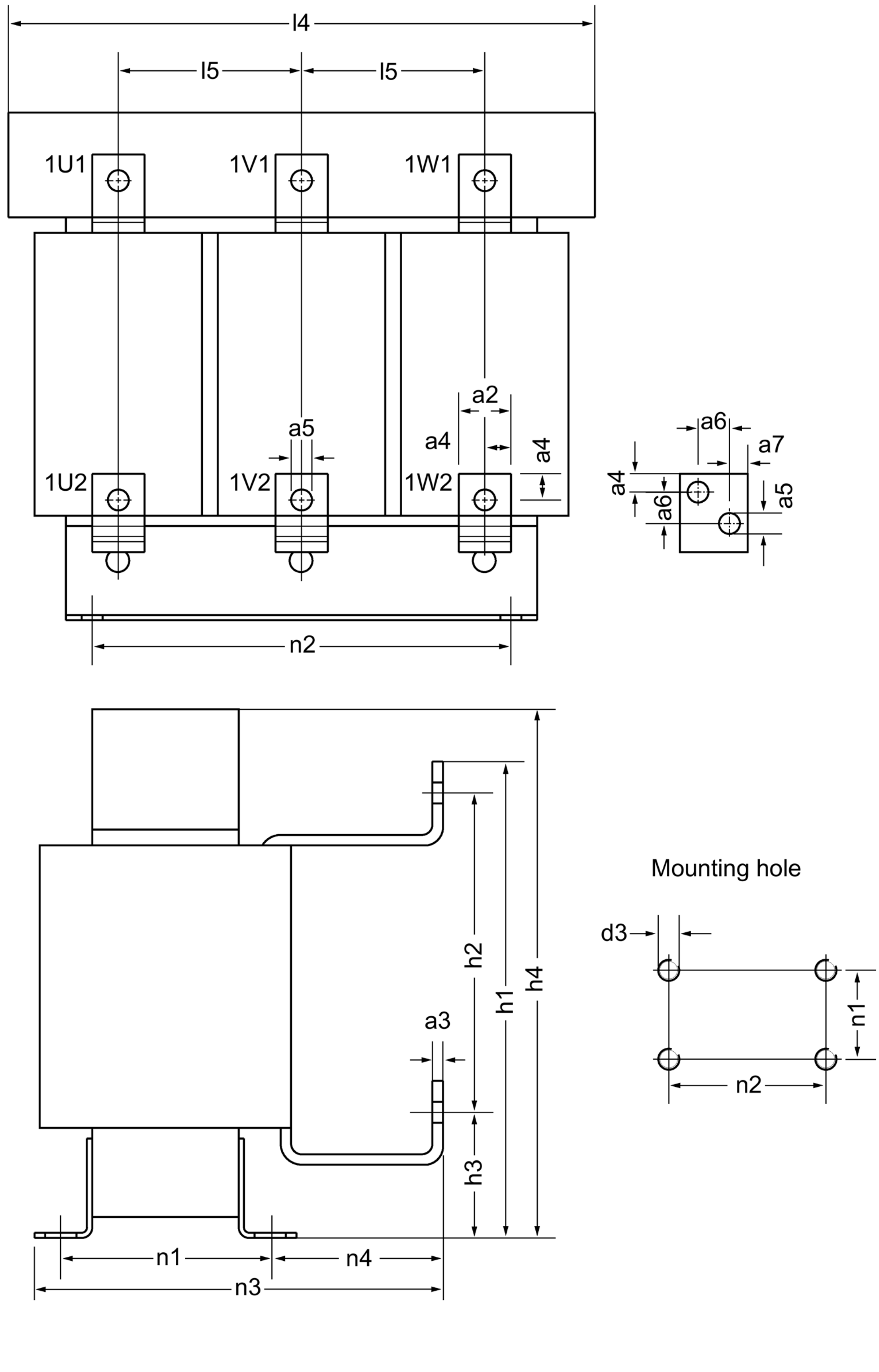


Figure 4-2 Dimension drawing of line reactors for Basic Line Modules

Table 4- 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 4- 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

4.2.4 Technical data

Table 4- 5 Technical data, line reactors for Basic Line Modules, 380 ... 480 V 3 AC

Article 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	1060	1458	
Power loss	kW	0.368	0.498	0.776	
Line/load connection 1U1, 1V1, 1W1, 1U2, 1V2, 1W2		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	 350 321 211.5	 460 435 235	
Weight	kg	41.4	69.6	118	

Table 4- 6 Technical data, line reactors for Basic Line Modules, 500 ... 690 V 3 AC

Article 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 1U1, 1V1, 1W1, 1U2, 1V2, 1W2		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

4.3 Active Interface Modules, air-cooled

4.3.1 Description

Air-cooled Active Interface Modules are used in conjunction with liquid-cooled Active Line Modules in chassis format.

Only the following types are used, otherwise, liquid-cooled Active Interface Modules are available:

- 3 AC 380 ... 480 V: 300 kW
- 3 AC 500 ... 690 V: 630 kW

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.

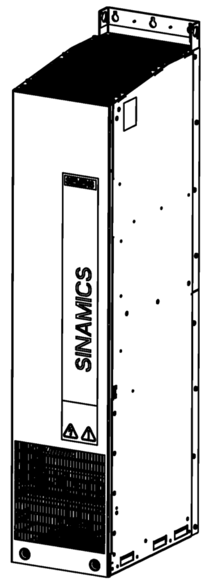
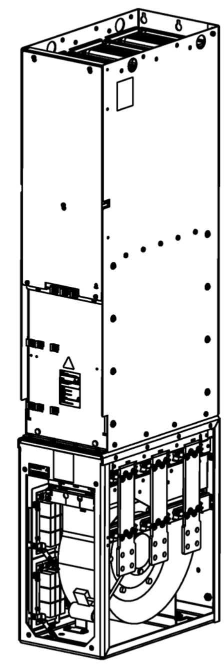
Frame size GI is equipped as standard with a bypass contactor which ensures a highly compact design. The bypass contactor must be provided separately for frame size HI.

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)
- Line voltage sensing module VSM10
- Fan

Table 4- 7 Active Interface Modules

	
Frame size GI	Frame size HI

Active Interface Module and Active Line Module assignment

The assignment of the Active Interface Modules (liquid cooled and air cooled) to the liquid-cooled Active Line Modules is shown in the following table.

Table 4- 8 Active Interface Module and Active Line Module assignment

Suitable for Active Line Module chassis format, liquid cooled	**Rated power of the Active Line Modules at 400 V or 690 V** **kW**	**Active Interface Modules, liquid-cooled** **Article No.**	**Active Interface Modules, air-cooled** **Article No.**
Line voltage 3 AC 380 ... 480 V			
6SL3335-7TE35-0AA3	300	– 1)	6SL3300-7TE35-0AA1
6SL3335-7TE36-1AA3	380	6SL3305-7TE38-4AA5	
6SL3335-7TE38-4AA3	500	6SL3305-7TE38-4AA5	
6SL3335-7TE41-0AA3	630	6SL3305-7TE41-4AA5	
6SL3335-7TE41-4AA3	900	6SL3305-7TE41-4AA5	
Line voltage 3 AC 500 ... 690 V			
6SL3335-7TG35-8AA3	630	– 1)	6SL3300-7TG35-8AA1
6SL3335-7TG37-4AA3	800	6SL3305-7TG37-4AA5	
6SL3335-7TG38-1AA3	900	6SL3305-7TG41-0AA5	
6SL3335-7TG41-0AA3	1100	6SL3305-7TG41-0AA5	
6SL3335-7TG41-3AA3	1400	6SL3305-7TG41-3AA5	
6SL3335-7TG41-6AA3	1700	6SL3305-7TG41-6AA5	

1) No liquid-cooled Active Interface Modules are available for these rated powers. Alternatively, air-cooled devices can be used.

4.3.2 Safety information

WARNING

Not observing fundamental safety instructions and residual risks

Not observing fundamental safety instructions and residual risks listed in Chapter 1 can result in accidents with severe injuries or death.

- Comply with the fundamental safety instructions.
- When assessing the risk, take into account residual risks.

WARNING

Electric shock due to unconnected cable shields

Hazardous touch voltages can occur through capacitive cross-coupling due to unconnected cable shields.

- Connect the cable shields at both ends to the grounded housing potential.

WARNING

High leakage currents when the protective conductor in the line feeder cable is interrupted

The drive components conduct a high leakage current via the protective conductor. Touching conductive parts when the protective conductor is interrupted can result in death or serious injury.

- Ensure that the external protective conductor satisfies at least one of the following conditions:
  - It has been installed so that it is protected against mechanical damage. [1)]
  - For an individual core, it has a cross-section of at least 10 mm² Cu.
  - If it is a conductor of a multi-conductor cable, it has a cross-section of at least 2.5 mm² Cu.
  - It has a second protective conductor in parallel with the same cross-section.

  [1)] Cables laid within control cabinets or closed machine housings are considered to be adequately protected against mechanical damage.
- Observe the local regulations for protective conductors subject to a high leakage current at the operating location.

WARNING

Fire due to inadequate ventilation clearances

Inadequate ventilation clearances can cause overheating of components with subsequent fire and smoke. This can cause serious injury or even death. This can also result in increased failures and shorter service lives for devices/systems.

- Observe the ventilation clearances above, below and in front of the component, which are specified in the dimension drawings.

WARNING

Electric shock due to unexpectedly long discharge time

If you operate the Active Interface Module without an Active Line Module, the discharge time extends to more than 20 minutes after the supply voltage has been disconnected. As a result, dangerous voltage may unexpectedly be present at the terminals of the Active Interface Module.

Contact with live parts can result in death or serious injury.

- Only operate the Active Interface Module together with an Active Line Module.

4.3.3 Interface description

4.3.3.1 Overview

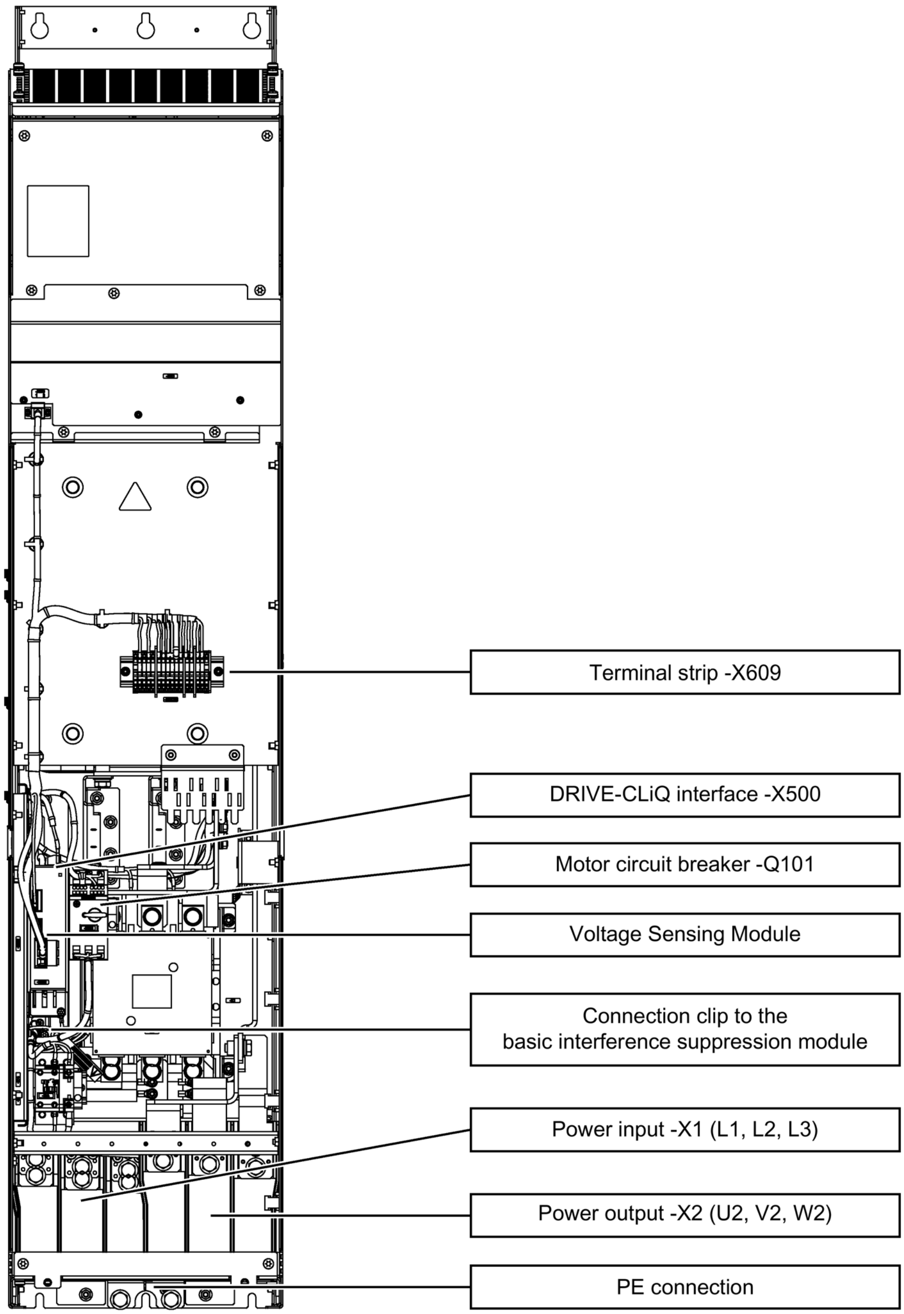


Figure 4-3 Interface overview in the Active Interface Module, frame size GI

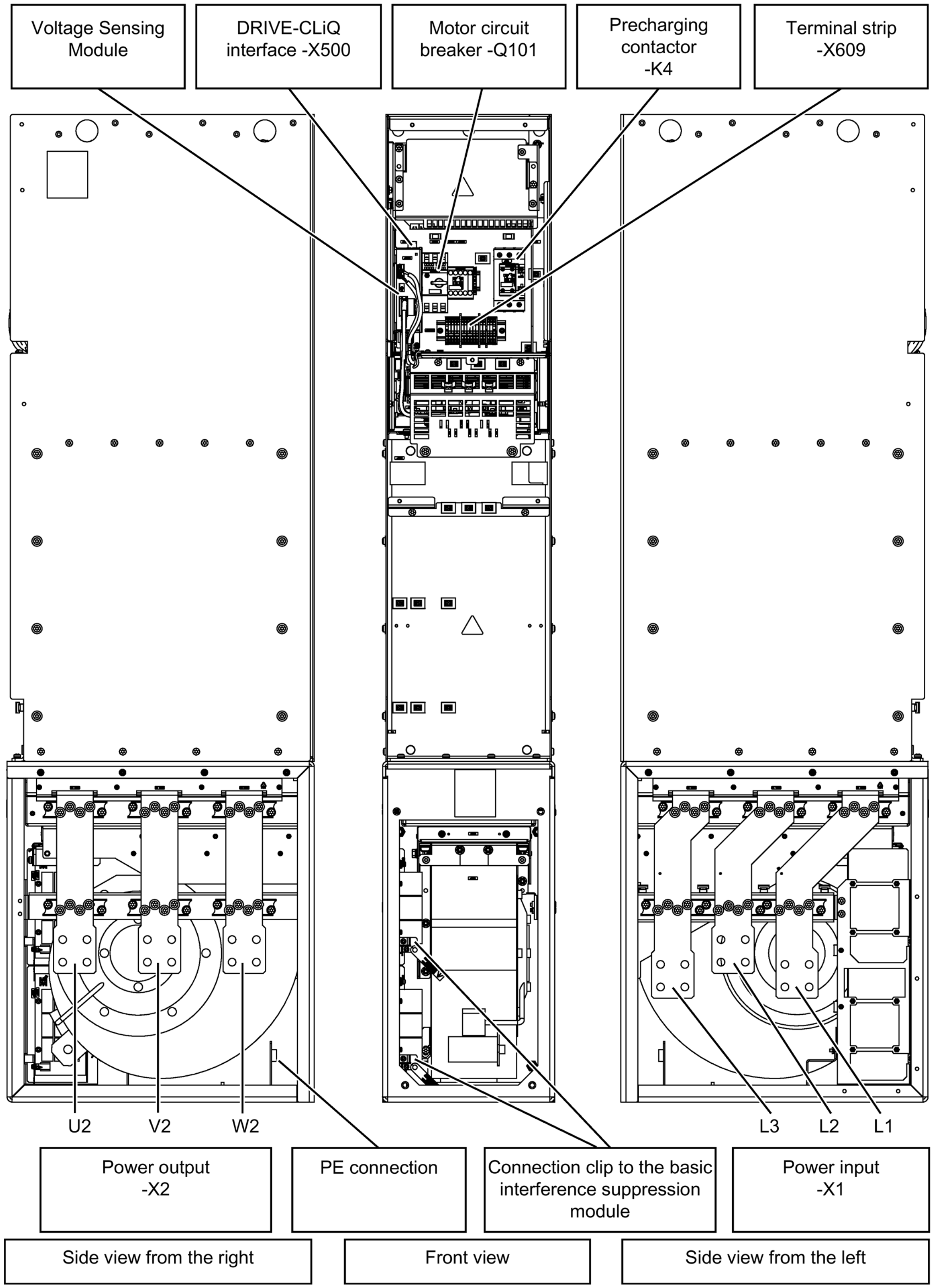


Figure 4-4 Interface overview in the Active Interface Module, frame size HI

4.3.3.2 Connection example

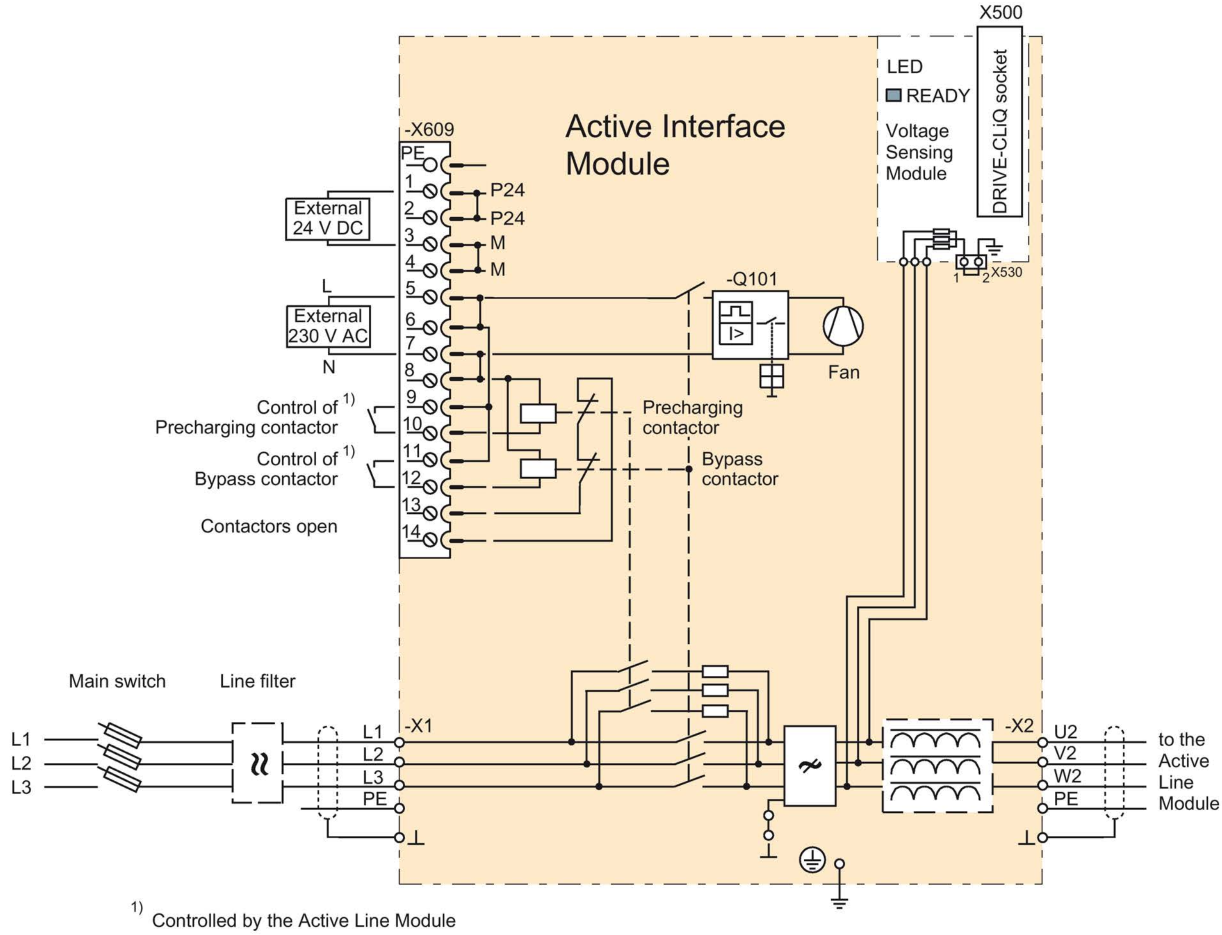


Figure 4-5 Connection example Active Interface Module, frame size GI

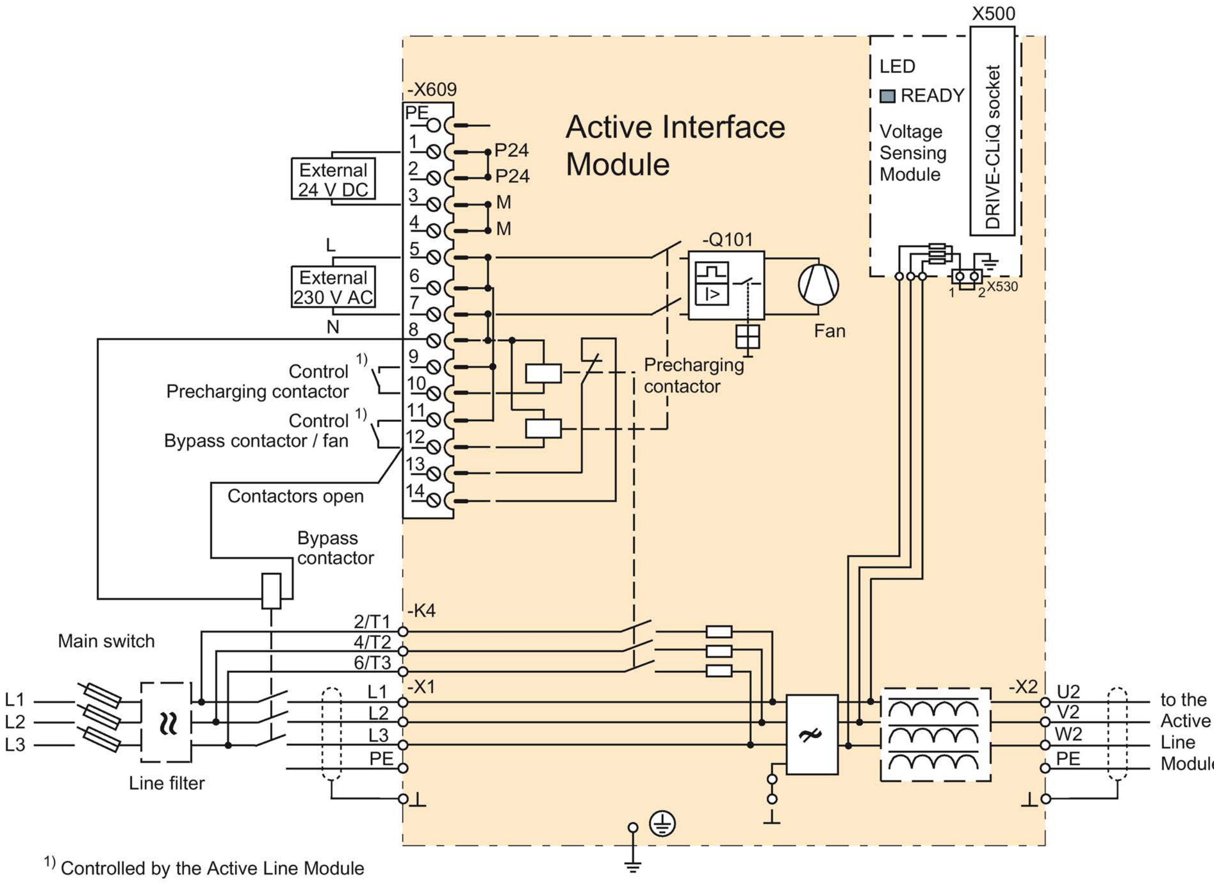


Figure 4-6 Connection example Active Interface Module, frame size HI

NOTICE
Damage to the devices as a result of excessively long switching times of the bypass contactor When using a bypass contactor with excessively long switching times (maximum 500 ms), the required overlap phase is not guaranteed, where both contactors are simultaneously pulled-in. As a consequence, the Active Interface Module can be overloaded and destroyed. • Only use Siemens bypass contactors; the associated data are provided in the technical data.

NOTICE
Damage to the device through different phase sequence in the pre-charging and main circuits Different phase sequences in the pre-charging and main circuits can overload and destroy the pre-charging resistors of the Active Interface Module during the brief overlap period, where both contactors are simultaneously closed. • Close the power cables in the pre-charging and main circuits with the same phase sequence.

4.3.3.3 Motor circuit breaker -Q101

Motor circuit breaker -Q101 is used to protect the fan.
The fan is adequately protected as result of the factory setting.

In the factory setting, the motor circuit breaker is set corresponding to the following table.

Table 4- 9 Factory setting of the motor circuit breaker

Active Interface Module	Motor circuit breaker type	Setting value
Frame size GI	3RV2011-0JA25 (0.7 ... 1 A)	1 A
Frame size HI	3RV2011-0GA25 (4.5 ... 6.3 A)	5.5 A

4.3.3.4 Line/load connection

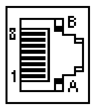
Table 4- 10 Connections for the Active Interface Module

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

[1]) Dimensions for connecting alternative cable lugs, see "cable lugs" in the appendix.

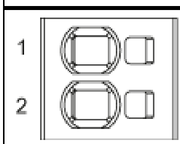
4.3.3.5 DRIVE-CLiQ interface X500

Table 4- 11 DRIVE-CLiQ interface X500

Connector	PIN	Signal name	Technical data
	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.) Article number: 6SL3066-4CA00-0AA0			

4.3.3.6 X530 neutral point grounding

Table 4- 12 Neutral point grounding X530

Connector	Terminal	Designation	Technical specifications
	1	Neutral point of the voltage sensing	Jumper inserted: Grounded measurement Jumper not inserted: isolated measurement
	2	Ground potential	

The Voltage Sensing Module is supplied with inserted jumper. When delivered, the neutral point is connected to the protective conductor via the connector jumper. Current can flow to PE. This connection is removed by removing the connector jumper. The measurement is then electrically isolated.

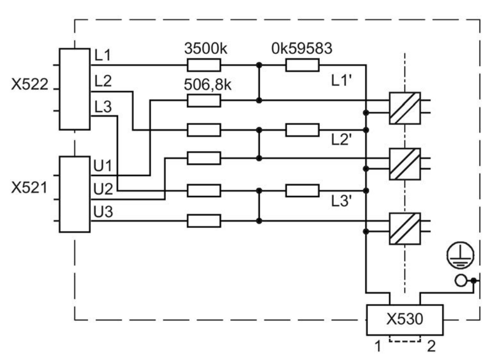


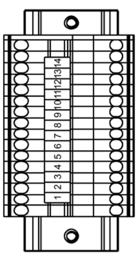
Figure 4-7 Internal circuit of the VSM10 Voltage Sensing Module

When the Active Interface Module is operated on an ungrounded line system (IT system), the connection clip must be removed, see "Electrical connection (Page 76)".

> **Note**
>
> **Replacing a VSM10 Voltage Sensing Module**
>
> When replacing a Voltage Sensing Module VSM10 by one with a different article number, then inform yourself about the applicable boundary conditions.

4.3.3.7 X609 terminal strip

Table 4- 13 Terminal strip X609

Connector	Terminal	Designation	Technical data	
	1	P24	External 24 V DC supply Voltage: 24 VDC (20.4 ... 28.5 V) Current consumption: Max. 0.25 A	
	2	P24		
	3	M		
	4	M		
	5	L	Voltage: 230 VAC (195.5 ... 264.5 V) Current consumption: Max. 10 A Fan operating currents, see "Technical data"	
	6	L		
	7	N		
	8	N		
	9	Pre-charging contactor–A1	Voltage: 230 V AC (195.5 ... 264.5 V) Current consumption: Max. 4 A	To Active Line Module, X9:5
	10	Pre-charging contactor–A2		To Active Line Module, X9:6
	11	Bypass contactor–A1	Voltage: 230 V AC (195.5 ... 264.5 V) Current consumption: Max. 6 A	To Active Line Module, X9:3
	12	Bypass contactor–A2		To Active Line Module, X9:4
	13	Contactor feedback signal 1*	Voltage: 230 VAC (195.5 ... 264.5 V) Max. permissible current: 6 A	
	14	Contactor feedback signal 2*		
Max. connectable cross-section: 2.5 mm²				

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

> **NOTICE**
>
> **Device failure due to overtemperature caused by incorrect wiring of Active Interface Modules with frame size HI**
>
> In operation, Active Interface Modules, frame sizes HI require a signal on terminals X609:11 and X609:12 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.
>
> - Connect the signals on terminals X609:11 and X609:12 to the Active Interface Modules of frame sizes HI to control the fans.

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

Table 4- 14 Description of the LED on the Voltage Sensing Module (VSM) in the Active Interface Module

LED	Color	Status	Description
RDY	---	Off	The electronics power supply is missing or lies outside the permissible tolerance range.
	Green	Continuous light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	Continuous light	DRIVE-CLiQ communication is being established.
	Red	Continuous light	This component has at least one fault. **Remark:** The LED is activated irrespective of whether the corresponding messages have been reconfigured.
	Green/red	Flashing 0.5 Hz	Firmware is being downloaded.
		2 Hz flashing light	Firmware download is complete. Waiting for POWER ON.
	Green / orange or red / orange	2 Hz flashing light	Detection of the components via LED is activated (p0144). **Remark:** Both options depend on the LED status when module recognition is activated via p0144 = 1.

4.3.4 Dimension drawing

Dimension drawing, frame size GI

The mandatory cooling clearances are indicated by the dotted line.

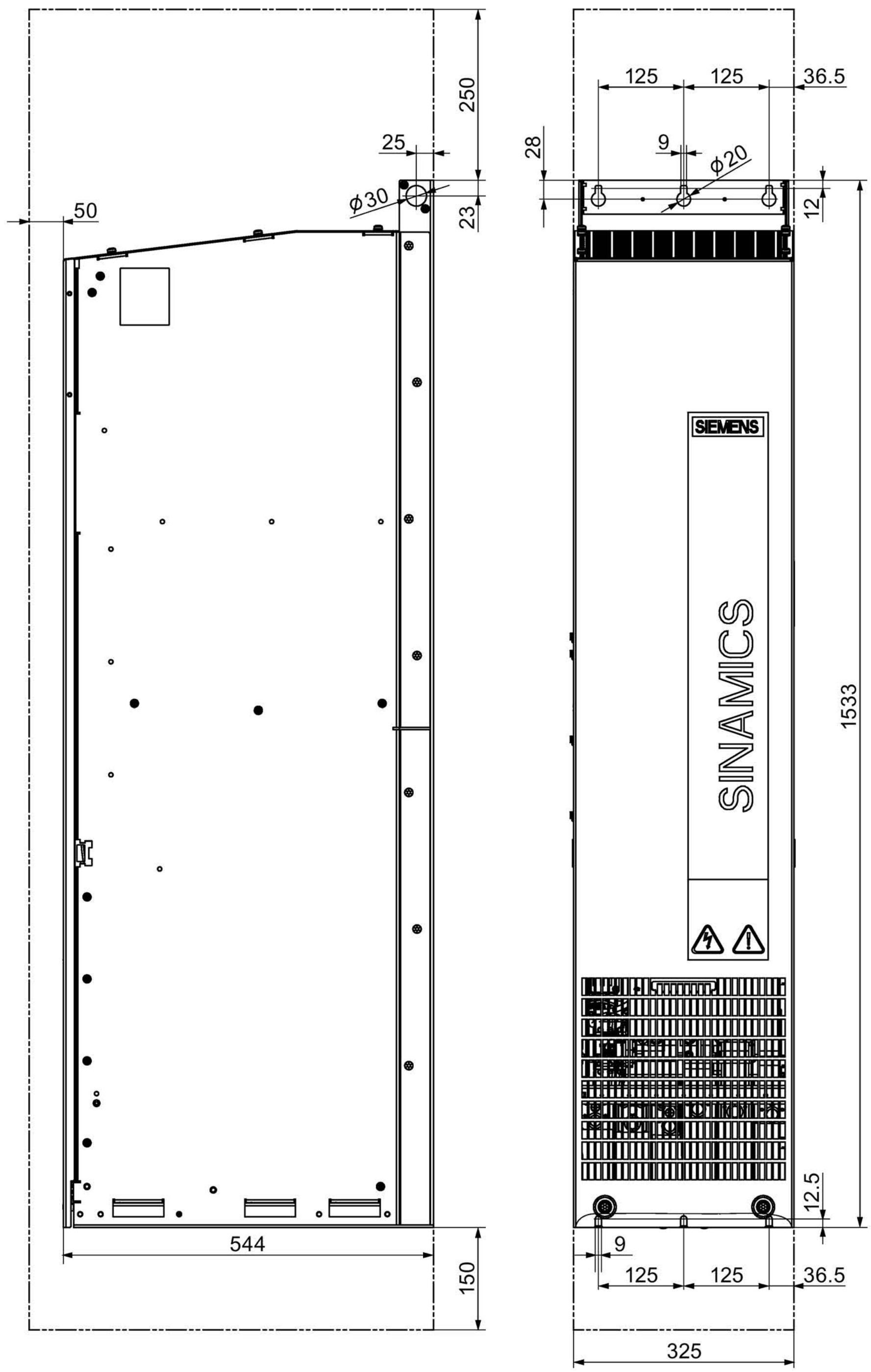


Figure 4-8 Dimension drawing for Active Interface Module, frame size GI Side view, front view

Dimension drawing, frame size HI

The mandatory cooling clearances are indicated by the dotted line.

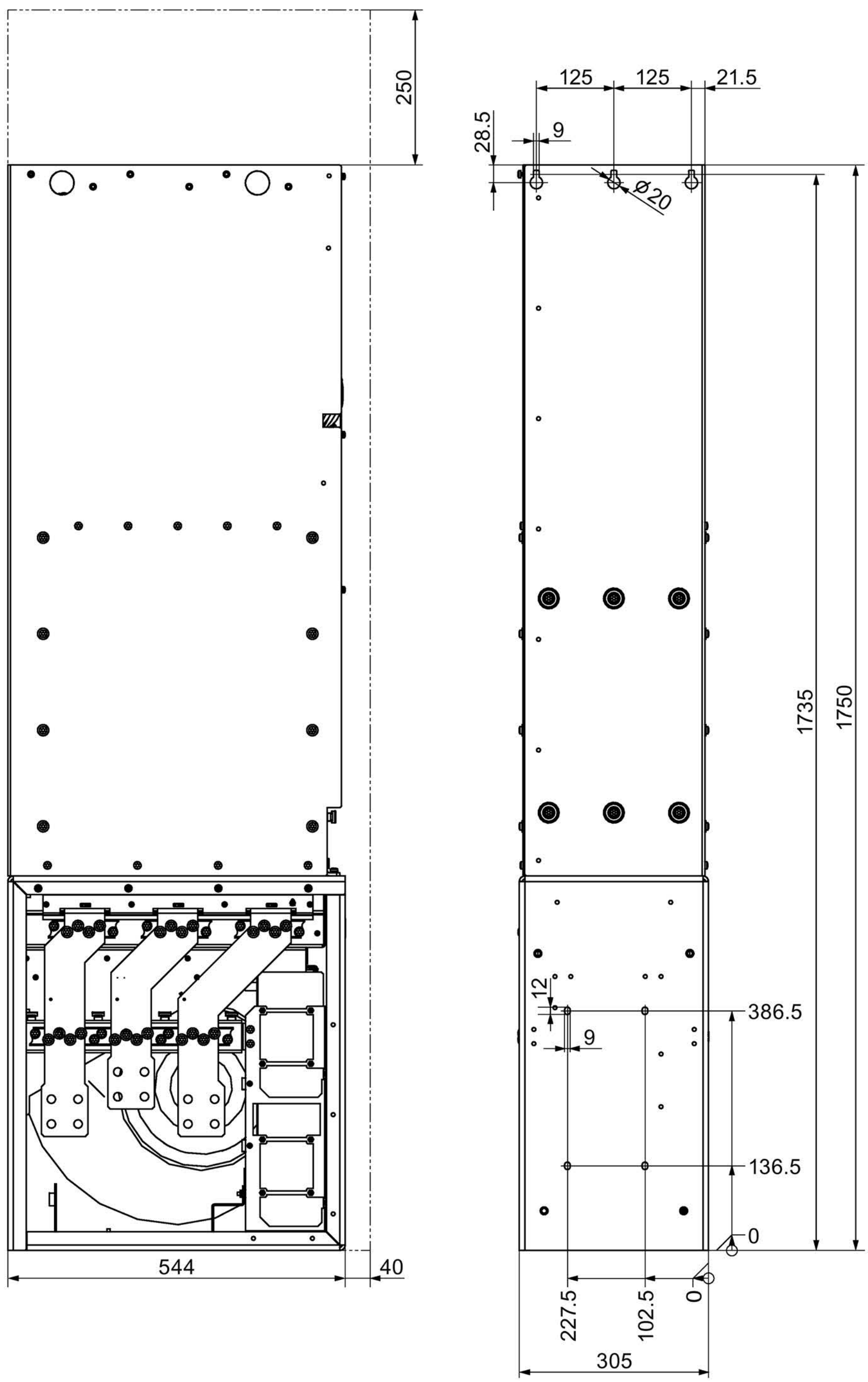


Figure 4-9 Dimension drawing for Active Interface Module, frame size HI Side view, rear view

4.3.5 Electrical connection

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

Removing the connection clip of the integrated basic interference suppression module to ground

The connection of the integrated basic interference suppression module to ground must be disconnected if the device is operated on one of the following line system configurations:

- Non-grounded line supply (IT supply system)
- Line supply with grounded line conductor

The connection is disconnected by removing the connection clip of the integrated basic interference suppression module to ground.

Note

Warning label on the connection clip

A yellow warning label is attached to each connection clip so that it is easier to find.

- The warning label must be removed from the connection clip (by pulling it off) if the connection clip is to remain in the device.

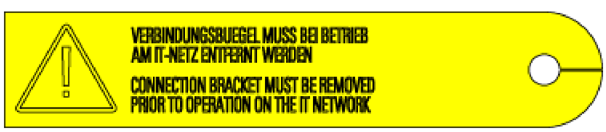


Figure 4-10 Warning label on the connection clip

NOTICE
Damage to the device by not removing the connection clip Failure to remove the connection clip of the integrated basic interference suppression module to ground for a non-grounded line supply (IT supply system) or a line supply with a grounded line conductor can cause significant damage to the device. • For a non-grounded line supply (IT supply system) or a line supply with a grounded line conductor, remove the connection clip of the integrated basic interference suppression module to ground.

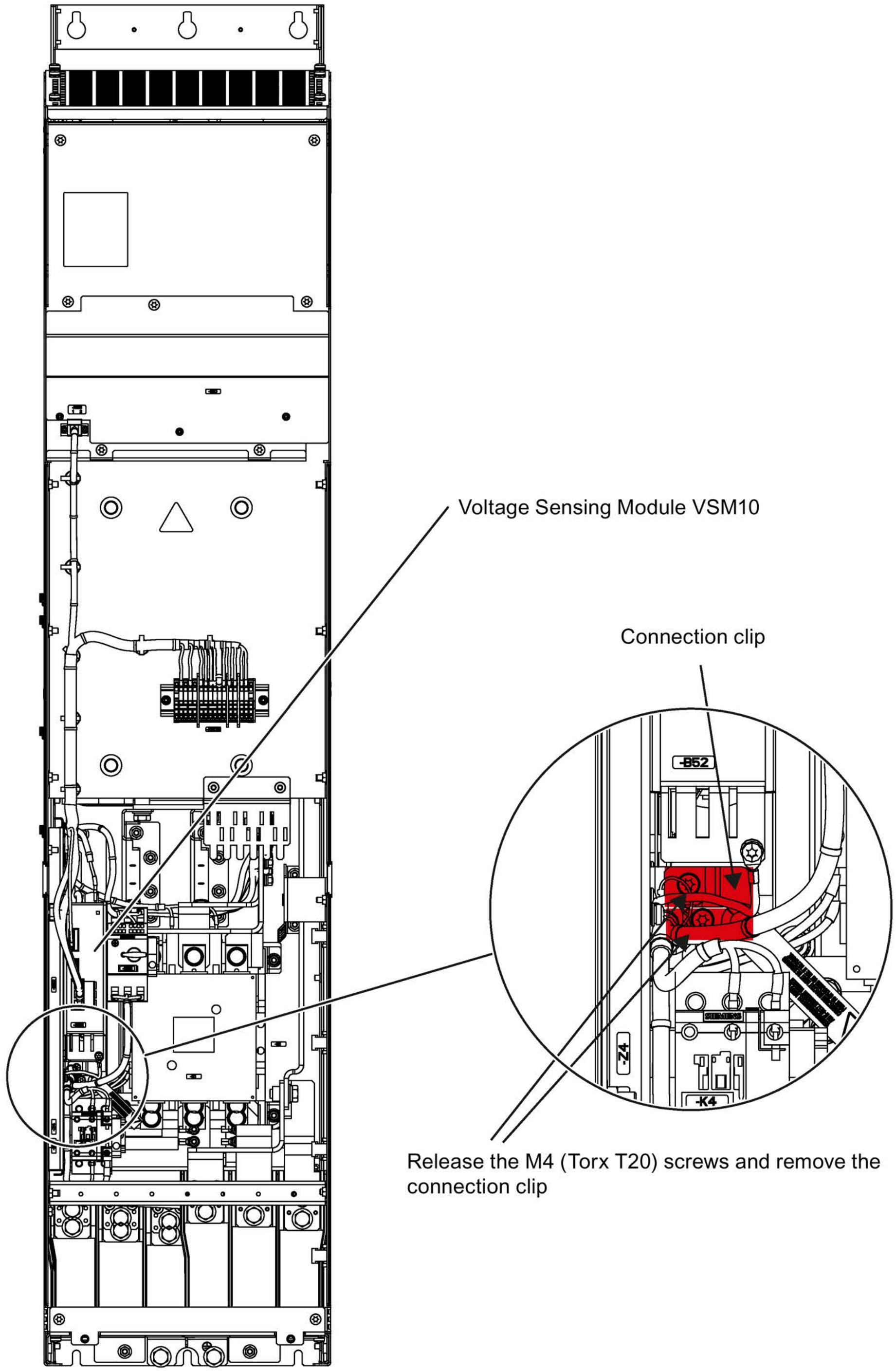


Figure 4-11 Removing the connection clip of the basic interference suppression module to ground for frame size GI

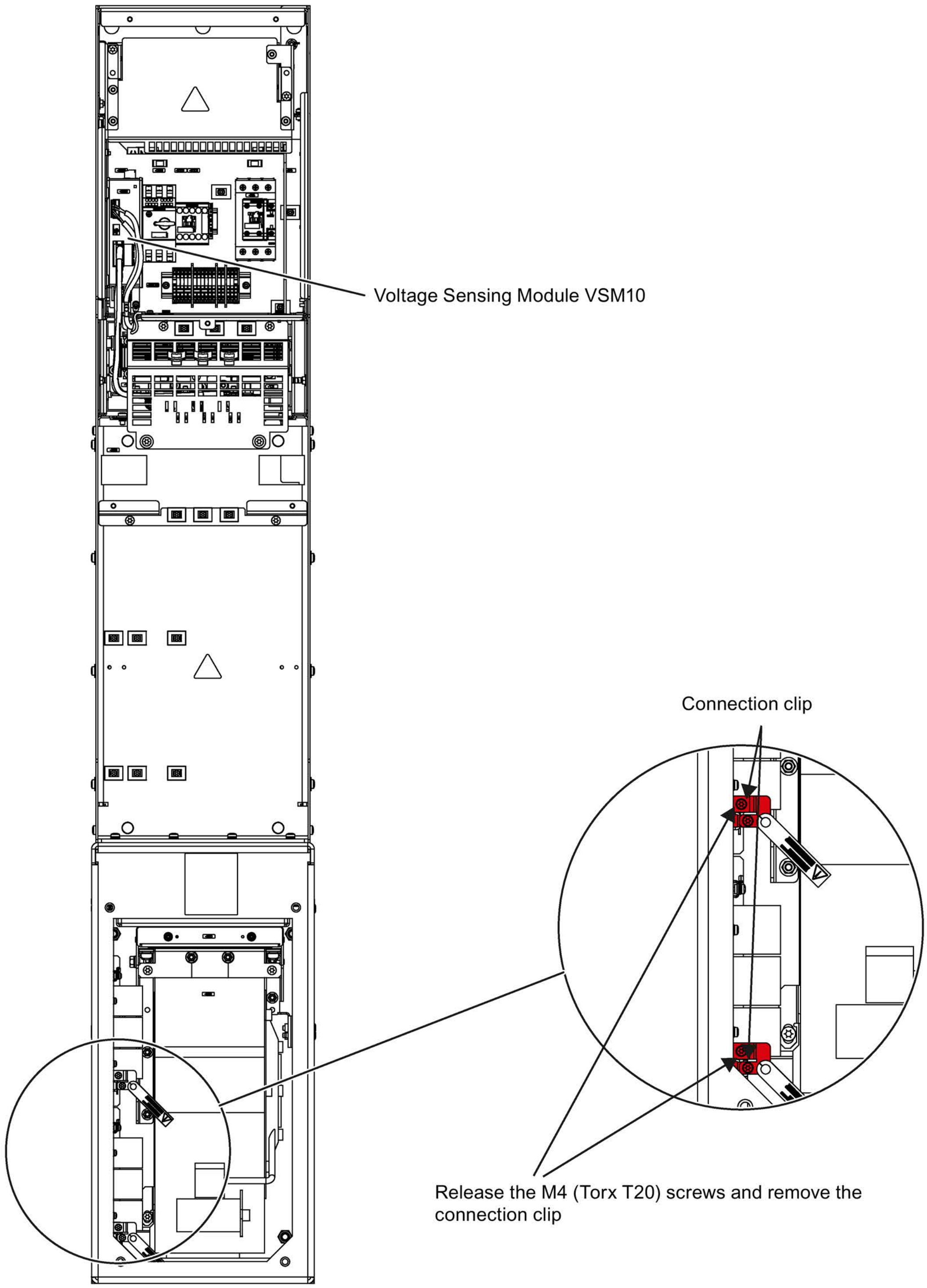


Figure 4-12 Removing the connection clip of the basic interference suppression module to ground for frame size HI

Removing the connector jumper in the VSM10 Voltage Sensing Module

When operating the Active Interface Module on a non-grounded line supply (IT system), at the Voltage Sensing Module (VSM10), remove the plug-in jumper in terminal X530 at the lower side of the component.
Use two screwdrivers or another suitable tool to relieve the holding springs in the terminal and then withdraw the plug-in jumper.

	
Terminal X530 with connector jumper	Relieve the springs and withdraw the connector jumper

4.3.6 Technical data

Table 4- 15 Technical data for Active Interface Modules, 3 AC 380 ... 480 V

Article number	**6SL3300–**	**7TE35–0AA1**			
Suitable for Active Line Module Rated power of Active Line Module	6SL3335- kW	7TE35-0AA3 300			
Rated input current of the Active Line Module	A	490			
Supply voltages - Line voltage - Line frequency - Electronics power supply - Fan supply voltage	 V_{ACrms} Hz V_{DC} V_{AC}	 3 AC 380 -10% (-15% < 1 min) ... 3 AC 480 +10% 47 ... 63 Hz 24 (20.4 ... 28.8) 230 (195.5 ... 264.5)			
DC link capacitance of the drive line-up, max.	 μF	 76800			
Current consumption - Electronics current consumption (24 V DC) - Fan supply, 230 V AC, 50/60 Hz, max. - Max. pre-charging current (max. 3 s)	 A A A	 0.17 0.9 / 1.2 57			
Bypass contactor		included			
Current drawn by the bypass contactor (230 V AC) - Making current - Holding current	 A A	 2.5 1.2			
Max. ambient temperature - Without derating - With derating	 °C °C	 40 55			
Power loss, max. 1) - at 50 Hz 400 V - at 60 Hz 460 V	 kW kW	 3.9 3.9			
Cooling air requirement	m^3/s	0.47			
Sound pressure level L_{pA} (1 m) at 50/60 Hz	 dB(A)	 71 / 73			
Line/load connection L1, L2, L3 / U2, V2, W2		Flat connector for screw M10			
PE connection		M10 screw			
Max. conductor cross-sections - Line connection (L1, L2, L3) - Load connection (U2, V2, W2) - PE connection	 mm² mm² mm²	 2 x 185 2 x 185 2 x 185			
Degree of protection		IP20			
Dimensions - Width - Height - Depth	 mm mm mm	 325 1533 542			
Frame size		GI			
Weight	kg	190			

1) The specified power loss is the maximum value at 100 % utilization. The value in normal operation is lower.

Table 4- 16 Technical data for Active Interface Modules, 3 AC 500 ... 690 V

Article number	6SL3300–	7TG35–8AA1			
Suitable for Active Line Module Rated power of Active Line Module	6SL3335- kW	7TG35-8AA3 630			
Rated input current of the Active Line Module	A	575			
Supply voltages - Line voltage - Line frequency - Electronics power supply - Fan supply voltage	 V_{ACrms} Hz V_{DC} V_{AC}	 3 AC 500 –10% (-15% < 1 min) ... 3 AC 690 +10% 47 ... 63 Hz 24 (20.4 ... 28.8) 230 (195.5 ... 264.5)			
DC link capacitance of the drive line-up, max.	 µF	 59200			
Current consumption - Electronics current consumption (24 V DC) - Fan supply, 230 V AC, max. - Max. pre-charging current (max. 3 s)	 A A A	 0.17 4.6 141			
Bypass contactor [1]	A	3RT1476- 6AP36			
Max. ambient temperature - Without derating - With derating	 °C °C	 40 55			
Power loss, max. [2] - at 50 Hz 690 V - at 60 Hz 575 V	 kW kW	 6.8 6.8			
Cooling air requirement	m^3/s	0.40			
Sound pressure level L_{pA} (1 m) at 50/60 Hz	 dB(A)	 71 / 73			
Line/load connection L1, L2, L3 / U2, V2, W2		Flat connector for screw M12			
PE connection		M12 screw			
Max. conductor cross-sections - Line connection (L1, L2, L3) - Load connection (U2, V2, W2) - PE connection	 mm² mm² mm²	 4 x 240 4 x 240 2 x 240			
Degree of protection		IP00			
Dimensions - Width - Height - Depth	 mm mm mm	 305 1750 544			
Frame size		HI			
Weight	kg	390			

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

2) The specified power loss is the maximum value at 100 % utilization level. The value in normal operation is lower.

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

Chassis units 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 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 lists the permissible output currents as a function of installation altitude and ambient temperature (the permissible compensation between installation altitude and ambient temperatures of < 40 °C – air intake temperature at the air intake of the chassis unit – is taken into account in the specified values).

The values apply under the precondition that a cooling air flow through the devices is ensured as specified in the technical specifications.

As an additional measure at installation altitudes from 2000 m up to 4000 m, an isolation transformer must be used to reduce transient overvoltages in accordance with IEC 61800-5-1.

Table 4- 17 Current derating for chassis units as a function of ambient temperature (air intake 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 air 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 %					

4.3.8 Parameterization

The thresholds for the temperature monitoring must be parameterized correctly for safe operation. This is realized automatically when commissioning the system using the STARTER or Startdrive commissioning tool. When doing this, by selecting the Active Line Module, the appropriate Active Interface Module is automatically assigned (p0220 "Infeed line filter type").

The values for the temperature monitoring for air-cooled Active Interface Modules are set as follows:

- Alarm threshold p3667: 150 °C
- Trip threshold p3668: 180 °C

Note

Note regarding STARTER V4.4.1

The product is supported from STARTER version V4.4.1.

4.4 Active Interface Modules, liquid-cooled

4.4.1 Description

Liquid-cooled Active Interface Modules are used in conjunction with liquid-cooled Active Line Modules in chassis format. The liquid-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.

The bypass contactor must be provided separately for frame size JIL.

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

The liquid-cooled Active Interface Module contains:

- Clean Power Filter
- Filter reactor
- Pre-charging circuit
- Line voltage sensing module VSM10

The liquid-cooled Active Interface Modules comprise the following components:

- Filter reactor
- Filter module
- Associated connection elements (pressure hose, cable, hose connections)

Components

The article numbers of the individual components (filter reactor and filter module) are listed in the following table:

Table 4- 18 Liquid-cooled Active Interface Modules, article numbers of the individual components

Active Interface Module	Filter reactor	Filter module
Line voltage 3 AC 380 ... 480 V		
6SL3305-7TE38-4AA5	6SL3005-0DE38-4AA0	6SL3005-0FE38-4AA5
6SL3305-7TE41-4AA5	6SL3005-0DE41-4AA0	6SL3005-0FE41-4AA5
Line voltage 3 AC 500 ... 690 V		
6SL3305-7TG37-4AA5	6SL3005-0DG37-4AA0	6SL3005-0FG37-4AA5
6SL3305-7TG41-0AA5	6SL3005-0DG41-3AA0	6SL3005-0FG41-0AA5
6SL3305-7TG41-3AA5	6SL3005-0DG41-3AA0	6SL3005-0FG41-3AA5
6SL3305-7TG41-6AA5	6SL3005-0DG41-6AA0	6SL3005-0FG41-6AA5

4.4.2 Safety information

WARNING

Not observing fundamental safety instructions and residual risks

Not observing fundamental safety instructions and residual risks listed in Chapter 1 can result in accidents with severe injuries or death.

- Comply with the fundamental safety instructions.
- When assessing the risk, take into account residual risks.

WARNING

Electric shock due to unconnected cable shields

Hazardous touch voltages can occur through capacitive cross-coupling due to unconnected cable shields.

- Connect the cable shields at both ends to the grounded housing potential.

WARNING

High leakage currents when the protective conductor in the line feeder cable is interrupted

The drive components conduct a high leakage current via the protective conductor. Touching conductive parts when the protective conductor is interrupted can result in death or serious injury.

- Ensure that the external protective conductor satisfies at least one of the following conditions:
  - It has been installed so that it is protected against mechanical damage. [1)]
  - For an individual core, it has a cross-section of at least 10 mm² Cu.
  - If it is a conductor of a multi-conductor cable, it has a cross-section of at least 2.5 mm² Cu.
  - It has a second protective conductor in parallel with the same cross-section.

  [1)] Cables laid within control cabinets or closed machine housings are considered to be adequately protected against mechanical damage.
- Observe the local regulations for protective conductors subject to a high leakage current at the operating location.

WARNING

Fire due to inadequate ventilation clearances

Inadequate ventilation clearances can cause overheating of components with subsequent fire and smoke. This can cause serious injury or even death. This can also result in increased failures and shorter service lives for devices/systems.

- Observe the ventilation clearances above, below and in front of the component, which are specified in the dimension drawings.

WARNING

Electric shock due to unexpectedly long discharge time

If you operate the Active Interface Module without an Active Line Module, the discharge time extends to more than 20 minutes after the supply voltage has been disconnected. As a result, dangerous voltage may unexpectedly be present at the terminals of the Active Interface Module.

Contact with live parts can result in death or serious injury.

- Only operate the Active Interface Module together with an Active Line Module.

CAUTION

Burns resulting from high surface temperature of the filter reactor

The filter reactors can become very hot. Contact with the surface can result in severe burns.

- Mount the filter reactors so that contact is not possible. If this is not possible, attach clearly visible and understandable warning notices at hazardous positions.
- To prevent adjacent components from suffering damage due to these high temperatures, maintain a ventilation clearance of at least 140 mm above the filter reactors.

NOTICE

Material damage caused by mechanically stressed busbars and coolant connections

Mechanically stressed busbars and coolant connections can damage the device.

- Do not use the busbars and liquid coolant connections protruding from the device as handles or as support surfaces during transport.

NOTICE

Damage to the device through operation of the Active Interface Module without Active Line Module

If the Active Interface Module is operated without the associated Active Line Module, it can be damaged.

- Only operate the Active Interface Module in conjunction with the associated Active Line Module.

NOTICE

Damage to the Active Interface Modules when operated without coolant

If the Active Interface Module is operated without liquid coolant, even when operated under no-load conditions, the Active Interface Module can be damaged.

- Only operate the Active Interface Module with a filled and functioning cooling circuit.

Note

Cable lengths

The connecting cables between the filter reactor and the filter module must be kept as short as possible (max. 2 m).

4.4.3 Interface description

4.4.3.1 Overview

Interface overview of the filter reactor

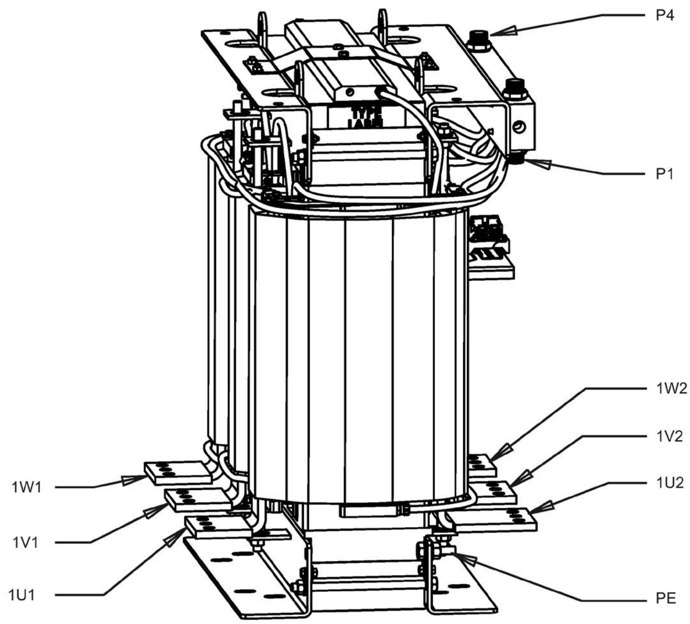


Figure 4-13 Interface overview filter reactor, size JIL, valid for article numbers 6SL3005-0DE38-4AA0, 6SL3005-0DG37-4AA0 and 6SL3005-0DG41-3AA0

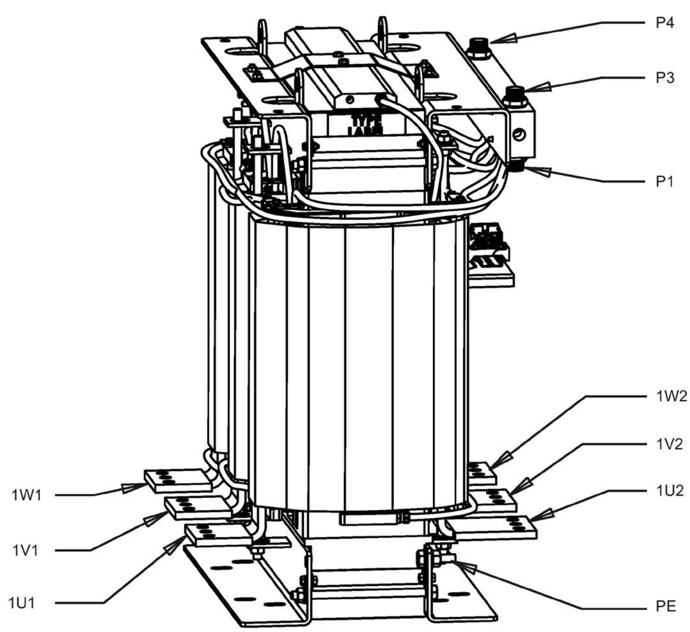
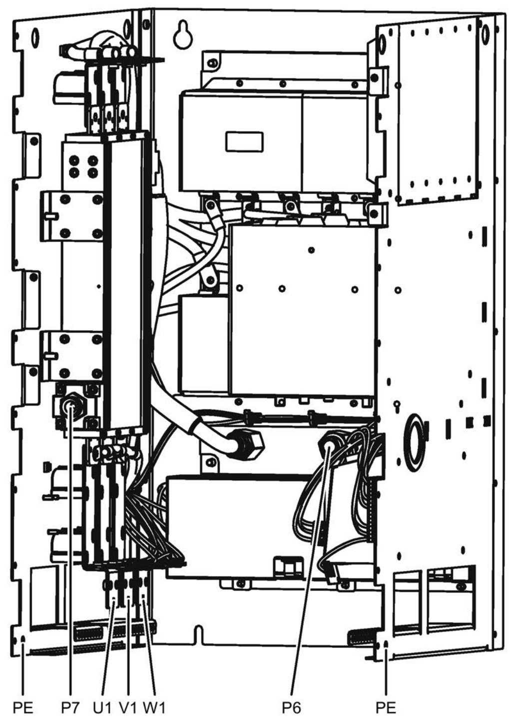


Figure 4-14 Interface overview filter reactor, frame size JIL, valid for article numbers 6SL3005-0DE41-4AA0 and 6SL3005-0DG41-6AA0

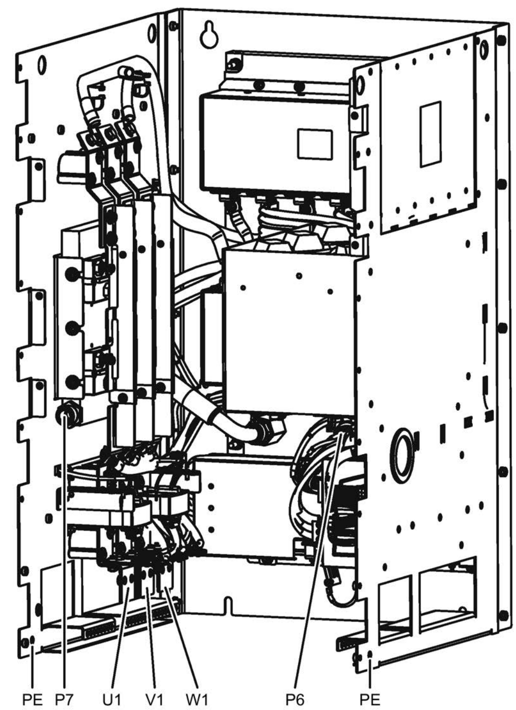
Interface overview of the filter module

The following interface overviews are valid for article numbers 6SL3005-0FE38-4AA5, 6SL3005-0FG37-4AA5, 6SL3005-0FG41-0AA5 and 6SL3005-0FG41-3AA5

The function release with designation "FS:" is stamped on the nameplate; there are two different filter module versions available.



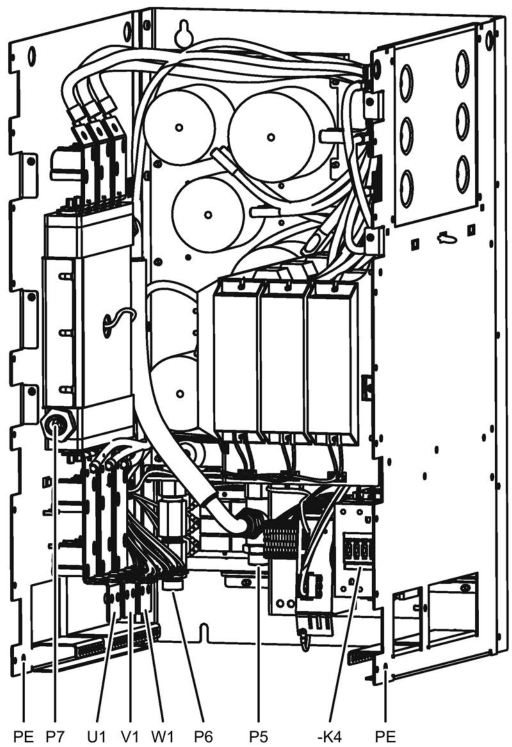
Interface overview filter module, size JIL, valid for function release FS ≠ 03



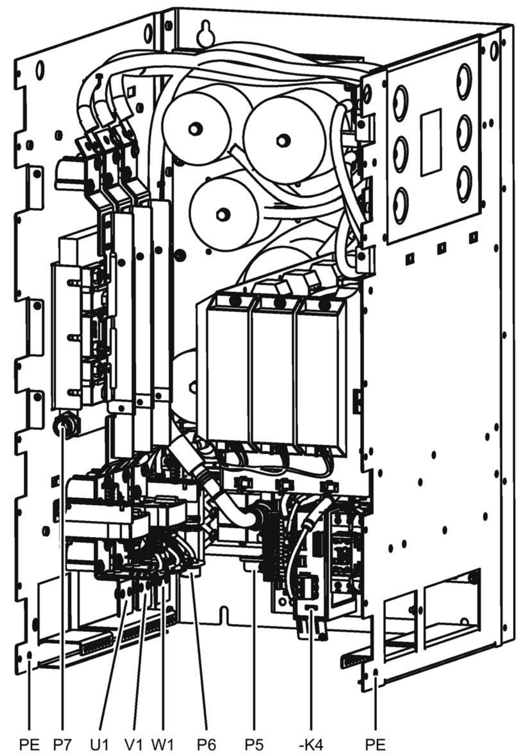
Interface overview filter module, size JIL, valid for function release FS = 03

The following interface overviews are valid for article numbers 6SL3005-0FE41-4AA5 and 6SL3005-0FG41-6AA5

The function release with designation "FS:" is stamped on the nameplate; there are two different filter module versions available.



Interface overview filter module, size JIL, valid for function release FS ≠ 03



Interface overview filter module, size JIL, valid for function release FS = 03

4.4.3.2 Connection example

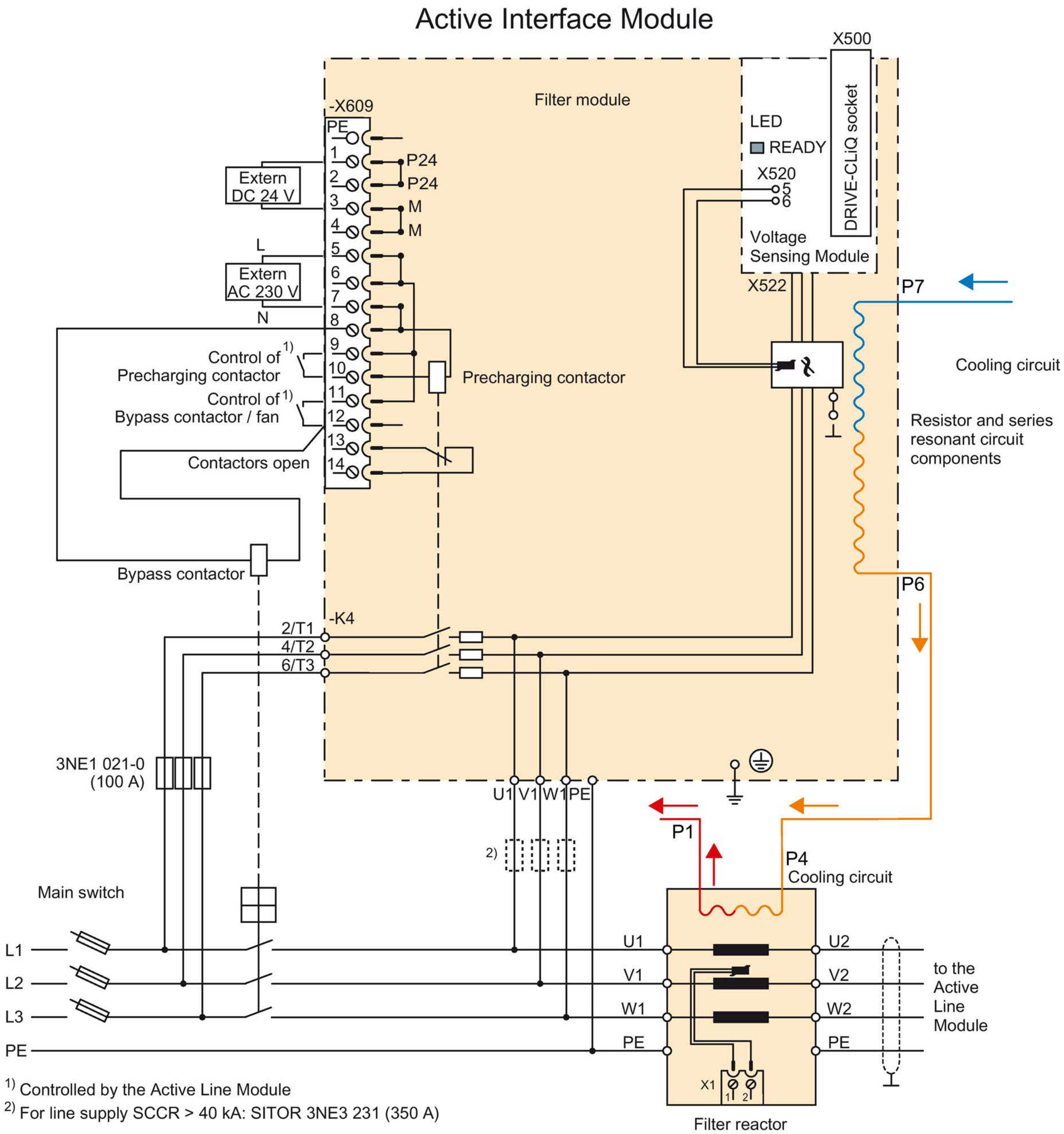


Figure 4-15 Connection example of liquid-cooled Active Interface Module, frame size JIL, valid for article numbers 6SL3305-7TE38-4AA5, 6SL3305-7TG37-4AA5, 6SL3305-7TG41-0AA5 and 6SL3305-7TG41-3AA5

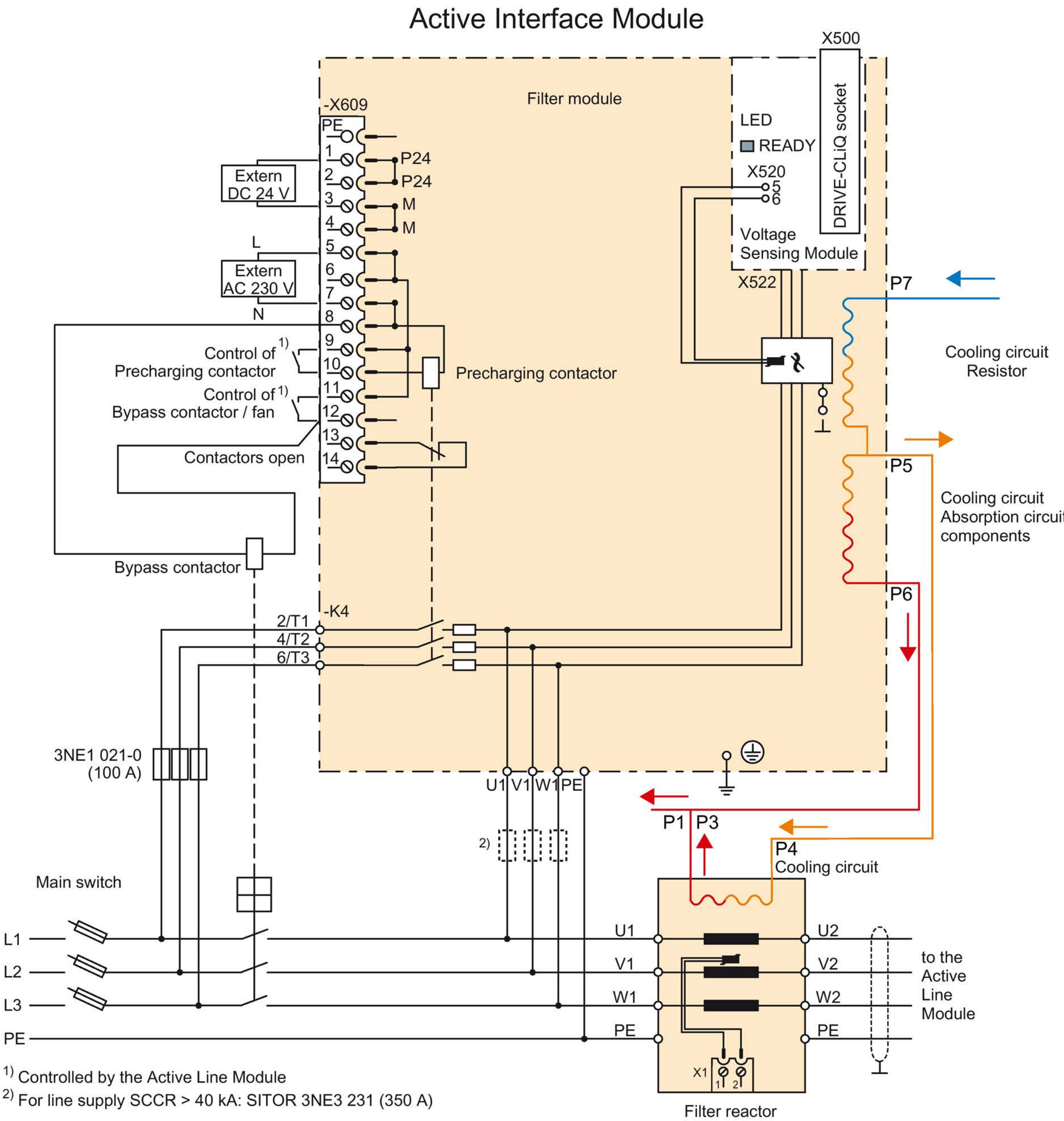


Figure 4-16 Connection example of liquid-cooled Active Interface Module, frame size JIL, valid for article numbers 6SL3305-7TE41-4AA5 and 6SL3305-7TG41-6AA5

> **NOTICE**
>
> **Damage to the devices as a result of excessively long switching times of the bypass contactor**
>
> When using a bypass contactor with excessively long switching times (maximum 500 ms), the required overlap phase is not guaranteed, where both contactors are simultaneously pulled-in. As a consequence, the Active Interface Module can be overloaded and destroyed.
>
> - Only use Siemens bypass contactors; the associated data are provided in the technical data.

> **NOTICE**
>
> **Damage to the device through different phase sequence in the pre-charging and main circuits**
>
> Different phase sequences in the pre-charging and main circuits can overload and destroy the pre-charging resistors of the Active Interface Module during the brief overlap period, where both contactors are simultaneously closed.
>
> - Close the power cables in the pre-charging and main circuits with the same phase sequence.

4.4.3.3 Line/load connection

Table 4- 19 Filter reactor connections

Terminals	Designations
Line connection: U1, V1, W1 Load connection: U2, V2, W2	Voltage: • 3 AC 380 V -10% (-15% < 1 min) ... 3 AC 480 V +10% • 3 AC 500 V -10% (-15% < 1 min) ... 3 AC 690 V +10% Frequency: 47 ... 63 Hz Connection lug: M12/50 Nm for busbar connection
PE connection	Connecting thread: M10 / 25 Nm for cable lugs in accordance with DIN 46234 / DIN 46235 [1)]

[1)] Dimensions for connecting alternative cable lugs, see "Cable lugs" in the Appendix.

> **Note**
>
> **Busbar connection for line/load connections with 4 screw holes from below**
>
> For filter reactors with line/load connections with 4 screw holes (connection type 1, see Chapter "Dimension drawing (Page 97)") the busbars must be installed from below to the connection lugs. It is not possible to connect the busbars from the top as a result of the position of the cooling lines for the filter reactor.

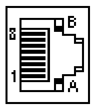
Table 4- 20 Filter module connections

Terminals	Designations
K4: 2/T1, 4/T2, 6/T3	Connection for pre-charging circuit directly on pre-charging contactor: 2 x 35mm² max. (3RT1044)
PE connection	Connection lug: M8 / 13 Nm for cable lugs in accordance with DIN 46234 / DIN 46235 [1)]

[1)] Dimensions for connecting alternative cable lugs, see "Cable lugs" in the Appendix.

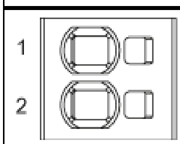
4.4.3.4 DRIVE-CLiQ interface X500

Table 4- 21 DRIVE-CLiQ interface X500

Connector	PIN	Signal name	Technical data
	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.) Article number: 6SL3066-4CA00-0AA0			

4.4.3.5 X530 neutral point grounding

Table 4- 22 Neutral point grounding X530

Connector	Terminal	Designation	Technical specifications
	1	Neutral point of the voltage sensing	Jumper inserted: Grounded measurement Jumper not inserted: isolated measurement
	2	Ground potential	

The Voltage Sensing Module is supplied with inserted jumper. When delivered, the neutral point is connected to the protective conductor via the connector jumper. Current can flow to PE. This connection is removed by removing the connector jumper. The measurement is then electrically isolated.

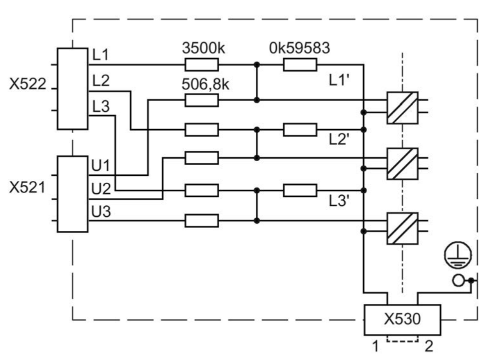


Figure 4-17 Internal circuit of the VSM10 Voltage Sensing Module

When the Active Interface Module is operated on an ungrounded line system (IT system), the connection clip must be removed, see "Electrical connection (Page 112)".

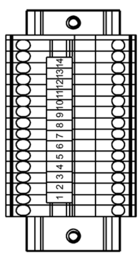
Note

Replacing a VSM10 Voltage Sensing Module

When replacing a Voltage Sensing Module VSM10 by one with a different article number, then inform yourself about the applicable boundary conditions.

4.4.3.6 X609 terminal strip

Table 4- 23 Terminal strip X609

Connector	Terminal	Designation	Technical data	
	PE	PE	PE connection	
	1	P24	External 24 V DC supply Voltage: 24 V DC (20.4 ... 28.5 V) Current consumption: max. 0.25 A	
	2	P24		
	3	M		
	4	M		
	5	L	Voltage: 230 V AC (195.5 ... 264.5 V) Current consumption: max. 4 A	
	6	L		
	7	N		
	8	N		
	9	Pre-charging contactor–A1	Voltage: 230 V AC (195.5 ... 264.5 V) Current consumption: max. 4 A	To Active Line Module, X9:5
	10	Pre-charging contactor–A2		To Active Line Module, X9:6
	11	Bypass contactor–A1	Voltage: 230 V AC (195.5 ... 264.5 V) Current consumption: max. 6 A	To Active Line Module, X9:3
	12	Bypass contactor–A2		To Active Line Module, X9:4
	13	Contactor feedback signal 1	Voltage: 230 V AC (195.5 ... 264.5 V) Max. permissible current: 6 A	
	14	Contactor feedback signal 2		
	PE	PE	PE connection	
Max. connectable cross-section: 2.5 mm²				

4.4.3.7 X1 temperature sensor connection at the filter reactor

Table 4- 24 Terminal strip X1 at filter reactor

Terminal	Designations
1	PT1000 temperature sensor connection
2	
Max. connectable cross-section: 2.5 mm²	

Note

When operating the Active Interface Module, it is not necessary to evaluate the temperature sensor at the filter reactor.
In the filter module cooling circuit, a water-cooled resistor has an integrated PT1000 temperature sensor, which is internally evaluated by the VSM10.

The following temperature thresholds apply for additional filter reactor temperature monitoring:

- Alarm: 140 °C
- Fault: 150 °C

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

Table 4- 25 Description of the LED on the Voltage Sensing Module (VSM) in the Active Interface Module

LED	Color	Status	Description
RDY	---	Off	The electronics power supply is missing or lies outside the permissible tolerance range.
	Green	Continuous light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	Continuous light	DRIVE-CLiQ communication is being established.
	Red	Continuous light	This component has at least one fault. **Remark:** The LED is activated irrespective of whether the corresponding messages have been reconfigured.
	Green/red	Flashing 0.5 Hz	Firmware is being downloaded.
		2 Hz flashing light	Firmware download is complete. Waiting for POWER ON.
	Green / orange or red / orange	2 Hz flashing light	Detection of the components via LED is activated (p0144). **Remark:** Both options depend on the LED status when module recognition is activated via p0144 = 1.

4.4.4 Dimension drawing

Dimension drawing, filter reactor

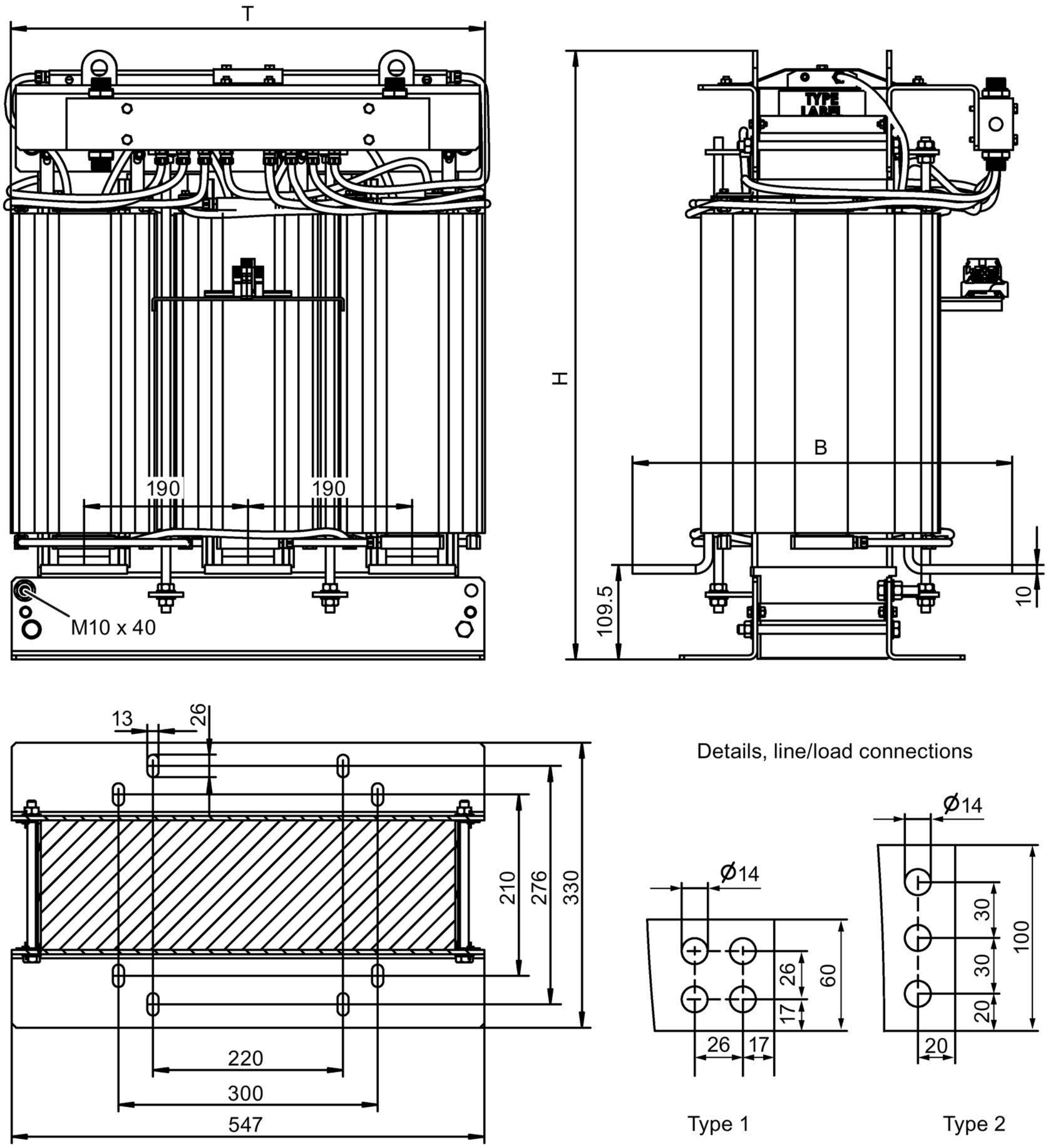


Figure 4-18 Dimension drawing, filter reactor frame size JIL

Table 4- 26 Dimensions of the filter reactors (all values in mm)

6SL3005-	0DE38-4AA0	0DE41-4AA0	0DG37-4AA0	0DG41-3AA0	0DG41-6AA0
W	349	382	358	440	440
H	700	698	675	705	705
D	<575	<575	<575	<575	<575
Connection type	Type 1	Type 1	Type 1	Type 2	Type 2

Dimension drawing, filter module

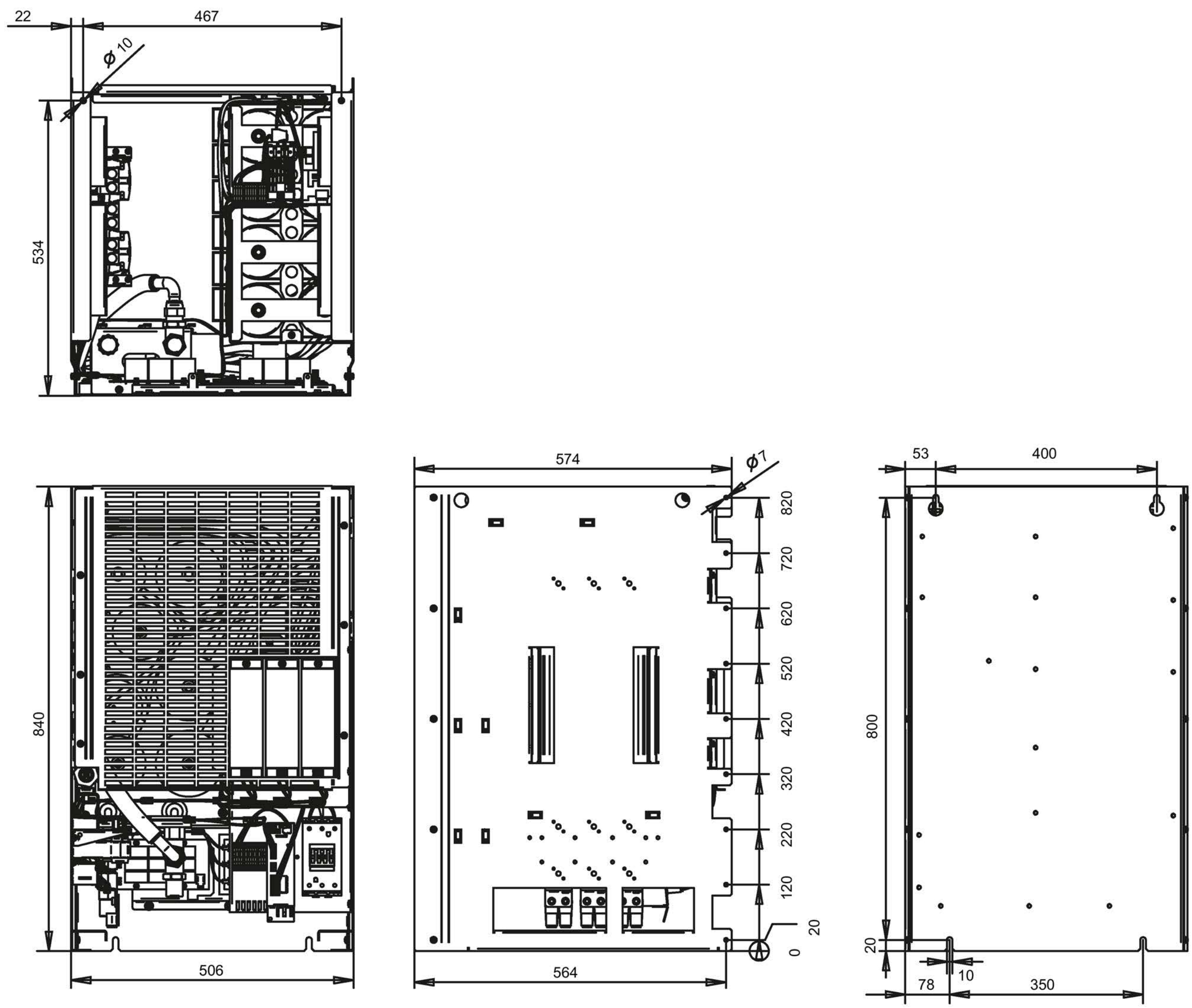


Figure 4-19 Dimension drawing, filter module, frame size JIL

4.4.5 Installation

Transport fixtures for the filter reactor

There are lifting eyes on the top of the filter reactor to facilitate transporting it.

NOTICE
Damage to the device due to improper transport
Improper transport can mechanically stress the housing of the filter reactor that can damage it. • Use a lifting harness with vertical ropes or chains when transporting the filter reactor. • Do not use the busbars of the filter reactor as handles or for fastening a lifting harness.

Screw coupling points to mechanically support the filter module

The filter module is mounted at the rear of the control cabinet. The side panels of the filter module must be mechanically supported against vibration. Screw coupling points are provided on the side panels for this purpose.

Removing the transport plate

A transport plate is mounted on the underside of the filter module for transport. Remove this transport plate before installation in a control cabinet.

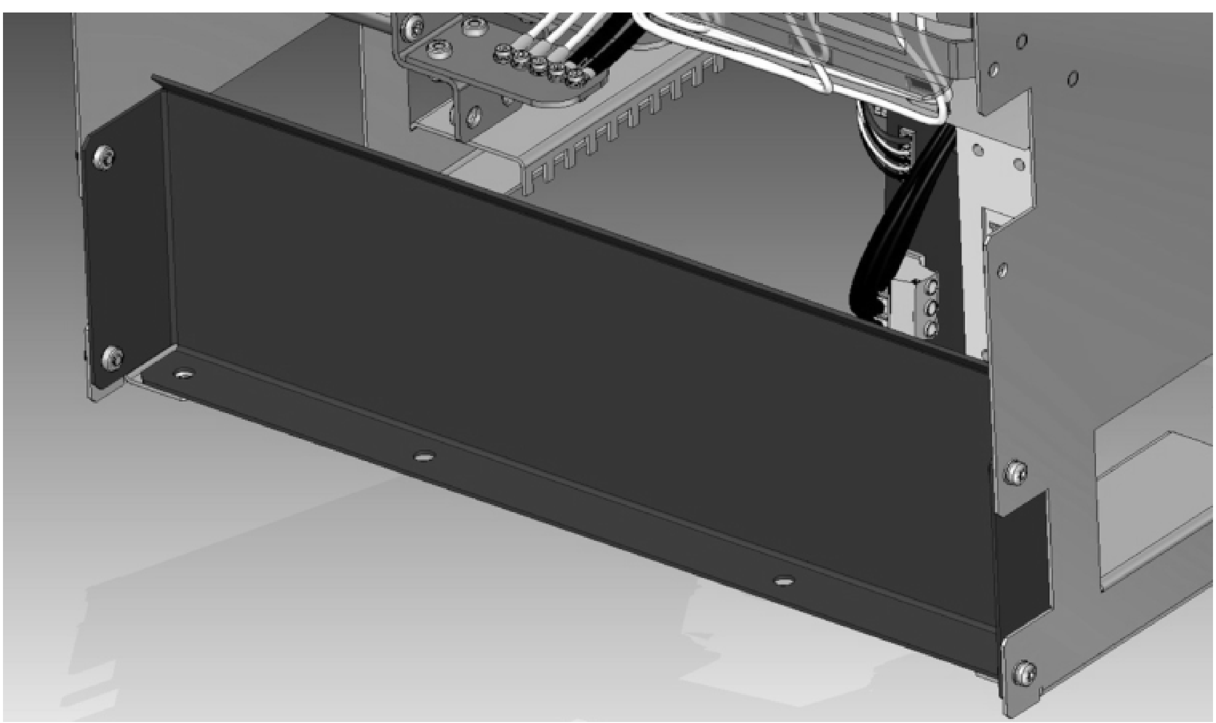


Figure 4-20 Transport plate on the underside of the filter module

4.4.6 Notes on installation in a control cabinet

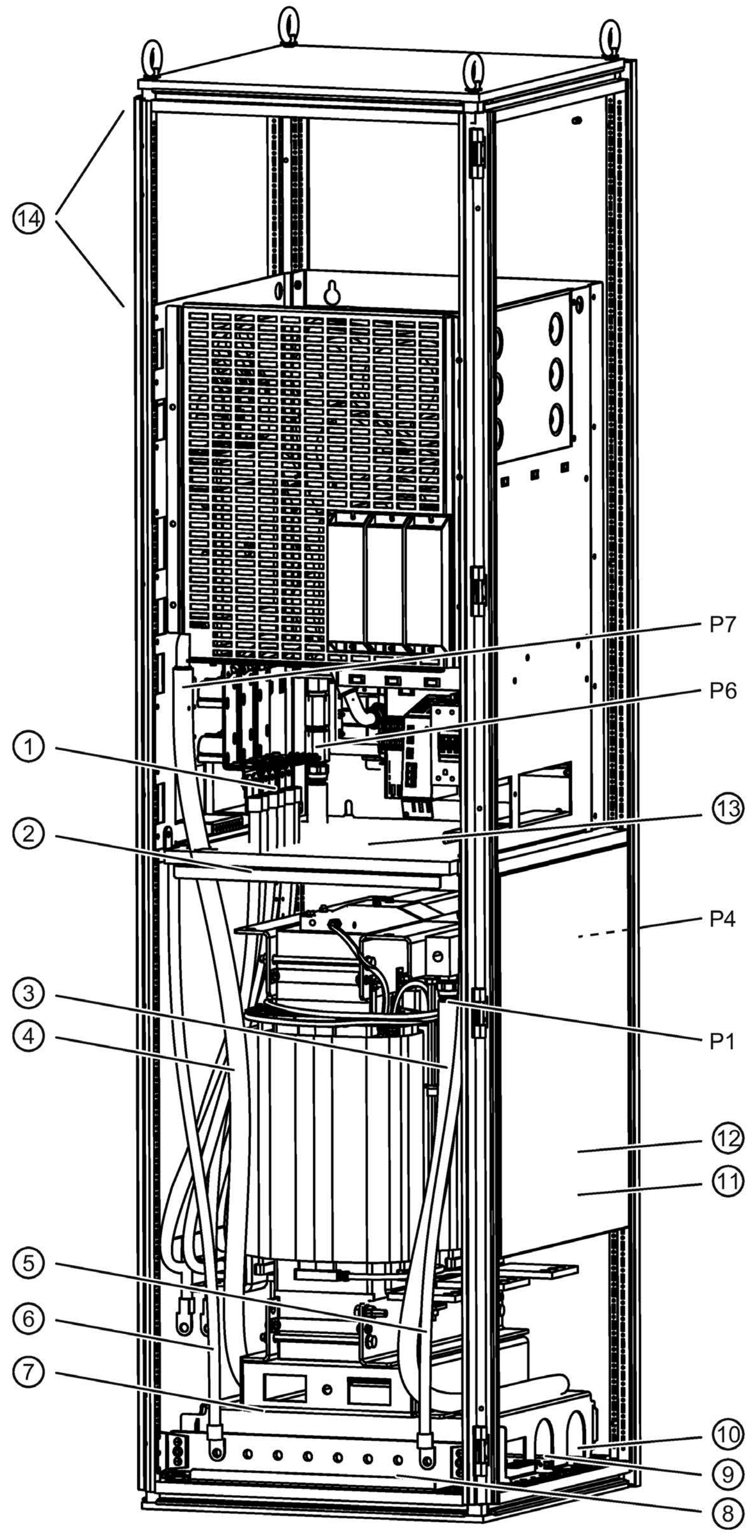
A typical control cabinet design is shown in the following that shows the mounting of the main components (filter reactor and filter module) with the supplied pressure hoses and connecting cables.

Connection kit for Active Interface Modules

The connection kit for liquid-cooled Active Interface Modules is shown in the following.

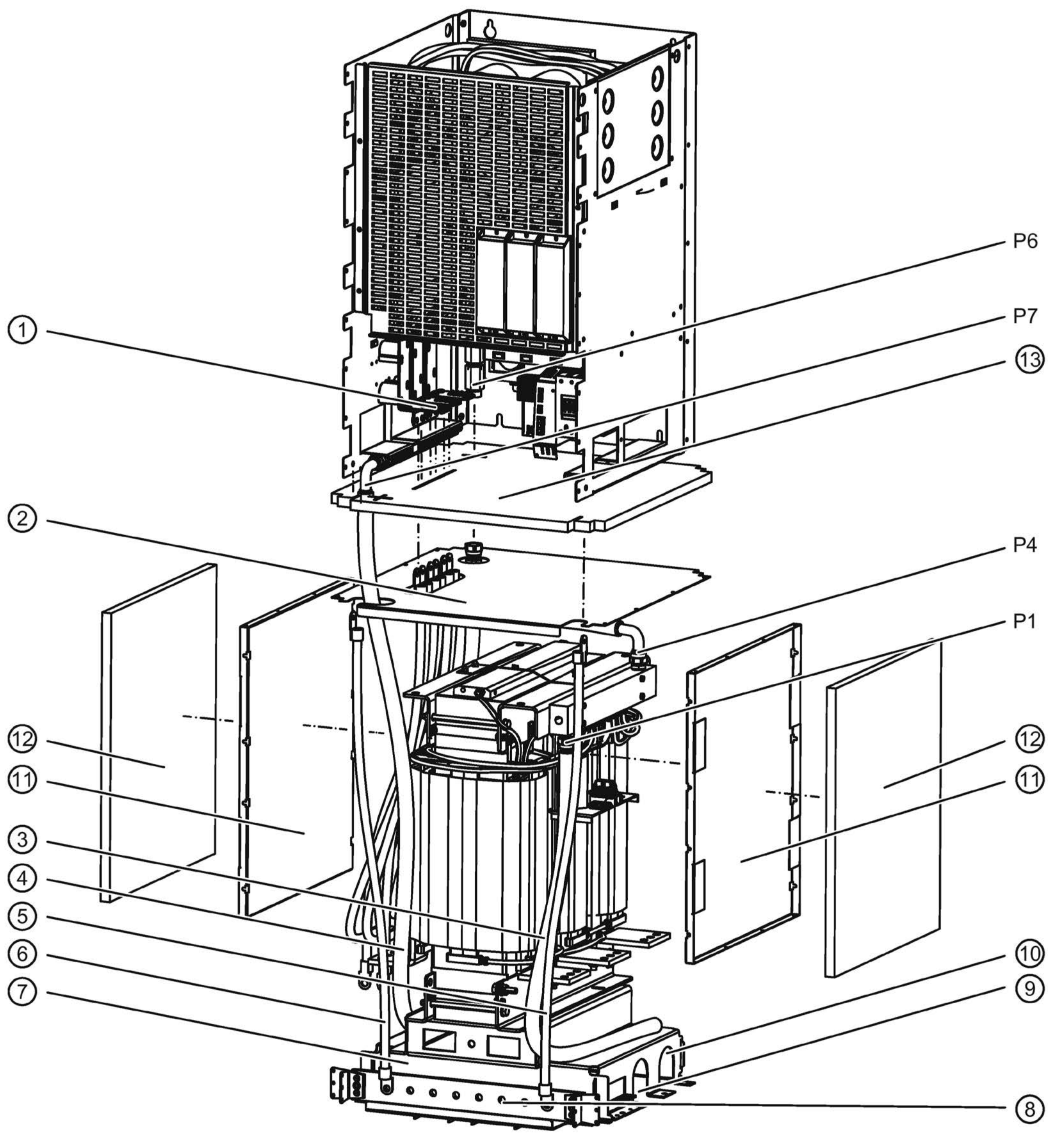
Figure 4-21 Connection kit for Active Interface Modules

Control cabinet example, valid for article numbers 6SL3305-7TE38-4AA5, 6SL3305-7TG37-4AA5, 6SL3305-7TG41-0AA5 and 6SL3305-7TG41-3AA5



① Connections (U1, V1, W1) at the filter module to establish the connection to the line side of the filter reactor (U1, V1, W1)
② Partition plate (not included in the scope of supply) to shield the power loss of the filter reactor from the filter module
③ Hose between the return and filter reactor (P1)
④ Hose between the intake and filter module (P7)
⑤ PE connection between the PE rail and filter module
⑥ PE connection between the PE rail and filter module
⑦ Support plate (not included in the scope of supply) for the filter reactor
⑧ PE rail (not included in the scope of supply)
⑨ Intake (not included in the scope of supply)
⑩ Return (not included in the scope of supply)
⑪ Holding plate for lateral insulating mats (not included in the scope of supply)
⑫ Lateral insulating mat (not included in the scope of supply)
⑬ Insulating mat between the filter reactor and filter module (not included in the scope of supply)
⑭ Mounting space for DC busbars, 200 mm high

Figure 4-22 Typical control cabinet design, Rittal TS8, cabinet width 600 mm



① Connections (U1, V1, W1) at the filter module to establish the connection to the line side of the filter reactor (U1, V1, W1)
② Partition plate (not included in the scope of supply) to shield the power loss of the filter reactor from the filter module
③ Hose between the return and filter reactor (P1)
④ Hose between the intake and filter module (P7)
⑤ PE connection between the PE rail and filter module
⑥ PE connection between the PE rail and filter module
⑦ Support plate (not included in the scope of supply) for the filter reactor
⑧ PE rail (not included in the scope of supply)
⑨ Intake (not included in the scope of supply)
⑩ Return (not included in the scope of supply)
⑪ Holding plate for lateral insulating mats (not included in the scope of supply)
⑫ Lateral insulating mat (not included in the scope of supply)
⑬ Insulating mat between the filter reactor and filter module (not included in the scope of supply)

Figure 4-23 Typical control cabinet design, Rittal TS8, cabinet width 600 mm, exploded view

There must be a minimum clearance of 970 mm between the lower edge of the transport plate (⑦) and the lower edge of the filter module.

The dimensions of the typical cabinet (Rittal TS8) are (width x height x depth) 600 mm x 2200 mm x 600 mm

The insulating mat between the filter reactor and the filter module is made of "AF/Armaflex AF-19MM/EA" and has the following properties:

- Thickness: 19 mm
- Thermal conductivity: ≤ 0.033 W/(m x K)
- Upper application temperature: 110 °C
- UL certification
- Self adhesive

The entries for the cables and hoses should be made so that there is no heat loss (e.g. cross-shaped cuts).

The lateral insulating mats are made of "HT/Armaflex HT-10-99/E" and have the following properties:

- Thickness: 10 mm
- Thermal conductivity: ≤ 0.042 W/(m x K)
- Upper application temperature: 150 °C
- UL certification
- Not self-adhesive (are held by the lugs of the lateral holding plate)

Additional insulating mats made of the same material should be attached to the front and rear of the control cabinet.

Note

Use of thermally insulating mats

In the electrical cabinet design shown as example, thermally insulating mats must be used in order to maintain the following boundary conditions:

- The insulating mats are used so that the power loss dissipated to the coolant is maintained, and the power loss dissipated to the environment is not exceeded.
- The lateral thermally insulating mats (⑫) prevent the adjacent cabinets and/or doors from becoming too hot.
- The thermally insulating mat between the filter reactor and filter module (⑬) prevents the filter module from overheating as a result of the power loss in the filter reactor.

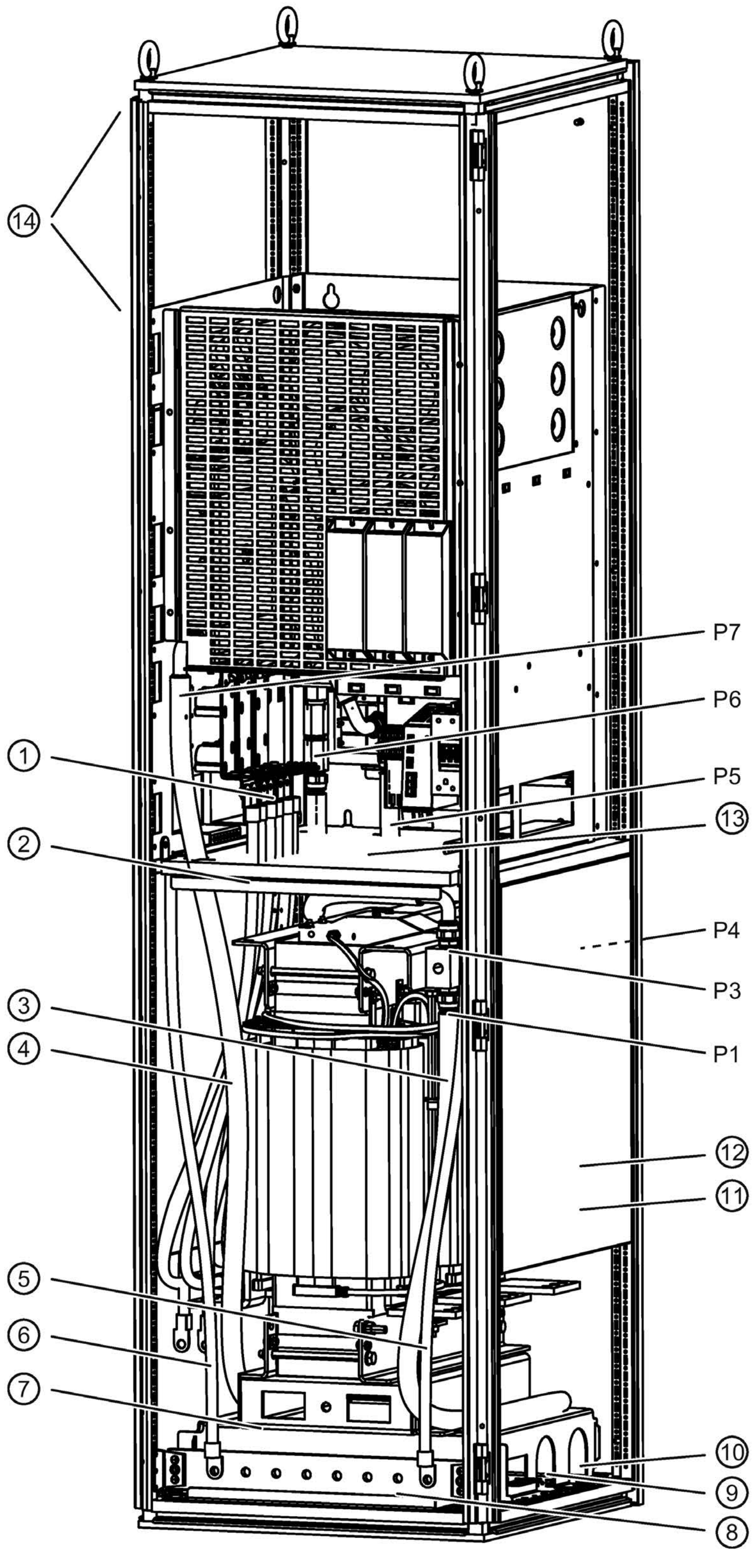
WARNING

Fire and device damage as a result of ground fault/short-circuit

Inadequate installation of the cables between the filter reactor and the filter module can result in a ground fault/short-circuit and place persons at risk as a result of the associated smoke and fire.

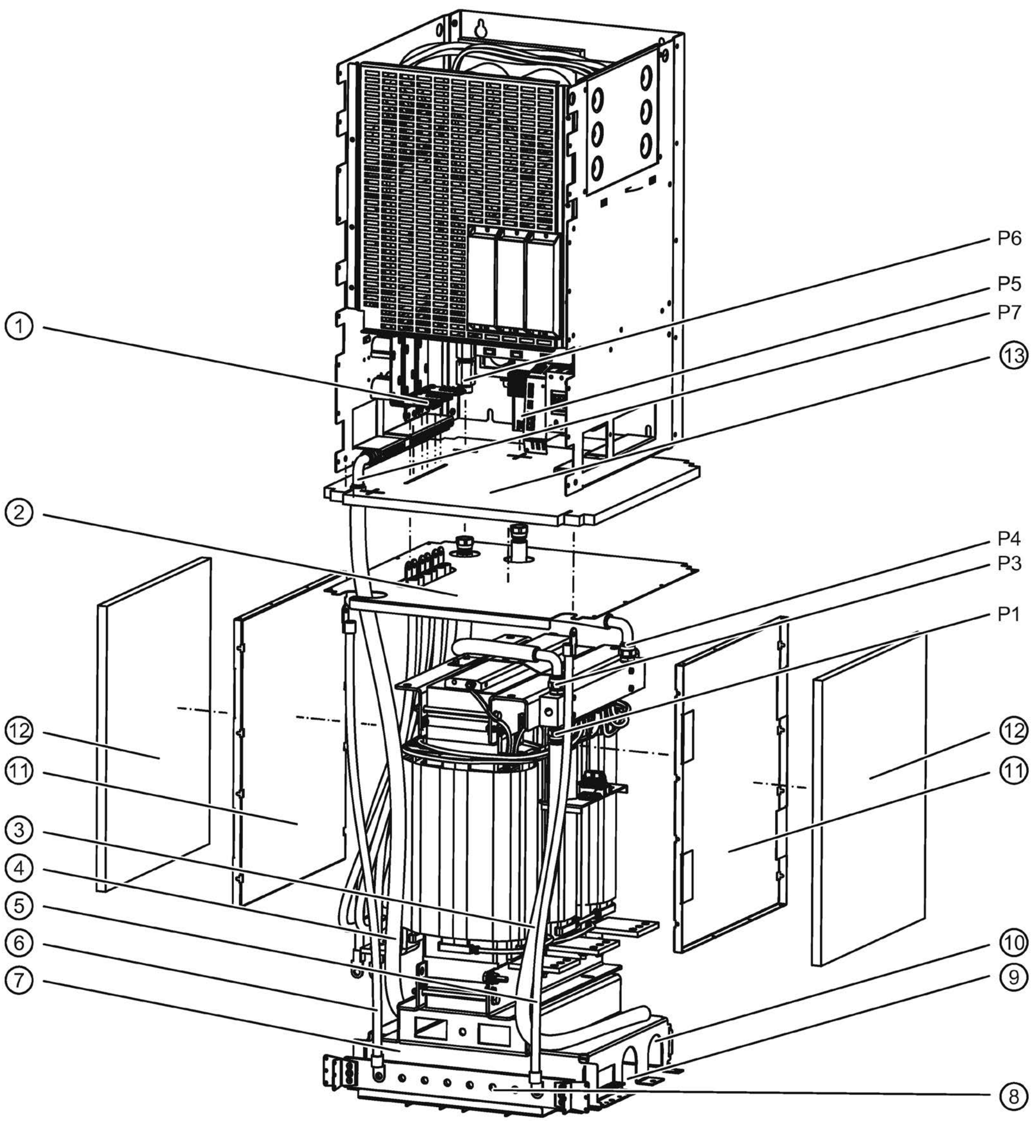
- Apply the local installation regulations to avoid this fault.
- Protect the cables against mechanical damage.
- Also implement one of the following measures:
  - Use cables with double insulation.
  - Maintain adequate clearance, e.g. by using spacers.
  - Lay the cables in separate cable ducts or conduits.

Control cabinet example, valid for article number 6SL3305-7TE41-4AA5 and 6SL3305-7TG41-6AA5



① Connections (U1, V1, W1) at the filter module to establish the connection to the line side of the filter reactor (U1, V1, W1)
② Partition plate (not included in the scope of supply) to stabilize the thermally insulating mat between the filter reactor and the filter module (⑬)
③ Hose between the return and filter reactor (P1)
④ Hose between the intake and filter module (P7)
⑤ PE connection between the PE rail and filter module
⑥ PE connection between the PE rail and filter module
⑦ Support plate (not included in the scope of supply) for the filter reactor
⑧ PE rail (not included in the scope of supply)
⑨ Intake (not included in the scope of supply)
⑩ Return (not included in the scope of supply)
⑪ Holding plate for lateral insulating mats (not included in the scope of supply)
⑫ Lateral insulating mat (not included in the scope of supply)
⑬ Insulating mat between the filter reactor and filter module (not included in the scope of supply)
⑭ Mounting space for DC busbars, 200 mm high

Figure 4-24 Typical control cabinet design, Rittal TS8, cabinet width 600 mm



① Connections (U1, V1, W1) at the filter module to establish the connection to the line side of the filter reactor (U1, V1, W1)
② Partition plate (not included in the scope of supply) to stabilize the thermally insulating mat between the filter reactor and the filter module (⑬)
③ Hose between the return and filter reactor (P1)
④ Hose between the intake and filter module (P7)
⑤ PE connection between the PE rail and filter module
⑥ PE connection between the PE rail and filter module
⑦ Support plate (not included in the scope of supply) for the filter reactor
⑧ PE rail (not included in the scope of supply)
⑨ Intake (not included in the scope of supply)
⑩ Return (not included in the scope of supply)
⑪ Holding plate for lateral insulating mats (not included in the scope of supply)
⑫ Lateral insulating mat (not included in the scope of supply)
⑬ Insulating mat between the filter reactor and filter module (not included in the scope of supply)

Figure 4-25 Typical control cabinet design, Rittal TS8, cabinet width 600 mm, exploded view

There must be a minimum clearance of 970 mm between the lower edge of the transport plate (⑦) and the lower edge of the filter module.

The dimensions of the typical cabinet (Rittal TS8) are (width x height x depth) 600 mm x 2200 mm x 600 mm

The insulating mat between the filter reactor and the filter module is made of "AF/Armaflex AF-19MM/EA" and has the following properties:

- Thickness: 19 mm
- Thermal conductivity: ≤ 0.033 W/(m x K)
- Upper application temperature: 110 °C
- UL certification
- Self adhesive

The entries for the cables and hoses should be made so that there is no heat loss (e.g. cross-shaped cuts).

The lateral insulating mats are made of "HT/Armaflex HT-10-99/E" and have the following properties:

- Thickness: 10 mm
- Thermal conductivity: ≤ 0.042 W/(m x K)
- Upper application temperature: 150 °C
- UL certification
- Not self-adhesive (are held by the lugs of the lateral holding plate)

Additional insulating mats made of the same material should be attached to the front and rear of the control cabinet.

Note

Use of thermally insulating mats

In the electrical cabinet design shown as example, thermally insulating mats must be used in order to maintain the following boundary conditions:

- The insulating mats are used so that the power loss dissipated to the coolant is maintained, and the power loss dissipated to the environment is not exceeded.
- The lateral thermally insulating mats (⑫) prevent the adjacent cabinets and/or doors from becoming too hot.
- The thermally insulating mat between the filter reactor and filter module (⑬) prevents the filter module from overheating as a result of the power loss in the filter reactor.

⚠ WARNING

Fire and device damage as a result of ground fault/short-circuit

Inadequate installation of the cables between the filter reactor and the filter module can result in a ground fault/short-circuit and place persons at risk as a result of the associated smoke and fire.

- Apply the local installation regulations to avoid this fault.
- Protect the cables against mechanical damage.
- Also implement one of the following measures:
  - Use cables with double insulation.
  - Maintain adequate clearance, e.g. by using spacers.
  - Lay the cables in separate cable ducts or conduits.

4.4.7 Cooling circuit connections

Scope of supply

The unassembled connecting hose is supplied with the loose parts so that it can be adapted to the local conditions.

Six hose connections (straight and angled) with the associated gaskets are also supplied.

The connection hose that is supplied is long enough so that the filter reactor and the filter module can be installed as described here: Notes on installation in a control cabinet (Page 100).

Connection diagram

The cooling circuit connections can be taken from the connection example.

Establishing the connections

If the components and the coolant intake are arranged as described above, then the pressure hose that is supplied unassembled can be used.

If a different arrangement is used, connecting hoses of the same quality must be used:

- Hose diameter 3/4"
- Pressure rating, minimum 12 bar
- Maximum hose length 2 m
- Non-conductive, resistance 1 MΩ/m

Article numbers 6SL3305-7TE41-4AA5 and 6SL3305-7TG41-6AA5:

The hose connections must be fastened with the gaskets with a tightening torque of 30 Nm:

- The straight hose connections are intended for P1, P5 and P6.
- The angled hose connections are intended for P3, P4 and P7.

Article numbers 6SL3305-7TE38-4AA5, 6SL3305-7TG37-4AA5, 6SL3305-7TG41-0AA5 and 6SL3305-7TG41-3AA5:

The hose connections must be fastened with the gaskets with a tightening torque of 30 Nm:

- The straight hose connection is intended for P1.
- The angled hose connections are intended for P4, P6 and P7.

The hoses must be fastened to the hose connections with two hose clamps each with a tightening torque of 3 Nm.

After assembly, the tightness must be tested with a pressure test.

⚠WARNING

Electric shock due to insufficient insulating clearance

Incorrect routing of the coolant hoses can result in insufficient insulating clearance with respect to live parts, and can therefore lead to death or serious injury.

- Route the coolant hoses very carefully.
- Ensure that the coolant hoses do not come into contact with live parts and that an insulation clearance (clearances and creepage distances) of >13 mm is always maintained.
- Mechanically fasten the coolant hoses and carefully check them for leaks.
- The materials used in the cooling circuit must be carefully selected to ensure that they will not be corroded as a result of electrochemical reactions.

Note

Checking coolant hoses

The inspection intervals depend on the prevailing ambient conditions.

The following points should be noted for the coolant hoses:

- Damage through abrasion points
- Embrittlement (e.g. forming of cracks)
- Leaks
- The hose slipping out of the coupling
- Deformations that do not comply with the natural shape of the hose (e.g. separation of layers and blistering)
- Exceeding the storage and usage times
  In accordance with the accepted rules and standards, we recommend a testing cycle of 5 years at the appropriate test pressure (twice the operating pressure).

Note

Replacement seal

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.

The replacement seal is commercially available as flat Viton polymer seal with hardness 75 (+/-5) Shore A (Viton is the commercial name for elastomers with the abbreviations FPM and FKM). The dimensions are as follows: Inner diameter 15 mm, thickness 1.5 mm.
Depending on the thread form of the union nut, the outer diameter is 26 mm (with undercut) or 24 mm (without undercut).

4.4.8 Electrical connection

Scope of delivery

Six cables to electrically connect the filter reactor with the filter module and two cables to ground the filter module are included in the scope delivery:

- 6 cables (cross-section 95 mm², reinforced insulation), 820 mm long to connect the filter module (U1, V1, W1) with the line side of the filter reactor (U1, V1, W1).
  The filter module has cable lug connections with diameters for M8 screws
- 2 cables, yellow/green (cross-sections 120 mm²), 1100 mm long for the ground connection (PE) of the filter module

Sufficient cable is supplied so that the filter reactor and the filter module can be installed, see Chapter "Notes on installation in a control cabinet (Page 100)".

The ground connection at the filter module must be realized at both PE connections.

Establishing the connections

If the components are arranged as described above, then the cables supplied can be used.

If a different arrangement is used, cables of the same quality must still be used.

⚠ WARNING

Fire and device damage as a result of short-circuit / ground fault

The cables to the filter module must be routed so that a ground fault or short-circuit can be ruled out. A ground fault can result in fire with associated smoke.

- Protect the cables from mechanical damage
- Comply with local installation regulations that enable this fault to be ruled out.

In addition, apply one of the following measures:

- Use cables with double insulation.
- Maintain adequate clearance, e.g. using spacers.
- Route the cables in separate cable ducts or pipes.

Removing the connection clip of the integrated basic interference suppression module to ground

The connection of the integrated basic interference suppression module to ground must be disconnected if the device is operated on one of the following line system configurations:

- Non-grounded line supply (IT supply system)
- Line supply with grounded line conductor

The connection is disconnected by removing the connection clip of the integrated basic interference suppression module to ground.

Note

Warning label on the connection clip

A yellow warning label is attached to each connection clip so that it is easier to find.

- The warning label must be removed from the connection clip (by pulling it off) if the connection clip is to remain in the device.

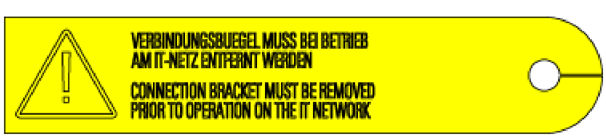


Figure 4-26 Warning label on the connection clip

NOTICE

Damage to the device by not removing the connection clip

Failure to remove the connection clip of the integrated basic interference suppression module to ground for a non-grounded line supply (IT supply system) or a line supply with a grounded line conductor can cause significant damage to the device.

- For a non-grounded line supply (IT supply system) or a line supply with a grounded line conductor, remove the connection clip of the integrated basic interference suppression module to ground.

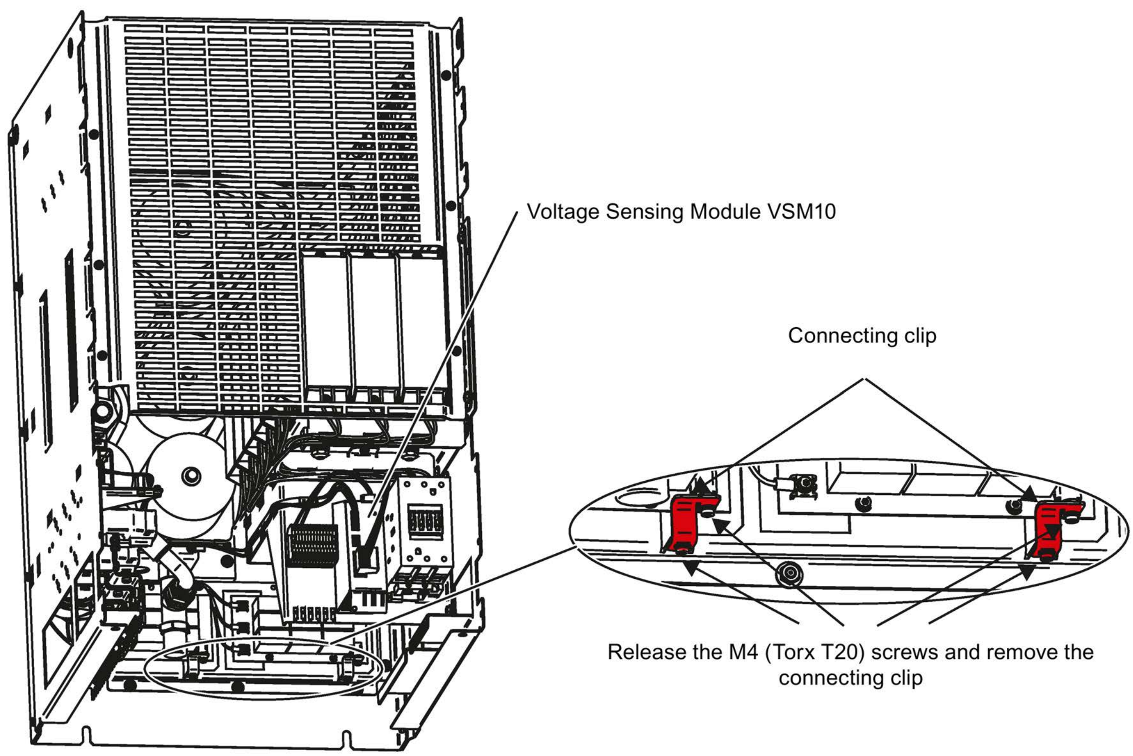


Figure 4-27 Removing the connection clip of the basic interference suppression module to ground

Removing the connector jumper in the VSM10 Voltage Sensing Module

When operating the Active Interface Module on a non-grounded line supply (IT system), at the Voltage Sensing Module (VSM10), remove the plug-in jumper in terminal X530 at the lower side of the component.
Use two screwdrivers or another suitable tool to relieve the holding springs in the terminal and then withdraw the plug-in jumper.

	
Terminal X530 with connector jumper	Relieve the springs and withdraw the connector jumper

4.4.9 Technical data

Table 4- 27 Technical data for Active Interface Modules, 3 AC 380 ... 480 V

Article number	**6SL3305–**	**7TE38–4AA5**	**7TE38–4AA5**	**7TE41–4AA5**	**7TE41–4AA5**
Suitable for Active Line Module Rated power of Active Line Module	6SL3335- kW	7TE36-1AA3 380	7TE38-4AA3 500	7TE41-0AA3 630	7TE41-4AA3 900
Rated input current of the Active Line Module	A	605	840	985	1405
Supply voltages - Line voltage - Line frequency - Electronics power supply	 V_{ACrms} Hz V_{DC}	 3 AC 380 –10 % (-15 % < 1 min) ... 3 AC 480 +10 % 47 ... 63 Hz 24 (20.4 ... 28.8)			
DC link capacitance of the drive line-up, max.	 µF	 134400	 134400	 230400	 230400
Electronics current consumption (24 V DC)	A	0.17	0.17	0.17	0.17
Bypass contactor [1)		3RT1476- 6AP36	3WA1110- 4AE03-4EQ0 [3)	3WA1112- 4AE03-4EQ0 [3)	3WA1116- 4AE03-4EQ0 [3)
Rated flow rate for water with 70 kPa pressure drop	l/min	10	10	16	16
Sound pressure level L_{pA} (1 m) at 50/60 Hz	 dB(A)	 71 / 71	 71 / 71	 71 / 71	 71 / 71
Frame size		JIL	JIL	JIL	JIL
Filter reactor					
Article number	6SL3005-	0DE38-4AA0	0DE38-4AA0	0DE41-4AA0	0DE41-4AA0
Cooling method		Liquid cooling (aluminum heat sink)			
Power loss, max. [2) - At 50 Hz 400 V - At 60 Hz 460 V - Dissipated to the ambient air	 kW kW kW	 3.5 3.5 1.2	 3.5 3.5 1.2	 8.6 8.6 0.9	 8.6 8.6 0.9
Liquid volumes - Integrated reactor cooler - Hoses supplied	 dm^3 dm^3/m	 0.6 0.285	 0.6 0.285	 0.6 0.285	 0.6 0.285
Rated flow rate for water with 70 kPa pressure drop	l/min	10	10	8	8
Coolant connections Return and connection to filter module		Pipe thread ISO 228 - G 3/4 B (external thread 3/4", flat-sealing)			
Tightening torque for coolant connections	Nm	6	6	6	6
Line/load connection U1, V1, W1 / U2, V2, W2		Flat connection for M12 screw			
PE connection		M10 bolts	M10 bolts	M10 bolts	M10 bolts
Max. conductor cross-section - line connection (U1, V1, W1) - load connection (U2, V2, W2) - to the filter Module (U1, V1, W1) - PE connection	 mm^2 mm^2 mm^2 mm^2	 1500 1500 2 x 95 1 x 240	 1500 1500 2 x 95 1 x 240	 1500 1500 2 x 95 1 x 240	 1500 1500 2 x 95 1 x 240
Degree of protection		IP00	IP00	IP00	IP00
Dimensions - Width - Height - Depth	 mm mm mm	 349 700 <575	 349 700 <575	 382 698 <575	 382 698 <575
Weight	kg	230	230	299	299

Article number	**6SL3305–**	**7TE38–4AA5**	**7TE38–4AA5**	**7TE41–4AA5**	**7TE41–4AA5**
Filter module					
Article number	6SL3005-	0FE38-4AA5	0FE38-4AA5	0FE41-4AA5	0FE41-4AA5
Cooling method		Liquid cooling (aluminum heat sink)			
Power loss, max. 2) - At 50 Hz 400 V - At 60 Hz 460 V - Dissipated to the ambient air	 kW kW kW	 2.7 2.7 0.15	 2.7 2.7 0.15	 3.6 3.6 0.15	 3.6 3.6 0.15
Liquid volumes of the filter module	dm^3	1	1	1	1
Coolant connections Intake and connection to filter reactor		Pipe thread ISO 228 - G 3/4 B (external thread 3/4", flat-sealing)			
Tightening torque for coolant connections	Nm	6	6	6	6
Max. connection cross-sections - to the filter reactor (U1, V1, W1) - PE connection	 mm^2 mm^2	 2 x 95 2 x 120	 2 x 95 2 x 120	 2 x 95 2 x 120	 2 x 95 2 x 120
Degree of protection		IP00	IP00	IP00	IP00
Dimensions - Width - Height - Depth	 mm mm mm	 506 840 574	 506 840 574	 506 840 574	 506 840 574
Weight	kg	110	110	110	110

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

2) The specified power loss is the maximum value at 100 % utilization level. The value in normal operation is lower.

3) The circuit breaker is controlled by the sequence control of the Active Line Module, and it is not permissible that it is manually closed.

Table 4- 28 Technical data for Active Interface Modules, 3 AC 500 ... 690 V

Article number	**6SL3305–**	**7TG37–4AA5**	**7TG41–0AA5**	**7TG41–3AA5**	**7TG41–6AA5**
Suitable for Active Line Module Rated power of Active Line Module	6SL3335- kW	7TG37-4AA3 800	7TG38-1AA3 900 7TG41-0AA3 1100	7TG41-3AA3 1400	7TG41-6AA3 1700
Rated input current of the Active Line Module	A	735	810 / 1025	1270	1560
Supply voltages - Line voltage - Line frequency - Electronics power supply	 V_{ACrms} Hz V_{DC}	 3 AC 500 –10% (-15% < 1 min) ... 3 AC 690 +10% 47 ... 63 Hz 24 (20.4 ... 28.8)			
DC link capacitance of the drive line-up, max.	 μF	 153600	 153600	 153600	 210000
Electronics current consumption (24 V DC)	A	0.17	0.17	0.17	0.17
Bypass contactor [1]		3RT1476-6A36 (3 x)	3WA1220- 4AE03-4EQ0-Z Z=B12 [3]	3WA1220- 4AE03-4EQ0-Z Z=B16 [3]	3WA1220- 4AE03-4EQ0-Z Z=B16 [3]
Rated flow rate for water with 70 kPa pressure drop	l/min	10	10	10	16
Sound pressure level L_{pA} (1 m) at 50/60 Hz	 dB(A)	 71 / 71	 71 / 71	 71 / 71	 71 / 71
Frame size		JIL	JIL	JIL	JIL
Filter reactor					
Article number	6SL3005-	0DG37-4AA0	0DG41-3AA0	0DG41-3AA0	0DG41-6AA0
Cooling method		Liquid cooling (aluminum heat sink)			
Power loss, max. [2] - At 50 Hz 690 V - At 60 Hz 575 V - Dissipated to the ambient air	 kW kW kW	 5.5 5.5 0.5	 6.2 6.2 0.6	 9.3 9.3 0.95	 11 11 1.15
Liquid volumes - Integrated reactor cooler - Hoses supplied	 dm^3 dm^3/m	 0.6 0.285	 0.6 0.285	 0.6 0.285	 0.6 0.285
Rated flow rate for water with 70 kPa pressure drop	l/min	10	10	10	8
Coolant connections Return and connection to filter module		Pipe thread ISO 228 - G 3/4 B (external thread 3/4", flat-sealing)			
Tightening torque for coolant connections	Nm	6	6	6	6
Line/load connection U1, V1, W1 / U2, V2, W2		Flat connection for M12 screw			
PE connection		M10 bolts	M10 bolts	M10 bolts	M10 bolts
Max. conductor cross-section - line connection (U1, V1, W1) - load connection (U2, V2, W2) - to the filter Module (U1, V1, W1) - PE connection	 mm^2 mm^2 mm^2 mm^2	 1000 1000 2 x 95 1 x 240	 1500 1500 2 x 95 1 x 240	 1500 1500 2 x 95 1 x 240	 1500 1500 2 x 95 1 x 240
Degree of protection		IP00	IP00	IP00	IP00
Dimensions - Width - Height - Depth	 mm mm mm	 358 675 <575	 440 705 <575	 440 705 <575	 440 705 <575
Weight	kg	234	365	365	365

Article number	**6SL3305–**	**7TG37–4AA5**	**7TG41–0AA5**	**7TG41–3AA5**	**7TG41–6AA5**
Filter module					
Article number	6SL3005-	0FG37-4AA5	0FG41-0AA5	0FG41-3AA5	0FG41-6AA5
Cooling method		Liquid cooling (aluminum heat sink)			
Power loss, max. 2) - At 50 Hz 690 V - At 60 Hz 575 V - Dissipated to the ambient air	 kW kW kW	 4.0 4.0 0.15	 5.0 5.0 0.15	 5.0 5.0 0.15	 7.5 7.5 0.15
Liquid volumes of the filter module	dm^3	1	1	1	1
Coolant connections Intake and connection to filter reactor		Pipe thread ISO 228 - G 3/4 B (external thread 3/4", flat-sealing)			
Tightening torque for coolant connections	Nm	6	6	6	6
Max. connection cross-sections - to the filter reactor (U1, V1, W1) - PE connection	 mm^2 mm^2	 2 x 95 2 x 120	 2 x 95 2 x 120	 2 x 95 2 x 120	 2 x 95 2 x 120
Degree of protection		IP00	IP00	IP00	IP00
Dimensions - Width - Height - Depth	 mm mm mm	 506 840 574	 506 840 574	 506 840 574	 506 840 574
Weight	kg	110	110	110	110

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

2) The specified power loss is the maximum value at 100 % utilization level. The value in normal operation is lower.

3) The circuit breaker is controlled by the sequence control of the Active Line Module, and it is not permissible that it is manually closed.

4.4.9.1 Parameterization

The thresholds for the temperature monitoring must be parameterized correctly for safe operation. This is realized automatically when commissioning the system using the STARTER or Startdrive commissioning tool. When doing this, by selecting the Active Line Module, the appropriate Active Interface Module is automatically assigned (p0220 "Infeed line filter type").

The values for the temperature monitoring for liquid-cooled Active Interface Modules are set as follows:

- Alarm threshold p3667: 60 °C
- Trip threshold p3668: 70 °C

Note

Note regarding STARTER V4.4.1

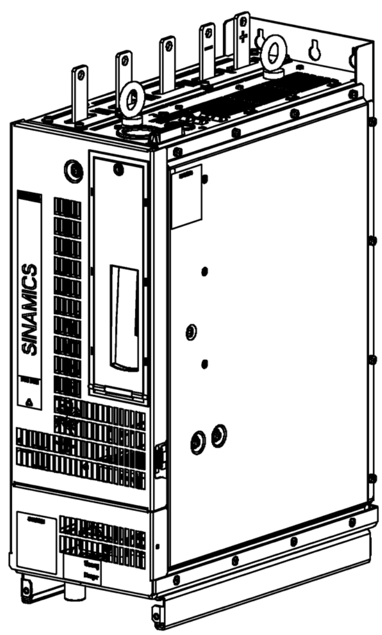
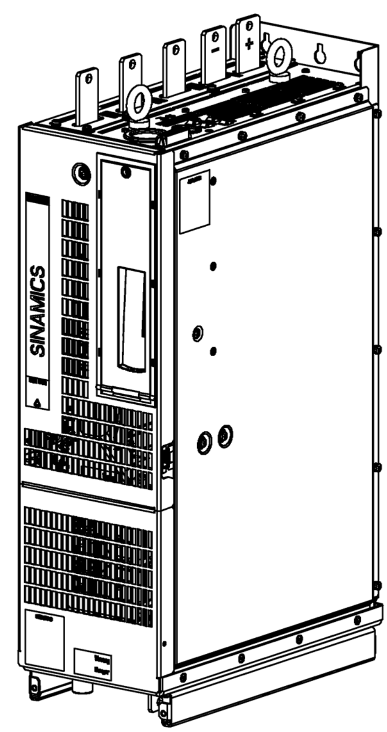
The product is supported from STARTER version V4.4.1.

5 Power Modules

5.1 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 5- 1 Power Modules

	
Frame size FL	Frame size GL

Characteristics of Power Modules

- Design for 3 AC 380 bis 3 AC 480 V from 210 A to 490 A
- Suitable for TN, TT, and IT supply systems
- Liquid cooled or water cooled
- Short-circuit/ground-fault-proof
- Electronic nameplate
- 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 CU310-2, CU320-2 or a SIMOTION D Control Unit.
- An external 24 V DC power supply is required to operate liquid-cooled/water-cooled Power Modules.
- The correct line reactor must be connected in series to achieve a Category C3 radio interference suppression according to IEC 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.

5.2 Safety information

WARNING

Not observing fundamental safety instructions and residual risks

Not observing fundamental safety instructions and residual risks listed in Chapter 1 can result in accidents with severe injuries or death.

- Comply with the fundamental safety instructions.
- When assessing the risk, take into account residual risks.

WARNING

Electric shock or fire due to overcurrent protective devices that trip too late

Overcurrent protective devices that do not trip or trip too late can cause an electric shock or fire.

- To protect personnel and for fire protection purposes, at the infeed point, the short-circuit rating and loop impedance must correspond to the specifications in the documentation in order for the installed overcurrent protection devices to trip within the specified time.

WARNING

High leakage currents when the protective conductor in the line feeder cable is interrupted

The drive components conduct a high leakage current via the protective conductor. Touching conductive parts when the protective conductor is interrupted can result in death or serious injury.

- Ensure that the external protective conductor satisfies at least one of the following conditions:
  - It has been installed so that it is protected against mechanical damage. [1)]
  - For an individual core, it has a cross-section of at least 10 mm² Cu.
  - If it is a conductor of a multi-conductor cable, it has a cross-section of at least 2.5 mm² Cu.
  - It has a second protective conductor in parallel with the same cross-section.

  [1)] Cables laid within control cabinets or closed machine housings are considered to be adequately protected against mechanical damage.
- Observe the local regulations for protective conductors subject to a high leakage current at the operating location.

WARNING

Fire due to inadequate ventilation clearances

Inadequate ventilation clearances can cause overheating with a risk for personnel through smoke development and fire. This can also result in more downtimes and reduced service lives of Power Modules.

- Observe the cooling clearances above, below, and in front of the Power Modules which are specified in the dimension drawings.

CAUTION

Fire due to overheating when the total length of the power cables is exceeded

Overheating and a fire can result when the total length of the power cables is exceeded.

- Ensure that the total length of the power cables (motor feeder cables and DC link cables) does not exceed the values specified in the technical data.

NOTICE

Material damage caused by mechanically loaded busbars and liquid coolant connections

Mechanically loaded busbars and liquid coolant connections can cause damage on the device.

- Do not use the busbars and liquid coolant connections protruding from the device as handles or as support surfaces during transport.

NOTICE

Material damage caused by loose power connections

Insufficient tightening torques or vibration can result in faulty electrical connections. This can cause fire damage or malfunctions.

- Tighten all power connections with the specified tightening torques, e.g. line connection, motor connection, DC link connections.
- Check the tightening torques of all power connections at regular intervals and tighten them when required. This applies in particular after transport.

NOTICE

Damage to the devices when performing a voltage test as a result of connections that have not been disconnected

As part of routine tests, SINAMICS S components undergo a voltage test according to IEC 61800-5-1.

- Disconnect or unplug all SINAMICS devices before the voltage test of the machine equipment according to IEC 60204-1, Section 18.4.

NOTICE

Damage through use of incorrect DRIVE-CLiQ cables

Damage or malfunctions can occur on the devices or system when DRIVE-CLiQ cables are used that are either incorrect or have not been released for this purpose.

- Only use suitable DRIVE-CLiQ cables that have been released by Siemens for the particular application.

5.3 Interface description

5.3.1 Overview

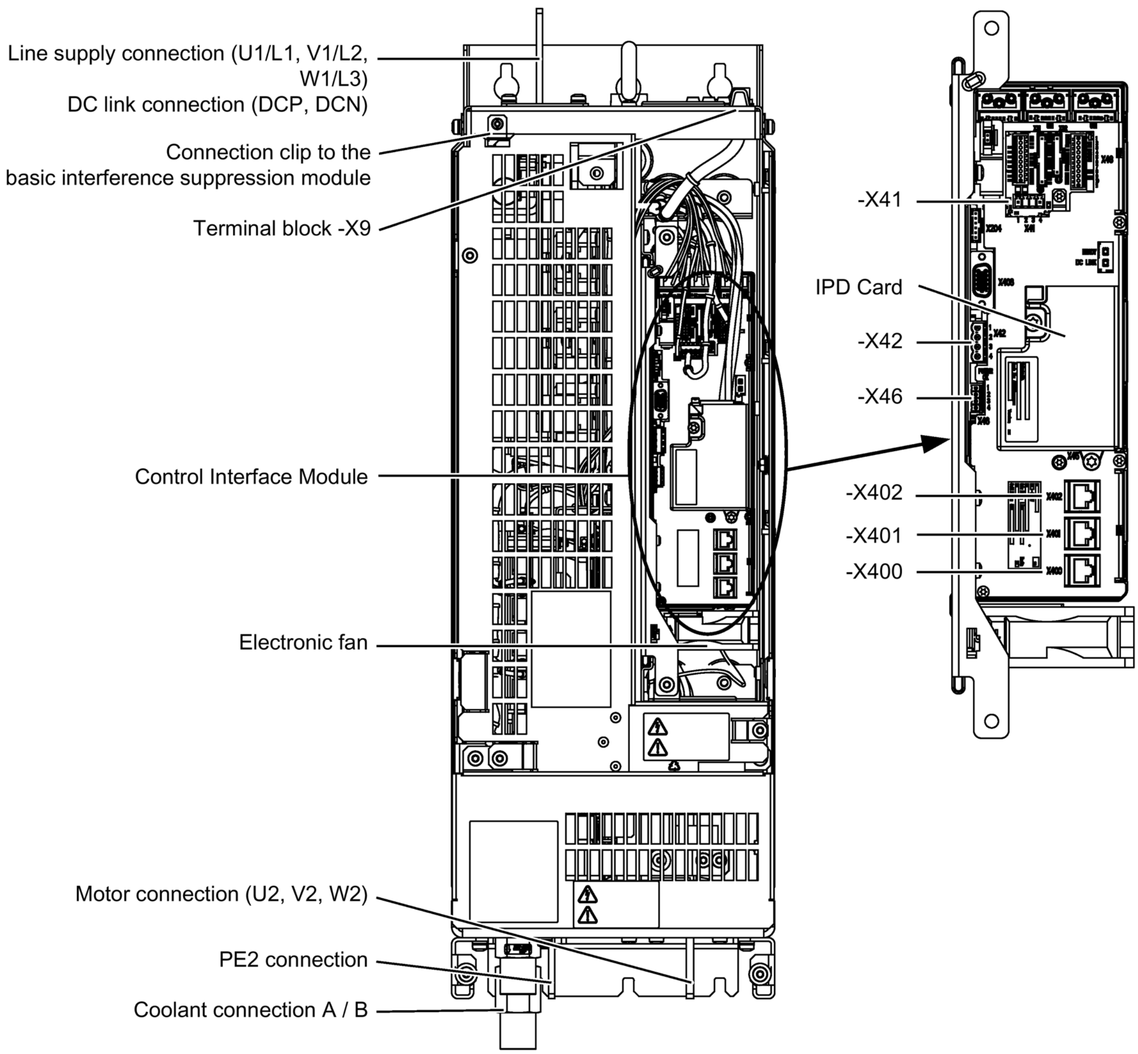


Figure 5-1 Power Module, frame size FL

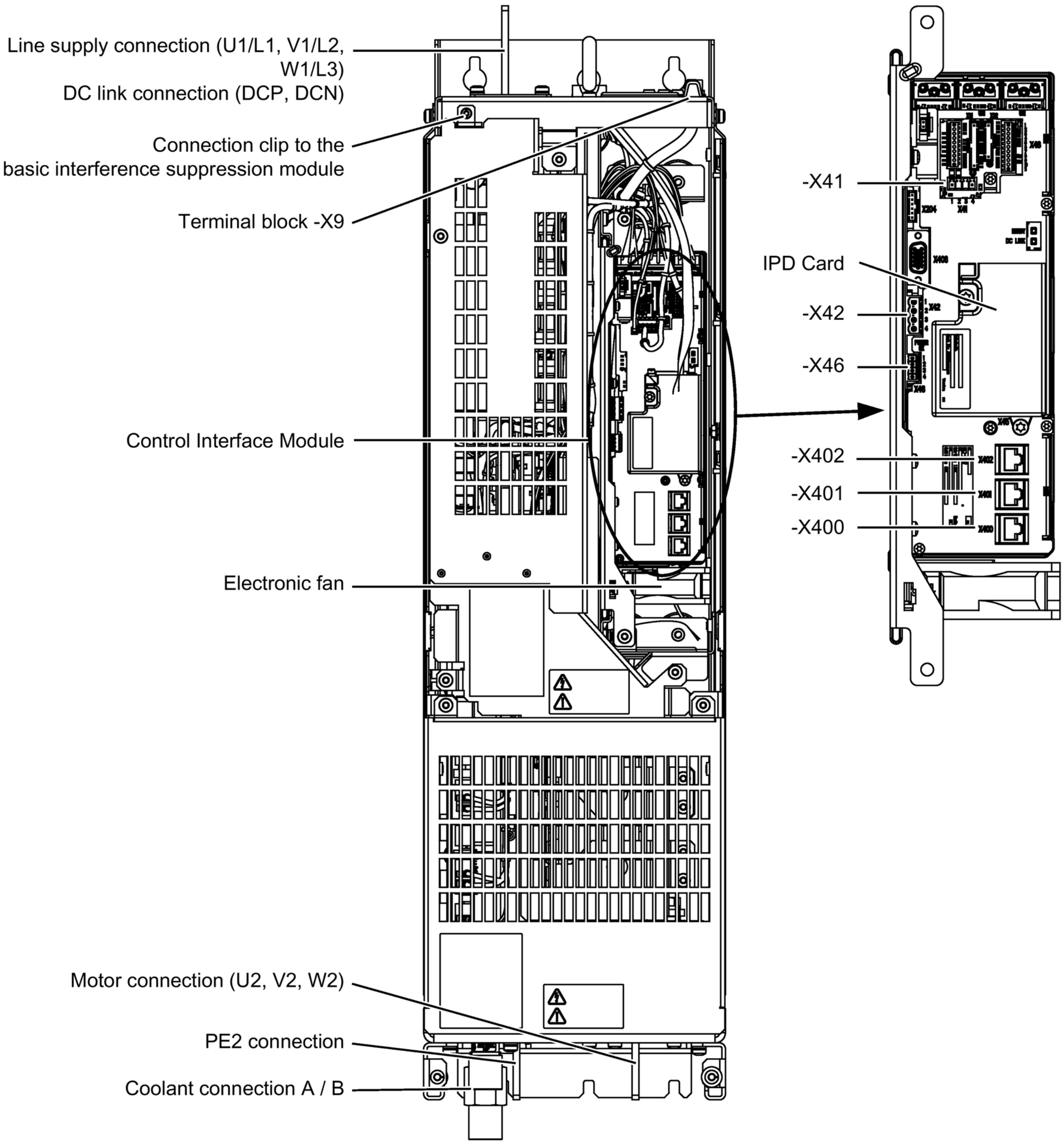


Figure 5-2 Power Module, frame size GL

5.3.2 Connection example

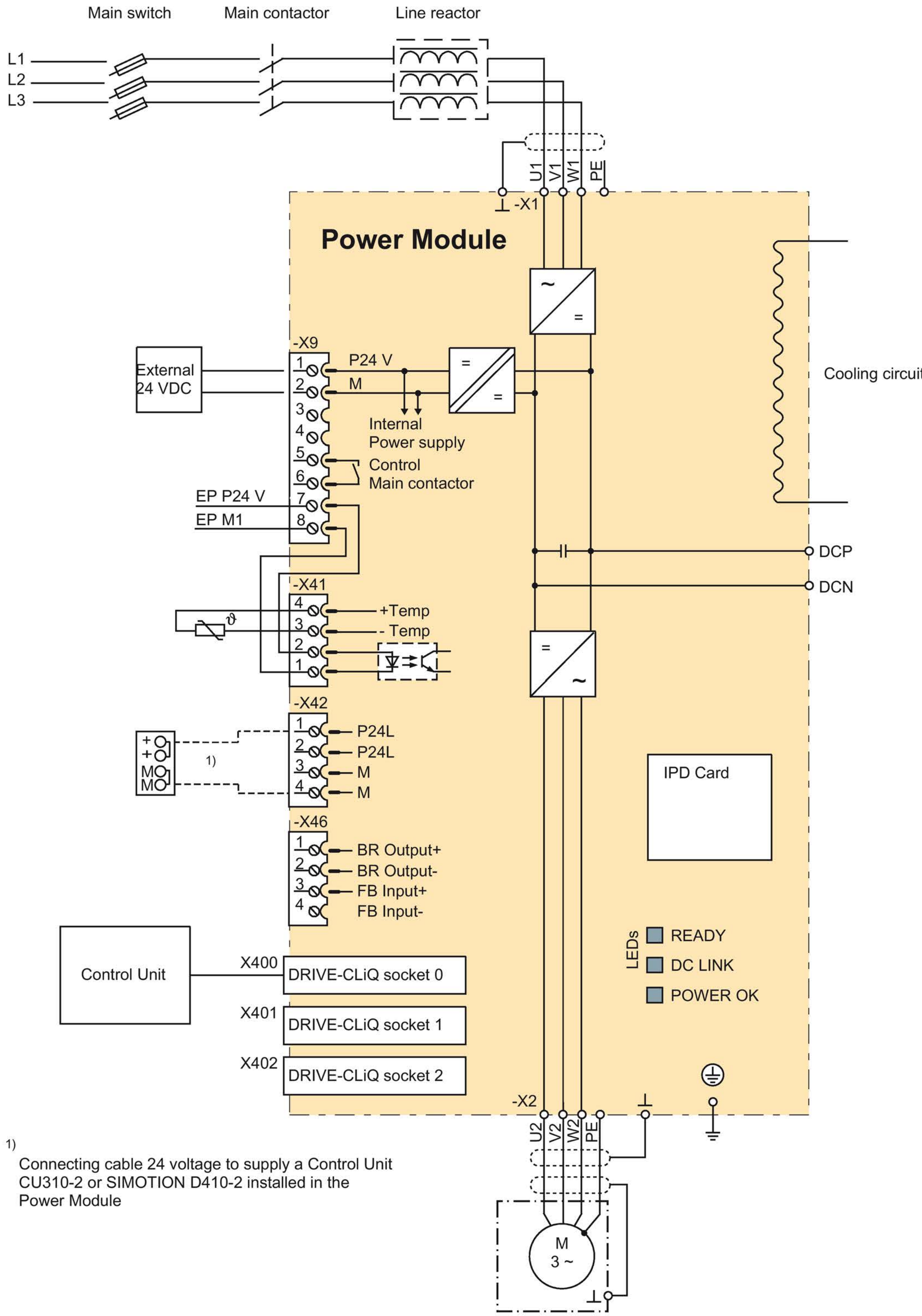


Figure 5-3 Connection example for Power module

5.3.3 Line/DC link/motor connection

Table 5- 2 Line/DC link/motor connection for Power Module

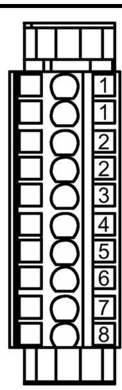
Terminals	Technical data
U1/L1, V1/L2, W1/L3 3 AC power input	Voltage: • 3 AC 380 V -10 % (-15 % < 1 min) ... 3 AC 480 V +10 % • 3 AC 500 V -10 % (-15 % < 1 min) ... 3 AC 690 V +10 % Frequency: 47 ... 63 Hz Connecting lugs: d = 13 mm (M12/50 Nm) for cable lugs in accordance with DIN 46234 / DIN 46235 [1]
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 [1]
U2, V2, W2 3 AC power output	Voltage: 3 AC 0 V to 0.75 x DC link voltage [2] Connecting lugs: d = 13 mm (M12/50 Nm) for cable lugs in accordance with DIN 46234 / DIN 46235 [1]
PE connection	Connecting lugs: d = 13 mm (M12/50 Nm) for cable lugs in accordance with DIN 46234 / DIN 46235 [1]

[1] Dimensions for connecting alternative cable lugs, see "Cable lugs" in the appendix.

[2] For pure space vector modulation, a factor of approximately 0.70 ... 0.72 applies.
For edge modulation, a factor of approximately 0.74 ... 0.75.

5.3.4 X9 terminal strip

Table 5- 3 Terminal strip X9

Connector	Terminal	Signal name	Technical data
	1	P24 V	External 24 V DC supply Voltage: 24 VDC (20.4 ... 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: 8 A max. 30 V DC: max. 1 A isolated
	6		
	7	EP +24 V (Enable Pulses)	Supply voltage: 24 VDC (20.4 ... 28.8 V) Power consumption: 10 mA The pulse inhibit function is only available when the "Safety Integrated Basic Functions via onboard terminals" is enabled in the software.
	8	EP M1 (Enable Pulses)	
Max. connectable cross-section: 1.5 mm^2			

Note

Function of the EP terminals

The function of the EP terminals for pulse inhibit is only available if the "Safety Integrated Basic Functions via onboard terminals" software is enabled.

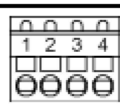
Note

Looping through the supply voltage

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

Connector	Terminal	Function	Technical data
	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 / PT100 / PT1000 / PTC
	4	+Temp	
Max. connectable cross-section: 1.5 mm²			

WARNING

Electric shock in the event of voltage flashovers at the temperature sensor

Voltage flashovers in the signal electronics can occur in motors without safe electrical separation of the temperature sensors.

- Only use temperature sensors that fully comply with the specifications of the safety isolation.
- If safe electrical separation cannot be guaranteed (for linear motors or third-party motors, for example), use a Sensor Module External (SME120 or SME125) or Terminal Module TM120.

NOTICE

Device failure as a result of unshielded or incorrectly routed cables to temperature sensors

Unshielded or incorrectly routed cables to temperature sensors can result in interference being coupled into the signal processing electronics from the power side. This can result in significant disturbance of all signals (fault messages) up to failure of individual components (destruction of the devices).

- Only use shielded cables as temperature sensor cables.
- If temperature sensor cables are routed together with the motor cable, use separately shielded cables twisted in pairs.
- Connect the cable shield to ground potential through a large surface area.

NOTICE
Damage to motor in the event of incorrectly connected KTY temperature sensor
If a KTY temperature sensor is connected with incorrect polarity, it is not possible to detect when the motor overheats. Overheating can cause damage to the motor.
• Connect a KTY temperature sensor with the correct polarity.

Note

The temperature sensor connection can be used for motors that are equipped with a KTY84-1C130, PT100, PT1000 or PTC measuring sensor in the stator windings.

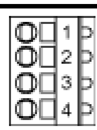
Note

Connection to terminal strip -X9

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

Connector	Terminal	Function	Technical data
	1	P24L	Power supply for Control Unit, Sensor Module and Terminal Module (18 ... 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 CU310-2 Control Unit via a cable harness supplied with the device.

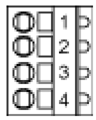
Note

Connection options of terminal strip X42

The terminal strip is not intended to supply other 24 VDC loads (for example, for supplying other components on the plant/system side), as the voltage supply of the Control Interface Module could also be overloaded and result in malfunctions.

5.3.7 X46 Brake control and monitoring

Table 5- 6 Terminal strip X46 brake control and monitoring

Connector	Terminal	Function	Technical data
	1	BR output +	Brake connection
	2	BR output -	Supply voltage: 24 V DC Max. load current: 200 mA
	3	FB input +	Internal feedback signal from the Safe Brake Adapter
	4	FB input -	
Max. connectable cross-section: 1.5 mm²			

Note

The interface is intended for connection of the Safe Brake Adapter.

WARNING

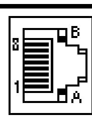
Fire due to overheating when the total length of the connecting cables is exceeded

Excessively long connection cables on terminal strip X46 can cause components to overheat with the associated risk of fire and smoke.

- Limit the length of the connecting cables to a maximum of 10 m.
- The connection cable must not be led out 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

Connector	PIN	Signal name	Technical data
	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.) Article number: 6SL3066-4CA00-0AA0			

5.3.9 Cooling circuit connections

Table 5- 8 Cooling circuit connections

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

Note

Replacement seal

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.

The replacement seal is commercially available as flat Viton polymer seal with hardness 75 (+/-5) Shore A (Viton is the commercial name for elastomers with the abbreviations FPM and FKM). The dimensions are as follows: Inner diameter 15 mm, thickness 1.5 mm. Depending on the thread form of the union nut, the outer diameter is 26 mm (with undercut) or 24 mm (without undercut).

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

Table 5- 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	--- [1]	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 lies outside the permitted tolerance range.
Orange	Orange	DRIVE-CLiQ communication is being established.
Red	--- [1]	This component has at least one fault. **Remark:** The LED is activated irrespective of whether the corresponding messages have been reconfigured.
Flashing light 0.5 Hz: green/red	--- [1]	Firmware is being downloaded.
Flashing light 2 Hz: green/red	--- [1]	Firmware download is complete. Waiting for POWER ON.
Flashing light 2 Hz: green/orange or red/orange	--- [1]	Detection of the components via LED is activated (p0124). Note: Both options depend on the LED status when module recognition is activated via p0124 = 1.

[1] Irrespective of the status of the LED "DC LINK"

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

LED	Color	State	Description
POWER OK	Green	Off	DC link voltage or control voltage at -X9 too low.
		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

Electric shock when live parts of the DC link are touched

Hazardous DC link voltages may be present at any time regardless of the status of the "DC LINK" LED. This means that when live parts are touched, this can result in death or serious injury.

- Observe the warning information on the component.

5.4 Dimension drawing

Dimension drawing for frame size FL

The mandatory cooling clearances are indicated by the dotted line.

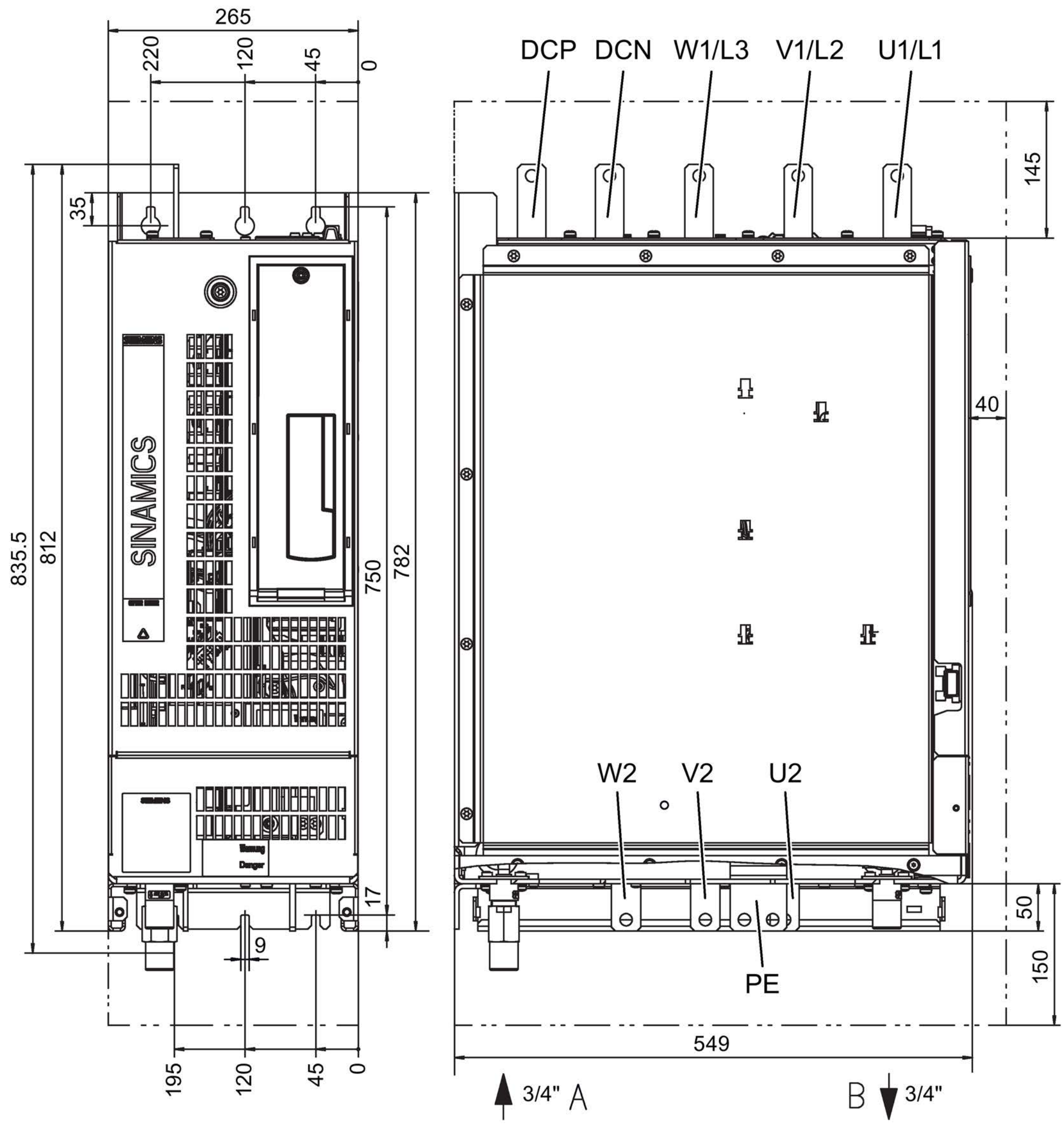


Figure 5-4 Dimension drawing Power Module, frame size FL. Front view, side view

Dimension drawing for frame size GL

The mandatory cooling clearances are indicated by the dotted line.

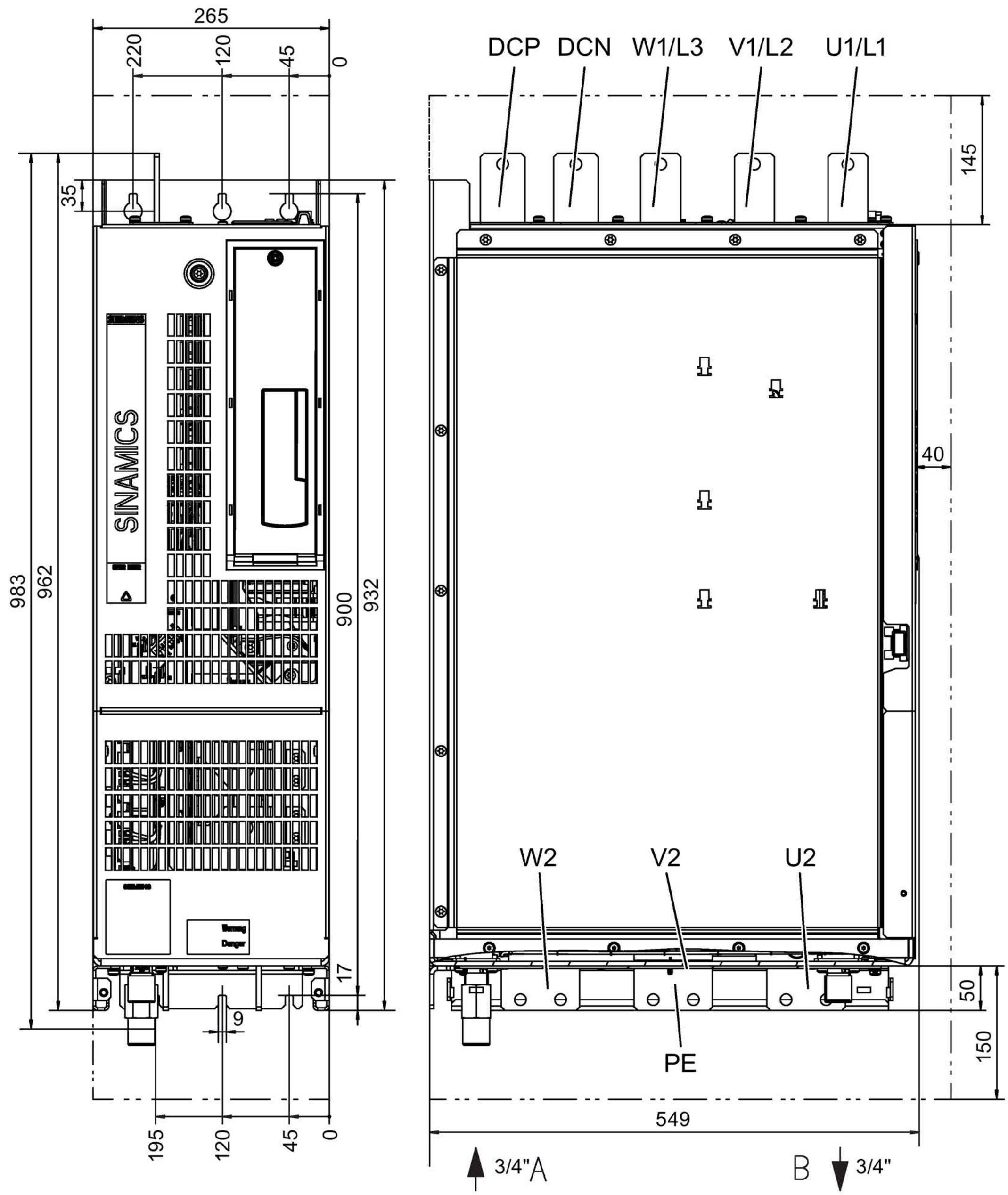


Figure 5-5 Dimension drawing Power Module, frame size GL. Front view, side view

5.5 Installation

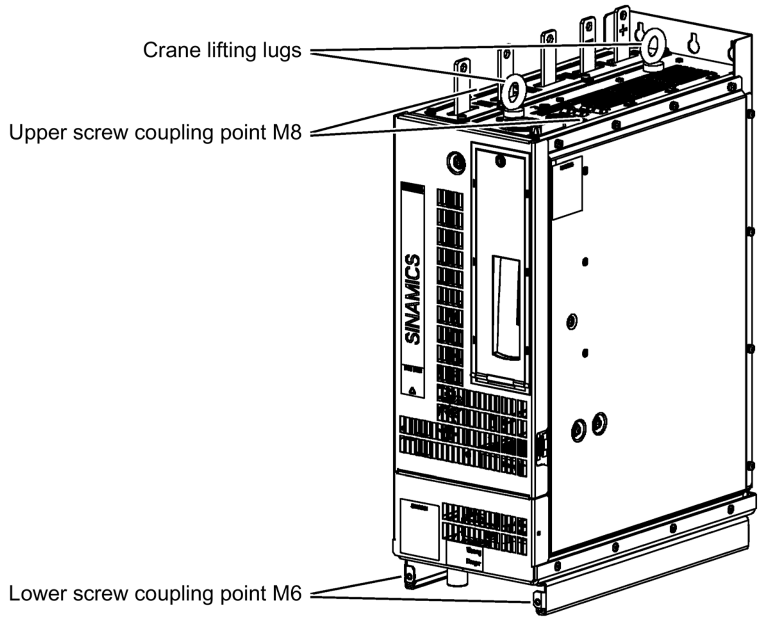


Figure 5-6 Crane lifting lugs / screw coupling points for mechanical support

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 placed down 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 four screws ("2" in the diagram) and remove the guard.

⚠CAUTION

Risk of injury due to toppling when placing down on the protection guard

A module placed down on the protection guard can topple over therefore causing injury.

- When the module is placed down on the protection guard, ensure that it cannot topple over.

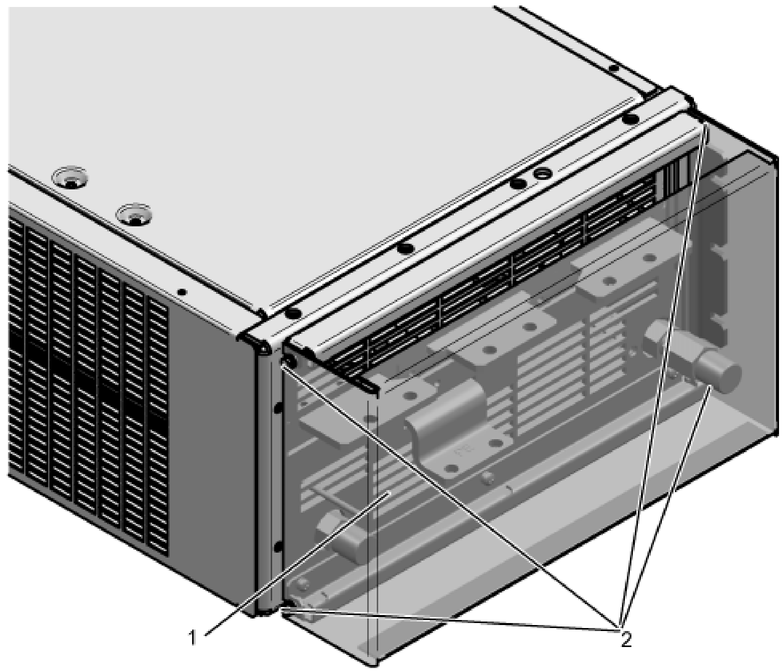


Figure 5-7 Protection guard

Note

Mounting fixture for power units

The mounting equipment for the power units can be used to mount the Power Modules, see "Mounting equipment for power units (Page 357)".

Crane lifting lugs

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

Note

Transport in the horizontal position

Transport in the horizontal position is permissible.

It is not permissible to screw the crane lifting lug into the thread at the lower side of the Power Module.

NOTICE

Damage to the device due to improper transport

Improper transport can cause mechanical loads on the housing or busbars which can result in damage to the device.

- Use a lifting harness with vertical ropes or chains during transport.
- Do not use the busbars as handles or for fastening a lifting harness.
- Only tighten the crane lifting lugs by hand. Remove the crane lifting lugs after the installation, but keep them for later 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; see the diagram at the beginning of the chapter.

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.

WARNING

Electric shock due to insufficient insulating clearance (air clearances and creepage distances)

Incorrect mounting of the reinforcing sheet metal parts can result in insufficient insulating clearance to live parts and can cause death or serious injury.

- Ensure that the reinforcing sheet metal parts do not come into contact with live parts and that an insulation clearance (air clearances and creepage distances) of >13 mm / 25 mm is always maintained.
- As a result of customer specifications or the specifications of certification bodies, under certain circumstances, larger air clearances and creepage distances may be required. Take this into account for the mechanical design of the cabinet and when installing.

5.6 Electrical connection

Removing the connection clip of the integrated basic interference suppression module to ground

The connection of the integrated basic interference suppression module to ground must be disconnected if the device is operated on one of the following line system configurations:

- Non-grounded line supply (IT supply system)
- Line supply with grounded line conductor

The connection is disconnected by removing the connection clip of the integrated basic interference suppression module to ground.
To do so, both screws ("1" in the following diagram) must be released and the connection bracket removed. 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.

NOTICE
Damage to the device by not removing the connection clip Failure to remove the connection clip of the integrated basic interference suppression module to ground for a non-grounded line supply (IT supply system) or a line supply with a grounded line conductor can cause significant damage to the device. • For a non-grounded line supply (IT supply system) or a line supply with a grounded line conductor, remove the connection clip of the integrated basic interference suppression module to ground.

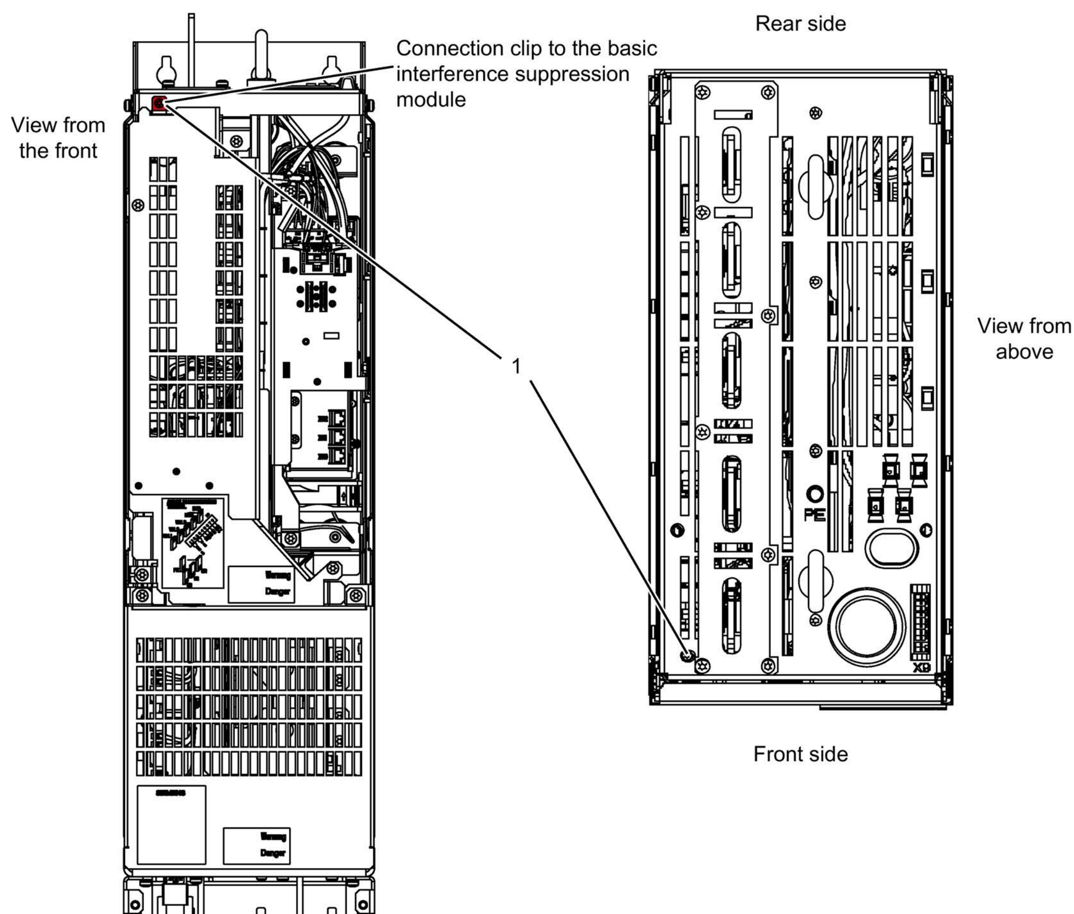


Figure 5-8 Removing the connection clip of the basic interference suppression module to ground

5.7 Technical specifications

5.7.1 Power Modules, 3 AC 380 ... 480 V

Table 5- 11 Technical data, Power Modules, 3 AC 380 ... 480 V

Article number	**6SL3315–**	**1TE32-1AA3**	**1TE32–6AA3**	**1TE33–1AA3**	**1TE35–0AA3**
Type 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
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
Supply voltages - Line voltage - Line frequency - Electronics power supply - DC link voltage - Output voltage	 V_{ACrms} Hz V_{DC} V_{DC} V_{ACrms}	 3 AC 380 –10% (-15% < 1 min) ... 3 AC 480 +10% 47 ... 63 Hz 24 (20.4 ... 28.8) 1.35 x U_{line} 0 ... 0.75 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
Electronics current 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 - Dissipated to the ambient air	 kW kW kW	 2.42 2.6 0.08	 3.04 3.2 0.09	 3.4 3.6 0.12	 5.43 5.7 0.18
Rated flow rate	l/min	9	9	12	12
Pressure drop, typical at the rated flow rate [4)]	Pa	70000	70000	70000	70000
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 connection for M12 screw			
Max. conductor 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

Article 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
Recommended fuse 5) 6) - Number per phase (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
Minimum short-circuit current 7)	kA	3	3.6	4.4	8

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

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

3) The specified power loss is the maximum value at 100% utilization. The value in normal operation is lower.

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.

6) Only 3NE1 fuses should be used to protect the devices. These must be located as close as possible to the converter. The specified 3NA3 fuses can be used for the additional cable protection, see Catalog D21.3.

7) Minimum current required for reliable triggering of the designated protective devices.

5.7.2 Overload capability

The Power Modules have an overload reserve (e.g. to overcome 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 overload data is valid under the precondition that the Power Module is operated as a maximum with its base load current before and after the overload occurs (a duty cycle duration of 300 s is used as a basis here).

Another precondition is that the Power Module is operated at its factory-set pulse frequency at output frequencies > 10 Hz.

Additional information on the overload capability is provided in the Low Voltage Configuration Manual and in the SINAMICS S120 Function Manual Drive Functions.

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.

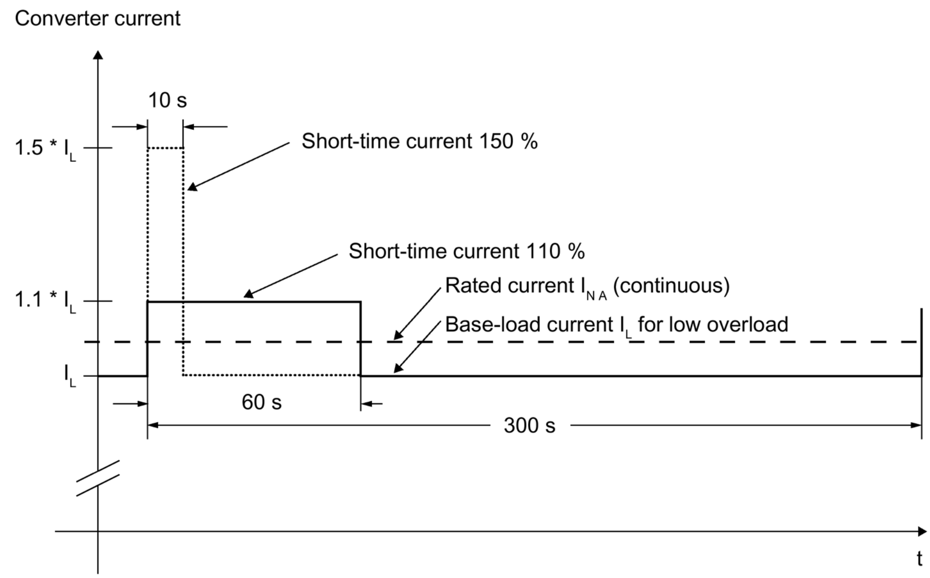


Figure 5-9 Low overload

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.

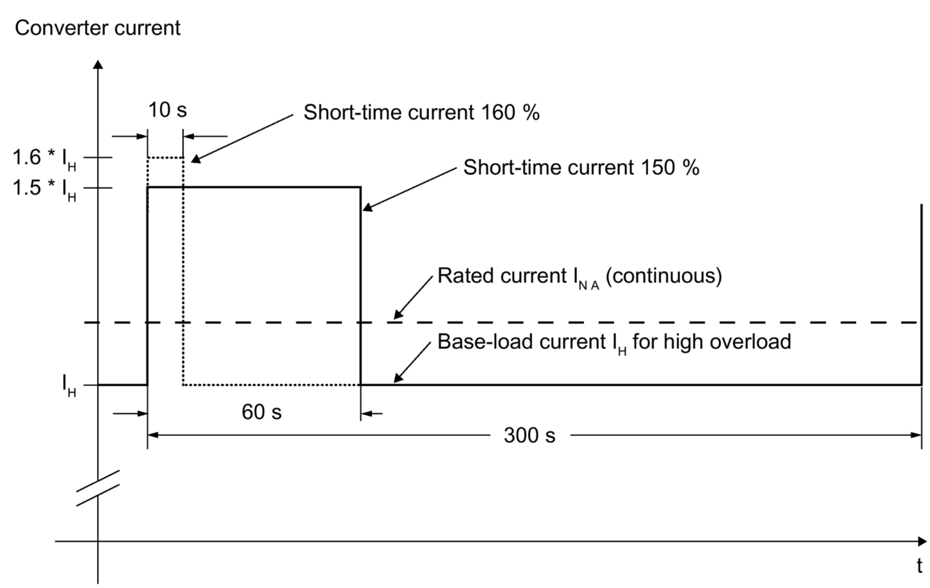


Figure 5-10 High overload

5.7.3 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 data.

Table 5- 12 Derating factor of the output current as a function of the pulse frequency for units with a rated pulse frequency of 2 kHz

Article No.	Type rating	Output current at 2 kHz	Derating factor at the pulse frequency				
6SL3315-...	**[kW]**	**[A]**	**2.5 kHz**	**4 kHz**	**5 kHz**	**7.5 kHz**	**8 kHz**
1TE32-1AA3	110	210	95 %	82 %	74 %	54 %	50 %
1TE32-6AA3	132	260	95 %	83 %	74 %	54 %	50 %
1TE33-1AA3	160	310	97 %	88 %	78 %	54 %	50 %
1TE35-0AA3	250	490	94 %	78 %	71 %	53 %	50 %

Note

Derating factors for pulse frequencies in the range between fixed values

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

The adjustable pulse frequencies - and therefore the output frequencies that can be achieved with the factory-set current controller clock cycles - are listed below.

Table 5- 13 Maximum output frequencies achieved by increasing the pulse frequency

Current controller clock cycle T_I	Adjustable pulse frequencies f_p	Maximum achievable output frequency f_A		
		V/f operating mode	Vector operating mode	Servo mode
250 µs	2 kHz 4 kHz 8 kHz	166 Hz 333 Hz 550 Hz [1)]	166 Hz 333 Hz 480 Hz	333 Hz 550 Hz [1)] 550 Hz [1)]

1) With the "High output frequencies" license, which can be ordered as option J01 on the CompactFlash card for SINAMICS S120, the maximum output frequency is increased up to 650 Hz.

Refer to the Low Voltage Configuration Manual for current controller clock cycles deviating from the factory setting.

Line Modules 6

6.1 Introduction

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

Line Infeeds comprise a Line Module and the associated line connection. They generate a DC voltage from the connected line voltage that is used to supply the connected Motor Modules.

Line Modules 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

6.2 Basic Line Modules

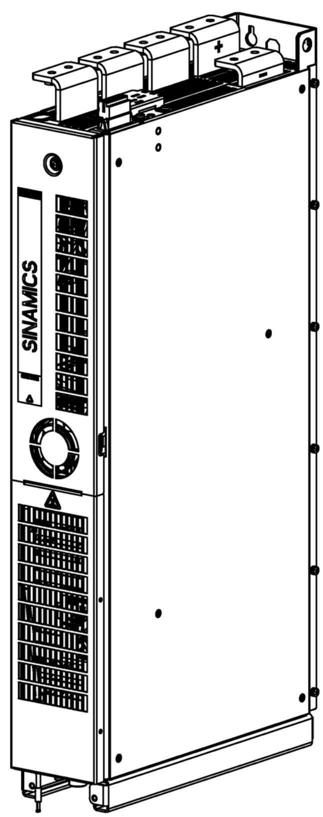
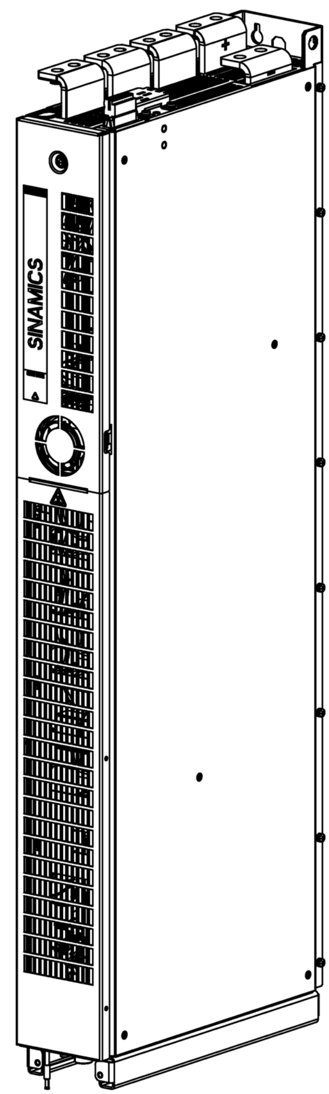
6.2.1 Description

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 voltage by a factor of 1.35 (under partial load) or 1.32 (under full load).

Table 6- 1 Overview of Basic Line Modules

	
Frame size FBL	Frame size GBL

Components of the Basic Infeed

A Basic Infeed comprises a Basic Line Module and an external line connection, which comprises a line reactor.

Operating principle

One or more Motor Modules can be connected to the power supply system 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 on TN, 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 directly determined.

An external 24 V DC power 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.
- For multiple infeeds, power must be supplied to the systems from a common infeed point (i.e. different line supplies 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

Different power units cannot be connected in parallel.

It is only possible to connect Basic Line Modules in parallel if all power units have the same hardware version.

It is not possible to connect Basic Line Modules with Article No. 6SL3335-1Txxx-xAA0 and Article No. 6SL3335-1Txxx-xAA3 in parallel.

6.2.2 Safety information

> ⚠ **WARNING**
>
> **Not observing fundamental safety instructions and residual risks**
>
> Not observing fundamental safety instructions and residual risks listed in Chapter 1 can result in accidents with severe injuries or death.
>
> - Comply with the fundamental safety instructions.
> - When assessing the risk, take into account residual risks.

> ⚠ **DANGER**
>
> **Electric shock due to a high DC link voltage**
>
> As long as the Line Module is connected to the line supply, the DC link is charged with a high voltage. Contact with components leads to death or serious injury.
>
> - Disconnect and isolate the Line Module from the line supply when carrying out installation and maintenance work.

> ⚠ **WARNING**
>
> **Electric shock or fire due to overcurrent protective devices that trip too late**
>
> Overcurrent protective devices that do not trip or trip too late can cause an electric shock or fire.
>
> - To protect personnel and for fire protection purposes, at the infeed point, the short-circuit rating and loop impedance must correspond to the specifications in the documentation in order for the installed overcurrent protection devices to trip within the specified time.

> ⚠ **WARNING**
>
> **High leakage currents when the protective conductor in the line feeder cable is interrupted**
>
> The drive components conduct a high leakage current via the protective conductor. Touching conductive parts when the protective conductor is interrupted can result in death or serious injury.
>
> - Ensure that the external protective conductor satisfies at least one of the following conditions:
>   - It has been installed so that it is protected against mechanical damage. [1)]
>   - For an individual core, it has a cross-section of at least 10 mm^2 Cu.
>   - If it is a conductor of a multi-conductor cable, it has a cross-section of at least 2.5 mm^2 Cu.
>   - It has a second protective conductor in parallel with the same cross-section.
>
>   [1)] Cables laid within control cabinets or closed machine housings are considered to be adequately protected against mechanical damage.
> - Observe the local regulations for protective conductors subject to a high leakage current at the operating location.

WARNING

Fire due to inadequate ventilation clearances

Inadequate ventilation clearances can cause overheating with a risk for personnel through smoke development and fire. This can also result in more downtimes and reduced service lives of Line Modules.

- Observe the ventilation clearances above, below and in front of the Line Modules, which are specified in the dimension drawings.

CAUTION

Fire due to overheating when the total length of the power cables is exceeded

Overheating and a fire can result when the total length of the power cables is exceeded.

- Ensure that the total length of the power cables (motor feeder cables and DC link cables) does not exceed the values specified in the technical data.

NOTICE

Material damage caused by mechanically loaded busbars and liquid coolant connections

Mechanically loaded busbars and liquid coolant connections can cause damage on the device.

- Do not use the busbars and liquid coolant connections protruding from the device as handles or as support surfaces during transport.

NOTICE

Material damage caused by loose power connections

Insufficient tightening torques or vibration can result in faulty electrical connections. This can cause fire damage or malfunctions.

- Tighten all power connections with the specified tightening torques, e.g. line connection, motor connection, DC link connections.
- Check the tightening torques of all power connections at regular intervals and tighten them when required. This applies in particular after transport.

NOTICE

Damage to the devices when performing a voltage test as a result of connections that have not been disconnected

As part of routine tests, SINAMICS S components undergo a voltage test according to IEC 61800-5-1.

- Disconnect or unplug all SINAMICS devices before the voltage test of the machine equipment according to IEC 60204-1, Section 18.4.

NOTICE
Damage through use of incorrect DRIVE-CLiQ cables Damage or malfunctions can occur on the devices or system when DRIVE-CLiQ cables are used that are either incorrect or have not been released for this purpose. • Only use suitable DRIVE-CLiQ cables that have been released by Siemens for the particular application.

6.2.3 Interface description

6.2.3.1 Overview

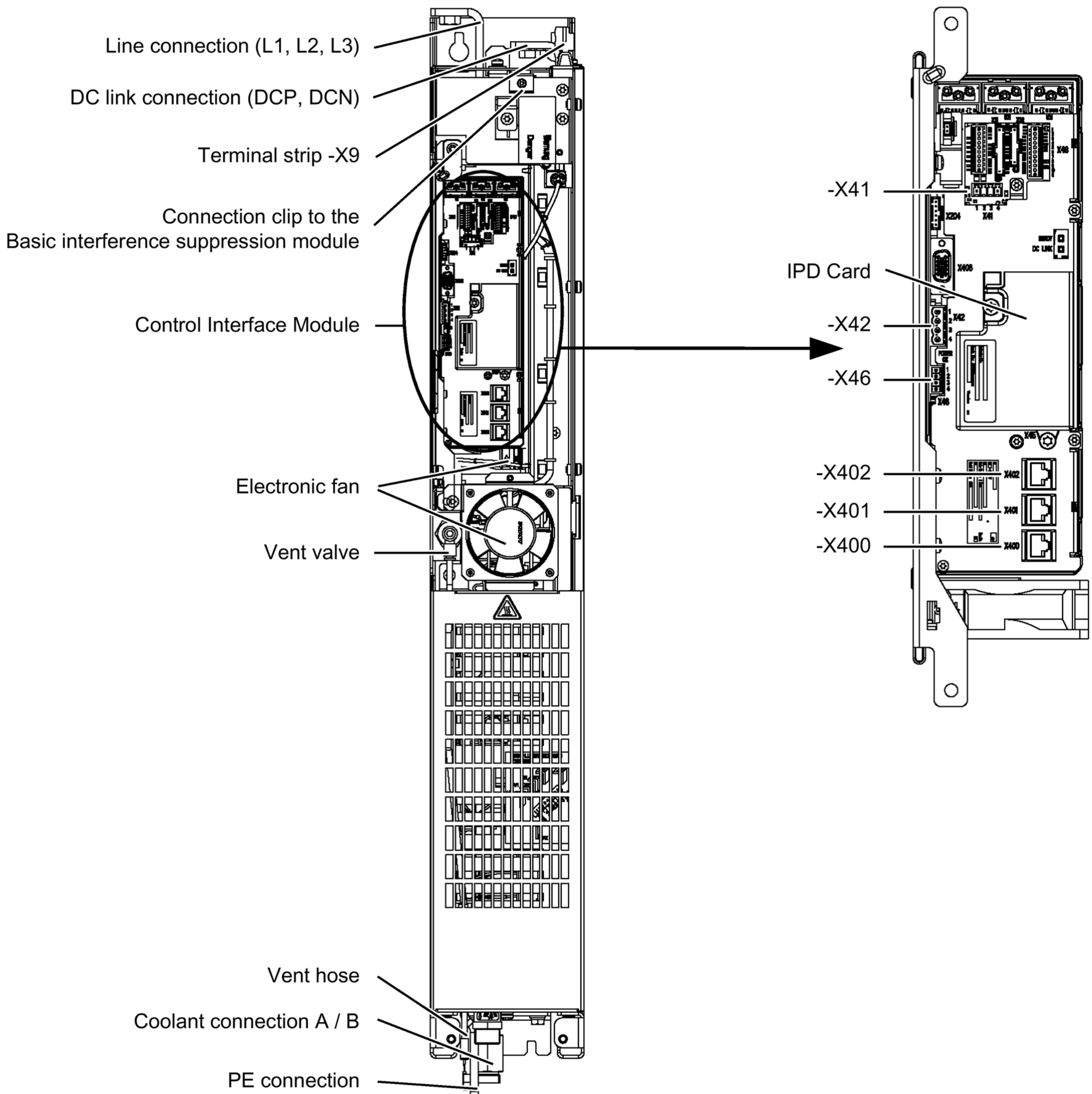


Figure 6-1 Basic Line Module, frame size FBL

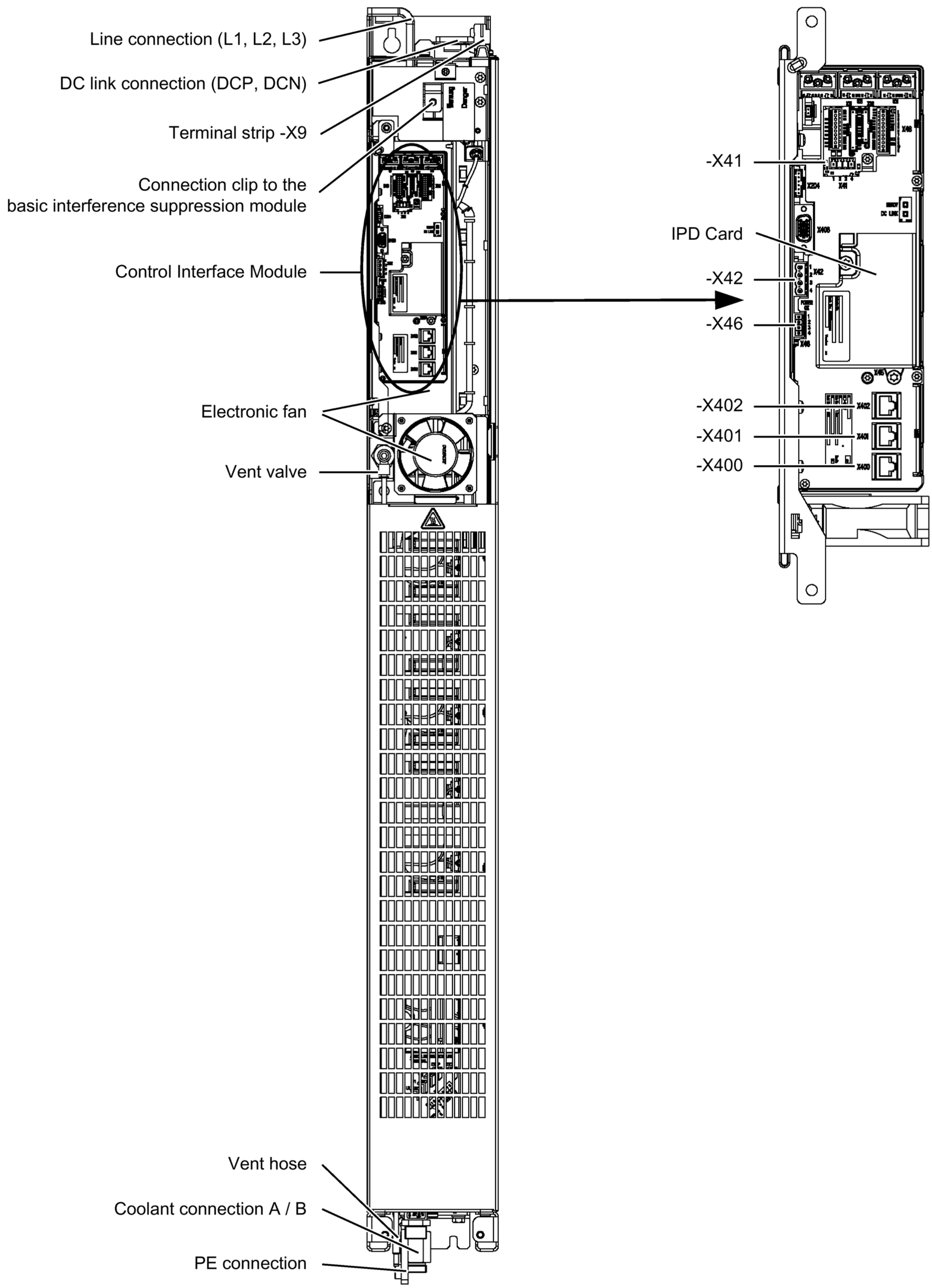


Figure 6-2 Basic Line Module, frame size GBL

6.2.3.2 Connection example

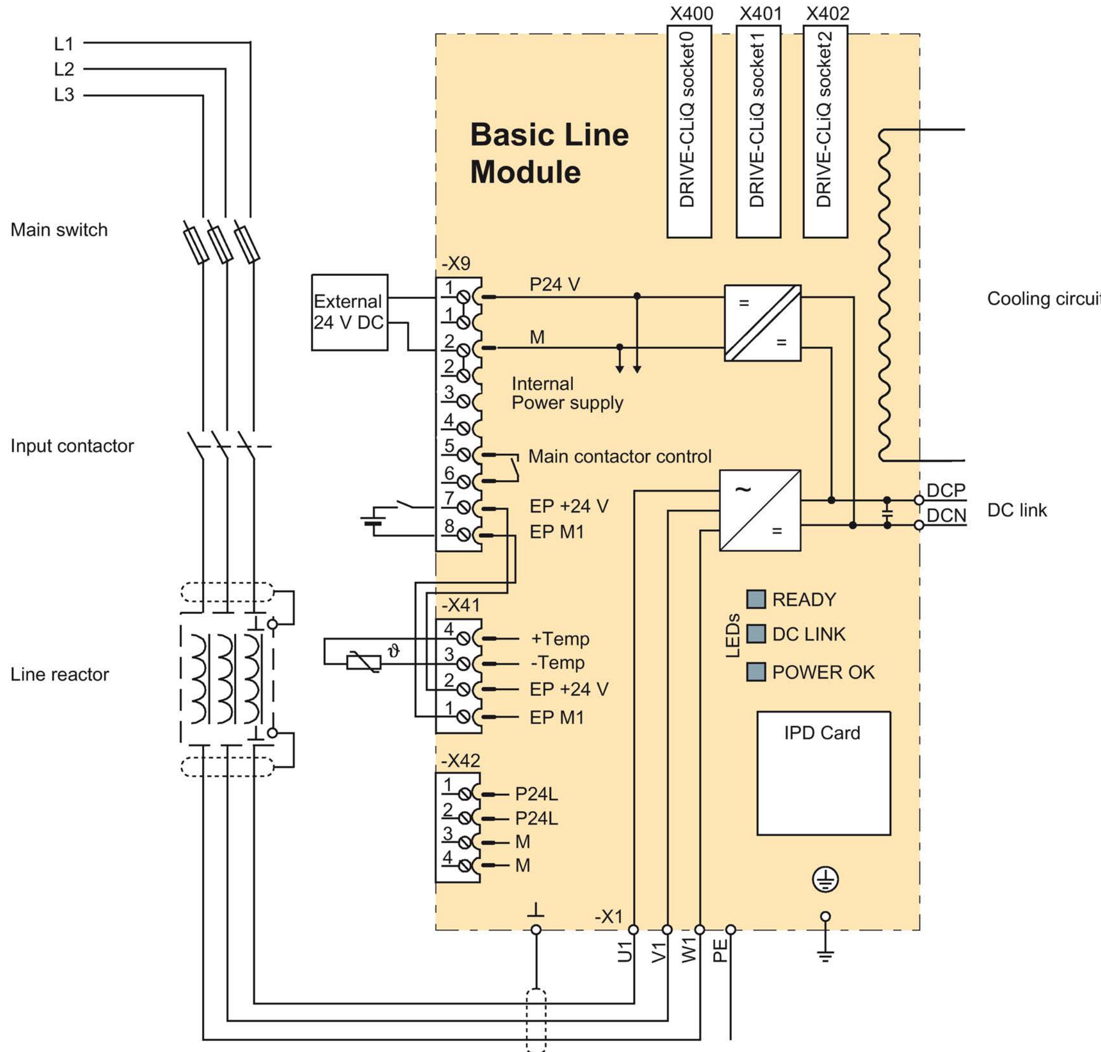


Figure 6-3 Connection example for Basic Line Modules

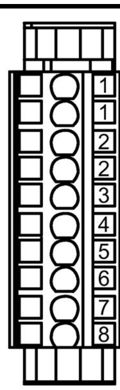
6.2.3.3 Line/load connection

Table 6- 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) ... 3 AC 480 V +10 % • 3 AC 500 V -10 % (-15 % < 1 min) ... 3 AC 690 V +10 % Frequency: 47 ... 63 Hz Connecting thread: M12/50 Nm for busbar connection
DCP, DCN DC power output	Voltage: • 513 ... 648 V DC • 675 ... 932 V DC Connecting thread: M12/50 Nm for busbar connection
PE connection	Connecting thread: M12/50 Nm for busbar connection

6.2.3.4 X9 terminal strip

Table 6- 3 Terminal strip X9

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

Note

Connection to terminals 7 and 8

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

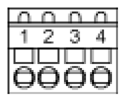
Note

Looping through the supply voltage

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.

6.2.3.5 X41 EP terminal / temperature sensor connection

Table 6- 4 Terminal strip X41

Connector	Terminal	Function	Technical data
	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 / PT1000 / PTC
	4	+ Temp	
Max. connectable cross-section: 1.5 mm²			

WARNING

Electric shock in the event of voltage flashovers at the temperature sensor

Voltage flashovers in the signal electronics can occur in motors without safe electrical separation of the temperature sensors.

- Only use temperature sensors that fully comply with the specifications of the safety isolation.
- If safe electrical separation cannot be guaranteed (for linear motors or third-party motors, for example), use a Sensor Module External (SME120 or SME125) or Terminal Module TM120.

NOTICE

Device failure as a result of unshielded or incorrectly routed cables to temperature sensors

Unshielded or incorrectly routed cables to temperature sensors can result in interference being coupled into the signal processing electronics from the power side. This can result in significant disturbance of all signals (fault messages) up to failure of individual components (destruction of the devices).

- Only use shielded cables as temperature sensor cables.
- If temperature sensor cables are routed together with the motor cable, use separately shielded cables twisted in pairs.
- Connect the cable shield to ground potential through a large surface area.

NOTICE

Damage to motor in the event of incorrectly connected KTY temperature sensor

If a KTY temperature sensor is connected with incorrect polarity, it is not possible to detect when the motor overheats. Overheating can cause damage to the motor.

- Connect a KTY temperature sensor with the correct polarity.

Note

The temperature sensor connection can be used for motors that are equipped with a KTY84-1C130, PT1000 or PTC measuring sensor in the stator windings.

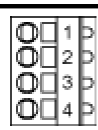
Note

Connection to terminal strip -X9

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

6.2.3.6 X42 terminal strip

Table 6- 5 Terminal strip X42 voltage supply for Control Unit, Sensor Module and Terminal Module

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

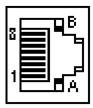
Note

Connection options of terminal strip X42

The terminal strip is not intended to supply other 24 VDC loads (for example, for supplying other components on the plant/system side), as the voltage supply of the Control Interface Module could also be overloaded and possibly result in malfunctions.

6.2.3.7 DRIVE-CLiQ interfaces X400, X401, X402

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

Connector	PIN	Signal name	Technical data
	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.) Article number: 6SL3066-4CA00-0AA0			

6.2.3.8 Cooling circuit connections

Table 6- 7 Cooling circuit connections

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

Note

Replacement seal

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.

The replacement seal is commercially available as flat Viton polymer seal with hardness 75 (+/-5) Shore A (Viton is the commercial name for elastomers with the abbreviations FPM and FKM). The dimensions are as follows: Inner diameter 15 mm, thickness 1.5 mm. Depending on the thread form of the union nut, the outer diameter is 26 mm (with undercut) or 24 mm (without undercut).

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

Table 6- 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	--- 1)	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 lies outside the permitted tolerance range.
Orange	Orange	DRIVE-CLiQ communication is being established.
Red	--- 1)	This component has at least one fault. **Remark:** The LED is activated irrespective of whether the corresponding messages have been reconfigured.
Flashing light 0.5 Hz: green/red	--- 1)	Firmware is being downloaded.
Flashing light 2 Hz: green/red	--- 1)	Firmware download is complete. Waiting for POWER ON.
Flashing light 2 Hz: green/orange or red/orange	--- 1)	Detection of the components via LED is activated (p0124). Note: Both options depend on the LED status when module recognition is activated via p0124 = 1.

1) Irrespective of the status of the LED "DC LINK"

Table 6- 9 Meaning of the LED "POWER OK" on the Control Interface Module in the Basic Line Module

LED	Color	State	Description
POWER OK	Green	Off	DC link voltage or control voltage at -X9 too low.
		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

Electric shock when live parts of the DC link are touched

Hazardous DC link voltages may be present at any time regardless of the status of the "DC LINK" LED. This means that when live parts are touched, this can result in death or serious injury.

- Observe the warning information on the component.

6.2.4 Dimension drawing

Dimension drawing, frame size FBL

The mandatory cooling clearances are indicated by the dotted line.

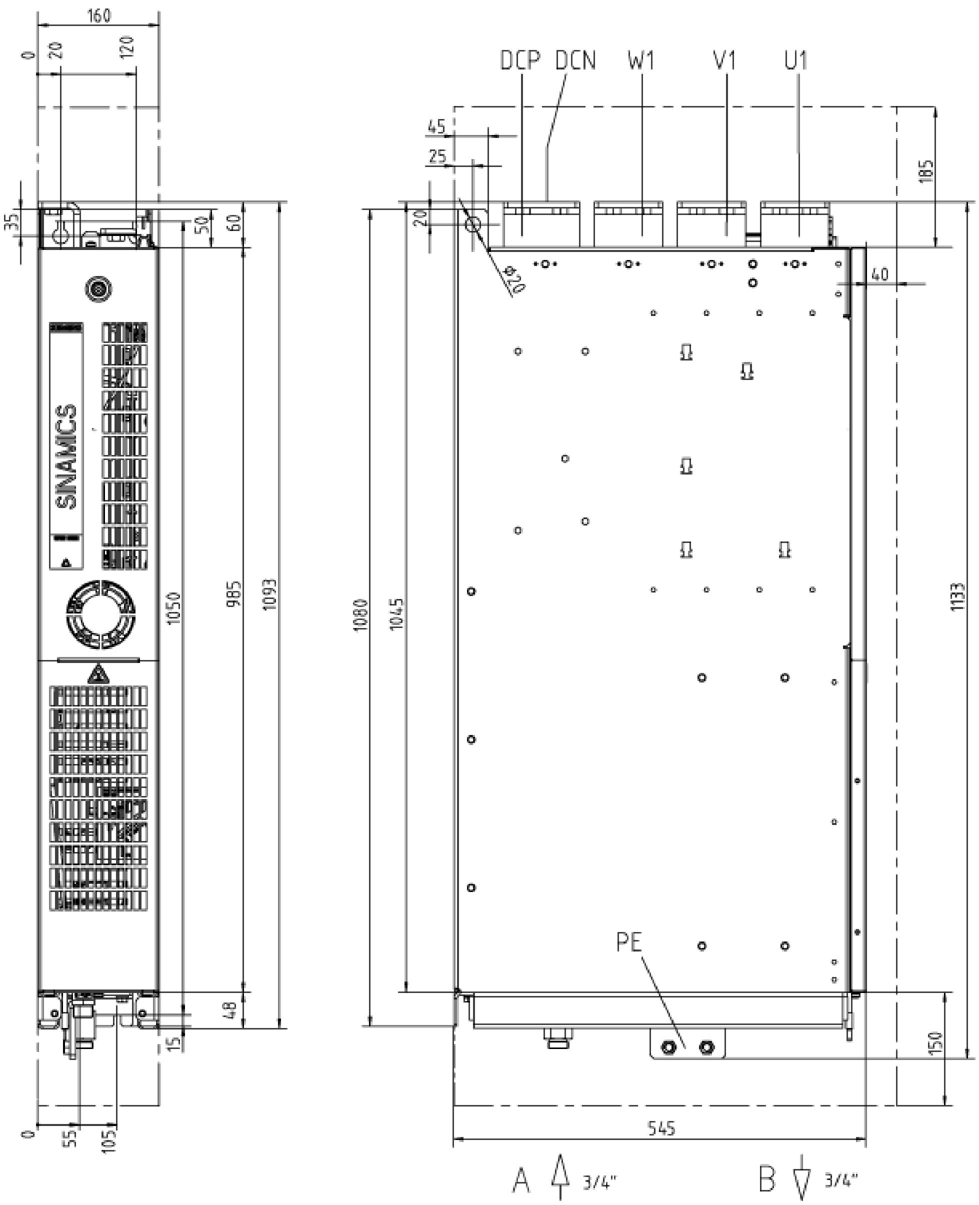


Figure 6-4 Dimension drawing, Basic Line Module, frame size GBL. Front view, side view

Dimension drawing, frame size GBL

The mandatory cooling clearances are indicated by the dotted line.

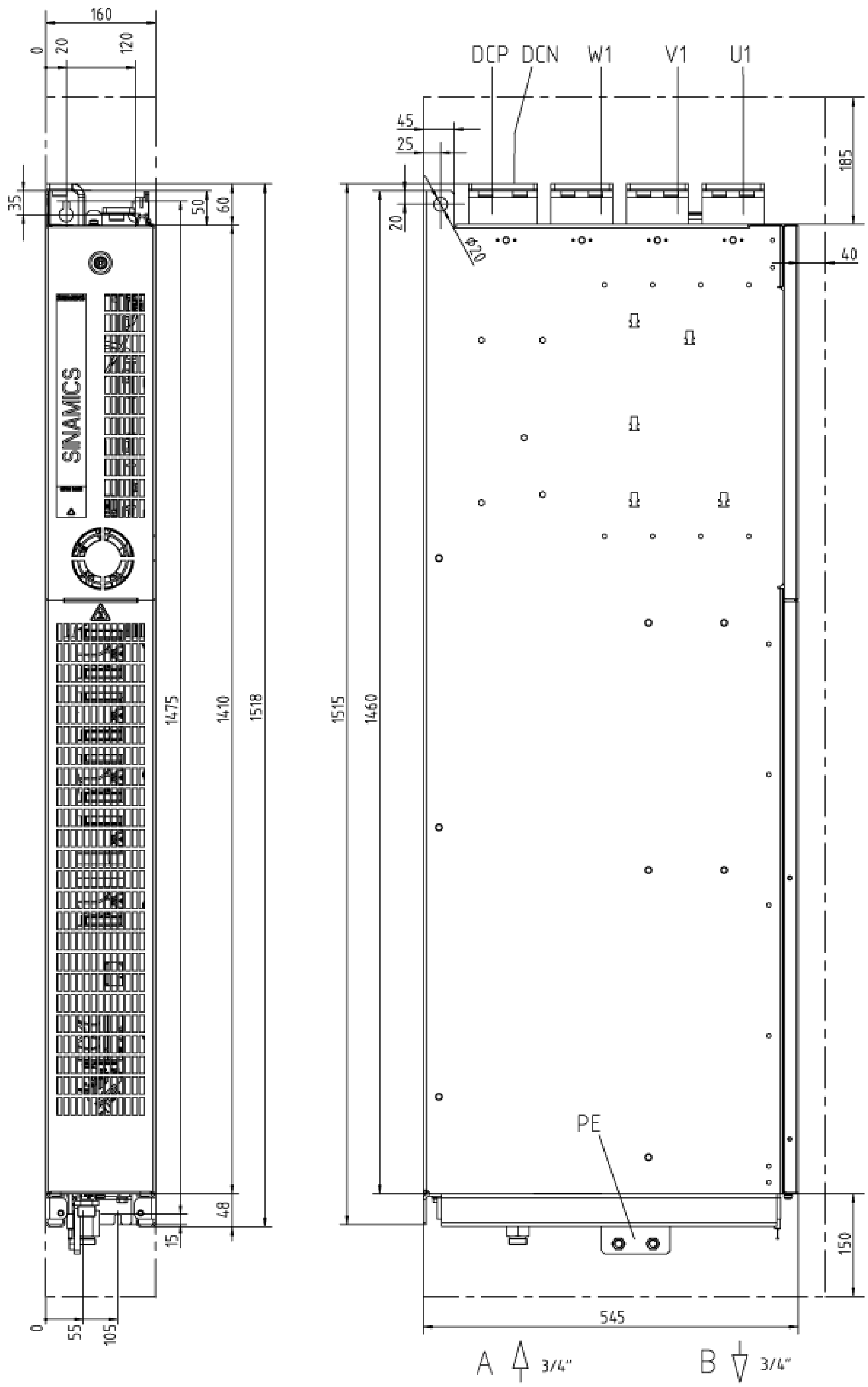


Figure 6-5 Dimension drawing, Basic Line Module, frame size GBL. Front view, side view

6.2.5 Installation

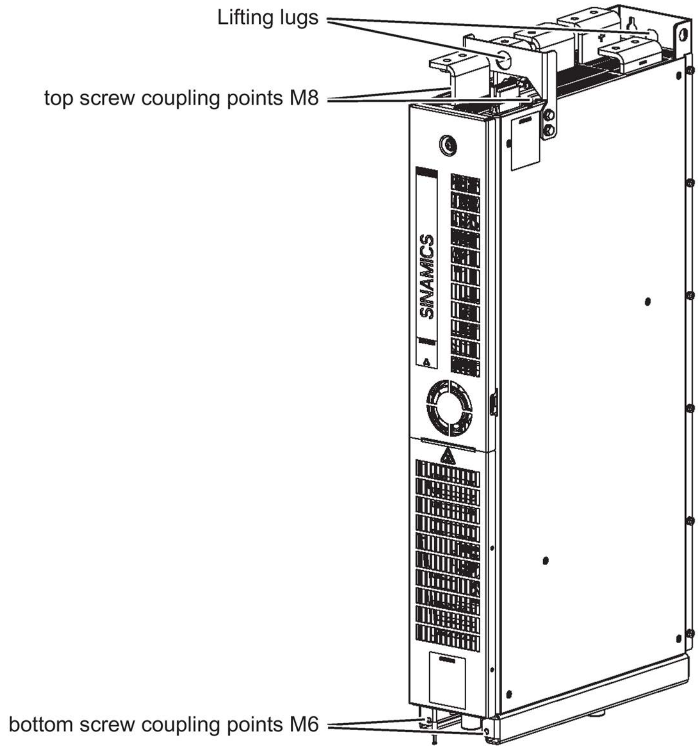


Figure 6-6 Lifting lugs / screw coupling points for mechanical support

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 four screws ("2" in the diagram) and remove the guard.

⚠CAUTION
Risk of injury due to toppling when placing down on the protection guard
A module placed down on the protection guard can topple over therefore causing injury.
• When the module is placed down on the protection guard, ensure that it cannot topple over.

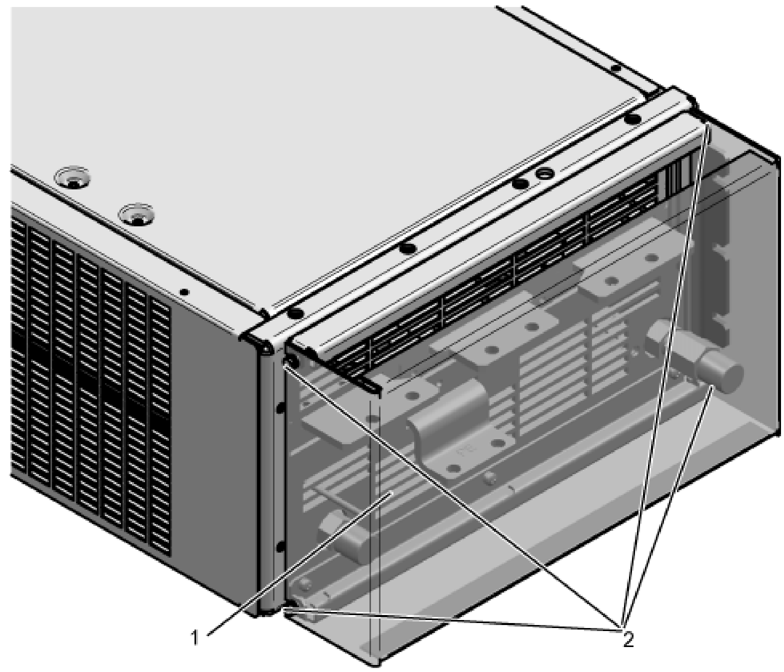


Figure 6-7 Protection guard

Note

Mounting fixture for power units

The mounting fixture for power units can be used to mount Basic Line Modules, see "Mounting equipment for power units (Page 357)".

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.

Note

Transport in the horizontal position

Transport in the horizontal position is permissible.

It is not permissible to screw the crane lifting lug into the thread at the lower side of the Line Module.

NOTICE

Damage to the device due to improper transport

Improper transport can cause mechanical loads on the housing or busbars which can result in damage to the device.

- Use a lifting harness with vertical ropes or chains during transport.
- Do not use the busbars as handles or for fastening a lifting harness.
- Only tighten the crane lifting lugs by hand. Remove the crane lifting lugs after the installation, but keep them for later 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 at 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.

WARNING

Electric shock due to insufficient insulating clearance (air clearances and creepage distances)

Incorrect mounting of the reinforcing sheet metal parts can result in insufficient insulating clearance to live parts and can cause death or serious injury.

- Ensure that the reinforcing sheet metal parts do not come into contact with live parts and that an insulation clearance (air clearances and creepage distances) of >13 mm / 25 mm is always maintained.
- As a result of customer specifications or the specifications of certification bodies, under certain circumstances, larger air clearances and creepage distances may be required. Take this into account for the mechanical design of the cabinet and when installing.

6.2.6 Electrical connection

Removing the connection clip of the integrated basic interference suppression module to ground

The connection of the integrated basic interference suppression module to ground must be disconnected if the device is operated on one of the following line system configurations:

- Non-grounded line supply (IT supply system)
- Line supply with grounded line conductor

The connection is disconnected by removing the connection clip of the integrated basic interference suppression module to ground.
To do so, both screws ("1" in the diagram below) must be released and the connection clip withdrawn from the device towards the front.

NOTICE

Damage to the device by not removing the connection clip

Failure to remove the connection clip of the integrated basic interference suppression module to ground for a non-grounded line supply (IT supply system) or a line supply with a grounded line conductor can cause significant damage to the device.

- For a non-grounded line supply (IT supply system) or a line supply with a grounded line conductor, remove the connection clip of the integrated basic interference suppression module to ground.

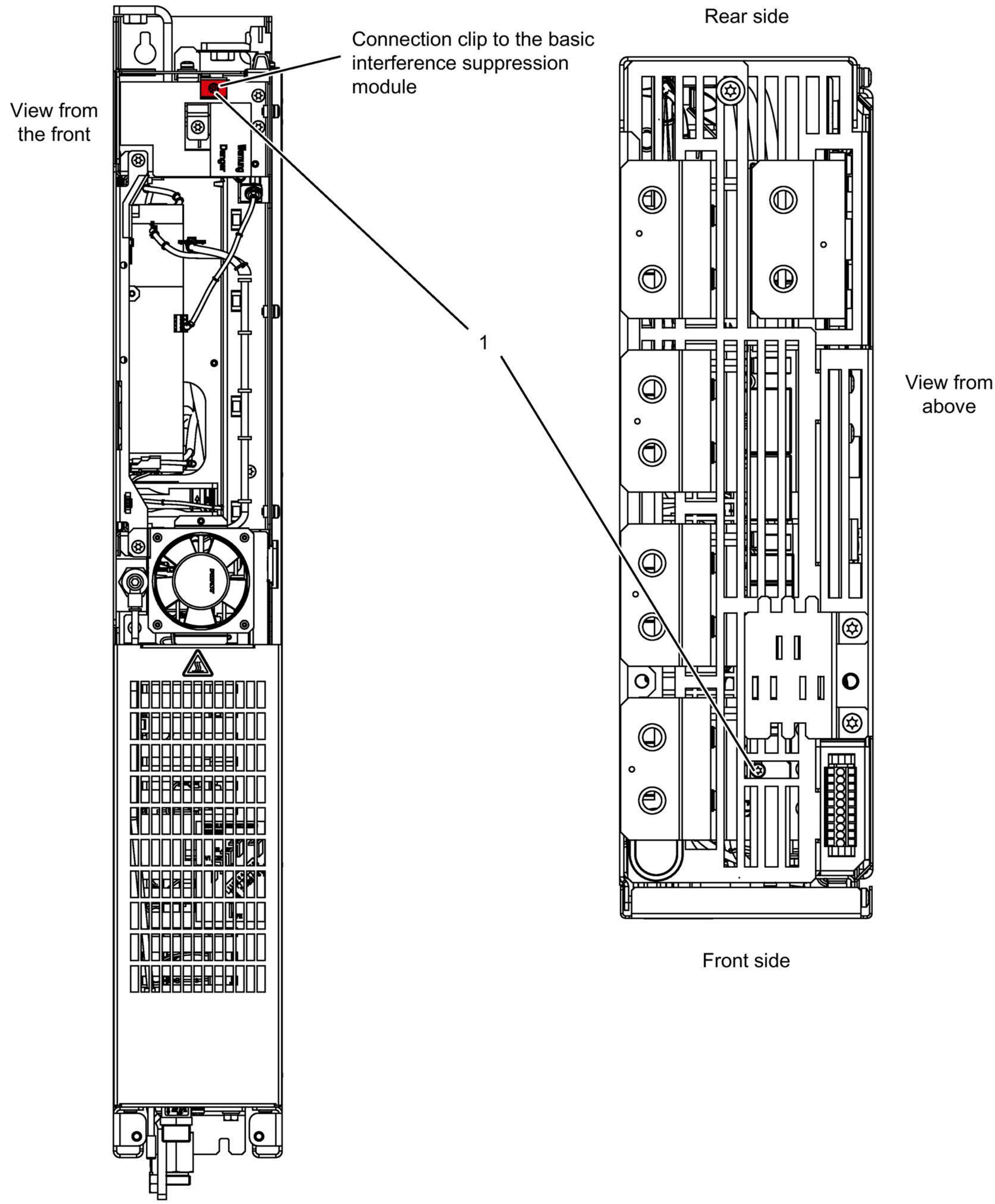


Figure 6-8 Removing the connection clip of the basic interference suppression module to ground

6.2.7 Technical specifications

6.2.7.1 Basic Line Modules, 380 ... 480 V 3 AC

Table 6- 10 Technical data for Basic Line Modules, 3 AC 380 ... 480 V

Article number	**6SL3335–**	**1TE37–4AA3**	**1TE41–2AA3**	**1TE41–7AA3**	
Rated power - At $I_{L\,DC}$ (50Hz 400V) - At $I_{H\,DC}$ (50Hz 400V) - At $I_{L\,DC}$ (60Hz 460V) - At $I_{H\,DC}$ (60Hz 460V)	 kW kW HP HP	 360 280 555 430	 600 450 925 690	 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 - Electronics power supply - Fan supply voltage - DC link voltage	 V_{ACrms} Hz V_{DC} V_{AC} V_{DC}	 3 AC 380 -10% (-15% < 1 min) ... 3 AC 480 +10% 47 ... 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)			
Electronics current 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 - Dissipated to the ambient air	 kW kW kW	 2.95 2.95 0.25	 4.77 4.77 0.41	 6.39 6.39 0.57	
Rated flow rate	l/min	9	9	12	
Pressure drop, typical at the rated flow rate [3]	Pa	70000	70000	70000	
Liquid volume of integrated heat exchanger	dm^3	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 connection for M12 screw			
Max. conductor cross-sections - Line connection (U1, V1, W1) - DC link connection (DCP, DCN) - PE connection	 mm^2 mm^2 mm^2	 Busbar Busbar Busbar	 Busbar Busbar Busbar	 Busbar Busbar Busbar	
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	

Article number	6SL3335–	1TE37–4AA3	1TE41–2AA3	1TE41–7AA3	
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	
Recommended fuse [4) 5)] - Number per phase (connected in parallel) - Rated current - Frame size acc. to IEC 60269	 A 	3NE1333-2 2 [6)] 450 2	3NE1435-2 2 [6)] 560 3	3NE1438-2 2 [6)] 800 3	
Minimum short-circuit current [7)]	kA	8.8	12.4	20	

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% utilization level. The value in normal operation is lower.

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.

5) Only 3NE1 fuses should be used to protect the devices. These must be located as close as possible to the converter. The specified 3NA3 fuses can be used for the additional cable protection, see Catalog D21.3.

6) When using fuses connected in parallel in each phase, if one fuse ruptures, then all of the fuses must be replaced.

7) Minimum current required for reliable triggering of the designated protective devices.

6.2.7.2 Basic Line Modules, 500 ... 690 V 3 AC

Table 6- 11 Technical data for Basic Line Modules, 3 AC 500 ... 690 V

Article number	6SL3335–	1TG34–2AA3	1TG37–3AA3	1TG41–3AA3	1TG41–7AA3
Rated power - At $I_{L\,DC}$ (50Hz 690V) - At $I_{H\,DC}$ (50Hz 690V) - At $I_{L\,DC}$ (50Hz 500V) - At $I_{H\,DC}$ (50Hz 500V) - At $I_{L\,DC}$ (60Hz 575V) - At $I_{H\,DC}$ (60Hz 575V)	 kW kW kW kW HP HP	 355 275 245 200 395 305	 630 475 420 345 705 530	 1100 840 750 610 1230 940	 1370 1070 950 775 1530 1195
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	 420 403 328 630	 730 700 570 1095	 1300 1248 1014 1950	 1650 1584 1287 2475
Input current - Rated current $I_{N\,E}$ - Maximum current $I_{max\,E}$	 A A	 340 510	 600 900	 1070 1605	 1350 2025
Supply voltages - Line voltage - Line frequency - Electronics power supply - Fan supply voltage - DC link voltage	 V_{ACrms} Hz V_{DC} V_{AC} V_{DC}	 3 AC 500 -10% (-15% < 1 min) ... 3 AC 690 +10% 47 ... 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)			
Electronics current 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 - At 60 Hz 575 V - Dissipated to the ambient air	 kW kW kW	 1.76 1.76 0.21	 3.09 3.09 0.38	 5.09 5.09 0.43	 6.25 6.25 0.55
Rated flow rate	l/min	9	9	12	12
Pressure drop, typical at the rated flow rate 3)	Pa	70000	70000	70000	70000
Liquid volume of integrated heat exchanger	dm^3	0.45	0.45	0.79	0.79
DC link capacitance - Basic Line Module - Drive line-up, max.	 µF µF	 4800 38400	 7700 61600	 15500 124000	 19300 154400
Sound pressure level L_{pA} (1 m) at 50/60 Hz	 dB(A)	 54	 54	 56	 56
Line/load connection		Flat connection for M12 screw			
Max. conductor cross-sections - Line connection (U1, V1, W1) - DC link connection (DCP, DCN) - PE connection	 mm^2 mm^2 mm^2	 Busbar Busbar Busbar	 Busbar Busbar Busbar	 Busbar Busbar Busbar	 Busbar Busbar Busbar
Max. cable length (total of all motor cables and DC link) - Shielded - Unshielded	 m m	 1500 2250	 1500 2250	 2250 3375	 2250 3375
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

Article number	6SL3335–	1TG34–2AA3	1TG37–3AA3	1TG41–3AA3	1TG41–7AA3
Weight	kg	108	108	185	185
Recommended fuse [4) 5)] - Number per phase (connected in parallel) - Rated current - Frame size acc. to IEC 60269	 A 	3NE1333-2 1 450 2	3NE1331-2 2 [6)] 350 2	3NE1447-2 2 [6)] 670 3	3NE1435-2 3 [6)] 560 3
Minimum short-circuit current [7)]	kA	4.4	7.2	16.8	18.9

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% utilization level. The value in normal operation is lower.

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.

6) Only 3NE1 fuses should be used to protect the devices. These must be located as close as possible to the converter. The specified 3NA3 fuses can be used for the additional cable protection, see Catalog D21.3.

6) When using fuses connected in parallel in each phase, if one fuse ruptures, then all of the fuses must be replaced.

7) Minimum current required for reliable triggering of the designated protective devices.

6.2.7.3 Overload capability

The Basic Line Modules have an overload reserve.

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

High overload

The base load current for a high overload I_{H_DC} is based on a duty cycle of 150 % for 60 s; the max. current I_{max_DC} can flow for 5 s.

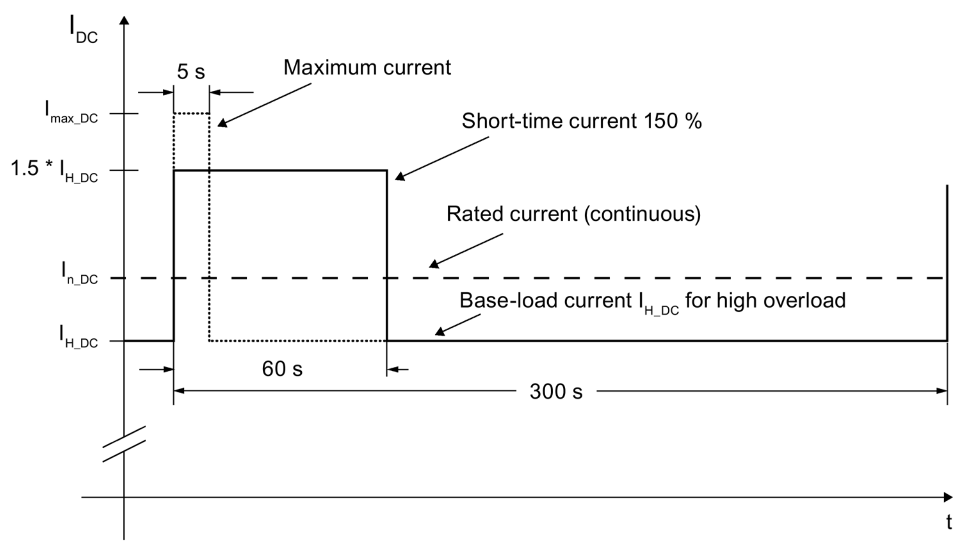


Figure 6-9 High overload

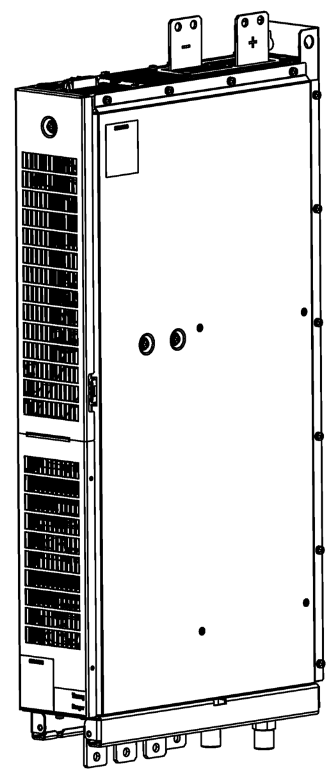
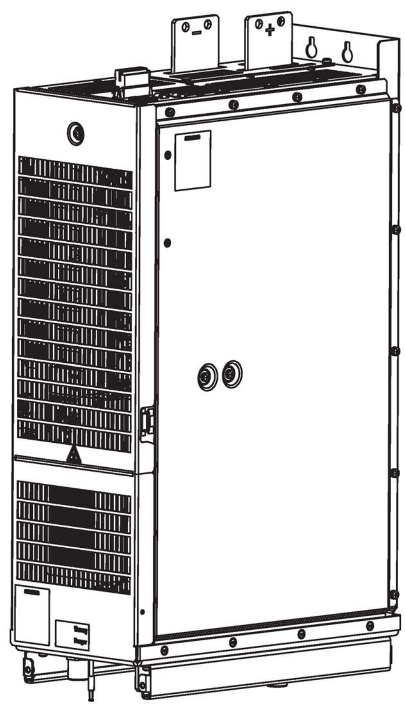
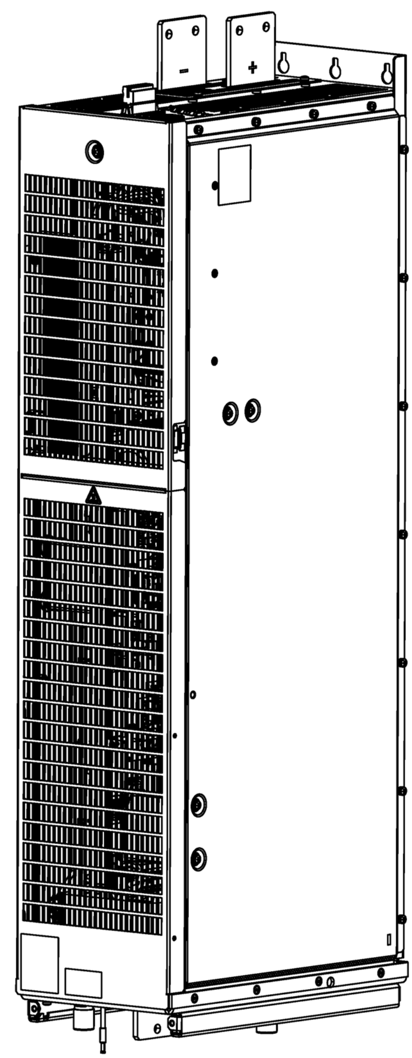
6.3 Active Line Modules

6.3.1 Description

The self-commutating infeed / regenerative feedback units act as step-up converters and generate a controlled DC link voltage that is 1.5x greater (factory setting) than the rated line 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.

Active Line Module can be used to implement reactive power compensation by specifying an additive reactive current.

Table 6- 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.

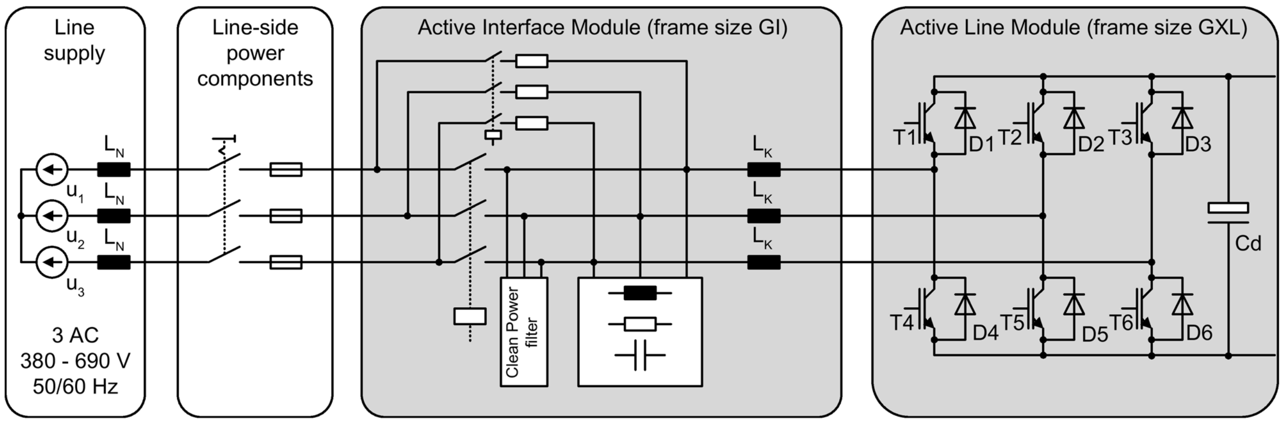


Figure 6-10 Overview of Active Infeeds, frame size GXL

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.

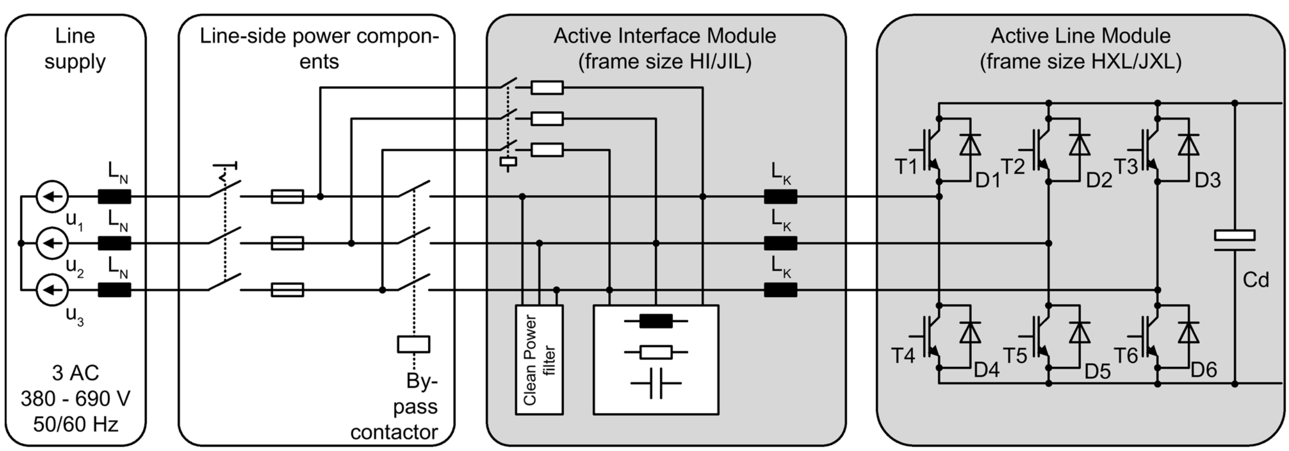


Figure 6-11 Overview of Active Infeeds, frame sizes HI/HXL and JI/JXL

Active Interface Module and Active Line Module assignment

The assignment of the Active Interface Modules (liquid cooled and air cooled) to the liquid-cooled Active Line Modules is shown in the following table.

Table 6- 13 Active Interface Module and Active Line Module assignment

Suitable for Active Line Module chassis format, liquid cooled	Rated power of the Active Line Modules at 400 V or 690 V kW	Active Interface Modules, liquid-cooled Article No.	Active Interface Modules, air-cooled Article No.
Line voltage 3 AC 380 ... 480 V			
6SL3335-7TE35-0AA3	300	– [1)]	6SL3300-7TE35-0AA1
6SL3335-7TE36-1AA3	380	6SL3305-7TE38-4AA5	
6SL3335-7TE38-4AA3	500	6SL3305-7TE38-4AA5	
6SL3335-7TE41-0AA3	630	6SL3305-7TE41-4AA5	
6SL3335-7TE41-4AA3	900	6SL3305-7TE41-4AA5	
Line voltage 3 AC 500 ... 690 V			
6SL3335-7TG35-8AA3	630	– [1)]	6SL3300-7TG35-8AA1
6SL3335-7TG37-4AA3	800	6SL3305-7TG37-4AA5	
6SL3335-7TG38-1AA3	900	6SL3305-7TG41-0AA5	
6SL3335-7TG41-0AA3	1100	6SL3305-7TG41-0AA5	
6SL3335-7TG41-3AA3	1400	6SL3305-7TG41-3AA5	
6SL3335-7TG41-6AA3	1700	6SL3305-7TG41-6AA5	

1) No liquid-cooled Active Interface Modules are available for these rated powers. Alternatively, air-cooled devices can be used.

Operating principle

One or more Motor Modules can be connected to the power supply system 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 on TN, IT and TT systems.

When the motors operate as generators, the Active Line Module feeds regenerative power back into the line supply.

The Active Line Module is used for:

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

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 device electronics 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 directly determined.

An external 24 V DC power supply is required to operate the 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.
- Each Active Line Module requires its own Active Interface Module.
- 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. the modules cannot be operated on different supplies).
- A derating factor of 5 % must be taken into consideration, regardless of the number of modules connected in parallel.

Note

Different power units cannot be connected in parallel.

It is only possible to connect Active Line Modules in parallel if all power units have the same hardware version.

It is not possible to connect Active Line Modules with Article No. 6SL3335-7Txxx-xAA0 and Article No. 6SL3335-7Txxx-xAA3 in parallel.

6.3.2 Safety information

WARNING

Not observing fundamental safety instructions and residual risks

Not observing fundamental safety instructions and residual risks listed in Chapter 1 can result in accidents with severe injuries or death.

- Comply with the fundamental safety instructions.
- When assessing the risk, take into account residual risks.

DANGER

Electric shock due to a high DC link voltage

As long as the Line Module is connected to the line supply, the DC link is charged with a high voltage. Contact with components leads to death or serious injury.

- Disconnect and isolate the Line Module from the line supply when carrying out installation and maintenance work.

WARNING

Electric shock or fire due to overcurrent protective devices that trip too late

Overcurrent protective devices that do not trip or trip too late can cause an electric shock or fire.

- To protect personnel and for fire protection purposes, at the infeed point, the short-circuit rating and loop impedance must correspond to the specifications in the documentation in order for the installed overcurrent protection devices to trip within the specified time.

WARNING

High leakage currents when the protective conductor in the line feeder cable is interrupted

The drive components conduct a high leakage current via the protective conductor. Touching conductive parts when the protective conductor is interrupted can result in death or serious injury.

- Ensure that the external protective conductor satisfies at least one of the following conditions:
  - It has been installed so that it is protected against mechanical damage. [1)]
  - For an individual core, it has a cross-section of at least 10 mm² Cu.
  - If it is a conductor of a multi-conductor cable, it has a cross-section of at least 2.5 mm² Cu.
  - It has a second protective conductor in parallel with the same cross-section.

  [1)] Cables laid within control cabinets or closed machine housings are considered to be adequately protected against mechanical damage.
- Observe the local regulations for protective conductors subject to a high leakage current at the operating location.

WARNING

Fire due to inadequate ventilation clearances

Inadequate ventilation clearances can cause overheating with a risk for personnel through smoke development and fire. This can also result in more downtimes and reduced service lives of Line Modules.

- Observe the ventilation clearances above, below and in front of the Line Modules, which are specified in the dimension drawings.

CAUTION

Fire hazard due to overheating when the total length of the power cables is exceeded

Overheating and a fire can result when the total length of the power cables is exceeded.

- Ensure that the total length of the power cables (motor feeder cables and DC link cables) does not exceed the values specified in the technical data.

NOTICE

Material damage caused by mechanically stressed busbars and coolant connections

Mechanically stressed busbars and coolant connections can damage the device.

- Do not use the busbars and liquid coolant connections protruding from the device as handles or as support surfaces during transport.

NOTICE

Material damage caused by loose power connections

Insufficient tightening torques or vibration can result in faulty electrical connections. This can cause fire damage or malfunctions.

- Tighten all power connections with the specified tightening torques, e.g. line connection, motor connection, DC link connections.
- Check the tightening torques of all power connections at regular intervals and tighten them when required. This applies in particular after transport.

NOTICE

Damage to the devices when performing a voltage test as a result of connections that have not been disconnected

As part of routine tests, SINAMICS S components undergo a voltage test according to IEC 61800-5-1.

- Disconnect or unplug all SINAMICS devices before the voltage test of the machine equipment according to IEC 60204-1, Section 18.4.

NOTICE

Damage through use of incorrect DRIVE-CLiQ cables

Damage or malfunctions can occur on the devices or system when DRIVE-CLiQ cables are used that are either incorrect or have not been released for this purpose.

- Only use suitable DRIVE-CLiQ cables that have been released by Siemens for the particular application.

Note

Operation on line supplies where energy recovery is not possible

In line supply systems without energy recovery capability (e.g. a diesel generator), device faults can occur as the braking energy cannot be dissipated.

- For line supplies without regenerative feedback capability (e.g. diesel generator), deactivate the regenerative feedback capability of the Line Modules using the appropriate parameter (see SINAMICS S120/S150 List Manual).
- The braking energy must then be dissipated via an additional Braking Module with braking resistor in the drive line-up.

6.3.3 Interface description

6.3.3.1 Overview

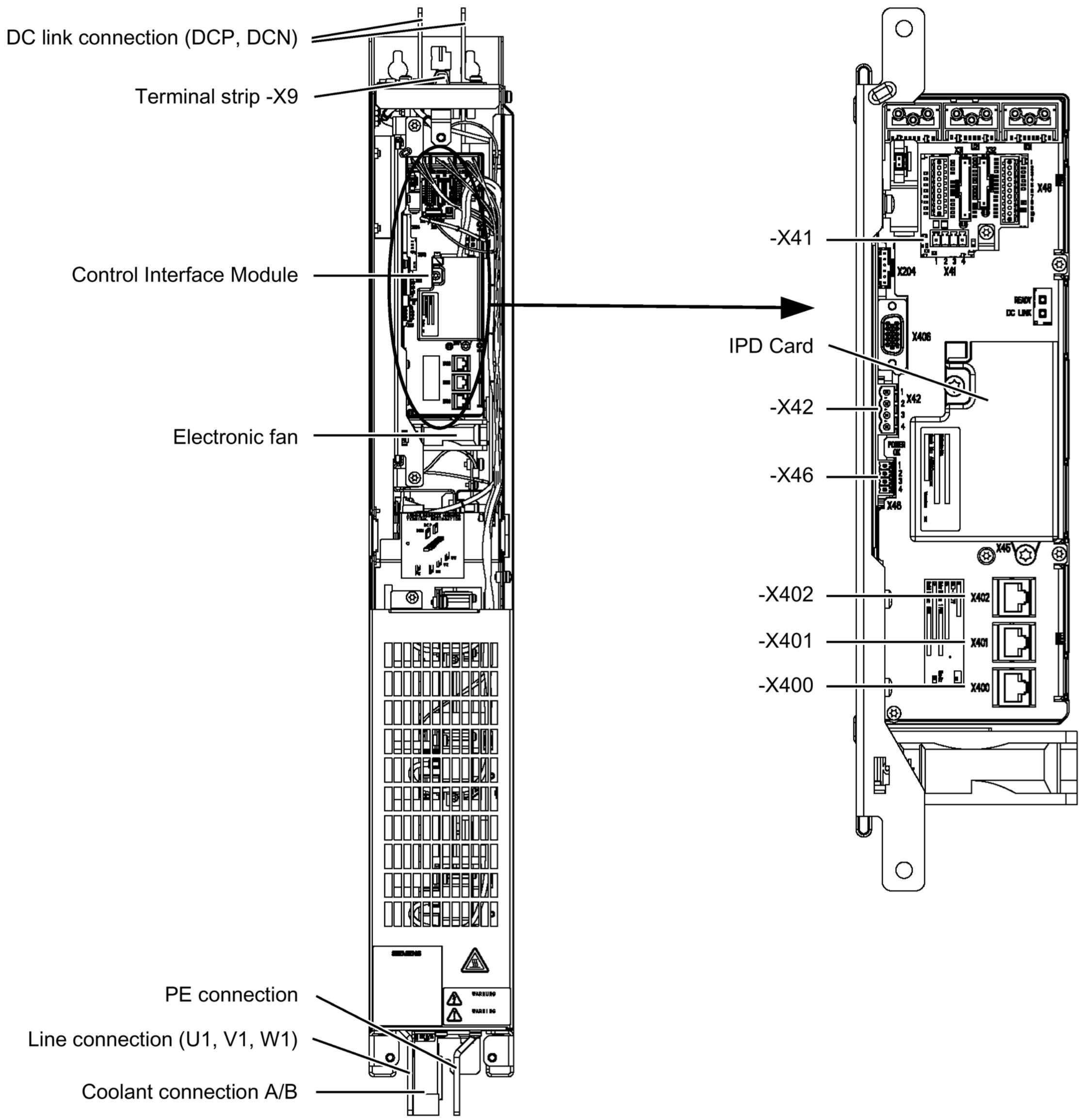


Figure 6-12 Active Line Module, frame size GXL

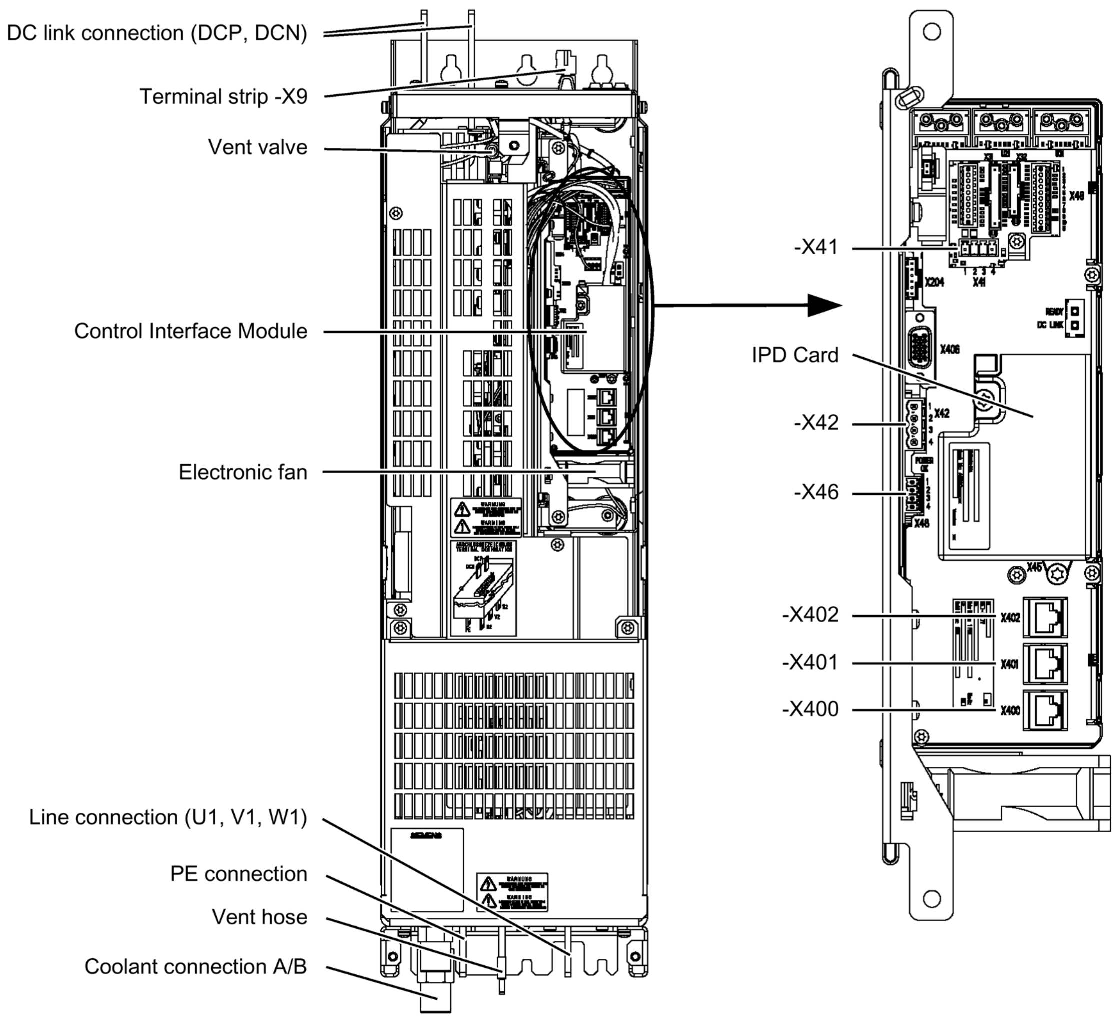


Figure 6-13 Active Line Module, frame size HXL

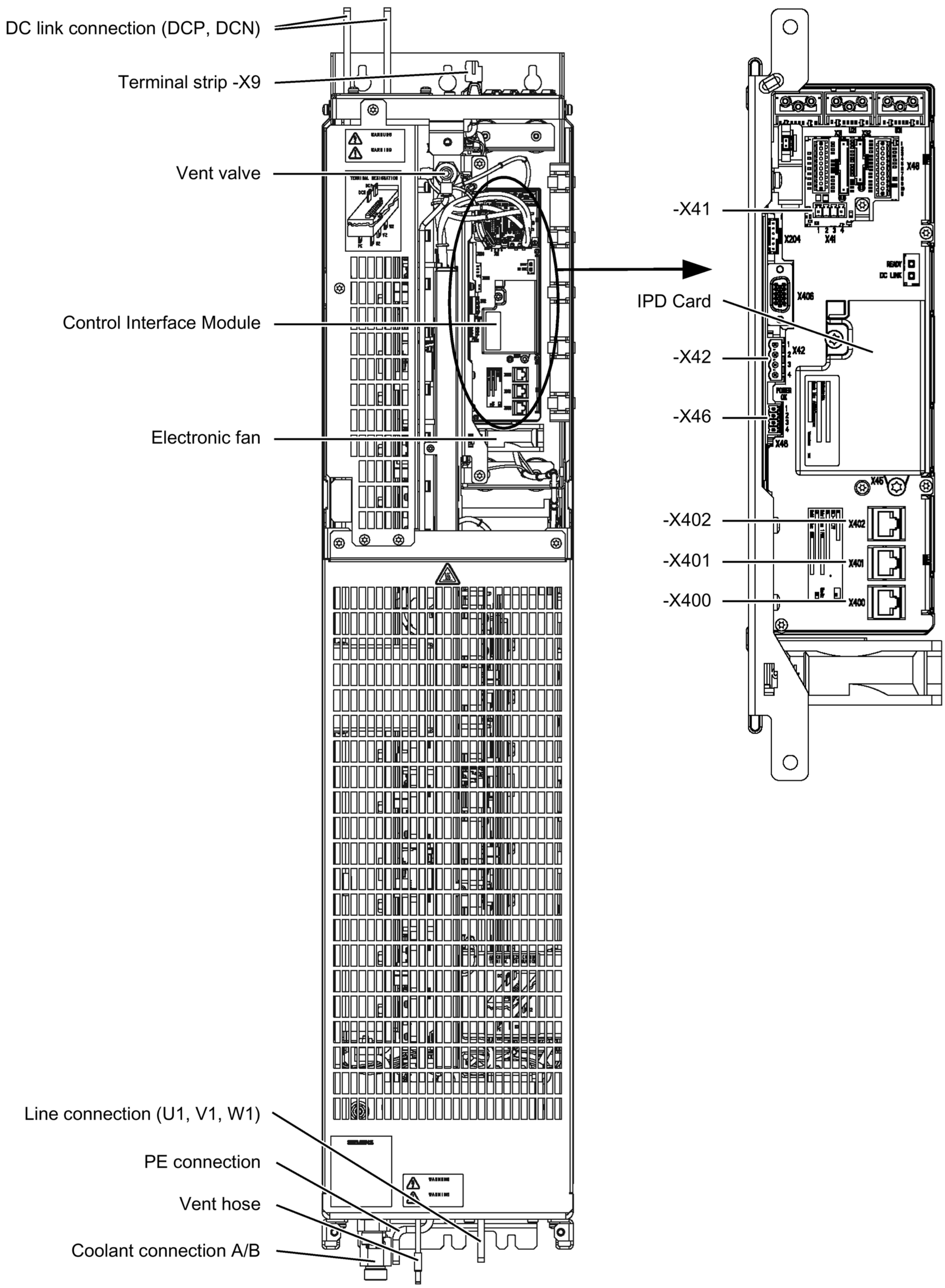


Figure 6-14 Active Line Module, frame size JXL

6.3.3.2 Connection example

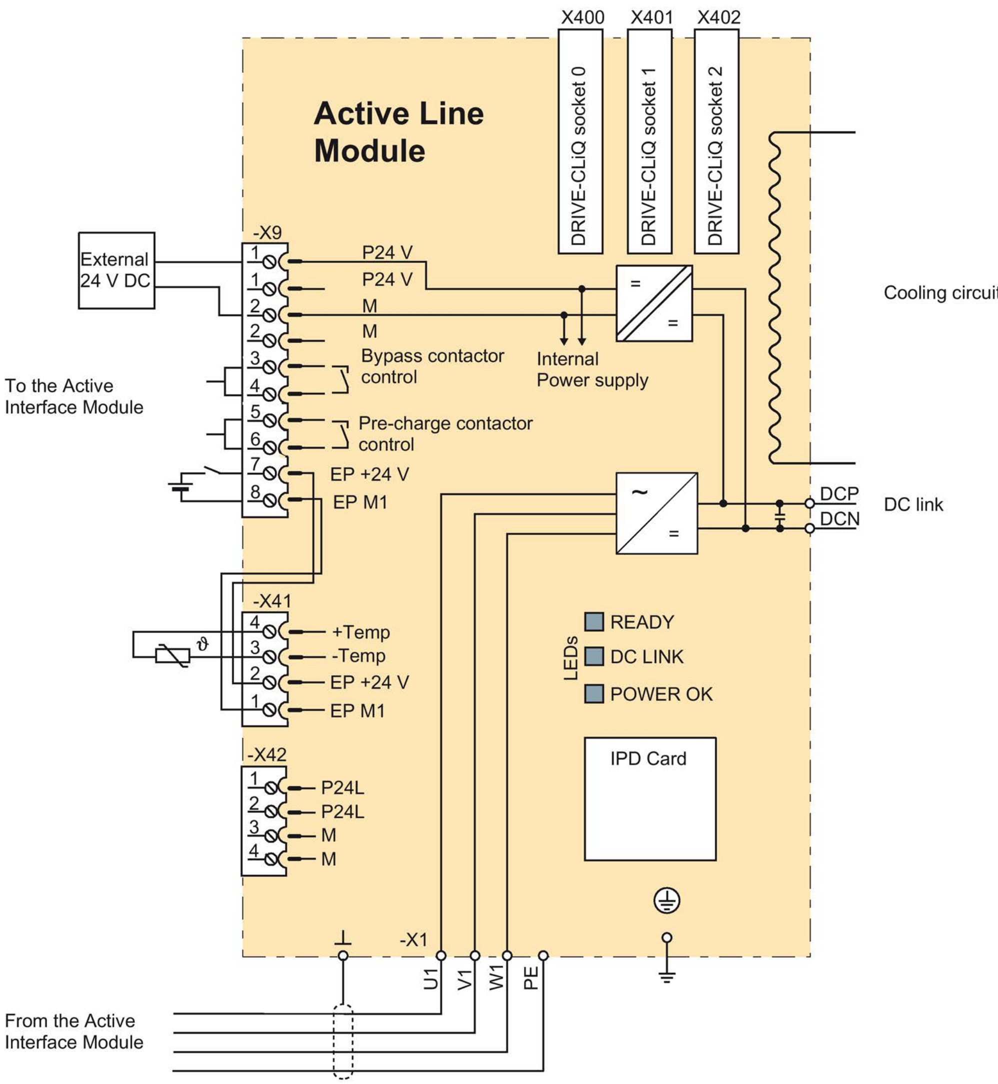


Figure 6-15 Example connection of Active Line Module

6.3.3.3 Line/load connection

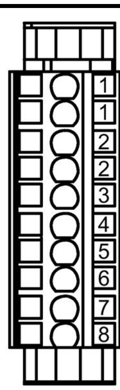
Table 6- 14 Line/load connection of the Active Line Module

Terminals	Technical specifications
U1, V1, W1 3 AC power input	Voltage: • 3 AC 380 V -10 % (-15 % < 1 min) ... 3 AC 480 V +10 % • 3 AC 500 V -10 % (-15 % < 1 min) ... 3 AC 690 V +10 % Frequency: 47 ... 63 Hz Connecting lugs: • Frame sizes FXL, GXL, HXL: d = 13 mm (M12/50 Nm) for cable lugs in accordance with DIN 46234 / DIN 46235 [1)] • Frame size JXL: d = 13 mm (M12/50 Nm) for busbar connection
DCP, DCN DC power output	Voltage: • 570 ... 720 V DC • 750 ... 1035 V DC Connecting lugs: d = 13 mm (M12/50 Nm) for busbar connection
PE connection	Connecting lugs: • Frame sizes FXL, GXL, HXL: d = 13 mm (M12/50 Nm) for cable lugs in accordance with DIN 46234 / DIN 46235 [1)] • Frame size JXL: d = 13 mm (M12/50 Nm) for busbar connection

[1]) Dimensions for connecting alternative cable lugs, see "cable lugs" in the appendix.

6.3.3.4 X9 terminal strip

Table 6- 15 Terminal strip X9

Connector	Terminal	Signal name	Technical data
	1	P24 V	External 24 V DC supply Voltage: 24 V DC (20.4 ... 28.8 V) Current 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 ... 28.8 V) Current consumption: 10 mA
	8	EP M1 (Enable Pulses)	
Max. connectable cross-section: 1.5 mm²			

Note

Connection to terminals 7 and 8

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

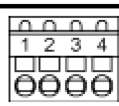
Note

Looping through the supply voltage

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.

6.3.3.5 X41 EP terminal / temperature sensor connection

Table 6- 16 Terminal strip X41

Connector	Terminal	Function	Technical data
	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 / PT1000 / PTC
	4	+ Temp	
Max. connectable cross-section: 1.5 mm²			

WARNING

Electric shock in the event of voltage flashovers at the temperature sensor

Voltage flashovers in the signal electronics can occur in motors without safe electrical separation of the temperature sensors.

- Only use temperature sensors that fully comply with the specifications of the safety isolation.
- If safe electrical separation cannot be guaranteed (for linear motors or third-party motors, for example), use a Sensor Module External (SME120 or SME125) or Terminal Module TM120.

NOTICE

Device failure as a result of unshielded or incorrectly routed cables to temperature sensors

Unshielded or incorrectly routed cables to temperature sensors can result in interference being coupled into the signal processing electronics from the power side. This can result in significant disturbance of all signals (fault messages) up to failure of individual components (destruction of the devices).

- Only use shielded cables as temperature sensor cables.
- If temperature sensor cables are routed together with the motor cable, use separately shielded cables twisted in pairs.
- Connect the cable shield to ground potential through a large surface area.

NOTICE

Damage to motor in the event of incorrectly connected KTY temperature sensor

If a KTY temperature sensor is connected with incorrect polarity, it is not possible to detect when the motor overheats. Overheating can cause damage to the motor.

- Connect a KTY temperature sensor with the correct polarity.

NOTICE

Looping in the circuit breaker into the EP terminal circuit for infeed units capable of energy recovery

If, for infeed units capable of energy recovery, the upstream circuit breaker is not controlled from the SINAMICS drive group, when the circuit breaker is opened, this can cause damage in the line section that was shutdown. As a consequence, in the line section involved - under certain circumstances - connected components can be damaged as a result of overvoltage.

- If, for infeed units capable of energy recovery, the upstream circuit breaker is not controlled from the SINAMICS drive group, then an auxiliary contact of the circuit breaker should be looped into the EP terminal circuit.

Note

The temperature sensor connection can be used for motors that are equipped with a KTY84-1C130, PT1000 or PTC measuring sensor in the stator windings.

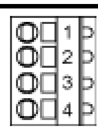
Note

Connection to terminal strip -X9

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

6.3.3.6 X42 terminal strip

Table 6- 17 Terminal strip X42 voltage supply for Control Unit, Sensor Module and Terminal Module

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

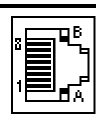
Note

Connection options of terminal strip X42

The terminal strip is not intended to supply other 24 VDC loads (for example, for supplying other components on the plant/system side), as the voltage supply of the Control Interface Module could also be overloaded and possibly result in malfunctions.

6.3.3.7 DRIVE-CLiQ interfaces X400, X401, X402

Table 6- 18 DRIVE-CLiQ interfaces X400, X401, X402

Connector	PIN	Signal name	Technical data
	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.) Article number: 6SL3066-4CA00-0AA0			

6.3.3.8 Cooling circuit connections

Table 6- 19 Cooling circuit connections

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

Note

Replacement seal

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.

The replacement seal is commercially available as flat Viton polymer seal with hardness 75 (+/-5) Shore A (Viton is the commercial name for elastomers with the abbreviations FPM and FKM). The dimensions are as follows: Inner diameter 15 mm, thickness 1.5 mm. Depending on the thread form of the union nut, the outer diameter is 26 mm (with undercut) or 24 mm (without undercut).

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

Table 6- 20 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	--- 1)	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 lies outside the permitted tolerance range.
Orange	Orange	DRIVE-CLiQ communication is being established.
Red	--- 1)	This component has at least one fault. **Remark:** The LED is activated irrespective of whether the corresponding messages have been reconfigured.
Flashing light 0.5 Hz: green/red	--- 1)	Firmware is being downloaded.
Flashing light 2 Hz: green/red	--- 1)	Firmware download is complete. Waiting for POWER ON.
Flashing light 2 Hz: green/orange or red/orange	--- 1)	Detection of the components via LED is activated (p0124). Note: Both options depend on the LED status when module recognition is activated via p0124 = 1.

1) Irrespective of the status of the LED "DC LINK"

Table 6- 21 Meaning of the LED "POWER OK" on the Control Interface Module in the Active Line Module

LED	Color	State	Description
POWER OK	Green	Off	DC link voltage or control voltage at -X9 too low.
		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

Electric shock when live parts of the DC link are touched

Hazardous DC link voltages may be present at any time regardless of the status of the "DC LINK" LED. This means that when live parts are touched, this can result in death or serious injury.

- Observe the warning information on the component.

6.3.4 Dimension drawing

Dimension drawing for frame size GXL

The mandatory cooling clearances are indicated by the dotted line.

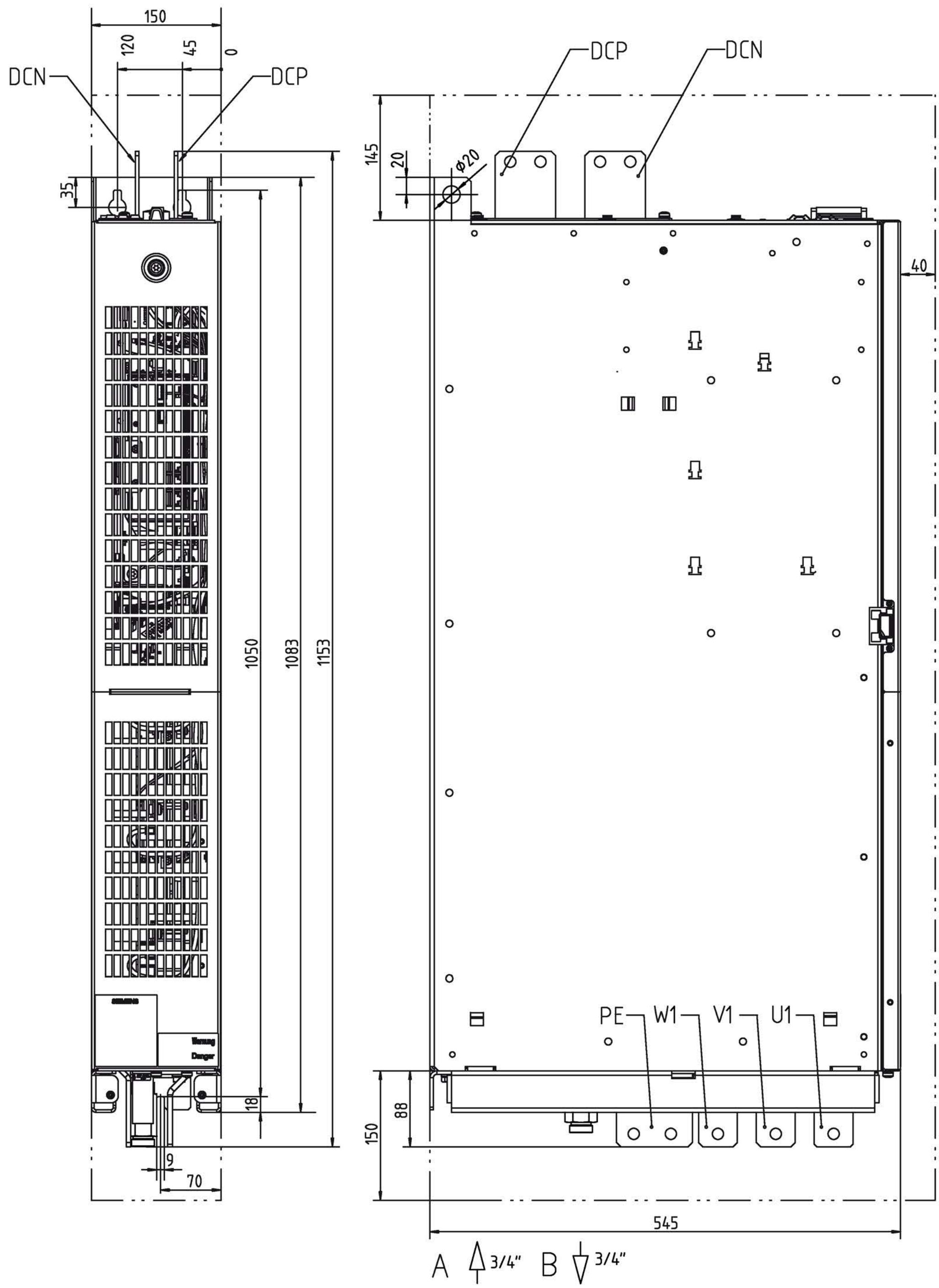


Figure 6-16 Dimension drawing Active Line Module, frame size GXL Front view, side view

Dimension drawing, frame size HXL

The mandatory cooling clearances are indicated by the dotted line.

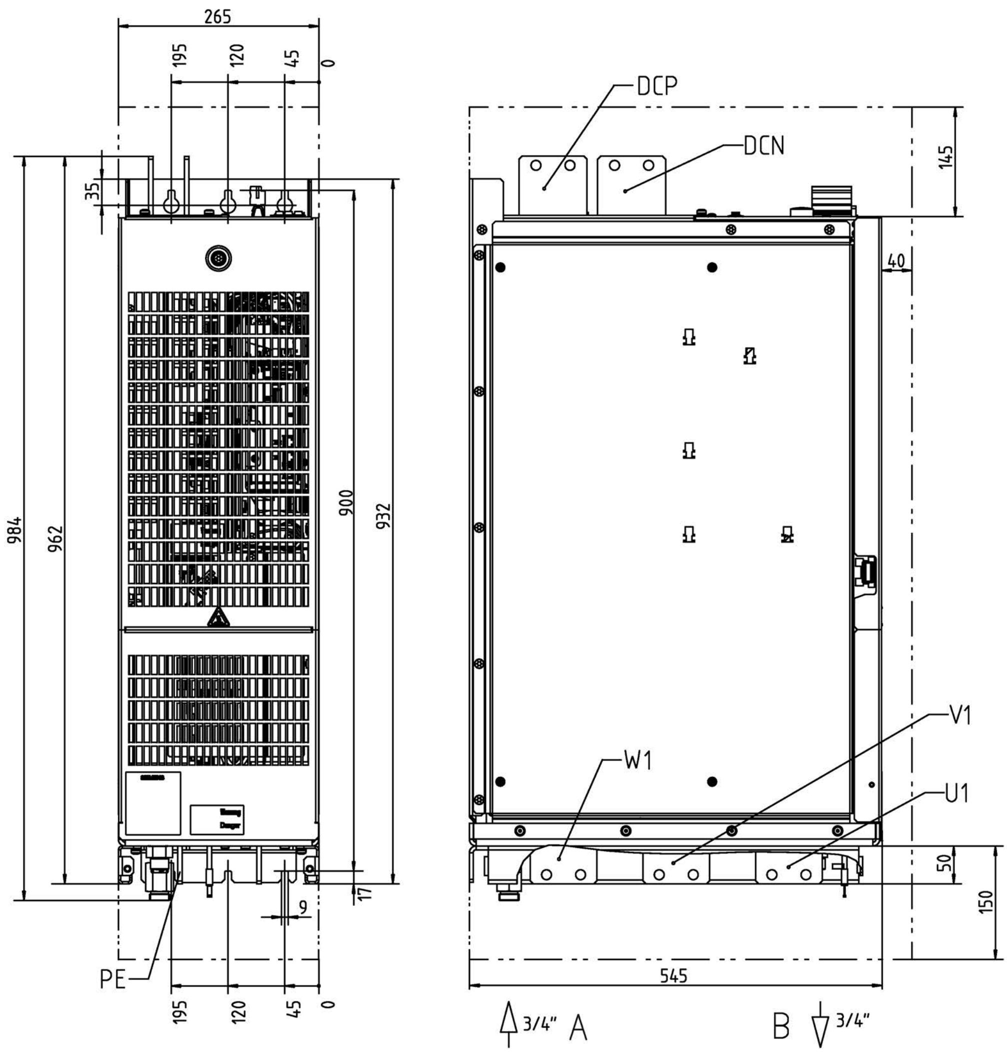


Figure 6-17 Dimension drawing Active Line Module, frame size HXL Front view, side view

Dimension drawing for frame size JXL

The mandatory cooling clearances are indicated by the dotted line.

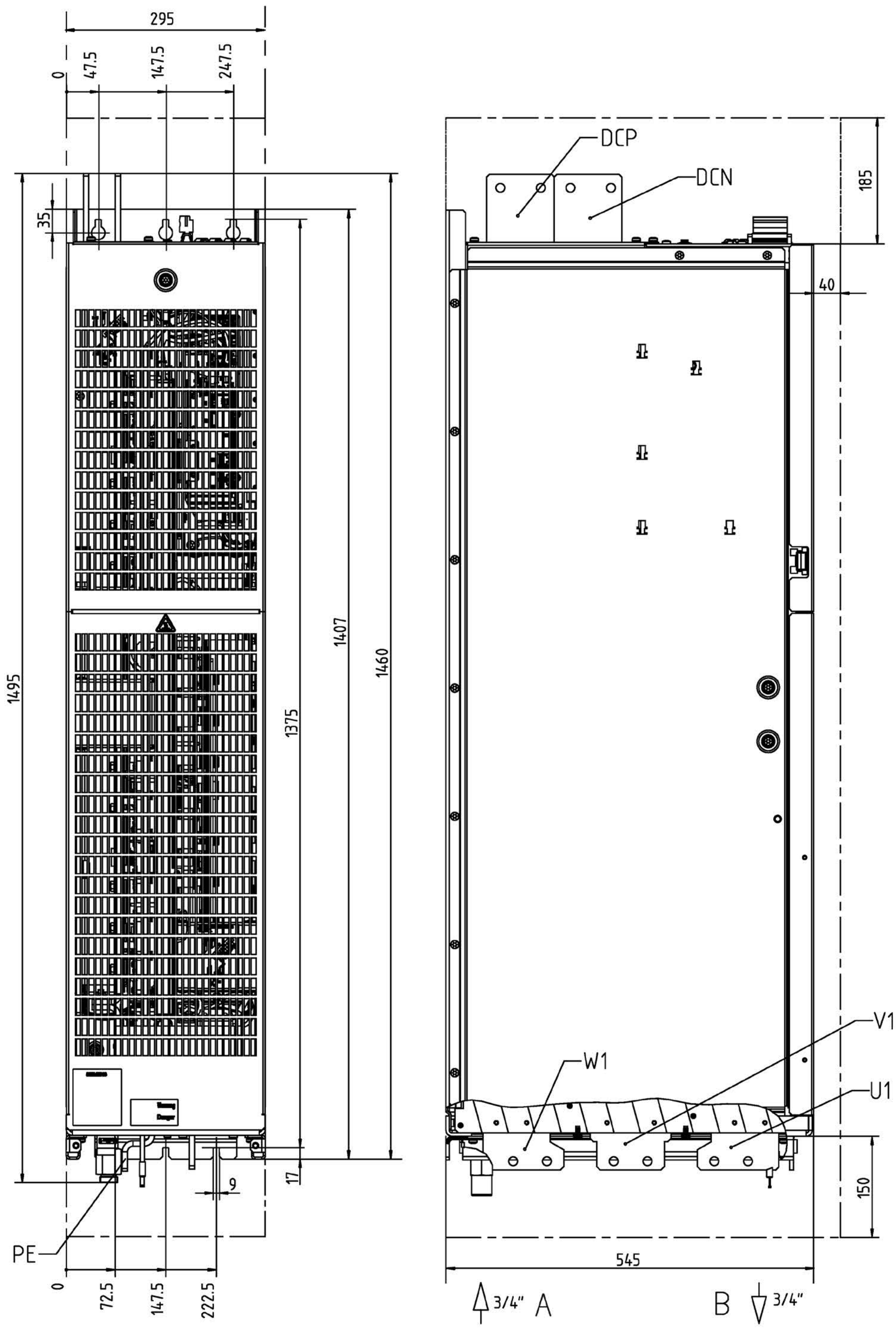


Figure 6-18 Dimension drawing Active Line Module, frame size JXL, article numbers 6SL3335-7TE41-0AA3, 6SL3335-7TE41-4AA3, 6SL3335-7TG41-0AA3, 6SL3335-7TG41-3AA3. Front view, side view

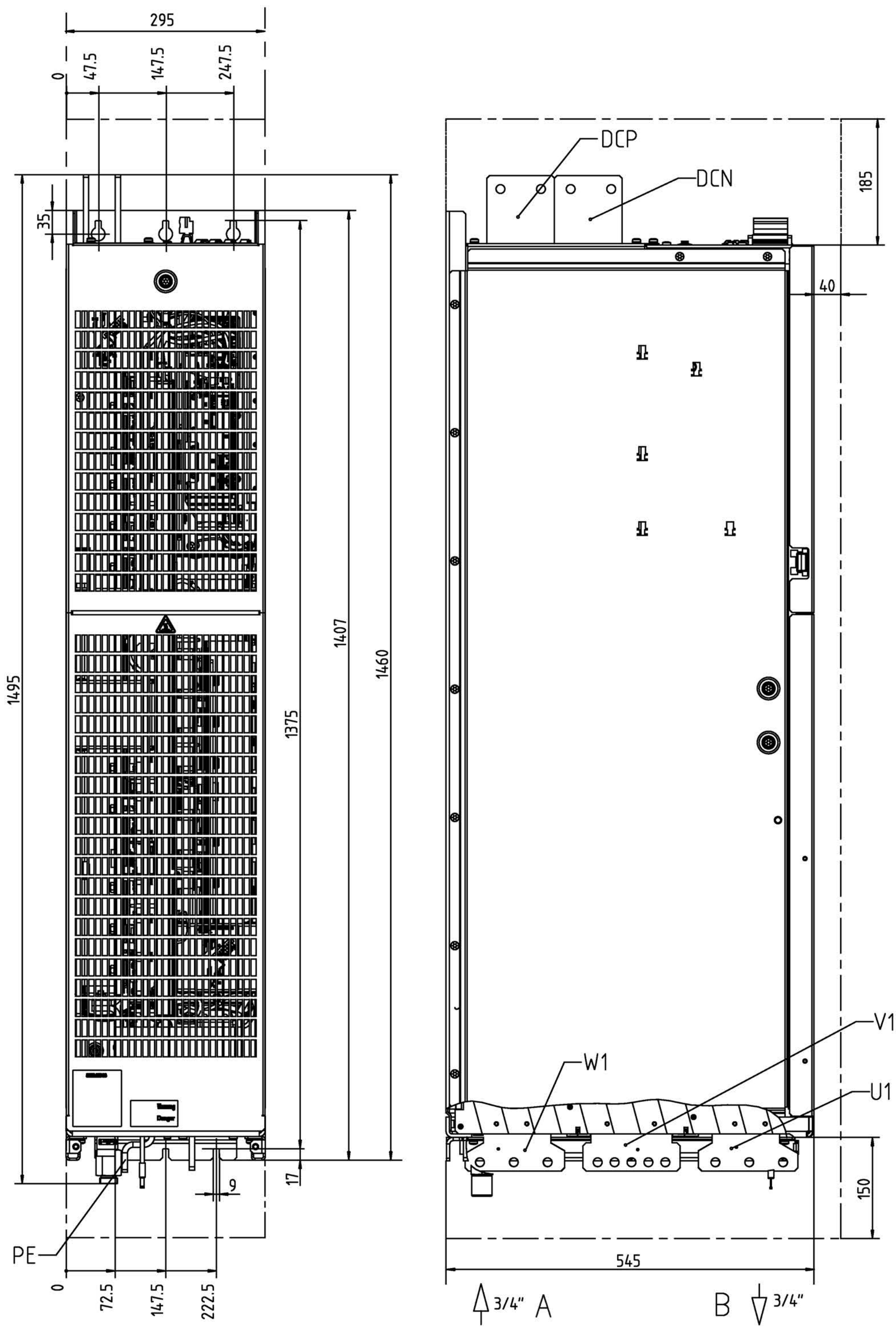


Figure 6-19 Dimension drawing Active Line Module, frame size JXL, article number 6SL3335-7TG41-6AA3. Front view, side view

6.3.5 Installation

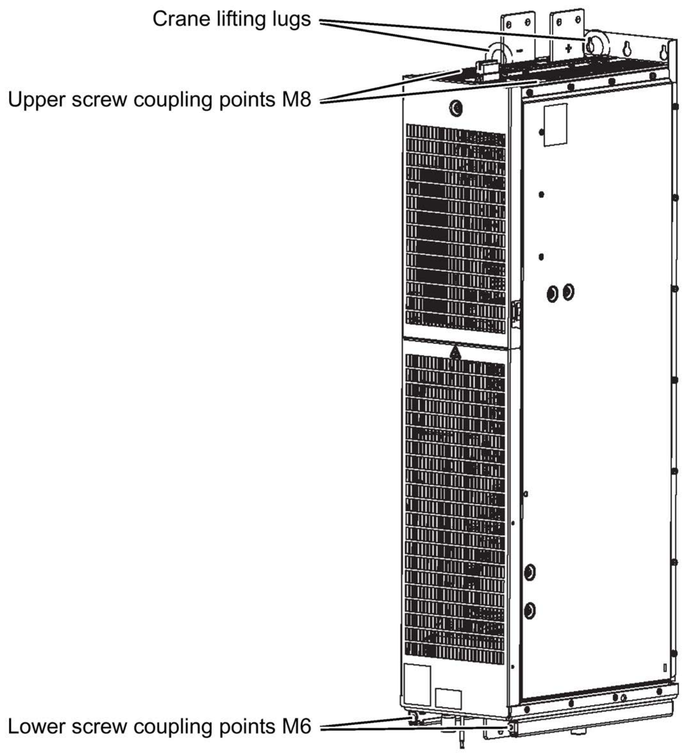


Figure 6-20 Crane lifting lugs / screw coupling points for mechanical support

Protection guard

A protection guard is mounted on the bottom of the Active Line Module ("1" in the diagram below) while it is being transported. The Active Line Module can be placed down on this protection guard while it is removed from the packaging and while being transported. 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.

⚠ CAUTION

Risk of injury due to toppling when placing down on the protection guard

A module placed down on the protection guard can topple over therefore causing injury.

- When the module is placed down on the protection guard, ensure that it cannot topple over.

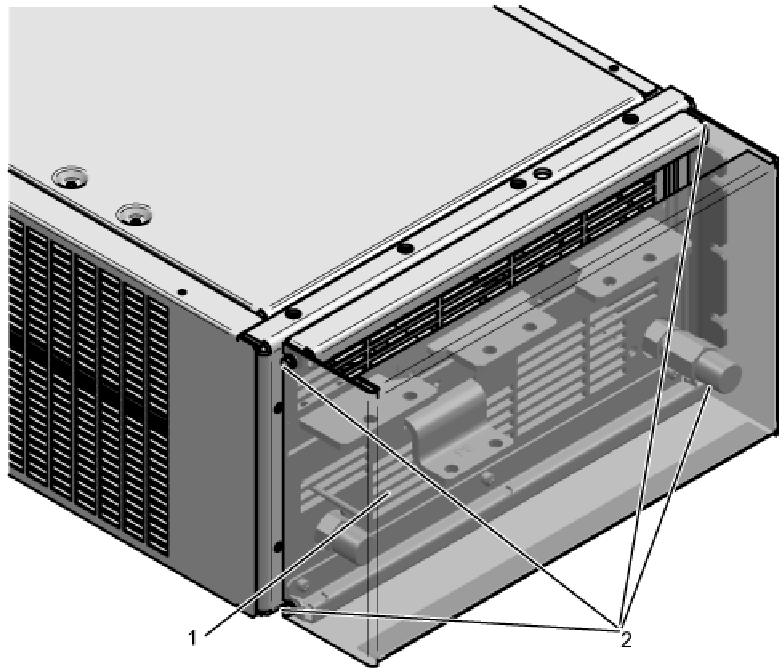


Figure 6-21 Protection guard

Note

Mounting fixture for power units

The mounting equipment for power units can be used to mount the Active Line Module, see "Mounting equipment for power units (Page 357)".

Crane lifting lugs

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

Note

Transport in the horizontal position

Transport in the horizontal position is permissible.

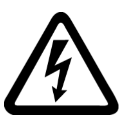
It is not permissible to screw the crane lifting lug into the thread at the lower side of the Line Module.

NOTICE
Damage to the device due to improper transport
Improper transport can cause mechanical loads on the housing or busbars which can result in damage to the device. • Use a lifting harness with vertical ropes or chains during transport. • Do not use the busbars as handles or for fastening a lifting harness. • Only tighten the crane lifting lugs by hand. Remove the crane lifting lugs after the installation, but keep them for later 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 at 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.



⚠ WARNING
Electric shock due to insufficient insulating clearance (air clearances and creepage distances)
Incorrect mounting of the reinforcing sheet metal parts can result in insufficient insulating clearance to live parts and can cause death or serious injury. • Ensure that the reinforcing sheet metal parts do not come into contact with live parts and that an insulation clearance (air clearances and creepage distances) of >13 mm / 25 mm is always maintained. • As a result of customer specifications or the specifications of certification bodies, under certain circumstances, larger air clearances and creepage distances may be required. Take this into account for the mechanical design of the cabinet and when installing.

6.3.6 Technical specifications

6.3.6.1 Active Line Modules, 380 ... 480 V 3 AC

Table 6- 22 Technical data for Active Line Modules, 3 AC 380 ... 480 V, Part 1

Article number	6SL3335–	7TE35–0AA3	7TE36–1AA3	7TE38–4AA3	7TE41–0AA3
Rated power					
- At $I_{L\,DC}$ (50Hz 400V)	kW	300	380	500	630
- At $I_{H\,DC}$ (50Hz 400V)	kW	270	335	465	545
- At $I_{L\,DC}$ (60Hz 460V)	HP	500	600	700	900
- At $I_{H\,DC}$ (60Hz 460V)	HP	400	500	700	800
DC link current					
- Rated current $I_{N\,DC}$	A	549	677	941	1100
- Base-load current $I_{L\,DC}$	A	535	661	917	1075
- Base-load current $I_{H\,DC}$	A	489	603	837	982
- Maximum current $I_{max\,DC}$ 1)	A	823	1017	1410	1654
Supply voltages					
- Line voltage	V_{ACrms}	3 AC 380 -10 % (-15 % < 1 min) ... 3 AC 480 +10 %			
- Line frequency	Hz	47 ... 63Hz			
- Electronics power supply	V_{DC}	24 (20.4 ... 28.8)			
- DC link voltage	V_{DC}	1.5 x U_{line}			
Infeed/regenerative feedback current					
- Rated current $I_{N\,E}$	A	490	605	840	985
- Maximum current $I_{max\,E}$ 2)	A	735	907	1260	1477
Pulse frequency	kHz	4	2.5	2.5	2.5
Electronics current consumption (24 V DC)	A	1.5	1.6	1.6	1.6
Cooling method		Liquid cooling with integrated heat exchanger made of			
		Stainless steel	Aluminum	Aluminum	Aluminum
Power loss, max. 3)					
- At 50 Hz 400 V	kW	3.1	4.82	5.3	7.9
- At 60 Hz 460 V	kW	3.36	5.25	5.75	8.53
- Dissipated to the ambient air	kW	0.14	0.17	0.23	0.44
Rated flow rate	l/min	12	16	16	27
Pressure drop, typical at the rated flow rate 4)	Pa	70000	70000	70000	70000
Liquid volume of integrated heat exchanger	dm³	0.91	0.74	0.74	1.56
DC link capacitance					
- Active Line Module	µF	9600	12600	17400	18900
- Drive line-up, max.	µF	76800	134400	134400	230400
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	52	54	54	56
Line/load connection		Flat connection for M12 screw			
Max. conductor cross-sections					
- Line connection (U1, V1, W1)	mm²	2 x 240	4 x 185	4 x 185	Busbar
- DC link connection (DCP, DCN)	mm²	Busbar	Busbar	Busbar	Busbar
- PE connection	mm²	2 x 240	4 x 185	4 x 185	Busbar
Max. cable length (total of all motor cables and DC link)					
- Shielded	m	2700	3900	3900	3900
- Unshielded	m	4050	5850	5850	5850
Degree of protection		IP00	IP00	IP00	IP00

Article number	6SL3335–	7TE35–0AA3	7TE36–1AA3	7TE38–4AA3	7TE41–0AA3
Dimensions - Width - Height - Depth	 mm mm mm	 150 1172 545	 265 1002 545	 265 1002 545	 295 1516 545
Frame size		GXL	HXL	HXL	JXL
Weight	kg	80	110	110	220
Recommended fuse [5) 6)] - Number per phase (connected in parallel) - Rated current - Frame size acc. to IEC 60269	 A 	3NE1436-2 1 630 3	3NE1438-2 1 800 3	3NE1334-2 2 [7)] 500 3	3NE1436-2 2 [7)] 630 3
Minimum short-circuit current [8)]	kA	8	9.2	10.4	16

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

2) Valid for a 5 s duty cycle (overload duration) and a duty cycle duration of 300 s based on the rated infeed/regenerative feedback current.

3) The specified power loss is the maximum value at 100% utilization. The value in normal operation is lower.

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.

6) Only 3NE1 fuses should be used to protect the devices. These must be located as close as possible to the converter. The specified 3NA3 fuses can be used for the additional cable protection, see Catalog D21.3.

7) When using fuses connected in parallel in each phase, all of the fuses must be replaced if one fuse ruptures.

8) Minimum current required for reliable triggering of the protective devices.

Table 6- 23 Technical data for Active Line Modules, 3 AC 380 ... 480 V, Part 2

Article number	**6SL3335–**	**7TE41–4AA3**			
Rated power - At $I_{L\ DC}$ (50Hz 400V) - At $I_{H\ DC}$ (50Hz 400V) - At $I_{L\ DC}$ (60Hz 460V) - At $I_{H\ DC}$ (60Hz 460V)	 kW kW HP HP	 900 780 1250 1000			
DC link current - Rated current $I_{N\ DC}$ - Base-load current $I_{L\ DC}$ - Base-load current $I_{H\ DC}$ - Maximum current $I_{max\ DC}$ 1)	 A A A A	 1573 1534 1401 2361			
Supply voltages - Line voltage - Line frequency - Electronics power supply - DC link voltage	 V_{ACrms} Hz V_{DC} V_{DC}	 3 AC 380 -10 % (-15 % < 1 min) ... 3 AC 480 +10 % 47 ... 63Hz 24 (20.4 ... 28.8) 1.5 x U_{line}			
Infeed/regenerative feedback current - Rated current $I_{N\ E}$ - Maximum current $I_{max\ E}$ 2)	 A A	 1405 2055			
Pulse frequency	kHz	2.5			
Electronics current consumption (24 V DC)	A	1.6			
Cooling method		Liquid cooling with integrated heat exchanger made of			
		Aluminum			
Power loss, max. 3) - At 50 Hz 400 V - At 60 Hz 460 V - Dissipated to the ambient air	 kW kW kW	 10.2 11.19 0.62			
Rated flow rate	l/min	27			
Pressure drop, typical at the rated flow rate 4)	Pa	70000			
Liquid volume of integrated heat exchanger	dm³	1.56			
DC link capacitance - Active Line Module - Drive line-up, max.	 µF µF	 28800 230400			
Sound pressure level L_{pA} (1 m) at 50/60 Hz	 dB(A)	 54			
Line/load connection		Flat connection for M12 screw			
Max. conductor cross-sections - Line connection (U1, V1, W1) - DC link connection (DCP, DCN) - PE connection	 mm² mm² mm²	 Busbar Busbar Busbar			
Max. cable length (total of all motor cables and DC link) - Shielded - Unshielded	 m m	 3900 5850			
Degree of protection		IP00			
Dimensions - Width - Height - Depth	 mm mm mm	 295 1516 545			
Frame size		JXL			
Weight	kg	220			

Article number	6SL3335–	7TE41–4AA3			
Recommended fuse 5) 6) - Number per phase (connected in parallel) - Rated current - Frame size acc. to IEC 60269	 A 	3NE1448-2 2 7) 850 3			
Minimum short-circuit current 8)	kA	21			

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

2) Valid for a 5s duty cycle (overload duration) and a duty cycle duration of 300s based on the rated infeed/regenerative feedback current.

3) The specified power loss is the maximum value at 100% utilization. The value in normal operation is lower.

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.

6) Only 3NE1 fuses should be used to protect the devices. These must be located as close as possible to the converter. The specified 3NA3 fuses can be used for the additional cable protection, see Catalog D21.3.

7) When using fuses connected in parallel in each phase, all of the fuses must be replaced if one fuse ruptures.

8) Minimum current required for reliable triggering of the protective devices.

6.3.6.2 Active Line Modules, 500 ... 690 V 3 AC

Table 6- 24 Technical data for Active Line Modules, 3 AC 500 ... 690 V, Part 1

Article number	6SL3335–	7TG35–8AA3	7TG37-4AA3	7TG38-1AA3	7TG41–0AA3
Rated power - At $I_{L\,DC}$ (50Hz 690V) - At $I_{H\,DC}$ (50Hz 690V) - At $I_{L\,DC}$ (50Hz 500V) - At $I_{H\,DC}$ (50Hz 500V) - At $I_{L\,DC}$ (60Hz 575V) - At $I_{H\,DC}$ (60Hz 575V)	 kW kW kW kW HP HP	 630 620 447 450 675 506	 800 705 560 510 900 600	 900 670 620 485 975 765	 1100 1000 780 710 1250 1000
DC link current - Rated current $I_{N\,DC}$ - Base-load current $I_{L\,DC}$ - Base-load current $I_{H\,DC}$ - Maximum current $I_{max\,DC}$ [1]	 A A A A	 644 627 573 966	 823 800 732 1235	 907 883 808 1360	 1147 1193 936 1722
Supply voltages - Line voltage - Line frequency - Electronics power supply - DC link voltage	 V_{ACrms} Hz V_{DC} V_{DC}	 3 AC 500 -10% (-15% < 1 min) ... 3 AC 690 +10% 47 ... 63Hz 24 (20.4 ... 28.8) 1.5 x U_{line}			
Infeed/regenerative feedback current - Rated current $I_{N\,E}$ - Maximum current $I_{max\,E}$ [2]	 A A	 575 862	 735 1100	 810 1214	 1025 1537
Pulse frequency	kHz	2.5	2.5	2.5	2.5
Electronics current consumption (24 V DC)	A	1.6	1.6	1.6	1.6
Cooling method		Liquid cooling with integrated aluminum heat exchanger			
Power loss, max. [3] - At 50 Hz 690 V - At 60 Hz 575 V - Dissipated to the ambient air	 kW kW kW	 5.6 4.9 0.16	 7.65 6.67 0.2	 8.5 7.4 0.22	 10.9 9.53 0.53
Rated flow rate	l/min	16	16	16	27
Pressure drop, typical at the rated flow rate [4]	Pa	70000	70000	70000	70000
Liquid volume of integrated heat exchanger	dm³	0.74	0.74	0.74	1.56
DC link capacitance - Active Line Module - Drive line-up, max.	 µF µF	 9670 59200	 10500 153600	 10500 153600	 16000 153600
Sound pressure level L_{pA} (1 m) at 50/60 Hz	 dB(A)	 54	 54	 54	 56
Line/load connection		Flat connection for M12 screw			
Max. conductor cross-sections - Line connection (U1, V1, W1) - DC link connection (DCP, DCN) - PE connection	 mm² mm² mm²	 4 x 185 Busbar 4 x 185	 4 x 185 Busbar 4 x 185	 4 x 185 Busbar 4 x 185	 Busbar Busbar Busbar
Max. cable length (total of all motor cables and DC link) - Shielded - Unshielded	 m m	 2250 3375	 2250 3375	 2250 3375	 2250 3375
Degree of protection		IP00	IP00	IP00	IP00
Dimensions - Width - Height - Depth	 mm mm mm	 265 1002 545	 265 1002 545	 265 1002 545	 295 1516 545

Article number	6SL3335–	7TG35–8AA3	7TG37-4AA3	7TG38-1AA3	7TG41–0AA3
Frame size		HXL	HXL	HXL	JXL
Weight	kg	110	110	110	220
Recommended fuse [5) 6)] - Number per phase (connected in parallel) - Rated current - Frame size acc. to IEC 60269	 A	3NE1447-2 1 670 3	3NE1448-2 1 850 3	3NE1435-2 2 [7)] 560 3	3NE1436-2 2 [7)] 630 3
Minimum short-circuit current [8)]	kA	8.4	10.5	12.6	16

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

2) Valid for a 5 s duty cycle (overload duration) and a duty cycle duration of 300 s based on the rated infeed/regenerative feedback current.

3) The specified power loss is the maximum value at 100 % utilization. The value in normal operation is lower.

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.

6) Only 3NE1 fuses should be used to protect the devices. These must be located as close as possible to the converter. The specified 3NA3 fuses can be used for the additional cable protection, see Catalog D21.3.

7) When using fuses connected in parallel in each phase, all of the fuses must be replaced if one fuse ruptures.

8) Minimum current required for reliable triggering of the protective devices.

Table 6- 25 Technical data for Active Line Modules, 3 AC 500 ... 690 V, Part 2

Article number	6SL3335–	7TG41–3AA3	7TG41-6AA3		
Rated power - At $I_{L\,DC}$ (50Hz 690V) - At $I_{H\,DC}$ (50Hz 690V) - At $I_{L\,DC}$ (50Hz 500V) - At $I_{H\,DC}$ (50Hz 500V) - At $I_{L\,DC}$ (60Hz 575V) - At $I_{H\,DC}$ (60Hz 575V)	 kW kW kW kW HP HP	 1400 1215 965 880 1500 1250	 1700 1490 1180 1080 1855 1530		
DC link current - Rated current $I_{N\,DC}$ - Base-load current $I_{L\,DC}$ - Base-load current $I_{H\,DC}$ - Maximum current $I_{max\,DC}$ 1)	 A A A A	 1422 1386 1266 2133	 1740 1700 1550 2620		
Supply voltages - Line voltage - Line frequency - Electronics power supply - DC link voltage	 V_{ACrms} Hz V_{DC} V_{DC}	 3 AC 500 -10% (-15% < 1 min) ... 3 AC 690 +10% 47 ... 63Hz 24 (20.4 ... 28.8) 1.5 x U_{line}			
Infeed/regenerative feedback current - Rated current $I_{N\,E}$ - Maximum current $I_{max\,E}$ 2)	 A A	 1270 1905	 1560 2055		
Pulse frequency	kHz	2.5	2.5		
Electronics current consumption (24 V DC)	A	1.46	1.5		
Cooling method		Liquid cooling with integrated aluminum heat exchanger			
Power loss, max. 3) - At 50 Hz 690 V - At 60 Hz 575 V - Dissipated to the ambient air	 kW kW kW	 13.55 11.85 0.57	 17.96 15.7 0.79		
Rated flow rate	l/min	27	27		
Pressure drop, typical at the rated flow rate 4)	Pa	70000	70000		
Liquid volume of integrated heat exchanger	dm^3	1.56	1.56		
DC link capacitance - Active Line Module - Drive line-up, max.	 µF µF	 19330 153600	 21000 210000		
Sound pressure level L_{pA} (1 m) at 50/60 Hz	 dB(A)	 56	 56		
Line/load connection		Flat connection for M12 screw			
Max. conductor cross-sections - Line connection (U1, V1, W1) - DC link connection (DCP, DCN) - PE connection	 mm^2 mm^2 mm^2	 Busbar Busbar Busbar	 Busbar Busbar Busbar		
Max. cable length (total of all motor cables and DC link) - Shielded - Unshielded	 m m	 2250 3375	 2250 3375		
Degree of protection		IP00	IP00		
Dimensions - Width - Height - Depth	 mm mm mm	 295 1516 545	 295 1516 545		
Frame size		JXL	JXL		
Weight	kg	220	230		

Article number	6SL3335–	7TG41–3AA3	7TG41-6AA3		
Recommended fuse [5) 6)] - Number per phase (connected in parallel) - Rated current - Frame size acc. to IEC 60269	 A 	3NE1438-2 2 [7)] 800 3	3NE1436-2 3 [7)] 630 3		
Minimum short-circuit current [8)]	kA	20	24		

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

2) Valid for a 5 s duty cycle (overload duration) and a duty cycle duration of 300 s based on the rated infeed/regenerative feedback current.

3) The specified power loss is the maximum value at 100 % utilization. The value in normal operation is lower.

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.

6) Only 3NE1 fuses should be used to protect the devices. These must be located as close as possible to the converter. The specified 3NA3 fuses can be used for the additional cable protection, see Catalog D21.3.

7) When using fuses connected in parallel in each phase, all of the fuses must be replaced if one fuse ruptures.

8) Minimum current required for reliable triggering of the protective devices.

6.3.6.3 Overload capability

The Active Line Modules have an overload reserve.

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

High overload

The base load current for a high overload I_{H_DC} is based on a duty cycle of 150 % for 60 s; the max. current I_{max_DC} can flow for 5 s.

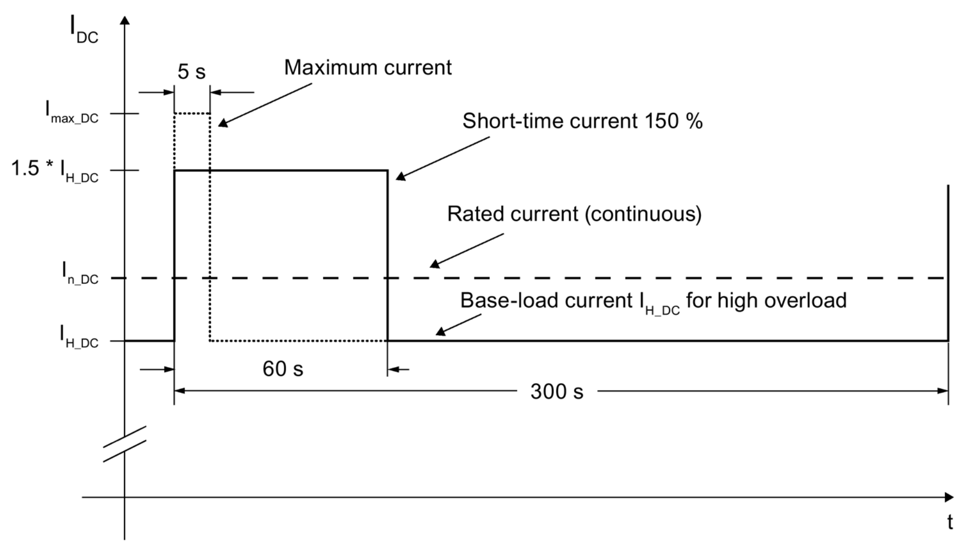


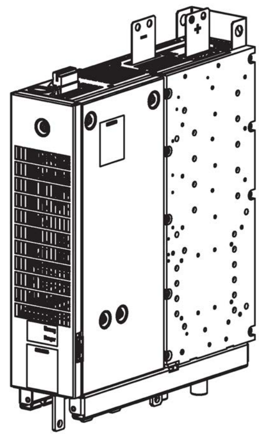
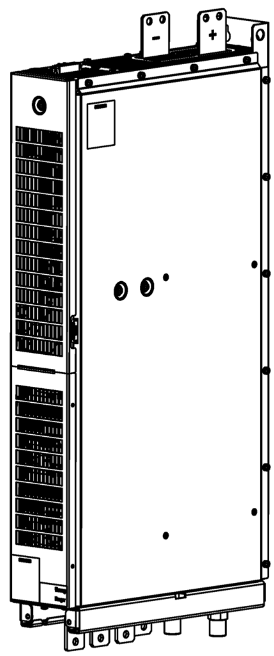
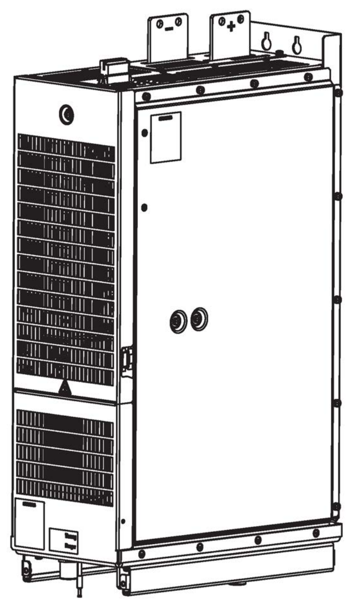
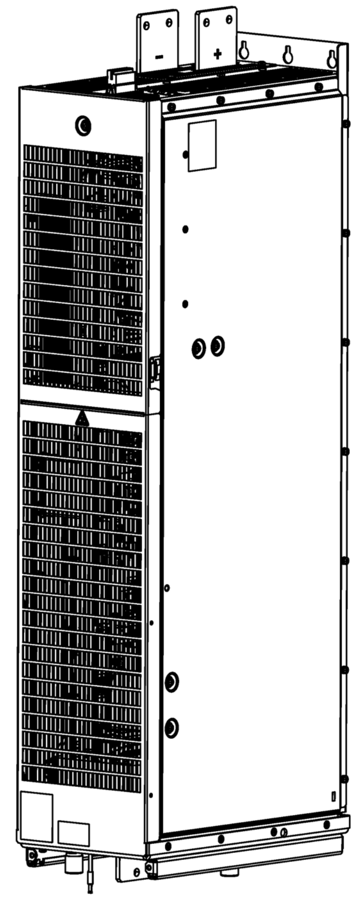
Figure 6-22 High overload

Motor Modules 7

7.1 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 7- 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 ... 720 V DC (line voltage 380 ... 480 V 3 AC) from 210 to 1405 A
  Version for 675 ... 1035 V DC (line voltage 500 ... 690 V 3 AC) from 100 to 1560 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 power 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.

7.2 Safety information

WARNING

Not observing fundamental safety instructions and residual risks

Not observing fundamental safety instructions and residual risks listed in Chapter 1 can result in accidents with severe injuries or death.

- Comply with the fundamental safety instructions.
- When assessing the risk, take into account residual risks.

WARNING

High leakage currents when the protective conductor in the line feeder cable is interrupted

The drive components conduct a high leakage current via the protective conductor. Touching conductive parts when the protective conductor is interrupted can result in death or serious injury.

- Ensure that the external protective conductor satisfies at least one of the following conditions:
  - It has been installed so that it is protected against mechanical damage. [1)]
  - For an individual core, it has a cross-section of at least 10 mm² Cu.
  - If it is a conductor of a multi-conductor cable, it has a cross-section of at least 2.5 mm² Cu.
  - It has a second protective conductor in parallel with the same cross-section.

  [1)] Cables laid within control cabinets or closed machine housings are considered to be adequately protected against mechanical damage.
- Observe the local regulations for protective conductors subject to a high leakage current at the operating location.

WARNING

Fire due to inadequate ventilation clearances

Inadequate ventilation clearances can cause overheating with a risk for personnel through smoke development and fire. This can also result in increased downtime and reduced service lives for Motor Modules.

- Observe the cooling clearances above, below, and in front of the Power Modules which are specified in the dimension drawings.

CAUTION

Fire hazard due to overheating when the total length of the power cables is exceeded

Overheating and a fire can result when the total length of the power cables is exceeded.

- Ensure that the total length of the power cables (motor feeder cables and DC link cables) does not exceed the values specified in the technical data.

NOTICE
Material damage caused by mechanically stressed busbars and coolant connections
Mechanically stressed busbars and coolant connections can damage the device. • Do not use the busbars and liquid coolant connections protruding from the device as handles or as support surfaces during transport.

NOTICE
Material damage caused by loose power connections
Insufficient tightening torques or vibration can result in faulty electrical connections. This can cause fire damage or malfunctions. • Tighten all power connections with the specified tightening torques, e.g. line connection, motor connection, DC link connections. • Check the tightening torques of all power connections at regular intervals and tighten them when required. This applies in particular after transport.

NOTICE
Damage to the devices when performing a voltage test as a result of connections that have not been disconnected
As part of routine tests, SINAMICS S components undergo a voltage test according to IEC 61800-5-1. • Disconnect or unplug all SINAMICS devices before the voltage test of the machine equipment according to IEC 60204-1, Section 18.4.

NOTICE
Damage through use of incorrect DRIVE-CLiQ cables
Damage or malfunctions can occur on the devices or system when DRIVE-CLiQ cables are used that are either incorrect or have not been released for this purpose. • Only use suitable DRIVE-CLiQ cables that have been released by Siemens for the particular application.

7.3 Interface description

7.3.1 Overview

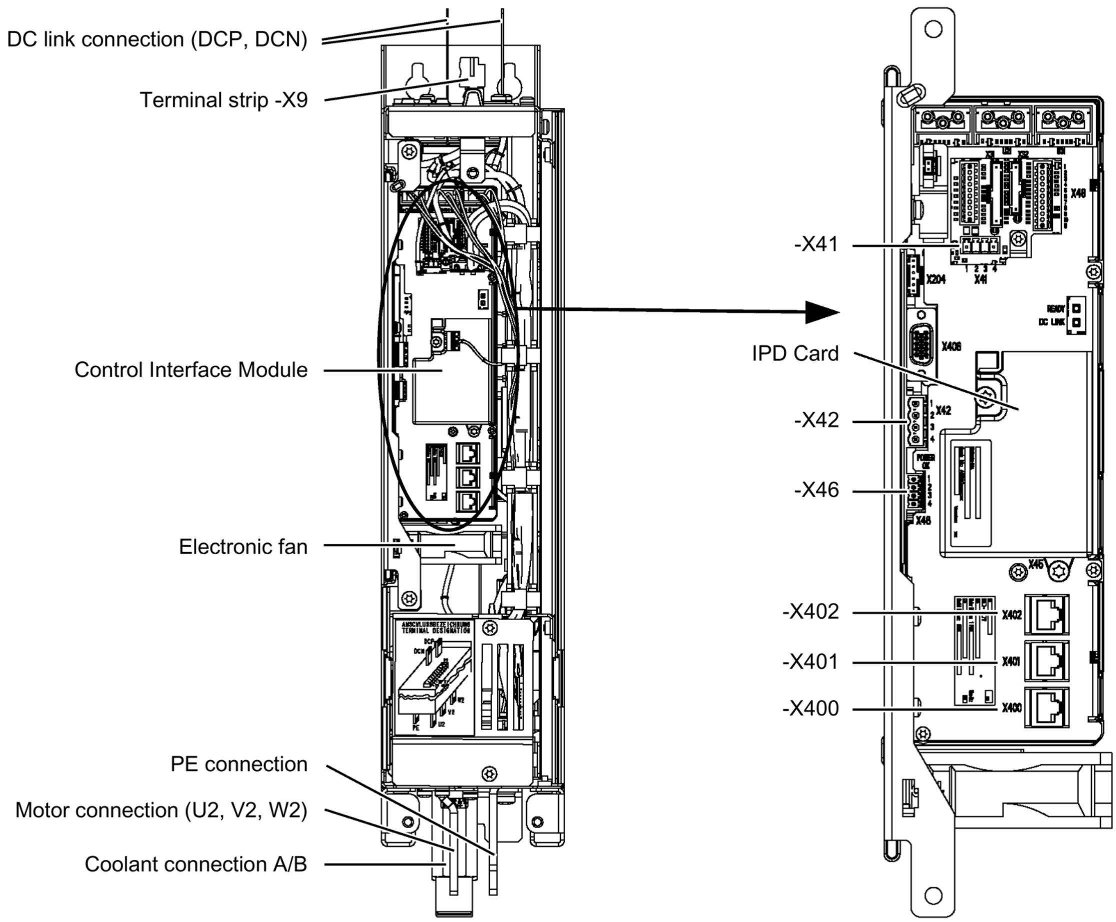


Figure 7-1 Motor Module, frame size FXL

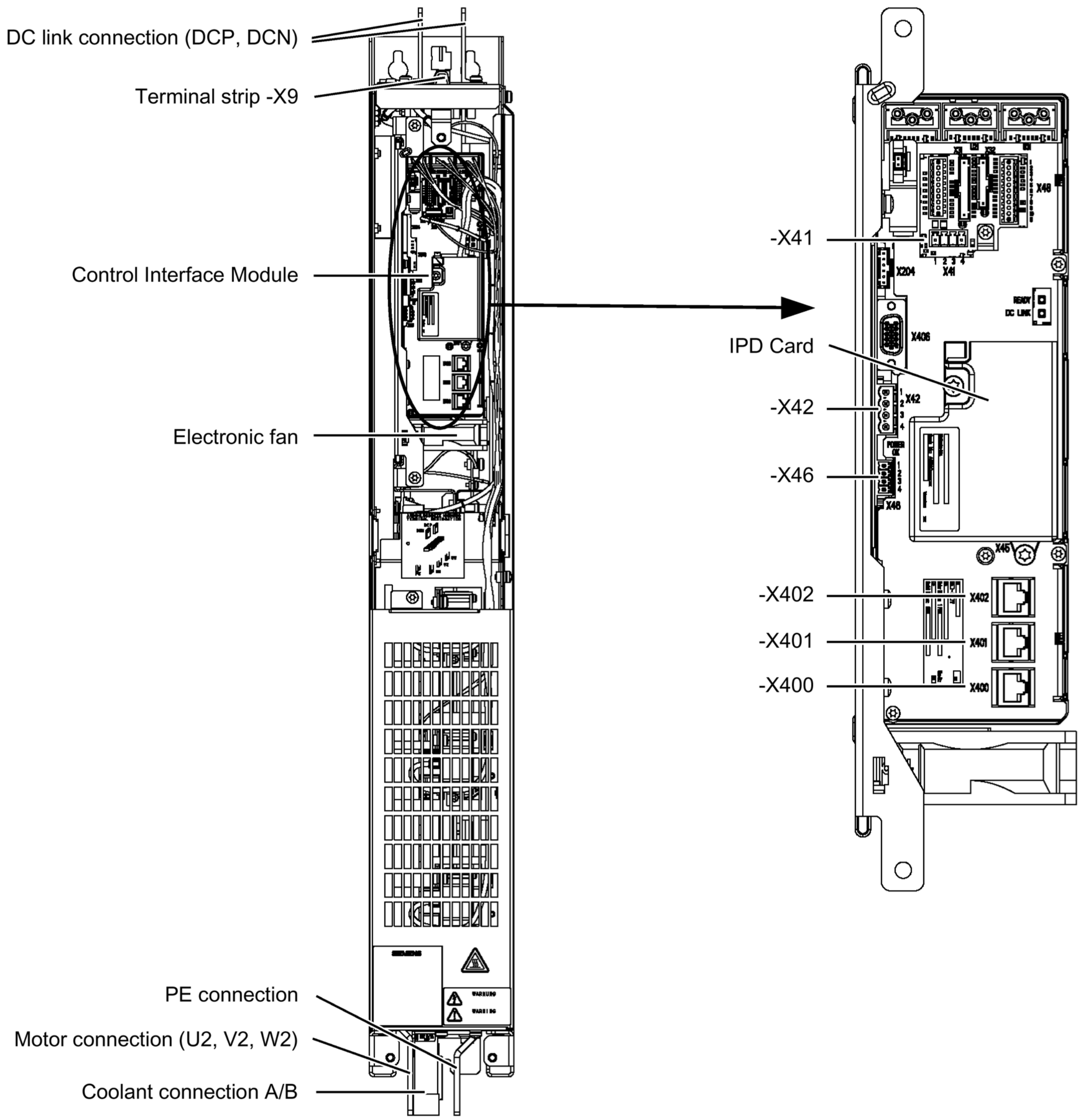


Figure 7-2 Motor Module, frame size GXL

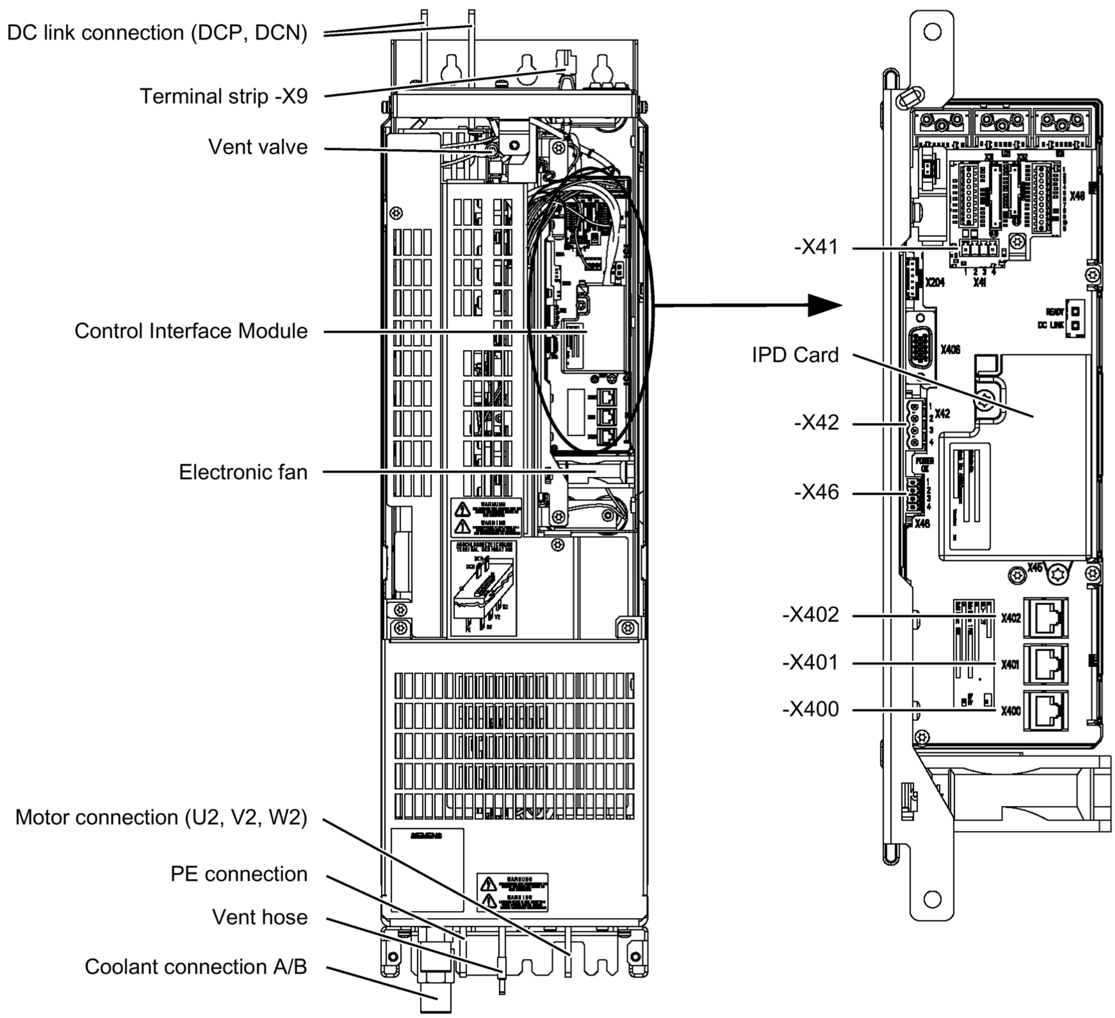


Figure 7-3 Motor Module, frame size HXL

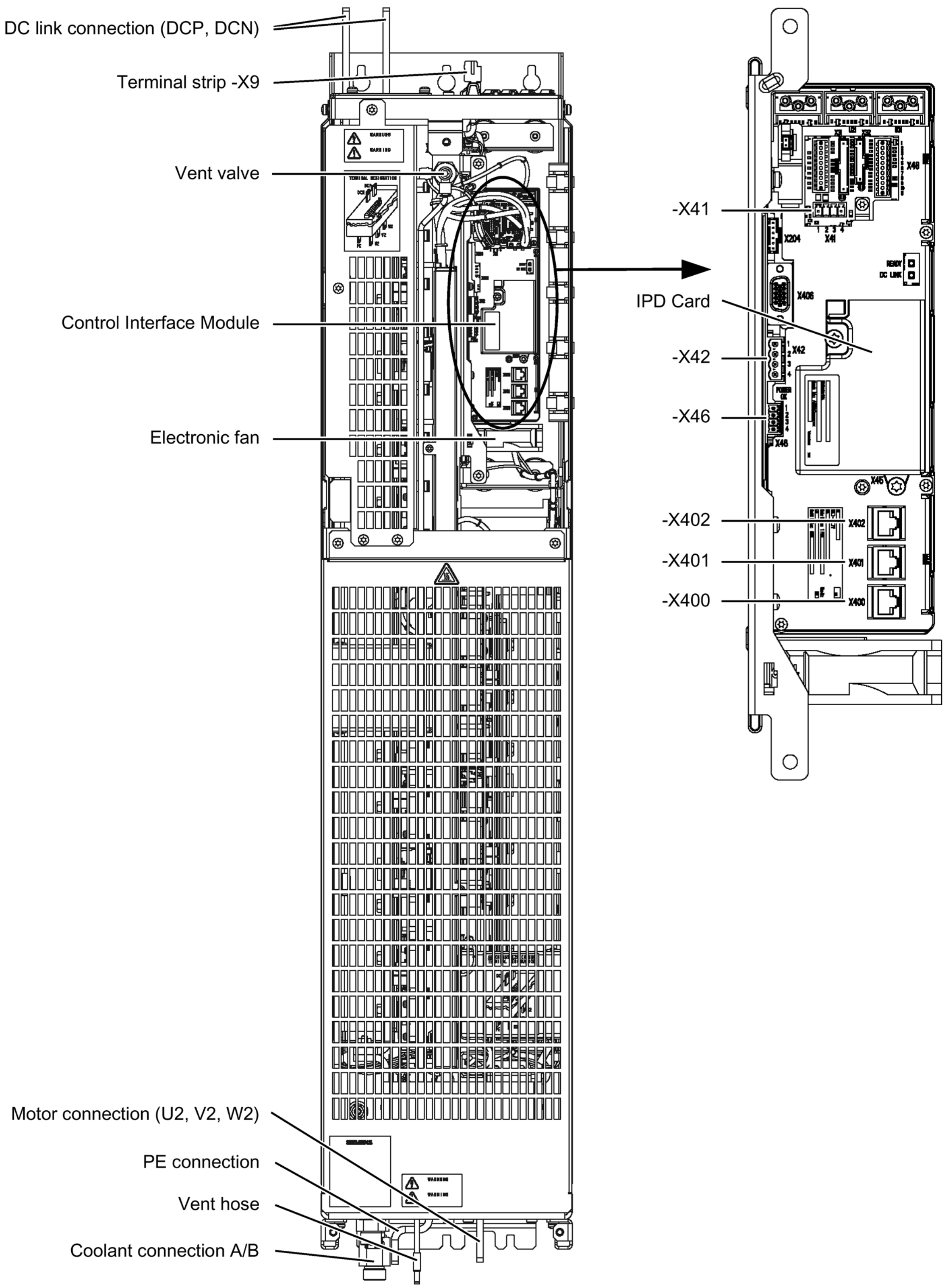


Figure 7-4 Motor Module, frame size JXL

7.3.2 Connection example

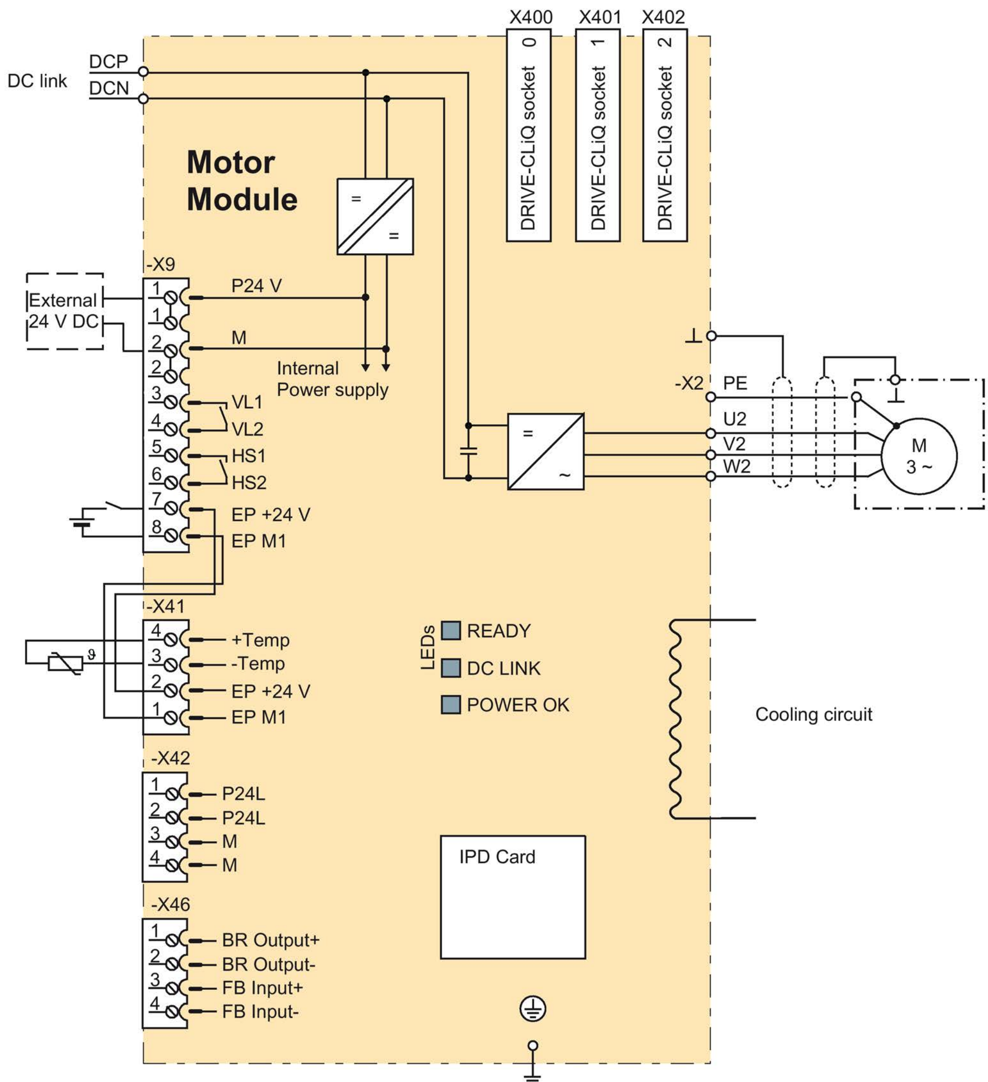


Figure 7-5 Connection example Motor Module

7.3.3 DC link/motor connection

Table 7- 2 DC link/motor connection of the Motor Module

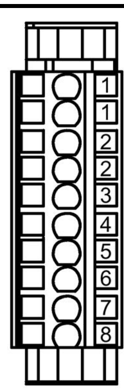
Terminals	Technical data
DCP, DCN DC power input	Voltage: • 510 ... 720 VDC • 675 ... 1035 VDC Connecting lugs: d = 13 mm (M12/50 Nm) for busbar connection
U2, V2, W2 3 AC power output	Voltage: • 3 AC 0 V to 0.75 x DC link voltage 1) Connecting lugs: • Frame sizes FXL, GXL, HXL: d = 13 mm (M12/50 Nm) for cable lugs in accordance with DIN 46234 / DIN 46235 2) • Frame size JXL: d = 13 mm (M12/50 Nm) for busbar connection
PE connection	Connecting lugs: • Frame sizes FXL, GXL, HXL: d = 13 mm (M12/50 Nm) for cable lugs in accordance with DIN 46234 / DIN 46235 2) • Frame size JXL: d = 13 mm (M12/50 Nm) for busbar connection

1) For pure space vector modulation, a factor of approximately 0.70 ... 0.72 applies.
For edge modulation, a factor of approximately 0.74 ... 0.75.

2) Dimensions for connecting alternative cable lugs, see "cable lugs" in the appendix.

7.3.4 X9 terminal strip

Table 7- 3 Terminal strip X9

Connector	Terminal	Signal name	Technical data
	1	P24 V	24 VDC (20.4 ... 28.8 V) Voltage: 24 V DC (20.4 ... 28.8 V) Current 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 ... 28.8 V) Current consumption: 10 mA The pulse inhibit function is only available when the "Safety Integrated Basic Functions via onboard terminals" is enabled in the software.
	8	EP M1 (Enable Pulses)	
Max. connectable cross-section: 1.5 mm²			

Note

Function of the EP terminals

The function of the EP terminals for pulse inhibit is only available if the "Safety Integrated Basic Functions via onboard terminals" software is enabled.

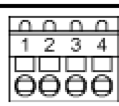
Note

Looping through the supply voltage

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.

7.3.5 X41 EP terminal / temperature sensor connection

Table 7- 4 Terminal strip X41

Connector	Terminal	Function	Technical data
	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 / PT100 / PT1000 / PTC
	4	+Temp	
Max. connectable cross-section: 1.5 mm²			

WARNING

Electric shock in the event of voltage flashovers at the temperature sensor

Voltage flashovers in the signal electronics can occur in motors without safe electrical separation of the temperature sensors.

- Only use temperature sensors that fully comply with the specifications of the safety isolation.
- If safe electrical separation cannot be guaranteed (for linear motors or third-party motors, for example), use a Sensor Module External (SME120 or SME125) or Terminal Module TM120.

NOTICE

Device failure as a result of unshielded or incorrectly routed cables to temperature sensors

Unshielded or incorrectly routed cables to temperature sensors can result in interference being coupled into the signal processing electronics from the power side. This can result in significant disturbance of all signals (fault messages) up to failure of individual components (destruction of the devices).

- Only use shielded cables as temperature sensor cables.
- If temperature sensor cables are routed together with the motor cable, use separately shielded cables twisted in pairs.
- Connect the cable shield to ground potential through a large surface area.

NOTICE

Damage to motor in the event of incorrectly connected KTY temperature sensor

If a KTY temperature sensor is connected with incorrect polarity, it is not possible to detect when the motor overheats. Overheating can cause damage to the motor.

- Connect a KTY temperature sensor with the correct polarity.

Note

The temperature sensor connection can be used for motors that are equipped with a KTY84-1C130, PT100, PT1000 or PTC measuring sensor in the stator windings.

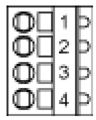
Note

Connection to terminal strip -X9

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

7.3.6 X42 terminal strip

Table 7- 5 Terminal strip X42 voltage supply for Control Unit, Sensor Module and Terminal Module

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

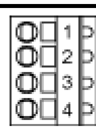
Note

Connection options of terminal strip X42

The terminal strip is not intended to supply other 24 VDC loads (for example, for supplying other components on the plant/system side), as the voltage supply of the Control Interface Module could also be overloaded and possibly result in malfunctions.

7.3.7 X46 Brake control and monitoring

Table 7- 6 Terminal strip X46 brake control and monitoring

Connector	Terminal	Function	Technical data
	1	BR output +	Brake connection
	2	BR output -	Supply voltage: 24 V DC Max. load current: 200 mA
	3	FB input +	Internal feedback signal from the Safe Brake Adapter
	4	FB input -	
Max. connectable cross-section: 1.5 mm²			

Note

The interface is intended for connection of the Safe Brake Adapter.

WARNING

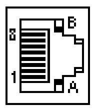
Fire due to overheating when the total length of the connecting cables is exceeded

Excessively long connection cables on terminal strip X46 can cause components to overheat with the associated risk of fire and smoke.

- Limit the length of the connecting cables to a maximum of 10 m.
- The connection cable must not be led out the control cabinet or control cabinet group.

7.3.8 DRIVE-CLiQ interfaces X400, X401, X402

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

Connector	PIN	Signal name	Technical data
	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.) Article number: 6SL3066-4CA00-0AA0			

7.3.9 Cooling circuit connections

Table 7- 8 Cooling circuit connections

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

Note

Replacement seal

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.

The replacement seal is commercially available as flat Viton polymer seal with hardness 75 (+/-5) Shore A (Viton is the commercial name for elastomers with the abbreviations FPM and FKM). The dimensions are as follows: Inner diameter 15 mm, thickness 1.5 mm. Depending on the thread form of the union nut, the outer diameter is 26 mm (with undercut) or 24 mm (without undercut).

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

Table 7- 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	--- 1)	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 lies outside the permitted tolerance range.
Orange	Orange	DRIVE-CLiQ communication is being established.
Red	--- 1)	This component has at least one fault. **Remark:** The LED is activated irrespective of whether the corresponding messages have been reconfigured.
Flashing light 0.5 Hz: green/red	--- 1)	Firmware is being downloaded.
Flashing light 2 Hz: green/red	--- 1)	Firmware download is complete. Waiting for POWER ON.
Flashing light 2 Hz: green/orange or red/orange	--- 1)	Detection of the components via LED is activated (p0124). Note: Both options depend on the LED status when module recognition is activated via p0124 = 1.

1) Irrespective of the status of the LED "DC LINK"

Table 7- 10 Meaning of the LED "POWER OK" on the Control Interface Module in the Motor Module

LED	Color	State	Description
POWER OK	Green	Off	DC link voltage or control voltage at -X9 too low.
		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

Electric shock when live parts of the DC link are touched

Hazardous DC link voltages may be present at any time regardless of the status of the "DC LINK" LED. This means that when live parts are touched, this can result in death or serious injury.

- Observe the warning information on the component.

7.4 Dimension drawing

Dimension drawing, frame size FXL

The mandatory cooling clearances are indicated by the dotted line.

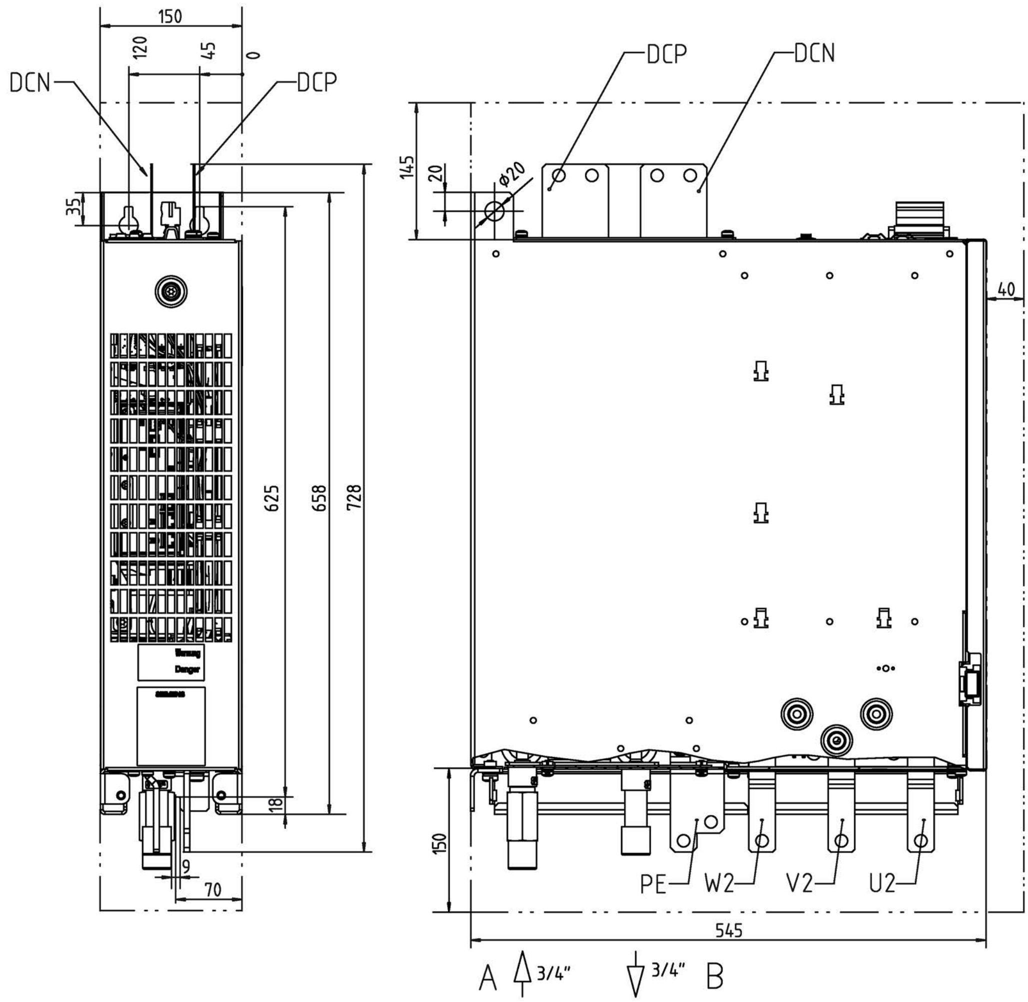


Figure 7-6 Dimension drawing Motor Module, frame size FXL. Front view, side view

Dimension drawing for frame size GXL

The mandatory cooling clearances are indicated by the dotted line.

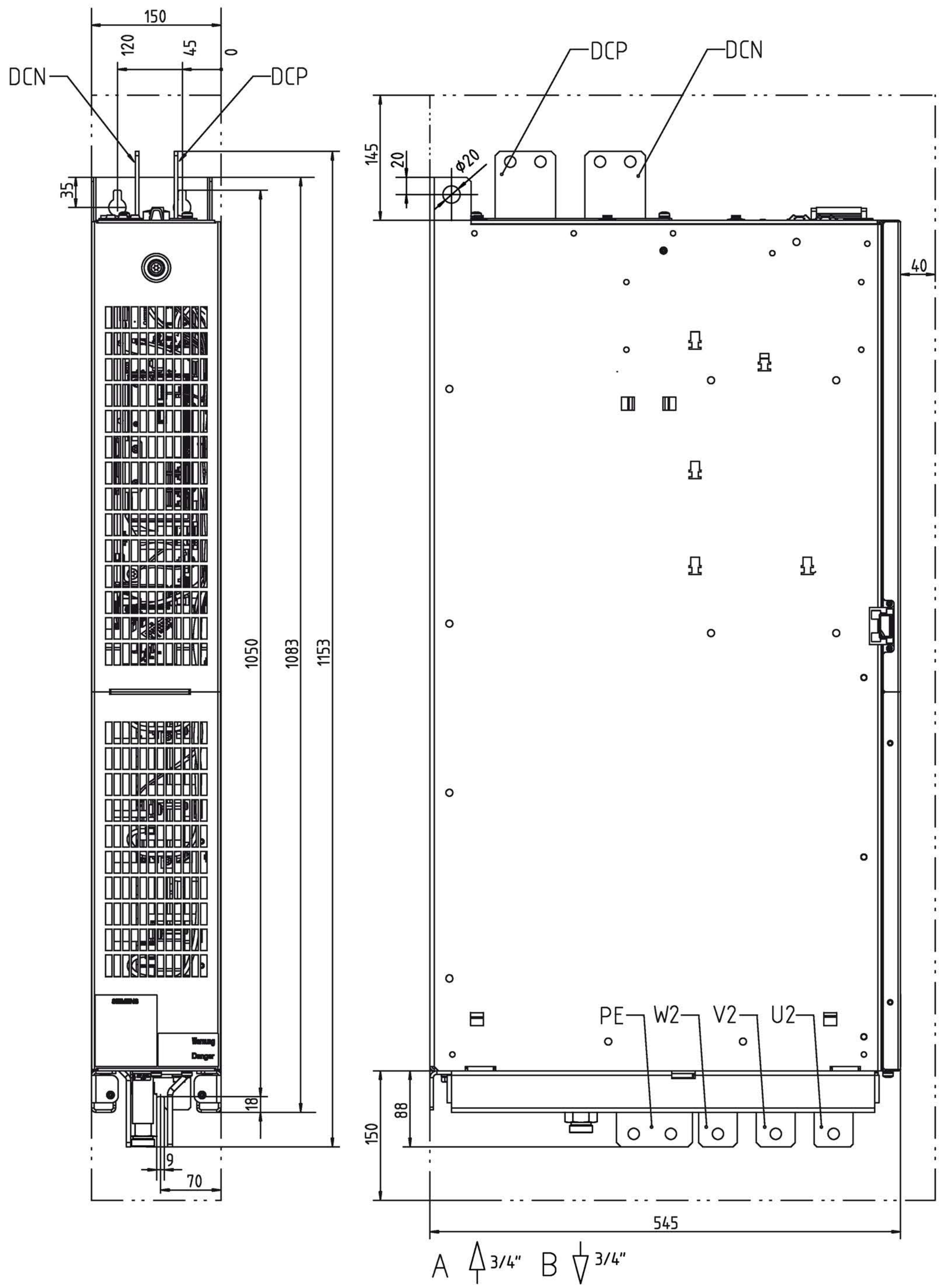


Figure 7-7 Dimension drawing Motor Module, frame size GXL. Front view, side view

Dimension drawing, frame size HXL

The mandatory cooling clearances are indicated by the dotted line.

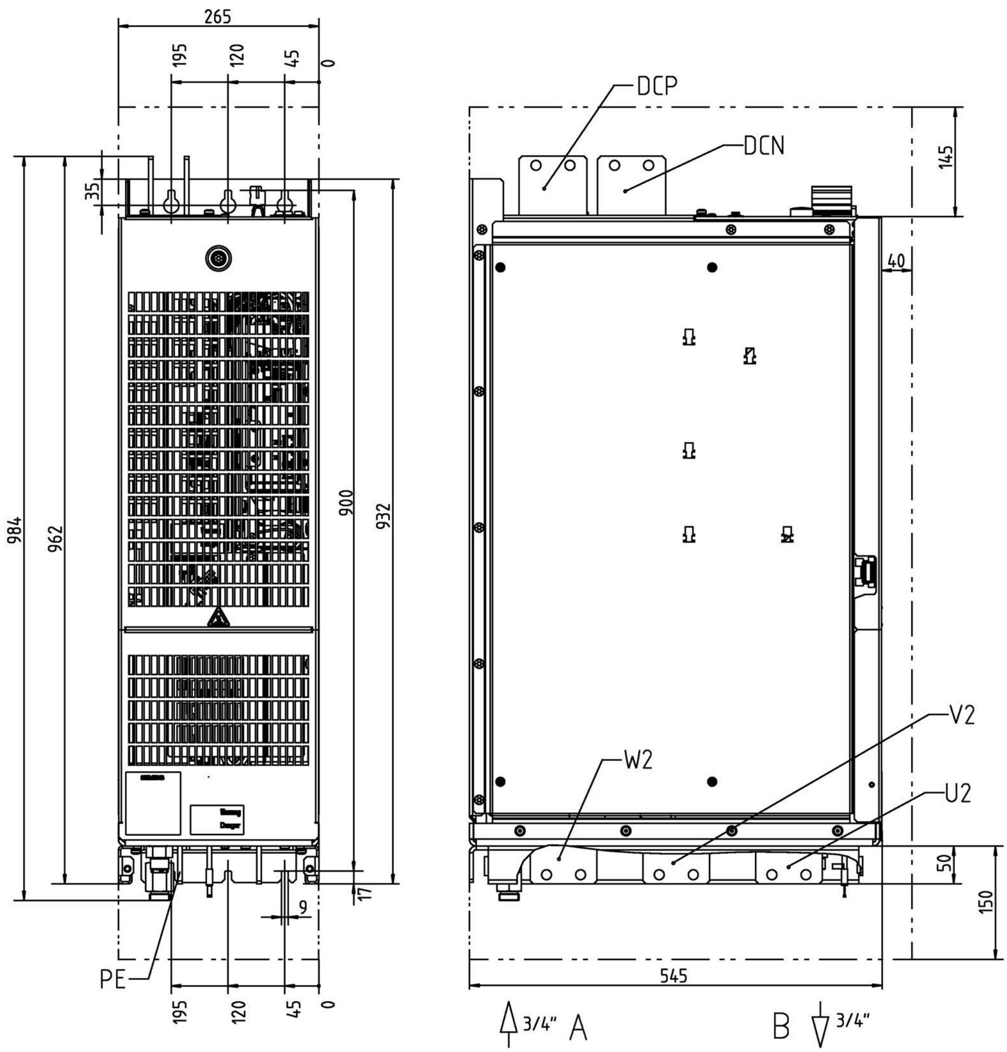


Figure 7-8 Dimension drawing Motor Module, frame size HXL. Front view, side view

Dimension drawing for frame size JXL

The mandatory cooling clearances are indicated by the dotted line.

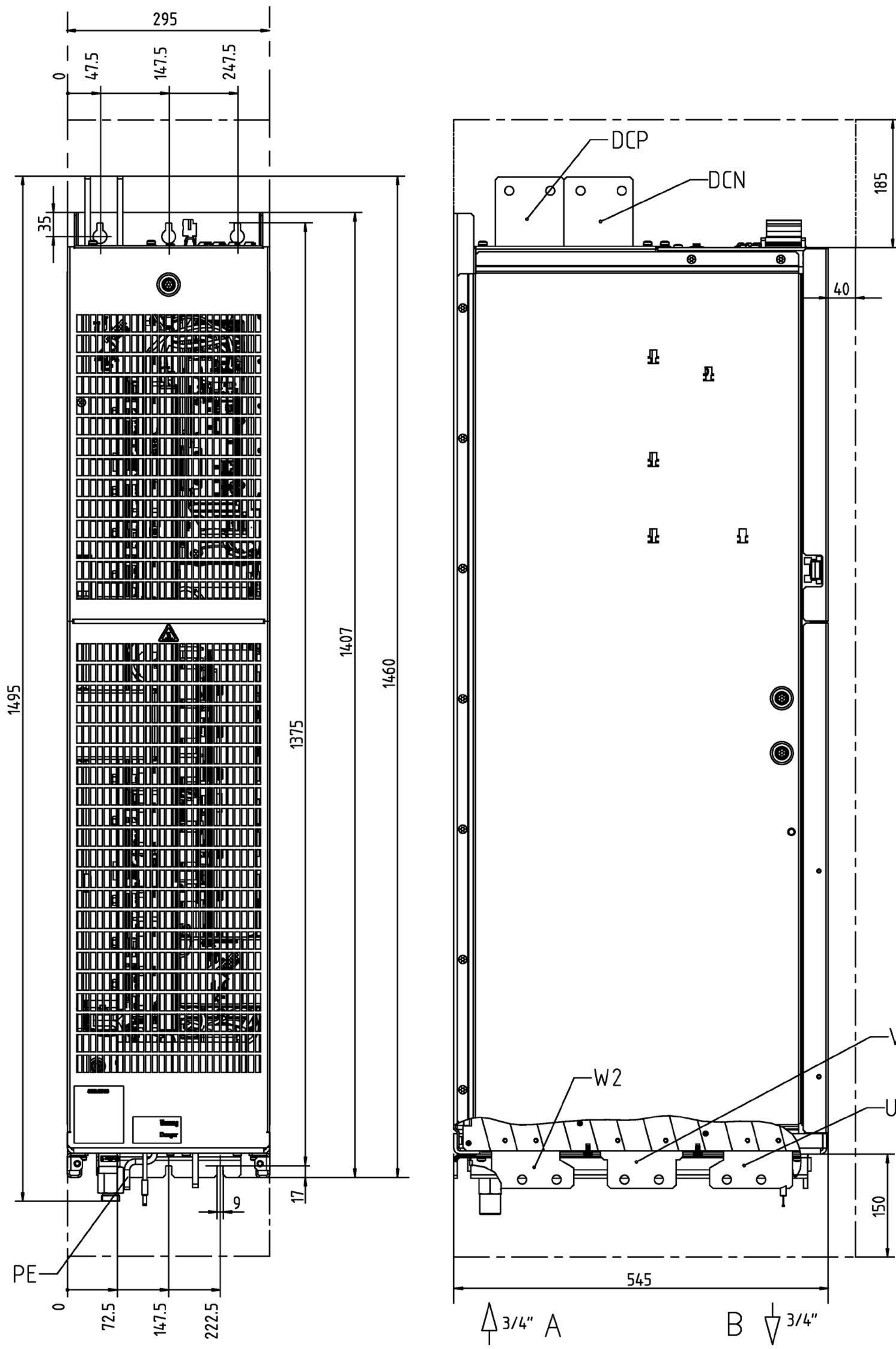


Figure 7-9 Dimension drawing Motor Module, frame size JXL, article numbers 6SL3325-1TE41-0AA3, 6SL3325-1TE41-4AA3, 6SL3325-1TG38-1AA3, 6SL3325-1TG41-0AA3, 6SL3325-1TG41-2AA3, 6SL3325-1TG41-3AA3. Front view, side view

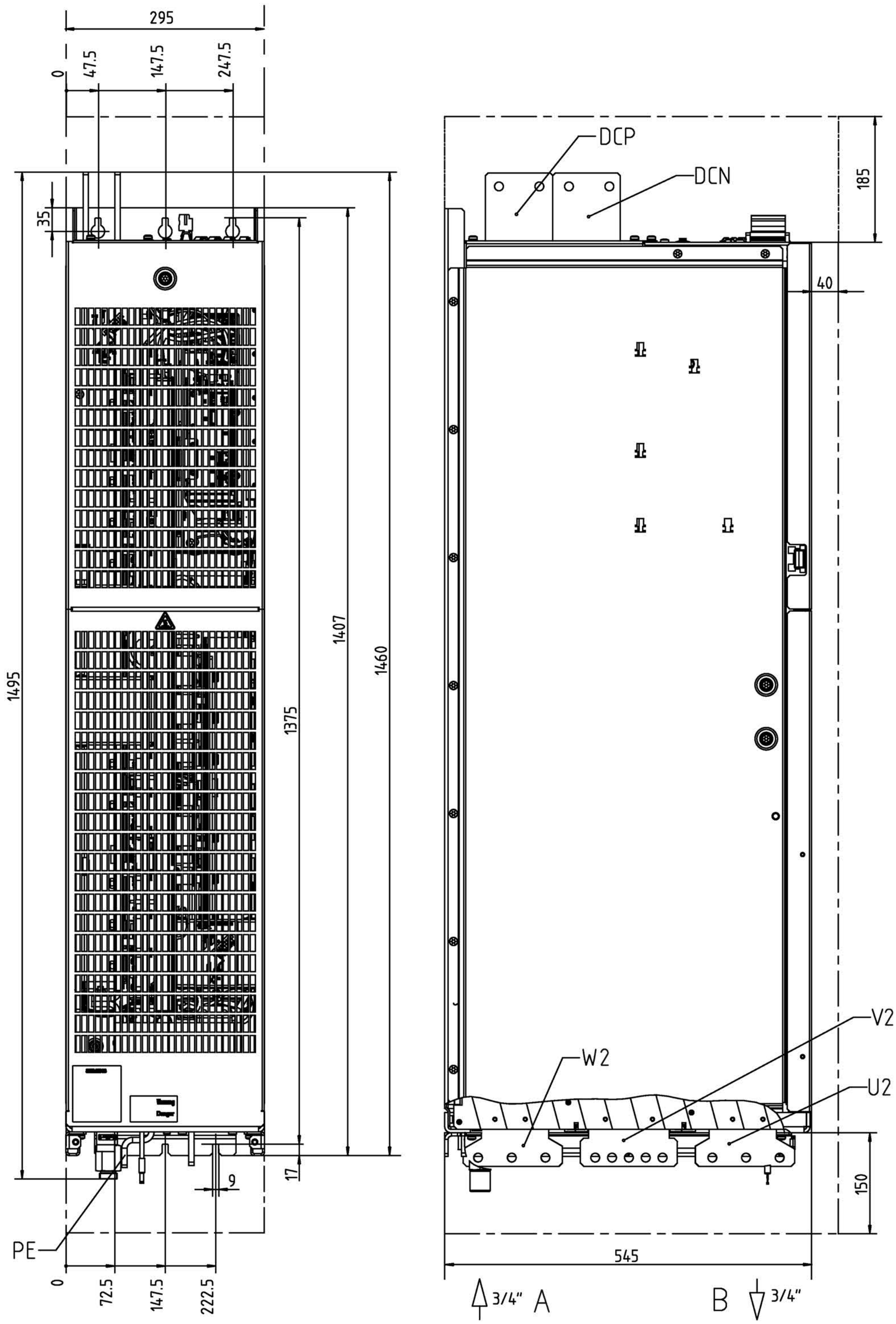


Figure 7-10 Dimension drawing Motor Module, frame size JXL, article numbers 6SL3325-1TE41-4AS3, 6SL3325-1TG41-6AA3. Front view, side view

7.5 Installation

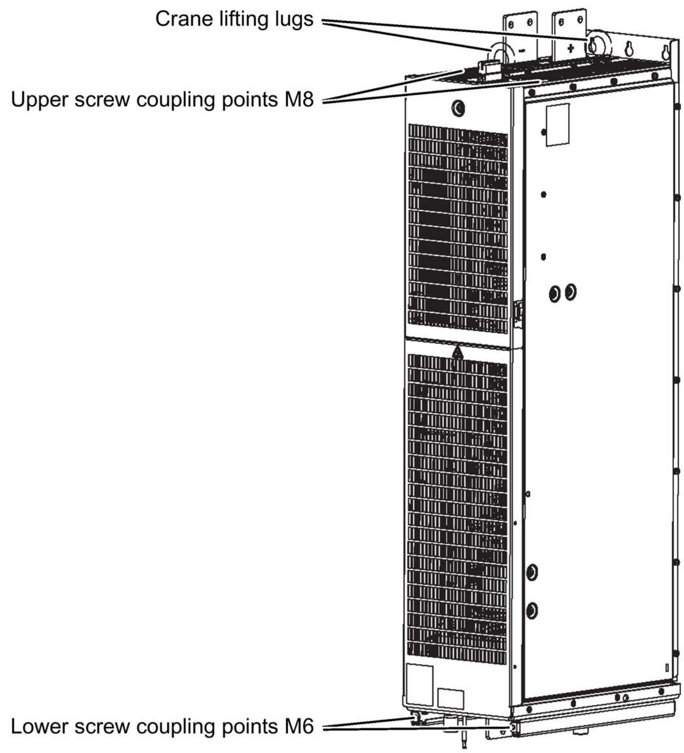


Figure 7-11 Crane lifting lugs / screw coupling points for mechanical support

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 four screws ("2" in the diagram) and remove the guard.

⚠ CAUTION
Risk of injury due to toppling when placing down on the protection guard
A module placed down on the protection guard can topple over therefore causing injury. • When the module is placed down on the protection guard, ensure that it cannot topple over.

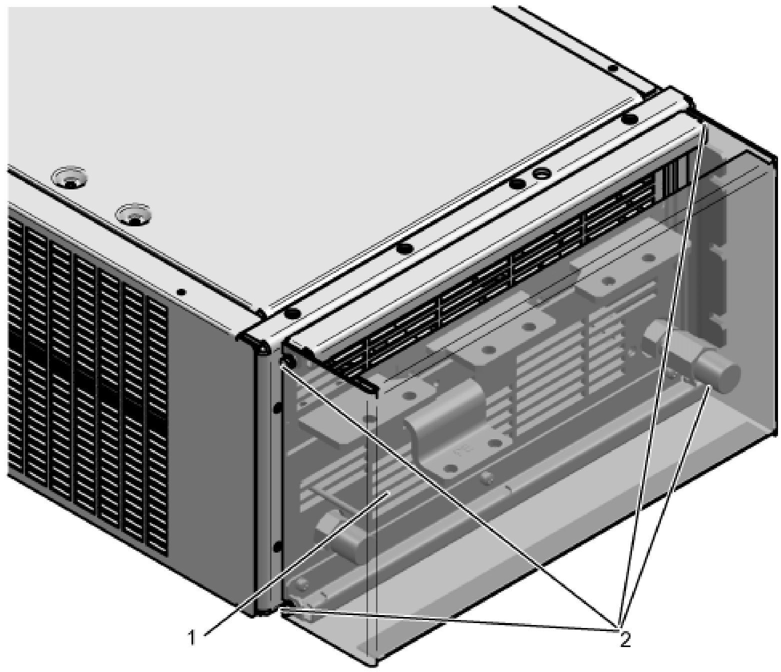


Figure 7-12 Protection guard

Note

Mounting fixture for power units

The mounting equipment for the power units can be used to mount the Motor Module, see "Mounting equipment for power units (Page 357)".

Crane lifting lugs

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

Note

Transport in the horizontal position

Transport in the horizontal position is permissible.

It is not permissible to screw the crane lifting lug into the thread at the lower side of the Motor Module.

NOTICE

Damage to the device due to improper transport

Improper transport can cause mechanical loads on the housing or busbars which can result in damage to the device.

- Use a lifting harness with vertical ropes or chains during transport.
- Do not use the busbars as handles or for fastening a lifting harness.
- Only tighten the crane lifting lugs by hand. Remove the crane lifting lugs after the installation, but keep them for later 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 at 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.

WARNING

Electric shock due to insufficient insulating clearance (air clearances and creepage distances)

Incorrect mounting of the reinforcing sheet metal parts can result in insufficient insulating clearance to live parts and can cause death or serious injury.

- Ensure that the reinforcing sheet metal parts do not come into contact with live parts and that an insulation clearance (air clearances and creepage distances) of >13 mm / 25 mm is always maintained.
- As a result of customer specifications or the specifications of certification bodies, under certain circumstances, larger air clearances and creepage distances may be required. Take this into account for the mechanical design of the cabinet and when installing.

7.6 Technical specifications

7.6.1 Motor Modules 510 V ... 720 V DC (line voltage, 3 AC 380 ... 480 V)

Table 7- 11 Technical data for Motor Modules, 510 ... 720 V DC (line voltage 380 ... 480 V3 AC), Part 1

Article number	6SL3325–	1TE32-1AA3	1TE32–6AA3	1TE33-1AA3	1TE35–0AA3
Type 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
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
DC link current - Rated current $I_{N DC}$ when fed via - Basic Line Module - Active Line Module - Base-load current $I_{L DC}$ when fed via - Basic Line Module - Active Line Module - Base-load current $I_{H DC}$ when fed via - Basic Line Module - Active Line Module	 A A A A A A	 256 230 250 225 227 195	 317 287 305 274 284 255	 380 340 368 331 338 303	 600 538 581 522 534 480
Supply voltages - Electronics power supply - DC link voltage - Output voltage	 V_{DC} V_{DC} V_{ACrms}	 24 (20.4 ... 28.8) 510 ... 720 0 to 0.75 x DC link voltage			
DC link capacitance	µF	4800	5800	8400	9600
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
Electronics current 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 - Dissipated to the ambient air	 kW kW kW	 1.61 1.68 0.06	 1.95 2.06 0.07	 2.29 2.38 0.09	 3.56 3.74 0.14
Rated flow rate	l/min	9	9	12	12
Pressure drop, typical at the rated flow rate [4]	Pa	70000	70000	70000	70000
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 connection for M12 screw			
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)			

Article number	**6SL3325–**	**1TE32-1AA3**	**1TE32–6AA3**	**1TE33-1AA3**	**1TE35–0AA3**
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
Recommended fuse acc. to IEC - Number per phase (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 1 630 2
Recommended fuse acc. to UL [5)] Type 3NE3 - Number per phase (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 1 630 2
Type 3NB1/3NB2 - rated current	 A	3NB1231- 4KK11 315	3NB1234- 4KK11 400	3NB1337- 4KK11 500	3NB1345- 4KK11 800

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

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

3) The specified power loss is the maximum value for a 100% utilization level. The value in normal operation is lower.

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 7- 12 Technical data for Motor Modules, 510 ... 720 V DC (line voltage 380 ... 480 V3 AC), Part 2

Article number	6SL3325–	1TE36-1AA3	1TE37-5AA3	1TE38–4AA3	1TE41-0AA3
Type 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	 315 250 500 350	 400 315 600 450	 450 400 700 600	 560 450 800 700
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	 605 590 460 885	 745 725 570 1087	 840 820 700 1230	 985 960 860 1440
DC link current - Rated current $I_{N\,DC}$ when fed via - Basic Line Module - Active Line Module - Base-load current $I_{L\,DC}$ when fed via - Basic Line Module - Active Line Module - Base-load current $I_{H\,DC}$ when fed via - Basic Line Module - Active Line Module	 A A A A A A	 738 664 719 646 561 504	 894 805 871 784 795 716	 1025 922 1000 898 853 767	 1202 1080 1170 1051 1048 942
Supply voltages - Electronics power supply - DC link voltage - Output voltage	 V_{DC} V_{DC} V_{ACrms}	 24 (20.4 ... 28.8) 510 ... 720 0 to 0.75 x DC link voltage			
DC link capacitance	µF	12600	17400	17400	21000
Rated pulse frequency - Max. pulse frequency without derating - Max. pulse frequency with derating	kHz kHz kHz	1.25 1.25 7.5	1.25 1.25 7.5	1.25 1.25 7.5	1.25 1.25 8
Electronics current consumption (24 V DC)	A	1.6	1.6	1.6	1.46
Cooling method		Liquid cooling with integrated aluminum heat exchanger			
Power loss, max. [3)] - At 50 Hz 400 V - At 60 Hz 460 V - Dissipated to the ambient air	 kW kW kW	 4.81 5.25 0.16	 5.1 5.61 0.2	 5.75 6.33 0.23	 7.9 8.55 0.44
Rated flow rate	l/min	16	16	16	27
Pressure drop, typical at the rated flow rate [4)]	Pa	70000	70000	70000	70000
Liquid volume of integrated heat exchanger	dm³	0.74	0.74	0.74	1.56
Sound pressure level L_{pA} (1 m) at 50/60 Hz	 dB(A)	 54	 54	 54	 56
DC link/motor connection		Flat connection for M12 screw			
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 4 x 185 4 x 185	 Busbar 4 x 185 4 x 185	 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	 265 1002 545	 265 1002 545	 295 1516 545
Frame size		HXL	HXL	HXL	JXL
Weight	kg	110	110	110	220

Article number	6SL3325–	1TE36-1AA3	1TE37-5AA3	1TE38–4AA3	1TE41-0AA3
Recommended fuse acc. to IEC - Number per phase (connected in parallel) - Rated current - Frame size acc. to IEC 60269	 A 	3NE3338-8 1 800 2	3NE3334-0B 2 [6)] 500 2	3NE3335 2 [6)] 560 2	3NE3336 2 [6)] 630 2
Recommended fuse acc. to UL [5)] Type 3NE3 - Number per phase (connected in parallel) - Rated current - Frame size acc. to IEC 60269	 A 	 3NE3338-8 1 800 2	 --	 3NE3335 2 [6)] 560 2	 3NE3336 2 [6)] 630 2
Type 3NB1/3NB2 - rated current	 A	3NB2345- 4KK16 800	3NB2350- 4KK16 1000	3NB2350- 4KK16 1000	3NB2355- 4KK16 1400

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

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

3) The specified power loss is the maximum value at 100% utilization. The value in normal operation is lower.

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.

6) When using fuses connected in parallel in each phase, if one fuse ruptures, then all of the fuses must be replaced.

Table 7- 13 Technical data for Motor Modules, 510 ... 720 V DC (line voltage 380 ... 480 V3 AC), Part 3

Article number	**6SL3325–**	**1TE41–2AA3**	**1TE41–4AA3**	**1TE41–4AS3** 7)	
Type 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	 710 630 1000 900	 800 710 1150 1000	 800 630 1000 900	
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	 1260 1230 1127 1845	 1405 1370 1257 2055	 1330 1310 1150 2055	
DC link current - Rated current $I_{N\,DC}$ when fed via - Basic Line Module - Active Line Module - Base-load current $I_{L\,DC}$ when fed via - Basic Line Module - Active Line Module - Base-load current $I_{H\,DC}$ when fed via - Basic Line Module - Active Line Module	 A A A A A A	 1512 1361 1474 1326 1345 1211	 1714 1544 1670 1500 1532 1377	 1550 1403 1525 1405 1676 1403	
Supply voltages - Electronics power supply - DC link voltage - Output voltage	 V_{DC} V_{DC} V_{ACrms}	 24 (20.4 ... 28.8) 510 ... 720 0 to 0.75 x DC link voltage			
DC link capacitance	µF	29000	29000	21000	
Rated pulse frequency - Max. pulse frequency without derating - Max. pulse frequency with derating	kHz kHz kHz	1.25 1.25 8	1.25 1.25 8	2 2 4	
Electronics current consumption (24 V DC)	A	1.46	1.46	1.46	
Cooling method		Liquid cooling with integrated aluminum heat exchanger			
Power loss, max. 3) - At 50 Hz 400 V - At 60 Hz 460 V - Dissipated to the ambient air	 kW kW kW	 9.15 10.05 0.56	 10.2 11.2 0.62	 10.9 12.3 0.65	
Rated flow rate	l/min	27	27	27	
Pressure drop, typical at the rated flow rate 4)	Pa	70000	70000	70000	
Liquid volume of integrated heat exchanger	dm³	1.56	1.56	1.56	
Sound pressure level L_{pA} (1 m) at 50/60 Hz	 dB(A)	 56	 56	 56	
DC link/motor connection		Flat connection for M12 screw			
Max. conductor cross-sections - DC link connection (DCP, DCN) - Motor connection (U2, V2, W2) - PE connection	 mm² mm² mm²	 Busbar Busbar Busbar	 Busbar Busbar Busbar	 Busbar Busbar Busbar	
Max. cable length	m	300 (shielded) / 450 (unshielded)			
Degree of protection		IP00	IP00	IP00	
Dimensions - Width - Height - Depth	 mm mm mm	 295 1516 545	 295 1516 545	 295 1516 545	
Frame size		JXL	JXL	JXL	

Article number	6SL3325–	1TE41–2AA3	1TE41–4AA3	1TE41–4AS3 [7]	
Weight	kg	220	220	230	
Recommended fuse acc. to IEC - Number per phase (connected in parallel) - Rated current - Frame size acc. to IEC 60269	 A 	3NE3340-8 2 [6] 900 2	3NE3340-8 2 [6] 900 2	3NE3340-8 2 [6] 900 2	
Recommended fuse acc. to UL [5] Type 3NE3 - Number per phase (connected in parallel) - Rated current - Frame size acc. to IEC 60269 Type 3NB1/3NB2 - rated current	 A A	 -- 3NB2364- 4KK17 2100	 3NE3340-8 2 [6] 900 2 3NB2364- 4KK17 2100	 -- 3NB2364- 4KK17 2100	

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

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

3) The specified power loss is the maximum value at 100% utilization. The value in normal operation is lower.

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.

6) When using fuses connected in parallel in each phase, if one fuse ruptures, then all of the fuses must be replaced.

7) This Motor Module has been specifically designed for loads demanding a high dynamic performance.

7.6.2 Motor Modules 675 V ... 1035 V DC (line voltage, 3 AC 500 ... 690 V)

Table 7- 14 Technical data for Motor Modules, 675 ... 1035 V DC (line voltage 3 AC 500 ... 690 V), Part 1

Article number	**6SL3325–**	**1TG31-0AA3**	**1TG31–5AA3**	**1TG32-2AA3**	**1TG33–3AA3**
Type rating - Based on I_L (50 Hz 690 V) [1)] - Based on I_H (50 Hz 690 V) [1)] - Based on I_L (50 Hz 500 V) [1)] - Based on I_H (50 Hz 500 V) [1)] - Based on I_L (60 Hz 575 V) [2)] - Based on I_H (60 Hz 575 V) [2)]	 kW kW kW kW HP HP	 90 75 55 55 75 75	 132 110 90 90 150 125	 200 160 132 132 200 200	 315 250 200 200 300 250
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	 100 95 89 142	 150 142 134 213	 215 208 192 312	 330 320 280 480
DC link current - Rated current $I_{N\,DC}$ when fed via - Basic Line Module - Active Line Module - Base-load current $I_{L\,DC}$ when fed via - Basic Line Module - Active Line Module - Base-load current $I_{H\,DC}$ when fed via - Basic Line Module - Active Line Module	 A A A A A A	 122 110 116 105 108 98	 183 165 173 156 163 147	 263 237 253 229 234 211	 403 363 390 352 341 308
Supply voltages - Electronics power supply - DC link voltage - Output voltage	 V_{DC} V_{DC} V_{ACrms}	 24 (20.4 ... 28.8) 675 ... 1035 0 to 0.75 x DC link voltage			
DC link capacitance	µF	2800	2800	4200	5800
Rated pulse frequency - Max. pulse frequency without derating - Max. pulse frequency with derating	kHz kHz kHz	1.25 1.25 7.5	1.25 1.25 7.5	1.25 1.25 7.5	1.25 1.25 7.5
Electronics current 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 690 V - At 60 Hz 575 V - Dissipated to the ambient air	 kW kW kW	 1.15 1.02 0.06	 1.64 1.45 0.07	 2.34 2.05 0.09	 3.38 2.96 0.12
Rated flow rate	l/min	9	9	12	12
Pressure drop, typical at the rated flow rate [4)]	Pa	70000	70000	70000	70000
Liquid volume of integrated heat exchanger	dm^3	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 connection for M12 screw			
Max. conductor cross-sections - DC link connection (DCP, DCN) - Motor connection (U2, V2, W2) - PE connection	 mm^2 mm^2 mm^2	 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

Article number	6SL3325–	1TG31-0AA3	1TG31–5AA3	1TG32-2AA3	1TG33–3AA3
Dimensions - Width - Height - Depth	 mm mm mm	 150 728 545	 150 728 545	 150 1172 545	 150 1172 545
Frame size		FXL	FXL	GXL	GXL
Weight	kg	41	41	80	80
Recommended fuse acc. to IEC - Number per phase (connected in parallel) - Rated current - Frame size acc. to IEC 60269	 A 	3NE3224 1 160 1	3NE3225 1 200 1	3NE3230-0B 1 315 1	3NE3233 1 450 2
Recommended fuse acc. to UL [5)] Type 3NE3 - Number per phase (connected in parallel) - Rated current - Frame size acc. to IEC 60269 Type 3NB1/3NB2 - rated current	 A A	 3NE3224 1 160 1 3NB1126- 4KK11 200	 3NE3225 1 200 1 3NB1128- 4KK11 250	 3NE3230-0B 1 315 1 3NB1231- 4KK11 315	 3NE3233 1 450 2 3NB1337- 4KK11 500

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

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

3) The specified power loss is the maximum value at 100% utilization. The value in normal operation is lower.

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 7- 15 Technical data for Motor Modules, 675 ... 1035 V DC (line voltage 3 AC 500 ... 690 V), Part 2

Article number	**6SL3325–**	**1TG34-7AA3**	**1TG35-8AA3**	**1TG37-4AA3**	**1TG38–0AA3** [7)]
Type rating					
- Based on I_L (50 Hz 690 V) [1)]	kW	450	560	710	800
- Based on I_H (50 Hz 690 V) [1)]	kW	400	450	630	710
- Based on I_L (50 Hz 500 V) [1)]	kW	315	400	500	560
- Based on I_H (50 Hz 500 V) [1)]	kW	250	315	450	500
- Based on I_L (60 Hz 575 V) [2)]	HP	450	600	700	800
- Based on I_H (60 Hz 575 V) [2)]	HP	450	500	700	700
Output current					
- Rated current $I_{N\,A}$	A	465	575	735	810
- Base-load current I_L	A	452	560	710	790
- Base-load current I_H	A	416	514	657	724
- Max. output current $I_{max\,A}$	A	678	840	1065	1185
DC link current					
- Rated current $I_{N\,DC}$ when fed via					
- Basic Line Module	A	558	702	903	990
- Active Line Module	A	502	632	808	891
- Base-load current $I_{L\,DC}$ when fed via					
- Basic Line Module	A	544	683	870	948
- Active Line Module	A	489	616	781	870
- Base-load current $I_{H\,DC}$ when fed via					
- Basic Line Module	A	496	627	795	885
- Active Line Module	A	446	565	732	808
Supply voltages					
- Electronics power supply	V_{DC}	24 (20.4 ... 28.8)			
- DC link voltage	V_{DC}	675 ... 1035			
- Output voltage	V_{ACrms}	0 to 0.75 x DC link voltage			
DC link capacitance	µF	9670	9670	10500	10500
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
Electronics current consumption (24 V DC)	A	1.6	1.6	1.6	1.6
Cooling method		Liquid cooling with integrated aluminum heat exchanger			
Power loss, max. [3)]					
- At 50 Hz 690 V	kW	5.44	5.61	7.65	8.47
- At 60 Hz 575 V	kW	5.1	4.89	6.67	7.39
- Dissipated to the ambient air	kW	0.14	0.16	0.2	0.22
Rated flow rate	l/min	16	16	16	16
Pressure drop, typical at the rated flow rate [4)]	Pa	70000	70000	70000	70000
Liquid volume of integrated heat exchanger	dm³	0.74	0.74	0.74	0.74
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	54	54	54	54
DC link/motor connection		Flat connection 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	4 x 185	4 x 185
- PE connection	mm²	4 x 185	4 x 185	4 x 185	4 x 185
Max. cable length	m	300 (shielded) / 450 (unshielded)			
Degree of protection		IP00	IP00	IP00	IP00
Dimensions					
- Width	mm	265	265	265	265
- Height	mm	1002	1002	1002	1002
- Depth	mm	545	545	545	545

Article number	**6SL3325–**	**1TG34-7AA3**	**1TG35-8AA3**	**1TG37-4AA3**	**1TG38–0AA3** [7]
Frame size		HXL	HXL	HXL	HXL
Weight	kg	110	110	110	110
Recommended fuse acc. to IEC - Number per phase (connected in parallel) - Rated current - Frame size acc. to IEC 60269	 A	3NE3336 1 630 2	3NE3232-0B 2 [6] 400 1	3NE3335 2 [6] 560 2	3NE3335 2 [6] 560 2
Recommended fuse acc. to UL [5] Type 3NE3 - Number per phase (connected in parallel) - Rated current - Frame size acc. to IEC 60269 Type 3NB1/3NB2 - rated current	 A A	 -- 3NB1345- 4KK11 800	 3NE3232-0B 2 [6] 400 1 3NB2345- 4KK16 800	 -- 3NB2350- 4KK16 1000	 -- 3NB2350- 4KK16 1000

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

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

3) The specified power loss is the maximum value at 100% utilization. The value in normal operation is lower.

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.

6) When using fuses connected in parallel in each phase, if one fuse ruptures, then all of the fuses must be replaced.

7) Device 6SL3325-1TG38-0AA3 is optimized for a base pulse frequency of 1.25 kHz, for an increased pulse frequency, the derating factor is higher than for the device with article number 6SL3325-1TG38-1AA3.

Table 7- 16 Technical data for Motor Modules, 675 ... 1035 V DC (line voltage 3 AC 500 ... 690 V), Part 3

Article number	**6SL3325–**	**1TG38–1AA3**	**1TG41–0AA3**	**1TG41–3AA3**	**1TG41-6AA3**
Type rating					
- Based on I_L (50 Hz 690 V) [1]	kW	800	1000	1200	1500
- Based on I_H (50 Hz 690 V) [1]	kW	710	900	1000	1260
- Based on I_L (50 Hz 500 V) [1]	kW	560	710	900	1000
- Based on I_H (50 Hz 500 V) [1]	kW	560	630	800	900
- Based on I_L (60 Hz 575 V) [2]	HP	800	1000	1250	1500
- Based on I_H (60 Hz 575 V) [2]	HP	700	900	1000	1250
Output current					
- Rated current $I_{N\,A}$	A	810	1025	1270	1560
- Base-load current I_L	A	790	1000	1230	1500
- Base-load current I_H	A	724	917	1136	1284
- Max. output current $I_{max\,A}$	A	1185	1500	1845	2055
DC link current					
- Rated current $I_{N\,DC}$ when fed via					
- Basic Line Module	A	990	1250	1550	1903
- Active Line Module	A	891	1125	1395	1714
- Base-load current $I_{L\,DC}$ when fed via					
- Basic Line Module	A	963	1219	1500	1800
- Active Line Module	A	869	1100	1353	1650
- Base-load current $I_{H\,DC}$ when fed via					
- Basic Line Module	A	883	1118	1384	1680
- Active Line Module	A	796	1009	1250	1550
Supply voltages					
- Electronics power supply	V_{DC}	24 (20.4 ... 28.8)			
- DC link voltage	V_{DC}	675 ... 1035			
- Output voltage	V_{ACrms}	0 to 0.75 x DC link voltage			
DC link capacitance	μF	14000	16000	19330	21000
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
Electronics current consumption (24 V DC)	A	1.46	1.46	1.46	1.46
Cooling method		Liquid cooling with integrated aluminum heat exchanger			
Power loss, max. [3]					
- At 50 Hz 690 V	kW	9.56	10.87	13.49	17.9
- At 60 Hz 575 V	kW	8.34	9.55	11.84	15.7
- Dissipated to the ambient air	kW	0.43	0.53	0.57	0.78
Rated flow rate	l/min	27	27	27	27
Pressure drop, typical at the rated flow rate [4]	Pa	70000	70000	70000	70000
Liquid volume of integrated heat exchanger	dm³	1.56	1.56	1.56	1.56
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	56	56	56	56
DC link/motor connection		Flat connection for M12 screw			
Max. conductor cross-sections					
- DC link connection (DCP, DCN)	mm²	Busbar	Busbar	Busbar	Busbar
- Motor connection (U2, V2, W2)	mm²	Busbar	Busbar	Busbar	Busbar
- PE connection	mm²	Busbar	Busbar	Busbar	Busbar
Max. cable length	m	300 (shielded) / 450 (unshielded)			
Degree of protection		IP00	IP00	IP00	IP00
Dimensions					
- Width	mm	295	295	295	295
- Height	mm	1516	1516	1516	1516
- Depth	mm	545	545	545	545

Article number	6SL3325–	1TG38–1AA3	1TG41–0AA3	1TG41–3AA3	1TG41-6AA3
Frame size		JXL	JXL	JXL	JXL
Weight	kg	220	220	220	230
Recommended fuse acc. to IEC - Number per phase (connected in parallel) - Rated current - Frame size acc. to IEC 60269	 A	3NE3335 2 [6)] 560 2	3NE3337-8 2 [6)] 710 2	3NE3340-8 2 [6)] 900 2	3NE3337-8 3 [6)] 710 2
Recommended fuse acc. to UL [5)] Type 3NE3 - Number per phase (connected in parallel) - Rated current - Frame size acc. to IEC 60269	 A	 3NE3335 2 [6)] 560 2	 3NE3337-8 2 [6)] 710 2	 3NE3340-8 2 [6)] 900 2	 --
Type 3NB1/3NB2 - rated current	 A	3NB2350- 4KK16 1000	3NB2357- 4KK16 1600	3NB2364- 4KK17 2100	3NB2366- 4KK17 2400

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

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

3) The specified power loss is the maximum value at 100% utilization. The value in normal operation is lower.

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.

6) When using fuses connected in parallel in each phase, if one fuse ruptures, then all of the fuses must be replaced.

Table 7- 17 Technical data for Motor Modules, 675 ... 1035 V DC (line voltage 3 AC 500 ... 690 V), Part 4

Article number	6SL3325–	1TG41-6AP3 [7)]			
Type rating - Based on I_L (50 Hz 690 V) [1)] - Based on I_H (50 Hz 690 V) [1)] - Based on I_L (50 Hz 500 V) [1)] - Based on I_H (50 Hz 500 V) [1)] - Based on I_L (60 Hz 575 V) [2)] - Based on I_H (60 Hz 575 V) [2)]	 kW kW kW kW HP HP	 1500 1260 1000 900 1500 1250			
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	 1560 1500 1370 2250			
DC link current - Rated current $I_{N\,DC}$ when fed via - Basic Line Module - Active Line Module - Base-load current $I_{L\,DC}$ when fed via - Basic Line Module - Active Line Module - Base-load current $I_{H\,DC}$ when fed via - Basic Line Module - Active Line Module	 A A A A A A	 1903 1714 1800 1650 1680 1550			
Supply voltages - Electronics power supply - DC link voltage - Output voltage	 V_{DC} V_{DC} V_{ACrms}	 24 (20.4 ... 28.8) 675 ... 1035 0 to 0.75 x DC link voltage			
DC link capacitance	µF	21000			
Rated pulse frequency - Max. pulse frequency without derating - Max. pulse frequency with derating	kHz kHz kHz	1.25 1.25 7.5			
Electronics current consumption (24 V DC)	A	1.46			
Cooling method		Liquid cooling with integrated aluminum heat exchanger			
Power loss, max. [3)] - At 50 Hz 690 V - At 60 Hz 575 V - Dissipated to the ambient air	 kW kW kW	 17.9 15.7 0.78			
Rated flow rate	l/min	27			
Pressure drop, typical at the rated flow rate [4)]	Pa	70000			
Liquid volume of integrated heat exchanger	dm³	1.56			
Sound pressure level L_{pA} (1 m) at 50/60 Hz	 dB(A)	 56			
DC link/motor connection		Flat connection for M12 screw			
Max. conductor cross-sections - DC link connection (DCP, DCN) - Motor connection (U2, V2, W2) - PE connection	 mm² mm² mm²	 Busbar Busbar Busbar			
Max. cable length	m	300 (shielded) / 450 (unshielded)			
Degree of protection		IP00			
Dimensions - Width - Height - Depth	 mm mm mm	 295 1516 545			

Article number	6SL3325–	1TG41-6AP3 [7]			
Frame size		JXL			
Weight	kg	230			
Recommended fuse acc. to IEC - Number per phase (connected in parallel) - Rated current - Frame size acc. to IEC 60269	 A 	3NE3337-8 3 [6] 710 2			
Recommended fuse acc. to UL [5] Type 3NE3 - Number per phase (connected in parallel) - Rated current - Frame size acc. to IEC 60269	 A 	 --			
Type 3NB1/3NB2 - rated current	 A	3NB2366- 4KK17 2400			

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

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

3) The specified power loss is the maximum value at 100% utilization. The value in normal operation is lower.

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.

6) When using fuses connected in parallel in each phase, if one fuse ruptures, then all of the fuses must be replaced.

7) Additional duty cycle for output frequencies from 5 Hz to 10 Hz: Base-load current = 1460 A, short-time current = 2340 A for 5 s with a duty cycle duration of 600 s. For output frequencies from 1 Hz to 5 Hz, the short-time current is 1900 A for 5 s.

7.6.3 Overload capability

The Motor Modules have an overload reserve (e.g. to overcome 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 as a maximum with its base load current before and after the overload occurs (a load duration of 300 s is used as a basis here).

Another precondition is that the Motor Module is operated at its factory-set pulse frequency at output frequencies > 10 Hz.

Additional information on the overload capability is provided in the Low Voltage Configuration Manual and in the SINAMICS S120 Function Manual Drive Functions.

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.

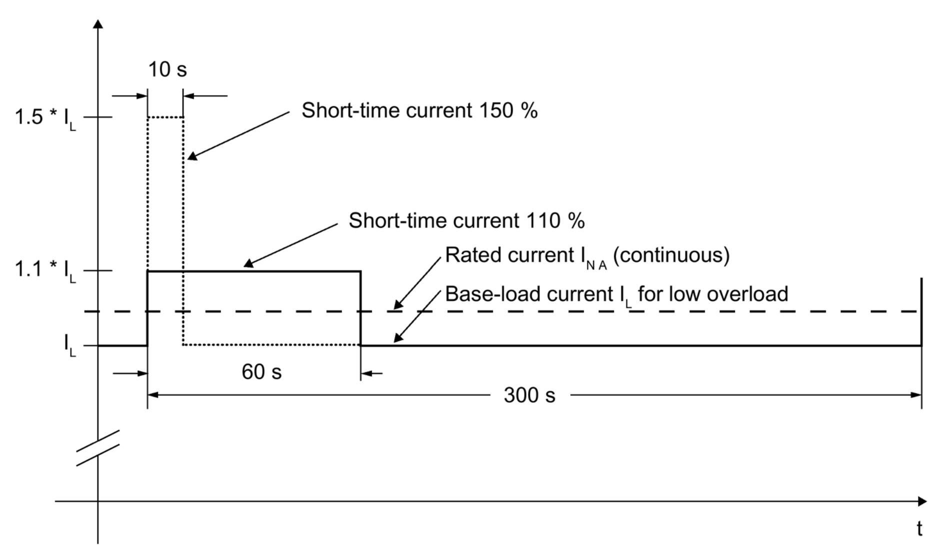


Figure 7-13 Low overload

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.

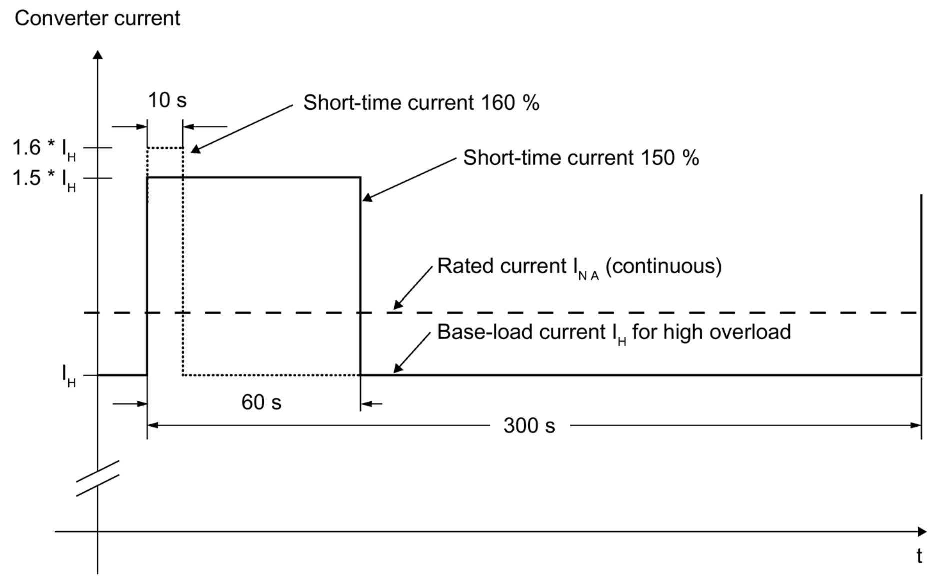


Figure 7-14 High overload

High overload for Motor Module 6SL3325-1TG41-6AP3

This Motor Module is particularly suitable for high breakaway torques with applications such as drilling, mixers, centrifuges and test bays. In this case, an additional duty cycle applies for output frequencies from 5 Hz to 10 Hz. At output frequencies of 1 Hz to 5 Hz, the short-time current is 1900 A for 5 s.

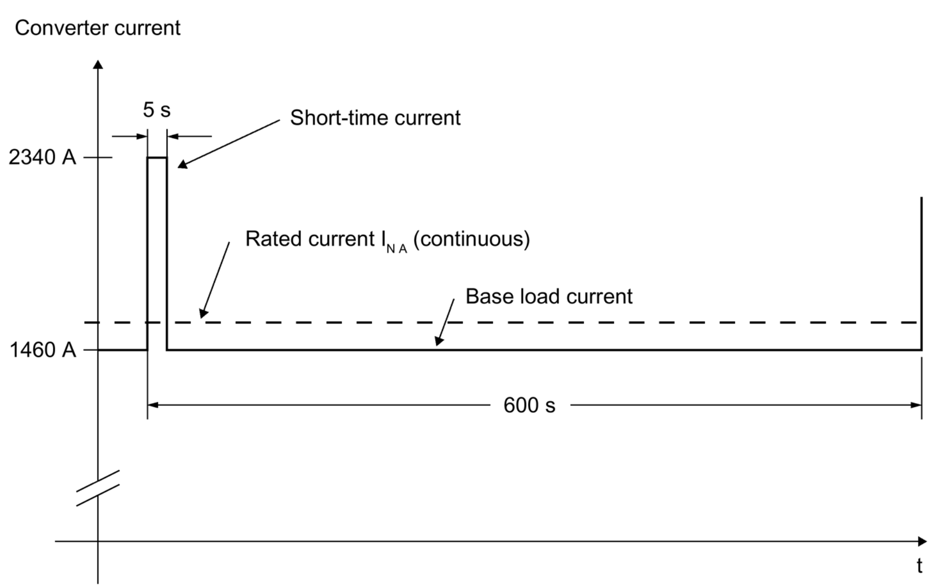


Figure 7-15 High overload for Motor Module 6SL3325-1TG41-6AP3

7.6.4 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 7- 18 Derating factor of the output current as a function of the pulse frequency for devices with a rated pulse frequency of 2 kHz

Article No.	Type rating	Output current at 2 kHz	Derating factor at the pulse frequency				
6SL3325-...	[kW]	[A]	2.5 kHz	4 kHz	5 kHz	7.5 kHz	8 kHz
Connection voltage 510 ... 720 V DC (line voltage 3 AC 380 ... 480 V)							
1TE32-1AA3	110	210	95 %	82 %	74 %	54 %	50 %
1TE32-6AA3	132	260	95 %	83 %	74 %	54 %	50 %
1TE33-1AA3	160	310	97 %	88 %	78 %	54 %	50 %
1TE35-0AA3	250	490	94%	78 %	71 %	53 %	50 %
1TE41-4AS3	800	1330	88 %	55 %	--	--	--

Table 7- 19 Derating factor of the output current as a function of the pulse frequency for units with a rated pulse frequency of 1.25 kHz

Article No.	Type rating	Output current at 1.25 kHz	Derating factor at the pulse frequency					
6SL3325-...	[kW]	[A]	2 kHz	2.5 kHz	4 kHz	5 kHz	7.5 kHz	8 kHz
Connection voltage 510 ... 720 V DC (line voltage 3 AC 380 ... 480 V)								
1TE36-1AA3	315	605	83 %	72 %	64 %	60 %	40 %	36 %
1TE37-5AA3	400	745	87 %	79 %	64 %	55 %	40 %	37 %
1TE38-4AA3	450	840	87 %	79 %	64 %	60 %	40 %	37 %
1TE41-0AA3	560	985	92 %	87 %	70 %	60 %	50 %	47 %
1TE41-2AA3	710	1260	97 %	95 %	74 %	60 %	50 %	47 %
1TE41-4AA3	800	1405	97 %	95 %	74 %	60 %	50 %	47 %
Supply voltage 675 ... 1035 V DC (line voltage 3 AC 500 ... 690 V)								
1TG31-0AA3	90	100	92 %	88 %	71 %	60 %	40 %	--
1TG31-5AA3	132	150	90%	84 %	66%	55 %	35 %	--
1TG32-2AA3	200	215	92 %	87 %	70 %	60 %	40 %	--
1TG33-3AA3	315	330	89 %	82 %	65 %	55 %	40 %	--
1TG34-7AA3	450	465	92 %	87 %	67 %	55 %	35 %	--
1TG35-8AA3	560	575	91 %	85 %	64 %	50 %	35 %	--
1TG37-4AA3	710	735	84 %	74 %	53 %	40 %	25 %	--
1TG38-0AA3	800 [1)]	810	83 %	72 %	49%	35 %	25 %	--
1TG38-1AA3	800	810	97 %	95 %	71 %	55 %	35 %	--
1TG41-0AA3	1000	1025	91 %	86 %	64 %	50 %	30 %	--
1TG41-3AA3	1200	1270	87 %	79 %	55 %	40 %	25 %	--
1TG41-6AA3	1500	1560	87 %	79 %	55 %	40 %	25 %	--
1TG41-6AP3	1500	1560	87 %	79 %	55 %	40 %	25 %	--

[1)] Device 6SL3325-1TG38-0AA3 is optimized for a base pulse frequency of 1.25 kHz, for an increased pulse frequency, the derating factor is higher than for the device with article number 6SL3325-1TG38-1AA3.

Note

Derating factors for pulse frequencies in the range between two fixed values

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

The adjustable pulse frequencies - and therefore the output frequencies that can be achieved with the factory-set current controller clock cycles - are listed below.

Table 7- 20 Maximum output frequencies achieved by increasing the pulse frequency

Current controller clock cycle T_I	Adjustable pulse frequencies f_p	Maximum achievable output frequency f_A		
		U/f operating mode	Vector operating mode	Servo mode
250 µs [1]	2 kHz 4 kHz 8 kHz	166 Hz 333 Hz 550 Hz [3]	166 Hz 333 Hz 480 Hz	333 Hz 550 Hz [3] 550 Hz [3]
400 µs [2]	1.25 kHz 2.50 kHz 5.00 kHz 7.50 kHz	104 Hz 208 Hz 416 Hz 550 Hz [3]	104 Hz 208 Hz 300 Hz 300 Hz	- - - -

[1] As factory setting, the following devices have a current controller clock cycle of 250 µs - and a pulse frequency of 2 kHz:
- 510 ... 720 V DC: ≤250 kW / 490 A, 6SL3325-1TE41-4AS3

[2] As factory setting, the following devices have a current controller clock cycle of 400 µs - and a pulse frequency of 1.25 kHz:
- 510 ... 720 V DC: ≥315 kW / 605 A, with the exception of 6SL3325-1TE41-4AS3
- 675 ... 1035 V DC: All power ratings

[3] With the "High output frequencies" license, which can be ordered as option J01 on the CompactFlash card for SINAMICS S120, the maximum output frequency is increased up to 650 Hz.

Refer to the Low Voltage Engineering Manual for current controller clock cycles deviating from the factory setting.

7.6.5 Parallel connection of Motor Modules

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

- Up to four identical Motor Modules (the same Article No.) can be connected in parallel.
- A common Control Unit is required whenever the modules are connected in parallel.
- The motor supply cables must have 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.
- For motors with multi-winding systems, carefully observe the notes provided in the Low Voltage Engineering Manual.
- A derating factor of 5% must be taken into consideration, regardless of the number of Motor Modules connected in parallel.

Note

Different power units cannot be connected in parallel.

It is only possible to connect Motor Module in parallel if all power units have the same hardware version.

It is not possible to connect Motor Modules with Article No. 6SL3325-1Txxx-xAA0 and Article No. 6SL3325-1Txxx-xAA3 in parallel.

It is not possible to connect Motor Modules with Article No. 6SL3325-1TG41-6AA3 and Article No. 6SL3325-1TG41-6AP3 in parallel.

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

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Note

Minimum cable lengths

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 7- 21 Motor Modules, DC 510 ... 720 V (line voltage 3 AC 380 ... 480 V)

Article number	Type rating [kW]	Output current [A]	Minimum cable length [m]
6SL3325-1TE32-1AA3	110	210	30
6SL3325-1TE32-6AA3	132	260	27
6SL3325-1TE33-1AA3	160	310	20
6SL3325-1TE35-0AA3	250	490	15
6SL3325-1TE36-1AA3	315	605	13
6SL3325-1TE37-5AA3	400	745	10
6SL3325-1TE38-4AA3	450	840	9
6SL3325-1TE41-0AA3	560	985	8
6SL3325-1TE41-2AA3	710	1260	8
6SL3325-1TE41-4AA3	800	1405	5
6SL3325-1TE41-4AS3	800	1330	5

Table 7- 22 Motor Modules, DC 675 ... 1035 V (line voltage 3 AC 500 ... 690 V)

Article number	Type rating [kW]	Output current [A]	Minimum cable length [m]
6SL3325-1TG31-0AA3	90	100	90
6SL3325-1TG31-5AA3	132	150	70
6SL3325-1TG32-2AA3	200	215	50
6SL3325-1TG33-3AA3	315	330	30
6SL3325-1TG34-7AA3	450	465	25
6SL3325-1TG35-8AA3	560	575	20
6SL3325-1TG37-4AA3	710	735	18
6SL3325-1TG38-0AA3	800	810	18
6SL3325-1TG38-1AA3	800	810	15
6SL3325-1TG41-0AA3	1000	1025	10
6SL3325-1TG41-3AA3	1200	1270	8
6SL3325-1TG41-6AA3	1500	1560	7
6SL3325-1TG41-6AP3	1500	1560	7

Motor-side power components

8

8.1 Sine-wave filter

8.1.1 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 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. As a consequence, the output current of the Power Module or Motor Module decreases.
When commissioning the drive, sine-wave filters must be activated using parameter p0230 = 3 so that the required parameter changes in conjunction with the sine-wave filter are automatically set (e.g. a pulse frequency of 4 kHz).

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

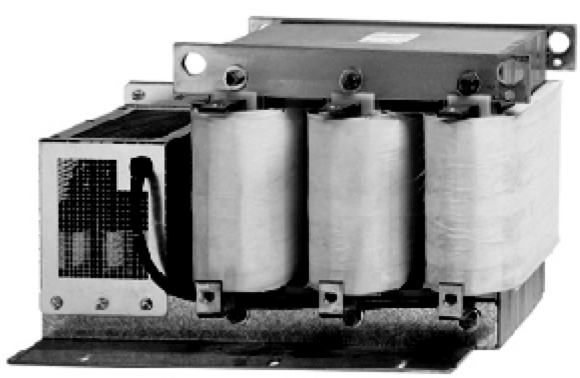


Figure 8-1 Sine-wave filter

8.1.2 Safety information

⚠ WARNING
Not observing fundamental safety instructions and residual risks
Not observing fundamental safety instructions and residual risks listed in Chapter 1 can result in accidents with severe injuries or death. • Comply with the fundamental safety instructions. • When assessing the risk, take into account residual risks.

⚠ WARNING
Fire due to overheating because of inadequate ventilation clearances
Inadequate ventilation clearances can cause overheating with a risk for personnel through smoke development and fire. Furthermore, an increased number of failures and shorter service life of the components can occur. • Maintain 100 mm ventilation clearances above and to the side of the component.

⚠ CAUTION
Risk of burns resulting from high surface temperature of the sine-wave filter
The surface temperature of the sine-wave filters can exceed 80 °C. You can get seriously burnt when touching the surface. • Mount the sine-wave filter so that it cannot be touched. If this is not possible, attach a clearly visible and understandable warning notice at hazardous positions.

NOTICE
Sine-wave filter damage due to interchanged connections
Interchanging the input and output connections will damage the sine-wave filter. • Connect the incoming cable from the Power Modules or Motor Modules to 1U1, 1V1, 1W1. • Connect the outgoing cable to the load at 1U2, 1V2, 1W2.

NOTICE
Damage to the Power Module or Motor Module by using components that have not been released
When using components that have not been released, damage or malfunctions can occur at the devices or the system itself. • Only use sine-wave filters that SIEMENS has released for SINAMICS.

NOTICE

Risk of damaging sine-wave filter by exceeding the maximum output frequency

The maximum permissible output frequency when sine-wave filters are used is 150 Hz. The sine-wave filter can be damaged if the output frequency is exceeded.

- Operate the sine-wave filter with a maximum output frequency of 150 Hz.

NOTICE

Damage to the sine-wave filter if it is not activated during commissioning

The sine-wave filter may be damaged if it is not activated during commissioning.

- Activate the sine-wave filter during commissioning via parameter p0230 = 3.

NOTICE

Damage to the sine-wave filter if a motor is not connected

Sine-wave filters, which are operated without a motor being connected, can be damaged or destroyed.

- Never operate a sine-wave filter on the Power Module or Motor Module without a connected motor.

Note

Cable lengths

Keep the connecting cables to the Power Module or Motor Module as short as possible (max. 5 m).

8.1.3 Dimension drawing

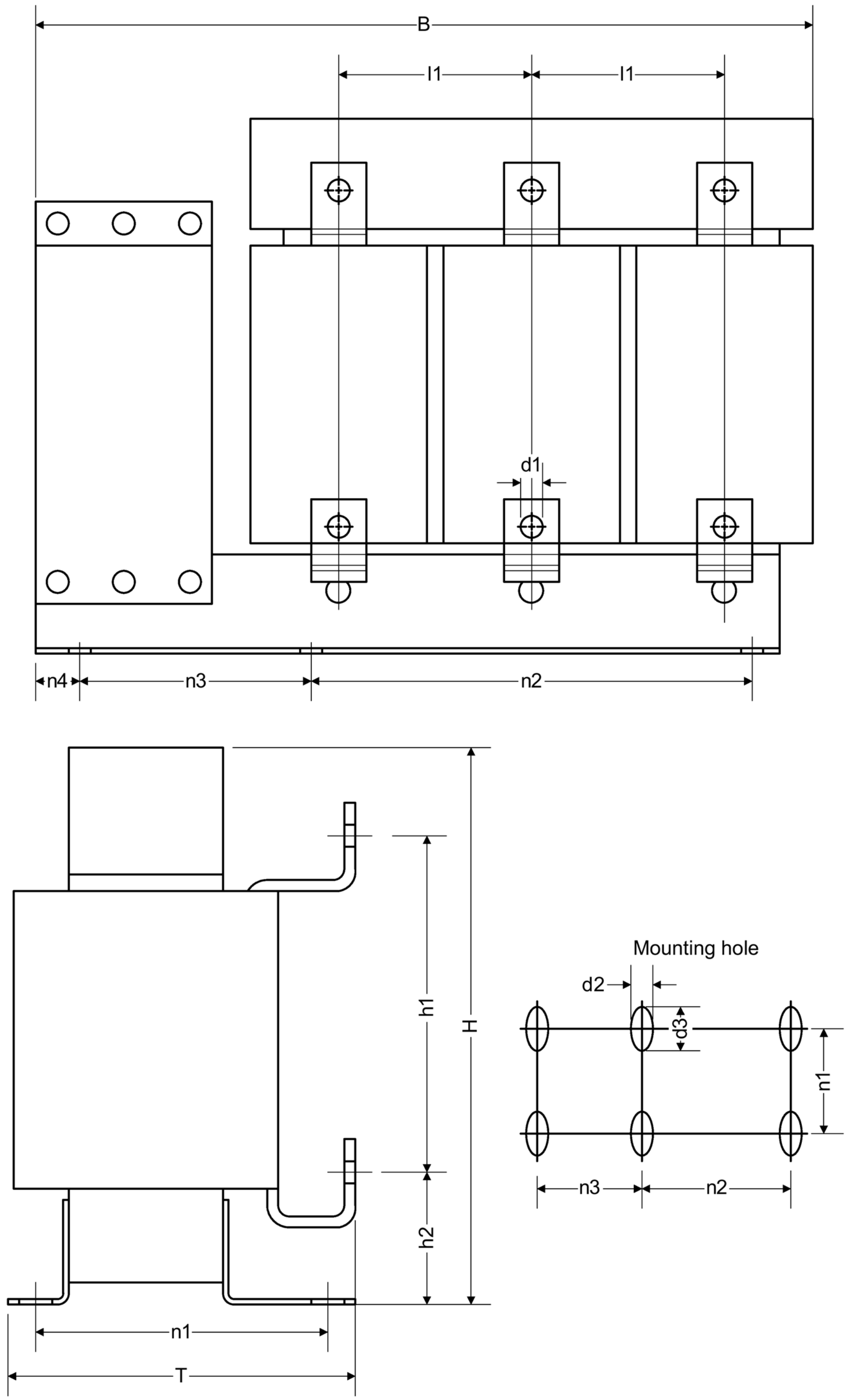


Figure 8-2 Dimension drawing, sine-wave filter

Table 8- 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

8.1.4 Technical data

Table 8- 2 Technical data of sine-wave filters 380 V ... 480 V 3 AC

Article number	6SL3000-	2CE32-3AA0	2CE32-3AA0	2CE32-8AA0	2CE34-1AA0
Suitable for Power Module	6SL3315-	1TE32-1AA3	1TE32-6AA3	1TE33-1AA3	1TE35-0AA3
Suitable for Motor Module	6SL3325-	1TE32-1AA3	1TE32-6AA3	1TE33-1AA3	1TE35-0AA3
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

8.2 Motor reactors

8.2.1 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.

Table 8- 3 Max. pulse frequency when using a motor reactor for Power Modules and/or Motor Modules with a rated pulse frequency of 2 kHz

Article No. of the Power Module or Motor Module	Type rating [kW]	Output current for a pulse frequency of 2 kHz [A]	Maximum pulse frequency when using a motor reactor
Line voltage 3 AC 380 ... 480 V			
6SL3315-1TE32-1AA3 6SL3325-1TE32-1AA3	110	210	4 kHz
6SL3315-1TE32-6AA3 6SL3325-1TE32-6AA3	132	260	4 kHz
6SL3315-1TE33-1AA3 6SL3325-1TE33-1AA3	160	310	4 kHz
6SL3315-1TE35-0AA3 6SL3325-1TE35-0AA3	250	490	4 kHz
6SL3325-1TE41-4AS3	800	1330	4 kHz

Table 8- 4 Max. pulse frequency when using a motor reactor for Power Modules and/or Motor Modules with a rated pulse frequency of 1.25 kHz

Article No. of the Power Module or Motor Module	Type rating [kW]	Output current for a pulse frequency of 1.25 kHz [A]	Maximum pulse frequency when using a motor reactor
Line voltage 3 AC 380 ... 480 V			
6SL3325-1TE36-1AA3	315	605	2.5 kHz
6SL3325-1TE38-4AA3	450	840	2.5 kHz
6SL3325-1TE41-0AA3	560	985	2.5 kHz
6SL3325-1TE41-2AA3	710	1260	2.5 kHz
6SL3325-1TE41-4AA3	800	1405	2.5 kHz

Article No. of the Power Module or Motor Module	Type rating [kW]	Output current for a pulse frequency of 1.25 kHz [A]	Maximum pulse frequency when using a motor reactor
Line voltage 3 AC 500 ... 690 V			
6SL3325-1TG31-0AA3	90	100	2.5 kHz
6SL3325-1TG31-5AA3	132	150	2.5 kHz
6SL3325-1TG32-2AA3	200	215	2.5 kHz
6SL3325-1TG33-3AA3	315	330	2.5 kHz
6SL3325-1TG34-7AA3	450	465	2.5 kHz
6SL3325-1TG35-8AA3	560	575	2.5 kHz
6SL3325-1TG37-4AA3	710	735	2.5 kHz
6SL3325-1TG38-0AA3	800	810	2.5 kHz
6SL3325-1TG38-1AA3	800	810	2.5 kHz
6SL3325-1TG41-0AA3	1000	1025	2.5 kHz
6SL3325-1TG41-3AA3	1200	1270	2.5 kHz

8.2.2 Safety information

⚠WARNING

Not observing fundamental safety instructions and residual risks

Not observing fundamental safety instructions and residual risks listed in Chapter 1 can result in accidents with severe injuries or death.

- Comply with the fundamental safety instructions.
- When assessing the risk, take into account residual risks.

⚠WARNING

Fire through overheating due to insufficient ventilation clearances

Inadequate ventilation clearances can cause overheating with a risk for personnel through smoke development and fire. Furthermore, an increased number of failures and shorter service life of the components can occur.

- Maintain 100 mm ventilation clearances above and to the side of the component.

⚠CAUTION

Risk of burns resulting from high surface temperature of the motor reactor

The surface temperature of the motor reactors can exceed 80 °C. You can get seriously burnt when touching the surface.

- Mount the motor reactor so that it cannot be touched. If this is not possible, attach a clearly visible and understandable warning notice at hazardous positions.

NOTICE

Damage to the Power Module or Motor Module by using components that have not been released

When using components that have not been released, damage or malfunctions can occur at the devices or the system itself.

- Only use motor reactors that SIEMENS has released for SINAMICS.

NOTICE

Risk of damaging the motor reactor by exceeding the maximum output frequency

The maximum permissible output frequency when a motor reactor is used is 150 Hz. The motor reactor can be damaged if the output frequency is exceeded.

- Operate the motor reactor with a maximum output frequency of 150 Hz.

NOTICE

Damage to the motor reactor if the maximum pulse frequency is exceeded

The maximum permissible pulse frequency when a motor reactor is used is 2.5 kHz or 4 kHz. The motor reactor can be damaged if the pulse frequency is exceeded.

- When using the motor reactor, operate the Power Module or Motor Module with a maximum pulse frequency of 2.5 kHz or 4 kHz.

NOTICE

Damage to the motor reactor if it is not activated during commissioning

The motor reactor may be damaged if it is not activated during commissioning.

- Activate the motor reactor during commissioning via parameter p0230 = 1.

Note

Cable lengths

Keep the connecting cables to the Power Module or Motor Module as short as possible (max. 5 m).

8.2.3 Dimension drawing

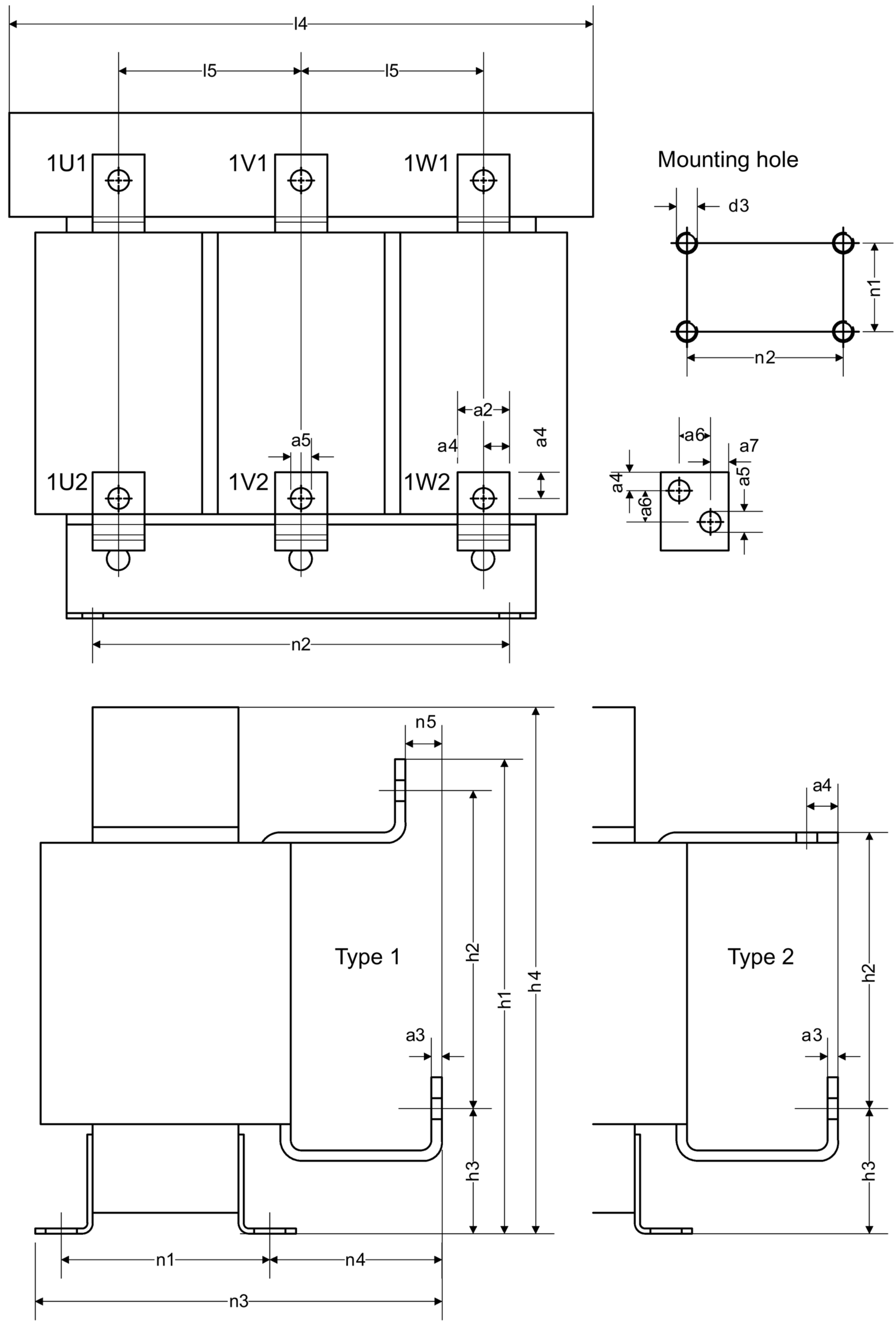


Figure 8-3 Dimension drawing, motor reactor

Table 8- 5 Dimensions of motor reactors, 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 2
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 8- 6 Dimensions of motor reactors, 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 8- 7 Dimensions of motor reactors, 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
n5	-	-	-	-
d3	M8	M8	M8	M8

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

Table 8- 8 Dimensions of motor reactors, 3 AC 500 V ... 690 V, Part 2 (all specifications in mm)

6SL3000-	2AH34-7AA0	2AH35-8AA0	2AH38-1AA0	2AH41-1AA0	2AH41-3AA0
Connection type	Type 1	Type 1	Type 1	Type 1	Type 1
a2	40	40	40	50	60
a3	8	8	8	8	12
a4	20	20	20	14	17
a5	14	14	14	14	14
a6	-	-	-	22	22
a7	-	-	-	-	19
l4	410	410	410	410	460
l5	140	140	140	140	160
h1	392	392	392	392	392
h2	252	252	252	258	255
h3	120	120	120	120	120
h4	385	385	385	385	385
n1 [1)]	141	141	183	206	182
n2 [1)]	316	316	316	316	356
n3	292	292	279	317	296
n4	134.5	134.5	79.5	94.5	94.5
n5	30	30	-	-	-
d3	M10	M10	M10	M10	M10

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

8.2.4 Technical data

Table 8- 9 Technical data of motor reactors 3 AC 380 ... 480 V, Part 1

Article number	**6SL3000-**	**2BE32-1AA0**	**2BE32-6AA0**	**2BE33-2AA0**	**2BE35-0AA0**
Suitable for Power Module	6SL3315-	1TE32-1AA3	1TE32-6AA3	1TE33-1AA3	1TE35-0AA3
Suitable for Motor Module	6SL3325-	1TE32-1AA3	1TE32-6AA3	1TE33-1AA3	1TE35-0AA3
Type 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 (1U1, 1V1, 1W1) - Load (1U2, 1V2, 1W2) - PE		 M10 M10 M8	 M10 M10 M8	 M10 M10 M8	 M12 M12 M8
Max. permissible cable length between the motor reactor and motor - without motor reactor - for 1 motor reactor - for 2 motor reactors in series	 m m m	 300 (shielded) / 450 (unshielded) 300 (shielded) / 450 (unshielded) 525 (shielded) / 787 (unshielded)			
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 8- 10 Technical data of motor reactors 3 AC 380 ... 480 V, Part 2

Article number	**6SL3000-**	**2AE36-1AA0**	**2AE38-4AA0**	**2AE41-0AA0**	**2AE41-4AA0**
Suitable for Motor Module	6SL3325-	1TE36-1AA3	1TE37-5AA3 1TE38-4AA3	1TE41-0AA3	1TE41-2AA3 1TE41-4AA3 1TE41-4AS3
Type rating of the Motor Module	kW	315	400 / 450	560	710 / 800 / 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 (1U1, 1V1, 1W1) - Load (1U2, 1V2, 1W2) - PE		 M12 M12 M10	 M12 M12 M10	 M12 M12 M10	 2 x M12 2 x M12 M10
Max. permissible cable length between the motor reactor and motor - without motor reactor - for 1 motor reactor - for 2 motor reactors in series	 m m m	 300 (shielded) / 450 (unshielded) 300 (shielded) / 450 (unshielded) 525 (shielded) / 787 (unshielded)			
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 8- 11 Technical data of motor reactors 3 AC 500 ... 690 V, Part 1

Article number	**6SL3000-**	**2AH31-0AA0**	**2AH31-5AA0**	**2AH32-4AA0**	**2AH33-6AA0**
Suitable for Motor Module	6SL3325-	1TG31-0AA3	1TG31-5AA3	1TG32-2AA3	1TG33-3AA3
Type 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 (1U1, 1V1, 1W1) - Load (1U2, 1V2, 1W2) - PE		 M10 M10 M6	 M10 M10 M6	 M10 M10 M6	 M10 M10 M6
Max. permissible cable length between the motor reactor and motor - without motor reactor - for 1 motor reactor - for 2 motor reactors in series	 m m m	 300 (shielded) / 450 (unshielded) 300 (shielded) / 450 (unshielded) 525 (shielded) / 787 (unshielded)			
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 8- 12 Technical data of motor reactors 3 AC 500 ... 690 V, Part 2

Article number	**6SL3000-**	**2AH34-7AA0**	**2AH35-8AA0**	**2AH38-1AA0**	**2AH41-1AA0**
Suitable for Motor Module	6SL3325-	1TG34-7AA3	1TG35-8AA3	1TG37-4AA3 1TG38-0AA3 1TG38-1AA3	1TG41-0AA3
Type rating of Power Module or Motor Module	kW	450	560	710 800 800	1000
Rated current	A	465	575	810	1025
Power loss - At 50 Hz - At 150 Hz	 kW kW	 0.631 0.723	 0.705 0.801	 0.877 1.003	 0.927 1.052
Connections - To the Power Module or Motor Module (1U1, 1V1, 1W1) - Load (1U2, 1V2, 1W2) - PE		 M12 M12 M8	 M12 M12 M8	 M12 M12 M8	 M12 M12 M8
Max. permissible cable length between the motor reactor and motor - without motor reactor - for 1 motor reactor - for 2 motor reactors in series	 m m m	 300 (shielded) / 450 (unshielded) 300 (shielded) / 450 (unshielded) 525 (shielded) / 787 (unshielded)			
Degree of protection		IP00	IP00	IP00	IP00
Dimensions Width Height Depth	 mm mm mm	 410 392 292	 410 392 292	 410 392 279	 410 392 317
Weight, approx.	kg	80	80	146	163

Table 8- 13 Technical data of motor reactors, 3 AC 500 ... 690 V, Part 3

Article No.	**6SL3000-**	**2AH41-3AA0**			
Suitable for Motor Module	6SL3325-	1TG41-3AA3			
Type rating of the Motor Module	kW	1200			
Rated current	A	1270			
Power loss - At 50 Hz - At 150 Hz	 kW kW	 0.862 0.952			
Connections - To the Motor Module (1U1, 1V1, 1W1) - Load (1U2, 1V2, 1W2) - PE		 M12 M12 M8			
Max. permissible cable length between the motor reactor and motor - without motor reactor - for 1 motor reactor - for 2 motor reactors in series	 m m m	 300 (shielded) / 450 (unshielded) 300 (shielded) / 450 (unshielded) 525 (shielded) / 787 (unshielded)			
Degree of protection		IP00			
Dimensions Width Height Depth	 mm mm mm	 460 392 296			
Weight, approx.	kg	153			

8.3 dv/dt filter plus Voltage Peak Limiter

8.3.1 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.

The dv/dt filter plus Voltage Peak Limiter limit the rate of voltage rise dv/dt to values < 500 V/µs and the typical voltage peaks $\hat{U}_{LL}$ for rated line voltages to the following values (for motor cable lengths of ≤ 150 m):

< 1000 V at U_{line} < 575 V

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

Components

The article numbers of the individual components (dv/dt reactor and Voltage Peak Limiter) are listed in the following table:

Table 8- 14 dv/dt filter plus Voltage Peak Limiter, article numbers of the individual components

dv/dt filter plus voltage peak limiter	dv/dt reactor	Voltage peak limiter
Line voltage 3 AC 380 ... 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 3 AC 500 ... 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

Table 8- 15 Max. pulse frequency when a dv/dt filter is used with Power Modules and/or Motor Modules with a rated pulse frequency of 2 kHz

Article No. of the Power Module or Motor Module	Type rating [kW]	Output current for a pulse frequency of 2 kHz [A]	Max. pulse frequency when a dv/dt filter is used
Line voltage 3 AC 380 ... 480 V			
6SL3315-1TE32-1AA3 6SL3325-1TE32-1AA3	110	210	4 kHz
6SL3315-1TE32-6AA3 6SL3325-1TE32-6AA3	132	260	4 kHz
6SL3315-1TE33-1AA3 6SL3325-1TE33-1AA3	160	310	4 kHz
6SL3315-1TE35-0AA3 6SL3325-1TE35-0AA3	250	490	4 kHz
6SL3325-1TE41-4AS3	800	1330	4 kHz

Table 8- 16 Max. pulse frequency when a dv/dt filter is used with Power Modules and/or Motor Modules with a rated pulse frequency of 1.25 kHz

Article No. of the Power Module or Motor Module	Type rating [kW]	Output current for a pulse frequency of 1.25 kHz [A]	Max. pulse frequency when a dv/dt filter is used
Line voltage 3 AC 380 ... 480 V			
6SL3325-1TE36-1AA3	315	605	2.5 kHz
6SL3325-1TE38-4AA3	450	840	2.5 kHz
6SL3325-1TE41-0AA3	560	985	2.5 kHz
6SL3325-1TE41-2AA3	710	1260	2.5 kHz
6SL3325-1TE41-4AA3	800	1405	2.5 kHz
Line voltage 3 AC 500 ... 690 V			
6SL3325-1TG31-0AA3	90	100	2.5 kHz
6SL3325-1TG31-5AA3	132	150	2.5 kHz
6SL3325-1TG32-2AA3	200	215	2.5 kHz
6SL3325-1TG33-3AA3	315	330	2.5 kHz
6SL3325-1TG34-7AA3	450	465	2.5 kHz
6SL3325-1TG35-8AA3	560	575	2.5 kHz
6SL3325-1TG37-4AA3	710	735	2.5 kHz
6SL3325-1TG38-0AA3	800	810	2.5 kHz
6SL3325-1TG38-1AA3	800	810	2.5 kHz
6SL3325-1TG41-0AA3	1000	1025	2.5 kHz
6SL3325-1TG41-3AA3	1200	1270	2.5 kHz

8.3.2 Safety information

⚠WARNING

Not observing fundamental safety instructions and residual risks

Not observing fundamental safety instructions and residual risks listed in Chapter 1 can result in accidents with severe injuries or death.

- Comply with the fundamental safety instructions.
- When assessing the risk, take into account residual risks.

⚠WARNING

Fire through overheating due to insufficient ventilation clearances

Inadequate ventilation clearances can cause overheating with a risk for personnel through smoke development and fire. Furthermore, an increased number of failures and shorter service life of the components can occur.

- Maintain 100 mm clearances above and below the components.

⚠CAUTION

Risk of burns due to high surface temperature of the dv/dt reactor

The surface temperature of the du/dt reactors may exceed 80 °C. You can get seriously burnt when touching the surface.

- Mount the dv/dt reactor so that it cannot be touched. If this is not possible, attach a clearly visible and understandable warning notice at hazardous positions.

NOTICE

Damage to the voltage peak limiter due to interchanged connections

The voltage peak limiter will be damaged if the input and output connections are interchanged.

- Connect the incoming cable from the DC link of the Power Module or Motor Module to DCP, DCN.
- Connect the outgoing cable to the dv/dt reactor to 1U2, 1V2, 1W2.

NOTICE

Damage to the dv/dt filter by using components that have not been released

When using components that have not been released, damage or malfunctions can occur at the devices or the system itself.

- Only use dv/dt filters that SIEMENS has approved for operation with SINAMICS.

NOTICE

Damage to the dv/dt filter by exceeding the maximum output frequency

The maximum permissible output frequency when using a du/dt filter is 150 Hz. The dv/dt filter can be damaged if the output frequency is exceeded.

- Operate the du/dt filter with a maximum output frequency of 150 Hz.

NOTICE

Damage to the dv/dt filter by exceeding the maximum pulse frequency

The maximum permissible pulse frequency when using a du/dt filter is 2.5 kHz or 4 kHz. The dv/dt filter can be damaged if the pulse frequency is exceeded.

- When using the du/dt filter, operate the Power Module or Motor Module with a maximum pulse frequency of 2.5 kHz or 4 kHz.

NOTICE

Damage to the dv/dt filter if it is not activated during commissioning

The dv/dt filter may be damaged if it is not activated during commissioning.

- Activate the du/dt filter during commissioning via parameter p0230 = 2.

NOTICE

Damage to the dv/dt filter if a motor is not connected

dv/dt filters which are operated without a motor being connected can be damaged or destroyed.

- Never operate a dv/dt filter on the Power Module or Motor Module without a connected motor.

Note

Cable lengths

Keep the connecting cables to the Power Module or Motor Module as short as possible (max. 5 m).

8.3.3 Interface description

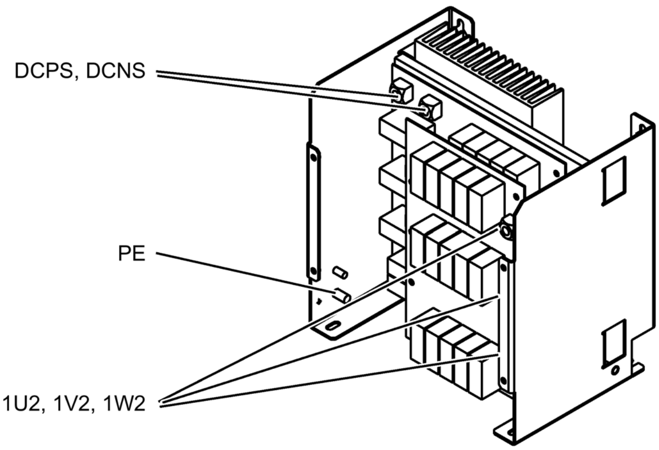


Figure 8-4 Interface overview, voltage peak limiter, type 1

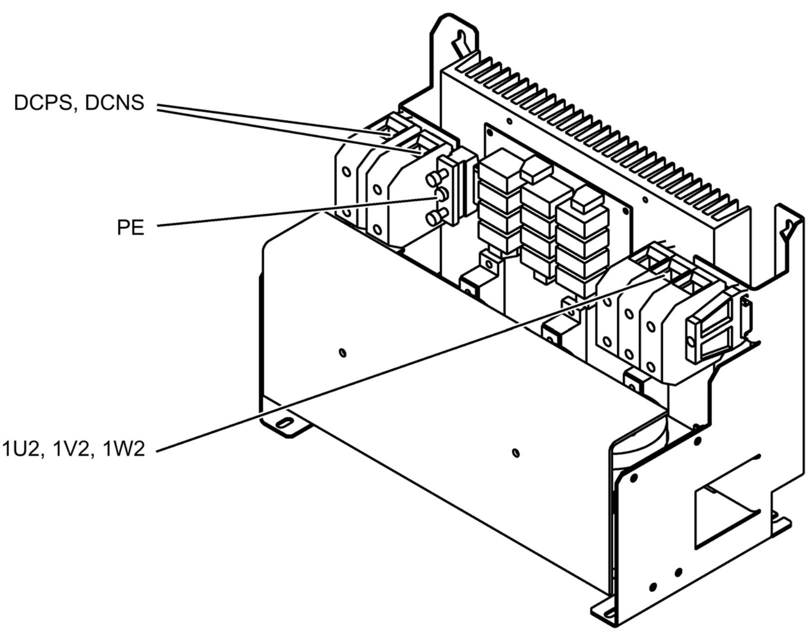


Figure 8-5 Interface overview, voltage peak limiter, type 2

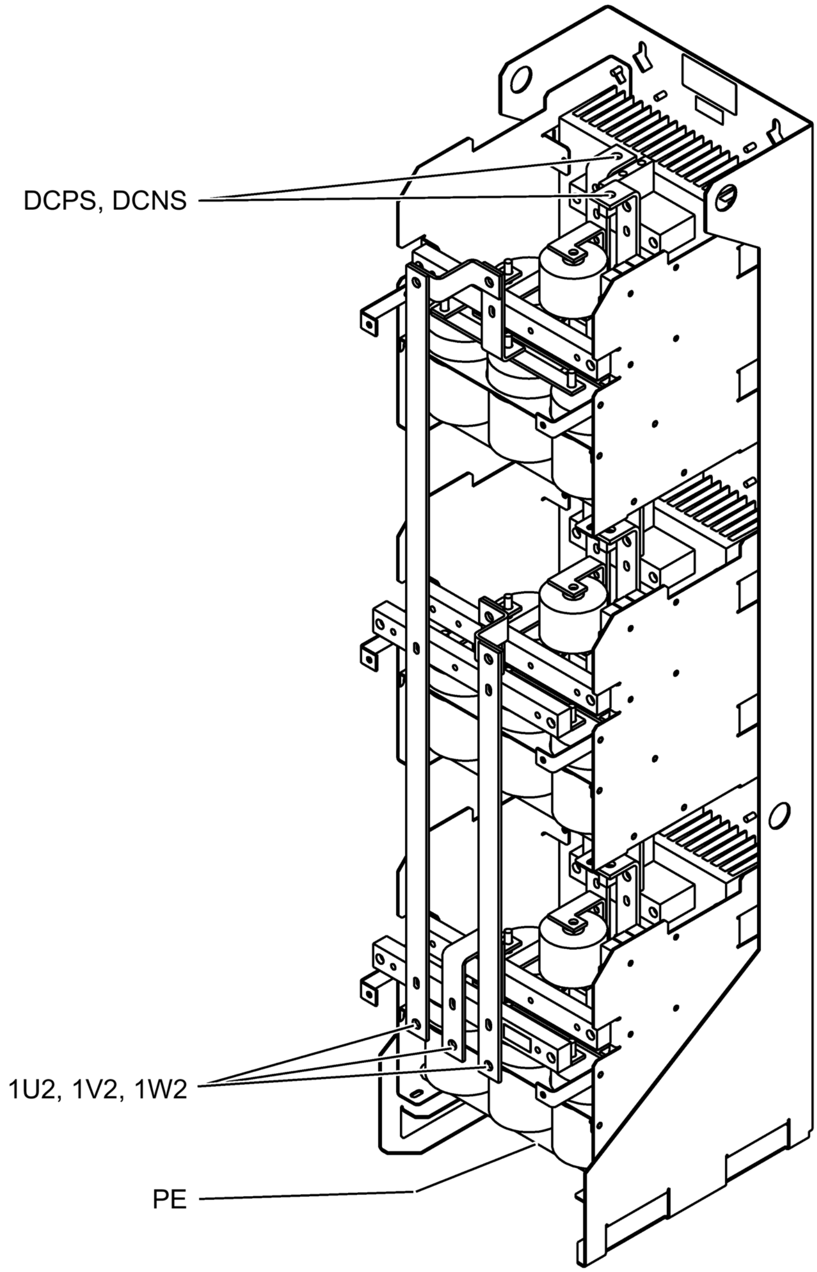


Figure 8-6 Interface overview, voltage peak limiter, type 3

8.3.4 Connecting the dv/dt filter plus Voltage Peak Limiter

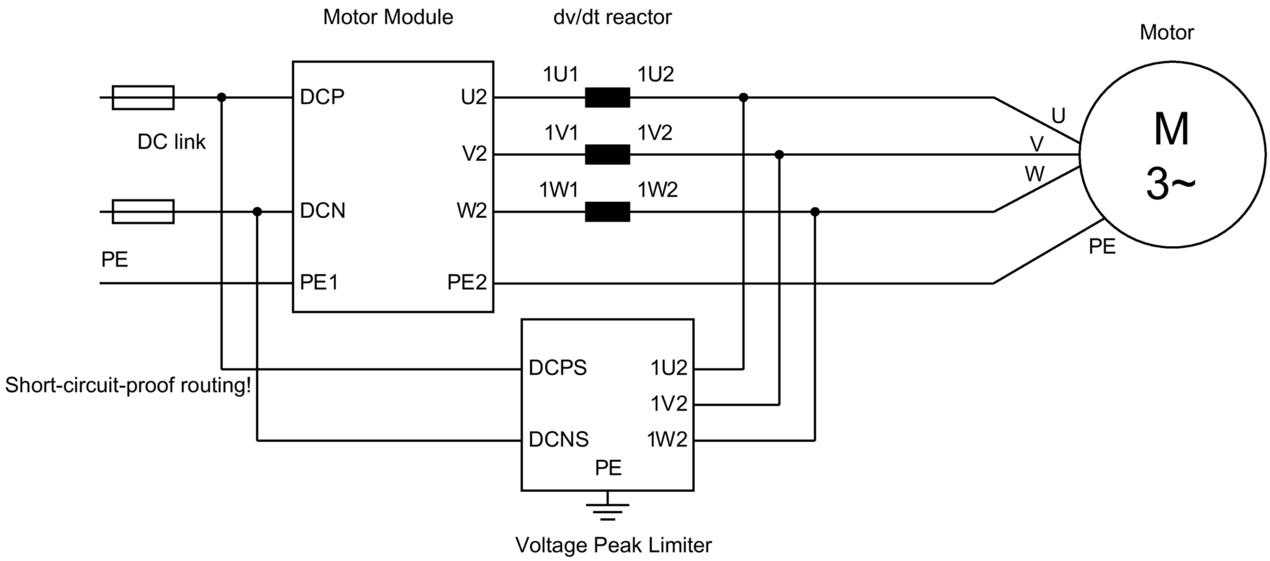


Figure 8-7 Connecting a dv/dt filter plus voltage peak limiter for versions with one dv/dt reactor

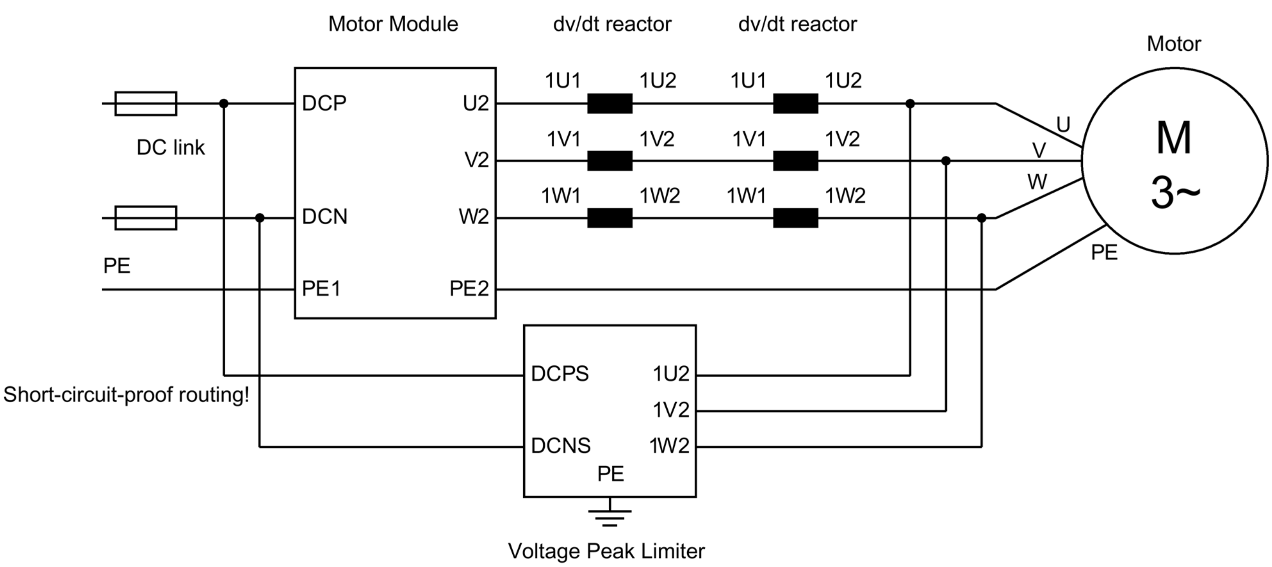


Figure 8-8 Connecting a dv/dt filter plus voltage peak limiter for versions with two dv/dt reactors

Cable cross-sections

Table 8- 17 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 limiting network (1U2, 1V2, 1W2) [mm²]
Line voltage 3 AC 380 ... 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 3 AC 500 ... 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

⚠ WARNING

Fire and device damage as a result of ground fault/short-circuit

Inadequate installation of the cables to the Power Module or Motor Module DC link can result in a ground fault / short-circuit and place persons at risk as a result of the associated smoke and fire.

- Comply with local installation regulations that enable this fault to be ruled out.
- Protect the cables from mechanical damage.
- In addition, apply one of the following measures:
  - Use cables with double insulation.
  - Maintain adequate clearance, e.g. by using spacers.
  - Route the cables in separate cable ducts or pipes.

Note

Maximum cable lengths

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

8.3.5 Dimension drawing, dv/dt reactor

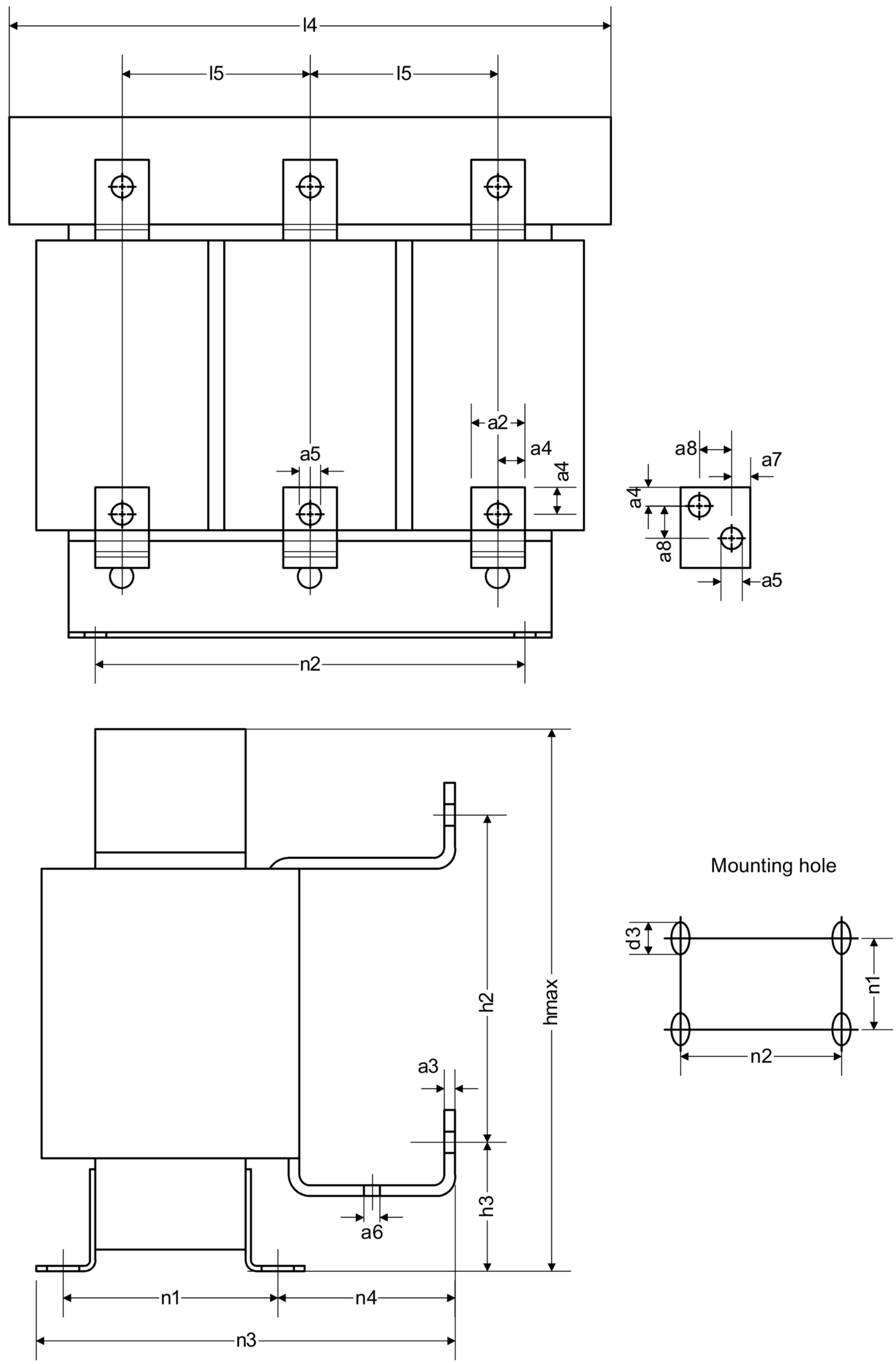


Figure 8-9 Dimension drawing, dV/dt reactor

Table 8- 18 Dimensions of dV/dt reactor, 380 V ... 480 V 3 AC (all dimensions 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 8- 19 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 8- 20 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

8.3.6 Dimension drawing of the voltage peak limiter

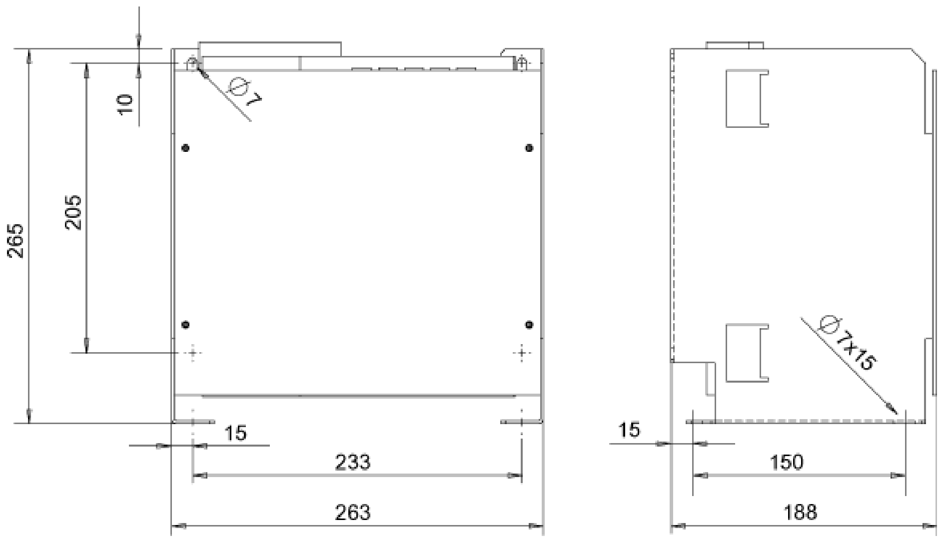


Figure 8-10 Dimension drawing of the voltage peak limiter, type 1

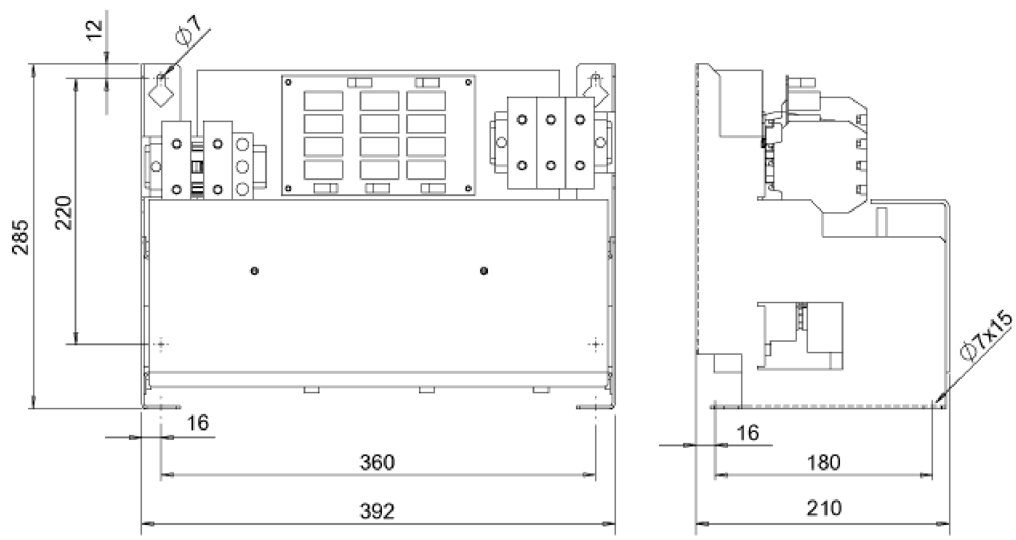


Figure 8-11 Dimension drawing of the voltage peak limiter, type 2

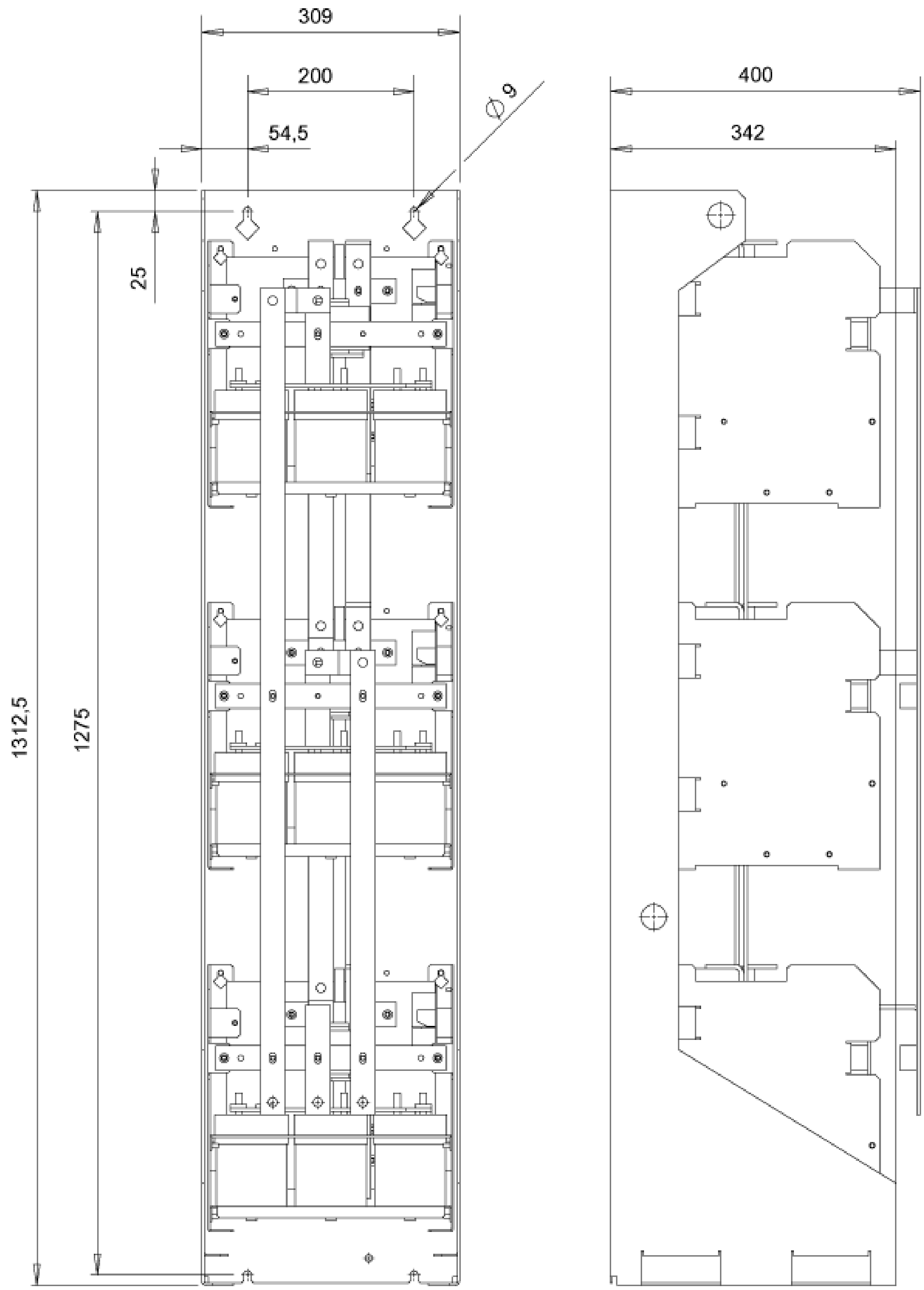


Figure 8-12 Dimension drawing of the voltage peak limiter, type 3

Table 8- 21 Assigning voltage peak limiter to dimension drawings

Voltage peak limiter	Dimension drawing type
Line voltage 3 AC 380 ... 480 V	
6SL3000-2DE32-6BA0	Type 1
6SL3000-2DE35-0BA0	Type 2
6SL3000-2DE38-4BA0	Type 3
6SL3000-2DE41-4BA0	Type 3
Line voltage 3 AC 500 ... 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

8.3.7 Technical data

Table 8- 22 Technical data of the dv/dt filter plus voltage peak limiter, 3 AC 380 ... 480 V

Article number	6SL3000-	2DE32-6AA0	2DE35-0AA0	2DE38-4AA0	2DE41-4AA0 [1]
Suitable for Power Module	6SL3315-	1TE32-1AA3 1TE32-6AA3	1TE33-1AA3 1TE35-0AA3	--	--
Suitable for Motor Module	6SL3325-	1TE32-1AA3 1TE32-6AA3	1TE33-1AA3 1TE35-0AA3	1TE36-1AA3 1TE37-5AA3 1TE38-4AA3	1TE41-0AA3 1TE41-2AA3 1TE41-4AA3 1TE41-4AS3
Type rating of Power Module or Motor Module	kW	110 / 132	160 / 250	315 / 400 / 450	560 / 710 / 800 / 800
I_{thmax}	A	260	490	840	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	 0.701 0.729 0.78	 0.874 0.904 0.963	 1.106 1.115 1.226	 1.111 1.154 1.23
Connections - To the Power Module or Motor Module - Load - PE		M10 M10 M6	M12 M12 M6	M12 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	 410 370 229	 460 370 275	 460 385 312	 445 385 312
Weight, approx.	kg	66	122	149	158
Voltage peak limiter					
Power loss - at 50 Hz - at 60 Hz - at 150 Hz	 kW kW kW	 0.029 0.027 0.025	 0.042 0.039 0.036	 0.077 0.072 0.066	 0.134 0.125 0.114
Connections - To the dv/dt reactor - DC - PE		 M8 M8 M8	 Terminal 70 mm² Terminal 70 mm² Terminal 35 mm²	 M8 M8 M8	 M10 M10 M8
Dimensions Width Height Depth	 mm mm mm	 263 265 188	 392 285 210	 309 1312.5 400	 309 1312.5 400
Weight, approx.	kg	6	16	48	72

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

Note

Cable lengths for versions with two dv/dt reactors

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

Table 8- 23 Technical data of the dv/dt filter plus voltage peak limiter, 3 AC 500 ... 690 V, Part 1

Article number	**6SL3000-**	**2DH31-0AA0**	**2DH31-5AA0**	**2DH32-2AA0**	**2DH33-3AA0**
Suitable for Motor Module	6SL3325-	1TG31-0AA3	1TG31-5AA3	1TG32-2AA3	1TG33-3AA3
Type 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 8- 24 Technical data of the dv/dt filter plus voltage peak limiter, 3 AC 500 ... 690 V, Part 2

Article number	**6SL3000-**	**2DH35-8AA0**	**2DH38-1AA0 [1)]**	**2DH41-3AA0 [1)]**	
Suitable for Motor Module	6SL3325-	1TG34-7AA3 1TG35-8AA3	1TG37-4AA3 1TG38-0AA3 1TG38-1AA3	1TG41-0AA3 1TG41-3AA3	
Type rating of Power Module or Motor Module	kW	450 / 560	710 / 800 / 800	1000 / 1200	
I_{thmax}	A	575	810	1270	
Degree of protection		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	
Connections - To the Power Module or Motor Module - Load - PE		 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	 445 385 312	 445 385 312	
Weight, approx.	kg	172	160	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	
Connections - To the dv/dt reactor - DC - PE		 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	
Weight, approx.	kg	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

Cable lengths for versions with two dv/dt reactors

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

8.4 dv/dt filter compact plus Voltage Peak Limiter

8.4.1 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.

dv/dt filters compact plus Voltage Peak Limiters limit the voltage rate of rise dv/dt to values < 1600 V/μs - and the typical voltage peaks to the following values according to limit value curve A according to IEC 60034-25:2007:

- < 1150 V at U_{line} < 575 V
- < 1400 V at 660 V < U_{line} < 690 V.

Note

Setting range for pulse frequencies

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

Current derating at increased pulse frequency

Current derating at an increased pulse frequency depends on the derating of the associated Power Module or Motor Module.

Note

Components of the dv/dt filter

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 8- 25 Max. pulse frequency when a dv/dt filter compact plus voltage peak limiter is used in Power Modules or Motor Modules with a rated pulse frequency of 2 kHz

Article No. of the Power Module or Motor Module	Type 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
Line voltage 3 AC 380 ... 480 V			
6SL3315-1TE32-1AA3 6SL3325-1TE32-1AA3	110	210	4 kHz
6SL3315-1TE32-6AA3 6SL3325-1TE32-6AA3	132	260	4 kHz
6SL3315-1TE33-1AA3 6SL3325-1TE33-1AA3	160	310	4 kHz
6SL3315-1TE35-0AA3 6SL3325-1TE35-0AA3	250	490	4 kHz
6SL3325-1TE41-4AS3	800	1330	4 kHz

Table 8- 26 Max. pulse frequency when a dv/dt filter compact plus voltage peak limiter is used in Power Modules or Motor Modules with a rated pulse frequency of 1.25 kHz

Article No. of the Power Module or Motor Module	Type 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
Line voltage 3 AC 380 ... 480 V			
6SL3325-1TE36-1AA3	315	605	2.5 kHz
6SL3325-1TE38-4AA3	450	840	2.5 kHz
6SL3325-1TE41-0AA3	560	985	2.5 kHz
6SL3325-1TE41-2AA3	710	1260	2.5 kHz
6SL3325-1TE41-4AA3	800	1405	2.5 kHz
Line voltage 3 AC 500 ... 690 V			
6SL3325-1TG31-0AA3	90	100	2.5 kHz
6SL3325-1TG31-5AA3	132	150	2.5 kHz
6SL3325-1TG32-2AA3	200	215	2.5 kHz
6SL3325-1TG33-3AA3	315	330	2.5 kHz
6SL3325-1TG34-7AA3	450	465	2.5 kHz
6SL3325-1TG35-8AA3	560	575	2.5 kHz
6SL3325-1TG37-4AA3	710	735	2.5 kHz
6SL3325-1TG38-0AA3	800	810	2.5 kHz
6SL3325-1TG38-1AA3	800	810	2.5 kHz
6SL3325-1TG41-0AA3	1000	1025	2.5 kHz
6SL3325-1TG41-3AA3	1200	1270	2.5 kHz

8.4.2 Safety information

WARNING

Not observing fundamental safety instructions and residual risks

Not observing fundamental safety instructions and residual risks listed in Chapter 1 can result in accidents with severe injuries or death.

- Comply with the fundamental safety instructions.
- When assessing the risk, take into account residual risks.

WARNING

Fire through overheating due to insufficient ventilation clearances

Inadequate ventilation clearances can cause overheating with a risk for personnel through smoke development and fire. Furthermore, an increased number of failures and shorter service life of the components can occur.

- Maintain 100 mm clearances above and below the components.
- Always mount the dv/dt filters compact plus voltage peak limiter in a vertical, upright position, to enable cooling air to flow through the heat sink on the voltage peak limiter from the bottom to the top.

CAUTION

Risk of burns due to high surface temperature of the dv/dt filter compact

The surface temperature of the du/dt filters compact may exceed 80 °C. You can get seriously burnt when touching the surface.

- Mount the dv/dt filters compact so that they cannot be touched. If this is not possible, attach a clearly visible and understandable warning notice at hazardous positions.

NOTICE

Damage to the voltage peak limiter due to interchanged connections

The Voltage Peak Limiter will be damaged if the input and output connections are interchanged on devices with the article numbers 6SL3000-2DE41-4EA0, 6SL3000-2DG38-1EA0, and 6SL3000-2DG41-3EA0.

- Connect the incoming cable from the DC link of the Motor Module to DCP, DCN.
- Connect the outgoing cable to the dv/dt reactor to 1U2, 1V2, 1W2.

NOTICE

Damage to the dv/dt filter compact by using components that have not been released

When using components that have not been released, damage or malfunctions can occur at the devices or the system itself.

- Only use a dv/dt filter compact that SIEMENS has approved for operation with SINAMICS.

NOTICE
Damage to the dv/dt filter by exceeding the maximum output frequency The maximum permissible output frequency when a dv/dt filter compact is used is 150 Hz. The dv/dt filter compact can be damaged if the output frequency is exceeded. • Operate the du/dt filter compact with a maximum output frequency of 150 Hz.

NOTICE
Damage to the dv/dt filter compact during continuous operation with low output frequencies Uninterrupted duty at an output frequency less than 10 Hz can result in thermal overload and destroy the du/dt filter. • When using a du/dt filter compact plus voltage peak limiter do not operate the drive continuously with an output frequency less than 10 Hz. • You may operate the drive for a maximum load duration of 5 minutes at an output frequency less than 10 Hz, provided that you then select operation with an output frequency higher than 10 Hz for a period of 5 minutes.

NOTICE
Damage to the dv/dt filter compact by exceeding the maximum pulse frequency The maximum permissible pulse frequency when a dv/dt filter compact is used is 2.5 kHz or 4 kHz. The dv/dt filter compact can be damaged if the pulse frequency is exceeded. • When using the dv/dt filter compact, operate the Power Module or Motor Module with a maximum pulse frequency of 2.5 kHz or 4 kHz.

NOTICE
Damage to the dv/dt filter compact if it is not activated during commissioning The dv/dt filter compact may be damaged if it is not activated during commissioning. • Activate the du/dt filter compact during commissioning using parameter p0230 = 2.

NOTICE
Damage to the dv/dt filter compact if a motor is not connected dv/dt filters compact which are operated without a motor being connected can be damaged or destroyed. • Never operate a dv/dt filter compact on the Power Module or Motor Module without a connected motor.

Note

Cable lengths

Keep the connecting cables to the Power Module or Motor Module as short as possible (max. 5 m). Use an equivalent cable type when replacing the cables supplied.

8.4.3 Interface description

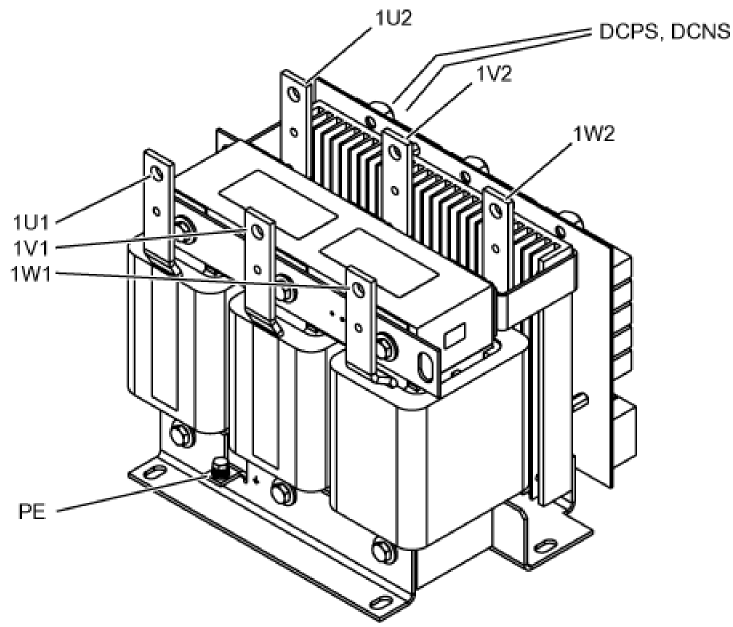


Figure 8-13 Interface overview for dv/dt filter compact plus Voltage Peak Limiter, Type 1

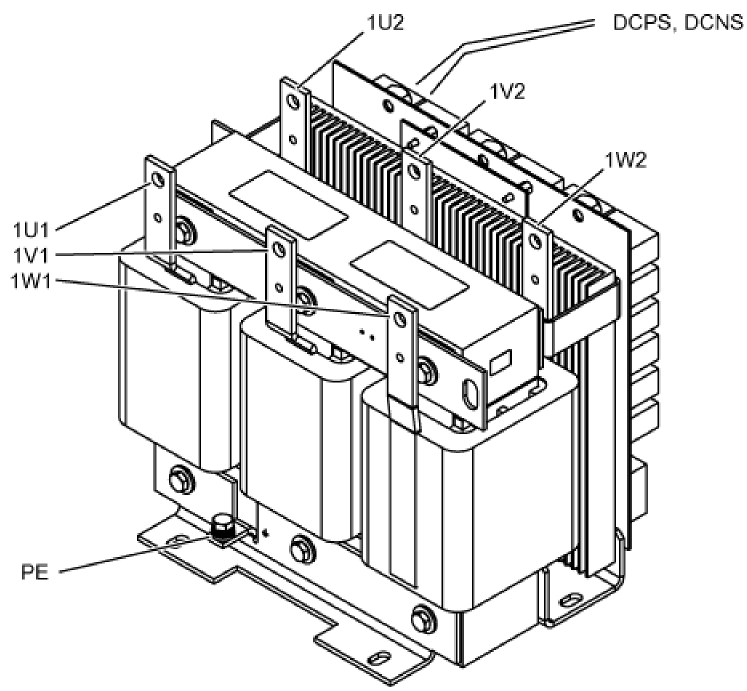


Figure 8-14 Interface overview for dv/dt filter compact plus Voltage Peak Limiter, Type 2

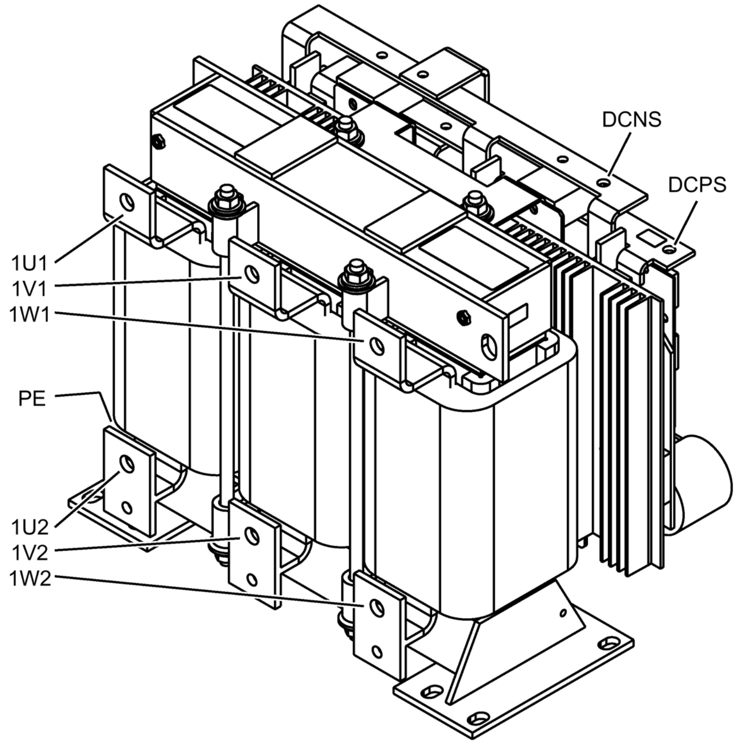


Figure 8-15 Interface overview for dv/dt filter compact plus Voltage Peak Limiter, Type 3

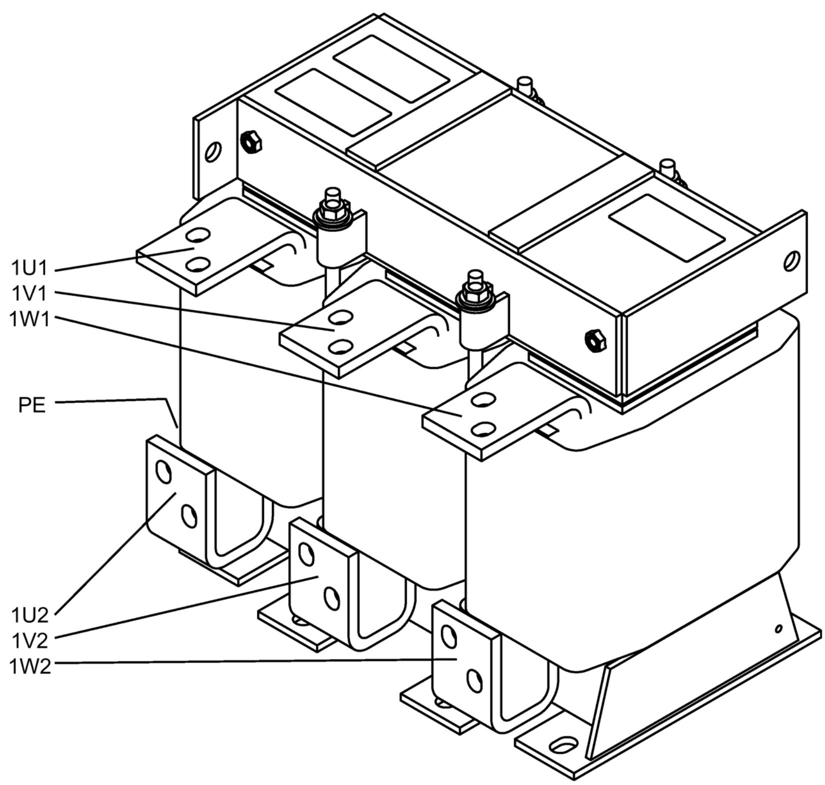


Figure 8-16 Interface overview for dv/dt filter compact plus Voltage Peak Limiter, Type 4 dv/dt reactor

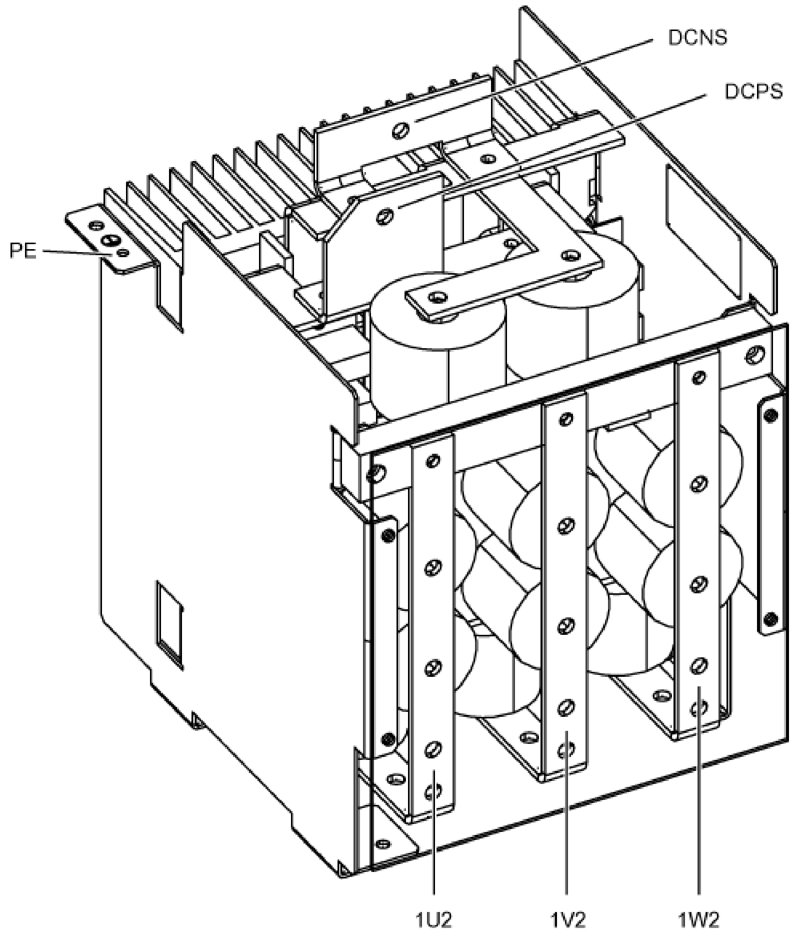


Figure 8-17 Interface overview for dv/dt filter compact plus Voltage Peak Limiter, Type 4 Voltage Peak Limiter

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

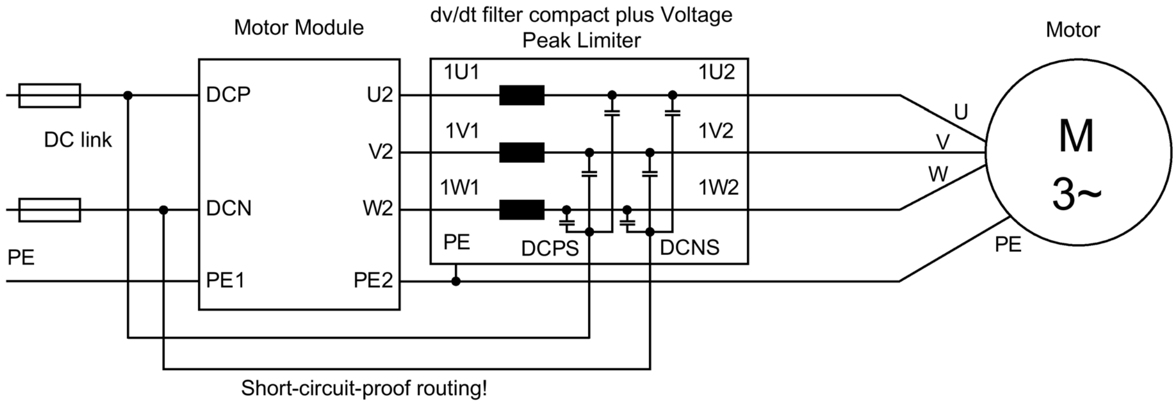


Figure 8-18 Connecting the dv/dt filter compact plus Voltage Peak Limiter - complete unit

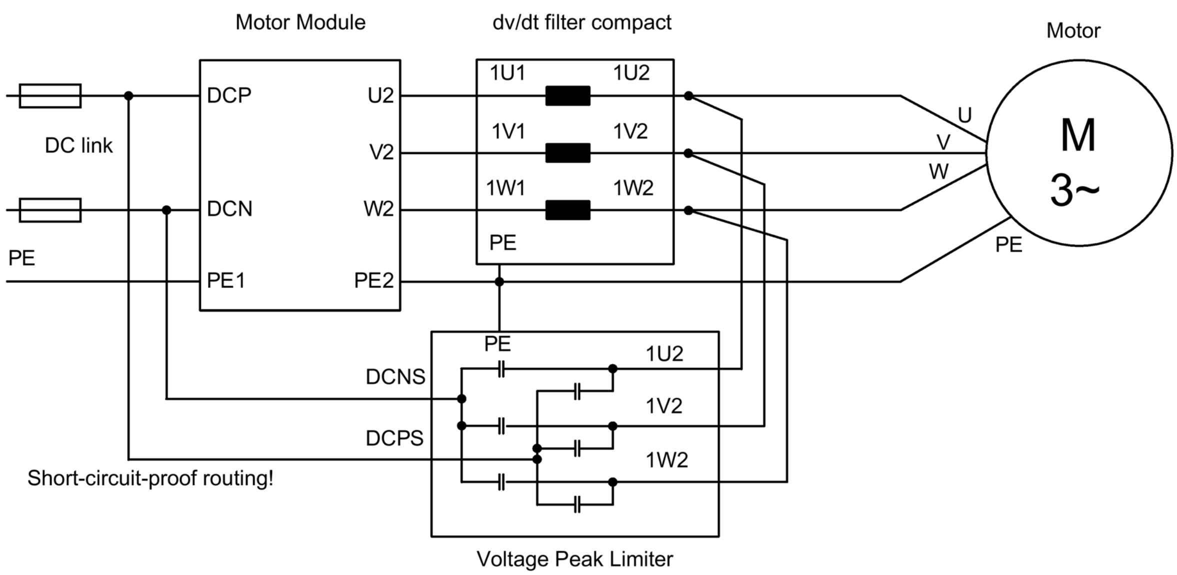


Figure 8-19 Connecting the dv/dt filter compact plus Voltage Peak Limiter - separate components

Cable cross-sections

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

Table 8- 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 (DCPS, DCNS)
Type 1	16	Screw M8 / 12 Nm
Type 2	25	Screw M8 / 12 Nm
Type 3	50	Copper bar for M8 bolt / 12 Nm

Table 8- 28 Cable cross-sections for connections between a Voltage Peak Limiter and Motor Module

dv/dt filter compact plus Voltage Peak Limiter	Cross-section [mm²]	Connection to Voltage Peak Limiter (DCPS, DCNS)
Type 4	95	Copper bar for M8 bolt / 12 Nm

Table 8- 29 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

⚠ WARNING

Fire and device damage as a result of ground fault/short-circuit

Inadequate installation of the cables to the Power Module or Motor Module DC link can result in a ground fault / short-circuit and place persons at risk as a result of the associated smoke and fire.

- Comply with local installation regulations that enable this fault to be ruled out.
- Protect the cables from mechanical damage.
- In addition, apply one of the following measures:
  - Use cables with double insulation.
  - Maintain adequate clearance, e.g. by using spacers.
  - Route the cables in separate cable ducts or pipes.

Note

Maximum cable lengths

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

Damage to the dv/dt filter compact due to mechanical load at the connections

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

- Take measures on the plant or system side to ensure that the connections cannot be deformed by the mechanical load exerted by the connected cables.

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

dV/dt filter compact plus voltage peak limiter, type 1

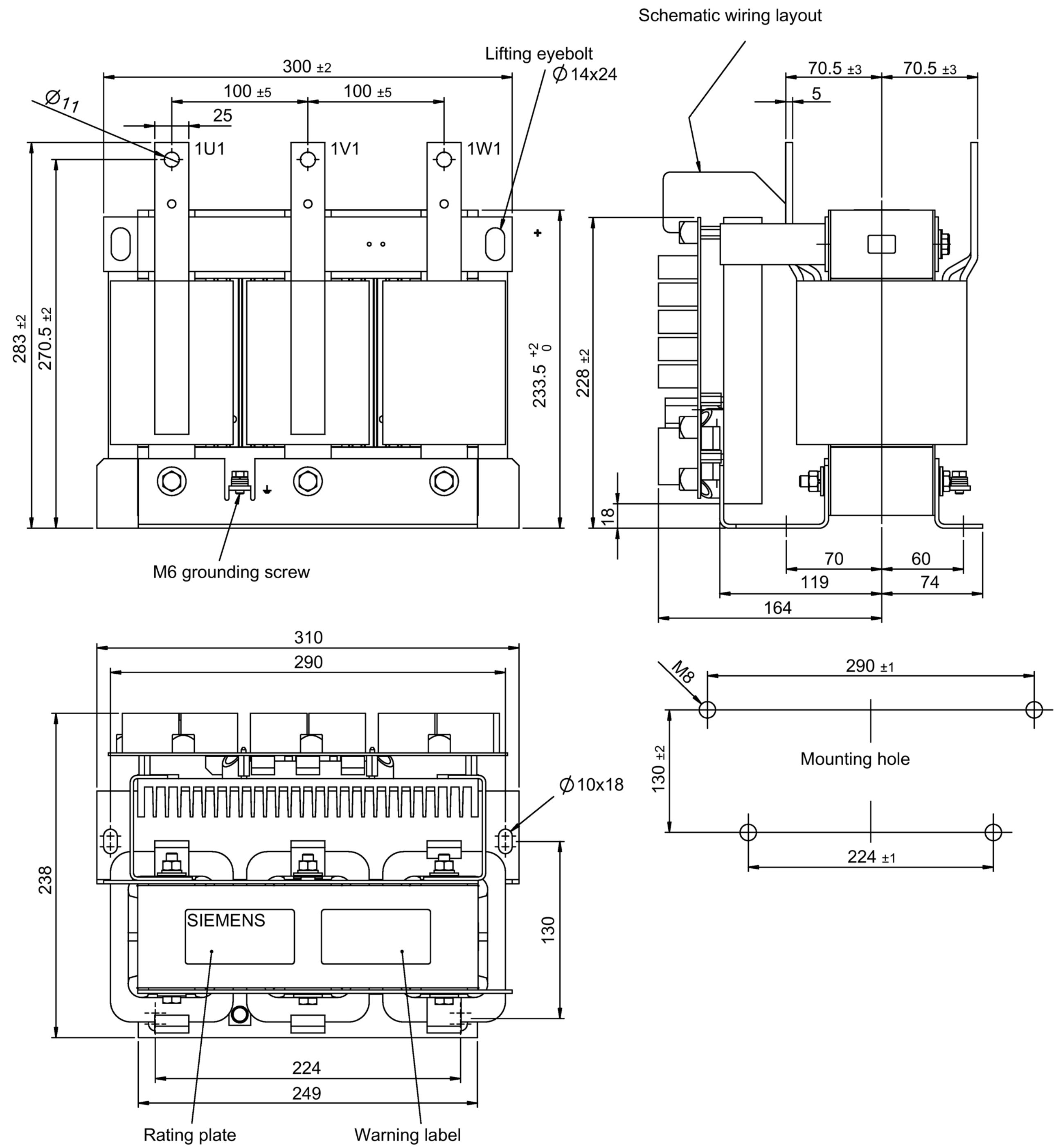


Figure 8-20 Dimension drawing for dV/dt filter compact plus voltage peak limiter, type 1

dV/dt filter compact plus voltage peak limiter, type 2

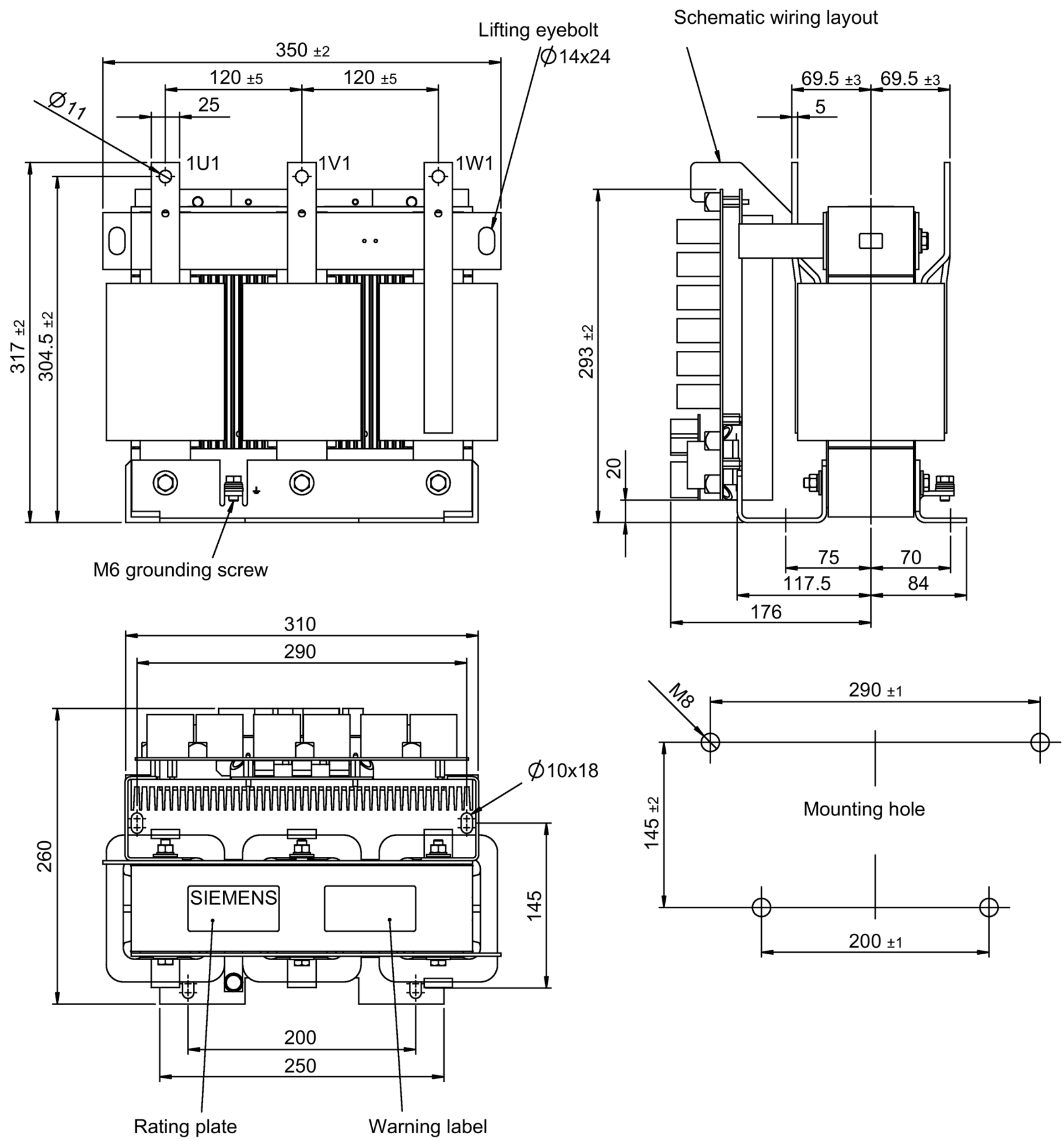


Figure 8-21 Dimension drawing for dV/dt filter compact plus voltage peak limiter, type 2

dV/dt filter compact plus voltage peak limiter, type 3

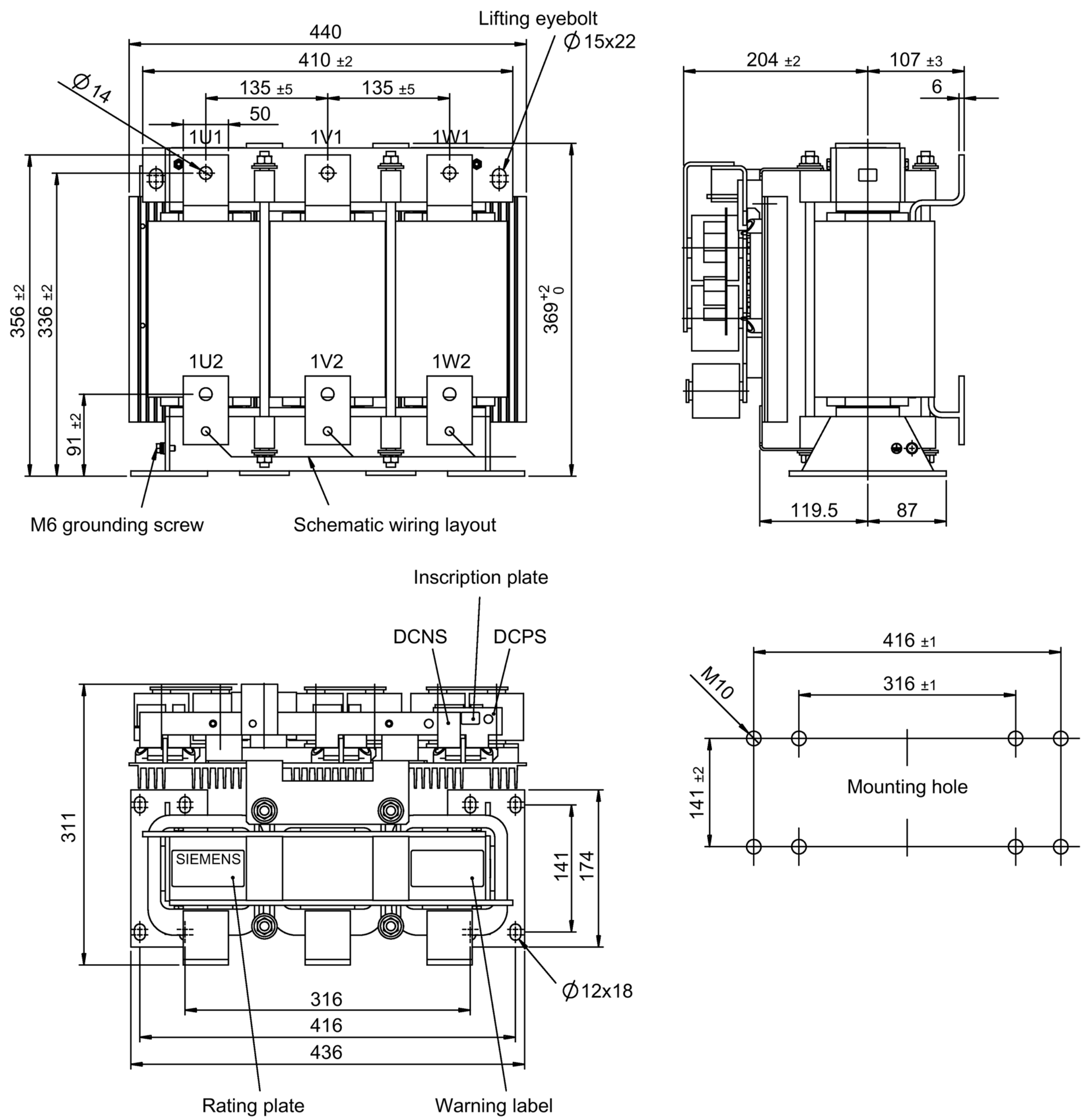


Figure 8-22 Dimension drawing for dV/dt filter compact plus voltage peak limiter, type 3

dV/dt filter compact plus voltage peak limiter, type 4

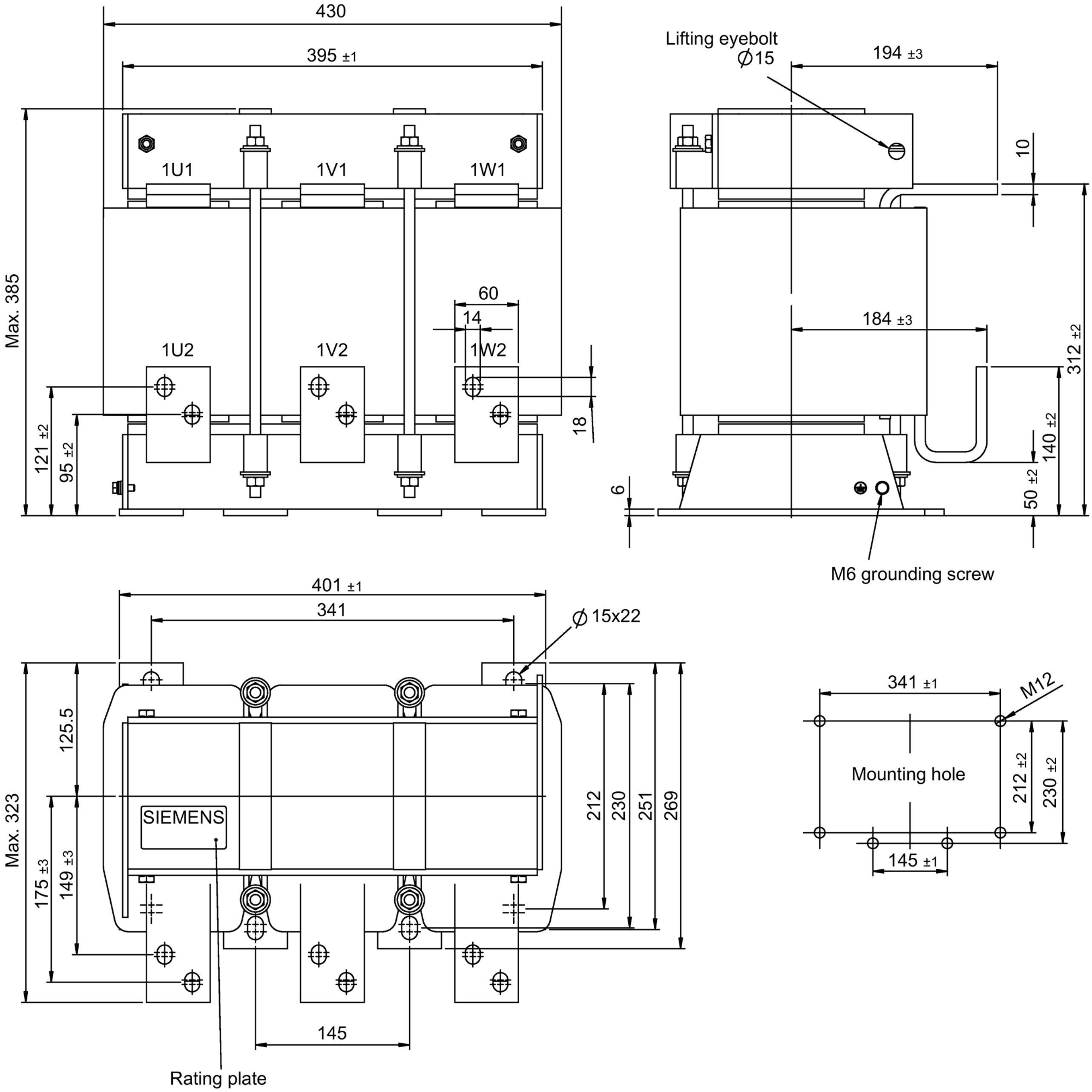


Figure 8-23 Dimension drawing for dV/dt filter compact plus voltage peak limiter, type 4 dV/dt reactor

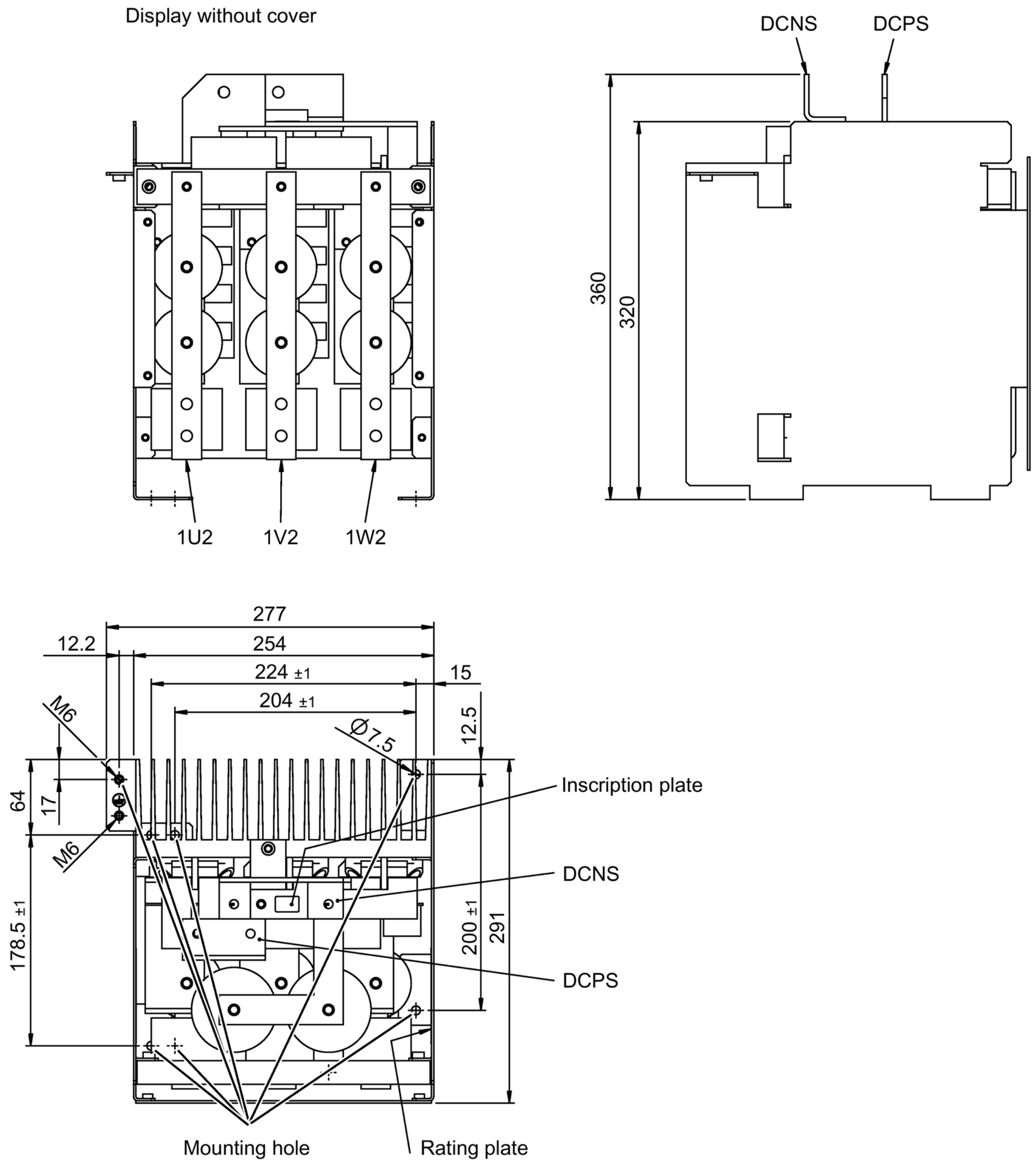


Figure 8-24 Dimension drawing for dV/dt filter compact plus voltage peak limiter, type 4 Voltage peak limiter

Table 8- 30 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 3 AC 380 ... 480 V	
6SL3000-2DE32-6EA0	Type 1
6SL3000-2DE35-0EA0	Type 2
6SL3000-2DE38-4EA0	Type 3
6SL3000-2DE41-4EA0	Type 4
Line voltage 3 AC 500 ... 690 V	
6SL3000-2DG31-0EA0	Type 1
6SL3000-2DG31-5EA0	Type 1
6SL3000-2DG32-2EA0	Type 2
6SL3000-2DG33-3EA0	Type 2
6SL3000-2DG35-8EA0	Type 3
6SL3000-2DG38-1EA0	Type 4
6SL3000-2DG41-3EA0	Type 4

8.4.6 Technical data

Table 8- 31 Technical data of the dv/dt filter compact plus voltage peak limiter, 3 AC 380 ... 480 V, Part 1

Article number	6SL3000-	2DE32-6EA0	2DE35-0EA0	2DE38-4EA0
Suitable for Power Module (unit rating)	6SL3315-	1TE32-1AA3 (110 kW) 1TE32-6AA3 (132 kW)	1TE33-1AA3 (160 kW) 1TE35-0AA3 (250 kW)	--
Suitable for Motor Module (unit rating)	6SL3325-	1TE32-1AA3 (110 kW) 1TE32-6AA3 (132 kW)	1TE33-1AA3 (160 kW) 1TE35-0AA3 (250 kW)	1TE36-1AA3 (315 kW) 1TE37-5AA3 (400 kW) 1TE38-4AA3 (450 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 8- 32 Technical data of the dv/dt filter compact plus voltage peak limiter, 3 AC 380 ... 480 V, Part 2

Article number	**6SL3000-**	**2DE41-4EA0**		
Suitable for Motor Module (unit rating)	6SL3325-	1TE41-0AA3 (560 kW) 1TE41-2AA3 (710 kW) 1TE41-4AA3 (800 kW) 1TE41-4AS3 (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 8- 33 Technical data of the dv/dt filter compact plus voltage peak limiter, 3 AC 500 ... 690 V, Part 1

Article number	**6SL3000-**	**2DG31-0EA0**	**2DG31-5EA0**	**2DG32-2EA0**
Suitable for Motor Module (unit rating)	6SL3325-	1TG31-0AA3 (90 kW)	1TG31-5AA3 (132 kW)	1TG32-2AA3 (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 8- 34 Technical data of the dv/dt filter compact plus voltage peak limiter, 3 AC 500 ... 690 V, Part 2

Article number	**6SL3000-**	**2DG33-3EA0**	**2DG35-8EA0**	
Suitable for Motor Module (unit rating)	6SL3325-	1TG33-3AA3 (315 kW)	1TG34-7AA3 (450 kW) 1TG35-8AA3 (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 8- 35 Technical data of the dv/dt filter compact plus voltage peak limiter, 3 AC 500 ... 690 V 3, Part 3

Article number	**6SL3000-**	**2DG38-1EA0**	**2DG41-3EA0**	
Suitable for Motor Module (unit rating)	6SL3325-	1TG37-4AA3 (710 kW) 1TG38-0AA3 (800 kW) 1TG38-1AA3 (800 kW)	1TG41-0AA3 (1000 kW) 1TG41-3AA3 (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

9

9.1 Notes

9.1.1 General

The modular concept of SINAMICS S120 chassis units 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 configured to ensure electromagnetic compatibility and adequate cooling – therefore ensuring reliable operation with the appropriate functionality.

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

9.1.2 Safety information

⚠WARNING

Not observing fundamental safety instructions and residual risks

Not observing fundamental safety instructions and residual risks listed in Chapter 1 can result in accidents with severe injuries or death.

- Comply with the fundamental safety instructions.
- When assessing the risk, take into account residual risks.

⚠WARNING

Injuring caused by foreign objects in the device

Parts and components falling into the device (e.g. drilling chips, end sleeves, etc.) can cause short-circuits and damage to the insulation. This can lead to serious injuries (arcing, bangs, pieces flying out of the equipment).

- Only perform installation and other work when the devices are current-free.
- Cover the ventilation slits during the installation of the cabinet and remove the cover before switching on.

NOTICE

Limiting of overvoltages

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

Note

Protection against the spread of fire

The converter may be operated only in closed housings or in higher-level control cabinets with protective covers that are closed, and when all of the protective devices are used.

Converters of the Open Type/IP20 degree of protection must be installed in a metal control cabinet or protected by another equivalent measure such that fire cannot spread and emissions outside of the control cabinet are prevented.

Note

Protection against condensation and electrically conductive contamination

To prevent damage caused by (conductive) pollution and moisture, protect the components by installing them in a control cabinet with ingress protection IP54 according to IEC 60529 or Type 12 according to NEMA 250.

- A higher degree of enclosure protection may be required for especially critical operating conditions. Technical measures such as heating devices may be required to prevent condensation.
- Provided that the occurrence of conductive pollution and/or condensation can be excluded at the installation site, a correspondingly low degree of protection is permissible for the control cabinet and the corresponding technical measures may be dispensed with.

Maximum cable lengths

Table 9- 1 Maximum cable lengths

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

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

Table 9- 2 Recommendations for overvoltage protection

24 V power supply	24 V signal cables
Manufacturer: Dehn Article: BVT AVD 24 Article number: 918422	**For digital inputs and outputs up to 0.1 A** Manufacturer: Dehn Article: BXT ML4 BE C 24 and BSP BAS 4 Article numbers: 920364 and 926304 **For digital inputs and outputs up to 0.5 A** Manufacturer: Dehn Article: DCO SD2 ME 24 and DCO SD2 MD 24 Article numbers: 917921 and 917941

9.1.3 Directives

The control cabinet must satisfy the following EC Directives in the European Economic Area (EEA):

Table 9- 3 Directives

Directive	Description
2014/35/EU	Directive of the European Parliament and Council from February 26, 2014 on the approximation of the laws relating to the provision of electrical equipment designed for use within certain voltage limits (Low-Voltage Directive)
2014/30/EU	Directive of the European Parliament and Council of February 26, 2014 for the harmonization of the laws of the member states relating to electromagnetic compatibility (EMC directive)
2006/42/EC	Directive of the European Parliament and Council of May 17, 2006 on machinery and for changing Directive 95/16/EC (amendment) (machinery directive)

9.2 EMC-compliant design and control cabinet configuration

Detailed configuration instructions regarding the EMC-compliant design of drives and control cabinet configuration can be found in the "SINAMICS Low Voltage Configuration Manual", see Configuration Manual for SINAMICS G130, G150, S120 Built-in Units, S120 Cabinet Modules, S150 (https://support.industry.siemens.com/cs/ww/de/view/83180185).

9.3 Electromagnetic fields at the workplace

9.3.1 Preliminary remarks

Protection of workers from electromagnetic fields is specified in the European EMF Directive 2013/35/EU. This directive is implemented in national law in the European Economic Area (EEA). Employers are obligated to design workplaces in such a way that workers are protected from impermissibly strong electromagnetic fields. To this end, assessments and/or measurements must be performed for workplaces.

General conditions for correct assessment or measurement

1. The laws for protection from electromagnetic fields in force in individual EU member states can go beyond the minimum requirements of the EMF Directive 2013/35/EU and always take precedence.
2. The ICNIRP 2010 limits for the workplace are the basis for the assessment.
3. The 100 μT (RMS) mentioned below for assessment of active implants comes from the 26th BImSchV (German Federal Emission Protection Regulations).
   According to Directive 2013/35/EU, 500 μT (RMS) at 50 Hz is applicable here.
4. Compliance with the limit values was checked for the following frequencies:
   - Line frequency 47 ... 63 Hz (see system data)
   - Pulse frequency, for example 1.25/2/2.5/4/5/7.5/8 kHz and multiples thereof, evaluated up to a maximum of 100 kHz (see system data or relevant technical specifications)
5. The routing of power cables has a significant impact on the electromagnetic fields that occur. More detailed information is provided in the "SINAMICS Low Voltage Configuration Manual".

9.3.2 Measurements/evaluations for SINAMICS S120 chassis liquid cooled

Note

Validity

The following information regarding electromagnetic fields relates solely to products and components supplied by Siemens. A precondition is the installation and operation of components inside metal control cabinets in compliance with the documentation and the "SINAMICS Low Voltage Engineering Manual" and the use of shielded motor cables. More detailed information is provided in the "SINAMICS Low Voltage Engineering Manual".

The components are normally used in machines. Assessment and testing is based on DIN EN 12198-1.

Table 9- 4 Information for frequency range 0 Hz to 300 GHz

Frequency range	0 Hz ... 100 kHz	100 kHz ... 300 GHz
Electric field strength	Limits not exceeded	Limits not exceeded
Magnetic flux density	For assessment, see the following table	Limits not exceeded

Table 9- 5 Minimum clearances to SINAMICS S120 chassis liquid cooled for 0 Hz ... 100 kHz

Power of the Line Module	Generally		Individuals with active implants	
	Control cabinet closed	Control cabinet open	Control cabinet closed	Control cabinet open
P ≤ 1700 kW	50 cm [1)]	200 cm	Must be separately assessed depending on the active implant.	Must be separately assessed depending on the active implant.

1) The minimum clearances in the area around the power connections is 100 cm.

Note

The minimum distances indicated above apply to the head and complete torso of the human body. Shorter distances are possible for extremities.

9.4 Cabinet installation, vertical and horizontal installation

9.4.1 Vertical installation

The SINAMICS S120 liquid-cooled devices are suitable for vertical installation in a cabinet with a minimum width of 400 mm.

A partition must be installed between the cabinets housing and the SINAMICS device to ensure that the device is adequately ventilated.

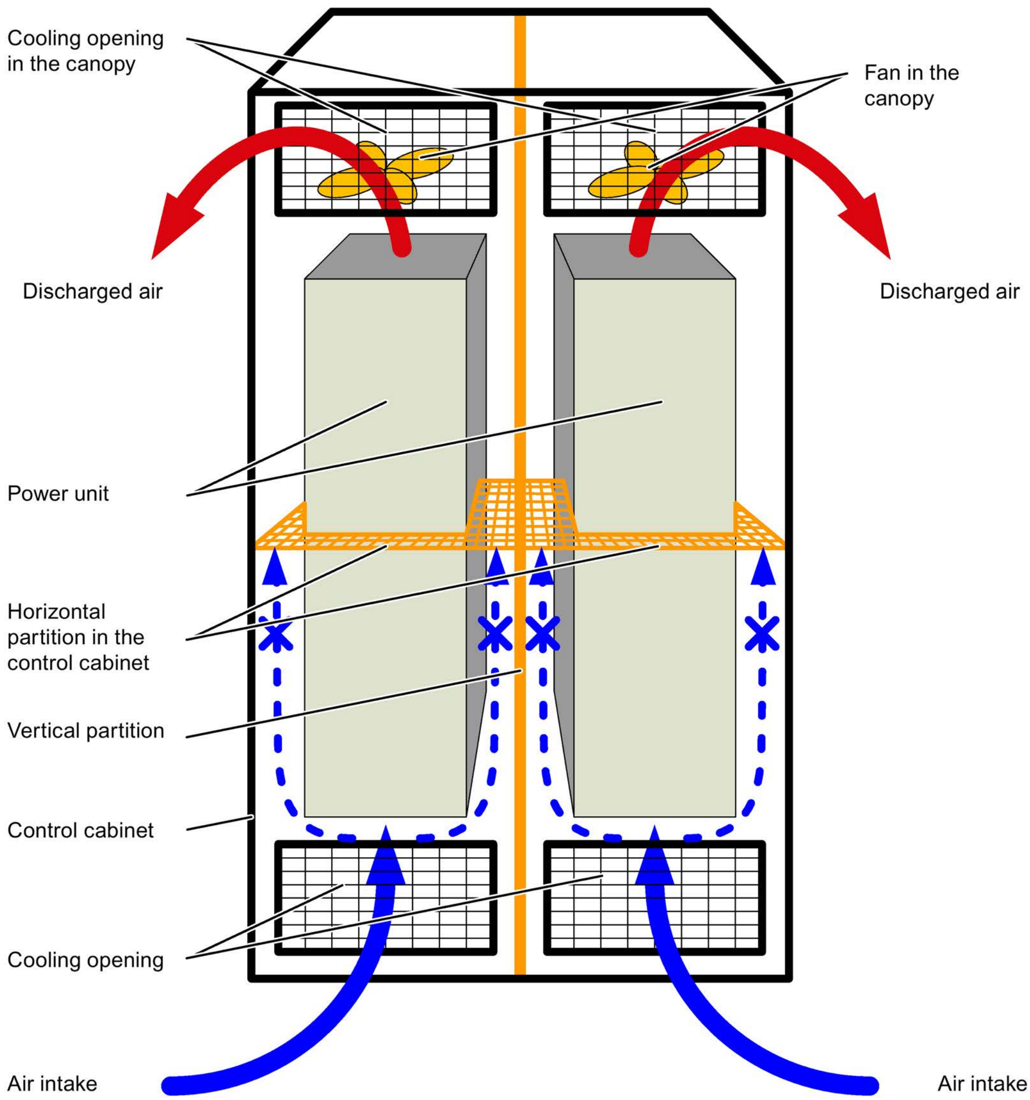


Figure 9-1 Example showing a partition in the control cabinet

The dimensions for the installation heights of the partition are specified in the following table.

Table 9- 6 Installation height of the partition from the lower side of the device (from the lower edge of the device)

Type	Installation height of the partition [mm]
Power Module FL	140
Power Module GL	290
Basic Line Module FBL	480
Basic Line Module GBL	910
Active Line Module FXL, Motor Module FXL	150
Active Line Module GXL, Motor Module GXL	480
Active Line Module HXL, Motor Module HXL	340
Active Line Module JXL, Motor Module JXL	800

Installing in a control cabinet

Carefully observe the following notes regarding the installation of Chassis format power units (Power Modules, Active Interface Modules, Basic Line Modules, Active Line Modules, Motor Modules) and the additional power components in a control cabinet or in an appropriately secured electrical room:

- When screwing to the mounting surface of the control cabinet, use all attachment points of the power units and/or the additional power components.
  The mounting points are shown in the dimension drawings.
- Use screws of property class 8.8 in accordance with DIN EN ISO 898-1.
- Use large washers, e.g. in accordance with ISO 7093 or ISO 7094.
- Use spring washers, e.g. in accordance with DIN 6796.

9.4.1.1 Mounting on mounting rails

The liquid-cooled SINAMICS S120 devices can be mounted in the control cabinet on mounting rails. For this purpose, mounting rails are provided on the lower side of the power units, which can be used to mount the device in the control cabinet.

The mounting rails are intended to simplify installing or removing the power unit (Active Line Modules, Basic Line Modules, Motor Modules, Power Modules).
For this purpose, the mounting equipment for the power units can be attached to the mounting rails (article number 6SL3766-1CA00-0AA0), in order to simplify mounting and installation work, see "Mounting equipment for power units (Page 357)".

By suitably designing the mounting rails in the control cabinet, the mechanical load of the power unit can be better distributed to the cabinet frame elements.

The mounting rails must be designed and manufactured on a system-for-system specific basis.

Bolting points for the mounting rails

In order that the mounting equipment for the power units can be correctly attached to the mounting rails, the mounting rails must be provided with the subsequently described bolting points at the front.

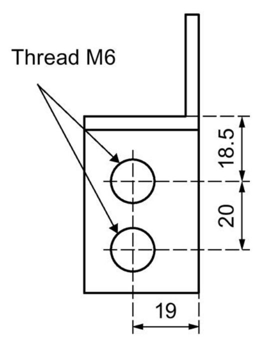


Figure 9-2 Bolting points for the mounting rails (dimensions in mm)

Rail profile at the power units

The dimensions of the rail profiles for the various power units are shown in the following drawings.

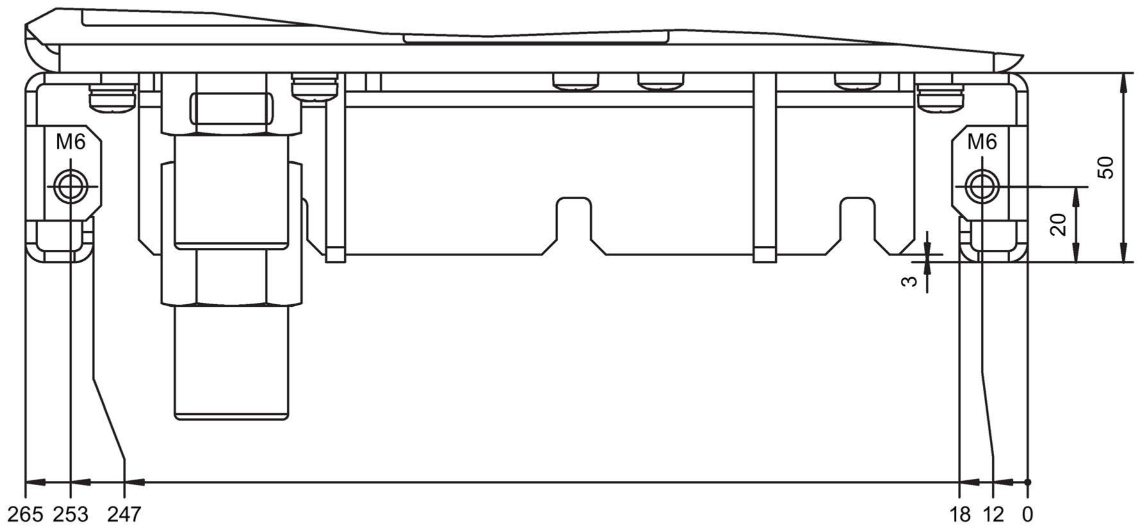


Figure 9-3 Rail profile, Power Modules, frame sizes FL, GL (dimensions in mm)

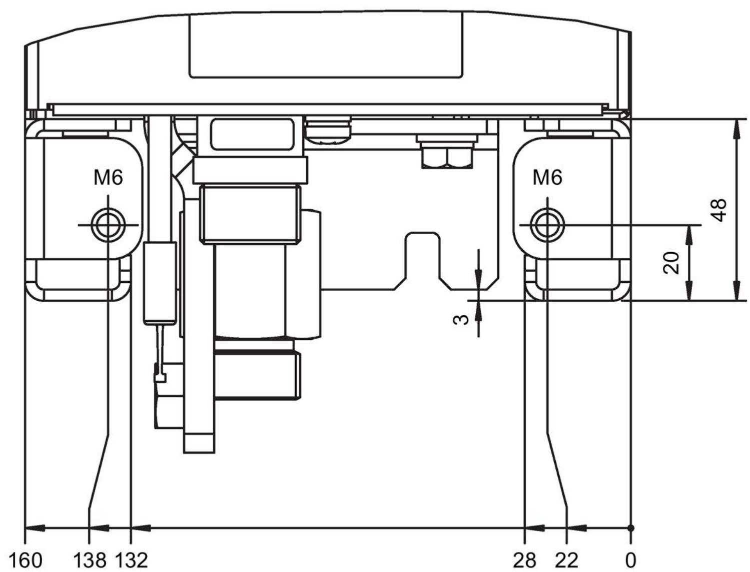


Figure 9-4 Rail profile, Basic Line Module, frame sizes FBL, GBL (dimensions in mm)

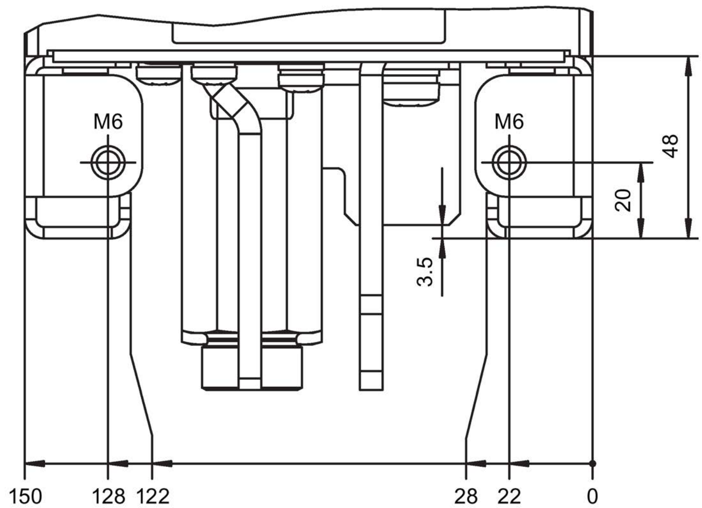


Figure 9-5 Rail profile, Motor Module, frame size FXL (dimensions in mm)

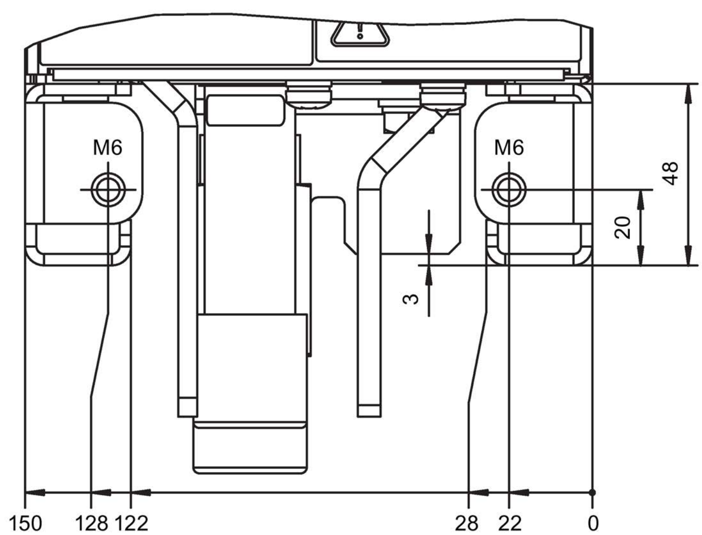


Figure 9-6 Rail profile, Active Line Module and Motor Module, frame size GXL, (dimensions in mm)

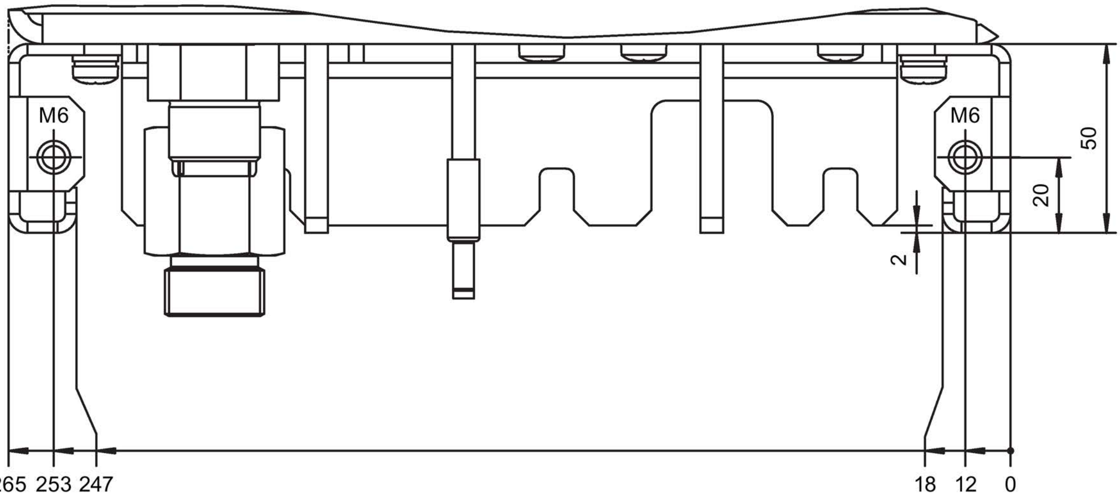


Figure 9-7 Rail profile, Active Line Module and Motor Module, frame size HXL (dimension data in mm)

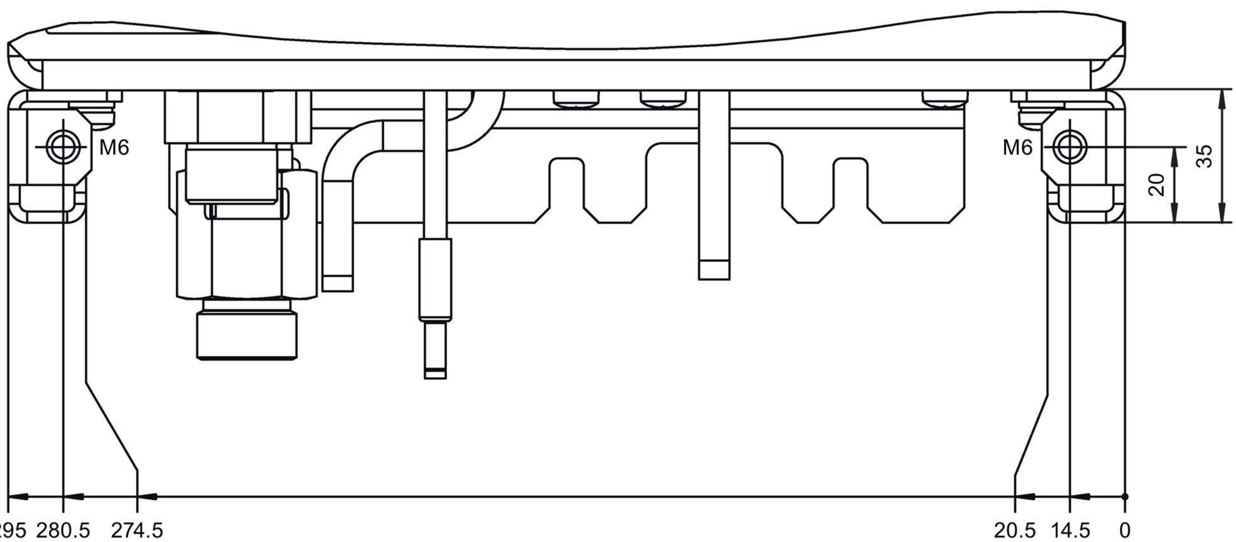


Figure 9-8 Rail profile, Active Line Module and Motor Module, frame size JXL, (dimensions in mm)

9.4.1.2 Volumetric air flow and fans required

Note

Notes for installation in control cabinets

The SINAMICS S120 liquid-cooled devices have IP20 degree of protection with the exception of the electrical connections (overall degree of protection IP00).

Depending on the degree of protection of the cabinet, it must be guaranteed that the thermal losses in the cabinet are extracted from the cabinet using a fan or an air/water heat exchanger.
the respective thermal losses can be found in the technical data of each individual device.

We recommend that a heat run is performed in order to confirm that the temperature ranges specified in the technical data can be maintained even when installed in a cabinet.

Note

Notes when mounting vertically

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 avoid the formation of hotspots.

The table below specifies the required volumetric flows and the average rates of flow within a canopy (400 mm high).

If a single module is installed in a cabinet with IP54 degree of protection, then the fan can be dispensed with if the required volumetric flow for the module is <0.01 m^3/s.

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 cabinet canopies are interconnected, the total volumetric flow must also be calculated and a fan selected accordingly.

Table 9- 7 Required fan flow rate through the power unit for degree of protection > IP21

Type	Required volumetric flow dv/dt of roof-mounted fan [m^3/s]	Average rate of flow [m/s]
Power Module FL, 210 A (400 V)	0.003	0.01
Power Module FL, 260 A (400 V)	0.003	0.02
Power Module GL, 310 A (400 V)	0.004	0.02
Power Module GL, 490 A (400 V)	0.006	0.03

Type	Required volumetric flow dv/dt of roof-mounted fan [m³/s]	Average rate of flow [m/s]
Basic Line Module FBL, 740 A (400 V)	0.010	0.05
Basic Line Module FBL, 1220 A (400 V)	0.017	0.09
Basic Line Module GBL, 1420 A (400 V)	0.024	0.12
Basic Line Module FBL, 420 A (690 V)	0.009	0.05
Basic Line Module FBL, 730 A (690 V)	0.016	0.08
Basic Line Module GBL, 1300 A (690 V)	0.018	0.09
Basic Line Module GBL, 1650 A (690 V)	0.023	0.12
Active Line Module GXL, 490 A (400 V)	0.006	0.03
Active Line Module HXL, 840 A (400 V)	0.010	0.05
Active Line Module HXL, 575 A (690 V)	0.006	0.03
Active Line Module JXL, 1422 A (690 V)	0.024	0.12
Motor Module FXL, 210 A (400 V)	0.002	0.01
Motor Module FXL, 260 A (400 V)	0.003	0.02
Motor Module GXL, 310 A (400 V)	0.004	0.02
Motor Module GXL, 490 A (400 V)	0.006	0.03
Motor Module HXL, 605 A (400 V)	0.007	0.04
Motor Module HXL, 674 A (400 V)	0.008	0.05
Motor Module HXL, 840 A (400 V)	0.010	0.05
Motor Module JXL, 985 A (400 V)	0.020	0.10
Motor Module JXL, 1405 A (400 V)	0.026	0.14
Motor Module FXL, 100 A (690 V)	0.002	0.01
Motor Module FXL, 150 A (690 V)	0.003	0.02
Motor Module FXL, 215 A (690 V)	0.004	0.02
Motor Module FXL, 330 A (690 V)	0.005	0.03
Motor Module HXL, 465 A (690 V)	0.006	0.03
Motor Module HXL, 575 A (690 V)	0.007	0.03
Motor Module HXL, 735 A (690 V)	0.018	0.10
Motor Module HXL, 810 A (690 V)	0.018	0.10
Motor Module JXL, 810 A (690 V)	0.019	0.10
Motor Module JXL, 1025 A (690 V)	0.021	0.11
Motor Module JXL, 1270 A (690 V)	0.024	0.12
Motor Module JXL, 1560 A (690 V)	0.038	0.21

Recommended fan: EBM-Papst, type W2E200-HH38-01

Note

Note regarding vertical installation

It must be ensured that the ambient temperature of the device in the cabinet does not exceed 45 °C at any location. From 45 °C to 50 °C, see Chapter "Derating factors (Page 44)".

9.4.2 Horizontal installation

The SINAMICS S120 liquid-cooled devices can operate in a vertical position with the device resting on its rear panel.

To prevent heat concentrations inside the devices in this mounting position, an external fan needs to be installed which is capable of removing heated air from the devices, see Volumetric air flow and fans required (Page 313).

A baffle (referred to below as air distribution baffle) must also be mounted above the device. 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 device remain within the permissible tolerance range (see figure below).

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

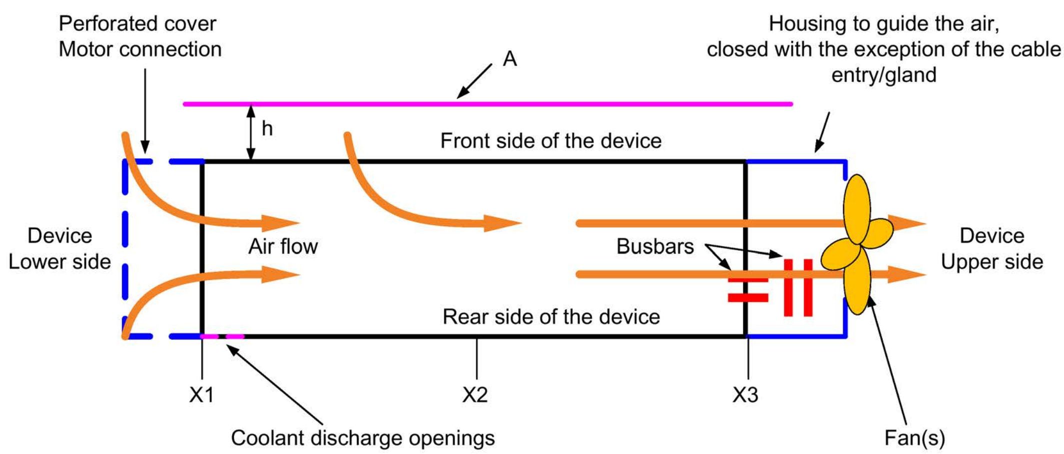


Figure 9-9 Basic layout for horizontal installation position (side view)

The height h (the distance between the device 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 device (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 devices 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 device half (in the figure above, between X1 and X2).

9.4.2.1 Housing for air guidance

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

9.4.2.2 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.

9.4.2.3 Volumetric air flow and fans required

Note

Notes for installation in control cabinets

The SINAMICS S120 liquid-cooled devices have IP20 degree of protection with the exception of the electrical connections (overall degree of protection IP00).

Depending on the degree of protection of the cabinet, it must be guaranteed that the thermal losses in the cabinet are extracted from the cabinet using a fan or an air/water heat exchanger.
the respective thermal losses can be found in the technical data of each individual device.

We recommend that a heat run is performed in order to confirm that the temperature ranges specified in the technical data can be maintained even when installed in a cabinet.

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. These are minimum values, without taking into account additional components in the cabinet (e.g. fuses, busbars, etc.). The additional power losses must be taken into account.

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 fan with characteristic (minimum requirement) are available on request from EBM-Papst.

Table 9- 8 Volumetric flow requirement and number of fans needed for horizontal mounting

Type	Required volumetric air flow [m^3/s]	Number of fans Papst 4114NXH or Papst 4114NHH or Papst 4184NXH (120 x 120 mm) *)
Power Module, frame sizes FL, GL	0.015	1
Basic Line Module FBL, 740 A (400 V), 420 A (690 V)	0.027	1
Basic Line Module FBL, 1220 A (400 V), 730 A (690 V)	0.044	2
Basic Line Module GBL	0.063	2
Active Line Module GXL, Motor Module FXL, GXL	0.015	1
Active Line Module HXL, Motor Module HXL	0.025	1
Active Line Module JXL, Motor Module JXL	0.063	2

*) Available from info2@de.ebmpapst.com

Note

Note regarding horizontal installation

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

9.4.3 Coolant connection

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

Cooling circuit, coolant properties and protection against condensation 10

⚠ WARNING

Non-observance of the fundamental safety instructions and residual risks

The non-observance of the fundamental safety instructions and residual risks stated in Chapter 1 can result in accidents with severe injuries or death.

- Adhere to the fundamental safety instructions.
- When assessing the risk, take into account residual risks.

Note

Contact addresses

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

10.1 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 devices, 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, zinc or halogenated plastic (PVC hoses and seals), should not be used or should be limited to the absolutely essential minimum. The materials must be selected so that no electrical corrosion occurs (electro-chemical series of metals), see Chapter "Materials (Page 343)".

As a result of the combination of different materials, it is not permissible that coolant without corrosion protection inhibitors is used. Switching over to another inhibitor system should be avoided as there is a risk that the different inhibitor systems will not be compatible with one another therefore making corrosion protection ineffective.
In a cooling circuit, old coolant should only be replaced by new identical coolant.

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. A separate pressure-relief valve (<6 bar) must be connected to the discharge side of the pump. The coolant is guided only through the SINAMICS devices, the heat exchange components and possibly to a motor (for example, see Figure below). The materials used in the cooling circuit comply with the specifications provided in Chapter "Materials (Page 343)".
2. Semi-open cooling circuit
   Oxygen can only enter the coolant through the pressure equalization tank, otherwise the same as for 1.
   The coolant is fed through the SINAMICS devices, and the components required for cooling, as well as through third-party components. This is only possible for components with stainless steel heat sinks.

Table 10- 1 Cooling circuit for SINAMICS devices

SINAMICS devices	**Basic Line Module, frame sizes FBL, GBL** **Active Line Module, frame sizes HXL, JXL** **Motor Modules, frame sizes HXL, JXL** **Active Interface Module, frame size JIL**	**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! Only permissible with inhibitors with the appropriate concentration; possibly included in the antifreeze agent, see Chapter "Antifreeze, biocides, inhibitors (Page 340)".	The closed cooling circuit is the recommended standard solution! Only permissible with inhibitors with the appropriate concentration, see Chapter "Antifreeze, biocides, inhibitors (Page 340)".
Closed common cooling circuit (with motor)	Not permissible!	Only permissible with inhibitors with the appropriate concentration, see Chapter "Antifreeze, biocides, inhibitors (Page 340)".
Semi-open common cooling circuit (open pressure compensation tank)	Not permissible!	Only permissible with inhibitors with the appropriate concentration, see Chapter "Antifreeze, biocides, inhibitors (Page 340)".

Pressure

The maximum permissible 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: 150 kPa (is applicable for water as coolant).

The layout must be selected so that the total length of intake and discharge lines is the same for each SINAMICS device or motor.

It is not permissible to connect the water cooling systems of devices or devices and motors in series as the increased flow rate increases the risk of cavitation and abrasion.

Coolant temperature

To prevent condensation, the coolant temperature should be controlled depending on the ambient temperature and the air humidity. Condensation on the device is not permissible.

The coolant temperature ranges are specified in Chapters "Technical specifications (Page 40)" and "Derating factors (Page 44)".

Operation with a coolant temperature between 0° C and 5° C is only permitted with antifreeze. Operation below 0° C is also not permitted with antifreeze.

Volume flow monitoring

The devices are equipped with volume flow monitoring. If the average output flow is less than the rated flow, then the volume flow may also be correspondingly lower. If occasionally overloads occur during operation with the average output flow that are higher than the average output flow, then the rated volume flow must also be provided.

It must be ensured that the volume flow is never zero.

Installation

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

The following hose types are recommended:

- EPDM hoses with an electrical resistance >10^9 Ohm/m, e.g. Semperflex FKD; supplied by Semperit, or
- DEMITTEL made of PE / EPDM supplied by Telle
- Fixed using clamps conforming to DIN 2871, available, e.g. from the Telle company, see Table in Chapter "Materials (Page 343)".

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 the diagram in Chapter "Preventing cavitation (Page 321)").
- 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). It is not permissible that the flushback filter is bridged by a bypass circuit.
  In these types of applications, automatic flashback filters have clearly proven themselves.

Note

Checking coolant hoses

The inspection intervals depend on the prevailing ambient conditions.

The following points should be noted for the coolant hoses:

- Damage through abrasion points
- Embrittlement (e.g. forming of cracks)
- Leaks
- The hose slipping out of the coupling
- Deformations that do not comply with the natural shape of the hose (e.g. separation of layers and blistering)
- Exceeding the storage and usage times
  In accordance with the accepted rules and standards, we recommend a testing cycle of 5 years at the appropriate test pressure (twice the operating pressure).

10.1.1 Cooling circuit for aluminium heat sinks

To ensure an optimum heat sink service life, please note the following specifications for the aluminum heat sinks (Active Interface Module JIL, 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 steel (ST37) with antifreeze in the coolant.

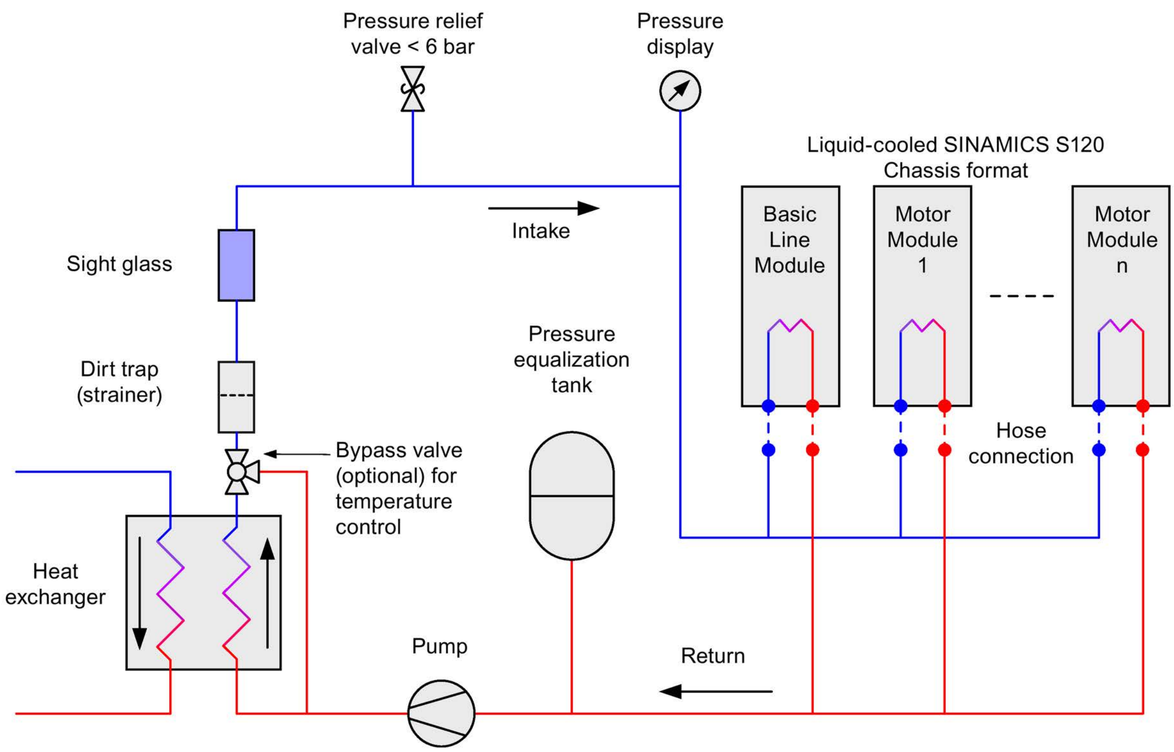


Figure 10-1 Recommendation for closed circuit

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

Table 10- 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 on the suction side of the pump, standard type used for heating systems, only suitable for closed cooling circuits, with antifreeze, see Chapter "Antifreeze, biocides, inhibitors (Page 340)".
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 cast iron wherever possible.
5. Connecting cables	Stainless steel, also common steel in closed circuits with antifreeze in the coolant.
6 Sight glass	Recommended for diagnosing turbidity and discoloration of the coolant which can indicate ageing or corrosion problems.
7. Dirt trap (strainer), mesh width ≤100 µm	Dissolved substances (reaction products) must be trapped before they cause blockages in the heat sink!
8. Pressure measuring location	Required for servicing.
9. Connecting hose	EPDM hose
10. Heat exchanger	Ideally of stainless steel, also copper-brazed in closed circuits.
11. Bypass valve	The customer must take measures to protect the devices against condensation, e.g. with a bypass valve. It must be ensured that unfiltered coolant does not enter the cooling circuit of the converter.
12. Coolant	See Chapter "Coolant properties (Page 338)".

10.1.2 Cooling circuit for stainless steel heat sinks

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

- Semi-open 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 steel (ST37) with antifreeze in the coolant.

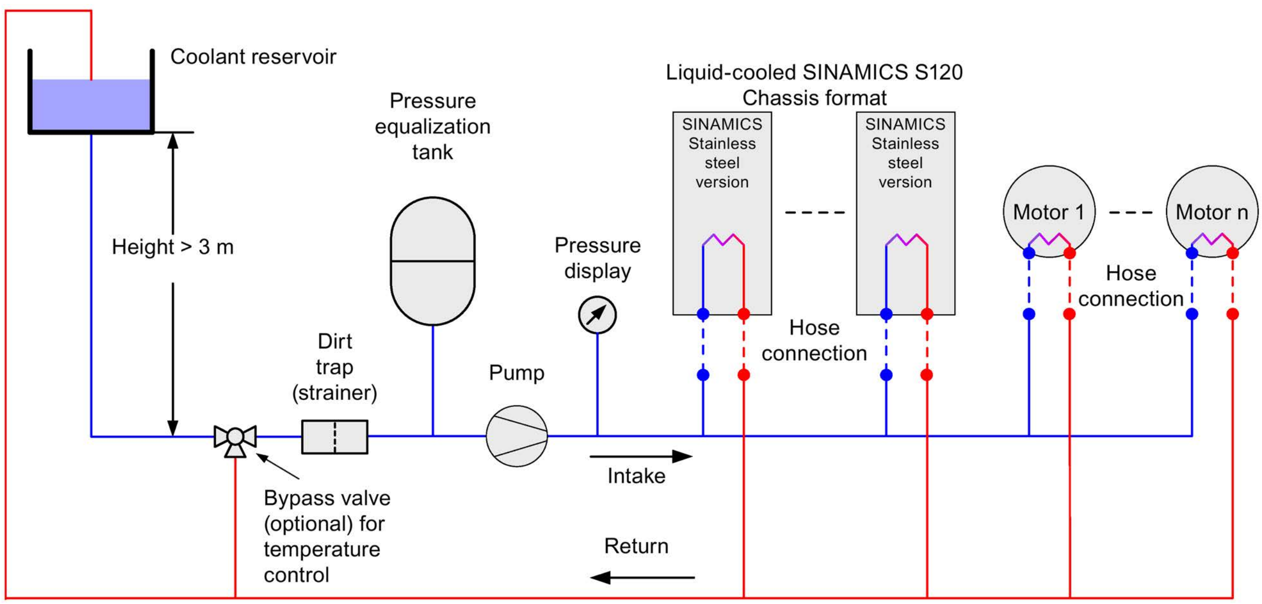


Figure 10-2 Recommendation for open circuit

Note

Requirements regarding the coolant reservoir

It must be guaranteed that the coolant is cooled down in the coolant reservoir.

Note

Arrangement of the devices in the cooling circuit

When arranging the devices in the cooling circuit, please note that the SINAMICS S120 devices must always be positioned upstream of the motors.

Dirt traps (strainer) with a mesh width ≤100 µm, at least one pressure measuring point and a sight class are important for service.

The customer must take measures (e.g. by monitoring the level) that the level in the coolant reservoir does not fall below a certain height.

Air bubbles in the coolant can cause the device to overheat. Information on venting is provided in Chapter "Commissioning (Page 350)".

10.1.3 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 (0.3 bar), or the geodesic height from the reservoir to the pump suction side must be >3 m.
- The pressure drop across a SINAMICS device must not exceed 200 kPa (2 bar) in continuous operation, as the resultant increase in volumetric flow increases the risk of cavitation and/or abrasion.
- The guidelines given in Chapter Cooling circuit configuring information (Page 322) regarding series connections and maximum pressure must also be followed.

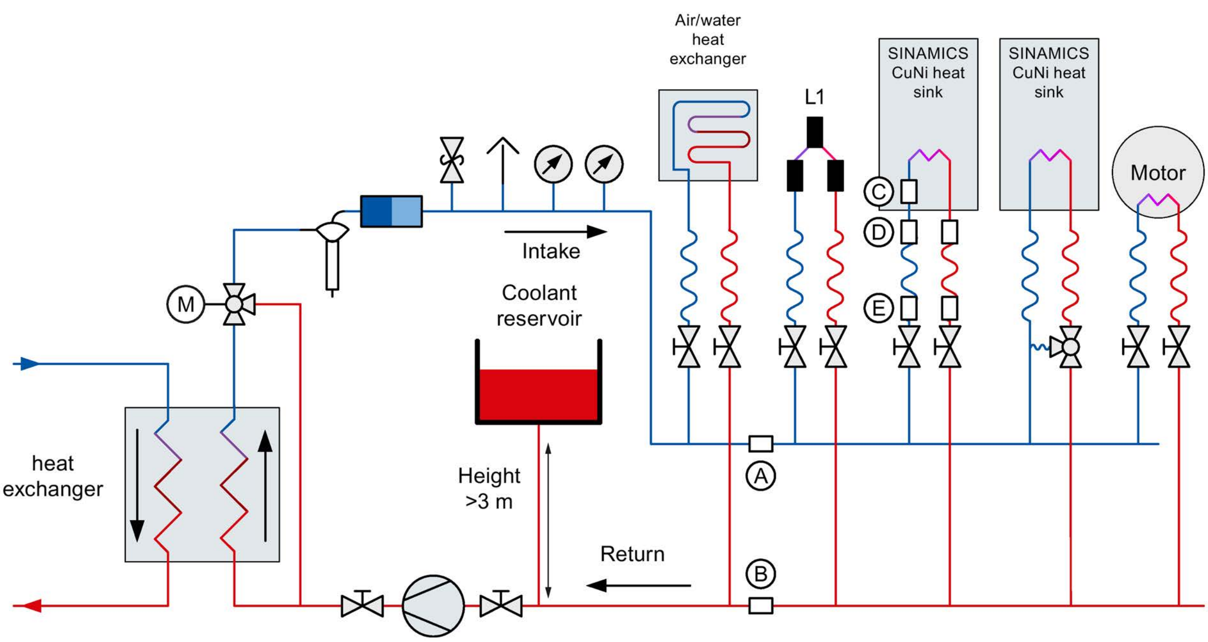


Figure 10-3 Arrangement of pressure compensator, component pressure drops

10.1.4 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 relevant devices. The devices are normalized to a rated pressure of 70 kPa (for water as coolant) using an orifice (throttle).

If a mixture of antifreeze and water is used as a coolant, the rated pressure must be calculated according to the ratio.

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 ≤ 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 intake and return lines should be selected to allow pumps with a flat characteristic to be used.

The maximum differential pressure across a heat sink is 150 kPa (for water as coolant); higher differential pressures significantly increase the risk of cavitation and abrasion.

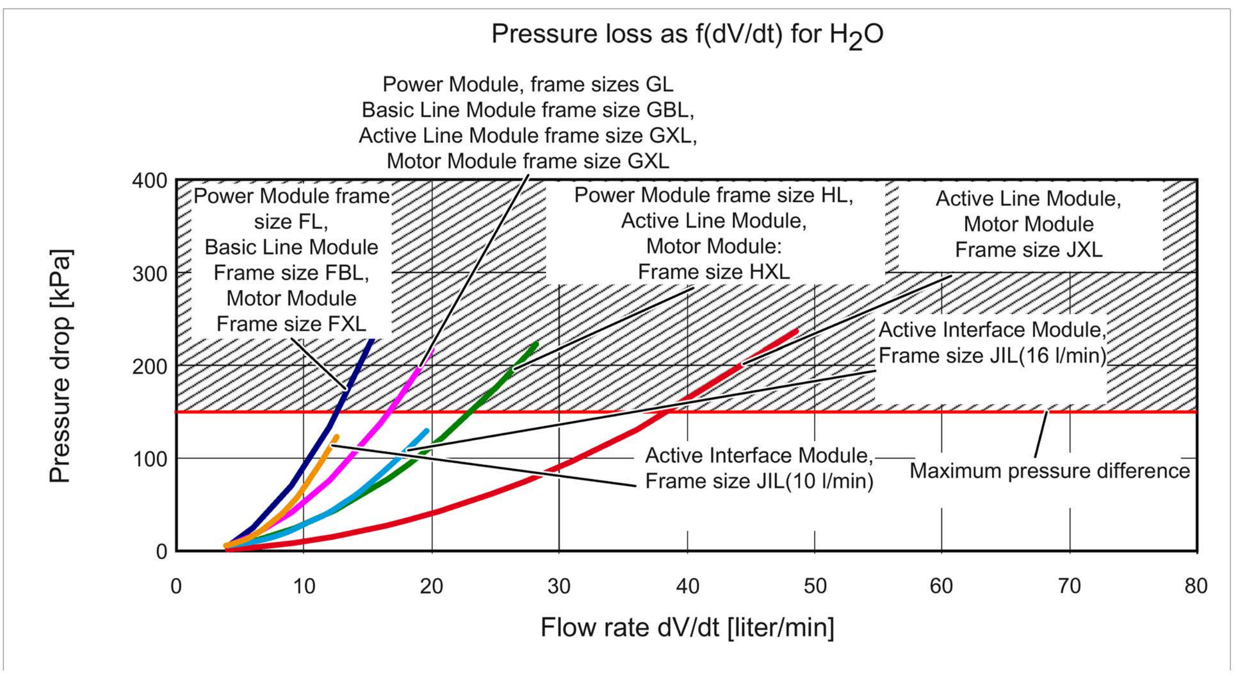


Figure 10-4 Pressure drop as a function of volumetric flow

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

- The risk of cavitation and abrasion increases as a result of the high total flow rate.
- It is not possible to connect SINAMICS S120 in series because the total volumetric flow inherent to any 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 antifreeze and water coolant combination, as can be seen in the following figures.

Coolant mixture comprising Antifrogen N or Dowcal 100 and water

The following diagrams show the pressure drop as a function of the volumetric flow rates for the different SINAMICS S120 liquid-cooled components when using Antifrogen N or Dowcal 100.

Dowcal 100 has the same flow attribute as Antifrogen N.

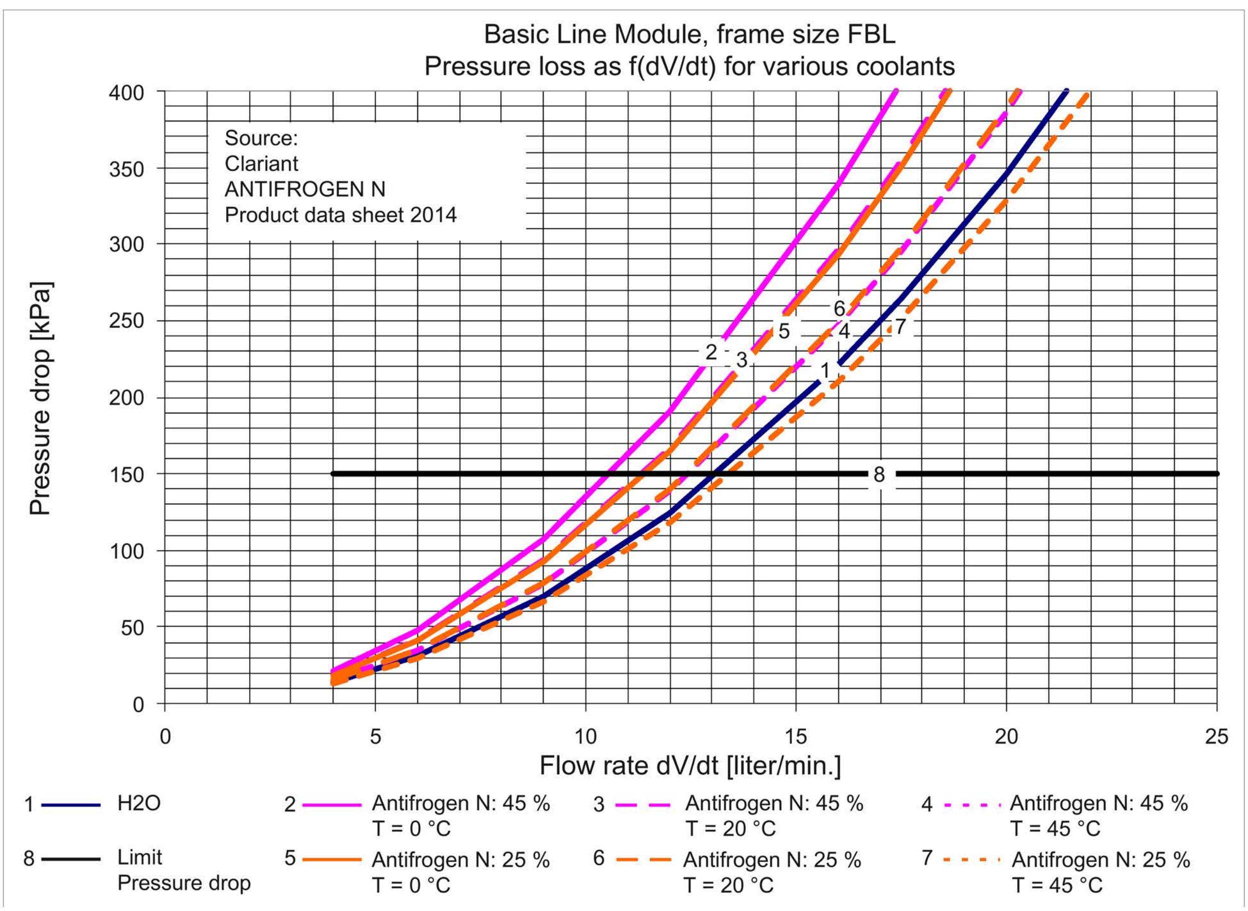


Figure 10-5 Pressure drop as a function of volumetric flow for Basic Line Module, frame size FBL

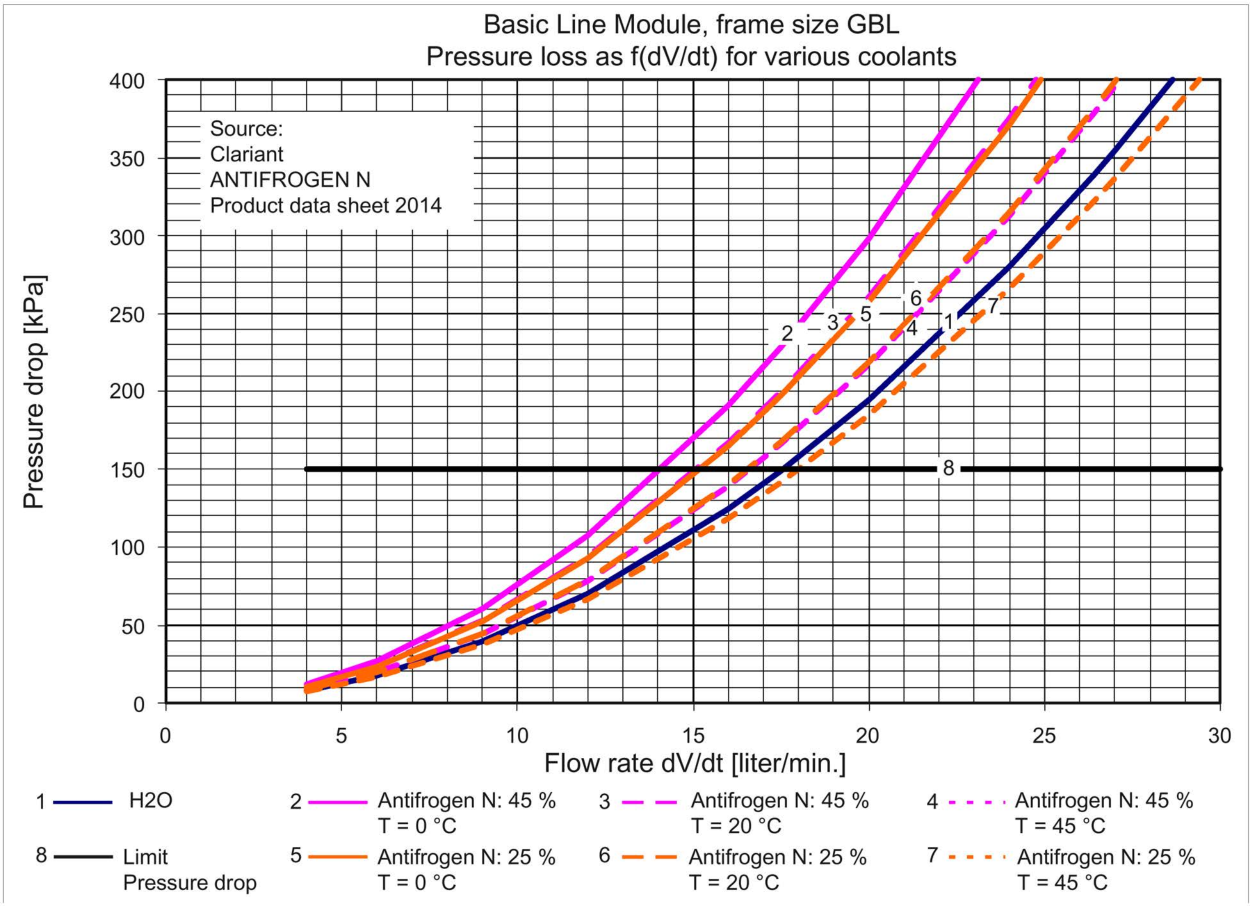


Figure 10-6 Pressure drop as a function of volumetric flow for Basic Line Module, frame size GBL

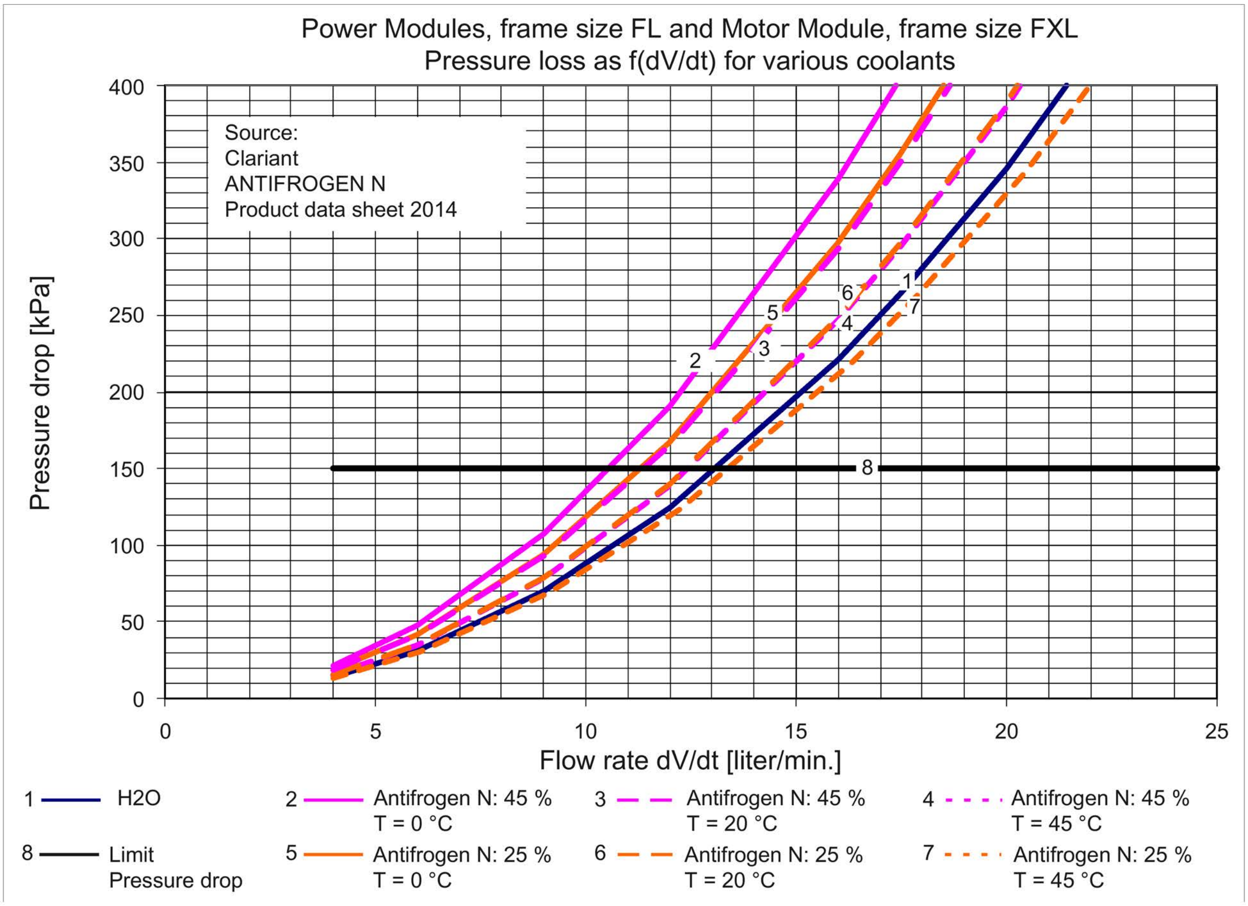


Figure 10-7 Pressure drop as a function of volumetric flow for Power Module frame size FL, and Motor Module frame size FXL

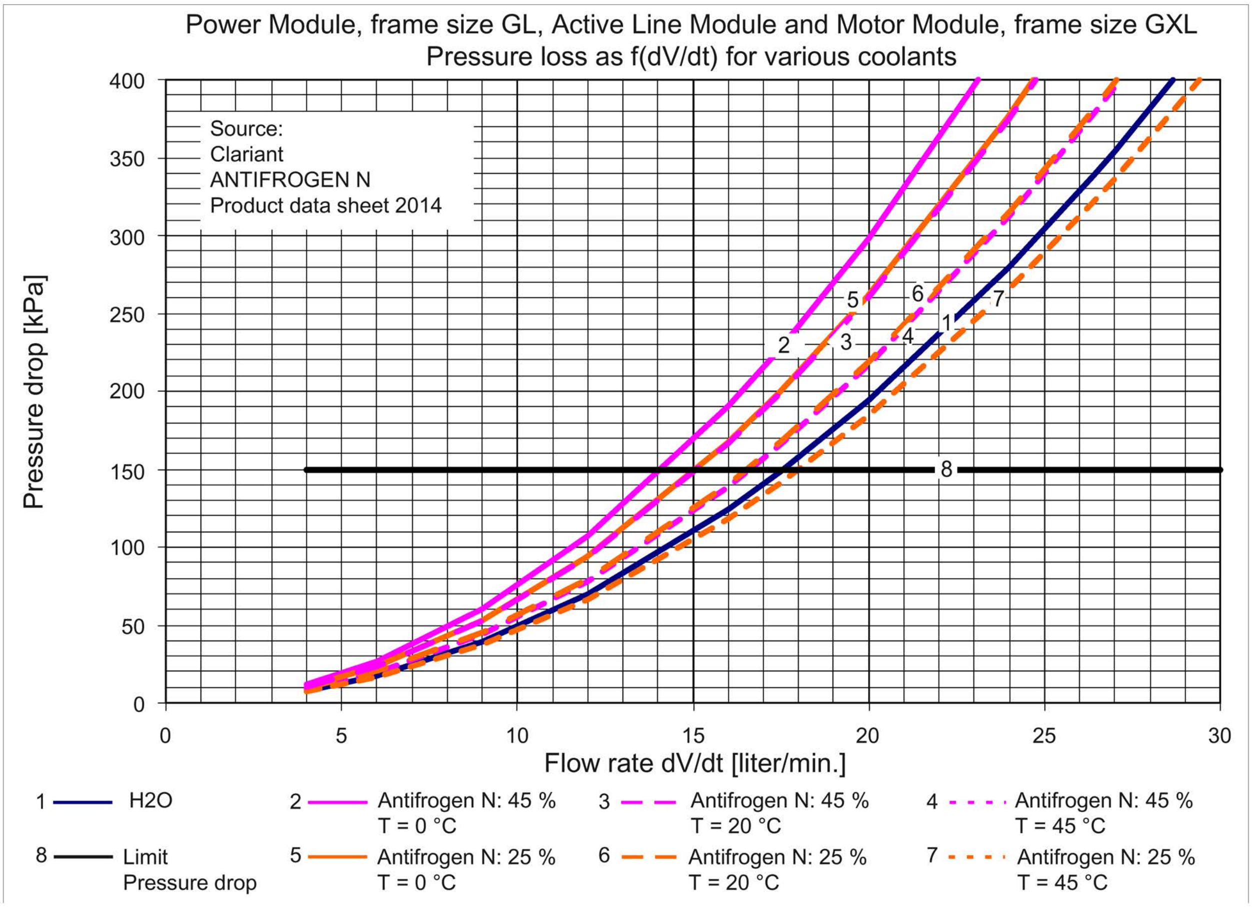


Figure 10-8 Pressure drop as a function of volumetric flow for Power Module frame size GL, Active Line Module and Motor Module frame size GXL

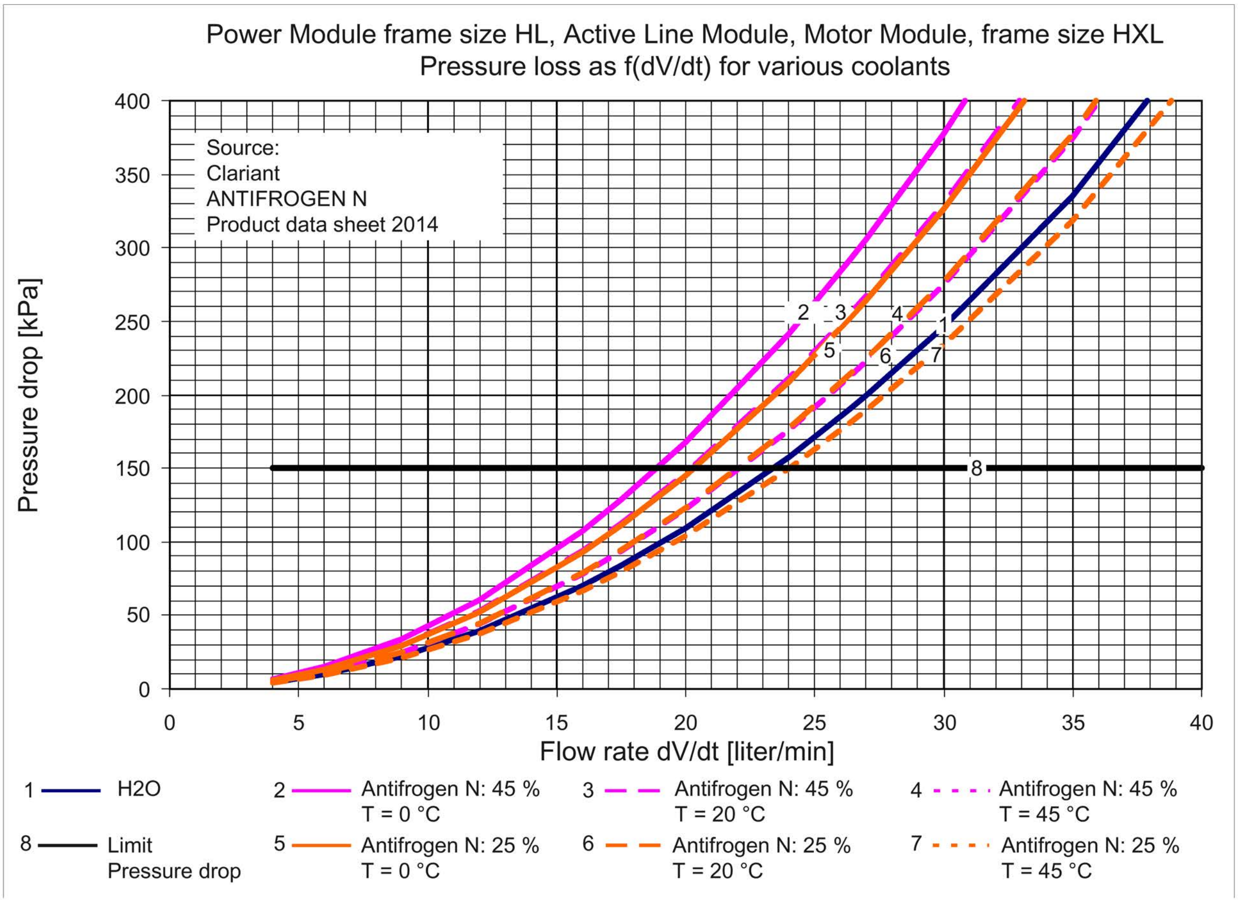


Figure 10-9 Pressure drop as a function of flow rate for Power Module frame size HL, Active Line Module and Motor Module frame size HXL

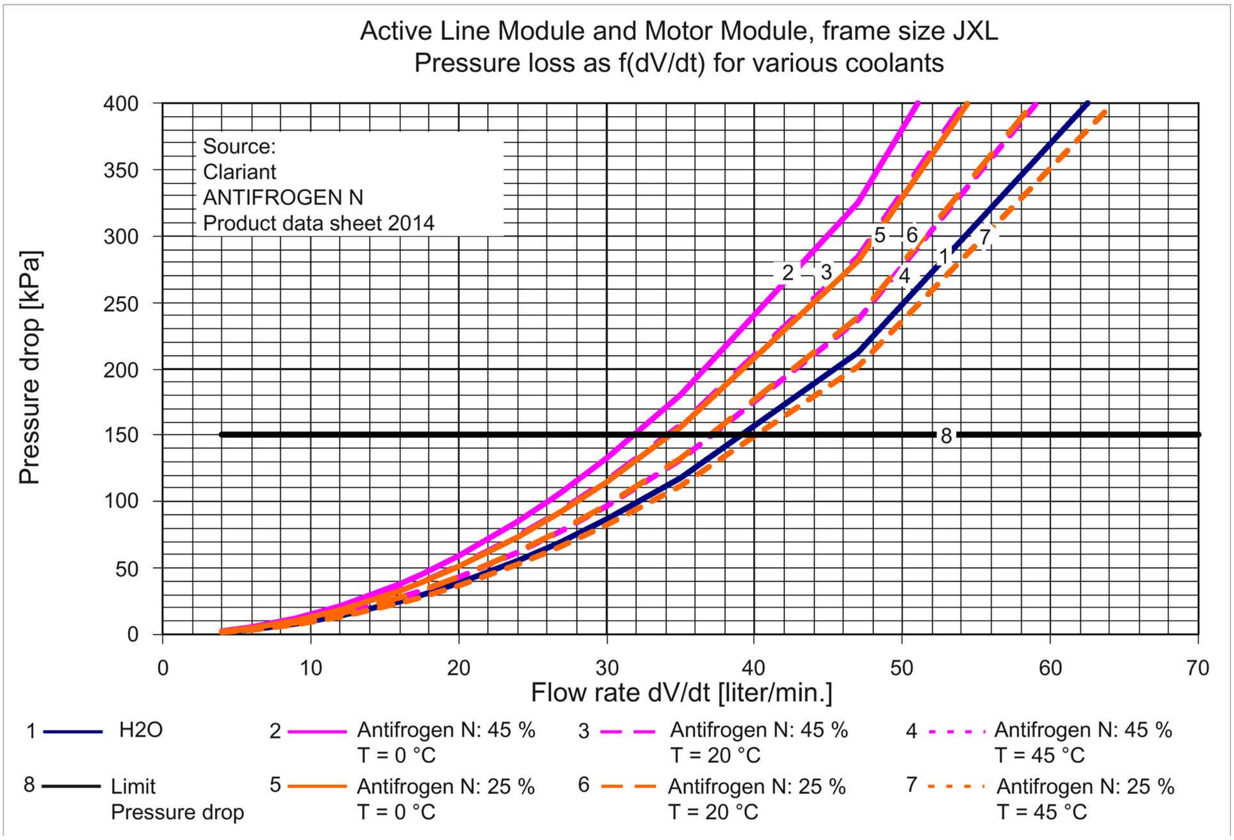


Figure 10-10 Pressure drop as a function of volumetric flow for Active Line Module and Motor Module, frame size JXL

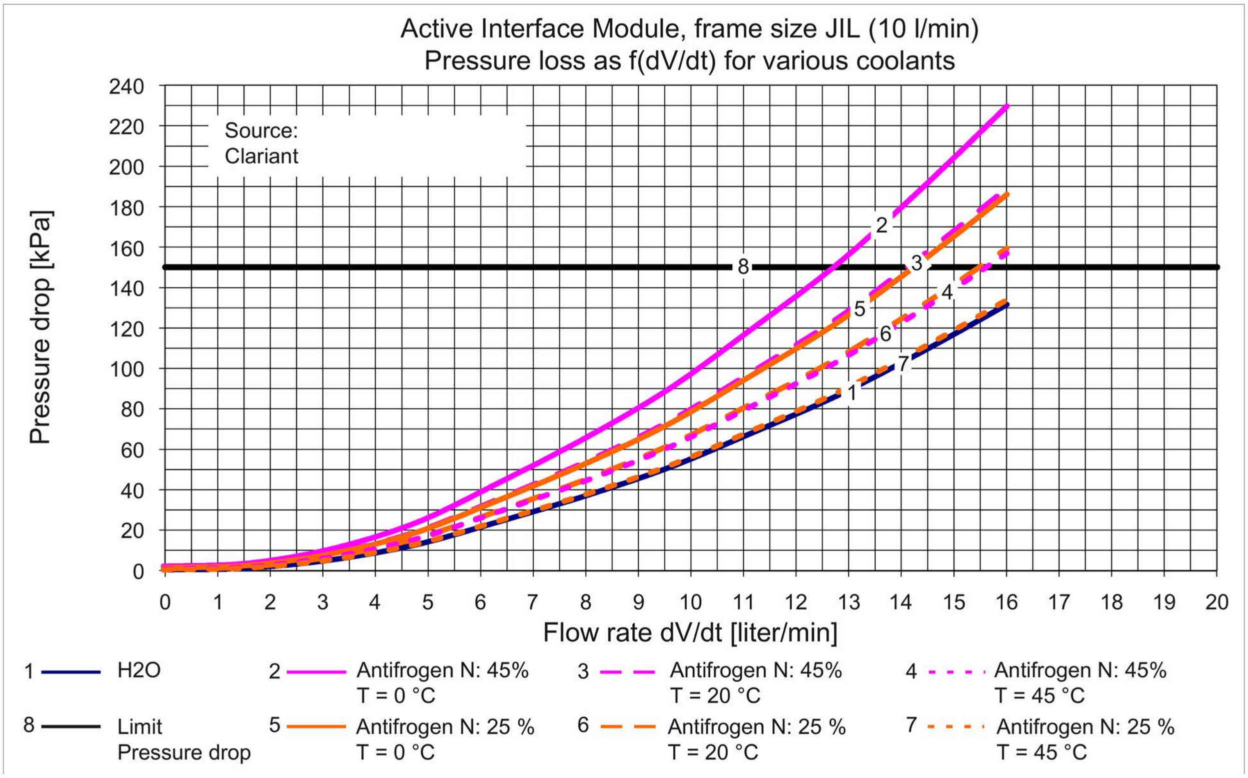


Figure 10-11 Pressure drop as a function of the flow rate for Active Interface Modules, frame size JIL, 10 l/min

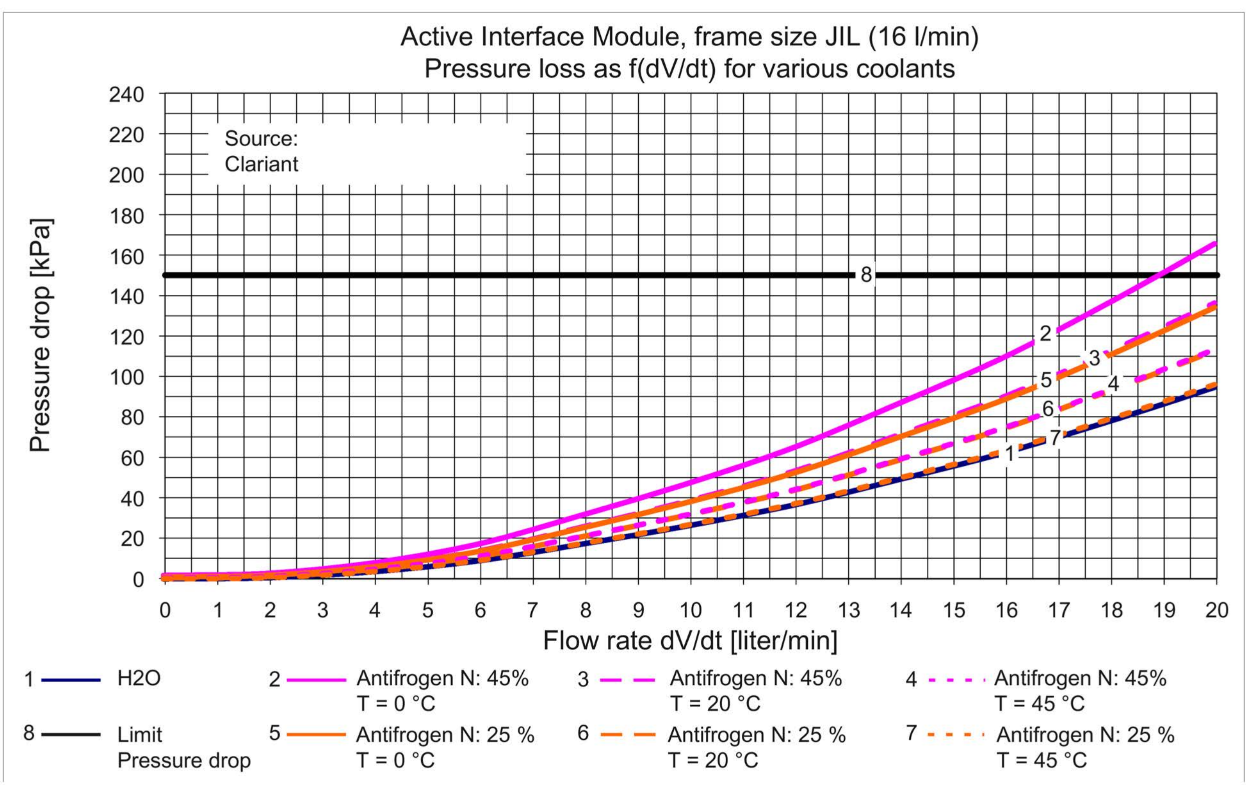


Figure 10-12 Pressure drop as a function of the flow rate for Active Interface Modules, frame size JIL, 16 l/min

Coolant mixture comprising Antifrogen L and water

The following diagrams show the pressure drop as a function of the volumetric flow rates for the different SINAMICS S120 liquid-cooled components when using Antifrogen L.

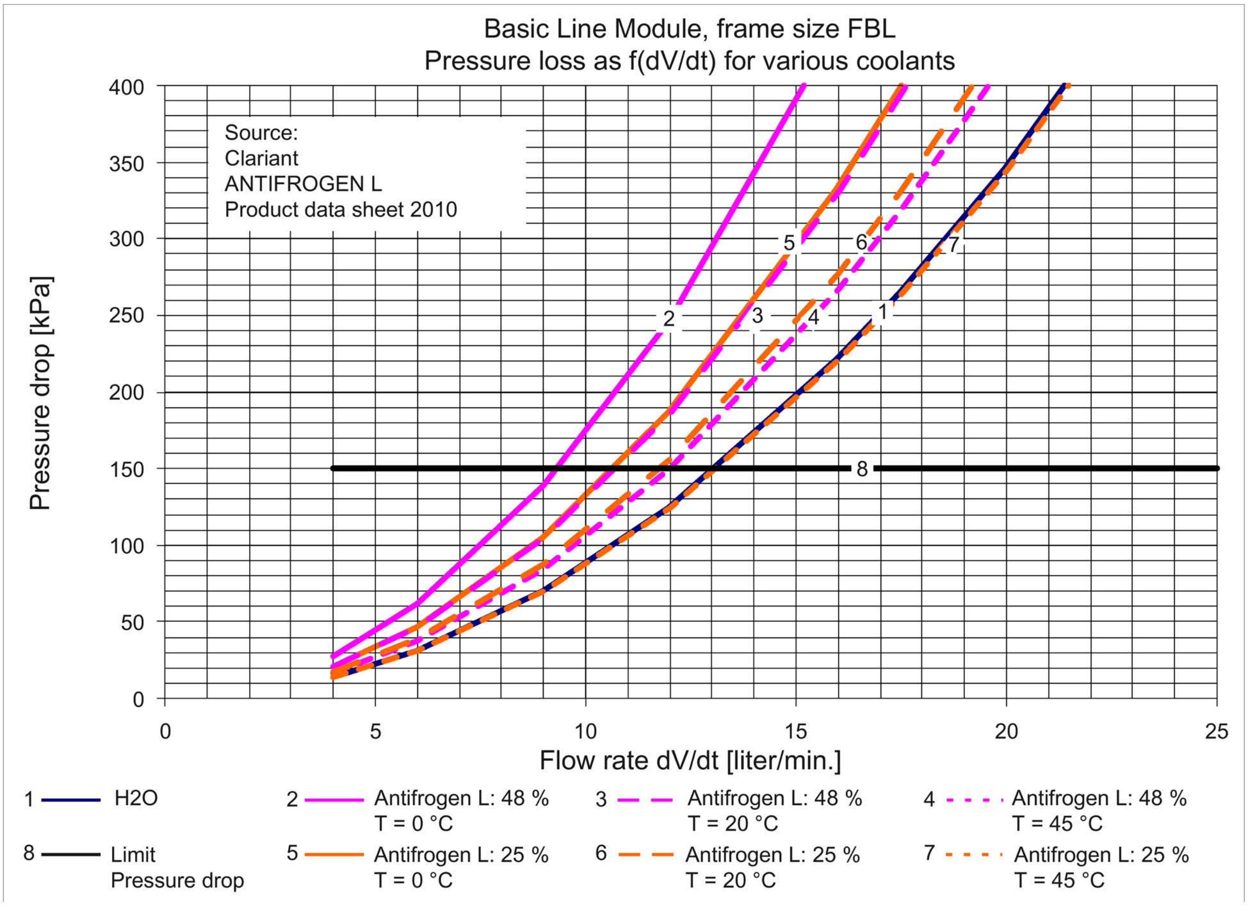


Figure 10-13 Pressure drop as a function of volumetric flow for Basic Line Module, frame size FBL

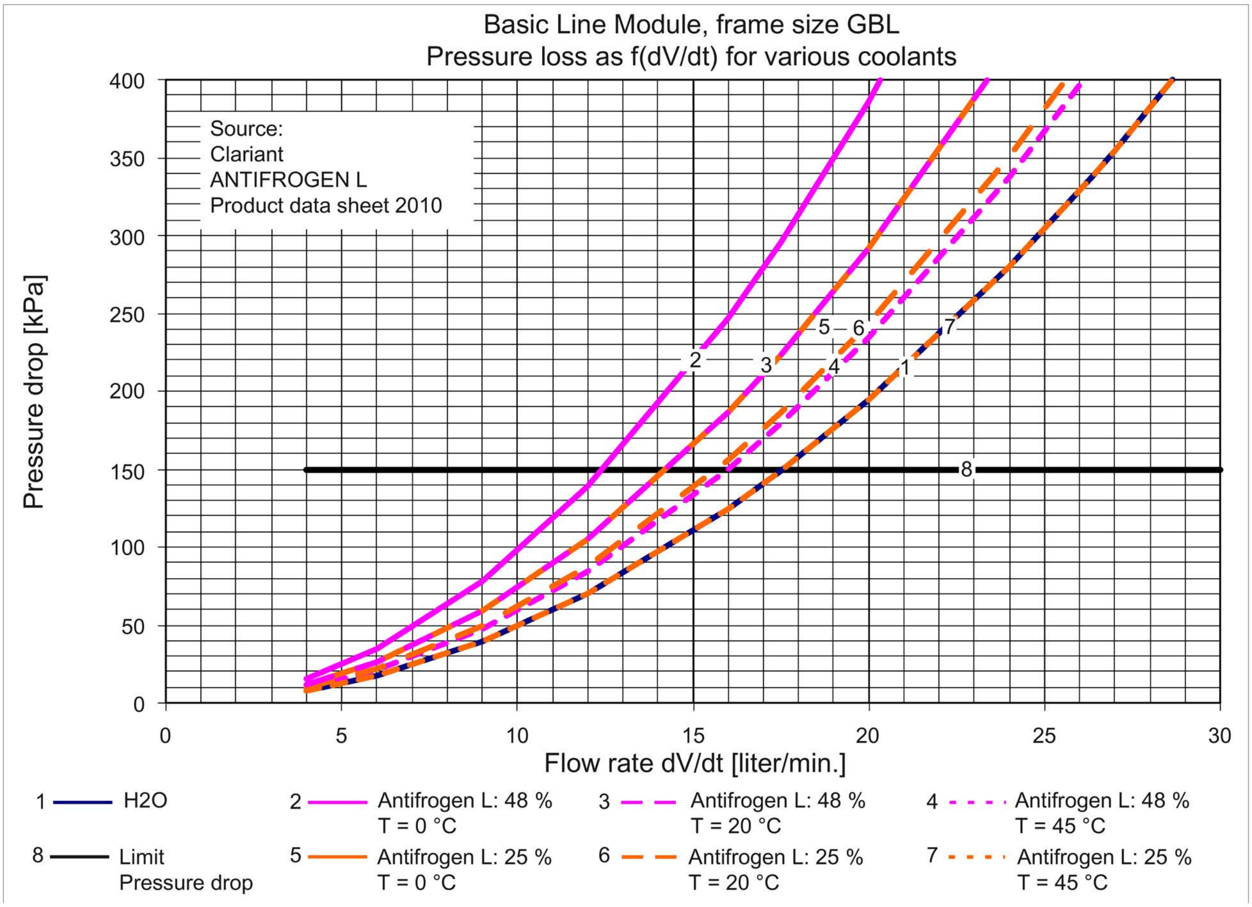


Figure 10-14 Pressure drop as a function of volumetric flow for Basic Line Module, frame size GBL

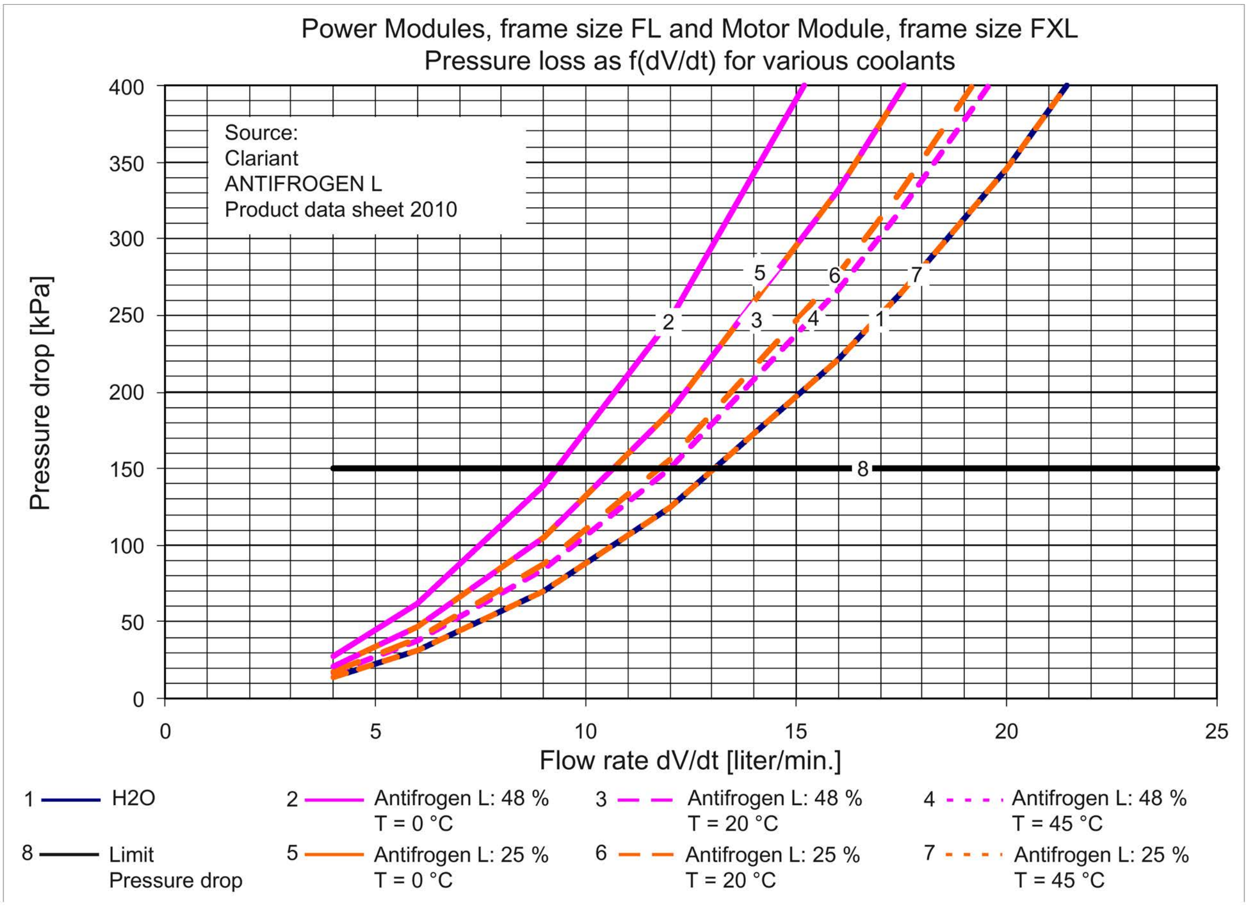


Figure 10-15 Pressure drop as a function of volumetric flow for Power Module frame size FL, and Motor Module frame size FXL

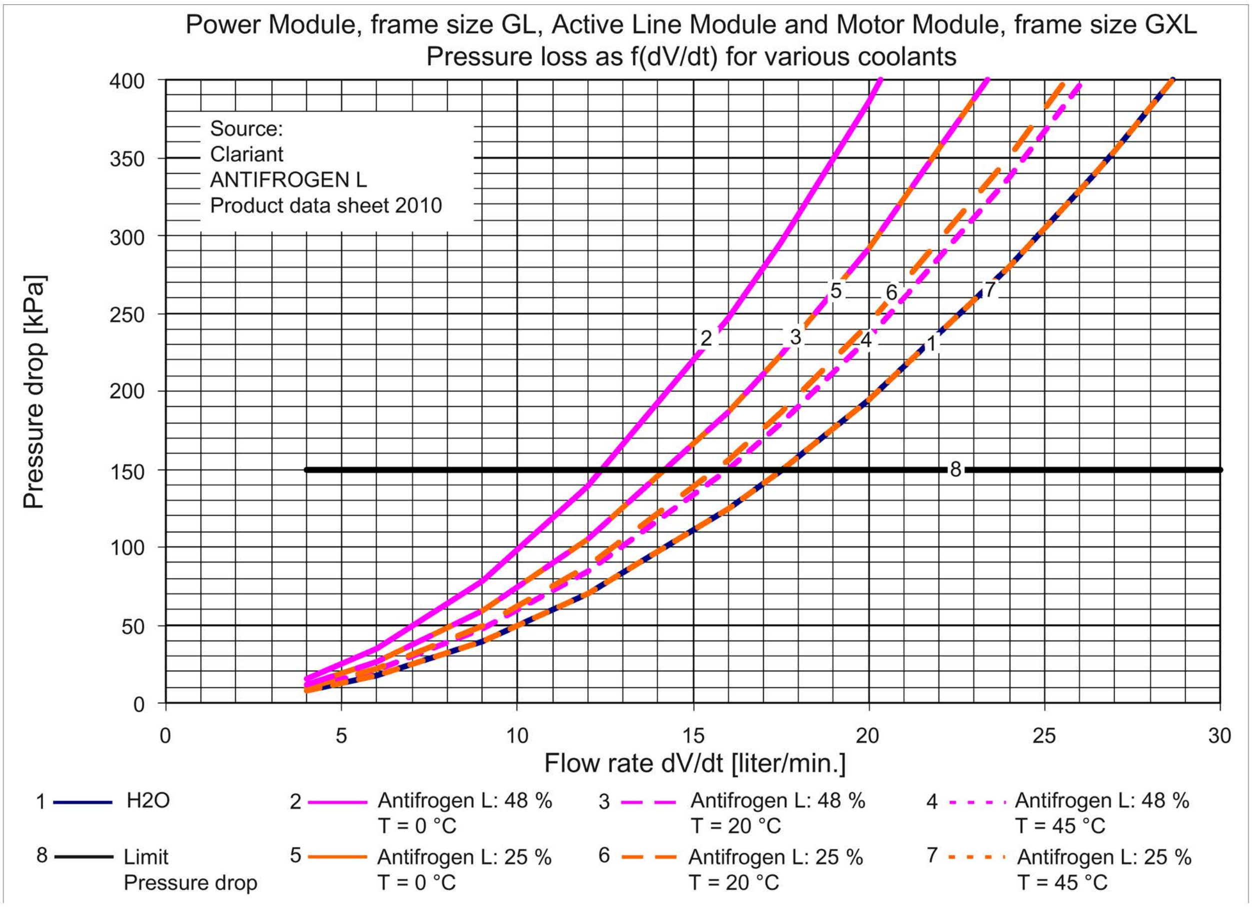


Figure 10-16 Pressure drop as a function of volumetric flow for Power Module frame size GL, Active Line Module and Motor Module frame size GXL

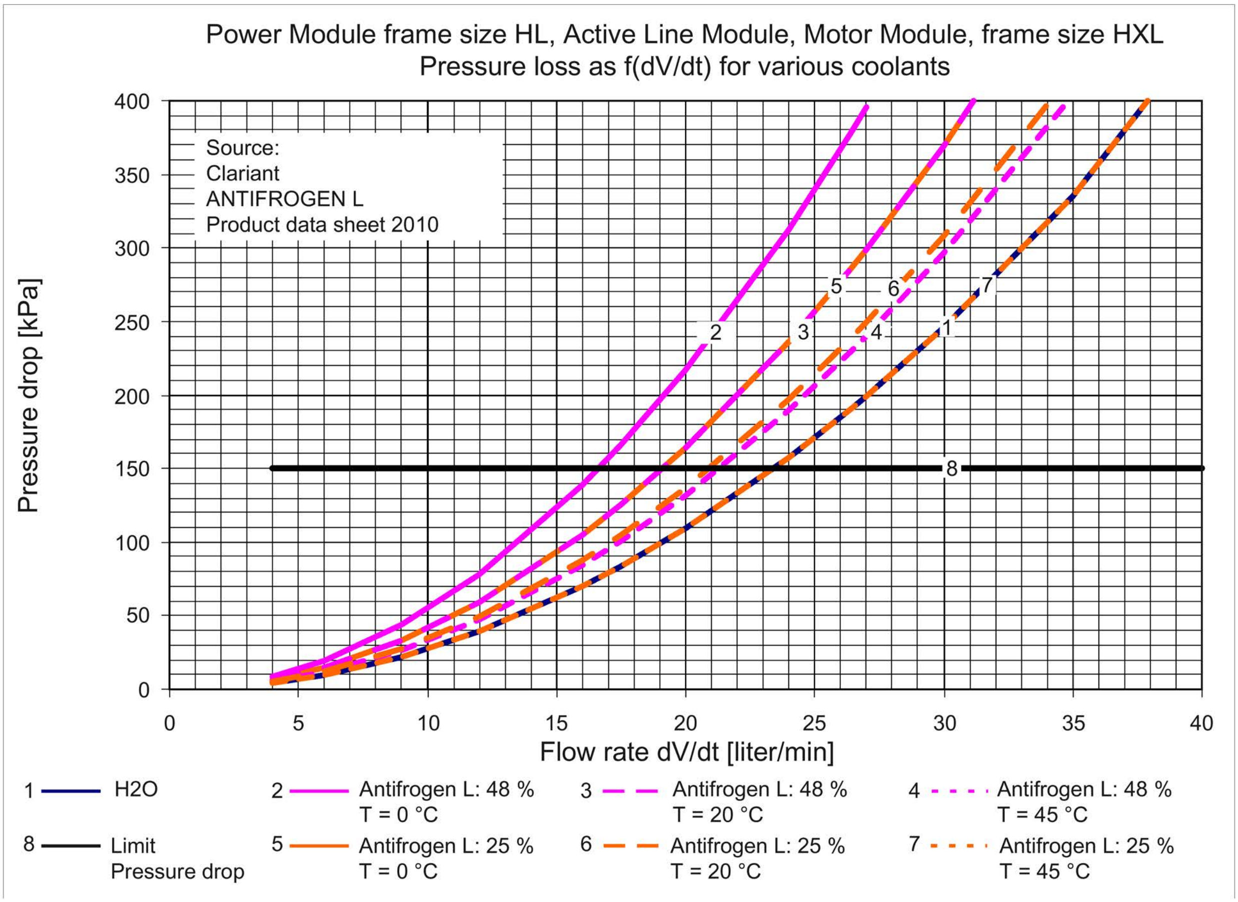


Figure 10-17 Pressure drop as a function of flow rate for Power Module frame size HL, Active Line Module and Motor Module frame size HXL

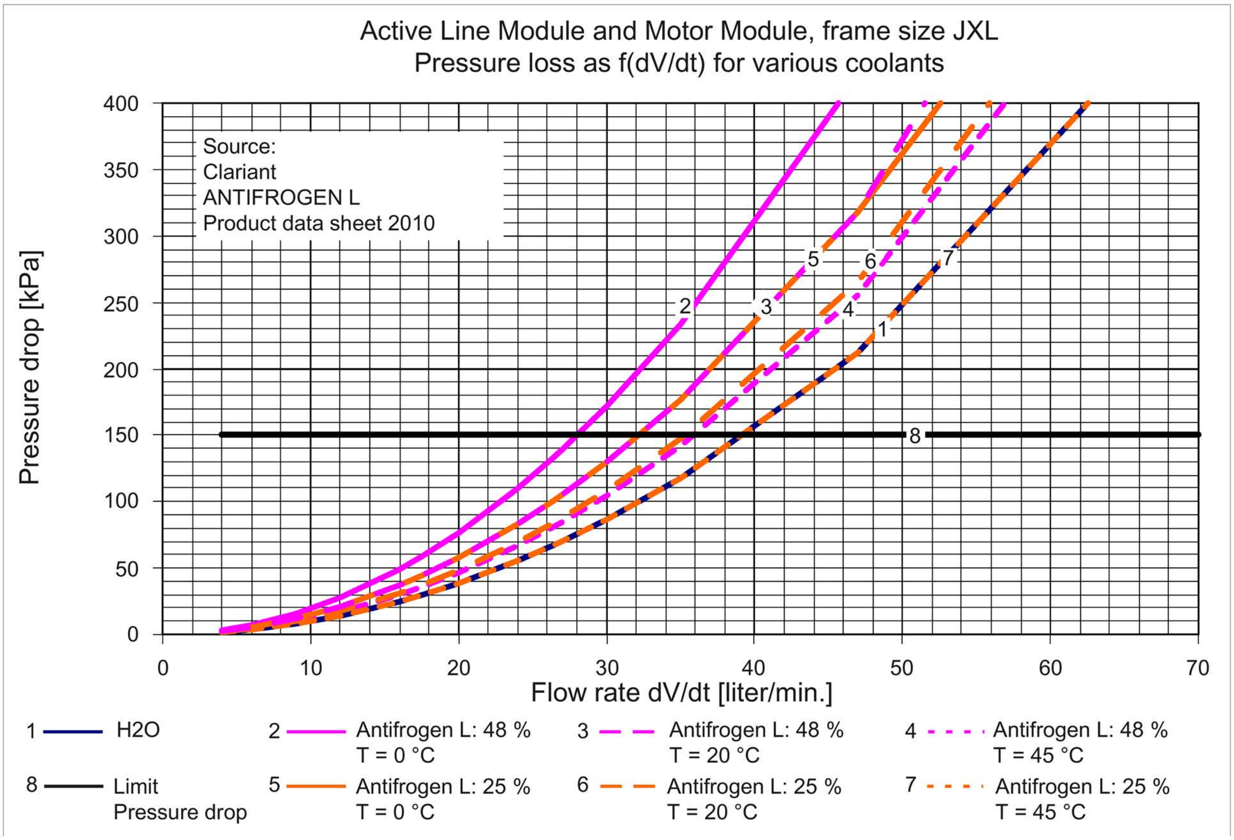


Figure 10-18 Pressure drop as a function of volumetric flow for Active Line Module and Motor Module, frame size JXL

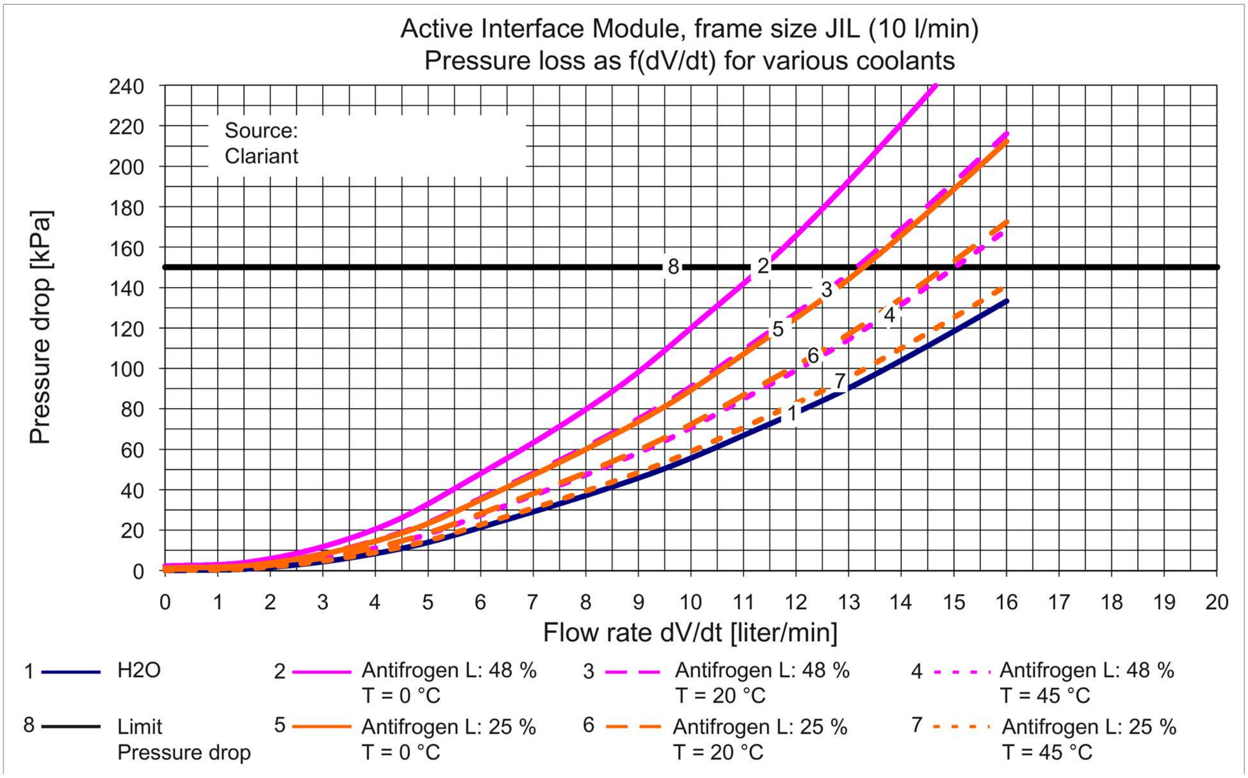


Figure 10-19 Pressure drop as a function of volumetric flow for Active Interface Module, frame size JIL, 10 l/min

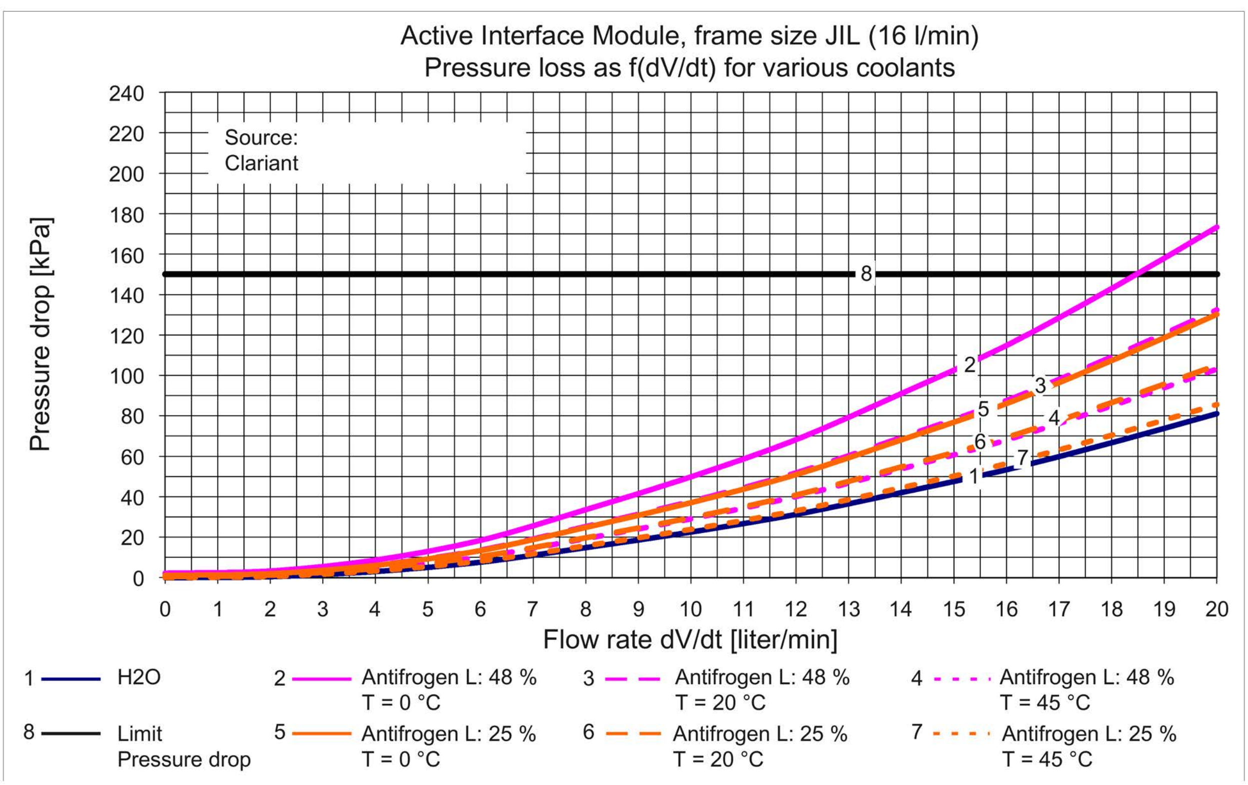


Figure 10-20 Pressure drop as a function of volumetric flow for Active Interface Module, frame size JIL, 16 l/min

Dimensioning the cooling circuit

Recommendation for dimensioning the cooling circuit:

The differential pressure between the intake and return lines should be selected so 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 devices connected in parallel, valves, dirt traps, pipe bends, etc.).

WARNING

Electric shock due to incorrectly routed coolant hoses

Incorrectly routed coolant hoses can come into contact with live parts and components and can result in danger to life as a result of electric shock.

- Route coolant hoses so that they cannot come into contact with live components. Maintain an insulating clearance (clearances and creepage distances) of >13 mm.
- Mechanically fasten the coolant hoses securely and carefully check them for leaks.
- The materials used in the cooling circuit must be carefully selected to ensure that they will not be corroded as a result of electrochemical reactions.

10.1.5 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. This must be realized using a copper bar or stranded copper with the appropriate conductor cross-sections to prevent electrochemical processes from occurring.

If the installation comprises more than one control cabinet, they must be bolted together to establish a good electrical connection (e.g. bolt cabinet cross-beams together directly at several points to establish a good electrical connection). This eliminates potential differences and thus the risk of electrochemical corrosion. A PE bar must be installed in every cabinet (including the cooling system) and the individual bars then interconnected.

10.2 Coolant definition

10.2.1 Coolant properties

The coolant must fulfill the following requirements over the long term.

The coolant comprises a coolant basis and an additional antifreeze, see Chapter "Antifreeze, biocides, inhibitors (Page 340)".

Table 10- 3 Coolant specifications for aluminum heat sinks

Basis coolant	**Distilled, demineralized water, completely desalinated water or de-ionized water with reduced electrical conductivity according to ISO 3696, quality 3** **or based on IEC 60993 with the following values:**
pH value	5.0 ... 8.0
Electrical conductivity	≤ 30 µS/cm (3 mS/m)
Components that can be oxidized as oxygen content	< 30 mg/l
Residue after vaporization and drying at 110 °C	< 10 mg/kg

Table 10- 4 Coolant specifications for stainless steel heat sinks 1)

Basis coolant	**Filtered drinking, process and cooling water with the following quality:**
Electrical conductivity	< 2500 µS/cm (250 mS/m)
pH value	6.5 ... 9.0
Total salt content TDS	< 1550 mg/l
Chloride ions (Cl^-)	< 250 mg/l
Sodium (Na^+)	< 200 mg/l
Sulfate ions (SO_4^{2-})	< 240 mg/l
Sulfide ions (S^{2-})	< 1 mg/l
Nitrate ions (NO_3^-)	< 50 mg/l
Iron	< 1 mg/l
Silicate	< 10 mg/l
Ammonia (NH_3), ammonium (NH_4^+)	< 1 mg/l
Total hardness of which, maximum: - calcium hardness - magnesium hardness - carbonate hardness	< 1.78 mmol/l (corresponds to 10 °dH) < 1.25 mmol/l (corresponds to 7 °dH or 50 mg/l calcium) < 1.43 mmol/l (corresponds to 8 °dH or 35 mg/l magnesium) < 0.45 mmol/l earth alkali equivalent (corresponds to 2.5 °dH) This corresponds to < 0.9 mmol/l hydrogen carbonate (HCO_3^-) or < 0.45 mmol/l carbonate (CO_3^{2-}).
Suspended solids / suspended substances: - solids - size of entrained particles	 < 340 mg/l < 100 µm

1) The requirements relating to the coolant are also applicable for the Power Modules with a copper-nickel alloy heat exchanger.

Note

Suitable coolant

Distilled, demineralized water, also known as de-ionized water, completely desalinated water or Deionat, is not suitable by itself as coolant.
It can be used as basis when using antifreeze.

Note

Analyzing the coolant

To analyze the coolant, it is recommended that you contact a coolant manufacturer.

The coolant should be checked 3 months after the cooling circuit is filled for the first time and, subsequently, once a year.
The cooling circuit must be cleaned and refilled if the coolant becomes cloudy, discolored or becomes contaminated by mold spores.

To better explain the coolant specifications in this document, a number of problems which can be encountered if these specifications are ignored are listed in the table below.

Table 10- 5 Substances which can cause irreparable heat sink damage

Problem	**Possible causes/consequences** **Properties of the coolant or limit value exceeded**	**Countermeasure**
Increase corrosion, deposits	Sea water	Do not use sea water!
	Water compliant with limit values	Use an appropriate concentration of antifreeze, cooling circuit must be equipped with a pressure-relief valve.
	Chloride	Use the specified coolant basis and the appropriate concentration of antifreeze.
	Sulfate	Dilute with de-ionized water until the limit value is reached.
Semi-open cooling circuit	Ingress of oxygen	Use a closed cooling circuit equipped with a pressure relief valve, the specified coolant basis and the appropriate concentration of antifreeze.
Erosion/particles	Suspended solids (e.g. sand)	Rinse cooling circuit without SINAMICS devices. Use a dirt trap (=strainer, fine filter).
Whitish deposits	Excessively high total hardness	Use the specified coolant basis and the appropriate concentration of antifreeze.
Electro corrosion	Voltage potential can be identified Inadequate equipotential bonding	Connect all components to equipotential bonding system. Device connected using a high ohmic hose.
Deposits, residues, algae	Biological contamination	Use of biocides, dirt traps (=strainers, fine filters).
	Oil residue	Use the appropriate concentration of antifreeze, flush cooling circuit without SINAMICS.
	Mechanical contamination	Flush the cooling circuit without SINAMICS. Use a dirt trap (=strainer, fine filter).

10.2.2 Antifreeze, biocides, inhibitors

Table 10- 6 Overview and application of approved coolant additives

	Application with SINAMICS S120, liquid-cooled, with aluminum heat sink	**Application with SINAMICS S120, liquid-cooled, with stainless steel heat sink**	**Please note the following in particular**
Antifreeze/inhibitor	Antifrogen N, 25 % < X ≤ 45 % Antifrogen L, 25 % < X ≤ 48 % Dowcal 100, 25 % < X ≤ 45 %	Antifrogen N, 25 % < X ≤ 45 % Antifrogen L, 25 % < X ≤ 48 % Dowcal 100, 25 % < X ≤ 45 %	For Antifrogen L, for the same antifreeze protection, a higher concentration is required than for Antifrogen N
Biocide*	Yes Antifrogen N, minimum quantity 25% Antifrogen L, minimum quantity 25 % Dowcal 100, minimum quantity 25 %	Yes Antifrogen N, minimum quantity 25% Antifrogen L, minimum quantity 25 % Dowcal 100, minimum quantity 25 %	Cooling circuit with open pressurizer
Antifreeze + biocide*	Antifreeze already has a biocidal effect in the minimum concentration specified above.	Antifreeze already has a biocidal effect in the minimum concentration specified above.	
Inhibitor	Required Fuchs ANTICORIT S 2000 AA mixed with a ratio of 3 ... 5 %	Not required	

* Effectiveness regarding the growth of microorganisms

Note

Combination of different heat sinks in one common cooling circuit

For a combination of liquid-cooled devices with aluminum heat sinks and stainless-steel heat sinks, then the specifications for the aluminum heat sinks always apply.

⚠ CAUTION

Risk of injury caused by splashing coolant

The coolant is harmful to eyes and skin and can damage surfaces.

If the coolant escapes intermittently, coolant spray can come into contact with your skin or eyes.

- Therefore, wear appropriate protective clothing when carrying out any work on the converter. However, if your eyes or skin do come into contact with coolant, rinse the affected area thoroughly with tap water as soon as possible. If coolant has escaped, remove the liquid from the affected surfaces.
- Please refer to the EU safety data sheet of the coolant manufacturer.

Antifreeze

Only the following agents can be used as antifreeze:

- Antifrogen N (chemical basis: Ethylene glycol, manufacturer: Clariant) with a percentage X of 25% < X ≤ 45% is the anti-freeze used. Coolants containing 45% Antifrogen N provide protection down to -30° C.
- Antifrogen L (chemical basis: Propylene glycol, manufacturer: Clariant) with a percentage X of 25% < X ≤ 48% is the anti-freeze used. Coolants containing 48% Antifrogen L provide protection down to -30° C.
- Dowcal 100 (chemical basis: Ethylene glycol, manufacturer: DOW) used with a percentage X of 25 % < X ≤ 45 %. A Dowcal 100 percentage of 45 % provides frost protection down to -30 °C.

All agents contain anti-corrosion inhibitors which permanently protect the metal in the cooling system against corrosion.

It is particularly important to ensure that the percentage of antifreeze when topping up the cooling system always corresponds to the minimum quantity, otherwise the mixture becomes corrosive.

NOTICE

Material damage caused by incorrectly adding antifreeze

Incorrectly adding antifreeze to the cooling circuit can result in material damage caused by corrosion and cooling circuit leaks.

- Always mix the coolant outside the cooling circuit before filling it.
- Do not add the individual cooling components one after the other.

NOTICE

Damage caused by leaks if the appropriate concentration of antifreeze is not used

An insufficient concentration of antifreeze can result in material damage caused by corrosion and cooling circuit leaks.

- Regularly check the antifreeze concentration. Add the appropriate amount of antifreeze when required.

NOTICE

Material damage caused by mixing different antifreeze products

Incorrectly adding antifreeze to the cooling circuit can result in material damage caused by corrosion and cooling circuit leaks.

- Do not use different antifreeze products in a common cooling circuit.
- When changing the antifreeze, you must first empty the cooling circuit and flush it out before filling the new coolant. To do this, refer to the instructions provided by the manufacturer of the antifreeze.

Biocide

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 when the appropriate quantity of antifreeze 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. We recommend that a biocide is used depending on the ambient conditions – and that the compatibility with the components in the cooling circuit is carefully checked.

Note

Determining the appropriate biocide

The type of bacteria determines the biocide.

The concentration must be adapted to be in compliance with what the manufacturer recommends.

It is not permissible that biocides and antifreeze are mixed.

Antifreeze already has a biocidal effect in the minimum concentration specified above.

Inhibitors

When using one of the approved antifreezes, an inhibitor is already included with the specified concentration.

When operated without antifreeze, then Fuchs ANTICORIT S 2000 AA inhibitor must be added with a ratio of 3 ... 5 %.

10.3 Materials

The following table lists a wide variety of materials and components which are permissible or not permissible for use in a cooling circuit.

Table 10- 7 Materials and components of a cooling circuit

Material	Used as	Application with SINAMICS S120 liquid-cooled
Aluminum	Pipes, valves and fittings	Not recommended as a result of potential material erosion.
Zinc	Pipes, valves and fittings	Do not use zinc!
Brass	Pipes, valves and fittings	Can be used in closed circuits with antifreeze.
Nickel	Nickel solder in the heat exchanger	Can be used in closed circuits with antifreeze.
Copper	Pipes, valves and fittings	Can be used only in closed circuits with antifreeze/inhibitor in which the heat sink and copper component are separated (e.g. connection hose on devices). Copper should not be used or be restricted to the absolutely essential minimum.
Common steel (e.g. St37)	Pipes	Permissible in closed circuits with antifreeze, check for oxide formation, inspection window/sight glass 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)	Pipe, valves and fittings, heat exchanger	Can be used for drinking or tap water with a chloride content up to <250 mg/l, suitable according to definition in Chapter "Coolant properties (Page 338)".
High-alloy steel, Group 2 (V4A)	Pipe, valves and fittings, heat exchanger	Can be used for drinking or tap water with a chloride content up to <500 mg/l, suitable according to definition in Chapter "Coolant properties (Page 338)".
Installation made of different materials (mixed installation)	Pipe, valves and fittings, heat exchanger	Do not use a mixed installation.
PE (polyethylene)	Pipes	Do not use PE (polyethylene) for water pipes as they have an excessively high coefficient of expansion. Pipes manufactured out of PP-T are suitable and can be used.
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 resistance >10^9 Ohm/m, (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	Fix with clamps conforming to DIN 2817, available e.g. from Telle.

Note

Checking the hose lines

The inspection intervals depend on the prevailing ambient conditions.

The following points should be noted for the coolant hoses:

- Damage through abrasion points
- Embrittlement (e.g. forming of cracks)
- Leaks
- The hose slipping out of the coupling
- Deformations that do not comply with the natural shape of the hose (e.g. separation of layers and blistering)
- Exceeding the storage and use times
  In accordance with the accepted rules and standards, we recommend a testing cycle of five years with the appropriate test pressure (twice the operating pressure).

10.4 Anti-condensation measures

The customer must take measures to protect the devices against condensation.

If condensation occurs in the device, it must be de-energized and dried before switching on again.

Condensation normally occurs at the intake connection of the devices.

Condensation occurs when the coolant intake temperature is significantly lower than room temperature (air temperature in the control cabinet). Condensation in the control cabinet can also occur if components with residual heat can increase the temperature inside the control cabinet as a result of the cooling water temperature after shutdown (e.g. filter reactors). To avoid this, for components such as these, it must be ensured that the cooling system runs-on for an adequately long time. 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 greater than or equal to the dew point temperature.
The coolant temperature must be controlled according to the following table.

Table 10- 8 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.

10.5 Examples of coolant control

With liquid-cooled devices, warm ambient air can condense on the cold surfaces of heat sink. The resulting condensate can cause electrical damage such as leakage current bridges and flashovers. Condensation must be avoided by means of an appropriate temperature of the coolant by always maintaining the temperature of the heat sink above the dew point of the ambient air. This can be achieved either by a permanently set and correspondingly high coolant temperature, or by controlling the temperature of the coolant in accordance with the ambient air and the relative humidity.

A temperature control of the coolant adds a temperature difference T_L of approximately 1 K ... 3 K above the condensation temperature to the ambient temperature T_U and forms the setpoint T_{set} for the coolant temperature, see following figure. The control compares the temperature setpoint with the actual value at the coolant inlet T_{act}, which can be accessed via parameter r0037[19]. The coolant temperature control is performed by the three-step controller with the aid of the servo motor connected to the 3-way valve.

The three-step controller has three switch positions for control of the servo motor:

- +Y1 for forward motion
- 0 for standstill
- –Y1 for backward motion

When the control deviation x exceeds the upper switching hysteresis x_u, the servo motor is switched on, when the deviation falls below the lower switching hysteresis x_l, the servo motor is switched off. When the control deviation falls below the switching hysteresis in the negative direction, the servomotor runs in the opposite direction until the control deviation has been cleared and the servomotor is switched off.

From the control point of view, the servomotor at a 3-way valve has an I behavior. The feedback shown as dotted line is recommended for a stable control with P response.

The 3-way valve is controlled so that the path B-AB is opened when the coolant is cold. The coolant is led past the heat exchanger and the heat sink is heated by the switching losses of the power semiconductors. When the coolant inlet temperature T_{act} reaches the setpoint, the three-step controller opens the 3-way valve and the path A-AB.

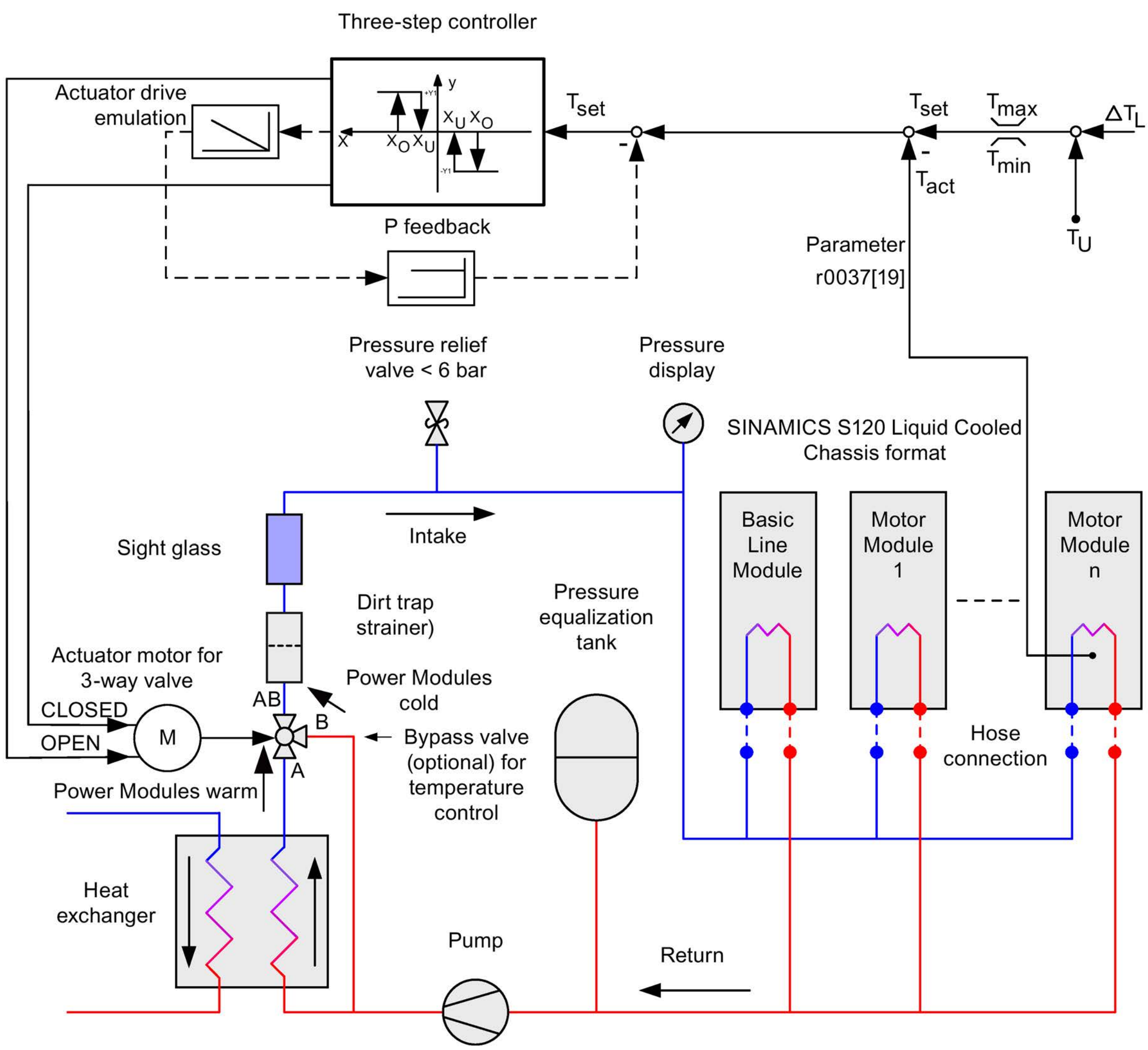


Figure 10-21 Principle of a flow control with 3-way valve as protection against condensation

Example of control of the coolant temperature depending on the relative humidity and the ambient temperature

The temperature correction value delta T_L (ΔT_L) is added to the ambient temperature to maintain the temperature setpoint (T_{set}) for the coolant. The value depends on the relative humidity plus 2 °C above the dew point.

Coolant temperature setpoint = ambient temperature + ΔT_L

Table 10- 9 ΔT_L depends on the humidity

Relative humidity [%]	20	30	40	50	60	70	80	85	90	95	100
[° C] 1)	25	18	15	12	9	7	4	3	2	1	0
Delta T_L [° C] 2)	-23	-16	-13	-10	-7	-5	-2	-1	0	+1	+2

1) Temperature difference to the dew point

2) Condensation point plus 2 °C

If delta T_L (ΔT_L) is now added to the ambient temperature this provides the setpoint for the coolant temperature.

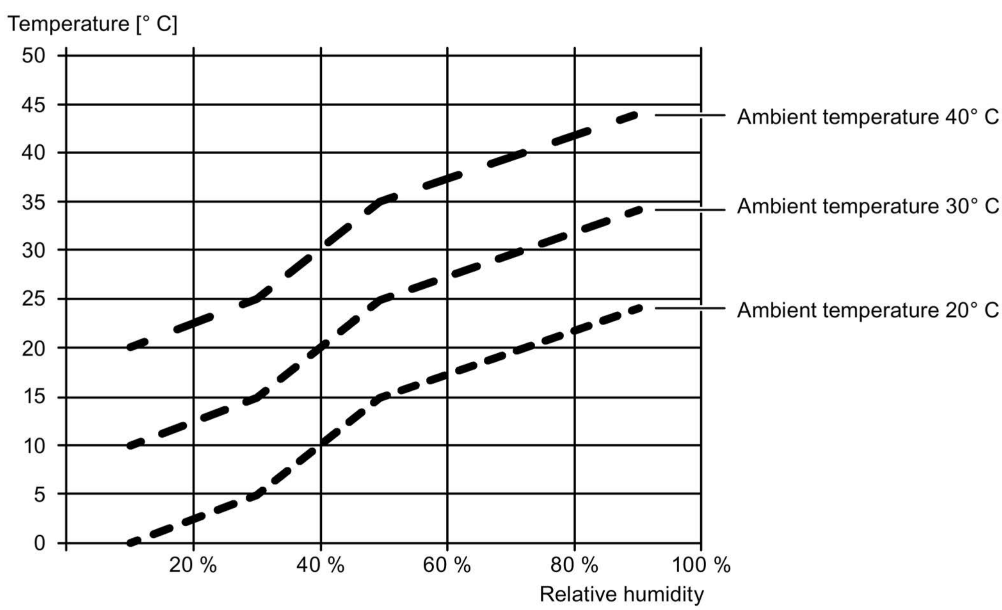


Figure 10-22 Examples of the minimum coolant temperature setpoint depending on the humidity for ambient temperatures of 20, 30 and 40 °C (dew point plus 2 °C)

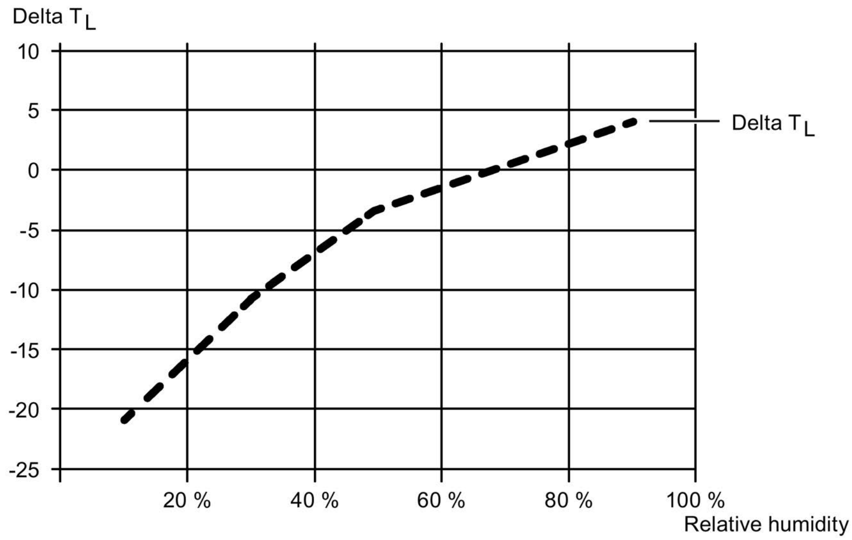
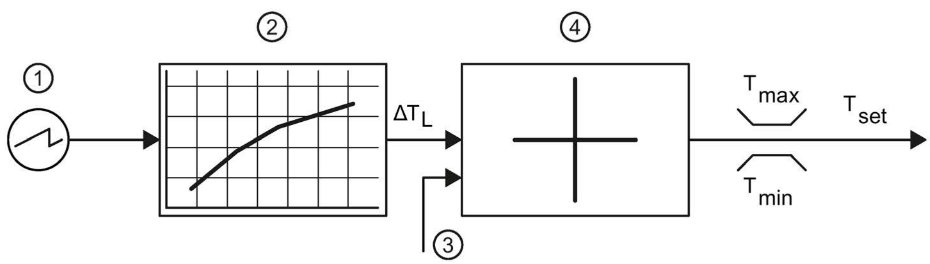


Figure 10-23 Curve to determine the temperature ΔT_L

The temperature ΔT_L can be determined according to the characteristic based on the measured humidity.

Example of the formation of the temperature setpoint of the coolant



① Actual humidity value
② Humidity characteristic – temperature difference
③ Actual ambient temperature value
④ Adder for temperatures

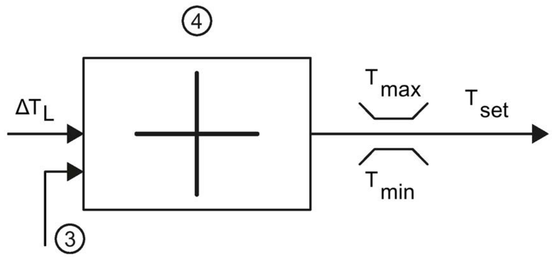
Figure 10-24 Formation of the coolant temperature setpoint

Tmin should be limited to plus 10 °C, Tmax to 50 °C.

Sensors for simultaneous measurement of the relative humidity and temperature can be supplied, for example, by JUMO.

Examples of the coolant temperature setpoint depending on the ambient temperature

This method is based on a high humidity (95%). The advantage is that only the ambient temperature and the coolant temperature are required as actual values for the coolant temperature control. A sensor for the humidity is not required.



③ Actual ambient temperature value

④ Adder for temperatures

Figure 10-25 Formation of the setpoint depending on the ambient temperature

The temperature difference ΔT_L should be 2 °C. Condensation is therefore excluded for a humidity up to 95%.

SIEMENS cooling units

Cooling units (Heat Exchanger Modules) as cabinet units with cooling capacities of 32, 48, 72 and 120 kW can be ordered from Siemens.

Please contact your local Siemens office or your local sales office.

The cooling units in a Siemens control cabinet have a closed-control unit with a bypass valve as protection against condensation. The risk of condensation can be minimized by manually setting the coolant temperature using the Siemens control. Recognition of the danger of condensation due to too high an ambient temperature in relation to the coolant temperature is integrated as a warning to be issued.

10.6 Connection methods

The electrical connections on the SINAMICS S120 liquid-cooled devices must be made with cables having the cross-section stipulated in the technical data for the relevant device.

The coolant connection is made using 3/4" couplings.

A connection with a defined cross-section reduction (throttle) is mounted at the intake to the devices. As a consequence, the defined 70 kPa pressure drop is kept constant for the particular flow rate.

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 0.5 m in length (total of supply and return lines).

The coolant hoses should be connected before the devices are mounted.

Figure 10-26 Coolant connections

10.7 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, frame sizes FL and GL, on Active Interface Module, frame size JXL, on Active Line Modules, frame size JXL and on Motor Modules, frame sizes FXL and GXL before they are filled for the first time.
- The heat sinks on Basic Line Modules, frame sizes FBL, GBL, on Active Line Modules, frame sizes HXL, JXL and on Motor Modules, frames sizes HXL, JXL must be vented before they are filled for the first time.
  - For this purpose, the devices 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 device 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 venting and re-inserted after venting.
  - The positions of vent valves and hoses are shown in the interface overviews of the various components.

Venting the heat sink with removal of the front electronics fan

On the following Basic Line Modules the front electronics fan must be removed in order to operate the vent valve:

- 6SL3335-1TE41-2AA3 (380 to 480 V, 1220 A, 600 kW)
- 6SL3335-1TE41-7AA3 (380 to 480 V, 1730 A, 830 kW)
- 6SL3335-1TG41-3AA3 (500 to 690 V, 1300 A, 1100 kW)
- 6SL3335-1TG41-7AA3 (500 to 690 V, 1650 A, 1370 kW)

The necessary steps following removal of the top housing cover are shown in the illustration below.

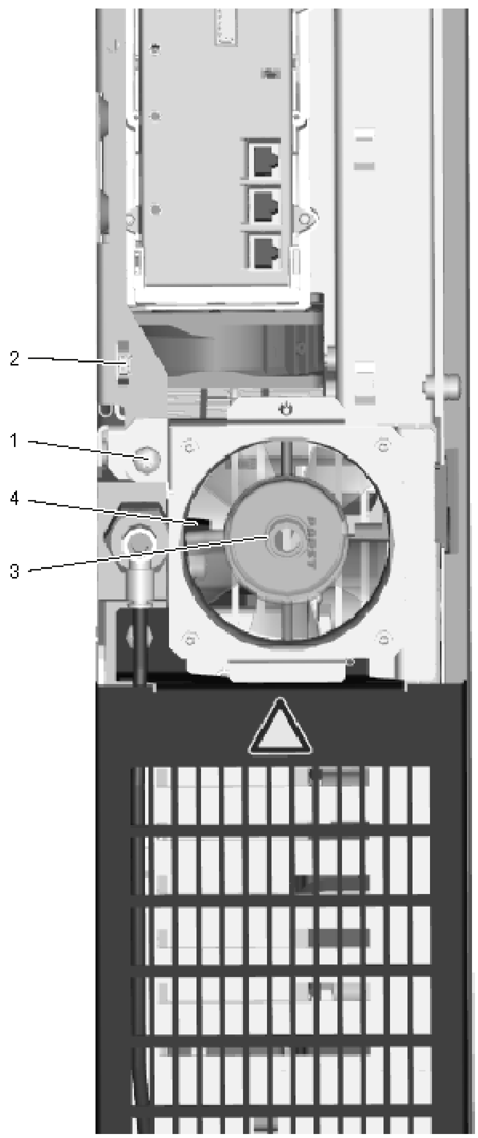


Figure 10-27 Removing the electronics fan to actuate the vent valve

The numbering below corresponds to the numbers in the figure.

1. Remove the lower fastening screw for the plug-in electronics module / the front electronics fan.
2. Detach the plug-in connection of the power cable for the front electronics fan.
3. Tilt the electronics fan forward and remove it.
4. The vent valve (behind the electronics fan) is now freely accessible.

WARNING

Electric shock due to discharge of coolant

A discharge of coolant can result in short-circuits with damage and malfunctions up to death or serious injury.

- Make sure that liquid-cooled devices are 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 during venting.
- Switch off immediately if there are any leaks causing liquid to escape (drips or pools).

NOTICE

Failure of the cooling due to air bubbles in the cooling circuit

Air bubbles in the cooling circuit impair the correct cooling function.

- Make sure there are no air bubbles in the cooling circuit by venting.

10.8 Service

Service

Recommended service activities for the cooling circuit are described in Chapter "Maintenance (Page 353)".

Maintenance and servicing 11

11.1 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 device is serviced
- Forming the DC link capacitors

⚠ WARNING

Not observing fundamental safety instructions and residual risks

If the fundamental safety instructions and remaining risks are not observed, accidents involving severe injuries or death can occur.

- Comply with the fundamental safety instructions.
- When assessing the risk, take into account residual risks.

⚠ WARNING

Electric shock from external supply voltages

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 switch is open.

Contact with live parts can result in death or serious injury.

- Switch off external supply voltages and external 230 V AC auxiliary supply before opening the device.

11.2 Maintenance

The devices comprise mostly electronic components. Apart from the electronics 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 electronics 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 tight, 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

Maintenance intervals

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.

Service for the cooling circuit

The following service is recommended for the cooling circuit:

- The coolant should be checked 3 months after the cooling circuit is filled for the first time and, subsequently, once a year.
  When analyzing the coolant, the concentration and the constraints of the inhibitor/antifreeze should be checked.
- In addition, every two years a coolant sample should be sent in for checking to investigate the relevant coolant values (e.g. Ph value, density, nitride content, dissolved metal ions, alkalinity, ...).
  Contact the manufacturer of the coolant agent.
- The cooling circuit must be cleaned and refilled if the coolant becomes cloudy, discolored or becomes contaminated by mold spores.
- If the coolant level has dropped, the loss should be corrected for closed or semi-open circuits with a prepared mixture of coolant basis and antifreeze, see Chapters "Coolant properties (Page 338)" and "Antifreeze, biocides, inhibitors (Page 340)".

Maintaining coolant hoses

The coolant hoses must be inspected in regular intervals for cracks and leaks. If there are any leakages at the hose joints, the flat seal may need to be replaced.

EPDM hoses with cracks or that the leak should be replaced.

11.3 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:

- Standard set of tools with screwdrivers, screw wrenches, socket wrenches, etc.
- Torque wrenches 1.5 Nm up to 100 Nm
- 600 mm extension for socket wrenches

Tightening torques for screw connections

The following tightening torques apply when tightening current-conducting connections (DC link, motor connections, busbars, cable lugs) and other connections (ground connections, PE connections).

Table 11- 1 Tightening torques for screw connections

Thread	Ground connections, PE connections, steel threaded connections	Aluminum threaded connections, plastic, busbars, cable lugs
M3	1.3 Nm	0.8 Nm
M4	3 Nm	1.8 Nm
M5	6 Nm	3 Nm
M6	10 Nm	6 Nm
M8	25 Nm	13 Nm
M10	50 Nm	25 Nm
M12	88 Nm	50 Nm
M16	215 Nm	115 Nm

Note

Screw connections for protective covers

The threaded connections for the protective covers made of Makrolon may only be tightened with 2.5 Nm.

11.4 Replacing components

11.4.1 Safety information

⚠ WARNING

Improper transport and installation of devices and components

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

- Transport, mount, and remove the devices and components only if you are qualified to do so.
- Take into account that the devices and components are in some cases heavy and top-heavy and take the necessary precautionary measures.

NOTICE

Material damage caused by mechanically stressed busbars and coolant connections

Mechanically stressed busbars and coolant connections can damage the device.

- Do not use the busbars and liquid coolant connections protruding from the device as handles or as support surfaces during transport.

11.4.2 Messages after replacement of DRIVE-CLiQ components

After DRIVE-CLiQ components are replaced (Control Interface Module, TM31, SMCxx) when service is required, generally no message is output after power-up, since an identical component is identified and accepted as component when the system boots.

The reason for this is that an identical component is detected and accepted as spare part when running-up. If, unexpectedly, a fault message of the "topology fault" category is displayed, then when replacing a component, one of the following faults/errors should have occurred:

- A Control Interface Module with different firmware data was installed.
- When connecting-up DRIVE-CLiQ cables, connections were interchanged.

Automatic firmware update

A firmware update for the replaced DRIVE-CLiQ component may run automatically after switching on the electronics.

- The following LEDs will flash slowly to indicate that an automatic firmware update is in progress: the "RDY" LED on the Control Unit (orange, 0.5 Hz) and an LED on the relevant DRIVE-CLiQ component (green/red, 0.5 Hz).

Note

Do not shut down the converter

Do not shut down the converter during this process as the firmware update will otherwise have to be started again.

- Once the automatic firmware update is complete, the "RDY" LED on the Control Unit will flash quickly (orange, 2 Hz) along with an LED on the relevant DRIVE-CLiQ component (green/red, 2 Hz).
- To complete the automatic firmware update process, a POWER ON is required (switch the device off and back on again).

11.4.3 Mounting equipment for power units

Mounting equipment

The mounting equipment is used to mount or remove liquid-cooled power units (Active Line Modules, Basic Line Modules, Motor Modules, Power Modules) into or out of a control cabinet.

The mounting equipment can be used if the power units are mounted on mounting rails, which at the front have two M6 threads at a vertical distance of 20 mm to attach the mounting equipment.

The mounting equipment is used to help mount the device; it is placed in front of the power unit, and attached to the mounting rails below the power unit.
Using the telescopic rails, the mounting equipment can be adapted to the actual mounting height and the power unit width. The power unit can be removed from the control cabinet after releasing the mechanical and electrical connections and the coolant connections. Whereby the power unit is guided and supported by the guide rails on the mounting equipment. To prevent it toppling over, the power unit must be secured to a crane, tripod or similar assembly using the lifting lugs or the lifting equipment. The device can then be lowered down from the mounting equipment.

Figure 11-1 Mounting aid

Article number of the mounting equipment

The article number for the mounting equipment is 6SL3766-1CA00-0AA0.

11.4.4 Replacing the Control Interface Module, Power Module, frame size FL

Replacing the Control Interface Module

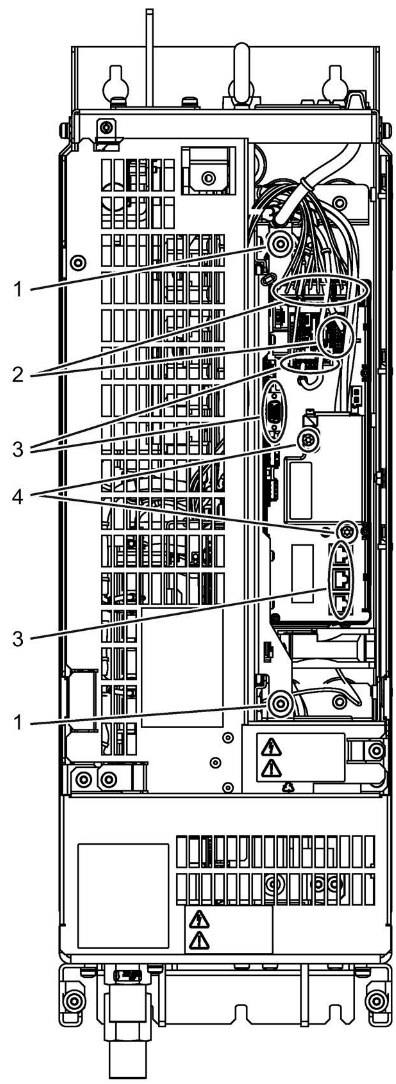


Figure 11-2 Replacing the Control Interface Module, Power Module, frame size FL

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 numbers in the diagram.

1. Release the retaining screws for the control module holder and the plug-in electronics module (2 screws) and remove the control module holder.
2. Disconnect the plug-in connections for the fiber-optic cables and signal cables (maximum five connectors).
3. Remove DRIVE-CLiQ cables and connections at -X41 / -X42 / -X46 (max. 6 connectors). The DRIVE-CLiQ cables should be marked to ensure that they are subsequently correctly inserted.
4. Remove 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 additional connectors one after the other (2 at the top, 3 at the bottom) and the PE connection (1 screw below).

NOTICE

Damage to the device due to damaged signal cables during disassembly

Signal cables can be damaged when withdrawing the Control Interface Module, which can result in a device failure.

- When withdrawing the Control Interface Module, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

Tightening torque for the fastening screws of the plug-in electronics module (M6 x 16, item ①): 6 Nm

Tightening torque for the PE screw (M4 x 8): 1.8 Nm

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug connections and ensure that they are secure.

When using connectors with a locking mechanism, 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 connectors 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 may only be tightened by hand.

11.4.5 Replacing the Control Interface Module, Power Module, frame size GL

Replacing the Control Interface Module

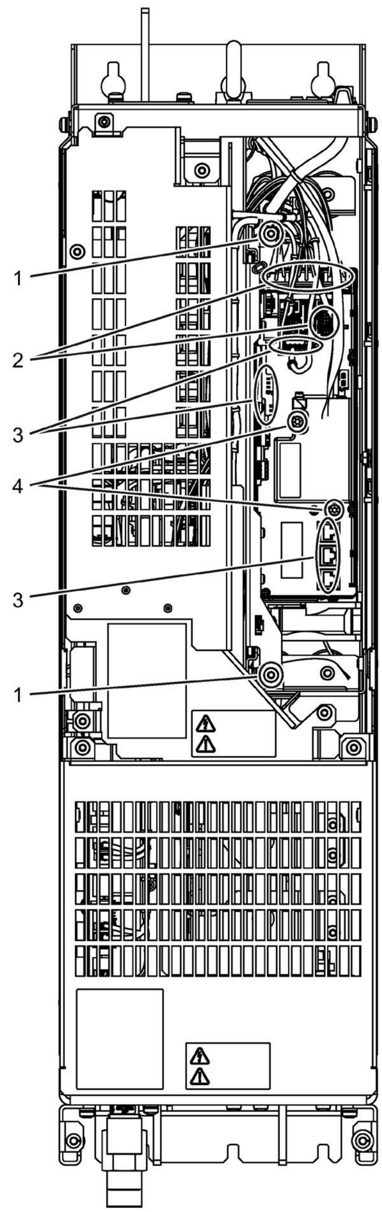


Figure 11-3 Replacing the Control Interface Module, Power Module, frame size GL

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 numbers in the diagram.

1. Release the retaining screws for the control module holder and the plug-in electronics module (2 screws) and remove the control module holder.
2. Disconnect the plug-in connections for the fiber-optic cables and signal cables (maximum five connectors).
3. Remove DRIVE-CLiQ cables and connections at -X41 / -X42 / -X46 (max. 6 connectors). The DRIVE-CLiQ cables should be marked to ensure that they are subsequently correctly inserted.
4. Remove 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 additional connectors one after the other (2 at the top, 3 at the bottom) and the PE connection (1 screw below).

NOTICE
Damage to the device due to damaged signal cables during disassembly
Signal cables can be damaged when withdrawing the Control Interface Module, which can result in a device failure. • When withdrawing the Control Interface Module, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

Tightening torque for the fastening screws of the plug-in electronics module (M6 x 16, item ①): 6 Nm

Tightening torque for the PE screw (M4 x 8): 1.8 Nm

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug connections and ensure that they are secure.

When using connectors with a locking mechanism, 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 connectors 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 may only be tightened by hand.

11.4.6 Replacing the Control Interface Module, Motor Module, frame size FXL

Replacing the Control Interface Module

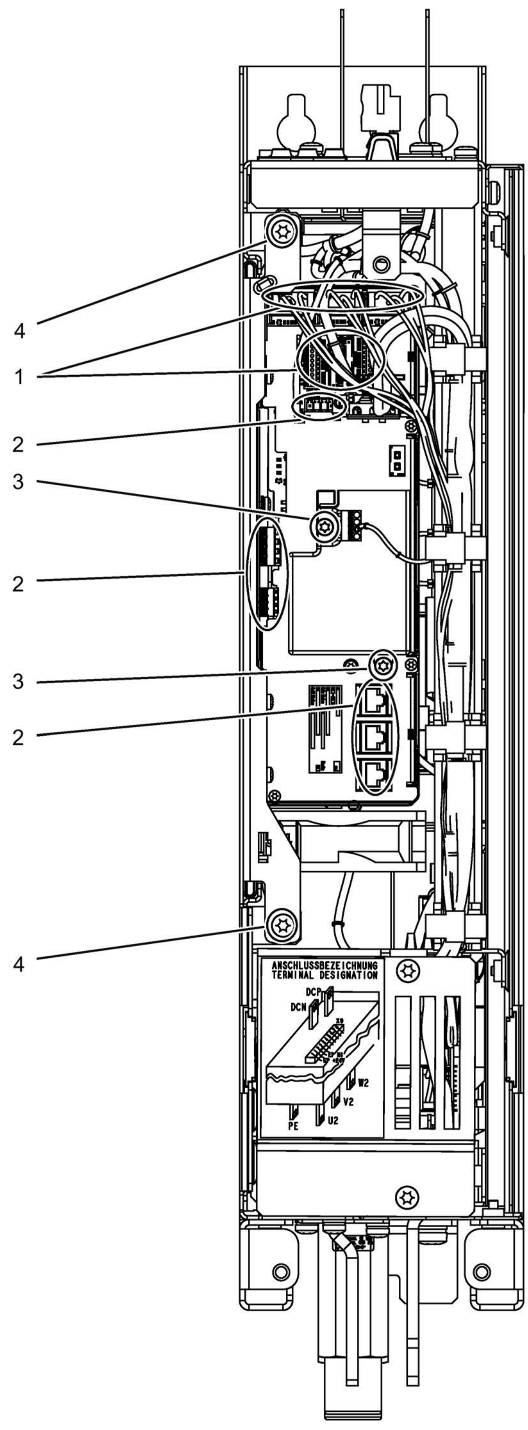


Figure 11-4 Replacing the Control Interface Module, Motor Module, frame size FXL

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 numbers in the diagram.

1. Disconnect the plug-in connections for the fiber-optic cables and signal cables (maximum five connectors).
2. Remove DRIVE-CLiQ cables and connections at –X41/–X42/–X46 (maximum six connectors). The DRIVE-CLiQ cables should be marked to ensure that they are subsequently correctly inserted.
3. Take out the retaining screws for the IPD card (two screws) and remove the IPD card from connector -X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (two screws).

When removing the Control Interface Module, you have to disconnect a maximum of five additional connectors one after the other (two at the top, three below) and the PE connection (one screw below).

NOTICE
Damage to the device due to damaged signal cables during disassembly
Signal cables can be damaged when withdrawing the Control Interface Module, which can result in a device failure. • When withdrawing the Control Interface Module, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

Tightening torque for the fastening screws of the Control Interface Module (M6 x 16, item ④): 6 Nm

Tightening torque for the PE screw (M4 x 8): 1.8 Nm

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug connections and ensure that they are secure.

When using connectors with a locking mechanism, 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 connectors 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 may only be tightened by hand.

11.4.7 Replacing the Control Interface Module, Active Line Module and Motor Module, frame size GXL

Replacing the Control Interface Module

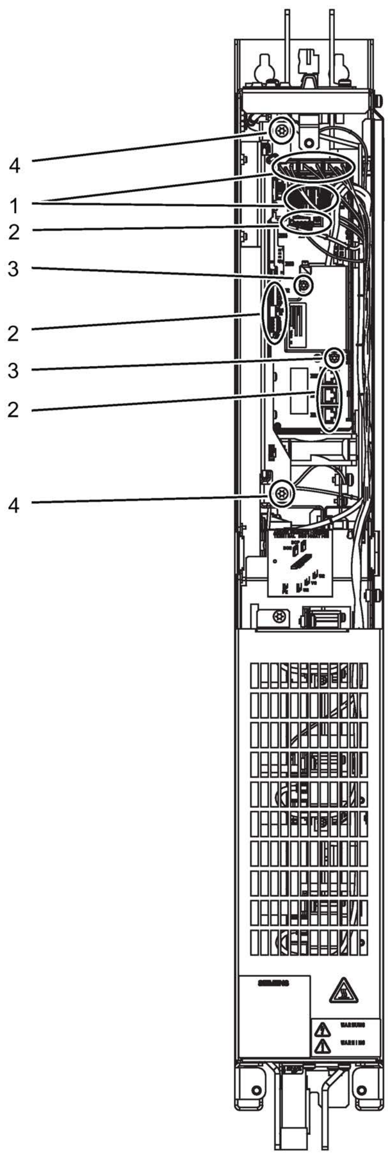


Figure 11-5 Replacing the Control Interface Module, Active Line Module and Motor Module, frame size GXL

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 numbers in the diagram.

1. Disconnect the plug-in connections for the fiber-optic cables and signal cables (maximum five connectors).
2. Remove DRIVE-CLiQ cables and connections at –X41/–X42/–X46 (maximum six connectors). The DRIVE-CLiQ cables should be marked to ensure that they are subsequently correctly inserted.
3. Take out the retaining screws for the IPD card (two screws) and remove the IPD card from connector -X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (two screws).

When removing the Control Interface Module, you have to disconnect a maximum of five additional connectors one after the other (two at the top, three below) and the PE connection (one screw below).

NOTICE

Damage to the device due to damaged signal cables during disassembly

Signal cables can be damaged when withdrawing the Control Interface Module, which can result in a device failure.

- When withdrawing the Control Interface Module, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

Tightening torque for the fastening screws of the Control Interface Module (M6 x 16, item ④): 6 Nm

Tightening torque for the PE screw (M4 x 8): 1.8 Nm

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug connections and ensure that they are secure.

When using connectors with a locking mechanism, 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 connectors 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 may only be tightened by hand.

11.4.8 Replacing the Control Interface Module, Active Line Module and Motor Module, frame size HXL

Replacing the Control Interface Module

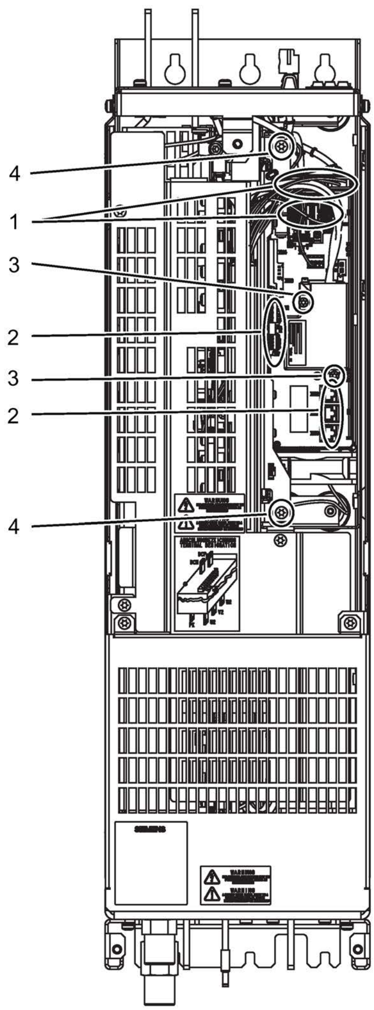


Figure 11-6 Replacing the Control Interface Module, Active Line Module and Motor Module, frame size HXL

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 numbers in the diagram.

1. Disconnect the plug-in connections for the fiber-optic cables and signal cables (maximum five connectors).
2. Remove DRIVE-CLiQ cables and connections at –X41/–X42/–X46 (maximum six connectors). The DRIVE-CLiQ cables should be marked to ensure that they are subsequently correctly inserted.
3. Take out the retaining screws for the IPD card (two screws) and remove the IPD card from connector -X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (two screws).

When removing the Control Interface Module, you have to disconnect a maximum of five additional connectors one after the other (two at the top, three below) and the PE connection (one screw below).

NOTICE

Damage to the device due to damaged signal cables during disassembly

Signal cables can be damaged when withdrawing the Control Interface Module, which can result in a device failure.

- When withdrawing the Control Interface Module, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

Tightening torque for the fastening screws of the Control Interface Module (M6 x 16, item ④): 6 Nm

Tightening torque for the PE screw (M4 x 8): 1.8 Nm

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug connections and ensure that they are secure.

When using connectors with a locking mechanism, 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 connectors 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 may only be tightened by hand.

11.4.9 Replacing the Control Interface Module, Active Line Module and Motor Module, frame size JXL

Replacing the Control Interface Module

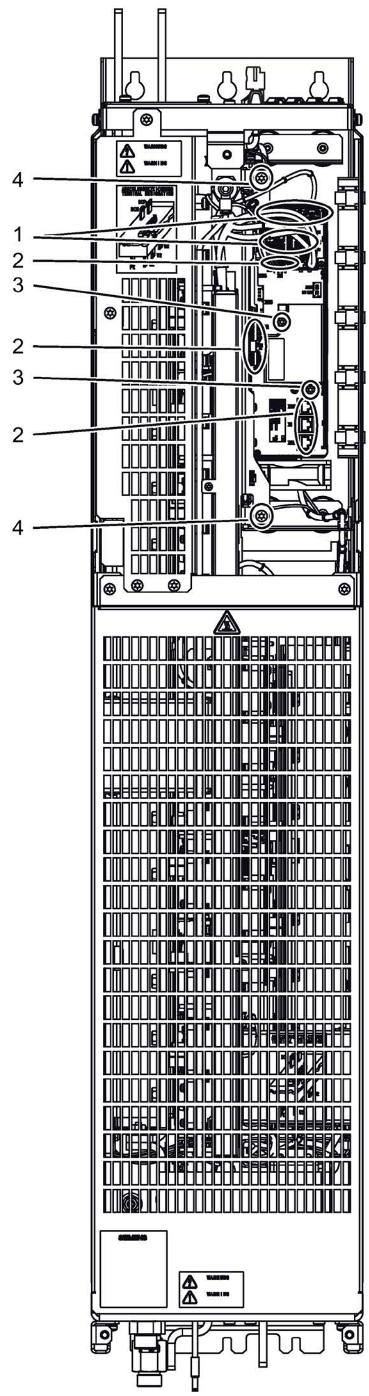


Figure 11-7 Replacing the Control Interface Module, Active Line Module and Motor Module, frame size JXL

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 numbers in the diagram.

1. Disconnect the plug-in connections for the fiber-optic cables and signal cables (maximum five connectors).
2. Remove DRIVE-CLiQ cables and connections at –X41/–X42/–X46 (maximum six connectors). The DRIVE-CLiQ cables should be marked to ensure that they are subsequently correctly inserted.
3. Take out the retaining screws for the IPD card (two screws) and remove the IPD card from connector -X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (two screws).

When removing the Control Interface Module, you have to disconnect a maximum of five additional connectors one after the other (two at the top, three below) and the PE connection (one screw below).

NOTICE
Damage to the device due to damaged signal cables during disassembly Signal cables can be damaged when withdrawing the Control Interface Module, which can result in a device failure. • When withdrawing the Control Interface Module, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

Tightening torque for the fastening screws of the Control Interface Module (M6 x 16, item ④): 6 Nm

Tightening torque for the PE screw (M4 x 8): 1.8 Nm

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug connections and ensure that they are secure.

When using connectors with a locking mechanism, 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 connectors 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 may only be tightened by hand.

11.4.10 Replacing the Control Interface Module, Motor Module, frame size JXL 6SL3325-1TG41-6AP3

Replacing the Control Interface Module of the 6SL3325-1TG41-6AP3 Motor Module

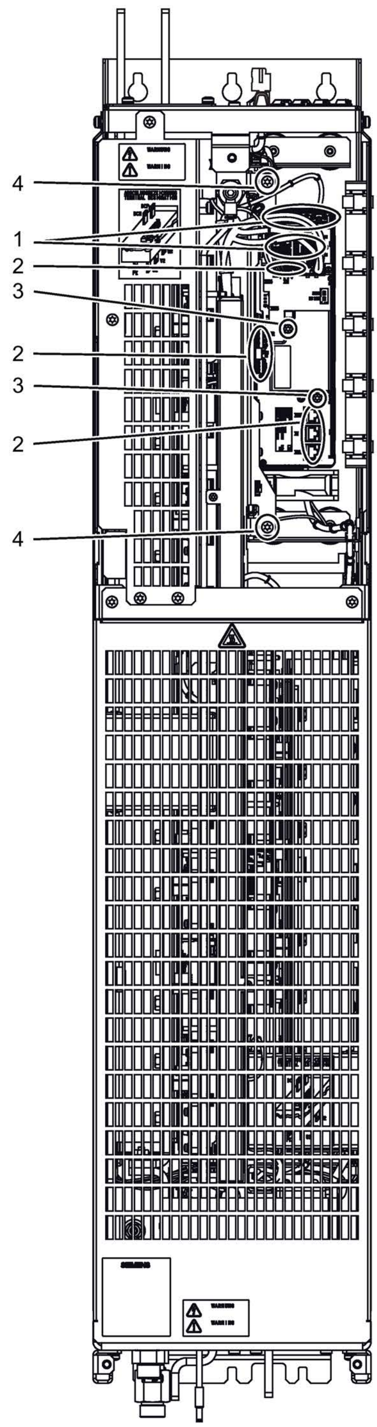


Figure 11-8 Replacing the Control Interface Module, 6SL3325-1TG41-6AP3 Motor Module

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 numbers in the diagram.

1. Disconnect the plug-in connections for the fiber-optic cables and signal cables (maximum five connectors).
2. Remove DRIVE-CLiQ cables and connections at -X41 / -X42 / -X46 (maximum 6 connectors). The DRIVE-CLiQ cables should be marked to ensure that they are subsequently correctly inserted.
3. Take out the retaining screws for the IPD card (two screws) and remove the IPD card from connector -X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (two screws).

When removing the Control Interface Module, you have to disconnect a maximum of five additional connectors one after the other (two at the top, three below) and the PE connection (one screw below).

NOTICE
Damage to the device due to damaged signal cables during disassembly Signal cables can be damaged when withdrawing the Control Interface Module, which can result in a device failure. • When withdrawing the Control Interface Module, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

Tightening torque for the fastening screws of the Control Interface Module (M6 x 16, item ④): 6 Nm

Tightening torque for the PE screw (M4 x 8): 1.8 Nm

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug-in connections and ensure that they are secure.

When using connectors with a locking mechanism, make sure that the locking lever is securely engaged once connected.

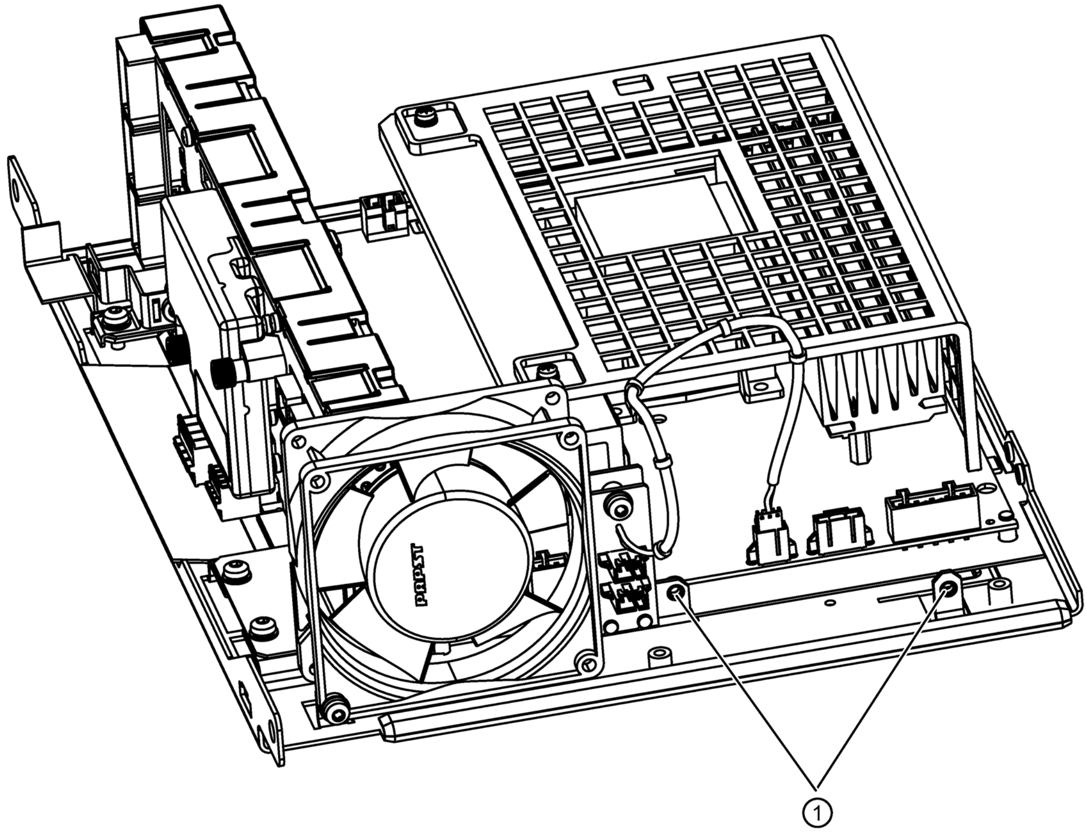
The fiber-optic cable connectors must be remounted at their original slot. Fiber-optic cables and sockets are accordingly labeled for correct assignment (U11, U21, U31).

The DRIVE-CLiQ cable connectors 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 may only be tightened by hand.

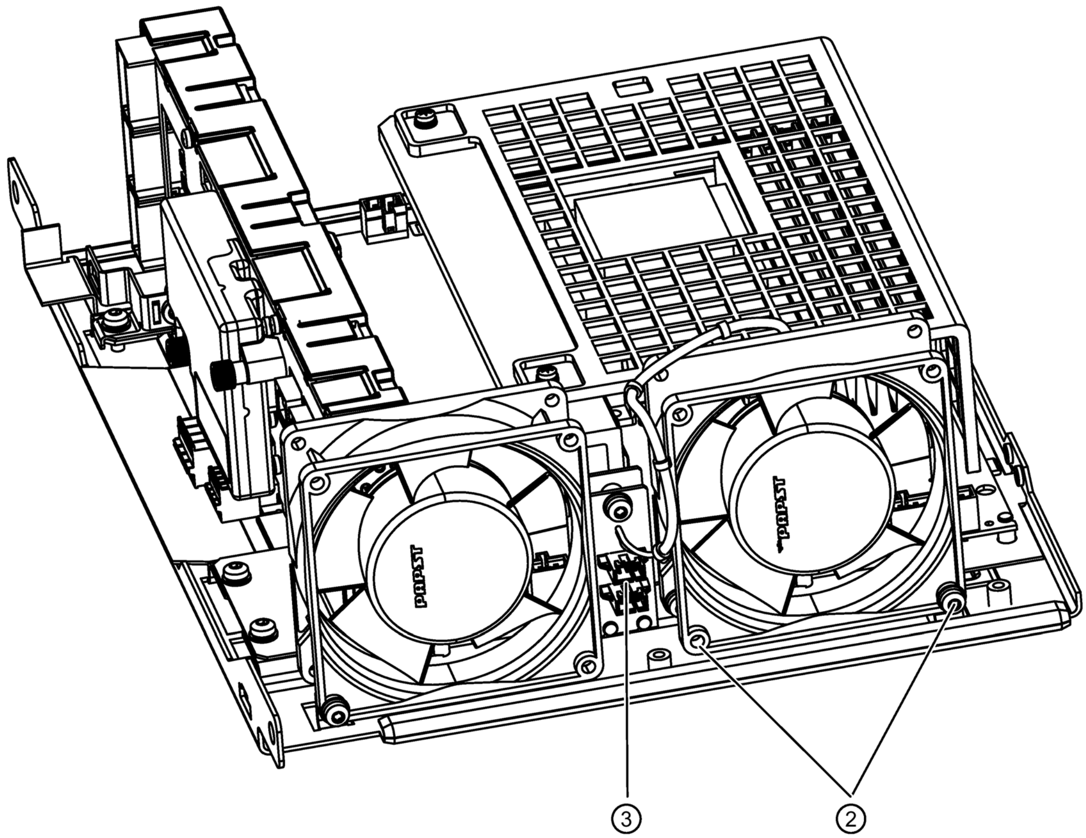
Mounting the second electronics fan

Before installing the replacement part for the Control Interface Module, the second electronics fan must first be ordered as replacement part and installed.



① Mounting location for the second electronics fan

Figure 11-9 Replacement part, Control Interface Module with an electronics fan



② Fixing screws for the second electronics fan

③ Slots for the power supply of the two electronics fans

Figure 11-10 Replacement part, Control Interface Module with mounted, second electronics fan

The installation is shown in the diagrams above.

1. Mount the second electronics fan at mounting location ①, and attach it using the two fixing screws ②, tightening torque: 1.8 Nm.
   Check the direction of rotation of the fan; arrows on the enclosure show the direction of rotation - the direction of rotation must be the same as that of the first fan.
2. Insert the connecting cable for the power supply of the second electronics fan at the free slot of adapter ③.
3. Attach the connecting cable using cable ties, so that the cable cannot come in contact with the fan blades.

11.4.11 Replacing the Control Interface Module, Basic Line Module, frame size FBL

Replacing the Control Interface Module

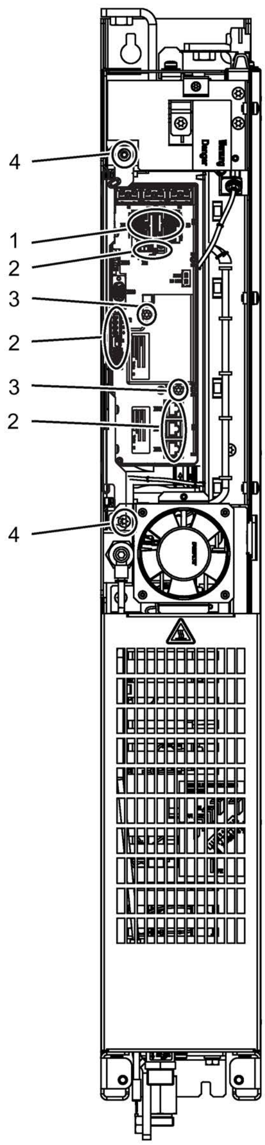


Figure 11-11 Replacing the Control Interface Module, Basic Line Module, frame size FBL

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 numbers in the diagram.

1. Disconnect the plugs for the signal cables (two connectors).
2. Remove DRIVE-CLiQ cables and connections at –X41/–X42 (maximum five connectors). The DRIVE-CLiQ cables should be marked to ensure that they are subsequently correctly inserted.
3. Take out the retaining screws for the IPD card (two screws) and remove the IPD card from connector -X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (two screws). The bottom screw also secures the front electronic fan.

When removing the Control Interface Module, you have to disconnect a maximum of five additional connectors one after the other (two at the top, three below) and the PE connection (one screw below).

NOTICE
Damage to the device due to damaged signal cables during disassembly
Signal cables can be damaged when withdrawing the Control Interface Module, which can result in a device failure. • When withdrawing the Control Interface Module, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

Tightening torque for the fastening screws of the Control Interface Module (M6 x 16, item ④): 6 Nm

Tightening torque for the PE screw (M4 x 8): 1.8 Nm

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug connections and ensure that they are secure.

When using connectors with a locking mechanism, make sure that the locking lever is securely engaged once connected.

The DRIVE-CLiQ cable connectors 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 may only be tightened by hand.

11.4.12 Replacing the Control Interface Module, Basic Line Module, frame size GBL

Replacing the Control Interface Module

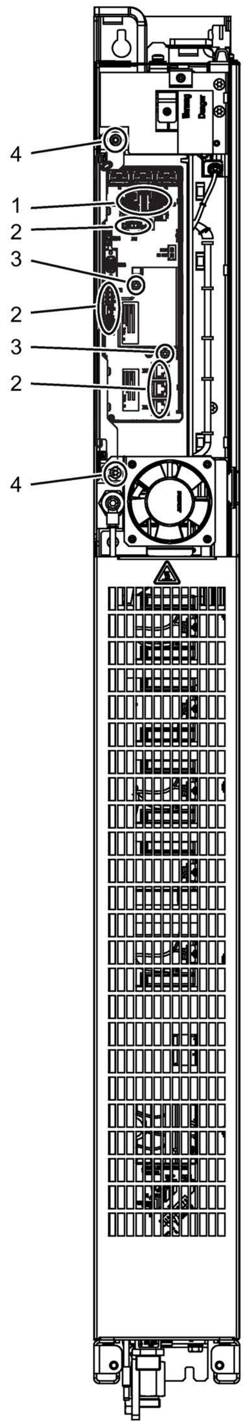


Figure 11-12 Replacing the Control Interface Module, Basic Line Module, frame size GBL

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 numbers in the diagram.

1. Disconnect the plugs for the signal cables (two connectors).
2. Remove DRIVE-CLiQ cables and connections at –X41/–X42 (maximum five connectors). The DRIVE-CLiQ cables should be marked to ensure that they are subsequently correctly inserted.
3. Take out the retaining screws for the IPD card (two screws) and remove the IPD card from connector -X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (two screws). The bottom screw also secures the front electronic fan.

When removing the Control Interface Module, you have to disconnect a maximum of five additional connectors one after the other (two at the top, three below) and the PE connection (one screw below).

NOTICE
Damage to the device due to damaged signal cables during disassembly
Signal cables can be damaged when withdrawing the Control Interface Module, which can result in a device failure. • When withdrawing the Control Interface Module, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

Tightening torque for the fastening screws of the Control Interface Module (M6 x 16, item ④): 6 Nm

Tightening torque for the PE screw (M4 x 8): 1.8 Nm

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug connections and ensure that they are secure.

When using connectors with a locking mechanism, make sure that the locking lever is securely engaged once connected.

The DRIVE-CLiQ cable connectors 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 may only be tightened by hand.

11.4.13 Replacing the electronic fan, Power Module, frame size FL

Replacing the electronic fan

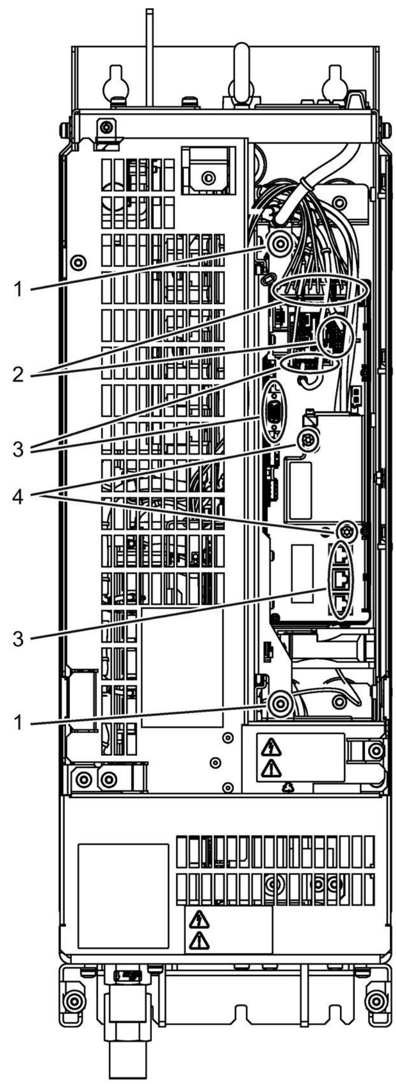


Figure 11-13 Replacing the electronic fan, Power Module, frame size FL

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 numbers in the diagram.

1. Release the retaining screws for the control module holder and the plug-in electronics module (2 screws) and remove the control module holder.
2. Disconnect the plug-in connections for the fiber-optic cables and signal cables (maximum five connectors).
3. Remove DRIVE-CLiQ cables and connections at -X41 / -X42 / -X46 (maximum 6 connectors). The DRIVE-CLiQ cables should be marked to ensure that they are subsequently correctly inserted.
4. Remove 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 additional connectors one after the other (2 at the top, 3 at the bottom) and the PE connection (1 screw below).

NOTICE
Damage to the device due to damaged signal cables during disassembly
Signal cables can be damaged when withdrawing the Control Interface Module, which can result in a device failure.
• When withdrawing the Control Interface Module, ensure that you do not damage any signal cables.

You can then replace the electronic fan for the Control Interface Module.

A description on how to replace the fan is provided here: Replacing the electronic fan of the Control Interface Module (Page 407).

Installation steps

Installing is the same as removing, however in the reverse order.

Tightening torque for the fastening screws of the plug-in electronics module (M6 x 16, item ①): 6 Nm

Tightening torque for the PE screw (M4 x 8): 1.8 Nm

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug connections and ensure that they are secure.

When using connectors with a locking mechanism, 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 connectors 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 may only be tightened by hand.

11.4.14 Replacing the electronic fan, Power Module, frame size GL

Replacing the electronic fan

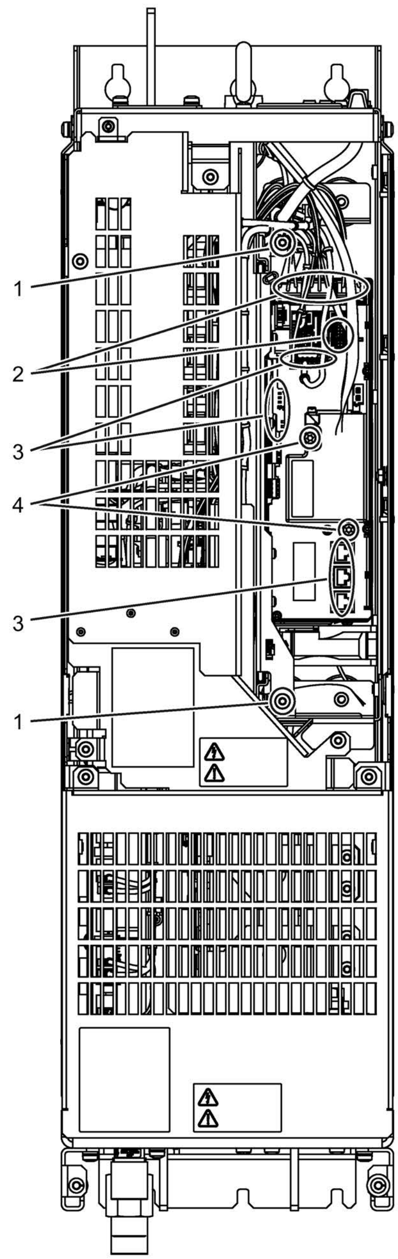


Figure 11-14 Replacing the electronic fan, Power Module, frame size GL

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 numbers in the diagram.

1. Release the retaining screws for the control module holder and the plug-in electronics module (2 screws) and remove the control module holder.
2. Disconnect the plug-in connections for the fiber-optic cables and signal cables (maximum five connectors).
3. Remove DRIVE-CLiQ cables and connections at -X41 / -X42 / -X46 (maximum 6 connectors). The DRIVE-CLiQ cables should be marked to ensure that they are subsequently correctly inserted.
4. Remove 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 additional connectors one after the other (2 at the top, 3 at the bottom) and the PE connection (1 screw below).

NOTICE
Damage to the device due to damaged signal cables during disassembly
Signal cables can be damaged when withdrawing the Control Interface Module, which can result in a device failure. • When withdrawing the Control Interface Module, ensure that you do not damage any signal cables.

You can then replace the electronic fan for the Control Interface Module.

A description on how to replace the fan is provided here: Replacing the electronic fan of the Control Interface Module (Page 407).

Installation steps

Installing is the same as removing, however in the reverse order.

Tightening torque for the fastening screws of the plug-in electronics module (M6 x 16, item ①): 6 Nm

Tightening torque for the PE screw (M4 x 8): 1.8 Nm

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug connections and ensure that they are secure.

When using connectors with a locking mechanism, 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 connectors 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 may only be tightened by hand.

11.4.15 Replacing the electronic fan, Motor Module, frame size FXL

Replacing the electronic fan

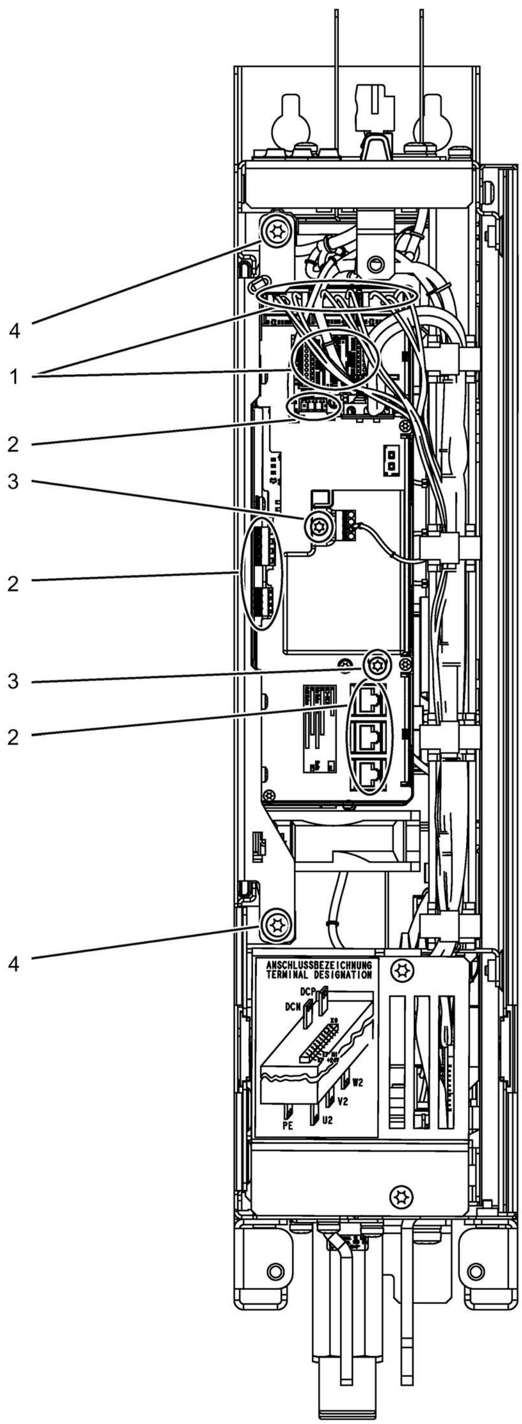


Figure 11-15 Replacing the electronic fan, Motor Module, frame size FXL

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 numbers in the diagram.

1. Disconnect the plug-in connections for the fiber-optic cables and signal cables (maximum five connectors).
2. Remove DRIVE-CLiQ cables and connections at –X41/–X42/–X46 (maximum six connectors). The DRIVE-CLiQ cables should be marked to ensure that they are subsequently correctly inserted.
3. Take out the retaining screws for the IPD card (two screws) and remove the IPD card from connector -X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (two screws).

When removing the Control Interface Module, you have to disconnect a maximum of five additional connectors one after the other (two at the top, three below) and the PE connection (one screw below).

NOTICE
Damage to the device due to damaged signal cables during disassembly
Signal cables can be damaged when withdrawing the Control Interface Module, which can result in a device failure. • When withdrawing the Control Interface Module, ensure that you do not damage any signal cables.

You can then replace the electronic fan for the Control Interface Module.

A description on how to replace the fan is provided here: Replacing the electronic fan of the Control Interface Module (Page 407).

Installation steps

Installing is the same as removing, however in the reverse order.

Tightening torque for the fastening screws of the Control Interface Module (M6 x 16, item ④): 6 Nm

Tightening torque for the PE screw (M4 x 8): 1.8 Nm

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug connections and ensure that they are secure.

When using connectors with a locking mechanism, 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 connectors 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 may only be tightened by hand.

11.4.16 Replacing the electronic fan, Active Line Module, and Motor Module, frame size GXL

Replacing the electronic fan

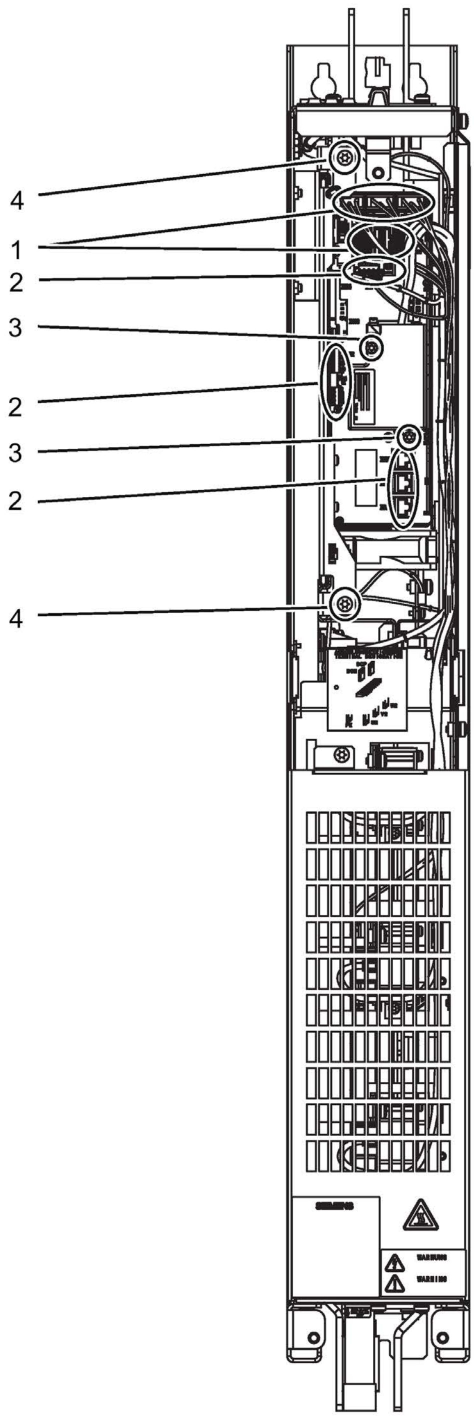


Figure 11-16 Replacing the electronic fan, Active Line Module, and Motor Module, frame size GXL

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 numbers in the diagram.

1. Disconnect the plug-in connections for the fiber-optic cables and signal cables (maximum five connectors).
2. Remove DRIVE-CLiQ cables and connections at –X41/–X42/–X46 (maximum six connectors). The DRIVE-CLiQ cables should be marked to ensure that they are subsequently correctly inserted.
3. Take out the retaining screws for the IPD card (two screws) and remove the IPD card from connector -X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (two screws).

When removing the Control Interface Module, you have to disconnect a maximum of five additional connectors one after the other (two at the top, three below) and the PE connection (one screw below).

NOTICE
Damage to the device due to damaged signal cables during disassembly
Signal cables can be damaged when withdrawing the Control Interface Module, which can result in a device failure. • When withdrawing the Control Interface Module, ensure that you do not damage any signal cables.

You can then replace the electronic fan for the Control Interface Module.

A description on how to replace the fan is provided here: Replacing the electronic fan of the Control Interface Module (Page 407).

Installation steps

Installing is the same as removing, however in the reverse order.

Tightening torque for the fastening screws of the Control Interface Module (M6 x 16, item ④): 6 Nm

Tightening torque for the PE screw (M4 x 8): 1.8 Nm

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug connections and ensure that they are secure.

When using connectors with a locking mechanism, 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 connectors 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 may only be tightened by hand.

11.4.17 Replacing the electronic fan, Active Line Module, and Motor Module, frame size HXL

Replacing the electronic fan

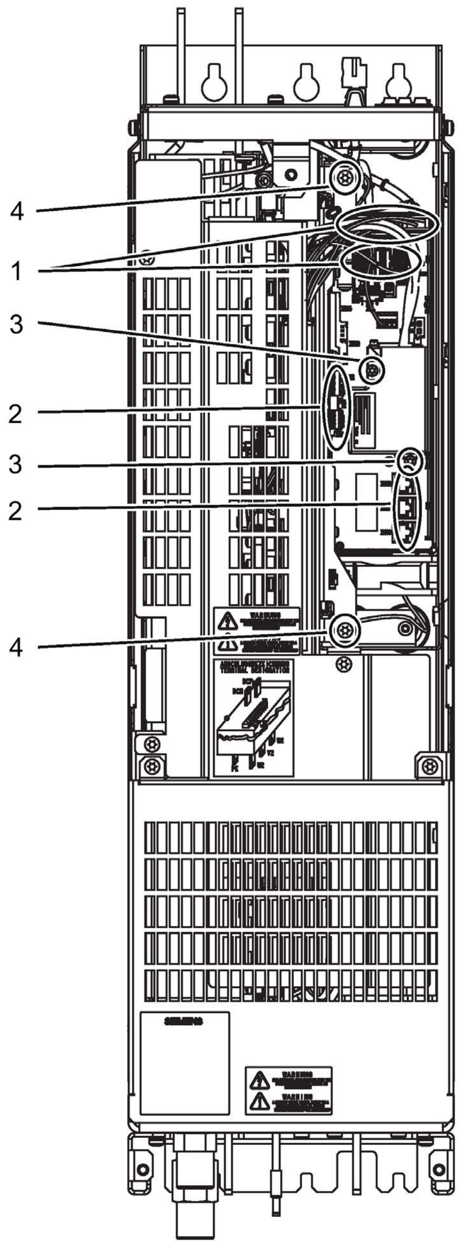


Figure 11-17 Replacing the electronic fan, Active Line Module, and Motor Module, frame size HXL

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 numbers in the diagram.

1. Disconnect the plug-in connections for the fiber-optic cables and signal cables (maximum five connectors).
2. Remove DRIVE-CLiQ cables and connections at –X41/–X42/–X46 (maximum six connectors). The DRIVE-CLiQ cables should be marked to ensure that they are subsequently correctly inserted.
3. Take out the retaining screws for the IPD card (two screws) and remove the IPD card from connector -X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (two screws).

When removing the Control Interface Module, you have to disconnect a maximum of five additional connectors one after the other (two at the top, three below) and the PE connection (one screw below).

NOTICE
Damage to the device due to damaged signal cables during disassembly Signal cables can be damaged when withdrawing the Control Interface Module, which can result in a device failure. • When withdrawing the Control Interface Module, ensure that you do not damage any signal cables.

You can then replace the electronic fan for the Control Interface Module.

A description on how to replace the fan is provided here: Replacing the electronic fan of the Control Interface Module (Page 407).

Installation steps

Installing is the same as removing, however in the reverse order.

Tightening torque for the fastening screws of the Control Interface Module (M6 x 16, item ④): 6 Nm

Tightening torque for the PE screw (M4 x 8): 1.8 Nm

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug connections and ensure that they are secure.

When using connectors with a locking mechanism, 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 connectors 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 may only be tightened by hand.

11.4.18 Replacing the electronic fan, Active Line Module, and Motor Module, frame size JXL

Replacing the electronic fan

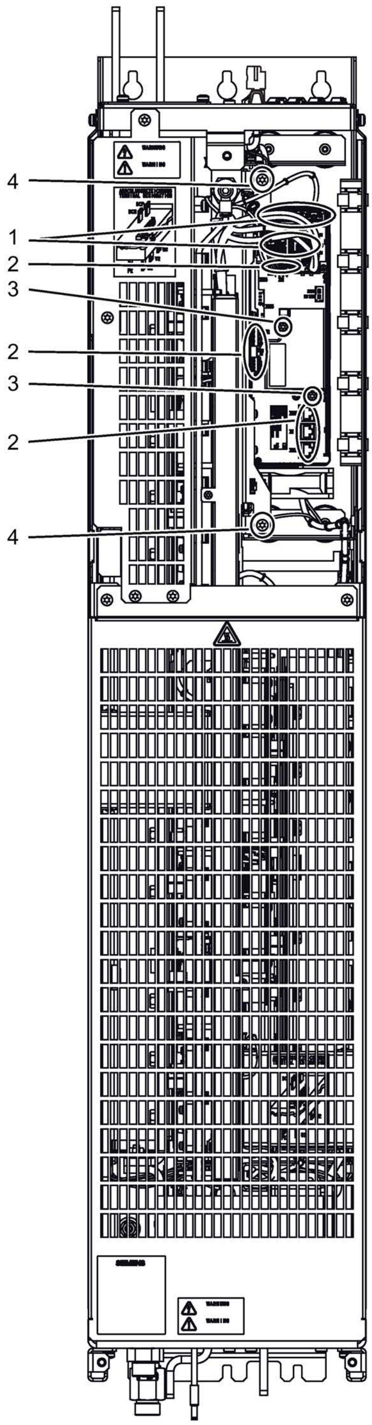


Figure 11-18 Replacing the electronic fan, Active Line Module, and Motor Module, frame size JXL

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 numbers in the diagram.

1. Disconnect the plug-in connections for the fiber-optic cables and signal cables (maximum five connectors).
2. Remove DRIVE-CLiQ cables and connections at –X41/–X42/–X46 (maximum six connectors). The DRIVE-CLiQ cables should be marked to ensure that they are subsequently correctly inserted.
3. Take out the retaining screws for the IPD card (two screws) and remove the IPD card from connector -X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (two screws).

When removing the Control Interface Module, you have to disconnect a maximum of five additional connectors one after the other (two at the top, three below) and the PE connection (one screw below).

NOTICE
Damage to the device due to damaged signal cables during disassembly
Signal cables can be damaged when withdrawing the Control Interface Module, which can result in a device failure. • When withdrawing the Control Interface Module, ensure that you do not damage any signal cables.

You can then replace the electronic fan for the Control Interface Module.

A description on how to replace the fan is provided here: Replacing the electronic fan of the Control Interface Module (Page 407).

Note

Both electronic fans must be replaced for Motor Modules with Article No. 6SL3325-1TG41-6AP3.

Installation steps

Installing is the same as removing, however in the reverse order.

Tightening torque for the fastening screws of the Control Interface Module (M6 x 16, item ④): 6 Nm

Tightening torque for the PE screw (M4 x 8): 1.8 Nm

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug connections and ensure that they are secure.

When using connectors with a locking mechanism, 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 connectors 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 may only be tightened by hand.

11.4.19 Replacing the electronic fan, Basic Line Module, frame size FBL

Replacing the electronic fan

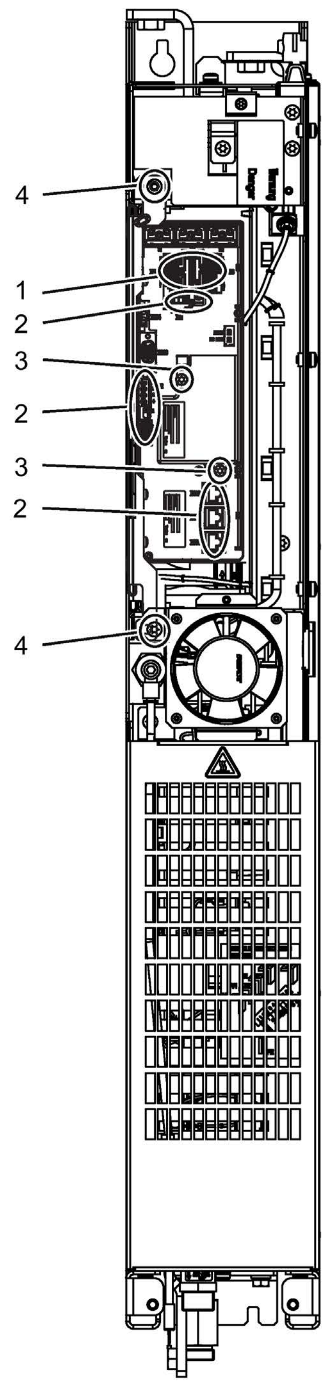


Figure 11-19 Replacing the electronic fan, Basic Line Module, frame size FBL

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 numbers in the diagram.

1. Disconnect the plugs for the signal cables (two connectors).
2. Remove DRIVE-CLiQ cables and connections at –X41/–X42 (maximum five connectors). The DRIVE-CLiQ cables should be marked to ensure that they are subsequently correctly inserted.
3. Take out the retaining screws for the IPD card (two screws) and remove the IPD card from connector -X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (two screws). The bottom screw also secures the front electronic fan.

When removing the Control Interface Module, you have to disconnect a maximum of five additional connectors one after the other (two at the top, three below) and the PE connection (one screw below).

NOTICE
Damage to the device due to damaged signal cables during disassembly
Signal cables can be damaged when withdrawing the Control Interface Module, which can result in a device failure. • When withdrawing the Control Interface Module, ensure that you do not damage any signal cables.

You can then replace the electronic fans of the Control Interface Module.

A description on how to replace the fan is provided here: Replacing the electronic fan of the Control Interface Module (Page 407).

Installation steps

Installing is the same as removing, however in the reverse order.

Tightening torque for the fastening screws of the Control Interface Module (M6 x 16, item ④): 6 Nm

Tightening torque for the PE screw (M4 x 8): 1.8 Nm

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug connections and ensure that they are secure.

When using connectors with a locking mechanism, make sure that the locking lever is securely engaged once connected.

The DRIVE-CLiQ cable connectors 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 may only be tightened by hand.

11.4.20 Replacing the electronic fan, Basic Line Module, frame size GBL

Replacing the electronic fan

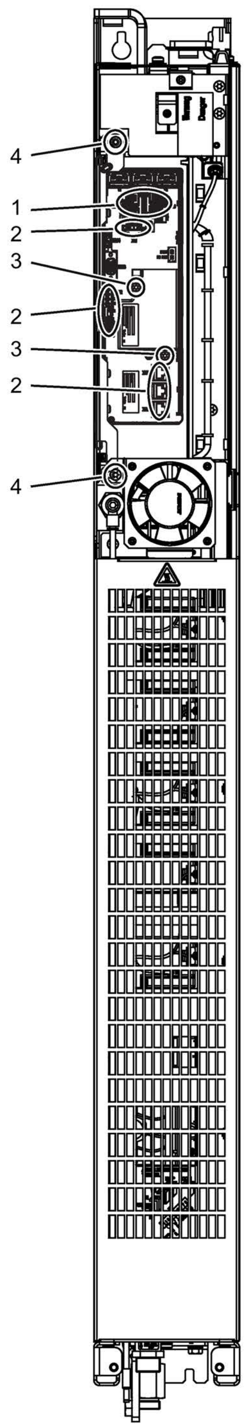


Figure 11-20 Replacing the electronic fan, Basic Line Module, frame size GBL

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 numbers in the diagram.

1. Disconnect the plugs for the signal cables (two connectors).
2. Remove DRIVE-CLiQ cables and connections at –X41/–X42 (maximum five connectors). The DRIVE-CLiQ cables should be marked to ensure that they are subsequently correctly inserted.
3. Take out the retaining screws for the IPD card (two screws) and remove the IPD card from connector -X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (two screws). The bottom screw also secures the front electronic fan.

When removing the Control Interface Module, you have to disconnect a maximum of five additional connectors one after the other (two at the top, three below) and the PE connection (one screw below).

NOTICE
Damage to the device due to damaged signal cables during disassembly
Signal cables can be damaged when withdrawing the Control Interface Module, which can result in a device failure. • When withdrawing the Control Interface Module, ensure that you do not damage any signal cables.

You can then replace the electronic fans of the Control Interface Module.

A description on how to replace the fan is provided here: Replacing the electronic fan of the Control Interface Module (Page 407).

Installation steps

Installing is the same as removing, however in the reverse order.

Tightening torque for the fastening screws of the Control Interface Module (M6 x 16, item ④): 6 Nm

Tightening torque for the PE screw (M4 x 8): 1.8 Nm

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug connections and ensure that they are secure.

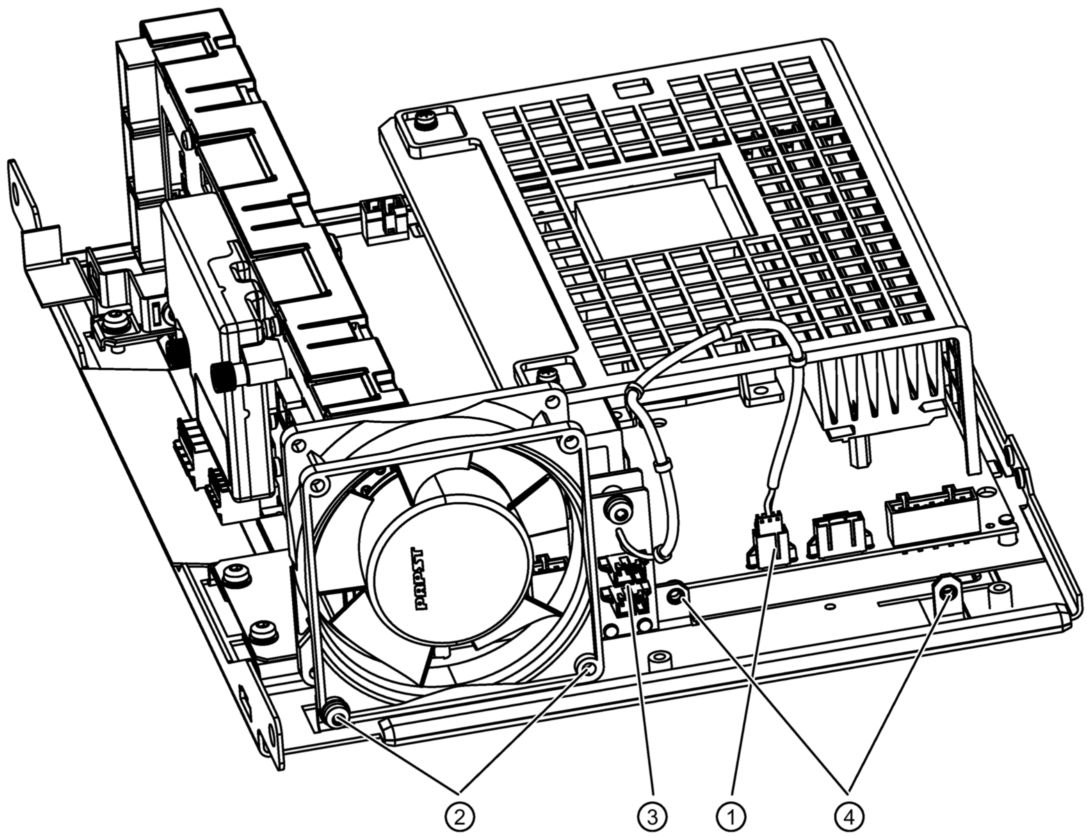
When using connectors with a locking mechanism, make sure that the locking lever is securely engaged once connected.

The DRIVE-CLiQ cable connectors 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 may only be tightened by hand.

11.4.21 Replacing the electronic fan of the Control Interface Module

Replacing the electronic fan of the Control Interface Module



① Slot for the fan power supply for versions equipped with an electronic fan
② Fixing screws for the first electronic fan
③ Slot for the fan power supply for versions equipped with two electronic fans
④ Fixing screws for the second electronic fan

Figure 11-21 Replacing the electronic fan of the Control Interface Module

Preparatory steps

- Disconnect the drive line-up from the power supply
- Allow unimpeded access
- Remove the protective cover
- Remove the Control Interface Module of the corresponding device (see the relevant description)

Replacement

The replacement procedure is shown in the previous diagram.

Version with one electronic fan

1. Withdraw the connector for the fan power supply ①.
2. Remove the fan fixing screws ② and withdraw the fan from the Control Interface Module.
   Note the fan direction of rotation - the appropriate arrows are stamped on the housing.
3. Mount the new electronic fan at the original location, fix it with the two fixing screws ② (tightening torque: 1.8 Nm).
   Check the arrows on the fan housing – they must match the alignment of the replaced fan.
4. Insert the connecting cable for the power supply of the electronic fan at slot ①.
5. Attach the connecting cable using cable ties, so that the cable cannot come in contact with the fan blades.

Version with two electronic fans

1. Withdraw the connectors for the fan power supply ③.
2. Remove the fixing screws ②, ④ of the fans and withdraw the fans from the Control Interface Module.
   Note the fan direction of rotation, it is shown in the form of arrows on the housing.
3. Mount the new electronic fans at their original locations, fix them using the two fixing screws ②, ④ (tightening torque: 1.8 Nm).
   Check the arrows on the fan housing – they must match the alignment of the replaced fans.
4. Connect the connecting cables for the fan power supply of the electronic fans at slots ③.
5. Attach the connecting cable using cable ties, so that the cable cannot come in contact with the fan blades.

11.4.22 Replacing the fan, Active Interface Module, frame size GI

Replacing the fan

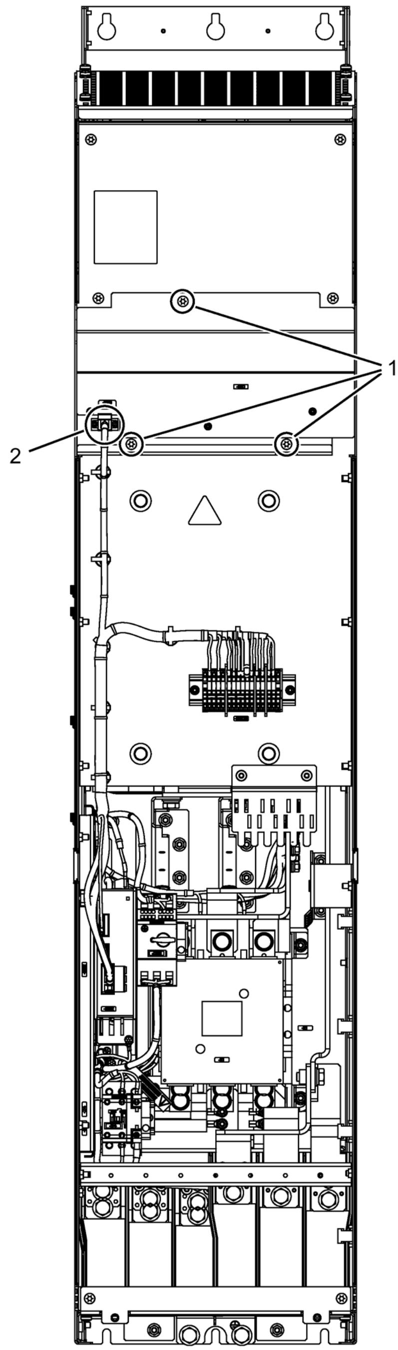


Figure 11-22 Replacing the fan, Active Interface Module, frame size GI

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 numbers in the diagram.

1. Remove the retaining screws for the fan unit (3 screws).
2. Unplug connector –X630.

You can now carefully remove the fan.

NOTICE
Damage to the device if signal cables become damaged during removal
Signal cables can become damaged when the fan is removed. This can cause the device to fail. • When removing the fan, ensure that you do not damage any signal cables.

Installation steps

To reinstall, perform the above steps in reverse order.

Note

Pay attention to the tightening torques

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

11.4.23 Replacing the fan, Active Interface Module, frame size HI

Replacing the fan

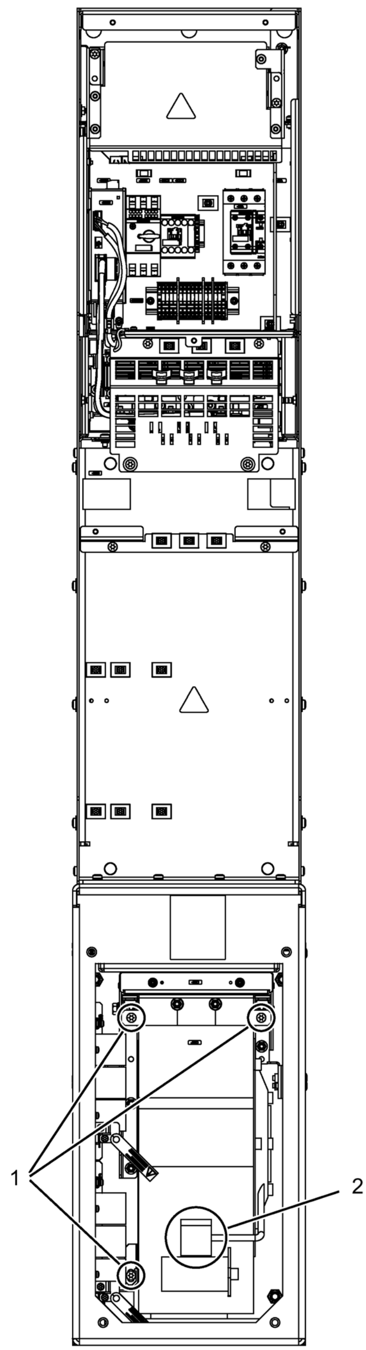


Figure 11-23 Replacing the fan, Active Interface Module, frame size HI

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 numbers in the diagram.

1. Remove the retaining screws for the fan unit (3 screws).
2. Disconnect the supply cables (1 x "L", 1 x "N").

You can now carefully remove the fan.

NOTICE
Damage to the device if signal cables become damaged during removal
Signal cables can become damaged when the fan is removed. This can cause the device to fail.
• When removing the fan, ensure that you do not damage any signal cables.

Installation steps

To reinstall, perform the above steps in reverse order.

Note

Pay attention to the tightening torques

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

11.5 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, then the DC link capacitors do not need to be reformed. The date of manufacture can be taken from the serial number on the nameplate.

Note

Storage period

It is important that the storage period is calculated from the date of manufacture and not from the date that the equipment was shipped.

Nameplate

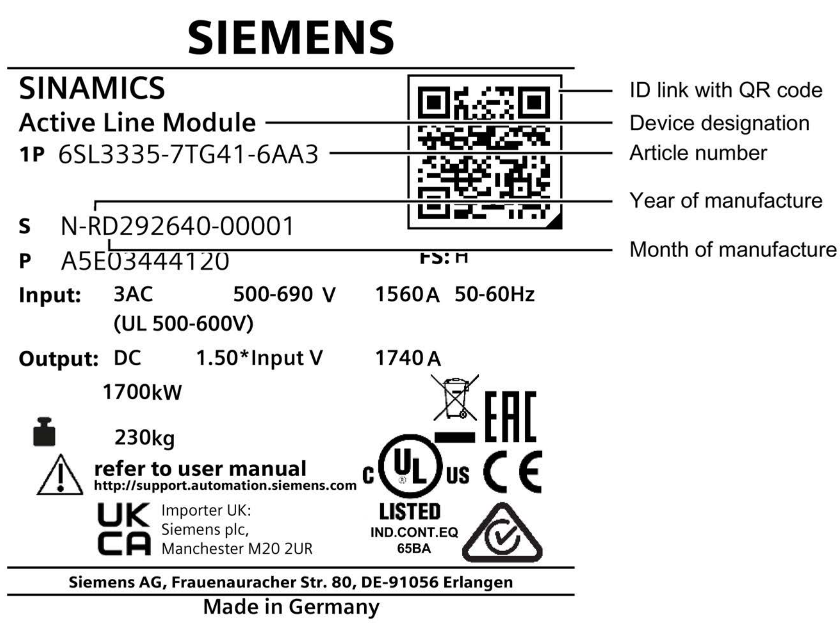


Figure 11-24 Nameplate using an Active Line Module as example

Date of manufacture

The date of manufacture can be determined as follows:

Table 11- 2 Production year and month

Character	Year of manufacture		Character	Month of manufacture
A	2010		1 ... 9	January to September
B	2011		O	October
C	2012		N	November
D	2013		D	December
E	2014			
F	2015			
H	2016			
J	2017			
K	2018			
L	2019			
M	2020			
N	2021			
P	2022			
R	2023			
S	2024			
T	2025			
U	2026			
V	2027			
W	2028			
X	2029			

Procedure in the event of repair or replacement

A replacement Line Module or Motor Module or the corresponding replacement power block has to be formed after being in storage for a period of more than two years.

The DC link capacitors are reformed 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 reforming 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 reformed 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 3 AC 380 to 480 V.
  Alternatively, use three 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 3 AC 500 to 690 V, where two incandescent lamps must be connected in series in each supply phase.
  Alternatively, use three 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.

WARNING

Electric shock when lamp sockets are installed so that they are not insulated

If two incandescent lamps connected in series are used, the insulation of the lamp sockets is not designed for a high voltage of 3 AC 500 to 690 V.

- For a line voltage of 3 AC 500 to 690 V, install the two lamp sockets connected in series with insulation and protect them from being touched.

Forming circuit for Line Modules

Note

Forming the Line Modules

Voltage must be supplied to Line Modules via a connected Motor Module and the associated DC link.

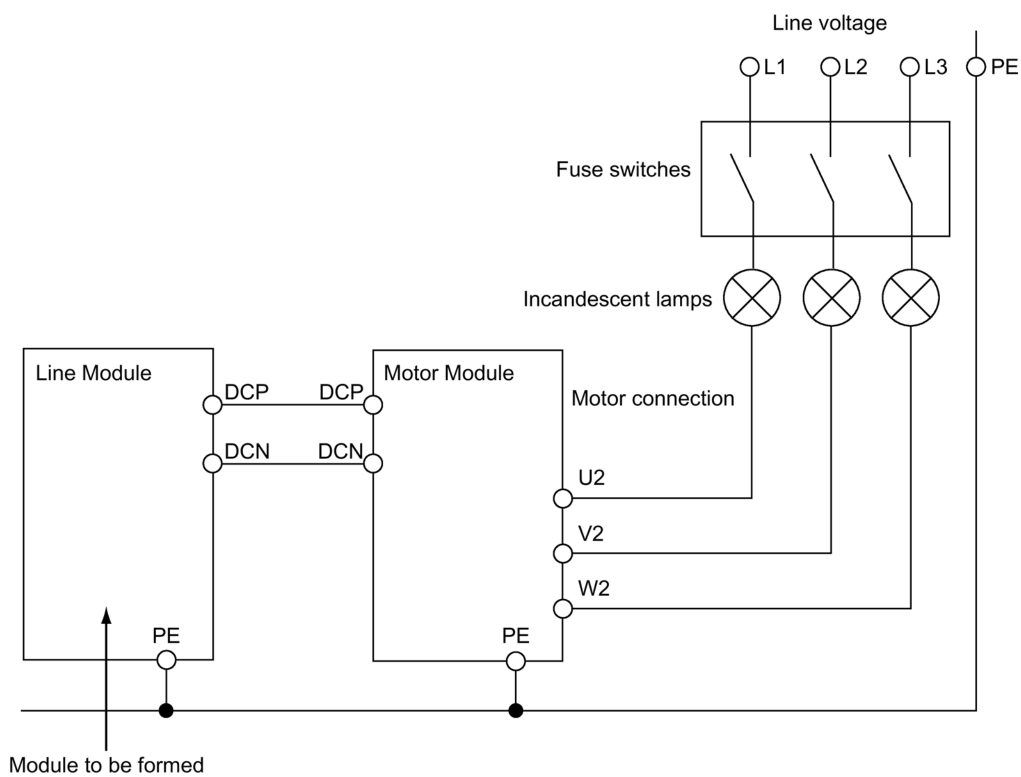


Figure 11-25 Forming circuit for Line Modules

Forming circuit for Motor Modules

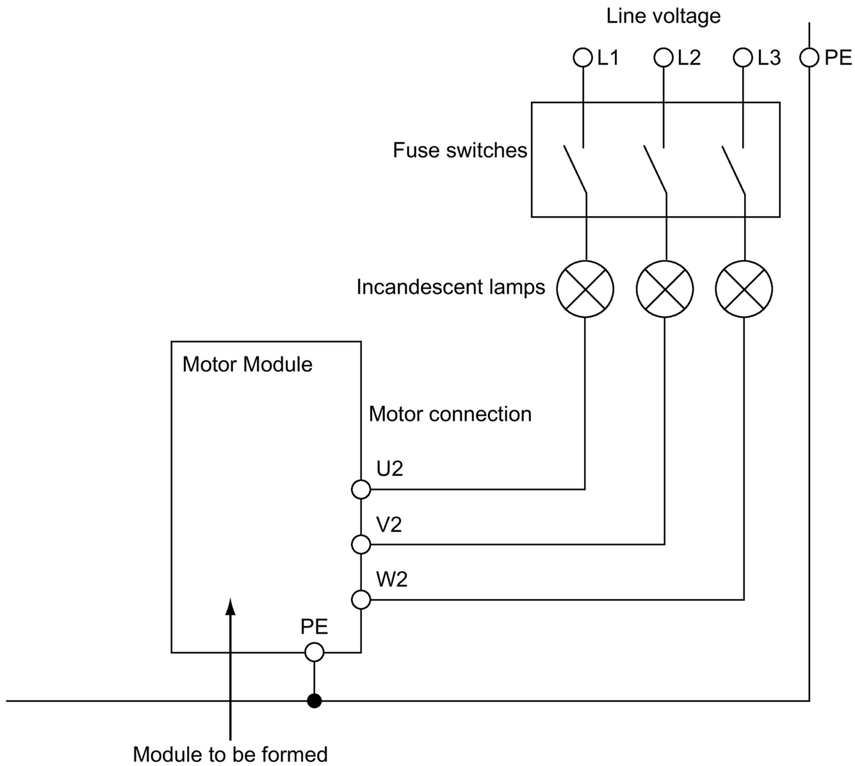
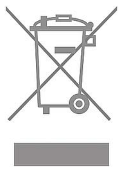


Figure 11-26 Forming circuit for Motor Modules

Procedure

- It is not permissible that the device being formed receives a power-on command (e.g. from the keyboard, BOP20 or terminal strip).
- Connect the appropriate forming circuit.
- Forming has been completed if the DC link voltage no longer increases.

11.6 Recycling and disposal



For environmentally friendly recycling and disposal of your old device, please contact a company certified for the disposal of old electrical and electronic devices and dispose of the device in accordance with the regulations in your country.

Appendix A

A.1 Cable lugs

Cable lugs

The cable connections on the devices are designed for cable lugs according to DIN 46234 or DIN 46235.

For connection of alternative cable lugs, the maximum dimensions are listed in the table below.
These cable lugs are not to exceed these dimensions, as mechanical fastening and adherence to the voltage distances is not guaranteed otherwise.

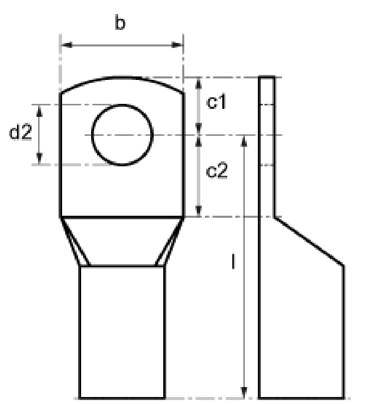


Figure A-1 Dimensions of the cable lugs

Table A- 1 Dimensions of the cable lugs

Screw / bolts	Connection cross-section [mm²]	d2 [mm]	b [mm]	l [mm]	c1 [mm]	c2 [mm]
M8	70	8.4	24	55	13	10
M10	185	10.5	37	82	15	12
M10	240	13	42	92	16	13
M12	95	13	28	65	16	13
M12	185	13	37	82	16	13
M12	240	13	42	92	16	13
M16	240	17	42	92	19	16

Attaching 2 cable lugs per phase

The cable lugs can be attached as shown in the following diagram if 2 cable lugs must be connected at each phase connection.

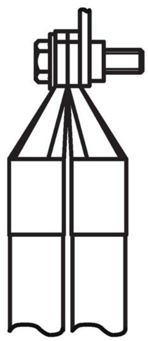


Figure A-2 2 cable lugs per connection

A.2 List of abbreviations

Note

The following list of abbreviations includes all abbreviations and their meanings used in the entire SINAMICS family of drives.

Abbreviation	Derivation of abbreviation	Meaning
A		
A...	Alarm	Alarm
AC	Alternating Current	Alternating current
ADC	Analog Digital Converter	Analog digital converter
AI	Analog Input	Analog input
AIM	Active Interface Module	Active Interface Module
ALM	Active Line Module	Active Line Module
AO	Analog Output	Analog output
AOP	Advanced Operator Panel	Advanced Operator Panel
APC	Advanced Positioning Control	Advanced Positioning Control
AR	Automatic Restart	Automatic restart
ASC	Armature Short-Circuit	Armature short-circuit
ASCII	American Standard Code for Information Interchange	American coding standard for the exchange of information
AS-i	AS-Interface (Actuator Sensor Interface)	AS-Interface (open bus system in automation tech-nology)
ASM	Asynchronmotor	Induction motor
AVS	Active Vibration Suppression	Active vibration suppression
B		
BB	Betriebsbedingung	Operating condition
BERO	-	Contactless proximity switch
BI	Binector Input	Binector input
BIA	Berufsgenossenschaftliches Institut für Arbeitssicherheit	BG Institute for Occupational Safety and Health
BICO	Binector Connector Technology	Binector connector technology
BLM	Basic Line Module	Basic Line Module
BO	Binector Output	Binector output
BOP	Basic Operator Panel	Basic Operator Panel
C		
C	Capacitance	Capacitance
C...	-	Safety message
CAN	Controller Area Network	Serial bus system
CBC	Communication Board CAN	Communication board CAN
CBE	Communication Board Ethernet	PROFINET communication module (Ethernet)
CD	Compact Disc	Compact disc
CDS	Command Data Set	Command data set
CF Card	CompactFlash Card	CompactFlash card
CI	Connector Input	Connector input

Abbreviation	Derivation of abbreviation	Meaning
CLC	Clearance Control	Clearance control
CNC	Computerized Numerical Control	Computerized numerical control
CO	Connector Output	Connector output
CO/BO	Connector Output/Binector Output	Connector output/binector output
COB-ID	CAN Object-Identification	CAN object identification
CoL	Certificate of License	Certificate of License
COM	Common contact of a change-over relay	Common contact of a change-over relay
COMM	Commissioning	Commissioning
CP	Communication Processor	Communications processor
CPU	Central Processing Unit	Central processing unit
CRC	Cyclic Redundancy Check	Cyclic redundancy check
CSM	Control Supply Module	Control Supply Module
CU	Control Unit	Control Unit
CUA	Control Unit Adapter	Control Unit Adapter
CUD	Control Unit DC	Control Unit DC
D		
DAC	Digital Analog Converter	Digital analog converter
DC	Direct Current	Direct current
DCB	Drive Control Block	Drive Control Block
DCBRK	DC Brake	DC braking
DCC	Drive Control Chart	Drive Control Chart
DCN	Direct Current Negative	Direct current negative
DCP	Direct Current Positive	Direct current positive
DDC	Dynamic Drive Control	Dynamic Drive Control
DDS	Drive Data Set	Drive Data Set
DI	Digital Input	Digital input
DI/DO	Digital Input/Digital Output	Digital input/output, bidirectional
DMC	DRIVE-CLiQ Hub Module Cabinet	DRIVE-CLiQ Hub Module Cabinet
DME	DRIVE-CLiQ Hub Module External	DRIVE-CLiQ Hub Module External
DMM	Double Motor Module	Double Motor Module
DO	Digital Output	Digital output
DO	Drive Object	Drive object
DP	Decentralized Peripherals	Decentralized peripherals
DPRAM	Dual Ported Random Access Memory	Dual-Port Random Access Memory
DQ	DRIVE-CLiQ	DRIVE-CLiQ
DRAM	Dynamic Random Access Memory	Dynamic Random Access Memory
DRIVE-CLiQ	Drive Component Link with IQ	Drive Component Link with IQ
DSC	Dynamic Servo Control	Dynamic Servo Control
DSM	Doppelsubmodul	Double submodule
DTC	Digital Time Clock	Timer
E		
EASC	External Armature Short-Circuit	External armature short-circuit
EDS	Encoder Data Set	Encoder data set
EEPROM	Electrically Erasable Programmable Read-Only Memory	Electrically Erasable Programmable Read-Only Memory
EGB	Elektrostatisch gefährdete Baugruppen	Electrostatically sensitive devices

Abbreviation	Derivation of abbreviation	Meaning
EIP	EtherNet/IP	EtherNet Industrial Protocol (real-time Ethernet)
ELCB	Earth Leakage Circuit Breaker	Residual current operated circuit breaker
ELP	Earth Leakage Protection	Ground-fault monitoring
EMC	Electromagnetic Compatibility	Electromagnetic compatibility
EMF	Electromotive Force	Electromotive force
EMK	Elektromotorische Kraft	Electromotive force
EMV	Elektromagnetische Verträglichkeit	Electromagnetic compatibility
EN	Europäische Norm	European standard
EnDat	Encoder-Data-Interface	Encoder interface
EP	Enable Pulses	Pulse enable
EPOS	Einfachpositionierer	Basic positioner
ES	Engineering System	Engineering system
ESB	Ersatzschaltbild	Equivalent circuit diagram
ESD	Electrostatic Sensitive Devices	Electrostatically sensitive devices
ESM	Essential Service Mode	Essential service mode
ESR	Extended Stop and Retract	Extended stop and retract
F		
F...	Fault	Fault
FAQ	Frequently Asked Questions	Frequently Asked Questions
FBLOCKS	Free Blocks	Free function blocks
FCC	Function Control Chart	Function control chart
FCC	Flux Current Control	Flux current control
FD	Function Diagram	Function diagram
F-DI	Failsafe Digital Input	Fail-safe digital input
F-DO	Failsafe Digital Output	Fail-safe digital output
FEPROM	Flash-EPROM	Non-volatile write and read memory
FG	Function Generator	Function generator
FI	-	Fault current
FOC	Fiber-Optic Cable	Fiber-optic cable
FP	Funktionsplan	Function diagram
FPGA	Field Programmable Gate Array	Field Programmable Gate Array
FW	Firmware	Firmware
G		
GB	Gigabyte	Gigabyte
GC	Global Control	Global control telegram (broadcast telegram)
GND	Ground	Reference potential for all signal and operating voltages, usually defined as 0 V (also referred to as M)
GSD	Gerätestammdatei	Generic Station Description: Describes the features of a PROFIBUS slave
GSV	Gate Supply Voltage	Gate supply voltage
GUID	Globally Unique Identifier	Globally Unique Identifier
H		
HF	High frequency	High frequency
HFD	Hochfrequenzdrossel	Radio frequency reactor
HLA	Hydraulic Linear Actuator	Hydraulic linear actuator

Abbreviation	Derivation of abbreviation	Meaning
HLG	Hochlaufgeber	Ramp-function generator
HM	Hydraulic Module	Hydraulic Module
HMI	Human Machine Interface	Human Machine Interface
HTL	High-Threshold Logic	Logic with high interference threshold
HW	Hardware	Hardware
I		
i. V.	In Vorbereitung	Under development: This property is currently not available
I/O	Input/Output	Input/output
I2C	Inter-Integrated Circuit	Internal serial data bus
IASC	Internal Armature Short-Circuit	Internal armature short-circuit
IBN	Inbetriebnahme	Commissioning
ID	Identifier	Identification
IE	Industrial Ethernet	Industrial Ethernet
IEC	International Electrotechnical Commission	International Electrotechnical Commission
IF	Interface	Interface
IGBT	Insulated Gate Bipolar Transistor	Insulated gate bipolar transistor
IGCT	Integrated Gate-Controlled Thyristor	Semiconductor power switch with integrated control electrode
IL	Impulslöschung	Pulse suppression
IP	Internet Protocol	Internet Protocol
IPO	Interpolator	Interpolator
IT	Isolé Terre	Non-grounded three-phase line supply
IVP	Internal Voltage Protection	Internal voltage protection
J		
JOG	Jogging	Jogging
K		
KDV	Kreuzweiser Datenvergleich	Data cross-check
KHP	Know-how protection	Know-how protection
KIP	Kinetische Pufferung	Kinetic buffering
Kp	-	Proportional gain
KTY84-130	-	Temperature sensor
L		
L	-	Symbol for inductance
LED	Light Emitting Diode	Light emitting diode
LIN	Linearmotor	Linear motor
LR	Lageregler	Position controller
LSB	Least Significant Bit	Least significant bit
LSC	Line-Side Converter	Line-side converter
LSS	Line-Side Switch	Line-side switch
LU	Length Unit	Length unit
LWL	Lichtwellenleiter	Fiber-optic cable
M		
M	-	Symbol for torque
M	Masse	Reference potential for all signal and operating voltages, usually defined as 0 V (also referred to as GND)

Abbreviation	Derivation of abbreviation	Meaning
MB	Megabyte	Megabyte
MCC	Motion Control Chart	Motion Control Chart
MDI	Manual Data Input	Manual data input
MDS	Motor Data Set	Motor data set
MLFB	Maschinenlesbare Fabrikatebezeichnung	Machine-readable product code
MM	Motor Module	Motor Module
MMC	Man-Machine Communication	Man-machine communication
MMC	Micro Memory Card	Micro memory card
MSB	Most Significant Bit	Most significant bit
MSC	Motor-Side Converter	Motor-side converter
MSCY_C1	Master Slave Cycle Class 1	Cyclic communication between master (class 1) and slave
MSR	Motorstromrichter	Motor-side converter
MT	Messtaster	Probe
N		
N. C.	Not Connected	Not connected
N...	No Report	No report or internal message
NAMUR	Normenarbeitsgemeinschaft für Mess- und Regel-technik in der chemischen Industrie	Standardization association for measurement and control in chemical industries
NC	Normally Closed (contact)	NC contact
NC	Numerical Control	Numerical control
NEMA	National Electrical Manufacturers Association	Standardization association in USA (United States of America)
NM	Nullmarke	Zero mark
NO	Normally Open (contact)	NO contact
NSR	Netzstromrichter	Line-side converter
NTP	Network Time Protocol	Standard for synchronization of the time of day
NVRAM	Non-Volatile Random Access Memory	Non-volatile read/write memory
O		
OA	Open Architecture	Software component which provides additional functions for the SINAMICS drive system
OAIF	Open Architecture Interface	Version of the SINAMICS firmware as of which the OA application can be used
OASP	Open Architecture Support Package	Expands the commissioning tool by the corre-sponding OA application
OC	Operating Condition	Operating condition
OCC	One Cable Connection	One-cable technology
OEM	Original Equipment Manufacturer	Original equipment manufacturer
OLP	Optical Link Plug	Bus connector for fiber-optic cable
OMI	Option Module Interface	Option Module Interface
P		
p...	-	Adjustable parameters
P1	Processor 1	CPU 1
P2	Processor 2	CPU 2
PB	PROFIBUS	PROFIBUS
PcCtrl	PC Control	Master control
PD	PROFIdrive	PROFIdrive

Abbreviation	Derivation of abbreviation	Meaning
PDC	Precision Drive Control	Precision Drive Control
PDS	Power unit Data Set	Power unit data set
PDS	Power Drive System	Drive system
PE	Protective Earth	Protective ground
PELV	Protective Extra Low Voltage	Protective extra low voltage
PFH	Probability of dangerous failure per hour	Probability of dangerous failure per hour
PG	Programmiergerät	Programming device
PI	Proportional Integral	Proportional integral
PID	Proportional Integral Differential	Proportional integral differential
PLC	Programmable Logical Controller	Programmable logic controller
PLL	Phase-Locked Loop	Phase-locked loop
PM	Power Module	Power Module
PMI	Power Module Interface	Power Module Interface
PMSM	Permanent-magnet synchronous motor	Permanent-magnet synchronous motor
PN	PROFINET	PROFINET
PNO	PROFIBUS Nutzerorganisation	PROFIBUS user organization
PPI	Point to Point Interface	Point-to-point interface
PRBS	Pseudo Random Binary Signal	White noise
PROFIBUS	Process Field Bus	Serial data bus
PS	Power Supply	Power supply
PSA	Power Stack Adapter	Power Stack Adapter
PT1000	-	Temperature sensor
PTC	Positive Temperature Coefficient	Positive temperature coefficient
PTP	Point To Point	Point-to-point
PWM	Pulse Width Modulation	Pulse width modulation
PZD	Prozessdaten	Process data
Q		
R		
r...	-	Display parameters (read-only)
RAM	Random Access Memory	Memory for reading and writing
RCCB	Residual Current Circuit Breaker	Residual current operated circuit breaker
RCD	Residual Current Device	Residual current device
RCM	Residual Current Monitor	Residual current monitor
REL	Reluctance motor textile	Reluctance motor textile
RESM	Reluctance synchronous motor	Synchronous reluctance motor
RFG	Ramp-Function Generator	Ramp-function generator
RJ45	Registered Jack 45	Term for an 8-pin socket system for data transmission with shielded or non-shielded multi-wire copper cables
RKA	Rückkühlanlage	Cooling unit
RLM	Renewable Line Module	Renewable Line Module
RO	Read Only	Read only
ROM	Read-Only Memory	Read-only memory
RPDO	Receive Process Data Object	Receive Process Data Object
RS232	Recommended Standard 232	Interface standard for cable-connected serial data transmission between a sender and receiver (also known as EIA232)

Abbreviation	Derivation of abbreviation	Meaning
RS485	Recommended Standard 485	Interface standard for a cable-connected differential, parallel, and/or serial bus system (data transmission between a number of senders and receivers, also known as EIA485)
RTC	Real Time Clock	Real-time clock
RZA	Raumzeigerapproximation	Space-vector approximation
S		
S1	-	Continuous operation
S3	-	Intermittent duty
SAM	Safe Acceleration Monitor	Safe acceleration monitoring
SBC	Safe Brake Control	Safe brake control
SBH	Sicherer Betriebshalt	Safe operating stop
SBR	Safe Brake Ramp	Safe brake ramp monitoring
SBT	Safe Brake Test	Safe brake test
SCA	Safe Cam	Safe cam
SCC	Safety Control Channel	Safety Control Channel
SCSE	Single Channel Safety Encoder	Single-channel safety encoder
SD Card	SecureDigital Card	Secure digital memory card
SDC	Standard Drive Control	Standard Drive Control
SDI	Safe Direction	Safe motion direction
SE	Sicherer Software-Endschalter	Safe software limit switch
SESM	Separately-excited synchronous motor	Separately excited synchronous motor
SG	Sicher reduzierte Geschwindigkeit	Safely limited speed
SGA	Sicherheitsgerichteter Ausgang	Safety-related output
SGE	Sicherheitsgerichteter Eingang	Safety-related input
SH	Sicherer Halt	Safe stop
SI	Safety Integrated	Safety Integrated
SIC	Safety Info Channel	Safety Info Channel
SIL	Safety Integrity Level	Safety Integrity Level
SITOP	-	Siemens power supply system
SLA	Safely-Limited Acceleration	Safely limited acceleration
SLM	Smart Line Module	Smart Line Module
SLP	Safely-Limited Position	Safely Limited Position
SLS	Safely-Limited Speed	Safely limited speed
SLVC	Sensorless Vector Control	Sensorless vector control
SM	Sensor Module	Sensor Module
SMC	Sensor Module Cabinet	Sensor Module Cabinet
SME	Sensor Module External	Sensor Module External
SMI	SINAMICS Sensor Module Integrated	SINAMICS Sensor Module Integrated
SMM	Single Motor Module	Single Motor Module
SN	Sicherer Software-Nocken	Safe software cam
SOS	Safe Operating Stop	Safe operating stop
SP	Service Pack	Service pack
SP	Safe Position	Safe position
SPC	Setpoint Channel	Setpoint channel
SPI	Serial Peripheral Interface	Serial peripheral interface

Abbreviation	Derivation of abbreviation	Meaning
SPS	Speicherprogrammierbare Steuerung	Programmable logic controller
SS1	Safe Stop 1	Safe Stop 1 (time-monitored, ramp-monitored)
SS1E	Safe Stop 1 External	Safe Stop 1 with external stop
SS2	Safe Stop 2	Safe Stop 2
SS2E	Safe Stop 2 External	Safe Stop 2 with external stop
SSI	Synchronous Serial Interface	Synchronous serial interface
SSL	Secure Sockets Layer	Encryption protocol for secure data transfer (new TLS)
SSM	Safe Speed Monitor	Safe feedback from speed monitor
SSP	SINAMICS Support Package	SINAMICS support package
STO	Safe Torque Off	Safe torque off
STW	Steuerwort	Control word
T		
TB	Terminal Board	Terminal Board
TEC	Technology Extension	Software component which is installed as an additional technology package and which expands the functionality of SINAMICS (previously OA application)
TIA	Totally Integrated Automation	Totally Integrated Automation
TLS	Transport Layer Security	Encryption protocol for secure data transfer (previously SSL)
TM	Terminal Module	Terminal Module
TN	Terre Neutre	Grounded three-phase line supply
Tn	-	Integral time
TPDO	Transmit Process Data Object	Transmit Process Data Object
TSN	Time-Sensitive Networking	Time-Sensitive Networking
TT	Terre Terre	Grounded three-phase line supply
TTL	Transistor-Transistor-Logic	Transistor-transistor logic
Tv	-	Rate time
U		
UL	Underwriters Laboratories Inc.	Underwriters Laboratories Inc.
UPS	Uninterruptible Power Supply	Uninterruptible power supply
USV	Unterbrechungsfreie Stromversorgung	Uninterruptible power supply
UTC	Universal Time Coordinated	Universal time coordinated
V		
VC	Vector Control	Vector control
Vdc	-	DC link voltage
VdcN	-	Partial DC link voltage negative
VdcP	-	Partial DC link voltage positive
VDE	Verband Deutscher Elektrotechniker	Association of German Electrical Engineers
VDI	Verein Deutscher Ingenieure	Association of German Engineers
VPM	Voltage Protection Module	Voltage Protection Module
Vpp	Volt peak to peak	Volt peak to peak
VSM	Voltage Sensing Module	Voltage Sensing Module
W		
WEA	Wiedereinschaltautomatik	Automatic restart
WZM	Werkzeugmaschine	Machine tool

Abbreviation	Derivation of abbreviation	Meaning
X		
XML	Extensible Markup Language	Extensible markup language (standard language for Web publishing and document management)
Y		
Z		
ZK	Zwischenkreis	DC link
ZM	Zero Mark	Zero mark
ZSW	Zustandswort	Status word

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More information

Siemens:
www.siemens.com

Industry Online Support (service and support):
www.siemens.com/online-support

IndustryMall:
www.siemens.com/industrymall