SIEMENS



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EQUIPMENT MANUAL

SINAMICS

SINAMICS S120

Cabinet Modules liquid cooled

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SINAMICS

S120
Cabinet Modules liquid cooled

Equipment Manual

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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.

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Disclaimer of Liability

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

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Preface

SINAMICS documentation

The SINAMICS documentation is organized in the following categories:

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

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

Please contact your local Siemens office or your local sales representative for further information about other available SINAMICS publications.

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

The contents of this documentation are not part of an earlier or existing agreement, a promise, or a legal agreement, nor do they change this. The Purchase Agreement contains the complete and exclusive obligations of Siemens, including the warranty provisions. These contractual warranty provisions are neither extended nor curbed as a result of the statements made in this documentation.

Sales legislation

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 relating to the suitability of the respective product for use in specific individual cases. Unless explicitly agreed as part of a contract, Siemens assumes no liability relating to 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.

Objective

This manual describes the hardware components and design of the liquid-cooled SINAMICS S120 Cabinet Modules. It provides information about installation, electrical connection, and control cabinet design.

Training

At the following address, you can find information about SITRAIN - Siemens training courses on 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)

Spare parts

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

The spare parts available for the ordered cabinet unit are in the spare parts list, included in the individual device documentation.

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 "Industry Online Support" app to obtain technical information about the device.

The App "Siemens Industry Online Support" is available for Apple iOS and Android.

Test certificates

Test certificates for functional safety functions ("Safety Integrated") can be found at the following Address (https://support.industry.siemens.com/cs).

An up-to-date list of currently certified components is also available on request from your local Siemens office. If you have any questions relating to certifications that have not yet been completed, please ask your Siemens contact person.

Internet addresses

Current information about our products can be found on the Internet at the following Address (http://www.siemens.com).

Information about SINAMICS S120 Cabinet Modules is provided at the following Address (http://www.siemens.com/sinamics-s120-cabinet-modules).

Certification

The following certifications can be found on the Internet under the link SINAMICS S120 Cabinet Modules certificates (https://support.industry.siemens.com/cs/de/en/ps/13233/cert):

The following certifications are included in the documentation:

- EC declaration of conformity with reference to the Low-Voltage Directive:
- EC declaration of conformity with reference to the EMC Directive:
- EC declaration of conformity with reference to the machinery directive (safety)
- Manufacturer's declaration in reference to Safety Integrated

Information on product-related environmental protection

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

Standards that are not relevant



China Compulsory Certification

SINAMICS S120 Cabinet Modules do not fall in the area of validity of the China Compulsory Certification (CCC).

Web sites of third-party companies

This document may contain hyperlinks to third-party websites. Siemens is not responsible for and shall not be liable for these websites and is not responsible for the content or information they provide. Siemens does not check the information on these websites and is not responsible for the content and information provided there. The user bears the risk for their use.

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 in compliance with the following requirements:

- 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.

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

Compliance with the General Data Protection Regulation

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

For this product, this means:
The product does not process or store any person-related data, only technical function data (e.g. time stamps). If the user links this data with other data (e.g. shift plans) or if he/she stores person-related data on the same data medium (e.g. hard disk), thus personalizing this data, he/she must ensure compliance with the applicable data protection stipulations.

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Fundamental safety instructions

1

1.1 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 equipment if you are appropriately qualified.
- Always observe the country-specific safety rules for all work.

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 that every auxiliary circuit is de-energized.
6. Ensure that the motors cannot move.
7. Identify all other dangerous energy sources, e.g. compressed air, hydraulic systems or 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 by following the above steps in the reverse order.



⚠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.

- Connect cable shields and unused conductors of power cables (e.g. brake conductors) at least on one side to 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 limiting.
- 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 devices in a rugged 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 severe 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.

⚠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.

⚠CAUTION

Injuries at places that are difficult to access

There is risk of injury when working at locations that are difficult to access. For example, sharp edges and splinters can cause injuries to the head and skin.

- Use suitable personal protective equipment, for example gloves.

⚠CAUTION

Hot component surfaces

Certain components (e.g. the heat sink and reactor) can become very hot during operation. These components can remain hot for a long time after operation. Contact can result in serious injury, such as skin burns.

- Do not touch hot components, even after you have switched off the device.

⚠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.
- Perform a function test.
- Only put your plant into live operation once you have absolutely guaranteed that the functions relevant to safety are operating 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.

1.2 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).

1.3 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.

1.4 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.

You can find additional information on Industrial Cybersecurity protective measures that can be implemented at:
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 always stay informed about product updates, subscribe to the Siemens Industrial Cybersecurity RSS Feed at:
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 applying suitable protection measures, e.g. virus scanners.
- Carefully check all cybersecurity-relevant settings once commissioning has been completed.

1.5 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 installer 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 are subject to wear, 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.

System overview

2

2.1 Overview

SINAMICS S120 Cabinet Modules are the components of a modular cabinet unit system for multi-motor drives with a central supply infeed and a common DC link busbar, as typically found in the process industry, automotive industry, metal processing industry as well as in the crane and mining domains.

They contain liquid-cooled built-in units from the SINAMICS S120 product series, thus making them an ideal supplement to the SINAMICS G150 and SINAMICS S150 series of cabinet units for single drives.

All drive components, from the supply infeed to the motor-side inverters, are configured in a clear, compact layout in the individual Cabinet Modules. They can be combined with great flexibility and can be optimally adapted to customer-specific requirements thanks to a comprehensive array of options.

The main components of the system are as follows:

- Basic Line Connection Modules with line-side components such as contactors, fuses, circuit breakers, line reactors and line filters for two-quadrant operation.
- Active Line Connection Modules with line-side components such as contactors, fuses and circuit breakers and Active Interface Modules for four-quadrant operation with line harmonics that can be neglected
- Active Line Connection Modules compact with Active Interface Modules for four-quadrant operation with line harmonics that can be neglected
- Motor Modules
- Motor Modules compact
- Control Units
- Heat Exchanger Modules
- Auxiliary Power Supply Modules to supply the auxiliary power supply system

Standardized interfaces for both the power and the control connections facilitate configuration and installation. Communication between the Power Modules and the central Control Unit is established via the DRIVE-CLiQ system interface.

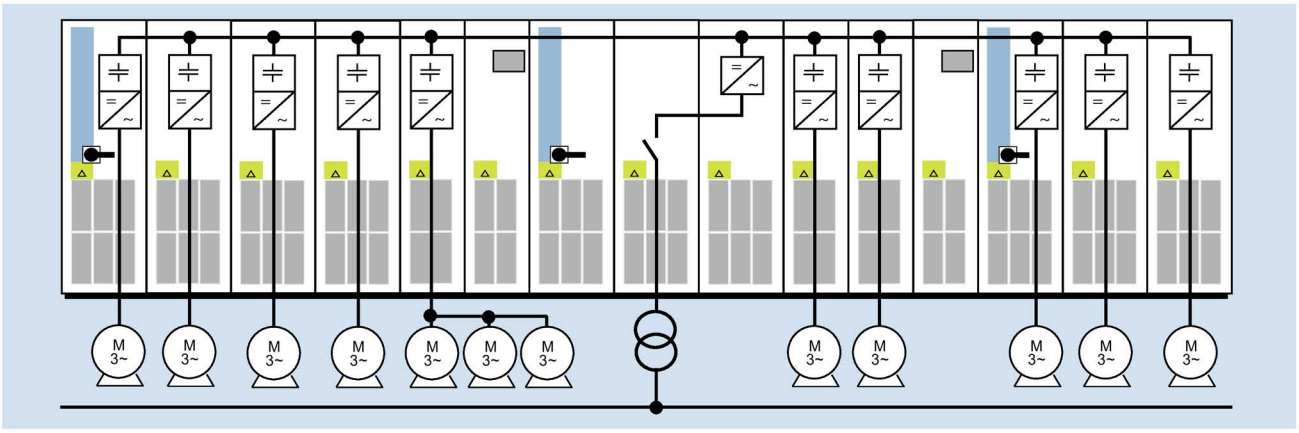


Figure 2-1 Example of a drive line-up with SINAMICS S120 Cabinet Modules for a multi-motor drive

The following table provides an overview of the voltage ranges and power ratings available for the liquid-cooled SINAMICS S120 Cabinet Modules:

Table 2- 1 Overview of voltage ranges and power ratings of the SINAMICS S120 Cabinet Modules

	Supply voltage 3 ph. AC	Input current	DC-link voltage DC	DC-link current	Output current	Power
Basic Line Connection Modules [1]	380 ... 480 V 500 ... 690 V	610 ... 1420 A 340 ... 1350 A	510 ... 650 V 675 ... 930 V	740 ... 1730 A 420 ... 1650 A		360 ... 830 kW 355 ... 1370 kW
Active Line Connection Modules [1]	380 ... 480 V 500 ... 690 V	605 ... 1405 A 735 ... 1560 A	570 ... 720 V 750 ... 1035 V	677 ... 1573 A 823 ... 1740 A		380 ... 900 kW 800 ... 1700 kW
Active Line Connection Modules compact [1]	380 ... 480 V 500 ... 690 V	605 ... 1405 A 735 ... 1560 A	570 ... 720 V 750 ... 1035 V	677 ... 1573 A 823 ... 1740 A		380 ... 900 kW 800 ... 1700 kW
Motor Modules [1]	(380 ... 480 V) (500 ... 690 V)		510 ... 720 V 675 ... 1035 V		210 ... 1405 A 100 ... 1560 A	110 ... 800 kW 90 ... 1500 kW
Motor Modules compact [1]	(380 ... 480 V) (500 ... 690 V)		510 ... 720 V 675 ... 1035 V		985 ... 1405 A 810 ... 1560 A	560 ... 800 kW 800 ... 1500 kW
Auxiliary Power Supply Module	380 ... 690 V	25 A				

[1] The power range can be extended as required by connecting up to four identical modules in parallel.

2.2 Field of application

The modular SINAMICS S120 Cabinet Modules drive system is used to coordinate multiple motors in a multi-axis drive system.

Typical examples include:

- Packaging machines
- Plastics processing machines
- Textile machines
- Presses, punches
- Printing and paper machines
- Machines used in the woodworking, glass and ceramics industries
- Hoisting gear
- Handling and assembly systems
- Machine tools
- Rolling mill drives
- Vehicle and gearbox test stands
- Test stand applications
- Shipbuilding and offshore applications for main and auxiliary drives as well as for integrating energy storage equipment

High-power single drives (parallel connection) can also be implemented with Cabinet Modules.

2.3 Benefits

The outstanding system features of the SINAMICS S120 Cabinet Modules provide plant operators with the following advantages:

- Process optimization with minimal effort:
  - A standard PROFIBUS or PROFINET interface and various analog and digital interfaces allow them to be easily integrated into automation solutions.
  - Vector and servo control ensures that they fulfill the most exacting requirements regarding the accuracy and dynamic response of drives.
- High level of reliability and availability:
  - Individual modules and power components can be replaced quickly and easily, which ensures a higher level of plant availability.
- Energy savings during operation:
  - The motor-side inverters are coupled via the common DC link and allow energy to be exchanged between motors that are motoring and generating. This means that energy is saved, there is less load on the supply infeed and line harmonics are reduced.
  - The supply infeed is generally only dimensioned for the maximum motor power required / maximum motor current and not the sum of the energy requirements of the Motor Modules connected to the DC link. For example, for conveyor systems or engine test stands with Motor Modules that are simultaneously in the motoring and regenerative mode, this frequently results in smaller line supplies.
- Cost minimization during operation, maintenance, and service:
  - Simple commissioning thanks to the menu-driven "STARTER" commissioning tool.
  - Optional, menu-assisted AOP30 Advanced Operator Panel with plain text display and bar-type display.
  - All device modules are easily accessible, which makes them extremely service friendly.
- Space-saving design
- Environmentally-friendly operation:
  - The converters are exceptionally quiet and compact thanks to state-of-the-art IGBT power semiconductors and liquid cooling.
  - Energy and CO_2 saving for liquid cooling when compared to air cooling as a result of the higher density and the higher thermal transfer coefficients of water.

2.4 Line Connection Modules

2.4.1 General information

Power is fed to the drive assembly via Line Connection Modules, which generate a DC voltage from the line voltage and, therefore, supply energy to the Motor Modules connected to the DC link. They are suitable for connection to systems grounded at the neutral point (TN, TT) and non-grounded (IT) systems.

Line Connection Modules are connected to the line supply and are implemented as standard in accordance with IEC 61800-3 Category C3.

2.4.2 Basic Line Connection Modules

Basic Line Connection Modules comprise a Line Connection Module and a liquid-cooled Basic Line Module installed in a cabinet system.

Basic Line Connection Modules are designed only for infeed operation, i.e., they are not capable of feeding regenerative energy back into the supply system.

If regenerative energy is produced, e.g. when the drives brake, it must be converted into heat in external braking resistors using a supplementary Motor Module, which is used as Braking Module.

When a Basic Line Connection Module is used as the infeed, a line reactor appropriate for the supply conditions must be installed. If the infeed is realized via a transformer with an appropriate rating in 6-pulse operation with a Basic Line Connection Module or in 12-pulse operation with two Basic Line Connection Modules, the line reactor is optional and can be omitted.

If two or more Basic Line Connection Modules are operated in parallel on a common supply system in order to increase power, then line reactors must also be used.

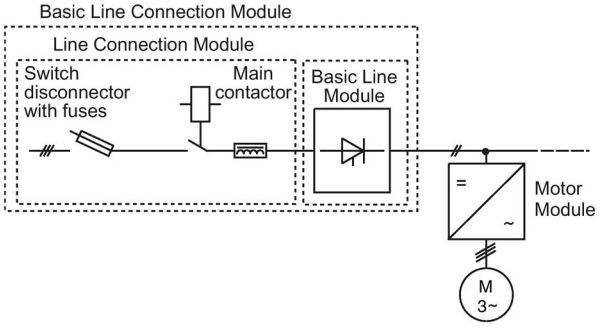


Figure 2-2 Basic Line Connection Module ≤800 A

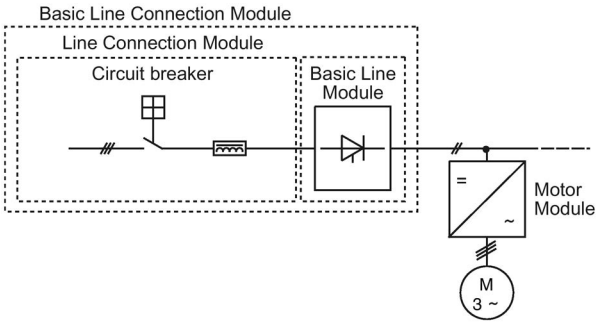


Figure 2-3 Basic Line Connection Module >800 A

2.4.3 Active Line Connection Modules

Active Line Connection Modules comprise a Line Connection Module, a liquid-cooled Active Interface Module and a liquid-cooled Active Line Module installed in a cabinet system.

Active Line Connection Modules can supply energy to the DC link and return regenerative energy to the line supply (energy recovery). The use of an additional Motor Module as Braking Module is only required if the drives need to be decelerated in a controlled manner after a power failure (i.e. when energy cannot be fed back into the line supply).

In contrast to Basic Line Connection Modules, Active Line Connection Modules generate a regulated DC voltage which remains constant irrespective of fluctuations in the line voltage. However, in this case, the line voltage must remain within the permissible tolerance range. Active Line Connection Modules draw an almost sinusoidal current from the line supply. Almost no harmonics occur. The total harmonic distortion factors of current THD(I) and voltage THD(U) at the rated current are typically in the range of 3 %. THD(I) is calculated according to IEEE 519 (2014) and THD(U) according to IEC 61000-2-4 (2002). The stringent limit values of IEEE 519 (2014) are typically complied with.

Active Line Connection Modules always contain an Active Interface Module, which in addition to a Clean Power Filter, also includes the necessary precharging circuit for the Active Line Module.

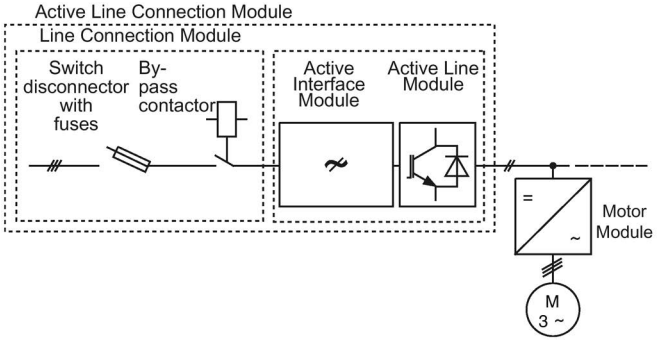


Figure 2-4 Active Line Connection Module with Active Interface Module and Active Line Module ≤800 A

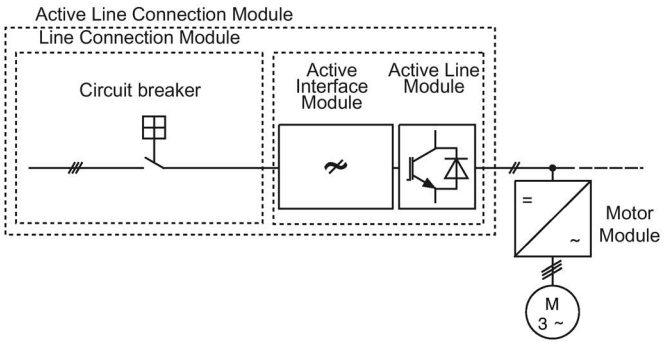


Figure 2-5 Active Line Connection Module with Active Interface Module and Active Line Module >800 A

2.4.4 Active Line Connection Modules compact

Active Line Connection Modules compact comprise a liquid-cooled Active Interface Module and a liquid-cooled Active Line Module installed in two control cabinets with a total width of 1200 mm. These are not equipped with a circuit breaker. The line-side infeed via the main switch with fuse switch disconnector or circuit breaker must be implemented on the plant/system side.

Active Line Connection Modules compact can supply energy to the DC link and return regenerative energy to the line supply (energy recovery). The use of an additional Motor Module as Braking Module is only required if the drives need to be decelerated in a controlled manner after a power failure (i.e. when energy cannot be fed back into the line supply).

In contrast to Basic Line Connection Modules, Active Line Connection Modules compact generate a controlled DC voltage that remains constant irrespective of fluctuations in the line voltage. However, in this case, the line voltage must remain within the permissible tolerance range. Active Line Connection Modules compact draw an almost sinusoidal current from the line supply. Almost no harmonics occur. The total harmonic distortion factors of current THD(I) and voltage THD(U) at the rated current are typically in the range of 3 %. THD(I) is calculated according to IEEE 519 (2014) and THD(U) according to IEC 61000-2-4 (2002). The stringent limit values of IEEE 519 (2014) are typically complied with.

Active Line Connection Modules compact always contain an Active Interface Module, which in addition to a Clean Power Filter, also includes the necessary precharging circuit for the Active Line Module.

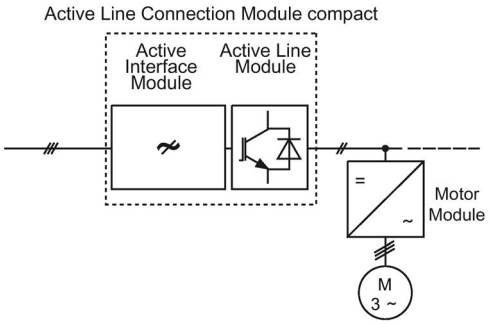


Figure 2-6 Active Line Connection Module compact with Active Interface Module and Active Line Module

2.5 Motor Modules

The Cabinet Modules are fitted with one SINAMICS S120 Motor Module in the chassis format and cover the power range from 90 kW to 1500 kW (380 V to 480 V or 500 V to 690 V). Power ratings up to approximately 5700 kW are possible by connecting units in parallel.

The Motor Modules can also be used as braking module (braking chopper) if a 3-phase braking resistor is connected instead of a motor.

For more detailed information on this topic, please refer to the SINAMICS Low Voltage Configuration Manual.

2.6 Motor Modules compact

Each Cabinet Module is equipped with one SINAMICS S120 Motor Module in the chassis format and covers the power range from 560 kW to 1500 kW (380 V to 480 V or 500 V to 690 V). They are installed in a 400 mm wide control cabinet in an especially space-saving fashion. The cable connection area is also designed to save space.
The power rating can be extended up to approx. 5700 kW by connecting in parallel.

The Motor Modules compact can also be used as braking module (braking chopper) if a 3-phase braking resistor is connected instead of a motor.

For more detailed information on this topic, please refer to the SINAMICS Low Voltage Configuration Manual.

2.7 Auxiliary Power Supply Modules

Auxiliary Power Supply Modules supply power to the auxiliary power supply system of the SINAMICS S120 Cabinet Modules.

The additional heat exchangers installed in the Cabinet Modules are some of the devices connected to this auxiliary power supply system. In addition, the auxiliary power supply system supplies the electronic modules with an external 24 V DC voltage. This is required when the DC link is not charged, for instance, in order to maintain PROFIBUS or PROFINET communication.

2.8 Heat Exchanger Modules

Heat Exchanger Modules are used to dissipate the power loss from the converter. They comprise a converter-side de-ionized water circuit and a plant-side raw water circuit.

The warm liquid (water and antifreeze and/or inhibitors) in the de-ionized water circuit of the converter is pumped to the water/water plate-type heat exchanger using circulating pumps (2 pumps for option W01). The heat exchanger is manufactured out of stainless steel and is connected to the plant-side raw water circuit.
The liquid in the de-ionized water circuit on the converter side is cooled by the raw water of the plant-side cooling system and then flows back to the converter.
Protection against condensation is implemented via the intake temperature of the converter-side de-ionized water circuit using a 3-way valve.

Heat Exchanger Modules are available for the following voltages and cooling capacities:

Line voltage	Cooling capacity
3 AC 380 ... 415 V	32 ... 120 kW
3 AC 500 ... 690 V	32 ... 120 kW

Note

Voltage adaptation for the pump

For Heat Exchanger Modules for line voltages of 3 AC 500 ... 690 V, the voltage is adapted to the 3 AC 400 V supply voltage of the pump using a transformer.

2.9 Overview of options

Table 2- 2 Overview of options

Option code	Brief description of option
C95	Supply voltage for the Heat Exchanger Module, 440 - 480 V/60 Hz
C97	Supply voltage for the Heat Exchanger Module, 500 - 690 V/60 Hz
B43	Production flowchart document: Generated once
B44	Production flowchart document: Updated every two weeks
B45	Production flowchart document: Updated every month
B50	Generation of a material declaration Green Passport
B55	Generation of a preliminary and a final packing list (shipping)
B56	Packed items with a customized label
B57	Photo documentation of the ordered units
D00	Documentation in German
D02	Customer documentation (circuit diagram, terminal diagram, layout diagram) in DXF format
D14	Preliminary version of customer documentation in PDF format
D56	Documentation in Russian
D58	Documentation in: English/French
D60	Documentation in: English/Spanish
D72	Documentation in Italian
D74	Documentation in English/German
D76	Documentation in English
D77	Documentation in French
D78	Documentation in Spanish
D80	Documentation in: English/Italian
D91	Documentation in: English/Chinese
D94	Documentation in: English/Russian
D99	Without operating instructions
E51	Individual certificate from the DNV
E61	Individual certificate from the American Bureau of Shipping (ABS)
E71	Individual certificate from the China Classification Society (CCS)
F03	Visual acceptance
F71	Function test with no motor connected (with the customer present)
F72	Function test with no motor connected (without the customer present)
F74	Function test with test bay motor (without the customer present)
F75	Function test with test bay motor (with the customer present)
F76	Insulation test (without the customer present)
F77	Insulation test (with the customer present)
F97	Customer-specific acceptance inspections (on request)
G20	CBC10 Communication Board
G33	CBE20 Communication Board
G51	1 temperature sensor module TM150
G52	2 temperature sensor modules TM150
G53	3 temperature sensor modules TM150
G54	4 temperature sensor modules TM150
G60	TM31 Terminal Module

Option code	Brief description of option
G61	Additional TM31 Terminal Module
G62	TB30 Terminal Board
K01	Safety license for 1 axis
K02	Safety license for 2 axes
K03	Safety license for 3 axes
K04	Safety license for 4 axes
K05	Safety license for 5 axes
K08	AOP30 Advanced Operator Panel installed in the cabinet door
K46	Sensor Module Cabinet-Mounted SMC10
K48	Sensor Module Cabinet-Mounted SMC20
K50	Sensor Module Cabinet-Mounted SMC30
K51	Voltage Sensing Module for determining the motor speed and the phase angle
K52	Additional SMC30 Sensor Module
K76	Auxiliary power generation in the Line Connection Module
K82	Terminal module to control "Safe Torque Off" and "Safe Stop 1"
K87	Terminal Module TM54F
K88	Safe Brake Adapter SBA 230 V AC
K90	Control Unit CU320-2 DP (PROFIBUS)
K94	Performance extension for CU320-2
K95	Control Unit CU320-2 PN (PROFINET)
L13	Main contactor (for supply currents of ≤ 800 A)
L21	Surge suppression
L22	Line reactor not included in scope of delivery
L25	Circuit breaker in withdrawable unit design
L40	Line filter monitoring
L41	Current transformer upstream of the main switch
L45	EMERGENCY OFF pushbutton installed in the cabinet door
L50	Cabinet lighting with service socket
L55	Cabinet anti-condensation heating
L87	Insulation monitoring
M06	Base 100 mm high, RAL 9005
M07	Cable-marshaling compartment 200 mm high, RAL 7035
M16	Dust protection packaging
M23	IP23 degree of protection
M26	Side panel (right)
M27	Side panel (left)
M43	Degree of protection IP43
M45	Cable entry via MCT frame
M54	IP54 degree of protection
M55	Degree of protection IP55
M61	Comfort-grip handle with a 3 mm double-bit lock insert
M62	Comfort-grip handle with integrated pushbutton lock insert
M63	Comfort-grip handle for a padlock with pushbutton as lock insert
M66	Marine version
M70	EMC shield rail
M72	Quick-release couplings for water hoses

Option code	Brief description of option
M80	DC busbar system (Id = 1170 A, 1x 60 x 10 mm)
M81	DC busbar system (Id = 1500 A, 1x 80 x 10 mm)
M82	DC busbar system (Id = 1840 A, 1x 100 x 10 mm)
M83	DC busbar system (Id = 2150 A, 2x 60 x 10 mm)
M84	DC busbar system (Id = 2730 A, 2x 80 x 10 mm)
M85	DC busbar system (Id = 3320 A, 2x 100 x 10 mm)
M86	DC busbar system (Id = 3720 A, 3x 80 x 10 mm)
M87	DC busbar system (Id = 4480 A, 3x 100 x 10 mm)
M88	DC busbar system for line-side Cabinet Modules
M90	Crane transport assembly (top-mounted)
M91	Marking of all control cable wire ends (including customer-specific cables)
N52	DC link fuses
P10	Measuring instrument for line variables (installed in the cabinet door)
P11	Measuring instrument for line variables with PROFIBUS connection, installed in the cabinet door
P13	Measuring instrument for line variables with PROFINET connection, installed in the cabinet door
P14	Measuring instrument for line variables with PROFINET connection, installed in the cabinet door
T58	Rating plate data in English/French
T60	Rating plate data in English/Spanish
T80	Rating plate data in English/Italian
T85	Rating plate data in English/Russian
T91	Rating plate data in English/Chinese
W01	Heat Exchanger Module, partially redundant with 2 pumps
W10	Insulation of the pipes in the raw water circuit and the heat exchanger
W20	Raw water connection from the bottom
W25	Raw water connection from the side
W34	Heat Exchanger Module for installation on left
W36	Heat Exchanger Module for installation on right
W43	Release valve in the de-ionized water circuit
W48	Leakage sensor at the converter cabinet floor panel
W49	Leakage sensor in the Heat Exchanger Module, at the bottom in the cabinet floor
W62	Sensors in the raw water circuit on the plant/system side
Y09	Special paint finish for cabinet
Y11	Factory assembly into transport units
Y31	Single-line labeling strip for plant identification, 40 x 80 mm
Y32	Two-line labeling strip for plant identification, 40 x 180 mm
Y33	Four-line labeling strip for plant identification, 40 x 180 mm

2.10 System structure

Line Modules are coupled with the various Motor Modules using prefabricated DC busbar sets with different current load ratings.

All standard busbars, as well as electronics components, are protected against environmental effects. This is achieved through the use of nickel-plated copper bars and coated modules throughout.

An auxiliary power supply system for the individual Cabinet Modules supplies the auxiliary power required for the heat exchanger fans and the 24 V DC loads.

Communication between the Control Unit, Line Module and Motor Module, and other active SINAMICS components takes place via DRIVE-CLiQ connections.

DRIVE-CLiQ is an internal serial interface of the drive that enables fast and easy configuration of the complete drive line-up with prefabricated cables in varying lengths.

As an option, Cabinet Modules can be delivered in preconfigured transport units with a total width of up to 2,400 mm each. Transport units enable the various devices to be quickly and easily assembled on-site.

2.11 System data

General technical system data

General data		
Line voltages and power ranges	380 ... 480 V 3 AC, ±10 % (-15 % < 1 min), 110 ... 800 kW [1)] 500 ... 690 V 3 AC, ±10 % (-15 % < 1 min), 90 ... 1500 kW [1)]	
Line system configurations	Line supplies grounded at the neutral point (TN/TT systems) or non-grounded line supplies (IT supply systems)	
Line frequency	47 ... 63 Hz	
Output frequency	Vector control: 0 ... 550 Hz· Servo control: 0 ... 550 Hz U/f control: 0 ... 550 Hz (higher output frequencies on request)	
Line power factor fundamental factor	Basic Line Modules: > 0.96	Active Line Modules: Can be adjusted (set in factory to cos φ =1)
Efficiency	> 99.0%	> 97.5%
Control method	Servo control, vector control with and without encoder or U/f control	
Fixed speeds	15 fixed speeds plus 1 minimum speed, programmable	
Skipped speed ranges	4, parameterizable	
Braking operation	Using energy recovery or a Motor Module as Braking Module with external braking resistors	
Degree of protection	IP21 (standard version) IP23, IP43, IP54 and IP55 (optional) (with options M26 and M27, side panels on the right-hand side or left-hand side)	
Protection class	Safety class I according to IEC 61800-5-1	
Overvoltage category	III according to IEC 61800-5-1	

General data	
Degree of pollution	2 according 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, which provide a positive air intake and discharge. The other alternative is to use heaters 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.
Cooling method	Cooling in accordance with IEC 60146: • Basic Line Connection Modules, Active Line Connection Modules, Motor Modules: **WE** – W: Liquid cooling – E: Forced cooling, drive device outside the equipment • Line filters, line reactors, motor reactors, dv/dt filters with Voltage Peak Limiter: **AN** – A: Air cooling – N: Natural cooling (convection)
Touch protection	EN 50274 and DGUV regulation 3 when used for the intended purpose
Cabinet system	Rittal TS 8, doors with double-bit lock, floor plates in the form of a tray to collect any leakage water. Cable entry from below through a neoprene mat
Paint finish	RAL 7035 (indoor requirements)

1) Power data for the basic version, power rating can be increased using a parallel connection.

Liquid cooling data	
Plant-side raw water circuit	
• Minimal system pressure with respect to the atmosphere	• 180 kPa
• Maximum system pressure with respect to the atmosphere	• 600 kPa
• Recommended system pressure with respect to the atmosphere	• 100 ... 250 kPa
• Maximum differential pressure drop in the Heat Exchanger Module at the rated volume flow	• 50 kPa ... 90 kPa
• Intake temperature of the coolant	• Dependent on ambient temperature and cabinet degree of protection, condensation is not permitted – <IP55: +5 ... +38 °C (recommended temperature range: +25 ... +30 °C) – IP55: +5 ... +33 °C (recommended temperature range: +25 ... +30 °C) – Temperature range between 0 °C and 5 °C only possible with antifreeze agent; recommended antifreeze agent: "Antifrogen N" supplied by Clariant

Liquid cooling data	
De-ionized water circuit in the converter	
• Maximum system pressure with respect to the atmosphere	• 600 kPa
• Recommended system pressure with respect to the atmosphere	• 160 ... 250 kPa
• Differential pressure drop across the Cabinet Module at the rated volume flow	• 150 kPa (incl. connections)
• Intake temperature of the coolant	• Dependent on ambient temperature and cabinet degree of protection, condensation is not permitted – <IP55: 0 ... 45 °C without derating, > 45 ... 50 °C see derating characteristics – IP55: 0 ... 40 °C without derating, > 40 ... 45 °C see derating characteristics – Temperature range between 0 °C and 5 °C only possible with antifreeze agent; recommended antifreeze agent: "Antifrogen N" and "Antifrogen L" from the Clariant company

Electromagnetic compatibility (EMC)	
Emitted interference	Category C3 (second environment) according to IEC 61800-3 [2)] Use according to IEC 60533 only in specific power distribution zones
Noise immunity	Use in the first and second environments according to IEC 61800-3

[2)] At the rated pulse frequency, for higher pulse frequencies, additional measures may be required.

Compliance with standards	
Standards	EN 50274, IEC 60146-1, IEC 60204-1, IEC 60529, IEC 61800-2, IEC 61800-3, IEC 61800-5-1
Conformities	CE (EMC Directive 2014/30/EU, Low-Voltage Directive 2014/35/EU and machinery directive 2006/42/EC for functional safety) RCM, RoHS II, UKCA

Ambient conditions			
	During storage [3)]	**During transport** [3)]	**In operation** [3)]
Ambient temperature	-25 °C ... +55 °C	-25 °C ... +70 °C from *-40 °C* for 24 hours	*0 °C* ... +45 °C to +50 °C see derating data
Relative air humidity (condensation not permissible) corresponds to class	*5 %* ... *95 %* 1K4 in accordance with IEC 60721-3-1:1997	5 % ... 95 % at 40 °C 2K3 in accordance with IEC 60721-3-2:1997	5 % ... *95 %* 3K3 in accordance with IEC 60721-3-3:2002
Environmental class / harmful chemical substances	1C2 according to IEC 60721-3-1:1997	2C2 according to IEC 60721-3-2:1997	3C2 according to IEC 60721-3-3:2002
Organic/biological influences	1B1 according to IEC 60721-3-1:1997	2B1 according to IEC 60721-3-2:1997	3B1 according to IEC 60721-3-3:2002
Mechanically active substances	1S1 according to IEC 60721-3-1:1997	2S1 according to IEC 60721-3-2:1997	3S1 according to IEC 60721-3-3:2002
Installation altitude	up to 2000 m above sea level - no derating, > 2000 m - see characteristics/derating data		

[3)] Deviations from the specified class are shown in *italics* .

Mechanical strength			
	During storage [3]	**During transport** [3]	**In operation** [3]
Vibratory load - Displacement - Acceleration - Corresponds to class	 1.5 mm at *5 Hz* ... 9 Hz 5 m/s² at > 9 ... 200 Hz 1M2 according to IEC 60721-3-1:1997	 3.1 mm at *5 Hz* ... 9 Hz 10 m/s² at > 9 ... 200 Hz 2M2 according to IEC 60721-3-2:1997	 0.075 mm at 10 ... 58 Hz 9.8 m/s² at >58 ... 200 Hz -
Shock load - Acceleration - Corresponds to class	 40 m/s² for 22 ms 1M2 according to IEC 60721-3-1:1997	 100 m/s² for 11 ms 2M2 according to IEC 60721-3-2:1997	 Test values according to EN 60068-2-27 Test Ea: 5 g, 30 ms, 3 shocks 3M1 according to IEC 60721-3-3:2002

[3] Deviations from the specified class are shown in *italics* .

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

Weight of a cabinet unit

The relevant weight of a cabinet unit is specified on the test certificate supplied and on the nameplate. The specified weight corresponds to the actual expansion stage of the cabinet unit.

Note

Limiting overvoltages

On systems with a grounded line conductor and a line voltage > 600 V, plant-side measures should be applied to limit overvoltages to overvoltage Category II according to IEC 61800-5-1.

2.12 Derating data

2.12.1 Derating factors as a function of coolant temperature

The SINAMICS S120 liquid-cooled devices are suitable for H_2O or a mixture of H_2O and antifreeze as coolant, corresponding to Chapter "Antifreeze, biocides, inhibitors (Page 140)".

When using H_2O with inhibitor as coolant for the de-ionized water circuit on the converter side, the units can supply 100 % output current in the temperature range between 5 °C and 45 °C (<IP55) or 5 °C and 40 °C (IP55); in the temperature range between 45 °C and 50 °C (<IP55) or 40 °C and 45 °C (IP55), the maximum output current linearly decreases to 90 %.
When using the above specified mixture comprising H_2O and antifreeze, the units can supply 100 % output current in the temperature range between 0 °C and 45 °C (<IP55) or 0 °C and 40 °C (IP55); in the temperature range between 45 °C and 50 °C (<IP55) or 40 °C and 45 °C (IP55) the maximum output current linearly decreases to 90 %.

When using H_2O with inhibitor as coolant for the raw water circuit on the plant side, the units can supply 100 % output current in the temperature range between 5 °C and 38 °C (<IP55) or 5 °C and 33 °C (IP55); in the temperature range between 38 °C and 43 °C (<IP55) or 33 °C and 38 °C (IP55), the maximum output current linearly decreases to 90 %.
When using the above specified mixture comprising H_2O and antifreeze, the units can supply 100 % output current in the temperature range between 0 °C and 38 °C (<IP55) or 0 °C and 33 °C (IP55); in the temperature range between 38 °C and 43 °C (<IP55) or 33 °C and 38 °C (IP55) the maximum output current linearly decreases to 90 %.

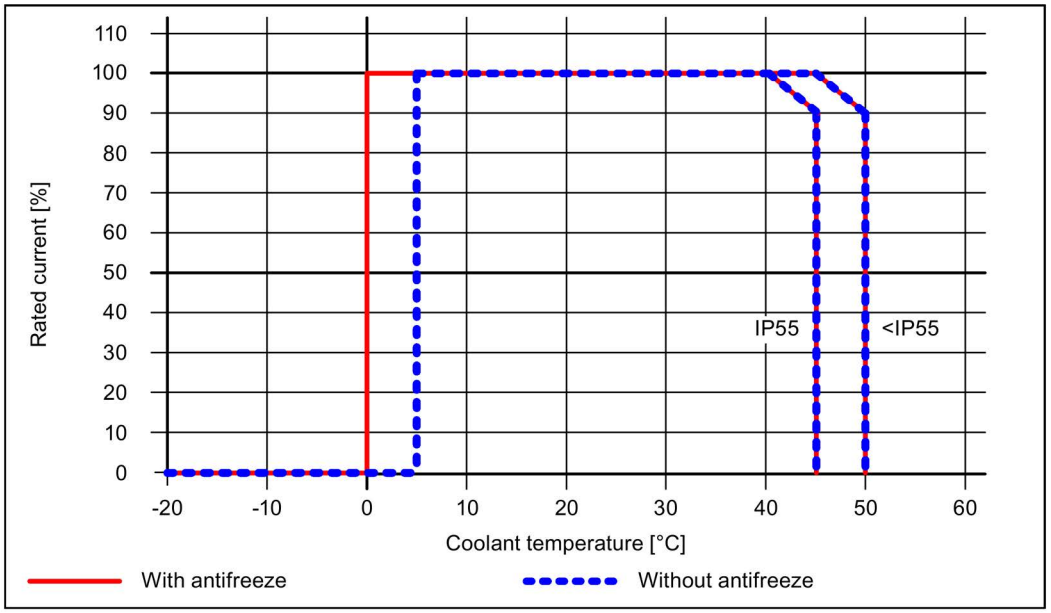


Figure 2-7 Maximum current as a function of coolant temperature of the de-ionized water circuit on the converter side

The intake temperatures in the plant-side raw water circuit must always be at least 7K below the intake temperatures in the de-ionized water circuit. This ensures that the cooling capacity of the Heat Exchanger Module of the de-ionized water circuit, specified in the technical data, can be dissipated to the raw water circuit.

The coolant intake temperature must always be kept above the ambient temperature to prevent condensation.

For additional information, please refer to the SINAMICS Low Voltage Engineering Manual.

2.12.2 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.

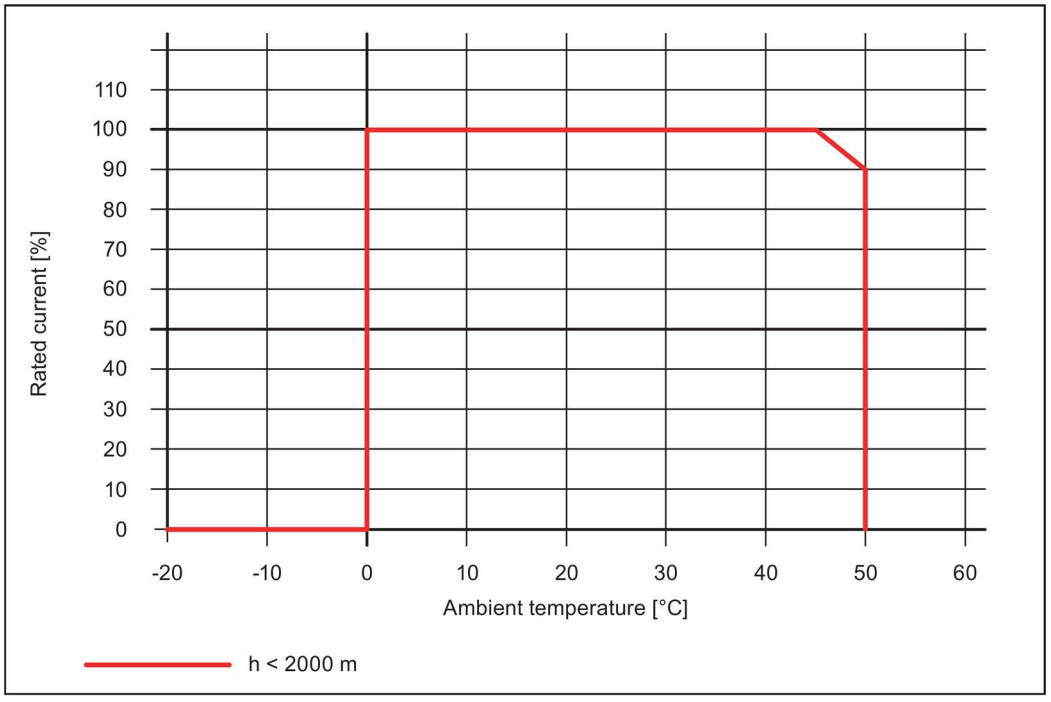


Figure 2-8 Maximum current as a function of ambient temperature

2.12.3 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.

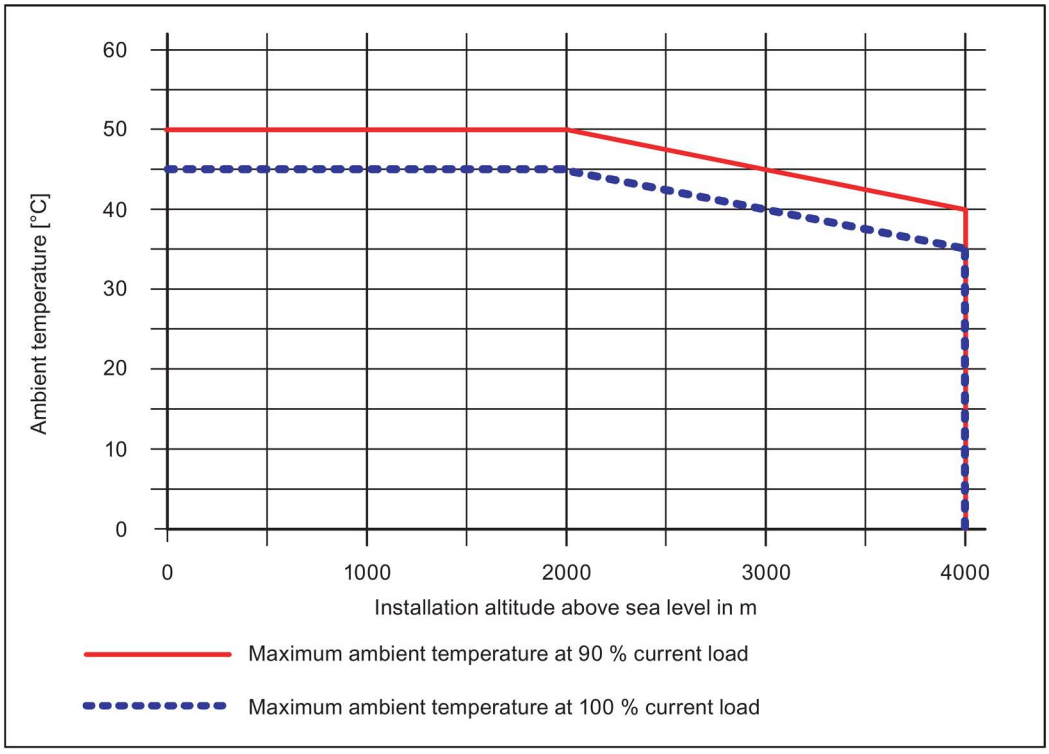


Figure 2-9 Maximum ambient temperature as a function of installation altitude

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 61800-5-1 for overvoltage 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.

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

Mechanical installation 3

3.1 Important notes

Transport

⚠WARNING

Incorrectly transporting the device

The unit can tip over if you transport it incorrectly – or if you use transport equipment that is not permitted for the purpose. This can result in death, serious injury or material damage.

- Ensure that only trained personnel transport the device with approved transport equipment and lifting tools.
- Observe the center of gravity specifications. A label or stamp is attached to each transport unit and precisely shows the center of gravity of the cabinet.
- Transport the unit only in the original marked upright position. Do not tilt the device or allow it to fall.
- The forks of the truck must protrude at the rear of the transport pallet. The floor panels of the transport units cannot be loaded or stressed.

⚠WARNING

Using forklift trucks that are not approved

If the forks are too short, this can cause the transport unit/cabinet to tip over resulting in death, serious injury or damage to the cabinet.

- The forks of the truck must protrude at the rear of the transport pallet. The floor panels of the transport units cannot be loaded or stressed.
- Only use forklift trucks approved for this purpose to transport the units.

Note

Notes regarding transportation

- The devices are packaged by the manufacturer in accordance with the climatic conditions and stress encountered during transport and in the receiving country.
- The notes on the packaging relating to transportation, storage, and proper handling must be observed.
- For transportation using forklifts, the devices must be set down on a wooden pallet.
- When the devices are unpacked, they can be transported using the optional transport eyebolts (option M90) or rails on the cabinet unit. The load must be distributed evenly. Heavy blows or impact must be avoided during transport and when the devices are being set down, for example.
- Shock and tilt indicators are attached to the packaging to detect unacceptable impact or tilting of the cabinet unit during transport (see Chapter Shipping and handling indicators (Page 58)).
- Permissible ambient temperatures:
  Air cooling: -25 to +70 °C, Class 2K3 acc. to IEC 60721-3-2:1997
  Briefly up to -40 °C for max. 24 hours

Note

Notes regarding damage during transport

- Carry out a thorough visual inspection of the device before accepting the delivery from the transportation company. Pay special attention to transport damage that is not readily apparent but indicated by the tilt and shock indicators.
- Check that you have received all the articles specified on the delivery note.
- Notify the shipping company immediately of any missing components or damage.
- If you identify any hidden defects or damage, contact the transportation company immediately and ask them to examine the device.
- If you fail to notify them immediately, you may lose your right to claim compensation for the defects and damage.
- If necessary, you can request support from your local Siemens office or your local sales representative.

Storage

The devices must be stored in clean, dry rooms. Temperatures between -25° C and +55 °C are permissible (class 1K4 according to IEC 60721-3-1:1997). Temperature fluctuations greater than 20 K per hour are not permitted.

If the cabinet unit is stored for a prolonged period once it has been unpacked, cover it or take other appropriate measures to ensure that it does not become dirty and that it is protected against environmental influences. If such measures are not taken, the warranty becomes invalid in the event of a claim for damages.

3.2 Mechanical installation: Checklist

Use the following checklist to guide you through the mechanical installation procedure for the cabinet/transport unit. Read the Chapter "Fundamental safety instructions" before you start working on the cabinet.

For installation instructions, see the following sections or refer to the documents listed in the table below.

Note

Checking the checklist

Check the boxes accordingly in the right-hand column if the option involved applies to the scope of delivery. In the same way, check the boxes once you have finished the installation procedure to confirm that the activities have been completed.

Table 3- 1 Mechanical installation: Checklist

Item	Activity	Applicable?/Completed?	
1	Check the transport indicators prior to installation. (→ See Chapter "Installation/preparation", Section "Transport indicators")	☐	☐
2	Check the cabinet center of gravity shown on the label provided.	☐	☐
3	The ambient conditions must be permissible. (→ See general technical specifications in Chapter "System overview", Section "System data")	☐	☐
4	The load-carrying capacity and properties of the ground must fulfill the requirements for installation of the Cabinet Modules. (→ See Chapter "Cabinet Modules" in the technical specifications for the relevant Cabinet Modules) (→ See Chapter "Mechanical installation", Section "Preparation")	☐	☐
5	Before the cabinet units are finally installed, the wooden pallets supplied with the transport unit must be professionally removed. (→ See Chapter "Installation", Section "Lifting from the transport pallet and installing the cabinet units")	☐	☐
6	The crane transport assembly (option M90) attached for delivery must be removed once the transport unit or individual cabinet units have been set down at the final installation location. (→ See Chapter "Installation", Section "Disassembling the crane transport assembly")	☐	☐
7	The required minimum ceiling height must be observed. The cooling air supply and discharge must not be obstructed and must provide an adequate quantity. (→ See Chapter "Installation", Section "Preparation")	☐	☐
8	The cabinet must be firmly attached to the fixing points provided. The cabinet units must be correctly connected with one another. The collecting pipes of the cooling circuit must be connected. (→ See Chapter "Installation", in Section "Mechanical connection of the cabinet units")	☐	☐
9	If it is possible to enter the area underneath the cabinet units, plant-side touch protection must be provided for this area.	☐	☐

Item	Activity	Applicable?/Completed?	
10	With option M26, the installed cabinet equipment must be enclosed on the right, and with option M27, the installed cabinet equipment must be enclosed on the left! • Side panel installed on the right (option M26) • Side panel installed on the left (option M27) (→ See Chapter "Options", Section "M26 / M27, side panels mounted to the right or left".)	☐	☐
11	All shock protection measures (guards, plates) in and on the cabinet units must be installed before commissioning.	☐	☐
12	The clearance around an open control cabinet door (escape route) specified in the applicable accident prevention guidelines must be observed.	☐	☐

3.3 Installing

3.3.1 Important safety precautions

⚠WARNING

Failure to observe the general safety instructions and residual risks

If the general safety instructions and remaining risks are not observed, accidents can occur involving severe injuries or death.

- Observe the general safety instructions.
- When assessing the risk, take into account residual risks.

Protection against the spread of fire

The device may only be operated in enclosed housings with closed protective covers or in higher-level electrical rooms, with all of the protective devices in use. The installation of the device in an electrical room or the protection provided by another equivalent measure must prevent the spread of fire and emissions outside the control cabinet.

Protection against condensation or electrically conductive contamination

Protect the device, e.g. by installing it in an electrical room with degree of protection IP54 according to IEC 60529 or NEMA 12. Further measures may be necessary for particularly critical operating conditions.

If condensation or conductive pollution can be ruled out at the installation site, then it is permissible to have an electrical room with a lower degree of protection.

3.3.2 Preparation

3.3.2.1 On-site requirements

The Cabinet Modules are designed for installation in closed, electrical operating areas according to IEC 61800-5-1. A closed electrical operating area is a room or area containing electrical equipment which can be accessed by trained personnel only. Access is controlled by a door or other form of barricade which can be opened only by means of a key or other tool. The room or area is also clearly signed with appropriate warning notices.

The installation location must be dry and dust-free. The air supplied must not contain any electrically conductive gas, vapors, or dust, which could impair operation. It may be necessary to filter the air supplied to the installation room. If the air contains dust, filter mats (option M43/M54) can be installed in front of the ventilation grilles in the cabinet doors. Option M55 offers additional protection against water splashed against the housing from any direction and corresponds to IP55 degree of protection.

The permissible values for climatic ambient conditions must be taken into account.

Derating is required for ambient temperatures > 45 °C (113 °F) or installation altitudes > 2000 m (→ refer to the derating data in Chapter "System overview").

The basic version of the cabinet units has degree of protection IP21 in accordance with IEC 60529.

Note

Requirements for IP21

Cabinet Modules do not fulfill the requirements for IP21 until they have been closed off by installing a side panel on the right (option M26) and a side panel on the left (option M27)!

The cabinet units are installed in accordance with the dimension drawings supplied. The clearance to be maintained between the top of the cabinet and the ceiling is shown in the diagram below. Additional dimensions must be taken into account for the M06 (cabinet base) and M07 (cable-marshaling compartment) options.

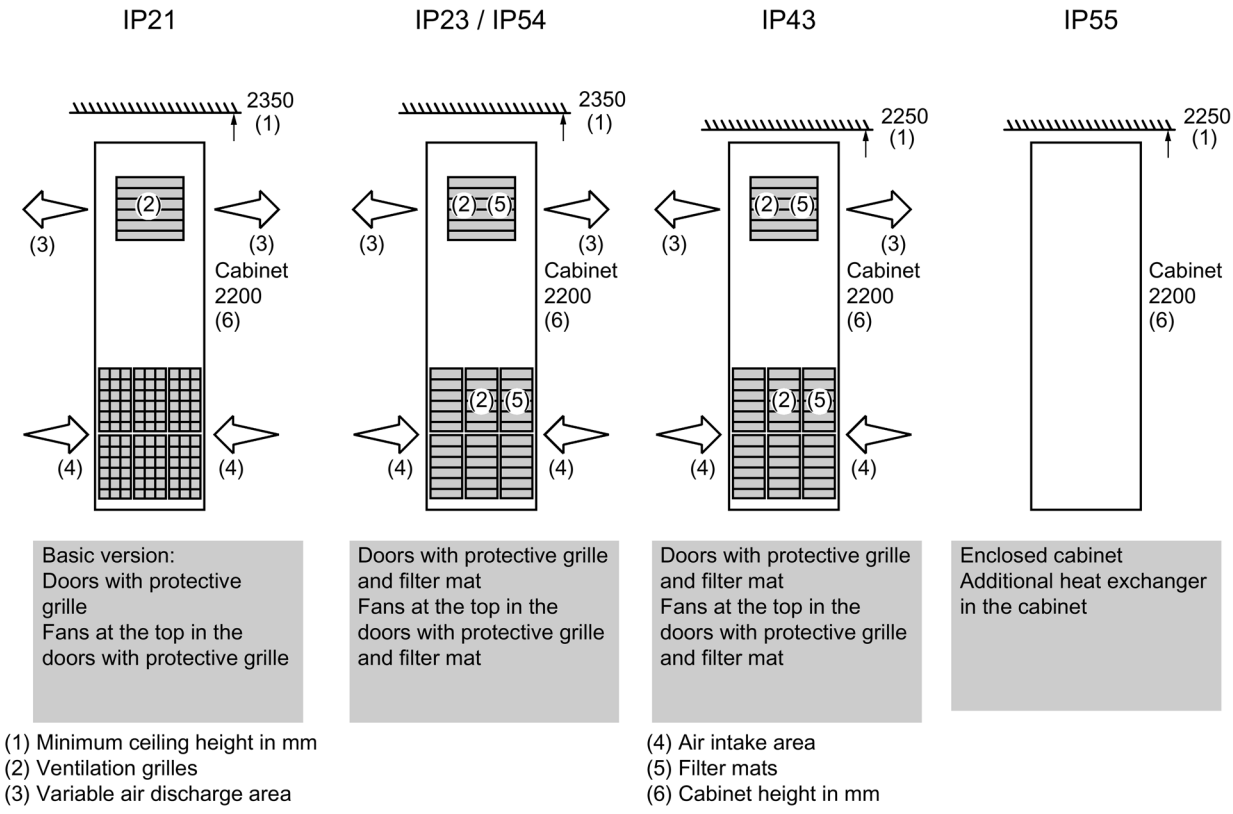


Figure 3-1 Required room height for different degrees of protection (without Options M06 and M07)

Note

Further dimensions

Additional dimensions are specified on the associated dimension drawings, included in the device documentation provided.

For degrees of protection IP21/IP23/IP43/IP54, the cooling air for the cabinet is drawn in through the ventilation grilles in the lower section of the cabinet doors. The warmed air is discharged through the ventilation grilles in the upper area of the doors (with options M23/M43/M54 for degrees of protection IP23/IP43/IP54).
For option M55 for an IP55 degree of protection, the cabinet is closed and most of the heat generated in the cabinet is dissipated to the coolant through the heat exchanger. The remaining power loss is dissipated to the ambient air through the surface of the cabinet.

Note

Interference to radio/wireless services due to high frequency (radio frequency) disturbances

The converter can cause high frequency disturbances, which may make interference suppression measures necessary.

This device is not designed for unrestricted operation in the first environment (residential environment) and may not be used in the first environment without suitable interference suppression measures.

- Have the installation and commissioning with appropriate radio interference suppression measures performed by qualified personnel.

3.3.2.2 Requirements on the levelness of the floor

The foundation at the installation location must be horizontal and level, to ensure proper functioning of the cabinet units.

- Care must be taken to ensure that the doors can be opened and closed, the locking systems work properly.
- Flat sections (such as doors, side panels) must be sealed correctly to ensure compliance with the specified degree of protection.
- When connecting cabinet units side-by-side, ensure that no air can enter through gaps.

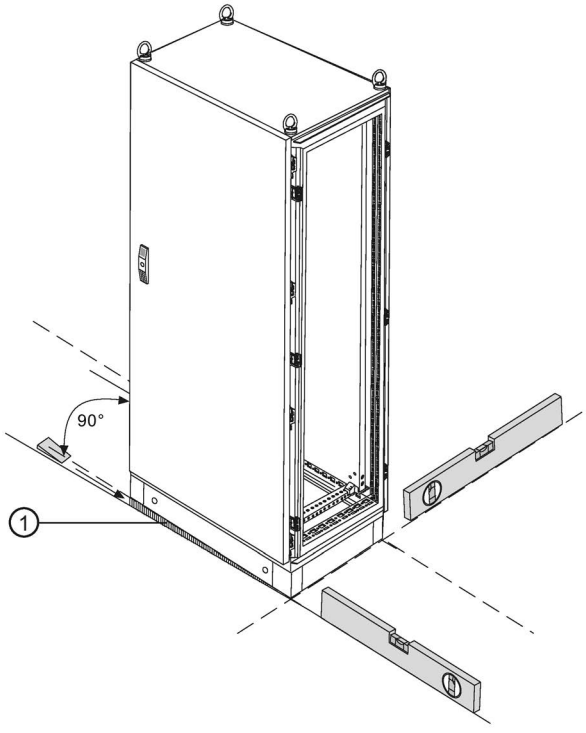


Figure 3-2 Requirements on the levelness of the floor

The following requirements must be met to ensure the full functionality of the cabinet units:

- The foundation must be level and horizontal.
- Irregularities must be leveled out.
- Gaps where air can enter, created when aligning (e.g.: ① in the diagram) must be closed.

3.3.2.3 Shipping and handling indicators

The cabinet units are equipped with tilt and shock indicators to monitor for damage during transit.



Figure 3-3 Tilt indicator



Figure 3-4 Shock indicator

Position of the shipping and handling indicators

The tilt indicators are affixed to the top of the cabinet unit inside the doors.

The shock indicators are affixed to the bottom of the cabinet unit inside the doors.

Checking the shipping and handling indicators prior to commissioning

It is essential to check the shipping and handling indicators prior to commissioning the converter.

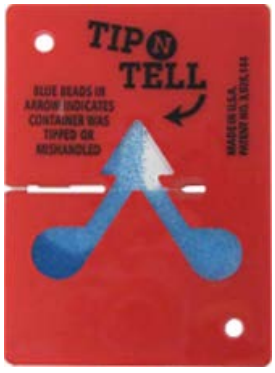


Figure 3-5 Tilt indicator tripped

The tilt indicator provides immediate visible evidence of whether the cabinet units have been handled and 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 3-6 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

Damage to the device when shock or tilt indicators are 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.

- Terminate the commissioning if one of the shock or tilt indicators has tripped.
- Contact Technical Support immediately for clarification.

Removing the shipping and handling indicators prior to commissioning

NOTICE
Material damage caused by transport indicators remaining in the device during operation If transport indicators remain in the device during operation, material damage can result from falling off or through temperature damage. • Remove the transport indicators before commissioning the converter.

Ethyl alcohol can be used to remove any remains of adhesive after removing the transport indicators from the control cabinet.

3.3.2.4 Unpacking the cabinets

The packaging material must be discarded in accordance with the applicable country-specific guidelines and rules.

3.3.2.5 Tools required

To install the connections, you will need:

- Standard toolboxes with screwdrivers, screw wrenches, socket wrenches, etc.
- Torque wrenches from 1.5 Nm up to 100 Nm
- 400 mm extension for socket wrenches

Tightening torques for screw connections

The following tightening torques apply when tightening current-conducting connections (DC-link connections, motor connections, busbars, lugs) and other connections (ground connections, protective conductor connections, steel threaded connections).

Table 3- 2 Tightening torques for screw connections

Thread	Ground connections, protective conductor connections, steel threaded connections	Aluminum threaded connections, plastic, busbars, 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

NOTICE
Screw connections for protective covers The threaded connections for the protective covers made of Makrolon may only be tightened with 2.5 Nm.

3.3.3 Lifting the cabinet units off the transport pallet and installing them

The applicable local guidelines regarding the transportation of the cabinet from the transport pallet to the installation location must be observed.

A crane transport assembly (option M90) can also be fitted on the top of the cabinet.

The fastening screws of the transport pallets can be removed without having to lift the cabinet unit. The positions of the fastening screws are indicated by red markings on the outside of the pallets.



Figure 3-7 Lifting from the transport pallet (left: without base; right: with base)

For cabinet units without base (in the figure on the left), the fastening screws of the transport pallets must be removed from the lower side of the pallet.
For cabinet units with base (in the figure on the right), the fastening screws of the transport pallet are accessible only after the cover is opened. They can then be loosened and removed directly from the front.

⚠WARNING

Failure to observe the weight and the center of gravity

Not observing restrictions regarding the weight and the center of gravity can result in death or severe injury when lifting and transporting.

- The weight specified on the packaging and the designated center of gravity must always be taken into account when lifting or transporting the equipment.
- This potential hazard must be taken into account particularly once you have unscrewed the cabinet units from the transport pallet.

Center of gravity of the cabinet

The diagram below shows the center of gravity of the cabinet (for all sizes), which must always be taken into account when lifting and installing the cabinet.

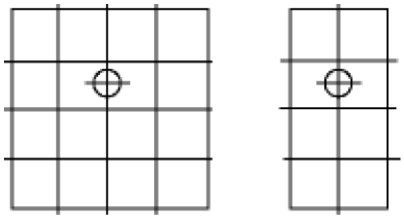


Figure 3-8 Center of gravity of the cabinet

Note

Center of gravity of the cabinet

A label with the precise position of the center of gravity of the cabinet is attached to each cabinet or each transport unit.

3.3.4 Disassembling the crane transport assembly

With option M90 (crane transport assembly), the Cabinet Modules are equipped with either transport eyebolts or mounting rails.

With option Y11 (assembly into transport units in the factory), the Cabinet Modules are always equipped with a mounting rail.



Figure 3-9 Option M90 / Y11, mounting rails

Removal

The transport eyebolts can be unscrewed and removed. Depending on the length of the cabinet or transport unit, the support rails can have a varying number of fastening screws. These must be unscrewed and removed before the rails can be removed.

⚠WARNING

Incorrect handling of the mounting rail

The improper handling of heavy carrying rails during disassembly can cause injuries or material damage.

- Ensure careful handling of the carrying rails during disassembly.
- Prevent screws from falling into the unit during disassembly and so causing damage during operation.

Original roof screws



Figure 3-10 Original roof screws accessory kit

After removing the crane transport aids, the transport eyebolts or the fixing screws of the mounting rail that have been removed must be replaced by the original roof screws from the accessories pack supplied in order to ensure compliance with the degree of protection and proper grounding of the cabinet.

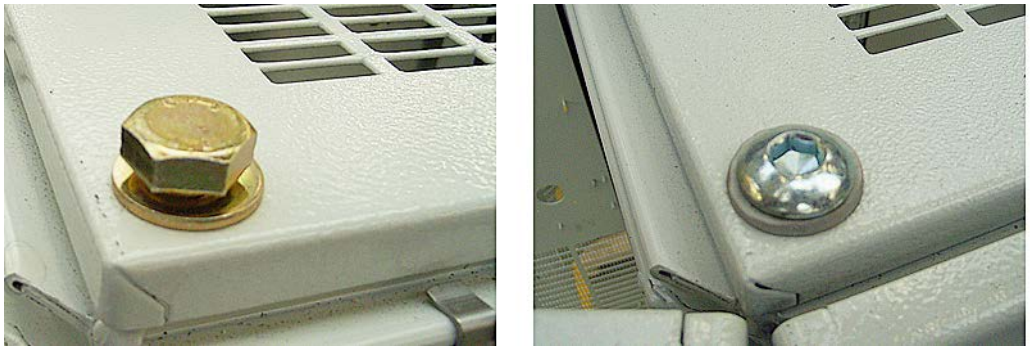


Figure 3-11 Delivery state (left), original roof screws (right)

3.3.5 Mechanical connection of the cabinet units

3.3.5.1 Connecting the cooling circuit collecting pipes

Description

The collecting pipes of the cooling circuit must be connected during the installation of the cabinet units or transport units. The collecting pipes are located at the rear lower cabinet area.

The pipe couplings to connect the collecting pipes are included when shipped in the accessory kits of the cabinet unit. The pipe couplings are designated "PLAST GRIP".



Figure 3-12 PLAST GRIP pipe coupling

The collecting pipes are covered with protective covers that must be removed prior to installation.

The connection locations must be stabilized using support rings to ensure that the plastic collecting pipes are adequately connected and stable. The support rings are already mounted in the factory.

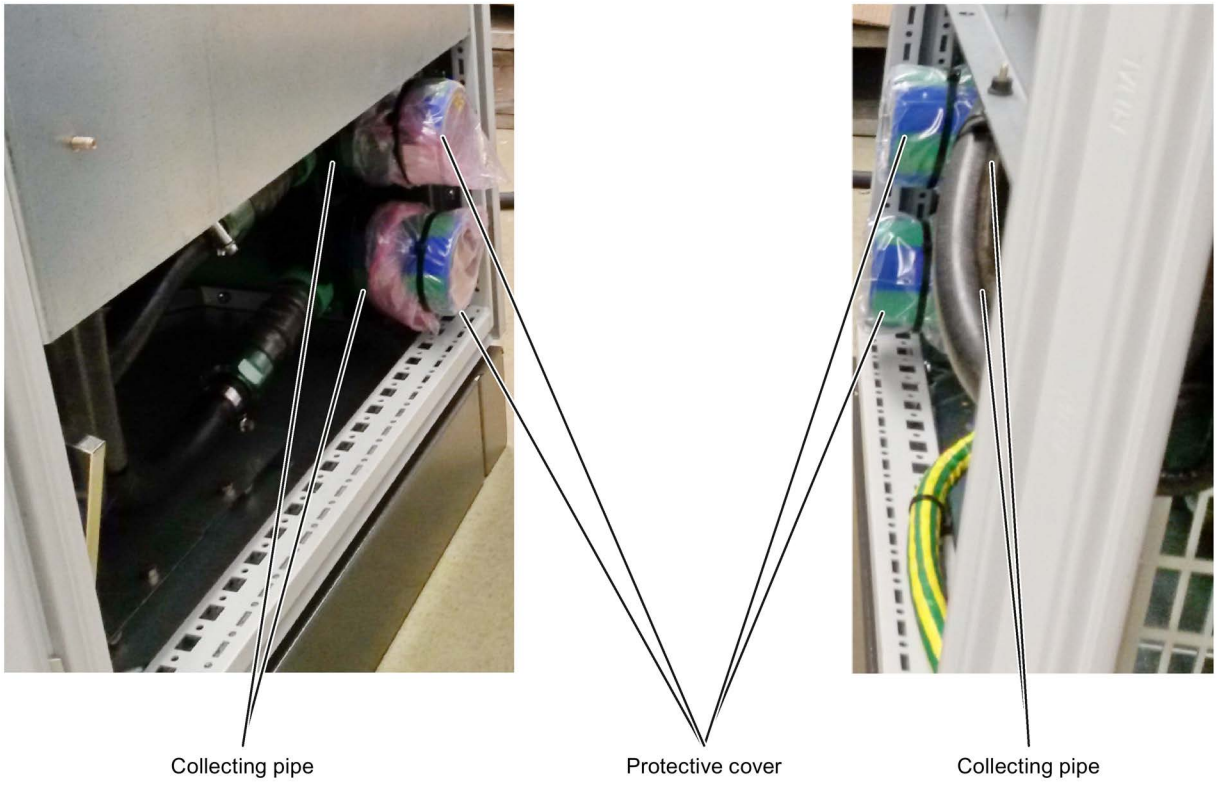


Figure 3-13 Connecting the collecting pipes

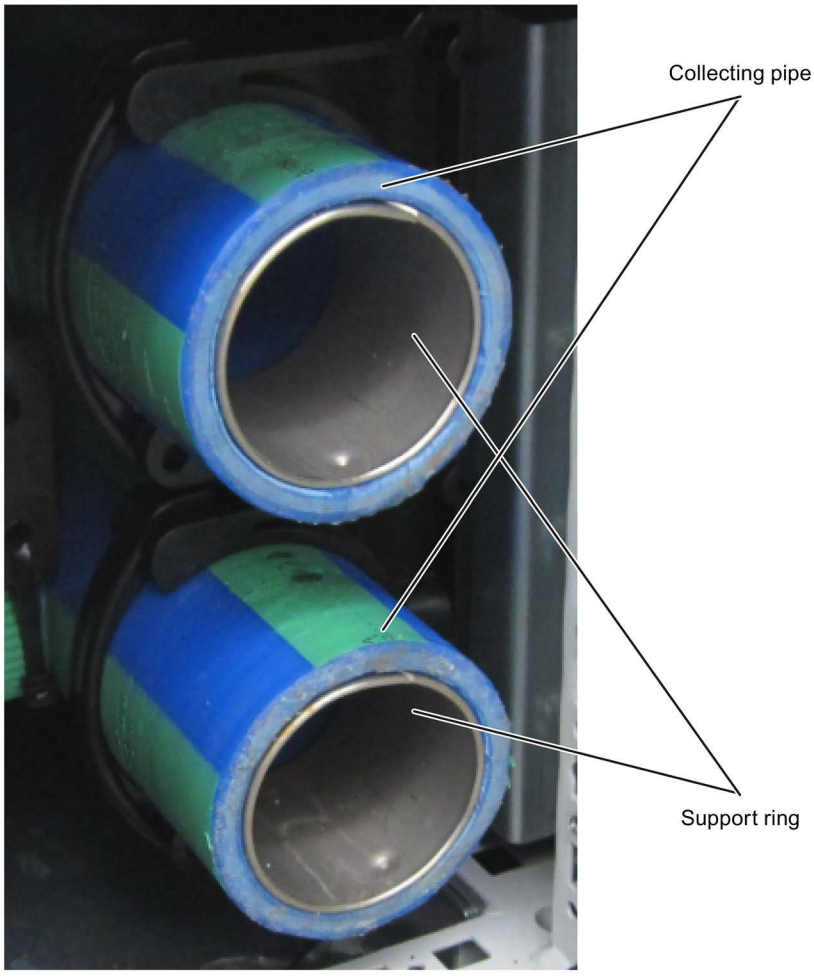


Figure 3-14 Collecting pipes with inserted support rings

Connecting the collecting pipes

The collecting pipes are connected in the sequence:

1. Install the cabinet units at the intended location.
2. Remove the protective caps from the collecting pipes.
3. Ensure that the support rings are inserted in the connection locations of the collection pipe. Ensure that the support rings are flush with the collection pipe.
4. Insert the pipe couplings into the collecting pipes of the left-hand or right-hand cabinet unit.
5. Move the cabinet units together to the final installation dimension, also see Chapter "Connecting the cabinet units (Page 67)".
6. Align the individual cabinet units so that they are in a perfectly straight line and at the same height. This may require the use of leveling measures, such as the insertion of spacer plates. Ensure that the water pipes precisely line up axially with one another:

Note

Attach the sealing tape beforehand

Before assembling the cabinet units, the supplied sealing tape from the accessory kit must be attached.

Installing the pipe couplings

First fasten the lower and then the upper pipe coupling.

The pipe couplings are installed in the following sequence:

1. Push the upper pipe coupling as far left or right of center as possible to create enough space to be able to mount the lower pipe coupling.
2. Slide the lower pipe coupling centered over the connection point.
3. Tighten the hexagon socket-head screws of the lower pipe coupling with the tightening torque specified on the pipe coupling.
4. Slide the upper pipe coupling centered over the connection point.
5. Tighten the hexagon socket-head screws of the upper pipe coupling with the tightening torque specified on the pipe coupling.

3.3.5.2 Connecting the cabinet units

Description

An accessories kit is provided with each cabinet or transport unit for the connection of cabinet units in a side-by-side installation. The table below shows the content of this accessories kit for connecting the cabinet units.

Table 3- 3 Content of the accessories kit for connecting the cabinet units

Quantity	Material	Figure	Notes
1 x	Sealing strip		The sealing strip must be glued to the cabinets before connecting them.
3 x	Outer cabinet connectors including Mounting material		The cabinet connector is fitted and screwed on from the outside. Tightening torque: 9 Nm
3 x	Inner cabinet connectors including Mounting material		The cabinet connector is fastened with 4 screws. Tightening torque: 5 Nm

Assembly

1. Glue the sealing strip to the cabinet frames of the cabinets to be connected.
2. Push the cabinets together, they must come completely together both at the front and rear sides. The distance between the cabinets must be approximately 3 mm.
3. Attach the cabinet connectors to the outside and inside corresponding to the subsequent drawing.
4. If necessary, reattach the protective covers and doors. The ground connections must also be attached to the doors.

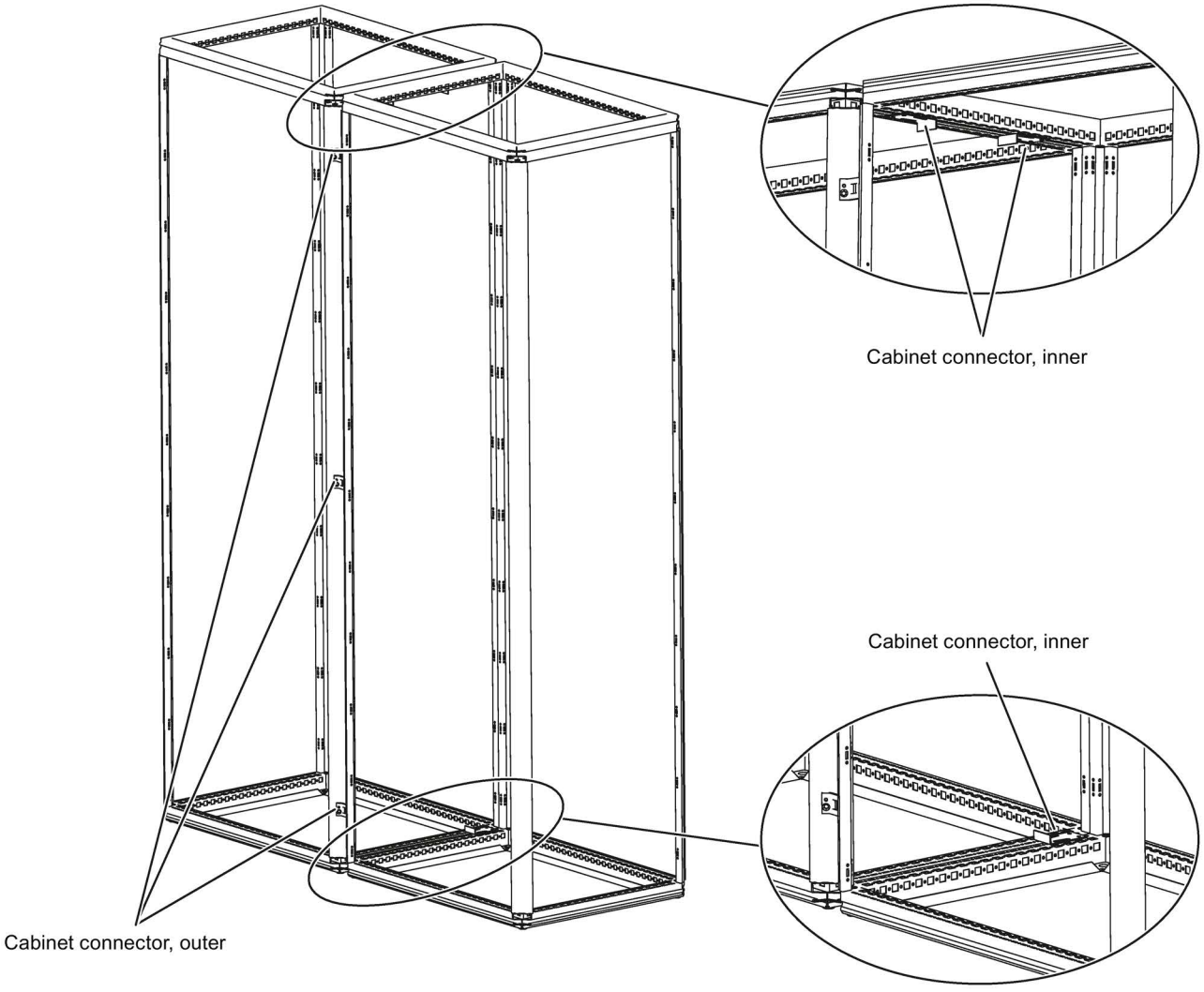


Figure 3-15 Positions of the cabinet connectors

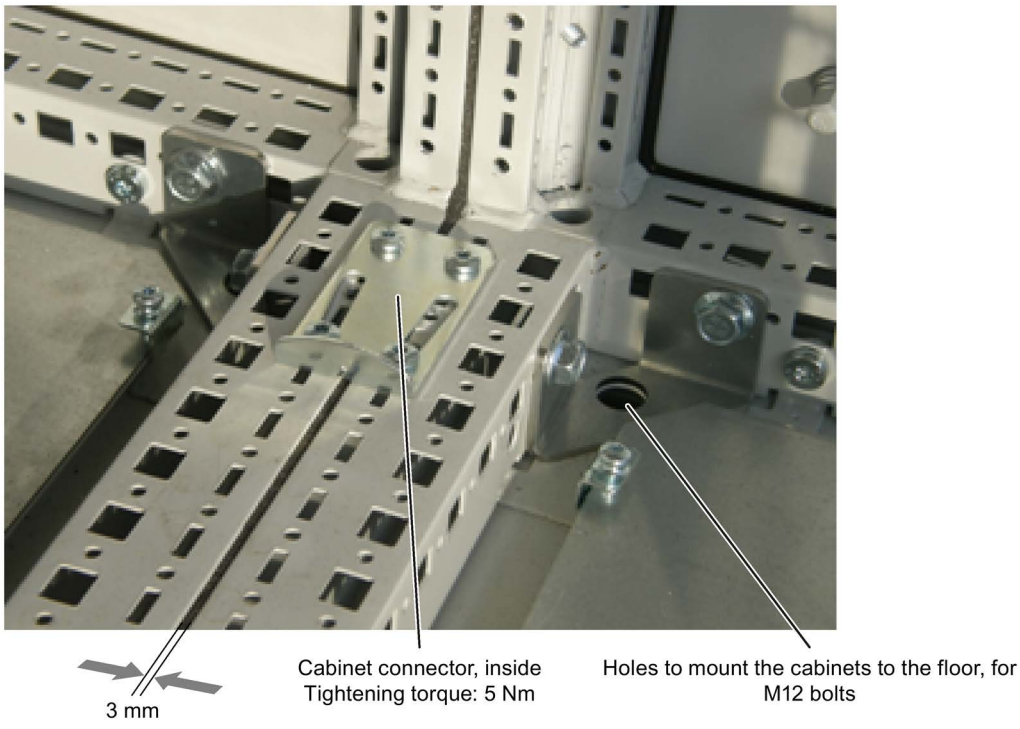


Figure 3-16 Inner cabinet connectors at the lower cabinet frame

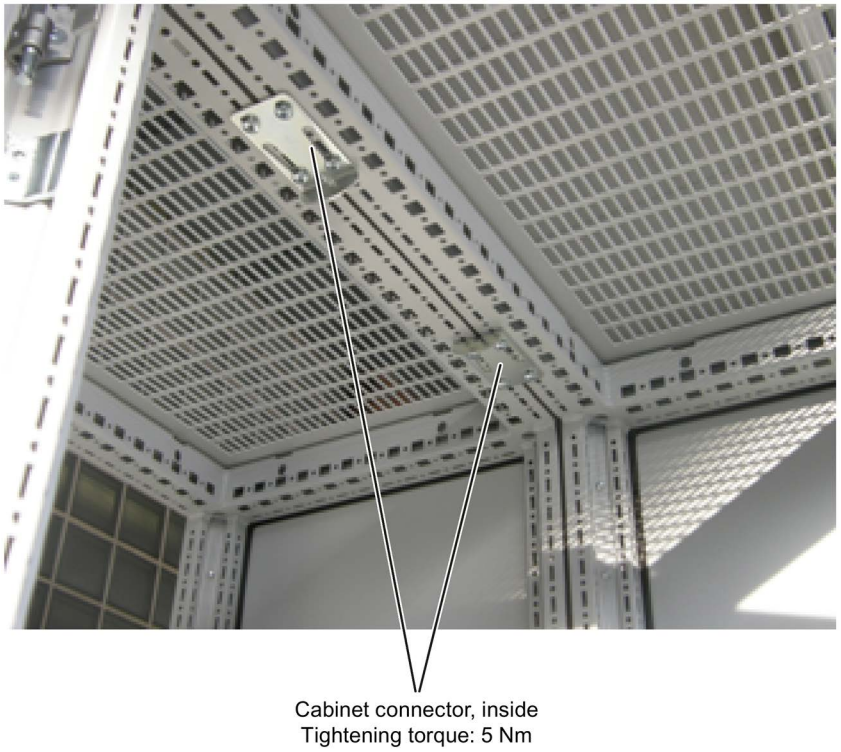


Figure 3-17 Inner cabinet connectors at the upper cabinet frame



Figure 3-18 Cabinet connector, outer

Note

Installing the side panels

For each row of cabinets installed, one side panel must be installed on the right (option M26) and one side panel on the left (option M27).

3.3.5.3 Connection to the foundation

Preparatory steps

- If possible, allow unimpeded access to the holes at the bottom of the cabinet units by removing the protective covers when carrying out installation work.

Connection to the foundation

Four holes for M12 screws are provided on each cabinet panel to secure the cabinet to the foundation. The fixing dimensions are specified in the associated dimension drawings.

Every cabinet panel must be attached to the ground using at least two opposing attachment points (one screw each in the front and rear part of the cabinet panel).
If this is not possible for reasons of accessibility, then the attachment points of the adjacent cabinet panels must be correspondingly raised.
Generally, as many attachment points as possible should be used.

Note

Additional information

Additional dimensions are specified on the associated dimension drawings, which are included in the individual device documentation.

Electrical installation

4

4.1 Safety information

Required safety precautions before installation work is carried out

⚠WARNING

Failure to observe the general safety instructions and residual risks

If the general safety instructions and remaining risks are not observed, accidents can occur involving severe injuries or death.

- Observe the general safety instructions.
- When assessing the risk, take into account residual risks.



⚠WARNING

Electric shock when using unsuitable fuses

If unsuitable fuses are used, an electric shock can cause severe injury or death.

- Use only fuses recommended in the technical data.
- Observe the necessary minimum short circuit current for the relevant fuse.



⚠WARNING

Electric shock due to the residual charge of the DC link capacitors

Because of the DC-link capacitors, a hazardous voltage is still present for a period of time after the power supply has been switched off.

Coming into contact with live components can result in severe injury or death.

- Open the device only after the time specified on the warning label has elapsed.
- Before starting work, check the absence of voltage by measuring all poles/phases, also to ground.

NOTICE

Material damage resulting from switching on the device without forming the DC-link capacitors

After a storage time exceeding two years, switching on the device without forming the DC-link capacitors can damage it.

- Before switching on the device, it should be formed after a storage time exceeding two years, see Chapter "Maintenance and servicing".

Note

Touch protection

When the cabinet door is opened, cabinet units have touch protection in compliance with DGUV Regulation 3 according to EN 50274.

For versions that are equipped with option M60, additional protective covers are fitted. When the cabinet door is open, these provide increased protection against touching live components.

These protective covers may need to be removed during installation and connection procedures. Once work has been completed, the protective covers must be properly refitted.

Note

Different versions

The Cabinet Modules come in a range of different frame sizes, with each size differing from the others in several ways. The main differences are:

- The covers can have different dimensions, and they can be arranged and secured differently.
- The components can be arranged differently within the cabinet units.
- The components can be mounted differently within the cabinet units.

These variations result from the different requirements made of the components/equipment installed in the cabinet units. These differences are intentional and exist for "EMC optimization" reasons.

4.2 Electrical installation: Checklist

The checklist below guides you through the electrical installation procedure for the cabinet. Read the Chapter "Fundamental safety instructions" before you start working on the cabinet.

For wiring instructions, see the "Electrical installation" section or refer to the documents listed in the table below.

Note

Checking the checklist

Check the boxes accordingly in the right-hand column if the option involved applies to the scope of delivery. In the same way, check the boxes once you have finished the installation procedure to confirm that the activities have been completed.

Table 4- 1 Electrical installation: Checklist

Item	Activity		Applicable?/Completed?	
General information				
1	For strain relief, the cables must be clamped on the cable propping bar (C-type mounting bar).		☐	☐
2	When EMC shielded cables are used, screw glands that connect the shield to ground with the greatest possible surface area must be provided on the motor terminal box. In the cabinet, the cable shields must be secured to the shield buses/plates with the fixing accessories provided to ensure proper EMC.		☐	☐
3	PE busbar	The PE busbar between the cabinet units or transport units must be linked. A connection with the ground for the entire system must also be established! (→ See following Section "PE busbar")	☐	☐
4	DC busbar	When several cabinet units or transport units are installed side-by-side, the DC busbars must be connected to each other by means of the jumpers provided. (→ See following Section "DC busbar")	☐	☐
5	Auxiliary power supply system	The terminals for the auxiliary power supply must be connected with one another between the cabinet units or transport units. Make sure that the correct voltage is applied! (→ See following Section "Auxiliary power supply system")	☐	☐
6	For Cabinet Modules not used as a transport unit, connections on the plant side must be made according to the circuit diagram. The open connections that are correspondingly marked must be wired according to the circuit diagram.		☐	☐
Power connections				
7	A yellow warning label is attached to each connection clip of the integrated basic interference suppression module to ground. • The warning label must be removed from the connection clip (by pulling it off) if the connection clip should remain in the device. • The warning label must be removed together with the connection clip if the unit is operated on a non-grounded line supply (IT supply system) or a line supply with grounded line conductor. (→ See the following Section "Removing the connection clip of the integrated basic interference suppression module to ground")		☐	☐
8	The cables must be properly connected with the required torque to the terminals provided. The maximum permissible cable lengths between the Motor Module and the motor must be observed depending on the type of cable used. (→ See following Section "Connecting the motor cables") (→ See Chapter "Cabinet Modules", Section "Motor Modules" and "Motor Modules compact")		☐	☐
9	When Motor Modules are connected in parallel and connected to a motor with a single-winding system, it is essential that either the specified minimum cable lengths are strictly complied with or a motor reactor is used. (→ See Chapter "Cabinet Modules" in Section "Motor Modules" and "Motor Modules compact")		☐	☐
10	The cable shields must be properly applied.		☐	☐

Item	Activity		Applicable?	Completed?
11	Check the circuit breaker settings. (→ See Chapter "Cabinet Modules" in Section "Basic Line Connection Modules" or "Active Line Connection Modules")		☐	☐
12	The internal power supply must be correctly set in the Basic Line Connection Module or Active Line Connection Module and in the Auxiliary Power Supply Module. Fine tuning to the relevant line voltage is performed by reconnecting the transformer taps. (→ see Chapter "Cabinet Modules" in Section "Basic Line Connection Modules" or "Active Line Connection Modules") (→ see Chapter "Cabinet Modules" in Section "Auxiliary Power Supply Module")		☐	☐
13	You can determine the date of manufacture based on the nameplates of the power components in the "Basic Line Connection Module", "Active Line Connection Module" and "Motor Module" Cabinet Modules. If the period from the date of manufacture to the first commissioning or the downtime of the power components is shorter than two years, the DC link capacitors do not have to be reformed. If the unit has not been operational for longer than two years, then the DC link capacitors must be reformed as described in Chapter "Maintenance and service", Section "Reforming the DC link capacitors".		☐	☐
Signal connections				
14	Cabinet operation by higher-level controller / control room. The control cables must be connected in accordance with the interface assignment and the shield applied! To prevent interference, the control cables must be laid separately from the power cables. Cabling and connections must always comply with the relevant EMC guidelines. (→ See Chapter "Electrical installation")		☐	☐
15	DRIVE-CLiQ cables	All DRIVE-CLiQ cables must be connected correctly. The permissible cable lengths should be carefully observed. (→ See "S120 Commissioning Manual, Rules for wiring with DRIVE-CLiQ") (→ See "S120 Equipment Manual for Booksize Power Units, DRIVE-CLiQ Cabinet Gland" and "S120 Equipment Manual for Booksize Power Units, DRIVE-CLiQ Coupling")	☐	☐
Options				
16	G20, CBC10 Communication Board	The supplied CBC10 is installed in the factory in the option slot of the Control Unit. (→ See Chapter "Options", Section "G20, CBC10 Communication Board")	☐	☐
17	G33, CBE20 Communication Board	The supplied CBE20 is installed in the factory in the option slot of the Control Unit. Remove the CBE20 in a no-current state and note down the MAC address. Install the CBE20 into the option slot again. (→ See Chapter "Options", Section "G33, CBE20 Communication Board")	☐	☐
18	G51 to G54, TM150 temperature sensor module	The Terminal Module TM150 can be connected to a maximum of 12 temperature sensors (PT100, PT1000, KTY84, PTC, bimetallic NC contact). (→ See Chapter "Options", Section "G51 to G54, temperature sensor module TM150 ")	☐	☐

Item	Activity		Applicable?/Completed?	
19	G60, TM31 Terminal Module	Digital inputs, digital outputs, analog inputs, analog outputs and temperature sensors can be connected to the TM31 Terminal Module. (→ see Chapter "Options", Section "G60, Terminal Module TM31")	☐	☐
20	G61, additional TM31 Terminal Module	Additional digital inputs, digital outputs, analog inputs, analog outputs and temperature sensors can be connected to the additional TM31 Terminal Module. (→ see Chapter "Options", Section "G61, additional TM31 Terminal Module ")	☐	☐
21	G62, TB30 Terminal Board	Digital inputs, digital outputs, analog inputs and analog outputs can be connected to the TB30 Terminal Board (→ see Chapter "Options", Section "G62, TB30 Terminal Board")	☐	☐
22	K01 to K05, Safety license for 1 to 5 axes	Activating the safety licenses. (→ See Chapter "Options", Section "K01 to K05, Safety license for 1 to 5 axes")	☐	☐
23	K46, SMC10 Sensor Module	The SMC10 Sensor Module is used for detecting the actual motor speed and the rotor position angle. The following encoders are supported by the SMC10 Sensor Module: • Resolver, 2-pin • Resolver, multi-pole (→ See Chapter "Options", in Section "K46, SMC10 Sensor Module Cabinet-Mounted")	☐	☐
24	K48, SMC20 Sensor Module	The SMC20 Sensor Module is used for detecting the actual motor speed and the path length. The following encoders are supported by the SMC20 Sensor Module: • Incremental encoder sin/cos 1Vpp • EnDat absolute encoder • SSI encoder (→ See Chapter "Options", in Section "K48, SMC20 Sensor Module Cabinet-Mounted")	☐	☐
25	K50, SMC30 Sensor Module	The SMC30 Sensor Module is used for detecting the actual motor speed. The following encoders are supported by the SMC30 Sensor Module: • TTL encoder • HTL encoder • SSI encoder (→ See Chapter "Options", in Section "K50, SMC30 Sensor Module Cabinet-Mounted")	☐	☐

Item	Activity		Applicable?/Completed?	
26	K51, VSM10 Voltage Sensing Module Cabinet-Mounted	The VSM10 Voltage Sensing Module is used to sense the voltage characteristic on the motor side, so that the following functions can be implemented: • Operation of a permanent-magnet synchronous motor without encoder with the requirement to be able to connect to a motor that is already running (flying restart function) • Fast flying restart of large induction motors: The time for the demagnetization of the motor is eliminated as a result of the voltage sensing. When operating a permanent-magnet synchronous motor without encoder, the "Flying restart" function must be activated with p1200. (→ See Chapter "Options", Section "K51, VSM10 Voltage Sensing Module cabinet-mounted")	☐	☐
27	K52, additional SMC30 Sensor Module	The additional SMC30 Sensor Module is used for safe actual value acquisition when using the Safety Integrated Extended Functions. (→ See Chapter "Options", Section "K52, Additional SMC30 Sensor Module")	☐	☐
28	K76, auxiliary voltage generation in the Line Connection Module	In order to supply the auxiliary voltage power supply system with the appropriate voltages, the phase must be connected to the corresponding transformer tap. Make sure that the correct voltage is applied! (→ See Chapter "Options", Section "K76, auxiliary voltage generating unit in the Line Connection Module")	☐	☐
29	K82, terminal module for controlling safety functions "Safe Torque Off" and "Safe Stop 1"	Connect according to "Cable routing for the "Safe Torque Off" and "Safe STOP 1" functions". (→ See Chapter "Electrical installation", in Section "Cable routing for the "Safe Torque Off" and "Safe STOP 1" functions") (→ See Chapter "Options", Section "K82, Terminal Module for controlling safety functions "Safe Torque Off" and "Safe Stop 1"")	☐	☐
30	K87, TM54F Terminal Module	Establish the connection according to "Cable routing for the functions TM54F". (→ See Chapter "Electrical installation", Section "Cable routing for the Terminal Module TM54F") (→ See Chapter "Options", Section "K87, Terminal Module TM54F")	☐	☐
31	K88, Safe Brake Adapter SBA 230 V AC	To control the brake, a connection must be established between -X14 on the Safe Brake Adapter and the holding brake. (→ See Chapter "Options", Section "K88, Safe Brake Adapter SBA 230 V AC")	☐	☐
32	L13, main contactor	Connect the feedback signal contacts of the main contactor. (→ See Chapter "Options", Section "L13, main contactor")	☐	☐
33	L21, surge voltage limiting	The monitoring of the surge arresters and the upstream fuses must be connected to terminal- X700. (→ See Chapter "Options", Section "L21, surge suppression")	☐	☐

Item	Activity		Applicable?/Completed?	
34	L25, circuit breaker in withdrawable unit design	Connect the feedback signal contacts of the circuit breaker. (→ See Chapter "Options", Section "L25, circuit breaker in withdrawable unit design")	☐	☐
35	L40, line filter monitoring	Commission the line filter monitoring function. (→ See Chapter "Options", Section "L40, line filter monitoring")	☐	☐
36	L41, current transformer upstream of main switch	Connect the measuring connections of the current transformer. (→ See Chapter "Options", Section "L41, current transformer upstream of main switch")	☐	☐
37	L45, EMERGENCY OFF pushbutton in the cabinet door	Integrate the option into the EMERGENCY OFF circuit. (→ See Chapter "Options", Section "L45, EMERGENCY OFF pushbutton in the cabinet door")	☐	☐
38	L50, cabinet lighting with service socket	Provide the power supply. (→ See Chapter "Options", Section "L50, cabinet lighting with service socket")	☐	☐
39	L55, cabinet anti-condensation heating	Provide the power supply. (→ See Chapter "Options", Section "L55, cabinet anti-condensation heating")	☐	☐
40	L87, insulation monitoring	Integrate the option into the plant-side fault and alarm circuit. (→ See Chapter "Options", Section "L87, insulation monitoring")	☐	☐
41	P10, measuring instrument for line variables, installed in the cabinet door	Adjust the measuring instrument according to the system relationships. (→ see Chapter "Options" in Section "P10, measuring instrument for line variables installed in the cabinet door")	☐	☐
42	P11, measuring instrument for line variables with PROFIBUS connection, installed in the cabinet door	Adjust the measuring instrument according to the system relationships. (→ see Chapter "Options" in Section "P11, measuring instrument for line variables with PROFIBUS connection installed in the cabinet door")	☐	☐
43	P13, measuring instrument for line variables with PROFINET connection, installed in the cabinet door	Adjust the measuring instrument according to the system relationships. (→ see Chapter "Options" in Section "P13, measuring instrument for line variables with PROFINET connection installed in the cabinet door")	☐	☐
44	P14, measuring instrument for line variables with PROFINET connection, installed in the cabinet door	Adjust the measuring instrument according to the system relationships. (→ see Chapter "Options" in Section "P14, measuring instrument for line variables with PROFINET connection installed in the cabinet door")	☐	☐

4.3 EMC-compliant design

For detailed engineering instructions regarding the EMC-compliant design of drives and control cabinet configuration, refer to the "SINAMICS Low Voltage Engineering Manual", which is included in the device documentation provided.

4.4 Electromagnetic fields at the workplace

4.4.1 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".

4.4.2 Measurements/evaluations for SINAMICS S120 Cabinet Modules 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 4- 2 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 4- 3 Minimum clearances to SINAMICS S120 Cabinet Modules 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)]	100 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.

4.5 Connecting shielded three-phase cables

A good shield support is achieved by connecting the shields in the converter cabinet through a large surface area to the EMC shield rail using EMC shield clamps.
The following cable clamps are recommended for establishing the connection to the shield rail:
Cable clamps for C mounting rails with slot widths 11 ... 12 mm, 6 mm deep (e.g. from the PUK company: cable clamps, model "HB").

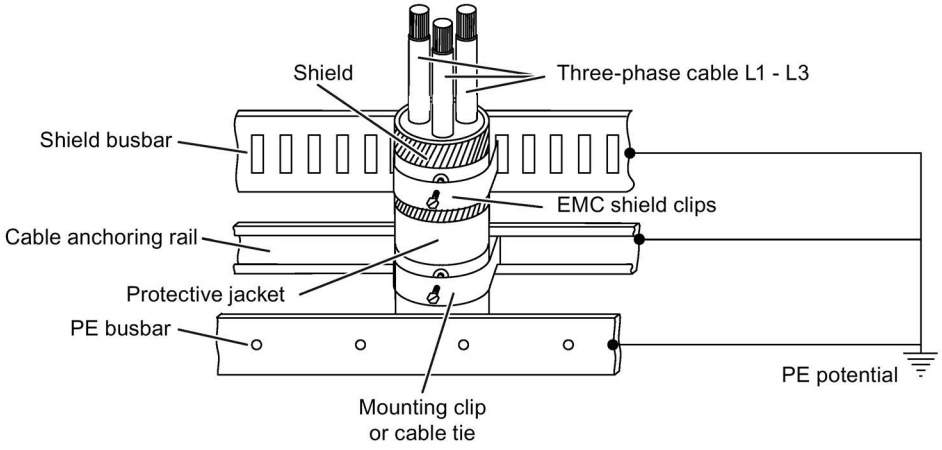


Figure 4-1 Connecting shields at the EMC shield rail using EMC shield clamps

Note

Detailed engineering information for connecting shielded three-phase cables with concentrically arranged shields is provided in the "SINAMICS Low Voltage Engineering Manual" included in the device documentation provided.

4.6 Connections

4.6.1 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.

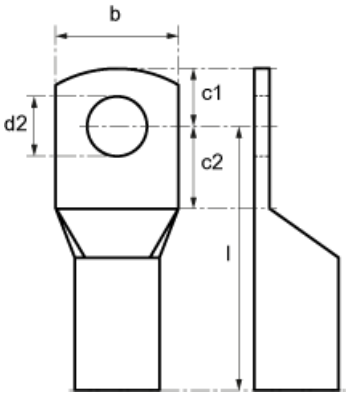


Figure 4-2 Dimensions of the cable lugs

Table 4- 4 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, at one connection per phase, 2 cable lugs can be connected.

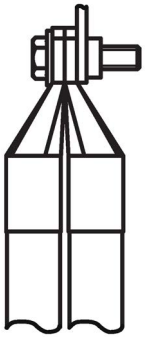


Figure 4-3 2 cable lugs per connection

4.6.2 Connection overview

Connection overview

The following table shows the connections between the individual Cabinet Modules and their connections. When supplied as transport unit (option Y11, transport units assembled in the factory), these connections only have to be established between the individual transport units as configured. The connections are established within transport units in the factory.

Note

System circuit diagram and layout plan

The table only shows the maximum possible number of connections to be established.

The system planning and engineering departments are responsible in deciding whether the individual connections should be established. See the system circuit diagram and layout plan.

Table 4- 5 Connection overview for Cabinet Modules

Cabinet Modules	Connection					
	PE busbar	DC busbars between the Cabinet Modules	Auxiliary power supply system	Line connection	Motor cables	Braking resistor
Basic Line Connection Module	Yes	Yes	Yes	Yes	No	No
Active Line Connection Module	Yes	Yes	Yes	Yes	No	No
Active Line Connection Module compact	Yes	Yes	Yes	Yes	No	No
Motor Module	Yes	Yes	Yes	No	Yes	2)
Motor Module compact	Yes	Yes	Yes	No	Yes	2)
Auxiliary Power Supply Module	Yes	1)	Yes	Yes	No	No
Heat Exchanger Module	Yes	No	No	Yes	No	No

1) optional

2) When using the Motor Module as braking chopper

4.6.3 PE busbar

4.6.3.1 General information

Availability

PE busbars are included in the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules
- Active Line Connection Modules compact
- Motor Modules
- Motor Modules compact
- Auxiliary Power Supply Modules
- Heat Exchanger Modules

Description

Each Cabinet Module contains a PE busbar for grounding the components installed in the cabinet. For all cabinet units, the busbar is a 60 x 10 mm nickel-plated bar. It is located at the bottom of the cabinet and is secured on the left and right to the ground straps in the cabinet.

Note

Close the cabinet doors

When connecting the ground connections to the PE busbar, make sure that the cabinet doors will still close.

4.6.3.2 Connection for side-by-side installation of cabinet units

A connection jumper for the PE busbar is supplied with every cabinet.

Note

Connect only after the installation and the mechanical connection of the transport units

Installing the transport units as well as connecting the transport units with one another (see Chapter "Mechanical installation", Section "Connection for side-by-side installation of cabinet units"), must have been completed!

Preparatory steps

- Install and secure the cabinet units properly.
- Disconnect the cabinet units from the power supply.
- Allow unimpeded access to the PE busbar of the cabinet units (if necessary, remove the protective covers during installation work).

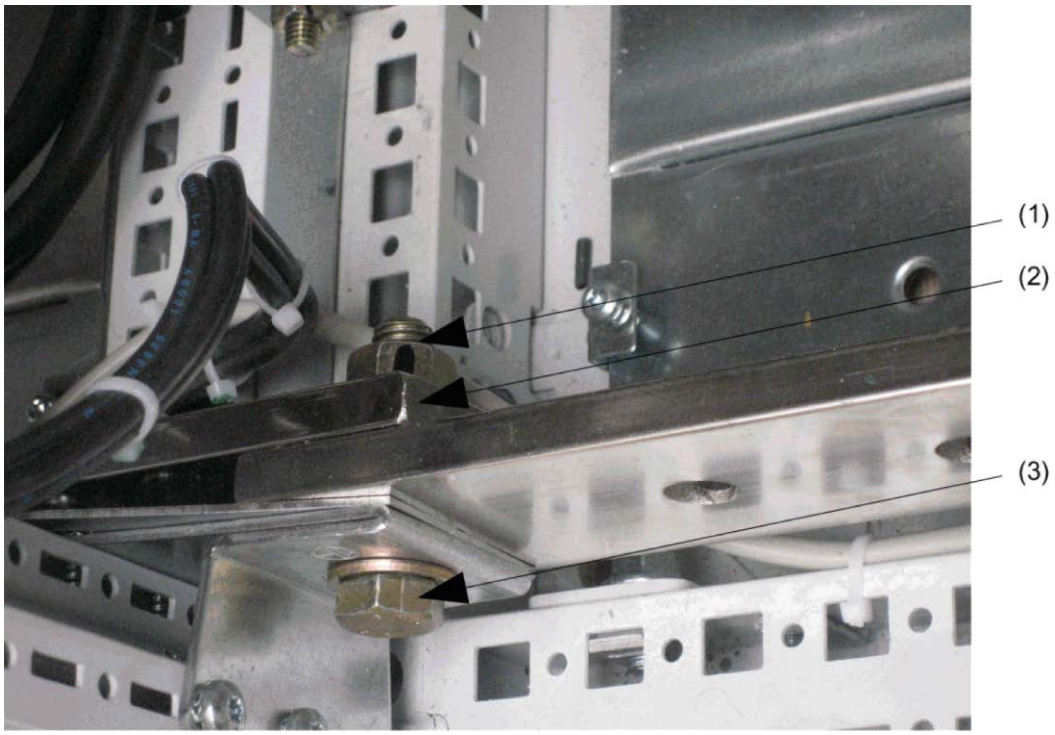


Figure 4-4 Connecting the PE busbar when cabinet units are installed side-by-side

Establishing the connection

1. Loosen the 1 x M12 nut (1) of the PE busbar at the 1st cabinet.
2. Remove the nut (1), washer and screw (3).
3. Loosen the 1 x M12 nut of the PE busbar on the 2nd cabinet.
4. Remove the nut, washer and screw.
5. Place the connection jumper (2) at the back on the PE busbar of the cabinet units to be connected.
6. Insert the screws in the ground straps of the PE busbar from the front.
7. Reattach the washers and nuts.
8. Tighten the nut (tightening torque: 50 Nm)

4.6.3.3 Connection according to the system-side grounding concept



⚠WARNING

Electric shock if there is no ground connection

If there is no connection to the central grounding of the complete plant, the cabinet unit may be at a dangerous voltage level in a fault situation. This means that when touched, this can result in death or severe injury

- Ground the device in compliance with the applicable regulations.

4.6.3.4 Connecting external cables to the PE busbar

Establishing the connection

1. Insert the screw from the front.
2. Attach the cable lug from the rear.
3. Attach the nut and, if necessary, the washers and tighten (tightening torque: 50 Nm).

Note

Close the cabinet doors

When external cables that are to be connected to the PE busbar have been laid, make sure that the cabinet doors close properly.

4.6.4 DC busbar

4.6.4.1 General information

Availability

The DC busbar is always integrated in the following S120 Cabinet Modules and must be ordered as option M80 to M87:

- Basic Line Connection Modules
- Active Line Connection Modules
- Active Line Connection Modules compact
- Motor Modules
- Motor Modules compact

Description

The DC busbar is used to connect Line Modules with Motor Modules; the connection is made using prefabricated busbar sets with different current-conducting capacities.

Note

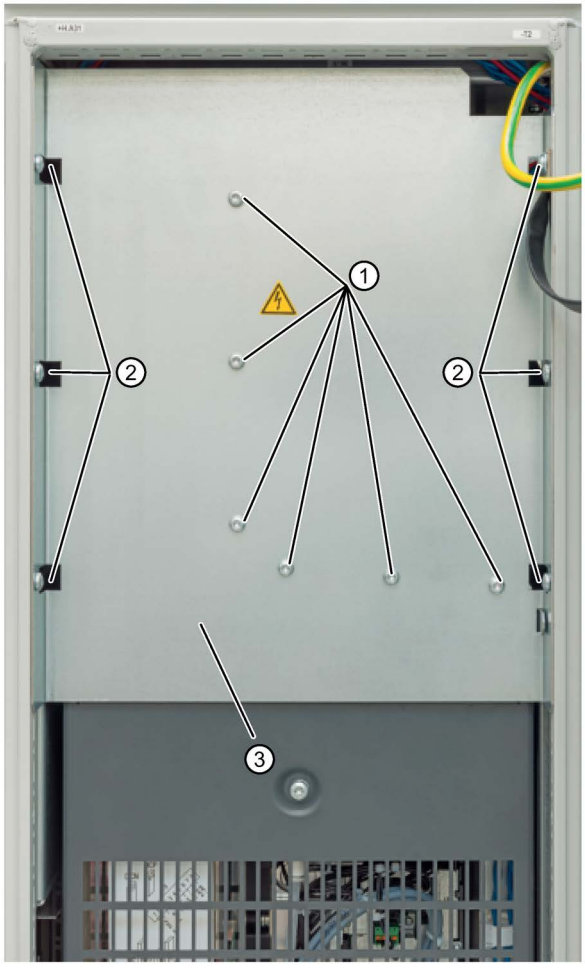
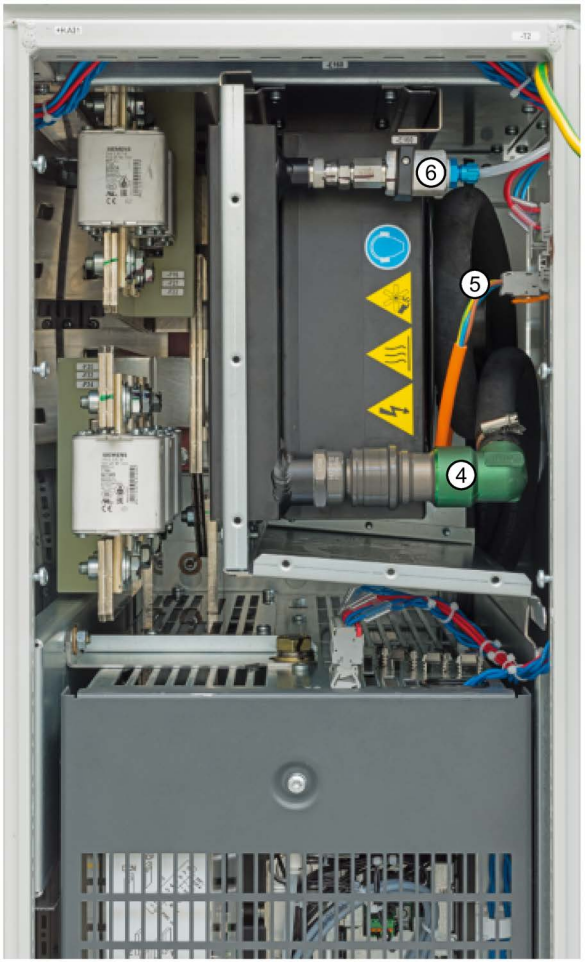
Remove the heat exchanger for degree of protection IP55

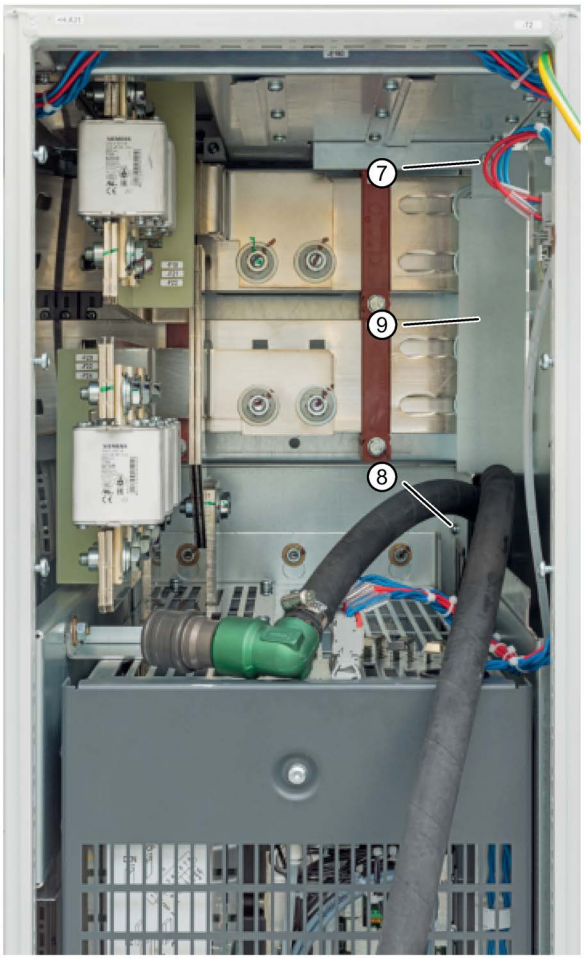
For degree of protection IP55, to facilitate better access to the DC busbars, you must remove the additional heat exchanger, see the following chapter.

4.6.4.2 Removing the heat exchanger for degree of protection IP55

The heat exchanger must be removed so that the DC busbars can be connected when the cabinet units are lined up next to one another.

Removing the heat exchanger

Loosen the 6 screws ① at the front side of the upper air deflector plate. Release the lateral screws ②, and remove the air baffle ③ towards the front.	Open the fast release connection of the front coolant connection ④. Remove the connecting cable for the fan power supply at connector X160 ⑤. Close the vent valve, remove the vent hose ⑥. Remove the heat exchanger from the cabinet towards the front. Open the fast release connector of the rear coolant connection.
	

The following diagram shows the heat exchanger after releasing the connections described above. Carefully and completely withdraw the heat exchanger.	Remove the upper ⑦ and lower ⑧ fixing screws and then take the heat deflection baffle ⑨ out of the electrical cabinet. Do not fully unscrew the screws as otherwise they can fall into the control cabinet! You can then establish the DC bus bar connection, see the following section.
	

Note

Correct attachment of the components and covers after connecting the DC busbars

After connecting the DC busbars in the cabinet units, the components and covers that were removed must be correctly reattached again.

4.6.4.3 Connection for side-by-side installation of cabinet units

Note

DC busbar

The procedure described below uses a DC busbar 1 x 60 x 10 mm (option M80) as an example, but applies to all other DC busbar versions as well.

For the other available versions, the number of jumpers on each busbar for connecting the DC busbar is as follows:

- 1 jumper for each DC busbar for 1 x nn x 10 busbars (options M80 to M82)
- 2 jumpers for a DC busbar comprising 2 x nn x 10 busbars (options M83 to M85)
- 3 jumpers for a DC busbar comprising 3 x nn x 10 busbars (options M86 and M87)

A connection jumper (① in the diagram below) on the right-hand side of the DC busbar in the cabinet connects the DC busbar across several Cabinet Modules. This connection jumper is already integrated in every DC busbar of the Cabinet Modules.

Preparatory steps

- Install and secure the cabinet units properly.
- Verify that the cabinet units to be connected have been isolated from the supply.
- Allow unimpeded access to the DC busbar (if necessary, remove the protective covers during installation work).

Note

Better accessibility from the top

In some cases, it is far simpler to connect the DC busbar from the top (with the top covers removed) than from the front.

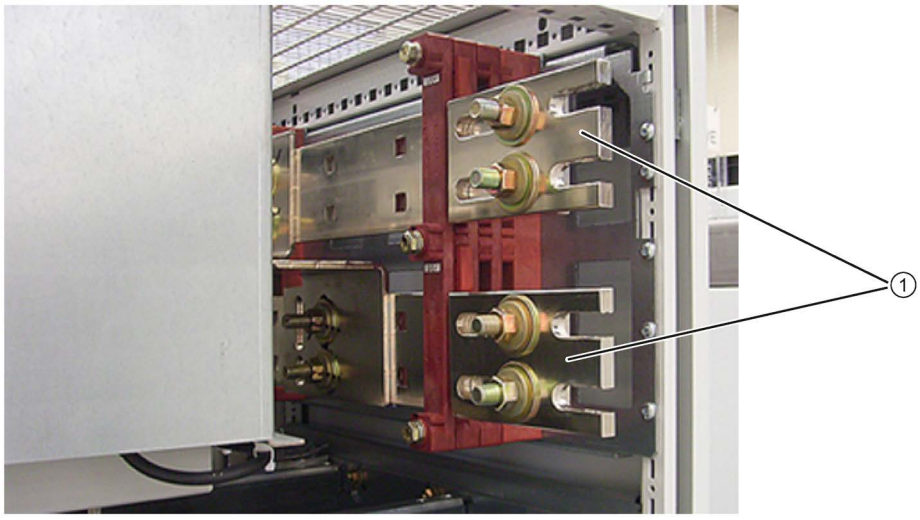


Figure 4-5 Delivery state of the DC busbar



Figure 4-6 Connecting the DC busbar when cabinet units are installed side-by-side

Establishing the connection

1. Loosen the 2 x M12 nuts on the upper DC busbar (DC P) on the right-hand side ① at the first cabinet.
2. Loosen the 2 x M12 nuts on the DC busbar on the left-hand side of the cabinet to be connected.
3. Withdraw jumper ① of the DC busbar from the first cabinet and insert into the DC busbar of the second cabinet up to its end stop ②.

NOTICE

Material damage due to incorrect connection of the jumpers for the DC busbar

Incorrect connection of the jumpers for the DC busbar can heat up the busbars and therefore cause material damage.

- Insert the jumper ① of the first cabinet into the cabinet to be connected until the washers ② are in full contact with the jumper.

4. Re-tighten the nuts on the DC busbars in both cabinet units (torque: 50 Nm).
5. Repeat steps 1 to 4 for the lower DC busbar (DC N).

Note

Mounting specifications

The screws must only be loosened rather than removed because otherwise the nuts could fall into the device.

The torque (50 Nm) must be observed to avoid excessive heating of the terminal contacts during operation!

For the busbar systems, all jumpers of the DC busbar must always be connected!

For each cabinet row installed, you must mount one side panel on the right (option M26) and one on the left (option M27)!

Before mounting the side panels on an installed cabinet row, you must remove any jumpers present in the DC busbars of the cabinet on the right!

Note

DC busbars for the transport units

In the case of transport units with standard integrated DC busbars within the cabinet group, you only need to connect the ends of the busbars of the transport units.

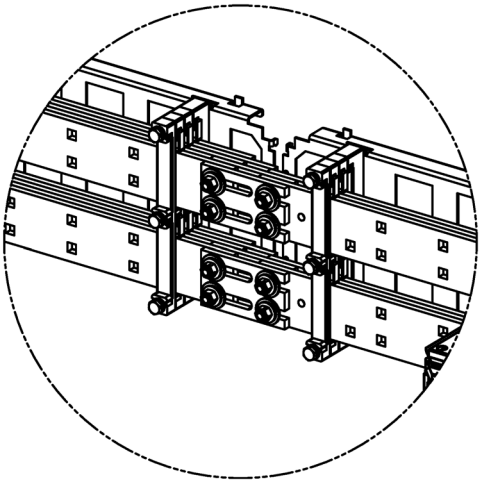
4.6.4.4 Connecting cabinet units with different numbers of DC busbars

When connecting cabinet units with different numbers of busbars, the DC busbars are connected as shown in the following diagrams.

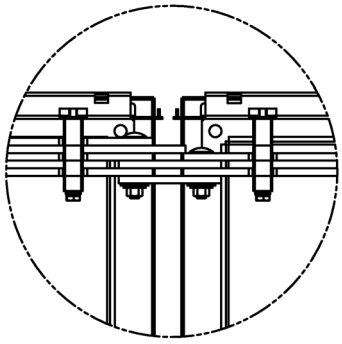
Transition from three busbars to two busbars

Of the three jumpers supplied to connect the DC busbars, only two jumpers have to be connected from the left-hand to the right-hand cabinet. The rear jumper remains in the position when the device is originally shipped, and is fixed using the screws of the left-hand DC busbars.

Oblique view of the connection location



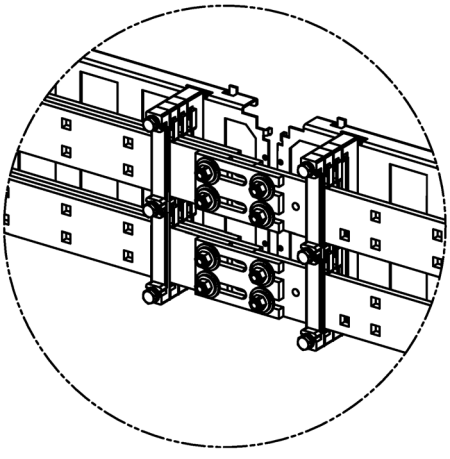
Top view of the connection location



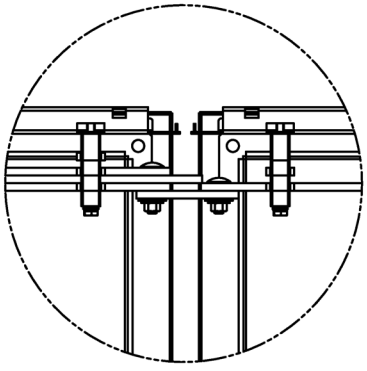
Transition from two busbars to one busbar

Of the two jumpers supplied to connect the DC busbars, only one jumper has to be connected from the left-hand to the right-hand cabinet. The rear jumper remains in the position when the device is originally shipped, and is fixed using the screws of the left-hand DC busbars.

Oblique view of the connection location



Top view of the connection location



4.6.5 Auxiliary power supply system

4.6.5.1 General information

Availability

To facilitate the auxiliary voltage supply to S120 Cabinet Modules, the individual modules are fitted with a special, standardized auxiliary voltage supply system. This system is delivered pre-installed. The cabling required from the Auxiliary Power Supply Module into the relevant Cabinet Module are factory-installed.

In the following S120 Cabinet Modules, two further voltage taps are available for the customer at the terminal for each voltage level:

- Basic Line Connection Modules
- Active Line Connection Modules
- Active Line Connection Modules compact
- Motor Modules
- Motor Modules compact

Description

The auxiliary power supply system installed in the Cabinet Module distributes the voltages provided by an auxiliary power supply. Components in the cabinets are supplied with power (e.g. electronic modules, fans, circuit breakers, contactors, ...) from the 230 V AC and/or 24 V DC auxiliary voltages. Details on the power supply of the components are provided in the circuit diagrams supplied with the equipment.

Ideally, these voltages are generated by an Auxiliary Power Supply Module. Another way to supply power is to use option K76 "Auxiliary voltage generating unit in the Line Connection Module" (only possible in the Basic Line Connection Module or Active Line Connection Module) – or to feed the auxiliary voltages to the auxiliary power supply system from an external power supply.

The maximum current rating of the auxiliary power supply system is 28 A. If the total power requirement of the cabinet line-up exceeds the maximum load capability, the auxiliary power supply system must be divided into segments and several infeed points selected.

The auxiliary power supply system for an individual cabinet unit consists of terminals and the connecting cables.

The terminals comprise two terminal blocks (-X140, -X150) and one fuse (-F150) for the 24 V DC supply.
The terminals are used to tap the necessary auxiliary voltages and to transfer auxiliary voltages to the terminal block in the adjacent cabinet unit.

The auxiliary power supply system is ready-to-operate as supplied. The cabling required from the terminal block into the relevant Cabinet Module are factory-installed. Only the connection to the adjacent transport unit must be established on site by connecting the cables to the next terminals. These connections are already established within transport units.

NOTICE

Inadmissible equalization currents as a result of potential differences when using several infeed points

Using different power sources for the auxiliary power system for several subsections can result in potential differences and inadmissible equalizing currents.

- Use the same voltage source for the electronics power supply of the individual subsections.
- Connect the PE busbars of the subsections to one another.

Connecting terminals

At least two terminals are always available to the customer at the terminal blocks for accessing the auxiliary voltages.

Table 4- 6 X140: 230 V AC

Terminal	Designation	Assigned voltages	Rated current
1, 2	L1	230 V 1 AC (max. 265 VAC)	Max. 10 A [1]
3, 4	N		
The maximum current rating of the auxiliary power supply system is 28 A. Max. connectable cross-section: 2.5 mm²			

[1] Max. total current of all tapping terminals available

Table 4- 7 X150: 24 V DC

Terminal	Designation	Assigned voltages	Rated current
1, 2	P24	24 VDC for the electronics power supply (max. 30 VDC)	Max. 28 A
4, 5	M		
The maximum current rating of the auxiliary power supply system is 28 A. Max. connectable cross-section: 2.5 mm²			

Infeed terminal in the Basic Line Connection Module or Active Line Connection Module

The terminal in the Basic Line Connection Module or the Active Line Connection Module comprises the X100 terminal block for connecting the auxiliary voltages. No voltage taps are available to the customer. When option K76 is available (auxiliary power generation in the Line Connection Module), then terminal X100 is already assigned in the factory.

Table 4- 8 X100, terminal block in the Basic Line Connection Module or Active Line Connection Module to connect the auxiliary voltages

Terminal	Voltage tap	Rated current
1	230 V 1 AC (max. 265 VAC)	Max. 28 A
1		
2		
2		
3	24 VDC for the electronics power supply (max. 30 VDC) Protective extra low-voltage PELV/SELV	Max. 28 A
3		
4		
4		
The maximum current rating of the auxiliary power supply system is 28 A. Max. connectable cross-section: 10 mm²		

Note

External infeed

An external customer infeed to the auxiliary power supply system can be connected at terminal block X100 of the Basic Line Connection Module or the Active Line Connection Module.



⚠WARNING

Electric shock when connecting to an unsuitable power supply

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

- When connecting to -X100/3,4 terminals, only use power supplies that provide SELV (Safety Extra Low Voltage) or PELV (Protective Extra Low Voltage) output voltages.

Supply terminal in the Active Line Connection Module compact

The terminal in the Active Line Connection Module compact comprises the -X100 terminal block for connecting the auxiliary voltages. No voltage taps are available to the customer.

Table 4- 9 X100, terminal block in the Active Line Connection Module compact to connect the auxiliary voltages

Terminal	Function	Technical data
1	L	External 1 AC 230 V supply (max. 265 V AC) Current consumption: Max. 28 A
2		
3	Reserved, do not use	
4	N	
5		
PE	PE connection	
6	P24	24 V DC for the electronics power supply (max. 30 V DC) Protective extra-low voltage PELV/SELV Current consumption: Max. 28 A
7		
The maximum current rating of the auxiliary power supply system is 28 A. Max. connectable cross-section: 10 mm^2		

Note

External infeed

An external customer infeed for the auxiliary power supply system can be connected at terminal block -X100 of the Active Line Connection Module compact.



⚠WARNING

Electric shock when connecting to an unsuitable power supply

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

- When connecting to -X100/6,7 terminals, only use power supplies that provide SELV (Safety Extra Low Voltage) or PELV (Protective Extra Low Voltage) output voltages.

4.6.5.2 Connection overview

The following connections must be established for the auxiliary power supply system:

- Connection for side-by-side installation of cabinet units
- Connecting to the infeed when using an external supply

Preparatory steps for all work carried out on the auxiliary power supply system

- Install and secure the cabinet units properly.
- Disconnect the cabinet units from the power supply.
- Disconnect the auxiliary power supply system from the power supply.
- Allow unimpeded access to the auxiliary power supply system of the cabinet units (if necessary, remove the protective covers during installation work)

4.6.5.3 Connection for side-by-side installation of cabinet units

Description

Prefabricated cables with an -X180 connector are attached in each transport unit in the area of the upper cabinet struts to connect the auxiliary power supply system. If the cabinets are delivered as single units, then these cables must be routed to the next cabinet and connected to the corresponding -X180 connector.

Note

Connecting the terminals for transport units.

These connections are already established within transport units. Only the transport units need to be interconnected.

Note

There is no cable for wiring the auxiliary voltages if a Cabinet Module is equipped with a right-hand side panel (option M26).

Establishing the connection

Insert connector -X180 of each transport unit to connector -X180 of the adjacent transport unit.

4.6.5.4 Connecting to the infeed

Description

The voltages provided on the auxiliary power supply system must be produced by an auxiliary power supply (e.g. by an Auxiliary Power Supply Module or by option K76 "Auxiliary voltage generating unit in the Line Connection Module").

If an Auxiliary Power Supply Module is not available to supply power to the auxiliary power supply system or if the Auxiliary Power Supply Module and the Cabinet Modules to be supplied are installed in different parts of the cabinet line-up, an auxiliary power module in the Basic Line Connection Module, Active Line Connection Module or Active Line Connection Module compact can be used to feed power to the auxiliary power supply system. The maximum current-carrying capacity of the auxiliary power supply system is 28 A. In the case of the external power supply, this must be protected on the plant/system side.

4.6.6 Connecting the motor cables

Preparatory steps

- Install and secure the cabinet units properly.
- Disconnect the cabinet units from the power supply.
- Make sure that all the necessary safety measures have been taken at the installation location.



⚠WARNING

Electric shock when permanent magnet synchronous motors rotate

As soon as the motor rotates, a voltage is generated at the terminals, which when touched, can result in death or severe injury.

- Electrically disconnect the motor when working on the converter.
- If it is not possible to disconnect the connecting cables to the motor, secure the motor so that it cannot undesirably rotate, e.g. using a holding brake.

Motor connection, Motor Modules

Table 4- 10 Motor connection, Motor Modules

Terminals	Technical data
DCP, DCN DC power input	Voltage: 510 ... 720 V DC 675 ... 1035 V DC
U2/T1, V2/T2, W2/T3 3 AC power output	Voltage: 3 AC 0 V to 0.75 x DC link voltage [1] Connection: M12/50 Nm for cable lugs in accordance with DIN 46234 or DIN 46235 [2]

[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 Chapter "Cable lugs", Section "Electrical installation".

Motor connection, Motor Modules compact

Table 4- 11 Motor connection, Motor Modules compact

Terminals	Technical data
DCP, DCN DC power input	Voltage: 510 ... 720 V DC 675 ... 1035 V DC
U2/T1, V2/T2, W2/T3 3 AC power output	Voltage: 3 AC 0 V to 0.75 x DC link voltage [1] Connection: M12/50 Nm for cable lugs in accordance with DIN 46234 or DIN 46235 [2]

[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 Chapter "Cable lugs", Section "Electrical installation".

Note

As a result of the space situation, only flexible, shielded cables with a bending radius <7 x outer diameter can be connected.

Connecting the motor cables

Note

Position of the connections

For the location of the connections, see the layout diagrams.

1. Open the cabinet and remove the covers in front of the connection panel for motor cables (terminals U2/T1, V2/T2, W2/T3; X2).
2. Insert the cables through the elastic cable entry below the connection panel.

   For example, you can use a knife to make a circular slit in the cable entry at the appropriate positions and then introduce the cable from below so that subsequent sealing is not required.
3. Screw the protective earth (PE) onto the PE busbar at the specified points in the cabinet (50 Nm with M12).
4. Screw the motor cables onto the terminals.
   Make sure that the conductors have been connected in the correct sequence (U2/T1, V2/T2, W2/T3)!

NOTICE

Material damage due to loose power connections

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

- Tighten all power connections with the specified tightening torques, e.g. line supply connection, motor connection, DC link connections.
- Regularly check all power connections by retightening them with the specified tightening torque. This applies in particular after transport.

5. Secure the motor cables on the cable propping bar to avoid placing mechanical strain on the terminals.
6. When shielded motor cables are used, the shields must be secured to the EMC shield bus (option M70) in an EMC-compliant manner.

Note

PE connection of the motor

The PE connection on the motor must be guided back directly to the cabinet unit and connected there.

Connection cross-sections

Refer to the "Technical specifications" for the Motor Modules, Chapter "Cabinet Modules" for the maximum connection cross-sections.

Direction of motor rotation

IEC 60034-7 defines the two ends of an electric motor as follows:

- DE (Drive End): Usually the drive end of the motor
- NDE (Non-Drive End): Usually the non-drive end of the motor

An electric motor rotates clockwise if the shaft is turning clockwise when viewing the DE.

For electric motors with two shaft ends, the direction of rotation must be determined based on the shaft end specified as the drive end.

For clockwise rotation, the electric motor must be connected according to the following table.

Table 4- 12 Cabinet and motor connection terminals

Cabinet (motor connection terminals)	Motor (connection terminals)
U2/T1	U
V2/T2	V
W2/T3	W

In contrast to the connection for the clockwise phase sequence, two phases have to be reversed with a counter-clockwise phase sequence (looking at the drive shaft).

Note

Direction of motor rotation

If the motor was connected with an incorrect direction of phase rotation, it can be corrected without replacement of the phase sequence via p1821 (phase rotation direction reversal). For more information, refer to the parameter description in the List Manual.

The correct phase sequence must be observed in both sub-cabinets when connecting cabinet units in parallel, since it is not possible to use converter functions to correct different phase sequences in the two sub-cabinets at a later stage.

For motors that can be star-connected or delta-connected, it must be ensured that the windings are interconnected consistent with the operating voltage indicated on the type plate or in the motor documentation. Make sure that the winding insulation of the connected motor has sufficient insulation strength to meet the requirements for converter operation.

4.6.7 Line supply connections

Basic Line Connection Module or Active Line Connection Module

The line supply is connected in the Basic Line Connection Module or active Line Connection Module at terminal -X1.

Table 4- 13 Line connection in the Basic Line Connection Module or Active Line Connection Module

Terminals	Technical data
U1/L1, V1/L2, W1/L3 3-ph. AC power input	Voltage: 380 V 3 AC -10% to 480 V 3 AC +10% (-15% < 1 min) 500 V 3AC -10% to 690 V 3 AC +10% (-15% < 1 min) Connection thread: M12 / 50 Nm for cable lugs in accordance with DIN 46234 or DIN 46235 [1)]

[1)] Dimensions for connecting alternative cable lugs, see Chapter "Cable lugs", Section "Electrical installation".

Active Line Connection Module compact

The line supply is connected in the Active Line Connection Module compact at terminal -X1.

Table 4- 14 Line supply connection in the Active Line Connection Module compact

Terminals	Technical data
U1/L1, V1/L2, W1/L3 3-ph. AC power input	Voltage: 380 V 3 AC -10% to 480 V 3 AC +10% (-15% < 1 min) 500 V 3AC -10% to 690 V 3 AC +10% (-15% < 1 min) Connection thread: M12 / 50 Nm for cable lugs in accordance with DIN 46234 or DIN 46235 [1)]

[1)] Dimensions for connecting alternative cable lugs, see Chapter "Cable lugs", Section "Electrical installation".

Note

As a result of the space situation, we recommend that flexible, shielded cables with a bending radius <7 x outer diameter are used.

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

The connection between the integrated basic interference suppression module and ground must be disconnected if the Cabinet Modules are 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 in the following Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules and Active Line Connection Modules compact (connection clip in the Active Interface Module) including the Voltage Sensing Module VSM10

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.

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 4-7 Warning label on the connection clip

Basic Line Connection Modules

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

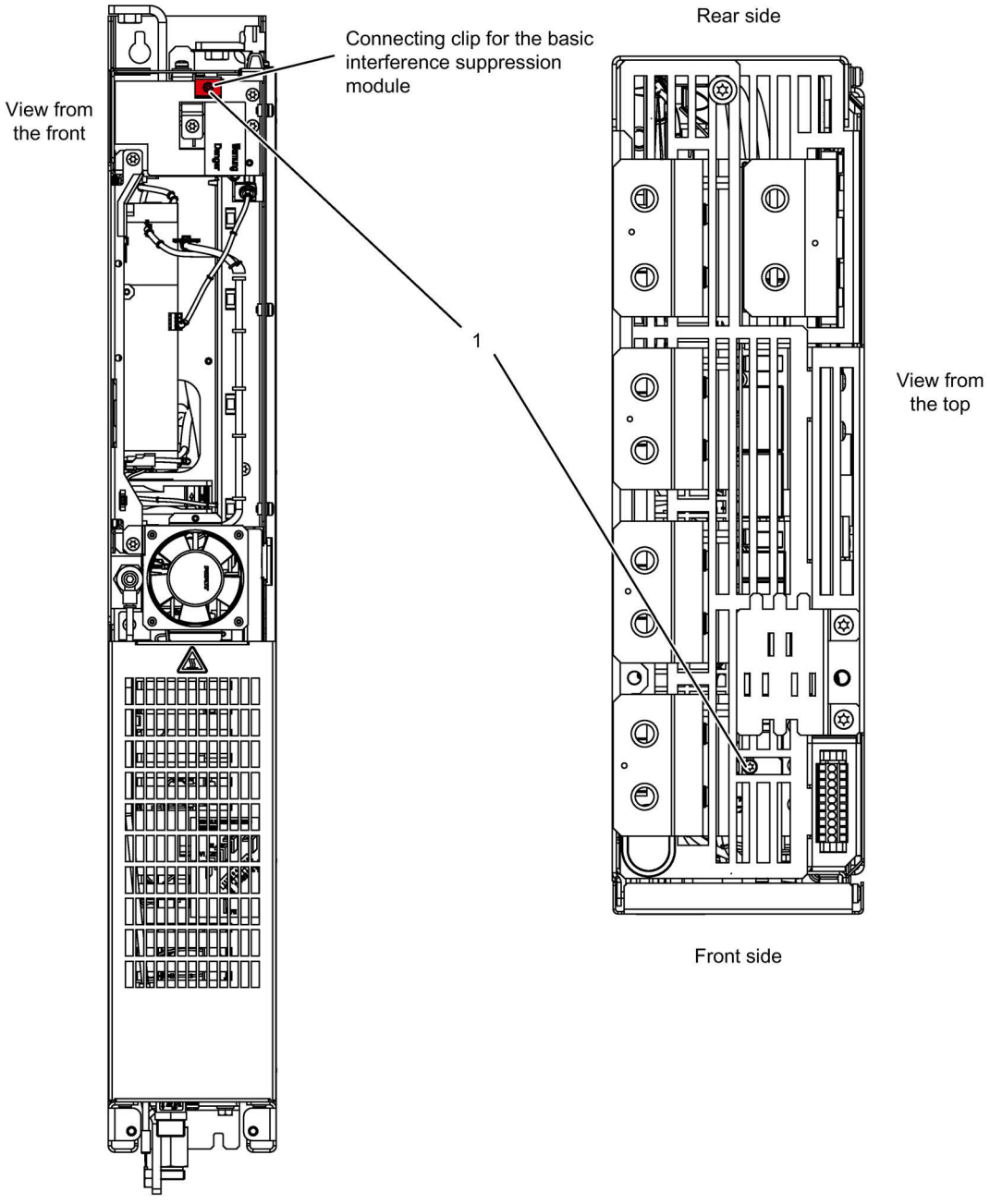


Figure 4-8 Removing the connection clip of the basic interference suppression module to ground in the Basic Line Connection Module

Active Line Connection Modules and Active Line Connection Modules compact

The connection clip of the basic interference suppression module to ground is in the filter module of the associated Active Interface Module.

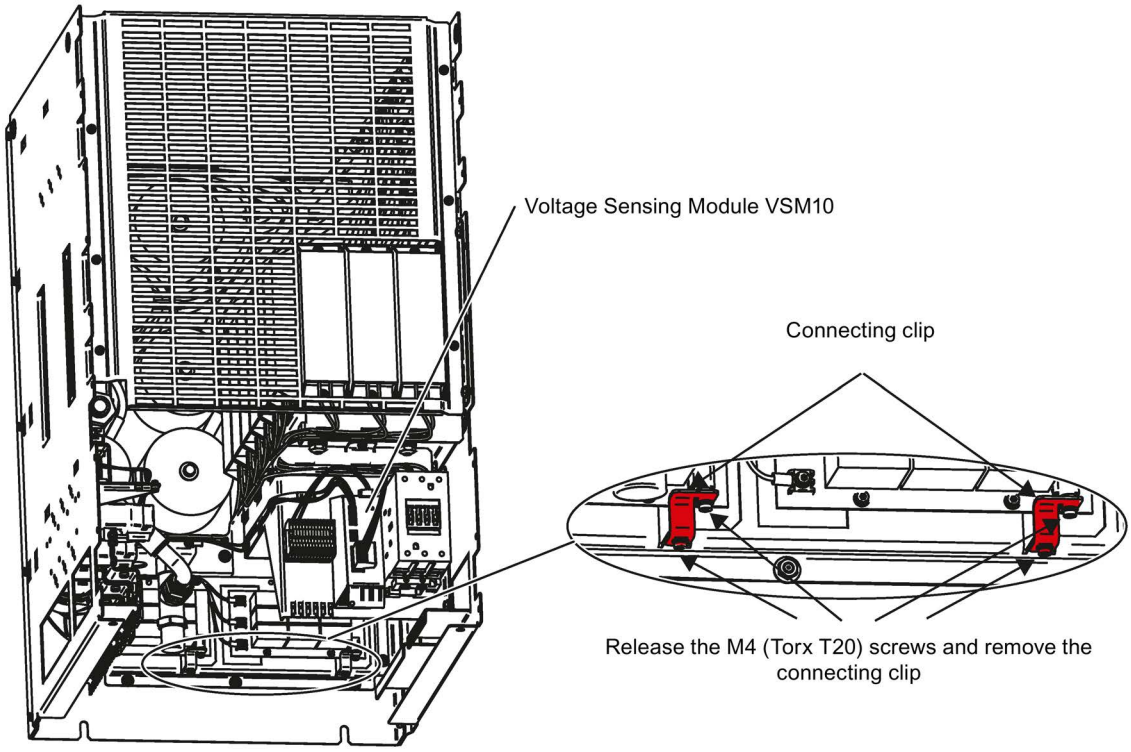


Figure 4-9 Removing the connection clip to the basic interference suppression module to ground at the filter module in the Active Interface Module

Removing the connector jumper in the Voltage Sensing Module VSM10

If an Active Line Connection Module or Active Line Connection Module compact is operated on an ungrounded system (IT system), the connector jumper in terminal X530 on the lower side of the component must be removed from the Voltage Sensing Module (VSM10).

The position of the Voltage Sensing Module must be taken from the previous drawing.

Use two screwdrivers or a suitable tool in order to relieve the holding springs in the terminal and then withdraw the connector jumper.

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

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.

4.6.9 Signal connections

Note

Pre-assignment and position of the customer terminal block

The factory setting and description of the customer terminal blocks are documented in the circuit diagrams.

The location of the customer terminal blocks of the individual Cabinet Modules is documented in the layout diagrams.

The interfaces or customer terminal blocks are documented for the respective Cabinet Modules.

DRIVE-CLiQ cables must be locally routed according to the customer-specific engineering specifications for the entire system.

4.6.10 Other connections

Depending on the range of options installed, further connections may have to be made.

For more information about the interfaces of available options, refer to the relevant sections in this manual.

4.6.11 Cable routing

4.6.11.1 General information

Basic rules for cable routing

The Cabinet Modules are delivered pre-wired.

The following basic rules must always be observed for all Cabinet Modules should any additional cabling and wiring or connection work be necessary.

- Observe EMC guidelines.
- Use existing routing for cable assemblies.
- Always use the shield plates provided (do not bypass them).
- Use existing cable propping bars as required.
- Attach the cable ties at suitable points on metal frames and cabinet frame profiles.
- Use a cabinet upright to route cables into adjacent cabinets.
- Refit any covers removed during cable routing before completing the work and commissioning!

Preparatory steps

Before starting any cabling or connection work in the Cabinet Modules, ensure that the following measures are performed:

- Disconnect the cabinet unit from the power supply.
- Allow unimpeded access to the necessary components in the Cabinet Module (if necessary, remove the covers).

Safety and EMC



⚠WARNING

Dangerous voltage when covers are missing

If covers are missing, live parts may be touched which can result in death or serious injury.

- Mount all covers again that you removed for the cable routing before commissioning the Cabinet Module.

Note

Internal cabinet wiring

When routing cables, utmost care must be taken not to change any existing internal cabinet wiring.

Note

EMC-compliant shielding

The shield plates must be re-mounted before the cabinet is commissioned to ensure EMC-compliant shielding.

The shields of the motor cables must be secured on the EMC shield bus (M70 option), and the PE cables must be secured on the PE busbar.

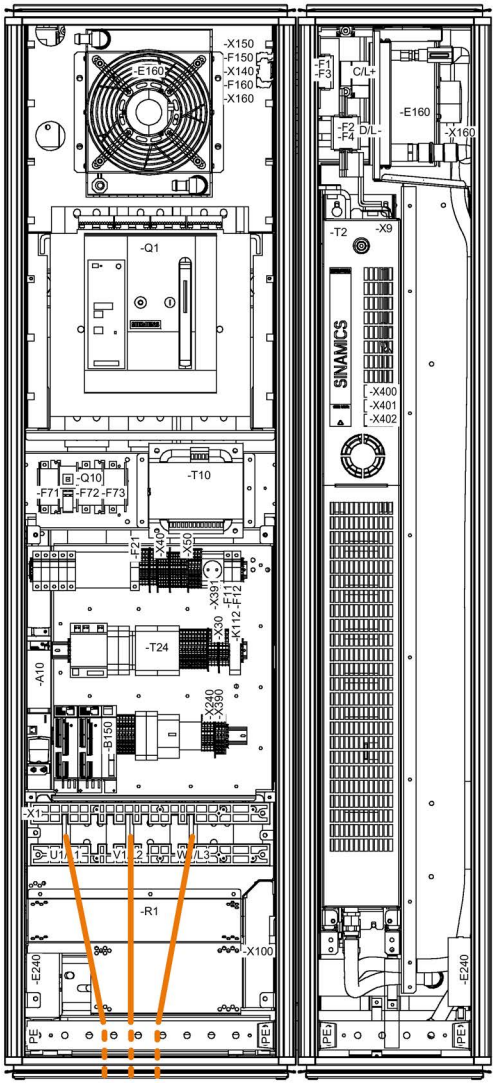
4.6.11.2 Cable routing for Basic Line Connection Modules

For the Basic Line Connection Modules, the customer must carry out the following cabling or connection work:

Table 4- 15 Checklist for cable routing or connection work for Basic Line Connection Modules

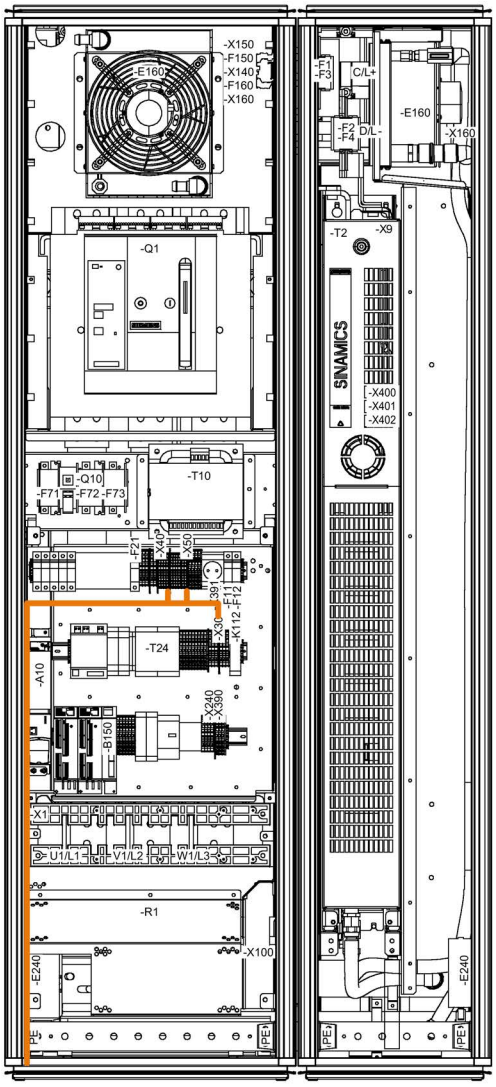
Cable routing	Completed?
Cable for the line supply (L1, L2, L3, PE)	
Signal cables to terminals -X30, -X40, -X50	
PROFIBUS cable or PROFINET cable to the Control Unit	
DRIVE-CLiQ connections / signal cables to the Control Unit and to the Basic Line Module	
Note: The "Basic rules for cable routing" and "Preparatory steps" described above must be observed whenever any cabling or connection work is performed!	

Cable routing for connecting to the supply infeed



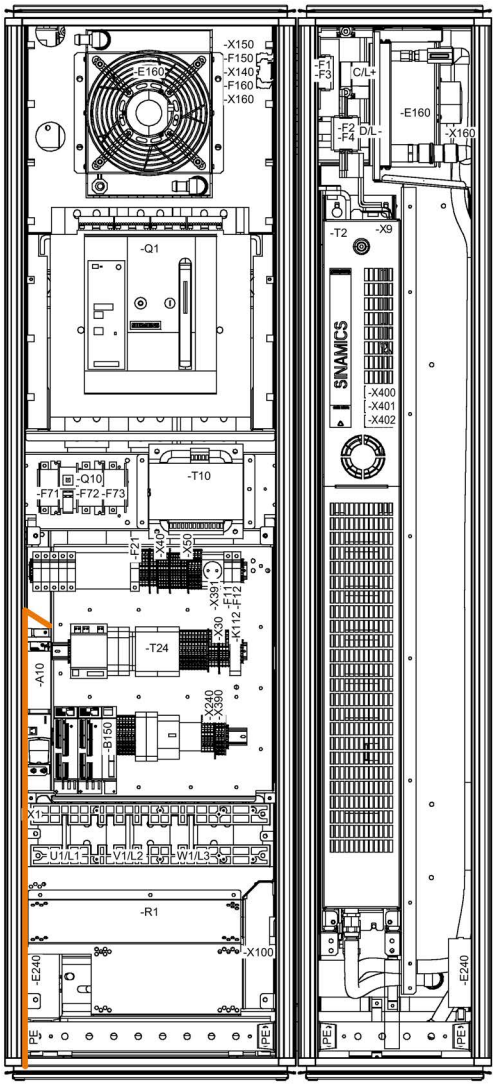
1. Route the cable for the infeed into the cabinet from the bottom.
2. Connect the PE cable to the grounding bar.
3. Route the cable up through the cabinet to the line connections -X1 (-U1/-L1, -V1/-L2, -W1/-L3).
4. Fasten the cable at suitable points.
5. Connect the cable to the connections.

Signal cables



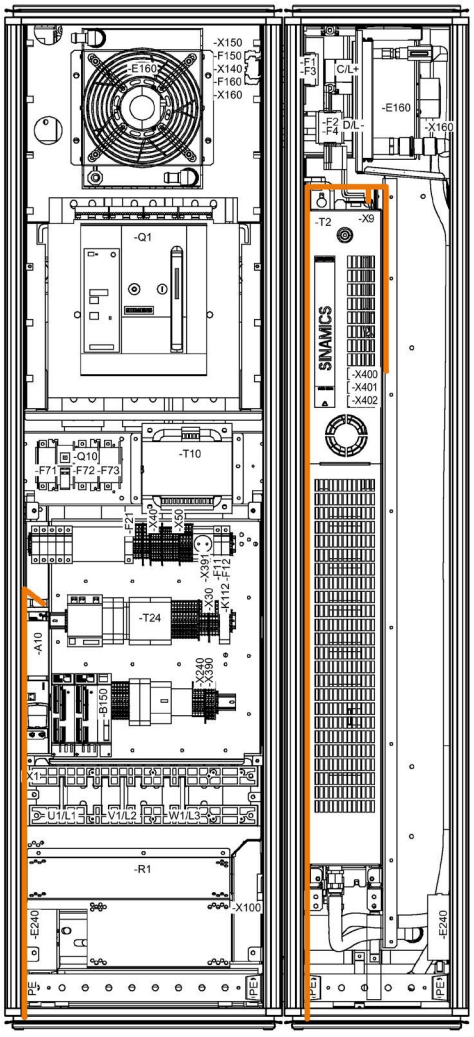
1. Route the signal cables into the cabinet from the bottom left.
2. Route the signal cables up through the cabinet to terminal blocks -X30, -X40 or-X50.
3. Attach the signal cables at suitable points.
4. Connect the signal cables to the terminal blocks.

Cable routing for PROFIBUS or PROFINET connection to the Control Unit



1. Feed the cable for the Control Unit into the cabinet from the bottom left.
2. Remove approx. 3 cm of the cable insulation at the level of the shield plate in the lower part of the cabinet and attach the cable there.
3. To secure the cable in accordance with EMC requirements, snap the clip onto the shield plate.
4. Use cable ties to secure the cable at suitable points.
5. Route the cable further in the cabinet to the upper side of the Control Unit. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
6. Use cable ties to secure the cable at suitable points.
7. Connect the cable to the Control Unit.
   (→See SINAMICS S120 Manual GH1 Control Units)

Cable routing for DRIVE-CLiQ connections and signal cables



1. Route the DRIVE-CLiQ/signal cable to the Control Unit into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Route the cable further in the cabinet to the upper side of the Control Unit. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
4. Use cable ties to secure the cable at suitable points.
5. Connect DRIVE-CLiQ/signal cable to the Control Unit.
6. Route the DRIVE-CLiQ/signal cable to the Basic Line Module from the bottom left into the cabinet.
7. Use cable ties to secure the cable at suitable points.
8. Route the cable further in the cabinet to the upper side of the Basic Line Module. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
9. Use cable ties to secure the cable at suitable points.
10. Connect the signal cable at terminal block -X9.
11. Route the DRIVE-CLiQ cable through the cable bushing from the top into the Basic Line Module, continue to the DRIVE-CLiQ connection -X400, -X401, -X402 and connect there.

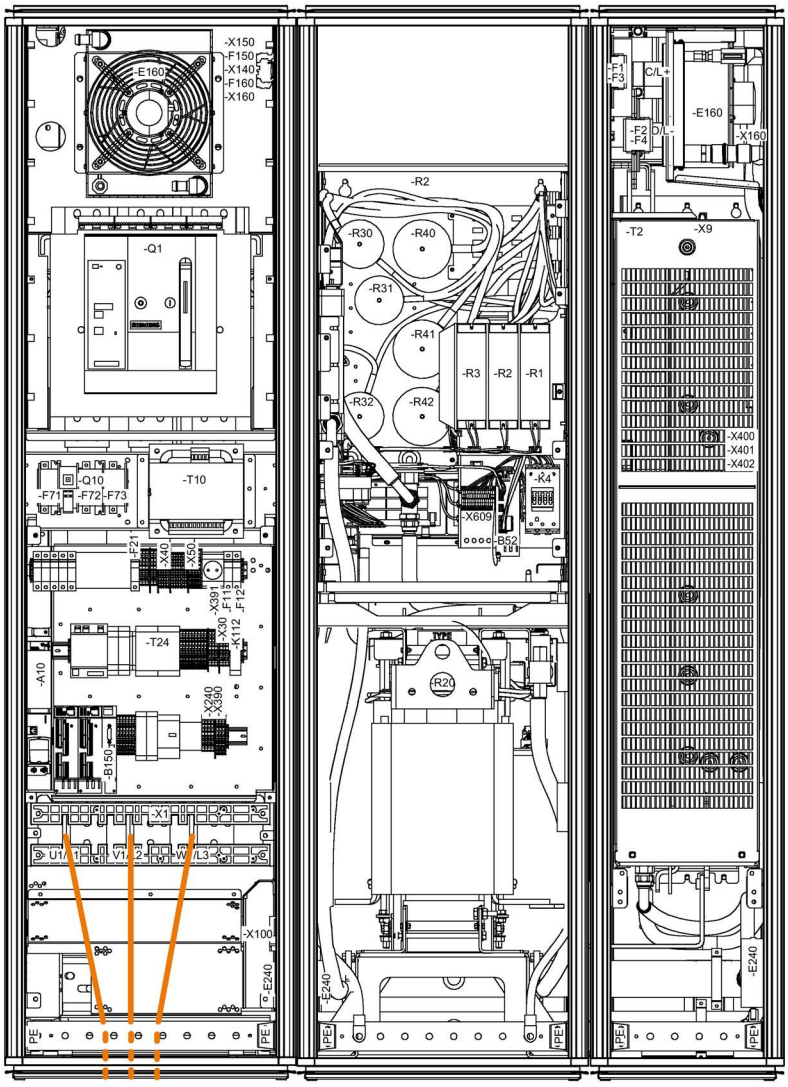
4.6.11.3 Cable routing for Active Line Connection Modules

For Active Line Connection Modules, customers must carry out the following cabling or connection work:

Table 4- 16 Checklist for cable routing and connection work for Active Line Connection Modules

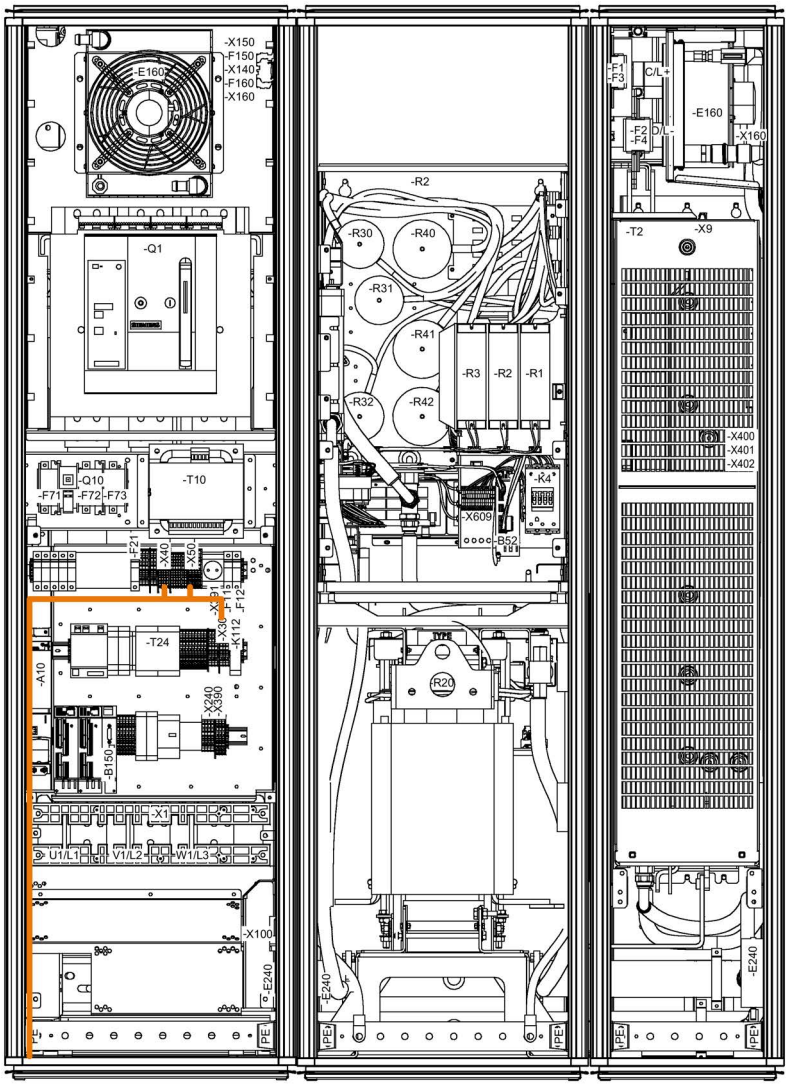
Cable routing	**Completed?**
Cable for the line supply (L1, L2, L3, PE)	
Signal cables to terminals -X30, -X40, -X50	
PROFIBUS cable or PROFINET cable to the Control Unit	
DRIVE-CLiQ connections / signal cables to the Control Unit and to the Active Line Module	
Note: The "Basic rules for cable routing" and "Preparatory steps" described above must be observed whenever any cabling or connection work is performed!	

Cable routing for connecting to the supply infeed



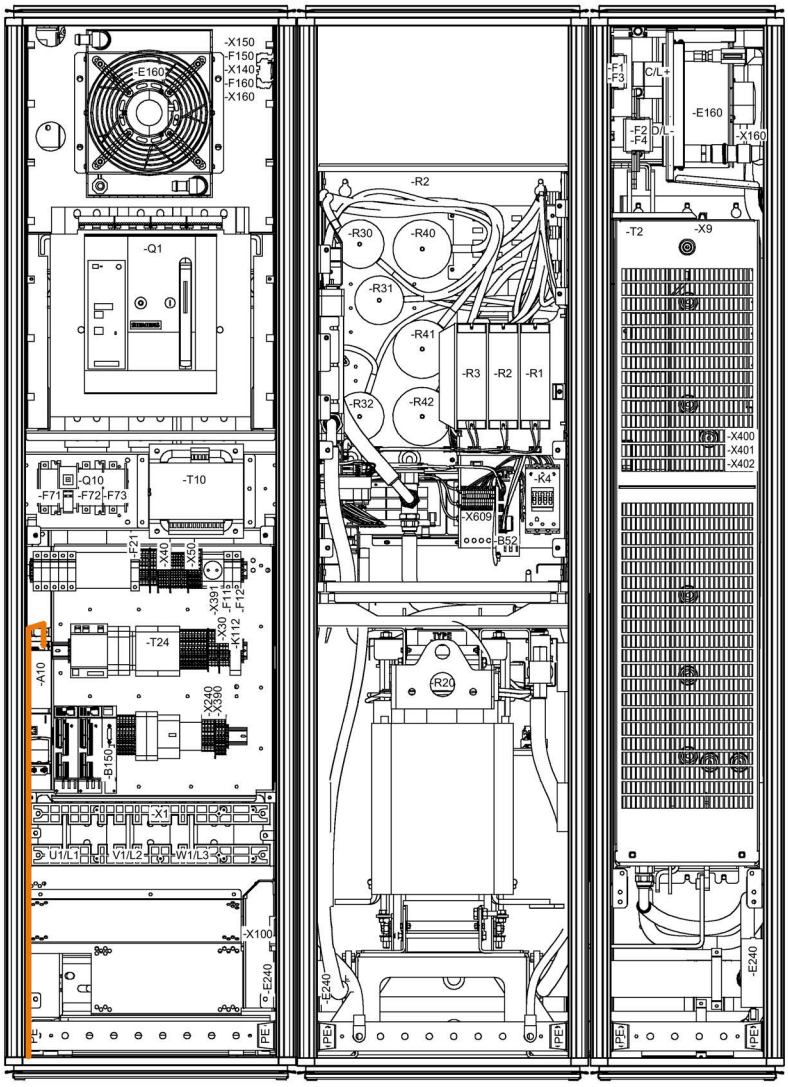
1. Feed the infeed cable into the cabinet from the bottom.
2. Connect the PE cable to the grounding bar.
3. Route the cable up through the cabinet to the line connections -X1 (-U1/-L1, -V1/-L2, -W1/-L3).
4. Fasten the cable at suitable points.
5. Connect the cable to the connections.

Signal cables



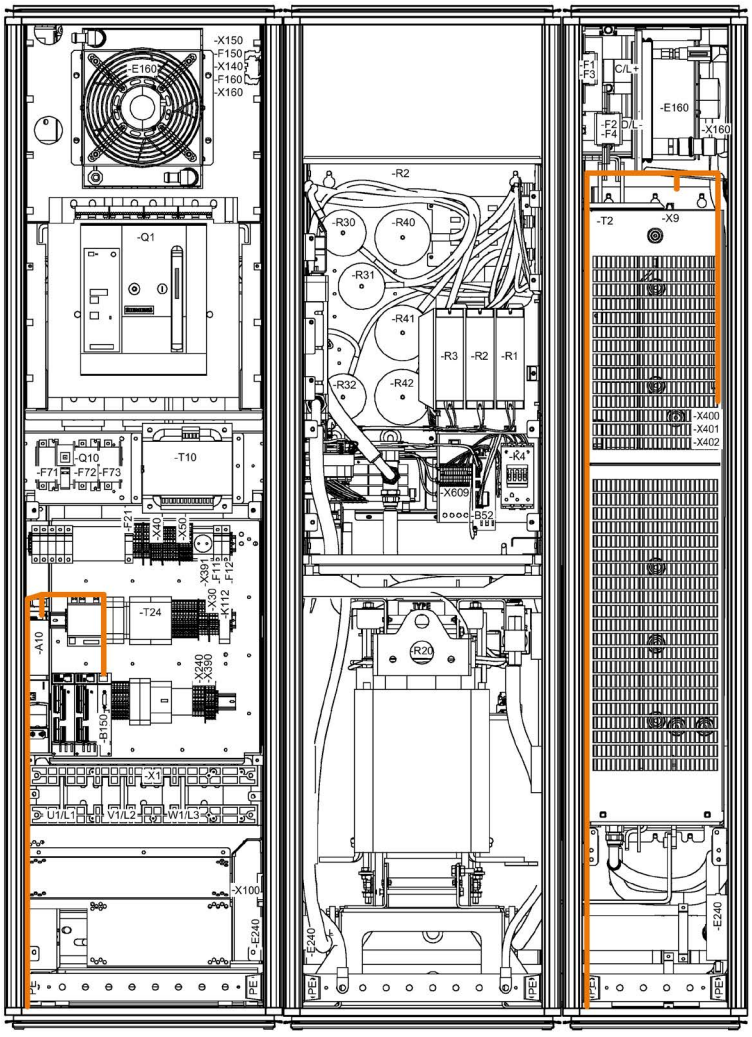
1. Route the signal cables into the cabinet from the bottom left.
2. Route the signal cables up through the cabinet to terminal blocks -X30, -X40 or-X50.
3. Attach the signal cables at suitable points.
4. Connect the signal cables to the terminal blocks.

Cable routing for PROFIBUS or PROFINET connection to the Control Unit



1. Feed the cable for the Control Unit into the cabinet from the bottom left.
2. Remove approx. 3 cm of the cable insulation at the level of the shield plate in the lower part of the cabinet and attach the cable there.
3. To secure the cable in accordance with EMC requirements, snap the clip onto the shield plate.
4. Use cable ties to secure the cable at suitable points.
5. Route the cable further in the cabinet to the upper side of the Control Unit. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
6. Use cable ties to secure the cable at suitable points.
7. Connect the cable to the Control Unit.
   (→See SINAMICS S120 Manual GH1 Control Units)

Cable routing for DRIVE-CLiQ connections and signal cables



1. Route the DRIVE-CLiQ/signal cable to the Control Unit into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Route the cable further in the cabinet to the upper side of the Control Unit. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
4. Use cable ties to secure the cable at suitable points.
5. Connect DRIVE-CLiQ/signal cable to the Control Unit.
6. Route the DRIVE-CLiQ/signal cable to the Active Line Module from the bottom left into the cabinet.
7. Use cable ties to secure the cable at suitable points.
8. Route the cable further in the cabinet to the upper side of the Active Line Module. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
9. Use cable ties to secure the cable at suitable points.
10. Connect the signal cable at terminal block -X9.
11. Route the DRIVE-CLiQ cable through the cable bushing from the top into the Active Line Module, continue to the DRIVE-CLiQ connection -X400, -X401, -X402 and connect there.

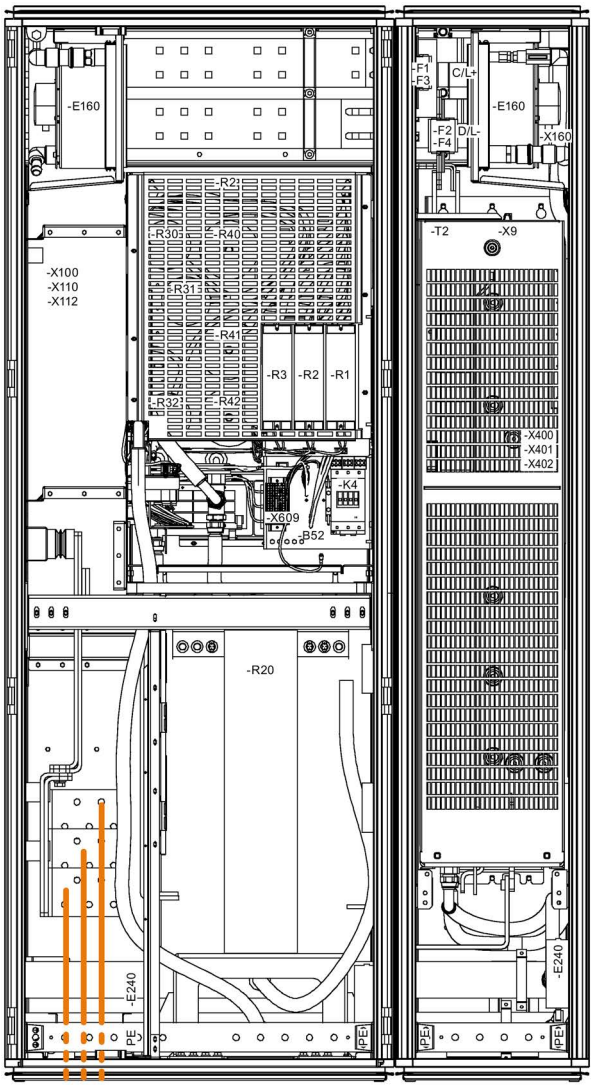
4.6.11.4 Cable routing for Active Line Connection Modules compact

For Active Line Connection Modules compact, customers must carry out the following cabling or connection work:

Table 4- 17 Checklist for cable routing and connection work for Active Line Connection Modules compact

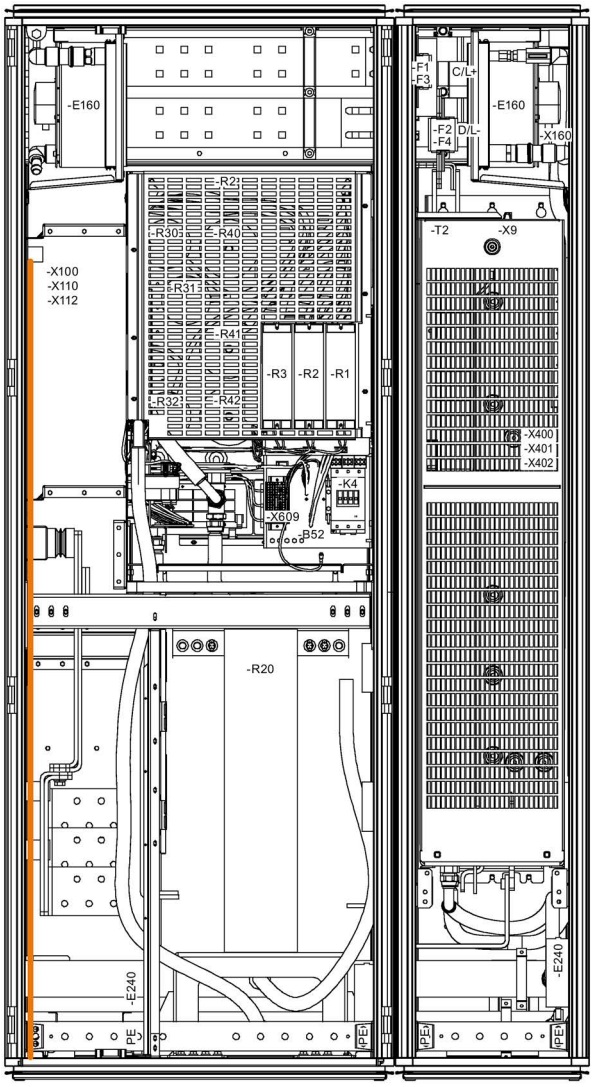
Cable routing	**Completed?**
Cable for the line supply (L1, L2, L3, PE)	
Signal cable to terminal -X100, -X110, -X112	
DRIVE-CLiQ connecting/signal cables to the Active Line Module	
Note: The "Basic rules for cable routing" and "Preparatory steps" described above must be observed whenever any cabling or connection work is performed!	

Cable routing for connecting to the supply infeed



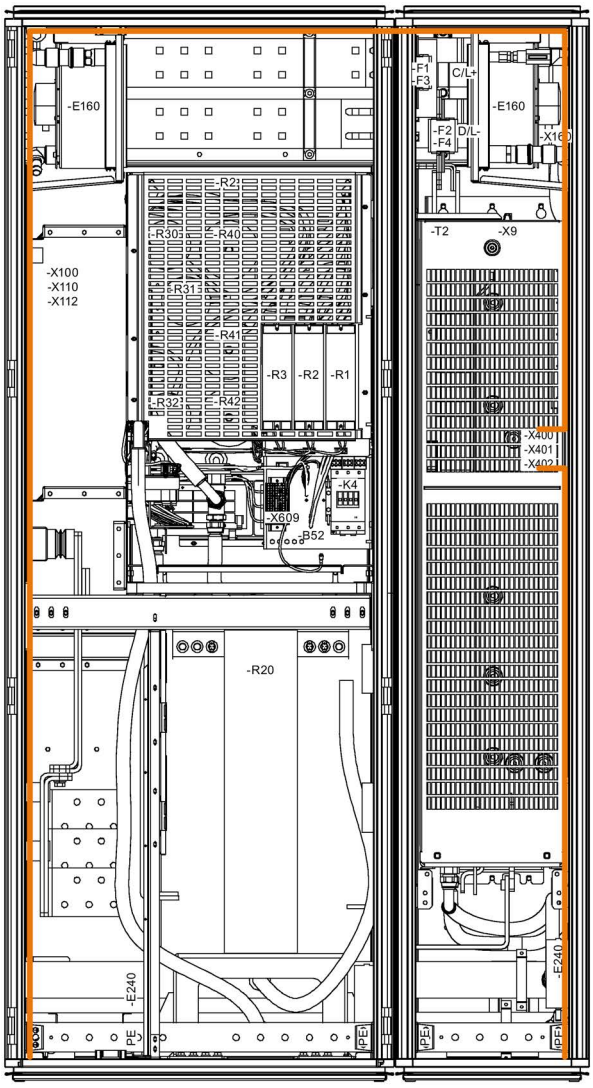
1. Feed the infeed cable into the cabinet from the bottom.
2. Connect the PE cable to the grounding bar.
3. Route the cable up through the cabinet to the line connections -X1 (-U1/-L1, -V1/-L2, -W1/-L3).
4. Fasten the cable at suitable points.
5. Connect the cable to the connections.

Signal cables



1. Route the signal cables into the cabinet from the bottom left.
2. Route the signal cables further up through the cabinet to terminals -X100, -X110, -X112.
3. Attach the signal cables at suitable points.
4. Connect the signal cables to the terminal block.

Cable routing for DRIVE-CLiQ connections



1. Route the DRIVE-CLiQ cable to the Active Line Module from the bottom left up to the upper side.
2. Use cable ties to secure the cable at suitable points.
3. Route the cable along the cross beam of the cabinet to the Active Line Module and then along the right-hand cabinet strut back down to the DRIVE-CLiQ connections.
4. Use cable ties to secure the cable at suitable points.
5. Route the DRIVE-CLiQ cable through the cable bushing from the top into the Active Line Module, continue to the DRIVE-CLiQ connection -X400, -X401, -X402 and connect there.

   Alternatively, the DRIVE-CLiQ cable can also be routed along the right-hand side of the cabinet from below into the cabinet and up to the DRIVE-CLiQ connections.

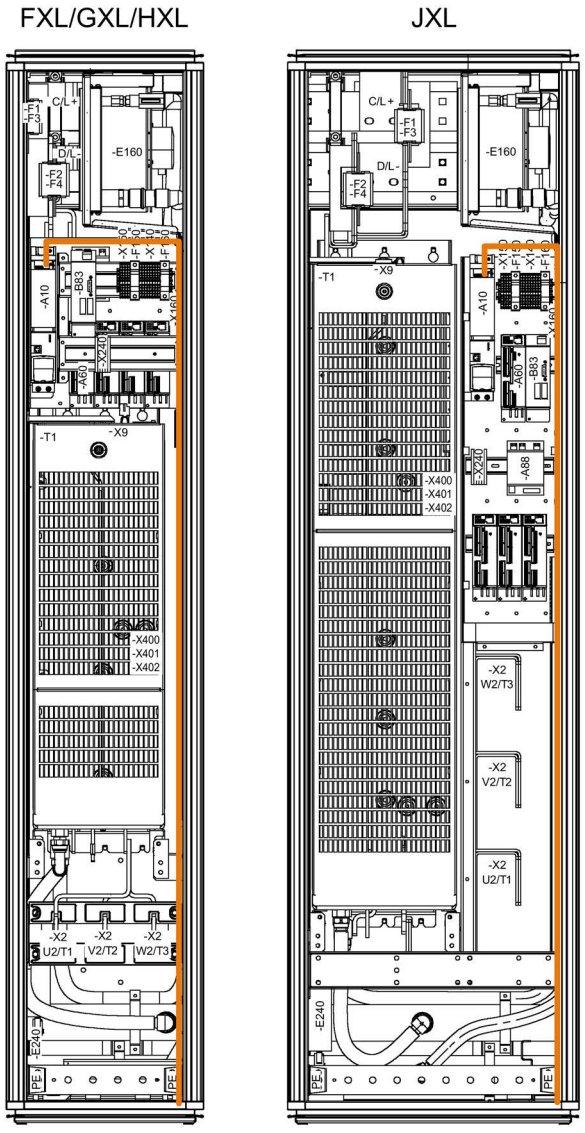
4.6.11.5 Cable routing for Motor Modules

For the Motor Modules, the customer must carry out the following cabling or connection work:

Table 4- 18 Checklist for cable routing or connection work for Motor Modules

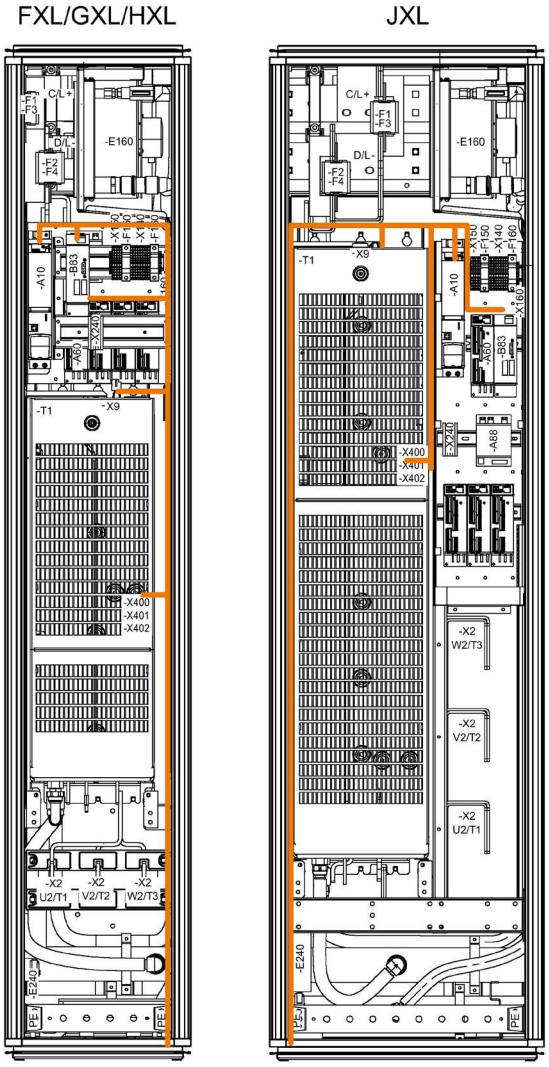
Cable routing	**Completed?**
PROFIBUS cable or PROFINET cable to the Control Unit	
DRIVE-CLiQ connections / signal cables to the Control Unit	
Signal cables to the SMC10/20/30 Sensor Module (-B81/-B82/-B83)	
Option K82, terminal module for controlling safety functions "Safe Torque Off" and "Safe Stop 1"	
Option K87, Terminal Module TM54F	
Option K88, Safe Brake Adapter SBA 230 VAC	
Cable connection between motor and Motor Module	
Note: The "Basic rules for cable routing" and "Preparatory steps" described above must be observed whenever any cabling or connection work is performed!	

Cable routing for PROFIBUS or PROFINET connection to the Control Unit



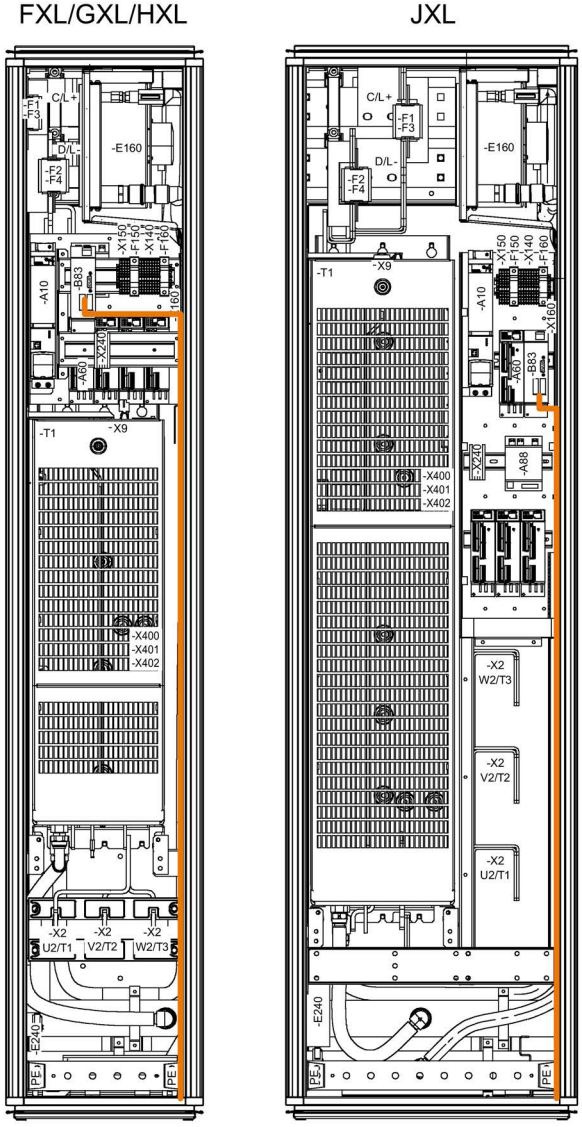
1. Route the Control Unit connecting cable into the cabinet from the bottom.
2. Remove approx. 3 cm of the insulation at the level of the shield plate in the lower part of the cabinet and attach the cable there.
3. To secure the cable in accordance with EMC requirements, snap the clip onto the shield plate.
4. Use cable ties to secure the cable at suitable points.
5. Route the cable further in the cabinet to the upper side of the Control Unit. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
6. Use cable ties to secure the cable at suitable points.
7. Connect the cable to the Control Unit.
   (→See SINAMICS S120 Manual GH1 Control Units)

Cable routing for DRIVE-CLiQ connections and signal cables to the Control Unit



1. Route the DRIVE-CLiQ/signal cable to the Control Unit into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Route the cable further in the cabinet to the upper side of the Control Unit. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
4. Use cable ties to secure the cable at suitable points.
5. Connect DRIVE-CLiQ/signal cable to the Control Unit.
6. Route the DRIVE-CLiQ/signal cable to the Motor Module from the bottom left into the cabinet.
7. Use cable ties to secure the cable at suitable points.
8. Route the cable further in the cabinet to the upper side of the Motor Module. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
9. Use cable ties to secure the cable at suitable points.
10. Connect the signal cable at terminal block -X9.
11. Route the DRIVE-CLiQ cable through the cable bushing from the top into the Motor Module, continue to the DRIVE-CLiQ connection -X400, -X401, -X402 and connect there.

Cable routing for signal cables to SMC10/20/30 Sensor Module



1. Route the encoder connecting cable into the cabinet from the bottom.
2. Remove approx. 3 cm of the insulation at the level of the shield plate in the lower part of the cabinet and attach the cable there.
3. To secure the cable in accordance with EMC requirements, snap the clip onto the shield plate.
4. Use cable ties to secure the cable at suitable points.
5. Route the cable further up into the cabinet and, when it reaches the SMC10/20/30 Sensor Module (-B81/-B82/-B83), guide it to the right to the Sensor Module. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
6. Use cable ties to secure the cable at suitable points.
7. Connect the cable at the encoder module SMC10/20/30 (-B81/-B82/-B83).
   (→ See Chapter "Options", K46, K48 and K50 (Sensor Module Cabinet-Mounted SMC 10, 20 or 30))

Cable routing for the "Safe Torque off" and "Safe Stop 1" functions

Note
Cable routing

The procedure is analogous to the signal cables to the encoder module.

Connect the cable to the terminals to control the functions.

(→ See Chapter "Options", in Section "K82, terminal module for controlling "Safe Torque Off" and "Safe Stop 1"")

Cable routing for the Terminal Module TM54F

Note
Cable routing

The procedure is analogous to the signal cables to the encoder module.

Connect the cable to the terminals to control the functions.

(→ See Chapter "Options", Section "K87, Terminal Module TM54F")

Cable routing for Safe Brake Adapters SBA 230 V AC

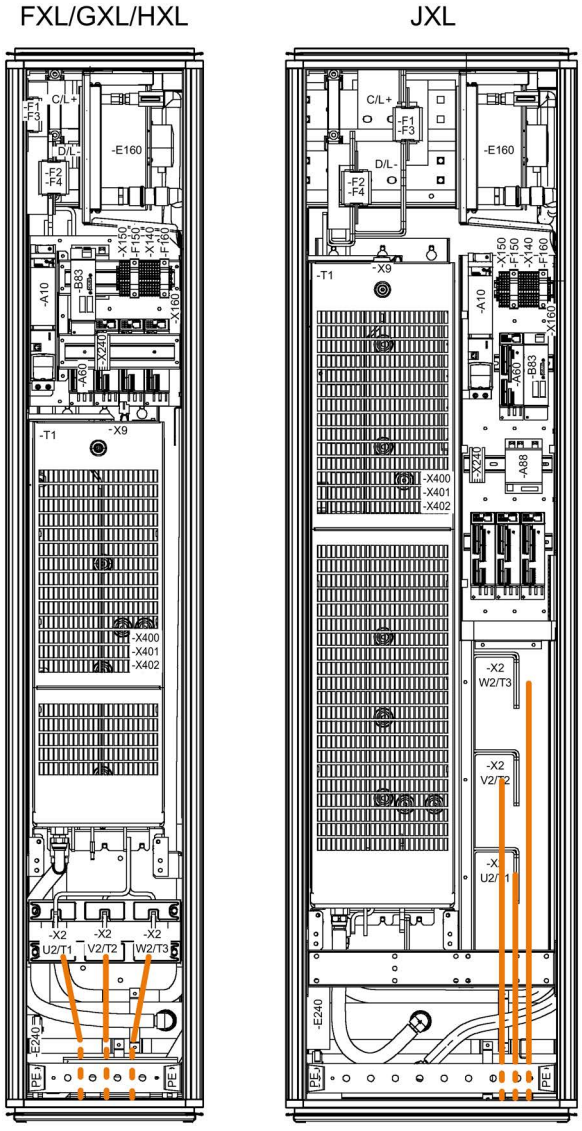
Note
Cable routing

The procedure is analogous to the signal cables to the encoder module.

Connect the cable to the terminals to control the functions.

(→ See chapter "Options" in Section "K88, Safe Brake Adapter SBA AC 230 V"")

Cable routing for motor connection



1. Feed the cable into the cabinet from below.
2. Connect the PE cable to the grounding bar.
3. Route the cable up through the cabinet to the motor connections X2 (-U2/-T1, -V2/-T2, -W2/-T3).
4. Fasten the cable at suitable points.
5. Connect the cable to the connections.

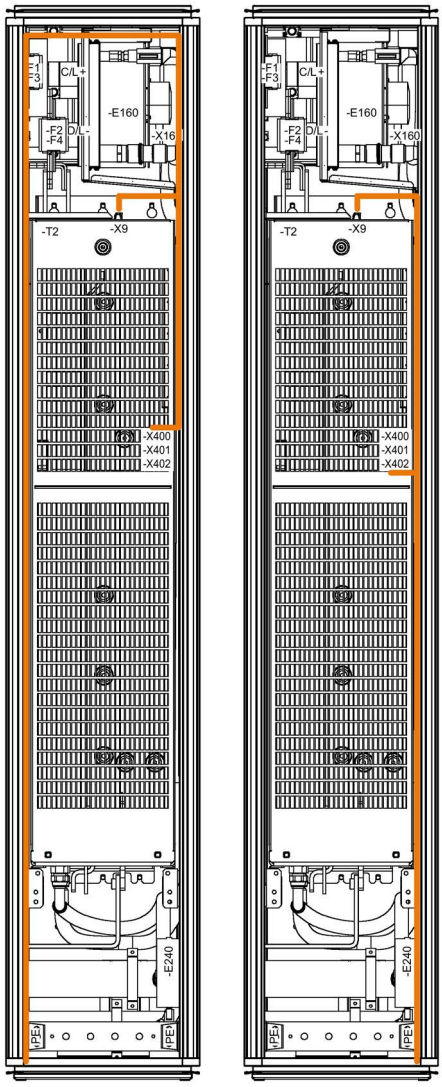
4.6.11.6 Cable routing for Motor Modules compact

For the Motor Modules, the customer must carry out the following cabling or connection work:

Table 4- 19 Checklist for cable routing or connection work for Motor Modules compact

Cable routing	**Completed?**
DRIVE-CLiQ connections / signal cables	
Cable connection between motor and Motor Module	
Note: The "Basic rules for cable routing" and "Preparatory steps" described above must be observed whenever any cabling or connection work is performed!	

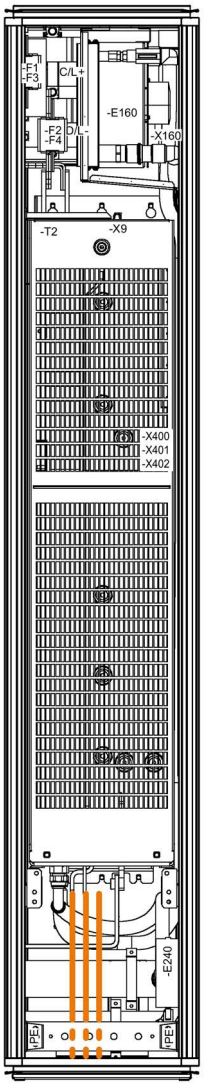
Cable routing for DRIVE-CLiQ connections and signal cables



1. Route the DRIVE-CLiQ/signal cable to the Motor Module from the bottom left into the cabinet.
2. Use cable ties to secure the cable at suitable points.
3. Route the cable horizontally along the cross beam of the cabinet to the right and along the right-hand cabinet strut and back down to the connections.
4. Use cable ties to secure the cable at suitable points.
5. Connect the signal cable at terminal block -X9.
6. Route the DRIVE-CLiQ cable through the cable bushing from the top into the Motor Module, continue to the DRIVE-CLiQ connection -X400, -X401, -X402 and connect there.

   Alternatively, the DRIVE-CLiQ/signal cable can also be routed along the right-hand side of the cabinet from below into the cabinet and up to the connections.

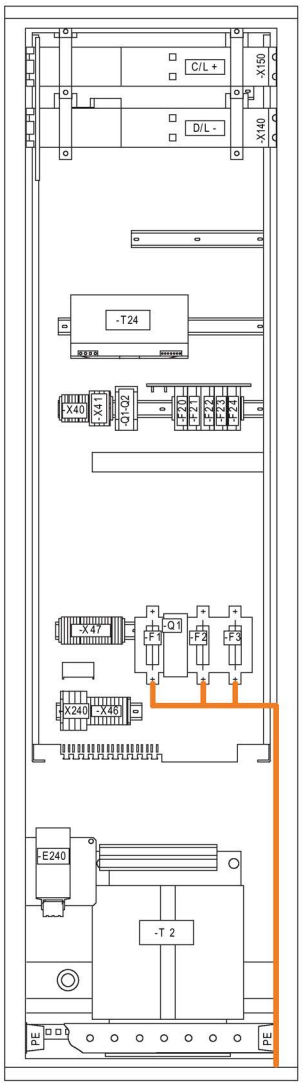
Cable routing for motor connection



1. Feed the cable into the cabinet from below.
2. Connect the PE cable to the grounding bar.
3. Route the cable up through the cabinet to the motor connections X2 (-U2/-T1, -V2/-T2, -W2/-T3).
4. Fasten the cable at suitable points.
5. Connect the cable to the connections.

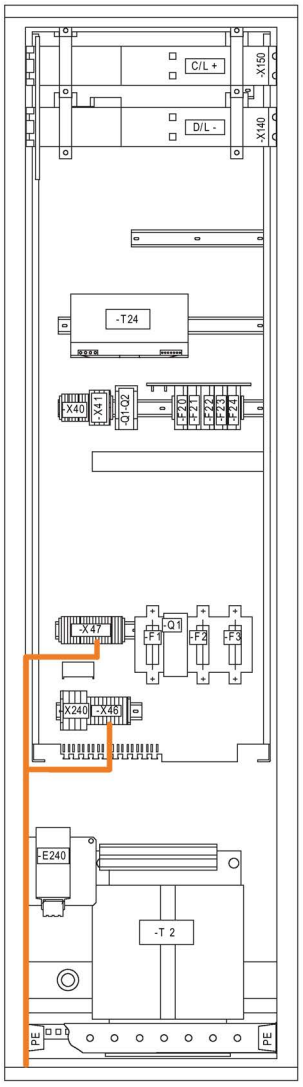
4.6.11.7 Cable routing for Auxiliary Power Supply Modules

Cable routing for connecting to the supply infeed



1. Feed the cable into the cabinet from the bottom right.
2. Guide the cable up and, when it reaches the level of the line connection, guide it to the left.
3. Fasten the cable at suitable points.
4. Connect the cable to the line terminals.

Cable routing for signal cables to terminal strips-X46, -X47



1. Feed the cable into the cabinet from the bottom left.
2. Guide the cable up and, when it reaches the terminal blocks, to the right.
3. Fasten the cable at suitable points.
4. Connect the cable to terminals -X46 and -X47.

Commissioning the cooling circuit

5

5.1 Checklist for commissioning the cooling circuit with Heat Exchanger Module

Use the following checklist when commissioning the cooling circuit. Read the Chapter "Fundamental safety instructions" before you start working on the cabinet.

For information about the various activities, refer to the subsequent chapters or the documents listed in the following table.

Note

Checking the checklist

Check the boxes accordingly in the right-hand column if the option involved applies to the scope of delivery. In the same way, check the boxes once you have finished the installation procedure to confirm that the activities have been completed.

Table 5- 1 Checklist for commissioning the cooling circuit

Item	Activity	Applicable?/Completed?	
General information			
1	Carefully check that all of the pipes are firmly installed, especially for separately supplied transport units. Do not retighten the marked pipe unions.	☐	☐
2	In the Heat Exchanger Module, connect the external power supply for the pump at terminal -X1.	☐	☐
3	In the Heat Exchanger Module, connect the external 24 V DC power supply to terminal -X6/1,3.	☐	☐
4	In the Heat Exchanger Module, connect the TM31 with the appropriate CU320-2 Control Unit via DRIVE-CLiQ to control the cooling system. Generally, this is the Control Unit, which also controls the infeed of the drive line-up.	☐	☐
5	Fill and vent the converter-side de-ionized water circuit.	☐	☐
6	Commission Technology Extension "Heat Exchanger Module".	☐	☐
7	Switchover to manual mode and start the pump.	☐	☐
8	Check the direction of rotation of the pump.	☐	☐
9	Set the differential pressure using the ball valve (77.3).	☐	☐
10	Set a temperature setpoint	☐	☐
11	If necessary, change the temperature limits for alarm/fault.	☐	☐

Note

Description of how the Heat Exchanger Module is controlled

A description of the Heat Exchanger Module control is provided in the "Heat Exchanger Module Function Manual", which is included in the individual device documentation.

5.2 Coolant for the raw water circuit on the plant side

5.2.1 Coolant properties

The coolant must fulfill the following requirements over the long term.

Table 5- 2 Requirements relating to the coolant (basis VDI 3803)

	Unit	Value
Electrical conductivity	µS/cm	< 2200
pH value		7.5 ... 9.0
Total hardness	°dH	< 20 (T < 40 °C)
SK 4.3 (upper limit value of polymer phosphates for untreated additional water)	mmol/l	< 10
Dissolved iron	mg/l	< 3.0
Dissolved copper	mg/l	< 0.2
Ortho phosphate	mg/l	< 50
Chlorides (CL^-)	mg/l	< 180
Sulfate (SO_4^{2-})	mg/l	< 200
Biological load	CFU/ml	< 50
SiO_2 as silicic acid	mg/l	< 47
Aluminum	mg/l	< 2.65
Fluoride	mg/l	< 4.0
Size of entrained particles	mm	≤ 0.5

Permissible limit values for suspended particles in the coolant: No deposits of solid particles at ≥ 0.5 m/s

Note

Coolant that can be alternatively used

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

It is recommended that you contact the coolant manufacturer for the analysis of the coolant.

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 flushed and refilled if the coolant becomes cloudy, becomes discolored or becomes contaminated by mold spores.

To better explain the coolant recommendations in this document, a number of problems, which can be encountered if the recommendations are ignored, are listed in the table below.

Table 5- 3 Substances which can cause irreparable heat sink damage

Problem	**Possible causes/consequences Properties of the coolant or limit value exceeded**	**Countermeasure**
Increased corrosion, deposits	Sea water	Do not use sea water!
	Water compliant with limit values	Use an appropriate concentration of antifreeze; the cooling circuit must have 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.
Open or 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)	Flush 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.
Electrical corrosion	Voltage potential can be identified Inadequate equipotential bonding	Provide all components with an equipotential bonding system.
Deposits, residues, algae	Biological contamination	Use of biocides, dirt traps (= strainer, 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).

Note

Flushing the cooling circuit

"Flushing the cooling circuit" involves the following process:

1. Drain the old coolant from the cooling circuit
2. Fill the cooling circuit with fresh coolant
3. Operate the cooling circuit for some time (up to approximately 1/2 hour)
4. Drain the coolant again and clean the dirt trap
5. Fill the cooling circuit with fresh coolant

5.3 Coolant for the converter-side de-ionized water circuit

5.3.1 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 140)".

Table 5- 4 Coolant requirements

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

Note

Analyzing the coolant

It is recommended that you contact the coolant manufacturer for the analysis of the coolant.

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 flushed and refilled if the coolant becomes cloudy, becomes discolored or becomes contaminated by mold spores.

You can find more information on this in Chapter "Take a coolant sample (Page 153)".

To better explain the coolant recommendations in this document, a number of problems, which can be encountered if the recommendations are ignored, are listed in the table below.

Table 5- 5 Substances which can cause irreparable heat sink damage

Problem	**Possible causes/consequences Properties of the coolant or limit value exceeded**	**Countermeasure**
Increased corrosion, deposits	Sea water	Do not use sea water!
	Water compliant with limit values	Use an appropriate concentration of antifreeze; the cooling circuit must have 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.
Erosion/particles	Suspended solids (e.g. sand)	Flush 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.
Electrical corrosion	Voltage potential can be identified Inadequate equipotential bonding	Provide all components with an equipotential bonding system.
Deposits, residues, algae	Biological contamination	Use of biocides, dirt traps (= strainer, 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).

Note

Flushing the cooling circuit

"Flushing the cooling circuit" involves the following process:

1. Drain the old coolant from the cooling circuit
2. Fill the cooling circuit with fresh coolant
3. Operate the cooling circuit for some time (up to approximately 1/2 hour)
4. Drain the coolant again and clean the dirt trap
5. Fill the cooling circuit with fresh coolant

5.3.2 Antifreeze, biocides, inhibitors

Table 5- 6 Overview and application of coolant additives

	Used for SINAMICS S120 Cabinet Modules liquid cooled	Please note the following in particular
Antifreeze	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 %	
Antifreeze + biocide*	Antifreeze already has a biocidal effect in the minimum concentration specified above.	
Inhibitors	Required Fuchs ANTICORIT S 2000 AA mixed with a ratio of 3 ... 5 %	

* Effectiveness regarding the growth of microorganisms

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 proportion 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

Mixing different antifreeze agents in 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 %.

5.4 Filling the converter-side de-ionized water circuit

To fill the converter-side de-ionized water circuit you require a drum pump and a 1/2 " hose. We recommend that a drum pump is used that can produce a pressure of 3 bar.

The coolant must be mixed before filling the cooling circuit. 100 l drums are suitable for the purpose, for example.

Note

The drum pump is not included in the scope of delivery.

Filling the cooling circuit

1. Close all vent valves and drain valves.
2. Connect the drum pump to the filling connections (65.1) of the Heat Exchanger Module using the hose.
3. Open all of the valves in the Heat Exchanger Module, with the exception of the valves for draining.
4. Using the drum pump, pump the coolant into the cooling circuit until the pressure gauge for the system pressure (44) shows approx. 2.1 bar.

Note

Prevent the ingress of dirt and foreign bodies into the cooling circuit.

Note

Venting the cooling circuit

When filling, in most cases, the cooling circuit must be vented according to the following description.

5.4.1 Venting the cooling circuit

5.4.1.1 Venting the components

The hose for venting the following components can be found in the cabinet. Release the venting hose (arrow) from the cabinet frame. Hold the vent hose outside the cabinet in a bucket.



Figure 5-1 Vent hose

Vent the component until clear coolant escapes in a continuous stream.



⚠WARNING

Danger to life due to electric shock when coolant escapes

Escaping 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 coolant is sprayed onto the devices or additionally mounted electrical components while venting.
- Switch off immediately if there are any leaks causing coolant to escape (drips or pools).

⚠CAUTION

Risk of injury caused by splashing coolant

The coolant is harmful to eyes and skin and can damage surfaces.

If the air 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.

5.4.1.2 Vent the heat exchanger for degree of protection IP55

The air-to-water heat exchangers in the Basic Line Connection Module, Active Line Connection Module, Active Line Connection Module compact, Motor Module and Motor Module compact are mounted at the highest location in the cooling circuit.

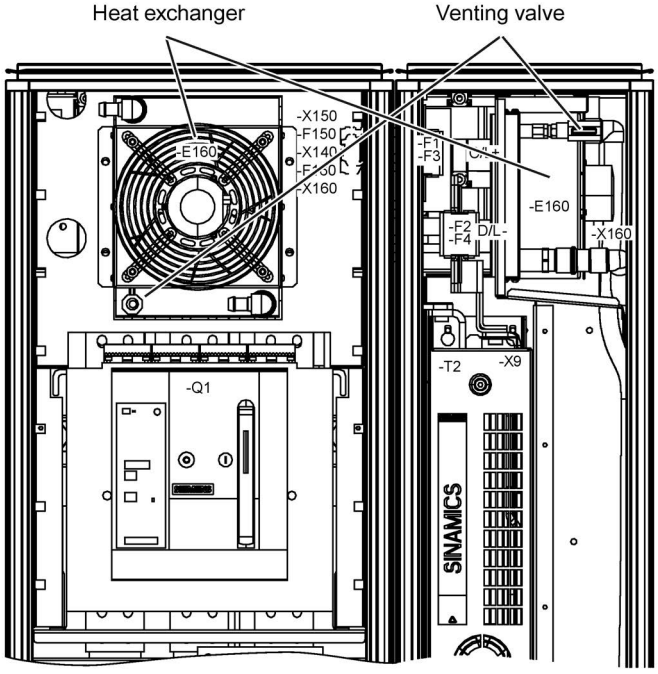


Figure 5-2 Position of the vent valves in the Basic Line Connection Module

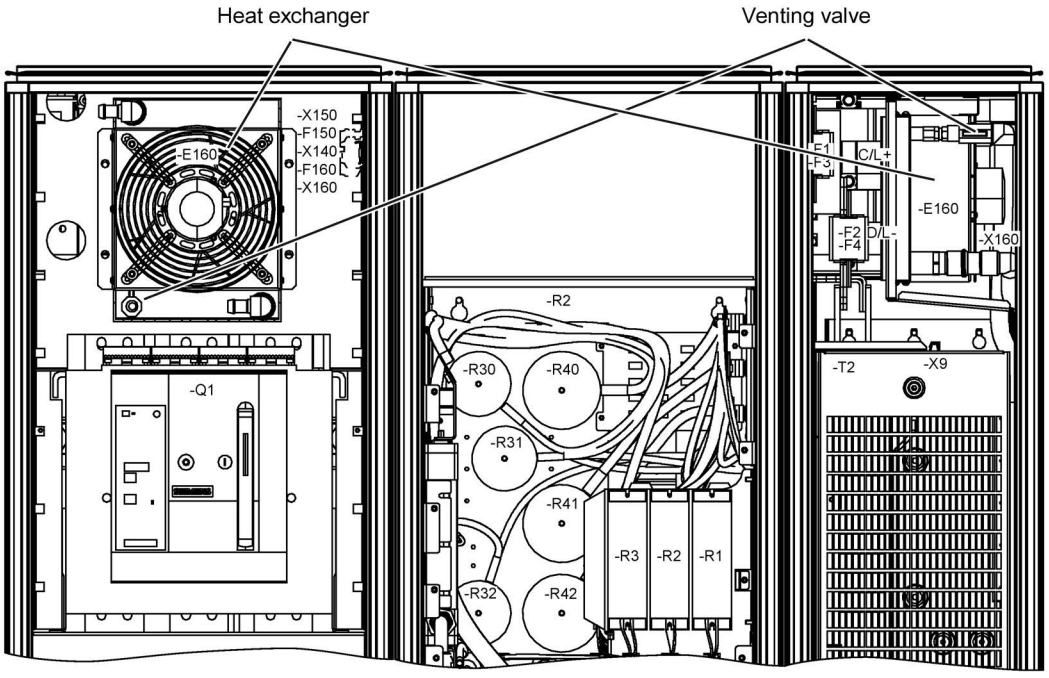


Figure 5-3 Position of the vent valves in the Active Line Connection Module

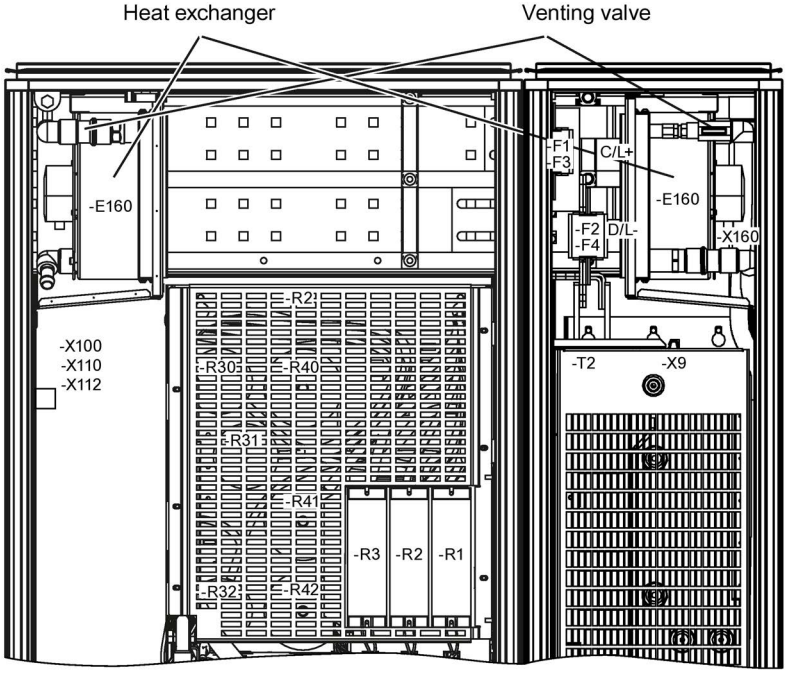


Figure 5-4 Position of the vent valves in the Active Line Connection Module compact

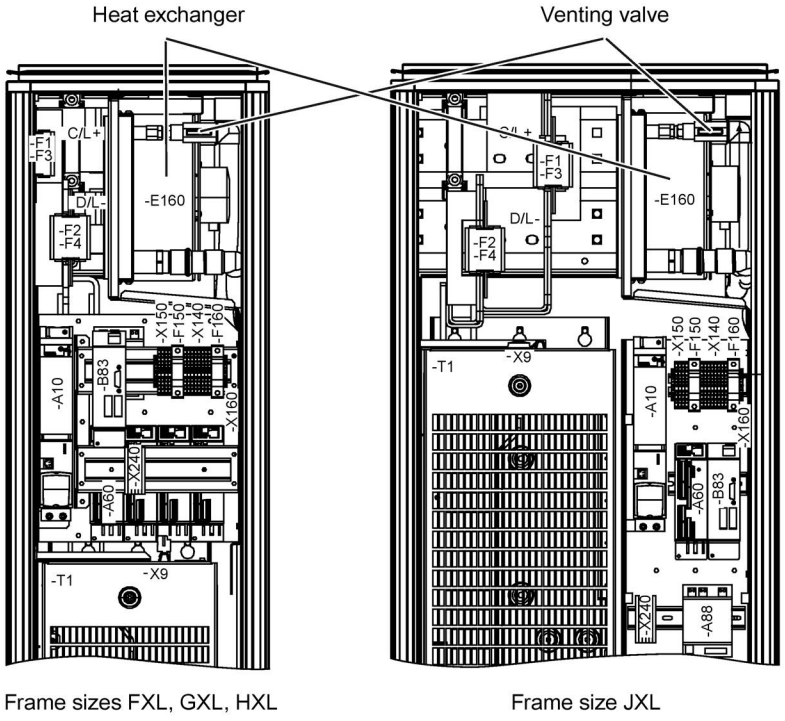


Figure 5-5 Position of the vent valves in the Motor Module

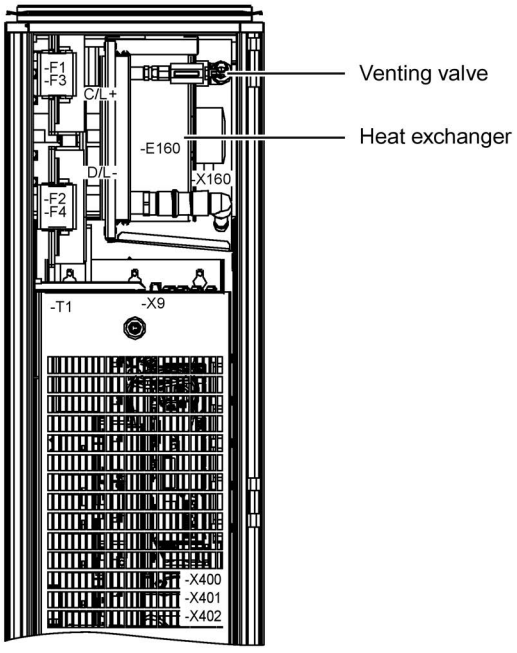


Figure 5-6 Position of the vent valves in the Motor Module compact

Proceed as follows to vent the heat exchanger:

1. Hold the blue vent hose outside the cabinet in a bucket, see Chapter "Venting the components (Page 143)".
2. Open the vent valve at the heat exchanger so that air can escape.
   Continue venting until clear cooling coolant escapes in a steady stream from the vent hose.
3. Close the vent valve.

⚠ CAUTION

Risk of injury caused by splashing coolant

The coolant is harmful to eyes and skin and can damage surfaces.

If the air 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.

5.4.1.3 Venting the heatsinks of the SINAMICS power units

In some devices, the heat sink has to be vented when the cooling circuit is being filled, depending on the device type and the frame size.

- It is not necessary to vent the heat sinks on Active Interface Modules, frame size JXL, on Active Line Modules, frame size GXL 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 the end of 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 blanking plug is inserted in the lower end of the vent hose at the factory. This must be removed before the heat sink is vented and inserted again afterwards.

Proceed as follows to vent the heat sink

1. Hold the venting hose outside the cabinet in a bucket, see Chapter "Venting the components (Page 143)".
2. Open the vent valve at the power unit so that air can escape.
   Continue venting until clear coolant escapes in a steady stream from the vent hose.
3. Close the vent valve.

⚠CAUTION

Risk of injury caused by splashing coolant

The coolant is harmful to eyes and skin and can damage surfaces.

If the air 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.

Venting the heat sink with removal of the front electronics fan

For the following Basic Line Connection Modules, the front electronics fan must be removed in order to actuate the vent valve in the Basic Line Module:

- 6SL3735-1TE41-2AA3 (380 ... 480 V, 1220 A, 600 kW)
- 6SL3735-1TE41-7AA3 (380 ... 480 V, 1730 A, 830 kW)
- 6SL3735-1TG41-3AA3 (500 ... 690 V, 1300 A, 1100 kW)
- 6SL3735-1TG41-7AA3 (500 ... 690 V, 1650 A, 1370 kW)

The necessary steps following removal of the top housing cover are shown in the illustration below.

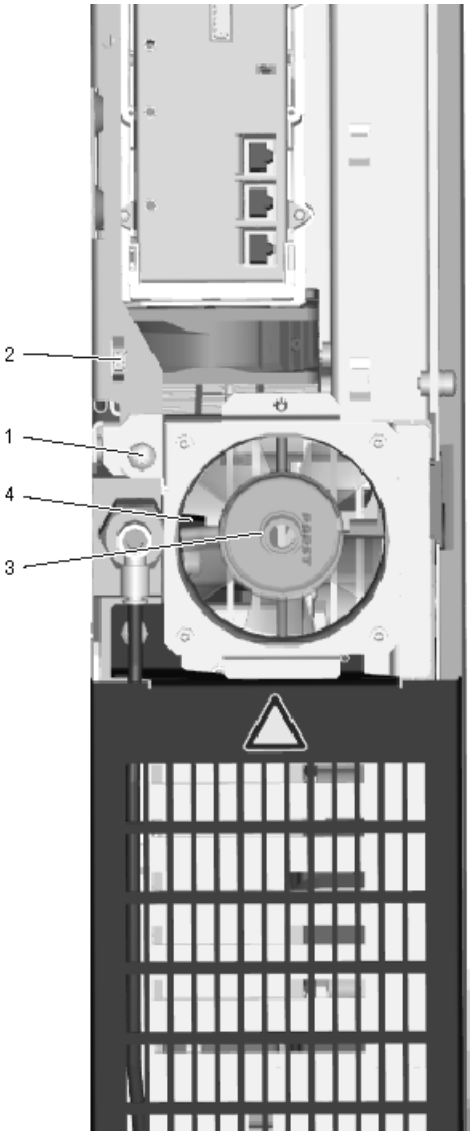


Figure 5-7 Removing the electronics fan to actuate the vent valve

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 supply 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.

⚠CAUTION

Risk of injury caused by splashing coolant

The coolant is harmful to eyes and skin and can damage surfaces.

If the air 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.

5.4.1.4 Checking the system standstill pressure

The system standstill pressure falls significantly when the system is vented. Fill coolant into the system using a drum pump until the system standstill pressure shown at the pressure gauge (44) is approx. 2.1 bar.

5.4.1.5 Completing venting

Vent the heat exchanger and components again and fill with short pauses several times.

Allow the system to stabilize a short time after each venting so that the air can collect at the highest points. Because the coolant is viscous, the air bubbles only gather at the highest points slowly and with difficulty.

5.5 Plant-specific settings

The Heat Exchanger Module is controlled with its own software via a CU320-2 Control Unit integrated in the drive system.

This controls the pump and uses the 3-way valve actuator drive to regulate the intake temperature in the converter de-ionized water circuit to a fixed, adjustable value.

The control system also monitors the pressures in the intake and return flow lines of the de-ionized water circuit, the intake temperature in the de-ionized water circuit and the ambient temperature. Alarm or fault messages are output if the measured values exceed or fall below the limits stored internally in the control system.

The control software also includes a function to automatically avoid condensation.

Connection with Control Unit

To integrate the Heat Exchanger Module, you must establish a DRIVE-CLiQ connection between the Control Unit and the TM31 Terminal Module in the control box of the Heat Exchanger Module.

Adjust the ball valve to reduce the pressure at the intake of the converter-side de-ionized water circuit.

Adjust the ball valve to reduce the pressure at the intake of the converter-side de-ionized water circuit (77.3) to "half open" in order to prevent the safety valve (63.1) from being triggered during the commissioning phase.

After filling and venting have been completed, the ball valve (77.3) must be set so that a differential pressure of at least 1.5 bar (+0.5) is obtained.
After commissioning the Technology Extension "Heat Exchanger Module", this value is available in the assigned TM31 under r32450[2].

More information

A description of the functions and operation is provided in the separate documentation "Heat Exchanger Module Function Manual", which is included in the individual device documentation.

5.6 Anti-condensation measures

The customer must take measures on the plant side 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 intake temperature of the coolant is significantly lower than room temperature (air temperature in the control cabinet). Condensation can also occur in the control cabinet if components with residual heat can increase the temperature inside the electrical cabinet after shutdown via the cooling water temperature (e.g. filter reactors). To avoid this, an adequate cooling system run-on time must be ensured for components such as these. 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 can be expected, i.e. the coolant temperature must always be greater or equal to the dew point temperature.
The coolant temperature must be controlled according to the following table.

Table 5- 7 Dew point temperature as a function of relative air humidity ϕ and room temperature at an installation altitude of 0 m.

T room [°C]	φ=20%	φ=30%	φ=40%	φ=50%	φ=60%	φ=70%	φ=80%	φ=85%	φ=90%	φ=95%	φ=100%
10	<0	<0	<0	0.2	2.7	4.8	6.7	7.6	8.4	9.2	10
20	<0	2	6	9.3	12	14.3	16.4	17.4	18.3	19.1	20
25	0.6	6.3	10.5	13.8	16.7	19.1	21.2	22.2	23.2	24.1	24.9
30	4.7	10.5	14.9	18.4	21.3	23.8	26.1	27.1	28.1	29	29.9
35	8.7	14.8	19.3	22.9	26	28.6	30.9	32	33	34	34.9
38	11.1	17.4	22	25.7	28.8	31.5	33.8	34.9	36	36.9	37.9
40	12.8	19.1	23.7	27.5	30.6	33.4	35.8	36.9	37.9	38.9	39.9
45	16.8	23.3	28.2	32	35.3	38.1	40.6	41.8	42.9	43.9	44.9
50	20.8	27.5	32.6	36.6	40	42.9	45.5	46.6	47.8	48.9	49.9

The dew point also depends on the absolute pressure, i.e. the installation altitude.

The dew points for low atmospheric pressure are lower than those at an altitude of 0 m, i.e. it is always acceptable to calculate the coolant supply temperature for an altitude of 0 m.

5.7 Emptying the converter-side de-ionized water circuit

To empty the converter-side de-ionized water circuit, the accessory kit for the electrical cabinet includes a piece of hose and a quick-release coupling.

You can connect this hose to the lower water pipe (intake); this allows you to drain a very large percentage of the converter-side de-ionized water circuit.

Empty the converter-side de-ionized water circuit

1. At the shutoff valve (65.4) in the Heat Exchanger Module, connect a 1/2 "hose to drain the coolant (for option W01, also at shutoff valve 65.5).
2. Remove the quick-release coupling at the intake to the de-ionized water circuit on the converter side at one of the points in the cabinet line-up opposite the Heat Exchanger Module.
3. Connect the hose with the quick-release coupling (from the accessory kit) to the intake to the converter-side de-ionized water circuit.
4. Route the hoses to a suitable tank to drain the coolant.
5. Open all shutoff valves (65.4, 65.5) and vent valves (at the power units and the heat exchangers) and drain the coolant.
6. At the filling connection points (65.1) of the Heat Exchanger Module, connect a hose with dry compressed air with a maximum pressure of 6.0 bar.
7. Wait until coolant no longer drains from all of the hoses.

⚠CAUTION

Risk of injury caused by splashing coolant

The coolant is harmful to eyes and skin and can damage surfaces.

If the air 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.

5.8 Take a coolant sample

A coolant sample must be taken to send the coolant to the manufacturer of the coolant additive for testing.

Take a coolant sample

1. Connect a clean 1/2 " hose to the shutoff valve (65.4) in the Heat Exchanger Module.
2. Place the hose in a suitable container to fill the coolant sample.
3. Carefully open the shutoff valve (65.4) and allow the coolant to slowly run into the container.
   Ensure that the container does not overflow.
4. Close the shutoff valve (65.4).

⚠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.

Cabinet Modules

6

6.1 Basic Line Connection Modules

6.1.1 Description

Note

Additional information

Refer to the layout diagrams (AO) and circuit diagrams (SP) provided in the individual device documentation for the arrangement of components and interfaces and for the wiring.



Figure 6-1 Basic Line Connection Module

Basic Line Connection Modules are compact line infeeds for two-quadrant operation, i.e. no regenerative feedback. They are used in applications where energy does not have to be fed back into the line supply.

Basic Line Connection Modules comprise a Line Connection Module and a liquid-cooled Basic Line Module installed in a cabinet system.

Line Connection Modules contain the line-side infeed via main switch with fuse switch disconnector or circuit breaker and establish the connection between the plant-side supply system and the Basic Line Modules. It is equipped as standard with a radio interference suppression filter according to IEC 61800-3 Category C3.

As standard, the Basic Line Connection Module is positioned in the drive line-up so that the Motor Modules are arranged to the right.
If Motor Modules are to be arranged to the left of the Basic Line Connection Module then option M88 (DC busbar system for line-side Cabinet Modules) must be used.

Under full load, the DC link voltage is higher than the rms value of the rated line voltage by a factor of 1.32, and under partial load by a factor of 1.35.

If regenerative conditions occur in the drive line-up, a Motor Module can be used as braking chopper, which then converts excess energy to heat in a braking resistor.

Basic Line Connection Modules are suitable for connection to supply systems grounded at the neutral point (TN, TT) and non-grounded (IT) supply systems. The following voltages and power ratings are available:

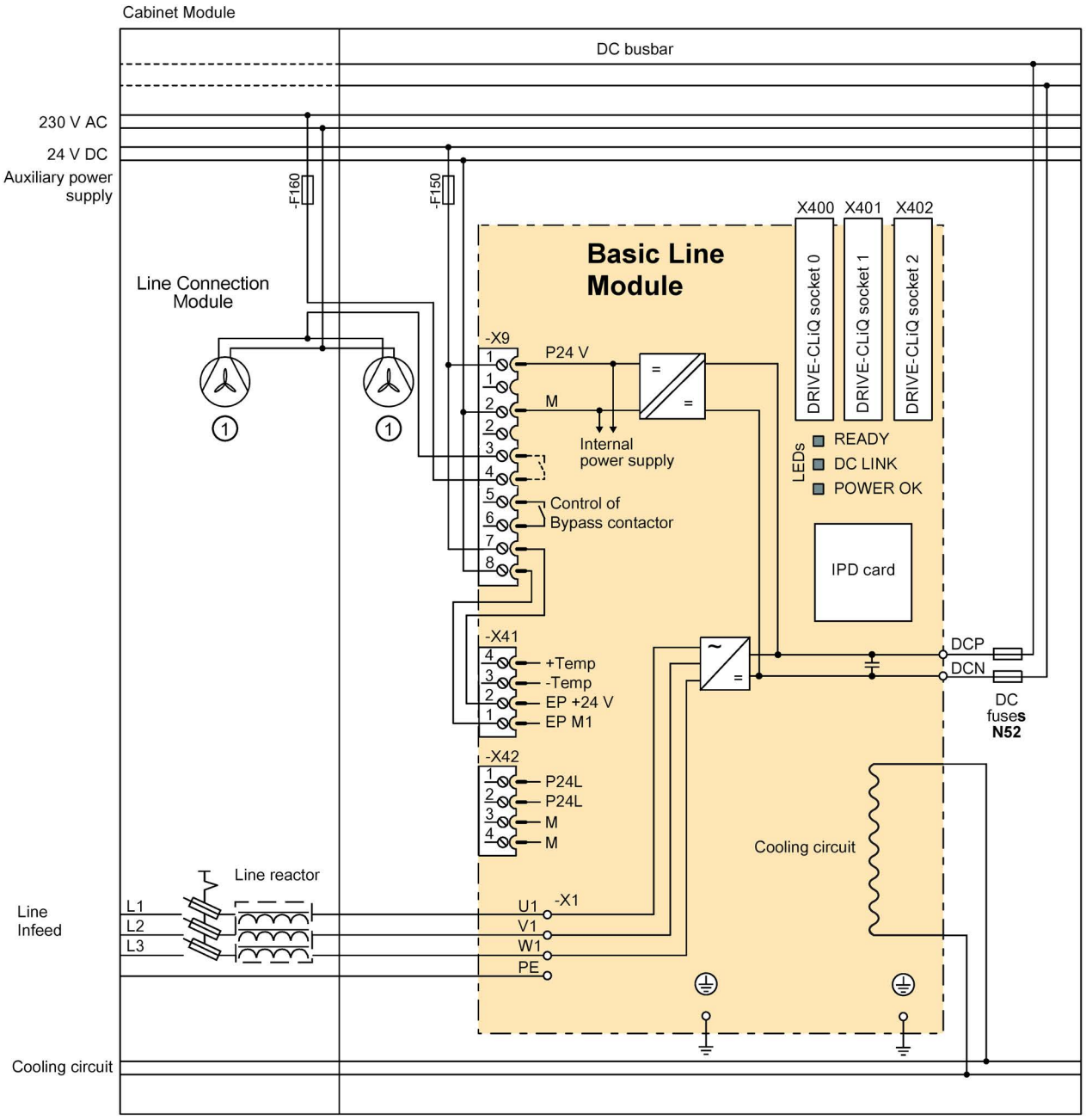
Line voltage	**Rated power**
3 AC 380 ... 480 V	360 ... 830kW
3 AC 500 ... 690 V	355 ... 1370kW

Depending on the input current, the following designs are used:

- ≤ 800 A: Main switch with fuse switch disconnector
- > 800 A: Circuit breaker, type 3WL, with option L25 as draw-out circuit breaker

The power rating can be increased by connecting Basic Line Connection Modules in parallel.

Integration



① Door fan -G160 (IP21, IP23, IP43, IP54) or heat exchanger -E160 (IP55)

Figure 6-2 Connection example, Basic Line Connection Module

Configuration

A fully controlled thyristor bridge is used to precharge the Basic Line Connection Module and the connected DC link. The thyristors normally operate with a trigger delay angle of 0 °.

Note

Additional information

The configuration examples of the individual Basic Line Connection Modules illustrate the arrangement of the factory-fitted components. They show the maximum possible configuration of the modules, which contain all options that can be ordered.

Refer to the layout diagrams (AO) provided in the individual device documentation for the precise order-specific location of the components.

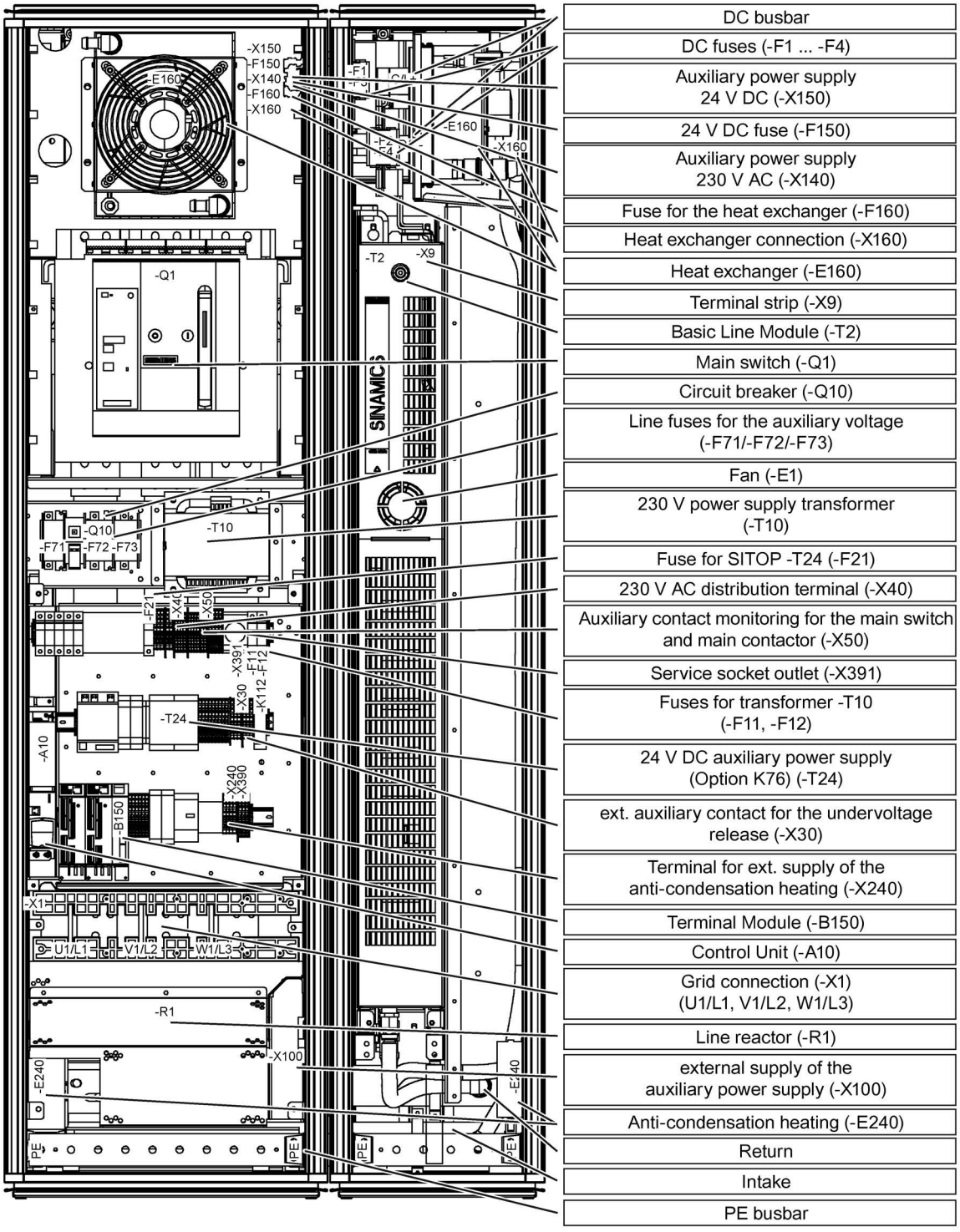


Figure 6-3 Configuration example, Basic Line Connection Module (IP55)

Parallel connection of Basic Line Connection Modules to increase power rating

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

- Up to 4 identical Basic Line Connection Modules can be connected in parallel.
- Option M88 (DC busbar system for the line-side Cabinet Modules) must be installed so that the infeed can be realized at the common DC link.
- A common Control Unit is required whenever the modules are connected in parallel.
- The parallel connection must be supplied from a common infeed point (i.e. different supply systems are not permitted); see also SINAMICS Low Voltage Engineering Manual.
- A derating factor of 7.5 % must be taken into consideration, regardless of the number of modules connected in parallel.
- The main contactors or circuit breakers of the respective Line Connection Modules must close together and simultaneously.
  The monitoring is realized via terminals -X50 of the particular Line Connection Module.
- Every Basic Line Connection Module connected in parallel must include a line reactor.

6.1.1.1 Fuse switch disconnector (input current ≤ 800 A)

Up to 800 A, a switch disconnector with integrated fuses and a main contactor are installed. The contactor is controlled internally.

X50 feedback signal contact "Fuse switch disconnector" and "Main contactor"

Table 6- 1 Terminal block X50 feedback signal contact "Fuse switch disconnector" and "Main contactor"

Terminal	Designation [1]	Technical data
1	NO	"Fuse switch disconnector" checkback contacts Max. load current: 3 A max. Switching voltage: 250 VAC
2	NC	
3	COM	
4	NO	"Main contactor" feedback signal contacts Max. load current: 10 A Max. Switching voltage: 250 V AC Max. contact rating: 250 VA Required minimum load: ≥1 mA
5	NC	
6	COM	
Max. connectable cross-section: 2.5 mm²		

[1] NC: normally-closed contact, NO: normally-open contact, COM: Center contact

6.1.1.2 Circuit breaker (input current > 800 A)

For currents greater than 800 A, the circuit breaker, which is located in the center of the cabinet, takes on the function of isolating the system from the supply and providing overload and short-circuit protection. The circuit breaker is internally activated and has its own internal power supply.

As a consequence, the device is sufficiently protected using the factory setting.

The circuit breaker is set as follows in the factory:

Table 6- 2 Factory setting of the circuit breaker for the Basic Line Connection Modules

Article number Basic Line Connection Module	Input current	Overload trip (L)	Short-time delayed short-circuit release (S)	Short-circuit release delay (t_{sd})
6SL3735-1TE41-2LA3	1000 A	0.8	2	0
6SL3735-1TE41-7LA3	1420 A	0.9	2	0
6SL3735-1TG41-3LA3	1070 A	0.9	2	0
6SL3735-1TG41-7LA3	1350 A	0.9	2	0

⚠WARNING

Incorrect circuit breaker setting

Incorrect settings can cause unwanted or delayed tripping of the circuit breaker and result in damage to the cabinet unit and can therefore result in death or severe injury.

- Check the settings described above, and if required, adapt the circuit breaker settings corresponding to the factory setting.

Note

Additional information

Detailed and comprehensive instructions and information for the circuit breaker as well as standard and additional options are given in the associated operating instructions, which are included in the device documentation provided.

X50 "circuit breaker" checkback contact

Table 6- 3 Terminal block X50 "Circuit breaker" feedback signal contact

Terminal	Designation [1]	Technical data
1	NO	"Circuit breaker" checkback contacts Max. load current: 3 A Max. switching voltage: 250 V AC
2	NC	
3	COM	
Max. connectable cross-section: 2.5 mm²		

[1] NC: Normally closed contact, NO: Normally open contact, COM: Center contact

X30 looping in an external EMERGENCY OFF

Terminal block -X30 provides you with the option of connecting an external EMERGENCY OFF (normally closed contact) for switching off the circuit breaker.

Table 6- 4 Terminal block X30 "External EMERGENCY OFF" checkback contact

Terminal	Technical data
1	Factory-installed jumper between terminal 1 and terminal 2; this jumper must be removed if a normally closed contact is looped in externally.
2	
Max. connectable cross-section: 2.5 mm²	

6.1.2 Interface description

6.1.2.1 General information

This chapter describes only those interfaces in the cabinet unit that require additional connection work by the customer. All other interfaces are pre-wired at the factory and are not designed for customer connections.

Note

Additional information

All connections to be established on the plant side as well as the interfaces for integration into the plant control system are described in the circuit and terminal diagrams, included in the individual device documentation.

6.1.2.2 Control Interface Module

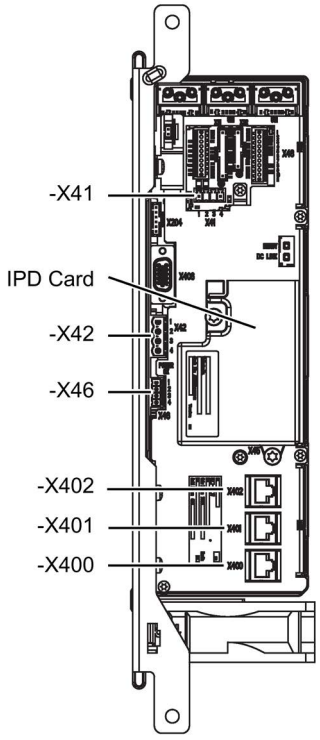
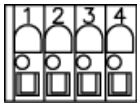


Figure 6-4 Control Interface Module

6.1.2.3 X41 EP terminal / temperature sensor connection

Table 6- 5 Terminal strip X41 EP terminals / temperature sensor connection

Connector	Terminal	Function	Technical data
	1	EP M1 (Enable Pulses)	Supply voltage: 24 VDC (20.4 ... 28.8 V) Current consumption: 10 mA
	2	EP +24 V (Enable Pulses)	
	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.

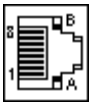
Note

Connection to terminals 1 and 2

24 VDC must be present at terminal 2 and ground at terminal 1 for operation. Pulse suppression is activated when removed.

6.1.2.4 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			

6.1.2.5 Terminal block -X40 external 230 V AC auxiliary infeed

Terminal block -X40 provides you with the option of connecting an external auxiliary infeed (such as an uninterruptible power supply) that is independent of the main infeed. The connection may be protected with up to a 16 A fuse.

Table 6- 7 Terminal block X40 external 230 VAC auxiliary infeed

Terminal	Designation	Technical data
1	L1	Factory-installed jumper to terminal 2; this jumper must be removed if an external infeed is used.
2	L1	Connection of external 230 VAC auxiliary infeed: L1
5	N	Factory-installed jumper to terminal 6; this jumper must be removed if an external infeed is used.
6	N	Connection of external 230 VAC auxiliary infeed: N
Max. connectable cross-section: 2.5 mm^2		

6.1.3 Options

Note
Additional information

The individual options are described in Chapter "Options".

Electrical options

Component	Option
CBC10 Communication Board	G20
CBE20 Communication Board	G33
1 temperature sensor module TM150	G51
2 temperature sensor modules TM150	G52
3 temperature sensor modules TM150	G53
4 temperature sensor modules TM150	G54
TM31 Terminal Module	G60
Additional TM31 Terminal Module	G61
TB30 Terminal Board	G62
AOP30 operator panel	K08
Auxiliary power generation in the Line Connection Module	K76
Control Unit CU320-2 DP (PROFIBUS)	K90
Performance extension for CU320-2	K94
Control Unit CU320-2 PN (PROFINET)	K95
Main contactor (for Basic Line Connection Modules ≤800 A)	L13
Surge suppression	L21
Line reactor not included in scope of delivery	L22
Draw-out circuit breaker (for Basic Line Connection Modules >800 A)	L25
Current transformer upstream of the main switch	L41
EMERGENCY OFF pushbutton installed in the cabinet door	L45
Cabinet lighting with service socket	L50
Cabinet anti-condensation heating	L55
Insulation monitoring	L87
DC link fuses	N52
Measuring instrument for line variables (installed in the cabinet door)	P10
Measuring instrument for line variables with PROFIBUS connection, installed in the cabinet door	P11
Measuring instrument for line variables with PROFINET connection, installed in the cabinet door	P13
Measuring instrument for line variables with PROFINET connection, installed in the cabinet door	P14
Leakage sensor in the converter cabinet	W48

Mechanical options

Component	Option
Base 100 mm high, RAL 9005	M06
Cable-marshaling compartment 200 mm high, RAL 7035	M07
Dust protection packaging	M16
IP23 degree of protection	M23
Side panel (right)	M26
Side panel (left)	M27
Degree of protection IP43	M43
Cable entry via MCT frame	M45
IP54 degree of protection	M54
Degree of protection IP55	M55
Comfort-grip handle with a 3 mm double-bit lock insert	M61
Comfort-grip handle with integrated pushbutton lock insert	M62
Comfort-grip handle for a padlock with pushbutton as lock insert	M63
Marine version	M66
EMC shield rail	M70
Quick-release couplings for water hoses	M72
DC busbar system	M80 ... M87
DC busbar system for line-side Cabinet Modules	M88
Crane transport assembly (top-mounted)	M90
Special paint finish for cabinet	Y09
Factory assembly into transport units	Y11

Other options

Component	Option
Generation of a material declaration Green Passport	B50
Individual certificate from the DNV	E51
Individual certificate from the American Bureau of Shipping (ABS)	E61
Individual certificate from the China Classification Society (CCS)	E71
Marking of all control cable conductor ends	M91
Rating plate data in English/French	T58
Rating plate data in English/Spanish	T60
Rating plate data in English/Italian	T80
Rating plate data in English/Russian	T85
Rating plate data in English/Chinese	T91
Single-line labeling strip for system identification, 40 x 80 mm	Y31
Two-line labeling strip for system identification, 40 x 180 mm	Y32
Four-line labeling strip for system identification, 40 x 180 mm	Y33

6.1.4 Technical data

Table 6- 8 Technical specifications for Basic Line Connection Modules, 3 AC 380 ... 480 V

Article No.	**6SL3735-**	**1TE37-4LA3**	**1TE41-2LA3**	**1TE41-7LA3**	
Rated power					
- for $I_{N\,DC}$ (50 Hz 400 V)	kW	360	600	830	
- for $I_{H\,DC}$ (50 Hz 400 V)	kW	280	450	650	
- for $I_{N\,DC}$ (60 Hz 460 V)	hp	555	925	1280	
- for $I_{H\,DC}$ (60 Hz 460 V)	hp	430	690	1000	
DC link current					
- Rated current $I_{N\,DC}$	A	740	1220	1730	
- Base-load current $I_{H\,DC}$ 1)	A	578	936	1350	
- Maximum current $I_{max\,DC}$	A	1110	1830	2595	
Input current					
- Rated current $I_{N\,E}$	A	610	1000	1420	
- Maximum current $I_{max\,E}$	A	915	1500	2130	
Supply voltages					
- Line voltage	V_{ACrms}	380 V 3 AC -10 % to 480 V 3 AC +10 % (-15 % < 1 min)			
- Line frequency	Hz	47 to 63 Hz			
- Electronics power supply	V_{DC}	24 (20.4 to 28.8)			
Current consumption (1 AC 230 V)	A	1.2	1.2	1.2	
Current consumption of the electronics (24 V DC)	A	0.8	0.8	0.8	
DC link capacitance					
- Basic Line Module	µF	12000	20300	26100	
- Drive line-up, max.	µF	96000	162400	208800	
Power loss, max., at 50 Hz 400 V 2)					
- <IP55:					
- dissipated to the coolant	kW	2.7	4.4	5.8	
- dissipated to the ambient air	kW	2.7	3.5	4.2	
- IP55:					
- dissipated to the coolant	kW	4.9	7.4	9.5	
- dissipated to the ambient air	kW	0.5	0.5	0.5	
Material of the integrated heat exchanger		Aluminum	Aluminum	Aluminum	
Rated flow rate					
- degree of protection <IP55	l/min	9	9	12	
- degree of protection IP55	l/min	36	36	39	
Pressure drop, typical at the rated flow rate 3)	Pa	150000	150000	150000	
Volume of liquid					
- degree of protection <IP55	dm^3	6.6	6.6	6.9	
- degree of protection IP55	dm^3	10.2	10.2	10.5	
Cooling air requirement (degree of protection <IP55)	m^3/s	0.272	0.272	0.272	
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	54	56	56	
Line connection L1, L2, L3		2/M12	10/M12	10/M12	
- conductor cross-section, max (IEC)	mm^2	4 x 240	8 x 240	8 x 240	
PE/GND connection		PE busbar			
- Busbar cross-section	mm^2	600			
- Conductor cross-section, max. (IEC)	mm^2	240			
Cable length, max. 4)					
- Shielded	m	2600	4000	4800	
- Unshielded	m	3900	6000	7200	
Degree of protection (standard version)		IP21	IP21	IP21	

Article No.	**6SL3735-**	**1TE37-4LA3**	**1TE41-2LA3**	**1TE41-7LA3**	
Dimensions (standard version) - Width - Height - Depth	 mm mm mm	 1000 2200 600	 1000 2200 600	 1000 2200 600	
Weight (standard version)	kg	688	838	995	
Frame size - Line Connection Module - Basic Line Module		 HL FBL	 JL FBL	 JL GBL	
Maximum short-circuit current I_{CC} acc. to IEC	kA	65	84	100	
Minimum short-circuit current [5]	kA	8.8	2	3.2	

[1] The base-load current $I_{H\ DC}$ is based on a duty cycle of 150 % for 60 s or $I_{max\ DC}$ for 5 s with a duty cycle duration of 300 s.

[2] The specified power loss represents the maximum value at 100 % utilization. The value in normal operation is lower.

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

[4] Total of all motor cables and DC link. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low Voltage Engineering Manual in the device documentation provided.

[5] Minimum current required for reliable tripping of the protective devices.

Table 6- 9 Technical specifications for Basic Line Connection Modules, 3 AC 500 ... 690 V

Article No.	**6SL3735-**	**1TG34-2LA3**	**1TG37-3LA3**	**1TG41-3LA3**	**1TG41-7LA3**
Rated power					
- for $I_{N\,DC}$ (50 Hz 690 V)	kW	355	630	1100	1370
- for $I_{H\,DC}$ (50 Hz 690 V)	kW	275	475	840	1070
- for $I_{N\,DC}$ (50 Hz 500 V)	kW	245	420	750	950
- for $I_{N\,DC}$ (50 Hz 500 V)	kW	200	345	610	775
- for $I_{N\,DC}$ (60 Hz 575 V)	hp	395	705	1230	1530
- for $I_{H\,DC}$ (60 Hz 575 V)	hp	305	530	940	1195
DC link current					
- Rated current $I_{N\,DC}$	A	420	730	1300	1650
- Base-load current $I_{H\,DC}$ [1]	A	328	570	1014	1287
- Maximum current $I_{max\,DC}$	A	630	1095	1950	2475
Input current					
- Rated current $I_{N\,E}$	A	340	600	1070	1350
- Maximum current $I_{max\,E}$	A	510	900	1605	2025
Supply voltages					
- Line voltage	V_{ACrms}	500 V 3 AC -10 % to 690 V 3 AC +10 % (-15 % < 1 min)			
- Line frequency	Hz	47 to 63 Hz			
- Electronics power supply	V_{DC}	24 (20.4 to 28.8)			
Current consumption (1 AC 230 V)	A	1.2	1.2	1.2	1.2
Current consumption of the electronics (24 V DC)	A	0.8	0.8	0.8	0.8
DC link capacitance					
- Basic Line Module	µF	4800	7700	15500	19300
- Drive line-up, max.	µF	38400	61600	124000	154400
Power loss, max., at 50 Hz 690 V [2]					
- <IP55:					
- dissipated to the coolant	kW	1.5	2.7	4.7	5.7
- dissipated to the ambient air	kW	2.3	2.7	3.3	5.1
- IP55:					
- dissipated to the coolant	kW	3.3	4.9	7.5	10.3
- dissipated to the ambient air	kW	0.5	0.5	0.5	0.5
Material of the integrated heat exchanger		Aluminum	Aluminum	Aluminum	Aluminum
Rated flow rate					
- degree of protection <IP55	l/min	9	9	12	12
- degree of protection IP55	l/min	36	36	39	39
Pressure drop, typical at the rated flow rate [3]	Pa	150000	150000	150000	150000
Volume of liquid					
- degree of protection <IP55	dm^3	6.6	6.6	6.9	6.9
- degree of protection IP55	dm^3	10.2	10.2	10.5	10.5
Cooling air requirement (degree of protection <IP55)	m^3/s	0.272	0.272	0.272	0.272
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	54	54	56	56
Line connection L1, L2, L3		2/M12	2/M12	10/M12	10/M12
- conductor cross-section, max (IEC)	mm^2	2 x 150	4 x 240	8 x 240	8 x 240
PE/GND connection		PE busbar			
- Busbar cross-section	mm^2	600			
- Conductor cross-section, max. (IEC)	mm^2	240			
Cable length, max. [4]					
- Shielded	m	1500	1500	2250	2250
- Unshielded	m	2250	2250	3375	3375
Degree of protection (standard version)		IP21	IP21	IP21	IP21

Article No.	**6SL3735-**	**1TG34-2LA3**	**1TG37-3LA3**	**1TG41-3LA3**	**1TG41-7LA3**
Dimensions (standard version) - Width - Height - Depth	 mm mm mm	 1000 2200 600	 1000 2200 600	 1000 2200 600	 1000 2200 600
Weight (standard version)	kg	578	668	995	1025
Frame size - Line Connection Module - Basic Line Module		 GL FBL	 HL FBL	 JL GBL	 JL GBL
Maximum short-circuit current I_{CC} acc. to IEC	kA	65	84	100	100
Minimum short-circuit current [5]	kA	4.4	7.2	2.5	3.2

1) The base-load current $I_{H\ DC}$ is based on a duty cycle of 150 % for 60 s or $I_{max\ DC}$ for 5 s with a duty cycle duration of 300 s.

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

3) This value applies to the water coolant option; for other coolant types, see Chapter "Coolant".

4) Total of all motor cables and DC link. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low Voltage Engineering Manual in the device documentation provided.

5) Minimum current required for reliable tripping of the protective devices.

6.2 Active Line Connection Modules

6.2.1 Description

Note

Additional information

Refer to the layout diagrams (AO) and circuit diagrams (SP) provided in the individual device documentation for the arrangement of components and interfaces and for the wiring.



Figure 6-5 Active Line Connection Module

Active Line Connection Modules can inject energy into the DC link and therefore feed regenerative energy into the line supply.

Active Line Connection Modules comprise a Line Connection Module, a liquid-cooled Active Interface Module and a liquid-cooled Active Line Module installed in a cabinet system.

Line Connection Modules contain the line-side infeed via main switch with fuse switch disconnector or circuit breaker and establish the connection between the plant-side supply system and the Active Line Modules. It is equipped as standard with a radio interference suppression filter according to IEC 61800-3 Category C3.

As standard, the Active Line Connection Module is positioned in the drive line-up so that the Motor Modules can be arranged to the right.
If Motor Modules are to be arranged to the left of the Active Line Connection Module then option M88 (DC busbar system for line-side Cabinet Modules) must be used.

Active Line Connection Modules generate a controlled DC voltage that is kept constant regardless of fluctuations in the line voltage (the line voltage must lie within the permissible tolerances).

In the factory setting, the DC voltage is controlled to 1.5 times the rms value of the rated line voltage.

Active Line Connection Modules draw a virtually sinusoidal current from the line supply and cause virtually no line harmonics.

Active Line Connection Modules are suitable for connection to supply systems grounded at the neutral point (TN, TT) and non-grounded (IT) supply systems. The following voltages and power ratings are available:

Line voltage	**Rated power**
3 AC 380 ... 480 V	380 ... 900 kW
3 AC 500 ... 690 V	800 ... 1700 kW

Depending on the input current, the following designs are used:

- ≤ 800 A: Main switch with fuse switch disconnector
- > 800 A: Circuit breaker, type 3WL, with option L25 as draw-out circuit breaker

The power rating can be increased by connecting Active Line Connection Modules in parallel.

Integration

Connection example, valid for article numbers 6SL3735-7TE36-1LA3, 6SL3735-7TE38-4LA3, 6SL3735-7TG37-4LA3, 6SL3735-7TG38-1LA3, 6SL3735-7TG41-0LA3, 6SL3735-7TG41-3LA3

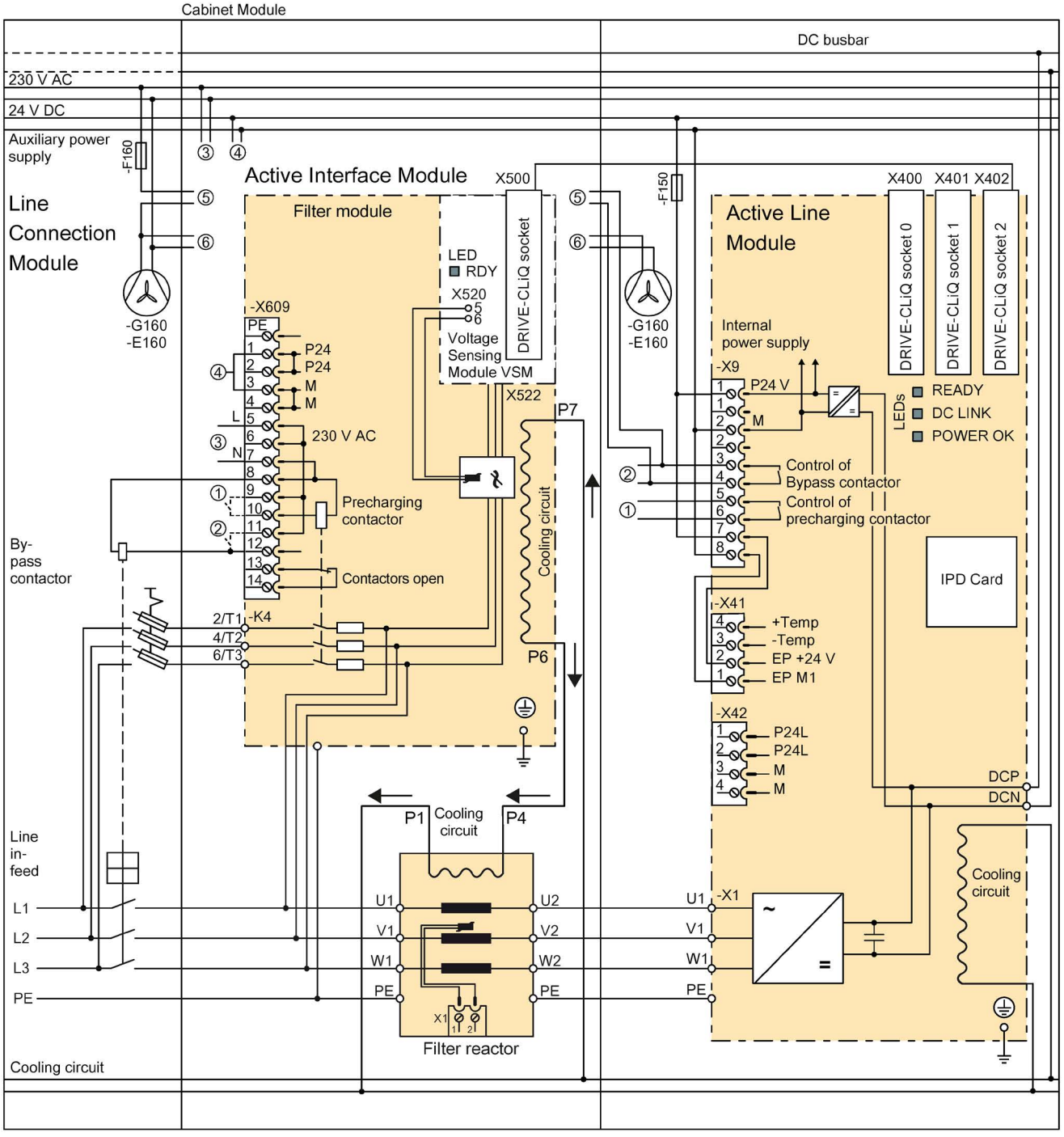


Figure 6-6 Connection example, Active Line Connection Module (frame sizes JIL/HXL, JIL/JXL), serial cooling circuit in the Active Interface Module

Connection example, valid for article numbers 6SL3735-7TE41-0LA3, 6SL3735-7TE41-4LA3, 6SL3735-7TG41-6LA3

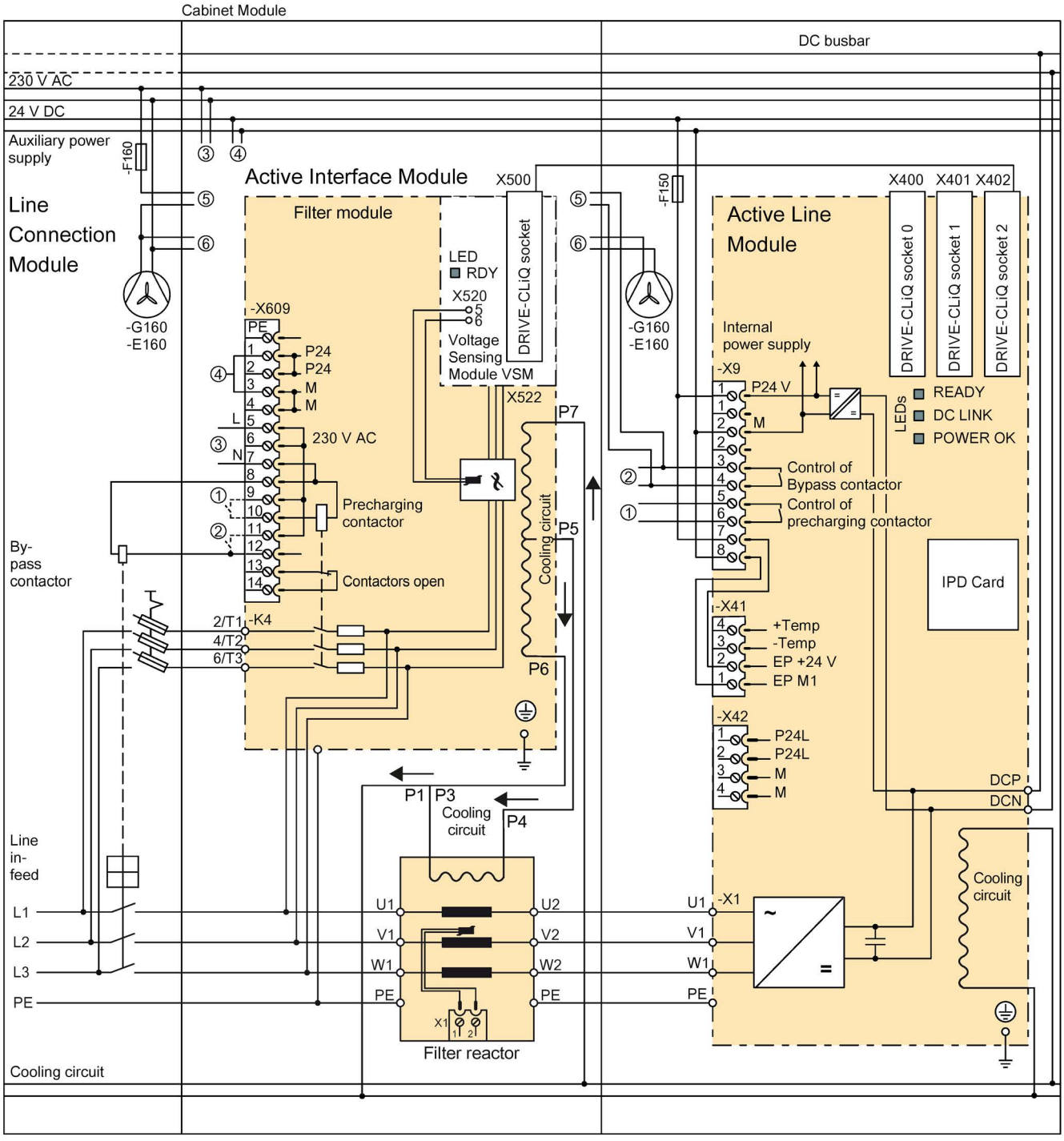


Figure 6-7 Connection example, Active Line Connection Module (frame sizes JIL/JXL), parallel cooling circuit in the Active Interface Module

Configuration

Active Line Connection Modules always include an Active Interface Module, which contains the associated Clean Power Filter and pre-charging circuit. The included line filter enables compliance with the EMC requirements for the "second environment".

Note

Additional information

The configuration examples of the individual Active Line Connection Modules illustrate the arrangement of the factory-fitted components. They show the maximum possible configuration of the modules, which contain all options that can be ordered.

Refer to the layout diagrams (AO) provided in the individual device documentation for the precise order-specific location of the components.

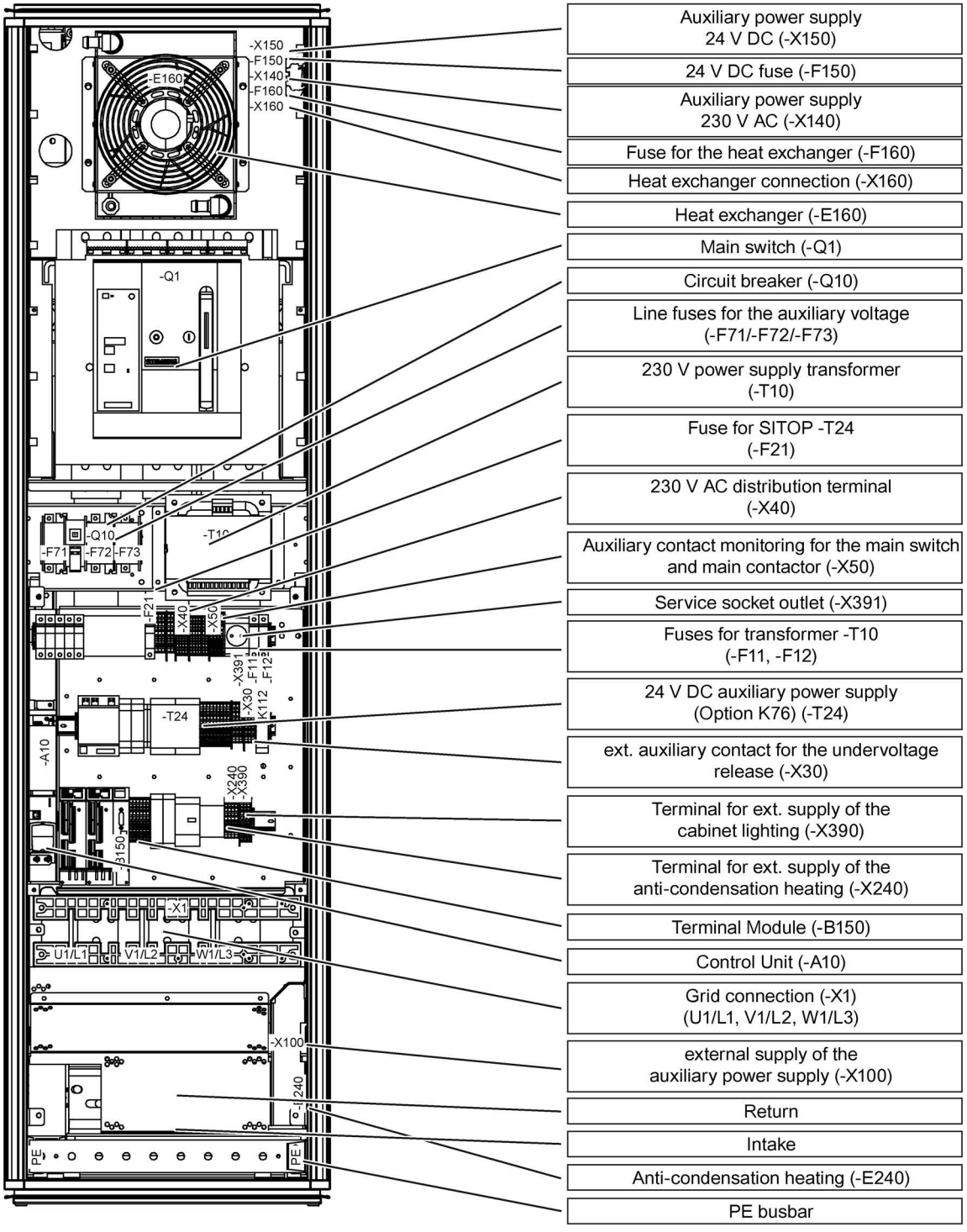


Figure 6-8 Line Connection Module configuration example (frame size JL) (IP55)

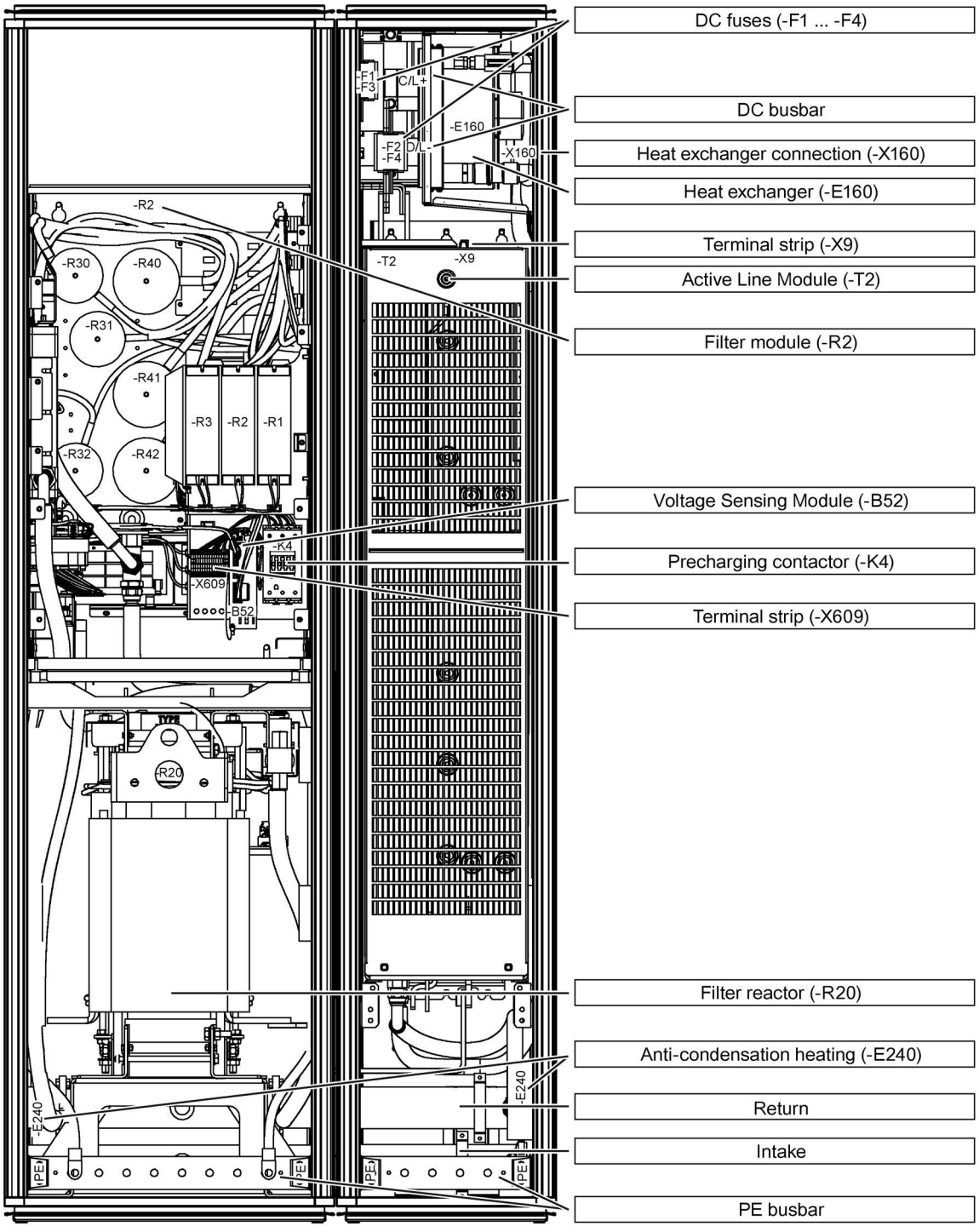


Figure 6-9 Active Interface Module configuration example (frame size JIL) and Active Line Module (frame size JXL) (IP55)

Parallel connection of Active Line Connection Modules to increase the power rating

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

- Up to 4 identical Active Line Connection Modules can be connected in parallel.
- Option M88 (DC busbar system for the line-side Cabinet Modules) must be installed so that the infeed can be realized at the common DC link.
- A common Control Unit is required whenever the modules are connected in parallel.
- The parallel connection must be supplied from a common infeed point (i.e. different supply systems are not permitted); see also SINAMICS Low Voltage Engineering Manual.
- A derating factor of 5% must be taken into consideration, regardless of the number of modules connected in parallel.
- The main contactors or circuit breakers of the respective Line Connection Modules must close together and simultaneously.
  The monitoring is realized via terminals -X50 of the particular Line Connection Module.

Note

It is not possible to connect different power units in parallel

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

6.2.1.1 Fused switch disconnector (input current ≤ 700 A)

Up to 700 A, a switch disconnector with integrated fuses and a main contactor are installed. The contactor is controlled internally.

X50 feedback signal contact "Fuse switch disconnector" and "Main contactor"

Table 6- 10 Terminal block X50 feedback signal contact "Fuse switch disconnector" and "Main contactor"

Terminal	Designation [1]	Technical data
1	NO	"Fuse switch disconnector" checkback contacts Max. load current: 3 A max. Switching voltage: 250 VAC
2	NC	
3	COM	
4	NO	"Main contactor" feedback signal contacts Max. load current: 10 A Max. Switching voltage: 250 V AC Max. contact rating: 250 VA Required minimum load: ≥1 mA
5	NC	
6	COM	
Max. connectable cross-section: 2.5 mm²		

[1] NC: normally-closed contact, NO: normally-open contact, COM: Center contact

6.2.1.2 Circuit breaker (input current > 700 A)

For currents greater than 700 A, the circuit breaker, which is located in the center of the cabinet, takes on the function of isolating the system from the supply and providing overload and short-circuit protection. The circuit breaker is internally activated and has its own internal power supply.

As a consequence, the device is sufficiently protected using the factory setting.

The circuit breaker is set as follows in the factory:

Table 6- 11 Factory setting of the circuit breaker for the Active Line Connection Module

Article number Active Line Connection Module	Input current	Overload trip (L)	Short-time delayed short-circuit release (S)	Short-circuit release delay (t_{sd})
6SL3735-7TE38-4LA3	840 A	0.9	2	0
6SL3735-7TE41-0LA3	985 A	0.8	2	0
6SL3735-7TE41-4LA3	1405 A	0.9	2	0
6SL3735-7TG37-4LA3	735 A	0.9	2	0
6SL3735-7TG38-1LA3	810 A	0.9	2	0
6SL3735-7TG41-0LA3	1025 A	0.9	2	0
6SL3735-7TG41-3LA3	1270 A	0.8	2	0
6SL3735-7TG41-6LA3	1560 A	1.0	2	0

⚠WARNING

Incorrect circuit breaker setting

Incorrect settings can cause unwanted or delayed tripping of the circuit breaker and result in damage to the cabinet unit and can therefore result in death or severe injury.

- Check the settings described above, and if required, adapt the circuit breaker settings corresponding to the factory setting.

Note

Additional information

Detailed and comprehensive instructions and information for the circuit breaker as well as standard and additional options are given in the associated operating instructions, which are included in the device documentation provided.

X50 "circuit breaker" checkback contact

Table 6- 12 Terminal block X50 "Circuit breaker" feedback signal contact

Terminal	Designation [1]	Technical data
1	NO	"Circuit breaker" checkback contacts Max. load current: 3 A Max. switching voltage: 250 V AC
2	NC	
3	COM	
Max. connectable cross-section: 2.5 mm²		

[1] NC: Normally closed contact, NO: Normally open contact, COM: Center contact

X30 looping in an external EMERGENCY OFF

Terminal block -X30 provides you with the option of connecting an external EMERGENCY OFF (normally closed contact) for switching off the circuit breaker.

Table 6- 13 Terminal block X30 "External EMERGENCY OFF" checkback contact

Terminal	Technical data
1	Factory-installed jumper between terminal 1 and terminal 2; this jumper must be removed if a normally closed contact is looped in externally.
2	
Max. connectable cross-section: 2.5 mm²	

6.2.2 Interface description

6.2.2.1 General information

This chapter describes only those interfaces in the cabinet unit that require additional connection work by the customer. All other interfaces are pre-wired at the factory and are not designed for customer connections.

Note

Additional information

All connections to be established on the plant side as well as the interfaces for integration into the plant control system are described in the circuit and terminal diagrams, included in the individual device documentation.

6.2.2.2 Control Interface Module

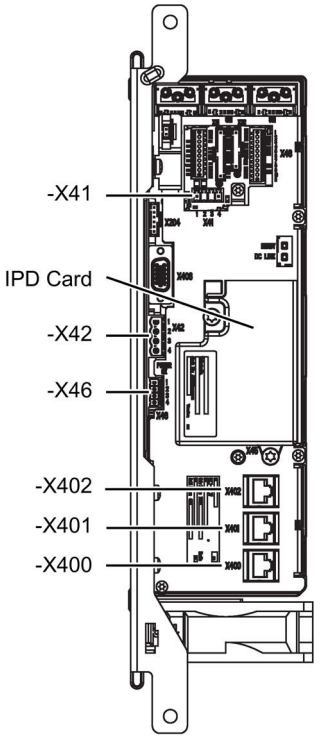
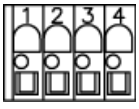


Figure 6-10 Control Interface Module

6.2.2.3 X41 EP terminal / temperature sensor connection

Table 6- 14 Terminal strip X41 EP terminals / temperature sensor connection

Connector	Terminal	Function	Technical data
	1	EP M1 (Enable Pulses)	Supply voltage: 24 VDC (20.4 ... 28.8 V) Current consumption: 10 mA
	2	EP +24 V (Enable Pulses)	
	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.

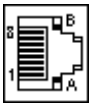
Note

Connection to terminals 1 and 2

24 VDC must be present at terminal 2 and ground at terminal 1 for operation. Pulse suppression is activated when removed.

6.2.2.4 DRIVE-CLiQ interfaces X400, X401, X402

Table 6- 15 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			

6.2.2.5 Terminal block -X40 external 230 V AC auxiliary infeed

Terminal block -X40 provides you with the option of connecting an external auxiliary infeed (such as an uninterruptible power supply) that is independent of the main infeed. The connection may be protected with up to a 16 A fuse.

Table 6- 16 Terminal block X40 external 230 VAC auxiliary infeed

Terminal	Designation	Technical data
1	L1	Factory-installed jumper to terminal 2; this jumper must be removed if an external infeed is used.
2	L1	Connection of external 230 VAC auxiliary infeed: L1
5	N	Factory-installed jumper to terminal 6; this jumper must be removed if an external infeed is used.
6	N	Connection of external 230 VAC auxiliary infeed: N
Max. connectable cross-section: 2.5 mm²		

6.2.3 Options

Note

Additional information

The individual options are described in Chapter "Options".

Electrical options

Component	Option
CBC10 Communication Board	G20
CBE20 Communication Board	G33
1 temperature sensor module TM150	G51
2 temperature sensor modules TM150	G52
3 temperature sensor modules TM150	G53
4 temperature sensor modules TM150	G54
TM31 Terminal Module	G60
Additional TM31 Terminal Module	G61
TB30 Terminal Board	G62
AOP30 operator panel	K08
Auxiliary power generation in the Line Connection Module	K76
Control Unit CU320-2 DP (PROFIBUS)	K90
Performance extension for CU320-2	K94
Control Unit CU320-2 PN (PROFINET)	K95
Main contactor (for Active Line Connection Modules ≤700 A)	L13
Surge suppression	L21
Draw-out circuit breaker (for Active Line Connection Modules >700 A)	L25
Line filter monitoring	L40
Current transformer upstream of the main switch	L41
EMERGENCY OFF pushbutton installed in the cabinet door	L45
Cabinet lighting with service socket	L50
Cabinet anti-condensation heating	L55
Insulation monitoring	L87
DC link fuses	N52
Measuring instrument for line variables (installed in the cabinet door)	P10
Measuring instrument for line variables with PROFIBUS connection, installed in the cabinet door	P11
Measuring instrument for line variables with PROFINET connection, installed in the cabinet door	P13
Measuring instrument for line variables with PROFINET connection, installed in the cabinet door	P14

Mechanical options

Component	Option
Base 100 mm high, RAL 9005	M06
Cable-marshaling compartment 200 mm high, RAL 7035	M07
Dust protection packaging	M16
IP23 degree of protection	M23
Side panel (right)	M26
Side panel (left)	M27
Degree of protection IP43	M43
Cable entry via MCT frame	M45
IP54 degree of protection	M54
Degree of protection IP55	M55
Comfort-grip handle with a 3 mm double-bit lock insert	M61
Comfort-grip handle with integrated pushbutton lock insert	M62
Comfort-grip handle for a padlock with pushbutton as lock insert	M63
Marine version	M66
EMC shield rail	M70
Quick-release couplings for water hoses	M72
DC busbar system	M80 ... M87
DC busbar system for line-side Cabinet Modules	M88
Crane transport assembly (top-mounted)	M90
Special paint finish for cabinet	Y09
Factory assembly into transport units	Y11

Other options

Component	Option
Generation of a material declaration Green Passport	B50
Individual certificate from the DNV	E51
Individual certificate from the American Bureau of Shipping (ABS)	E61
Individual certificate from the China Classification Society (CCS)	E71
Marking of all control cable conductor ends	M91
Rating plate data in English/French	T58
Rating plate data in English/Spanish	T60
Rating plate data in English/Italian	T80
Rating plate data in English/Russian	T85
Rating plate data in English/Chinese	T91
Single-line labeling strip for system identification, 40 x 80 mm	Y31
Two-line labeling strip for system identification, 40 x 180 mm	Y32
Four-line labeling strip for system identification, 40 x 180 mm	Y33

6.2.4 Technical data

Table 6- 17 Technical specifications for Active Line Connection Modules, 3 AC 380 V ... 480 V

Article No.	6SL3735-	7TE36-1LA3	7TE38-4LA3	7TE41-0LA3	7TE41-4LA3
Rated power					
- for $I_{N\,DC}$ (50 Hz 400 V)	kW	380	500	630	900
- for $I_{H\,DC}$ (50 Hz 400 V)	kW	335	465	545	780
- for $I_{N\,DC}$ (60 Hz 460 V)	hp	600	700	900	1250
- for $I_{H\,DC}$ (60 Hz 460 V)	hp	500	700	800	1000
DC link current					
- Rated current $I_{N\,DC}$	A	677	941	1100	1573
- Base-load current $I_{H\,DC}$ 1)	A	603	837	982	1401
- Maximum current $I_{max\,DC}$	A	1017	1410	1654	2361
Input/regenerative feedback current					
- rated current $I_{N\,E}$	A	605	840	985	1405
- maximum current $I_{max\,E}$	A	907	1260	1477	2055
Supply voltages					
- Line voltage	V_{ACrms}	3 AC 380 -10 % ... 3 AC 480 +10 % (-15 % < 1 min)			
- Line frequency	Hz	47 ... 63 Hz			
- Electronics power supply	V_{DC}	24 (20.4 ... 28.8)			
- DC link voltage	V_{DC}	1.5 x U_{line}			
Current consumption (1 AC 230 V)	A	1.2	1.2	1.2	1.2
Current consumption of the electronics (24 V DC)	A	1.77	1.77	1.7	1.7
DC link capacitance					
- Active Line Module	µF	12600	17400	18900	28800
- Drive line-up, max.	µF	134400	134400	230400	230400
Power loss, max., at 50 Hz 400 V 2)					
- <IP55:					
- dissipated to the coolant	kW	10.9	11.7	19.6	21.8
- dissipated to the ambient air	kW	2.4	2.3	3.1	3.8
- IP55:					
- dissipated to the coolant	kW	12.2	13.1	21.8	24.7
- dissipated to the ambient air	kW	0.9	0.9	0.9	0.9
Material of the integrated heat exchanger					
- Active Line Module		Aluminum	Aluminum	Aluminum	Aluminum
- Active Interface Module		Aluminum	Aluminum	Aluminum	Aluminum
Rated flow rate					
- degree of protection <IP55	l/min	26	26	43	43
- degree of protection IP55	l/min	53	53	70	70
Pressure drop, typical at the rated flow rate 3)	Pa	150000	150000	150000	150000
Volume of liquid					
- degree of protection <IP55	dm^3	13	13	14	14
- degree of protection IP55	dm^3	16.6	16.6	17.6	17.6
Cooling air requirement (degree of protection <IP55)	m^3/s	0.272	0.272	0.272	0.272
Sound pressure level L_{pA} (1 m) at 50/60 Hz 4)	dB(A)	65/65	65/65	65/65	65/65
Line connection L1, L2, L3		4/M12	10/M12	10/M12	10/M12
- conductor cross-section, max (IEC)	mm^2	4 x 240	4 x 240	8 x 240	8 x 240
PE/GND connection		PE busbar			
- Busbar cross-section	mm^2	600			
- Conductor cross-section, max. (IEC)	mm^2	240			

Article No.	**6SL3735-**	**7TE36-1LA3**	**7TE38-4LA3**	**7TE41-0LA3**	**7TE41-4LA3**
Cable length, max. [5]					
- Shielded	m	3900	3900	3900	3900
- Unshielded	m	5850	5850	5850	5850
Degree of protection (standard version)		IP21	IP21	IP21	IP21
Dimensions (standard version)					
- Width	mm	1600	1600	1600	1600
- Height	mm	2200	2200	2200	2200
- Depth	mm	600	600	600	600
Weight (standard version)	kg	1134	1244	1430	1470
Frame size					
- Line Connection Module		HL	JL	JL	JL
- Active Interface Module		JIL	JIL	JIL	JIL
- Active Line Module		HXL	HXL	JXL	JXL
Maximum short-circuit current I_{CC} acc. to IEC	kA	65	84	84	100
Minimum short-circuit current [6]	kA	9.2	2	2	3.2

[1] The base-load current $I_{H\,DC}$ is based on a duty cycle of 150 % for 60 s or $I_{max\,DC}$ for 5 s with a duty cycle duration of 300 s.

[2] The specified power loss represents the maximum value at 100 % utilization. The value in normal operation is lower.

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

[4] Total sound pressure level of Active Interface Module and Active Line Module.

[5] Total of all motor cables and DC link. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low Voltage Engineering Manual in the device documentation provided.

[6] Minimum current required for reliable tripping of the protective devices.

Table 6- 18 Technical specifications for Active Line Connection Modules, 3 AC 500 V ... 690 V, Part 1

Article No.	**6SL3735-**	**7TG37-4LA3**	**7TG38-1LA3**	**7TG41-0LA3**	**7TG41-3LA3**
Rated power					
- At $I_{N\,DC}$ (50 Hz 690 V)	kW	800	900	1100	1400
- At $I_{H\,DC}$ (50 Hz 690 V)	kW	705	670	1000	1215
- At $I_{N\,DC}$ (50 Hz 500 V)	kW	560	620	780	965
- At $I_{H\,DC}$ (50 Hz 500 V)	kW	510	485	710	880
- At $I_{N\,DC}$ (60 Hz 575 V)	hp	900	975	1250	1500
- At $I_{H\,DC}$ (60 Hz 575 V)	hp	600	765	1000	1250
DC link current					
- Rated current $I_{N\,DC}$	A	823	907	1147	1422
- Base-load current $I_{H\,DC}$ [1]	A	732	808	936	1266
- Maximum current $I_{max\,DC}$	A	1235	1360	1722	2133
Input/regenerative feedback current					
- rated current $I_{N\,E}$	A	735	810	1025	1270
- maximum current $I_{max\,E}$	A	1100	1214	1537	1905
Supply voltages					
- Line voltage	V_{ACrms}	3 AC 500 -10 % ... 3 AC 690 +10 % (-15 % < 1 min)			
- Line frequency	Hz	47 ... 63 Hz			
- Electronics power supply	V_{DC}	24 (20.4 ... 28.8)			
- DC link voltage	V_{DC}	1.5 x U_{line}			
Current consumption (1 AC 230 V)	A	1.2	1.2	1.2	1.2
Current consumption of the electronics (24 V DC)	A	1.7	1.7	1.7	1.7
DC link capacitance					
- Active Line Module	µF	10500	10500	16000	19330
- Drive line-up, max.	µF	153600	153600	153600	153600
Power loss, max., at 50 Hz 690 V [2]					
- <IP55:					
- dissipated to the coolant	kW	17.0	19.5	21.67	27.3
- dissipated to the ambient air	kW	2.4	2.4	3.1	3.7
- IP55:					
- dissipated to the coolant	kW	18.4	20.9	23.7	30.1
- dissipated to the ambient air	kW	0.9	0.9	0.9	0.9
Material of the integrated heat exchanger					
- Active Line Module		Aluminum	Aluminum	Aluminum	Aluminum
- Active Interface Module		Aluminum	Aluminum	Aluminum	Aluminum
Rated flow rate					
- degree of protection <IP55	l/min	26	26	37	37
- degree of protection IP55	l/min	53	53	64	64
Pressure drop, typical at the rated flow rate [3]	Pa	150000	150000	150000	150000
Volume of liquid					
- degree of protection <IP55	dm^3	13	14	14	14
- degree of protection IP55	dm^3	16.6	17.6	17.6	17.6
Cooling air requirement (degree of protection <IP55)	m^3/s	0.272	0.272	0.272	0.272
Sound pressure level L_{pA} (1 m) at 50/60 Hz [4]	dB(A)	65/65	65/65	65/65	65/65
Line connection L1, L2, L3		4/M12	10/M12	10/M12	10/M12
- conductor cross-section, max (IEC)	mm^2	8 x 240	8 x 240	8 x 240	8 x 240
PE/GND connection		PE busbar			
- Busbar cross-section	mm^2	600			
- Conductor cross-section, max. (IEC)	mm^2	240			
Cable length, max. [5]					
- Shielded	m	2250	2250	2250	2250
- Unshielded	m	3375	3375	3375	3375

Article No.	**6SL3735-**	**7TG37-4LA3**	**7TG38-1LA3**	**7TG41-0LA3**	**7TG41-3LA3**
Degree of protection (standard version)		IP21	IP21	IP21	IP21
Dimensions (standard version) - Width - Height - Depth	 mm mm mm	 1600 2200 600	 1600 2200 600	 1600 2200 600	 1600 2200 600
Weight (standard version)	kg	1150	1365	1520	1540
Frame size - Line Connection Module - Active Interface Module - Active Line Module		 HL JIL HXL	 JL JIL HXL	 JL JIL JXL	 JL JIL JXL
Maximum short-circuit current I_{CC} acc. to IEC	kA	84	100	100	100
Minimum short-circuit current [6]	kA	10.5	2	2	3.2

[1] The base-load current $I_{H\ DC}$ is based on a duty cycle of 150 % for 60 s or $I_{max\ DC}$ for 5 s with a duty cycle duration of 300 s.

[2] The specified power loss represents the maximum value at 100 % utilization. The value in normal operation is lower.

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

[4] Total sound pressure level of Active Interface Module and Active Line Module.

[5] Total of all motor cables and DC link. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low Voltage Engineering Manual in the device documentation provided.

[6] Minimum current required for reliable tripping of the protective devices.

Table 6- 19 Technical specifications for Active Line Connection Modules, 3 AC 500 V ... 690 V, Part 2

Article No.	**6SL3735-**	**7TG41-6LA3**			
Rated power					
- At $I_{N\,DC}$ (50 Hz 690 V)	kW	1700			
- At $I_{H\,DC}$ (50 Hz 690 V)	kW	1490			
- At $I_{N\,DC}$ (50 Hz 500 V)	kW	1180			
- At $I_{H\,DC}$ (50 Hz 500 V)	kW	1080			
- At $I_{N\,DC}$ (60 Hz 575 V)	hp	1855			
- At $I_{H\,DC}$ (60 Hz 575 V)	hp	1530			
DC link current					
- Rated current $I_{N\,DC}$	A	1740			
- Base-load current $I_{H\,DC}$ [1)]	A	1550			
- Maximum current $I_{max\,DC}$	A	2620			
Input/regenerative feedback current					
- rated current $I_{N\,E}$	A	1560			
- maximum current $I_{max\,E}$	A	2055			
Supply voltages					
- Line voltage	V_{ACrms}	3 AC 500 -10 % ... 3 AC 690 +10 % (-15 % < 1 min)			
- Line frequency	Hz	47 ... 63 Hz			
- Electronics power supply	V_{DC}	24 (20.4 ... 28.8)			
- DC link voltage	V_{DC}	1.5 x U_{line}			
Current consumption (1 AC 230 V)	A	1.2			
Current consumption of the electronics (24 V DC)	A	1.67			
DC link capacitance					
- Active Line Module	µF	21000			
- Drive line-up, max.	µF	210000			
Power loss, max., at 50 Hz 690 V [2)]					
- <IP55:					
- dissipated to the coolant	kW	37.7			
- dissipated to the ambient air	kW	4.4			
- IP55:					
- dissipated to the coolant	kW	39.2			
- dissipated to the ambient air	kW	0.9			
Material of the integrated heat exchanger					
- Active Line Module		Aluminum			
- Active Interface Module		Aluminum			
Rated flow rate					
- degree of protection <IP55	l/min	43			
- degree of protection IP55	l/min	70			
Pressure drop, typical at the rated flow rate [3)]	Pa	150000			
Volume of liquid					
- degree of protection <IP55	dm^3	14			
- degree of protection IP55	dm^3	17.6			
Cooling air requirement (degree of protection <IP55)	m^3/s	0.272			
Sound pressure level L_{pA} (1 m) at 50/60 Hz [4)]	dB(A)	65/65			
Line connection L1, L2, L3		10/M12			
- conductor cross-section, max (IEC)	mm^2	8 x 240			
PE/GND connection		PE busbar			
- Busbar cross-section	mm^2	600			
- Conductor cross-section, max. (IEC)	mm^2	240			
Cable length, max. [5)]					
- Shielded	m	2250			
- Unshielded	m	3375			

Article No.	**6SL3735-**	**7TG41-6LA3**			
Degree of protection (standard version)		IP21			
Dimensions (standard version) - Width - Height - Depth	 mm mm mm	 1600 2200 600			
Weight (standard version)	kg	1640			
Frame size - Line Connection Module - Active Interface Module - Active Line Module		 JL JIL JXL			
Maximum short-circuit current I_{CC} acc. to IEC	kA	100			
Minimum short-circuit current [6]	kA	3.2			

1) The base-load current $I_{H\ DC}$ is based on a duty cycle of 150 % for 60 s or $I_{max\ DC}$ for 5 s with a duty cycle duration of 300 s.

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

3) This value applies to the water coolant option; for other coolant types, see Chapter "Coolant".

4) Total sound pressure level of Active Interface Module and Active Line Module.

5) Total of all motor cables and DC link. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low Voltage Engineering Manual in the device documentation provided.

6) Minimum current required for reliable tripping of the protective devices.

6.3 Active Line Connection Modules compact

6.3.1 Description

Note

Additional information

Refer to the layout diagrams (AO) and circuit diagrams (SP) provided in the individual device documentation for the arrangement of components and interfaces and for the wiring.



Figure 6-11 Active Line Connection Module compact

Active Line Connection Modules compact can inject energy into the DC link and feed regenerative energy into the line supply.

Active Line Connection Modules compact comprise a liquid-cooled Active Interface Module and a liquid-cooled Active Line Module installed in two control cabinets with a total width of 1200 mm. These are not equipped with a circuit breaker.

Note

On the line side infeed

The line-side infeed via the main switch with fuse switch disconnector or circuit breaker must be implemented on the plant side.

As standard, the Active Line Connection Module compact is positioned in the drive line-up so that Motor Modules can be arranged to the right or the left.

Active Line Connection Modules compact generate a controlled DC voltage that is kept constant regardless of line voltage fluctuations (the line voltage must remain within the permissible tolerances).

In the factory setting, the DC voltage is controlled to 1.5 times the rms value of the rated line voltage.

Active Line Connection Modules draw an almost sinusoidal current from the line supply and cause virtually no line harmonics.

Active Line Connection Modules compact can be connected to line supplies grounded at the neutral point (TN, TT) and non-grounded (IT) line supplies. The following voltages and power ratings are available:

Line voltage	Rated power
3 AC 380 ... 480 V	380 ... 900 kW
3 AC 500 ... 690 V	800 ... 1700 kW

The power rating can be increased by connecting Active Line Connection Modules compact in parallel.

Note

Complying with EMC limit values

To comply with EMC limit values according to IEC 61800-3, the connection to the line infeed should be established through the shortest possible distance.

Carefully observe the applicable regulations to comply with EMC limit values for classification in accordance with a specified marine approval.

Integration

Connection example, valid for Article numbers 6SL3735-7TE36-1MA3, 6SL3735-7TE38-4MA3, 6SL3735-7TG37-4MA3, 6SL3735-7TG38-1MA3, 6SL3735-7TG41-0MA3, 6SL3735-7TG41-3MA3, 6SL3735-7TG41-3MA4

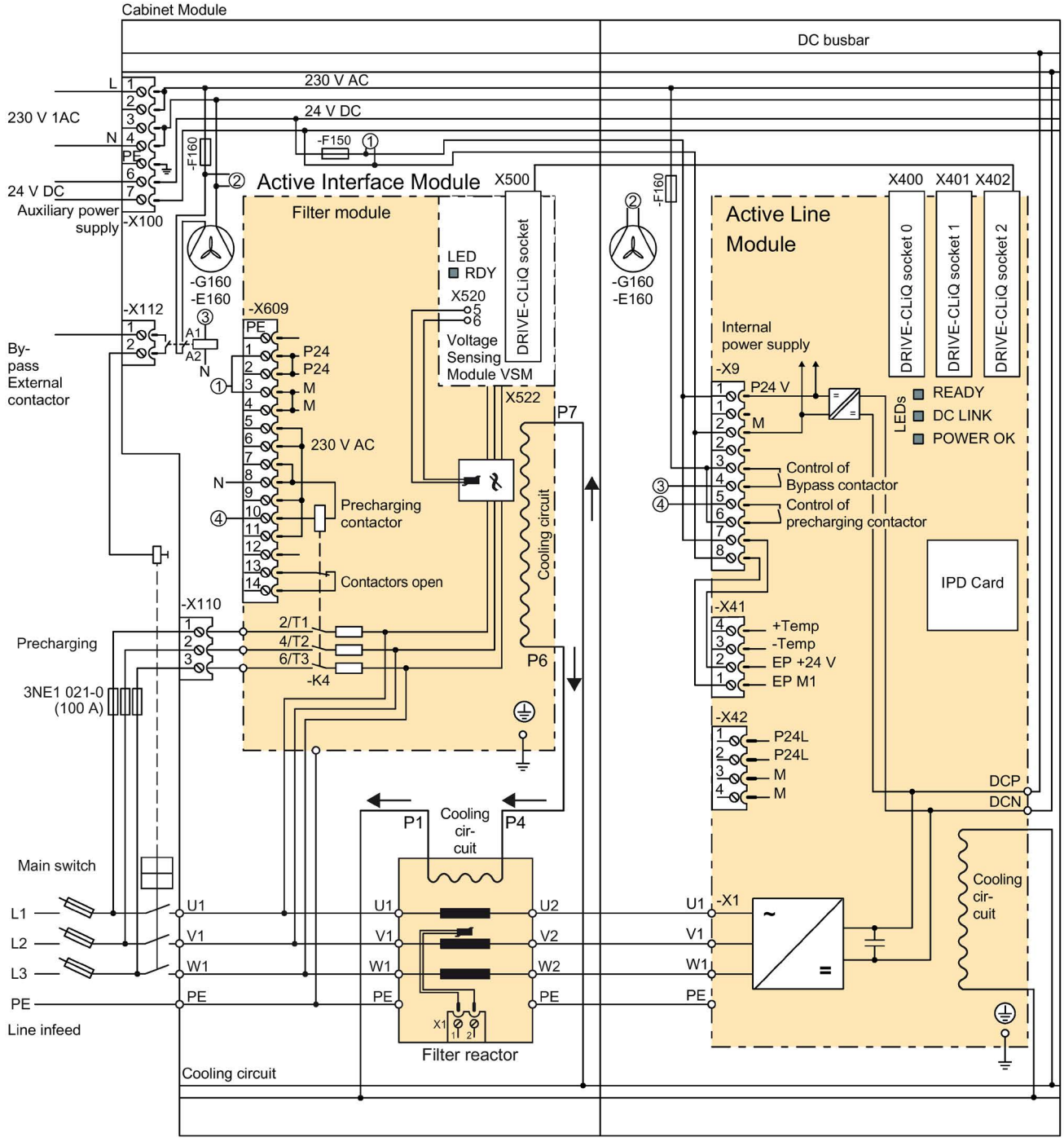


Figure 6-12 Connection example, Active Line Connection Module compact (frame sizes JIL/HXL, JIL/JXL), series cooling circuit in the Active Interface Module

Connection example, valid for article numbers 6SL3735-7TE41-0MA3, 6SL3735-7TE41-4MA3, 6SL3735-7TG41-6MA3, 6SL3735-7TG41-6MA4

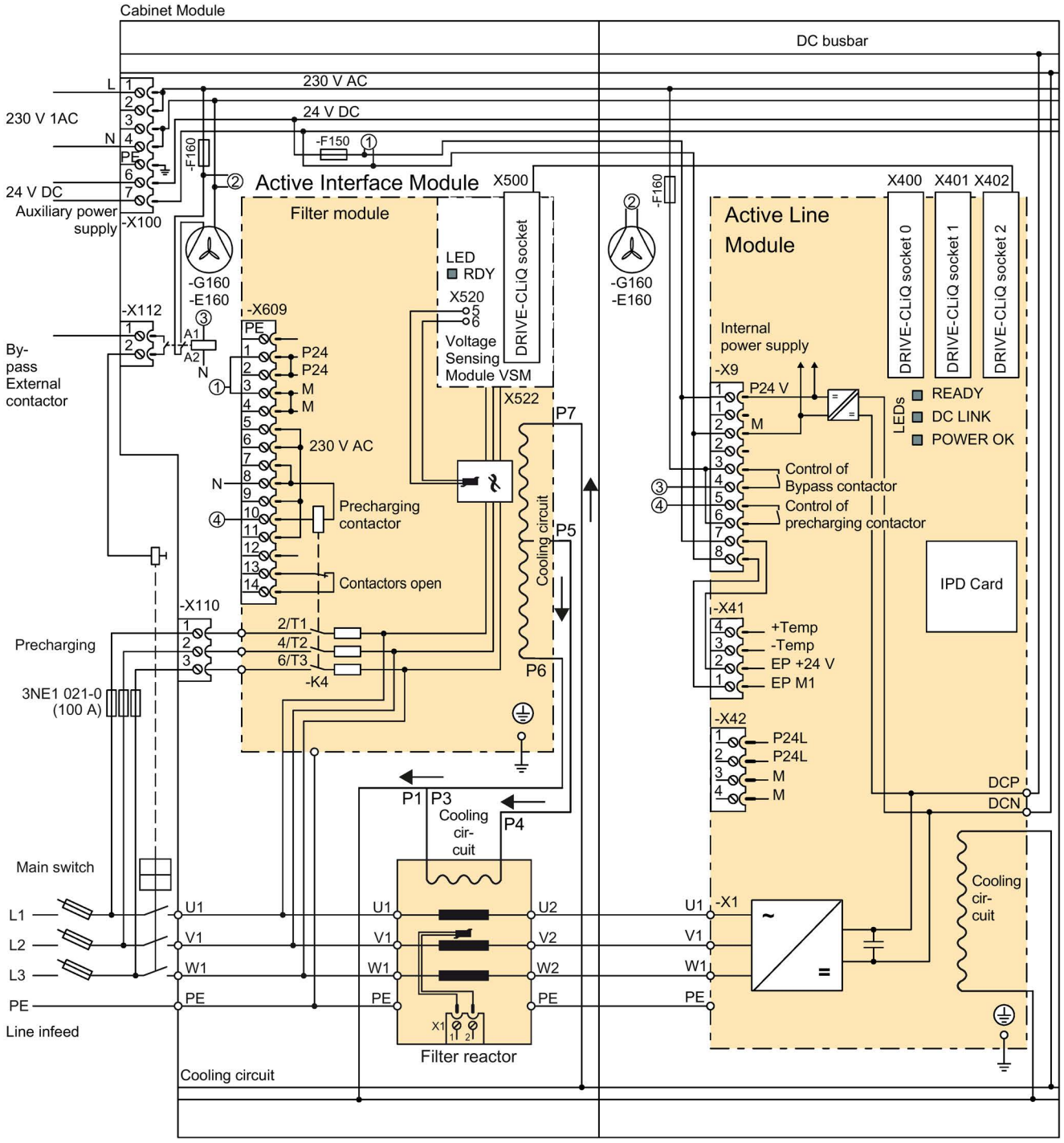


Figure 6-13 Connection example, Active Line Connection Module compact (frame sizes JIL/JXL), parallel cooling circuit in the Active Interface Module

Configuration

Active Line Connection Modules compact always include an Active Interface Module, which contains the associated Clean Power Filter and pre-charging circuit. The included line filter enables compliance with the EMC requirements for the "second environment".

Note

Additional information

The configuration examples of the individual Active Line Connection Modules compact are used to illustrate the location of the factory-fitted components. They show the maximum possible configuration of the modules, which contain all options that can be ordered.

The devices with article numbers 6SL3735-7TG41-3MA4 and 6SL3735-7TG41-6MA4 have the shaft generator drive function (SGD), additional notes are provided in Grid Infeed System Manual (https://support.industry.siemens.com/cs/ww/en/view/109782591).

Refer to the layout diagrams (AO) provided in the individual device documentation for the precise order-specific location of the components.

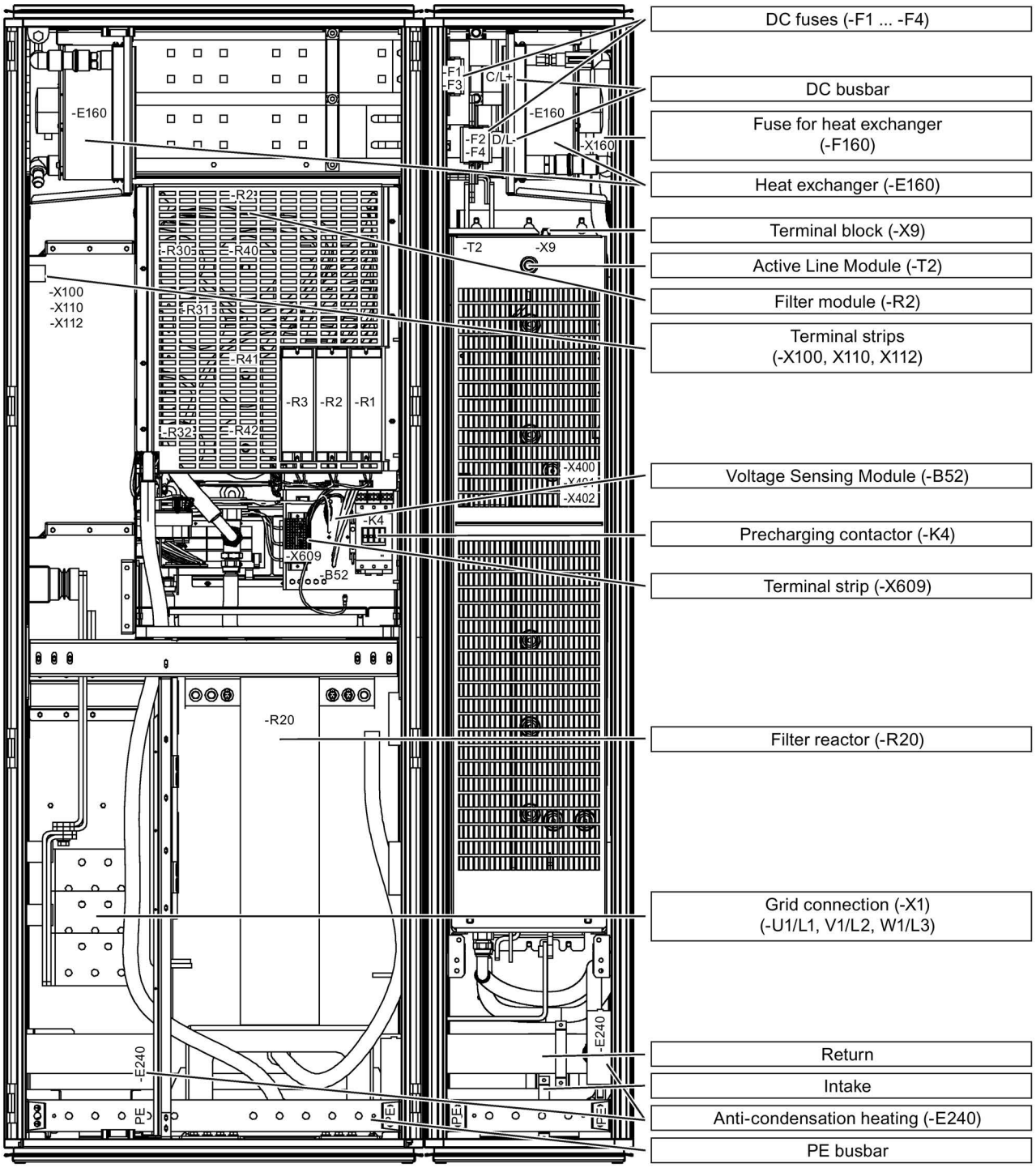


Figure 6-14 Configuration example for Active Line Module compact (IP55)

Active Line Connection Modules compact connected in parallel to increase the power rating

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

- Up to 4 identical Active Line Connection Modules compact can be connected in parallel.
- A common Control Unit is required whenever the modules are connected in parallel.
- The parallel connection must be supplied from a common infeed point (i.e. different supply systems are not permitted); see also SINAMICS Low Voltage Engineering Manual.
- A derating factor of 5% must be taken into consideration, regardless of the number of modules connected in parallel.
- The main contactors or circuit breakers of the respective line infeeds must close together and at the same time.
  The monitoring that these components close simultaneously must be realized on the plant/system side.

Note

It is not possible to connect different power units in parallel

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

6.3.2 Interface description

6.3.2.1 General information

This chapter describes only those interfaces in the cabinet unit that require additional connection work by the customer. All other interfaces are pre-wired at the factory and are not designed for customer connections.

Note

Additional information

All connections to be established on the plant side as well as the interfaces for integration into the plant control system are described in the circuit and terminal diagrams, included in the individual device documentation.

6.3.2.2 X100

Table 6- 20 X100, terminal block in the Active Line Connection Module compact to connect the auxiliary voltages

Terminal	Function	Technical data
1	L1	External 1 AC 230 V supply (max. 265 V AC) Current consumption: Max. 16 A
2		
3	N	
4		
PE	PE connection	
6	P24	24 V DC for the electronics power supply (max. 30 V DC) Protective extra-low voltage PELV/SELV Current consumption: Max. 20 A
7	M	
Max. connectable cross-section: 2.5 mm²		

Note

External infeed

An external customer infeed for the auxiliary power supply system can be connected at terminal block -X100 of the Active Line Connection Module compact.



⚠WARNING

Electric shock when connecting to an unsuitable power supply

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

- When connecting to -X100/6,7 terminals, only use power supplies that provide SELV (Safety Extra Low Voltage) or PELV (Protective Extra Low Voltage) output voltages.

6.3.2.3 X110

Table 6- 21 Terminal strip X110, pre-charging connection

Terminal	Function	Technical data
1	2/T1	Connection of the pre-charging of the Active Line Connection Modules compact Connection to the precharging contactor -K4
2	4/T2	
3	6/T3	
PE	PE connection	
Max. connectable cross-section: 4 mm²		

The external fusing is 35 A.

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.

- Use Siemens bypass contactors; the associated data are provided in the technical data.

NOTICE

Damage to the device as a result of 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.

- Connect the power cables in the pre-charging and main circuits with the same phase sequence.

6.3.2.4 X112

Table 6- 22 Terminal strip X112 bypass contactor control

Terminal	Function	Technical data
1	Bypass contactor control	240 V AC: Max. 3 A 24 V DC: max. 1 A isolated relay contact
2		
Max. connectable cross-section: 4 mm^2		

This signal is used to control the system-side external bypass contactor or circuit breaker.

Terminals X112:1 and X112:2 are closed to connect the external bypass contactor and/or circuit breaker.

6.3.2.5 Control Interface Module

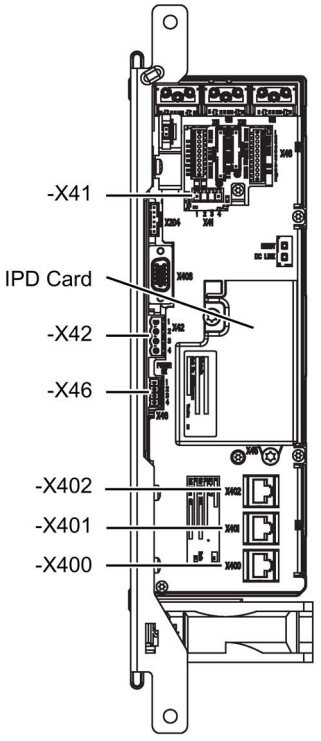
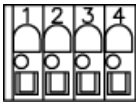


Figure 6-15 Control Interface Module

6.3.2.6 X41 EP terminal / temperature sensor connection

Table 6- 23 Terminal strip X41 EP terminals / temperature sensor connection

Connector	Terminal	Function	Technical data
	1	EP M1 (Enable Pulses)	Supply voltage: 24 VDC (20.4 ... 28.8 V) Current consumption: 10 mA
	2	EP +24 V (Enable Pulses)	
	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.

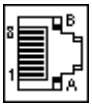
Note

Connection to terminals 1 and 2

24 VDC must be present at terminal 2 and ground at terminal 1 for operation. Pulse suppression is activated when removed.

6.3.2.7 DRIVE-CLiQ interfaces X400, X401, X402

Table 6- 24 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 Options

Note

Additional information

The individual options are described in Chapter "Options".

Electrical options

Component	Option
Line filter monitoring	L40
EMERGENCY OFF pushbutton installed in the cabinet door	L45
Cabinet anti-condensation heating	L55
DC link fuses	N52
Leakage sensor in the converter cabinet	W48

Mechanical options

Component	Option
Base 100 mm high, RAL 9005	M06
Cable-marshaling compartment 200 mm high, RAL 7035	M07
Dust protection packaging	M16
IP23 degree of protection	M23
Side panel (right)	M26
Side panel (left)	M27
Degree of protection IP43	M43
Cable entry via MCT frame	M45
IP54 degree of protection	M54
Degree of protection IP55	M55
Comfort-grip handle with a 3 mm double-bit lock insert	M61
Comfort-grip handle with integrated pushbutton lock insert	M62
Comfort-grip handle for a padlock with pushbutton as lock insert	M63
Marine version	M66
Quick-release couplings for water hoses	M72
DC busbar system	M80 ... M87
DC busbar system for line-side Cabinet Modules	M88
Crane transport assembly (top-mounted)	M90
Special paint finish for cabinet	Y09
Factory assembly into transport units	Y11

Other options

Component	Option
Generation of a material declaration Green Passport	B50
Individual certificate from the DNV	E51
Individual certificate from the American Bureau of Shipping (ABS)	E61
Individual certificate from the China Classification Society (CCS)	E71
Marking of all control cable conductor ends	M91
Rating plate data in English/French	T58
Rating plate data in English/Spanish	T60
Rating plate data in English/Italian	T80
Rating plate data in English/Russian	T85
Rating plate data in English/Chinese	T91
Single-line labeling strip for system identification, 40 x 80 mm	Y31
Two-line labeling strip for system identification, 40 x 180 mm	Y32
Four-line labeling strip for system identification, 40 x 180 mm	Y33

6.3.4 Technical data

Table 6- 25 Technical specifications for Active Line Connection Modules compact, 3 AC 380 V ... 480 V

Article No.	**6SL3735-**	**7TE36-1MA3**	**7TE38-4MA3**	**7TE41-0MA3**	**7TE41-4MA3**
Rated power					
- for $I_{N\,DC}$ (50 Hz 400 V)	kW	380	500	630	900
- for $I_{H\,DC}$ (50 Hz 400 V)	kW	335	465	545	780
- for $I_{N\,DC}$ (60 Hz 460 V)	hp	600	700	900	1250
- for $I_{H\,DC}$ (60 Hz 460 V)	hp	500	700	800	1000
DC link current					
- Rated current $I_{N\,DC}$	A	677	941	1100	1573
- Base-load current $I_{H\,DC}$ 1)	A	603	837	982	1401
- Maximum current $I_{max\,DC}$	A	1017	1410	1654	2361
Input/regenerative feedback current					
- rated current $I_{N\,E}$	A	605	840	985	1405
- maximum current $I_{max\,E}$	A	907	1260	1477	2055
Supply voltages					
- Line voltage	V_{ACrms}	3 AC 380 -10 % ... 3 AC 480 +10 % (-15 % < 1 min)			
- Line frequency	Hz	47 ... 63 Hz			
- Electronics power supply	V_{DC}	24 (20.4 ... 28.8)			
- DC link voltage	V_{DC}	1.5 x U_{line}			
Current consumption (1 AC 230 V)	A	1.2	1.2	1.2	1.2
Current consumption of the electronics (24 V DC)	A	1.77	1.77	1.7	1.7
DC link capacitance					
- Active Line Module	µF	12600	17400	18900	28800
- Drive line-up, max.	µF	134400	134400	230400	230400
Bypass contactor 2)		3RT1476-6AP36	3WL1110-2BB34-4AN2-Z Z=C22 3)	3WL1112-2BB34-4AN2-Z Z=C22 3)	3WL1116-2BB34-4AN2-Z Z=C22 3)
Power loss, max., at 50 Hz 400 V 4)					
- <IP55:					
- dissipated to the coolant	kW	10.9	11.7	19.6	21.8
- dissipated to the ambient air	kW	2.0	2.1	2.8	3.4
- IP55:					
- dissipated to the coolant	kW	11.8	12.9	21.5	24.3
- dissipated to the ambient air	kW	0.9	0.9	0.9	0.9
Material of the integrated heat exchanger					
- Active Line Module		Aluminum	Aluminum	Aluminum	Aluminum
- Active Interface Module		Aluminum	Aluminum	Aluminum	Aluminum
Rated flow rate					
- degree of protection <IP55	l/min	26	26	43	43
- degree of protection IP55	l/min	53	53	70	70
Pressure drop, typical at the rated flow rate 5)	Pa	150000	150000	150000	150000
Volume of liquid					
- degree of protection <IP55	dm^3	13	13	14	14
- degree of protection IP55	dm^3	16.6	16.6	17.6	17.6
Cooling air requirement (degree of protection <IP55)	m^3/s	0.272	0.272	0.272	0.272
Sound pressure level L_{pA} (1 m) at 50/60 Hz 6)	dB(A)	65/65	65/65	65/65	65/65
Line connection L1, L2, L3 7)		5/M12	5/M12	5/M12	5/M12
- conductor cross-section, max. (IEC)	mm^2	4 x 185	4 x 185	10 x 185	10 x 185

Article No.	**6SL3735-**	**7TE36-1MA3**	**7TE38-4MA3**	**7TE41-0MA3**	**7TE41-4MA3**
PE/GND connection - Busbar cross-section - Conductor cross-section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240			
Cable length, max. [8] - shielded - unshielded	 m m	 3900 5850	 3900 5850	 3900 5850	 3900 5850
Degree of protection (standard version)		IP21	IP21	IP21	IP21
Dimensions (standard version) - Width - Height - Depth	 mm mm mm	 1200 2200 600	 1200 2200 600	 1200 2200 600	 1200 2200 600
Weight (standard version)	kg	841	841	1027	1027
Frame size - Active Interface Module - Active Line Module		 JIL HXL	 JIL HXL	 JIL JXL	 JIL JXL
Maximum short-circuit current I_{CC} acc. to IEC	kA	65	84	84	100
Recommended fuse [9] - Number per phase (connected in parallel) - Rated current - Frame size acc. to IEC 60269	 A	3NE1438-2 1 800 3	3NE1334-2 2 [10] 500 3	3NE1436-2 2 [10] 630 3	3NE1448-2 2 [10] 850 3
Minimum short-circuit current [11]	kA	9.2	10.4	16	21

1) The base-load current $I_{H\ DC}$ is based on a duty cycle of 150 % for 60 s or $I_{max\ DC}$ for 5 s with a duty cycle duration of 300 s.

2) The recommended bypass contactor is not included, must be provided separately.

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. Therefore, we recommend that the circuit breaker is equipped with a locking set 3WL9111-0BA21-0AA0.

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

5) This value applies to water as coolant; for other coolant types, see Chapter "Coolant".

6) Total sound pressure level of Active Interface Module and Active Line Module.

7) As a result of the space situation, we recommend that flexible, shielded cables with a bending radius <7 x outer diameter are used.

8) Total of all motor cables and DC link. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low Voltage Engineering Manual in the device documentation provided.

9) 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.

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

11) Minimum current required so that protective devices reliably respond and trip.

Table 6- 26 Technical specifications for Active Line Connection Modules compact, 3 AC 500 V ... 690 V, Part 1

Article No.	**6SL3735-**	**7TG37-4MA3**	**7TG38-1MA3**	**7TG41-0MA3**	**7TG41-3MA3**
Rated power					
- At $I_{N\,DC}$ (50 Hz 690 V)	kW	800	900	1100	1400
- At $I_{H\,DC}$ (50 Hz 690 V)	kW	705	670	1000	1215
- At $I_{N\,DC}$ (50 Hz 500 V)	kW	560	620	780	965
- At $I_{H\,DC}$ (50 Hz 500 V)	kW	510	485	710	880
- At $I_{N\,DC}$ (60 Hz 575 V)	hp	900	975	1250	1500
- At $I_{H\,DC}$ (60 Hz 575 V)	hp	600	765	1000	1250
DC link current					
- Rated current $I_{N\,DC}$	A	823	907	1147	1422
- Base-load current $I_{H\,DC}$ [1]	A	732	808	936	1266
- Maximum current $I_{max\,DC}$	A	1235	1360	1722	2133
Input/regenerative feedback current					
- rated current $I_{N\,E}$	A	735	810	1025	1270
- maximum current $I_{max\,E}$	A	1100	1214	1537	1905
Supply voltages					
- Line voltage	V_{ACrms}	3 AC 500 -10 % ... 3 AC 690 +10 % (-15 % < 1 min)			
- Line frequency	Hz	47 ... 63 Hz			
- Electronics power supply	V_{DC}	24 (20.4 ... 28.8)			
- DC link voltage	V_{DC}	1.5 x U_{line}			
Current consumption (1 AC 230 V)	A	1.2	1.2	1.2	1.2
Current consumption of the electronics (24 V DC)	A	1.7	1.7	1.7	1.7
DC link capacitance					
- Active Line Module	µF	10500	10500	16000	19330
- Drive line-up, max.	µF	153600	153600	153600	153600
Bypass contactor [2]		3RT1476-6A36 (3 x)	3WL1212-4BB34-4AN2-Z Z=C22 [3]	3WL1212-4BB34-4AN2-Z Z=C22 [3]	3WL1216-4BB34-4AN2-Z Z=C22 [3]
Power loss, max., at 50 Hz 690 V [4]					
- <IP55:					
- dissipated to the coolant	kW	17.0	19.5	21.6	27.3
- dissipated to the ambient air	kW	2.0	2.2	2.8	3.3
- IP55:					
- dissipated to the coolant	kW	18.0	20.7	23.4	29.7
- dissipated to the ambient air	kW	0.9	0.9	0.9	0.9
Material of the integrated heat exchanger					
- Active Line Module		Aluminum	Aluminum	Aluminum	Aluminum
- Active Interface Module		Aluminum	Aluminum	Aluminum	Aluminum
Rated flow rate					
- degree of protection <IP55	l/min	26	26	37	37
- degree of protection IP55	l/min	53	53	64	64
Pressure drop, typical at the rated flow rate [5]	Pa	150000	150000	150000	150000
Volume of liquid					
- degree of protection <IP55	dm^3	13	14	14	14
- degree of protection IP55	dm^3	16.6	17.6	17.6	17.6
Cooling air requirement (degree of protection <IP55)	m^3/s	0.272	0.272	0.272	0.272
Sound pressure level L_{pA} (1 m) at 50/60 Hz [6]	dB(A)	65/65	65/65	65/65	65/65
Line connection L1, L2, L3 [7]		5/M12	5/M12	5/M12	5/M12
- conductor cross-section, max. (IEC)	mm^2	10 x 185	10 x 185	10 x 185	10 x 185

Article No.	**6SL3735-**	**7TG37-4MA3**	**7TG38-1MA3**	**7TG41-0MA3**	**7TG41-3MA3**
PE/GND connection - Busbar cross-section - Conductor cross-section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240			
Cable length, max. [8] - shielded - unshielded	 m m	 2250 3375	 2250 3375	 2250 3375	 2250 3375
Degree of protection (standard version)		IP21	IP21	IP21	IP21
Dimensions (standard version) - Width - Height - Depth	 mm mm mm	 1200 2200 600	 1200 2200 600	 1200 2200 600	 1200 2200 600
Weight (standard version)	kg	937	942	1077	1077
Frame size - Active Interface Module - Active Line Module		 JIL HXL	 JIL HXL	 JIL JXL	 JIL JXL
Maximum short-circuit current I_{CC} acc. to IEC	kA	84	100	100	100
Recommended fuse [9] - Number per phase (connected in parallel) - Rated current - Frame size acc. to IEC 60269	 A	3NE1448-2 1 850 3	3NE1435-2 2 [10] 560 3	3NE1436-2 2 [10] 630 3	3NE1438-2 2 [10] 800 3
Minimum short-circuit current [11]	kA	8.4	10.5	12.6	20

1) The base-load current $I_{H\ DC}$ is based on a duty cycle of 150 % for 60 s or $I_{max\ DC}$ for 5 s with a duty cycle duration of 300 s.

2) The recommended bypass contactor is not included, must be provided separately.

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. Therefore, we recommend that the circuit breaker is equipped with a locking set 3WL9111-0BA21-0AA0.

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

5) This value applies to water as coolant; for other coolant types, see Chapter "Coolant".

6) Total sound pressure level of Active Interface Module and Active Line Module.

7) As a result of the space situation, we recommend that flexible, shielded cables with a bending radius <7 x outer diameter are used.

8) Total of all motor cables and DC link. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low Voltage Engineering Manual in the device documentation provided.

9) 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.

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

11) Minimum current required so that protective devices reliably respond and trip.

Table 6- 27 Technical specifications for Active Line Connection Modules compact, 3 AC 500 V ... 690 V, Part 2

Article No.	**6SL3735-**	**7TG41-3MA4** 12)	**7TG41-6MA3**	**7TG41-6MA4** 12)	
Rated power					
- At $I_{N\,DC}$ (50 Hz 690 V)	kW	1400	1700	1700	
- At $I_{H\,DC}$ (50 Hz 690 V)	kW	1215	1490	1490	
- At $I_{N\,DC}$ (50 Hz 500 V)	kW	965	1180	1180	
- At $I_{H\,DC}$ (50 Hz 500 V)	kW	880	1080	1080	
- At $I_{N\,DC}$ (60 Hz 575 V)	hp	1500	1855	1855	
- At $I_{H\,DC}$ (60 Hz 575 V)	hp	1250	1530	1530	
DC link current					
- Rated current $I_{N\,DC}$	A	1422	1740	1740	
- Base-load current $I_{H\,DC}$ 1)	A	1266	1550	1550	
- Maximum current $I_{max\,DC}$	A	2133	2620	2620	
Input/regenerative feedback current					
- rated current $I_{N\,E}$	A	1270	1560	1560	
- maximum current $I_{max\,E}$	A	1905	2055	2055	
Supply voltages					
- Line voltage	V_{ACrms}	3 AC 500 -10 % ... 3 AC 690 +10 % (-15 % < 1 min)			
- Line frequency	Hz	47 ... 63 Hz			
- Electronics power supply	V_{DC}	24 (20.4 ... 28.8)			
- DC link voltage	V_{DC}	1.5 x U_{line}			
Current consumption (1 AC 230 V)	A	1.2	1.2	1.2	
Current consumption of the electronics (24 V DC)	A	1.7	1.7	1.7	
DC link capacitance					
- Active Line Module	µF	19330	21000	21000	
- Drive line-up, max.	µF	153600	210000	210000	
Bypass contactor 2)		3WL1216-4BB34-4AN2-Z Z=C22 3)	3WL1216-4BB34-4AN2-Z Z=C22 3)	3WL1216-4BB34-4AN2-Z Z=C22 3)	
Power loss, max., at 50 Hz 690 V 4)					
- <IP55:					
- dissipated to the coolant	kW	29.5	36.7	40.2	
- dissipated to the ambient air	kW	4.0	4.0	4.0	
- IP55:					
- dissipated to the coolant	kW	31.9	39.8	43.3	
- dissipated to the ambient air	kW	0.9	0.9	0.9	
Material of the integrated heat exchanger					
- Active Line Module		Aluminum	Aluminum	Aluminum	
- Active Interface Module		Aluminum	Aluminum	Aluminum	
Rated flow rate					
- degree of protection <IP55	l/min	37	43	52	
- degree of protection IP55	l/min	64	70	79	
Pressure drop, typical at the rated flow rate 5)	Pa	150000	150000	150000	
Volume of liquid					
- degree of protection <IP55	dm^3	14	14	14	
- degree of protection IP55	dm^3	17.6	17.6	17.6	
Cooling air requirement (degree of protection <IP55)	m^3/s	0.272	0.272	0.272	
Sound pressure level L_{pA} (1 m) at 50/60 Hz 6)	dB(A)	65/65	65/65	65/65	
Line connection L1, L2, L3 7)		5/M12	5/M12	5/M12	
- conductor cross-section, max. (IEC)	mm^2	10 x 185	10 x 185	10 x 185	

Article No.	**6SL3735-**	**7TG41-3MA4** [12]	**7TG41-6MA3**	**7TG41-6MA4** [12]	
PE/GND connection - Busbar cross-section - Conductor cross-section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240			
Cable length, max. [8] - shielded - unshielded	 m m	 2250 3375	 2250 3375	 2250 3375	
Degree of protection (standard version)		IP21	IP21	IP21	
Dimensions (standard version) - Width - Height - Depth	 mm mm mm	 1200 2200 600	 1200 2200 600	 1200 2200 600	
Weight (standard version)	kg	1077	1177	1177	
Frame size - Active Interface Module - Active Line Module		 JIL JXL	 JIL JXL	 JIL JXL	
Maximum short-circuit current I_{CC} acc. to IEC	kA	100	100	100	
Recommended fuse [9] - Number per phase (connected in parallel) - Rated current - Frame size acc. to IEC 60269	 A	3NE1438-2 2 [10] 800 3	3NE1436-2 3 [10] 630 3	3NE1436-2 3 [10] 630 3	
Minimum short-circuit current [11]	kA	20	24	24	

1) The base-load current $I_{H\,DC}$ is based on a duty cycle of 150 % for 60 s or $I_{max\,DC}$ for 5 s with a duty cycle duration of 300 s.

2) The recommended bypass contactor is not included, must be provided separately.

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. Therefore, we recommend that the circuit breaker is equipped with a locking set 3WL9111-0BA21-0AA0.

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

5) This value applies to water as coolant; for other coolant types, see Chapter "Coolant".

6) Total sound pressure level of Active Interface Module and Active Line Module.

7) As a result of the space situation, we recommend that flexible, shielded cables with a bending radius <7 x outer diameter are used.

8) Total of all motor cables and DC link. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low Voltage Engineering Manual in the device documentation provided.

9) 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.

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

11) Minimum current required so that protective devices reliably respond and trip.

12) The devices with article numbers 6SL3735-7TG41-3MA4 and 6SL3735-7TG41-6MA4 have the shaft generator drive function (SGD), additional notes are provided in the System Manual, Line Infeed, see the subsequent note.

Note

System Manual Line Infeed

The manual is available in the Internet at the following address: Grid Infeed System Manual (https://support.industry.siemens.com/cs/ww/en/view/109782591).

6.4 Motor Modules

6.4.1 Description

Note

Additional information

Refer to the layout diagrams (AO) and circuit diagrams (SP) provided in the individual device documentation for the arrangement of components and interfaces and for the wiring.



Figure 6-16 Motor Module

A Motor Module is a 3-phase inverter (IGBT technology) that supplies energy to the connected motor. Energy is supplied to the Motor Modules via the DC busbar.

Motor Modules are available for the following voltages and power ratings:

Line voltage	DC link voltage	Type rating
3 AC 380 ... 480 V	510 ... 720 V DC	110 ... 800 kW
3 AC 500 ... 690 V	675 ... 1035 V DC	90 ... 1500 kW

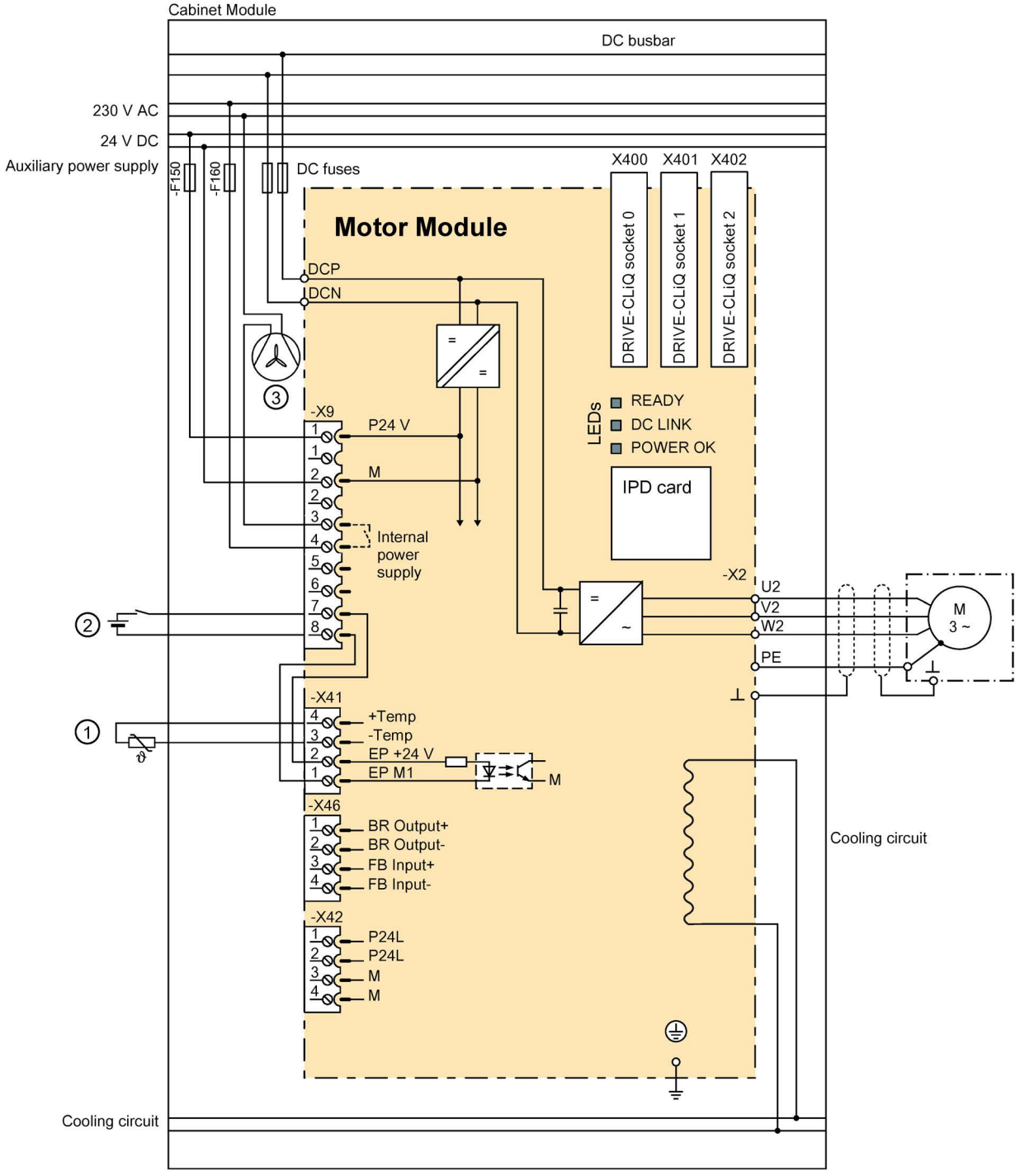
The available shaft output can be increased by connecting up to four Motor Modules in parallel. These modules are operated on one Control Unit and feed one motor.

Note

Parallel connection to a common Control Unit

Note that the Motor Modules connected in parallel are operated on a common Control Unit.

Integration



① Connection of a temperature sensor for motors without a DRIVE-CLiQ interface.
② Required for Safety Integrated
③ Door fan -G160 (IP21, IP23, IP43, IP54) or heat exchanger -E160 (IP55)

Figure 6-17 Connection example, Motor Module

Configuration

Motor Modules contain the following components as standard:

- Retaining device for the DC busbar, including the interface to the DC connections of the Motor Module (the necessary DC busbar must be provided separately as option M80 to M87).
- Connecting bar for the motor cables
- Cable propping bar for the electric power cables
- DRIVE-CLiQ connection (3 DRIVE-CLiQ sockets), without Control Unit
- 4-pole auxiliary power supply, including terminal and cables for looping through to the next Cabinet Module
- PE busbar (60 x 10 mm), including jumper for looping through to the next Cabinet Module.
- EMC-compliant design thanks to additional shielding measures and appropriate laying of cables.

Note

Additional information

The configuration examples of the individual Motor Modules illustrate the positioning of the factory-fitted components. They show the maximum possible configuration of the modules, which contain all options that can be ordered.

Refer to the layout diagrams (AO) provided in the individual device documentation for the precise order-specific location of the components.

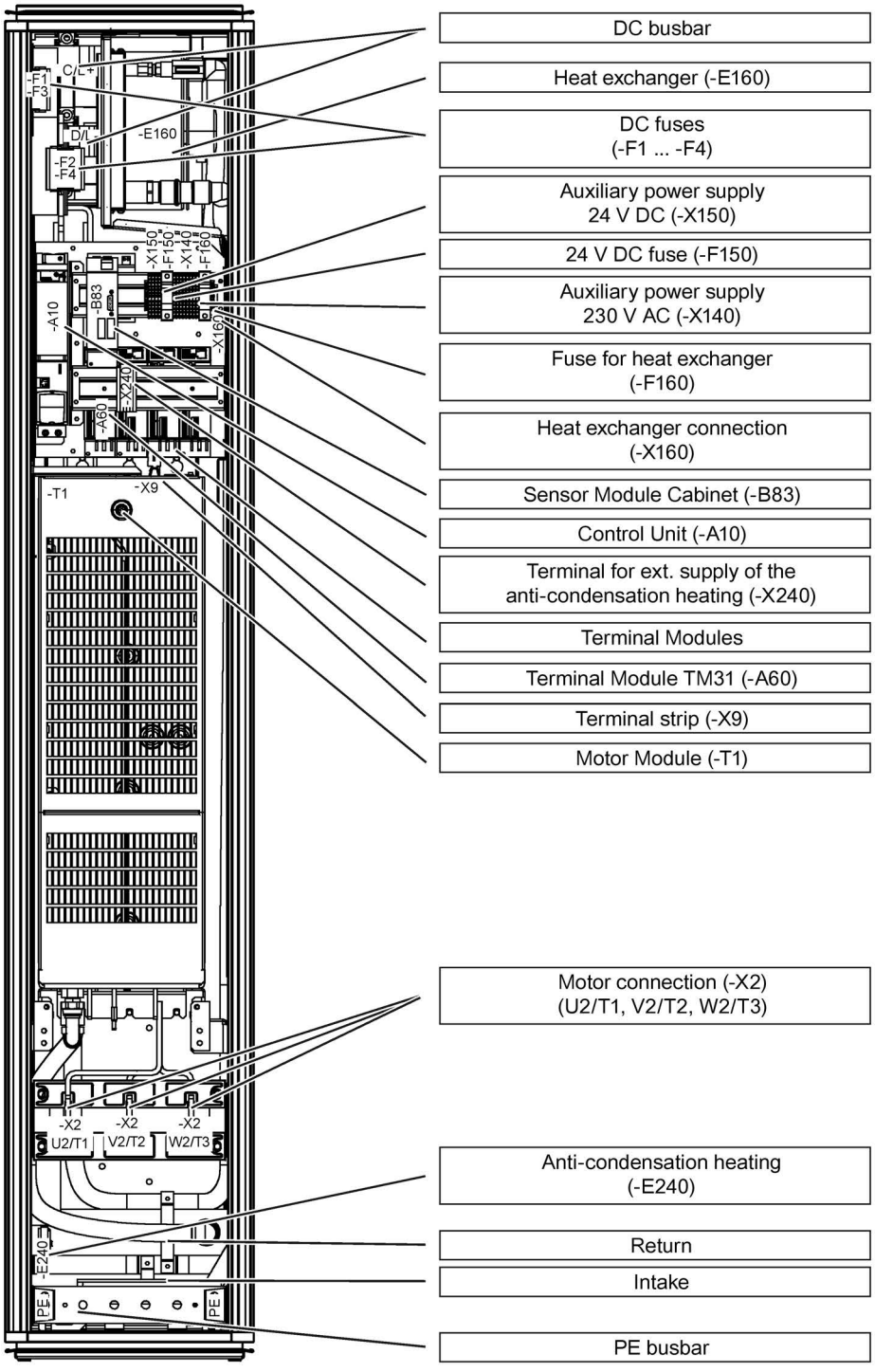


Figure 6-18 Motor Module design (frame size HXL, without motor-side options) (IP55)

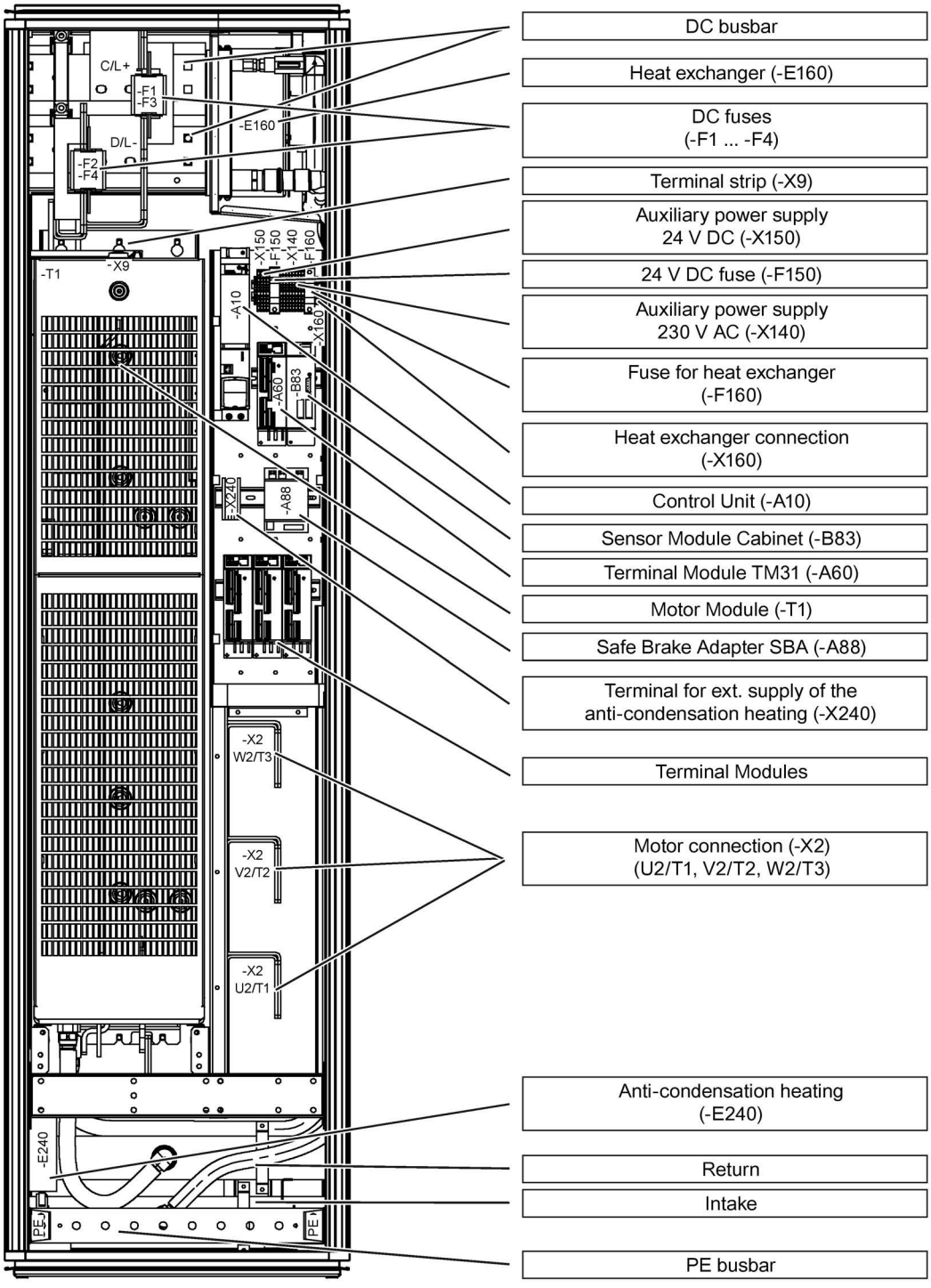


Figure 6-19 Motor Module design (frame size JXL, without motor-side options) (IP55)

Parallel connection of Motor Modules to increase power rating

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

- Up to four identical Motor Modules can be connected in parallel.
- A common Control Unit is required whenever the modules are connected in parallel.
- The motor supply cables must be the same length (symmetrical design).
- Power must be supplied to the Motor Modules from a common DC busbar.
- A derating factor of 5% must be taken into consideration, regardless of the number of modules connected in parallel.
- For motors with multi-winding systems, carefully observe the notes in the Low Voltage Engineering Manual.
- For motors with a single-winding system, the length of the supply cables must be kept to a minimum. The cable lengths are listed in the following tables.

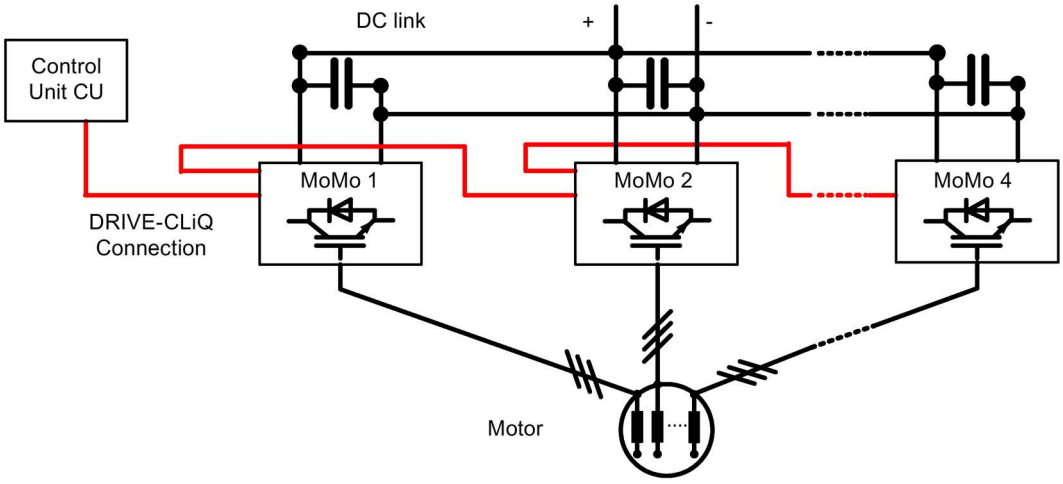


Figure 6-20 Motor with electrically isolated winding systems supplied by a parallel connection of S120 Motor Modules

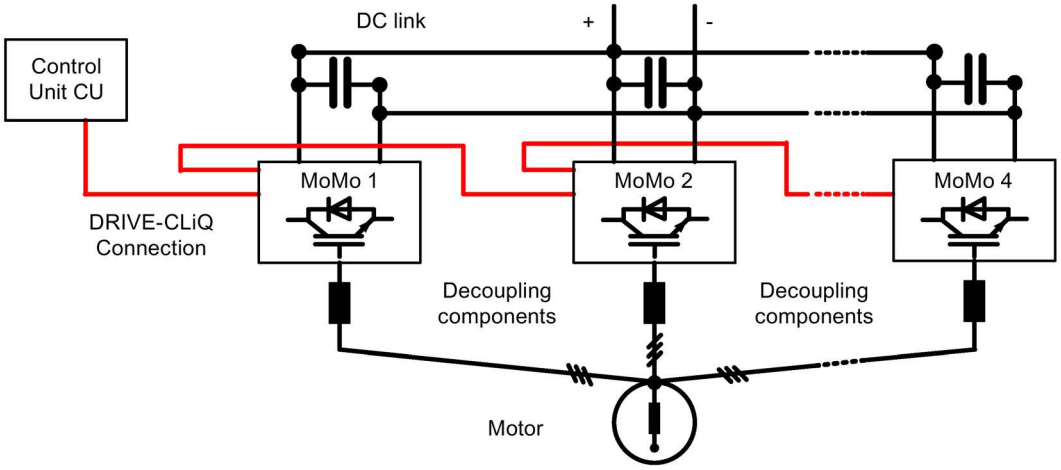


Figure 6-21 Motor with common winding system supplied by a parallel connection of S120 Motor Modules

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

Note

Minimum cable lengths

The minimum cable lengths specified in the table 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. The motor cables of Motor Modules connected in parallel may only be connected with one another at the motor terminal box.
A motor reactor (as shown in the diagram above) must be used if the required cable length cannot be reached in the application.

Table 6- 28 Motor Modules, 510 ... 720 V DC

Article No.	Frame size	P_{rated} [kW]	$I_{rated\ rms}$ [A]	Minimum length [m]
6SL3725-1TE32-1AA3	FXL	110	210	30
6SL3725-1TE32-6AA3	FXL	132	260	27
6SL3725-1TE33-3AA3	GXL	160	310	20
6SL3725-1TE35-0AA3	GXL	250	490	15
6SL3725-1TE36-1AA3	HXL	315	605	13
6SL3725-1TE37-5AA3	HXL	400	745	10
6SL3725-1TE38-4AA3	HXL	450	840	9
6SL3725-1TE41-0AA3	JXL	560	985	8
6SL3725-1TE41-2AA3	JXL	710	1260	6
6SL3725-1TE41-4AA3	JXL	800	1405	5
6SL3725-1TE41-4AS3	JXL	800	1330	5

Table 6- 29 Motor Modules, 675 ...1035 V DC

Article No.	Frame size	P_{rated} [kW]	$I_{rated\ rms}$ [A]	Minimum length [m]
6SL3725-1TG31-0AA3	FXL	90	100	90
6SL3725-1TG31-5AA3	FXL	132	150	70
6SL3725-1TG32-2AA3	GXL	200	215	50
6SL3725-1TG33-3AA3	GXL	315	330	30
6SL3725-1TG34-7AA3	HXL	450	465	25
6SL3725-1TG35-8AA3	HXL	560	575	20
6SL3725-1TG37-4AA3	HXL	710	735	18
6SL3725-1TG38-0AA3	HXL	800	810	18
6SL3725-1TG38-1AA3	JXL	800	810	15
6SL3725-1TG41-0AA3	JXL	1000	1025	10
6SL3725-1TG41-3AA3	JXL	1200	1270	8
6SL3725-1TG41-6AA3	JXL	1500	1560	7
6SL3725-1TG41-6AP3	JXL	1500	1560	7

6.4.2 Interface description

6.4.2.1 General information

This chapter describes only those interfaces in the cabinet unit that require additional connection work by the customer. All other interfaces are pre-wired at the factory and are not designed for customer connections.

Note

Additional information

All connections to be established on the plant side as well as the interfaces for integration into the plant control system are described in the circuit and terminal diagrams, included in the individual device documentation.

6.4.2.2 Control Interface Module

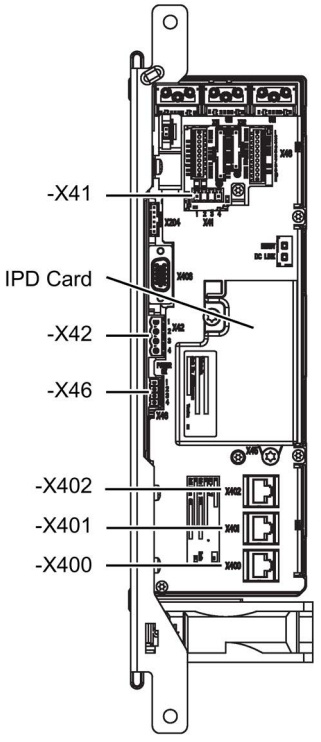
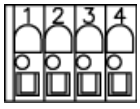


Figure 6-22 Control Interface Module

6.4.2.3 X41 EP terminal / temperature sensor connection

Table 6- 30 Terminal strip X41 EP terminals / temperature sensor connection

Connector	Terminal	Function	Technical data
	1	EP M1 (Enable Pulses)	Supply voltage: 24 V DC (20.4 ... 28.8 V) Current consumption: 10 mA
	2	EP +24 V (Enable Pulses)	The pulse inhibit function is only available when the "Safety Integrated Basic Functions via onboard terminals" is enabled in the software.
	3	- Temp	Temperature sensor connection: KTY84-1C130, PTC, PT100, PT1000, bimetallic temperature switch with NC contact
	4	+ Temp	
Max. connectable cross-section: 2.5 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 at both ends 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

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.

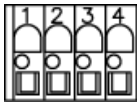
Note

Safety Integrated Function Manual

Detailed and comprehensive instructions and information for handling Safety Integrated functions is given in the associated Function Manual, included in the device documentation provided.

6.4.2.4 X46 Brake control and monitoring

Table 6- 31 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: 2.5 mm²			

Note

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

⚠WARNING

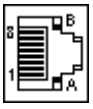
Fire due to overheating when the total length of the connecting cables is exceeded

Excessively long connection cables connected to 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.
- Do not route the connection cable outside the control cabinet or control cabinet group.

6.4.2.5 DRIVE-CLiQ interfaces X400, X401, X402

Table 6- 32 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			

6.4.3 Options

Note

Additional information

The individual options are described in Chapter "Options".

Electrical options

Component	Option
CBC10 Communication Board	G20
CBE20 Communication Board	G33
1 temperature sensor module TM150	G51
2 temperature sensor modules TM150	G52
TM31 Terminal Module	G60
Additional TM31 Terminal Module	G61
TB30 Terminal Board	G62
Safety license for 1 to 5 axes	K01 ... K05
AOP30 operator panel	K08
SMC 10/20/30 Sensor Modules	K46, K48, K50
VSM10 Voltage Sensing Module Cabinet-Mounted	K51
Additional SMC30 Sensor Module	K52
Terminal Module for activating "Safe Torque Off" and "Safe STOP 1"	K82
Terminal Module TM54F	K87
Safe Brake Adapter SBA 230 V AC	K88
Control Unit CU320-2 DP (PROFIBUS)	K90
Performance extension for CU320-2	K94

Component	Option
Control Unit CU320-2 PN (PROFINET)	K95
Cabinet anti-condensation heating	L55
Leakage sensor in the converter cabinet	W48

Mechanical options

Component	Option
Base 100 mm high, RAL 9005	M06
Cable-marshaling compartment 200 mm high, RAL 7035	M07
Dust protection packaging	M16
IP23 degree of protection	M23
Side panel (right)	M26
Side panel (left)	M27
Degree of protection IP43	M43
Cable entry via MCT frame	M45
IP54 degree of protection	M54
Degree of protection IP55	M55
Comfort-grip handle with a 3 mm double-bit lock insert	M61
Comfort-grip handle with integrated pushbutton lock insert	M62
Comfort-grip handle for a padlock with pushbutton as lock insert	M63
Marine version	M66
EMC shield rail	M70
Quick-release couplings for water hoses	M72
DC busbar system	M80 ... M87
Crane transport assembly (top-mounted)	M90
Special paint finish for cabinet	Y09
Factory assembly into transport units	Y11

Other options

Component	Option
Generation of a material declaration Green Passport	B50
Individual certificate from the DNV	E51
Individual certificate from the American Bureau of Shipping (ABS)	E61
Individual certificate from the China Classification Society (CCS)	E71
Marking of all control cable conductor ends	M91
Rating plate data in English/French	T58
Rating plate data in English/Spanish	T60
Rating plate data in English/Italian	T80
Rating plate data in English/Russian	T85
Rating plate data in English/Chinese	T91
Single-line labeling strip for system identification, 40 x 80 mm	Y31
Two-line labeling strip for system identification, 40 x 180 mm	Y32
Four-line labeling strip for system identification, 40 x 180 mm	Y33

6.4.4 Technical data

Table 6- 33 Technical specifications for Motor Modules, line voltage 3 AC 380 ... 480 V, DC link voltage 510 ... 720 V DC, Part I

Article No.	6SL3725-	1TE32-1AA3	1TE32-6AA3	1TE33-3AA3	1TE35-0AA3
Type rating					
- for I_L (50 Hz 400 V) [1]	kW	110	132	160	250
- for I_H (50 Hz 400 V) [1]	kW	90	110	132	200
- for I_L (60 Hz 460 V) [2]	hp	150	200	250	400
- for I_H (60 Hz 460 V) [2]	hp	150	200	200	350
Output current					
- Rated current $I_{N\,A}$	A	210	260	310	490
- Base-load current I_L [3]	A	205	250	302	477
- Base-load current I_H [4]	A	178	233	277	438
- Maximum current $I_{max\,A}$	A	307	375	453	715
DC link current					
- Rated current $I_{N\,DC}$ when supplied via:					
- Basic Line Module	A	256	317	380	600
- Active Line Module	A	230	287	340	538
- Base-load current $I_{L\,DC}$ [3] when supplied via:					
- Basic Line Module	A	250	305	368	581
- Active Line Module	A	225	274	331	522
- Base-load current $I_{H\,DC}$ [4] when supplied via:					
- Basic Line Module	A	227	284	338	534
- Active Line Module	A	195	255	303	480
Supply voltages					
- DC link voltage	V_{DC}	510 ... 720			
- Electronics power supply	V_{DC}	24 (20.4 ... 28.8)			
- Output voltage	V_{ACrms}	0 ... 0.75 x DC link voltage			
Current consumption (1 AC 230 V)	A	0.6	0.6	0.6	0.6
Current consumption of the electronics (24 V DC)	A	1.3	1.3	1.3	1.3
DC link capacitance	µF	4800	5800	8400	9600
Pulse frequency					
- rated frequency	kHz	2	2	2	2
- pulse frequency, max.					
- without current derating	kHz	2	2	2	2
- with current derating	kHz	8	8	8	8
Power loss, max., at 50 Hz 400 V [5]					
- <IP55:					
- dissipated to the coolant	kW	1.6	1.9	2.2	3.4
- dissipated to the ambient air	kW	0.2	0.2	0.2	0.3
- IP55:					
- dissipated to the coolant	kW	1.7	2.1	2.4	3.8
- dissipated to the ambient air	kW	0.2	0.2	0.2	0.2
Material of the integrated heat exchanger		Stainless steel	Stainless steel	Stainless steel	Stainless steel
Rated flow rate (all degrees of protection)	l/min	9	9	12	12
Pressure drop, typical at the rated flow rate [6]	Pa	150000	150000	150000	150000
Volume of liquid					
- degree of protection <IP55	dm^3	2.9	2.9	3.5	3.5
- degree of protection IP55	dm^3	4.7	4.7	5.3	5.3
Cooling air requirement (degree of protection <IP55)	m^3/s	0.136	0.136	0.136	0.136

Article No.	**6SL3725-**	**1TE32-1AA3**	**1TE32-6AA3**	**1TE33-3AA3**	**1TE35-0AA3**
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	52	52	52	52
Motor connection U2, V2, W2 - Screws - Conductor cross-section, max. (IEC)	 mm^2	 M12 2 x 95	 M12 2 x 95	 M12 2 x 240	 M12 2 x 240
Cable length, max. [7] - shielded - unshielded	 m m	 300 450	 300 450	 300 450	 300 450
PE/GND connection - Busbar cross-section - Conductor cross-section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240			
Degree of protection (standard version)		IP21	IP21	IP21	IP21
Dimensions (standard version) - Width - Height - Depth	 mm mm mm	 400 2200 600	 400 2200 600	 400 2200 600	 400[)] 2200 600
Weight, approx. (standard version)	kg	280	280	320	320
Frame size		FXL	FXL	GXL	GXL
Maximum short-circuit current I_{CC} acc. to IEC	kA	65	65	65	65

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

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

3) The base-load current I_L is based on a duty cycle of 110 % for 60 s or 150 % for 10 s with a duty cycle duration of 300 s.

4) The base-load current I_H is based on a duty cycle of 150 % for 60 s or 160 % for 10 s with a duty cycle duration of 300 s.

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

6) This value applies to the water coolant option; for other coolant types, see Chapter "Coolant".

7) Total of all motor cables. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low Voltage Engineering Manual in the device documentation provided.

Table 6- 34 Technical specifications of the Motor Modules, line voltage 380 ... 480 V 3 AC, DC link voltage 510 ... 720 V DC, Part I

Article No.	**6SL3725-**	**1TE36-1AA3**	**1TE37-5AA3**	**1TE38-4AA3**	**1TE41-0AA3**
Type rating					
- for I_L (50 Hz 400 V) [1]	kW	315	400	450	560
- for I_H (50 Hz 400 V) [1]	kW	250	315	400	450
- for I_L (60 Hz 460 V) [2]	hp	500	600	700	800
- for I_H (60 Hz 460 V) [2]	hp	350	450	600	700
Output current					
- Rated current $I_{N\,A}$	A	605	745	840	985
- Base-load current I_L [3]	A	590	725	820	960
- Base-load current I_H [4]	A	460	570	700	860
- Maximum current $I_{max\,A}$	A	885	1087	1230	1440
DC link current					
- Rated current $I_{N\,DC}$ when supplied via:					
- Basic Line Module	A	738	894	1025	1202
- Active Line Module	A	664	805	922	1080
- Base-load current $I_{L\,DC}$ [3] when supplied via:					
- Basic Line Module	A	719	871	1000	1170
- Active Line Module	A	646	784	898	1051
- Base-load current $I_{H\,DC}$ [4] when supplied via:					
- Basic Line Module	A	561	795	853	1048
- Active Line Module	A	504	716	767	942
Supply voltages					
- DC link voltage	V_{DC}	510 ... 720			
- Electronics power supply	V_{DC}	24 (20.4 ... 28.8)			
- Output voltage	V_{ACrms}	0 ... 0.75 x DC link voltage			
Current consumption (1 AC 230 V)	A	0.6	0.6	0.6	0.6
Current consumption of the electronics (24 V DC)	A	1.5	1.5	1.5	1.5
DC link capacitance	µF	12600	17400	17400	21000
Pulse frequency					
- rated frequency	kHz	1.25	1.25	1.25	1.25
- pulse frequency, max.					
- without current derating	kHz	1.25	1.25	1.25	1.25
- with current derating	kHz	8	8	8	8
Power loss, max., at 50 Hz 400 V [5]					
- <IP55:					
- dissipated to the coolant	kW	4.6	5.2	5.5	7.5
- dissipated to the ambient air	kW	0.6	0.7	0.8	1.0
- IP55:					
- dissipated to the coolant	kW	5.0	5.7	6.2	8.3
- dissipated to the ambient air	kW	0.2	0.2	0.2	0.2
Material of the integrated heat exchanger		Aluminum	Aluminum	Aluminum	Aluminum
Rated flow rate (all degrees of protection)	l/min	16	16	16	27
Pressure drop, typical at the rated flow rate [6]	Pa	150000	150000	150000	150000
Volume of liquid					
- degree of protection <IP55	dm^3	3.3	3.3	3.3	5.2
- degree of protection IP55	dm^3	5.1	5.1	5.1	7.0
Cooling air requirement (degree of protection <IP55)	m^3/s	0.136	0.136	0.136	0.136
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	54	54	54	56

Article No.	**6SL3725-**	**1TE36-1AA3**	**1TE37-5AA3**	**1TE38-4AA3**	**1TE41-0AA3**
Motor connection U2, V2, W2 - Screws - Conductor cross-section, max. (IEC)	 mm^2	 2/M12 4 x 185	 2/M12 4 x 185	 2/M12 4 x 185	 3/M12 4 x 240
Cable length, max. [7] - shielded - unshielded	 m m	 300 450	 300 450	 300 450	 300 450
PE/GND connection - Busbar cross-section - Conductor cross-section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240			
Degree of protection (standard version)		IP21	IP21	IP21	IP21
Dimensions (standard version) - Width - Height - Depth	 mm mm mm	 400 2200 600	 400 2200 600	 400 2200 600	 600 2200 600
Weight, approx. (standard version)	kg	350	350	350	460
Frame size		HXL	HXL	HXL	JXL
Maximum short-circuit current I_{CC} acc. to IEC	kA	65	65	84	84

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

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

3) The base-load current I_L is based on a duty cycle of 110 % for 60 s or 150 % for 10 s with a duty cycle duration of 300 s.

4) The base-load current I_H is based on a duty cycle of 150 % for 60 s or 160 % for 10 s with a duty cycle duration of 300 s.

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

6) This value applies to the water coolant option; for other coolant types, see Chapter "Coolant".

7) Total of all motor cables. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low Voltage Engineering Manual in the device documentation provided.

Table 6- 35 Technical specifications for Motor Modules, line voltage 380 ... 480 V 3 AC, DC link voltage 510 ... 720 V DC, Part III

Article No.	**6SL3725-**	**1TE41-2AA3**	**1TE41-4AA3**	**1TE41-4AS3**	
Type rating					
- for I_L (50 Hz 400 V) [1]	kW	710	800	800	
- for I_H (50 Hz 400 V) [1]	kW	630	710	630	
- for I_L (60 Hz 460 V) [2]	hp	1000	1150	1000	
- for I_H (60 Hz 460 V) [2]	hp	900	1000	900	
Output current					
- Rated current $I_{N\,A}$	A	1260	1405	1330	
- Base-load current I_L [3]	A	1230	1370	1310	
- Base-load current I_H [4]	A	1127	1257	1150	
- Maximum current $I_{max\,A}$	A	1845	2055	2055	
DC link current					
- Rated current $I_{N\,DC}$ when supplied via:					
- Basic Line Module	A	1512	1714	1550	
- Active Line Module	A	1361	1544	1403	
- Base-load current $I_{L\,DC}$ [3] when supplied via:					
- Basic Line Module	A	1474	1670	1525	
- Active Line Module	A	1326	1500	1405	
- Base-load current $I_{H\,DC}$ [4] when supplied via:					
- Basic Line Module	A	1345	1532	1676	
- Active Line Module	A	1211	1377	1403	
Supply voltages					
- DC link voltage	V_{DC}	510 ... 720			
- Electronics power supply	V_{DC}	24 (20.4 ... 28.8)			
- Output voltage	V_{ACrms}	0 ... 0.75 x DC link voltage			
Current consumption (1 AC 230 V)	A	0.6	0.6	0.6	
Current consumption of the electronics (24 V DC)	A	1.5	1.5	1.5	
DC link capacitance	µF	29000	29000	21000	
Pulse frequency					
- rated frequency	kHz	1.25	1.25	2	
- pulse frequency, max.					
- without current derating	kHz	1.25	1.25	2	
- with current derating	kHz	8	8	4	
Power loss, max., at 50 Hz 400 V [5]					
- <IP55:					
- dissipated to the coolant	kW	8.6	9.5	10.2	
- dissipated to the ambient air	kW	1.3	1.5	1.4	
- IP55:					
- dissipated to the coolant	kW	9.6	10.7	11.3	
- dissipated to the ambient air	kW	0.3	0.3	0.3	
Material of the integrated heat exchanger		Aluminum	Aluminum	Aluminum	
Rated flow rate (all degrees of protection)	l/min	27	27	27	
Pressure drop, typical at the rated flow rate [6]	Pa	150000	150000	150000	
Volume of liquid					
- degree of protection <IP55	dm^3	5.2	5.2	5.2	
- degree of protection IP55	dm^3	7.0	7.0	7.0	
Cooling air requirement (degree of protection <IP55)	m^3/s	0.136	0.136	0.136	
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	56	56	56	

Article No.	**6SL3725-**	**1TE41-2AA3**	**1TE41-4AA3**	**1TE41-4AS3**	
Motor connection U2, V2, W2 - Screws - Conductor cross-section, max. (IEC)	 mm^2	 2/M12 4 x 240	 2/M12 4 x 240	 2/M12 4 x 240	
Cable length, max. 7) - shielded - unshielded	 m m	 300 450	 300 450	 300 450	
PE/GND connection - Busbar cross-section - Conductor cross-section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240			
Degree of protection (standard version)		IP21	IP21	IP21	
Dimensions (standard version) - Width - Height - Depth	 mm mm mm	 600 2200 600	 600 2200 600	 600 2200 600	
Weight, approx. (standard version)	kg	460	460	470	
Frame size		JXL	JXL	JXL	
Maximum short-circuit current I_{CC} acc. to IEC	kA	100	100	100	

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

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

3) The base-load current I_L is based on a duty cycle of 110 % for 60 s or 150 % for 10 s with a duty cycle duration of 300 s.

4) The base-load current I_H is based on a duty cycle of 150 % for 60 s or 160 % for 10 s with a duty cycle duration of 300 s.

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

6) This value applies to the water coolant option; for other coolant types, see Chapter "Coolant".

7) Total of all motor cables. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low Voltage Engineering Manual in the device documentation provided.

Table 6- 36 Technical specifications of the Motor Modules, line voltage 3 AC 500 ... 690 V, DC link voltage 675 ... 1035 V DC, Part I

Article No.	**6SL3725-**	**1TG31-0AA3**	**1TG31-5AA3**	**1TG32-2AA3**	**1TG33-3AA3**
Type rating					
- for I_L (50 Hz 690 V) [1]	kW	90	132	200	315
- for I_H (50 Hz 690 V) [1]	kW	75	110	160	250
- for I_L (50 Hz 500 V) [1]	kW	55	90	132	200
- for I_H (50 Hz 500 V) [1]	kW	55	90	132	200
- for I_L (60 Hz 575 V) [2]	hp	75	150	200	300
- for I_H (60 Hz 575 V) [2]	hp	75	125	200	250
Output current					
- Rated current $I_{N\,A}$	A	100	150	215	330
- Base-load current I_L [3]	A	95	142	208	320
- Base-load current I_H [4]	A	89	134	192	280
- Maximum current $I_{max\,A}$	A	142	213	312	480
DC link current					
- Rated current $I_{N\,DC}$ when supplied via:					
- Basic Line Module	A	122	183	262	403
- Active Line Module	A	110	165	237	363
- Base-load current $I_{L\,DC}$ [3] when supplied via:					
- Basic Line Module	A	116	173	253	390
- Active Line Module	A	105	156	229	352
- Base-load current $I_{H\,DC}$ [4] when supplied via:					
- Basic Line Module	A	108	163	234	341
- Active Line Module	A	98	147	211	308
Supply voltages					
- DC link voltage	V_{DC}	675 ... 1035			
- Electronics power supply	V_{DC}	24 (20.4 ... 28.8)			
- Output voltage	V_{ACrms}	0 ... 0.75 x DC link voltage			
Current consumption (1 AC 230 V)	A	0.6	0.6	0.6	0.6
Current consumption of the electronics (24 V DC)	A	1.3	1.3	1.3	1.3
DC link capacitance	µF	2800	2800	4200	5800
Pulse frequency					
- rated frequency	kHz	1.25	1.25	1.25	1.25
- pulse frequency, max.					
- without current derating	kHz	1.25	1.25	1.25	1.25
- with current derating	kHz	7.5	7.5	7.5	7.5
Power loss, max., at 50 Hz 690 V [5]					
- <IP55:					
- dissipated to the coolant	kW	1.1	1.6	2.3	3.3
- dissipated to the ambient air	kW	0.1	0.1	0.2	0.3
- IP55:					
- dissipated to the coolant	kW	1.2	1.7	2.4	3.5
- dissipated to the ambient air	kW	0.1	0.1	0.2	0.2
Material of the integrated heat exchanger		Stainless steel	Stainless steel	Stainless steel	Stainless steel
Rated flow rate (all degrees of protection)	l/min	9	9	12	12
Pressure drop, typical at the rated flow rate [6]	Pa	150000	150000	150000	150000
Volume of liquid					
- degree of protection <IP55	dm^3	2.9	2.9	3.5	3.5
- degree of protection IP55	dm^3	4.7	4.7	5.3	5.3
Cooling air requirement (degree of protection <IP55)	m^3/s	0.136	0.136	0.136	0.136
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	52	52	52	52

Article No.	**6SL3725-**	**1TG31-0AA3**	**1TG31-5AA3**	**1TG32-2AA3**	**1TG33-3AA3**
Motor connection U2, V2, W2 - Screws - Conductor cross-section, max. (IEC)	 mm^2	 M12 2 x 95	 M12 2 x 95	 M12 2 x 240	 M12 2 x 240
Cable length, max. [7] - shielded - unshielded	 m m	 300 450	 300 450	 300 450	 300 450
PE/GND connection - Busbar cross-section - Conductor cross-section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240			
Degree of protection (standard version)		IP21	IP21	IP21	IP21
Dimensions (standard version) - Width - Height - Depth	 mm mm mm	 400 2200 600	 400 2200 600	 400 2200 600	 400 2200 600
Weight, approx. (standard version)	kg	280	280	320	320
Frame size		FXL	FXL	GXL	GXL
Maximum short-circuit current I_{CC} acc. to IEC	kA	65	65	65	65

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

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

[3] The base-load current I_L is based on a duty cycle of 110 % for 60 s or 150 % for 10 s with a duty cycle duration of 300 s.

[4] The base-load current I_H is based on a duty cycle of 150 % for 60 s or 160 % for 10 s with a duty cycle duration of 300 s.

[5] The specified power loss represents the maximum value at 100 % utilization. The value in normal operation is lower.

[6] This value applies to the water coolant option; for other coolant types, see Chapter "Coolant".

[7] Total of all motor cables. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low Voltage Engineering Manual in the device documentation provided.

Table 6- 37 Technical specifications of the Motor Modules, line voltage 500 ... 690 V3 AC, DC link voltage 675 ... 1035 V DC, Part II

Article No.	**6SL3725-**	**1TG34-7AA3**	**1TG35-8AA3**	**1TG37-4AA3**	**1TG38-0AA3** 8)
Type rating					
- for I_L (50 Hz 690 V) 1)	kW	450	560	710	800
- for I_H (50 Hz 690 V) 1)	kW	400	450	630	710
- for I_L (50 Hz 500 V) 1)	kW	315	400	500	560
- for I_H (50 Hz 500 V) 1)	kW	250	315	450	500
- for I_L (60 Hz 575 V) 2)	hp	450	600	700	800
- for 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 3)	A	452	560	710	790
- Base-load current I_H 4)	A	416	514	657	724
- Maximum current $I_{max\,A}$	A	678	840	1065	1185
DC link current					
- Rated current $I_{N\,DC}$ when supplied via:					
- Basic Line Module	A	558	702	903	990
- Active Line Module	A	502	632	808	891
- Base-load current $I_{L\,DC}$ 3) when supplied via:					
- Basic Line Module	A	544	683	870	948
- Active Line Module	A	489	616	781	870
- Base-load current $I_{H\,DC}$ 4) when supplied via:					
- Basic Line Module	A	496	627	795	885
- Active Line Module	A	446	565	732	808
Supply voltages					
- DC link voltage	V_{DC}	675 ... 1035			
- Electronics power supply	V_{DC}	24 (20.4 ... 28.8)			
- Output voltage	V_{ACrms}	0 ... 0.75 x DC link voltage			
Current consumption (1 AC 230 V)	A	0.6	0.6	0.6	0.6
Current consumption of the electronics (24 V DC)	A	1.5	1.5	1.5	1.5
DC link capacitance	µF	9670	9670	10500	10500
Pulse frequency					
- rated frequency	kHz	1.25	1.25	1.25	1.25
- pulse frequency, max.					
- without current derating	kHz	1.25	1.25	1.25	1.25
- with current derating	kHz	7.5	7.5	7.5	7.5
Power loss, max., at 50 Hz 690 V 5)					
- <IP55:					
- dissipated to the coolant	kW	5.3	5.5	7.5	8.3
- dissipated to the ambient air	kW	0.4	0.5	0.6	0.7
- IP55:					
- dissipated to the coolant	kW	5.6	5.8	7.9	8.8
- dissipated to the ambient air	kW	0.2	0.2	0.2	0.2
Material of the integrated heat exchanger		Aluminum	Aluminum	Aluminum	Aluminum
Rated flow rate (all degrees of protection)	l/min	16	16	16	16
Pressure drop, typical at the rated flow rate 6)	Pa	150000	150000	150000	150000
Volume of liquid					
- degree of protection <IP55	dm^3	3.3	3.3	3.3	3.3
- degree of protection IP55	dm^3	5.1	5.1	5.1	5.1
Cooling air requirement (degree of protection <IP55)	m^3/s	0.136	0.136	0.136	0.136

Article No.	**6SL3725-**	**1TG34-7AA3**	**1TG35-8AA3**	**1TG37-4AA3**	**1TG38-0AA3** 8)
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	54	54	54	54
Motor connection U2, V2, W2 - Screws - Conductor cross-section, max. (IEC)	 mm^2	 2/M12 4 x 185	 2/M12 4 x 185	 2/M12 4 x 185	 2/M12 4 x 185
Cable length, max. 7) - shielded - unshielded	 m m	 300 450	 300 450	 300 450	 300 450
PE/GND connection - Busbar cross-section - Conductor cross-section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240			
Degree of protection (standard version)		IP21	IP21	IP21	IP21
Dimensions (standard version) - Width - Height - Depth	 mm mm mm	 400 2200 600	 400 2200 600	 400 2200 600	 400 2200 600
Weight, approx. (standard version)	kg	350	350	350	350
Frame size		HXL	HXL	HXL	HXL
Maximum short-circuit current I_{CC} acc. to IEC	kA	84	84	100	100

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

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

3) The base-load current I_L is based on a duty cycle of 110 % for 60 s or 150 % for 10 s with a duty cycle duration of 300 s.

4) The base-load current I_H is based on a duty cycle of 150 % for 60 s or 160 % for 10 s with a duty cycle duration of 300 s.

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

6) This value applies to the water coolant option; for other coolant types, see Chapter "Coolant".

7) Total of all motor cables. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low Voltage Engineering Manual in the device documentation provided.

8) The device is optimized for a base pulse frequency of 1.25 kHz, for an increased pulse frequency – or for certain overloads the derating factor is higher than that for the device with Article number 6SL3725-1TG38-1AA3.

Table 6- 38 Technical specifications for Motor Modules, line voltage 500 ... 690 V 3 AC, DC link voltage 675 ... 1035 V DC, Part III

Article No.	**6SL3725-**	**1TG38-1AA3**	**1TG41-0AA3**	**1TG41-3AA3**	**1TG41-6AA3**
Type rating					
- for I_L (50 Hz 690 V) [1]	kW	800	1000	1200	1500
- for I_H (50 Hz 690 V) [1]	kW	710	900	1000	1260
- for I_L (50 Hz 500 V) [1]	kW	560	710	900	1000
- for I_H (50 Hz 500 V) [1]	kW	560	630	800	900
- for I_L (60 Hz 575 V) [2]	hp	800	1000	1250	1500
- for 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 [3]	A	790	1000	1230	1500
- Base-load current I_H [4]	A	724	917	1136	1284
- Maximum current $I_{max\,A}$	A	1185	1500	1845	2055
DC link current					
- Rated current $I_{N\,DC}$ when supplied via:					
- Basic Line Module	A	990	1250	1550	1903
- Active Line Module	A	891	1125	1395	1714
- Base-load current $I_{L\,DC}$ [3] when supplied via:					
- Basic Line Module	A	963	1219	1500	1800
- Active Line Module	A	869	1100	1353	1650
- Base-load current $I_{H\,DC}$ [4] when supplied via:					
- Basic Line Module	A	883	1118	1384	1680
- Active Line Module	A	796	1009	1250	1550
Supply voltages					
- DC link voltage	V_{DC}	675 ... 1035			
- Electronics power supply	V_{DC}	24 (20.4 ... 28.8)			
- Output voltage	V_{ACrms}	0 ... 0.75 x DC link voltage			
Current consumption (1 AC 230 V)	A	0.6	0.6	0.6	0.6
Current consumption of the electronics (24 V DC)	A	1.5	1.5	1.5	1.5
DC link capacitance	µF	14000	16000	19330	21000
Pulse frequency					
- rated frequency	kHz	1.25	1.25	1.25	1.25
- pulse frequency, max.					
- without current derating	kHz	1.25	1.25	1.25	1.25
- with current derating	kHz	7.5	7.5	7.5	7.5
Power loss, max., at 50 Hz 690 V [5]					
- <IP55:					
- dissipated to the coolant	kW	9.0	10.0	12.9	17.1
- dissipated to the ambient air	kW	1.1	1.2	1.4	1.6
- IP55:					
- dissipated to the coolant	kW	9.8	11.2	14.0	18.4
- dissipated to the ambient air	kW	0.3	0.3	0.3	0.3
Material of the integrated heat exchanger		Aluminum	Aluminum	Aluminum	Aluminum
Rated flow rate (all degrees of protection)	l/min	27	27	27	27
Pressure drop, typical at the rated flow rate [6]	Pa	150000	150000	150000	150000
Volume of liquid					
- degree of protection <IP55	dm^3	5.2	5.2	5.2	5.2
- degree of protection IP55	dm^3	7.0	7.0	7.0	7.0
Cooling air requirement (degree of protection <IP55)	m^3/s	0.136	0.136	0.136	0.136
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	56	56	56	56

Article No.	**6SL3725-**	**1TG38-1AA3**	**1TG41-0AA3**	**1TG41-3AA3**	**1TG41-6AA3**
Motor connection U2, V2, W2 - Screws - Conductor cross-section, max. (IEC)	 mm^2	 2/M12 4 x 240	 2/M12 4 x 240	 2/M12 4 x 240	 2/M12 4 x 240
Cable length, max. [7] - shielded - unshielded	 m m	 300 450	 300 450	 300 450	 300 450
PE/GND connection - Busbar cross-section - Conductor cross-section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240			
Degree of protection (standard version)		IP21	IP21	IP21	IP21
Dimensions (standard version) - Width - Height - Depth	 mm mm mm	 600 2200 600	 600 2200 600	 600 2200 600	 600 2200 600
Weight, approx. (standard version)	kg	460	460	460	470
Frame size		JXL	JXL	JXL	JXL
Maximum short-circuit current I_{CC} acc. to IEC	kA	100	100	100	100

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

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

[3] The base-load current I_L is based on a duty cycle of 110 % for 60 s or 150 % for 10 s with a duty cycle duration of 300 s.

[4] The base-load current I_H is based on a duty cycle of 150 % for 60 s or 160 % for 10 s with a duty cycle duration of 300 s.

[5] The specified power loss represents the maximum value at 100 % utilization. The value in normal operation is lower.

[6] This value applies to the water coolant option; for other coolant types, see Chapter "Coolant".

[7] Total of all motor cables. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low Voltage Engineering Manual in the device documentation provided.

Table 6- 39 Technical specifications for Motor Modules, line voltage 500 ... 690 V 3 AC, DC link voltage 675 ... 1035 V DC, Part IV

Article No.	**6SL3725-**	**1TG41-6AP3** [8]			
Type rating					
- for I_L (50 Hz 690 V) [1]	kW	1500			
- for I_H (50 Hz 690 V) [1]	kW	1260			
- for I_L (50 Hz 500 V) [1]	kW	1000			
- for I_H (50 Hz 500 V) [1]	kW	900			
- for I_L (60 Hz 575 V) [2]	hp	1500			
- for I_H (60 Hz 575 V) [2]	hp	1250			
Output current					
- Rated current $I_{N\,A}$	A	1560			
- Base-load current I_L [3]	A	1500			
- Base-load current I_H [4]	A	1370			
- Maximum current $I_{max\,A}$	A	2255			
DC link current					
- Rated current $I_{N\,DC}$ when supplied via:					
- Basic Line Module	A	1903			
- Active Line Module	A	1714			
- Base-load current $I_{L\,DC}$ [3] when supplied via:					
- Basic Line Module	A	1800			
- Active Line Module	A	1650			
- Base-load current $I_{H\,DC}$ [4] when supplied via:					
- Basic Line Module	A	1680			
- Active Line Module	A	1550			
Supply voltages					
- DC link voltage	V_{DC}	675 ... 1035			
- Electronics power supply	V_{DC}	24 (20.4 ... 28.8)			
- Output voltage	V_{ACrms}	0 ... 0.75 x DC link voltage			
Current consumption (1 AC 230 V)	A	0.6			
Current consumption of the electronics (24 V DC)	A	1.5			
DC link capacitance	µF	21000			
Pulse frequency					
- rated frequency	kHz	1.25			
- pulse frequency, max.					
- without current derating	kHz	1.25			
- with current derating	kHz	7.5			
Power loss, max., at 50 Hz 690 V [5]					
- <IP55:					
- dissipated to the coolant	kW	17.1			
- dissipated to the ambient air	kW	1.6			
- IP55:					
- dissipated to the coolant	kW	18.4			
- dissipated to the ambient air	kW	0.3			
Material of the integrated heat exchanger		Aluminum			
Rated flow rate (all degrees of protection)	l/min	27			
Pressure drop, typical at the rated flow rate [6]	Pa	150000			
Volume of liquid					
- degree of protection <IP55	dm^3	5.2			
- degree of protection IP55	dm^3	7.0			
Cooling air requirement (degree of protection <IP55)	m^3/s	0.136			
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	56			

Article No.	**6SL3725-**	**1TG41-6AP3** [8]			
Motor connection U2, V2, W2 - Screws - Conductor cross-section, max. (IEC)	 mm^2	 2/M12 4 x 240			
Cable length, max. [7] - shielded - unshielded	 m m	 300 450			
PE/GND connection - Busbar cross-section - Conductor cross-section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240			
Degree of protection (standard version)		IP21			
Dimensions (standard version) - Width - Height - Depth	 mm mm mm	 600 2200 600			
Weight, approx. (standard version)	kg	480			
Frame size		JXL			
Maximum short-circuit current I_{CC} acc. to IEC	kA	100			

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

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

3) The base-load current I_L is based on a duty cycle of 110 % for 60 s or 150 % for 10 s with a duty cycle duration of 300 s.

4) The base-load current I_H is based on a duty cycle of 150 % for 60 s or 160 % for 10 s with a duty cycle duration of 300 s.

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

6) This value applies to the water coolant option; for other coolant types, see Chapter "Coolant".

7) Total of all motor cables. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low Voltage Engineering Manual in the device documentation provided.

8) 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.

6.4.5 Overload capability

The Motor Modules Chassis format have an overload reserve (e.g. to handle breakaway torques).

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

For overload, the following precondition applies: The drive 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 drive is operated with its factory-set pulse frequency at output frequencies >10 Hz.

For additional information on the overload capability, see the Low Voltage Configuration Manual and in the SINAMICS S 120 Function Manual Drive Functions.

Low overload

The base load current I_L is based on a duty cycle of 110 % for 60 s or 150 % for 10 s with a duty cycle of 300 s.

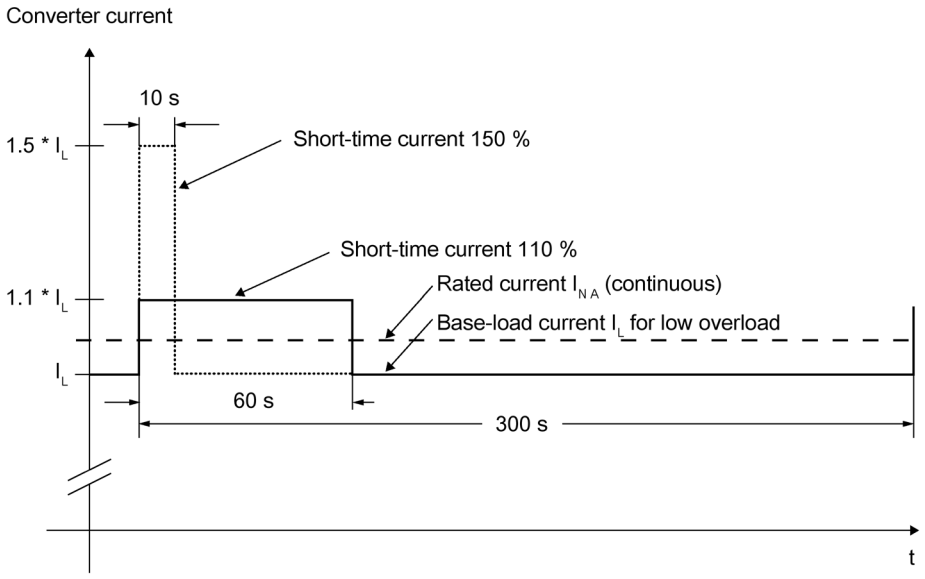


Figure 6-23 Low overload

High overload

The base load current I_H is based on a load cycle of 150% for 60 s or 160 % for 10 s with a load cycle of 300 s.

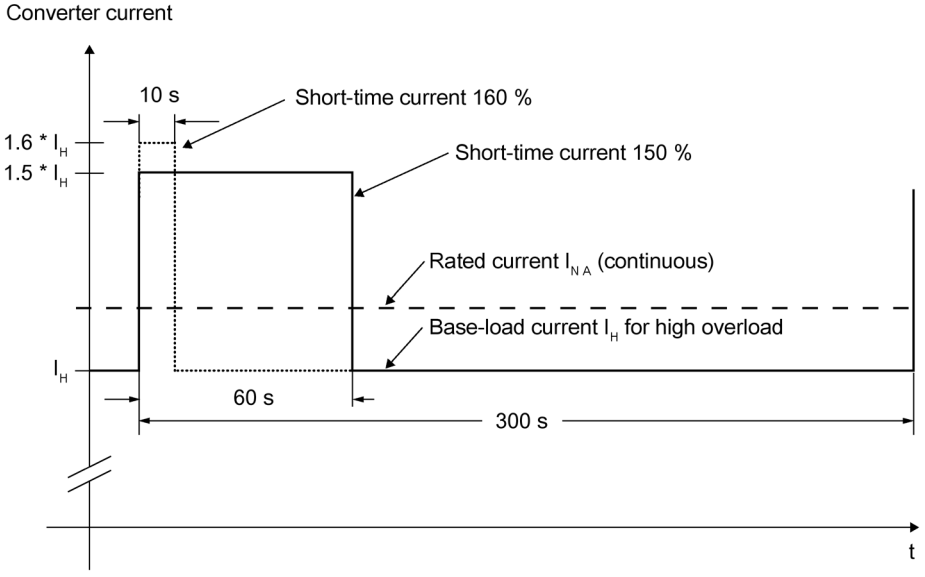


Figure 6-24 High overload

High overload for Motor Module 6SL3725-1TG41-6AP3

This Motor Module is particularly suitable for high breakaway torques in applications such as drilling, mixers, centrifuges and test bays. For this purpose, there is an additional load cycle for output frequencies between 5 Hz and 10 Hz. For output frequencies from 1 Hz to 5 Hz, the short-time current is 1900 A for 5 s.

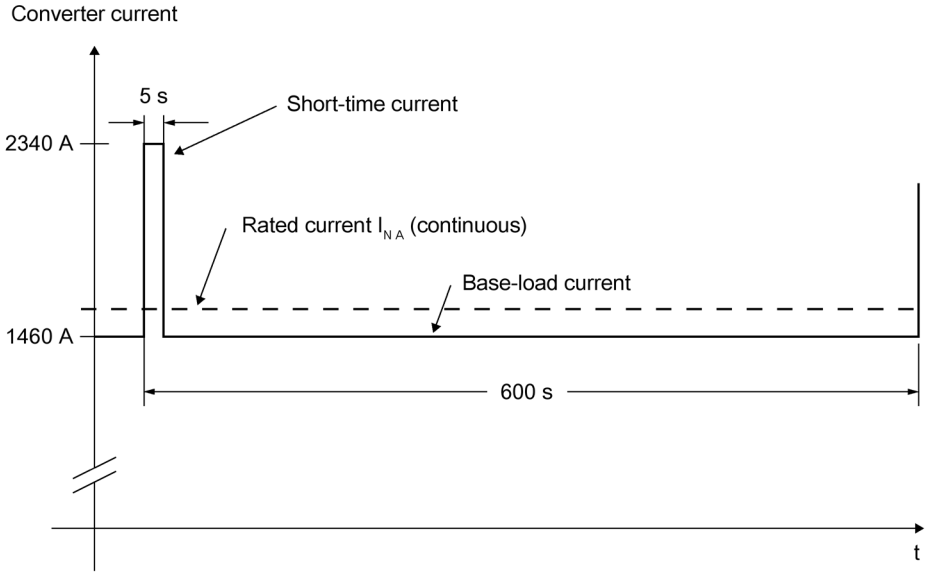


Figure 6-25 High overload for Motor Module 6SL3725-1TG41-6AP3

6.4.6 Current de-rating depending on 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 for Motor Modules.

Table 6- 40 Derating factor of the output current as a function of the pulse frequency for devices with a rated pulse frequency of 2 kHz

Motor Module Article No.	Type rating	Output current at 2 kHz	Derating factor at the pulse frequency				
6SL3725-...	[kW]	[A]	2.5 kHz	4 kHz	5 kHz	7.5 kHz	8 kHz
Supply voltage 510 – 720 V DC							
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 6- 41 Derating factor of the output current as a function of the pulse frequency for devices with a rated pulse frequency of 1.25 kHz

Motor Module Article No.	Type rating	Output current at 1.25 kHz	Derating factor at the pulse frequency					
6SL3725-...	[kW]	[A]	2 kHz	2.5 kHz	4 kHz	5 kHz	7.5 kHz	8 kHz
Supply voltage 510 – 720 V DC								
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 %	55 %	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								
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	82 %	71 %	52%	40 %	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 6SL3725-1TG38-0AA3 is optimized for low overload, with increased pulse frequency, the derating factor is higher than for the device with article number 6SL3725-1TG38-1AA3.

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.

More information is given in the "SINAMICS Low Voltage Engineering Manual", which is included in the device documentation provided.

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 6- 42 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 operating 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, 6SL3725-1TE41-4AS3

[2] As factory setting, the following devices have a current controller cycle of 400 µs and a pulse frequency of 1.25 kHz:
- 510 ... 720 V DC: ≥ 315 kW / 605 A, except 6SL3725-1TE41-4AS3
- 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.

6.5 Motor Modules compact

6.5.1 Description

Note

Additional information

Refer to the layout diagrams (AO) and circuit diagrams (SP) provided in the individual device documentation for the arrangement of components and interfaces and for the wiring.



Figure 6-26 Motor Module compact

A Motor Module is a 3-phase inverter (IGBT technology) that supplies energy to the connected motor. Energy is supplied to the Motor Modules via the DC busbar.

Motor Modules with the supplementary designation compact are installed in a compact control cabinet 400 mm wide. The cable connection compartment is also optimized from a space perspective. The devices therefore differ from the Motor Modules with an identical power rating, installed in a 600 mm-wide cabinet.

Motor Modules compact are available for the following voltages and power ratings:

Line voltage	DC link voltage	Type rating
3 AC 380 ... 480 V	510 ... 720 V DC	560 ... 800 kW
3 AC 500 ... 690 V	675 ... 1035 V DC	800 ... 1500 kW

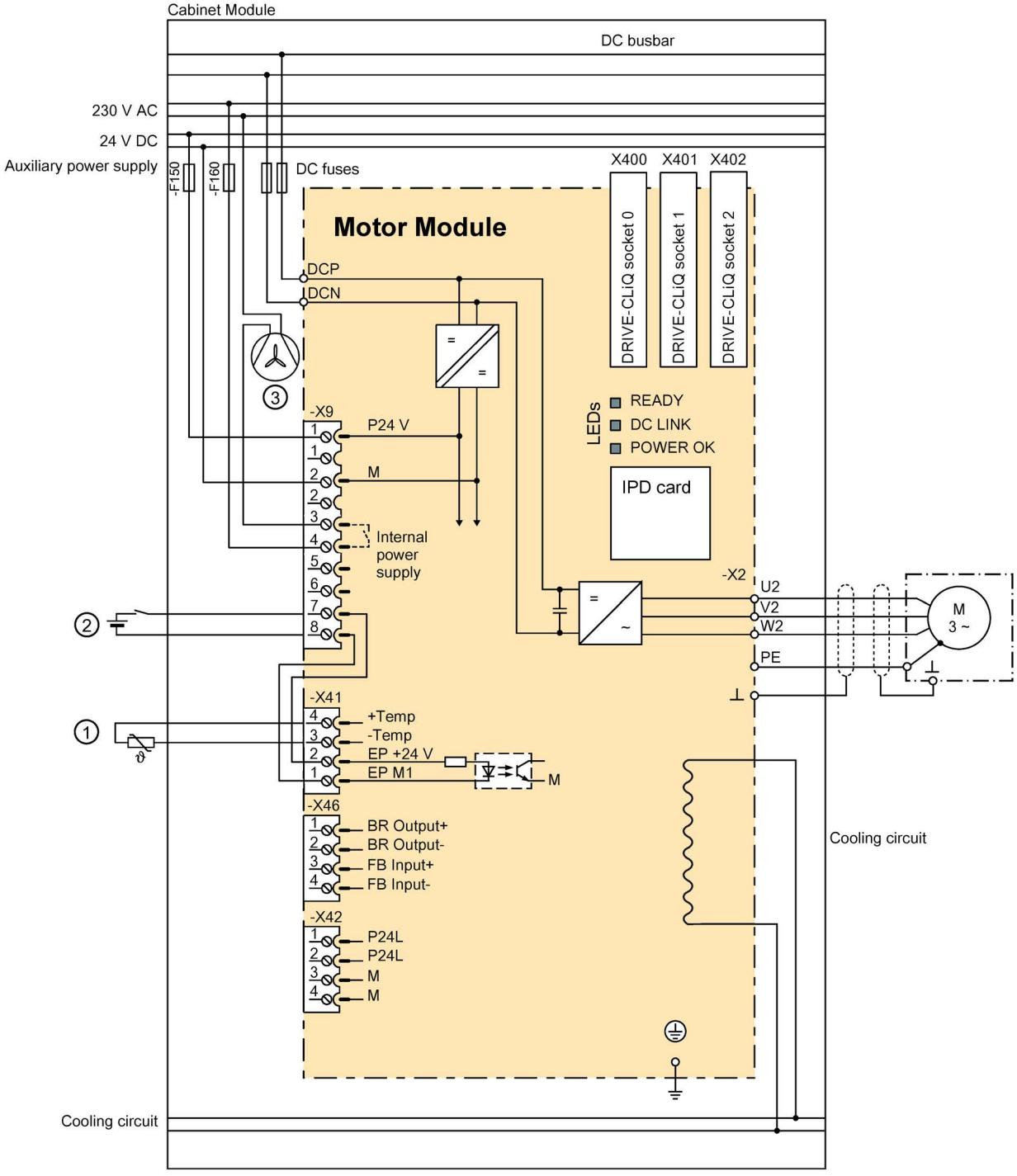
The available shaft output can be increased by connecting up to four Motor Modules in parallel. These modules are operated on one Control Unit and feed one motor.

Note

Parallel connection to a common Control Unit

Note that the Motor Modules connected in parallel are operated on a common Control Unit.

Integration



① Connection of a temperature sensor for motors without a DRIVE-CLiQ interface.
② Required for Safety Integrated
③ Door fan -G160 (IP21, IP23, IP43, IP54) or heat exchanger -E160 (IP55)

Figure 6-27 Connection example of a Motor Module compact

Configuration

Motor Modules contain the following components as standard:

- Retaining device for the DC busbar, including the interface to the DC connections of the Motor Module (the necessary DC busbar must be provided separately as option M80 to M87).
- Connecting bar for the motor cables
- Cable propping bar for the electric power cables
- DRIVE-CLiQ connection (3 DRIVE-CLiQ sockets), without Control Unit
- 4-pole auxiliary power supply, including terminal and cables for looping through to the next Cabinet Module
- PE busbar (60 x 10 mm), including jumper for looping through to the next Cabinet Module.
- EMC-compliant design thanks to additional shielding measures and appropriate laying of cables.

Note

Additional information

The configuration examples of the individual Motor Modules illustrate the positioning of the factory-fitted components. They show the maximum possible configuration of the modules, which contain all options that can be ordered.

Refer to the layout diagrams (AO) provided in the individual device documentation for the precise order-specific location of the components.

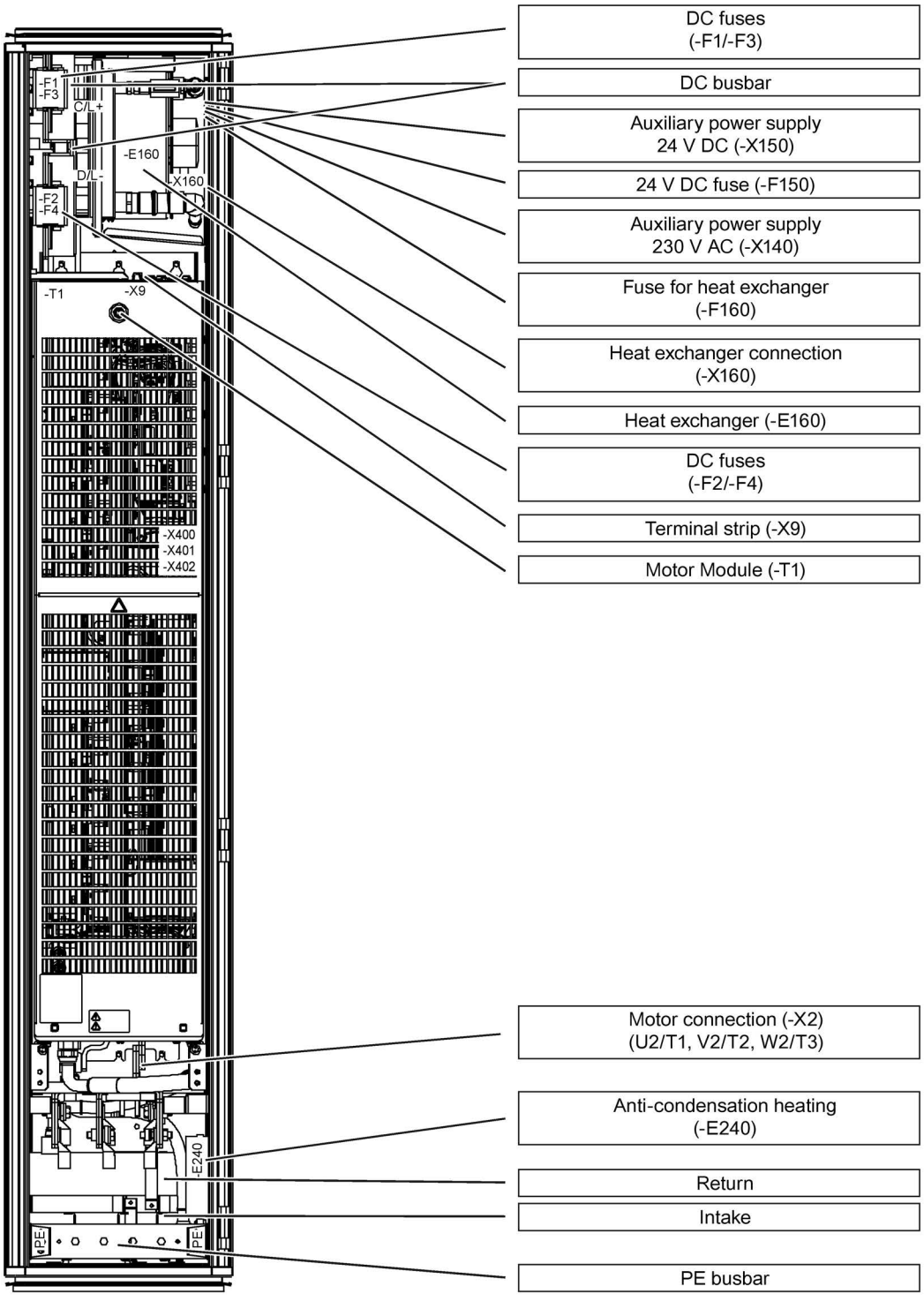


Figure 6-28 Motor Module design compact (without motor-side options) (IP55)

Parallel connection of Motor Modules to increase power rating

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

- Up to four identical Motor Modules can be connected in parallel.
- A common Control Unit is required whenever the modules are connected in parallel.
- The motor supply cables must be the same length (symmetrical design).
- Power must be supplied to the Motor Modules from a common DC busbar.
- A derating factor of 5% must be taken into consideration, regardless of the number of modules connected in parallel.
- For motors with multi-winding systems, carefully observe the notes in the Low Voltage Engineering Manual.
- For motors with a single-winding system, the length of the supply cables must be kept to a minimum. The cable lengths are listed in the following tables.

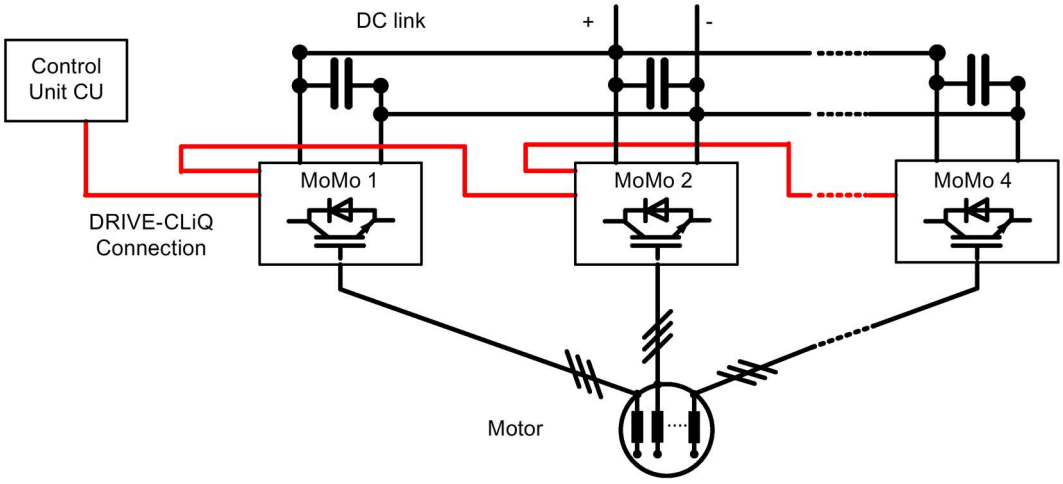


Figure 6-29 Motor with electrically isolated winding systems supplied by a parallel connection of S120 Motor Modules

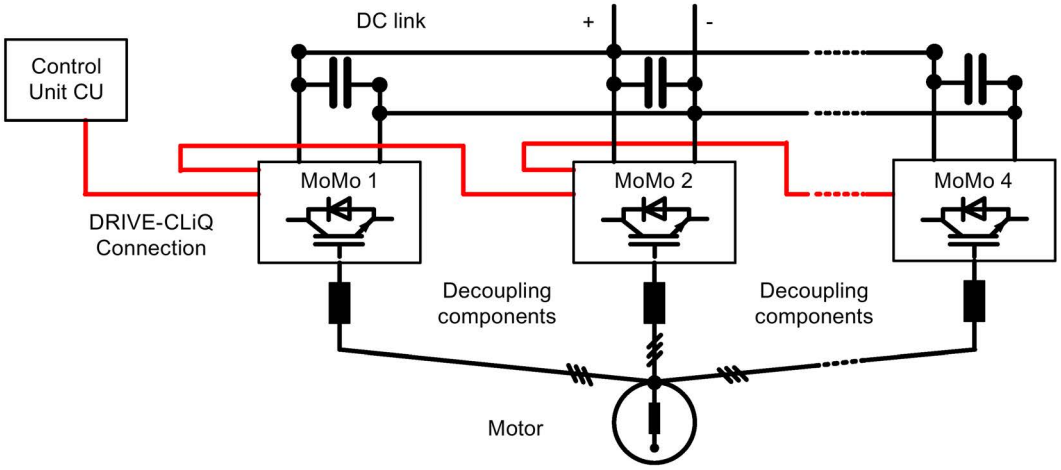


Figure 6-30 Motor with common winding system supplied by a parallel connection of S120 Motor Modules

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

Note

Minimum cable lengths

The minimum cable lengths specified in the table 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. The motor cables of Motor Modules connected in parallel may only be connected with one another at the motor terminal box.
A motor reactor (as shown in the diagram above) must be used if the required cable length cannot be reached in the application.

Table 6- 43 Motor Modules compact, 510 ... 720 V DC

Article No.	Frame size	P_{rated} [kW]	$I_{rated\ rms}$ [A]	Minimum length [m]
6SL3725-1TE41-0MA3	JXL	560	985	8
6SL3725-1TE41-2MA3	JXL	710	1260	6
6SL3725-1TE41-4MA3	JXL	800	1405	5

Table 6- 44 Motor Modules compact, 675 ...1035 V DC

Article No.	Frame size	P_{rated} [kW]	$I_{rated\ rms}$ [A]	Minimum length [m]
6SL3725-1TG38-1MA3	JXL	800	810	15
6SL3725-1TG41-0MA3	JXL	1000	1025	10
6SL3725-1TG41-3MA3	JXL	1200	1270	8
6SL3725-1TG41-6MP3	JXL	1500	1560	7

6.5.2 Interface description

6.5.2.1 General information

This chapter describes only those interfaces in the cabinet unit that require additional connection work by the customer. All other interfaces are pre-wired at the factory and are not designed for customer connections.

Note

Additional information

All connections to be established on the plant side as well as the interfaces for integration into the plant control system are described in the circuit and terminal diagrams, included in the individual device documentation.

6.5.2.2 Control Interface Module

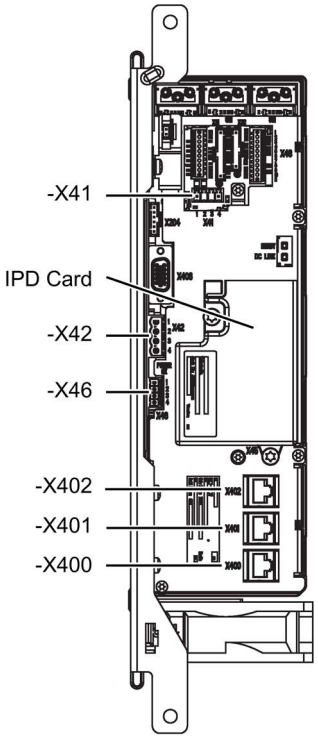
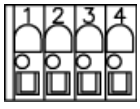


Figure 6-31 Control Interface Module

6.5.2.3 X41 EP terminal / temperature sensor connection

Table 6- 45 Terminal strip X41 EP terminals / temperature sensor connection

Connector	Terminal	Function	Technical data
	1	EP M1 (Enable Pulses)	Supply voltage: 24 V DC (20.4 ... 28.8 V) Current consumption: 10 mA
	2	EP +24 V (Enable Pulses)	The pulse inhibit function is only available when the "Safety Integrated Basic Functions via onboard terminals" is enabled in the software.
	3	- Temp	Temperature sensor connection: KTY84-1C130, PTC, PT100, PT1000, bimetallic temperature switch with NC contact
	4	+ Temp	
Max. connectable cross-section: 2.5 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 at both ends 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

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.

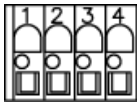
Note

Safety Integrated Function Manual

Detailed and comprehensive instructions and information for handling Safety Integrated functions is given in the associated Function Manual, included in the device documentation provided.

6.5.2.4 X46 Brake control and monitoring

Table 6- 46 Terminal strip X46 brake control and monitoring

Connector	Terminal	Function	Technical data
	1	BR output +	Brake connection Supply voltage: 24 V DC Max. load current: 200 mA
	2	BR output -	
	3	FB input +	Internal feedback signal from the Safe Brake Adapter
	4	FB input -	
Max. connectable cross-section: 2.5 mm^2			

Note

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

⚠WARNING

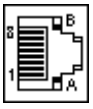
Fire due to overheating when the total length of the connecting cables is exceeded

Excessively long connection cables connected to 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.
- Do not route the connection cable outside the control cabinet or control cabinet group.

6.5.2.5 DRIVE-CLiQ interfaces X400, X401, X402

Table 6- 47 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			

6.5.3 Options

Note

Additional information

The individual options are described in Chapter "Options".

Electrical options

Component	Option
Cabinet anti-condensation heating	L55
Leakage sensor in the converter cabinet	W48

Mechanical options

Component	Option
Base 100 mm high, RAL 9005	M06
Cable-marshaling compartment 200 mm high, RAL 7035	M07
Dust protection packaging	M16
IP23 degree of protection	M23
Side panel (right)	M26
Side panel (left)	M27
Degree of protection IP43	M43
Cable entry via MCT frame	M45
IP54 degree of protection	M54
Degree of protection IP55	M55
Comfort-grip handle with a 3 mm double-bit lock insert	M61
Comfort-grip handle with integrated pushbutton lock insert	M62
Comfort-grip handle for a padlock with pushbutton as lock insert	M63
Marine version	M66
EMC shield rail	M70
Quick-release couplings for water hoses	M72
DC busbar system	M80 ... M87
Crane transport assembly (top-mounted)	M90
Special paint finish for cabinet	Y09
Factory assembly into transport units	Y11

Other options

Component	Option
Generation of a material declaration Green Passport	B50
Individual certificate from the DNV	E51
Individual certificate from the American Bureau of Shipping (ABS)	E61
Individual certificate from the China Classification Society (CCS)	E71
Marking of all control cable conductor ends	M91
Rating plate data in English/French	T58
Rating plate data in English/Spanish	T60
Rating plate data in English/Italian	T80
Rating plate data in English/Russian	T85
Rating plate data in English/Chinese	T91
Single-line labeling strip for system identification, 40 x 80 mm	Y31
Two-line labeling strip for system identification, 40 x 180 mm	Y32
Four-line labeling strip for system identification, 40 x 180 mm	Y33

6.5.4 Technical data

Table 6- 48 Technical specifications of Motor Modules Chassis compact, line voltage 3 AC 380 ... 480 V, DC link voltage 510 ... 720 V DC

Article No.	**6SL3725-**	**1TE41-0MA3**	**1TE41-2MA3**	**1TE41-4MA3**	
Type rating					
- for I_L (50 Hz 400 V) [1]	kW	560	710	800	
- for I_H (50 Hz 400 V) [1]	kW	450	630	710	
- for I_L (60 Hz 460 V) [2]	hp	800	1000	1150	
- for I_H (60 Hz 460 V) [2]	hp	700	900	1000	
Output current					
- Rated current $I_{N\,A}$	A	985	1260	1405	
- Base-load current I_L [3]	A	960	1230	1370	
- Base-load current I_H [4]	A	860	1127	1257	
- Maximum current $I_{max\,A}$	A	1440	1845	2055	
DC link current					
- Rated current $I_{N\,DC}$ when supplied via:					
- Basic Line Module	A	1202	1512	1714	
- Active Line Module	A	1080	1361	1544	
- Base-load current $I_{L\,DC}$ [3] when supplied via:					
- Basic Line Module	A	1170	1474	1670	
- Active Line Module	A	1051	1326	1500	
- Base-load current $I_{H\,DC}$ [4] when supplied via:					
- Basic Line Module	A	1048	1345	1532	
- Active Line Module	A	942	1211	1377	
Supply voltages					
- DC link voltage	V_{DC}	510 ... 720			
- Electronics power supply	V_{DC}	24 (20.4 ... 28.8)			
- Output voltage	V_{ACrms}	0 ... 0.75 x DC link voltage			
Current consumption (1 AC 230 V)	A	0.6	0.6	0.6	
Current consumption of the electronics (24 V DC)	A	1.5	1.5	1.5	
DC link capacitance	µF	21000	29000	29000	
Pulse frequency					
- rated frequency	kHz	1.25	1.25	1.25	
- pulse frequency, max.					
- without current derating	kHz	1.25	1.25	1.25	
- with current derating	kHz	8	8	8	
Power loss, max., at 50 Hz 400 V [5]					
- <IP55:					
- dissipated to the coolant	kW	7.5	8.6	9.5	
- dissipated to the ambient air	kW	1.0	1.3	1.5	
- IP55:					
- dissipated to the coolant	kW	8.3	9.6	10.7	
- dissipated to the ambient air	kW	0.2	0.3	0.3	
Material of the integrated heat exchanger		Aluminum	Aluminum	Aluminum	
Rated flow rate (all degrees of protection)	l/min	27	27	27	
Pressure drop, typical at the rated flow rate [6]	Pa	150000	150000	150000	
Volume of liquid					
- degree of protection <IP55	dm^3	5.2	5.2	5.2	
- degree of protection IP55	dm^3	7.0	7.0	7.0	
Cooling air requirement (degree of protection <IP55)	m^3/s	0.136	0.136	0.136	

Article No.	**6SL3725-**	**1TE41-0MA3**	**1TE41-2MA3**	**1TE41-4MA3**	
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	56	56	56	
Motor connection U2, V2, W2 [7] - Screws - Conductor cross-section, max. (IEC)	 mm^2	 10/M12 10 x 95	 10/M12 10 x 95	 10/M12 10 x 95	
Cable length, max. [8] - shielded - unshielded	 m m	 300 450	 300 450	 300 450	
PE/GND connection - Busbar cross-section - Conductor cross-section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240			
Degree of protection (standard version)		IP21	IP21	IP21	
Dimensions (standard version) - Width - Height - Depth	 mm mm mm	 400 2200 600	 400 2200 600	 400 2200 600	
Weight, approx. (standard version)	kg	440	440	440	
Frame size		JXL	JXL	JXL	
Maximum short-circuit current I_{CC} acc. to IEC	kA	84	100	100	

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

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

3) The base-load current I_L is based on a duty cycle of 110 % for 60 s or 150 % for 10 s with a duty cycle duration of 300 s.

4) The base-load current I_H is based on a duty cycle of 150 % for 60 s or 160 % for 10 s with a duty cycle duration of 300 s.

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

6) This value applies to the water coolant option; for other coolant types, see Chapter "Coolant".

7) As a result of the space situation, only flexible, shielded cables with a bending radius <7 x outer diameter can be connected.

8) Total of all motor cables. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low Voltage Engineering Manual in the device documentation provided.

Table 6- 49 Technical data of Motor Modules compact, line voltage 3 AC 500 ... 690 V, DC link voltage 675 ... 1035 V DC

Article No.	**6SL3725-**	**1TG38-1MA3**	**1TG41-0MA3**	**1TG41-3MA3**	**1TG41-6MP3** [9]
Type rating					
- for I_L (50 Hz 690 V) [1]	kW	800	1000	1200	1500
- for I_H (50 Hz 690 V) [1]	kW	710	900	1000	1260
- for I_L (50 Hz 500 V) [1]	kW	560	710	900	1000
- for I_H (50 Hz 500 V) [1]	kW	560	630	800	900
- for I_L (60 Hz 575 V) [2]	hp	800	1000	1250	1500
- for 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 [3]	A	790	1000	1230	1500
- Base-load current I_H [4]	A	724	917	1136	1370
- Maximum current $I_{max\,A}$	A	1185	1500	1845	2250
DC link current					
- Rated current $I_{N\,DC}$ when supplied via:					
- Basic Line Module	A	990	1250	1550	1903
- Active Line Module	A	891	1125	1395	1714
- Base-load current $I_{L\,DC}$ [3] when supplied via:					
- Basic Line Module	A	963	1219	1500	1800
- Active Line Module	A	869	1100	1353	1650
- Base-load current $I_{H\,DC}$ [4] when supplied via:					
- Basic Line Module	A	883	1118	1384	1680
- Active Line Module	A	796	1009	1250	1550
Supply voltages					
- DC link voltage	V_{DC}	675 ... 1035			
- Electronics power supply	V_{DC}	24 (20.4 ... 28.8)			
- Output voltage	V_{ACrms}	0 ... 0.75 x DC link voltage			
Current consumption (1 AC 230 V)	A	0.6	0.6	0.6	0.6
Current consumption of the electronics (24 V DC)	A	1.5	1.5	1.5	1.5
DC link capacitance	µF	14000	16000	19330	21000
Pulse frequency					
- rated frequency	kHz	1.25	1.25	1.25	1.25
- pulse frequency, max.					
- without current derating	kHz	1.25	1.25	1.25	1.25
- with current derating	kHz	7.5	7.5	7.5	7.5
Power loss, max., at 50 Hz 690 V [5]					
- <IP55:					
- dissipated to the coolant	kW	9.0	10.0	12.9	17.1
- dissipated to the ambient air	kW	1.1	1.2	1.4	1.6
- IP55:					
- dissipated to the coolant	kW	9.8	11.2	14.0	18.4
- dissipated to the ambient air	kW	0.3	0.3	0.3	0.3
Material of the integrated heat exchanger		Aluminum	Aluminum	Aluminum	Aluminum
Rated flow rate (all degrees of protection)	l/min	27	27	27	27
Pressure drop, typical at the rated flow rate [6]	Pa	150000	150000	150000	150000
Volume of liquid					
- degree of protection <IP55	dm^3	5.2	5.2	5.2	5.2
- degree of protection IP55	dm^3	7.0	7.0	7.0	7.0
Cooling air requirement (degree of protection <IP55)	m^3/s	0.136	0.136	0.136	0.136
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	56	56	56	56

Article No.	**6SL3725-**	**1TG38-1MA3**	**1TG41-0MA3**	**1TG41-3MA3**	**1TG41-6MP3** [9]
Motor connection U2, V2, W2 [7] - Screws - Conductor cross-section, max. (IEC)	 mm^2	 10/M12 10 x 95	 10/M12 10 x 95	 10/M12 10 x 95	 10/M12 10 x 95
Cable length, max. [8] - shielded - unshielded	 m m	 300 450	 300 450	 300 450	 300 450
PE/GND connection - Busbar cross-section - Conductor cross-section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240			
Degree of protection (standard version)		IP21	IP21	IP21	IP21
Dimensions (standard version) - Width - Height - Depth	 mm mm mm	 400 2200 600	 400 2200 600	 400 2200 600	 400 2200 600
Weight, approx. (standard version)	kg	440	440	440	460
Frame size		JXL	JXL	JXL	JXL
Maximum short-circuit current I_{CC} acc. to IEC	kA	100	100	100	100

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

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

3) The base-load current I_L is based on a duty cycle of 110 % for 60 s or 150 % for 10 s with a duty cycle duration of 300 s.

4) The base-load current I_H is based on a duty cycle of 150 % for 60 s or 160 % for 10 s with a duty cycle duration of 300 s.

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

6) This value applies to the water coolant option; for other coolant types, see Chapter "Coolant".

7) As a result of the space situation, only flexible, shielded cables with a bending radius <7 x outer diameter can be connected.

8) Total of all motor cables. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low Voltage Engineering Manual in the device documentation provided.

9) 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.

6.5.5 Overload capability

The Motor Modules Chassis format have an overload reserve (e.g. to handle breakaway torques).

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

For overload, the following precondition applies: The drive 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 drive is operated with its factory-set pulse frequency at output frequencies >10 Hz.

For additional information on the overload capability, see the Low Voltage Configuration Manual and in the SINAMICS S 120 Function Manual Drive Functions.

Low overload

The base load current I_L is based on a duty cycle of 110 % for 60 s or 150 % for 10 s with a duty cycle of 300 s.

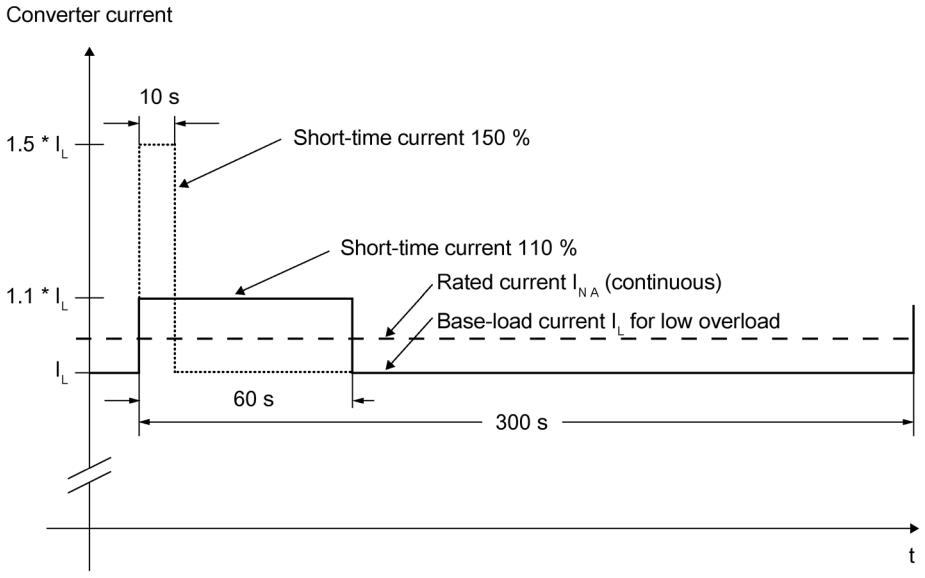


Figure 6-32 Low overload

High overload

The base load current I_H is based on a load cycle of 150% for 60 s or 160 % for 10 s with a load cycle of 300 s.

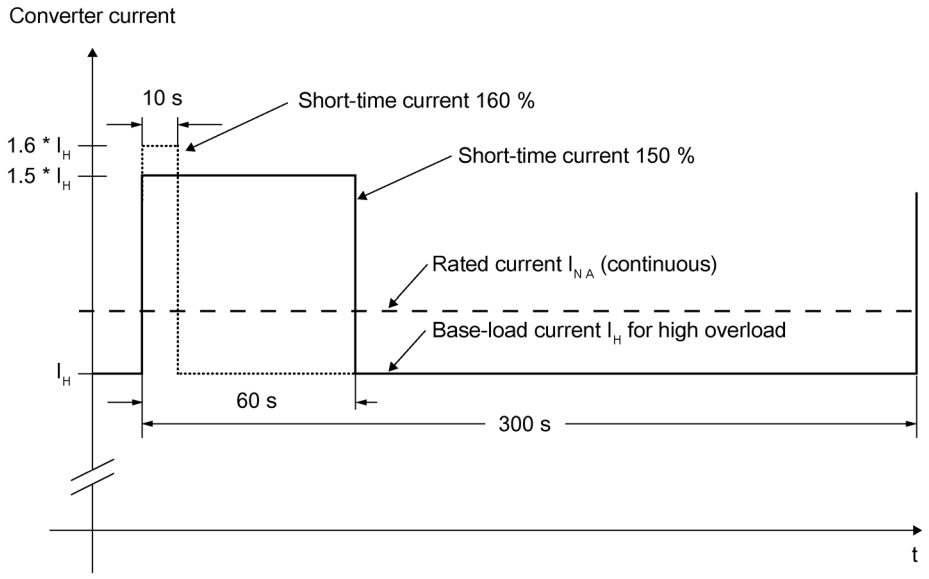


Figure 6-33 High overload

High overload for Motor Modules compact 6SL3725-1TG41-6MP3

This Motor Module compact is particularly suitable for high breakaway torques in applications such as drilling, mixers, centrifuges and test bays. For this purpose, there is an additional load cycle for output frequencies between 5 Hz and 10 Hz. For output frequencies from 1 Hz to 5 Hz, the short-time current is 1900 A for 5 s.

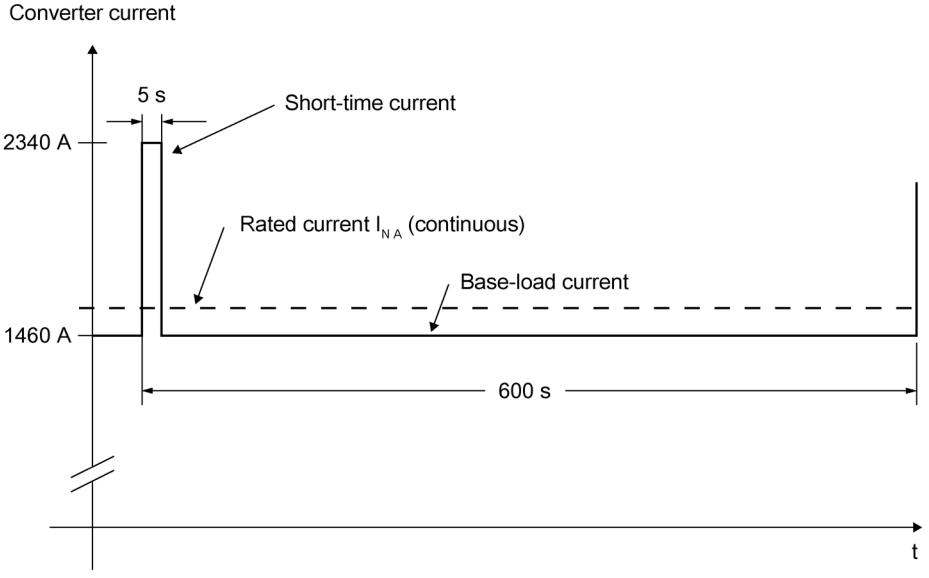


Figure 6-34 High overload for Motor Modules compact 6SL3725-1TG41-6MP3

6.5.6 Current de-rating depending on 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 for Motor Modules compact.

Table 6- 50 Derating factor of the output current as a function of the pulse frequency for devices with a rated pulse frequency of 1.25 kHz

Motor Module Article No.	Type rating	Output current at 1.25 kHz	Derating factor at the pulse frequency					
6SL3725-...	[kW]	[A]	2 kHz	2.5 kHz	4 kHz	5 kHz	7.5 kHz	8 kHz
Supply voltage 510 – 720 V DC								
1TE41-0MA3	560	985	92 %	87 %	70 %	60 %	50 %	47 %
1TE41-2MA3	710	1260	97 %	95 %	74 %	60 %	50 %	47 %
1TE41-4MA3	800	1405	97 %	95 %	74 %	60 %	50 %	47 %
Supply voltage 675 – 1035 V DC								
1TG38-1MA3	800	810	97 %	95 %	71 %	55 %	35 %	--
1TG41-0MA3	1000	1025	91 %	86 %	64 %	50 %	30 %	--
1TG41-3MA3	1200	1270	87 %	79 %	55 %	40 %	25 %	--
1TG41-6MP3	1500	1560	87 %	79 %	55 %	40 %	25 %	--

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.

More information is given in the "SINAMICS Low Voltage Engineering Manual", which is included in the device documentation provided.

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 6- 51 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 operating mode
400 µs	1.25 kHz 2.50 kHz 5.00 kHz 7.50 kHz	104 Hz 208 Hz 416 Hz 550 Hz [1]	104 Hz 208 Hz 300 Hz 300 Hz	- - - -

[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 Engineering Manual for current controller clock cycles deviating from the factory setting.

6.6 Heat Exchanger Modules

6.6.1 Description

Note

Additional information

Refer to the layout diagrams (AO) and circuit diagrams (SP) provided in the individual device documentation for the arrangement of components and interfaces and for the wiring.



Figure 6-35 Heat Exchanger Modules, examples with some additional options

Heat Exchanger Modules are used to dissipate the power loss from the converter. They comprise a converter-side de-ionized water circuit and a plant-side raw water circuit.

The hot de-ionized water in the converter-side de-ionized water circuit flows through a low-maintenance circulating pump into the water/water plate-type heat exchanger. This is manufactured out of stainless steel and connected to the raw water circuit on the plant side. The de-ionized water is cooled there by the raw water of the plant-side circuit and flows back into the converter.

To avoid condensation at excessively low raw water temperatures, a 3-way valve for controlling the water temperature is installed as standard in the de-ionized water intake.

The Heat Exchanger Modules are controlled and monitored in the external CU320-2 Control Unit or CU310-2 Control Unit (as of V1.2 on request) as "Technology Extension HEM".

As a minimum, the Heat Exchanger Module contains the following components:

- 1 pump
- 1 plate-type heat exchanger
- 1 3-way valve
- Filter, expansion tank, vent, safety valve, pressure sensors, pressure display, temperature sensor, TM31 Terminal Module.

Heat Exchanger Modules are available for the following voltages and cooling capacities:

Line voltage	Cooling capacity
3 AC 380 ... 415 V	32 ... 120 kW
3 AC 500 ... 690 V	32 ... 120 kW

Note

Voltage adaptation for the pump

For Heat Exchanger Modules for line voltages of 3 AC 500 ... 690 V, the voltage is adapted to the 3 AC 400 V supply voltage of the pump using a transformer.

SINAMICS Technology Extension HEM

The software and the Function Manual for the SINAMICS HEM V1.2 can be found at the following address:

SINAMICS Technology Extension HEM (Heat Exchanger Module) V1.2 (https://support.industry.siemens.com/cs/ww/de/view/109772200)

Licensing the Technology Extension HEM is also described under the following link: Licensing (https://support.industry.siemens.com/cs/ww/en/view/109782608).

Integration

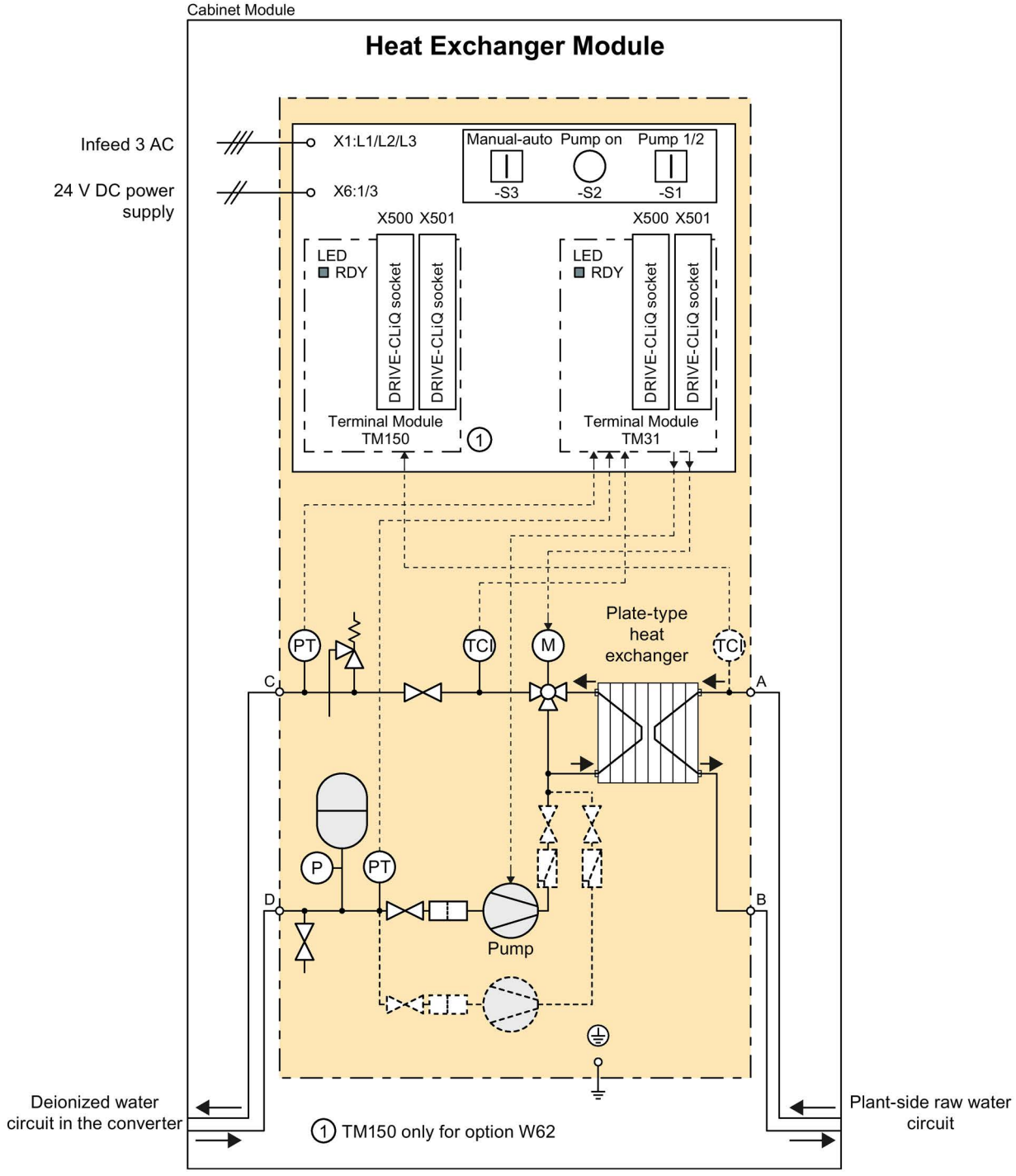


Figure 6-36 Connection example for the Heat Exchanger Module

Configuration

Note

Additional information

The configuration examples of the individual Heat Exchanger Modules are used to illustrate the location of the factory-fitted components. They show the maximum possible configuration of the modules, which contain all options that can be ordered.

Refer to the layout diagrams (AO) provided in the individual device documentation for the precise order-specific location of the components.

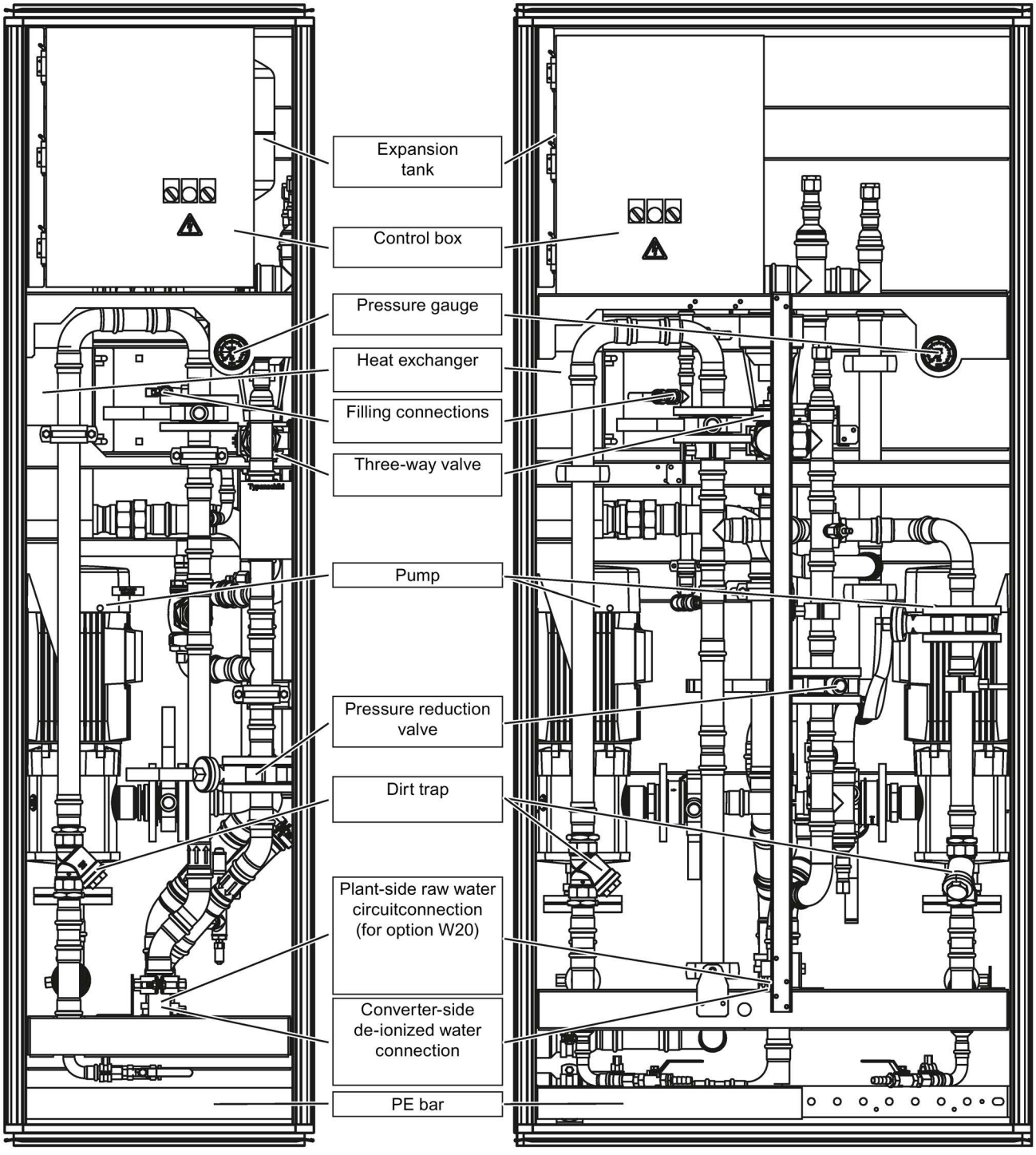


Figure 6-37 Configuration example, Heat Exchanger Modules, examples with some additional options

6.6.2 Electrical interfaces

6.6.2.1 General information

This chapter describes only those interfaces in the cabinet unit that require additional connection work by the customer. All other interfaces are pre-wired at the factory and are not designed for customer connections.

Note

Additional information

All connections to be established on the plant side as well as the interfaces for integration into the plant control system are described in the circuit and terminal diagrams, included in the individual device documentation.

6.6.2.2 Overview of the electrical interfaces

The main components and interfaces of the control box in the Heat Exchanger Module are shown in the following diagram.

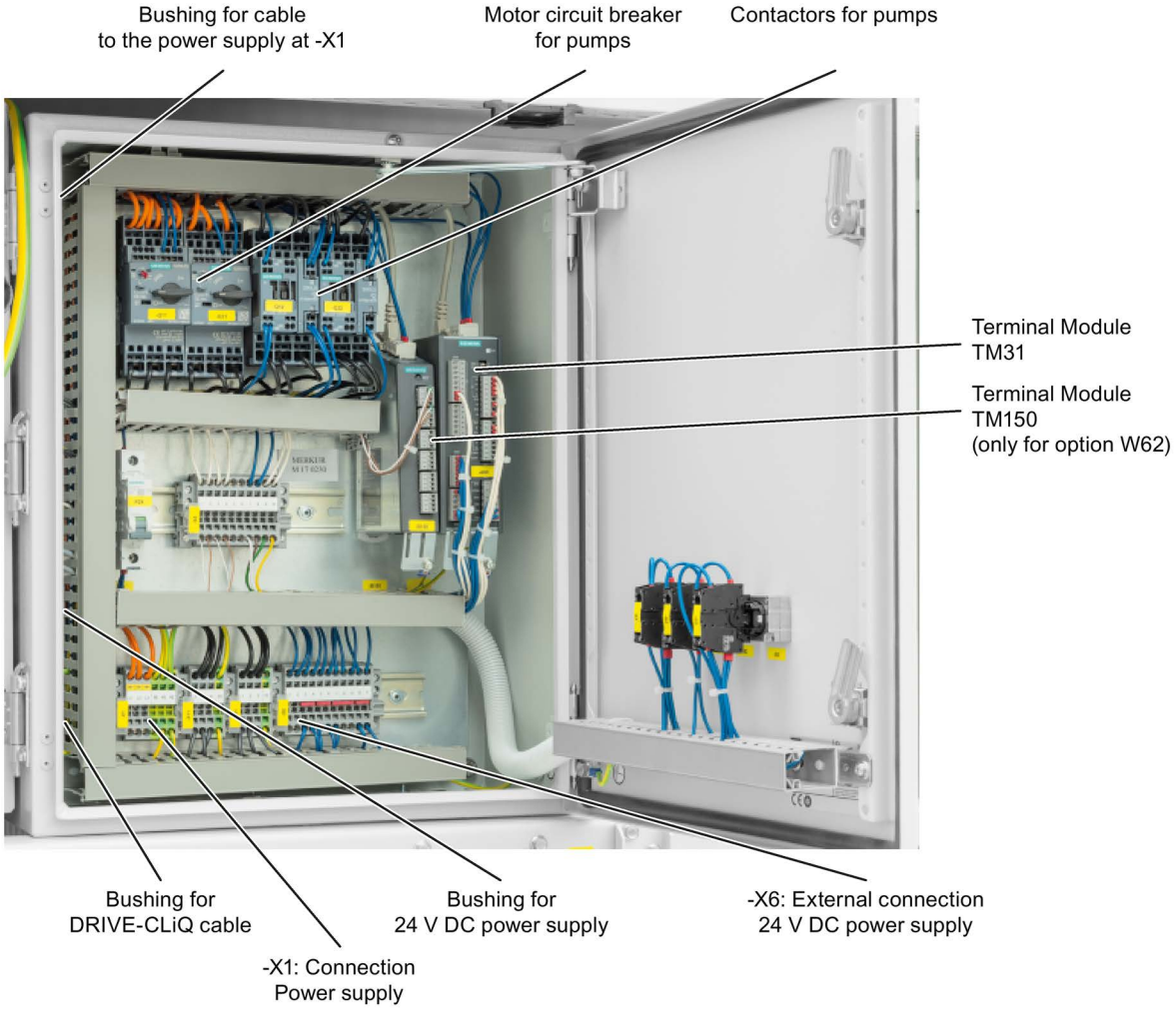


Figure 6-38 Heat Exchanger Module - overview of the components and interfaces in the control box

The control box can be swiveled to the left so that it is easier to introduce the external power supply cables into the cable glands. To do this, 2 screws must be released in the upper part of the control box.

6.6.2.3 X1 - power supply

Table 6- 52 Terminal strip X1

Terminal	Function	Technical data
L1	Phase L1	Voltage: • 3 AC 380 V -10 % ... 3 AC 415 V +10 % or • 3 AC 500 V -10 % ... 3 AC 690 V +10 % Current consumption: See Technical specifications
L2	Phase L2	
L3	Phase L3	
PE	PE connection	
max. connection cross-section: 4 mm² recommended cross-section: 2.5 mm²		

Note

Tripping characteristic of the cable protection circuit breaker

For the cable protection of the power supply, note that the pump starting current can briefly be up to 20x of the operating current.

6.6.2.4 X6 - external 24 V DC power supply

Table 6- 53 Terminal strip X6

Terminal	Function	Technical data
1	M	Voltage: 24 V DC (20.4 to 28.8 V) Current consumption: max. 1.0 A
3	+24 V	
PE	PE connection	
max. connection cross-section: 4 mm² recommended cross-section: 2.5 mm²		

The maximum cable length that can be connected is 10 m.

NOTICE

Inadmissible equalization currents as a result of potential differences when using different power supply sources

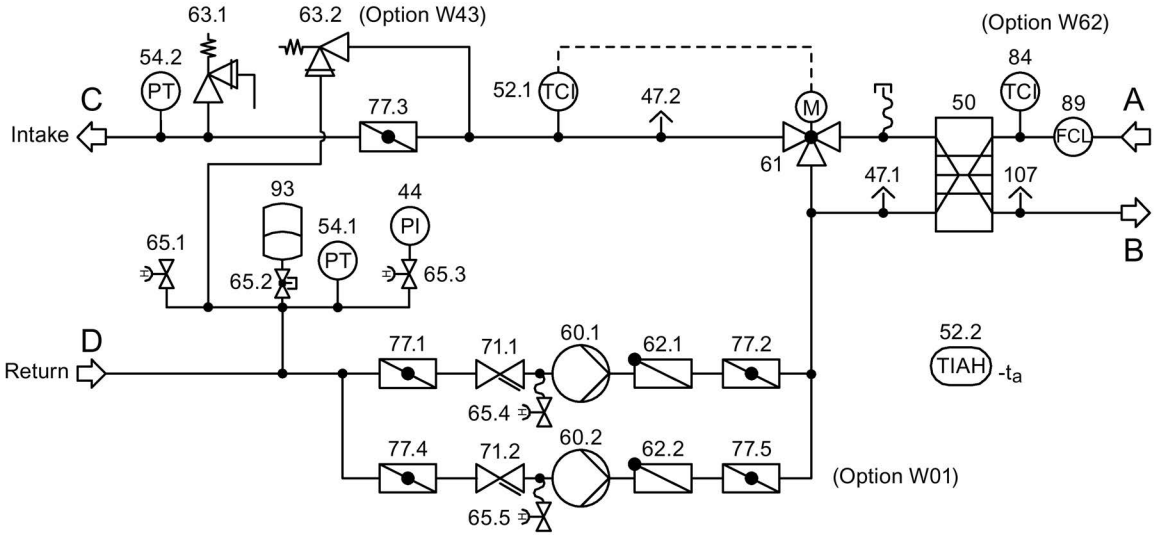
Using different power sources for the Heat Exchanger Module and the other Cabinet Modules can result in potential differences and inadmissible equalizing currents flowing through the DRIVE-CLiQ interface of the TM31 Terminal Module.

- For the external 24 V DC power supply of the control box, use the same power supply that is used for the other Cabinet Modules in the same DRIVE-CLiQ line.

6.6.3 Interfaces in the cooling circuit

6.6.3.1 Flow diagram of the cooling circuit

The components of the cooling circuit in the Heat Exchanger Module are shown in the following diagram.



A	Intake, plant-side raw water circuit	63.1	Safety valve in the intake of the converter-side de-ionized water circuit
B	Return, plant-side raw water circuit	63.2	Release valve (only for option W43)
C	Intake, converter-side de-ionized water circuit	65.1	Filling connections
D	Return, converter-side de-ionized water circuit	65.2	Shutoff valve of the expansion tank
44	Pressure gauge for the system pressure	65.3	Shutoff valve of the pressure gauge
47.1	Vent/deaerator	65.4	Shutoff valve for filling/emptying pump 1
47.2	Vent/deaerator	65.5	Shutoff valve for filling/emptying pump 2 (only for option W01)
50	Plate-type heat exchanger	71.1	Dirt trap, pump 1
52.1	Temperature sensor in the intake of the converter-side de-ionized water circuit	71.2	Dirt trap, pump 2 (only for option W01)
52.2	Temperature sensor in the electrical cabinet	77.1	Shutoff valve for maintaining pump 1
54.1	Pressure sensor in the return line of the converter-side de-ionized water circuit	77.2	Shutoff valve for maintaining pump 1
54.2	Pressure sensor in the intake line of the converter-side de-ionized water circuit	77.3	Ball valve to reduce the pressure at the intake of the converter de-ionized water circuit
60.1	Pump 1	77.4	Shutoff valve for maintaining pump 2 (only for option W01)
60.2	Pump 2 (only for option W01)	77.5	Shutoff valve for maintaining pump 2 (only for option W01)
61	Three-way valve with actuator drive	84	Temperature sensor in the intake line of the plant-side raw-water circuit (only for option W62)
62.1	Non-return valve	89	Flow monitor in the intake line of the plant-side raw-water circuit (only for option W62)
62.2	Non-return valve (only for option W01)	93	Expansion tank
		107	Vent, plant-side raw water circuit

Figure 6-39 Flow diagram of the cooling circuit

6.6.3.2 Layout of the components

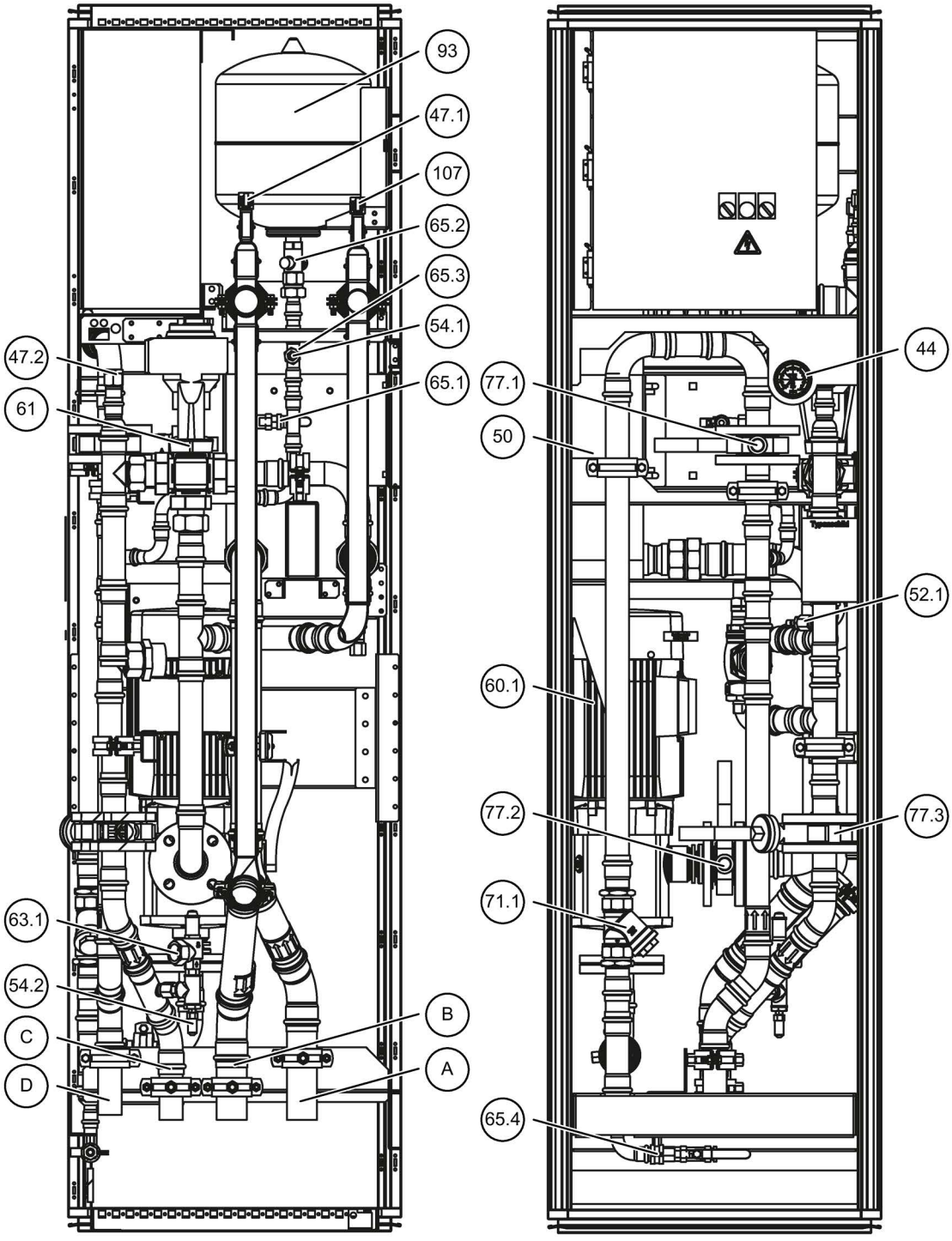


Figure 6-40 Component arrangement, Heat Exchanger Module with 1 pump

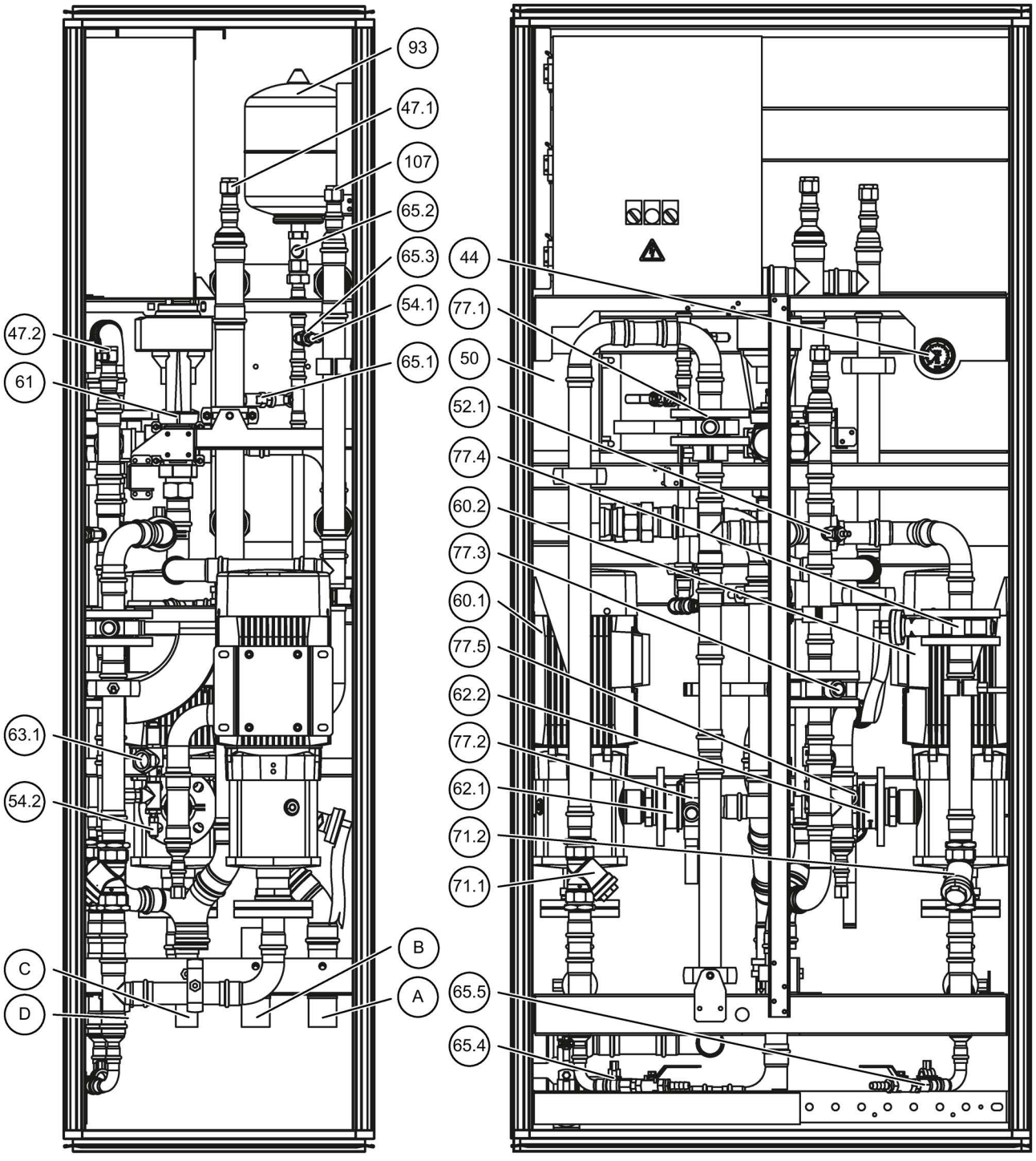


Figure 6-41 Component arrangement, Heat Exchanger Module, partially redundant with 2 pumps (option W01)

6.6.4 Coolant connections

6.6.4.1 Overview of connections

The coolant connections for the Heat Exchanger Module are shown in the following diagram.

Note

The raw water circuit on the plant side shown is implemented according to option W20 (raw water connection from below).

The converter-side de-ionized water circuit shown is implemented according to option W36 (Heat Exchanger Module for installation on the right).

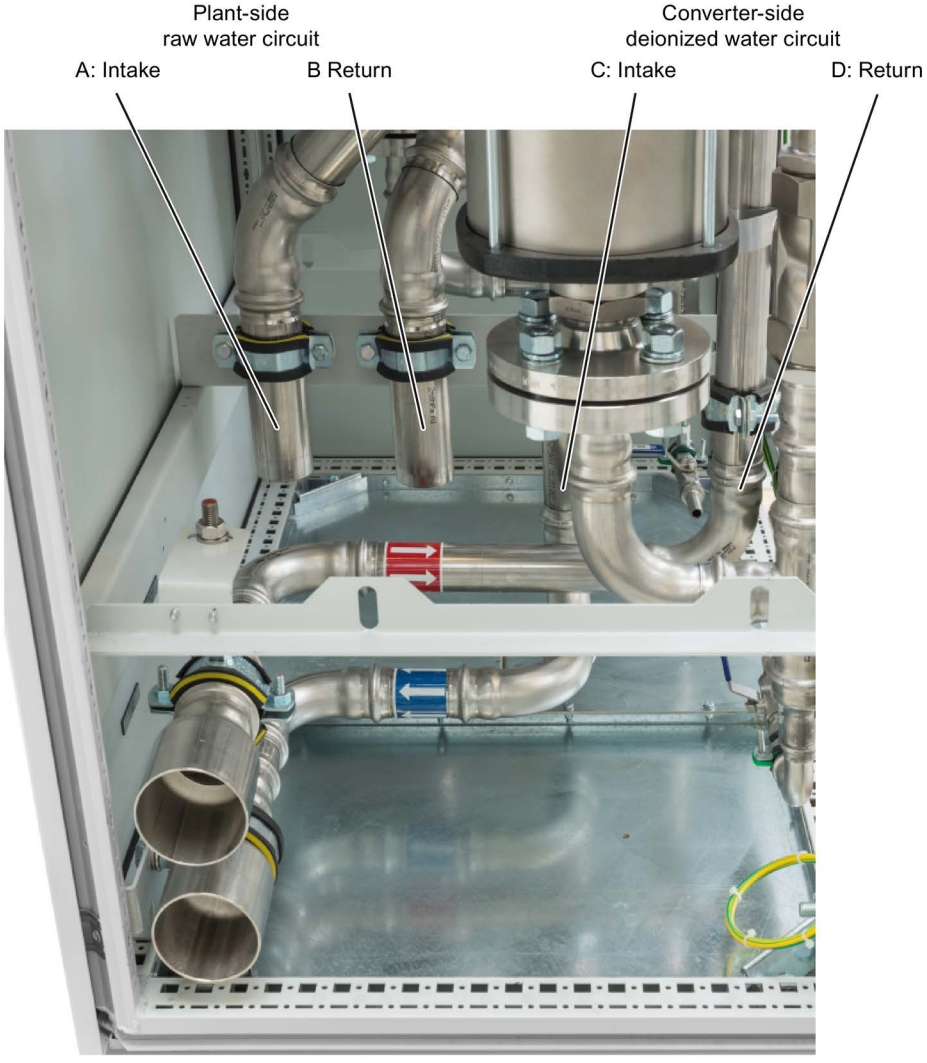


Figure 6-42 Heat Exchanger Module - coolant connections (using option W20, raw water connection from below and option W36, Heat Exchanger Module for installation on the right)

6.6.4.2 Connection of the converter-side deionized water circuit

The converter-side de-ionized water circuit is connected to the collecting pipes of the adjacent Cabinet Module using permanently installed pipes:

- When option W34 is ordered, the fixed pipe connections are routed downward to the right-hand side of the Heat Exchanger Module.
  The Heat Exchanger Module can therefore be installed at the left-hand end of the drive line-up and connected to the de-ionized water circuit on the converter side.
- When option W36 is ordered, the fixed pipe connections are routed downward to the left-hand side of the Heat Exchanger Module.
  As a consequence, the Heat Exchanger Module can be installed at the right-hand end of the drive line-up and connected to the de-ionized water circuit on the converter side.
- For a transport unit (option Y11), these connections to the de-ionized water circuit on the converter side of the drive line-up are already installed at the factory; when supplied separately, after the cabinet units have been mechanically connected, then they must be connected up on the plant side.

Establishing the connections

Connection with the collecting pipes of the adjacent Cabinet Modules:

1. For this connection, use "COMBI-GRIP" pipe couplings.
   These are pipe couplings that are used to connect pipes manufactured out of different materials (plastic and steel).
   It is important that the pipe couplings are used with the correct alignment, otherwise the connections will not be watertight.

Anchoring ring for the plastic pipe	Anchoring ring for the metal pipe
	

2. Ensure that the support rings are inserted in the connection locations of the collection pipe. Ensure that the support rings are flush with the collection pipe.
3. Insert the pipe couplings into the collecting pipes of the left-hand or right-hand cabinet unit.
4. Move the cabinet units together to the final installation dimension, also see Chapter "Connecting the cooling circuit collecting pipes (Page 64)".
5. Align the individual cabinet units so that they are in a perfectly straight line and at the same height. This may require the use of leveling measures, such as the insertion of spacer plates. Ensure that the water pipes precisely line up axially with one another:

Note

Attach the sealing tape beforehand

Before assembly, the supplied sealing tape from the accessories kit must be attached.

Installing the pipe couplings

1. Shift the pipe couplings so that they are off-centered over the connection points of the collecting pipes.
2. Slide the lower pipe coupling centered over the connection point.
3. Tighten the hexagon socket-head screws of the lower pipe coupling with the tightening torques specified on the pipe couplings.
4. Slide the upper pipe coupling centered over the connection point.
5. Tighten the hexagon socket-head screws of the upper pipe coupling with the tightening torques specified on the pipe couplings.

Connection of the converter-side de-ionized water circuit without option W34 or W36

Without one of the options mentioned above, you must establish the connection of the converter-side de-ionized water circuit between the Heat Exchanger Module and the converter cabinets to be cooled on the plant side.

- The Heat Exchanger Module connections are designed as simple metal pipe ends; the various pipe diameters are listed in the technical data.
- The converter cabinet connections are in the form of simple plastic pipe ends with an outer diameter of 75 mm.

For the connections, you must insert the connecting pipes (suitable for the cooling medium and the plant pressure levels), and connect to the existing connections using the appropriate pipe couplings.

6.6.4.3 Connection of the plant-side raw water circuit

The plant-side raw water circuit is connected at the pipe ends of the Heat Exchanger Module.

The plant-side pipe couplings are not part of the scope of supply.

Establishing the connection

Connection with the coolant connection at the Heat Exchanger Module:

1. For this connection use a connecting pipe and a pipe coupling with the appropriate diameter.
   Data is provided under Technical data.
2. Attach the pipe couplings corresponding to the manufacturer's data.

Establish potential equalization

When installing pipework for the plant-side raw water circuit, ensure that the potential equalization is correct.

6.6.5 Options

Note
Additional information

The individual options are described in Chapter "Options".

Electrical options

Component	Option
Supply voltage for the Heat Exchanger Module, 440 - 480 V/60 Hz	C95
Supply voltage for the Heat Exchanger Module, 500 - 690 V/60 Hz	C97
Cabinet anti-condensation heating	L55
Heat Exchanger Module, partially redundant with 2 pumps	W01
Leakage sensor in the Heat Exchanger Module	W49
Sensors in the raw water circuit on the plant/system side	W62

Mechanical options

Component	Option
Base 100 mm high, RAL 9005	M06
Cable-marshaling compartment 200 mm high, RAL 7035	M07
Side panel (right)	M26
Side panel (left)	M27
Comfort-grip handle with a 3 mm double-bit lock insert	M61
Comfort-grip handle with integrated pushbutton lock insert	M62
Comfort-grip handle for a padlock with pushbutton as lock insert	M63
Marine version	M66
EMC shield rail	M70
Crane transport assembly (top-mounted)	M90
Insulation of the pipes in the raw water circuit and the heat exchanger	W10
Raw water connection from the bottom	W20
Raw water connection from the side	W25
Heat Exchanger Module for installation on left	W34
Heat Exchanger Module for installation on right	W36
Release valve in the de-ionized water circuit	W43
Special paint finish for cabinet	Y09

Other options

Component	Option
Generation of a material declaration Green Passport	B50
Individual certificate from the DNV	E51
Individual certificate from the American Bureau of Shipping (ABS)	E61
Individual certificate from the China Classification Society (CCS)	E71
Rating plate data in English/French	T58
Rating plate data in English/Spanish	T60
Rating plate data in English/Italian	T80
Rating plate data in English/Russian	T85
Rating plate data in English/Chinese	T91
Single-line labeling strip for system identification, 40 x 80 mm	Y31
Two-line labeling strip for system identification, 40 x 180 mm	Y32
Four-line labeling strip for system identification, 40 x 180 mm	Y33

6.6.6 Technical data

Table 6- 54 Technical data of the Heat Exchanger Modules, line voltage 3 AC 380 ... 415 V

Article No.	6SL3705-	0RE23-2AA5	0RE24-8AA5	0RE27-2AA5	0RE31-1AA5
Deionized water circuit in the converter					
Cooling power	kW	32	48	72	120
Intake temperature - min. - max: - <IP55 (drive line-up) - IP55 (drive line-up)	 °C °C °C	 1) 45 40	 1) 45 40	 1) 45 40	 1) 45 40
Intake pressure - min - max	 bar bar	 1.7 6.0	 1.7 6.0	 1.7 6.0	 1.7 6.0
Rated flow rate 2)	l/min	88	132	197	267
Volume of liquid	dm^3	20.4	21.4	30.5	32.5
Connection, intake/return - outer diameter x wall thickness	 mm	 76.1 x 2.0	 76.1 x 2.0	 76.1 x 2.0	 76.1 x 2.0
Plant-side raw water circuit					
Intake temperature - min. - max: - <IP55 - IP55	 °C °C °C	 5 3) 38 33	 5 3) 38 33	 5 3) 38 33	 5 3) 38 33
Intake pressure, max.	bar	6.0	6.0	6.0	6.0
Rated flow rate 2)	l/min	132	198	263	445
Maximum differential pressure drop for rated volume flow	kPa	50	60	70	90
Connection, intake/return - outer diameter x wall thickness	 mm	 42.0 x 1.5	 42.0 x 1.5	 76.1 x 2.0	 76.1 x 2.0

Article No.	**6SL3705-**	**0RE23-2AA5**	**0RE24-8AA5**	**0RE27-2AA5**	**0RE31-1AA5**
General data					
Supply voltages - Line voltage - Line frequency - Electronics power supply	 V_{ACrms} Hz V_{DC}	 3 AC 380 -10 % ... 3 AC 415 +10 % 50 Hz 24 (20.4 ... 28.8)			
Current consumption - Total operating current, 3 AC 400 V, 50/60 Hz - Electronics current (24 V DC)	 A A	 7.5/7.0 1.0	 7.5/7.0 1.0	 11.0/12.0 1.0	 11.0/12.0 1.0
Power consumption, max., 3 AC 400 V, 50/60 Hz	kW	3.5/4.7	3.5/4.7	5.5/6.4	5.5/6.4
Power loss, max., dissipated to the ambient air [4]	kW	0.5	0.5	0.5	0.5
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	<65	<65	<65	<65
Material of the integrated heat exchanger		Stainless steel	Stainless steel	Stainless steel	Stainless steel
Degree of protection (standard version)		IP55	IP55	IP55	IP55
Dimensions (standard version) - width - height - depth	 mm mm mm	 600 [5] 2200 600	 600 [5] 2200 600	 600 [5] 2200 600	 600 [5] 2200 600
Weight, approx. (standard version)	kg	310 [6]	310 [6]	320 [6]	320 [6]

1) Depending on the ambient temperature and humidity, see Chapter "Protection against condensation" in Section "Commissioning the cooling circuit".

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

3) 0 °C with antifreeze.

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

5) With option W01, the cabinet width increases to 1000 mm.

6) With option W01, the cabinet weight increases by approximately 110 kg.

Table 6- 55 Technical data of the Heat Exchanger Modules, line voltage 3 AC 500 ... 690 V

Article No.	**6SL3705-**	**0RG23-2AA5** [7]	**0RG24-8AA5** [7]	**0RG27-2AA5** [7]	**0RG31-1AA5** [7]
Deionized water circuit in the converter					
Cooling power	kW	32	48	72	120
Intake temperature - min. - max: - <IP55 (drive line-up) - IP55 (drive line-up)	 °C °C °C	 1) 45 40	 1) 45 40	 1) 45 40	 1) 45 40
Intake pressure - min - max	 bar bar	 1.7 6.0	 1.7 6.0	 1.7 6.0	 1.7 6.0
Rated flow rate [2]	l/min	88	132	197	267
Volume of liquid	dm^3	20.4	21.4	30.5	32.5
Connection, intake/return - outer diameter x wall thickness	 mm	 76.1 x 2.0	 76.1 x 2.0	 76.1 x 2.0	 76.1 x 2.0

Article No.	**6SL3705-**	**0RG23-2AA5** 7)	**0RG24-8AA5** 7)	**0RG27-2AA5** 7)	**0RG31-1AA5** 7)
Plant-side raw water circuit					
Intake temperature - min. - max: - <IP55 - IP55	°C °C °C	5 3) 38 33	5 3) 38 33	5 3) 38 33	5 3) 38 33
Intake pressure, max.	bar	6.0	6.0	6.0	6.0
Rated flow rate 2)	l/min	132	198	263	445
Maximum differential pressure drop for rated volume flow	kPa	50	60	70	90
Connection, intake/return - outer diameter x wall thickness	mm	42.0 x 1.5	42.0 x 1.5	76.1 x 2.0	76.1 x 2.0
General data					
Supply voltages - Line voltage - Line frequency - Electronics power supply	V_{ACrms} Hz V_{DC}	3 AC 500 -10 % ... 3 AC 690 +10 % 50 Hz 24 (20.4 ... 28.8)			
Current consumption - Total operating current 690 V 3 AC, 50/60 Hz - Electronics current (24 V DC)	A A	4.4/4.1 1.0	4.4/4.1 1.0	6.4/7.0 1.0	6.4/7.0 1.0
Power consumption, max., 3 AC 690 V, 50/60 Hz	kW	3.5/4.7	3.5/4.7	5.5/6.4	5.5/6.4
Power loss, max., dissipated to the ambient air 4)	kW	0.5	0.5	0.5	0.5
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	<65	<65	<65	<65
Material of the integrated heat exchanger		Stainless steel	Stainless steel	Stainless steel	Stainless steel
Degree of protection (standard version)		IP55	IP55	IP55	IP55
Dimensions (standard version) - width - height - depth	 mm mm mm	 600 5) 2200 600	 600 5) 2200 600	 600 5) 2200 600	 600 5) 2200 600
Weight, approx. (standard version)	kg	350 6)	350 6)	360 6)	360 6)

1) Depending on the ambient temperature and humidity, see Chapter "Protection against condensation" in Section "Commissioning the cooling circuit".

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

3) 0 °C with antifreeze.

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

5) With option W01, the cabinet width increases to 1000 mm.

6) With option W01, the cabinet weight increases by approximately 110 kg.

7) For Heat Exchanger Modules for line voltages of 3 AC 500 ... 690 V, the voltage is adapted to the 3 AC 400 V / 50 Hz or 460 V / 60 Hz supply voltage using a transformer.

6.7 Auxiliary Power Supply Modules

6.7.1 Description

Note

Additional information

Refer to the layout diagrams (AO) and circuit diagrams (SP) provided in the individual device documentation for the arrangement of components and interfaces and for the wiring.



Figure 6-43 Auxiliary Power Supply Module

Auxiliary Power Supply Modules supply power to the auxiliary power supply system of the SINAMICS S120 Cabinet Modules as well as to other external loads. The fans of the heat exchangers installed in the Cabinet Modules are also connected to this auxiliary power supply system. In addition, the auxiliary power supply system supplies the electronics modules with external 24 V DC. This voltage is required when the DC link is not charged, for example, to maintain PROFIBUS/PROFINET communication.

The 230 V AC supply can also be fed in externally via an uninterruptible power supply (UPS) and terminal -X46.

Note

Supply infeed

The same rated voltage must be fed into the supply infeed of the Auxiliary Power Supply Module as for the connected Cabinet Modules, as the voltage fed into the Auxiliary Power Supply Module supplies the entire system with auxiliary voltage via the auxiliary power supply system.

If a different voltage than that of the connected Cabinet Modules is connected, there is a risk of an insufficient power supply for the fans or too high a voltage, which can cause damage to the system.

Integration

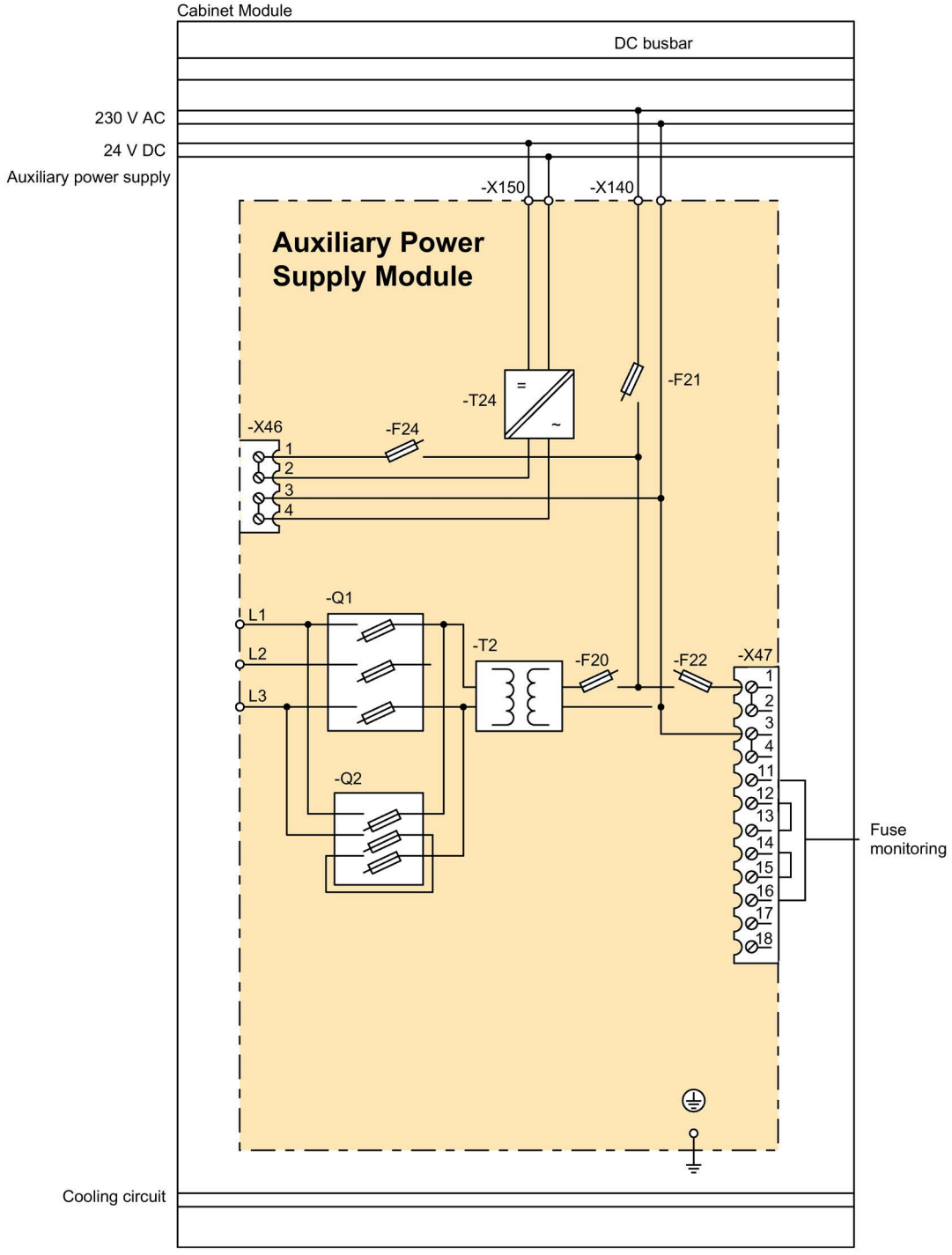


Figure 6-44 Connection example for Auxiliary Power Supply Modules

Configuration

The Auxiliary Power Supply Module is connected on the plant side to a voltage corresponding to the respective rated device voltage.

The standard version contains the following components:

- Fuse switch disconnector with fuse monitoring for external evaluation
- Supply of auxiliary power supply system with 2 auxiliary voltages:
  - 24 V DC for the electronics power supply
  - 2 AC 230 V to supply to 230 V AC loads
- Transformer with output voltage 2 AC 230 V
- SITOP power supply 24 V DC
- PE busbar, nickel-plated (60 x 10 mm), including jumper for looping through to the next Cabinet Module.

Note

Additional information

The configuration example of the Auxiliary Power Supply Module illustrates the positioning of the factory-fitted components. They show the maximum possible configuration of the modules, which contain all options that can be ordered.

Refer to the layout diagrams (AO) provided in the individual device documentation for the precise order-specific location of the components.

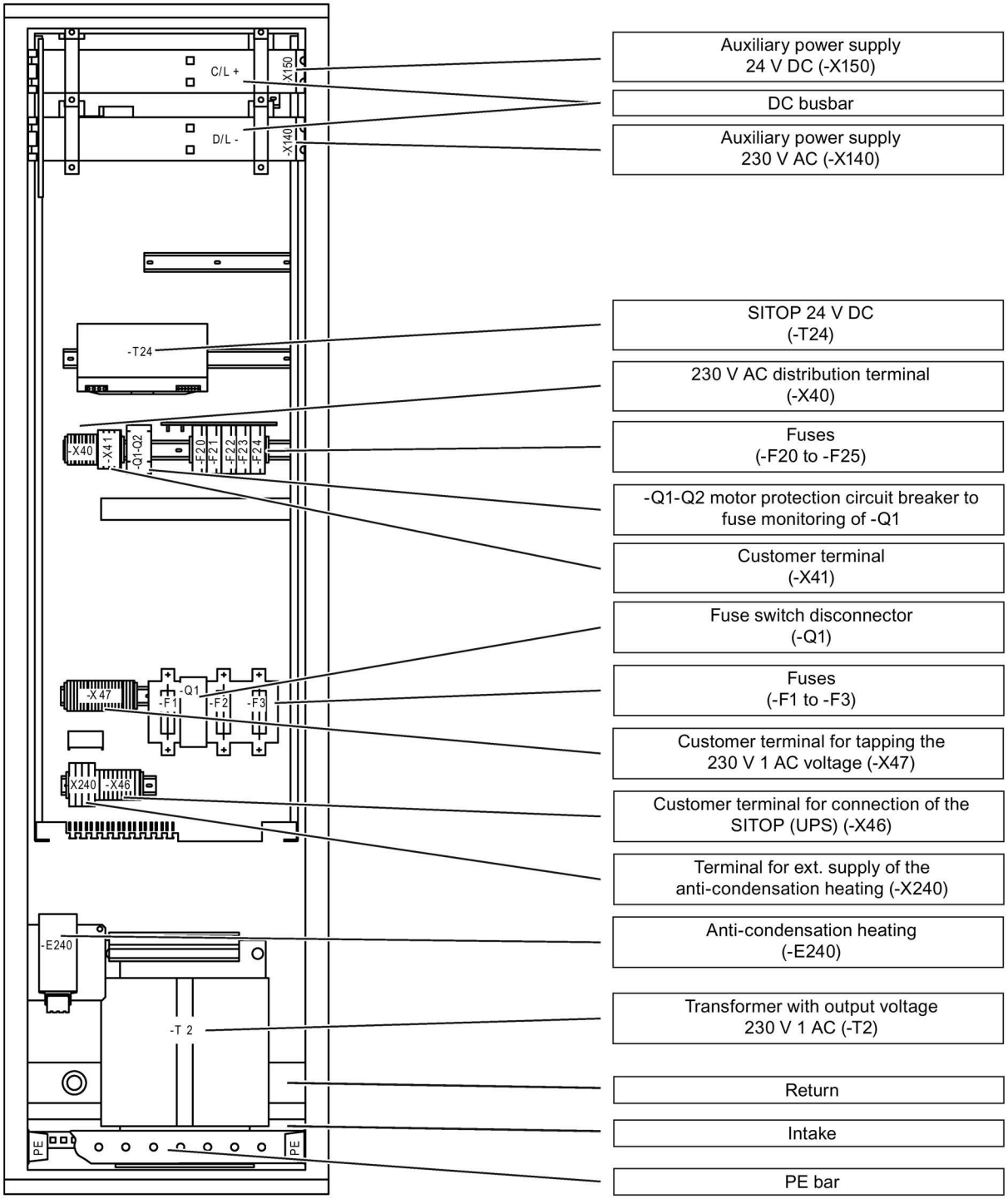


Figure 6-45 Configuration example for Auxiliary Power Supply Modules

6.7.2 Fuse switch disconnector (-Q1)

The infeed of the Auxiliary Power Supply Module occurs for the customer at the fuse switch disconnector (-Q1). The plant-side current required is listed in the "Technical data" table.

6.7.3 Transformer (-T2) for generating the auxiliary voltage 230 V AC

A transformer is incorporated to generate the 230 VAC, 2-phase voltage. This voltage is made available in order to supply the auxiliary power system and the SITOP power supply.

When delivered, the taps are always set to the highest level. The line-side terminals of the transformer may need to be reconnected according to the existing line voltage.

The line voltage assignments for making the appropriate setting on the transformer for the internal power supply are indicated in the following table.

Note

Reconnecting the terminals according to the actual line voltage

The terminals must be reconnected to the actual line voltage so that the 230 VAC, 2-phase voltage required in the system is provided correctly.

Table 6- 56 Assignment of the available line voltage for generating the 230 VAC, 2-phase voltage

Tap	Taps of voltage adaptation transformer (T2) L_A – L_B
380 V	3 – 4
400 V	2 – 4
415 V	1 – 4
440 V	3 – 5
460 V	2 – 5
480 V	1 – 5
500 V	3 – 6
525 V	2 – 6
550 V	1 – 6
575 V	3 – 7
600 V	2 – 7
660 V	3 – 8
690 V	1 – 8

6.7.4 Auxiliary power supply system

Description

The auxiliary power supply system is used to distribute the available voltages (230 V 2 AC and 24 V DC). The table below shows an overview of the connected voltages and associated fuses for the auxiliary power supply system in the Auxiliary Power Supply Module. The 24 V DC voltage is provided directly from the SITOP power supply and is not protected separately by a fuse. The 24 V DC power supply itself is current-limited and short-circuit-proof at the output.

Note

The 24 VDC voltage is available only via the auxiliary power supply system.

The assignment of the auxiliary power module is described in Chapter "Electrical installation", Section "Connections / auxiliary power supply system".

Table 6- 57 Overview of the fuses for the auxiliary power supply system in the Auxiliary Power Supply Module

Article No.	**6SL3705-0MX22-0AA3**
Fuse protection in A	
230 V 2 AC	10
24 VDC	20

6.7.5 Customer interfaces for supplying power to an additional auxiliary power supply system

This chapter describes only those interfaces in the cabinet that require additional connection work by the customer. All other interfaces are pre-wired at the factory and are not designed for customer connections. The table below provides an overview of the most important technical data of the customer terminals in the cabinet.

Note

Additional information

All connections to be established on the plant side as well as the interfaces for integration into the plant control system are described in the circuit and terminal diagrams, included in the individual device documentation.

Table 6- 58 Overview of customer terminals in the Auxiliary Power Supply Module

Article No.	6SL3705-0MX22-0AA3
Customer terminal -X46 for connection of an uninterruptible power supply for SITOP [1]	
Fuse protection in A [2]	10
Max. connection cross section in mm^2	6
Customer terminal -X47 for tapping the 230 V AC, 1-phase voltage	
Fuse protection in A	10
Max. connection cross section in mm^2	2.5

[1] When an uninterruptible power supply is connected, the jumpers between -X46:1/2 and -X46:5/6 must be removed.

[2] The customer is responsible for providing external fuse protection for the uninterruptible power supply according to the specifications for the 24 V DC power supply used.

6.7.6 Options

Note

Additional information

The individual options are described in Chapter "Options".

Electrical options

Component	Option
Cabinet anti-condensation heating	L55

Mechanical options

Component	Option
Base 100 mm high, RAL 9005	M06
Cable-marshaling compartment 200 mm high, RAL 7035	M07
Dust protection packaging	M16
IP23 degree of protection	M23
Side panel (right)	M26
Side panel (left)	M27
Degree of protection IP43	M43
Cable entry via MCT frame	M45
IP54 degree of protection	M54
Degree of protection IP55	M55
Comfort-grip handle with a 3 mm double-bit lock insert	M61
Comfort-grip handle with integrated pushbutton lock insert	M62
Comfort-grip handle for a padlock with pushbutton as lock insert	M63
Marine version	M66
EMC shield rail	M70
DC busbar system	M80 ... M87
Crane transport assembly (top-mounted)	M90
Special paint finish for cabinet	Y09
Factory assembly into transport units	Y11

Other options

Component	Option
Generation of a material declaration Green Passport	B50
Individual certificate from the DNV	E51
Individual certificate from the American Bureau of Shipping (ABS)	E61
Individual certificate from the China Classification Society (CCS)	E71
Marking of all control cable conductor ends	M91
Rating plate data in English/French	T58
Rating plate data in English/Spanish	T60
Rating plate data in English/Italian	T80
Rating plate data in English/Russian	T85
Rating plate data in English/Chinese	T91
Single-line labeling strip for system identification, 40 x 80 mm	Y31
Two-line labeling strip for system identification, 40 x 180 mm	Y32
Four-line labeling strip for system identification, 40 x 180 mm	Y33

6.7.7 Technical data

Table 6- 59 Technical specifications for the Auxiliary Power Supply Modules

Article No.	**6SL3705-**	**0MX22-0AA3**
Supply voltage on the plant/system side **380 ... 690 V 3 AC**	 A	 25
Line connection - Cable cross-section, max. (IEC) - Recommended cable cross-section	 mm^2 mm^2	 70 6
Current carrying capacity, max. - Load feeder connection 230 V AC - At the auxiliary power supply system - At customer terminal -X47 - Load feeder connection 24 V DC - At the auxiliary power supply system	 A A A	 10 10 20
Cable cross-section, max. - Terminal -X47	 mm^2	 2.5
PE/GND connection - Busbar cross-section - Connection cross-section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240
Cooling air requirement		Natural convection
Degree of protection (standard version)		IP21
Dimensions (standard version) - width - height - depth	 mm mm mm	 600 2200 600
Weight, approx. (standard version)	kg	160
Maximum short-circuit current I_{CC} acc. to IEC	kA	80
Minimum short-circuit current [1]	kA	0.4

[1] Current required for reliably tripping the integrated protective devices

Maintenance and servicing 7

7.1 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
- Replacing device components when the unit is serviced
- Forming the DC-link capacitors

⚠WARNING

Not observing 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.



⚠DANGER

Electric shock due to the residual charge of the DC link capacitors

Because of the DC-link capacitors, a hazardous voltage is present for up to five minutes after the power supply has been switched off.

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

- Only open the device after five minutes have elapsed.
- Measure the voltage before starting work on the DCP and DCN DC-link terminals.

⚠DANGER

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 circuit breaker 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.

7.2 Cleaning the cabinet

The cabinet mainly comprises electronic components. Apart from the fan(s), the unit contains very few components that are subject to wear or require maintenance or service. The purpose of maintenance is to maintain the cabinet in the original state. Dirt and contamination must be removed regularly and parts subject to wear replaced.

The following points must generally be observed.

Dust deposits

Dust deposits inside the cabinet 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 of the cabinet must always be kept free and unobstructed. The fan must be checked to make sure that it is functioning correctly.

Maintaining the filter medium for option M23/M43/M54

For option M23/M43/M54, the filter medium must be maintained according to the local environmental conditions. The filter medium must be regularly inspected and replaced as required.
You can obtain additional information regarding a maintenance contract from your Siemens contact person.

7.3 Servicing the cabinet

Servicing involves activities and procedures for maintaining and restoring the operating condition of the cabinet.

Required tools

The following tools are required for replacing components:

- Standard toolboxes with screwdrivers, screw wrenches, socket wrenches, etc.
- Torque wrenches from 1.5 Nm up to 100 Nm
- 400 mm extension for socket wrenches

Cable and screw terminals

Cable and screw terminals must be checked regularly to ensure that they are securely in position and, if necessary, retightened. Cabling must be checked for defects. Defective parts must be replaced immediately.

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.

Tightening torques for screw connections

The following tightening torques apply when tightening current-conducting connections (DC-link connections, motor connections, busbars, lugs) and other connections (ground connections, protective conductor connections, steel threaded connections).

Table 7- 1 Tightening torques for screw connections

Thread	Ground connections, protective conductor connections, steel threaded connections	Aluminum threaded connections, plastic, busbars, 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.

Maintenance work at the main switch or circuit breaker

For an optionally installed main switch or circuit breaker, the inspection must be carried out at the intervals specified in the attached description.

7.4 Maintaining the cooling circuit

7.4.1 General information

Note

Recommended cooling circuit service

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.
- The cooling circuit must be flushed and refilled if the coolant becomes cloudy, becomes discolored or becomes contaminated by mold spores.
- It is recommended that you contact the coolant additive manufacturer to analyze the coolant.
- 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 138)" and "Antifreeze, biocides, inhibitors (Page 140)". The same coolant and antifreeze specifications apply for both the plant-side de-ionized water circuit and the plant-side raw water circuit.

Note

Flushing the cooling circuit

"Flushing the cooling circuit" involves the following process:

1. Drain the old coolant from the cooling circuit
2. Fill the cooling circuit with fresh coolant
3. Operate the cooling circuit for some time (up to approximately 1/2 hour)
4. Drain the coolant again and clean the dirt trap
5. Fill the cooling circuit with fresh coolant

Components to drain or fill the cooling circuit: 65.4 and 65.5 (only for option W01), see Chapter "Flow diagram of the cooling circuit (Page 270)".

Note

The operating instructions of the component manufacturer must be observed when maintaining the cooling circuit.

7.4.2 Maintenance intervals

Note

The specified test and maintenance intervals are limit values that may need to be shortened depending on the operational conditions.

The operating company must always ensure that an appropriate maintenance is performed.

The test and maintenance intervals depend on the specified time or the operating hours, whichever occurs first.

Test or maintenance intervals

Table 7- 2 Test or maintenance intervals

Component	Review	Replacing
Coolant	Annually Checked every 2 years by the manufacturer of the coolant agent	Depending on the state, evaluation by the manufacturer or for a high suspended solid content, see Chapter "Maintenance of the coolant (Page 296)"
Expansion tank	Annually	Replacement according to external state or damage to the pressure bubble, see Chapter "Maintaining the expansion tank (Page 297)"
Dirt trap	Every 1000 h operating hours; depending on the pollution degree, intervals can be increased by 1000 h up to a max. of 8000 h	When the dirt trap is damaged
Gaskets	Regularly, at least every 6 months	After 6 years
Coolant hoses	Regularly, at least every 6 months	For cracks and leaks
Internal heat exchanger fan	Regularly, at least every 6 months	After approximately 50 000 operating hours
Pumps	Regularly, at least every 6 months	Replace for increased leakage rate >15 ml/ day or bearing noise, over-temperatures

7.4.3 Maintenance of the coolant

Note

Please refer to the safety instructions of the manufacturer of the coolant additive!

Observe the environmental protection regulations as well as the local soil and water protection regulations.

Replacement should only be made with the same coolant. Special cleaning measures are required when the manufacturer is changed or the inhibitor system is changed.

Usability

Experience has shown that although the coolant remains usable in plants for many years, the antifreeze concentration in the system should be checked once per year. This check is also advisable when liquid is added. Specialist dealers can provide antifreeze testers for the particular coolant.

In addition, every two years a coolant sample should be sent in for testing to analyze the relevant values of the coolant (e.g. pH value, specific density, nitride content, dissolved metal ions, alkalinity,...).
Contact the manufacturer of the coolant agent.

Information on taking a coolant sample is provided in the following chapter: Take a coolant sample (Page 153).

Observe the storage life of the coolant.

Safety regulations

The safety regulations of the manufacturer must be observed when handling coolant-water mixtures.

The associated valid EU safety data sheet contains safety-relevant notes.

Disposal

Coolant-water mixtures must be disposed of, carefully observing the local regulations. Recycling is preferred over disposal. Contact the manufacturer of the coolant agent.

7.4.4 Maintaining the expansion tank

Check that the expansion tank is functioning correctly and has the correct operating pressure on an annual basis.

The arrangement of the shutoff valves and the expansion tank (93) is provided in the following Chapter: "Interfaces in the cooling circuit (Page 270)".

Checking the expansion tank

There are several techniques to test the expansion tank and/or the membrane contained in it.

Pointer of the pressure gauge for the system pressure (44)

Check whether the pointer of the pressure gauge for the system pressure (44) "vibrates" when the drive line-up is operational.

If this is the case, then it is likely that the expansion tank is no longer working properly.

Hot expansion tank surface

Check the temperature of the surface of the expansion tank after operating the Heat Exchanger Module. The lower half must be warm, then it is OK.

If it is completely warm, then it is likely that the expansion tank is no longer working properly.

Knock test of the expansion tank

Check the expansion tank by knocking on it. The upper half must sound hollow, then it is OK.

If the upper half does not sound hollow, then it is likely that the expansion tank is no longer working properly.

Checking the nitrogen filling

Check whether the expansion tank is still filled with nitrogen.

1. Close the shutoff valve of the expansion tank (65.2).
2. Place a lint-free cloth on the filling valve in order to avoid coolant from being splashed.
3. Briefly actuate the filling valve and check whether only nitrogen escapes or also coolant.

If coolant does not escape, then the membrane is still intact.

If coolant does escape, then the membrane is no longer intact and the expansion tank must be replaced.

Replacing the expansion tank

To replace the expansion tank, contact Siemens Service.

Checking and/or setting the gas pressure of the expansion tank

If the expansion tank and/or the membrane contained in it is OK, then you can check the gas pressure and if required, fill up with nitrogen.

Have a suitable container ready to catch the coolant (capacity: approx. 5 ... 10 l).

1. Unscrew the cap at the shutoff valve of the expansion tank (65.2). Connect a drain hose with a screw connection to the thread and place the free end of the drain hose into the collection container.
2. Turn the ball shut-off valve to the left (approx. 90 °) using an Allen key (SW6) and drain the coolant from the expansion tank into the collecting tank (approx. 3 liters).
3. Check the gas pressure; the correct pressure is 0.8 bar.
   If required, increase the pressure to the correct pressure by adding nitrogen.
4. Using an Allen key (size 6), rotate the ball shutoff valve to the right (approx. 90 °).
5. Remove the drain hose and attach the screw cap.

Then check the pressure in the converter-side deionized water circuit at the pressure gauge for the system pressure (44). If required, top up the coolant, see Chapter "Filling the converter-side de-ionized water circuit (Page 142)".

7.4.5 Maintaining the dirt trap

The dirt trap must be checked at regular intervals and cleaned when required.

To do this, the shutoff valve associated with the particular pump must be closed. The filter element can then be screwed out.

The arrangement of the shutoff valves and the dirt trap (71.1 and 71.2, only for Option W01) is provided in the following Chapter: "Interfaces in the cooling circuit (Page 270)".

- For a Heat Exchanger Module with one pump, the drive line-up must be shut down.
- For a Heat Exchanger Module with two pumps (option W01), the dirt trap can be serviced in operation.
  To do this, you must open the motor circuit breaker of the appropriate pump and you can then close the shutoff valve and remove the filter cartridge.
  Opening the circuit breaker generates the corresponding alarm messages in the SINAMICS software, which are automatically deleted after reclosing.

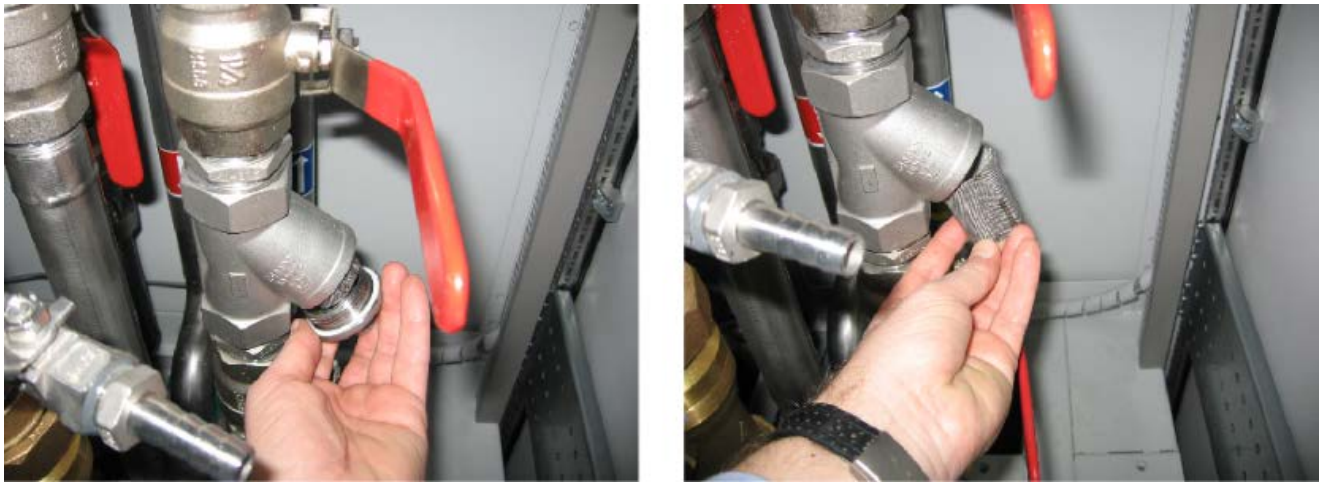


Figure 7-1 Diagram showing an example of how the dirt trap is maintained

⚠CAUTION

Risk of injury caused by splashing coolant

The coolant is harmful to eyes and skin and can damage surfaces.

Coolant can escape when the dirt trap is opened and can splash onto the skin or into 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.

Note

After checking and/or cleaning the dirt trap, the relevant shutoff valve must be re-opened so that the coolant can flow through the dirt trap.

7.4.6 Maintaining coolant hoses

Carefully inspect the coolant hoses every six months for cracks and leaks. Replace any coolant hoses that have cracks or leaks.

If the hose couplings leak, then replace the EPDM seal/gasket.

⚠CAUTION

Risk of injury caused by splashing coolant

The coolant is harmful to eyes and skin and can damage surfaces.

Coolant can escape when the dirt trap is opened and can splash onto the skin or into 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.



⚠WARNING

Electric shock due to insufficient insulating clearance

Incorrectly routing coolant hoses can result in insufficient insulating clearance to live parts and can cause death or serious injury.

- Route the coolant hoses very carefully.
- Make sure 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 strictly maintained.
- Mechanically fasten the coolant hoses and check that they have no leaks.
- The materials used in the cooling circuit must be carefully selected to ensure that they will not corrode as a result of electrochemical reactions.

7.4.7 Testing the fan of the internal heat exchanger

The fans should be inspected in regular intervals for smooth running and normal housing temperatures.

The service life of the fans is approximately 50,000 hours. However, the actual service life depends on other variables (e.g. ambient temperature) and may therefore deviate from this value.

If required, the heat exchanger fans can be replaced, see Chapter "Replacing the fan of the internal heat exchanger (Page 312)".

7.4.8 Testing the pumps

The pumps should be inspected in regular intervals for smooth running, leakages and normal housing temperatures.

A small amount of cooling liquid escaping from the pump cannot be avoided as a result of the inherent design; a loss of 15 ml/day of liquid is not critical.

This may result in a precipitation of glycol, which is visible in crystalline form.

The quantity depends on the amount of glycol in the coolant. This is only a visual impairment and can be reduced by regular cleaning.

This is not a defect or functional impairment and is not subject to the warranty conditions.

7.4.9 Replacing the pumps

7.4.9.1 General information

Replacing the pump is described using a Heat Exchanger Module with 2 redundant pumps as example.

For other Heat Exchanger Modules, removing the components can deviate on a case-for-case basis from the description; however, the basic sequence of the work steps is the same.

⚠CAUTION

Risk of injury caused by splashing coolant

The coolant is harmful to eyes and skin and can damage surfaces.

Coolant can escape when removing the pump and can splash onto the skin or into 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.

Storing pumps as spare part

For pumps stored on site or in a customer warehouse as a spare part, care must be taken to ensure that the shaft is rotated at regular intervals to maintain the bearing and mechanical seal.

Observe the instructions provided by the pump manufacturer.

7.4.9.2 Replacing the left-hand pump

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget external power supplies!)
- Allow unimpeded access
- Disconnect the pump electrical connections in the terminal box of the pump ①. When doing this note the positions of the individual cores for subsequent connection.
- Have a suitable container ready to catch the coolant (capacity: at least 5 l).

Removing the pump

The numbers of individual components (e.g. "77.1") refer to the drawings in Chapter "Interfaces in the cooling circuit (Page 270)".

After removal, keep the screws or components in an orderly manner for subsequent installation.

Open the cooling circuit and remove the pipe

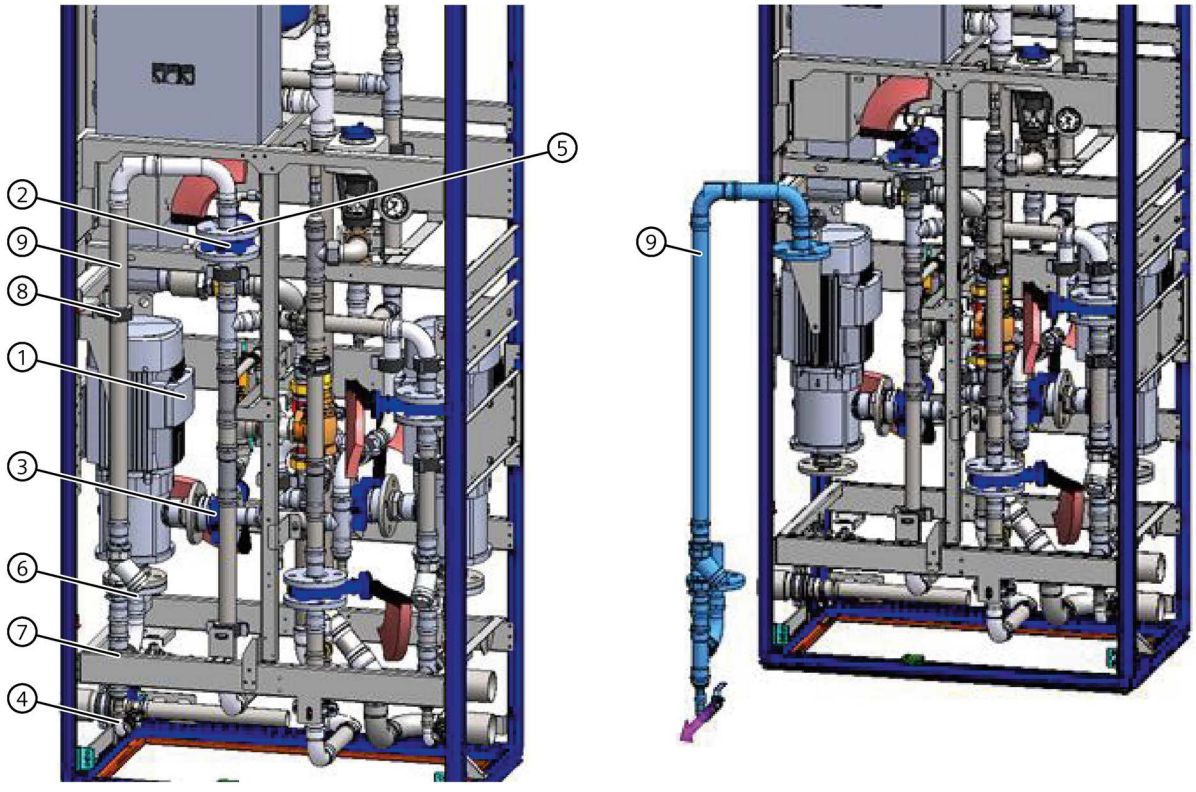


Figure 7-2 Open the cooling circuit and remove the pipe

1. Close the shutoff valves ② (77.1) and ③ (77.2).
2. Connect a 1/2 " hose to the shutoff valve ④ (65.4), open the valve and allow the coolant to drain into a suitable container.
3. Remove the screws at flange ⑤ and at flange ⑥.
4. Release clamps ⑦ and ⑧. When doing this, secure the pipe ⑨ so that it cannot fall.
5. Carefully withdraw the pipe ⑨ towards the front from the control cabinet.

Removing the pump

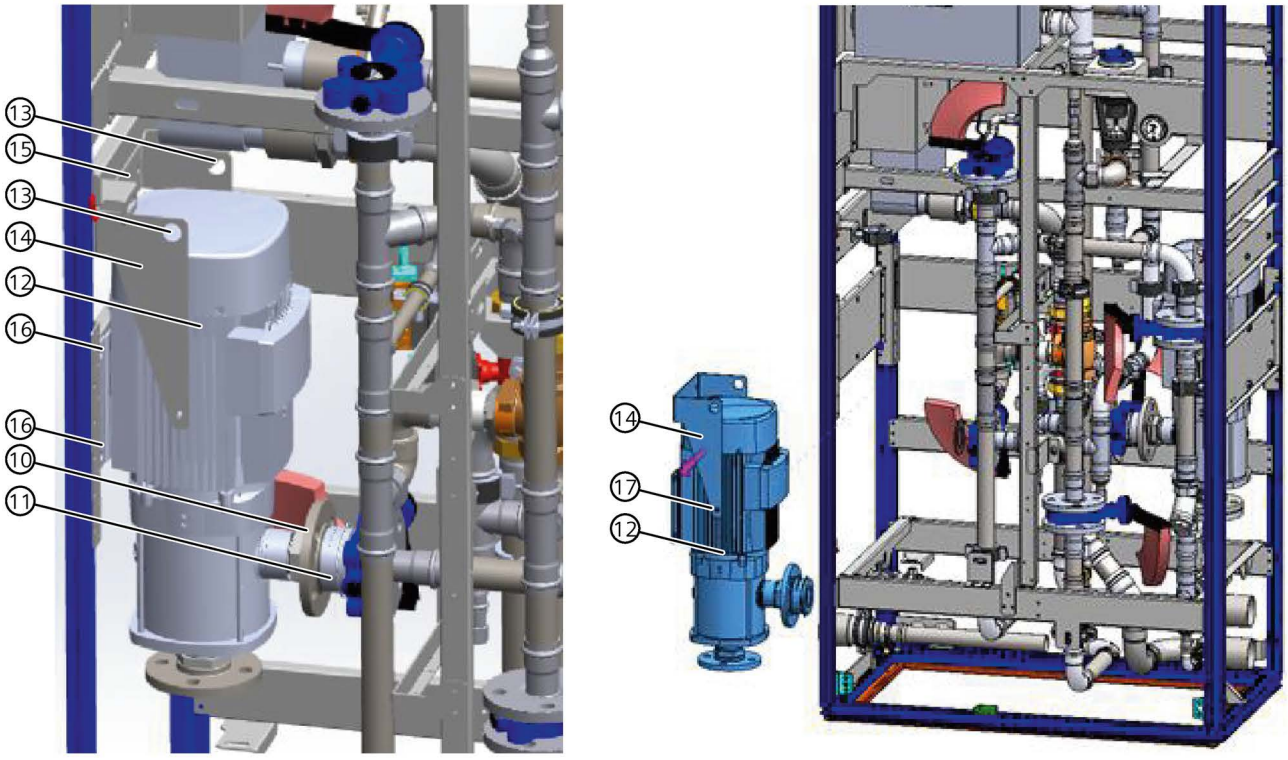


Figure 7-3 Removing the pump

1. Remove the screws from flange ⑩.
2. Carefully remove the non-return valve ⑪ (62.1). When doing this, note the position and the alignment for subsequent installation.
3. Using suitable equipment, secure the pump ⑫ (60.1) so that it cannot fall (pump weight, approx. 55 kg). The eyes ⑬ on the upper bracket ⑭ can be used to lift or secure the pump.
4. Remove the two screws ⑮ from the upper bracket ⑭.
5. Remove the four screws ⑯ from the lower bracket.
6. Carefully withdraw the pipe ⑫ towards the front from the control cabinet and place it down on a suitable assembly station.
7. Remove the two screws ⑰ and remove the upper bracket ⑭.

Installing the pump

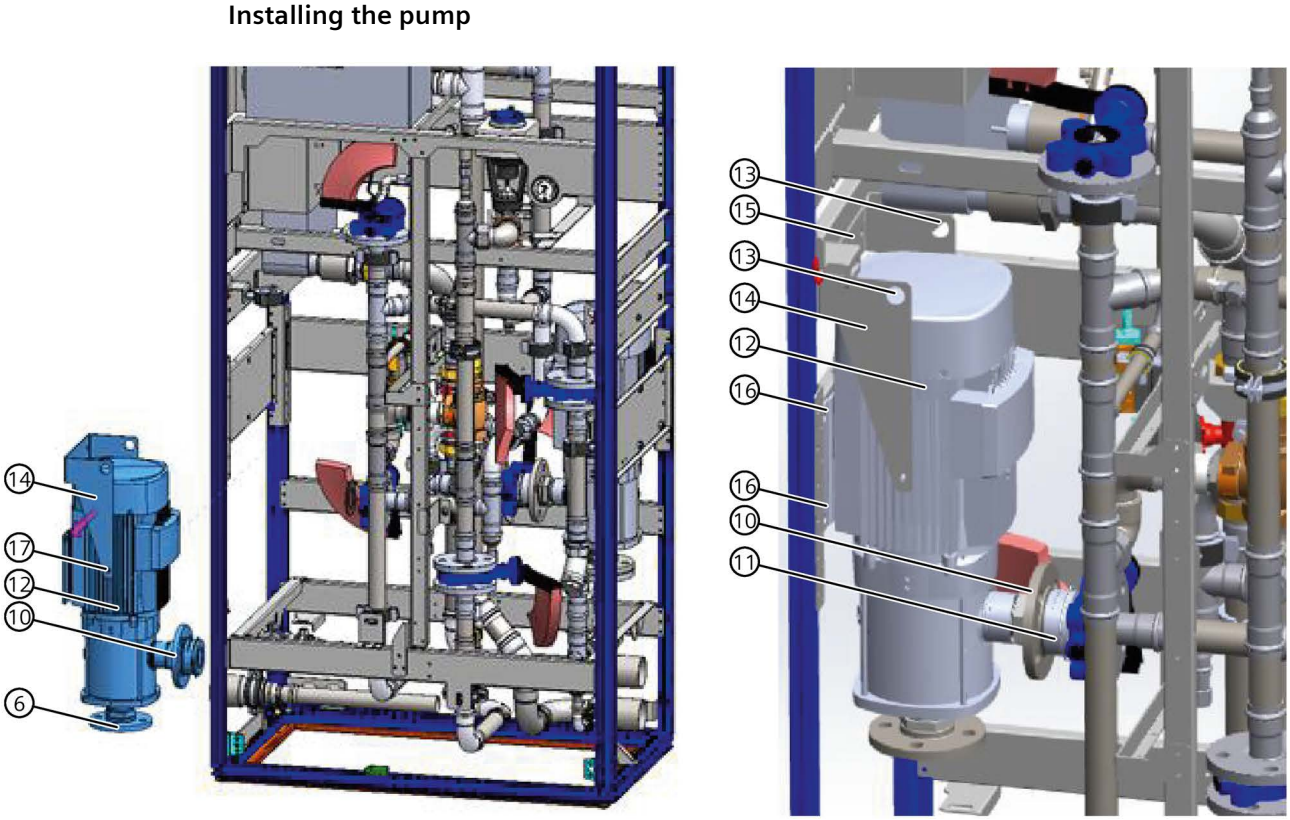


Figure 7-4 Installing the pump

1. Mount flanges ⑥ and ⑩ to the new pump ⑫ using screw connections. Seal the threads using Araldite 2011.
2. Fasten the upper bracket ⑭ to the pump ⑫ using two screws ⑰, tightening torque: 10 Nm.
3. Using suitable equipment, secure the pump ⑫ so that it cannot fall (pump weight, approx. 55 kg). The eyes ⑬ on the upper bracket ⑭ can be used to lift or secure the pump.
4. Carefully bring the pump ⑫ into the installation position and using suitable fixtures, secure it so that it cannot fall.
5. Insert the four screws ⑯ at the lower bracket, tightening torque: 10 Nm.
6. Insert the two screws ⑮ at the upper bracket ⑭, tightening torque: 10 Nm.
7. Carefully bring the non-return valve ⑪ into the correct installation position. When doing this, ensure the correct direction of flow and that the non-return valve is precisely centered.
8. Insert the screws into the flange ⑩.

Installing the pipe and closing the cooling circuit

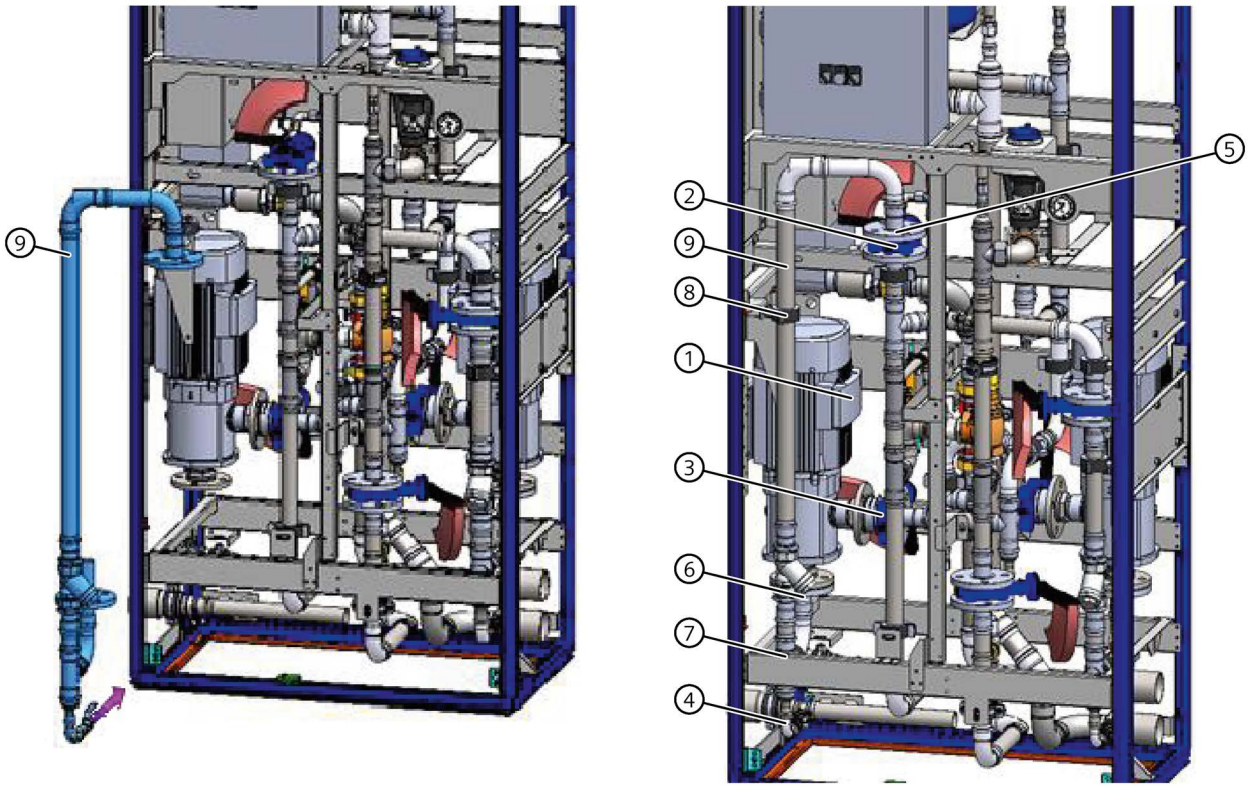


Figure 7-5 Installing the pipe and closing the cooling circuit

1. Carefully place the pipe ⑨ at the installation position and secure it so that it cannot fall.
2. Fasten the pipe ⑨ using clamps ⑦ and ⑧.
3. Attach the screws at flange ⑤ and at flange ⑥.
4. Close the shutoff valve ④ (65.4).
5. Open the shutoff valves ② (77.1) and ③ (77.2).
6. Top up the coolant, see Chapter "Filling the converter-side de-ionized water circuit (Page 142)".
7. Establish the electrical connections of the pump in the terminal box of the pump ① corresponding to the positions of the individual cores that were documented when removing.

Checking the direction of rotation by making a test run

Switch on the supply voltage taking into consideration the fundamental safety instructions.

Test run the pump to check that the direction of rotation is correct.

A small element to display the direction of rotation is provided in the cover of the motor fan.

- If the display is black when the pump is operational, then the direction of rotation is correct.
- If the display is white when the pump is operational, then the direction of rotation is not correct.
  In this case, connect the phases correctly in the pump terminal box to select the correct direction of rotation.

7.4.9.3 Replacing the right-hand pump

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget external power supplies!)
- Allow unimpeded access
- Disconnect the pump electrical connections in the terminal box of the pump ①. When doing this note the positions of the individual cores for subsequent connection.
- Have a suitable container ready to catch the coolant (capacity: at least 5 l).

Removing the pump

The numbers of individual components (e.g. "77.4") refer to the drawings in Chapter "Interfaces in the cooling circuit (Page 270)".

After removal, keep the screws or components in an orderly manner for subsequent installation.

Open the cooling circuit and remove the pipe

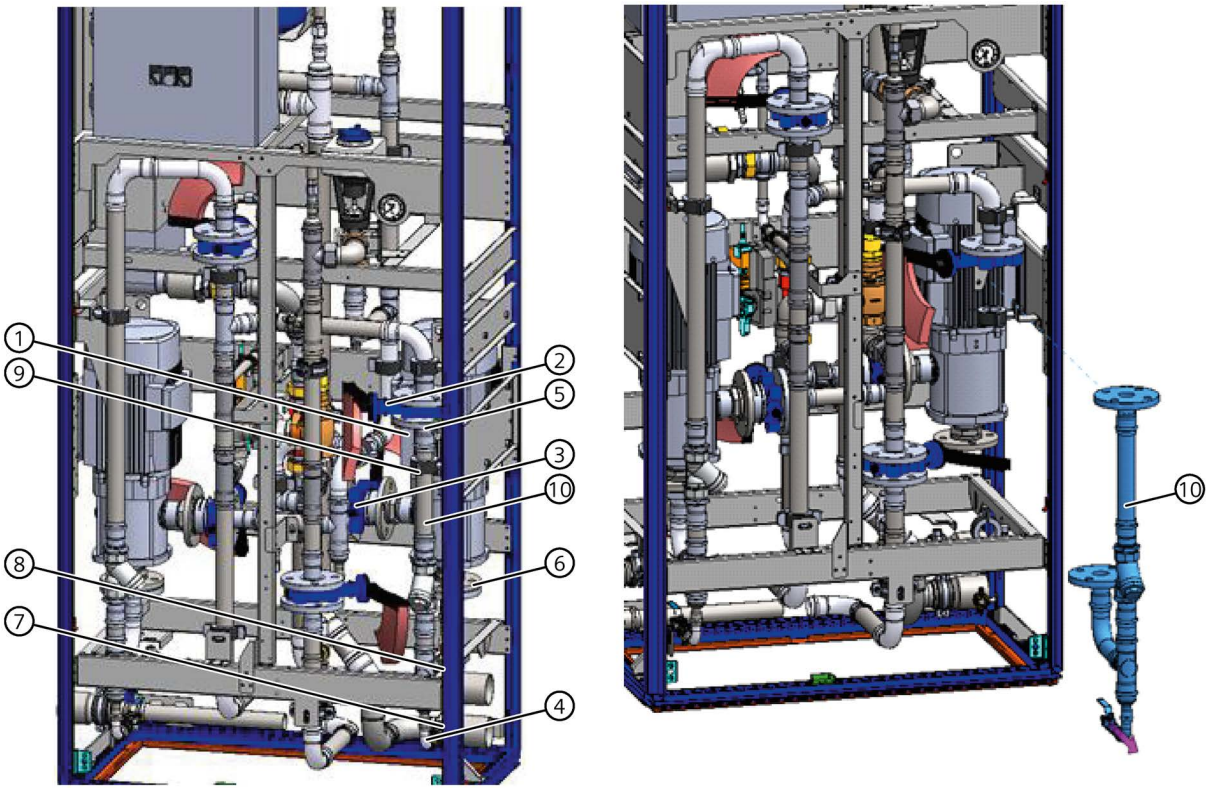


Figure 7-6 Open the cooling circuit and remove the pipe

1. Close the shutoff valves ② (77.4) and ③ (77.5).
2. Connect a 1/2 " hose to the shutoff valve ④ (65.5), open the valve and allow the coolant to drain into a suitable container.
3. Remove the screws at flange ⑤ and at flange ⑥.
4. Release clamps ⑦, ⑧ and ⑨. When doing this, secure the pipe ⑩ so that it cannot fall.
5. Carefully withdraw the pipe ⑩ towards the front from the control cabinet.

Removing the pump

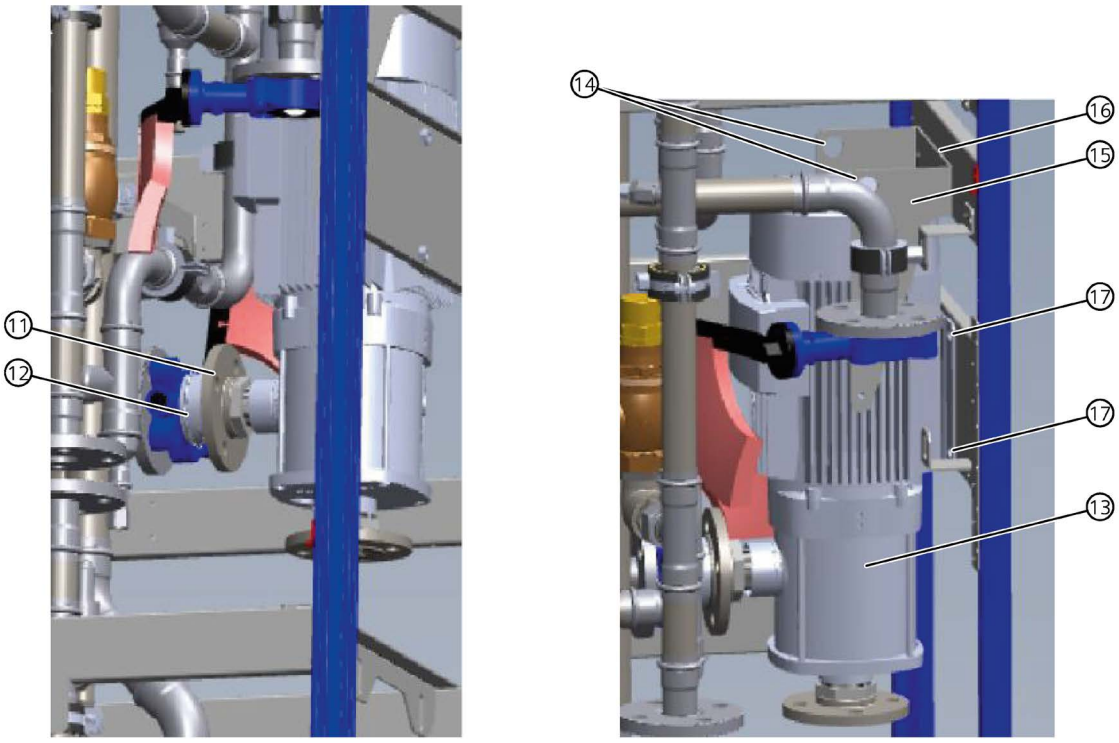


Figure 7-7 Removing the pump, Part 1

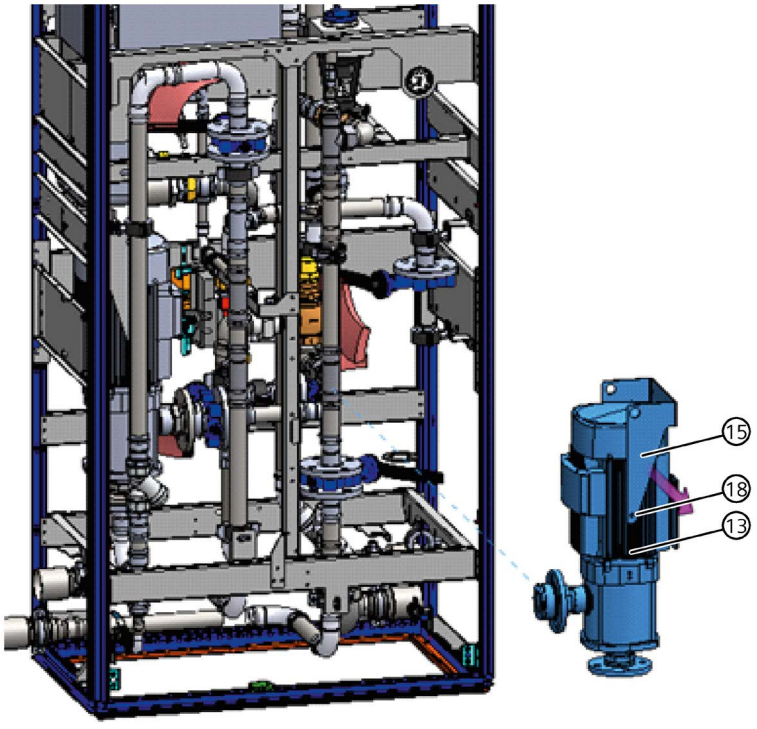


Figure 7-8 Removing the pump, Part 2

1. Remove the screws from flange ⑪.
2. Carefully remove the non-return valve ⑫ (62.2). When doing this, note the position and the alignment for subsequent installation.
3. Using suitable equipment, secure the pump ⑬ (60.2) so that it cannot fall (pump weight, approx. 55 kg). The eyes ⑭ on the upper bracket ⑮ can be used to lift or secure the pump.
4. Remove the two screws ⑯ from the upper bracket ⑮.
5. Remove the four screws ⑰ from the lower bracket.
6. Carefully withdraw the pipe ⑬ towards the front from the control cabinet and place it down on a suitable assembly station.
7. Remove the two screws ⑱ and remove the upper bracket ⑮.

Installing the pump

Installing the pump

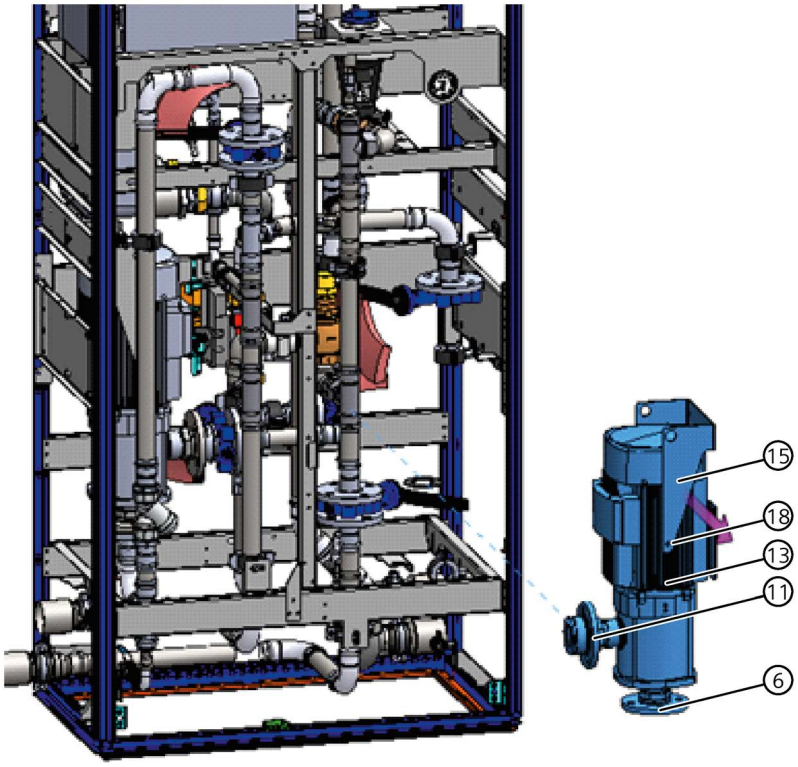


Figure 7-9 Installing the pump, Part 1

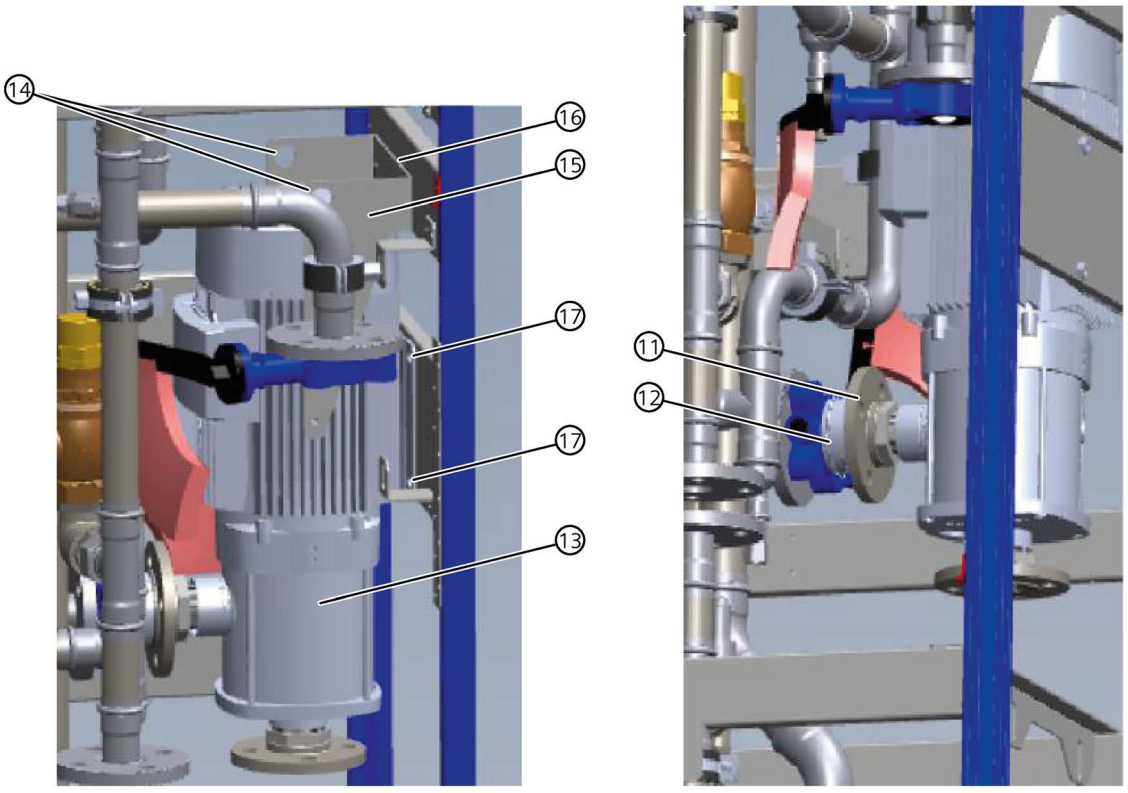


Figure 7-10 Installing the pump, Part 2

1. Mount flanges ⑥ and ⑪ with screw connections to the new pump ⑬. Seal the threads using Araldite 2011.
2. Fasten the upper bracket ⑮ to the pump ⑬ using two screws ⑱, tightening torque: 10 Nm.
3. Using suitable equipment, secure the pump ⑬ so that it cannot fall (pump weight, approx. 55 kg). The eyes ⑭ on the upper bracket ⑮ can be used to lift or secure the pump.
4. Carefully bring the pump ⑬ into the installation position and using suitable fixtures, secure it so that it cannot fall.
5. Insert the four screws ⑰ at the lower bracket, tightening torque: 10 Nm.
6. Insert the two screws ⑯ at the upper bracket ⑮, tightening torque: 10 Nm.
7. Carefully bring the non-return valve ⑫ into the correct installation position. When doing this, ensure the correct direction of flow and that the non-return valve is precisely centered.
8. Insert the screws into the flange ⑪.

Installing the pipe and closing the cooling circuit

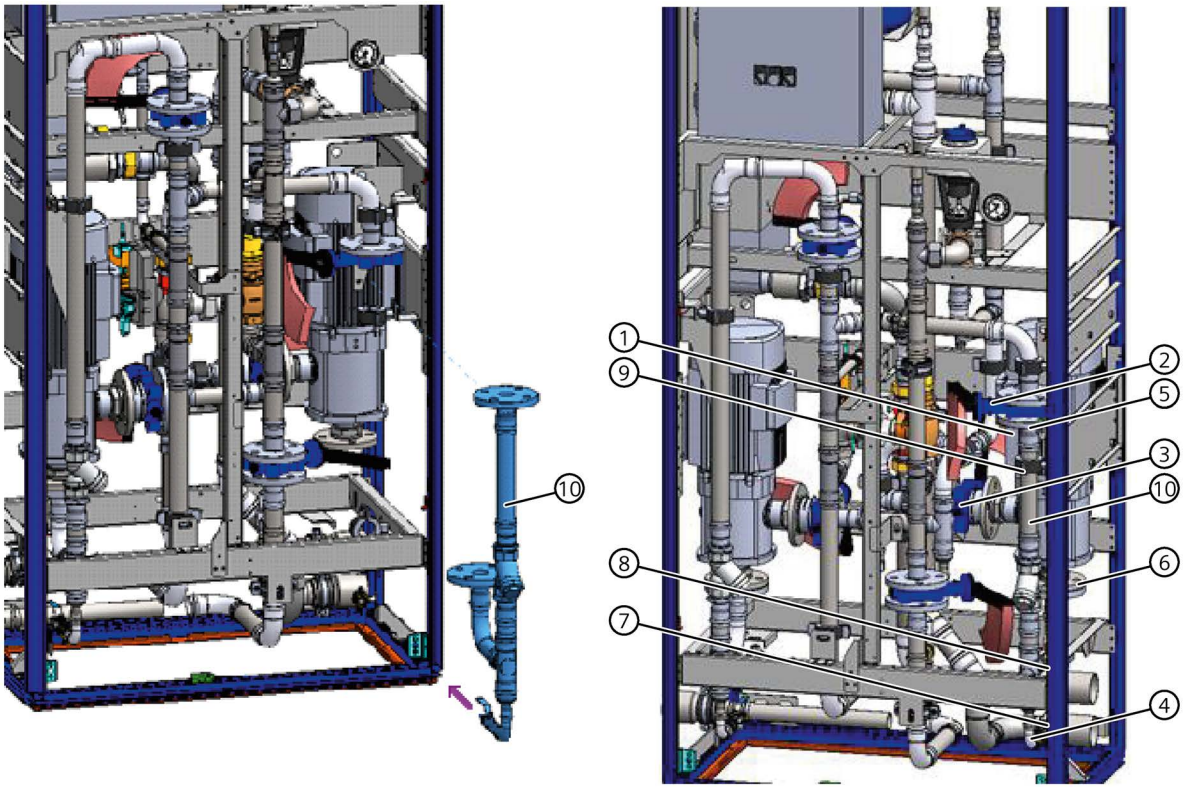


Figure 7-11 Installing the pipe and closing the cooling circuit

1. Carefully place the pipe ⑩ at the installation position and secure it so that it cannot fall.
2. Fasten the pipe ⑩ using clamps ⑦, ⑧ and ⑨.
3. Attach the screws at flange ⑤ and at flange ⑥.
4. Close the shutoff valve ④ (65.5).
5. Open the shutoff valves ② (77.4) and ③ (77.5).
6. Top up the coolant, see Chapter "Filling the converter-side de-ionized water circuit (Page 142)".
7. Establish the electrical connections of the pump in the terminal box of the pump ① corresponding to the positions of the individual cores that were documented when removing.

Checking the direction of rotation by making a test run

Switch on the supply voltage taking into consideration the fundamental safety instructions.

Test run the pump to check that the direction of rotation is correct.

A small element to display the direction of rotation is provided in the cover of the motor fan.

- If the display is black when the pump is operational, then the direction of rotation is correct.
- If the display is white when the pump is operational, then the direction of rotation is not correct.
  In this case, connect the phases correctly in the pump terminal box to select the correct direction of rotation.

7.4.10 Replacing the fan of the internal heat exchanger

Replacing the fan

The typical service life of the fan is 50,000 hours. However, the actual service life depends on other influencing variables (e.g. ambient temperature) and may therefore deviate from this value.

The fans must be replaced in good time to ensure that the device is available.

The article number of the replacement fan is 6SL3760-0SB00-0AA0.

Preparatory steps

- Disconnect the drive line-up from the power supply
- Allow unimpeded access
- The pressure in the liquid circuit should be reduced so that it is easier to open and close the quick-release couplings.

Remove the air baffle plate

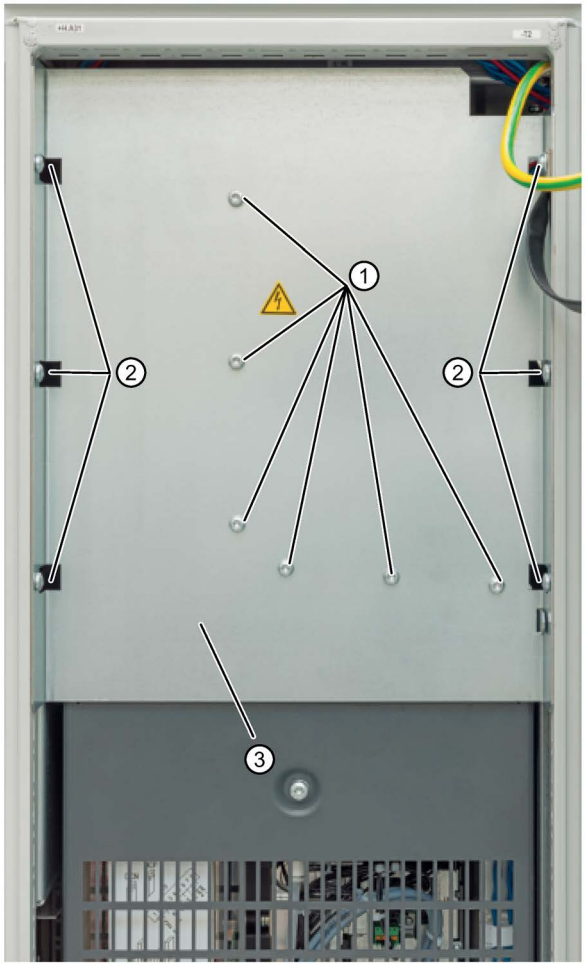


Figure 7-12 Remove the air baffle plate

The removal steps correspond to the numbers shown in the diagram.

1. Remove the front screws of the air baffle (①).
2. Remove the lateral screws of the air baffle (②).
3. Remove the air baffle (③) towards the front (③).

Removing the heat exchanger from the control cabinet

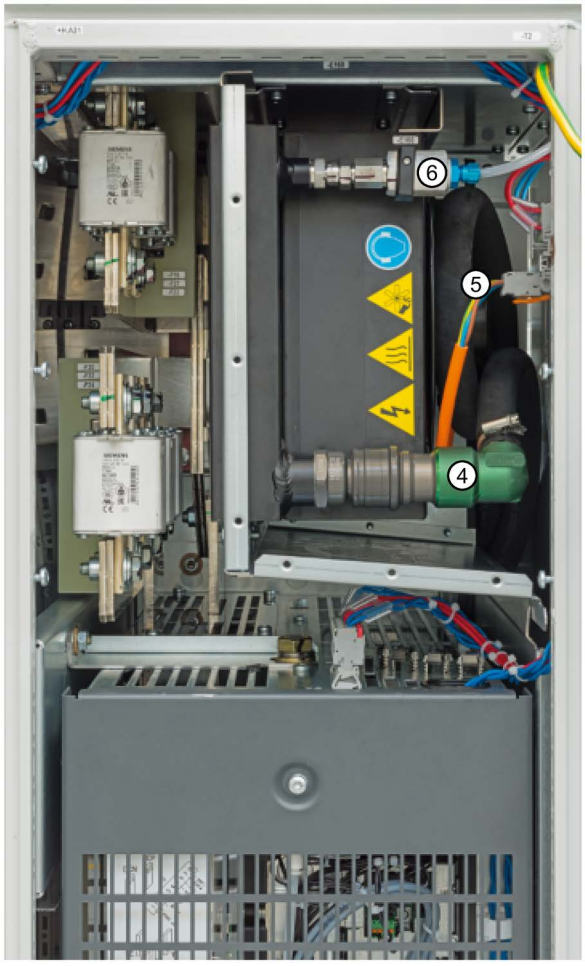


Figure 7-13 Remove the heat exchanger

The removal steps correspond to the numbers shown in the diagram.

1. Open the quick-release connection of the front coolant connection (④).
2. Withdraw the connecting cable for the fan power supply at connector X160 (⑤).
3. Close the vent valve, remove the vent hose (⑥).
4. Carefully withdraw the heat exchanger.
5. Open the quick-release connector of the rear coolant connection.

You can then replace the fan motor of the heat exchanger.

Installation steps

Installing is the same as removing, however in the reverse order.

NOTICE
Pay attention to the tightening torques The tightening torques specified in the table "Tightening torques for screwed connections" must be observed. The screwed connections for the protective covers may only be tightened by hand.

Note

Establishing the system pressure

Establish the specified system pressure of the converter-side de-ionized water circuit.

7.5 Replacing components

7.5.1 General information

This chapter discusses replacing components that may need to be replaced during service and maintenance. Other components are not normally subject to wear and tear and are, therefore, not covered in this chapter.

Note

Additional information

The Article Nos. for spare parts are specified in the spare parts list, included in the individual device documentation.

7.5.2 Safety information

Required safety precautions to be taken before carrying out maintenance and servicing

⚠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.

7.5.3 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).

7.5.4 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) into or out of a control cabinet.

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 7-14 Mounting aid

Article number of the mounting equipment

The article number for the mounting equipment is 6SL3766-1CA00-0AA0.

7.5.5 Replacing the filter cartridges

For the standard IP21 degree of protection, the cooling air is drawn in from the front through the ventilation grilles in the lower part of the cabinet doors.

For IP23, IP43 and IP54 degrees of protection, the cooling air is drawn in from the front through the ventilation grilles with filter cartridges in the lower part of the cabinet doors.

The hot air is blown out in the upper part of the cabinet doors by motor-operated fans with filter cartridges.

The filter cartridges (e.g. filter mats) must be checked at regular intervals. If the mats are too dirty to allow the air supply to flow normally, they must be replaced.

Note

Replacing the filter mats

If you do not replace dirty filter mats, this can cause a premature thermal shutdown of the drive.

Ordering data are available in the spare parts lists.

7.5.5.1 Replacing the filter mats in the air intake

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Allow unimpeded access to the grille area of the doors.

Note

The cabinet must be disconnected from the power supply to prevent the fans from drawing in contaminated external air. If an external power supply for the fans is used, take the coasting-down period of the fan into account or switch off the power supply.

Replacing filter mats in the cabinet doors (IP23/IP43/IP54)

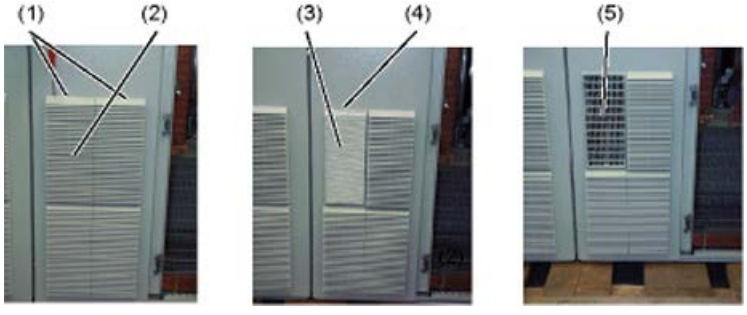


Figure 7-15 Removing/installing filter mats (IP23/IP43)

1. Insert the screwdriver into the cut-out sections provided (1) and gently push the grille cover (2) down and forwards, then remove it.
2. Remove the filter mat (3).
3. Clean the ventilation grille (5).
4. Insert the new filter mat.
5. Replace the grille cover and gently snap it back into position in the cut-out sections.
6. Repeat the procedure for all filter mats that need to be replaced.

Note

Correct replacement of filter mats

Make sure that no dirt falls into the cabinet!

The filter mat with IP54 degree of protection must be placed in the correct position (arrow points towards the cabinet).
The filter mat must be placed on the upper guide edge (4).

If you do not do this, the specified degree of protection IP23/IP43/IP54 will not be achieved!

When disposing of old filter mats, observe the applicable legal requirements!

7.5.5.2 Replacing the fan filter mats in the air discharge

Motor-operated fans with filter mats are used in the air discharge of the cabinet doors.

These are "TopTherm filter fans" from the Rittal company with article number SK 3243.100.

You can order replacement filter mats directly from the manufacturer, see here: www.rittal.com (www.rittal.com).

Filter mats are replaced from the outside without requiring any tools. You can replace the filter mats after releasing the louvered grilles.

7.5.6 Replacing power units

The components required for connecting the DC busbars to the power unit are supplied as standard. If a component is replaced, you may have to restore these connections. The connection procedure is described in the following section.

Preparatory steps:

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Allow unimpeded access to the DC busbars
  (if necessary, remove the protective covers during installation work)

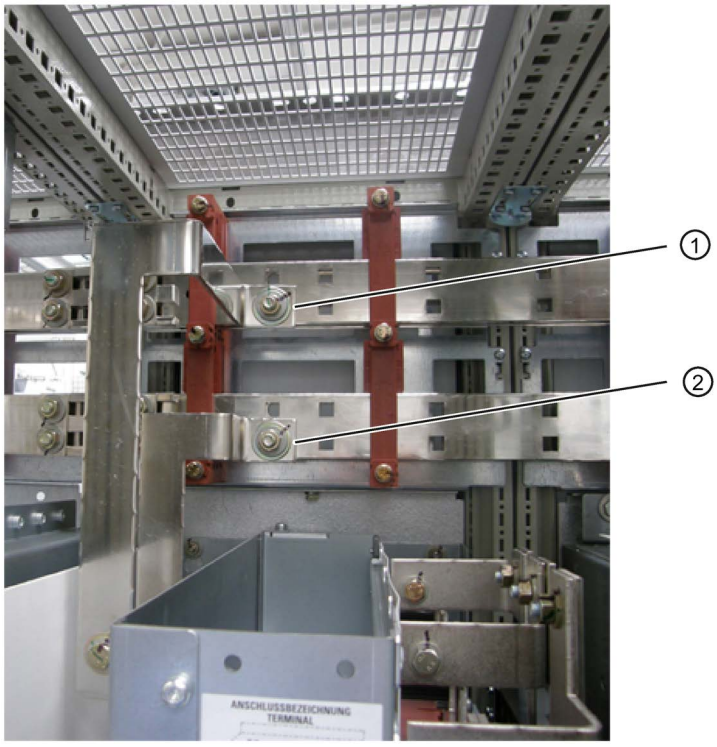


Figure 7-16 Connection to the DC busbar on the Basic Line Module, Active Line Module and Motor Module

Establishing the connection

Note

Do not use cables

The use of cables instead of the factory-installed busbars is not permitted!

Note

Make sure that you do not drop any nuts, washers, or screws as this could cause damage.

1. Connect the "DC P" connection at the Basic Line Module, Module, Active Line Module or Motor Module to the upper DC busbar (DC P) (1 x M12 screw + nut + washer; torque: 50 Nm).
2. Connect the "DC N" connection at the Basic Line Module, Active Line Module or Motor Module to the lower DC busbar (DC N) (1 x M12 screw + nut + washer; torque: 50 Nm).

7.5.7 Replacing the power unit

Replacing the power unit

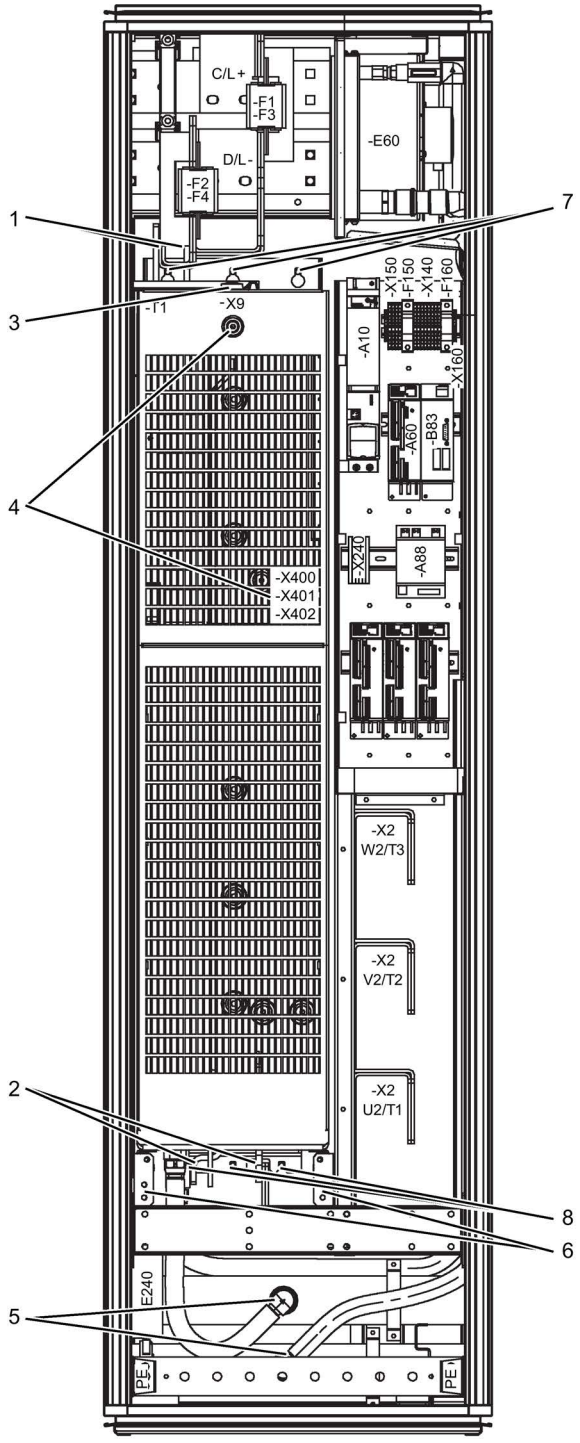


Figure 7-17 Replacing the power unit, using a Motor Module as example

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget external power supplies!)
- Remove the guard cover
- Ensure that the power unit can be freely accessed
- If required, remove the heat exchanger so that you can better access the DC busbars (see Section "Replacing the heat exchanger fan").
- Ensure that the mounting device for the power units is available (see Section "Mounting device for power units")

Removal

The removal steps are numbered in accordance with the figure above.

1. Remove the connections of the busbars to the DC busbars.
2. Remove the connections to the line supply connection (Basic Line Module, Active Line Module) or motor connection (Motor Module) and the PE connection.
3. Remove connector X9.
4. Withdraw DRIVE-CLiQ plugs -X400, -X401, -X402 ab. Note the positions of the DRIVE-CLiQ connectors.
5. Remove the connections to the cooling circuit; to do this, open the quick-release couplings at the collecting pipes.
6. Remove the connecting plates and attach the guide rails of the mounting device for the power units at the mounting points provided.
7. Remove the upper fixing nuts.
8. Remove the lower fixing nuts.

You can then pull out the power unit from the electrical cabinet.

NOTICE
Damage to the device if signal cables are damaged when removing Signal cables can be damaged when the power unit is removed. This can cause the device to fail. • When removing the power unit, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Note

Connection clip of the integrated basic interference suppression module to ground for Basic Line Modules

For Basic Line Modules, the connection clip of the integrated basic interference suppression module to ground is mounted on the spare part together with a yellow warning label.

When doing this, observe the notes in Chapter "Removing the connection clip of the integrated basic interference suppression module to ground".

7.5.8 Replacing the Control Interface Module

7.5.8.1 Replacing the Control Interface Module, Motor Module, frame size FXL

Replacing the Control Interface Module

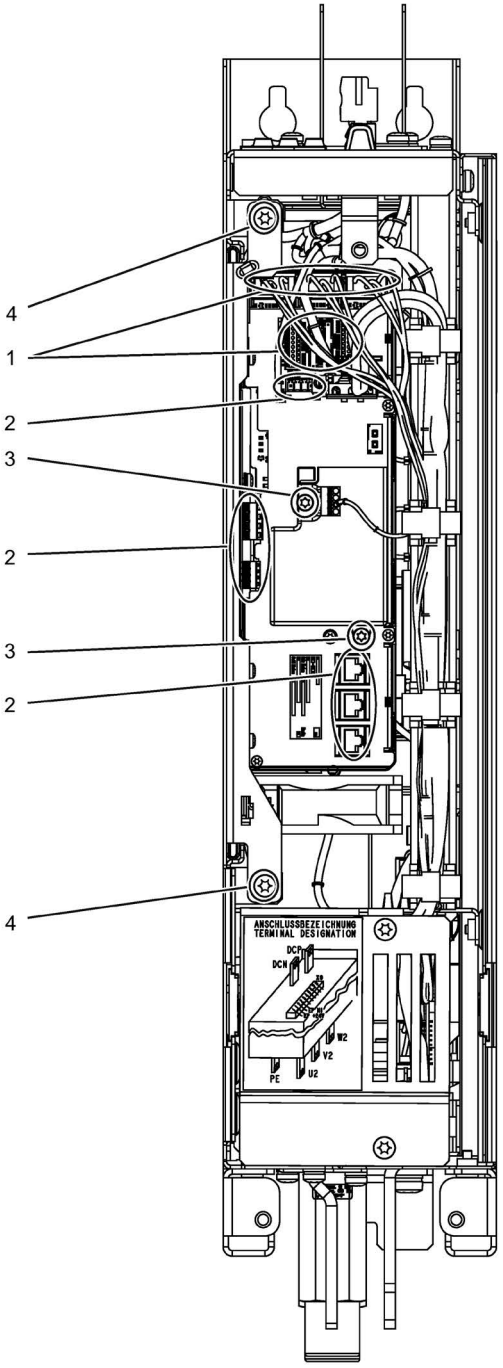


Figure 7-18 Replacing the Control Interface Module, Motor Module, frame size FXL

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

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.

7.5.8.2 Replacing the Control Interface Module, Active Line Module and Motor Module, frame size GXL

Replacing the Control Interface Module

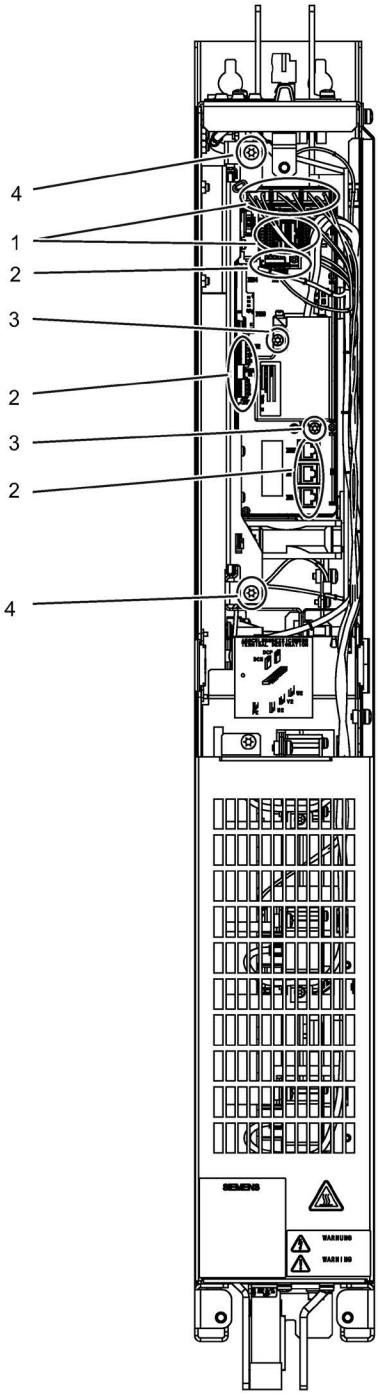


Figure 7-19 Replacing the Control Interface Module, Active Line Module and Motor Module, frame size GXL

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

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.

7.5.8.3 Replacing the Control Interface Module, Active Line Module and Motor Module, frame size HXL

Replacing the Control Interface Module

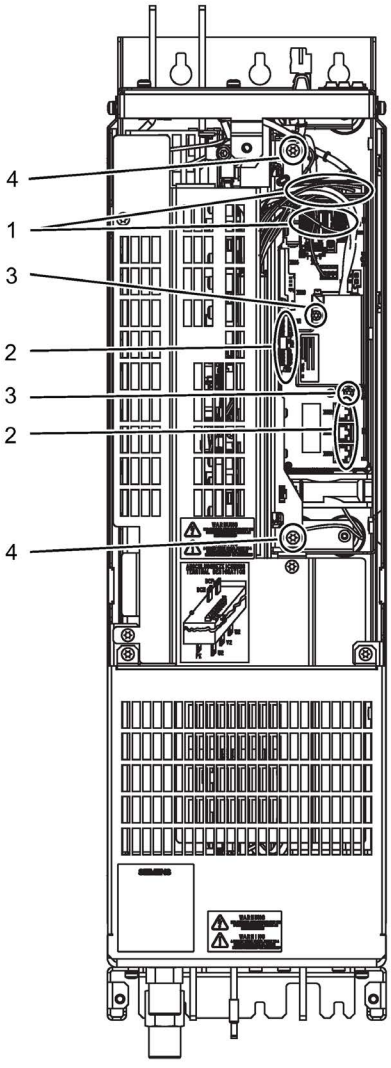


Figure 7-20 Replacing the Control Interface Module, Active Line Module and Motor Module, frame size HXL

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

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.

7.5.8.4 Replacing the Control Interface Module, Active Line Module and Motor Module, frame size JXL

Replacing the Control Interface Module

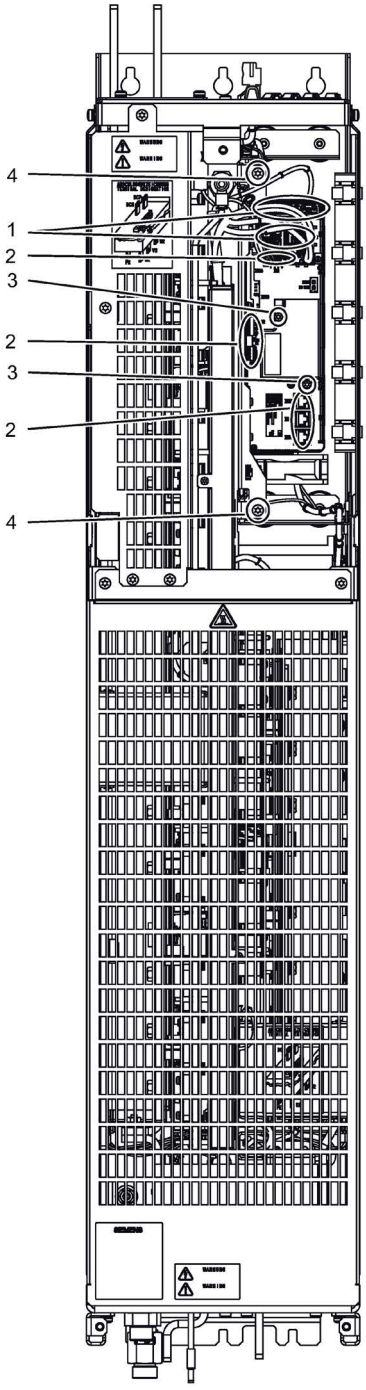


Figure 7-21 Replacing the Control Interface Module, Active Line Module and Motor Module, frame size JXL

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

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.

7.5.8.5 Replacing the Control Interface Module, Motor Module, frame size JXL 6SL3325-1TG41-6AP3

Replacing the Control Interface Module of the 6SL3725-1TG41-6AP3 Motor Module

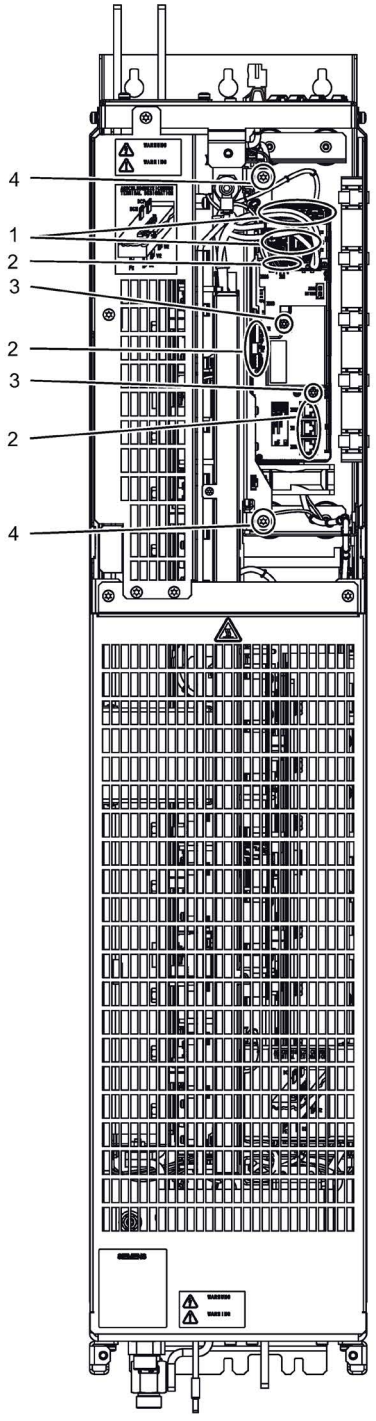


Figure 7-22 Replacing the Control Interface Module, 6SL3725-1TG41-6AP3 Motor Module

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 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 if signal cables are damaged when removing 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

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.

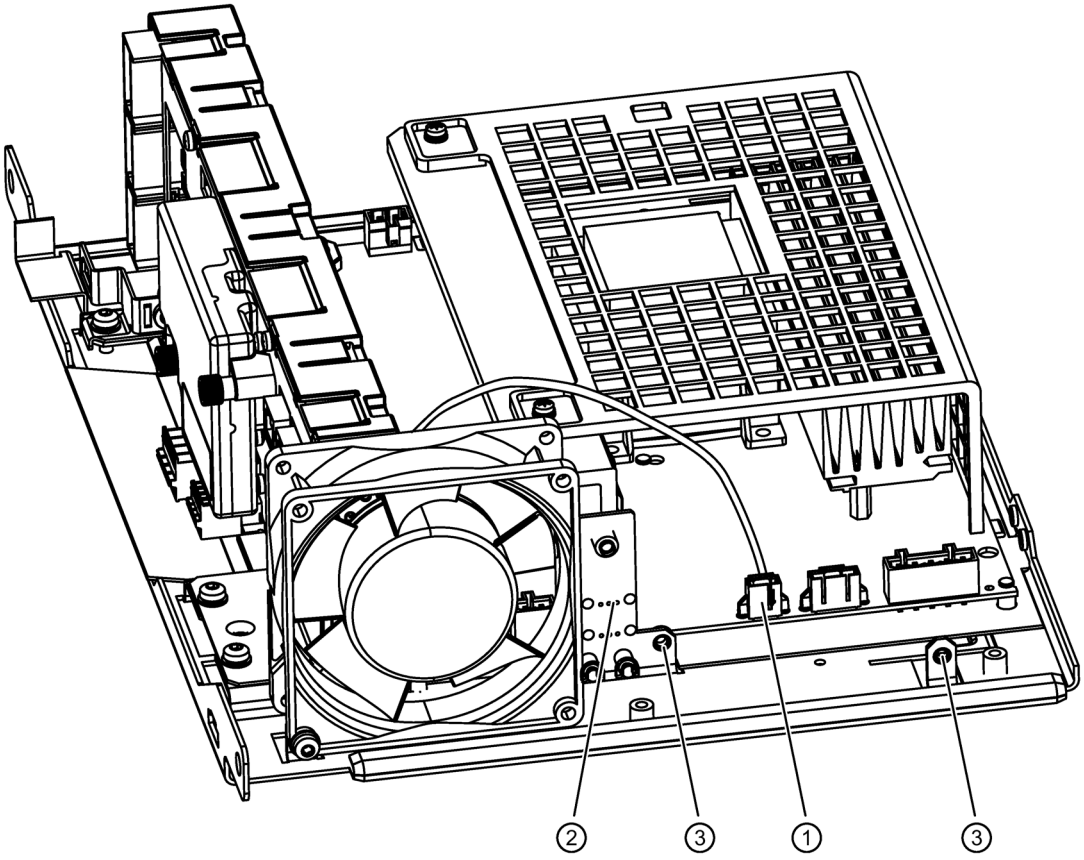
The fiber optic cable plugs must be remounted at their original slot. Fiber optic cables and sockets are accordingly labeled for correct assignment (U11, U21, U31).

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.

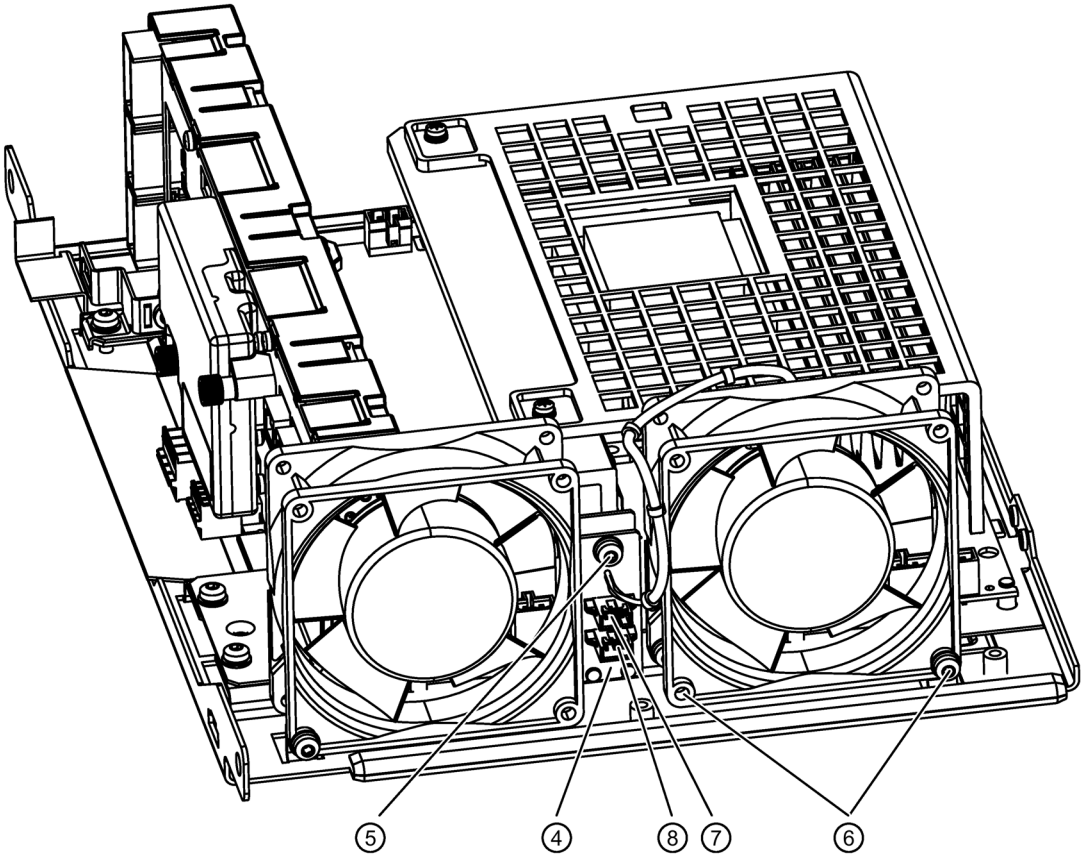
Mounting the second electronic fan

Before installing the replacement part for the Control Interface Module, the second electronic fan must first be installed in the replacement part.



① Connector for fan power supply
② Mounting location for the adapter
③ Mounting location for the second electronic fan

Figure 7-23 Replacement part, Control Interface Module with an electronic fan



④ Mounted adapter
⑤ Fastening screw for the adapter
⑥ Fixing screws for the second electronic fan
⑦ Slot for the supply for the first electronic fan (left)
⑧ Slot for the supply for the second electronic fan (right)

Figure 7-24 Replacement part, Control Interface Module with mounted, second electronic fan

The retrofit is shown in the diagrams above.

1. Release the fan supply at the connector ①.
2. Mount the adapter ④ at the mounting location provided ②, insert the adapter into the holder from above and fix using the fastening screw ⑤.
3. Mount the second electronic fan and fix it using the two fixing screws ⑥.
4. Connect the two connecting cables for the fan power supply at the provided slots ⑦ and ⑧ of the adapter.

7.5.8.6 Replacing the Control Interface Module, Basic Line Module, frame size FBL

Replacing the Control Interface Module

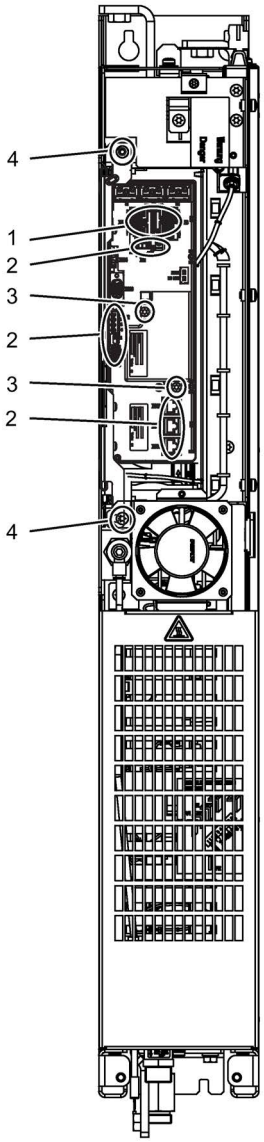


Figure 7-25 Replacing the Control Interface Module, Basic Line Module, frame size FBL

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

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.

7.5.8.7 Replacing the Control Interface Module, Basic Line Module, frame size GBL

Replacing the Control Interface Module

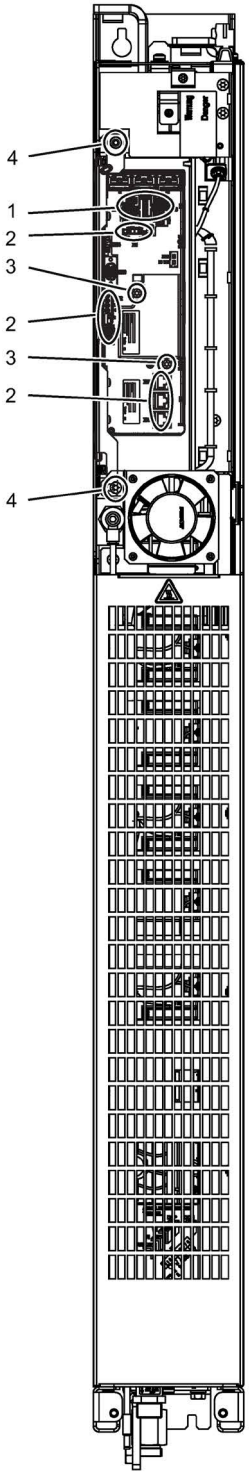


Figure 7-26 Replacing the Control Interface Module, Basic Line Module, frame size GBL

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

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.

7.5.9 Replacing the Control Unit

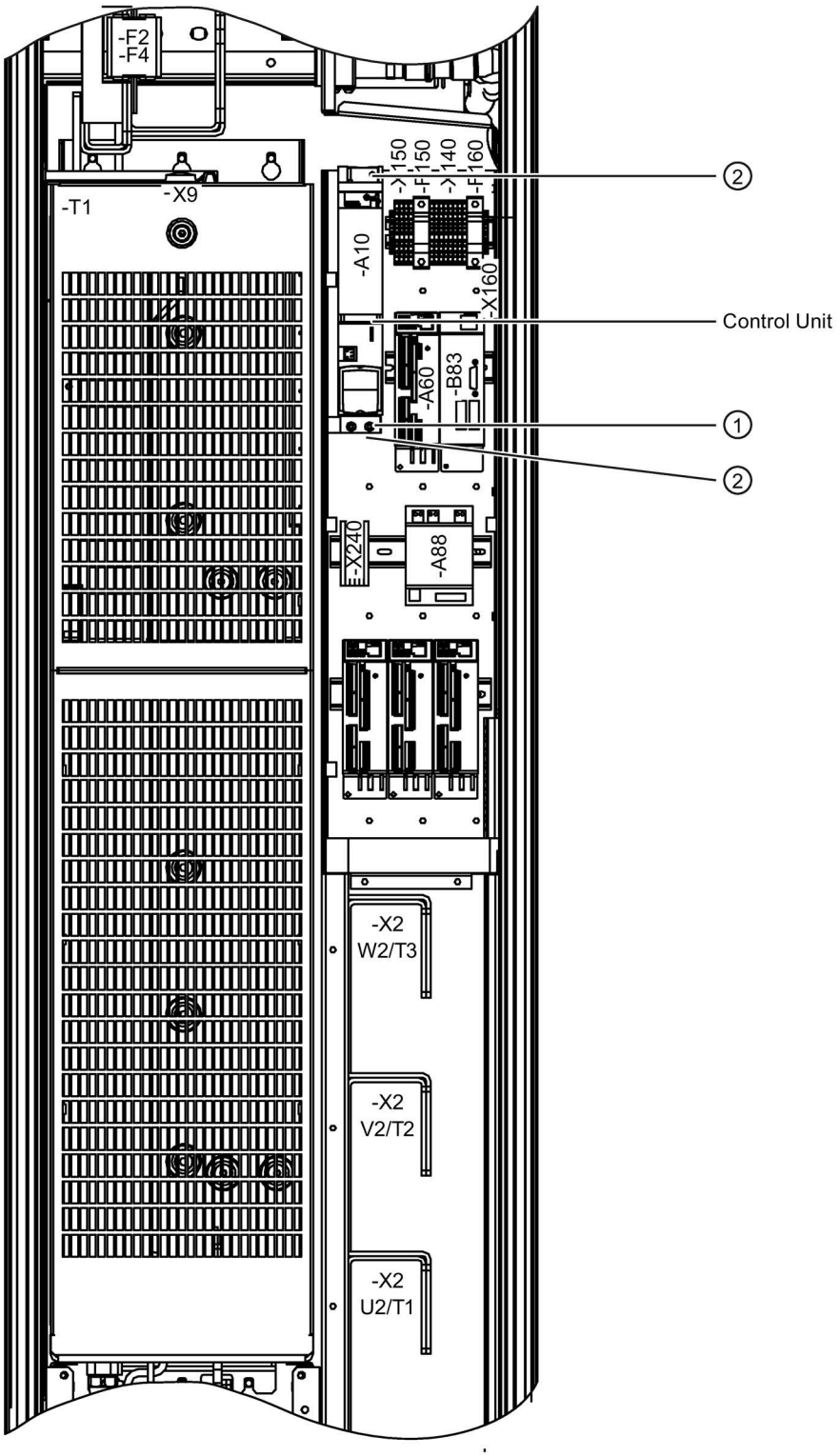


Figure 7-27 Replacing the Control Unit

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access

Removal steps

1. Release nut ①
2. Remove fastening screws ②.
3. Before withdrawing the Control Unit, remove all cables connected to the Control Unit
4. Remove and replace the Control Unit

NOTICE
Damage to the device if signal cables are damaged when removing Signal cables can be damaged when the Control Unit is removed. This can cause the device to fail. • When removing the Control Unit, ensure that you do not damage any signal cables.

Note

When installing the new Control Unit, you must reconnect the cables to exactly the same positions.

7.5.10 Replacing the fans

7.5.10.1 Replacing the electronic fan, Motor Module, frame size FXL

Replacing the electronic fan

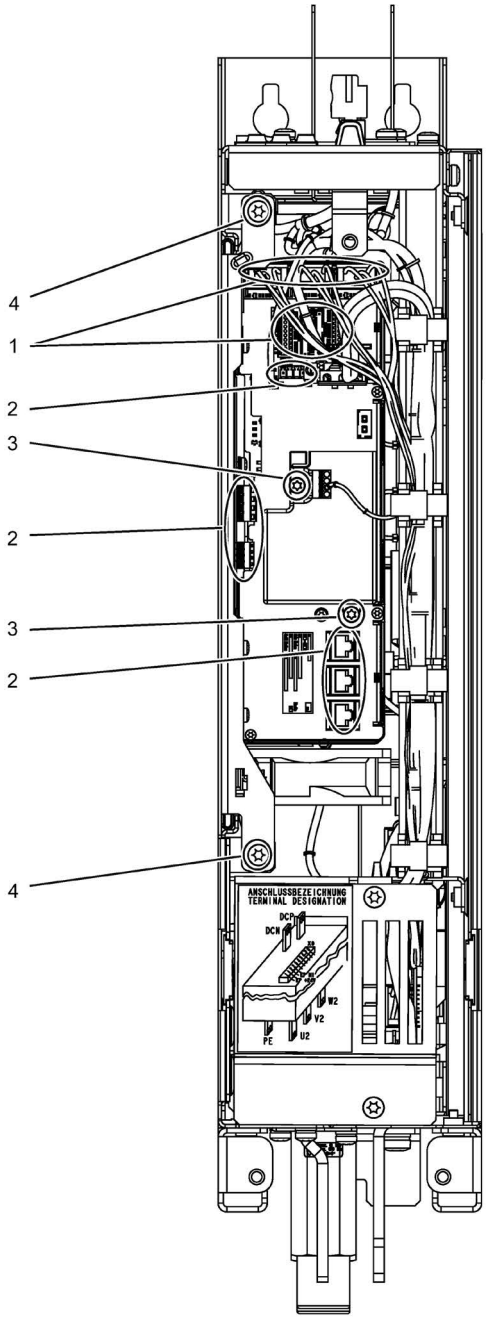


Figure 7-28 Replacing the electronic fan, Motor Module, frame size FXL

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 if signal cables are damaged when removing 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 365).

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

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.

7.5.10.2 Replacing the electronic fan, Active Line Module, and Motor Module, frame size GXL

Replacing the electronic fan

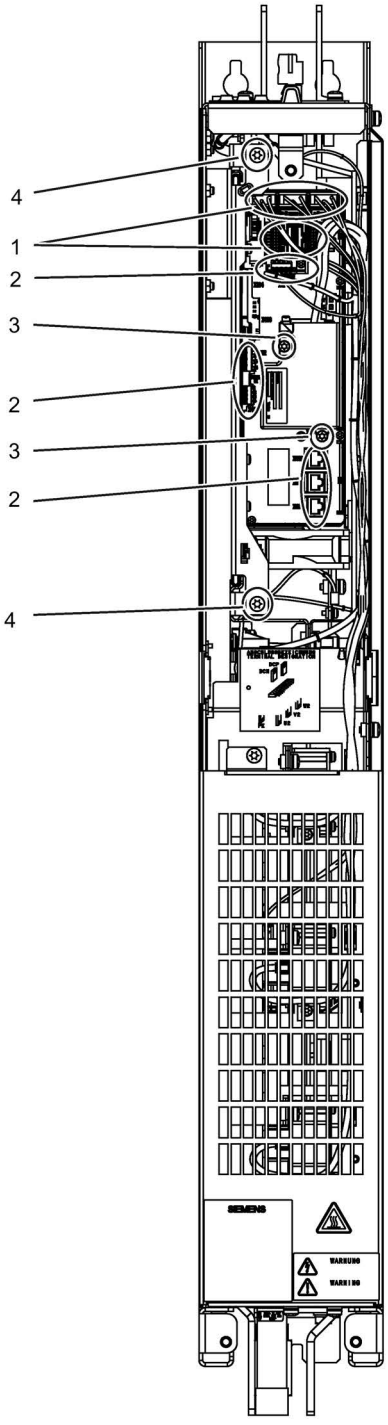


Figure 7-29 Replacing the electronic fan, Active Line Module, and Motor Module, frame size GXL

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 if signal cables are damaged when removing 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 365).

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

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.

7.5.10.3 Replacing the electronic fan, Active Line Module, and Motor Module, frame size HXL

Replacing the electronic fan

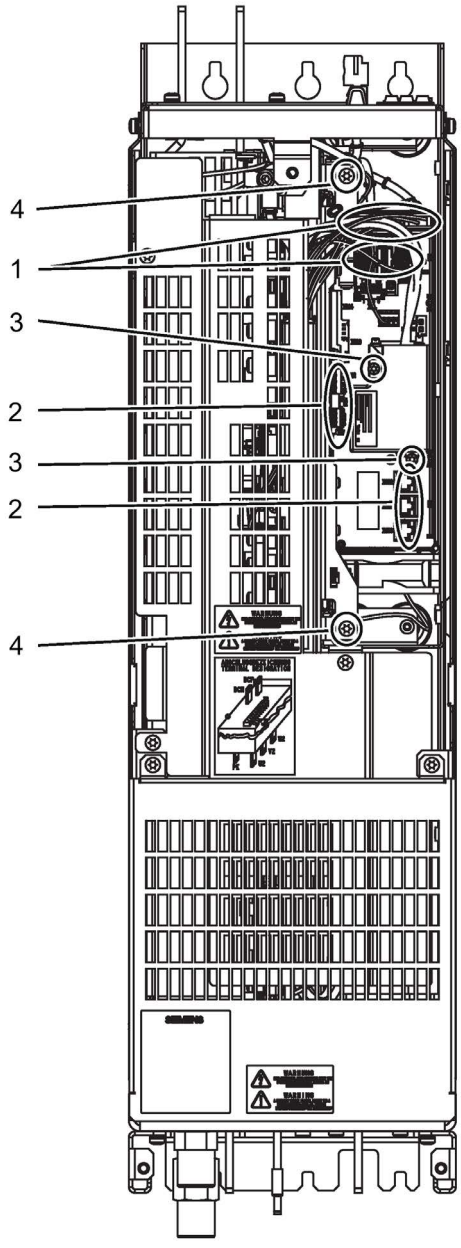


Figure 7-30 Replacing the electronic fan, Active Line Module, and Motor Module, frame size HXL

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 if signal cables are damaged when removing 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 365).

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

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.

7.5.10.4 Replacing the electronic fan, Active Line Module, and Motor Module, frame size JXL

Replacing the electronic fan

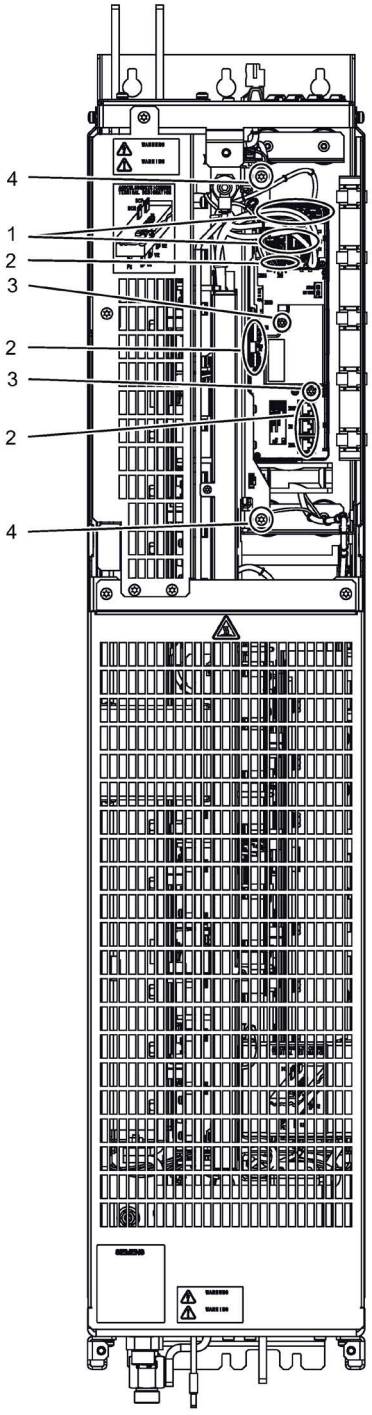


Figure 7-31 Replacing the electronic fan, Active Line Module, and Motor Module, frame size JXL

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 if signal cables are damaged when removing

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 365).

Note

Both electronic fans must be replaced for Motor Modules with Article No. 6SL3725-1TG41-6AP3.

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

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.

7.5.10.5 Replacing the electronic fan, Basic Line Module, frame size FBL

Replacing the electronic fan

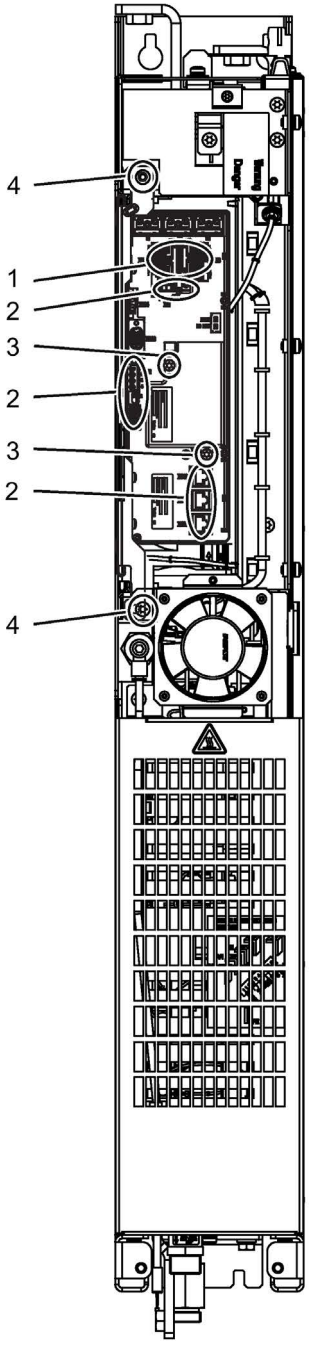


Figure 7-32 Replacing the electronic fan, Basic Line Module, frame size FBL

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 if signal cables are damaged when removing 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 365).

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

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.

7.5.10.6 Replacing the electronic fan, Basic Line Module, frame size GBL

Replacing the electronic fan

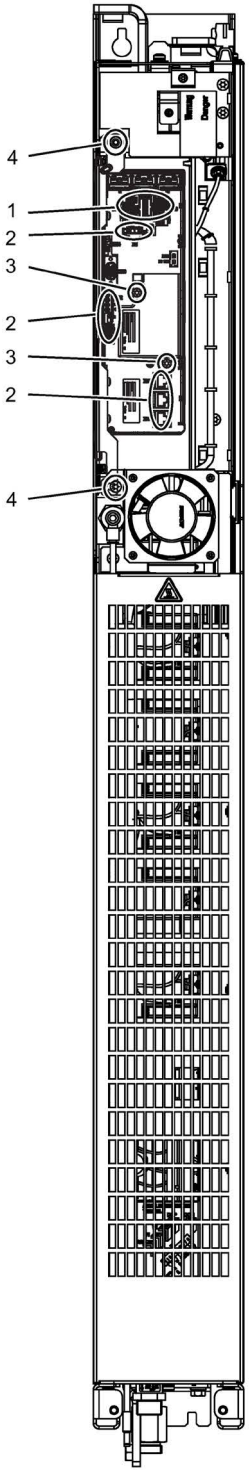


Figure 7-33 Replacing the electronic fan, Basic Line Module, frame size GBL

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 if signal cables are damaged when removing 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 365).

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

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.

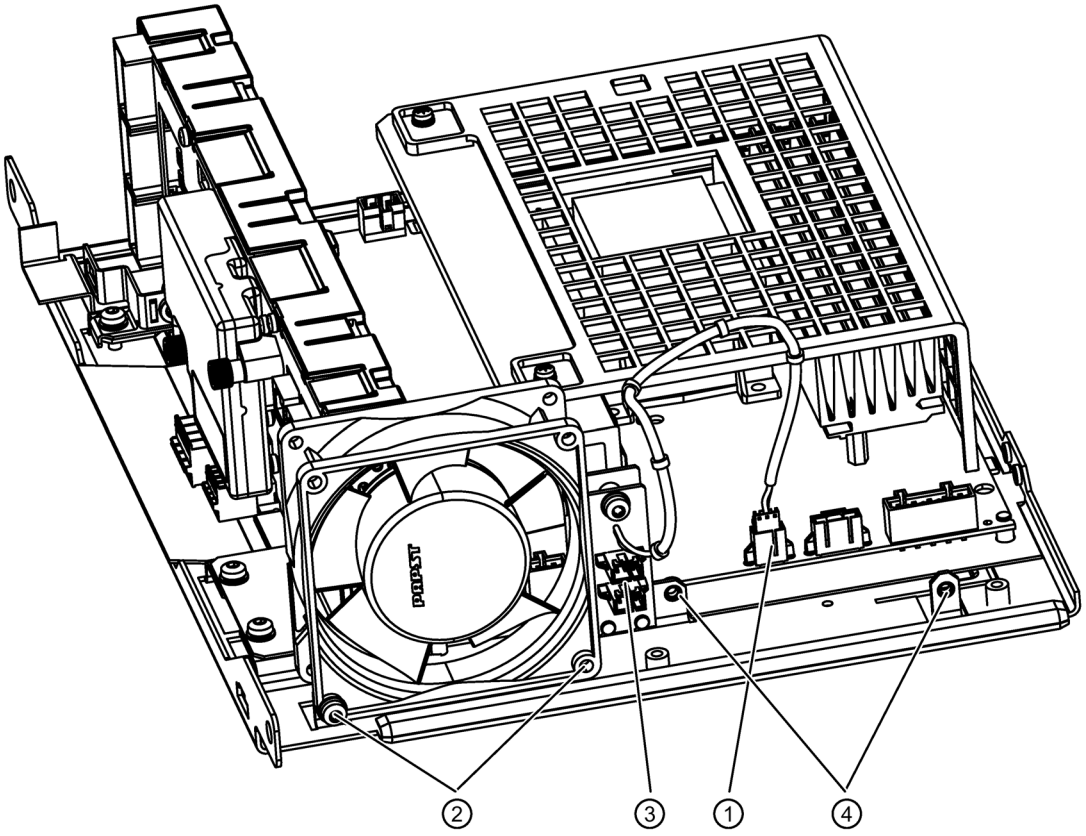
When using connectors with a locking mechanism, make sure that the locking lever is securely engaged once connected.

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.

7.5.10.7 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 7-34 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.

7.5.11 Replacing the fuses

7.5.11.1 General information

Replacement fuses

Article numbers for replacing fuses that have blown are contained in the spare parts list.

7.5.11.2 Replacing the fuses for the auxiliary power supply

Replacement fuses

You can find the article numbers in the spare parts list for replacing auxiliary power supply fuses that have blown.

Note

The fuses for the auxiliary power supply are freely accessible and can be replaced once the fault cause has been eliminated.

7.5.11.3 Replacing fuses (F71 to F73)

Fuses F71 to F73 are accommodated in the Basic Line Connection Modules and Active Line Connection Modules.

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Have the fuse grip ready.

Removal and installation procedures

Note

For Basic Line Connection Modules and Active Line Connection Modules with a rated current of < 800 A, the fuses are freely accessible and can be replaced once the fault cause has been resolved.

Note

For Basic Line Connection Modules and Active Line Connection Modules with a rated currents of between 800 A and 1600 A, the removal procedures described below must be very carefully followed when replacing fuses.

1. Open the cabinet.
2. Take the top screws out of the support plate underneath the fuses. Loosen the bottom screws slightly. The support plate can then be pushed downwards.
3. Attach the fuse grip to the fuse.
4. Remove the defective fuse.
5. Press the yellow button on the fuse grip to release the defective fuse from it.
6. Attach the new fuse onto the grip.
7. Place the new fuse in the fuse holder in the cabinet.
8. Press the yellow button on the fuse grip to release the new fuse from it.
9. Attach the support plates underneath the fuses again.
10. Close the cabinet.

Note

If necessary, the fuse grip can be ordered from Siemens.

7.5.11.4 Replacing cylindrical fuses

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).

Replacement steps

1. Open the cabinet.
2. Open the fuse holder (push the flap down/up).
3. Remove the defective fuse.
4. Insert the replacement fuse.
5. Close the fuse holder (push the flap up/down).
6. Close the cabinet.

7.5.11.5 Replacement of LV HRC fuses with blade contacts

Description

LV HRC fuses (LV HRC fuses) with blade contacts, also called blade fuses, are used, for example, in the main switches of the supply infeed.



Figure 7-35 LV HRC fuse with blade contacts

Preparatory steps

- Keep the safety equipment close at hand: LV HRC fuse puller with forearm protection for LV HRC fuse-links
- Observe the national safety regulations.



Figure 7-36 LV HRC fuse puller with forearm protection for LV HRC fuses

Note

If required, the LV HRC fuse grip can be ordered from Siemens using article number 3NX1.

Removal steps

The NH fuse is removed in the following steps:

1. Open the main switch.
2. Remove the front shock hazard protection cover of the cabinet in front of the fuses.



⚠ WARNING

Electric shock due to removed cover above the power connections

When the lower cover (over the line connections) is removed, line voltage is present even when the main switch is switched off. Contact with the connections can result in death or serious injury.

- Do not remove the cover (shock protection) over the line connections.

3. Locate the LV HRC fuse puller with forearm protection for LV HRC fuse-links over the fuse.
4. Remove the defective fuse.

NOTICE

Device failure after a LV HRC fuse trips

The neighboring LV HRC fuses may also become damaged if a LV HRC fuse trips. Failure to replace all fuses at the same time can cause the device to fail.

- After an LV HRC fuse trips, always replace all LV HRC fuses at the same time. Always use fuses of the same type.

Installation steps

The NH fuse is installed in the following steps:

1. Insert the new fuse into the LV HRC fuse puller.
2. Insert the fuse into the fuse holder.
3. Press the release button on the LV HRC fuse puller to release the grip from the new fuse.
4. Attach the front touch protection cover.

The main switch can then be switched on.



⚠WARNING

Electric shock when using unsuitable fuses

If unsuitable fuses are used, an electric shock can cause severe injury or death.

- Use only fuses specified in the spare parts list.

7.5.12 Replacing the backup battery for the cabinet operator panel

The buffer battery must be replaced if the battery voltage drops to below 2.3 V.

The battery voltage is displayed at the cabinet unit operator panel in the following menu: "Commissioning/Service" > "AOP diagnostics" > "Battery state".

Replacing the backup battery

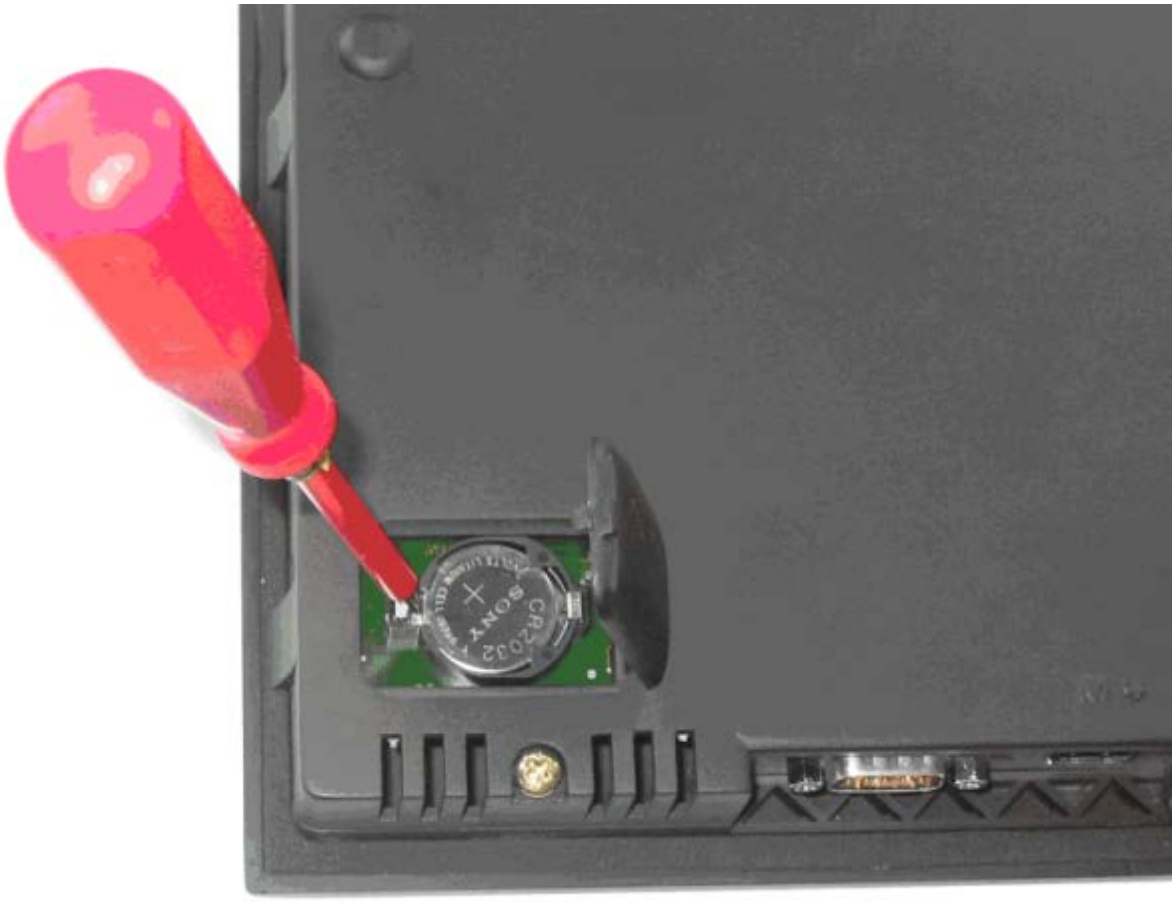


Figure 7-37 Replacing the backup battery

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).

Replacing

1. Disconnect the 24 V DC power supply and communications line on the operator panel.
2. Open the cover of the battery compartment.
3. Remove the old battery.
4. Install the new batteries.
5. Close the cover of the battery compartment.
6. Reconnect the 24 V DC power supply and communications cable.

Note

Time for replacing the battery

The battery should be replaced within one minute to ensure that no AOP settings are lost.

Technical specifications

Table 7- 3 Technical data for the backup battery

Type	**CR2032 3 V lithium battery**
Vendor	Maxell, Sony, Panasonic
Rated capacity	220 mAh
Maximum permissible charging current	10 mA (limited to <2 mA in the operator panel)
Self-discharge at 20° C	1%/year
Service life (in backup mode)	>1 year at 70 °C; >1.5 years at 20 °C
Service life (in operation)	>2 years

Disposal

The battery must be disposed of in accordance with the applicable country-specific guidelines and regulations.

7.6 Forming the DC link capacitors

Description

The DC link capacitors must be reformed if Basic Line Modules, Active Line Modules and Motor Modules have not been used for more than two years. If this is not carried out, the units could be damaged after the DC-link voltage is applied under load.

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

Note

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

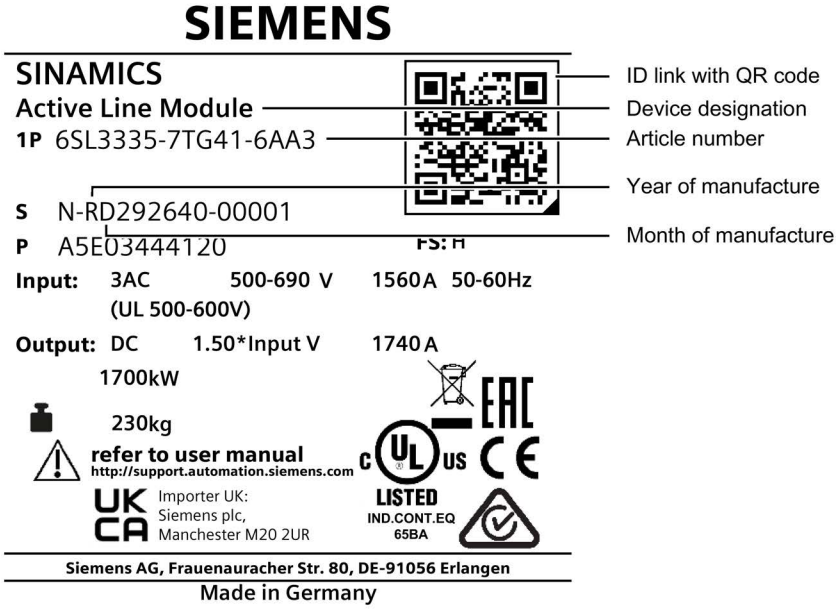


Figure 7-38 Rating plate using an Active Line Module as example

Date of manufacture

The date of manufacture can be determined as follows:

Table 7- 4 Production year and month

Character	Year of manufacture		Character	Month of manufacture
A	2010		1 to 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 has to be reformed after being in storage for a period of more than two years.

The DC link capacitors are formed by connecting the line voltage without any load connected for at least 30 minutes.
To do this, the DC link must be precharged (i.e. the Line Modules switched on), while the controller for the existing Motor Modules must not be enabled for the specified length of time.

Procedure for re-forming outside the drive line-up

Replacement power units which have to be held ready for immediate use in the event of repair or replacement can also be 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 380 to 480 V 3 AC. Alternatively, use 3 resistors of 1 kΩ / 100 W each (e.g. GWK150J1001KLX000 from Vishay) instead of the incandescent lamps.
- 6 incandescent lamps 230 V / 100 W for a line voltage of 500 to 690 V 3 AC, where 2 incandescent lamps must be connected in series in each supply phase. Alternatively, use 3 resistors of 1 kΩ / 160 W each (e.g. GWK200J1001KLX000 from Vishay) instead of the incandescent lamps.
- Various small components, such as lamp sockets, cable 1.5 mm^2, etc.



⚠ 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, insulate the two lamp sockets connected in series 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.

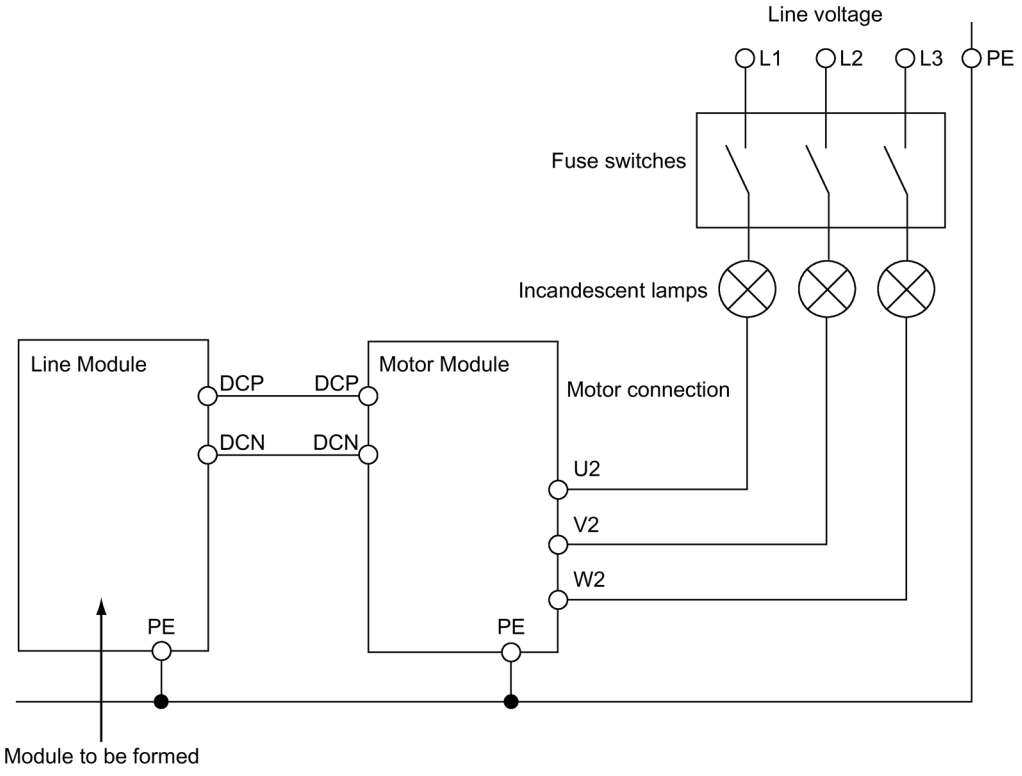


Figure 7-39 Forming circuit for Line Modules

Forming circuit for Motor Modules

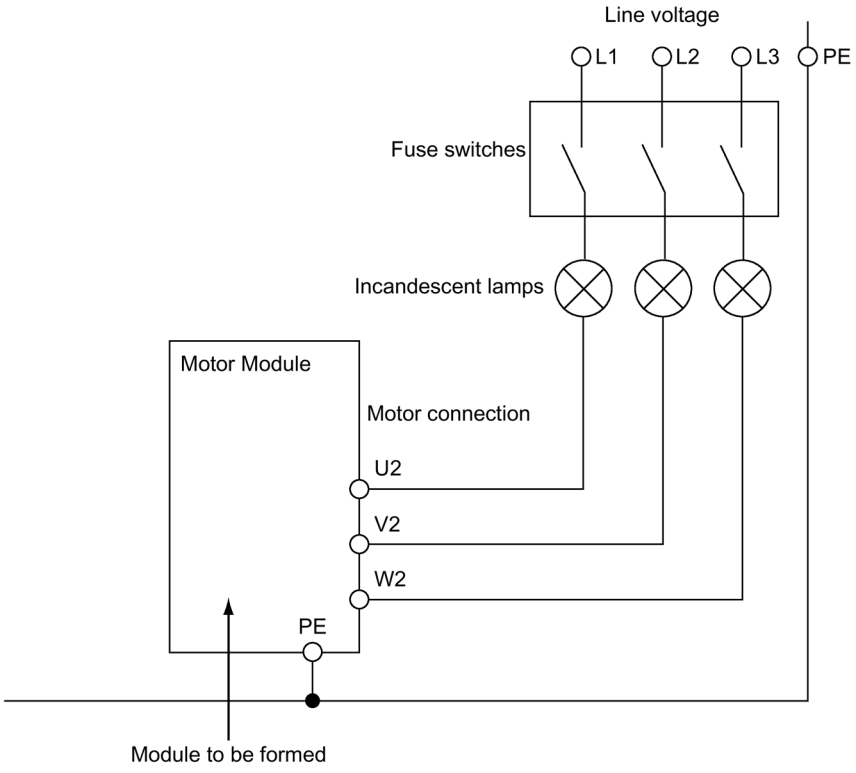


Figure 7-40 Forming circuit for Motor Modules

Procedure

- The device being formed must not receive a switch-on command (e.g. from the keyboard or terminal block).
- Connect the appropriate forming circuit.
- Forming has been completed if the DC link voltage no longer rises.

7.7 Environmental compatibility



For environmentally sustainable recycling and disposal of your old device, contact a company certified for the disposal of old electrical and electronic equipment, and dispose of the device as specified in the regulations for your particular country.

Diagnostics

8

8.1 Chapter content

This chapter provides an overview of the LEDs on the various cabinet unit components. Detailed descriptions of the components are included either in this Equipment Manual or in the device documentation provided.

The overview of the LEDs provided here is intended for rapid diagnostic purposes.

8.2 LEDs on the CU320-2 DP Control Unit

Description of the LED states

The different states while booting are indicated by LEDs on the Control Unit.

- The duration of the individual states varies.
- If an error occurs, the booting procedure is terminated and the cause is indicated on the LEDs.
- Once the unit has successfully booted, all the LEDs are briefly switched off.
- Once the unit has booted, the LEDs are controlled via the loaded software.

Behavior of the LEDs during booting

Table 8- 1 Load software

LED			State	Comments
RDY	COM	OPT		
Red	Orange	Orange	Reset	Hardware reset RDY LED lights up red, all other LEDs light up orange
Red	Red	Off	BIOS loaded	–
Red flashing light 2 Hz	Red	Off	BIOS error	• Error occurred while loading the BIOS
Red flashing light 2 Hz	Red flashing light 2 Hz	Off	File error	• Memory card not inserted or faulty • Software on memory card not present or corrupted
Red	Orange Flashing light	Off	FW loading	RDY LED lights up red, COM LED flashes orange without fixed frequency
Red	Off	Off	Firmware loaded	–
Off	Red	Off	FW checked (no CRC error)	–
Red flashing light 0.5 Hz	Red flashing light 0.5 Hz	Off	FW checked (CRC error)	• CRC error

Table 8- 2 Firmware

LED			State	Comments
RDY	COM	OPT		
Orange	Off	Off	Initializing	–
Alternating			Running	See the table below

Behavior of the LEDs after booting

Table 8- 3 Control Unit CU320-2 DP – Description of the LEDs after booting

LED	Color	State	Description, cause	Remedy
RDY (READY)	-	Off	The electronics power supply is missing or outside the permissible tolerance range.	Check power supply
	Green	Steady light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.	–
		Flashing 0.5 Hz	Commissioning/reset	–
		Flashing light 2 Hz	Writing to the memory card	–
		Flashing light 0.5 s on, 3 s off	PROFIenergy energy-saving mode is active (in conjunction with option G33 - CBE20)	–

LED	Color	State	Description, cause	Remedy
	Red	Flashing light 2 Hz	General errors	Check parameterization / configuration data
	Red/ green	Flashing light 0.5 Hz	Control Unit is ready for operation. However, there are no software licenses.	Upgrade licenses
	Orange	Flashing 0.5 Hz	Updating the firmware of the connected DRIVE-CLiQ components	–
		Flashing light 2 Hz	DRIVE-CLiQ component firmware update has been completed. Wait for POWER ON of the respective component.	Carry out POWER ON for the components in question
	Green/ orange or red/ orange	Flashing light 2 Hz	Component recognition via LED is activated. **Note**: Both options depend on the LED status when component recognition is activated via p0124[0] = 1.	–
COM PROFIdrive cyclic operation	–	Off	Cyclic communication has not (yet) taken place. **Comment:** PROFIdrive is ready for communication if the Control Unit is ready (see LED RDY).	–
	Green	Steady light	Cyclic communication is taking place.	–
		Flashing light 0.5 Hz	Full cyclic communication has not yet taken place. Possible causes: • The controller is not transferring any setpoints. • During isochronous operation, no global control (GC) or a faulty global control (GC) is transferred by the controller.	–
	Red	Flashing light 0.5 Hz	PROFIBUS master is sending wrong parameterization/configuration data	Adapt configuration between master/controller and CU
		Flashing light 2 Hz	Cyclic bus communication has been interrupted or could not be established	Correct the fault
OPT (OPTION)	–	Off	The electronics power supply is missing or outside the permissible tolerance range. Component is not ready. Option board not installed or no associated drive object has been created.	Check power supply and/or component
	Green	Steady light	Option board is ready.	–
		Flashing light 0.5 Hz	Depends on the option board used[1].	–
	Red	Continuous light	Depends on the option board used[1].	–
		Flashing light 0.5 Hz	Depends on the option board used[1].	–
		Flashing light 2 Hz	At least one fault is present in this component. Option board not ready (e.g. after switching on).	Remedy and acknowledge fault
RDY and COM	Red	Flashing light 2 Hz	Bus fault - communication has been interrupted	Correct the fault
RDY and OPT	Orange	Flashing light 0.5 Hz	The firmware of the connected option board is being updated.	–

[1] Any individual response of the LED OPT is described for the respective Option Board.

8.3 LEDs on the CU320-2 PN Control Unit

Description of the LED states

The different states while booting are indicated by LEDs on the Control Unit.

- The duration of the individual states varies.
- If an error occurs, the booting procedure is terminated and the cause is indicated on the LEDs.
- Once the unit has successfully booted, all the LEDs are briefly switched off.
- Once the unit has booted, the LEDs are controlled via the loaded software.

Behavior of the LEDs during booting

Table 8- 4 Load software

LED			State	Comments
RDY	COM	OPT		
Red	Orange	Orange	Reset	Hardware reset RDY LED lights up red, all other LEDs light up orange
Red	Red	Off	BIOS loaded	–
Red flashing light 2 Hz	Red	Off	BIOS error	• Error occurred while loading the BIOS
Red flashing light 2 Hz	Red flashing light 2 Hz	Off	File error	• Memory card not inserted or faulty • Software on memory card not present or corrupted
Red	Orange flashing light	Off	FW loading	RDY LED lights up red, COM LED flashes orange without fixed frequency
Red	Off	Off	Firmware loaded	–
Off	Red	Off	FW checked (no CRC error)	–
Red flashing light 0.5 Hz	Red flashing light 0.5 Hz	Off	FW checked (CRC error)	• CRC error

Table 8- 5 Firmware

LED			State	Comments
RDY	COM	OPT		
Orange	Off	Off	Initializing	–
Alternating			Running	See the table below

Behavior of the LEDs after booting

Table 8- 6 Control Unit CU320-2 PN – Description of the LEDs after booting

LED	Color	State	Description, cause	Remedy
RDY (READY)	–	Off	The electronics power supply is missing or outside the permissible tolerance range.	Check power supply
	Green	Steady light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.	–
		Flashing light 0.5 Hz	Commissioning/reset	–
		Flashing light 2 Hz	Writing to the memory card	–
		Flashing light 0.5 s on, 3 s off	PROFIenergy energy saving mode is active	–
	Red	Flashing light 2 Hz	General errors	Check parameterization / configuration data
	Red/ green	Flashing light 0.5 Hz	Control Unit is ready for operation. However, there are no software licenses.	Upgrade licenses
	Orange	Flashing light 0.5 Hz	Updating the firmware of the connected DRIVE-CLiQ components	–
		Flashing light 2 Hz	DRIVE-CLiQ component firmware update has been completed. Wait for POWER ON of the respective component.	Carry out POWER ON for the components in question
	Green/ orange or red/ orange	Flashing light 2 Hz	Component recognition via LED is activated. **Remark**: Both options depend on the LED status when activating p0124[0] = 1.	–
COM PROFIdrive cyclic operation	–	Off	Cyclic communication has not (yet) taken place. **Remark:** PROFIdrive is ready for communication when the Control Unit is ready (see LED RDY).	–
	Green	Steady light	Cyclic communication is taking place.	–
		Flashing light 0.5 Hz	Full cyclic communication has not yet taken place. Possible causes: • The controller is not transferring any setpoints. • During isochronous operation, no global control (GC) or a faulty global control (GC) is transferred by the controller. • "Shared Device" is selected and only one controller connected.	–
	Red	Flashing light 0.5 Hz	Bus error, incorrect parameter assignment/configuration	Adapt configuration between controller and devices
		Flashing light 2 Hz	Cyclic bus communication has been interrupted or could not be established	Correct the fault

LED	Color	State	Description, cause	Remedy
OPT (OPTION)	–	Off	The electronics power supply is missing or outside the permissible tolerance range. Component is not ready. Option board not installed or no associated drive object has been created.	Check power supply and/or component
	Green	Steady light	Option board is ready.	–
		Flashing light 0.5 Hz	Depends on the option board used[1].	–
	Red	Continuous light	Depends on the option board used[1].	–
		Flashing light 0.5 Hz	Depends on the option board used[1].	–
		Flashing light 2 Hz	At least one fault is present in this component. Option board not ready (e.g. after switching on).	Remedy and acknowledge fault
RDY and COM	Red	Flashing light 2 Hz	Bus fault – communication has been interrupted	Correct the fault
RDY and OPT	Orange	Flashing light 0.5 Hz	The firmware of the connected option board is being updated.	–

[1] Any individual response of the LED OPT is described for the respective Option Board.

8.4 LEDs on the CBE20 Communication Board

Table 8- 7 Meaning of the LEDs at ports 1 to 4 of the X1400 interface

LED	Color	State	Description
Link port	–	Off	The electronics power supply is missing or outside the permissible tolerance range (link missing or defective).
	Green	Steady light	A different device is connected to port x and a physical connection exists.
Activity port	–	Off	The electronics power supply is missing or outside the permissible tolerance range (no activity).
	Yellow	Flashing light	Data is being received or sent at port x.

Table 8- 8 Meaning of the Sync and Fault LEDs on the CBE20

LED	Color	State	Description
Fault	–	Off	If the link port LED is green: The CBE20 is operating error-free, and data is being exchanged with the configured IO controller.
	Red	Flashing light	- The watchdog timer has elapsed. - Communication has been interrupted. - The IP address is incorrect. - Incorrect or missing configuration. - Incorrect parameter assignment. - Incorrect or missing device name. - IO controller not present/switched off but Ethernet connection present. - Other CBE20 errors.
		Steady light	CBE20 bus error - No physical connection to a subnet/switch. - Incorrect transmission rate. - Full-duplex transmission is not activated.
Sync	–	Off	If the link port LED is green: Control Unit task system is not synchronized with the IRT clock. An internal substitute clock is generated.
	Green	Flashing light	Control unit task system has synchronized with the IRT clock and data is being exchanged.
		Steady light	Task system and MC-PLL have synchronized with the IRT clock.

Table 8- 9 Meaning of the OPT LED on the Control Unit

LED	Color	State	Description, cause
OPT	–	OFF	Electronics power supply is missing or outside permissible tolerance range. The CBE20 is defective or not inserted.
	Green	Steady light	CBE20 is ready and cyclic communication is taking place.
		Flashing light 0.5 Hz	CBE20 is ready but cyclic communication is not running. Possible causes: - Communication is being established. -At least one fault is present.
	Red	Steady light	Cyclic communication via PROFINET has not yet been established. However, acyclic communication is possible. SINAMICS is waiting for a parameterization/configuration telegram.
		Flashing light 0.5 Hz	The firmware download to the CBE20 has failed. Possible causes: - The memory card of the Control Unit is faulty. - The CBE20 is out of order. The CBE20 cannot be used in this state.
		Flashing light 2 Hz	Communication between the Control Unit and the CBE20 is faulty. Possible causes: - The CBE20 was removed following power-up. - The CBE20 is defective.
	Orange	Flashing light 0.5 Hz	Firmware is being updated.

8.5 LEDs on the Control Interface Module in the Basic Line Module

Table 8- 10 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 outside the permissible tolerance range.
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. Wait 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 8- 11 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 < 100 V and voltage at -X9:1/2 less than 12 V.
		On	The component is ready for operation.
		Flashing light	There is a fault. If the LED continues to flash after you have performed a POWER ON, please contact your Siemens service center.



⚠WARNING

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.

8.6 LEDs on the Control Interface Module in the Active Line Module

Table 8- 12 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 outside the permissible tolerance range.
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. Wait 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 8- 13 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 < 100 V and voltage at -X9:1/2 less than 12 V.
		On	The component is ready for operation.
		Flashing light	There is a fault. If the LED continues to flash after you have performed a POWER ON, please contact your Siemens service center.



⚠WARNING

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.

8.7 LEDs on the Control Interface Module in the Motor Module

Table 8- 14 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 outside the permissible tolerance range.
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. Wait 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 8- 15 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 < 100 V and voltage at -X9:1/2 less than 12 V.
		On	The component is ready for operation.
		Flashing light	There is a fault. If the LED continues to flash after you have performed a POWER ON, please contact your Siemens service center.



⚠WARNING

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.

8.8 LEDs on the Voltage Sensing Module (VSM) in the Active Interface Module

Table 8- 16 Meaning of the LEDs on the Voltage Sensing Module in the Active Interface Module

LED	Color	State	Description
RDY (READY)	---	Off	The electronics power supply is missing or outside the permissible tolerance range.
	Green	Steady light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	Steady light	DRIVE-CLiQ communication is being established.
	Red	Steady 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.

8.9 LEDs on the SMC10 Sensor Module

Table 8- 17 Meaning of the LEDs on the SMC10 Sensor Module

LED	Color	State	Description
RDY (READY)	---	Off	The electronics power supply is missing or outside the permissible tolerance range.
	Green	Steady light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	Steady light	DRIVE-CLiQ communication is being established.
	Red	Steady 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.

8.10 LEDs on the SMC20 Sensor Module

Table 8- 18 Meaning of the LEDs on the SMC20 Sensor Module

LED	Color	State	Description
RDY (READY)	---	Off	The electronics power supply is missing or outside the permissible tolerance range.
	Green	Steady light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	Steady light	DRIVE-CLiQ communication is being established.
	Red	Steady 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.

8.11 LEDs on the SMC30 Sensor Module

Table 8- 19 Meaning of the LEDs on the SMC30 Sensor Module

LED	Color	State	Description
RDY (READY)	---	Off	The electronics power supply is missing or outside the permissible tolerance range.
	Green	Steady light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	Steady light	DRIVE-CLiQ communication is being established.
	Red	Steady 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.

LED	Color	State	Description
OUT > 5V	-	Off	The electronics power supply is missing or outside the permissible tolerance range. Power supply ≤ 5 V.
	Orange	Steady light	The electronics power supply for the measuring system is available. Measuring system supply > 5 V **Notice:** You must ensure that the connected encoder can be operated with a 24 V power supply. If an encoder that is designed for a 5 V supply is operated with a 24 V supply, this can destroy the encoder electronics.

8.12 LEDs on the TM31 Terminal Module

Table 8- 20 Description of the LEDs on the TM31

LED	Color	State	Description
READY	-	Off	The electronics power supply is missing or out of tolerance.
	Green	Steady light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	Steady light	DRIVE-CLiQ communication is being established.
	Red	Steady 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 light 0.5 Hz	Firmware is being downloaded.
		Flashing light 2 Hz	Firmware download is complete. Waiting for POWER ON.
	Green/ orange or Red/ orange	Flashing light 2 Hz	Detection of the components via LED is activated (p0154). **Remark:** Both options depend on the LED status when module recognition is activated via p0154 = 1.

8.13 LEDs on the TM54F Terminal Module

Table 8- 21 Meaning of the LEDs on the Terminal Module TM54F

LED	Color		State	Description, cause
READY	-		Off	The electronics power supply is missing or outside the permissible tolerance range.
	Green		Steady light	The component is ready for operation, cyclic DRIVE-CLiQ communication is taking place.
	Orange		Steady light	DRIVE-CLiQ communication is being established.
	Red		Steady 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 light 0.5 Hz	Firmware is being downloaded.
			Flashing light 2 Hz	Firmware download has been completed. Wait for POWER ON.
	Green/orange or Red/Orange		Flashing light	Detection of the components via LED is activated (p0154). **Remark:** Both options depend on the LED status when module recognition is activated via p0154 = 1.
L1+, L2+,	–		On	The controllable sensor power supply is functioning fault-free.
	Red		Steady light	There is a fault in the controllable sensor power supply.
L3+	–		On	The sensor power supply is operating fault-free.
	Red		Steady light	The sensor power supply has a fault.
Fail-safe inputs / double inputs				
F_DI z (input x, (x+1)+, (x+1)-)	**LED**	**LED**		
	x	x+1		**NC contact/NC contact[1]: (z = 0 ... 9, x = 0, 2, ... 18)**
	–	Red	Steady light	Different signal states at input x and x+1
	–	–	–	No signal at input x and no signal at input x+1
				NC contact/NO contact[1]: (z = 0 ... 9, x = 0, 2, ... 18)
	–	Red	Steady light	Same signal states at input x and x+1
	–	–	–	No signal at input x and no signal at input x+1
	LED	**LED**		
	x	x+1		**NC contact/NC contact[1]: (z = 0 ... 9, x = 0, 2, ... 18)**
	Green	Green	Steady light	One signal at input x and one signal at input x+1
				NC contact/NO contact[1]: (z = 0 ... 9, x = 0, 2, ... 18)
	Green	Green	Steady light	One signal at input x and no signal at input x+1
Single digital inputs, not fail-safe				
DI x	–		Off	No signal at digital input x (x = 20 ... 23)
	Green		Steady light	Signal at digital input x
Fail-safe digital outputs with associated readback channel				
F_DO y (0+..3+, 0-..3-)	Green		Steady light	Output y (y = 0 ... 3) has an active signal
Read back input DI 2y for output F_DO y (y = 0 ... 3) for test stop. The state of the LEDs depends on the type of external circuitry.				
DI 2y	–		Off	One of the two output lines y+ or y- or both lines of output y carry a signal
	Green		Steady light	Both output lines y+ and y- carry no signal

[1] Inputs x+1 (DI 1+, 3+, .. 19+) can be individually adjusted by a parameter (see List Manual)

8.14 LEDs on the TM150 Terminal Module

TM150 Terminal Module (-A151 to -A154)

Table 8- 22 Description of the LEDs on the TM150

LED	Color	State	Description
READY	-	Off	The electronics power supply is missing or outside the permissible tolerance range.
	Green	Steady light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	Steady light	DRIVE-CLiQ communication is being established.
	Red	Steady 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 light 0.5 Hz	Firmware is being downloaded.
		Flashing light 2 Hz	Firmware download is complete. Waiting for POWER ON.
	Green/ orange or Red/ orange	Flashing light 2 Hz	Detection of the components via LED is activated (p0154). **Remark:** Both options depend on the LED status when module recognition is activated via p0154 = 1.

8.15 LEDs on the SITOP power supply unit

Table 8- 23 Meaning of the LEDs on the SITOP power supply unit

LED	Meaning
Green	Output voltage > 20.5 V
Yellow	Overload, output voltage < 20.5 V ("constant current" mode)
Red	Latching shutdown ("Shutdown" mode)

Options

9

9.1 Safety information

⚠WARNING

Failure to observe the general safety instructions and residual risks

If the general safety instructions and remaining risks are not observed, accidents can occur involving severe injuries or death.

- Observe the general safety instructions.
- When assessing the risk, take into account residual risks.

Note

Different types of Cabinet Modules

The Cabinet Modules come in a range of different frame sizes, with each size differing from the others in several ways. The main differences are:

- The covers can have different dimensions, and they can be arranged and secured differently.
- The components can be arranged differently within the cabinet units.
- The components can be mounted differently within the cabinet units.

These variations result from the different requirements made of the components/equipment installed in the cabinet units. These differences are intentional and exist for "EMC optimization" reasons.

9.2 B50, generation of a material declaration Green Passport

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules
- Active Line Connection Modules compact
- Motor Modules
- Motor Modules compact
- Heat Exchanger Module
- Auxiliary Power Supply Modules

Description

With the option, a form for the material declaration according to the Green Passport is generated.

The subject of the declaration described is harmonized with the Guidelines for the Development of the Inventory of Hazardous Materials - Resolution MEPC.269(68).

9.3 C95, supply voltage for the Heat Exchanger Module 440 - 480 V / 60 Hz

Availability of option

This option is available for the following S120 Cabinet Modules:

- Heat Exchanger Modules

Description

The power supply voltage of the Heat Exchanger Module is 440 V ... 480 V 3 AC, the line frequency is 60 Hz.

9.4 C97, supply voltage for the Heat Exchanger Module 500 - 690 V / 60 Hz

Availability of option

This option is available for the following S120 Cabinet Modules:

- Heat Exchanger Modules

Description

The power supply voltage of the Heat Exchanger Module is 3 AC 500 V ... 690 V, the line frequency is 60 Hz.

Note

Voltage adaptation for the pump

For Heat Exchanger Modules for line voltages of 3 AC 500 ... 690 V, the voltage is adapted to the 3 AC 400 V ... 460 V (60 Hz) pump supply voltage using a transformer.

9.5 E51, E61, E71, individual certificates

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules
- Active Line Connection Modules compact
- Motor Modules
- Motor Modules compact
- Heat Exchanger Module
- Auxiliary Power Supply Modules

Description

The type certificates for marine classification societies DNV, ABS and CCS are provided for the Cabinet Modules described in the Equipment Manual.

An individual certificate for a specific marine classification society is generated:

- E51: Individual certificate from the DNV
- E61: Individual certificate from the American Bureau of Shipping (ABS)
- E71: Individual certificate from the China Classification Society (CCS)

An additional individual certification of the Cabinet Module by the relevant marine classification society includes the expansions described under option M66.

With the specific option, the documentation and the converter are accepted by the relevant marine classification society and an individual certificate is created.

9.6 G20, CBC10 Communication Board

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules
- Motor Modules

Description

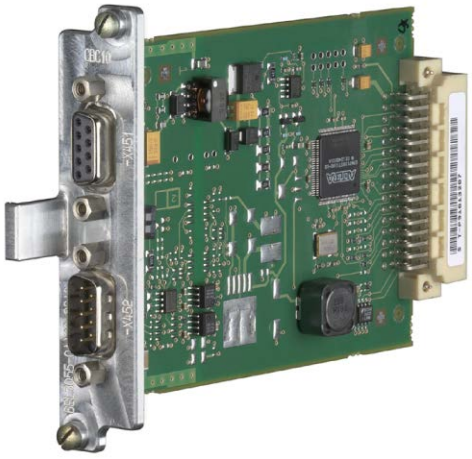


Figure 9-1 Communication Board CAN CBC10

The CBC10 CANopen communications module (Communication Board CAN) is used to connect drives in the SINAMICS drive system to higher-level automation systems with a CAN Bus.

The CANopen option module uses two 9-pin D-sub connectors for the connection to the CAN bus system.

The connectors can be used as input or output. Unused pins are plated-through.

The following baud rates are also supported:
10, 20, 50, 125, 250, 500, 800 kBaud and 1 MBaud.

The module is installed in the factory in the option slot of the CU320-2 Control Unit.

NOTICE
Damage or malfunctions to the Option Board by inserting and withdrawing in operation Withdrawing and inserting Option Boards during operation can damage them or cause the Option Boards to malfunction. • Only withdraw or insert Option Boards when the Control Unit is in a no voltage state.

Note

Additional information

Detailed and comprehensive instructions and information regarding the CBC10 Communication Board are provided in the operating instructions in the device documentation.

Interface overview

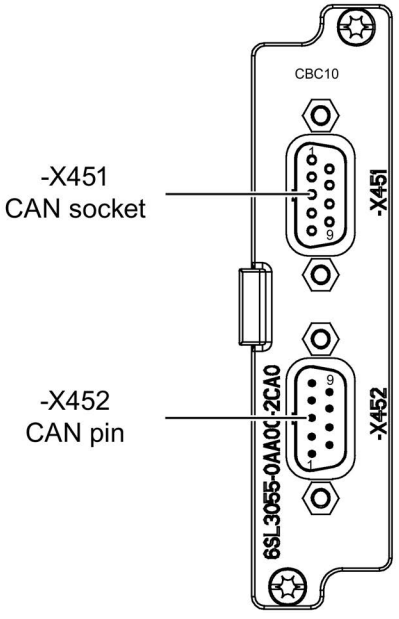
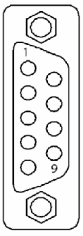


Figure 9-2 CBC10 Communication Board CAN, interface overview

X451 CAN bus interface

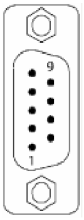
Table 9- 1 CAN bus interface X451

Connector	Pin	Designation	Technical data
	1	Reserved, do not use	
	2	CAN_L	CAN signal (dominant low)
	3	CAN_GND	CAN ground
	4	Reserved, do not use	
	5	CAN_SHLD	Optional shield
	6	GND	CAN ground
	7	CAN_H	CAN signal
	8	Reserved, do not use	
	9	Reserved, do not use	
Connector type: 9-pin D-sub socket			

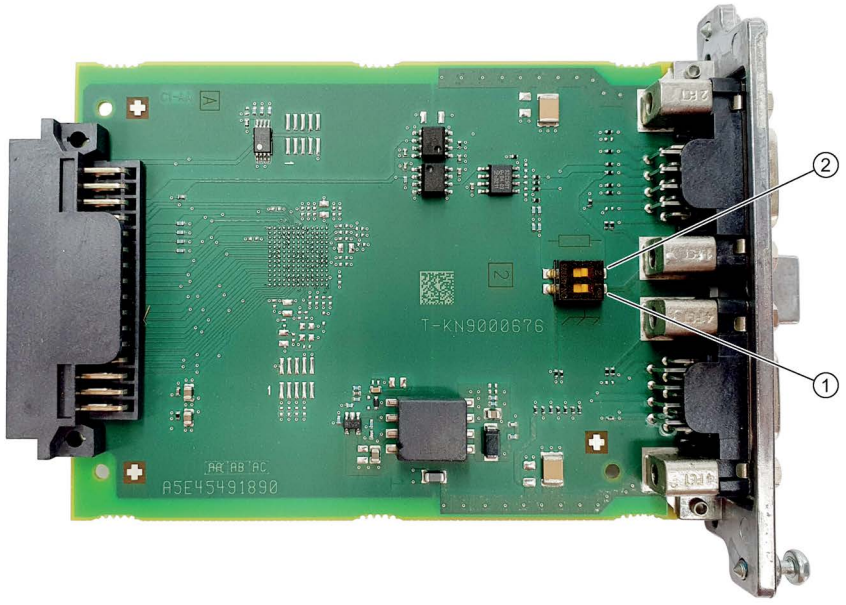
NOTICE
Destruction of the CAN interface due to the wrong connector
If PROFIBUS connectors are connected to CAN bus interfaces during operation, this may lead to the CAN interfaces being destroyed.
• Do not connect PROFIBUS connectors to CAN bus interfaces.

X452 CAN bus interface

Table 9- 2 CAN BUS interface X452

Connector	Pin	Designation	Technical data
	1	Reserved, do not use	
	2	CAN_L	CAN signal (dominant low)
	3	CAN_GND	CAN ground
	4	Reserved, do not use	
	5	CAN_SHLD	Optional shield
	6	GND	CAN ground
	7	CAN_H	CAN signal
	8	Reserved, do not use	
	9	Reserved, do not use	
Connector type: 9-pin D-sub connector (pins)			

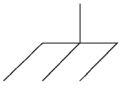
2-pin SMD DIL switch



① Switch 1
② Switch 2

Figure 9-3 2-pin SMD DIL switch 1 and 2 on the CBC10

Table 9- 3 2-pin SMD DIL switch

Marking on the component	Switch	Function	Switch position	Meaning	Default
	2	Bus terminating resistor 120 Ω	OFF	Inactive	OFF
			ON	Active	
	1	Operation with/without ground	OFF	Non-grounded operation	OFF
			ON	Operation connected with ground	

9.7 G33, CBE20 Communication Board

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules
- Motor Modules

Description

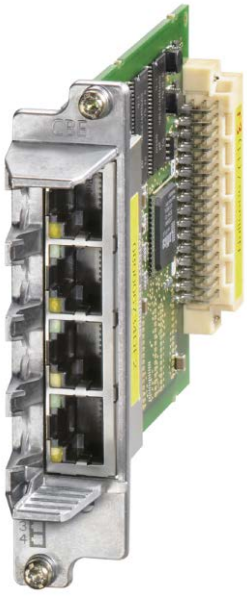


Figure 9-4 CBE20 Communication Board Ethernet

Interface module CBE20 is used for communication via PROFINET.

The module is installed in the factory in the option slot of the CU320-2 Control Unit.

Four Ethernet interfaces are available on the module. Diagnosis of the function mode and communication are possible via LEDs.

Interface overview

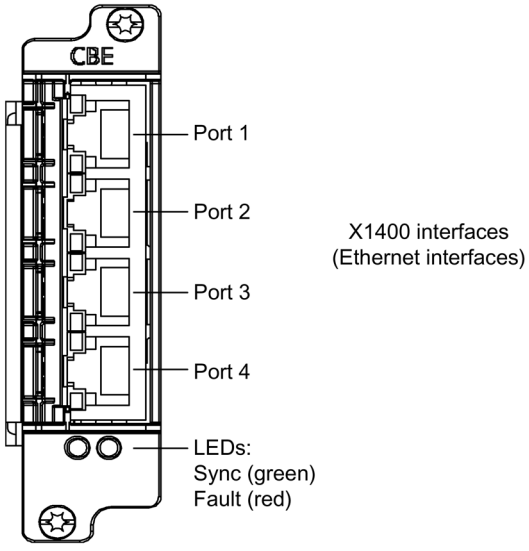


Figure 9-5 CBE20 Ethernet Communication Board, interface overview

MAC address

The MAC address of the Ethernet interfaces is indicated on the top side of the CBE20. The label is only visible when the module has been removed.

Note

Note the MAC address

Remove the module and note down the MAC address of the module so that you have it available for subsequent commissioning. Re-install the module.

Removal/installation

NOTICE
Damage or malfunctions to the Option Board by inserting and withdrawing in operation Withdrawing and inserting Option Boards during operation can damage them or cause the Option Boards to malfunction. • Only withdraw or insert Option Boards when the Control Unit is in a no voltage state.

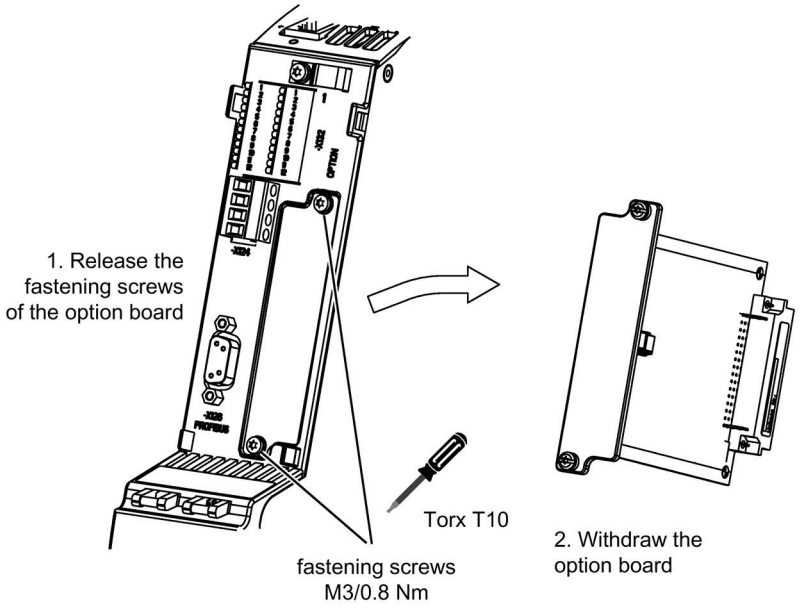
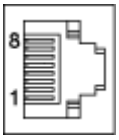


Figure 9-6 Removing the CBE20 from the option slot on the Control Unit

X1400 Ethernet interface

Table 9- 4 Connector X1400, port 1 - 4

Connector	Pin	Signal name	Technical data
	1	RX+	Receive data +
	2	RX-	Receive data -
	3	TX+	Transmit data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	TX-	Transmit data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	Screened backshell	M_EXT	Shield, permanently connected
Connector type: RJ45 socket			

9.8 G51 to G54, temperature sensor module TM150

9.8.1 General information

Availability of option

These options are available for the following S120 Cabinet Modules:

- Basic Line Connection Module
- Active Line Connection Module
- Motor Modules

Description

The Terminal Module TM150 is used for acquiring and evaluating several temperature sensors.

In this case, option G51 is for 1 temperature sensor module, option G52 for 2 temperature sensor modules TM150 etc.:

- G51: 1 temperature sensor module TM150
- G52: 2 temperature sensor modules TM150
- G53: 3 temperature sensor modules TM150
- G54: 4 temperature sensor modules TM150

The temperature is measured in a temperature range from -99° C to +250° C for the following temperature sensors:

- PT100 (with monitoring for wire breakage and short-circuit)
- PT1000 (with monitoring for wire breakage and short-circuit)
- KTY84 (with monitoring for wire breakage and short-circuit)
- PTC (with short-circuit monitoring)
- Bimetallic NC contact (without monitoring)

For the temperature sensor inputs, for each terminal block the evaluation can be parameterized for 1x2-wire, 2x2-wire, 3-wire or 4-wire. There is no galvanic isolation in the TM150.

A maximum of 12 temperature sensors can be connected to Terminal Module TM150.

9.8.2 Interfaces

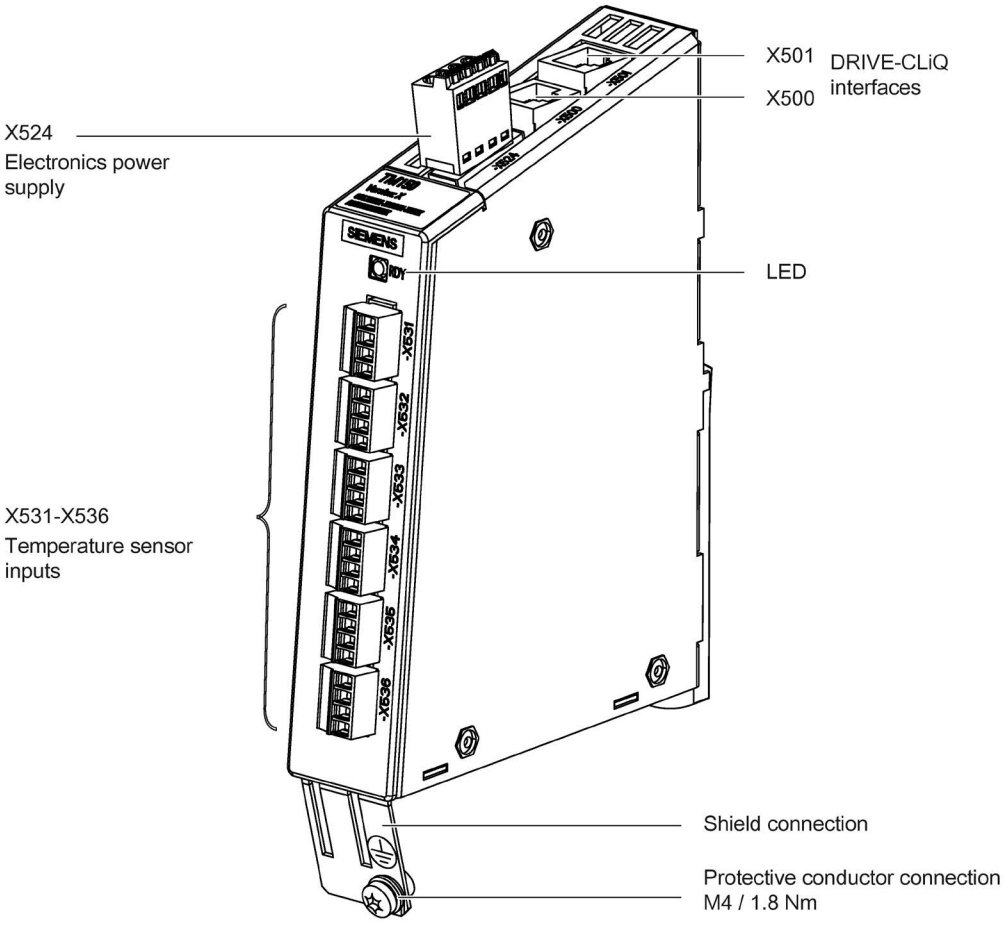
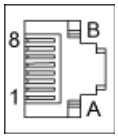


Figure 9-7 TM150 Terminal Module

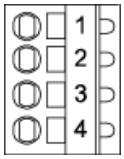
X500, X501: DRIVE-CLiQ interface

Table 9- 5 DRIVE-CLiQ interface X500 and X501

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)	Power supply
	B	M (0 V)	Electronics ground
Blanking plate for DRIVE-CLiQ interfaces (50 units) Article number: 6SL3066-4CA00-0AA0			

Temperature sensor connections

Table 9- 6 X531-X536 temperature sensor inputs

Connector	Terminal	Function 1x2- / 2x2-wire	Function 3 and 4-wire	Technical data
	1	+ Temp (channel x)	+ (Channel x)	Temperature sensor connection for sensors with 1x2 wires Connection of the 2nd measuring cable for sensors with 3 and 4 wires (in parallel with terminal 3)
	2	- Temp (channel x)	- (Channel x)	Temperature sensor connection for sensors with 1x2 wires Connection of the 1st measuring cable for sensors with 4 wires (in parallel with terminal 4)
	3	+ Temp (channel y)	+ I_c (constant current, positive channel x)	Temperature sensor connection for sensors with 2x2, 3 and 4 wires
	4	- Temp (channel y)	- I_c (constant current, negative channel x)	
Max. connectable cross-section: 1.5 mm²				

Measuring current via temperature sensor connection: approx. 0.83 mA

When connecting temperature sensors with 3 wires, a jumper must be inserted between X53x.2 and X53x.4.

Table 9- 7 Channel assignment

Terminal	Channel number [x] for 1x2, 3 and 4-wires	Channel number [y] for 2x2 wires
X531	0	6
X532	1	7
X533	2	8
X534	3	9
X535	4	10
X536	5	11

NOTICE

Damage to the 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

Overheating of the motor through jumpering the temperature sensor connections

Jumpering temperature sensor connections "+Temp" and "-Temp" results in incorrect measurement results. Damage to the motor can result if the overheating is not detected.

- When using several temperature sensors, separately connect the individual sensors to "+Temp" and "-Temp".

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.

Note

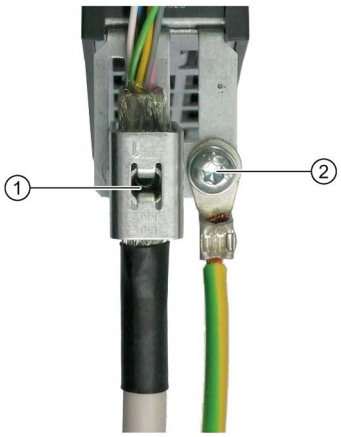
Incorrect temperature measured values as a result of cables with an excessively high resistance

An excessively long cable length or an excessively small cable cross-section can falsify the temperature measurement (for a PT100, 10 Ω cable resistance can falsify the measurement result by 10%). As a consequence, excessively high measured values are output, which could lead to the motor being unnecessarily tripped prematurely.

- Use only cable lengths ≤ 300 m.
- For cable lengths >100 m, use cables with a cross-section of ≥1 mm^2.
- Align the cable resistances (software function in the TM150).

Protective conductor connection and shield support

The following diagram shows a typical Weidmüller shield connection clamp for the shield supports.



① Shield connection terminal, Weidmüller company, type: KLBÜ CO1, order number: 1753311001
② Protective conductor connection M4 / 1.8 Nm

Figure 9-8 Shield support and protective conductor connection

9.8.3 Connection example

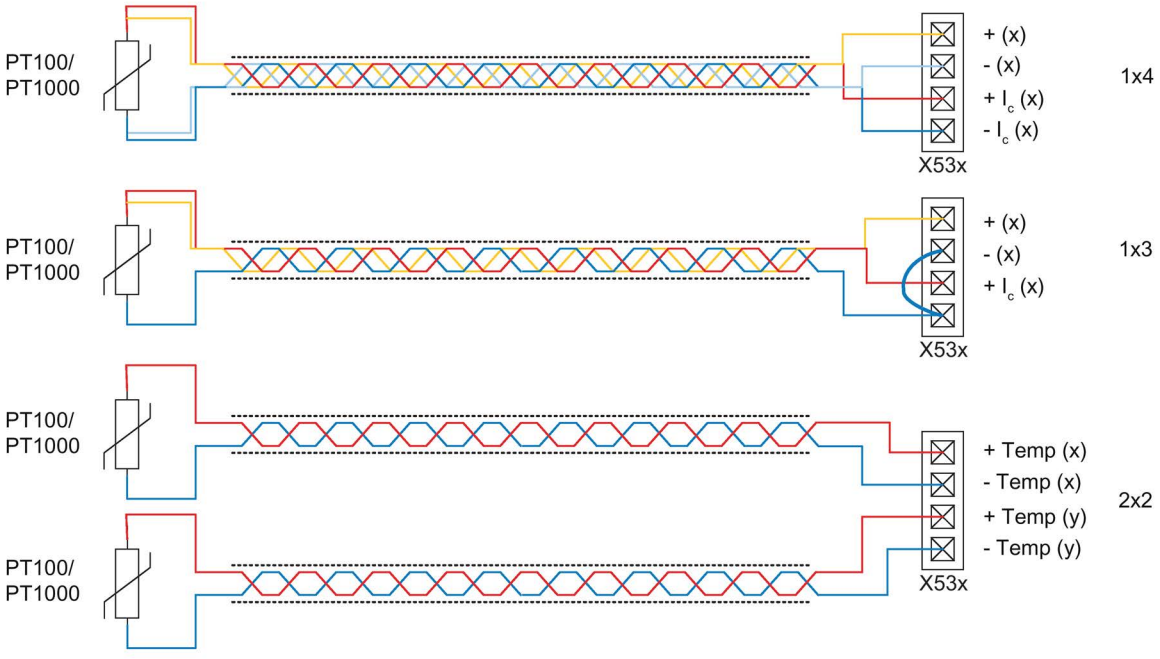


Figure 9-9 Connecting a PT100/PT1000 with 2x2, 3 and 4-wires to the temperature sensor inputs X53x of Terminal Module TM150

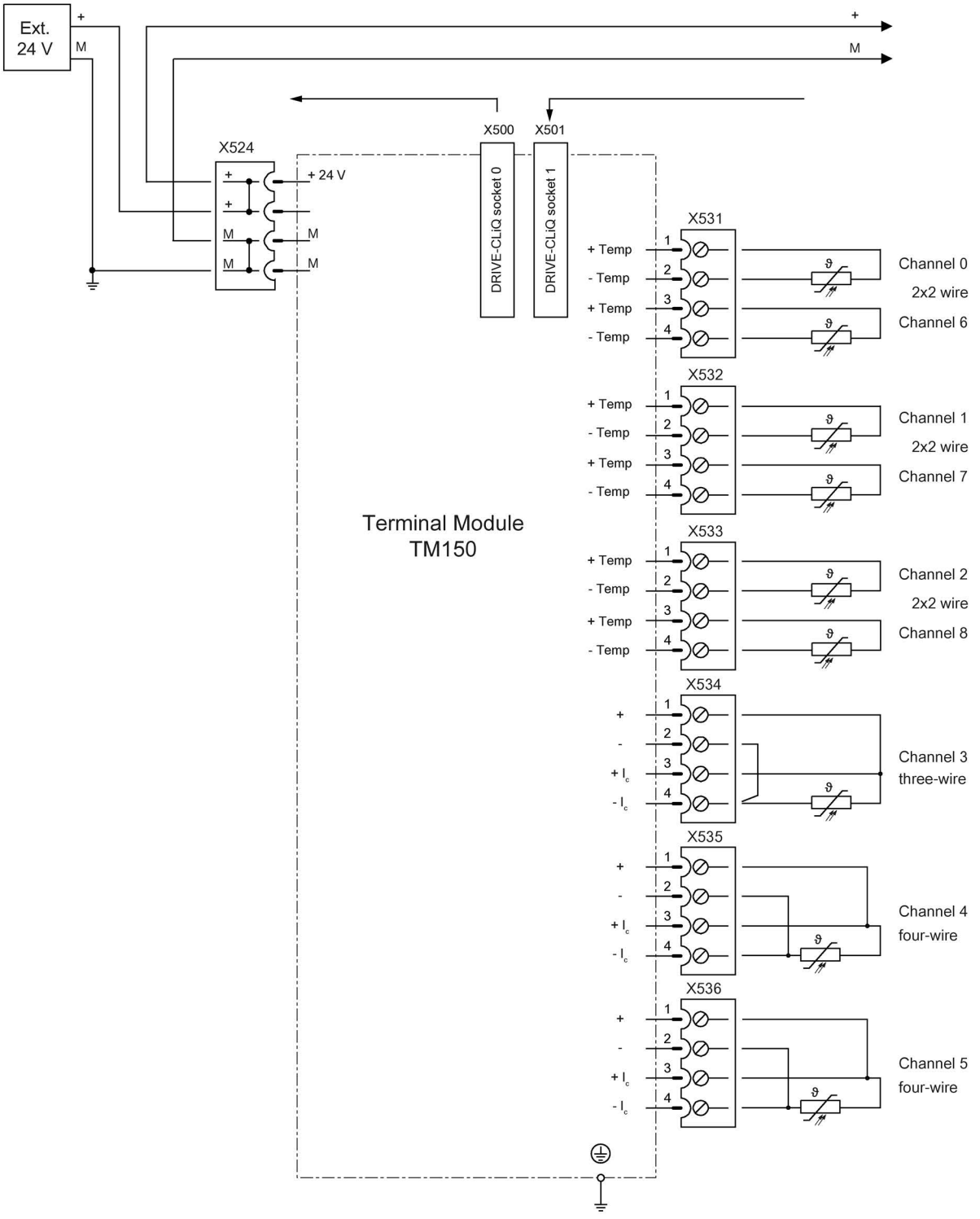


Figure 9-10 Connection example for a Terminal Module TM150

9.9 G60, Terminal Module TM31

9.9.1 General information

Availability of option

These options are available for the following S120 Cabinet Modules:

- Basic Line Connection Module
- Active Line Connection Module
- Motor Modules

Description

With option G60, a TM31 Terminal Module is included in the cabinet unit. This provides the following interfaces:

- 8 digital inputs
- 4 bidirectional digital inputs/outputs
- 2 relay outputs with changeover contact
- 2 analog inputs
- 2 analog outputs
- 1 temperature sensor input (PT1000 / PTC / KTY84-130)

The TM31 Terminal Module must be integrated on the system side. It is not installed in the factory.

Overview

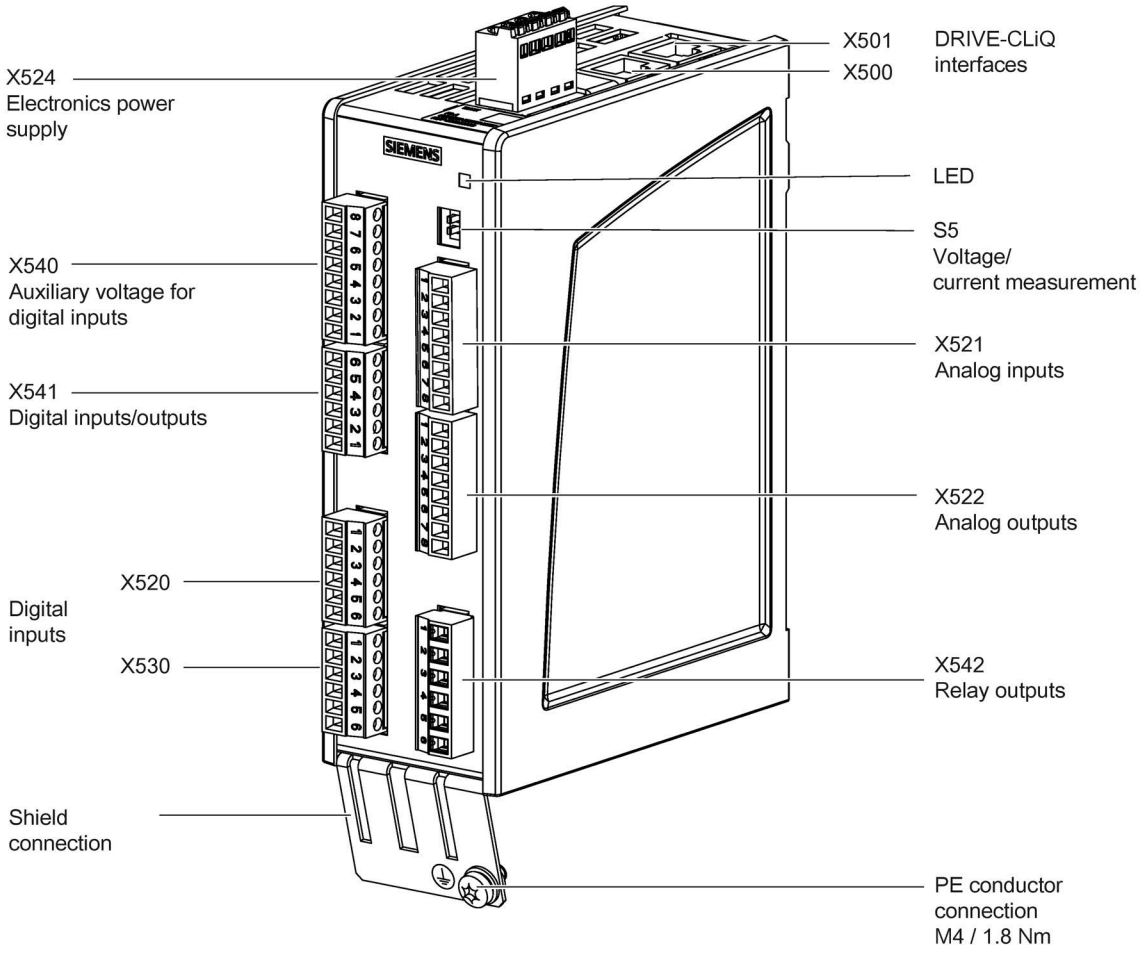


Figure 9-11 TM31 Terminal Module

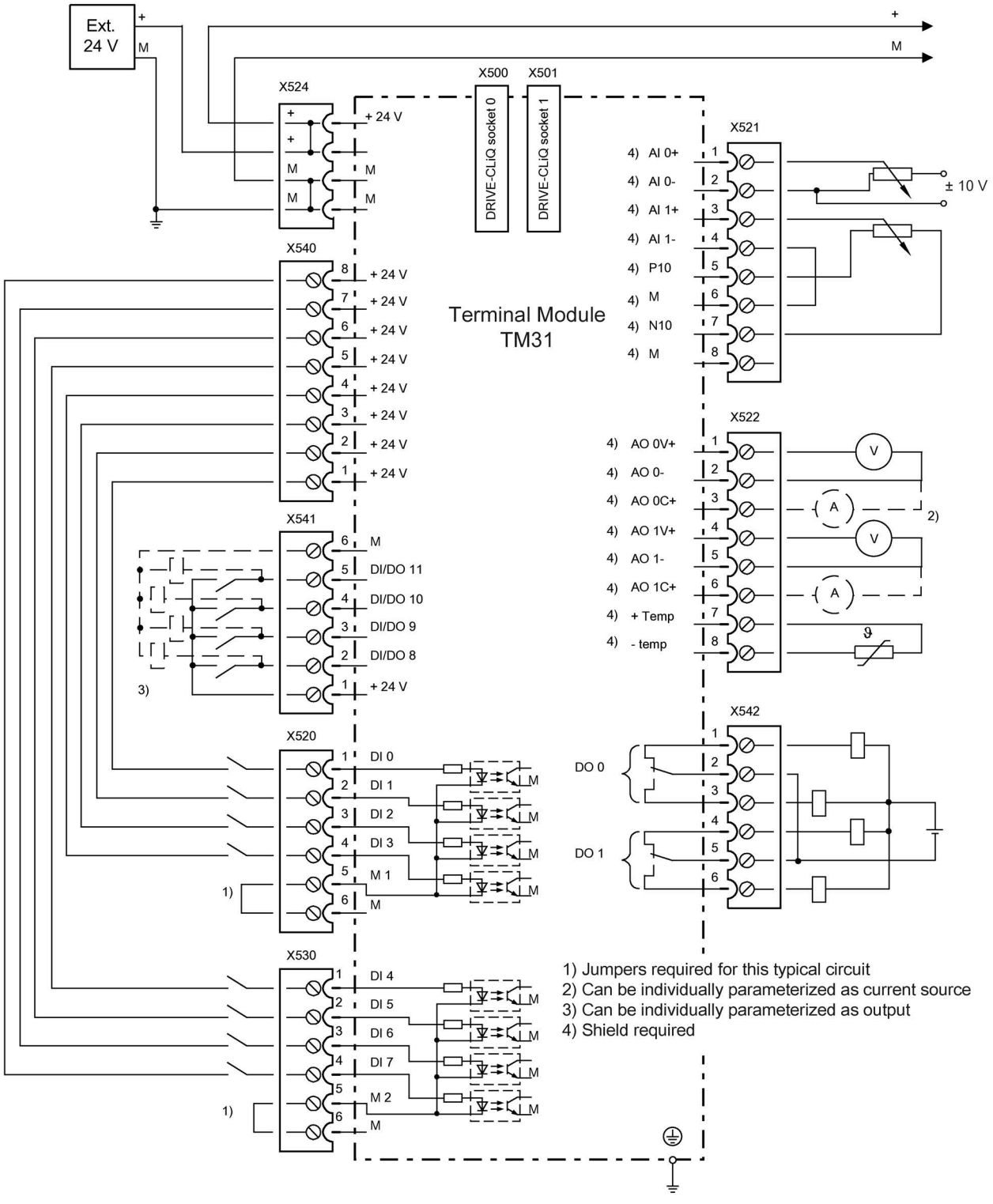
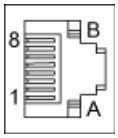


Figure 9-12 Connection overview of TM31 Terminal Module

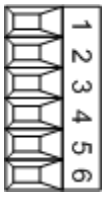
X500, X501: DRIVE-CLiQ interface

Table 9- 8 DRIVE-CLiQ interface X500 and X501

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)	Power supply
	B	M (0 V)	Electronics ground
Blanking plate for DRIVE-CLiQ interfaces (50 units) Article number: 6SL3066-4CA00-0AA0			

X520: 4 digital inputs

Table 9- 9 Terminal block X520

Connector	Terminal	Designation [1]	Technical data
	1	DI 0	**Voltage**: -3 ... +30 V **Current consumption** typical: 10 mA at 24 V DC **Input delay**: for "0" to "1": Typ. 50 µs max. 100 µs for "1" to "0": Typ. 130 µs, max. 150 µs **Electrical isolation**: Reference potential is terminal M1 **Signal level** (including ripple) High level: 15 ... 30 V Low level: -3 ... +5 V
	2	DI 1	
	3	DI 2	
	4	DI 3	
	5	M1	
	6	M	
Max. connectable cross-section: 1.5 mm²			

[1] DI: digital input; M1: ground reference; M: Electronics ground

Note

Ensuring the function of digital inputs

An open input is interpreted as "low".

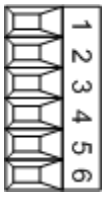
Terminal M1 must be connected so that the digital inputs (DI) can function.

This is achieved through one of the following measures:

1. Also route the reference ground of the digital inputs.
2. A jumper to terminal M. (**Note:** This removes the electrical isolation for these digital inputs.)

X530: 4 digital inputs

Table 9- 10 Terminal block X530

Connector	Terminal	Designation [1]	Technical data
	1	DI 4	**Voltage**: -3 ... +30 V **Current consumption** typical: 10 mA at 24 V DC **Input delay**: for "0" to "1": Typ. 50 µs max. 100 µs for "1" to "0": Typ. 130 µs, max. 150 µs **Electrical isolation**: Reference potential is terminal M2 **Signal level** (including ripple) High level: 15 ... 30 V Low level: -3 ... +5 V
	2	DI 5	
	3	DI 6	
	4	DI 7	
	5	M2	
	6	M	
Max. connectable cross-section: 1.5 mm²			

[1] DI: digital input; M2: ground reference; M: Electronics ground

Note

Ensuring the function of digital inputs

An open input is interpreted as "low".

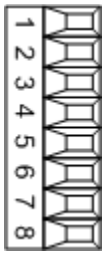
To enable the digital inputs (DI) to function, terminal M2 must be connected.

This is achieved through one of the following measures:

1. Also route the reference ground of the digital inputs.
2. A jumper to terminal M. (**Note:** This removes the electrical isolation for these digital inputs.)

X521: 2 analog inputs (differential inputs)

Table 9- 11 Terminal block X521

Connector	Terminal	Designation [1]	Technical data
	1	AI 0+	The analog inputs can be toggled between current and voltage input using switches S5.0 and S5.1. **As voltage input**: -10 ... +10 V; R_i > 100 kΩ Resolution: 11 bits + sign **As current input**: -20 ... +20 mA; R_i = 250 kΩ Resolution: 10 bits + sign
	2	AI 0-	
	3	AI 1+	
	4	AI 1-	
	5	P10	**Auxiliary voltage**: P10 = 10 V N10 = -10 V Continuously short-circuit proof
	6	M	
	7	N10	
	8	M	
Max. connectable cross-section: 1.5 mm²			

[1] AI: analog input; P10/N10: auxiliary voltage, M: Ground reference

NOTICE

Damage or malfunctions through impermissible voltage values

If a current exceeding ±35 mA flows through the analog current input, then the component could be destroyed.

The common mode range must not be violated in order to avoid incorrect analog-digital conversion results.

- The input voltage may only be in the range between -30 V and +30 V (destruction limit).
- The common mode voltage may only be in the range between -10 V and +10 V (error limit).
- The back EMF at the auxiliary voltage connections may only be in the range between -15 V and +15 V.

Note

The power supply for the analog inputs can be taken internally or from an external power supply unit.

S5: Selector for voltage/current AI0, AI1

Table 9- 12 Selector for voltage/current S5

	Switch	Function
	S5.0	Selector voltage (V) / current (I) AI0
	S5.1	Selector voltage (V) / current (I) AI1

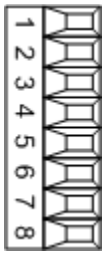
Note

Delivery condition

When delivered, both switches are set to current measurement (switch set to "I").

X522: 2 analog outputs, temperature sensor connection

Table 9- 13 Terminal block X522

Connector	Terminal	Designation [1]	Technical data
	1	AO 0V+	You can set the following output signals using parameters: **Voltage**: -10 ... +10 V (max. 3 mA) **Current 1**: 4 ... 20 mA (max. load resistance ≤ 500 Ω) **Current 2**: -20 ... +20 mA (max. load resistance ≤ 500 Ω) **Current 3**: 0 ... 20 mA (max. load resistance ≤ 500 Ω) Resolution: 11 bits + sign Continuously short-circuit proof
	2	AO 0-	
	3	AO 0C+	
	4	AO 1V+	
	5	AO 1-	
	6	AO 1C+	
	7	+ Temp [2]	Temperature sensor PT1000 / PTC / KTY84-1C130 Measuring current via temperature sensor connection: 2 mA
	8	- Temp [2]	
Max. connectable cross-section: 1.5 mm²			

[1] AO xV: analog output voltage; AO xC: Analog output current

[2] Accuracy of temperature measurement: (Temperature sensor including evaluation)
- PT1000: ±5 °C (PT1000 tolerance class B acc. to IEC 60751)
- PTC: ±5 °C
- KTY: ±7 °C

NOTICE

Damage or malfunctions through impermissible voltage values

If the back EMF is impermissible, the components may be damaged or malfunction.

- The back EMF at the outputs may only be in the range between -15 V and +15 V.

NOTICE

Damage to the 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.



WARNING

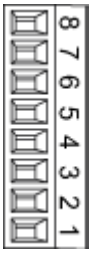
Electric shock when the motor temperature sensor insulation fails

When connecting temperature sensors which are not isolated from the motor power circuit according to safe electrical separation, arcing to the signal electronics may occur.

- Use motors whose temperature sensors have safe electrical separation.
- Only use connecting cables and connectors with safe electrical separation between the insulated conductors of the temperature sensor and the insulated conductors of the power circuit.

X540: Joint auxiliary voltage for the digital inputs

Table 9- 14 Terminal block X540

Connector	Terminal	Designation	Technical data
	8	+24 V	Voltage: +24 V DC Max. total load current of +24 V auxiliary voltage for terminals X540 and X541 combined: 150 mA Continuously short-circuit proof
	7	+24 V	
	6	+24 V	
	5	+24 V	
	4	+24 V	
	3	+24 V	
	2	+24 V	
	1	+24 V	
Max. connectable cross-section: 1.5 mm²			

Note

Use of the power supply

This voltage supply is only for powering the digital inputs.

X541: 4 bidirectional digital inputs/outputs

Table 9- 15 Terminal strip X541

Connector	Terminal	Designation [1]	Technical data
	6	M	**As input**: Voltage: -3 ... 30 V Electrical isolation: no Reference potential: M Input characteristic acc. to IEC 61131-2, type 1 Input voltage (including ripple) "1" signal: 15 ... 30 V "0" signal: -3 ... +5 V Input current at 24 V DC: typ. 9 mA at < 0.5 mA: "0" signal reliably detected Input delay: For "0" → "1": typ. 50 µs -for "1" → "0" typ. 100 µs **As output:** Voltage: 24 V DC Electrical isolation: no Reference potential: M Output voltage "1" signal, with load: > X524.+ -2 V Output current for each output: ≤ 0.5 A Sum of all 4 outputs: ≤ 0.1 A (when parameter p4046 = 0) ≤ 1.0 A (when parameter p4046 = 1) Residual current for "0" signal: < 0.5 mA Short-circuit protection, automatic restart after a short-circuit Load types: ohmic, capacitive, inductive Output delay for "0" → "1": typ. 150 µs / max. 500 µs (ohmic load) for "1" → "0": typ. 50 µs (ohmic load) Switching frequency for ohmic load: max. 100 Hz for inductive load: max. 0.5 Hz for lamp load: max. 10 Hz Lamp load: max. 5 W
	5	DI/DO 11	
	4	DI/DO 10	
	3	DI/DO 9	
	2	DI/DO 8	
	1	+24 V	Auxiliary voltage: Voltage: +24 V DC Max. total load current of +24 V auxiliary voltage for terminals X540 and X541 combined: 150 mA
Max. connectable cross-section: 1.5 mm²			

[1] DI/DO: Bidirectional digital input/output; M: Electronics ground

Note

Open input

An open input is interpreted as "low".

Note

If the 24 V supply is briefly interrupted, then the digital outputs are deactivated during this time.

X542: 2 relay outputs (two-way contact)

Table 9- 16 Terminal block X542

Connector	Terminal	Designation [1]	Technical data
	1	DO 0.NC	Contact type: Changeover contact max. load current: 8 A Max. switching voltage: 250 V_{AC}. 30 V_{DC} Max. switching capacity at 250 V_{AC}: 2000 VA (cosϕ = 1) Max. switching capacity at 250 V_{AC}: 750 VA (cosϕ = 0.4) Max. switching capacity at 30 V_{DC}: 240 W (resistive load) Required minimum current: 100 mA Output delay: ≤ 20 ms [2] Overvoltage category: Class II according to IEC 60664-1
	2	DO 0.COM	
	3	DO 0.NO	
	4	DO 1.NC	
	5	DO 1.COM	
	6	DO 1.NO	
Max. connectable cross-section: 2.5 mm²			

[1] DO: digital output, NO: normally-open contact, NC: normally-closed contact, COM: Center contact

[2] Depending on the parameterization and the supply voltage (P24) of the TM31

Note

Additional protective conductor

If 230 V AC is applied to the relay outputs, the Terminal Module must also be grounded via a 6 mm² protective conductor.

9.10 G61, additional TM31 Terminal Module

Availability of option

These options are available for the following S120 Cabinet Modules:

- Basic Line Connection Module
- Active Line Connection Module
- Motor Modules

Description

With option G60, a TM31 Terminal Module is included in the cabinet unit. A second Terminal Module provides the following additional digital and analog inputs/outputs in the drive system:

- 8 digital inputs
- 4 bidirectional digital inputs/outputs
- 2 relay outputs with changeover contact
- 2 analog inputs
- 2 analog outputs
- 1 temperature sensor input (PT1000 / PTC / KTY84-130)

The second TM31 Terminal Module must be integrated on the system side. It is not installed in the factory.

9.11 G62, TB30 Terminal Board

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules
- Motor Modules

Description



Figure 9-13 TB30 Terminal Board

The TB30 Terminal Board supports the addition of digital inputs/digital outputs and analog inputs/analog outputs to the Control Unit.

The following are located on the TB30 Terminal Board:

- Power supply for digital inputs/digital outputs
- 4 digital inputs
- 4 digital outputs
- 2 analog inputs
- 2 analog outputs

The TB30 Terminal Board plugs into the option slot on the Control Unit.

A shield support for the signal cable shield is located on the Control Unit.

NOTICE
Damage or malfunctions to the Option Board by inserting and withdrawing in operation Withdrawing and inserting Option Boards during operation can damage them or cause the Option Boards to malfunction. • Only withdraw or insert Option Boards when the Control Unit is in a no voltage state.

The module is inserted in the option slot of the Control Unit at the factory.

Interface overview

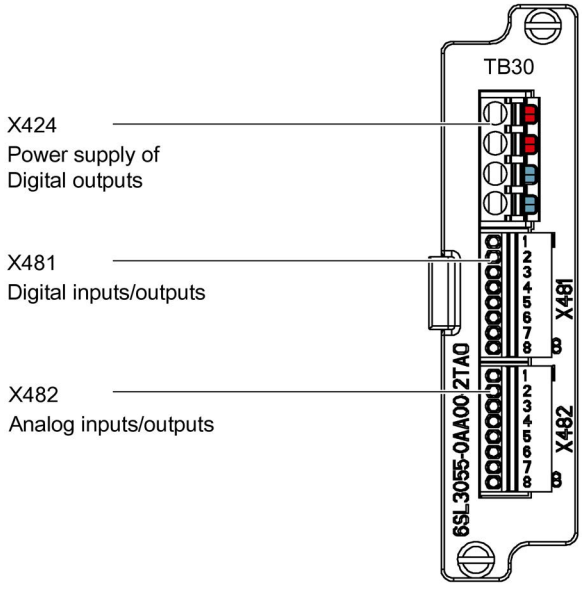


Figure 9-14 TB30 Terminal Board interface overview

Connection overview

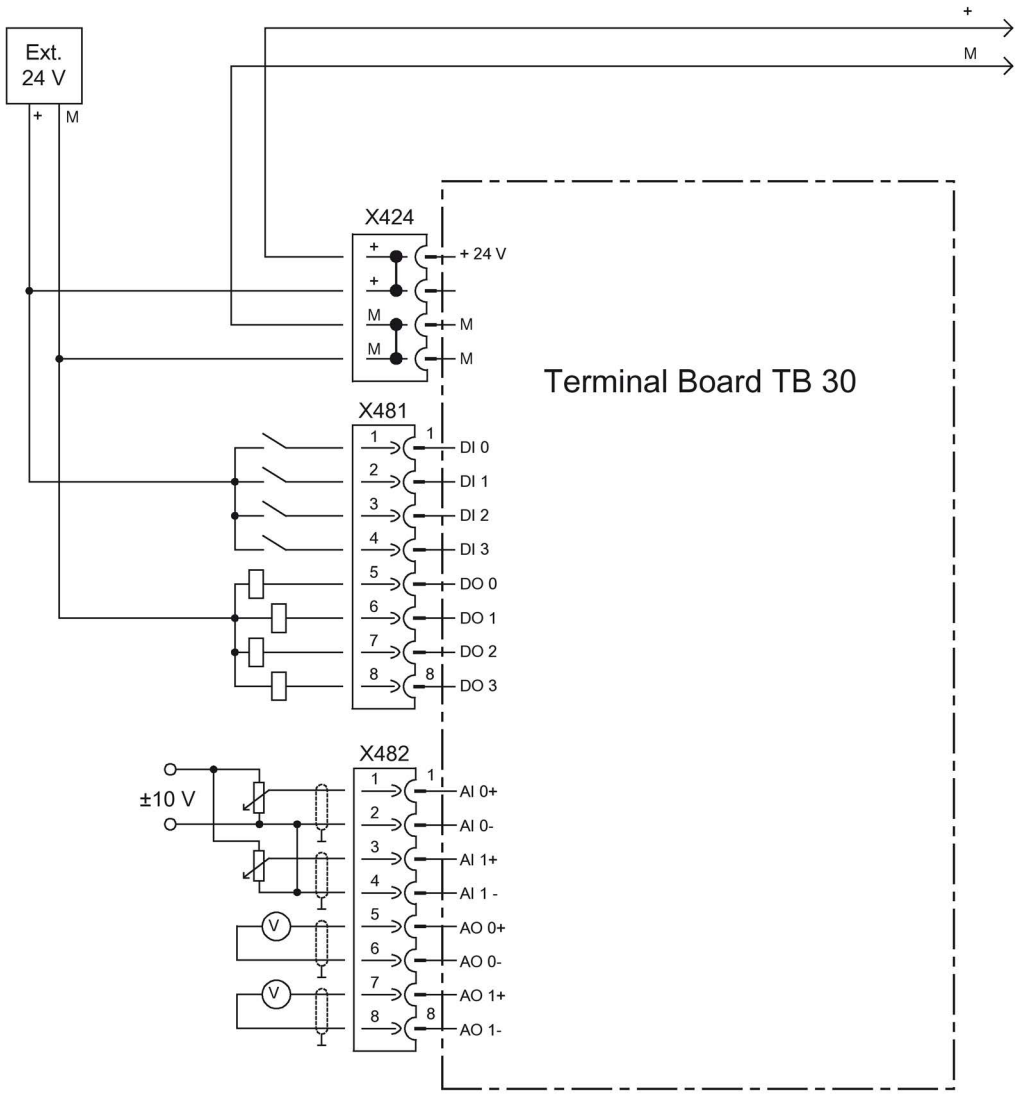
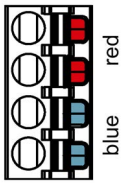


Figure 9-15 Connection overview TB30 Terminal Board

X424 power supply, digital outputs

Table 9- 17 Terminal strip X424

	Terminal	Function	Technical data
	+	Power supply	Voltage: 24 V DC (20.4 ... 28.8 V) Current consumption: Max. 4 A (per digital output max. 0.5 A) Max. current via jumper in connector: 20 A (15 A according to UL/CSA)
	+	Power supply	
	M	Ground	
	M	Ground	
Max. connectable cross-section: 2.5 mm²			

The maximum cable length that can be connected is 10 m.

Note

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

This power supply is required for the digital outputs only.
The electronics power supply and the power supply for the analog inputs/outputs are taken from the option slot of the Control Unit.

Note

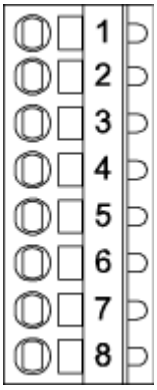
The power supply of the digital outputs and the electronic power supply of the Control Unit are isolated.

Note

If the 24 V supply is briefly interrupted, then the digital outputs are deactivated during this time.

X481 Digital inputs/outputs

Table 9- 18 Terminal strip X481

Connector	Terminal	Designation [1]	Technical data
	1	DI 0	Voltage: -3 ... 30 V DC Electrical isolation: Yes Reference potential: X424.M Input characteristic acc. to IEC 61131-2, type 1 Input voltage (including ripple) "1" signal: 15 ... 30 V "0" signal: -3 ... +5 V Input current at 24 V DC: typ. 3.5 mA at <0.5 mA: "0" signal reliably detected Input delay for "0" → "1": typ. 20 µs for "1" → "0": typ. 100 µs
	2	DI 1	
	3	DI 2	
	4	DI 3	
	5	DO 0	Voltage: 24 V DC Electrical isolation: Yes Reference potential: X424.M Output voltage "1" signal, with load: > X424.+ -2 V Output current for each output: ≤ 0.5 A Sum of all four outputs: ≤ 2 A Residual current for "0" signal: < 0.5 mA Short-circuit protection, automatic restart after a short-circuit Load types: ohmic, capacitive, inductive Output delay[3] for "0" → "1": typ. 150 µs / max. 500 µs (ohmic load) for "1" → "0": typ. 50 µs (ohmic load) Switching frequency for resistive load: max. 100 Hz for inductive load: max. 0.5 Hz for lamp load: max. 10 Hz Lamp load: max. 5 W
	6	DO 1	
	7	DO 2	
	8	DO 3	
Max. connectable cross-section: 0.5 mm²			

[1] DI: digital input, DO: Digital output

Note

Open input

An open input is interpreted as "low".

The power supply and the digital inputs/outputs are isolated from the Control Unit.

Note

Transient voltage interruptions

If the 24 V supply is briefly interrupted, then the digital outputs are deactivated during this time.

Note

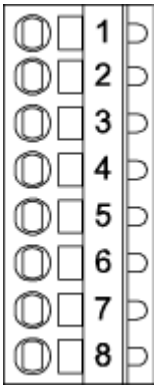
Malfunction in the switched-off state due to diagnostic currents

Unlike mechanical switching contacts, e.g. Emergency Stop switches, diagnostic currents can also flow when the semiconductor is in the switched-off state (logical state "0" or "OFF"). If incorrectly interconnected with digital inputs, the diagnostic currents can result in incorrect switching states. Incorrect signal states of digital inputs can cause unwanted motions of machine parts and trigger malfunctions.

- Observe the conditions for digital inputs and digital outputs specified in the relevant manufacturer's documentation.
- Check the conditions of the digital inputs and digital outputs with regard to currents in the "OFF" state and, if necessary, connect the digital inputs to suitably dimensioned, external resistors to protect against the reference potential of the digital inputs.

X482 Analog inputs/outputs

Table 9- 19 Terminal strip X482

Connector	Terminal	Designation [1]	Technical data
	1	AI 0+	Analog inputs (AI) **Voltage**: -10 ... +10 V; R_i: 65 kΩ **Common mode range**: ±30 V **Resolution**: 13 bits + sign
	2	AI 0-	
	3	AI 1+	
	4	AI 1-	
	5	AO 0+	Analog outputs (AO) **Voltage range**: -10 ... +10 V **Load current**: max. -3 ... +3 mA **Resolution**: 11 bit + signed Continuous short-circuit proof
	6	AO 0-	
	7	AO 1+	
	8	AO 1-	
Max. connectable cross-section: 0.5 mm²			

[1] AI: analog input, AO: Analog output

Note

Permissible voltage values

In order to avoid incorrect results of the analog-digital conversion, the analog differential voltage signals can have a maximum offset voltage of +/-30 V with respect to ground potential.

Note

Open input

An open input is interpreted as approximately "0 V".

The power supply of the analog inputs/outputs is drawn via the option slot of the Control Unit and not via X424.

The shield is connected to the Control Unit.

Shield connection of the TB30 on the Control Unit

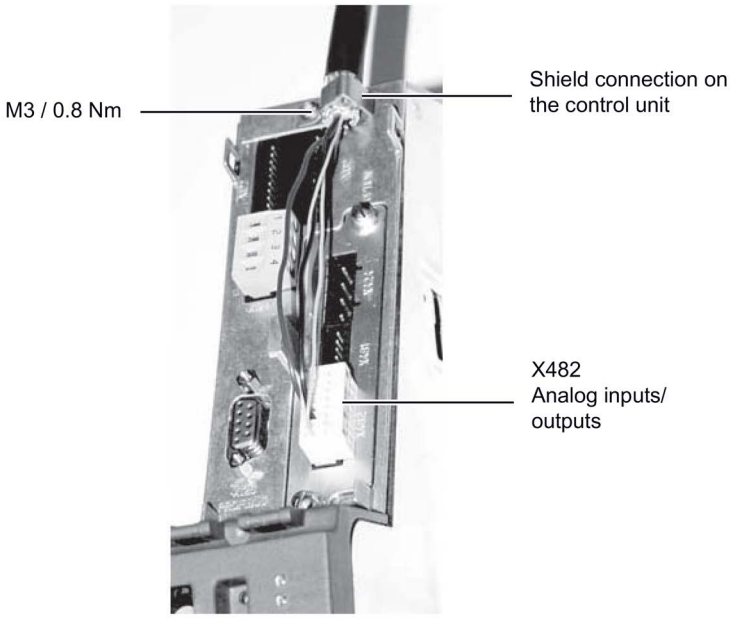


Figure 9-16 TB30 shield connection

The permissible bending radii for the cables must not be exceeded when the cables are being installed.

9.12 K01 to K05, safety license for 1 to 5 axes

Availability of option

This option is available for the following S120 Cabinet Modules:

- Motor Modules

Description

The Safety Integrated Basic functions do not require a license. A license is, however, required for each axis with safety functions in the case of Safety Integrated Extended functions. It is irrelevant which safety functions are used and how many.

In this case, option K01 is for 1 axis, option K02 for 2 axes etc. - up to option K05 for 5 axes.

- K01: Safety license for 1 axis
- K02: Safety license for 2 axes
- K03: Safety license for 3 axes
- K04: Safety license for 4 axes
- K05: Safety license for 5 axes

Note

Presently, a maximum of 5 safety axes with Safety Integrated Extended functions are possible on a Control Unit CU320-2.

Licenses

The required licenses can be ordered via options K01 - K05 together with the CompactFlash card.

Retroactive licensing is executed on the Internet via the "WEB License Manager" by generating a license key:
http://www.siemens.com/automation/license

Note

The generation of the license key is described in detail in the SINAMICS S120 Function Manual, Chapter "Basics of the drive system" under "Licensing".

Activation

The associated license key is entered into parameter p9920 in the ASCII code. The license key is activated using parameter p9921 = 1.

Diagnostics

An insufficient license is indicated via the following alarm and LED:

- Alarm A13000 → License not sufficient
- LED READY → Flashes green/red at 0.5 Hz

Note

Safety Integrated Function Manual

Detailed and comprehensive instructions and information for handling Safety Integrated functions is given in the associated Function Manual, included in the device documentation provided.

9.13 K08 , AOP30 advanced operator panel

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules
- Motor Modules

Note

Option K08 is only available in conjunction with the CU320-2 Control Unit (option K90 or K95).

Description



Figure 9-17 AOP30 Advanced Operator Panel (option K08)

The user-friendly AOP30 Advanced Operator Panel is an optional input/output device for commissioning, operation and diagnostic purposes.

The AOP30 communicates with the CU320-2 Control Unit via an RS232 serial interface using the PPI protocol.

Characteristics

- Display with green backlighting (resolution: 240 x 64 pixels)
- 26-key keypad
- RS232 interface
- Time and date memory powered by internal battery backup
- Selectable languages: German, English, French, Italian, Spanish, Chinese, Russian, Portuguese
- 4 LEDs indicate the operating condition of the drive unit:
  RUN (operation), green
  ALARM, yellow
  FAULT, red
  LOCAL/REMOTE, green

Note

Additional documents

Detailed and comprehensive instructions and information regarding the Advanced Operator Panel AOP30 are given in the operating instructions "SINAMICS S120 Cabinet Module AOP30", included in the device documentation provided.

9.14 K46, Sensor Module Cabinet-Mounted SMC10

9.14.1 General information

Availability of option

This option is available for the following S120 Cabinet Modules:

- Motor Modules

Description

The SMC10 Sensor Module is used for detecting the actual motor speed and the rotor position angle. The signals emitted by the resolver are converted here and made available to the closed-loop controller via the DRIVE-CLiQ interface for evaluation purposes.

The following encoders can be connected to the SMC10 Sensor Module:

- 2-pole resolver
- Resolver, multi-pole

In addition, the motor temperature can be sensed using temperature sensors (PT1000, PTC or KTY84-130).

Table 9- 20 SMC10 specification

	Value
Transmission ratio of the resolver	ü = 0.5
Excitation voltage on the SMC10 for ü = 0.5 (cannot be parameterized)	4.1 V_{rms}
Amplitude monitoring threshold (secondary tracks) of the SMC10	0.76 V_{rms}
Excitation frequency (synchronized to the current controller clock cycle)	5 to 16 kHz

The maximum encoder cable length is 130 m.

Table 9- 21 Max. frequency that can be evaluated (speed)

Resolver		**Max. speed resolver / motor**		
Number of poles	**Number of pole pairs**	**8 kHz / 125 µs**	**4 kHz / 250 µs**	**2 kHz / 500 µs**
2 pole	1	120000 rpm	60000 rpm	30000 rpm
4-pole	2	60000 rpm	30000 rpm	15000 rpm
6-pole	3	40000 rpm	20000 rpm	10000 rpm
8-pole	4	30000 rpm	15000 rpm	7500 rpm

The ratio between ohmic resistance R and inductance L determines whether the resolver can be evaluated with the SMC10 (see diagram below).

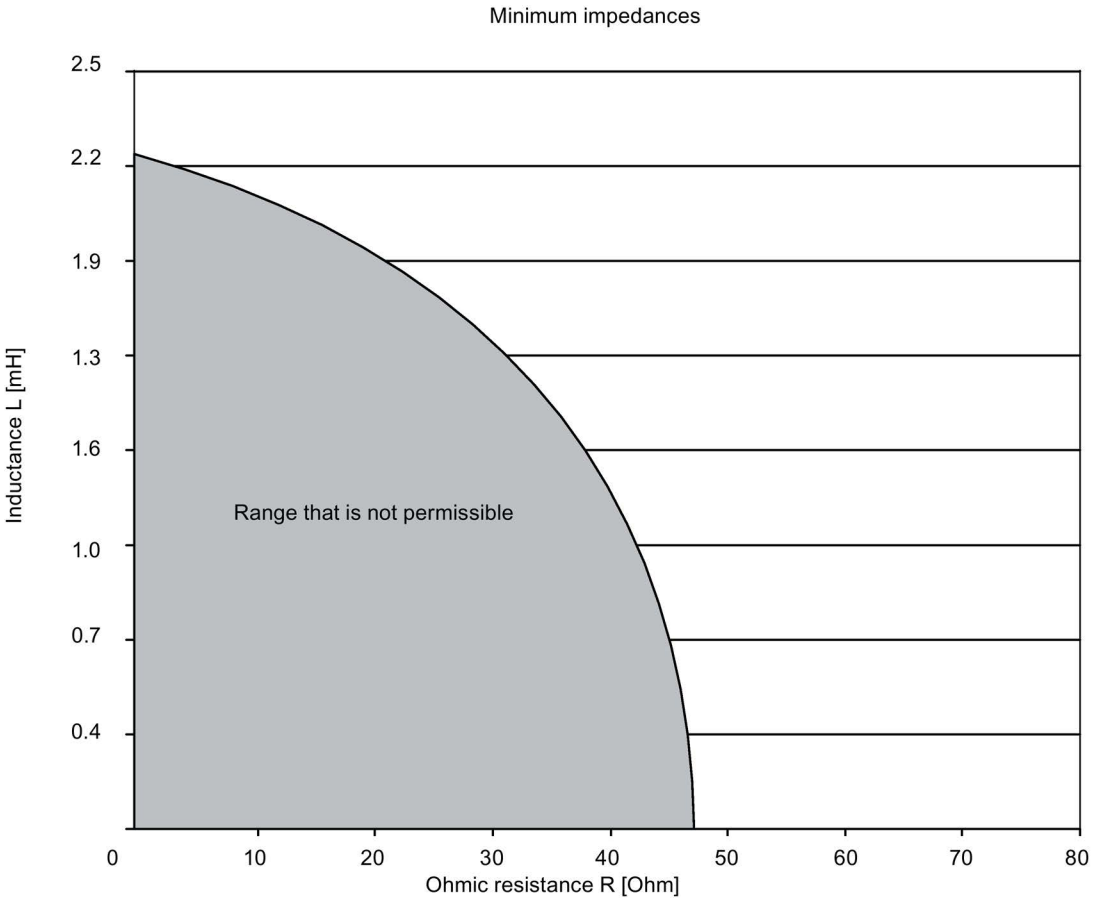


Figure 9-18 Connectable impedances with an excitation frequency f = 5000 Hz

To carry out a check as shown in the diagram above, the impedances Z_{rs} or Z_{ro} (impedance between R1 and R2 with short-circuited or open outputs) as specified in the encoder manufacturer's data sheet must be used.

9.14.2 Safety information

NOTICE

Damage when connecting an impermissible number of encoder systems

If more than the maximum permissible number of encoder systems are connected to a Sensor Module, this will cause damage.

- Only connect one encoder system to a Sensor Module.

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.

Note

Diminished level of interference immunity due to equalizing currents via the electronics ground

Ensure that there is no electrical connection between the encoder system housing and the signal cables, or the encoder system electronics.

If this is not carefully observed, under certain circumstances the system will not be able to reach the required interference immunity level (there is then a danger of equalization currents flowing through the electronics ground).

9.14.3 Interfaces

Overview

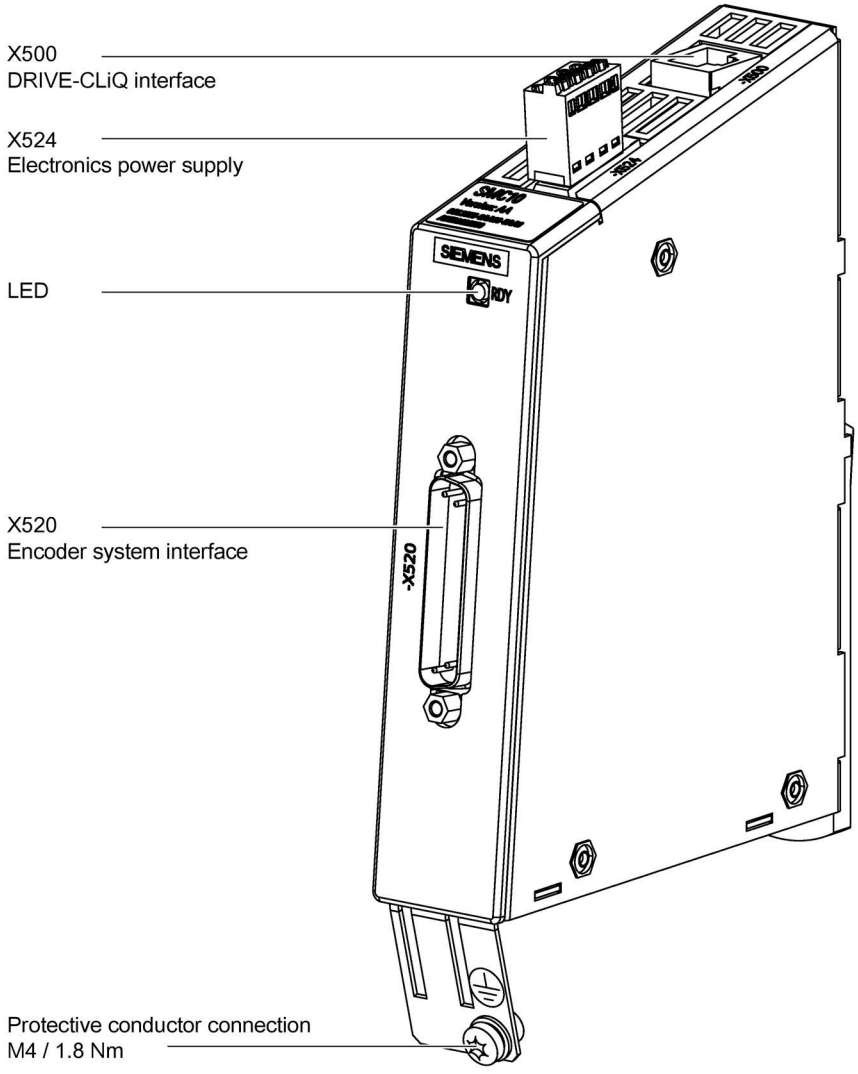
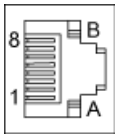


Figure 9-19 Interface overview for the SMC10

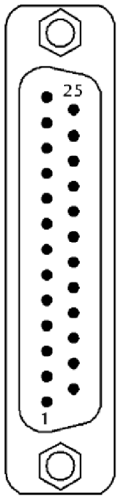
X500: DRIVE-CLiQ interface

Table 9- 22 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)	Power supply
	B	M (0 V)	Electronics ground
Blanking plate for DRIVE-CLiQ interfaces (50 units) Article number: 6SL3066-4CA00-0AA0			

X520 encoder interface

Table 9- 23 Encoder interface X520

Connector	Pin	Signal name	Technical data
	1	Reserved, do not use	
	2	Reserved, do not use	
	3	S2	Resolver signal A (sin+)
	4	S4	Inverted resolver signal A (sin-)
	5	Ground	Ground (for internal shield)
	6	S1	Resolver signal B (cos+)
	7	S3	Inverted resolver signal B (cos-)
	8	Ground	Ground (for internal shield)
	9	R1	Resolver excitation positive
	10	Reserved, do not use	
	11	R2	Resolver excitation negative
	12	Reserved, do not use	
	13	+Temp [1)]	Temperature sensor connection PT1000 / PTC / KTY84-1C130
	14	Reserved, do not use	
	15	Reserved, do not use	
	16	Reserved, do not use	
	17	Reserved, do not use	
	18	Reserved, do not use	
	19	Reserved, do not use	
	20	Reserved, do not use	
	21	Reserved, do not use	
	22	Reserved, do not use	
	23	Reserved, do not use	
	24	Ground	Ground (for internal shield)
	25	- Temp [1)]	Temperature sensor connection PT1000 / PTC / KTY84-1C130
Connector type: 25-pin SUB D connector (pins)			
Measuring current via temperature sensor connection: 2 mA			

[1)] Accuracy of the temperature measurement (temperature sensor including evaluation)
- PT1000: ±5 °C (PT1000 tolerance class B acc. to IEC 60751)
- PTC: ±5 °C
- KTY: ±7 °C

NOTICE

Damage to the 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.

⚠WARNING

Electric shock when the motor temperature sensor insulation fails

When connecting temperature sensors which are not isolated from the motor power circuit according to safe electrical separation, arcing to the signal electronics may occur.

- Use motors whose temperature sensors have safe electrical separation.
- Only use connecting cables and connectors with safe electrical separation between the insulated conductors of the temperature sensor and the insulated conductors of the power circuit.

Note

Maximum signal cable length

The maximum signal cable length is 130 m.

9.14.4 Connection example

Connection example: Resolver, 8-pin

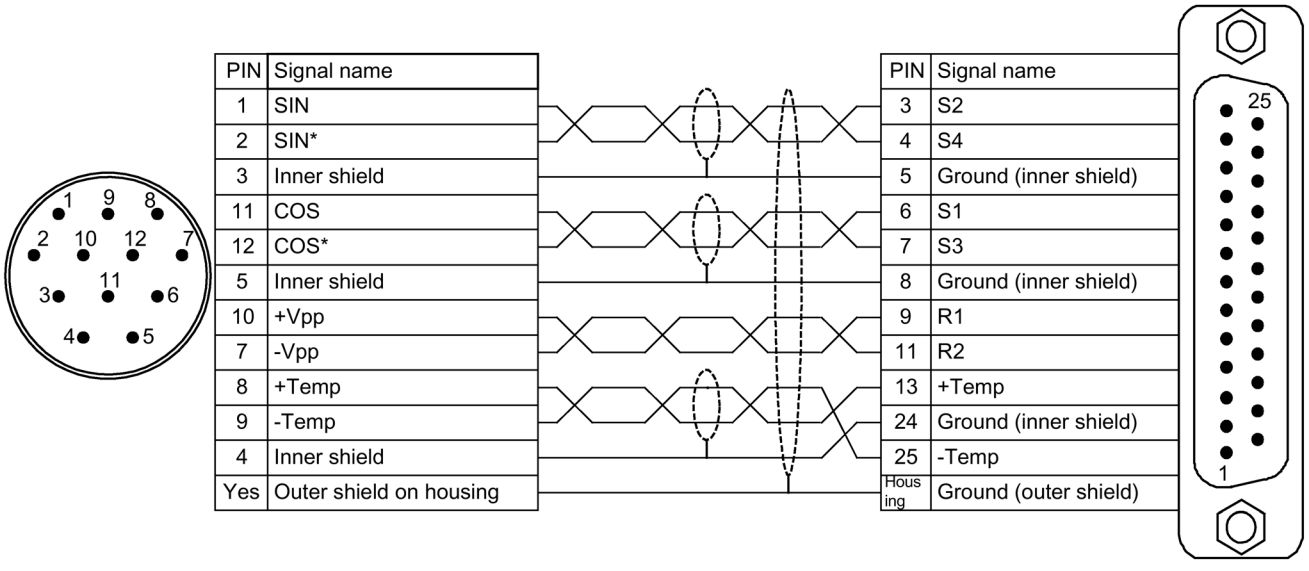


Figure 9-20 Connection example: Resolver, 8-pin

9.15 K48, Sensor Module Cabinet-Mounted SMC20

9.15.1 General information

Availability of option

This option is available for the following S120 Cabinet Modules:

- Motor Modules

Description

The SMC20 Sensor Module is used to simultaneously record the speed and position. The signals emitted by the incremental encoder are converted here and made available to the closed-loop controller via the DRIVE-CLiQ interface for evaluation purposes.

The following encoders can be connected to the SMC20 Sensor Module:

- Incremental encoder SIN/COS (1 Vpp) with and without reference signal
- Absolute encoder EnDat 2.1 (with SIN/COS incremental signals 1 Vpp)
- Absolute encoder EnDat 2.2 with order designation EnDat01 or EnDat02
- Absolute encoder SSI (with 5 V supply)
- Absolute encoder SSI (with 5 V supply) with SIN/COS incremental signals 1 Vpp

In addition, the motor temperature can be sensed using temperature sensors (PT1000, PTC or KTY84-130).

The maximum encoder cable length is 100 m.

9.15.2 Safety information

NOTICE

Damage when connecting an impermissible number of encoder systems

If more than the maximum permissible number of encoder systems are connected to a Sensor Module, this will cause damage.

- Only connect one encoder system to a Sensor Module.

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.

Note

Diminished level of interference immunity due to equalizing currents via the electronics ground

Ensure that there is no electrical connection between the encoder system housing and the signal cables, or the encoder system electronics.

If this is not carefully observed, under certain circumstances the system will not be able to reach the required interference immunity level (there is then a danger of equalization currents flowing through the electronics ground).

9.15.3 Interfaces

Overview

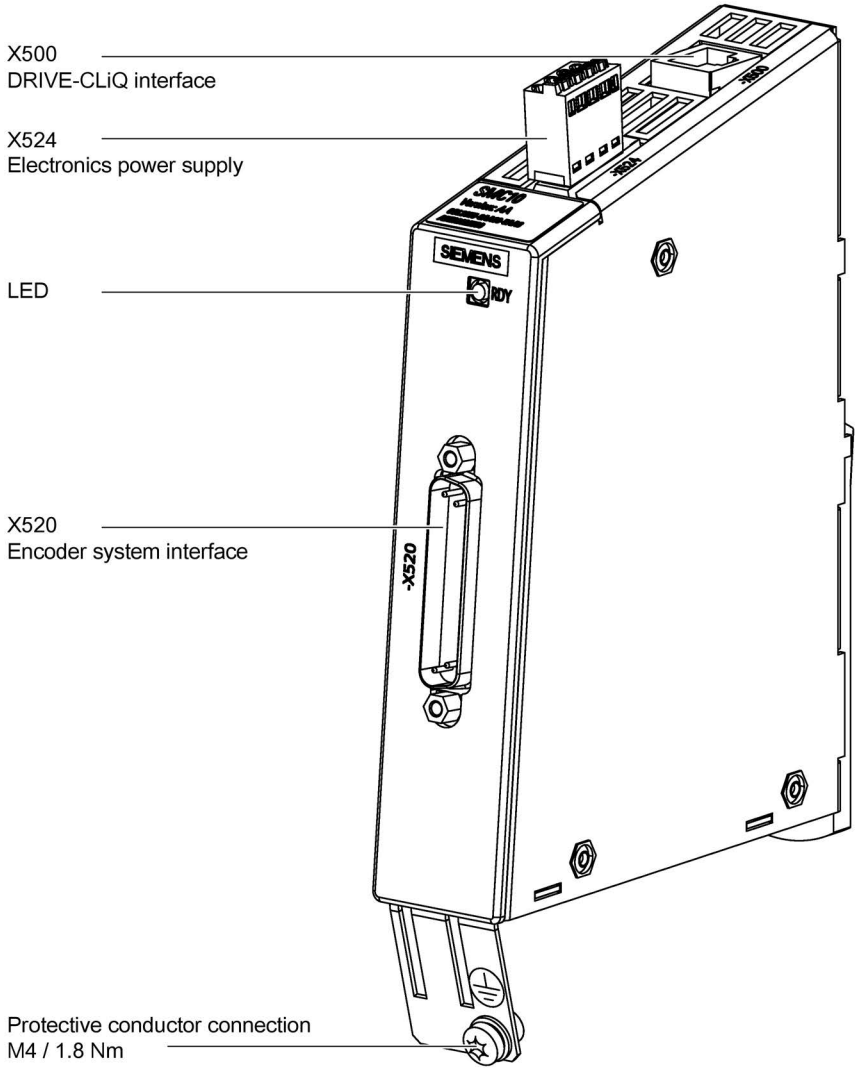
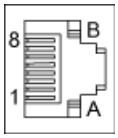


Figure 9-21 Interface overview for the SMC20

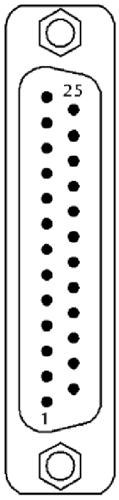
X500: DRIVE-CLiQ interface

Table 9- 24 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)	Power supply
	B	M (0 V)	Electronics ground
Blanking plate for DRIVE-CLiQ interfaces (50 units) Article number: 6SL3066-4CA00-0AA0			

X520 encoder interface

Table 9- 25 Encoder interface X520

Connector	Pin	Signal name	Technical data
	1	P encoder	Encoder power supply
	2	M encoder	Ground for encoder power supply
	3	A	Incremental signal A
	4	A*	Inverted incremental signal A
	5	Ground	Ground (for internal shield)
	6	B	Incremental signal B
	7	B*	Inverted incremental signal B
	8	Ground	Ground (for internal shield)
	9	Reserved, do not use	
	10	Clock	Clock, EnDat interface, SSI clock
	11	Reserved, do not use	
	12	Clock*	Inverted clock, EnDat interface, inverted SSI clock
	13	+Temp [1)]	Temperature sensor connection PT1000 / PTC / KTY84-1C130
	14	P sense	Sense input for encoder power supply
	15	Data	Data, EnDat interface, SSI data
	16	M sense	Ground for sense input for encoder power supply
	17	R	Reference signal R
	18	R*	Inverted reference signal R
	19	C	Absolute track signal C
	20	C*	Inverted absolute value signal C
	21	D	Absolute track signal D
	22	D*	Inverted absolute track signal D
	23	Data*	Inverted data, EnDat interface, inverted SSI data
	24	Ground	Ground (for internal shield)
	25	-Temp [1)]	Temperature sensor connection PT1000 / PTC / KTY84-1C130
Connector type: 25-pin SUB D connector (pins)			
Measuring current via temperature sensor connection: 2 mA			

[1)] Accuracy of the temperature measurement (temperature sensor including evaluation)
- PT1000: ±5 °C (PT1000 tolerance class B acc. to IEC 60751)
- PTC: ±5 °C
- KTY: ±7 °C

NOTICE

Damage to the 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.



⚠WARNING

Electric shock when the motor temperature sensor insulation fails

When connecting temperature sensors which are not isolated from the motor power circuit according to safe electrical separation, arcing to the signal electronics may occur.

- Use motors whose temperature sensors have safe electrical separation.
- Only use connecting cables and connectors with safe electrical separation between the insulated conductors of the temperature sensor and the insulated conductors of the power circuit.

Note

P sense and M sense

The cables for P sense or M sense with P encoder or M encoder must be jumpered at the encoder end. The supply voltage of the encoder is detected by the SMC20 and automatically adjusted to 5 V to compensate any power loss.

Note

Maximum signal cable length

The maximum signal cable length is 100 m.

9.15.4 Connection example

Connection example: Incremental encoder sin/cos 1 Vpp, 2,048

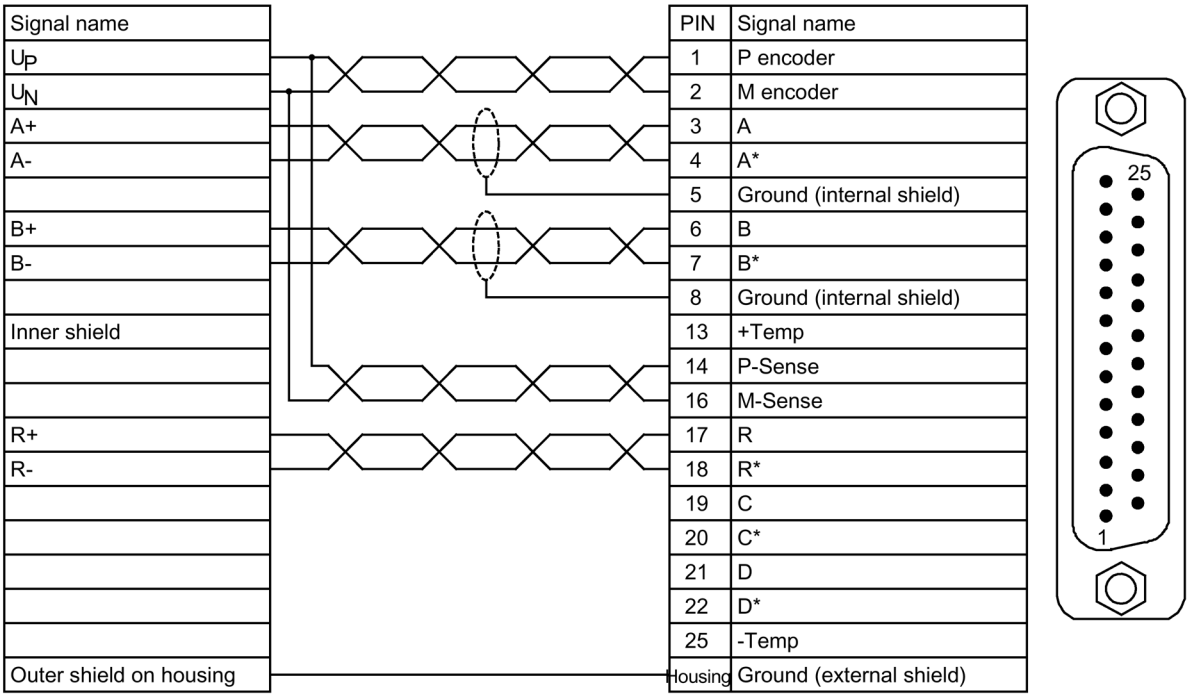


Figure 9-22 K48, connection example: Incremental encoder sin/cos 1 Vpp, 2,048

9.16 K50, Sensor Module Cabinet-Mounted SMC30

9.16.1 General information

Availability of option

This option is available for the following S120 Cabinet Modules:

- Motor Modules

Description

The SMC30 Sensor Module is used for detecting the actual motor speed. The signals emitted by the rotary pulse encoder are converted here and made available to the closed-loop controller via the DRIVE-CLiQ interface for evaluation purposes.

The following encoders can be connected to the SMC30 Sensor Module:

- TTL encoder
- HTL encoder
- SSI encoder
- PT1000, PTC or KTY temperature sensor

Table 9- 26 Connectable encoders with supply voltage

Encoder type	X520 (SUB-D)	X521 (terminal)	X531 (terminal)	Open-circuit monitoring	Remote sense
HTL bipolar 24 V	Yes	Yes	Yes	Yes	No
HTL unipolar 24 V	Yes	Yes	Yes	No	No
TTL bipolar 24 V	Yes	Yes	Yes	Yes	No
TTL bipolar 5 V	Yes	Yes	Yes	Yes	To X520
TTL unipolar	No	No	No	No	No
SSI 24 V/5 V	Yes	Yes	Yes	No	No

Table 9- 27 Maximum encoder cable length

Encoder type	Maximum signal cable length in m
TTL	100
HTL unipolar	100
HTL bipolar	300
SSI	100

Note

Prefer a bipolar connection

Because the physical transmission media is more robust, the bipolar connection should always be used for HTL encoders. The unipolar connection should only be used if the encoder type does not output push-pull signals.

Note

Only connect one encoder system

Only one encoder system may be connected to the encoder module, either at X520 or at X521/X531. The corresponding unused interface must not be used.

Table 9- 28 Specification of encoder systems that can be connected

Parameter	Designation	Thresh-old	Min.	Max.	Unit
High signal level (TTL bipolar at X520 or X521/X531) 1)	U_{Hdiff}		2	5	V
Low signal level (TTL bipolar at X520 or X521/X531) 1)	U_{Ldiff}		-5	-2	V
High signal level (HTL unipolar)	U_H 4)	High	17	V_{CC}	V
		Low	10	V_{CC}	V
Low signal level (HTL unipolar)	U_L 4)	High	0	7	V
		Low	0	2	V
High signal level (HTL bipolar) 2)	U_{Hdiff}		3	V_{CC}	V
Low signal level (HTL bipolar) 2)	U_{Ldiff}		$-V_{CC}$	-3	V
High signal level (SSI bipolar at X520 or X521/X531) 1)	U_{Hdiff}		2	5	V
Low signal level (SSI bipolar at X520 or X521/X531) 1)	U_{Ldiff}		-5	-2	V
Signal frequency	f_S		-	300	kHz
Edge clearance	t_{min}		100	-	ns
Zero pulse inactive time (before and after A=B=high)	t_{Lo}		640	$(t_{ALo-BHi} - t_{Hi})/2$ 3)	ns
Zero pulse active time (while A=B=high and beyond)	t_{Hi}		640	$t_{ALo-BHi} - 2 \times t_{Lo}$ 3)	ns

1) Other signal levels according to the RS422 standard.

2) The absolute level of the individual signals varies between 0 V and V_{CC} of the encoder system.

3) $t_{ALo-BHi}$ is not a specified value, but is the time between the falling edge of track A and the next but one rising edge of track B.

4) The threshold can be set via p0405.04 (switching threshold); the setting when delivered is "Low".

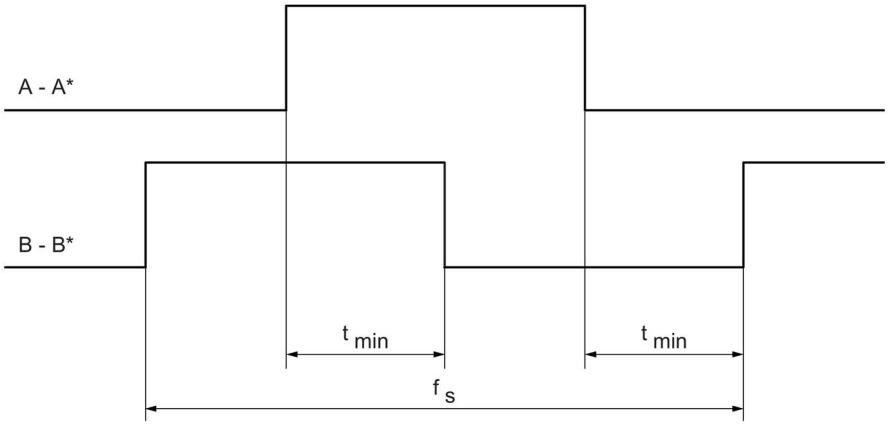


Figure 9-23 Signal characteristic of the A and B track between two edges: Time between two edges with pulse encoders

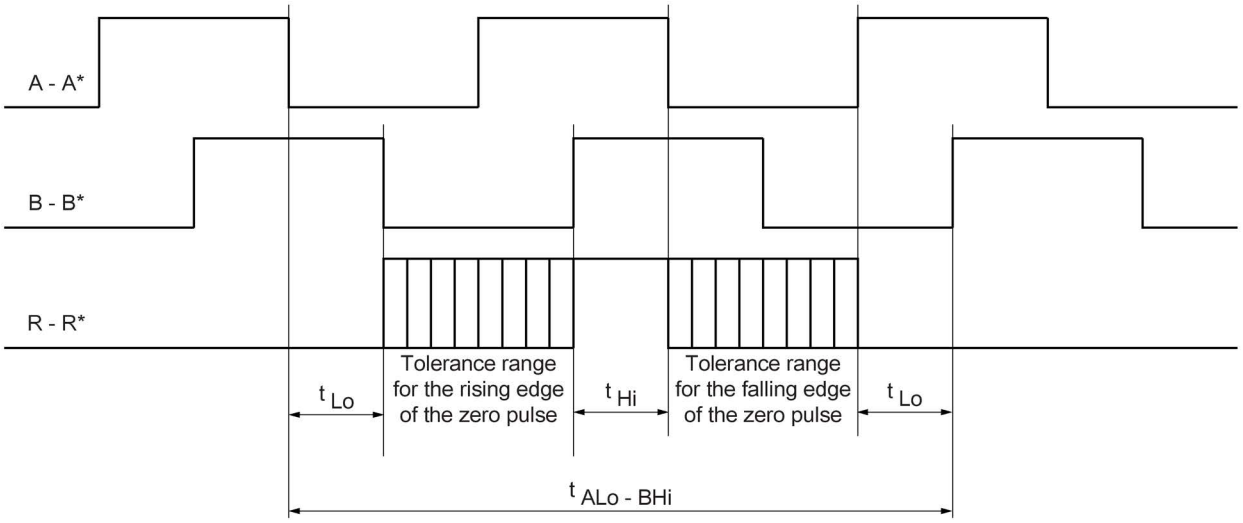


Figure 9-24 Position of the zero pulse to the track signals

For encoders with a 5 V supply at X521/X531, the cable length is dependent on the encoder current (this applies to cable cross-sections of 0.5 mm²):

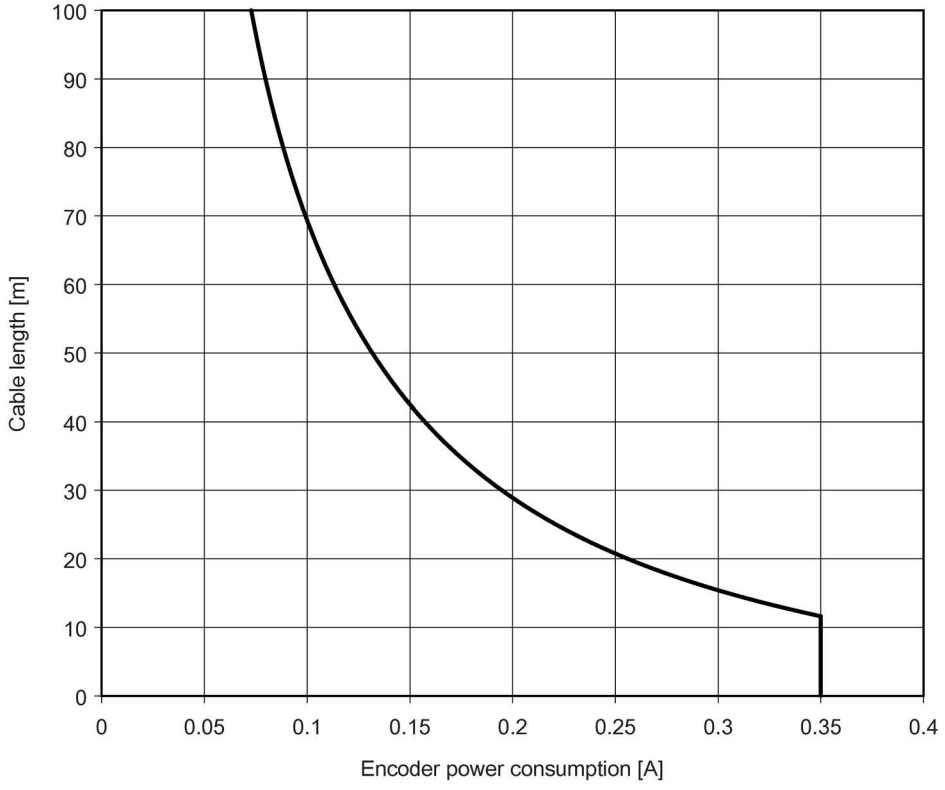


Figure 9-25 Signal cable length as a function of the encoder current consumption

For encoders without Remote Sense the permissible cable length is restricted to 100 m (reason: the voltage drop depends on the cable length and the encoder current).

9.16.2 Safety information

NOTICE

Damage when connecting an impermissible number of encoder systems

If more than the maximum permissible number of encoder systems are connected to a Sensor Module, this will cause damage.

- Only connect one encoder system to a Sensor Module.

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.

Note

Diminished level of interference immunity due to equalizing currents via the electronics ground

Ensure that there is no electrical connection between the encoder system housing and the signal cables, or the encoder system electronics.

If this is not carefully observed, under certain circumstances the system will not be able to reach the required interference immunity level (there is then a danger of equalization currents flowing through the electronics ground).

9.16.3 Interfaces

Overview

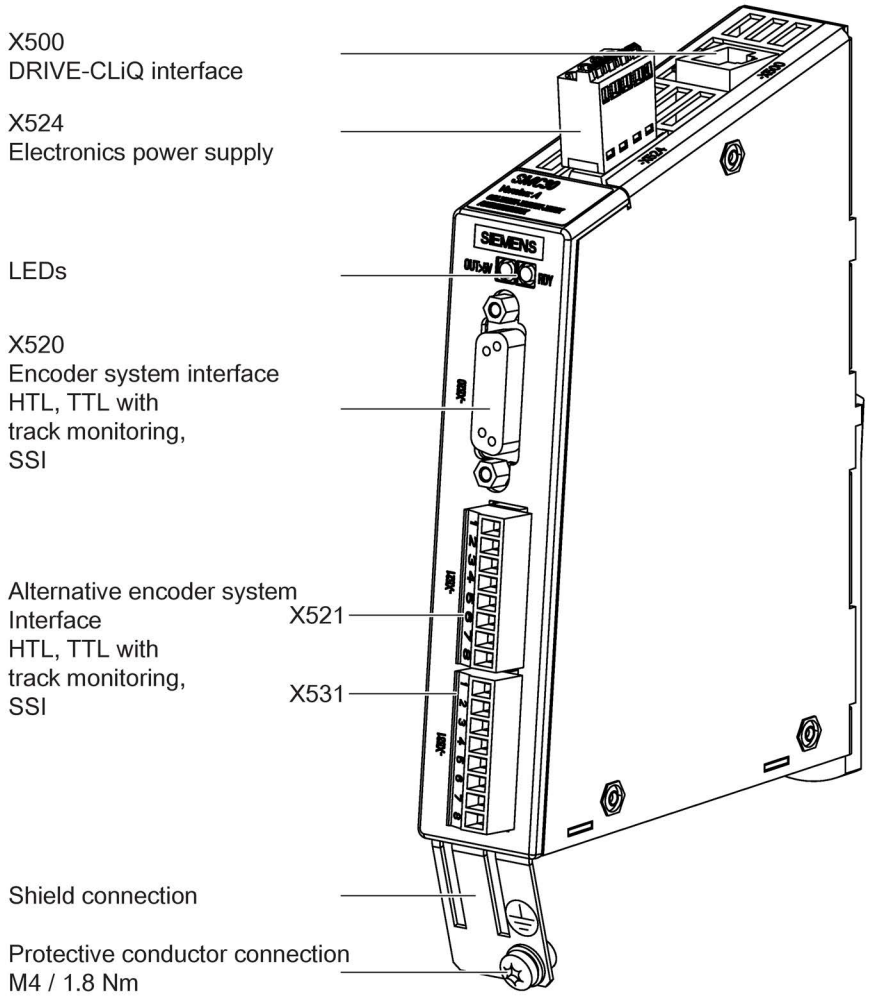
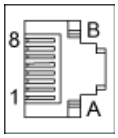


Figure 9-26 Interface overview for the SMC30

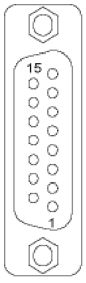
X500: DRIVE-CLiQ interface

Table 9- 29 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)	Power supply
	B	M (0 V)	Electronics ground
Blanking plate for DRIVE-CLiQ interfaces (50 units) Article number: 6SL3066-4CA00-0AA0			

X520 encoder connection 1 for HTL/TTL/SSI encoder with open-circuit monitoring

Table 9- 30 Encoder connection X520

Connector	Pin	Signal name	Technical data
	1	+Temp [1)]	Temperature sensor connection PT1000 / PTC / KTY84-1C130
	2	Clock	SSI clock
	3	Clock*	Inverted SSI clock
	4	P encoder 5 V / 24 V	Encoder power supply
	5	P encoder 5 V / 24 V	Encoder power supply
	6	P sense	Sense input for encoder power supply
	7	M encoder (M)	Ground for encoder power supply
	8	-Temp [1)]	Temperature sensor connection PT1000 / PTC / KTY84-1C130
	9	M sense	Ground for sense input
	10	R	Reference signal R
	11	R*	Inverted reference signal R
	12	B*	Inverted incremental signal B
	13	B	Incremental signal B
	14	A*/data*	Inverted incremental signal A/inverted SSI data
	15	A/data	Incremental signal A/SSI data
Connector type: 15-pin Sub-D socket			
Measuring current via temperature sensor connection: 2 mA			

[1)] Accuracy of the temperature measurement (temperature sensor including evaluation)
- PT1000: ±5 °C (PT1000 tolerance class B acc. to IEC 60751)
- PTC: ±5 °C
- KTY: ±7 °C

NOTICE

Damage or malfunctions through impermissible voltage values

If the back EMF is impermissible, the components may be damaged or malfunction.

- The back EMF at the outputs may only be in the range between -15 V and +15 V.

NOTICE

Damage to the 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.



⚠WARNING

Electric shock when the motor temperature sensor insulation fails

When connecting temperature sensors which are not isolated from the motor power circuit according to safe electrical separation, arcing to the signal electronics may occur.

- Use motors whose temperature sensors have safe electrical separation.
- Only use connecting cables and connectors with safe electrical separation between the insulated conductors of the temperature sensor and the insulated conductors of the power circuit.

NOTICE

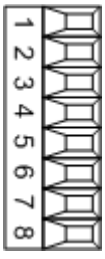
Damage to the encoder due to incorrect supply voltage

The encoder power supply can be parameterized to 5 V or 24 V. The encoder may be damaged if you enter the wrong parameter.

- Select the appropriate supply voltage.

X521/X531 encoder connection 2 for HTL/TTL/SSI encoder with open-circuit monitoring

Table 9- 31 Encoder connection X521

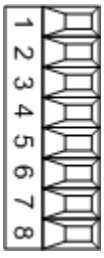
Connector	Terminal	Signal name	Technical data
	1	A	Incremental signal A
	2	A*	Inverted incremental signal A
	3	B	Incremental signal B
	4	B*	Inverted incremental signal B
	5	R	Reference signal R
	6	R*	Inverted reference signal R
	7	CTRL	Control signal
	8	M	Ground
Max. connectable cross-section: 1.5 mm²			

Note

Operation of unipolar HTL encoders

When unipolar HTL encoders are used, terminal block A*, B*, and R* must be jumpered with M encoder (-X531).

Table 9- 32 Encoder connection X531

Connector	Terminal	Signal name	Technical data
	1	P encoder 5 V / 24 V	Encoder power supply
	2	M encoder	Ground for encoder power supply
	3	-Temp [1)]	Temperature sensor connection PT1000 / PTC / KTY84-1C130
	4	+Temp [1)]	Temperature sensor connection PT1000 / PTC / KTY84-1C130
	5	Clock	SSI clock
	6	Clock*	Inverted SSI clock
	7	Data	SSI data
	8	Data*	Inverted SSI data
Max. connectable cross-section: 1.5 mm²			
Measuring current via temperature sensor connection: 2 mA			

[1)] Accuracy of the temperature measurement (temperature sensor including evaluation)
- PT1000: ±5 °C (PT1000 tolerance class B acc. to IEC 60751)
- PTC: ±5 °C
- KTY: ±7 °C

NOTICE

Damage or malfunctions through impermissible voltage values

If the back EMF is impermissible, the components may be damaged or malfunction.

- The back EMF at the outputs may only be in the range between -15 V and +15 V.

NOTICE

Damage to the 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.



WARNING

Electric shock when the motor temperature sensor insulation fails

When connecting temperature sensors which are not isolated from the motor power circuit according to safe electrical separation, arcing to the signal electronics may occur.

- Use motors whose temperature sensors have safe electrical separation.
- Only use connecting cables and connectors with safe electrical separation between the insulated conductors of the temperature sensor and the insulated conductors of the power circuit.

NOTICE

Damage to the encoder due to incorrect supply voltage

The encoder power supply can be parameterized to 5 V or 24 V. The encoder may be damaged if you enter the wrong parameter.

- Select the appropriate supply voltage.

Note

Cable shield for the encoder connection via terminals

Note that when the encoder is connected via terminals, the cable shield must be applied to the module.

9.16.4 Connection example

Connection example 1: HTL encoder with reference signal, bipolar connection

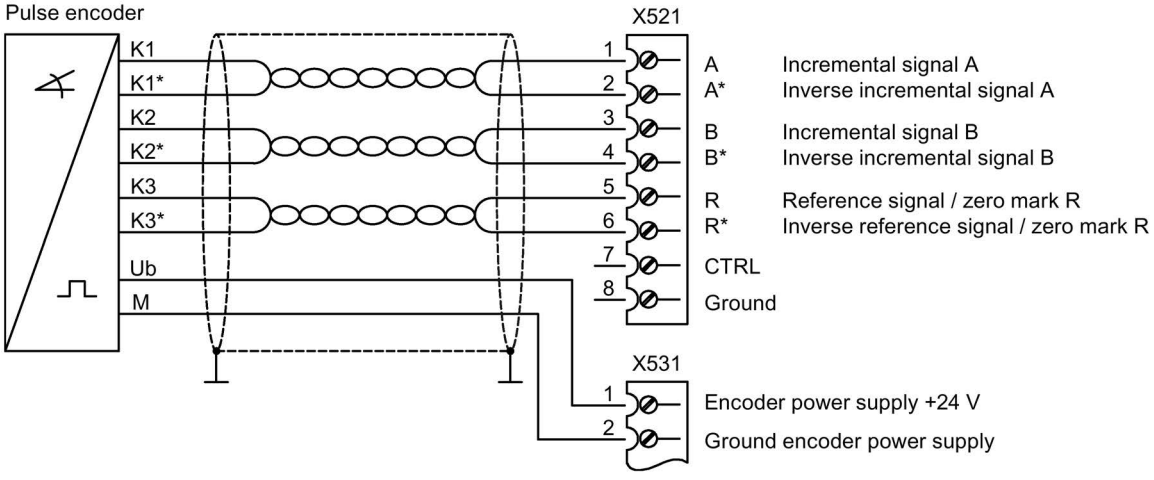


Figure 9-27 Connection example 1: HTL encoder with reference signal, bipolar connection

Signal cables must be twisted in pairs in order to improve immunity against induced interference.

Connection example 2: HTL encoder with reference signal, unipolar connection including the encoder ground

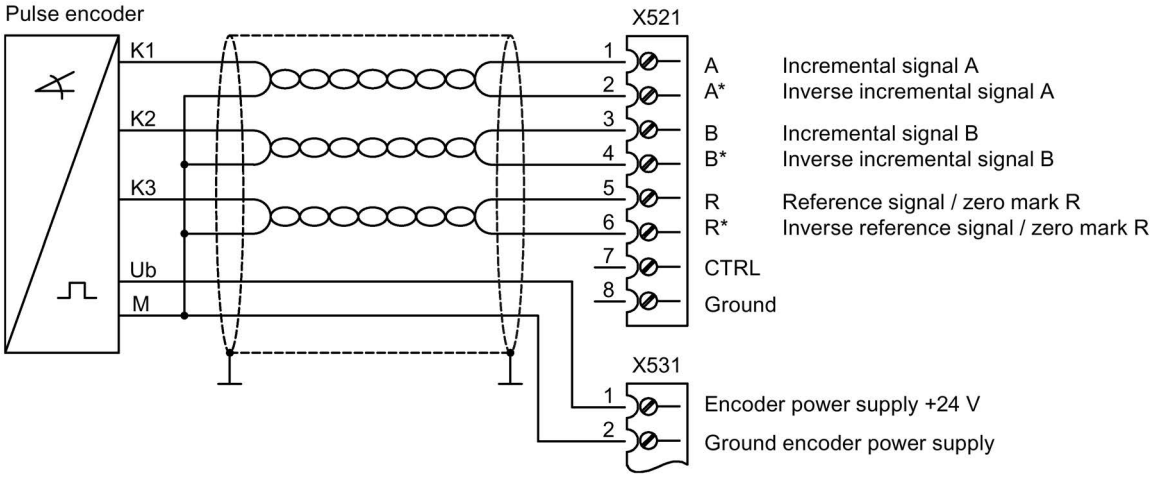


Figure 9-28 Connection example 2: HTL encoder with reference signal, unipolar connection including the encoder ground

Signal cables must be twisted in pairs in order to improve immunity against induced interference.

Connection example 3: HTL encoder with reference signal, unipolar connection without the encoder ground

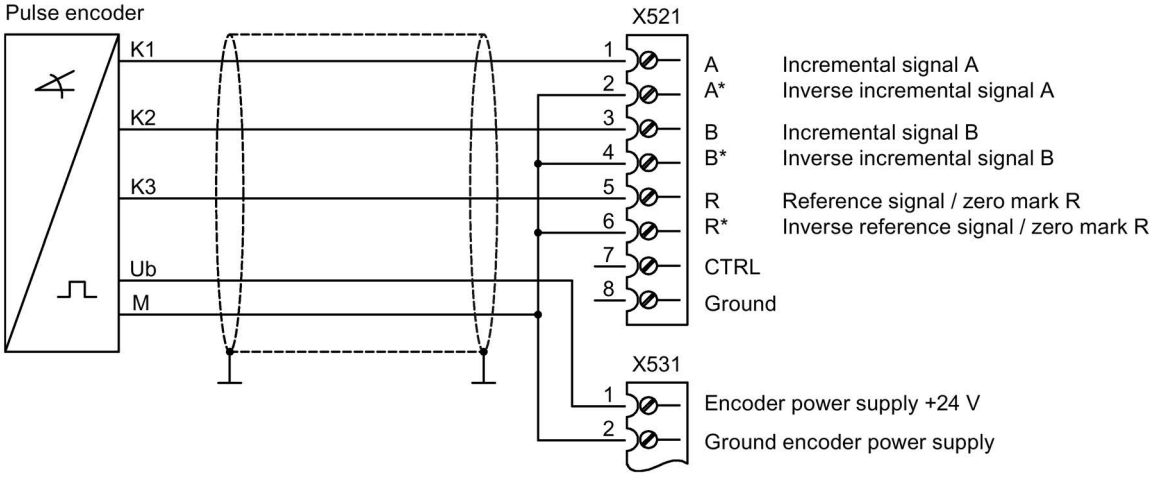


Figure 9-29 Connection example 3: HTL encoder with reference signal, unipolar connection without the encoder ground

9.17 K51, VSM10 Voltage Sensing Module Cabinet-Mounted

Availability of option

This option is available for the following S120 Cabinet Modules:

- Motor Modules

Description

The VSM10 Voltage Sensing Module is used to sense the voltage characteristic on the motor side, so that the following functions can be implemented:

- Operation of a permanent-magnet synchronous motor without encoder with the requirement to be able to connect to a motor that is already running (flying restart function)
- Fast flying restart of large induction motors: The time for the demagnetization of the motor is eliminated as a result of the voltage sensing.

The terminals on the Voltage Sensing Module (-T1-B51) are pre-assigned in the factory and must not be changed by the customer.

When operating a permanent-magnet synchronous motor without encoder, the "Flying restart" function must be activated with p1200.

Interfaces

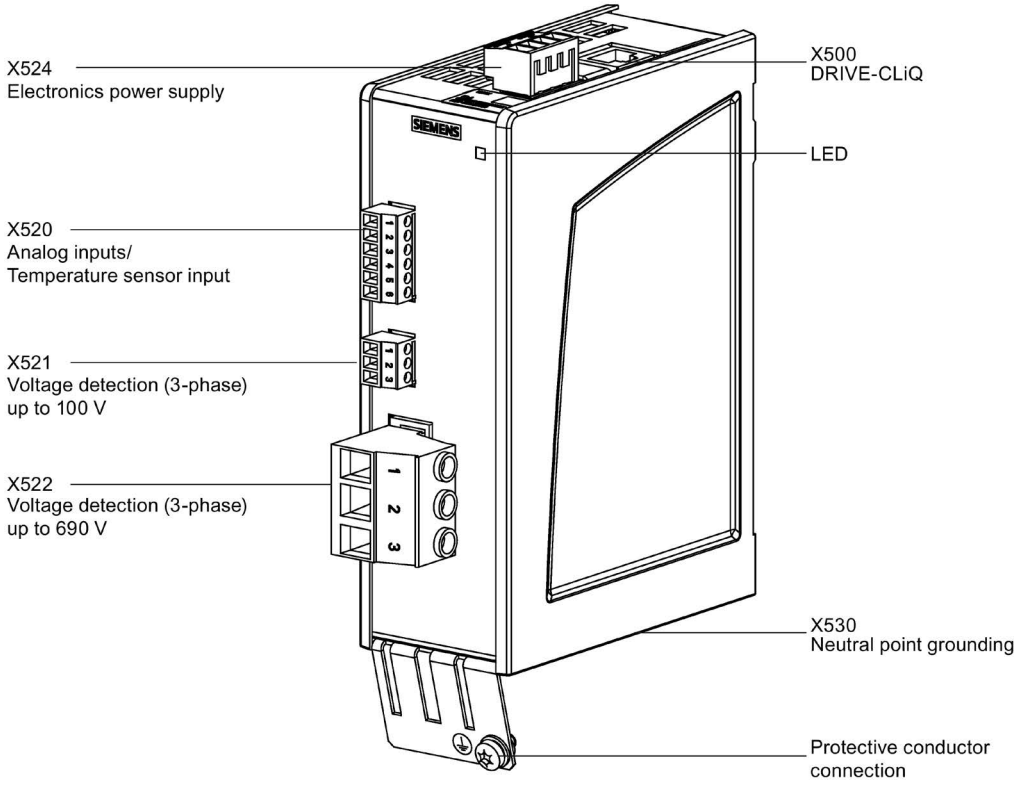


Figure 9-30 Interface overview for the Voltage Sensing Module (option K51)

Removing the connector jumper in the Voltage Sensing Module VSM10

At the Voltage Sensing Module (VSM10), the connector jumper in terminal X530 on the lower side of the component must be removed if you are using the cabinet unit on a non-grounded line supply (IT system).

Use two screwdrivers or a suitable tool in order to relieve the holding springs in the terminal and then withdraw the connector jumper.

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

Note

False tripping caused by not removing the connection clip with a non-grounded line supply

Failure to remove the connector jumper on a non-grounded line supply (IT system) can cause false tripping in case of sensitive IT network monitoring.

- For an ungrounded line supply system (IT system), remove the plug-in jumper.

9.18 K52, Additional SMC30 Sensor Module

Availability of option

This option is available for the following S120 Cabinet Modules:

- Motor Modules

Description

With option K50, an SMC30 Sensor Module is included in the cabinet unit. The additional SMC30 Sensor Module enables reliable actual value acquisition when using Safety Integrated Extended Functions.

Note

Safety Integrated Function Manual

Detailed and comprehensive instructions and information for handling Safety Integrated functions is given in the associated Function Manual, included in the device documentation provided.

9.19 K76, auxiliary voltage generating unit in the Line Connection Module

Availability of option

- Basic Line Connection Modules
- Active Line Connection Modules

Description

Cabinet Modules require an auxiliary energy supply to function properly. This current demand must be included in the configuration and supplied from an external source. If an external supply is not possible, the required auxiliary voltages can be generated by an Auxiliary Power Supply Module.

Alternatively, option K76 can be selected to generate the auxiliary voltages in the Line Connection Module. This is particularly advisable for smaller device configurations.

The following auxiliary voltages are available:

- 230 V AC (poss. tap approx. 4 ... 10 A)
- 24 V DC (poss. tap approx. 5 ... 20 A)

In the Basic Line Connection Module or Active Line Connection Module the auxiliary voltages are connected to the auxiliary power supply and therefore supply the complete group of cabinets.

If the Cabinet Modules are delivered as factory-assembled transport units (option Y11), the electrical installation work has already been carried out.
If the parts are delivered individually, then the auxiliary power interface must be installed on site.

Depending on the version, the power loss is approx. 100 W.

Adapting the auxiliary power supply (-T10)

A transformer is installed in the Basic Line Connection Module and/or active Line Connection Module (-T10) for the 230 V AC auxiliary power supply. The location of the transformer is indicated in the layout diagrams supplied.

When delivered, the taps are always set to the highest level. The line-side terminals of the transformer may need to be reconnected to the existing line voltage.

The line voltage assignments for making the appropriate setting on the transformer for the internal power supply are indicated in the following tables.

Table 9- 33 Line voltage assignment for the internal power supply (380 to 480 V AC, 3 phase)

Line supply voltage range	Tap	Adaptation transformer taps (-T10) LH1 – LH2
342 ... 390 V	380 V	1 – 2
391 ... 410 V	400 V	1 – 3
411 ... 430 V	415 V	1 – 4
431 ... 450 V	440 V	1 – 5
451 ... 470 V	460 V	1 – 6
471 ... 528 V	480 V	1 – 7

Table 9- 34 Line voltage assignment for the internal power supply (500 to 690 VAC, 3 phase)

Line supply voltage range	Tap	Adaptation transformer taps (-T10) LH1 – LH2
450 ... 515 V	500 V	1 – 8
516 ... 540 V	525 V	1 – 9
541 ... 560 V	550 V	1 – 10
561 ... 590 V	575 V	1 – 11
591 ... 630 V	600 V	1 – 12
631 ... 680 V	660 V	1 to 14, terminals 12 and 13 are jumpered
681 ... 759 V	690 V	1 to 15, terminals 12 and 13 are jumpered

NOTICE

Material damage when the voltage is set too high

If the terminals are not reconnected corresponding to the actual line voltage, this can damage the device if the voltage is set too high.

- Set the terminals in accordance with the actual line voltage.

9.20 K82, terminal module for activating safety functions "Safe Torque Off" and "Safe Stop 1"

Availability of option

This option is available for the following S120 Cabinet Modules:

- Motor Modules

Description

The option K82 (Terminal Module for activating "Safe Torque Off" and "Safe STOP 1") is used for isolated activation via a variable control voltage range of the safety functions already present in the standard, which can also be used without option K82.

Use option K82 to activate the following Safety Integrated Functions (terminology according to IEC 61800-5-2):

- Safe Torque Off (STO)
- Safe Stop 1 (SS1, time-controlled)

Note

Standard requirements

The integrated safety functions, starting from the Safety Integrated (SI) input terminals of the SINAMICS components (Control Unit, Motor Module), satisfy the requirements according to IEC 61800-5-2, IEC 60204-1, ISO 13849-1 Category 3 for Performance Level (PL) d and IEC 61508 SIL 2.

In combination with the option K82, the requirements specified in IEC 61800-5-2, IEC 60204-1 as well as ISO 13849-1 Category 3 for Performance Level (PL) d and IEC 61508 SIL 2 are fulfilled.

Note

Safety Integrated Function Manual

Detailed and comprehensive instructions and information for handling Safety Integrated functions is given in the associated Function Manual, included in the device documentation provided.

9.21 K87, Terminal Module TM54F



Figure 9-31 Option K87, Terminal Module TM54F

Availability of option

- Motor Modules

Description

The TM54F Terminal Module is a terminal expansion module with safe digital inputs and outputs for controlling the Safety Integrated functions of SINAMICS.

The TM54F must be directly connected to a Control Unit via DRIVE-CLiQ. Motor Modules or Line Modules must not be connected to a TM54F.
Precisely one TM54F can be assigned to each Control Unit.

TM54F features the following interfaces:

Table 9- 35 Overview of the TM54F interfaces

Type	Quantity
Fail-safe digital outputs (F-DO)	4
Fail-safe digital inputs (F-DI)	10
Sensor[1] power supplies, dynamic response supported [2]	2
Sensor[1] power supply, no dynamic response	1
Digital inputs to check F_DO for a test stop	4

[1] Sensors: Fail-safe devices to issue commands and sense, for example, emergency stop buttons and safety locks, position switches and light arrays/light curtains.

[2] Forced checking procedure: The sensor power supply is switched on and off by the TM54F when the forced checking procedure is active to check the sensors, cable routing and the evaluation electronics.

The TM54F provides 4 fail-safe digital outputs and 10 fail-safe digital inputs. A fail-safe digital output consists of a 24 V DC switching output, a ground switching output, and a digital input for checking the switching state. A fail-safe digital input comprises two digital inputs.

Note

Rated values of the F-DO

The rated values of the F-DO meet the requirements of IEC 61131-2 for digital DC outputs with 0.5 A rated current.

The operating ranges of the F-DI meet the requirements of IEC 61131-2 for type 1 digital inputs.

Note

Shielding cables

Please note that the F-DI must take the form of shielded cables if they are > 30 m in length.

Note

Safety Integrated Function Manual

Detailed and comprehensive instructions and information for handling Safety Integrated functions is given in the associated Function Manual, included in the device documentation provided.

9.22 K88, Safe Brake Adapter SBA 230 V AC

Availability of option

This option is available for the following S120 Cabinet Modules:

- Motor Modules

Description

The Safe Brake Control (SBC) is a safety function, that is used in safety-related applications, e.g. in presses or in rolling mills. In the current-free state, the brake acts on the motor of the drive by spring force. The brake is released when current flows (=low active).

The maximum brake current is 2 A.

The Safe Brake Adapter 230 V AC is installed in the cabinet unit in the factory. An infeed is connected to terminal -X12 on the Safe Brake Adapter to provide the necessary power. For control, a connection is established between the Safe Brake Adapter and the Control Interface Module using a cable harness installed in the factory.

For controlling the brake, a connection must be established on the plant side between terminal -X14 on the Safe Brake Adapter and the rectifier of the brake. It is not permissible that AC brakes are directly controlled.

NOTICE

Device failure as a 24 V DC brake has been connected

When a 24 V DC brake is connected to option K88 (Safe Brake Adapter 230 V AC) this can damage the Safe Brake Adapter and cause the device to fail (when the brake closes this is not displayed by an LED, the fuses can then trip, the relay contact service life is reduced).

- Do not connect a 24 VDC brake to the 230 VAC Safe Brake Adapter.

Note

Maximum cable length of the brake control

The maximum permissible cable length of 300 m between the Safe Brake Adapter 230 V AC and the brake must be observed. To accurately calculate the maximum cable length, see the SINAMICS Low Voltage Engineering Manual, which is included in the device documentation provided.

Fast de-energization

Some brake rectifier types are equipped with two additional connections for switching the brake load on the DC side. This allows the brake coil to be quickly de-energized, i.e. braking starts earlier.

The Safe Brake Adapter supports such fast de-energization using the two additional connections -X15:1 and -X15:2. This function does not belong to safe brake control.

Notes

Note

Spare fuses

The article numbers for spare fuses can be taken from the spare parts list supplied.

Note

Standard requirements

The integrated safety functions, starting from the Safety Integrated (SI) input terminals of the SINAMICS components (Control Unit, Motor Module), satisfy the requirements according to IEC 61800-5-2, IEC 60204-1, ISO 13849-1 Category 3 for Performance Level (PL) d and IEC 61508 SIL 2.

With the Safe Brake Adapter (option K88), the requirements specified in IEC 61800-5-2, IEC 60204-1, ISO 13849-1 Category 3 for Performance Level (PL) d and IEC 61508 SIL 2 are complied with.

Note

Safety Integrated Function Manual

Detailed and comprehensive instructions and information for handling Safety Integrated functions is given in the associated Function Manual, included in the device documentation provided.

9.23 K90, Control Unit CU320-2 DP

9.23.1 General information

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules
- Motor Modules

Description

With option K90, a CU320-2 DP Control Unit is installed in the Line Modules and Motor Modules of the drive line-up; this assumes the functions of communications, open-loop control, and closed-loop control for up to 4 Motor Modules, in addition to 1 Line Module.

The connection to the relevant modules and any additional I/O modules is established via DRIVE-CLiQ. A standard PROFIBUS interface is available for higher-level communication.

Communications with other participants via PROFIBUS or DRIVE-CLiQ connection is possible, see the "SINAMICS Low Voltage Engineering Manual" in the device documentation provided.

Note

CU320-2 Control Unit without performance enhancement

Without performance enhancement, it is generally possible to operate 2 Motor Modules plus 1 Line Module.

Note

Performance enhancement

The computing capacity required increases in proportion to the number of connected Motor Modules and system components and in relation to the dynamic response required. The full computing capacity of the CU320-2 Control Unit is available only with performance enhancement.

9.23.2 Connection overview

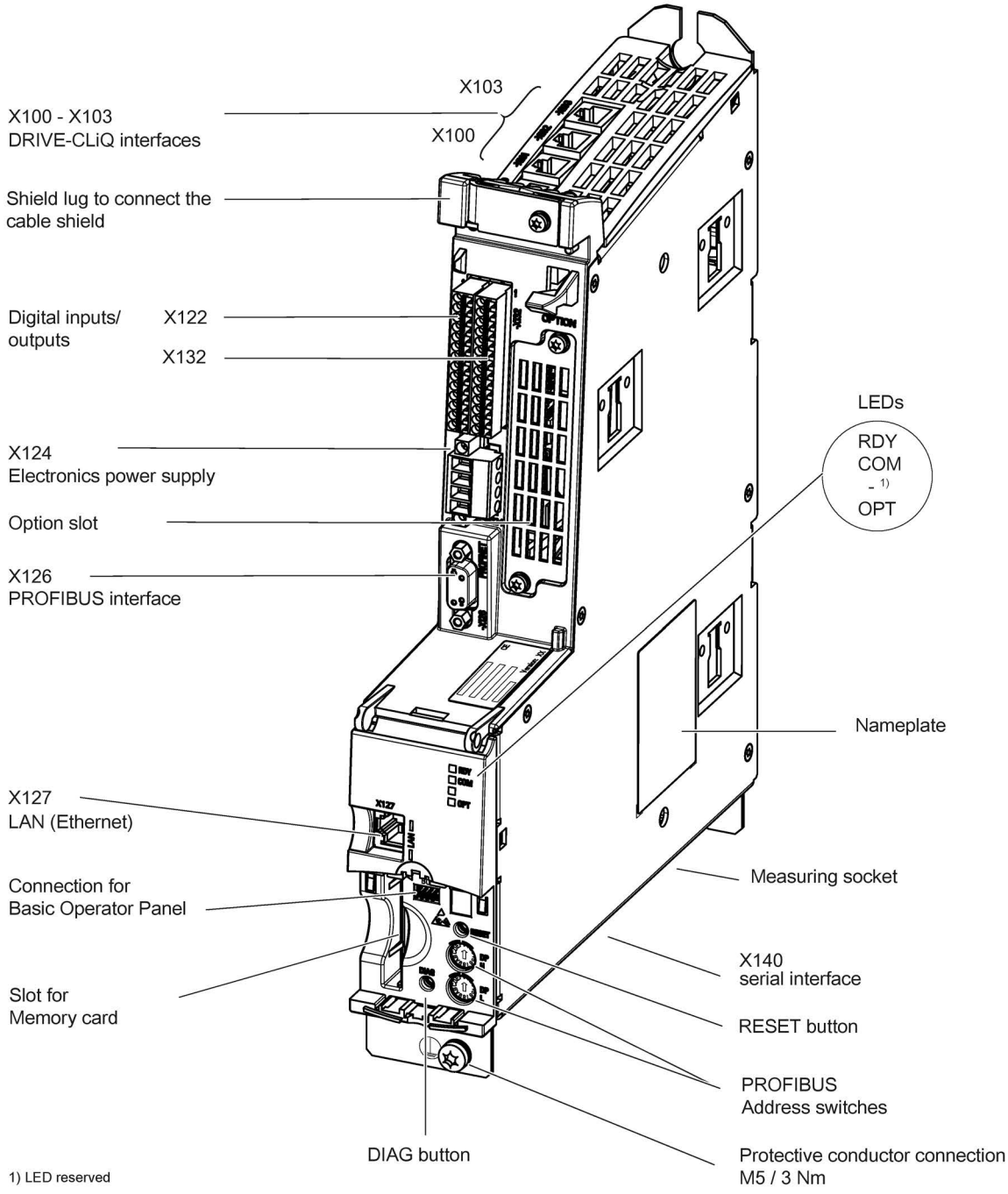


Figure 9-32 Connection overview of the CU320-2 DP Control Unit (without cover)

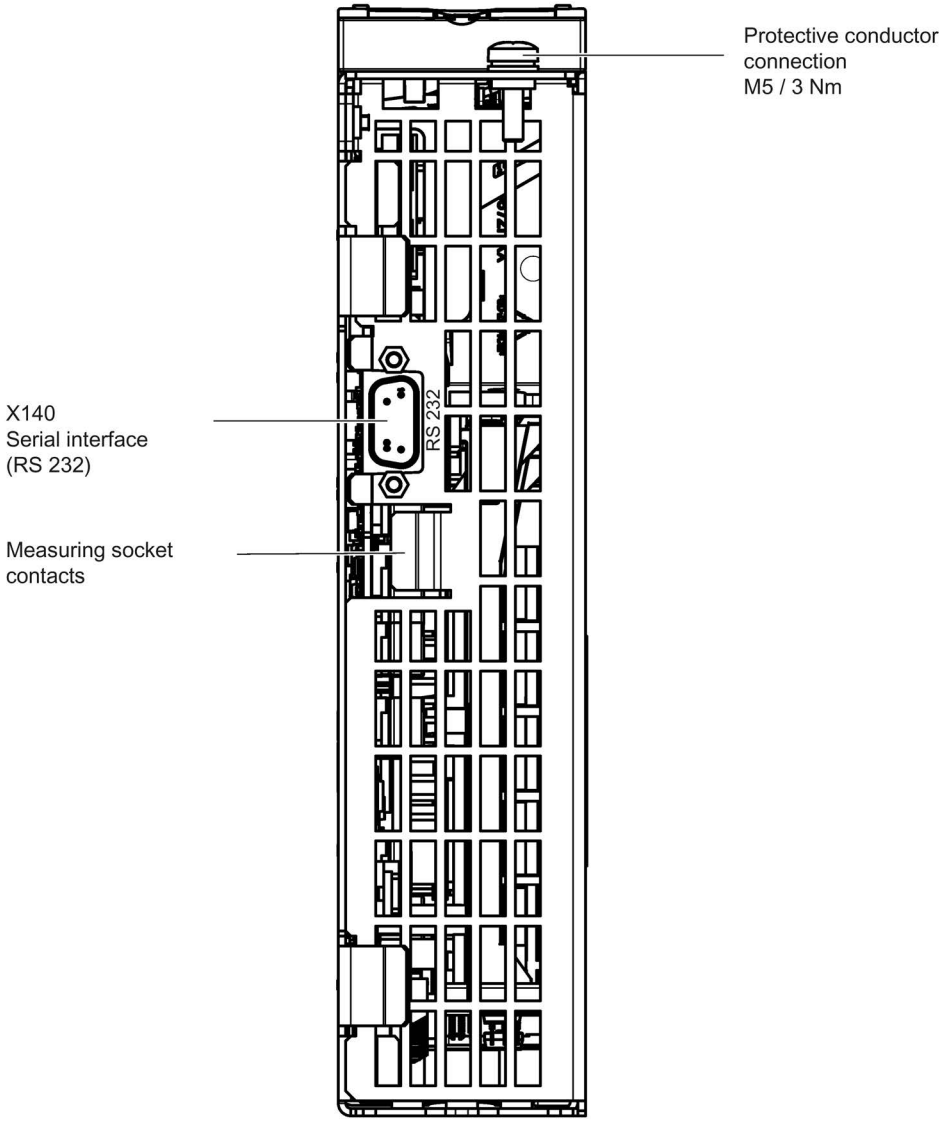


Figure 9-33 Interface X140 and measuring sockets T0 to T2 - CU320-2 DP (view from below)

NOTICE
Malfunctions or damage to the option board by inserting and withdrawing in operation Withdrawing and inserting the option board in operation can damage it or cause it to malfunction. • Only withdraw or insert the Option Board when the Control Unit is in a no-current condition.

9.23.3 Connection example

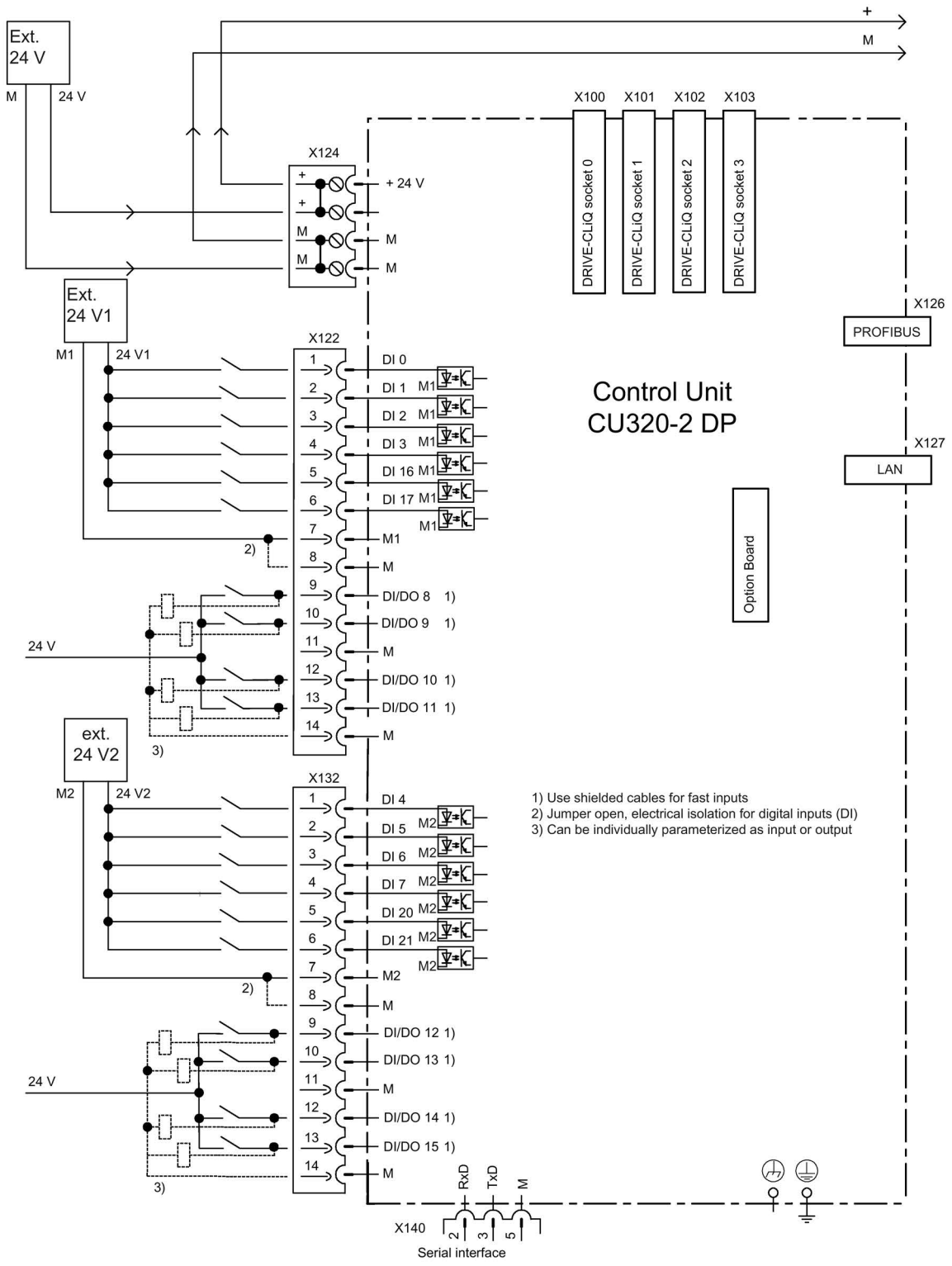


Figure 9-34 Connection example of CU320-2 DP

Note

Power supply for the digital inputs

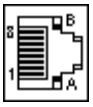
In the circuit example, the power for the digital inputs (terminals -X122 and -X132) is supplied from the internal 24 V supply of the Control Unit (terminal -X124).

The two groups of digital inputs (optocoupler inputs) each have a common reference potential (reference ground M1 or M2). To close the circuit when the internal 24 V supply is used, the reference grounds M1 / M2 are connected to internal ground (M).

If power is not supplied from the internal 24 V supply (terminal -X124), the jumper between grounds M1 and M or M2 and M must be removed in order to avoid potential current loops. The external ground must then be connected to terminals M1 and M2.

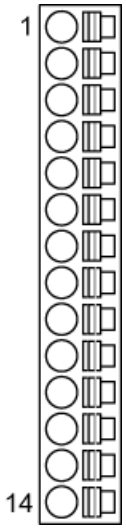
9.23.4 X100 - X103 DRIVE-CLiQ interface

Table 9- 36 DRIVE-CLiQ interface X100 - X103

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)	Power supply
	B	M (0 V)	Electronics ground
Connector type: RJ45 socket Blanking plate for DRIVE-CLiQ interfaces (50 units) Article number: 6SL3066-4CA00-0AA0			

9.23.5 X122 digital inputs/outputs

Table 9- 37 X122 terminal strip

Connector	Pin	Designation [1]	Technical data
	1	DI 0	Voltage (max.): -3 ... +30 V DC Typical power consumption: 9 mA at 24 V Electrical isolation: reference potential is terminal M1 Level (with ripple) High level: 15 ... 30 V Low level: -3 ... +5 V Input delay (typ.): For "0" → "1": 50 µs For "1" → "0": 150 µs
	2	DI 1	
	3	DI 2	
	4	DI 3	
	5	DI 16	
	6	DI 17	
	7	M1	Reference potential for terminal 1 ... 6
	8	M	Electronics ground
	9	DI/DO 8	**As input**: Voltage: -3 ... +30 VDC Current consumption, typical: 9 mA at 24 V Level (with ripple) High level: 15 ... 30 V Low level: -3 ... +5 V DI/DO 8, 9, 10, and 11 are "high-speed inputs" [2] Input delay (typ.): For "0" → "1": 5 µs For "1" → "0": 50 µs **As output**: Voltage: 24 V DC Max. load current per output: 500 mA Continuous short-circuit proof Output delay (typ./max.): [3] For "0" → "1": 150 µs / 400 µs For "1" → "0": 75 µs / 100 µs Switching frequency: For ohmic load: Max. 100 Hz For inductive load: Max. 0.5 Hz For lamp load: Max. 10 Hz Maximum lamp load: 5 W
	10	DI/DO 9	
	11	M	
	12	DI/DO 10	
	13	DI/DO 11	
	14	M	
Max. connectable cross-section: 1.5 mm²			

[1] DI: digital input; DI/DO: bidirectional digital input/output; M: Electronics ground M1: reference potential

[2] The rapid inputs can be used as probe inputs or as inputs for the external zero mark.

[3] Data for: V_{cc} = 24 V; load 48 Ω; high ("1") = 90% V_{out}; low ("0") = 10% V_{out}

The maximum cable length that can be connected is 30 m.

Note

Ensuring the function of digital inputs

An open input is interpreted as "low".

Terminal M1 must be connected so that the digital inputs (DI) can function.

This is achieved through one of the following measures:

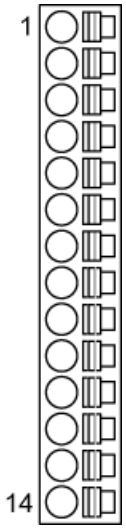
1. Also route the reference ground of the digital inputs.
2. A jumper to terminal M. (**Note:** This removes the electrical isolation for these digital inputs.)

Note

If the 24 V supply is briefly interrupted, then the digital outputs are deactivated during this time.

9.23.6 X132 digital inputs/outputs

Table 9- 38 X132 terminal strip

Connector	Pin	Designation [1]	Technical data
	1	DI 4	Voltage (max.): -3 ... +30 VDC Current consumption, typical: 9 mA at 24 V Electrical isolation: The reference potential is terminal M2 Level (including ripple) High level: 15 ... 30 V Low-level: -3 ... +5 V Input delay (typ.): For "0" → "1": 50 µs For "1" → "0": 150 µs
	2	DI 5	
	3	DI 6	
	4	DI 7	
	5	DI 20	
	6	DI 21	
	7	M2	Reference potential for terminal 1 ... 6
	8	M	Electronics ground
	9	DI/DO 12	**As input**: Voltage: -3 ... +30 VDC Current consumption, typical: 9 mA at 24 V Level (including ripple) High level: 15 ... 30 V Low-level: -3 ... +5 V DI/DO 12, 13, 14, and 15 are "high-speed inputs" [2] Input delay (typ.): For "0" → "1": 5 µs For "1" → "0": 50 µs **As output**: Voltage: 24 V DC Max. load current per output: 500 mA Continuous short-circuit proof Output delay (typ./max.): [3] For "0" → "1": 150 µs / 400 µs For "1" → "0": 75 µs / 100 µs Switching frequency: For ohmic load: Max. 100 Hz For inductive load: Max. 0.5 Hz For lamp load: Max. 10 Hz Maximum lamp load: 5 W
	10	DI/DO 13	
	11	M	
	12	DI/DO 14	
	13	DI/DO 15	
	14	M	
Max. connectable cross-section: 1.5 mm²			

[1] DI: digital input; DI/DO: bidirectional digital input/output; M: Electronics ground; M2: reference potential

[2] The rapid inputs can be used as probe inputs or as inputs for the external zero mark

[3] Data for: V_{cc} = 24 V; load 48 Ω; high ("1") = 90% V_{out}; low ("0") = 10% V_{out}

The maximum cable length that can be connected is 30 m.

Note

Ensuring the function of digital inputs

An open input is interpreted as "low".

To enable the digital inputs (DI) to function, terminal M2 must be connected.

This is achieved through one of the following measures:

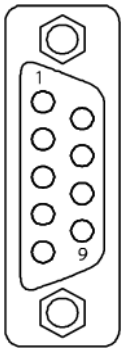
1. Also route the reference ground of the digital inputs.
2. A jumper to terminal M. (**Note:** This removes the electrical isolation for these digital inputs.)

Note

If the 24 V supply is briefly interrupted, then the digital outputs are deactivated during this time.

9.23.7 X126 PROFIBUS

Table 9- 39 X126 PROFIBUS interface

Connector	Pin	Signal name	Meaning	Range
	1	-	Not assigned	
	2	M24_SERV	Teleservice supply, ground	0 V
	3	RxD / TxD–P	Receive/transmit data P (B)	RS485
	4	CNTR–P	Control signal	TTL
	5	DGND	PROFIBUS data reference potential	
	6	VP	Supply voltage plus	5 V ± 10%
	7	P24_SERV	Teleservice supply, + (24 V)	24 V (20.4 ... 28.8 V)
	8	RxD / TxD–N	Receive/transmit data N (A)	RS485
	9	-	Not assigned	
Connector type: 9-pin Sub-D socket				

NOTICE

Damage to the Control Unit or other PROFIBUS nodes due to high leakage currents

Significant leakage currents can flow along the PROFIBUS cable if a suitable equipotential bonding conductor is not used and destroy the Control Unit or other PROFIBUS nodes.

- An equipotential bonding conductor with a cross-section of at least 25 mm^2 must be used between components in a system that are located at a distance from each other.

NOTICE
Damage to the Control Unit or other CAN bus nodes due to the connection of a CAN cable If a CAN cable is connected to the X126 interface, this can destroy the Control Unit or other CAN bus nodes. • Do not connect any CAN cables to the X126 interface.

Note

Remote diagnostics

A teleservice adapter can be connected to the PROFIBUS interface (X126) for remote diagnostics.
The power supply for the teleservice (terminals 2 and 7) can have a max. load of 150 mA.

PROFIBUS connectors

The first and last nodes in a bus must contain terminating resistors. Otherwise, data transmission will not function correctly.

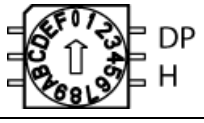
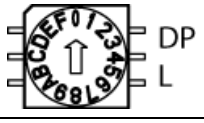
The bus terminating resistors are activated in the connector.

The cable shield must be connected at both ends and over a large surface area.

9.23.8 PROFIBUS address switch

The PROFIBUS address is set as a hexadecimal value via two rotary coding switches. Values between 0_{dec} (00_{hex}) and 127_{dec} ($7F_{hex}$) can be set as the address. The upper rotary coding switch (H) is used to set the hexadecimal value for 16^1 and the lower rotary coding switch (L) is used to set the hexadecimal value for 16^0.

Table 9- 40 PROFIBUS address switch

Rotary coding switches	Significance	Examples		
		21_{dec}	**35_{dec}**	**126_{dec}**
		15_{hex}	**23_{hex}**	**$7E_{hex}$**
	$16^1 = 16$	1	2	7
	$16^0 = 1$	5	3	E

Setting the PROFIBUS address

The factory setting for the rotary coding switches is 0_{dec} (00_{hex}).

There are two ways to set the PROFIBUS address:

1. Using parameter p0918
   - To set the bus address for a PROFIBUS node using STARTER, first set the rotary code switches to 0_{dec} (00_{hex}) and/or 127_{dec} ($7F_{hex}$).
   - Then use parameter p0918 to set the address to a value between 1 and 126.
2. Using the PROFIBUS address switches on the Control Unit
   - The address is set manually to values between 1 and 126 using the rotary coding switches. In this case, p0918 is only used to read the address.

The address switch is behind the blanking plate. The blanking plate is part of the scope of supply.

9.23.9 X127 LAN (Ethernet)

Note

Use

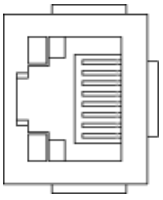
Ethernet interface X127 is intended for commissioning and diagnostics, which means that it must always be accessible (e.g. for service).

Further, the following restrictions apply to X127:

- Only local access is possible
- No networking - or only local networking in a closed and locked electrical cabinet permissible

If it is necessary to remotely access the electrical cabinet, then additional security measures must be applied so that misuse through sabotage, unqualified data manipulation and intercepting confidential data is completely ruled out (also see Chapter "Industrial Security (Page 27)").

Table 9- 41 X127 LAN (Ethernet)

Connector	Pin	Designation	Technical data
	1	TXP	Ethernet transmit data +
	2	TXN	Ethernet transmit data -
	3	RXP	Ethernet receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Ethernet receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
Connector type: RJ45 socket			

Note

The LAN (Ethernet) interface does not support Auto MDI(X). If the LAN interface of the communication partner also cannot handle auto-MDI(X), then a crossover cable must be used to establish the connection.

Note

Support during commissioning

The X127 LAN interface supports commissioning and diagnostic functions. It must not be connected for normal operation.

For diagnostic purposes, the X127 LAN interface features a green and a yellow LED. These LEDs indicate the following status information:

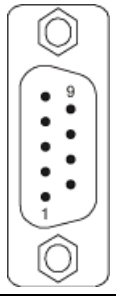
Table 9- 42 LED statuses for the X127 LAN interface

LED	State	Description
Green	On	10 or 100 Mbit link available
	Off	Missing or faulty link
Yellow	On	Sending or receiving
	Off	No activity

9.23.10 X140 serial interface (RS232)

The AOP30 operator panel for operating/parameterizing the device can be connected via the serial interface. The interface is located on the underside of the Control Unit.

Table 9- 43 Serial interface (RS232) X140

Connector	Pin	Designation	Technical data
	2	RxD	Receive data
	3	TxD	Transmit data
	5	Ground	Ground reference
Connector type: 9-pin Sub-D connector			

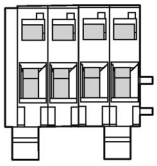
Note

Connecting cable to the AOP30

The connecting cable to AOP30 may only contain the three contacts which are listed in the table; a completely assigned cable may not be used.

9.23.11 Measuring socket

Table 9- 44 Measuring socket with mounted PC board connector

Connector	Socket	Function	Technical data
M T0 T1 T2 	M	Ground	Voltage: 0 ... 5 V Resolution: 8 bits Load current: max. 3 mA Continuous short-circuit proof The reference potential is terminal M
	T0	Measuring terminal 0	
	T1	Measuring terminal 1	
	T2	Measuring terminal 2	
PCB plug connector from Phoenix Contact, type: ZEC 1.0/ 4-ST-3.5 C1 R1.4, order number: 1893708			

Note

Cable cross-section

The measuring socket contacts are only suitable for cable cross-sections of 0.2 mm^2 to 1 mm^2.

Note

Using the measuring socket contacts

The measuring socket contacts support commissioning and diagnostic functions. It must not be connected for normal operation.

9.23.12 Memory card

Description

The computing capacity required and utilization of the CU320-2 Control Unit can be calculated with the SIZER engineering tool. The firmware options are supplied in license form, which are written to the memory card in the factory as license codes. The firmware options can also be enabled on-site, for example, if the required expanded performance is not known at the time of placing the order. You will need the serial number of the memory card and the article number of the firmware option to be released. With this information, you can purchase the associated license code from a license database and enable the firmware option.

The license code is only valid for the memory card declared and cannot be transferred to other memory cards.

⚠WARNING

Software manipulation when using exchangeable data storage media

Storing files onto exchangeable storage media amounts to an increased risk of infection, e.g. with viruses and malware. As a result of incorrect parameterization, machines can malfunction, which in turn can lead to injuries or death.

- Protect files stored on exchangeable storage media from malicious software by with suitable protection measures, e.g. virus scanners.

Note

Data loss when the Control Unit with memory card is returned

When returning a defective Control Unit for repair or testing, the data on the memory card (parameters, firmware, licenses, etc.) could be lost.

- Do not return the memory card as well, but rather keep it in a safe place so that it can be inserted in the replacement unit.

Note

Please note that only SIEMENS memory cards can be used to operate the Control Unit.

9.23.12.1 Using the memory card

Description

The STARTER commissioning tool is used to store configuration data centrally on the memory card. This ensures that if the Control Unit is defective, it can be simply replaced without the loss of any data. It also enables data to be stored on external storage media.

The data on the memory card can also be accessed using a CompactFlash card reader connected to a PC. This card reader is not included in the scope of supply.

System prerequisites for installing STARTER V5.4

Hardware
The following minimum requirements must be met:

- PG or PC with Pentium III min. 1 GHz (recommended > 1 GHz)
- 2 GB work memory (4 GB recommended)
- Screen resolution 1024 × 768 pixels, 16-bit color depth
- Free hard disk space > 5 GB

Software
The following minimum requirements must be met when using STARTER without an existing STEP 7 installation:

64-bit operating systems:

- Microsoft Windows 7 Professional SP1
- Microsoft Windows 7 Ultimate SP1
- Microsoft Windows 7 Enterprise SP1 (standard installation)
- Microsoft Windows 10 Professional, from version 1709
- Microsoft Windows 10 Enterprise, from Version 1709
- Microsoft Windows 10 Enterprise 2016 LTSB (OS build 14393)
- Microsoft Windows Server 2016
- Microsoft Windows Server 2019

STARTER setup is possible with native Windows versions with Asian languages only if the Microsoft Windows 7 software is an MUI version.

Acrobat Reader V9.4 or higher is required to open the function diagrams in the online help.

Note
Preconditions in conjunction with STEP7

If STARTER is used in combination with other STEP7 components, the prerequisites for the S7 components shall apply.

Additional system requirements for installing a CompactFlash card reader

- Free USB connection

9.23.12.2 Data functions

Once a card reader has been connected and successfully installed, the data on the memory card can be accessed in the same way as data stored on other PC storage media (e.g. access to hard disk, memory stick, etc.). To access its data, the memory card must first be removed from the CU320-2 Control Unit and inserted in the card reader connected to the PC.

The actual procedure for accessing the memory card data depends on the operating system used.

9.23.12.3 Saving the memory card parameter settings

Following commissioning, it is advisable to back up the data on the memory card to an external storage medium (hard disk, data carrier, etc.).

To do this, the memory card is read out via a card reader connected to a PC. Ensure that all the files and directories are stored in the same form as on the memory card.

If necessary, the device status following commissioning of the drive can be restored by uploading the saved data to the memory card.

Note

Plant standstill by withdrawing or inserting the memory card while operational

If the memory card is withdrawn or inserted during operation, then data can be lost, possibly resulting in a plant standstill.

- Only withdraw and insert the memory card when the Control Unit is in a no-voltage condition.

9.23.12.4 Slot for the memory card

Slot for the memory card



Figure 9-35 Slot for the memory card

Note

Insertion direction for the memory card

Only insert the memory card as shown in the photo above (arrow at top right).

Note

Data loss when the Control Unit with memory card is returned

When returning a defective Control Unit for repair or testing, the data on the memory card (parameters, firmware, licenses, etc.) could be lost.

- Do not return the memory card as well, but rather keep it in a safe place so that it can be inserted in the replacement unit.

9.24 K94, Performance extension for CU320-2

Availability of option

This option is available for the following options:

- Option K90, Control Unit CU320-2 PROFIBUS
- Option K95, Control Unit CU320-2 PROFINET

Description

A CU320-2 Control Unit can perform the communication, open-loop and closed-loop control functions for several power units. The computing capacity requirement increases in proportion to the number of power units and system components and in relation to the dynamic response required. The full computing capacity of the CU320-2 Control Unit is available only with performance enhancement.

In addition to the firmware, the memory card also contains licensing codes, which are required to enable firmware options (such as performance enhancement and the Safety Integrated Extended functions).

9.25 K95, Control Unit CU320-2 PN

9.25.1 General information

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules
- Motor Modules

Description

With option K95, a CU320-2 PN Control Unit is installed in the Line Modules and Motor Modules of the drive line-up; this assumes the functions of communications, open-loop control, and closed-loop control for up to 4 Motor Modules, in addition to 1 Line Module.

The connection to the relevant modules and any additional I/O modules is established via DRIVE-CLiQ. A standard PROFINET interface is available for higher-level communication.

Communications with other participants via PROFIBUS or DRIVE-CLiQ connection is possible, see the "SINAMICS Low Voltage Engineering Manual" in the device documentation provided.

Note

CU320-2 Control Unit without performance enhancement

Without performance enhancement, it is generally possible to operate 2 Motor Modules plus 1 Line Module.

Note

Performance enhancement

The computing capacity required increases in proportion to the number of connected Motor Modules and system components and in relation to the dynamic response required. The full computing capacity of the CU320-2 Control Unit is available only with performance enhancement.

9.25.2 Connection overview

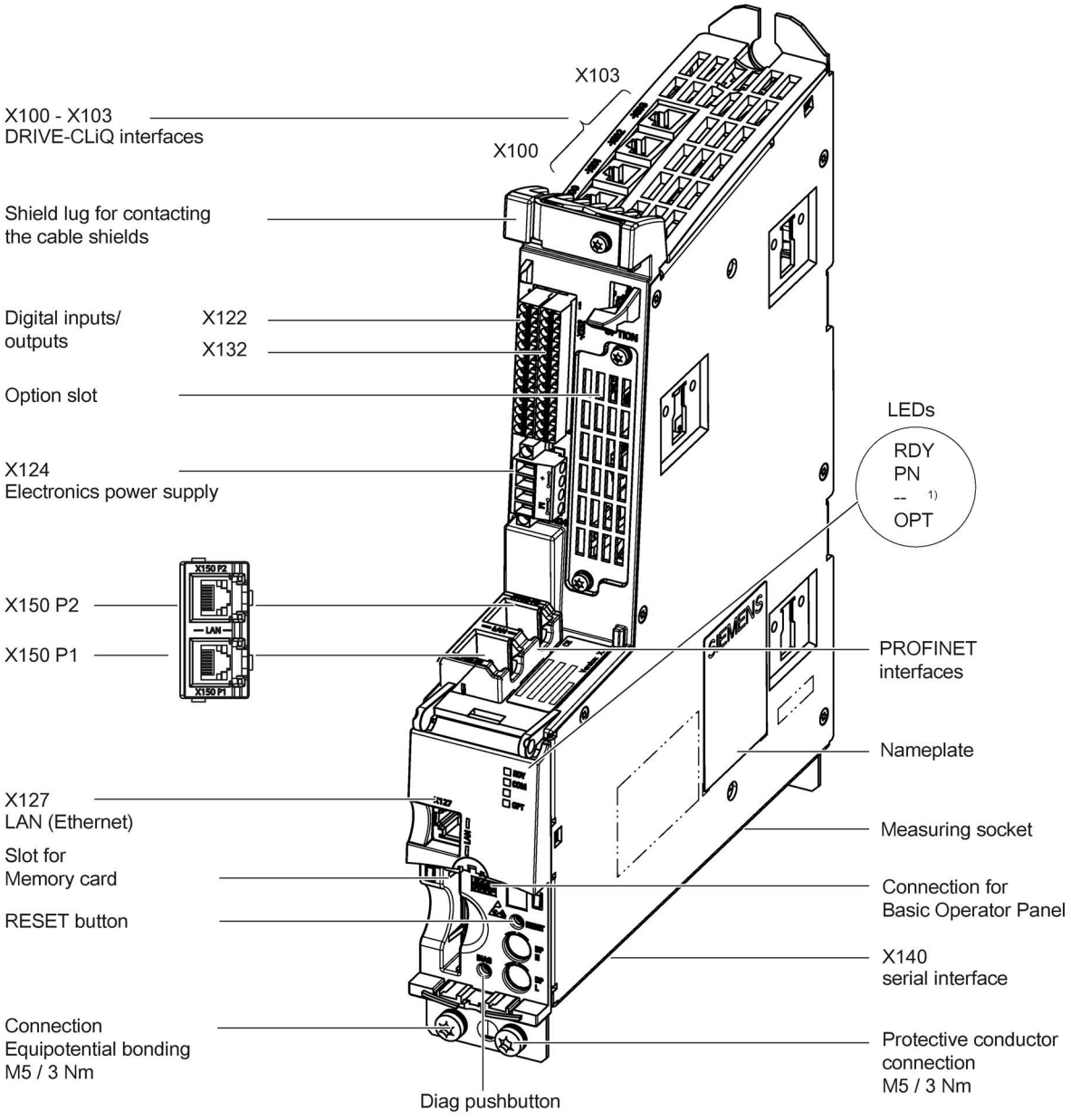


Figure 9-36 Overview of connections for the CU3202 PN Control Unit (without cover)

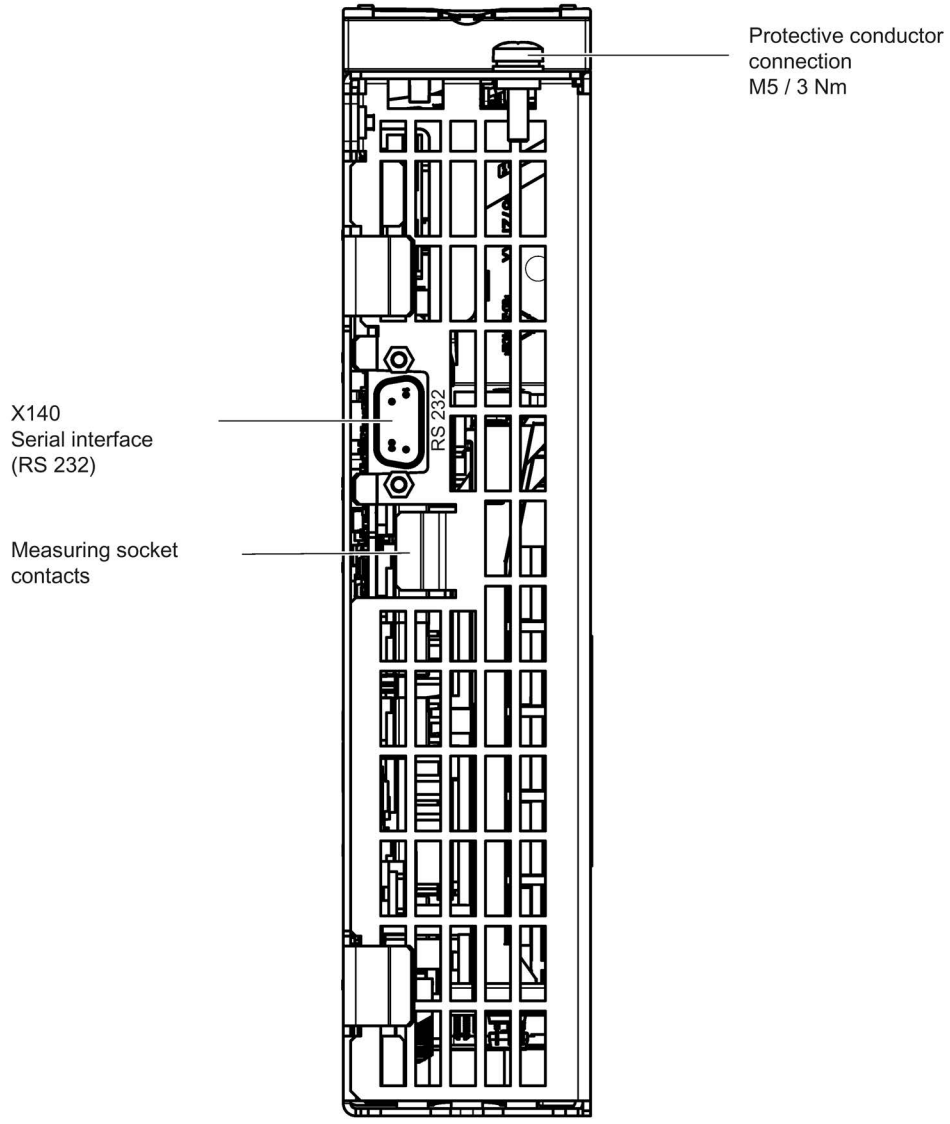


Figure 9-37 Interface X140 and measuring sockets T0 to T2 - CU320-2 PN (view from below)

NOTICE
Malfunctions or damage to the option board by inserting and withdrawing in operation Withdrawing and inserting the option board in operation can damage it or cause it to malfunction. • Only withdraw or insert the Option Board when the Control Unit is in a no-current condition.

9.25.3 Connection example

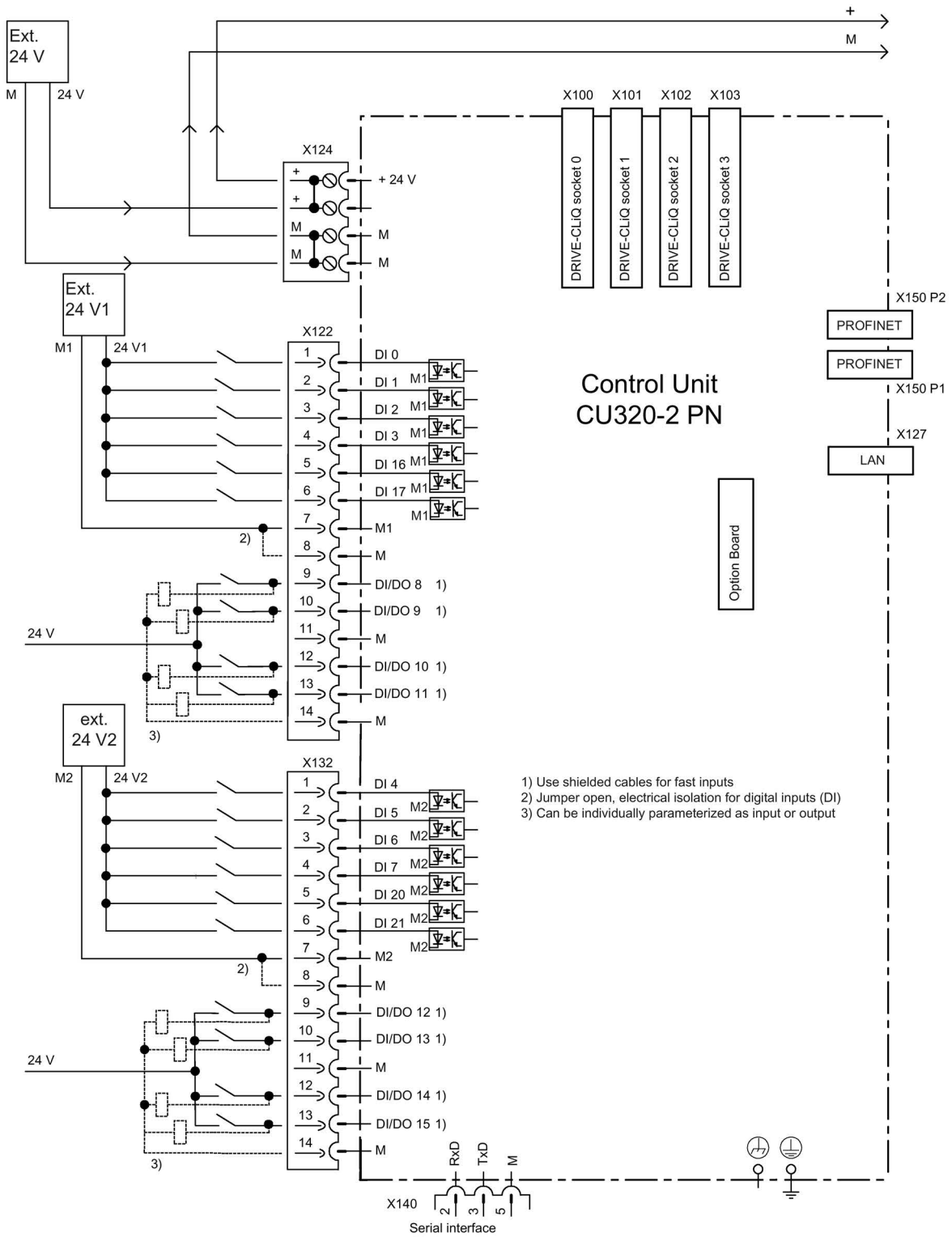


Figure 9-38 Connection example, CU320-2 PN

Note

Power supply for the digital inputs

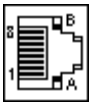
In the circuit example, the power for the digital inputs (terminals -X122 and -X132) is supplied from the internal 24 V supply of the Control Unit (terminal -X124).

The two groups of digital inputs (optocoupler inputs) each have a common reference potential (reference ground M1 or M2). To close the circuit when the internal 24 V supply is used, the reference grounds M1 / M2 are connected to internal ground (M).

If power is not supplied from the internal 24 V supply (terminal -X124), the jumper between grounds M1 and M or M2 and M must be removed in order to avoid potential current loops. The external ground must then be connected to terminals M1 and M2.

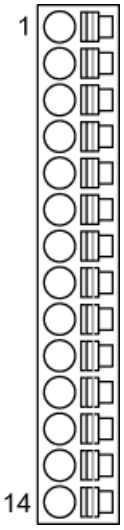
9.25.4 X100 - X103 DRIVE-CLiQ interface

Table 9- 45 DRIVE-CLiQ interface X100 - X103

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)	Power supply
	B	M (0 V)	Electronics ground
Connector type: RJ45 socket Blanking plate for DRIVE-CLiQ interfaces (50 units) Article number: 6SL3066-4CA00-0AA0			

9.25.5 X122 digital inputs/outputs

Table 9- 46 X122 terminal strip

Connector	Pin	Designation [1]	Technical data
	1	DI 0	Voltage (max.): -3 ... +30 V DC Typical power consumption: 9 mA at 24 V Electrical isolation: reference potential is terminal M1 Level (with ripple) High level: 15 ... 30 V Low level: -3 ... +5 V Input delay (typ.): For "0" → "1": 50 µs For "1" → "0": 150 µs
	2	DI 1	
	3	DI 2	
	4	DI 3	
	5	DI 16	
	6	DI 17	
	7	M1	Reference potential for terminal 1 ... 6
	8	M	Electronics ground
	9	DI/DO 8	**As input**: Voltage: -3 ... +30 VDC Current consumption, typical: 9 mA at 24 V Level (with ripple) High level: 15 ... 30 V Low level: -3 ... +5 V DI/DO 8, 9, 10, and 11 are "high-speed inputs" [2] Input delay (typ.): For "0" → "1": 5 µs For "1" → "0": 50 µs **As output**: Voltage: 24 V DC Max. load current per output: 500 mA Continuous short-circuit proof Output delay (typ./max.): [3] For "0" → "1": 150 µs / 400 µs For "1" → "0": 75 µs / 100 µs Switching frequency: For ohmic load: Max. 100 Hz For inductive load: Max. 0.5 Hz For lamp load: Max. 10 Hz Maximum lamp load: 5 W
	10	DI/DO 9	
	11	M	
	12	DI/DO 10	
	13	DI/DO 11	
	14	M	
Max. connectable cross-section: 1.5 mm²			

[1] DI: digital input; DI/DO: bidirectional digital input/output; M: Electronics ground M1: reference potential

[2] The rapid inputs can be used as probe inputs or as inputs for the external zero mark.

[3] Data for: V_{cc} = 24 V; load 48 Ω; high ("1") = 90% V_{out}; low ("0") = 10% V_{out}

The maximum cable length that can be connected is 30 m.

Note

Ensuring the function of digital inputs

An open input is interpreted as "low".

Terminal M1 must be connected so that the digital inputs (DI) can function.

This is achieved through one of the following measures:

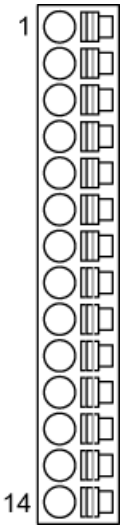
1. Also route the reference ground of the digital inputs.
2. A jumper to terminal M. (**Note:** This removes the electrical isolation for these digital inputs.)

Note

If the 24 V supply is briefly interrupted, then the digital outputs are deactivated during this time.

9.25.6 X132 digital inputs/outputs

Table 9- 47 X132 terminal strip

Connector	Pin	Designation [1]	Technical data
	1	DI 4	Voltage (max.): -3 ... +30 VDC Current consumption, typical: 9 mA at 24 V Electrical isolation: The reference potential is terminal M2 Level (including ripple) High level: 15 ... 30 V Low-level: -3 ... +5 V Input delay (typ.): For "0" → "1": 50 µs For "1" → "0": 150 µs
	2	DI 5	
	3	DI 6	
	4	DI 7	
	5	DI 20	
	6	DI 21	
	7	M2	Reference potential for terminal 1 ... 6
	8	M	Electronics ground
	9	DI/DO 12	**As input**: Voltage: -3 ... +30 VDC Current consumption, typical: 9 mA at 24 V Level (including ripple) High level: 15 ... 30 V Low-level: -3 ... +5 V DI/DO 12, 13, 14, and 15 are "high-speed inputs" [2] Input delay (typ.): For "0" → "1": 5 µs For "1" → "0": 50 µs **As output**: Voltage: 24 V DC Max. load current per output: 500 mA Continuous short-circuit proof Output delay (typ./max.): [3] For "0" → "1": 150 µs / 400 µs For "1" → "0": 75 µs / 100 µs Switching frequency: For ohmic load: Max. 100 Hz For inductive load: Max. 0.5 Hz For lamp load: Max. 10 Hz Maximum lamp load: 5 W
	10	DI/DO 13	
	11	M	
	12	DI/DO 14	
	13	DI/DO 15	
	14	M	
Max. connectable cross-section: 1.5 mm²			

[1] DI: digital input; DI/DO: bidirectional digital input/output; M: Electronics ground; M2: reference potential

[2] The rapid inputs can be used as probe inputs or as inputs for the external zero mark

[3] Data for: V_{cc} = 24 V; load 48 Ω; high ("1") = 90% V_{out}; low ("0") = 10% V_{out}

The maximum cable length that can be connected is 30 m.

Note

Ensuring the function of digital inputs

An open input is interpreted as "low".

To enable the digital inputs (DI) to function, terminal M2 must be connected.

This is achieved through one of the following measures:

1. Also route the reference ground of the digital inputs.
2. A jumper to terminal M. (**Note:** This removes the electrical isolation for these digital inputs.)

Note

If the 24 V supply is briefly interrupted, then the digital outputs are deactivated during this time.

9.25.7 X127 LAN (Ethernet)

Note

Use

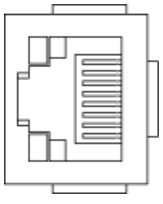
Ethernet interface X127 is intended for commissioning and diagnostics, which means that it must always be accessible (e.g. for service).

Further, the following restrictions apply to X127:

- Only local access is possible
- No networking - or only local networking in a closed and locked electrical cabinet permissible

If it is necessary to remotely access the electrical cabinet, then additional security measures must be applied so that misuse through sabotage, unqualified data manipulation and intercepting confidential data is completely ruled out (also see Chapter "Industrial Security (Page 27)").

Table 9- 48 X127 LAN (Ethernet)

Connector	Pin	Designation	Technical data
	1	TXP	Ethernet transmit data +
	2	TXN	Ethernet transmit data -
	3	RXP	Ethernet receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Ethernet receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
Connector type: RJ45 socket			

Note

The LAN (Ethernet) interface does not support Auto MDI(X). If the LAN interface of the communication partner also cannot handle auto-MDI(X), then a crossover cable must be used to establish the connection.

Note

Support during commissioning

The X127 LAN interface supports commissioning and diagnostic functions. It must not be connected for normal operation.

For diagnostic purposes, the X127 LAN interface features a green and a yellow LED. These LEDs indicate the following status information:

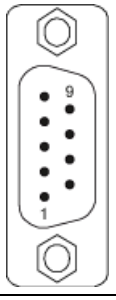
Table 9- 49 LED statuses for the X127 LAN interface

LED	State	Description
Green	On	10 or 100 Mbit link available
	Off	Missing or faulty link
Yellow	On	Sending or receiving
	Off	No activity

9.25.8 X140 serial interface (RS232)

The AOP30 operator panel for operating/parameterizing the device can be connected via the serial interface. The interface is located on the underside of the Control Unit.

Table 9- 50 Serial interface (RS232) X140

Connector	Pin	Designation	Technical data
	2	RxD	Receive data
	3	TxD	Transmit data
	5	Ground	Ground reference
Connector type: 9-pin Sub-D connector			

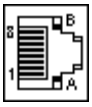
Note

Connecting cable to the AOP30

The connecting cable to AOP30 may only contain the three contacts which are listed in the table; a completely assigned cable may not be used.

9.25.9 X150 P1/P2 PROFINET connection

Table 9- 51 X150 P1 and X150 P2 PROFINET

Connector	Pin	Signal name	Technical data
	1	RXP	Receive data +
	2	RXN	Receive data -
	3	TXP	Transmit data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	TXN	Transmit data -
	7	Reserved, do not use	
	8	Reserved, do not use	
Connector type: RJ45 socket Cable type: PROFINET			

Note

Connecting cables

The PROFINET interfaces support Auto MDI(X). It is therefore possible to use both crossed and uncrossed cables to connect the devices.

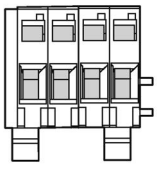
For diagnostic purposes, the two PROFINET interfaces are each equipped with a green and a yellow LED. These LEDs indicate the following status information:

Table 9- 52 LED states at the X150 P1/P2 PROFINET interface

LED	Color	State	Description
Link port	-	Off	Missing or faulty link
	Green	Steady light	10 or 100 Mbit link available
Activity port	-	Off	No activity
	Yellow	Flashing light	Data is being received or sent at port x

9.25.10 Measuring socket

Table 9- 53 Measuring socket with mounted PC board connector

Connector	Socket	Function	Technical data
	M	Ground	Voltage: 0 ... 5 V Resolution: 8 bits Load current: max. 3 mA Continuous short-circuit proof The reference potential is terminal M
	T0	Measuring terminal 0	
	T1	Measuring terminal 1	
	T2	Measuring terminal 2	
PCB plug connector from Phoenix Contact, type: ZEC 1.0/ 4-ST-3.5 C1 R1.4, order number: 1893708			

Note

Cable cross-section

The measuring socket contacts are only suitable for cable cross-sections of 0.2 mm^2 to 1 mm^2.

Note

Using the measuring socket contacts

The measuring socket contacts support commissioning and diagnostic functions. It must not be connected for normal operation.

9.25.11 Memory card

Description

The computing capacity required and utilization of the CU320-2 Control Unit can be calculated with the SIZER engineering tool. The firmware options are supplied in license form, which are written to the memory card in the factory as license codes. The firmware options can also be enabled on-site, for example, if the required expanded performance is not known at the time of placing the order. You will need the serial number of the memory card and the article number of the firmware option to be released. With this information, you can purchase the associated license code from a license database and enable the firmware option.

The license code is only valid for the memory card declared and cannot be transferred to other memory cards.

⚠WARNING

Software manipulation when using exchangeable data storage media

Storing files onto exchangeable storage media amounts to an increased risk of infection, e.g. with viruses and malware. As a result of incorrect parameterization, machines can malfunction, which in turn can lead to injuries or death.

- Protect files stored on exchangeable storage media from malicious software by with suitable protection measures, e.g. virus scanners.

Note

Data loss when the Control Unit with memory card is returned

When returning a defective Control Unit for repair or testing, the data on the memory card (parameters, firmware, licenses, etc.) could be lost.

- Do not return the memory card as well, but rather keep it in a safe place so that it can be inserted in the replacement unit.

Note

Please note that only SIEMENS memory cards can be used to operate the Control Unit.

9.25.11.1 Using the memory card

Description

The STARTER commissioning tool is used to store configuration data centrally on the memory card. This ensures that if the Control Unit is defective, it can be simply replaced without the loss of any data. It also enables data to be stored on external storage media.

The data on the memory card can also be accessed using a CompactFlash card reader connected to a PC. This card reader is not included in the scope of supply.

System prerequisites for installing STARTER V5.4

Hardware
The following minimum requirements must be met:

- PG or PC with Pentium III min. 1 GHz (recommended > 1 GHz)
- 2 GB work memory (4 GB recommended)
- Screen resolution 1024 × 768 pixels, 16-bit color depth
- Free hard disk space > 5 GB

Software
The following minimum requirements must be met when using STARTER without an existing STEP 7 installation:

64-bit operating systems:

- Microsoft Windows 7 Professional SP1
- Microsoft Windows 7 Ultimate SP1
- Microsoft Windows 7 Enterprise SP1 (standard installation)
- Microsoft Windows 10 Professional, from version 1709
- Microsoft Windows 10 Enterprise, from Version 1709
- Microsoft Windows 10 Enterprise 2016 LTSB (OS build 14393)
- Microsoft Windows Server 2016
- Microsoft Windows Server 2019

STARTER setup is possible with native Windows versions with Asian languages only if the Microsoft Windows 7 software is an MUI version.

Acrobat Reader V9.4 or higher is required to open the function diagrams in the online help.

Note

Preconditions in conjunction with STEP7

If STARTER is used in combination with other STEP7 components, the prerequisites for the S7 components shall apply.

Additional system requirements for installing a CompactFlash card reader

- Free USB connection

9.25.11.2 Data functions

Once a card reader has been connected and successfully installed, the data on the memory card can be accessed in the same way as data stored on other PC storage media (e.g. access to hard disk, memory stick, etc.). To access its data, the memory card must first be removed from the CU320-2 Control Unit and inserted in the card reader connected to the PC.

The actual procedure for accessing the memory card data depends on the operating system used.

9.25.11.3 Saving the memory card parameter settings

Following commissioning, it is advisable to back up the data on the memory card to an external storage medium (hard disk, data carrier, etc.).

To do this, the memory card is read out via a card reader connected to a PC. Ensure that all the files and directories are stored in the same form as on the memory card.

If necessary, the device status following commissioning of the drive can be restored by uploading the saved data to the memory card.

Note

Plant standstill by withdrawing or inserting the memory card while operational

If the memory card is withdrawn or inserted during operation, then data can be lost, possibly resulting in a plant standstill.

- Only withdraw and insert the memory card when the Control Unit is in a no-voltage condition.

9.25.11.4 Slot for the memory card

Slot for the memory card



Figure 9-39 Slot for the memory card

Note

Insertion direction for the memory card

Only insert the memory card as shown in the photo above (arrow at top right).

Note

Data loss when the Control Unit with memory card is returned

When a defective Control Unit is returned, the data on the memory card (parameters, firmware, licenses, etc.) may be lost during repair and testing.

- Do not return the memory card with the Control Unit. Instead, keep it in a safe place so that it can be inserted in the replacement unit.

9.26 L13, main contactor for Basic Line Connection Modules < 800 A

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules

Description

Up to a rated current of 800 A, the Basic Line Connection Module is only equipped as standard with a manually operated fused load disconnector. Option L13 is needed if a switching element is also required for disconnecting the cabinet from the infeed. In this case, the contactor is activated from the connected Line Module.

NOTICE
Material damage caused by switching the line contactor under load Switching the line contactor under load can result in increased wear and consequently to premature failure of the line contactor. • Always switch the line contactor at zero current.

X50 "main contactor" checkback contact

Table 9- 54 Terminal block X50 "main contactor" checkback contact

Terminal	Designation [1]	Technical data
4	NO	Max. load current: 10 A Max. switching voltage: 250 V AC Max. contact rating: 250 VA Required minimum load: ≥1 mA
5	NC	
6	COM	
Max. connectable cross-section: 4 mm²		

[1] NO: Normally-open contact, NC: Normally-closed contact, COM: Center contact

9.27 L21, surge suppression

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules

Description

The option includes the installation of surge arresters and upstream fuses for each phase. The signaling contacts of the monitoring of the surge arresters and the fuses are connected in series and connected to a customer interface.

Safety note

Note

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

The connection between the integrated basic interference suppression module and ground must be disconnected if the cabinet unit 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 (see Chapter "Removing the connection clip of the integrated basic interference suppression module to ground (Page 105)").

X700 - monitoring surge arresters and fuses

Table 9- 55 Terminal block X700, monitoring surge arresters and fuses

Terminal	Designation [1]	Technical data
1	NC	Max. load current: - at 24 V DC: 1 A - At 230 VAC: 0.5 A
4	NC	
Max. connectable cross-section: 2.5 mm²		

[1] NC: NC contact

Reason why the monitoring function responds

After the monitoring function responds at terminal block X700:1/4, the cause must be identified:

- Surge arresters (-A703, -A704-, A705) have a display showing the operating state.
- In the event of a fault, the fuses (-Q700) must be checked and possibly replaced once the fault cause has been eliminated.

Replacing surge arresters

The surge arrestor involved must be replaced in the case of a fault:

- Basic Line Connection Modules, Active Line Connection Modules, 3 AC 380 ... 480 V: The insert (protection module) is removed by withdrawing the defective insert and installing the spare part.
- Basic Line Connection Modules, Active Line Connection Modules, 3 AC 500 ... 690 V: The complete surge arrester is replaced.

9.28 L22, supplied as standard without line reactor

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules

Description

If the Basic Line Connection module is fed via a separate transformer, or if the line supply has a sufficiently low line short-circuit power (fault rating), then the line reactor, used as standard, can be omitted.

For the Basic Line Connection Module with option L22, the standard line reactor is not supplied.

9.29 L25, circuit breaker in withdrawable unit design

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules

Description

The circuit breaker in a withdrawable unit design is available as option for Basic Line Connection Modules above a rated current of > 800 A and Active Line Connection Modules above a rated current of > 700 A. This breaker replaces the standard built-in circuit breaker.

The circuit breaker in withdrawable unit design features a visible isolating distance.

X50 "circuit breaker" checkback contact

Table 9- 56 Terminal block X50 "Circuit breaker" feedback signal contact

Terminal	Designation [1]	Technical data
1	NC	"Circuit breaker" checkback contacts Max. load current: 3 A Max. switching voltage: 250 V AC
2	NO	
3	COM	
Max. connectable cross-section: 2.5 mm²		

[1] NC: Normally closed contact, NO: Normally open contact, COM: Center contact

Note

Additional information

Detailed and comprehensive instructions and information for the circuit breaker as well as options integrated in the factory are given in the associated operating instructions, which are included in the device documentation provided.

9.30 L40, line filter monitoring

Availability of option

This option is available for the following S120 Cabinet Modules:

- Active Line Connection Modules
- Active Line Connection Modules compact

Description

The line filter monitoring option is used to monitor that line harmonic distortion levels are maintained by the filter in the Active Interface Module.

By measuring the current and voltage in the Active Interface Module, the capacitance of the filter capacitors of the integrated filter are continuously calculated and compared with the installed nominal capacitance.

Alarm A06250 is initiated if the calculated capacitance is higher than the set comparison threshold.

Commissioning

To activate the comparison threshold of the nominal capacitance of the particular Active Interface Module, you must use a script. This automatically sets the corresponding parameters in STARTER.

Script "Option_L40_deu.txt" in German or "Option_L40_engl.txt" in English is included in the device documentation provided.

Inserting the script into the STARTER project:

1. Select the Infeed unit symbol in the STARTER project using the right mouse key, select "Expert" – "Insert script folder".
   The "SCRIPTS" folder is inserted.
2. Select the "SCRIPTS" folder using the right mouse key, select "Export/import" - "ASCII import..." and select script "Option_L40_deu.txt" or "Option_L40_eng.txt".
   Script "Option_L40" is inserted after acknowledging the following screen form.
3. Select script "Option_L40" using the right mouse key and then select "Accept and execute".

After the script has been successfully executed, message "L40 option successfully parameterized!" is output.

If message "No ALM/line filter found! The script execution was interrupted" or "Only for ALM", appears, then the script is in the incorrect folder or an unknown Active Interface Module was found.

Alarm A06250 is output

If Alarm A06250 "Infeed: Defective capacitor(s) in at least one phase of line filter" is output, then there is a risk that the line harmonics no longer correspond to the original nominal values. As a consequence, sensitive devices that are connected to the same line connection point could be damaged.

Contact customer service within the next 4 weeks.

9.31 L41, current transformer upstream of main switch

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules

Description

If current transformers are used for measuring or monitoring purposes, they are installed in the Line Connection Modules with option L41. The current transformers are installed upstream of the main breaker in all three line phases of the infeed.

The transformers have an accuracy class of 1.0. The secondary current is maximum 1 A.

The measuring connections for the current transformers are routed in the Line Connection Module to terminal block -X60.

Current transformer ratio in the Basic Line Connection Module

The assignment of the article numbers of the Basic Line Connection Modules to the ratios of the current transformers are listed in the following table.

Table 9- 57 Transformation ratios of the current transformers

Article No.	V_{IN}	Input current	DC link current IDC	Transformation ratio
6SL3735-1TE37-4LA3	380 to 480 V AC, 3-phase	610	740	800/1
6SL3735-1TE41-2LA3	380 to 480 V AC, 3-phase	1000	1220	2000/1
6SL3735-1TE41-7LA3	380 to 480 V AC, 3-phase	1420	1730	2000/1
6SL3735-1TG34-2LA3	500 to 690 V AC, 3-phase	340	420	800/1
6SL3735-1TG37-3LA3	500 to 690 V AC, 3-phase	600	730	800/1
6SL3735-1TG41-3LA3	500 to 690 V AC, 3-phase	1070	1300	2000/1
6SL3735-1TG41-7LA3	500 to 690 V AC, 3-phase	1350	1650	2000/1

Transformation ratio of the current transformer in the Line Connection Module

The assignment of the article numbers of the Active Line Connection Modules to the ratios of the current transformers are listed in the following table.

Table 9- 58 Transformation ratios of the current transformers

Article No.	V_{IN}	Infeed/regenerative feedback current	DC link current IDC	Transformation ratio
6SL3735-7LE41-0LA3	380 to 480 V AC, 3-phase	985	1100	2000/1
6SL3735-7LE41-4LA3	380 to 480 V AC, 3-phase	1405	1573	2000/1
6SL3735-7LG35-8LA3	500 to 690 V AC, 3-phase	575	644	800/1
6SL3735-7LG41-0LA3	500 to 690 V AC, 3-phase	1025	1147	2000/1
6SL3735-7LG41-3LAx	500 to 690 V AC, 3-phase	1270	1422	2000/1
6SL3735-7LG41-6LAx	500 to 690 V AC, 3-phase	1560	1740	2000/1

X60 line current transformer

Table 9- 59 Terminal block X60

Terminal	Designation	Technical data
1	-T110: k/S1	Current transformer on phase U1/L1
2	-T110: l/S1	
3	-T111: k/S1	Current transformer on phase V1/L2
4	-T111: l/S1	
5	-T112: k/S1	Current transformer on phase W1/L3
6	-T112: l/S1	
Max. connectable cross-section: 2.5 mm²		

9.32 L45, EMERGENCY OFF pushbutton installed in the cabinet door

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules
- Active Line Connection Modules compact

Description

The EMERGENCY OFF pushbutton with protective collar is integrated in the cabinet door of the Basic Line Connection Module or the Active Line Connection Module. The contacts of the pushbutton are connected to a terminal block. From here, the EMERGENCY OFF pushbutton can be integrated into the plant-side EMERGENCY OFF chain.

Note

Ensure the EMERGENCY OFF function on the plant side

The EMERGENCY OFF function must be ensured on the plant side.

X120 checkback contact "EMERGENCY OFF pushbutton in the cabinet door"

Table 9- 60 Terminal block X120

Terminal	Designation [1]	Technical data
1	NC	Feedback signal contacts of the EMERGENCY OFF pushbutton in the cabinet door Max. load current: 10 A Max. switching voltage: 250 V AC Max. contact rating: 250 VA Required minimum load: ≥1 mA
2		
3	NC (internal)	
4		
Max. connectable cross-section: 4 mm²		

[1] NC: NC contact

9.33 L50, cabinet lighting with service socket

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules

Description

With option L50, cabinet lighting and an additional service socket outlet is included for grounding plug (connector type F) according to CEE 7/4. The power supply for the cabinet lighting and the service socket is external and must be fuse-protected for max. 10 A.

The cabinet lighting consists of an LED hand lamp with On/Off switch and with magnetic fasteners with an approx. 3 m long connecting cable. When delivered from the factory, the lamp is already positioned at the defined marks in the cabinet door and the connecting cable is wound on the holder.

Note

During operation of the cabinet unit, the cabinet lighting must remain attached in its position on the cabinet door. The position on the cabinet door is marked by an adhesive label. The connecting cable must be wound on its holder.

Connection

Table 9- 61 Terminal block X390 – connection for cabinet lighting with service socket

Terminal	Designation	Technical data
1	L1	230 V AC power supply
2	N	
3	PE	Protective conductor
Max. connectable cross-section: 4 mm²		

9.34 L55, cabinet anti-condensation heating

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules
- Active Line Connection Modules compact
- Motor Modules
- Motor Modules compact
- Heat Exchanger Modules
- Auxiliary Power Supply Modules

Description

The cabinet anti-condensation heating prevents at low ambient temperatures and high levels of humidity the formation of condensation.

A 100 W heater is used for a 400 mm and 600 mm cabinet (-E240). Two 100 W heaters (-E240, -E241) are deployed for cabinet widths of 800 mm or higher.

The power supply (110 to 230 VAC) must be provided externally and protected with a fuse of up to 16 A.

X240 connection for cabinet anti-condensation heating

Table 9- 62 Terminal block X240

Terminal	Designation	Technical data
1	L1	110 to 230 VAC voltage supply
2	N	Current demand: - min.: approx. 0.43 A (for 230 VAC, 100 W) - max.: approx. 1.8 A (for 110 VAC, 200 W)
3	PE	Protective conductor
Max. connectable cross-section: 4 mm²		



⚠WARNING

Dangerous electrical voltage as a result of external auxiliary supplies

When the external supply voltage for the cabinet anti-condensation heating is connected, dangerous voltages are present in the cabinet unit even when the main switch is open. Death or serious injury can result when live parts are touched.

- Observe the general safety rules when working on the device.



⚠CAUTION

Burns caused by hot surfaces of the cabinet anti-condensation heating

In operation, the cabinet anti-condensation heating can reach high temperatures, which can cause burns if touched.

- Allow the cabinet anti-condensation heating to cool down before starting any work.
- Use the appropriate personnel protection equipment, e.g. gloves.

Note

Provide a temperature controlled supply voltage

The supply voltage can be provided by means of a temperature control, to prevent the anti-condensation heating unnecessarily operating at a higher ambient temperature.

9.35 L87, insulation monitoring

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules

Description

On non-grounded line supplies (IT supply systems), the insulation monitoring device monitors the entire electrically-connected circuit for insulation faults. The insulation resistance and all insulation faults from the line infeed to the motor are detected in the Cabinet Modules. Two response values (between 1 kΩ and 10 MΩ) can be separately set. If a set response value for alarm 1 and/or alarm 2 is fallen below, then the associated alarm relays switch, LEDs "ALARM 1" and/or "ALARM 2" light up and the LC display indicates the measured value.

Note

Number of insulation monitors

Only one insulation monitor can be used within the same electrically-connected network!

Note

Connection clip of the integrated basic interference suppression module to ground removed in the factory

When using the insulation monitoring option, the connection clip of the integrated basic interference suppression module to ground is removed in the factory in the following Cabinet Modules and placed loose in the cabinet unit:

- Basic Line Connection Modules
- Active Line Connection Modules (connection clip in the Active Interface Module) including the Voltage Sensing Module VSM10 included in it

The positions of the connection clips in the Cabinet Modules can be taken from Chapter "Removing the connection clip of the integrated basic interference suppression module to ground (Page 105)".

Commissioning

When the Cabinet Module is delivered, the plant configuration (one or several loads in one electrically-connected line) and the protection strategy (immediate shutdown in the event of an insulation fault or restricted continued motion) are not known The signaling relays of the insulation monitor must be integrated into the fault and alarm circuit of the customer.

The insulation monitoring device is adapted to the system relationships using the commissioning Wizard.

Additional information

Note

Additional information

Detailed and comprehensive instructions and information regarding the insulation monitor are provided in the operating instructions in the device documentation.

9.36 M06, base 100 mm high, RAL 9005

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules
- Active Line Connection Modules compact
- Motor Modules
- Motor Modules compact
- Heat Exchanger Module
- Auxiliary Power Supply Modules

Description

Because it is raised 100 mm, the supplementary cabinet base facilitates higher cable bending radii (cable is fed in from below) and cable routing within the cabinet base.

The cabinet base comes completely assembled and has color RAL 9005.

Table 9- 63 Components of the cabinet base

Component	Connection element	Fixing elements
1 x base element (rear) 1 x base element (front) Base covers (option M26/M27 only) 4 x cover caps		On the cabinet: The cabinet base is shipped pre-assembled. On the foundation: The holes are in line with the holes in the cabinet (see dimension drawings).

Connection to the foundation

To connect the cable marshalling compartment to the foundation, four holes for M12 screws are provided. These are in line with the holes in the cabinet. The fixing dimensions are specified on the associated dimension drawings.

Connection for side-by-side installation of cabinet units

The individual bases are not connected for cabinet units installed in a side-by-side configuration. The connection from the base to the cabinet and between the cabinet units ensures sufficient stability.

Note

In transport units, the base covers inside the transport unit are only secured at the bottom and are folded down parallel to the ground.

9.37 M07, cable-marshalling compartment 200 mm high, RAL 7035

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules
- Active Line Connection Modules compact
- Motor Modules
- Motor Modules compact
- Heat Exchanger Module
- Auxiliary Power Supply Modules

Description

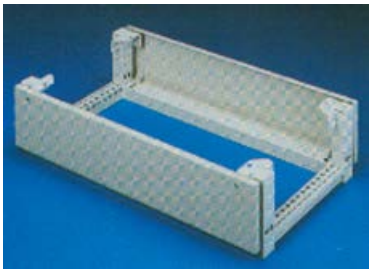
Because it is raised 200 mm, the supplementary cable marshalling compartment made of rigid sheet steel facilitates higher cable bending radii (cable is fed in from below) and cable routing within the cable marshalling compartment.

The cable-marshalling compartment comes completely assembled and has color RAL 7035 as standard.

Note

The cable marshalling compartment increases the cabinet height by 200 mm.

Table 9- 64 Components of the cable marshalling compartment

Component	Connection element	Fixing elements
1 x cable marshalling compartment element		On the cabinet: The cabinet's cable marshalling compartment is shipped pre-assembled.
Side shutters (not shown) for the cable marshalling compartment (option M26/M27 only).		On the foundation: The holes are in line with the holes in the cabinet (see dimension drawings).

Connection to the foundation

To connect the cable marshalling compartment to the foundation, four holes for M12 screws are provided. These are in line with the holes in the cabinet. The fixing dimensions are specified on the associated dimension drawings.

Connection for side-by-side installation of cabinet units

The individual cable marshalling compartments are not connected for cabinet units installed in a side-by-side configuration. The connection from the cable marshalling compartments to the cabinet and between the cabinet units ensures sufficient stability.

Side shutters for cable marshalling compartments

When the cabinet units are installed in a side-by-side configuration, the side shutters can be folded inward and upward.

9.38 M16, dust protection packaging

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules
- Active Line Connection Modules compact
- Motor Modules
- Motor Modules compact
- Auxiliary Power Supply Modules

Description

All Cabinet Modules are covered with a protective film.

The connection panels are cut out so that the power cables can be connected.

2-language warning labels are attached to the protective film.

Note

Recommendation for ordering option M16 for shipbuilding and offshore applications for main and auxiliary drives.

In the event of consequential damage caused by on-site installation work, Siemens will not assume any liability or costs in the event of contamination.

9.39 M23/M43/M54/M55, IP23/IP43/IP54/IP55 degree of protection

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules
- Active Line Connection Modules compact
- Motor Modules
- Motor Modules compact
- Auxiliary Power Supply Modules

Description

The table below explains the properties of the various degrees of protection that are available.

Table 9- 65 Degrees of protection

Degree of protection	Protection against contact	Protection against water
IP23	Protection against the ingress of solid foreign bodies with a diameter > 12.5 mm	Protection against spraying water (up to 60° against the vertical)
IP43	Protection against the ingress of solid foreign bodies with a diameter > 1 mm	Protection against spraying water (up to 60° against the vertical)
IP54	Complete shock protection Protection against damaging internal dust deposits	Protection against splash water from all sides
IP55	Complete shock protection Protection against damaging internal dust deposits	Protection against jets of water (nozzle) from any angle

Option M23/M43/M54 for IP23/IP43/IP54 degrees of protection

Additional filter media are separately supplied to increase the degree of protection of the Cabinet Modules to IP23, IP43, IP54.

Air is discharged at the front using a fan in the cabinet door.

The filter media can be simply installed and changed from the outside.

Compliance with the increased degree of protection requires intact filter media, which must be replaced on a regular basis according to the prevailing environmental conditions.

Option M55 for IP55 degrees of protection

The cabinet is completely enclosed to increase the degree of protection of the Cabinet Modules to IP55.

More than 90% of the heat generated in the cabinet is dissipated to the coolant through the heat exchanger. The remaining power loss is dissipated to the ambient air through the surface of the cabinet.

9.40 M26/M27, side panels mounted on right and left

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules
- Active Line Connection Modules compact
- Motor Modules
- Motor Modules compact
- Heat Exchanger Modules
- Auxiliary Power Supply Modules

Description

The side panels (option M26 = side panel mounted on the right; option M27 = side panel mounted on the left) are fitted at either end of a side-by-side cabinet unit configuration.

With the option M26, the Cabinet Module is fitted with a side panel on the right.

With the option M27, the Cabinet Module is fitted with a side panel on the left.

Note

Installing the side panels

For each cabinet row installed, you must mount one side panel on the right (option M26) and one on the left (option M27)!

For Cabinet Modules that are delivered with a side panel, the DC connection clamp is omitted from the side panel. If the installation sequence is modified and the side panel removed, then a DC connection clamp must be inserted!

9.41 M45, cable entry via MCT frame

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules
- Active Line Connection Modules compact
- Motor Modules
- Motor Modules compact
- Auxiliary Power Supply Modules

Description

For the line and motor connections, the floor plates included as standard are not used; instead of these, an MCT-Brattberg frame, type RGSFB with 120x280 mm cutout without inserts is installed.

The appropriate inserts must be purchased by the customer depending on the number of cables, cable cross-section and the seal required.

Detailed clarification regarding cabinet installation, possibly in conjunction with a baseframe, must be carried out as part of the application engineering.

Additional information at: https://www.mctbrattberg.com/products/

9.42 M61, comfort-grip handle with a 3 mm double-bit lock insert

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules
- Active Line Connection Modules compact
- Motor Modules
- Motor Modules compact
- Heat Exchanger Module
- Auxiliary Power Supply Modules

Description

Instead of a standard lock with double-bit lock, a comfort-grip handle with a 3 mm double-bit lock insert is installed in the cabinet door of the respective Cabinet Module.

A cabinet key with a 3 mm double-bit is required to open the door.

Because the folding method of the comfort-grip handle does not require any swivel range, the door surface can be used optimally for additional fixtures.

9.43 M62, comfort-grip handle with integrated pushbutton lock insert

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules
- Active Line Connection Modules compact
- Motor Modules
- Motor Modules compact
- Heat Exchanger Module
- Auxiliary Power Supply Modules

Description

Instead of a standard lock with double-bit lock, a comfort-grip handle with a pushbutton lock insert is installed in the cabinet door of the respective Cabinet Module.

A cabinet key is not required to open the door. Access protection to the control cabinet must be taken care of on the plant/system side. It must be absolutely ensured that access is only possible for qualified technical personnel.

Because the folding method of the comfort-grip handle does not require any swivel range, the door surface can be used optimally for additional fixtures.

9.44 M63, comfort-grip handle for a padlock with pushbutton as lock insert

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules
- Active Line Connection Modules compact
- Motor Modules
- Motor Modules compact
- Heat Exchanger Module
- Auxiliary Power Supply Modules

Description

Instead of a standard lock with double-bit lock, a comfort-grip handle with a bracket for a padlock and a pushbutton as a lock insert are installed in the cabinet door of the respective Cabinet Module.

The door can therefore be locked using an external lock with a U-shaped shackle of max. 8.5 mm.

Access protection to the control cabinet must be taken care of on the plant/system side. It must be absolutely ensured that access is only possible for qualified technical personnel.

Because the folding method of the comfort-grip handle does not require any swivel range, the door surface can be used optimally for additional fixtures.

9.45 M66, marine version

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules
- Active Line Connection Modules compact
- Motor Modules
- Motor Modules compact
- Heat Exchanger Modules
- Auxiliary Power Supply Modules

Description

Corresponding to the requirements of the classification societies:

- DNV: Det Norske Veritas
- ABS: American Bureau of Shipping
- CCS: China Classification Society

The marine version option includes:

- reinforced mechanical design
- IP23 degree of protection (option M23)
- Cabinet anti-condensation heating (option L55)
- Base/welded frame 100 mm
- Handrails
- Door lock
- Fuse overview

9.46 M70, EMC shield bus

9.46.1 General information

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules
- Motor Modules
- Motor Modules compact
- Heat Exchanger Modules
- Auxiliary Power Supply Modules

Description

With option M70, an EMC shield rail is incorporated for the use of shielded power cables for line supply and motor feeder cables.

The cable shields for the cables routed to the cabinet must be connected to the EMC shield bus in accordance with EMC guidelines. The shields can be connected through a large surface area with the EMC shield clips provided.

9.46.2 Connecting the cables to the EMC shield bus

Preparatory steps

- Allow unimpeded access to the EMC shield bus (if necessary, remove the protective covers during installation work)

Securing the cables to the shield bus

1. Remove approximately 5 cm of the protective sheath of the cable around the shield bus.
2. Place the shielded cable on the shield bus.
3. Snap the clip into the opening provided and tighten it.

9.47 M72, quick-release couplings water hoses

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules
- Active Line Connection Modules compact
- Motor Modules
- Motor Modules compact

Description

As standard, water hose connections of SINAMICS components and the additional heat exchanger are attached using hose clamps.

The following quick-release couplings are used when specifying option M72:
This means that the hoses, also with the cooling circuit filled, can be withdrawn from the SINAMICS power unit or the heat exchanger without losing any liquid.

9.48 M80 to M87, DC busbar system

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules
- Active Line Connection Modules compact
- Motor Modules
- Motor Modules compact
- Auxiliary Power Supply Modules

Description

The DC busbar connects the DC voltage across the drive line-up. The DC busbar system comprises an upper busbar (DC P) and a lower busbar (DC N).

The following DC busbars are available as options:

- Option M80 = busbar system 1 x 60 x 10
- Option M81 = busbar system 1 x 80 x 10
- Option M82 = busbar system 1 x 100 x 10
- Option M83 = busbar system 2 x 60 x 10
- Option M84 = busbar system 2 x 80 x 10
- Option M85 = busbar system 2 x 100 x 10
- Option M86 = busbar system 3 x 80 x 10
- Option M87 = busbar system 3 x 100 x 10

Note

Current rating of the DC busbar

The required current intensity of the DC busbar depends on the individual plant configuration. For this reason, a fixed DC busbar thickness is not assigned to the individual Cabinet Modules. The required thickness must be configured for each individual case and specified as option M80 to M87 (mandatory option).

For transport units, integrated busbars are installed at the factory. Connection jumpers are not required inside a transport unit.

For option M26 (side panel on the right), connection jumpers are not required, nor are they permitted.

DC busbar



Figure 9-40 M80 - M87, DC busbar

9.49 M88, DC busbar system for line-side Cabinet Modules

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules
- Active Line Connection Modules compact

Description

As standard, there are no DC busbars in Basic Line Connection Modules and Active Line Connection Modules.
If DC busbars are required, then option M88 is required:

- The Motor Modules are arranged to the left of the Basic Line Connection Modules or Active Line Connection Modules
- A parallel connection of up to 4 Basic Line Connection Modules or Active Line Connection Modules should be realized.

The DC busbars are installed in the line-side Cabinet Modules with option, also in the upper part on the left-hand side.

The busbars are nickel plated as standard, and are dimensioned for different current carrying capacities depending on the selected option M80 – M87.

9.50 M90, crane transport assembly (top-mounted)

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules
- Active Line Connection Modules compact
- Motor Modules
- Motor Modules compact
- Heat Exchanger Modules
- Auxiliary Power Supply Modules

Description

A top-mounted crane transport assembly can be ordered as an option for Cabinet Modules.

Depending on the width of the module, the crane transport assembly consists of either transport eyebolts (for cabinet width ≤ 800 mm) or transport rails (for cabinet width > 800 mm).

Note

A crane transport assembly is included if transport units are supplied (option Y11).

After installing Cabinet Modules at the final installation location, crane transport aids must be removed, see also Chapter "Disassembling the crane transport assembly (Page 62)".

Safety instructions

⚠WARNING

Incorrect handling of the mounting rail

The improper handling of heavy carrying rails during disassembly can cause injuries or material damage.

- Ensure careful handling of the carrying rails during disassembly.
- Prevent screws from falling into the unit during disassembly and so causing damage during operation.

9.51 N52, DC link fuses

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules
- Active Line Connection Modules compact

Description

Fuses are installed on the DC side to protect the Basic Line Module or the Active Line Module.

Installation of DC fuses is recommended if the DC current load in the configured drive line-up can be higher than the rated DC link current of the Basic Line Module or the Active Line Module.

Furthermore, the DC fuses protect the Basic Line Module or the Active Line Module against an overvoltage on the DC busbar of the drive line-up in the event of a malfunction.

9.52 P10, measuring instrument for line variables, installed in the cabinet door

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules

Description

The "DIRIS A-30" measuring instrument with display, installed in the cabinet door of the Line Connection Module, acquires measured variables of the power supply.

The measuring instrument has a serial RS485 interface with JBUS/MODBUS®, which supports a max. data transfer rate of 38.4 kbaud.

The device can measure the following as standard:

- Instantaneous values, average and maximum values of currents, voltages, powers and power factors
- Counting active energy, reactive energy und operating hours
- Analysis of the harmonics

Note

Current transformers are required in the Line Connection Module to measure line currents. Option L41 (current transformer upstream of the main switch) is included in option P10. The "DIRIS A-30" measuring instrument is wired in the factory according to connection type 3NBL.

The current transformers must not be operated unloaded.

Note

Cable routing for the communication connection

For the cable routing and the EMC-compliant mounting of the communication connection, orient yourself to the corresponding descriptions in Chapter "Cable routing (Page 109)".

Note

Additional information

Detailed and comprehensive instructions and information regarding the "DIRIS A-30" measuring instrument is provided in the operating instructions in the device documentation.

9.53 P11, measuring instrument for line values with PROFIBUS connection (installed in the cabinet door)

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules

Description

A measuring instrument "SENTRON PAC3220" with graphic display, installed in the cabinet door of the Line Connection Module, acquires measured variables of the power supply.

The measuring instrument has a PROFIBUS interface that supports a data transfer rate of 12 Mbit/s.

The device has the following functions as standard:

Measurement

- Measurement of all relevant electrical variables of an alternating current system
- Acquiring the minimum and maximum values of all measured variables
- Generation of the average value for all measured values directly in the device in two independent stages that can be freely configured (aggregation)

Counters and average power values

- Several energy counters capture active energy, reactive energy, apparent energy for off-peak and peak tariffs, import and export.
- Calculation and storage of the last measurement period mean value for active power and reactive power to simply generate load profiles using software.
  Programmable measurement periods from 1 to 60 min
- Daily energy counter for active energy for each day in the last 2 months
- Monthly energy counter for active energy for each month in the last 2 years
- Configurable universal counter for counting limit violations and status changes at the digital input and output, or for indicating the measured active energy or reactive energy transmitted from a connected pulse transmitter
- Operating hours counter for monitoring the operating time of a connected load.

Note

Current transformers are required in the Line Connection Module to measure line currents. Option L41 (current transformer upstream of the main switch) is included in option P11. The measuring instrument "SENTRON PAC3220" is wired according to connection type 3P3W in the factory.

The current transformers must not be operated unloaded.

Note

Cable routing for the communication connection

For the cable routing and the EMC-compliant mounting of the communication connection, orient yourself to the corresponding descriptions in Chapter "Cable routing (Page 109)".

Note

Additional information

Detailed and comprehensive instructions and information regarding the "SENTRON PAC3220" measuring instrument is provided in the operating instructions in the device documentation.

9.54 P13, measuring instrument for line variables with PROFINET connection, installed in the cabinet door

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules

Description

A measuring instrument "SENTRON PAC3220" with graphic display, installed in the cabinet door of the Line Connection Module, acquires measured variables of the power supply.

The measuring instrument has a PROFINET interface that permits a data transfer rate of 10/100 Mbit/s.

The device has the following functions as standard:

Measurement

- Measurement of all relevant electrical variables of an alternating current system
- Acquiring the minimum and maximum values of all measured variables
- Generation of the average value for all measured values directly in the device in two independent stages that can be freely configured (aggregation)

Counters and average power values

- Several energy counters capture active energy, reactive energy, apparent energy for off-peak and peak tariffs, import and export.
- Calculation and storage of the last measurement period mean value for active power and reactive power to simply generate load profiles using software.
  Programmable measurement periods from 1 to 60 min
- Daily energy counter for active energy for each day in the last 2 months
- Monthly energy counter for active energy for each month in the last 2 years
- Configurable universal counter for counting limit violations and status changes at the digital input and output, or for indicating the measured active energy or reactive energy transmitted from a connected pulse transmitter
- Operating hours counter for monitoring the operating time of a connected load.

Note

Current transformers are required in the Line Connection Module to measure line currents. Option L41 (current transformer upstream of the main switch) is included in option P13. The measuring instrument "SENTRON PAC3220" is wired according to connection type 3P3W in the factory.

The current transformers must not be operated unloaded.

Note

Cable routing for the communication connection

For the cable routing and the EMC-compliant mounting of the communication connection, orient yourself to the corresponding descriptions in Chapter "Cable routing (Page 109)".

Note

Additional information

Detailed and comprehensive instructions and information regarding the "SENTRON PAC3220" measuring instrument is provided in the operating instructions in the device documentation.

9.55 P14, measuring instrument for line variables with PROFINET connection, installed in the cabinet door

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules

Description

A measuring instrument "SENTRON PAC4200" with graphic display, installed in the cabinet door of the Line Connection Module, acquires measured variables of the power supply.

The measuring instrument has a PROFINET interface that permits a data transfer rate of 10/100 Mbit/s.

The device has the following functions as standard:

Measurement

- Measurement of all relevant electrical variables of an alternating current system
- Acquisition of the minimum and maximum values of all measured variables
- Real rms value determination for voltage and current up to the 63rd harmonic component
- 4-quadrant measurement (import and export)
- Generation of the average value for all measured values directly in the device in two independent stages that can be freely configured (aggregation)
- Calculation of the average voltage and current values across all phases.
- Zero blind measurement
- High measurement accuracy: For example, accuracy class 0.2 according to IEC 61557-12 for active energy. This means: An accuracy of 0.2 % with respect to the measured value under reference conditions.
- Detection of voltage dips, overvoltage and voltage interruptions with user-defined threshold values

Counters and average power values

- A total of 10 energy counters capture reactive energy, apparent energy and active energy for off-peak and peak, import and export.
- Energy consumption for active energy, reactive energy and apparent energy per day and tariff for 366 days.
- 2 configurable universal counters for counting:
  - Limit value violations
  - Status changes at the digital input
  - Status changes at the digital output
  - Pulses of a connected pulse transmitter (e.g. from electricity, gas or water meters). The pulse shape and time response must correspond to the signal waveshape according to IEC 62053-31.

  Operating hours counter for monitoring the operating time of a connected load. Only counts energy above an adjustable threshold.

  One apparent energy counter, one active energy counter and one reactive energy counter for detecting the total energy import, regardless of the active tariff for display on the device.

  One apparent energy counter, one active energy counter and one reactive energy counter for detecting the power consumption of a manufacturing process. The process energy counters can be started and stopped using the digital inputs available.

  Operating hours counter for acquiring the duration of a manufacturing process.

Note

Current transformers are required in the Line Connection Module to measure line currents. Option L41 (current transformer upstream of the main switch) is included in option P14. The "SENTRON PAC4200" measuring instrument is wired in the factory according to connection type 3P3W.

The current transformers must not be operated unloaded.

Note

Cable routing for the communication connection

For the cable routing and the EMC-compliant mounting of the communication connection, orient yourself to the corresponding descriptions in Chapter "Cable routing (Page 109)".

Note

Additional information

Detailed and comprehensive instructions and information regarding the "SENTRON PAC4200" measuring instrument is provided in the operating instructions in the device documentation.

9.56 W01, Heat Exchanger Module, partially redundant with 2 pumps

Availability of option

This option is available for the following S120 Cabinet Modules:

- Heat Exchanger Modules

Description

The Heat Exchanger Module is equipped with a pump and a plate-type heat exchanger as standard.

With option W01 two redundant pumps with two dirt traps and two non-return valves are installed in the system.
The pumps, which operate alternating, pump the hot coolant of the converter-side de-ionized water circuit into the plate-type heat exchanger and there is cooled by the raw water of the plant-side cooling circuit.

Operational reliability is increased as a result of the alternating operation of the redundant pumps. The time in hours can be parameterized.

In addition, the dirt traps can be cleaned independently and during operation, as shutoff valves are installed before and after the individual pumps.

Note

Increased cabinet width and cabinet weight

With option W01, the cabinet width increases to 1000 mm.

With option W01, the cabinet weight increases by approximately 110 kg.

9.57 W10, insulation of the pipes in the raw water circuit and heat exchanger

Availability of option

This option is available for the following S120 Cabinet Modules:

- Heat Exchanger Modules

Description

With this option, the pipes in the raw water circuit and the pipes of the heat exchanger are insulated. This means that if the raw water on the plant side is too cold, condensation does not occur on the pipes and liquid does not collect in the Heat Exchanger Module.

9.58 W20, raw water connection from the bottom

Availability of option

This option is available for the following S120 Cabinet Modules:

- Heat Exchanger Modules

Description

The plant-side raw water is fed into the Heat Exchanger Module from above as standard.

With option W20, the plant-side raw water connection in the Heat Exchanger Module is at the bottom.

The piping system is manufactured out of V2A stainless steel.

9.59 W25, raw water connection from the side

Availability of option

This option is available for the following S120 Cabinet Modules:

- Heat Exchanger Modules

Description

The plant-side raw water is fed into the Heat Exchanger Module from above as standard.

With option W25, the connection is realized from the side.

W34 and W36 define how the option is actually implemented:

- In conjunction with option W34, the raw water connection is routed on the left-hand side.
- In conjunction with option W36, the raw water connection is routed on the right-hand side.

9.60 W34, Heat Exchanger Module prepared for installation on the left in the cabinet lineup

Availability of option

This option is available for the following S120 Cabinet Modules:

- Heat Exchanger Modules

Description

With the option, a fixed pipe connection is routed downward on the right-hand side.

As a consequence, the Heat Exchanger Module can be installed at the left-hand end of the drive lineup and connected to the deionized water circuit on the converter side. The connecting parts (pipe couplings) are provided with the converter.

9.61 W36, Heat Exchanger Module prepared for installation on the right in the cabinet lineup

Availability of option

This option is available for the following S120 Cabinet Modules:

- Heat Exchanger Modules

Description

With the option, a fixed pipe connection is routed downward on the left-hand side.

As a consequence, the Heat Exchanger Module can be installed at the right-hand end of the drive lineup and connected to the deionized water circuit on the converter side. The connecting parts (pipe couplings) are provided with the converter.

9.62 W43, release valve in the deionized water circuit

Availability of option

This option is available for the following S120 Cabinet Modules:

- Heat Exchanger Modules

Description

A release valve (63.2) is installed between the intake and return in the converter-side deionized water circuit, see Chapter "Interfaces in the cooling circuit (Page 270)".

The relief valve limits the pressure of the circulating pumps. It ensures a minimum flow rate by opening as soon as the pressure exceeds the value set at the valve.

When the Heat Exchanger Module is shipped, the relief valve is set to a fixed value, so that the safety valve (63.1) does not respond in operation. This setting can be adapted to the situation in the system.

Adjusting the differential pressure between the intake and return using the ball valve (77.3)

Keep the relief valve (63.2) in the state when originally delivered, and adjust the ball valve (77.3) so that a differential pressure of approximately 1.5 bar (+0.5) is obtained.
After commissioning Technology Extension "Heat Exchanger Module", this value is available in the assigned TM31 under r32450[2].

More information

A description of the functions and operation is provided in the separate documentation "Heat Exchanger Module Function Manual", which is included in the individual device documentation.

9.63 W48, leakage sensor at the converter cabinet floor panel

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules
- Active Line Connection Modules compact
- Motor Modules
- Motor Modules compact

Description

With this option, a leakage sensor is installed at the floor panel of the converter cabinet for which the option is ordered.

A common evaluation module is installed in the Basic Line Connection Module, Active Line Connection Module or active Line Connection Module compact.

The wiring to the Terminal Module TM31 in the Heat Exchanger Module must be carried out on the system side.

When a leak is detected, a corresponding alarm or fault (can be parameterized) is output.

9.64 W49, leakage sensor in the Heat Exchanger Module, at the bottom in the cabinet floor

Availability of option

This option is available for the following S120 Cabinet Modules:

- Heat Exchanger Modules

Description

With the option, a leakage sensor is installed at the cabinet floor of the Heat Exchanger Module. The installed evaluation module is connected with a digital input of the TM31 Terminal Module.

When a leak is detected, a corresponding alarm or fault (can be parameterized) is output.

9.65 W62, sensors in the raw water circuit on the plant/system side

Availability of option

This option is available for the following S120 Cabinet Modules:

- Heat Exchanger Modules

Description

With this option, a flow monitor and a temperature sensor are installed in the intake of the plant-side raw water circuit.
In addition, a TM150 Terminal Module is installed to evaluate the temperature signals.

The signals are connected at the TM31 or the TM150 Terminal Module.

This means that the flow and temperature can be monitored.

The temperature alarm limit can be parameterized in the Control Unit.
The flow signal is parameterized at the sensor, and is evaluated by the TM31 Terminal Module.

9.66 Y11, factory assembly into transport units

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Connection Modules
- Active Line Connection Modules
- Active Line Connection Modules compact
- Motor Modules
- Motor Modules compact
- Auxiliary Power Supply Modules

Description

With this option, Cabinet Modules can be ordered as factory-assembled transport units with a maximum width of up to 2400 mm. In this case, the relevant modules are shipped as interconnected units (both electrically and mechanically).

Note

No additional wiring between the Cabinet Modules is required, with the exception of the DRIVE-CLiQ connections to interconnect the cabinets.

A crane transport assembly in the form of a transport rail is already included if transport units are supplied.

Table 9- 66 Installation sequence of the transport unit

Plain text required to order	**TU 1 - 1...6**
Transport unit	TU
Consecutive number of the transport unit	1 -
Position of the Cabinet Module within the transport unit	1 ... 6

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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