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EQUIPMENT MANUAL

# SINAMICS

## S120

Cabinet Modules, air-cooled
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# SINAMICS

# S120
# Air-cooled Cabinet Modules

**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 persons are those who, because of their training and experience, are familiar with the installation, assembly, commissioning, operation, decommissioning and disassembly of the product and can recognize risks and avoid possible hazards.

## Proper use of Siemens products

Note the following:

| ⚠**WARNING** |
| --- |
| Siemens products may only be used for the application described in the catalog and the associated usage information. 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.

Contact your local Siemens office or your local sales office 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 SINAMICS S120 Cabinet Modules. It provides information about installation, electrical connection, and cabinet design.

## Training

At the following address you can find information about SITRAIN – Siemens training 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 can be found in the spare parts list, which is 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.

## 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).

## EMC limit values for South Korea

⚠ **경고**
카테고리 C2
**제2환경용 정격 전압 <1000 V 고정식 구동 시스템.**
카테고리 C2 구동 시스템은 전문 인력에 의해 설치 및 커미셔닝이 수행되며 고조파 전류 한계가 준수되는 경우에만 제1 환경(주거 환경)에서 사용할 수 있습니다.
주거 환경에서 본 제품은 고주파 간섭을 유발할 수 있으며, 간섭 방지 조치가 필요합니다.
- 설치 및 커미셔닝 시 전문 인력이 적절한 간섭 방지 조치를 취하도록 하십시오.

⚠ **Warning**
Category C2
**Stationary drive systems with a rated voltage < 1000 V for operation in the second environment.**
Drive systems of Category C2 may only be used in the first environment (residential environment) if they are installed and commissioned by an expert and the limit values for harmonic currents are complied with.
In a residential environment, this product can cause radio-frequency interference, which may make interference suppression measures necessary.
- Have qualified personnel carry out the installation and commissioning with appropriate radio interference suppression measures.

⚠ **경고**
카테고리 C3
**제2환경에서만 사용하도록 설계된 정격 전압 <1000 V 구동 시스템.**
주거 환경에서 본 제품은 고주파 간섭을 유발할 수 있습니다.
- 본 장치를 제1환경(주거 환경)에서는 사용하지 마십시오.

⚠ **Warning**
Category C3
**Drive systems with a rated voltage < 1000 V that are solely intended for use in the second environment.**
In a residential environment, this product may cause radio interference.
- Do not use this device in the first environment (residential environment).

## Certifications

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

- EU Declaration of Conformity with reference to the Low-Voltage Directive
- EU Declaration of Conformity with reference to the EMC Directive
- EU Declaration of Conformity with reference to the Machinery Directive (Safety)
- Manufacturers 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 when the following requirements are complied with:

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

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

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

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 protection, in particular the data minimization rules (privacy by design).

For this product, this means:
The product does not process neither store any person-related data, only technical function data (e.g. time stamps). If the user links 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 has to ensure compliance with the applicable data protection regulations.

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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 paper-making machines, roller mills, test stands, or hoisting gear.

They contain 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:

- Line Connection Modules with line-side components such as contactors, fuses and circuit breakers, as well as line reactors for Basic Line Modules.
- Line Modules for the infeed in the following versions:
  - Basic Line Modules for two-quadrant operation
  - Smart Line Modules for four-quadrant operation
  - Active Line Modules for four-quadrant operation with negligible line harmonics
- Active Line Connection Modules-2 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
- Central Braking Modules for braking operation
- The following types of Motor Module:
  - Booksize Cabinet Kits
  - Chassis format
  - Chassis-2 format
- Control Units
- 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.

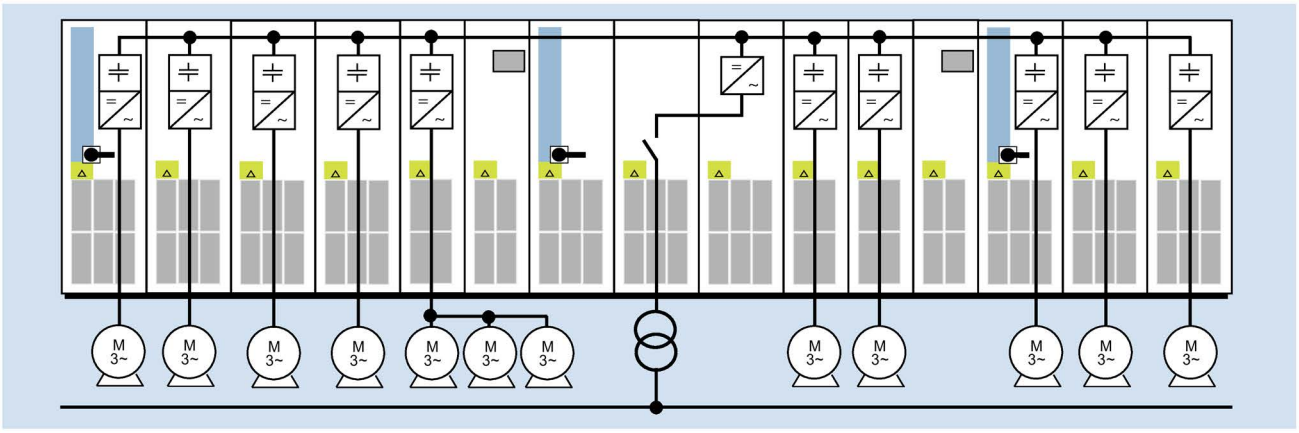


Figure 2-1 Example of a drive line-up with SINAMICS S120 Cabinet Modules for a multi-motor drive

The following table provides an overview of the voltage ranges and power ratings available for the 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 |
|---|---|---|---|---|---|---|
| **Line Connection Modules** [1] | 380 ... 480 V<br>500 ... 690 V | 250 ... 3200 A<br>280 ... 3200 A | | | | |
| **Basic Line Modules** [1] | 380 ... 480 V<br>500 ... 690 V | 365 ... 1630 A<br>260 ... 1580 A | 510 ... 650 V<br>675 ... 930 V | 420 ... 1880 A<br>300 ... 1880 A | | 200 ... 900 kW<br>250 ... 1500 kW |
| **Smart Line Modules** [1] | 380 ... 480 V<br>500 ... 690 V | 463 ... 1430 A<br>463 ... 1430 A | 510 ... 650 V<br>675 ... 930 V | 550 ... 1700 A<br>550 ... 1700 A | | 250 ... 800 kW<br>450 ... 1400 kW |
| **Active Line Modules** [1] | 380 ... 480 V<br>500 ... 690 V | 210 ... 1405 A<br>575 ... 1270 A | 570 ... 720 V<br>750 ... 1035 V | 235 ... 1574 A<br>644 ... 1422 A | | 132 ... 900 kW<br>630 ... 1400 kW |
| **Active Line Connection Modules-2** [2] | 380 ... 480 V | 560 ... 1405 A | 570 ... 720 V | 630 ... 1575 A | | 355 ... 900 kW |
| **Motor Modules Booksize** | (380 ... 480 V) | | 510 ... 720 V | 11 ... 158 A | 9 ... 132 A | 4.8 ... 71 kW |
| **Motor Modules Chassis** [1] | (380 ... 480 V)<br>(500 ... 690 V) | | 510 ... 720 V<br>675 ... 1035 V | 252 ... 1686 A<br>102 ... 1524 A | 210 ... 1405 A<br>85 ... 1270 A | 110 ... 800 kW<br>75 ... 1200 kW |
| **Motor Modules Chassis-2** [2] | (380 ... 480 V) | | 510 ... 720 V | 785 ...1795 A | 655 ... 1495 A | 315 ... 800 kW |
| **Central Braking Modules** [1] | (380 ... 480 V)<br>(500 ... 600 V)<br>(660 ... 690 V) | | 510 ... 720 V<br>675 ... 900 V<br>890 ... 1035 V | | | 500 ... 1000 kW<br>550 ... 1100 kW<br>630 ... 1200 kW |
| **Auxiliary Power Supply Module** | 380 ... 690 V | 125 ... 250 A | | | | |

[1] The power range can be extended as required by connecting up to 4 identical modules in parallel.

[2] The power range can be extended as required by connecting up to 6 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 ensure that these drives fulfill the most exacting requirements regarding accuracy and dynamic response.
- 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 generating modes, this frequently results in smaller supply infeeds.
- 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 an innovative cooling concept.

# 2.4 Line Modules

## 2.4.1 General information

Power is fed to the drive line-up via Line 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.

The Line Modules are connected to the line supply via Line Connection Modules and are implemented in accordance with IEC 61800-3 category C3.

## 2.4.2 Basic Line Modules

Basic Line 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 braking drives, it must be converted to heat by means of a supplementary braking module and a braking resistor.

For infeeds with a Basic Line Module, a line reactor appropriate to 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 Module or in 12-pulse operation with two Basic Line Modules, the line reactor is optional and can be omitted.

If two or more Basic Line Modules are operated in parallel on a common supply system in order to increase power, line reactors are also included in the associated Line Connection Module.

For a compact configuration, Line Connection Modules up to input currents of 3,200 A are available. Two Basic Line Modules can be operated in parallel on these Line Connection Modules. When Basic Line Modules are connected in parallel, for selective protection of the individual devices, line-side fuses are installed.

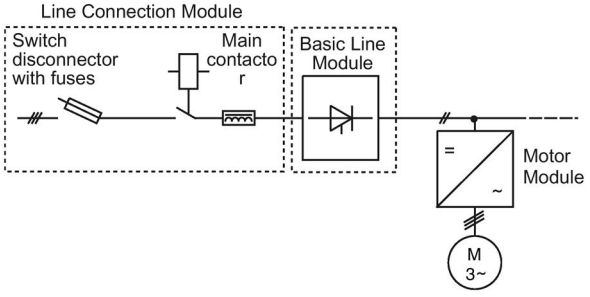



Figure 2-2 Line Connection Module with Basic Line Module ≤ 800 A

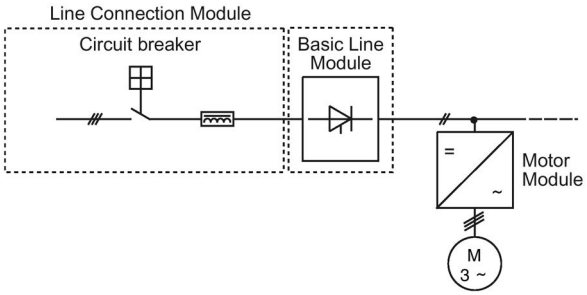



Figure 2-3 Line Connection Module with Basic Line Module > 800 A

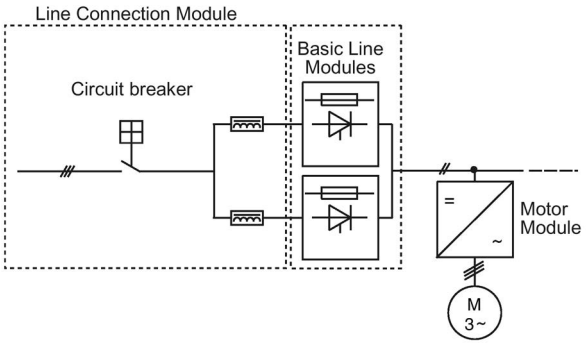



Figure 2-4 Line Connection Module with Basic Line Modules connected in parallel

## 2.4.3 Smart Line Modules

Smart Line Modules can supply energy to the DC link and feed back regenerative energy to the supply system. A Braking Module and braking resistor are required only if the drives need to be decelerated in a controlled manner after a power failure (i.e. when energy cannot be recovered to the supply). When a Smart Line Module is used as the infeed, the appropriate line reactor is included in the device as standard.

For a compact configuration, Line Connection Modules up to input currents of 3,200 A are available. Two Smart Line Modules can be operated in parallel on these Line Connection Modules.

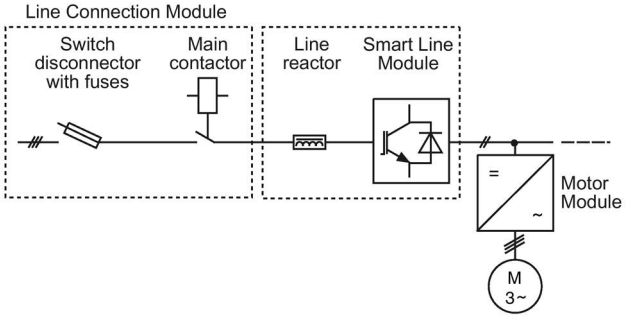



Figure 2-5 Line Connection Module with Smart Line Module ≤ 800 A

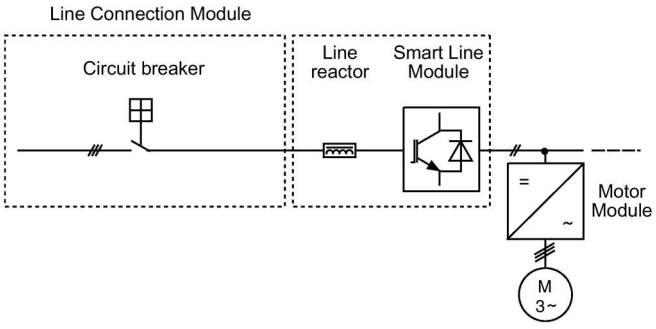



Figure 2-6 Line Connection Module with Smart Line Module > 800 A

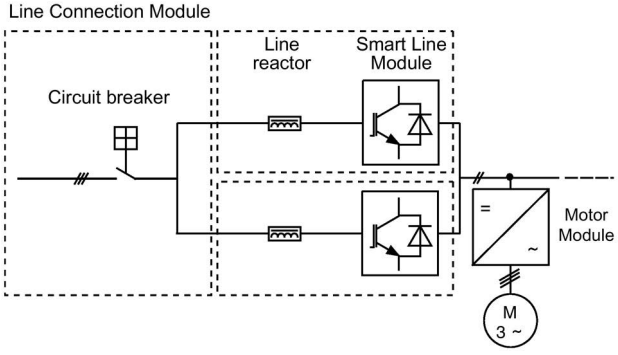



Figure 2-7 Line Connection Module with Smart Line Modules connected in parallel

## 2.4.4 Active Line Modules

Active Line Modules can supply energy to the DC link and return regenerative energy to the supply system. A Braking Module and braking resistor are required only if the drives need to be decelerated in a controlled manner after a power failure (i.e. when energy cannot be fed back to the supply).

In contrast to Basic Line Modules and Smart Line Modules, Active Line Modules generate a regulated DC voltage, which remains constant despite fluctuations in the line voltage. However, in this case, the line voltage must remain within the permissible tolerance range. Active Line 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 Modules are always used in conjunction with an Active Interface Module. Active Interface Modules include the required pre-charging input circuit for the Active Line Module, in addition to a Clean Power Filter.

These two components are considered to be an integral unit for SINAMICS S120 Cabinet Modules and are supplied together.

For a compact configuration, Line Connection Modules up to input currents of 3,200 A are available. Two Active Line Modules with their associated Active Interface Modules can be operated in parallel on these Line Connection Modules.

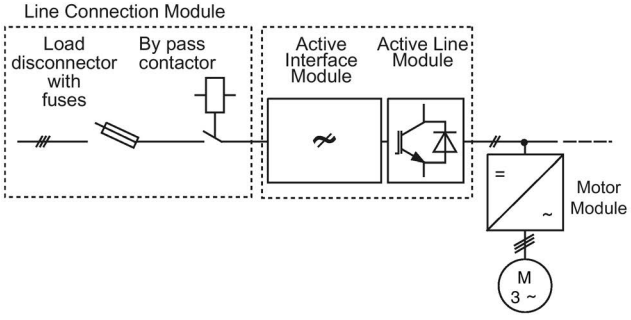



Figure 2-8 Line Connection Module with Active Interface Module and Active Line Module ≤ 800 A, example frame size HX + HI

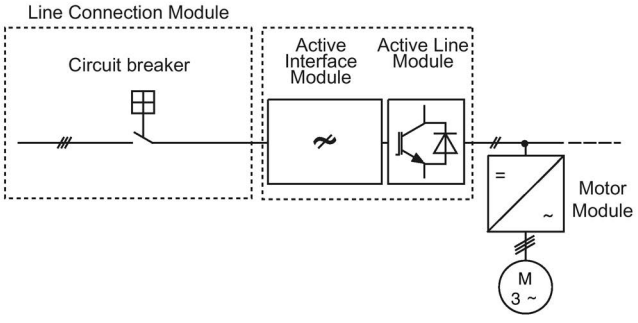



Figure 2-9 Line Connection Module with Active Interface Module and Active Line Module > 800 A

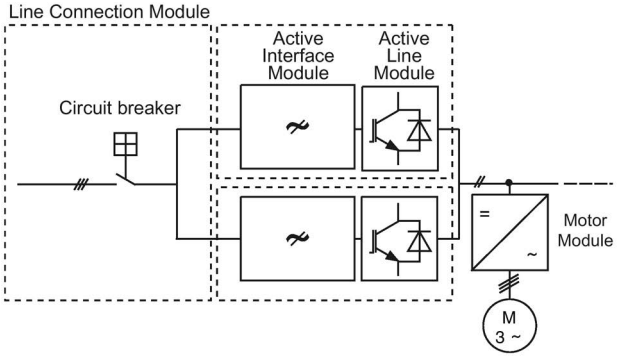



Figure 2-10 Line Connection Module with Active Interface Modules and Active Line Modules connected in parallel

## 2.5 Active Line Connection Modules

Active Line Connection Modules-2 comprise a Line Connection Module, an Active Interface Module-2 and an Active Line Module in the Chassis-2 format installed in a cabinet system. They are suitable for connection to line systems grounded at the neutral point (TN, TT) and non-grounded line systems (IT).

Active Line Connection Modules-2 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).

Active Line Connection Modules-2 generate a regulated DC voltage that remains constant despite fluctuations in the line voltage. However, in this case, the line voltage must remain within the permissible tolerance range. Active Line Connection Modules-2 draw a virtually sinusoidal current from the supply system. 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.

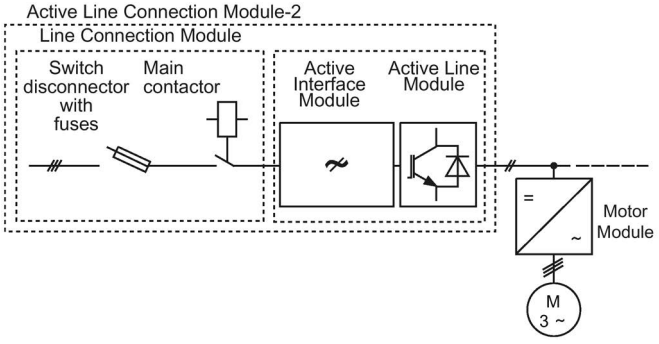



Figure 2-11 Active Line Connection Module-2 with Active Interface Module Chassis-2 and Active Line Module Chassis-2 ≤800 A

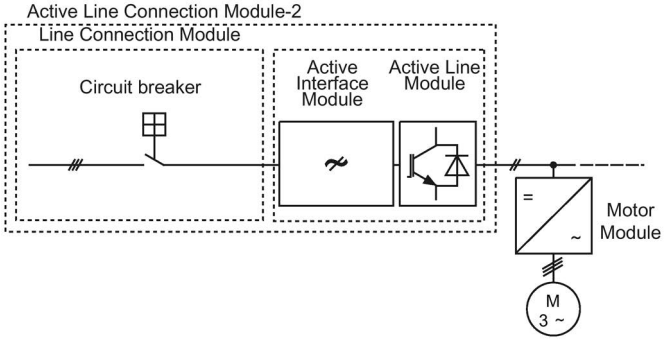



Figure 2-12 Active Line Connection Module-2 with Active Interface Module Chassis-2 and Active Line Module Chassis-2 ≤800 A

## 2.6 DC link components

Braking Modules are used so that the regenerative energy, which is produced when drives brake, can be converted into heat using braking resistors.

Using a Braking Module and braking resistance it is also possible to brake motors when the power fails.

### 2.6.1 Braking Modules as a Line Module or Motor Module option

For lower braking powers, Braking Modules are available with continuous braking powers up to 50 kW. These Braking Modules are available as option L61/L64 (25 kW) or L62/L65 (50 kW) for Basic Line Modules, Smart Line Modules, Active Line Modules or Motor Modules.

### 2.6.2 Central Braking Modules

For larger continuous braking powers, separate Central Braking Modules are available. These modules are implemented centrally in the drive line-up. To increase the braking power, up to four Central Braking Modules can be connected in parallel.

## 2.7 Motor Modules

There are three different types of Motor Modules available with the SINAMICS S120 Cabinet Modules drive system.

### 2.7.1 Booksize Base Cabinets with Booksize Cabinet Kits

Motor Modules at the low end of the power range from 4.8 kW to 71 kW are configured as Booksize Cabinet Kits installed in Booksize Base Cabinets.

### 2.7.2 Chassis Cabinets

Each Chassis Cabinet is fitted with one SINAMICS S120 Motor Module in the chassis format, and covers the power range from 75 kW up to 1200 kW.

Higher powers can be achieved by connecting the Motor Modules 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.

### 2.7.3 Chassis-2 Cabinets

Each Chassis-2 Cabinet is fitted with one SINAMICS S120 Motor Module in the Chassis-2 format, and covers the power range from 315 kW up to 800 kW.

Higher powers can be achieved by connecting the Motor Modules Chassis-2 in parallel.

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

## 2.8 Auxiliary Power Supply Modules

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

The fans of the SINAMICS S120 devices 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 VDC voltage. This is required when the DC link is not charged, for example, in order to maintain PROFIBUS communication.

# 2.9 Overview of options

Table 2- 2 Overview of options

| Option code | Brief description of option |
|---|---|
| D00 | Documentation in German |
| D02 | Customer documentation (circuit diagram, terminal diagram, layout diagram) in DXF format |
| D14 | Draft of customer documentation |
| 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 |
| D84 | Documentation in Chinese |
| D91 | Documentation in: English/Chinese |
| D93 | Documentation in: English/Portuguese (Brazil) |
| D94 | Documentation in: English/Russian |
| 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 TM150 Temperature Sensor Module |
| G52 | 2 TM150 Temperature Sensor Modules |
| G53 | 3 TM150 Temperature Sensor Modules |
| G54 | 4 TM150 temperature sensor modules |
| G56 | Contactor monitoring |
| G62 | Terminal Board TB30 |
| 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 |

| Option code | Brief description of option |
|---|---|
| K51 | Voltage Sensing Module for determining the motor speed and the phase angle |
| K52 | Additional SMC30 Sensor Module |
| K70 | Fan power supply |
| K73 | Auxiliary power supply 24 V DC |
| K76 | Auxiliary power generation in the Line Connection Module |
| K82 | Terminal Module for controlling the "Safe Torque Off" and "Safe Stop 1" safety functions |
| K87 | Terminal Module TM54F |
| K88 | Safe Brake Adapter SBA 230 VAC |
| K90 | Control Unit CU320-2 PROFIBUS |
| K94 | Performance extension for CU320-2 |
| K95 | Control Unit CU320-2 PROFINET |
| L00 | Use in Category C2 according to IEC 61800-3 (TN/TT networks) |
| L07 | dv/dt filter compact plus Voltage Peak Limiter |
| L08 | Motor reactor |
| L09 | 2 motor reactors connected in series |
| L10 | dv/dt filter plus Voltage Peak Limiter |
| L13 | Main contactor |
| L21 | Surge suppression |
| L22 | Line reactor not included in scope of delivery |
| L25 | Circuit breaker in withdrawable unit design |
| L34 | Output-side circuit breaker |
| L37 | DC coupling incl. pre-charging input circuit of the associated DC link capacitance |
| L40 | Line filter monitoring |
| L41 | Current transformer upstream of the main switch |
| L42 | Line Connection Module for Active Line Modules |
| L43 | Line Connection Module for Basic Line Modules |
| L44 | Line Connection Module for Smart Line Modules |
| L45 | EMERGENCY OFF pushbutton installed in the cabinet door |
| L46 | Grounding switch upstream of main switch |
| L47 | Grounding switch downstream of main switch |
| L50 | Cabinet lighting with service socket outlet |
| L55 | Cabinet anti-condensation heating |
| L61 | 25/125 kW Braking Module for line voltages of 380 ... 480 V and 660 ... 690 V |
| L62 | 50/250 kW Braking Module for line voltages of 380 ... 480 V and 660 ... 690 V |
| L64 | 25/125 kW Braking Module for line voltages of 500 ... 600 V |
| L65 | 50/250 kW Braking Module for line voltages of 500 ... 600 V |
| L87 | Insulation monitoring |
| M06 | Base 100 mm high, RAL 9005 |
| M07 | Cable-marshaling compartment 200 mm high, RAL 7035 |
| M21 | Degree of protection IP21 |
| M23 | Degree of protection IP23 |
| M26 | Side panel, mounted on the right |
| M27 | Side panel, mounted on the left |
| M43 | Degree of protection IP43 |
| M51 | Motor reactor terminal connection |
| M54 | Degree of protection IP54 |

| Option code | Brief description of option |
|---|---|
| M59 | Closed cabinet door (air inlet from below through floor opening) |
| M60 | Additional touch protection |
| 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 |
| M70 | EMC shield bus |
| M77 | Version without component support plates and without additional control components |
| 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) |
| M89 | Extended motor connection panel |
| M90 | Crane transport assembly (top-mounted) |
| N52 | DC link fuses for Basic Line Module |
| 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 |
| T83 | Rating plate data in English / Portuguese (Brazil) |
| T85 | Rating plate data in English / Russian |
| T91 | Rating plate data in English / Chinese |
| Y09 | Special paint finish for cabinet |
| Y11 | Factory assembly into transport units |
| Y31 | Single-line labeling strip for system identification, 40 x 80 mm |
| Y32 | Two-line labeling strip for system identification, 40 x 180 mm |
| Y33 | Four-line labeling strip for system 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 influences. This is achieved through the use of nickel-plated copper bars and painted modules throughout.

An auxiliary power supply system spanning the individual Cabinet Modules supplies the required auxiliary voltages for the equipment fans and the 24 VDC 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. This option is recommended in particular for Line Modules together with Line Connection Modules since, in this case, the Line Connection Module must be equipped with a pre-charging DC link or line reactors (depending on the type of Line Module), in addition to the electrical interface (mounted on a busbar). 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), 4.8 ... 800 kW [1)]<br>3 AC 500 ... 690 V, ±10% (-15% < 1 min), 55 ... 1200 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<br>servo control: 0 ... 550 Hz<br>U/f control: 0 ... 550 Hz<br>(higher output frequencies on request) | | |
| **Line power factor fundamental factor** | Basic Line Modules:<br>> 0.96 | Smart Line Modules:<br>> 0.96 | Active Line Modules:<br>Can be adjusted (set in factory to cos φ =1) |
| **Efficiency** | > 99.0% | > 98.5% | > 97.5% |
| **Control method** | Servo control, vector control with and without sensor or U/f control | | |
| **Fixed speeds** | 15 fixed speeds plus 1 minimum speed, programmable | | |
| **Skipped speed ranges** | 4, parameterizable | | |
| **Braking operation** | With regenerative feedback or by additional Braking Modules and braking resistors | | |
| **Degree of protection** | IP20, IP21, IP23, IP43 and IP54<br>(with options M26 and M27, side panels on the right and left respectively) | | |
| **Protection class** | Protection class I according to IEC 61800-5-1 | | |
| **Overvoltage category** | III according to IEC 61800-5-1 | | |
| **Degree of pollution** | II according to IEC 61800-5-1 | | |
| **Cooling method** | Forced air cooling AF in accordance with IEC 60146 | | |
| **Touch protection** | EN 50274 and DGUV regulation 3 when used for the intended purpose | | |
| **Cabinet system** | Rittal TS 8, doors with double-bit key, tripartite base plates for cable inlet | | |
| **Paint finish** | RAL 7035 (indoor requirements) | | |

[1)] Output data in the basic version, performance enhancement possible with parallel connection.

| Electromagnetic compatibility (EMC) | |
|---|---|
| **Emitted interference** | |
| • Standard | • Category C3 acc. to IEC 61800-3 |
| • With line filter (option L00) | • Category C2 acc. to IEC 61800-3<br>When used on a public supply network, installation and commissioning may only be performed by a qualified electrician with the necessary experience in the EMC aspects of drive systems. |
| **Noise immunity** | Public and industrial supply networks according to IEC 61800-3 |

| 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)<br>RCM, RoHS II, UKCA |

| Ambient conditions | | | |
|---|---|---|---|
| | **During storage** [2] | **During transport** [2] | **In operation** [2] |
| **Ambient temperature** | -25 °C ... +55 °C | -25 °C ... +70 °C<br>from *-40* °C for 24 hours | *0* °C ... +40 °C<br>to +50° C see derating data |
| **Relative humidity**<br>(condensation not permissible)<br>corresponds to class | *5% ... 95%*<br><br>1K4 in accordance with IEC 60721-3-1:1997 | 5% ... 95% at 40 °C<br><br>2K3 in accordance with IEC 60721-3-2:1997 | 5% ... *95%*<br><br>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** | • Motor Modules, Booksize Cabinet Kit format: up to 1000 m above sea level - no derating, > 1000 m - see characteristics/derating data<br>• Cabinet Modules: up to 2000 m above sea level - no derating, > 2000 m - see characteristics/derating data | | |

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

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

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

**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 line supplies 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 data for booksize format

SINAMICS S120 Cabinet Modules with power units, booksize format, and the associated system components are dimensioned for an ambient temperature of 40 °C and installation altitudes up to 1000 m above sea level. If SINAMICS S120 Cabinet Modules with power units in the booksize format are operated at ambient temperatures higher than 40 °C and/or installation altitudes higher than 1000 m above sea level, then the corresponding derating factors must be taken into account as a function of the ambient temperature and/or the installation altitude. These derating factors are different to the derating factors for power units in the chassis format, and can be found in Catalog D 21.4, in Section "SINAMICS S120 drive system". They are valid for SINAMICS S120 Cabinet Modules with booksize format power units in degrees of protection IP20, IP21, IP23, IP43 and IP54.

### 2.12.2 Derating data for chassis format

#### 2.12.2.1 General

SINAMICS S120 Cabinet Modules as well as the associated system components are dimensioned for an ambient temperature of 40° C and installation altitudes up to 2000 m above sea level.

S120 Cabinet Modules include Basic Line Modules, Smart Line Modules, Active Line Modules and Motor Modules with power units, chassis format including the associated system components, (e.g. line filter, chassis Braking Modules and motor filter), as well as Line Connection Modules and Auxiliary Power Supply Modules.

Exceptions are S120 Cabinet Modules with power units, Booksize format and the Central Braking Modules. This derating data can be taken from Chapter "Cabinet Modules" in subchapter "Derating data" of the particular S120 Cabinet Modules.

### Permissible output current as a function of the ambient temperature

If SINAMICS S120 Cabinet Modules are operated at ambient temperatures higher than 40° C, then the output current must be reduced. Ambient temperatures higher than 50° C are not permissible. The following tables specify the permissible output current as a function of the ambient temperature for the various degrees of protection.

Table 2- 3 Current derating as a function of ambient temperature (inlet air temperature at the air inlet of the cabinet unit) and installation altitude for cabinet units with degree of protection IP20/IP21/IP23/IP43

| Installation altitude above sea level in m | Current derating factor (as a % of the rated current) for an ambient air temperature (air intake temperature) of | | | | | | |
|---|---|---|---|---|---|---|---|
| | 20 °C | 25 °C | 30 °C | 35 °C | 40 °C | 45 °C | 50 °C |
| 0 ... 2000 | 100 % | 100 % | 100 % | 100 % | 100 % | 93.3 % | 86.7 % |

Table 2- 4 Current derating as a function of the ambient temperature (inlet air temperature at the air inlet of the cabinet unit) and installation altitude for cabinet units with degree of protection IP54

| Installation altitude above sea level in m | Current derating factor (as a % of the rated current) for an ambient air temperature (air intake temperature) of | | | | | | |
|---|---|---|---|---|---|---|---|
| | 20 °C | 25 °C | 30 °C | 35 °C | 40 °C | 45 °C | 50 °C |
| 0 ... 2000 | 100 % | 100 % | 100 % | 100 % | 93.3 % | 86.7 % | 80.0 % |

### Installation altitudes greater than 2000 to 5000 m above sea level

If SINAMICS S120 Cabinet Modules are operated at installation altitudes greater than 2000 m above sea level, then it must be taken into account that with increasing installation altitude, the air pressure and therefore the density of the air decreases. The cooling effect as well as the insulating capability of the air decrease as a result of the lower air density.

Installation altitudes greater than 2000 to 5000 m can be achieved if the derating measures in the following chapter are applied.

## 2.12.2.2 Derating measures

Installation altitudes greater than 2000 up to 5000 m are possible if the following derating measures are applied. These measures apply for the following drive configurations with SINAMICS S120 Cabinet Modules:

- Drives with Basic Line Modules at all voltage levels (3 AC 380 to 480 V and 3 AC 500 to 690 V).
- Drives with Smart Line Modules in all voltage levels (3 AC 380 to 480 V and 3 AC 500 to 690 V).
- Drives with Active Line Modules in the voltage level 3 AC 380 to 480 V (drives with Active Line Modules for 3 AC 500 to 690 V on request).
- Drives with Active Line Connection Modules-2 at voltage levels 3 AC 380 to 480 V.

## Reducing the ambient temperature and the output current

Due to the reduced cooling efficiency, it is necessary, on the one hand, to reduce the ambient temperature and, on the other, to lower heat loss in the Cabinet Module by reducing the output current, whereby ambient temperatures lower than 40° C may be offset to compensate. The following tables specify the permissible output currents as a function of the installation altitude and ambient temperature for the various degrees of protection. The specified values already take into account the permissible compensation between installation altitude and ambient temperature less than 40° C (air intake temperature where the air enters the Cabinet Module). The values apply under the precondition that the cooling air flow through the devices – as specified in the technical data – is guaranteed as a result of the cabinet installation.

Table 2- 5 Current derating as a function of ambient temperature (inlet air temperature at the air inlet of the cabinet unit) and installation altitude for cabinet units with degree of protection IP20/IP21/IP23/IP43

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

Table 2- 6 Current derating as a function of the ambient temperature (inlet air temperature at the air inlet of the cabinet unit) and installation altitude for cabinet units with degree of protection IP54

| Installation altitude above sea level in m | Current derating factor (as a % of the rated current) for an ambient air temperature (air intake temperature) of | | | | | | |
|---|---|---|---|---|---|---|---|
| | 20 °C | 25 °C | 30 °C | 35 °C | 40 °C | 45 °C | 50 °C |
| 0 ... 2000 | 100 % | 100 % | 100 % | 100 % | 93.3 % | 86.7 % | 80.0 % |
| ... 2500 | 100 % | 100 % | 100 % | 96.3% | 89.8 % | | |
| ... 3000 | 100 % | 100 % | 98.7% | 92.5% | | | |
| ... 3500 | 100 % | 100 % | 94.7% | | | | |
| ... 4000 | 100 % | 96.3% | 90.7% | | | | |
| ... 4500 | 97.5% | 92.1% | | | | | |
| ... 5000 | 93.0% | | | | | | |

**Use of an isolating transformer to reduce transient overvoltages according to IEC 61800-5-1**

As a consequence, overvoltage category III is reduced to overvoltage category II – which in turn reduces the demands placed on the insulating capability of air. An additional voltage derating (reduction of the input voltage) is not required if the following secondary conditions are maintained:

- The isolation transformer must be fed from a low-voltage grid or a medium-voltage grid and must not be directly supplied from a high-voltage grid.
- The isolation transformer may supply one or several Line Modules.
- The cables between the isolation transformer and the Line Module or Line Modules must be routed so that a direct lightning strike is completely ruled out, i.e. cables must not be routed outside.
- The following line supply types are permissible for drives equipped with Basic Line Modules and Smart Line Modules:
  - TN systems with grounded neutral point (no grounded line conductor).
  - IT supply systems (operation with a ground fault must be restricted to the absolutely shortest possible time).
- The following line supply types are permissible for drives equipped with Active Line Modules:
  - TN systems with grounded neutral point (no grounded line conductor, no IT supply systems) for installation altitudes of greater than 2000 m.

## 2.12.3 Derating data for devices in Chassis-2 format

### 2.12.3.1 General

SINAMICS S120 Cabinet Modules-2 as well as the associated system components are dimensioned for an ambient temperature of 40 °C and installation altitudes up to 1000 m above sea level.

S120 Cabinet Modules-2 include Active Line Connection Modules-2 and Motor Modules with power units in the Chassis-2 format including the associated system components, (e.g. motor filter).

### Permissible output current as a function of the ambient temperature

If SINAMICS S120 Cabinet Modules-2 are operated at ambient temperatures higher than 40 °C, then the output current must be reduced. Ambient temperatures higher than 50° C are not permissible. The following tables specify the permissible output current as a function of the ambient temperature for the various degrees of protection.

Table 2- 7 Current derating as a function of ambient temperature (inlet air temperature at the air inlet of the cabinet unit) and installation altitude for cabinet units with degree of protection IP20/IP21/IP23/IP43

| Installation altitude above sea level in m | Current derating factor (as a % of the rated current) for an ambient air temperature (air intake temperature) of | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 15 °C | 20 °C | 25 °C | 30 °C | 35 °C | 40 °C | 45 °C | 50 °C |
| 0 ... 1000 | 100 % | 100 % | 100 % | 100 % | 100 % | 100 % | 83% | 69% |

Table 2- 8 Current derating as a function of the ambient temperature (inlet air temperature at the air inlet of the cabinet unit) and installation altitude for cabinet units with degree of protection IP54

| Installation altitude above sea level in m | Current derating factor (as a % of the rated current) for an ambient air temperature (air intake temperature) of | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 10 °C | 15 °C | 20 °C | 25 °C | 30 °C | 35 °C | 40 °C | 45 °C | 50 °C |
| 0 ... 1000 | 100 % | 100 % | 100 % | 100 % | 100 % | 100 % | 83% | 69% | 54% |

### Installation altitudes greater than 1000 to 5000 m above sea level

If SINAMICS S120 Cabinet Modules-2 are operated at installation altitudes greater than 1000 m above sea level, then it must be taken into account that with increasing installation altitude, the air pressure and therefore the density of the air decreases. The cooling effect as well as the insulating capability of the air decrease as a result of the lower air density.

Installation altitudes greater than 1000 up to 5000 m can be achieved if the derating measures in the subsequent chapter are applied.

## 2.12.3.2 Derating measures

Installation altitudes greater than 1000 up to 5000 m can be achieved if the following derating measures are applied. These measures apply for the following drive configurations with SINAMICS S120 Cabinet Modules-2:

- Drives with Active Line Connection Modules-2 at voltage levels 3 AC 380 to 480 V.
- Drives with Motor Modules Chassis-2 at voltage levels 3 AC 380 to 480 V.

## Reducing the ambient temperature and the output current

Due to the reduced cooling efficiency, it is necessary, on the one hand, to reduce the ambient temperature and, on the other, to lower heat loss in the Cabinet Module by reducing the output current, whereby ambient temperatures lower than 40° C may be offset to compensate. The following tables specify the permissible output currents as a function of the installation altitude and ambient temperature for the various degrees of protection. The specified values already take into account the permissible compensation between installation altitude and ambient temperature less than 40° C (air intake temperature where the air enters the Cabinet Module). The values apply under the precondition that the cooling air flow through the devices – as specified in the technical data – is guaranteed as a result of the cabinet installation.

Table 2- 9 Current derating as a function of ambient temperature (inlet air temperature at the air inlet of the cabinet unit) and installation altitude for cabinet units with degree of protection IP20/IP21/IP23/IP43

| **Installation altitude above sea level in m** | **Current derating factor (as a % of the rated current) for an ambient air temperature (air intake temperature) of** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **15 °C** | **20 °C** | **25 °C** | **30 °C** | **35 °C** | **40 °C** | **45 °C** | **50 °C** |
| 0 ... 1000 | 100 % | 100 % | 100 % | 100 % | 100 % | 100 % | 83% | 69% |
| ... 1500 | 100 % | 100 % | 100 % | 100 % | 100 % | 98% | 81% | 67% |
| ... 2000 | 100 % | 100 % | 100 % | 100 % | 100 % | 93% | 78% | 65% |
| ... 2500 | 100 % | 100 % | 100 % | 100 % | 96% | | | |
| ... 3000 | 100 % | 100 % | 100 % | 99% | | | | |
| ... 3500 | 100 % | 100 % | 100 % | | | | | |
| ... 4000 | 100 % | 100 % | 96% | | | | | |
| ... 4500 | 100 % | 97% | | | | | | |
| ... 5000 | 98% | | | | | | | |

Table 2- 10 Current derating as a function of the ambient temperature (inlet air temperature at the air inlet of the cabinet unit) and installation altitude for cabinet units with degree of protection IP54

| **Installation altitude above sea level in m** | **Current derating factor (as a % of the rated current) for an ambient air temperature (air intake temperature) of** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **10 °C** | **15 °C** | **20 °C** | **25 °C** | **30 °C** | **35 °C** | **40 °C** | **45 °C** | **50 °C** |
| 0 ... 1000 | 100 % | 100 % | 100 % | 100 % | 100 % | 100 % | 83% | 69% | 54% |
| ... 1500 | 100 % | 100 % | 100 % | 100 % | 100 % | 98% | 81% | 67% | 52% |
| ... 2000 | 100 % | 100 % | 100 % | 100 % | 100 % | 93% | 78% | 65% | 50 % |
| ... 2500 | 100 % | 100 % | 100 % | 100 % | 96% | | | | |
| ... 3000 | 100 % | 100 % | 100 % | 99% | | | | | |
| ... 3500 | 100 % | 100 % | 100 % | | | | | | |
| ... 4000 | 100 % | 100 % | 96% | | | | | | |
| ... 4500 | 100 % | 97% | | | | | | | |
| ... 5000 | 98% | | | | | | | | |

### Use of an isolating transformer to reduce transient overvoltages according to IEC 61800-5-1

As a consequence, overvoltage category III is reduced to overvoltage category II – which in turn reduces the demands placed on the insulating capability of air. An additional voltage derating (reduction of the input voltage) is not required if the following secondary conditions are maintained:

- The isolation transformer must be fed from a low-voltage grid or a medium-voltage grid and must not be directly supplied from a high-voltage grid.
- The isolation transformer may supply one or several Line Modules.
- The cables between the isolation transformer and the Line Module or Line Modules must be routed so that a direct lightning strike is completely ruled out, i.e. cables must not be routed outside.
- The following line supply types are permissible for drives equipped with Active Line Connection Modules-2:
  - TN systems with grounded neutral point (no grounded line conductor, no IT supply systems) for installation altitudes of greater than 2000 m.

# Mechanical installation 3

## 3.1 Important notes

### Transport

**⚠WARNING**

**Incorrect transport of 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 transportation 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**

**Use of non-approved fork-lift trucks**

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 fork-lift 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 transit and in the recipient 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 unpacked, they can be transported using the optional transport eyebolts (option M90) or rails attached to 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 65)).
- 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 in transit**

- 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 items 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 contact 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 variations greater than 20 K per hour are not permitted.

If the enclosed drive 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.

| NOTICE |
|---|
| **Material damage to the canopies caused by impermissible mechanical loading**<br>The separately delivered canopies may be damaged if they are subjected to mechanical loads before being installed on the cabinets.<br>• Do not apply any mechanical loads to the canopies. |

## 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.<br>(→ 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.<br>(→ See general technical data 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.<br>(→ See Chapter "Cabinet Modules" in the technical data for the relevant Cabinet Modules)<br>(→ 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.<br>(→ See Chapter "Installation", Section "Lifting from the transport pallet and installing the cabinet units") | ☐ | ☐ |
| 6 | The crane transport aids (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.<br>(→ See Chapter "Installation", Section "Removing the crane transport aids") | ☐ | ☐ |

| Item | Activity | Applicable? | Completed? |
|---|---|---|---|
| 7 | The minimum ceiling height required (for unhindered air discharge) must be observed. The cooling air supply and discharge must not be obstructed and must provide an adequate quantity.<br>(→ See Chapter "Installation", Section "Preparation") | ☐ | ☐ |
| 8 | The cabinet must be firmly attached to the fixing points provided.<br>A proper connection must be established if the cabinet units are installed side-by-side.<br>(→ See Chapter "Installation", Section "Connection for side-by-side installation of cabinet units") | ☐ | ☐ |
| 9 | The following optional components, which are supplied separately for transport reasons, must be assembled on the plant side. This applies to the following options:<br>• IP21 degree of protection with canopy (option M21)<br>• IP23/IP43/IP54 degree of protection with hood or filter elements (options M23, M43, M54)<br>(→ See Chapter "Options", Section "M21, degree of protection IP21 " and "M23 / M43 / M54, degrees of protection IP23 / IP43 / IP54" under Installation.) | ☐ | ☐ |
| 10 | If it is possible to enter the area underneath the cabinet units, plant-side shock protection must be provided for this area. | ☐ | ☐ |
| 11 | The handle must be mounted for option L37 (DC interface including pre-charging input circuit).<br>(→ See Chapter "Options", Section "DC interface including pre-charging input circuit of the associated DC link capacitance") | ☐ | ☐ |
| 12 | 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!<br>• Side panel installed on the right (option M26)<br>• Side panel installed on the left (option M27)<br>(→ See Chapter "Options", Section "M26 / M27, side panels mounted to the right or left".) | ☐ | ☐ |
| 13 | All shock protection measures (guards, plates) in and on the cabinet units must be installed before commissioning. | ☐ | ☐ |
| 14 | The clearance around an open control cabinet door (escape route) specified in the applicable accident prevention guidelines must be observed. | ☐ | ☐ |

# 3.3 Installation

## 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 Preparatory steps

### 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 M54) can be installed in front of the ventilation grilles in the cabinet doors and also in front of the hoods, if necessary. Option M54 offers additional protection against water sprayed against the housing from any direction and corresponds to degree of protection IP54.

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

Derating is required for ambient temperatures > 40° C (104° F) or installation altitudes > 1000 m (Booksize Cabinet Kit) or > 2000 m (Chassis) (→ see Chapter "System overview" under derating data).

The basic version of the cabinet units complies with degree of protection IP20 in accordance with IEC 60529.

**Note**

**Requirements for IP20**

Cabinet Modules do not fulfill the requirements for IP20 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.

**Note**

**Additional dimensions**

Additional dimensions are specified on the associated dimension drawings.

**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 on a public supply network. It must not be used on public supply networks in accordance with IEC 61800-3, Category C2, without suitable interference suppression measures.

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

## Required room height for Cabinet Modules

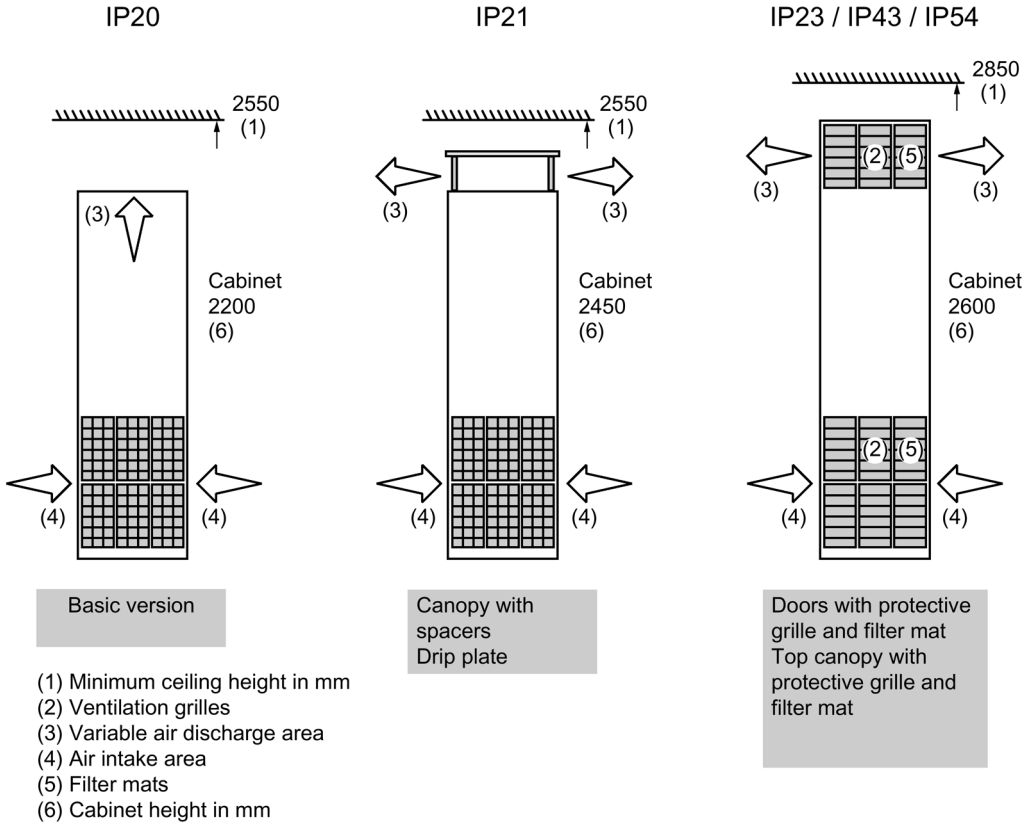



Figure 3-1 Required room height for Cabinet Modules with different degrees of protection (without Options M06 and M07)

The cooling air for the power unit is drawn in from the front through the ventilation grilles in the lower part of the cabinet doors. The warmed air is blown out to the front and rear through the perforated top cover or through the ventilation grilles in the hood (for options M23/M43/M54 for degrees of protection IP23/IP43/IP54). Cooling air can also be supplied from below through intermediate floors, air ducts, etc. Openings must be made in the split base plates to do this.

### Required room height for Cabinet Modules Chassis-2

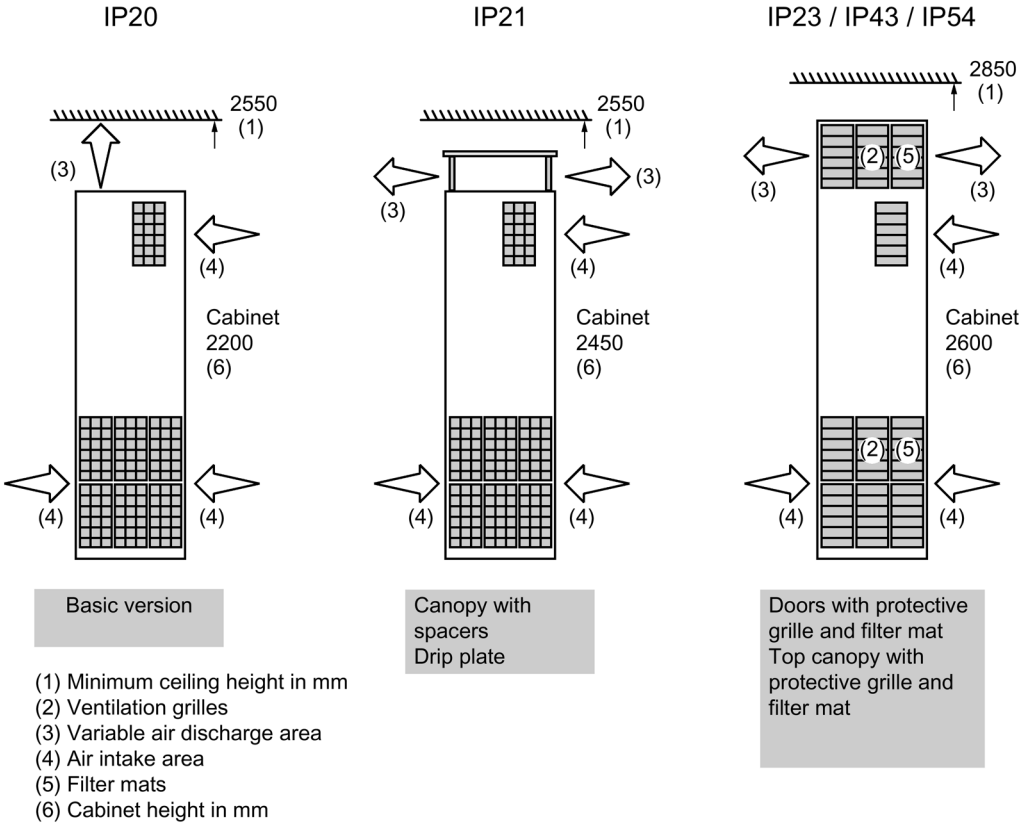



Figure 3-2 Required room height for Cabinet Modules Chassis-2 with different degrees of protection (without Options M06 and M07)

The cooling air for the power unit is drawn in from the front through the ventilation grilles in the lower part of the cabinet doors and in the upper part of the cabinet. The warmed air is blown out to the front and rear through the perforated top cover or through the ventilation grilles in the hood (for options M23/M43/M54 for degrees of protection IP23/IP43/IP54).

### 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 and hoods) 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.

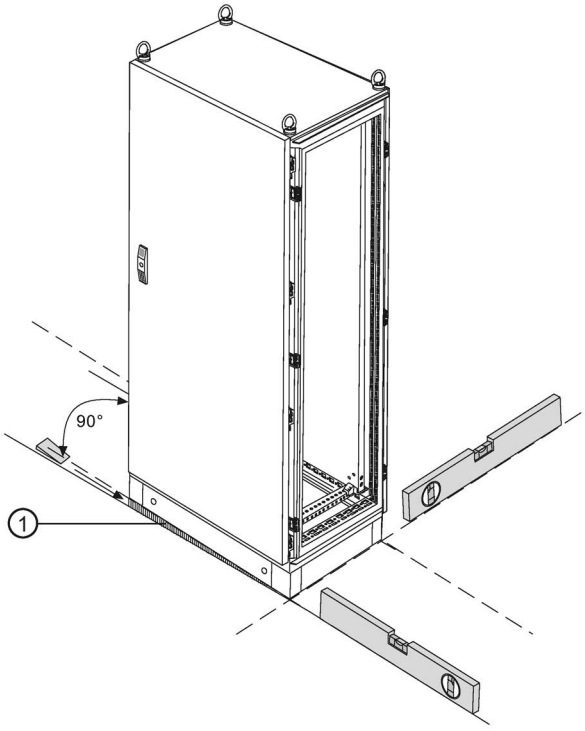



Figure 3-3 Requirements on the levelness of the floor

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 and sealed.

### 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 3-4 Tilt indicator




Figure 3-5 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.

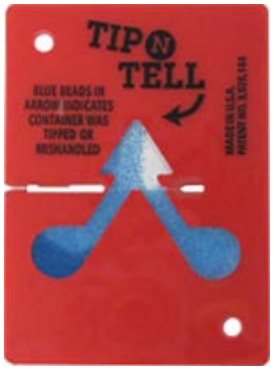



Figure 3-6 Tilt indicator tripped

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 3-7 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 3-8 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.

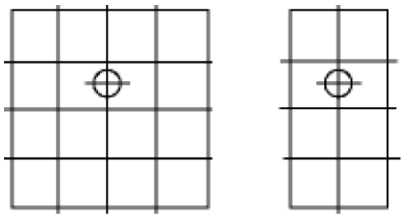


Figure 3-9 Center of gravity of the cabinet

**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 3-10 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 3-11 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 3-12 Delivery state (left), original roof screws (right)

## 3.3.5 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.

## 3.3.6 Connection for side-by-side installation of 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.<br>Tightening torque: 9 Nm |
| 3 x | Inner cabinet connectors including Mounting material |  | The cabinet connector is fastened with 4 screws.<br>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.

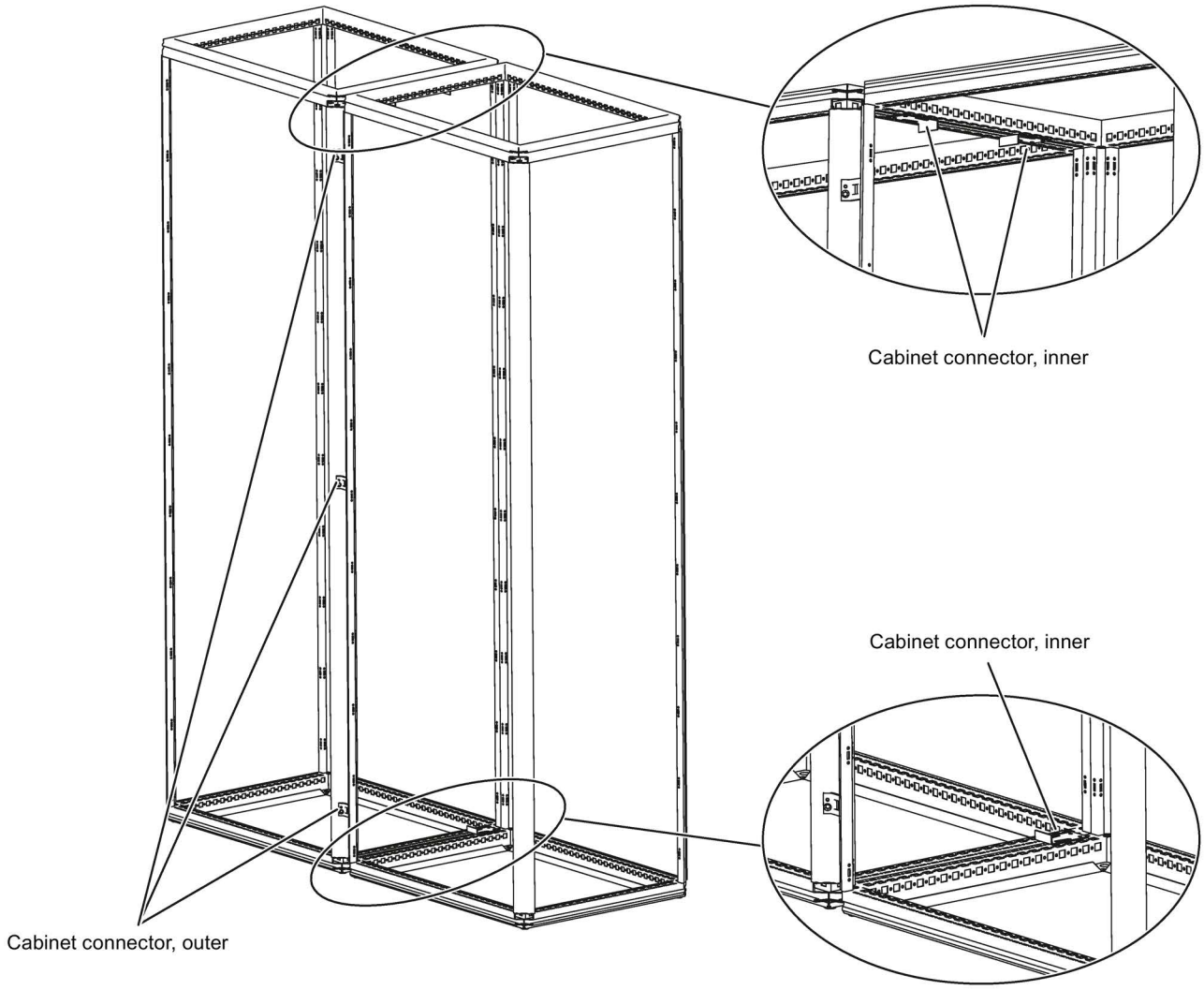



Figure 3-13 Positions of the cabinet connectors

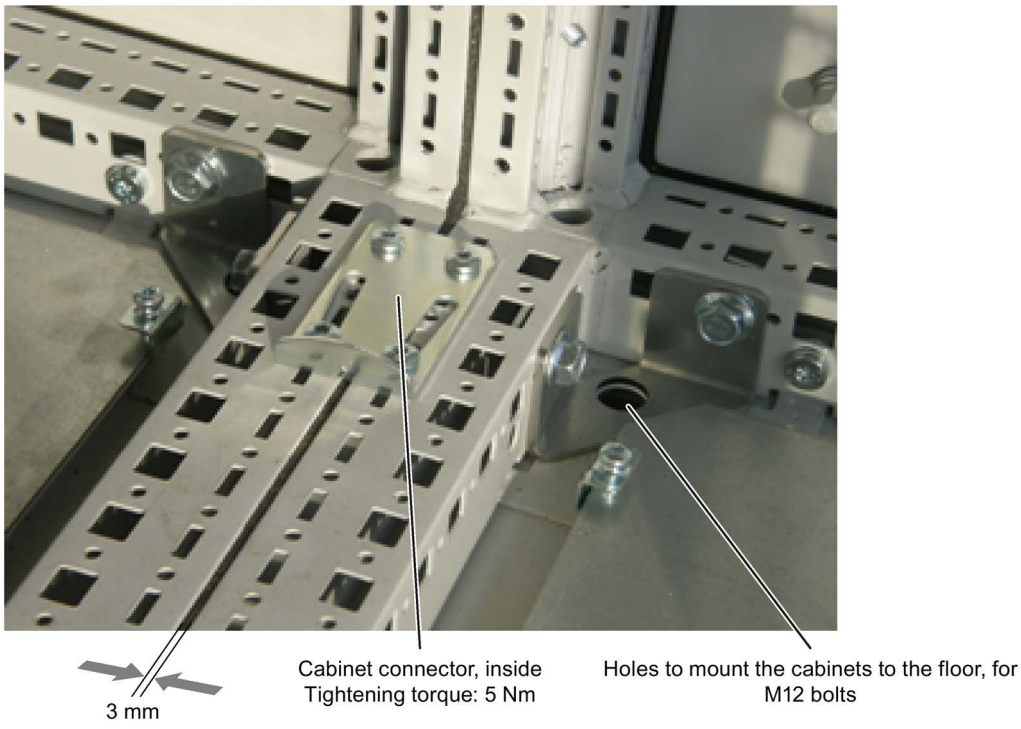



Figure 3-14 Inner cabinet connectors at the lower cabinet frame

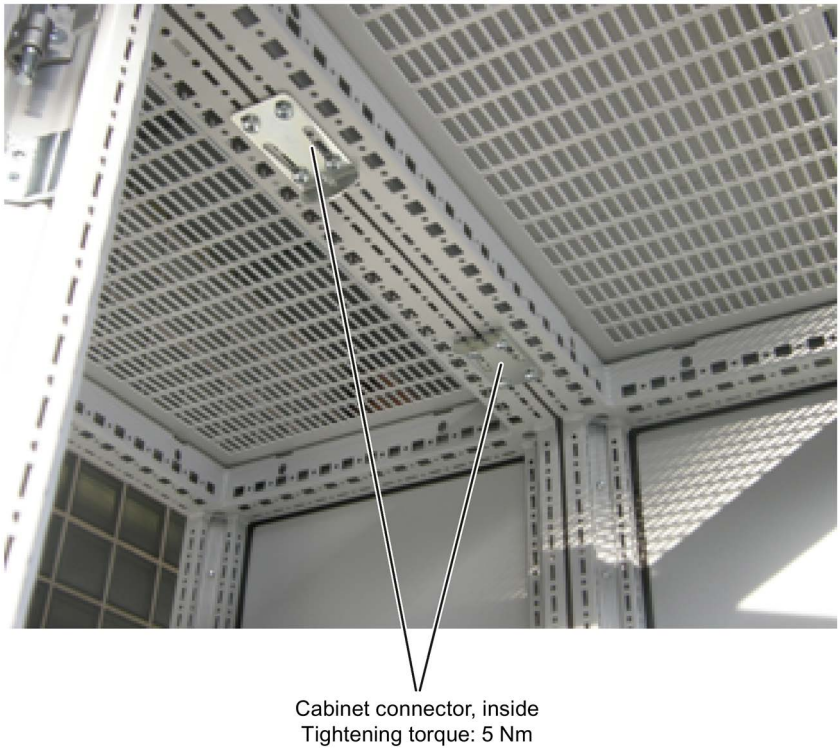



Figure 3-15 Inner cabinet connectors at the upper cabinet frame




Figure 3-16 Cabinet connector, outer

**Note**

**Installing the canopy or hood at an early stage**

It is recommended to attach the canopy or hood at an early stage to prevent foreign matter entering the cabinet units.

**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).

# 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 | Action | | 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, screwed 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.<br>A connection with the ground for the entire system must also be established!<br>(→ 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.<br>(→ See following Section "DC busbar") | ☐ | ☐ |
| 5 | Auxiliary power supply system | The Auxiliary Power Supply Modules must be interconnected between the cabinet units or transport units and supplied with the correct voltages.<br>Make sure that the correct voltage is applied!<br>(→ 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.<br>The open connections that are correspondingly marked must be wired according to the circuit diagram. | | ☐ | ☐ |

| Item | Action | Applicable?/Completed? | |
|---|---|---|---|
| **Power connections** | | | |
| 7 | A yellow warning label is attached to each connection clip of the integrated basic interference suppression module to ground.<br>• The warning label must be removed from the connection clip (by pulling it off) if the connection clip should remain in the device.<br>• 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.<br>(→ 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.<br>The maximum permissible cable lengths between the Motor Module and the motor must be observed depending on the type of cable used.<br>(→ see the following Section "Connecting the motor cables")<br>(→ see Chapter "Cabinet Modules" in Section "Motor Modules Booksize format ")<br>(→ see Chapter "Cabinet Modules" in Section "Motor Modules Chassis format")<br>(→ see Chapter "Cabinet Modules" in Section "Motor Modules Chassis-2 format ") | ☐ | ☐ |
| 9 | When connecting the braking resistor, the maximum permissible cable lengths between the Braking Module (options L61/L62, L64/L65) and the associated braking resistor must be observed.<br>The resistor is connected directly to terminal -X5.<br>The thermal contact of the braking resistor must be wired and its signal evaluated by the controller.<br>(→ See Chapter "Options", Section "L61/L62, L64/L65, braking units") | ☐ | ☐ |
| 10 | When connecting the braking resistor, the maximum permissible cable lengths between Central Braking Module and the associated braking resistor must be observed.<br>The thermal contact of the braking resistor must be wired and its signal evaluated by the Control Unit or the controller.<br>(→ See Chapter "Cabinet Modules", Section "Central Braking Module") | ☐ | ☐ |
| 11 | With a parallel connection of Motor Modules Chassis format and connection to a motor with a single-winding system, it is essential either to observe the specified minimum cable lengths or to install a motor reactor (option L08).<br>(→ See Chapter "Cabinet Modules", Section "Motor Modules Chassis format")<br>(→ See Chapter "Cabinet Modules" in Section "Motor Modules Chassis-2 format ") | ☐ | ☐ |
| 12 | The DC coupling – including the pre-charging input circuit of the associated DC link capacitance (Option L37) – must be connected properly, and all the fuses must be checked to ensure that they are secure.<br>The digital signal for pulse inhibit must be properly wired and parameterized.<br>(→ See Chapter "Options" under "L37, DC coupling, incl. pre-charging input circuit of the associated DC link capacitance" in section "Commissioning the DC coupling") | ☐ | ☐ |
| 13 | The cable shields must be properly applied. | ☐ | ☐ |
| 14 | Check the circuit breaker settings.<br>(→ See Chapter "Cabinet Modules", Section "Line Connection Modules")<br>(→ See Chapter "Cabinet Modules" in Section "Active Line Connection Modules-2") | ☐ | ☐ |
| 15 | The operating voltage must be correctly set for the 230 V AC fans in Line Connection Module, Basic Line Module, Smart Line Module, Active Line Module, Active Line Connection Module-2 and Motor Module Chassis format.<br>Fine tuning to the relevant line voltage is performed by reconnecting the transformer taps.<br>(→ See Chapter "Electrical installation", Section "Adjusting the fan voltage") | ☐ | ☐ |

| Item | Action | | Applicable? | Completed? |
|---|---|---|---|---|
| 16 | The internal power supply must be correctly set in the Line Connection Module and the Auxiliary Power Supply Module.<br>Fine tuning to the relevant line voltage is performed by reconnecting the transformer taps.<br>(→ See Chapter "Cabinet Modules", Section "Line Connection Modules")<br>(→ See Chapter "Cabinet Modules" in Section "Active Line Connection Modules-2")<br>(→ See Chapter "Cabinet Modules" in Section "Auxiliary Power Supply Module") | | ☐ | ☐ |
| 17 | In the Auxiliary Power Supply Module, for a line supply in the voltage range 3 AC 380 ... 480 V, the fuse must be adapted for the transformer.<br>(→ See Chapter "Cabinet Modules", Section "Auxiliary Power Supply Module") | | ☐ | ☐ |
| 18 | The date of manufacture can be determined from the nameplates of the power components in the Cabinet Modules "Basic Line Module", "Smart Line Module", "Active Line Module", "Active Line Connection Module-2", "Motor Module Chassis format", "Motor Module Chassis-2 format" and "Booksize Cabinet Kit". If the period from the date of manufacture to initial 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** | | | | |
| 19 | Cabinet operation by higher-level controller/control room.<br>The control cables must be connected in accordance with the interface assignment and the shield applied!<br>To prevent interference, the control cables must be laid separately from the power cables.<br>Cabling and connections must always comply with the relevant EMC guidelines.<br>(→ See Chapter "Electrical installation") | | ☐ | ☐ |
| 20 | DRIVE-CLiQ cables | All DRIVE-CLiQ cables must be connected correctly.<br>The permissible cable lengths should be carefully observed.<br>(→ See "S120 Commissioning Manual, Rules for wiring with DRIVE-CLiQ" )<br>(→ See "S120 Equipment Manual for Booksize Power Units, DRIVE-CLiQ Cabinet Gland" and "S120 Equipment Manual for Booksize Power Units, DRIVE-CLiQ Coupling") | ☐ | ☐ |
| **Options** | | | | |
| 21 | G20,<br>CBC10 Communication Board | The supplied CBC10 is installed in the factory in the option slot of the Control Unit.<br>(→ See Chapter "Options", Section "G20, CBC10 Communication Board") | ☐ | ☐ |
| 22 | G33,<br>CBE20 Communication Board | The supplied CBE20 is installed in the factory in the option slot of the Control Unit.<br>Remove the CBE20 in a no-current state and note down the MAC address. Install the CBE20 into the option slot again.<br>(→ See Chapter "Options", Section "G33, CBE20 Communication Board") | ☐ | ☐ |
| 23 | G51 to G54,<br>Temperature sensor module TM150 | The Terminal Module TM150 can be connected to a maximum of 12 temperature sensors (PT100, PT1000, KTY84, PTC, bimetallic NC contact).<br>(→ See Chapter "Options", Sections "G51 to G54, TM150 Temperature Sensor Module") | ☐ | ☐ |

| Item | Action | | Applicable?/Completed? | |
|---|---|---|---|---|
| 24 | G60,<br>TM31 Terminal Module | Digital inputs, digital outputs, analog inputs, analog outputs and temperature sensors can be connected to the TM31 Terminal Module.<br>(→ See Chapter "Options", Section "G60, TM31 Terminal Module") | ☐ | ☐ |
| 25 | G61,<br>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.<br>(→ see Chapter "Options", Section "G61, additional TM31 Terminal Module ") | ☐ | ☐ |
| 26 | G62,<br>TB30 Terminal Board | Digital inputs, digital outputs, analog inputs and analog outputs can be connected to the TB30 Terminal Board<br>(→ See Chapter "Options", Section "G62, TB30 Terminal Board") | ☐ | ☐ |
| 27 | K01 to K05,<br>Safety license for 1 to 5 axes | Activating the safety licenses.<br>(→ See Chapter "Options", Section "K01 to K05, Safety license for 1 to 5 axes") | ☐ | ☐ |
| 28 | K46,<br>SMC10 Sensor Module | The SMC10 Sensor Module is used for detecting the actual motor speed and the rotor position angle.<br>The following encoders are supported by the SMC10 Sensor Module:<br>• Resolver, 2-pin<br>• Resolver, multi-pole<br>(→ See Chapter "Options", Section "K46, SMC10 Sensor Module Cabinet-Mounted") | ☐ | ☐ |
| 29 | K48,<br>SMC20 Sensor Module | The SMC20 Sensor Module is used for detecting the actual motor speed and the path length.<br>The following encoders are supported by the SMC20 Sensor Module:<br>• Incremental sin/cos 1Vpp<br>• EnDat absolute encoder<br>• SSI encoder<br>(→ See Chapter "Options", Section "K48, SMC20 Sensor Module Cabinet-Mounted") | ☐ | ☐ |
| 30 | K50,<br>SMC30 Sensor Module | The SMC30 Sensor Module is used for detecting the actual motor speed.<br>The following encoders are supported by the SMC30 Sensor Module:<br>• TTL encoder<br>• HTL encoder<br>• SSI encoder<br>(→ See Chapter "Options", Section "K50, SMC30 Sensor Module Cabinet-Mounted") | ☐ | ☐ |

| Item | Action | | Applicable?/Completed? | |
|---|---|---|---|---|
| 31 | K51,<br>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:<br>• 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)<br>• Fast flying restart of large induction motors: The time for the demagnetization of the motor is eliminated as a result of the voltage sensing.<br>When operating a permanent-magnet synchronous motor without encoder, the "Flying restart" function must be activated with p1200.<br>(→ See Chapter "Options", Section "K51, VSM10 Voltage Sensing Module cabinet-mounted") | ☐ | ☐ |
| 32 | K52,<br>Additional SMC30 Sensor Module | The additional SMC30 Sensor Module is used for safe actual value sensing when using the Safety Integrated Extended Functions.<br>(→ See Chapter "Options", Section "K52, Additional SMC30 Sensor Module") | ☐ | ☐ |
| 33 | K70,<br>Fan power supply | Voltages 230 V 1 AC and 24 V DC of the auxiliary power supply system must be supplied externally.<br>(→ See Chapter "Options", Section "K70, fan power supply") | ☐ | ☐ |
| 34 | K76,<br>auxiliary voltage generation in Line Connection Modules | In order to supply the auxiliary power supply system with the appropriate voltages, the phase must be connected to the corresponding transformer tap.<br>Make sure that the correct voltage is applied!<br>(→ See Chapter "Options", Section "K76, Auxiliary voltage generating unit in the Line Connection Module") | ☐ | ☐ |
| 35 | K82,<br>Terminal Module for activating safety functions "Safe Torque Off" and "Safe Stop 1" | Connect according to "Cable routing for the "Safe Torque Off" and "Safe STOP 1" functions".<br>(→ See Chapter "Electrical installation", Section "Cable routing for the "Safe Torque Off" and "Safe STOP 1" functions")<br>(→ See Chapter "Options", Section "K82, Terminal Module for controlling safety functions "Safe Torque Off" and "Safe Stop 1"") | ☐ | ☐ |
| 36 | K87,<br>Terminal Module TM54F | Establish the connection according to "Cable routing for the functions TM54F".<br>(→ See Chapter "Electrical installation", Section "Cable routing for the Terminal Module TM54F")<br>(→ See Chapter "Options", Section "K87, Terminal Module TM54F") | ☐ | ☐ |
| 37 | K88,<br>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.<br>(→ See Chapter "Options", Section "K88, Safe Brake Adapter SBA 230 V AC") | ☐ | ☐ |
| 38 | L13,<br>main contactor | Connect the feedback signal contacts of the circuit breaker.<br>(→ See Chapter "Options", Section "L13, main contactor") | ☐ | ☐ |

| Item | Action | | Applicable?/Completed? | |
|---|---|---|---|---|
| 39 | L21,<br>surge suppression | The monitoring of the surge arresters and the upstream fuses must be connected to terminal- X700.<br>(→ See Chapter "Options", Section "L21, surge suppression") | ☐ | ☐ |
| 40 | L25,<br>circuit breaker in withdrawable unit design | Connect the feedback signal contacts of the circuit breaker.<br>(→ See Chapter "Options", Section "L25, circuit breaker in withdrawable unit design") | ☐ | ☐ |
| 41 | L34,<br>output-side circuit breaker | Parameterize the control of the circuit breaker.<br>(→ See Chapter "Options", Section "L34, output-side circuit breaker") | ☐ | ☐ |
| 42 | L37,<br>DC coupling, incl. precharging input circuit of the associated DC link capacitance | Commission the DC coupling.<br>(→ See Chapter "Options", section "L37, DC coupling including pre-charging input circuit of the associated DC link capacitance") | ☐ | ☐ |
| 43 | L40,<br>line filter monitoring | Commission the line filter monitoring function.<br>(→ See Chapter "Options", Section "L40, line filter monitoring") | ☐ | ☐ |
| 44 | L41,<br>current transformer upstream of main switch | Connect the measuring connections of the current transformer.<br>(→ See Chapter "Options", Section "L41, current transformer upstream of main switch") | ☐ | ☐ |
| 45 | L45,<br>EMERGENCY OFF pushbutton in the cabinet door | Integrate the option into the EMERGENCY OFF circuit.<br>(→ See Chapter "Options", Section "L45, EMERGENCY OFF pushbutton in the cabinet door") | ☐ | ☐ |
| 46 | L46,<br>grounding switch upstream of circuit breaker | The interlock for the upstream, plant-side main switch must be ensured.<br>(→ See Chapter "Options", Section "L46/L47, grounding switch upstream/downstream of circuit breaker") | ☐ | ☐ |
| 47 | L47,<br>grounding switch downstream of circuit breaker | The main switch cannot be closed when the grounding switch is closed.<br>(→ See Chapter "Options", Section "L46/L47, grounding switch upstream/downstream of circuit breaker") | ☐ | ☐ |
| 48 | L50,<br>cabinet lighting with service socket | Provide the power supply.<br>(→ See Chapter "Options", Section "L50, cabinet lighting with service socket") | ☐ | ☐ |
| 49 | L55,<br>cabinet anti-condensation heating | Provide the power supply.<br>(→ See Chapter "Options", Section "L55, cabinet anti-condensation heating") | ☐ | ☐ |
| 50 | L87,<br>insulation monitoring | Integrate the option into the plant-side fault and alarm circuit.<br>(→ See Chapter "Options", Section "L87, insulation monitoring") | ☐ | ☐ |
| 51 | P10,<br>Measuring instrument for line variables, installed in the cabinet door | Adjust the measuring instrument according to the relationships in the plant.<br>(→ see Chapter "Options", Section "P10, measuring instrument for line variables installed in the cabinet door") | ☐ | ☐ |

| Item | Action | | Applicable?/Completed? | |
|---|---|---|---|---|
| 52 | P11,<br>measuring instrument for line variables with PROFIBUS connection, installed in the cabinet door | Adjust the measuring instrument according to the relationships in the plant.<br>(→ see Chapter "Options", Section "P11, measuring instrument for line variables with PROFIBUS connection installed in the cabinet door") | ☐ | ☐ |
| 53 | P13,<br>measuring instrument for line variables with PROFINET connection, installed in the cabinet door | Adjust the measuring instrument according to the relationships in the plant.<br>(→ see Chapter "Options" in Section "P13, measuring instrument for line variables with PROFINET connection installed in the cabinet door") | ☐ | ☐ |
| 54 | P14,<br>measuring instrument for line variables with PROFINET connection, installed in the cabinet door | Adjust the measuring instrument according to the relationships in the plant.<br>(→ 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 air 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 Configuration Manual" and the use of shielded motor cables. More detailed information is provided in the "SINAMICS Low Voltage Configuration 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 ≤ 1500 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

Good shield support is achieved by connecting the shield over a large surface area to the EMC shield rail in the converter cabinet 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, depth 6 mm.

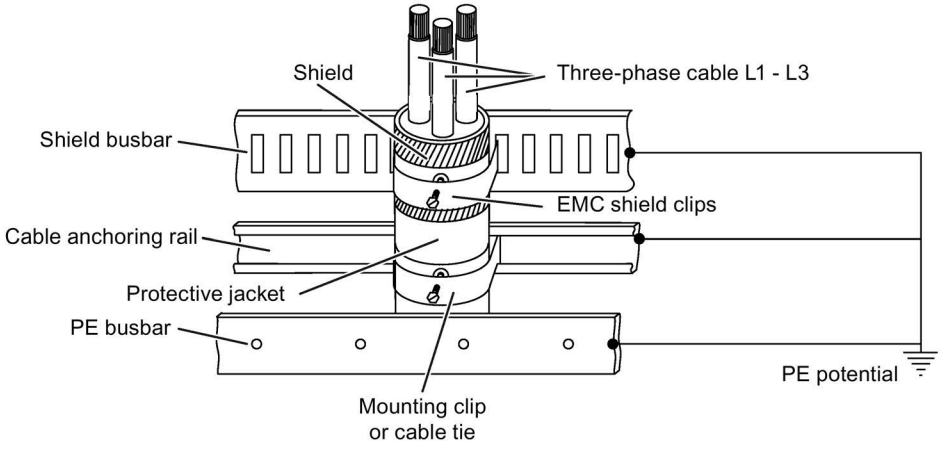



Figure 4-1 Connecting shields at the EMC shield rail using EMC shield clamps for chassis format

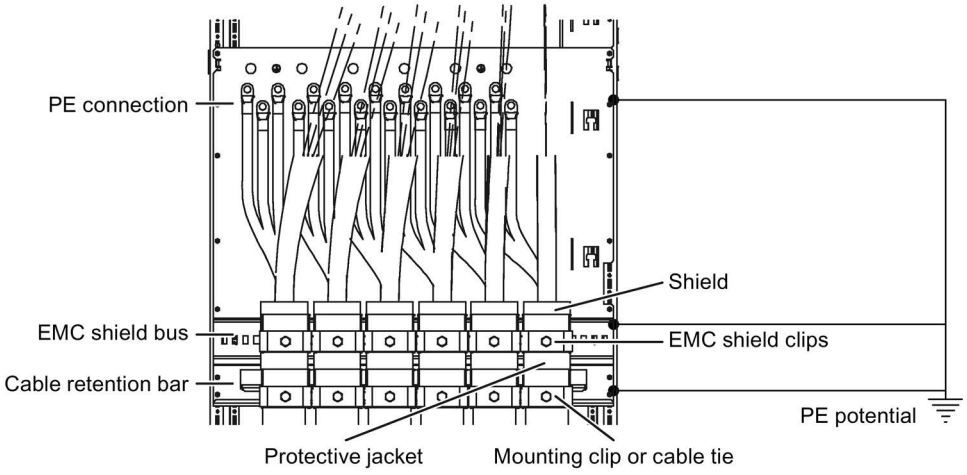



Figure 4-2 Connecting shields at the EMC shield rail using EMC shield clamps for chassis-2 format

**Note**

Detailed engineering information for connecting shielded three-phase cables with concentrically arranged shields is given 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.

When connecting alternative cable lugs, the maximum dimensions are listed in the following table.
These cable lugs are not to exceed these dimensions, as otherwise mechanical fastening and compliance with the voltage clearances is not guaranteed.

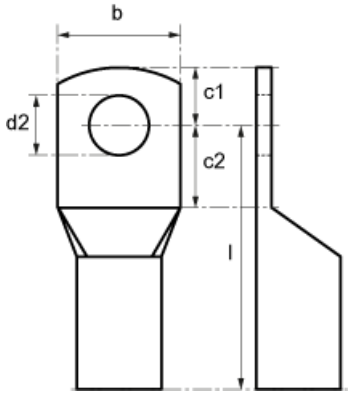



Figure 4-3 Dimensions of the cable lugs

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.

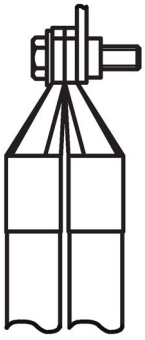


Figure 4-4 2 cable lugs per connection

### Cable lugs for Motor Modules Chassis-2 format

The motor connections at the Motor Modules Chassis-2 format are dimensioned for M12 cable lugs, as listed in the following table.
These cable lugs are not to exceed these dimensions, as mechanical fastening and adherence to the voltage clearances is otherwise not guaranteed.

Table 4- 5 Dimensions of the cable lugs

| Screw / bolts | Connection cross-section [mm²] | d2 [mm] | b [mm] | l [mm] | c1 [mm] | c2 [mm] |
|---|---|---|---|---|---|---|
| M12 | 240 | 13 | 43 | 87 | 24 | 24 |

## 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- 6 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 |
| Line Connection Module | Yes | * | No | Yes | No | No |
| Basic Line Module | Yes | Yes | No | No | No | * |
| Smart Line Module | Yes | Yes | No | No | No | * |
| Active Line Module | Yes | Yes | No | No | No | * |
| Active Line Connection Module-2 | Yes | Yes | Yes | Yes | No | No |
| Booksize Base Cabinet | Yes | Yes | Yes | No | No | No |
| Booksize Cabinet Kit | No | No | No | No | Yes | No |
| Motor Module Chassis format | Yes | Yes | Yes | No | Yes | * |
| Motor Module Chassis-2 format | Yes | Yes | Yes | No | Yes | No |
| Central Braking Module | Yes | Yes | Yes | No | No | Yes |
| Auxiliary Power Supply Module | Yes | * | Yes | Yes | No | No |

* optional

## 4.6.3 PE busbar

### 4.6.3.1 General information

#### Availability

PE busbars are included in the following S120 Cabinet Modules:

- Line Connection Modules
- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Base Cabinets
- Motor Modules Chassis format
- Motor Modules Chassis-2 format
- Central Braking Modules
- Auxiliary Power Supply 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).

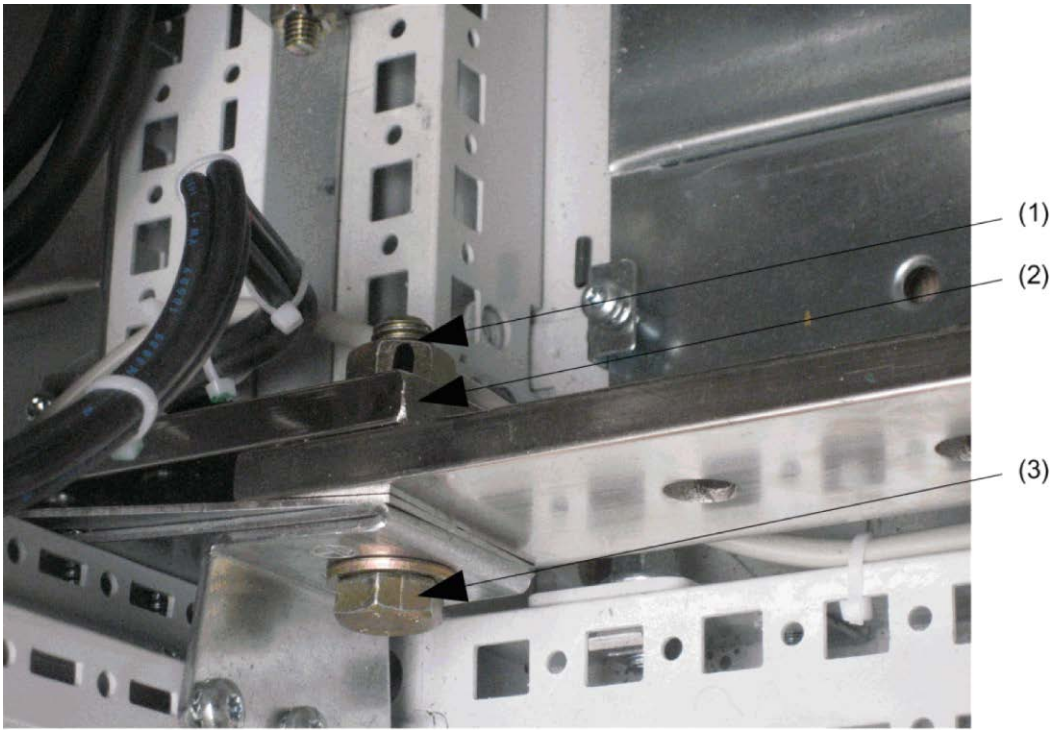



Figure 4-5 Connecting the PE busbar when cabinet units are installed side-by-side

### 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 Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Base Cabinets
- Motor Modules Chassis format
- Motor Modules Chassis-2 format
- Central Braking Modules

#### 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.

The DC busbar can be optionally included in the following Cabinet Modules:

- Line Connection Modules
- Auxiliary Power Supply Modules

### 4.6.4.2 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 hood or top cover removed) than from the front.

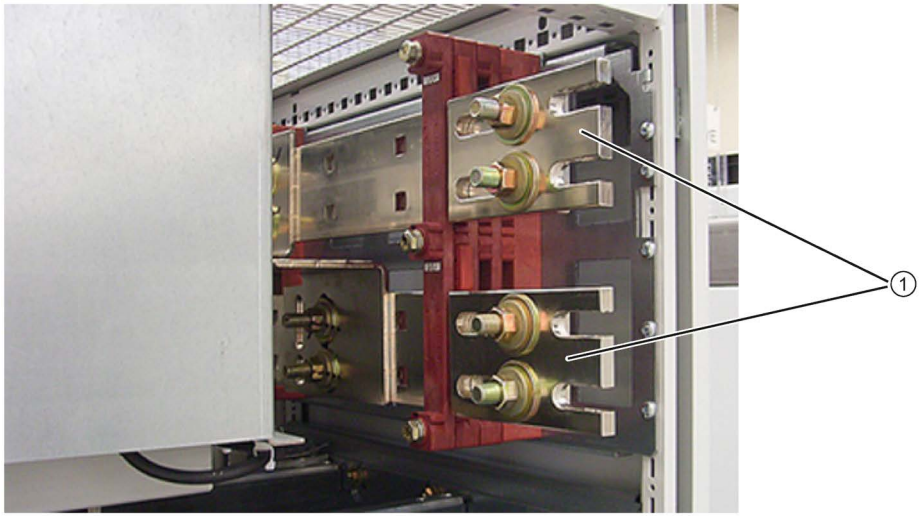



Figure 4-6 Delivery state of the DC busbar




Figure 4-7 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**<br>Incorrect connection of the jumpers for the DC busbar can heat up the busbars and therefore cause material damage.<br>• 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.

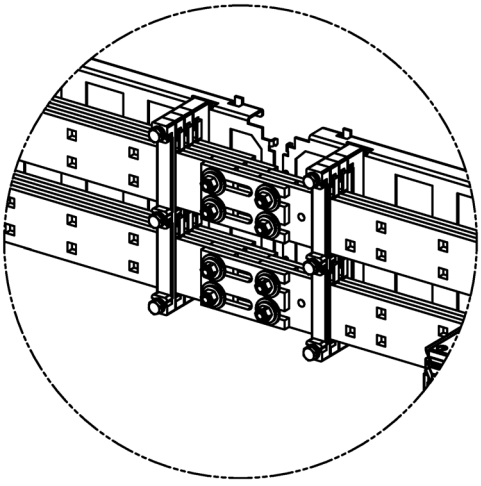
### 4.6.4.3 Connecting cabinet units with different numbers of DC busbars

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

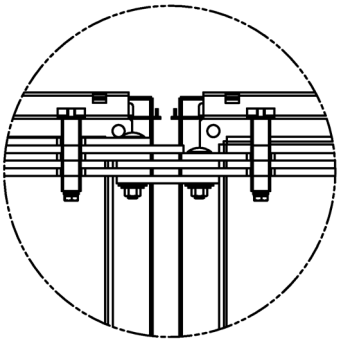
**Transition from three busbars to two busbars**

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



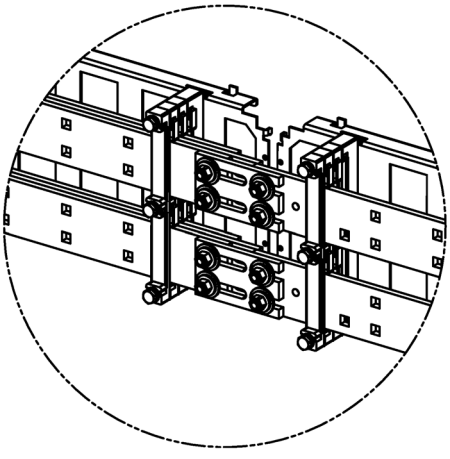
Top view of the connection location



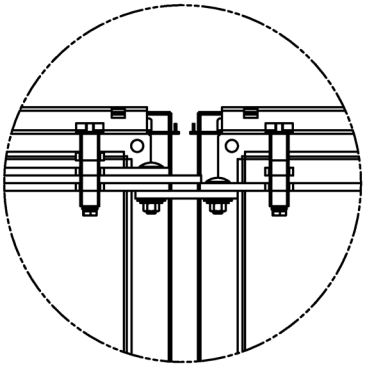
**Transition from two busbars to one busbar**

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 to the customer on the Auxiliary Power Supply Module for each voltage level:

- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Base Cabinets
- Motor Modules Chassis format
- Motor Modules Chassis-2 format
- Central Braking Modules

#### Description

The auxiliary power supply system installed in the Cabinet Module distributes the voltages provided by an auxiliary power supply.

Ideally, these voltages are generated by an Auxiliary Power Supply Module. Other ways to supply power is to use option K76 "Auxiliary voltage generating unit in the Line Connection Module" or to feed the auxiliary voltages to the auxiliary power supply system from an external source.

The maximum load capability of the auxiliary power supply system is 80 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 following diagram shows the mechanical design of the auxiliary power supply system. The standard assignment with the three auxiliary voltages is shown in the tables below.

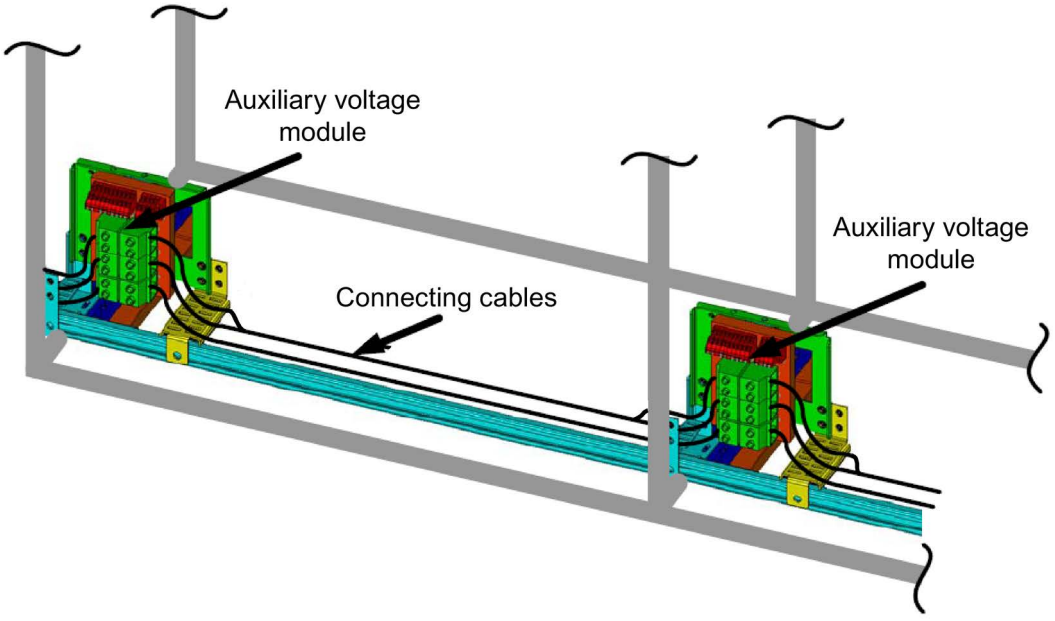



Figure 4-8 Auxiliary power supply system for voltage distribution

The auxiliary power supply system for an individual cabinet unit consists of an Auxiliary Power Supply Module and the connecting cables.

The Auxiliary Power Supply Module comprises two terminal blocks (-X100, -X101) and one fuse (-F24) for the 24 V DC supply. The Auxiliary Power Supply Module taps the necessary auxiliary voltages at terminal block -X100 and forwards auxiliary voltages to terminal block -X101 in the adjacent cabinet unit.

The connections are made using two special cables. One 4-phase cable for the power supply (1, 2) and for 230 V AC (3, 4), and an additional screened 2-phase cable for 24 V DC (1, 2).

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 Cabinet Module must be established on site by fastening the cables to the next terminal block. These connections are already established within transport units. Only the transport units need to be interconnected.

## Auxiliary Power Supply Module

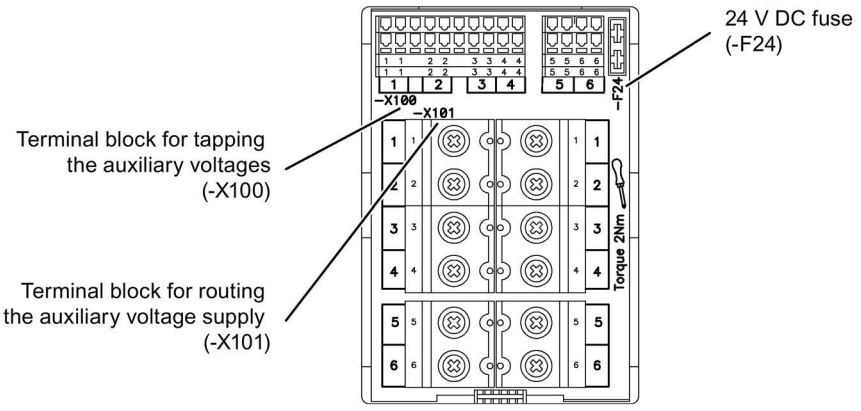
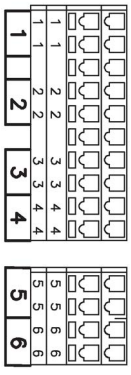



Figure 4-9 Auxiliary Power Supply Module with terminal blocks -X100, -X101 and 24 V DC fuse

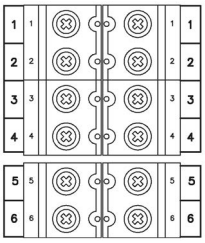
At least two terminals are always available to the customer at terminal block -X100 for tapping the auxiliary voltages.

Table 4- 7 X100, terminal block for tapping the auxiliary voltages

| | Terminal | Designation | Voltage tap | Rated current |
|---|---|---|---|---|
|  | 1 | L1 | Line voltage (for fan supply via transformer):<br>• 380 to 480 V 2 AC or<br>• 500 to 690 V 2 AC (max. 759 V AC) | Max. 16 A [1] |
| | 2 | L2 | | |
| | 3 | L1 | 230 V 1 AC (max. 265 V AC) | Max. 16 A [1] |
| | 4 | N | | |
| | 5 | P24 | 24 V DC for the electronics power supply (max. 30 VDC) | Max. 10 A [1] |
| | 6 | M | | |
| The maximum load capability of the auxiliary power supply system is 80 A.<br>Max. connectable cross-section: 2.5 mm$^2$ | | | | |

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

Table 4- 8 X101, terminal block for routing the auxiliary voltage connecting cables

| | Terminal | Designation | Assigned voltages | Rated current |
|---|---|---|---|---|
|  | 1 | L1 | Line voltage (for fan supply via transformer):<br>• 380 to 480 V 2 AC or<br>• 500 to 690 V 2 AC (max. 759 V AC) | Max. 80 A |
| | 2 | L2 | | |
| | 3 | L1 | 230 V 1 AC (max. 265 V AC) | Max. 80 A |
| | 4 | N | | |
| | 5 | P24 | 24 V DC for the electronics power supply (max. 30 VDC) | Max. 80 A |
| | 6 | M | | |
| The maximum load capability of the auxiliary power supply system is 80 A.<br>Max. connectable cross-section: 35 $mm^2$<br>Tightening torque: 2 Nm | | | | |

## Auxiliary Power Supply Module in the Line Connection Module

The Auxiliary Power Supply Module in the Line Connection Module consists of the -X100 terminal block for feeding in and routing the auxiliary voltages in both directions. No voltage taps are available to the customer.

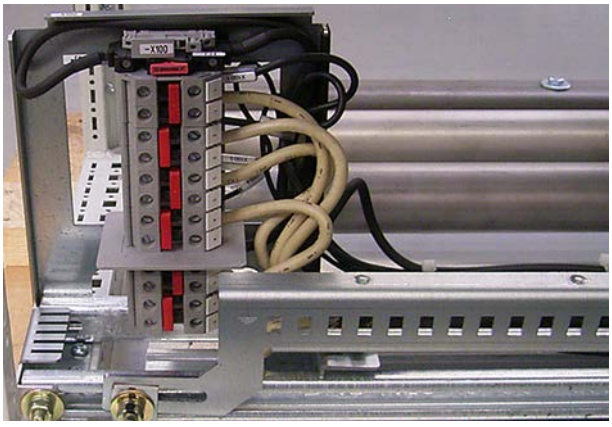
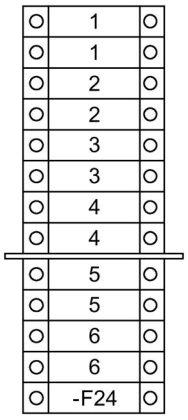



Figure 4-10 Auxiliary Power Supply Module in the Line Connection Module

Table 4- 9 X100, terminal block in the Line Connection Module for routing the auxiliary voltages

| | Terminal | Voltage tap | Rated current |
|---|---|---|---|
|  | 1 | Line voltage:<br>• 380 to 480 V 2 AC or<br>• 500 to 690 V 2 AC (max. 759 V AC) | Max. 80 A |
| | 1 | | |
| | 2 | | |
| | 2 | | |
| | 3 | 230 V 1 AC (max. 265 V AC) | Max. 80 A |
| | 3 | | |
| | 4 | | |
| | 4 | | |
| | 5 | 24 V DC for the electronics power supply (max. 30 VDC) | Max. 80 A |
| | 5 | | |
| | 6 | | |
| | 6 | | |
| | -F24 | 24 V DC fuse | Max. 10 A |
| The maximum load capability of the auxiliary power supply system is 80 A.<br>Max. connectable cross-section: 16 $mm^2$<br>Tightening torque: 2 Nm | | | |

**Note**

**External infeed**

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

## Fuse

A 10 A-fuse is incorporated in the Auxiliary Power Supply Modules to protect the 24 V DC auxiliary voltage. If a replacement part is required, this can be ordered, specifying Article number 6SL3760-0BG00-0AA0.
Fuse type: TAC ATO flat plug-in fuse according to DIN 72581-3, UL 248 Special Purpose Fuses, 10 A, 58 V, manufacturer: Littlefuse

### Connecting cables

Table 4- 10 Voltage assignment for connecting cables

| Cable | Phase | Assigned voltages |
|---|---|---|
| 4-phase | 1 | Line voltage:<br>• 380 to 480 V 2 AC or<br>• 500 to 690 V 2 AC (max. 759 V AC) |
| | 2 | |
| | 3 | 230 V 1 AC (max. 265 V AC) |
| | 4 | |
| 2-phase | 1 | 24 V DC for the electronics power supply (max. 30 V DC)<br>The cable marked "1" must be connected to terminal 5 on the terminal block. The cable marked "2" must be connected to terminal 6 on the terminal block. |
| | 2 | |



**⚠WARNING**

**Dangerous voltage as a result of incorrect voltage assignment**

Incorrect voltage assignment on the auxiliary power supply system can result in high voltages on unsuitable components and thus damage or destroy these components. Contact with these high voltages can result in death or serious injury.

- When establishing connections to the auxiliary power supply system, you must ensure that you do not interchange the power supplies.

#### 4.6.5.2 Connection overview

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

- Connection of auxiliary power module when cabinet units are installed side-by-side
- Connecting to the infeed

### 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 for connecting the Auxiliary Power Supply Modules are attached to the -X101 terminal block of the module in each cabinet. If the cabinets are delivered as single units, these must be routed to the next module and attached to the appropriate terminals of the -X101 terminal block. The procedure is described below.

**Note**

**Connecting the Auxiliary Power Supply Modules for transport units.**

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



Figure 4-11 Connecting cables in the delivered state (e.g. transport units)

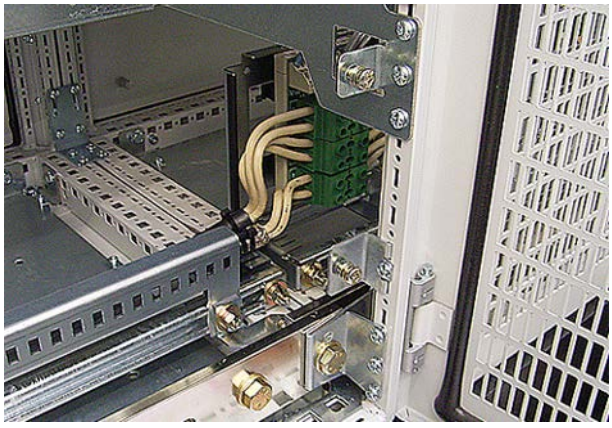


Figure 4-12 Connected connecting cables

### Establishing the connection

Attach the cable to terminal block -X101 of the next module:

- 4-phase cable(1-2): for the line voltage to terminals 1 and 2
- 4-phase cable(3-4): for 230 VAC to terminals 3 and 4
- 2-phase cable(1-2): for 24 VDC to terminals 5 and 6

**Note**

**Establishing the connection for Basic Line Modules**

Basic Line Modules do not contain Auxiliary Power Supply Modules. The 24 VDC power supply is provided by connecting the 2-phase cable included in the Basic Line Module to the Auxiliary Power Supply Module of the adjacent cabinet 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 Line Connection Module can be used to feed power to the auxiliary power supply system. Further alternatives for feeding power are in the first or last auxiliary power module of the drive line-up. The maximum current-carrying capacity of the auxiliary power supply system is 80 A. In the case of the external power supply, this must be fuse protected on the line 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 Modules Booksize Cabinet Kit

Table 4- 11 Motor connection, Motor Modules

| Terminals | Technical data |
|---|---|
| DCP, DCN<br>DC power input | Voltage:<br>510 ... 720 V DC |
| U2/T1, V2/T2, W2/T3<br>3 AC power output | Voltage:<br>3 AC 0 V to 0.717 x DC link voltage<br>Terminals:<br>6 ... 95 $mm^2$ (→ see Technical data) |

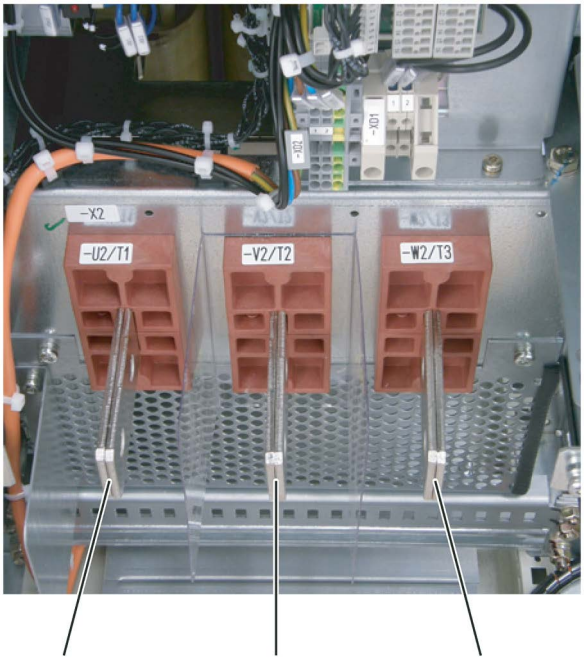
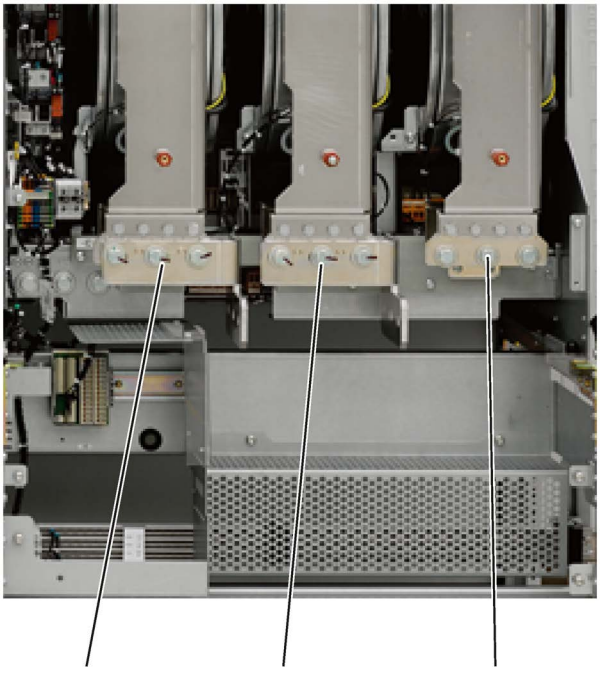
### Motor Modules in chassis format

Table 4- 12 Motor connection, Motor Modules

| Terminals | Technical data |
|---|---|
| DCP, DCN<br>DC power input | Voltage:<br>510 ... 720 V DC<br>675 ... 1035 V DC |
| U2/T1, V2/T2, W2/T3<br>3 AC power output | Voltage:<br>3 AC 0 V to 0.75 x DC link voltage [1)]<br>Connection:<br>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".

| Frame sizes FX and GX | | | Frame sizes HX and JX | | |
|---|---|---|---|---|---|
|  | | |  | | |
| -U2/-T1 | -V2/-T2 | -W2/-T3 | -U2/-T1 | -V2/-T2 | -W2/-T3 |

### 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. Move or remove the base plate below the connection panel through which the motor cables are fed.
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 cause fire damage or malfunctions.

- Tighten all power connections with the specified tightening torques, e.g. line connection, motor connection, and DC link connections.
- Regularly check all power connections by retightening them with the prescribed 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.

### Motor Modules in Chassis-2 format

The following figure shows a side view that better illustrates the plate for connecting the PE conductor, the EMC shield bus and the cable clamping bar.

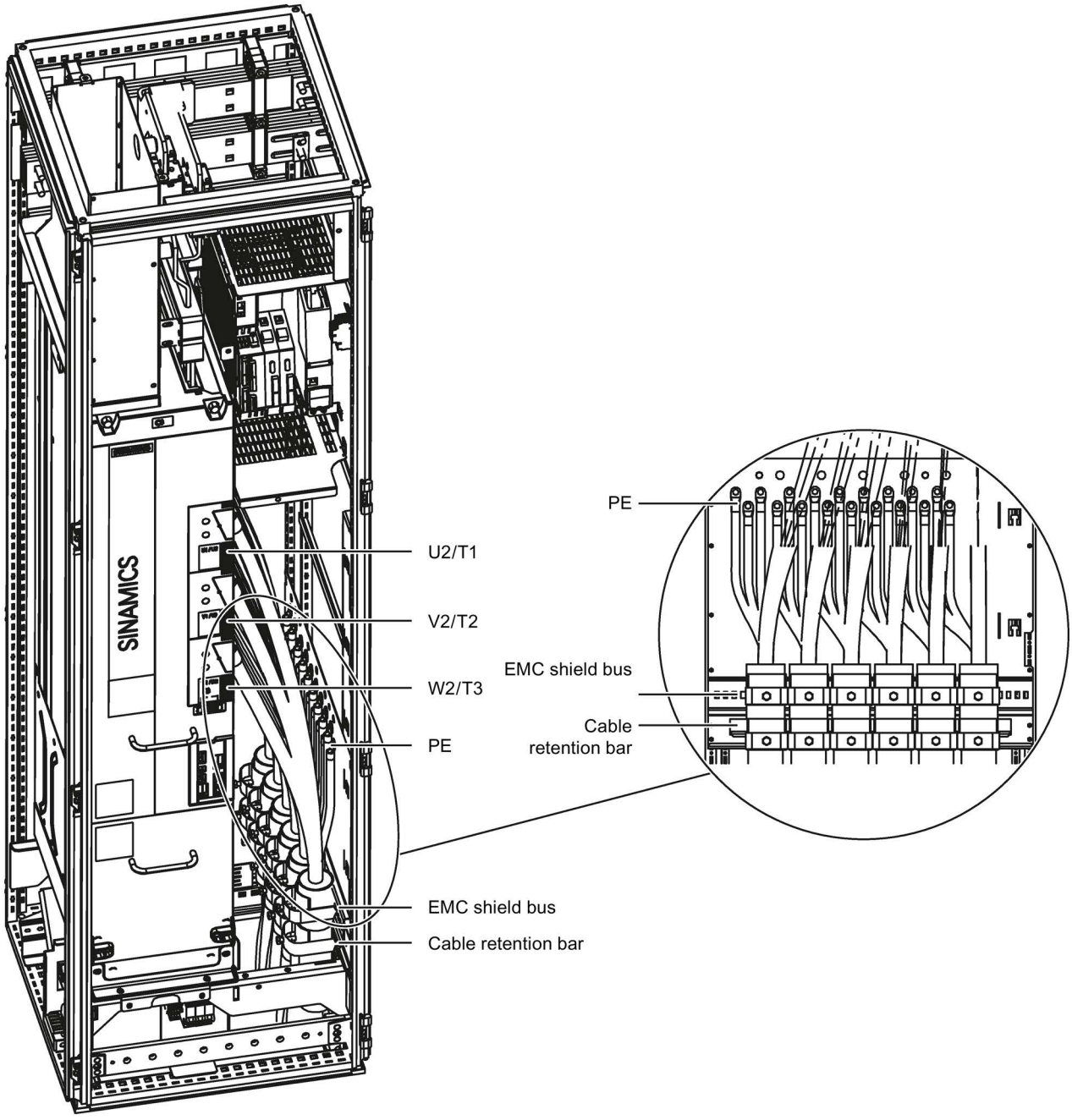



Figure 4-13 Connecting the motor cables, Motor Modules Chassis-2 format

**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. Move or remove the base plate below the connection panel through which the motor cables are fed.
3. Install the cable corresponding to the description provided in Chapter "Cable routing for Motor Modules in the Chassis-2 format (Page 160)".

**NOTICE**

**Material damage due to loose power connections**

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

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

**⚠WARNING**

**Electric shock by using unsuitable screws**

The plastic enclosure behind the motor connections can be damaged if screws longer than 40 mm are used. This represents danger to life, and equipment can be damaged.

- Only use the original M12x40 screws, including the spring washer, when connecting the motor cables.
- If you have to replace screws, then only use screws with the same length. Always use a spring washer.

## Conductor cross-sections

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

## Direction of motor rotation

Standard 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- 13 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 nameplate 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

### Line Connection Modules

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

Table 4- 14 Line supply connection, Line Connection Modules

| Terminals | Technical data |
|---|---|
| U1/L1, V1/L2, W1/L3<br>3-phase AC power input | Voltage:<br>380 V 3 AC -10% to 480 V 3 AC +10% (-15% < 1 min)<br>500 V 3AC -10% to 690 V 3 AC +10% (-15% < 1 min)<br>Connection thread:<br>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 Modules-2

The line supply is connected in the Active Line Connection Module-2 at terminal -X1.

Table 4- 15 Line connection, Active Line Connection Modules-2

| Terminals | Technical data |
|---|---|
| U1/L1, V1/L2, W1/L3<br>3-ph. AC power input | Voltage:<br>3 AC 380 V -10 % ... 3 AC 480 V +10 % (-15 % < 1 min)<br>Connection thread:<br>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".

## 4.6.8 Adjusting the fan voltage

A transformer is incorporated in the Motor Module in the chassis format (-T1-T10) and/or Basic Line Module / Smart Line Module / Active Line Module (-T2-T10) for setting the correct operating voltage for the 230 VAC fans. The mounting positions of the transformers are indicated in the layout diagrams supplied.

The transformer is fitted with line-side taps so that it can be fine-tuned to the line voltage. When delivered, the taps are always set to the highest level. When connected to a lower line supply voltage, the appropriate transformer tap must be used. The neutral conductor is left on terminal "0" and the phase is clamped to the existing line voltage.

The fans are designed for 50/60 Hz operation.

**Note**

**Positions of the setting terminals**

The position of the setting terminals for the fan transformers is provided in Chapter "Cabinet Modules in the design descriptions of the appropriate modules.

**Note**

**Two transformers for frame sizes HX and JX**

In the case of Smart Line Modules, Active Line Modules, and Motor Modules with "HX" and "JX" frame sizes, two transformers are incorporated (-T10/-T11). The two line-side terminals on each of these devices must be adjusted together.

**Note**

**No transformers in Active Line Modules Chassis-2 and Motor Modules Chassis-2**

No transformers to adapt the fan voltage are installed in Active Line Modules Chassis-2 and Motor Modules Chassis-2.

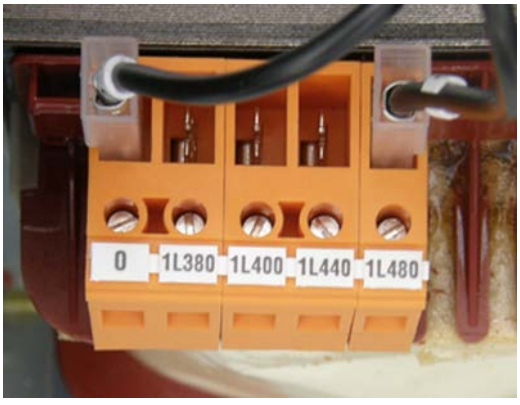



Figure 4-14 Connecting terminals for the fan transformers (380 to 480 V 2 AC)

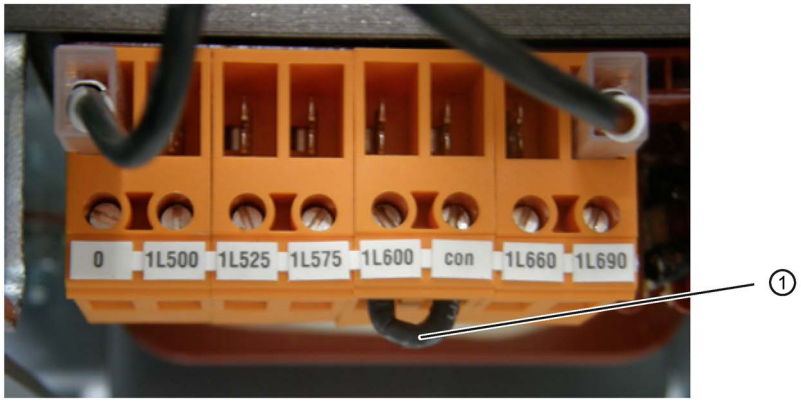



Figure 4-15 Connecting terminals for the fan transformers (500 to 690 V 2 AC)

The line-voltage assignments for making the appropriate setting on the fan transformer are indicated in the following table.

**⚠WARNING**

**Fire due to overheating resulting from insufficient equipment fan voltage**

If the terminals are not reconnected to correspond with the actual line voltage, overheating and risks to personnel due to smoke and fire may result.
This can also cause the fan fuses to fail due to overload.

- Set the terminals in accordance with the actual line voltage.

**Note**

For the fan transformer (500 to 690 V 2 AC), a jumper is inserted between terminal "600 V" and "CON" terminal - ① in the diagram above). Terminal "CON" is for internal use.

The article numbers for fan fuses that have blown can be found in the spare parts list.

Table 4- 16 Line voltage assignment for the setting at the fan transformer (380 ... 480 V 2 AC)

| Line voltage | Fan transformer tap (-T1/-T2 –T10, -T20) |
|---|---|
| 380 V ± 10% | 380 V |
| 400 V ± 10% | 400 V |
| 440 V ± 10% | 440 V |
| 480 V ± 10% | 480 V |

Table 4- 17 Line voltage assignment for the setting at the fan transformer (500 ... 690 V 2 AC)

| Line voltage | Fan transformer tap (-T1/-T2 -T10, -T20) |
|---|---|
| 500 V ± 10% | 500 V |
| 525 V ± 10% | 525 V |
| 575 V ± 10% | 575 V |
| 600 V ± 10% | 600 V |
| 660 V ± 10% | 660 V |
| 690 V ± 10% | 690 V |

## 4.6.9 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 Modules
- Smart Line Modules (for frame sizes HX and JX, the connection clip is located behind the fan) - including the Voltage Sensing Module VSM10 included with it
- Active Line Modules (connection clip in the Active Interface Module) including the Voltage Sensing Module VSM10 included in it
- Active Line Connection Modules-2 (connection clip in the Active Interface Module-2) 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 4-16 Warning label on the connection clip

## Basic Line Modules

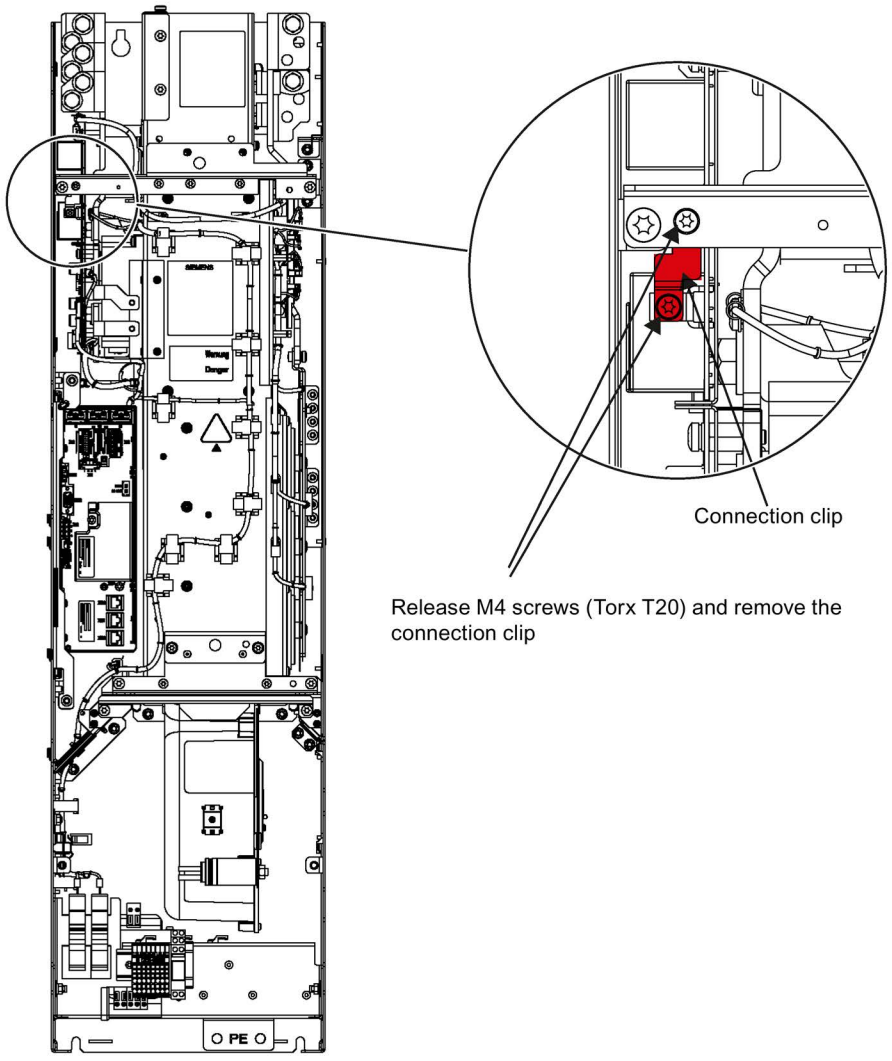



Figure 4-17 Removing the connection clip of the basic interference suppression module to ground in the Basic Line Module for frame size FB

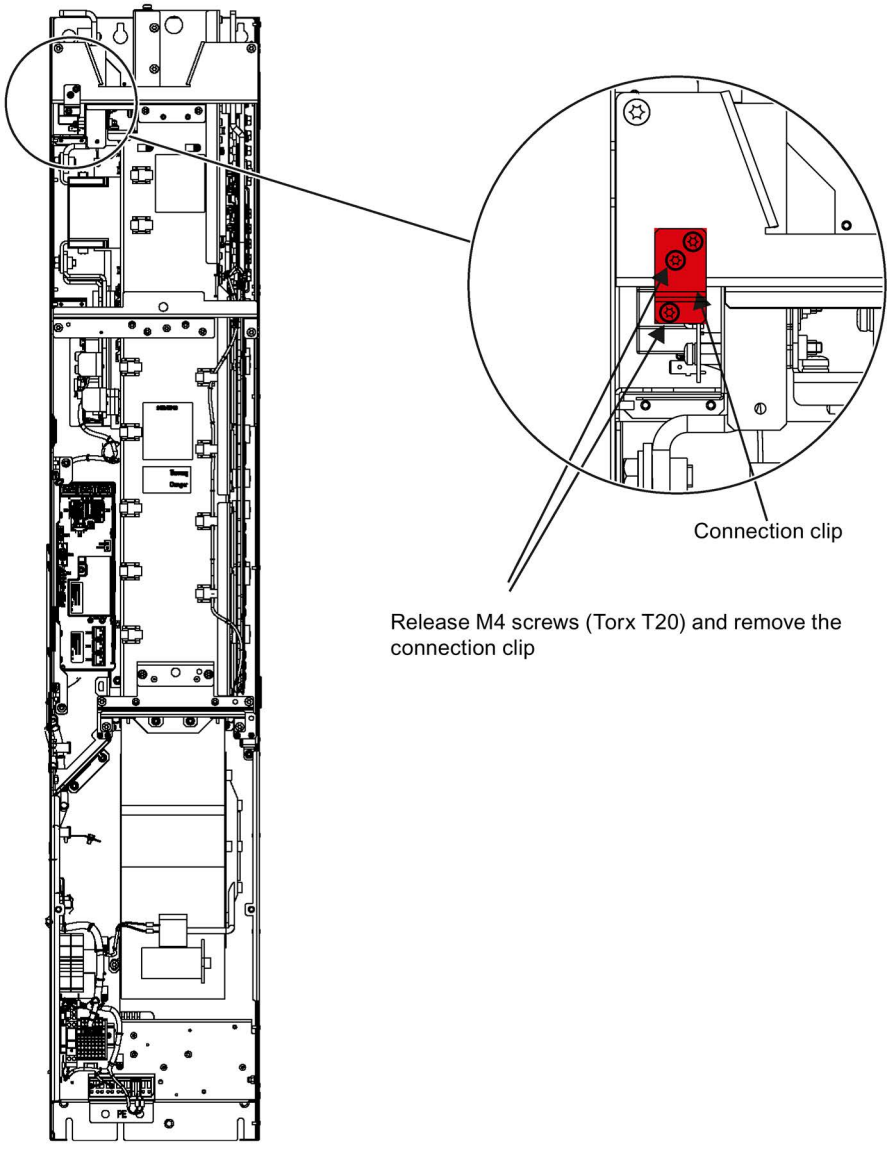



Figure 4-18 Removing the connection clip of the basic interference suppression module to ground in the Basic Line Module for frame size GB

## Smart Line Modules

With frame sizes HX and JX, you must remove the left-hand fan before removing the connection bar (see Chapter "Replacing components").

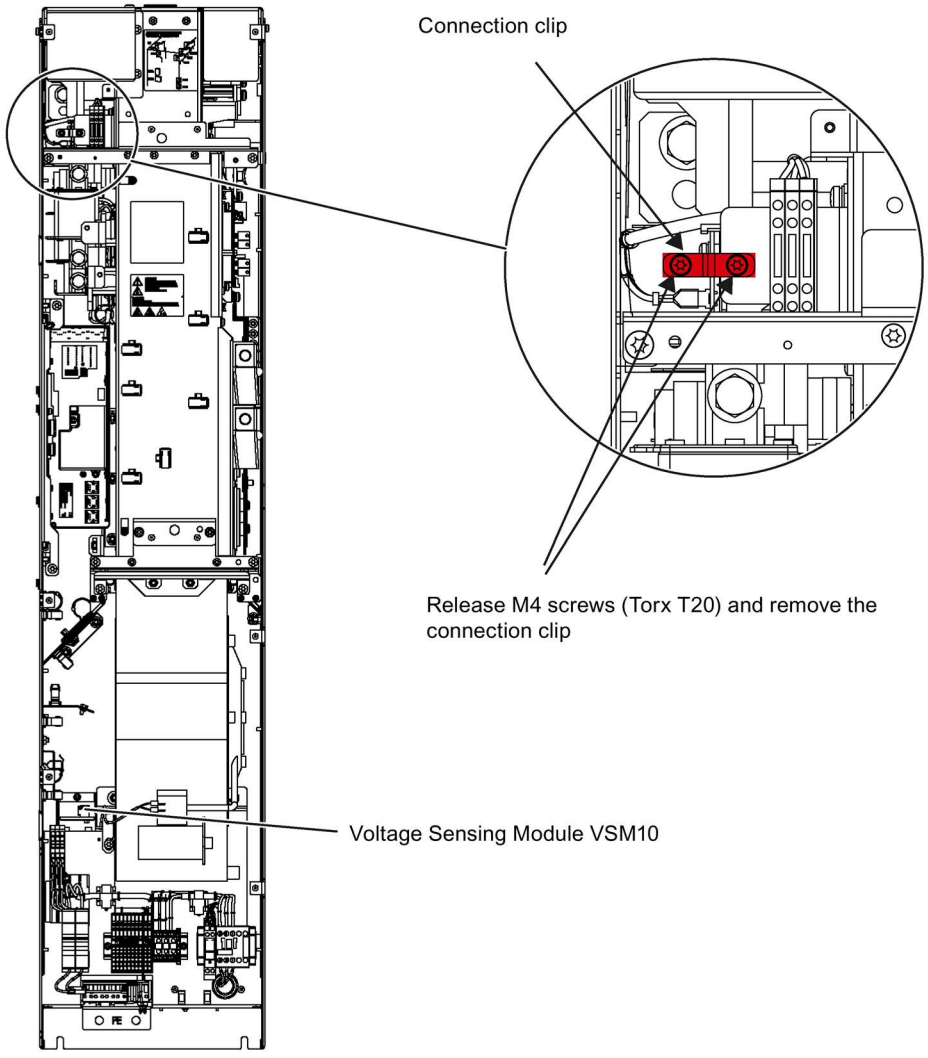



Figure 4-19 Removing the connection clip of the basic interference suppression module to ground in the Smart Line Module for frame size GX

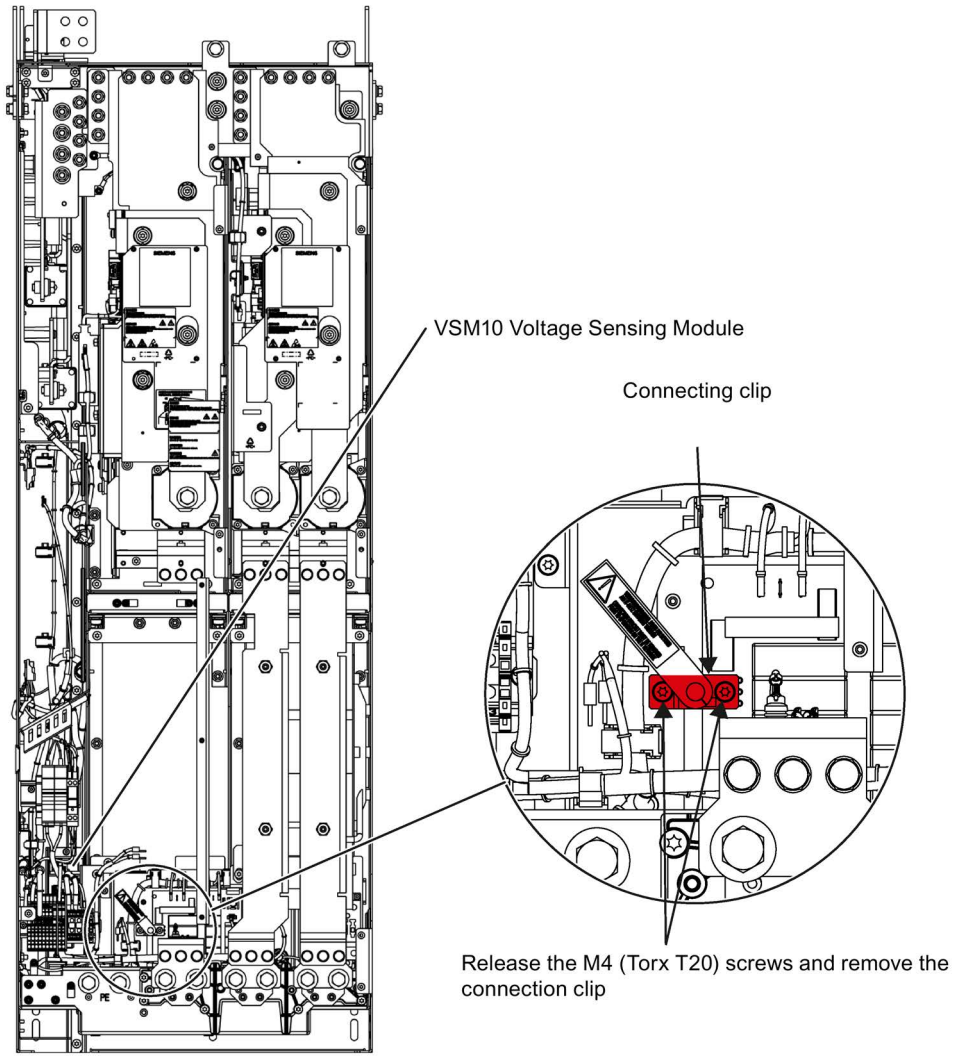



Figure 4-20 Removing the connection clip of the basic interference suppression module to ground in the Smart Line Module for frame size HX

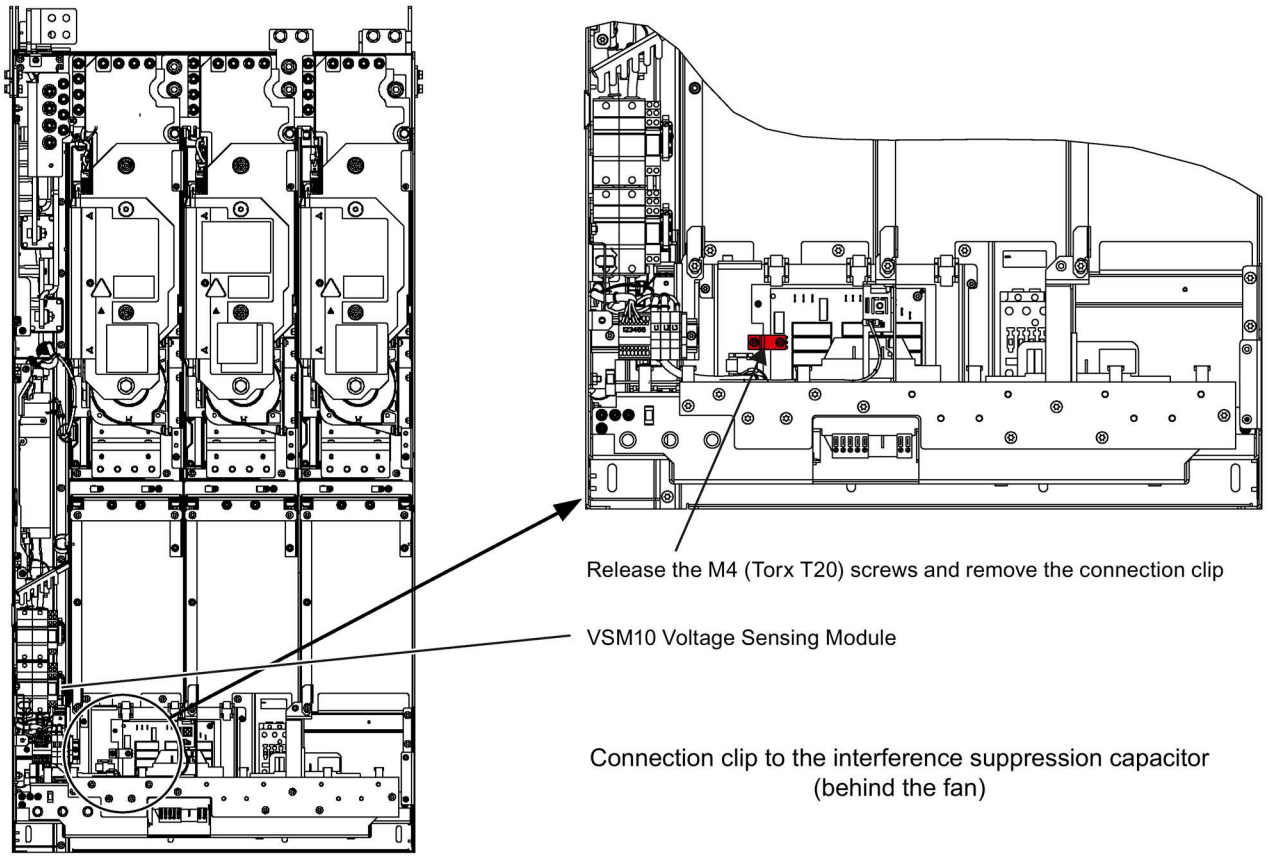



Figure 4-21 Removing the connection clip of the basic interference suppression module to ground in the Smart Line Module for frame size JX

### Active Line Modules including Active Interface Modules

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

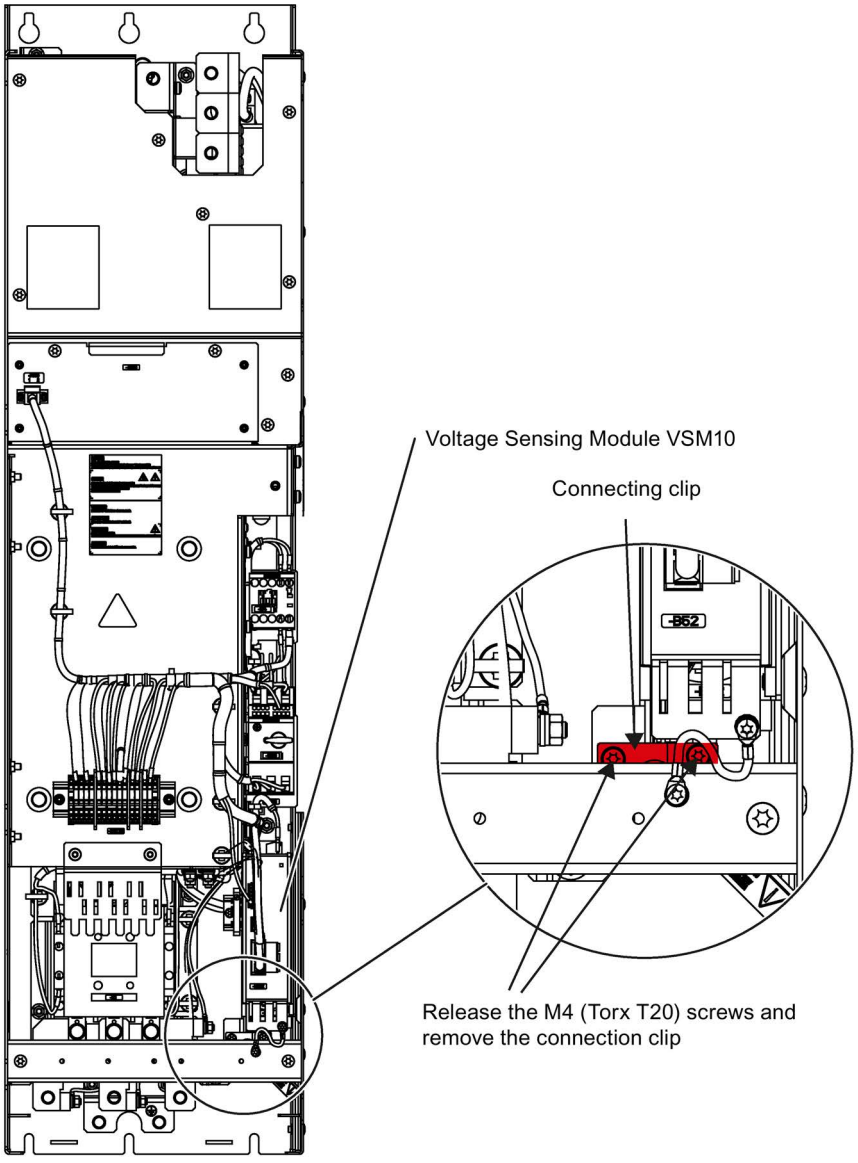



Figure 4-22 Removing the connection clip of the basic interference suppression module to ground in the Active Interface Module for frame size FI

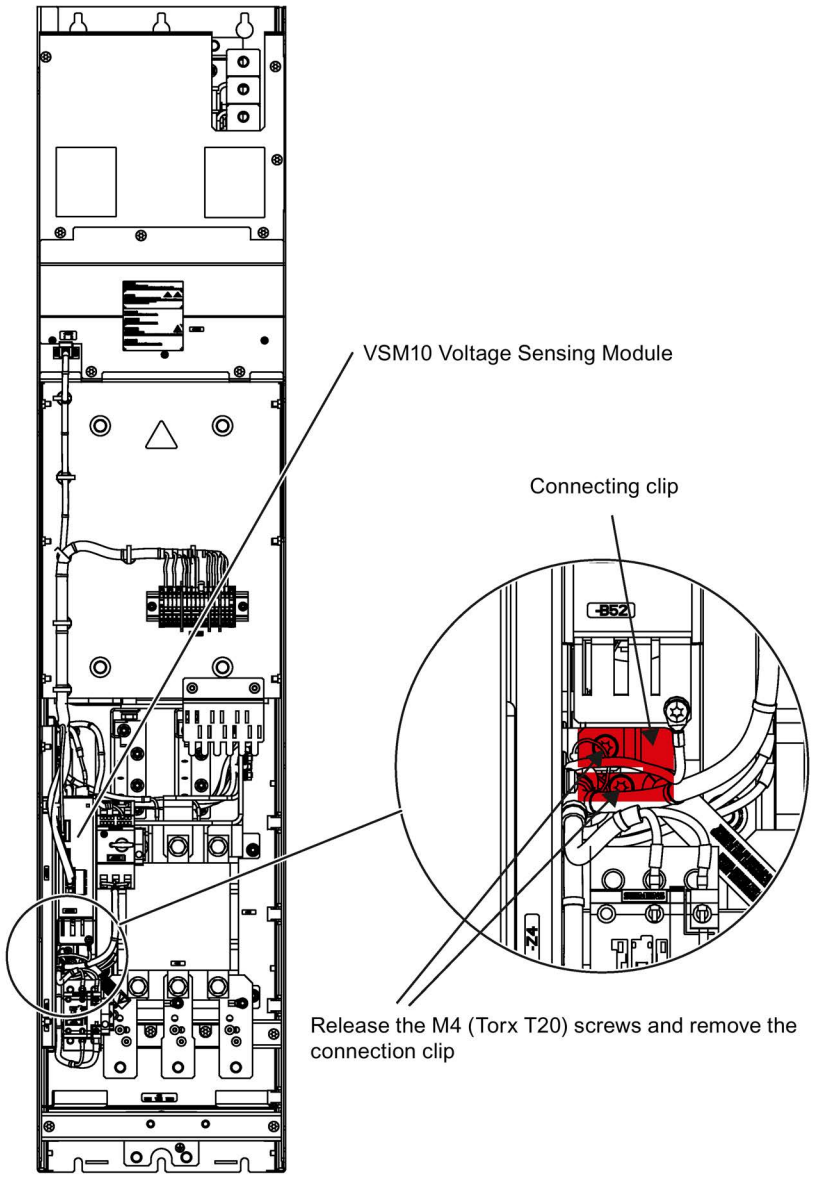



Figure 4-23 Removing the connection clip of the basic interference suppression module to ground in the Active Interface Module for frame size GI

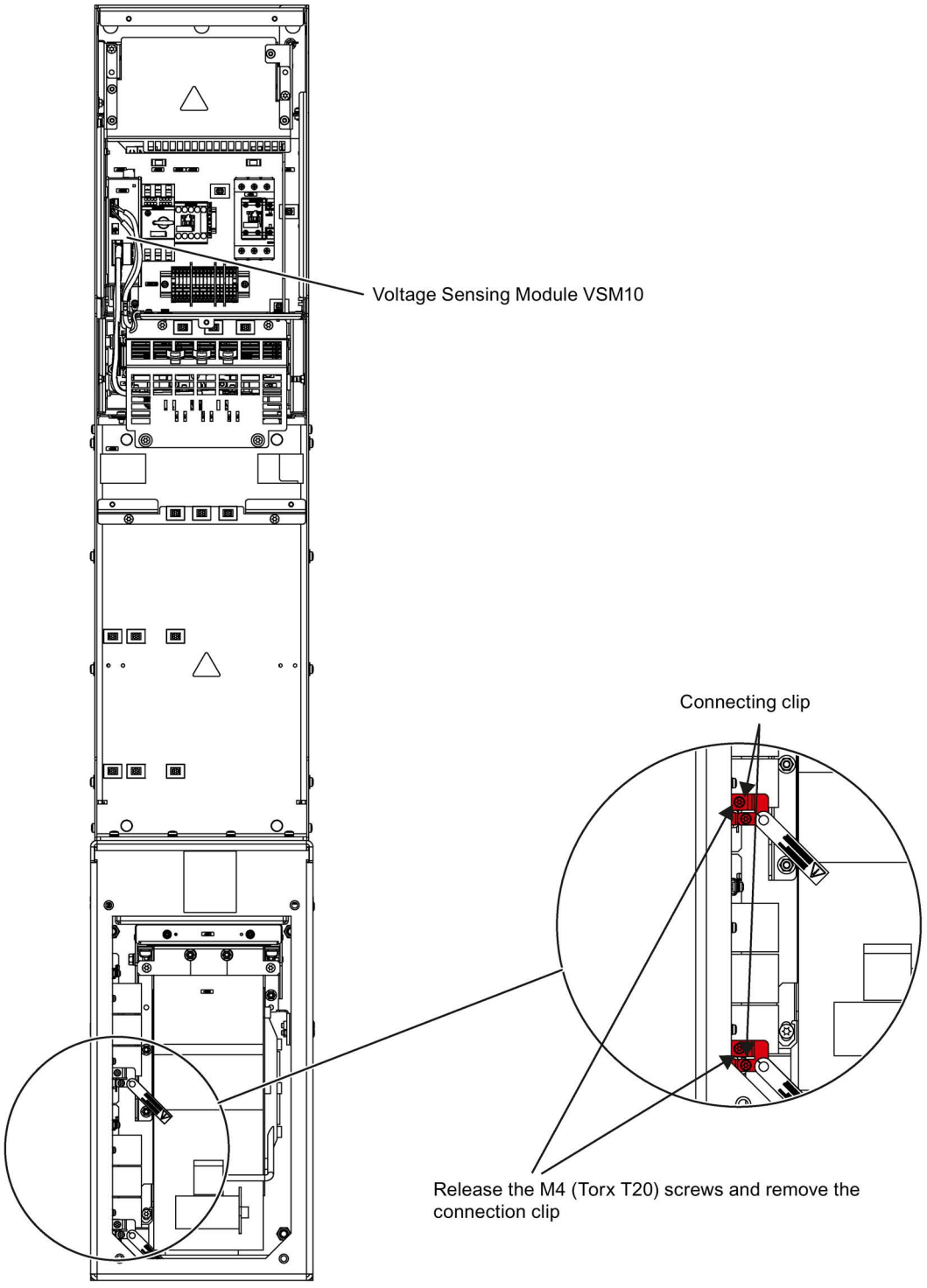



Figure 4-24 Removing the connection clip to the basic interference suppression module to ground in the Active Interface Module for frame size HI

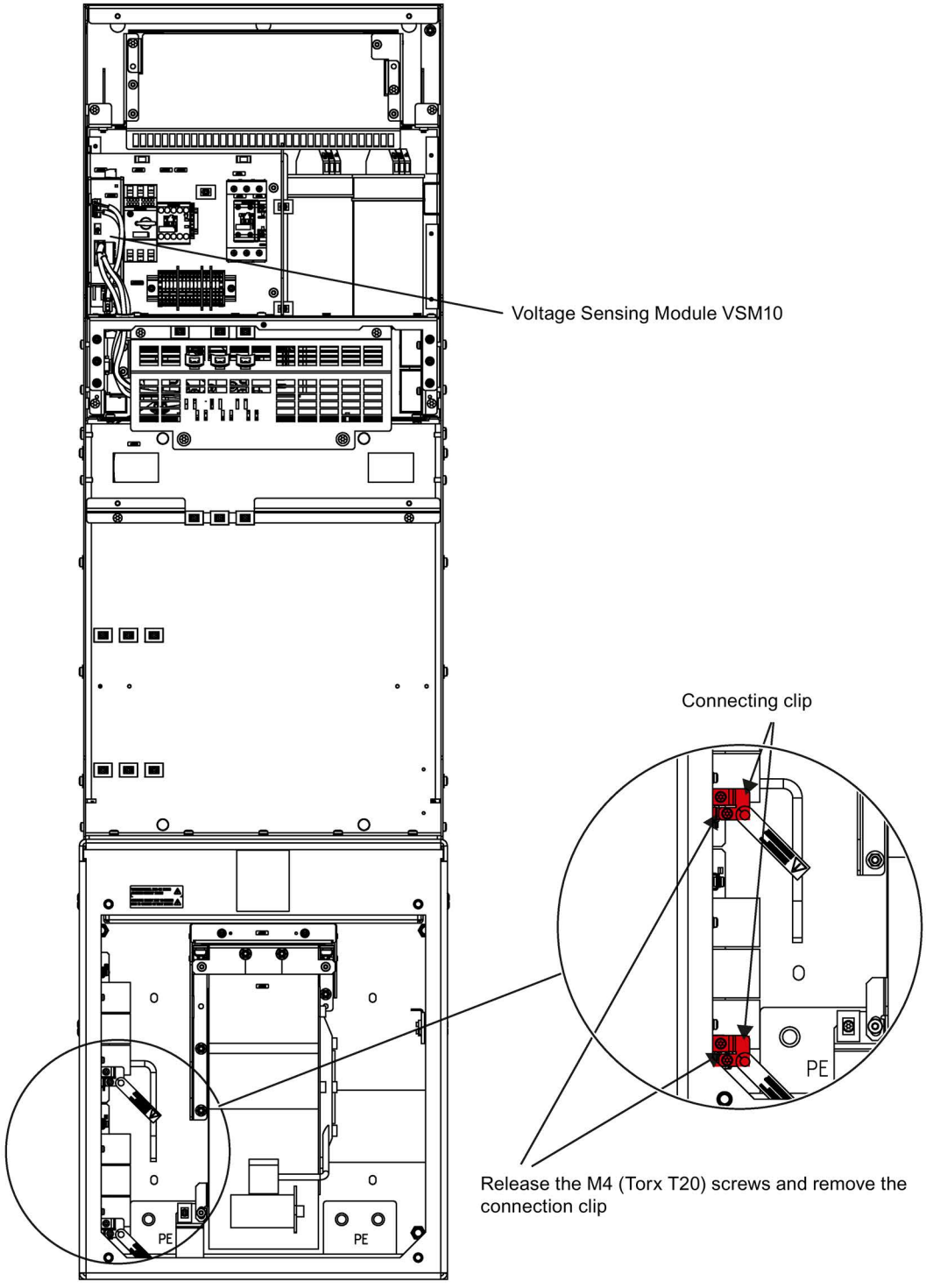



Figure 4-25 Removing the connection clip to the basic interference suppression module to ground in the Active Interface Module for frame size JI

## Active Line Connection Modules-2

The connection clip to the basic interference suppression module to ground is in the associated Active Interface Module, Chassis-2.

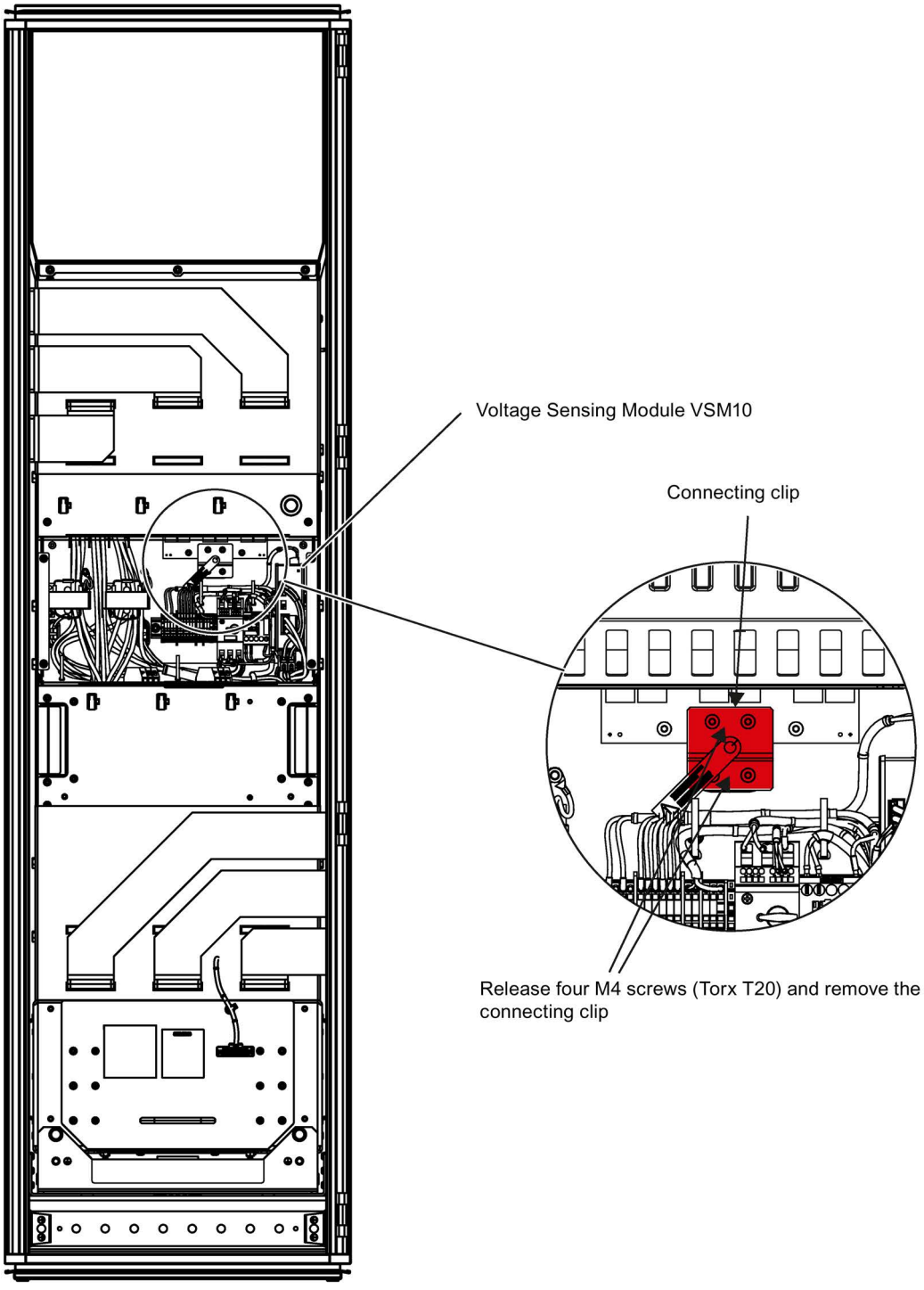



Figure 4-26 Removing the connection clip of the basic interference suppression module to ground in the Active Interface Module, Chassis-2

## Removing the connector jumper in the Voltage Sensing Module VSM10

If a Smart Line Module, Active Line Module or an Active Line Connection Module-2 is operated on a non-grounded system (IT supply system), at the Voltage Sensing Module (VSM 10), the connector jumper in terminal X530 on the lower side of the component must be removed.

The position of the Voltage Sensing Module must be obtained from the previous drawings.

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

## 4.6.10 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.

## 4.6.11 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.

## 4.6.12 Cable routing

### 4.6.12.1 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.

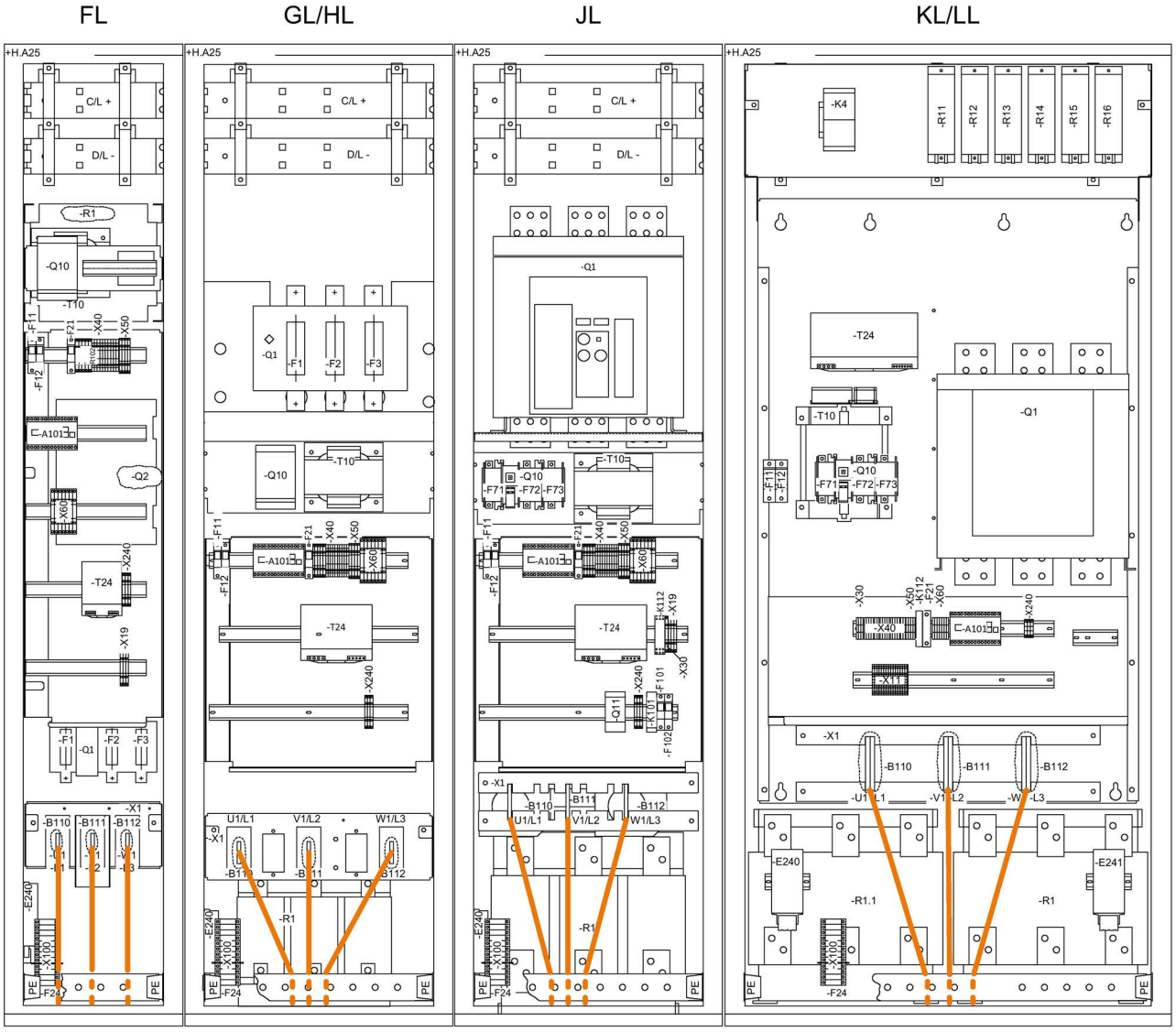
## 4.6.12.2 Cable routing for Line Connection Modules

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

Table 4- 18 Checklist for cabling or connection work for Line Connection Modules

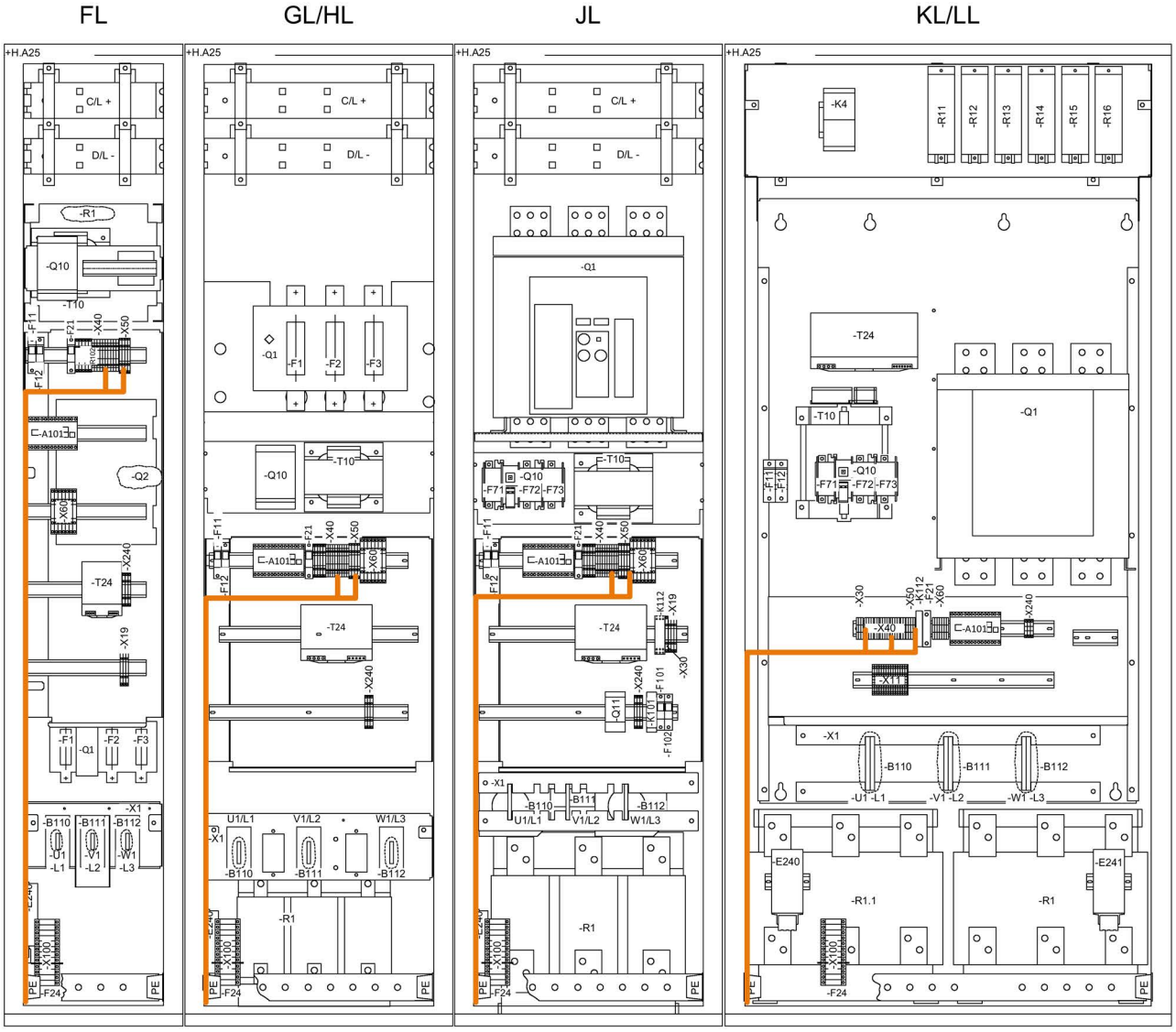
| Cable routing | Completed? |
|---|---|
| Cable for the line supply (L1, L2, L3, PE) | |
| Signal cables | |
| Note:<br>The "Basic rules for cable routing" and "Preparatory steps" described above must be observed whenever any cabling or connection work is performed! | |

## Cable routing for connecting to the line supply




1. Feed the infeed cable into the cabinet from the bottom.
2. Connect the PE cable to the grounding bar.
3. Feed the cable up through the cabinet to terminal block -X1.
4. Fasten the cable at suitable points.
5. Connect the cable to the terminal block.

## 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. Fasten the signal cables at suitable points.
4. Connect the signal cables to the terminal blocks.

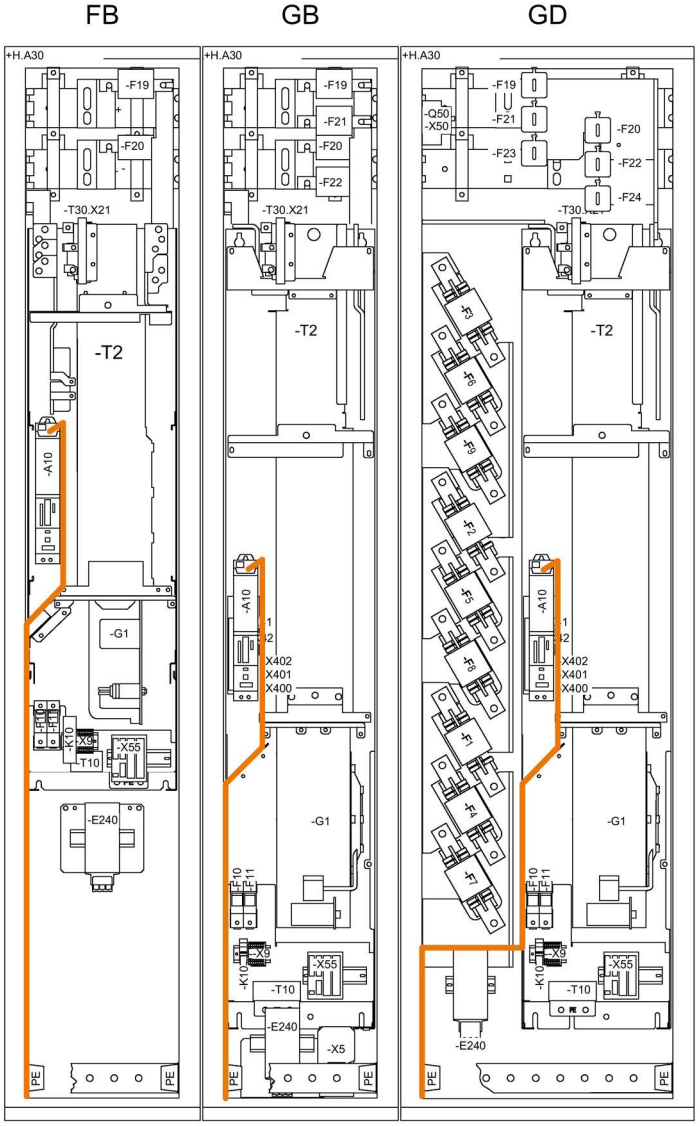
### 4.6.12.3 Cable routing for Basic Line Modules

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

Table 4- 19 Checklist for cabling or connection work for Basic Line Modules

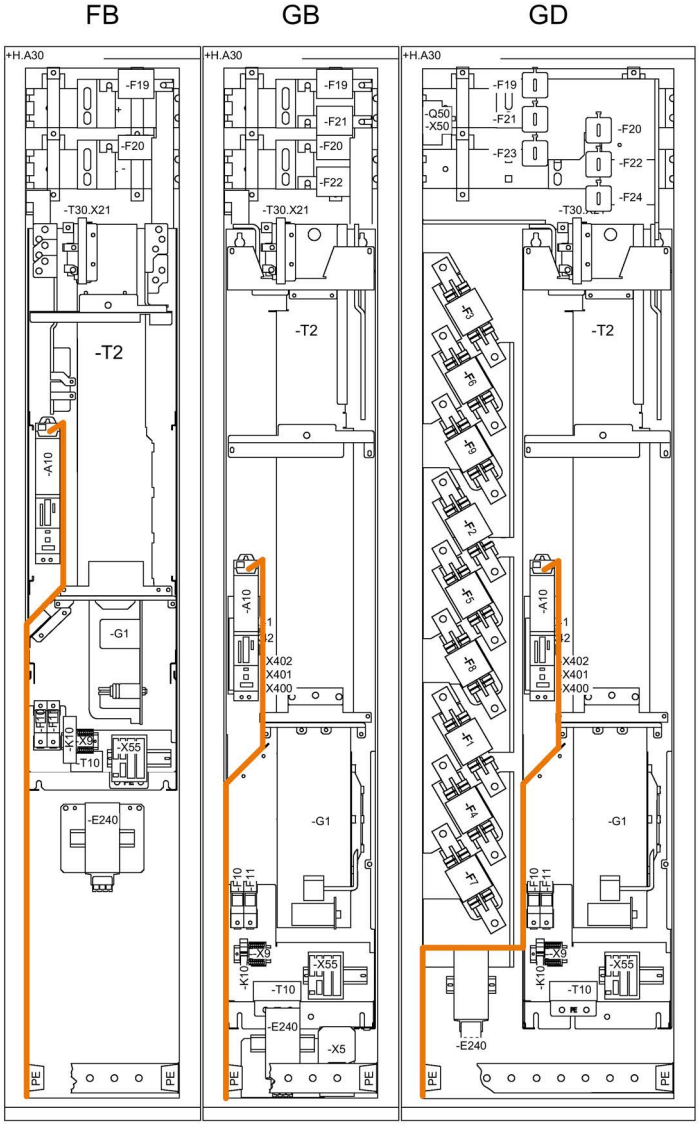
| **Cable routing** | **Completed?** |
|---|---|
| PROFIBUS cable or PROFINET cable to the Control Unit | |
| DRIVE-CLiQ connections / signal cables to the Control Unit | |
| Signal cables to the customer terminal block –X55 | |
| Note:<br>The "Basic rules for cable routing" and "Preparatory steps" described above must be observed whenever any cabling or connection work is performed! | |

## Cable routing for PROFIBUS or PROFINET connection to the Control Unit



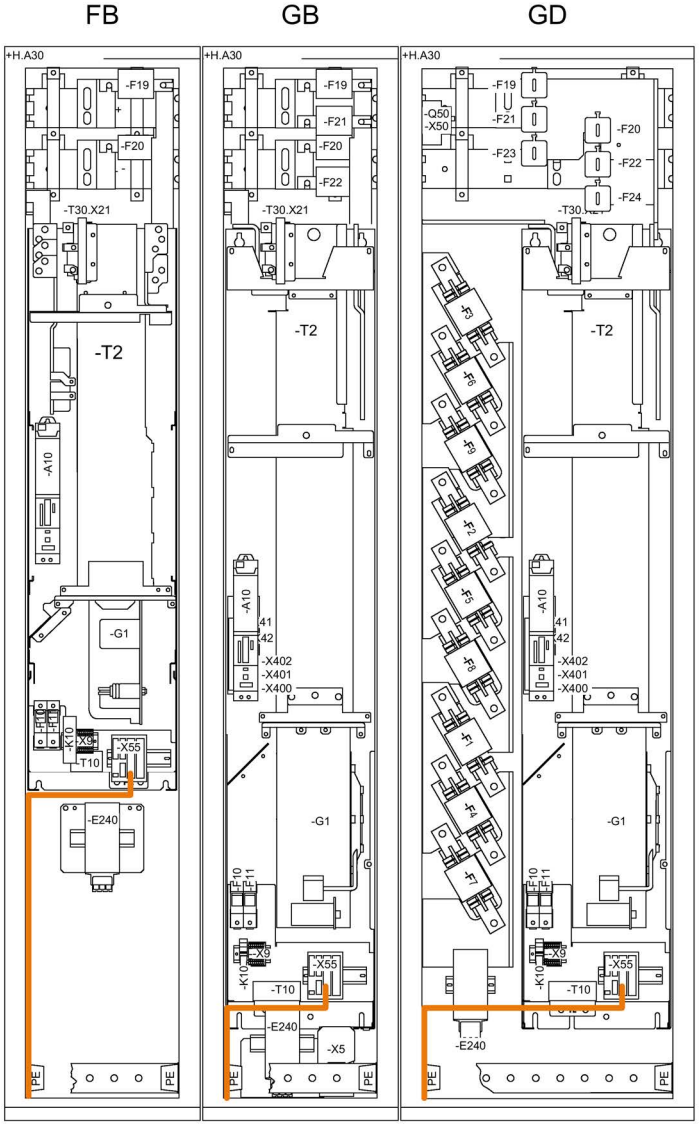

1. Feed the cable for the Control Unit into the cabinet from the bottom left.
2. Remove approx. 3 cm of the insulation at the level of the shield plate in the lower part of the cabinet and attach the cable there.
3. To secure the cable in accordance with EMC requirements, snap the clip onto the shield plate.
4. Use cable ties to secure the cable at suitable points.
5. Feed the cable up through the cabinet and, when it reaches the Control Unit, guide it up and to the right towards 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 Equipment Manual GH1 Control Units)

## Cable routing for DRIVE-CLiQ connections and signal cables




1. Feed the DRIVE-CLiQ/signal cable into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Feed the cable up through the cabinet and, when it reaches the Control Unit, guide it up and to the right towards 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.

## Cable routing to customer terminal strip -X55




1. Feed the cable for the customer terminal block into the cabinet from the bottom left.
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. Guide the cable further up into the cabinet and, when it reaches customer terminal block -X55, guide it to the left or right to -X55. 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 cables to the customer terminal block -X55.

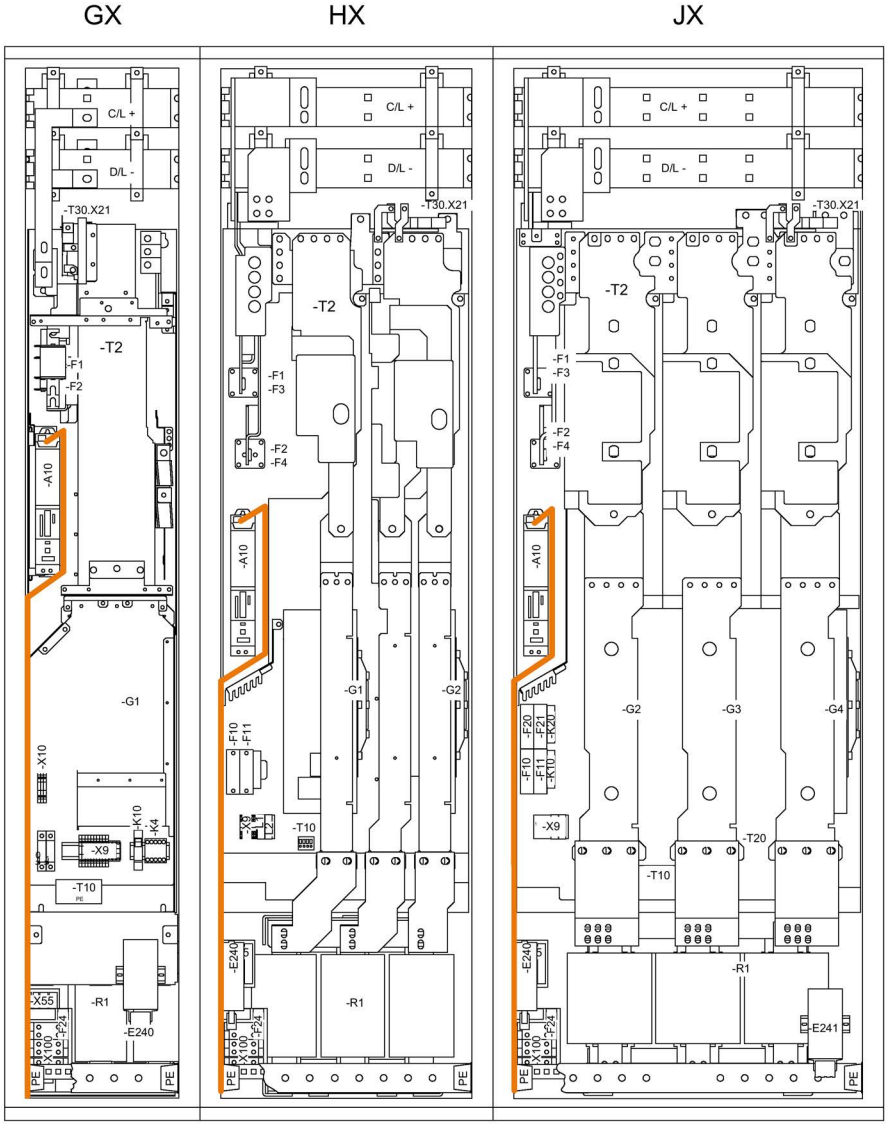
### 4.6.12.4 Cable routing for Smart Line Modules

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

Table 4- 20 Checklist for cabling or connection work for Smart Line Modules

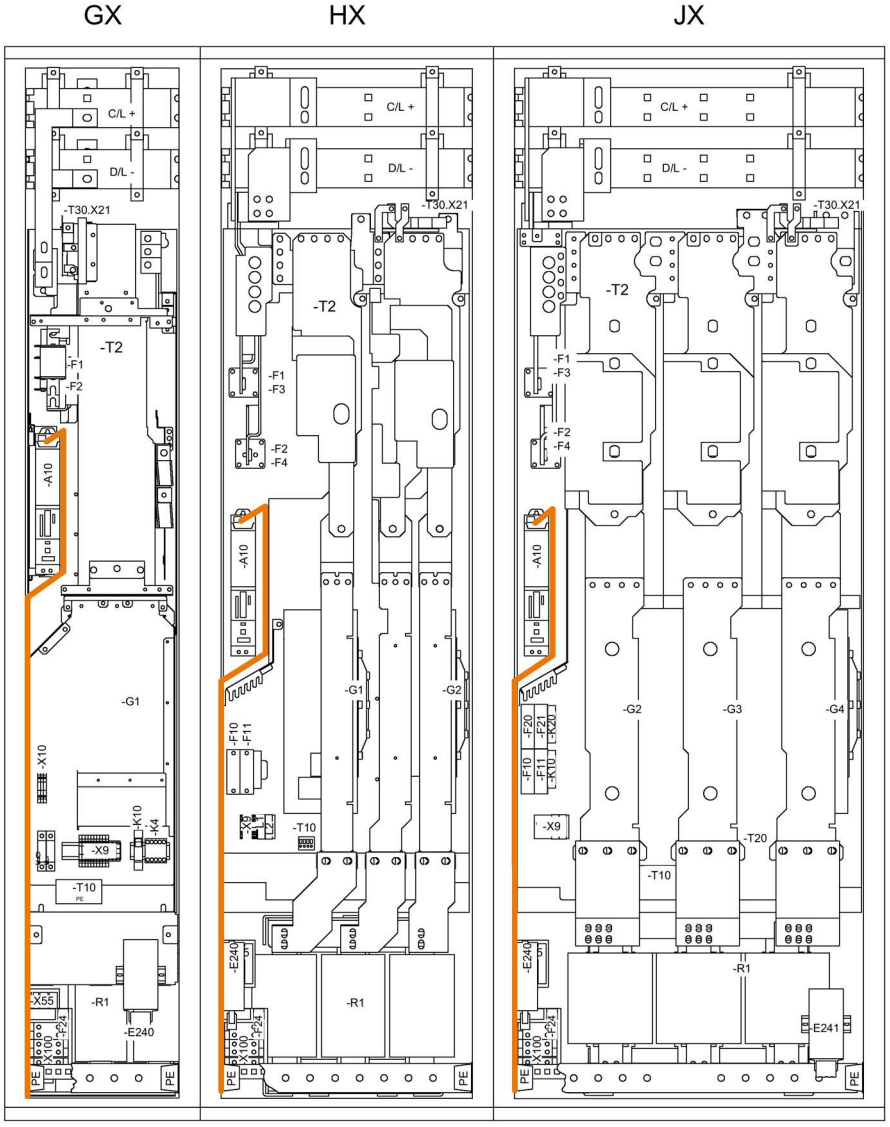
| **Cable routing** | **Completed?** |
|---|---|
| PROFIBUS cable or PROFINET cable to the Control Unit | |
| DRIVE-CLiQ connections / signal cables to the Control Unit | |
| Signal cables to customer terminal strip -X55 | |
| Note:<br>The "Basic rules for cable routing" and "Preparatory steps" described above must be observed whenever any cabling or connection work is performed! | |

## Cable routing for PROFIBUS or PROFINET connection to the Control Unit



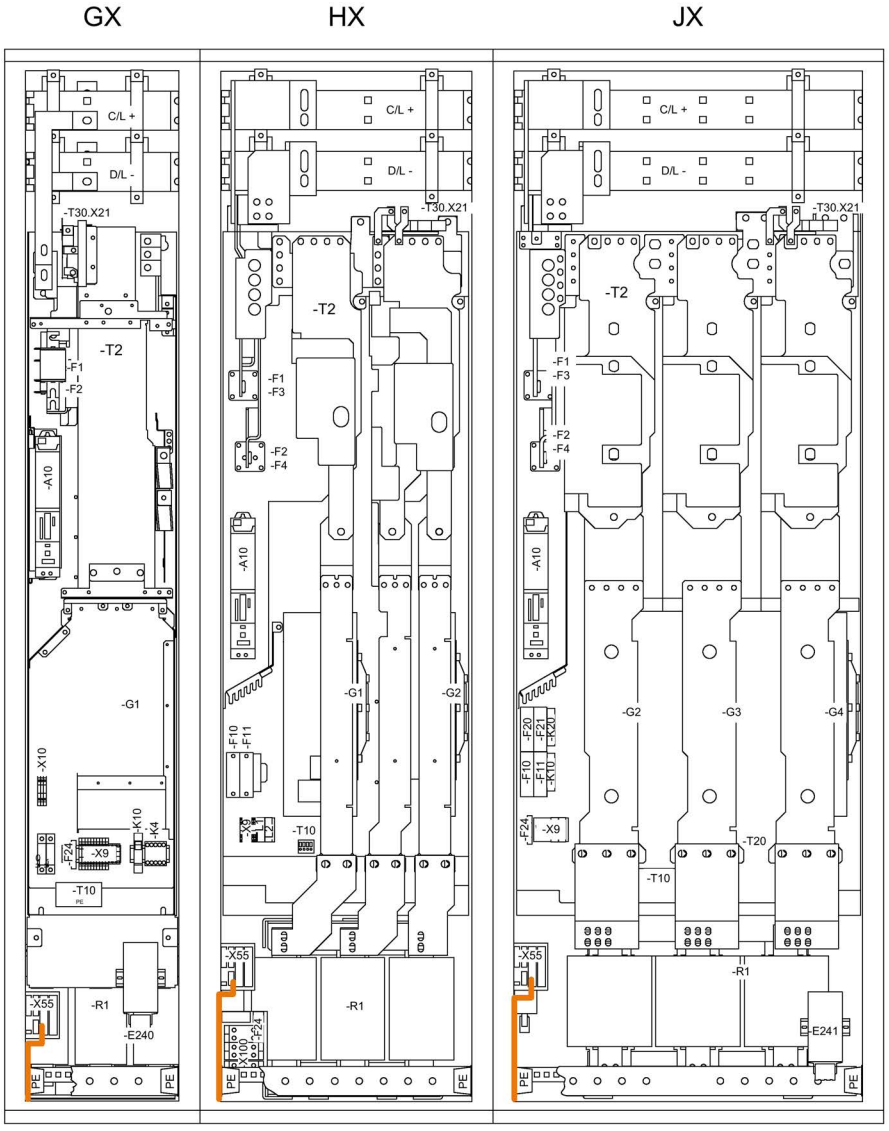

1. Feed the cable for the Control Unit into the cabinet from the bottom left.
2. Remove approx. 3 cm of the insulation at the level of the shield plate in the lower part of the cabinet and attach the cable there.
3. To secure the cable in accordance with EMC requirements, snap the clip onto the shield plate.
4. Use cable ties to secure the cable at suitable points.
5. Feed the cable up through the cabinet and, when it reaches the Control Unit, guide it up and to the right towards 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 Equipment Manual GH1 Control Units)

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




1. Feed the DRIVE-CLiQ/signal cable into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Feed the cable up through the cabinet and, when it reaches the Control Unit, guide it up and to the right towards 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.

## Cable routing to customer terminal strip -X55




1. Feed the cable for the customer terminal block into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Guide the cable further up into the cabinet and, when it reaches customer terminal block -X55, guide it to the left or right to -X55. 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 the cables to the customer terminal block -X55.

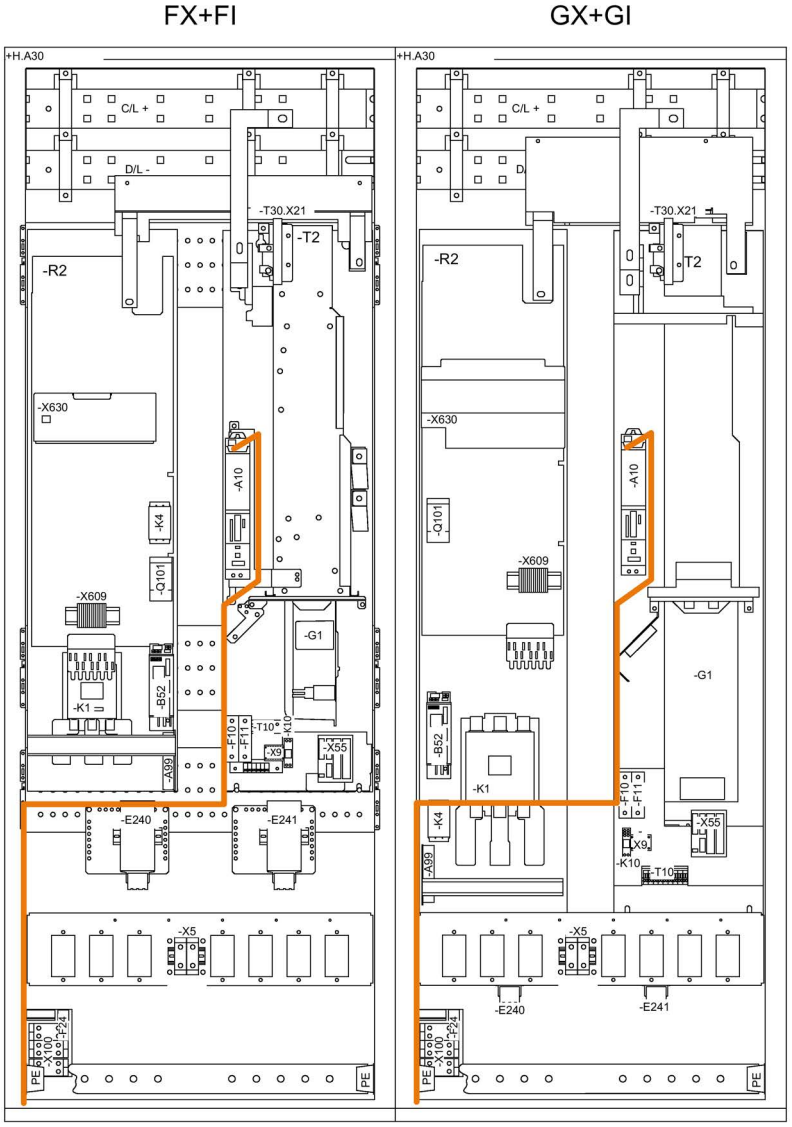
### 4.6.12.5 Cable routing for Active Line Modules

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

Table 4- 21 Checklist for cabling or connection work for Active Line Modules

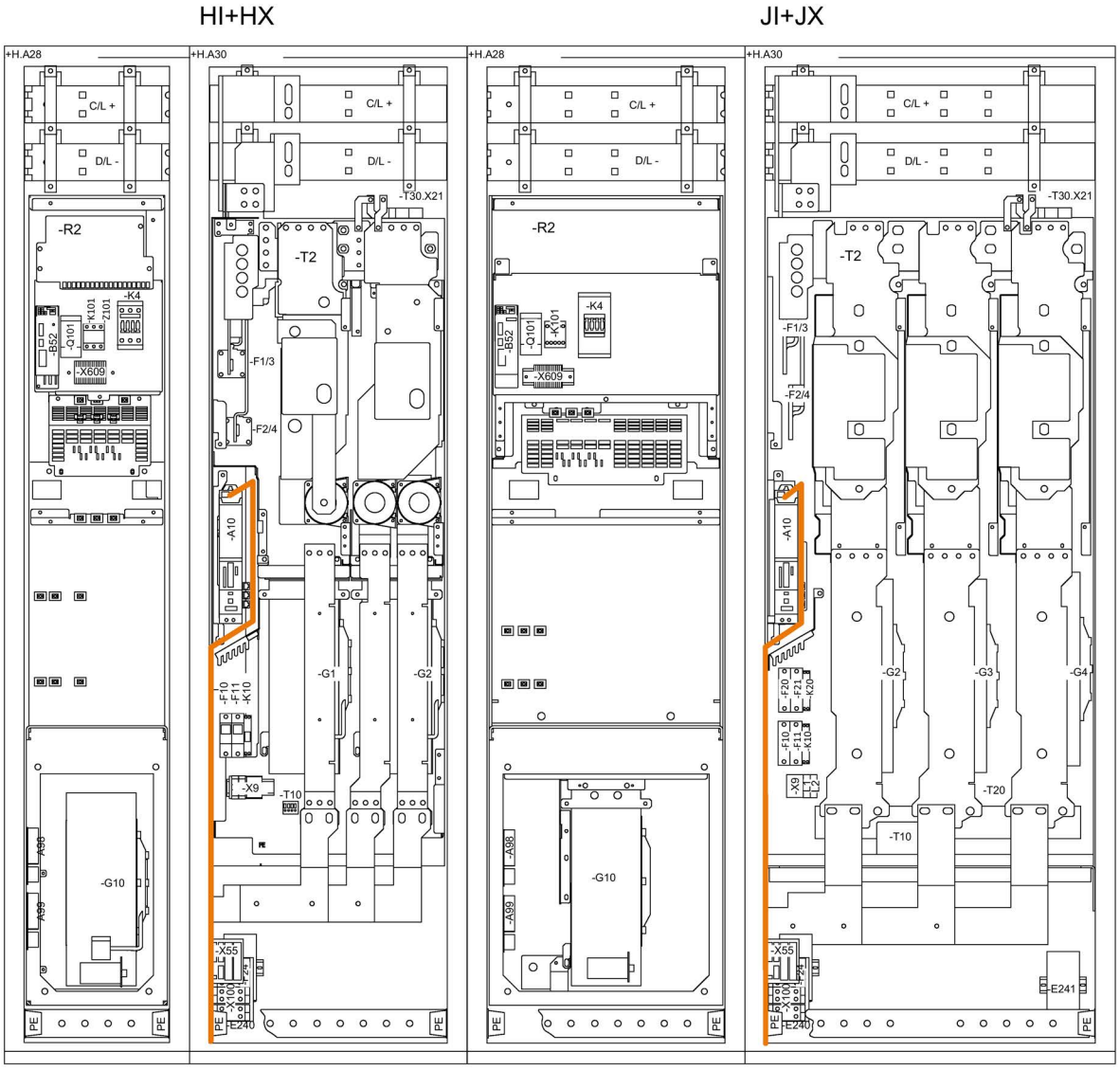
| **Cable routing** | **Completed?** |
|---|---|
| PROFIBUS cable or PROFINET cable to the Control Unit | |
| DRIVE-CLiQ connections / signal cables to the Control Unit | |
| Signal cables to the customer terminal block –X55 | |
| Note:<br>The "Basic rules for cable routing" and "Preparatory steps" described above must be observed whenever any cabling or connection work is performed! | |

## Cable routing for PROFIBUS or PROFINET connection to the Control Unit, frame sizes FX+FI and GX+GI



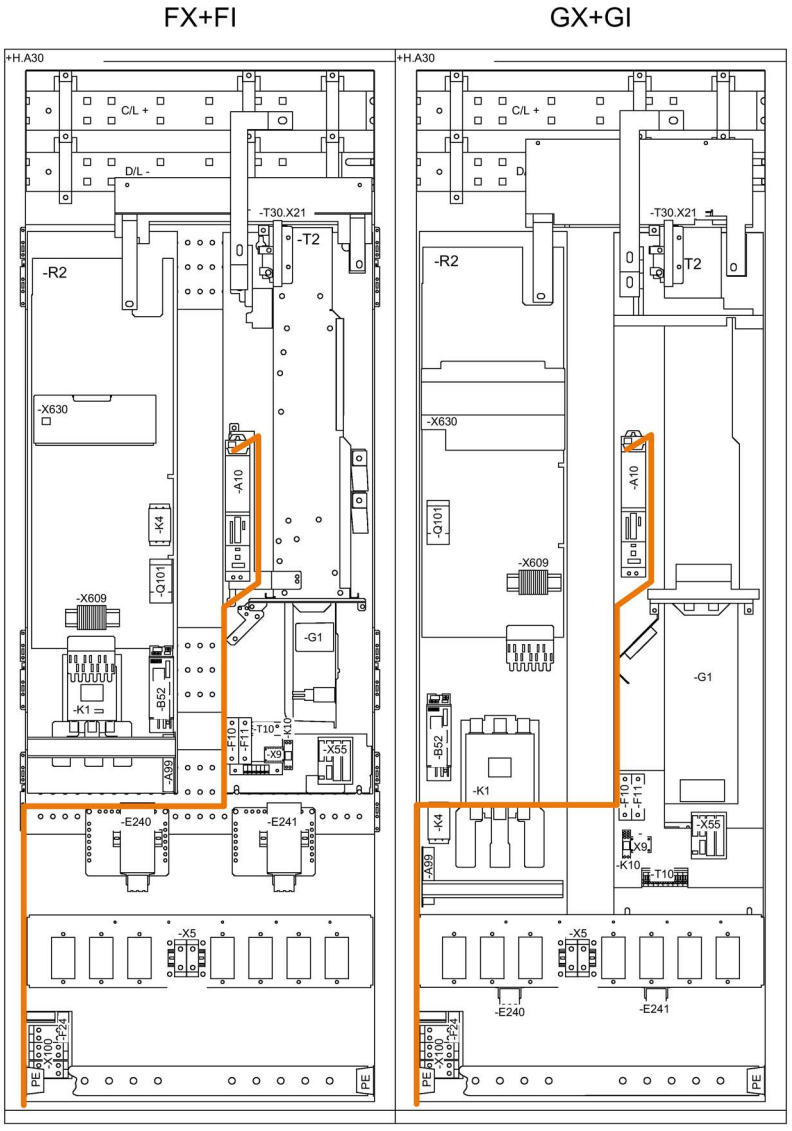

1. Feed the cable for the Control Unit into the cabinet from the bottom left.
2. Remove approx. 3 cm of the insulation at the level of the shield plate in the lower part of the cabinet and attach the cable there.
3. To secure the cable in accordance with EMC requirements, snap the clip onto the shield plate.
4. Use cable ties to secure the cable at suitable points.
5. Feed the cable up through the cabinet and, when it reaches the Control Unit, guide it up and to the right towards 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 Equipment Manual GH1 Control Units)

## Cable routing for PROFIBUS or PROFINET connection to the Control Unit, frame sizes HX+HI and JX+JI



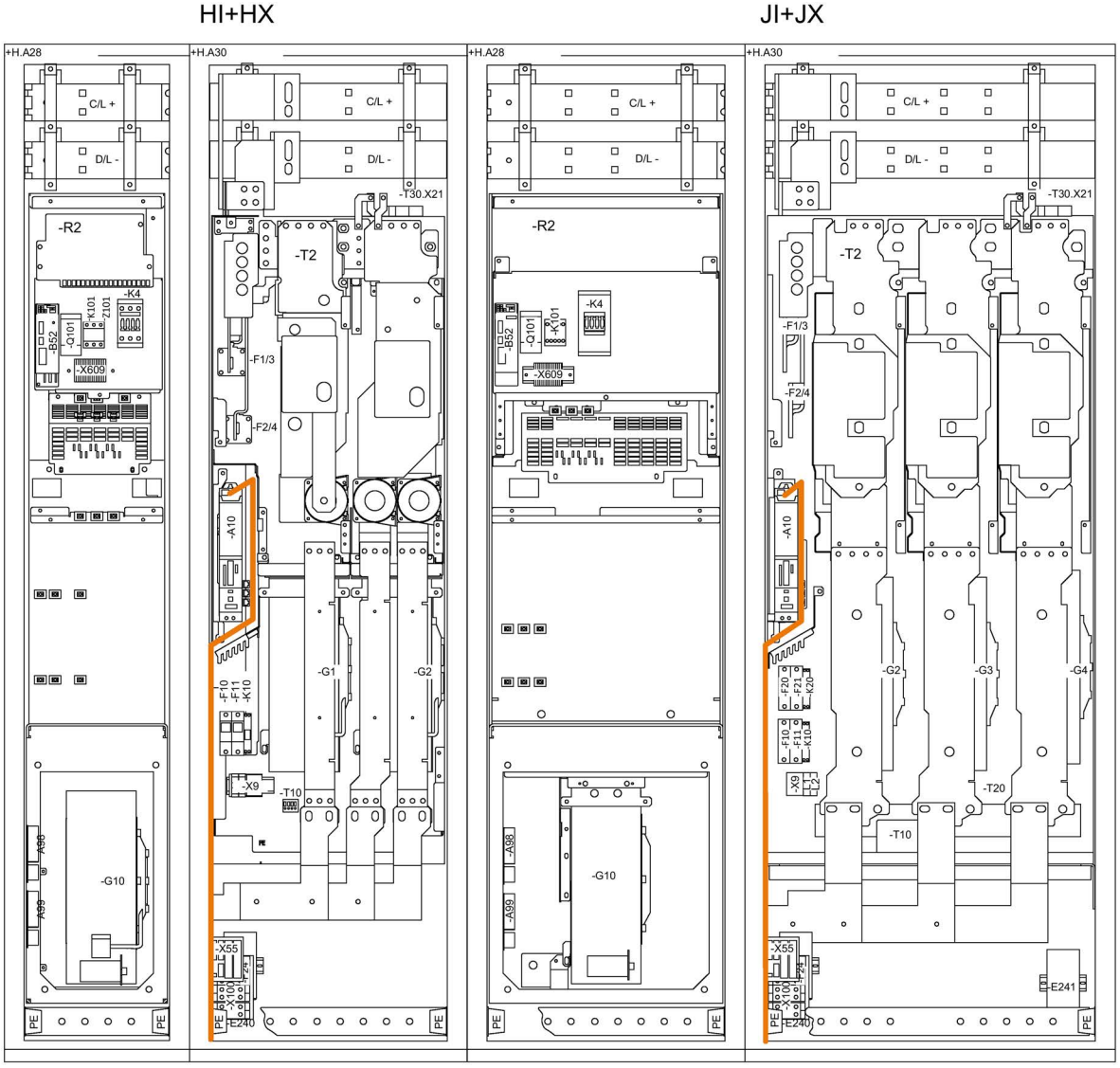

1. Feed the cable for the Control Unit into the cabinet from the bottom left.
2. Remove approx. 3 cm of the insulation at the level of the shield plate in the lower part of the cabinet and attach the cable there.
3. To secure the cable in accordance with EMC requirements, snap the clip onto the shield plate.
4. Use cable ties to secure the cable at suitable points.
5. Feed the cable up through the cabinet and, when it reaches the Control Unit, guide it up and to the right towards 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 Equipment Manual GH1 Control Units)

## Cable routing for DRIVE-CLiQ connections and signal cables, frame sizes FX+FI and GX+GI



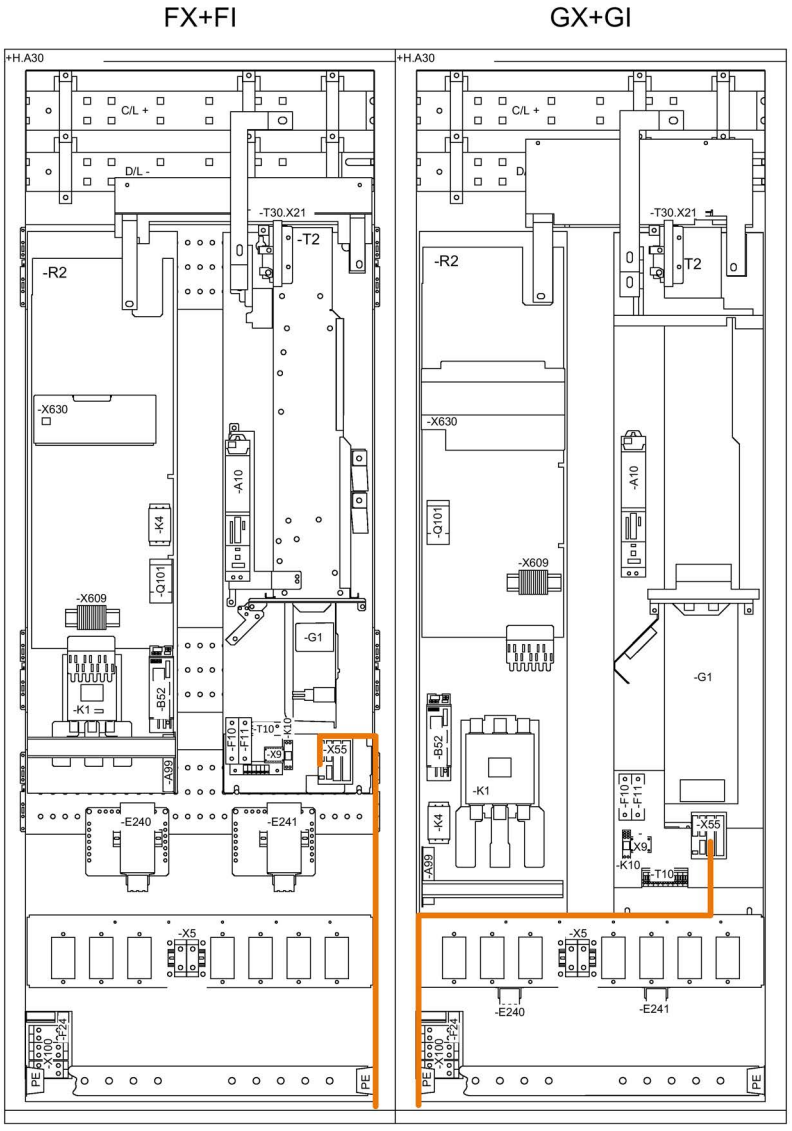

1. Feed the cable for the DRIVE-CLiQ/signal cables into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Feed the cable up through the cabinet and, when it reaches the Control Unit, guide it up and to the right towards the Control Unit. When doing so, route 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 or signal cable to the Control Unit.

## Cable routing for DRIVE-CLiQ connections and signal cables, frame sizes HX+HI and JX+JI



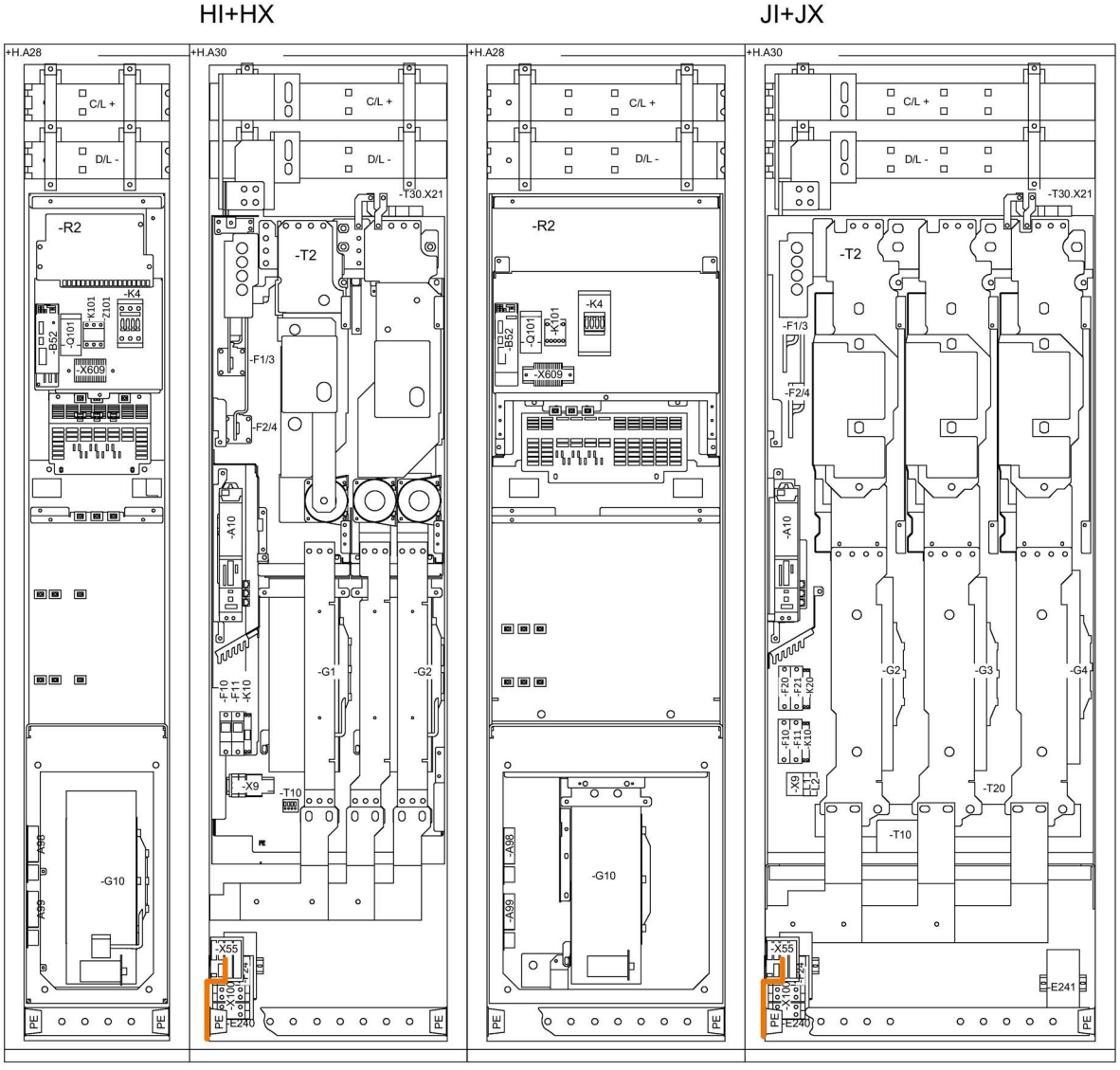

1. Feed the cable for the DRIVE-CLiQ/signal cables into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Feed the cable up through the cabinet and, when it reaches the Control Unit, guide it up and to the right towards the Control Unit. When doing so, route 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 or signal cable to the Control Unit.

## Cable routing to customer terminal strip -X55, frame sizes FX+FI and GX+GI




1. Feed the cable for the customer terminal block into the cabinet from the bottom right (frame size FX+FI) or bottom left (frame size GX+GI).
2. Use cable ties to secure the cable at suitable points.
3. Guide the cable further up into the cabinet and, when it reaches customer terminal block -X55, guide it to the left or right to -X55. 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 the cables to the customer terminal block -X55.

## Cable routing to customer terminal strip -X55, frame sizes HX+HI and JX+JI




1. Feed the cable for the customer terminal block into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Guide the cable further up into the cabinet and, when it reaches customer terminal block -X55, guide it to the left or right to -X55. 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 the cables to the customer terminal block -X55.

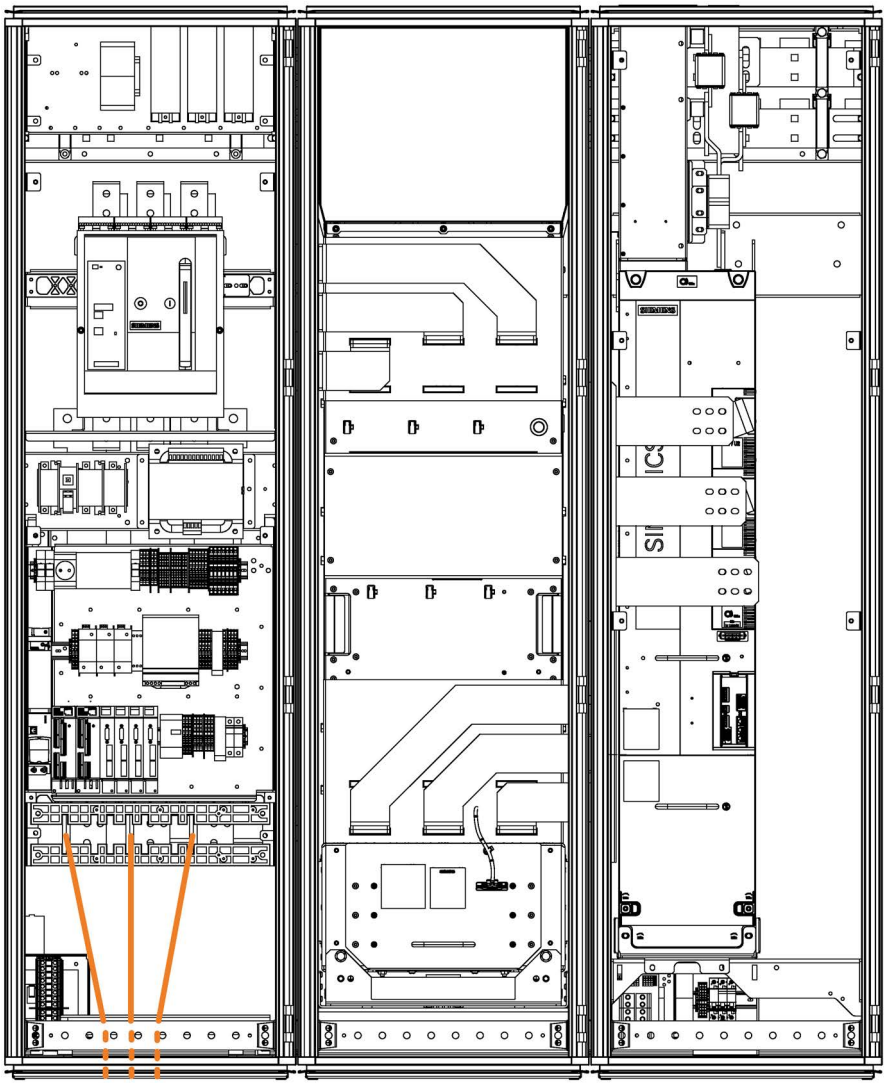
### 4.6.12.6 Cable routing for Active Line Connection Modules-2

For Active Line Connection Modules-2, customers must carry out the following cabling or connection work:

Table 4- 22 Checklist for cable routing and connection work for Active Line Connection Modules-2

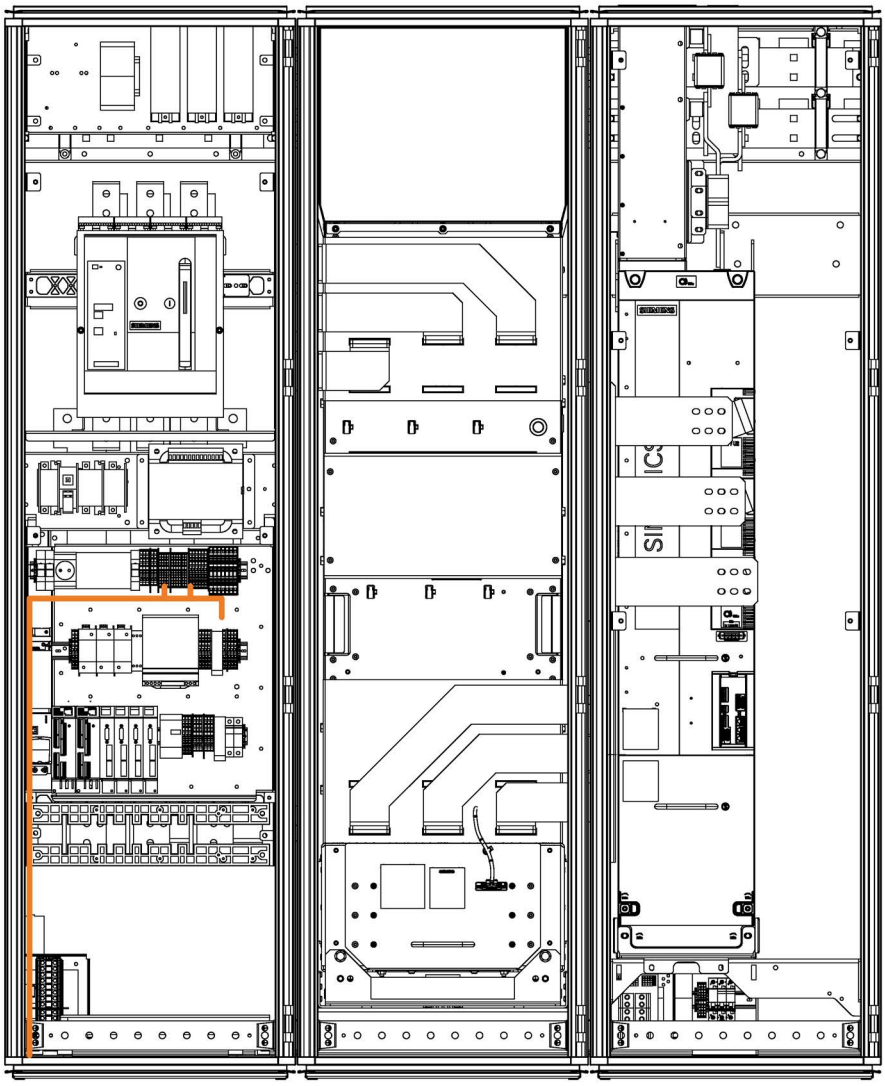
| **Cable routing** | **Completed?** |
|---|---|
| Cable for the line supply (L1, L2, L3, PE) | |
| Signal cables to terminals -X30, -X40, -X50 | |
| PROFIBUS cable or PROFINET cable to the Control Unit | |
| DRIVE-CLiQ connections / signal cables to the Control Unit | |
| Note:<br>The "Basic rules for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

## Cable routing for connecting to the line supply



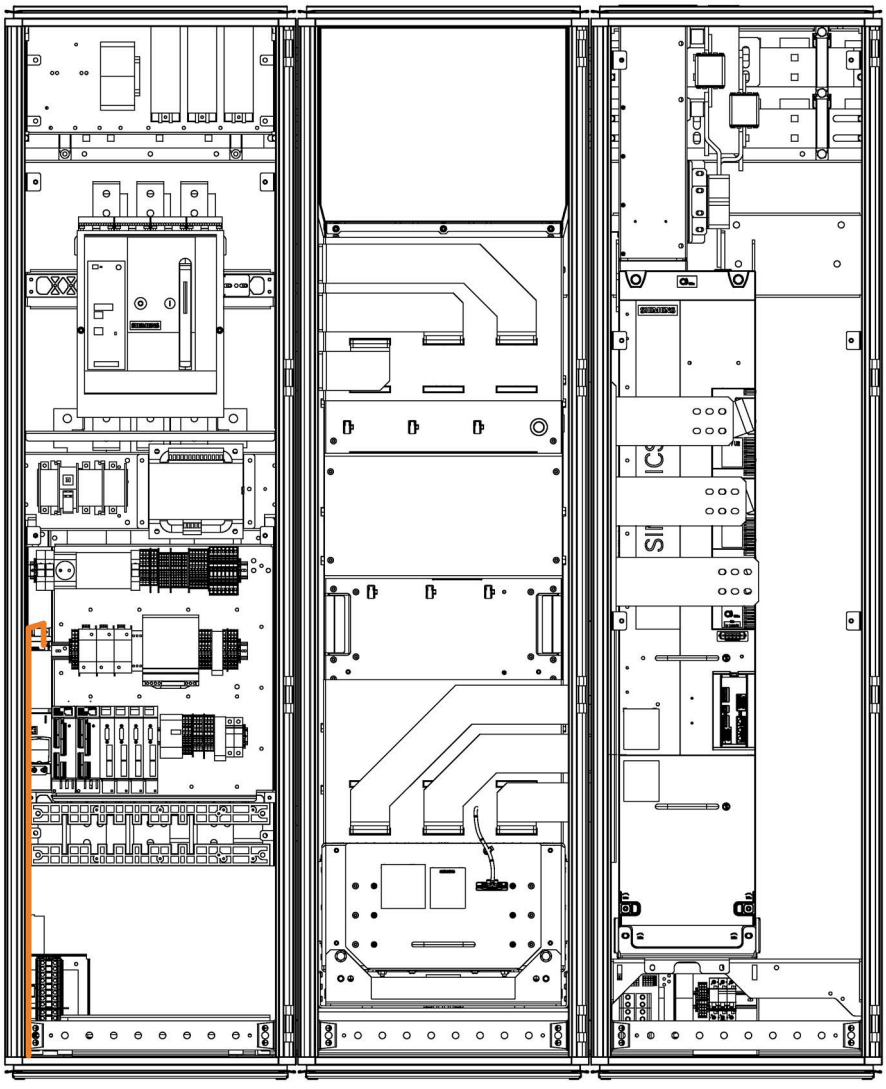
1. Feed the infeed cable into the cabinet from the bottom.
2. Connect the PE cable to the grounding bar.
3. Route the cable up through the cabinet to the line connections -X1 (-U1/-L1, -V1/-L2, -W1/-L3).
4. Fasten the cable at suitable points.
5. Connect the cable to the connections.

## Routing signal cables



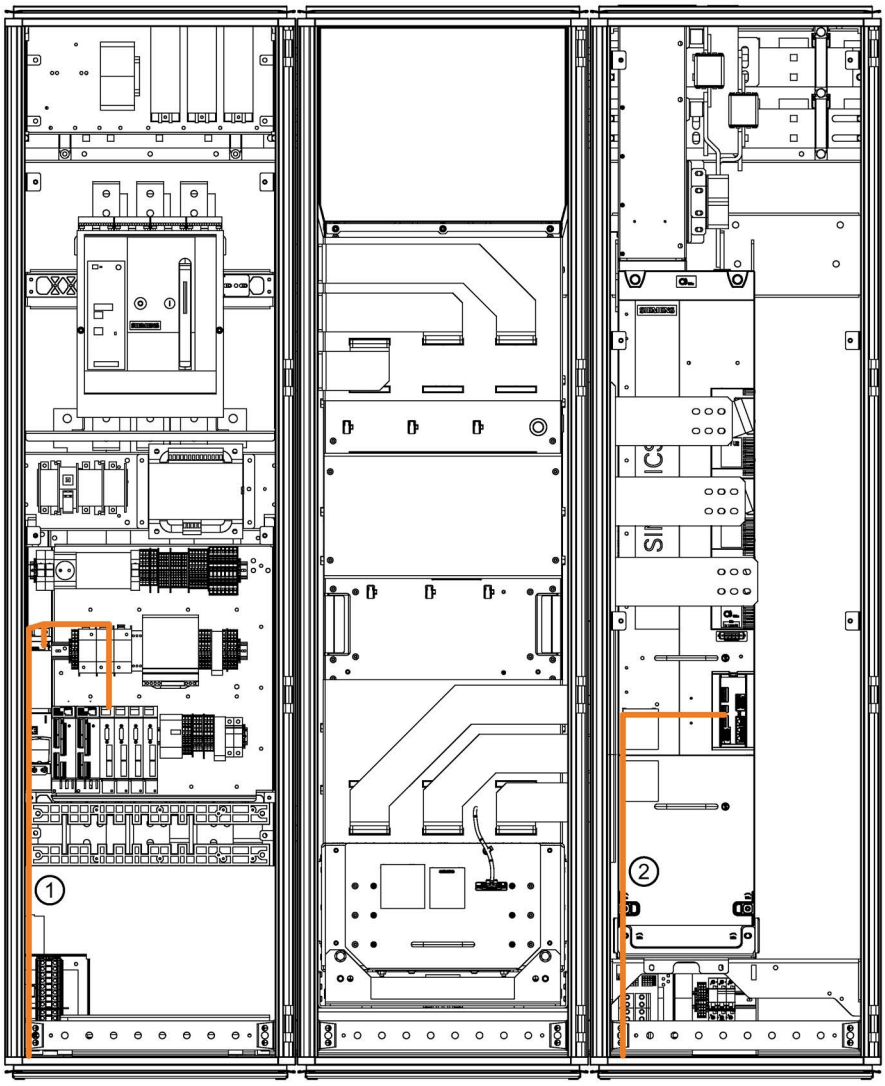
1. Route the signal cables into the cabinet from the bottom left.
2. Route the signal cables up through the cabinet to terminal blocks -X30, -X40 or -X50.
3. Fasten the signal cables at suitable points.
4. Connect the signal cables to the terminal blocks.

## 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 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 Equipment 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 ①.
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 ②.
7. Use cable ties to secure the cable at suitable points.
8. Route the cable further in the cabinet up to the height of the signal connections. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
9. Connect the DRIVE-CLiQ/signal cable at the appropriate interfaces.

### 4.6.12.7 Cable routing for Booksize Base Cabinets and Booksize Cabinet Kit

**Note**

**Cable routing**

The procedure is the same as that for the Cabinet Modules Motor Module in chassis format. (→ See Section "Cable routing for Motor Modules in chassis format")

### Cable routing of motor cable

**Note**

**Connecting the motor cables**

The motor cables are easy to connect to terminals in the lower part of the customer connection area.

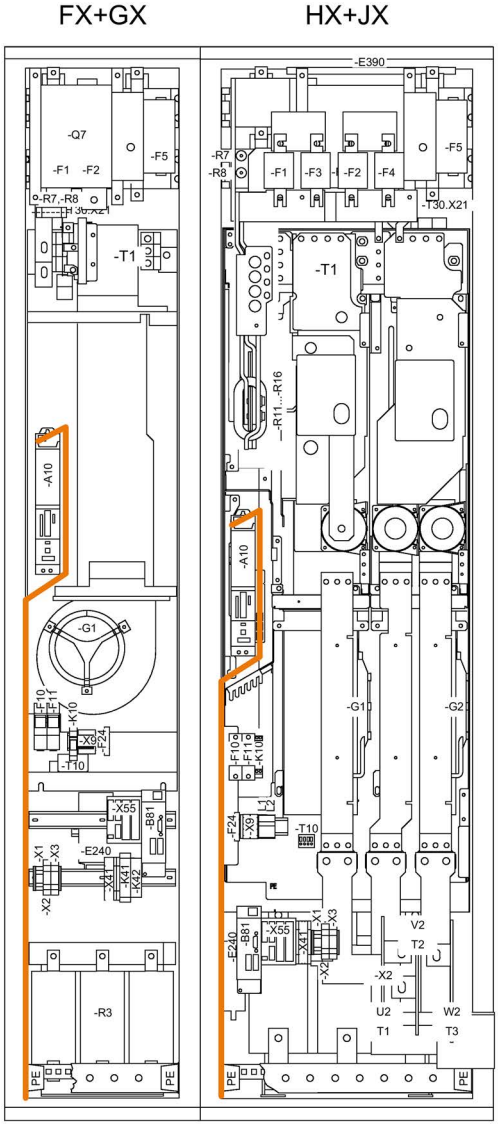
### 4.6.12.8 Cable routing for Motor Modules in the chassis format

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

Table 4- 23 Checklist for cabling or connection work for Motor Modules in the chassis format

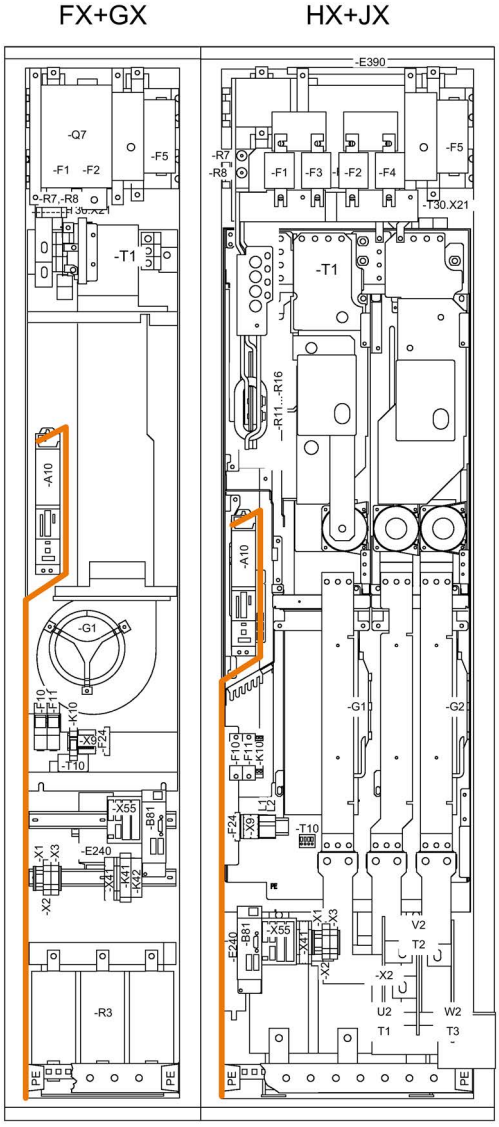
| Cable routing | Completed? |
|---|---|
| PROFIBUS cable or PROFINET cable to the Control Unit | |
| DRIVE-CLiQ connections / signal cables to the Control Unit | |
| Signal cables to customer terminal strip -X55 | |
| Option K82, terminal module for controlling safety functions "Safe Torque Off" and "Safe Stop 1" | |
| Option K87, Terminal Module TM54F | |
| Option K88, Safe Brake Adapter SBA 230 VAC | |
| Signal cables to Sensor Module SMC10/20/30 (-B81/-B82/-B83) | |
| Cable connection between motor and Motor Module | |
| Note:<br>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



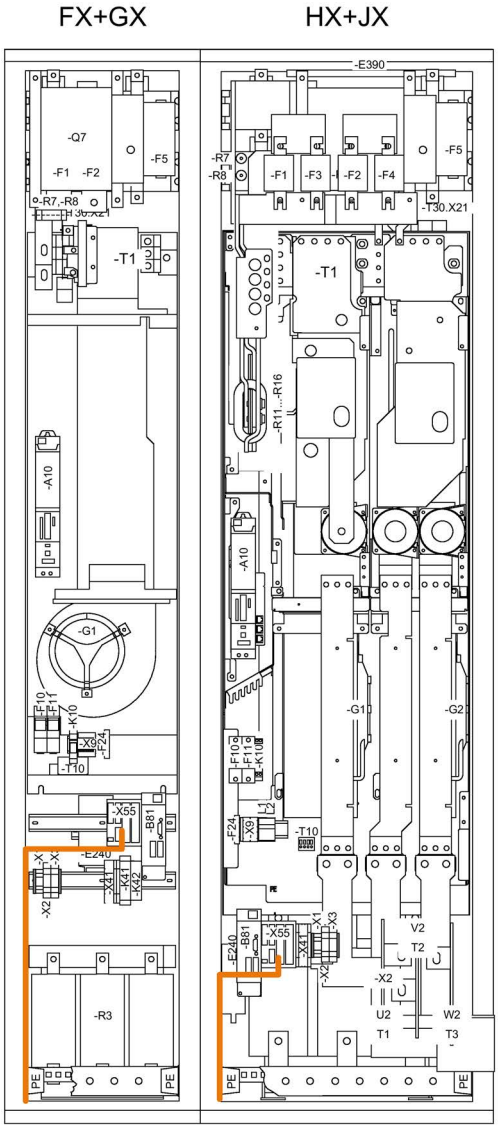

1. Feed the cable for the Control Unit into the cabinet from the bottom left.
2. Remove approx. 3 cm of the insulation at the level of the shield plate in the lower part of the cabinet and attach the cable there.
3. To secure the cable in accordance with EMC requirements, snap the clip onto the shield plate.
4. Use cable ties to secure the cable at suitable points.
5. Feed the cable up through the cabinet and, when it reaches the Control Unit, guide it up and to the right towards 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 Equipment Manual GH1 Control Units)

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




1. Feed the DRIVE-CLiQ/signal cable into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Feed the cable up through the cabinet and, when it reaches the Control Unit, guide it up and to the right towards 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.

## Cable routing of signal cables to customer terminal strip -X55




1. Feed the cable for the customer terminal block into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Guide the cable further up into the cabinet and, when it reaches customer terminal block -X55, guide it to the left or right to -X55. 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 the cables to the customer terminal block -X55.

## Cable routing for the "Safe Torque Off" and "Safe Stop 1" functions

**Note**
**Cable routing**

The procedure is the same as that for customer terminal block -X55.

Connect the cable to the terminals to control the functions.

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

## Cable routing for the Terminal Module TM54F

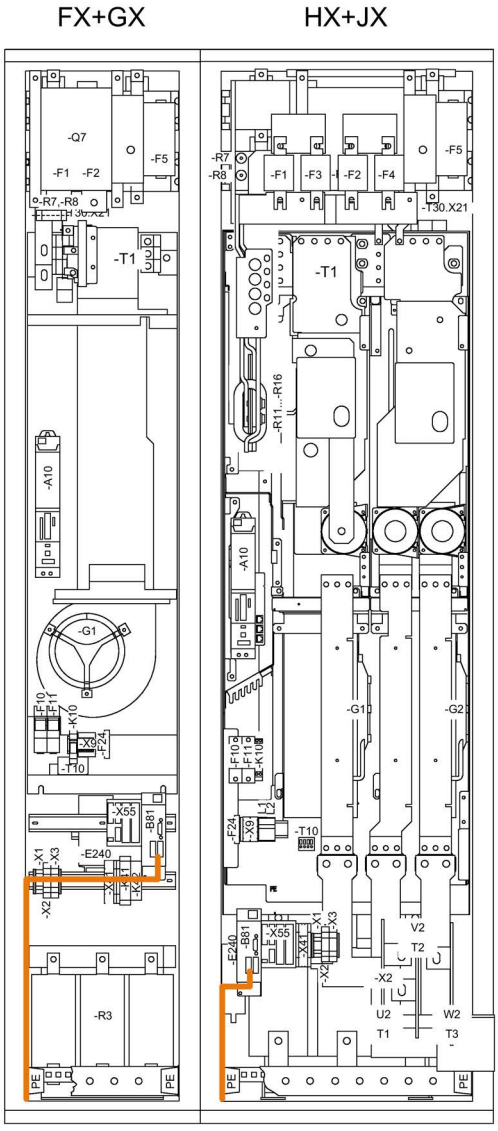
**Note**
**Cable routing**

The procedure is the same as that for customer terminal block -X55.

Connect the cable to the terminals to control the functions.

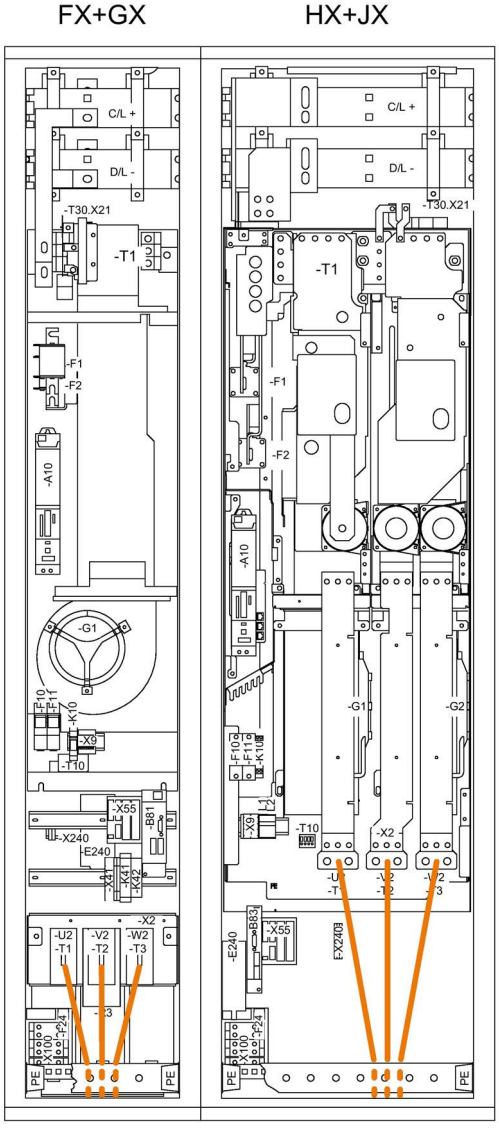
(→ See Chapter "Options", Section "K87, Terminal Module TM54F")

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




1. Feed the cable for the customer terminal block into the cabinet from the bottom left.
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. Guide 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 SMC10, 20 and 30))

## Cable routing for motor connection




1. Feed the cable into the cabinet from below.
2. Feed the cable up through the cabinet to the motor connections -U2/-T1, -V2/-T2, -W2/-T3.
3. Fasten the cable at suitable points.
4. Connect the cable to the connections.

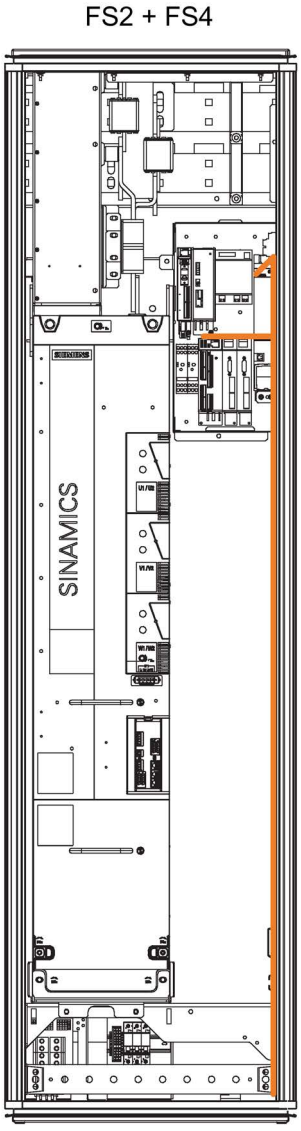
### 4.6.12.9 Cable routing for Motor Modules in the Chassis-2 format

For Motor Modules in the Chassis-2 format, the customer must carry out the following cabling or connection work:

Table 4- 24 Checklist for cabling or connection work for Motor Modules in the Chassis-2 format

| **Cable routing** | **Completed?** |
|---|---|
| PROFIBUS cable or PROFINET cable, DRIVE-CLiQ connections/signal cables to the Control Unit<br>Signal cables to option modules | |
| Signal cables to the terminal strips on the Motor Module Chassis-2 | |
| Cable connection between motor and Motor Module | |
| Note:<br>The "Basic rules for cable routing" and "Preparatory steps" described above must be observed whenever any cabling or connection work is performed! | |

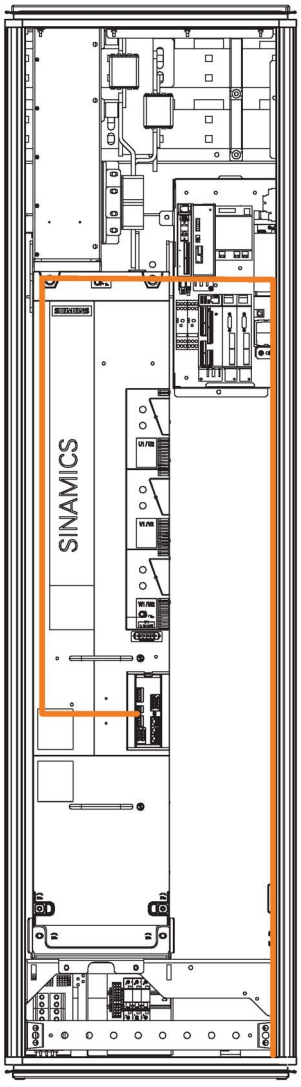
### Cable routing for PROFIBUS or PROFINET connection, signal cables to the Control Unit, signal cables to option modules




1. Introduce the signal cable from the bottom right in the cabinet, and route upwards in the cable duct.
2. At the height of the Control Unit or the option modules, route the cable out of the cable duct and route in parallel to the already installed standard cables in the cabinet.
3. Use cable ties to secure the cable at suitable points.
4. Connect the cable to the Control Unit or to the appropriate option modules.
   (→See SINAMICS S120 Equipment Manual Control Units and supplementary system components)

## Cable routing for signal cables to the terminal strips on the Motor Module Chassis-2

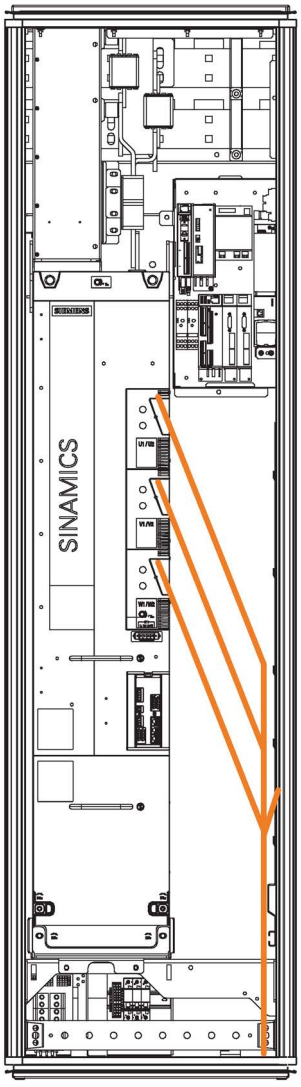
FS2 + FS4




1. Route the signal cable to the terminal strips from the bottom right in the cabinet, and route upwards in the cable duct.
2. At the height of the option modules, route the cable out of the cable duct to the left hand side of the Motor Modules Chassis-2, and then route downwards to the terminal strips.
3. Use cable ties to secure the cable at suitable points.
4. Connect the cable to the terminal strip.

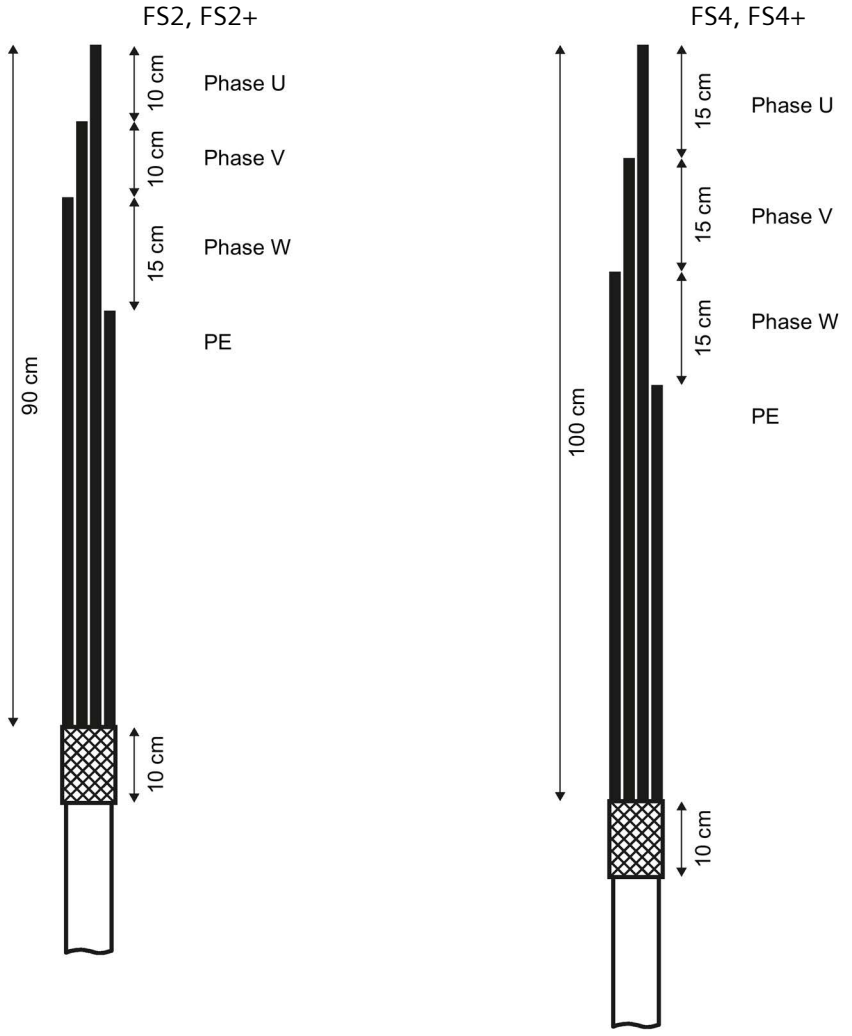
## Cable routing for motor connection

FS2 + FS4




1. Prepare the motor cable by stripping the insulation and cutting to length as shown in the following diagram.
2. Route the motor cable into the cabinet from below.
3. Fasten the motor cable to the cable retaining bar, and were applicable to the shield bar.
4. Measure the final lengths of the motor cable in the cabinet, and appropriately adapt the individual phases.
5. Attach the cable lugs to the individual phases.
6. Connect the cable to the motor connections.
7. Connect the PE cables to the PE connection plate.

Table 4- 25 Dimensions for stripping insulation and cutting the motor cables to length

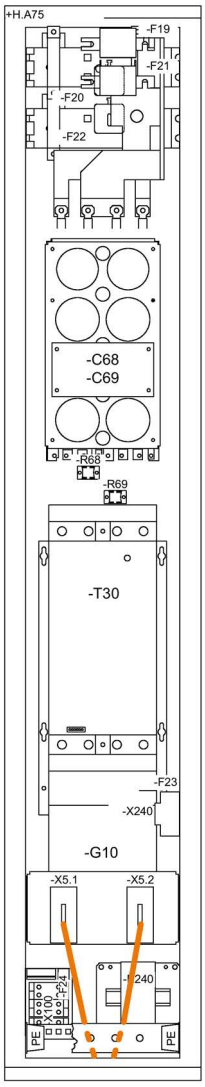



**Note**

Dimensions for stripping insulation and cutting the motor cables to length for option M89 "Extended motor connection power" are provided in Chapter "M89, extended motor connection panel (Page 718)".

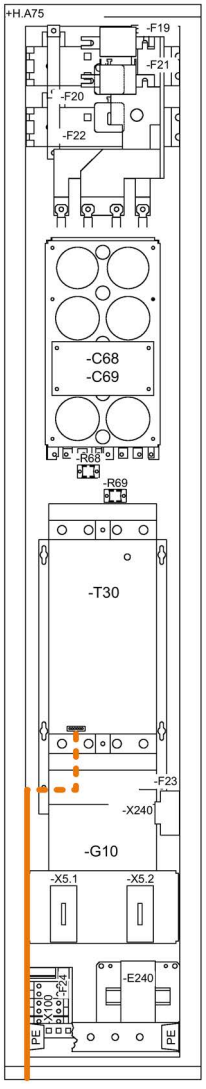
### 4.6.12.10 Cable routing for Central Braking Modules

#### Cable routing to the braking resistor




1. Feed the cable into the cabinet from below.
2. Feed the cable up and behind the PE busbar to the braking resistor terminals.
3. Connect the cable to terminals -X5.1 and -X5.2.

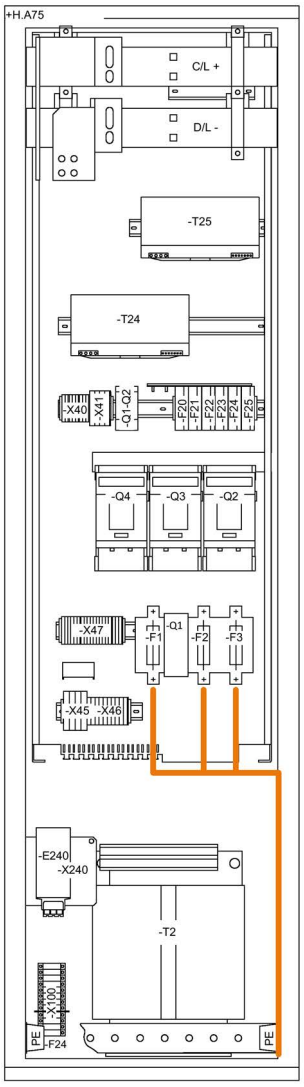
## Cable routing to terminal block -X2




1. Feed the cable into the cabinet from the bottom left.
2. Guide the cable up and, when it reaches the level of terminal -X2, guide it to the right.
3. Continue to feed the cable upwards, securing it at suitable points using cable ties.
4. Connect the cable to terminals -X2.

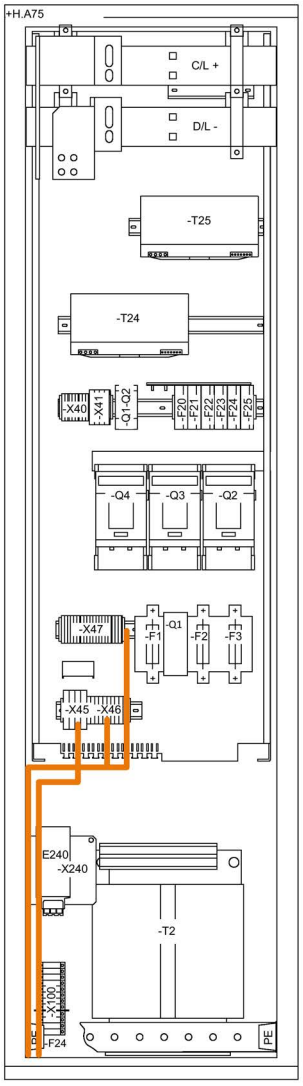
### 4.6.12.11 Cable routing for Auxiliary Power Supply Modules

#### Cable routing for connecting to the line supply




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 connections.

## Cable routing for signal cables to terminal blocks -X45, -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 -X45, -X46, and -X47.

# Cabinet Modules

# 5

## 5.1 Line Connection Modules

### 5.1.1 Description

**Note**

**Additional information**

The arrangement of the components and interfaces as well as the wiring are shown in the attached layout diagrams (AO) or circuit diagrams (SP), which are included in the individual device documentation.



Figure 5-1 Line Connection Module

Power is fed to the drive line-up via Line 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. The Line Modules are connected to the line supply via Line Connection Modules and are equipped with a radio interference suppression filter in accordance with IEC 61800-3 of Category C3 as a standard feature.

Line Connection Modules contain the line-side infeed with main switch and fuse switch disconnector or circuit breaker and provide the connection between the plant power system and the Line Modules.

Line Connection Modules are available for the following voltages and currents:

| Input voltage | Rated infeed / regenerative feedback current |
|---|---|
| 380 ... 480 V 3 AC | 250 ... 3200 A |
| 500 ... 690 V 3 AC | 280 ... 3200 A |

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

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

## Configuration

**Note**

**Additional information**

The configuration examples of the individual Line Connection 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.

The precise order-specific location of the components is provided in the layout diagrams (AO) in the individual device documentation.

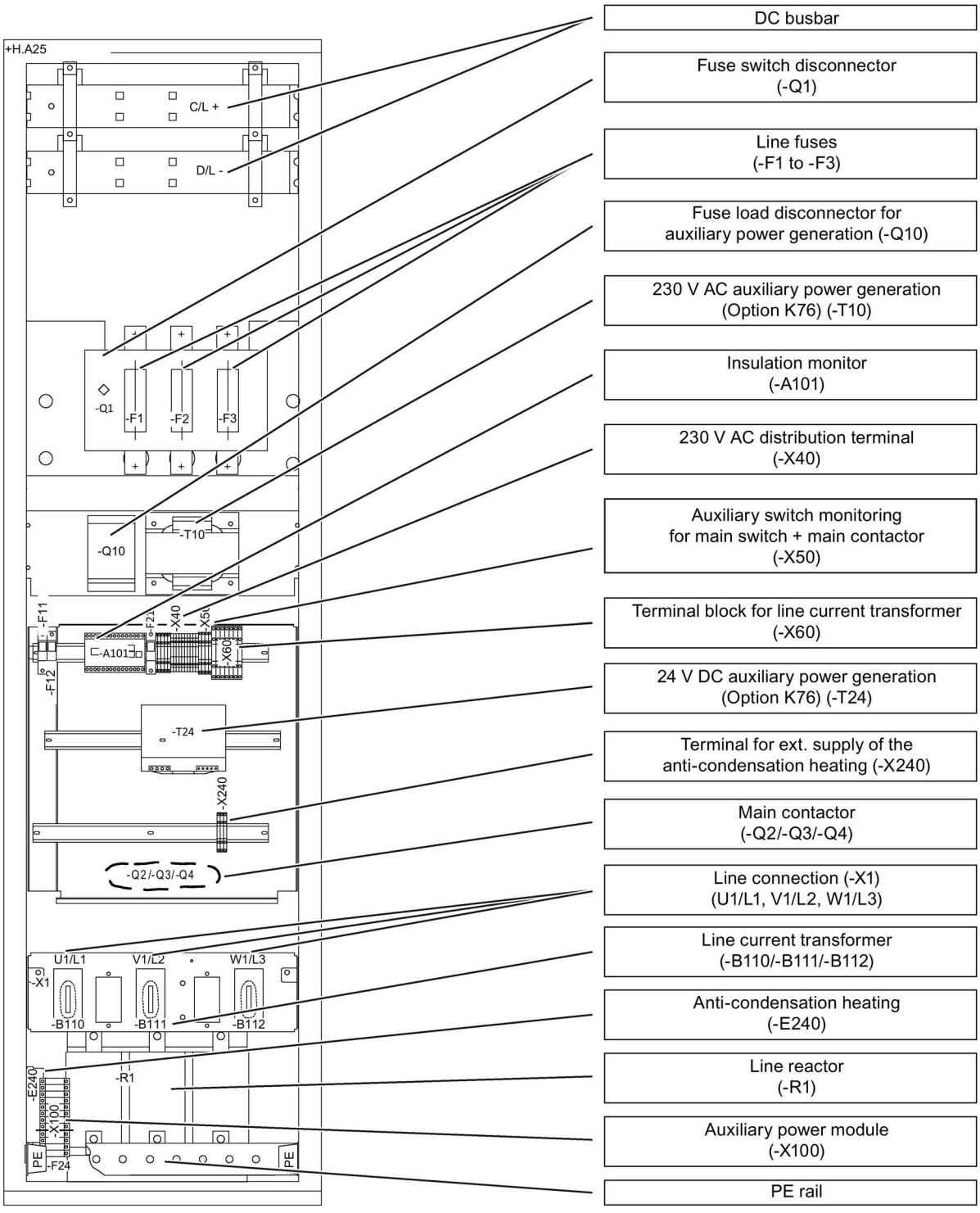



Figure 5-2 Configuration example for Line Connection Modules (frame size HL)

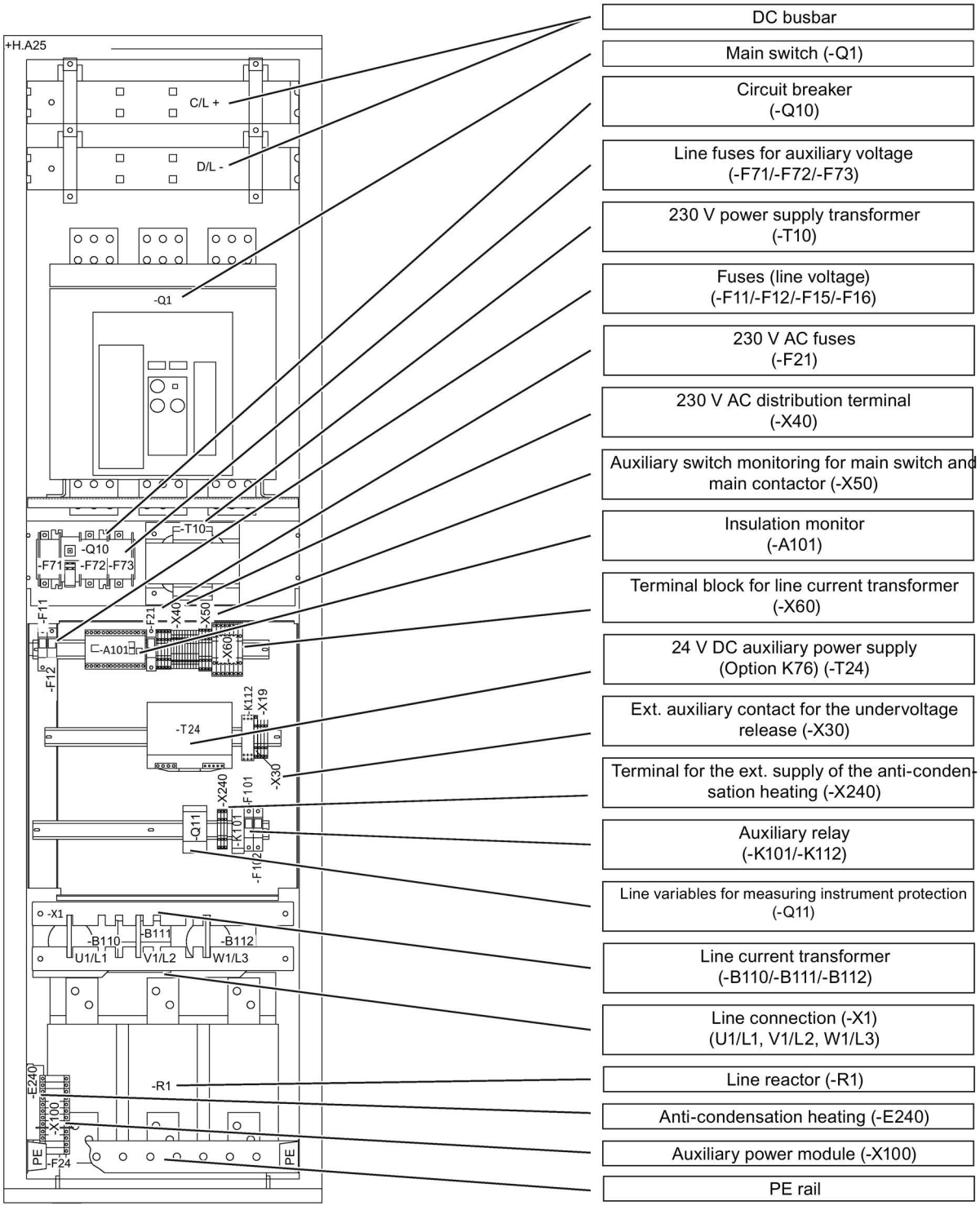



Figure 5-3 Configuration example for Line Connection Modules (frame size JL)

### 5.1.1.1 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.

| NOTICE |
| --- |
| **Material damage caused by switching the line contactor under load**<br>Switching the line contactor under load can result in increased wear and consequently to premature failure of the line contactor.<br>• Always switch the line contactor at zero current. |

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

Table 5- 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<br>Max. load current: 3 A<br>max. Switching voltage: 250 VAC |
| 2 | NC | |
| 3 | COM | |
| 4 | NO | "Main contactor" feedback signal contacts<br>Max. load current: 10 A<br>Max. Switching voltage: 250 V AC<br>Max. contact rating: 250 VA<br>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

### 5.1.1.2 Circuit breaker (input current > 800 A)

For currents exceeding 800 A, the circuit breaker, which is located in the center of the cabinet, isolates the system from the supply and provides the 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 in the factory corresponding to the following table:

Table 5- 2 Factory setting of the circuit breaker for Line Connection Modules for Basic Line Modules

| **Line Connection Module** | **Basic Line Module** | **Input current Line Module** | **L: Overload protection LT** | | **S: Short-time delayed short-circuit protection ST** | | **I: Short-time delayed short-circuit protection INST** |
|---|---|---|---|---|---|---|---|
| | | | **Current setting $I_r$** | **Tripping time $t_r$@ 6×$I_r$/s** | **Current setting $I_{sd}$** | **Tripping time $t_{sd}$/s** | **Current setting $I_i$** |
| **6SL3700-** | **6SL3730-** | | | | | | |
| 0LE41-3AA3 | 1TE41-2AA3 | 1010 A | 0.9 | 10 | OFF | 0.08 | 2 |
| 0LE41-6AA3 | 1TE41-5AA3 | 1265 A | 0.8 | 10 | OFF | 0.08 | 2 |
| 0LE42-0AA3 | 1TE41-8AA3 | 1630 A | 0.9 | 10 | OFF | 0.08 | 2 |
| 0LE42-0BA3 | 1TE41-2Bx3 | 2x 935 A | 1 | 10 | OFF | 0.08 | 2 |
| 0LE42-5BA3 | 1TE41-5Bx3 | 2x 1170 A | 1 | 10 | OFF | 0.08 | 2 |
| 0LE43-2BA3 | 1TE41-8Bx3 | 2x 1508 A | 1 | 10 | OFF | 0.08 | 2 |
| 0LG41-0AA3 | 1TG41-1AA3 | 925 A | 1 | 10 | OFF | 0.08 | 2 |
| 0LG41-3AA3 | 1TG41-4AA3 | 1180 A | 1 | 10 | OFF | 0.08 | 2 |
| 0LG41-6AA3 | 1TG41-8AA3 | 1580 A | 1 | 10 | OFF | 0.08 | 2 |
| 0LG42-0BA3 | 1TG41-1Bx3 | 2 x 855 A | 0.9 | 10 | OFF | 0.08 | 2 |
| 0LG42-5BA3 | 1TG41-4Bx3 | 2 x 1092 A | 0.9 | 10 | OFF | 0.08 | 2 |
| 0LG43-2BA3 | 1TG41-8Bx3 | 2 x 1462 A | 1 | 10 | OFF | 0.08 | 2 |

Table 5- 3 Factory setting of the circuit breaker for Line Connection Modules for Smart Line Modules

| **Line Connection Module** | **Smart Line Module** | **Input current Line Module** | **L: Overload protection LT** | | **S: Short-time delayed short-circuit protection ST** | | **I: Short-time delayed short-circuit protection INST** |
|---|---|---|---|---|---|---|---|
| | | | **Current setting $I_r$** | **Tripping time $t_r$@ 6×$I_r$/s** | **Current setting $I_{sd}$** | **Tripping time $t_{sd}$/s** | **Current setting $I_i$** |
| **6SL3700-** | **6SL3730-** | | | | | | |
| 0LE41-0AA3 | 6TE41-1AA3 | 883 A | 0.9 | 10 | OFF | 0.08 | 2 |
| 0LE41-3AA3 | 6TE41-3AA3 | 1093 A | 0.9 | 10 | OFF | 0.08 | 2 |
| 0LE41-6AA3 | 6TE41-7AA3 | 1430 A | 0.9 | 10 | OFF | 0.08 | 2 |
| 0LE42-0BA3 | 6TE41-1Bx3 | 2 x 817 A | 0.9 | 10 | OFF | 0.08 | 2 |
| 0LE42-5BA3 | 6TE41-3Bx3 | 2 x 1011 A | 0.9 | 10 | OFF | 0.08 | 2 |
| 0LE43-2BA3 | 6TE41-7Bx3 | 2 x 1323 A | 0.9 | 10 | OFF | 0.08 | 2 |
| 0LG41-3AA3 | 6TG41-2AA3 | 1009 A | 0.9 | 10 | OFF | 0.08 | 2 |
| 0LG41-6AA3 | 6TG41-7AA3 | 1430 A | 0.9 | 10 | OFF | 0.08 | 2 |
| 0LG42-0BA3 | 6TG38-8Bx3 | 2 x 700 A | 0.8 | 10 | OFF | 0.08 | 2 |
| 0LG42-0BA3 | 6TG41-2Bx3 | 2 x 934 A | 1 | 10 | OFF | 0.08 | 2 |
| 0LG43-2BA3 | 6TG41-7Bx3 | 2 x 1323 A | 0.9 | 10 | OFF | 0.08 | 2 |

Table 5- 4 Factory setting of the circuit breaker for Line Connection Modules for Active Line Modules

| Line Connection Module | Active Line Module | Input current Line Module | L: Overload protection LT | | S: Short-time delayed short-circuit protection ST | | I: Short-time delayed short-circuit protection INST |
|---|---|---|---|---|---|---|---|
| | | | Current setting $I_r$ | Tripping time $t_r$@ 6×$I_r$/s | Current setting $I_{sd}$ | Tripping time $t_{sd}$/s | Current setting $I_i$ |
| 6SL3700- | 6SL3730- | | | | | | |
| 0LE41-0AA3 | 7TE38-4BA3 | 840 A | 0.9 | 10 | OFF | 0.08 | 2 |
| 0LE41-3AA3 | 7TE41-0BA3 | 985 A | 0.8 | 10 | OFF | 0.08 | 2 |
| 0LE41-6AA3 | 7TE41-4BA3 | 1405 A | 0.9 | 10 | OFF | 0.08 | 2 |
| 0LE42-0BA3 | 7TE41-0Bx3 | 2 x 936 A | 1 | 10 | OFF | 0.08 | 2 |
| 0LE43-2BA3 | 7TE41-4Bx3 | 2 x 1335 A | 0.9 | 10 | OFF | 0.08 | 2 |
| 0LG41-3AA3 | 7TG41-0BA3 | 1025 A | 0.9 | 10 | OFF | 0.08 | 2 |
| 0LG41-6AA3 | 7TG41-3BA3 | 1270 A | 0.8 | 10 | OFF | 0.08 | 2 |
| 0LG42-0BA3 | 7TG37-4Bx3 | 2 x 698 A | 0.7 | 10 | OFF | 0.08 | 2 |
| 0LG42-0BA3 | 7TG41-0Bx3 | 2 x 974 A | 1 | 10 | OFF | 0.08 | 2 |
| 0LG42-5BA3 | 7TG41-3Bx3 | 2 x 1206 A | 1 | 10 | OFF | 0.08 | 2 |

**⚠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 5- 5 Terminal block X50 "Circuit breaker" feedback signal contact

| Terminal | Designation [1] | Technical data |
|---|---|---|
| 1 | NC | "Circuit breaker" checkback contacts |
| 2 | NO | Max. load current: 6 A |
| 3 | COM | Max. switching voltage: 250 V AC |
| Max. connectable cross-section: 2.5 mm² | | |

[1] NC: Normally closed contact, NO: Normally open contact, COM: mid-position 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 5- 6 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 | |

## 5.1.1.3 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 5- 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 mm² | | |

## 5.1.2 Versions of Line Connection Modules

Different versions to suit specific input currents are available:

- Units ≤ 800 A are equipped with a main breaker with fuse switch disconnector
- Units > 800 A are equipped with a fixed-mounted circuit breaker (draw-out circuit breaker is available as option)

Line Connection Modules come in the following versions (specified by an option code) according to the type of the Line Module that is being fed:

- for Active Line Modules: Order code L42
- for Basic Line Modules: Order code L43
- for Smart Line Modules: Order code L44

### 5.1.2.1 Version L42 for Active Line Modules

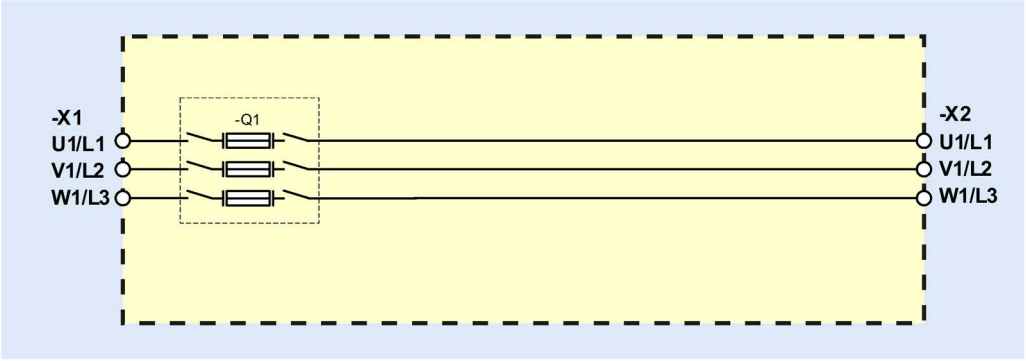



Figure 5-4 Connection example: Line Connection Module ≤800 A for connection to Active Line Modules, option L42

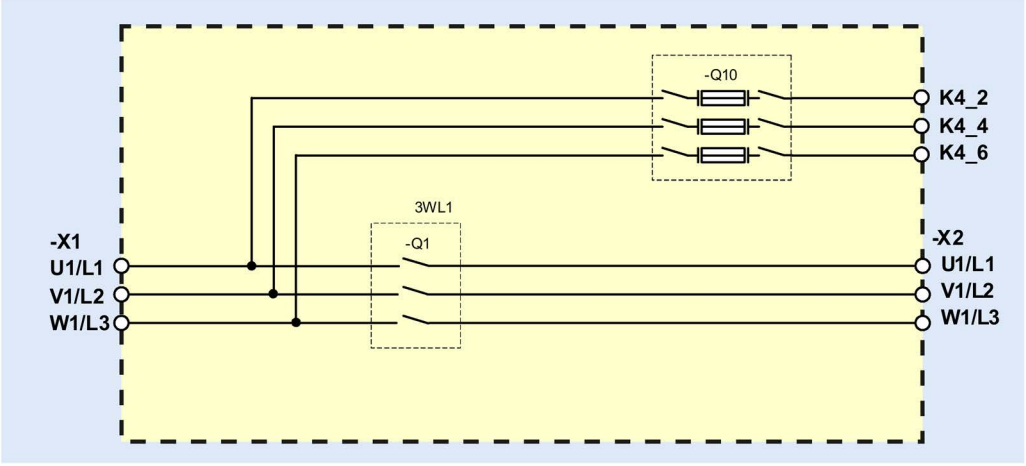



Figure 5-5 Connection example: Line Connection Module >800 A for connection to Active Line Modules, option L42

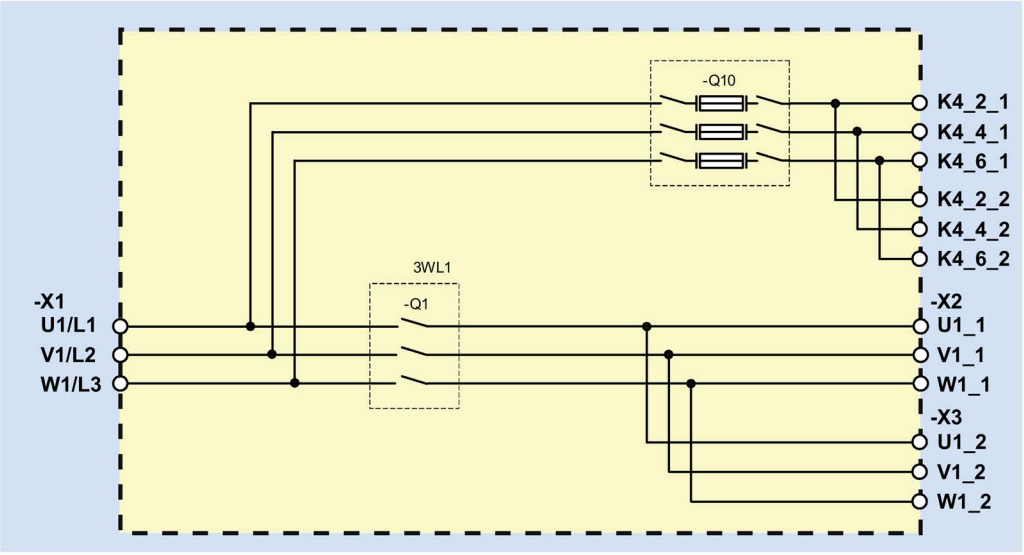



Figure 5-6 Connection example: Line Connection Module ≥2000 A for connection to Active Line Modules in parallel connection, option L42

### 5.1.2.2 Version L43 for Basic Line Modules

When Basic Line Modules are used, a line reactor is incorporated as a standard feature.

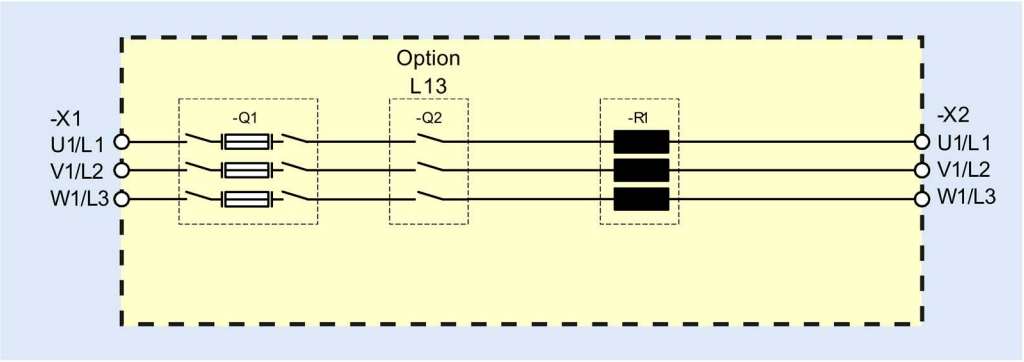



Figure 5-7 Connection example: Line Connection Module ≤ 800 A for connection to Basic Line Modules, options: L43, L13

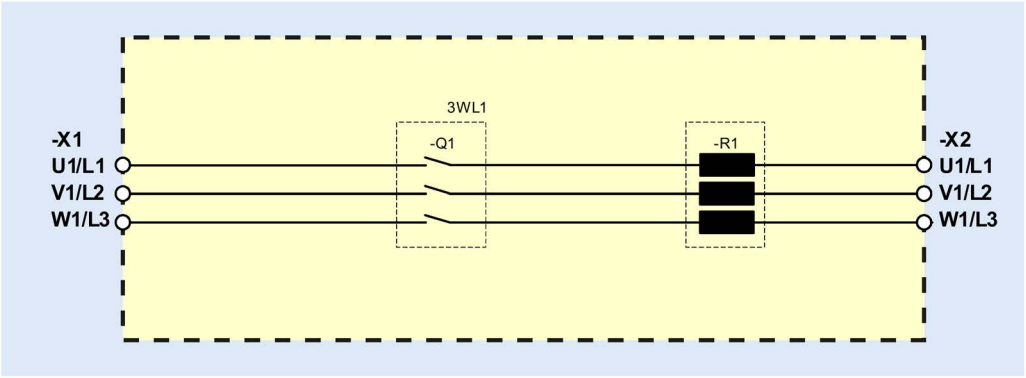



Figure 5-8 Connection example: Line Connection Module >800 A, <1800 A for connection to Basic Line Modules, option L43

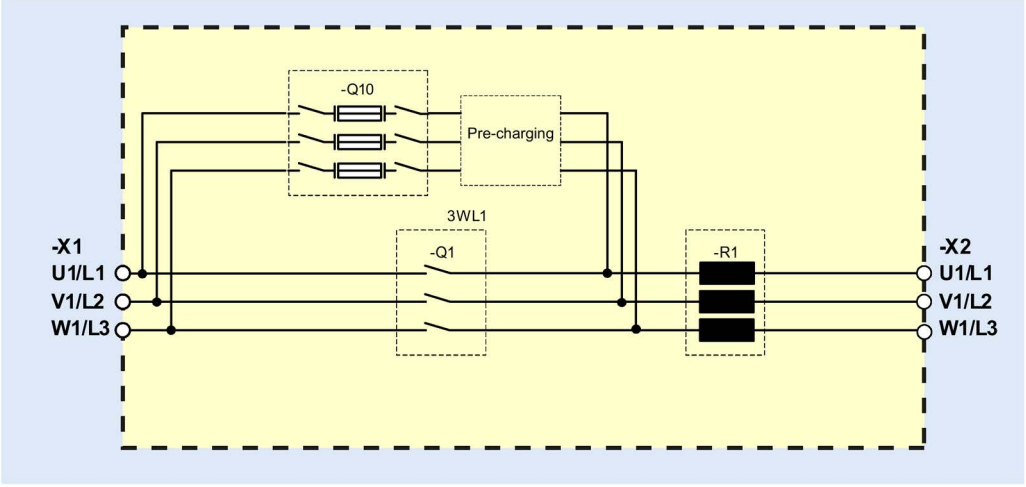



Figure 5-9 Connection example: Line Connection Module >1800 A, <2000 A for connection to Basic Line Modules, option L43

If Basic Line Modules that are fed via a common Line Connection Module are connected in parallel, line reactors are generally incorporated in the Line Connection Module.

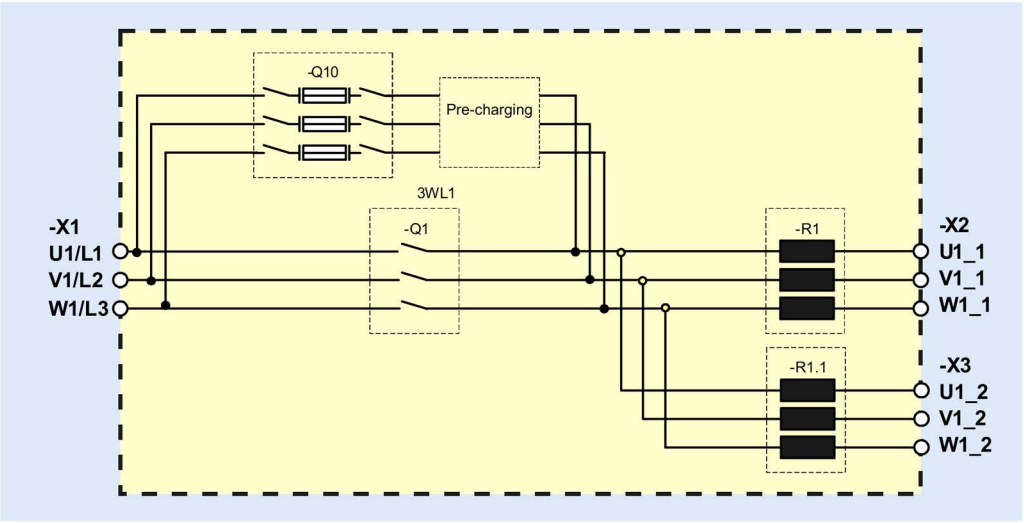



Figure 5-10 Connection example: Line Connection Module ≥2000 A for connection to Basic Line Modules in parallel connection, option L43

### 5.1.2.3 Version L44 for Smart Line Modules

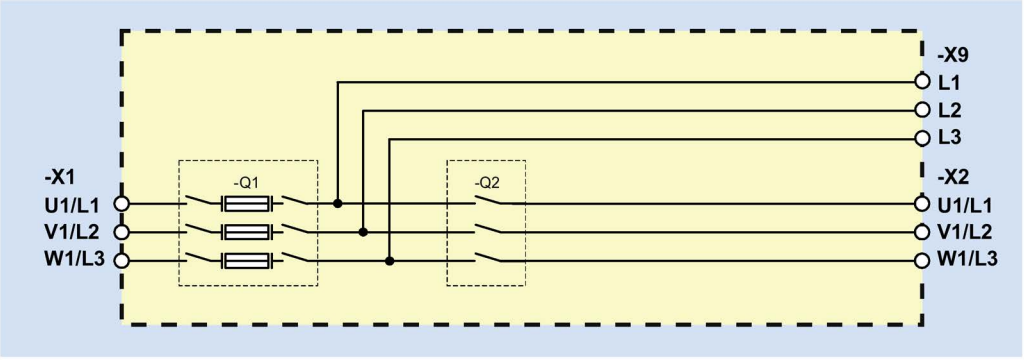



Figure 5-11 Connection example: Line Connection Module ≤800 A for connection to Smart Line Modules, option L44

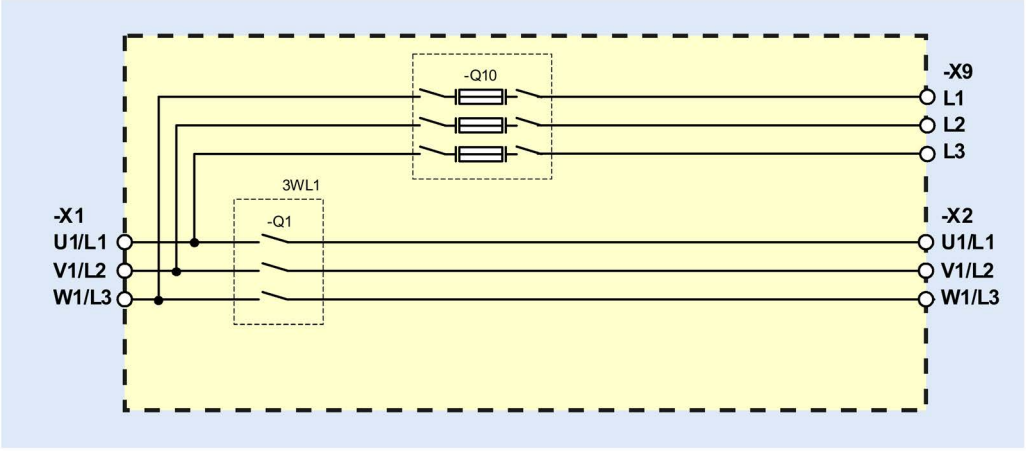



Figure 5-12 Connection example: Line Connection Module >800 A for connection to Smart Line Modules, option L44

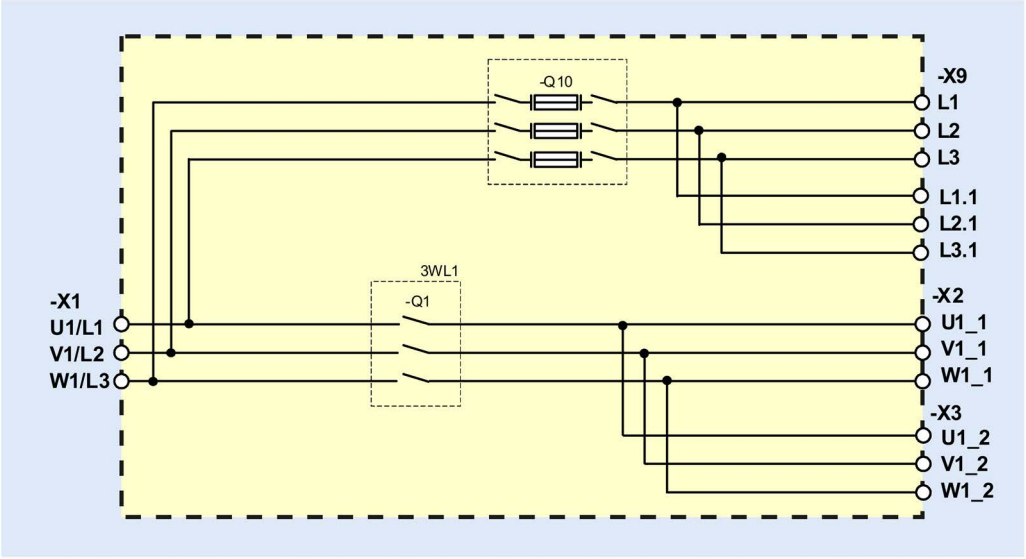



Figure 5-13 Connection example: Line Connection Module >1600 A for connection to Smart Line Modules in parallel connection, option L44

## 5.1.3 Options

**Note**
**Additional information**

The individual options are described in Chapter "Options".

### Electrical options

| Component | Option |
|---|---|
| 1 TM150 Temperature Sensor Module | G51 |
| 2 TM150 Temperature Sensor Modules | G52 |
| 3 TM150 Temperature Sensor Modules | G53 |
| 4 TM150 temperature sensor modules | G54 |
| Fan power supply | K70 |
| Auxiliary power generation in the Line Connection Module | K76 |
| Use in Category C2 according to IEC 61800-3 (TN/TT networks) | L00 |
| Main contactor (for Line Connection Modules ≤800 A) | L13 |
| Surge suppression | L21 |
| Line reactor not included in the scope of delivery (for Basic Line Modules) | L22 |
| Draw-out circuit breaker (for Line Connection Modules >800 A) | L25 |
| Current transformer upstream of the main switch | L41 |
| Line Connection Module for Active Line Modules | L42 |
| Line Connection Module for Basic Line Modules | L43 |
| Line Connection Module for Smart Line Modules | L44 |
| EMERGENCY OFF pushbutton installed in the cabinet door | L45 |
| Grounding switch upstream of circuit breaker | L46 |
| Grounding switch downstream of circuit breaker | L47 |
| Cabinet lighting with service socket outlet | L50 |
| Cabinet anti-condensation heating | L55 |
| Insulation monitoring | L87 |
| 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 |
| Degree of protection IP21 | M21 |
| Degree of protection IP23 | M23 |
| Side panel, mounted on the left | M27 |
| Degree of protection IP43 | M43 |
| Degree of protection IP54 | M54 |
| Closed cabinet door (air inlet from below through floor opening) | M59 |
| Additional touch protection | M60 |
| 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 |
| EMC shield bus | 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 |
|---|---|
| Complete 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 / Portuguese (Brazil) | T83 |
| 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 |

## 5.1.4 Technical data

Table 5- 8 Technical specifications for Line Connection Modules, 380 ... 480 V 3 AC, part I

| **Article No.** | **6SL3700-** | **0LE32-5AA3** | **0LE34-0AA3** | **0LE36-3AA3** | **0LE38-0AA3** | **0LE41-0AA3** |
|---|---|---|---|---|---|---|
| **Infeed/regenerative feedback current**<br>- Rated current $I_{N\,E}$ | <br>A | <br>250 | <br>380 | <br>600 | <br>770 | <br>1000 |
| **Supply voltages**<br>- Line voltage<br>- Line frequency | <br>$V_{ACrms}$<br>Hz | 380 3 AC -10% ... 480 3 AC +10% (-15% < 1 min)<br>47 ... 63 Hz | | | | |
| **230 V AC current consumption** [1]<br>- Inrush current<br>- Holding current | <br>A<br>A | <br>3.6<br>0.04 | <br>3.6<br>0.04 | <br>3.6<br>0.04 | <br>10.8<br>0.12 | <br>0.5<br>0.06 |
| **Power loss, max.** [2]<br>**with 50 Hz 400 V**<br>- Option L42/L44<br>- Option L43<br>**with 60 Hz 460 V**<br>- Option L42/L44<br>- Option L43 | <br><br>kW<br>kW<br><br>kW<br>kW | <br><br>0.115<br>--<br><br>0.115<br>-- | <br><br>0.19<br>--<br><br>0.19<br>-- | <br><br>0.31<br>0.675<br><br>0.31<br>0.675 | <br><br>0.39<br>0.74<br><br>0.39<br>0.74 | <br><br>0.18<br>--<br><br>0.18<br>-- |
| **Fan**<br>- Current consumption 230 VAC<br>- Cooling air requirement [3]<br>- Sound pressure level $L_{PA}$<br>(1 m) with 50/60 Hz | <br>A<br>$m^3/s$<br>dB(A) | <br>--<br>--<br>-- | <br>--<br>--<br>-- | <br>--<br>--<br>-- | <br>--<br>--<br>-- | <br>1.07<br>0.36<br>68/70 |
| **Line connection L1, L2, L3**<br>- Conductor cross-section, max. (IEC) | <br>$mm^2$ | 2/M12<br>2 x 150 | 2/M12<br>2 x 150 | 2/M12<br>4 x 240 | 4/M12<br>8 x 240 | 10/M12<br>8 x 240 |
| **PE/GND connection**<br>- Busbar cross-section<br>- Connection cross-section, max. (IEC) | <br>$mm^2$<br>$mm^2$ | PE busbar<br>600<br>240 | | | | |
| **Degree of protection** (standard version) | | IP20 | IP20 | IP20 | IP20 | IP20 |
| **Dimensions** (standard version, IP20)<br>- Width<br>- Height [4]<br>- Depth | <br>mm<br>mm<br>mm | <br>400<br>2200<br>600 | <br>400<br>2200<br>600 | <br>600<br>2200<br>600 | <br>600<br>2200<br>600 | <br>600<br>2200<br>600 |
| **Weight**<br>- Option L42, L44<br>- Option L43 | <br>kg<br>kg | <br>210<br>-- | <br>230<br>-- | <br>310<br>360 | <br>340<br>420 | <br>450<br>-- |
| **Frame size** | | FL | FL | GL | HL | JL |
| **Maximum short-circuit current $I_{CC}$ acc. to IEC** | kA | 50 | 50 | 50 | 50 | 100 |
| **Minimum short-circuit current** [5] | kA | 3 | 3 | 8 | 12 | 2 |

[1] Current consumption of contactors/circuit breakers and fans with IP23, IP43, IP54 degree of protection (in combination with Basic Line Modules).

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

[3] For IP23, IP43 or IP54 degree of protection only (in combination with Basic Line Modules).

[4] The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

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

Table 5- 9 Technical specifications for Line Connection Modules, 380 ... 480 V 3 AC, part II

| **Article No.** | **6SL3700-** | **0LE41-3AA3** | **0LE41-6AA3** | **0LE42-0AA3** | **0LE42-0BA3** [5] | **0LE42-5BA3** [5] | **0LE43-2BA3** [5] |
|---|---|---|---|---|---|---|---|
| **Infeed/regenerative feedback current**<br>- Rated current $I_{NE}$ | A | 1250 | 1600 | 2000 | 2000 | 2500 | 3200 |
| **Supply voltages**<br>- Line voltage<br>- Line frequency | $V_{ACrms}$<br>Hz | 380 3 AC -10% ... 480 3 AC +10% (-15% < 1 min)<br>47 ... 63 Hz | | | | | |
| **230 V AC current consumption** [1]<br>- Inrush current<br>- Holding current | <br>A<br>A | <br>0.5<br>0.06 | <br>0.5<br>0.06 | <br>0.5<br>0.06 | <br>0.5<br>0.06 | <br>0.5<br>0.06 | <br>0.5<br>0.04 |
| **Power loss, max.** [2]<br>**with 50 Hz 400 V**<br>- Option L42/L44<br>- Option L43<br>**with 60 Hz 460 V**<br>- Option L42/L44<br>- Option L43 | <br><br>kW<br>kW<br><br>kW<br>kW | <br><br>0.29<br>0.787<br><br>0.29<br>0.787 | <br><br>0.41<br>1.186<br><br>0.41<br>1.186 | <br><br>0.6<br>1.366<br><br>0.6<br>1.366 | <br><br>0.6<br>1.594<br><br>0.6<br>1.594 | <br><br>0.95<br>2.502<br><br>0.95<br>2.502 | <br><br>0.95<br>2.482<br><br>0.95<br>2.482 |
| **Fan**<br>- Current consumption 230 VAC<br>- Cooling air requirement [3]<br>- Sound pressure level $L_{PA}$ (1 m) with 50/60 Hz | A<br>$m^3/s$<br>dB(A) | 1.07<br>0.36<br>68/70 | 1.07<br>0.36<br>68/70 | 2.14<br>0.72<br>70/72 | 2.14<br>0.72<br>70/72 | 2.14<br>0.72<br>70/72 | 2.14<br>0.72<br>70/72 |
| **Line connection L1, L2, L3** | | 10/M12 | 10/M12 | 10/M12 + 4/M16 | 10/M12 + 4/M16 | 10/M12 + 4/M16 | 10/M12 + 4/M16 |
| - Conductor cross-section, max. (IEC) | $mm^2$ | 8 x 240 | 10 x 240 | 10 x 240 | 10 x 240 | 10 x 240 | 10 x 300 |
| **PE/GND connection**<br>- Busbar cross-section<br>- Connection cross-section, max. (IEC) | <br>$mm^2$<br>$mm^2$ | PE busbar<br>600<br>240 | | | | | |
| **Degree of protection** (standard version) | | IP20 | IP20 | IP20 | IP20 | IP20 | IP20 |
| **Dimensions** (standard version, IP20)<br>- Width<br>- Height [4]<br>- Depth | <br>mm<br>mm<br>mm | <br>600<br>2200<br>600 | <br>600<br>2200<br>600 | <br>1000<br>2200<br>600 | <br>1000<br>2200<br>600 | <br>1000<br>2200<br>600 | <br>1000<br>2200<br>600 |
| **Weight**<br>- Option L42, L44<br>- Option L43 | <br>kg<br>kg | <br>470<br>570 | <br>490<br>650 | <br>600<br>760 | <br>620<br>820 | <br>620<br>900 | <br>720<br>1000 |
| **Frame size** | | JL | JL | KL | KL | KL | LL |
| **Maximum short-circuit current $I_{CC}$ acc. to IEC** | kA | 100 | 100 | 100 | 100 | 100 | 100 |
| **Minimum short-circuit current** [6] | kA | 2.5 | 3.2 | 4 | 4 | 5 | 6.4 |

1) Current consumption of contactors/circuit breakers and fans with IP23, IP43, IP54 degree of protection (in combination with Basic Line Modules).

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

3) For IP23, IP43 or IP54 degree of protection only (in combination with Basic Line Modules).

4) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

5) Ready to connect to parallel Line Modules.

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

Table 5- 10 Technical specifications for Line Connection Modules, 500 ... 690 V 3 AC, part I

| **Article No.** | **6SL3700-** | **0LG32-8AA3** | **0LG34-0AA3** | **0LG36-3AA3** | **0LG38-0AA3** | **0LG41-0AA3** |
|---|---|---|---|---|---|---|
| **Infeed/regenerative feedback current**<br>- Rated current $I_{N\,E}$ | <br>A | <br>280 | <br>380 | <br>600 | <br>780 | <br>1000 |
| **Supply voltages**<br>- Line voltage<br>- Line frequency | <br>$V_{ACrms}$<br>Hz | 500 3 AC -10% ... 690 3 AC +10% (-15% < 1 min)<br>47 ... 63 Hz | | | | |
| **230 V AC current consumption** [1]<br>- Inrush current<br>- Holding current | <br>A<br>A | <br>3.6<br>0.04 | <br>3.6<br>0.04 | <br>3.6<br>0.04 | <br>10.8<br>0.12 | <br>0.5<br>0.06 |
| **Power loss, max.** [2]<br>**with 50 Hz 500/690 V**<br>- Option L42/L44<br>- Option L43<br>**with 60 Hz 575 V**<br>- Option L42/L44<br>- Option L43 | <br><br>kW<br>kW<br><br>kW<br>kW | <br><br>0.125<br>0.402<br><br>0.125<br>0.402 | <br><br>0.19<br>0.668<br><br>0.19<br>0.668 | <br><br>0.31<br>0.794<br><br>0.31<br>0.794 | <br><br>0.39<br>--<br><br>0.39<br>-- | <br><br>0.18<br>0.963<br><br>0.18<br>0.963 |
| **Fan**<br>- Current consumption 230 VAC<br>- Cooling air requirement [3]<br>- Sound pressure level $L_{PA}$<br>(1 m) with 50/60 Hz | <br>A<br>$m^3/s$<br>dB(A) | <br>--<br>--<br>-- | <br>--<br>--<br>-- | <br>--<br>--<br>-- | <br>--<br>--<br>-- | <br>1.07<br>0.36<br>68/70 |
| **Line connection L1, L2, L3**<br>- Conductor cross-section, max. (IEC) | <br>$mm^2$ | 2/M12<br>2 x 150 | 2/M12<br>2 x 150 | 2/M12<br>4 x 240 | 2/M12<br>8 x 240 | 10/M12<br>8 x 240 |
| **PE/GND connection**<br>- Busbar cross-section<br>- Connection cross-section, max. (IEC) | <br>$mm^2$<br>$mm^2$ | PE busbar<br>600<br>240 | | | | |
| **Degree of protection** (standard version) | | IP20 | IP20 | IP20 | IP20 | IP20 |
| **Dimensions** (standard version, IP20)<br>- Width<br>- Height [4]<br>- Depth | <br>mm<br>mm<br>mm | <br>400<br>2200<br>600 | <br>600<br>2200<br>600 | <br>600<br>2200<br>600 | <br>600<br>2200<br>600 | <br>600<br>2200<br>600 |
| **Weight**<br>- Option L42, L44<br>- Option L43 | <br>kg<br>kg | <br>220<br>260 | <br>230<br>310 | <br>310<br>400 | <br>340<br>-- | <br>450<br>650 |
| **Frame size** | | FL | FL | GL | HL | JL |
| **Maximum short-circuit current $I_{CC}$ acc. to IEC** | kA | 50 | 50 | 50 | 50 | 85 |
| **Minimum short-circuit current** [5] | kA | 3 | 3.5 | 9 | 15 | 2 |

[1] Current consumption of contactors/circuit breakers and fans with IP23, IP43, IP54 degree of protection (in combination with Basic Line Modules).

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

[3] For IP23, IP43 or IP54 degree of protection only (in combination with Basic Line Modules).

[4] The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

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

Table 5- 11 Technical specifications for Line Connection Modules, 500 ... 690 V 3 AC, part II

| **Article No.** | **6SL3700-** | **0LG41-3AA3** | **0LG41-6AA3** | **0LG42-0BA3** [5] | **0LG42-5BA3** [5] | **0LG43-2BA3** [5] |
|---|---|---|---|---|---|---|
| **Infeed/regenerative feedback current**<br>- Rated current $I_{NE}$ | A | 1250 | 1600 | 2000 | 2500 | 3200 |
| **Supply voltages**<br>- Line voltage<br>- Line frequency | $V_{ACrms}$<br>Hz | 500 3 AC -10% ... 690 3 AC +10% (-15% < 1 min)<br>47 ... 63 Hz | | | | |
| **230 V AC current consumption** [1]<br>- Inrush current<br>- Holding current | A<br>A | 0.5<br>0.06 | 0.5<br>0.06 | 0.5<br>0.06 | 0.5<br>0.06 | 0.5<br>0.06 |
| **Power loss, max.** [2]<br>**with 50 Hz 500/690 V**<br>- Option L42/L44<br>- Option L43<br>**with 60 Hz 575 V**<br>- Option L42/L44<br>- Option L43 | <br><br>kW<br>kW<br><br>kW<br>kW | <br><br>0.29<br>1.073<br><br>0.29<br>1.073 | <br><br>0.41<br>1.387<br><br>0.41<br>1.387 | <br><br>0.6<br>2.166<br><br>0.6<br>2.166 | <br><br>0.6<br>2.166<br><br>0.6<br>2.166 | <br><br>0.95<br>2.894<br><br>0.95<br>2.894 |
| **Fan**<br>- Current consumption 230 VAC<br>- Cooling air requirement [3]<br>- Sound pressure level $L_{PA}$ (1 m) with 50/60 Hz | A<br>$m^3/s$<br>dB(A) | 1.07<br>0.36<br>68/70 | 1.07<br>0.36<br>68/70 | 2.14<br>0.72<br>70/72 | 2.14<br>0.72<br>70/72 | 2.14<br>0.72<br>70/72 |
| **Line connection L1, L2, L3** | | 10/M12 | 10/M12 | 10/M12 + 4/M16 | 10/M12 + 4/M16 | 10/M12 + 4/M16 |
| - Conductor cross-section, max. (IEC) | $mm^2$ | 8 x 240 | 8 x 240 | 10 x 240 | 10 x 240 | 10 x 240 |
| **PE/GND connection**<br>- Busbar cross-section<br>- Connection cross-section, max. (IEC) | <br>$mm^2$<br>$mm^2$ | PE busbar<br>600<br>240 | | | | |
| **Degree of protection** (standard version) | | IP20 | IP20 | IP20 | IP20 | IP20 |
| **Dimensions** (standard version, IP20)<br>- Width<br>- Height [4]<br>- Depth | <br>mm<br>mm<br>mm | <br>600<br>2200<br>600 | <br>600<br>2200<br>600 | <br>1000<br>2200<br>600 | <br>1000<br>2200<br>600 | <br>1000<br>2200<br>600 |
| **Weight**<br>- Option L42, L44<br>- Option L43 | <br>kg<br>kg | <br>470<br>670 | <br>490<br>680 | <br>600<br>980 | <br>620<br>1000 | <br>720<br>1080 |
| **Frame size** | | JL | JL | KL | KL | LL |
| **Maximum short-circuit current $I_{CC}$ acc. to IEC** | kA | 85 | 85 | 85 | 85 | 85 |
| **Minimum short-circuit current** [6] | kA | 2.5 | 3.2 | 4 | 5 | 6.4 |

1) Current consumption of contactors/circuit breakers and fans with IP23, IP43, IP54 degree of protection (in combination with Basic Line Modules).

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

3) For IP23, IP43 or IP54 degree of protection only (in combination with Basic Line Modules).

4) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

5) Ready to connect to parallel Line Modules.

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

# 5.2 Basic Line Modules

## 5.2.1 Description

**Note**

**Additional information**

The arrangement of the components and interfaces as well as the wiring are shown in the attached layout diagrams (AO) or circuit diagrams (SP), which are included in the individual device documentation.



Figure 5-14 Basic Line Module

Basic Line Modules are compact line infeeds for two-quadrant operation, i.e. no regenerative feedback.

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.

They are used in applications where energy does not have to be fed back into the line.

If regenerative conditions occur in the drive line-up, Braking Modules must be used because they convert the excess energy in braking resistors into heat.

Basic Line 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 | 200 ... 900 kW |
| 3 AC 500 ... 690 V | 250 ... 1500 kW |

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

## Integration

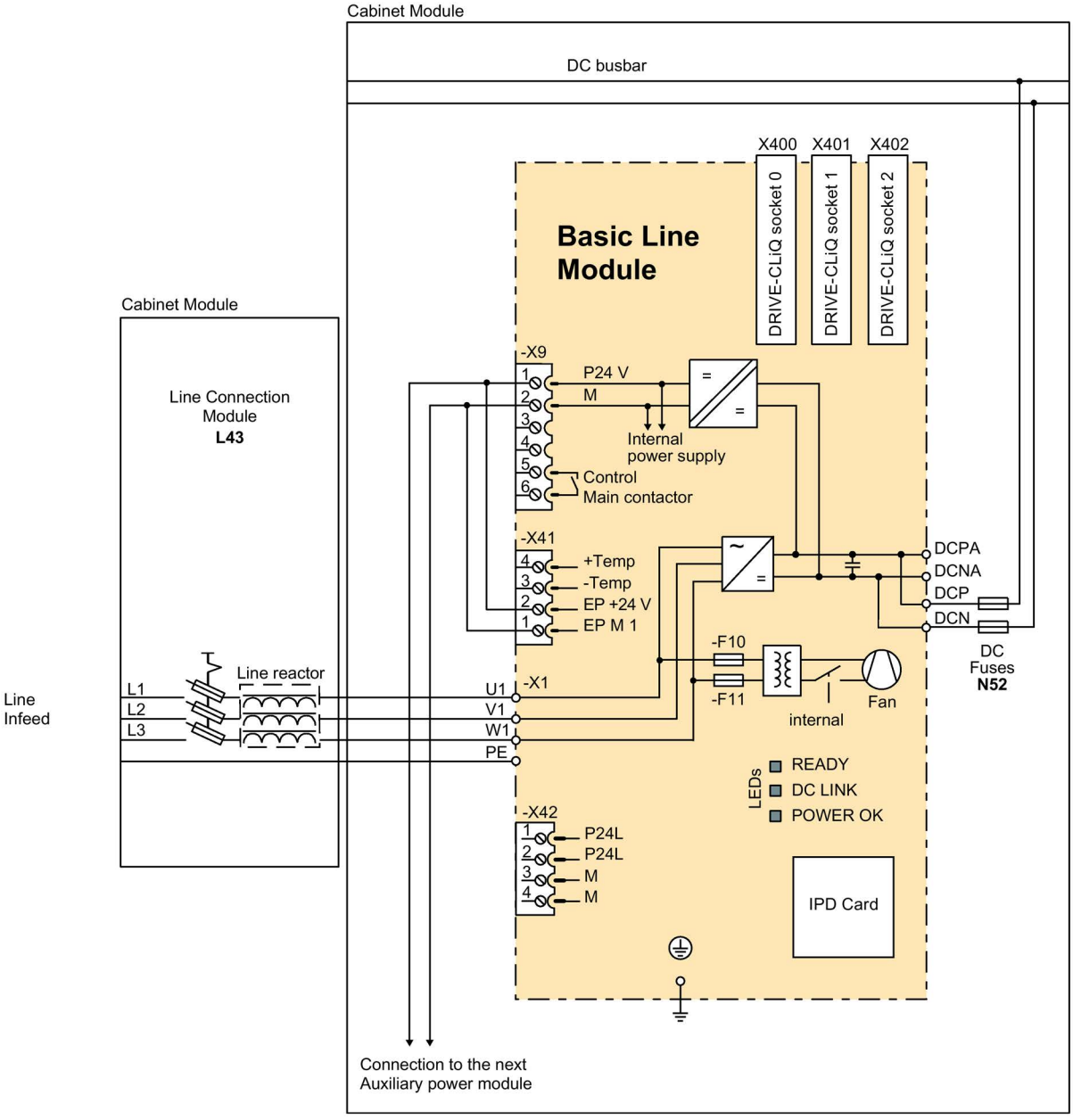



Figure 5-15 Connection example for Basic Line Modules (frame size FB and GB)

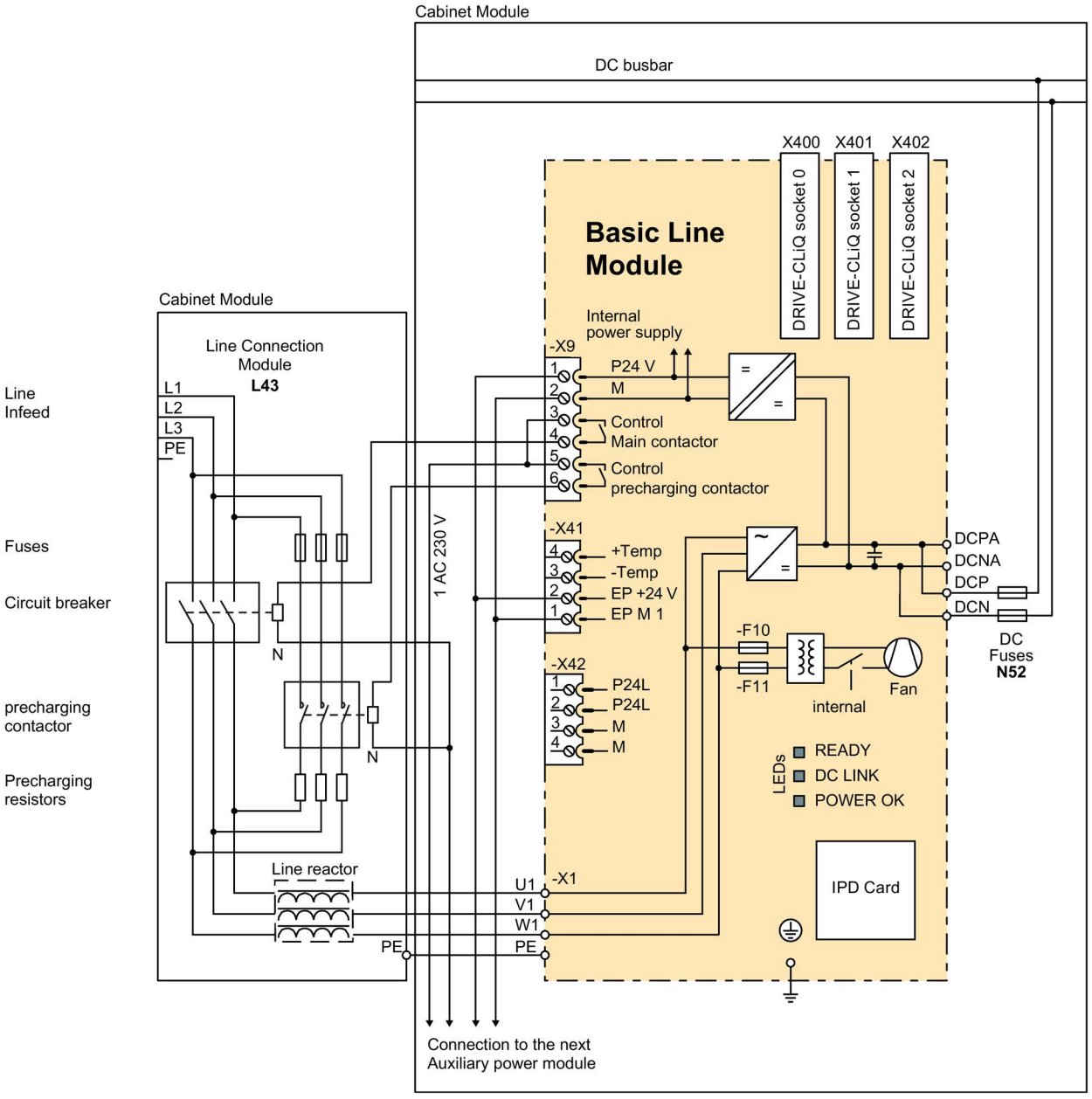



Figure 5-16 Connection example, Basic Line Module (frame size GD)

**Note**

**X9 terminal assignment for the Basic Line Module (frame size GD)**

For the Basic Line Modules, frame size GD, equipped with diode bridge

- The bypass contactor is controlled at terminals -X9:3 and -X9:4
- Precharging is controlled at terminals -X9:5 and -X9:6

## Configuration

In Basic Line Modules of frame sizes FB and GB, a fully controlled thyristor bridge precharges the Basic Line Module and the connected DC link. The thyristors normally operate with a trigger delay angle of 0 °.

Basic Line Modules of type GD for 900 kW (400 V) or 1500 kW (690 V) feature a diode bridge. On these units, the DC link is precharged via a separate, line-side precharging device.

**Note**

**Additional information**

The configuration examples of the individual Basic Line 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.

The precise order-specific location of the components is provided in the layout diagrams (AO) in the individual device documentation.

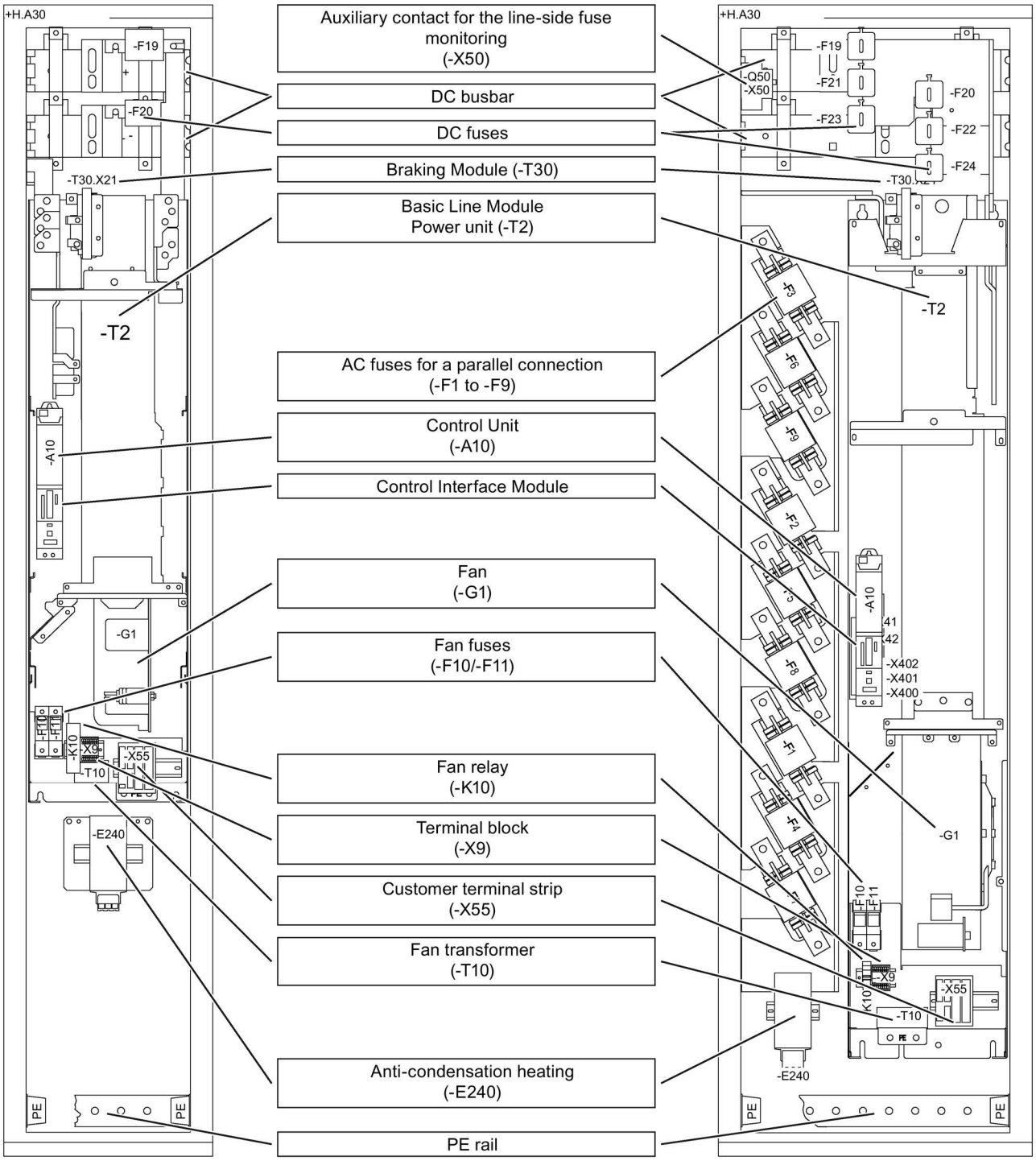



Figure 5-17 Configuration example for Basic Line Modules (frame size FB and GD)

## Parallel connection of Basic Line Modules to increase power rating

A pair of Basic Line Modules is available for creating drive line-ups with more power. These modules can be operated on a common Line Connection Module and are arranged to the right and left of the Line Connection Module. The power connections on the Basic Line Module on the left of the Line Connection Module are a mirror image (Article number with "C" in the next to last position, example: 6SL3730-1Tx41-xBC3), which produces a very compact design for the line infeed.

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

- Up to four identical Basic Line Modules can be connected in parallel.
- A common Control Unit is required whenever the modules are connected in parallel.
- Special Line Connection Modules are available for connecting the modules in parallel.
- For multiple infeed units, power must be supplied to the systems from a common infeed point (i.e. different supply systems are not permitted).
- A derating factor of 7.5% must be taken into consideration, regardless of the number of modules connected in parallel.

**Note**

**It is not possible to connect different power units in parallel**

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

It is not possible to connect Basic Line Modules with Article No. 6SL3730-1xxxx-xAA0 and Article No. 6SL3730-1xxxx-xAA3 in parallel.

When Basic Line Modules are connected in parallel, each having its own Line Connection Module, the main contactors or circuit breakers of the respective Line Connection Modules must switch on together and simultaneously.
The monitoring is realized via terminals -X50 of the particular Line Connection Module.

**Note**

**Requirements placed on the line supply**

In addition to the requirements of the three-winding transformer and the SINAMICS infeed, the line supply system must also meet certain standards with respect to the voltage harmonics present at the point of common coupling of the three-winding transformer. You can find more in-depth information about the requirements placed on the line supply in the "SINAMICS - Low Voltage Engineering Manual".

## 5.2.2 Interface description

### 5.2.2.1 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.

### 5.2.2.2 Control Interface Module

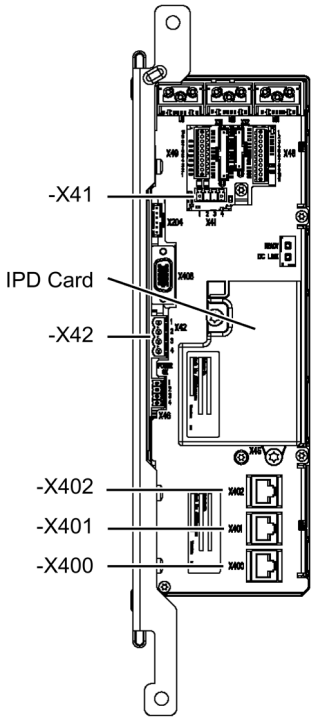
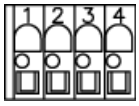



Figure 5-18 Control Interface Module

### 5.2.2.3 X41 EP terminal / temperature sensor connection

Table 5- 12 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)<br>Current consumption: 10 mA |
| | 2 | EP +24 V (Enable Pulses) | |
| | 3 | - Temp | Temperature sensor connection:<br>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.

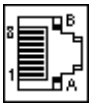
**Note**

**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.

### 5.2.2.4 DRIVE-CLiQ interfaces X400, X401, X402

Table 5- 13 DRIVE-CLiQ interfaces X400, X401, X402

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

## 5.2.3 Options

**Note**

**Additional information**

The individual options are described in Chapter "Options".

### Electrical options

| Component | Option |
|---|---|
| CBC10 Communication Board | G20 |
| CBE20 Communication Board | G33 |
| Contactor monitoring | G56 |
| Terminal Board TB30 | G62 |

| Component | Option |
|---|---|
| AOP30 operator panel | K08 |
| Control Unit CU320-2 PROFIBUS | K90 |
| Performance extension for CU320-2 | K94 |
| Control Unit CU320-2 PROFINET | K95 |
| Cabinet anti-condensation heating | L55 |
| 25/125 kW braking unit | L61/L64 |
| 50/250 kW braking unit | L62/L65 |
| DC fuses | N52 |

## Mechanical options

| Component | Option |
|---|---|
| Base 100 mm high, RAL 9005 | M06 |
| Cable-marshaling compartment 200 mm high, RAL 7035 | M07 |
| IP21 degree of protection | M21 |
| IP23 degree of protection | M23 |
| Side panel right mounted | M26 |
| Side panel left mounted | M27 |
| IP43 degree of protection | M43 |
| IP54 degree of protection | M54 |
| Closed cabinet door (air inlet from below through floor opening) | M59 |
| Additional shock protection | M60 |
| 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 |
| 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 |
|---|---|
| Complete 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 / Portuguese (Brazil) | T83 |
| 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 |

## 5.2.4 Technical data

Table 5- 14 Technical specifications for Basic Line Modules, 380 ... 480 V 3 AC

| **Article No.** | **6SL3730-** | **1TE34-2AA3** | **1TE35-3AA3** | **1TE38-2AA3** | **1TE41-2AA3** | **1TE41-5AA3** | **1TE41-8AA3** |
|---|---|---|---|---|---|---|---|
| **For parallel connection**<br>- Attached to Line Connection Module on right side<br>- Attached to Line Connection Module on left side | | --<br>-- | --<br>-- | --<br>-- | ...-2BA3<br>...-2BC3 | ...-5BA3<br>...-5BC3 | ...-8BA3<br>...-8BC3 |
| **Rated power**<br>- for $I_{N\,DC}$ (50 Hz 400 V)<br>- for $I_{H\,DC}$ (50 Hz 400 V)<br>- for $I_{N\,DC}$ (60 Hz 460 V)<br>- for $I_{H\,DC}$ (60 Hz 460 V) | <br>kW<br>kW<br>hp<br>hp | <br>200<br>160<br>305<br>275 | <br>250<br>200<br>380<br>310 | <br>400<br>315<br>585<br>475 | <br>560<br>450<br>855<br>695 | <br>710<br>560<br>1070<br>870 | <br>900<br>705<br>1340<br>1090 |
| **DC link current**<br>- Rated current $I_{N\,DC}$<br>- Base-load current $I_{H\,DC}$ 1)<br>- Maximum current $I_{max\,DC}$ | <br>A<br>A<br>A | <br>420<br>328<br>630 | <br>530<br>413<br>795 | <br>820<br>640<br>1230 | <br>1200<br>936<br>1800 | <br>1500<br>1170<br>2250 | <br>1880<br>1467<br>2820 |
| **Infeed current**<br>- Rated current $I_{N\,E}$<br>- Maximum current $I_{max\,E}$ | <br>A<br>A | <br>365<br>547 | <br>460<br>690 | <br>710<br>1065 | <br>1010<br>1515 | <br>1265<br>1897 | <br>1630<br>2380 |
| **Current consumption**<br>- Auxiliary supply 24 V DC<br>- 400 V AC 2) | <br>A<br>A | 1.1<br>internal | | | | | |
| **DC link capacitance**<br>- Basic Line Module<br>- Drive line-up, max. | <br>µF<br>µF | <br>7200<br>57600 | <br>9600<br>76800 | <br>14600<br>116800 | <br>23200<br>185600 | <br>29000<br>232000 | <br>34800<br>139200 |
| **Power loss, max.** 3)<br>- at 50 Hz 400 V<br>- at 60 Hz 460 V | <br>kW<br>kW | <br>1.9<br>1.9 | <br>2.1<br>2.1 | <br>3.2<br>3.2 | <br>4.6<br>4.6 | <br>5.5<br>5.5 | <br>6.9<br>6.9 |
| **Cooling air requirement** | $m^3/s$ | 0.17 | 0.17 | 0.17 | 0.36 | 0.36 | 0.36 |
| **Sound pressure level $L_{pA}$** (1 m) at 50/60 Hz | dB(A) | 66/68 | 66/68 | 66/68 | 71/73 | 71/73 | 71/73 |
| **PE/GND conductor**<br>- Busbar cross-section<br>- Conductor cross-section, max. (IEC) | <br>$mm^2$<br>$mm^2$ | PE busbar<br>600<br>240 | | | | | |
| **Cable length, max.** 4)<br>- Shielded<br>- Unshielded | <br>m<br>m | <br>2600<br>3900 | <br>2600<br>3900 | <br>2600<br>3900 | <br>4000<br>6000 | <br>4000<br>6000 | <br>4000<br>7200 |
| **Degree of protection** (standard version) | | IP20 | IP20 | IP20 | IP20 | IP20 | IP20 |
| **Dimensions** (standard version, IP20)<br>- Width<br>- Height 5)<br>- Depth | <br>mm<br>mm<br>mm | <br>400<br>2200<br>600 | <br>400<br>2200<br>600 | <br>400<br>2200<br>600 | 400/600/600<br>2200<br>600 | | |
| **Weight** (standard version) | kg | 166 | 166 | 166 | 320/440/480 | | |
| **Frame size** | | FB | FB | FB | GB | GB | GD |

| **Article No.** | **6SL3730-** | **1TE34-2AA3** | **1TE35-3AA3** | **1TE38-2AA3** | **1TE41-2AA3** | **1TE41-5AA3** | **1TE41-8AA3** |
|---|---|---|---|---|---|---|---|
| **Maximum short-circuit current $I_{CC}$ acc. to IEC** | kA | 65 | 65 | 65 | 84 | 100 | 100 |
| **Minimum short-circuit current** [6)]<br>- with parallel connection | kA | 4.4 | 5.2 | 10 | 2.5<br>4 | 3.2<br>5 | 4<br>6.4 |

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 power required for the 400 V AC auxiliary supply is provided from the line input voltage.

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

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

5) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

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

Table 5- 15 Technical specifications for Basic Line Modules, 500 ... 690 V 3 AC

| **Article No.** | **6SL3730-** | **1TG33-0AA3** | **1TG34-3AA3** | **1TG36-8AA3** | **1TG41-1AA3** | **1TG41-4AA3** | **1TG41-8AA3** |
|---|---|---|---|---|---|---|---|
| **For parallel connection**<br>- Attached to Line Connection Module on right side<br>- Attached to Line Connection Module on left side | | --<br>-- | --<br>-- | --<br>-- | ...-2BA3<br>...-2BC3 | ...-4BA3<br>...-4BC3 | ...-8BA3<br>...-8BC3 |
| **Rated power**<br>- for $I_{N\,DC}$ (50 Hz 690 V)<br>- for $I_{H\,DC}$ (50 Hz 690 V)<br>- for $I_{N\,DC}$ (50 Hz 500 V)<br>- for $I_{N\,DC}$ (50 Hz 500 V)<br>- for $I_{N\,DC}$ (60 Hz 575 V)<br>- for $I_{H\,DC}$ (60 Hz 575 V) | <br>kW<br>kW<br>kW<br>kW<br>hp<br>hp | <br>250<br>195<br>175<br>165<br>250<br>200 | <br>355<br>280<br>250<br>235<br>350<br>300 | <br>560<br>440<br>390<br>365<br>600<br>450 | <br>900<br>710<br>635<br>595<br>900<br>800 | <br>1100<br>910<br>810<br>755<br>1250<br>1000 | <br>1500<br>1220<br>1085<br>1015<br>1500<br>1250 |
| **DC link current**<br>- Rated current $I_{N\,DC}$<br>- Base-load current $I_{H\,DC}$ 1)<br>- Maximum current $I_{max\,DC}$ | <br>A<br>A<br>A | <br>300<br>234<br>450 | <br>430<br>335<br>645 | <br>680<br>530<br>1020 | <br>1100<br>858<br>1650 | <br>1400<br>1092<br>2100 | <br>1880<br>1467<br>2820 |
| **Infeed current**<br>- Rated current $I_{N\,E}$<br>- Maximum current $I_{max\,E}$ | <br>A<br>A | <br>260<br>390 | <br>375<br>563 | <br>575<br>863 | <br>925<br>1388 | <br>1180<br>1770 | <br>1580<br>2370 |
| **Current consumption**<br>- Auxiliary supply 24 V DC<br>- 500/690 V AC 2) | <br>A<br>A | 1.1<br>internal | | | | | |
| **DC link capacitance**<br>- Basic Line Module<br>- Drive line-up, max. | <br>µF<br>µF | <br>3200<br>25600 | <br>4800<br>38400 | <br>7300<br>58400 | <br>11600<br>92800 | <br>15470<br>123760 | <br>19500<br>78000 |
| **Power loss, max.** 3)<br>- at 50 Hz 690 V<br>- at 60 Hz 575 V | <br>kW<br>kW | <br>1.5<br>1.5 | <br>2.1<br>2.1 | <br>3.0<br>3.0 | <br>5.4<br>5.4 | <br>5.8<br>5.8 | <br>7.3<br>7.3 |
| **Cooling air requirement** | $m^3/s$ | 0.17 | 0.17 | 0.17 | 0.36 | 0.36 | 0.36 |
| **Sound pressure level $L_{pA}$** (1 m) at 50/60 Hz | dB(A) | 66/68 | 66/68 | 66/68 | 71/73 | 71/73 | 71/73 |
| **PE/GND conductor**<br>- Busbar cross-section<br>- Conductor cross-section, max. (IEC) | <br>$mm^2$<br>$mm^2$ | PE busbar<br>600<br>240 | | | | | |
| **Cable length, max.** 4)<br>- Shielded<br>- Unshielded | <br>m<br>m | <br>1500<br>2250 | <br>1500<br>2250 | <br>1500<br>2250 | <br>2250<br>3375 | <br>2250<br>3375 | <br>2250<br>3375 |
| **Degree of protection** (standard version) | | IP20 | IP20 | IP20 | IP20 | IP20 | IP20 |
| **Dimensions** (standard version, IP20)<br>- Width<br>- Height 5)<br>- Depth | <br>mm<br>mm<br>mm | <br>400<br>2200<br>600 | <br>400<br>2200<br>600 | <br>400<br>2200<br>600 | 400/600/600<br>2200<br>600 | | |
| **Weight** (standard version) | kg | 166 | 166 | 166 | 320/440/480 | | |
| **Frame size** | | FB | FB | FB | GB | GB | GD |

| **Article No.** | **6SL3730-** | **1TG33-0AA3** | **1TG34-3AA3** | **1TG36-8AA3** | **1TG41-1AA3** | **1TG41-4AA3** | **1TG41-8AA3** |
|---|---|---|---|---|---|---|---|
| **Maximum short-circuit current $I_{CC}$ acc. to IEC** | kA | 65 | 65 | 65 | 65 | 100 | 100 |
| **Minimum short-circuit current** [6] - with parallel connection | kA | 3 | 4.4 | 8 | 2<br>4 | 2.5<br>5 | 3.2<br>6.4 |

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 power required for the 500/690 V AC auxiliary supply is provided by the line input voltage.

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

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

5) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

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

# 5.3 Smart Line Modules

## 5.3.1 Description

**Note**

**Additional information**

The arrangement of the components and interfaces as well as the wiring are shown in the attached layout diagrams (AO) or circuit diagrams (SP), which are included in the individual device documentation.




Figure 5-19 Smart Line Module

Smart Line Modules are uncontrolled Active Line Modules. Like the Basic Line Module, they supply energy to the connected Motor Modules, but unlike the Basic Line Module, they can feed back regenerative energy. The infeed occurs over a diode jumper, while stable, line-commutated regenerative feedback takes place via IGBTs with 100% continuous energy regeneration.

Under full load, the DC link voltage is higher than the rms value of the rated line voltage by a factor of 1.30, and under partial load by a factor of 1.32.

Smart Line 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 | 250 ... 800 kW |
| 3 AC 500 ... 690 V | 450 ... 1400 kW |

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

## Integration

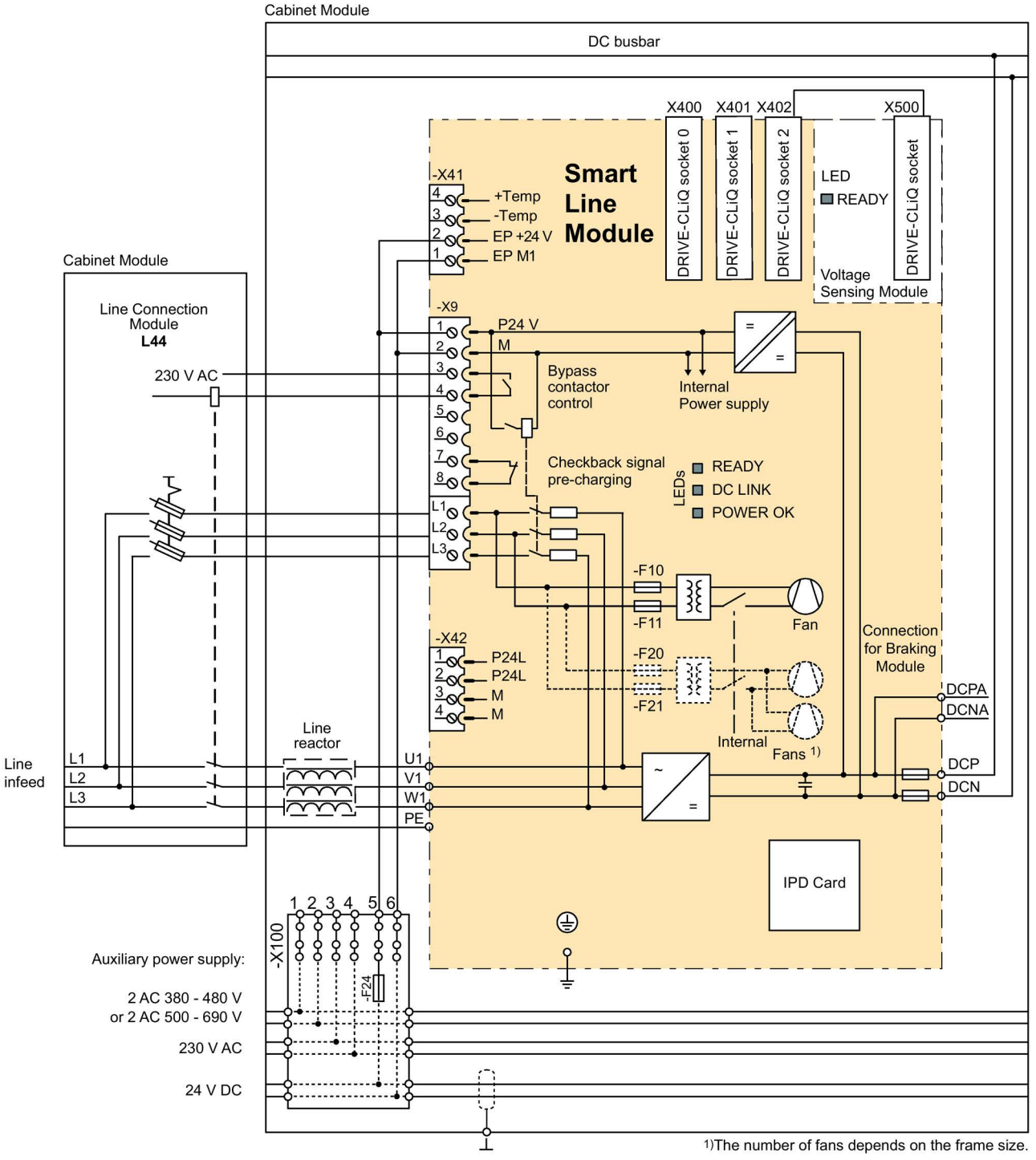



Figure 5-20 Connection example for Smart Line Modules

## Configuration

IGBTs (fundamental frequency-switched) are used as power semiconductors of the Smart Line Modules. Because this reduces switching losses, high current utilization of the power units can be achieved.

The current flows in the direction of the infeed via the freewheeling diodes of the IGBTs. While a diode is conducting, the anti-parallel IGBT is also activated. If the DC link voltage increases due to regenerative operation of the drives, the IGBTs conduct electricity, thus feeding the energy back into the supply system.

Smart Line Modules do not require a line-side filter. A line reactor (4% $u_k$) is included in the standard package. The unit has a built-in precharging input circuit for the DC link capacitors. For this purpose, a main contactor or a motor-operated circuit breaker is included in the Line Connection Module on the line side.

It should be noted that the capacity of the precharging input circuit for charging the DC link capacitors depends on the unit being used. It is limited to no more than 4 to 7.8 times the value of the DC link capacitance installed in the device.

**Note**

**Additional information**

The configuration examples of the individual Smart Line 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.

The precise order-specific location of the components is provided in the layout diagrams (AO) in the individual device documentation.

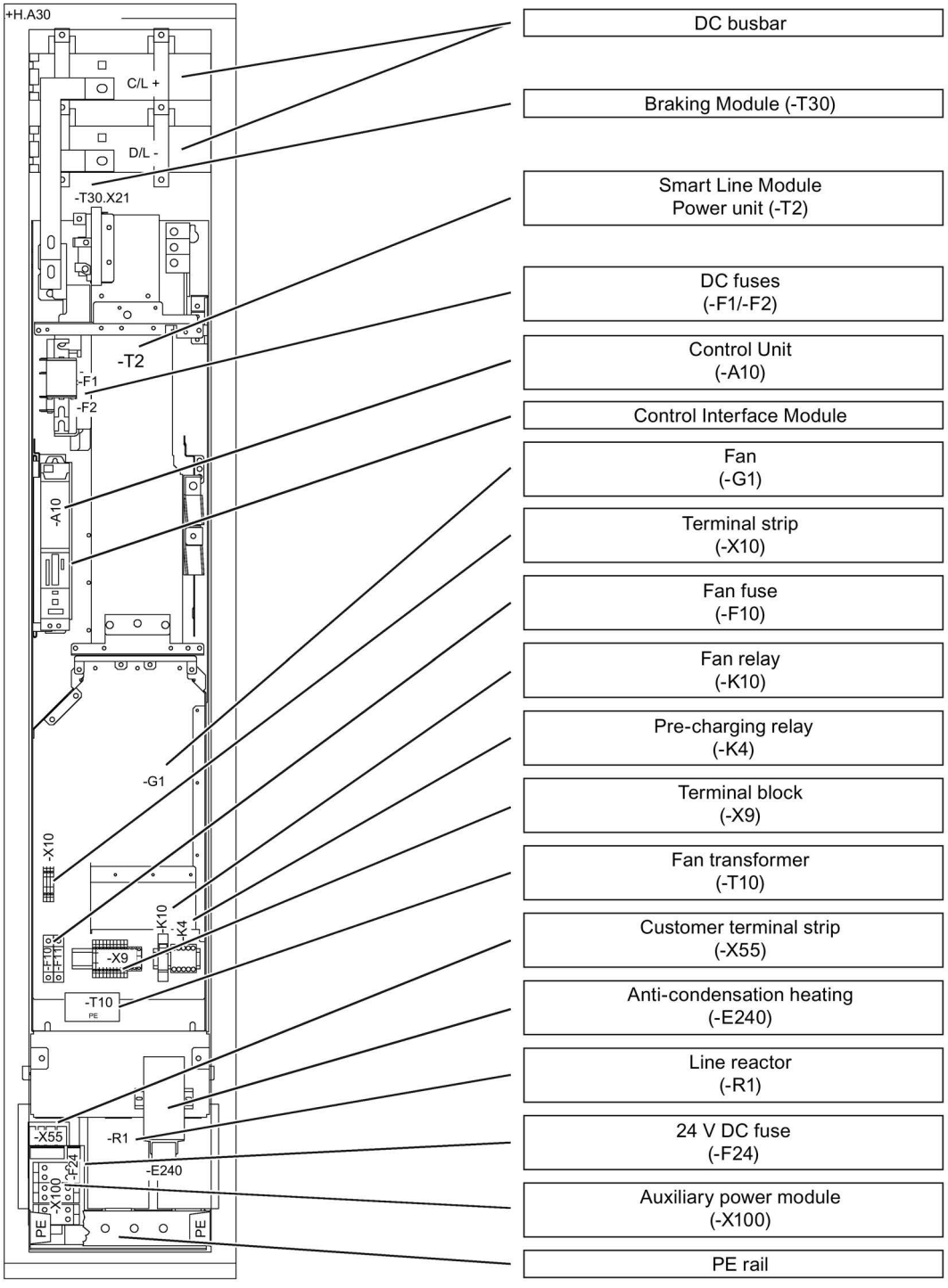



Figure 5-21 Configuration example for Smart Line Modules (frame size GX)

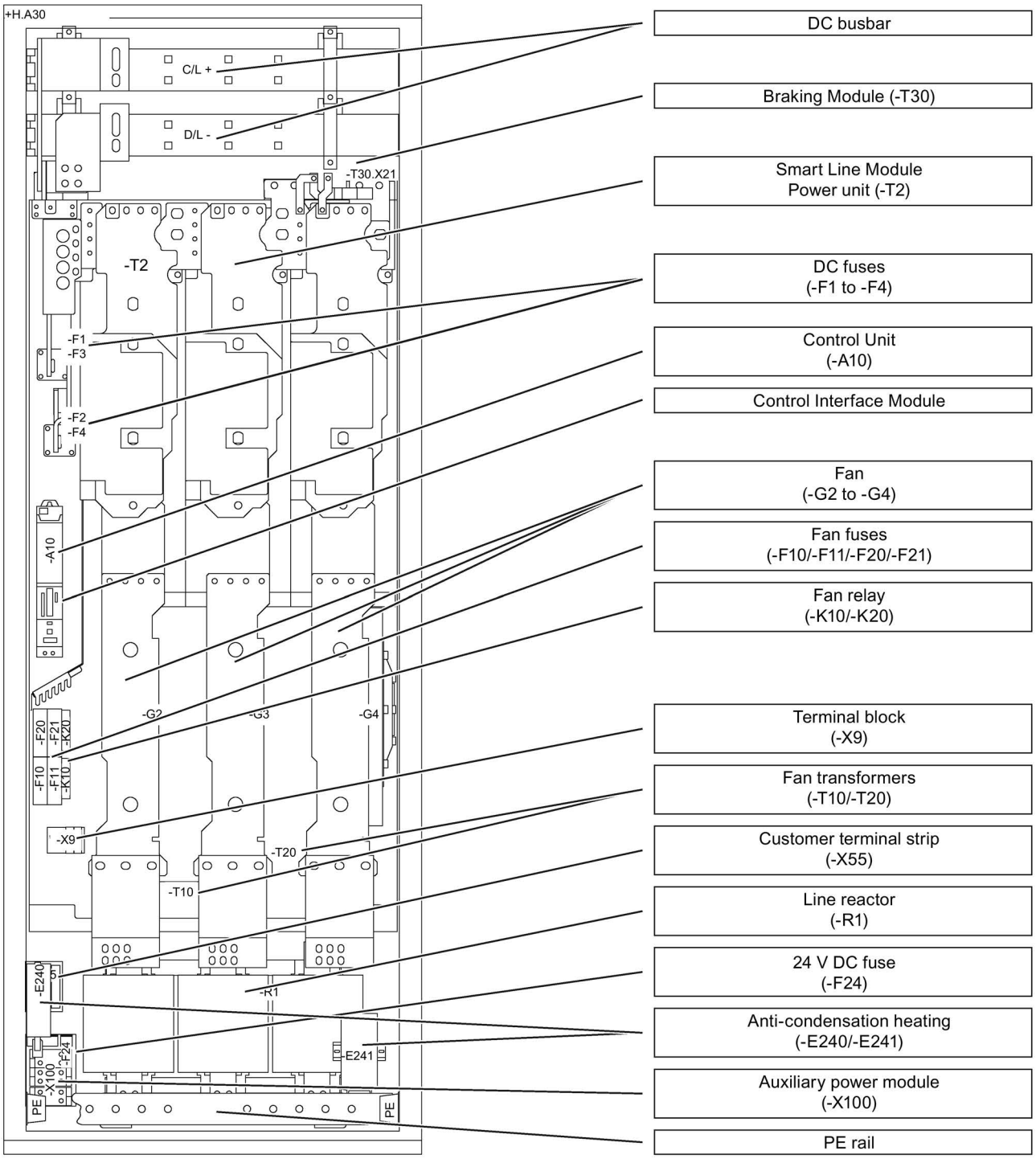



Figure 5-22 Configuration example for Smart Line Modules (frame size JX)

### Parallel connection of Smart Line Modules to increase power rating

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

Smart Line Modules with "mirror-image" power connections enable the parallel connection of these modules in a compact configuration. Article numbers for devices that are arranged to the left of the Line Connection Module have a "C" in the next-to-last position, Example: 6SL3730-6TE41-1BC3.

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

- Up to four identical Smart Line Modules can be connected in parallel.
- The parallel connection must be implemented using a Control Unit.
- A 4 % reactor is always required upstream of each Smart Line Module for the purpose of current balancing.
- Special Line Connection Modules are available for connecting the modules in parallel.
- For multiple infeed units, power must be supplied to the systems from a common infeed point (i.e. different supply systems are not permitted).
- A derating factor of 7.5% must be taken into consideration, regardless of the number of modules connected in parallel.

**Note**

**It is not possible to connect different power units in parallel**

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

It is not possible to connect Smart Line Modules with Article No. 6SL3730-6xxxx-xAA0 and Article No. 6SL3730-6xxxx-xAA3 in parallel.

## 5.3.2 Interface description

### 5.3.2.1 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.

### 5.3.2.2 Control Interface Module

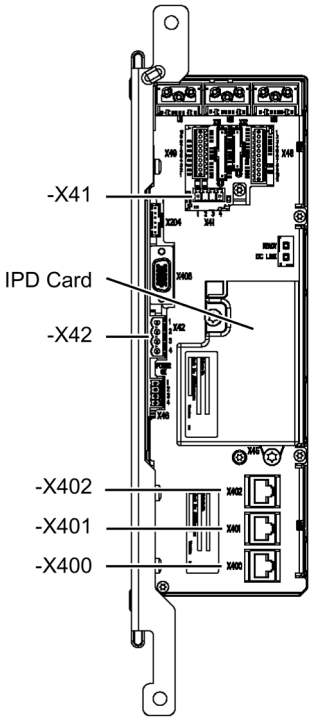
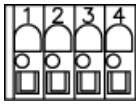



Figure 5-23 Control Interface Module

### 5.3.2.3 X41 EP terminal / temperature sensor connection

Table 5- 16 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)<br>Current consumption: 10 mA |
| | 2 | EP +24 V (Enable Pulses) | |
| | 3 | - Temp | Temperature sensor connection:<br>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.

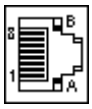
**Note**

**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.

### 5.3.2.4 DRIVE-CLiQ interfaces X400, X401, X402

Table 5- 17 DRIVE-CLiQ interfaces X400, X401, X402

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

## 5.3.3 Options

**Note**

**Additional information**

The individual options are described in Chapter "Options".

### Electrical options

| Component | Option |
|---|---|
| CBC10 Communication Board | G20 |
| CBE20 Communication Board | G33 |
| Contactor monitoring | G56 |
| Terminal Board TB30 | G62 |
| AOP30 operator panel | K08 |
| Control Unit CU320-2 PROFIBUS | K90 |
| Performance extension for CU320-2 | K94 |
| Control Unit CU320-2 PROFINET | K95 |
| Line reactor not included in scope of delivery | L22 |
| Cabinet anti-condensation heating | L55 |
| 50/250 kW braking unit | L62/L65 |

## Mechanical options

| Component | Option |
|---|---|
| Base 100 mm high, RAL 9005 | M06 |
| Cable-marshaling compartment 200 mm high, RAL 7035 | M07 |
| IP21 degree of protection | M21 |
| IP23 degree of protection | M23 |
| Side panel right mounted | M26 |
| Side panel left mounted | M27 |
| IP43 degree of protection | M43 |
| IP54 degree of protection | M54 |
| Closed cabinet door (air inlet from below through floor opening) | M59 |
| Additional shock protection | M60 |
| 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 |
| 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 |
|---|---|
| Complete 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 / Portuguese (Brazil) | T83 |
| 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 |

## 5.3.4 Technical data

Table 5- 18 Technical data for Smart Line Modules, 3 AC 380 ... 480 V

| **Article No.** | **6SL3730-** | **6TE35-5AA3** | **6TE37-3AA3** | **6TE41-1AA3** | **6TE41-3AA3** | **6TE41-7AA3** |
|---|---|---|---|---|---|---|
| **For parallel connection**<br>- Attached to Line Connection Module on right side<br>- Attached to Line Connection Module on left side | | --<br>-- | --<br>-- | ...-1BA3<br>...-1BC3 | ...-3BA3<br>...-3BC3 | ...-7BA3<br>...-7BC3 |
| **Rated power**<br>- for $I_{N\,DC}$ (50 Hz 400 V)<br>- for $I_{H\,DC}$ (50 Hz 400 V)<br>- for $I_{N\,DC}$ (60 Hz 460 V)<br>- for $I_{H\,DC}$ (60 Hz 460 V) | <br>kW<br>kW<br>hp<br>hp | <br>250<br>235<br>395<br>360 | <br>355<br>315<br>545<br>485 | <br>500<br>450<br>770<br>695 | <br>630<br>555<br>970<br>860 | <br>800<br>730<br>1230<br>1120 |
| **DC link current**<br>- Rated current $I_{N\,DC}$<br>- Base-load current $I_{H\,DC}$ [1]<br>- Maximum current $I_{max\,DC}$ | <br>A<br>A<br>A | <br>550<br>490<br>825 | <br>730<br>650<br>1095 | <br>1050<br>934<br>1575 | <br>1300<br>1157<br>1950 | <br>1700<br>1513<br>2550 |
| **Input/regenerative feedback current**<br>- Rated current $I_{N\,E}$<br>- Maximum current $I_{max\,E}$ | <br>A<br>A | <br>463<br>694 | <br>614<br>921 | <br>883<br>1324 | <br>1093<br>1639 | <br>1430<br>2145 |
| **Current consumption**<br>- Auxiliary supply 24 VDC<br>- 400 VAC [2] | <br>A<br>A | <br>1.35<br>1.8 | <br>1.35<br>1.8 | <br>1.4<br>3.6 | <br>1.5<br>5.4 | <br>1.7<br>5.4 |
| **DC link capacitance**<br>- Smart Line Module<br>- Drive line-up, max. | <br>µF<br>µF | <br>8400<br>42000 | <br>12000<br>60000 | <br>16800<br>67200 | <br>18900<br>75600 | <br>28800<br>115200 |
| **Power loss, max.** [3]<br>- at 50 Hz 400 V<br>- at 60 Hz 460 V | <br>kW<br>kW | <br>3.7<br>3.7 | <br>4.7<br>4.7 | <br>7.1<br>7.1 | <br>11.0<br>11.0 | <br>11.5<br>11.5 |
| **Cooling air requirement** | $m^3/s$ | 0.36 | 0.36 | 0.78 | 1.08 | 1.08 |
| **Sound pressure level $L_{pA}$** (1 m) at 50/60 Hz | dB(A) | 69/73 | 69/73 | 70/73 | 70/73 | 70/73 |
| **PE/GND conductor**<br>- Busbar cross-section<br>- Conductor cross-section, max. (IEC) | <br>$mm^2$<br>$mm^2$ | PE busbar<br>600<br>240 | | | | |
| **Cable length, max.** [4]<br>- Shielded<br>- Unshielded | <br>m<br>m | <br>4000<br>6000 | <br>4000<br>6000 | <br>4800<br>7200 | <br>4800<br>7200 | <br>4800<br>7200 |
| **Degree of protection** (standard version) | | IP20 | IP20 | IP20 | IP20 | IP20 |
| **Dimensions** (standard version, IP20)<br>- Width<br>- Height [5]<br>- Depth | <br>mm<br>mm<br>mm | <br>400<br>2200<br>600 | <br>400<br>2200<br>600 | <br>600<br>2200<br>600 | <br>800<br>2200<br>600 | <br>800<br>2200<br>600 |
| **Weight** (standard version) | kg | 270 | 270 | 490 | 775 | 775 |
| **Frame size** | | GX | GX | HX | JX | JX |

| **Article No.** | **6SL3730-** | **6TE35-5AA3** | **6TE37-3AA3** | **6TE41-1AA3** | **6TE41-3AA3** | **6TE41-7AA3** |
|---|---|---|---|---|---|---|
| **Maximum short-circuit current $I_{CC}$ acc. to IEC** | kA | 65 | 65 | 84 | 84 | 100 |
| **Minimum short-circuit current** [6)] | kA | 6.2 | 9.2 | 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 power required for the 400 V AC auxiliary supply is provided by the line input voltage.

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

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

5) The cabinet height increases by 250 mm for IP21 degree of protection, and by 400 mm for IP23, IP43 and IP54 degree of protection.

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

Table 5- 19 Technical data for Smart Line Modules, 3 AC 500 ... 690 V

| **Article No.** | **6SL3730-** | **6TG35-5AA3** | **6TG38-8AA3** | **6TG41-2AA3** | **6TG41-7AA3** |
|---|---|---|---|---|---|
| **For parallel connection**<br>- Attached to Line Connection Module on right side<br>- Attached to Line Connection Module on left side | | --<br>-- | ...-8BA3<br>...-8BC3 | ...-2BA3<br>...-2BC3 | ...-7BA3<br>...-7BC3 |
| **Rated power**<br>- for $I_{N\,DC}$ (50 Hz 690 V)<br>- for $I_{H\,DC}$ (50 Hz 690 V)<br>- for $I_{N\,DC}$ (50 Hz 500 V)<br>- for $I_{H\,DC}$ (50 Hz 500 V)<br>- for $I_{N\,DC}$ (60 Hz 575 V)<br>- for $I_{H\,DC}$ (60 Hz 575 V) | <br>kW<br>kW<br>kW<br>kW<br>hp<br>hp | <br>450<br>405<br>320<br>295<br>500<br>450 | <br>710<br>665<br>525<br>480<br>790<br>740 | <br>1000<br>885<br>705<br>640<br>1115<br>990 | <br>1400<br>1255<br>995<br>910<br>1465<br>1400 |
| **DC link current**<br>- Rated current $I_{N\,DC}$<br>- Base-load current $I_{H\,DC}$ 1)<br>- Maximum current $I_{max\,DC}$ | <br>A<br>A<br>A | <br>550<br>490<br>825 | <br>900<br>800<br>1350 | <br>1200<br>1068<br>1800 | <br>1700<br>1513<br>2550 |
| **Input/regenerative feedback current**<br>- Rated current $I_{N\,E}$<br>- Maximum current $I_{max\,E}$ | <br>A<br>A | <br>463<br>694 | <br>757<br>1135 | <br>1009<br>1513 | <br>1430<br>2145 |
| **Current consumption**<br>- Auxiliary supply 24 VDC<br>- 500/690 VAC 2) | <br>A<br>A | <br>1.35<br>1.4/1.0 | <br>1.4<br>2.9/2.1 | <br>1.5<br>4.3/3.1 | <br>1.7<br>4.3/3.1 |
| **DC link capacitance**<br>- Smart Line Module<br>- Drive line-up, max. | <br>µF<br>µF | <br>5600<br>28000 | <br>7400<br>29600 | <br>11100<br>44400 | <br>14400<br>57600 |
| **Power loss, max.** 3)<br>- at 50 Hz 690 V<br>- at 60 Hz 575 V | <br>kW<br>kW | <br>4.3<br>4.3 | <br>6.5<br>6.5 | <br>12<br>12 | <br>13.8<br>13.8 |
| **Cooling air requirement** | $m^3/s$ | 0.36 | 0.78 | 1.08 | 1.08 |
| **Sound pressure level $L_{pA}$** (1 m) at 50/60 Hz | dB(A) | 69/73 | 70/73 | 70/73 | 70/73 |
| **PE/GND conductor**<br>- Busbar cross-section<br>- Conductor cross-section, max. (IEC) | <br>$mm^2$<br>$mm^2$ | PE busbar<br>600<br>240 | | | |
| **Cable length, max.** 4)<br>- Shielded<br>- Unshielded | <br>m<br>m | <br>2250<br>3375 | <br>2750<br>4125 | <br>2750<br>4125 | <br>2750<br>4125 |
| **Degree of protection** (standard version) | | IP20 | IP20 | IP20 | IP20 |
| **Dimensions** (standard version, IP20)<br>- Width<br>- Height 5)<br>- Depth | <br>mm<br>mm<br>mm | <br>400<br>2200<br>600 | <br>600<br>2200<br>600 | <br>800<br>2200<br>600 | <br>800<br>2200<br>600 |
| **Weight** (standard version) | kg | 340 | 550 | 795 | 795 |
| **Frame size** | | GX | HX | JX | JX |

| **Article No.** | **6SL3730-** | **6TG35-5AA3** | **6TG38-8AA3** | **6TG41-2AA3** | **6TG41-7AA3** |
|---|---|---|---|---|---|
| **Maximum short-circuit current $I_{CC}$ acc. to IEC** | kA | 65 | 84 | 100 | 100 |
| **Minimum short-circuit current** [6)] | kA | 6.2 | 10.5 | 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 power required for the 500/690 V AC auxiliary supply is provided by the supply input voltage.

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

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

5) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

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

# 5.4 Active Line Modules including Active Interface Modules

## 5.4.1 Description

**Note**

**Additional information**

The arrangement of the components and interfaces as well as the wiring are shown in the attached layout diagrams (AO) or circuit diagrams (SP), which are included in the individual device documentation.




Figure 5-24 Active Line Module including Active Interface Module

Active Line Modules can supply motoring energy and return regenerative energy to the supply system.

Active Line Modules generate a regulated DC voltage that is kept consistent regardless of fluctuations in the line voltage (the line voltage must range 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 Modules draw a virtually sinusoidal current from the supply system and cause virtually no line harmonic distortions.

Active Line 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 |
|---|---|
| 380 ... 480 V 3 AC | 132 ... 900 kW |
| 500 ... 690 V 3 AC | 630 ... 1400 kW |

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

## Integration

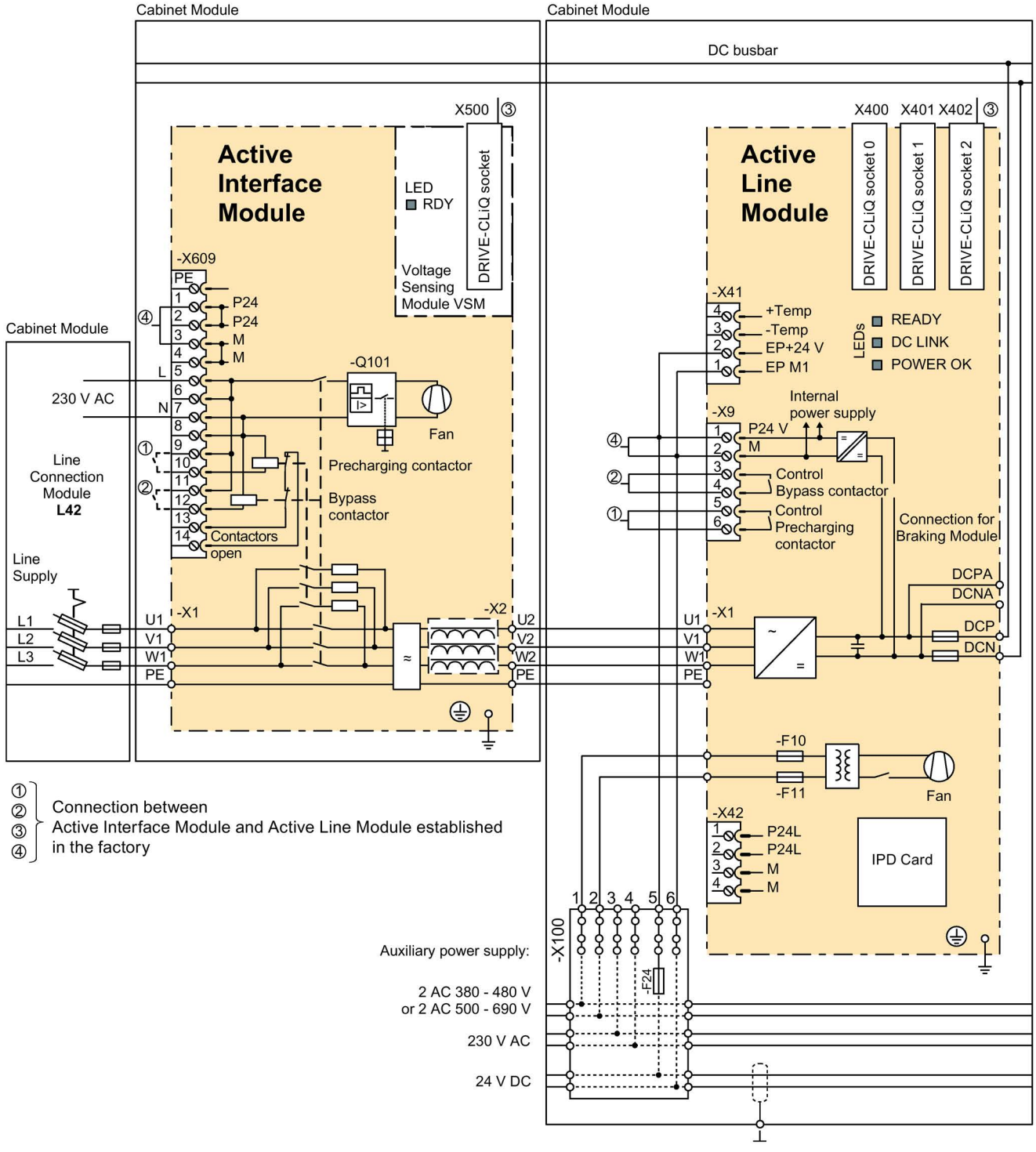



Figure 5-25 Connection example for Active Line Modules (frame size FI/FX and GI/GX)

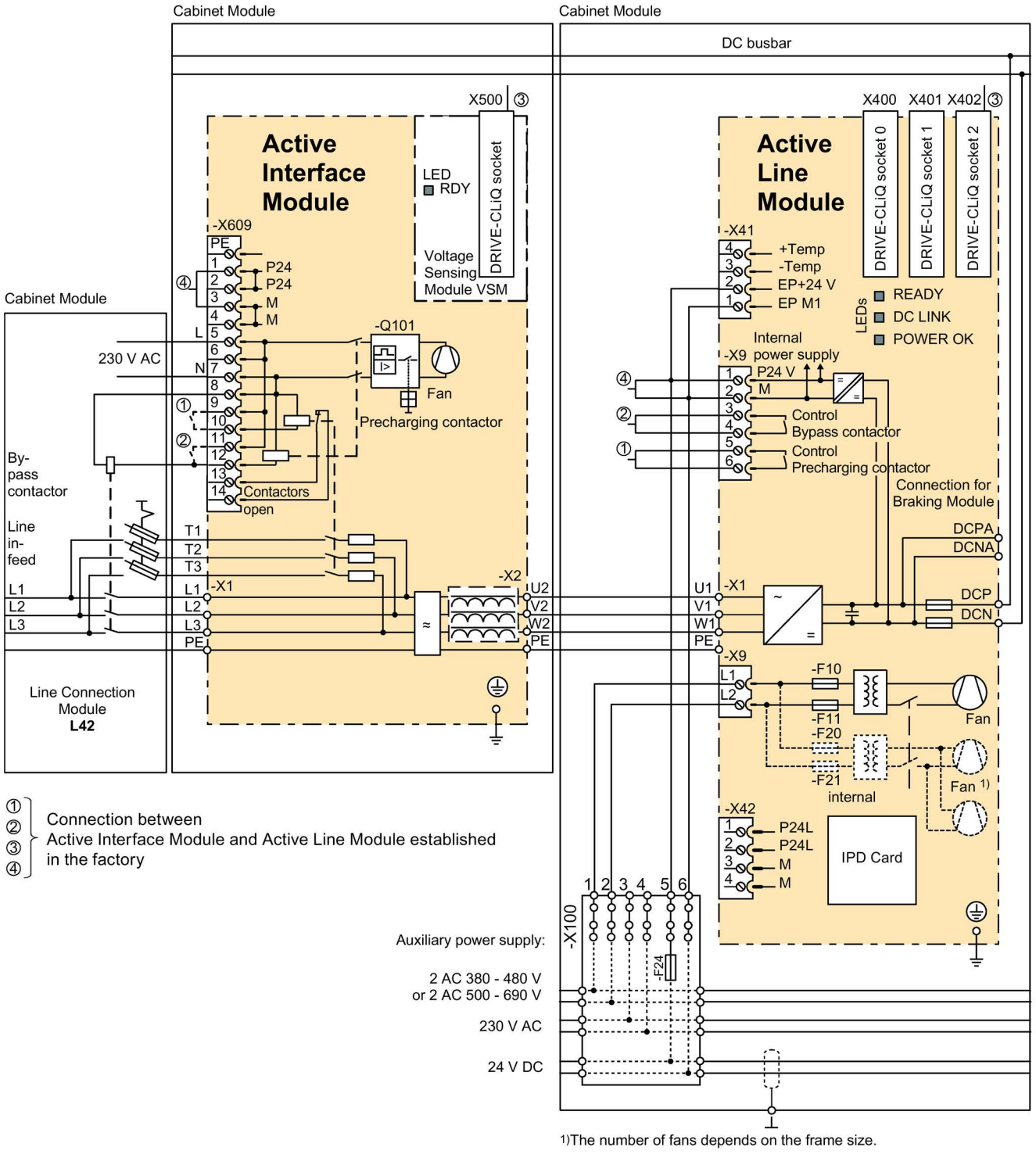



Figure 5-26 Connection example for Active Line Modules (frame size HI/HX and JI/JX)

## Configuration

Active Line Modules are always operated together with an Active Interface Module, which contains the associated Clean Power Filter and precharging circuit. The included line filter enables compliance with the EMC requirements according to IEC 61800-3, Category C3.

**Note**

**Additional information**

The configuration examples of the individual Active Line 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.

The precise order-specific location of the components is provided in the layout diagrams (AO) in the individual device documentation.

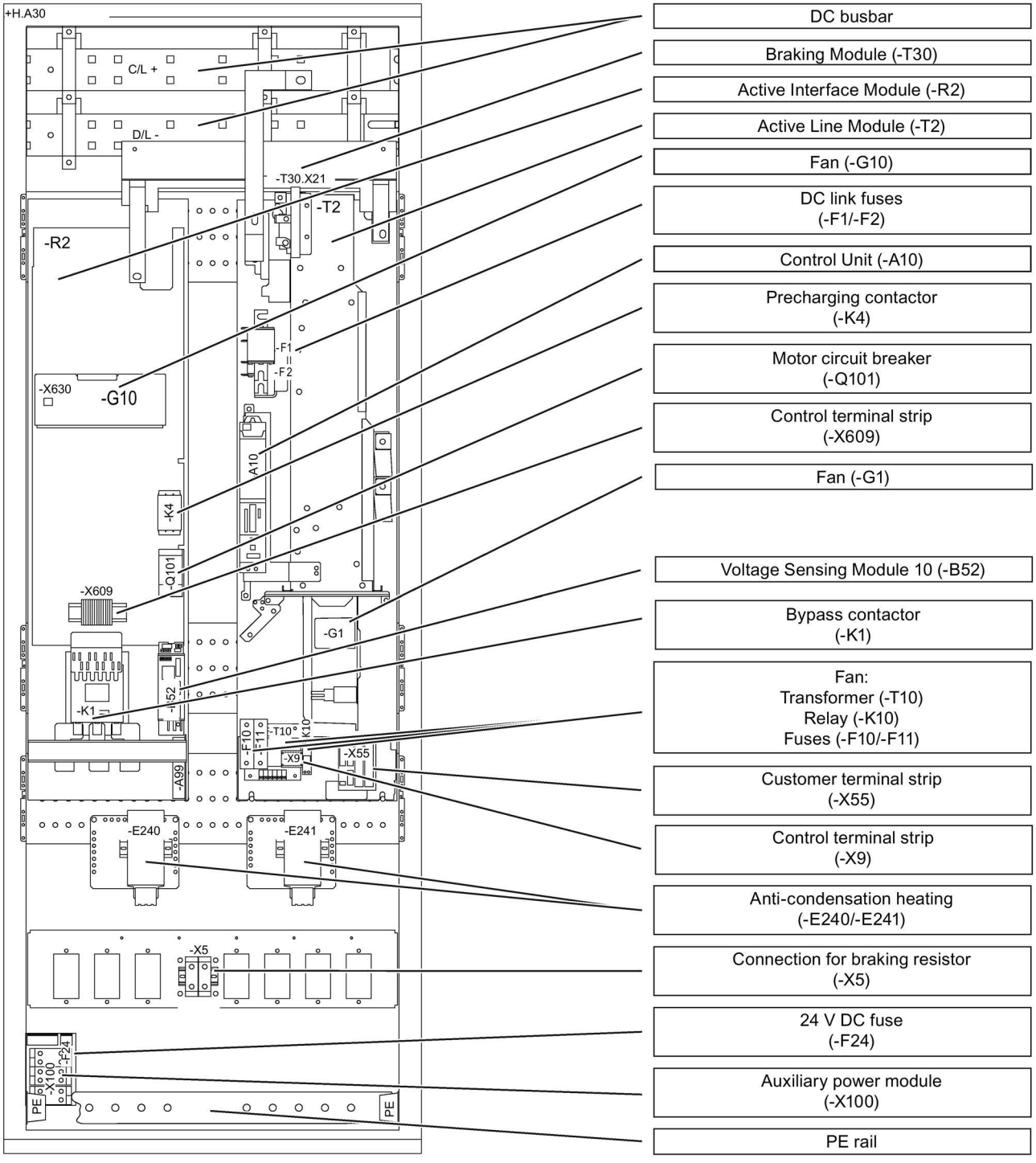



Figure 5-27 Configuration examples for Active Line Modules (frame size FX+FI)

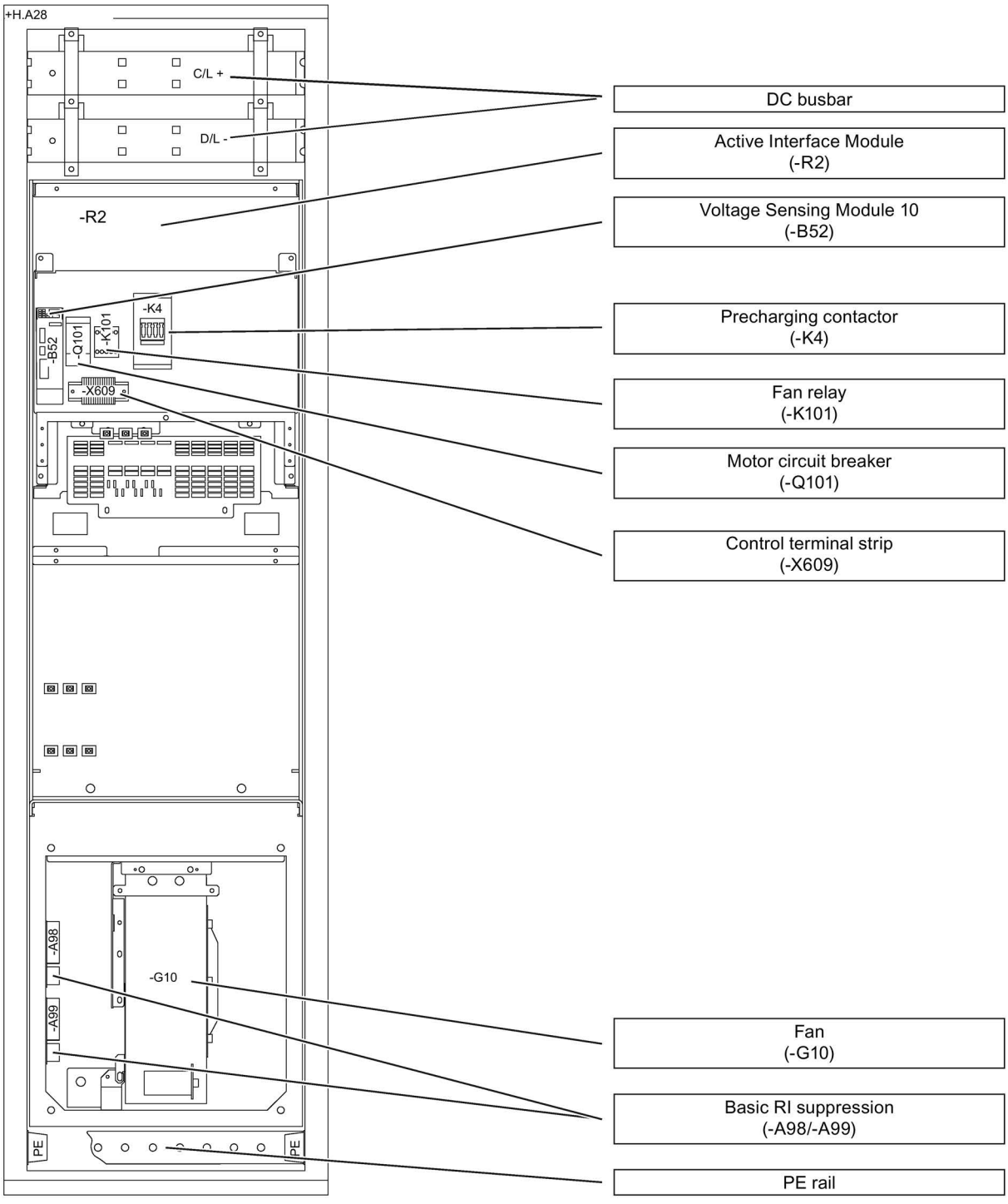



Figure 5-28 Configuration examples for Active Interface Modules (frame size JI)

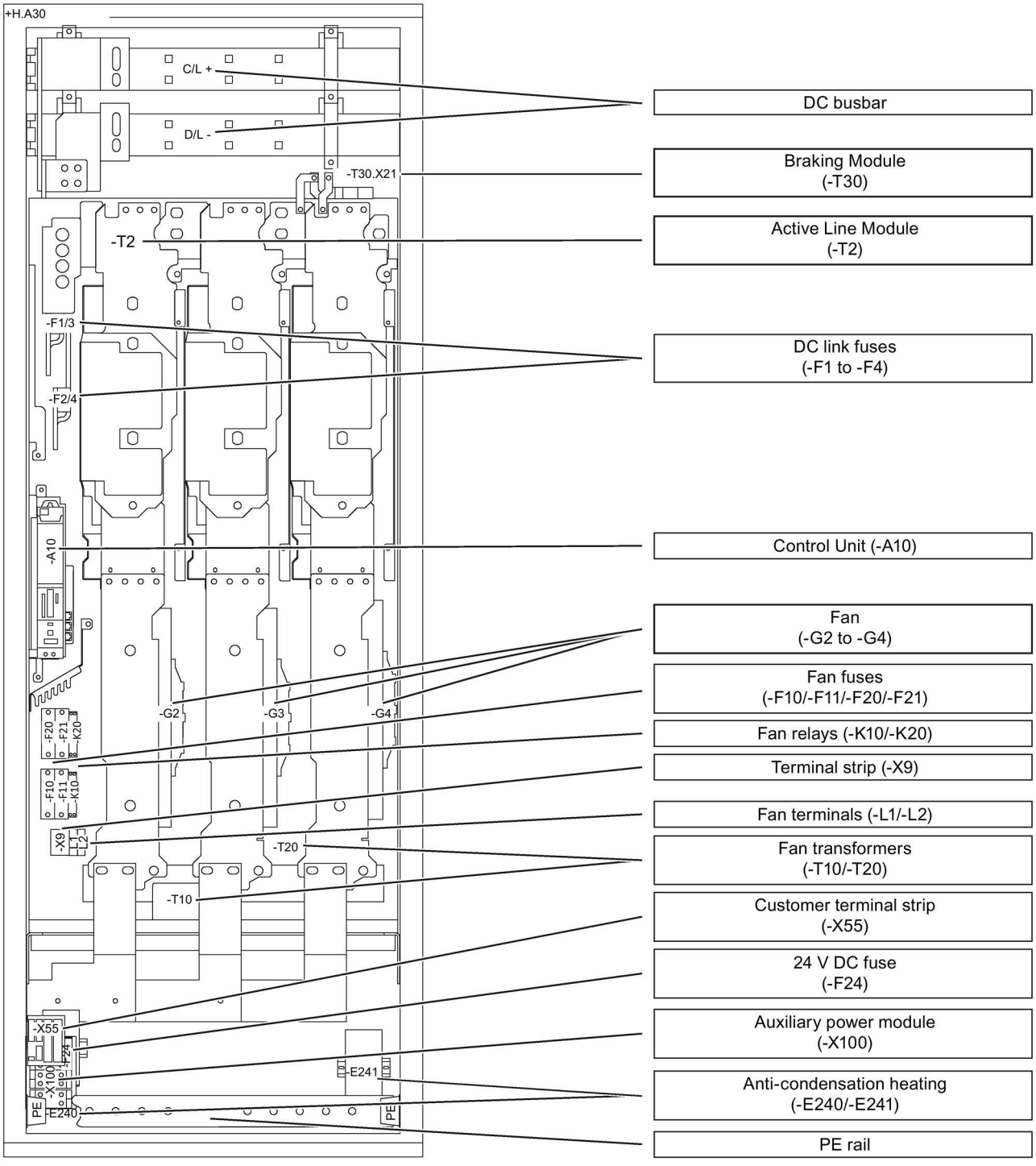



Figure 5-29 Configuration examples for Active Line Modules (frame size JX)

### Parallel connection of Active Line Modules to increase power rating

Active Line Modules are available for creating drive line-ups with more power. These modules can be operated in parallel on a common Line Connection Module and are arranged to the right and left of the Line Connection Module. The power connections on the Active Line Module on the left of the Line Connection Module are a mirror image (Article No. with "C" in the next to last position, example: 6SL3730-7Tx41x-xBC3a), which produces a very compact design for the line infeed.

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

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

**Note**

**It is not possible to connect different power units in parallel**

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

It is not possible to connect Active Line Modules with Article No. 6SL3730-7Txxx-xAA0 and Article No. 6SL3730-7Txxx-xAA3 in parallel.

## 5.4.2 Interface description

### 5.4.2.1 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.

### 5.4.2.2 Control Interface Module

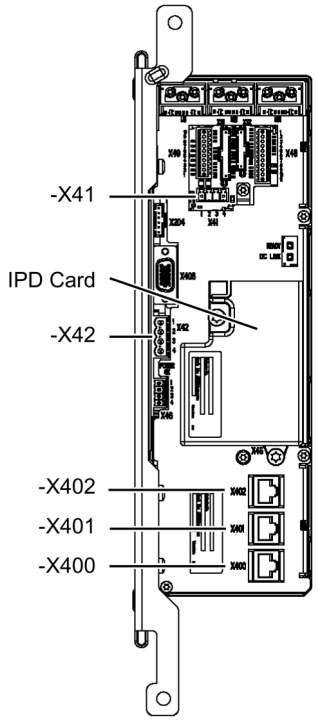
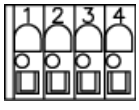



Figure 5-30 Control Interface Module

### 5.4.2.3 X41 EP terminal / temperature sensor connection

Table 5- 20 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)<br>Current consumption: 10 mA |
| | 2 | EP +24 V (Enable Pulses) | |
| | 3 | - Temp | Temperature sensor connection:<br>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.

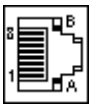
**Note**

**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.

### 5.4.2.4 DRIVE-CLiQ interfaces X400, X401, X402

Table 5- 21 DRIVE-CLiQ interfaces X400, X401, X402

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

### 5.4.2.5 Motor circuit breaker -Q101

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

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

Table 5- 22 Factory setting of the motor circuit breaker

| Active Interface Module | Motor circuit breaker type | Set value |
|---|---|---|
| Size FI | 3RV2011-0JA25 (0.7 ... 1 A) | 0.7 A |
| Size GI | 3RV2011-0JA25 (0.7 ... 1 A) | 1 A |
| Size HI/JI | 3RV2011-0GA25 (4.5 ... 6.3 A) | 5.5 A |

#### Checking the position of the rotary knob

Before commissioning, check that the rotary knob is in the correct position.

- When the Active Interface Module is operational, the rotary knob must be in the "ON" position.
- If the rotary knob is in the "OFF" or "TRIPPED" position, for operation, it must be brought into the "ON" position.
  - Switching from the "OFF" position to the "ON" position must be done quickly and without any interruption.
  - Starting from the "TRIPPED" position, the rotary knob must first be turned to the "OFF" position and then to the "ON" position.
    The fault that caused the motor circuit breaker to trip must first be resolved.

## 5.4.3 Options

**Note**
**Additional information**

The individual options are described in Chapter "Options".

### Electrical options

| Component | Option |
|---|---|
| CBC10 Communication Board | G20 |
| CBE20 Communication Board | G33 |
| Contactor monitoring | G56 |
| Terminal Board TB30 | G62 |
| AOP30 operator panel | K08 |
| Control Unit CU320-2 PROFIBUS | K90 |
| Performance extension for CU320-2 | K94 |
| Control Unit CU320-2 PROFINET | K95 |
| Line filter monitoring | L40 |
| Cabinet anti-condensation heating | L55 |
| 25/125 kW braking unit | L61/L64 |
| 50/250 kW braking unit | L62/L65 |

### Mechanical options

| Component | Option |
|---|---|
| Base 100 mm high, RAL 9005 | M06 |
| Cable-marshaling compartment 200 mm high, RAL 7035 | M07 |
| IP21 degree of protection | M21 |
| IP23 degree of protection | M23 |
| Side panel right mounted | M26 |
| Side panel left mounted | M27 |
| IP43 degree of protection | M43 |
| IP54 degree of protection | M54 |
| Closed cabinet door (air inlet from below through floor opening) | M59 |
| Additional shock protection | M60 |
| 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 |
| 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 |
|---|---|
| Complete 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 / Portuguese (Brazil) | T83 |
| 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 |

## 5.4.4 Technical data

Table 5- 23 Technical data for Active Line Modules (including Active Interface Module), 3 AC 380 ... 480 V, Part I

| **Article No.** | **6SL3730-** | **7TE32-1BA3** | **7TE32-6BA3** | **7TE33-8BA3** | **7TE35-0BA3** |
|---|---|---|---|---|---|
| **For parallel connection**<br>- Attached to Line Connection Module on left side | | --- | --- | --- | --- |
| **Rated power**<br>- for $I_{N\,DC}$ (50 Hz 400 V)<br>- for $I_{H\,DC}$ (50 Hz 400 V)<br>- for $I_{N\,DC}$ (60 Hz 460 V)<br>- for $I_{H\,DC}$ (60 Hz 460 V) | <br>kW<br>kW<br>hp<br>hp | <br>132<br>115<br>200<br>150 | <br>160<br>145<br>250<br>200 | <br>235<br>210<br>400<br>300 | <br>300<br>270<br>500<br>400 |
| **DC link current**<br>- Rated current $I_{N\,DC}$<br>- Base-load current $I_{H\,DC}$ 1)<br>- Maximum current $I_{max\,DC}$ | <br>A<br>A<br>A | <br>235<br>209<br>352 | <br>291<br>259<br>436 | <br>425<br>378<br>637 | <br>549<br>489<br>823 |
| **Input/regenerative feedback current**<br>- Rated current $I_{N\,E}$<br>- Maximum current $I_{max\,E}$ | <br>A<br>A | <br>210<br>315 | <br>260<br>390 | <br>380<br>570 | <br>490<br>735 |
| **Current demand**<br>- Auxiliary supply 24 V DC<br>- 400 V AC at 50/60 Hz 2)<br>- 230 V AC 2) | <br>A<br>A<br>A | <br>1.27<br>0.63 / 0.95<br>0.6 | <br>1.27<br>1.13 / 1.7<br>0.6 | <br>1.52<br>1.8 / 2.7<br>1.2 | <br>1.52<br>1.8 / 2.7<br>1.2 |
| **DC link capacitance**<br>- Active Line Module<br>- Drive line-up, max. | <br>µF<br>µF | <br>4200<br>41600 | <br>5200<br>41600 | <br>7800<br>76800 | <br>9600<br>76800 |
| **Power loss, max.** 3)<br>- at 50 Hz 400 V<br>- at 60 Hz 460 V | <br>kW<br>kW | <br>4.3<br>4.4 | <br>4.9<br>5.1 | <br>6.9<br>7.2 | <br>8.7<br>9.0 |
| **Cooling air requirement** | $m^3/s$ | 0.47 | 0.47 | 0.83 | 0.83 |
| **Sound pressure level $L_{pA}$** (1 m) at 50/60 Hz 4) | dB(A) | 74/76 | 75/77 | 76/78 | 76/78 |
| **PE/GND conductor**<br>- Busbar cross-section<br>- Conductor cross-section, max. (IEC) | <br>$mm^2$<br>$mm^2$ | PE busbar<br>600<br>240 | | | |
| **Cable length, max.** 5)<br>- Shielded<br>- Unshielded | <br>m<br>m | <br>2700<br>4050 | <br>2700<br>4050 | <br>2700<br>4050 | <br>2700<br>4050 |
| **Degree of protection** (standard version) | | IP20 | IP20 | IP20 | IP20 |
| **Dimensions** (standard version, IP20)<br>- Width<br>- Height 6)<br>- Depth | <br>mm<br>mm<br>mm | <br>800<br>2200<br>600 | <br>800<br>2200<br>600 | <br>800<br>2200<br>600 | <br>800<br>2200<br>600 |
| **Weight** (standard version) | kg | 380 | 380 | 530 | 530 |
| **Frame size** | | FX + FI | FX + FI | GX + GI | GX + GI |

| **Article No.** | **6SL3730-** | **7TE32-1BA3** | **7TE32-6BA3** | **7TE33-8BA3** | **7TE35-0BA3** |
|---|---|---|---|---|---|
| **Maximum short-circuit current $I_{CC}$ acc. to IEC** | kA | 65 | 65 | 65 | 65 |
| **Minimum short-circuit current** [7)] | kA | 6.2 | 10.5 | 10.5 | 10.5 |

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 power required for the 400 V AC and 230 V AC auxiliary supplies is taken from the line supply input voltage.

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

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

5) Total of all motor cables and DC link. Longer cable lengths for specific configurations that are available on request, see the SINAMICS - Low Voltage Engineering Manual in the device documentation provided.
The cable lengths are for use in an IT supply system. When used in TN systems, the cable lengths are reduced down to 30 % of the specified value.
When used in TN systems, and when the connected Motor Modules are operated with a higher pulse frequency, then the permissible cable lengths are available on request.

6) The cabinet height increases by 250 mm for IP21 degree of protection, and by 400 mm for IP23, IP43 and IP54 degree of protection.

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

Table 5- 24 Technical data for Active Line Modules (including Active Interface Module), 3 AC 380 ... 480 V, Part II

| **Article No.** | **6SL3730-** | **7TE36-1BA3** | **7TE38-4BA3** | **7TE41-0BA3** | **7TE41-4BA3** |
|---|---|---|---|---|---|
| **For parallel connection**<br>- Attached to Line Connection Module on left side | | -- | -- | ...-0BC3 | ...-4BC3 |
| **Rated power**<br>- for $I_{N\,DC}$ (50 Hz 400 V)<br>- for $I_{H\,DC}$ (50 Hz 400 V)<br>- for $I_{N\,DC}$ (60 Hz 460 V)<br>- for $I_{H\,DC}$ (60 Hz 460 V) | <br>kW<br>kW<br>hp<br>hp | <br>380<br>335<br>600<br>500 | <br>500<br>465<br>700<br>700 | <br>630<br>545<br>900<br>800 | <br>900<br>780<br>1250<br>1000 |
| **DC link current**<br>- Rated current $I_{N\,DC}$<br>- Base-load current $I_{H\,DC}$ 1)<br>- Maximum current $I_{max\,DC}$ | <br>A<br>A<br>A | <br>678<br>603<br>1017 | <br>940<br>837<br>1410 | <br>1103<br>982<br>1654 | <br>1574<br>1401<br>2361 |
| **Input/regenerative feedback current**<br>- Rated current $I_{N\,E}$<br>- Maximum current $I_{max\,E}$ | <br>A<br>A | <br>605<br>907 | <br>840<br>1260 | <br>985<br>1260 | <br>1405<br>2107 |
| **Current demand**<br>- Auxiliary supply 24 V DC<br>- 400 V AC at 50/60 Hz 2)<br>- 230 V AC 2) | <br>A<br>A<br>A | <br>1.57<br>3.6 / 5.4<br>4.6 | <br>1.57<br>3.6 / 5.4<br>4.6 | <br>1.67<br>5.4 / 8.1<br>4.9 | <br>1.67<br>5.4 / 8.1<br>4.9 |
| **DC link capacitance**<br>- Active Line Module<br>- Drive line-up, max. | <br>µF<br>µF | <br>12600<br>134400 | <br>16800<br>134400 | <br>18900<br>230400 | <br>28800<br>230400 |
| **Power loss, max.** 3)<br>- at 50 Hz 400 V<br>- at 60 Hz 460 V | <br>kW<br>kW | <br>11.7<br>12.1 | <br>13.8<br>14.3 | <br>17.6<br>18.3 | <br>21.8<br>22.7 |
| **Cooling air requirement** | $m^3/s$ | 1.18 | 1.18 | 1.48 | 1.48 |
| **Sound pressure level $L_{pA}$** (1 m) at 50/60 Hz 4) | dB(A) | 78/80 | 78/80 | 78/80 | 78/80 |
| **PE/GND conductor**<br>- Busbar cross-section<br>- Conductor cross-section, max. (IEC) | <br>$mm^2$<br>$mm^2$ | PE busbar<br>600<br>240 | | | |
| **Cable length, max.** 5)<br>- Shielded<br>- Unshielded | <br>m<br>m | <br>3900<br>5850 | <br>3900<br>5850 | <br>3900<br>5850 | <br>3900<br>5850 |
| **Degree of protection** (standard version) | | IP20 | IP20 | IP20 | IP20 |
| **Dimensions** (standard version, IP20)<br>- Width<br>- Height 6)<br>- Depth | <br>mm<br>mm<br>mm | <br>1000<br>2200<br>600 | <br>1000<br>2200<br>600 | <br>1400<br>2200<br>600 | <br>1400<br>2200<br>600 |
| **Weight** (standard version) | kg | 930 | 930 | 1360 | 1360 |
| **Frame size** | | HX + HI | HX + HI | JX + JI | JX + JI |

| **Article No.** | **6SL3730-** | **7TE36-1BA3** | **7TE38-4BA3** | **7TE41-0BA3** | **7TE41-4BA3** |
|---|---|---|---|---|---|
| **Maximum short-circuit current $I_{CC}$ acc. to IEC** | kA | 65 | 84 | 84 | 100 |
| **Minimum short-circuit current** [7] | kA | 12 | 2 | 4 | 6.4 |

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 power required for the 400 V AC and 230 V AC auxiliary supplies is taken from the line supply input voltage.

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

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

5) Total of all motor cables and DC link. Longer cable lengths for specific configurations that are available on request, see the SINAMICS - Low Voltage Engineering Manual in the device documentation provided.
The cable lengths are for use in an IT supply system. When used in TN systems, the cable lengths are reduced down to 30 % of the specified value.
When used in TN systems, and when the connected Motor Modules are operated with a higher pulse frequency, then the permissible cable lengths are available on request.

6) The cabinet height increases by 250 mm for IP21 degree of protection, and by 400 mm for IP23, IP43 and IP54 degree of protection.

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

Table 5- 25 Technical data for Active Line Modules (including Active Interface Module), 3 AC 500 ... 690 V

| **Article No.** | **6SL3730-** | **7TG35-8BA3** | **7TG37-4BA3** | **7TG41-0BA3** | **7TG41-3BA3** |
|---|---|---|---|---|---|
| **For parallel connection**<br>- Attached to Line Connection Module on left side | | -- | ...-4BC3 | ...-0BC3 | ...-3BC3 |
| **Rated power**<br>- for $I_{N\,DC}$ (50 Hz 690 V)<br>- for $I_{H\,DC}$ (50 Hz 690 V)<br>- for $I_{N\,DC}$ (50 Hz 500 V)<br>- for $I_{H\,DC}$ (50 Hz 500 V)<br>- for $I_{N\,DC}$ (60 Hz 575 V)<br>- for $I_{H\,DC}$ (60 Hz 575 V) | <br>kW<br>kW<br>kW<br>kW<br>hp<br>hp | <br>630<br>620<br>447<br>450<br>675<br>506 | <br>800<br>705<br>560<br>510<br>900<br>600 | <br>1100<br>980<br>780<br>710<br>1250<br>1000 | <br>1400<br>1215<br>965<br>880<br>1500<br>1250 |
| **DC link current**<br>- Rated current $I_{N\,DC}$<br>- Base-load current $I_{H\,DC}$ 1)<br>- Maximum current $I_{max\,DC}$ | <br>A<br>A<br>A | <br>644<br>573<br>966 | <br>823<br>732<br>1234 | <br>1148<br>1022<br>1722 | <br>1422<br>1266<br>2133 |
| **Input/regenerative feedback current**<br>- Rated current $I_{N\,E}$<br>- Maximum current $I_{max\,E}$ | <br>A<br>A | <br>575<br>862 | <br>735<br>1102 | <br>1025<br>1537 | <br>1270<br>1905 |
| **Current demand**<br>- Auxiliary supply 24 V DC<br>- 500 V AC at 50/60 Hz 2)<br>- 690 V AC at 50/60 Hz 2)<br>- 230 V AC 2) | <br>A<br>A<br>A<br>A | <br>1.57<br>3 / 4.5<br>2.1 / 3.1<br>4.6 | <br>1.67<br>4.4 / 6.6<br>3.1 / 4.6<br>4.9 | <br>1.87<br>4.4 / 6.6<br>3.1 / 4.6<br>4.9 | <br>1.87<br>4.4 / 6.6<br>3.1 / 4.6<br>4.9 |
| **DC link capacitance**<br>- Active Line Module<br>- Drive line-up, max. | <br>µF<br>µF | <br>7400<br>59200 | <br>11100<br>153600 | <br>14400<br>153600 | <br>19200<br>153600 |
| **Power loss, max.** 3)<br>- at 50 Hz 500/690 V<br>- at 60 Hz 575 V | <br>kW<br>kW | <br>13.6<br>13.0 | <br>19.2<br>18.6 | <br>22.8<br>22.1 | <br>26.1<br>24.9 |
| **Cooling air requirement** | $m^3/s$ | 1.18 | 1.48 | 1.48 | 1.48 |
| **Sound pressure level $L_{pA}$** (1 m) at 50/60 Hz 4) | dB(A) | 78/80 | 78/80 | 78/80 | 78/80 |
| **PE/GND conductor**<br>- Busbar cross-section<br>- Conductor cross-section, max. (IEC) | <br>$mm^2$<br>$mm^2$ | PE busbar<br>600<br>240 | | | |
| **Cable length, max.** 5)<br>- Shielded<br>- Unshielded | <br>m<br>m | <br>2250<br>3375 | <br>2250<br>3375 | <br>2250<br>3375 | <br>2250<br>3375 |
| **Degree of protection** (standard version) | | IP20 | IP20 | IP20 | IP20 |
| **Dimensions** (standard version, IP20)<br>- Width<br>- Height 6)<br>- Depth | <br>mm<br>mm<br>mm | <br>1000<br>2200<br>600 | <br>1400<br>2200<br>600 | <br>1400<br>2200<br>600 | <br>1400<br>2200<br>600 |
| **Weight** (standard version) | kg | 930 | 1360 | 1360 | 1360 |
| **Frame size** | | HX + HI | JX + JI | JX + JI | JX + JI |

| **Article No.** | **6SL3730-** | **7TG35-8BA3** | **7TG37-4BA3** | **7TG41-0BA3** | **7TG41-3BA3** |
|---|---|---|---|---|---|
| **Maximum short-circuit current $I_{CC}$ acc. to IEC** | kA | 65 | 84 | 100 | 100 |
| **Minimum short-circuit current** [7]<br>- For a parallel connection | kA | 9 | 15<br>4 | 2.5<br>4 | 3.2<br>5 |

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 power required for the 500/690 V AC auxiliary supply is taken from the supply input voltage.

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

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

5) Total of all motor cables and DC link. Longer cable lengths for specific configurations that are available on request, see the SINAMICS - Low Voltage Engineering Manual in the device documentation provided.
The cable lengths are for use in an IT supply system. When used in TN systems, the cable lengths are reduced down to 30 % of the specified value.
When used in TN systems, and when the connected Motor Modules are operated with a higher pulse frequency, then the permissible cable lengths are available on request.

6) The cabinet height increases by 250 mm for IP21 degree of protection, and by 400 mm for IP23, IP43 and IP54 degree of protection.

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

# 5.5 Active Line Connection Modules-2

## 5.5.1 Description

**Note**

**Additional information**

The arrangement of the components and interfaces as well as the wiring are shown in the attached layout diagrams (AO) or circuit diagrams (SP), which are included in the individual device documentation.



Figure 5-31 Active Line Connection Module-2

Active Line Connection Modules-2 can inject energy into the DC voltage link and feed regenerative energy into the line supply.

Active Line Connection Modules-2 comprise a Line Connection Module, an Active Interface Module and an Active Line Module Chassis-2 format installed in a cabinet system.

The Active Line Connection Module-2 contains the line-side infeed via main switch and circuit breaker and precharging, it establishes the connection between the line supply on the system side and the Active Line Module Chassis-2. It is equipped as standard with a radio interference suppression filter according to IEC 61800-3 Category C3.

Active Line Connection Modules-2 generate a controlled DC voltage that is kept consistent 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-2 draw a virtually sinusoidal current from the supply system and cause virtually no line harmonics.

Active Line Connection Modules-2 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 |
|---|---|
| 380 ... 480 V 3 AC | 355 ... 900 kW |

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

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

The power rating can be increased by connecting Active Line Connection Modules-2 in parallel.

**NOTICE**

**Operation only with a firmware version from V5.2 HF4 and higher.**

The Active Line Module Chassis-2 can be damaged if operated with unsuitable firmware.

- Only operate the Active Line Module Chassis-2 with a firmware version from V5.2 HF4 and higher.

## Integration

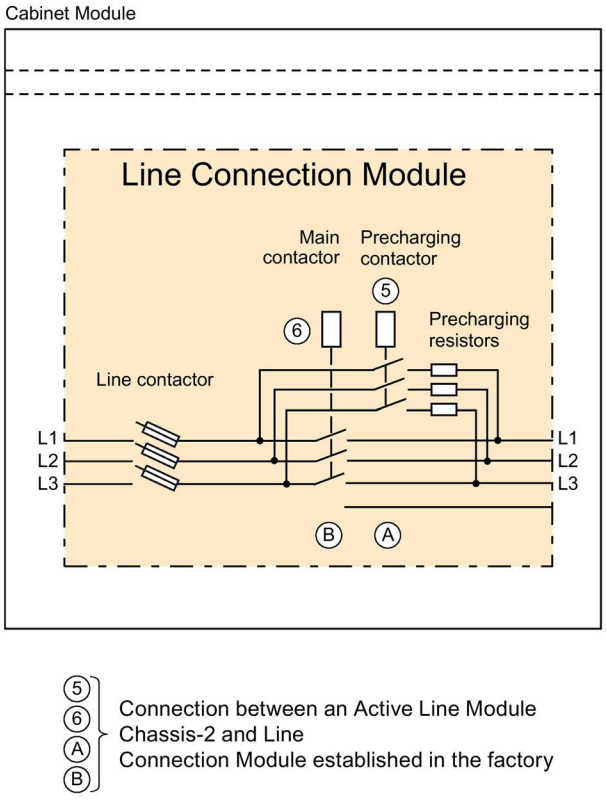



Figure 5-32 Connection example, Active Line Connection Module-2: Line Connection Module

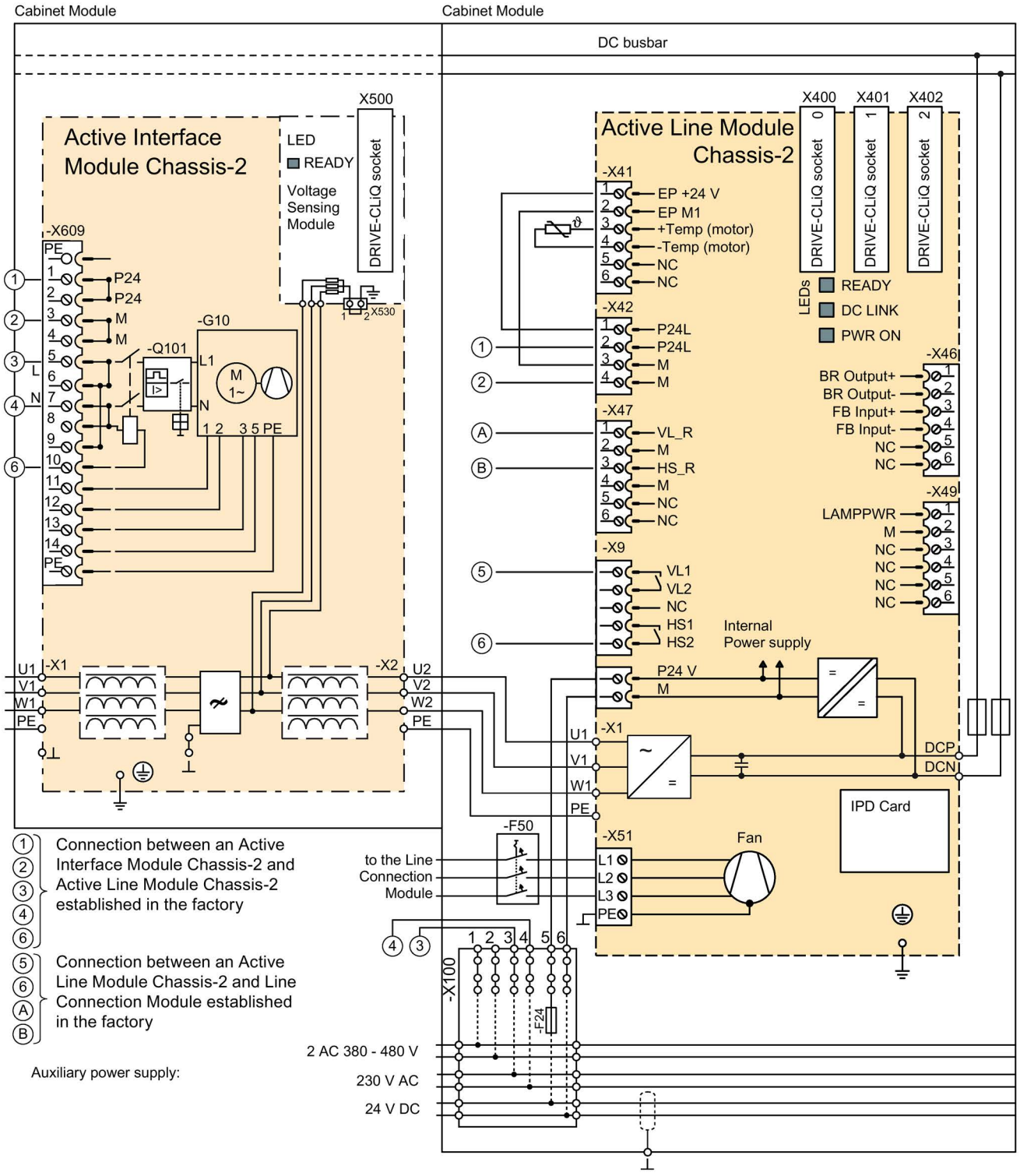



Figure 5-33 Connection example, Active Line Connection Module-2: Active Interface Module Chassis-2 and Active Line Module Chassis-2

## Configuration

An Active Line Connection Module-2 always includes an Active Interface Module Chassis-2, which contains the associated Clean Power Filter for compliance with the EMC requirements according to IEC 61800-3, Category C3.

Active Line Connection Modules-2 are available for installing the Motor Modules to the right (Article number "...RE0") and for installing the Motor Modules to the left (Article number "...LE0"). The Line Connection Module with the line connection is installed directly next to the Active Interface Module.

**Note**

**Additional information**

The configuration examples of the individual Active Line Connection Modules-2 show the arrangement of the factory-fitted components. They show the maximum possible configuration of the modules, which contain all options that can be ordered.

The precise order-specific location of the components is provided in the layout diagrams (AO) in the individual device documentation.

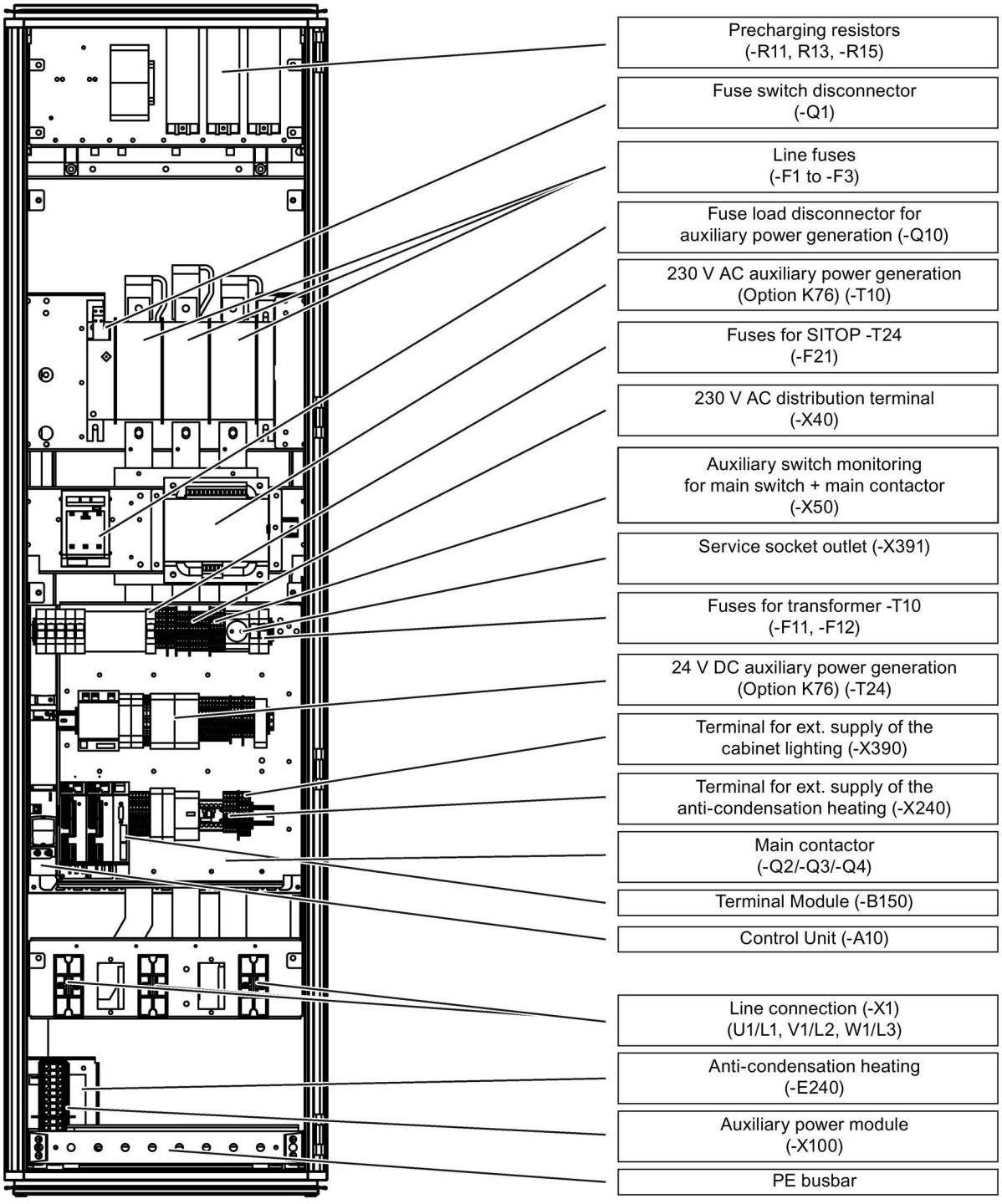



Figure 5-34 Configuration example for Line Connection Modules (frame size HL)

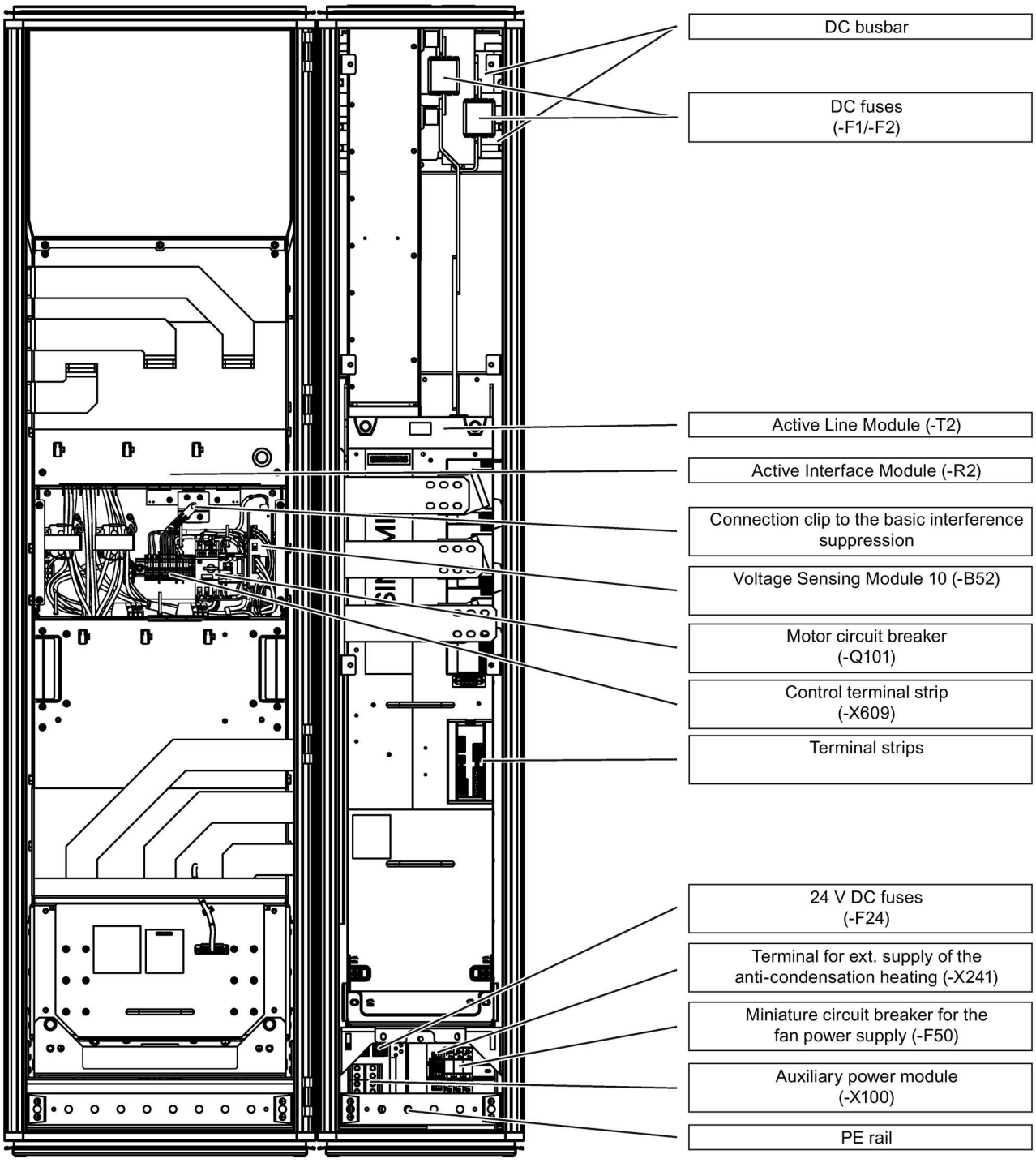



Figure 5-35 Configuration example, Active Interface Module Chassis-2 (frame size FS2) and Active Line Module Chassis-2 (frame sizes FS2, FS2+) – for installing the Motor Modules to the right

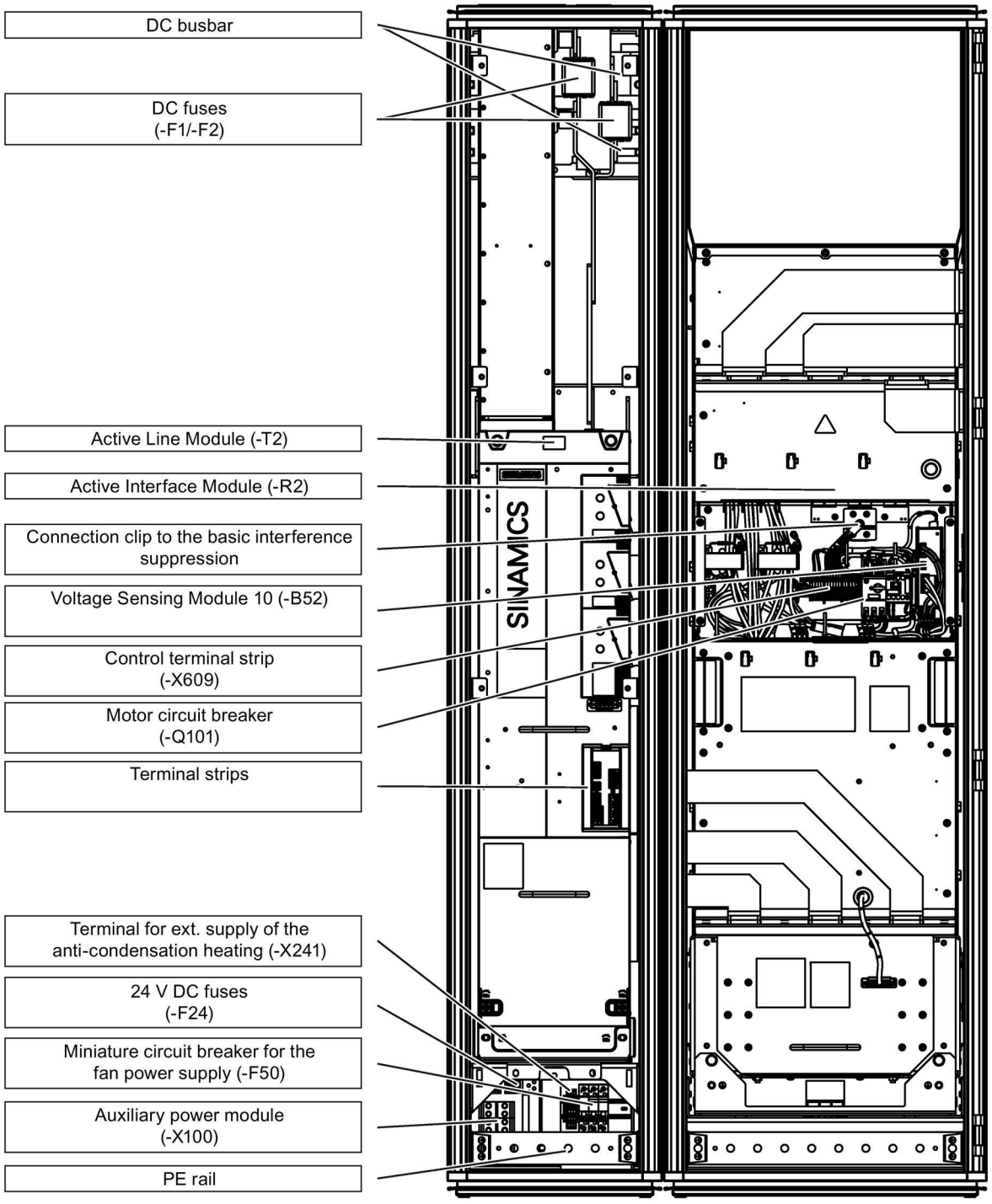



Figure 5-36 Configuration example, Active Interface Module Chassis-2 (frame size FS2) and Active Line Module Chassis-2 (frame sizes FS2, FS2+) – for installing the Motor Modules to the left

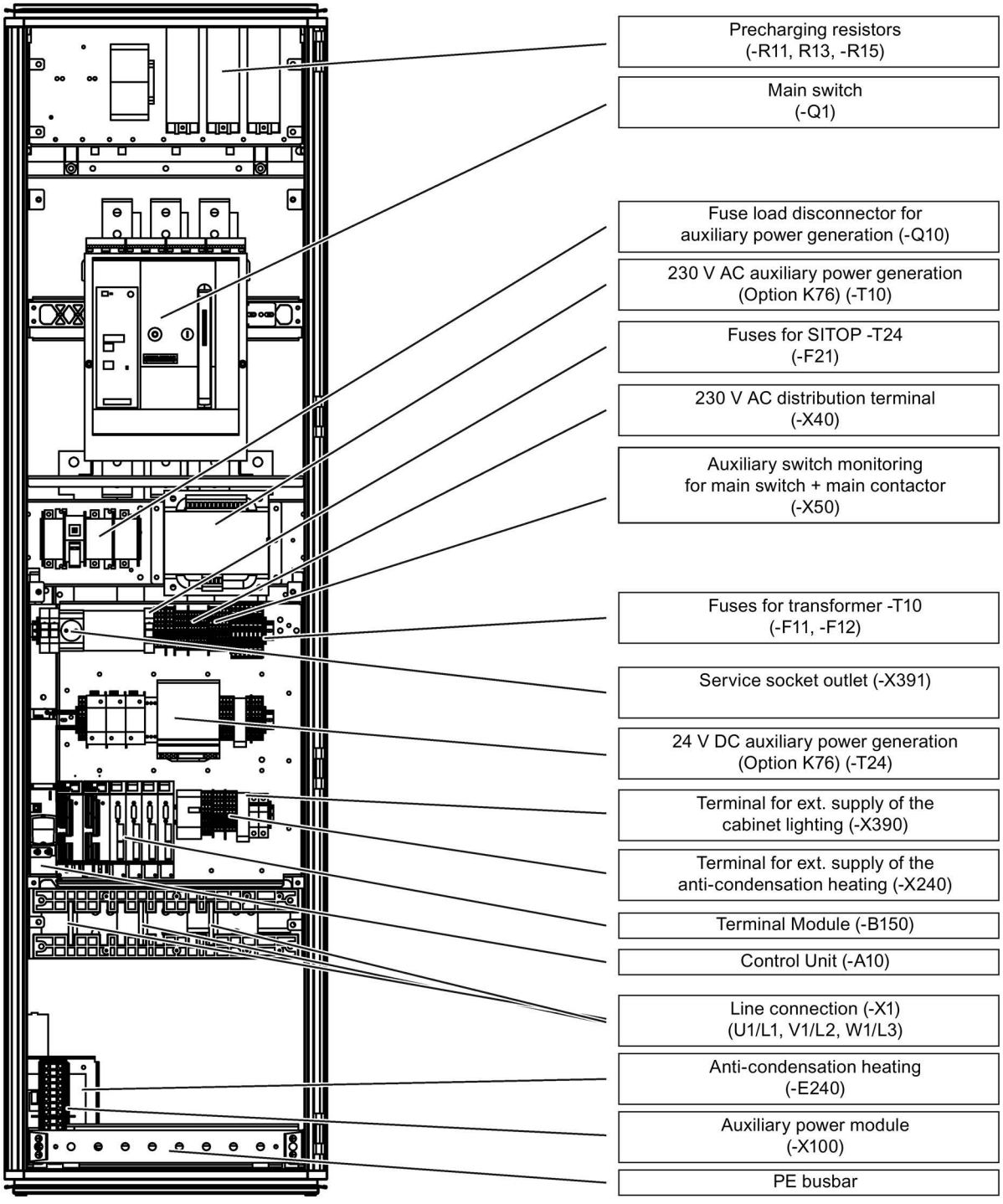



Figure 5-37 Configuration example for Line Connection Modules (frame size JL)

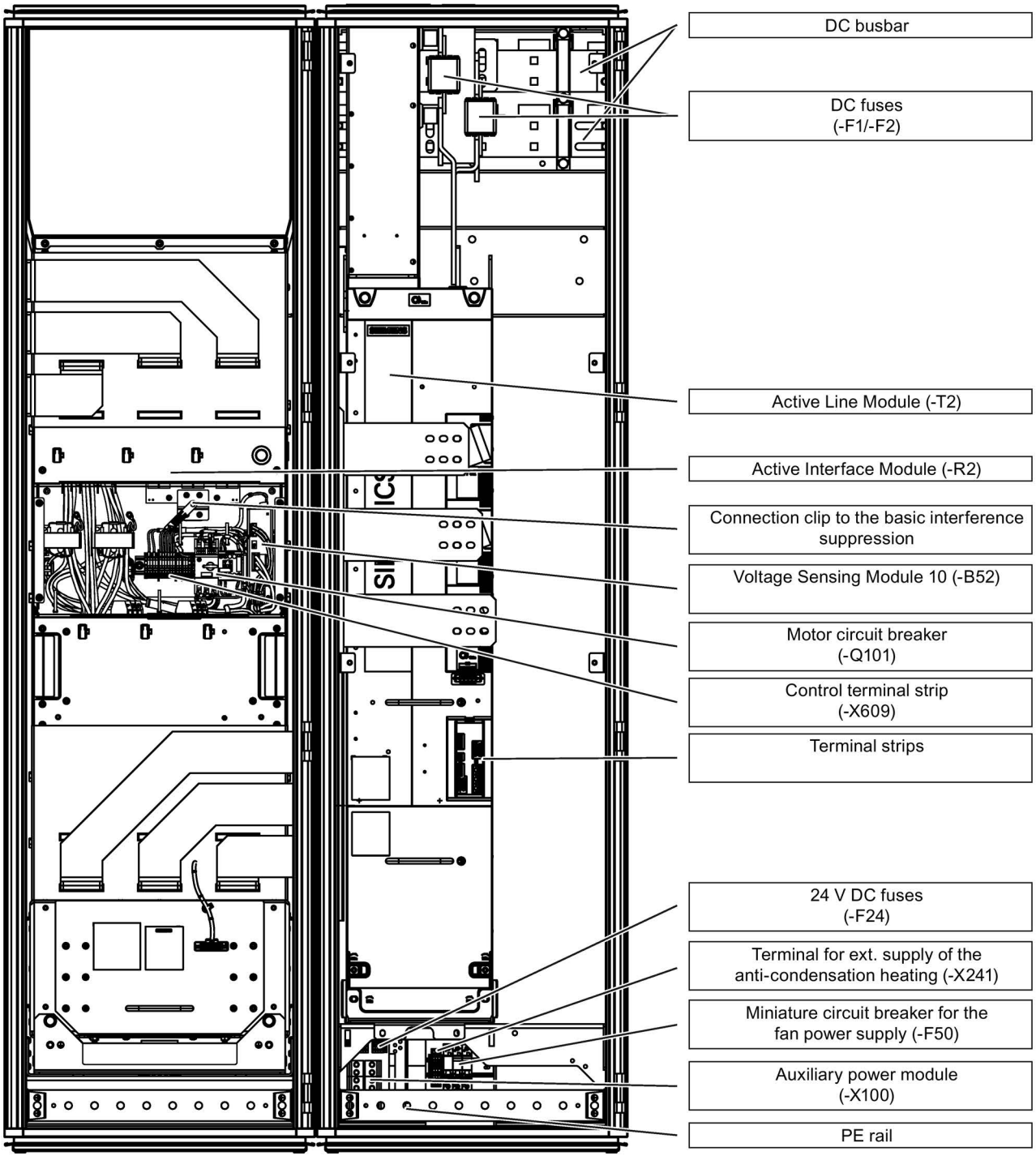



Figure 5-38 Configuration example, Active Interface Module Chassis-2 (frame size FS4) and Active Line Module Chassis-2 (frame size FS4, FS4+) – for installing the Motor Modules to the right

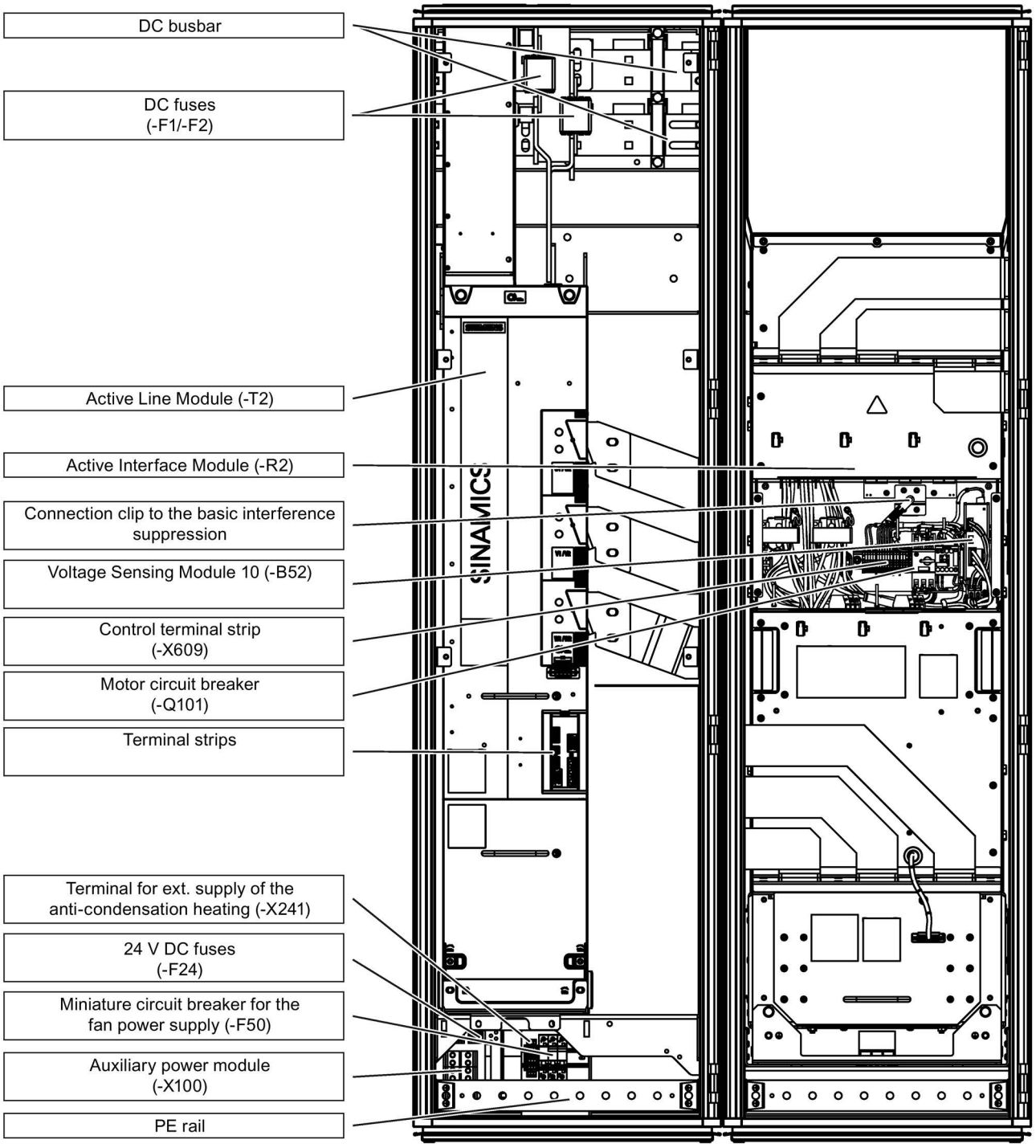



Figure 5-39 Configuration example, Active Interface Module Chassis-2 (frame size FS4) and Active Line Module Chassis-2 (frame size FS4, FS4+) – for installing the Motor Modules to the left

### Connecting Active Line Connection Modules-2 in parallel to increase the power rating

The following rules must be observed when connecting Active Line Connection Modules-2 in parallel:

- Up to 6 identical Active Line Connection Modules-2 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.
- Parallel connection can only be implemented using one common Control Unit.
  For more than 4 power units, these must be distributed as symmetrically as possible between at least two DRIVE-CLiQ ports (e.g. 3x 2 Active Line Connection Modules-2 in series, or a minimum of 2x 3 Active Line Connection Modules-2 in series).
- 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-2 in parallel if all the power units have the same hardware version.

It is not possible to connect Active Line Modules (Article No. 6SL3730-7Txxx-xAAx) and Active Line Connection Modules-2 (Article No. 6SL3731-7Txxx-xxE0).

### Using Active Line Connection Modules-2 in line supplies in conformance with IEC 61000-2-4, Class 2

When using Active Line Connection Modules-2 in line supplies in conformance with Standard IEC 61000-2-4, Class 2, the following conditions must be carefully observed:

- Class 2 of IEC 61000-2-4 is complied with for the step-up factor set in the factory (= 1.5) and an $R_{SC}$ > 20 and a pulse frequency of 4 kHz.
- For a step-up factor ≥1.5, the pulse frequency of Active Line Modules Chassis-2 must be set to 8 kHz.
  When used in TN systems and when the Active Line Modules Chassis-2 or the connected Motor Modules are operated with a higher pulse frequency, then the permissible cable lengths are available on request.

**Note**

When complying with the limit values according to standard IEC 61000-2-4, Class 2 and Class 3, the evaluation of the conductor-conductor voltage in a frequency range of <9 kHz is assumed.

### Operating Active Line Connection Modules-2 on weak line supplies

When using an Active Line Connection Module-2 on weak line supplies ($R_{SC}$ < 20), the bandstop filter must be activated (parameter p5200.0 = 1), in order to suppress increased line harmonics.

**Note**

**Activating the bandstop filter**

Function module "Supplementary control" must be activated to activate the bandstop filter. For additional information, see "SINAMICS S120 Function Manual Drive Functions".

After activating the bandstop filter, no additional settings are required; it can be operated with the factory parameterization.

When using an Active Line Connection Module-2 on strong (stiff) line supplies ($R_{SC}$ > 20), the bandstop filter should not be activated (parameter p5200.0 = 0), in order to avoid unfavorable overshoots. For more information, see Low Voltage Engineering Manual.

## 5.5.1.1 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.

| NOTICE |
|---|
| **Material damage caused by switching the line contactor under load**<br>Switching the line contactor under load can result in increased wear and consequently to premature failure of the line contactor.<br>• Always switch the line contactor at zero current. |

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

Table 5- 26 Terminal block X50 feedback signal contact "Fuse switch disconnector" and "Main contactor"

| Terminal | Designation [1] | Technical data |
|---|---|---|
| 1 | NO | "Fuse switch disconnector" checkback contacts<br>Max. load current: 3 A<br>max. Switching voltage: 250 VAC |
| 2 | NC | |
| 3 | COM | |
| 4 | NO | "Main contactor" feedback signal contacts<br>Max. load current: 10 A<br>Max. Switching voltage: 250 V AC<br>Max. contact rating: 250 VA<br>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

### 5.5.1.2 Circuit breaker (input current > 800 A)

For currents exceeding 800 A, the circuit breaker, which is located in the center of the cabinet, isolates the system from the supply and provides the 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 5- 27 Factory setting of the circuit breaker for the Active Line Connection Module-2

| Article number<br>Active Line Connection Module-2 | Input current | Overload trip (L) | Short-time delayed short-circuit release (S) | Short-circuit release delay ($t_{sd}$) |
|---|---|---|---|---|
| 6SL3731-7TE38-4RE0<br>6SL3731-7TE38-4LE0 | 840 A | 0.9 | 2 | 0 |
| 6SL3731-7TE38-8RE0<br>6SL3731-7TE38-8LE0 | 900 A | 0.9 | 2 | 0 |
| 6SL3731-7TE41-0RE0<br>6SL3731-7TE41-0LE0 | 985 A | 0.8 | 2 | 0 |
| 6SL3731-7TE41-2RE0<br>6SL3731-7TE41-2LE0 | 1110 A | 0.9 | 2 | 0 |
| 6SL3731-7TE41-3RE0<br>6SL3731-7TE41-3LE0 | 1260 A | 0.8 | 2 | 0 |
| 6SL3731-7TE41-4RE0<br>6SL3731-7TE41-4LE0 | 1405 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**

A detailed description of the complete principle of operation of the circuit breaker and its handling, the options integrated in the factory as well as additional available options are given in the associated operating instructions, which are included in the device documentation provided.

### X50 "circuit breaker" checkback contact

Table 5- 28 Terminal block X50 "Circuit breaker" checkback contact

| Terminal | Designation [1)] | Technical data |
|---|---|---|
| 1 | NO | "Circuit breaker" checkback contacts<br>Max. load current: 3 A<br>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 5- 29 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 | |

## 5.5.1.3 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 5- 30 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 | | |

#### 5.5.1.4 Motor circuit breaker -Q101

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

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

Table 5- 31 Factory setting of the motor circuit breaker

| Active Interface Module | Motor circuit breaker type | Setting value |
|---|---|---|
| Frame sizes FS2, FS4, FS4+ | 3RV2011-0GA25 (4.5 ... 6.3 A) | 4.5 A |

**Checking the position of the rotary knob**

Before commissioning, check that the rotary knob is in the correct position.

- When the Active Interface Module is operational, the rotary knob must be in the "ON" position.
- If the rotary knob is in the "OFF" or "TRIPPED" position, then for operation it must be brought into the "ON" position.
  - Switching from the "OFF" position to the "ON" position must be done quickly and without any interruption.
  - Starting from the "TRIPPED" position, the rotary knob must first be turned to the "OFF" position and then to the "ON" position.
    The fault that caused the motor circuit breaker to trip must first be resolved.

### 5.5.2 Interface description

#### 5.5.2.1 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, which are included in the individual device documentation.

### Overview of the terminal strips at the Active Line Connection Module-2

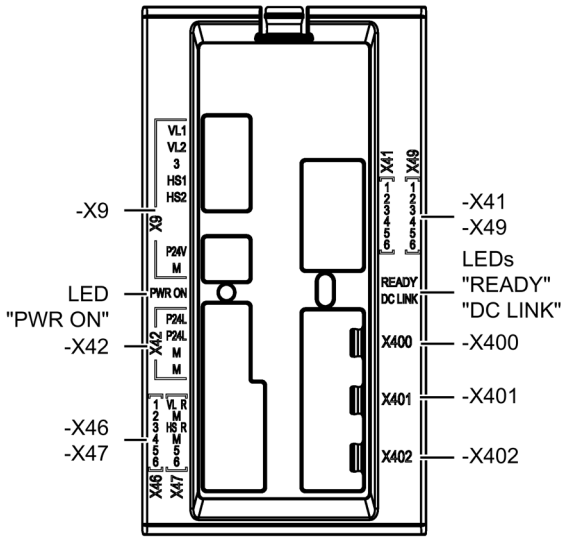



Figure 5-40 Terminal strips at the Active Line Connection Module-2

## 5.5.2.2 X41 EP terminal / temperature sensor connection

Table 5- 32 Terminal strip X41 EP terminals / temperature sensor connection

| Connector | Terminal | Function | Technical data |
|---|---|---|---|
|  | 1 | EP +24 V (enable pulses) | Supply voltage: 24 VDC (20.4 to 28.8 V)<br>Current consumption: 10 mA |
| | 2 | EP M1 (enable pulses) | |
| | 3 | +Temp (motor) | Temperature sensor connection: KTY84-1C130 / PT100 / PT1000 / PTC |
| | 4 | -Temp (motor) | |
| | 5 | NC | Reserved, do not use |
| | 6 | NC | Reserved, do not use |
| Max. connectable cross-section: 1.5 mm$^2$<br>At terminals 1 and 2, the terminal strip has a yellow marking, it is coded at terminal 4; please use the corresponding connector from the accessory pack. | | | |



**⚠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 the motor in the event of incorrectly connected KTY temperature sensor at terminals X41:3,4**

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

- Connect a KTY temperature sensor with the correct polarity.

**NOTICE**

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

If the upstream circuit breakers are not controlled from the SINAMICS drive group in the case of infeed units capable of energy recovery, then this can have a damaging reaction on the section that has been shut down when the circuit breaker is opened. As a consequence, under certain circumstances, the components connected in the line supply section involved could be damaged as a result of overvoltage.

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

**Note**

The temperature sensor connection at terminals X41:3,4 can be used for motors that are equipped with a KTY84-1C130, PT100, PT1000 or PTC measuring sensor in the stator windings.

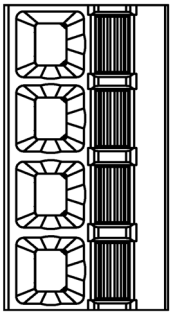
**Note**

**Connection to terminals 1 and 2**

For operation, 24 V DC must be connected to terminal 1 and ground to terminal 2. Pulse inhibit is activated when withdrawn.

### 5.5.2.3 X42 terminal strip

Table 5- 33 Terminal strip X42 voltage supply for Control Unit, Sensor Module and Terminal Module

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

**Note**

**Connection options for terminal strip X42**

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

When required, additional system-side components can be connected via the central auxiliary power supply (X100).

### 5.5.2.4 X47 contactor feedback signal

Table 5- 34 Terminal strip X47, contactor feedback signal

| Connector | Terminal | Signal name | Technical specifications |
|---|---|---|---|
|  | 1 | VL_R | Precharging contactor feedback signal |
| | 2 | M | Supply voltage: 24 V DC<br>Max. Load current: 10 mA |
| | 3 | HS_R | Main contactor feedback signal |
| | 4 | M | Supply voltage: 24 V DC<br>Max. Load current: 10 mA |
| | 5 | NC | Reserved, do not use |
| | 6 | NC | Reserved, do not use |
| Max. connectable cross-section: 1.5 mm$^2$<br>The terminal strip is coded at terminal 3; please use the corresponding connector from the accessory pack. | | | |

Monitoring the precharging and main contactor of the Active Line Connection Module-2 is activated in the factory setting.

Fault messages

- F30060 (A) status monitoring for the precharging contactor
- F30061 (A): Status monitoring for the main contactor

### 5.5.2.5 X49 terminal block

Table 5- 35 Terminal strip X49

| Connector | Terminal | Function | Technical specifications |
|---|---|---|---|
|  | 1 | LAMPPWR | Supply voltage: 24 V DC<br>Max. Load current: 100 mA<br>If a fault is active at the power unit, then a voltage is present at the terminals. |
| | 2 | M | |
| | 3 | NC | Reserved, do not use |
| | 4 | NC | Reserved, do not use |
| | 5 | NC | Reserved, do not use |
| | 6 | NC | Reserved, do not use |
| Max. connectable cross-section: 1.5 mm$^2$<br>The terminal strip is coded at terminal 6; please use the corresponding connector from the accessory pack. | | | |

**Note**

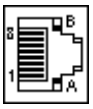
**Function of the "LAMPPWR" signal**

Terminal "LAMPPWR" can be used in large cabinet lineups to connect a signal lamp, which is then used to indicate which power unit has a problem. 24 V DC is output as soon as a fault becomes active in a power unit.

Note: For a firmware update, the output alternates between 0 V and 24 V.

### 5.5.2.6 DRIVE-CLiQ interfaces X400, X401, X402

Table 5- 36 DRIVE-CLiQ interfaces X400, X401, X402

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

### 5.5.2.7 Test points for 1 mm test probes

Test points for 1 mm test probes are provided at the sides of connectors X41, X46, X47 and X49, see ① in the following diagram.

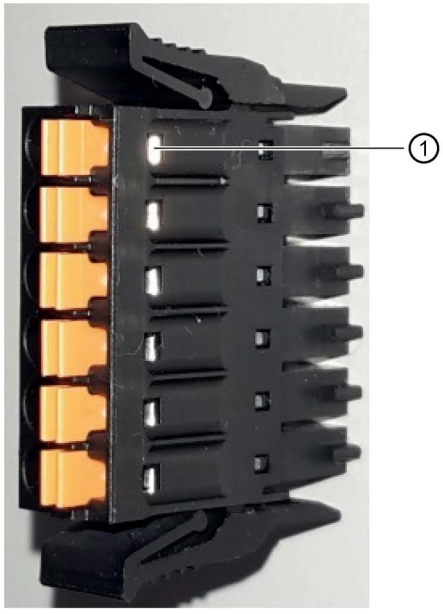



Figure 5-41 Test points for 1 mm test probes

## 5.5.3 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 TM150 temperature sensor modules | G53 |
| 4 TM150 temperature sensor modules | G54 |
| Terminal Module TM31 | G60 |
| Additional TM31 Terminal Module | G61 |
| Terminal Board TB30 | 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 |
| Surge suppression | L21 |
| Draw-out circuit breaker (for Line Connection Modules >800 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 outlet | 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 |
| IP21 degree of protection | M21 |
| IP23 degree of protection | M23 |
| Side panel right mounted | M26 |
| Side panel left mounted | M27 |
| IP43 degree of protection | M43 |
| IP54 degree of protection | M54 |
| 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 |
| 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 |
|---|---|
| Complete 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 / Portuguese (Brazil) | T83 |
| 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 |

## 5.5.4 Technical data

### 5.5.4.1 Active Line Connection Modules-2, 3 AC 380 ... 480 V

Table 5- 37 Technical data for Active Line Connection Modules-2, 380 V ... 480 V 3 AC, Part 1

| **Article No.** [1] | **6SL3731-** | **7TE35-6RE0**<br>**7TE35-6LE0** | **7TE36-4RE0**<br>**7TE36-4LE0** | **7TE37-5RE0**<br>**7TE37-5LE0** | **7TE38-4RE0**<br>**7TE38-4LE0** |
|---|---|---|---|---|---|
| **Rated power**<br>- for $I_{N\,DC}$ (50 Hz 400 V)<br>- for $I_{L\,DC}$ (50 Hz 400 V)<br>- for $I_{N\,DC}$ (60 Hz 460 V)<br>- for $I_{L\,DC}$ (60 Hz 460 V) | <br>kW<br>kW<br>hp<br>hp | <br>355<br>300<br>500<br>400 | <br>400<br>350<br>550<br>500 | <br>450<br>400<br>650<br>550 | <br>500<br>450<br>700<br>650 |
| **DC link current**<br>- Rated current $I_{N\,DC}$<br>- Base-load current $I_{L\,DC}$ [2]<br>- Maximum current $I_{max\,DC}$ | <br>A<br>A<br>A | <br>630<br>571<br>857 | <br>710<br>649<br>974 | <br>835<br>760<br>1140 | <br>940<br>854<br>1281 |
| **Input/regenerative feedback current**<br>- Rated current $I_{N\,E}$<br>- Maximum current $I_{max\,E}$ | <br>A<br>A | <br>560<br>773 | <br>635<br>878 | <br>745<br>1028 | <br>840<br>1155 |
| **Supply voltages**<br>- Line voltage<br>- Line frequency<br>- Electronics power supply<br>- DC link voltage | <br>$V_{ACrms}$<br>Hz<br>$V_{DC}$<br>$V_{DC}$ | 3 AC 380 -10 % ... 3 AC 480 +10 % (-15 % < 1 min)<br>47 ... 63 Hz<br>24 (20.4 ... 28.8)<br>1.5 x $U_{line}$ | | | |
| **Pulse frequency** [3] | kHz | 4 | 4 | 4 | 4 |
| **Current consumption (230 V 1 AC)** | A | 4.1 | 4.1 | 4.1 | 4.1 |
| **Current consumption of the electronics (24 V DC)** | A | 1.5 | 1.5 | 1.5 | 1.5 |
| **DC link capacitance**<br>- Active Line Module<br>- Drive line-up, max. | <br>µF<br>µF | <br>16450<br>250000 | <br>16450<br>250000 | <br>18800<br>250000 | <br>18800<br>250000 |
| **Power loss, max.** [4]<br>- at 50 Hz 400 V<br>- at 60 Hz 460 V | <br>kW<br>kW | <br>12.14<br>12.14 | <br>12.65<br>12.65 | <br>16.38<br>16.38 | <br>17.32<br>17.32 |
| **Cooling air requirement** | $m^3/s$ | 1.3 | 1.3 | 1.7 | 1.7 |
| **Sound pressure level $L_{pA}$** (1 m) at 50/60 Hz [5] | dB(A) | 75/75 | 75/75 | 75/75 | 75/75 |
| **Line connection L1, L2, L3**<br>- Conductor cross-section, max. (IEC) | <br>$mm^2$ | 4M12<br>8 x 240 | 4/M12<br>8 x 240 | 10/M12<br>8 x 240 | 10/M12<br>8 x 240 |
| **PE/GND conductor**<br>- Busbar cross-section<br>- Conductor cross-section, max. (IEC) | <br>$mm^2$<br>$mm^2$ | PE busbar<br>600<br>240 | | | |
| **Cable length, max.** [6]<br>- shielded<br>- unshielded | <br>m<br>m | <br>3900<br>5850 | <br>3900<br>5850 | <br>3900<br>5850 | <br>3900<br>5850 |
| **Degree of protection** (standard version) | | IP20 | IP20 | IP20 | IP20 |
| **Dimensions** (standard version)<br>- Width<br>- Height<br>- Depth | <br>mm<br>mm<br>mm | <br>1600<br>2200<br>600 | <br>1600<br>2200<br>600 | <br>1600<br>2200<br>600 | <br>1600<br>2200<br>600 |
| **Weight** (standard version) | kg | 989 | 994 | 1192 | 1192 |

| **Article No.** [1] | **6SL3731-** | **7TE35-6RE0<br>7TE35-6LE0** | **7TE36-4RE0<br>7TE36-4LE0** | **7TE37-5RE0<br>7TE37-5LE0** | **7TE38-4RE0<br>7TE38-4LE0** |
|---|---|---|---|---|---|
| **Frame size**<br>- Line Connection Module<br>- Active Interface Module<br>- Active Line Module | | <br>HL<br>FS2<br>FS2 | <br>HL<br>FS2<br>FS2 | <br>JL<br>FS4<br>FS2+ | <br>JL<br>FS4<br>FS2+ |
| **Maximum short-circuit current $I_{CC}$ acc. to IEC** | kA | 50 | 50 | 100 | 100 |
| **Minimum short-circuit current** [7] | kA | 18 | 18 | 2 | 2 |

1) Article number "...RE0": Motor Modules installed to the right, "...LE0": Motor Modules installed to the left.

2) The base-load current $I_{L\,DC}$ is based on a duty cycle of 115% for 60 s or $I_{max\,DC}$ for 5 s with a duty cycle duration of 300 s.

3) Derating for higher pulse frequencies on request.

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

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

6) Total of all motor cables and DC link. Longer cable lengths for specific configurations that are available on request, see the SINAMICS - Low Voltage Engineering Manual in the device documentation provided.
The cable lengths are for use in an IT supply system. When used in TN systems, the cable lengths are reduced down to 30 % of the specified value.
When used in TN systems and when the Active Line Module Chassis-2 or the connected Motor Modules are operated with a higher pulse frequency, then the permissible cable lengths are available on request.

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

Table 5- 38 Technical data for Active Line Connection Modules-2, 380 V ... 480 V 3 AC, Part 2

| **Article No.** [1] | **6SL3731-** | **7TE38-8RE0 7TE38-8LE0** | **7TE41-0RE0 7TE41-0LE0** | **7TE41-2RE0 7TE41-2LE0** | **7TE41-3RE0 7TE41-3LE0** |
|---|---|---|---|---|---|
| **Rated power** | | | | | |
| - for $I_{N\,DC}$ (50 Hz 400 V) | kW | 560 | 630 | 710 | 800 |
| - for $I_{L\,DC}$ (50 Hz 400 V) | kW | 500 | 560 | 630 | 710 |
| - for $I_{N\,DC}$ (60 Hz 460 V) | hp | 800 | 900 | 1050 | 1150 |
| - for $I_{L\,DC}$ (60 Hz 460 V) | hp | 700 | 800 | 900 | 1000 |
| **DC link current** | | | | | |
| - Rated current $I_{N\,DC}$ | A | 1010 | 1100 | 1245 | 1415 |
| - Base-load current $I_{L\,DC}$ [2] | A | 915 | 1004 | 1131 | 1287 |
| - Maximum current $I_{max\,DC}$ | A | 1373 | 1506 | 1697 | 1931 |
| **Input/regenerative feedback current** | | | | | |
| - Rated current $I_{N\,E}$ | A | 900 | 985 | 1110 | 1260 |
| - Maximum current $I_{max\,E}$ | A | 1238 | 1358 | 1530 | 1740 |
| **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 $U_{line}$ | | | |
| **Pulse frequency** [3] | kHz | 4 | 4 | 4 | 4 |
| **Current consumption (230 V 1 AC)** | A | 4.1 | 4.1 | 4.1 | 4.1 |
| **Current consumption of the electronics (24 V DC)** | A | 1.5 | 1.5 | 1.5 | 1.5 |
| **DC link capacitance** | | | | | |
| - Active Line Module | µF | 25900 | 25900 | 25900 | 40800 |
| - Drive line-up, max. | µF | 250000 | 250000 | 250000 | 250000 |
| **Power loss, max.** [4] | | | | | |
| - at 50 Hz 400 V | kW | 17.70 | 18.55 | 19.62 | 23.9 |
| - at 60 Hz 460 V | kW | 17.70 | 18.55 | 19.62 | 23.9 |
| **Cooling air requirement** | $m^3/s$ | 1.7 | 1.7 | 1.7 | 1.7 |
| **Sound pressure level $L_{pA}$** (1 m) at 50/60 Hz [5] | dB(A) | 75/75 | 75/75 | 75/75 | 75/75 |
| **Line connection L1, L2, L3** | | 10/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 conductor** | | PE busbar | | | |
| - Busbar cross-section | $mm^2$ | 600 | | | |
| - Conductor cross-section, max. (IEC) | $mm^2$ | 240 | | | |
| **Cable length, max.** [6] | | | | | |
| - shielded | m | 3900 | 3900 | 3900 | 3900 |
| - unshielded | m | 5850 | 5850 | 5850 | 5850 |
| **Degree of protection** (standard version) | | IP20 | IP20 | IP20 | IP20 |
| **Dimensions** (standard version) | | | | | |
| - Width | mm | 1800 | 1800 | 1800 | 1800 |
| - Height | mm | 2200 | 2200 | 2200 | 2200 |
| - Depth | mm | 600 | 600 | 600 | 600 |
| **Weight** (standard version) | kg | 1264 | 1345 | 1406 | 1509 |
| **Frame size** | | | | | |
| - Line Connection Module | | JL | JL | JL | JL |
| - Active Interface Module | | FS4 | FS4 | FS4 | FS4 |
| - Active Line Module | | FS4 | FS4 | FS4 | FS4+ |

| **Article No.** [1] | **6SL3731-** | **7TE38-8RE0 7TE38-8LE0** | **7TE41-0RE0 7TE41-0LE0** | **7TE41-2RE0 7TE41-2LE0** | **7TE41-3RE0 7TE41-3LE0** |
|---|---|---|---|---|---|
| **Maximum short-circuit current $I_{CC}$ acc. to IEC** | kA | 100 | 100 | 100 | 100 |
| **Minimum short-circuit current** [7] | kA | 2 | 2.5 | 2.5 | 3.2 |

1) Article number "...RE0": Motor Modules installed to the right, "...LE0": Motor Modules installed to the left.

2) The base-load current $I_{L\,DC}$ is based on a duty cycle of 115% for 60 s or $I_{max\,DC}$ for 5 s with a duty cycle duration of 300 s.

3) Derating for higher pulse frequencies on request.

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

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

6) Total of all motor cables and DC link. Longer cable lengths for specific configurations that are available on request, see the SINAMICS - Low Voltage Engineering Manual in the device documentation provided.
The cable lengths are for use in an IT supply system. When used in TN systems, the cable lengths are reduced down to 30 % of the specified value.
When used in TN systems and when the Active Line Module Chassis-2 or the connected Motor Modules are operated with a higher pulse frequency, then the permissible cable lengths are available on request.

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

Table 5- 39 Technical data for Active Line Connection Modules-2, 3 AC 380 ... 480 V, Part 3

| **Article No.** [1] | **6SL3731-** | **7TE41-4RE0**<br>**7TE41-4LE0** | | | |
|---|---|---|---|---|---|
| **Rated power**<br>- for $I_{N\,DC}$ (50 Hz 400 V)<br>- for $I_{L\,DC}$ (50 Hz 400 V)<br>- for $I_{N\,DC}$ (60 Hz 460 V)<br>- for $I_{L\,DC}$ (60 Hz 460 V) | <br>kW<br>kW<br>hp<br>hp | <br>900<br>800<br>1300<br>1150 | | | |
| **DC link current**<br>- Rated current $I_{N\,DC}$<br>- Base-load current $I_{L\,DC}$ [2]<br>- Maximum current $I_{max\,DC}$ | <br>A<br>A<br>A | <br>1575<br>1431<br>2147 | | | |
| **Input/regenerative feedback current**<br>- Rated current $I_{N\,E}$<br>- Maximum current $I_{max\,E}$ | <br>A<br>A | <br>1405<br>1935 | | | |
| **Supply voltages**<br>- Line voltage<br>- Line frequency<br>- Electronics power supply<br>- DC link voltage | <br>$V_{ACrms}$<br>Hz<br>$V_{DC}$<br>$V_{DC}$ | <br>3 AC 380 -10 % ... 3 AC 480 +10 % (-15 % < 1 min)<br>47 ... 63 Hz<br>24 (20.4 ... 28.8)<br>1.5 x $U_{line}$ | | | |
| **Pulse frequency** [3] | kHz | 4 | | | |
| **Current consumption (230 V 1 AC)** | A | 4.1 | | | |
| **Current consumption of the electronics (24 V DC)** | A | 1.5 | | | |
| **DC link capacitance**<br>- Active Line Module<br>- Drive line-up, max. | <br>µF<br>µF | <br>40800<br>250000 | | | |
| **Power loss, max.** [4]<br>- at 50 Hz 400 V<br>- at 60 Hz 460 V | <br>kW<br>kW | <br>26.5<br>26.5 | | | |
| **Cooling air requirement** | $m^3/s$ | 1.7 | | | |
| **Sound pressure level $L_{pA}$** (1 m) at 50/60 Hz [5] | dB(A) | 75/75 | | | |
| **Line connection L1, L2, L3**<br>- Conductor cross-section, max. (IEC) | <br>$mm^2$ | 10/M12<br>8 x 240 | | | |
| **PE/GND conductor**<br>- Busbar cross-section<br>- Conductor cross-section, max. (IEC) | <br>$mm^2$<br>$mm^2$ | PE busbar<br>600<br>240 | | | |
| **Cable length, max.** [6]<br>- shielded<br>- unshielded | <br>m<br>m | <br>3900<br>5850 | | | |
| **Degree of protection** (standard version) | | IP20 | | | |
| **Dimensions** (standard version)<br>- Width<br>- Height<br>- Depth | <br>mm<br>mm<br>mm | <br>1800<br>2200<br>600 | | | |
| **Weight** (standard version) | kg | 1529 | | | |
| **Frame size**<br>- Line Connection Module<br>- Active Interface Module<br>- Active Line Module | | <br>JL<br>FS4<br>FS4+ | | | |

| **Article No.** [1] | **6SL3731-** | **7TE41-4RE0<br>7TE41-4LE0** | | | |
|---|---|---|---|---|---|
| **Maximum short-circuit current $I_{CC}$ acc. to IEC** | kA | 100 | | | |
| **Minimum short-circuit current** [7] | kA | 3.2 | | | |

1) Article number "...RE0": Motor Modules installed to the right, "...LE0": Motor Modules installed to the left.

2) The base-load current $I_{L\,DC}$ is based on a duty cycle of 115% for 60 s or $I_{max\,DC}$ for 5 s with a duty cycle duration of 300 s.

3) Derating for higher pulse frequencies on request.

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

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

6) Total of all motor cables and DC link. Longer cable lengths for specific configurations that are available on request, see the SINAMICS - Low Voltage Engineering Manual in the device documentation provided.
The cable lengths are for use in an IT supply system. When used in TN systems, the cable lengths are reduced down to 30 % of the specified value.
When used in TN systems and when the Active Line Module Chassis-2 or the connected Motor Modules are operated with a higher pulse frequency, then the permissible cable lengths are available on request.

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

### 5.5.4.2 Overload capability

The Active Line Connection Modules-2 have an overload reserve.

The criterion for overload is that the Active Line Connection Module-2 is operated as a maximum with its base load current before and after the overload occurs.

For the specified load cycles, it may be necessary to take into account derating factors (e.g. pulse frequency, ambient temperature).

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 load cycle of 115% for 60 s with a cycle duration of 300 s.

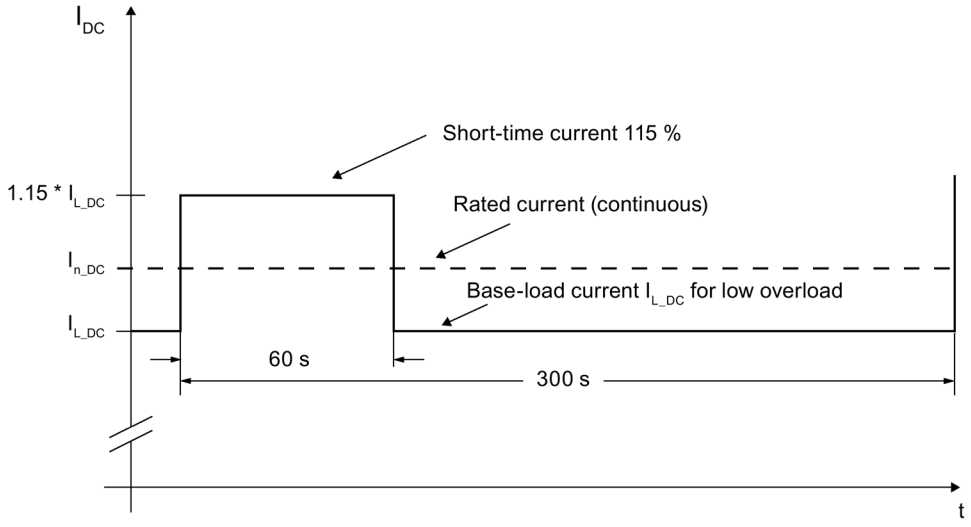



Figure 5-42 Low overload

## Load cycle with maximum current

The load cycle with maximum current $I_{max_DC}$ is based on a load cycle 150 % for 5 s with a cycle duration of 300 s.

The load cycle for $I_{max_DC}$ is valid for a pulse frequency of 4 kHz.

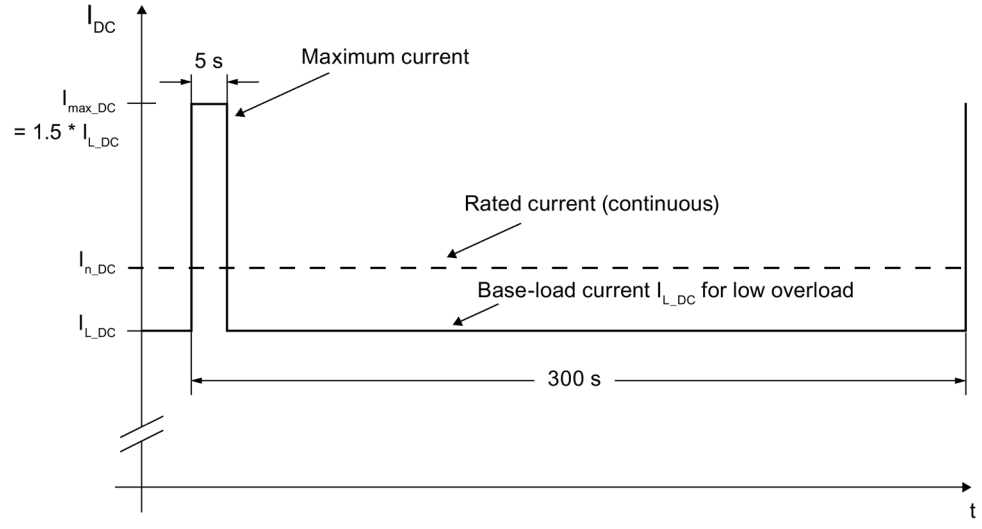



Figure 5-43 Load cycle with maximum current

# 5.6 Booksize format Motor Modules

## 5.6.1 Description

**Note**

**Additional information**

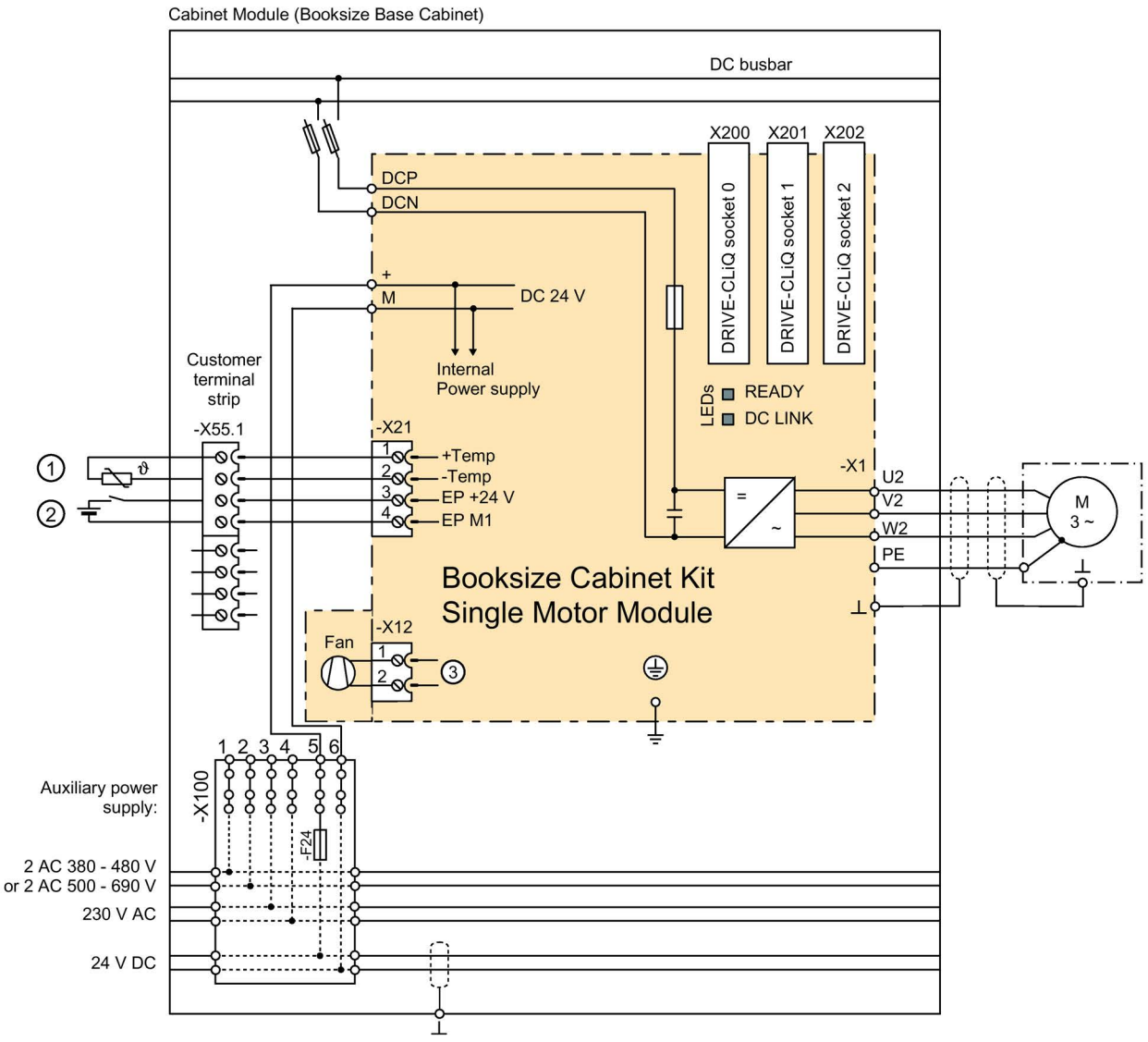
The arrangement of the components and interfaces as well as the wiring are shown in the attached layout diagrams (AO) or circuit diagrams (SP), which are included in the individual device documentation.



Figure 5-44 Motor Modules in booksize format

Motor Modules are also available in a Booksize Cabinet Kit version for power ratings from 4.8 to 71 kW in voltage class 380 to 480 V (DC link voltage 510 to 720 V).

## Integration




① Connection of a temperature sensor for motors without a DRIVE-CLiQ interface.
② Required for Safety Integrated
③ Withdrawable fan unit with a rated output current of 132 A

Figure 5-45 Connection example: Motor Module in Booksize Cabinet Kit format

## Configuration

Motor Modules in booksize format are factory-installed as "Booksize Cabinet Kits" in Booksize Base Cabinets and delivered as a complete unit including cabinet-side connection components.

Several Booksize Cabinet Kits can be installed in one Booksize Base Cabinet, depending on the mounting width requirements, which in turn depend on the power. Each Motor Module is connected separately to the DC busbar of the Cabinet Modules via a separate fuse switch disconnector. The DC link rail integrated in the devices is not used. As a 24 VDC supply buffered by the DC link is not possible for Booksize units, an auxiliary power supply is tapped to provide the 24 VDC required for the Booksize Cabinet Kit. The required 24 VDC supply must be provided by an external source via the auxiliary power supply.
With option K73, the 24 VDC supply is provided by a dedicated SITOP device.

**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.

The precise order-specific location of the components is provided in the layout diagrams (AO) in the individual device documentation.

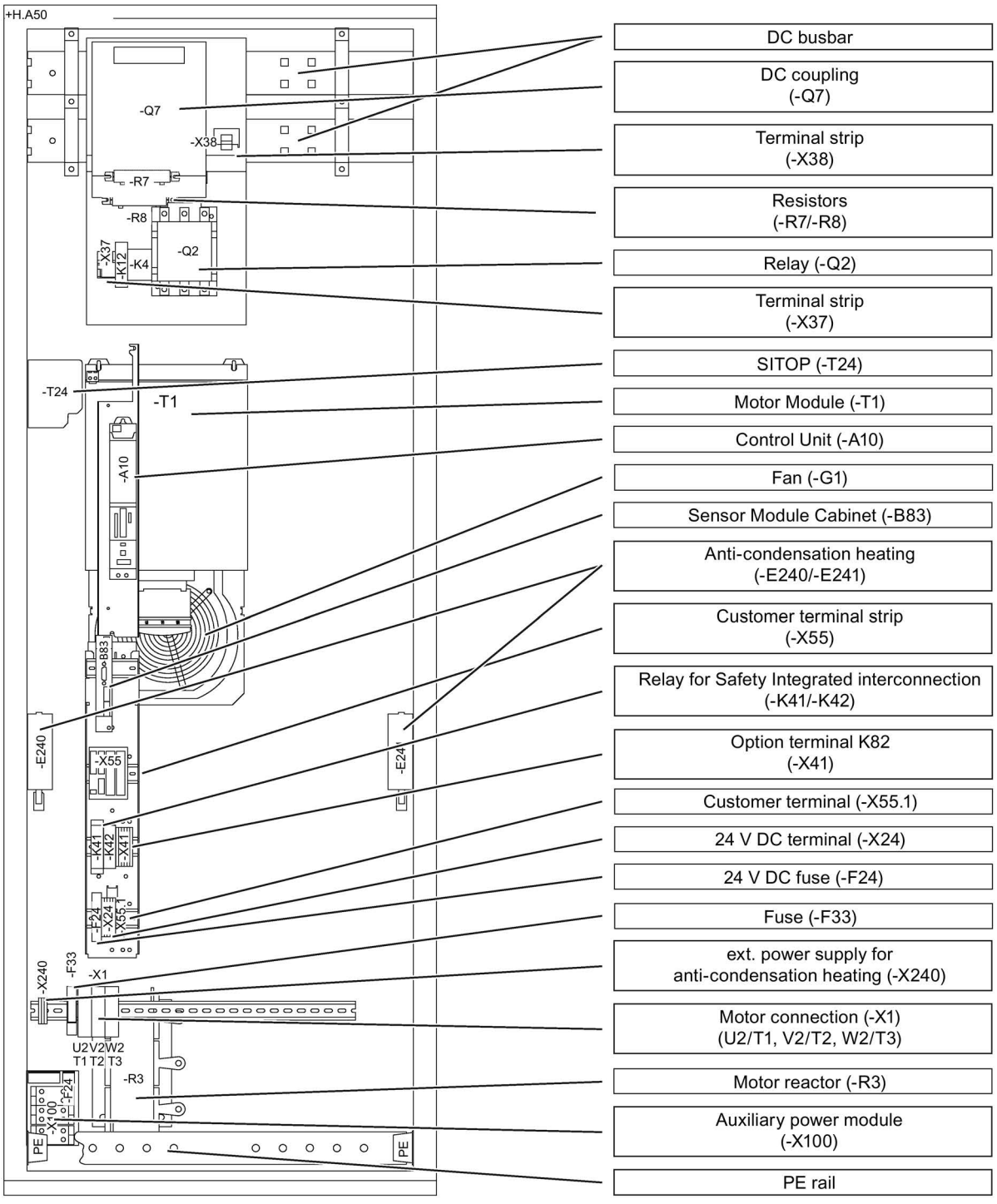



Figure 5-46 Configuration example for Motor Modules in Booksize Cabinet Kit format

### Mounting grid arrangement in the cabinet

The area for connecting the Motor Modules in the cabinet is divided into three grid widths:

- 100 mm
- 200 mm
- 300 mm

The table below shows the grid width assigned to the various Motor Modules.

Table 5- 40 The assignment of the Motor Modules according to grid width

| Grid width | Assignment of Motor Modules (see Section "Technical data") |
|---|---|
| 100 mm | 9 to 30 A Motor Modules |
| 200 mm | 45 to 85 A Motor Modules |
| 300 mm | 132 A Motor Module |

**Note**

**Available space in the Booksize base cabinets**

The space available for the Motor Modules in the Booksize Base Cabinets is determined by taking the actual space and subtracting a clearance of 200 mm.

## 5.6.2 Interface description

### 5.6.2.1 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.

### 5.6.2.2 Customer terminal block X55.1

#### Description

The customer terminal block (-X55.1) is mounted as standard in the cabinet for each Booksize Cabinet Kit. It provides the function-related inputs/outputs for temperature monitoring and for the "Safe Torque Off" and "Safe Stop 1" functions.

**Note**

**Additional information**

All other cabinet interfaces and connections are explained in the circuit and terminal diagrams included in the individual device documentation.

#### X55.1 customer terminal block

Table 5- 41 Customer terminal block -X55.1

| Terminal | Designation | Technical data |
|---|---|---|
| 1 | + Temp | Temperature sensor connection KTY84-1C130 / PT1000 / PTC / bimetallic switch with NC contact |
| 2 | - Temp | |
| 3 | EP +24 V<br>Enable Pulses | Supply voltage: 24 V DC (20.4 ... 28.8 V)<br>Current consumption: 10 mA |
| 4 | EP M1<br>Enable Pulses | Isolated input<br>The pulse inhibit function is only available when the "Safety Integrated Basic Functions via onboard terminals" software is enabled. |
| 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 to ground potential through a large surface area.

**NOTICE**

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

A KTY temperature sensor connected with incorrect polarity cannot detect if the motor overheats. Overheating can cause damage to the motor.

- Connect the 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**

**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.

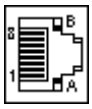
**Note**

**Safety Integrated Function Manual**

A detailed description of the complete principle of operation of the Safety Integrated functions and their handling is given in the associated Function Manual, which is included in the device documentation provided.

### 5.6.2.3 X200, X201, X202 DRIVE-CLiQ interfaces

Table 5- 42 DRIVE-CLiQ interfaces X400, X401, X402

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

## 5.6.3 Options

**Note**

**Additional information**

The individual options are described in Chapter "Options".

## Electrical options for Booksize Base Cabinets

| Component | Option |
|---|---|
| Auxiliary power supply 24 V DC | K73 |
| Cabinet anti-condensation heating | L55 |

## Mechanical options for Booksize Base Cabinets

| Component | Option |
|---|---|
| Base 100 mm high, RAL 9005 | M06 |
| Cable-marshaling compartment 200 mm high, RAL 7035 | M07 |
| Degree of protection IP21 | M21 |
| Degree of protection IP23 | M23 |
| Side panel, mounted on the right | M26 |
| Side panel, mounted on the left | M27 |
| Degree of protection IP43 | M43 |
| Degree of protection IP54 | M54 |
| Closed cabinet door (air inlet from below through floor opening) | M59 |
| 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 |
| EMC shield bus | M70 |
| Version without component support plates and without additional control components | M77 |
| 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 for Booksize base cabinets

| Component | Option |
|---|---|
| Complete 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 / Portuguese (Brazil) | T83 |
| 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 |

### Electrical options for Booksize Cabinet Kits

| Component | Option |
|---|---|
| CBC10 Communication Board | G20 |
| CBE20 Communication Board | G33 |
| 1 TM150 Temperature Sensor Module | G51 |
| 2 TM150 Temperature Sensor Modules | G52 |
| Terminal Module TM31 | G60 |
| Additional TM31 Terminal Module | G61 |
| Terminal Board TB30 | G62 |
| Safety license for 1... 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 |
| Control Unit CU320-2 PROFIBUS | K90 |
| Performance extension for CU320-2 | K94 |
| Control Unit CU320-2 PROFINET | K95 |
| Motor reactor | L08/L09 |
| DC coupling incl. pre-charging input circuit of the associated DC link capacitance | L37 |
| Motor reactor terminal connection | M51 |

## 5.6.4 Technical data

Table 5- 43 Technical data for Booksize Base Cabinet

| **Article No.** | **6SL3720-** | **1TX38-0AA3** | **1TX41-2AA3** |
|---|---|---|---|
| **Usable installation width** | mm | 600 | 1000 |
| **Weight** (standard version) | kg | 185 | 270 |
| **Dimensions** (standard version, IP20)<br>- Width<br>- Height<br>- Depth | <br>mm<br>mm<br>mm | <br>800<br>2200<br>600 | <br>1200<br>2200<br>600 |

Table 5- 44 Technical data for Motor Modules in Booksize Cabinet Kit format, Single Motor Modules, line voltage 3 AC 380 ... 480 V, DC link voltage 510 ... 720 VDC, part I

| **Article No.** | **6SL3720-** | **1TE21-0AB4** | **1TE21-8AB4** | **1TE23-0AB4** | **1TE24-5AB4** |
|---|---|---|---|---|---|
| **Type rating** | | | | | |
| - for $I_N$ (50 Hz 400 V) [1] | kW | 4.8 | 9.7 | 16 | 24 |
| - for $I_H$ (50 Hz 400 V) [1] | kW | 4.1 | 8.2 | 13.7 | 21 |
| - for $I_N$ (60 Hz 460 V) [2] | hp | 5 | 10 | 20 | 30 |
| - for $I_H$ (60 Hz 460 V) [2] | hp | 5 | 10 | 15 | 25 |
| **Output current** | | | | | |
| - Rated current $I_{N\,A}$ | A | 9 | 18 | 30 | 45 |
| - Base-load current $I_H$ [3] | A | 7.7 | 15.3 | 25.5 | 38 |
| - Maximum current $I_{max\,A}$ | A | 27 | 54 | 90 | 90 |
| **DC link current** $I_d$ [4] | A | 11 | 22 | 36 | 54 |
| **Current consumption** | | | | | |
| - 24 VDC, max. | A | 0.75 | 0.75 | 0.8 | 0.9 |
| **DC link capacitance** | µF | 110 | 220 | 705 | 1230 |
| **Pulse frequency** [5] | | | | | |
| - Rated frequency | kHz | 4 | 4 | 4 | 4 |
| - Pulse frequency, max. with current derating | kHz | 16 | 16 | 16 | 16 |
| **Power loss, max.** [6] | | | | | |
| - at 50 Hz 400 V | kW | 0.08 | 0.165 | 0.29 | 0.36 |
| - at 60 Hz 460 V | kW | 0.08 | 0.165 | 0.29 | 0.36 |
| **Cooling air requirement** | $m^3/s$ | 0.009 | 0.009 | 0.016 | 0.023 |
| **Sound pressure level** $L_{pA}$ (1 m) at 50/60 Hz | dB(A) | <60 | <60 | <60 | <65 |
| **Motor connection U2, V2, W2** | | Terminal | | | |
| - Conductor cross-section, max. (IEC) | $mm^2$ | 6 | 6 | 6 | 16 |
| **Cable length, max.** [7] | | | | | |
| - Shielded | m | 50 | 70 | 100 | 100 |
| - Unshielded | m | 75 | 100 | 150 | 150 |
| **PE/GND conductor** | | PE busbar | | | |
| - Busbar cross-section | $mm^2$ | 600 | | | |
| - Conductor cross-section, max. (IEC) | $mm^2$ | 240 | | | |
| **Degree of protection** | | IP20 | IP20 | IP20 | IP20 |
| **Weight, approx.** | kg | 20 | 20 | 21.9 | 27 |
| **Wide Motor Module** | mm | 50 | 50 | 100 | 150 |
| **Installation width** | mm | 100 | 100 | 100 | 200 |
| **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 $I_N$ or $I_H$ at 3 AC 50 Hz 400 V.

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

[3] The base-load current $I_H$ is based on a duty cycle of 150 % for 60 s or 176 % for 30 s with a duty cycle duration of 300 s.

[4] For a DC link voltage of 600 V DC.

[5] For the interdependency of pulse frequency and max. output current/output frequency, see SINAMICS Low Voltage Engineering Manual included in the device documentation provided.

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

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

Table 5- 45 Technical data for Motor Modules in Booksize Cabinet Kit format, Single Motor Modules, line voltage 3 AC 380 ... 480 V, DC link voltage 510 ... 720 VDC, part II

| **Article No.** | **6SL3720-** | **1TE26-0AB4** | **1TE28-5AB3** | **1TE31-3AB3** | |
|---|---|---|---|---|---|
| **Type rating** | | | | | |
| - for $I_N$ (50 Hz 400 V) [1] | kW | 32 | 46 | 71 | |
| - for $I_H$ (50 Hz 400 V) [1] | kW | 28 | 37 | 57 | |
| - for $I_N$ (60 Hz 460 V) [2] | hp | 40 | 60 | 100 | |
| - for $I_H$ (60 Hz 460 V) [2] | hp | 40 | 50 | 75 | |
| **Output current** | | | | | |
| - Rated current $I_{N\,A}$ | A | 60 | 85 | 132 | |
| - Base-load current $I_H$ [3] | A | 51 | 65 | 105 | |
| - Maximum current $I_{max\,A}$ | A | 120 | 141 | 210 | |
| **DC link current** $I_d$ [4] | A | 72 | 102 | 158 | |
| **Current consumption** | | | | | |
| - 24 VDC, max. | A | 0.9 | 1.5 | 1.5 | |
| **DC link capacitance** | µF | 1410 | 1880 | 2820 | |
| **Pulse frequency** [5] | | | | | |
| - Rated frequency | kHz | 4 | 4 | 4 | |
| - Pulse frequency, max. with current derating | kHz | 16 | 16 | 16 | |
| **Power loss, max.** [6] | | | | | |
| - at 50 Hz 400 V | kW | 0.48 | 0.75 | 1.25 | |
| - at 60 Hz 460 V | kW | 0.48 | 0.75 | 1.25 | |
| **Cooling air requirement** | $m^3/s$ | 0.023 | 0.044 | 0.144 | |
| **Sound pressure level** $L_{pA}$ (1 m) at 50/60 Hz | dB(A) | <65 | <60 | <73 | |
| **Motor connection U2, V2, W2** | | Terminal | | | |
| - Conductor cross-section, max. (IEC) | $mm^2$ | 16 | 35 | 70 | |
| **Cable length, max.** [7] | | | | | |
| - Shielded | m | 100 | 100 | 100 | |
| - Unshielded | m | 150 | 150 | 150 | |
| **PE/GND conductor** | | PE busbar | | | |
| - Busbar cross-section | $mm^2$ | 600 | | | |
| - Conductor cross-section, max. (IEC) | $mm^2$ | 240 | | | |
| **Degree of protection** | | IP20 | IP20 | IP20 | |
| **Weight, approx.** | kg | 27 | 33 | 41 | |
| **Wide Motor Module** | mm | 150 | 200 | 300 | |
| **Installation width** | mm | 200 | 200 | 300 | |
| **Maximum short-circuit current** $I_{CC}$ **acc. to IEC** | kA | 65 | 65 | 65 | |

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

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

[3] The base-load current $I_H$ is based on a duty cycle of 150 % for 60 s or 176 % for 30 s with a duty cycle duration of 300 s.

[4] For a DC link voltage of 600 V DC.

[5] For the interdependency of pulse frequency and max. output current/output frequency, see SINAMICS Low Voltage Engineering Manual included in the device documentation provided.

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

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

## 5.6.5 Overload capability

### Duty cycle with 30 s and 60 s overload with a duty cycle duration of 300 s

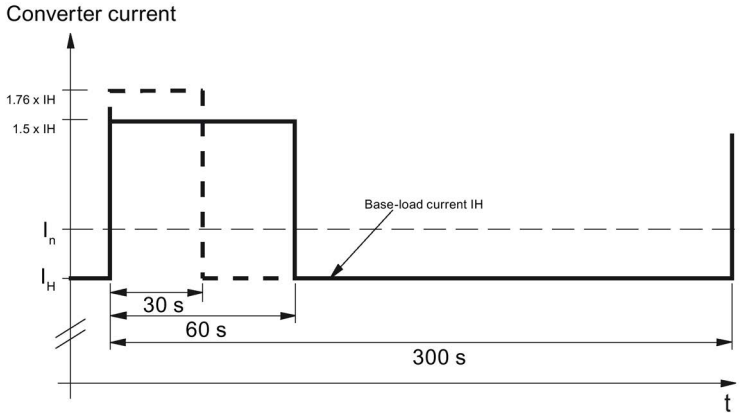



Figure 5-47 Duty cycle with 30 s and 60 s overload with a duty cycle duration of 300 s

# 5.7 Chassis format Motor Modules

## 5.7.1 Description

**Note**

**Additional information**

The arrangement of the components and interfaces as well as the wiring are shown in the attached layout diagrams (AO) or circuit diagrams (SP), which are included in the individual device documentation.




Figure 5-48 Motor Module Chassis format

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 Chassis format are available for the following voltages and power ratings:

| Line voltage | DC link voltage | Type rating |
|---|---|---|
| 3 AC 380 ... 480 V | 510 ... 720 VDC | 110 ... 800 kW |
| 3 AC 500 ... 690 V | 675 ... 1035 V DC | 75 ... 1200 kW |

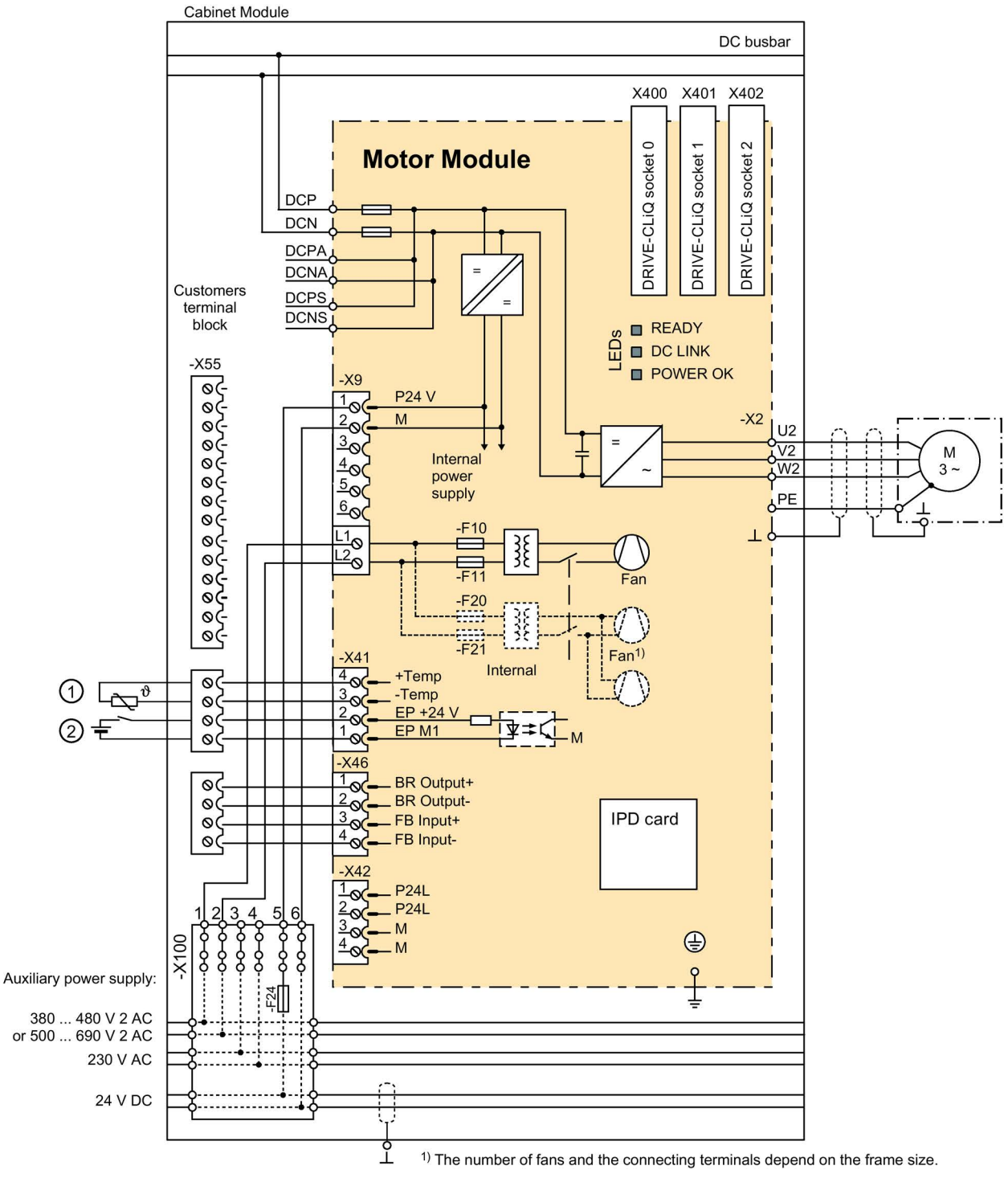
The available shaft output can be increased by connecting up to four Motor Modules in parallel. These modules are operated on one Control Unit and feed one motor.

**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

Figure 5-49 Connection example for Motor Modules Chassis format

## 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).
- Connection busbar, nickel-plated, for motor cables for Motor Modules with frame sizes FX and GX; for Motor Modules with frame sizes HX and JX, the motor cables are connected directly to the device.
- Cable propping bar for the electric power cables
- DRIVE-CLiQ interface (three DRIVE-CLiQ sockets), without Control Unit
- Customer interface -X55
- 6-pole auxiliary voltage supply, including auxiliary power module 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.

The precise order-specific location of the components is provided in the layout diagrams (AO) in the individual device documentation.

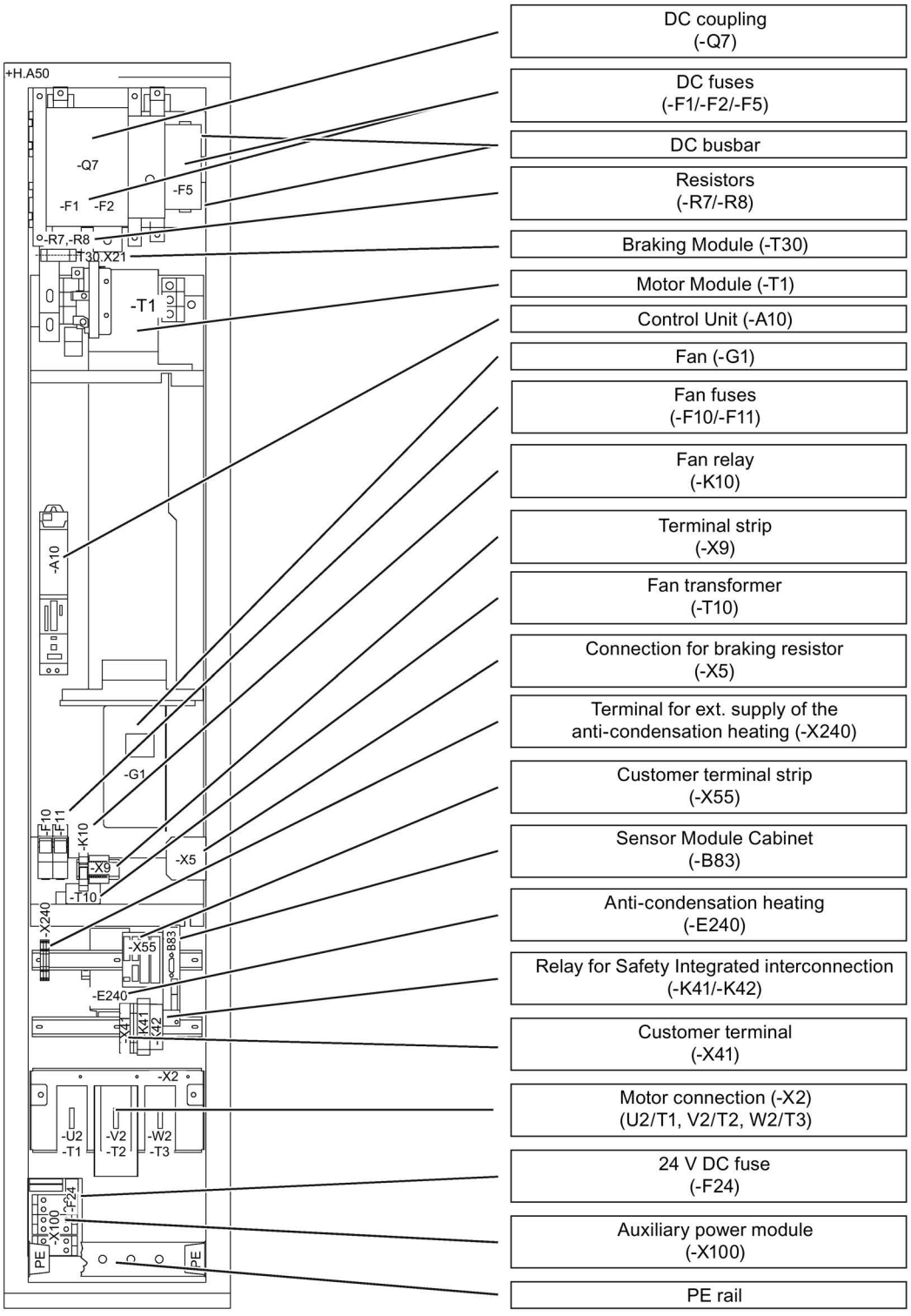



Figure 5-50 Configuration of Motor Modules Chassis format (frame size FX)

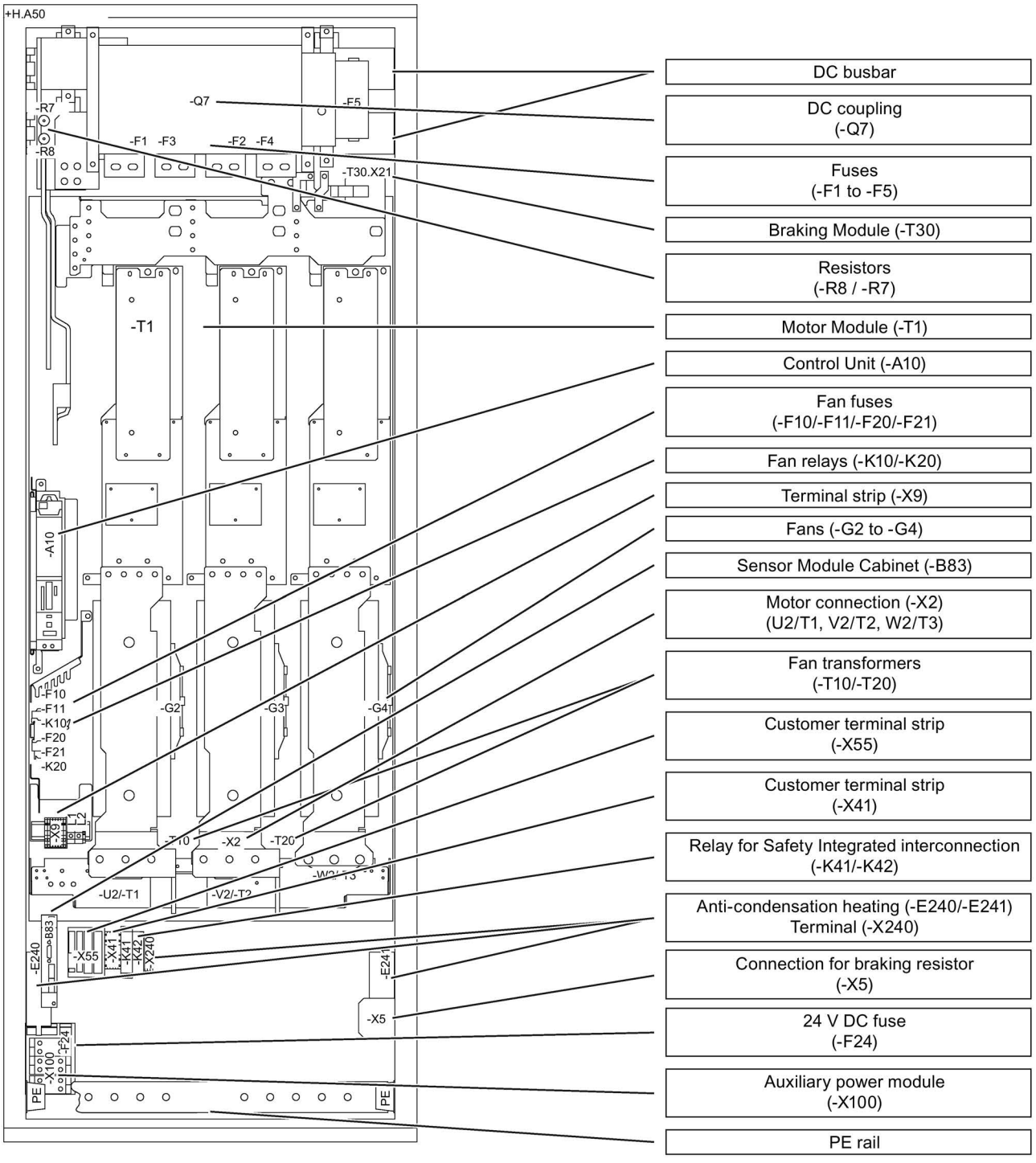



Figure 5-51 Configuration of Motor Modules Chassis format (frame size JX)

## 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 cables lengths are listed in the following tables.

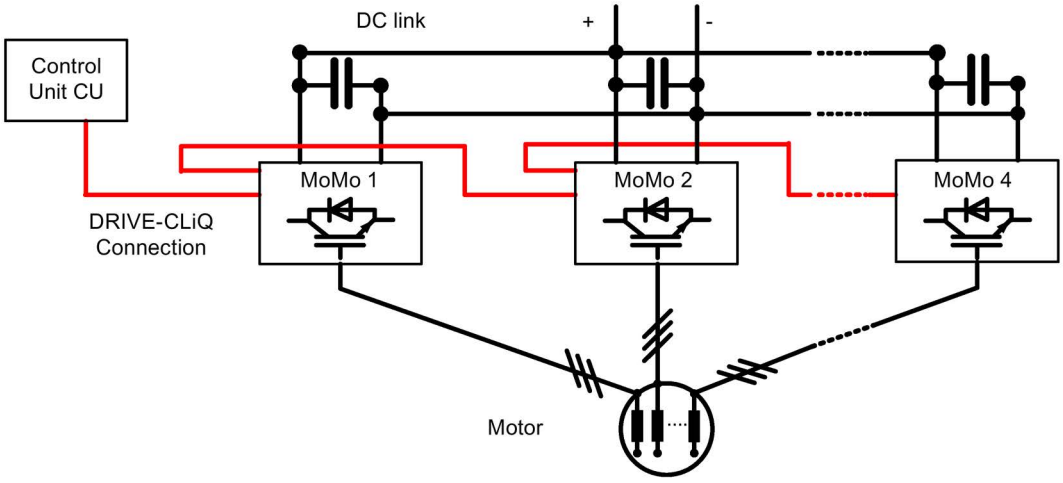



Figure 5-52 Motor with electrically isolated winding systems supplied by a parallel connection of S120 Motor Modules

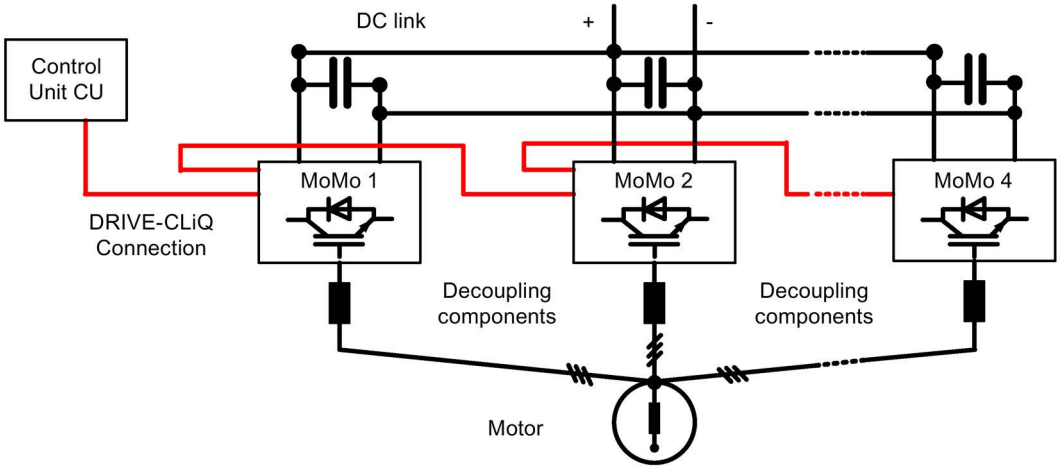



Figure 5-53 Motor with common winding system supplied by a parallel connection of S120 Motor Modules

**Note**

**It is not possible to connect different power units in parallel**

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

It is not possible to connect Motor Modules with Article No. 6SL3720-1Txxx-xAA0 and Article No. 6SL3720-1Txxx-xAA3 in parallel.

## 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 (option L08, as is shown in the diagram above) must be used if the required cable length cannot be reached in the application.

Table 5- 46 Motor Modules, 510 ... 720 VDC

| Article No. | Frame size | $P_{rated}$ [kW] | $I_{rated\ rms}$ [A] | Minimum length [m] |
|---|---|---|---|---|
| 6SL3720-1TE32-1AA3 | FX | 110 | 210 | 30 |
| 6SL3720-1TE32-6AA3 | FX | 132 | 260 | 27 |
| 6SL3720-1TE33-1AA3 | GX | 160 | 310 | 20 |
| 6SL3720-1TE33-8AA3 | GX | 200 | 380 | 17 |
| 6SL3720-1TE35-0AA3 | GX | 250 | 490 | 15 |
| 6SL3720-1TE36-1AA3 | HX | 315 | 605 | 13 |
| 6SL3720-1TE37-5AA3 | HX | 400 | 745 | 10 |
| 6SL3720-1TE38-4AA3 | HX | 450 | 840 | 9 |
| 6SL3720-1TE41-0AA3 | JX | 560 | 985 | 8 |
| 6SL3720-1TE41-2AA3 | JX | 710 | 1260 | 6 |
| 6SL3720-1TE41-4AA3 | JX | 800 | 1405 | 5 |

Table 5- 47 Motor Modules, 675 ...1035 VDC

| Article No. | Frame size | $P_{rated}$ [kW] | $I_{rated\ rms}$ [A] | Minimum length [m] |
|---|---|---|---|---|
| 6SL3720-1TG28-5AA3 | FX | 75 | 85 | 100 |
| 6SL3720-1TG31-0AA3 | FX | 90 | 100 | 90 |
| 6SL3720-1TG31-2AA3 | FX | 110 | 120 | 80 |
| 6SL3720-1TG31-5AA3 | FX | 132 | 150 | 70 |
| 6SL3720-1TG31-8AA3 | GX | 160 | 175 | 60 |
| 6SL3720-1TG32-2AA3 | GX | 200 | 215 | 50 |
| 6SL3720-1TG32-6AA3 | GX | 250 | 260 | 40 |
| 6SL3720-1TG33-3AA3 | GX | 315 | 330 | 30 |
| 6SL3720-1TG34-1AA3 | HX | 400 | 410 | 25 |
| 6SL3720-1TG34-7AA3 | HX | 450 | 465 | 25 |
| 6SL3720-1TG35-8AA3 | HX | 560 | 575 | 20 |
| 6SL3720-1TG37-4AA3 | JX | 710 | 735 | 18 |
| 6SL3720-1TG38-1AA3 | JX | 800 | 810 | 15 |
| 6SL3720-1TG38-8AA3 | JX | 900 | 910 | 12 |
| 6SL3720-1TG41-0AA3 | JX | 1000 | 1025 | 10 |
| 6SL3720-1TG41-3AA3 | JX | 1200 | 1270 | 8 |

## 5.7.2 X55 customer terminal strip

### 5.7.2.1 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.

## Description

The customer interface -X55 is available in the cabinet irrespective of the CU320-2 Control Unit. Terminal strips -X41 and -X46 are assigned by default.

With option K90/K95, terminal strips -X122 and -X132 are also fully assigned (→ see "Options", section "K90, Control Unit CU320-2 DP" or section "K95, Control Unit CU320-2 PN")

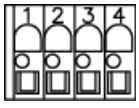
**Note**

Interfaces -X1, -X2, -X3 and -X4 are wired within the cabinet and are not available for customer connections!

If the customer terminal strip is ever replaced, connectors -X1 and -X2 must not be interchanged! Otherwise, the "Safe Torque Off" and "Safe Stop 1" safety functions will malfunction!

### 5.7.2.2 X41 EP terminal / temperature sensor connection

Table 5- 48 Terminal strip X41 EP terminals / temperature sensor connection

| Connector | Terminal | Function | Technical data |
|---|---|---|---|
|  | 1 | EP M1<br>(Enable Pulses) | Supply voltage: 24 V DC (20.4 ... 28.8 V)<br>Current consumption: 10 mA<br>The pulse inhibit function is only available when the "Safety Integrated Basic Functions via onboard terminals" software is enabled. |
| | 2 | EP +24 V<br>(Enable Pulses) | |
| | 3 | - Temp | Temperature sensor connection for motor temperature measurement:<br>KTY84-1C130, PTC, PT100, PT1000, bimetallic 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 to ground potential through a large surface area.

**NOTICE**

**Damage to the motor in the event of an incorrectly connected KTY temperature sensor at terminals -X41:3,4**

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.

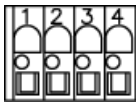
**Note**

**Safety Integrated Function Manual**

A detailed description of the complete principle of operation and handling of the Safety Integrated functions is provided in the associated Function Manual, which is included in the device documentation provided.

### 5.7.2.3 X46 Brake control and monitoring

Table 5- 49 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<br>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**

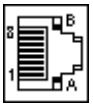
**Fire due to overheating when the total length of the connecting cables is exceeded**

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.

### 5.7.2.4 DRIVE-CLiQ interfaces X400, X401, X402

Table 5- 50 DRIVE-CLiQ interfaces X400, X401, X402

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

## 5.7.3 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 TM150 Temperature Sensor Module | G51 |
| 2 TM150 Temperature Sensor Modules | G52 |
| Terminal Module TM31 | G60 |
| Additional TM31 Terminal Module | G61 |
| Terminal Board TB30 | 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 PROFIBUS | K90 |
| Performance extension for CU320-2 | K94 |
| Control Unit CU320-2 PROFINET | K95 |
| dv/dt filter compact plus Voltage Peak Limiter | L07 |
| Motor reactor | L08 |
| dv/dt filter plus Voltage Peak Limiter | L10 |
| Output-side circuit breaker (motorized) | L34 |
| DC coupling incl. pre-charging input circuit of the associated DC link capacitance | L37 |
| Cabinet anti-condensation heating | L55 |
| 25/125 kW braking unit | L61/L64 |
| 50/250 kW braking unit | L62/L65 |

## Mechanical options

| Component | Option |
|---|---|
| Base 100 mm high, RAL 9005 | M06 |
| Cable-marshaling compartment 200 mm high, RAL 7035 | M07 |
| Degree of protection IP21 | M21 |
| Degree of protection IP23 | M23 |
| Side panel, mounted on the right | M26 |
| Side panel, mounted on the left | M27 |
| Degree of protection IP43 | M43 |
| Degree of protection IP54 | M54 |
| Closed cabinet door (air inlet from below through floor opening) | M59 |
| Additional touch protection | M60 |
| 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 |
| EMC shield bus | 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 |
|---|---|
| Complete 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 / Portuguese (Brazil) | T83 |
| 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 |

## 5.7.4 Technical data

Table 5- 51 Technical data for Motor Modules in chassis format, line voltage 3 AC 380 ... 480 V, DC link voltage 510 ... 720 VDC, part I

| **Article No.** | **6SL3720-** | **1TE32-1AA3** | **1TE32-6AA3** | **1TE33-1AA3** | **1TE33-8AA3** | **1TE35-0AA3** | **1TE36-1AA3** |
|---|---|---|---|---|---|---|---|
| **Type rating** | | | | | | | |
| - for $I_L$ (50 Hz 400 V) 1) | kW | 110 | 132 | 160 | 200 | 250 | 315 |
| - for $I_H$ (50 Hz 400 V) 1) | kW | 90 | 110 | 132 | 160 | 200 | 250 |
| - for $I_L$ (60 Hz 460 V) 2) | hp | 150 | 200 | 250 | 300 | 400 | 500 |
| - for $I_H$ (60 Hz 460 V) 2) | hp | 150 | 200 | 200 | 250 | 350 | 350 |
| **Output current** | | | | | | | |
| - Rated current $I_{N\,A}$ | A | 210 | 260 | 310 | 380 | 490 | 605 |
| - Base-load current $I_L$ 3) | A | 205 | 250 | 302 | 370 | 477 | 590 |
| - Base-load current $I_H$ 4) | A | 178 | 233 | 277 | 340 | 438 | 460 |
| - Maximum current $I_{max\,A}$ | A | 307 | 375 | 456 | 555 | 715 | 885 |
| **DC link current** | | | | | | | |
| - rated current $I_{N\,DC}$ when fed via: | | | | | | | |
| - Basic/Smart Line Module | A | 252 | 312 | 372 | 456 | 588 | 726 |
| - Active Line Module | A | 227 | 281 | 335 | 411 | 529 | 653 |
| - base-load current $I_{L\,DC}$ 3) when fed via: | | | | | | | |
| - Basic/Smart Line Module | A | 245 | 304 | 362 | 444 | 573 | 707 |
| - Active Line Module | A | 221 | 273 | 326 | 400 | 515 | 636 |
| - base-load current $I_{H\,DC}$ 4) when fed via: | | | | | | | |
| - Basic/Smart Line Module | A | 224 | 277 | 331 | 405 | 523 | 646 |
| - Active Line Module | A | 202 | 250 | 298 | 365 | 470 | 581 |
| **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** | | | | | | | |
| - Auxiliary supply 24 V DC | A | 0.8 | 0.8 | 0.9 | 0.9 | 0.9 | 1.0 |
| - 400 V AC | A | 0.63 | 1.13 | 1.8 | 1.8 | 1.8 | 3.6 |
| **DC link capacitance** | µF | 4200 | 5200 | 6300 | 7800 | 9600 | 12600 |
| **Pulse frequency** | | | | | | | |
| - rated frequency | kHz | 2 | 2 | 2 | 2 | 2 | 1.25 |
| - pulse frequency, max. | | | | | | | |
| - without current derating | kHz | 2 | 2 | 2 | 2 | 2 | 1.25 |
| - with current derating | kHz | 8 | 8 | 8 | 8 | 8 | 8 |
| **Power loss, max.** 5) | | | | | | | |
| - at 50 Hz 400 V | kW | 1.86 | 2.5 | 2.96 | 3.67 | 4.28 | 5.84 |
| - at 60 Hz 460 V | kW | 1.94 | 2.65 | 3.1 | 3.8 | 4.5 | 6.3 |
| **Cooling air requirement** | $m^3/s$ | 0.17 | 0.23 | 0.36 | 0.36 | 0.36 | 0.78 |
| **Sound pressure level $L_{pA}$** (1 m) at 50/60 Hz | dB(A) | 67 | 69 | 69 | 69 | 69 | 72 |
| **Motor connection U2, V2, W2** | | | | | | | |
| - Screws | | 2/M12 | 2/M12 | 2/M12 | 2/M12 | 2/M12 | 2/M12 |
| - Conductor cross-section, max. (IEC) | $mm^2$ | 2 x 185 | 2 x 185 | 2 x 240 | 2 x 240 | 2 x 240 | 4 x 240 |
| **Cable length, max.** 6) | | | | | | | |
| - shielded | m | 300 | 300 | 300 | 300 | 300 | 300 |
| - unshielded | m | 450 | 450 | 450 | 450 | 450 | 450 |
| **PE/GND conductor** | | PE busbar | | | | | |
| - Busbar cross-section | $mm^2$ | 600 | | | | | |
| - Conductor cross-section, max. (IEC) | $mm^2$ | 240 | | | | | |
| **Degree of protection** (standard version) | | IP20 | IP20 | IP20 | IP20 | IP20 | IP20 |

| **Article No.** | **6SL3720-** | **1TE32-1AA3** | **1TE32-6AA3** | **1TE33-1AA3** | **1TE33-8AA3** | **1TE35-0AA3** | **1TE36-1AA3** |
|---|---|---|---|---|---|---|---|
| **Dimensions** (standard version, IP20)<br>- width [7]<br>- height [8]<br>- depth | <br>mm<br>mm<br>mm | <br>400<br>2200<br>600 | <br>400<br>2200<br>600 | <br>400<br>2200<br>600 | <br>400<br>2200<br>600 | <br>400<br>2200<br>600 | <br>600<br>2200<br>600 |
| **Weight, approx.** (standard version) | kg | 145 | 145 | 286 | 286 | 286 | 490 |
| **Frame size** | | FX | FX | GX | GX | GX | HX |
| **Maximum short-circuit current $I_{CC}$ acc. to IEC** | kA | 65 | 65 | 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) 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.
When used in a TN system with an infeed via Active Line Module and when the Motor Modules are operated with a higher pulse frequency, then you can obtain the permissible motor cable lengths on request.

7) With option L08 (motor reactor):
- Frame size HX/JX →Supplementary cabinet 600 mm wide
With option L10 (dv/dt filter plus VPL):
- Frame size FX/GX/HX/JX →Supplementary cabinet 600 mm wide
With option L34 (circuit breaker at output side):
- Frame size FX/GX →Supplementary cabinet 400 mm wide
- Frame size HX/JX →Supplementary cabinet 600 mm wide.

8) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

Table 5- 52 Technical data for Motor Modules in chassis format, line voltage 3 AC 380 ... 480 V, DC link voltage 510 ... 720 VDC, part II

| **Article No.** | **6SL3720-** | **1TE37-5AA3** | **1TE38-4AA3** | **1TE41-0AA3** | **1TE41-2AA3** | **1TE41-4AA3** |
|---|---|---|---|---|---|---|
| **Type rating** | | | | | | |
| - for $I_L$ (50 Hz 400 V) 1) | kW | 400 | 450 | 560 | 710 | 800 |
| - for $I_H$ (50 Hz 400 V) 1) | kW | 315 | 400 | 450 | 560 | 710 |
| - for $I_L$ (60 Hz 460 V) 2) | hp | 600 | 700 | 800 | 1000 | 1150 |
| - for $I_H$ (60 Hz 460 V) 2) | hp | 450 | 600 | 700 | 900 | 1000 |
| **Output current** | | | | | | |
| - Rated current $I_{N\,A}$ | A | 745 | 840 | 985 | 1260 | 1405 |
| - Base-load current $I_L$ 3) | A | 725 | 820 | 960 | 1230 | 1370 |
| - Base-load current $I_H$ 4) | A | 570 | 700 | 860 | 1127 | 1257 |
| - Maximum current $I_{max\,A}$ | A | 1087 | 1230 | 1440 | 1845 | 2055 |
| **DC link current** | | | | | | |
| - rated current $I_{N\,DC}$ when fed via: | | | | | | |
| - Basic/Smart Line Module | A | 894 | 1008 | 1182 | 1512 | 1686 |
| - Active Line Module | A | 805 | 907 | 1064 | 1361 | 1517 |
| - base-load current $I_{L\,DC}$ 3) when fed via: | | | | | | |
| - Basic/Smart Line Module | A | 871 | 982 | 1152 | 1474 | 1643 |
| - Active Line Module | A | 784 | 884 | 1037 | 1326 | 1479 |
| - base-load current $I_{H\,DC}$ 4) when fed via: | | | | | | |
| - Basic/Smart Line Module | A | 795 | 897 | 1051 | 1345 | 1500 |
| - Active Line Module | A | 716 | 807 | 946 | 1211 | 1350 |
| **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** | | | | | | |
| - Auxiliary supply 24 V DC | A | 1.0 | 1.0 | 1.25 | 1.4 | 1.4 |
| - 400 V AC | A | 3.6 | 3.6 | 5.4 | 5.4 | 5.4 |
| **DC link capacitance** | µF | 15600 | 16800 | 18900 | 26100 | 28800 |
| **Pulse frequency** | | | | | | |
| - rated frequency | kHz | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 |
| - pulse frequency, max. | | | | | | |
| - without current derating | kHz | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 |
| - with current derating | kHz | 8 | 8 | 8 | 8 | 8 |
| **Power loss, max.** 5) | | | | | | |
| - at 50 Hz 400 V | kW | 6.68 | 7.15 | 9.5 | 11.1 | 12 |
| - at 60 Hz 460 V | kW | 7.3 | 7.8 | 10.2 | 12.0 | 13 |
| **Cooling air requirement** | $m^3/s$ | 0.78 | 0.78 | 1.08 | 1.08 | 1.08 |
| **Sound pressure level $L_{pA}$** (1 m) at 50/60 Hz | dB(A) | 72 | 72 | 72 | 72 | 72 |
| **Motor connection U2, V2, W2** | | | | | | |
| - Screws | | 2/M12 | 2/M12 | 3/M12 | 3/M12 | 3/M12 |
| - Conductor cross-section, max. (IEC) | $mm^2$ | 4 x 240 | 4 x 240 | 6 x 240 | 6 x 240 | 6 x 240 |
| **Cable length, max.** 6) | | | | | | |
| - shielded | m | 300 | 300 | 300 | 300 | 300 |
| - unshielded | m | 450 | 450 | 450 | 450 | 450 |
| **PE/GND conductor** | | PE busbar | | | | |
| - Busbar cross-section | $mm^2$ | 600 | | | | |
| - Conductor cross-section, max. (IEC) | $mm^2$ | 240 | | | | |
| **Degree of protection** (standard version) | | IP20 | IP20 | IP20 | IP20 | IP20 |
| **Dimensions** (standard version, IP20) | | | | | | |
| - width 7) | mm | 600 | 600 | 800 | 800 | 800 |
| - height 8) | mm | 2200 | 2200 | 2200 | 2200 | 2200 |
| - depth | mm | 600 | 600 | 600 | 600 | 600 |

| **Article No.** | **6SL3720-** | **1TE37-5AA3** | **1TE38-4AA3** | **1TE41-0AA3** | **1TE41-2AA3** | **1TE41-4AA3** |
|---|---|---|---|---|---|---|
| **Weight, approx.** (standard version) | kg | 490 | 490 | 700 | 700 | 700 |
| **Frame size** | | HX | HX | JX | JX | JX |
| **Maximum short-circuit current $I_{CC}$ acc. to IEC** | kA | 65 | 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 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) 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.
When used in a TN system with an infeed via Active Line Module and when the Motor Modules are operated with a higher pulse frequency, then you can obtain the permissible motor cable lengths on request.

7) With option L08 (motor reactor):
- Frame size HX/JX →Supplementary cabinet 600 mm wide
With option L10 (dv/dt filter plus VPL):
- Frame size FX/GX/HX/JX →Supplementary cabinet 600 mm wide
With option L34 (circuit breaker at output side):
- Frame size FX/GX →Supplementary cabinet 400 mm wide
- Frame size HX/JX →Supplementary cabinet 600 mm wide.

8) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

Table 5- 53 Technical data for Motor Modules in chassis format, line voltage 3 AC 500 ... 690 V, DC link voltage 675 ... 1035 VDC; part I

| **Article No.** | **6SL3720-** | **1TG28-5AA3** | **1TG31-0AA3** | **1TG31-2AA3** | **1TG31-5AA3** | **1TG31-8AA3** | **1TG32-2AA3** |
|---|---|---|---|---|---|---|---|
| **Type rating** | | | | | | | |
| - for $I_L$ (50 Hz 690 V) 1) | kW | 75 | 90 | 110 | 132 | 160 | 200 |
| - for $I_H$ (50 Hz 690 V) 1) | kW | 55 | 75 | 90 | 110 | 132 | 160 |
| - for $I_L$ (50 Hz 500 V) 1) | kW | 55 | 55 | 75 | 90 | 110 | 132 |
| - for $I_H$ (50 Hz 500 V) 1) | kW | 45 | 55 | 75 | 90 | 90 | 110 |
| - for $I_L$ (60 Hz 575 V) 2) | hp | 75 | 75 | 100 | 150 | 150 | 200 |
| - for $I_H$ (60 Hz 575 V) 2) | hp | 75 | 75 | 100 | 125 | 150 | 200 |
| **Output current** | | | | | | | |
| - Rated current $I_{N\,A}$ | A | 85 | 100 | 120 | 150 | 175 | 215 |
| - Base-load current $I_L$ 3) | A | 80 | 95 | 115 | 142 | 170 | 208 |
| - Base-load current $I_H$ 4) | A | 76 | 89 | 107 | 134 | 157 | 192 |
| - Maximum current $I_{max\,A}$ | A | 120 | 142 | 172 | 213 | 255 | 312 |
| **DC link current** | | | | | | | |
| - rated current $I_{N\,DC}$ when fed via: | | | | | | | |
| - Basic/Smart Line Module | A | 102 | 120 | 144 | 180 | 210 | 258 |
| - Active Line Module | A | 92 | 108 | 130 | 162 | 189 | 232 |
| - base-load current $I_{L\,DC}$ 3) when fed via: | | | | | | | |
| - Basic/Smart Line Module | A | 99 | 117 | 140 | 175 | 204 | 251 |
| - Active Line Module | A | 89 | 105 | 126 | 157 | 184 | 226 |
| - base-load current $I_{H\,DC}$ 4) when fed via: | | | | | | | |
| - Basic/Smart Line Module | A | 90 | 106 | 128 | 160 | 186 | 229 |
| - Active Line Module | A | 81 | 96 | 115 | 144 | 168 | 206 |
| **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** | | | | | | | |
| - Auxiliary supply 24 V DC | A | 0.8 | 0.8 | 0.8 | 0.8 | 0.9 | 0.9 |
| - 500/690 VAC | A | 0.7/0.4 | 0.7/0.4 | 0.7/0.4 | 0.7/0.4 | 1.5/1.0 | 1.5/1.0 |
| **DC link capacitance** | µF | 1200 | 1200 | 1600 | 2800 | 2800 | 2800 |
| **Pulse frequency** | | | | | | | |
| - rated frequency | kHz | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 |
| - pulse frequency, max. | | | | | | | |
| - without current derating | kHz | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 |
| - with current derating | kHz | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 |
| **Power loss, max.** 5) | | | | | | | |
| - at 50 Hz 690 V | kW | 1.17 | 1.43 | 1.89 | 1.8 | 2.67 | 3.09 |
| - at 60 Hz 575 V | kW | 1.1 | 1.3 | 1.77 | 1.62 | 2.5 | 2.91 |
| **Cooling air requirement** | $m^3/s$ | 0.17 | 0.17 | 0.17 | 0.17 | 0.36 | 0.36 |
| **Sound pressure level $L_{pA}$** (1 m) at 50/60 Hz | dB(A) | 67 | 67 | 67 | 67 | 69 | 69 |
| **Motor connection U2, V2, W2** | | | | | | | |
| - Screws | | 2/M12 | 2/M12 | 2/M12 | 2/M12 | 2/M12 | 2/M12 |
| - Conductor cross-section, max. (IEC) | $mm^2$ | 2 x 185 | 2 x 185 | 2 x 185 | 2 x 185 | 2 x 240 | 2 x 240 |
| **Cable length, max.** 6) | | | | | | | |
| - shielded | m | 300 | 300 | 300 | 300 | 300 | 300 |
| - unshielded | m | 450 | 450 | 450 | 450 | 450 | 450 |
| **PE/GND conductor** | | PE busbar | | | | | |
| - Busbar cross-section | $mm^2$ | 600 | | | | | |
| - Conductor cross-section, max. (IEC) | $mm^2$ | 240 | | | | | |
| **Degree of protection** (standard version) | | IP20 | IP20 | IP20 | IP20 | IP20 | IP20 |

| **Article No.** | **6SL3720-** | **1TG28-5AA3** | **1TG31-0AA3** | **1TG31-2AA3** | **1TG31-5AA3** | **1TG31-8AA3** | **1TG32-2AA3** |
|---|---|---|---|---|---|---|---|
| **Dimensions** (standard version, IP20)<br>- width [7]<br>- height [8]<br>- depth | <br>mm<br>mm<br>mm | <br>400<br>2200<br>600 | <br>400<br>2200<br>600 | <br>400<br>2200<br>600 | <br>400<br>2200<br>600 | <br>400<br>2200<br>600 | <br>400<br>2200<br>600 |
| **Weight, approx.** (standard version) | kg | 145 | 145 | 145 | 145 | 286 | 286 |
| **Frame size** | | FX | FX | FX | FX | GX | GX |
| **Maximum short-circuit current $I_{CC}$ acc. to IEC** | kA | 65 | 65 | 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) 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.
When used in a TN system with an infeed via Active Line Module and when the Motor Modules are operated with a higher pulse frequency, then you can obtain the permissible motor cable lengths on request.

7) With option L08 (motor reactor):
- Frame size HX/JX →Supplementary cabinet 600 mm wide
With option L10 (dv/dt filter plus VPL):
- Frame size FX/GX/HX/JX →Supplementary cabinet 600 mm wide
With option L34 (circuit breaker at output side):
- Frame size FX/GX →Supplementary cabinet 400 mm wide
- Frame size HX/JX →Supplementary cabinet 600 mm wide.

8) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

Table 5- 54 Technical data for Motor Modules in chassis format, line voltage 3 AC 500 ... 690 V, DC link voltage 675 ... 1035 VDC; part II

| **Article No.** | **6SL3720-** | **1TG32-6AA3** | **1TG33-3AA3** | **1TG34-1AA3** | **1TG34-7AA3** | **1TG35-8AA3** |
|---|---|---|---|---|---|---|
| **Type rating** | | | | | | |
| - for $I_L$ (50 Hz 690 V) 1) | kW | 250 | 315 | 400 | 450 | 560 |
| - for $I_H$ (50 Hz 690 V) 1) | kW | 200 | 250 | 315 | 400 | 450 |
| - for $I_L$ (50 Hz 500 V) 1) | kW | 160 | 200 | 250 | 315 | 400 |
| - for $I_H$ (50 Hz 500 V) 1) | kW | 132 | 160 | 200 | 250 | 315 |
| - for $I_L$ (60 Hz 575 V) 2) | hp | 250 | 300 | 400 | 450 | 600 |
| - for $I_H$ (60 Hz 575 V) 2) | hp | 200 | 250 | 350 | 450 | 500 |
| **Output current** | | | | | | |
| - Rated current $I_{N\,A}$ | A | 260 | 330 | 410 | 465 | 575 |
| - Base-load current $I_L$ 3) | A | 250 | 320 | 400 | 452 | 560 |
| - Base-load current $I_H$ 4) | A | 233 | 280 | 367 | 416 | 514 |
| - Maximum current $I_{max\,A}$ | A | 375 | 480 | 600 | 678 | 840 |
| **DC link current** | | | | | | |
| - rated current $I_{N\,DC}$ when fed via: | | | | | | |
| - Basic/Smart Line Module | A | 312 | 396 | 492 | 558 | 690 |
| - Active Line Module | A | 281 | 356 | 443 | 502 | 621 |
| - base-load current $I_{L\,DC}$ 3) when fed via: | | | | | | |
| - Basic/Smart Line Module | A | 304 | 386 | 479 | 544 | 672 |
| - Active Line Module | A | 273 | 347 | 431 | 489 | 605 |
| - base-load current $I_{H\,DC}$ 4) when fed via: | | | | | | |
| - Basic/Smart Line Module | A | 277 | 352 | 437 | 496 | 614 |
| - Active Line Module | A | 250 | 316 | 394 | 446 | 552 |
| **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** | | | | | | |
| - Auxiliary supply 24 V DC | A | 0.9 | 0.9 | 1.0 | 1.0 | 1.0 |
| - 500/690 VAC | A | 1.5/1.0 | 1.5/1.0 | 3/2.1 | 3/2.1 | 3/2.1 |
| **DC link capacitance** | µF | 3900 | 4200 | 7400 | 7400 | 7400 |
| **Pulse frequency** | | | | | | |
| - rated frequency | kHz | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 |
| - pulse frequency, max. | | | | | | |
| - without current derating | kHz | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 |
| - with current derating | kHz | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 |
| **Power loss, max.** 5) | | | | | | |
| - at 50 Hz 690 V | kW | 3.62 | 4.34 | 6.13 | 6.8 | 10.3 |
| - at 60 Hz 575 V | kW | 3.38 | 3.98 | 5.71 | 6.32 | 9.7 |
| **Cooling air requirement** | $m^3/s$ | 0.36 | 0.36 | 0.78 | 0.78 | 0.78 |
| **Sound pressure level $L_{pA}$** (1 m) at 50/60 Hz | dB(A) | 69/73 | 69/73 | 70/73 | 70/73 | 70/73 |
| **Motor connection U2, V2, W2** | | | | | | |
| - Screws | | 2/M12 | 2/M12 | 2/M12 | 2/M12 | 2/M12 |
| - Conductor cross-section, max. (IEC) | $mm^2$ | 2 x 240 | 2 x 240 | 4 x 240 | 4 x 240 | 4 x 240 |
| **Cable length, max.** 6) | | | | | | |
| - shielded | m | 300 | 300 | 300 | 300 | 300 |
| - unshielded | m | 450 | 450 | 450 | 450 | 450 |
| **PE/GND conductor** | | PE busbar | | | | |
| - Busbar cross-section | $mm^2$ | 600 | | | | |
| - Conductor cross-section, max. (IEC) | $mm^2$ | 240 | | | | |
| **Degree of protection** (standard version) | | IP20 | IP20 | IP20 | IP20 | IP20 |

| **Article No.** | **6SL3720-** | **1TG32-6AA3** | **1TG33-3AA3** | **1TG34-1AA3** | **1TG34-7AA3** | **1TG35-8AA3** |
|---|---|---|---|---|---|---|
| **Dimensions** (standard version, IP20)<br>- width [7]<br>- height [8]<br>- depth | <br>mm<br>mm<br>mm | <br>400<br>2200<br>600 | <br>400<br>2200<br>600 | <br>600<br>2200<br>600 | <br>600<br>2200<br>600 | <br>600<br>2200<br>600 |
| **Weight, approx.** (standard version) | kg | 286 | 286 | 490 | 490 | 490 |
| **Frame size** | | GX | GX | HX | HX | HX |
| **Maximum short-circuit current $I_{CC}$ acc. to IEC** | kA | 65 | 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 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) 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.
When used in a TN system with an infeed via Active Line Module and when the Motor Modules are operated with a higher pulse frequency, then you can obtain the permissible motor cable lengths on request.

7) With option L08 (motor reactor):
- Frame size HX/JX →Supplementary cabinet 600 mm wide
With option L10 (dv/dt filter plus VPL):
- Frame size FX/GX/HX/JX →Supplementary cabinet 600 mm wide
With option L34 (circuit breaker at output side):
- Frame size FX/GX →Supplementary cabinet 400 mm wide
- Frame size HX/JX →Supplementary cabinet 600 mm wide.

8) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

Table 5- 55 Technical data for Motor Modules in chassis format, line voltage 3 AC 500 ... 690 V, DC link voltage 675 ... 1035 VDC; part III

| **Article No.** | **6SL3720-** | **1TG37-4AA3** | **1TG38-1AA3** | **1TG38-8AA3** | **1TG41-0AA3** | **1TG41-3AA3** |
|---|---|---|---|---|---|---|
| **Type rating** | | | | | | |
| - for $I_L$ (50 Hz 690 V) [1] | kW | 710 | 800 | 900 | 1000 | 1200 |
| - for $I_H$ (50 Hz 690 V) [1] | kW | 630 | 710 | 800 | 900 | 1000 |
| - for $I_L$ (50 Hz 500 V) [1] | kW | 500 | 560 | 630 | 710 | 900 |
| - for $I_H$ (50 Hz 500 V) [1] | kW | 450 | 500 | 560 | 630 | 800 |
| - for $I_L$ (60 Hz 575 V) [2] | hp | 700 | 800 | 900 | 1000 | 1250 |
| - for $I_H$ (60 Hz 575 V) [2] | hp | 700 | 700 | 800 | 900 | 1000 |
| **Output current** | | | | | | |
| - Rated current $I_{N\,A}$ | A | 735 | 810 | 910 | 1025 | 1270 |
| - Base-load current $I_L$ [3] | A | 710 | 790 | 880 | 1000 | 1230 |
| - Base-load current $I_H$ [4] | A | 657 | 724 | 814 | 917 | 1136 |
| - Maximum current $I_{max\,A}$ | A | 1065 | 1185 | 1320 | 1500 | 1845 |
| **DC link current** | | | | | | |
| - rated current $I_{N\,DC}$ when fed via: | | | | | | |
| - Basic/Smart Line Module | A | 882 | 972 | 1092 | 1230 | 1524 |
| - Active Line Module | A | 794 | 875 | 983 | 1107 | 1372 |
| - base-load current $I_{L\,DC}$ [3] when fed via: | | | | | | |
| - Basic/Smart Line Module | A | 859 | 947 | 1064 | 1199 | 1485 |
| - Active Line Module | A | 774 | 853 | 958 | 1079 | 1337 |
| - base-load current $I_{H\,DC}$ [4] when fed via: | | | | | | |
| - Basic/Smart Line Module | A | 784 | 865 | 971 | 1094 | 1356 |
| - Active Line Module | A | 706 | 778 | 874 | 985 | 1221 |
| **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** | | | | | | |
| - Auxiliary supply 24 V DC | A | 1.25 | 1.25 | 1.4 | 1.4 | 1.4 |
| - 500/690 VAC | A | 4.4/3.1 | 4.4/3.1 | 4.4/3.1 | 4.4/3.1 | 4.4/3.1 |
| **DC link capacitance** | µF | 11100 | 11100 | 14400 | 14400 | 19200 |
| **Pulse frequency** | | | | | | |
| - rated frequency | kHz | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 |
| - pulse frequency, max. | | | | | | |
| - without current derating | kHz | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 |
| - with current derating | kHz | 7.5 | 7.5 | 7.5 | 7.5 | 7.5 |
| **Power loss, max.** [5] | | | | | | |
| - at 50 Hz 690 V | kW | 10.9 | 11.5 | 11.7 | 13.2 | 16.0 |
| - at 60 Hz 575 V | kW | 10 | 10.5 | 10.6 | 12.0 | 14.2 |
| **Cooling air requirement** | $m^3/s$ | 1.08 | 1.08 | 1.08 | 1.08 | 1.08 |
| **Sound pressure level $L_{pA}$** (1 m) at 50/60 Hz | dB(A) | 71/73 | 71/73 | 71/73 | 71/73 | 71/73 |
| **Motor connection U2, V2, W2** | | | | | | |
| - Screws | | 3/M12 | 3/M12 | 3/M12 | 3/M12 | 3/M12 |
| - Conductor cross-section, max. (IEC) | $mm^2$ | 6 x 240 | 6 x 240 | 6 x 240 | 6 x 240 | 6 x 240 |
| **Cable length, max.** [6] | | | | | | |
| - shielded | m | 300 | 300 | 300 | 300 | 300 |
| - unshielded | m | 450 | 450 | 450 | 450 | 450 |
| **PE/GND conductor** | | PE busbar | | | | |
| - Busbar cross-section | $mm^2$ | 600 | | | | |
| - Conductor cross-section, max. (IEC) | $mm^2$ | 240 | | | | |
| **Degree of protection** (standard version) | | IP20 | IP20 | IP20 | IP20 | IP20 |

| **Article No.** | **6SL3720-** | **1TG37-4AA3** | **1TG38-1AA3** | **1TG38-8AA3** | **1TG41-0AA3** | **1TG41-3AA3** |
|---|---|---|---|---|---|---|
| **Dimensions** (standard version, IP20)<br>- width [7)]<br>- height [8)]<br>- depth | <br>mm<br>mm<br>mm | <br>800<br>2200<br>600 | <br>800<br>2200<br>600 | <br>800<br>2200<br>600 | <br>800<br>2200<br>600 | <br>800<br>2200<br>600 |
| **Weight, approx.** (standard version) | kg | 700 | 700 | 700 | 700 | 700 |
| **Frame size** | | JX | JX | JX | JX | JX |
| **Maximum short-circuit current $I_{CC}$ acc. to IEC** | kA | 100 | 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) 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.
When used in a TN system with an infeed via Active Line Module and when the Motor Modules are operated with a higher pulse frequency, then you can obtain the permissible motor cable lengths on request.

7) With option L08 (motor reactor):
- Frame size HX/JX →Supplementary cabinet 600 mm wide
With option L10 (dv/dt filter plus VPL):
- Frame size FX/GX/HX/JX →Supplementary cabinet 600 mm wide
With option L34 (circuit breaker at output side):
- Frame size FX/GX →Supplementary cabinet 400 mm wide
- Frame size HX/JX →Supplementary cabinet 600 mm wide.

8) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

## 5.7.5 Overload capability

The Motor Modules Chassis format have an overload reserve (e.g. to handle breakaway torques).

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

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.

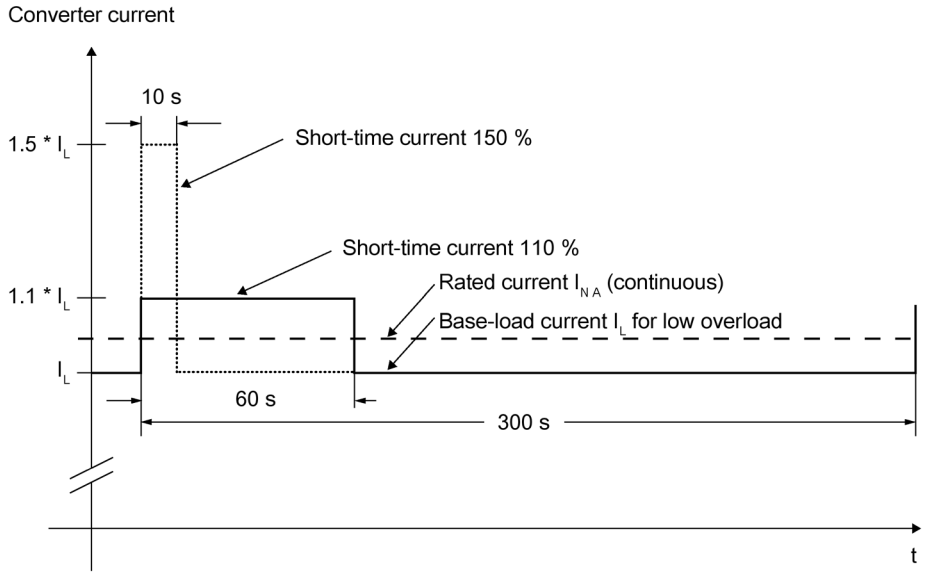



Figure 5-54 Low overload

## 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.

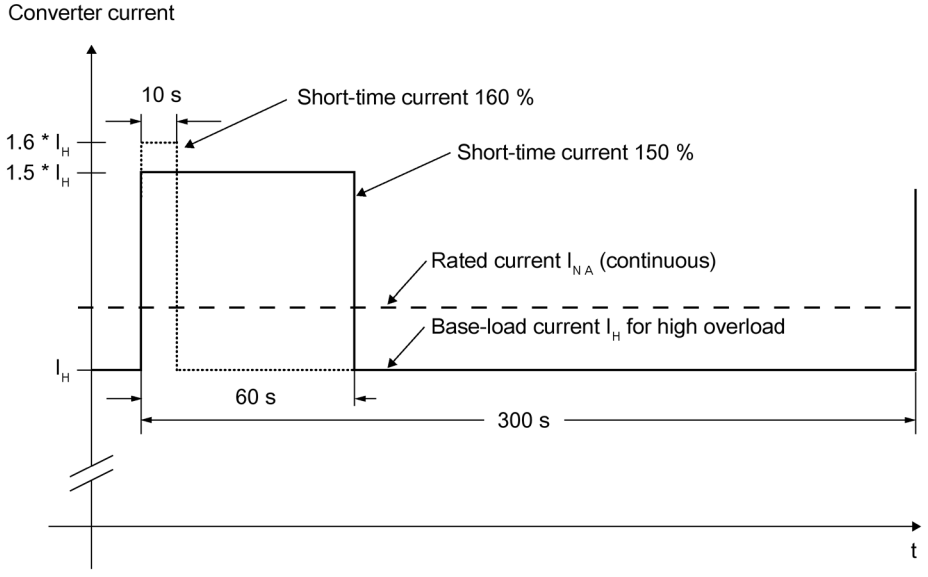



Figure 5-55 High overload

## 5.7.6 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 5- 56 Derating factor of the output current as a function of the pulse frequency for devices with a rated pulse frequency of 2 kHz

| Article No. | Type rating | Output current at 2 kHz | Derating factor at the pulse frequency | | | | |
|---|---|---|---|---|---|---|---|
| 6SL3720-... | [kW] | [A] | 2.5 kHz | 4 kHz | 5 kHz | 7.5 kHz | 8 kHz |
| **Supply voltage 510 – 720 VDC** | | | | | | | |
| 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% |
| 1TE33-8AA3 | 200 | 380 | 96% | 87% | 77% | 54% | 50% |
| 1TE35-0AA3 | 250 | 490 | 94% | 78% | 71% | 53% | 50% |

Table 5- 57 Derating factor of the output current as a function of the pulse frequency for devices with a rated pulse frequency of 1.25 kHz

| Article No. | Type rating | Output current at 1.25 kHz | Derating factor at the pulse frequency | | | | | |
|---|---|---|---|---|---|---|---|---|
| 6SL3720-... | [kW] | [A] | 2 kHz | 2.5 kHz | 4 kHz | 5 kHz | 7.5 kHz | 8 kHz |
| **Supply voltage 510 – 720 VDC** | | | | | | | | |
| 1TE36-1AA3 | 315 | 605 | 83% | 72% | 64% | 60% | 40% | 36% |
| 1TE37-5AA3 | 400 | 745 | 83% | 72% | 64% | 60% | 40% | 36% |
| 1TE38-4AA3 | 450 | 840 | 87% | 79% | 64% | 55% | 40% | 37% |
| 1TE41-0AA3 | 560 | 985 | 92% | 87% | 70% | 60% | 50% | 47% |
| 1TE41-2AA3 | 710 | 1260 | 92% | 87% | 70% | 60% | 50% | 47% |
| 1TE41-4AA3 | 800 | 1405 | 97% | 95% | 74% | 60% | 50% | 47% |
| **Supply voltage 675 – 1035 VDC** | | | | | | | | |
| 1TG28-5AA3 | 75 | 85 | 93% | 89% | 71% | 60% | 40% | -- |
| 1TG31-0AA3 | 90 | 100 | 92% | 88% | 71% | 60% | 40% | -- |
| 1TG31-2AA3 | 110 | 120 | 92% | 88% | 71% | 60% | 40% | -- |
| 1TG31-5AA3 | 132 | 150 | 90% | 84% | 66% | 55% | 35% | -- |
| 1TG31-8AA3 | 160 | 175 | 92% | 87% | 70% | 60% | 40% | -- |
| 1TG32-2AA3 | 200 | 215 | 92% | 87% | 70% | 60% | 40% | -- |
| 1TG32-6AA3 | 250 | 260 | 92% | 88% | 71% | 60% | 40% | -- |
| 1TG33-3AA3 | 315 | 330 | 89% | 82% | 65% | 55% | 40% | -- |
| 1TG34-1AA3 | 400 | 410 | 89% | 82% | 65% | 55% | 35% | -- |
| 1TG34-7AA3 | 450 | 465 | 92% | 87% | 67% | 55% | 35% | -- |
| 1TG35-8AA3 | 560 | 575 | 91% | 85% | 64% | 50% | 35% | -- |
| 1TG37-4AA3 | 710 | 735 | 87% | 79% | 64% | 55% | 35% | -- |
| 1TG38-1AA3 | 800 | 810 | 97% | 95% | 71% | 55% | 35% | -- |
| 1TG38-8AA3 | 900 | 910 | 92% | 87% | 67% | 55% | 33% | -- |
| 1TG41-0AA3 | 1000 | 1025 | 91% | 86% | 64% | 50% | 30% | -- |
| 1TG41-3AA3 | 1200 | 1270 | 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.

## Maximum output frequencies achieved by increasing the pulse frequency

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

Table 5- 58 Maximum output frequencies achieved by increasing the pulse frequency

| Current controller clock cycle $T_I$ | Adjustable pulse frequencies $f_p$ | Maximum achievable output frequency $f_A$ | | |
|---|---|---|---|---|
| | | U/f operating mode | Vector operating mode | Servo mode |
| 250 µs [1] | 2 kHz<br>4 kHz<br>8 kHz | 166 Hz<br>333 Hz<br>550 Hz [3] | 166 Hz<br>333 Hz<br>480 Hz | 333 Hz<br>550 Hz [3]<br>550 Hz [3] |
| 400 µs [2] | 1.25 kHz<br>2.50 kHz<br>5.00 kHz<br>7.50 kHz | 104 Hz<br>208 Hz<br>416 Hz<br>550 Hz [3] | 104 Hz<br>208 Hz<br>300 Hz<br>300 Hz | -<br>-<br>-<br>- |

[1] As factory setting, the following Motor Modules in the chassis format have a current controller clock cycle of 250 µs - and a pulse frequency of 2 kHz:
- 510 ... 720 V DC: ≤250 kW / 490 A

[2] As factory setting, the following Motor Modules in the chassis format have a current controller clock cycle of 400 µs - and a pulse frequency of 1.25 kHz:
- 510 ... 720 V DC: ≥315 kW / 605 A
- 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.

**Note**

**Higher output frequencies**

- 510 ... 720 V DC: Higher output frequencies up to a maximum of 1600 Hz are possible.
- 675 ... 1035 V DC: Higher output frequencies up to a maximum of 1481 Hz are possible.

Consult your Siemens contact person regarding this.

# 5.8 Motor Modules - Chassis-2 format

## 5.8.1 Description

**Note**

**Additional information**

The arrangement of the components and interfaces as well as the wiring are shown in the attached layout diagrams (AO) or circuit diagrams (SP), which are included in the individual device documentation.

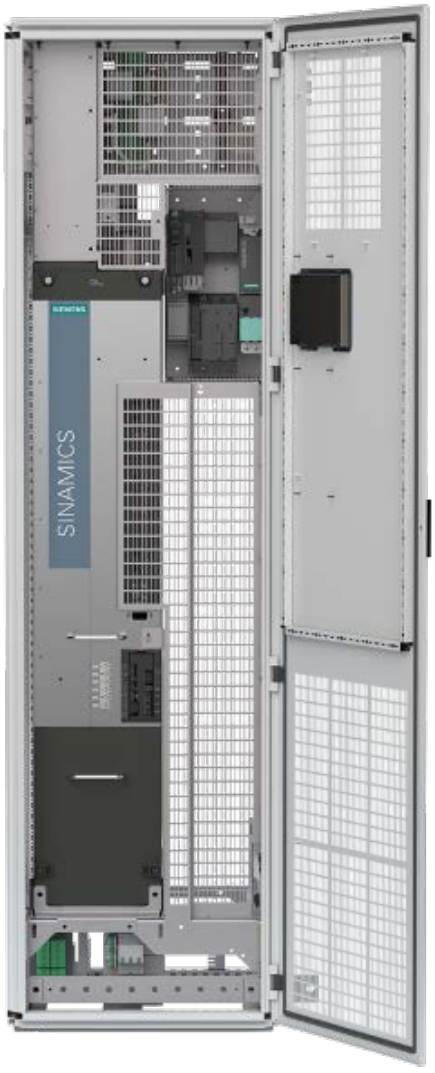



Figure 5-56 Motor Module - Chassis-2 format

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 in Chassis-2 format are available for the following voltages and power ratings:

| Line voltage | DC link voltage | Type rating |
|---|---|---|
| 3 AC 380 ... 480 V | 510 ... 720 VDC | 315 ... 800 kW |

The available shaft output can be increased by connecting up to 6 Motor Modules Chassis-2 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.

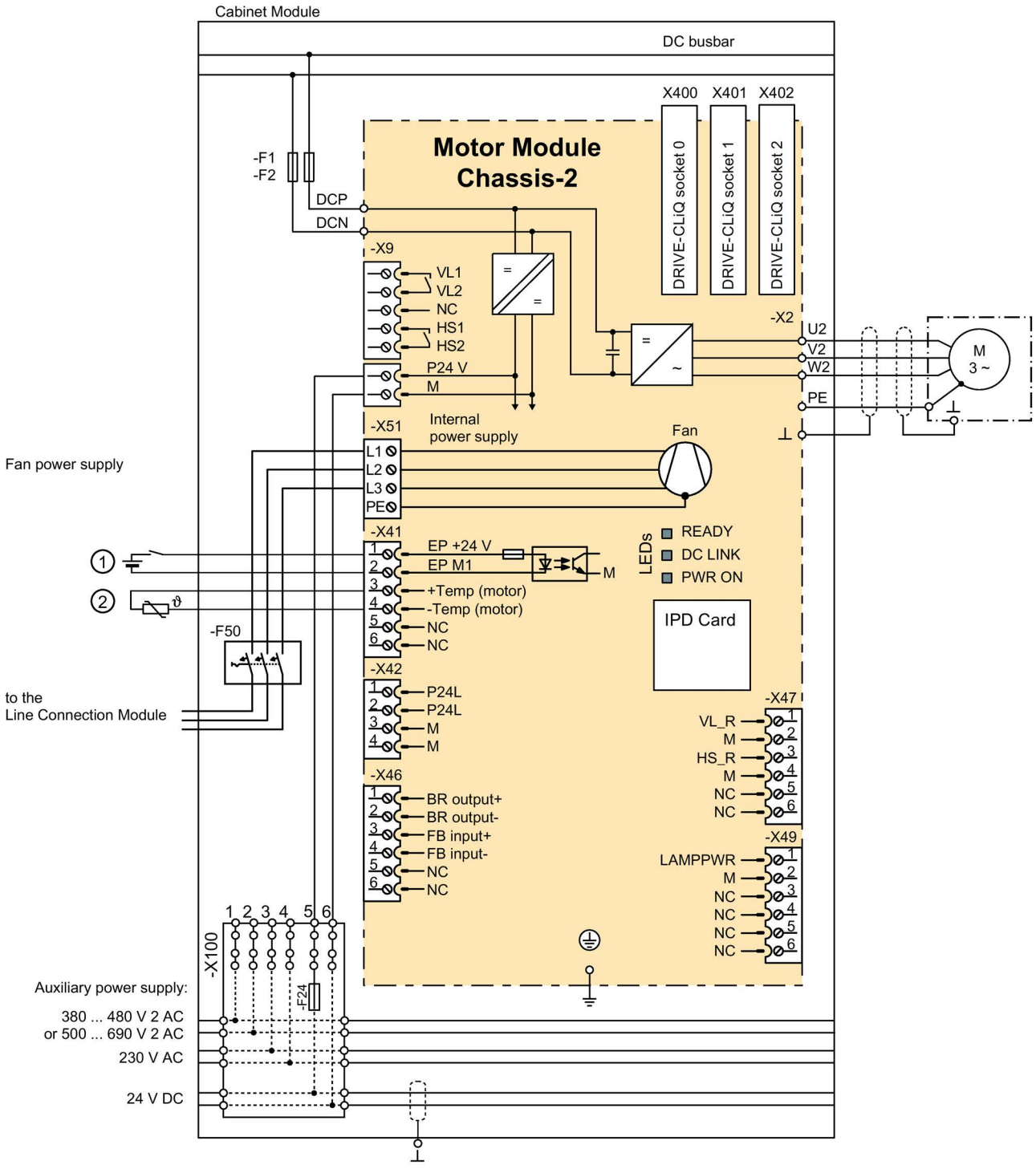
**NOTICE**

**Operation only with a firmware version from V5.2 HF4 and higher.**

The Motor Module Chassis-2 can be damaged if operated with unsuitable firmware.

- Only operate the Motor Module Chassis-2 with a firmware version from V5.2 HF4 and higher.

## Integration




① Required for Safety Integrated

② Connection of a temperature sensor for motors without a DRIVE-CLiQ interface.

Figure 5-57 Connection example: Motor Module in Chassis-2 format

## 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).
- Connection busbars, nickel-plated.
- DC fuses
- Cable propping bar for the electric power cables
- DRIVE-CLiQ interface (three DRIVE-CLiQ sockets), without Control Unit
- 6-pole auxiliary voltage supply, including auxiliary power module 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.

The precise order-specific location of the components is provided in the layout diagrams (AO) in the individual device documentation.

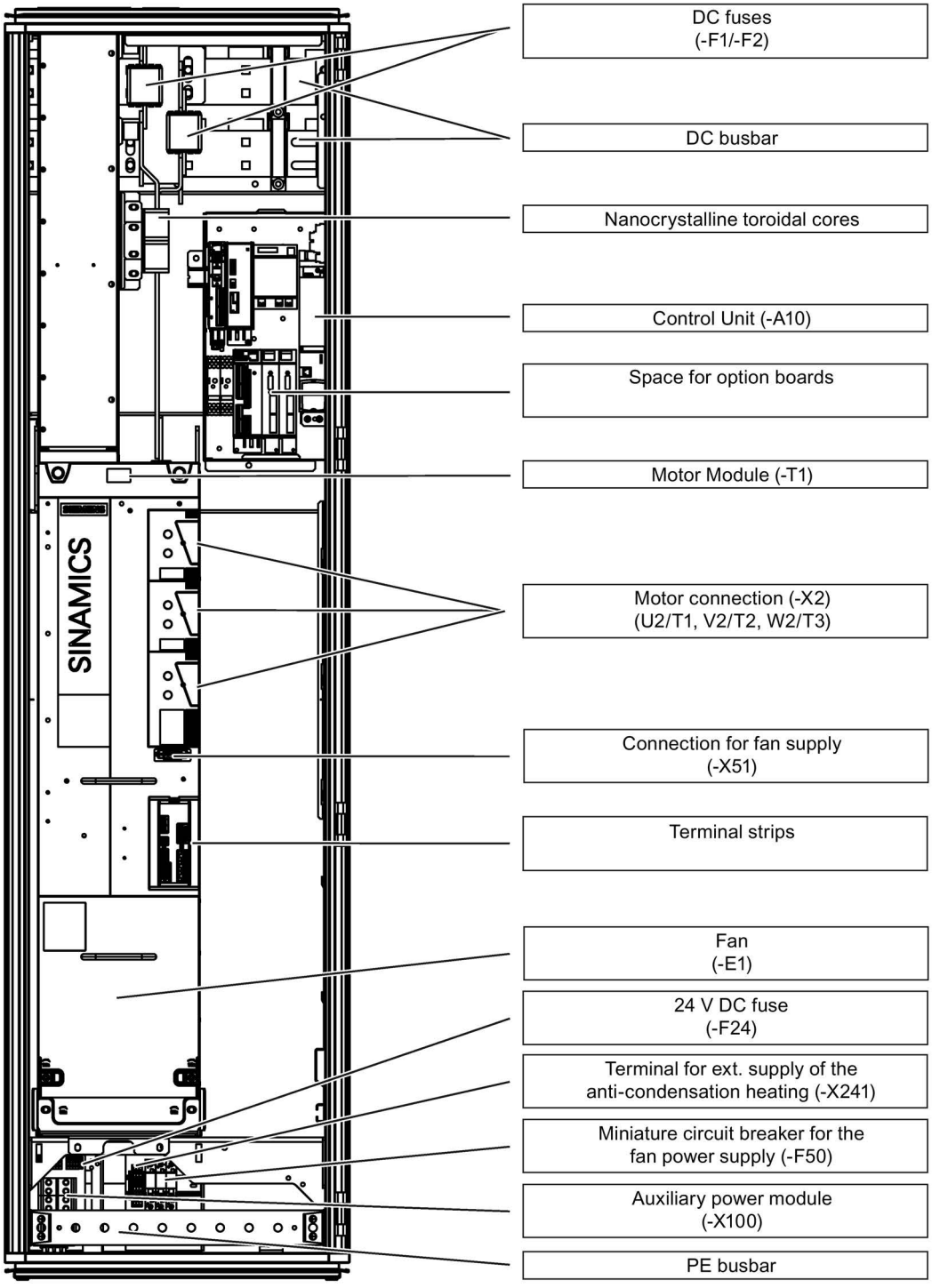



Figure 5-58 Configuration example for Motor Module in Chassis-2 format (frame sizes FS2, FS2+)

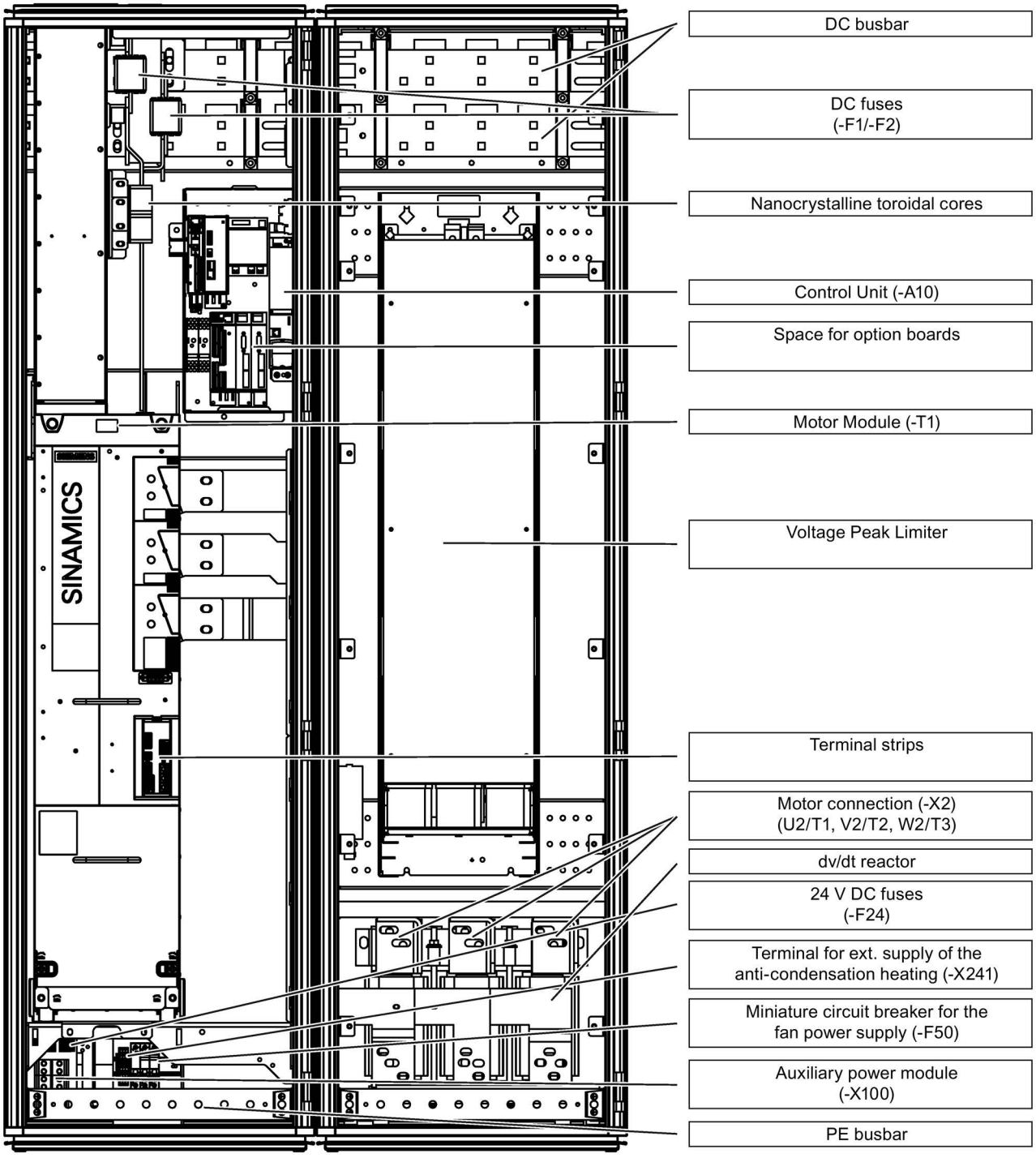



Figure 5-59 Configuration example for Motor Module in Chassis-2 format (frame sizes FS2, FS2+) with Option L10

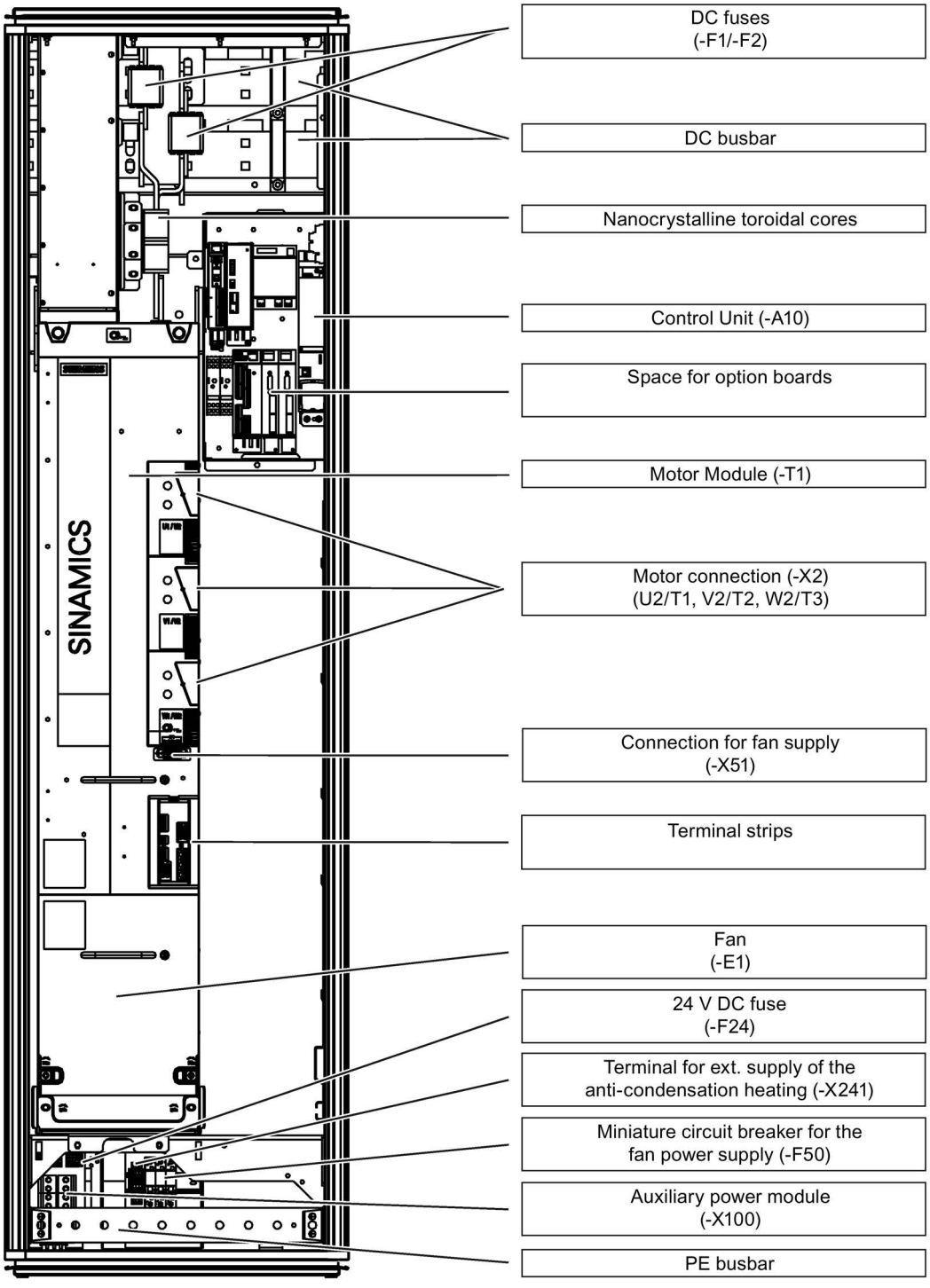



Figure 5-60 Configuration example for Motor Module in Chassis-2 format (frame size FS4, FS4+)

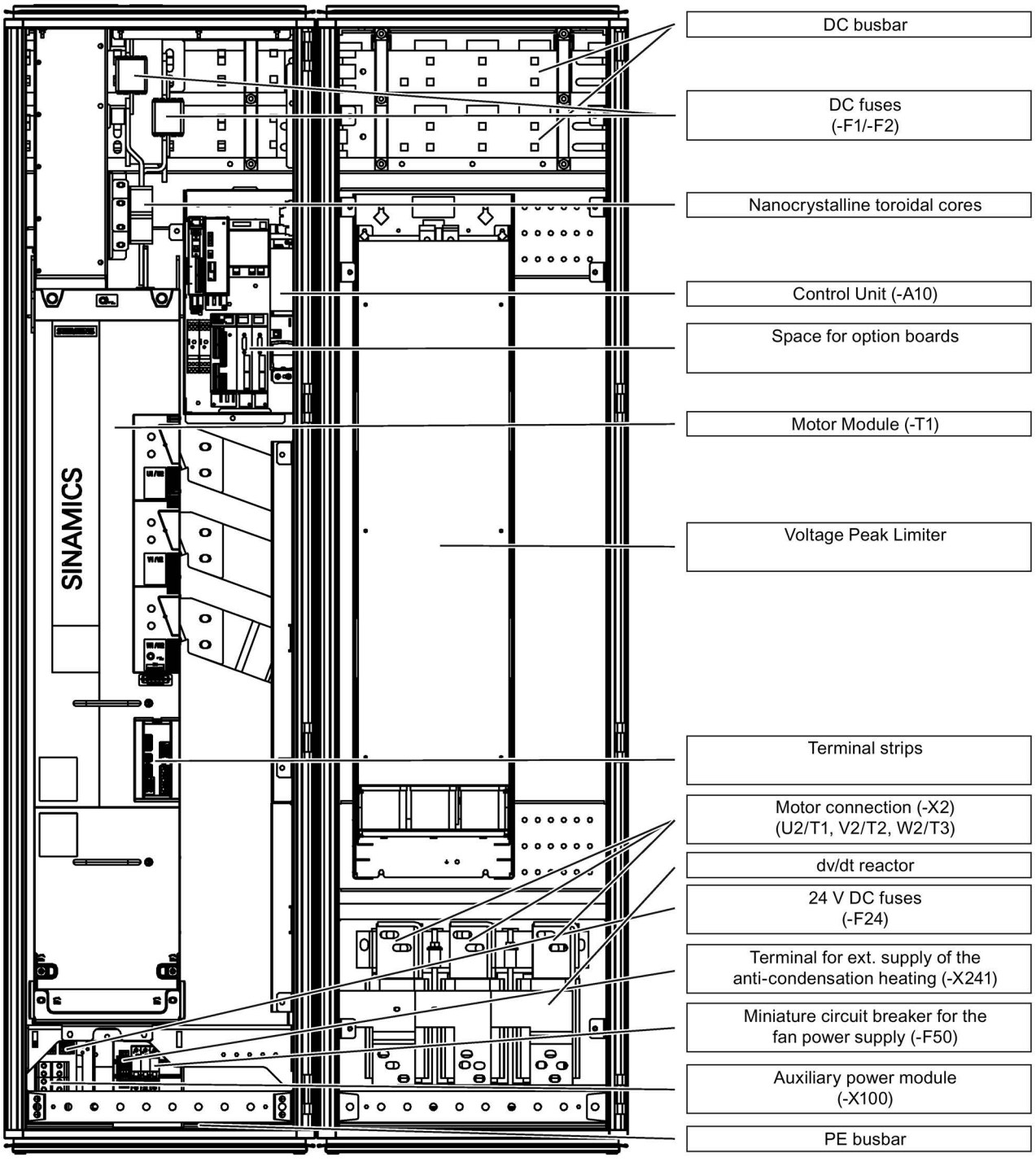



Figure 5-61 Configuration example for Motor Module in Chassis-2 format (frame size FS4, FS4+) with Option L10

## Parallel connection of Motor Modules Chassis-2 to increase the power

The following rules must be observed when connecting Motor Modules Chassis-2 in parallel:

- Up to 6 identical Motor Modules Chassis-2 can be connected in parallel.
- Parallel connection can only be implemented using one common Control Unit.
  For more than 4 power units, these must be distributed as symmetrically as possible between at least two DRIVE-CLiQ ports (e.g. 3x 2 Motor Modules Chassis-2 in series, or a minimum of 2x 3 Motor Modules Chassis-2 in series).
- The motor supply cables must have 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 cables lengths are listed in the following tables.

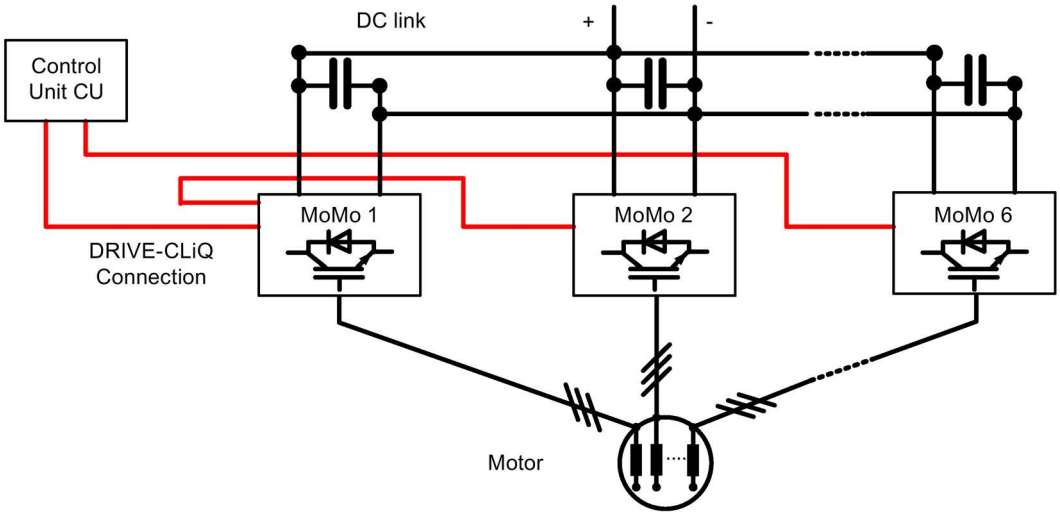



Figure 5-62 Motor with electrically isolated winding systems supplied by a parallel connection of S120 Motor Modules Chassis-2

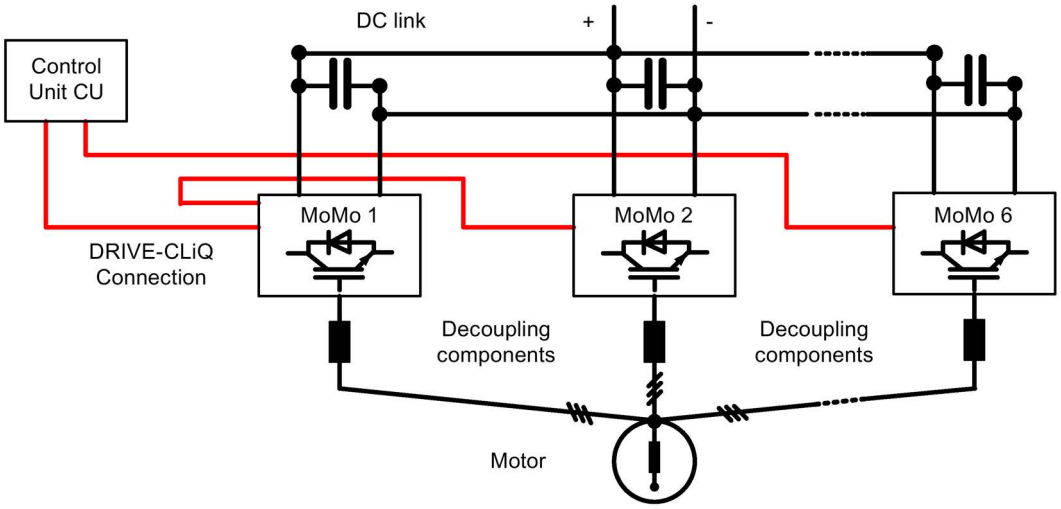



Figure 5-63 Motor with common winding system supplied by a parallel connection of S120 Motor Modules Chassis-2

**Note**

**It is not possible to connect different power units in parallel**

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

It is not possible to connect Motor Modules in the chassis format (Article No. 6SL3720-1Txxx-xAA3) and Motor Modules Chassis-2 (Article No. 6SL3721-1TExx-xBE0) in parallel.

### 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 (option L08, as is shown in the diagram above) must be used if the required cable length cannot be reached in the application.

Table 5- 59 Motor Modules Chassis-2, 510 ... 720 V DC

| Article No. | Frame size | $P_{rated}$ [kW] | $I_{rated\ rms}$ [A] | Minimum length [m] |
|---|---|---|---|---|
| 6SL3721-1TE36-6BE0 | FS2 | 315 | 655 | 13 |
| 6SL3721-1TE37-4BE0 | FS2 | 355 | 740 | 12 |
| 6SL3721-1TE38-1BE0 | FS2+ | 400 | 810 | 10 |
| 6SL3721-1TE38-8BE0 | FS2+ | 450 | 910 | 9 |
| 6SL3721-1TE41-0BE0 | FS4 | 500 | 975 | 8 |
| 6SL3721-1TE41-1BE0 | FS4 | 560 | 1075 | 8 |
| 6SL3721-1TE41-2BE0 | FS4 | 630 | 1200 | 8 |
| 6SL3721-1TE41-3BE0 | FS4+ | 710 | 1325 | 8 |
| 6SL3721-1TE41-5BE0 | FS4+ | 800 | 1495 | 8 |

## 5.8.2 Interface description

### 5.8.2.1 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, which are included in the individual device documentation.

### Overview of the terminal strips on the Motor Module Chassis-2

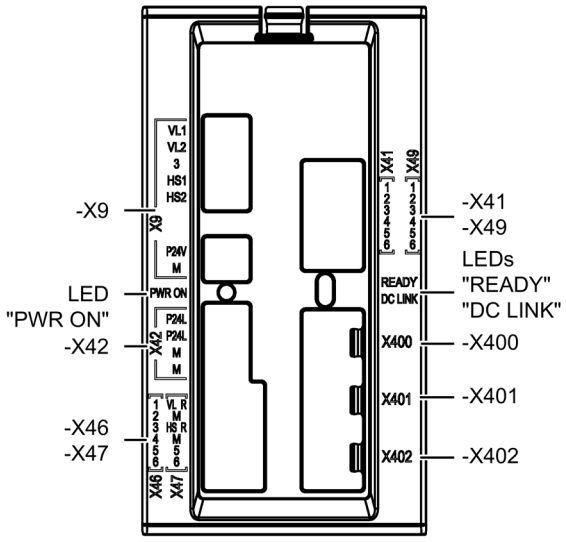
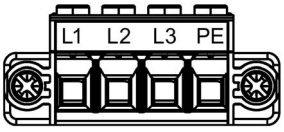



Figure 5-64 Terminal strips on the Motor Module Chassis-2

## 5.8.2.2 X51 connection, fan power supply

Table 5- 60 Terminal strip X51, fan power supply connection

| Connector | Terminal | Function | Technical data |
|---|---|---|---|
|   | L1 | L1 | Supply voltage: 3 AC 380 V ... 480 V<br>Frequency: 47 ... 63 Hz<br>Max. load current: 1.8 A |
| | L2 | L2 | |
| | L3 | L3 | |
| | PE | PE | Connection is connected to the fan housing. |
| Max. connectable cross-section: 6.0 mm² | | | |

The connection is established through a cable from a tap in the Line Connection Module, and is protected using a miniature circuit breaker (-F50)

**Note**

In operation, the connector must always be correctly screwed into place.

**Note**

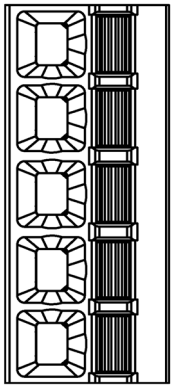
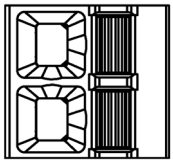
Connect the PE connection with the PE connection of the electrical cabinet.

**Note**

For installation altitudes exceeding 2000 m, an isolating transformer must be connected upstream of the fan power supply.

### 5.8.2.3 X9 terminal strip

Table 5- 61 Terminal strip X9

| Connector | Terminal | Signal name | Technical specifications |
|---|---|---|---|
|  | VL1 | Pre-charge contactor control | 240 V AC: 8 A max.<br>24 VDC: max. 1 A<br>isolated relay contact |
| | VL2 | | |
| | NC | NC | Reserved, do not use |
| | HS1 | Main contactor control | 240 V AC: 8 A max.<br>24 VDC: max. 1 A<br>isolated relay contact |
| | HS2 | | |
| | | | |
|  | P24V | P24V | External 24 V DC supply<br>Voltage: 24 V DC (20.4 ... 28.8 V)<br>Current consumption: max. 1.6 A |
| | M | M | |
| Max. connectable cross-section: 2.5 mm² | | | |

### 5.8.2.4 X41 EP terminal / temperature sensor connection

Table 5- 62 Terminal strip X41 EP terminals / temperature sensor connection

| Connector | Terminal | Function | Technical data |
|---|---|---|---|
|  | 1 | EP +24 V (enable pulses) | Supply voltage: 24 V DC (20.4 ... 28.8 V)<br>Current consumption: 10 mA<br>The pulse inhibit function is only available when the "Safety Integrated Basic Functions via onboard terminals" software is enabled. |
| | 2 | EP M1 (enable pulses) | |
| | 3 | +Temp (motor) | Temperature sensor connection for motor temperature measurement:<br>KTY84-1C130, PTC, PT100, PT1000, bimetallic switch with NC contact |
| | 4 | -Temp (motor) | |
| | 5 | NC | Reserved, do not use |
| | 6 | NC | Reserved, do not use |
| Max. connectable cross-section: 1.5 mm²<br>At terminals 1 and 2, the terminal strip has a yellow marking, it is coded at terminal 4; please use the corresponding connector from the accessory pack. | | | |



**⚠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 the motor in the event of an incorrectly connected KTY temperature sensor at terminals -X41:3,4**

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 at terminals X41:3,4 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.

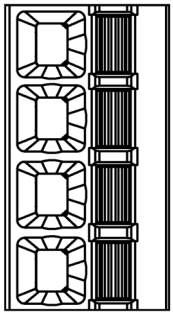
**Note**

**Safety Integrated Function Manual**

A detailed description of the complete principle of operation of the Safety Integrated functions and their handling is given in the associated Function Manual, which is included in the device documentation provided.

### 5.8.2.5 X42 terminal strip

Table 5- 63 Terminal strip X42 voltage supply for Control Unit, Sensor Module and Terminal Module

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

**Note**

**Connection options for terminal strip X42**

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

When required, additional system-side components can be connected via the central auxiliary power supply (X100).

### 5.8.2.6 X46 Brake control and monitoring

Table 5- 64 Terminal strip X46 brake control and monitoring

| Connector | Terminal | Function | Technical data |
|---|---|---|---|
|  | 1 | BR output + | Brake connection<br>Supply voltage: 24 V DC<br>Max. load current: 200 mA |
| | 2 | BR output - | |
| | 3 | FB input + | Internal feedback signal from the Safe Brake Adapter |
| | 4 | FB input - | |
| | 5 | NC | Reserved, do not use |
| | 6 | NC | Reserved, do not use |
| Max. connectable cross-section: 1.5 $mm^2$<br>The terminal strip is coded at terminal 1; please use the corresponding connector from the accessory pack. | | | |

**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.

### 5.8.2.7 X47 contactor feedback signal

Table 5- 65 Terminal strip X47, contactor feedback signal

| Connector | Terminal | Signal name | Technical specifications |
|---|---|---|---|
|  | 1 | VL_R | Precharging contactor feedback signal |
| | 2 | M | Supply voltage: 24 V DC<br>Max. Load current: 10 mA |
| | 3 | HS_R | Main contactor feedback signal |
| | 4 | M | Supply voltage: 24 V DC<br>Max. Load current: 10 mA |
| | 5 | NC | Reserved, do not use |
| | 6 | NC | Reserved, do not use |
| Max. connectable cross-section: 1.5 $mm^2$<br>The terminal strip is coded at terminal 3; please use the corresponding connector from the accessory pack. | | | |

### 5.8.2.8 X49 terminal block

Table 5- 66 Terminal strip X49

| Connector | Terminal | Function | Technical specifications |
|---|---|---|---|
|  | 1 | LAMPPWR | Supply voltage: 24 V DC<br>Max. Load current: 100 mA<br>If a fault is active at the power unit, then a voltage is present at the terminals. |
| | 2 | M | |
| | 3 | NC | Reserved, do not use |
| | 4 | NC | Reserved, do not use |
| | 5 | NC | Reserved, do not use |
| | 6 | NC | Reserved, do not use |
| Max. connectable cross-section: 1.5 $mm^2$<br>The terminal strip is coded at terminal 6; please use the corresponding connector from the accessory pack. | | | |

**Note**

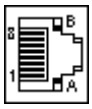
**Function of the "LAMPPWR" signal**

Terminal "LAMPPWR" can be used in large cabinet lineups to connect a signal lamp, which is then used to indicate which power unit has a problem. 24 V DC is output as soon as a fault becomes active in a power unit.

Note: For a firmware update, the output alternates between 0 V and 24 V.

### 5.8.2.9 DRIVE-CLiQ interfaces X400, X401, X402

Table 5- 67 DRIVE-CLiQ interfaces X400, X401, X402

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

### 5.8.2.10 Test points for 1 mm test probes

Test points for 1 mm test probes are provided at the sides of connectors X41, X46, X47 and X49, see ① in the following diagram.

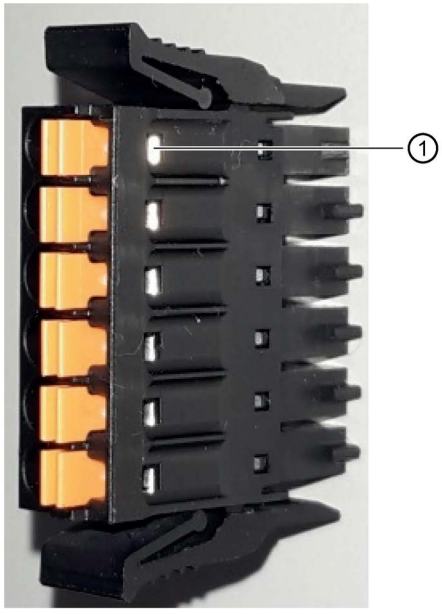



Figure 5-65 Test points for 1 mm test probes

## 5.8.3 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 TM150 Temperature Sensor Module | G51 |
| 2 TM150 Temperature Sensor Modules | G52 |
| Terminal Module TM31 | G60 |
| Additional TM31 Terminal Module | G61 |
| Terminal Board TB30 | 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 PROFIBUS | K90 |
| Performance extension for CU320-2 | K94 |
| Control Unit CU320-2 PROFINET | K95 |
| dv/dt filter compact plus Voltage Peak Limiter | L07 |
| Motor reactor | L08 |
| dv/dt filter plus Voltage Peak Limiter | L10 |
| Output-side circuit breaker (motorized) | L34 |
| 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 |
| Degree of protection IP21 | M21 |
| Degree of protection IP23 | M23 |
| Side panel, mounted on the right | M26 |
| Side panel, mounted on the left | M27 |
| Degree of protection IP43 | M43 |
| Degree of protection IP54 | M54 |
| 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 |
| DC busbar system | M80 ... M87 |
| Extended motor connection panel | M89 |
| Crane transport assembly (top-mounted) | M90 |
| Special paint finish for cabinet | Y09 |
| Factory assembly into transport units | Y11 |

## Other options

| Component | Option |
|---|---|
| Complete 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 / Portuguese (Brazil) | T83 |
| 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 |

## 5.8.4 Technical data

Table 5- 68 Technical data, Motor Modules in Chassis-2 format, line voltage 3 AC 380 ... 480 V, DC link voltage 510 ... 720 V DC, Part 1

| **Article No.** | **6SL3721-** | **1TE36-6BE0** | **1TE37-4BE0** | **1TE38-1BE0** | **1TE38-8BE0** |
|---|---|---|---|---|---|
| **Type rating** | | | | | |
| - for $I_L$ (50 Hz 400 V) 1) | kW | 315 | 355 | 400 | 450 |
| - for $I_H$ (50 Hz 400 V) 1) | kW | 280 | 315 | 355 | 400 |
| - for $I_L$ (60 Hz 460 V) 2) | hp | 500 | 600 | 650 | 700 |
| - for $I_H$ (60 Hz 460 V) 2) | hp | 450 | 500 | 550 | 650 |
| **Output current** | | | | | |
| - Rated current IN A | A | 655 | 740 | 810 | 910 |
| - Base-load current $I_L$ 3) | A | 620 | 700 | 770 | 865 |
| - Base-load current $I_H$ 4) | A | 555 | 620 | 675 | 760 |
| - Maximum current $I_{max\ A}$ | A | 917 | 1036 | 1134 | 1274 |
| **DC link current** | | | | | |
| - Rated current $I_{N\ DC}$ | A | 785 | 890 | 975 | 1090 |
| **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** | | | | | |
| - Auxiliary supply 24 V DC | A | 1.3 | 1.3 | 1.3 | 1.3 |
| - 400 V AC | A | 1.8 | 1.8 | 1.8 | 1.8 |
| **DC link capacitance** | µF | 16450 | 16450 | 18800 | 18800 |
| **Pulse frequency** | | | | | |
| - rated frequency | kHz | 2.5 | 2.5 | 2.5 | 2.5 |
| - pulse frequency, max. | | | | | |
| - without current derating | kHz | 2.5 | 2.5 | 2.5 | 2.5 |
| - with current derating | kHz | 8 | 8 | 8 | 8 |
| **Power loss, max.** 5) | | | | | |
| - at 50 Hz 400 V | kW | 6.7 | 7.0 | 7.8 | 8.8 |
| - at 60 Hz 460 V | kW | 6.9 | 7.3 | 8.1 | 9.1 |
| **Cooling air requirement** | $m^3/s$ | 0.64 | 0.64 | 0.64 | 0.64 |
| **Sound pressure level $L_{pA}$** (1 m) at 50/60 Hz | dB(A) | 53 ... 70 | 53 ... 70 | 53 ... 70 | 53 ... 70 |
| **Motor connection U2, V2, W2** | | | | | |
| - Screws | | 4/M12 | 4/M12 | 4/M12 | 4/M12 |
| - Conductor cross-section, max. (IEC) | $mm^2$ | 4 x 240 | 4 x 240 | 4 x 240 | 4 x 240 |
| **Cable length, max.** 6) | | | | | |
| - shielded | m | 300 | 300 | 300 | 300 |
| - unshielded | m | 450 | 450 | 450 | 450 |
| **PE/GND conductor** | | PE busbar | | | |
| - Busbar cross-section | $mm^2$ | 600 | | | |
| - Conductor cross-section, max. (IEC) | $mm^2$ | 240 | | | |
| **Degree of protection** (standard version) | | IP20 | IP20 | IP20 | IP20 |
| **Dimensions** (standard version, IP20) | | | | | |
| - width 7) | mm | 600 | 600 | 600 | 600 |
| - height 8) | mm | 2200 | 2200 | 2200 | 2200 |
| - depth | mm | 600 | 600 | 600 | 600 |
| **Weight, approx.** (standard version) | kg | 257 | 265 | 270 | 270 |

| **Article No.** | **6SL3721-** | **1TE36-6BE0** | **1TE37-4BE0** | **1TE38-1BE0** | **1TE38-8BE0** |
|---|---|---|---|---|---|
| **Frame size** | | FS2 | FS2 | FS2+ | FS2+ |
| **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 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 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 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) 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.
When used in a TN system with an infeed via Active Line Module and when the Motor Modules Chassis-2 are operated with a higher pulse frequency, then you can obtain the permissible motor cable lengths on request.

7) With option L07 (dv/dt filter compact plus VPL), L08 (motor reactor), L10 (dv/dt filter plus VPL), L34 (circuit breaker at the output side): → supplementary cabinet, 600 mm wide.

8) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

Table 5- 69 Technical data, Motor Modules in Chassis-2 format, line voltage 3 AC 380 ... 480 V, DC link voltage 510 ... 720 V DC, Part 2

| **Article No.** | **6SL3721-** | **1TE41-0BE0** | **1TE41-1BE0** | **1TE41-2BE0** | **1TE41-3BE0** |
|---|---|---|---|---|---|
| **Type rating** | | | | | |
| - for $I_L$ (50 Hz 400 V) 1) | kW | 500 | 560 | 630 | 710 |
| - for $I_H$ (50 Hz 400 V) 1) | kW | 450 | 500 | 560 | 630 |
| - for $I_L$ (60 Hz 460 V) 2) | hp | 750 | 850 | 950 | 1050 |
| - for $I_H$ (60 Hz 460 V) 2) | hp | 650 | 750 | 850 | 900 |
| **Output current** | | | | | |
| - Rated current $I_{N\,A}$ | A | 975 | 1075 | 1200 | 1325 |
| - Base-load current $I_L$ 3) | A | 910 | 1000 | 1145 | 1260 |
| - Base-load current $I_H$ 4) | A | 800 | 890 | 1000 | 1100 |
| - Maximum current $I_{max\,A}$ | A | 1365 | 1505 | 1680 | 1855 |
| **DC link current** | | | | | |
| - Rated current $I_{N\,DC}$ | A | 1170 | 1290 | 1440 | 1590 |
| **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** | | | | | |
| - Auxiliary supply 24 V DC | A | 1.3 | 1.3 | 1.3 | 1.3 |
| - 400 V AC | A | 1.8 | 1.8 | 1.8 | 1.8 |
| **DC link capacitance** | µF | 25900 | 25900 | 25900 | 40800 |
| **Pulse frequency** | | | | | |
| - rated frequency | kHz | 2.5 | 2.5 | 2.5 | 2.5 |
| - pulse frequency, max. | | | | | |
| - without current derating | kHz | 2.5 | 2.5 | 2.5 | 2.5 |
| - with current derating | kHz | 8 | 8 | 8 | 8 |
| **Power loss, max.** 5) | | | | | |
| - at 50 Hz 400 V | kW | 9.2 | 9.8 | 11.0 | 12.1 |
| - at 60 Hz 460 V | kW | 9.5 | 10.1 | 11.4 | 13.2 |
| **Cooling air requirement** | $m^3/s$ | 0.64 | 0.64 | 0.64 | 0.64 |
| **Sound pressure level $L_{pA}$** (1 m) at 50/60 Hz | dB(A) | 53 ... 70 | 53 ... 70 | 53 ... 70 | 53 ... 70 |
| **Motor connection U2, V2, W2** | | | | | |
| - Screws | | 6/M12 | 6/M12 | 6/M12 | 6/M12 |
| - Conductor cross-section, max. (IEC) | $mm^2$ | 6 x 240 | 6 x 240 | 6 x 240 | 6 x 240 |
| **Cable length, max.** 6) | | | | | |
| - shielded | m | 300 | 300 | 300 | 300 |
| - unshielded | m | 450 | 450 | 450 | 450 |
| **PE/GND conductor** | | PE busbar | | | |
| - Busbar cross-section | $mm^2$ | 600 | | | |
| - Conductor cross-section, max. (IEC) | $mm^2$ | 240 | | | |
| **Degree of protection** (standard version) | | IP20 | IP20 | IP20 | IP20 |
| **Dimensions** (standard version, IP20) | | | | | |
| - width 7) | mm | 600 | 600 | 600 | 600 |
| - height 8) | mm | 2200 | 2200 | 2200 | 2200 |
| - depth | mm | 600 | 600 | 600 | 600 |
| **Weight, approx.** (standard version) | kg | 305 | 305 | 305 | 316 |

| **Article No.** | **6SL3721-** | **1TE41-0BE0** | **1TE41-1BE0** | **1TE41-2BE0** | **1TE41-3BE0** |
|---|---|---|---|---|---|
| **Frame size** | | FS4 | FS4 | FS4 | FS4+ |
| **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 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 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 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) 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.
When used in a TN system with an infeed via Active Line Module and when the Motor Modules Chassis-2 are operated with a higher pulse frequency, then you can obtain the permissible motor cable lengths on request.

7) With option L07 (dv/dt filter compact plus VPL), L08 (motor reactor), L10 (dv/dt filter plus VPL), L34 (circuit breaker at the output side): → supplementary cabinet, 600 mm wide.

8) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

Table 5- 70 Technical data, Motor Modules in Chassis-2 format, line voltage 3 AC 380 ... 480 V, DC link voltage 510 ... 720 V DC, Part 3

| **Article No.** | **6SL3721-** | **1TE41-5BE0** | | | |
|---|---|---|---|---|---|
| **Type rating** | | | | | |
| - for $I_L$ (50 Hz 400 V) [1] | kW | 800 | | | |
| - for $I_H$ (50 Hz 400 V) [1] | kW | 710 | | | |
| - for $I_L$ (60 Hz 460 V) [2] | hp | 1200 | | | |
| - for $I_H$ (60 Hz 460 V) [2] | hp | 1050 | | | |
| **Output current** | | | | | |
| - Rated current $I_{N\,A}$ | A | 1495 | | | |
| - Base-load current $I_L$ [3] | A | 1420 | | | |
| - Base-load current $I_H$ [4] | A | 1240 | | | |
| - Maximum current $I_{max\,A}$ | A | 2093 | | | |
| **DC link current** | | | | | |
| - Rated current $I_{N\,DC}$ | A | 1795 | | | |
| **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** | | | | | |
| - Auxiliary supply 24 V DC | A | 1.3 | | | |
| - 400 V AC | A | 1.8 | | | |
| **DC link capacitance** | µF | 40800 | | | |
| **Pulse frequency** | | | | | |
| - rated frequency | kHz | 2.5 | | | |
| - pulse frequency, max. | | | | | |
| - without current derating | kHz | 2.5 | | | |
| - with current derating | kHz | 8 | | | |
| **Power loss, max.** [5] | | | | | |
| - at 50 Hz 400 V | kW | 13.7 | | | |
| - at 60 Hz 460 V | kW | 14.8 | | | |
| **Cooling air requirement** | $m^3/s$ | 0.64 | | | |
| **Sound pressure level $L_{pA}$** (1 m) at 50/60 Hz | dB(A) | 53 ... 70 | | | |
| **Motor connection U2, V2, W2** | | | | | |
| - Screws | | 6/M12 | | | |
| - Conductor cross-section, max. (IEC) | $mm^2$ | 6 x 240 | | | |
| **Cable length, max.** [6] | | | | | |
| - shielded | m | 300 | | | |
| - unshielded | m | 450 | | | |
| **PE/GND conductor** | | PE busbar | | | |
| - Busbar cross-section | $mm^2$ | 600 | | | |
| - Conductor cross-section, max. (IEC) | $mm^2$ | 240 | | | |
| **Degree of protection** (standard version) | | IP20 | | | |
| **Dimensions** (standard version, IP20) | | | | | |
| - width [7] | mm | 600 | | | |
| - height [8] | mm | 2200 | | | |
| - depth | mm | 600 | | | |
| **Weight, approx.** (standard version) | kg | 316 | | | |

| **Article No.** | **6SL3721-** | **1TE41-5BE0** | | | |
|---|---|---|---|---|---|
| **Frame size** | | FS4+ | | | |
| **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 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 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 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) 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.
When used in a TN system with an infeed via Active Line Module and when the Motor Modules Chassis-2 are operated with a higher pulse frequency, then you can obtain the permissible motor cable lengths on request.

7) With option L07 (dv/dt filter compact plus VPL), L08 (motor reactor), L10 (dv/dt filter plus VPL), L34 (circuit breaker at the output side): → supplementary cabinet, 600 mm wide.

8) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

## 5.8.5 Overload capability

The Motor Modules Chassis-2 format have an overload reserve (e.g. to handle breakaway torques).

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

The overloads apply under the precondition that the drive is operated as a maximum with its base load current before and after the overload; this is based on a duty cycle of 300 s (low overload, high overload) - or 60 s (S6 duty cycle).

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 load cycle of 110% for 60 s with a load cycle of 300 s.

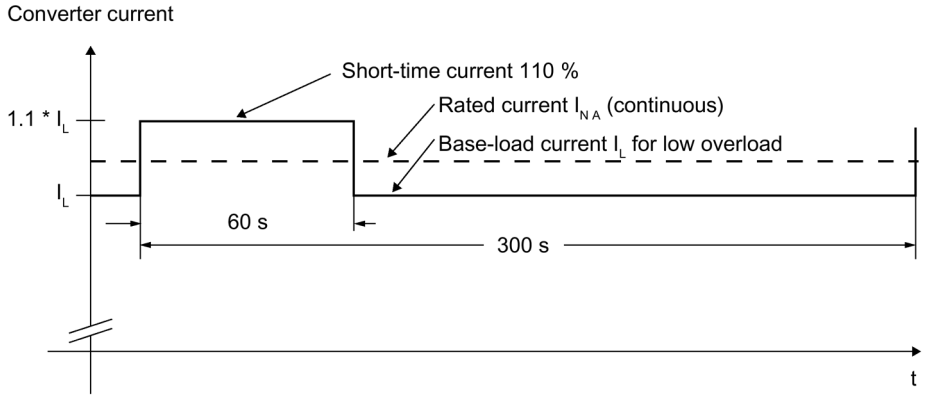



Figure 5-66 Low overload

## High overload

The base-load current $I_H$ is based on a load cycle of 150% for 60 s with a load cycle of 300 s.

The duty cycle for $I_H$ is valid for a pulse frequency of 2 kHz. It is also valid for a pulse frequency of 2.5 kHz, if p0290 is set = 12 (automatic pulse frequency and output current reduction for a thermal power unit overload).

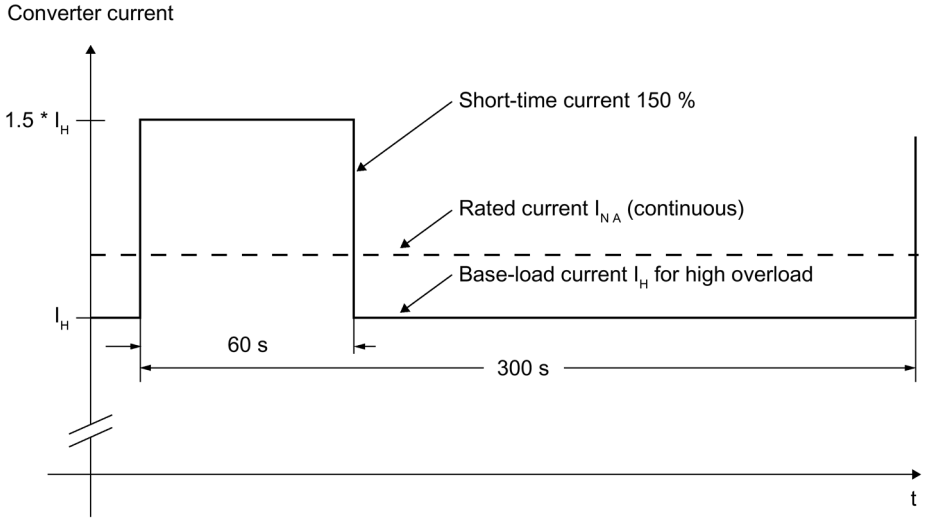



Figure 5-67 High overload

## S6 duty cycle

The base-load current $I_{S6}$ is based on a load cycle of 200% for 6 s with a load cycle of 60 s.

The load cycle for $I_{S6}$ is valid for a pulse frequency of 2 kHz. It is also valid for a pulse frequency of 2.5 kHz, if p0290 is set = 12 (automatic pulse frequency and output current reduction for a thermal power unit overload).

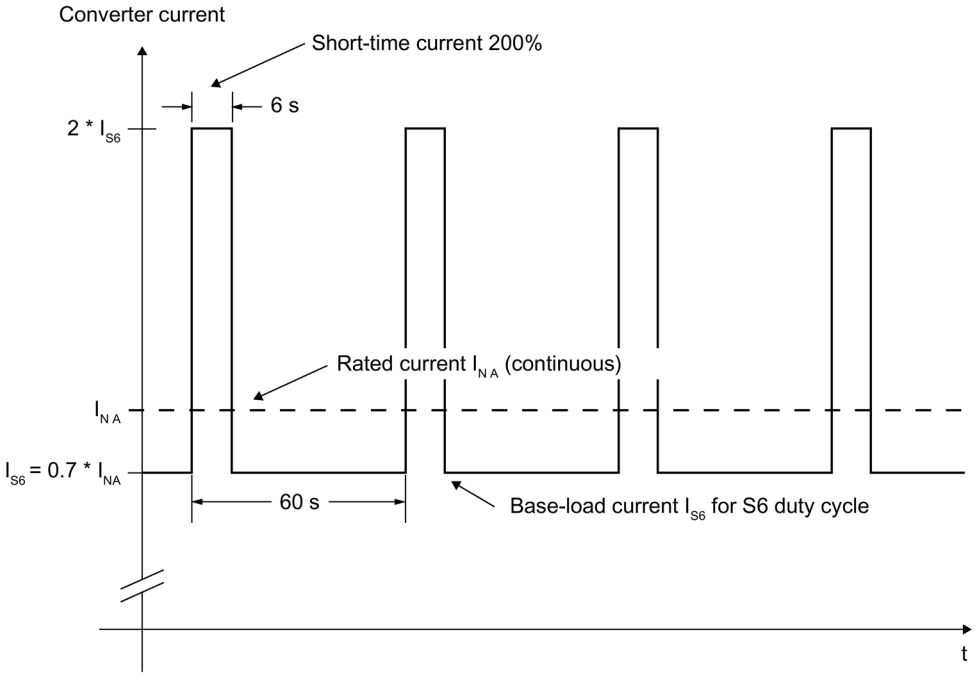



Figure 5-68 S6 duty cycle with initial load with a duty cycle duration of 60 s

## 5.8.6 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 Chassis-2.

Table 5- 71 Derating factor of the output current as a function of the pulse frequency for devices with a rated pulse frequency of 2.5 kHz

| Article No. | Type rating | Output current at 2.5 kHz | Derating factor at the pulse frequency | | | |
|---|---|---|---|---|---|---|
| 6SL3721-... | [kW] | [A] | 4 kHz | 5 kHz | 7.5 kHz | 8 kHz |
| Connection voltage 510 ... 720 V DC (line voltage 3 AC 380 ... 480 V) | | | | | | |
| 1TE36-6BE0 | 315 | 655 | 78% | 67% | 48% | 45% |
| 1TE37-4BE0 | 355 | 740 | 78% | 67% | 48% | 45% |
| 1TE38-1BE0 | 400 | 810 | 78% | 67% | 48% | 45% |
| 1TE38-8BE0 | 450 | 910 | 78% | 67% | 48% | 45% |
| 1TE41-0BE0 | 500 | 975 | 78% | 67% | 48% | 45% |
| 1TE41-1BE0 | 560 | 1075 | 78% | 67% | 48% | 45% |
| 1TE41-2BE0 | 630 | 1200 | 78% | 67% | 48% | 45% |
| 1TE41-3BE0 | 710 | 1325 | 78% | 67% | 48% | 45% |
| 1TE41-5BE0 | 800 | 1495 | 75% | 62% | 39% | 36% |

**Note**

**Derating factors for pulse frequencies in the range between fixed values**

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

## Maximum output frequencies achieved by increasing the pulse frequency

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

Table 5- 72 Maximum output frequencies achieved by increasing the pulse frequency

| Current controller clock cycle $T_I$ | Adjustable pulse frequencies $f_P$ | Maximum achievable output frequency $f_A$ | | |
|---|---|---|---|---|
| | | U/f operating mode | Vector operating mode | Servo mode |
| 400 µs [1] | 2.50 kHz<br>5.00 kHz<br>7.50 kHz | 208 Hz<br>416 Hz<br>550 Hz [2] | 208 Hz<br>300 Hz<br>300 Hz | -<br>-<br>- |

[1] In the factory setting, the current controller clock cycle is set to 400 µs and the pulse frequency to 2.5 kHz.

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

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

**Note**

**Higher output frequencies**

Higher output frequencies up to a maximum of 1600 Hz are possible.

Consult your Siemens contact person regarding this.

# 5.9 Central Braking Modules

## 5.9.1 Description

**Note**

**Additional information**

The arrangement of the components and interfaces as well as the wiring are shown in the attached layout diagrams (AO) or circuit diagrams (SP), which are included in the individual device documentation.




Figure 5-69 Central Braking Module

Central Braking Modules limit the DC link voltage at a central location in the drive line-up when the motors are operated in regenerative mode and energy recovery to the supply system is not possible. If, in regenerative mode, the voltage of the DC busbar exceeds a limit value, an externally installed braking resistor is switched in, thus restricting the voltage from increasing further. The regenerative energy is converted to heat loss. The braking resistor is switched in by the Braking Module inside the Cabinet Module.

Central Braking Modules are an alternative to the optional Braking Modules (option L61/L62 or L64/L65) and are particularly suitable when high braking power is required in a drive line-up.

The capacitor module in the Central Braking Module is an extension of the DC link-capacitance for the safe functioning of the Braking Module.

The built-in fan means that Central Braking Modules are also suitable for high continuous power systems.

Braking resistors corresponding to the rated powers are available for the Central Braking Modules.
Braking resistors which are suitable for other applications are available on request.

**Note**

**Dimensioning the braking resistor**

The Braking Module incorporated into the Central Braking Module is able to support a higher braking power than standard braking resistors.

The braking resistor is only designed for occasional regenerative operation in accordance with the specified duty cycles.

If the braking resistor does not meet your particular requirements, an appropriate braking resistor must be requested on an order-specific basis.

Central Braking Modules are available for the following voltages and power ratings:

| Line voltage | Rated power |
|---|---|
| 3 AC 380 ... 480 V | 500/1000 kW |
| 3 AC 500 ... 600 V | 550/1100 kW |
| 3 AC 660 ... 690 V | 630/1200 kW |

The braking power can be increased by connecting Central Braking Modules in parallel, refer to Point "Parallel connection of Central Braking Modules" at the end of this section.

## Integration

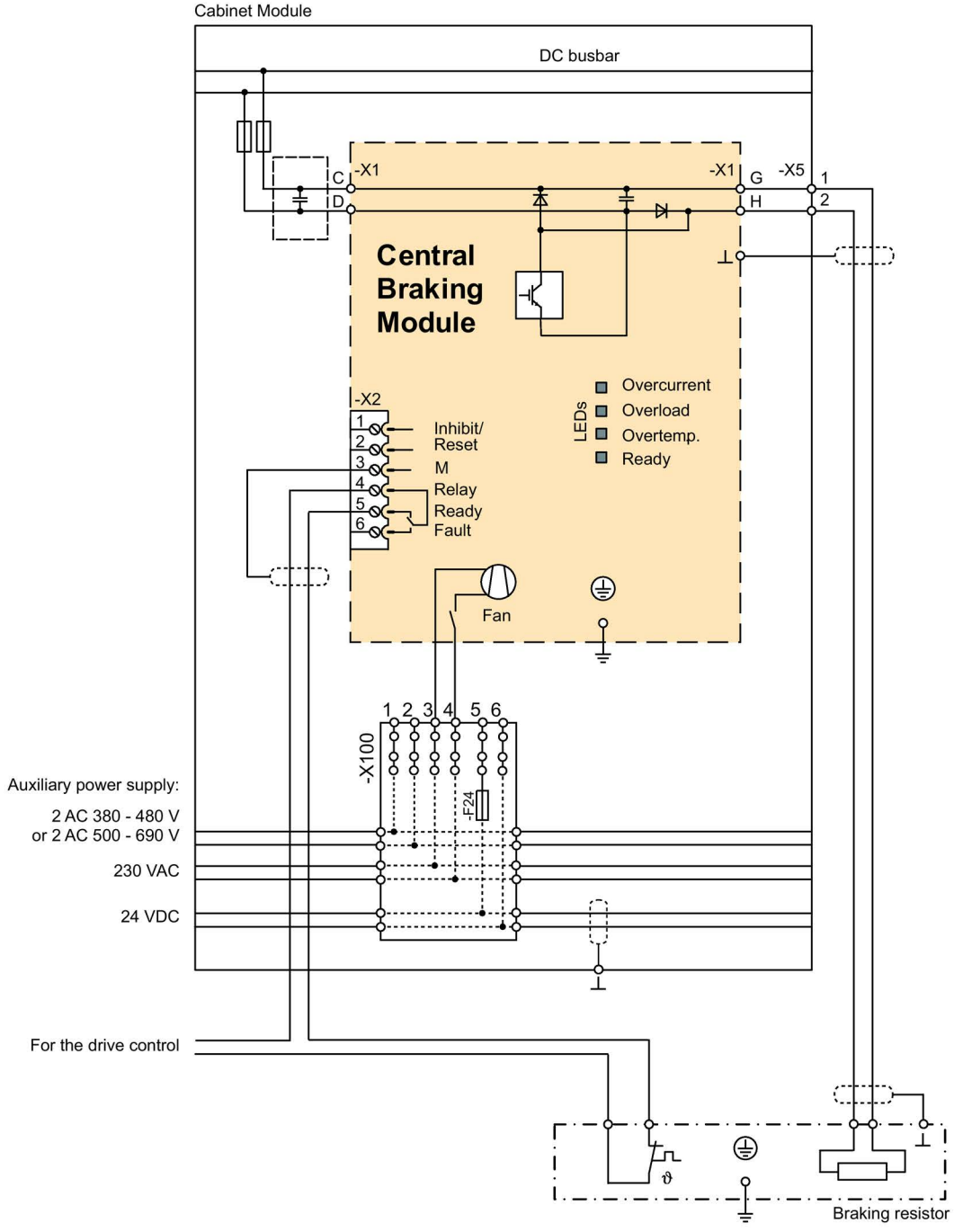



Figure 5-70 Connection example for Central Braking Modules

## Configuration

Central Braking Modules are installed in a 400 mm wide Cabinet module. The Central Braking Modules are connected to the overhead DC busbar with fuses.

The Central Braking Module comprises:

- Braking Module
- Capacitor Module
- 230 VAC connection with fuses
- Covers
- Braking resistor connection

**Note**

**Additional information**

The configuration example of the Central Braking 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.

The precise order-specific location of the components is provided in the layout diagrams (AO) in the individual device documentation.

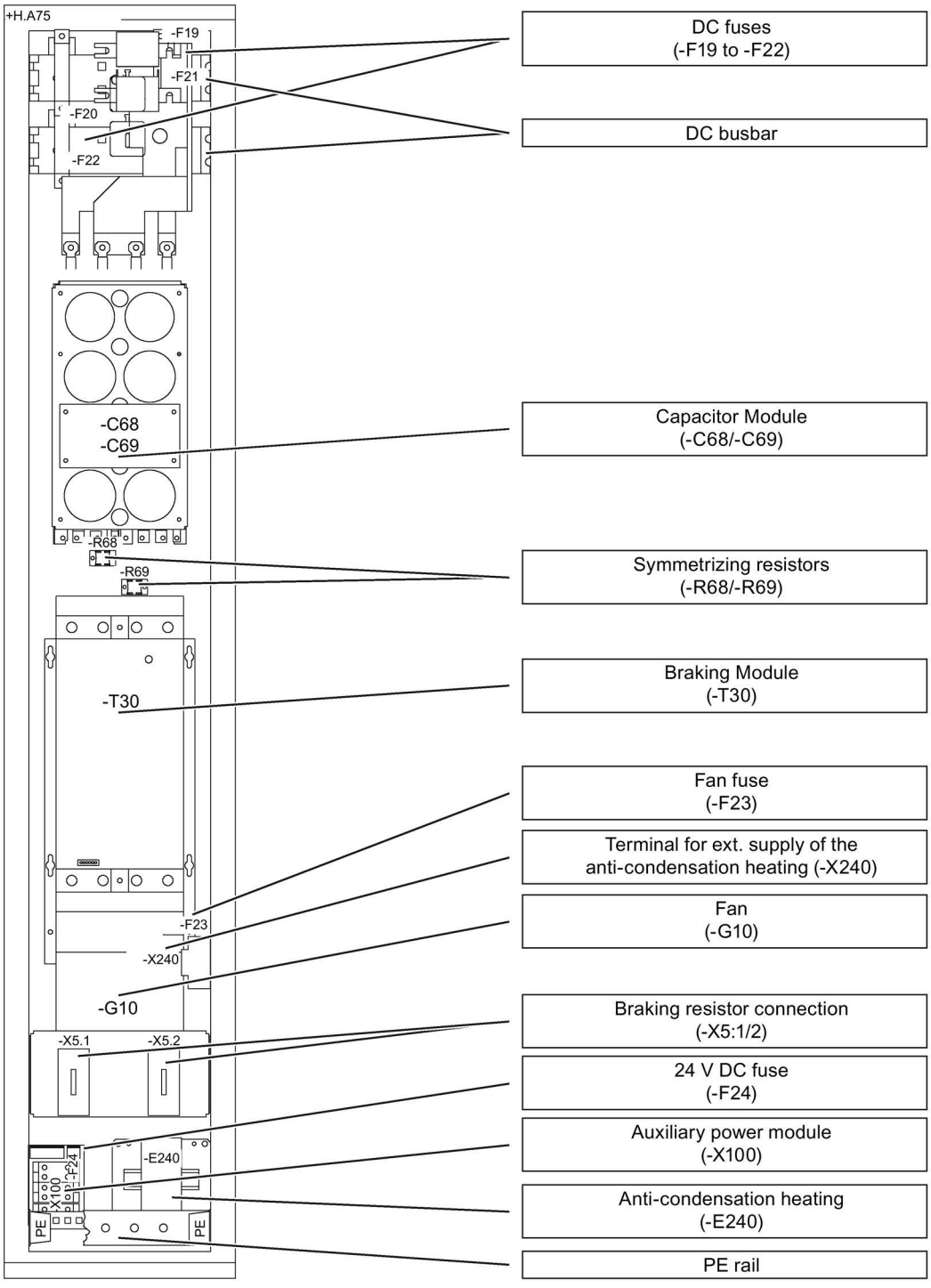



Figure 5-71 Configuration of Central Braking Modules

### Parallel connection of Central Braking Modules

To increase the braking power, it is permissible for Central Braking Modules to be connected in parallel under the following conditions:

- Only Central Braking Modules of the same rating may be connected in parallel.
- A separate braking resistor must be connected to each Central Braking Module.
- Asymmetric load distribution (possibly tolerance-related) will result in a drop of 10% in terms of the total braking power provided by the Central Braking Modules that are connected in parallel.
- The maximum number of Central Braking Modules per DC busbar should be limited to four with regard to the power split. Higher numbers are in principle available on request after the boundary conditions have been checked on a case-for-case basis.

## 5.9.2 Interfaces

### Description

The Central Braking Module has the following interfaces:

- Control terminals (Disable/Reset, Ready, Fault)
- Braking resistor connection
- Reset key
- Threshold switch
- Braking resistor monitoring
- Switch-on ratio of the braking resistor

## Interface overview

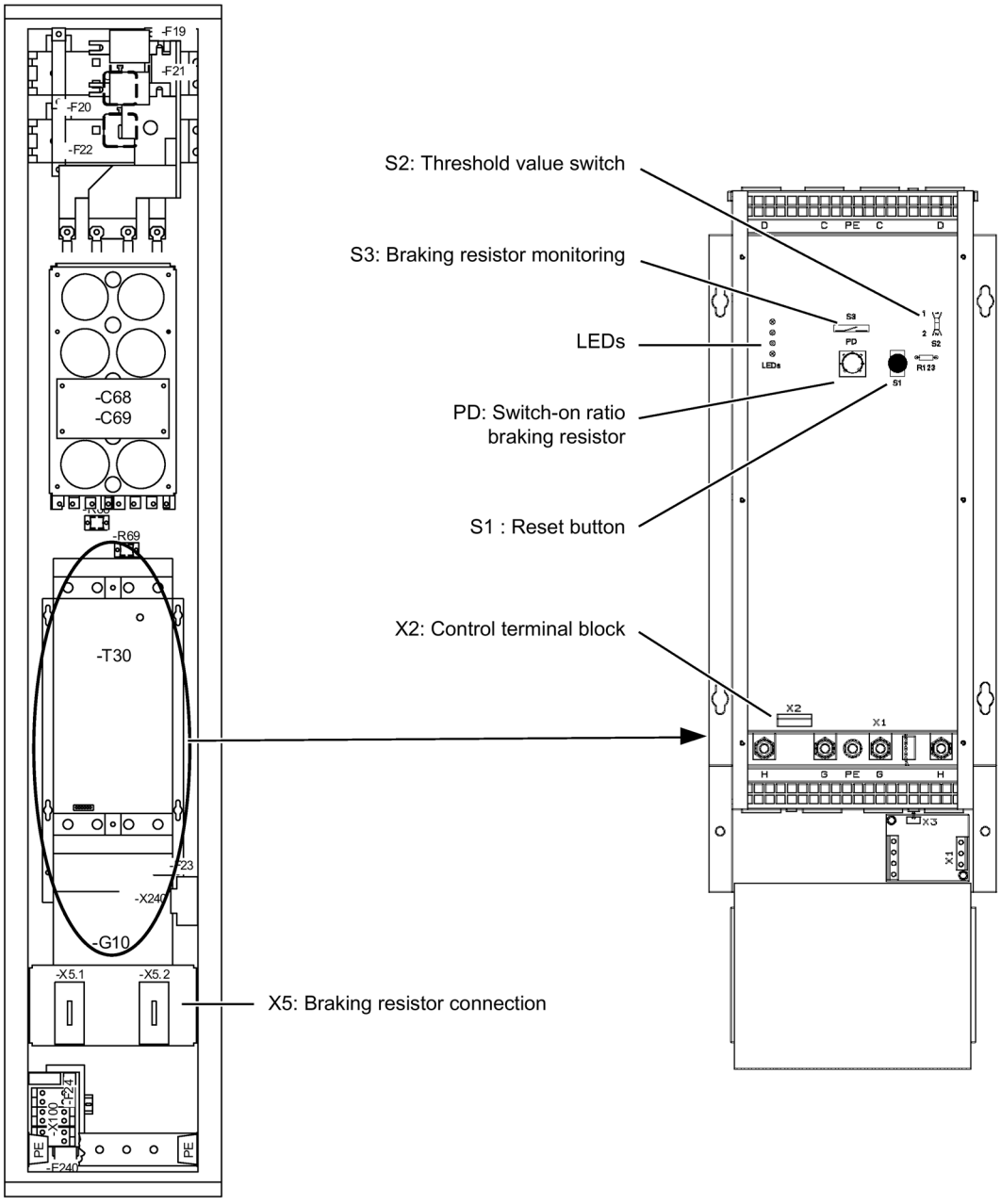
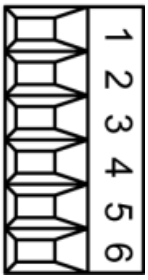



Figure 5-72 Interface overview for the Central Braking Module

## X2 control terminals

Table 5- 73 Terminal strip X2 control terminals

| | Terminal | Function | Meaning | Technical data |
|---|---|---|---|---|
|  | 1<br>2 | DI 24V<br>ground | 0 = Normal operation<br>1 = Inhibit, reset | 24 V AC/DC, input load approximately 10 mA (connection not required) |
| | 3 | Ground | Ground | |
| | 4 | DO.COM [1] | Center contact | Centralized fault indication for:<br>No DC-link voltage, overtemperature, overload, short-circuit / ground fault.<br>Switching capacity: 250 V, 2 A, 250 VA AC voltage |
| | 5 | DO.NO [1] | 0 = Fault<br>1 = Ready | |
| | 6 | DO.NC [1] | 0 = Ready<br>1 = Fault | |
| Max. connectable cross-section: 2.5 mm$^2$ | | | | |

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

## X5 braking resistor connection

Table 5- 74 Terminal strip X5 braking resistor

| Terminal | Function |
|---|---|
| 1 | Braking resistor connection |
| 2 | Braking resistor connection |

## S1 reset key

Table 5- 75 Reset key S1

| Function | Meaning |
|---|---|
| Reset key | 0 = Normal operation<br>1 = Disable, reset |

The key performs the same function as control terminal -X2:1/2.

## S2 threshold switch

Table 5- 76 Threshold switch S2

| Item | Function |
|---|---|
| 1 | Upper switching threshold (factory setting) |
| 2 | Lower switching threshold |

The response threshold at which the Braking Module is activated and the resulting activated DC-link voltage for braking mode are specified in the following table.

| NOTICE |
| --- |
| **Material damage due to switching the threshold switch when a DC-link voltage is present**<br>Switching the threshold switch when the Braking Module is switched on or when a DC-link voltage is present results in damage to the Braking Module.<br>• Only operate the threshold switch at zero voltage and the DC-link capacitors are discharged. |

Table 5- 77 Response thresholds of the Braking Module

| Rated voltage | Response threshold | Switch position | Comments |
| --- | --- | --- | --- |
| 380 ... 480 V | 774 V | 1 | 774 V is the default factory setting. With line voltages of between 380 V and 400 V, the response threshold can be set to 673 V to reduce the voltage stress on the motor and drive. This does, however, reduce the possible braking power with the square of the voltage $(673/774)^2 = 0.75$.<br>The maximum possible braking power is, therefore, 75%. |
| | 673 V | 2 | |
| 500 ... 600 V | 967 V | 1 | 967 V is the default factory setting. With a line voltage of 500 V, the response threshold can be set to 841 V to reduce the voltage stress on the motor and converter. This does, however, reduce the possible braking power with the square of the voltage $(841/967)^2 = 0.75$.<br>The maximum possible braking power is, therefore, 75%. |
| | 841 V | 2 | |
| 660 ... 690 V | 1158 V | 1 | 1158 V is the default factory setting. With a line voltage of 660 V, the response threshold can be set to 1070 V to reduce the voltage stress on the motor and converter. This does, however, reduce the possible braking power with the square of the voltage $(1070/1158)^2 = 0.85$.<br>The maximum possible braking power is, therefore, 85%. |
| | 1070 V | 2 | |

## S3 braking resistor monitoring

Table 5- 78 Braking resistor monitoring S3

| Function | Meaning |
| --- | --- |
| Braking resistor monitoring | 0 (open) = Monitoring active<br>1 (closed) = Monitoring disabled |

When monitoring is activated, the switch-on ratio (ratio between ON time and OFF time) set for the braking resistor on potentiometer "PD" is evaluated electronically.

If the set switch-on ratio is exceeded, the "MUL - Overload message" LED will be activated and at the same time the centralized fault indication will be triggered at terminal -X2:4/5,6. The fault message can be used by a higher-level controller to ensure timely shutdown, thereby preventing damage to the connected braking resistor.

**Note**

**Monitoring the braking resistor**

Monitoring is carried out solely on the basis of the switch-on ratio that has been set on potentiometer PD, which means that the actual temperature of the braking resistor is not monitored.

### PD, switch-on ratio of the braking resistor

The braking resistor's switch-on ratio (ratio between ON time and OFF time) is set via potentiometer PD. The setting made is only evaluated when activated via the S3 switch. The adjustable values for the switch-on ratio at potentiometer PD correspond to the graphic below. A value of "40%" is used for the default factory setting.

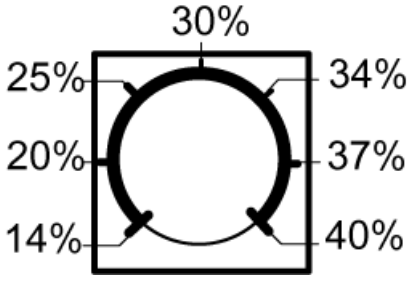



Figure 5-73 Setting of the switch-on ratio

| Brake type | Explanation | PD setting |
|---|---|---|
| $P_{15}$ | Power that is permissible for 15 s every 600 s | 14% (min.) |
| $P_{150}$ | Power that is permissible for 150 s every 600 s | 23% |
| $P_{270}$ | Power that is permissible for 270 s every 600 s | 12% |
| $P_{DB}$ | Continuous braking power | 40% (max) |

## 5.9.3 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 |
| IP21 degree of protection | M21 |
| IP23 degree of protection | M23 |
| Side panel right mounted | M26 |
| Side panel left mounted | M27 |
| IP43 degree of protection | M43 |
| IP54 degree of protection | M54 |
| Closed cabinet door (air inlet from below through floor opening) | M59 |
| 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 |
| 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 |
|---|---|
| Complete 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 / Portuguese (Brazil) | T83 |
| 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 |

## 5.9.4 Technical data

Table 5- 79 Technical data for Central Braking Modules

| **Article No.** | **6SL3700-** | **1AE35-0AA3** | **1AE41-0AA3** | **1AF35-5AA3** | **1AF41-1AA3** | **1AH36-3AA3** | **1AH41-2AA3** |
|---|---|---|---|---|---|---|---|
| **Line voltage** | V | 380 ... 480 | | 500 ... 600 | | 660 ... 690 | |
| **Supply voltage** | $V_{DC}$ | 510 ... 720 | | 675 ... 900 | | 890 ... 1035 | |
| **Braking power $P_{150}$** | kW | 500 | 1000 | 550 | 1100 | 630 | 1200 |
| **Continuous braking power $P_{DB}$** | kW | 200 | 370 | 220 | 420 | 240 | 460 |
| **Braking power $P_{15}$** | kW | 730 | 1380 | 830 | 1580 | 920 | 1700 |
| **Braking power $P_{270}$** | kW | 300 | 580 | 340 | 650 | 380 | 720 |
| **Braking current for $P_{150}$** | A | 650 | 1200 | 580 | 1100 | 520 | 1000 |
| **Braking current for $P_{DB}$** | A | 260 | 480 | 230 | 430 | 210 | 400 |
| **Braking current for $P_{15}$** | A | 950 | 1800 | 870 | 1650 | 800 | 1500 |
| **Braking current for $P_{270}$** | A | 400 | 750 | 350 | 680 | 330 | 630 |
| **Power demand** [1] 2 AC 230 V | A | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| **Power loss, max.** [2] at 50 Hz 400/500/690 V | kW | 0.8 | 1.5 | 0.8 | 1.5 | 0.8 | 1.5 |
| **DC-link capacitance** | µF | 8160 | 9720 | 7640 | 8680 | 7640 | 8680 |
| **Connectable resistance** | | | | | | | |
| **- for braking power $P_{150}$** | | | | | | | |
| S2:1 | Ω | 1.2 | 0.65 | 1.65 | 0.87 | 2.2 | 1.15 |
| S2:2 | Ω | 1.0 | 0.56 | 1.45 | 0.77 | 2.05 | 1.05 |
| **- for braking power $P_{DB}$** | | | | | | | |
| S2:1 | Ω | 3.0 | 1.6 | 4.2 | 2.25 | 5.5 | 2.9 |
| S2:2 | Ω | 2.6 | 1.4 | 3.65 | 2.0 | 5.1 | 2.7 |
| **- for braking power $P_{15}$** | | | | | | | |
| S2:1 | Ω | 0.8 | 0.43 | 1.1 | 0.58 | 1.45 | 0.8 |
| S2:2 | Ω | 0.7 | 0.37 | 1.0 | 0.51 | 1.35 | 0.7 |
| **- for braking power $P_{270}$** | | | | | | | |
| S2:1 | Ω | 1.9 | 1.0 | 2.7 | 1.58 | 3.5 | 1.8 |
| S2:2 | Ω | 1.6 | 0.9 | 2.4 | 1.2 | 3.3 | 1.7 |
| **Cooling demand** | $m^3/s$ | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 | 0.14 |
| **Sound pressure level $L_{PA}$** (1 m) at 50/60 Hz | dB(A) | 55 | 55 | 55 | 55 | 55 | 55 |
| **Braking resistor connection** - Connection cross-section, max. (IEC) | $mm^2$ | M12 2 x 240 | M12 2 x 240 | M12 2 x 240 | M12 2 x 240 | M12 2 x 240 | M12 2 x 240 |
| **PE/GND connection** | | PE busbar | | | | | |
| - Busbar cross-section | $mm^2$ | 600 | | | | | |
| - Connection cross-section, max. (IEC) | $mm^2$ | 240 | | | | | |
| **Degree of protection** (standard version) | --- | IP20 | IP20 | IP20 | IP20 | IP20 | IP20 |
| **Dimensions** (standard version, IP20) | | | | | | | |
| - Width | mm | 400 | 400 | 400 | 400 | 400 | 400 |
| - Height [3] | mm | 2200 | 2200 | 2200 | 2200 | 2200 | 2200 |
| - Depth | mm | 600 | 600 | 600 | 600 | 600 | 600 |
| **Weight, approx.** (standard version) | kg | 230 | 230 | 230 | 230 | 230 | 230 |

| Article No. | 6SL3700- | 1AE35-0AA3 | 1AE41-0AA3 | 1AF35-5AA3 | 1AF41-1AA3 | 1AH36-3AA3 | 1AH41-2AA3 |
|---|---|---|---|---|---|---|---|
| **Frame size** | mm | 400 | 400 | 400 | 400 | 400 | 400 |
| **Rated short-circuit current acc. to IEC** | kA | 65 | 65 | 65 | 65 | 65 | 65 |

1) Power demand of fans.

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

3) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP43 and IP54 degree of protection.

### Duty cycle

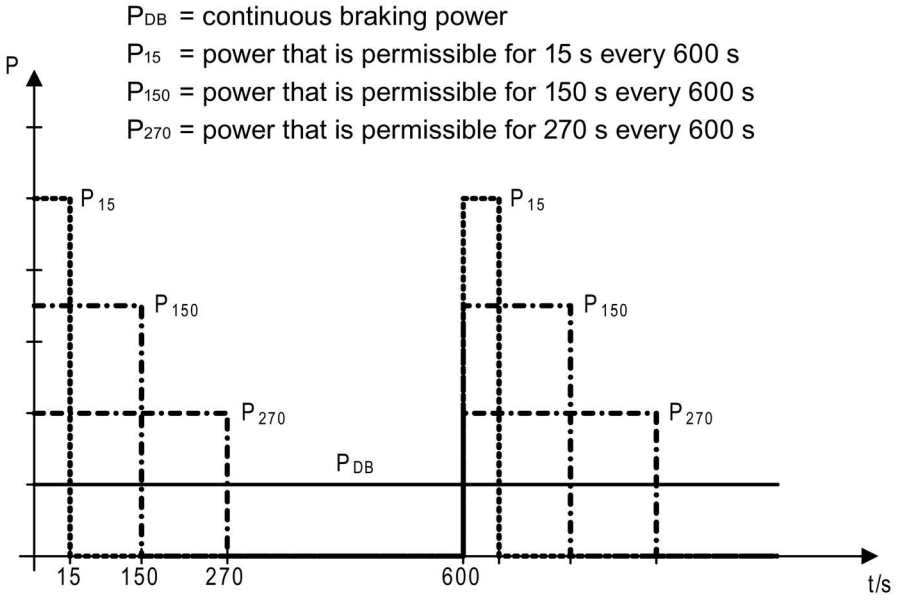



Figure 5-74 Duty cycle of the Central Braking Modules

## 5.9.5 Derating data

The Central Braking Modules have an integrated temperature monitoring function. A fan included as standard supports the power unit cooling. The fan is switched on and off by means of a temperature control, which prevents it from running unnecessarily. The permissible ambient temperature is from 0 °C to 40 °C. For temperatures between 40 °C and 50 °C, the power must be reduced according to the following formula:

- $P = [1 - 0.025 \times (T - 40\ °C)] \times P_n$

The installation altitude above sea level can be up to 2000 m. The power must be reduced for altitudes above 1000 m (derating). In this case, the derating is 1.5 % per 100 m.

## 5.9.6 Braking resistor

### 5.9.6.1 Description

The regenerative energy of the drive line-up is dissipated via the braking resistor. The braking resistor is connected to a Braking Module. The braking resistor is positioned outside the cabinet or switchgear room. This enables the resulting heat loss to be dissipated, thereby reducing the amount of air conditioning required.

A thermostat monitors the braking resistor for overheating and, if the limit value is exceeded, it is signaled via a floating contact. The tripping temperature is 120° C; this corresponds to a surface temperature on the resistor elements of approximately 400° C.

Only one braking resistor may be connected to a Central Braking Module.

The power of the braking resistors is matched to the rated braking power of the Central Braking Modules; however, operation is restricted to a reduced duty cycle of 15 seconds every 20 minutes.

**⚠WARNING**

**Fire due to overheating as the thermostatic switch on the braking resistor is not connected**

Missing wiring and evaluation of the thermostatic switch on the braking resistor can result in overheating of the braking resistor with fire and smoke

- Wire the contact of the thermostatic switch on the braking resistor for evaluation in the Control Unit or a higher-level controller, see Section "Commissioning the overtemperature checkback signal".

### 5.9.6.2 Safety information

**⚠WARNING**

**Failure to observe fundamental safety instructions and residual risks**

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

- Adhere to the fundamental safety instructions.
- When assessing the risk, take into account residual risks.

**⚠WARNING**

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

Excessively long Braking Module connection cables can cause components to overheat with the associated risk of fire and smoke.

- The lengths of the Braking Module connection cables may not exceed 300 m.

**⚠ WARNING**

**Fire through overheating due to insufficient ventilation clearances**

Inadequate ventilation clearances can cause overheating with a risk for personnel as a result of fire and smoke. This can also result in increased failures and reduced service lives of braking resistors.

- It is essential that you maintain a ventilation clearance of 200 mm on all sides of the component with ventilation grilles.

**⚠ WARNING**

**Fire due to ground fault / short-circuit**

Inadequate installation of the cables to the braking resistor can result in a ground fault/short-circuit and place persons at risk as a result of the associated smoke and fire.

- Comply with local installation regulations that enable this fault to be ruled out.
- Protect the cables from mechanical damage.
- In addition, apply one of the following measures:
  - Use cables with double insulation.
  - Maintain adequate clearance, e.g. by using spacers.
  - Route the cables in separate cable ducts or pipes.



**⚠ CAUTION**

**Burns resulting from high surface temperature of the braking resistor**

The braking resistor can become very hot. You can get seriously burnt when touching the surface.

- Mount the braking resistors so that contact is not possible. If this is not possible, attach a clearly visible and understandable warning notice at hazardous positions.

**NOTICE**

**Damage to braking resistor due to ingress of water**

Water penetration may damage the braking resistor.

- For outdoor installations, a hood must be provided to protect it from precipitation in accordance with IP20 degree of protection.

**Note**

**Braking resistor/fire alarm sensor interaction**

If a braking resistor is placed underneath a fire alarm sensor, then the heat produced may trigger the fire alarm sensor.

### 5.9.6.3 Duty cycle

The following duty cycle applies only to the braking resistors that are described in this Chapter.

**Duty cycle**

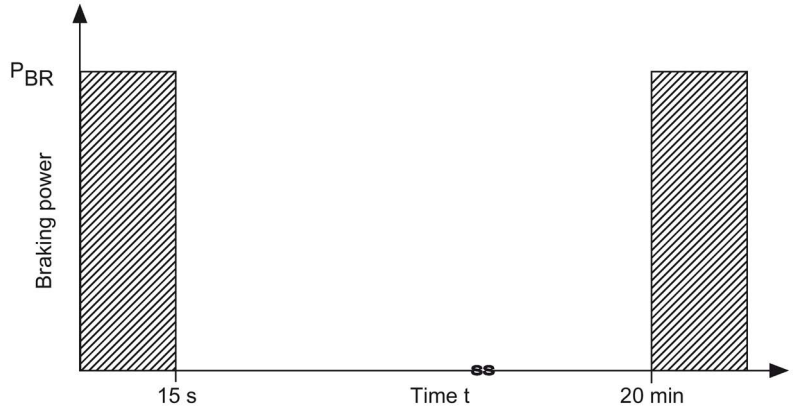



Figure 5-75 Duty cycle for braking resistor

**Note**

For other duty cycles, the braking resistors must be requested on an order-specific basis.

### 5.9.6.4 Interfaces on the braking resistor

**Power connections on the braking resistor**

Table 5- 80 Power connections on the braking resistor

| Terminal | Function |
|---|---|
| 1 | Connection to the Central Braking Module: -X5 |
| 2 | Connection to the Central Braking Module: -X5 |
| PE | PE connection |
| Max. connectable cross-section: 2 x 240 $mm^2$ | |

Cables are always entered from below; a cable propping fixture must be provided by the customer.

### X10 thermostatic switch checkback contact

Table 5- 81 Terminal strip X10 thermostatic switch checkback contact

| Terminal | Function |
|---|---|
| 1 | Thermostatic switch checkback contact |
| 2 | Normally-closed contact, 250 VAC, max. 1 A |
| Max. connectable cross-section: 1.5 mm² | |

## 5.9.6.5 Configuring the "Overtemperature" checkback

The checkback contact of the braking resistor thermostatic switch must be wired to a digital input so that the drive is shut down in the event of a malfunction.

- Assumption 1:
  The thermostatic switch feedback signal contact is wired to digital input 3 (DI3) of CU320-2 (-X122:4)
- Assumption 2:
  Once the thermostatic switch trips, "External Fault 3" (F7862) is triggered and the drive is shut down with OFF2.
- Setting required:
  (Drive) p2108 = (CU320-2) 0722.3

Control engineering measures must also be implemented to prevent the drive from starting up again before the braking resistor has had a chance to cool down properly.

## 5.9.6.6 Technical data

Table 5- 82 Technical data of the braking resistors

| Article No. | 6SL3000- | 1BE35-0AA0 | 1BE41-0AA0 | 1BF35-5AA0 | 1BF41-1AA0 | 1BH36-3AA0 | 1BH41-2AA0 |
|---|---|---|---|---|---|---|---|
| **Line voltage** | V | 380 ... 480 | | 500 ... 600 | | 660 ... 690 | |
| **Supply voltage** | $V_{DC}$ | 510 ... 720 | | 675 ... 900 | | 890 ... 1035 | |
| **Braking power $P_{BR}$**[1)] | kW | 500 | 1000 | 550 | 1100 | 630 | 1200 |
| **Continuous braking power $P_{DB}$** | kW | 23.8 | 58.65 | 34.8 | 62 | 42.5 | 75.6 |
| **Resistance value** | Ω | 0.95 | 0.49 | 1.35 | 0.69 | 1.8 | 0.95 |
| $I_{max}$ | A | 766 | 1518 | 672 | 1343 | 643 | 1232 |
| **Degree of protection** | | IP21 | IP21 | IP21 | IP21 | IP21 | IP21 |
| **Dimensions**<br>- Width<br>- Height<br>- Depth | <br>mm<br>mm<br>mm | <br>960<br>790<br>620 | <br>960<br>1430<br>620 | <br>960<br>1110<br>620 | <br>960<br>1430<br>620 | <br>960<br>1110<br>620 | <br>960<br>1430<br>620 |
| **Fastening holes** | mm | 13 | 13 | 13 | 13 | 13 | 13 |
| **Weight** | kg | 82 | 170 | 110 | 180 | 124 | 196 |

1) Valid for specified duty cycle of 15 s (load) with a duty cycle duration of 20 min.

Table 5- 83 Assignments between braking resistors and dimension drawings below

| Braking resistor | Dimension drawing, type |
|---|---|
| **380 ... 480 V supply voltage** | |
| 6SL3000-1BE35-0AA0 | Type 1 |
| 6SL3000-1BE41-0AA0 | Type 3 |
| **500 ... 600 V supply voltage** | |
| 6SL3000-1BF35-5AA0 | Type 2 |
| 6SL3000-1BF41-1AA0 | Type 3 |
| **660 ... 690 V supply voltage** | |
| 6SL3000-1BH36-3AA0 | Type 2 |
| 6SL3000-1BH41-2AA0 | Type 3 |

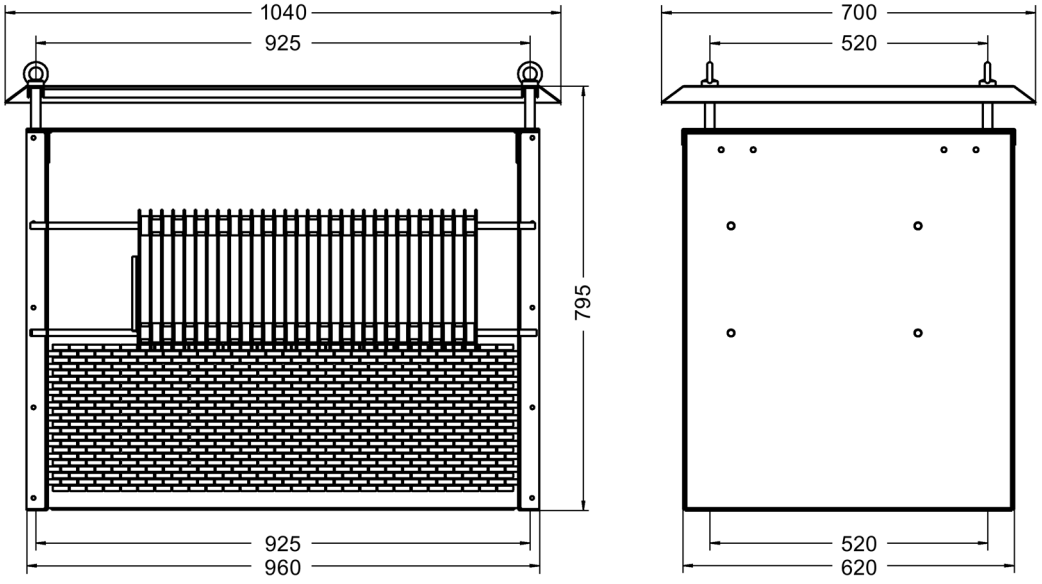



Figure 5-76 Dimension drawing type 1

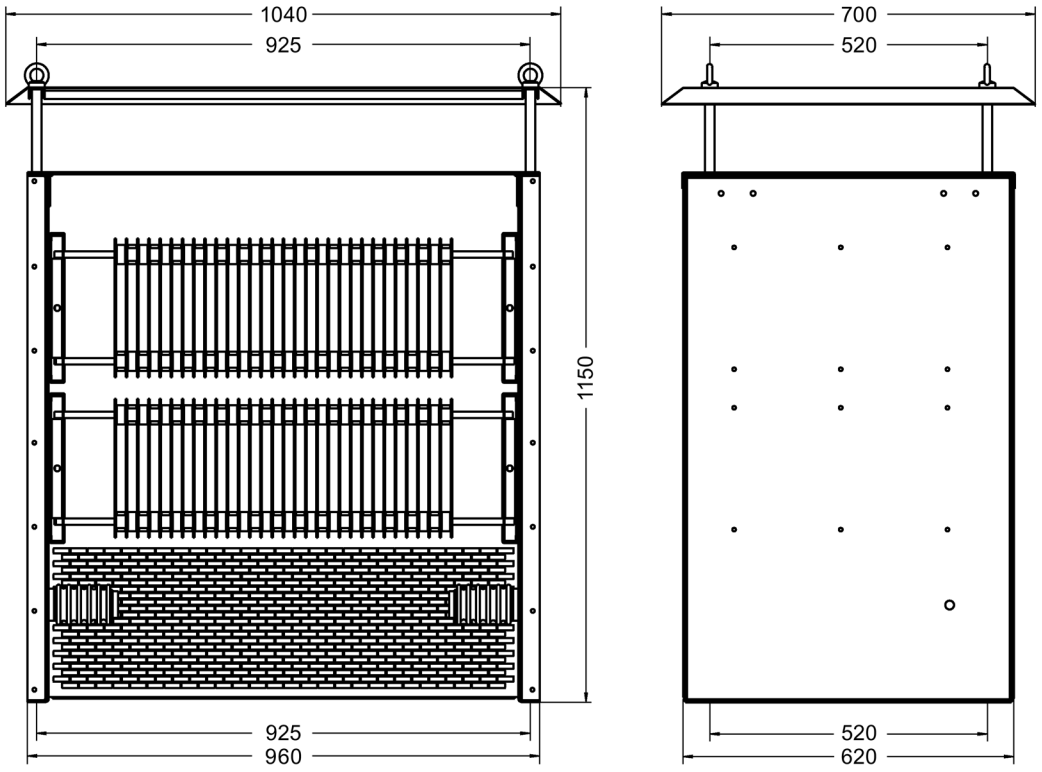



Figure 5-77 Dimension drawing type 2

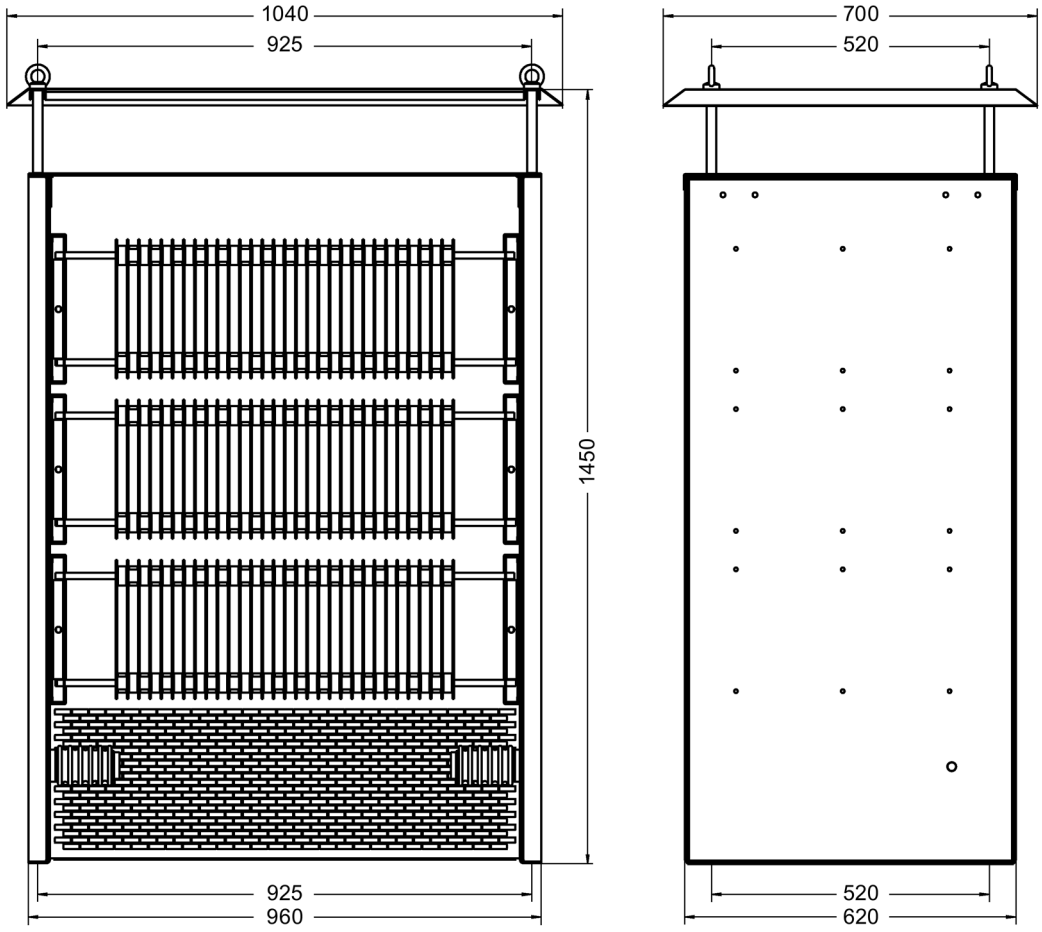



Figure 5-78 Dimension drawing type 3

# 5.10 Auxiliary Power Supply Modules

## 5.10.1 Description

**Note**

**Additional information**

The arrangement of the components and interfaces as well as the wiring are shown in the attached layout diagrams (AO) or circuit diagrams (SP), which are included in the individual device documentation.



Figure 5-79 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 SINAMICS S120 devices 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 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 VAC 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 connected to the Auxiliary Power Supply Module as 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 fed in, there is a risk of an insufficient energy supply to the device fans or too high a voltage, which can cause damage to the system.

## Integration

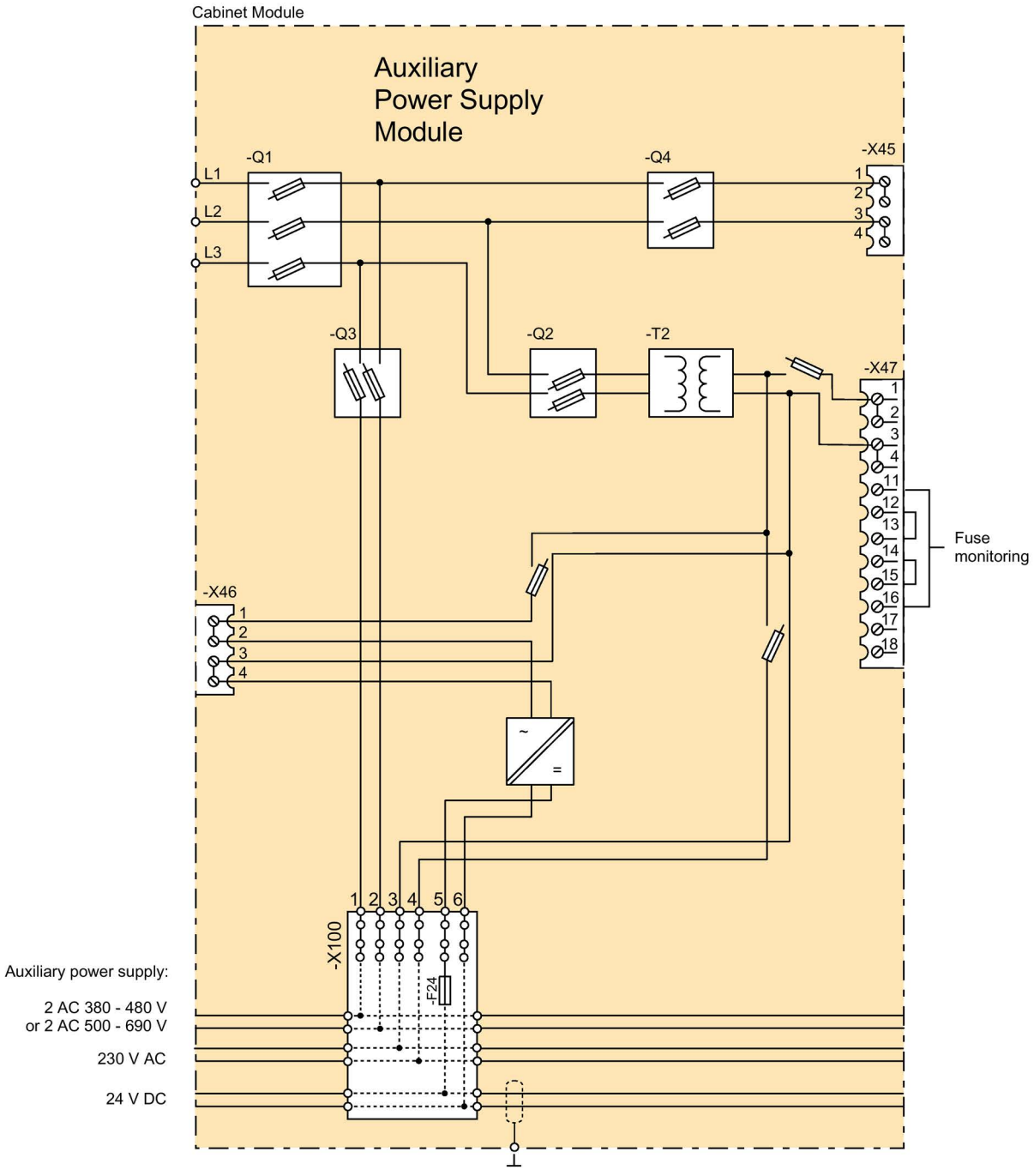



Figure 5-80 Connection example for Auxiliary Power Supply Modules

## 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 system with three auxiliary voltages:
  - 24 V DC for the electronics power supply
  - 230 V 1 AC to supply 230 V AC loads
  - 380 to 690 V 2 AC for supply of device fans (corresponding to the respective rated device voltage)
- Transformer with output voltage 230 V 1 AC
- SITOP power supply 24 VDC
- 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.

The precise order-specific location of the components is provided in the layout diagrams (AO) in the individual device documentation.

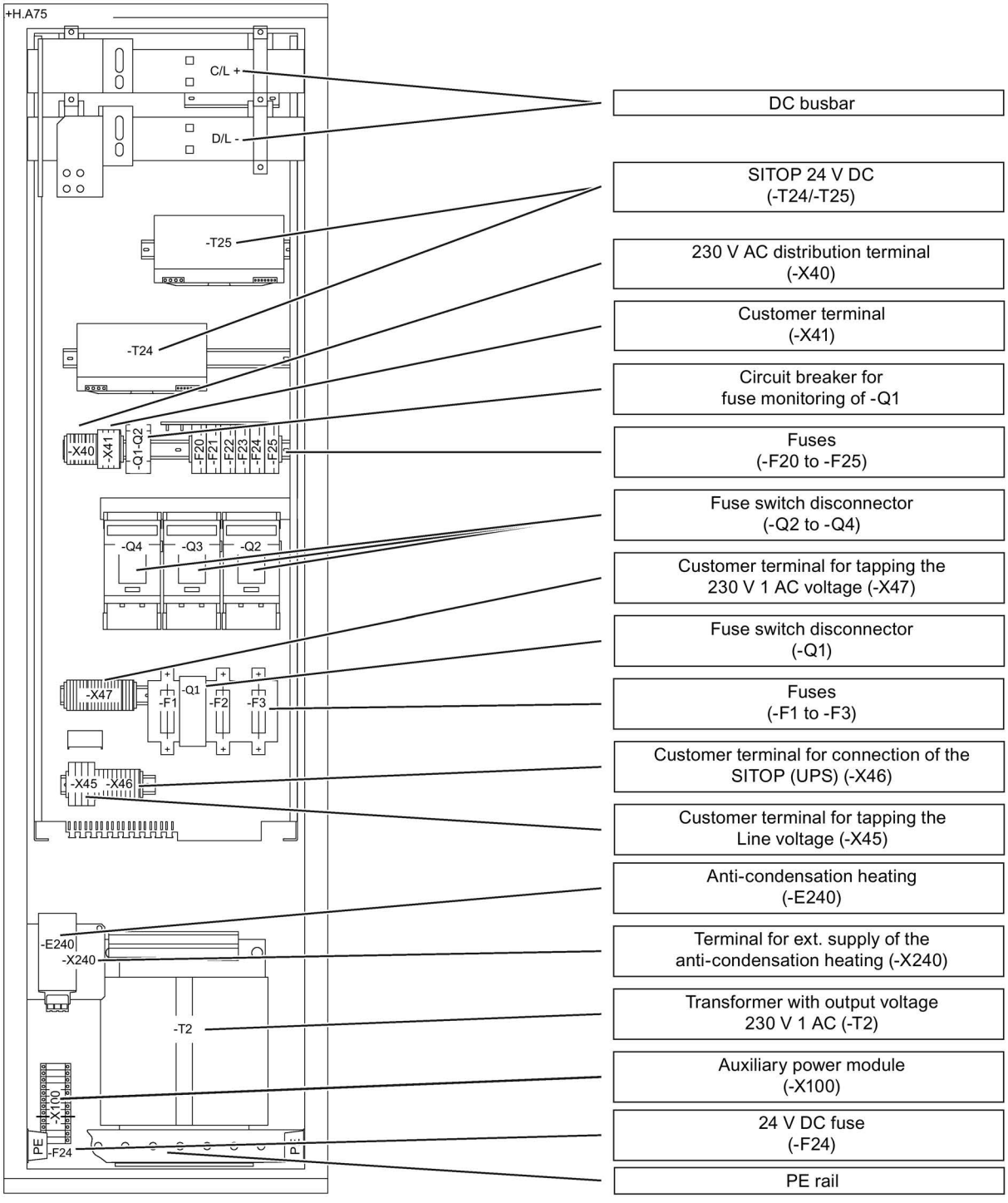



Figure 5-81 Configuration example for Auxiliary Power Supply Modules

## 5.10.2 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 power demand indicated in the table "Technical data" varies according to the version of the Cabinet Module used.

## 5.10.3 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 5- 84 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 |

## Fuse adaptation (-Q2) for transformer (-T2)

Two LV HRC fuses (-Q2:-F1/-F2) are installed upstream of the transformer (-T2) to protect it.

Fuses rated for a line infeed of between 500 ... 690 V are fitted in the factory. Customers must replace the fuses for supply voltages in the range from 380 ... 480 V. The required fuses are supplied as accessories with the Auxiliary Power Supply Module.

| **NOTICE** |
|---|
| **Replacing the fuses**<br>If the customer fails to replace the fuses when the system is connected to a supply voltage in the 380 ... 480 V range, there is a risk of fuse overloading in the low voltage range (380 ... 480 V) so that the fuses will need to be replaced by new ones. |

**Note**

**Only replace the fuses using the fuse grip**

A fuse grip must always be used to replace the fuses.

If necessary, the fuse grip can be ordered from Siemens.

Table 5- 85 Overview of fuses for the transformer (-T2) in the Auxiliary Power Supply Module

| **Auxiliary Power Supply Module**<br>**Article No. 6SL3700-** | **0MX14-0AA3** | **0MX16-3AA3** | **0MX21-0AA3** | **0MX21-4AA3** |
|---|---|---|---|---|
| **LV HRC fuse for voltage range 3 AC 380 to 480 V** | | | | |
| Fuse protection in A | gG 20 | gG 25 | gG 35 | gG 50 |
| Fuse | 3NA3807-6 | 3NA3810-6 | 3NA3814-6 | 3NA3820-6 |
| **LV HRC fuse for voltage range 3 AC 500 to 690 V (fitted at factory)** | | | | |
| Fuse protection in A | gG 16 | gG 20 | gG 32 | gG 40 |
| Fuse | 3NA3805-6 | 3NA3807-6 | 3NA3812-6 | 3NA3817-6 |

## 5.10.4 Auxiliary power supply system

### Description

The auxiliary power supply system is used to distribute the available voltages (line voltage for device fans, 230 VAC, 2-phase and 24 VDC). 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 VDC voltage is provided directly from the SITOP power supply and is not protected separately by a fuse. The 24 VDC 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 5- 86 Overview of the fuses for the auxiliary power supply system in the Auxiliary Power Supply Module

| Article No. 6SL3700- | 0MX14-0AA3 | 0MX16-3AA3 | 0MX21-0AA3 | 0MX21-4AA3 |
|---|---|---|---|---|
| **Fuse protection in A** | | | | |
| 380 to 690 V 2 AC (depending on the rated device voltage) | 63 | 80 | 100 | 100 |
| 230 V 1 AC | 6 | 10 | 10 | 20 |
| 24 VDC | 20 | 40 | 80 | 80 |

## 5.10.5 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, which are included in the individual device documentation.

Table 5- 87 Overview of customer terminals in the Auxiliary Power Supply Module

| **Cabinet Module**<br>**Article No. 6SL3700-** | **0MX14-0AA3** | **0MX16-3AA3** | **0MX21-0AA3** | **0MX21-4AA3** |
|---|---|---|---|---|
| **Customer terminal -X45 for tapping the line voltage (380 to 480 V 3 AC or 500 to 690 V 3 AC)** | | | | |
| Fuse protection in A | 50 | 63 | 80 | 80 |
| Max. conductor cross-section in mm² | 16 | 16 | 16 | 16 |
| **Customer terminal -X46 for connection of an uninterruptible power supply for SITOP** [1] | | | | |
| Fuse protection in A [2] | 10 | 20 | 35 | 35 |
| Max. conductor cross-section in mm² | 6 | 6 | 6 | 6 |
| **Customer terminal -X47 for tapping the 230 V AC, 1-phase voltage** | | | | |
| Fuse protection in A | 8 | 10 | 10 | 20 |
| Max. conductor cross-section in mm² | 2.5 | 2.5 | 2.5 | 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.

## 5.10.6 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 |
| IP21 degree of protection | M21 |
| IP23 degree of protection | M23 |
| Side panel right mounted | M26 |
| Side panel left mounted | M27 |
| IP43 degree of protection | M43 |
| IP54 degree of protection | M54 |
| Closed cabinet door (air inlet from below through floor opening) | M59 |
| 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 |
| EMC shield bus | 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 |
|---|---|
| Complete 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 / Portuguese (Brazil) | T83 |
| 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 |

## 5.10.7 Technical data

Table 5- 88 Technical data for the Auxiliary Power Supply Modules

| **Article No.** | **6SL3700-** | **0MX14-0AA3** | **0MX16-3AA3** | **0MX21-0AA3** | **0MX21-4AA3** |
|---|---|---|---|---|---|
| **Supply voltage on the plant/system side 380 ... 690 V 3 AC** | A | 125 | 160 | 200 | 250 |
| **Line connection**<br>- Cable cross-section, max. (IEC) | mm² | 150 | 150 | 150 | 150 |
| **Current carrying capacity, max.**<br>- load feeder connection 380 ... 690 VAC<br>- at the auxiliary power supply system<br>- at customer terminal -X45<br>- load feeder connection 230 VAC<br>- at the auxiliary power supply system<br>- at customer terminal -X47<br>- load feeder connection 24 VDC<br>- at the auxiliary power supply system | <br><br>A<br>A<br><br>A<br>A<br><br>A | <br><br>63<br>50<br><br>6<br>8<br><br>20 | <br><br>80<br>63<br><br>10<br>10<br><br>40 | <br><br>100<br>80<br><br>10<br>10<br><br>80 | <br><br>100<br>80<br><br>20<br>20<br><br>80 |
| **Cable cross-section, max.**<br>- connection -X45<br>- connection -X47 | <br>mm²<br>mm² | <br>16<br>2.5 | <br>16<br>2.5 | <br>16<br>2.5 | <br>16<br>2.5 |
| **PE/GND connection**<br>- Busbar cross-section<br>- Connection cross-section, max. (IEC) | <br>mm²<br>mm² | PE busbar<br>600<br>240 | | | |
| **Cooling air requirement** | | Natural convection | | | |
| **Degree of protection** (standard version) | | IP20 | IP20 | IP20 | IP20 |
| **Dimensions** (standard version, IP20)<br>- Width<br>- Height [1]<br>- Depth | <br>mm<br>mm<br>mm | <br>600<br>2200<br>600 | <br>600<br>2200<br>600 | <br>600<br>2200<br>600 | <br>600<br>2200<br>600 |
| **Weight, approx.** (standard version) | kg | 170 | 180 | 210 | 240 |
| **Maximum short-circuit current $I_{CC}$ acc. to IEC** | kA | 80 | 80 | 80 | 80 |
| **Minimum short-circuit current** [2] | kA | 3.2 | 4 | 5 | 7 |

[1] The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP24 and IP54 degree of protection.

[2] Current required for reliable tripping of the protective devices.

# 5.11 Extension Modules

## 5.11.1 Description

**Note**

**Additional information**

The arrangement of the components and interfaces as well as the wiring are shown in the attached layout diagrams (AO) or circuit diagrams (SP), which are included in the individual device documentation.

Extension Modules are based on the proven mechanical platform of the SINAMICS Cabinet Modules. They increase the overall width of the cabinet system to accommodate plant-specific spacing requirements. The cabinet widths are scalable and numerous standard options are available for customizing the Extension Modules.

Extension Modules are available for the following cabinet widths:

| Line voltage | Cabinet width |
|---|---|
| 380 ... 690 V 3 AC | 400 / 600 / 800 / 1000 / 1200 mm |

### Configuration

Each Extension Module consists of a cabinet module with a width of 400 / 600 / 800 / 1000 / 1200 mm.

An Extension Module includes:

- Nickel-plated PE busbar (60 x 10 mm), including jumper for looping through to the next Cabinet Module
- Rear panel / doors
- Cover

**Note**

**Additional information**

The configuration example for the Extension 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.

The precise order-specific location of the components is provided in the layout diagrams (AO) in the individual device documentation.

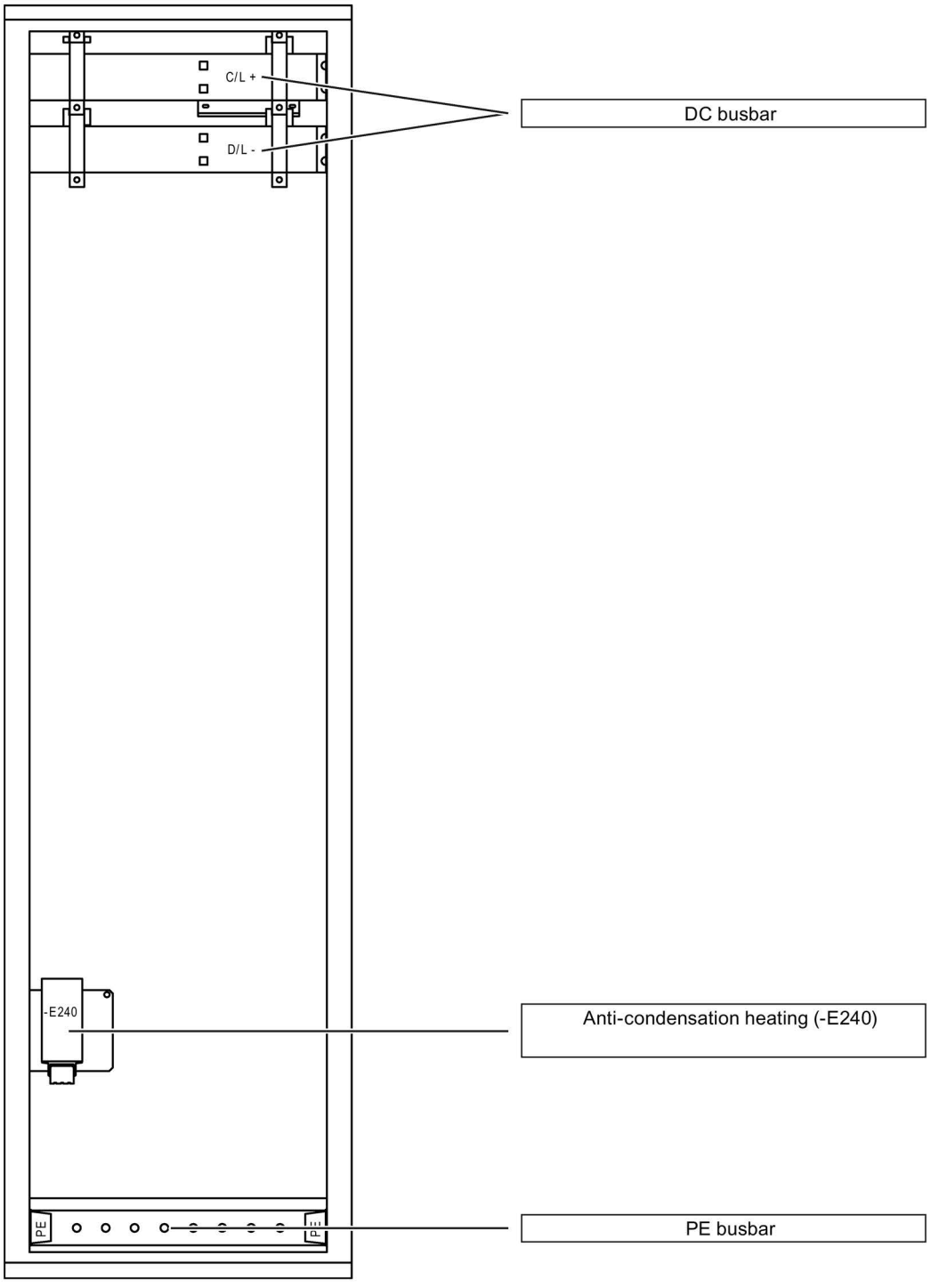



Figure 5-82 Extension Module configuration

## 5.11.2 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 |
| Degree of protection IP21 | M21 |
| Degree of protection IP23 | M23 |
| Side panel, mounted on the right | M26 |
| Side panel, mounted on the left | M27 |
| Degree of protection IP43 | M43 |
| Degree of protection IP54 | M54 |
| Closed cabinet door (air inlet from below through floor opening) | M59 |
| Additional touch protection | M60 |
| 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 |
| EMC shield bus | 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 |
|---|---|
| Complete 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 / Portuguese (Brazil) | T83 |
| 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 |

## 5.11.3 Technical data

Table 5- 89 Technical specifications for Extension Modules

| **Article No.** | **6SL3700-** | **0SX34-0AA3** | **0SX36-0AA3** | **0SX38-0AA3** | **0SX41-0AA3** | **0SX41-2AA3** |
|---|---|---|---|---|---|---|
| **Line voltage** | V | 380 ... 690 | | | | |
| **Supply voltage** | $V_{DC}$ | 510 ... 1035 | | | | |
| **PE/GND connection**<br>- Busbar cross-section<br>- Connection cross-section, max. (IEC) | <br>$mm^2$<br>$mm^2$ | PE busbar<br>600<br>240 | | | | |
| **Degree of protection** (standard version) | --- | IP20 | IP20 | IP20 | IP20 | IP20 |
| **Dimensions** (standard version, IP20)<br>- Width<br>- Height [1]<br>- Depth | <br>mm<br>mm<br>mm | <br>400<br>2200<br>600 | <br>600<br>2200<br>600 | <br>800<br>2200<br>600 | <br>1000<br>2200<br>600 | <br>1200<br>2200<br>600 |
| **Weight, approx.** (standard version) | kg | 64 | 88 | 110 | 128 | 146 |

[1] The cabinet height increases by 250 mm with degree of protection IP21, and by 400 mm with degrees of protection IP23, IP43 and IP54.

# Maintenance and servicing 6

## 6.1 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.

## 6.2 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.

## 6.3 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 6- 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.

# 6.4 Replacing components

## 6.4.1 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.

## 6.4.2 Safety information

### Required safety precautions to be taken before carrying out maintenance and servicing

**⚠WARNING**

**Incorrect 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; take the necessary precautionary measures.
  The weights of the individual power blocks are listed in the corresponding section.

## 6.4.3 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).

## 6.4.4 Installation device for power blocks

### Installation device

The installation device is used for installing and removing the power blocks for the Basic Line Modules, Active Line Modules, Smart Line Modules, and Motor Modules in the Chassis format.

The mounting device cannot be used for Motor Modules in the Chassis-2 format.

It is used as an mounting aid, which is placed in front of and secured to the module. The telescopic guide support allows the withdrawable device to be adjusted according to the height at which the power blocks are installed. Once the mechanical and electrical connections have been removed, the power block can be removed from the module, Whereby the power block is guided and supported by the guide rails on the withdrawable devices.



Figure 6-1 Installation device

### Article number of the installation device

The article number for the installation device is 6SL3766-1FA00-0AA0.

## 6.4.5 Replacing the filter mats

### Replacing the filter mats (for IP23/IP43/IP54)

The 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.

### 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.

## Removing/Installing filter mats from/in the cabinet doors (IP23/IP43/IP54)

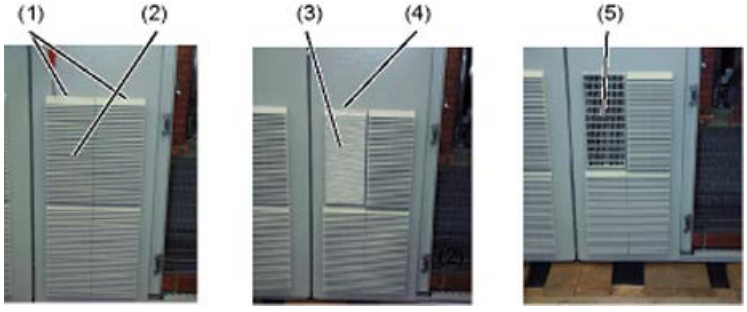



Figure 6-2 Removing/Installing filter mats (IP23/IP43/IP54)

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!

## 6.4.6 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)

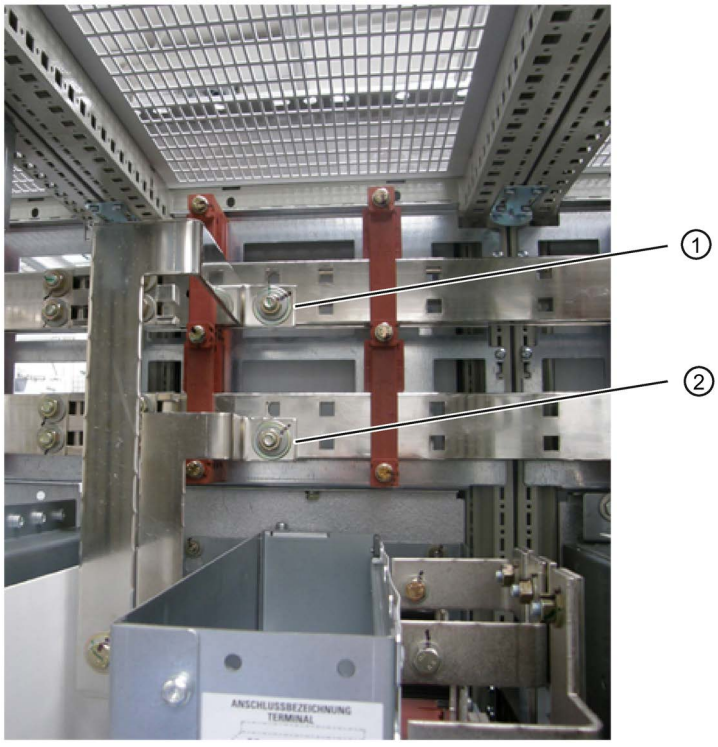



Figure 6-3 Connection to the DC busbar on the Basic Line Module, Smart Line Module, Active Line Module and Motor Module in the chassis format

### Establishing the connection for booksize format

**Note**

Make sure that you do not drop any nuts, washers, or screws as this could cause damage.

1. Connect the "DC P" connection on the Motor Module to the upper DC busbar (DC P) (1 x M12 screw + nut + washer; torque: 50 Nm).
2. Connect the "DC N" connection on the Motor Module to the lower DC busbar (DC N) (1 x M12 screw + nut + washer; torque: 50 Nm).

## Establishing the connection for chassis format

**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, Smart Line 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, Smart Line Module, Active Line Module or Motor Module to the lower DC busbar (DC N) (1 x M12 screw + nut + washer; torque: 50 Nm).

## 6.4.7 Using crane lifting lugs to transport power blocks

### Crane lifting lugs

The power blocks are fitted with crane lifting lugs for transportation on a lifting harness in the context of replacement.

The positions of the crane lifting lugs are illustrated by arrows in the figures below.

| **NOTICE** |
| --- |
| **Damage to the device due to improper transport**<br>Improper transport can cause mechanical loads on the power block housing or the busbars, which result in damage to the device.<br>• When transporting the power blocks, use a lifting harness with vertical ropes or chains.<br>• Do not use the power block busbars to support or secure lifting harnesses. |

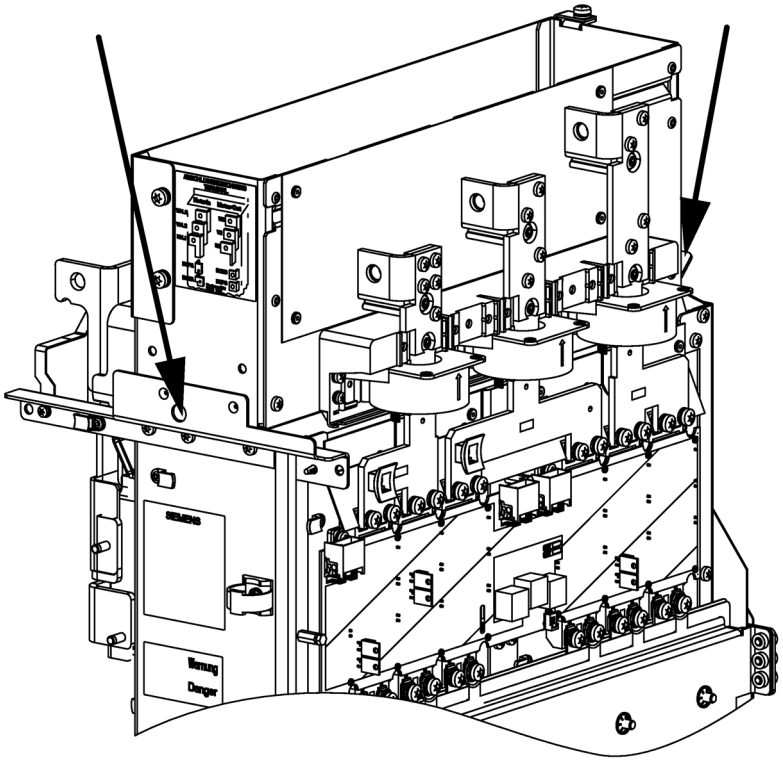


Figure 6-4 Crane lifting lugs on power block frame size FX, GX, FB

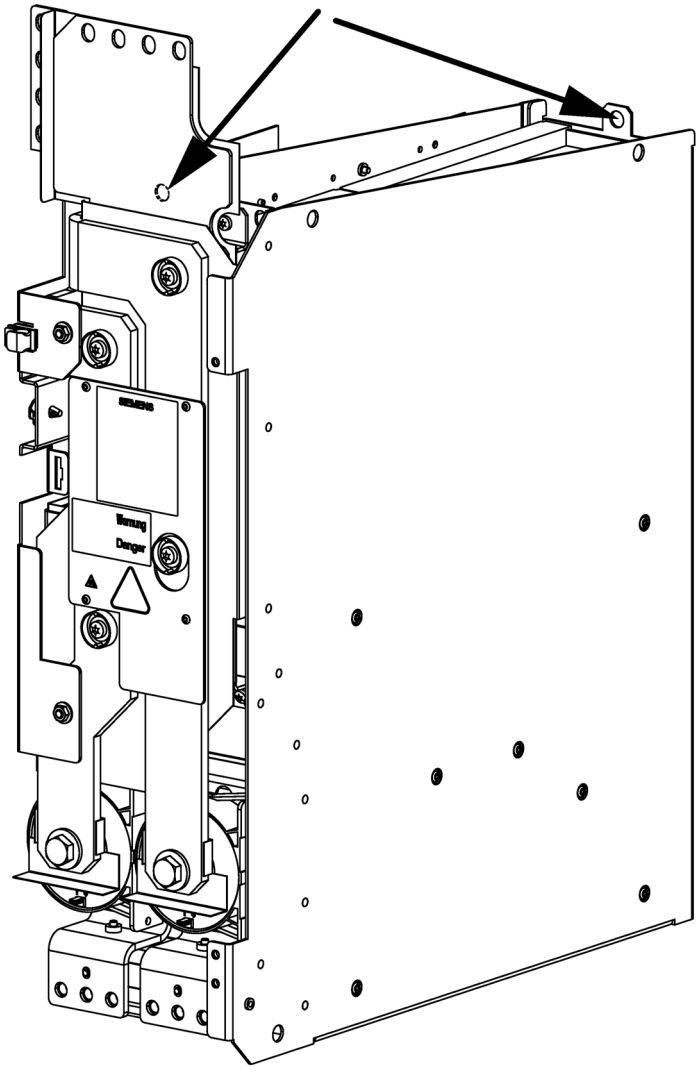



Figure 6-5 Crane lifting lugs on HX, JX power block

**Note**

**Crane lifting lugs on HX, JX power block**

On HX and JX power blocks, the front crane lifting lug is located behind the busbar.

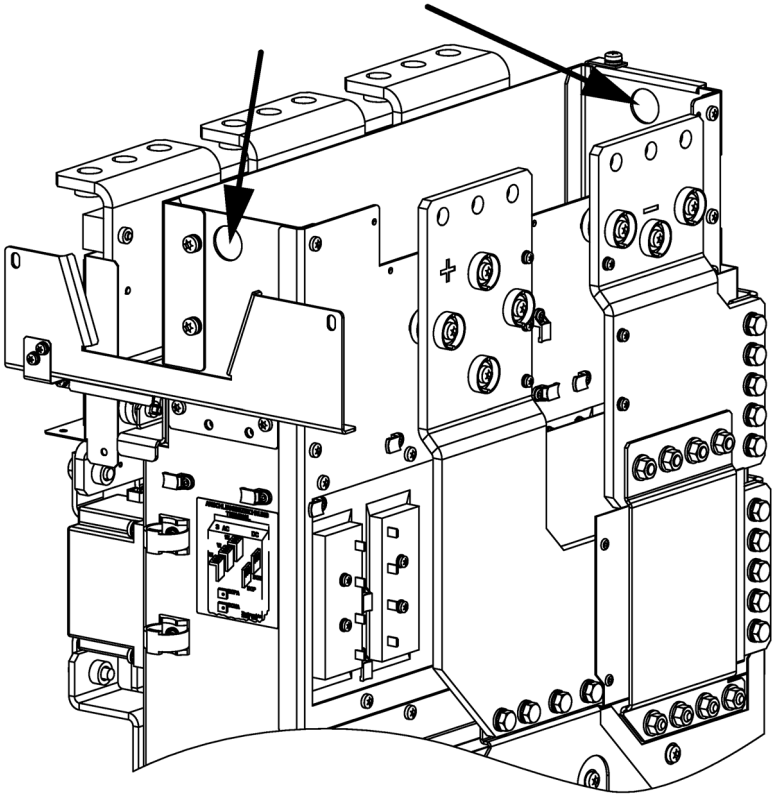


Figure 6-6 Crane lifting lugs on power block frame size GB, GD

## Crane lifting lugs for Active Interface Modules Chassis-2

Active Interface Modules Chassis-2 are fitted with crane lifting lugs for transport using a lifting harness to facilitate replacement.

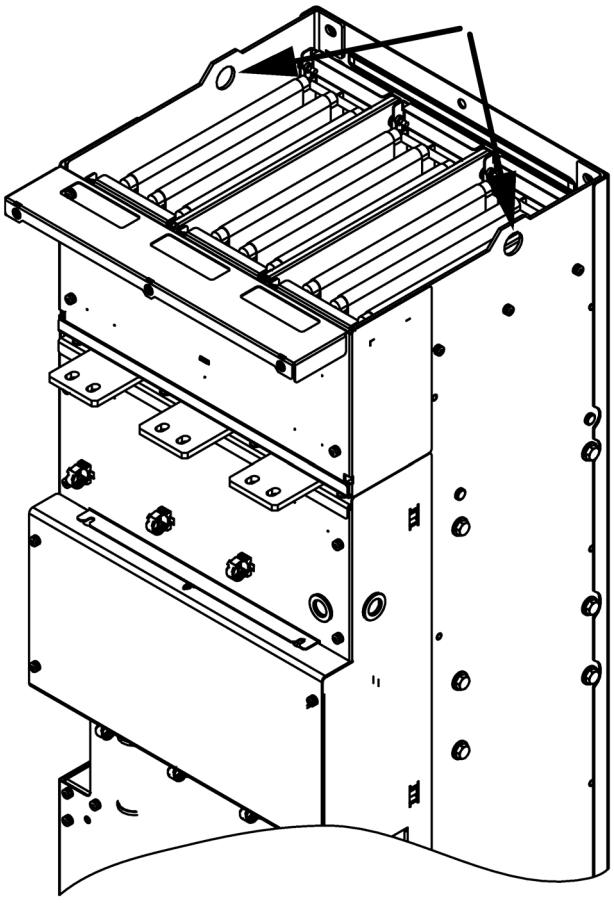


Figure 6-7 Crane lifting lugs for Active Interface Modules Chassis-2

## Crane lifting lugs for Active Line Module and Motor Modules Chassis-2

Active Line Modules and Motor Modules Chassis-2 are fitted with crane lifting lugs for transport using a lifting harness to facilitate replacement.

The crane lifting lug on the side of the motor connections is used to secure the unit when it is turned and placed on its side, if this is required when the unit is being replaced.

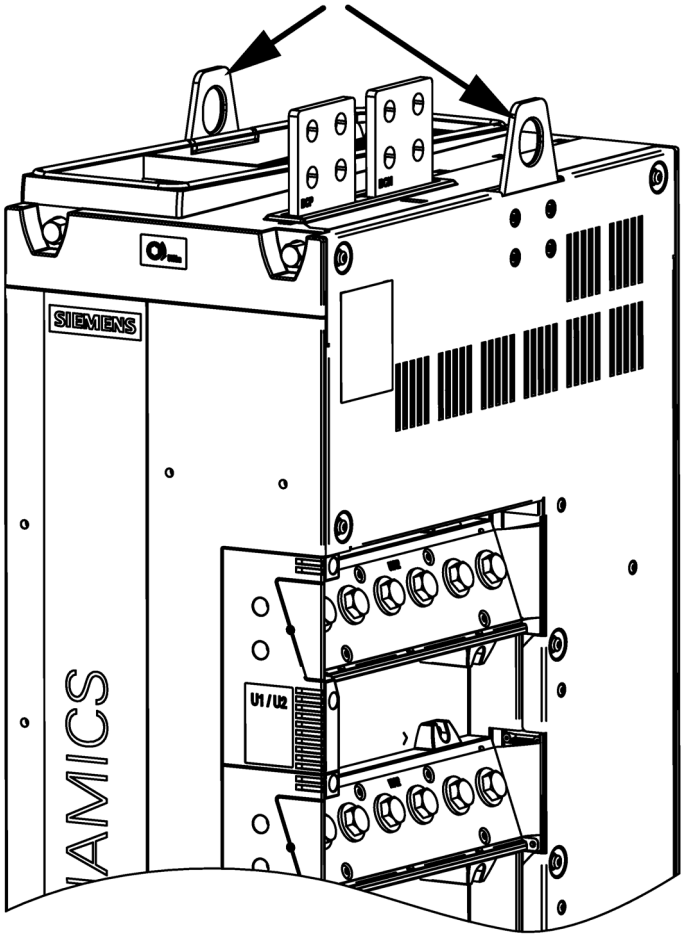



Figure 6-8 Crane lifting lugs for Active Line Module and Motor Module Chassis-2

## 6.4.8 Replacing the Motor Module, booksize format

### Preparatory steps

- Remove the protective cover.
- Allow unimpeded access.

### Removal

1. Disconnect the Control Unit and remove from the plate (if present).
2. Detach the cable from the plate and put to one side.
3. Remove the Control Unit plates.
4. Remove the DC-link rectifier adapter.
5. Remove and insulate the 24 VDC terminal adapter.
6. Remove the DRIVE-CLiQ cables.
7. Remove, short-circuit, and insulate the motor cable.
8. Unscrew the fastening screws of the Motor Module (two turns only).
9. Remove the Motor Module.

### Installation

Installing is the same as removing, however in the reverse order.

## 6.4.9 Replacing the power block, chassis format

### 6.4.9.1 Replacing the power block, frame size FB

**Replacing the power block**

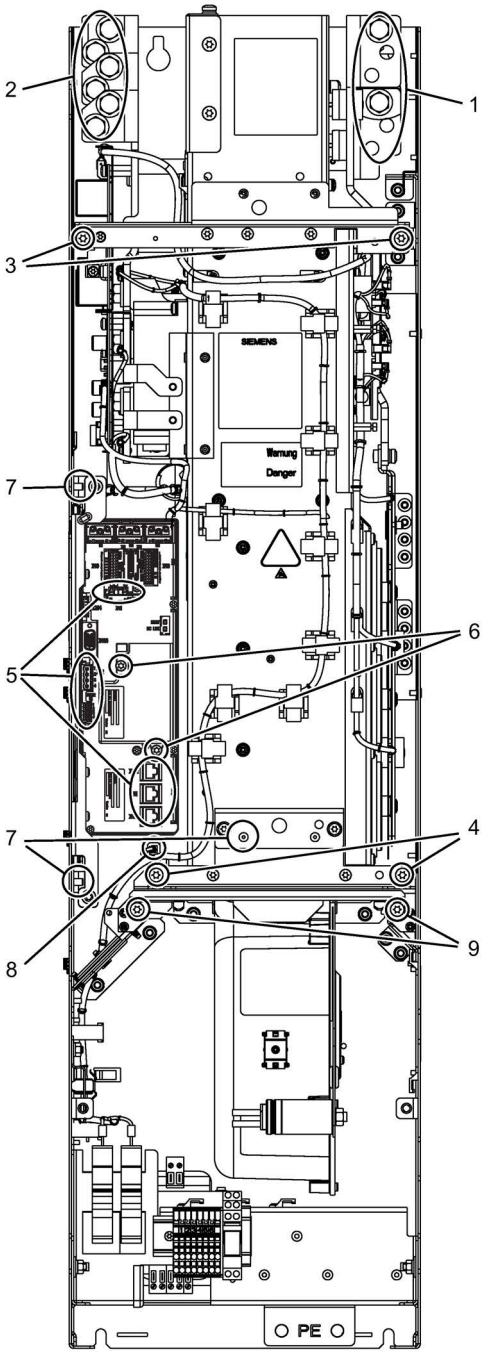



Figure 6-9 Replacing the power block, Basic Line Module, frame size FB

### Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access to the power block.
- Set up the installation device for the power block and keep it at hand (see Section "Installation device for power blocks").

### Removal steps

The removal steps are numbered in accordance with the figure above.

1. Unscrew the connection to the DC link (4 screws).
2. Unscrew the connection to the line connection (6 screws).
3. Remove the retaining screws at the top (2 screws).
4. Remove the retaining screws at the bottom (2 screws).
5. Remove DRIVE-CLiQ cables and connections at - X41 /- X42 /- X46 (6 plugs).
   The DRIVE-CLiQ cables should be marked so that they can be correctly connected at a later time.
6. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from plug -X45 on the Control Interface Module.
7. Remove the mounts for the Control Interface Module (1 screw and 2 nuts) and carefully pull out the Control Interface Module.

   When removing the Control Interface Module, you have to disconnect 5 additional plugs one after the other (2 at the top, 3 below).
8. Disconnect the plug for the thermocouple.
9. Unscrew the 2 retaining screws for the fan and attach the installation device for the power block at this position.

You can now remove the power block.

**Note**

The power block weighs approx. 65 kg!

**NOTICE**

**Damage to the device if signal cables are damaged when removing**

Signal cables can be damaged when the power block is removed. This can cause the device to fail.

- When removing the power block, 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.

Carefully insert the plug-in connections and ensure that they are secure.

**Note**

**Connection clip of the integrated basic interference suppression module to ground**

The connection clip of the integrated basic interference suppression module to ground is mounted on the spare power block together with a yellow warning label.

Observe the notes in Chapter "Removing the connection clip of the integrated basic interference suppression module to ground".

### 6.4.9.2 Replacing the power block, frame sizes GB and GD

**Replacing the power block**

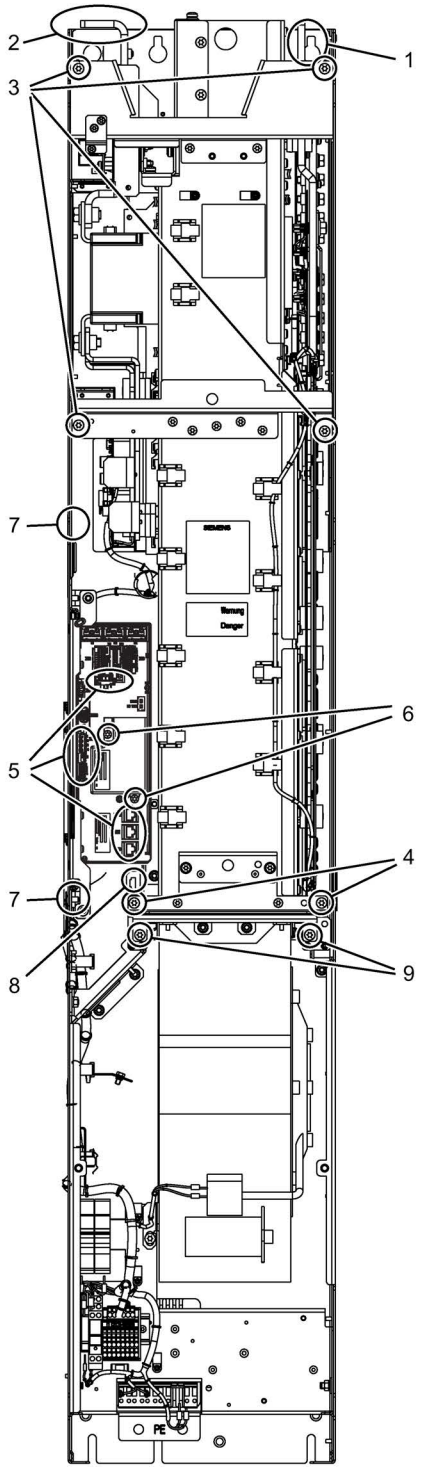



Figure 6-10 Replacing the power block, Basic Line Module, frame sizes GB and GD

### Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access to the power block.
- Set up the installation device for the power block and keep it at hand (see Section "Installation device for power blocks").

### Removal steps

The removal steps are numbered in accordance with the figure above.

1. Unscrew the connection to the DC link (6 screws).
2. Unscrew the connection to the line connection (9 screws).
3. Remove the retaining screws at the top (4 screws).
4. Remove the retaining screws at the bottom (2 screws).
5. Remove DRIVE-CLiQ cables and connections at - X41 /- X42 /- X46 (6 plugs).
   The DRIVE-CLiQ cables should be marked so that they can be correctly connected at a later time.
6. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from plug -X45 on the Control Interface Module.
7. Remove the mounts for the Control Interface Module (2 nuts) and carefully pull out the Control Interface Module.

   When removing the Control Interface Module, you have to disconnect 5 additional plugs one after the other (2 at the top, 3 below).
8. Disconnect the plug for the thermocouple.
9. Unscrew the 2 retaining screws for the fan and attach the installation device for the power block at this position.

You can now remove the power block.

**Note**

The power block weighs approx. 135 kg!

**NOTICE**

**Damage to the device if signal cables are damaged when removing**

Signal cables can be damaged when the power block is removed. This can cause the device to fail.

- When removing the power block, 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.

Carefully insert the plug-in connections and ensure that they are secure.

**Note**

**Connection clip of the integrated basic interference suppression module to ground**

The connection clip of the integrated basic interference suppression module to ground is mounted on the spare power block together with a yellow warning label.

Observe the notes in Chapter "Removing the connection clip of the integrated basic interference suppression module to ground".

### 6.4.9.3 Replacing the power block, frame size FX

**Replacing the power block**

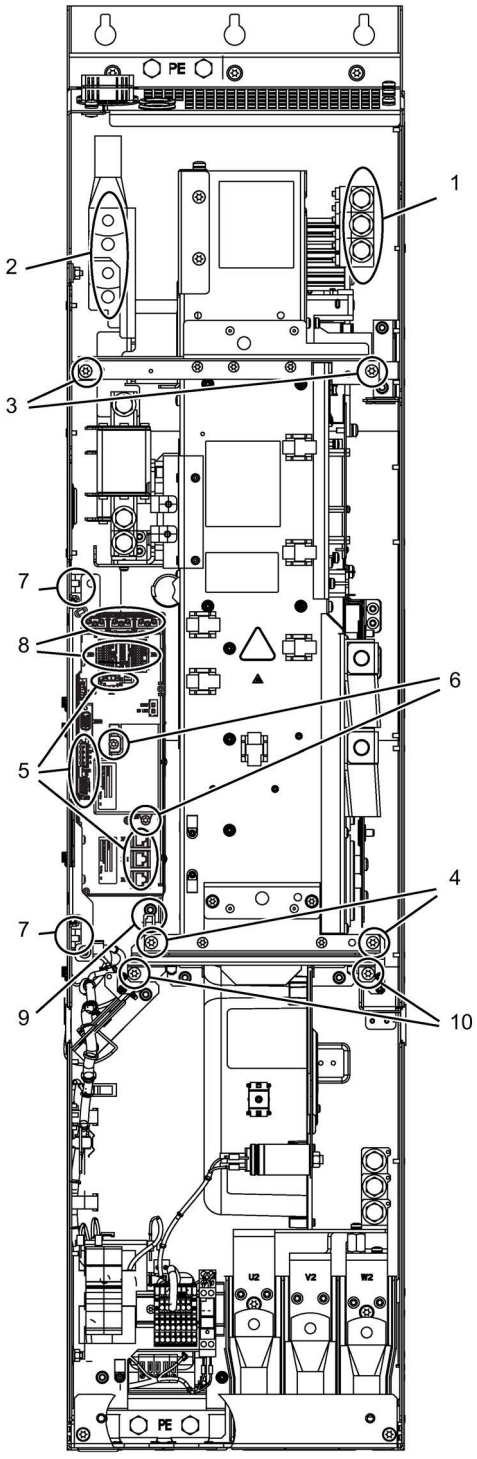



Figure 6-11 Replacing the power block, Active Line Module, and Motor Module, frame size FX

### Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access to the power block.
- Set up the installation device for the power block and keep it at hand (see Section "Installation device for power blocks").

### Removal steps

The removal steps are numbered in accordance with the figure.

1. Unscrew the connection to the line or to the motor (3 screws).
2. Unscrew the connection to the DC link (4 screws).
3. Remove the retaining screws at the top (2 screws).
4. Remove the retaining screws at the bottom (2 screws).
5. Remove DRIVE-CLiQ cables and connections at - X41 /- X42 /- X46 (6 plugs).
   The DRIVE-CLiQ cables should be marked so that they can be correctly connected at a later time.
6. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from plug -X45 on the Control Interface Module.
7. Remove the mounts for the Control Interface Module (2 nuts) and carefully pull out the Control Interface Module.

   When removing the Control Interface Module, you have to disconnect 5 additional plugs one after the other (2 at the top, 3 below).
8. Disconnect the plug-in connections for the fiber-optic cables and signal cables (5 plugs).
9. Disconnect the plug for the thermocouple.
10. Unscrew the 2 retaining screws for the fan and attach the installation device for the power block at this position.

You can now remove the power block.



**⚠DANGER**

**Live parts and components**

Death or serious injury can result when live parts are touched.
Up to 1200 V may still be present on the DC busbar system even after the DC interface (option L37) has been switched off.

- Avoid contact with the DC busbar system.

**Note**

The power block weighs approx. 66 kg!

**NOTICE**

**Damage to the device if signal cables are damaged when removing**

Signal cables can be damaged when the power block is removed. This can cause the device to fail.

- When removing the power block, ensure that you do not damage any signal cables.
- The second plug connection for the fiber optic cables cannot be disconnected until the power block has been pulled out slightly (see Step 7).

## 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.

Carefully insert the plug-in connections and ensure that they are secure.

The fiber-optic cable plugs must be remounted at their original slot. Fiber-optic cables and sockets are labeled to ensure that they are assigned correctly (U11, U21, U31).

### 6.4.9.4 Replacing the power block, frame size GX

#### Replacing the power block

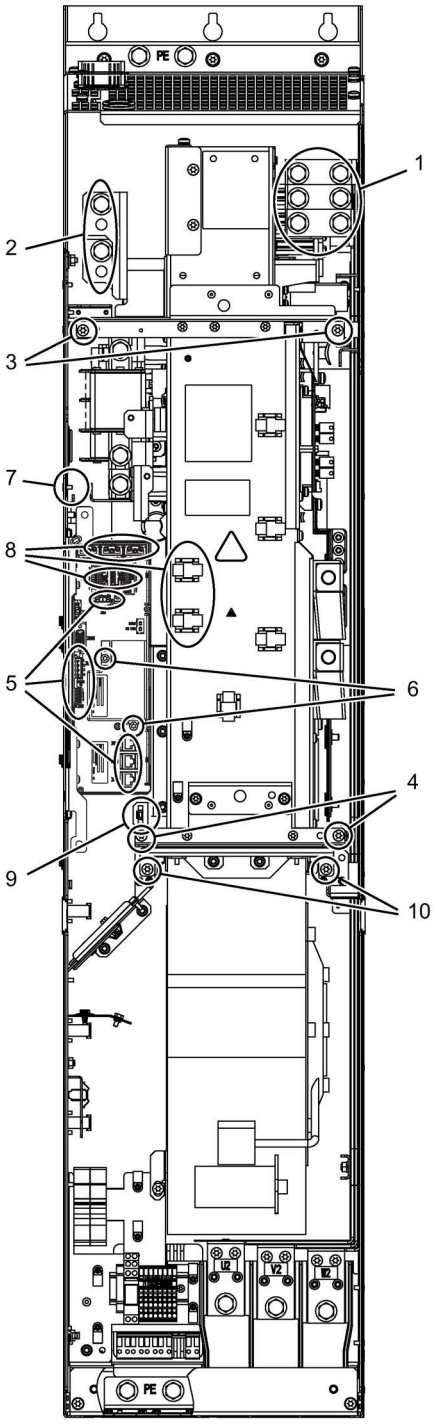



Figure 6-12 Replacing the power block, Smart Line Module, Active Line Module, and Motor Module, frame size GX

### Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access to the power block.
- Set up the installation device for the power block and keep it at hand (see Section "Installation device for power blocks").

### Removal steps

The removal steps are numbered in accordance with the figure.

1. Unscrew the connection to the line or to the motor (3 screws).
2. Unscrew the connection to the DC link (4 screws).
3. Remove the retaining screws at the top (2 screws).
4. Remove the retaining screws at the bottom (2 screws).
5. Remove DRIVE-CLiQ cables and connections at - X41 /- X42 /- X46 (6 plugs).
   The DRIVE-CLiQ cables should be marked so that they can be correctly connected at a later time.
6. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from plug -X45 on the Control Interface Module.
7. Remove the mount for the Control Interface Module (1 nut) and carefully pull out the Control Interface Module.

   When removing the Control Interface Module, you have to disconnect 5 additional plugs one after the other (2 at the top, 3 below).
8. Disconnect the plug-in connections for the fiber-optic cables and signal cables (5 plugs) and release the cable connectors for the signal cables (2 connectors).
9. Disconnect the plug for the thermocouple.
10. Unscrew the 2 retaining screws for the fan and attach the installation device for the power block at this position.

You can now remove the power block.



**⚠DANGER**

**Live parts and components**

Death or serious injury will result when live parts are touched.
Up to 1200 V may still be present on the DC busbar system even after the DC interface (option L37) has been switched off.

- Avoid contact with the DC busbar system.

**Note**

The power block weighs approx. 89 kg!

**NOTICE**

**Damage to the device if signal cables are damaged when removing**

Signal cables can be damaged when the power block is removed. This can cause the device to fail.

- When removing the power block, ensure that you do not damage any signal cables.
- The second plug-in connection for the fiber-optic cables cannot be disconnected until the power block has been pulled out slightly (see Step 7).

## 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.

Carefully insert the plug-in connections and ensure that they are secure.

The fiber-optic cable plugs must be remounted at their original slot. Fiber-optic cables and sockets are labeled to ensure that they are assigned correctly (U11, U21, U31).

**Note**

**Connection clip of the integrated basic interference suppression module to ground at the Smart Line Module, frame size GX**

The connection clip of the integrated basic interference suppression module to ground is mounted on the spare power block together with a yellow warning label.

Observe the notes in Chapter "Removing the connection clip of the integrated basic interference suppression module to ground".

### 6.4.9.5 Replacing the power block, frame size HX

**Replacing the power block, Smart Line Module, Active Line Module, and Motor Module, frame size HX – left power block**

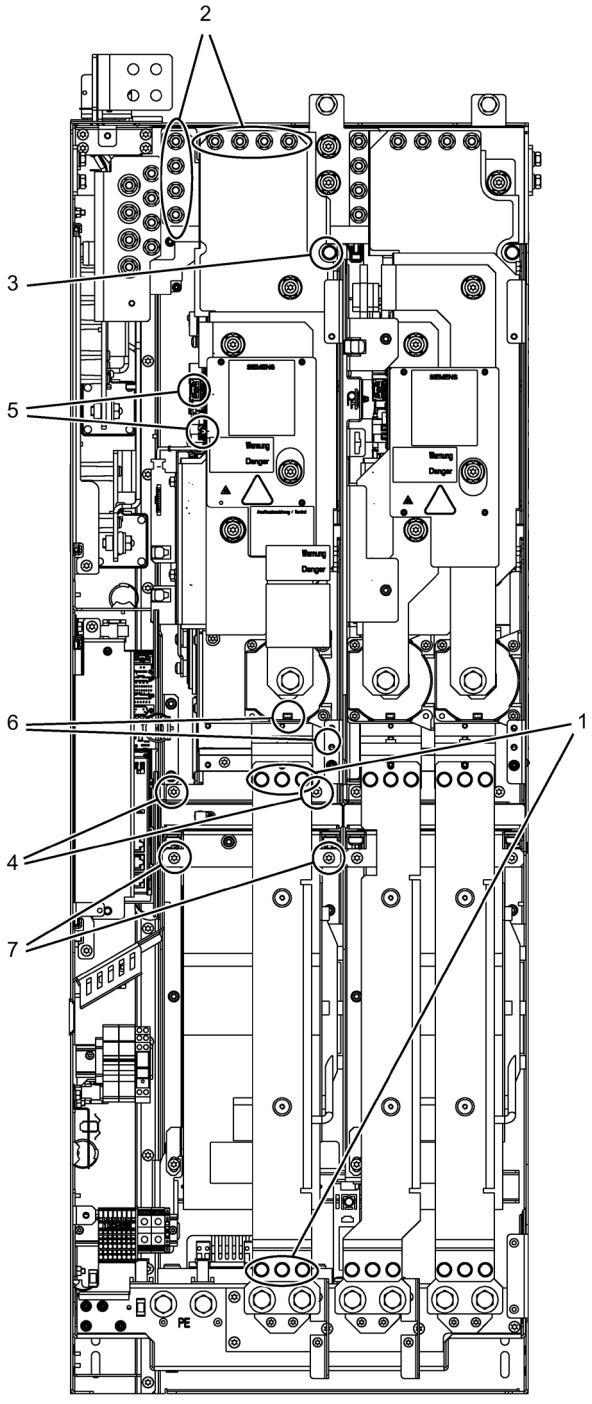



Figure 6-13 Replacing the power block, Smart Line Module, Active Line Module, and Motor Module, frame size HX – left power block

### Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access to the power block.
- Set up the installation device for the power block and keep it at hand (see Section "Installation device for power blocks").

### Removal steps

The removal steps are numbered in accordance with the figure above.

1. Remove the busbar (6 screws).
2. Unscrew the connection to the DC link (8 nuts).
3. Remove the retaining screw at the top (1 screw).
4. Remove the retaining screws at the bottom (2 screws).
5. Disconnect the plug connections for the fiber optic cables and signal cables (2 plugs).
6. Remove the connection for the current transformer and associated PE connection (1 plug).
7. Unscrew the 2 retaining screws for the fan and attach the installation device for the power block at this position.

You can now remove the power block.



**⚠DANGER**

**Live parts and components**

Death or serious injury will result when live parts are touched.
Up to 1200 V may still be present on the DC busbar system even after the DC interface (option L37) has been switched off.

- Avoid contact with the DC busbar system.

**Note**

The power block weighs approx. 64 kg!

**NOTICE**

**Damage to the device if signal cables are damaged when removing**

Signal cables can be damaged when the power block is removed. This can cause the device to fail.

- When removing the power block, ensure that you do not damage any signal cables.
- The second plug connection for the fiber optic cables cannot be disconnected until the power block has been pulled out slightly (see Step 5).

## 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.

Carefully insert the plug-in connections and ensure that they are secure.

The fiber-optic cable plugs must be remounted at their original slot. Fiber-optic cables and sockets are labeled to ensure that they are assigned correctly (U11, U21, U31).

## Replacing the power block, Smart Line Module, Active Line Module, and Motor Module, frame size HX - right power block

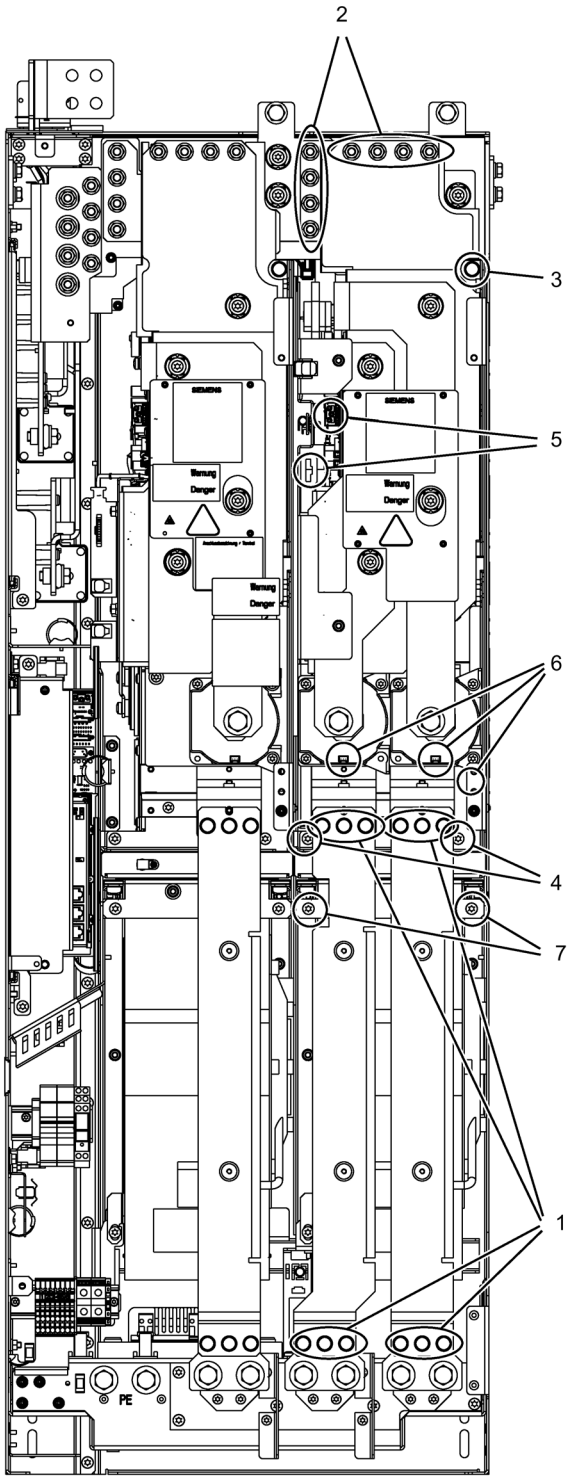



Figure 6-14 Replacing the power block, Smart Line Module, Active Line Module, and Motor Module, frame size HX - right power block

### Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access to the power block.
- Set up the installation device for the power block and keep it at hand (see Section "Installation device for power blocks").

### Removal steps

The removal steps are numbered in accordance with the figure above.

1. Remove the busbars (12 screws).
2. Unscrew the connection to the DC link (8 nuts).
3. Remove the retaining screw at the top (1 screw).
4. Remove the retaining screws at the bottom (2 screws).
5. Disconnect the plug connections for the fiber optic cables and signal cables (2 plugs).
   The second plug connection for the fiber optic cables cannot be disconnected until the power block has been pulled out slightly.
6. Remove the connection for the current transformer and associated PE connection (2 plugs).
7. Unscrew the 2 retaining screws for the fan and attach the installation device for the power block at this position.

You can now remove the power block.



**⚠DANGER**

**Live parts and components**

Death or serious injury will result when live parts are touched.
Up to 1200 V may still be present on the DC busbar system even after the DC interface (option L37) has been switched off.

- Avoid contact with the DC busbar system.

**Note**

The power block weighs approx. 86 kg!

**NOTICE**

**Damage to the device if signal cables are damaged when removing**

Signal cables can be damaged when the power block is removed. This can cause the device to fail.

- When removing the power block, ensure that you do not damage any signal cables.
- The second plug connection for the fiber optic cables cannot be disconnected until the power block has been pulled out slightly (see Step 5).

### 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.

Carefully insert the plug-in connections and ensure that they are secure.

The fiber-optic cable plugs must be remounted at their original slot. Fiber-optic cables and sockets are labeled to ensure that they are assigned correctly (U11, U21, U31).

### 6.4.9.6 Replacing the power block, frame size JX

#### Replacing the power block

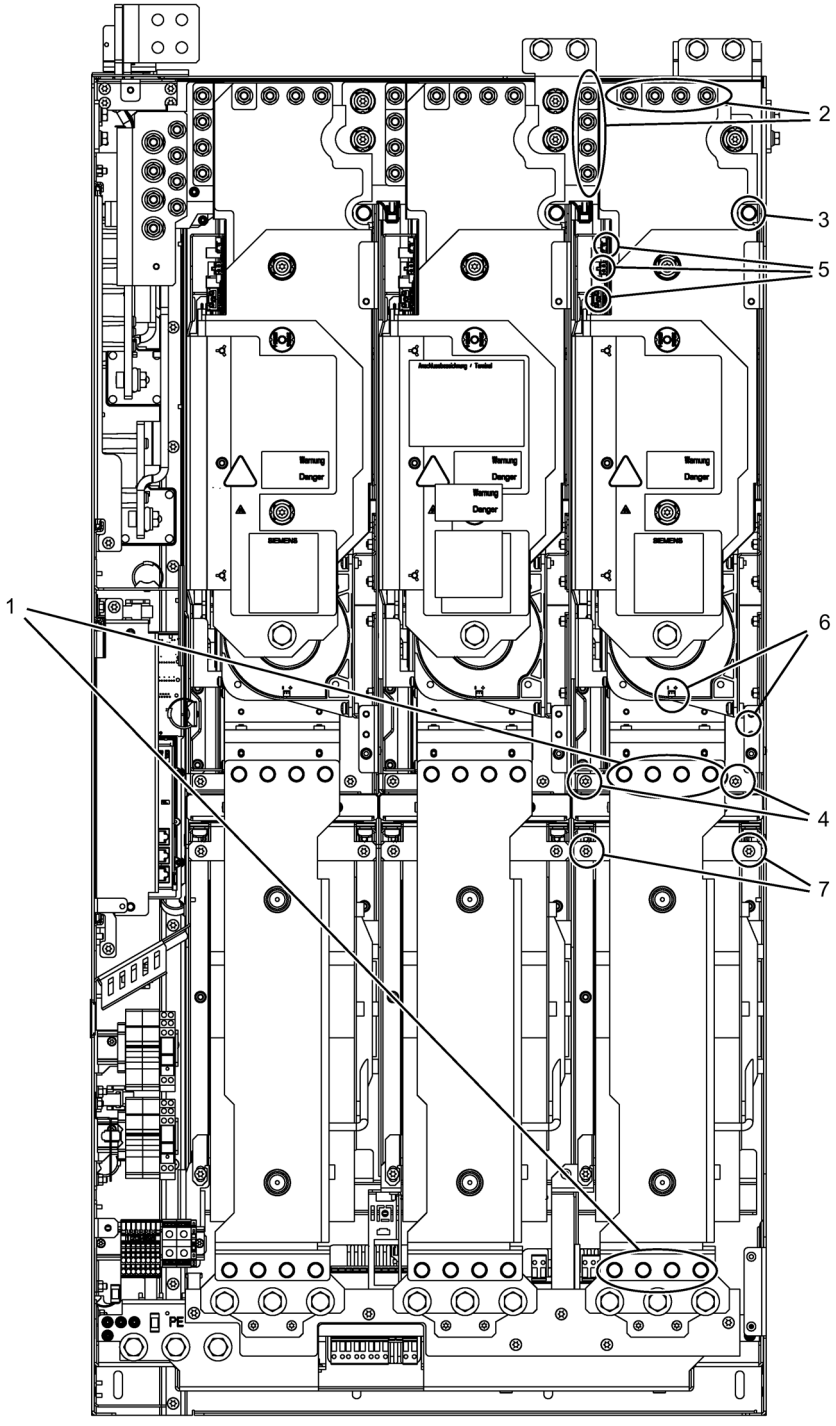



Figure 6-15 Replacing the power block, Active Line Module, Smart Line Module, and Motor Module, frame size JX

### Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access to the power block.
- Set up the installation device for the power block and keep it at hand (see Section "Installation device for power blocks").

### Removal steps

The removal steps are numbered in accordance with the figure above.

1. Remove the busbar (8 screws).
2. Unscrew the connection to the DC link (8 nuts).
3. Remove the retaining screw at the top (1 screw).
4. Remove the retaining screws at the bottom (2 screws).
5. Disconnect the plug connections for the fiber optic cables and signal cables (2 plugs).
6. Remove the connection for the current transformer and associated PE connection (1 plug).
7. Unscrew the 2 retaining screws for the fan and attach the installation device for the power block at this position.

You can now remove the power block.



**⚠DANGER**

**Live parts and components**

Death or serious injury can result when live parts are touched.
Up to 1200 V may still be present on the DC busbar system even after the DC interface (option L37) has been switched off.

- Avoid contact with the DC busbar system.

**Note**

The power block weighs approx. 90 kg!

**NOTICE**

**Damage to the device if signal cables are damaged when removing**

Signal cables can be damaged when the power block is removed. This can cause the device to fail.

- When removing the power block, 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.

Carefully insert the plug-in connections and ensure that they are secure.

The fiber-optic cable plugs must be remounted at their original slot. Fiber-optic cables and sockets are labeled to ensure that they are assigned correctly (U11, U21, U31).

The procedure described here for replacing the power block refers to the module on the right. The other modules are handled in the same way.

## 6.4.10 Replacing Chassis-2 format devices

### 6.4.10.1 Replacing the Active Line Module Chassis-2, frame sizes FS2 and FS2+

**Replacing the Active Line Module, frame sizes FS2 and FS2+**

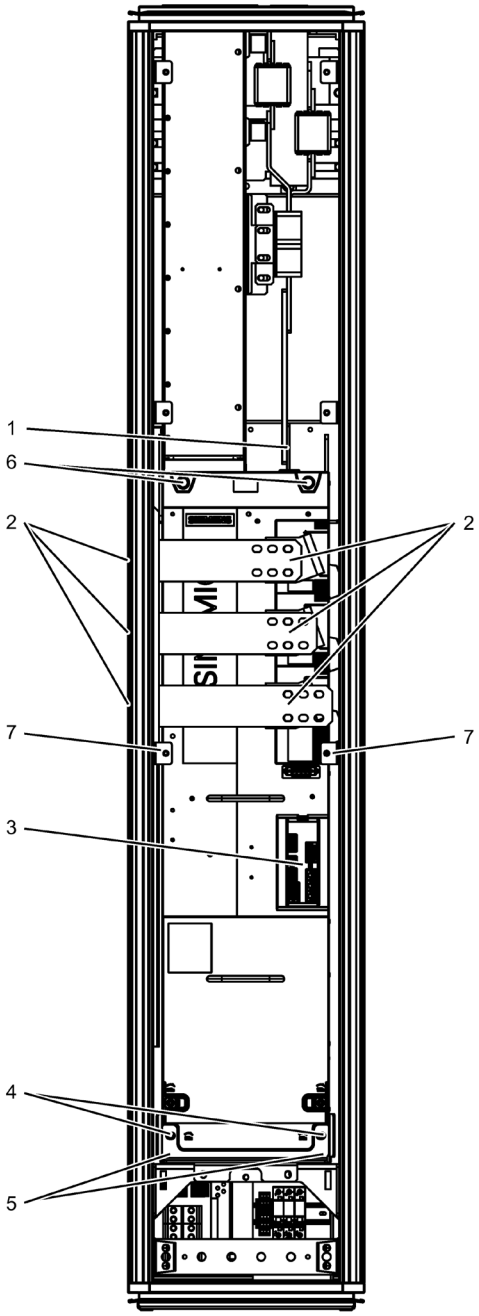



Figure 6-16 Replacing the Active Line Module Chassis-2, frame sizes FS2 and FS2+ when the Motor Modules are installed to the right

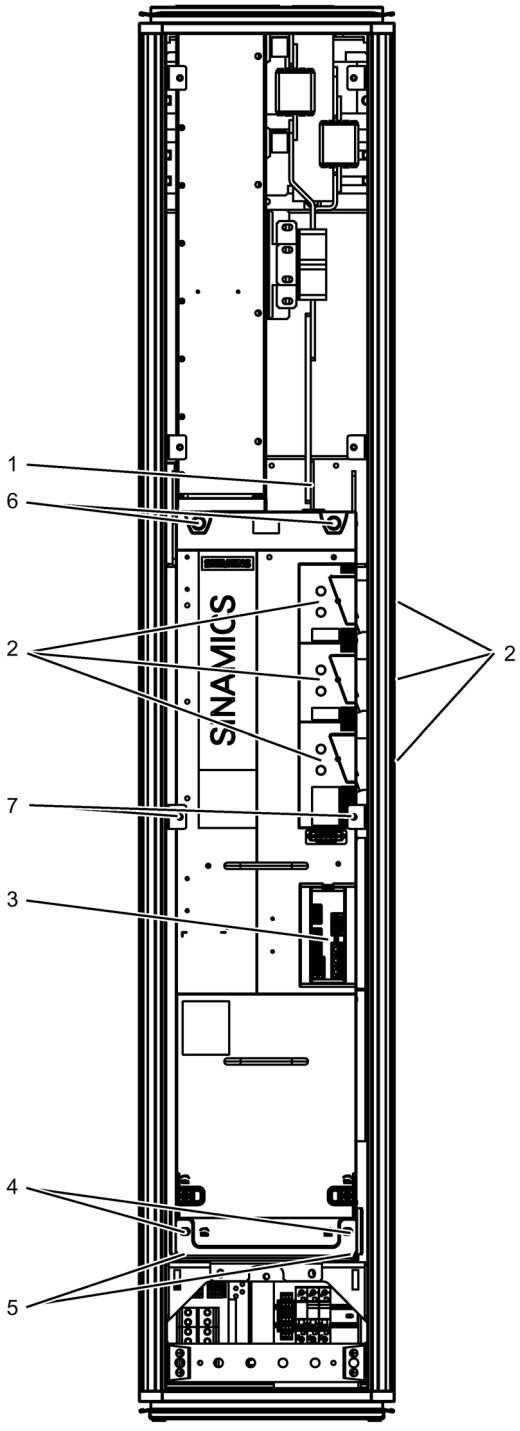



Figure 6-17 Replacing the Active Line Module Chassis-2, frame sizes FS2 and FS2+ when the Motor Modules are installed to the left

### Preparatory steps

- Disconnect the cabinet from the power supply (do not forget external power supplies!)
- Remove the protective cover in front of the Active Line Module and the Active Interface Module.
- Facilitate free access to the Active Line Module and the Active Interface Module.

### Removal steps

The removal steps are numbered in accordance with the figure above.

1. Release the connection to the DC link.
2. Release the busbars to the line connections at U1, V1, W1.
   - When installing the Motor Modules to the right:
     You can reach the screws on the left-hand side of the busbars from the Active Interface Module cabinet.
   - When the Motor Modules are installed to the left:
     Remove the screws at the connecting bars to the Active Interface Module.
     You can access the screws on the right-hand side of the connecting bars from the Active Interface Module cabinet.
3. Withdraw the signal cable connectors.
4. Remove the upper fastening screws of the mounting bracket (2 screws).
5. Remove the lower fastening screws of the mounting bracket (2 screws).
6. Remove the fastening screws (2 screws).
7. Remove the mounting bracket for the plastic cover.

The Active Line Module can then be withdrawn.

**⚠ CAUTION**

**When removing the device without using a suitable mounting aid, the device may be damaged or cause injury.**

When removing the Active Line Module from the control cabinet without using a suitable mounting aid, the Active Line Module may be damaged or cause injury.

- When removing the Active Line Module from the control cabinet, use a suitable mounting aid such that the device can be horizontally drawn out of the control cabinet.

**⚠ CAUTION**

**Injury or damage to the device if it topples or rolls away.**

During and after removing the Active Line Module from the control cabinet, the Active Line Module may topple over or roll away. This can result in injuries or damage to the device.

- Secure the Active Line Module so that it cannot topple over or roll away while being removed from the control cabinet.

**NOTICE**

**Damage to the device if signal cables are damaged when removing**

Signal cables can be damaged when the Active Line Module is removed. This can cause the device to fail.

- When withdrawing the Active Line Module, 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.

Carefully insert the plug-in connections and ensure that they are secure.

### 6.4.10.2 Replacing the Active Line Module Chassis-2, frame sizes FS4 and FS4+

**Replacing the Active Line Module, frame sizes FS4 and FS4+**

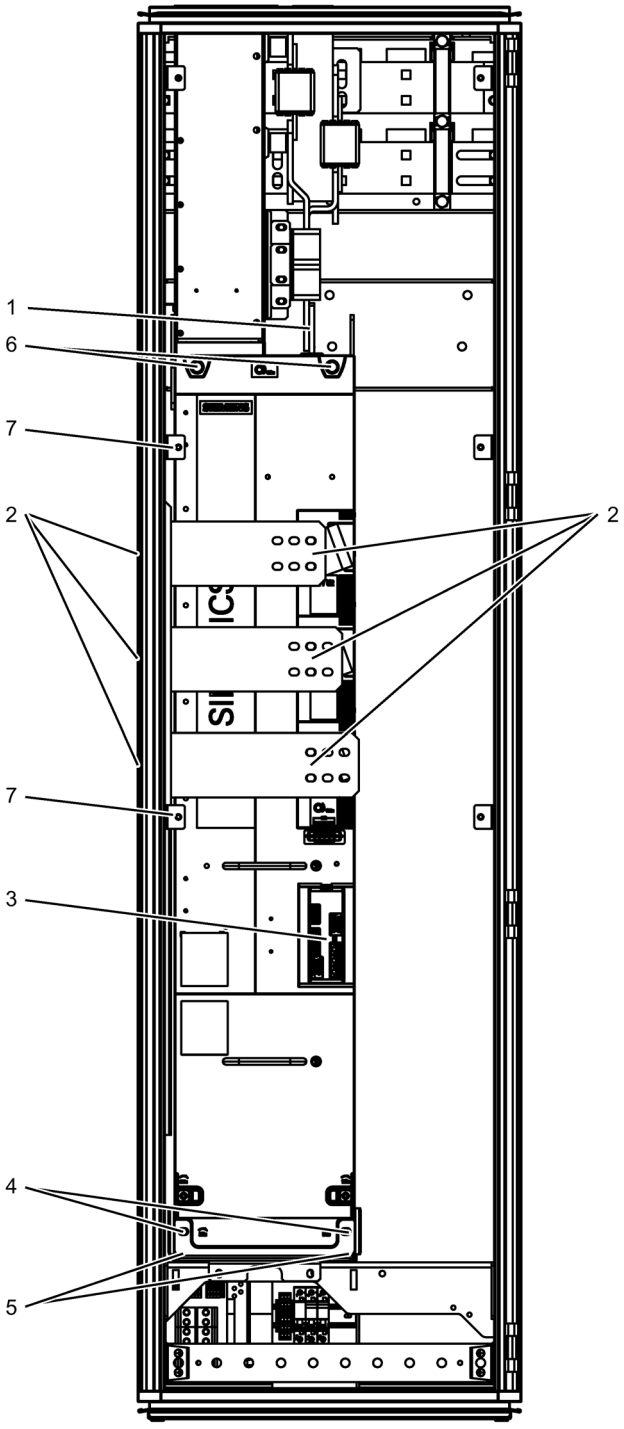



Figure 6-18 Replacing the Active Line Module Chassis-2, frame sizes FS4 and FS4+ when the Motor Modules are installed to the right

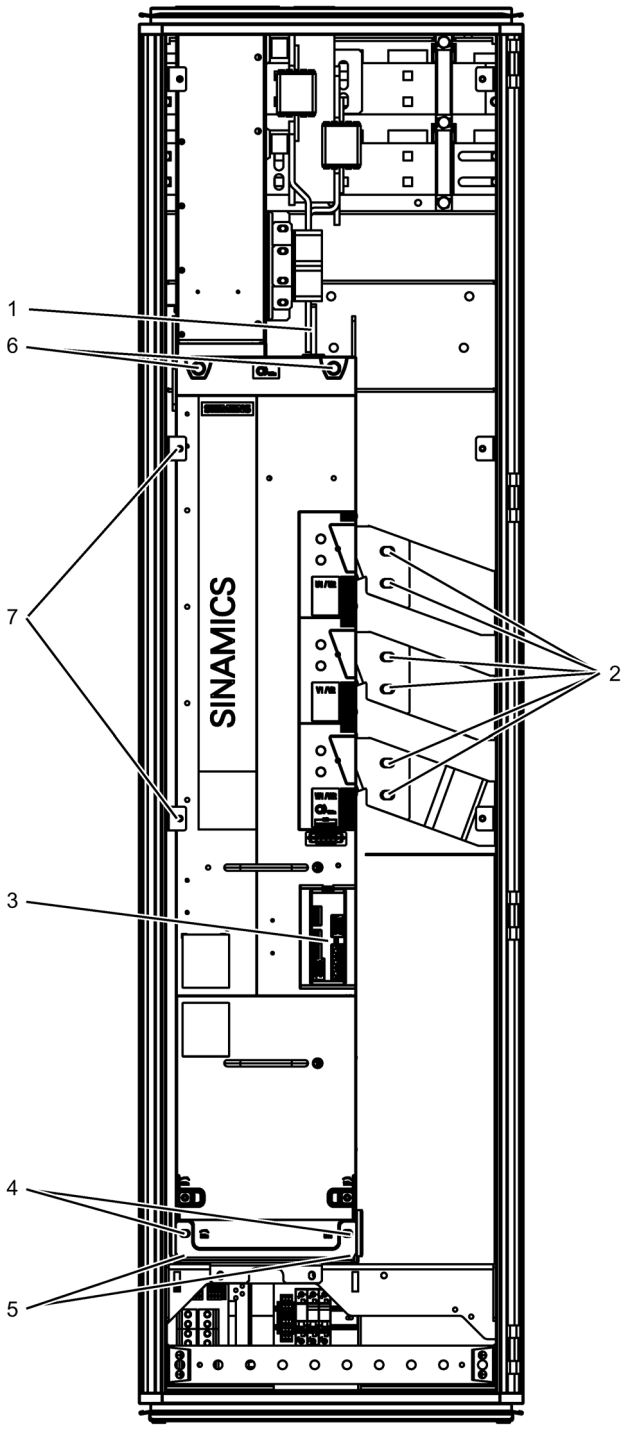



Figure 6-19 Replacing the Active Line Module Chassis-2, frame sizes FS4 and FS4+ when the Motor Modules are installed to the left

### Preparatory steps

- Disconnect the cabinet from the power supply (do not forget external power supplies!)
- Remove the protective cover in front of the Active Line Module and the Active Interface Module.
- Facilitate free access to the Active Line Module and the Active Interface Module.

### Removal steps

The removal steps are numbered in accordance with the figure above.

1. Release the connection to the DC link.
2. Release the busbars to the line connections at U1, V1, W1.
   – When installing the Motor Modules to the right:
   You can reach the screws on the left-hand side of the busbars from the Active Interface Module cabinet.
   – When the Motor Modules are installed to the left:
   Remove the screws at the connecting bars to the Active Interface Module.
3. Withdraw the signal cable connectors.
4. Remove the upper fastening screws of the mounting bracket (2 screws).
5. Remove the lower fastening screws of the mounting bracket (2 screws).
6. Remove the fastening screws (2 screws).
7. Remove the mounting bracket for the plastic cover.

The Active Line Module can then be withdrawn.

**⚠ CAUTION**

**When removing the device without using a suitable mounting aid, the device may be damaged or cause injury.**

When removing the Active Line Module from the control cabinet without using a suitable mounting aid, the Active Line Module may be damaged or cause injury.

- When removing the Active Line Module from the control cabinet, use a suitable mounting aid such that the device can be horizontally drawn out of the control cabinet.

**⚠ CAUTION**

**Injury or damage to the device if it topples or rolls away.**

During and after removing the Active Line Module from the control cabinet, the Active Line Module may topple over or roll away. This can result in injuries or damage to the device.

- Secure the Active Line Module so that it cannot topple over or roll away while being removed from the control cabinet.

**NOTICE**

**Damage to the device if signal cables are damaged when removing**

Signal cables can be damaged when the Active Line Module is removed. This can cause the device to fail.

- When withdrawing the Active Line Module, 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.

Carefully insert the plug-in connections and ensure that they are secure.

### 6.4.10.3 Replacing the Motor Module Chassis-2

#### Replacing the Motor Module

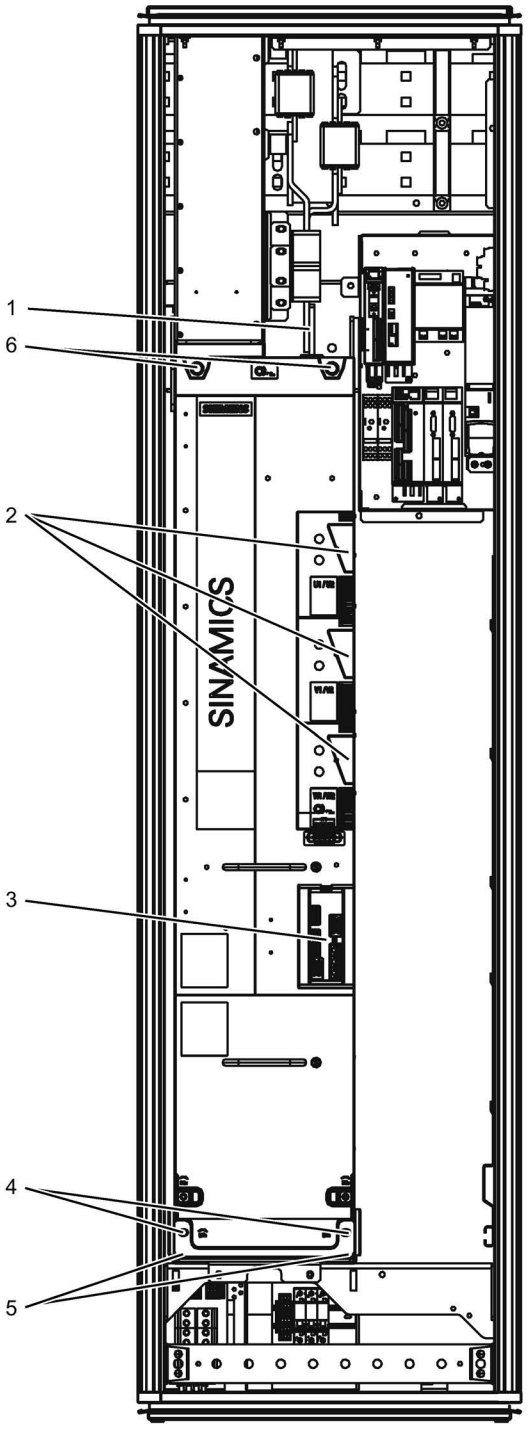



Figure 6-20 Replacing the Motor Module Chassis-2, frame sizes FS2, FS2+, FS4 and FS4

### Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover
- Allow unimpeded access to the Motor Module.

### Removal steps

The removal steps are numbered in accordance with the figure above.

1. Release the connection to the DC link.
2. Release the motor cables at U2, V2, W2.
3. Withdraw the signal cable connectors.
4. Remove the upper fastening screws of the mounting bracket (2 screws).
5. Remove the lower fastening screws of the mounting bracket (2 screws).
6. Remove the fastening screws (2 screws).

The Motor Module can then be withdrawn.

**⚠CAUTION**

**When removing the device without using a suitable mounting aid, the device may be damaged or cause injury.**

When removing the Motor Module from the control cabinet without using a suitable mounting aid, the Motor Module may be damaged or cause injury.

- When removing the Motor Module from the control cabinet, use a suitable mounting aid such that the device can be horizontally drawn out of the control cabinet.

**⚠CAUTION**

**Injury or damage to the device if it topples or rolls away.**

During and after removal of the Motor Module from the control cabinet, the Motor Module may topple over or roll away. This can result in injuries or damage to the device.

- Secure the Motor Module so that it cannot topple over or roll away while being removed from the control cabinet.

**NOTICE**

**Damage to the device if signal cables are damaged when removing**

Signal cables can become damaged when the Motor Module is removed. This can cause the device to fail.

- When withdrawing the Motor Module, 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.

Carefully insert the plug-in connections and ensure that they are secure.

## 6.4.11 Replacing the Control Interface Module

### 6.4.11.1 Replacing the Control Interface Module, frame size FB

#### Replacing the Control Interface Module

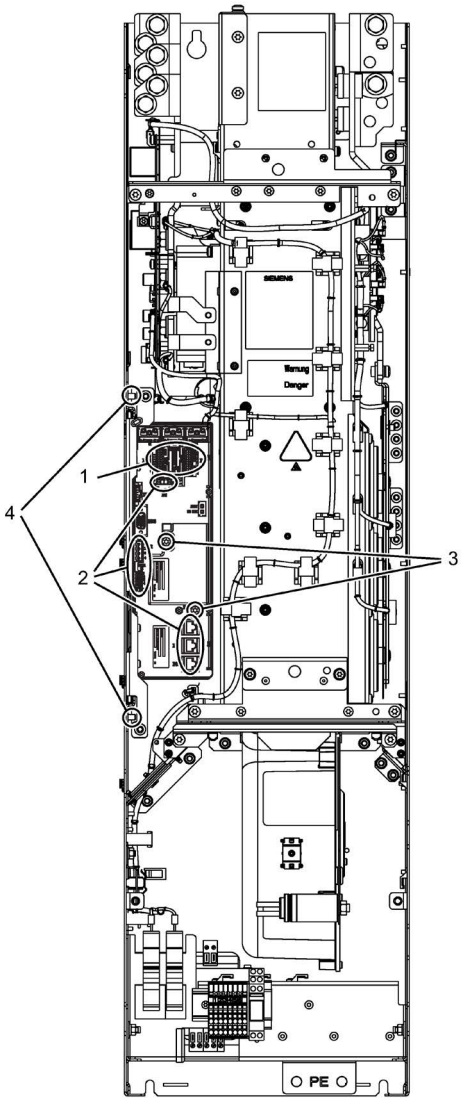



Figure 6-21 Replacing the Control Interface Module, frame size FB

#### Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Allow unimpeded access
- Remove the front cover

### Removal steps

The removal steps are numbered in accordance with the figure.

1. Withdraw the signal cable connectors (2 connectors).
2. Remove the DRIVE-CLiQ cables and connections on -X41 / -X42 / -X46 (6 connectors).
3. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from connector -X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (2 screws).

When removing the Control Interface Module, you have to disconnect 5 additional connectors one after the other (2 at the top, 3 at the bottom).

**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 device failure.

- When removing 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.

**Note**

**Specifications for the installation**

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug-in connections and ensure that they are secure.

The fiber-optic cable connectors must be re-inserted in their original slot. Fiber-optic cables and sockets are labeled to ensure that they are assigned correctly (U11, U21, U31).

**Note**

**It is not possible to connect different power units in parallel**

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

It is not possible to connect Basic Line Modules with a Control Interface Module and Basic Line Modules with a Control Interface Board in parallel.

### 6.4.11.2 Replacing the Control Interface Module, frame sizes GB and GD

#### Replacing the Control Interface Module

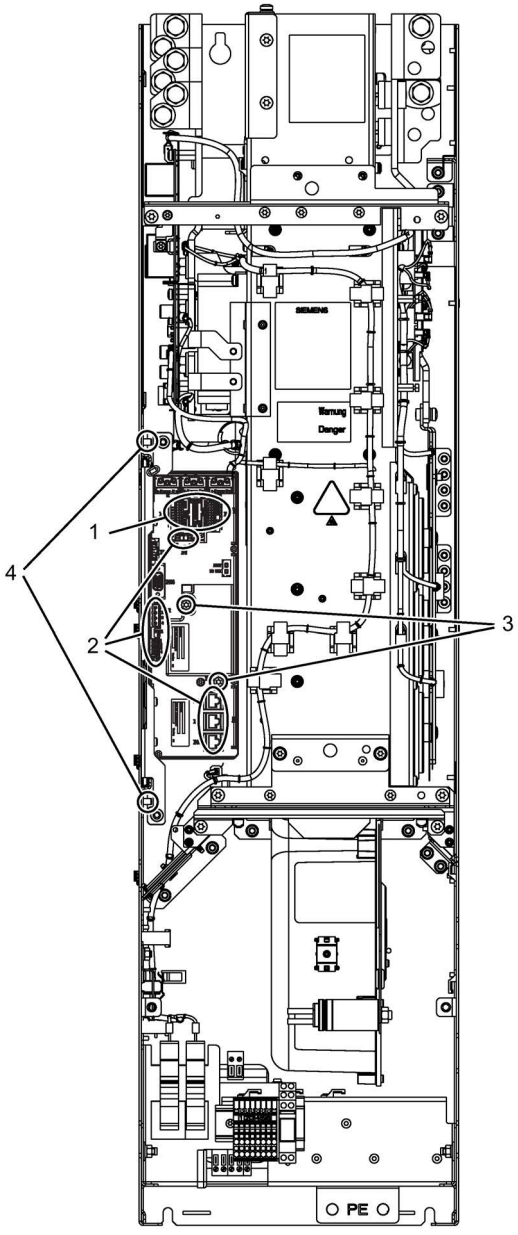



Figure 6-22 Replacing the Control Interface Module, frame sizes GB and GD

#### Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Allow unimpeded access
- Remove the front cover

### Removal steps

The removal steps are numbered in accordance with the figure.

1. Withdraw the signal cable connectors (2 connectors).
2. Remove the DRIVE-CLiQ cables and connections on -X41 / -X42 / -X46 (6 connectors).
3. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from connector -X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (2 screws).

When removing the Control Interface Module, you have to disconnect 5 additional connectors one after the other (2 at the top, 3 at the bottom).

**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 device failure.

- When removing 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.

**Note**

**Specifications for the installation**

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

Carefully insert the plug-in connections and ensure that they are secure.

The fiber-optic cable connectors must be re-inserted in their original slot. Fiber-optic cables and sockets are labeled to ensure that they are assigned correctly (U11, U21, U31).

**Note**

**It is not possible to connect different power units in parallel**

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

It is not possible to connect Basic Line Modules with a Control Interface Module and Basic Line Modules with a Control Interface Board in parallel.

### 6.4.11.3 Replacing the Control Interface Module, frame size FX

#### Replacing the Control Interface Module

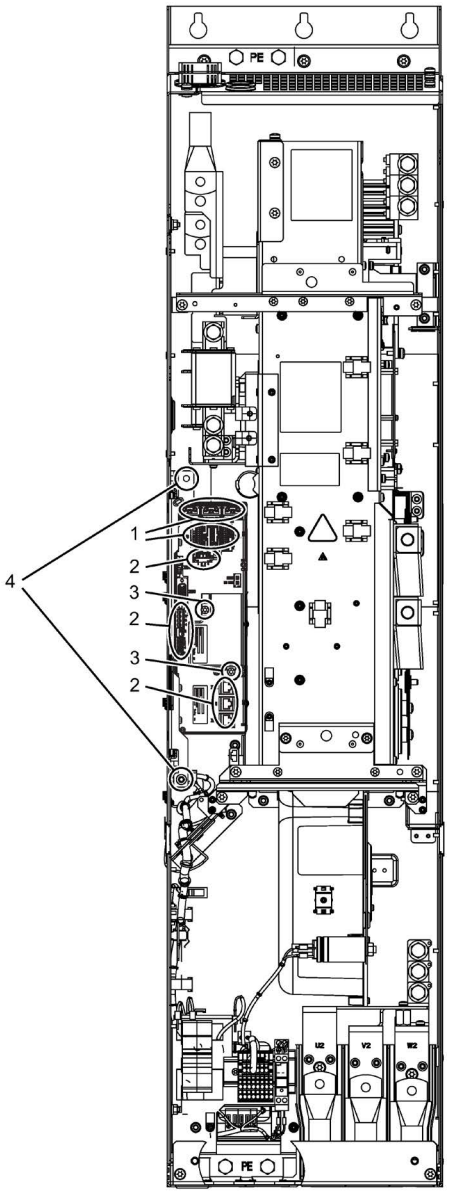



Figure 6-23 Replacing the Control Interface Module, frame size FX

#### Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Allow unimpeded access
- Remove the front cover

### Removal steps

The removal steps are numbered in accordance with the figure.

1. Disconnect the plug-in connections for the fiber-optic cables and signal cables (5 connectors).
2. Remove DRIVE-CLiQ cables and connections at - X41 /- X42 /- X46 (6 connectors).
   The DRIVE-CLiQ cables should be marked so that they can be correctly connected at a later time.
3. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from connector -X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (2 screws).

When removing the Control Interface Module, you have to disconnect 5 additional connectors one after the other (2 at the top, 3 at the bottom).

**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 device failure.

- When removing 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 fixing 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-in connections and ensure that they are secure.

The fiber-optic cable connectors must be re-inserted in their original slot. Fiber-optic cables and sockets are labeled to ensure that they are assigned correctly (U11, U21, U31).

**Note**

**It is not possible to connect different power units in parallel**

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

It is not possible to connect Smart Line Modules / Active Line Modules / Motor Modules with a Control Interface Module and Smart Line Modules / Active Line Modules / Motor Modules with a Control Interface Board in parallel.

### 6.4.11.4 Replacing the Control Interface Module, frame size GX

#### Replacing the Control Interface Module

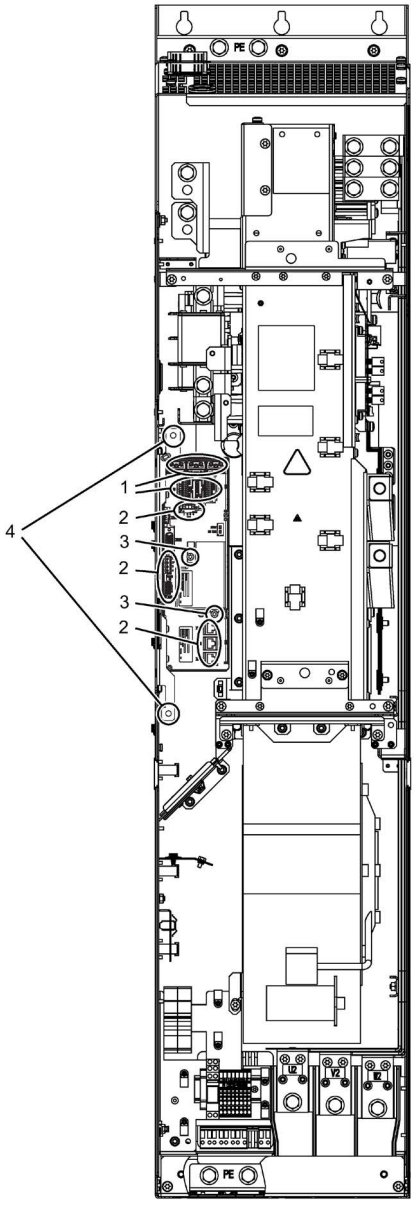



Figure 6-24 Replacing the Control Interface Module, frame size GX

#### Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Allow unimpeded access
- Remove the front cover

### Removal steps

The removal steps are numbered in accordance with the figure.

1. Disconnect the plug-in connections for the fiber-optic cables and signal cables (5 connectors).
2. Remove DRIVE-CLiQ cables and connections at - X41 /- X42 /- X46 (6 connectors).
   The DRIVE-CLiQ cables should be marked so that they can be correctly connected at a later time.
3. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from connector -X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (2 screws).

When removing the Control Interface Module, you have to disconnect 5 additional connectors one after the other (2 at the top, 3 at the bottom).

**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 device failure.

- When removing 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 fixing 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-in connections and ensure that they are secure.

The fiber-optic cable connectors must be re-inserted in their original slot. Fiber-optic cables and sockets are labeled to ensure that they are assigned correctly (U11, U21, U31).

**Note**

**It is not possible to connect different power units in parallel**

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

It is not possible to connect Smart Line Modules / Active Line Modules / Motor Modules with a Control Interface Module and Smart Line Modules / Active Line Modules / Motor Modules with a Control Interface Board in parallel.

### 6.4.11.5 Replacing the Control Interface Module, frame size HX

#### Replacing the Control Interface Module

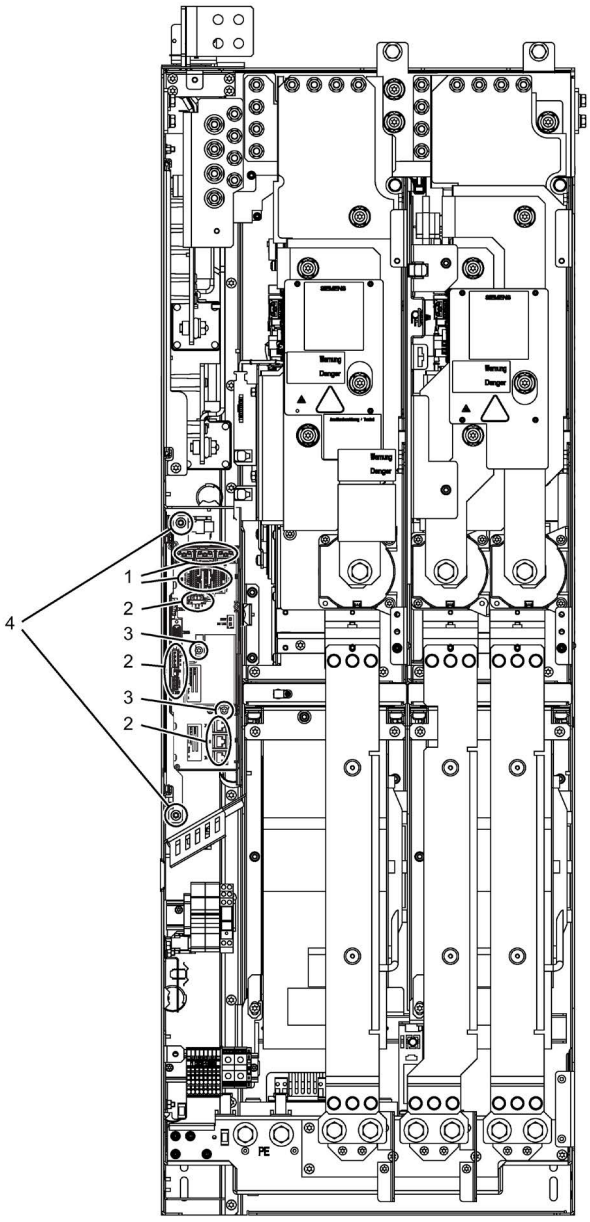



Figure 6-25 Replacing the Control Interface Module, frame size HX

#### Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Allow unimpeded access
- Remove the protective cover

### Removal steps

The removal steps are numbered in accordance with the figure.

1. Disconnect the plug-in connections for the fiber-optic cables and signal cables (5 connectors).
2. Remove DRIVE-CLiQ cables and connections at - X41 /- X42 /- X46 (6 connectors).
   The DRIVE-CLiQ cables should be marked so that they can be correctly connected at a later time.
3. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from connector -X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (2 screws).

When removing the Control Interface Module, you have to disconnect 5 additional connectors one after the other (2 at the top, 3 at the bottom).

**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 device failure.

- When removing 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 fixing 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-in connections and ensure that they are secure.

The fiber-optic cable connectors must be re-inserted in their original slot. Fiber-optic cables and sockets are labeled to ensure that they are assigned correctly (U11, U21, U31).

**Note**

**It is not possible to connect different power units in parallel**

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

It is not possible to connect Smart Line Modules / Active Line Modules / Motor Modules with a Control Interface Module and Smart Line Modules / Active Line Modules / Motor Modules with a Control Interface Board in parallel.

### 6.4.11.6 Replacing the Control Interface Module, frame size JX

#### Replacing the Control Interface Module

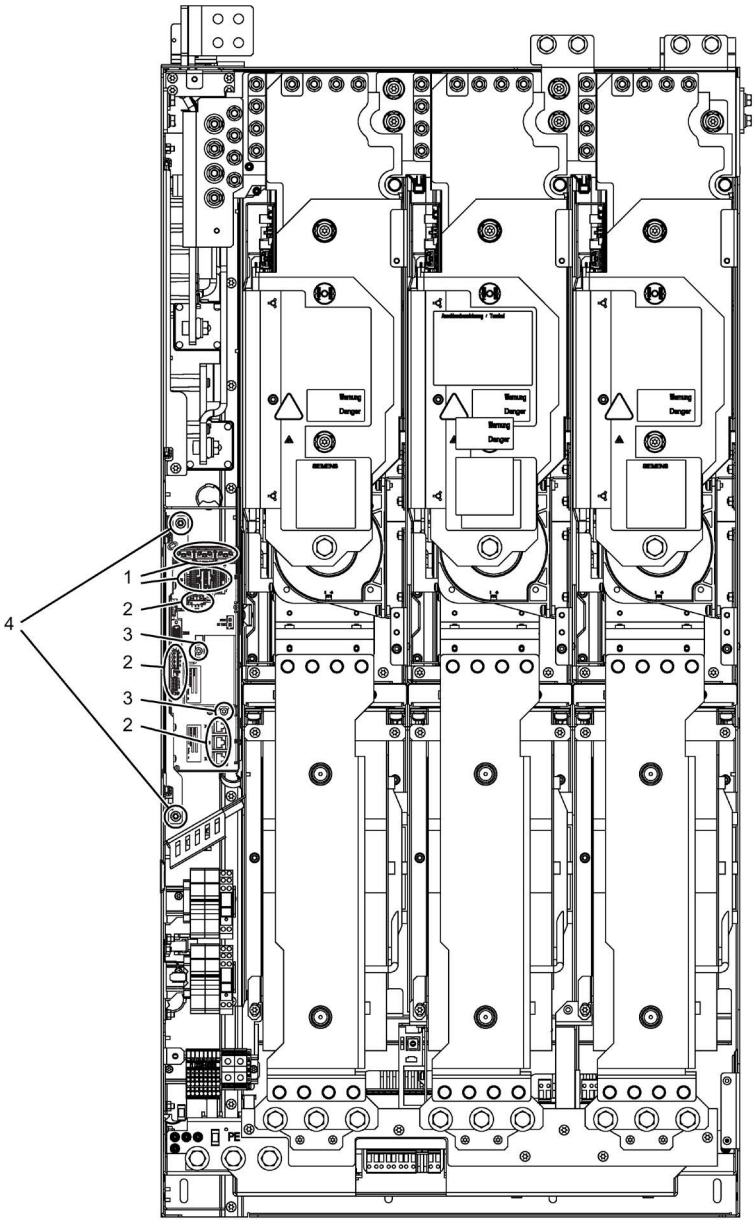



Figure 6-26 Replacing the Control Interface Module, frame size JX

#### Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Allow unimpeded access.
- Remove the protective cover.

### Removal steps

The removal steps are numbered in accordance with the figure.

1. Disconnect the plug-in connections for the fiber-optic cables and signal cables (5 plugs).
2. Remove DRIVE-CLiQ cables and connections at - X41 /- X42 /- X46 (6 plugs).
   The DRIVE-CLiQ cables should be marked so that they can be correctly connected at a later time.
3. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from plug -X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (2 screws).

When removing the Control Interface Module, you have to disconnect 5 additional plugs one after the other (2 at the top, 3 below).

**NOTICE**

**Damage to the device if signal cables are damaged when removing**

Signal cables can be damaged when the Control Interface Module is removed. This can cause the device to fail.

- When removing 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 fixing 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-in connections and ensure that they are secure.

The fiber-optic cable plugs must be remounted at their original slot. Fiber-optic cables and sockets are labeled to ensure that they are assigned correctly (U11, U21, U31).

**Note**

**It is not possible to connect different power units in parallel**

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

It is not possible to connect Smart Line Modules / Active Line Modules / Motor Modules with Control Interface Module and Smart Line Modules / Active Line Modules / Motor Modules with Control Interface Board in parallel.

### 6.4.11.7 Replacing the Control Interface Module, frame sizes FS2, FS2+, FS4 and FS4+

**Replacing the Control Interface Module**

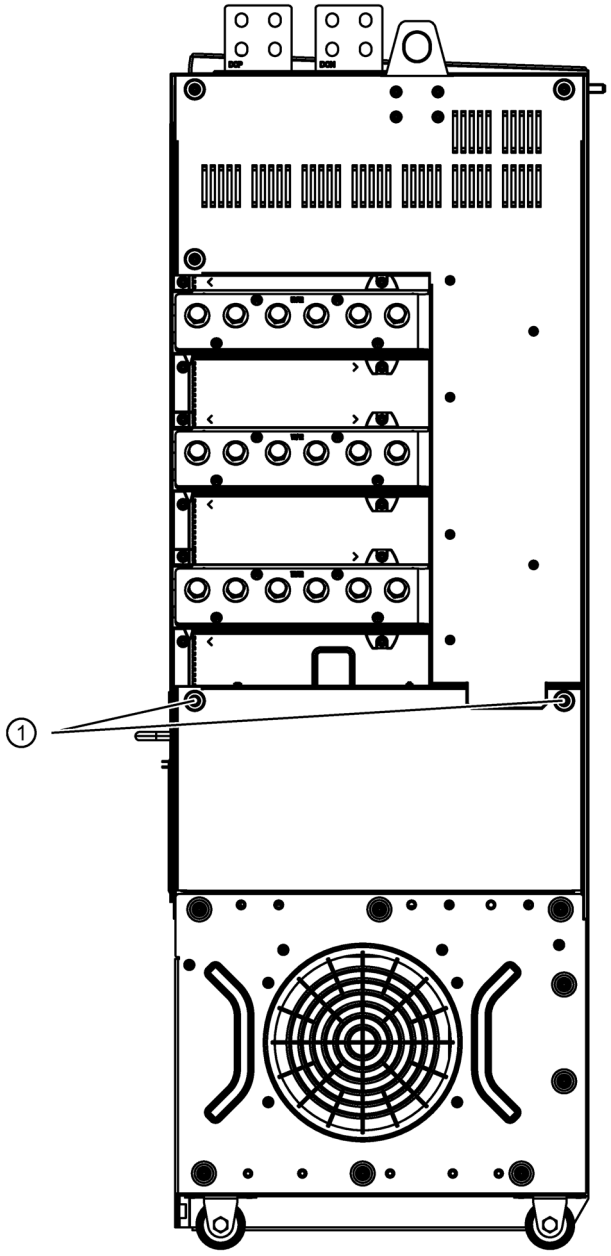



Figure 6-27 Replacing the Control Interface Module, frame sizes FS2, FS2+, FS4 and FS4+, Part 1

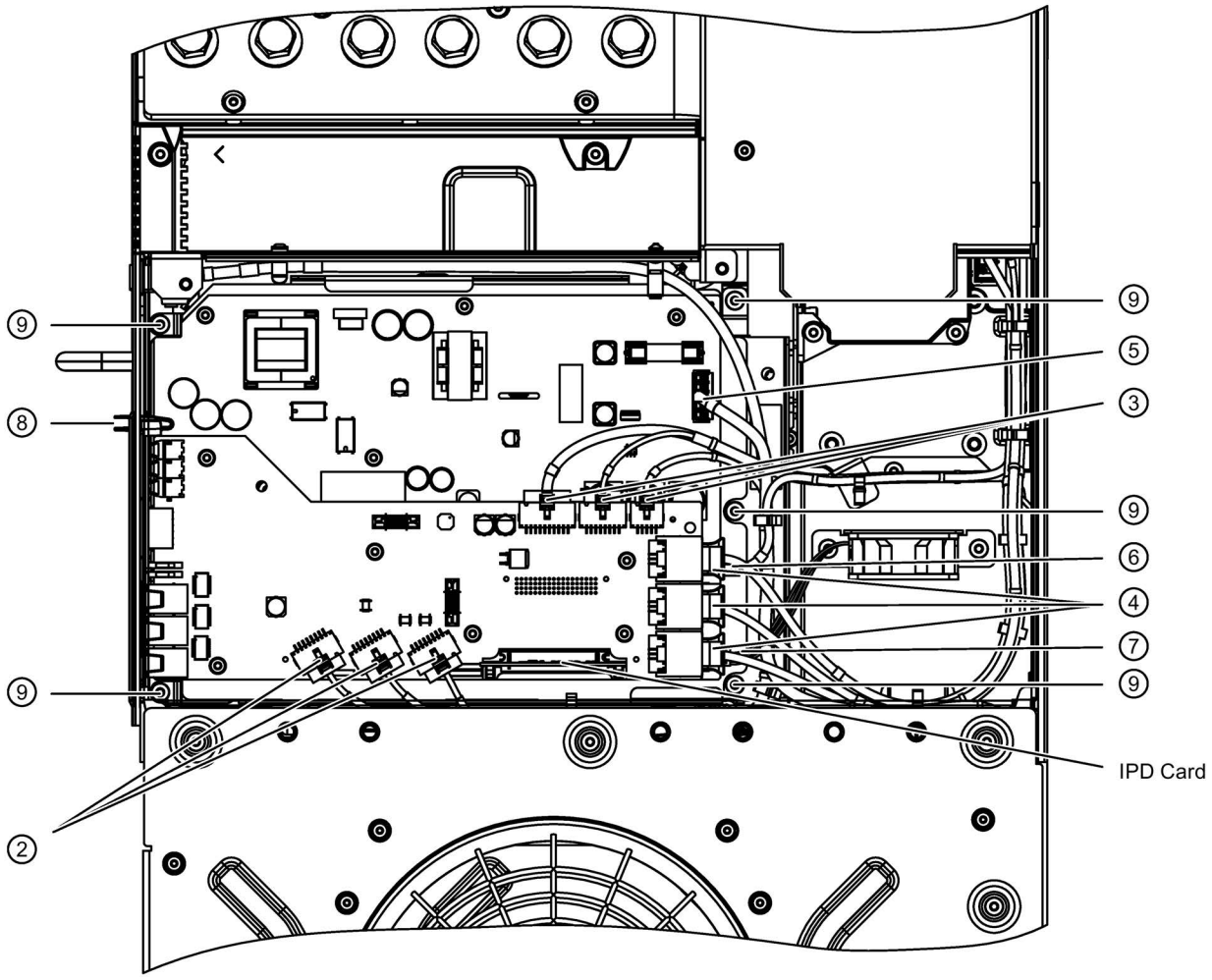



Figure 6-28 Replacing the Control Interface Module, frame sizes FS2, FS2+, FS4 and FS4+, Part 2

### Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Allow unimpeded access.
- Remove the protective cover.
- Withdraw all plug connectors to the signal connections (–X9, –X41 ... –X49, –X400 ... –X402).
- Removing the device from the control cabinet is described in Chapter "Replacing Chassis-2 format devices (Page 410)".
- While removing the device from the control cabinet, it must be secured so that it can neither topple over nor roll away.

## Removal steps

The removal step numbering corresponds to the numbers in the diagrams.

1. Open the service flap for the Control Interface Module (2 screws).
2. Withdraw the plug connectors of the current transformers X431 - X433 (3 plug connectors).
3. Withdraw the plug connectors for the temperature sensors X31, X32 (·2 plug connectors) and the fan control X50 (1 plug connector).
4. Withdraw the plug connectors of the fiber-optic cables U11, U21, U31 (3 plug connectors).
5. Withdraw the plug connector for the DC link voltage sensing X60 (1 connector).
6. Withdraw the plug connector of the 24 V DC control X271 (1 connector at the lower module).
7. Withdraw the plug connector of the internal fan X272 (1 connector at the lower module).
8. Press the latch of the cover for the signal connections and remove the cover.
9. Remove the fastening screws for the Control Interface Module (5 screws).

You can now remove the Control Interface Module.

| **NOTICE** |
| --- |
| **Damage to the device if signal cables are damaged when removing**<br>Signal cables can be damaged when withdrawing the Control Interface Module, which can result in a device failure.<br>• When withdrawing the Control Interface Module, ensure that you do not damage any signal cables. |

### Transferring the IPD card

When replacing the Control Interface Module with a replacement part, after removing the defective module, the IPD card must be transferred into the replacement part.

The IPD card contains the internal device data; it is not included with a replacement Control Interface Module.

Remove the IPD Card:
Open the locking mechanism and withdraw the IPD card from the Control Interface Module.

Insert the IPD card:
Insert the IPD card into the slot until the locking mechanism engages.

## 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 ⑨): 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-in connections and ensure that they are secure.

The fiber-optic cable plugs must be remounted at their original slot. To ensure correct assignment, the fiber-optic cables and the slots on the module are appropriately labeled (U11, U21, U31); the same is true for the plug connections for the current transformers (X431, X432, X433).

## 6.4.12 Replacing the Control Unit

### Replacing the Control Unit in the chassis format

The Control Unit is mounted on a slide-in unit that can be withdrawn if the Control Unit needs to be replaced.

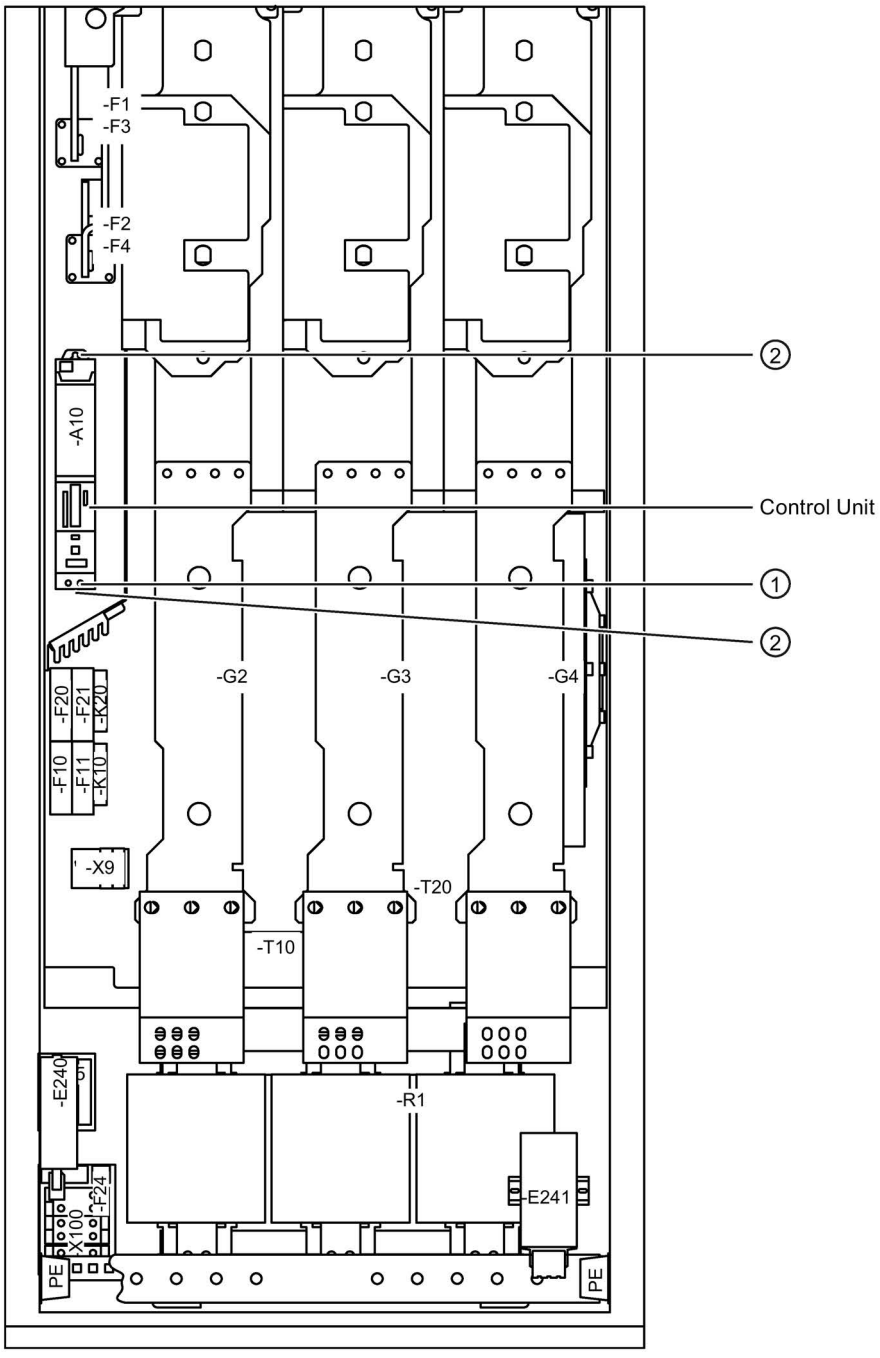



Figure 6-29 Replacing the Control Unit in the chassis format

**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 pulling out the Control Unit on the slide-in unit completely, remove all cables connected to the Control Unit.
4. Pull out the Control Unit on the slide-in unit and install the new one.

| **NOTICE** |
| --- |
| **Damage to the device if signal cables are damaged when removing**<br>Signal cables can be damaged when the Control Unit is removed. This can cause the device to fail.<br>• 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 at precisely the same positions.

## Replacing the Control Unit for Active Line Connection Modules-2

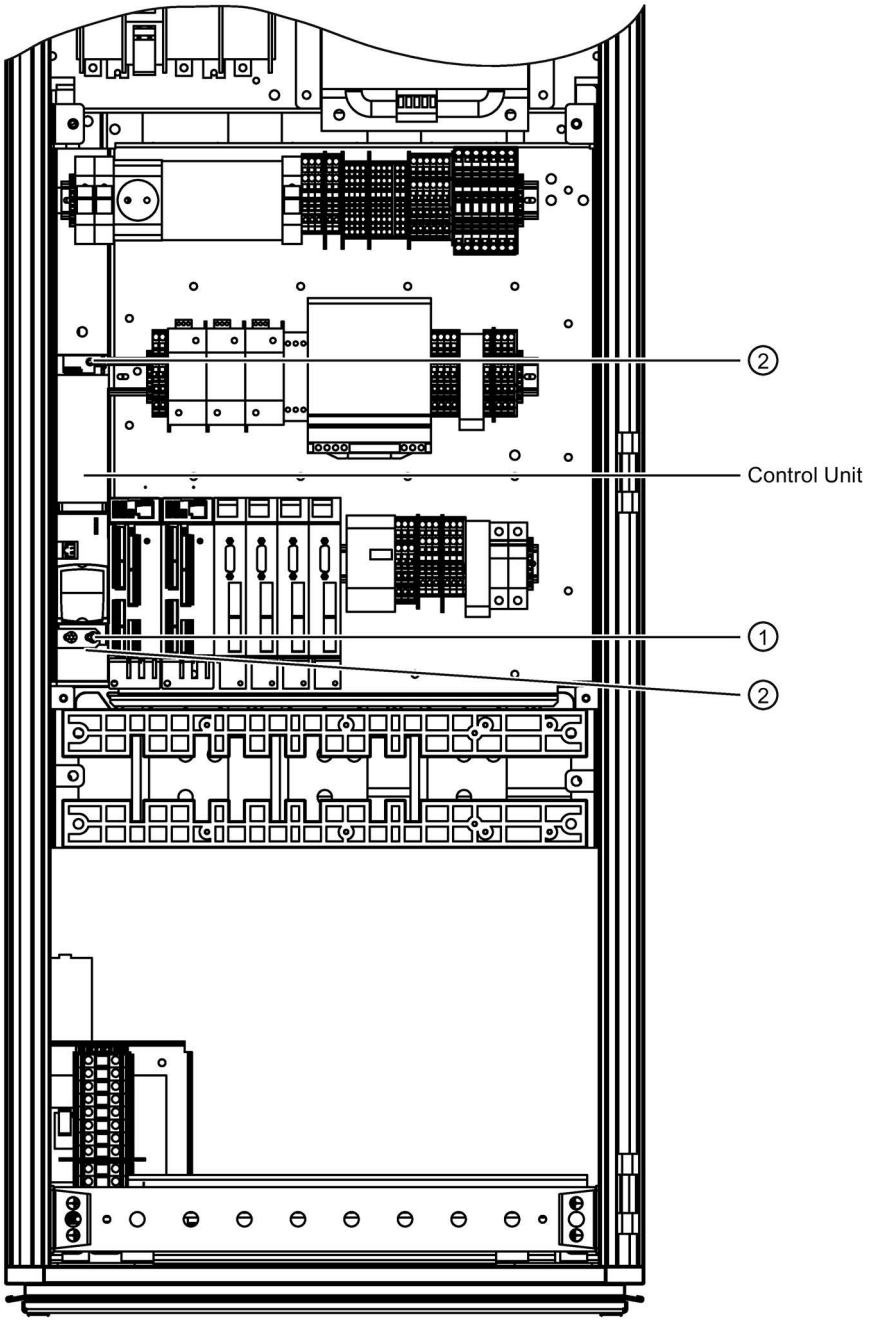



Figure 6-30 Replacing the Control Unit for Active Line Connection Modules-2

**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**<br>Signal cables can be damaged when the Control Unit is removed. This can cause the device to fail.<br>• 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 at precisely the same positions.

## Replacing the Control Unit for Motor Modules in the Chassis-2 format

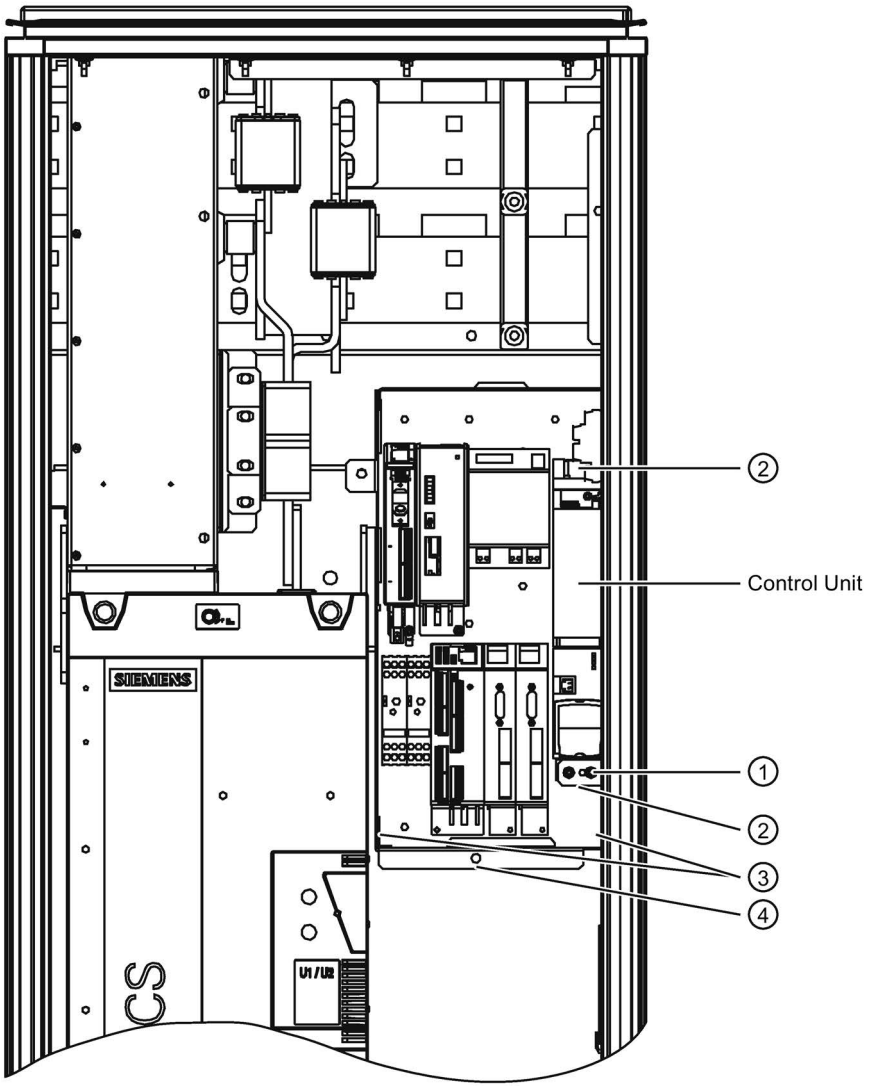



Figure 6-31 Replacing the Control Unit for Motor Modules in the Chassis-2 format

### 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. Access to the lower fastening screw of the Control Unit can be simplified by releasing the two screws ③ and removing the sheet steel plate ④.

4. Before withdrawing the Control Unit, remove all cables connected to the Control Unit
5. 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 at precisely the same positions.

## 6.4.13 Replacing the fans

### 6.4.13.1 Replacing the fan, Booksize Cabinet Kit

#### Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access.

#### Fan replacement for Motor Modules with a width of 50 mm (9 A, 18 A)

**Removing the existing fan module**

| | | |
|---|---|---|
|  |  |  |
| Remove the shield connection clamp.<br>Screwdriver: slotted, 0.8 x 5.5 mm | Release the catch of the motor connection plug and pull the plug out of the Motor Module. | Remove the shield connection plate from the Motor Module.<br>Screwdriver: Torx 20 |
|  |  |   |
| Detach the protective conductor from the Motor Module.<br>Screwdriver: Torx 20 | Pull the fan module forwards out of the Motor Module. | Motor Module with removed fan module |

**Installing a new fan module**

1. Insert a new fan module into the Motor Module. The power supply for the fan is automatically established.
2. Connect the protective conductor to the Motor Module, tightening torque: 3 Nm.
3. Reattach the shield connection plate and tighten the fastening screws, tightening torque: 3 Nm.
4. Reinsert the motor connection plug.
5. Reattach the shield connection clamp and tighten the fastening screws, tightening torque: 0.8 Nm.

## Fan replacement for Motor Modules with a width of 100 mm (30 A)

Fan replacement for Motor Modules with a width of 100 mm is the same as for Motor Modules with a width of 50 mm. Since the protective conductor is located not behind the connection plate but next to it, you can loosen it first and, after installation of the new fan module, screw it down as the last step.

## Fan replacement for Motor Modules with a width of 150 ... 200 mm (45 ... 85 A)

**Removing the fan**

1. Disconnect the power supplies (24 V DC and 400 V AC)
   Wait 5 minutes while the DC link capacitors discharge.
2. Remove the Motor Module from the drive line-up.
3. Release the catches to open the fan cover.

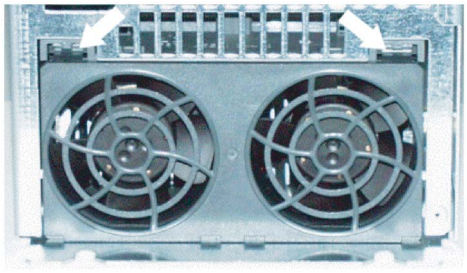


Figure 6-32 Position of the catches

4. Release and withdraw the connection plugs (1).
5. Release the catches (2) and remove the fan.

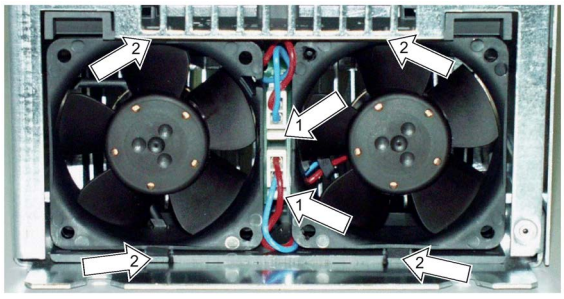



Figure 6-33 Position of the connection plugs (1) and catches (2)

| NOTICE |
| --- |
| **Damage to the device if signal cables are damaged when removing** |
| Signal cables can be damaged when the fan is removed. This can cause the device to fail.<br>• When removing the fan, ensure that you do not damage any signal cables. |

### Installing the fan

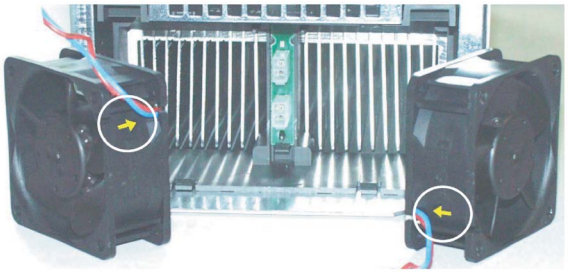


Figure 6-34 Fan installation, 150 ... 200 mm

1. Before installing the fan, note the direction of the airflow. The arrow on the fan must point toward the cooling ribs.
2. Push the fan into position until it is fully engaged. Take care not to crush the connecting cables.
3. Insert the connection plugs until they engage.
4. Attach the fan cover.

## Fan replacement for Motor Modules with a width of 300 mm (132 A)

### Removing the fan

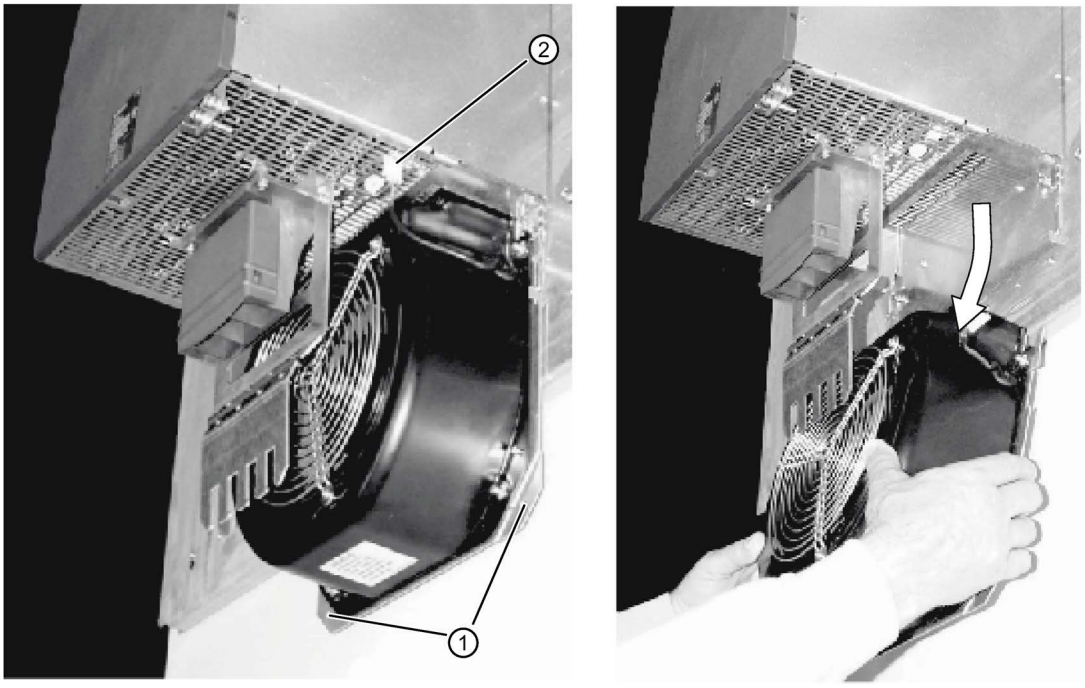



Figure 6-35 Fan removal, 300 mm

1. Loosen the M6 screws (1).
2. Disconnect the fan power supply (2).
3. You can now remove the fan.

| NOTICE |
| --- |
| **Damage to the device if signal cables are damaged when removing**<br>Signal cables can be damaged when the fan is removed. This can cause the device to fail.<br>• When removing the fan, ensure that you do not damage any signal cables. |

### Installing the fan

1. Insert the fan.
2. Secure the fan with the M6 screws, tightening torque: 6 Nm.
3. Connect the fan power supply (2).

### 6.4.13.2 Replacing the fan, frame sizes FB, GB and GD

**Replacing the fan**

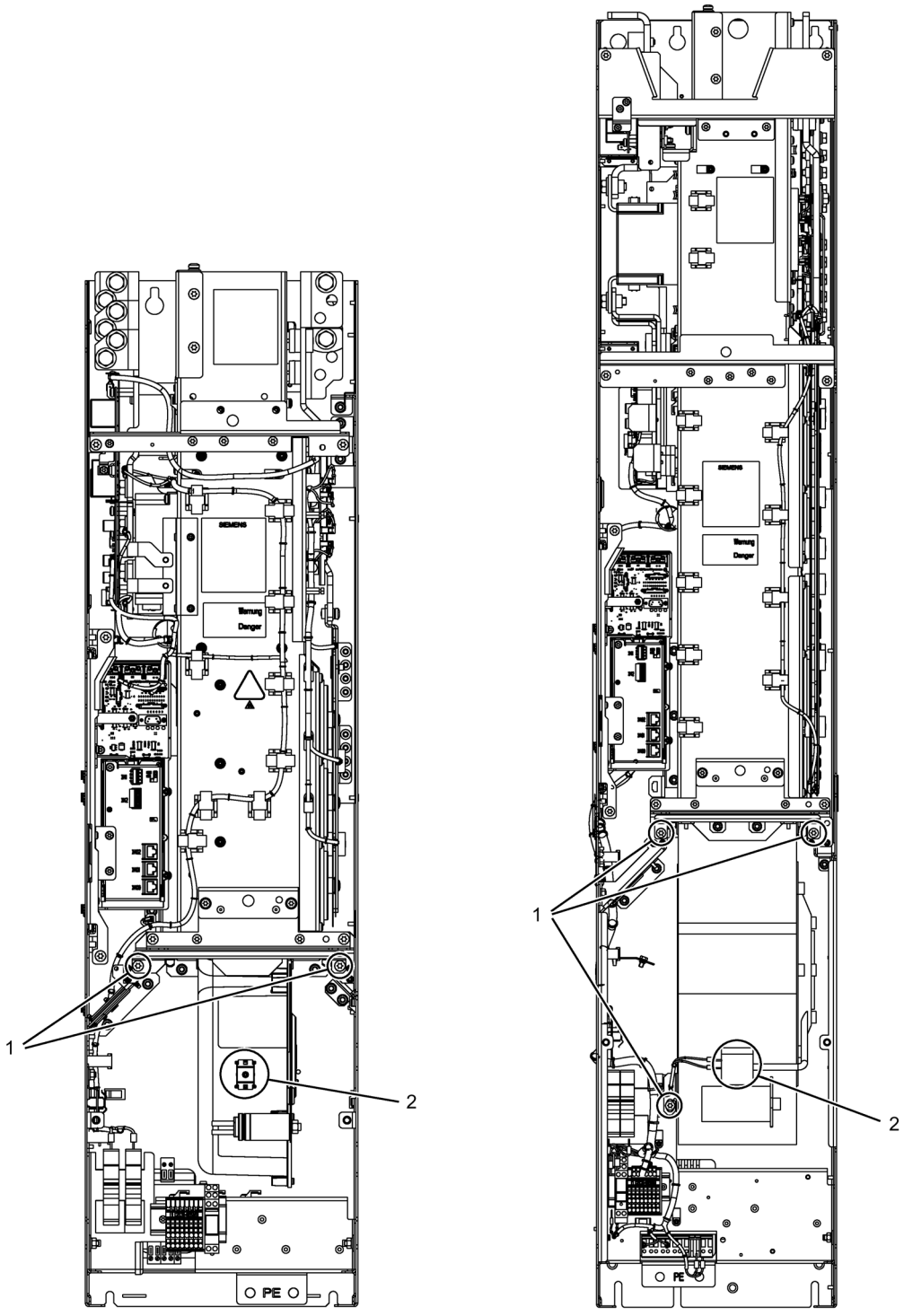



Figure 6-36 Replacing the fan, Basic Line Module, frame sizes FB, GB, and GD

## Description

The average service life of the device fans is approximately 50,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and, therefore, may deviate from this value.

The fans must be replaced in good time to ensure the availability of the Cabinet Module.

## 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

The removal steps are numbered in accordance with the figure above.

1. Remove the retaining screws for the fan
   (2 screws for frame size FB; 3 screws for frame sizes GB and GD).
2. Disconnect the supply cables (1 x "L", 1 x "N").

You can now carefully remove the fan.

| **NOTICE** |
| --- |
| **Damage to the device if signal cables are damaged when removing**<br>Signal cables can be damaged when the fan is removed. This can cause the device to fail.<br>• When removing the fan, ensure that you do not damage any signal cables. |

## Installation steps

Installing is the same as removing, however in the reverse order.

**Note**

**Pay attention to the tightening torques**

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

### 6.4.13.3 Replacing the fan, sizes FX and GX

#### Replacing the fan

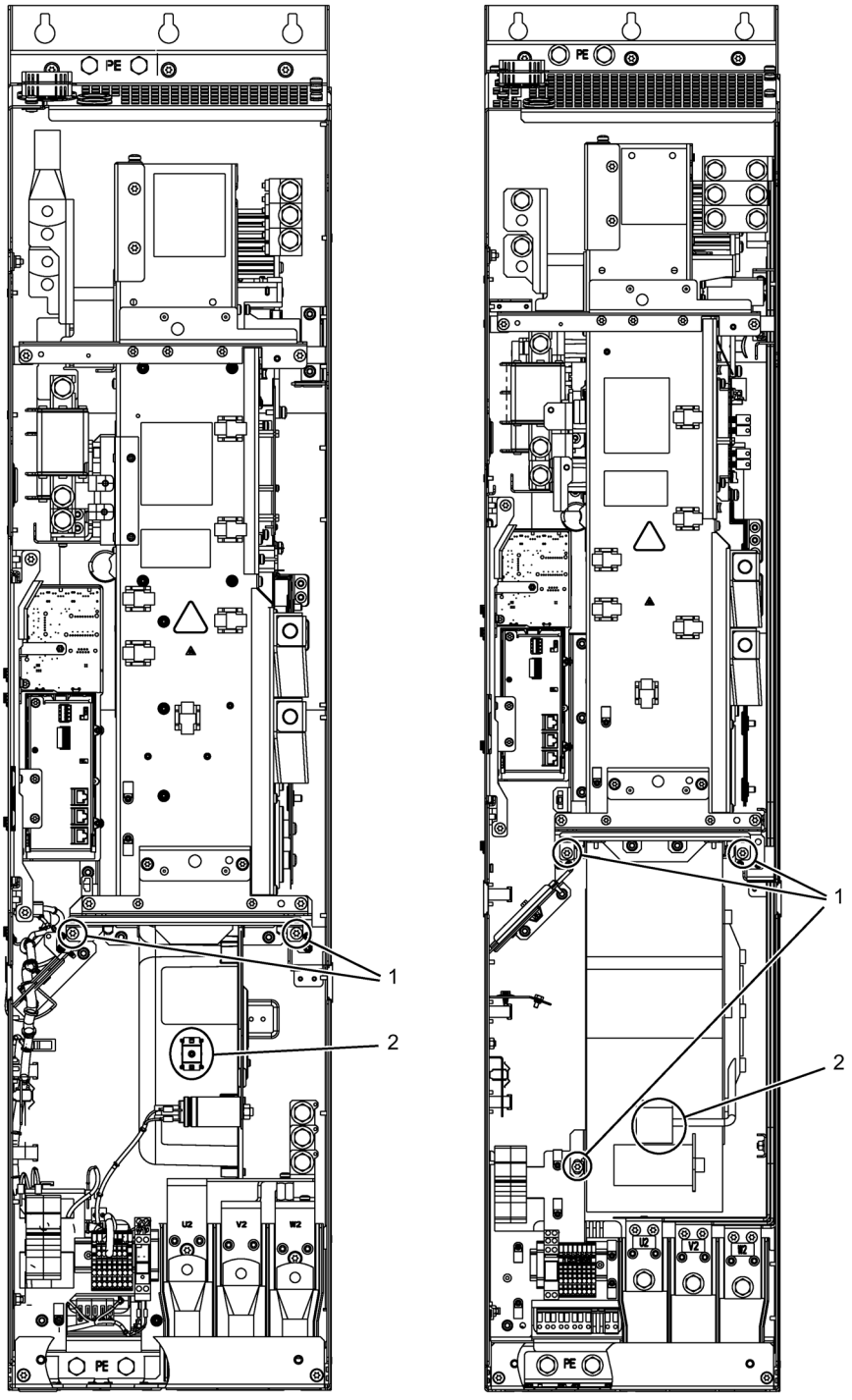



Figure 6-37 Replacing the fan, Smart Line Module, Active Line Module, and Motor Module, frame sizes FX and GX

### Description

The average service life of the device fans is approximately 50,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and, therefore, may deviate from this value.

The fans must be replaced in good time to ensure the availability of the Cabinet Module.

### 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

The removal steps are numbered in accordance with the figure above.

1. Remove the retaining screws for the fan
   (2 screws for frame size FX; 3 screws for frame size GX)
2. Disconnect the supply cables (1 x "L", 1 x "N").

You can now carefully remove the fan.

| **NOTICE** |
| --- |
| **Damage to the device if signal cables are damaged when removing**<br>Signal cables can be damaged when the fan is removed. This can cause the device to fail.<br>• When removing the fan, ensure that you do not damage any signal cables. |

### Installation steps

Installing is the same as removing, however in the reverse order.

**Note**

**Pay attention to the tightening torques**

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

### 6.4.13.4 Replacing the fan, size HX

#### Replacing the fan, left power block

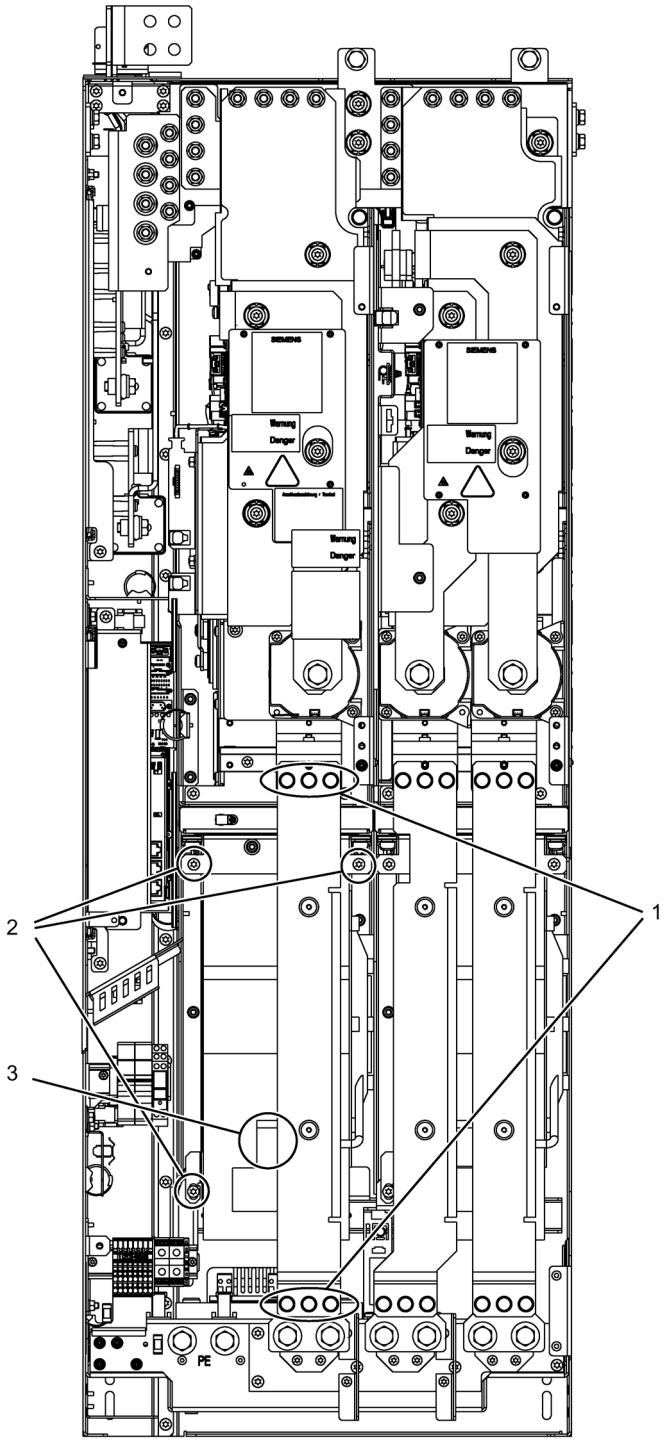



Figure 6-38 Replacing the fan, Active Line Module, Smart Line Module, and Motor Module, frame size HX - left power block

## Description

The average service life of the device fans is approximately 50,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and, therefore, may deviate from this value.

The fans must be replaced in good time to ensure the availability of the Cabinet Module.

## 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

The removal steps are numbered in accordance with the figure above.

1. Remove the busbar (6 screws).
2. Remove the retaining screws for the fan (3 screws).
3. Disconnect the supply cables (1 x "L", 1 x "N").

You can now carefully remove the fan.

| **NOTICE** |
| --- |
| **Damage to the device if signal cables are damaged when removing**<br>Signal cables can be damaged when the fan is removed. This can cause the device to fail.<br>• When removing the fan, ensure that you do not damage any signal cables. |

## Installation steps

Installing is the same as removing, however in the reverse order.

**Note**

**Pay attention to the tightening torques**

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

## Replacing the fan, right power block

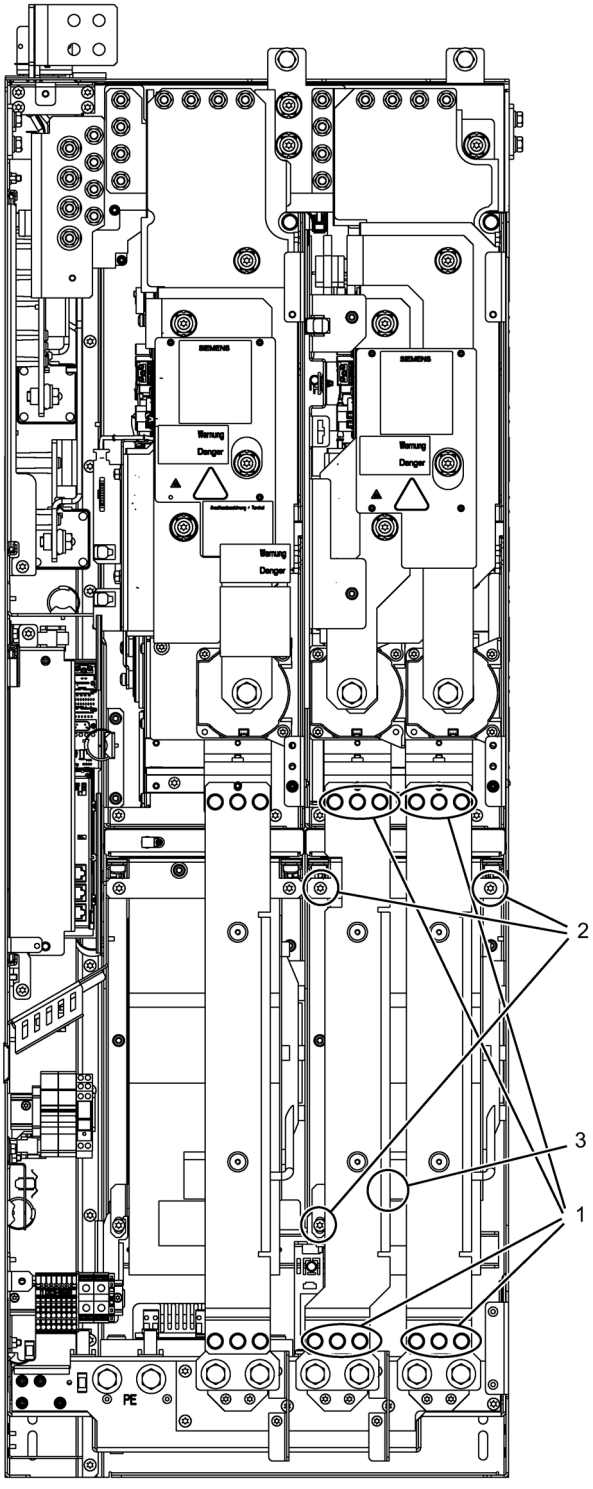



Figure 6-39 Replacing the fan, Active Line Module, Smart Line Module, and Motor Module, frame size HX - right power block

## Description

The average service life of the device fans is approximately 50,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and, therefore, may deviate from this value.

The fans must be replaced in good time to ensure the availability of the Cabinet Module.

## 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

The removal steps are numbered in accordance with the figure above.

1. Remove the busbars (12 screws).
2. Remove the retaining screws for the fan (3 screws).
3. Disconnect the supply cables (1 x "L", 1 x "N").

You can now carefully remove the fan.

| **NOTICE** |
| --- |
| **Damage to the device if signal cables are damaged when removing**<br>Signal cables can be damaged when the fan is removed. This can cause the device to fail.<br>• When removing the fan, ensure that you do not damage any signal cables. |

## Installation steps

Installing is the same as removing, however in the reverse order.

**Note**

**Pay attention to the tightening torques**

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

### 6.4.13.5 Replacing the fan, frame size JX

#### Replacing the fan

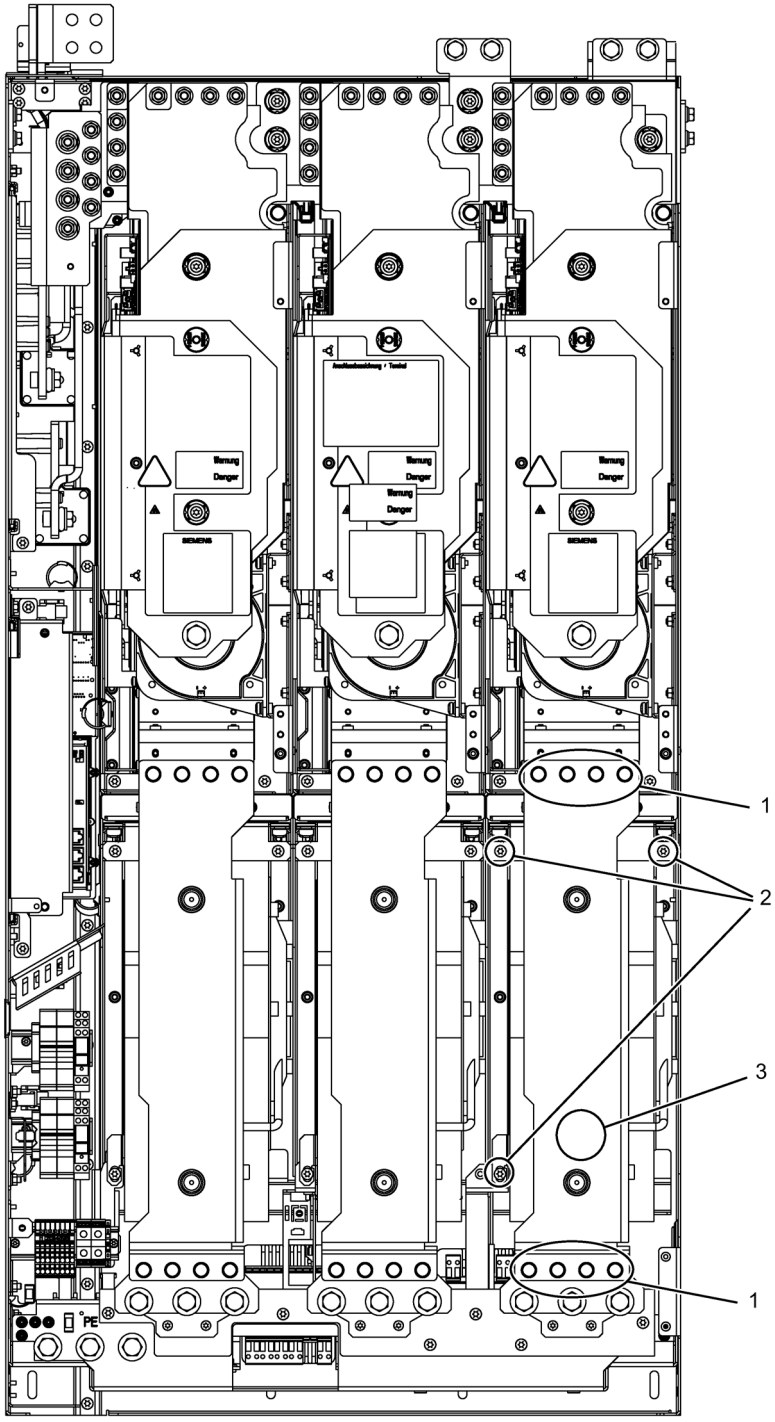



Figure 6-40 Replacing the fan, Active Line Module, Smart Line Module, and Motor Module, frame size JX

## Description

The average service life of the device fans is approximately 50,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and, therefore, may deviate from this value.

The fans must be replaced in good time to ensure the availability of the Cabinet Module.

## 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

The removal steps are numbered in accordance with the figure above.

1. Remove the busbar (8 screws).
2. Remove the retaining screws for the fan (3 screws).
3. Disconnect the supply cables (1 x "L", 1 x "N").

You can now carefully remove the fan.

| **NOTICE** |
| --- |
| **Damage to the device if signal cables are damaged when removing**<br>Signal cables can be damaged when the fan is removed. This can cause the device to fail.<br>• When removing the fan, ensure that you do not damage any signal cables. |

## Installation steps

Installing is the same as removing, however in the reverse order.

**Note**

**Pay attention to the tightening torques**

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

### 6.4.13.6 Replacing the fan, frame sizes FS2, FS2+, FS4 and FS4+

**Replacing the fan**

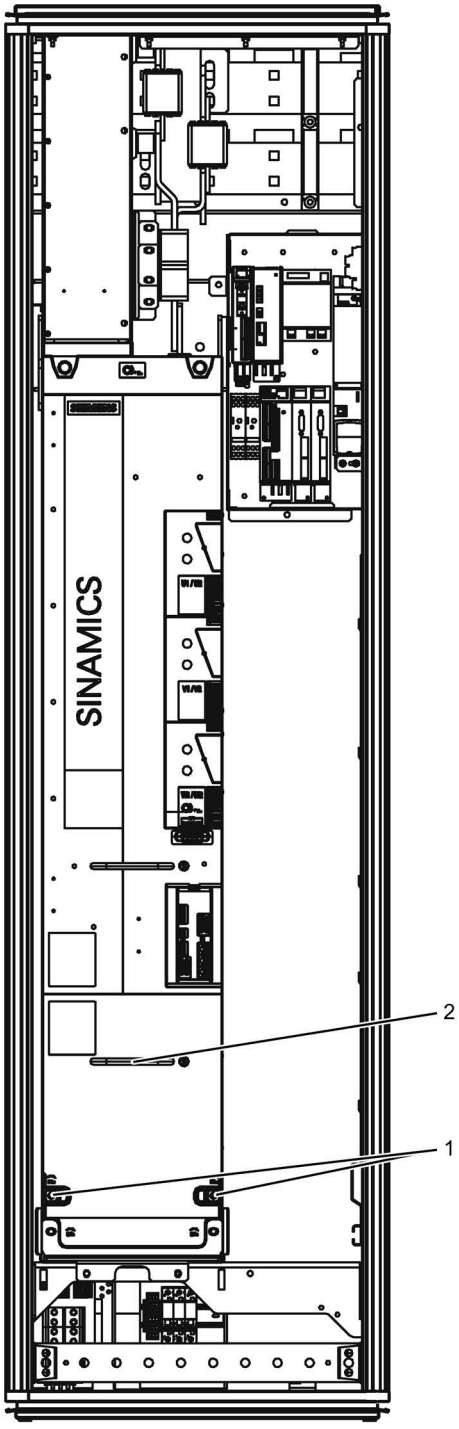



Figure 6-41 Replacing the fan, Active Line Module and Motor Module Chassis-2, frame size FS2, FS2+, FS4 and FS4+

## Description

The fan does not operate continuously, but only when required; it is monitored in operation.

The expected remaining operating time of the fan can be read-out from parameter p0277 "Heat sink fan wear counter" as a percentage of the service life.

500 hours before reaching the maximum operating duration, Alarm A30042 "Power unit: Fan has reached the maximum operating hours" indicated with alarm value "0" in r2124.

When reaching 99 % of the maximum operating duration, Alarm A30042 is output with alarm value "1" in r2124.

When reaching the maximum operating duration, Alarm A30042 is output with alarm value "2" in r2124.

If the fan no longer operates correctly, then this is signaled using Alarm A30048 "Power unit: Fan defective" with alarm value "0" is indicated in r2124.
If the fan does not correctly operate within 10 seconds after powering up after the pulses have been enabled, then fault F30058 "Power Unit: Heat sink fan defective" is displayed and shut down with OFF2.

The fan must be replaced in good time to ensure that the device is available.

## 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

The removal steps are numbered in accordance with the numbers in the diagram.

1. Remove the fastening screws for the fan assembly (2 screws)
2. Completely remove the fan assembly from the device. The power supply automatically disengages when withdrawing.

| NOTICE |
| --- |
| **Secure the fan assembly so that cannot topple over**<br>When withdrawing the fan assembly, the module housing or the plug connector can be damaged if the module is not secured to prevent it toppling over.<br>• Carefully withdraw the fan assembly and secure it so that it cannot topple over. |

## Installation steps

**NOTICE**

**Checking the new fan assembly contacts for any damage**

A damaged plug connection at the new fan assembly can damage the mating contacts when the module is inserted into the housing.

- Before inserting it, check the plug connection at the new fan assembly for any damage.

**Note**

**Sealing surface at the upper side of the new fan assembly**

When mounting, ensure that the seal on the upper side of the new fan assembly is in a good condition.

Installing is the same as removing, however in the reverse order. The power supply automatically engages when inserting.

The tightening torque of the fixing screws for the fan assembly is 10 Nm.

### 6.4.13.7 Replacing the electronic fan, frame sizes FS2, FS2+, FS4 and FS4+

**Replacing the electronic fan**

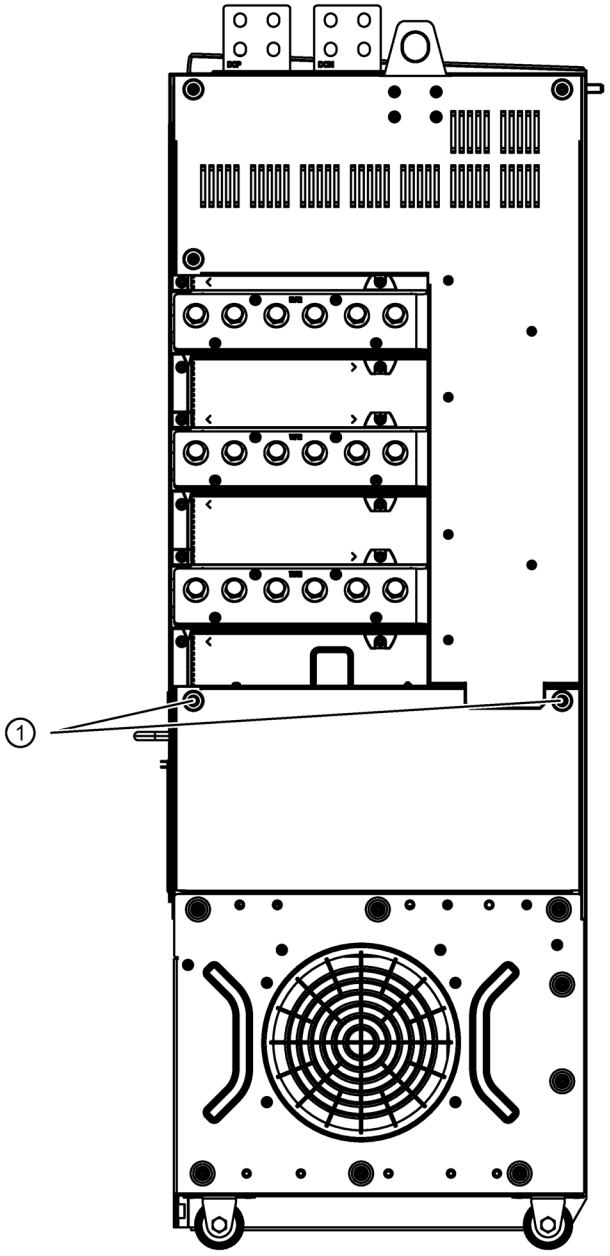



Figure 6-42 Replacing the electronic fan, frame sizes FS2, FS2+, FS4 and FS4+, Part 1

**Replacing the electronic fan, Active Line Modules and Motor Module Chassis-2, frame sizes FS2, FS2+, FS4**

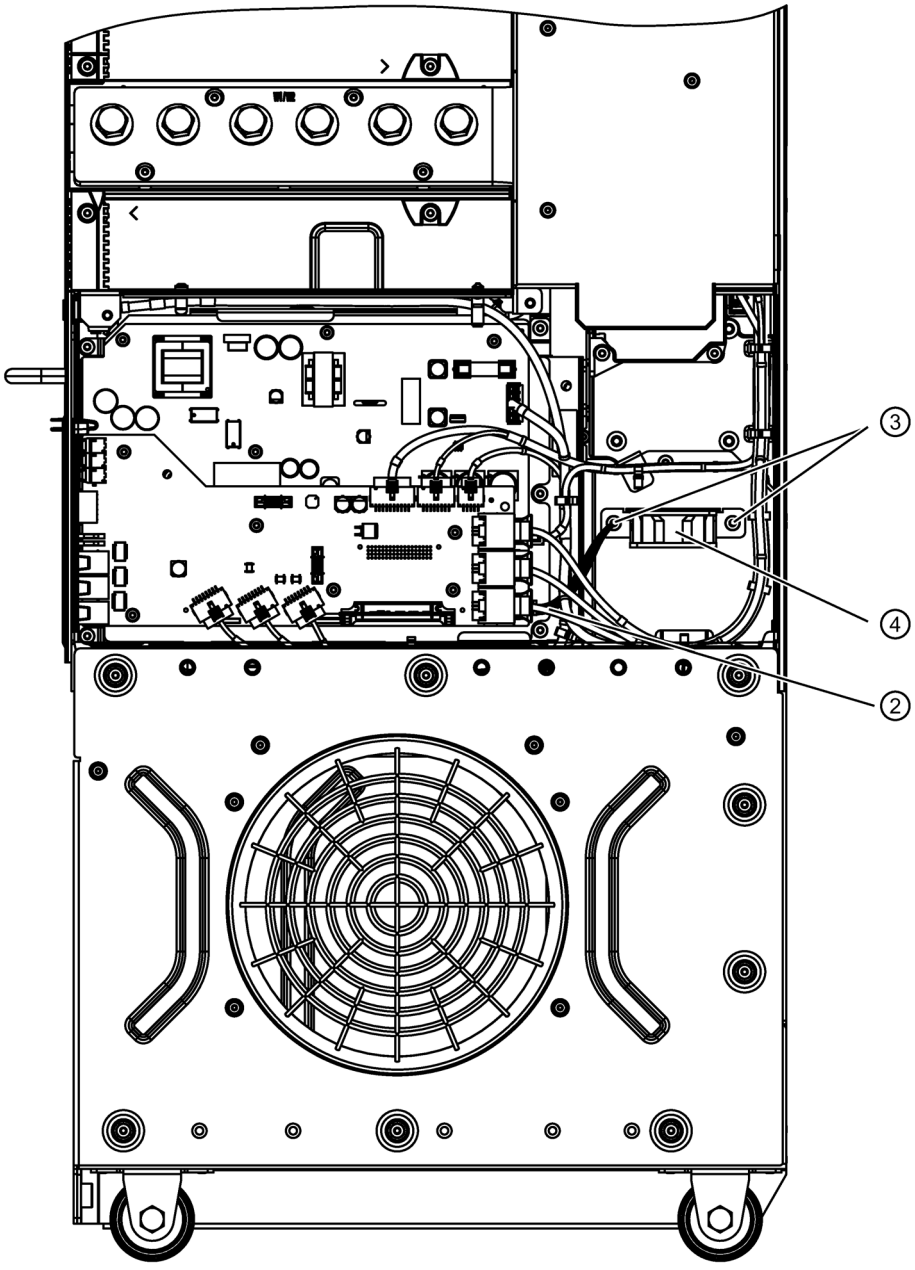



Figure 6-43 Replacing the electronic fan, frame sizes FS2, FS2+ and FS4, Part 2

**Replacing the electronic fan, Active Line Modules and Motor Module Chassis-2, frame size FS4+**

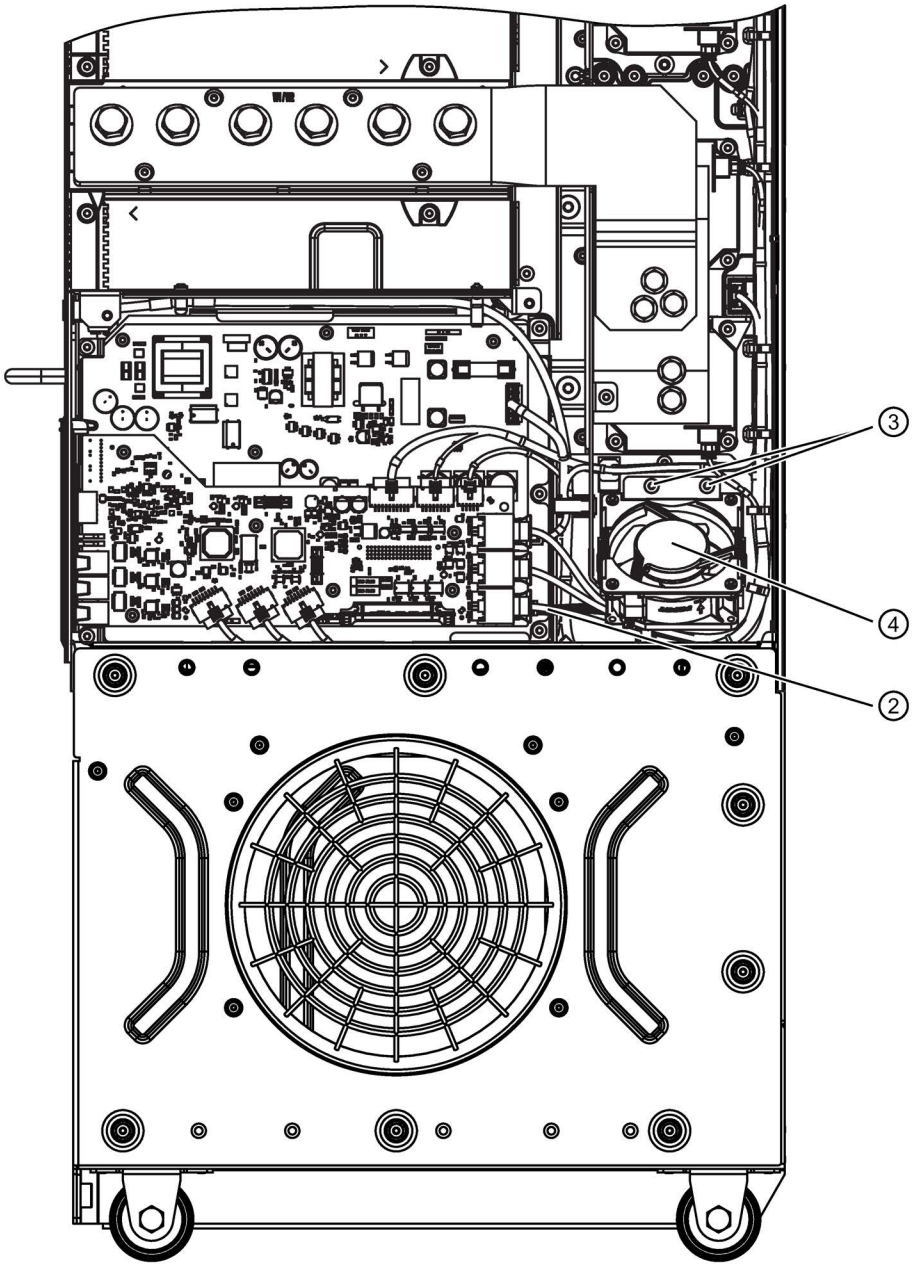



Figure 6-44 Replacing the electronic fan, frame size FS4+, Part 2

## Description

The service life of the electronic fan is designed for the typical service life of the device itself - it doesn't operate continuously, but only when required. The electronic fan is monitored in operation.

If the fan no longer operates correctly, then this is signaled using Alarm A30048 "Power unit: Fan defective" with alarm value "1" in r2124.
If, with Alarm A30048 active, the measured air intake temperature indicated in r0037[3] violates an appropriate threshold, then fault F30059 "Power unit: Interior fan defective" is displayed, and the system is shut down with OFF2.

## Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access.
- Removing the device from the control cabinet is described in Chapter "Replacing Chassis-2 format devices (Page 410)".
- While removing the device from the control cabinet, it must be secured so that it can neither topple over nor roll away.

## Removal steps

The removal step numbering corresponds to the numbers in the diagrams.

1. Open the service flap for the Control Interface Module (2 screws).
2. Withdraw the plug connector for the electronic fan the power supply.
3. Release the fastening screws for the electronic fan (2 screws).
4. Remove the electronic fan.

## Installation steps

Installing is the same as removing, however in the reverse order.

Tightening torque for the fastening screws of the electronic fan (M6 x 16, item ③): 6 Nm.

**Note**

**Pay attention to the tightening torques**

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

### 6.4.13.8 Replacing the fan, frame size FI

#### Replacing the fan

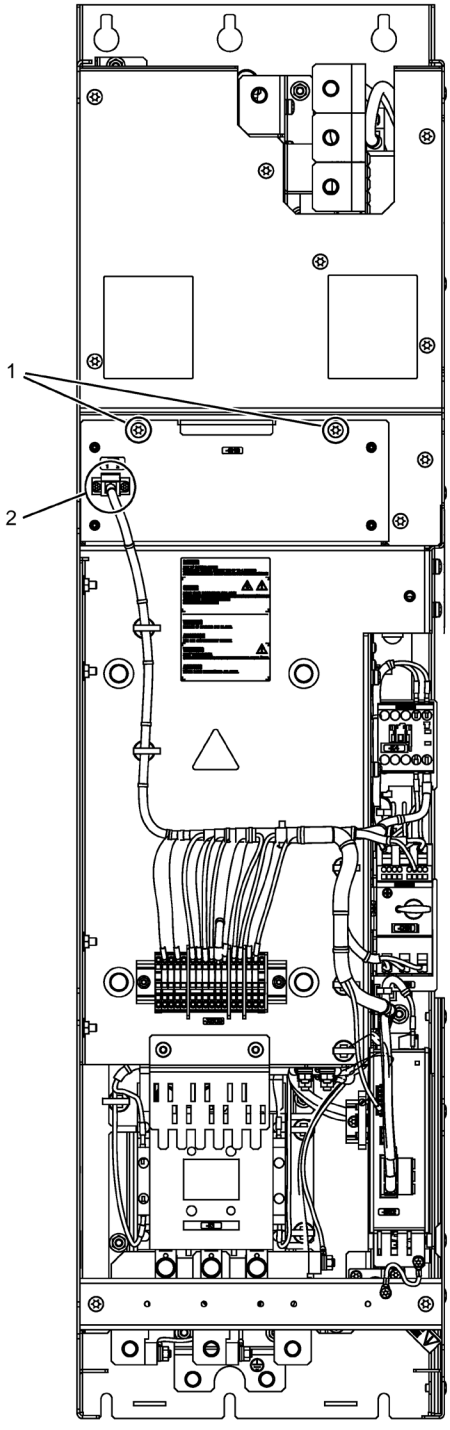



Figure 6-45 Replacing the fan, Active Interface Module, frame size FI

## Description

The average service life of the device fans is approximately 50,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and, therefore, may deviate from this value.

The fans must be replaced in good time to ensure the availability of the Cabinet Module.

## 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

The removal steps are numbered in accordance with the figure above.

1. Remove the retaining screws for the fan unit (2 screws).
2. Unplug connector -X630.

You can now carefully remove the fan.

| **NOTICE** |
| --- |
| **Damage to the device if signal cables are damaged when removing**<br>Signal cables can be damaged when the fan is removed. This can cause the device to fail.<br>• When removing the fan, ensure that you do not damage any signal cables. |

## Installation steps

Installing is the same as removing, however in the reverse order.

**Note**

**Pay attention to the tightening torques**

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

### 6.4.13.9 Replacing the fan, frame size GI

#### Replacing the fan

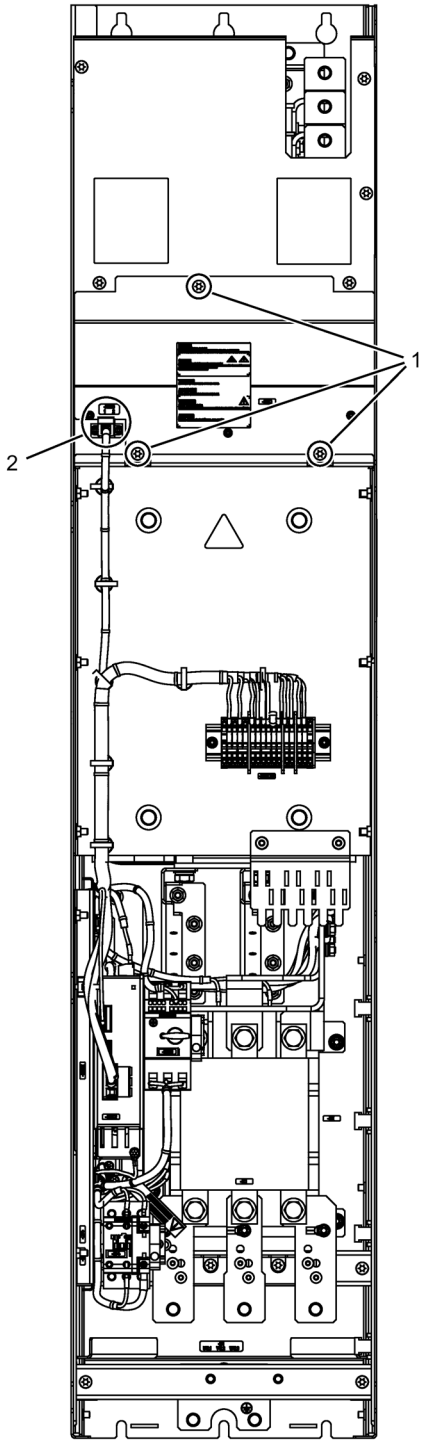



Figure 6-46 Replacing the fan, Active Interface Module, frame size GI

## Description

The average service life of the device fans is approximately 50,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and, therefore, may deviate from this value.

The fans must be replaced in good time to ensure the availability of the Cabinet Module.

## 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

The removal steps are numbered in accordance with the figure above.

1. Remove the retaining screws for the fan unit (3 screws).
2. Unplug connector -X630.

You can now carefully remove the fan.

| **NOTICE** |
| --- |
| **Damage to the device if signal cables are damaged when removing**<br>Signal cables can be damaged when the fan is removed. This can cause the device to fail.<br>• When removing the fan, ensure that you do not damage any signal cables. |

## Installation steps

Installing is the same as removing, however in the reverse order.

**Note**

**Pay attention to the tightening torques**

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

### 6.4.13.10 Replacing the fan, frame size HI

#### Replacing the fan

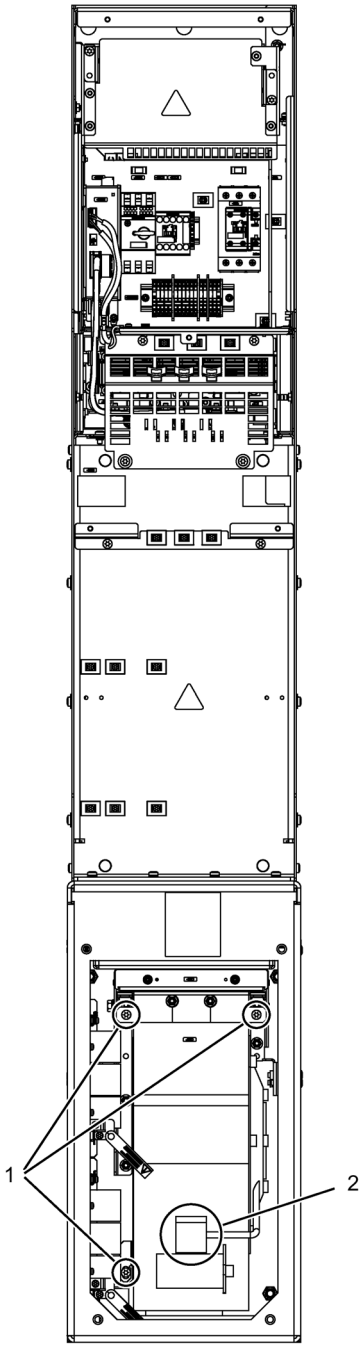



Figure 6-47 Replacing the fan, Active Interface Module, frame size HI

## Description

The average service life of the device fans is approximately 50,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and, therefore, may deviate from this value.

The fans must be replaced in good time to ensure the availability of the Cabinet Module.

## 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

The removal steps are numbered in accordance with the figure above.

1. Remove the retaining screws for the fan unit (3 screws).
2. Disconnect the supply cable (1 x "L", 1 x "N").

You can now carefully remove the fan.

| **NOTICE** |
| --- |
| **Damage to the device if signal cables are damaged when removing**<br>Signal cables can be damaged when the fan is removed. This can cause the device to fail.<br>• When removing the fan, ensure that you do not damage any signal cables. |

## Installation steps

Installing is the same as removing, however in the reverse order.

**Note**

**Pay attention to the tightening torques**

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

### 6.4.13.11 Replacing the fan, frame size JI

## Replacing the fan

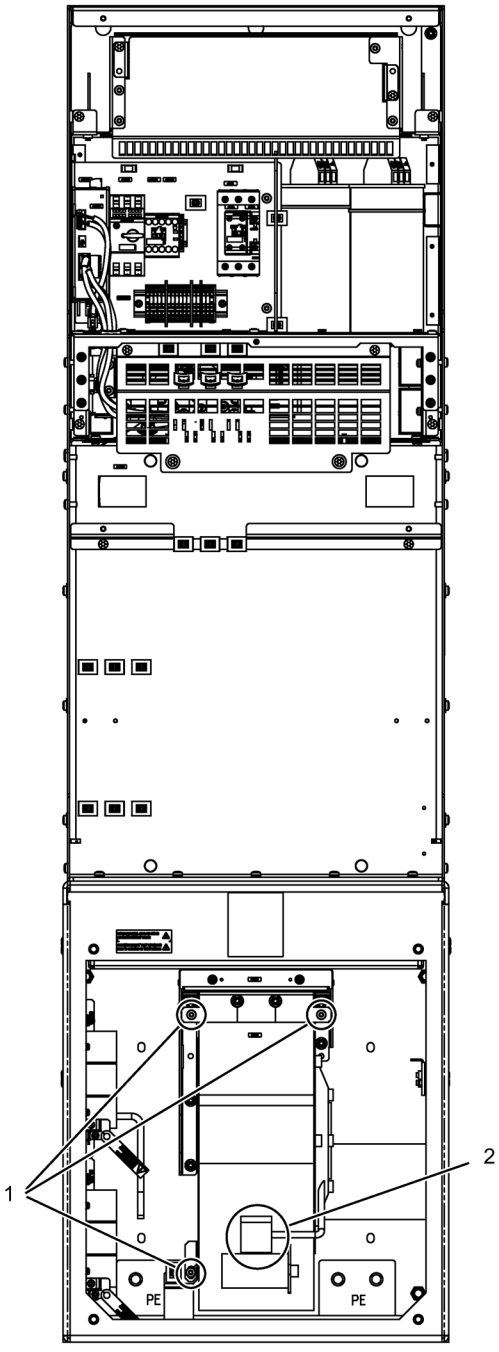



Figure 6-48 Replacing the fan, Active Interface Module, frame size JI

## Description

The average service life of the device fans is approximately 50,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and, therefore, may deviate from this value.

The fans must be replaced in good time to ensure the availability of the Cabinet Module.

## 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

The removal steps are numbered in accordance with the figure above.

1. Remove the retaining screws for the fan unit (3 screws).
2. Disconnect the supply cable (1 x "L", 1 x "N").

You can now carefully remove the fan.

| **NOTICE** |
| --- |
| **Damage to the device if signal cables are damaged when removing**<br>Signal cables can be damaged when the fan is removed. This can cause the device to fail.<br>• When removing the fan, ensure that you do not damage any signal cables. |

## Installation steps

Installing is the same as removing, however in the reverse order.

**Note**

**Pay attention to the tightening torques**

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

### 6.4.13.12 Replacing the fan in the Active Interface Module Chassis-2

**Replacing the fan**

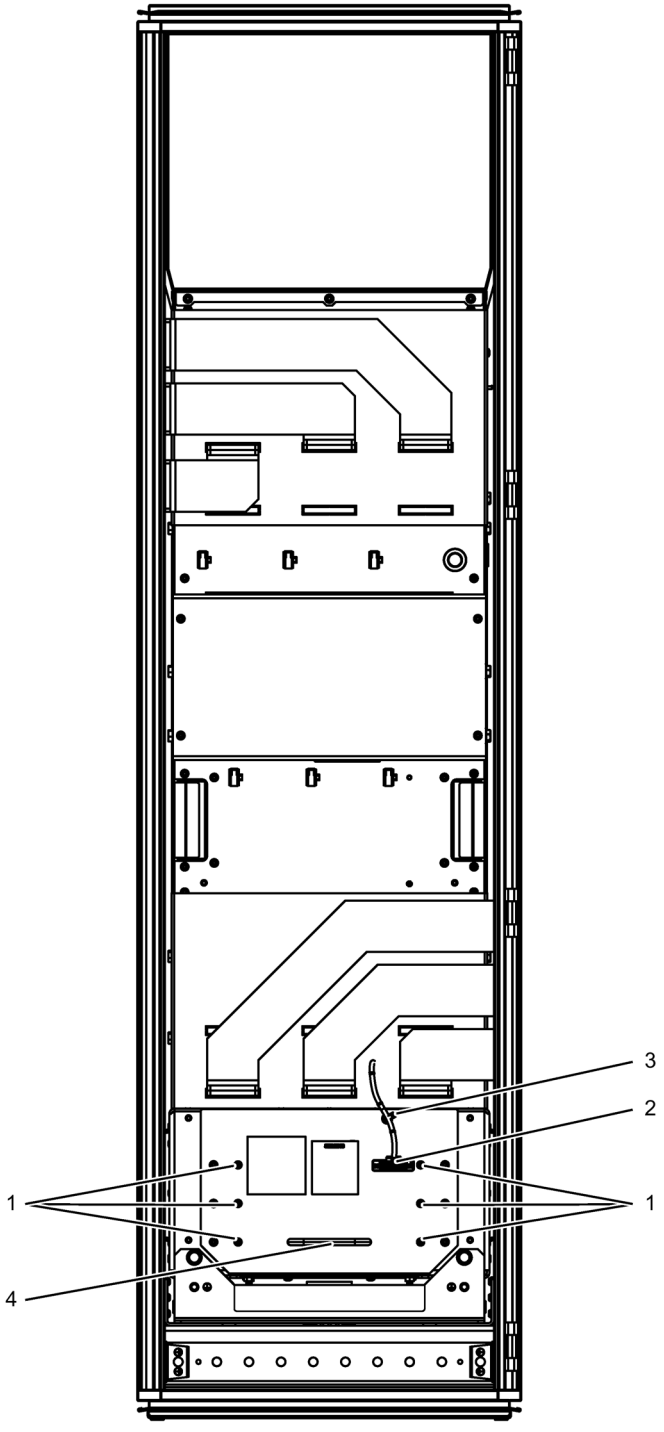



Figure 6-49 Replacing the fan, Active Interface Module Chassis-2

### Description

The typical service life of the device fan is 40,000 hours. In practice, however, the service life depends on other variables (e.g. ambient temperature, degree of cabinet protection, etc.) and may therefore deviate from this value.

The fan must be replaced in good time to ensure that the device is available.

### 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

The removal steps are numbered in accordance with the numbers in the diagram.

1. Remove the fastening screws for the fan assembly (6 screws).
2. Release the connector for the fan supply and remove it.
3. Release the cable from the cable holder.
4. Completely remove the fan assembly from the device.

### Installation steps

Installing is the same as removing, however in the reverse order.

The tightening torque of the fixing screws for the fan assembly is 10 Nm.

The tightening torque for the holding screws of the fan power supply connector is 0.5 ... 0.6 Nm.

## 6.4.14 Replacing the fuses

### Replacement fuses

Article numbers for replacing fuses that have blown are contained in the spare parts list.

### 6.4.14.1 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.

### 6.4.14.2 Replacing the fuses in the auxiliary power supply module

### Fuse in the auxiliary power supply module

A 10 A-fuse is incorporated in the auxiliary power supply modules to protect the 24 V DC auxiliary voltage. If a replacement part is required, this can be ordered, specifying Article number 6SL3760-0BG00-0AA0.

Fuse type: TAC ATO flat plug-in fuse according to DIN 72581-3, UL 248 Special Purpose Fuses, 10 A, 58 V, manufacturer: Littlefuse

**Note**

The fuses for the auxiliary power supply are freely accessible and can be replaced once the fault cause has been eliminated.

### 6.4.14.3 Replacing fuses (F71 to F73)

Fuses F71 to F73 are included in the Line Connection Modules and Active Line Connection Modules-2.

#### 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 Line Connection Modules and Active Line Connection Modules-2 with a rated current of < 800 A, the fuses are freely accessible and can be replaced once the fault cause has been eliminated.

**Note**

For Line Connection Modules and Active Line Connection Modules-2 with a rated current of between 800 A to 1600 A, the removal procedures described below must be very carefully followed to replace the 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.

### 6.4.14.4 Replacing fuses in the fuse switch disconnector for Booksize Cabinet Kit

#### Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).

#### Replacing

1. If option L37 is present, switch off the relevant DC interface in the door.
2. Open the door.
3. Open the fuse switch disconnector.
4. Remove the fuse link.
5. Replace the defective fuses.
6. Complete the procedure by carrying out the above actions in reverse order.

### 6.4.14.5 Replacing the DC fuses for chassis format

#### Replacing the DC fuses for Smart Line Module, Active Line Module, and Motor Module, frame sizes FX and GX

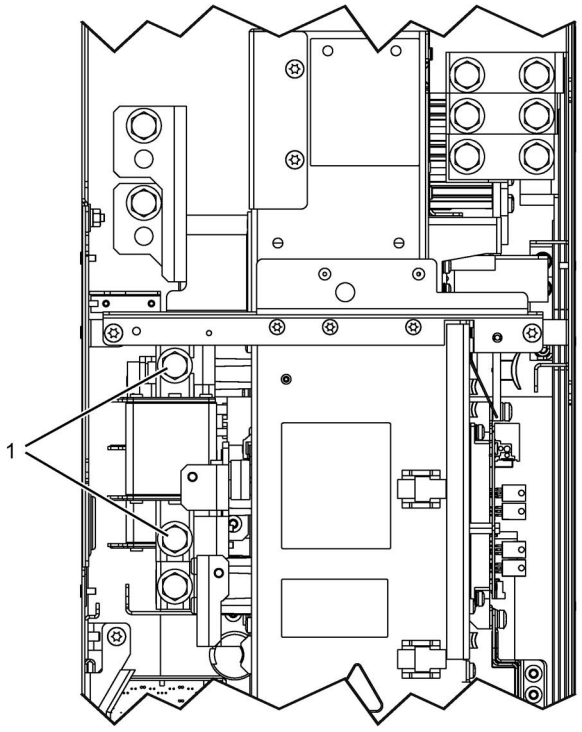



Figure 6-50 Replacing the DC fuses, frame sizes FX and GX

### Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access.

### Replacing the front fuse

1. Unscrew and remove the screws and nuts (1) from the front DC fuse.
2. Remove the DC fuse.

### Replacing the back fuse

1. Unscrew and remove the screws and nuts from the front DC fuse (1).
2. Remove the front DC fuse.
3. Unscrew and remove the screws and nuts from the rear DC fuse, which can now be accessed.
4. Remove the rear DC fuse.

| **NOTICE** |
| --- |
| **Device failure after a DC fuse trips**<br>The neighboring DC fuses may also become damaged if a DC fuse trips. Failure to replace all fuses at the same time can cause the device to fail.<br>• After a DC fuse trips, always replace all DC fuses at the same time. Always use fuses of the same type. |

**Note**

**Replacing a complete power unit**

If you order a complete power unit as a replacement, make sure that DC fuses are always used. If the Option L37 (DC interface including precharging input circuit) is installed in your cabinet, the DC fuses of the replacement part must be replaced with the copper lugs of the existing power unit.

## Replacing the DC fuses for Smart Line Module, Active Line Module, and Motor Module, frame sizes HX and JX

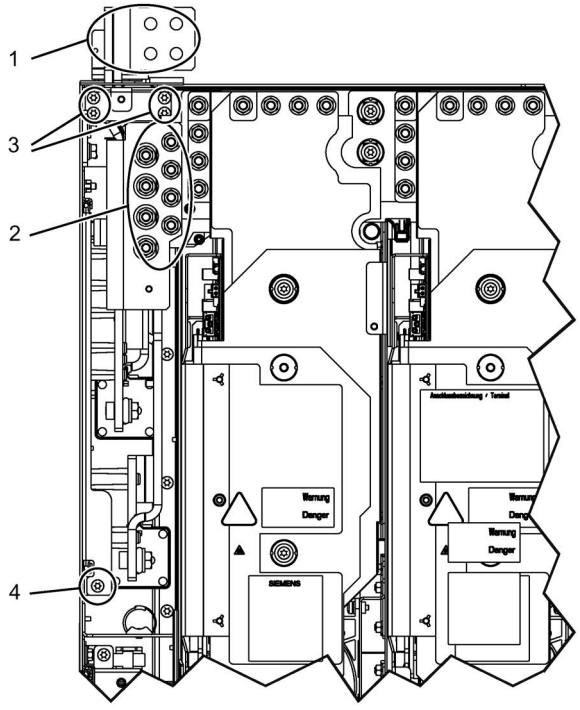



Figure 6-51 Replacing the DC fuses, frame sizes HX and JX

### Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access.

| NOTICE |
| --- |
| **Device failure after a DC fuse trips**<br>The neighboring DC fuses may also become damaged if a DC fuse trips. Failure to replace all fuses at the same time can cause the device to fail.<br>• After a DC fuse trips, always replace all DC fuses at the same time. Always use fuses of the same type. |

**Note**

**Replacing a complete power unit**

If you order a complete power unit as a replacement, make sure that DC fuses are always used. If the option L37 (DC interface including precharging input circuit) is installed in your cabinet, the DC fuses of the replacement part must be replaced with the copper lugs of the existing power unit.

### Removal steps

1. Release the DC connections at DCP and DCN (4 screws each).
2. Remove nuts (8 screws).
3. Remove the retaining screws for the connection plate of the housing (4 screws) and remove the connection plate.
4. Remove the retaining screws for the fuse insert (1 screw).

You can now remove the fuse insert.

| **NOTICE** |
| --- |
| **Damage to the device if signal cables or plastic parts are damaged when removing**<br>Signal cables or plastic parts can be damaged when the fuse insert is removed. This can cause the device to fail.<br>• When removing the fuse insert, ensure that you do not damage any signal cables or plastic parts. |

You can then replace the DC fuses.

### Installation steps

Installing is the same as removing, however in the reverse order.

**Note**

**Pay attention to the tightening torques**

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

### 6.4.14.6 Replacing the DC fuses for the Chassis-2 format

#### Replacing the DC fuses for the Motor Module, Chassis-2 format

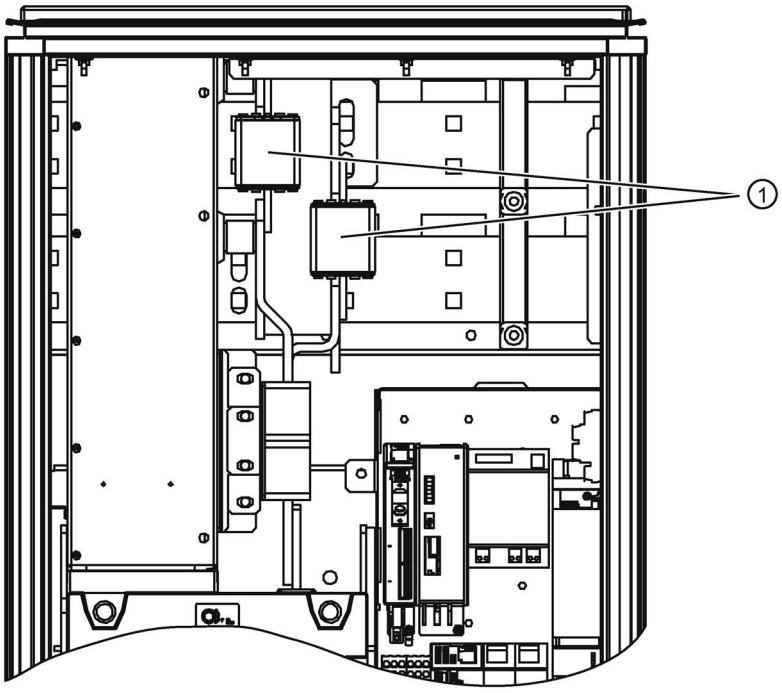



Figure 6-52 Replacing the DC fuses, Chassis-2 format

#### Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access.

#### Removing the DC fuses

1. Release the screws and nuts at the DC fuses (①) and remove.
2. Remove the DC fuses.

| NOTICE |
| --- |
| **Device failure after a DC fuse trips**<br>The neighboring DC fuses may also become damaged if a DC fuse trips. Failure to replace all fuses at the same time can cause the device to fail.<br>• After a DC fuse trips, always replace all DC fuses at the same time. Always use fuses of the same type. |

### Installation steps

Installing is the same as removing, however in the reverse order.

**Note**

**Pay attention to the tightening torques**

The tightening torques specified in the table "Tightening torques for screw connections" must be observed.

## 6.4.14.7 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.

### 6.4.14.8 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 6-53 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 6-54 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.

## 6.4.15 Replacing the DC interface (option L37)

### Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Allow unimpeded access (Motor Module);
  (if no Control Unit is present, the plate can simply be unscrewed and turned to one side).

### Removal

1. Switch off the relevant DC interface in the door.
2. Open the cabinet.
3. Open the fuse switch disconnector and remove the fuse link.
4. Remove the infeed cable to the Motor Module at the contactor.
5. Detach the motor plug or disconnect and insulate the motor cables.
6. Open the cover for the Motor Module.
7. Remove the 24 VDC connector and insulate the contact surfaces so that they cannot be touched.
8. Remove the cable (2 -T1) at the contactor.
9. Remove the screws on the DC rectifier adapter.
10. Remove the connector (-X37).
11. Remove the cable ties on the cable to the DC rectifier adapter.
12. Remove the lower screws (up to 3) on the support plate for the pre-charger.
13. Remove the upper screws (up to 3) on the support plate for the pre-charger.

**Note**

**Secure the pre-charger**

The pre-charger is only secured by the upper and lower screws, which means that it must be supported when you remove the final screws!

14. Carefully remove the support plate for the pre-charger and the DC rectifier adapter.

### Installation

Installing is the same as removing, however in the reverse order.

**Note**
**Use new cable ties**

Use new cable ties to secure the cable to the DC rectifier adapter.

## 6.4.16 Replacing the pre-charging resistors of the DC interface (option L37)

### Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).

### Removal

1. Remove the DC interface (see Section "Replacing the DC interface").
2. Remove the fastening screws for the pre-charging resistors.
3. Remove the resistors.

### Installation

1. Insert the new resistors.
2. Tighten the fastening screws of the pre-charging resistors.
3. Re-install the DC interface.

## 6.4.17 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

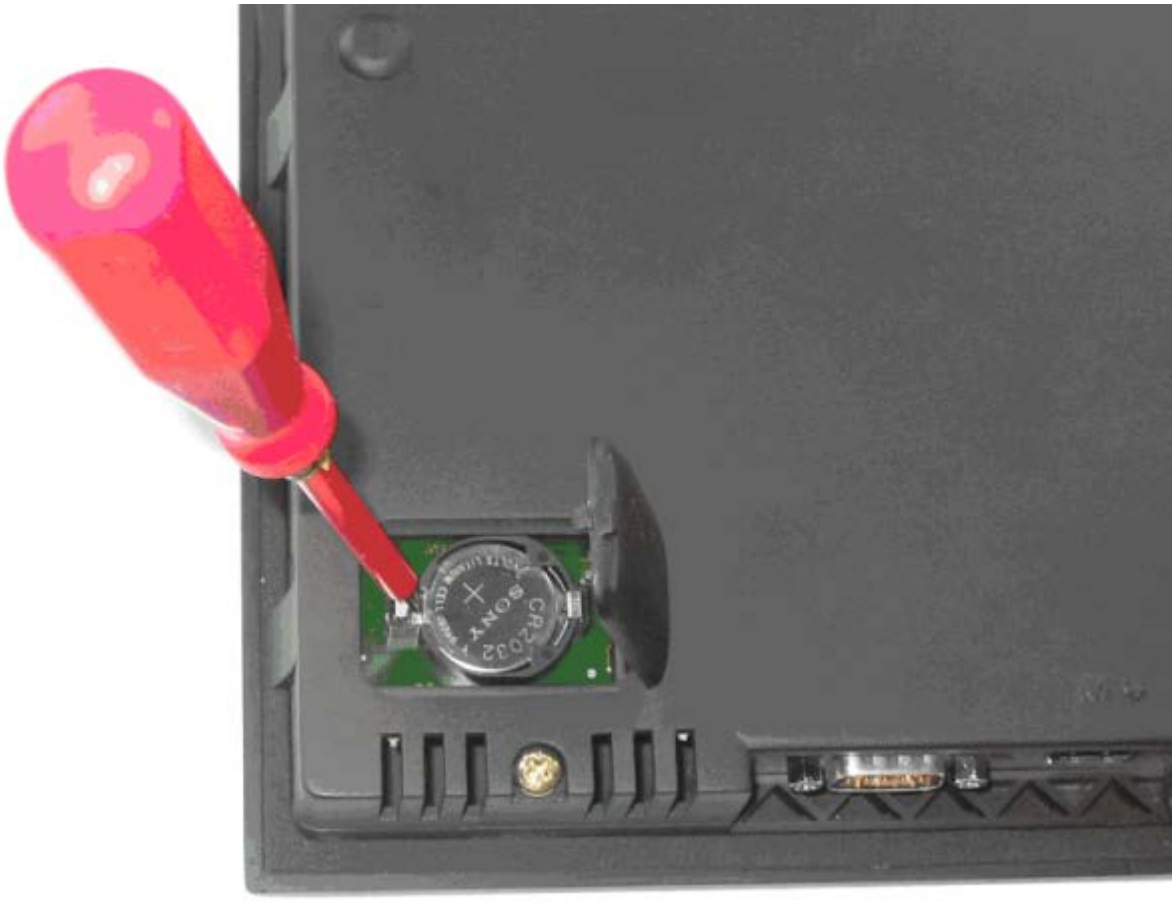



Figure 6-55 Replacing the backup battery

### 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 6- 2 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.

# 6.5 Long time storage of replacement parts

## 6.5.1 Storing fans for devices in the Chassis-2 format

When replacement fans are stored, the fan bearings are subject to an aging process. This can result in a higher level of wear and in turn, premature fan failure.

For replacement fans for Active Interface Module, Active Line Module and Motor Module in the Chassis-2 format, the following constraints must be taken into consideration.

### Storing fans for Active Line Module and Motor Module in the Chassis-2 format

To ensure proper operation and the longest possible service life, we recommend that you do not store the device for more than one year.

### Storing electronic fans for Active Line Modules and Motor Modules in the Chassis-2 format

If stored for longer periods of time, the fan should be operated for approximately 15 minutes every year in order to move the motor bearings.

### Storing fans for Active Interface Modules in the Chassis-2 format

Avoid excessively long storage times; we recommend a maximum one year (for longer periods of time, contact the manufacturer before commissioning).

- Before installing, carefully check the motor bearings to ensure that they function correctly.
- Recommendation: Regularly rotate the fan impeller to prevent it from seizing up and damaging the bearings.

# 6.6 Forming the DC link capacitors

## Description

If the Basic Line Modules, Smart Line Modules, Active Line Modules, and Motor Modules have not been used for more than two years, the DC link capacitors must be reformed. If this is not carried out, the units could be damaged 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 nameplate.

**Note**

**Storage period**

It is important that the storage period is calculated from the date of manufacture and not from the date that the equipment was shipped.

## Nameplate

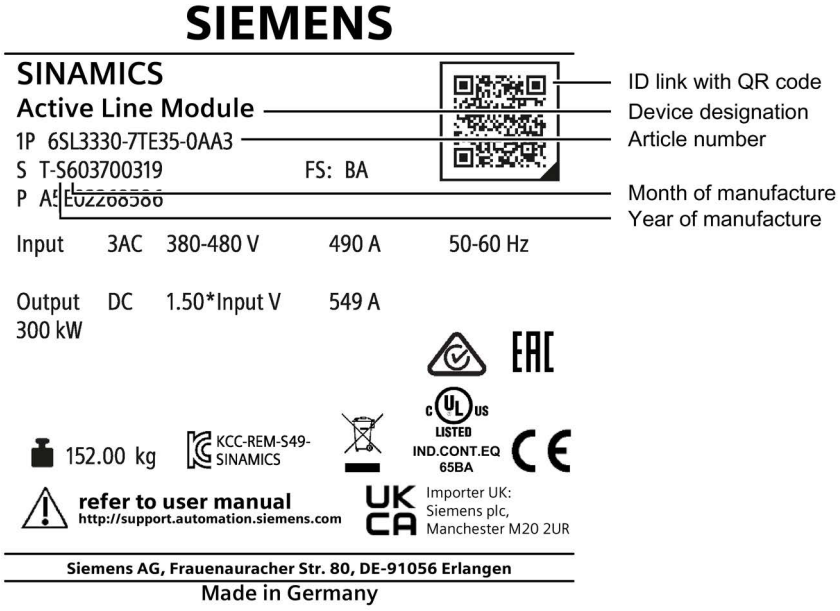



Figure 6-56 Nameplate using an Active Line Module as example

## Date of manufacture

The date of manufacture can be determined as follows:

Table 6- 3 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 or the corresponding replacement power block has to be re-formed after being in storage for a period of more than two years.

The DC link capacitors are 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.

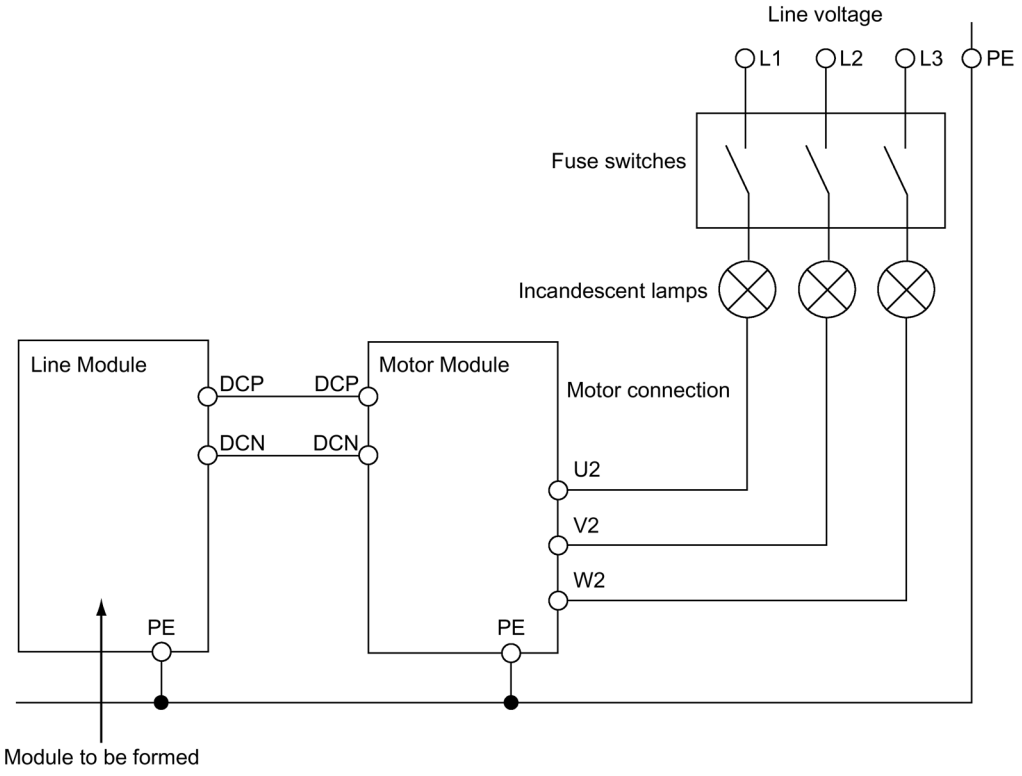



Figure 6-57 Forming circuit for Line Modules

**Forming circuit for Motor Modules**

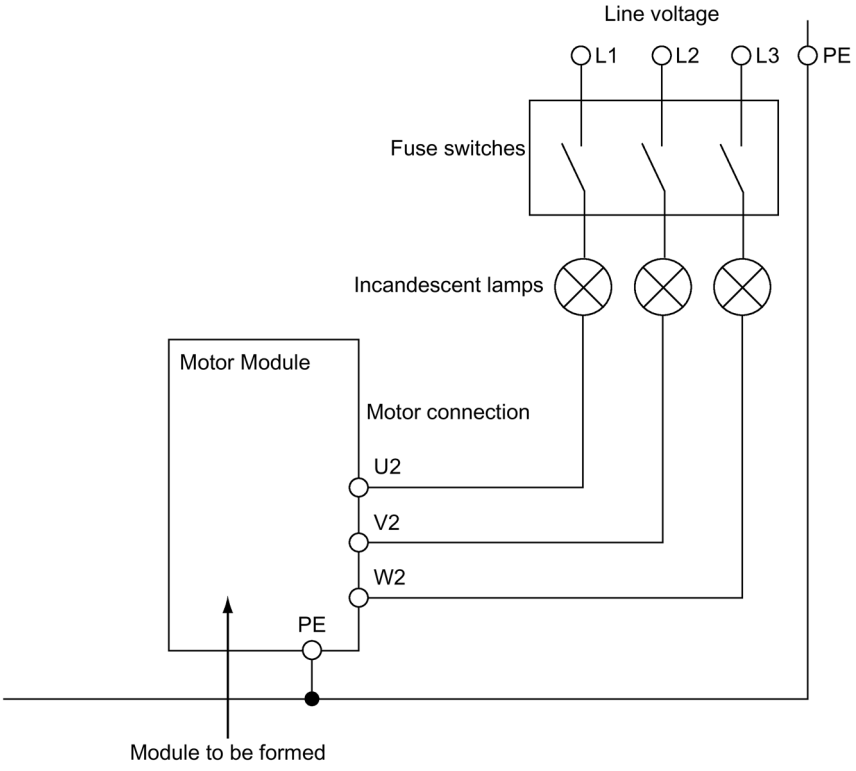



Figure 6-58 Forming circuit for Motor Modules

**Procedure**

- It is not permissible that the device being formed receives a power-on command (e.g. from the keyboard, BOP20 or terminal block).
- Connect the appropriate forming circuit.
- Forming has been completed if the DC link voltage no longer increases.

## Maintaining the operational readiness of individual power blocks for servicing

It is recommended that during the planned downtimes, the power blocks positioned on the line side are replaced in order to guarantee the correct functioning of the power blocks during servicing.

## 6.7 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

# 7

## 7.1 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.

# 7.2 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 7- 1 Load software

| LED | | | State | Comments |
|---|---|---|---|---|
| RDY | COM | OPT | | |
| Red | Orange | Orange | Reset | Hardware reset<br>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<br>• 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 7- 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 7- 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) | – |
| | Red | Flashing light 2 Hz | General errors | Check parameterization / configuration data |
| | Red/ green | Flashing light 0.5 Hz | Control Unit is ready for operation.<br>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.<br>**Note**:<br>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.<br>**Comment:**<br>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.<br>Possible causes:<br>• The controller is not transferring any setpoints.<br>• 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 |

| LED | Color | State | Description, cause | Remedy |
|---|---|---|---|---|
| OPT (OPTION) | – | Off | The electronics power supply is missing or outside the permissible tolerance range.<br>Component is not ready.<br>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 | Continu-ous 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.<br>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.

# 7.3 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 7- 4 Load software

| LED | | | State | Comments |
|---|---|---|---|---|
| RDY | COM | OPT | | |
| Red | Orange | Orange | Reset | Hardware reset<br>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<br>• 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 7- 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 7- 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.<br>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.<br>**Remark**:<br>Both options depend on the LED status when activating p0124[0] = 1. | – |
| COM PROFIdrive cyclic operation | – | Off | Cyclic communication has not (yet) taken place.<br>**Remark:**<br>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.<br>Possible causes:<br>• The controller is not transferring any setpoints.<br>• During isochronous operation, no global control (GC) or a faulty global control (GC) is transferred by the controller.<br>• "Shared Device" is selected and only one controller connected. | – |
| | Red | Flashing light 0.5 Hz | Bus error,<br>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.<br>Component is not ready.<br>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.

## 7.4 LEDs on the CBE20 Communication Board

Table 7- 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 7- 8 Meaning of the Sync and Fault LEDs on the CBE20

| LED | Color | State | Description |
|---|---|---|---|
| Fault | – | Off | If the link port LED is green:<br>The CBE20 is operating error-free, and data is being exchanged with the configured IO controller. |
| | Red | Flashing light | - The watchdog timer has elapsed.<br>- Communication has been interrupted.<br>- The IP address is incorrect.<br>- Incorrect or missing configuration.<br>- Incorrect parameter assignment.<br>- Incorrect or missing device name.<br>- IO controller not present/switched off but Ethernet connection present.<br>- Other CBE20 errors. |
| | | Steady light | CBE20 bus error<br>- No physical connection to a subnet/switch.<br>- Incorrect transmission rate.<br>- Full-duplex transmission is not activated. |
| Sync | – | Off | If the link port LED is green:<br>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 7- 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.<br>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.<br>Possible causes:<br>- Communication is being established.<br>-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.<br>Possible causes:<br>- The memory card of the Control Unit is faulty.<br>- The CBE20 is out of order.<br>The CBE20 cannot be used in this state. |
| | | Flashing light 2 Hz | Communication between the Control Unit and the CBE20 is faulty.<br>Possible causes:<br>- The CBE20 was removed following power-up.<br>- The CBE20 is defective. |
| | Orange | Flashing light 0.5 Hz | Firmware is being updated. |

## 7.5 LEDs on the Control Interface Module in the Basic Line Module

Table 7- 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.<br>The DC-link voltage is present. |
| | Red | The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.<br>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.<br>**Remark:**<br>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).<br>Note:<br>Both options depend on the LED status when module recognition is activated via p0124 = 1. |

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

Table 7- 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.

## 7.6 LEDs on the Control Interface Module in the Smart Line Module

Table 7- 12 Meaning of the LEDs "READY" and "DC LINK" on the Control Interface Module in the Smart 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.<br>The DC-link voltage is present. |
| | Red | The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.<br>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.<br>**Remark:**<br>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).<br>Note:<br>Both options depend on the LED status when module recognition is activated via p0124 = 1. |

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

Table 7- 13 Meaning of the LED "POWER OK" on the Control Interface Module in the Smart 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.

## 7.7 LEDs on the Control Interface Module in the Active Line Module

Table 7- 14 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.<br>The DC-link voltage is present. |
| | Red | The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.<br>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.<br>**Remark:**<br>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).<br>Note:<br>Both options depend on the LED status when module recognition is activated via p0124 = 1. |

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

Table 7- 15 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.

# 7.8 LEDs on the Active Line Module, Chassis-2 format

Table 7- 16 Significance of the "READY" and "DC LINK" LEDs on the Active Line Module, Chassis-2 format

| 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.<br>The DC-link voltage is present. |
| | Red | The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.<br>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.<br>**Remark:**<br>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).<br>Note:<br>Both options depend on the LED status when module recognition is activated via p0124 = 1. |

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

Table 7- 17 Significance of the "PWR ON" LED on the Active Line Module, Chassis-2 format

| LED | Color | State | Description |
|---|---|---|---|
| POWER ON | Green | Off | DC link voltage or supply voltage at -X9 too low. |
| | | On | The component is ready for operation. |
| | Red | Flashing light | There is a fault. If the LED continues to flash after you have performed a POWER ON, please contact your Siemens service center. |



**WARNING**

**Electric shock when live parts of the DC link are touched**

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

- Observe the warning information on the component.

# 7.9 LEDs on the Control Interface Module in the Motor Module, chassis format

Table 7- 18 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.<br>The DC-link voltage is present. |
| | Red | The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.<br>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.<br>**Remark:**<br>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).<br>Note:<br>Both options depend on the LED status when module recognition is activated via p0124 = 1. |

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

Table 7- 19 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.

# 7.10 LEDs on the Motor Module, Chassis-2 format

Table 7- 20 Significance of the "READY" and "DC LINK" LEDs on the Motor Module, Chassis-2 format

| 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.<br>The DC-link voltage is present. |
| | Red | The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.<br>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.<br>**Remark:**<br>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).<br>Note:<br>Both options depend on the LED status when module recognition is activated via p0124 = 1. |

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

Table 7- 21 Significance of the "PWR ON" LED on the Motor Module, Chassis-2 format

| LED | Color | State | Description |
|---|---|---|---|
| POWER ON | Green | Off | DC link voltage or supply voltage at -X9 too low. |
| | | On | The component is ready for operation. |
| | Red | Flashing light | There is a fault. If the LED continues to flash after you have performed a POWER ON, please contact your Siemens service center. |



**WARNING**

**Electric shock when live parts of the DC link are touched**

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

- Observe the warning information on the component.

## 7.11 LEDs on the Motor Module in the booksize format

Table 7- 22 Meaning of the LEDs on the Motor Module in booksize format

| 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.<br>The DC-link voltage is present. |
| | Red | The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.<br>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.<br>**Remark:**<br>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).<br>Note:<br>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"



**⚠WARNING**

**Electric shock when live parts of the DC link are touched**

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

- Observe the warning information on the component.

## 7.12 LEDs on the Central Braking Module

Table 7- 23 Meaning of the LEDs on the Braking Module in the Central Braking Module

| LED | State | Description |
|---|---|---|
| ME - "Ready" message | OFF | $U_{DC}$ missing<br>Overtemperature<br>Maximum control setting |
| | Steady light | Ready |
| MUI - "Overcurrent" message | OFF | Normal status |
| | Steady light | Short-circuit / ground fault |
| MUL - "Overload" message | OFF | Normal status |
| | Steady light | Overload: Set brake ON time exceeded |
| MUT - "Overtemperature" message | OFF | Normal status |
| | Steady light | Overtemperature |

## 7.13 LEDs on the Voltage Sensing Module (VSM) in the Active Interface Module

Table 7- 24 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.<br>**Remark:**<br>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).<br>**Remark:**<br>Both options depend on the LED status when module recognition is activated via p0144 = 1. |

## 7.14 LEDs on the SMC10 Sensor Module

Table 7- 25 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.<br>**Remark:**<br>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).<br>**Remark:**<br>Both options depend on the LED status when module recognition is activated via p0144 = 1. |

## 7.15 LEDs on the SMC20 Sensor Module

Table 7- 26 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.<br>**Remark:**<br>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).<br>**Remark:**<br>Both options depend on the LED status when module recognition is activated via p0144 = 1. |

## 7.16 LEDs on the SMC30 Sensor Module

Table 7- 27 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.<br>**Remark:**<br>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).<br>**Remark:**<br>Both options depend on the LED status when module recognition is activated via p0144 = 1. |
| OUT > 5V | - | Off | The electronics power supply is missing or outside the permissible tolerance range.<br>Power supply ≤ 5 V. |
| | Orange | Steady light | The electronics power supply for the measuring system is available.<br>Measuring system supply > 5 V<br>**Notice:**<br>You must ensure that the connected encoder can be operated with a 24 V power supply.<br>If an encoder that is designed for a 5 V supply is operated with a 24 V supply, this can destroy the encoder electronics. |

## 7.17 LEDs on the TM31 Terminal Module

Table 7- 28 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.<br>**Remark:**<br>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).<br>**Remark:**<br>Both options depend on the LED status when module recognition is activated via p0154 = 1. |

## 7.18 LEDs on the TM54F Terminal Module

Table 7- 29 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.<br>**Remark:**<br>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<br>or<br>Red/Orange | Flashing light | Detection of the components via LED is activated (p0154).<br>**Remark:**<br>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. |

| LED | Color | | State | Description, cause |
|---|---|---|---|---|
| **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)

# 7.19 LEDs on the TM150 Terminal Module

### TM150 Terminal Module (-A151 to -A154)

Table 7- 30 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.<br>**Remark:**<br>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).<br>**Remark:**<br>Both options depend on the LED status when module recognition is activated via p0154 = 1. |

# 7.20 LEDs on the SITOP power supply unit

Table 7- 31 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 8

## 8.1 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.

## 8.2 D14, Preliminary copy of customer documentation

If documents such as circuit diagrams, terminal diagrams, arrangement diagrams and dimension drawings are required for the system engineering (integration of the plant in higher-level systems, interface clarification, installation, building planning, etc.), advance documentation can also be ordered when ordering the cabinet modules. These documents are then supplied electronically a few working days after the order has been entered. If the order includes options that fall outside the scope of standard delivery, these will not be covered by the documentation due to the obvious time constraints.

Documentation relating to the order is sent to the buyer by e-mail. The recipient's e-mail address must be specified with the order for this purpose. In the e-mail, the recipient is also provided with a link for downloading general advance documentation such as operating instructions, Manual and commissioning instructions.

# 8.3 G20, CBC10 Communication Board

## Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Cabinet Kits
- Motor Modules chassis format
- Motor Modules chassis-2 format

## Description

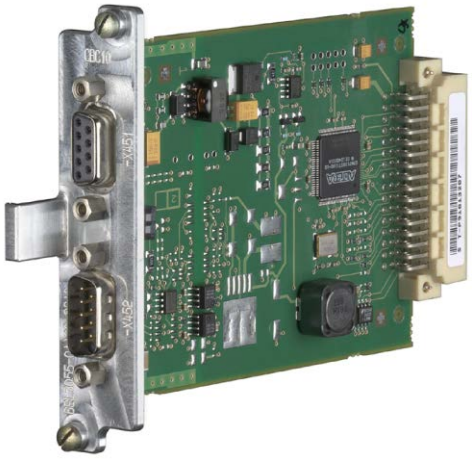


Figure 8-1 CAN CBC10 Communication Board

The CBC10 CANopen communication board (CAN Communication Board) is used to connect drives in the SINAMICS drive system to higher-level automation systems with a CAN bus.

The CANopen Option Board uses two 9-pin SUB D connectors for the connection to the CAN bus system.

The connectors can be used as inputs or outputs. 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 at 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**<br>Withdrawing and inserting Option Boards during operation can damage them or cause the Option Boards to malfunction.<br>• Only withdraw or insert Option Boards when the Control Unit is in a no voltage state. |

**Note**

**Additional information**

A detailed description of the complete principle of operation of the CBC10 Communication Board and how it is handled is given in the associated operating instructions, which are included in the device documentation provided.

## Interface overview

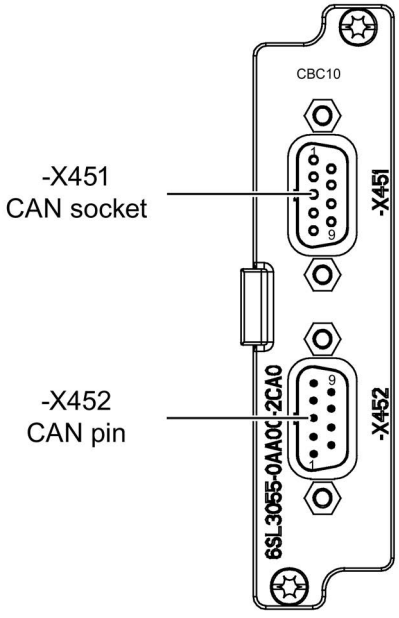
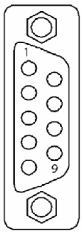



Figure 8-2 CAN CBC10 Communication Board, interface overview

## X451 CAN bus interface

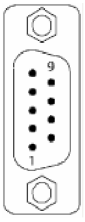
Table 8- 1 CAN bus interface X451

| 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 | | | |

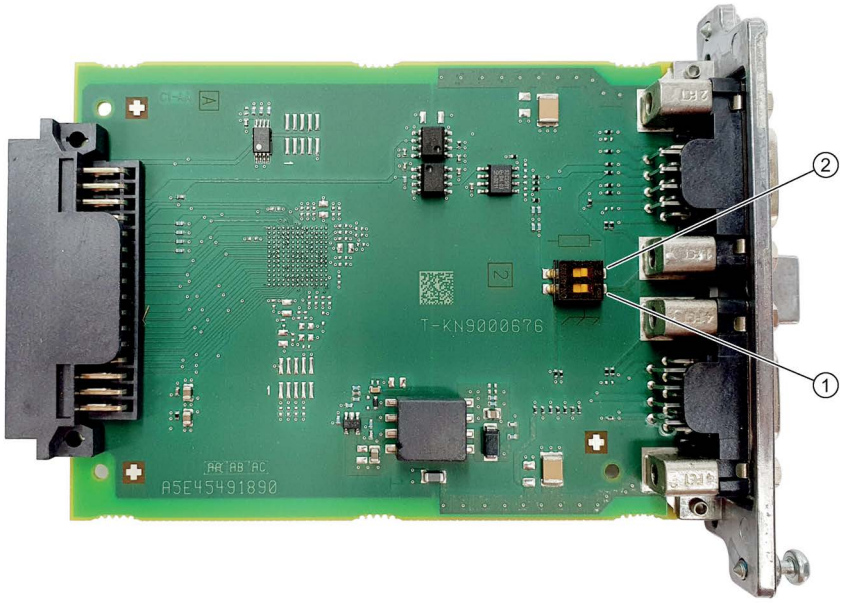
| NOTICE |
|---|
| **Destruction of the CAN bus interface as a result of an incorrect connector** |
| If PROFIBUS connectors are connected to CAN bus interfaces during operation, this may lead to the CAN bus interfaces being destroyed. |
| • Do not connect PROFIBUS connectors to CAN bus interfaces. |

## X452 CAN bus interface

Table 8- 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) | | | |

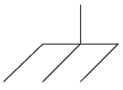
## 2-pin SMD DIP switch




① Switch 1
② Switch 2

Figure 8-3 2-pin SMD DIP switches 1 and 2 on the CBC10

Table 8- 3 2-pin SMD DIP switch

| Marking on the component | Switch | Function | Switch position | Meaning | Default |
|---|---|---|---|---|---|
|  | 2 | Bus terminating resistor 120 Ω | OFF | Inactive | OFF |
| | | | ON | Active | |
|  | 1 | Ungrounded, grounded operation | OFF | Non-grounded operation | OFF |
| | | | ON | Grounded operation | |

# 8.4 G33, CBE20 Communication Board

## Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Cabinet Kits
- Motor Modules in chassis format
- Motor Modules - Chassis-2 format

## Description



Figure 8-4 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

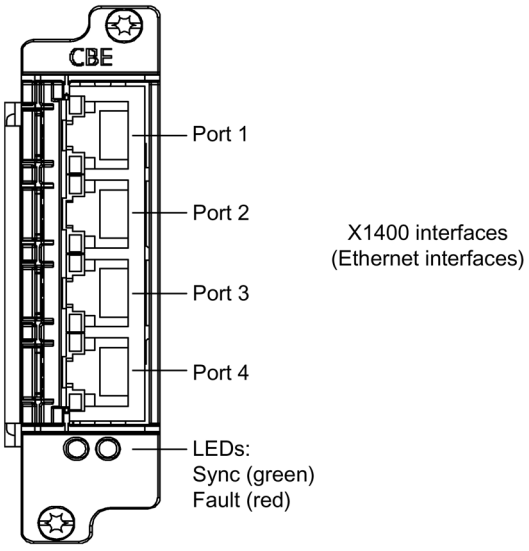



Figure 8-5 CBE20 Ethernet Communication Board, interface overview

## MAC address

The MAC address of the Ethernet interfaces is indicated on the upper 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**<br>Withdrawing and inserting Option Boards during operation can damage them or cause the Option Boards to malfunction.<br>• Only withdraw or insert Option Boards when the Control Unit is in a no voltage state. |

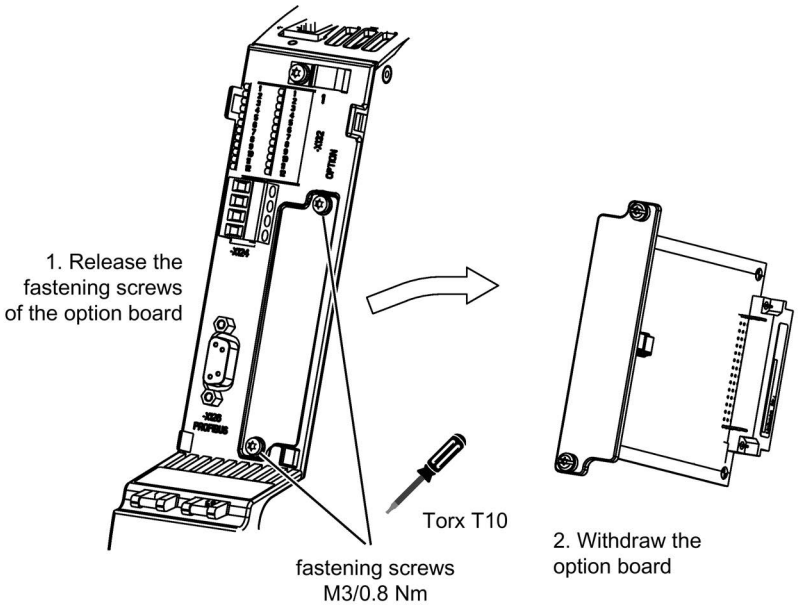
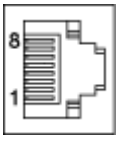



Figure 8-6 Removing the CBE20 from the option slot on the Control Unit

## X1400 Ethernet interface

Table 8- 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 | | | |

# 8.5 G51 to G54, temperature sensor module TM150

## 8.5.1 General information

### Availability of option

These options are available for the following S120 Cabinet Modules:

- Line Connection Module
- Active Line Connection Modules-2
- Booksize Cabinet Kit (only option G51, G52)
- Motor Modules in Chassis format (only options G51, G52)
- Motor Modules in Chassis-2 format (only options G51, G52)

### 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.

## 8.5.2 Interfaces

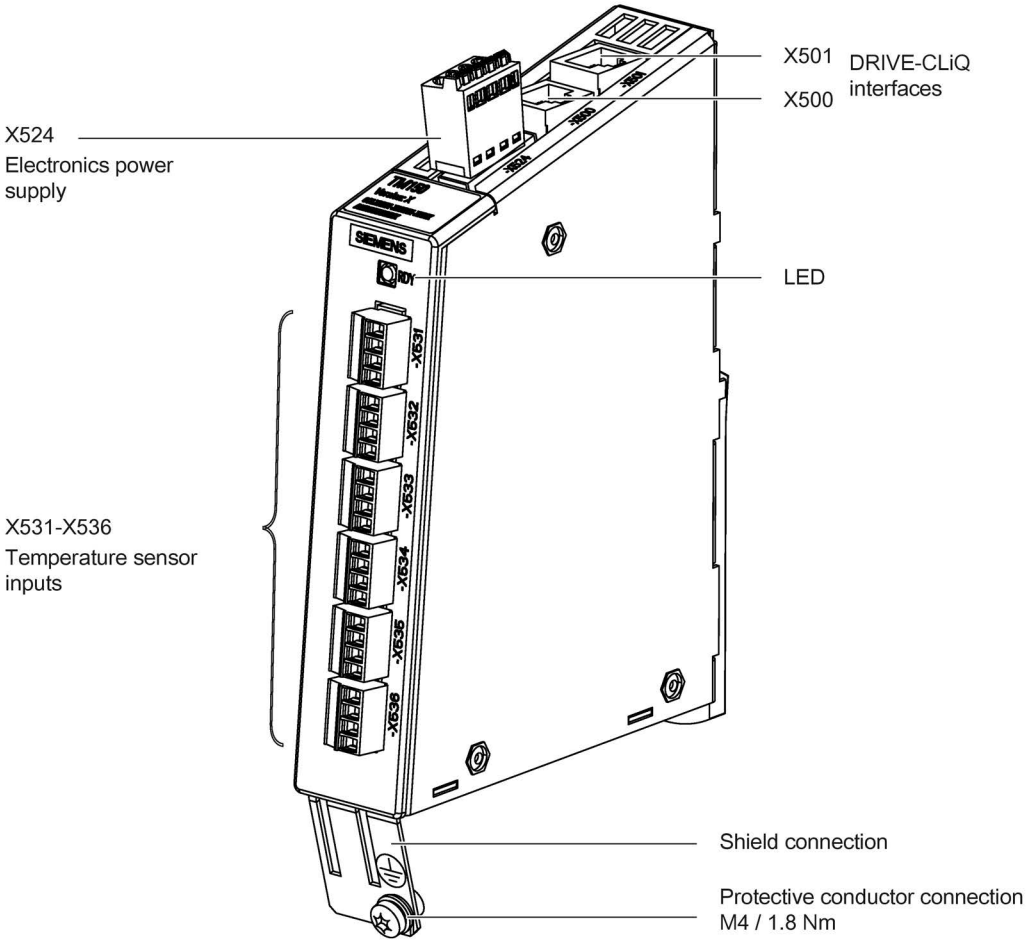
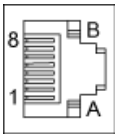



Figure 8-7 TM150 Terminal Module

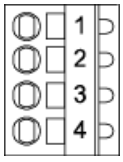
## X500, X501: DRIVE-CLiQ interface

Table 8- 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 8- 6 X531-X536 temperature sensor inputs

| Connector | Terminal | Function<br>1x2- / 2x2-wire | Function<br>3 and 4-wire | Technical data |
|---|---|---|---|---|
|  | 1 | + Temp<br>(channel x) | +<br>(Channel x) | Temperature sensor connection for sensors with 1x2 wires<br>Connection of the 2nd measuring cable for sensors with 3 and 4 wires (in parallel with terminal 3) |
| | 2 | - Temp<br>(channel x) | -<br>(Channel x) | Temperature sensor connection for sensors with 1x2 wires<br>Connection of the 1st measuring cable for sensors with 4 wires (in parallel with terminal 4) |
| | 3 | + Temp<br>(channel y) | + $I_c$<br>(constant current, positive channel x) | Temperature sensor connection for sensors with 2x2, 3 and 4 wires |
| | 4 | - Temp<br>(channel y) | - $I_c$<br>(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 8- 7 Channel assignment

| Terminal | Channel number [x]<br>for 1x2, 3 and 4-wires | Channel number [y]<br>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**

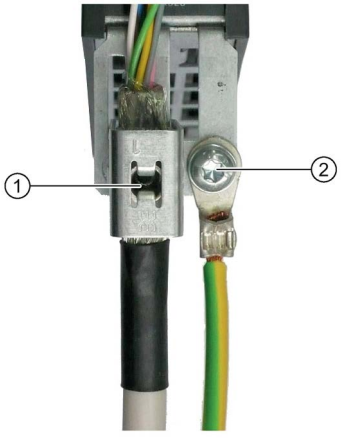
**Incorrect temperature measured values as a result of cables with an excessively high resistance**

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 8-8 Shield support and protective conductor connection

## 8.5.3 Connection example

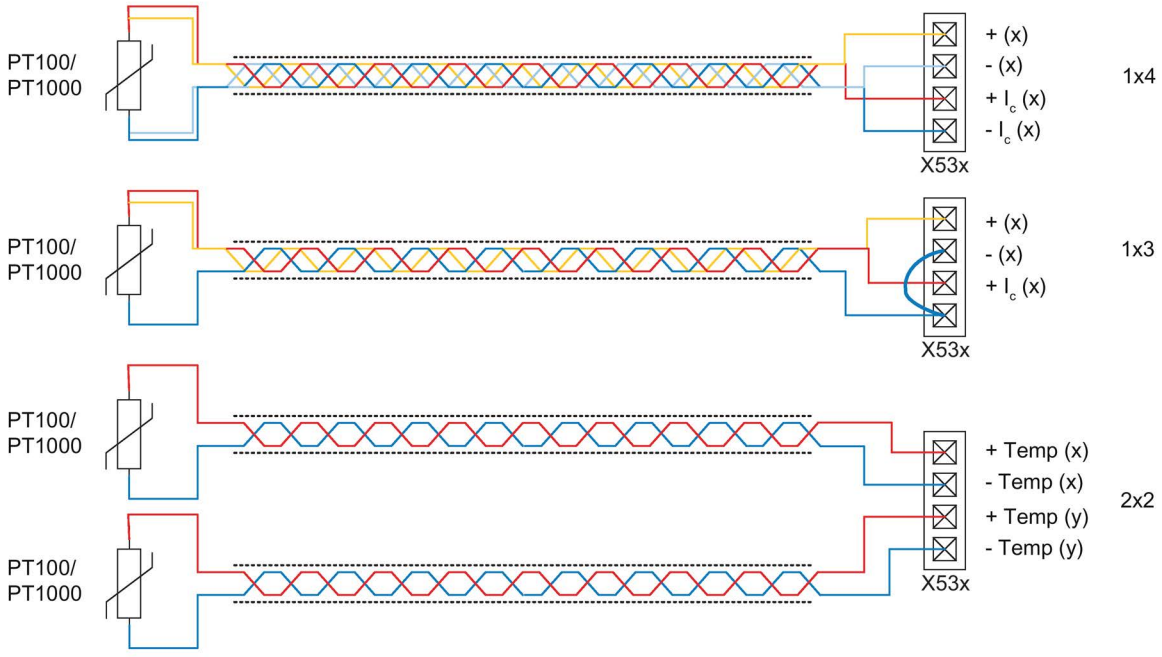



Figure 8-9 Connecting a PT100/PT1000 with 2x2, 3 and 4-wires to the temperature sensor inputs X53x of Terminal Module TM150

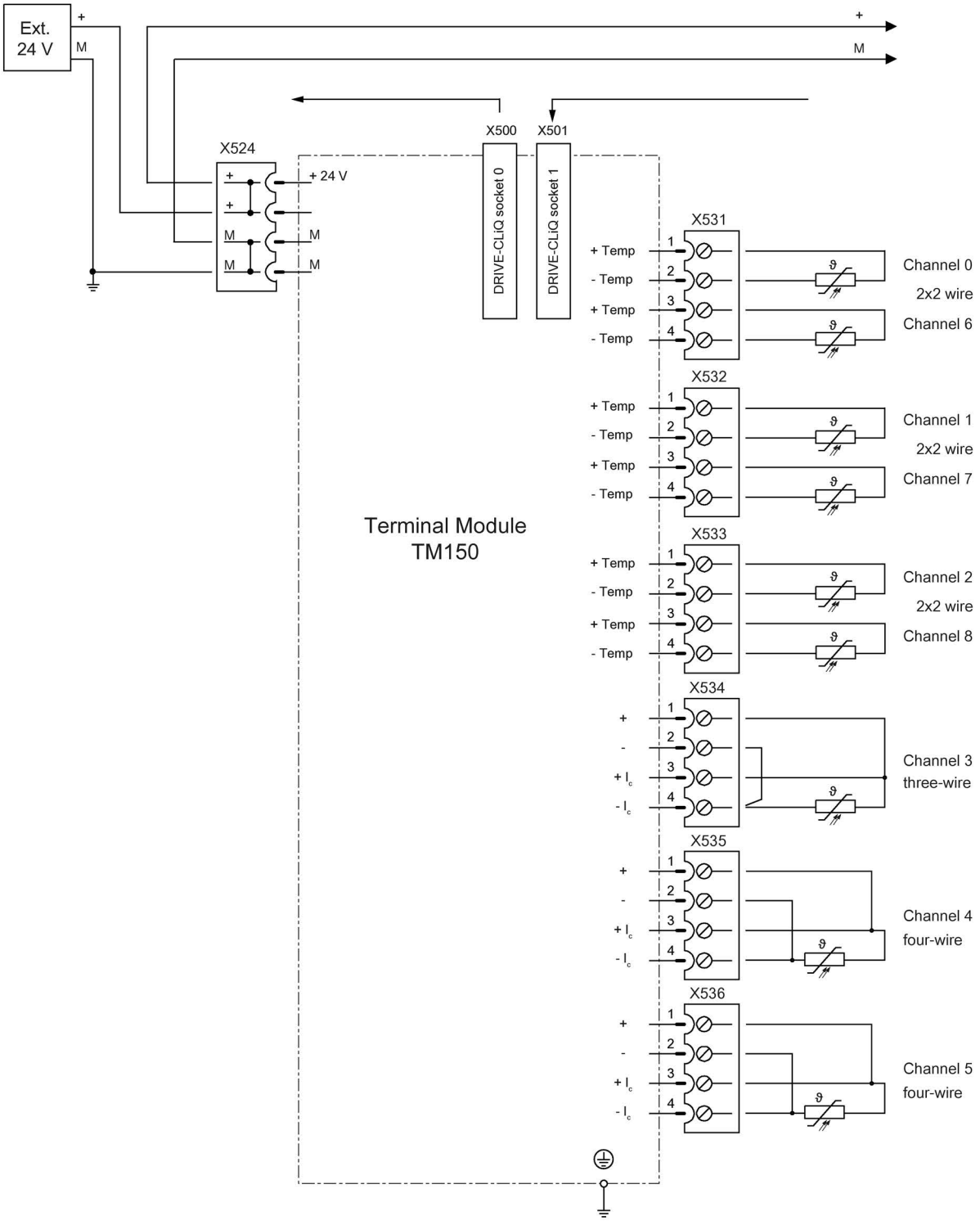



Figure 8-10 Connection example for a Terminal Module TM150

# 8.6 G60, Terminal Module TM31

## 8.6.1 General information

### Availability of option

These options are available for the following S120 Cabinet Modules:

- Booksize Cabinet Kits
- Motor Modules chassis format
- Motor Modules chassis-2 format

### 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 / bimetallic NC contact)

The TM31 Terminal Module must be integrated on the system side. It is not installed in the factory.

## Overview

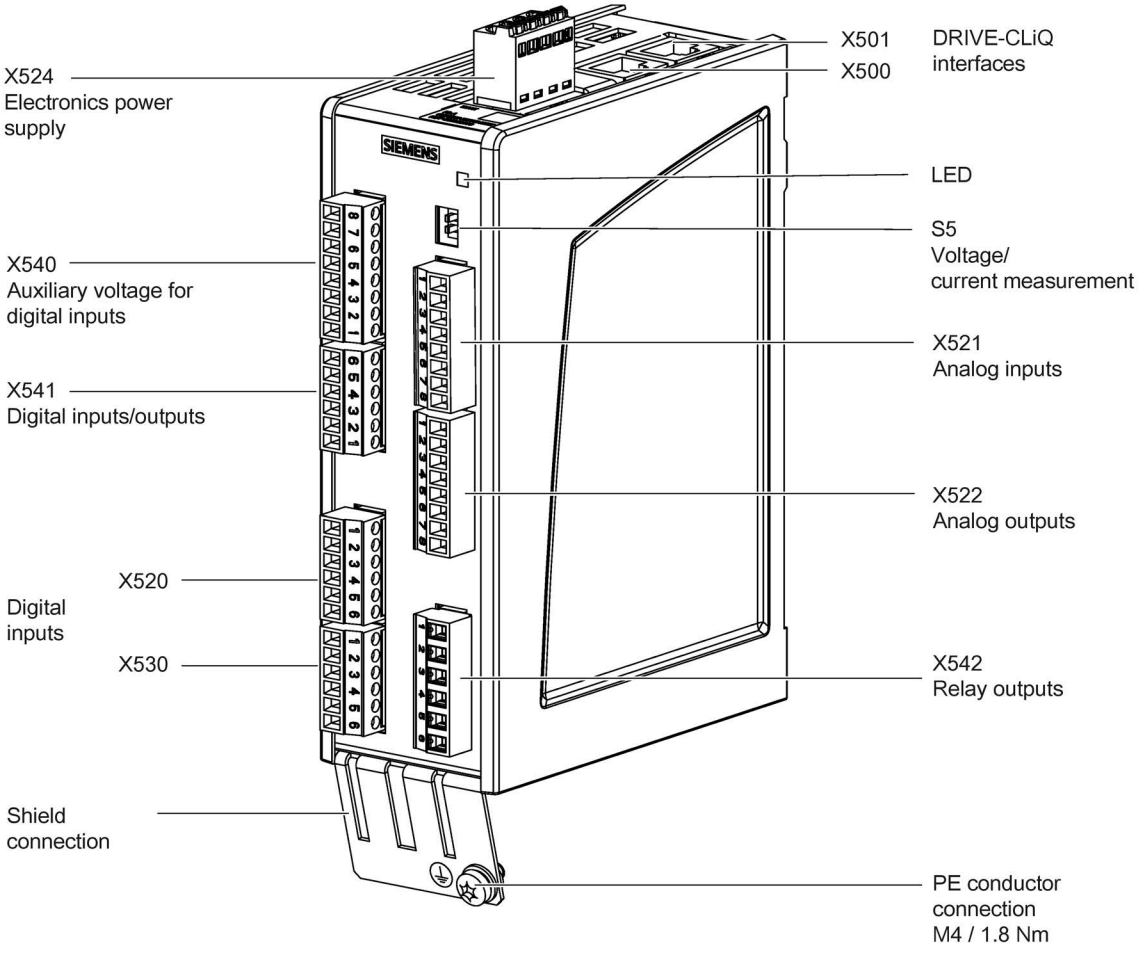



Figure 8-11 TM31 Terminal Module

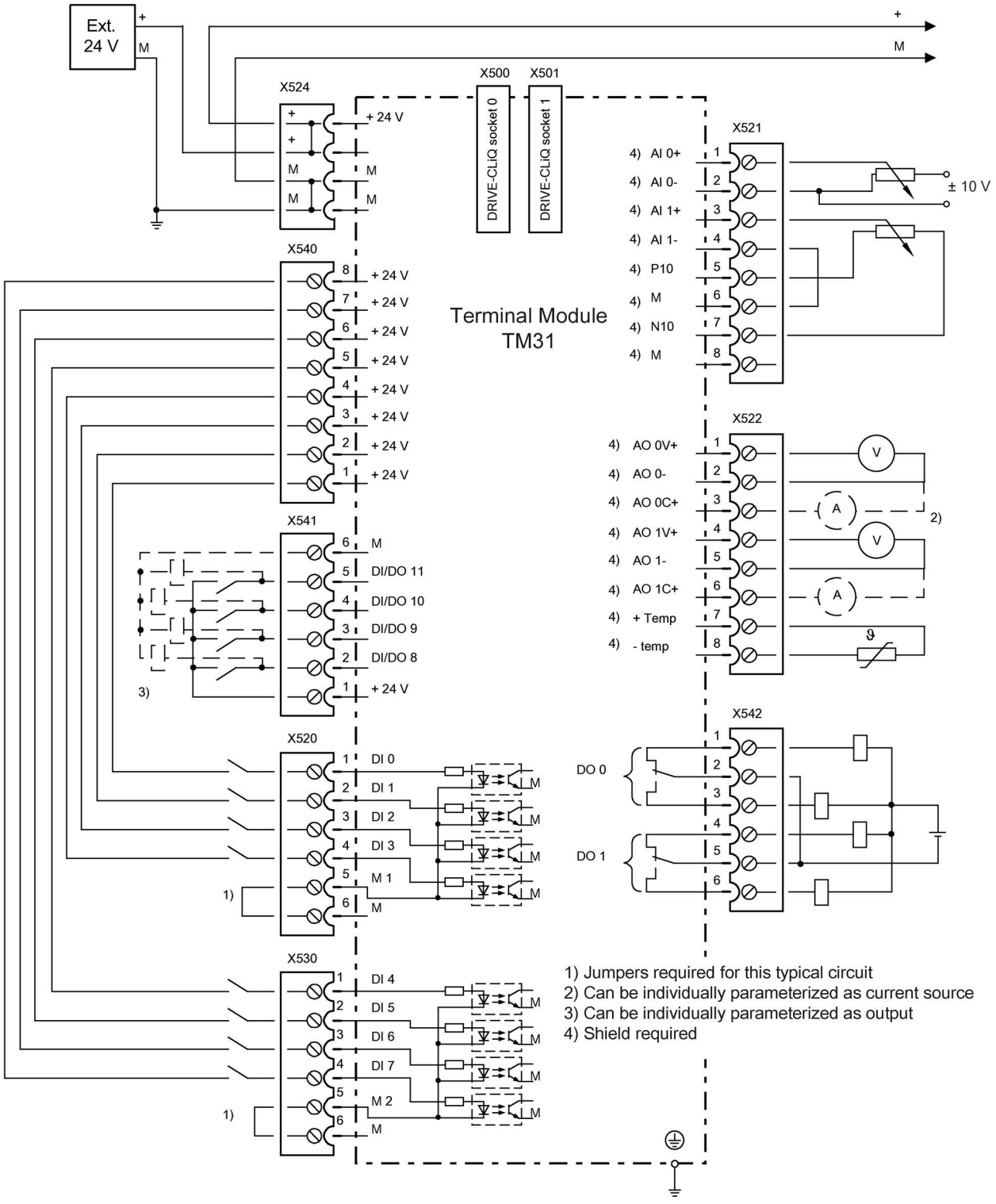
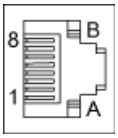



Figure 8-12 Connection overview of TM31 Terminal Module

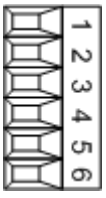
## X500, X501: DRIVE-CLiQ interface

Table 8- 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 8- 9 Terminal block X520

| Connector | Terminal | Designation [1] | Technical data |
|---|---|---|---|
|  | 1 | DI 0 | **Voltage**: -3 ... +30 V<br>**Current consumption** typical: 10 mA at 24 V DC<br>**Input delay**:<br>for "0" to "1": Typ. 50 µs max. 100 µs<br>for "1" to "0": Typ. 130 µs, max. 150 µs<br>**Electrical isolation**:<br>Reference potential is terminal M1<br>**Signal level** (including ripple)<br>High level: 15 ... 30 V<br>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".

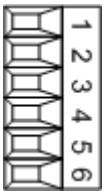
Terminal M1 must be connected so that the digital inputs (DI) can function.

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 8- 10 Terminal block X530

| Connector | Terminal | Designation [1] | Technical data |
|---|---|---|---|
|  | 1 | DI 4 | **Voltage**: -3 ... +30 V<br>**Current consumption** typical: 10 mA at 24 V DC<br>**Input delay**:<br>for "0" to "1": Typ. 50 µs max. 100 µs<br>for "1" to "0": Typ. 130 µs, max. 150 µs<br>**Electrical isolation**:<br>Reference potential is terminal M2<br>**Signal level** (including ripple)<br>High level: 15 ... 30 V<br>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".

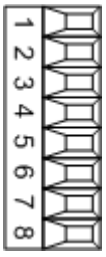
To enable the digital inputs (DI) to function, terminal M2 must be connected.

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 8- 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.<br>**As voltage input**:<br>-10 ... +10 V; $R_i$ > 100 kΩ<br>Resolution: 11 bits + sign<br>**As current input**:<br>-20 ... +20 mA; $R_i$ = 250 kΩ<br>Resolution: 10 bits + sign |
| | 2 | AI 0- | |
| | 3 | AI 1+ | |
| | 4 | AI 1- | |
| | 5 | P10 | **Auxiliary voltage**:<br>P10 = 10 V<br>N10 = -10 V<br>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 8- 12 Selector for voltage/current S5

| | Switch | Function |
|---|---|---|
|  | S5.0 | Selector voltage (V) / current (I) AI0 |
| | S5.1 | Selector voltage (V) / current (I) AI1 |

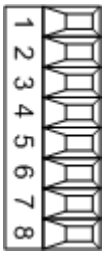
**Note**

**Delivery condition**

When delivered, both switches are set to current measurement (switch set to "I").

## X522: 2 analog outputs, temperature sensor connection

Table 8- 13 Terminal block X522

| Connector | Terminal | Designation [1] | Technical data |
|---|---|---|---|
|  | 1 | AO 0V+ | You can set the following output signals using parameters:<br>**Voltage**: -10 ... +10 V (max. 3 mA)<br>**Current 1**: 4 ... 20 mA (max. load resistance ≤ 500 Ω)<br>**Current 2**: -20 ... +20 mA (max. load resistance ≤ 500 Ω)<br>**Current 3**: 0 ... 20 mA (max. load resistance ≤ 500 Ω)<br>Resolution: 11 bits + sign<br>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 / KTY84-130 / bimetallic NC contact<br>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 malfunction due to impermissible voltage values**

If the counter EMF is impermissible, the components may be damaged and malfunctions can occur.

- The back EMF at the outputs may only be in the range between -15 V and +15 V.

**NOTICE**

**Damage to the motor due to 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 8- 14 Terminal block X540

| Connector | Terminal | Designation | Technical data |
|---|---|---|---|
|  | 8 | +24 V | Voltage: +24 V DC<br>Max. total load current of +24 V auxiliary voltage for terminals X540 and X541 combined: 150 mA<br>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 8- 15 Terminal strip X541

| Connector | Terminal | Designation [1] | Technical data |
|---|---|---|---|
|  | 6 | M | **As input**:<br>Voltage: -3 ... 30 V<br>Electrical isolation: no<br>Reference potential: M<br>Input characteristic acc. to IEC 61131-2, type 1<br>Input voltage (including ripple)<br>"1" signal: 15 ... 30 V<br>"0" signal: -3 ... +5 V<br>Input current<br>at 24 V DC: typ. 9 mA<br>at < 0.5 mA: "0" signal reliably detected<br>Input delay:<br>For "0" → "1": typ. 50 µs<br>-for "1" → "0" typ. 100 µs<br>**As output:**<br>Voltage: 24 V DC<br>Electrical isolation: no<br>Reference potential: M<br>Output voltage<br>"1" signal, with load: > X524.+ -2 V<br>Output current<br>for each output: ≤ 0.5 A<br>Sum of all 4 outputs:<br>≤ 0.1 A (when parameter p4046 = 0)<br>≤ 1.0 A (when parameter p4046 = 1)<br>Residual current for "0" signal: < 0.5 mA<br>Short-circuit protection, automatic restart after a short-circuit<br>Load types: ohmic, capacitive, inductive<br>Output delay<br>for "0" → "1": typ. 150 µs / max. 500 µs (ohmic load)<br>for "1" → "0": typ. 50 µs (ohmic load)<br>Switching frequency<br>for ohmic load: max. 100 Hz<br>for inductive load: max. 0.5 Hz<br>for lamp load: max. 10 Hz<br>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:<br>Voltage: +24 V DC<br>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 8- 16 Terminal block X542

| Connector | Terminal | Designation [1] | Technical data |
|---|---|---|---|
|  | 1 | DO 0.NC | Contact type: Changeover contact max. load current: 8 A<br>Max. switching voltage: 250 $V_{AC}$. 30 $V_{DC}$<br>Max. switching capacity at 250 $V_{AC}$: 2000 VA (cosϕ = 1)<br>Max. switching capacity at 250 $V_{AC}$: 750 VA (cosϕ = 0.4)<br>Max. switching capacity at 30 $V_{DC}$: 240 W (resistive load)<br>Required minimum current: 100 mA<br>Output delay: ≤ 20 ms [2]<br>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.

# 8.7 G61, additional TM31 Terminal Module

## Availability of option

These options are available for the following S120 Cabinet Modules:

- Booksize Cabinet Kits
- Motor Modules chassis format
- Motor Modules chassis-2 format

## 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 / bimetallic NC contact)

The second TM31 Terminal Module must be integrated on the system side. It is not installed in the factory.

# 8.8 G56, contactor monitoring

## Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Modules
- Smart Line Modules
- Active Line Modules

## Description

The protective monitoring option is used for monitoring the pre-charging and bypass contactors of the Line Modules.

The connecting cable from the contactors to the Control Interface Module is factory-installed.

## Activation

The monitoring is activated by the following parameters:

- p0255[0]: Precharging contactor closing time (factory setting = 0, max. 65535 ms)
- p0255[1]: Bypass contactor closing time (factory setting = 0, max. 65535 ms)
- p0255[2]: Precharging contactor opening time (factory setting = 0, max. 65535 ms)
- p0255[3]: Bypass contactor opening time (factory setting = 0, max. 65535 ms)

## Fault messages

- F30060 (A) pre-charging contactor status monitoring
- F30061 (A) bypass contactor status monitoring

# 8.9 G62, TB30 Terminal Board

## Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Cabinet Kits
- Motor Modules in chassis format
- Motor Modules in Chassis-2 format

## Description



Figure 8-13 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 connection 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**<br>Withdrawing and inserting Option Boards during operation can damage them or cause the Option Boards to malfunction.<br>• 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

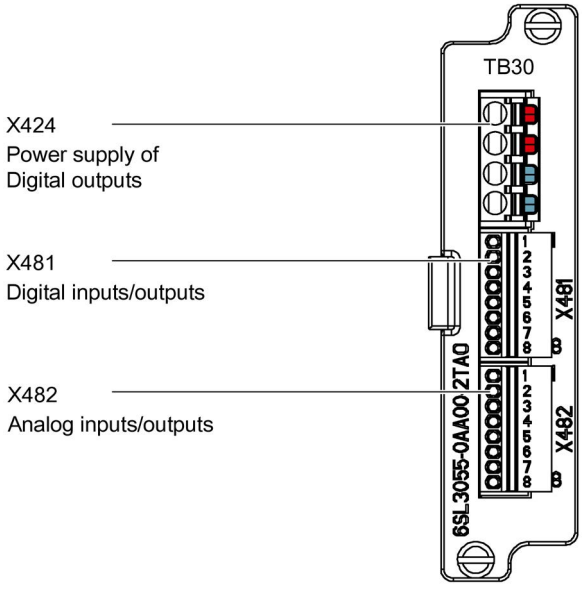



Figure 8-14 TB30 Terminal Board interface overview

## Connection overview

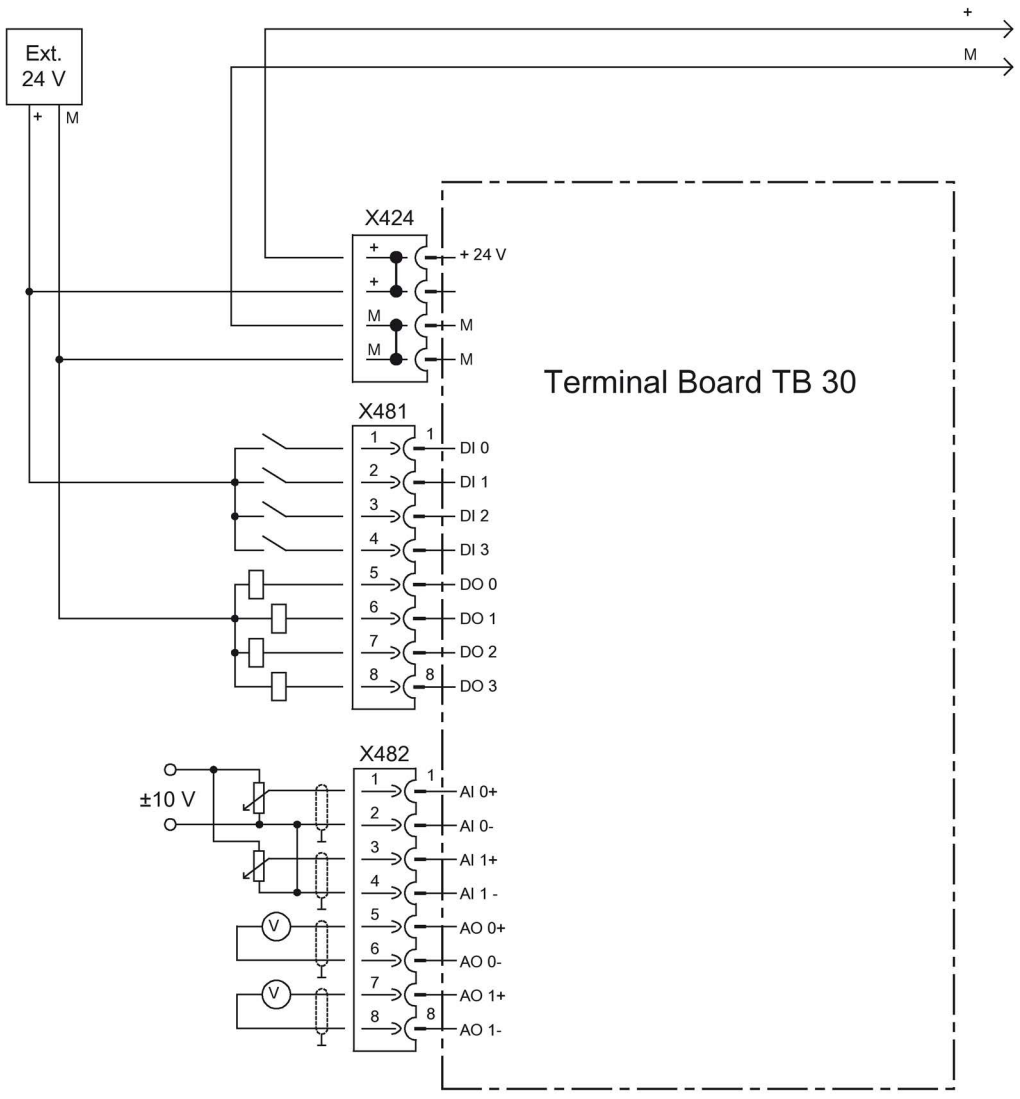
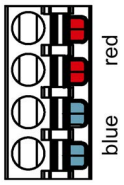



Figure 8-15 Connection overview TB30 Terminal Board

## X424 power supply, digital outputs

Table 8- 17 Terminal strip X424

| Connector | Terminal | Function | Technical data |
|---|---|---|---|
|  | + | Power supply | Voltage: 24 V DC (20.4 ... 28.8 V)<br>Current consumption: Max. 4 A<br>(per digital output max. 0.5 A)<br>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 jumpered 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**

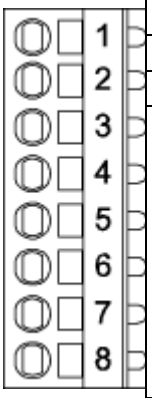
The power supply of the digital outputs and the electronic power supply of the Control Unit are isolated.

**Note**

If the 24 V supply is briefly interrupted, then the digital outputs are deactivated during this time.

## X481 Digital inputs/outputs

Table 8- 18 Terminal strip X481

| Connector | Terminal | Designation [1] | Technical data |
|---|---|---|---|
|  | 1 | DI 0 | Voltage: -3 ... 30 V DC<br>Electrical isolation: Yes<br>Reference potential: X424.M<br>Input characteristic acc. to IEC 61131-2, type 1<br>Input voltage (including ripple)<br>"1" signal: 15 ... 30 V<br>"0" signal: -3 ... +5 V<br>Input current<br>at 24 V DC: typ. 3.5 mA<br>at <0.5 mA: "0" signal reliably detected<br>Input delay<br>for "0" → "1": typ. 20 µs<br>for "1" → "0": typ. 100 µs |
| | 2 | DI 1 | |
| | 3 | DI 2 | |
| | 4 | DI 3 | |
| | 5 | DO 0 | Voltage: 24 V DC<br>Electrical isolation: Yes<br>Reference potential: X424.M<br>Output voltage<br>"1" signal, with load: > X424.+ -2 V<br>Output current<br>for each output: ≤ 0.5 A<br>Sum of all four outputs: ≤ 2 A<br>Residual current for "0" signal: < 0.5 mA<br>Short-circuit protection, automatic restart after a short-circuit<br>Load types: ohmic, capacitive, inductive<br>Output delay[3]<br>for "0" → "1": typ. 150 µs / max. 500 µs (ohmic load)<br>for "1" → "0": typ. 50 µs (ohmic load)<br>Switching frequency<br>for resistive load: max. 100 Hz<br>for inductive load: max. 0.5 Hz<br>for lamp load: max. 10 Hz<br>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**

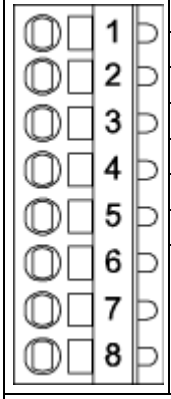
**Malfunction in the switched-off state due to diagnostic currents**

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 8- 19 Terminal strip X482

| Connector | Terminal | Designation [1] | Technical data |
|---|---|---|---|
|  | 1 | AI 0+ | Analog inputs (AI)<br>**Voltage**: -10 ... +10 V; $R_i$: 65 kΩ<br>**Common mode range**: ±30 V<br>**Resolution**: 13 bits + sign |
| | 2 | AI 0- | |
| | 3 | AI 1+ | |
| | 4 | AI 1- | |
| | 5 | AO 0+ | Analog outputs (AO)<br>**Voltage range**: -10 ... +10 V<br>**Load current**: max. -3 ... +3 mA<br>**Resolution**: 11 bit + signed<br>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

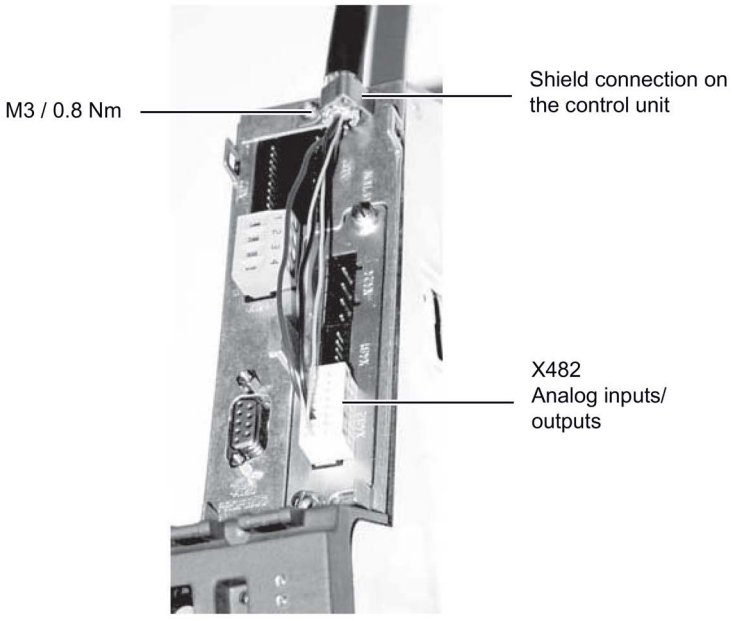



Figure 8-16 TB30 shield connection

The permissible bending radii for the cables must not be exceeded when the cables are being installed.

## 8.10 K01 to K05, safety license for 1 to 5 axes

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Booksize Cabinet Kits
- Motor Modules in chassis format
- Motor Modules in Chassis-2 format

### 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**

A detailed description of the complete principle of operation of the Safety Integrated functions and their handling is given in the associated Function Manual, which is included in the device documentation provided.

## 8.11 K08 , AOP30 advanced operator panel

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Cabinet Kits
- Motor Modules in chassis format
- Motor Modules in Chassis-2 format

**Note**

Option K08 is only available in conjunction with a CU320-2 Control Unit (option K90 or K95).

## Description




Figure 8-17 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 RS 232 serial interface using the PPI protocol.

## Characteristics

- Display with green backlighting (resolution: 240 x 64 pixels)
- 26-key keypad
- RS 232 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, green
  ALARM, yellow
  FAULT, red
  LOCAL/REMOTE, green

**Note**

**Additional documents**

A detailed description of the complete principle of operation of the AOP30 Advanced Operator Panel and its handling is given in the "SINAMICS S120 Cabinet Module AOP 30" operating instructions, which are included in the device documentation provided.

# 8.12 K46, Sensor Module Cabinet-Mounted SMC10

## 8.12.1 General information

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Booksize Cabinet Kits
- Motor Modules chassis format
- Motor Modules chassis-2 format

### 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

The motor temperature can also be detected using a temperature sensor (Pt1000 / PTC / KTY84-130 / bimetallic NC contact).

Table 8- 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 8- 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).

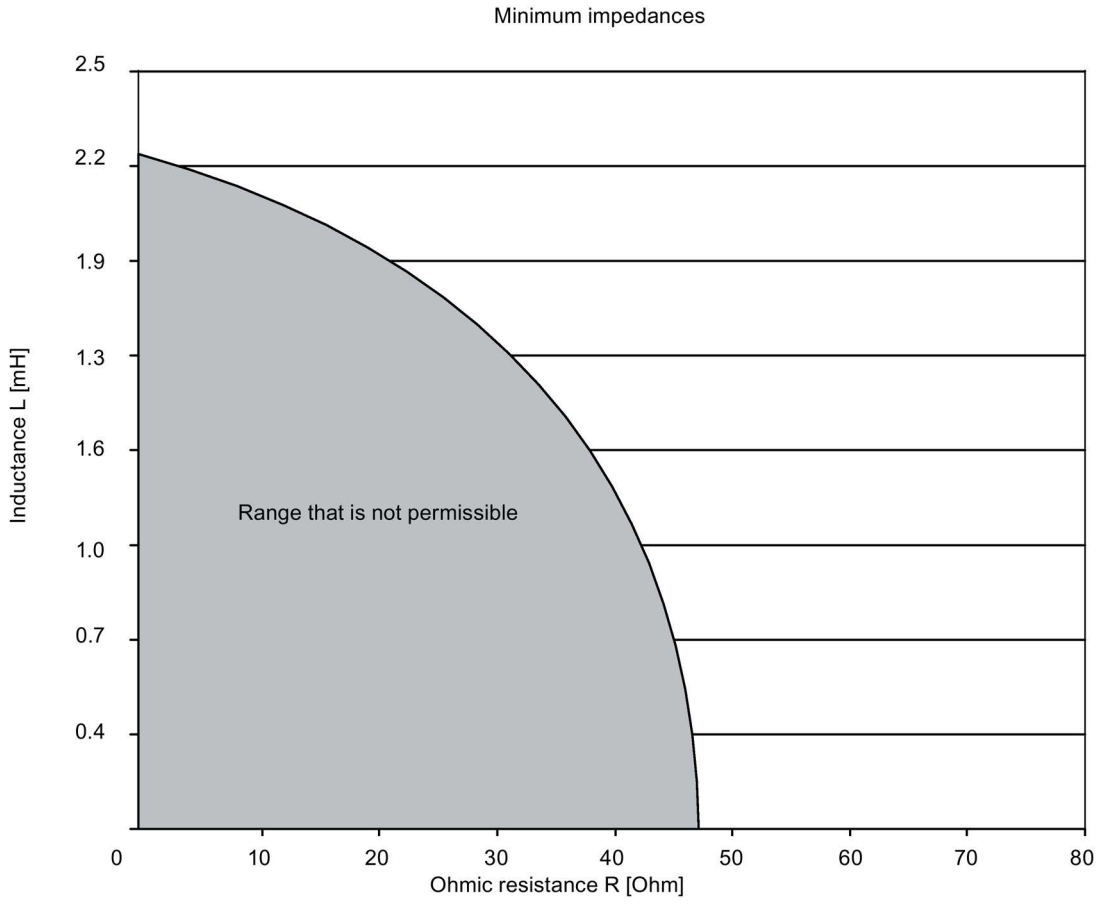



Figure 8-18 Connectable impedances with an excitation frequency f = 5000 Hz

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.

## 8.12.2 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).

## 8.12.3 Interfaces

### Overview

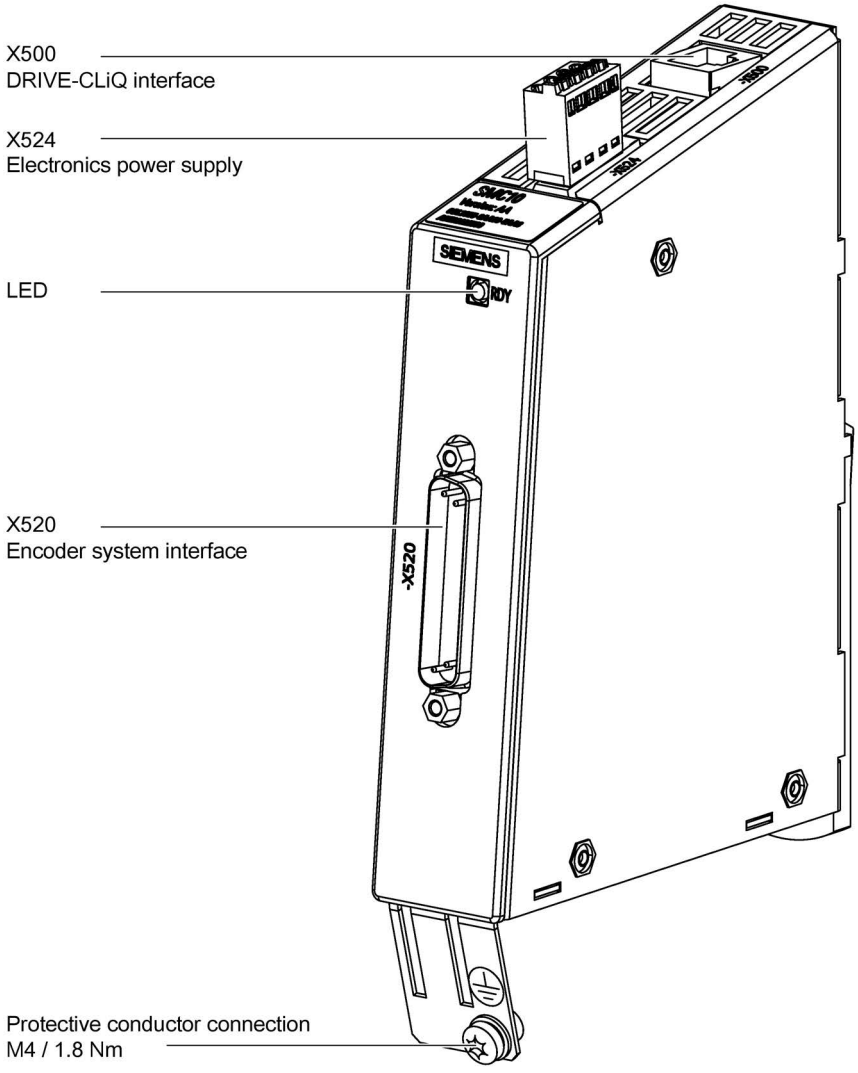
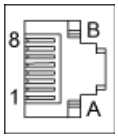



Figure 8-19 Interface overview for the SMC10

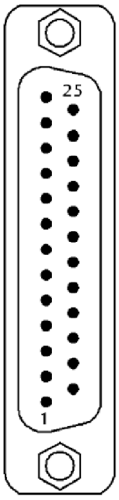
## X500: DRIVE-CLiQ interface

Table 8- 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 8- 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 / KTY84-130 / bimetallic NC contact |
| | 14 ... 23 | Reserved, do not use | |
| | 24 | Ground | Ground (for internal shield) |
| | 25 | - Temp [1] | Temperature sensor connection Pt1000 / PTC / KTY84-130 / bimetallic NC contact |
| Connector type: 25-pin D-sub 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 due to 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.

## 8.12.4 Connection example

### Connection example: Resolver, 8-pin

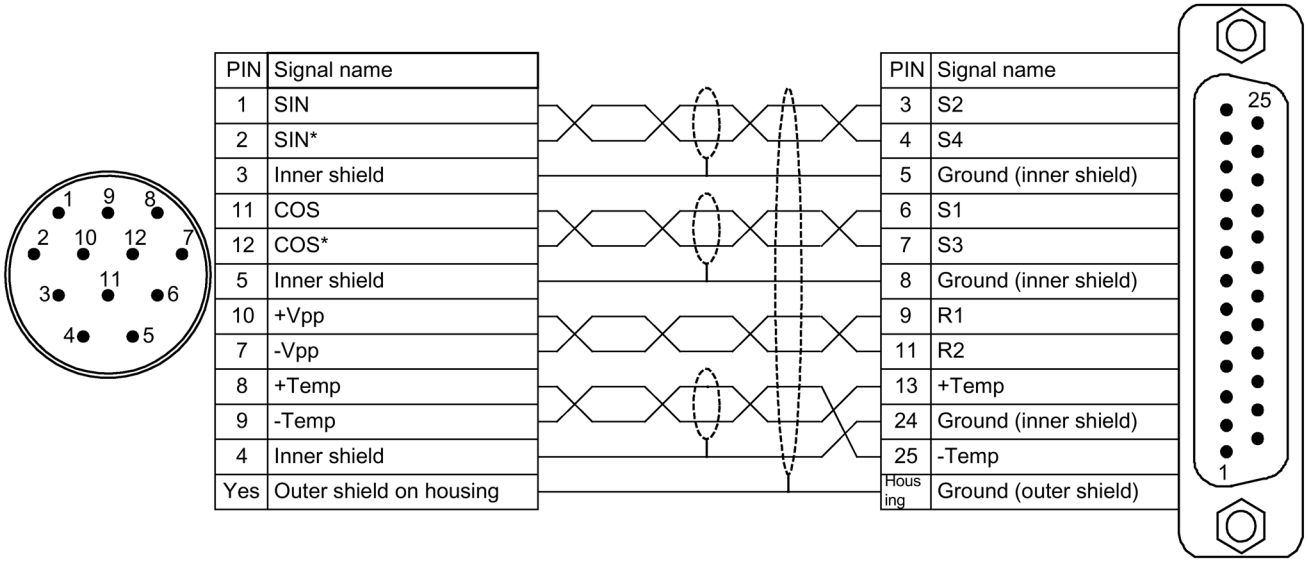



Figure 8-20 Connection example: Resolver, 8-pin

# 8.13 K48, Sensor Module Cabinet-Mounted SMC20

## 8.13.1 General information

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Booksize Cabinet Kits
- Motor Modules chassis format
- Motor Modules chassis-2 format

### Description

The SMC20 Sensor Module is used for simultaneous acquisition of 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

The motor temperature can also be detected using a temperature sensor (Pt1000 / PTC / KTY84-130 / bimetallic NC contact).

The maximum encoder cable length is 100 m.

## 8.13.2 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).

## 8.13.3 Interfaces

### Overview

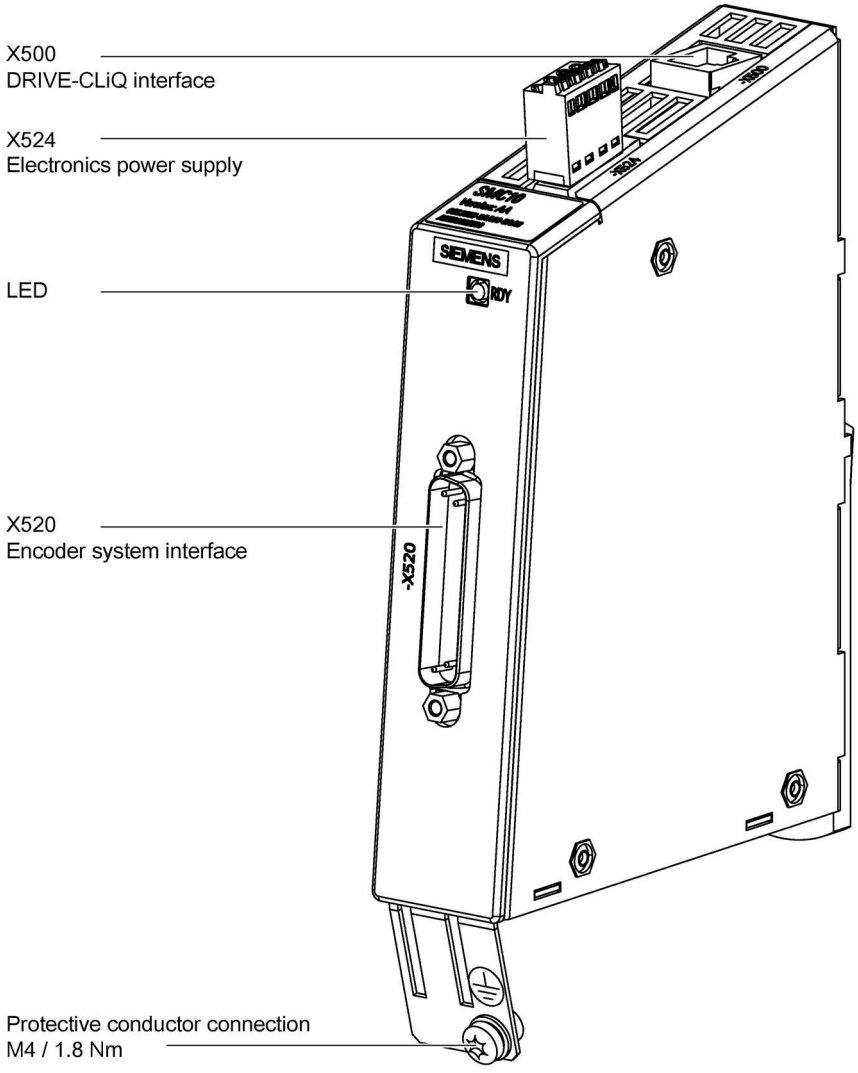
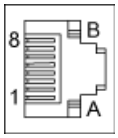



Figure 8-21 Interface overview for the SMC20

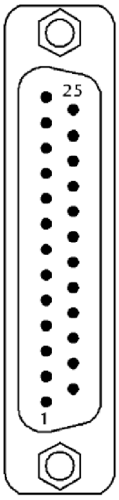
## X500: DRIVE-CLiQ interface

Table 8- 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 8- 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 / KTY84-130 / bimetallic NC contact |
| | 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 / KTY84-130 / bimetallic NC contact |
| Connector type: 25-pin D-sub 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 due to 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.

## 8.13.4 Connection example

### Connection example: Incremental encoder sin/cos 1 Vpp, 2,048

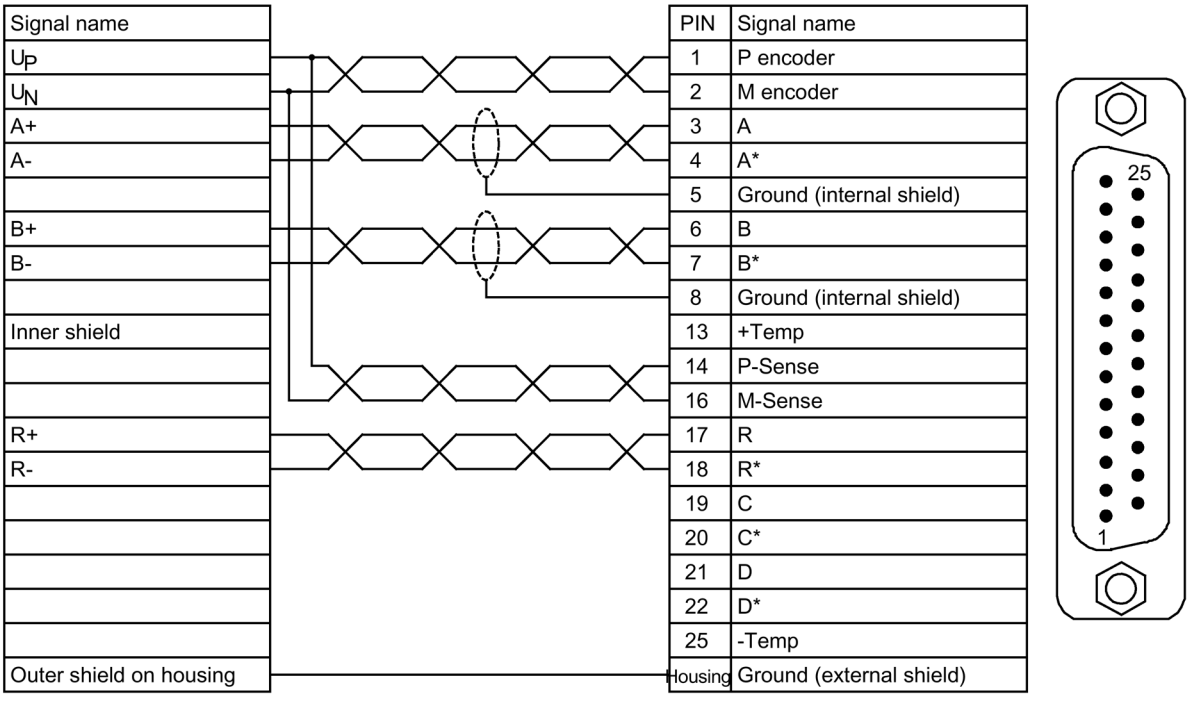



Figure 8-22 K48, connection example: Incremental encoder sin/cos 1 Vpp, 2,048

# 8.14 K50, Sensor Module Cabinet-Mounted SMC30

## 8.14.1 General information

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Booksize Cabinet Kits
- Motor Modules chassis format
- Motor Modules chassis-2 format

### 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

The motor temperature can also be detected using a temperature sensor (Pt1000 / PTC / KTY84-130 / bimetallic NC contact).

Table 8- 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 8- 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 8- 28 Specification of encoder systems that can be connected

| Parameter | Designation | Threshold [4] | 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 | $(t_{ALo\text{-}BHi} - t_{Hi})/2$ [3] | ns |
| Zero pulse active time (while A=B=high and beyond) | $t_{Hi}$ | | 640 | $t_{ALo\text{-}BHi} - 2 \times t_{Lo}$ [3] | ns |

[1] Further signal levels according to the RS 422 standard.

[2] The absolute level of the individual signals varies between 0 V and $V_{CC}$ of the encoder system.

[3] $t_{ALo\text{-}BHi}$ 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".

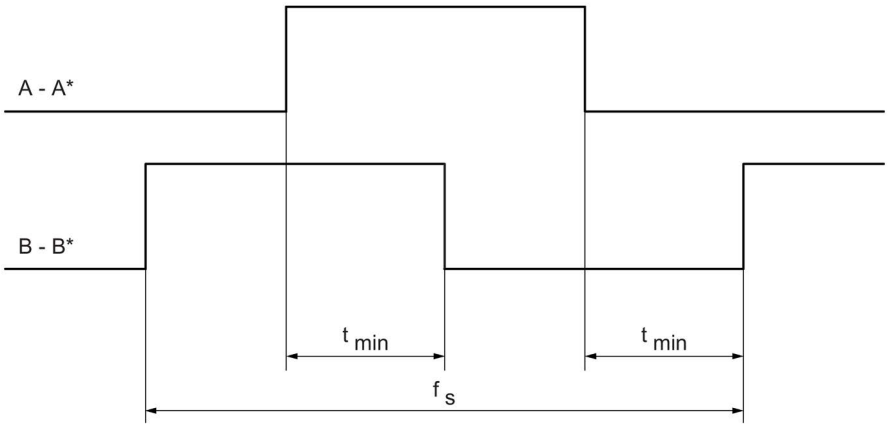



Figure 8-23 Signal characteristic of the A and B track between two edges: Time between two edges with pulse encoders

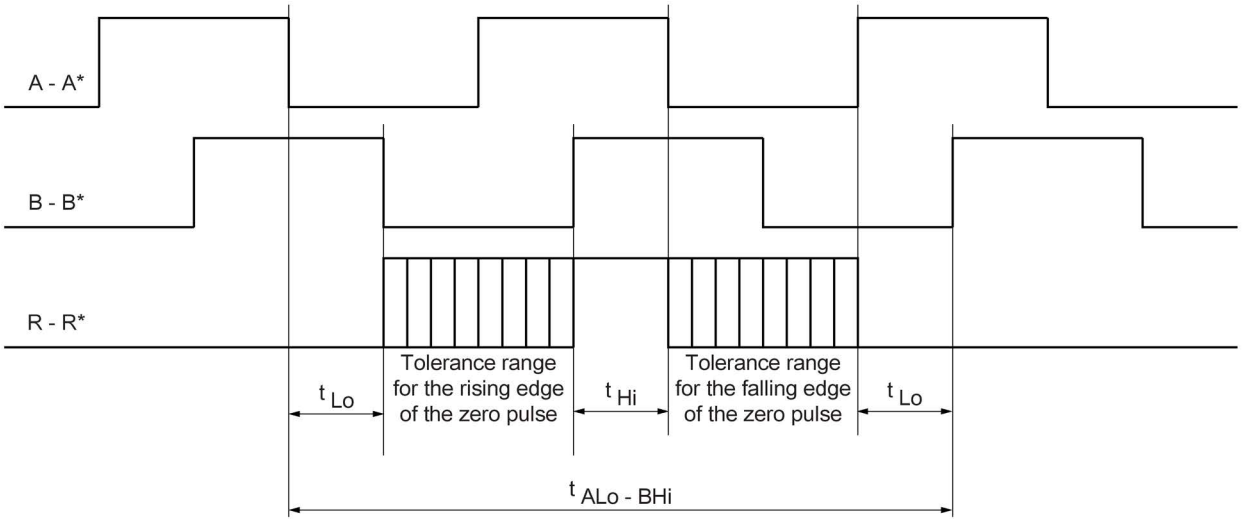



Figure 8-24 Position of the zero pulse to the track signals

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):

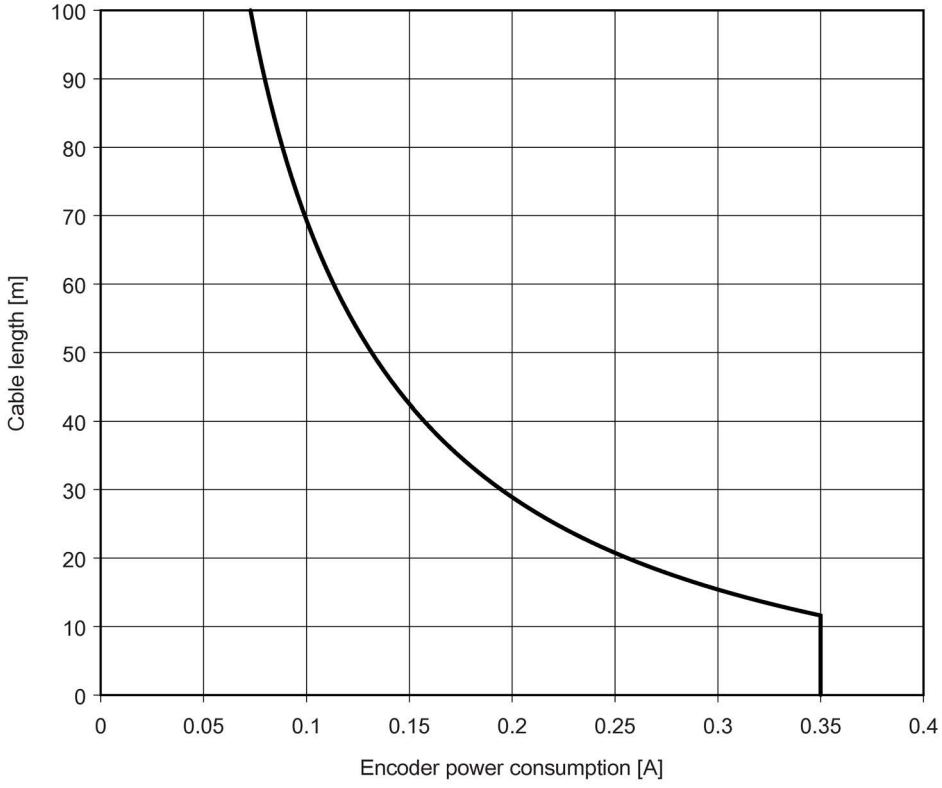



Figure 8-25 Signal cable length as a function of the encoder current consumption

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).

## 8.14.2 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).

## 8.14.3 Interfaces

### Overview

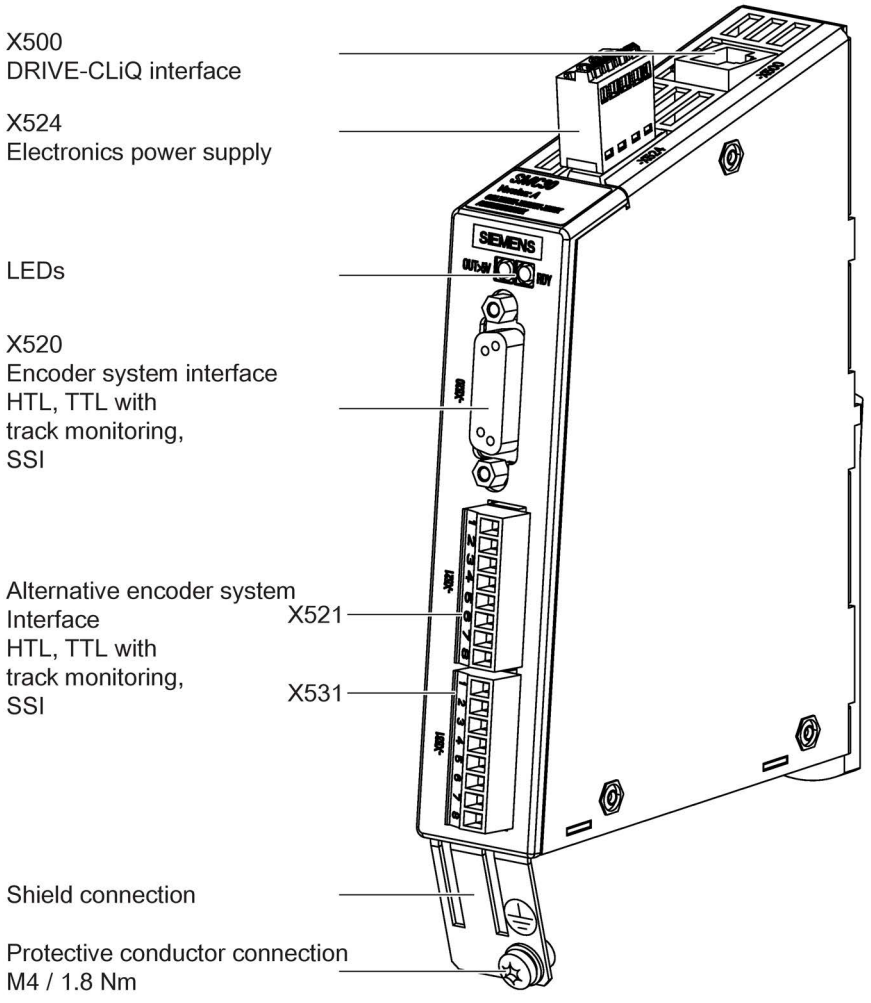
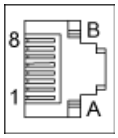



Figure 8-26 Interface overview for the SMC30

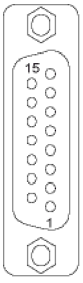
## X500: DRIVE-CLiQ interface

Table 8- 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 8- 30 Encoder connection X520

| Connector | Pin | Signal name | Technical data |
|---|---|---|---|
|  | 1 | +Temp [1] | Temperature sensor connection Pt1000 / PTC / KTY84-130 / bimetallic NC contact |
| | 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 / KTY84-130 / bimetallic NC contact |
| | 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 malfunction due to impermissible voltage values**

If the counter EMF is impermissible, the components may be damaged and malfunctions can occur.

- The back EMF at the outputs may only be in the range between -15 V and +15 V.

**NOTICE**

**Damage to the motor due to 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**

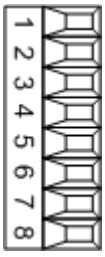
**Damage to the encoder due to incorrect supply voltage**

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 8- 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 | | | |

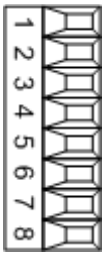


**Note**

**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 8- 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 / KTY84-130 / bimetallic NC contact |
| | 4 | +Temp [1] | Temperature sensor connection Pt1000 / PTC / KTY84-130 / bimetallic NC contact |
| | 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 malfunction due to impermissible voltage values**

If the counter EMF is impermissible, the components may be damaged and malfunctions can occur.

- The back EMF at the outputs may only be in the range between -15 V and +15 V.

**NOTICE**

**Damage to the motor due to 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.

## 8.14.4 Connection example

### Connection example 1: HTL encoder with reference signal, bipolar connection

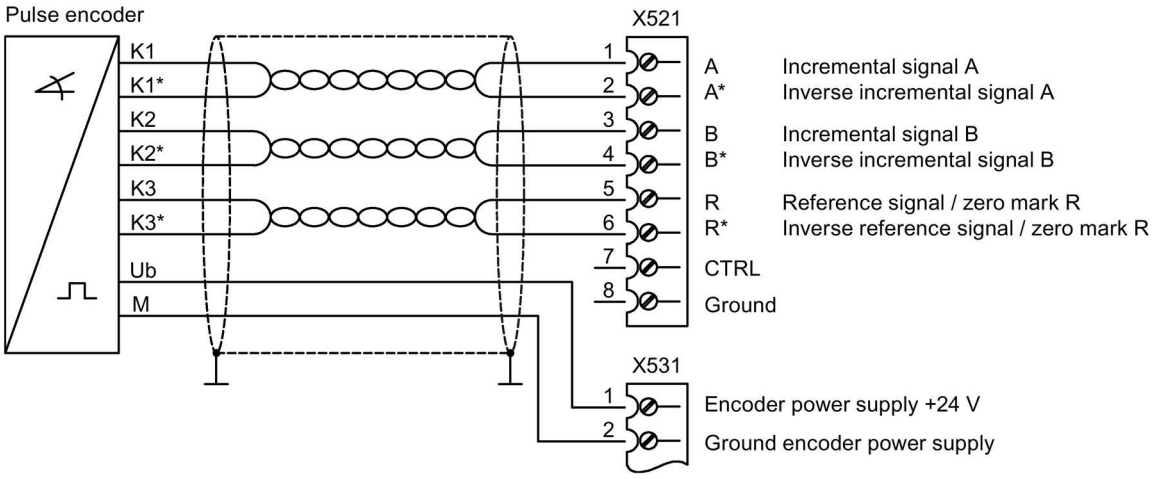



Figure 8-27 Connection example 1: HTL encoder with reference signal, bipolar connection

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

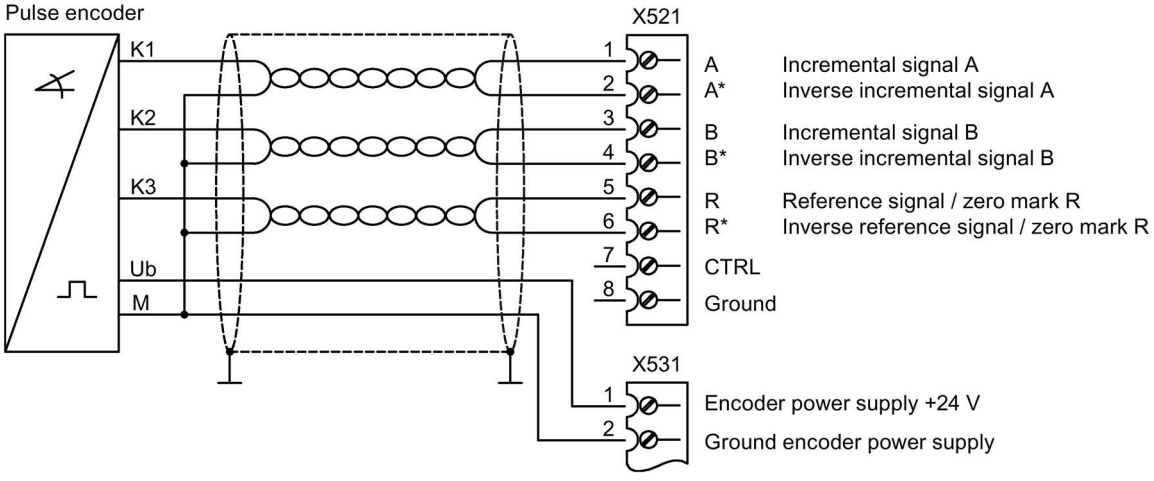



Figure 8-28 Connection example 2: HTL encoder with reference signal, unipolar connection including the encoder ground

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**

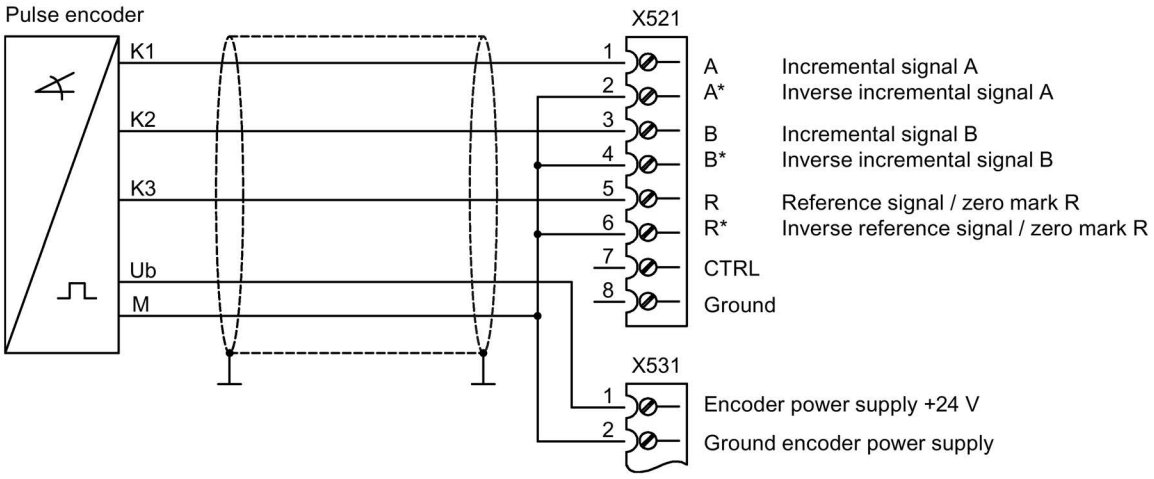



Figure 8-29 Connection example 3: HTL encoder with reference signal, unipolar connection without the encoder ground

## 8.15 K51, VSM10 Voltage Sensing Module Cabinet-Mounted

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Booksize Cabinet Kits
- Motor Modules in Chassis format
- Motor Modules in Chassis-2 format

### 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

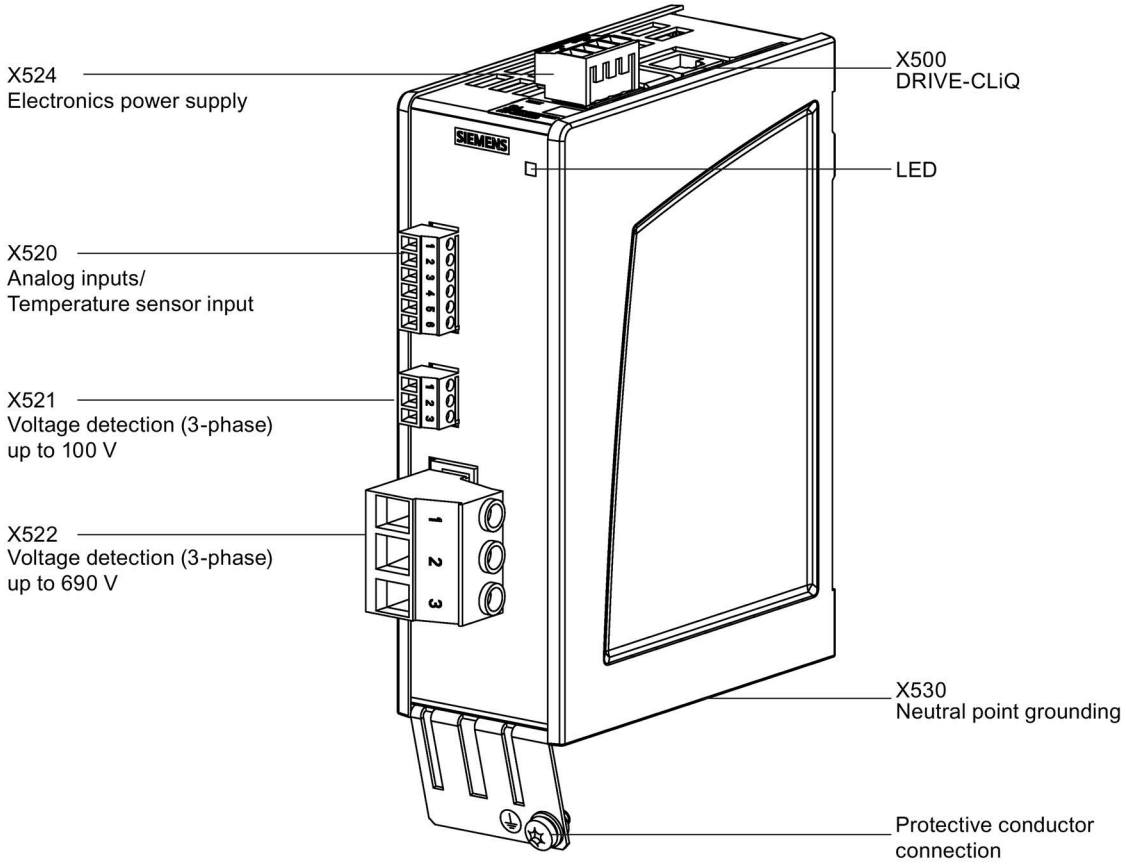



Figure 8-30 Interface overview for the Voltage Sensing Module (option K51)

### 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.

## 8.16 K52, Additional SMC30 Sensor Module

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Booksize Cabinet Kits
- Motor Modules in chassis format
- Motor Modules in Chassis-2 format

### 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**

A detailed description of the complete principle of operation of the Safety Integrated functions and their handling is given in the associated Function Manual, which is included in the device documentation provided.

## 8.17 K70, fan power supply

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Module

### Description

With this option, the line voltage supply for the auxiliary power supply system is picked off after the circuit-breaker (-Q10) and is protected using a motor protection circuit-breaker -(Q12).

Voltages 1 AC 230 V and 24 VDC of the auxiliary power supply system must be supplied on the plant side.

## 8.18 K73, auxiliary power supply 24 V DC

### Availability of option

- Booksize Base Cabinets

### Description

The 24 V DC supply for standard Booksize Cabinet Kits is tapped from the auxiliary power supply.

With option K73, the 24 V DC supply is provided by a dedicated SITOP.

# 8.19 K76, auxiliary voltage generating unit in the Line Connection Module

## Availability of option

- Line Connection Modules
- Active Line Connection Modules-2

## 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:

- 2 AC 380 ... 480 V or 500 ... 690 V
  possible tap for the following Line Connection Modules:
  - Line Connection Module with rated current up to 800 A: 35 A
  - Line Connection Module with rated current up to 1000 ... 1600 A: 50 A
  - Line Connection Module 6SL3700-0LE42-0AA3: 50 A
  - Line Connection Module with rated current up to 2000 ... 3200 A: 80 A
- 2 AC 380 ... 480 V
  possible tap for the following Active Line Connection Modules:
  - Line Connection Module with rated current up to 745 A: 30 A
  - Line Connection Module with rated current 840 ... 1405 A: 40 A
- 230 VAC (poss. tap approx. 4 ... 6 A)
- 24 VDC (poss. tap approx. 20 ... 40 A)

In the Line Connection Module, the auxiliary voltages are connected to the auxiliary voltage module, and therefore supply the complete cabinet group.

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, the auxiliary power supply interface must be installed with three cables 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 Line Connection Module (-T10) for the 230 VAC auxiliary power supply for the cabinet. 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 8- 33 Line voltage assignment for the internal power supply (380 ... 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 8- 34 Line voltage assignment for the internal power supply (500 ... 690 V AC, 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.

# 8.20 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:

- Booksize Cabinet Kits
- Motor Modules in chassis format
- Motor Modules in Chassis-2 format

## 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**

A detailed description of the complete principle of operation of the Safety Integrated functions and their handling is given in the associated Function Manual, which is included in the device documentation provided.

## 8.21 K87, Terminal Module TM54F




Figure 8-31 Option K87, Terminal Module TM54F

### Availability of option

- Booksize Cabinet Kits
- Motor Modules in chassis format
- Motor Modules in Chassis-2 format

### 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 8- 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 pushbuttons and safety locks, position switches and light arrays/light curtains.

[2] Dynamic response: The sensor power supply is switched on and off by the TM54F when the forced dormant error detection is active for 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 VDC 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-DIs must take the form of shielded cables if they are > 30 m in length.

**Note**

**Safety Integrated Function Manual**

A detailed description of the complete principle of operation of the Safety Integrated functions and their handling is given in the associated Function Manual, which is included in the device documentation provided.

# 8.22 K88, Safe Brake Adapter SBA 230 V AC

## Availability of option

This option is available for the following S120 Cabinet Modules:

- Motor Modules in chassis format
- Motor Modules in Chassis-2 format

## 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 VAC 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-site 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 VDC brake is connected to option K88 (Safe Brake Adapter 230 VAC) 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 VAC and the brake must be observed. To accurately calculate the maximum cable length, see the SINAMICS Low Voltage Engineering Manual 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 deenergized, i.e. braking starts earlier.

The Safe Brake Adapter supports such fast de-energizing using the two additional connections -X15:1 and -X15:2. This function does not belong to safe brake control.

## Notes

**Note**

**Replacement 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**

A detailed description of the complete principle of operation of the Safety Integrated functions and their handling is given in the associated Function Manual, which is included in the device documentation provided.

# 8.23 K90, Control Unit CU320-2 DP

## 8.23.1 General information

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Cabinet Kits
- Motor Modules in chassis format
- Motor Modules in Chassis-2 format

### 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 handles communications, open-loop control and closed-loop control functions 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.

The device can communicate with other participants via PROFIBUS or the DRIVE-CLiQ interface, 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.

## 8.23.2 Connection overview

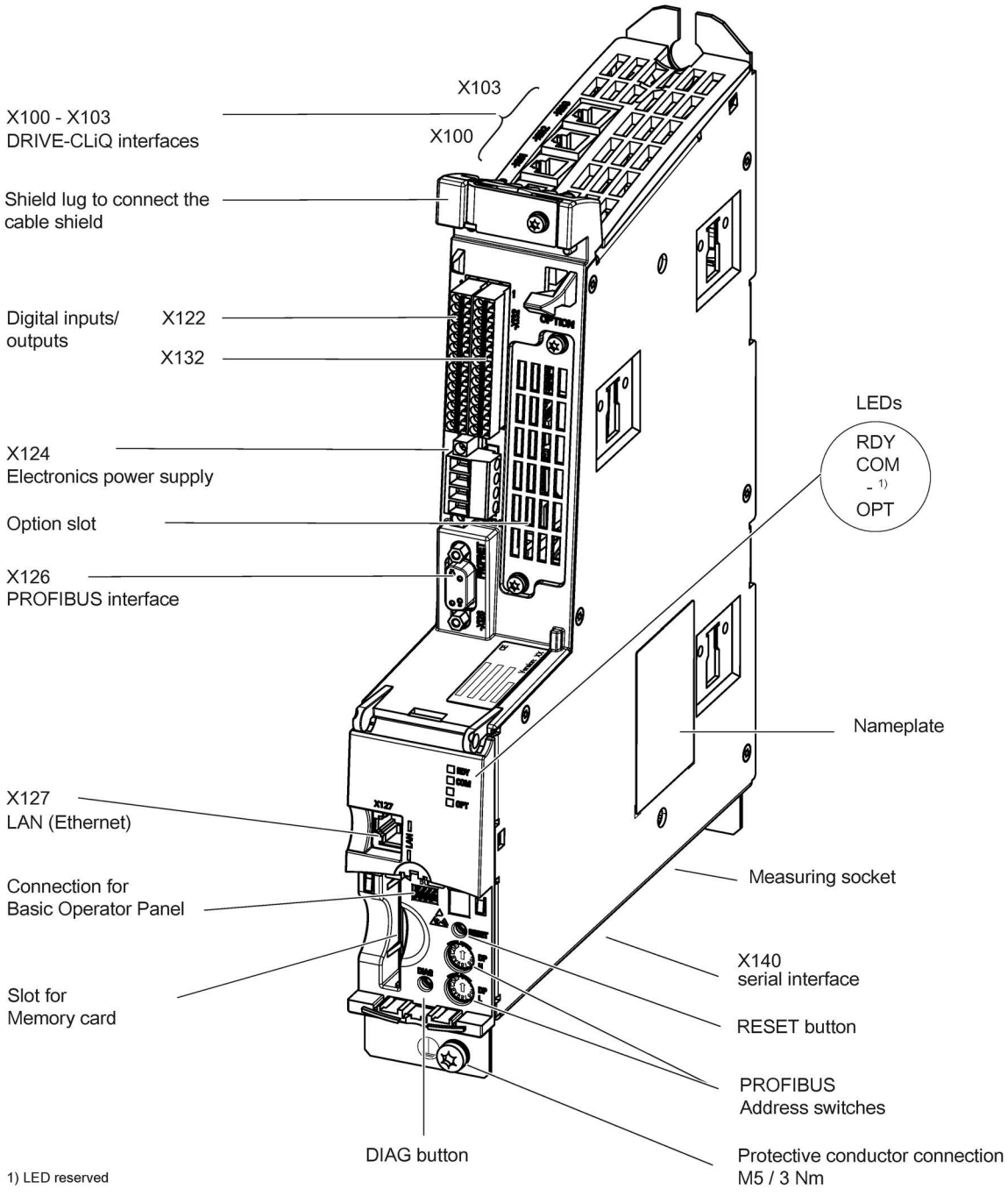



Figure 8-32 Connection overview of the CU320-2 DP Control Unit (without cover)

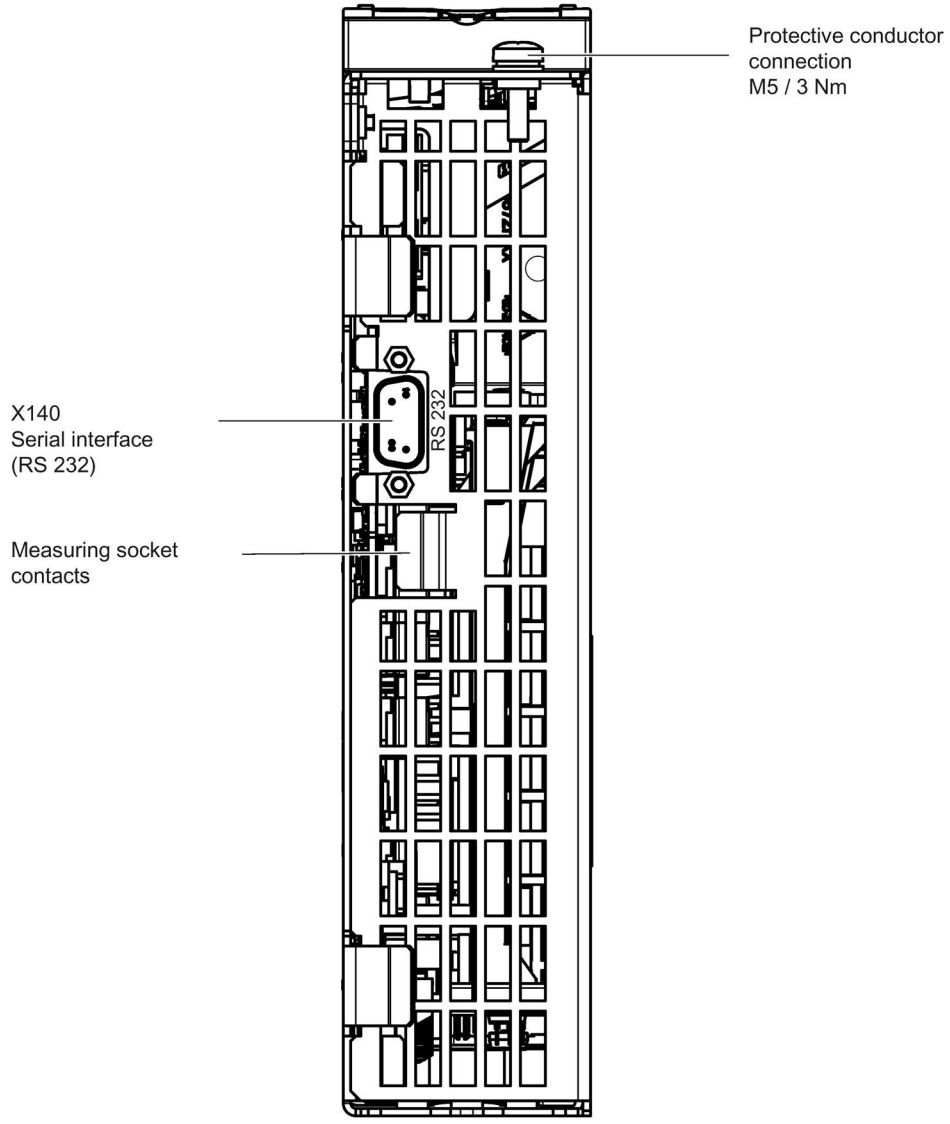



Figure 8-33 Interface X140 and measuring sockets T0 to T2 - CU320-2 DP (view from below)

| **NOTICE** |
| --- |
| **Malfunctions or damage to the option board by inserting and withdrawing in operation**<br>Withdrawing and inserting the option board in operation can damage it or cause it to malfunction.<br>• Only withdraw or insert the Option Board when the Control Unit is in a no-current condition. |

## 8.23.3 Connection example

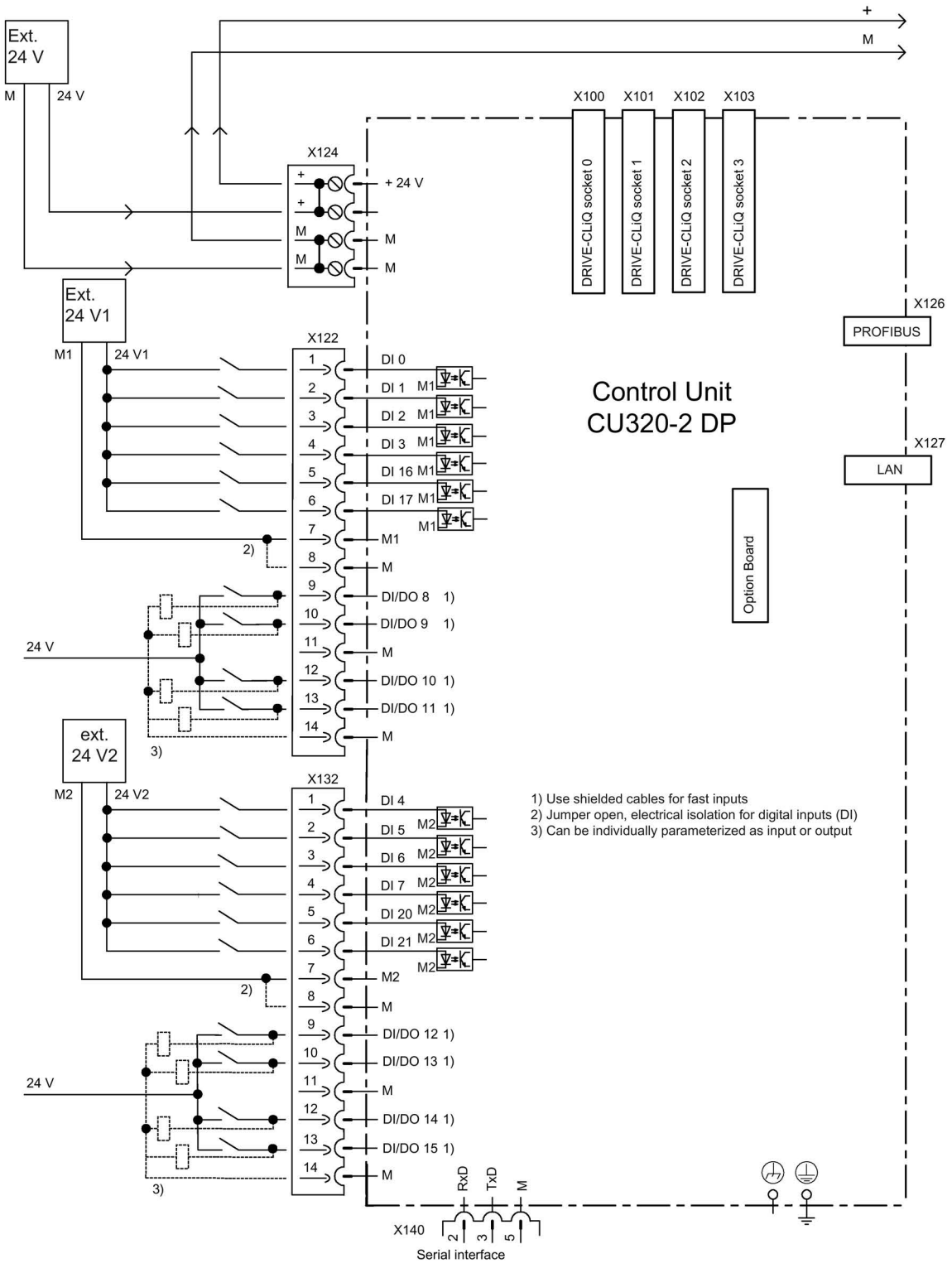



Figure 8-34 Connection example of CU320-2 DP

**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.

## 8.23.4 X55 customer terminal strip

### 8.23.4.1 Overview

#### Description

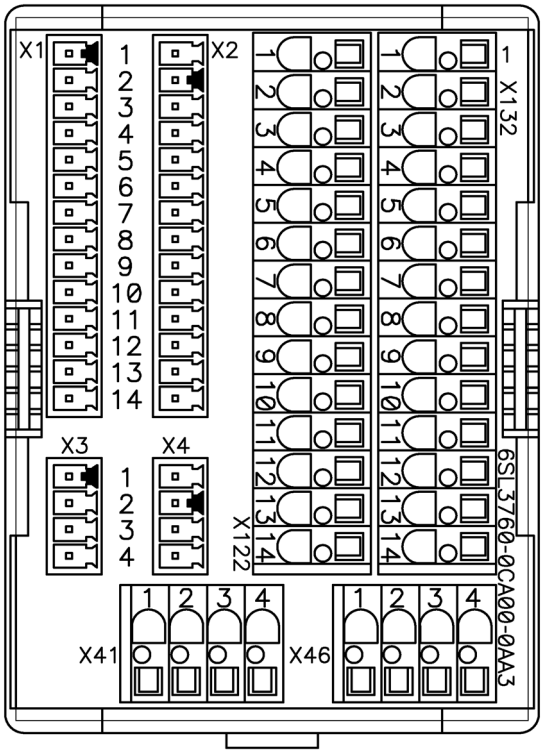



Figure 8-35 Customer terminal strip -X55

The customer terminal block- X55 is installed in the cabinet together with the CU320-2 Control Unit. The digital inputs/outputs of the Control Unit can be used via terminal blocks -X55-X122 and -X55-X132.

**Note**

**Internally wired interfaces**

Interfaces -X1, -X2, -X3 and -X4 are wired within the cabinet and are not available for customer connections!

If the customer terminal block is ever replaced, connectors -X1 and -X2 must not be interchanged! Otherwise, "Safe Torque Off" and "Safe Stop 1" will malfunction!

**Note**

**Customer terminal block as standard**

The customer terminal block is a standard component in the cabinet for the Motor Module Cabinet Module (chassis format). The digital inputs/outputs of the CU320-2 Control Unit on terminal blocks -X55-X122 and -X55-X132 can only be used in conjunction with a Control Unit.

**Note**

**Power supply for the digital inputs**

The two groups of digital inputs (DI0 to DI3, DI16 and DI17 or DI4 ... DI7, DI20 and DI21) each have a common reference potential per group (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 supplied from an external source, the jumper between ground M1 and M or M2 and M must be removed in order to avoid potential looping. The external ground must then be connected to terminals M1 or M2.

## Pin assignment of customer terminal strip –X55

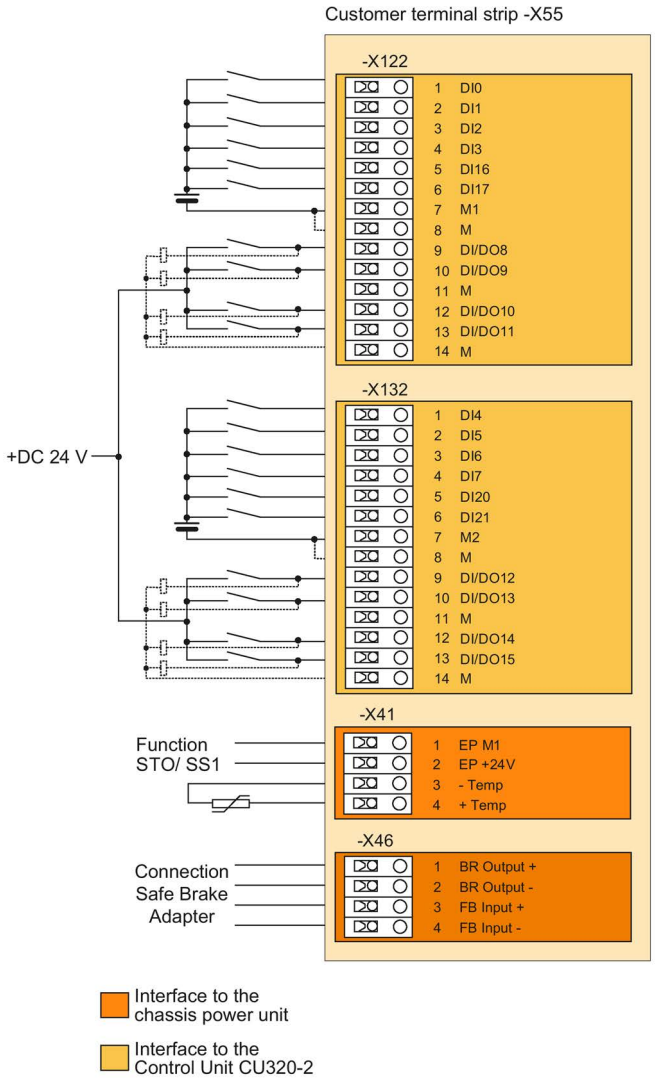
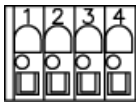



Figure 8-36 Connection assignment of customer terminal block -X55 (example: Motor Module Cabinet Module (chassis format))

### 8.23.4.2 X41 EP terminal / temperature sensor connection

Table 8- 36 Terminal strip X41 EP terminals / temperature sensor connection

| Connector | Terminal | Function | Technical data |
|---|---|---|---|
|  | 1 | EP M1<br>(Enable Pulses) | Supply voltage: 24 V DC (20.4 ... 28.8 V)<br>Current consumption: 10 mA<br>The pulse inhibit function is only available when the "Safety Integrated Basic Functions via onboard terminals" software is enabled. |
| | 2 | EP +24 V<br>(Enable Pulses) | |
| | 3 | - Temp | Temperature sensor connection for motor temperature measurement:<br>KTY84-1C130, PTC, PT100, PT1000, bimetallic 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 to ground potential through a large surface area.

**NOTICE**

**Damage to the motor in the event of an incorrectly connected KTY temperature sensor at terminals -X41:3,4**

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.

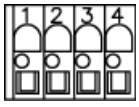
**Note**

**Safety Integrated Function Manual**

A detailed description of the complete principle of operation and handling of the Safety Integrated functions is provided in the associated Function Manual, which is included in the device documentation provided.

### 8.23.4.3 X46 Brake control and monitoring

Table 8- 37 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<br>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 $mm^2$ | | | |

**Note**

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

**⚠WARNING**

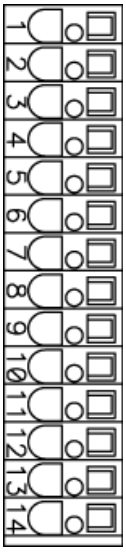
**Fire due to overheating when the total length of the connecting cables is exceeded**

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.

### 8.23.4.4 X122 digital inputs/outputs

Table 8- 38 Terminal block X122 on the customer terminal block X55

| Connector | Terminal | Designation [1] | Technical data |
|---|---|---|---|
|  | 1 | DI 0 | Voltage (max.): -3 ... +30 V DC<br>Typical power consumption: 9 mA at 24 V<br>Electrical isolation: reference potential is M1 terminal<br>Level (with ripple)<br>High level: 15 ... 30 V<br>Low level: -3 ... +5 V<br>Input delay (typ.):<br>For "0" → "1": 50 µs<br>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 terminals 1 ... 6 |
| | 8 | M | Electronics ground |
| | 9 | DI/DO 8 | **As input**:<br>Voltage: -3 ... +30 V DC<br>Current consumption, typical: 9 mA at 24 V<br>Level (with ripple)<br>High level: 15 ... 30 V<br>Low level: -3 ... +5 V<br>DI/DO 8, 9, 10, and 11 are "high-speed inputs" [2]<br>Input delay (typ.):<br>For "0" → "1": 5 µs<br>For "1" → "0": 50 µs<br>**As output**:<br>Voltage: 24 V DC<br>Max. load current per output: 500 mA<br>Continuous short-circuit proof<br>Output delay (typ./max.): [3]<br>For "0" → "1": 150 µs / 400 µs<br>For "1" → "0": 75 µs / 100 µs<br>Switching frequency:<br>For resistive load: Max. 100 Hz<br>For inductive load: max. 0.5 Hz<br>For lamp load: max. 10 Hz<br>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: 2.5 $mm^2$ | | | |

[1] DI: Digital input; DI/DO: Bidirectional digital input/output; M: Electronic 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".

To enable the digital inputs (DI) to function, terminal M1 must be connected.

This is achieved through one of the following measures:

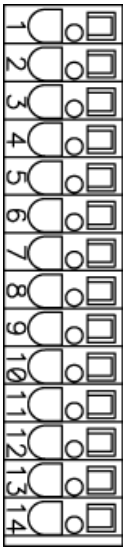
1. Also route the reference ground of the digital inputs.
2. A jumper to terminal M. (**Note:** This removes the electrical isolation for these digital inputs.)

**Note**

If the 24 V supply is briefly interrupted, then the digital outputs are deactivated during this time.

### 8.23.4.5 X132 digital inputs/outputs

Table 8- 39 Terminal block X132 on the customer terminal block X55

| Connector | Terminal | Designation [1] | Technical data |
|---|---|---|---|
|  | 1 | DI 4 | Voltage (max.): -3 ... +30 V DC<br>Current consumption, typical: 9 mA at 24 V<br>Electrical isolation: reference potential is M2 terminal<br>Level (including ripple)<br>High level: 15 ... 30 V<br>Low level: -3 ... +5 V<br>Input delay (typ.):<br>For "0" → "1": 50 µs<br>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 terminals 1 ... 6 |
| | 8 | M | Electronics ground |
| | 9 | DI/DO 12 | **As input**:<br>Voltage: -3 ... +30 V DC<br>Current consumption, typical: 9 mA at 24 V<br>Level (including ripple)<br>High level: 15 ... 30 V<br>Low level: -3 ... +5 V<br>DI/DO 12, 13, 14, and 15 are "rapid inputs" [2]<br>Input delay (typ.):<br>For "0" → "1": 5 µs<br>For "1" → "0": 50 µs<br>**As output**:<br>Voltage: 24 V DC<br>Max. load current per output: 500 mA<br>Continuous short-circuit proof<br>Output delay (typ./max.): [3]<br>For "0" → "1": 150 µs / 400 µs<br>For "1" → "0": 75 µs / 100 µs<br>Switching frequency:<br>For resistive load: Max. 100 Hz<br>For inductive load: max. 0.5 Hz<br>For lamp load: max. 10 Hz<br>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: 2.5 $mm^2$ | | | |

[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:

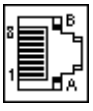
1. Also route the reference ground of the digital inputs.
2. A jumper to terminal M. (**Note:** This removes the electrical isolation for these digital inputs.)

**Note**

If the 24 V supply is briefly interrupted, then the digital outputs are deactivated during this time.

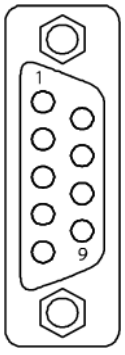
## 8.23.5 X100 - X103 DRIVE-CLiQ interface

Table 8- 40 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<br>Blanking plate for DRIVE-CLiQ interfaces (50 units) Article number: 6SL3066-4CA00-0AA0 | | | |

## 8.23.6 X126 PROFIBUS

Table 8- 41 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.

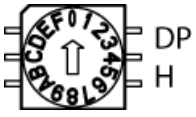
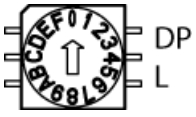
The bus terminating resistors are activated in the connector.

The cable shield must be connected at both ends and over a large surface area.

## 8.23.7 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 8- 42 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.

## 8.23.8 X127 LAN (Ethernet)

**Note**

**Use**

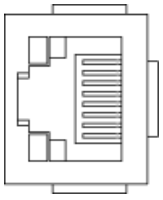
Ethernet interface X127 is intended for commissioning and diagnostics, which means that it must always be accessible (e.g. for service).

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 29)").

Table 8- 43 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:

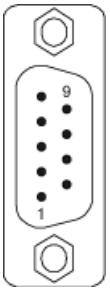
Table 8- 44 LED statuses for the X127 LAN interface

| LED | State | Description |
|---|---|---|
| Green | On | 10 or 100 Mbit link available |
| | Off | Missing or faulty link |
| Yellow | On | Sending or receiving |
| | Off | No activity |

## 8.23.9 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 8- 45 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 | | | |

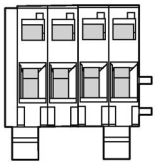
**Note**

**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.

## 8.23.10 Measuring socket

Table 8- 46 Measuring socket with mounted PC board connector

| Connector | Socket | Function | Technical data |
|---|---|---|---|
| M T0 T1 T2  | M | Ground | Voltage: 0 ... 5 V<br>Resolution: 8 bits<br>Load current: max. 3 mA<br>Continuous short-circuit proof<br>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.

## 8.23.11 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.

### 8.23.11.1 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

## 8.23.11.2 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.

### 8.23.11.3 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.

### 8.23.11.4 Slot for the memory card

**Slot for the memory card**




Figure 8-37 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.

## 8.24 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).

# 8.25 K95, Control Unit CU320-2 PN

## 8.25.1 General information

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Cabinet Kits
- Motor Modules in chassis format
- Motor Modules in Chassis-2 format

### 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 handles communications, open-loop control and closed-loop control functions 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.

The device can communicate with other participants via PROFIBUS or the DRIVE-CLiQ interface, 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.

## 8.25.2 Connection overview

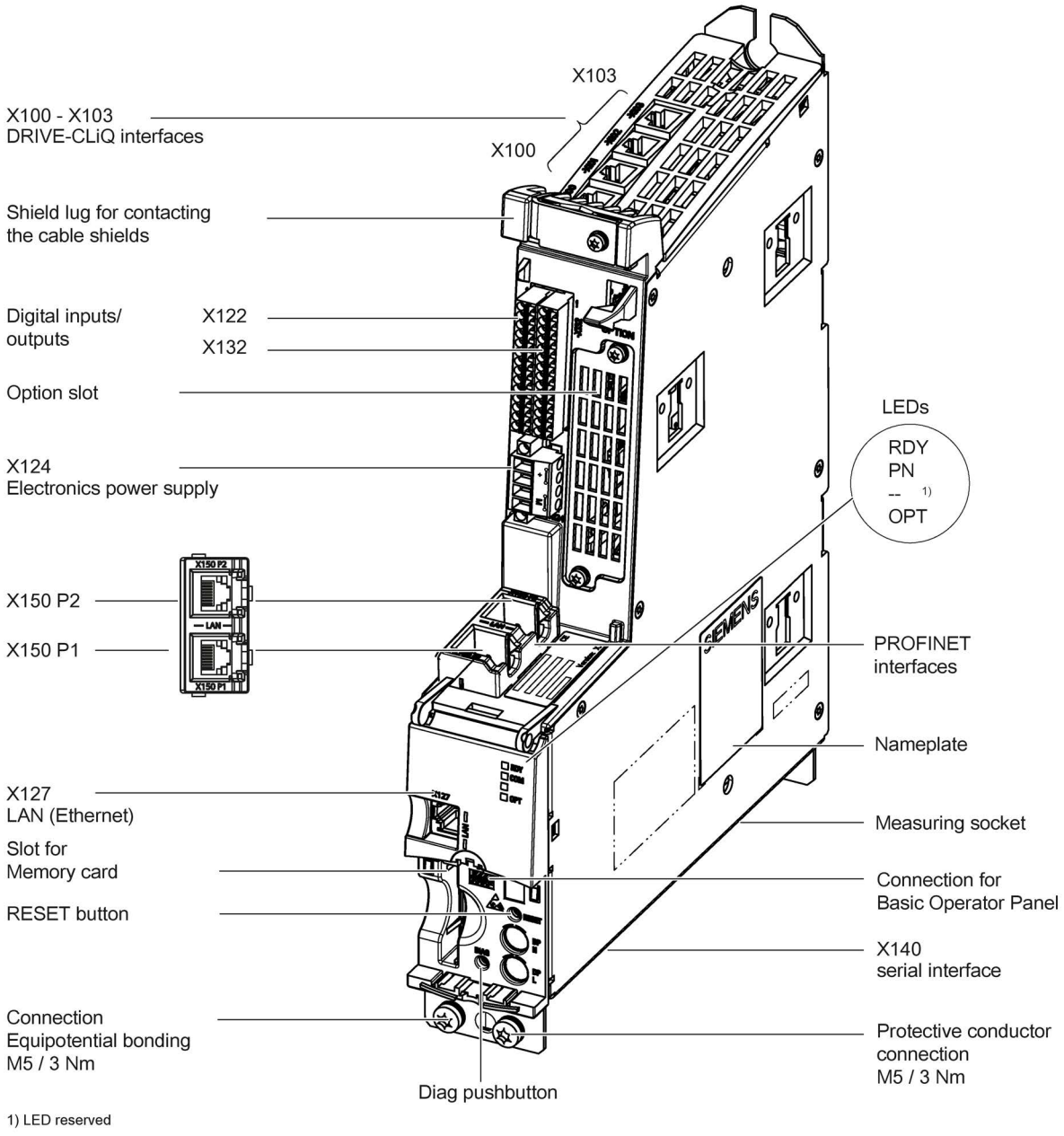



Figure 8-38 Overview of connections for the CU3202 PN Control Unit (without cover)

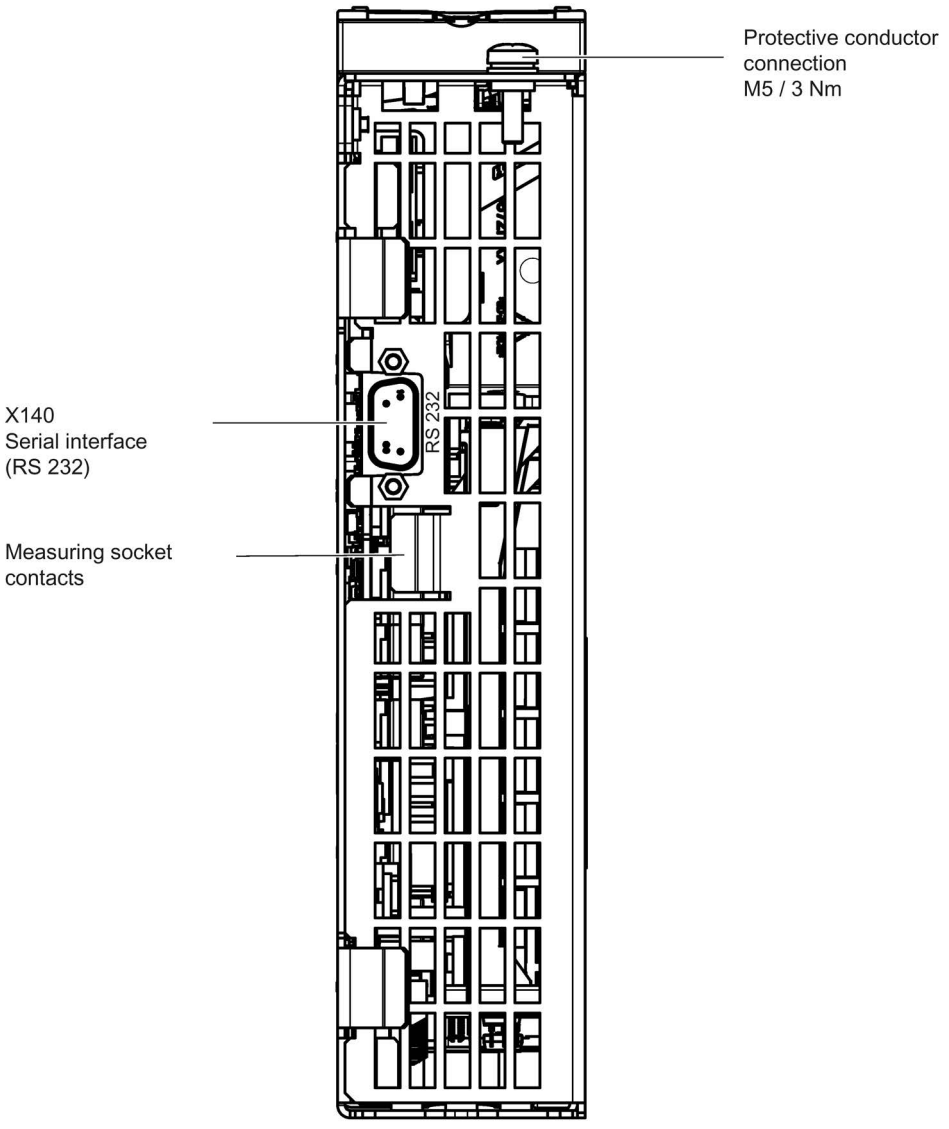



Figure 8-39 Interface X140 and measuring sockets T0 to T2 - CU320-2 PN (view from below)

| **NOTICE** |
| --- |
| **Malfunctions or damage to the option board by inserting and withdrawing in operation**<br>Withdrawing and inserting the option board in operation can damage it or cause it to malfunction.<br>• Only withdraw or insert the Option Board when the Control Unit is in a no-current condition. |

## 8.25.3 Connection example

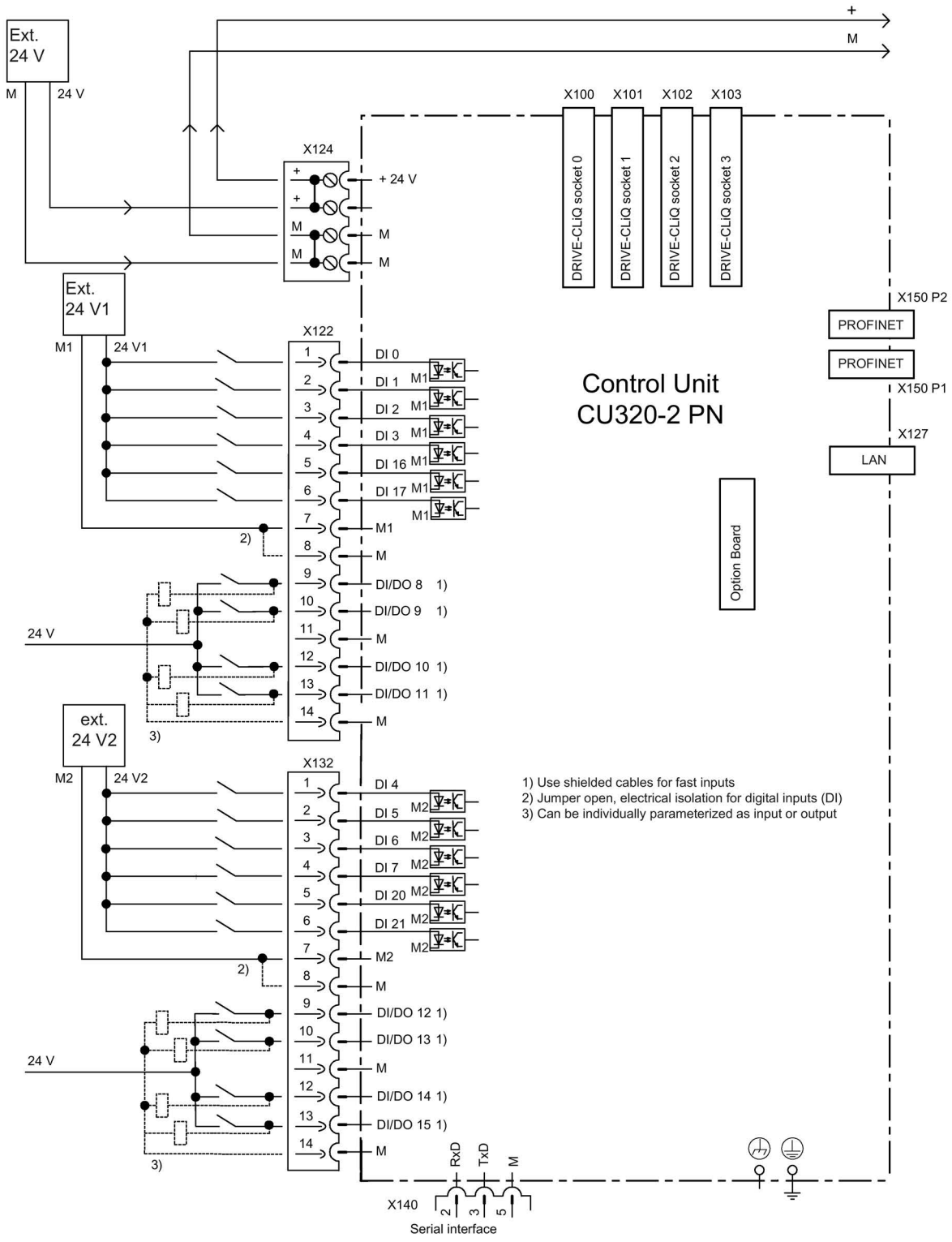



Figure 8-40 Connection example, CU320-2 PN

**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.

## 8.25.4 X55 customer terminal strip

### 8.25.4.1 Overview

**Description**

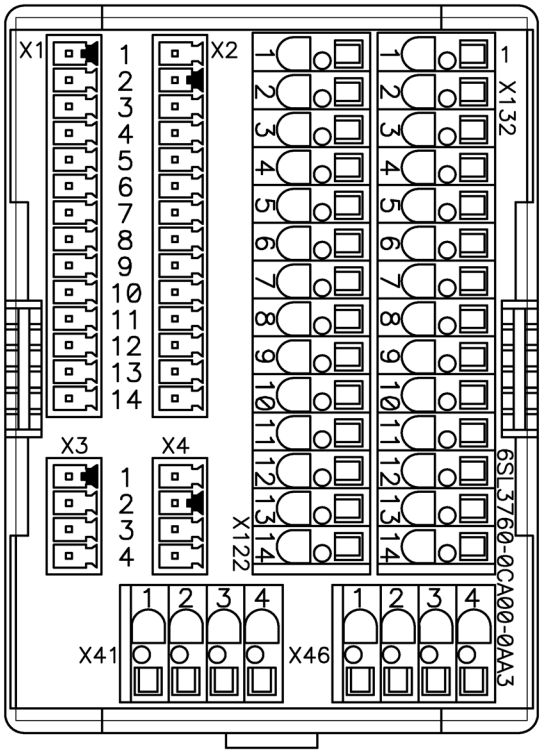



Figure 8-41 Customer terminal strip -X55

The customer terminal block- X55 is installed in the cabinet together with the CU320-2 Control Unit. The digital inputs/outputs of the Control Unit can be used via terminal blocks -X55-X122 and -X55-X132.

**Note**

**Internally wired interfaces**

Interfaces -X1, -X2, -X3 and -X4 are wired within the cabinet and are not available for customer connections!

If the customer terminal block is ever replaced, connectors -X1 and -X2 must not be interchanged! Otherwise, "Safe Torque Off" and "Safe Stop 1" will malfunction!

**Note**

**Customer terminal block as standard**

The customer terminal block is a standard component in the cabinet for the Motor Module Cabinet Module (chassis format). The digital inputs/outputs of the CU320-2 Control Unit on terminal blocks -X55-X122 and -X55-X132 can only be used in conjunction with a Control Unit.

**Note**

**Power supply for the digital inputs**

The two groups of digital inputs (DI0 to DI3, DI16 and DI17 or DI4 ... DI7, DI20 and DI21) each have a common reference potential per group (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 supplied from an external source, the jumper between ground M1 and M or M2 and M must be removed in order to avoid potential looping. The external ground must then be connected to terminals M1 or M2.

## Pin assignment of customer terminal strip –X55

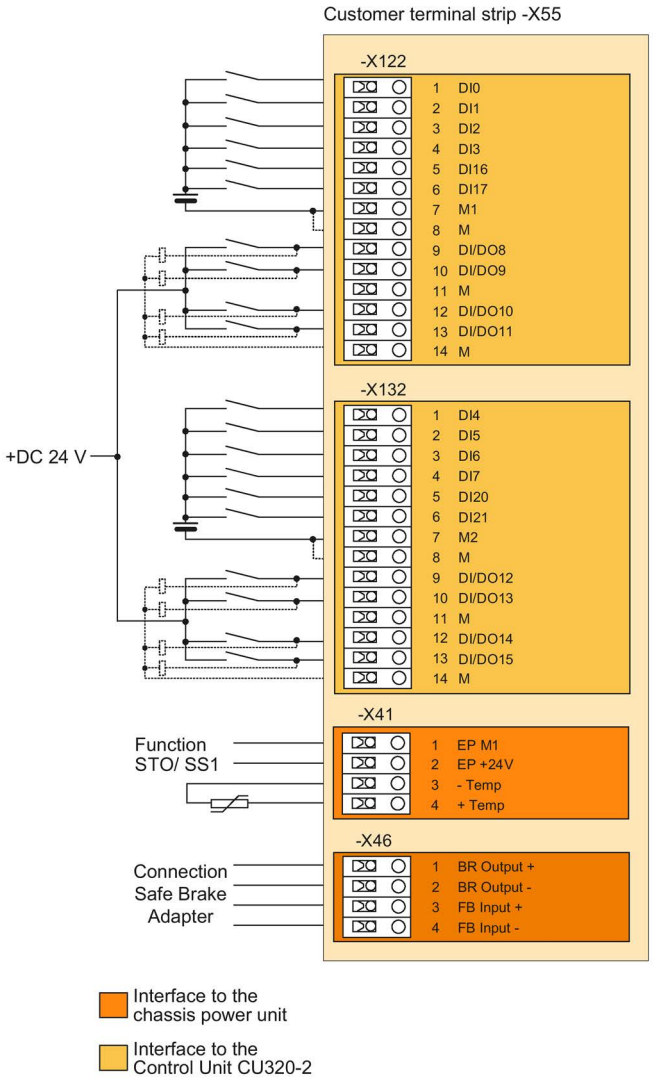
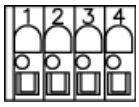



Figure 8-42 Connection assignment of customer terminal block -X55 (example: Motor Module Cabinet Module (chassis format))

### 8.25.4.2 X41 EP terminal / temperature sensor connection

Table 8- 47 Terminal strip X41 EP terminals / temperature sensor connection

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



**⚠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 the motor in the event of an incorrectly connected KTY temperature sensor at terminals -X41:3,4**

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.

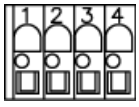
**Note**

**Safety Integrated Function Manual**

A detailed description of the complete principle of operation and handling of the Safety Integrated functions is provided in the associated Function Manual, which is included in the device documentation provided.

### 8.25.4.3 X46 Brake control and monitoring

Table 8- 48 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<br>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 $mm^2$ | | | |

**Note**

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

**⚠WARNING**

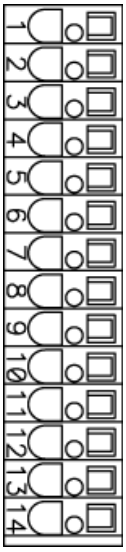
**Fire due to overheating when the total length of the connecting cables is exceeded**

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.

### 8.25.4.4 X122 digital inputs/outputs

Table 8- 49 Terminal block X122 on the customer terminal block X55

| Connector | Terminal | Designation [1] | Technical data |
|---|---|---|---|
|  | 1 | DI 0 | Voltage (max.): -3 ... +30 V DC<br>Typical power consumption: 9 mA at 24 V<br>Electrical isolation: reference potential is M1 terminal<br>Level (with ripple)<br>High level: 15 ... 30 V<br>Low level: -3 ... +5 V<br>Input delay (typ.):<br>For "0" → "1": 50 µs<br>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 terminals 1 ... 6 |
| | 8 | M | Electronics ground |
| | 9 | DI/DO 8 | **As input**:<br>Voltage: -3 ... +30 V DC<br>Current consumption, typical: 9 mA at 24 V<br>Level (with ripple)<br>High level: 15 ... 30 V<br>Low level: -3 ... +5 V<br>DI/DO 8, 9, 10, and 11 are "high-speed inputs" [2]<br>Input delay (typ.):<br>For "0" → "1": 5 µs<br>For "1" → "0": 50 µs<br>**As output**:<br>Voltage: 24 V DC<br>Max. load current per output: 500 mA<br>Continuous short-circuit proof<br>Output delay (typ./max.): [3]<br>For "0" → "1": 150 µs / 400 µs<br>For "1" → "0": 75 µs / 100 µs<br>Switching frequency:<br>For resistive load: Max. 100 Hz<br>For inductive load: max. 0.5 Hz<br>For lamp load: max. 10 Hz<br>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: 2.5 mm² | | | |

[1] DI: Digital input; DI/DO: Bidirectional digital input/output; M: Electronic 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".

To enable the digital inputs (DI) to function, terminal M1 must be connected.

This is achieved through one of the following measures:

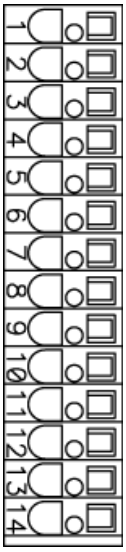
1. Also route the reference ground of the digital inputs.
2. A jumper to terminal M. (**Note:** This removes the electrical isolation for these digital inputs.)

**Note**

If the 24 V supply is briefly interrupted, then the digital outputs are deactivated during this time.

### 8.25.4.5 X132 digital inputs/outputs

Table 8- 50 Terminal block X132 on the customer terminal block X55

| Connector | Terminal | Designation [1] | Technical data |
|---|---|---|---|
|  | 1 | DI 4 | Voltage (max.): -3 ... +30 V DC<br>Current consumption, typical: 9 mA at 24 V<br>Electrical isolation: reference potential is M2 terminal<br>Level (including ripple)<br>High level: 15 ... 30 V<br>Low level: -3 ... +5 V<br>Input delay (typ.):<br>For "0" → "1": 50 µs<br>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 terminals 1 ... 6 |
| | 8 | M | Electronics ground |
| | 9 | DI/DO 12 | **As input**:<br>Voltage: -3 ... +30 V DC<br>Current consumption, typical: 9 mA at 24 V<br>Level (including ripple)<br>High level: 15 ... 30 V<br>Low level: -3 ... +5 V<br>DI/DO 12, 13, 14, and 15 are "rapid inputs" [2]<br>Input delay (typ.):<br>For "0" → "1": 5 µs<br>For "1" → "0": 50 µs<br>**As output**:<br>Voltage: 24 V DC<br>Max. load current per output: 500 mA<br>Continuous short-circuit proof<br>Output delay (typ./max.): [3]<br>For "0" → "1": 150 µs / 400 µs<br>For "1" → "0": 75 µs / 100 µs<br>Switching frequency:<br>For resistive load: Max. 100 Hz<br>For inductive load: max. 0.5 Hz<br>For lamp load: max. 10 Hz<br>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: 2.5 $mm^2$ | | | |

[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:

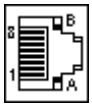
1. Also route the reference ground of the digital inputs.
2. A jumper to terminal M. (**Note:** This removes the electrical isolation for these digital inputs.)

**Note**

If the 24 V supply is briefly interrupted, then the digital outputs are deactivated during this time.

## 8.25.5 X100 - X103 DRIVE-CLiQ interface

Table 8- 51 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<br>Blanking plate for DRIVE-CLiQ interfaces (50 units) Article number: 6SL3066-4CA00-0AA0 | | | |

## 8.25.6 X127 LAN (Ethernet)

**Note**

**Use**

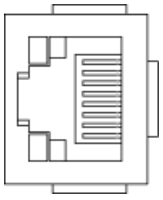
Ethernet interface X127 is intended for commissioning and diagnostics, which means that it must always be accessible (e.g. for service).

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 29)").

Table 8- 52 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:

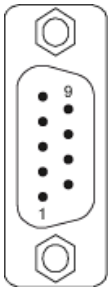
Table 8- 53 LED statuses for the X127 LAN interface

| LED | State | Description |
|---|---|---|
| Green | On | 10 or 100 Mbit link available |
| | Off | Missing or faulty link |
| Yellow | On | Sending or receiving |
| | Off | No activity |

## 8.25.7 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 8- 54 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 | | | |

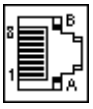
**Note**

**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.

## 8.25.8 X150 P1/P2 PROFINET connection

Table 8- 55 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<br>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.

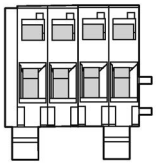
For diagnostic purposes, the two PROFINET interfaces are each equipped with a green and a yellow LED. These LEDs indicate the following status information:

Table 8- 56 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 |

## 8.25.9 Measuring socket

Table 8- 57 Measuring socket with mounted PC board connector

| Connector | Socket | Function | Technical data |
|---|---|---|---|
| M T0 T1 T2  | M | Ground | Voltage: 0 ... 5 V<br>Resolution: 8 bits<br>Load current: max. 3 mA<br>Continuous short-circuit proof<br>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.

## 8.25.10 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.

### 8.25.10.1 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

## 8.25.10.2 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.

### 8.25.10.3 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.

### 8.25.10.4 Slot for the memory card

**Slot for the memory card**




Figure 8-43 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.

## 8.26 L00, use in Category C2 according to IEC 61800-3 (TN/TT networks)

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules

### Description

To limit the emitted interference, the drive converters are equipped as standard with a radio interference suppression filter that conforms to the limits defined in Category C3. By using the optional line filter (option L00) and additional measures implemented in the cabinets at the factory, the SINAMICS S120 Cabinet Modules also comply with the limit values for use in Category C2 according to IEC 61800-3.

The line filters are suitable for TN or TT systems with grounded neutral point.

### Restrictions

**Note**

**Option L00 not available for a parallel connection**

Option L00, use in Category C2 according to IEC 61800-3, is not available for Line Modules in a parallel connection.

**Note**

**Additional information**

The "SINAMICS Low Voltage Engineering Manual" included in the provided device documentation describes the measures that the customer must take to comply with the limit values for use in Category C2 according to IEC 61800-3.

**Note**

**Combining a line filter and line reactor**

The optional line filter must always be combined with a line reactor, otherwise it cannot achieve its full filter effect.

**Note**

**EMC shield bus**

To allow the power cable shield to be connected in conformance with EMC requirements, an additional EMC shield bus (M70 option) is factory fitted at the converter input and output.

**Note**

**It is not possible to combine insulation monitoring and line filter**

It is not possible to use the insulation monitoring function (option L87) in conjunction with the optional line filter.

**Note**

**Maximum permissible motor cable length**

The maximum permissible total motor cable length when using the line filters in conjunction with Basic Line Modules is 100 m.
The maximum permissible total motor cable length when using the line filter in connection with Smart Line Modules and Active Line Modules is 300 m.

Shielded motor cables must always be used.

**Note**

**Motor cable length exceeded**

When the maximum permissible total motor cable length is exceeded, it can no longer be guaranteed that Class C2/C3 is maintained; for very long motor cables this can mean that the line-side or motor-side power components can overheat.

Additional information is provided in the Low Voltage Engineering Manual.

# 8.27 L07, dv/dt filter compact plus Voltage Peak Limiter

## Availability of option

This option is available for the following S120 Cabinet Modules:

- Motor Modules chassis format
- Motor Modules Chassis-2 format

## Description

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

dv/dt filters compact plus Voltage Peak Limiters limit the voltage rate of rise dv/dt to values < 1600 V/µs - and the typical voltage peaks to the following values according to limit value curve A according to IEC 60034-25:2007:

- < 1150 V at $U_{line}$ < 575 V
- < 1400 V at 660 V < $U_{line}$ < 690 V.

For Motor Modules Chassis-2 format, option L07 is accommodated in a supplementary cabinet with a width of 600 mm, which is arranged to the right of the Motor Module.

**Note**

Standard motors with standard insulation and without insulated bearing can be operated with SINAMICS converters up to line supply voltages of 690 V.

## Restrictions

The following constraints should be noted when a dv/dt filter compact plus Voltage Peak Limiter is used:

- The output frequency is limited to a maximum of 150 Hz.
- Maximum permissible motor cable lengths:
  - Shielded cables: max. 100 m (e.g. Protodur NYCWY)
  - Unshielded cables: max. 150 m (e.g. Protodur NYY)

**NOTICE**

**Damage to the dv/dt filter compact by exceeding the maximum output frequency**

The maximum permissible output frequency when a dv/dt filter compact is used is 150 Hz. The dv/dt filter compact can be damaged if the output frequency is exceeded.

- Operate the dv/dt filter compact with a maximum output frequency of 150 Hz.

**NOTICE**

**Damage to the dv/dt filter compact during continuous operation with low output frequencies**

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

- When using a dv/dt filter compact plus Voltage Peak Limiter do not operate the drive continuously with an output frequency less than 10 Hz.
- You may operate the drive under load for a maximum of 5 minutes at an output frequency less than 10 Hz, provided that you then select operation with an output frequency higher than 10 Hz for a period of 5 minutes.

**NOTICE**

**Damage to the dv/dt filter compact by exceeding the maximum pulse frequency**

The maximum permissible pulse frequency when a dv/dt filter compact is used is 2.5 kHz or 4 kHz. The dv/dt filter compact can be damaged if the pulse frequency is exceeded.

- When using the dv/dt filter compact, only operate the Motor Module with a maximum pulse frequency of 2.5 kHz or 4 kHz.

**NOTICE**

**Damage to the dv/dt filter compact if it is not activated during commissioning**

The dv/dt filter compact may be damaged if it is not activated during commissioning.

- Activate the dv/dt filter compact during commissioning using parameter p0230 = 2.

**NOTICE**

**Damage to the dv/dt filter compact if a motor is not connected**

dv/dt filters compact which are operated without a motor being connected can be damaged or destroyed.

- Never operate a dv/dt filter compact connected to the Motor Module without a connected motor.

**Note**

**Setting pulse frequencies**

It is permissible to set pulse frequencies in the range between the rated pulse frequency and the relevant maximum pulse frequency when a dv/dt filter compact plus Voltage Peak Limiter is used. "Current derating as a function of the pulse frequency" of the converter must be observed here (refer to the Technical data).

Table 8- 58 Max. pulse frequency when a dv/dt filter compact plus VPL is used for units with a rated pulse frequency of 2 kHz

| Article No. 6SL3720-... | Type rating [kW] | Output current for a pulse frequency of 2 kHz [A] | Max. pulse frequency when a dv/dt filter is used |
|---|---|---|---|
| **Line voltage 3 AC 380 ... 480 V (DC link voltage 510 ... 720 V DC)** | | | |
| 1TE32-1AA3 | 110 | 210 | 4 kHz |
| 1TE32-6AA3 | 132 | 260 | 4 kHz |
| 1TE33-1AA3 | 160 | 310 | 4 kHz |
| 1TE33-8AA3 | 200 | 380 | 4 kHz |
| 1TE35-0AA3 | 250 | 490 | 4 kHz |

Table 8- 59 Max. pulse frequency when a dv/dt filter compact plus VPL is used for units with a rated pulse frequency of 1.25 kHz

| Article No. 6SL3720-... | Type rating [kW] | Output current for a pulse frequency of 1.25 kHz [A] | Max. pulse frequency when a dv/dt filter is used |
|---|---|---|---|
| **Line voltage 3 AC 380 ... 480 V (DC link voltage 510 ... 720 V DC)** | | | |
| 1TE36-1AA3 | 315 | 605 | 2.5 kHz |
| 1TE37-5AA3 | 400 | 745 | 2.5 kHz |
| 1TE38-4AA3 | 450 | 840 | 2.5 kHz |
| 1TE41-0AA3 | 560 | 985 | 2.5 kHz |
| 1TE41-2AA3 | 710 | 1260 | 2.5 kHz |
| 1TE41-4AA3 | 800 | 1405 | 2.5 kHz |

| Article No. 6SL3720-... | Type rating [kW] | Output current for a pulse frequency of 1.25 kHz [A] | Max. pulse frequency when a dv/dt filter is used |
|---|---|---|---|
| **Line voltage 500 ... 690 V 3 AC (DC link voltage 675 ... 1035 V DC)** | | | |
| 1TG28-5AA3 | 75 | 85 | 2.5 kHz |
| 1TG31-0AA3 | 90 | 100 | 2.5 kHz |
| 1TG31-2AA3 | 110 | 120 | 2.5 kHz |
| 1TG31-5AA3 | 132 | 150 | 2.5 kHz |
| 1TG31-8AA3 | 160 | 175 | 2.5 kHz |
| 1TG32-2AA3 | 200 | 215 | 2.5 kHz |
| 1TG32-6AA3 | 250 | 260 | 2.5 kHz |
| 1TG33-3AA3 | 315 | 330 | 2.5 kHz |
| 1TG34-1AA3 | 400 | 410 | 2.5 kHz |
| 1TG34-7AA3 | 450 | 465 | 2.5 kHz |
| 1TG35-8AA3 | 560 | 575 | 2.5 kHz |
| 1TG37-4AA3 | 710 | 735 | 2.5 kHz |
| 1TG38-1AA3 | 800 | 810 | 2.5 kHz |
| 1TG38-8AA3 | 900 | 910 | 2.5 kHz |
| 1TG41-0AA3 | 1000 | 1025 | 2.5 kHz |
| 1TG41-3AA3 | 1200 | 1270 | 2.5 kHz |

Table 8- 60 Max. pulse frequency when a dv/dt filter compact plus VPL is used for units with a rated pulse frequency of 2.5 kHz

| Article No. 6SL3721-... | Type rating [kW] | Output current for a pulse frequency of 2.5 kHz [A] | Max. pulse frequency when a dv/dt filter is used |
|---|---|---|---|
| **Line voltage 3 AC 380 ... 480 V (DC link voltage 510 ... 720 V DC)** | | | |
| 1TE36-6BE0 | 315 | 655 | 2.5 kHz |
| 1TE37-4BE0 | 355 | 740 | 2.5 kHz |
| 1TE38-1BE0 | 400 | 810 | 2.5 kHz |
| 1TE38-8BE0 | 450 | 910 | 2.5 kHz |
| 1TE41-0BE0 | 500 | 975 | 2.5 kHz |
| 1TE41-1BE0 | 560 | 1075 | 2.5 kHz |
| 1TE41-2BE0 | 630 | 1200 | 2.5 kHz |
| 1TE41-3BE0 | 710 | 1325 | 2.5 kHz |
| 1TE41-5BE0 | 800 | 1495 | 2.5 kHz |

### Commissioning

During commissioning, the dv/dt filter compact plus Voltage Peak Limiter must be logged on using STARTER or via the AOP30 operator panel (p0230 = 2).

**Note**

**Reset when establishing the factory setting**

Parameter p0230 is reset when the factory setting is established. The parameter has to be reset when recommissioning.

## 8.28 L08/L09, motor reactor/2 motor reactors in series

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Booksize Cabinet Kits (L08/L09)
- Motor Module Chassis format (L08)
- Motor Module Chassis-2 format (L08)

### Description

Motor reactors reduce the voltage stress on the motor windings by reducing the voltage gradients at the motor terminals that occur when motors are fed from drive converters. At the same time, the capacitive charge/discharge currents that also occur on the output of the Motor Module when long motor cables are used are reduced.

In addition, a motor reactor must be used for parallel connection of Motor Modules Chassis format when a motor with a single-winding system is being supplied and the required minimum motor cable lengths cannot be maintained.

With option L08, one motor reactor is used; with option L09, two motor reactors switched in series are used to enable the use of a longer motor cable.

## Motor cable lengths

Table 8- 61 Maximum motor cable lengths when using motor reactors for Booksize Cabinet Kits

| Article No. 6SL3720- | Power in kW | Current in A | Maximum motor cable length in m | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | without motor reactors | | With 1 motor reactor (L08) | | With 2 motor reactors (L09) | |
| | | | Shielded | Unshielded | Shielded | Unshielded | Shielded | Unshielded |
| 1TE21-0AB4 | 4.8 | 9 | 50 | 75 | 135 | 200 | - | - |
| 1TE21-8AB4 | 9.7 | 18 | 70 | 100 | 160 | 240 | 320 | 480 |
| 1TE23-0AB4 | 16 | 30 | 100 | 150 | 190 | 280 | 375 | 560 |
| 1TE24-5AB4 | 24 | 45 | 100 | 150 | 200 | 300 | 400 | 600 |
| 1TE26-0AB4 | 32 | 60 | 100 | 150 | 200 | 300 | 400 | 600 |
| 1TE28-5AB3 | 46 | 85 | 100 | 150 | 200 | 300 | 400 | 600 |
| 1TE31-3AB3 | 71 | 132 | 100 | 150 | 200 | 300 | 400 | 600 |

**Note**

**Maximum motor cable length**

When motor reactors are used, the maximum motor cable lengths for Motor Modules Chassis and Chassis-2 formats is 300 m (shielded) or 450 m (unshielded).

## Motor connection

If the L08/L09 option is used with Booksize Cabinet Kits, the motor cables are connected to terminal block -X1.

Table 8- 62 Maximum conductor cross-section when using motor reactors for Booksize Cabinet Kits

| Article No. 6SL3720- | Power in kW | Maximum connection cross-section |
|---|---|---|
| 1TE21-0AB4 | 4.8 | 6 mm² |
| 1TE21-8AB4 | 9.7 | 6 mm² |
| 1TE23-0AB4 | 16 | 6 mm² |
| 1TE24-5AB3 | 24 | 16 mm² |
| 1TE26-0AB3 | 32 | 16 mm² |
| 1TE28-5AB3 | 46 | 35 mm² |
| 1TE31-3AB3 | 71 | 95 mm² |

# 8.29 L10, dv/dt filter plus Voltage Peak Limiter

## Availability of option

This option is available for the following S120 Cabinet Modules:

- Motor Modules chassis format
- Motor Modules Chassis-2 format

## Description

The dv/dt filter plus Voltage Peak Limiter comprises two components: the dv/dt reactor and the voltage-limiting network (Voltage Peak Limiter), which limits the voltage peaks to the level of the DC link voltage and returns energy to the DC link.

The dv/dt filters plus Voltage Peak Limiter must be deployed for motors for which the proof voltage of the insulation system is unknown or insufficient. Standard motors of the 1LA5, 1LA6, and 1LA8 series only require them at supply voltages > 500 V + 10%.

The dv/dt filter plus Voltage Peak Limiter limits the voltage rate of rise to values < 500 V/µs and the typical peak voltage $\hat{U}_{LL}$ at rated line voltages to the subsequent values (for motor cable lengths < 300 m for frame sizes FX, GX, HX or < 150 m for frame sizes JX, FS2, FS2+, FS4, FS4+):

< 1000 V at $U_{line}$ < 575 V

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

Option L10 is accommodated in a supplementary cabinet with a width of 600 mm, which is arranged to the right of the Motor Modules.

**Note**

Parts of option L10 do not have nickel-plated copper busbars.

## Restrictions

The following restrictions must be taken into account when a dv/dt filter is used:

- The output frequency is limited to a maximum of 150 Hz.
- Maximum permissible motor cable lengths:
  - Shielded cables: max. 300 m (frame sizes FX, GX, HX) / 150 m (frame sizes JX, FS2, FS2+, FS4, FS4+)
  - Unshielded cables: max. 450 m (frame sizes FX, GX, HX) / 225 m (frame sizes JX, FS2, FS2+, FS4, FS4+)

**NOTICE**

**Damage to the dv/dt filter by exceeding the maximum output frequency**

The maximum permissible output frequency when using a dv/dt filter is 150 Hz. The dv/dt filter can be damaged if the output frequency is exceeded.

- Operate the dv/dt filter with a maximum output frequency of 150 Hz.

**NOTICE**

**Damage to the dv/dt filter by exceeding the maximum pulse frequency**

The maximum permissible pulse frequency when using a dv/dt filter is 2.5 kHz or 4 kHz. The dv/dt filter can be damaged if the pulse frequency is exceeded.

- When using the dv/dt filter, operate the Motor Module with a maximum pulse frequency of 2.5 kHz or 4 kHz.

**NOTICE**

**Damage to the dv/dt filter if it is not activated during commissioning**

The dv/dt filter may be damaged if it is not activated during commissioning.

- Activate the dv/dt filter during commissioning using parameter p0230 = 2.

**NOTICE**

**Damage to the dv/dt filter if a motor is not connected**

dv/dt filters which are operated without a motor being connected can be damaged or destroyed.

- Never operate a dv/dt filter connected to the Motor Module without a connected motor.

**Note**

**Setting pulse frequencies**

It is permissible to set pulse frequencies in the range between the rated pulse frequency and the relevant maximum pulse frequency when a dv/dt filter plus Voltage Peak Limiter is deployed. When doing so, take into account the "Current derating as a function of the pulse frequency"; refer to the Technical data.

Table 8- 63 Maximum permissible motor cable lengths for the DC link voltage 510 ... 720 V DC

| **Frame sizes FX, GX, HX**<br>**Shielded cable max. 300 m or unshielded cable max. 450 m** | **Frame sizes JX, FS2, FS2+, FS4**<br>**Shielded cable max. 150 m or unshielded cable max. 225 m** |
|---|---|
| 6SL3720-1TE32-1AA3 | 6SL3720-1TE41-0AA3 |
| 6SL3720-1TE32-6AA3 | 6SL3720-1TE41-2AA3 |
| 6SL3720-1TE33-1AA3 | 6SL3720-1TE41-4AA3 |
| 6SL3720-1TE33-8AA3 | 6SL3721-1TE36-6BE0 |
| 6SL3720-1TE35-0AA3 | 6SL3721-1TE37-4BE0 |
| 6SL3720-1TE36-1AA3 | 6SL3721-1TE38-1BE0 |
| 6SL3720-1TE37-5AA3 | 6SL3721-1TE38-8BE0 |
| 6SL3720-1TE38-4AA3 | 6SL3721-1TE41-0BE0 |
| | 6SL3721-1TE41-1BE0 |
| | 6SL3721-1TE41-2BE0 |
| | 6SL3721-1TE41-3BE0 |
| | 6SL3721-1TE41-5BE0 |

Table 8- 64 Maximum permissible motor cable lengths for the DC link voltage 675 ... 1035 V DC

| **Frame sizes FX, GX, HX**<br>**Shielded cable max. 300 m or unshielded cable max. 450 m** | **Frame size JX**<br>**Shielded cable max. 150 m or unshielded cable max. 225 m** |
|---|---|
| 6SL3720-1TG28-5AA3 | 6SL3720-1TG37-4AA3 |
| 6SL3720-1TG31-0AA3 | 6SL3720-1TG38-1AA3 |
| 6SL3720-1TG31-2AA3 | 6SL3720-1TG38-8AA3 |
| 6SL3720-1TG31-5AA3 | 6SL3720-1TG41-0AA3 |
| 6SL3720-1TG31-8AA3 | 6SL3720-1TG41-3AA3 |
| 6SL3720-1TG32-2AA3 | - |
| 6SL3720-1TG32-6AA3 | - |
| 6SL3720-1TG33-3AA3 | - |
| 6SL3720-1TG34-1AA3 | - |
| 6SL3720-1TG34-7AA3 | - |
| 6SL3720-1TG35-8AA3 | - |

Table 8- 65 Max. pulse frequency when a dv/dt filter plus VPL is used for units with a rated pulse frequency of 2 kHz

| **Article No. 6SL3720-...** | **Type rating [kW]** | **Output current for a pulse frequency of 2 kHz [A]** | **Max. pulse frequency when a dv/dt filter is used** |
|---|---|---|---|
| **Line voltage 3 AC 380 ... 480 V (DC link voltage 510 ... 720 V DC)** | | | |
| 1TE32-1AA3 | 110 | 210 | 4 kHz |
| 1TE32-6AA3 | 132 | 260 | 4 kHz |
| 1TE33-1AA3 | 160 | 310 | 4 kHz |
| 1TE33-8AA3 | 200 | 380 | 4 kHz |
| 1TE35-0AA3 | 250 | 490 | 4 kHz |

Table 8- 66 Max. pulse frequency when a dv/dt filter plus VPL is used for units with a rated pulse frequency of 1.25 kHz

| Article No. 6SL3720-... | Type rating [kW] | Output current for a pulse frequency of 1.25 kHz [A] | Max. pulse frequency when a dv/dt filter is used |
|---|---|---|---|
| **Line voltage 3 AC 380 ... 480 V (DC link voltage 510 ... 720 V DC)** | | | |
| 1TE36-1AA3 | 315 | 605 | 2.5 kHz |
| 1TE37-5AA3 | 400 | 745 | 2.5 kHz |
| 1TE38-4AA3 | 450 | 840 | 2.5 kHz |
| 1TE41-0AA3 | 560 | 985 | 2.5 kHz |
| 1TE41-2AA3 | 710 | 1260 | 2.5 kHz |
| 1TE41-4AA3 | 800 | 1405 | 2.5 kHz |
| **Line voltage 500 ... 690 V 3 AC (DC link voltage 675 ... 1035 V DC)** | | | |
| 1TG28-5AA3 | 75 | 85 | 2.5 kHz |
| 1TG31-0AA3 | 90 | 100 | 2.5 kHz |
| 1TG31-2AA3 | 110 | 120 | 2.5 kHz |
| 1TG31-5AA3 | 132 | 150 | 2.5 kHz |
| 1TG31-8AA3 | 160 | 175 | 2.5 kHz |
| 1TG32-2AA3 | 200 | 215 | 2.5 kHz |
| 1TG32-6AA3 | 250 | 260 | 2.5 kHz |
| 1TG33-3AA3 | 315 | 330 | 2.5 kHz |
| 1TG34-1AA3 | 400 | 410 | 2.5 kHz |
| 1TG34-7AA3 | 450 | 465 | 2.5 kHz |
| 1TG35-8AA3 | 560 | 575 | 2.5 kHz |
| 1TG37-4AA3 | 710 | 735 | 2.5 kHz |
| 1TG38-1AA3 | 800 | 810 | 2.5 kHz |
| 1TG38-8AA3 | 900 | 910 | 2.5 kHz |
| 1TG41-0AA3 | 1000 | 1025 | 2.5 kHz |
| 1TG41-3AA3 | 1200 | 1270 | 2.5 kHz |

Table 8- 67 Max. pulse frequency when a dv/dt filter plus VPL is used for units with a rated pulse frequency of 2.5 kHz

| Article No. 6SL3721-... | Type rating [kW] | Output current for a pulse frequency of 2.5 kHz [A] | Max. pulse frequency when a dv/dt filter is used |
|---|---|---|---|
| **Line voltage 3 AC 380 ... 480 V (DC link voltage 510 ... 720 V DC)** | | | |
| 1TE36-6BE0 | 315 | 655 | 2.5 kHz |
| 1TE37-4BE0 | 355 | 740 | 2.5 kHz |
| 1TE38-1BE0 | 400 | 810 | 2.5 kHz |
| 1TE38-8BE0 | 450 | 910 | 2.5 kHz |
| 1TE41-0BE0 | 500 | 975 | 2.5 kHz |
| 1TE41-1BE0 | 560 | 1075 | 2.5 kHz |
| 1TE41-2BE0 | 630 | 1200 | 2.5 kHz |
| 1TE41-3BE0 | 710 | 1325 | 2.5 kHz |
| 1TE41-5BE0 | 800 | 1495 | 2.5 kHz |

### Commissioning

When commissioning, the dv/dt filter must be registered with STARTER or using the AOP30 operator panel (p0230 = 2).

**Note**

**Reset when establishing the factory setting**

Parameter p0230 is reset when the factory setting is established. The parameter has to be reset when recommissioning.

## 8.30 L13, main contactor for Line Connection Modules < 800 A

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules

### Description

The Line Connection Modules with option L43 (for Basic Line Modules) include a manually operated fuse switch disconnector as a standard feature for rated currents up to 800 A. 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.

- In conjunction with option L42 (for Active Line Module):
  - For a rated current < 605 A (380 ... 480 V 3 ph. AC) or < 575 A (3 AC 500... 690 V), the main contactor is included as a standard feature in the Active Interface Module of the Active Line Module.
  - For a rated current of 605 A (3 AC 380 ... 480 V) or 575 A and 730 A (3 AC 500 ... 690 V), option L13 (main contactor) is a standard feature in the Line Connection Module.
  - For a rated current > 605 A (3 AC 380 ... 480 V) or > 730 A (3 AC 500 ... 690 V), a circuit breaker is a standard feature in the Line Connection Module.
- In conjunction with option L43 (for Basic Line Module):
  - For a rated current < 800 A, option L13 (main contactor) can be ordered.
  - For a rated current > 800 A, a circuit breaker is a standard feature in the Line Connection Module.
- In conjunction with option L44 (for Smart Line Module):
  - For a rated current < 800 A, option L13 (main contactor) is a standard feature in the Line Connection Module.
  - For a rated current > 800 A, a circuit breaker is a standard feature in the Line Connection Module.

| NOTICE |
| --- |
| **Material damage caused by switching the line contactor under load**<br>Switching the line contactor under load can result in increased wear and consequently to premature failure of the line contactor.<br>• Always switch the line contactor at zero current. |

### X50 "main contactor" checkback contact

Table 8- 68 Terminal block X50 "main contactor" checkback contact

| Terminal | Designation [1] | Technical data |
| --- | --- | --- |
| 4 | NO | Max. load current: 10 A<br>Max. switching voltage: 250 V AC<br>Max. contact rating: 250 VA<br>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

## 8.31 L21, surge suppression

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Active Line Connection Modules-2

### Description

The option includes the installation of surge arresters and upstream fuses for each line phase. The signaling contacts of the surge arresters are connected in series for monitoring purposes and routed 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 117)").

## X700 - monitoring the surge arresters

Table 8- 69 Terminal block X700 Monitoring the surge arresters

| Terminal | Designation [1] | Technical data |
|---|---|---|
| 1 | NC | Max. load current:<br>- at 24 V DC: 1 A<br>- 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:

- Line Connection Modules 3 AC 380 ... 480 V:
  Remove the insert (protection module) by withdrawing the defective insert and inserting the replacement part.
- Line Connection Modules 3 AC 500 ... 690 V:
  Replacing the complete surge arrester.

## 8.32 L22, supplied as standard without line reactor

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules, only with option L43 (for Basic Line Modules)
- Smart Line Modules

### Description

If the Basic Line Module or Smart Line Module is supplied via a separate transformer, or if the supply system has a sufficiently low supply short-circuit power, the standard line reactor can be omitted.

For the Line Connection Module with option L22, the standard line reactor is not supplied in conjunction with the Basic Line Module (option L43).

The Smart Line Module with option L22 is supplied without a standard line reactor.

## 8.33 L25, circuit breaker in withdrawable unit design

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Active Line Connection Modules-2

### Description

The circuit breaker in a withdrawable unit design is available as option for Line Connection Modules and Active Line Connection Modules-2 from a rated current of > 800 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 8- 70 Terminal block X50 "Circuit breaker" checkback contact

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

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

**Note**

**Additional information**

A detailed description of the complete principle of operation of the circuit breaker and its handling along with the options integrated in the factory are included in the associated operating instructions, which are part of the device documentation provided.

## 8.34 L34, output-side circuit breaker

### 8.34.1 General information

#### Availability of option

This option is available for the following S120 Cabinet Modules:

- Motor Modules in chassis format
- Motor Modules in Chassis-2 format

## Description

Option L34 (output-side circuit breaker) can be used to disconnect the motor terminals from the converter.

It is pre-wired and installed in a separate cabinet.



**⚠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.
  Option L34 can be used to isolate a circuit in the event of a fault, or for maintenance work.
- 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.

**Note**

**Additional information**

A detailed description of the complete principle of operation of the circuit breaker and its handling is given in the additional option description, which is included in the device documentation provided.

Option L34 (output-side circuit breaker) is required in the following applications where permanent-field motors are used:

- Drives with a high moment of inertia, which require a longer period of time to coast down and generate a voltage at the motor terminals during this time.
- Mechanically coupled auxiliary drives, which can be driven together by a main drive.
- When carrying out maintenance and repairs on a converter if the motor cannot be stopped safely (e.g. using a mechanical brake).
- During high field weakening in conjunction with a suitable level of overvoltage protection, which suppresses the applied overvoltage effectively until the switch trips.

## Characteristics

Option L34 is completely pre-wired. It is controlled via a TM31 Terminal Module, which is included in the option. To control it, the parameterization specified in the following Chapter "Parameterization" must be made during commissioning.

**Note**

After setting the parameters, the user must ensure that the switch is operating correctly.

For this reason, the output-side breaker is automatically controlled via the converter.

**Note**

The "ON" pushbutton directly located at the output switch is only available with the full functional scope, if the following preconditions are fulfilled:

- There is no alarm or fault present.
- The customer remote OFF is set to "enable".

To close the output-side breaker, the following conditions must be fulfilled:

- There must be no faults on the Motor Module.
- There must be no OFF command active at the Motor Module
- The Motor Module must receive an ON command
- Pre-charging of the Motor Module must be complete.

The output-side breaker is opened under the following conditions:

- There is an active fault on the Motor Module.
- The power supply at the auxiliary power system for option L34 (230 VAC / 24 VDC) fails.
- The local "OFF" button on the output-side breaker is pressed.

**Note**

Pressing the "OFF" button directly on the output-side breaker will switch the Motor Module off (pulse suppression). The converter displays "External fault 3". The breaker can be closed again only by sending a new ON command via the Motor Module.

**Note**

To reduce the number of switching cycles, the output-side breaker will not open if the Motor Module receives an "OFF" command (OFF1, OFF2, OFF3).

If they are available, remote off switches (for optional use by customers) for disconnecting the output-side breaker must be connected accordingly via the undervoltage coil.

## Servicing and maintaining the output switch



**⚠WARNING**

**Malfunction because of neglected maintenance of the output-side breaker**

After reaching the permissible number of switching cycles for the output-side breaker under pulse inhibit or under load, the correct functioning of the output-side breaker is no longer guaranteed and can result in death or serious injury in the event of a fault.

- Monitor the specified permissible number of switching cycles for the output-side breaker. Observe the data in the additional option description.

**Note**

**Additional information**

A detailed description of the recommended time intervals and activities relating to inspection, maintenance and corrective maintenance of the circuit breaker is given in the additional option description, which is included in the device documentation provided.

The special circuit breaker used is described in the spare parts list, which is also included in the device documentation provided.

## 8.34.2 Overview diagram of option L34

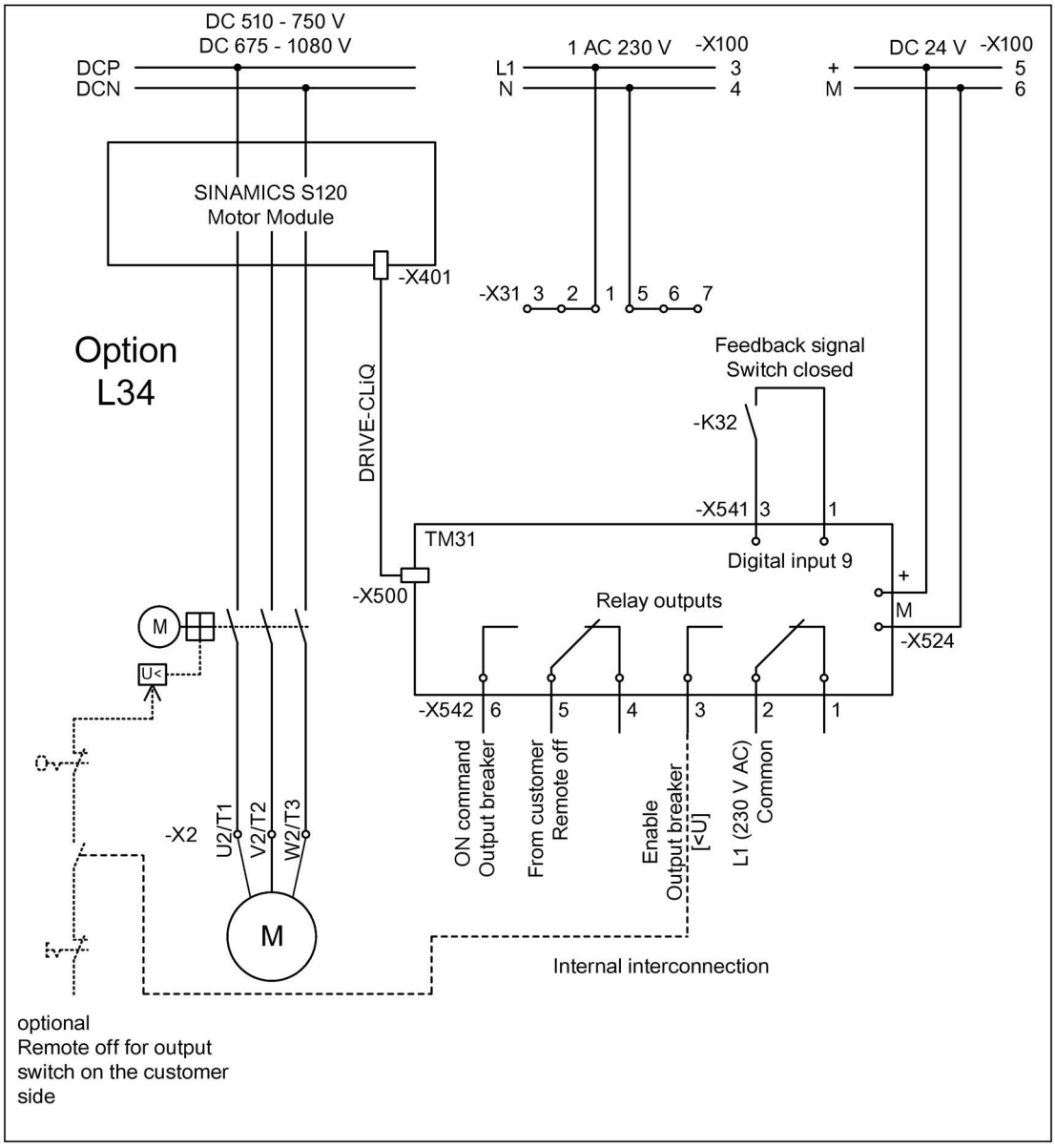



Figure 8-44 Overview diagram of option L34

## 8.34.3 Parameter assignment

### 8.34.3.1 Parameterization with script

A script can be used for the automatic parameterization, which automatically makes the parameter settings in STARTER. The script and the operating instructions for executing the script are included in the device documentation provided.

### 8.34.3.2 Parameterization with free function blocks

The free function blocks are used for the parameterization described in this section. You must start by activating them.

#### Activating the free function blocks

To be able to work with the free function blocks, they must first be activated/enabled:

- If you are not certain that the project in the STARTER corresponds to the drive configuration, you should start with an upload (load data to PG).
- In Offline mode -> Right-click the drive object -> Properties -> Activate the “Free function blocks” in the “Drive Properties” interactive screenform under “Select function modules”.
- You will then need to perform a download (load data to the target device) so that the “Free function blocks” function module is activated in the drive.

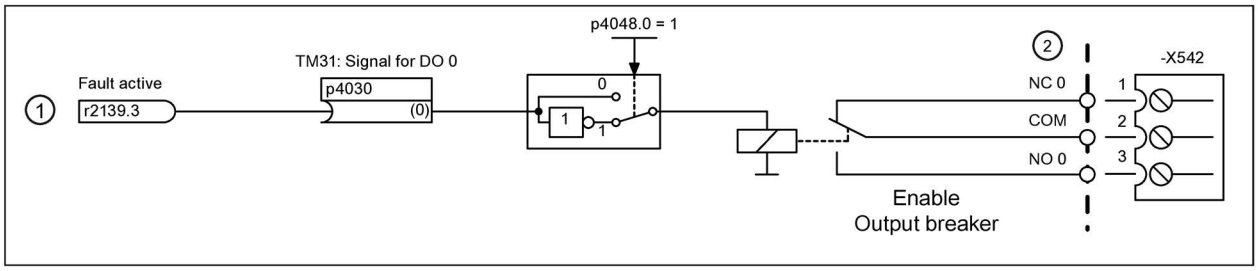
#### Setting the sampling time for runtime group 0 of the free function blocks

To activate the interconnection, parameterization (in the expert list) must be carried out as follows (in this example, it has been assumed that the drive is called “Drive_1” in the project navigator):

Table 8- 71 Setting the sampling time for runtime group 0 of the free function blocks

| Parameterization | Description |
|---|---|
| (Drive_1) p20000[0] = 8 | The sampling time of runtime group 0 of the free function blocks is assigned sampling time 8 (= 8 x r20002). |

## Interconnection for “Enable output-side breaker”




① r2139.3: Status word fault / alarms 1: Fault active (1 = yes / 0 = no)

② NO: Normally Open contact (in the quiescent state "open")

NC: Normally Closed contact (in the quiescent state "closed")

The relay contacts have a maximum rating of up to:

- 100 V DC / 240 W
- 250 V AC / 2500 W

Figure 8-45 Interconnection for “Enable output-side breaker”

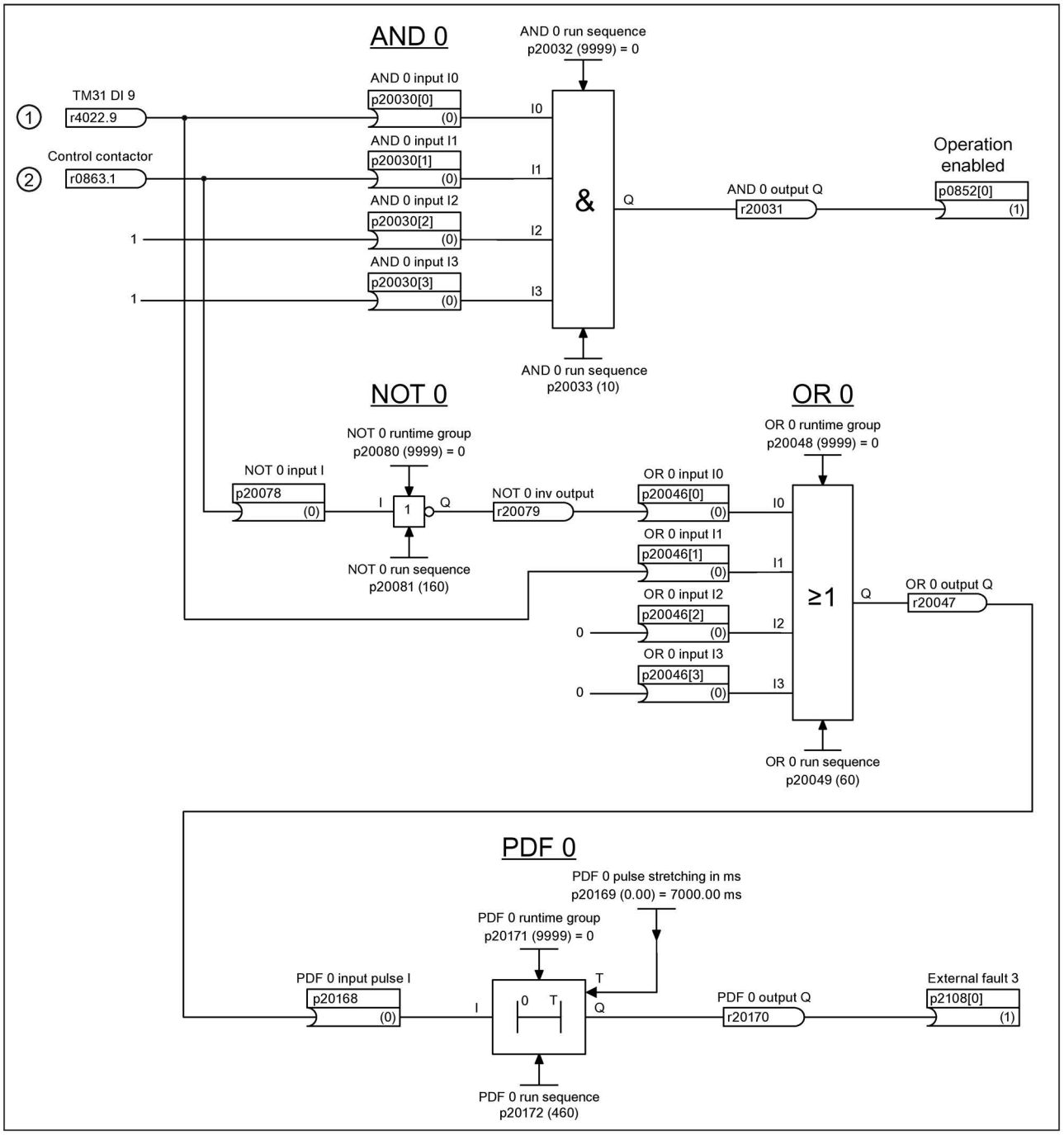
The breaker must also trip in the event of a converter fault. This is achieved using the specified interconnection.

To activate the interconnection, parameterization (in the expert list) must be carried out as follows (in this example, it has been assumed that the drive is called “Drive_1” in the project navigator):

Table 8- 72 Parameterization for the interconnection for "Enable output-side breaker"

| Parameterization | Description |
|---|---|
| (TM31) p4030 = (Drive_1) r2139.3 | The "Fault active" drive signal is output at digital output 0 (DO 0) of the TM31. |
| (TM31) p4048.0 = 1 = inverted | Digital output 0 (DO 0) is inverted. |

## Interconnection for “Enable operation”




① r4022.9: TM31: DI 9 = feedback signal, switch closed

② r0863.1: Contactor controlled

Figure 8-46 Interconnection for “Enable operation”

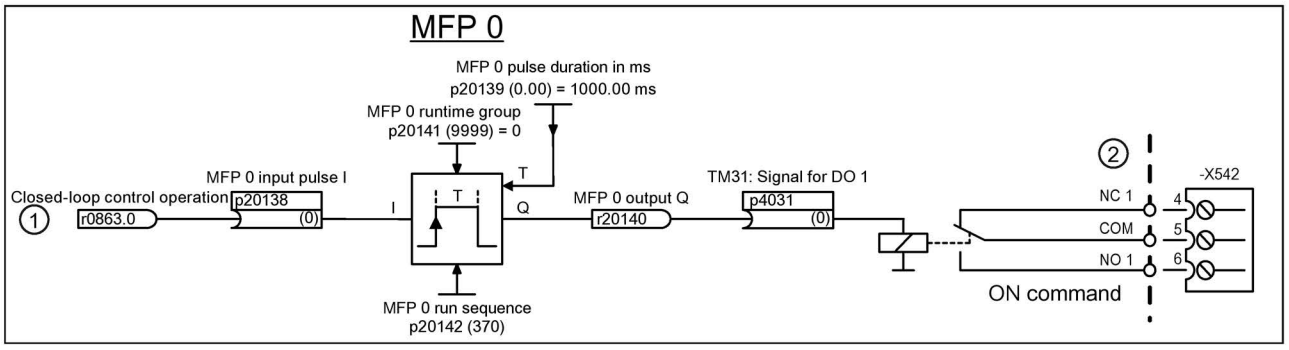
You must make sure that the converter only enables the pulses when the breaker is closed. This is achieved using the specified interconnection.

To activate the interconnection, parameterization (in the expert list) must be carried out as follows (in this example, it has been assumed that the drive is called “Drive_1” in the project navigator):

Table 8- 73 Parameterization for the interconnection for "Operation enabled"

| Parameterization | Description |
|---|---|
| **Function block "AND 0"** | |
| (Drive_1) p20032 = 0 | The "AND 0" function block is assigned to runtime group 0. |
| (Drive_1) p20030[0] = (Drive_1) r4022.9 | Input signal DI9, terminal X541.3 of TM31 is interconnected at input I0 of function block "AND 0". |
| (Drive_1) p20030[1] = (Drive_1) r0863.1 | The "control contactor" signal of the drive is interconnected at input I1 of the "AND 0" function block of the drive. |
| (Drive_1) p20030[2] = 1 | A "1" signal is interconnected at input I2 of function block "AND 0" of the drive. |
| (Drive_1) p20030[3] = 1 | A "1" signal is interconnected at input I3 of function block "AND 0" of the drive. |
| (Drive_1) p0852[0] = (Drive_1) r20031 | The output signal of the "AND 0" function block of the drive is used for the "Operation enabled" signal of the drive. |
| **Function block "NOT 0"** | |
| (Drive_1) p20080 = 0 | The "NOT 0" function block is assigned to runtime group 0. |
| (Drive_1) p20078 = (Drive_1) r0863.1 | The "Control contactor" signal of the drive is interconnected at input I of function block "NOT 0" of the drive. |
| **Function block "OR 0"** | |
| (Drive_1) p20048 = 0 | The "OR 0" function block is assigned to run-time group 0. |
| (Drive_1) p20046[0] = (Drive_1) r20079 | Inverted output signal Q of function block "NOT 0" of the drive is interconnected at input I0 of function block "OR 0" of the drive. |
| (Drive_1) p20046[1] = (TM31) r4022.9 | Input signal DI9, terminal X541.3 of TM31 is interconnected at input I1 of function block "OR 0". |
| (Drive_1) p20046[2] = 0 | A "0" signal is interconnected at input I2 of function block "OR 0" |
| (Drive_1) p20046[3] = 0 | A "0" signal is interconnected at input I3 of function block "OR 0" |
| **Function block "PDF 0"** | |
| (Drive_1) p20171 = 0 | The "switch off delay 0 (PDF 0)" function block is assigned to runtime group 0. |
| (Drive_1) p20168 = (Drive_1) r20047 | Output signal Q of function block "OR 0" of the drive is interconnected at input I of function block "Switch-off delay 0 (PDF 0)" of the drive. |
| (Drive_1) p20169 = 7000.00 | The pulse stretching time of function block "switch-off delay 0 (PDF 0)" of the drive is set to 7000.00 ms. |
| (Drive_1) p2108[0] = r20170.0 | Output pulse Q of function block "Switch-off delay 0 (PDF 0)" is used for signal "External fault 3" of the drive. |

### Interconnection for “ON command”




① r0863.0: Drive coupling status/control word: Closed-loop control operation: Pre-charging completed (0 = no / 1 = yes)

② NO: Normally Open contact (in the quiescent state "open")

NC: Normally Closed contact (in the quiescent state "closed")

The relay contacts have a maximum rating of up to:

- 100 V DC / 240 W
- 250 V AC / 2500 W

Figure 8-47 Interconnection for “ON command”

The drive must only be switched on when a DC link voltage is available. This is achieved using the specified interconnection.

To activate the interconnection, parameterization (in the expert list) must be carried out as follows (in this example, it has been assumed that the drive is called “Drive_1” in the project navigator):

Table 8- 74 Parameterization for the interconnection for “On command”

| Parameterization | Description |
|---|---|
| (Drive_1) p20141 = 0 | The "Pulse generator 0 (MFP 0)" function block is assigned to run-time group 0. |
| (Drive_1) p20138 = (Drive_1) r0863.0 | The "Control operation" signal of the drive is interconnected at the input of the “Pulse generator 0 (MFP 0)” function block. |
| (Drive_1) p20139 = 1000.00 | The pulse duration of the "Pulse generator 0 (MFP 0)" function block is set to 1000.00 ms. |
| (TM31) p4031 = (Drive_1) r20140 | The output signal of the “Pulse generator 0 (MPF 0)” function block of the drive is output to digital output 1 (DO 1) of the TM31. |

### 8.34.3.3 Parameterization with DCC (Drive Control Chart)

The parameter settings described in section "Parameterization with free function blocks" can also be achieved using DCC. For this purpose the interconnections shown must be simulated with the corresponding DCC blocks.

# 8.35 L37, DC coupling, incl. pre-charging input circuit of the associated DC link capacitance

## 8.35.1 General information

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Booksize Cabinet Kits
- Motor Modules in chassis format

### Description

If the Motor Module is to be disconnected or reconnected to the DC link of a drive line-up while the other Motor Modules and Line Modules remain in operation, this can be accomplished via the DC interface.

## 8.35.2 DC interface incl. pre-charging for Booksize Cabinet Kits

### 8.35.2.1 Important safety precautions

The Motor Module can be serviced after it has been disconnected from the DC busbar via the DC interface and after the capacitor discharge time has elapsed. However, the following safety precautions must be observed:

**⚠ 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.



**⚠DANGER**

**Electric shock due to hazardous voltage**

Once the DC busbar and the Motor Module in booksize format have been disconnected by means of the fuse switch disconnector (-Q7), dangerous voltages continue to be present in the adjacent Motor Modules in booksize format in the Cabinet Module:

- Up to 800 V on the DC busbar (protected against accidental contact).
- Line voltage (3 AC 380 ... 480 V) via the auxiliary power supply system or 2 AC 230 V downstream of the transformers for the fan supply.
- Up to 230 VAC via the auxiliary power supply system or via direct infeed for SITOP and fan supply.
- 24 VDC on the auxiliary power supply system (electronics power supply).
- On the motor connection (e.g. regenerative voltage due to residual speed).

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

- Only commission qualified specialists to carry out the work.
- Ensure that no voltage is present at the measuring points provided in the cabinet.
- Ensure that no voltage is present at the motor connections.
- When working close to the DC busbar in the cabinet, take care to avoid any contact with the DC busbar.
- When replacing components, make sure that no screws or small parts fall into the cabinet.
- Remove the fan fuse and fuse for the 24 VDC power supply

**Note**

**Compliance with legal regulations**

You must observe the applicable legal regulations when carrying out all work!

### 8.35.2.2 DC interface, principle of operation

The DC interface connects/disconnects the DC busbar and the Motor Module in the Cabinet Kit. This option is implemented with a pre-charging input circuit. A fuse switch disconnector, which is installed as a standard feature between the Motor Module and the DC busbar, as well as pre-charging resistors and contactor disconnectors connect the Motor Module with the DC busbar.

The contactor disconnector is triggered via a time relay, which is activated by the switch installed in the door.

**Note**

**Switch when not under load**

The DC interface should only be switched and the fuse switch disconnector should only be unplugged when not under load!

A checkback signal is transferred via the internal interconnection to the CU320-2 Control Unit which locks out switching under load.

### 8.35.2.3 Commissioning the DC interface with option K90/K95

With option K90/K95, a feedback signal contact from the fuse switch disconnector is connected to digital input 3 of the Control Unit (this connection is realized in the factory).

**Note**

**Check the feedback signal after making changes to the parameterization**

If changes are made to the factory-set parameters, you must verify that the "Infeed ready" feedback signal is connected to digital input 3 on the Control Unit (p0864 = r722.3).

If parameter p0864 is not wired to the feedback signal, then the switch can be operated under load. This can shorten the service life of the switch.

### 8.35.2.4 Commissioning the DC coupling without option K90/K95

If the cabinet does not contain a Control Unit (option K90 / K95), terminal -X41.12 of the DC coupling must be connected by the customer to a digital input of the Control Unit assigned to the controlled Motor Module. The 24 VDC supply for the feedback signal is provided via terminal -X41.11 (see circuit diagram).

The digital input to which the checkback contact is assigned must be connected to the "Infeed operation" parameter (p0864) of the drive object [Drive_1].

Example of digital input 3 on the Control Unit [CU]:

[Drive_1] p0864 = [CU] r722.3

The interconnection can be made with the STARTER commissioning tool or the AOP30 operator panel (option K08).

**Note**

**Switching under load when feedback signal wiring is missing**

If parameter p0864 is not wired to the feedback signal, it is possible to operate the switch under load. This can shorten the service life of the switch.

**Note**

**Additional information**

The digital input parameter assignment is described in the List Manual and S120 Commissioning Manual.

## 8.35.3 DC interface incl. pre-charging for Motor Modules in the chassis format

The main component of option L37 is a switch disconnector. This switch disconnector is installed on the busbar between the Motor Module and the DC busbar. This option also includes a pre-charging switch for the DC-link capacitors of the relevant Motor Module so that it can be switched in to the pre-charged DC busbar.

This switch can be actuated using an operating lever but only when the cabinet door is closed.

As an air guide, option L37 also includes option M60 (additional shock protection).

**Note**

This option is not used for switching the module on and off during operation.

Frame sizes FX and GX each contain two fuses, while frame size JX contains four fuses. Depending on the current carrying capacity, frame size HX contains either two or four fuses.

Four pre-charging resistors are also used in frame size JX for higher power ratings. For more detailed information, see the circuit diagrams.

**Note**

With option K90 (Control Unit), a checkback contact is wired from terminal -X41:12 to digital input 3 on customer terminal block -X55 to commission the DC interface via parameter interconnection (see "Commissioning the DC interface"). A jumper to the reference potential is also used.

### 8.35.3.1 Important safety precautions

The Motor Module can be serviced after it has been disconnected from the DC busbar via the DC interface and after the capacitor discharge time has elapsed. However, the following safety precautions must be observed:

**⚠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.



**⚠DANGER**

**Electric shock due to hazardous voltage**

Once the DC busbar and the Motor Module have been disconnected via the DC interface (-Q7), dangerous voltages may still be present in the Cabinet Module:

- Up to 1200 V on the DC busbar (protected against accidental contact).
- Line voltage (3 AC 380 ... 480 V or 3 AC 500 ... 690 V) on the auxiliary power supply system or 2 AC 230 V downstream of the transformers for the fan supply.
- Up to 230 VAC on the optional mounting locations.
- 24 VDC on the auxiliary power supply system (electronics power supply).
- On the motor connection (e.g. regenerative voltage due to residual speed).

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

- Only commission qualified specialists to carry out the work.
- Ensure that no voltage is present at the measuring points provided in the cabinet.
- Ensure that no voltage is present at the motor connections.
- When working close to the DC busbar in the cabinet, take care to avoid any contact with the DC busbar.
- When replacing components, make sure that no screws or small parts fall into the cabinet.
- Remove the fan fuse and fuse for the 24 VDC power supply.

**Note**

**Compliance with legal regulations**

You must observe the applicable legal regulations when carrying out all work!

The following figures show the location of the voltage source once disconnected from the DC busbar and the associated measuring points to verify isolation from the supply in the Cabinet Module.

### 8.35.3.2 Accessibility of the DC connection to the Motor Module

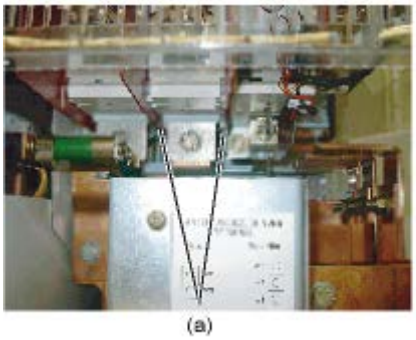



Figure 8-48 Front view




Figure 8-49 Side view (without side panel)

The current-conducting DC busbar behind the DC interface can be accessed once the power block has been removed ("(a)" in figure).

The DC busbar is sealed off sufficiently to prevent accidental contact.

### 8.35.3.3 Measuring points for verifying isolation from supply

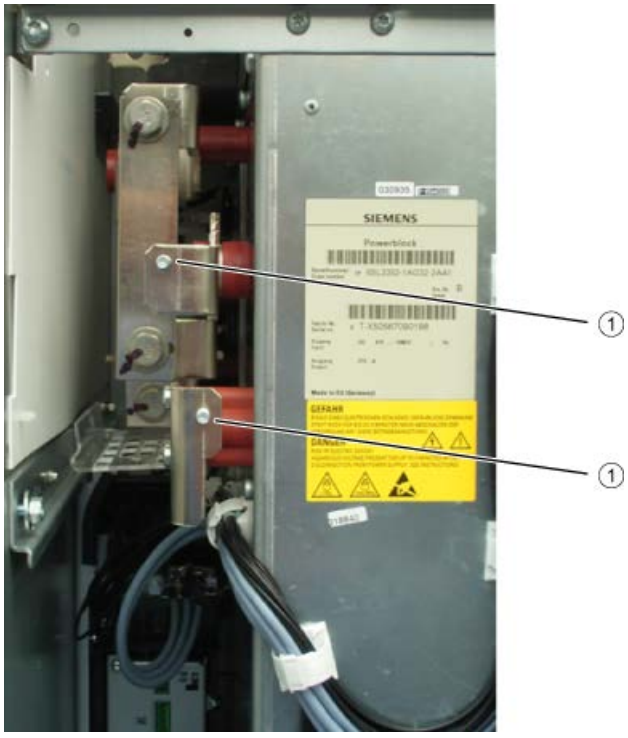



Figure 8-50 Measuring points at top, example for frame sizes FX and GX

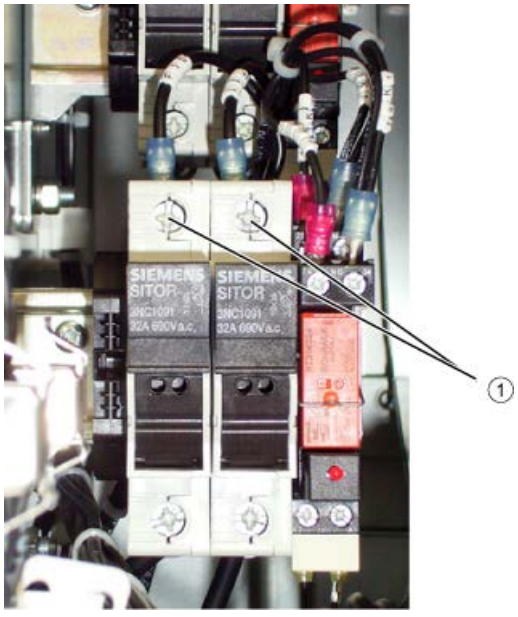



Figure 8-51 Measuring point, auxiliary power supply, fan supply bottom, frame sizes FX and GX

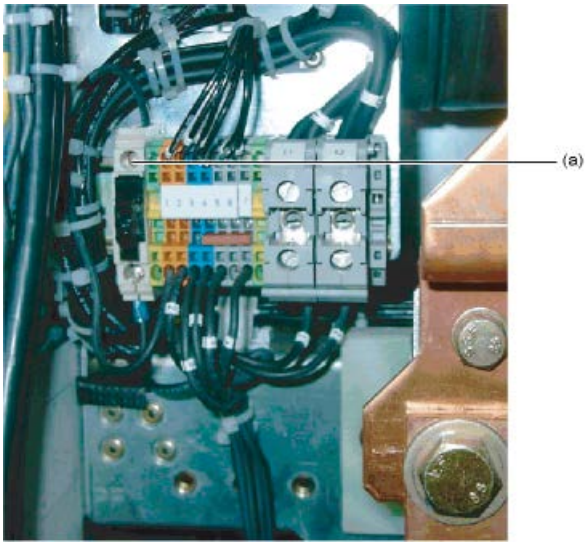



Figure 8-52 Measuring point, 24 VDC auxiliary power supply, frame sizes FX and GX

Take into account other voltages on optional components and refer to the circuit diagrams.

### 8.35.3.4 DC interface, principle of operation

Table 8- 75 DC interface, principle of operation

| Switch setting | Meaning | Result/Comments |
|---|---|---|
| 0 | Switching contacts are open | Neither the pre-charging section nor the main charging section are switched in. |
| Precharging | DC interface is switched to PRECHARGE.<br>DC-link capacitors are loaded. Pre-charging remains activated until the ON command is issued. | The pre-charging section is switched to the DC link busbar (the main section remains switched off).<br>Once the unit is switched on with the ON command, the Motor Module unlocks the DC interface and moves it into the operating position. |
| 1 | Switching contacts are closed | The DC interface switches to position "1".<br>When the DC switch is in the operating position, the connected auxiliary contacts are switched. |

The required auxiliary power supply is provided via the auxiliary power supply system. To ensure that this functions properly, a digital input must be interconnected during commissioning. Like all the other required connections, this is pre-wired in the cabinet.

If any signals are required (e.g. for checkback purposes or for activating other units), two switching contacts can be used. Two normally-open contacts (NO) are available here for use as required. The contacts switch in "Pre-charging" (contacts 53, 54) or "Operation" position (contacts 63, 64). The auxiliary contacts can be loaded with a maximum of 3 A.

**Note**

**Only activate the DC interface with the door closed**

The DC interface must only be activated when the door is completely closed, otherwise the switch coupling and the door handle could be damaged!

The door must only be opened in position "0".

In the "Pre-charging" and "1 (Operation)" positions, the door cannot be opened. Attempting to open the door by force would damage the DC interface.

**Note**

Considerable force must be applied to move the DC interface between positions "0" and "Pre-charge"!

### 8.35.3.5 Commissioning the DC interface with option K90/K95

With option K90 or K95, a checkback contact from the switch is connected in the factory to digital input 3 of the Control Unit.

**Note**

**Check the feedback signal after making changes to the parameterization**

If changes are made to the factory-set parameters, you must verify that the "Infeed ready" feedback signal is connected to digital input 3 on the Control Unit (p0864 = r722.3).

If parameter p0864 is not wired to the feedback signal, then the switch can be operated under load. This can shorten the service life of the switch.

### 8.35.3.6 Commissioning the DC coupling without option K90/K95

If the cabinet does not contain a Control Unit (option K90/K95), terminal -X41:12 of the DC interface must be connected by the customer to a digital input of the Control Unit assigned to the controlled Motor Module.

The digital input to which the checkback contact is assigned must be connected to the "Infeed operation" parameter (p0864) of the drive object [Drive_1].

Example of digital input 3 on the Control Unit [CU]:

[Drive_1] p0864 = [CU] r722.3

The interconnection can be made with the STARTER commissioning tool or the AOP30 operator panel (option K08).

**Note**

**Switching under load when feedback signal wiring is missing**

If parameter p0864 is not wired to the feedback signal, it is possible to operate the switch under load. This can shorten the service life of the switch.

**Note**

To switch from the "Precharging" to the "1 (Operation)" position, a switching current of 6 A/24 V DC is required for 30 ms. This must be provided via the auxiliary power supply and taken into account when dimensioning.

**Note**

**Additional information**

When activating digital inputs, note the guidelines provided in the List Manual and S120 Commissioning Manual.

## 8.36 L40, line filter monitoring

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Active Line Modules
- Active Line Connection Modules-2

### Description

The line filter monitoring option is used for monitoring the filter in the Active Interface Module for effectiveness against harmonic effects on the system.

By measuring the current and voltage in the Active Interface Module, the capacitance of the filter capacitors of the integrated filter is continuously calculated and compared with the installed nominal capacitance.

Alarm A06250 is triggered 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.

A 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 the 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 the 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, 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.

## 8.37 L41, current transformer upstream of main switch

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Active Line Connection Modules-2

## 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.

In the Line Connection Module, the measuring connections for the current transformers are routed to terminal block X60, which is equipped with special current transformer terminals.



**⚠WARNING**

**Electric shock when carrying out connection work at the current transformer connections that are not short-circuited**

When carrying out connection work, hazardous voltages can be present at terminal block X60, which can result in serious injury or death if touched.

- When carrying out connection work at terminal block X60 ensure that the lever position is always at position III "Measurement position".

## Transformation ratio of the current transformer in the Line Connection Module

The assignment of the article numbers of the Line Connection Modules to the ratios of the current transformers are listed in the following table.

Table 8- 76 Transformation ratios of the current transformers

| Article No. | $U_{IN}$ | Transformation ratio |
|---|---|---|
| 6SL3700-0LE32-5AA3 | 380 ... 480 V 3 AC | 400/1 |
| 6SL3700-0LE34-0AA3 | 380 ... 480 V 3 AC | 400/1 |
| 6SL3700-0LE36-3AA3 | 380 ... 480 V 3 AC | 800/1 |
| 6SL3700-0LE38-0AA3 | 380 ... 480 V 3 AC | 800/1 |
| 6SL3700-0LE41-0AA3 | 380 ... 480 V 3 AC | 2000/1 |
| 6SL3700-0LE41-3AA3 | 380 ... 480 V 3 AC | 2000/1 |
| 6SL3700-0LE41-6AA3 | 380 ... 480 V 3 AC | 2000/1 |
| 6SL3700-0LE42-0AA3 | 380 ... 480 V 3 AC | 4000/1 |
| 6SL3700-0LE42-0BA3 | 380 ... 480 V 3 AC | 4000/1 |
| 6SL3700-0LE42-5BA3 | 380 ... 480 V 3 AC | 4000/1 |
| 6SL3700-0LE43-2BA3 | 380 ... 480 V 3 AC | 4000/1 |
| 6SL3700-0LG32-8AA3 | 500 ... 690 V 3 AC | 400/1 |
| 6SL3700-0LG34-0AA3 | 500 ... 690 V 3 AC | 800/1 |
| 6SL3700-0LG36-3AA3 | 500 ... 690 V 3 AC | 800/1 |
| 6SL3700-0LG38-0AA3 | 500 ... 690 V 3 AC | 800/1 |
| 6SL3700-0LG41-0AA3 | 500 ... 690 V 3 AC | 2000/1 |
| 6SL3700-0LG41-3AA3 | 500 ... 690 V 3 AC | 2000/1 |
| 6SL3700-0LG41-6AA3 | 500 ... 690 V 3 AC | 2000/1 |
| 6SL3700-0LG42-0BA3 | 500 ... 690 V 3 AC | 4000/1 |
| 6SL3700-0LG42-5BA3 | 500 ... 690 V 3 AC | 4000/1 |
| 6SL3700-0LG43-2BA3 | 500 ... 690 V 3 AC | 4000/1 |

## Transformation ratio of the current transformer in the Active Line Connection Module-2

The assignment of the article numbers of the Active Line Connection Modules-2 to the ratios of the current transformers are listed in the following table.

Table 8- 77 Transformation ratios of the current transformers

| Article No. | $U_{IN}$ | Transformation ratio |
|---|---|---|
| 6SL3731-7TE35-6RE0<br>6SL3731-7TE35-6LE0 | 380 ... 480 V 3 AC | 800/1 |
| 6SL3731-7TE36-4RE0<br>6SL3731-7TE36-4LE0 | 380 ... 480 V 3 AC | 800/1 |
| 6SL3731-7TE37-5RE0<br>6SL3731-7TE37-5LE0 | 380 ... 480 V 3 AC | 2000/1 |
| 6SL3731-7TE38-4RE0<br>6SL3731-7TE38-4LE0 | 380 ... 480 V 3 AC | 2000/1 |
| 6SL3731-7TE38-8RE0<br>6SL3731-7TE38-8LE0 | 380 ... 480 V 3 AC | 2000/1 |
| 6SL3731-7TE41-0RE0<br>6SL3731-7TE41-0LE0 | 380 ... 480 V 3 AC | 2000/1 |
| 6SL3731-7TE41-2RE0<br>6SL3731-7TE41-2LE0 | 380 ... 480 V 3 AC | 2000/1 |
| 6SL3731-7TE41-3RE0<br>6SL3731-7TE41-3LE0 | 380 ... 480 V 3 AC | 2000/1 |
| 6SL3731-7TE41-4RE0<br>6SL3731-7TE41-4LE0 | 380 ... 480 V 3 AC | 2000/1 |

## X60 line current transformer

Table 8- 78 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 | | |

## Lever positions at the current transformer terminal

The current transformer terminal is equipped with a lever to connect or disconnect and short-circuit the current transformer connections.

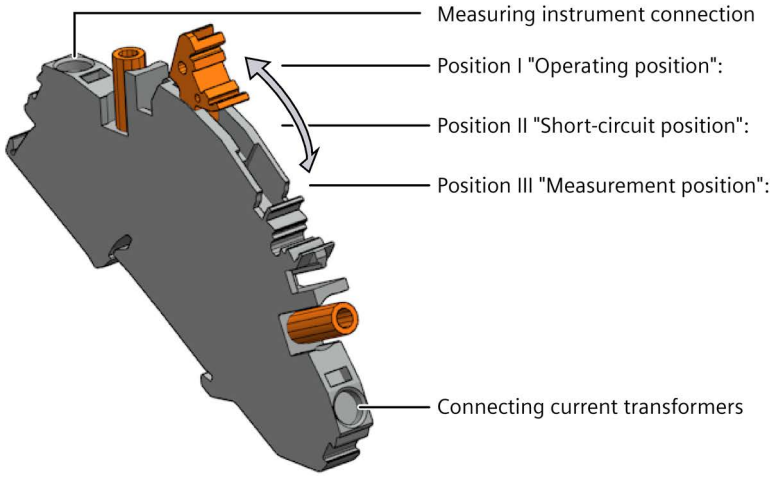



Figure 8-53 Lever positions at the current transformer terminal

Meaning of the lever positions at the current transformer terminal:

- Position I "Operating position": The current transformers are connected with the connections for the measuring instrument.
  In the installed state of terminal block X60, the lever is in the "Upper" position.
- Position II "Short-circuit position": The current transformer connections are short-circuited.
  In the installed state of terminal block X60, the lever is in the "Center" position.
- Position III "Measurement position": The current transformer connections are short-circuited and disconnected from the connections of the measuring instrument.
  In the installed state of terminal block X60, the lever is in the "Lower" position.

## 8.38 L42/L43/L44, Line Connection Module for Active/ Basic/Smart Line Modules

### Availability of options

These options are available for the following S120 Cabinet Modules:

- Line Connection Modules

### Option L42, Line Connection Module for Active Line Modules

This option allows the Line Connection Module to be adjusted for connection to an Active Line Module.

If a main contactor is required in the Line Connection Module for correct functioning, then this contactor is included.

### Option L43, Line Connection Module for Basic Line Modules

This option allows the Line Connection Module to be adjusted for connection to a Basic Line Module.

In this case, the Line Connection Modules are equipped with the line reactor for Basic Line Modules. If the line reactor is not required, it can be deselected with option L22 (line reactor not included in scope of supply).

### Option L44, Line Connection Module for Smart Line Modules

This option means that the Line Connection Module is adjusted for connection to a Smart Line Module.

If a main contactor is required in the Line Connection Module for correct functioning, then this contactor is included.

## 8.39 L45, EMERGENCY OFF pushbutton installed in the cabinet door

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Active Line Connection Modules-2

### Description

The EMERGENCY OFF pushbutton with protective collar is integrated in the cabinet door of the 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 8- 79 Terminal block X120

| Terminal | Designation [1] | Technical data |
|---|---|---|
| 1 | NC | Feedback signal contacts from the EMERGENCY OFF pushbutton in the cabinet door<br>Max. load current: 10 A<br>Max. switching voltage: 250 V AC<br>Max. contact rating: 250 VA<br>Required minimum load: ≥1 mA |
| 2 | | |
| 3 | NC (internal) | |
| 4 | | |
| Max. connectable cross-section: 4 mm² | | |

[1] NC: NC contact

## 8.40 L46/L47, grounding switch upstream/downstream of main switch

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules (frame sizes KL and LL)

### Description

The grounding switch short-circuits the incoming supply line to ground for servicing. It is engaged manually by means of a rotary actuator and ensures, for example, safe isolation from supply in the Cabinet Module during servicing.

Two versions are available and can be supplied at the same time:

- Version 1 (L46) establishes a ground connection for the connected power lines.
- Version 2 (L47) grounds the cabinet's internal components located downstream of the circuit breaker.

## 8.40.1 Grounding switch upstream of main breaker (option L46)

The grounding switch upstream of the internal main switch shorts the supply network to ground.



**⚠WARNING**

**Closing the grounding switch with the line voltage present**

Death or serious injury can result through closing the grounding switch with the line voltage present.

- Plant-side measures must be taken to prevent the grounding switch from engaging when the line voltage is present.
- For this purpose, connect the checkback signal "Interruption of higher-level switches" to the higher-level switching equipment so that, when required, the upstream main switch trips immediately.
- Ensure that the supply system cannot be connected when the grounding switch is engaged.

**Note**

The signals required for interlocking are available on the terminal block.

### X70 "Grounding switch upstream of internal main switch"

Table 8- 80 Terminal block X70

| Terminal | Designation [1] | Technical data |
|---|---|---|
| 1 | L1 | Grounding switch enable<br>230 VAC / 0.1 A |
| 2 | N | |
| 3 | NC | "Interruption of higher-level switches" feedback signal<br>Leading contact<br>Max. load current: 3 A<br>Max. switching voltage: 250 VAC |
| 4 | NO | |
| 5 | COM | |
| 6 | NC | "Switch actuated" checkback signal<br>Max. load current: 3 A<br>Max. switching voltage: 250 VAC |
| 7 | NO | |
| 8 | COM | |
| Max. connectable cross-section: 2.5 mm² | | |

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

## 8.40.2 Grounding switch downstream of main breaker (option L47)

The grounding switch downstream of the internal main switch short-circuits the components downstream of the circuit-breaker to ground.

**Note**

**Measures required when closing the grounding switch with the voltage available**

In this case, the grounding switch and the main switch of the Line Connection Module are interlocked electrically. This ensures that when the main switch is closed, it is opened again when the grounding switch is switched on.

If the grounding switch is engaged, it is interlocked to ensure that the main switch cannot be switched in.

### X71 terminal block "Grounding switch downstream of internal main switch"

Table 8- 81 Terminal block X71

| Terminal | Designation [1] | Technical data |
|---|---|---|
| 1 | L1 | Grounding switch enable<br>230 VAC / 0.1 A |
| 2 | N | |
| 3 | NC (reserved, do not use) | Circuit breaker interlock<br>("Grounding switch open") |
| 4 | NC (reserved, do not use) | |
| 5 | COM (reserved, do not use) | |
| 6 | NC | "Switch actuated" checkback signal<br>Max. load current: 3 A<br>Max. switching voltage: 250 VAC |
| 7 | NO | |
| 8 | COM | |
| Max. connectable cross-section: 2.5 mm² | | |

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

# 8.41 L50, cabinet lighting with service socket

## Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Active Line Connection Modules-2

## 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 and 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 8- 82 Terminal block X390 – connection for cabinet lighting with service socket

| Terminal | Designation | Technical data |
|---|---|---|
| 1 | L1 | 230 V AC<br>power supply |
| 2 | N | |
| 3 | PE | Protective conductor |
| Max. connectable cross-section: 4 mm² | | |

# 8.42 L55, cabinet anti-condensation heating

## Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Base Cabinets
- Motor Modules chassis format
- Motor Modules chassis-2 format
- Central Braking Modules
- Auxiliary Power Supply Modules
- Extension 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 (-E240) is deployed for 400 mm and 600 mm cabinets. 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 8- 83 Terminal block X240

| Terminal | Designation | Technical data |
|---|---|---|
| 1 | L1 | 110 to 230 VAC voltage supply |
| 2 | N | Current demand:<br>- min.: approx. 0.43 A (for 230 VAC, 100 W)<br>- 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.

# 8.43 L61/L62, L64/L65, braking units

## 8.43.1 General information

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Motor Modules in chassis format

### Description

Braking units may be required for drives in which motors might operate in generator mode but have no other facility for feeding energy back into the supply system.

The braking unit comprises two components:

- A Braking Module that is installed in the Power Module
- A braking resistor to be mounted externally (degree of protection IP20)

The braking unit functions as an autonomous unit, and does not require an external power supply.

The Braking Modules are installed in the air outlet channel of the Basic Line Module, Smart Line Module, Active Line Module, or Motor Module.

During the braking process, the kinetic energy is converted into heat in the externally mounted braking resistor.

A maximum cable length of 100 mm is permissible between the Braking Module and the braking resistor. This allows the braking resistor to be mounted externally so that heat losses can be released outside the converter enclosure. The braking resistor is connected directly to the Braking Module terminals.

The application threshold of the Braking Module can be adjusted to the plant-side requirements using a threshold switch.

**Note**

Higher braking powers are available on request.

## 8.43.2 Interfaces

### Connection for the braking resistor

The connection is made directly at terminal -X5.

Table 8- 84 Connection for the braking resistor

| Terminal | Designation |
|---|---|
| -X5:1 | Braking resistor connection R+ |
| -X5:2 | Braking resistor connection R- |

Recommended connection cross-sections:

- For option L61/L64 (25 kW): 35 mm²
- For option L62/L65 (50 kW): 50 mm²

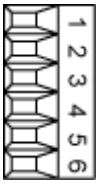
**Note**

**Strain relief**

For strain relief, the cables must be clamped on the cable propping bar (C-type mounting bar).

### X21 digital inputs/outputs

Table 8- 85 Terminal strip X21

| Connector | Terminal | Designation [1] | Technical data |
|---|---|---|---|
|  | 1 | Shield | Shield connection for terminals 2 to 6 |
| | 2 | 0 V | High level: +15 ... 30 V<br>Current drain: 2 ... 15 mA<br>Low level: -3 ... 5 V |
| | 3 | DI inhibit input | |
| | 4 | 0 V | High signal: No fault<br>Low signal: Fault present<br>Voltage: 24 VDC<br>Load current: 0.5 ... 0.6 A |
| | 5 | DO fault output | |
| | 6 | +24 V | Voltage: +18 ... 30 V<br>Typical current consumption (intrinsic current consumption):<br>10 mA at 24 VDC |
| Max. connectable cross-section: 1.5 mm² | | | |

[1] DI: digital input; DO: digital output

The signals of terminal strip -X21 are factory-routed to customer interface -X55 (maximum connectable cross-section: 2.5 $mm^2$):

- Jumper from -X21:2 to -X55-X132:14 (ground)
- Jumper from -X21:3 to -X55-X132:12 (DI/DO14)
- Jumper from -X21:5 to -X55-X132:1 (DI4)
- Jumper from -X21:6 to -X55-X132:9 (DI/DO12)

**Note**

The "DO fault output" signal can be used for evaluation in the Control Unit.

On the "+24 V" signal, 24 VDC must be provided by the customer to supply the Braking Module.

**Note**

**Signal characteristics of terminal X21.3**

Applying a high signal to terminal X21.3 inhibits the Braking Module. On a falling edge, pending error messages are acknowledged.

**Note**

The Braking Module requires DC-link voltage so that the "No fault" message can be issued correctly.

### Commissioning/parameterization

If a Control Unit is not available (option K90/K95), then the four signals of terminal block -X55-X132 must be wired to the corresponding Control Unit or to the customer interface -X55.

## 8.43.3 S1 - Threshold switch

The response threshold at which the Braking Module is activated and the DC-link voltage generated during braking is specified in the following table.

**⚠ WARNING**

**Electric shock when operating threshold switches**

Operating the threshold switch when a voltage is present can cause death or serious injury.

- Only use the threshold switch when the Basic Line, Smart Line, Active Line or Motor Module are switched off and the DC-link capacitors are discharged.

Table 8- 86 Response thresholds of the Braking Modules

| Voltage | Response threshold | Switch position | Comments |
|---|---|---|---|
| 3 AC 380 ... 480 V | 673 V | 1 | 774 V is the default factory setting. For line voltages of between 3 AC 380 V and 400 V, the response threshold can be set to 673 V to reduce the voltage stress on the motor and converter. This does, however, reduce the possible braking power with the square of the voltage $(673/774)^2 = 0.75$.<br>The maximum available braking power is therefore 75%. |
| | 774 V | 2 | |
| 3 AC 500 ... 600 V | 841 V | 1 | 967 V is the default factory setting. With a supply voltage of 500 V 3 AC, the response threshold can be set to 841 V to reduce the voltage stress on the motor and converter. This does, however, reduce the possible braking power with the square of the voltage $(841/967)^2 = 0.75$.<br>The maximum available braking power is therefore 75%. |
| | 967 V | 2 | |
| 3 AC 660 ... 690 V | 1070 V | 1 | 1158 V is the default factory setting. With a supply voltage of 660 V 3 AC, the response threshold can be set to 1070 V to reduce the voltage stress on the motor and converter. This does, however, reduce the possible braking power with the square of the voltage $(1070/1158)^2 = 0.85$.<br>The maximum available braking power is therefore 85%. |
| | 1158 V | 2 | |

**Note**

**Switch positions**

The positions of the threshold switches for the braking modules are as follows when installed:

- Braking Modules for frame sizes FX, FB, GX, GB: Position "1" is up; position "2" is down
- Braking Modules for frame sizes HX, JX: Position "1" is at the back; position "2" is at the front

**Note**

**"Overvoltage" fault**

Even when the response threshold is set to a low value, the DC-link voltage can still reach the maximum voltage value (hardware shutdown threshold), thus triggering the "Overvoltage" fault. This can occur, for example, in cases where there is too much regenerative energy for the available braking power.

To prevent the DC-link voltage from exceeding the threshold, the Vdc-max controller must be enabled (p1240) and the device supply voltage set accordingly (p0210).

## 8.43.4 Braking Module

### Braking Module for frame sizes FX, FB

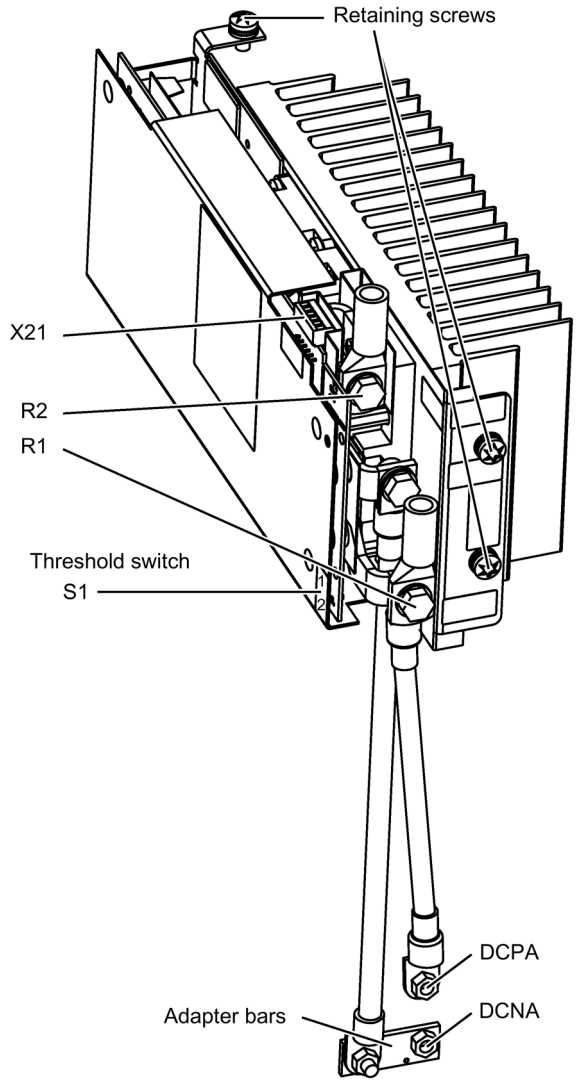



Figure 8-54 Braking Module for Active Line Module / Motor Module, frame size FX and for Basic Line Module, frame size FB

**Note**

**Connecting interfaces**

With this Braking Module, the R1 and DCPA interfaces use the same connection.

### Braking Module for frame sizes GX, GB

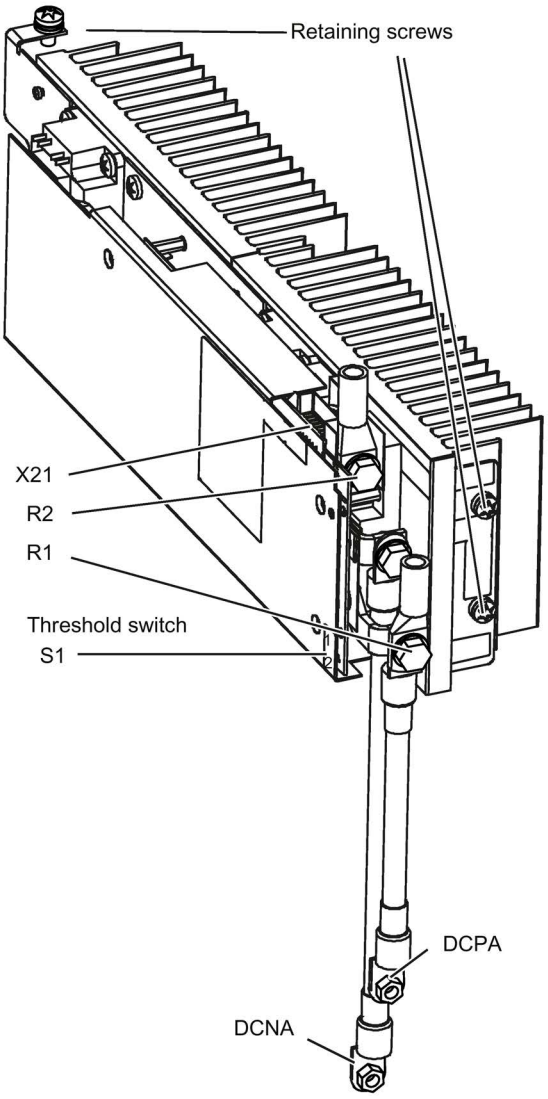



Figure 8-55 Braking Module for Smart Line Module / Active Line Module / Motor Module, frame size GX and for Basic Line Module, frame size GB

**Note**

**Connecting interfaces**

With this Braking Module, the R1 and DCPA interfaces use the same connection.

### Braking Module for frame sizes HX and JX

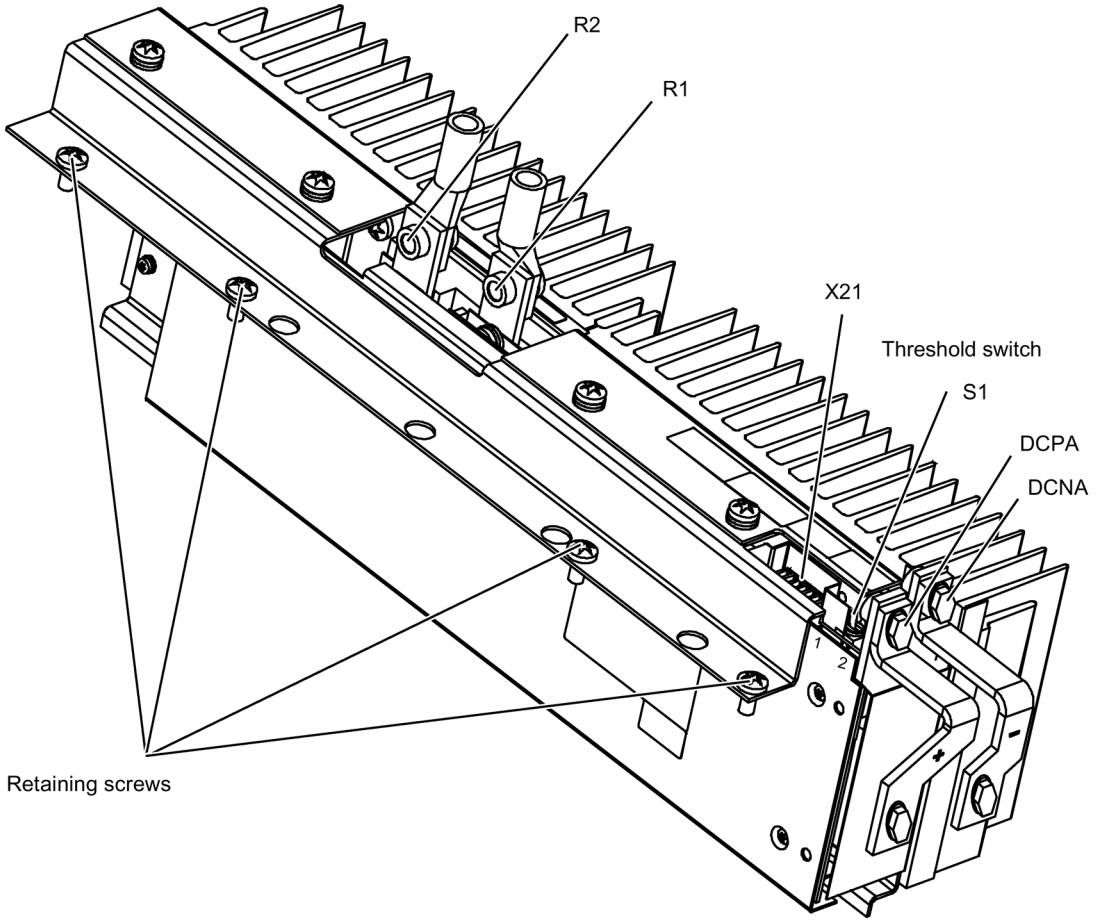



Figure 8-56 Braking Module for Smart Line Module / Active Line Module / Motor Module, frame sizes HX and JX

## 8.43.5 Example connection of Braking Module

The connections between the Braking Module and the DC link and control terminal strip -X21 are made in the factory.

The braking resistor is connected directly to terminal -X5.

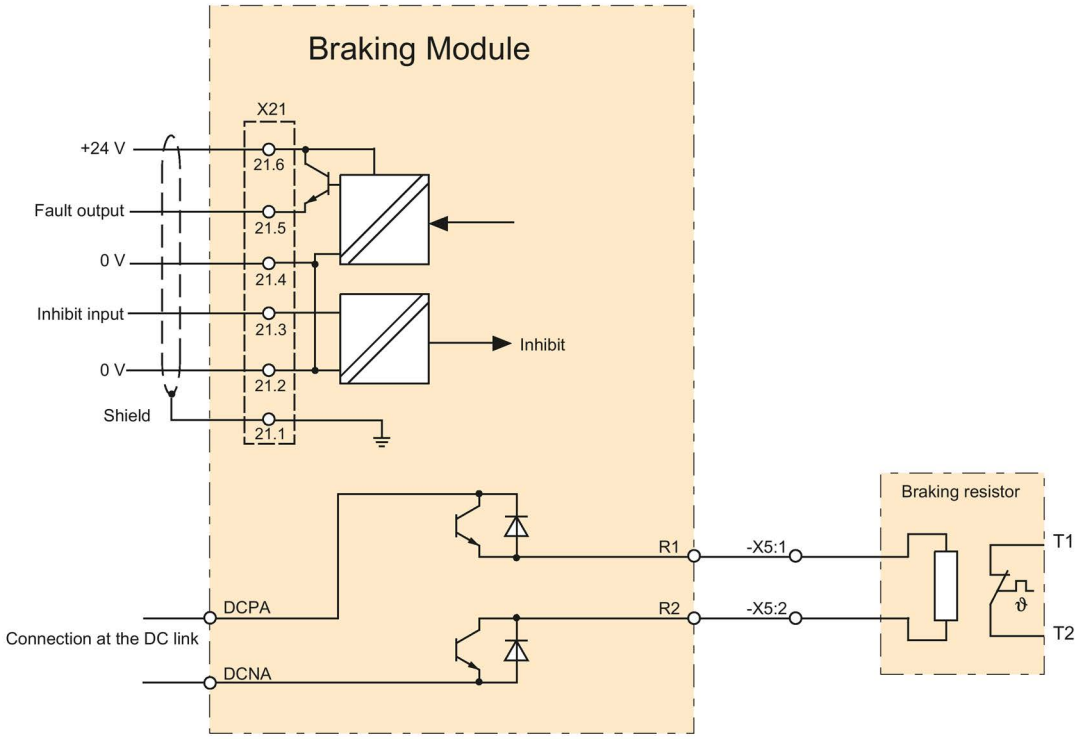



Figure 8-57 Example connection of Braking Module

## 8.43.6 Braking resistors

### Description

The excess energy of the DC link is dissipated via the braking resistor.

The braking resistor is connected to a Braking Module. The braking resistor is positioned outside the cabinet or switchgear room. This enables the resulting heat loss around the Basic Line Module, Smart Line Module, Active Line Module, or Motor Module to be dissipated, thereby reducing the amount of air conditioning required.

Resistors with a rated power (continuous power) of 25 kW and 50 kW are available.

A thermostatic switch monitors the braking resistor for overtemperature and issues a signal on a floating contact if the limit value is exceeded.

**Note**

These braking resistors are not the same as the components described in the "Central Braking Module" Cabinet Module and must not be connected to this Cabinet Module.

## Dimension drawings

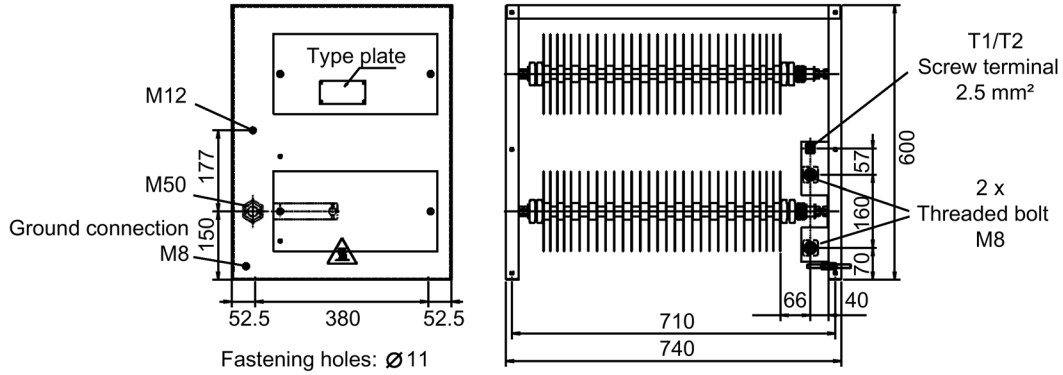



Figure 8-58 Dimension drawing for braking resistor 25 kW, 125 kW (option L61 / L64)

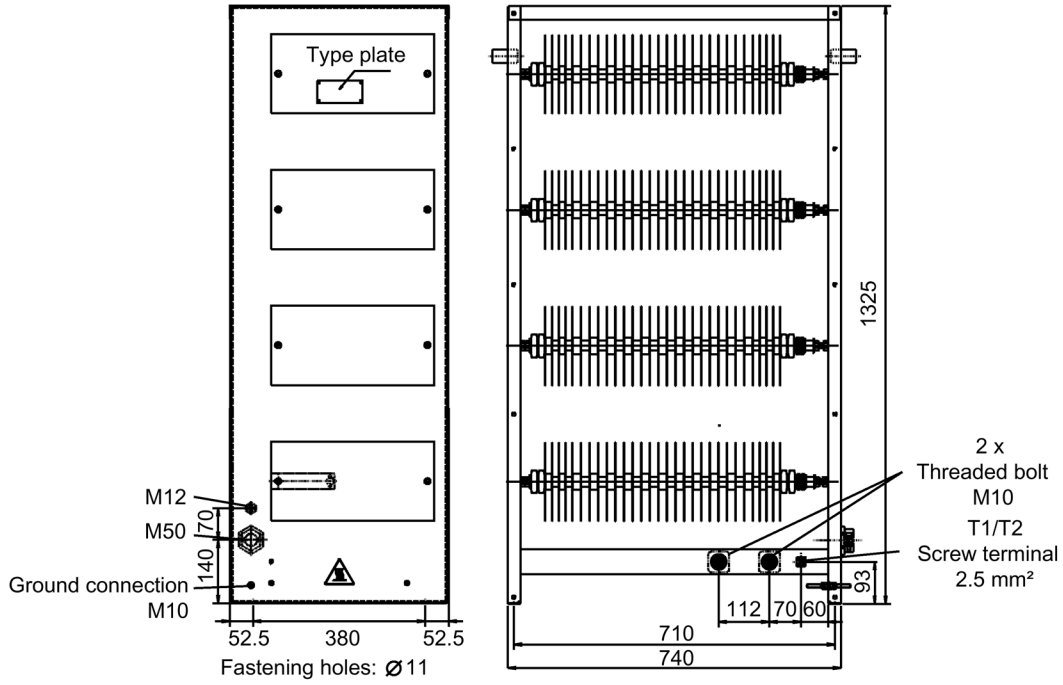



Figure 8-59 Dimension drawing for braking resistor 50 kW, 250 kW (option L62 / L65)

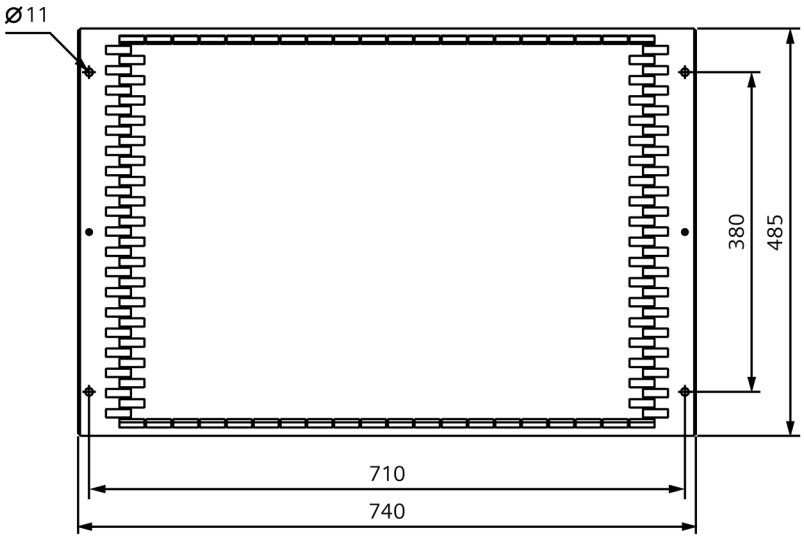



Figure 8-60 Mounting dimensions of the braking resistors

## Safety instructions

**⚠WARNING**

**Fire for an inadequate installation**

If incorrectly installed (non-observance of the cooling clearances or inadequate clearances to flammable objects), there is the danger of fire damage with death or severe injury.

- It is essential that you maintain a cooling clearance of 200 mm on all sides of the braking resistor with ventilation grills.
- Maintain sufficient clearance to objects that can burn.



**⚠CAUTION**

**Burns caused by hot surfaces of the braking resistor**

In operation, the braking resistor can reach high temperatures, which can cause burns if touched.

- Allow the braking resistor to cool down before starting any work.
- Use the appropriate personnel protection equipment, e.g. gloves.

**⚠WARNING**

**Fire caused by ground fault / short-circuit for non-protected connections to the braking resistor**

Non-protected connections to the braking resistor can cause fire with smoke in the event of a short-circuit or ground fault that can cause severe injuries or death.

- Route the cables to the braking resistor so that a ground fault or short-circuit can be ruled out.
- Comply with local installation regulations that enable this fault to be ruled out.
- Protect the cables from mechanical damage.
- Apply one of the following measures:
  - Use cables with double insulation.
  - Maintain adequate clearance, e.g. using spacers.
  - Route the cables in separate cable ducts or pipes.

**NOTICE**

**Material damage when exceeding the maximum permitted cable length**

Exceeding the maximum permitted cable length to the braking resistor can cause material damage in the event of component failure.

- Observe the maximum cable length between the cabinet unit and the braking resistor of 100 m.

## Thermostatic switch

Table 8- 87 Thermostatic switch connection

| Terminal | Description of function | Technical data |
|---|---|---|
| T1 | Thermostatic switch connection | Voltage: 240 VAC<br>Load current: Max. 10 A |
| T2 | Thermostatic switch connection | |

Max. connectable cross-section: 2.5 mm²

**⚠WARNING**

**Fire when there is no evaluation of the thermostatic switch**

If there is no evaluation of the thermostatic switch, there is the danger of fire damage with death or severe injury.

- Evaluate the thermostatic switch by the Control Unit or a higher-level controller, and a shutdown must be carried out if necessary.

## 8.43.7 Technical data

### Load data for the braking units

Table 8- 88 Load data for the braking units

| Line voltage | Braking Module continuous power $P_{DB}$ | Braking Module peak power $P_{15}$ | Braking Module $P_{20}$ power | Braking Module $P_{40}$ power | Braking resistor $R_B$ | Max. current |
|---|---|---|---|---|---|---|
| 380 ... 480 V | 25 kW | 125 kW | 100 kW | 50 kW | 4.4 Ω ± 7.5% | 189 A |
| 380 ... 480 V | 50 kW | 250 kW | 200 kW | 100 kW | 2.2 Ω ± 7.5% | 378 A |
| 500 ... 600 V | 50 kW | 250 kW | 200 kW | 100 kW | 3.4 Ω ± 7.5% | 306 A |
| 660 ... 690 V | 25 kW | 125 kW | 100 kW | 50 kW | 9.8 Ω ± 7.5% | 127 A |
| 660 ... 690 V | 50 kW | 250 kW | 200 kW | 100 kW | 4.9 Ω ± 7.5% | 255 A |

### Dimensions of the braking resistors

Table 8- 89 Dimensions of the braking resistors

| | Unit | 25 kW resistor (Option L61/L64) | 50 kW resistor (Option L62/L65) |
|---|---|---|---|
| Width | mm | 485 | 485 |
| Height | mm | 605 | 1325 |
| Depth | mm | 740 | 810 |

### Duty cycle

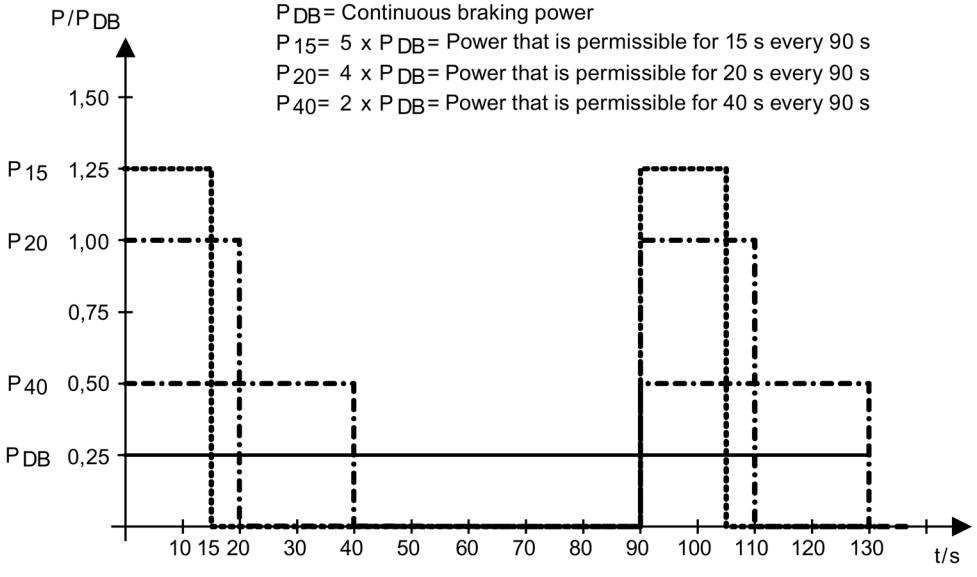



Figure 8-61 Duty cycle for braking resistors

# 8.44 L87, insulation monitoring

## Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Active Line Connection Modules-2

## Description

On non-grounded line supplies (IT supply systems), the insulation monitoring device checks the entire electrically-connected circuit for insulation faults. The insulation resistance and all insulation faults, from the line infeed to the motor, are acquired in the Cabinet Modules. Two response values (between 1 kΩ ...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" 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 connecting clip of the integrated basic interference suppression module to ground in the following Cabinet Modules is removed in the factory and placed loose in the cabinet unit:

- Basic Line Modules
- Smart Line Modules (for frame sizes HX and JX, the connection clip is located behind the fan) - including the Voltage Sensing Module VSM10 included with it
- Active Line Modules (connection clip in the Active Interface Module) including the Voltage Sensing Module VSM10 included in it
- Active Line Connection Modules-2 (connection clip in the Active Interface Module) including the Voltage Sensing Module VSM10

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 117)".

### Commissioning

When the Cabinet Module is delivered, the plant configuration (one or several loads in one electrically-connected network) and the protection strategy (immediate shutdown in the event of an insulation fault or restricted continued operation) is not known. The signaling relays of the insulation monitor must be integrated into the fault and alarm circuit by the customer.

The insulation monitoring device is adapted to the plant situation using the commissioning Wizard.

### Additional information

**Note**

**Additional information**

A detailed description of the complete principle of operation of the insulation monitor and its handling is given in the operating instructions, which are included in the device documentation provided.

## 8.45 M06, base 100 mm high, RAL 9005

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Base Cabinets
- Motor Modules chassis format
- Motor Modules chassis-2 format
- Central Braking Modules
- Auxiliary Power Supply Modules
- Extension Modules

### Description

Because it is raised 100 mm, the supplementary cabinet base facilitates larger bending radii for cables (cable inlet from below) and cable routing within the cabinet base.

The cabinet base comes completely assembled and is usually color RAL 9005.

Table 8- 90 Components of the cabinet base

| Component | Connection element | Fixing elements |
|---|---|---|
| 1 x base element (rear) |  | On the cabinet:<br>The cabinet base is shipped pre-assembled. |
| 1 x base element (front) | | |
| Base covers<br>(option M26/M27 only) | | On the foundation:<br>The holes are in line with the holes in the cabinet (see dimension drawings). |
| 4 x cover caps | | |

### 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.

## 8.46 M07, cable-marshalling compartment 200 mm high, RAL 7035

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Base Cabinets
- Motor Modules chassis format
- Motor Modules chassis-2 format
- Central Braking Modules
- Auxiliary Power Supply Modules
- Extension Modules

## Description

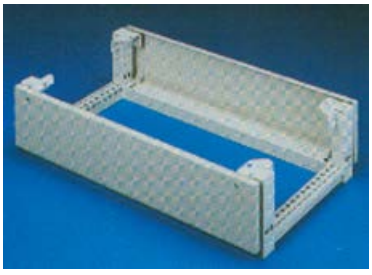
Because it is raised 200 mm, the supplementary cable marshalling compartment made of rigid sheet steel facilitates higher cable bending radii (cable inlet from below) and cable routing within the cable marshalling compartment.

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 8- 91 Components of the cable marshalling compartment

| Component | Connection element | Fixing elements |
|---|---|---|
| 1 x cable marshalling compartment element |  | On the cabinet:<br>The cabinet's cable marshalling compartment is shipped pre-assembled. |
| Side shutters<br>(not shown)<br>for the cable marshalling compartment<br>(option M26/M27 only). | | On the foundation:<br>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.

# 8.47 M21, degree of protection IP21

## 8.47.1 General information

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Base Cabinets
- Motor Modules chassis format
- Motor Modules chassis-2 format
- Central Braking Modules
- Auxiliary Power Supply Modules
- Extension Modules

### Description

To increase the degree of protection of the cabinet units from IP20 (standard) to IP21, additional canopies are supplied.

Increasing the degree of protection in this way ensures that not only is the cabinet unit protected against the ingress of foreign bodies with a diameter of 12.5 mm and above (IP20, protection level provided as standard), but also against the ingress of water droplets falling vertically from above (IP21).

The canopy is mounted using spacers at a distance of 250 mm above the top cover of the cabinet. The canopy increases the height of a cabinet unit by 250 mm, as shown in the diagram below (number (1)).

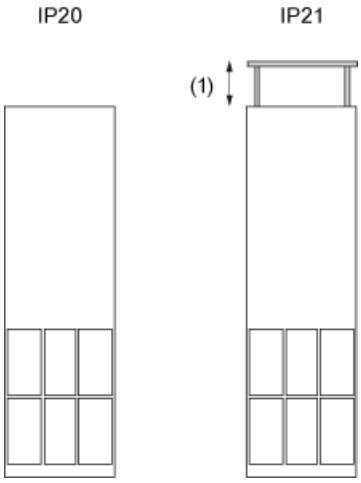



Figure 8-62 Cabinet with canopy (250 mm higher)

**Note**

**Installing the canopy or hood at a an early stage!**

It is recommended to attach the canopy or hood at an early stage to prevent foreign matter entering the cabinet units.

### Canopies for Cabinet Modules in the Chassis-2 format

With option M21, a canopy is only used on the cabinet with an Active Line Module or Motor Module in the Chassis-2 format.

For a possible additional option control cabinet located to the right, no hood is used, as this control cabinet is equipped with a closed and sealed top plate.

## 8.47.2 Mounting

### Mounting a drip plate to increase the degree of protection to IP21 (option M21)

The drip plate ② can be mounted variably in both directions (on the side and, to the front or back) on the top of the cabinet.
The arrangement can be adapted to the various installation conditions for the cabinets. This results in an adjustable overhang of the canopy to the front ① and to the rear ③.

This means that the canopy can overhang all around or have direct contact with the wall or with the canopy of the installation at the rear. If necessary, seal the contact points in the case of wall-mounting or back-to-back installation.

- Remove any existing crane transport assemblies.
- Attach the spacers (A) to the roof of the cabinet at the positions specified. Under certain circumstances, it may be necessary to remove the protective grill for installation.
  Install the screws ④ with contact washers from below through the perforated protective grill (tightening torque: 13 Nm for M6).
- Mount the drip plate (B) on the spacers.
  Attach the screw ⑤ with contact washer from above through the drip plate (tightening torque: 13 Nm for M6).

**Note**

**Mounting the drip plates for cabinets mounted side-by-side**

In order to prevent water dripping into the spaces between the cabinet units connected in series, there are overlaps on the sides of the drip plates. When fitting the canopies, make sure that the overlap engage in one another.

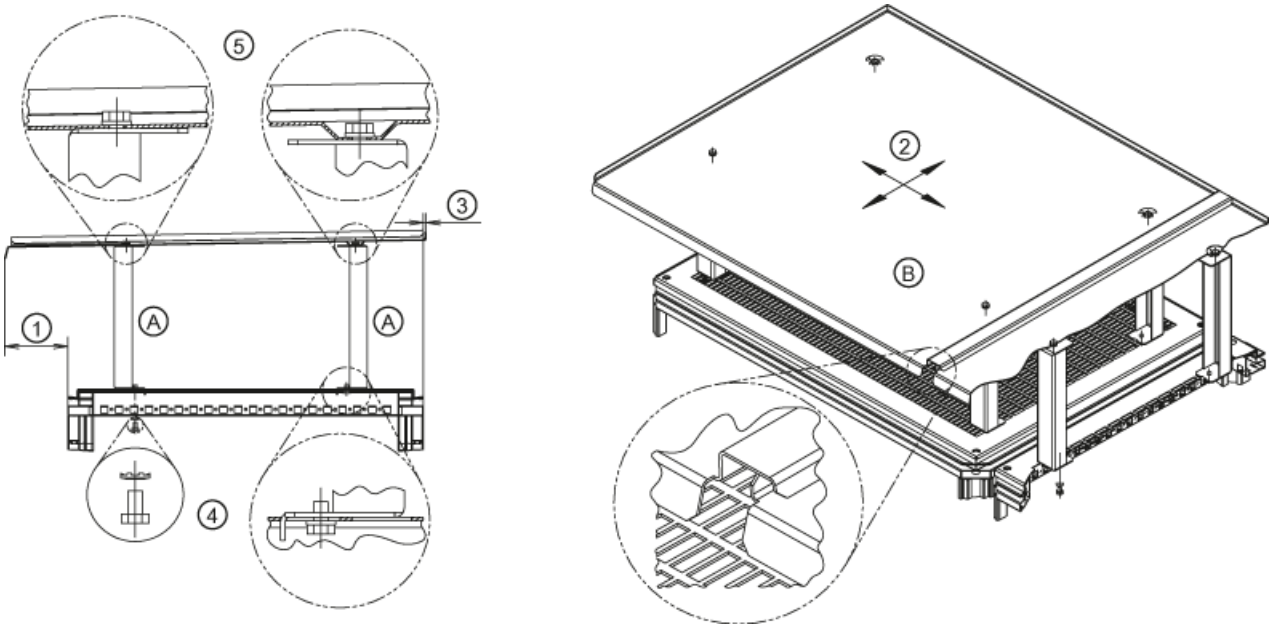



Figure 8-63 Fitting a canopy

# 8.48 M23/M43/M54, degree of protection IP23/IP43/IP54

## 8.48.1 General information

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Base Cabinets
- Motor Modules chassis format
- Motor Modules chassis-2 format
- Central Braking Modules
- Auxiliary Power Supply Modules
- Extension Modules

### Description

The table below explains the properties of the various degrees of protection that are available.

Table 8- 92 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<br>Protection against damaging internal dust deposits | Protects against splash water from all sides |

**Note**

Hoods (1) increase the height of the cabinet units by 400 mm.

For degree of protection IP54, the derating values of the relevant Cabinet Modules must be observed.

**Note**

**Installing a fan in the top cover**

In the Line Connection Module with option L43 and in the Booksize Base Cabinet, a fan is installed in the hood for degrees of protection IP23, IP43, and IP54.

**Note**

**Installing the canopy or hood at a an early stage!**

It is recommended to attach the canopy or hood at an early stage to prevent foreign matter entering the cabinet units.

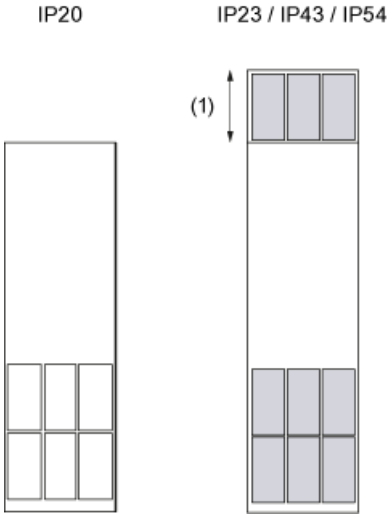



Figure 8-64 Cabinet with hood (400 mm higher)

If the degree of protection of the Cabinet Modules is to be increased, the additional hoods and filter media are delivered separately.

The hoods are flush with the cabinets at the side and front and have a recess at the rear so that air can escape even if the cabinet is mounted onto a wall or panel. Air escapes from the front and back.

The hoods are easily fitted and filter media easily changed from outside the cabinet. Air escapes from the front and back. 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.

### Hoods for Cabinet Modules in the Chassis-2 format

For Cabinet Modules in the Chassis-2 format, for options M23, M43 and M54 special hoods are used:

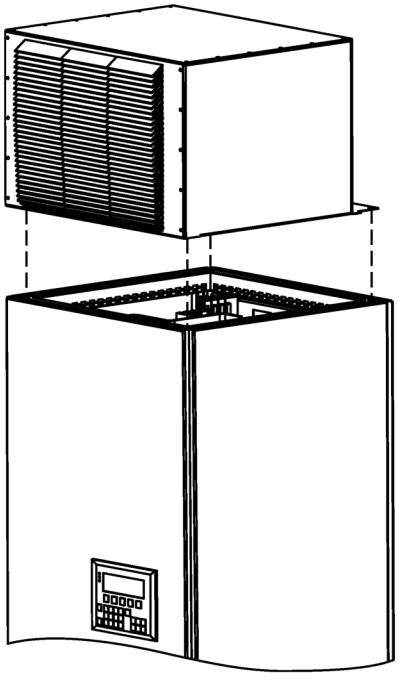
- For a cabinet with Active Line Modules or Motor Modules Chassis-2 format, a hood with additional air guidance plate is used at the front.
  This air guidance plate ensures that the hot air discharged from the hood cannot enter the upper air intake area of the control cabinet.
- For a possible additional option control cabinet located to the right, no hood is used, as this control cabinet is equipped with a closed and sealed top plate.

## 8.48.2 Mounting

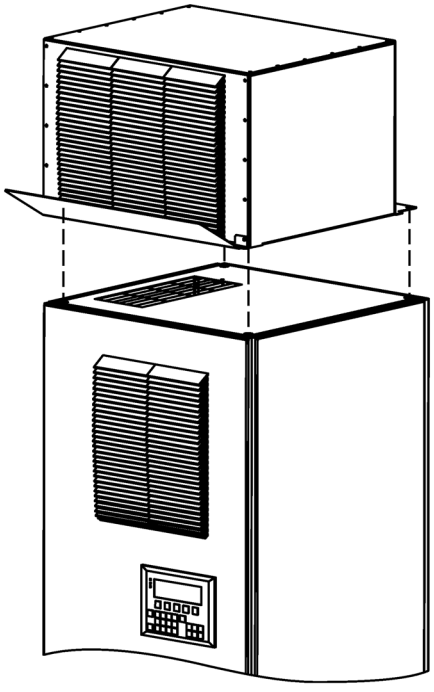
### Preparatory steps

- Remove the crane transport assemblies (if fitted)
  (-> see Chapter "Mechanical installation").
- Cabinet Modules:
  Remove the perforated roof plate on the upper side of the cabinet (if installed).
- Cabinet Modules-2:
  It is not permissible that the installed top plate is removed.

Cover hood for Cabinet Modules



Hood for Cabinet Modules-2



## Attaching the hood

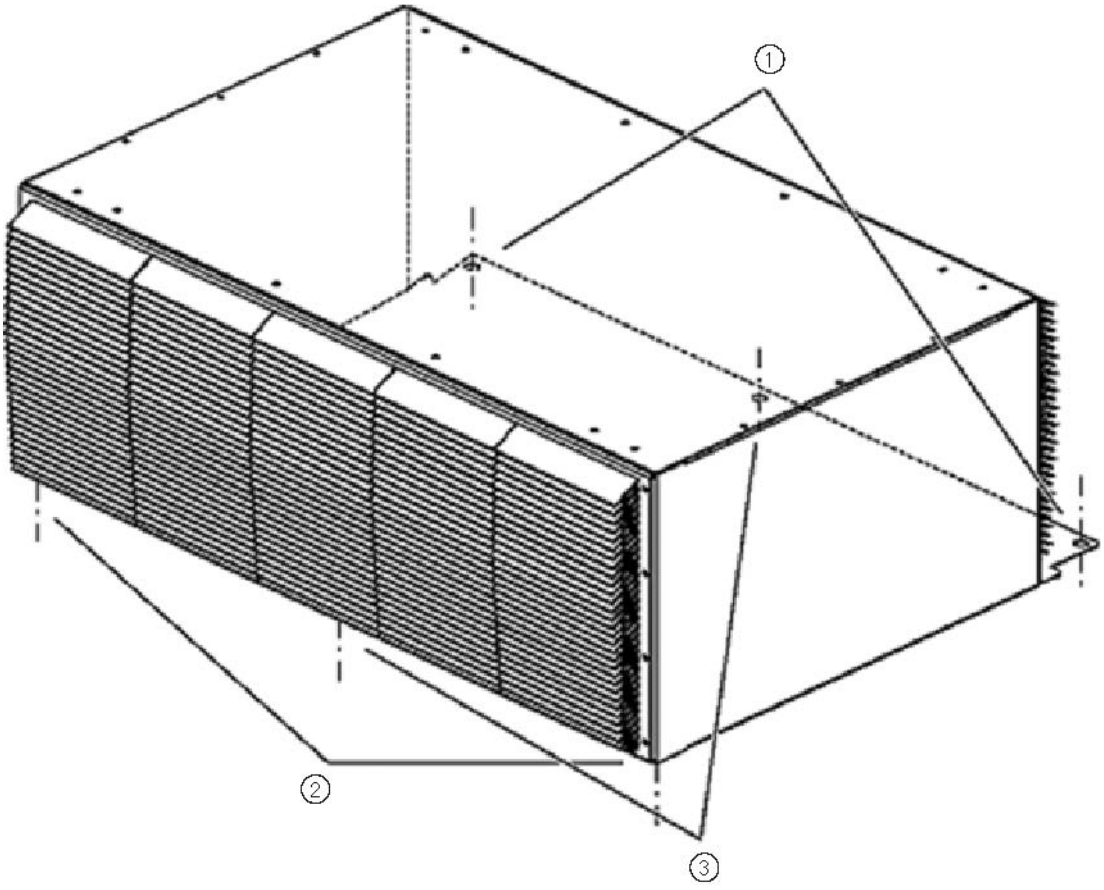



Figure 8-65 Mounted hood

The numbers in parentheses in the installation steps refer to the diagram.

1. Options M43 and M54 only:
   Use the sealing tape provided to attach the contact surfaces of the hood to the top of the cabinet.



Figure 8-66 Hood with attached sealing tape

2. Place the washers of the original roof screws between the cabinet upper side and the hood at the contact points of the cabinet front side. This prevents the hood from being pressed down too far when the screws are tightened, thus preventing the doors from being opened.



Figure 8-67 Attaching the washers

3. Fit the hood to the top of the enclosure at the positions specified (fixing points for the crane transport assemblies).
4. Attach the original M12 roof screws ① from above at the rear side; tightening torque: 20 + 5 Nm.
5. Attach the M6 screws and washers at the front side (sequence: screw, spring-lock element, small washer, large washer) ② from below.
6. If the hood is very wide, insert additional screws ③ in the center of the hood (front and rear).



Figure 8-68 View with opened cabinet door



Figure 8-69 View with closed cabinet door

**Note**

**Mounting the hoods in a side-by-side configuration**

If cabinet units are installed in a side-by-side configuration, the hoods must be flush-mounted in a line across the cabinet units.

**Note**

**Additional information**

See also Chapter "Maintenance and servicing", Section "Replacing the filter mats".

# 8.49 M26/M27, side panels mounted on right and left

## Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Base Cabinets
- Motor Modules chassis format
- Motor Modules chassis-2 format
- Central Braking Modules
- Auxiliary Power Supply Modules
- Extension 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!

# 8.50 M51, motor reactor terminal connection

## Availability of option

This option is available for the following S120 Cabinet Modules:

- Booksize Cabinet Kits

## Description

In conjunction with option M77 (version without component support plates and without additional control components), option L08/L09 (motor reactor / 2 motor reactors in series) allows the motor cables to be connected directly to the motor reactor.

With option M51, the connection of the motor cable is wired to a customer connection terminal -X1.

Table 8- 93 Maximum conductor cross-section when using motor reactors for Booksize Cabinet Kits

| Article No. 6SL3720- | Power in kW | Maximum connection cross-section |
|---|---|---|
| 1TE21-0AB4 | 4.8 | 6 mm² |
| 1TE21-8AB4 | 9.7 | 6 mm² |
| 1TE23-0AB4 | 16 | 6 mm² |
| 1TE24-5AB4 | 24 | 16 mm² |
| 1TE26-0AB4 | 32 | 16 mm² |
| 1TE28-5AB3 | 46 | 35 mm² |
| 1TE31-3AB3 | 71 | 95 mm² |

# 8.51 M59, closed cabinet door, air inlet from below through floor opening

## Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Base Cabinets
- Motor Modules chassis format
- Central Braking Modules
- Auxiliary Power Supply Modules
- Extension Modules

## Description

The standard cabinet units are supplied with integrated ventilation grilles in the bottom of the doors as standard.

With option M59, the Cabinet Modules are delivered with closed doors.

**Note**

When closed doors are used, the base plates, which are available as standard for ensuring a sufficient cooling air supply, are not required.

In this case, the customer must ensure that no dirt/conductive dust or moisture can enter the Cabinet Module. Cables must not be routed in such a way that they impede the flow of air through the cabinet floor opening.

If the area beneath the Cabinet Modules can be accessed, the customer must provide shock protection.

The required ambient conditions must be taken into account to prevent, for example, overheating of the cabinet and the ingress of dirt or moisture.

When removing doors, take care not to damage the grounding strips attached to them. Make sure that the strips are reattached properly when the doors are installed.

**Note**

**Opening angle of the door**

The door opening angle with free-standing cabinet units is 180°.

With a side-by-side configuration of the cabinet units, this opening angle is 130°.

For degrees of protection IP23/IP43/IP54 and with option L37 (DC interface incl. pre-charging input circuit), the door opening angle is only 110°.

## 8.52 M60, additional shock protection

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Motor Modules chassis format
- Extension Modules

### Description

The Cabinet Modules are designed in accordance with DGUV Regulation 3 as standard. With option M60, additional covers (out of reach of accessible control and switching elements) are attached upstream of the power unit.

**Note**

**Do not operate without cabinet door(s)**

The additional touch protection (option M60) is not a substitute for the cabinet door(s). It is not permissible to operate a cabinet unit **without** cabinet door or cabinet doors!

# 8.53 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:

- Line Connection Modules
- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize base cabinets
- Motor Modules chassis format
- Motor Modules chassis-2 format
- Central Braking Modules
- Auxiliary Power Supply Modules
- Extension 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.

# 8.54 M62, comfort-grip handle with integrated pushbutton lock insert

## Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize base cabinets
- Motor Modules chassis format
- Motor Modules chassis-2 format
- Central Braking Modules
- Auxiliary Power Supply Modules
- Extension 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 implemented on the plant/line 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.

# 8.55 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:

- Line Connection Modules
- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize base cabinets
- Motor Modules chassis format
- Motor Modules chassis-2 format
- Central Braking Modules
- Auxiliary Power Supply Modules
- Extension 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 implemented on the plant/line 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.

# 8.56 M70, EMC shield bus

## 8.56.1 General information

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Active Line Connection Modules-2
- Booksize Base Cabinets
- Motor Modules chassis format
- Auxiliary Power Supply Modules
- Extension Modules

### Description

With option M70, an EMC shield rail is incorporated for the use of shielded electric 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 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 PUK: cable clamps, model "HB").

## 8.56.2 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.

# 8.57 M77, version without component support plates and without additional control components

## Availability of option

This option is available for the following S120 Cabinet Modules:

- Booksize Base Cabinets

## Description

If electronic components (Control Unit, Terminal Module, Sensor Module) are not used in the Booksize Cabinet Kit, the mechanical component support plates are omitted with option M77.

When option L08/L09 is used (motor reactor / 2 motor reactors in series), the motor cables are connected directly to the motor reactor.

The motor cables are connected directly to the Booksize Motor Module.

Table 8- 94 Conductor cross-section when connecting motor cables directly to the Booksize Motor Module

| Article No. 6SL3720- | Power in kW | Connection cross-section |
|---|---|---|
| 1TE21-0AB4 | 4.8 | 1.5 ... 6 mm² |
| 1TE21-8AB4 | 9.7 | 1.5 ... 6 mm² |
| 1TE23-0AB4 | 16 | 1.5 ... 6 mm² |
| 1TE24-5AB4 | 24 | 6 ... 50 mm² |
| 1TE26-0AB4 | 32 | 6 ... 50 mm² |
| 1TE28-5AB3 | 46 | 16 ... 120 mm² |
| 1TE31-3AB3 | 71 | 25 ... 120 mm² |

# 8.58 M80 to M87, DC busbar system

## Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Base Cabinets
- Motor Modules chassis format
- Motor Modules chassis-2 format
- Central Braking Modules
- Auxiliary Power Supply Modules
- Extension 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 8-70 M80 - M87, DC busbar

## 8.59 M88, DC busbar system for line-side Cabinet Modules

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Active Line Connection Modules-2

### Description

As standard, there are no DC busbars in the upper part of Line Connection Modules and Active Interface Modules in Active Line Connection Modules-2.

Option M88 is required for parallel connection of up to 6 Active Line Connection Modules-2.

With this option the DC busbars can also be installed in the upper part of the corresponding line-side Cabinet Modules.

The busbars are nickel plated as standard, and are dimensioned for different current carrying capacities depending on the selected option M80 – M87.

## 8.60 M89, extended motor connection panel

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Motor Modules in Chassis-2 format

### Description

With this option, the motor cables are not directly connected at the Motor Module Chassis-2 format, but at prefabricated connecting bars in the Cabinet Module. In turn, these establish the contact to the Motor Module, which can be simply disconnected using screws.

As a consequence, the Motor Module can be simply disconnected from the motor cable; this simplifies installation and connecting the cables.

For example, this means that the Motor Module can be removed from the cabinet to make it simpler to connect the motor cables.

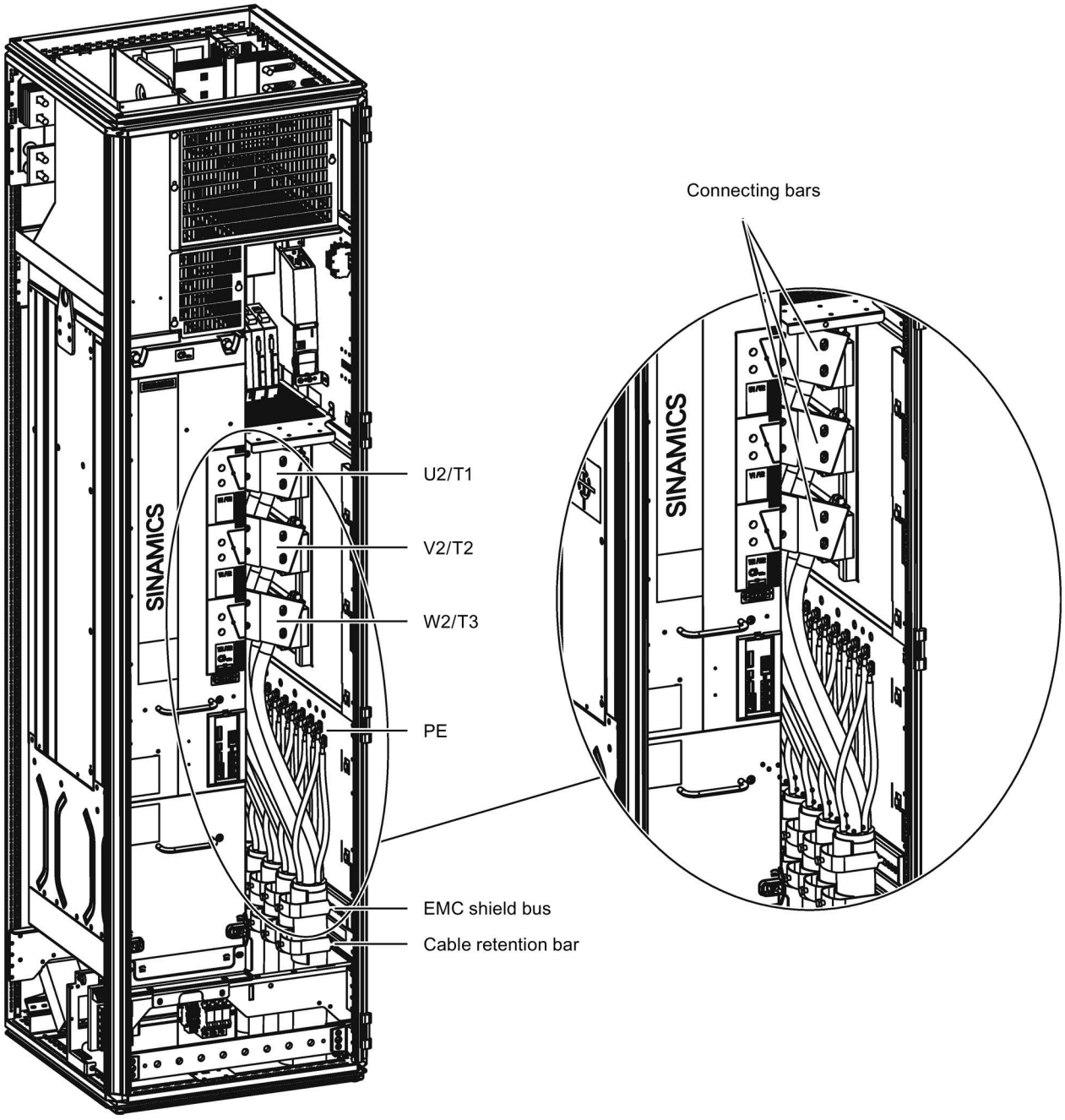
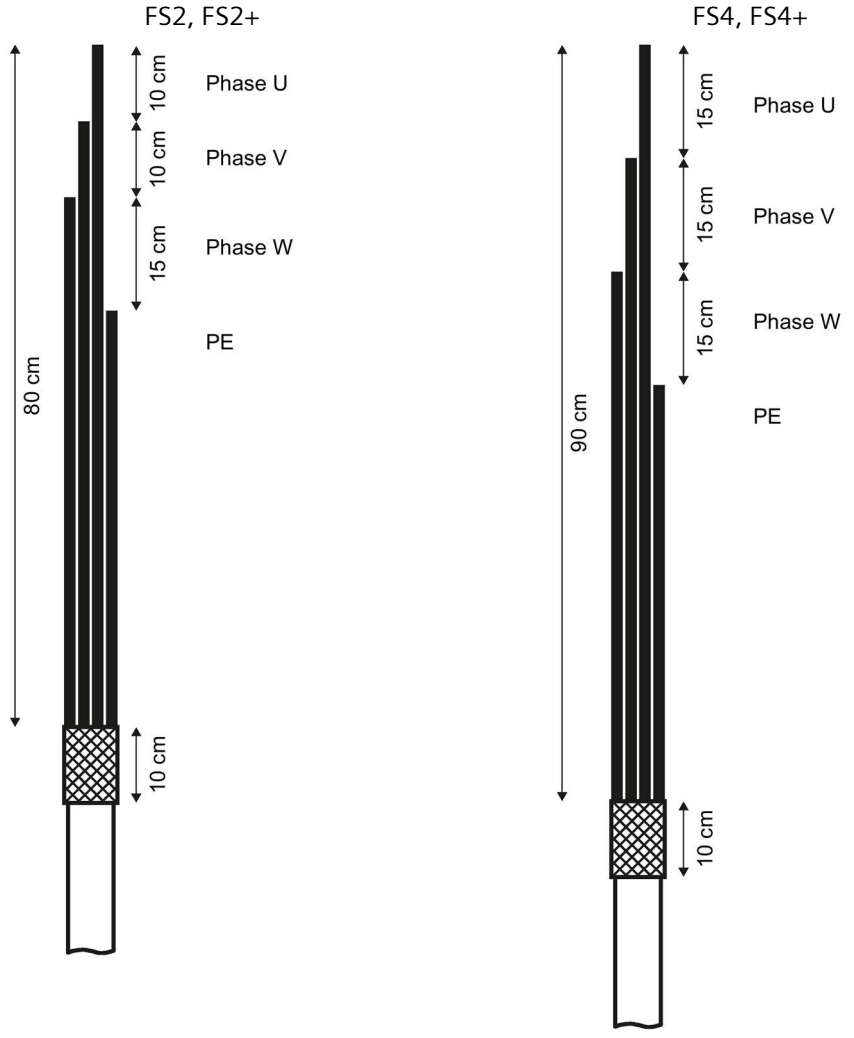



Figure 8-71 Connecting the motor feeder cables with option M89

Table 8- 95 Dimensions for stripping insulation and cutting the motor cables to length



# 8.61 M90, crane transport assembly (top-mounted)

## Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Base Cabinets
- Motor Modules chassis format
- Motor Modules chassis-2 format
- Central Braking Modules
- Auxiliary Power Supply Modules
- Extension 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 70)".

## 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.

## 8.62 N52, DC link fuses for Basic Line Modules

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Modules

### Description

Fuses are installed on the DC side to protect the Basic Line Module.

Installation of DC fuses is recommended if the DC current load in the configured drive line-up can be larger than the rated DC-link current of the Basic Line Module.

Furthermore, the DC fuses protect the Basic Line Module against an overvoltage on the DC busbar of the drive line-up in the event of a malfunction.

## 8.63 P10, measuring instrument for line variables, installed in the cabinet door

### Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Active Line Connection Modules-2

### Description

Measuring instrument "DIRIS A-30" with display, installed in the cabinet door of the Line Connection Module, acquires measured values of the power supply.

The measuring instrument has a serial RS485 interface with JBUS/MODBUS®, which permits 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
- Recording of active energy, reactive energy and 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. Measuring instrument "DIRIS A-30" 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**

When routing cables and EMC-compliant installation of the communication connection, orient yourself to the appropriate descriptions in Chapter "Cable routing (Page 129)".

## Lever positions at the current transformer terminal

The measuring connections of the current transformer are connected to customer interface X60 using special current transformer terminals.

The current transformer terminal is equipped with a lever to connect or disconnect and short-circuit the current transformer connections.



**⚠WARNING**

**Electric shock when carrying out connection work at the current transformer connections that are not short-circuited**

When carrying out connection work, hazardous voltages can be present at terminal block X60, which can result in serious injury or death if touched.

- When carrying out connection work at terminal block X60 ensure that the lever position is always at position III "Measurement position".

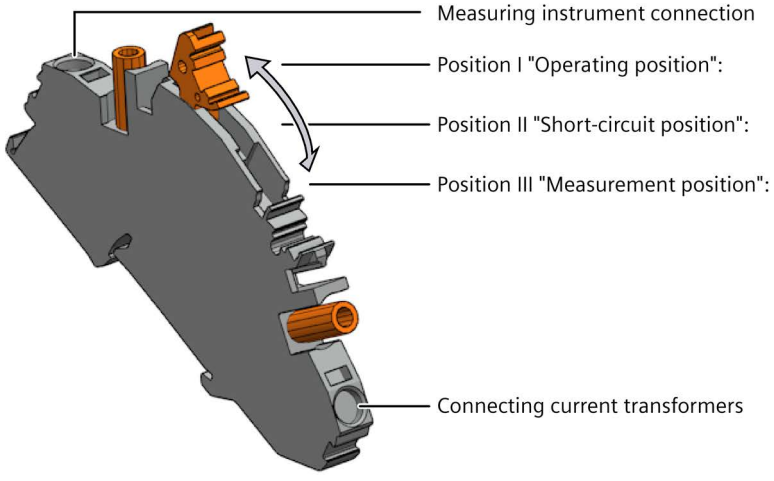



Figure 8-72 Lever positions at the current transformer terminal

Meaning of the lever positions at the current transformer terminal:

- Position I "Operating position": The current transformers are connected with the connections for the measuring instrument.
  In the installed state of terminal block X60, the lever is in the "Upper" position.
- Position II "Short-circuit position": The current transformer connections are short-circuited.
  In the installed state of terminal block X60, the lever is in the "Center" position.
- Position III "Measurement position": The current transformer connections are short-circuited and disconnected from the connections of the measuring instrument.
  In the installed state of terminal block X60, the lever is in the "Lower" position.

### Additional information

A detailed description of the complete principle of operation of the measuring instrument "DIRIS A-30" and its handling is given in the operating instructions, which are included in the device documentation provided.

## 8.64 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:

- Line Connection Modules
- Active Line Connection Modules-2

### Description

Measuring instrument "SENTRON PAC3220" with graphic display, installed in the cabinet door of the Line Connection Module, acquires measured values of the power supply.

The measuring instrument has a PROFIBUS interface that enables a max. data transfer rate of 12 Mbit/s.

The device has the following functional scope as standard:

**Measurement**

- Measurement of all the relevant electrical variables of an alternating current system
- Acquisition of the minimum and maximum values of all measured variables
- Generation of the mean value of all measured values directly in the device in two independent stages that can be freely configured (aggregation)

**Counters and mean power values**

- Several energy counters capture active energy, reactive energy, apparent energy for off-peak and peak, import and export.
- Calculation and storage of the last measuring period mean value for active power and reactive power to simply generate load profiles using software.
  Programmable measuring periods of 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. Measuring instrument "SENTRON PAC3220" 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**

When routing cables and EMC-compliant installation of the communication connection, orient yourself to the appropriate descriptions in Chapter "Cable routing (Page 129)".

## Lever positions at the current transformer terminal

The measuring connections of the current transformer are connected to customer interface X60 using special current transformer terminals.

The current transformer terminal is equipped with a lever to connect or disconnect and short-circuit the current transformer connections.



**⚠ WARNING**

**Electric shock when carrying out connection work at the current transformer connections that are not short-circuited**

When carrying out connection work, hazardous voltages can be present at terminal block X60, which can result in serious injury or death if touched.

- When carrying out connection work at terminal block X60 ensure that the lever position is always at position III "Measurement position".

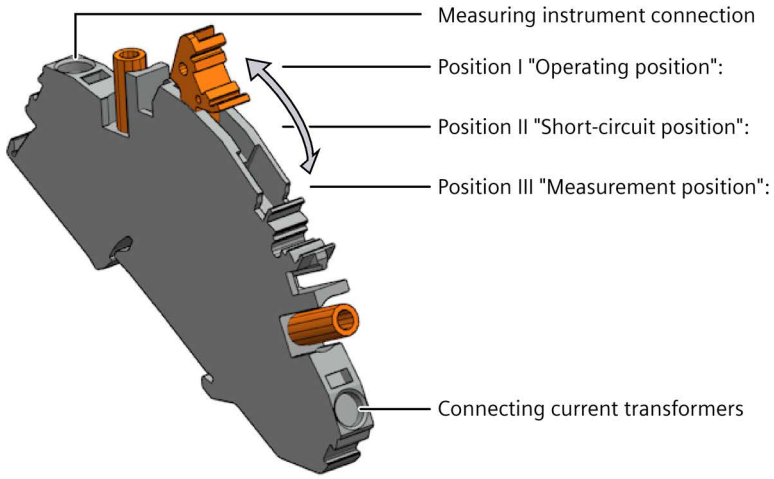



Figure 8-73 Lever positions at the current transformer terminal

Meaning of the lever positions at the current transformer terminal:

- Position I "Operating position": The current transformers are connected with the connections for the measuring instrument.
  In the installed state of terminal block X60, the lever is in the "Upper" position.
- Position II "Short-circuit position": The current transformer connections are short-circuited.
  In the installed state of terminal block X60, the lever is in the "Center" position.
- Position III "Measurement position": The current transformer connections are short-circuited and disconnected from the connections of the measuring instrument.
  In the installed state of terminal block X60, the lever is in the "Lower" position.

## Additional information

A detailed description of the complete principle of operation of the measuring instrument "SENTRON PAC3220" and its handling is given in the operating instructions, which are included in the device documentation provided.

# 8.65 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:

- Line Connection Modules
- Active Line Connection Modules-2

## Description

Measuring instrument "SENTRON PAC3220" with graphic display, installed in the cabinet door of the Line Connection Module, acquires measured values 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 functional scope as standard:

**Measurement**

- Measurement of all the relevant electrical variables of an alternating current system
- Acquisition of the minimum and maximum values of all measured variables
- Generation of the mean value of all measured values directly in the device in two independent stages that can be freely configured (aggregation)

**Counters and mean power values**

- Several energy counters capture active energy, reactive energy, apparent energy for off-peak and peak, import and export.
- Calculation and storage of the last measuring period mean value for active power and reactive power to simply generate load profiles using software.
  Programmable measuring periods of 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. Measuring instrument "SENTRON PAC3220" 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**

When routing cables and EMC-compliant installation of the communication connection, orient yourself to the appropriate descriptions in Chapter "Cable routing (Page 129)".

## Lever positions at the current transformer terminal

The measuring connections of the current transformer are connected to customer interface X60 using special current transformer terminals.

The current transformer terminal is equipped with a lever to connect or disconnect and short-circuit the current transformer connections.



**⚠WARNING**

**Electric shock when carrying out connection work at the current transformer connections that are not short-circuited**

When carrying out connection work, hazardous voltages can be present at terminal block X60, which can result in serious injury or death if touched.

- When carrying out connection work at terminal block X60 ensure that the lever position is always at position III "Measurement position".

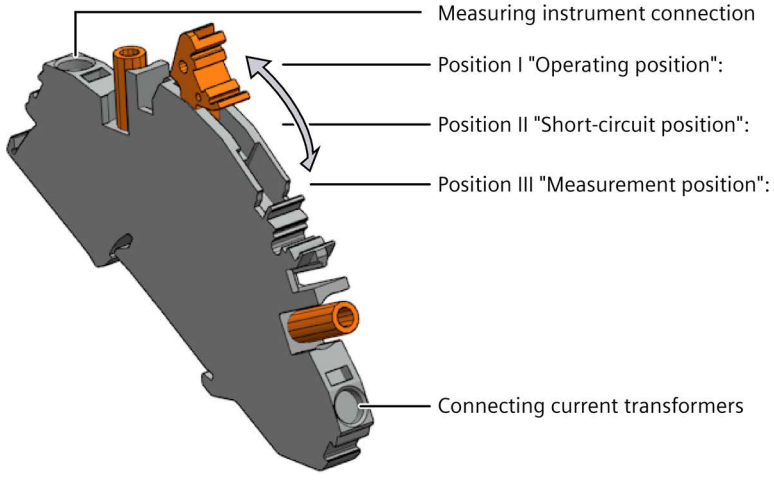



Figure 8-74 Lever positions at the current transformer terminal

Meaning of the lever positions at the current transformer terminal:

- Position I "Operating position": The current transformers are connected with the connections for the measuring instrument.
  In the installed state of terminal block X60, the lever is in the "Upper" position.
- Position II "Short-circuit position": The current transformer connections are short-circuited.
  In the installed state of terminal block X60, the lever is in the "Center" position.
- Position III "Measurement position": The current transformer connections are short-circuited and disconnected from the connections of the measuring instrument.
  In the installed state of terminal block X60, the lever is in the "Lower" position.

### Additional information

A detailed description of the complete principle of operation of the measuring instrument "SENTRON PAC3220" and its handling is given in the operating instructions, which are included in the device documentation provided.

## 8.66 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:

- Line Connection Modules
- Active Line Connection Modules-2

### Description

Measuring instrument "SENTRON PAC4220" with graphic display, installed in the cabinet door of the Line Connection Module, acquires measured values 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 functional scope as standard:

Measurement

- Measurement in two, three or four-wire systems. Suitable for TN, TT and IT systems
- Measurement of all the relevant electrical variables of a 50/60 Hz alternating current system
- Acquisition of the minimum and maximum values of all measured variables
- Determination of the real rms values for voltage and current up to the 64th harmonic
- 4 quadrant measurement (import and export)

- Generation of the mean value of all measured values directly in the device in two independent stages that can be freely configured (aggregation)
- Measurement of the harmonic components (harmonics) 1st to 63rd for voltage and current
- 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 the active energy.
  This means: An accuracy of 0.2% with respect to the measured value under reference conditions

Counters and mean power values

- A total of 50 energy meters acquire the reactive energy, apparent energy and active energy for each phase for tariff 1 and tariff 2, power import and export.
- Consumption of active energy, reactive energy and apparent energy per day / month / year and tariff
- 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 electric, 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 records the energy above an adjustable threshold.
- 10 freely configurable user counters that can be used to determine the consumption of any type of medium via the digital inputs of the PAC4220. The naming convention, unit and distribution relationships can be freely configured via SENTRON Powerconfig.
- One apparent energy counter, one active energy counter and one reactive energy counter for acquiring the total energy import, regardless of the active tariff, for display on the device.
  In addition to DI, process counters can also be operated via communications or the HMI.
- One apparent energy counter, one active energy counter and one reactive energy counter to acquire the power consumption of a manufacturing process. The process energy counters can be started and stopped using the digital inputs provided.
- Process counter for acquiring the duration of a manufacturing process. The start and stop command of the digital input, which controls the process energy meter, starts and stops the operating hours counter.

**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. Measuring instrument "SENTRON PAC4220" is wired at the factory according to connection type 3P3W.

The current transformers must not be operated unloaded.

**Note**

**Cable routing for the communication connection**

When routing cables and EMC-compliant installation of the communication connection, orient yourself to the appropriate descriptions in Chapter "Cable routing (Page 129)".

## Lever positions at the current transformer terminal

The measuring connections of the current transformer are connected to customer interface X60 using special current transformer terminals.

The current transformer terminal is equipped with a lever to connect or disconnect and short-circuit the current transformer connections.



**WARNING**

**Electric shock when carrying out connection work at the current transformer connections that are not short-circuited**

When carrying out connection work, hazardous voltages can be present at terminal block X60, which can result in serious injury or death if touched.

- When carrying out connection work at terminal block X60 ensure that the lever position is always at position III "Measurement position".

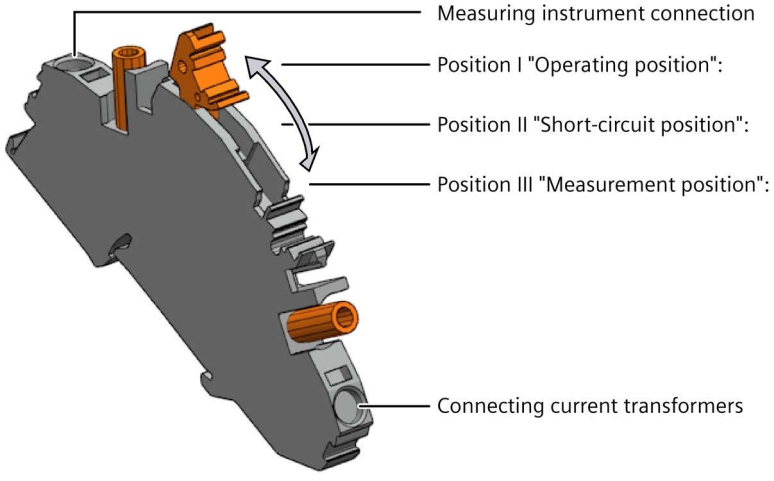



Figure 8-75 Lever positions at the current transformer terminal

Meaning of the lever positions at the current transformer terminal:

- Position I "Operating position": The current transformers are connected with the connections for the measuring instrument.
  In the installed state of terminal block X60, the lever is in the "Upper" position.
- Position II "Short-circuit position": The current transformer connections are short-circuited.
  In the installed state of terminal block X60, the lever is in the "Center" position.
- Position III "Measurement position": The current transformer connections are short-circuited and disconnected from the connections of the measuring instrument.
  In the installed state of terminal block X60, the lever is in the "Lower" position.

### Additional information

A detailed description of the complete principle of operation of measuring instrument "SENTRON PAC4220" and its handling is given in the operating instructions, which are included in the device documentation provided.

# 8.67 Y11, factory assembly into transport units

## Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Active Line Connection Modules-2
- Booksize Base Cabinets
- Motor Modules chassis format
- Motor Modules chassis-2 format
- Central Braking Modules
- Auxiliary Power Supply Modules
- Extension 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 8- 96 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

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