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EQUIPMENT MANUAL

SINAMICS

S120

Cabinet Modules, NEMA air-cooled
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S120
Cabinet Modules NEMA

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 divided into the following categories:

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

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

Please 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

Training

You can find information about SITRAIN - Siemens training courses on products, systems and solutions for drive and automation technology at the following address: 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 while on the move



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

- Resolving problems when implementing a project
- Troubleshooting when faults occur
- Expanding a system or planning a new system

Furthermore, 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 "Siemens Industry Online Support" app 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)
- Manufacturer's declaration in reference to Safety Integrated

Information on product-related environmental protection

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

Not relevant standards



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 complies with the principles of data privacy, in particular the principle of data minimization (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 must ensure compliance with the applicable data protection stipulations.

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Basic safety instructions

1

1.1 General safety instructions



⚠ DANGER

Lockout/tagout is designed for your safety

Lockout/tagout is a safety procedure that neutralizes and secures hazardous energy in a machine, device, or system so that employees can work on it safely. Lockout/tagout rules and procedures are found in OSHA regulation - 29 CFR 1910.147 - The Control of Hazardous Energy (Lockout/Tagout). You can read the regulation on the OSHA website: http://www.osha.gov.

These are the 6 steps for accomplishing lockout/tagout

1. **Prepare for shutdown**
   This includes notifying team members who will be affected by the procedure.
2. **Shut down the machine**
   This may involve reviewing the procedure to make sure that it was done correctly.
3. **Identify all the hazardous energy sources**
   Electricity is just one source. Be sure to identify "hidden" sources of energy, these may be residual energy or stored energy sources.
4. **Isolate or neutralize all hazardous energy sources**
   This includes closing switches, grounding or short-circuiting, closing valves, and other actions.
5. **Lock the energy sources**
   This is usually done at the same time you perform step 4. Be sure to neutralize the residual energy and stored energy sources.
6. **Verify your lockout procedure**
   Make sure that the machine is completely locked out, and that you have the right machine!



⚠ 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.

As a general rule, the following steps are required in order to ensure 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 absolutely no voltage between any of the power connections, or between them and the protective conductor connection.
5. Carefully check that the existing auxiliary supply circuits are in a no-voltage state.
6. Ensure that the motors cannot move.
7. Identify all other dangerous energy sources, e.g. compressed air, hydraulic systems or water. Bring all energy sources into a safe state.
8. Check that the correct drive system is completely locked out and de-energized.

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 systems 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 line connection point of the converter at least meets the minimum requirements for the response of the protective device used.



⚠ WARNING

Risk of electric shock and fire from supply systems 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 connection point 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

When the protective conductor connection of devices with protection class I is missing or incorrectly implemented, 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 when connecting to an unsuitable power supply

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

- 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 specifications during transport, storage, and operation.
- Do not use any damaged devices.



⚠ WARNING

Electric shock when a cable shield is not connected

Hazardous touch voltages can occur as a result of capacitive cross-coupling due to unconnected cable shields.

- Connect cable shields and unused cores of power cables (e.g. brake cores) to the grounded housing potential at least at one end.



⚠ WARNING

Arcing when a plug-in connection is opened during operation

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

- Only open plug-in 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 specified tightening torque.
- Check all power connections at regular intervals, particularly after equipment has been transported.

⚠ WARNING

Electromagnetic interference due to inadequate shield support

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

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

⚠ WARNING

Spread of fire from built-in devices

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

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

⚠ WARNING

Active implant malfunctions due to electromagnetic fields

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

- As operator of an EMF-emitting installation, carefully 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 machine movement 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 allowed to carry out service and maintenance work.

WARNING

Damage to motor insulation due to excessive voltages

When operated on line supplies with grounded line conductor or in the event of a ground fault in the IT supply 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 supply 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 downtime and reduced 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.
- For safety-relevant functions, carry out a safety analysis of the entire system, including all safety-relevant components.
- Assign parameters appropriately to ensure that the utilized safety functions are adapted to your drives and automation tasks, and are activated.
- Perform a function test.
- Only put your plant into productive operation once you have ensured the correct sequence of the safety-relevant functions.

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 NEMA are the components of a modular cabinet unit system for multi-motor drives with central line infeed and a common DC link busbar, as typically found in paper-making machines, roller mills, test stands, and 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 line 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
- The following types of Motor Module:
  - Booksize Cabinet Kits
  - Chassis 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.

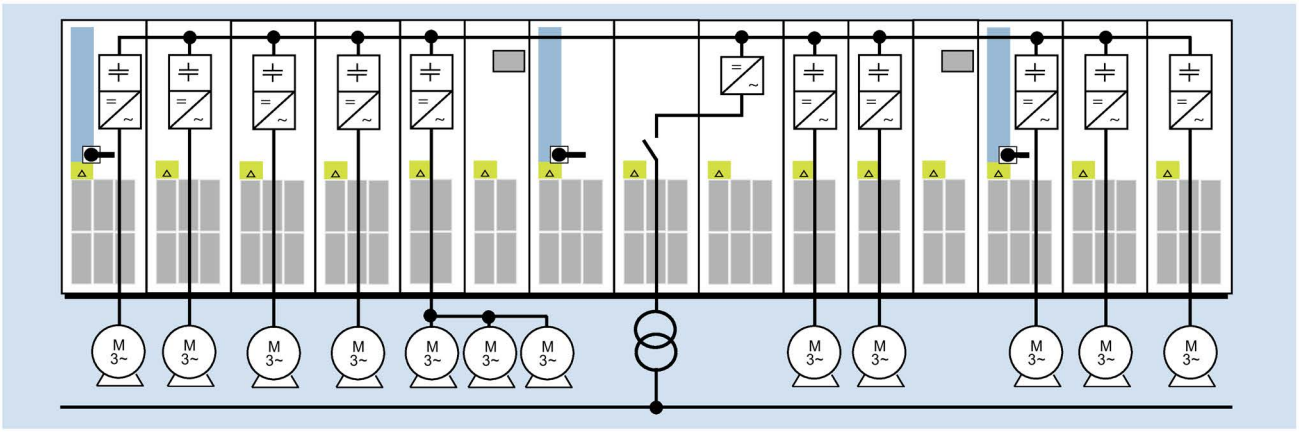


Figure 2-1 Example of a drive assembly with SINAMICS S120 Cabinet Modules for a multi-motor drive

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

	Line voltage 3 AC	Input current	DC link voltage DC	DC link current	Output current	Power
Line Connection Modules [1]	380 ... 480 V 500 ... 690 V	250 ... 3000 A 280 ... 3000 A				
Basic Line Modules [1]	380 ... 480 V 500 ... 690 V	365 ... 1630 A 260 ... 1580 A	510 ... 650 V 675 ... 930 V	420 ... 1880 A 300 ... 1880 A		200 ... 900 kW 250 ... 1500 kW
Smart Line Modules [1]	380 ... 480 V 500 ... 690 V	463 ... 1430 A 463 ... 1430 A	510 ... 650 V 675 ... 930 V	550 to 1700 A 550 to 1700 A		250 ... 800 kW 450 ... 1400 kW
Active Line Modules [1]	380 ... 480 V 500 ... 690 V	210 ... 1405 A 575 ... 1270 A	570 to 720 V 750 to 1035 V	235 to 1574 A 644 to 1422 A		132 ... 900 kW 560 ... 1400 kW
Motor Modules Booksize	(380 ... 480 V)		510 ... 720 V	11 ... 158 A	9 ... 132 A	5 ... 100 HP 4.8 ... 71 kW
Motor Modules Chassis [1]	(380 ... 480 V) (500 ... 690 V)		510 ... 720 V 675 ... 1035 V	252 to 1686 A 102 to 1524 A	210 to 1405 A 85 to 1270 A	150 ... 1000 HP 110 ... 800 kW 75 ... 1250 HP 75 ... 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.

2.2 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 star point (TN, TT) and non-grounded (IT) systems.

The Line Modules are connected to the incoming 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.

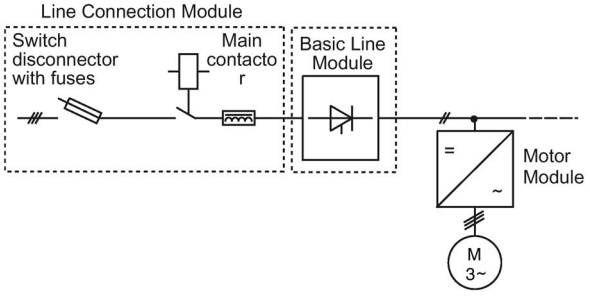


Figure 2-2 Line Connection Module with Basic Line Module ≤ 800 A

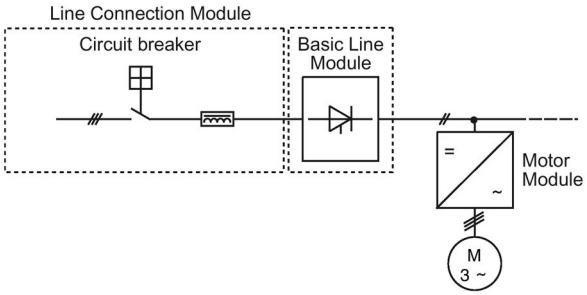


Figure 2-3 Line Connection Module with Basic Line Module > 800 A

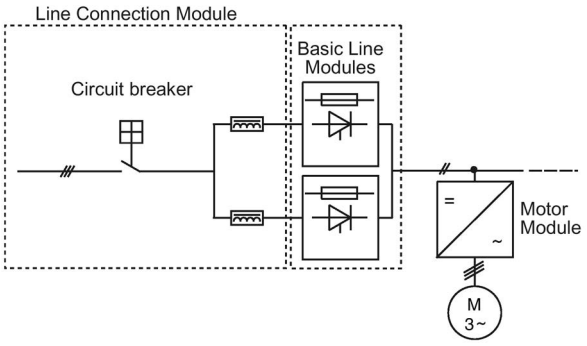


Figure 2-4 Line Connection Module with Basic Line Modules connected in parallel

2.4.3 Smart Line Modules

Smart Line Modules can supply energy to the DC link and return regenerative energy to the line supply. 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 with input currents of up to 3000 A are available. Two Smart Line Modules can be operated in parallel on these Line Connection Modules.

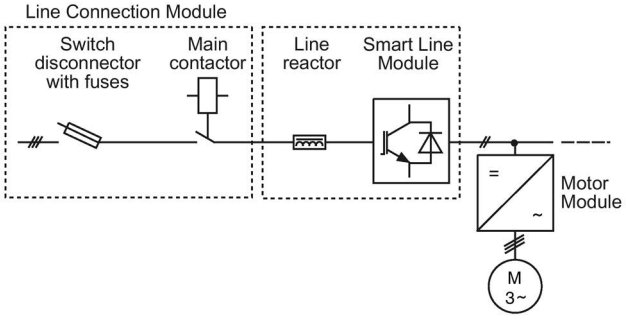


Figure 2-5 Line Connection Module with Smart Line Module ≤ 800 A

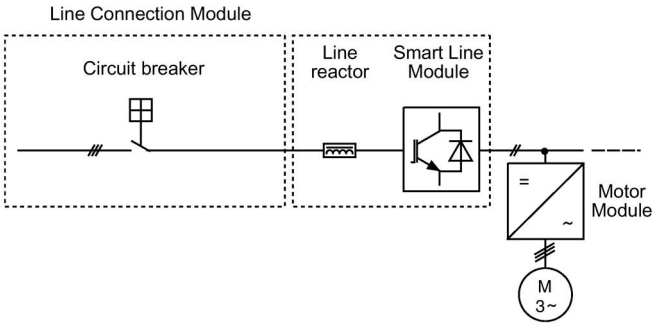


Figure 2-6 Line Connection Module with Smart Line Module > 800 A

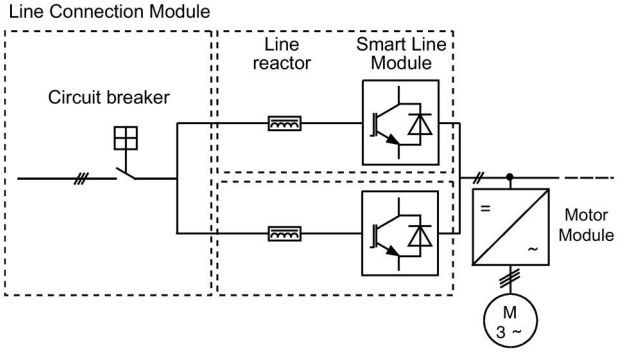


Figure 2-7 Line Connection Module with Smart Line Modules connected in parallel

2.4.4 Active Line Modules

Active Line Modules can supply energy to the DC link and also return regenerative energy to the line supply. 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 line 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 NEMA and are supplied together.

For a compact configuration, Line Connection Modules with input currents of up to 3000 A are available. Two Active Line Modules with their associated Active Interface Modules can be operated in parallel on these Line Connection Modules.

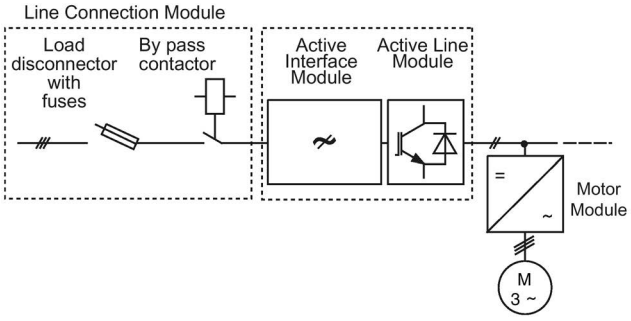


Figure 2-8 Line Connection Module with Active Interface Module and Active Line Module ≤ 800 A, example frame size HX + HI

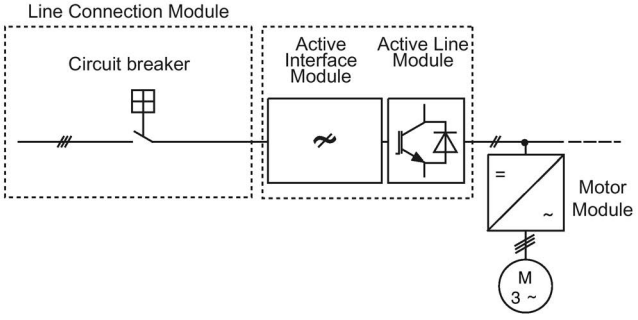


Figure 2-9 Line Connection Module with Active Interface Module and Active Line Module > 800 A

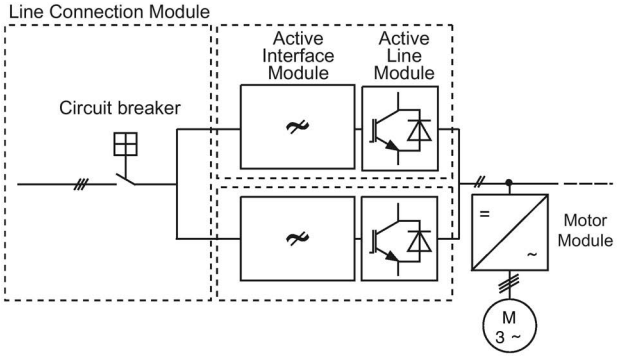


Figure 2-10 Line Connection Module with Active Interface Modules and Active Line Modules connected in parallel

2.5 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.

2.5.1 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 Motor Modules

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

2.6.1 Booksize Base Cabinets with Booksize Cabinet Kits

Motor Modules at the low end of the power range from 5 HP to 100 HP (4.8 kW to 71 kW) are configured as Booksize Cabinet Kits installed in Booksize Base Cabinets.

2.6.2 Chassis Cabinets

Each Chassis Cabinet is equipped with one SINAMICS S120 Motor Module in the chassis format, and covers the power range from 75 HP to 1250 HP (75 kW 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 Engineering Manual.

2.7 Auxiliary Power Supply Modules

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

The 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.

2.8 Overview of options

Table 2- 2 Overview of options

Option code	Brief description of option
D02	Customer documentation (circuit diagram, terminal diagram, layout diagram) in DXF format
D14	Draft of customer documentation
D58	Documentation in: English/French
D60	Documentation in: English/Spanish
D76	Documentation in English
D77	Documentation in French
D78	Documentation in Spanish
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 with no load (without the customer present)
F75	Function test with test bay motor with no load (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	TB30 Terminal Board
K01	Safety license for 1 axis
K02	Safety license for 2 axes
K03	Safety license for 3 axes
K04	Safety license for 4 axes
K05	Safety license for 5 axes
K08	AOP30 advanced operator panel installed in the cabinet door
K46	Sensor Module Cabinet-Mounted SMC10
K48	Sensor Module Cabinet-Mounted SMC20
K50	Sensor Module Cabinet-Mounted SMC30
K51	Voltage Sensing Module for determining the motor speed and the phase angle
K52	Additional SMC30 Sensor Module
K70	Fan voltage 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 V AC
K90	Control Unit CU320-2 PROFIBUS

Option code	Brief description of option
K94	Performance extension for CU320-2
K95	Control Unit CU320-2 PROFINET
L08	Motor reactor
L09	Two motor reactors connected in series
L10	dv/dt filter plus Voltage Peak Limiter
L13	Main contactor
L22	Line reactor not included in product package
L25	Circuit breaker in withdrawable unit design
L37	DC coupling incl. pre-charging input circuit of the associated DC link capacitance
L41	Current transformer upstream of 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
L50	Cabinet light with service socket
L55	Cabinet anti-condensation heating
L61	25/125 kW Braking Module for line voltages 380 ... 480 V and 660 ... 690 V
L62	50/250 kW Braking Module for line voltages 380 ... 480 V and 660 ... 690 V
L64	25/125 kW Braking Module for line voltages 500 ... 600 V
L65	50/250 kW Braking Module for line voltages 500 ... 600 V
L87	Insulation monitoring
M06	Base (plinth), 4" (100 mm) high, RAL 9005
M07	Cable marshalling compartment 8" (200 mm) high, RAL 7035
M21	Degree of protection IP21
M23	Degree of protection NEMA 1 filtered (IP23)
M26	Side panel (right)
M27	Side panel (left)
M43	IP43 degree of protection
M51	Motor reactor terminal connection
M54	Degree of protection NEMA12 (ventilated) (IP54)
M59	Closed cabinet door (air inlet from below through floor opening)
M60	Additional shock 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)
M90	Crane transport aid (top-mounted)

Option code	Brief description of option
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
T85	Rating plate data in English / Russian
T91	Rating plate in English / Chinese
U90	UL listing per UL 508A
U91	cUL listing for Canada per UL 508A
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

2.9 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 V DC loads.

Communication between the Control Unit, Line Modules, and Motor Modules 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 configuration with prefabricated cables in varying lengths.

As an option, Cabinet Modules can be delivered in pre-configured transport units with a total width of up to 94.5 inches (2400 mm) each. This option is recommended in particular for Line Modules together with Line Connection Modules because the Line Connection Module must be equipped with a pre-charging DC link or line reactors (depending on the type of Line Module) in this case, in addition to the electrical interface (mounted on a busbar). Transport units enable the various devices to be quickly and easily assembled on-site.

2.10 System data

General technical system data

General data			
Line voltages and power ranges	380 ... 480 V 3 AC, ±10% (-15% < 1 min), 5 ... 1150 HP (4.8 ... 800 kW) [1] 500 ... 690 V 3 AC, ±10% (-15% < 1 min), 75 ... 1250 HP (55 ... 1200 kW) [1]		
Electrical network configurations	Line supplies grounded at the neutral point (TN/TT systems) or non-grounded line supplies (IT supply systems)		
Line frequency	47 ... 63 Hz		
Output frequency	Vector control: 0 ... 550 Hz servo control: 0 ... 550 Hz U/f control: 0 ... 550 Hz (higher output frequencies on request)		
Line power factor fundamental factor	Basic Line Modules: > 0.96	Smart Line Modules: > 0.96	Active Line Modules: variable (set in factory to cos φ =1)
Efficiency	> 99.0%	> 98.5%	> 97.5%
Control method	Servo control, vector control with and without encoder or U/f control		
Fixed speeds	15 fixed speeds plus 1 minimum speed, programmable		
Skipped speed ranges	4, configurable		
Braking operation	With regenerative feedback or by additional braking modules and braking resistors		
Degree of protection	IP20, IP21, IP23 (NEMA1 filtered), IP43 and IP54 (NEMA12 ventilated) (with option M26 and M27, side panels on the right or left)		
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 according to IEC 60146		
Touch protection	EN 50274 with intended use		
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	Category C3 acc. to IEC 61800-3
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) RCM, RoHS II, UKCA
UL certificate (only up to 3 AC 600 V)	According to UL 508A (Option U90) or cUL 508A (Option U91)

Ambient conditions			
	During storage [2]	**During transport** [2]	**In operation** [2]
Ambient temperature	-13 °F ... +131 °F (-25 °C ... +55 °C)	-13 °F ... +158 °F (-25 °C ... +70 °C) above *-104 °F (-40 °C)* for 24 hours	*32 °F* ... +104 °F (*0 °C* ... +40 °C) to +122 °F (+50 °C) see derating data
Relative humidity (non-condensing) corresponds to class	*5% ... 95%* 1K4 in accordance with IEC 60721-3-1:1997	5% ... 95% at 104 °F (40 °C) 2K3 in accordance with IEC 60721-3-2:1997	5% ... *95%* 3K3 in accordance with IEC 60721-3-3:2002
Environmental class / harmful chemical substances	1C2 according to IEC 60721-3-1:1997	2C2 according to IEC 60721-3-2:1997	3C2 according to IEC 60721-3-3:2002
Organic/biological influences	1B1 according to IEC 60721-3-1:1997	2B1 according to IEC 60721-3-2:1997	3B1 according to IEC 60721-3-3:2002
Mechanically active substances	1S1 according to IEC 60721-3-1:1997	2S1 according to IEC 60721-3-2:1997	3S1 according to IEC 60721-3-3:2002
Installation altitude	• Motor Modules, Motor Module format: up to 3300 ft (1000 m) above sea level without derating, > 3300 ft (1000 m) - see characteristics/derating data • Cabinet Modules: up to 6600 ft (2000 m) above sea level without derating, > 6600 ft (2000 m) - see characteristics/derating data		

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

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

[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 of overvoltages

On systems with a grounded line conductor and a line voltage > 600 V, measures must be taken on the plant side to limit overvoltages to overvoltage category II according to IEC 61800-5-1.

2.11 Derating data

2.11.1 Derating data for booksize format

SINAMICS S120 Cabinet Modules NEMA with power units, booksize format, and the associated system components are dimensioned for an ambient temperature of 104 °F (40 °C) and installation altitudes up to 3,300 ft (1,000 m) above sea level. If SINAMICS S120 Cabinet Modules with power units in booksize format are operated at ambient temperatures above 104 °F (40 °C) and/or installation altitudes higher than 3,300 ft (1,000 m) above sea level, the corresponding derating factors must be taken into account as a function of the ambient temperature and/or the installation altitude. These derating factors differ from the derating factors for chassis format power units and are specified in Catalog PM21 / SINAMICS S120 Drive System. They are valid for SINAMICS S120 Cabinet Modules with booksize format power units in degrees of protection IP20, IP21, IP23 (NEMA1 filtered), IP43 and IP54 (NEMA12 ventilated).

2.11.2 Derating data for chassis format

2.11.2.1 General

SINAMICS S120 Cabinet Modules NEMA as well as the associated system components are dimensioned for an ambient temperature of 104 °F (40 °C) and installation altitudes up to 6,600 ft (2,000 m) above sea level.

S120 Cabinet Modules NEMA 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 the S120 Cabinet Modules with Booksize format power units. This derating data can be taken from Chapter "Cabinet Modules" in subsection "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 above 104 °F (40 °C), the output current must be reduced. Ambient temperatures above 122 °F (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 factors 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 degrees of protection IP20 / IP21/ IP23 (NEMA1 filtered) / IP43

Installation altitude above sea level	Current derating factor (as a % of the rated current) for an ambient air temperature (air intake temperature) of						
	68 °F (20 °C)	77 °F (25 °C)	86 °F (30 °C)	95 °F (35 °C)	104 °F (40 °C)	113 °F (45 °C)	122 °F (50 °C)
0 ... 6600 ft (0 ... 2000 m)	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 IP54 enclosure (NEMA12 ventilated)

Installation altitude above sea level	Current derating factor (as a % of the rated current) for an ambient air temperature (air intake temperature) of						
	68 °F (20 °C)	77 °F (25 °C)	86 °F (30 °C)	95 °F (35 °C)	104 °F (40 °C)	113 °F (45 °C)	122 °F (50 °C)
0 ... 6600 ft (0 ... 2000 m)	100 %	100 %	100 %	100 %	93.3 %	86.7 %	80.0 %

Installation altitudes over 6600 ft and up to 16500 ft (2000 m to 5000 m) above sea level

When operating SINAMICS S120 Cabinet Modules NEMA at altitudes over 6,600 ft (2,000 m) above sea level, keep in mind that as the altitude increases, the air pressure and therefore also the density of the air decrease. The cooling effect as well as the insulating capability of the air decrease as a result of the lower air density.

The units can be installed at altitudes over 6600 ft and up to 16500 ft (2000 m to 5000 m) if the derating measures described in the subsequent chapter are applied.

2.11.2.2 Derating measures

Installation altitudes higher than 6600 ft and up to 16500 ft (2000 m 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:

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

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 104 °F (40 °C) may be offset for compensation purposes. 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 include the permitted correction in respect of installation altitude and ambient temperatures lower than 104 °F (40 °C) (inlet air temperature at the air inlet of 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 factors 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 degrees of protection IP20 / IP21/ IP23 (NEMA1 filtered) / IP43

Installation altitude above sea level	Current derating factor (as a % of the rated current) for an ambient air temperature (air intake temperature) of						
	68 °F (20 °C)	77 °F (25 °C)	86 °F (30 °C)	95 °F (35 °C)	104 °F (40 °C)	113 °F (45 °C)	122 °F (50 °C)
0 ... 6600 ft (0 ... 2000 m)	100 %	100 %	100 %	100 %	100 %	93.3 %	86.7 %
... 8250 ft (... 2500 m)	100 %	100 %	100 %	100 %	96.3 %		
... 9900 ft (... 3000 m)	100 %	100 %	100 %	98.7 %			
... 11550 ft (... 3500 m)	100 %	100 %	100 %				
... 13200 ft (... 4000 m)	100 %	100 %	96.3 %				
... 14850 ft (... 4500 m)	100 %	97.5 %					
... 16500 ft (... 5000 m)	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 IP54 enclosure (NEMA12 ventilated)

Installation altitude above sea level	Current derating factor (as a % of the rated current) for an ambient air temperature (air intake temperature) of						
	68 °F (20 °C)	77 °F (25 °C)	86 °F (30 °C)	95 °F (35 °C)	104 °F (40 °C)	113 °F (45 °C)	122 °F (50 °C)
0 ... 6600 ft (0 ... 2000 m)	100 %	100 %	100 %	100 %	93.3 %	86.7 %	80.0 %
... 8250 ft (... 2500 m)	100 %	100 %	100 %	96.3 %	89.8 %		
... 9900 ft (... 3000 m)	100 %	100 %	98.7 %	92.5 %			
... 11550 ft (... 3500 m)	100 %	100 %	94.7 %				
... 13200 ft (... 4000 m)	100 %	96.3 %	90.7 %				
... 14850 ft (... 4500 m)	97.5 %	92.1 %					
... 16500 ft (... 5000 m)	93.0 %						

Using 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 constraints are maintained:

- The isolation transformer must be fed from a low-voltage supply or a medium-voltage supply and must not be directly supplied from a high-voltage supply.
- 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 above 6600 ft (2000 m).

Mechanical installation 3

3.1 Important notes

Transport

⚠ WARNING

Incorrectly transporting the device

The device can tip over if you transport it incorrectly or if you use non-approved transport equipment. Death, serious injury, and property damage can result.

- Ensure that only trained personnel transport the device with approved transport equipment and lifting tools.
- Comply with the information regarding the center of gravity. A label or stamp with exact information regarding the center of gravity of the cabinet is attached to each transport unit.
- Transport the unit only in the original marked upright position. Do not tilt the device.
- The forks of the forklift must protrude at the rear of the transport pallet. The floor panels of the transport units do not support loading.

⚠ WARNING

Using forklift trucks that are not approved

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

- The forks of the forklift must protrude at the rear of the transport pallet. The floor panels of the transport units do not support loading.
- Only use forklifts 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 packaging instructions relating to transportation, storage, and proper handling must be observed.
- For transport using forklifts, the devices must be mounted on a wooden pallet.
- When the devices are 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 57)").
- Permissible ambient temperatures:
  Air cooling: -13° to +158 °F (-25° to +70 °C), class 2K3 according to IEC 60721-3-2:1997
  Short time -40 °F (-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 the shipping company immediately, you may forfeit 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 -13°F (-25 °C) and 131°F (+55 °C) are permissible (class 1K4 according to IEC 60721-3-1:1997). Temperature fluctuations greater than 20 K per hour are not permitted.

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

NOTICE
Property damage to top hats caused by improper mechanical loading The separately delivered top hats may be irreparably damaged if they are subjected to mechanical loads before being installed on the cabinets. • Do not apply any mechanical loads to the top hats.

3.2 Mechanical installation: Checklist

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

For information on performing the installation, refer to the following sections and the documents listed in the table below.

Note

Checking the checklist

Check the first box in the column on the right if the action applies to your cabinet unit. In the same way, check the boxes once you have finished the installation procedure to confirm that the activities are complete.

Table 3- 1 Mechanical installation: Checklist

Item	Action	included/completed?	
1	Check the shipping and handling indicators prior to installation. (→ See Chapter "Installation/preparation", Section "Shipping and handling indicators")	☐	☐
2	Check the cabinet center of gravity shown on the label provided.	☐	☐
3	The environmental conditions must be permissible. (→ See general technical data in Chapter "System overview", Section "System data")	☐	☐
4	The load-carrying capacity and properties of the ground must meet the requirements for installation of the Cabinet Modules. (→ See Chapter "Cabinet Modules" in the technical specifications of the respective Cabinet Modules) (→ See "Mechanical installation/preparation")	☐	☐
5	Before the cabinet units are finally installed, the wooden pallets supplied with the transport unit must be removed properly. (→ See Chapter "Installation", Section "Lifting from the transport pallet and installing the cabinet units")	☐	☐
6	The crane transport aids (option M90) installed for delivery must be removed once the transport unit or individual cabinet units have been set down at the final installation location. (→ See Chapter "Installation", Section "Disassembling the crane transport aids")	☐	☐

Item	Action	included/completed?	
7	The minimum ceiling height (for unobstructed air outlet) must be observed. The cooling air supply and exhaust must not be obstructed and must be available in sufficient quantity. (→ See Chapter "Installation", Section "Preparation")	☐	☐
8	The cabinet must be firmly attached to the fixing points provided. A proper connection must be established if the cabinet units are installed side-by-side. (→ See Chapter "Installation", Section "Connection for side-by-side installation of cabinet units")	☐	☐
9	Components that are supplied separately for transport reasons must be assembled at the plant. This applies to the following options: • Degree of protection IP21 with canopy (option M21) • Degree of protection IP23 (NEMA1 filtered)/IP43/IP54 NEMA12 (ventilated) with hood or filter elements (options M23, M43, M54) (→ See Chapter "Options", Section "M21, Degree of protection IP21" and "M23/M43/M54, Degree of protection IP23 (NEMA1 filtered)/IP43/IP54 (NEMA12 ventilated)" 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). (→ See "DC interface including pre-charging input circuit of associated DC link capacitance" in "Options")	☐	☐
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. • Side panel installed on the right (option M26) • Side panel installed on the left (option M27) (→ See Chapter "Options", Section "M26 / M27, side panels mounted on 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 Preparation

3.3.2.1 Requirements for installation location

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

The installation location must be dry and free of dust. The air supplied must not contain any electrically conductive gas, vapors, or dust that 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 grills of the cabinet doors and also in front of the optional top hats. Option M54 offers additional protection against water sprayed against the enclosure from any direction and corresponds to enclosure type IP54 (NEMA12 ventilated).

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

At ambient temperatures > 104 °F (40 °C) and installation altitudes > 3300 ft (1000 m) (Booksize Cabinet Kit) or > 6600 ft (2000 m) (Chassis), the devices must be derated (→ 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.

NOTICE
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 between the top of the cabinet and the ceiling is shown in the figure below. Additional dimensions must be taken into account for the M06 (cabinet base) and M07 (cable marshalling compartment) options.

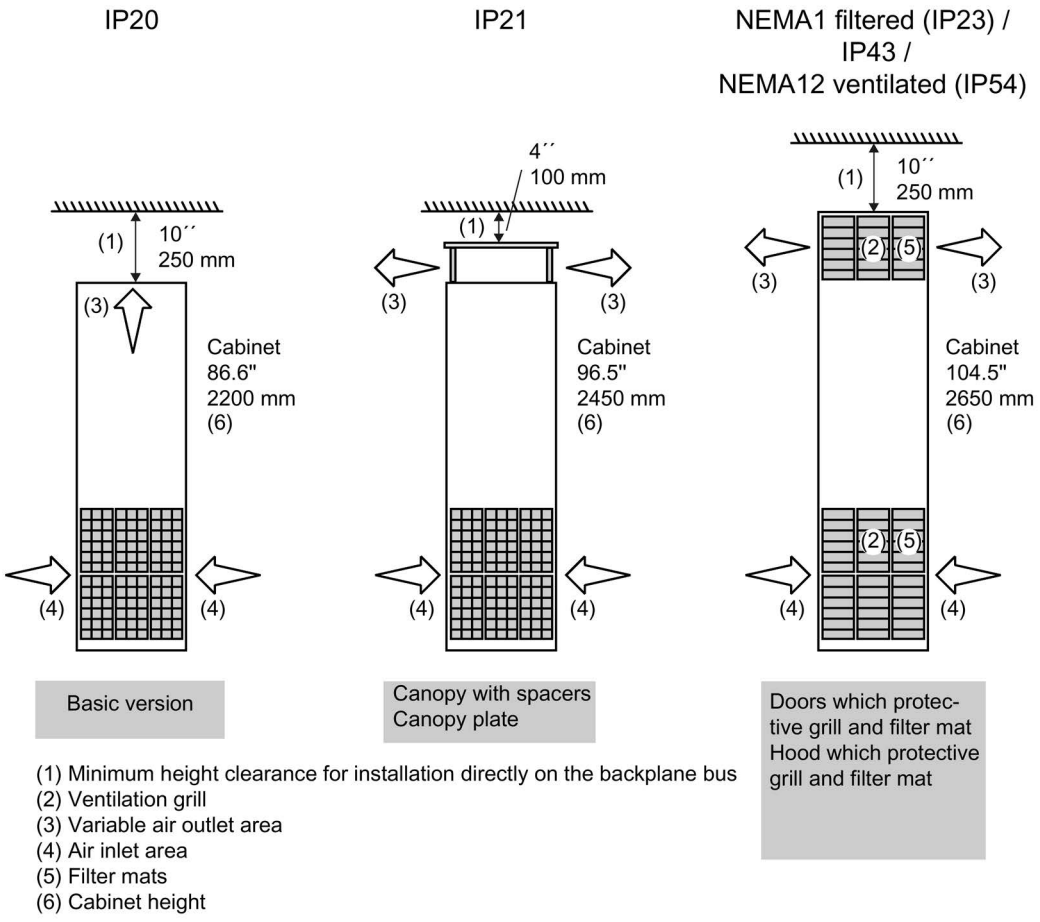


Figure 3-1 Required room height for different enclosures (without options M06 and M07)

Note

Further dimensions

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

The cooling air for the power unit is drawn in from the front through the ventilation grills in the lower part of the cabinet doors. The heated air is released through the perforated top cover or the ventilation grills in the hood (with options M23/M43/M54 for degrees of protection IP23 (NEMA1 filtered)/IP43/IP54 (NEMA12 ventilated)). 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.

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 radio interference suppression measures performed by qualified personnel.

3.3.2.2 Requirements on the levelness of the floor

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

- Care must be taken to ensure that the doors can be opened and closed, the locking systems work properly.
- Flat sections (such as doors, side panels 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.

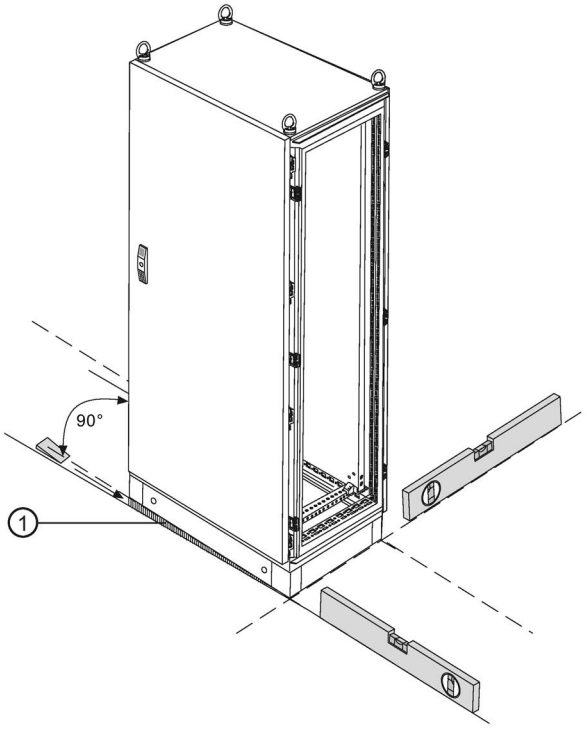


Figure 3-2 Requirements on the levelness of the floor

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

- The foundation must be level and horizontal.
- Irregularities must be leveled out.
- Gaps where air can enter, created when aligning (e.g.: ① in the diagram) must be closed 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 3-3 Tilt indicator



Figure 3-4 Shock indicator

Position of the shipping and handling indicators

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

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

Checking the shipping and handling indicators prior to commissioning

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

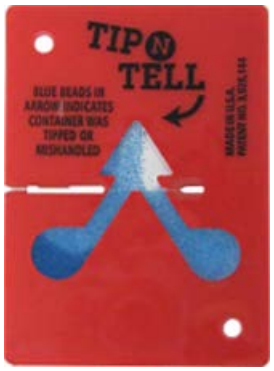


Figure 3-5 Tilt indicator tripped

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



Figure 3-6 Shock indicator tripped

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

⚠ WARNING

Damage to the device when shock or tilt indicators are tripped

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

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

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

Removing the shipping and handling indicators prior to commissioning

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

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

3.3.2.4 Unpacking the cabinets

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

3.3.2.5 Tools required

To install the connections, you will need:

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

Tightening torques for screw connections

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

Table 3- 2 Tightening torques for screw connections

Thread	Ground connections, protective conductor connections, steel threaded connections	Aluminum threaded connections, plastic, busbars, lugs
M3	1.3 Nm	0.8 Nm
M4	3 Nm	1.8 Nm
M5	6 Nm	3 Nm
M6	10 Nm	6 Nm
M8	25 Nm	13 Nm
M10	50 Nm	25 Nm
M12	88 Nm	50 Nm
M16	215 Nm	115 Nm

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

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

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

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

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



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

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

⚠ WARNING

Failure to observe the weight and the center of gravity

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

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

Center of gravity of the cabinet

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

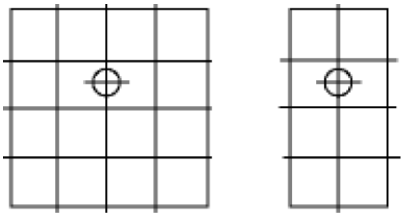


Figure 3-8 Center of gravity of the cabinet

Note

Center of gravity of the cabinet

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

3.3.4 Disassembling the crane transport assembly

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

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



Figure 3-9 Option M90 / Y11, mounting rails

Removal

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

⚠ WARNING

Incorrect handling of the mounting rail

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

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

Original roof screws



Figure 3-10 Original roof screws accessory kit

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



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

3.3.5 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. Tightening torque: 9 Nm
3 x	Inner cabinet connectors including Mounting material		The cabinet connector is fastened with 4 screws. Tightening torque: 5 Nm

Assembly

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

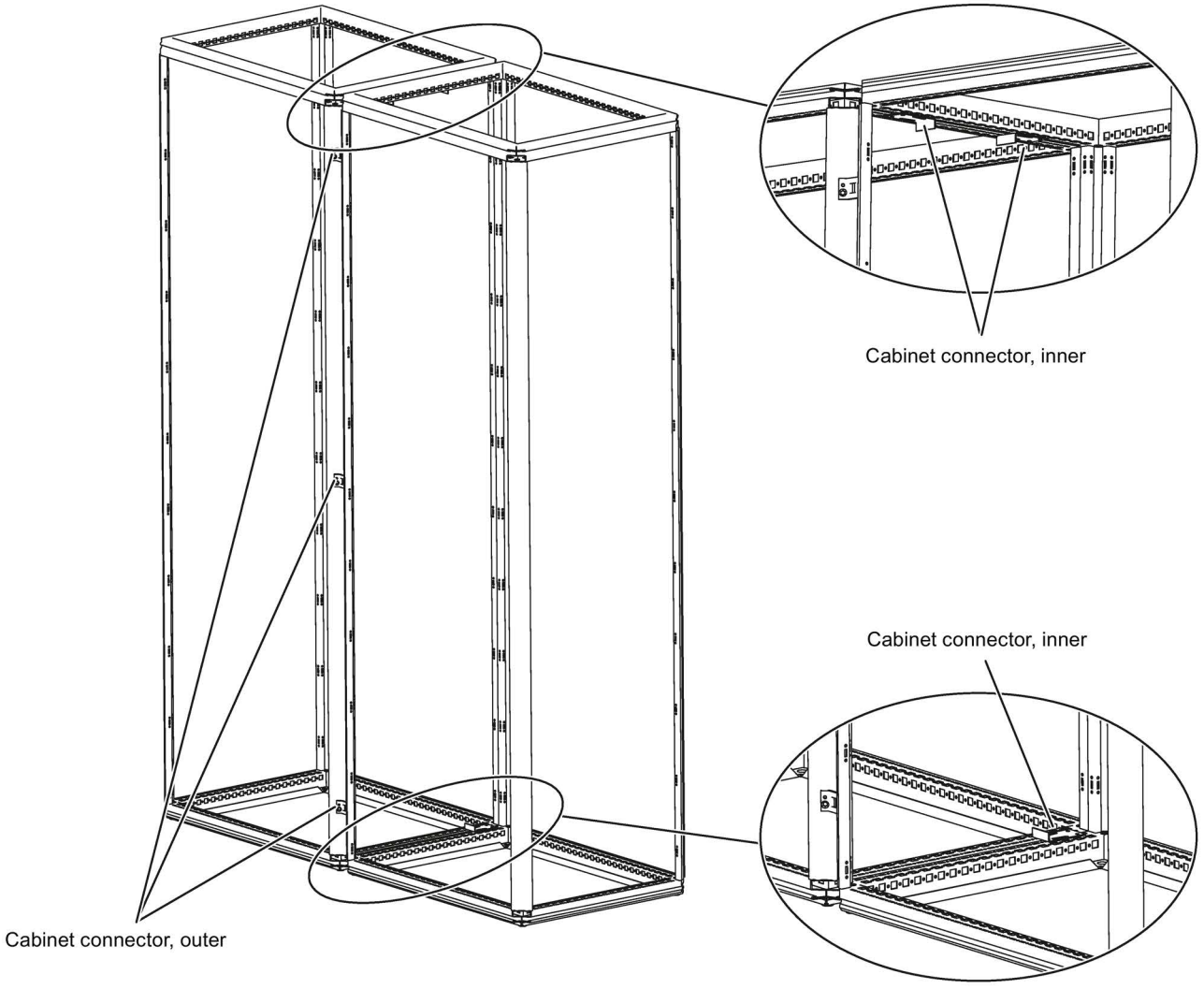


Figure 3-12 Positions of the cabinet connectors

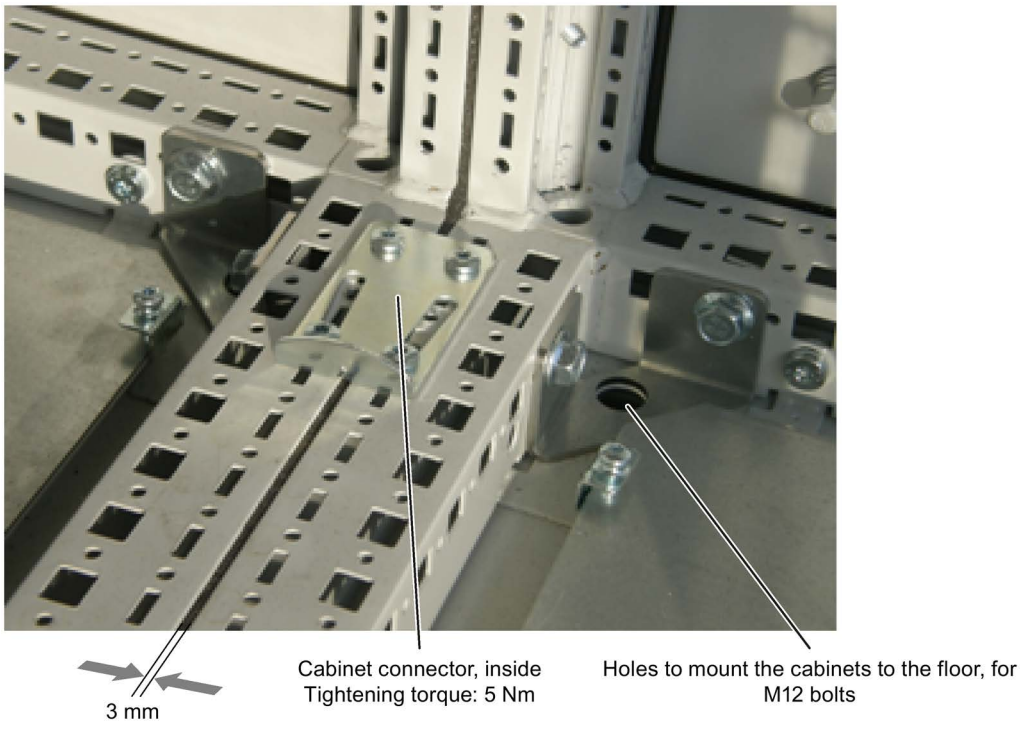


Figure 3-13 Inner cabinet connectors at the lower cabinet frame

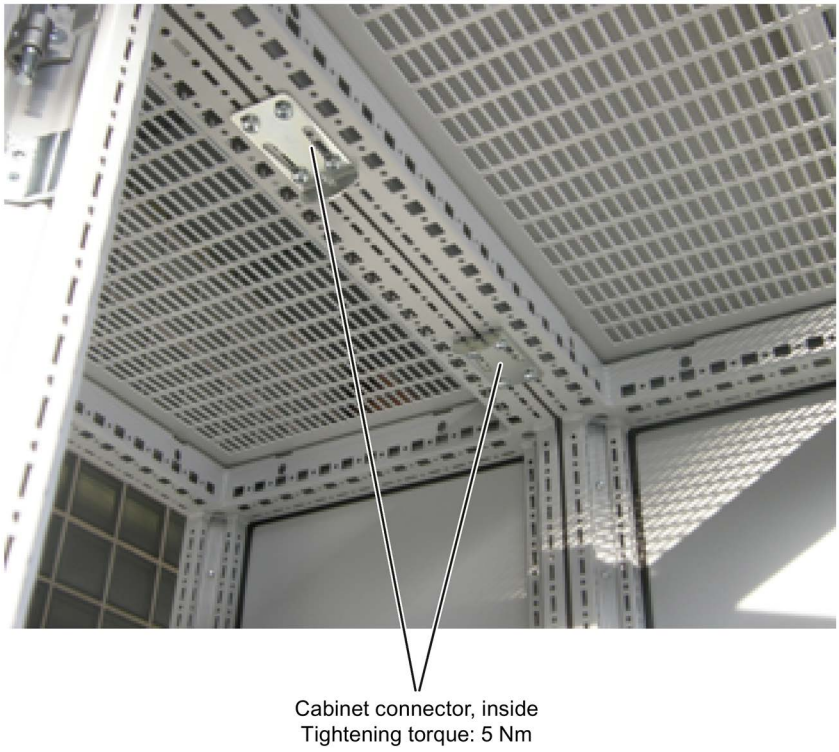


Figure 3-14 Inner cabinet connectors at the upper cabinet frame



Figure 3-15 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 instructions

Required safety precautions before installation work is carried out

⚠ WARNING

Failure to observe general safety instructions and residual risks

If the general safety instructions and residual risks are not observed, accidents can occur causing serious injuries or death.

- Observe the general safety instructions.
- Take into account residual risks when assessing 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 while after switching off the infeed voltage.

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

- Open the unit only after the time specified on the warning label has elapsed.
- Before starting work, check the absence of voltage by an all-pole measurement, including to ground.

NOTICE

Property damage resulting from switching on the device without forming of the DC link capacitors

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

- If the device has been stored for more than two years, form it before switching it on; see "Maintenance and service".

Note

Touch protection

When the cabinet door is opened, cabinet units have touch protection according to EN 50274.

In the version 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 must be removed for installation and connection work, if necessary. 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 used can have different dimensions, and they can be arranged and secured in different ways.
- The components can be arranged differently within the cabinet units.
- The components can be mounted within the cabinet units using different methods.

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 Checklist for electrical installation

Use the following checklist to guide you through the electrical installation procedure for the cabinet. Read Chapter "Basic safety instructions" before you start working on the cabinet.

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

Note

Checking the checklist

Check the first box in the column on the right if the action applies to your cabinet unit. In the same way, check the boxes once you have finished the installation procedure to confirm that the activities are complete.

Table 4- 1 Checklist for electrical installation

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

Item	Action	included/completed?	
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. The resistor is connected directly to terminal -X5. The thermal contact of the braking resistor must be wired up and its signal evaluated by the controller. (→ See Chapter "Options", Section "L61/L62, L64/L65, braking units")	☐	☐
10	With a parallel connection of Motor Modules in 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). (→ See Chapter "Cabinet Modules", Section "Motor Modules in chassis format")	☐	☐
11	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. The digital signal for pulse inhibit must be properly wired and configured. (→ See Chapter "Options" under "L37, DC coupling, incl. pre-charging input circuit of the associated DC link capacitance" in section "Commissioning the DC coupling")	☐	☐
12	The cable shields must be properly applied.	☐	☐
13	Check the circuit breaker settings. (→ See Chapter "Cabinet Modules", Section "Line Connection Modules")	☐	☐
14	The operating voltage must be correctly set for the 230 V AC fans in the Line Connection Module, Basic Line Module, Smart Line Module, Active Line Module, and Motor Module in the chassis format. Fine tuning to the relevant line voltage is performed by reconnecting the transformer taps. (→ See Chapter "Electrical installation", Section "Adjusting the fan voltage")	☐	☐
15	The internal power supply must be correctly set in the Line Connection Module and the Auxiliary Power Supply Module. Fine tuning to the relevant line voltage is performed by reconnecting the transformer taps. (→ See Chapter "Cabinet Modules", Section "Line Connection Modules") (→ See Chapter "Cabinet Modules", Section "Auxiliary power supply module")	☐	☐
16	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. (→ See Chapter "Cabinet Modules", Section "Auxiliary power supply module")	☐	☐
17	The date of manufacture can be determined from the nameplates of the power components in the "Basic Line Module", "Smart Line Module", "Active Line Module", "Motor Module in Chassis Format", and "Booksize Cabinet Kit" Cabinet Modules. If the period from the date of manufacture to first commissioning or the downtime of the power components is less than 2 years, the DC link capacitors do not have to be reformed. If the unit has not been operational for more than 2 years, the DC link capacitors must be reformed as described in Chapter "Maintenance and servicing", Section "Forming the DC link capacitors".	☐	☐

Item	Action		included/completed?	
Signal connections				
18	Cabinet operation by higher-level controller / control room. The control cables must be connected in accordance with the interface assignment and the shield applied. To prevent interference, the control cables must be routed separately from the power cables. Cabling and connections must always comply with the relevant EMC guidelines. (→ See Chapter "Electrical installation")		☐	☐
19	DRIVE-CLiQ cables	All DRIVE-CLiQ cables must be connected correctly. The permissible cable lengths should be carefully observed. (→ See "S120 Commissioning Manual, Rules for wiring with DRIVE-CLiQ") (→ See "S120 Equipment Manual for Booksize Power Units, DRIVE-CLiQ Cabinet Gland" and "S120 Equipment Manual for Booksize Power Units, DRIVE-CLiQ Coupling")	☐	☐
Options				
20	G20, CBC10 Communication Board	The supplied CBC10 is installed in the factory in the option slot of the Control Unit. (→ See Chapter "Options", Section "G20, CBC10 Communication Board")	☐	☐
21	G33, CBE20 Communication Board	The supplied CBE20 is installed in the factory in the option slot of the Control Unit. Remove the CBE20 in a de-energized state and note down the MAC address. Install the CBE20 into the option slot again. (→ See Chapter "Options", Section "G33, CBE20 Communication Board")	☐	☐
22	G51 to G54, TM150 Temperature Sensor Module	A maximum of 12 temperature sensors (PT100, PT1000, KTY84, PTC, bimetallic NC contact) can be connected to the TM150 Terminal Module. (→ See Chapter "Options", Sections "G51 to G54, TM150 Temperature Sensor Module")	☐	☐
23	G60, TM31 Terminal Module	Digital inputs, digital outputs, analog inputs, analog outputs and temperature sensors can be connected to the TM31 Terminal Module. (→ See Chapter "Options", Section "G60, TM31 Terminal Module")	☐	☐
24	G61, additional TM31 Terminal Module	Additional digital inputs, digital outputs, analog inputs, analog outputs and temperature sensors can be connected to the additional TM31 Terminal Module. (→ see Chapter "Options", Section "G61, additional TM31 Terminal Module ")	☐	☐
25	G62, TB30 Terminal Board	Digital inputs, digital outputs, analog inputs and analog outputs can be connected to the TB30 Terminal Board (→ See Chapter "Options", Section "G62, TB30 Terminal Board")	☐	☐
26	K01 to K05, safety license for 1 to 5 axes	Activating the safety licenses. (→ See Chapter "Options", Section "K01 to K05, Safety license for 1 to 5 axes")	☐	☐

Item	Action		included/completed?	
27	K46, SMC10 Sensor Module	The SMC10 Sensor Module is used for determining the actual motor speed and the rotor position angle. The following encoders are supported by the SMC10 Sensor Module: • Resolver, 2-pin • Resolver, multi-pin (→ See Chapter "Options", Section "K46, SMC10 Sensor Module Cabinet-Mounted")	☐	☐
28	K48, SMC20 Sensor Module	The SMC20 Sensor Module is used for determining the actual motor speed and the path length. The following encoders are supported by the SMC20 Sensor Module: • Incremental encoder sin/cos 1Vpp • Absolute encoder EnDat • SSI encoder (→ See Chapter "Options", Section "K48, SMC20 Sensor Module Cabinet-Mounted")	☐	☐
29	K50, SMC30 Sensor Module	The SMC30 Sensor Module is used for determining the actual motor speed. The following encoders are supported by the SMC30 Sensor Module: • TTL encoder • HTL encoder • SSI encoder (→ See Chapter "Options", Section "K50, SMC30 Sensor Module Cabinet-Mounted")	☐	☐
30	K51, VSM10 Voltage Sensing Module cabinet-mounted	The VSM10 Voltage Sensing Module is used to sense the voltage characteristic on the motor side, so that the following functions can be implemented: • Operating a permanent-magnet synchronous motor without encoder with the requirement to be able to connect to a motor that is already running (flying restart function) • Fast flying restart of large induction motors: The time for the demagnetization of the motor is eliminated as a result of the voltage sensing. When operating a permanent-magnet synchronous motor without encoder, the "Flying restart" function must be activated with p1200. (→ See Chapter "Options", Section "K51, VSM10 Voltage Sensing Module cabinet-mounted")	☐	☐
31	K52, additional SMC30 Sensor Module	The additional SMC30 Sensor Module is used for safe actual value acquisition when using the Safety Integrated Extended Functions. (→ See Chapter "Options", Section "K52, Additional SMC30 Sensor Module")	☐	☐
32	K70, fan power supply	Voltages 1 AC 230 V and 24 V DC of the auxiliary power supply system must be supplied externally. (→ See Chapter "Options", Section "K70, fan power supply")	☐	☐

Item	Action		included/completed?	
33	K76, auxiliary voltage generating unit in the Line Connection Module	In order to supply the auxiliary power supply system with the appropriate voltages, the phase must be connected to the corresponding transformer tap. Make sure that the correct voltage is applied. (→ See Chapter "Options", Section "K76, Auxiliary voltage generating unit in the Line Connection Module")	☐	☐
34	K82, 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". (→ See Chapter "Electrical installation", Section "Cable routing for the "Safe Torque Off" and "Safe STOP 1" functions") (→ See Chapter "Options", Section "K82, Terminal Module for controlling safety functions "Safe Torque Off" and "Safe Stop 1"")	☐	☐
35	K87, Terminal Module TM54F	Establish the connection according to "Cable routing for the functions TM54F". (→ See Chapter "Electrical installation", Section "Cable routing for the Terminal Module TM 54F") (→ See Chapter "Options", Section "K87, Terminal Module TM54F")	☐	☐
36	K88, Safe Brake Adapter SBA 230 V AC	To control the brake, a connection must be established between -X14 on the Safe Brake Adapter and the holding brake. (→ See Chapter "Options", Section "K88, Safe Brake Adapter SBA 230 V AC")	☐	☐
37	L13, main contactor	Connect the feedback signal contacts of the main contactor. (→ See Chapter "Options", Section "L13, main contactor")	☐	☐
38	L25, circuit breaker in withdrawable unit design	Connect the feedback signal contacts of the circuit breaker. (→ See Chapter "Options", Section "L25, circuit breaker in withdrawable unit design")	☐	☐
39	L34, output-side circuit breaker	Parameterize the control of the circuit breaker. (→ See Chapter "Options", Section "L34, output-side circuit breaker")	☐	☐
40	L37, DC coupling, incl. precharging input circuit of the associated DC link capacitance	Commission the DC coupling. (→ See Chapter "Options", section "L37, DC coupling including pre-charging input circuit of the associated DC link capacitance")	☐	☐
41	L41, current transformer upstream of main switch	Connect the measuring connections of the current transformer. (→ See Chapter "Options", Section "L41, current transformer upstream of main switch")	☐	☐
42	L45, EMERGENCY OFF pushbutton in the cabinet door	Integrate the option into the EMERGENCY OFF circuit. (→ See Chapter "Options", Section "L45, EMERGENCY OFF pushbutton in the cabinet door")	☐	☐
43	L50, cabinet lighting with service socket	Provide the power supply. (→ See Chapter "Options", Section "L50, cabinet lighting with service socket")	☐	☐
44	L55, cabinet anti-condensation heating	Provide the power supply. (→ See Chapter "Options", Section "L55, cabinet anti-condensation heating")	☐	☐

Item	Action		included/completed?	
45	L87, insulation monitoring	Integrate the option into the plant-side fault and alarm circuit. (→ See Chapter "Options", Section "L87, insulation monitoring")	☐	☐
46	P10, measuring instrument for line variables, installed in the cabinet door	Adjust the measuring instrument according to the system relationships. (→ see Chapter "Options", Section "P10, measuring instrument for line variables installed in the cabinet door")	☐	☐
47	P11, measuring instrument for line variables with PROFIBUS connection (installed in the cabinet door)	Adjust the measuring instrument according to the system relationships. (→ see Chapter "Options", Section "P11, measuring instrument for line variables with PROFIBUS connection installed in the cabinet door")	☐	☐
48	P13, measuring instrument for line variables with PROFINET connection, installed in the cabinet door	Adjust the measuring instrument according to the system relationships. (→ see Chapter "Options" in Section "P13, measuring instrument for line variables with PROFINET connection installed in the cabinet door")	☐	☐
49	P14, measuring instrument for line variables with PROFINET connection, installed in the cabinet door	Adjust the measuring instrument according to the system relationships. (→ see Chapter "Options" in Section "P14, measuring instrument for line variables with PROFINET connection installed in the cabinet door")	☐	☐

4.3 EMC-compliant design

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

4.4 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.

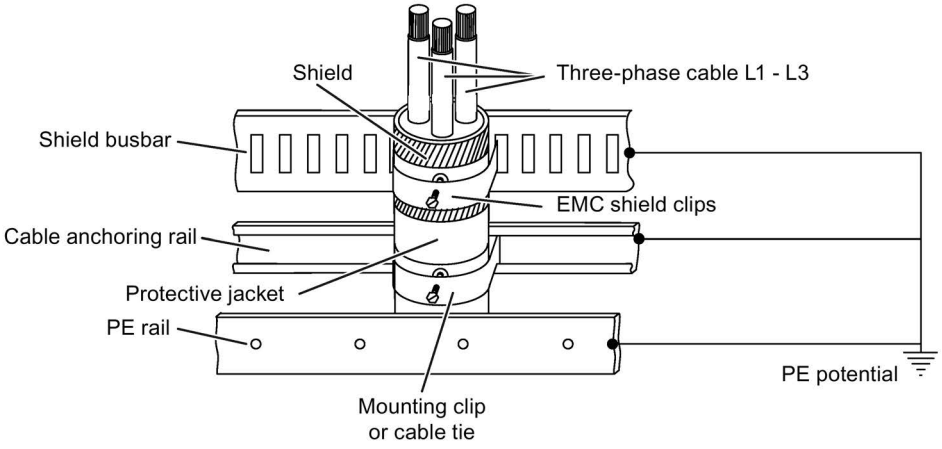


Figure 4-1 Connecting shields at the EMC shield rail using EMC shield clamps

Note

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

4.5 Connections

4.5.1 Cable lugs

Cable lugs

The cable connections on the devices are designed for cable lugs according to DIN 46234 or DIN 46235.

For connection of alternative cable lugs, the maximum dimensions are listed in the table below.
These cable lugs are not to exceed these dimensions, as mechanical fastening and adherence to the voltage distances is not guaranteed otherwise.

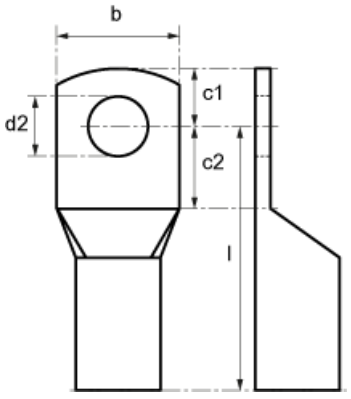


Figure 4-2 Dimensions of the cable lugs

Table 4- 2 Dimensions of the cable lugs

Screw / bolts	Conductor cross-section [AWG,MCM] ([mm²])	d2 [inch] ([mm])	b [inch] ([mm])	l [inch] ([mm])	c1 [inch] ([mm])	c2 [inch] ([mm])
M8	2/0 (70)	0.33 (8.4)	0.94 (24)	2.17 (55)	0.51 (13)	0.39 (10)
M10	350 (185)	0.41 (10.5)	1.46 (37)	3.23 (82)	0.59 (15)	0.47 (12)
M10	500 (240)	0.51 (13)	1.65 (42)	3.62 (92)	0.63 (16)	0.51 (13)
M12	4/0 (95)	0.51 (13)	1.10 (28)	2.56 (65)	0.63 (16)	0.51 (13)
M12	350 (185)	0.51 (13)	1.46 (37)	3.23 (82)	0.63 (16)	0.51 (13)
M12	500 (240)	0.51 (13)	1.65 (42)	3.62 (92)	0.63 (16)	0.51 (13)
M16	500 (240)	0.67 (17)	1.65 (42)	3.62 (92)	0.75 (19)	0.63 (16)

Attaching 2 cable lugs per phase

The cable lugs can be attached as shown in the following diagram if, at one connection per phase, 2 cable lugs can be connected.

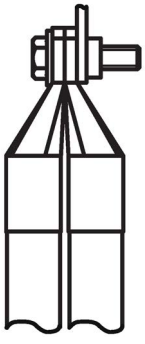


Figure 4-3 2 cable lugs per connection

4.5.2 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- 3 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	*
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	*
Auxiliary Power Supply Module	Yes	*	Yes	Yes	No	No

* optional

4.5.3 PE busbar

4.5.3.1 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
- Booksize base cabinets
- Motor Modules in chassis format
- 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

Closing the cabinet doors

When ground connections are connected to the PE busbar, it must be ensured that the cabinet doors can still be closed.

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

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

Note

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

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

Preparatory steps

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

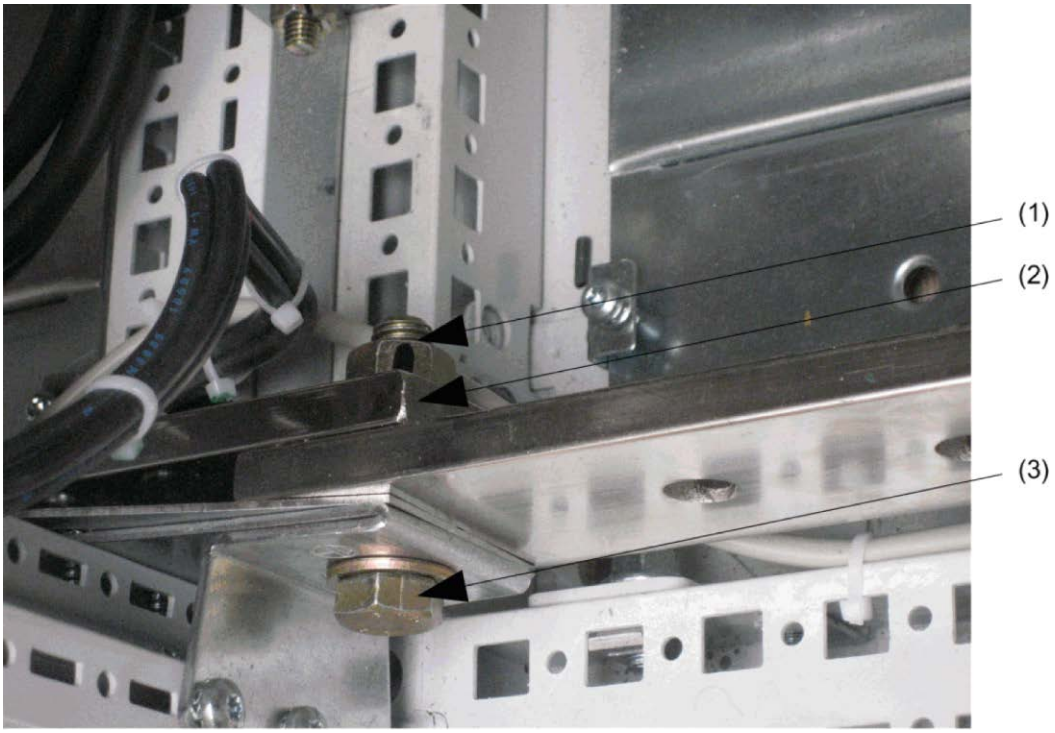


Figure 4-4 Connecting the PE busbar when cabinet units are installed side-by-side

Establishing the connection

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

4.5.3.3 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.

4.5.3.4 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.

4.5.4 DC busbar

4.5.4.1 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
- Booksize base cabinets
- Motor Modules in chassis format

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

4.5.4.2 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.

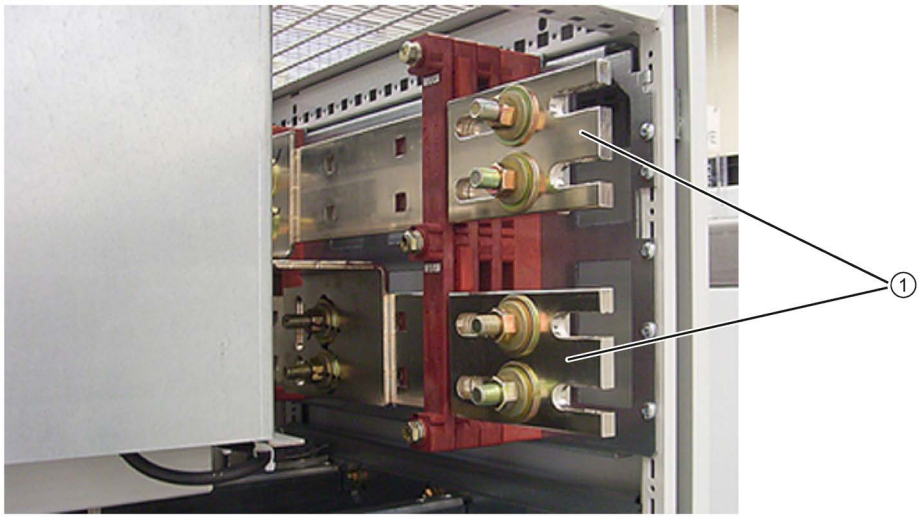


Figure 4-5 Delivery state of the DC busbar



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

Establishing the connection

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

NOTICE
Material damage due to incorrect connection of the jumpers for the DC busbar Incorrect connection of the jumpers for the DC busbar can heat up the busbars and therefore cause material damage. • Insert the jumper ① of the first cabinet into the cabinet to be connected until the washers ② are in full contact with the jumper.

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

Note

Mounting specifications

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

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

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

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

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

Note

DC busbars for the transport units

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

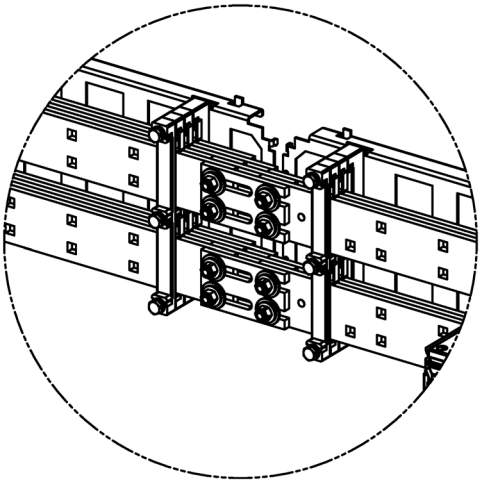
4.5.4.3 Connecting cabinet units with different numbers of DC busbars

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

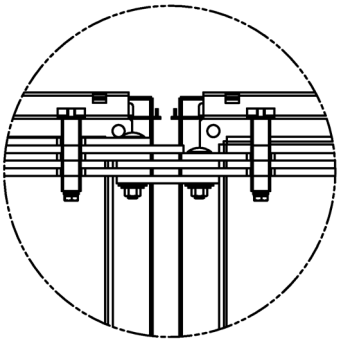
Transition from three busbars to two busbars

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



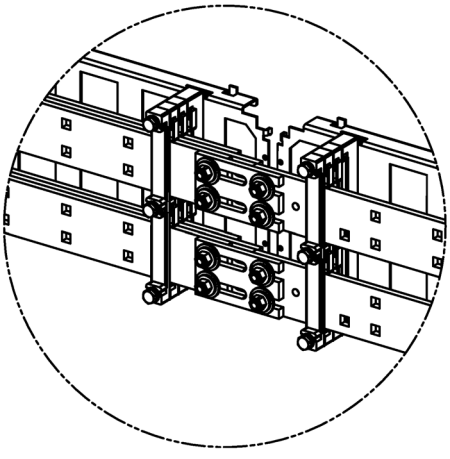
Top view of the connection location



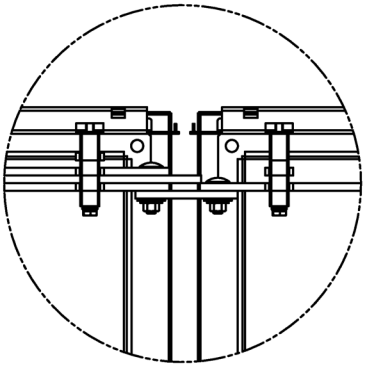
Transition from two busbars to one busbar

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



4.5.5 Auxiliary power supply system

4.5.5.1 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 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 module for each voltage level:

- Smart Line Modules
- Active Line Modules
- Booksize base cabinets
- Motor Modules in chassis format

Description

The auxiliary power supply system installed in the Cabinet Module is used to distribute the voltages provided by an auxiliary power supply.

Ideally, these voltages are generated by an Auxiliary Power Supply Module. Other ways to supply power are 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-carrying capacity of the auxiliary power supply system is 80 A according to IEC (or 80 A according to UL). If the total power requirement of the cabinet line-up exceeds the maximum load rating, 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.

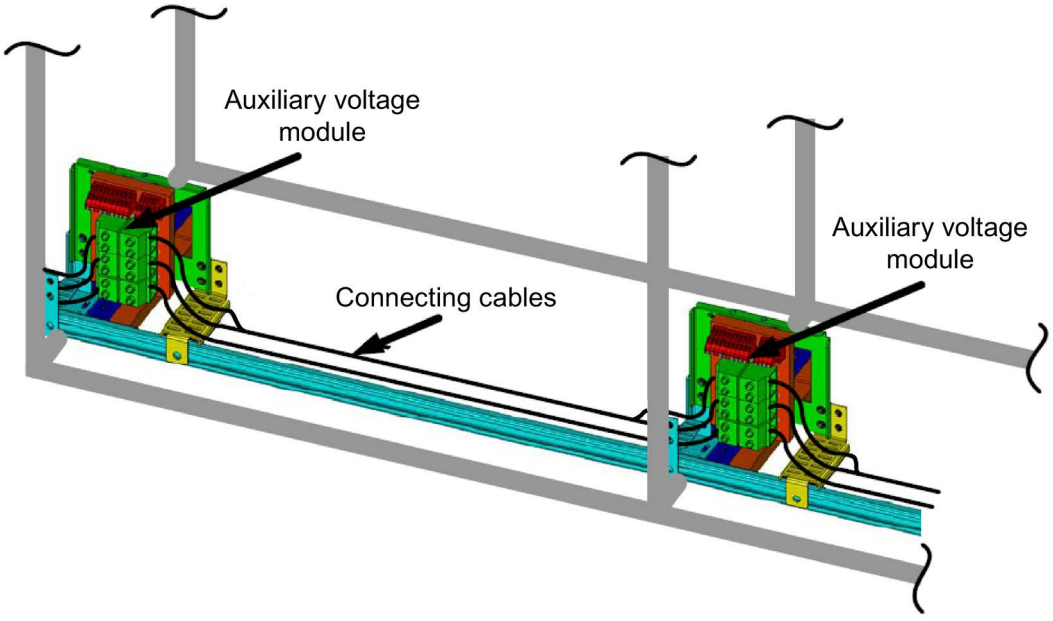


Figure 4-7 Auxiliary power supply system for voltage distribution

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

The auxiliary power module comprises two terminal blocks (-X100, -X101) and one fuse (-F24) for the 24 V DC supply. The auxiliary power module is used to tap the necessary auxiliary voltages at terminal block -X100 and to forward 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 line voltage (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 module

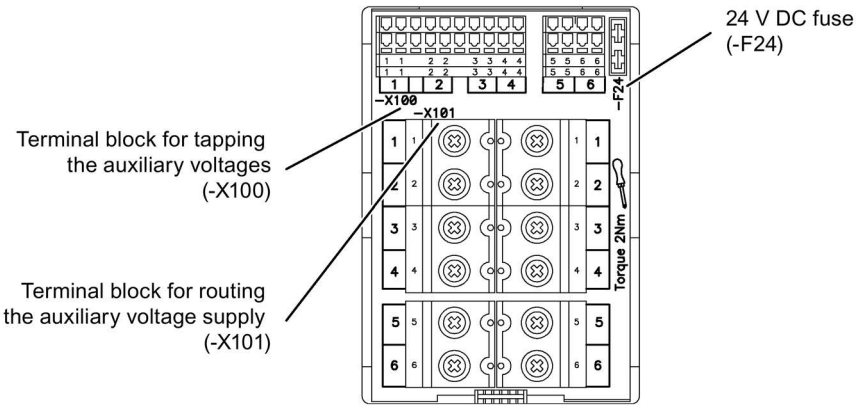
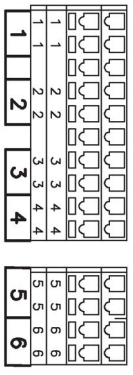


Figure 4-8 Auxiliary power module with terminal blocks -X100, -X101 and 24 V DC fuse

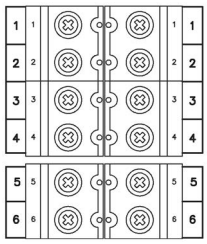
At least two terminals are always available to the customer at terminal block -X100 for tapping the auxiliary voltages.

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

	Terminal	Designation	Voltage tap	Rated current
	1	L1	Line voltage (for fan supply via transformer): • 2 AC 380 ... 480 V or • 2 AC 500 ... 690 V (max. AC 759 V)	Max. 16 A [1]
	2	L2		
	3	L1	1 AC 230 V (max. AC 265 V)	Max. 16 A [1]
	4	N		
	5	P24	24 V DC for the electronics power supply (max. 30 V DC)	Max. 10 A [1]
	6	M		
The maximum load-carrying capacity of the auxiliary power supply system is 80 A according to IEC (or 80 A according to UL). Max. connectable cross-section: #14 AWG (2.5 mm²)				

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

Table 4- 5 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): • 2 AC 380 ... 480 V or • 2 AC 500 ... 690 V (max. AC 759 V)	Max. 60 A
	2	L2		
	3	L1	1 AC 230 V (max. AC 265 V)	Max. 80 A
	4	N		
	5	P24	24 V DC for the electronics power supply (max. 30 V DC)	Max. 80 A
	6	M		
The maximum load-carrying capacity of the auxiliary power supply system is 80 A according to IEC (or 80 A according to UL). Max. connectable cross-section: #2 AWG (35 mm^2) Tightening torque: 2 Nm (max. 30 lb-in)				

Note

The connection is only permitted with copper cables.

The use is only permitted in environments with degree of pollution II in accordance with IEC 61800-5-1.

Auxiliary power module in the Line Connection Module

The auxiliary power 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.

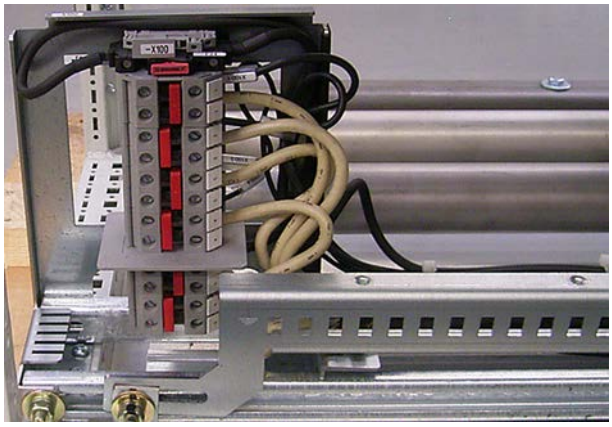
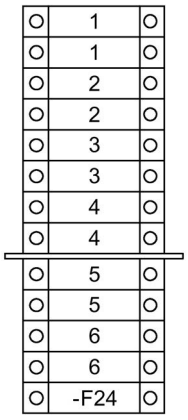


Figure 4-9 Auxiliary power module in the Line Connection Module

Table 4- 6 X100, terminal block in the Line Connection Module for routing the auxiliary voltages

	Terminal	Voltage tap	Rated current
	1	Line voltage: • 2 AC 380 ... 480 V or • 2 AC 500 ... 690 V (max. AC 759 V)	Max. 60 A
	1		
	2		
	2		
	3	1 AC 230 V (max. AC 265 V)	Max. 80 A
	3		
	4		
	4		
	5	24 V DC for the electronics power supply (max. 30 V DC)	Max. 80 A
	5		
	6		
	6		
	-F24	24 V DC fuse	Max. 10 A
The maximum load-carrying capacity of the auxiliary power supply system is 80 A according to IEC (or 80 A according to UL). Max. connectable cross-section: #6 AWG (16 mm^2) Tightening torque: 2 Nm (max. 30 lb-in)			

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 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- 7 Voltage assignment for connecting cables

Cable	Phase	Assigned voltages
4-phase	1	Line voltage: • 2 AC 380 ... 480 V or • 2 AC 500 ... 690 V (max. AC 759 V)
	2	
	3	1 AC 230 V (max. AC 265 V)
	4	
2-phase	1	24 V DC for the electronics power supply (max. 30 V DC) 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

Risk of death due to hazardous voltage resulting from incorrect voltage assignment

Incorrect voltage assignment on the auxiliary power supply system may result in high voltages on components not suited for them, thereby damaging or destroying these components. Touching these high voltage may result in death or serious injury.

- When carrying out any connection work to the auxiliary power supply system, avoid confusing the poles of the voltage supply.

4.5.5.2 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)

4.5.5.3 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 4-10 Connecting cables in the delivered state (e.g. transport units)

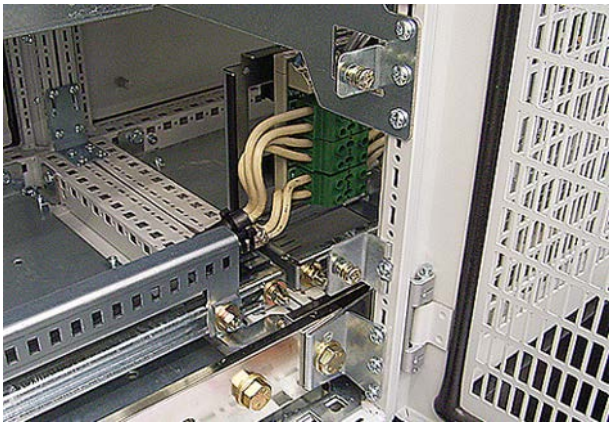


Figure 4-11 Connected connecting cables

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.

4.5.5.4 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.

4.5.6 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 turns, a voltage is generated at the connection terminals that when touched can result in death or serious injury.

- Disconnect the motor when working on the converter.
- If the cables to the motor cannot be disconnected, secure the motor to prevent unintended rotating movements, e.g., by a holding brake.

Motor Modules Booksize Cabinet Kit

Table 4- 8 Motor connection, Motor Modules

Terminals	Technical data
DCP, DCN DC power input	Voltage: 510 to 720 V DC
U2/T1, V2/T2, W2/T3 3 AC power output	Voltage: 3 AC 0 V to 0.717 x DC link voltage Terminals: AWG 10 to 4/0 (6 to 95 mm^2) (→ see Technical specifications)

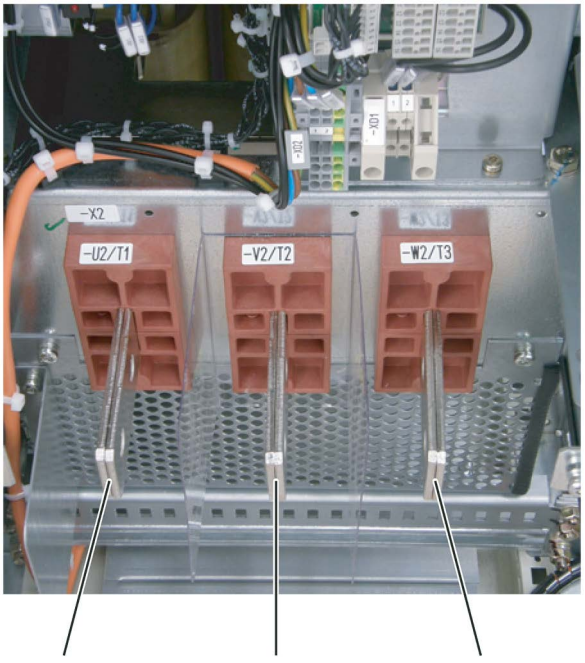
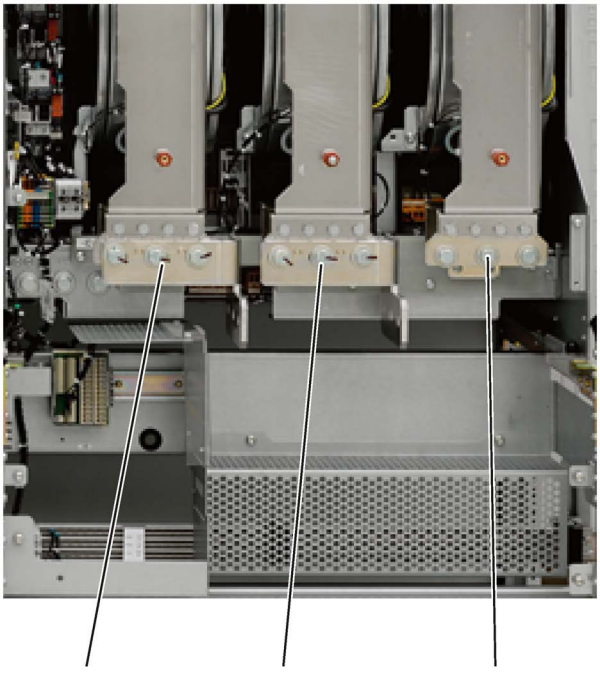
Motor Modules in chassis format

Table 4- 9 Motor connection, Motor Modules

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

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

[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 bottom plate below the terminals 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 properly (U2/T1, V2/T2, W2/T3).

NOTICE
Property damage due to loose power connections Insufficient tightening torques or vibrations 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.

Conductor cross-sections

Refer to the "Technical specifications" for the Motor Modules, "Cabinet Modules" section 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 2 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- 10 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 (viewed from 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.

4.5.7 Line supply connections

Line Connection Modules

The line supply is connected in the Line Connection Module at terminals U1/L1, V1/L2, W1/L3.

Table 4- 11 Line connection, Line Connection Modules

Terminals	Technical data
U1/L1, V1/L2, W1/L3 3 AC power input	Voltage: 3 AC 380 V -10 % ... 3 AC 480 V +10 % (-15 % < 1 min) 3 AC 500 V -10 % ... 3 AC 690 V +10 % (-15 % < 1 min) Connection: • For frame size FL and GL, the connection is made directly on the circuit breaker -Q1 (-> see Technical specifications) • For frame size JL, KL, and LL, the connection is made to connection panel -X1: M12 / 50 Nm for cable lugs in accordance with DIN 46234 or DIN 46235 [1)]

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

4.5.8 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 V AC fans. The location of the transformers is indicated in the layout diagrams supplied.

The transformer is fitted with primary taps so that it can be adapted to the line voltage. When delivered, the taps are always set to the highest level. When connected to a lower line 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 section "Cabinet Modules" in the design descriptions of the appropriate modules.

Note

Two transformers for frame sizes HX and JX

Two transformers (-T10/-T11) are installed in the case of Smart Line Modules, Active Line Modules, and Motor Modules with "HX" and "JX" frame sizes. The two primary terminals of these devices must be adjusted together.

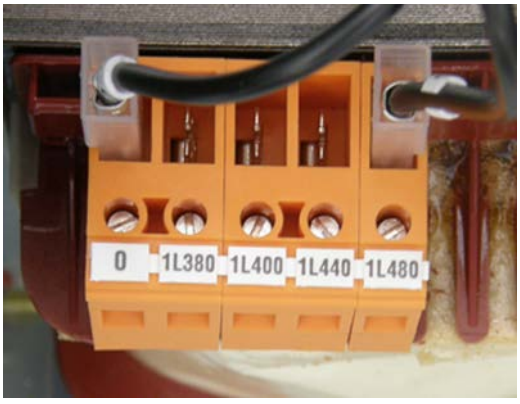


Figure 4-12 Connecting terminals for the fan transformers (380 to 480 V 2 ph. AC)



Figure 4-13 Connecting terminals for the fan transformers (500 to 690 V 2 ph. AC)

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

WARNING

Fire due to overheating resulting from insufficient equipment fan voltage

If the terminals are not reconnected to the actual line voltage, this can lead to overheating with a risk of personal injury due to smoke generation and fire.
This can also cause the fan fuses to blow due to overload.

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

Note

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

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

Table 4- 12 Line voltage assignments for setting the fan transformer (2 AC 380 ... 480 V)

Line voltage	Taps of the fan transformer (-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- 13 Line voltage assignments for setting the fan transformer (2 AC 500 ... 690 V)

Line voltage	Taps of the fan transformer (-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

4.5.9 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 (the connection clip is located behind the fan for frame sizes HX and JX) including a Voltage Sensing Module VSM10
- Active Line Modules (connection clip in the Active Interface Module) including the Voltage Sensing Module VSM10

NOTICE

Damage to the device by not removing the connection clip

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

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

Note

Warning label on the connection clip

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

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



Figure 4-14 Warning label on the connection clip

Basic Line Modules

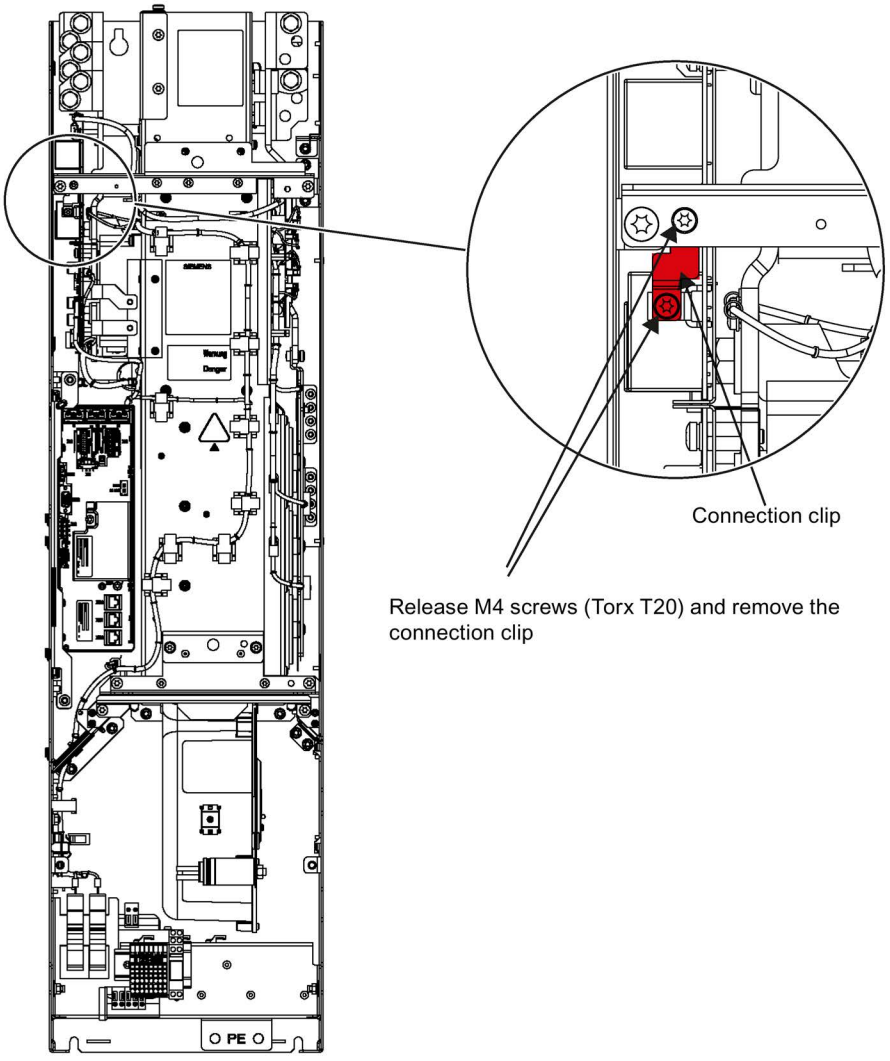


Figure 4-15 Removing the connection clip of the basic interference suppression module to ground in the Basic Line Module for frame size FB

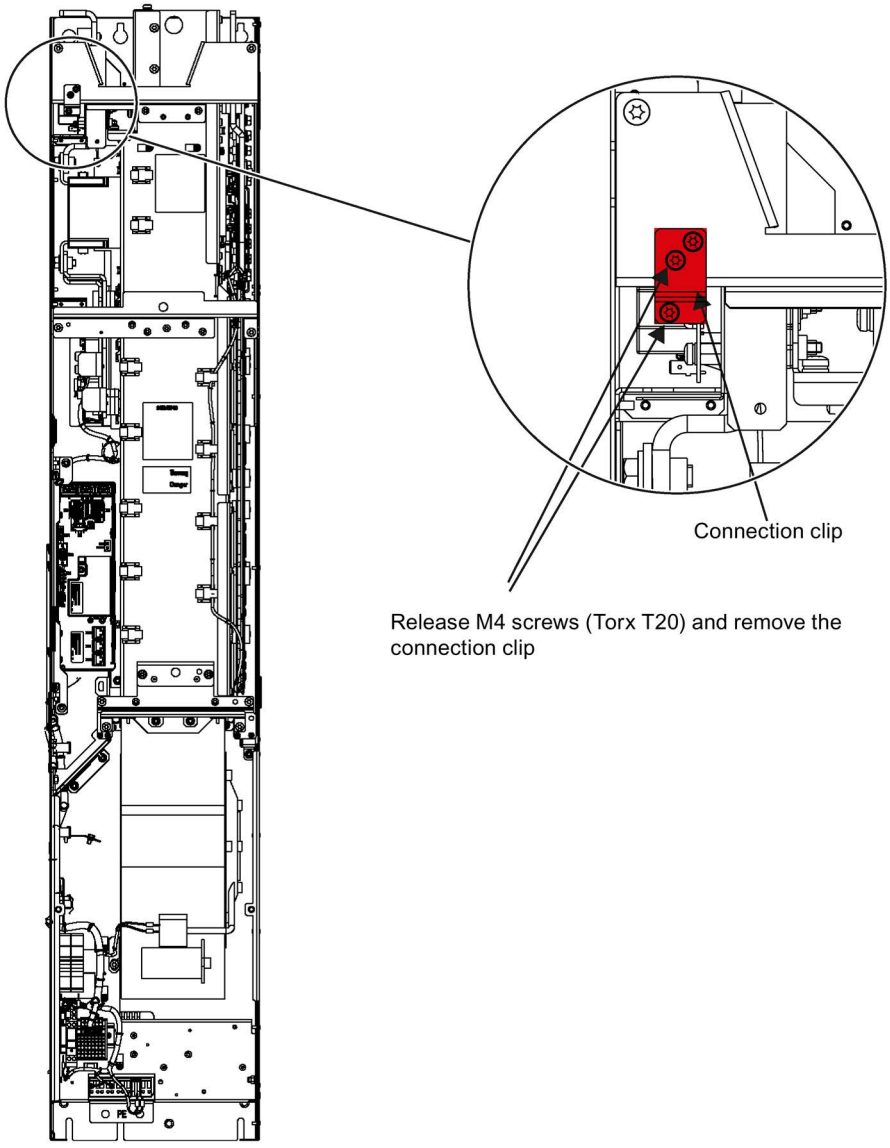


Figure 4-16 Removing the connection clip of the basic interference suppression module to ground in the Basic Line Module for frame size GB

Smart Line Modules

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

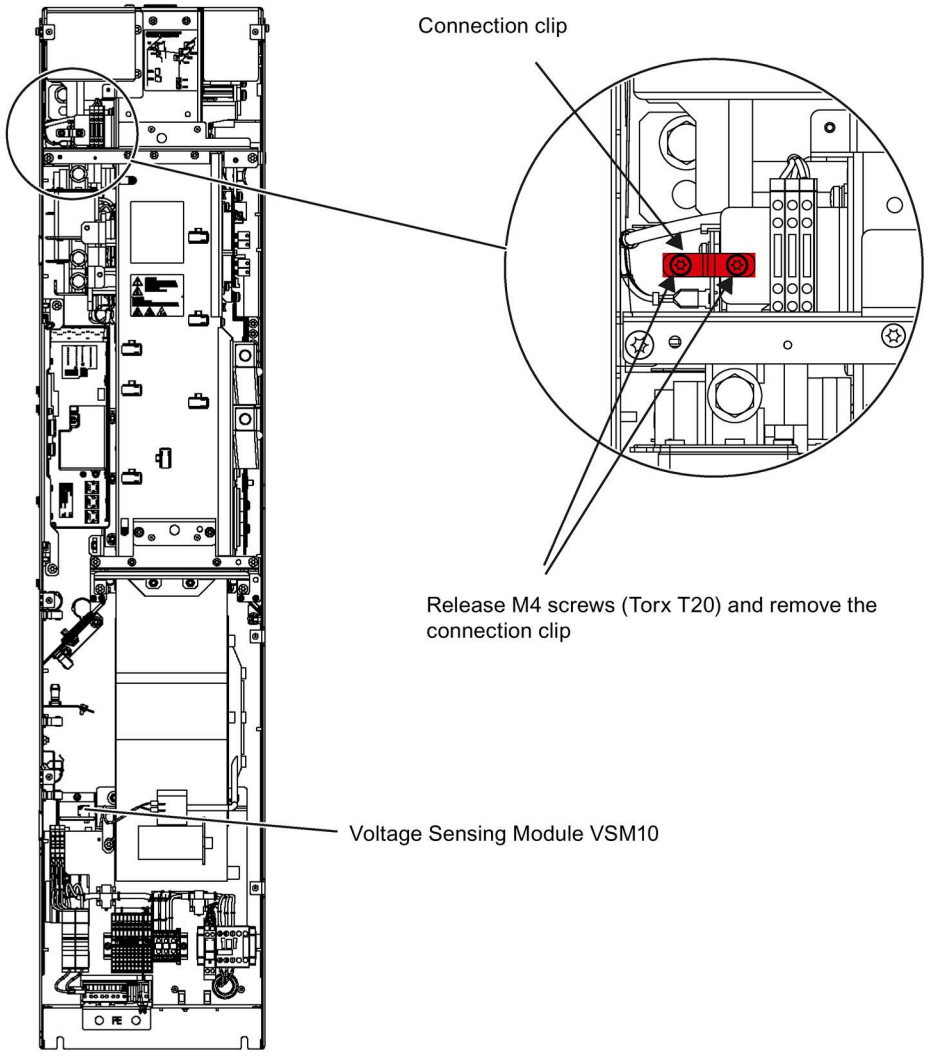


Figure 4-17 Removing the connection clip of the basic interference suppression module to ground in the Smart Line Module for frame size GX

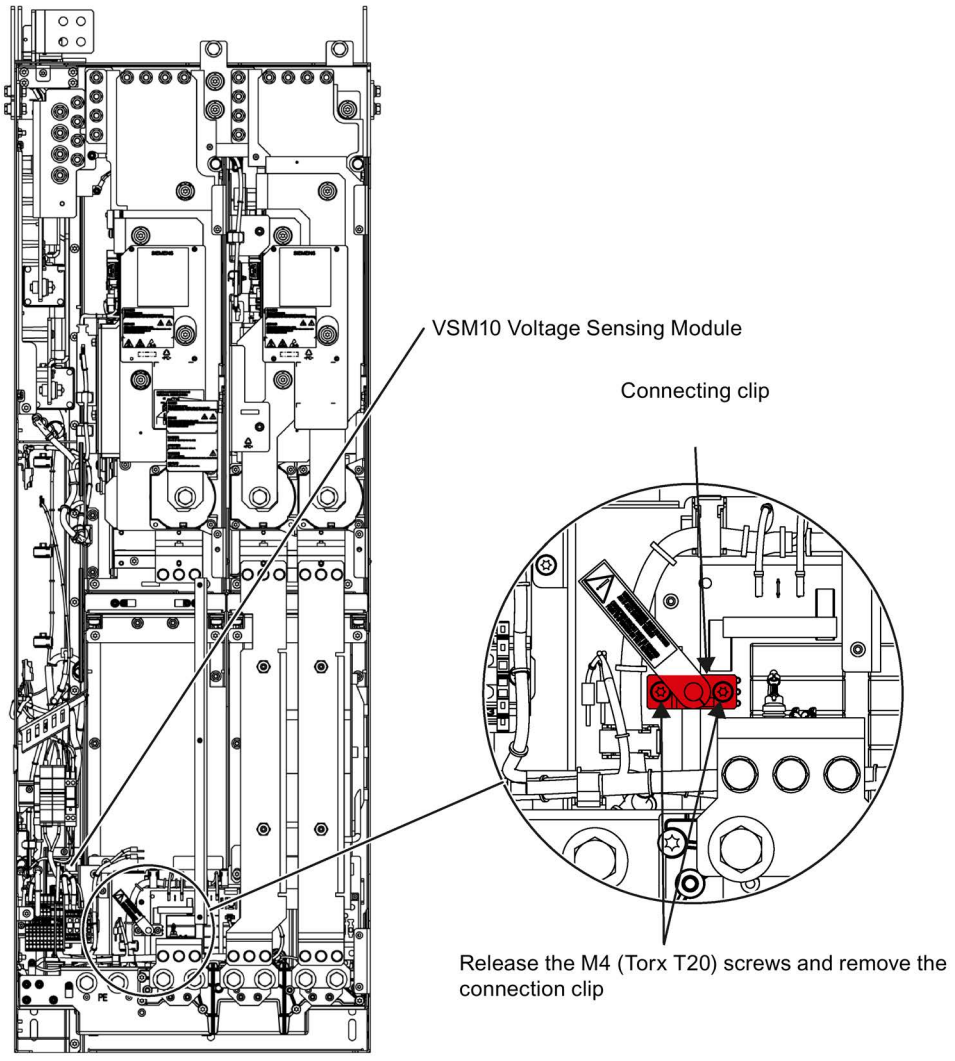


Figure 4-18 Removing the connection clip of the basic interference suppression module to ground in the Smart Line Module for frame size HX

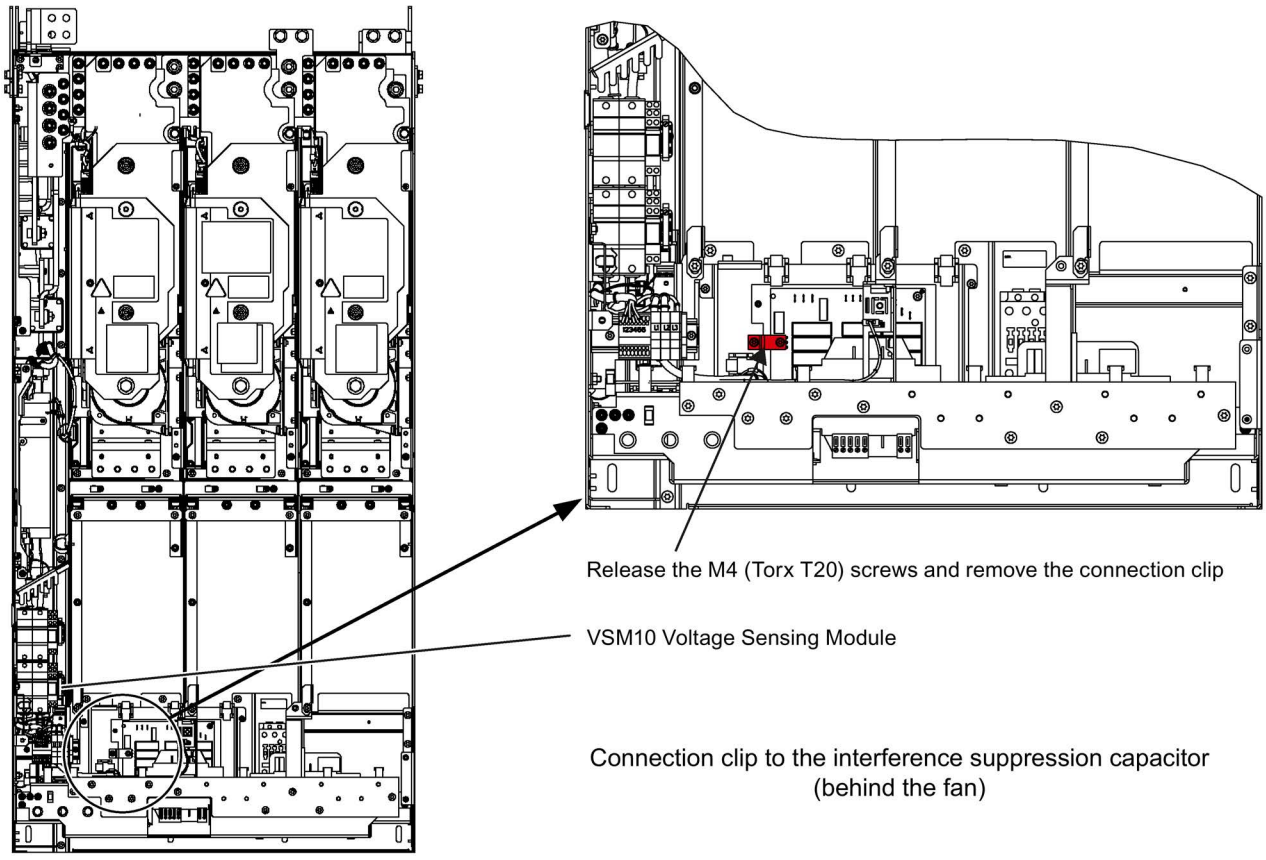


Figure 4-19 Removing the connection clip of the basic interference suppression module to ground in the Smart Line Module for frame size JX

Active Line Modules including Active Interface Modules

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

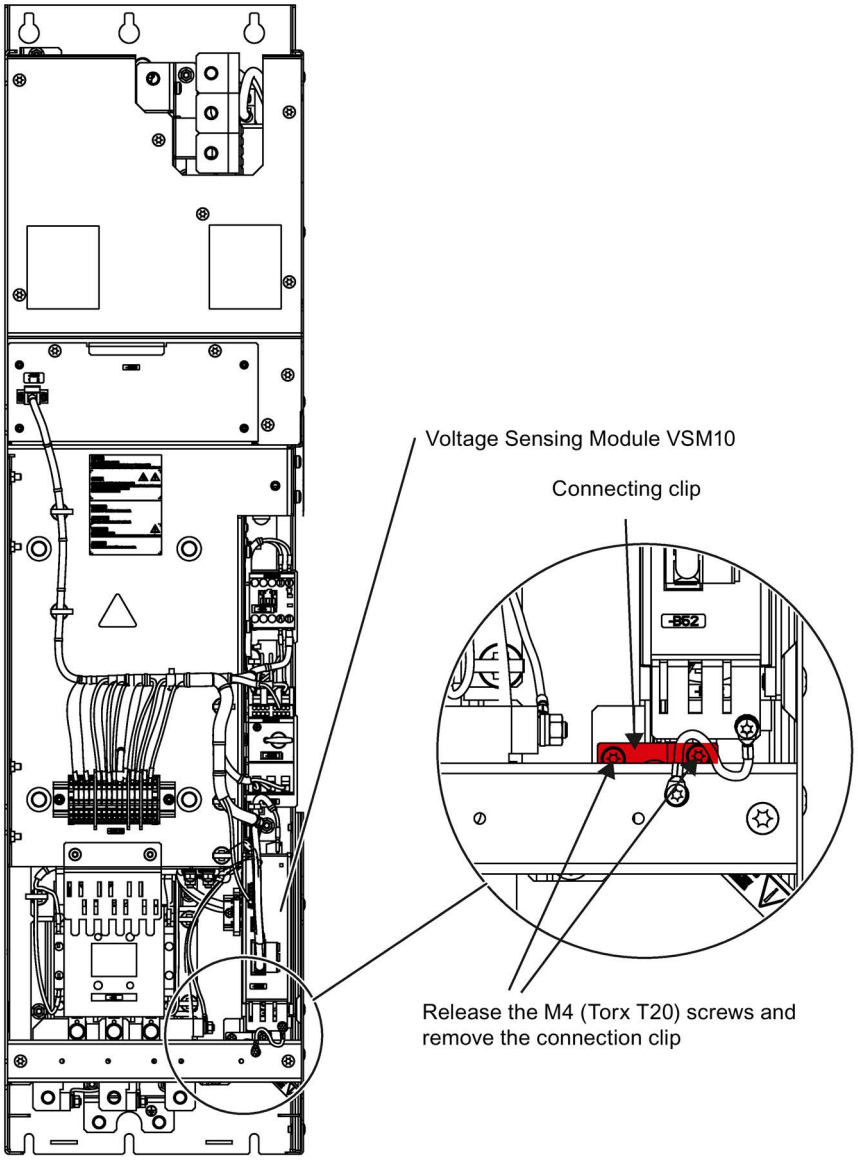


Figure 4-20 Removing the connection clip of the basic interference suppression module to ground in the Active Interface Module for frame size FI

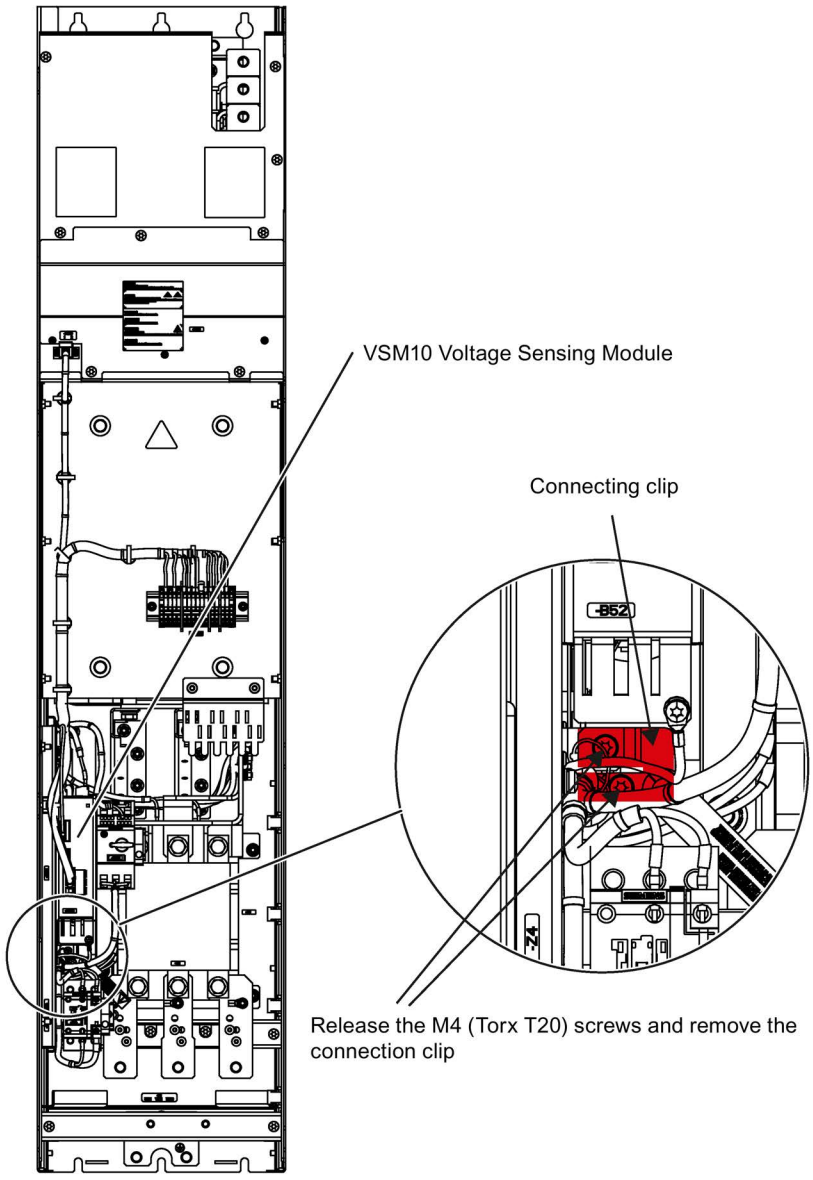


Figure 4-21 Removing the connection clip of the basic interference suppression module to ground in the Active Interface Module for frame size GI

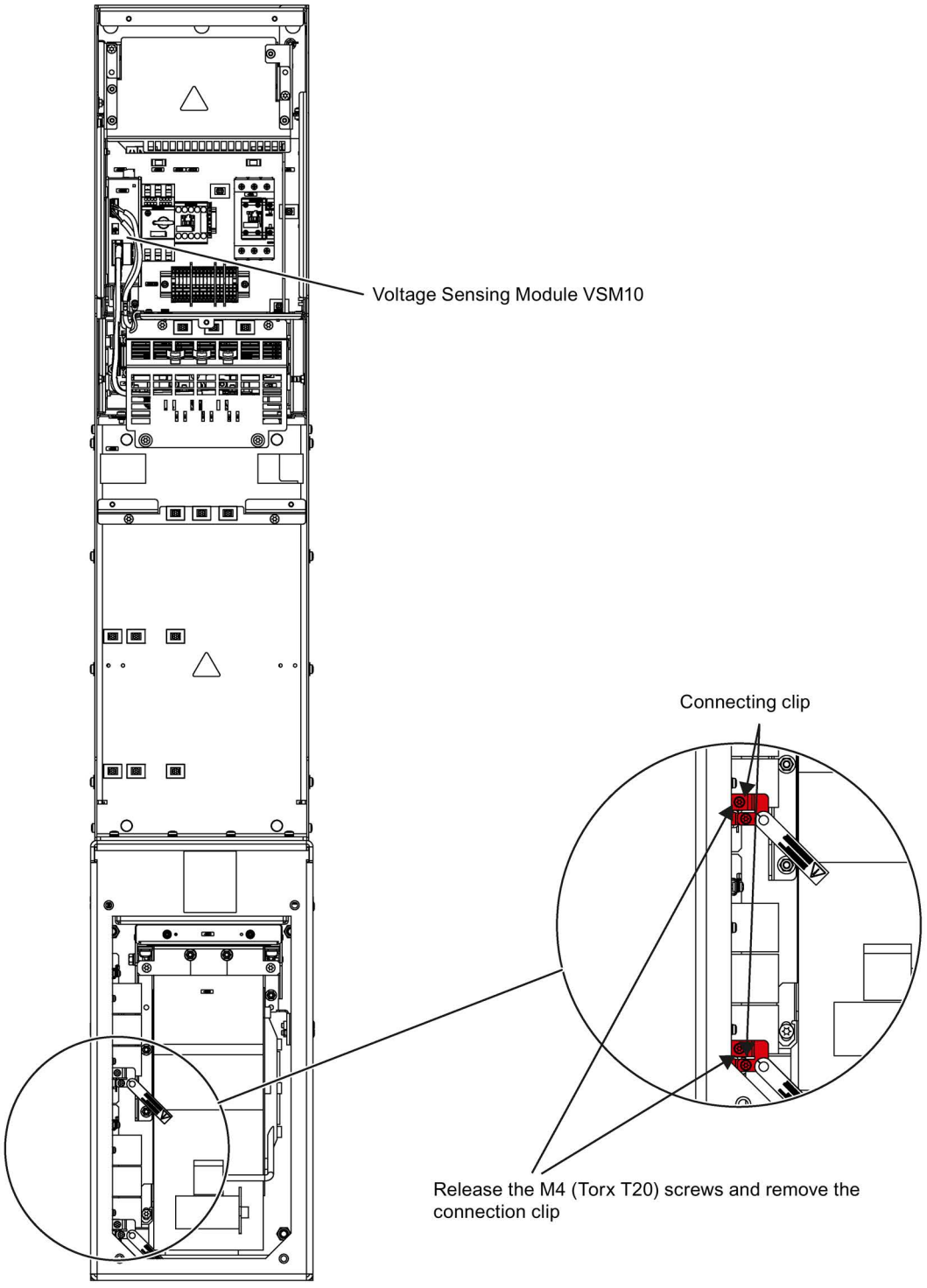


Figure 4-22 Removing the connection clip of the basic interference suppression module to ground in the Active Interface Module for frame size HI

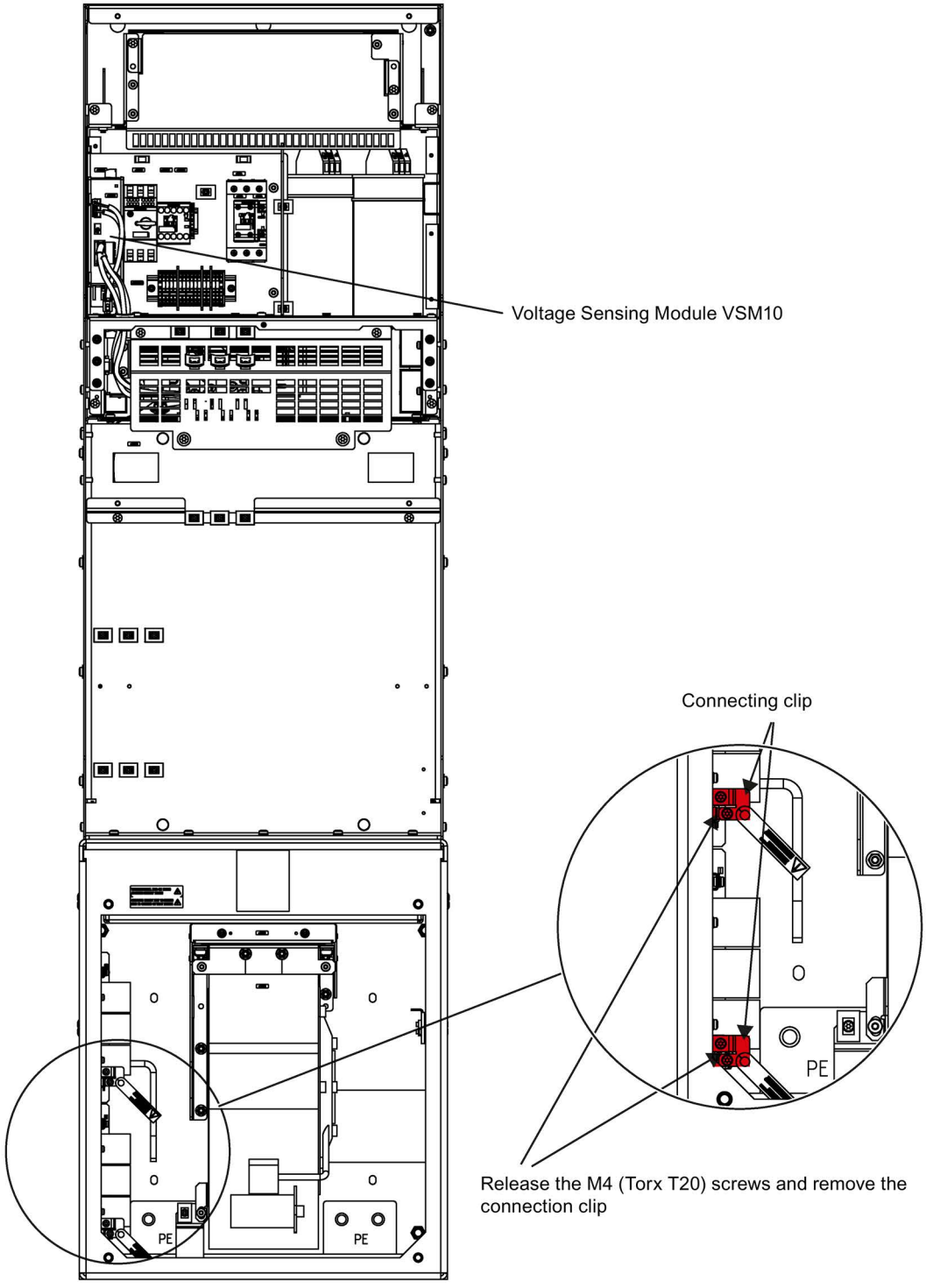


Figure 4-23 Removing the connection clip of the basic interference suppression module to ground in the Active Interface Module for frame size JI

Removing the connector jumper in the VSM10 Voltage Sensing Module

If a Smart Line Module or Active Line Module is operated on a non-grounded line supply (IT supply system), the connector jumper in terminal X530 on the button of the component must be removed from the Voltage Sensing Module (VSM10).

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 pull the connector jumper.

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

Note

Replacing a VSM10 Voltage Sensing Module

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

4.5.10 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.

4.5.11 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.

4.5.12 Cable routing

4.5.12.1 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.

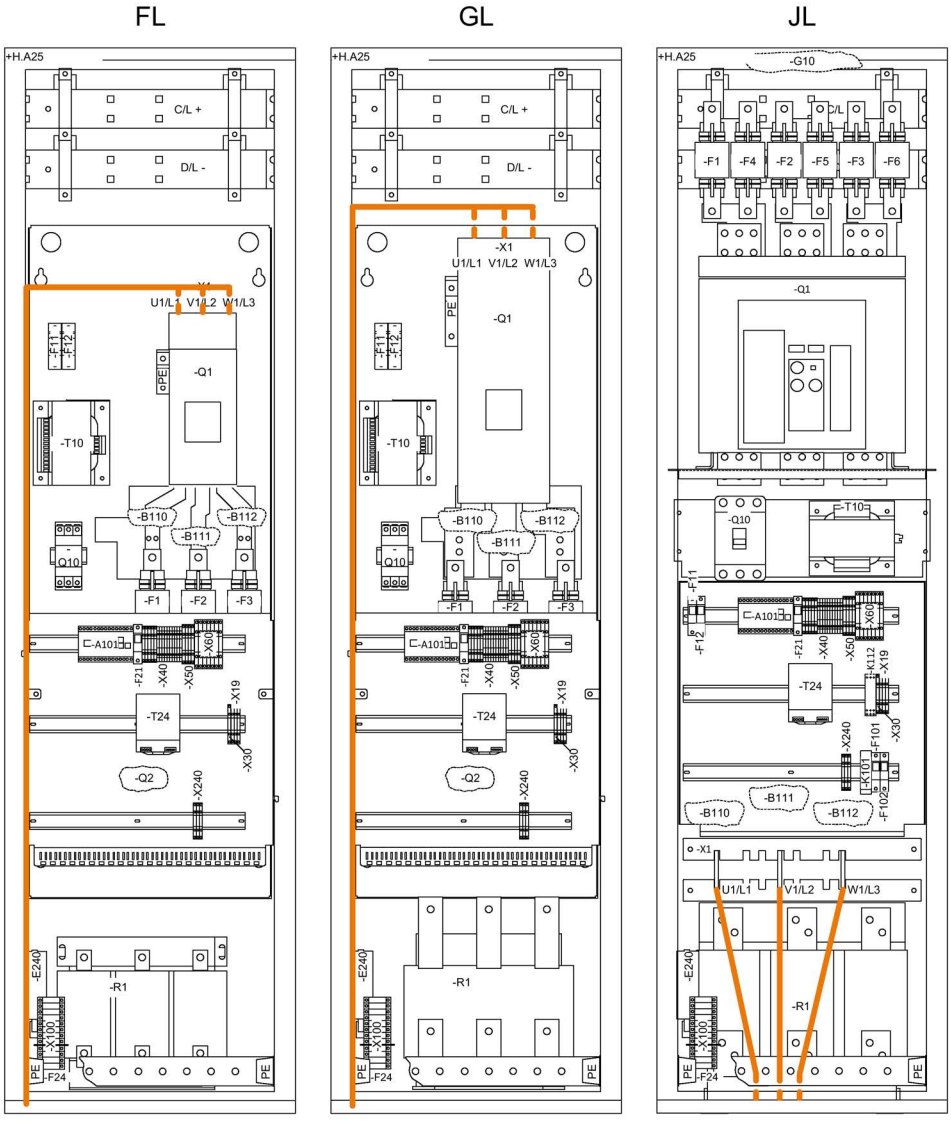
4.5.12.2 Cable routing for Line Connection Modules

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

Table 4- 14 Checklist for cabling or connection work for Line Connection Modules

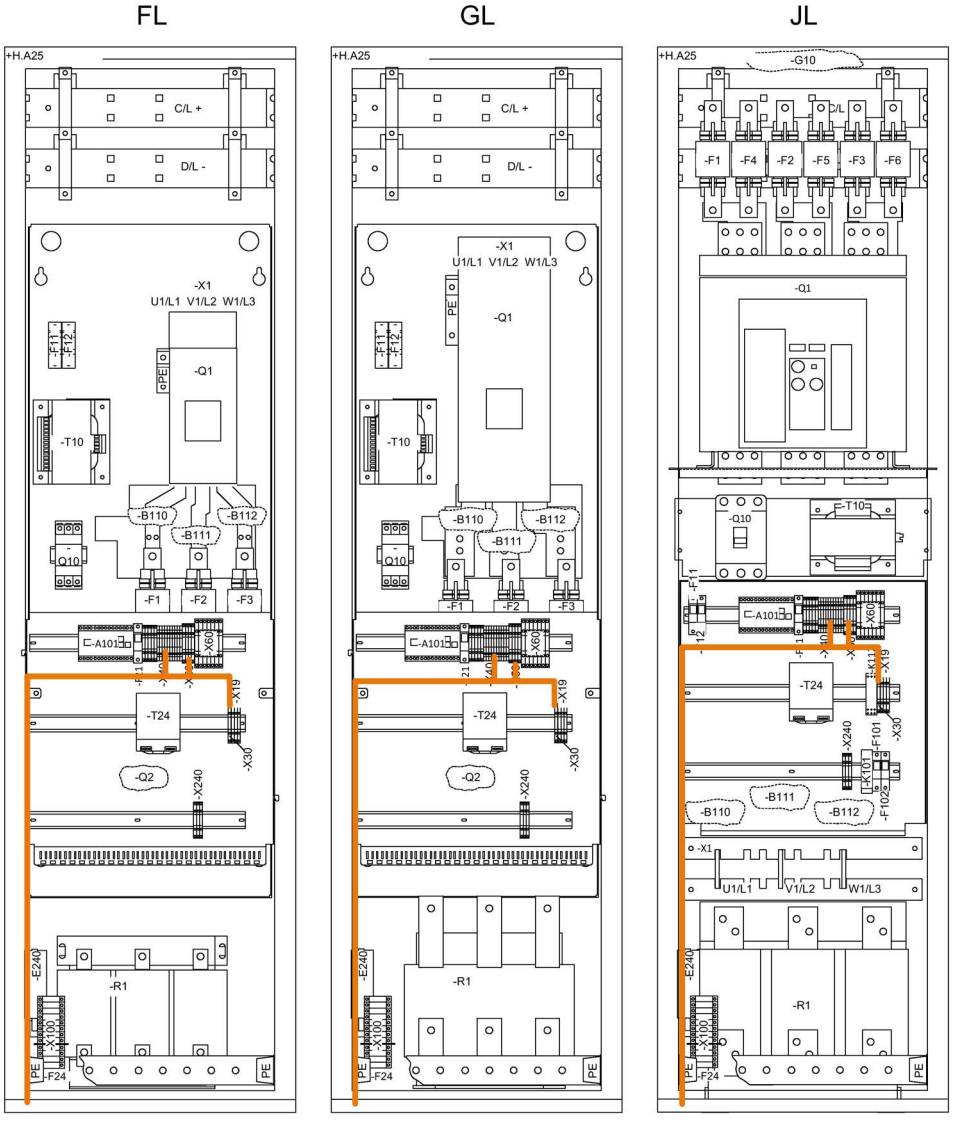
Cable routing	Completed?
Cable for the line supply (L1, L2, L3, PE)	
Signal cables	
Note: The "Basic rules for cable routing" and "Preparatory steps" described above must be observed whenever any cabling or connection work is performed.	

Cable routing for connection 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. Feed the signal cables into the cabinet from the bottom left.
2. Feed the signal cables up through the cabinet to terminal blocks -X30, -X40, and -X50.
3. Fasten the signal cables at suitable points.
4. Connect the signal cables to the terminal blocks.

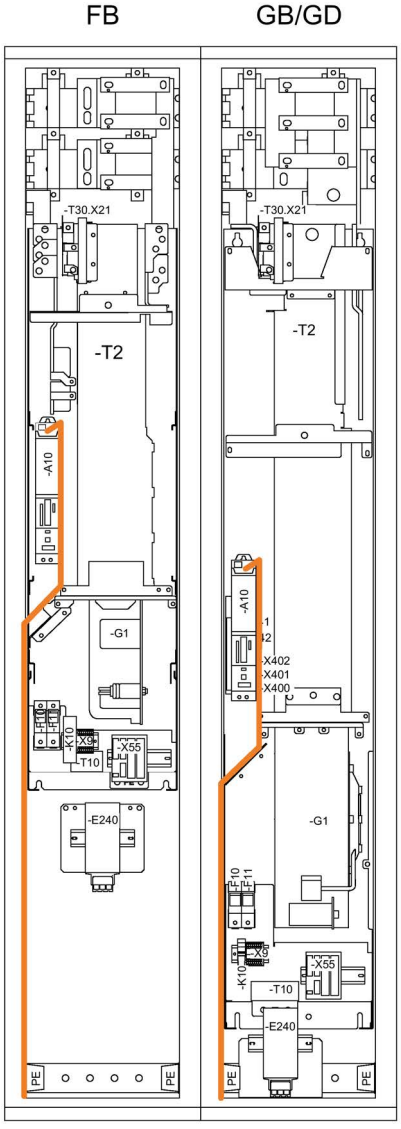
4.5.12.3 Cable routing for Basic Line Modules

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

Table 4- 15 Checklist for cabling or connection work for Basic Line Modules

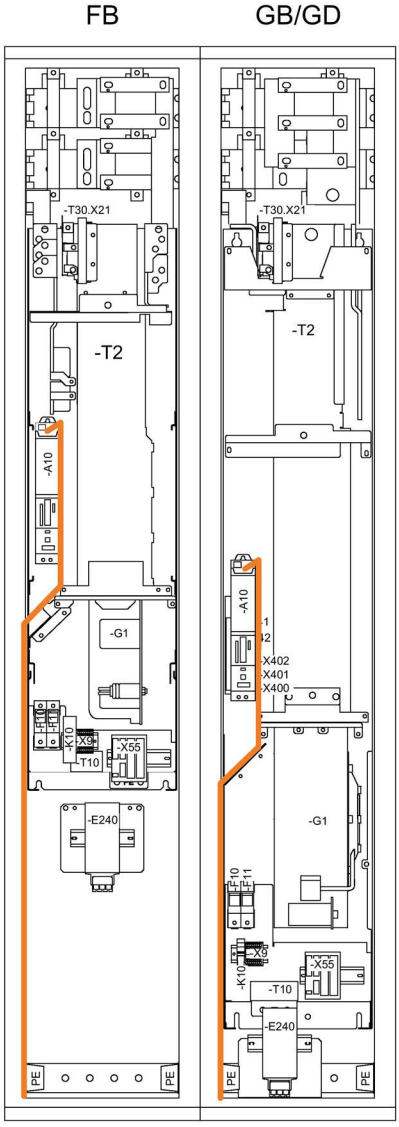
Cable routing	**Completed?**
PROFIBUS cable or PROFINET cable to the Control Unit	
DRIVE-CLiQ connections / signal cables to the Control Unit	
Signal cables to customer terminal strip -X55	
Note: The "Basic rules for cable routing" and "Preparatory steps" described above must be observed whenever any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

Cable routing for PROFIBUS or PROFINET connection to the Control Unit



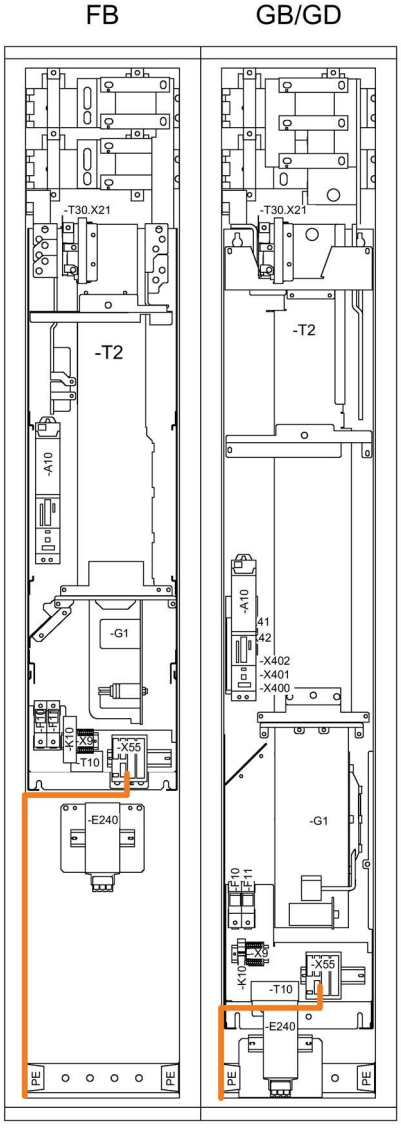
1. Feed the cable for the Control Unit into the cabinet from the bottom left.
2. Remove about 1.18 inch (3 cm) of the cable insulation at the level of the shield plate in the lower part of the cabinet and attach the cable there.
3. To secure the cable in accordance with EMC requirements, snap the clip onto the shield plate.
4. Use cable ties to secure the cable at suitable points.
5. Feed the cable toward the top of the cabinet and, when it reaches the level of the Control Unit, angle it to the right up to 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 toward the top of the cabinet and, when it reaches the level of the Control Unit, angle it to the right up to 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 the customer terminal strip -X55



1. Feed the cable for the customer terminal strip into the cabinet from the bottom left.
2. Remove about 1.18 inch (3 cm) of the cable insulation at the level of the shield plate in the lower part of the cabinet and attach the cable there.
3. To secure the cable in accordance with EMC requirements, snap the clip onto the shield plate.
4. Use cable ties to secure the cable at suitable points.
5. Feed the cable toward the top of the cabinet and, when it reaches the level of the customer terminal strip -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 strip -X55.

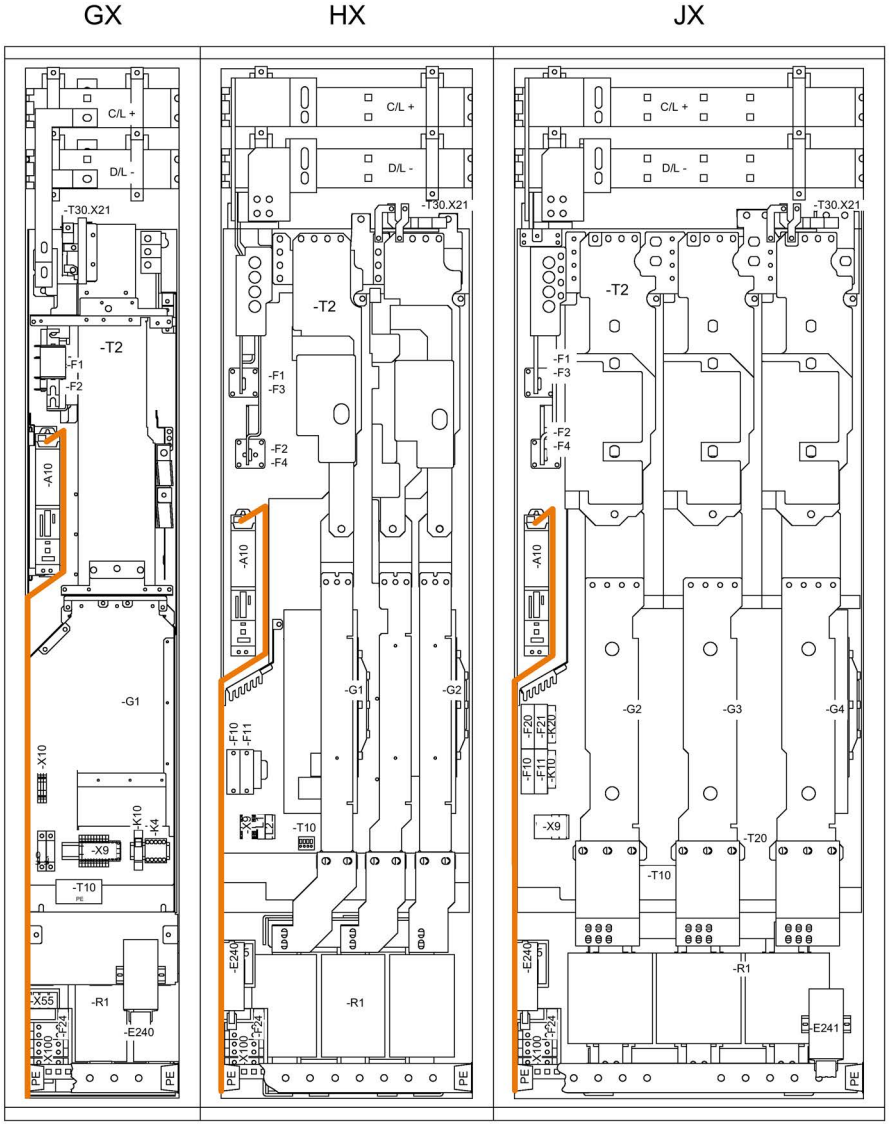
4.5.12.4 Cable routing for Smart Line Modules

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

Table 4- 16 Checklist for cabling or connection work for Smart Line Modules

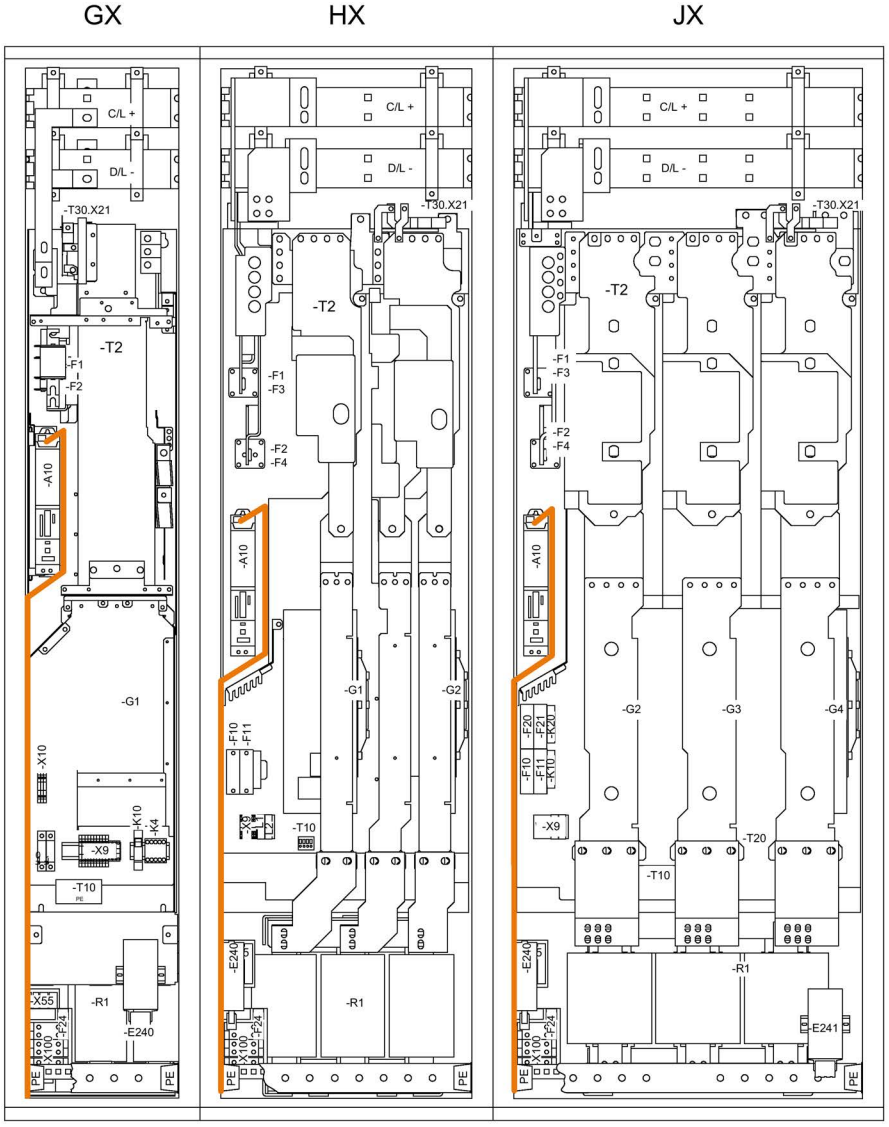
Cable routing	**Completed?**
PROFIBUS cable or PROFINET cable to the Control Unit	
DRIVE-CLiQ connections / signal cables to the Control Unit	
Signal cables to customer terminal strip -X55	
Note: The "Basic rules for cable routing" and "Preparatory steps" described above must be observed whenever any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

Cable routing for PROFIBUS or PROFINET connection to the Control Unit



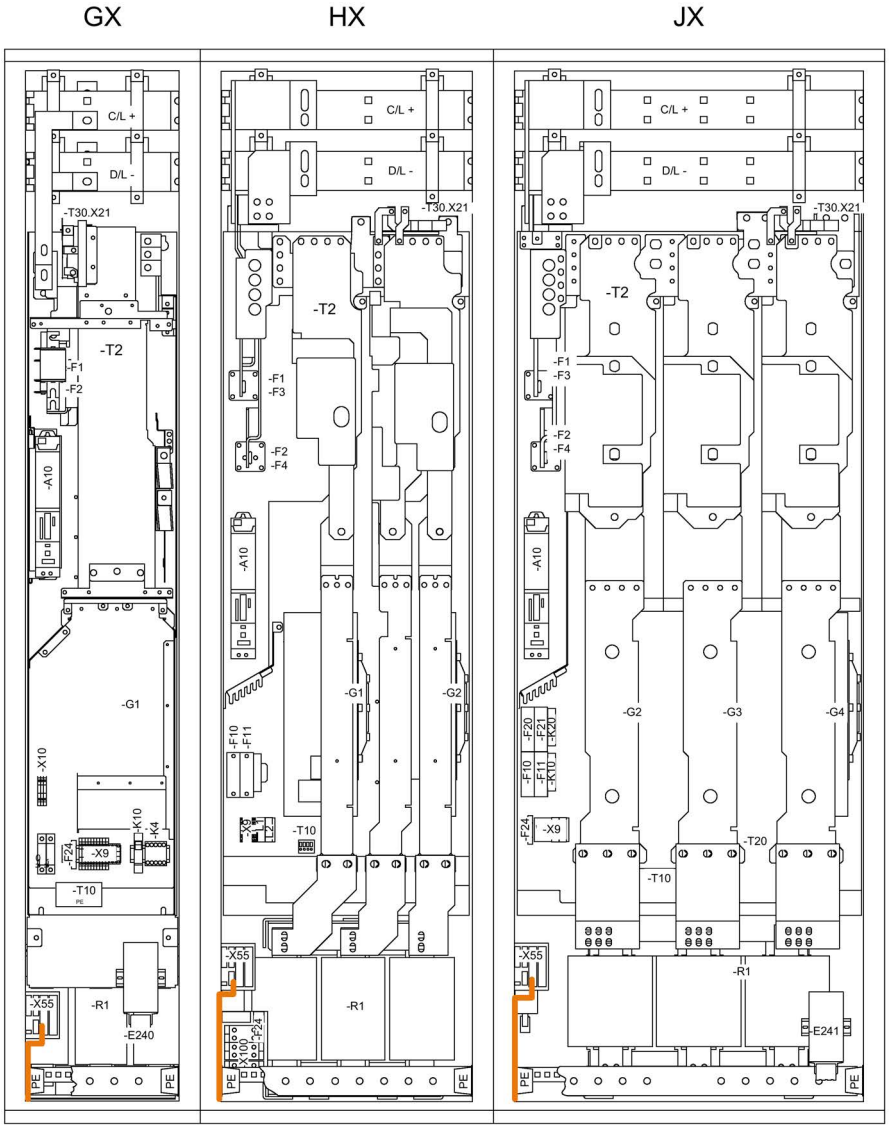
1. Feed the cable for the Control Unit into the cabinet from the bottom left.
2. Remove about 1.18 inch (3 cm) of the insulation at the level of the shield plate in the lower part of the cabinet and attach the cable there.
3. To secure the cable in accordance with EMC requirements, snap the clip onto the shield plate.
4. Use cable ties to secure the cable at suitable points.
5. Feed the cable toward the top of the cabinet and, when it reaches the level of the Control Unit, angle it to the right up to 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 toward the top of the cabinet and, when it reaches the level of the Control Unit, angle it to the right up to 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 the customer terminal strip -X55



1. Feed the cable for the customer terminal strip into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Feed the cable toward the top of the cabinet and, when it reaches the level of the customer terminal strip -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 strip -X55.

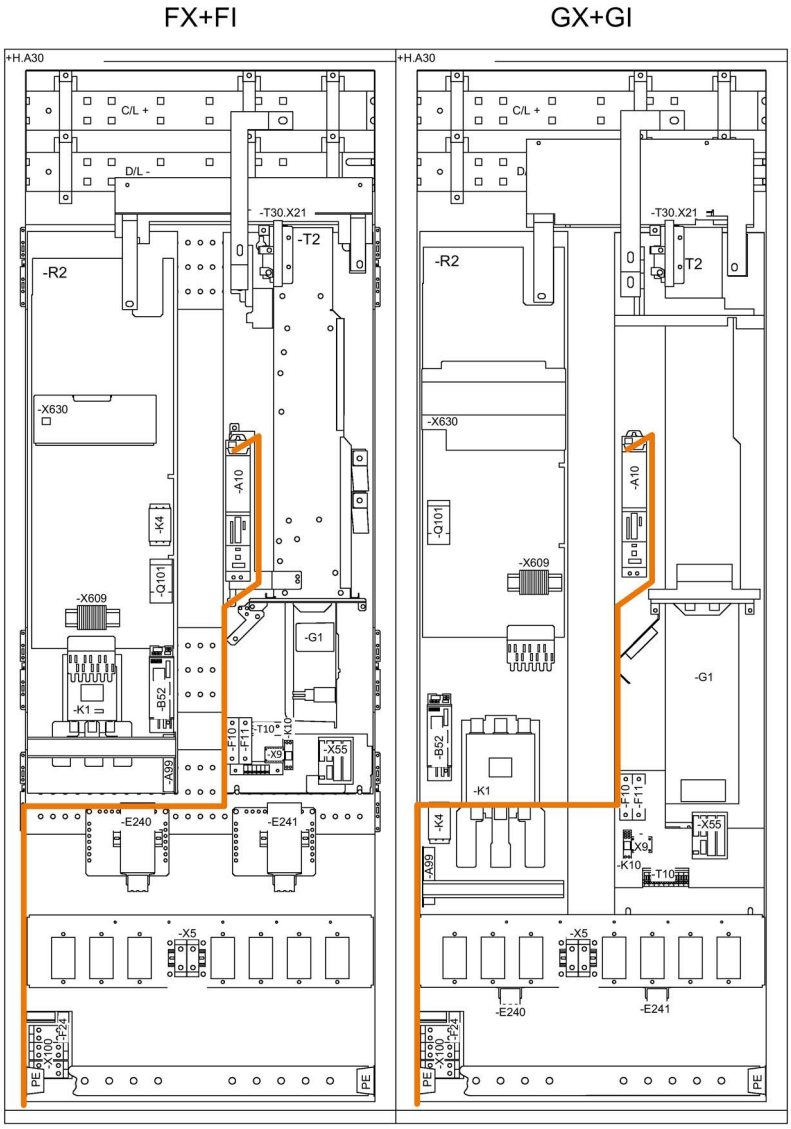
4.5.12.5 Cable routing for Active Line Modules

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

Table 4- 17 Checklist for cabling or connection work for Active Line Modules

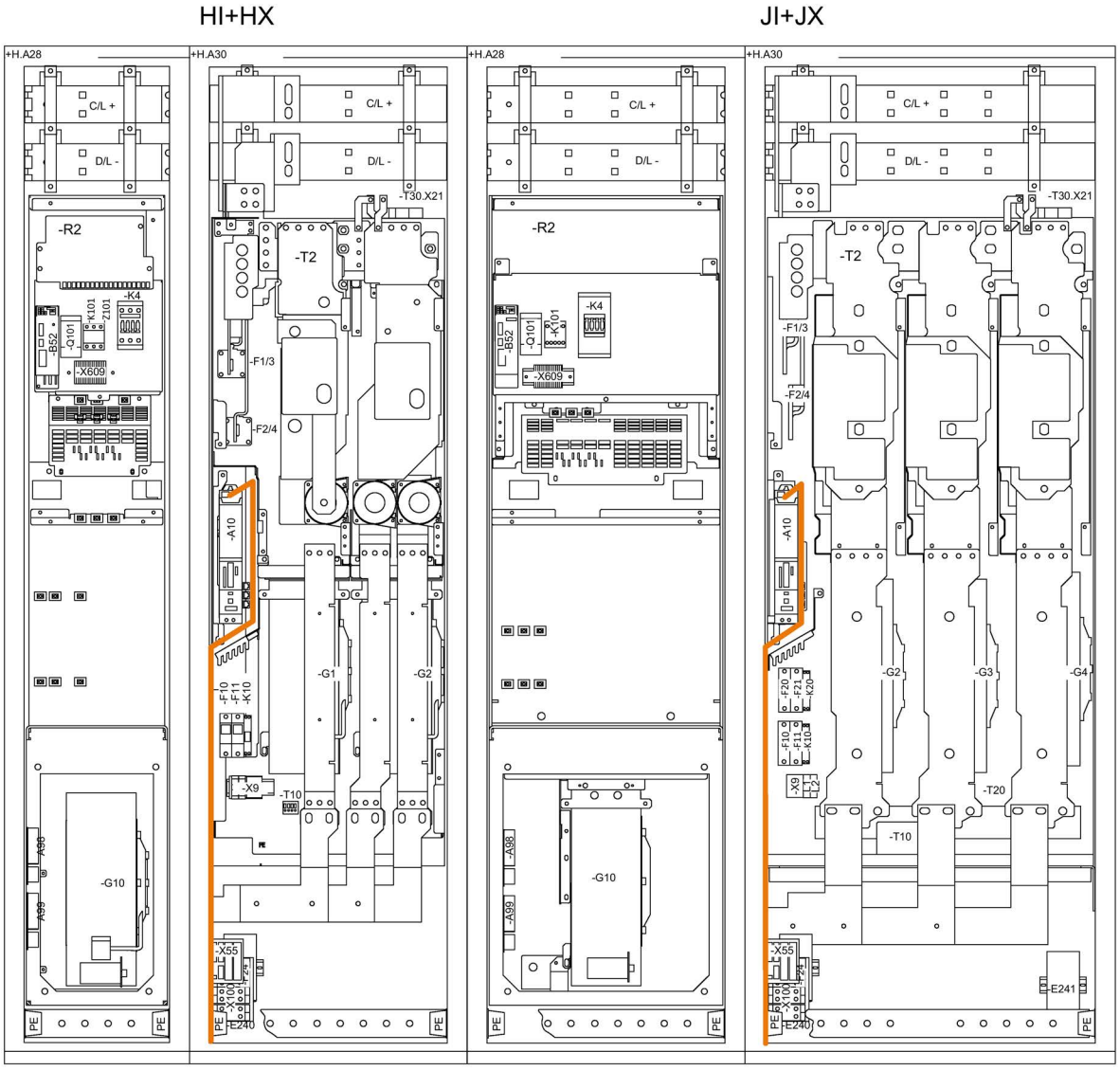
Cable routing	**Completed?**
PROFIBUS cable or PROFINET cable to the Control Unit	
DRIVE-CLiQ connections / signal cables to the Control Unit	
Signal cables to customer terminal strip -X55	
Note: The "Basic rules for cable routing" and "Preparatory steps" described above must be observed whenever any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

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



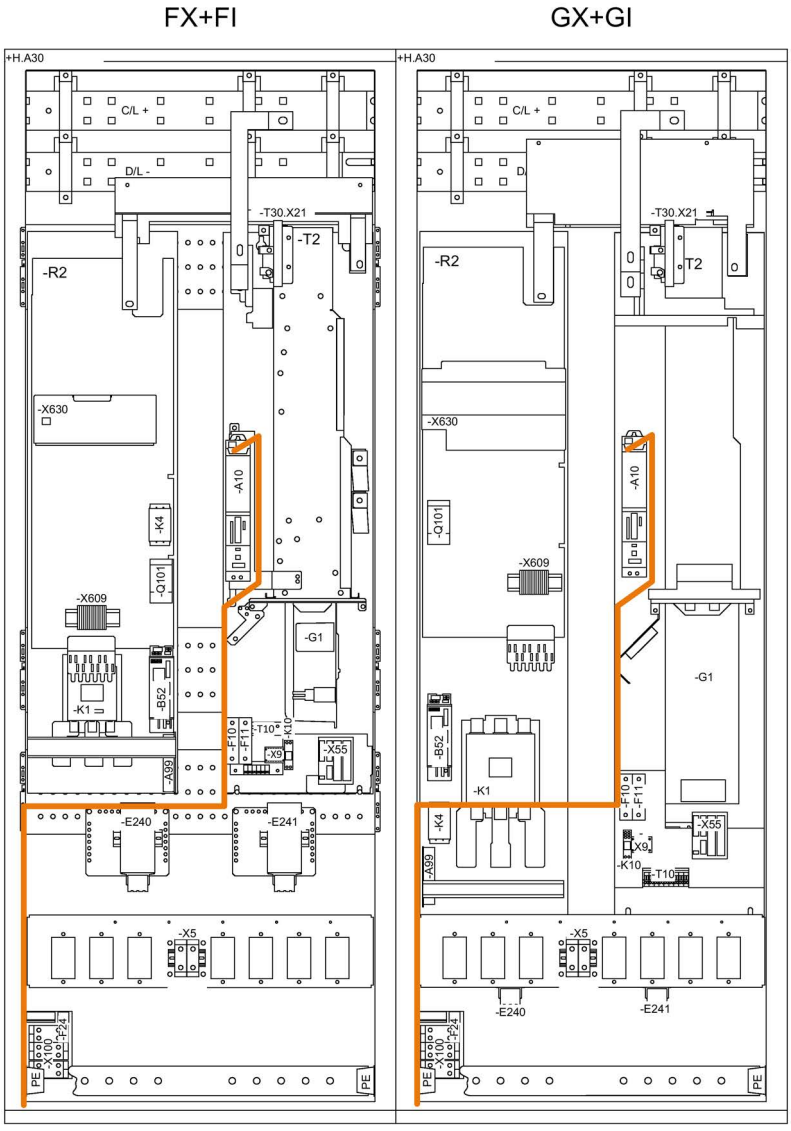
1. Feed the cable for the Control Unit into the cabinet from the bottom left.
2. Remove about 1.18 inch (3 cm) of the insulation at the level of the shield plate in the lower part of the cabinet and attach the cable there.
3. To secure the cable in accordance with EMC requirements, snap the clip onto the shield plate.
4. Use cable ties to secure the cable at suitable points.
5. Feed the cable toward the top of the cabinet and, when it reaches the level of the Control Unit, angle it to the right up to 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



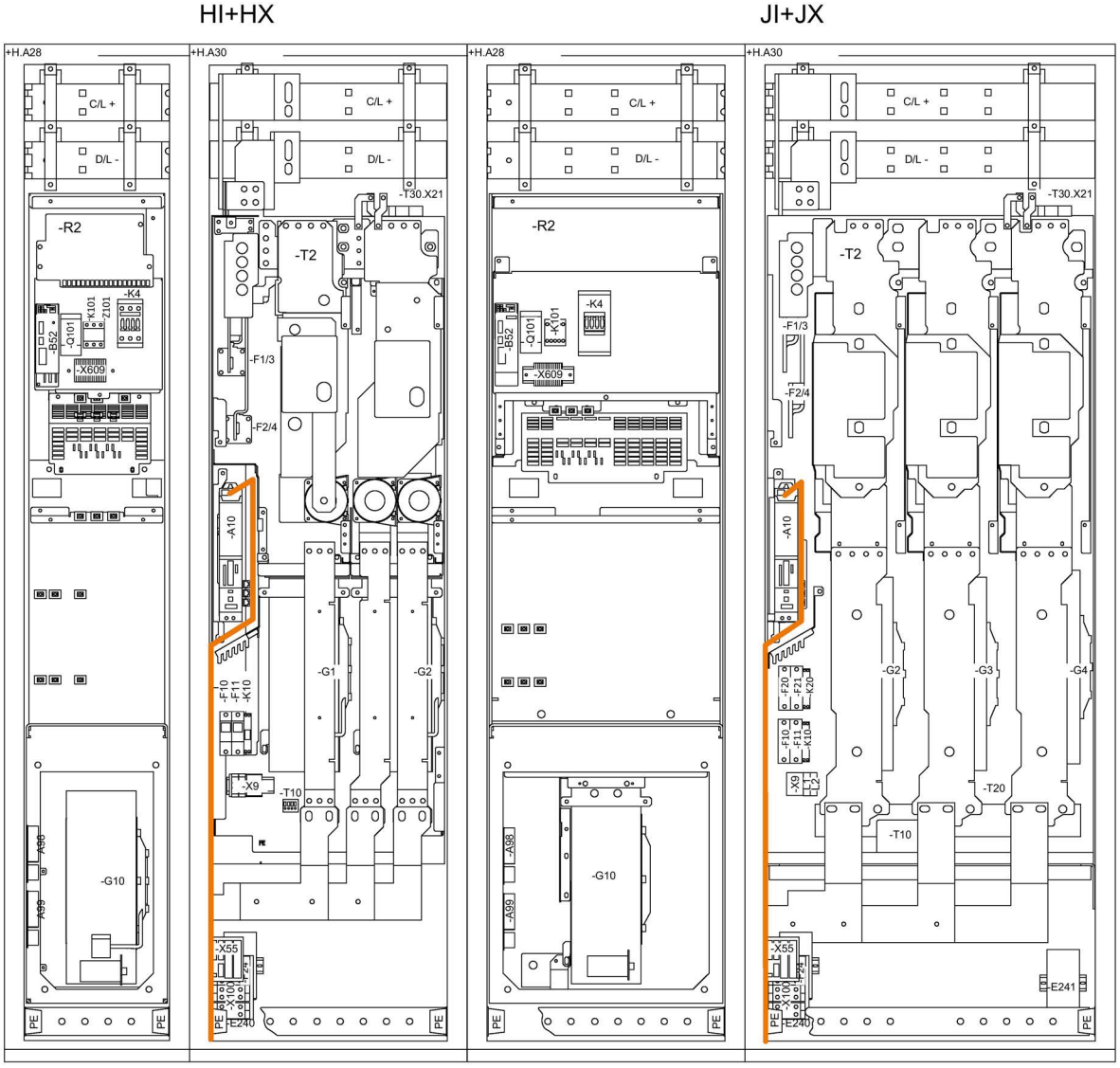
1. Feed the cable for the Control Unit into the cabinet from the bottom left.
2. Remove about 1.18 inch (3 cm) of the insulation at the level of the shield plate in the lower part of the cabinet and attach the cable there.
3. To secure the cable in accordance with EMC requirements, snap the clip onto the shield plate.
4. Use cable ties to secure the cable at suitable points.
5. Feed the cable toward the top of the cabinet and, when it reaches the level of the Control Unit, angle it to the right up to 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



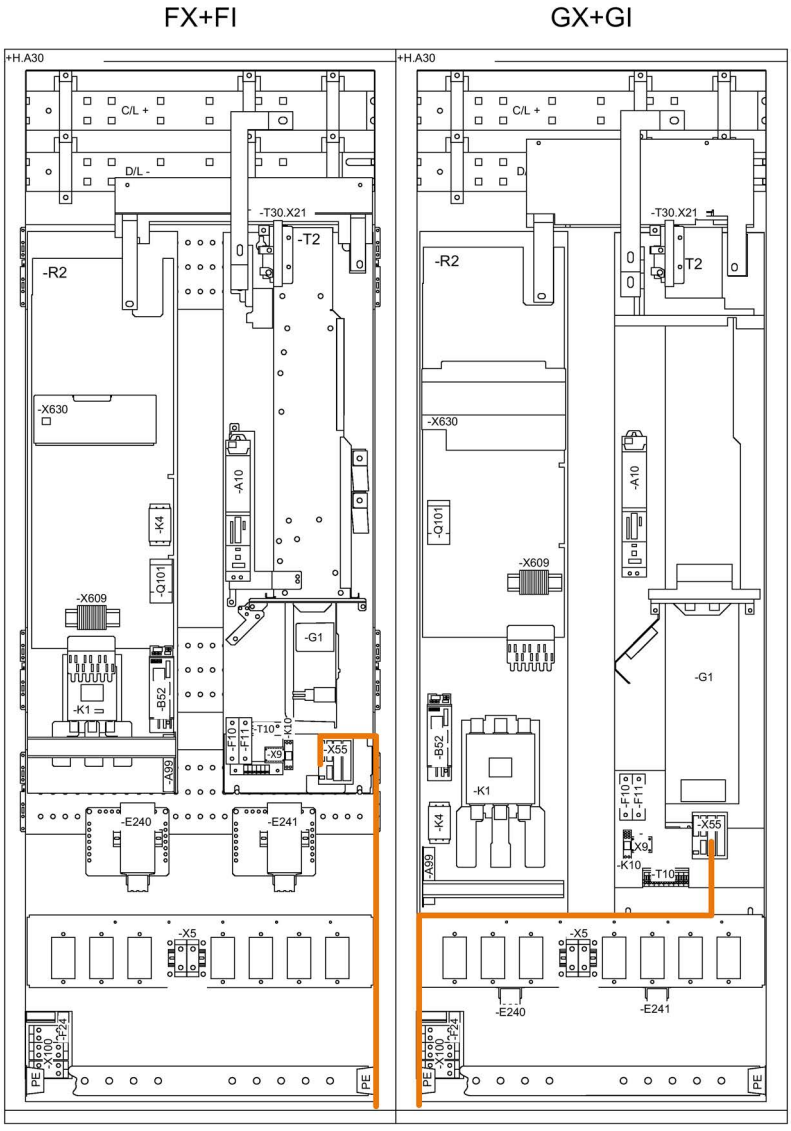
1. Feed the cable for the DRIVE-CLiQ/signal cables into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Feed the cable toward the top of the cabinet and, when it reaches the level of the Control Unit, angle it to the right up to the Control Unit. When doing 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



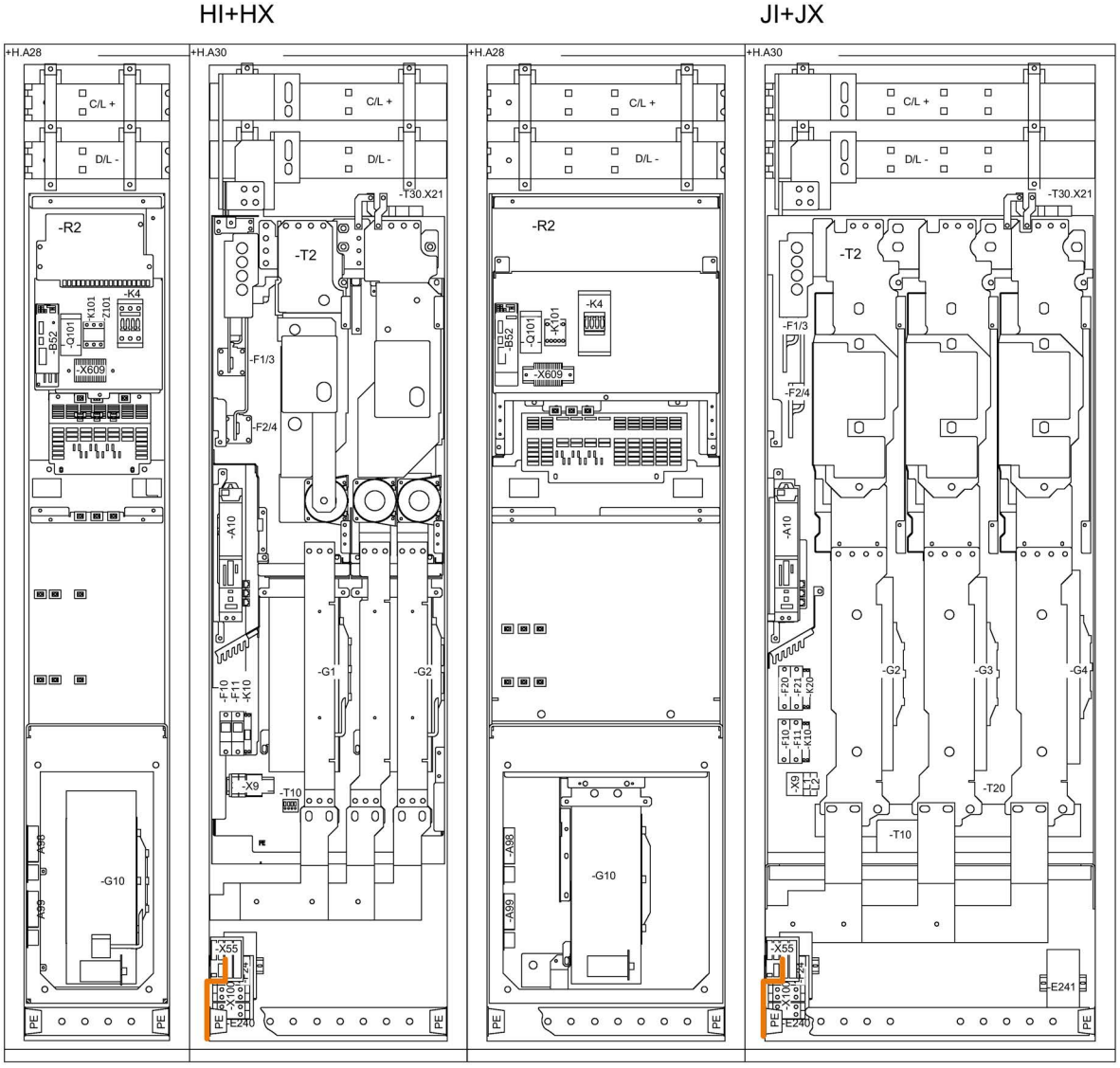
1. Feed the cable for the DRIVE-CLiQ/signal cables into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Feed the cable toward the top of the cabinet and, when it reaches the level of the Control Unit, angle it to the right up to the Control Unit. When doing 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 strip 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. Feed the cable toward the top of the cabinet and, when it reaches the level of the customer terminal strip -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 strip -X55.

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



1. Feed the cable for the customer terminal strip into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Feed the cable toward the top of the cabinet and, when it reaches the level of the customer terminal strip -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 strip -X55.

4.5.12.6 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 Modules in chassis format. (→ See the Section titled "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.

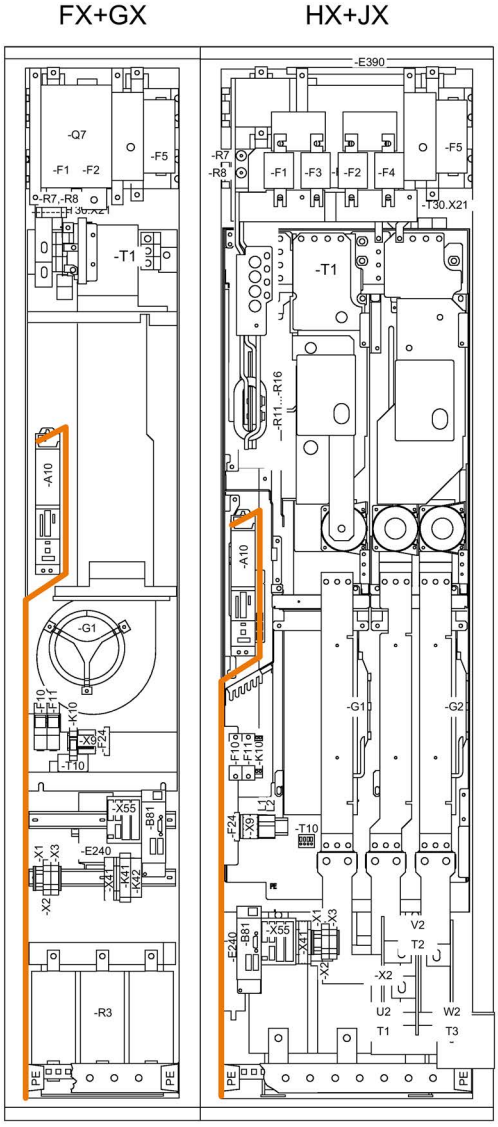
4.5.12.7 Cable routing for Motor Modules in the chassis format

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

Table 4- 18 Checklist for cabling or connection work for Motor Modules in chassis format

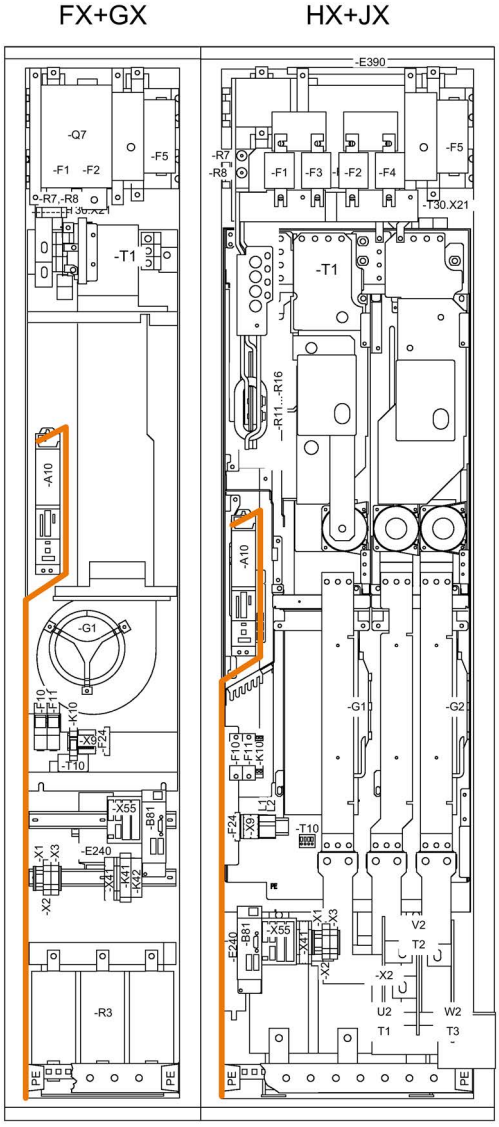
Cable routing	Completed?
PROFIBUS cable or PROFINET cable to the Control Unit	
DRIVE-CLiQ connections / signal cables to the Control Unit	
Signal cables to customer terminal strip -X55	
Option K82, Terminal Module for controlling safety functions "Safe Torque Off" and "Safe Stop 1"	
Option K87, Terminal Module TM54F	
Option K88, Safe Brake Adapter SBA 230 V AC	
Signal cables to Sensor Module SMC10/20/30 (-B81/-B82/-B83)	
Cable connection between motor and Motor Module	
Note: The "Basic rules for cable routing" and "Preparatory steps" described above must be observed whenever any cabling or connection work is performed.	

Cable routing for PROFIBUS or PROFINET connection to the Control Unit



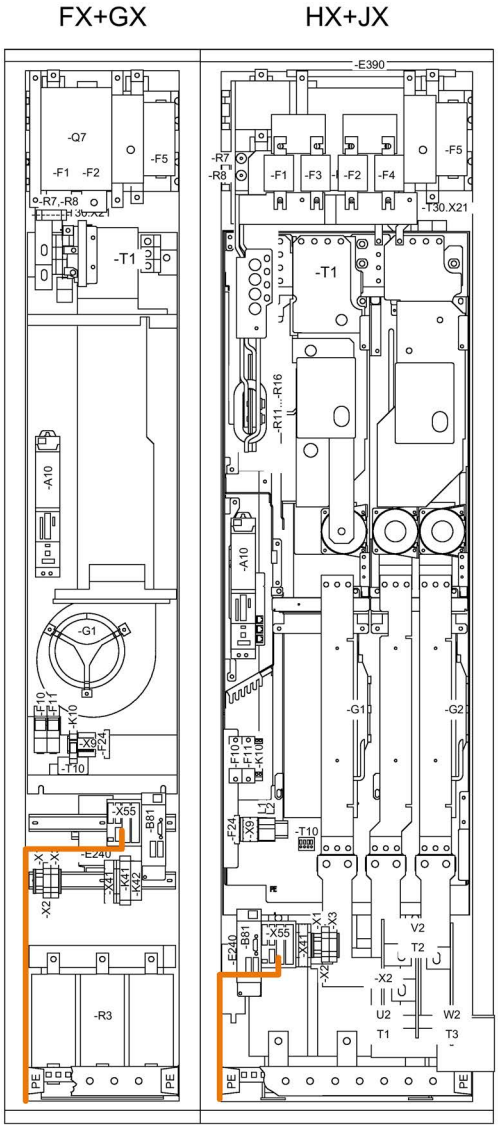
1. Feed the cable for the Control Unit into the cabinet from the bottom left.
2. Remove about 1.18 inch (3 cm) of the insulation at the level of the shield plate in the lower part of the cabinet and attach the cable there.
3. To secure the cable in accordance with EMC requirements, snap the clip onto the shield plate.
4. Use cable ties to secure the cable at suitable points.
5. Feed the cable toward the top of the cabinet and, when it reaches the level of the Control Unit, angle it to the right up to 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 toward the top of the cabinet and, when it reaches the level of the Control Unit, angle it to the right up to 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 for signal cables to the customer terminal strip –X55



1. Feed the cable for the customer terminal strip into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Feed the cable toward the top of the cabinet and, when it reaches the level of the customer terminal strip -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 strip -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 strip -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

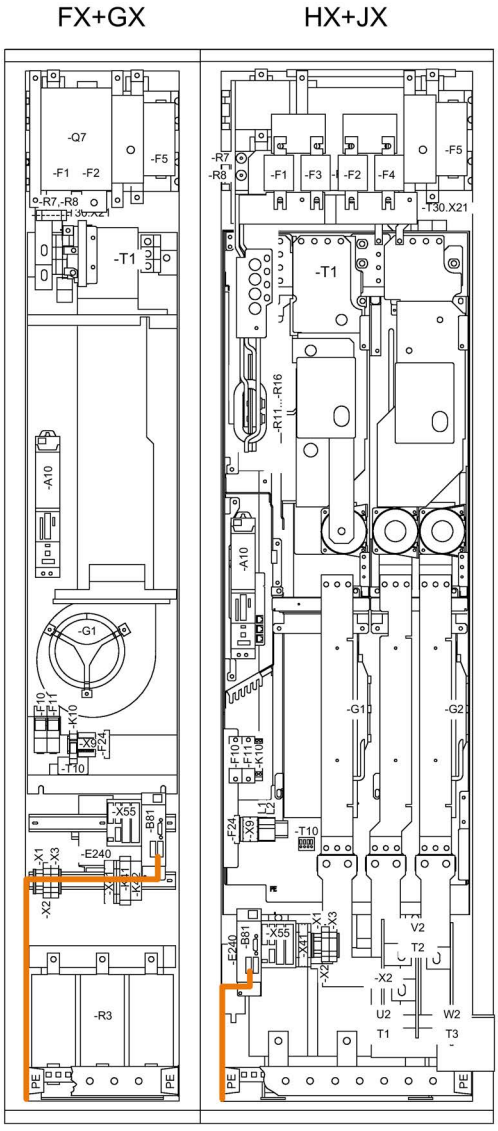
Note
Cable routing

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

Connect the cable to the terminals to control the functions.

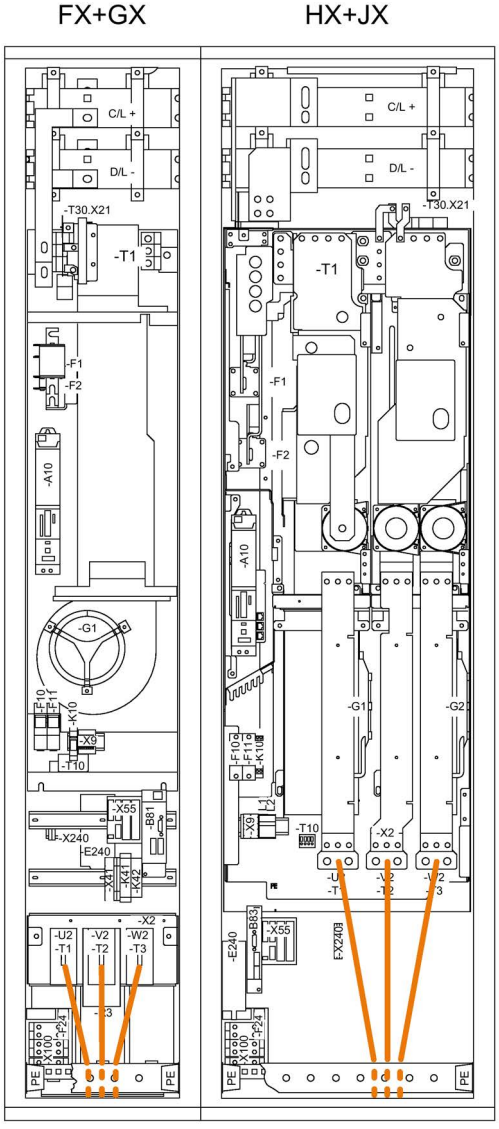
(→ See Chapter "Options", Section "K87, Terminal Module TM54F")

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



1. Feed the cable for the customer terminal strip into the cabinet from the bottom left.
2. Remove about 1.18 inch (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 SMC 10, 20 or 30))

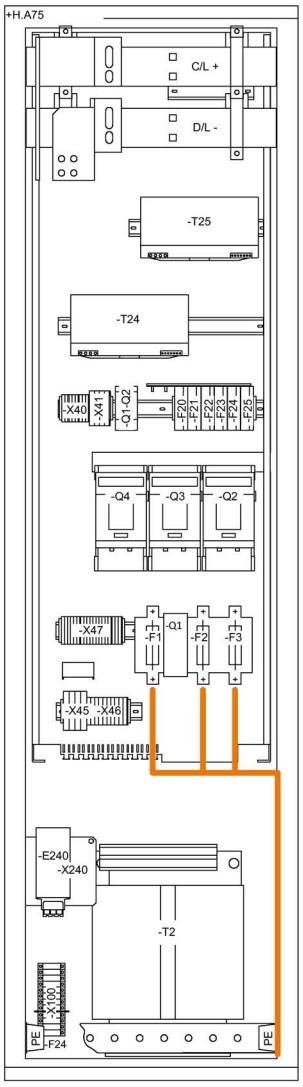
Cable routing for motor connection



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.

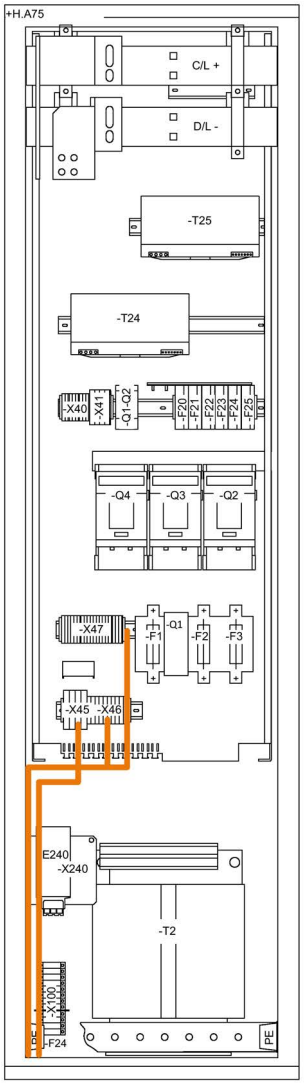
4.5.12.8 Cable routing for Auxiliary Power Supply Modules

Cable routing for connection 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 strips -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 strips, 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 provided in the layout diagrams (AO) and circuit diagrams (SP), which are included in the individual device documentation.



Figure 5-1 Line Connection Module

Power is fed to the drive assembly 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 systems (IT). The Line Modules are connected to the incoming 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 include the line-side infeed via main switch or circuit breaker and provide the connection between the plant line supply and the Line Modules.

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

Input voltage	Rated infeed/regenerative feedback current
3 AC 380 ... 480 V	250 ... 3000 A
3 AC 500 ... 690 V	280 ... 3000 A

Table 5- 1 X1 terminals for the line supply

Terminals	Technical data
U1/L1, V1/L2, W1/L3 3 AC power input	Voltage: 3 AC 380 V –10 % ... 3 AC 480 V +10 % (-15 % < 1 min) 3 AC 500 V –10 % ... 3 AC 690 V +10 % (-15 % < 1 min) Frequency: 47 ... 63 Hz

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

- ≤ 800 A: Main switch
- > 800 A: Circuit breaker, type 3WL, with option L25 as circuit breaker with overcurrent release (3VL) and series-connected fuses

Configuration

Note

Additional information

The configuration examples of the individual Line Connection Modules are used to 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 specified in the layout diagrams (AO) provided in the individual device documentation.

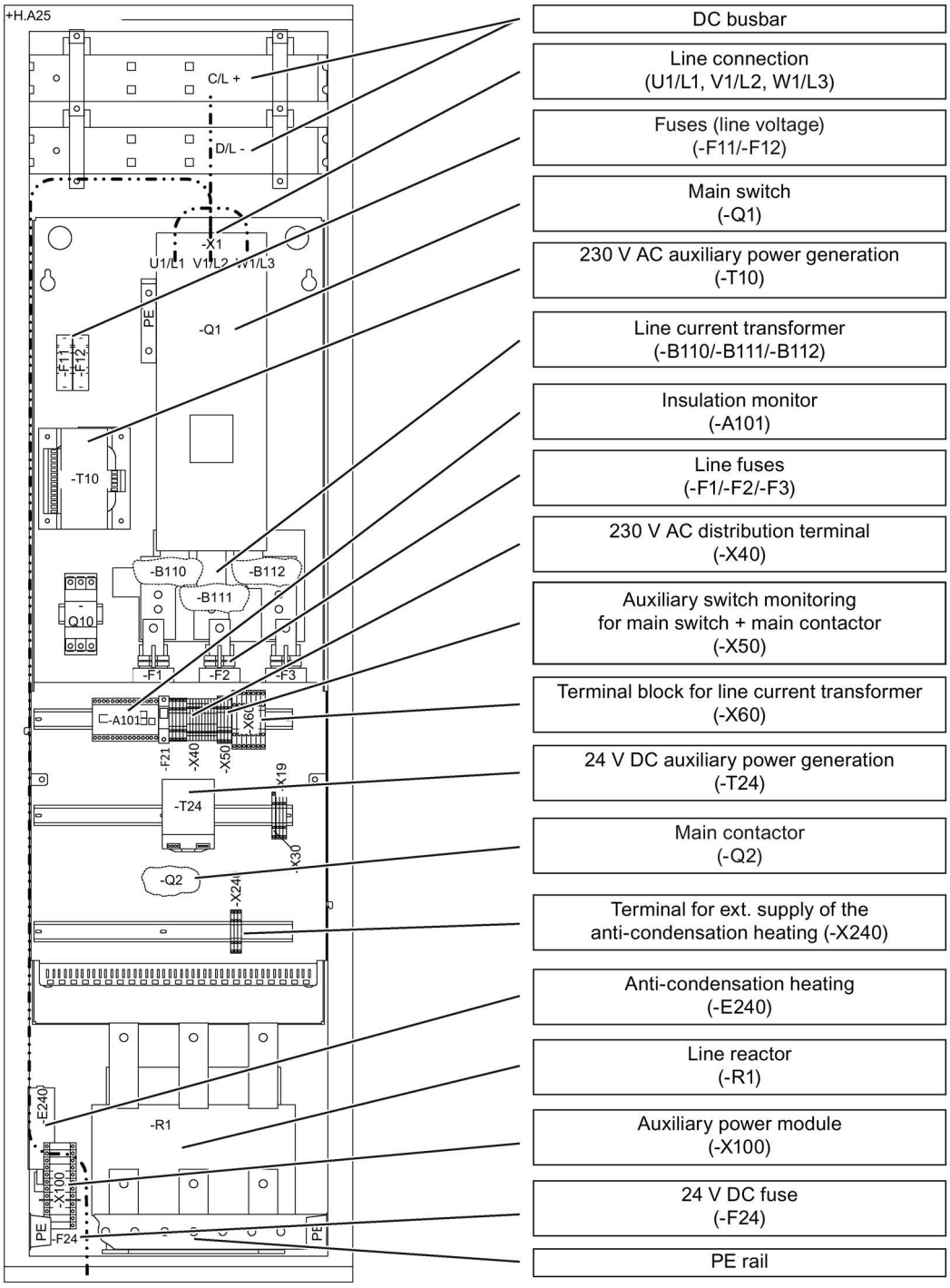


Figure 5-2 Configuration example for Line Connection Module (frame size GL)

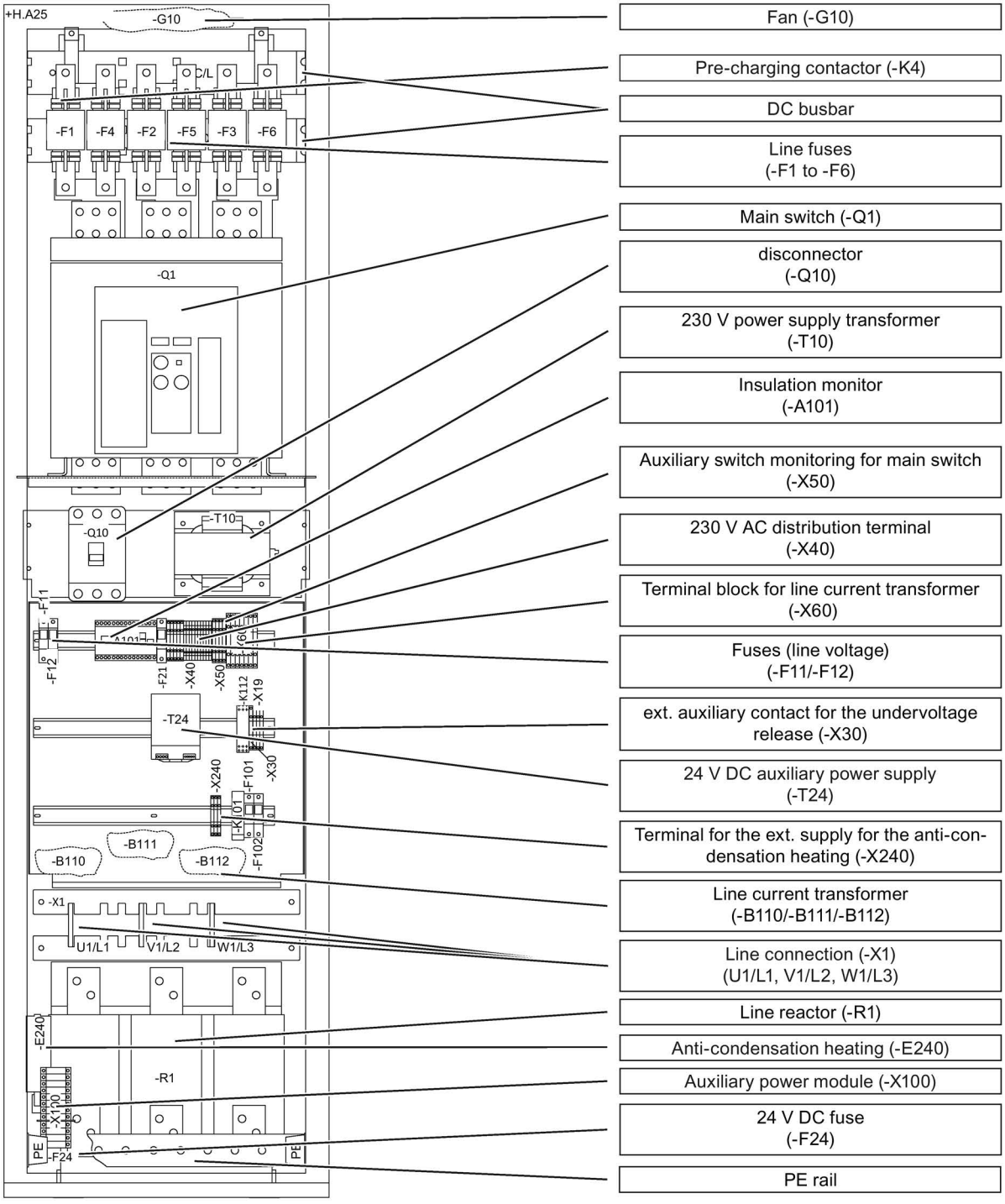


Figure 5-3 Configuration example for Line Connection Modules (frame size JL)

5.1.1.1 Main switch (input current ≤ 800 A)

Up to 800 A, a main switch is installed.

X50 "main switch" checkback contact

Table 5- 2 Terminal block X50 "main switch" checkback contact

Terminal	Designation [1)]	Technical specifications
1	NO	"Main switch checkback contacts Max. load current: 3 A Max. switching voltage: 250 V AC
2	NC	
3	COM	
Max. connectable cross-section #14 AWG (2.5 mm²)		

[1)] NC: normally-closed contact, NO: normally-open contact, COM: mid-position contact

5.1.1.2 Circuit breaker (input current > 800 A)

For currents greater than 800 A, the circuit breaker, which is located in the center of the cabinet, has the function of isolating the system from the line supply and 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.

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

Table 5- 3 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: Instantaneous 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-						
0LE41-3AU3	1TE41-2AU3	1010 A	0.9	10	OFF	0.08	2
0LE41-6AU3	1TE41-5AU3	1265 A	0.8	10	OFF	0.08	2
0LE42-0AU3	1TE41-8AU3	1630 A	0.9	10	OFF	0.08	2
0LE42-0BU3	1TE41-2xU3	2x 935 A	1	10	OFF	0.08	2
0LE42-5BU3	1TE41-5xU3	2x 1170 A	1	10	OFF	0.08	2
0LE43-2BU3	1TE41-8xU3	2x 1508 A	1	10	OFF	0.08	2
0LG41-0AU3	1TG41-1AU3	925 A	1	10	OFF	0.08	2
0LG41-3AU3	1TG41-4AU3	1180 A	1	10	OFF	0.08	2
0LG41-6AU3	1TG41-8AU3	1580 A	1	10	OFF	0.08	2
0LG42-0BU3	1TG41-1xU3	2 x 855 A	0.9	10	OFF	0.08	2
0LG42-5BU3	1TG41-4xU3	2 x 1092 A	0.9	10	OFF	0.08	2
0LG43-2BU3	1TG41-8xU3	2 x 1462 A	1	10	OFF	0.08	2

Table 5- 4 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: Instantaneous 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-						
0LE41-0AU3	6TE41-1AU3	883 A	0.9	10	OFF	0.08	2
0LE41-3AU3	6TE41-3AU3	1093 A	0.9	10	OFF	0.08	2
0LE41-6AU3	6TE41-7AU3	1430 A	0.9	10	OFF	0.08	2
0LE42-0BU3	6TE41-1xU3	2 x 817 A	0.9	10	OFF	0.08	2
0LE42-5BU3	6TE41-3xU3	2 x 1011 A	0.9	10	OFF	0.08	2
0LE43-2BU3	6TE41-7xU3	2 x 1323 A	0.9	10	OFF	0.08	2
0LG41-3AU3	6TG41-2AU3	1009 A	0.9	10	OFF	0.08	2
0LG41-6AU3	6TG41-7AU3	1430 A	0.9	10	OFF	0.08	2
0LG42-0BU3	6TG38-8xU3	2 x 700 A	0.8	10	OFF	0.08	2
0LG42-0BU3	6TG41-2xU3	2 x 934 A	1	10	OFF	0.08	2
0LG43-2BU3	6TG41-7xU3	2 x 1323 A	0.9	10	OFF	0.08	2

Table 5- 5 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: Instantaneous 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-						
0LE41-0AU3	7TE38-4AU3	840 A	0.9	10	OFF	0.08	2
0LE41-3AU3	7TE41-0AU3	985 A	0.8	10	OFF	0.08	2
0LE41-6AU3	7TE41-4AU3	1405 A	0.9	10	OFF	0.08	2
0LE42-0BU3	7TE41-0xU3	2 x 936 A	1	10	OFF	0.08	2
0LE43-2BU3	7TE41-4xU3	2 x 1335 A	0.9	10	OFF	0.08	2
0LG41-3AU3	7TG41-0AU3	1025 A	0.9	10	OFF	0.08	2
0LG41-6AU3	7TG41-3AU3	1270 A	0.8	10	OFF	0.08	2
0LG42-0BU3	7TG37-4xU3	2 x 698 A	0.7	10	OFF	0.08	2
0LG42-0BU3	7TG41-0xU3	2 x 974 A	1	10	OFF	0.08	2
0LG42-5BU3	7TG41-3xU3	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

A detailed description of the complete principle of operation of the circuit breaker and how it is handled, as well as options integrated in the factory and/or additional options are given in the associated operating instructions, which are included in the device documentation provided.

X50 "circuit breaker" checkback contact

Table 5- 6 Terminal block X50 "Circuit breaker" checkback contact

Terminal	Designation [1]	Technical data
1	NO	"Circuit breaker" checkback contacts
2	NC	Max. load current: 3 A
3	COM	Max. switching voltage: 250 V AC
Max. connectable cross-section #14 AWG (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- 7 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 #14 AWG (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- 8 Terminal block X40 external 230 V AC auxiliary infeed

Terminal	Designation	Technical specifications
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 V AC 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 V AC auxiliary infeed: N
Max. connectable cross-section #14 AWG (2.5 mm²)		

5.1.2 Versions of Line Connection Modules

Different versions to suit specific input currents are available:

- Devices ≤ 800 A are equipped with a main switch
- 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

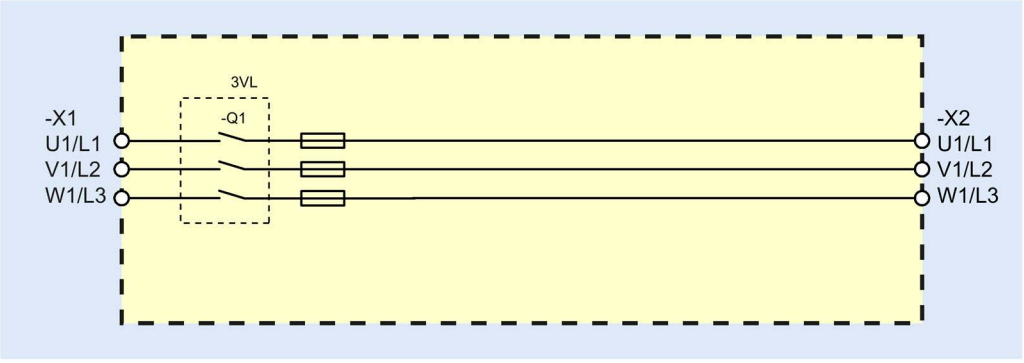


Figure 5-4 Connection example: Line Connection Module ≤800 A for connection to Active Line Modules, option L42

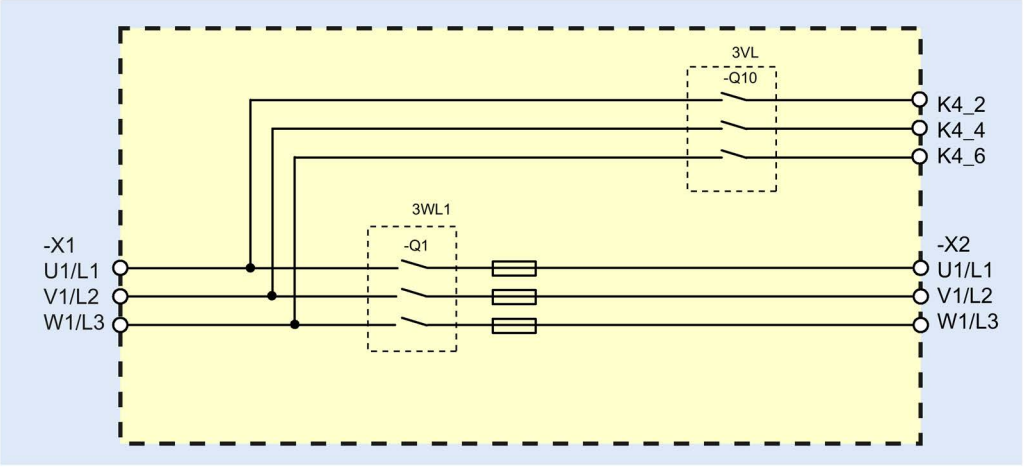


Figure 5-5 Connection example: Line Connection Module >800 A for connection to Active Line Modules, option L42

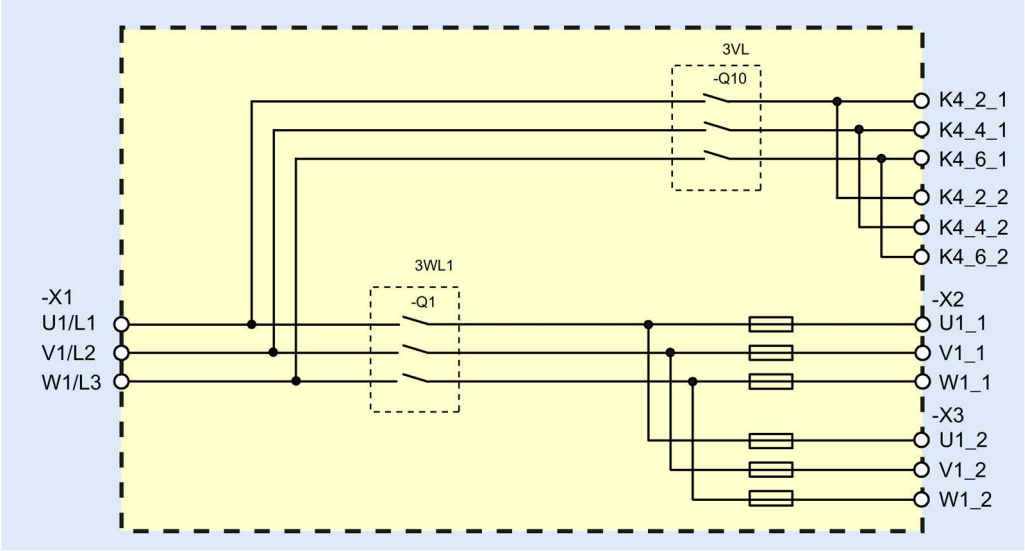


Figure 5-6 Connection example: Line Connection Module ≥2000 A for connection to Active Line Modules in parallel connection, option L42

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.

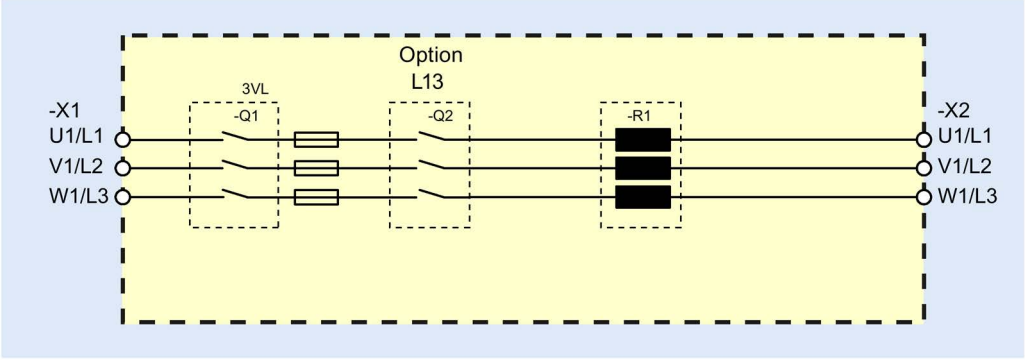


Figure 5-7 Connection example: Line Connection Module ≤ 800 A for connection to Basic Line Modules, options: L43, L13

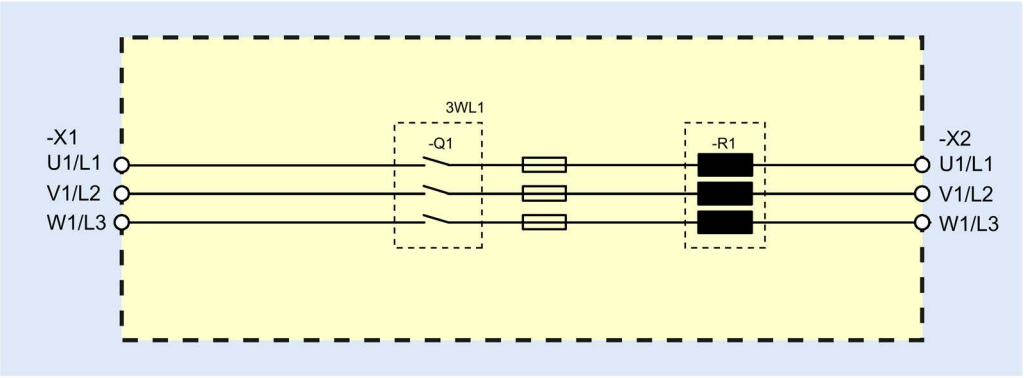


Figure 5-8 Connection example: Line Connection Module >800 A, <1800 A for connection to Basic Line Modules, option L43

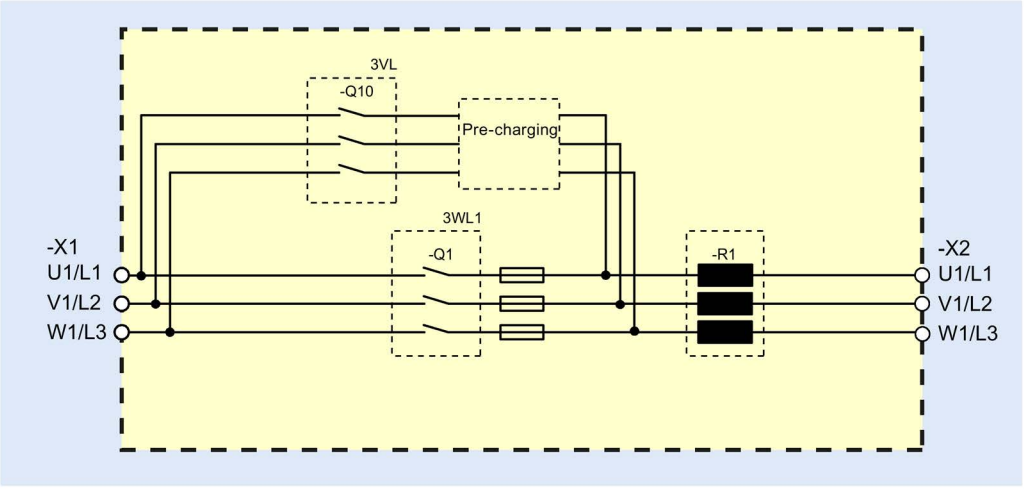


Figure 5-9 Connection example: Line Connection Module >1800 A, <2000 A for connection to Basic Line Modules, option L43

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.

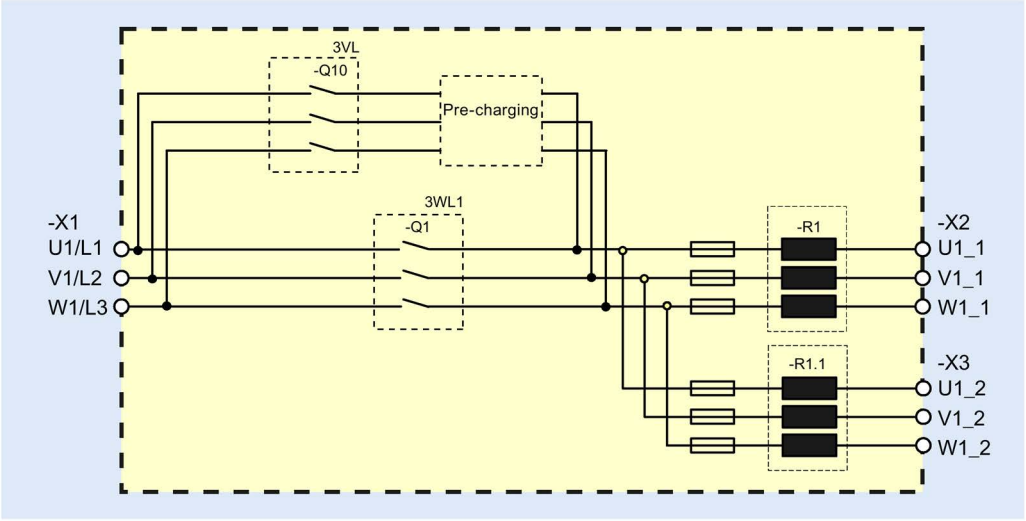


Figure 5-10 Connection example: Line Connection Module ≥2000 A for connection to Basic Line Modules in parallel connection, option L43

5.1.2.3 Version L44 for Smart Line Modules

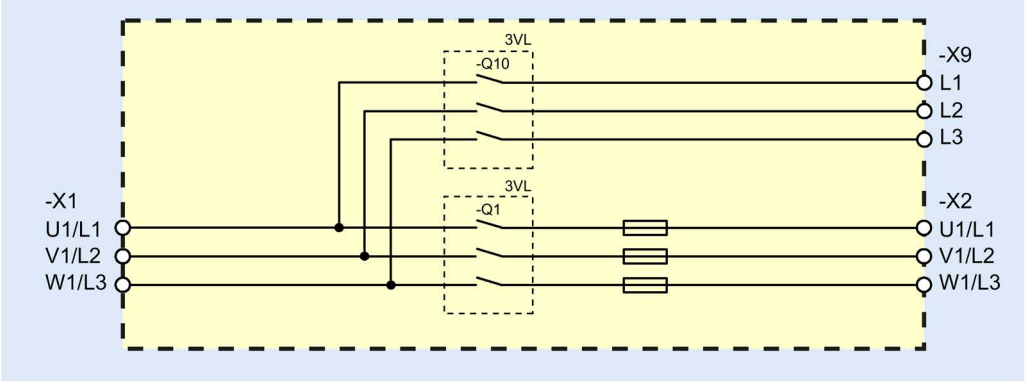


Figure 5-11 Connection example: Line Connection Module ≤800 A for connection to Smart Line Modules, option L44

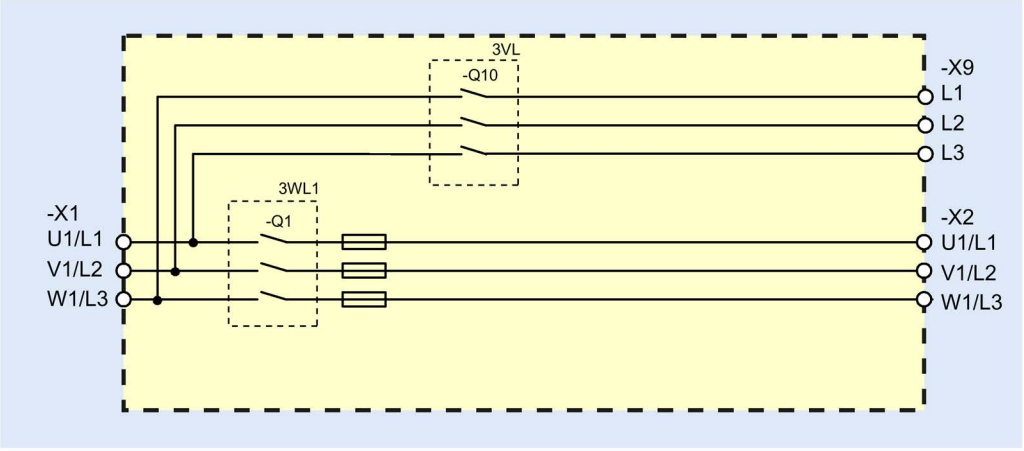


Figure 5-12 Connection example: Line Connection Module >800 A for connection to Smart Line Modules, option L44

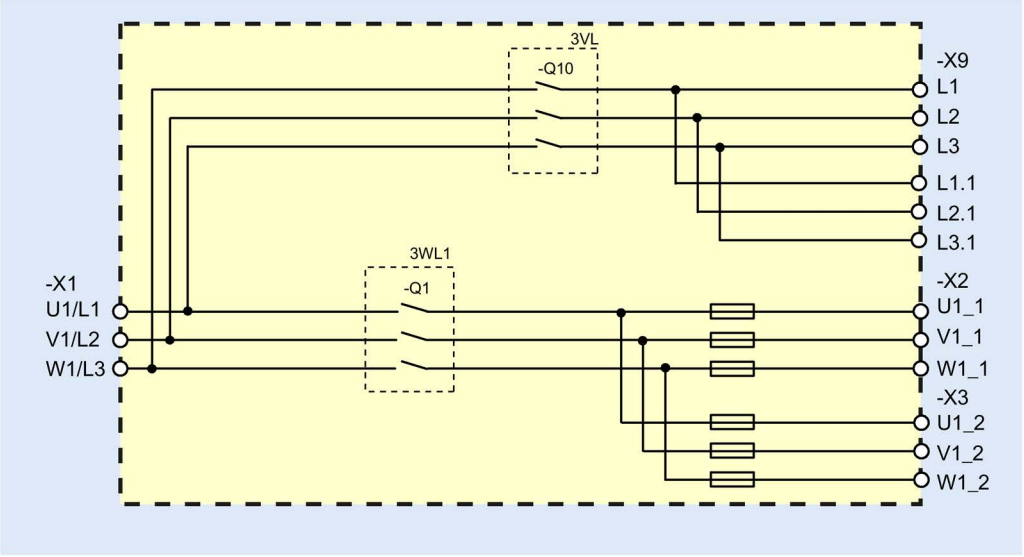


Figure 5-13 Connection example: Line Connection Module >1600 A for connection to Smart Line Modules in parallel connection, option L44

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 voltage supply	K70
Auxiliary power generation in the Line Connection Module	K76
Main contactor (for Line Connection Modules ≤800 A)	L13
Line reactor not included in product package (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
Cabinet light with service socket	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 (plinth), 4" (100 mm) high, RAL 9005	M06
Cable marshalling compartment 8" (200 mm) high, RAL 7035	M07
Degree of protection IP21	M21
Degree of protection IP23 (NEMA1 filtered)	M23
Side panel, mounted on the left	M27
Degree of protection IP43	M43
Degree of protection IP54 (NEMA12 ventilated)	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 aid (top-mounted)	M90
Special paint finish for cabinet	Y09
Factory assembly into transport units	Y11

Other options

Component	Option
Marking of all control cable conductor ends	M91
Rating plate data in English / French	T58
Rating plate data in English / Spanish	T60
Rating plate data in English / Italian	T80
Rating plate data in English / Russian	T85
Rating plate in English / Chinese	T91
UL listing per UL 508A	U90
cUL listing for Canada per UL 508A	U91
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 specifications

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

Article No.	**6SL3700-**	**0LE32-5AU3**	**0LE34-0AU3**	**0LE36-3AU3**	**0LE38-0AU3**	**0LE41-0AU3**
Infeed/regenerative feedback current - Rated current $I_{N\,E}$	 A	 250	 380	 600	 770	 1000
Supply voltages - Line voltage - Line frequency	 V_{ACrms} Hz	380 3 AC -10% ... 480 3 AC +10% (-15% < 1 min) 47 ... 63 Hz				
230 V AC current consumption [1] - Inrush current - Holding current	 A A	 3.6 0.04	 3.6 0.04	 3.6 0.04	 10.8 0.12	 0.5 0.06
Power loss, max. [2] **at 50 Hz 400 V** - Option L42/L44 - Option L43 **at 60 Hz 460 V** - Option L42/L44 - Option L43	 kW kW kW kW	 0.115 -- 0.115 --	 0.19 -- 0.19 --	 0.31 0.675 0.31 0.675	 0.39 0.74 0.39 0.74	 0.18 -- 0.18 --
Fan - 230 V AC current demand - Cooling air requirement - Sound pressure level L_{PA} (1 m) with 50/60 Hz	 A cfm m^3/s dB(A)	 -- -- --	 -- -- -- --	 -- -- -- --	 -- -- -- --	 1.07 763 0.36 68/70
Line connection L1, L2, L3 - Max. conductor cross-section (IEC) - Max. conductor cross-section (NEC, CEC)	 mm^2 AWG/MCM	[4] [5] 2 x 120 2 x 250	[4] [5] 2 x 120 2 x 250	[4] [6] 2 x 300 2 x 600	[4] [6] 3 x 240 3 x 500	10/M12 8 x 240 8 x 500
PE/GND connection - Busbar cross-section - Max. conductor cross-section (IEC) - Max. conductor cross-section (NEC, CEC)	 mm^2 mm^2 AWG/MCM	PE busbar 600 240 500				
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - Width - Height [3] - Depth - Width - Height [3] - Depth	 inch inch inch mm mm mm	 23.6 86.6 23.6 600 2200 600	 23.6 86.6 23.6 600 2200 600	 23.6 86.6 23.6 600 2200 600	 23.6 86.6 23.6 600 2200 600	 23.6 86.6 23.6 600 2200 600
Weight - Option L42, L44 - Option L43 	 lb kg lb kg	 419 190 -- --	 463 210 -- --	 640 290 750 340	 706 320 882 400	 992 450 -- --
Frame size		FL	FL	FL	GL	JL

Article No.	**6SL3700-**	**0LE32-5AU3**	**0LE34-0AU3**	**0LE36-3AU3**	**0LE38-0AU3**	**0LE41-0AU3**
SCCR (short circuit current rating)	kA IC	65	65	65	65	65
Minimum short-circuit current [7]	kA	3	3	8	12	9

[1] Current demand of contactors/circuit breakers and 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 10" (250 mm) with degree of protection IP21, and by 16" (400 mm) with degrees of protection IP23 (NEMA1 filtered), IP43, and IP54 (NEMA12 ventilated).

[4] The connection is made directly at the circuit breaker -Q1.

[5] Stripped lengths of the power cables: front 0.71" (18 mm), rear 1.46" (37 mm).
Tightening torque: 31 Nm.

[6] Stripped lengths of the power cables: front 1" (25.4 mm), rear 2" (50.8 mm).
Tightening torque: 42.4 Nm.

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

Table 5- 10 Technical specifications for Line Connection Modules, 380 ... 480 V 3 AC, part II

Article No.	**6SL3700-**	**0LE41-3AU3**	**0LE41-6AU3**	**0LE42-0AU3**	**0LE42-0BU3** [4]	**0LE42-5BU3** [4]	**0LE43-2BU3** [4]
Infeed/regenerative feedback current							
- Rated current I_{NE}	A	1250	1600	2000	2000	2500	3000
Supply voltages							
- Line voltage	V_{ACrms}	380 3 AC -10% ... 480 3 AC +10% (-15% < 1 min)					
- Line frequency	Hz	47 ... 63 Hz					
230 V AC current consumption [1]							
- Inrush current	A	0.5	0.5	0.5	0.5	0.5	0.5
- Holding current	A	0.06	0.06	0.06	0.06	0.06	0.04
Power loss, max. [2]							
at 50 Hz 400 V							
- Option L42/L44	kW	0.29	0.41	0.6	0.6	0.95	0.95
- Option L43	kW	0.787	1.186	1.366	1.594	2.502	2.482
at 60 Hz 460 V							
- Option L42/L44	kW	0.29	0.41	0.6	0.6	0.95	0.95
- Option L43	kW	0.787	1.186	1.366	1.594	2.502	2.482
Fan							
- 230 V AC current demand	A	1.07	1.07	2.14	2.14	2.14	2.14
- Cooling air requirement	cfm	763	763	1526	1526	1526	1526
	m^3/s	0.36	0.36	0.72	0.72	0.72	0.72
- Sound pressure level L_{PA} (1 m) with 50/60 Hz	dB(A)	68/70	68/70	70/72	70/72	70/72	70/72
Line connection L1, L2, L3	mm^2	10/M12	10/M12	10/M12 + 4/M16	10/M12 + 4/M16	10/M12 + 4/M16	10/M12 + 4/M16
- Max. conductor cross-section (IEC)	AWG/MCM	8 x 240	10 x 240	10 x 240	10 x 240	10 x 240	10 x 300
- Max. conductor cross-section (NEC, CEC)		8 x 500	10 x 500	10 x 500	10 x 500	10 x 500	10 x 600
PE/GND connection		PE busbar					
- Busbar cross-section	mm^2	600					
- Max. conductor cross-section (IEC)	mm^2	240					
- Max. conductor cross-section (NEC, CEC)	AWG/MCM	500					
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20)							
- Width	inch	23.6	23.6	39.4	39.4	39.4	39.4
- Height [3]	inch	86.6	86.6	86.6	86.6	86.6	86.6
- Depth	inch	23.6	23.6	23.6	23.6	23.6	23.6
- Width	mm	600	600	1000	1000	1000	1000
- Height [3]	mm	2200	2200	2200	2200	2200	2200
- Depth	mm	600	600	600	600	600	600
Weight							
- Option L42, L44	lb	1036	1080	1323	1367	1367	1587
	kg	470	490	600	620	620	720
- Option L43	lb	1250	1433	1676	1808	2000	2205
	kg	570	650	760	820	900	1000
Frame size		JL	JL	KL	KL	KL	LL

Article No.	**6SL3700-**	**0LE41-3AU3**	**0LE41-6AU3**	**0LE42-0AU3**	**0LE42-0BU3** [4]	**0LE42-5BU3** [4]	**0LE43-2BU3** [4]
SCCR (short circuit current rating)	kA IC	65	65	65	65	100	100
Minimum short-circuit current [5]	kA	16	30	30	16	21	30

1) Current demand of contactors/circuit breakers and 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 10" (250 mm) with degree of protection IP21, and by 16" (400 mm) with degrees of protection IP23 (NEMA1 filtered), IP43, and IP54 (NEMA12 ventilated).

4) Ready to connect to parallel Line Modules.

5) Minimum current required to reliably trip protective devices.

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

Article No.	**6SL3700-**	**0LG32-8AU3**	**0LG34-0AU3**	**0LG36-3AU3**	**0LG38-0AU3**	**0LG41-0AU3**
Infeed/regenerative feedback current - Rated current $I_{N\,E}$	A	280	380	600	780	1000
Supply voltages - Line voltage - Line frequency	V_{ACrms} Hz	500 3 AC -10% ... 690 3 AC +10% (-15% < 1 min) 47 ... 63 Hz				
230 V AC current consumption [1] - Inrush current - Holding current	 A A	 3.6 0.04	 3.6 0.04	 3.6 0.04	 10.8 0.12	 0.5 0.06
Power loss, max. [2] **at 50 Hz 500/690 V** - Option L42/L44 - Option L43 **at 60 Hz 575 V** - Option L42/L44 - Option L43	 kW kW kW kW	 0.125 0.402 0.125 0.402	 0.19 0.668 0.19 0.668	 0.31 0.794 0.31 0.794	 0.39 -- 0.39 --	 0.18 0.963 0.18 0.963
Fan - 230 V AC current demand - Cooling air requirement - Sound pressure level L_{PA} (1 m) with 50/60 Hz	 A cfm m^3/s dB(A)	 -- -- -- --	 -- -- -- --	 -- -- -- --	 -- -- -- --	 1.07 763 0.36 68/70
Line connection L1, L2, L3 - Max. conductor cross-section (IEC) - Max. conductor cross-section (NEC, CEC)	 mm^2 AWG/MCM	 [4] [5] 2 x 120 2 x 250	 [4] [5] 2 x 120 2 x 250	 [4] [6] 2 x 300 2 x 600	 [4] [6] 3 x 240 3 x 500	 10/M12 8 x 240 8 x 500
PE/GND connection - Busbar cross-section - Max. conductor cross-section (IEC) - Max. conductor cross-section (NEC, CEC)	 mm^2 mm^2 AWG/MCM	PE busbar 600 240 500				
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - Width - Height [3] - Depth - Width - Height [3] - Depth	 inch inch inch mm mm mm	 23.6 86.6 23.6 600 2200 600	 23.6 86.6 23.6 600 2200 600	 23.6 86.6 23.6 600 2200 600	 23.6 86.6 23.6 600 2200 600	 23.6 86.6 23.6 600 2200 600
Weight - Option L42, L44 - Option L43 	 lb kg lb kg	 441 200 530 240	 463 210 640 290	 640 290 838 380	 706 320 -- --	 992 450 1433 650
Frame size		FL	FL	FL	GL	JL

Article No.	**6SL3700-**	**0LG32-8AU3**	**0LG34-0AU3**	**0LG36-3AU3**	**0LG38-0AU3**	**0LG41-0AU3**
SCCR (short circuit current rating)	kA IC	25	25	25	35	85
Minimum short-circuit current [7]	kA	3	3.5	9	15	9

[1] Current demand of contactors/circuit breakers and 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 10" (250 mm) with degree of protection IP21, and by 16" (400 mm) with degrees of protection IP23 (NEMA1 filtered), IP43, and IP54 (NEMA12 ventilated).

[4] The connection is made directly at the circuit breaker -Q1.

[5] Stripped lengths of the power cables: front 0.71" (18 mm), rear 1.46" (37 mm).
Tightening torque: 31 Nm.

[6] Stripped lengths of the power cables: front 1" (25.4 mm), rear 2" (50.8 mm).
Tightening torque: 42.4 Nm.

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

Table 5- 12 Technical specifications for Line Connection Modules, 500 ... 690 V 3 AC, part II

Article No.	**6SL3700-**	**0LG41-3AU3**	**0LG41-6AU3**	**0LG42-0BU3** [4]	**0LG42-5BU3** [4]	**0LG43-2BU3** [4]
Infeed/regenerative feedback current						
- Rated current I_{NE}	A	1250	1600	2000	2500	3000
Supply voltages						
- Line voltage	V_{ACrms}	500 3 AC -10% ... 690 3 AC +10% (-15% < 1 min)				
- Line frequency	Hz	47 ... 63 Hz				
230 V AC current consumption [1]						
- Inrush current	A	0.5	0.5	0.5	0.5	0.5
- Holding current	A	0.06	0.06	0.06	0.06	0.06
Power loss, max. [2]						
at 50 Hz 500/690 V						
- Option L42/L44	kW	0.29	0.41	0.6	0.6	0.95
- Option L43	kW	1.073	1.387	2.166	2.166	2.894
at 60 Hz 575 V						
- Option L42/L44	kW	0.29	0.41	0.6	0.6	0.95
- Option L43	kW	1.073	1.387	2.166	2.166	2.894
Fan						
- 230 V AC current demand	A	1.07	1.07	2.14	2.14	2.14
- Cooling air requirement	cfm	763	763	1526	1526	1526
	m^3/s	0.36	0.36	0.72	0.72	0.72
- Sound pressure level L_{PA} (1 m) with 50/60 Hz	dB(A)	68/70	68/70	70/72	70/72	70/72
Line connection L1, L2, L3		10/M12	10/M12	10/M12 + 4/M16	10/M12 + 4/M16	10/M12 + 4/M16
- Max. conductor cross-section (IEC)	mm^2	8 x 240	8 x 240	10 x 240	10 x 240	10 x 240
- Max. conductor cross-section (NEC, CEC)	AWG/MCM	8 x 500	8 x 500	10 x 500	10 x 500	10 x 500
PE/GND connection		PE busbar				
- Busbar cross-section	mm^2	600				
- Max. conductor cross-section (IEC)	mm^2	240				
- Max. conductor cross-section (NEC, CEC)	AWG/MCM	500				
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20)						
- Width	inch	23.6	23.6	39.4	39.4	39.4
- Height [3]	inch	86.6	86.6	86.6	86.6	86.6
- Depth	inch	23.6	23.6	23.6	23.6	23.6
- Width	mm	600	600	1000	1000	1000
- Height [3]	mm	2200	2200	2200	2200	2200
- Depth	mm	600	600	600	600	600
Weight						
- Option L42, L44	lb	1036	1080	1323	1367	1587
	kg	470	490	600	620	720
- Option L43	lb	1477	1499	2161	2205	2381
	kg	670	680	980	1000	1080
Frame size		JL	JL	KL	KL	LL

Article No.	**6SL3700-**	**0LG41-3AU3**	**0LG41-6AU3**	**0LG42-0BU3** [4]	**0LG42-5BU3** [4]	**0LG43-2BU3** [4]
SCCR (short circuit current rating)	kA IC	85	85	85	85	85
Minimum short-circuit current [5]	kA	16	30	30	24	30

1) Current demand of contactors/circuit breakers and 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 10" (250 mm) with degree of protection IP21, and by 16" (400 mm) with degrees of protection IP23 (NEMA1 filtered), IP43, and IP54 (NEMA12 ventilated).

4) Ready to connect to parallel Line Modules.

5) Minimum current required to reliably trip 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 provided in the layout diagrams (AO) and circuit diagrams (SP), which are included in the individual device documentation.



Figure 5-14 Basic Line Module

Basic Line Modules (BLM) 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 assembly, 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 supply systems (IT). 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

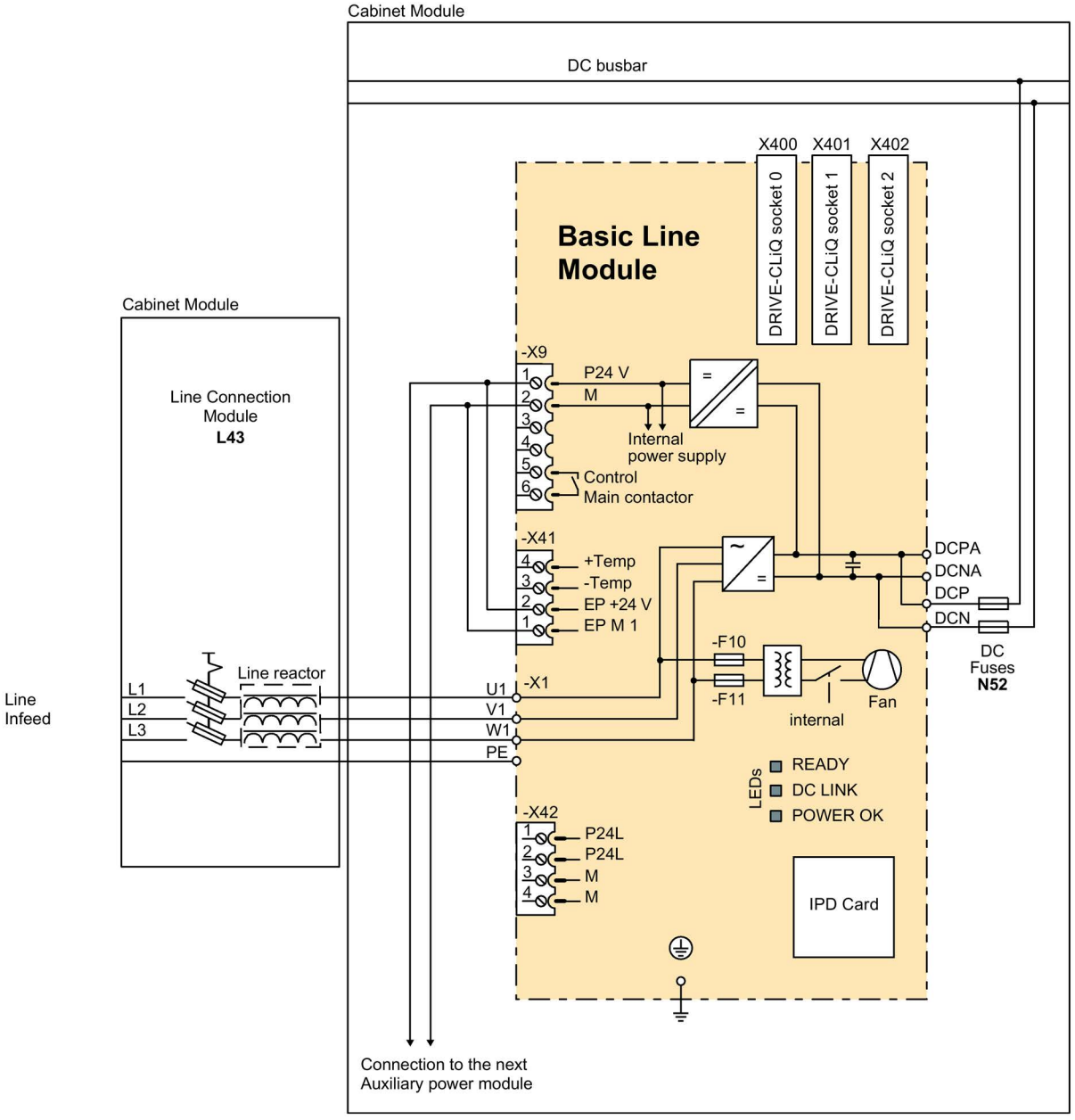


Figure 5-15 Connection example for Basic Line Modules (frame size FB and GB)

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
- Pre-charging 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 is used to pre-charge 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 specified in the layout diagrams (AO) provided in the individual device documentation.

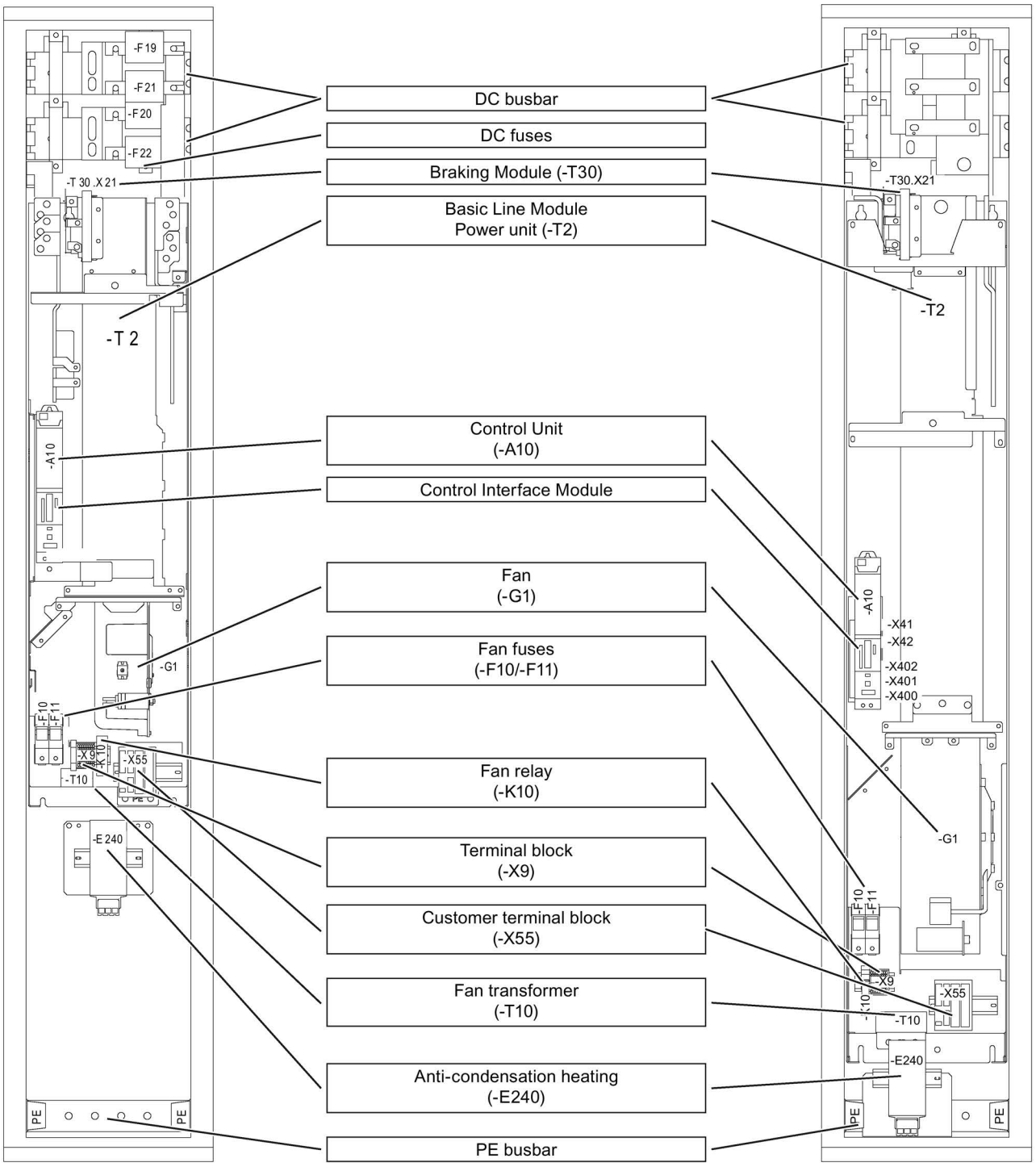


Figure 5-16 Configuration example for Basic Line Modules (frame size FB, GB, and GD)

Parallel connection of Basic Line Modules to increase power rating

Two Basic Line Modules are available for creating drive assemblies 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 to the left of the Line Connection Module are a mirror image (Article No. with "C" in the third-to-last position, example: 6SL3730-1Tx41-xCU3), 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.

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 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

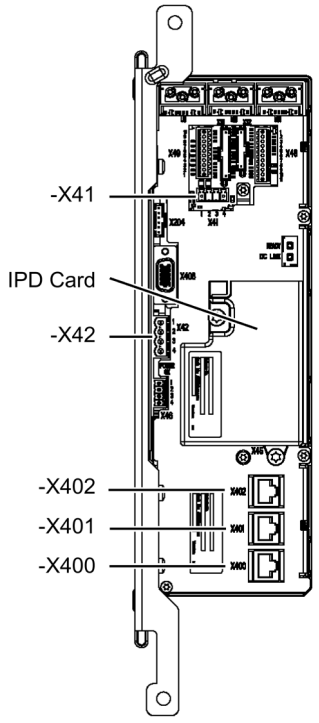
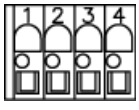


Figure 5-17 Control Interface Module

5.2.2.3 X41 EP terminal / temperature sensor connection

Table 5- 13 Terminal strip X41 EP terminals / temperature sensor connection

Connector	Terminal	Function	Technical data
	1	EP M1 (enable pulses)	Supply voltage: 24 V DC (20.4 to 28.8 V) Power consumption: 10 mA
	2	EP +24 V (enable pulses)	
	3	- Temp	Temperature sensor connection: KTY84-1C130 / PT1000 / PTC
	4	+ Temp	
Max. connectable cross-section: #16 AWG (1.5 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 electrical separation.
- 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 due to 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 twisted-pair, separately-shielded cables.
- Connect the cable shield at both ends to ground potential over a large surface area.

NOTICE

Damage to the motor when the KTY temperature sensor is connected incorrectly

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.

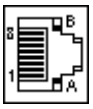
Note

Connection to terminals 1 and 2

For operation, 24 V DC must be present at terminal 2 and ground at terminal 1. When removed, pulse suppression is activated.

5.2.2.4 DRIVE-CLiQ interfaces X400, X401, X402

Table 5- 14 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
TB30 Terminal Board	G62
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 (plinth), 4" (100 mm) high, RAL 9005	M06
Cable marshalling compartment 8" (200 mm) high, RAL 7035	M07
Degree of protection IP21	M21
IP23 degree of protection (NEMA1 filtered)	M23
Side panel (right)	M26
Side panel (left)	M27
IP43 degree of protection	M43
IP54 degree of protection (NEMA12 ventilated)	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
Additional shock protection	M60
DC busbar system	M80 ... M87
Crane transport aid (top-mounted)	M90
Special paint finish for cabinet	Y09
Factory assembly into transport units	Y11

Other options

Component	Option
Marking of all control cable conductor ends	M91
Rating plate data in English / French	T58
Rating plate data in English / Spanish	T60
Rating plate data in English / Italian	T80
Rating plate data in English / Russian	T85
Rating plate in English / Chinese	T91
UL listing per UL 508A	U90
cUL listing for Canada per UL 508A	U91
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 specifications

Table 5- 15 Technical specifications for Basic Line Modules, 380 ... 480 V 3 AC

Article No.	**6SL3730-**	**1TE34-2AU3**	**1TE35-3AU3**	**1TE38-2AU3**	**1TE41-2AU3**	**1TE41-5AU3**	**1TE41-8AU3**
For parallel connection, - Attached to Line Connection Module on left side		--	--	--	...-2CU3	...-5CU3	...-8CU3
Rated power - for $I_{N\ DC}$ (50 Hz 400 V) - for $I_{H\ DC}$ (50 Hz 400 V) - for $I_{N\ DC}$ (60 Hz 460 V) - for $I_{H\ DC}$ (60 Hz 460 V)	 kW kW HP HP	 200 160 305 275	 250 200 380 310	 400 315 585 475	 560 450 855 695	 710 560 1070 870	 900 705 1340 1090
DC link current - Rated current $I_{N\ DC}$ - Base-load current $I_{H\ DC}$ 1) - Maximum current $I_{max\ DC}$	 A A A	 420 328 630	 530 413 795	 820 640 1230	 1200 936 1800	 1500 1170 2250	 1880 1467 2820
Input current - Rated current $I_{N\ E}$ - Maximum current $I_{max\ E}$	 A A	 365 547	 460 690	 710 1065	 1010 1515	 1265 1897	 1630 2380
Current consumption - Auxiliary supply 24 V DC - 400 V AC 2)	 A A	1.1 internal					
DC link capacitance - Basic Line Module - Drive assembly, max.	 µF µF	 7200 57600	 9600 76800	 14600 116800	 23200 185600	 29000 232000	 34800 139200
Power loss, max. 3) - at 50 Hz 400 V - at 60 Hz 460 V	 kW kW	 1.9 1.9	 2.1 2.1	 3.2 3.2	 4.6 4.6	 5.5 5.5	 6.9 6.9
Cooling air requirement	cfm m^3/s	360 0.17	360 0.17	360 0.17	763 0.36	763 0.36	763 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 connection - Busbar cross-section - Max. conductor cross-section (IEC) - Max. conductor cross-section (NEC, CEC)	 mm^2 mm^2 AWG/MCM	PE busbar 600 240 500					
Cable length, max. 4) - Shielded - Unshielded - Shielded - Unshielded	 ft ft m m	 8580 12870 2600 3900	 8580 12870 2600 3900	 8580 12870 2600 3900	 13200 19980 4000 6000	 13200 19980 4000 6000	 13200 19800 4000 7200
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - Width - Height 5) - Depth - Width - Height 5) - Depth	 inch inch inch mm mm mm	 15.8 86.6 23.6 400 2200 600	 15.8 86.6 23.6 400 2200 600	 15.8 86.6 23.6 400 2200 600	 15.8/23.6 86.6 23.6 400/600 2200 600		
Weight (standard version)	lb kg	366 166	366 166	366 166	706/1058 320/480		
Frame size		FB	FB	FB	GB	GB	GD

Article No.	**6SL3730-**	**1TE34-2AU3**	**1TE35-3AU3**	**1TE38-2AU3**	**1TE41-2AU3**	**1TE41-5AU3**	**1TE41-8AU3**
SCCR (short circuit current rating)	kA IC	65	65	65	84	100	100
Minimum short-circuit current [6]	kA	4.4	5.2	10	2.5	3.2	4
- with parallel connection					4	5	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 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 10" (250 mm) for IP21 degree of protection and by 16" (400 mm) for degree of protection IP23 (NEMA1 filtered), IP43 and IP54 (NEMA12 ventilated).

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

Table 5- 16 Technical specifications for Basic Line Modules, 500 ... 690 V 3 AC

Article No.	**6SL3730-**	**1TG33-0AU3**	**1TG34-3AU3**	**1TG36-8AU3**	**1TG41-1AU3**	**1TG41-4AU3**	**1TG41-8AU3**
For parallel connection, - Attached to Line Connection Module on left side		--	--	--	...-1CU3	...-4CU3	...-8CU3
Rated power - for $I_{N\,DC}$ (50 Hz 690 V) - for $I_{H\,DC}$ (50 Hz 690 V) - for $I_{N\,DC}$ (50 Hz 500 V) - for $I_{N\,DC}$ (50 Hz 500 V) - for $I_{N\,DC}$ (60 Hz 575 V) - for $I_{H\,DC}$ (60 Hz 575 V)	 kW kW kW kW HP HP	 250 195 175 165 250 200	 355 280 250 235 350 300	 560 440 390 365 600 450	 900 710 635 595 900 800	 1100 910 810 755 1250 1000	 1500 1220 1085 1015 1500 1250
DC link current - Rated current $I_{N\,DC}$ - Base-load current $I_{H\,DC}$ [1] - Maximum current $I_{max\,DC}$	 A A A	 300 234 450	 430 335 645	 680 530 1020	 1100 858 1650	 1400 1092 2100	 1880 1467 2820
Input current - Rated current $I_{N\,E}$ - Maximum current $I_{max\,E}$	 A A	 260 390	 375 563	 575 863	 925 1388	 1180 1770	 1580 2370
Current consumption - Auxiliary supply 24 V DC - 500/690 V AC [2]	 A A	 1.1 internal					
DC link capacitance - Basic Line Module - Drive assembly, max.	 µF µF	 3200 25600	 4800 38400	 7300 58400	 11600 92800	 15470 123760	 19500 78000
Power loss, max. [3] - at 50 Hz 690 V - at 60 Hz 575 V	 kW kW	 1.5 1.5	 2.1 2.1	 3.0 3.0	 5.4 5.4	 5.8 5.8	 7.3 7.3
Cooling air requirement	cfm m^3/s	360 0.17	360 0.17	360 0.17	763 0.36	763 0.36	763 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 connection - Busbar cross-section - Max. conductor cross-section (IEC) - Max. conductor cross-section (NEC, CEC)	 mm^2 mm^2 AWG/MCM	 PE busbar 600 240 500					
Cable length, max. [4] - Shielded - Unshielded - Shielded - Unshielded	 ft ft m m	 4950 7400 1500 2250	 4950 7400 1500 2250	 4950 7400 1500 2250	 7400 11100 2250 3375	 7400 11100 2250 3375	 7400 11100 2250 3375
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - Width - Height [5] - Depth - Width - Height [5] - Depth	 inch inch inch mm mm mm	 15.8 86.6 23.6 400 2200 600	 15.8 86.6 23.6 400 2200 600	 15.8 86.6 23.6 400 2200 600	 15.8/23.6 86.6 23.6 400/600 2200 600		
Weight (standard version)	lb kg	366 166	366 166	366 166	706/1058 320/480		
Frame size		FB	FB	FB	GB	GB	GD

Article No.	**6SL3730-**	**1TG33-0AU3**	**1TG34-3AU3**	**1TG36-8AU3**	**1TG41-1AU3**	**1TG41-4AU3**	**1TG41-8AU3**
SCCR (short circuit current rating)	kA IC	65	65	65	84	100	100
Minimum short-circuit current [6)] - with parallel connection	kA	3	4.4	8	2 4	2.5 5	3.2 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 10" (250 mm) for IP21 degree of protection and by 16" (400 mm) for degree of protection IP23 (NEMA1 filtered), IP43 and IP54 (NEMA12 ventilated).

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 provided in the layout diagrams (AO) and circuit diagrams (SP), which are included in the individual device documentation.



Figure 5-18 Smart Line Module

Smart Line Modules are unregulated infeed/regenerative feedback units. 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 supply systems (IT). The following voltages and power ratings are available:

Line voltage	**Rated power**
380 ... 480 V 3 AC	250 ... 800 kW
500 ... 690 V 3 AC	450 ... 1400 kW

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

Integration

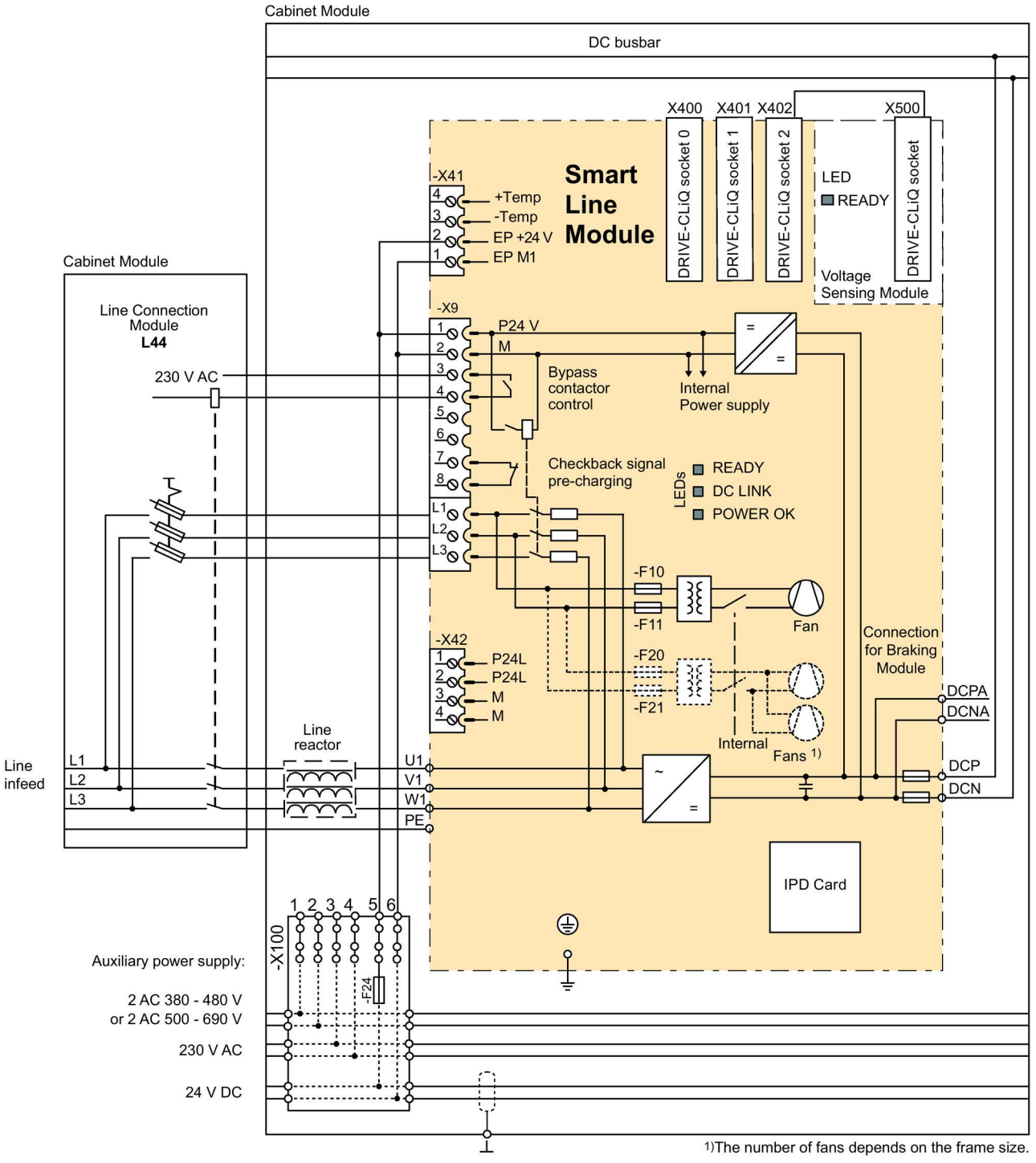


Figure 5-19 Connection example for Smart Line Modules

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 line.

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 pre-charging 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 pre-charging 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 are used to 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 specified in the layout diagrams (AO) provided in the individual device documentation.

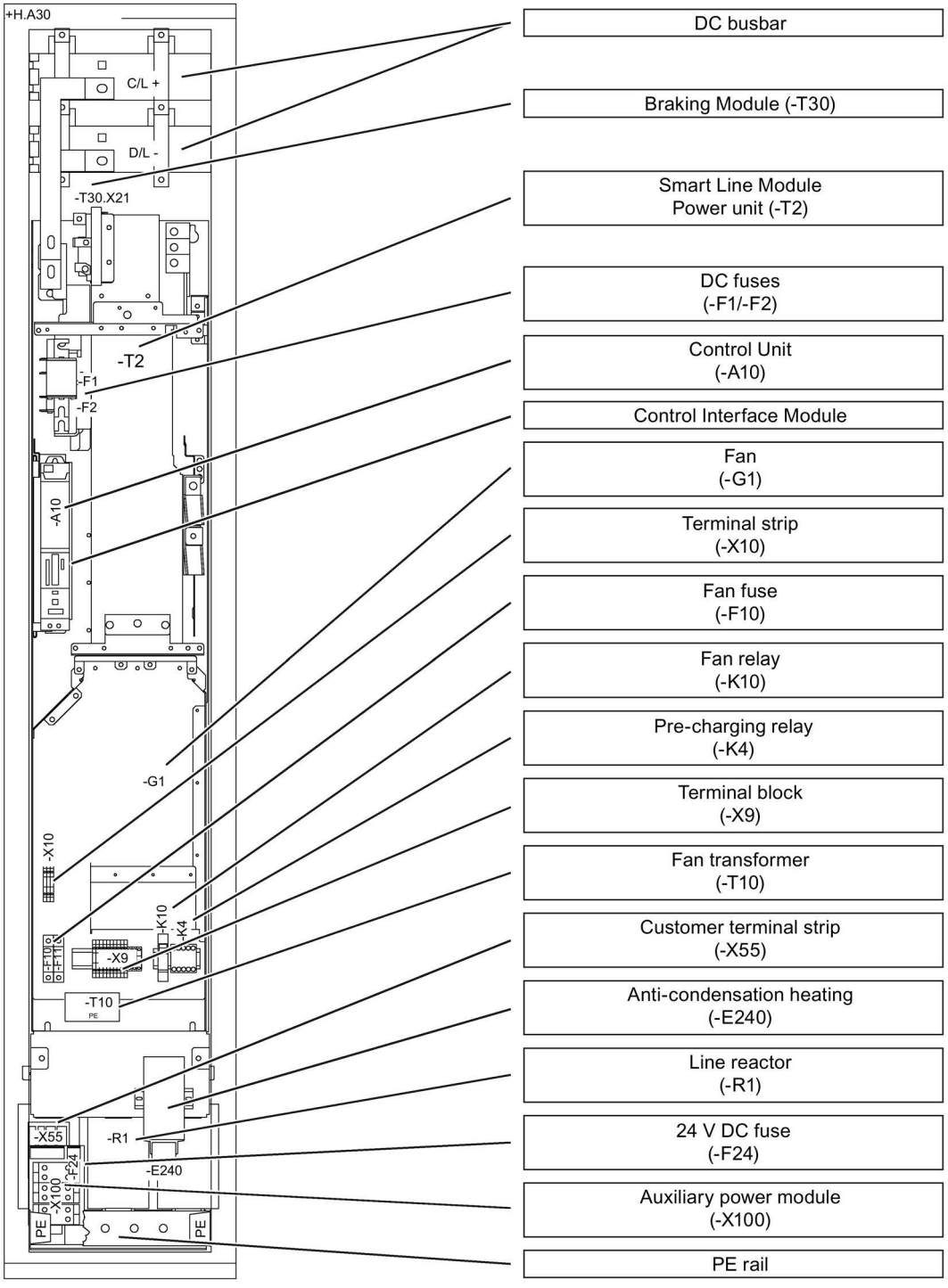


Figure 5-20 Configuration example for Smart Line Modules (frame size GX)

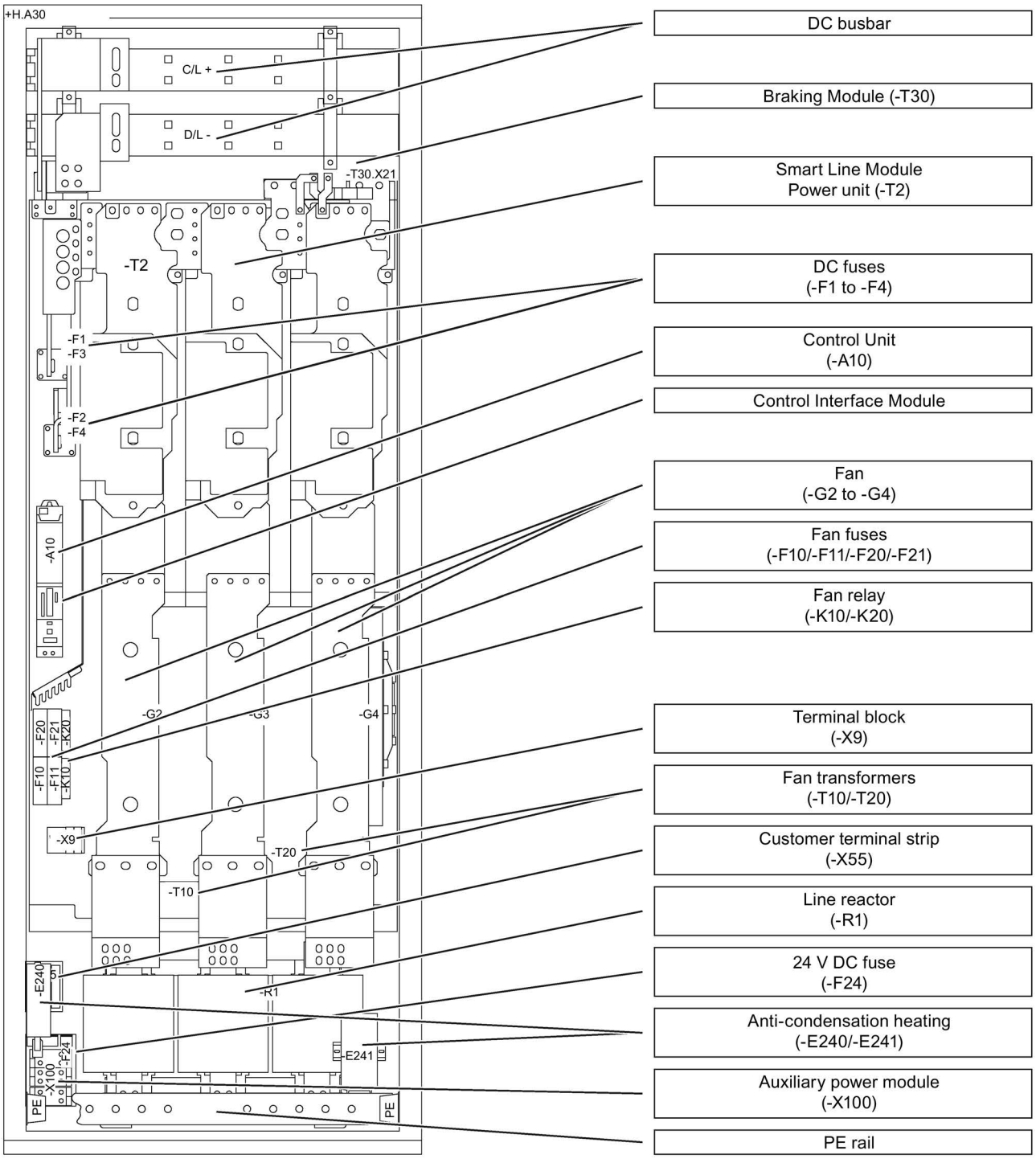


Figure 5-21 Configuration example for Smart Line Modules (frame size JX)

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 third-to-last position.
Example: 6SL3730-6TE41-1CU3.

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

- Up to 4 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.

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

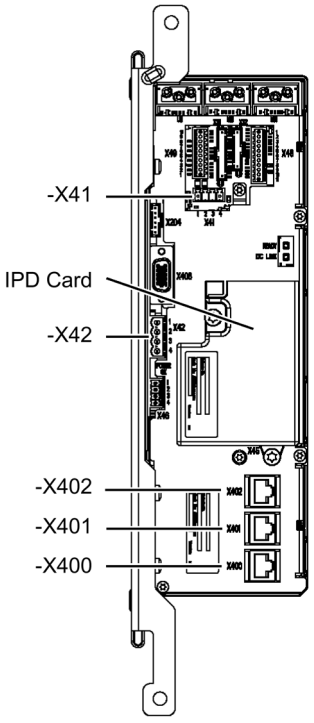
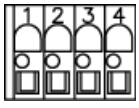


Figure 5-22 Control Interface Module

5.3.2.3 X41 EP terminal / temperature sensor connection

Table 5- 17 Terminal strip X41 EP terminals / temperature sensor connection

Connector	Terminal	Function	Technical data
	1	EP M1 (enable pulses)	Supply voltage: 24 V DC (20.4 to 28.8 V) Power consumption: 10 mA
	2	EP +24 V (enable pulses)	
	3	- Temp	Temperature sensor connection: KTY84-1C130 / PT1000 / PTC
	4	+ Temp	
Max. connectable cross-section: #16 AWG (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 electrical separation.
- 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 due to 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 twisted-pair, separately-shielded cables.
- Connect the cable shield at both ends to ground potential over a large surface area.

NOTICE

Damage to the motor when the KTY temperature sensor is connected incorrectly

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.

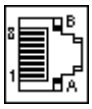
Note

Connection to terminals 1 and 2

For operation, 24 V DC must be present at terminal 2 and ground at terminal 1. When removed, pulse suppression is activated.

5.3.2.4 DRIVE-CLiQ interfaces X400, X401, X402

Table 5- 18 DRIVE-CLiQ interfaces X400, X401, X402

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

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
TB30 Terminal Board	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 product package	L22
Cabinet anti-condensation heating	L55
50/250 kW braking unit	L62/L65

Mechanical options

Component	Option
Base (plinth), 4" (100 mm) high, RAL 9005	M06
Cable marshalling compartment 8" (200 mm) high, RAL 7035	M07
Degree of protection IP21	M21
IP23 degree of protection (NEMA1 filtered)	M23
Side panel (right)	M26
Side panel (left)	M27
IP43 degree of protection	M43
IP54 degree of protection (NEMA12 ventilated)	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 aid (top-mounted)	M90
Special paint finish for cabinet	Y09
Factory assembly into transport units	Y11

Other options

Component	Option
Marking of all control cable conductor ends	M91
Rating plate data in English / French	T58
Rating plate data in English / Spanish	T60
Rating plate data in English / Italian	T80
Rating plate data in English / Russian	T85
Rating plate in English / Chinese	T91
UL listing per UL 508A	U90
cUL listing for Canada per UL 508A	U91
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 specifications

Table 5- 19 Technical specifications for Smart Line Modules, 3 AC 380 ... 480 V

Article No.	**6SL3730-**	**6TE35-5AU3**	**6TE37-3AU3**	**6TE41-1AU3**	**6TE41-3AU3**	**6TE41-7AU3**
For parallel connection, - attached to Line Connection Module on right side - attached to Line Connection Module on left side		-- --	-- --	...-1BU3 ...-1CU3	...-3BU3 ...-3CU3	...-7BU3 ...-7CU3
Rated power - for $I_{N\ DC}$ (50 Hz 400 V) - for $I_{H\ DC}$ (50 Hz 400 V) - for $I_{N\ DC}$ (60 Hz 460 V) - for $I_{H\ DC}$ (60 Hz 460 V)	 kW kW HP HP	 250 235 395 360	 355 315 545 485	 500 450 770 695	 630 555 970 860	 800 730 1230 1120
DC link current - Rated current $I_{N\ DC}$ - Base-load current $I_{H\ DC}$ 1) - Maximum current $I_{max\ DC}$	 A A A	 550 490 825	 730 650 1095	 1050 934 1575	 1300 1157 1950	 1700 1513 2550
Input/regenerative feedback current - Rated current $I_{N\ E}$ - Maximum current $I_{max\ E}$	 A A	 463 694	 614 921	 883 1324	 1093 1639	 1430 2145
Current demand - Auxiliary supply 24 V DC - 400 V AC 2)	 A A	 1.35 1.8	 1.35 1.8	 1.4 3.6	 1.5 5.4	 1.7 5.4
DC link capacitance - Smart Line Module - Drive assembly, max.	 µF µF	 8400 42000	 12000 60000	 16800 67200	 18900 75600	 28800 115200
Power loss, max. 3) - at 50 Hz 400 V - at 60 Hz 460 V	 kW kW	 3.7 3.7	 4.7 4.7	 7.1 7.1	 11.0 11.0	 11.5 11.5
Cooling air requirement	cfm m^3/s	763 0.36	763 0.36	1653 0.78	2288 1.08	2288 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 connection - Busbar cross-section - Max. conductor cross-section (IEC) - Max. conductor cross-section (NEC, CEC)	 mm^2 mm^2 AWG/MCM	PE busbar 600 240 500				
Cable length, max. 4) - Shielded - Unshielded - Shielded - Unshielded	 ft ft m m	 13200 19980 4000 6000	 13200 19980 4000 6000	 15840 23800 4800 7200	 15840 23800 4800 7200	 15840 23800 4800 7200
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - Width - Height 5) - Depth - Width - Height 5) - Depth	 inch inch inch mm mm mm	 15.8 86.6 23.6 400 2200 600	 15.8 86.6 23.6 400 2200 600	 23.6 86.6 23.6 600 2200 600	 31.6 86.6 23.6 800 2200 600	 31.6 86.6 23.6 800 2200 600
Weight (standard version)	lb kg	596 270	596 270	1080 490	1709 775	1709 775
Frame size		GX	GX	HX	JX	JX

Article No.	**6SL3730-**	**6TE35-5AU3**	**6TE37-3AU3**	**6TE41-1AU3**	**6TE41-3AU3**	**6TE41-7AU3**
SCCR (short circuit current rating)	kA IC	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 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 for specific configurations are available on request, see SINAMICS - Low Voltage Engineering Manual included in the device documentation provided.

5) The cabinet height increases by 10" (250 mm) for IP21 degree of protection and by 16" (400 mm) for degree of protection IP23 (NEMA1 filtered), IP43 and IP54 (NEMA12 ventilated).

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

Table 5- 20 Technical specifications for Smart Line Modules, 3 AC 500 ... 690 V

Article No.	**6SL3730-**	**6TG35- 5AU3**	**6TG38- 8AU3**	**6TG41- 2AU3**	**6TG41- 7AU3**
For parallel connection, - attached to Line Connection Module on right side - attached to Line Connection Module on left side		-- --	...-8BU3 ...-8CU3	...-2BU3 ...-2CU3	...-7BU3 ...-7CU3
Rated power - for $I_{N\ DC}$ (50 Hz 690 V) - for $I_{H\ DC}$ (50 Hz 690 V) - for $I_{N\ DC}$ (50 Hz 500 V) - for $I_{H\ DC}$ (50 Hz 500 V) - for $I_{N\ DC}$ (60 Hz 575 V) - for $I_{H\ DC}$ (60 Hz 575 V)	 kW kW kW kW HP HP	 450 405 320 295 500 450	 710 665 525 480 790 740	 1000 885 705 640 1115 990	 1400 1255 995 910 1465 1400
DC link current - Rated current $I_{N\ DC}$ - Base-load current $I_{H\ DC}$ [1] - Maximum current $I_{max\ DC}$	 A A A	 550 490 825	 900 800 1350	 1200 1068 1800	 1700 1513 2550
Input/regenerative feedback current - Rated current $I_{N\ E}$ - Maximum current $I_{max\ E}$	 A A	 463 694	 757 1135	 1009 1513	 1430 2145
Current demand - Auxiliary supply 24 V DC - 500/690 V AC [2]	 A A	 1.35 1.4/1.0	 1.4 2.9/2.1	 1.5 4.3/3.1	 1.7 4.3/3.1
DC link capacitance - Smart Line Module - Drive assembly, max.	 µF µF	 5600 28000	 7400 29600	 11100 44400	 14400 57600
Power loss, max. [3] - at 50 Hz 690 V - at 60 Hz 575 V	 kW kW	 4.3 4.3	 6.5 6.5	 12 12	 13.8 13.8
Cooling air requirement	cfm m^3/s	763 0.36	1653 0.78	2288 1.08	2288 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 connection - Busbar cross-section - Max. conductor cross-section (IEC) - Max. conductor cross-section (NEC, CEC)	 mm^2 mm^2 AWG/MCM	PE busbar 600 240 500			
Cable length, max. [4] - Shielded - Unshielded - Shielded - Unshielded	 ft ft m m	 7400 11100 2250 3375	 9075 13600 2750 4125	 9075 13600 2750 4125	 9075 13600 2750 4125
Degree of protection (standard version)		IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - Width - Height [5] - Depth - Width - Height [5] - Depth	 inch inch inch mm mm mm	 15.8 86.6 23.6 400 2200 600	 23.6 86.6 23.6 600 2200 600	 31.6 86.6 23.6 800 2200 600	 31.6 86.6 23.6 800 2200 600
Weight (standard version)	lb kg	750 340	1213 550	1753 795	1753 795
Frame size		GX	HX	JX	JX

Article No.	**6SL3730-**	**6TG35-5AU3**	**6TG38-8AU3**	**6TG41-2AU3**	**6TG41-7AU3**
SCCR (short circuit current rating)	kA IC	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 current demand 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 for specific configurations are available on request, see SINAMICS - Low Voltage Engineering Manual included in the device documentation provided.

[5] The cabinet height increases by 10" (250 mm) for IP21 degree of protection and by 16" (400 mm) for degree of protection IP23 (NEMA1 filtered), IP43 and IP54 (NEMA12 ventilated).

[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 provided in the layout diagrams (AO) and circuit diagrams (SP), which are included in the individual device documentation.



Figure 5-23 Active Line Module including Active Interface Module

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

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).

With 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 line supply 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 power systems (IT). 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	560 ... 1400 kW

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

Integration

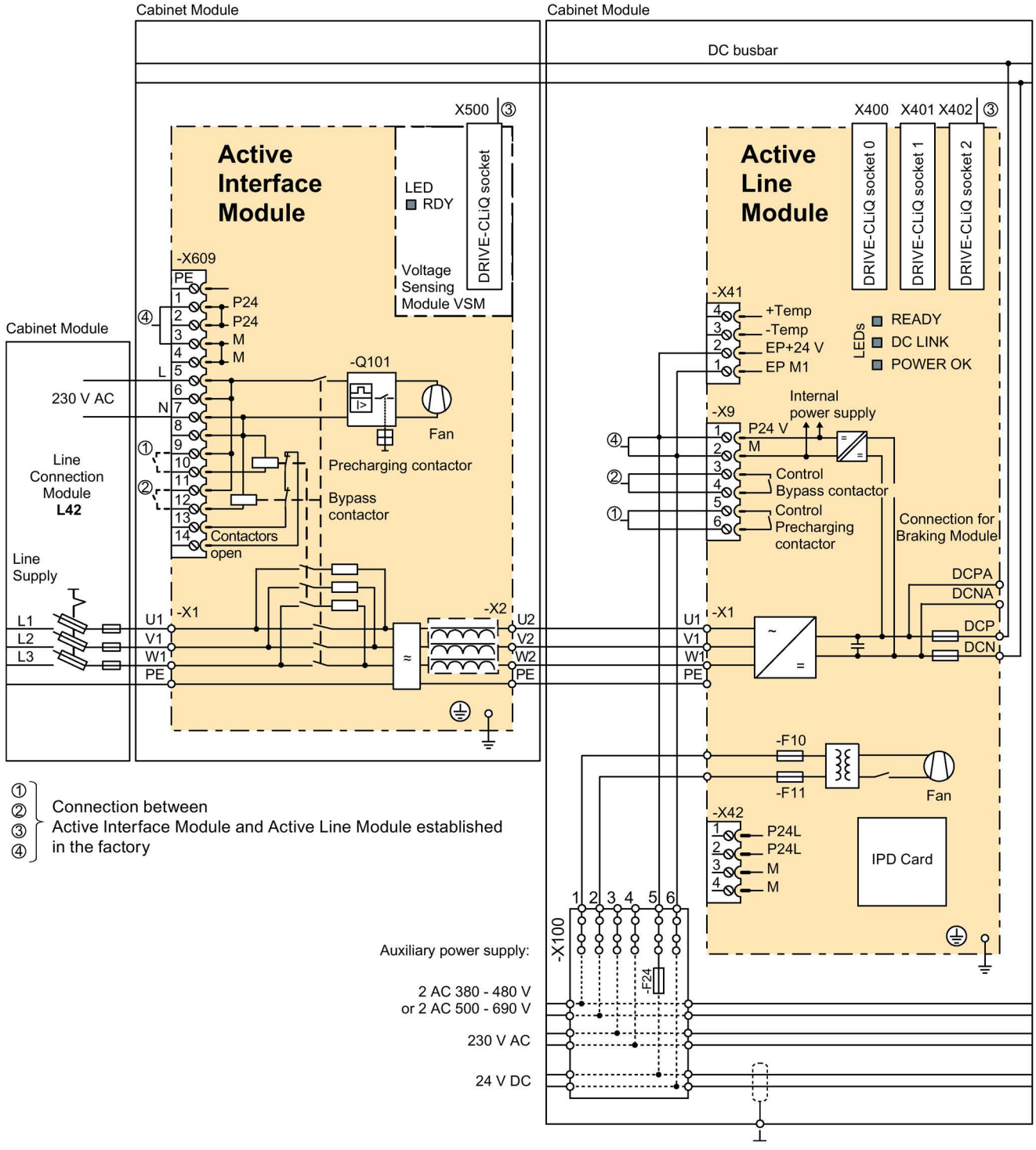


Figure 5-24 Connection example for Active Line Modules (frame size FI/FX and GI/GX)

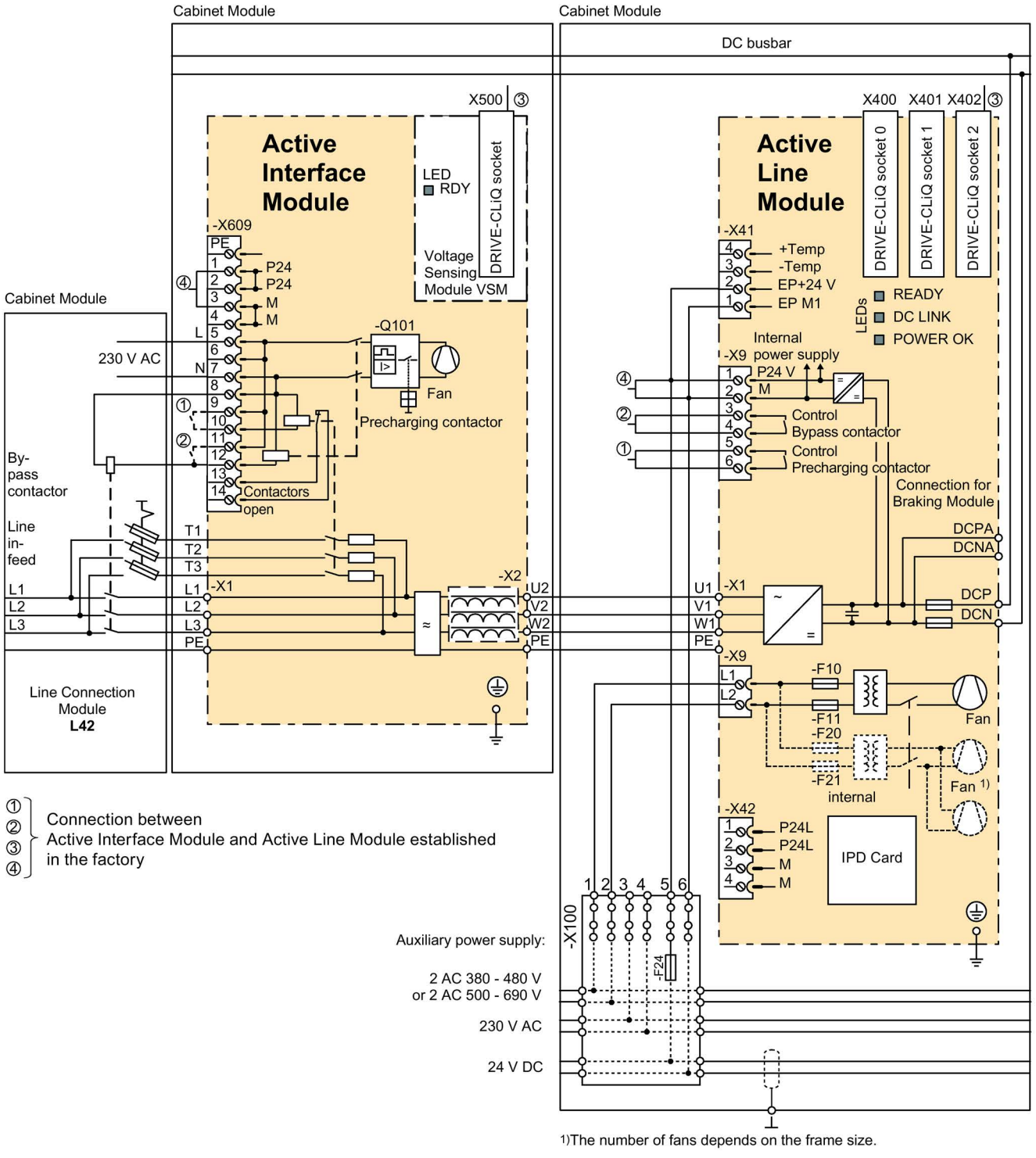


Figure 5-25 Connection example for Active Line Modules (frame size HI/HX and JI/JX)

Configuration

Active Line Modules are always operated together with an Active Interface Module, which contains the associated Clean Power Filter and pre-charging 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 specified in the layout diagrams (AO) provided in the individual device documentation.

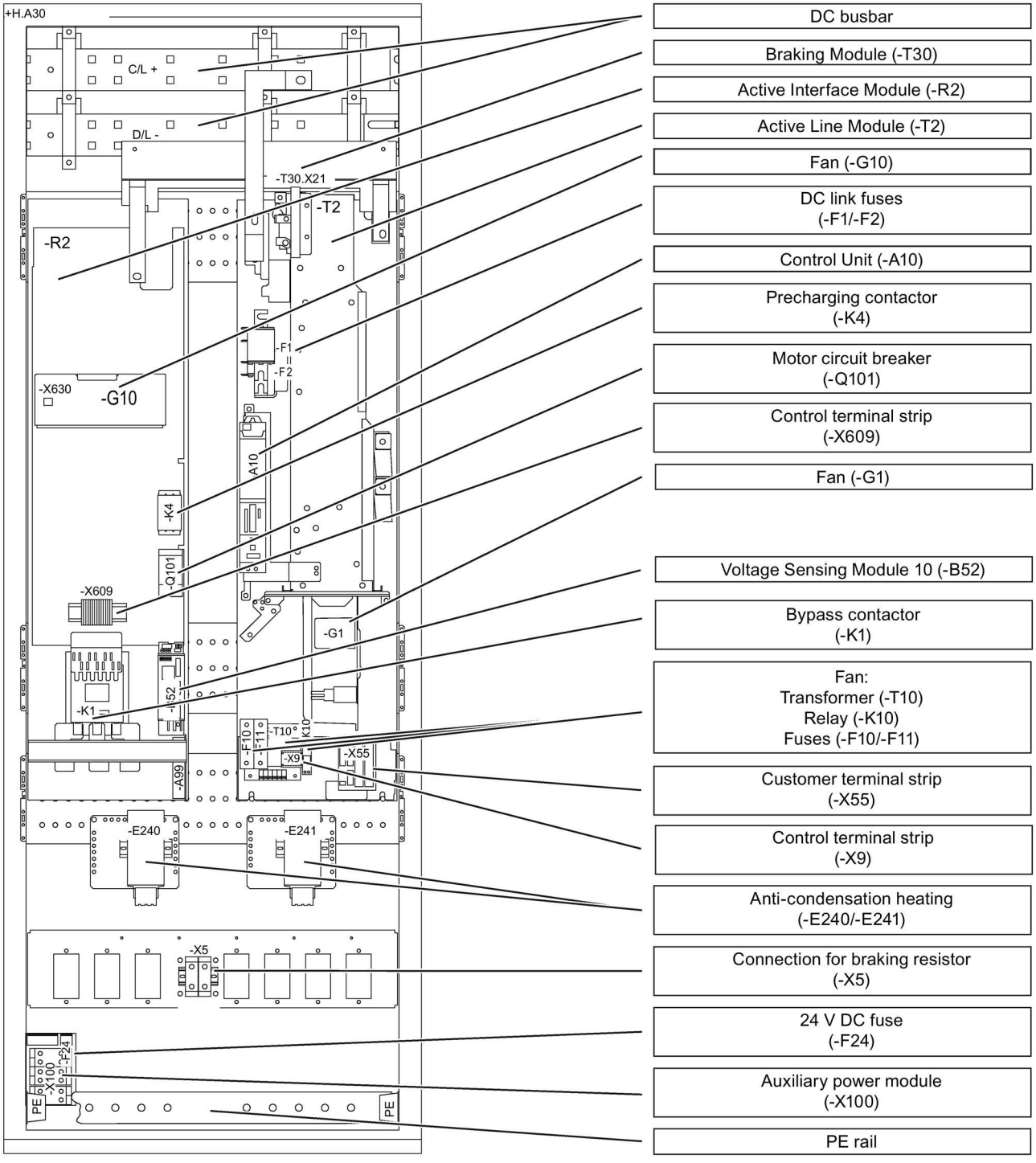


Figure 5-26 Configuration examples for Active Line Modules (frame size FX+FI)

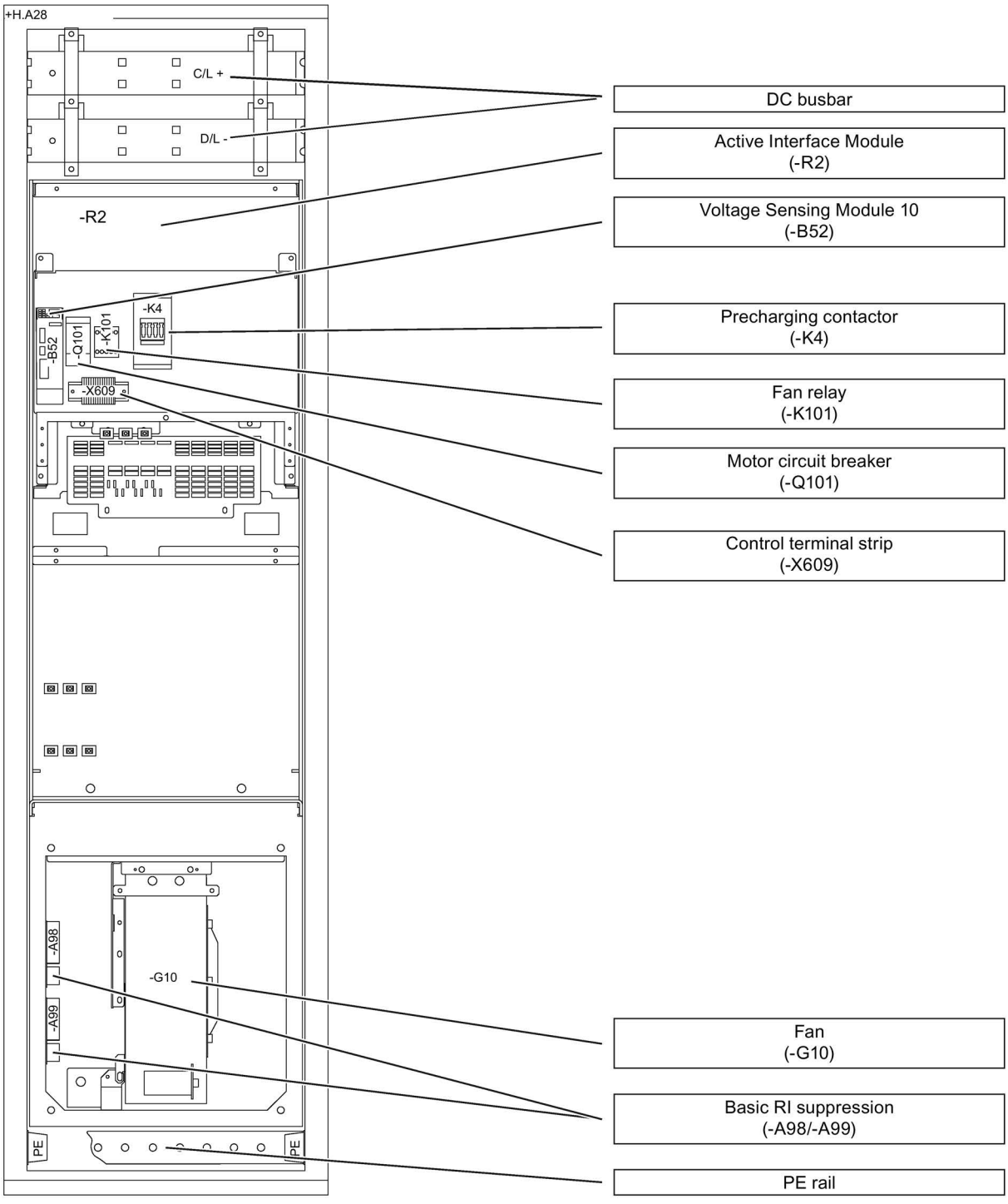


Figure 5-27 Configuration examples for Active Interface Modules (frame size JI)

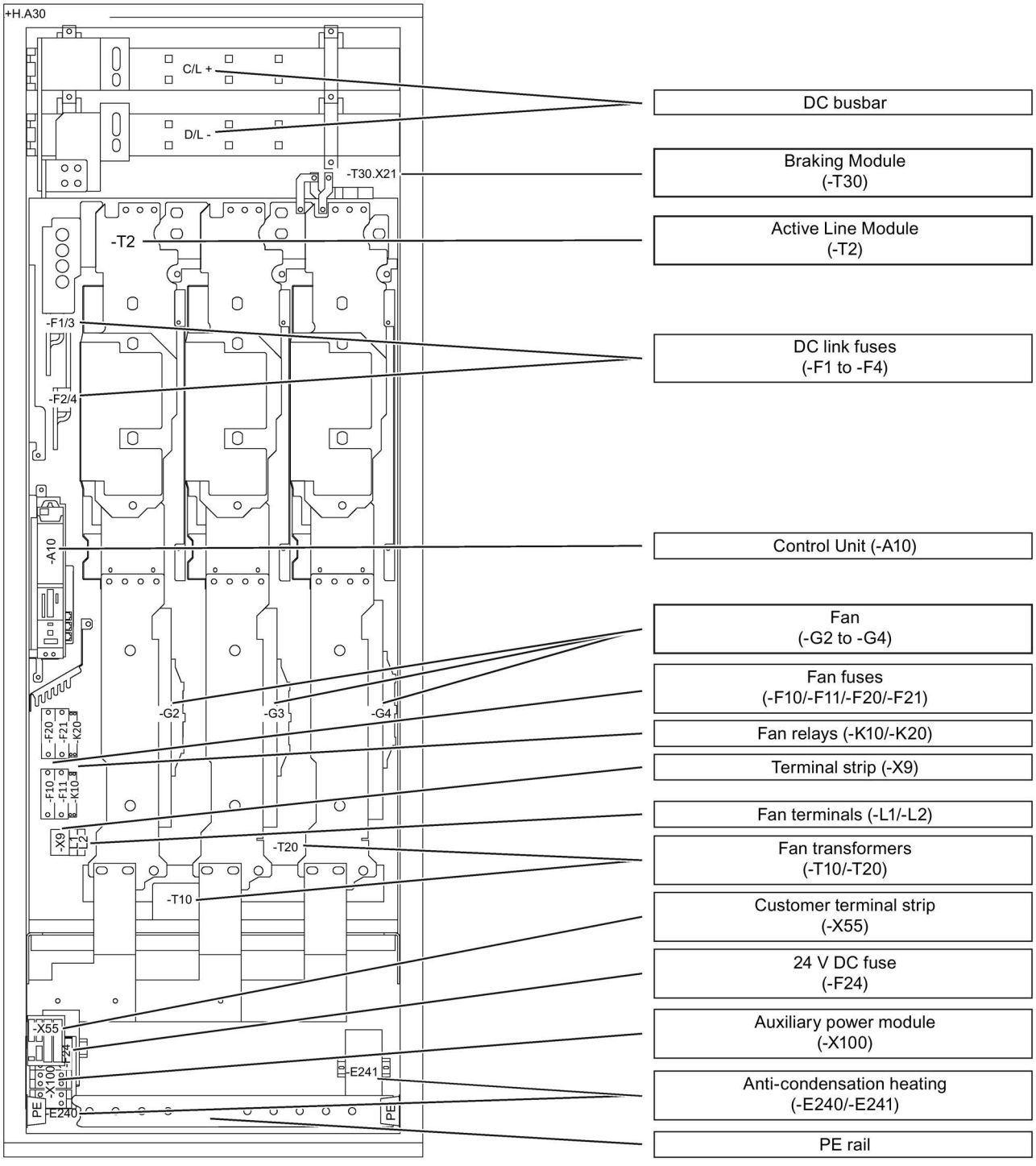


Figure 5-28 Configuration examples for Active Line Modules (frame size JX)

Parallel connection of Active Line Modules to increase power rating

Active Line Modules are available for creating drive assemblies 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 to the left of the Line Connection Module are a mirror image (device Article No. with "C" in the third-to-last position, example: 6SL3730-7Tx41x-xCU3), 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

Mixed operation is not possible

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

It is not possible to operate Active Line Modules with Article No. 6SL3730-7Txxx-xxU3 and Article No. 6SL3730-7Txxx-xxU6 together.

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

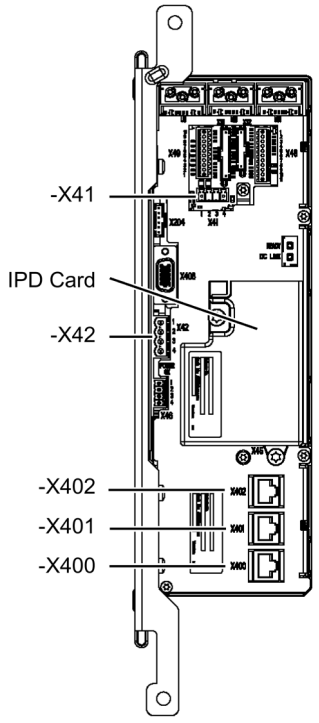
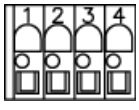


Figure 5-29 Control Interface Module

5.4.2.3 X41 EP terminal / temperature sensor connection

Table 5- 21 Terminal strip X41 EP terminals / temperature sensor connection

Connector	Terminal	Function	Technical data
	1	EP M1 (enable pulses)	Supply voltage: 24 V DC (20.4 to 28.8 V) Power consumption: 10 mA
	2	EP +24 V (enable pulses)	
	3	- Temp	Temperature sensor connection: KTY84-1C130 / PT1000 / PTC
	4	+ Temp	
Max. connectable cross-section: #16 AWG (1.5 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 electrical separation.
- 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 due to 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 twisted-pair, separately-shielded cables.
- Connect the cable shield at both ends to ground potential over a large surface area.

NOTICE

Damage to the motor when the KTY temperature sensor is connected incorrectly

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.

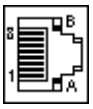
Note

Connection to terminals 1 and 2

For operation, 24 V DC must be present at terminal 2 and ground at terminal 1. When removed, pulse suppression is activated.

5.4.2.4 DRIVE-CLiQ interfaces X400, X401, X402

Table 5- 22 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- 23 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
TB30 Terminal Board	G62
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

Mechanical options

Base (plinth), 4" (100 mm) high, RAL 9005	M06
Cable marshalling compartment 8" (200 mm) high, RAL 7035	M07
Degree of protection IP21	M21
IP23 degree of protection (NEMA1 filtered)	M23
Side panel (right)	M26
Side panel (left)	M27
IP43 degree of protection	M43
IP54 degree of protection (NEMA12 ventilated)	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 aid (top-mounted)	M90
Special paint finish for cabinet	Y09
Factory assembly into transport units	Y11

Other options

Component	Option
Marking of all control cable conductor ends	M91
Rating plate data in English / French	T58
Rating plate data in English / Spanish	T60
Rating plate data in English / Italian	T80
Rating plate data in English / Russian	T85
Rating plate in English / Chinese	T91
UL listing per UL 508A	U90
cUL listing for Canada per UL 508A	U91
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 specifications

Table 5- 24 Technical specifications for Active Line Modules (including Active Interface Module), 3 AC 380 ... 480 V, part I

Article No.	**6SL3730-**	**7TE32-1AU3**	**7TE32-6AU3**	**7TE33-8AU3**	**7TE35-0AU3**
For parallel connection, - Attached to Line Connection Module on left side		--	--	--	--
Rated power - for $I_{N\ DC}$ (50 Hz 400 V) - for $I_{H\ DC}$ (50 Hz 400 V) - for $I_{N\ DC}$ (60 Hz 460 V) - for $I_{H\ DC}$ (60 Hz 460 V)	 kW kW HP HP	 132 115 200 150	 160 145 250 200	 235 210 400 300	 300 270 500 400
DC link current - Rated current $I_{N\ DC}$ - Base-load current $I_{H\ DC}$ 1) - Maximum current $I_{max\ DC}$	 A A A	 235 209 352	 291 259 436	 425 378 637	 549 489 823
Input/regenerative feedback current - Rated current $I_{N\ E}$ - Maximum current $I_{max\ E}$	 A A	 210 315	 260 390	 380 570	 490 735
Current demand - Auxiliary supply 24 V DC - 400 V AC at 50/60 Hz 2) - 230 V AC 2)	 A A A	 1.27 0.63 / 0.95 0.6	 1.27 1.13 / 1.7 0.6	 1.52 1.8 / 2.7 1.2	 1.52 1.8 / 2.7 1.2
DC link capacitance - Active Line Module - Drive line-up, max.	 µF µF	 4200 41600	 5200 41600	 7800 76800	 9600 76800
Power loss, max. 3) - at 50 Hz 400 V - at 60 Hz 460 V	 kW kW	 4.3 4.4	 4.9 5.1	 6.9 7.2	 8.7 9.0
Cooling air requirement	cfm m^3/s	996 0.47	996 0.47	1759 0.83	1759 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 connection - Busbar cross-section - Max. conductor cross-section (IEC) - Max. conductor cross-section (NEC, CEC)	 mm^2 mm^2 AWG/MCM	PE busbar 600 240 500			
Cable length, max. 5) - Shielded - Unshielded - Shielded - Unshielded	 ft ft m m	 8910 13300 2700 4050	 8910 13300 2700 4050	 8910 13300 2700 4050	 8910 13300 2700 4050
Degree of protection (standard version)		IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - Width - Height 6) - Depth - Width - Height 6) - Depth	 inch inch inch mm mm mm	 31.6 86.6 23.6 800 2200 600	 31.6 86.6 23.6 800 2200 600	 31.6 86.6 23.6 800 2200 600	 31.6 86.6 23.6 800 2200 600
Weight (standard version)	lb kg	838 380	838 380	1169 530	1169 530
Frame size		FX + FI	FX + FI	GX + GI	GX + GI

Article No.	**6SL3730-**	**7TE32-1AU3**	**7TE32-6AU3**	**7TE33-8AU3**	**7TE35-0AU3**
SCCR (short circuit current rating)	kA IC	65	65	65	65
Minimum short-circuit current [7)]	kA	3	3	8	8

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 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 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 are available on request, see SINAMICS - Low Voltage Engineering Manual included in the device documentation provided.

6) The cabinet height increases by 10" (250 mm) for IP21 degree of protection and by 16" (400 mm) for IP23 degree of protection (NEMA1 filtered), IP43 and IP54 (NEMA12 ventilated).

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

Table 5- 25 Technical specifications for Active Line Modules (including Active Interface Module), 3 AC 380 ... 480 V, part II

Article No.	**6SL3730-**	**7TE36-1AU3**	**7TE38-4AU3**	**7TE41-0AU3**	**7TE41-4AU3**
For parallel connection, - Attached to Line Connection Module on left side		 --	 --	 ...-0CU3	 ...-4CU3
Rated power - for $I_{N\ DC}$ (50 Hz 400 V) - for $I_{H\ DC}$ (50 Hz 400 V) - for $I_{N\ DC}$ (60 Hz 460 V) - for $I_{H\ DC}$ (60 Hz 460 V)	 kW kW HP HP	 380 335 600 500	 500 465 700 700	 630 545 900 800	 900 780 1250 1000
DC link current - Rated current $I_{N\ DC}$ - Base-load current $I_{H\ DC}$ 1) - Maximum current $I_{max\ DC}$	 A A A	 678 603 1017	 940 837 1410	 1103 982 1654	 1574 1401 2361
Input/regenerative feedback current - Rated current $I_{N\ E}$ - Maximum current $I_{max\ E}$	 A A	 605 907	 840 1260	 985 1260	 1405 2107
Current demand - Auxiliary supply 24 V DC - 400 V AC at 50/60 Hz 2) - 230 V AC 2)	 A A A	 1.57 3.6 / 5.4 4.6	 1.57 3.6 / 5.4 4.6	 1.67 5.4 / 8.1 4.9	 1.67 5.4 / 8.1 4.9
DC link capacitance - Active Line Module - Drive line-up, max.	 µF µF	 12600 134400	 16800 134400	 18900 230400	 28800 230400
Power loss, max. 3) - at 50 Hz 400 V - at 60 Hz 460 V	 kW kW	 11.7 12.1	 13.8 14.3	 17.6 18.3	 21.8 22.7
Cooling air requirement	cfm m^3/s	2500 1.18	2500 1.18	3136 1.48	3136 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 connection - Busbar cross-section - Max. conductor cross-section (IEC) - Max. conductor cross-section (NEC, CEC)	 mm^2 mm^2 AWG/MCM	PE busbar 600 240 500			
Cable length, max. 5) - Shielded - Unshielded - Shielded - Unshielded	 ft ft m m	 12870 19300 3900 5850	 12870 19300 3900 5850	 12870 19300 3900 5850	 12870 19300 3900 5850
Degree of protection (standard version)		IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - Width - Height 6) - Depth - Width - Height 6) - Depth	 inch inch inch mm mm mm	 39.4 86.6 23.6 1000 2200 600	 39.4 86.6 23.6 1000 2200 600	 55.2 86.6 23.6 1400 2200 600	 55.2 86.6 23.6 1400 2200 600
Weight (standard version)	lb kg	2050 930	2050 930	3000 1360	3000 1360
Frame size		HX + HI	HX + HI	JX + JI	JX + JI

Article No.	**6SL3730-**	**7TE36-1AU3**	**7TE38-4AU3**	**7TE41-0AU3**	**7TE41-4AU3**
SCCR (short circuit current rating)	kA IC	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 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 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 are available on request, see SINAMICS - Low Voltage Engineering Manual included in the device documentation provided.

6) The cabinet height increases by 10" (250 mm) for IP21 degree of protection and by 16" (400 mm) for IP23 degree of protection (NEMA1 filtered), IP43 and IP54 (NEMA12 ventilated).

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

Table 5- 26 Technical data for Active Line Modules (including Active Interface Module), 3 AC 500 ... 690 V

Article No.	**6SL3730-**	**7TG35-8AU3**	**7TG37-4AU3**	**7TG41-0AU3**	**7TG41-3AU3**
For parallel connection, - Attached to Line Connection Module on left side		--	...-4CU3	...-0CU3	...-3CU3
Rated power - for $I_{N\,DC}$ (50 Hz 690 V) - for $I_{H\,DC}$ (50 Hz 690 V) - for $I_{N\,DC}$ (50 Hz 500 V) - for $I_{H\,DC}$ (50 Hz 500 V) - for $I_{N\,DC}$ (60 Hz 575 V) - for $I_{H\,DC}$ (60 Hz 575 V)	 kW kW kW kW HP HP	 560 550 435 400 600 450	 800 705 560 510 900 600	 1100 980 780 710 1250 1000	 1400 1215 965 880 1500 1250
DC link current - Rated current $I_{N\,DC}$ - Base-load current $I_{H\,DC}$ [1] - Maximum current $I_{max\,DC}$	 A A A	 644 573 966	 823 732 1234	 1148 1022 1722	 1422 1266 2133
Input/regenerative feedback current - Rated current $I_{N\,E}$ - Maximum current $I_{max\,E}$	 A A	 575 862	 735 1102	 1025 1537	 1270 1905
Current demand - Auxiliary supply 24 V DC - 500 V AC at 50/60 Hz [2] - 690 V AC at 50/60 Hz [2] - 230 V AC [2]	 A A A A	 1.57 3 / 4.5 2.1 / 3.1 4.6	 1.67 4.4 / 6.6 3.1 / 4.6 4.9	 1.87 4.4 / 6.6 3.1 / 4.6 4.9	 1.87 4.4 / 6.6 3.1 / 4.6 4.9
DC link capacitance - Active Line Module - Drive line-up, max.	 µF µF	 7400 59200	 11100 153600	 14400 153600	 19200 153600
Power loss, max. [3] - at 50 Hz 500/690 V - at 60 Hz 575 V	 kW kW	 13.6 13.0	 19.2 18.6	 22.8 22.1	 26.1 24.9
Cooling air requirement	cfm m^3/s	2500 1.18	3136 1.48	3136 1.48	3136 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 connection - Busbar cross-section - Max. conductor cross-section (IEC) - Max. conductor cross-section (NEC, CEC)	 mm^2 mm^2 AWG/MCM	PE busbar 600 240 500			
Cable length, max. [5] - Shielded - Unshielded - Shielded - Unshielded	 ft ft m m	 7400 11100 2250 3375	 7400 11100 2250 3375	 7400 11100 2250 3375	 7400 11100 2250 3375
Degree of protection (standard version)		IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - Width - Height [6] - Depth - Width - Height [6] - Depth	 inch inch inch mm mm mm	 39.4 86.6 23.6 1000 2200 600	 55.2 86.6 23.6 1400 2200 600	 55.2 86.6 23.6 1400 2200 600	 55.2 86.6 23.6 1400 2200 600
Weight (standard version)	lb kg	2050 930	3000 1360	3000 1360	3000 1360
Frame size		HX + HI	JX + JI	JX + JI	JX + JI

Article No.	**6SL3730-**	**7TG35-8AU3**	**7TG37-4AU3**	**7TG41-0AU3**	**7TG41-3AU3**
SCCR (short circuit current rating)	kA IC	65	84	100	100
Minimum short-circuit current [7] - For a parallel connection	kA	9	15 4	2.5 4	3.2 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 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 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 are available on request, see SINAMICS - Low Voltage Engineering Manual included in the device documentation provided.

6) The cabinet height increases by 10" (250 mm) for IP21 degree of protection and by 16" (400 mm) for IP23 degree of protection (NEMA1 filtered), IP43 and IP54 (NEMA12 ventilated).

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

5.5 Booksize format Motor Modules

5.5.1 Description

Note

Additional information

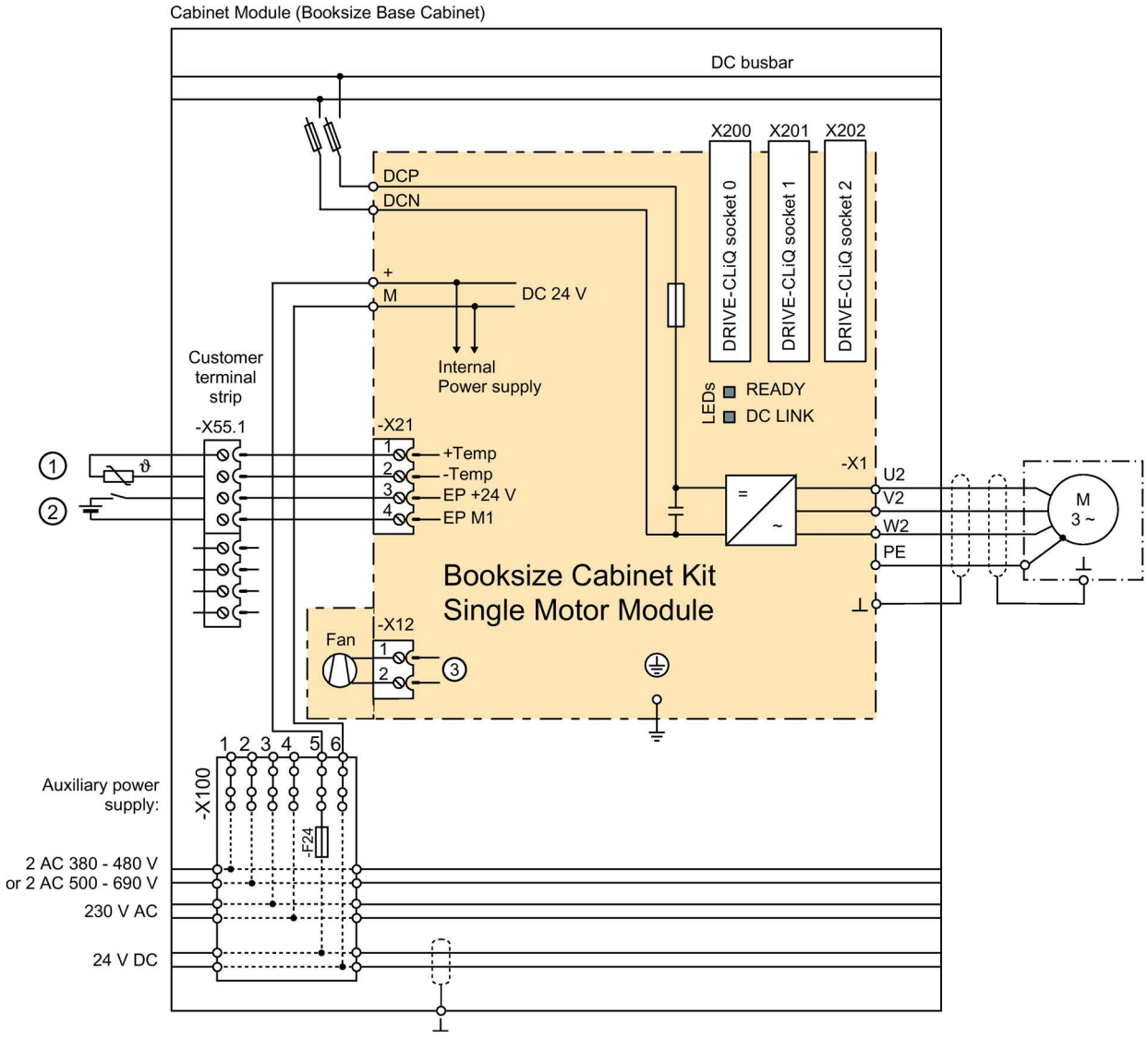
The arrangement of the components and interfaces, as well as the wiring, are provided in the layout diagrams (AO) and circuit diagrams (SP), which are included in the individual device documentation.



Figure 5-30 Motor Modules in booksize format

Motor Modules are also available in a booksize cabinet kit format for power ratings from 5 HP to 100 HP (4.8 kW to 71 kW) in voltage class 380 V to 480 V (DC link voltage 510 V 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 5-31 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 Module via a separate fuse switch disconnector. The DC link rail integrated in the devices is not used. As a 24 V DC supply buffered by the DC link is not possible for Booksize units, an auxiliary power supply is tapped to provide the 24 V DC required for the Booksize Cabinet Kit. The required 24 V DC supply must be provided by an external source via the auxiliary power supply.
With option K73, the 24 V DC supply is provided by a dedicated SITOP.

Note

Additional information

The configuration examples of the individual Motor Modules are used to 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 specified in the layout diagrams (AO) provided in the individual device documentation.

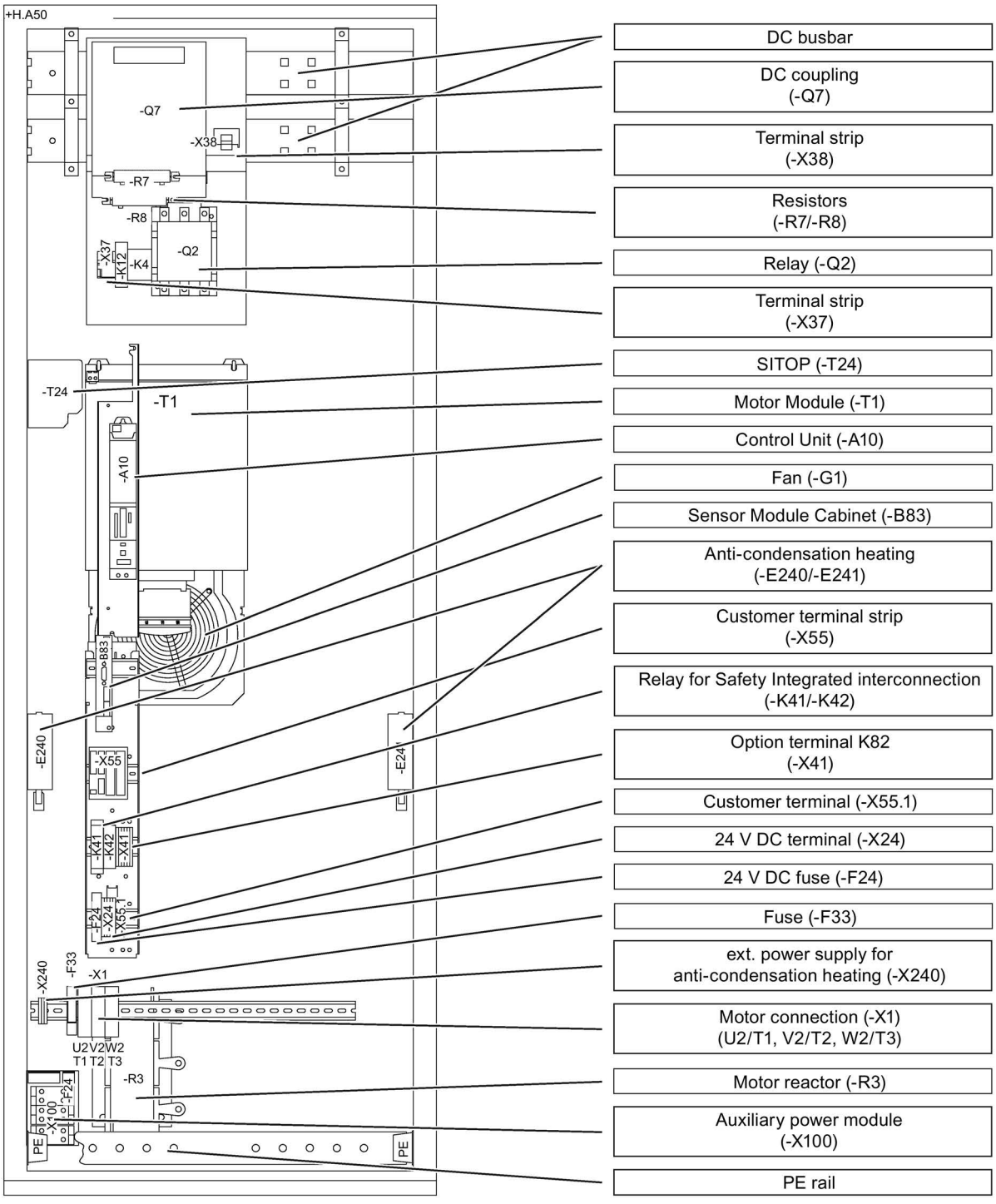


Figure 5-32 Configuration example for Motor Modules in booksize cabinet kit format

Mounting grid arrangement in the cabinet

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

- 4" (100 mm)
- 8" (200 mm)
- 12" (300 mm)

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

Table 5- 27 The assignment of the Motor Modules according to grid width

Grid width	Assignment of Motor Modules (see the section "Technical specifications")
4" (100 mm)	9 ... 30 A Motor Modules
8" (200 mm)	45 to 85 A Motor Modules
12" (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 8" (200 mm).

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, included in the individual device documentation.

5.5.2.2 Customer terminal block X55.1

Description

The customer terminal strip (-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, which are included in the individual device documentation.

X55.1 customer terminal strip

Table 5- 28 Customer terminal strip -X55.1

Terminal	Designation	Technical data
1	+ Temp	Temperature sensor connection KTY84-1C130 / PT1000 / PTC / bimetallic temperature switch with NC contact
2	- Temp	
3	EP +24 V enable pulses	Supply voltage: 24 V DC (20.4 ... 28.8 V) Current consumption: 10 mA
4	EP M1 enable pulses	Isolated input The pulse inhibit function is only available when the "Safety Integrated Basic Functions via onboard terminals" is enabled in the software.
Max. connectable cross-section: #14 AWG (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 electrical separation.
- 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 due to 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 twisted-pair, separately-shielded cables.
- Connect the cable shield at both ends to ground potential over a large surface area.

NOTICE

Damage to the motor when the KTY temperature sensor is connected incorrectly

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.

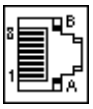
Note

Safety Integrated Function Manual

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

5.5.2.3 X200, X201, X202 DRIVE-CLiQ interfaces

Table 5- 29 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			

5.5.3 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 (plinth), 4" (100 mm) high, RAL 9005	M06
Cable marshalling compartment 8" (200 mm) high, RAL 7035	M07
Degree of protection IP21	M21
Degree of protection IP23 (NEMA1 filtered)	M23
Side panel, mounted on the right	M26
Side panel, mounted on the left	M27
Degree of protection IP43	M43
Degree of protection IP54 (NEMA12 ventilated)	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 aid (top-mounted)	M90
Special paint finish for cabinet	Y09
Factory assembly into transport units	Y11

Other options for Booksize base cabinets

Component	Option
Marking of all control cable conductor ends	M91
Rating plate data in English / French	T58
Rating plate data in English / Spanish	T60
Rating plate data in English / Italian	T80
Rating plate data in English / Russian	T85
Rating plate in English / Chinese	T91
UL listing per UL 508A	U90
cUL listing for Canada per UL 508A	U91
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
TM31 Terminal Module	G60
Additional TM31 Terminal Module	G61
TB30 Terminal Board	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

5.5.4 Technical specifications

Table 5- 30 Technical specifications for Booksize Base Cabinet

Article No.	6SL3720-	1TX38-0AU3	1TX41-2AU3
Usable installation width	inch mm	23.6 600	39.4 1000
Weight (standard version)	lb kg	408 185	596 270
Dimensions (standard version, IP20) - Width - Height [1)] - Depth - Width - Height [1)] - Depth	 inch inch inch mm mm mm	 31.6 86.6 23.6 800 2200 600	 47.2 86.6 23.6 1200 2200 600

[1)] The cabinet height increases by 10" (250 mm) with degree of protection IP21, and by 16" (400 mm) for degrees of protection IP23 (NEMA1 filtered), IP43 and IP54 (NEMA12 ventilated).

Table 5- 31 Technical specifications for Motor Modules in booksize cabinet kit format, Motor Modules, line voltage 3 AC 380 ... 480 V, DC link voltage 510 ... 720 V DC, part I

Article No.	**6SL3720-**	**1TE21-0AU3**	**1TE21-8AU3**	**1TE23-0AU3**	**1TE24-5AU3**
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 demand					
- 24 V DC, 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	cfm	19	19	34	49
	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			
- Max. conductor cross-section (IEC)	mm^2	6	6	6	16
- Max. conductor cross-section (NEC, CEC)	AWG/MCM	10	10	10	6
Cable length, max. [7]					
- Shielded	ft	165	230	330	330
- Unshielded	ft	250	330	490	490
- Shielded	m	50	70	100	100
- Unshielded	m	75	100	150	150
PE/GND connection		PE busbar			
- Busbar cross-section	mm^2	600			
- Max. conductor cross-section (IEC)	mm^2	240			
- Max. conductor cross-section (NEC, CEC)	AWG/MCM	500			
Degree of protection		IP20	IP20	IP20	IP20
Weight, approx.	lb	44	44	48.2	60
	kg	20	20	21.9	27
Wide Motor Module	inch	2	2	4	6
	mm	50	50	100	150

Article No.	**6SL3720-**	**1TE21-0AU3**	**1TE21-8AU3**	**1TE23-0AU3**	**1TE24-5AU3**
Installation width	inch mm	4 100	4 100	4 100	8 200
SCCR (short circuit current rating)	kA IC	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 the SINAMICS Low Voltage Engineering Manual 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 depending on the configuration are available on request, see SINAMICS - Low Voltage Engineering Manual in the device documentation provided.

Table 5- 32 Technical specifications for Motor Module in booksize cabinet kit format, Motor Modules, line voltage 3 AC 380 ... 480 V, DC link voltage 510 ... 720 V DC, part II

Article No.	**6SL3720-**	**1TE26-0AU3**	**1TE28-5AU3**	**1TE31-3AU3**	
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 demand					
- 24 V DC, 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	cfm	49	94	305	
	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			
- Max. conductor cross-section (IEC)	mm^2	16	35	70	
- Max. conductor cross-section (NEC, CEC)	AWG/MCM	6	2	2/0	
Cable length, max. 7)					
- Shielded	ft	330	330	330	
- Unshielded	ft	490	490	490	
- Shielded	m	100	100	100	
- Unshielded	m	150	150	150	
PE/GND connection		PE busbar			
- Busbar cross-section	mm^2	600			
- Max. conductor cross-section (IEC)	mm^2	240			
- Max. conductor cross-section (NEC, CEC)	AWG/MCM	500			
Degree of protection		IP20	IP20	IP20	
Weight, approx.	lb	60	73	91	
	kg	27	33	41	
Wide Motor Module	inch	6	8	12	
	mm	150	200	300	

Article No.	**6SL3720-**	**1TE26-0AU3**	**1TE28-5AU3**	**1TE31-3AU3**	
Installation width	inch mm	8 200	8 200	12 300	
SCCR (short circuit current rating)	kA IC	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 the SINAMICS Low Voltage Engineering Manual 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 depending on the configuration are available on request, see SINAMICS - Low Voltage Engineering Manual in the device documentation provided.

5.5.5 Overload capability

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

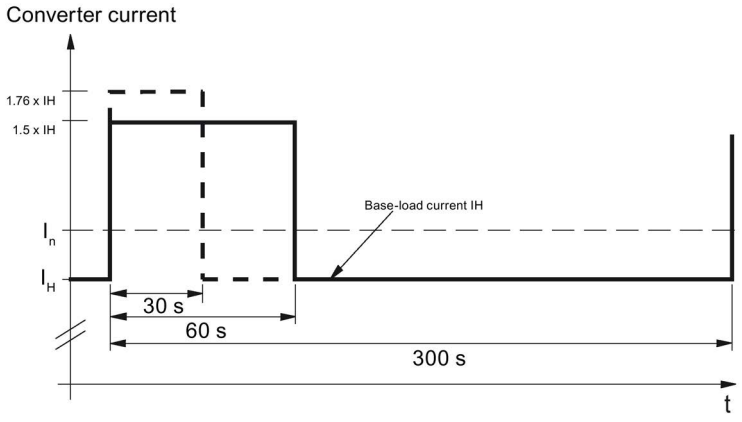


Figure 5-33 Duty cycle with 30 s and 60 s overload with a duty cycle duration of 300 s

5.6 Motor Modules in chassis format

5.6.1 Description

Note

Additional information

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



Figure 5-34 Motor Module in 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 in chassis format are available for the following voltages and power ratings:

Line voltage	DC link voltage	Type rating
3 AC 380 ... 480 V	510 to 720 V DC	150 ... 1000 HP (110 ... 800 kW)
3 AC 500 ... 690 V	675 to 1035 V DC	75 ... 1250 HP (75 ... 1200 kW)

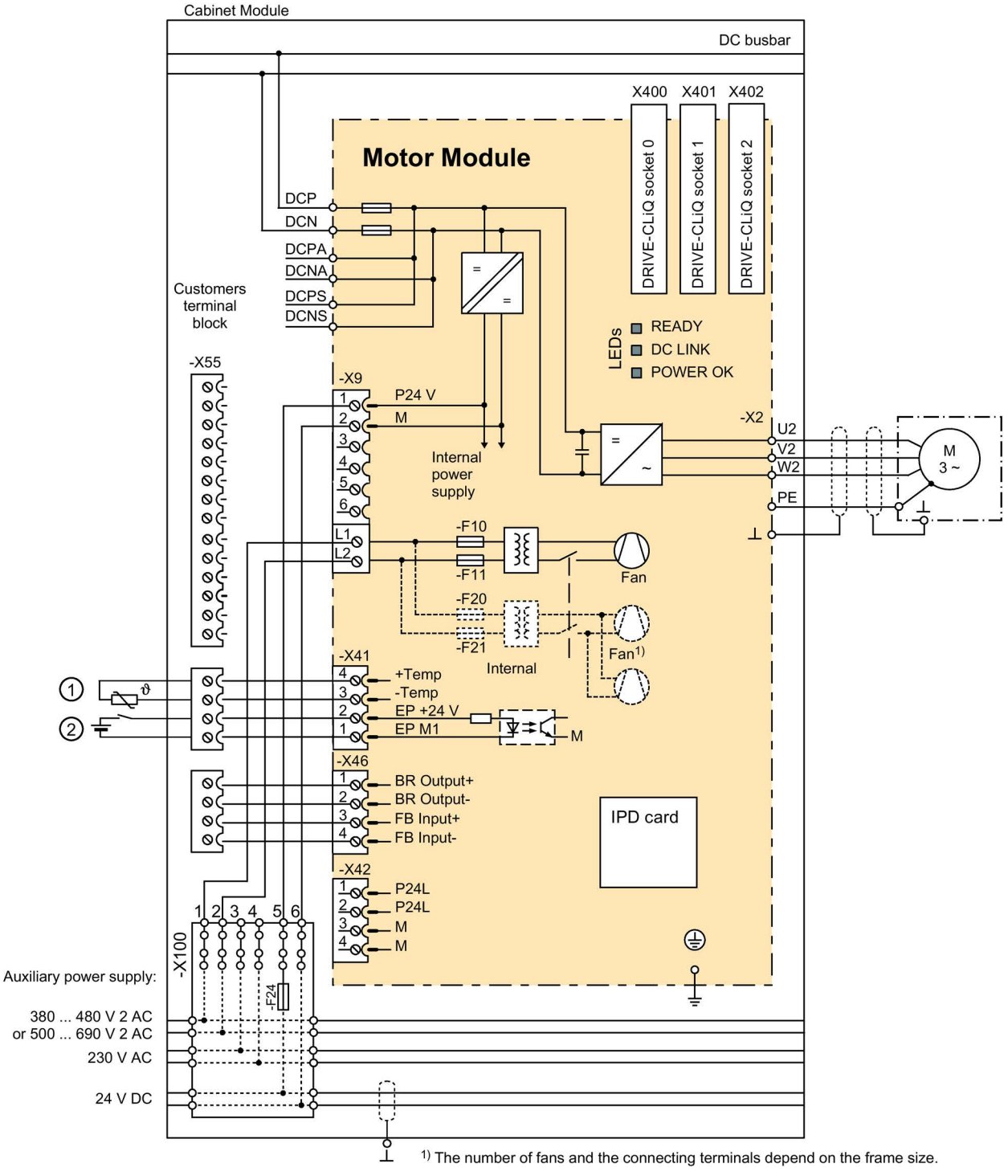
The available shaft output can be increased by connecting up to 4 Motor Modules in parallel. These modules are operated on one Control Unit and feed one motor.

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 5-35 Connection example for Motor Modules in 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 (3 DRIVE-CLiQ sockets), without Control Unit
- Customer interface -X55
- 6-pin 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 routing of cables.

Note

Additional information

The configuration examples of the individual Motor Modules are used to 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 specified in the layout diagrams (AO) provided in the individual device documentation.

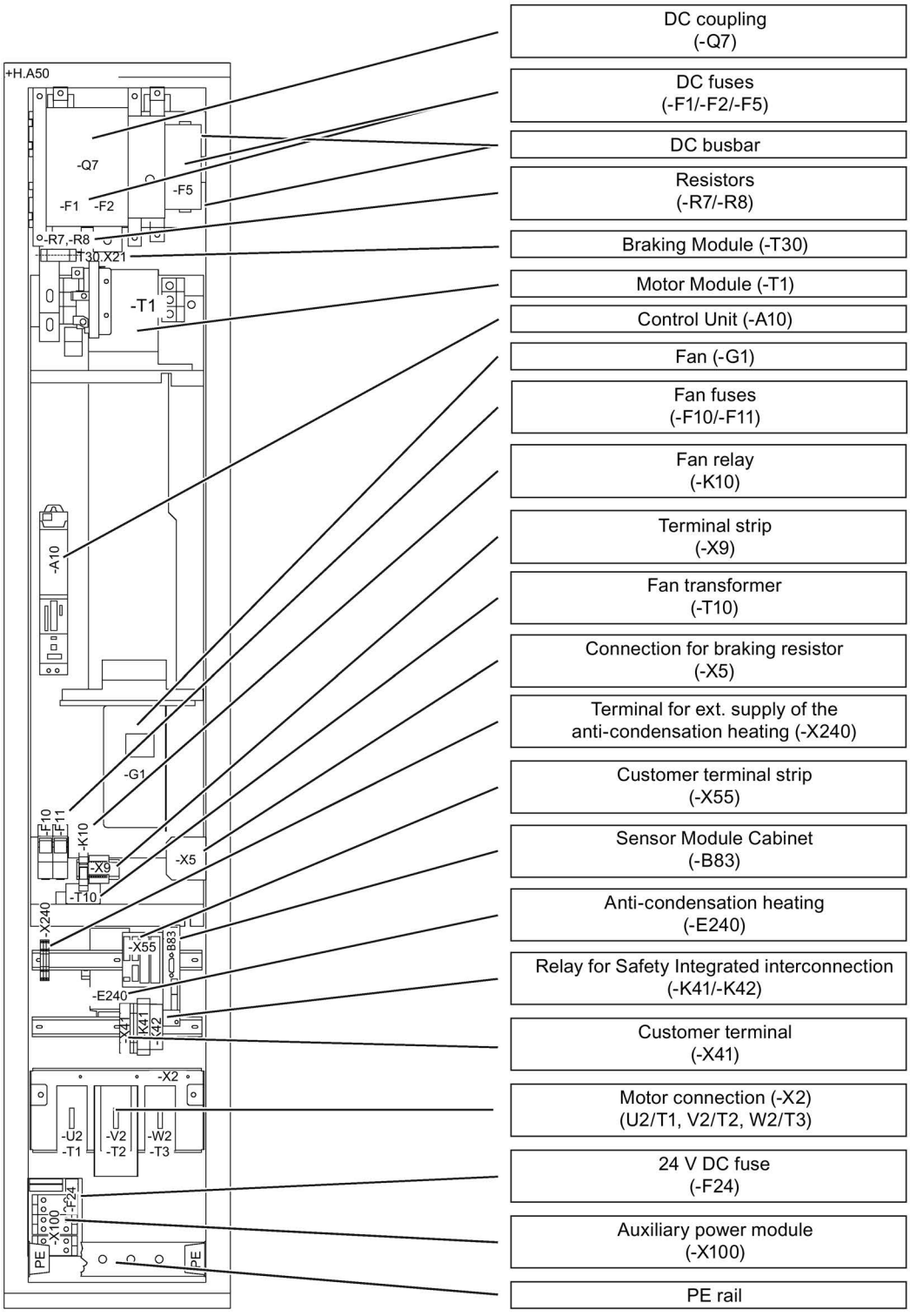


Figure 5-36 Configuration of Motor Modules in chassis format (frame size FX)

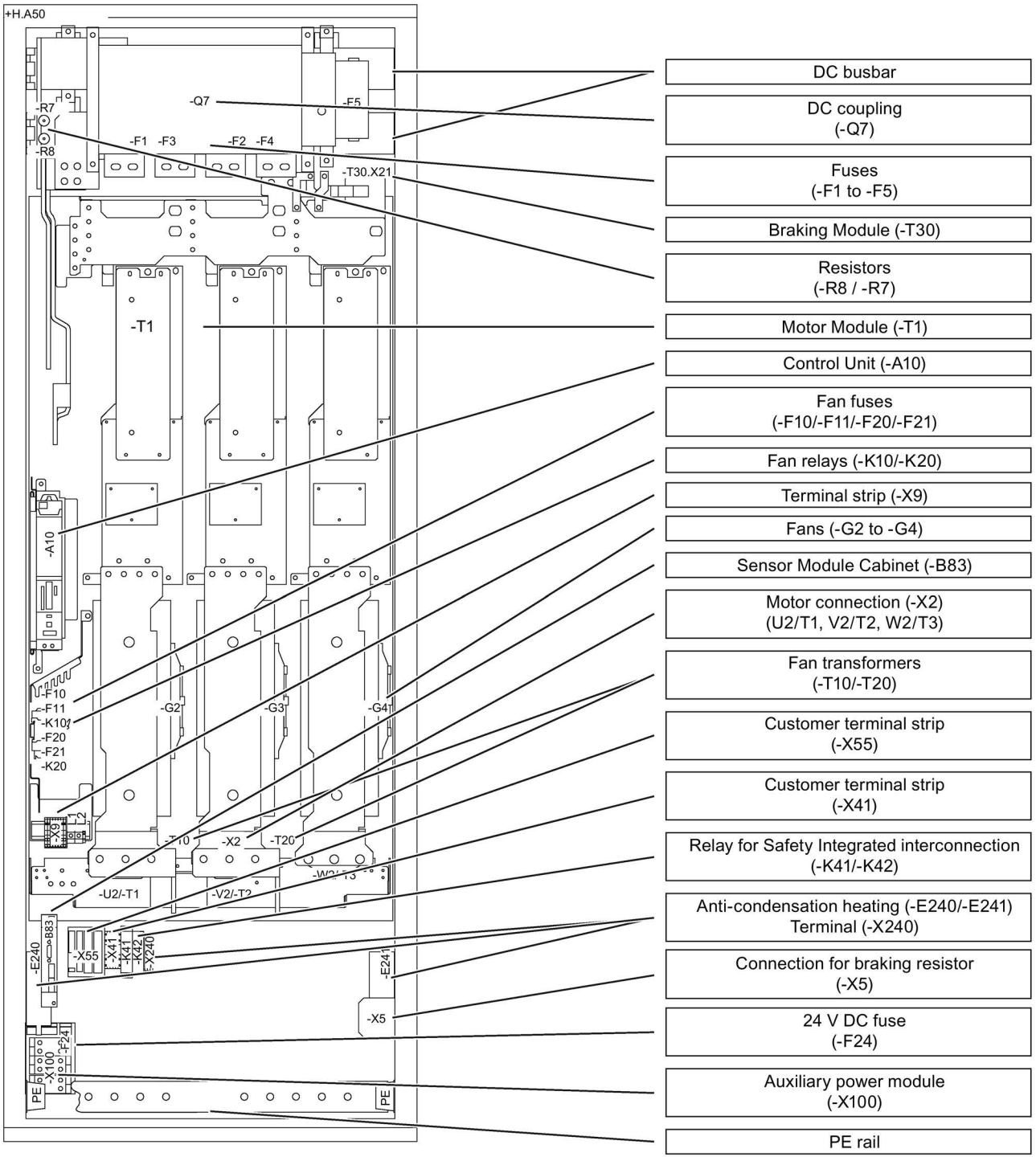


Figure 5-37 Configuration of Motor Modules in chassis format (frame size JX)

Parallel connection of Motor Modules to increase power rating

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

- Up to 4 identical Motor Modules can be connected in parallel.
- A common Control Unit is required whenever the modules are connected in parallel.
- The motor supply cables must be the same length (symmetrical design).
- Power must be supplied to the Motor Modules from a common DC 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.

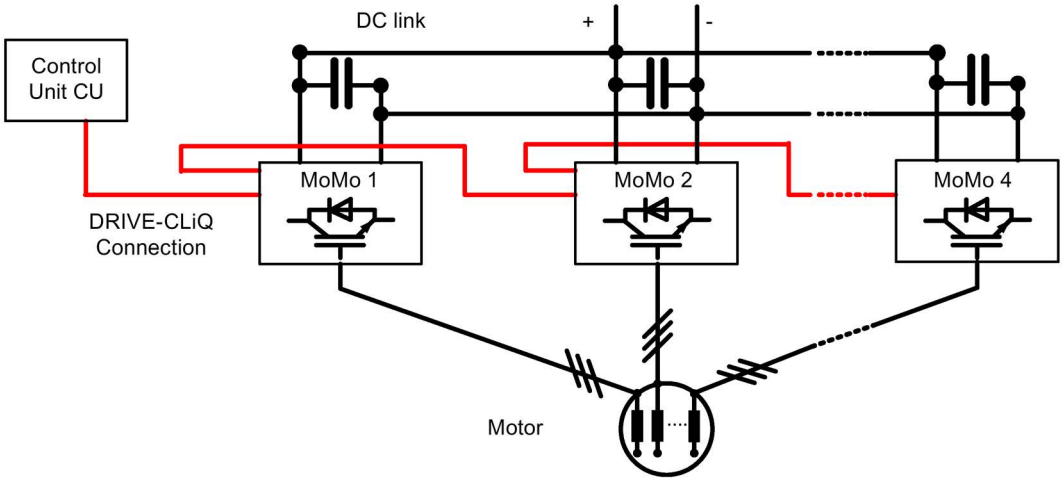


Figure 5-38 Motor with electrically isolated winding systems supplied by a parallel connection of S120 Motor Modules

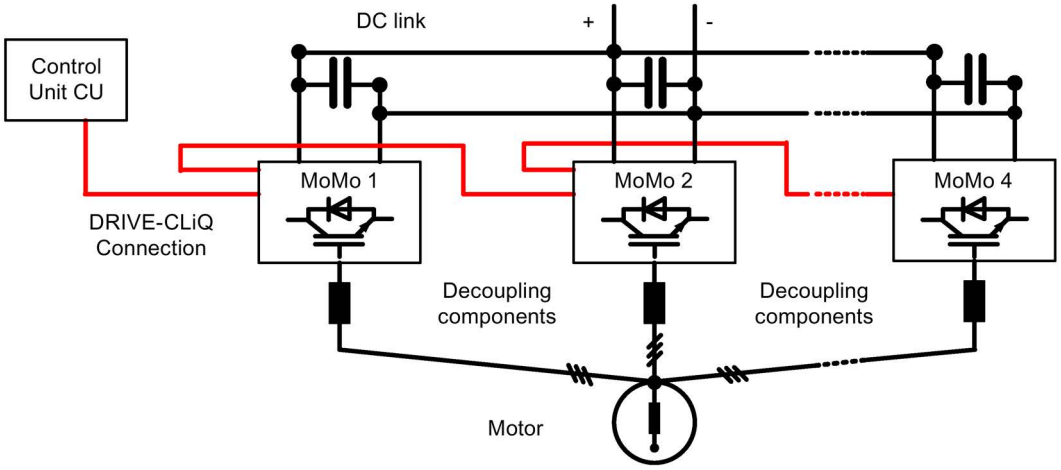


Figure 5-39 Motor with common winding system supplied by a parallel connection of S120 Motor Modules

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.

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- 33 Motor Modules, 510 to 720 VDC

Article No.	Frame size	P_n [HP] ([kW])	$I_{rated\ rms}$ [A]	Minimum length [ft] ([m])
6SL3720-1TE32-1AU3	FX	150 (110)	210	98 (30)
6SL3720-1TE32-6AU3	FX	200 (132)	260	89 (27)
6SL3720-1TE33-1AU3	GX	250 (160)	310	66 (20)
6SL3720-1TE33-8AU3	GX	300 (200)	380	56 (17)
6SL3720-1TE35-0AU3	GX	400 (250)	490	49 (15)
6SL3720-1TE36-1AU3	HX	500 (315)	605	43 (13)
6SL3720-1TE37-5AU3	HX	600 (400)	745	33 (10)
6SL3720-1TE38-4AU3	HX	700 (450)	840	29 (9)
6SL3720-1TE41-0AU3	JX	800 (560)	985	26 (8)
6SL3720-1TE41-2AU3	JX	1000 (710)	1260	20 (6)
6SL3720-1TE41-4AU3	JX	1150 (800)	1405	16 (5)

Table 5- 34 Motor Modules, 675 ...1035 V DC

Article No.	Frame size	P_n [HP] ([kW])	$I_{rated\ rms}$ [A]	Minimum length [ft] ([m])
6SL3720-1TG28-5AU3	FX	75 (75)	85	330 (100)
6SL3720-1TG31-0AU3	FX	75 (90)	100	295 (90)
6SL3720-1TG31-2AU3	FX	100 (110)	120	262 (80)
6SL3720-1TG31-5AU3	FX	150 (132)	150	230 (70)
6SL3720-1TG31-8AU3	GX	150 (160)	175	197 (60)
6SL3720-1TG32-2AU3	GX	200 (200)	215	165 (50)
6SL3720-1TG32-6AU3	GX	250 (250)	260	131 (40)
6SL3720-1TG33-3AU3	GX	300 (315)	330	98 (30)
6SL3720-1TG34-1AU3	HX	400 (400)	410	82 (25)
6SL3720-1TG34-7AU3	HX	450 (450)	465	82 (25)
6SL3720-1TG35-8AU3	HX	600 (560)	575	66 (20)
6SL3720-1TG37-4AU3	JX	700 (710)	735	59 (18)
6SL3720-1TG38-1AU3	JX	800 (800)	810	49 (15)
6SL3720-1TG38-8AU3	JX	900 (900)	910	39 (12)
6SL3720-1TG41-0AU3	JX	1000 (1000)	1025	33 (10)
6SL3720-1TG41-3AU3	JX	1250 (1200)	1270	26 (8)

5.6.2 X55 customer terminal strip

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.

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")

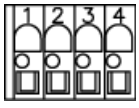
Note

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!

5.6.2.2 X41 EP terminal / temperature sensor connection

Table 5- 35 Terminal strip X41 EP terminals / temperature sensor connection

Connector	Terminal	Function	Technical data
	1	EP M1 (enable pulses)	Supply voltage: 24 V DC (20.4 ... 28.8 V) Current consumption: 10 mA The pulse inhibit function is only available when the "Safety Integrated Basic Functions via onboard terminals" is enabled in the software.
	2	EP +24 V (enable pulses)	
	3	- Temp	Temperature sensor connection for motor temperature measurement: KTY84-1C130, PTC, PT100, PT1000, bimetallic temperature switch with NC contact
	4	+ Temp	
Max. connectable cross-section: #14 AWG (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 electrical separation.
- 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 due to 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 twisted-pair, separately-shielded cables.
- Connect the cable shield at both ends to ground potential over a large surface area.

NOTICE

Damage to the motor when the KTY temperature sensor is connected incorrectly

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.

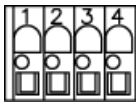
Note

Safety Integrated Function Manual

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

5.6.2.3 X46 Brake control and monitoring

Table 5- 36 Terminal strip X46 brake control and monitoring

Connector	Terminal	Function	Technical data
	1	BR output +	Brake connection
	2	BR output -	Supply voltage: 24 V DC Max. load current: 200 mA
	3	FB input +	Internal feedback signal from the Safe Brake Adapter
	4	FB input -	
Max. connectable cross-section: #14 AWG (2.5 mm^2)			

Note

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

WARNING

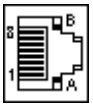
Fire due to overheating when the total length of the connecting cables is exceeded

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

- Limit the connected cable lengths to a maximum of 33 ft (10 m).
- Do not route the connection cable outside the control cabinet or control cabinet group.

5.6.2.4 DRIVE-CLiQ interfaces X400, X401, X402

Table 5- 37 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

Component	Option
CBC10 Communication Board	G20
CBE20 Communication Board	G33
1 TM150 Temperature Sensor Module	G51
2 TM150 Temperature Sensor Modules	G52
TM31 Terminal Module	G60
Additional TM31 Terminal Module	G61
TB30 Terminal Board	G62
Safety license for 1 to 5 axes	K01 ... K05
AOP30 operator panel	K08
SMC 10/20/30 Sensor Modules	K46, K48, K50
VSM10 Voltage Sensing Module Cabinet-Mounted	K51
Additional SMC30 Sensor Module	K52
Terminal Module for activating "Safe Torque Off" and "Safe STOP 1"	K82
Terminal Module TM54F	K87
Safe Brake Adapter SBA 230 V AC	K88
Control Unit CU320-2 PROFIBUS	K90
Performance extension for CU320-2	K94
Control Unit CU320-2 PROFINET	K95
Motor reactor	L08
dv/dt filter plus Voltage Peak Limiter	L10
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 (plinth), 4" (100 mm) high, RAL 9005	M06
Cable marshalling compartment 8" (200 mm) high, RAL 7035	M07
Degree of protection IP21	M21
Degree of protection IP23 (NEMA1 filtered)	M23
Side panel, mounted on the right	M26
Side panel, mounted on the left	M27
Degree of protection IP43	M43
Degree of protection IP54 (NEMA12 ventilated)	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 aid (top-mounted)	M90
Special paint finish for cabinet	Y09
Factory assembly into transport units	Y11

Other options

Component	Option
Marking of all control cable conductor ends	M91
Rating plate data in English / French	T58
Rating plate data in English / Spanish	T60
Rating plate data in English / Italian	T80
Rating plate data in English / Russian	T85
Rating plate in English / Chinese	T91
UL listing per UL 508A	U90
cUL listing for Canada per UL 508A	U91
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

5.6.4 Technical specifications

Table 5- 38 Technical specifications for Motor Modules in chassis format, line voltage 3 AC 380 ... 480 V, DC link voltage 510 ... 720 V DC, part I

Article No.	**6SL3720-**	**1TE32-1AU3**	**1TE32-6AU3**	**1TE33-1AU3**	**1TE33-8AU3**	**1TE35-0AU3**	**1TE36-1AU3**
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 demand							
- 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	cfm	360	487	763	763	763	1653
	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
- Max. conductor cross-section (IEC)	mm^2	2 x 185	2 x 185	2 x 240	2 x 240	2 x 240	4 x 240
- Max. conductor cross-section (NEC, CEC)	AWG/MCM	2 x 350	2 x 350	2 x 500	2 x 500	2 x 500	4 x 500
Cable length, max. [6]							
- Shielded	ft	980	980	980	980	980	980
- Unshielded	ft	1480	1480	1480	1480	1480	1480
- Shielded	m	300	300	300	300	300	300
- Unshielded	m	450	450	450	450	450	450

Article No.	**6SL3720-**	**1TE32-1AU3**	**1TE32-6AU3**	**1TE33-1AU3**	**1TE33-8AU3**	**1TE35-0AU3**	**1TE36-1AU3**
PE/GND connection - Busbar cross-section - Max. conductor cross-section (IEC) - Max. conductor cross-section (NEC, CEC)	 mm^2 mm^2 AWG/MCM	PE busbar 600 240 500					
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - Width [7] - Height [8] - Depth - Width [7] - Height [8] - Depth	 inch inch inch mm mm mm	 15.8 86.6 23.6 400 2200 600	 15.8 86.6 23.6 400 2200 600	 15.8 86.6 23.6 400 2200 600	 15.8 86.6 23.6 400 2200 600	 15.8 86.6 23.6 400 2200 600	 23.6 86.6 23.6 600 2200 600
Weight, approx. (standard version)	lb kg	320 145	320 145	631 286	631 286	631 286	1080 490
Frame size		FX	FX	GX	GX	GX	HX
SCCR (short circuit current rating)	kA IC	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 included in the device documentation provided.

7) With option L08 (motor reactor):
- frame size HX/JX →supplementary cabinet 23.6" (600 mm)
with option L10 (dv/dt filter plus VPL):
- frame size FX/GX/HX/JX →supplementary cabinet 23.6" (600 mm) wide

8) The cabinet height increases by 10" (250 mm) with IP21 degree of protection, and by 16" (400 mm) for degree of protection IP23 (NEMA1 filtered), IP43 and IP54 (NEMA12 ventilated).

Table 5- 39 Technical specifications for Motor Modules in chassis format, line voltage 3 AC 380 ... 480 V, DC link voltage 510 ... 720 V DC, part II

Article No.	**6SL3720-**	**1TE37-5AU3**	**1TE38-4AU3**	**1TE41-0AU3**	**1TE41-2AU3**	**1TE41-4AU3**
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 demand						
- 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	cfm	1653	1653	2288	2288	2288
	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
- Max. conductor cross-section (IEC)	mm^2	4 x 240	4 x 240	6 x 240	6 x 240	6 x 240
- Max. conductor cross-section (NEC, CEC)	AWG/MCM	4 x 500	4 x 500	6 x 500	6 x 500	6 x 500
Cable length, max. 6)						
- Shielded	ft	980	980	980	980	980
- Unshielded	ft	1480	1480	1480	1480	1480
	m	300	300	300	300	300
	m	450	450	450	450	450
PE/GND connection		PE busbar				
- Busbar cross-section	mm^2	600				
- Max. conductor cross-section (IEC)	mm^2	240				
- Max. conductor cross-section (NEC, CEC)	AWG/MCM	500				
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20

Article No.	**6SL3720-**	**1TE37-5AU3**	**1TE38-4AU3**	**1TE41-0AU3**	**1TE41-2AU3**	**1TE41-4AU3**
Dimensions (standard version, IP20)						
- Width [7]	inch	23.6	23.6	31.6	31.6	31.6
- Height [8]	inch	86.6	86.6	86.6	86.6	86.6
- Depth	inch	23.6	23.6	23.6	23.6	23.6
- Width [7]	mm	600	600	800	800	800
- Height [8]	mm	2200	2200	2200	2200	2200
- Depth	mm	600	600	600	600	600
Weight, approx. (standard version)	lb kg	1080 490	1080 490	1544 700	1544 700	1544 700
Frame size		HX	HX	JX	JX	JX
SCCR (short circuit current rating)	kA IC	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 included in the device documentation provided.

7) With option L08 (motor reactor):
- frame size HX/JX →supplementary cabinet 23.6" (600 mm)
With option L10 (dv/dt filter plus VPL):
- frame size FX/GX/HX/JX →supplementary cabinet 23.6" (600 mm) wide

8) The cabinet height increases by 10" (250 mm) with IP21 degree of protection, and by 16" (400 mm) for degree of protection IP23 (NEMA1 filtered), IP43 and IP54 (NEMA12 ventilated).

Table 5- 40 Technical specifications for Motor Modules in chassis format, line voltage 3 AC 500 ... 690 V, DC link voltage 675 ... 1080 V DC; part I

Article No.	**6SL3720-**	**1TG28-5AU3**	**1TG31-0AU3**	**1TG31-2AU3**	**1TG31-5AU3**	**1TG31-8AU3**	**1TG32-2AU3**
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 demand							
- Auxiliary supply 24 V DC	A	0.8	0.8	0.8	0.8	0.9	0.9
- 500/690 V AC	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	cfm	360	360	360	360	763	763
	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
- Max. conductor cross-section (IEC)	mm^2	2 x 185	2 x 185	2 x 185	2 x 185	2 x 240	2 x 240
- Max. conductor cross-section (NEC, CEC)	AWG/MCM	2 x 350	2 x 350	2 x 350	2 x 350	2 x 500	2 x 500
Cable length, max. [6]							
- Shielded	ft	980	980	980	980	980	980
- Unshielded	ft	1480	1480	1480	1480	1480	1480
- Shielded	m	300	300	300	300	300	300
- Unshielded	m	450	450	450	450	450	450

Article No.	**6SL3720-**	**1TG28-5AU3**	**1TG31-0AU3**	**1TG31-2AU3**	**1TG31-5AU3**	**1TG31-8AU3**	**1TG32-2AU3**
PE/GND connection - Busbar cross-section - Max. conductor cross-section (IEC) - Max. conductor cross-section (NEC, CEC)	 mm^2 mm^2 AWG/MCM	PE busbar 600 240 500					
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - Width [7] - Height [8] - Depth - Width [7] - Height [8] - Depth	 inch inch inch mm mm mm	 15.8 86.6 23.6 400 2200 600	 15.8 86.6 23.6 400 2200 600	 15.8 86.6 23.6 400 2200 600	 15.8 86.6 23.6 400 2200 600	 15.8 86.6 23.6 400 2200 600	 15.8 86.6 23.6 400 2200 600
Weight, approx. (standard version)	lb kg	320 145	320 145	320 145	320 145	631 286	631 286
Frame size		FX	FX	FX	FX	GX	GX
SCCR (short circuit current rating)	kA IC	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 included in the device documentation provided.

7) With option L08 (motor reactor):
- frame size HX/JX →supplementary cabinet 23.6" (600 mm)
With option L10 (dv/dt filter plus VPL):
- frame size FX/GX/HX/JX →supplementary cabinet 23.6" (600 mm) wide

8) The cabinet height increases by 10" (250 mm) with IP21 degree of protection, and by 16" (400 mm) for degree of protection IP23 (NEMA1 filtered), IP43 and IP54 (NEMA12 ventilated).

Table 5- 41 Technical specifications for Motor Modules in chassis format, line voltage 3 AC 500 ... 690 V, DC link voltage 675 ... 1035 V DC; part II

Article No.	**6SL3720-**	**1TG32-6AU3**	**1TG33-3AU3**	**1TG34-1AU3**	**1TG34-7AU3**	**1TG35-8AU3**
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 demand						
- Auxiliary supply 24 V DC	A	0.9	0.9	1.0	1.0	1.0
- 500/690 V AC	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	cfm	763	763	1653	1653	1653
	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
- Max. conductor cross-section (IEC)	mm^2	2 x 240	2 x 240	4 x 240	4 x 240	4 x 240
- Max. conductor cross-section (NEC, CEC)	AWG/MCM	2 x 500	2 x 500	4 x 500	4 x 500	4 x 500
Cable length, max. 6)						
- Shielded	ft	980	980	980	980	980
- Unshielded	ft	1480	1480	1480	1480	1480
- Shielded	m	300	300	300	300	300
- Unshielded	m	450	450	450	450	450

Article No.	**6SL3720-**	**1TG32-6AU3**	**1TG33-3AU3**	**1TG34-1AU3**	**1TG34-7AU3**	**1TG35-8AU3**
PE/GND connection - Busbar cross-section - Max. conductor cross-section (IEC) - Max. conductor cross-section (NEC, CEC)	 mm^2 mm^2 AWG/MCM	PE busbar 600 240 500				
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - Width [7] - Height [8] - Depth - Width [7] - Height [8] - Depth	 inch inch inch mm mm mm	 15.8 86.6 23.6 400 2200 600	 15.8 86.6 23.6 400 2200 600	 23.6 86.6 23.6 600 2200 600	 23.6 86.6 23.6 600 2200 600	 23.6 86.6 23.6 600 2200 600
Weight, approx. (standard version)	lb kg	631 286	631 286	1080 490	1080 490	1080 490
Frame size		GX	GX	HX	HX	HX
SCCR (short circuit current rating)	kA IC	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 included in the device documentation provided.

7) With option L08 (motor reactor):
- frame size HX/JX →supplementary cabinet 23.6" (600 mm)
With option L10 (dv/dt filter plus VPL):
- frame size FX/GX/HX/JX →supplementary cabinet 23.6" (600 mm) wide

8) The cabinet height increases by 10" (250 mm) with IP21 degree of protection, and by 16" (400 mm) for degree of protection IP23 (NEMA1 filtered), IP43 and IP54 (NEMA12 ventilated).

Table 5- 42 Technical specifications for Motor Modules in chassis format, line voltage 3 AC 500 ... 690 V, DC link voltage 675 ... 1035 V DC; part III

Article No.	**6SL3720-**	**1TG37-4AU3**	**1TG38-1AU3**	**1TG38-8AU3**	**1TG41-0AU3**	**1TG41-3AU3**
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 demand						
- Auxiliary supply 24 V DC	A	1.25	1.25	1.4	1.4	1.4
- 500/690 V AC	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	cfm	2288	2288	2288	2288	2288
	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
- Max. conductor cross-section (IEC)	mm^2	6 x 240	6 x 240	6 x 240	6 x 240	6 x 240
- Max. conductor cross-section (NEC, CEC)	AWG/MCM	6 x 500	6 x 500	6 x 500	6 x 500	6 x 500
Cable length, max. 6)						
- Shielded	ft	980	980	980	980	980
- Unshielded	ft	1480	1480	1480	1480	1480
- Shielded	m	300	300	300	300	300
- Unshielded	m	450	450	450	450	450

Article No.	**6SL3720-**	**1TG37-4AU3**	**1TG38-1AU3**	**1TG38-8AU3**	**1TG41-0AU3**	**1TG41-3AU3**
PE/GND connection - Busbar cross-section - Max. conductor cross-section (IEC) - Max. conductor cross-section (NEC, CEC)	 mm^2 mm^2 AWG/MCM	PE busbar 600 240 500				
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - Width [7] - Height [8] - Depth - Width [7] - Height [8] - Depth	 inch inch inch mm mm mm	 31.6 86.6 23.6 800 2200 600	 31.6 86.6 23.6 800 2200 600	 31.6 86.6 23.6 800 2200 600	 31.6 86.6 23.6 800 2200 600	 31.6 86.6 23.6 800 2200 600
Weight, approx. (standard version)	lb kg	1544 700	1544 700	1544 700	1544 700	1544 700
Frame size		JX	JX	JX	JX	JX
SCCR (short circuit current rating)	kA IC	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 included in the device documentation provided.

7) With option L08 (motor reactor):
- frame size HX/JX →supplementary cabinet 23.6" (600 mm)
With option L10 (dv/dt filter plus VPL):
- frame size FX/GX/HX/JX →supplementary cabinet 23.6" (600 mm) wide

8) The cabinet height increases by 10" (250 mm) with IP21 degree of protection, and by 16" (400 mm) for degree of protection IP23 (NEMA1 filtered), IP43 and IP54 (NEMA12 ventilated).

5.6.5 Overload capability

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

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

For overload, the following precondition applies: The drive is operated as a maximum with its base-load current before and after the overload occurs (a duty cycle duration of 300 s is used as a basis here).

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

More information on the overload capability is provided in the Low Voltage Engineering Manual and in the SINAMICS S 120 Function Manual Drive Functions.

Slight 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 duration of 300 s.

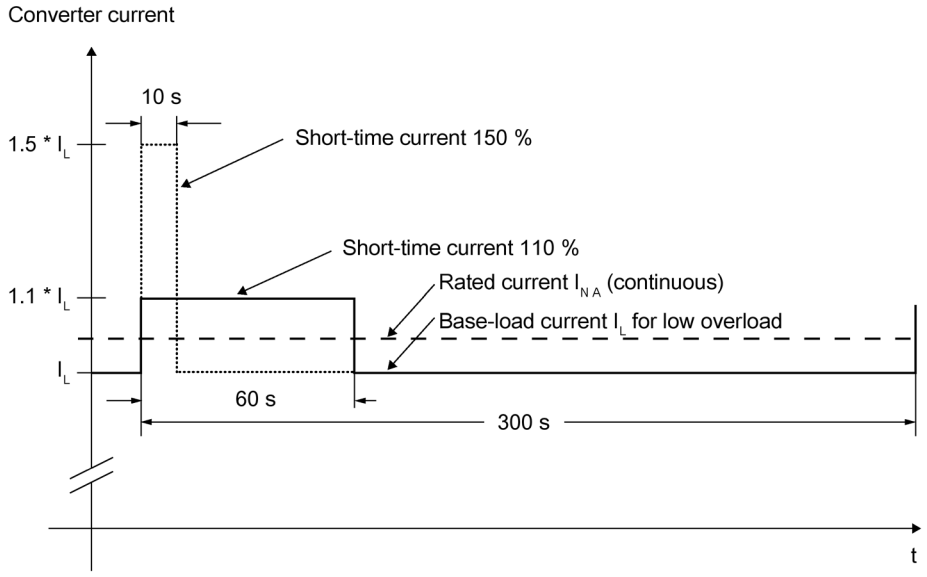


Figure 5-40 Slight overload

High overload

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.

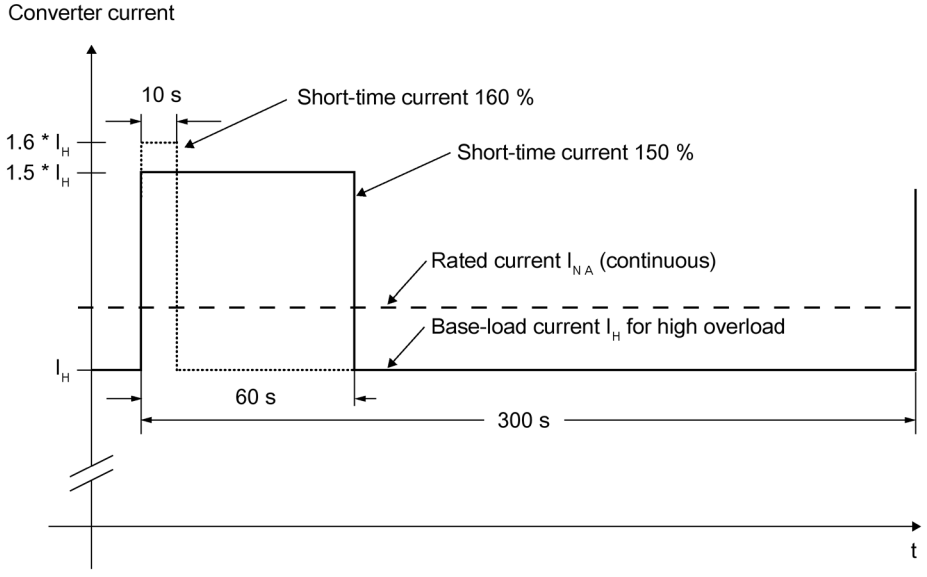


Figure 5-41 High overload

5.6.6 Current derating 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- 43 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-...	[HP] ([kW])	[A]	2.5 kHz	4 kHz	5 kHz	7.5 kHz	8 kHz
Supply voltage 510 – 720 VDC							
1TE32-1AU3	150 (110)	210	95%	82%	74%	54%	50%
1TE32-6AU3	200 (132)	260	95%	83%	74%	54%	50%
1TE33-1AU3	250 (160)	310	97%	88%	78%	54%	50%
1TE33-8AU3	300 (200)	380	96%	87%	77%	54%	50%
1TE35-0AU3	400 (250)	490	94%	78%	71%	53%	50%

Table 5- 44 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-...	[HP] ([kW])	[A]	2 kHz	2.5 kHz	4 kHz	5 kHz	7.5 kHz	8 kHz
Supply voltage 510 – 720 VDC								
1TE36-1AU3	500 (315)	605	83%	72%	64%	60%	40%	36%
1TE37-5AU3	600 (400)	745	83%	72%	64%	60%	40%	36%
1TE38-4AU3	700 (450)	840	87%	79%	64%	55%	40%	37%
1TE41-0AU3	800 (560)	985	92%	87%	70%	60%	50%	47%
1TE41-2AU3	1000 (710)	1260	92%	87%	70%	60%	50%	47%
1TE41-4AU3	1150 (800)	1405	97%	95%	74%	60%	50%	47%
Supply voltage 675 – 1035 VDC								
1TG28-5AU3	75 (75)	85	93%	89%	71%	60%	40%	--
1TG31-0AU3	75 (90)	100	92%	88%	71%	60%	40%	--
1TG31-2AU3	100 (110)	120	92%	88%	71%	60%	40%	--
1TG31-5AU3	150 (132)	150	90%	84%	66%	55%	35%	--
1TG31-8AU3	150 (160)	175	92%	87%	70%	60%	40%	--
1TG32-2AU3	200 (200)	215	92%	87%	70%	60%	40%	--
1TG32-6AU3	250 (250)	260	92%	88%	71%	60%	40%	--
1TG33-3AU3	300 (315)	330	89%	82%	65%	55%	40%	--
1TG34-1AU3	400 (400)	410	89%	82%	65%	55%	35%	--
1TG34-7AU3	450 (450)	465	92%	87%	67%	55%	35%	--
1TG35-8AU3	600 (560)	575	91%	85%	64%	50%	35%	--
1TG37-4AU3	700 (710)	735	87%	79%	64%	55%	35%	--
1TG38-1AU3	800 (800)	810	97%	95%	71%	55%	35%	--
1TG38-8AU3	900 (900)	910	92%	87%	67%	55%	33%	--
1TG41-0AU3	1000 (1000)	1025	91%	86%	64%	50%	30%	--
1TG41-3AU3	1250 (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- 45 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 operating mode
250 µs [1]	2 kHz 4 kHz 8 kHz	166 Hz 333 Hz 550 Hz [3]	166 Hz 333 Hz 480 Hz	333 Hz 550 Hz [3] 550 Hz [3]
400 µs [2]	1.25 kHz 2.50 kHz 5.00 kHz 7.50 kHz	104 Hz 208 Hz 416 Hz 550 Hz [3]	104 Hz 208 Hz 300 Hz 300 Hz	- - - -

[1] As factory setting, the following devices have a current controller clock cycle of 250 µs - and a pulse frequency of 2 kHz:
- 510 ... 720 V DC: ≤250 kW (400 HP) / 490 A

[2] As factory setting, the following devices have a current controller clock cycle of 400 µs - and a pulse frequency of 1.25 kHz:
- 510 ... 720 V DC: ≥315 kW (500 HP) / 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.

5.7 Auxiliary Power Supply Modules

5.7.1 Description

Note

Additional information

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



Figure 5-42 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 V AC power supply can also be fed in externally via an uninterruptible power supply (UPS) and terminal -X46.

Note

Voltage 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

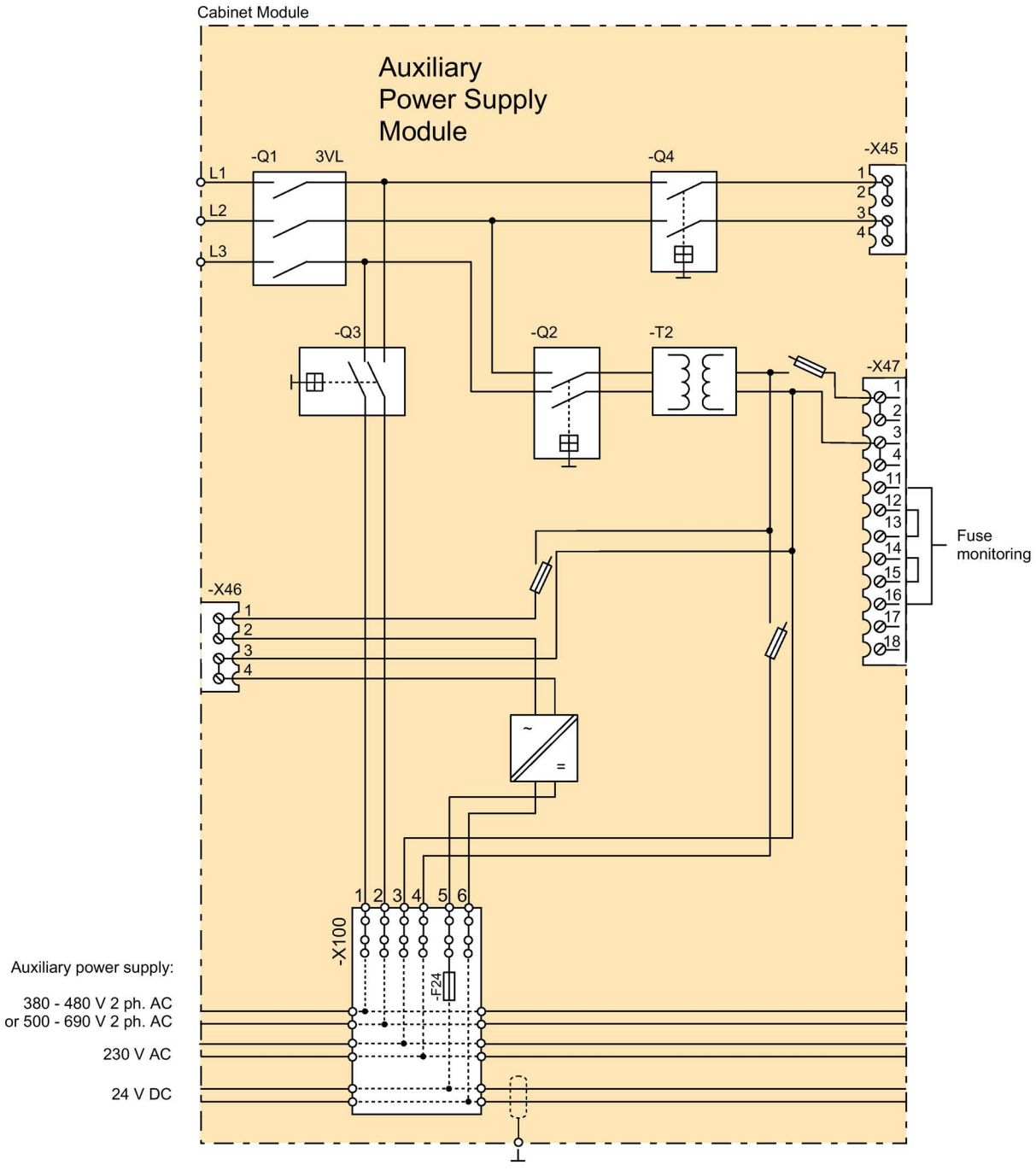


Figure 5-43 Connection example for Auxiliary Power Supply Modules

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:

- Circuit breaker with auxiliary contacts for external evaluation
- Supply of auxiliary power system with three auxiliary voltages:
  - 24 V DC for the electronics power supply
  - 230 V 1 ph. AC for supply of 230 V AC loads
  - 380 to 690 V 2 ph. AC for supply of device fans (corresponding to the respective rated device voltage)
- Transformer with output voltage 230 V 1 ph. AC
- SITOP power supply 24 V DC
- PE busbar, nickel-plated (60 x 10 mm), including jumper for looping through to the next Cabinet Module.

Note

Additional information

The configuration examples of the auxiliary power supply module 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 specified in the layout diagrams (AO) provided in the individual device documentation.

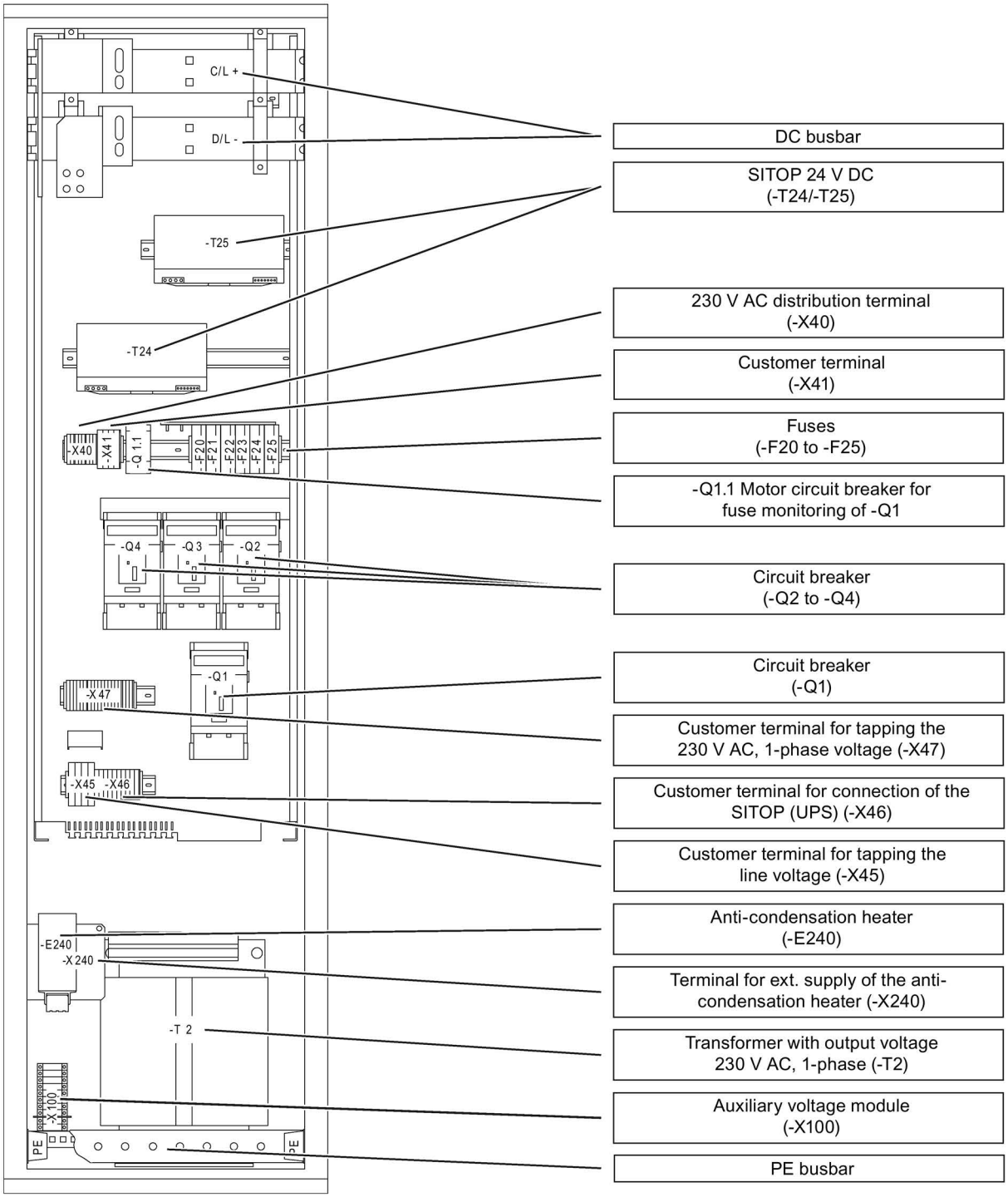


Figure 5-44 Configuration example for Auxiliary Power Supply Modules

5.7.2 Circuit breaker (-Q1)

The infeed of the Auxiliary Power Supply Module occurs for the customer at the circuit breaker (-Q1). The plant-side power demand indicated in the table "Technical specifications" varies according to the version of the Cabinet Module used.

5.7.3 Transformer (-T2) for generating the auxiliary voltage 230 V AC

A transformer is incorporated to generate the 230 V 2 ph. AC 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 terminals on the primary side of the transformer may need to be reconnected according to the available 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 according to the actual line voltage so that the 230 V 2 ph. AC voltage required in the system is provided correctly.

Table 5- 46 Assignment of the available line voltage for generating the 2 AC 230 V

Tap	Taps of matching 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

Adaptation of the circuit breaker (-Q2) for transformer (-T2)

For the protection of the transformer (-T2), a circuit breaker (-Q2) is installed before the transformer.

The circuit breakers for the line infeed are set at the factory for the voltage range from 500 ... 690 V. The circuit breaker must be adapted on the plant side for supply voltages in the range 380 ... 480 V.

NOTICE
Adapting the circuit breaker If the circuit breaker for a line infeed in the voltage range from 380 ... 480 V is not adapted on the plant side, the circuit breaker could trip inadvertently in the low voltage range from 380 ... 480 V.

Table 5- 47 Overview of the settings of the circuit breaker (-Q2) for the transformer (-T2) in the auxiliary power supply module

Auxiliary Power Supply Module **Article No. 6SL3700-**	**0MX14-0AU3**	**0MX16-3AU3**	**0MX21-0AU3**	**0MX21-4AU3**
Voltage range 3 AC 380 ... 480 V				
Setting in A	20	25	35	40
Voltage range 3 AC 500 ... 690 V (factory setting)				
Setting in A	16	20	32	38

5.7.4 Auxiliary power supply system

Description

The auxiliary power supply system is used to distribute the available voltages (line voltage for device fans, 230 V 2 ph. AC and 24 V DC). The table below shows an overview of the connected voltages and associated fuses for the auxiliary power supply system in the Auxiliary Power Supply Module. The 24 V DC voltage is provided directly from the SITOP power supply and is not protected separately by a fuse. The 24 V DC power supply itself is current-limited and short-circuit-proof at the output.

Note

The 24 V DC voltage is only available via the auxiliary power supply system.

The assignment of the auxiliary power module is described in the section "Electrical installation", section "Connections/auxiliary power supply system".

Table 5- 48 Overview of the fuses for the auxiliary power supply system in the Auxiliary Power Supply Module

Article No. 6SL3700-	0MX14-0AU3	0MX16-3AU3	0MX21-0AU3	0MX21-4AU3
Fuse protection in A				
380 to 690 V 2 ph. AC (depending on the rated device voltage)	63	80	80	80
230 V 1 ph. AC	6	10	10	20
24 V DC	20	40	80	80

5.7.5 Customer interfaces for supplying power to an additional auxiliary power supply system

This section describes only those interfaces in the cabinet that require additional connection work by the customer. All other interfaces are pre-wired at the factory and are not designed for customer connections. The table below provides an overview of the most important technical data of the customer terminals in the cabinet.

Note

Additional information

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

Table 5- 49 Overview of customer terminals in the auxiliary power supply module

Cabinet Module Article No. 6SL3700-	0MX14-0AU3	0MX16-3AU3	0MX21-0AU3	0MX21-4AU3
Customer terminal -X45 for tapping the line voltage (3 AC 380 ... 480 V or 3 AC 500 ... 690 V)				
Fuse protection in A [1]	50	63	80	80
Max. conductor cross-section in AWG (mm^2)	6 (16)	6 (16)	6 (16)	6 (16)
Customer terminal -X46 for connection of an uninterruptible power supply for SITOP [2]				
Fuse protection in A [3]	10	20	35	35
Max. conductor cross-section in AWG (mm^2)	10 (6)	10 (6)	10 (6)	10 (6)
Customer terminal -X47 for tapping the 230 V 1 ph. AC voltage				
Fuse protection in A	8	10	10	20
Max. conductor cross-section in AWG (mm^2)	14 (2.5)	14 (2.5)	14 (2.5)	14 (2.5)

[1] The fuse protection is implemented via the circuit breaker -Q4, the specified currents correspond to the factory setting.

[2] When an uninterruptible power supply is connected, the jumpers between -X46:1/2 and -X46:5/6 must be removed.

[3] 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.

5.7.6 Options

Note
Additional information

The individual options are described in Chapter "Options".

Electrical options

Component	Option
Cabinet anti-condensation heating	L55

Mechanical options

Component	Option
Base (plinth), 4" (100 mm) high, RAL 9005	M06
Cable marshalling compartment 8" (200 mm) high, RAL 7035	M07
Degree of protection IP21	M21
IP23 degree of protection (NEMA1 filtered)	M23
Side panel (right)	M26
Side panel (left)	M27
IP43 degree of protection	M43
IP54 degree of protection (NEMA12 ventilated)	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 aid (top-mounted)	M90
Special paint finish for cabinet	Y09
Factory assembly into transport units	Y11

Other options

Component	Option
Marking of all control cable conductor ends	M91
Rating plate data in English / French	T58
Rating plate data in English / Spanish	T60
Rating plate data in English / Italian	T80
Rating plate data in English / Russian	T85
Rating plate in English / Chinese	T91
UL listing per UL 508A	U90
cUL listing for Canada per UL 508A	U91
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

5.7.7 Technical specifications

Table 5- 50 Technical specifications for the Auxiliary Power Supply Modules

Article No.	**6SL3700-**	**0MX14-0AU3**	**0MX16-3AU3**	**0MX21-0AU3**	**0MX21-4AU3**
Plant-side supply **3 AC 380 ... 690 V**	A	125	160	200	250
Line connection - Cable cross-section, max. (IEC)	mm^2	150	150	150	150
Current carrying capacity, max. - Load feeder connection 380 to 690 V AC - at the auxiliary power supply system [1] - at customer terminal -X45 - Load feeder connection 230 V AC - at the auxiliary power supply system - at customer terminal -X47 - Load feeder connection 24 V DC - at the auxiliary power supply system	 A A A A A	 63 50 6 8 20	 80 63 10 10 40	 80 80 10 10 80	 80 80 20 20 80
Cable cross-section, max. - connection -X45 - connection -X47 - connection -X45 - connection -X47	 AWG AWG mm^2 mm^2	 6 14 16 2.5	 6 14 16 2.5	 6 14 16 2.5	 6 14 16 2.5
PE/GND connection - Busbar cross-section - Max. conductor cross-section (IEC) - Max. conductor cross-section (NEC, CEC)	 mm^2 mm^2 AWG/MCM	PE busbar 600 240 500			
Cooling air requirement		Natural convection			
Degree of protection (standard version)		IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - width - height [2] - depth - width - height [2] - depth	 inch inch inch mm mm mm	 23.6 86.6 23.6 600 2200 600	 23.6 86.6 23.6 600 2200 600	 23.6 86.6 23.6 600 2200 600	 23.6 86.6 23.6 600 2200 600
Weight, approx. (standard version)	lb kg	375 170	397 180	463 210	530 240
SCCR (short circuit current rating)	kA IC	100	100	100	100
Minimum short-circuit current [2]	kA	3.2	4	5	7

[1] The fuse protection is implemented via the circuit breaker -Q3, the specified currents correspond to the factory setting.

[2] The cabinet height increases by 10" (250 mm) with degree of protection IP21, and by 16" (400 mm) for degrees of protection IP23 (NEMA1 filtered), IP43 and IP54 (NEMA12 ventilated).

[2] Current required for reliable tripping of the contained protective devices.

5.8 Extension Modules

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.

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	15.8" (400 mm) / 23.6" (600 mm) / 31.6" (800 mm) / 39.6" (1000 mm) / 47.4" (1200 mm)

Configuration

Each Extension Module consists of a cabinet module with a width of 15.8" (400 m) / 23.6" (600 mm) / 31.6" (800 mm) / 39.6" (1000 mm) / 47.4" (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.

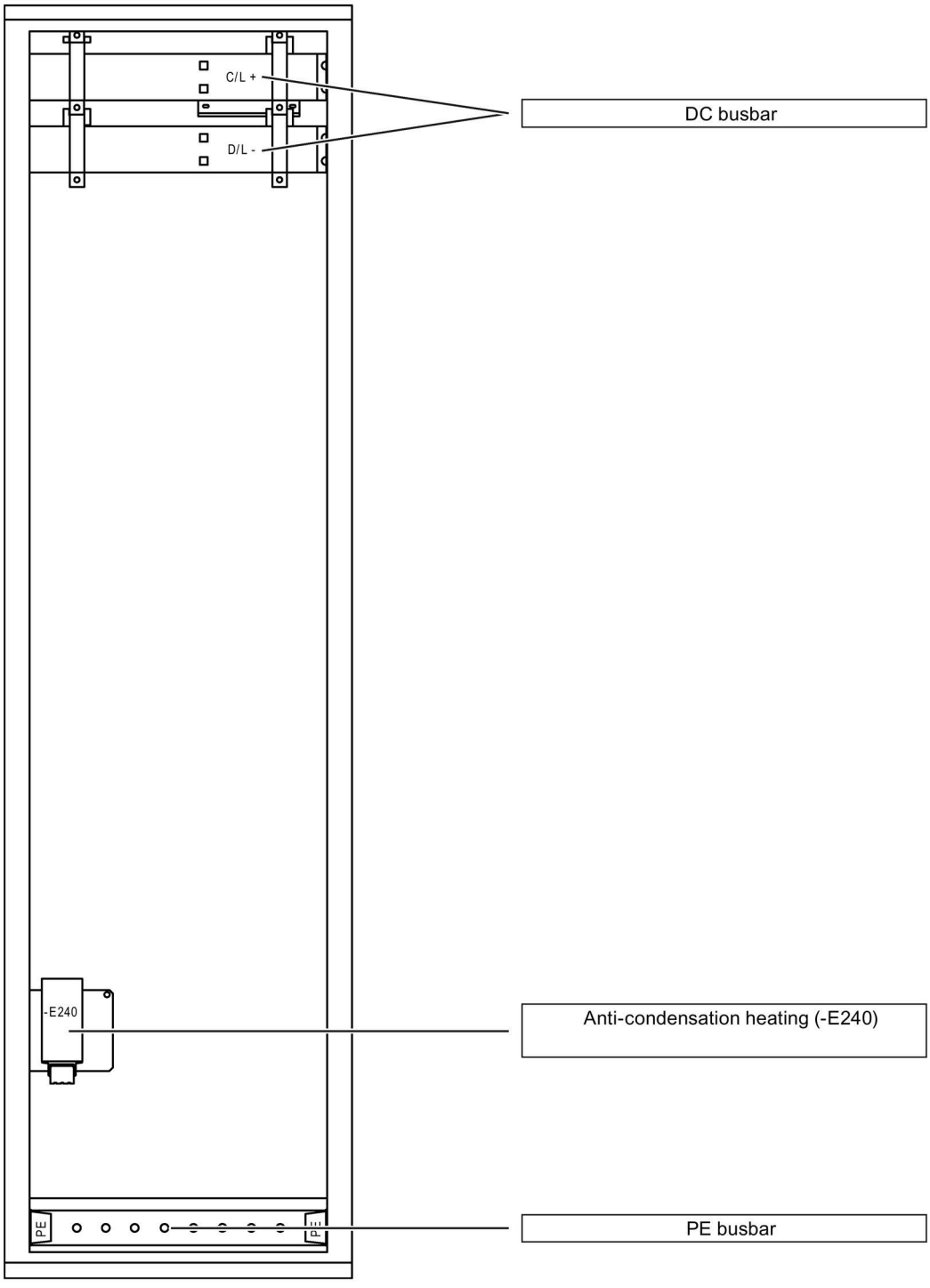


Figure 5-45 Extension Module configuration

5.8.2 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

5.8.3 Technical data

Table 5- 51 Technical specifications for Extension Modules

Article No.	**6SL3700-**	**0SX34-0AU3**	**0SX36-0AU3**	**0SX38-0AU3**	**0SX41-0AU3**	**0SX41-2AU3**
Line voltage	V	380 ... 690				
Supply voltage	V_{DC}	510 ... 1035				
PE/GND connection - Busbar cross-section - Max. conductor cross-section (IEC) - Max. conductor cross-section (NEC, CEC)	 mm^2 mm^2 AWG/MCM	PE busbar 600 240 500				
Degree of protection (standard version)	---	IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - Width - Height [1] - Depth - Width - Height [1] - Depth	 inch inch inch mm mm mm	 15.8 86.6 23.6 400 2200 600	 23.6 86.6 23.6 600 2200 600	 31.6 86.6 23.6 800 2200 600	 39.6 86.6 23.6 1000 2200 600	 47.4 86.6 23.6 1200 2200 600
Weight, approx. (standard version)	lb kg	141 64	194 88	243 110	282 128	322 146

[1] The cabinet height increases by 10" (250 mm) with degree of protection IP21, and by 16" (400 mm) with degrees of protection IP23 (NEMA1 filtered), IP43 and IP54 (NEMA12 ventilated).

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 chassis format.

It is used as a mounting aid and is placed in front of and secured to the module. The telescopic rails allow 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 undone, 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 Mounting aid

Article No. 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 (NEMA1 filtered)/IP43/IP54 (NEMA12 ventilated))

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 grill 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 in the cabinet doors (IP23 (NEMA1 filtered)/IP43/IP54 (NEMA12 ventilated))

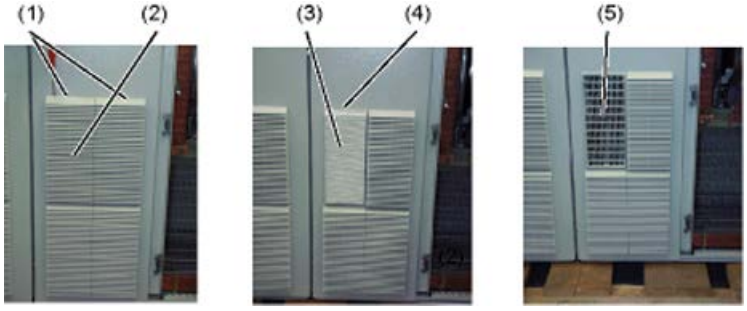


Figure 6-2 Removing/installing filter mats (IP23 (NEMA1 filtered)/IP43/IP54 (NEMA12 ventilated))

1. Insert the screwdriver into the cut-out sections provided (1) and gently push the grill cover (2) down and forwards, then remove it.
2. Remove the filter mat (3).
3. Clean the ventilation grill (5).
4. Insert the new filter mat.
5. Replace the grill 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 degree of protection IP54 must be placed in the correct position (arrow points towards the cabinet).
The filter mat must be placed on the upper guide edge (4).

The specified degree of protection IP23 (NEMA1 filtered)/IP43/IP54 (NEMA12 ventilated) is not achieved if not observed.

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)

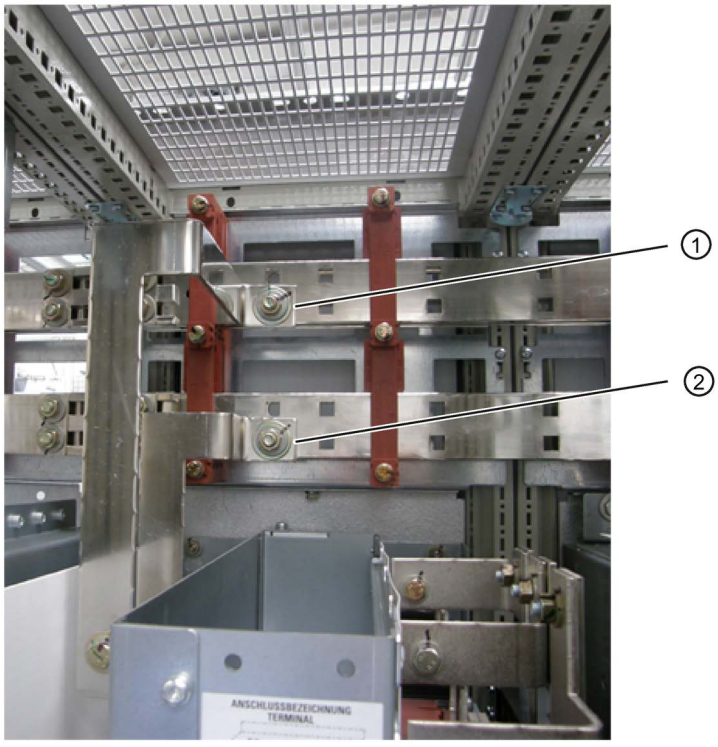


Figure 6-3 Connection to the DC busbar on the Basic Line Module, Smart Line Module, Active Line Module and Motor Module in the chassis format

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 Improper transport can cause mechanical loads on the power block housing or the busbars, which result in damage to the device. • When transporting the power blocks, use a lifting harness with vertical ropes or chains. • Do not use the power block busbars to support or secure lifting harnesses.

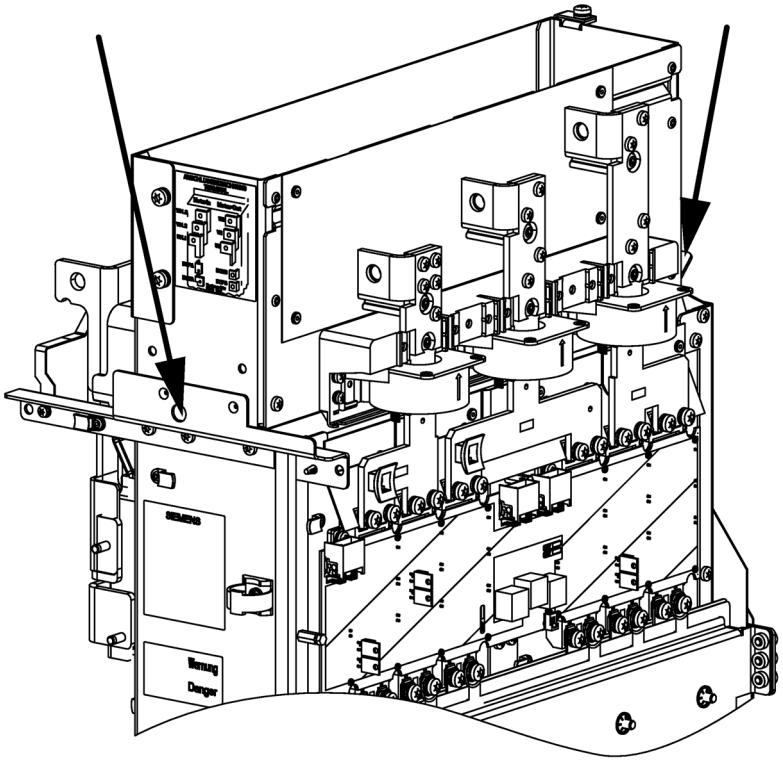


Figure 6-4 Crane lifting lugs on power block frame size FX, GX, FB

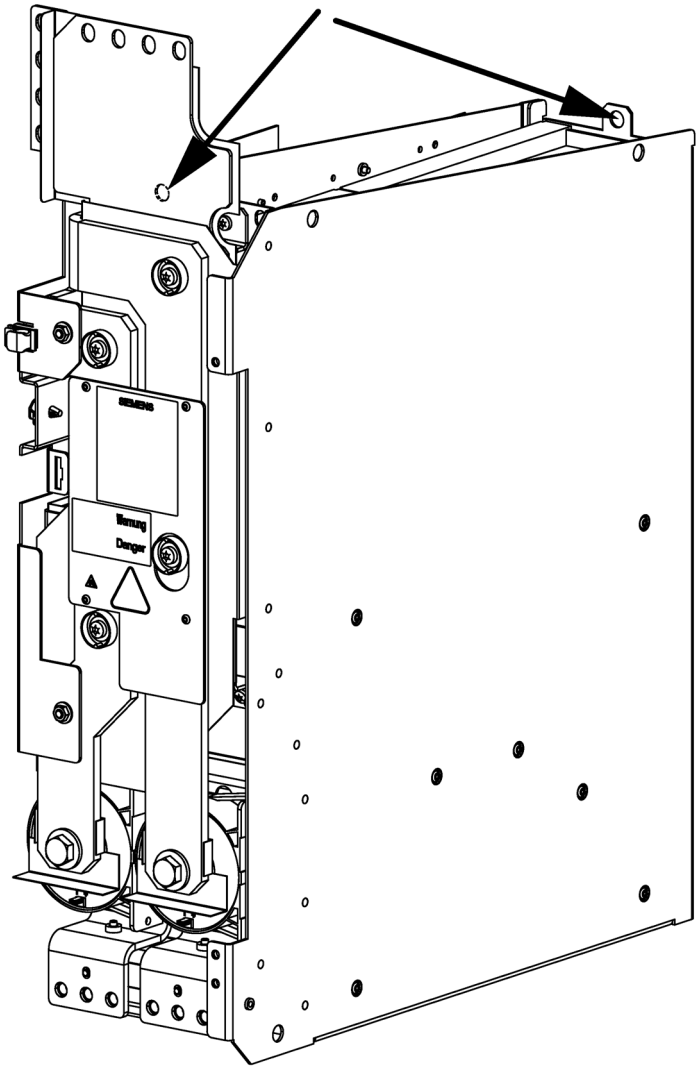


Figure 6-5 Crane lifting lugs on HX, JX power block

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.

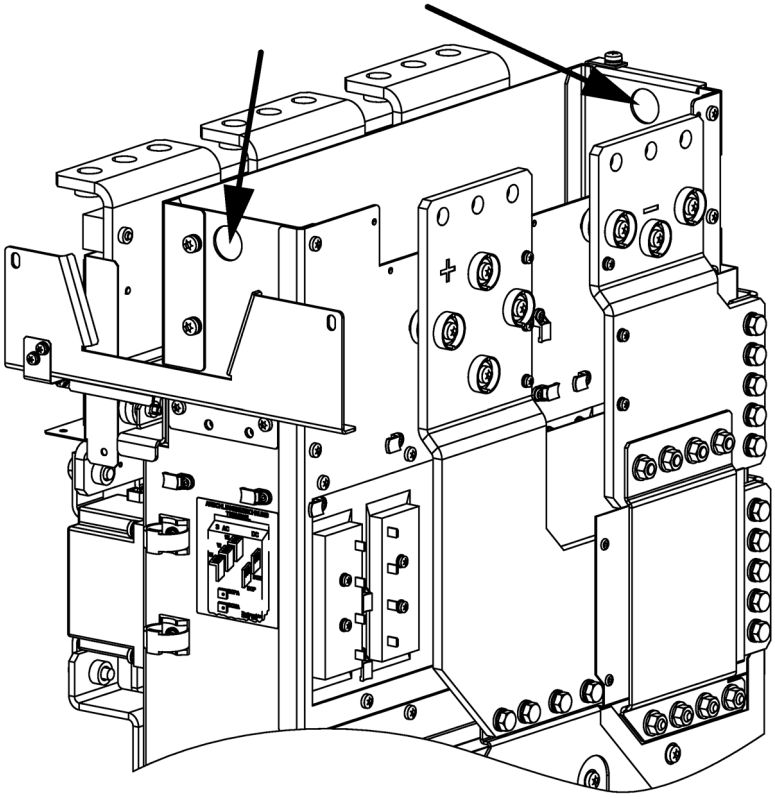


Figure 6-6 Crane lifting lugs on power block frame size GB, GD

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

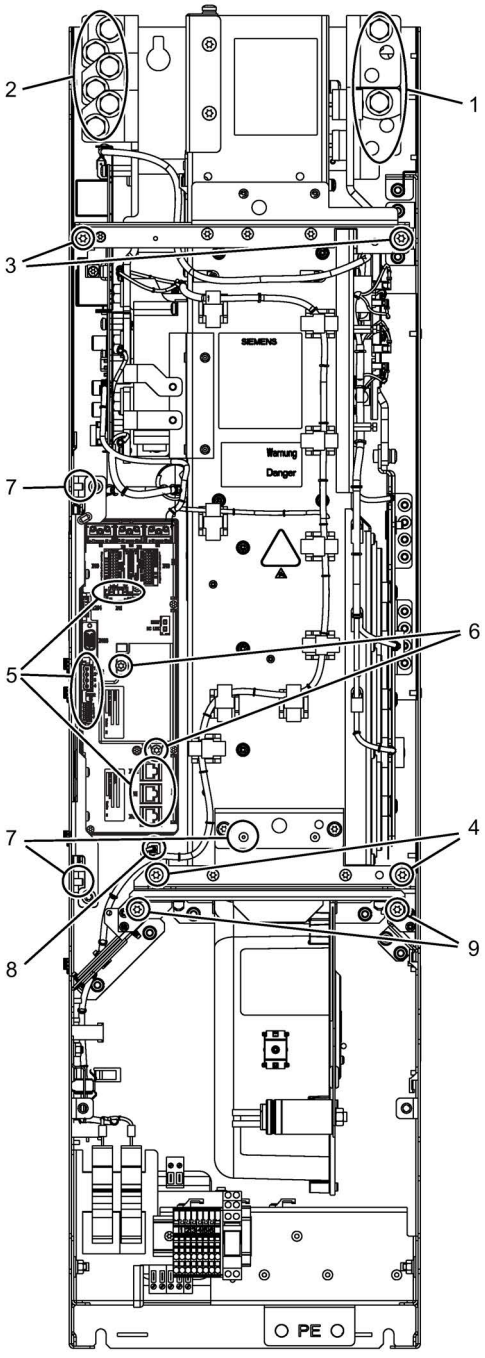


Figure 6-7 Replacing the power block, Basic Line Module, frame size FB

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 the section "Installation device for power blocks").

Removal steps

The steps of the removal procedure correspond to the numbers shown in the previous figure.

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 connectors).
   The DRIVE-CLiQ cables should be marked so that they can be correctly connected at a later time.
6. Remove the retaining screws for the IPD Card (2 screws) and remove the IPD Card from connector -X45 at 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 must disconnect 5 additional plugs one after the other (2 at the top, 3 at the bottom).
8. Disconnect the plug for the thermocouple.
9. Unscrew the 2 retaining screws for the fan and attach the fitting device for the power block at this position.

You can now remove the power block.

Note

The power block weighs approximately 144 lb (65 kg).

NOTICE

Damage to the device if signal cables are damaged when removing

Signal cables can become 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

Installation is performed the same as removal, but in the reverse order.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screwed connections" must be strictly 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.

When doing this, 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

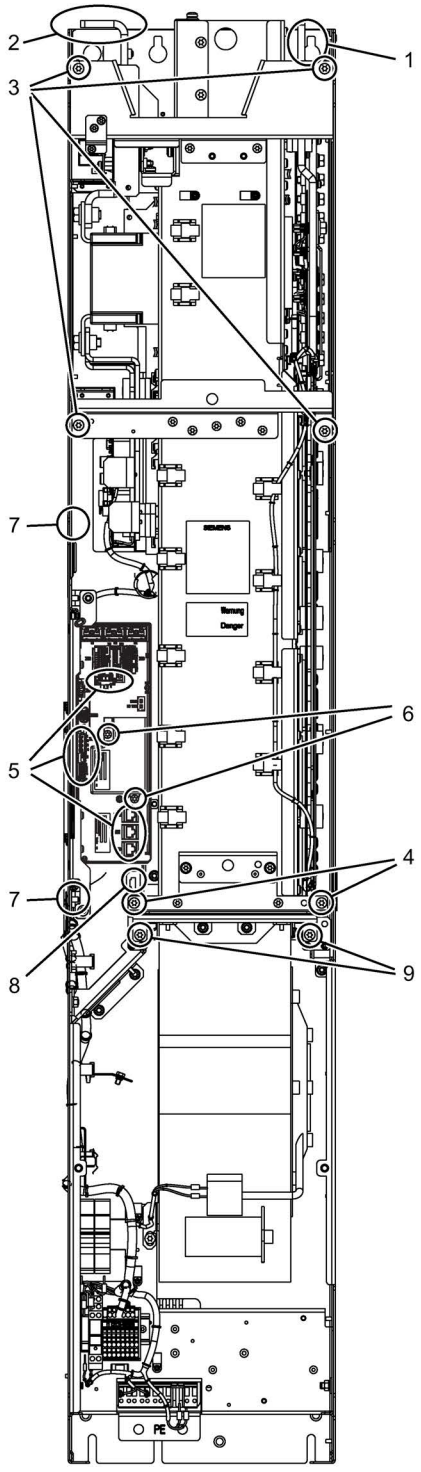


Figure 6-8 Replacing the power block, Basic Line Module, frame sizes GB and GD

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 the section "Installation device for power blocks").

Removal steps

The steps of the removal procedure correspond to the numbers shown in the previous figure.

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 connectors).
   The DRIVE-CLiQ cables should be marked so that they can be correctly connected at a later time.
6. Remove the retaining screws for the IPD Card (2 screws) and remove the IPD Card from connector -X45 at 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 must disconnect 5 additional plugs one after the other (2 at the top, 3 at the bottom).
8. Disconnect the plug for the thermocouple.
9. Unscrew the 2 retaining screws for the fan and attach the fitting device for the power block at this position.

You can now remove the power block.

Note

The power block weighs approximately 298 lb (135 kg).

NOTICE

Damage to the device if signal cables are damaged when removing

Signal cables can become 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

Installation is performed the same as removal, but in the reverse order.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screwed connections" must be strictly 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.

When doing this, 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

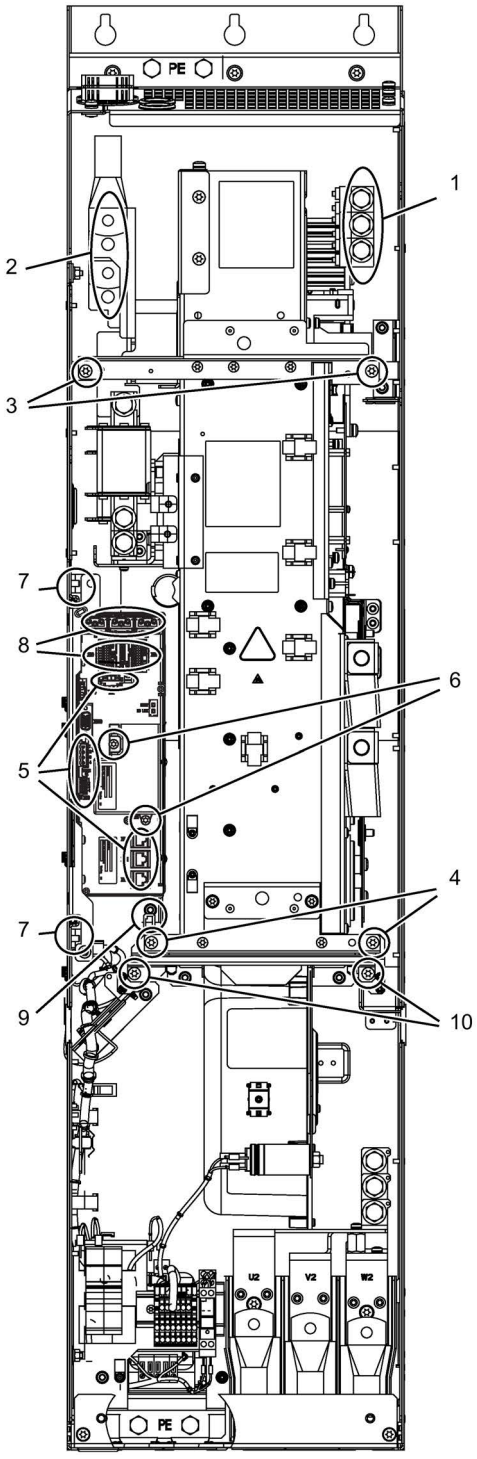


Figure 6-9 Replacing the power block, Active Line Module, and Motor Module, frame size FX

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 the section "Installation device for power blocks").

Removal steps

The steps of the removal procedure correspond to the numbers shown in 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 connectors).
   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 connector -X45 at 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 at the bottom).
8. Disconnect the plug-in connections for the fiber-optic cables and signal cables (5 connectors).
9. Disconnect the plug for the thermocouple.
10. Unscrew the 2 retaining screws for the fan and attach the fitting 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 touching the DC busbar system.

Note

The power block weighs approximately 146 lb (66 kg).

NOTICE

Damage to the device if signal cables are damaged when removing

Signal cables can become 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.
- Disconnect the second plug-in connection of the fiber-optic cables only after the power block has been withdrawn a little way (see step 7).

Installation steps

Installation is performed the same as removal, but in the reverse order.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screwed connections" must be observed.

Carefully insert the plug-in connections and ensure that they are secure.

The fiber-optic cable plugs 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).

6.4.9.4 Replacing the power block, frame size GX

Replacing the power block

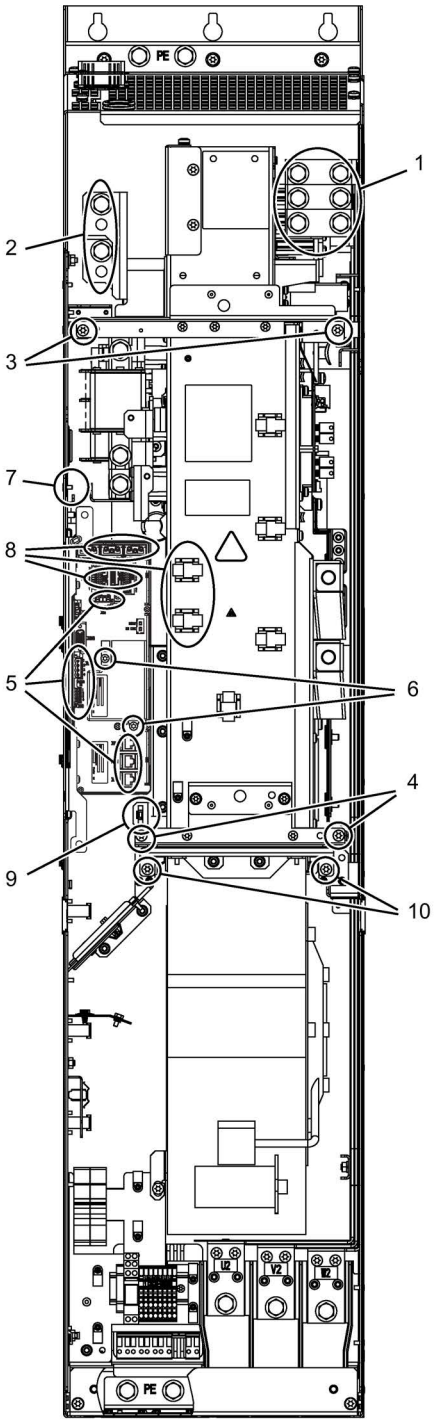


Figure 6-10 Replacing the power block, Smart Line Module, Active Line Module, and Motor Module, frame size GX

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 the section "Installation device for power blocks").

Removal steps

The steps of the removal procedure correspond to the numbers shown in 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 connectors).
   The DRIVE-CLiQ cables should be marked so that they can be correctly connected at a later time.
6. Remove the retaining screws for the IPD Card (2 screws) and remove the IPD Card from connector -X45 at 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 must disconnect 5 additional plugs one after the other (2 at the top, 3 at the bottom).
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 fitting 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 touching the DC busbar system.

Note

The power block weighs approximately 196 lb (89 kg).

NOTICE

Damage to the device if signal cables are damaged when removing

Signal cables can become 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.
- Disconnect the second plug-in connection of the fiber-optic cables only after the power block has been withdrawn a little way (see step 7).

Installation steps

Installation is performed the same as removal, but in the reverse order.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screwed connections" must be strictly observed.

Carefully insert the plug-in connections and ensure that they are secure.

The fiber-optic cable plugs 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

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.

When doing this, 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

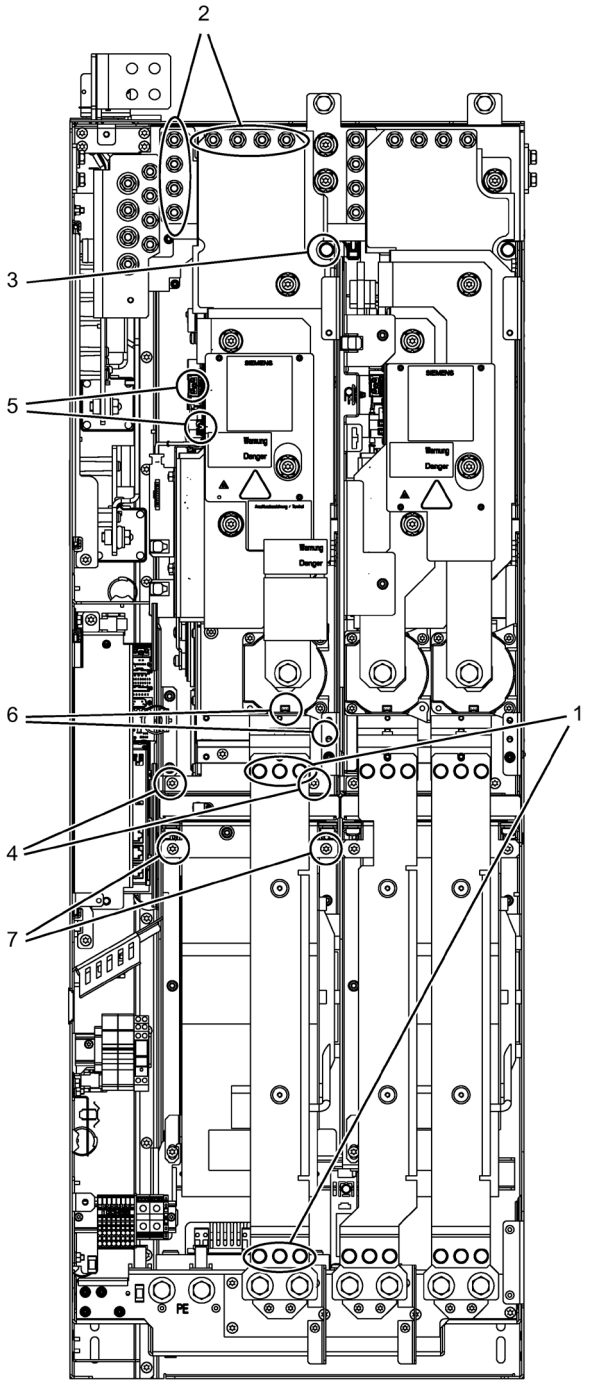


Figure 6-11 Replacing the power block, Smart Line Module, Active Line Module, and Motor Module, frame size HX – left power block

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 the section "Installation device for power blocks").

Removal steps

The steps of the removal procedure correspond to the numbers shown in the previous figure.

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-in connections for the fiber-optic cables and signal cables (2 connectors).
6. Remove the connection for the current transformer and associated ground (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 touching the DC busbar system.

Note

The power block weighs approximately 141 lb (64 kg).

NOTICE

Damage to the device if signal cables are damaged when removing

Signal cables can become 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.
- Disconnect the second plug-in connection of the fiber-optic cables only after the power block has been withdrawn a little way (see step 5).

Installation steps

Installation is performed the same as removal, but in the reverse order.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screwed connections" must be observed.

Carefully insert the plug-in connections and ensure that they are secure.

The fiber-optic cable plugs 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).

Replacing the power block, Smart Line Module, Active Line Module, and Motor Module, frame size HX - right power block

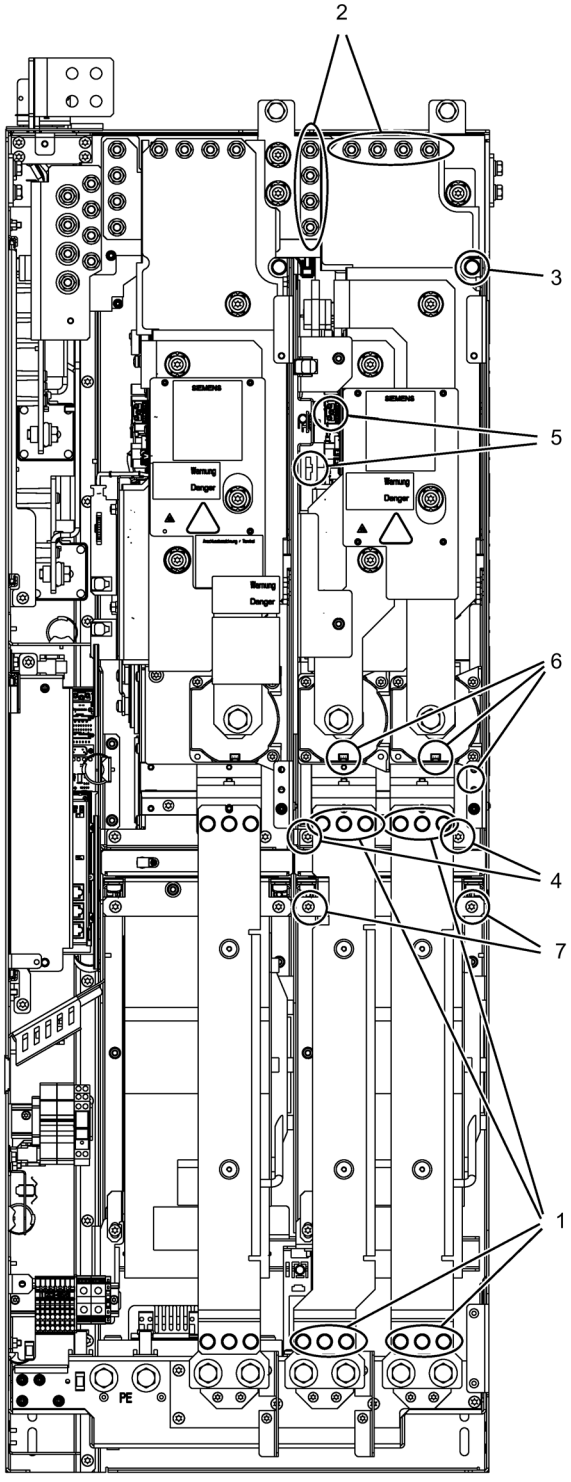


Figure 6-12 Replacing the power block, Smart Line Module, Active Line Module, and Motor Module, frame size HX - right power block

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 the section "Installation device for power blocks").

Removal steps

The steps of the removal procedure correspond to the numbers shown in the previous figure.

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-in 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 ground (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 touching the DC busbar system.

Note

The power block weighs approximately 190 lb (86 kg).

NOTICE

Damage to the device if signal cables are damaged when removing

Signal cables can become 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.
- Disconnect the second plug-in connection of the fiber-optic cables only after the power block has been withdrawn a little way (see step 5).

Installation steps

Installation is performed the same as removal, but in the reverse order.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screwed connections" must be observed.

Carefully insert the plug-in connections and ensure that they are secure.

The fiber-optic cable plugs 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).

6.4.9.6 Replacing the power block, frame size JX

Replacing the power block

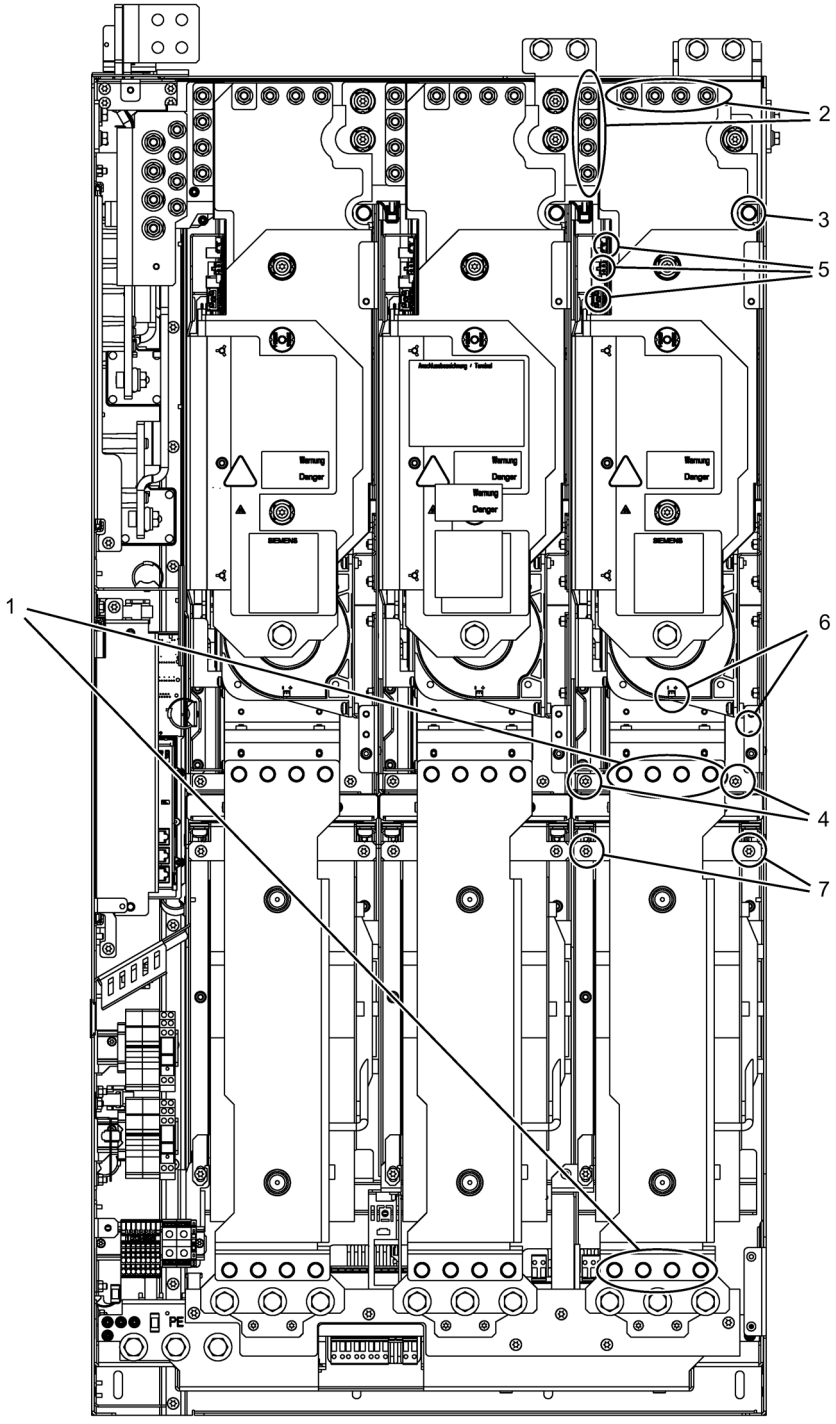


Figure 6-13 Replacing the power block, Active Line Module, Smart Line Module, and Motor Module, frame size JX

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 the section "Installation device for power blocks").

Removal steps

The steps of the removal procedure correspond to the numbers shown in the previous figure.

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-in connections for the fiber-optic cables and signal cables (2 connectors).
6. Remove the connection for the current transformer and associated ground (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 touching the DC busbar system.

Note

The power block weighs approximately 198 lb (90 kg).

NOTICE

Damage to the device if signal cables are damaged when removing

Signal cables can become 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

Installation is performed the same as removal, but in the reverse order.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screwed connections" must be observed.

Carefully insert the plug-in connections and ensure that they are secure.

The fiber-optic cable plugs 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).

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 the Control Interface Module

6.4.10.1 Replacing the Control Interface Module, frame size FB

Replacing the Control Interface Module

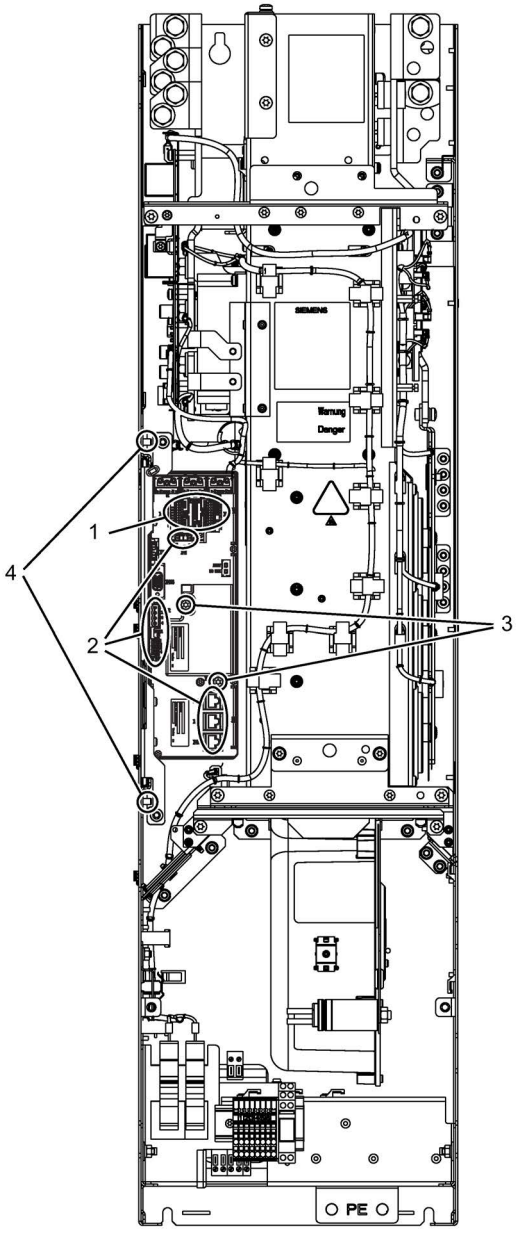


Figure 6-14 Replacing the Control Interface Module, frame size FB

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 steps of the removal procedure correspond to the numbers shown in the figure.

1. Disconnect the plugs for the signal cables (2 plugs).
2. Remove the DRIVE-CLiQ cables and connections on -X41 / -X42 / -X46 (6 plugs).
3. Take out the retaining screws for the IPD Card (2 screws) and remove the IPD Card from connector -X45 at 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 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

Installation is performed the same as removal, but in the reverse order.

Tightening torque for the fastening screws of the Control Interface Module (M6 x 16, item ④): 6 Nm.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screwed connections" must be observed.

Carefully insert the plug-in connections and ensure that they are secure.

The fiber-optic cable plugs 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).

6.4.10.2 Replacing the Control Interface Module, frame sizes GB and GD

Replacing the Control Interface Module

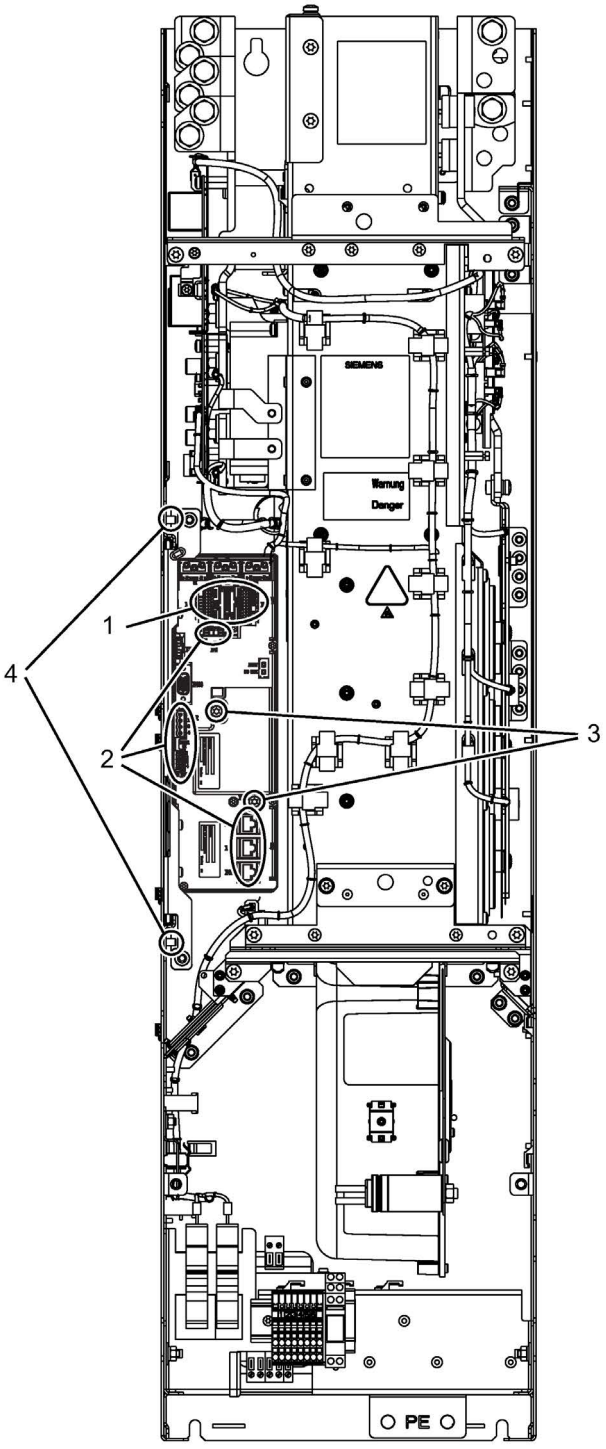


Figure 6-15 Replacing the Control Interface Module, frame sizes GB and GD

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 steps of the removal procedure correspond to the numbers shown in the figure.

1. Disconnect the plugs for the signal cables (2 plugs).
2. Remove the DRIVE-CLiQ cables and connections on -X41 / -X42 / -X46 (6 plugs).
3. Take out the retaining screws for the IPD Card (2 screws) and remove the IPD Card from connector -X45 at 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 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

Installation is performed the same as removal, but in the reverse order.

Tightening torque for the fastening screws of the Control Interface Module (M6 x 16, item ④): 6 Nm.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screwed connections" must be observed.

Carefully insert the plug-in connections and ensure that they are secure.

The fiber-optic cable plugs 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).

6.4.10.3 Replacing the Control Interface Module, frame size FX

Replacing the Control Interface Module

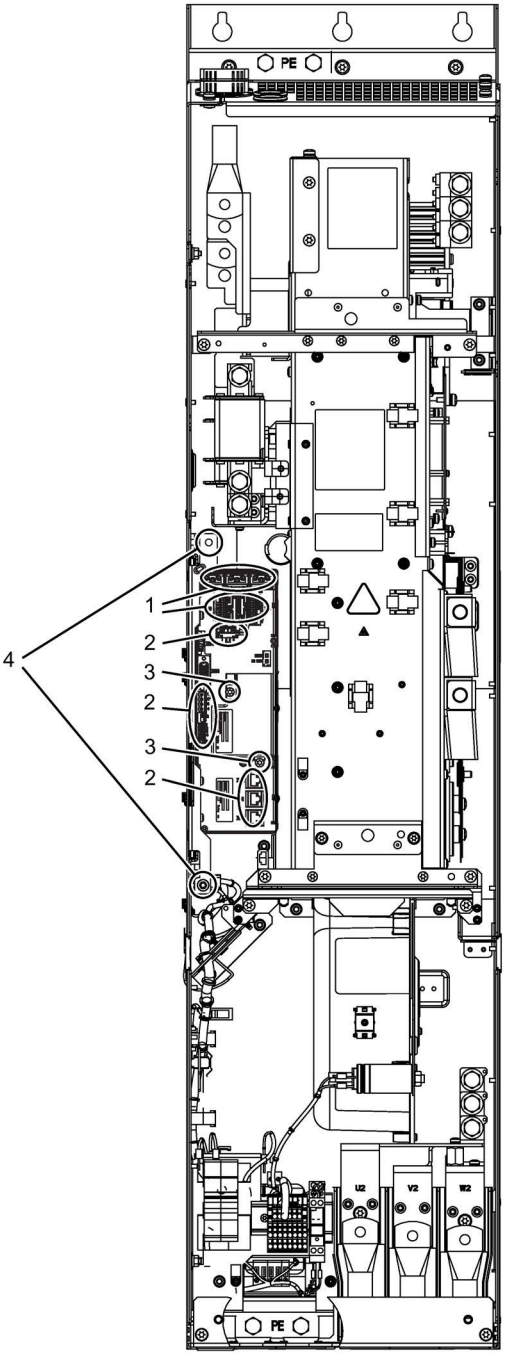


Figure 6-16 Replacing the Control Interface Module, frame size FX

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 steps of the removal procedure correspond to the numbers shown in 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 at 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 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

Installation is performed the same as removal, but in the reverse order.

Tightening torque for the fastening screws of the Control Interface Module (M6 x 16, item ④): 6 Nm.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screwed connections" must be observed.

Carefully insert the plug-in connections and ensure that they are secure.

The fiber-optic cable plugs 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).

6.4.10.4 Replacing the Control Interface Module, frame size GX

Replacing the Control Interface Module

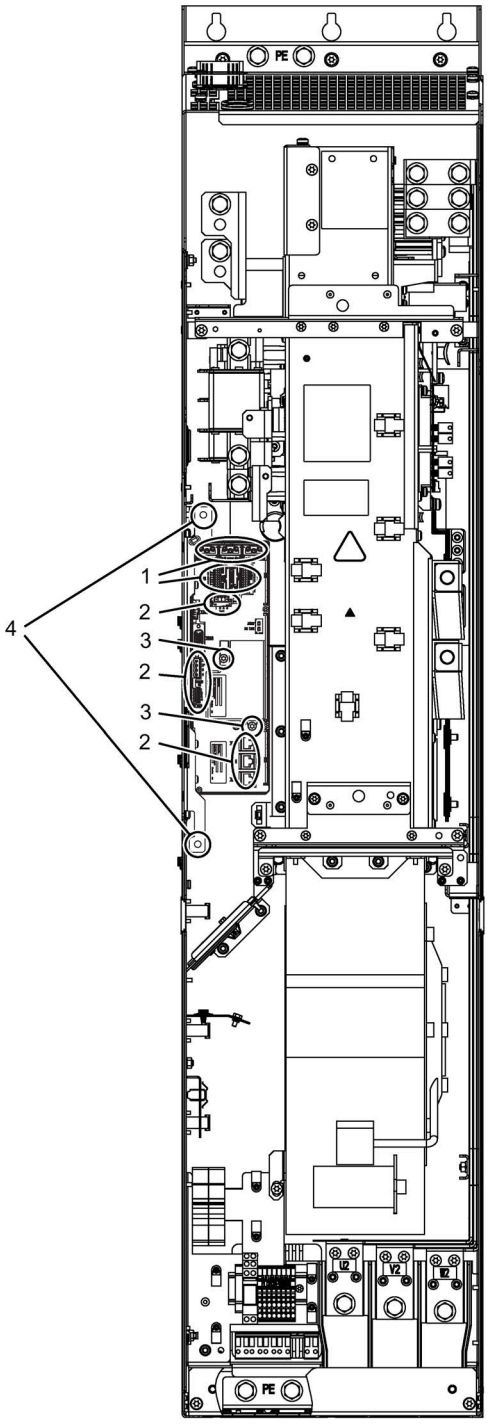


Figure 6-17 Replacing the Control Interface Module, frame size GX

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 steps of the removal procedure correspond to the numbers shown in 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 at 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 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

Installation is performed the same as removal, but in the reverse order.

Tightening torque for the fastening screws of the Control Interface Module (M6 x 16, item ④): 6 Nm.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screwed connections" must be observed.

Carefully insert the plug-in connections and ensure that they are secure.

The fiber-optic cable plugs 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).

6.4.10.5 Replacing the Control Interface Module, frame size HX

Replacing the Control Interface Module

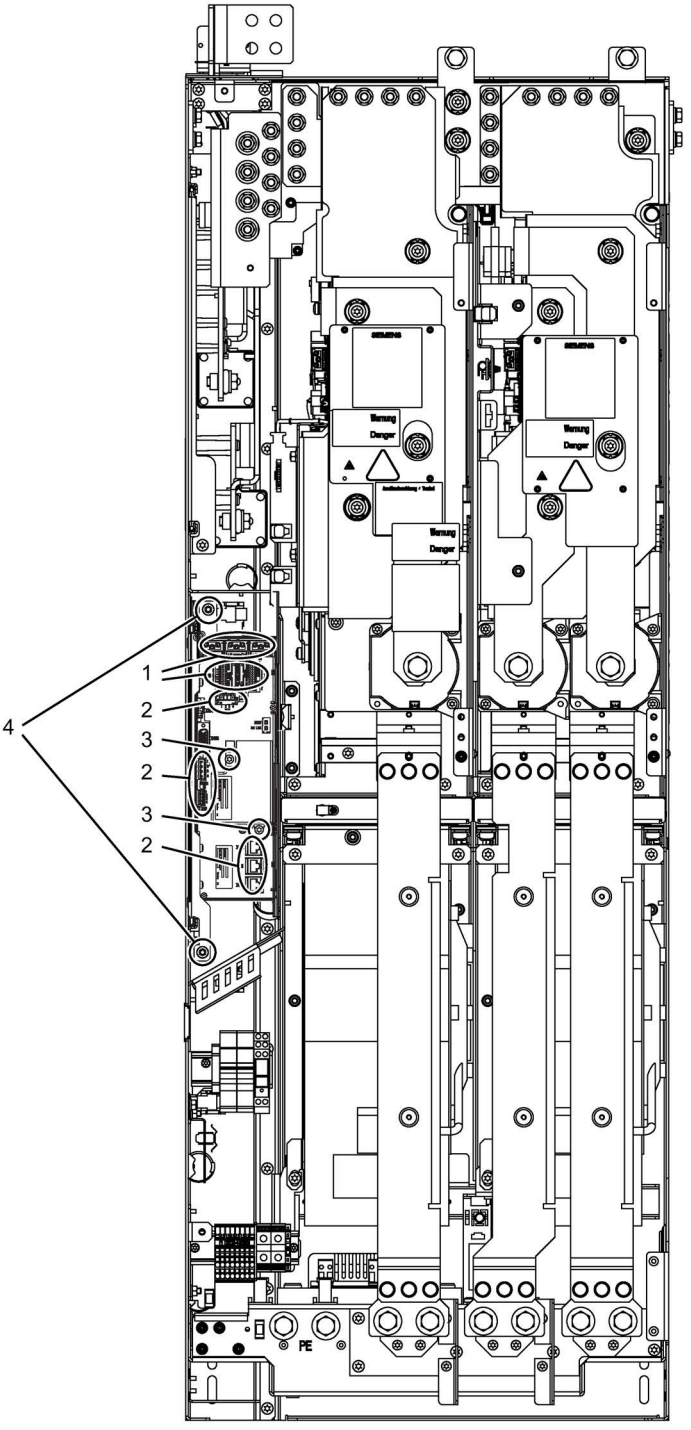


Figure 6-18 Replacing the Control Interface Module, frame size HX

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 steps of the removal procedure correspond to the numbers shown in 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 at 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 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

Installation is performed the same as removal, but in the reverse order.

Tightening torque for the fastening screws of the Control Interface Module (M6 x 16, item ④): 6 Nm.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screwed connections" must be observed.

Carefully insert the plug-in connections and ensure that they are secure.

The fiber-optic cable plugs 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).

6.4.10.6 Replacing the Control Interface Module, frame size JX

Replacing the Control Interface Module

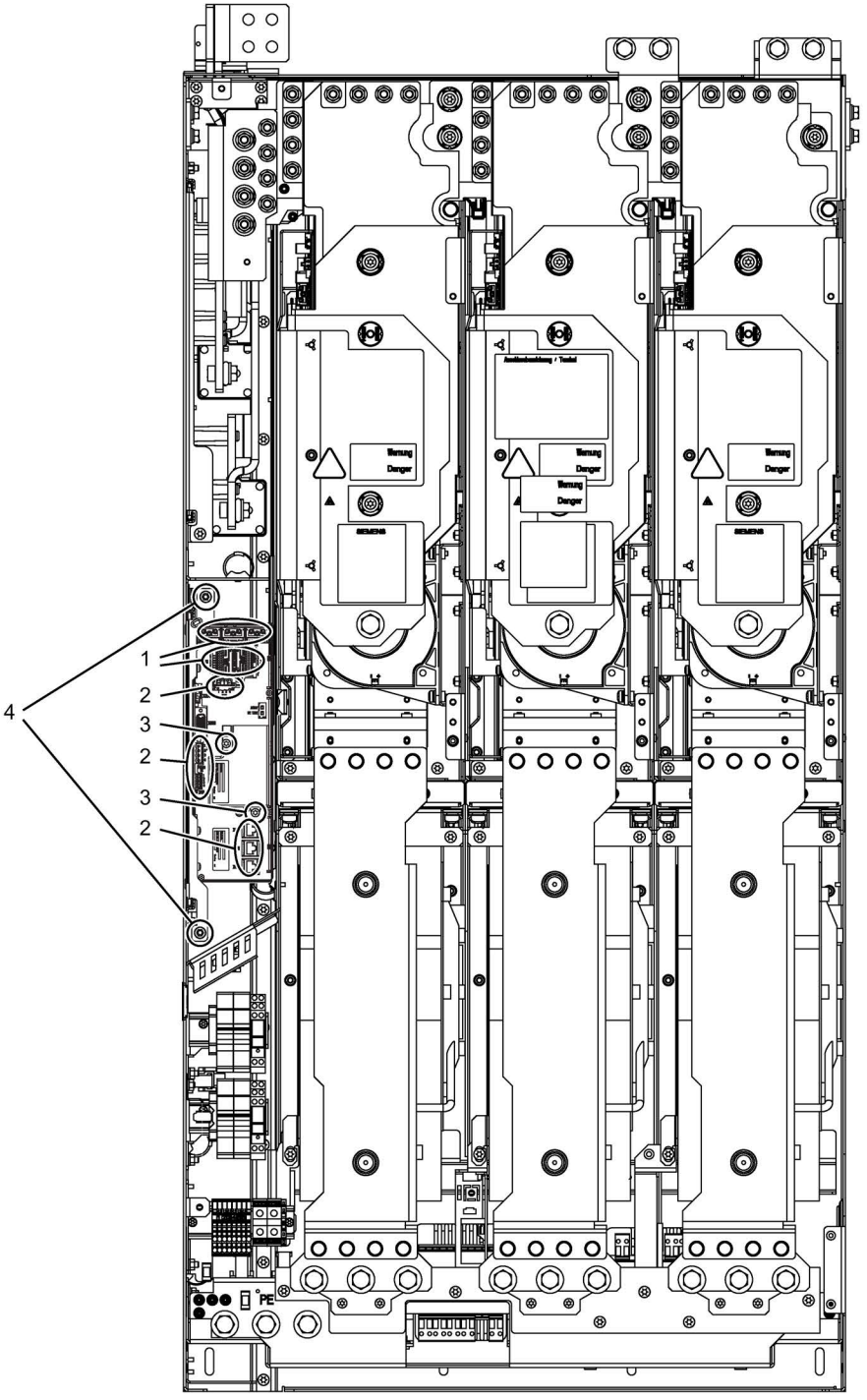


Figure 6-19 Replacing the Control Interface Module, frame size JX

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 steps of the removal procedure correspond to the numbers shown in 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 at 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 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

Installation is performed the same as removal, but in the reverse order.

Tightening torque for the fastening screws of the Control Interface Module (M6 x 16, item ④): 6 Nm.

Note

Specifications for the installation

The tightening torques specified in the table "Tightening torques for screwed connections" must be observed.

Carefully insert the plug-in connections and ensure that they are secure.

The fiber-optic cable plugs 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).

6.4.11 Replacing the Control Unit

The Control Unit is mounted on a slide-in unit, which can be withdrawn to replace the Control Unit.

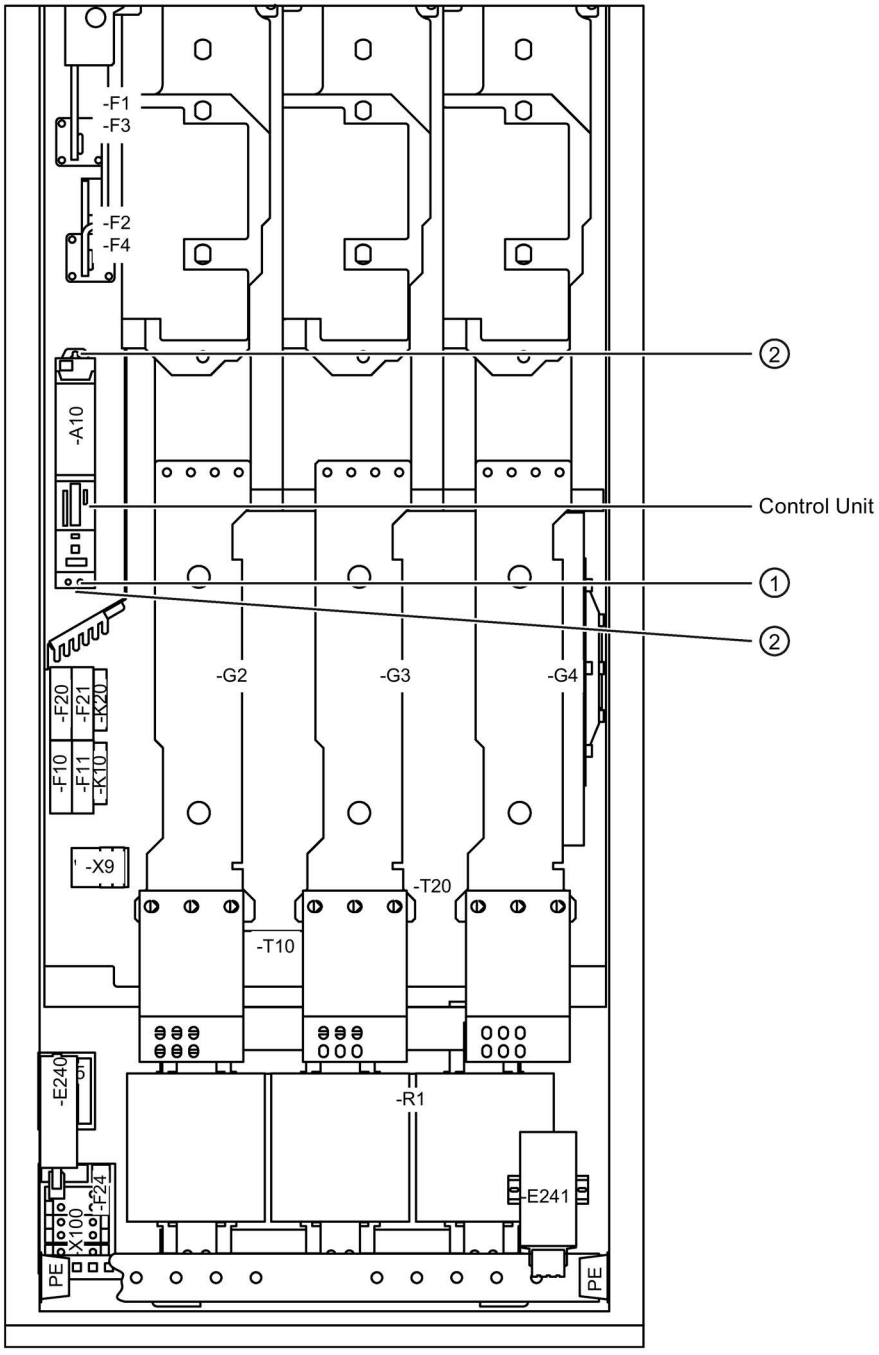


Figure 6-20 Replacing the Control Unit

Preparatory steps

- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Remove the protective cover.
- Allow unimpeded access.

Removal steps

1. Release nut ①
2. Remove fastening screws ②.
3. Before 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 Signal cables can become damaged when the Control Unit is removed. This can cause the device to fail. • When removing the Control Unit, ensure that you do not damage any signal cables.

Note

When installing the new Control Unit, you must reconnect the cables to exactly the same positions.

6.4.12 Replacing the fans

6.4.12.1 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 2" (50 mm) (9 A, 18 A)

Removing the existing fan module

		
Remove the shield connection clamp. 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. Screwdriver: Torx 20
		
Detach the protective conductor from the Motor Module. 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: 26.6 lbf in (3 Nm).
3. Reattach the shield connection plate and tighten the fastening screws, tightening torque: 26.6 lbf in (3 Nm).
4. Reinsert the motor connection plug.
5. Reattach the shield connection clamp and tighten the fastening screws, tightening torque: 26.6 lbf in (3 Nm).

Fan replacement for Motor Modules with a width of 4" (100 mm) (30 A)

Replacing the fan for Motor Modules with a width of 4" (100 mm) is same as when replacing Motor Modules with a width of 2" (50 mm). Since the protective conductor is located not behind the shield connection plate but next to it, you can loosen it first, and after the new fan module has been installed, you can then screw it tight as the last step.

Fan replacement for Motor Modules with a width of 6" to 8" (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.

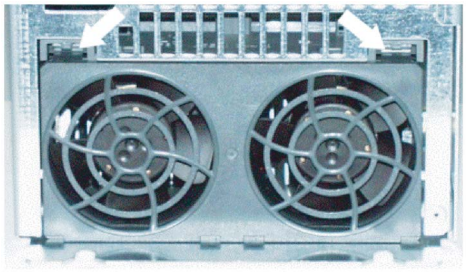


Figure 6-21 Position of the catches

4. Release and withdraw the connection plugs (1).
5. Release the catches (2) and remove the fan.

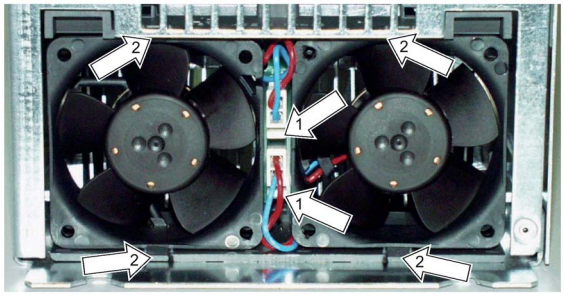


Figure 6-22 Position of the connection plugs (1) and catches (2)

NOTICE
Damage to the device if signal cables are damaged when removing Signal cables can become damaged when the fan is removed. This can cause the device to fail. • When removing the fan, ensure that you do not damage any signal cables.

Installing the fans

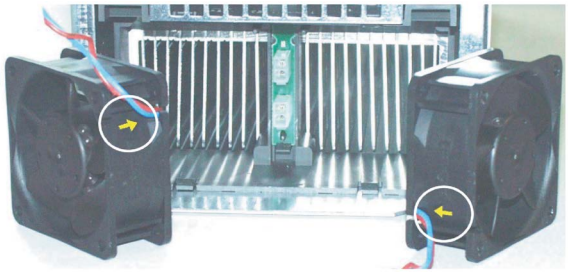


Figure 6-23 Fan installation 6" ... 8" (150 ... 200 mm)

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 12" (300 mm) (132 A)

Removing the fan

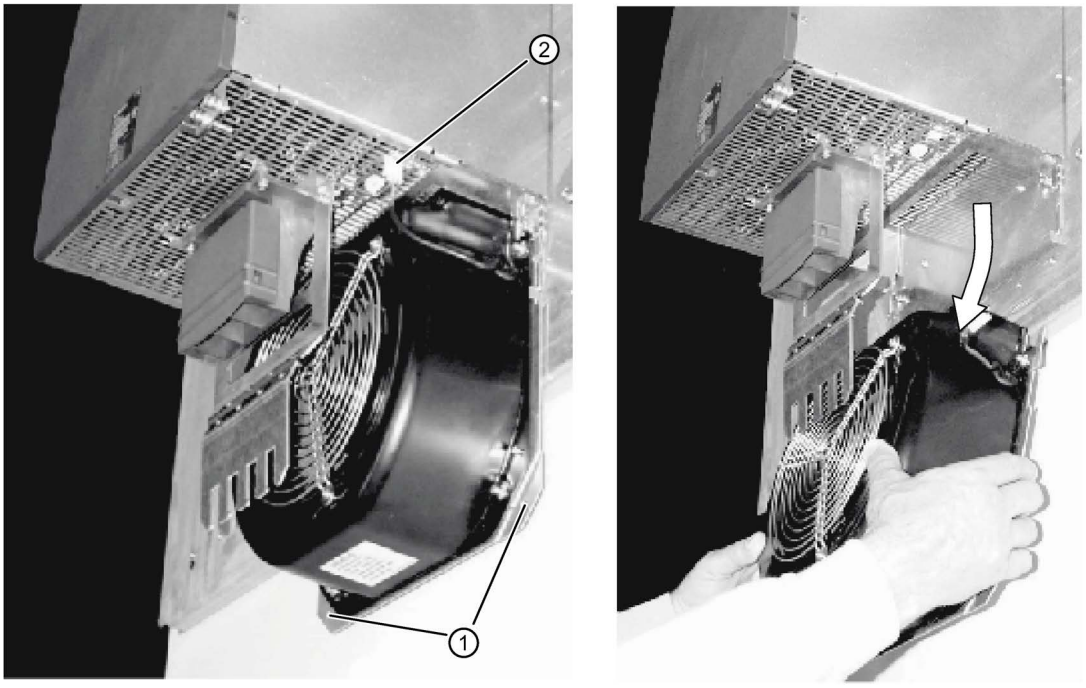


Figure 6-24 Fan removal 12" (300 mm)

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 Signal cables can become damaged when the fan is removed. This can cause the device to fail. • When removing the fan, ensure that you do not damage any signal cables.

Installing the fan

1. Insert the fan.
2. Secure the fan with the M6 screws, tightening torque: 53.1 lbf in (6 Nm).
3. Connect the fan power supply (2).

6.4.12.2 Replacing the fan, frame sizes FB, GB and GD

Replacing the fan

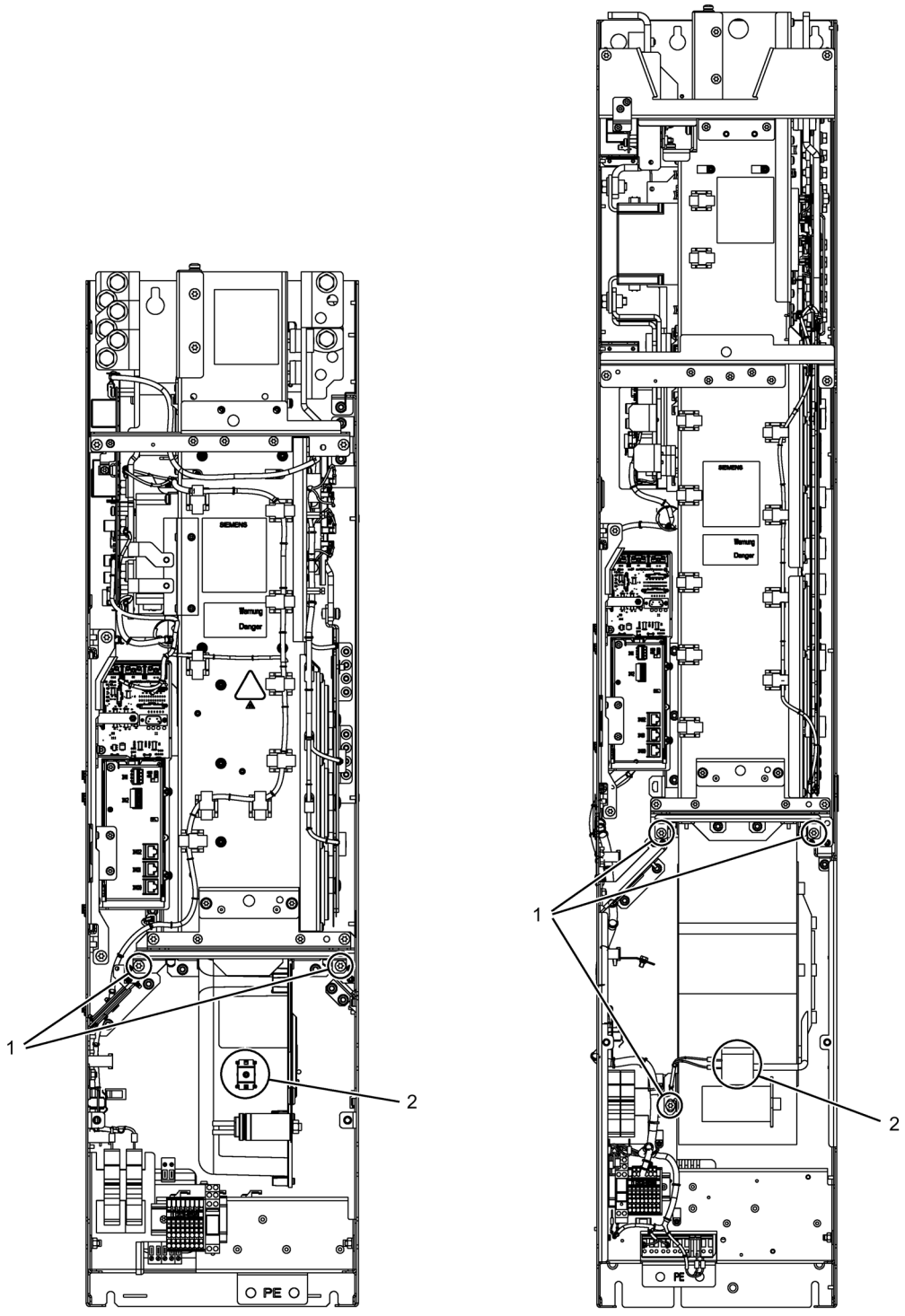


Figure 6-25 Replacing the fan, Basic Line Module, frame sizes FB, GB, and GD

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 Signal cables can be damaged when the fan is removed. This can cause the device to fail. • When removing the fan, ensure that you do not damage any signal cables.

Installation steps

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.

6.4.12.3 Replacing the fan, sizes FX and GX

Replacing the fan

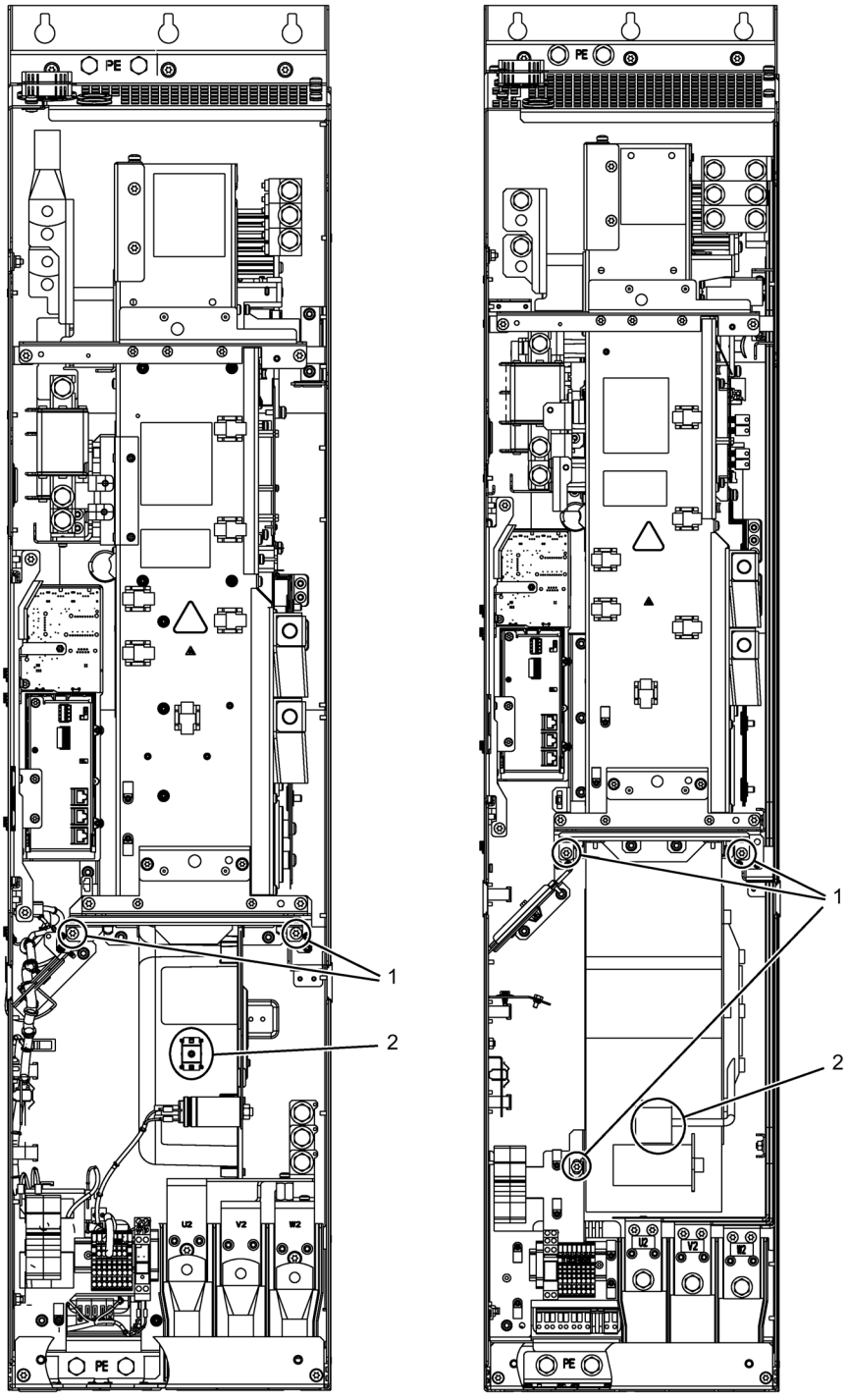


Figure 6-26 Replacing the fan, Smart Line Module, Active Line Module, and Motor Module, frame sizes FX and GX

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 Signal cables can be damaged when the fan is removed. This can cause the device to fail. • When removing the fan, ensure that you do not damage any signal cables.

Installation steps

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.

6.4.12.4 Replacing the fan, size HX

Replacing the fan, left power block

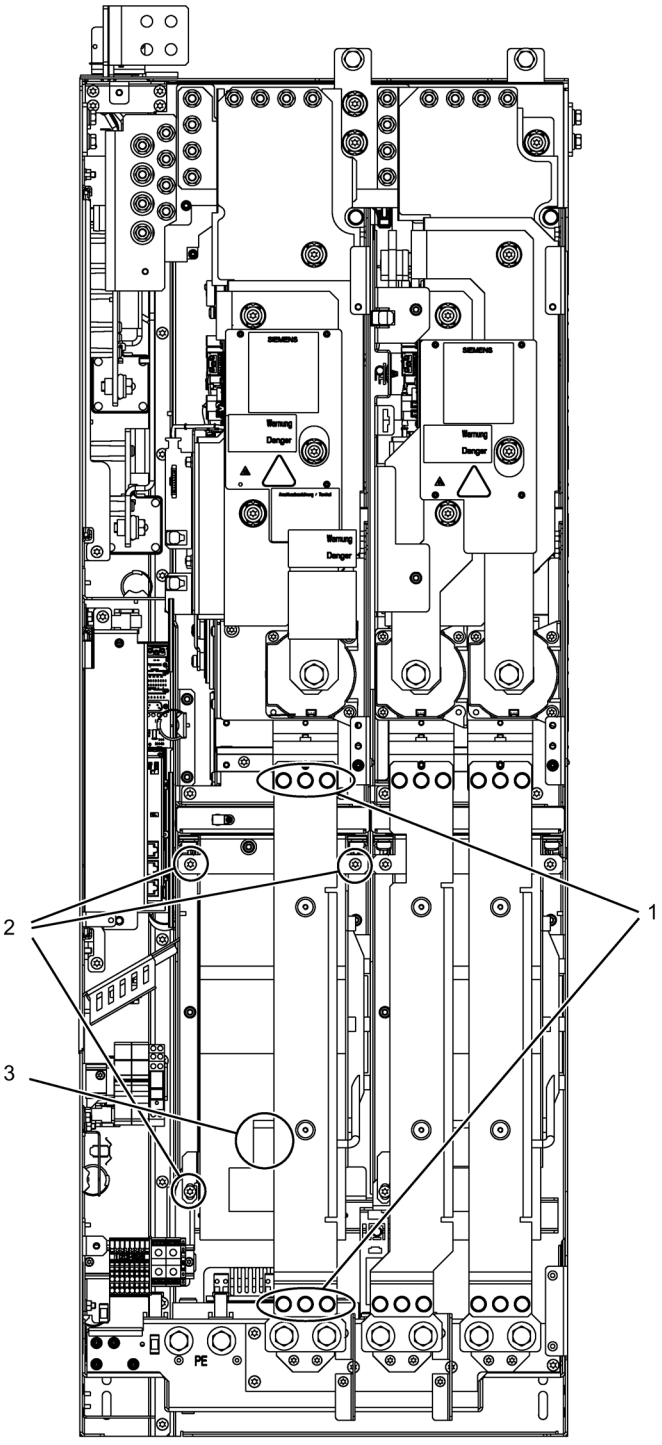


Figure 6-27 Replacing the fan, Active Line Module, Smart Line Module, and Motor Module, frame size HX - left power block

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 Signal cables can be damaged when the fan is removed. This can cause the device to fail. • When removing the fan, ensure that you do not damage any signal cables.

Installation steps

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

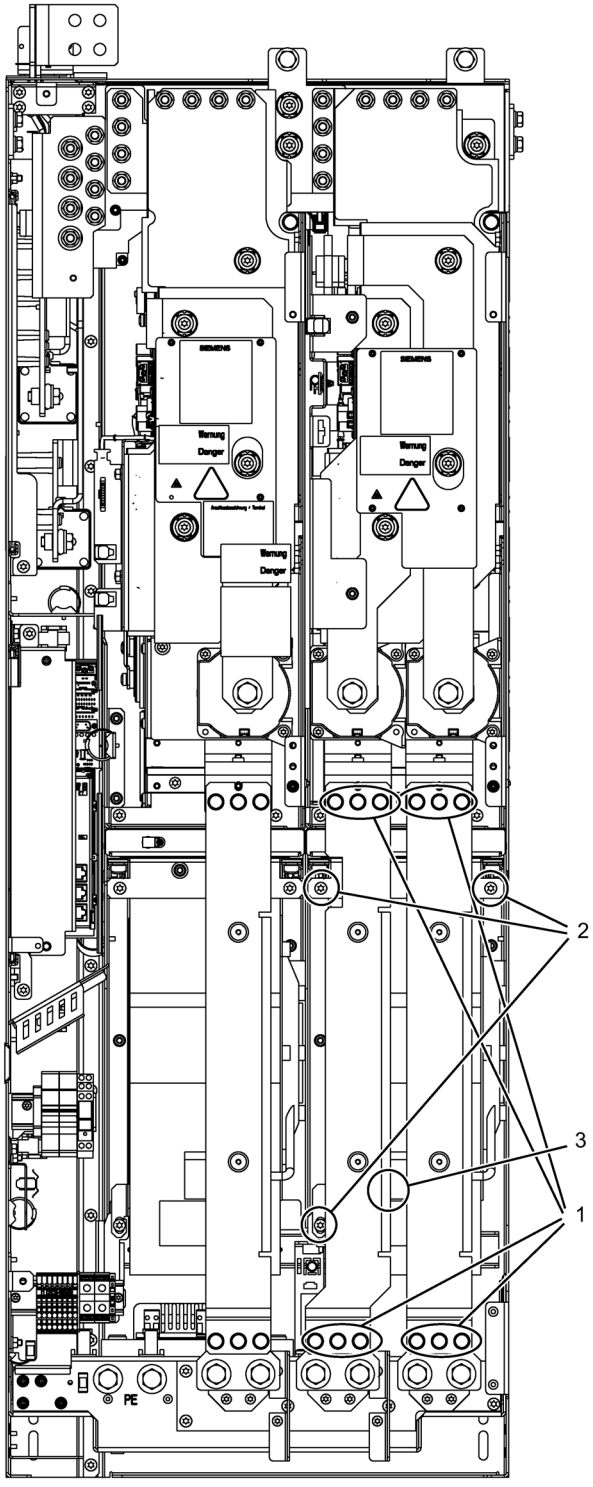


Figure 6-28 Replacing the fan, Active Line Module, Smart Line Module, and Motor Module, frame size HX - right power block

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 Signal cables can be damaged when the fan is removed. This can cause the device to fail. • When removing the fan, ensure that you do not damage any signal cables.

Installation steps

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.

6.4.12.5 Replacing the fan, frame size JX

Replacing the fan

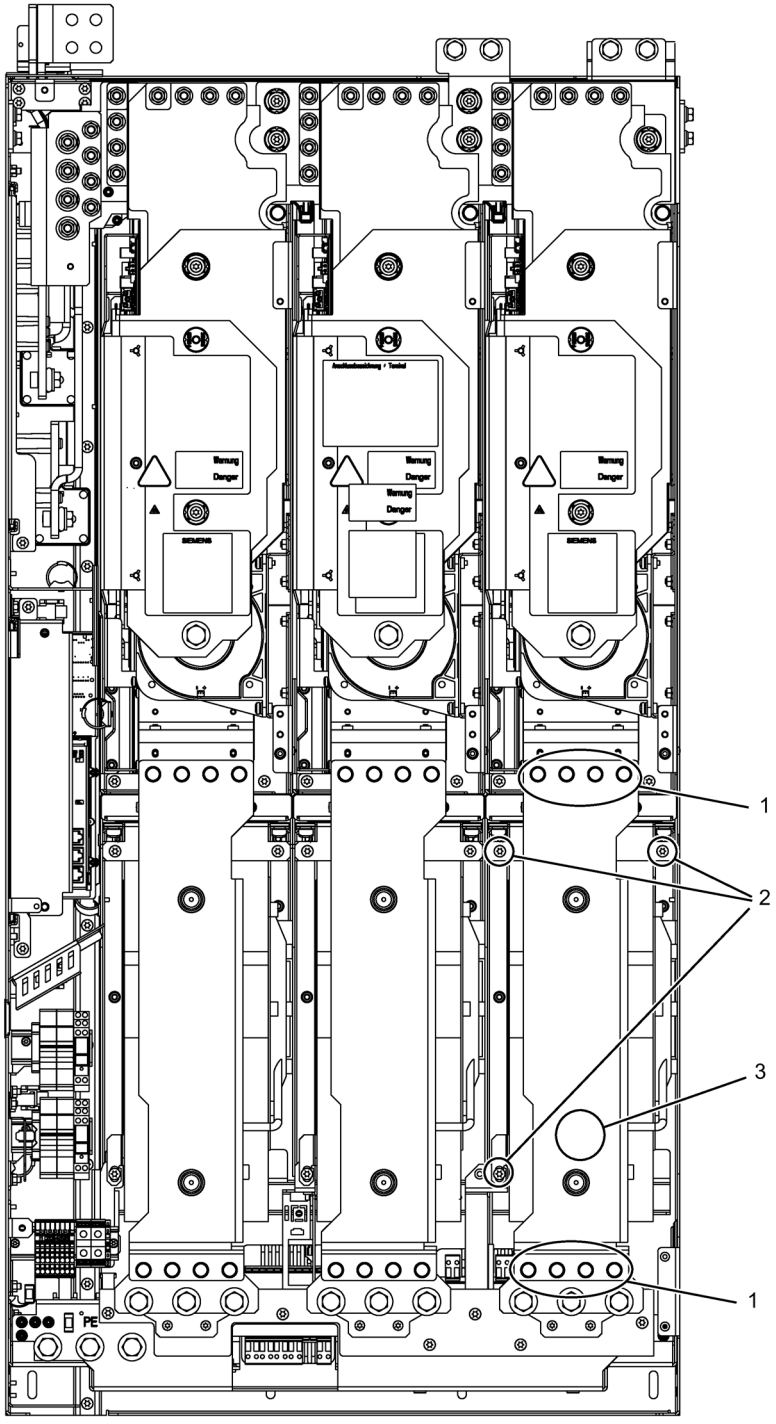


Figure 6-29 Replacing the fan, Active Line Module, Smart Line Module, and Motor Module, frame size JX

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 Signal cables can be damaged when the fan is removed. This can cause the device to fail. • When removing the fan, ensure that you do not damage any signal cables.

Installation steps

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.

6.4.12.6 Replacing the fan, frame size FI

Replacing the fan

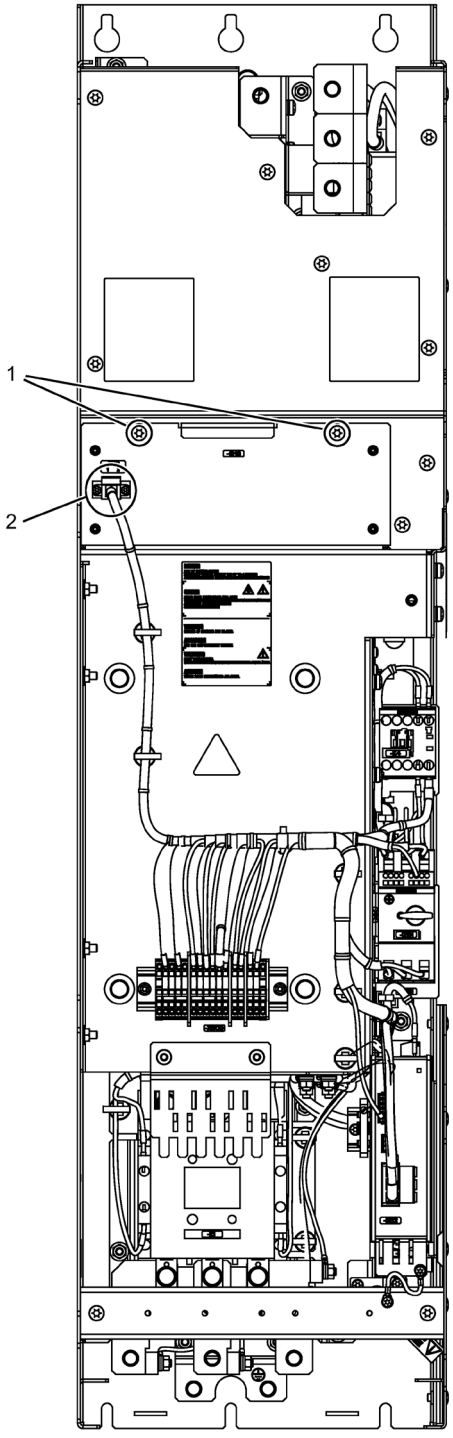


Figure 6-30 Replacing the fan, Active Interface Module, frame size FI

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 Signal cables can be damaged when the fan is removed. This can cause the device to fail. • When removing the fan, ensure that you do not damage any signal cables.

Installation steps

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.

6.4.12.7 Replacing the fan, frame size GI

Replacing the fan

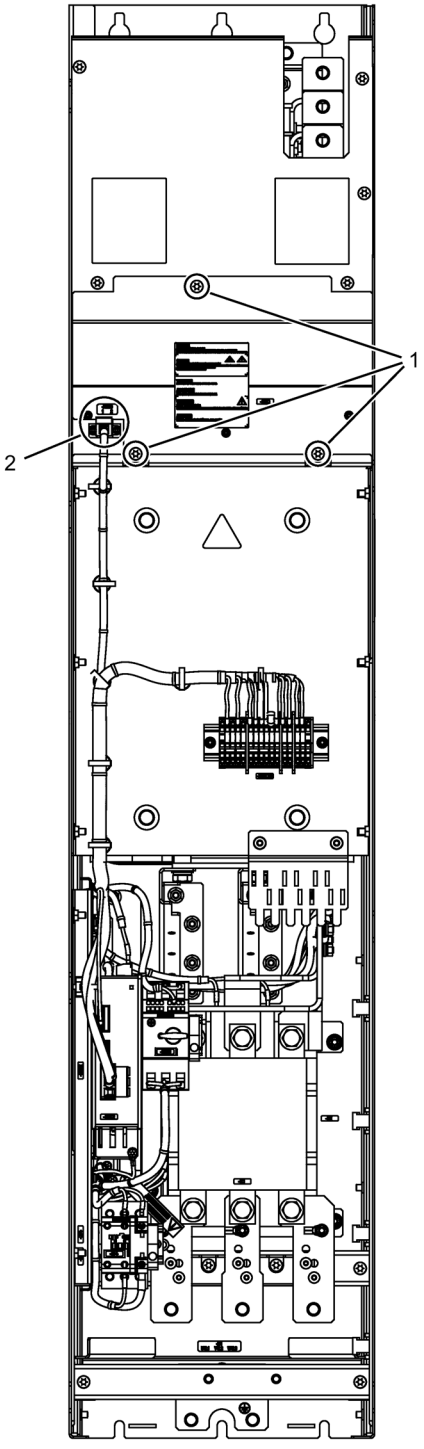


Figure 6-31 Replacing the fan, Active Interface Module, frame size GI

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 Signal cables can be damaged when the fan is removed. This can cause the device to fail. • When removing the fan, ensure that you do not damage any signal cables.

Installation steps

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.

6.4.12.8 Replacing the fan, frame size HI

Replacing the fan

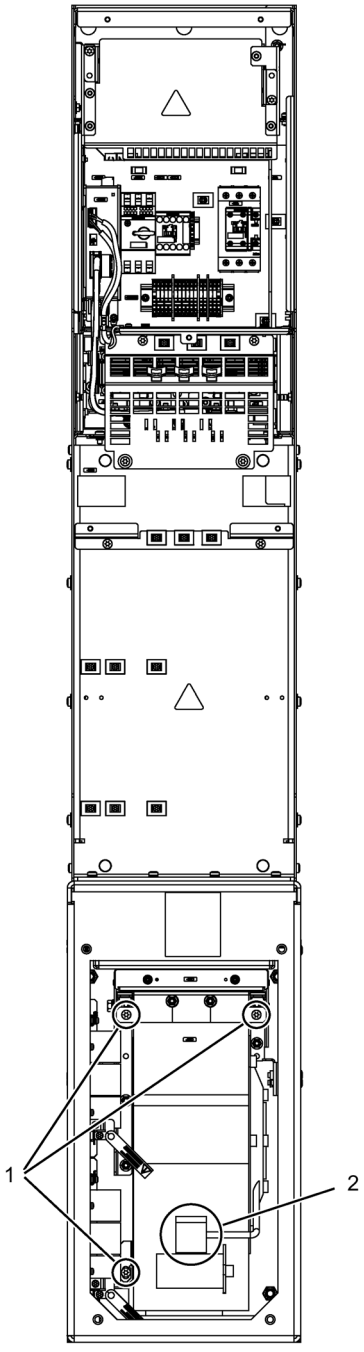


Figure 6-32 Replacing the fan, Active Interface Module, frame size HI

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 Signal cables can be damaged when the fan is removed. This can cause the device to fail. • When removing the fan, ensure that you do not damage any signal cables.

Installation steps

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.

6.4.12.9 Replacing the fan, frame size JI

Replacing the fan

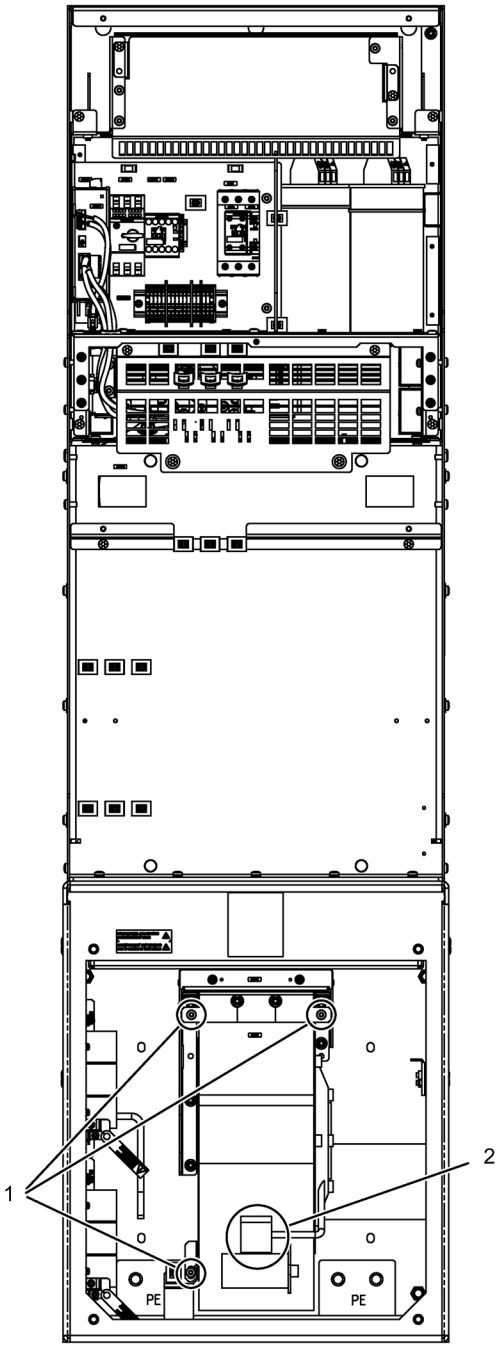


Figure 6-33 Replacing the fan, Active Interface Module, frame size JI

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 Signal cables can be damaged when the fan is removed. This can cause the device to fail. • When removing the fan, ensure that you do not damage any signal cables.

Installation steps

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 Replacing the fuses

Replacement fuses

Article numbers for replacing fuses that have blown are contained in the spare parts list.

6.4.13.1 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.

6.4.13.2 Replacing the fuses (F71 to F73) in the Line Connection Module

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

On Line Connection Modules with a rated current of < 800 A, the fuses are freely accessible and can be replaced once the fault cause has been eliminated.

Note

On Line Connection Modules with a rated current of between 800 and 1600 A, the removal procedures described below must be 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.

6.4.13.3 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.

6.4.13.4 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

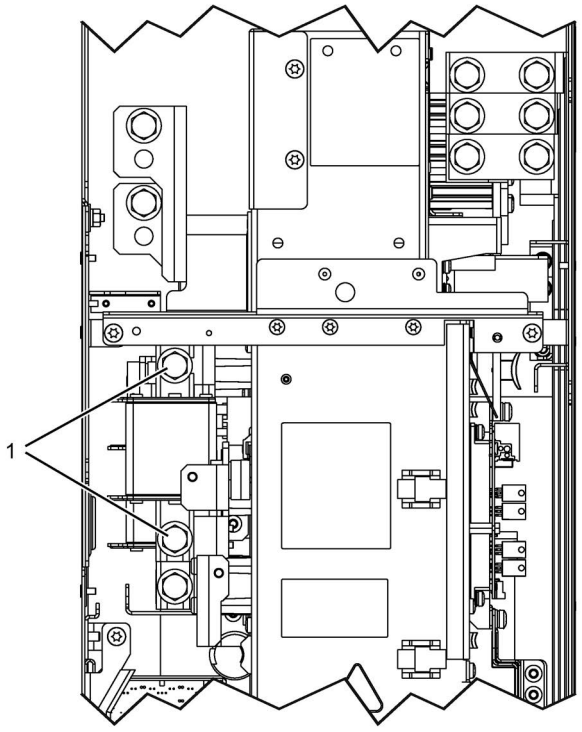


Figure 6-34 Replacing the DC fuses, frame sizes FX and GX

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 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. • 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

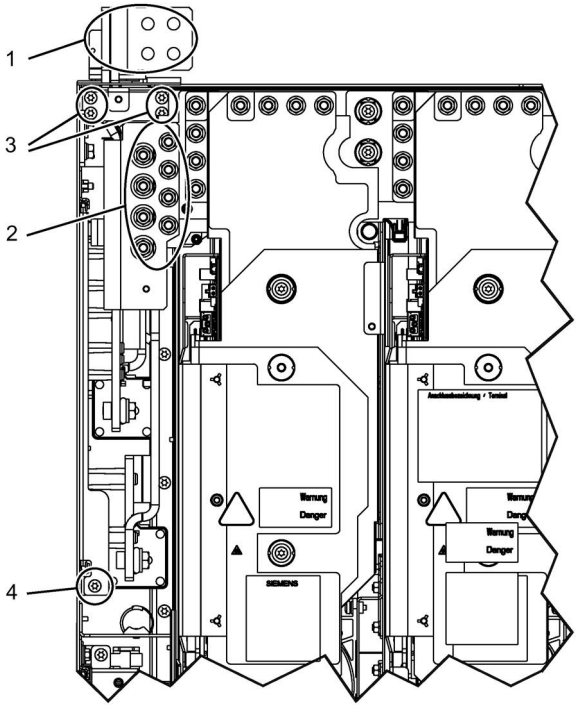


Figure 6-35 Replacing the DC fuses, frame sizes HX and JX

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 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. • 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 Signal cables or plastic parts can be damaged when the fuse insert is removed. This can cause the device to fail. • 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.

6.4.13.5 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.

6.4.13.6 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 6-36 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 6-37 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.

6.4.13.7 Replacing LV HRC fuses with screw mounting

Description

LV HRC fuses (LV HRC fuses) with screw mounting are used, for example, in the line infeed.



Figure 6-38 LV HRC fuse with screw mounting

Removal steps

The following steps are used to remove the LV HRC fuse:

1. Open the main switch.
2. Remove the front shock hazard protection cover of the cabinet in front of the fuses.



⚠ WARNING

Electric shock when the cover over the line connections is removed

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. Loosen the screws of the defective fuse.

Note

Loosen the screws, but do not fully unscrew them.

Do not fully unscrew the screws of the fuses as the screws can fall into the device.

4. Remove the defective fuse.

NOTICE

Device failure after an NH fuse trips

When a low-voltage high-rupturing-capacity fuse trips, the neighboring low-voltage high-rupturing-capacity fuses may also become damaged. Failure to replace all fuses at the same time can cause the device to fail.

- After a low-voltage high-rupturing-capacity fuse trips, always replace all low-voltage high-rupturing-capacity fuses at the same time. Always use fuses of the same type.

Installation steps

The following steps are used to install the screw-mounted LV HRC fuse:

1. Insert the new fuse in the correct position.
2. Tighten the screws with the required torque.
3. Attach the front shock hazard protection cover.

The main switch can then be closed.



⚠ 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.

6.4.14 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.

6.4.15 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.

6.4.16 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

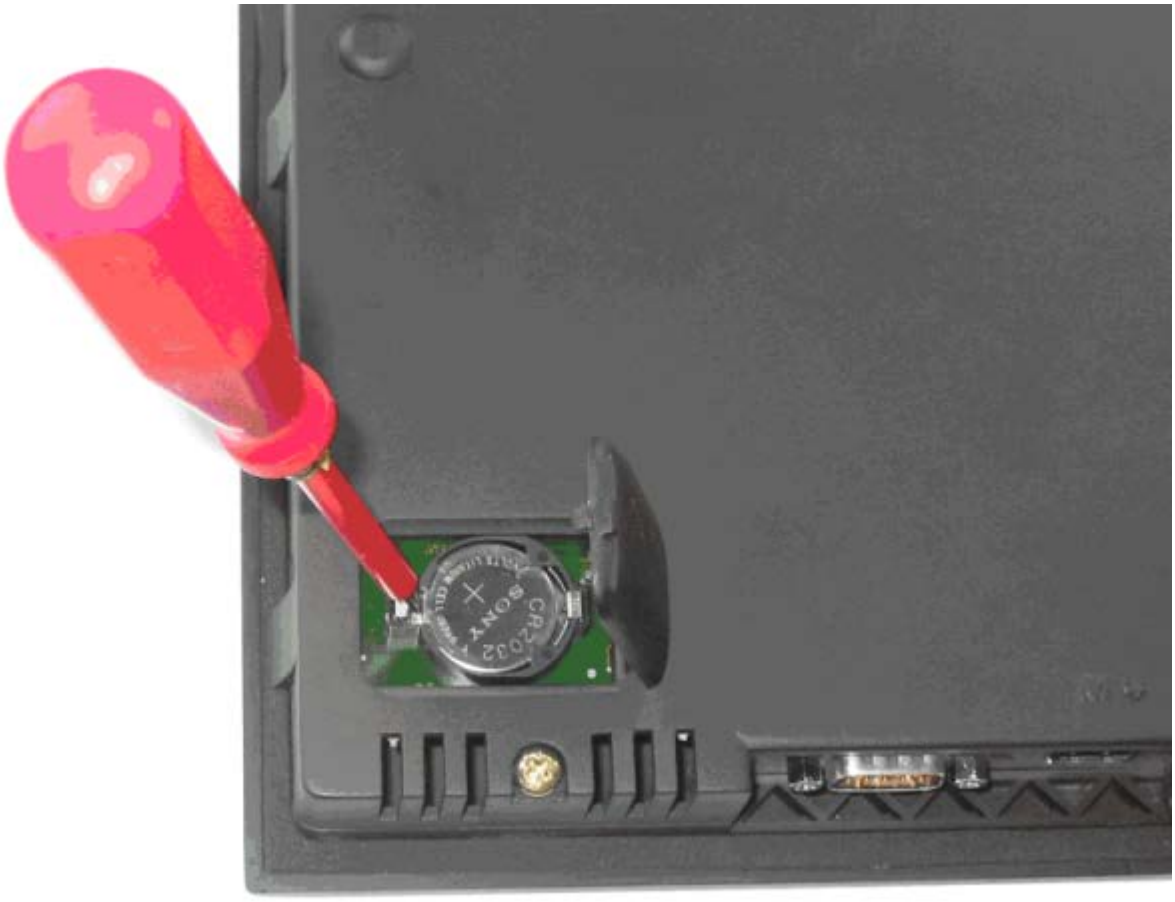


Figure 6-39 Replacing the backup battery

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 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 re-formed. If this is not done, the units could be damaged after the DC link voltage is applied under load.

If commissioning takes place within two years of the date of manufacture, the DC link capacitors do not need to be re-formed. The date of manufacture is indicated in the serial number on the nameplate.

Note

Storage period

It is important that the storage period be calculated from the date of manufacture and not from the date that the equipment was shipped.

Nameplate

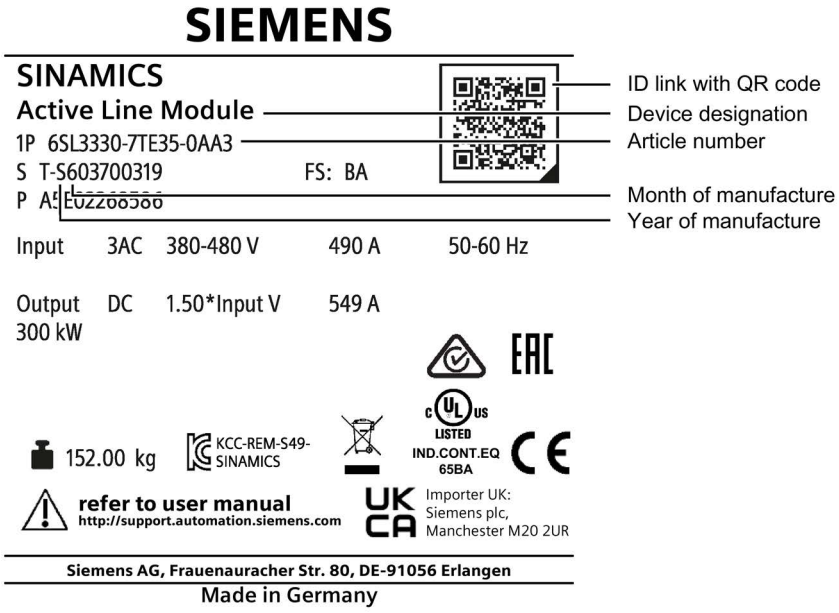


Figure 6-40 Nameplate using an Active Line Module as example

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 ... 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 rated 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 assembly

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
- 6 incandescent lamps 120 V / 50 W for a line voltage of 3 AC 380 bis 480 V, where 2 incandescent lamps must be connected in series in each supply phase.
  Alternatively, use 3 resistors of 1 kΩ / 100 W each (e.g. GWK150J1001KLX000 from Vishay) instead of the incandescent lamps.
- 12 incandescent lamps 120 V / 50 W for a line voltage of 3 AC 500 to 690 V, where 4 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 #16 AWG (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 rated for the high voltage of 500 to 690 V 3 ph AC.

- For a line voltage of 3 AC 500 to 690 V, install the two lamp sockets connected in series with insulation and protect them from being touched.

Forming circuit for Line Modules

Note

Forming the Line Modules

Voltage must be supplied to Line Modules via a connected Motor Module and the associated DC link.

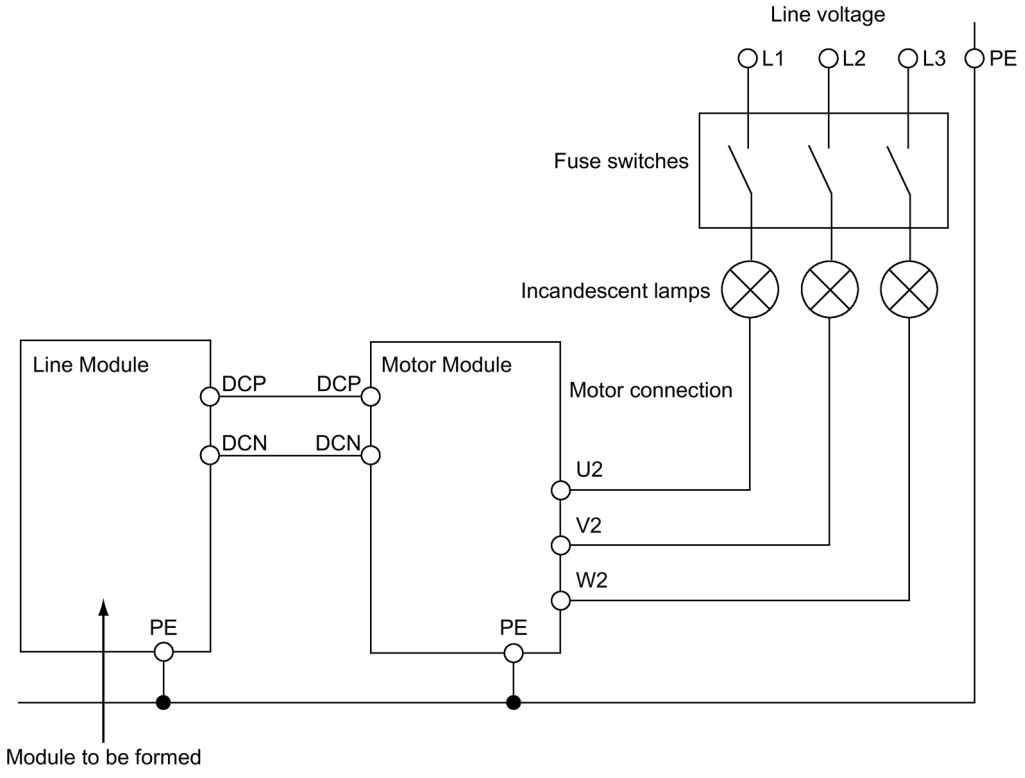


Figure 6-41 Forming circuit for Line Modules

Forming circuit for Motor Modules

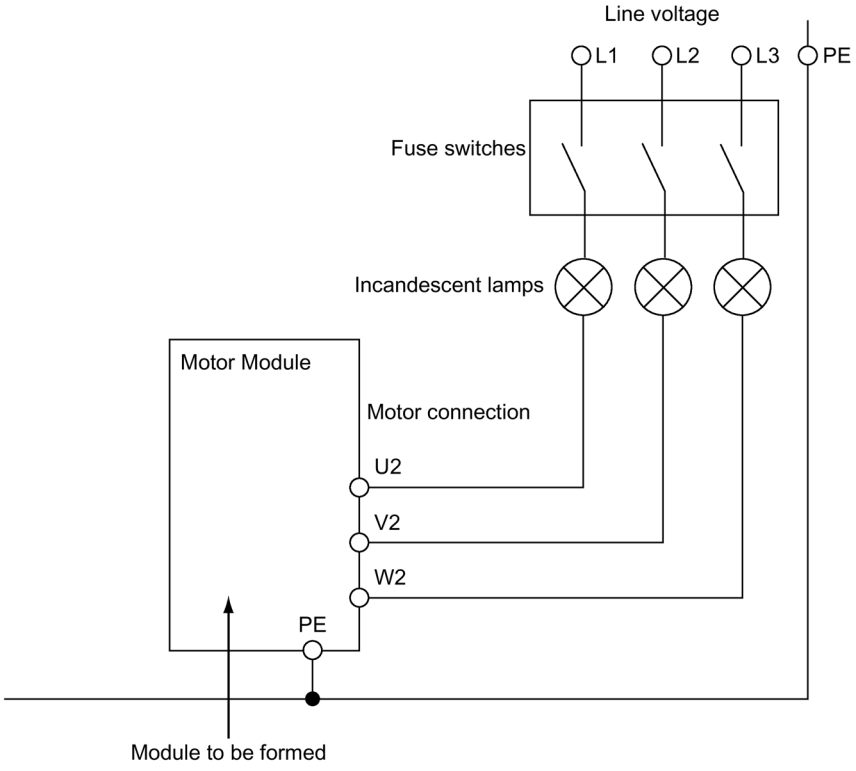


Figure 6-42 Forming circuit for Motor Modules

Procedure

- It is not permissible that the device being formed receives a power-on command (e.g. from the keyboard, BOP20 or terminal strip).
- Connect the appropriate forming circuit.
- Forming has been completed if the DC link voltage no longer increases.

Maintaining the operational readiness of individual power blocks for servicing

It is recommended that during the planned downtimes, the power blocks positioned on the plant side are replaced in order to guarantee the correct functioning of the power blocks during servicing.

6.6 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 RDY LED lights up red, all other LEDs light up orange
Red	Red	Off	BIOS loaded	–
Red flashing light 2 Hz	Red	Off	BIOS error	• Error occurred while loading the BIOS
Red flashing light 2 Hz	Red flashing light 2 Hz	Off	File error	• Memory card not inserted or faulty • Software on memory card not present or corrupted
Red	Orange Flashing light	Off	FW loading	RDY LED lights up red, COM LED flashes orange without fixed frequency
Red	Off	Off	Firmware loaded	–
Off	Red	Off	FW checked (no CRC error)	–
Red flashing light 0.5 Hz	Red flashing light 0.5 Hz	Off	FW checked (CRC error)	• CRC error

Table 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. However, there are no software licenses.	Upgrade licenses
	Orange	Flashing 0.5 Hz	Updating the firmware of the connected DRIVE-CLiQ components	–
		Flashing light 2 Hz	DRIVE-CLiQ component firmware update has been completed. Wait for POWER ON of the respective component.	Carry out POWER ON for the components in question
	Green/ orange or red/ orange	Flashing light 2 Hz	Component recognition via LED is activated. **Note**: Both options depend on the LED status when component recognition is activated via p0124[0] = 1.	–
COM PROFIdrive cyclic operation	–	Off	Cyclic communication has not (yet) taken place. **Comment:** PROFIdrive is ready for communication if the Control Unit is ready (see LED RDY).	–
	Green	Steady light	Cyclic communication is taking place.	–
		Flashing light 0.5 Hz	Full cyclic communication has not yet taken place. Possible causes: • The controller is not transferring any setpoints. • During isochronous operation, no global control (GC) or a faulty global control (GC) is transferred by the controller.	–
	Red	Flashing light 0.5 Hz	PROFIBUS master is sending wrong parameterization/configuration data	Adapt configuration between master/controller and CU
		Flashing light 2 Hz	Cyclic bus communication has been interrupted or could not be established	Correct the fault

LED	Color	State	Description, cause	Remedy
OPT (OPTION)	–	Off	The electronics power supply is missing or outside the permissible tolerance range. Component is not ready. Option board not installed or no associated drive object has been created.	Check power supply and/or component
	Green	Steady light	Option board is ready.	–
		Flashing light 0.5 Hz	Depends on the option board used[1].	–
	Red	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. 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 RDY LED lights up red, all other LEDs light up orange
Red	Red	Off	BIOS loaded	–
Red flashing light 2 Hz	Red	Off	BIOS error	• Error occurred while loading the BIOS
Red flashing light 2 Hz	Red flashing light 2 Hz	Off	File error	• Memory card not inserted or faulty • Software on memory card not present or corrupted
Red	Orange flashing light	Off	FW loading	RDY LED lights up red, COM LED flashes orange without fixed frequency
Red	Off	Off	Firmware loaded	–
Off	Red	Off	FW checked (no CRC error)	–
Red flashing light 0.5 Hz	Red flashing light 0.5 Hz	Off	FW checked (CRC error)	• CRC error

Table 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. However, there are no software licenses.	Upgrade licenses
	Orange	Flashing light 0.5 Hz	Updating the firmware of the connected DRIVE-CLiQ components	–
		Flashing light 2 Hz	DRIVE-CLiQ component firmware update has been completed. Wait for POWER ON of the respective component.	Carry out POWER ON for the components in question
	Green/ orange or red/ orange	Flashing light 2 Hz	Component recognition via LED is activated. **Remark**: Both options depend on the LED status when activating p0124[0] = 1.	–
COM PROFIdrive cyclic operation	–	Off	Cyclic communication has not (yet) taken place. **Remark:** PROFIdrive is ready for communication when the Control Unit is ready (see LED RDY).	–
	Green	Steady light	Cyclic communication is taking place.	–
		Flashing light 0.5 Hz	Full cyclic communication has not yet taken place. Possible causes: • The controller is not transferring any setpoints. • During isochronous operation, no global control (GC) or a faulty global control (GC) is transferred by the controller. • "Shared Device" is selected and only one controller connected.	–
	Red	Flashing light 0.5 Hz	Bus error, incorrect parameter assignment/configuration	Adapt configuration between controller and devices
		Flashing light 2 Hz	Cyclic bus communication has been interrupted or could not be established	Correct the fault

LED	Color	State	Description, cause	Remedy
OPT (OPTION)	–	Off	The electronics power supply is missing or outside the permissible tolerance range. Component is not ready. Option board not installed or no associated drive object has been created.	Check power supply and/or component
	Green	Steady light	Option board is ready.	–
		Flashing light 0.5 Hz	Depends on the option board used[1].	–
	Red	Continuous light	Depends on the option board used[1].	–
		Flashing light 0.5 Hz	Depends on the option board used[1].	–
		Flashing light 2 Hz	At least one fault is present in this component. Option board not ready (e.g. after switching on).	Remedy and acknowledge fault
RDY and COM	Red	Flashing light 2 Hz	Bus fault – communication has been interrupted	Correct the fault
RDY and OPT	Orange	Flashing light 0.5 Hz	The firmware of the connected option board is being updated.	–

[1] Any individual response of the LED OPT is described for the respective Option Board.

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: The CBE20 is operating error-free, and data is being exchanged with the configured IO controller.
	Red	Flashing light	- The watchdog timer has elapsed. - Communication has been interrupted. - The IP address is incorrect. - Incorrect or missing configuration. - Incorrect parameter assignment. - Incorrect or missing device name. - IO controller not present/switched off but Ethernet connection present. - Other CBE20 errors.
		Steady light	CBE20 bus error - No physical connection to a subnet/switch. - Incorrect transmission rate. - Full-duplex transmission is not activated.
Sync	–	Off	If the link port LED is green: Control Unit task system is not synchronized with the IRT clock. An internal substitute clock is generated.
	Green	Flashing light	Control unit task system has synchronized with the IRT clock and data is being exchanged.
		Steady light	Task system and MC-PLL have synchronized with the IRT clock.

Table 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. The CBE20 is defective or not inserted.
	Green	Steady light	CBE20 is ready and cyclic communication is taking place.
		Flashing light 0.5 Hz	CBE20 is ready but cyclic communication is not running. Possible causes: - Communication is being established. -At least one fault is present.
	Red	Steady light	Cyclic communication via PROFINET has not yet been established. However, acyclic communication is possible. SINAMICS is waiting for a parameterization/configuration telegram.
		Flashing light 0.5 Hz	The firmware download to the CBE20 has failed. Possible causes: - The memory card of the Control Unit is faulty. - The CBE20 is out of order. The CBE20 cannot be used in this state.
		Flashing light 2 Hz	Communication between the Control Unit and the CBE20 is faulty. Possible causes: - The CBE20 was removed following power-up. - The CBE20 is defective.
	Orange	Flashing light 0.5 Hz	Firmware is being updated.

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

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

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

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

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

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

Table 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 Control Interface Module in the Motor Module, chassis format

Table 7- 16 Meaning of the LEDs "READY" and "DC LINK" on the Control Interface Module in the Motor Module

LED, state		Description
READY	**DC LINK**	
Off	Off	The electronics power supply is missing or outside the permissible tolerance range.
Green	--- [1]	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC-link voltage is present.
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage lies outside the permitted tolerance range.
Orange	Orange	DRIVE-CLiQ communication is being established.
Red	--- [1]	This component has at least one fault. **Remark:** The LED is activated irrespective of whether the corresponding messages have been reconfigured.
Flashing light 0.5 Hz: green/red	--- [1]	Firmware is being downloaded.
Flashing light 2 Hz: green/red	--- [1]	Firmware download is complete. Wait for POWER ON.
Flashing light 2 Hz: green/orange or red/orange	--- [1]	Detection of the components via LED is activated (p0124). Note: Both options depend on the LED status when module recognition is activated via p0124 = 1.

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

Table 7- 17 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.

7.9 LEDs on the Motor Module in the booksize format

Table 7- 18 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. The DC-link voltage is present.
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage lies outside the permitted tolerance range.
Orange	Orange	DRIVE-CLiQ communication is being established.
Red	---[1)]	This component has at least one fault. **Remark:** The LED is activated irrespective of whether the corresponding messages have been reconfigured.
Flashing light 0.5 Hz: green/red	---[1)]	Firmware is being downloaded.
Flashing light 2 Hz: green/red	---[1)]	Firmware download is complete. Wait for POWER ON.
Flashing light 2 Hz: green/orange or red/orange	---[1)]	Detection of the components via LED is activated (p0124). Note: Both options depend on the LED status when module recognition is activated via p0124 = 1.

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



⚠ 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 Voltage Sensing Module (VSM) in the Active Interface Module

Table 7- 19 Meaning of the LEDs on the Voltage Sensing Module in the Active Interface Module

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

7.11 LEDs on the SMC10 Sensor Module

Table 7- 20 Meaning of the LEDs on the SMC10 Sensor Module

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

7.12 LEDs on the SMC20 Sensor Module

Table 7- 21 Meaning of the LEDs on the SMC20 Sensor Module

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

7.13 LEDs on the SMC30 Sensor Module

Table 7- 22 Meaning of the LEDs on the SMC30 Sensor Module

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

LED	Color	State	Description
OUT > 5V	-	Off	The electronics power supply is missing or outside the permissible tolerance range. Power supply ≤ 5 V.
	Orange	Steady light	The electronics power supply for the measuring system is available. Measuring system supply > 5 V **Notice:** You must ensure that the connected encoder can be operated with a 24 V power supply. If an encoder that is designed for a 5 V supply is operated with a 24 V supply, this can destroy the encoder electronics.

7.14 LEDs on the TM31 Terminal Module

Table 7- 23 Description of the LEDs on the TM31

LED	Color	State	Description
READY	-	Off	The electronics power supply is missing or out of tolerance.
	Green	Steady light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	Steady light	DRIVE-CLiQ communication is being established.
	Red	Steady light	This component has at least one fault. **Remark:** The LED is activated irrespective of whether the corresponding messages have been reconfigured.
	Green/red	Flashing light 0.5 Hz	Firmware is being downloaded.
		Flashing light 2 Hz	Firmware download is complete. Waiting for POWER ON.
	Green/orange or Red/orange	Flashing light 2 Hz	Detection of the components via LED is activated (p0154). **Remark:** Both options depend on the LED status when module recognition is activated via p0154 = 1.

7.15 LEDs on the TM54F Terminal Module

Table 7- 24 Meaning of the LEDs on the Terminal Module TM54F

LED	Color		State	Description, cause
READY	-		Off	The electronics power supply is missing or outside the permissible tolerance range.
	Green		Steady light	The component is ready for operation, cyclic DRIVE-CLiQ communication is taking place.
	Orange		Steady light	DRIVE-CLiQ communication is being established.
	Red		Steady light	This component has at least one fault. **Remark:** The LED is activated irrespective of whether the corresponding messages have been reconfigured.
	Green/red		Flashing light 0.5 Hz	Firmware is being downloaded.
			Flashing light 2 Hz	Firmware download has been completed. Wait for POWER ON.
	Green/orange or Red/Orange		Flashing light	Detection of the components via LED is activated (p0154). **Remark:** Both options depend on the LED status when module recognition is activated via p0154 = 1.
L1+, L2+,	–		On	The controllable sensor power supply is functioning fault-free.
	Red		Steady light	There is a fault in the controllable sensor power supply.
L3+	–		On	The sensor power supply is operating fault-free.
	Red		Steady light	The sensor power supply has a fault.
Fail-safe inputs / double inputs				
F_DI z (input x, (x+1)+, (x+1)-)	**LED**	**LED**		
	x	x+1		**NC contact/NC contact[1]: (z = 0 ... 9, x = 0, 2, ... 18)**
	–	Red	Steady light	Different signal states at input x and x+1
	–	–	–	No signal at input x and no signal at input x+1
				NC contact/NO contact[1]: (z = 0 ... 9, x = 0, 2, ... 18)
	–	Red	Steady light	Same signal states at input x and x+1
	–	–	–	No signal at input x and no signal at input x+1
	LED	**LED**		
	x	x+1		**NC contact/NC contact[1]: (z = 0 ... 9, x = 0, 2, ... 18)**
	Green	Green	Steady light	One signal at input x and one signal at input x+1
				NC contact/NO contact[1]: (z = 0 ... 9, x = 0, 2, ... 18)
	Green	Green	Steady light	One signal at input x and no signal at input x+1
Single digital inputs, not fail-safe				
DI x	–		Off	No signal at digital input x (x = 20 ... 23)
	Green		Steady light	Signal at digital input x
Fail-safe digital outputs with associated readback channel				
F_DO y (0+..3+, 0-..3-)	Green		Steady light	Output y (y = 0 ... 3) has an active signal
Read back input DI 2y for output F_DO y (y = 0 ... 3) for test stop. The state of the LEDs depends on the type of external circuitry.				
DI 2y	–		Off	One of the two output lines y+ or y- or both lines of output y carry a signal
	Green		Steady light	Both output lines y+ and y- carry no signal

[1] Inputs x+1 (DI 1+, 3+, .. 19+) can be individually adjusted by a parameter (see List Manual)

7.16 LEDs on the TM150 Terminal Module

TM150 Terminal Module (-A151 to -A154)

Table 7- 25 Description of the LEDs on the TM150

LED	Color	State	Description
READY	-	Off	The electronics power supply is missing or outside the permissible tolerance range.
	Green	Steady light	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	Steady light	DRIVE-CLiQ communication is being established.
	Red	Steady light	This component has at least one fault. **Remark:** The LED is activated irrespective of whether the corresponding messages have been reconfigured.
	Green/red	Flashing light 0.5 Hz	Firmware is being downloaded.
		Flashing light 2 Hz	Firmware download is complete. Waiting for POWER ON.
	Green/ orange or Red/ orange	Flashing light 2 Hz	Detection of the components via LED is activated (p0154). **Remark:** Both options depend on the LED status when module recognition is activated via p0154 = 1.

7.17 LEDs on the SITOP power supply unit

Table 7- 26 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
- Booksize Cabinet Kits
- Motor Modules chassis format

Description

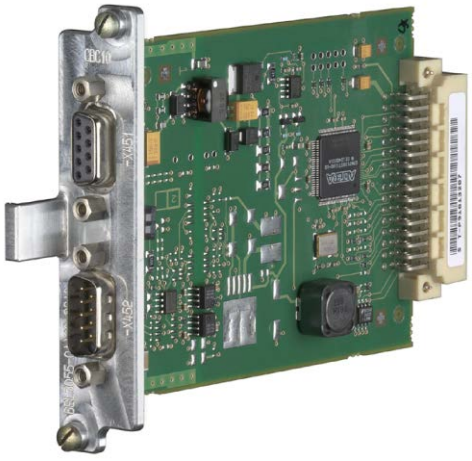


Figure 8-1 CAN CBC10 Communication Board

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
Option Boards can be damaged or malfunction if they are inserted or withdrawn in operation Withdrawing and inserting Option Boards during operation can cause them to be damaged or to malfunction. • Only withdraw and 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

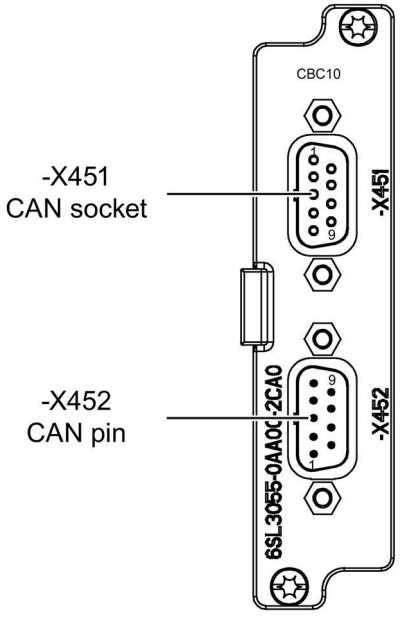
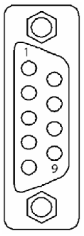


Figure 8-2 CAN CBC10 Communication Board, interface overview

X451 CAN bus interface

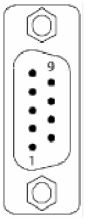
Table 8- 1 CAN bus interface X451

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			

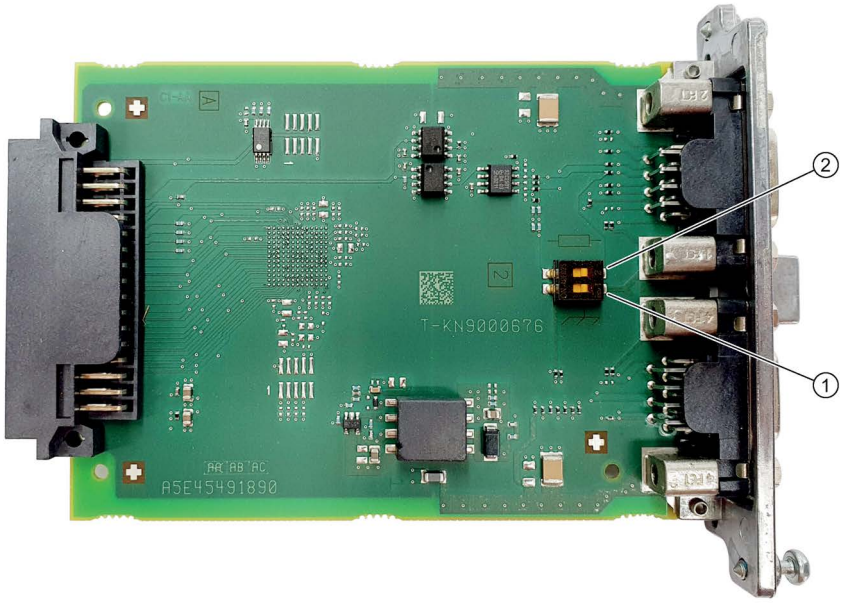
NOTICE
Destruction of the CAN bus interface as a result of an incorrect connector
If PROFIBUS connectors are connected to CAN bus interfaces during operation, this may lead to the CAN bus interfaces being destroyed.
• Do not connect PROFIBUS connectors to CAN bus interfaces.

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)			

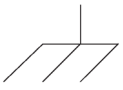
2-pin SMD DIP switch



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
- Booksize Cabinet Kits
- Motor Modules in chassis format

Description

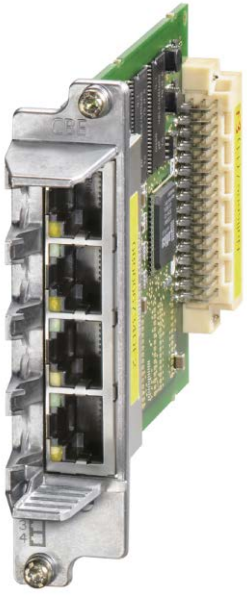


Figure 8-4 CBE20 Ethernet Communication Board

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.

There are 4 Ethernet interfaces available on the module. Diagnosis of the function mode and communication are possible via LEDs.

Interface overview

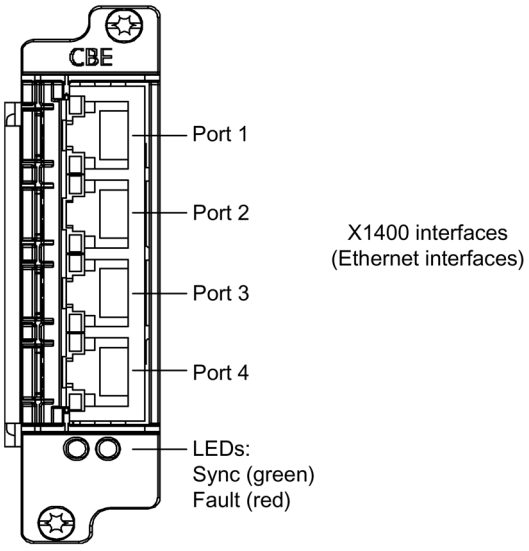


Figure 8-5 CBE20 Ethernet Communication Board, interface overview

MAC address

The MAC address of the Ethernet interfaces is indicated on the top side of the CBE20. The label is only visible when the module has been removed.

Note

Note the MAC address

Remove the module and note down the MAC address of the module so that you have it available for subsequent commissioning. Re-install the module.

Removal / installation

NOTICE
Option Boards can be damaged or malfunction if they are inserted or withdrawn in operation Withdrawing and inserting Option Boards during operation can cause them to be damaged or to malfunction. • Only withdraw and insert Option Boards when the Control Unit is in a no-voltage state.

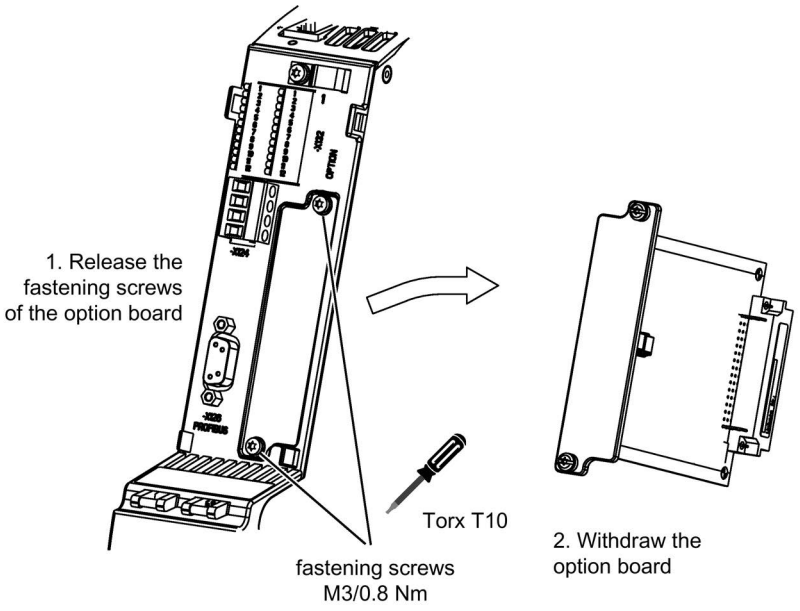
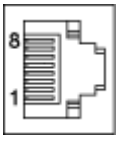


Figure 8-6 Removing the CBE20 from the option slot on the Control Unit

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+	Send data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	TX-	Send 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, TM150 temperature sensor module

8.5.1 General information

Availability of option

These options are available for the following S120 Cabinet Modules:

- Line Connection Module
- 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 TM150 Terminal Module is used to acquire and evaluate data from several temperature sensors.

Here, option G51 stands for 1 temperature sensor module, option G52 for 2 TM150 Temperature Sensor Modules, etc.:

- G51: 1 TM150 Temperature Sensor Module
- G52: 2 TM150 Temperature Sensor Modules
- G53: 3 TM150 Temperature Sensor Modules
- G54: 4 TM150 Temperature Sensor Modules

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, evaluation for 1x2-wire, 2x2-wire, 3-wire, or 4-wire per terminal block can be assigned. There is no galvanic isolation in the TM150.

A maximum of 12 temperature sensors can be connected to the TM150 Terminal Module.

8.5.2 Interfaces

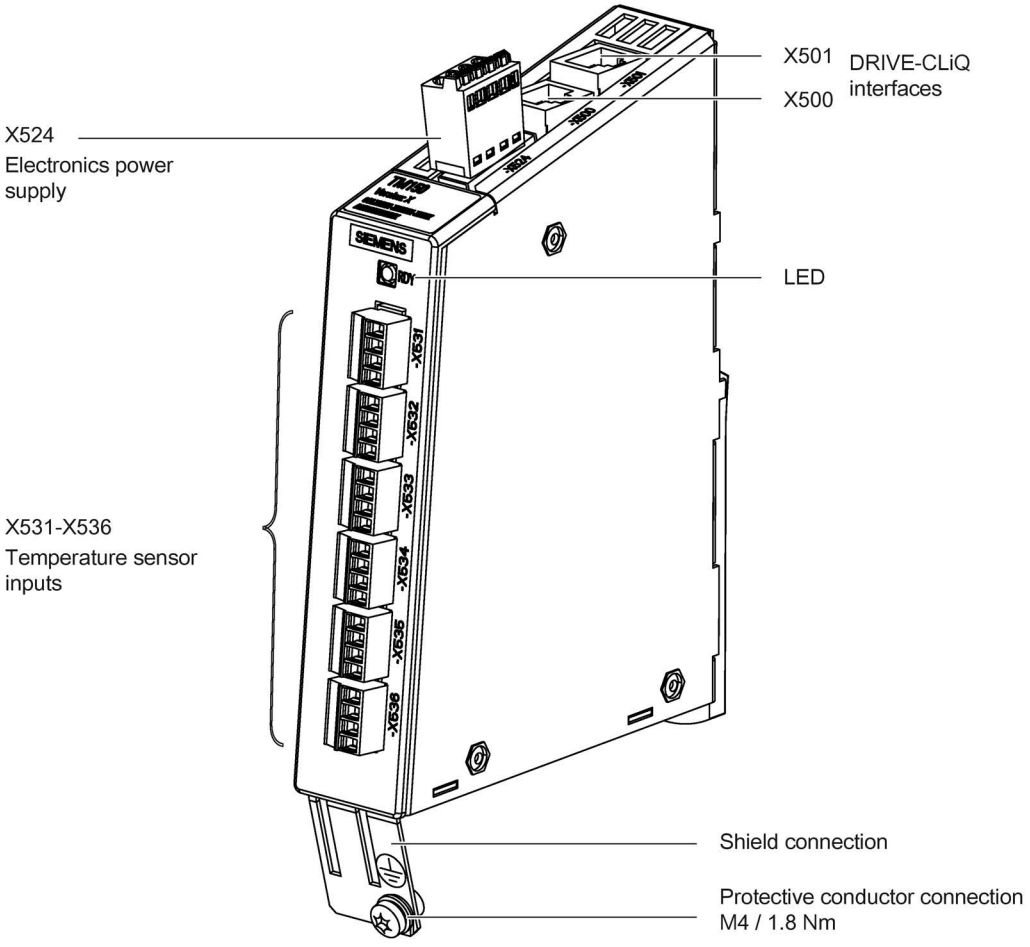
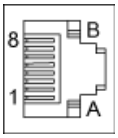


Figure 8-7 TM150 Terminal Module

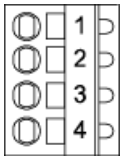
X500, X501: DRIVE-CLiQ interface

Table 8- 5 DRIVE-CLiQ interface X500 and X501

Connector	Pin	Signal name	Technical data
	1	TXP	Send data +
	2	TXN	Send 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 1x2- / 2x2-wire	Function 3- and 4-wire	Technical data
	1	+Temp (channel x)	+ (Channel x)	Temperature sensor connection for sensors with 1x2 wires Connection of the 2nd measuring cable for sensors with 3 and 4 wires (in parallel with terminal 3)
	2	-Temp (channel x)	- (Channel x)	Temperature sensor connection for sensors with 1x2 wires Connection of the 1st measuring cable for sensors with 4 wires (in parallel with terminal 4)
	3	+Temp (channel y)	+ I_c (constant current, positive channel x)	Temperature sensor connection for sensors with 2x2, 3 and 4 wires
	4	-Temp (channel y)	- I_c (constant current, negative channel x)	
Max. connectable cross-section: #16 AWG (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] for 1x2-, 3-, and 4-wires	Channel number [y] for 2x2-wires
X531	0	6
X532	1	7
X533	2	8
X534	3	9
X535	4	10
X536	5	11

NOTICE

Damage to the motor when the KTY temperature sensor is connected incorrectly

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 due to jumpering of 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 due to 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 twisted-pair, separately-shielded cables.
- Connect the cable shield at both ends to ground potential over a large surface area.

Note

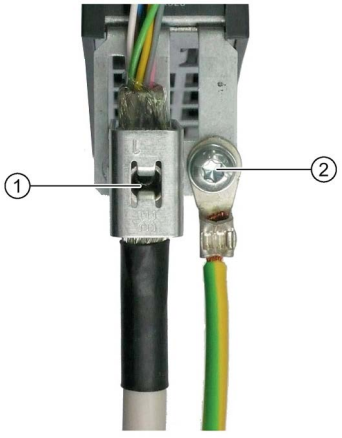
Incorrect temperature measured values as a result of cables with an excessively high resistance

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.

- Only use cable lengths ≤ 990 ft (300 m).
- For cable lengths > 330 ft (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

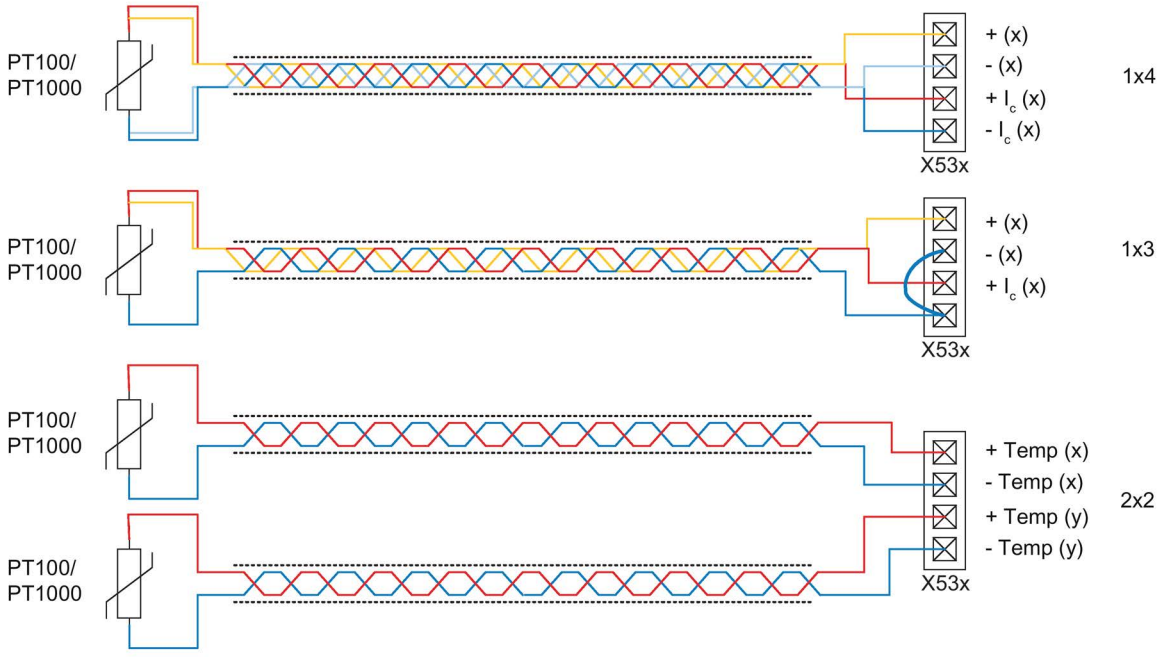


Figure 8-9 Connecting a PT100/PT1000 with 2x2, 3 and 4-wires to the temperature sensor inputs X53x of Terminal Module TM150

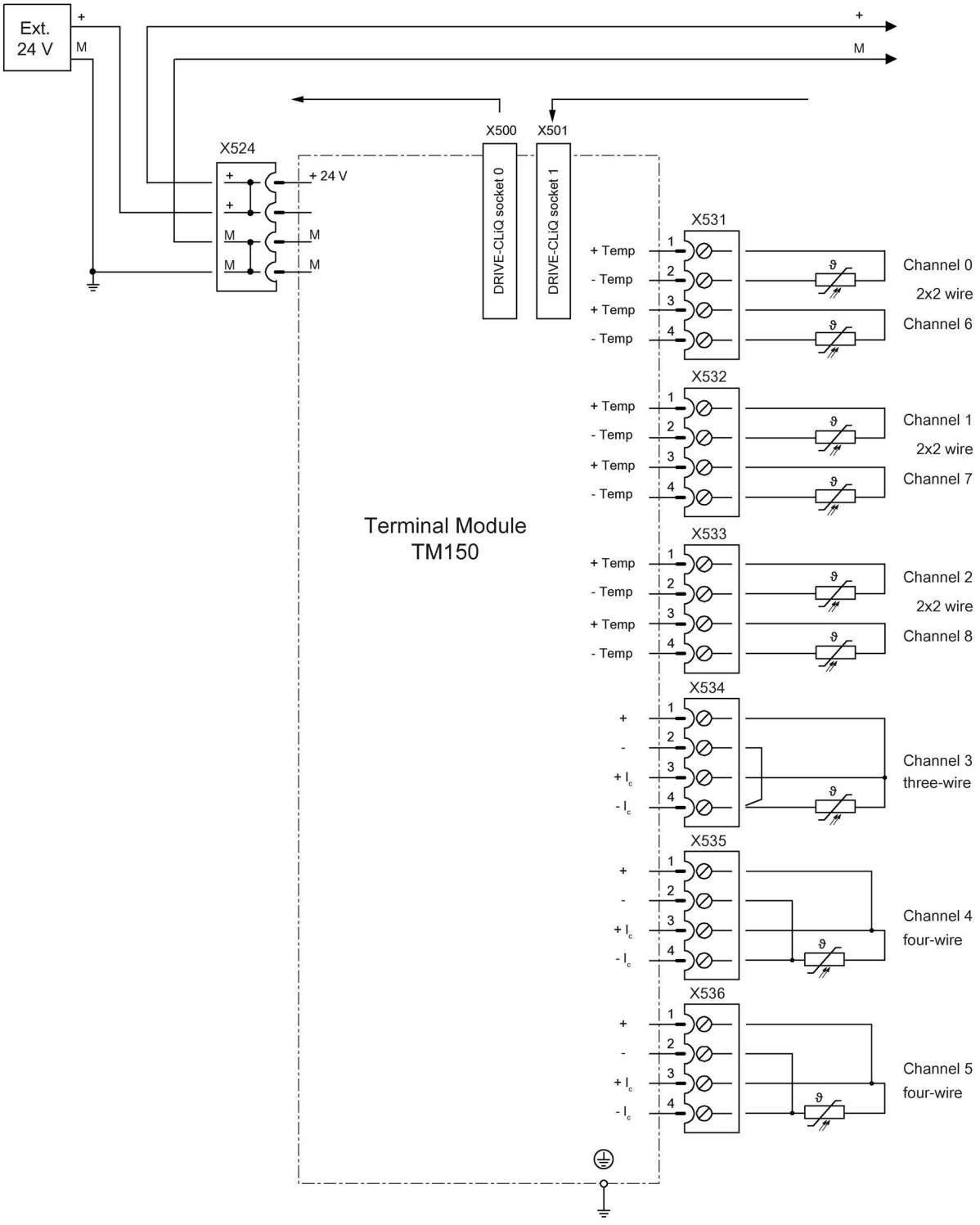


Figure 8-10 Connection example for a Terminal Module TM150

8.6 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

8.7 G60, TM31 Terminal Module

8.7.1 General information

Availability of option

These options are available for the following S120 Cabinet Modules:

- Booksize Cabinet Kits
- Motor Modules chassis 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 plant side. It is not installed in the factory.

Overview

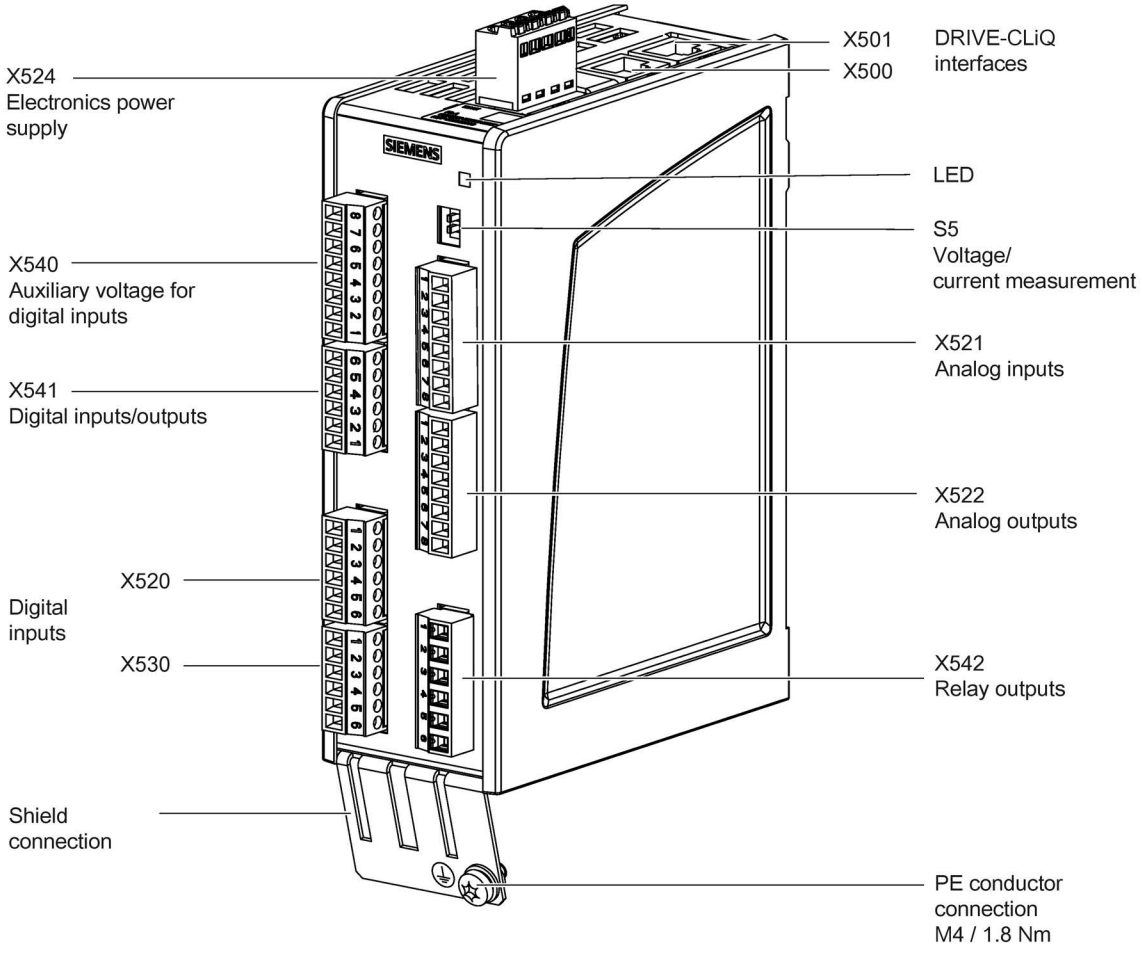


Figure 8-11 TM31 Terminal Module

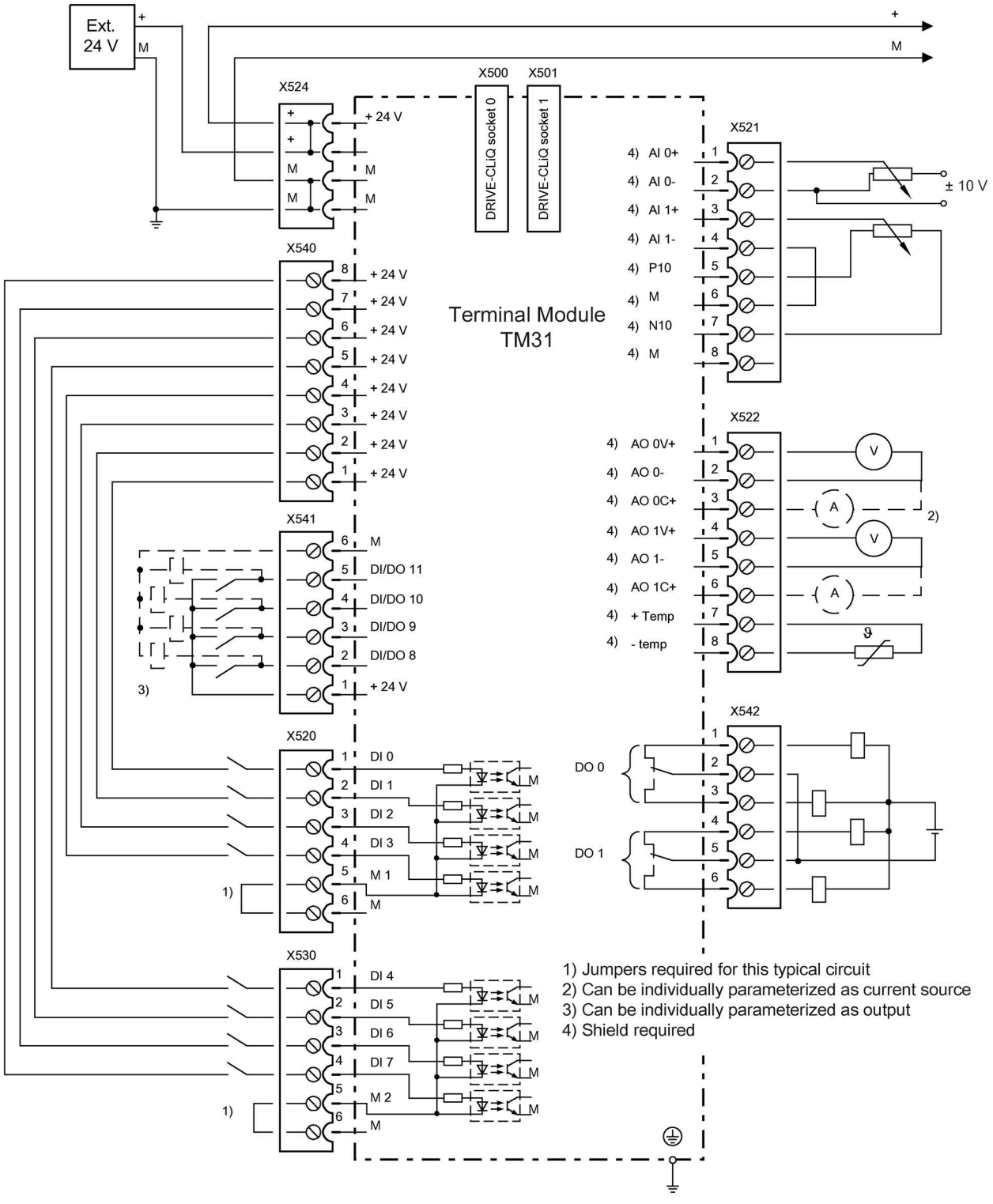
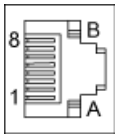


Figure 8-12 Connection overview of TM31 Terminal Module

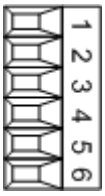
X500, X501: DRIVE-CLiQ interface

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 strip X520

Connector	Terminal	Designation [1]	Technical data
	1	DI 0	**Voltage**: -3 ... +30 V **Current consumption** typical: 10 mA at 24 V DC **Input delay**: for "0" to "1": Typ. 50 µs max. 100 µs for "1" to "0": Typ. 130 µs, max. 150 µs **Electrical isolation**: Reference potential is terminal M1 **Signal level** (including ripple) High level: 15 ... 30 V Low level: -3 ... +5 V
	2	DI 1	
	3	DI 2	
	4	DI 3	
	5	M1	
	6	M	
Max. connectable cross-section: #16 AWG (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".

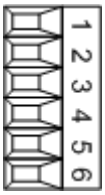
Terminal M1 must be connected so that the digital inputs (DI) can function.

This is achieved through one of the following measures:

1. 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 strip X530

Connector	Terminal	Designation [1]	Technical data
	1	DI 4	**Voltage**: -3 ... +30 V **Current consumption** typical: 10 mA at 24 V DC **Input delay**: for "0" to "1": Typ. 50 µs max. 100 µs for "1" to "0": Typ. 130 µs, max. 150 µs **Electrical isolation**: Reference potential is terminal M2 **Signal level** (including ripple) High level: 15 ... 30 V Low level: -3 ... +5 V
	2	DI 5	
	3	DI 6	
	4	DI 7	
	5	M2	
	6	M	
Max. connectable cross-section: #16 AWG (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".

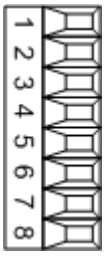
Terminal M2 must be connected so that the digital inputs (DI) can function.

This is achieved through one of the following measures:

1. 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 strip X521

Connector	Terminal	Designation [1]	Technical data
	1	AI 0+	The analog inputs can be toggled between current and voltage input using switches S5.0 and S5.1. **As voltage input**: -10 ... +10 V; R_i > 100 kΩ Resolution: 11 bits + sign **As current input**: -20 ... +20 mA; R_i = 250 kΩ Resolution: 10 bits + sign
	2	AI 0-	
	3	AI 1+	
	4	AI 1-	
	5	P10	**Auxiliary voltage**: P10 = 10 V N10 = -10 V Continuously short-circuit proof
	6	M	
	7	N10	
	8	M	
Max. connectable cross-section: #16 AWG (1.5 mm²)			

[1] AI: analog input; P10/N10: auxiliary voltage, M: Ground reference

NOTICE

Damage or malfunction due to 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 outputs 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

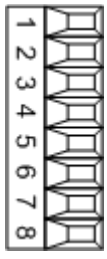
Note

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 strip X522

Connector	Terminal	Designation [1]	Technical data
	1	AO 0V+	You can set the following output signals using parameters: **Voltage**: -10 ... +10 V (max. 3 mA) **Current 1**: 4 ... 20 mA (max. load resistance ≤ 500 Ω) **Current 2**: -20 ... +20 mA (max. load resistance ≤ 500 Ω) **Current 3**: 0 ... 20 mA (max. load resistance ≤ 500 Ω) Resolution: 11 bits + sign Continuously short-circuit proof
	2	AO 0-	
	3	AO 0C+	
	4	AO 1V+	
	5	AO 1-	
	6	AO 1C+	
	7	+ Temp [2]	Temperature sensor Pt1000 / PTC / KTY84-130 / bimetallic NC contact Measuring current via temperature sensor connection: 2 mA
	8	- Temp [2]	
Max. connectable cross-section: #16 AWG (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 strip X540

Connector	Terminal	Designation	Technical data
	8	+24 V	Voltage: +24 V DC Max. total load current of +24 V auxiliary voltage for terminals X540 and X541 combined: 150 mA Continuously short-circuit proof
	7	+24 V	
	6	+24 V	
	5	+24 V	
	4	+24 V	
	3	+24 V	
	2	+24 V	
	1	+24 V	
Max. connectable cross-section: #16 AWG (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**: Voltage: -3 ... 30 V Electrical isolation: no Reference potential: M Input characteristic acc. to IEC 61131-2, type 1 Input voltage (including ripple) "1" signal: 15 ... 30 V "0" signal: -3 ... +5 V Input current at 24 V DC: typ. 9 mA at < 0.5 mA: "0" signal reliably detected Input delay: For "0" → "1": typ. 50 µs -for "1" → "0" typ. 100 µs **As output:** Voltage: 24 V DC Electrical isolation: no Reference potential: M Output voltage "1" signal, with load: > X524.+ -2 V Output current for each output: ≤ 0.5 A Sum of all 4 outputs: ≤ 0.1 A (when parameter p4046 = 0) ≤ 1.0 A (when parameter p4046 = 1) Residual current for "0" signal: < 0.5 mA Short-circuit protection, automatic reclosure after a short-circuit Load types: ohmic, capacitive, inductive Output delay for "0" → "1": typ. 150 µs / max. 500 µs (ohmic load) for "1" → "0": typ. 50 µs (ohmic load) Switching frequency for resistive load: Max. 100 Hz For inductive load: Max. 0.5 Hz For lamp load: Max. 10 Hz Lamp load: max. 5 W
	5	DI/DO 11	
	4	DI/DO 10	
	3	DI/DO 9	
	2	DI/DO 8	
	1	+24 V	Auxiliary voltage: Voltage: +24 V DC Max. total load current of +24 V auxiliary voltage for terminals X540 and X541 combined: 150 mA
Max. connectable cross-section: #16 AWG (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 strip X542

Connector	Terminal	Designation [1]	Technical data
	1	DO 0.NC	Contact type: Changeover contact max. load current: 8 A Max. switching voltage: 250 V_{AC}. 30 V_{DC} Max. switching capacity at 250 V_{AC}: 2000 VA (cosϕ = 1) Max. switching capacity at 250 V_{AC}: 750 VA (cosϕ = 0.4) Max. switching capacity at 30 V_{DC}: 240 W (resistive load) Required minimum current: 100 mA Output delay: ≤ 20 ms [2] Overvoltage category: Class II according to IEC 60664-1
	2	DO 0.COM	
	3	DO 0.NO	
	4	DO 1.NC	
	5	DO 1.COM	
	6	DO 1.NO	
Max. connectable cross-section: #14 AWG (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 115 V AC is applied to the relay outputs, the Terminal Module must also be grounded using a #14 AWG (2.5 mm²) protective conductor.

8.8 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

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 plant side. It is not installed in the factory.

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
- Booksize Cabinet Kits
- Motor Modules in chassis 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
Option Boards can be damaged or malfunction if they are inserted or withdrawn in operation Withdrawing and inserting Option Boards during operation can cause them to be damaged or to malfunction. • Only withdraw and 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

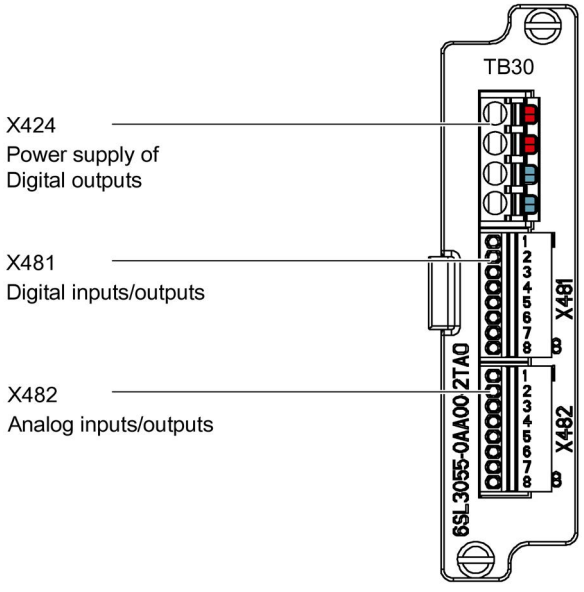


Figure 8-14 TB30 Terminal Board interface overview

Connection overview

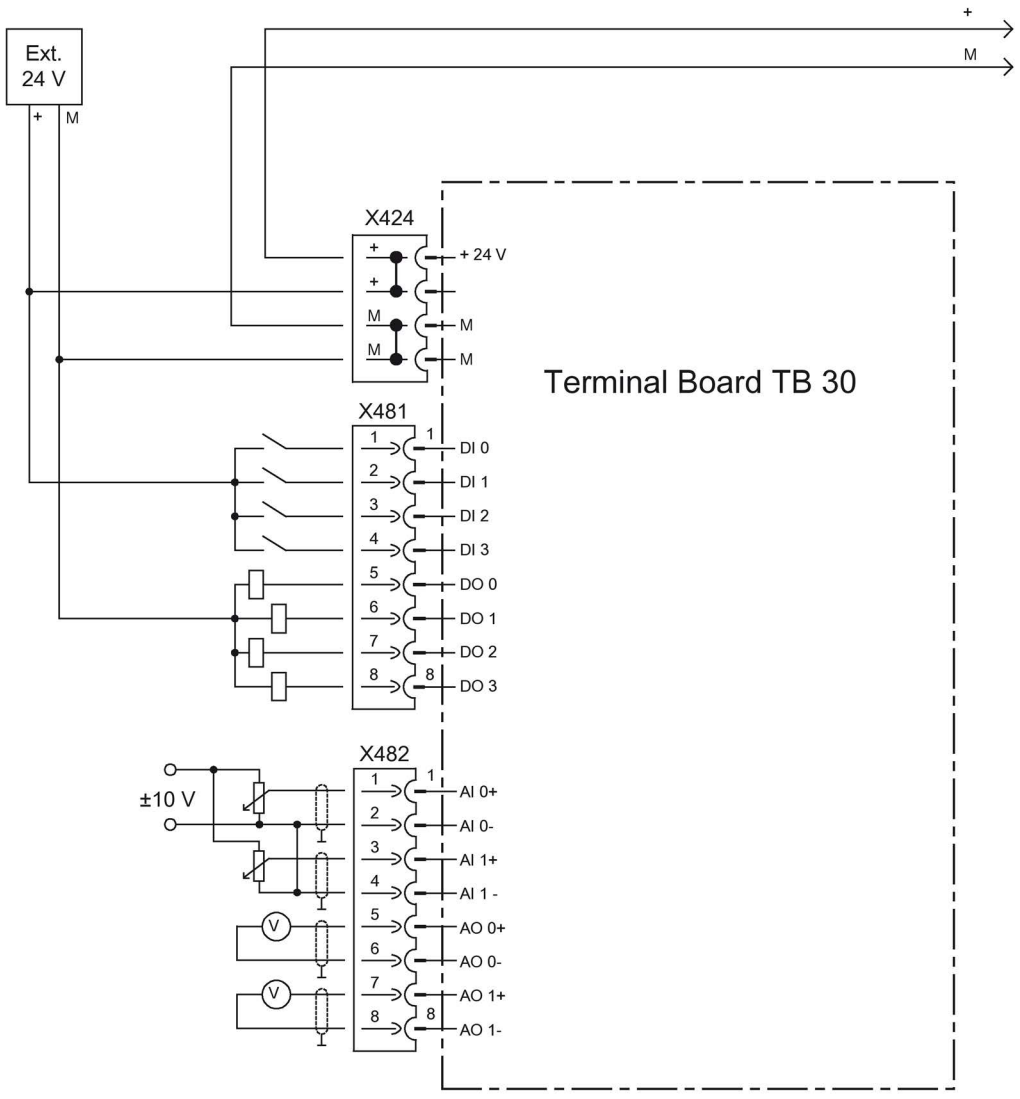
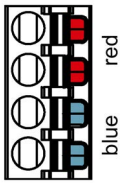


Figure 8-15 Connection overview TB30 Terminal Board

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) Current consumption: Max. 4 A (per digital output max. 0.5 A) Max. current via jumper in connector: 20 A (15 A according to UL/CSA)
	+	Power supply	
	M	Ground	
	M	Ground	
Max. connectable cross-section: #14 AWG (2.5 mm²)			

The maximum cable length that can be connected is 33 ft (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

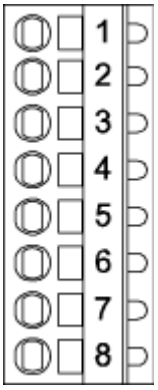
The power supply of the digital outputs and the electronic power supply of the Control Unit are isolated.

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 Electrical isolation: Yes Reference potential: X424.M Input characteristic acc. to IEC 61131-2, type 1 Input voltage (including ripple) "1" signal: 15 ... 30 V "0" signal: -3 ... +5 V Input current at 24 V DC: typ. 3.5 mA at <0.5 mA: "0" signal reliably detected Input delay for "0" → "1": typ. 20 µs for "1" → "0": typ. 100 µs
	2	DI 1	
	3	DI 2	
	4	DI 3	
	5	DO 0	Voltage: 24 V DC Electrical isolation: Yes Reference potential: X424.M Output voltage "1" signal, with load: > X424.+ -2 V Output current for each output: ≤ 0.5 A Sum of all four outputs: ≤ 2 A Residual current for "0" signal: < 0.5 mA Short-circuit protection, automatic restart after a short-circuit Load types: ohmic, capacitive, inductive Output delay[3] for "0" → "1": typ. 150 µs / max. 500 µs (ohmic load) for "1" → "0": typ. 50 µs (ohmic load) Switching frequency for resistive load: Max. 100 Hz For inductive load: Max. 0.5 Hz For lamp load: Max. 10 Hz Lamp load: max. 5 W
	6	DO 1	
	7	DO 2	
	8	DO 3	
Max. connectable cross-section: 20 AWG (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

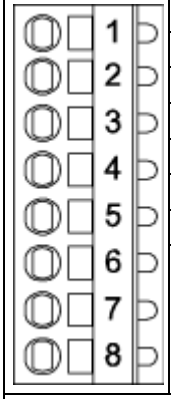
Malfunction in the switched-off state due to diagnostic currents

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 connected 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) **Voltage**: -10 ... +10 V; R_i: 65 kΩ **Common mode range**: ±30 V **Resolution**: 13 bits + sign
	2	AI 0-	
	3	AI 1+	
	4	AI 1-	
	5	AO 0+	Analog outputs (AO) **Voltage range**: -10 ... +10 V **Load current**: max. -3 ... +3 mA **Resolution**: 11 bit + signed Continuous short-circuit proof
	6	AO 0-	
	7	AO 1+	
	8	AO 1-	
Max. connectable cross-section: 20 AWG (0.5 mm^2)			

[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

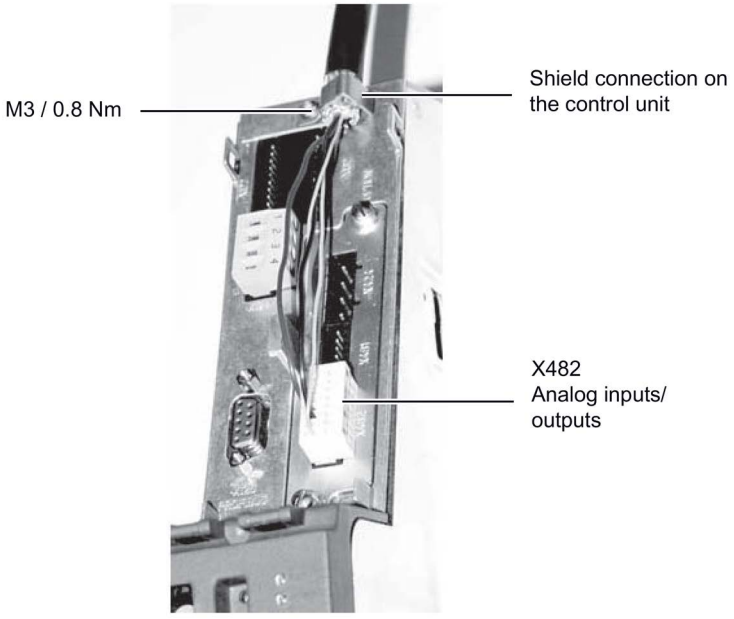


Figure 8-16 TB30 shield connection

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

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 optionally be ordered with the CompactFlash card using options K01 - K05.

Subsequent licensing is executed on the Internet via the "WEB License Manager" by generation of 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
- READY LED → Flashes green/red at 0.5 Hz

Note

Safety Integrated Function Manual

A detailed description of the complete principle of operation of Safety Integrated functions and their handling is given in the associated Function Manual, 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
- Booksize Cabinet Kits
- Motor Modules in chassis format

Note

Option K08 is only available in conjunction with the 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 used 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.

Features

- 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 state 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 how it is handled is given in the "SINAMICS S120 Cabinet Module AOP30" 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

Description

The SMC10 Sensor Module is used for determining 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-pin 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 with 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 427 ft (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).

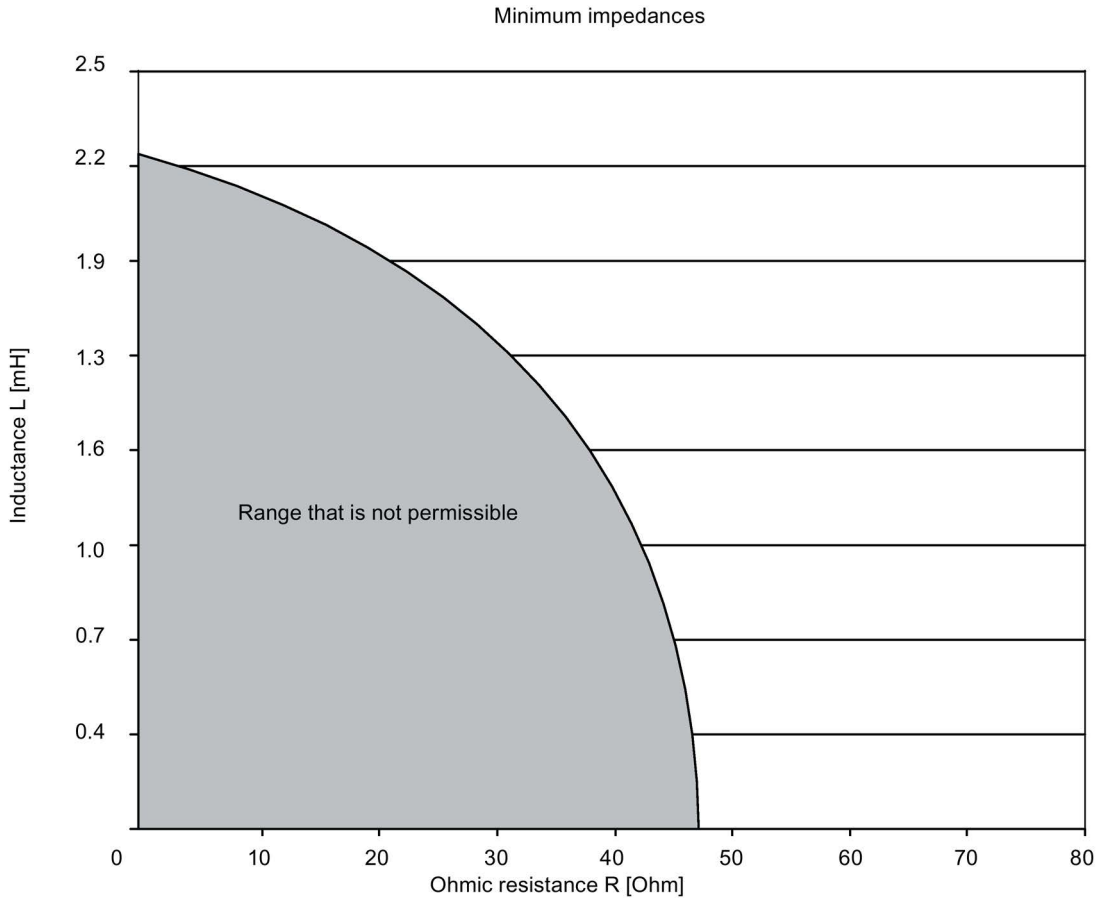


Figure 8-18 Connectable impedances with an excitation frequency f = 5000 Hz

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

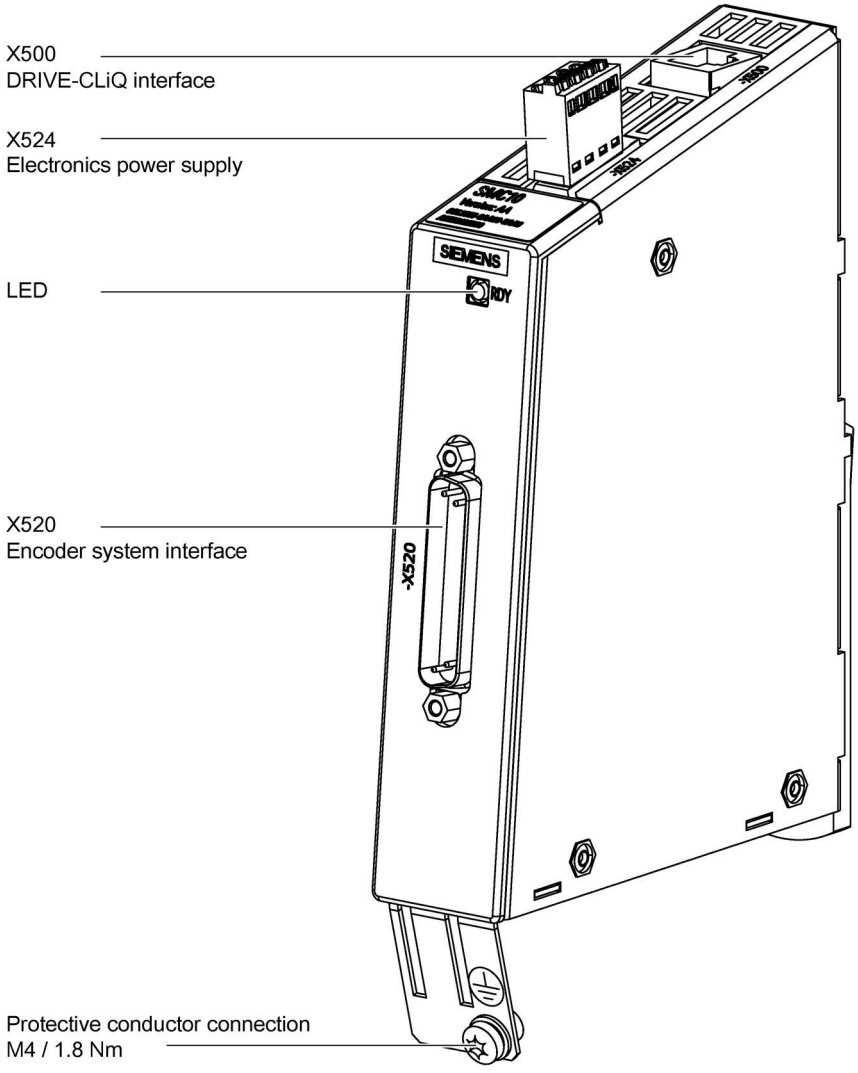
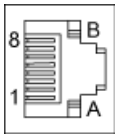


Figure 8-19 Interface overview for the SMC10

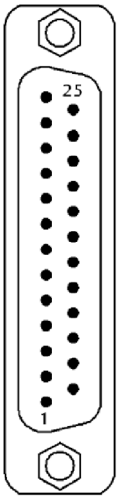
X500: DRIVE-CLiQ interface

Table 8- 22 DRIVE-CLiQ interface X500

Connector	Pin	Signal name	Technical data
	1	TXP	Send data +
	2	TXN	Send 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 427 ft (130 m).

8.12.4 Connection example

Connection example: Resolver, 8-pin

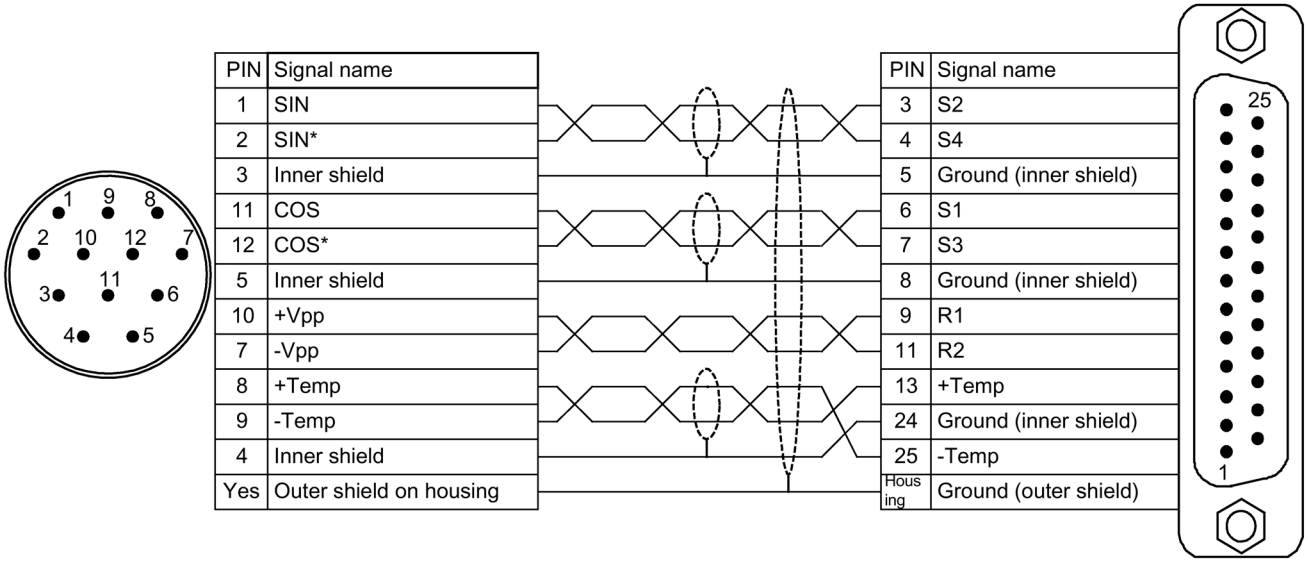


Figure 8-20 Connection example: Resolver, 8-pin

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

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 330 ft (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

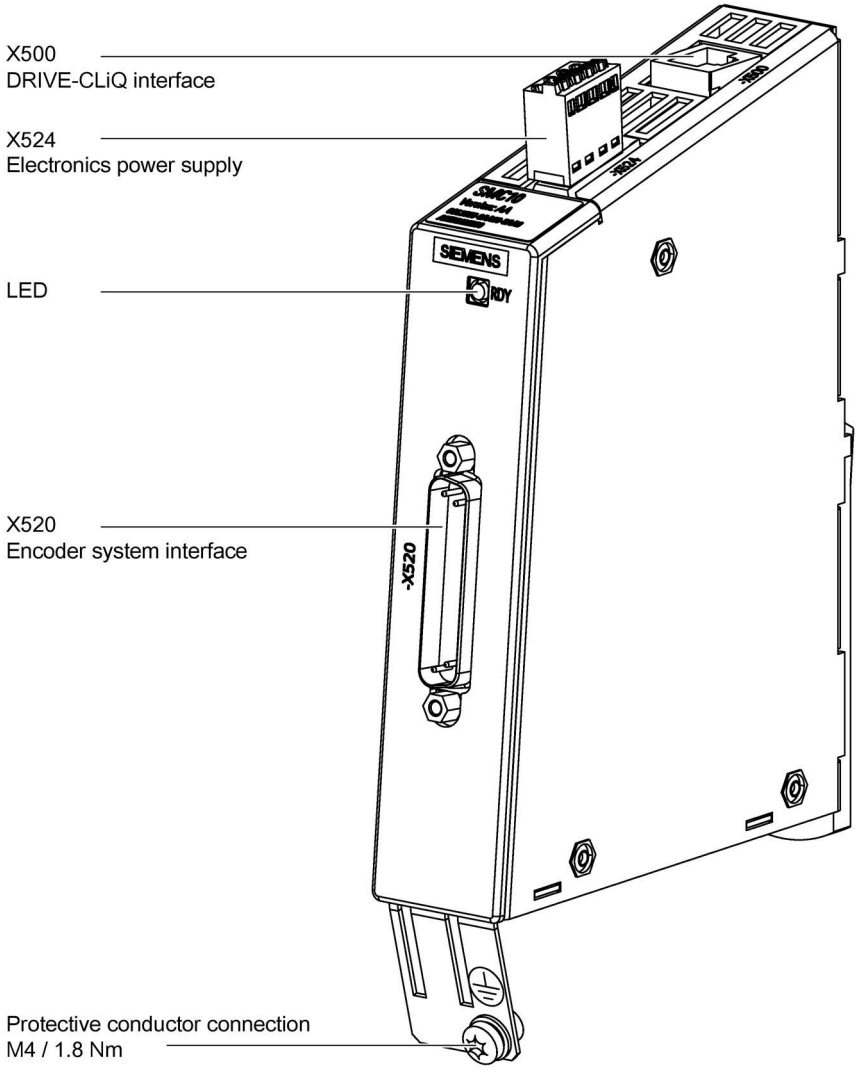
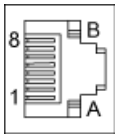


Figure 8-21 Interface overview for the SMC20

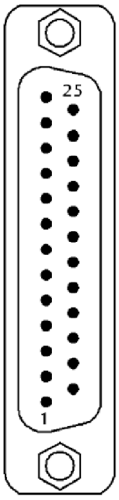
X500: DRIVE-CLiQ interface

Table 8- 24 DRIVE-CLiQ interface X500

Connector	Pin	Signal name	Technical data
	1	TXP	Send data +
	2	TXN	Send 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 supply
	2	M encoder	Ground, encoder 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, encoder supply
	15	Data	Data, EnDat interface, SSI data
	16	M sense	Ground, sense input, encoder 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 on the encoder end. The supply voltage of the encoder is detected by the SMC20 and automatically controlled to 5 V to compensate any power loss.

Note

Maximum signal cable length

The maximum signal cable length is 330 ft (100 m).

8.13.4 Connection example

Connection example: Incremental encoder sin/cos 1 Vpp, 2,048

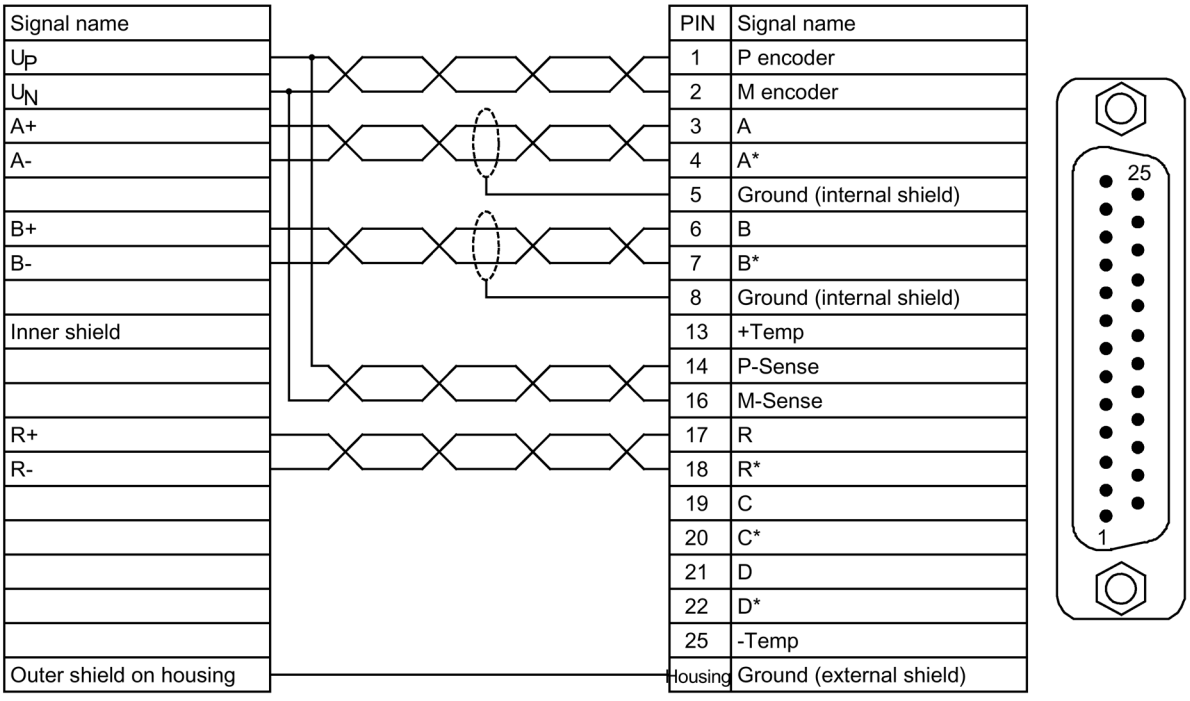


Figure 8-22 K48, connection example: Incremental encoder sin/cos 1 Vpp, 2,048

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

Description

The SMC30 Sensor Module is used for determining the actual motor speed. The signals coming from 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
TTL	330 ft (100 m)
HTL unipolar	330 ft (100 m)
HTL bipolar	980 ft (300 m)
SSI	330 ft (100 m)

Note

Preference should be given to 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	Thresh-old	Min.	Max.	Unit
High signal level (TTL bipolar at X520 or X521/X531) [1]	U_{Hdiff}		2	5	V
Low signal level (TTL bipolar at X520 or X521/X531) [1]	U_{Ldiff}		-5	-2	V
High signal level (HTL unipolar)	U_H [4]	High	17	V_{CC}	V
		Low	10	V_{CC}	V
Low signal level (HTL unipolar)	U_L [4]	High	0	7	V
		Low	0	2	V
High signal level (HTL bipolar) [2]	U_{Hdiff}		3	V_{CC}	V
Low signal level (HTL bipolar) [2]	U_{Ldiff}		$-V_{CC}$	-3	V
High signal level (SSI bipolar at X520 or X521/X531) [1]	U_{Hdiff}		2	5	V
Low signal level (SSI bipolar at X520 or X521/X531) [1]	U_{Ldiff}		-5	-2	V
Signal frequency	f_S		-	300	kHz
Edge clearance	t_{min}		100	-	ns
Zero pulse inactive time (before and after A=B=high)	t_{Lo}		640	$(t_{ALo\text{-}BHi} - t_{Hi})/2$ [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 rising edge of track B after next.

[4] The threshold can be set via p0405.04 (switching threshold); the factory state setting is "Low".

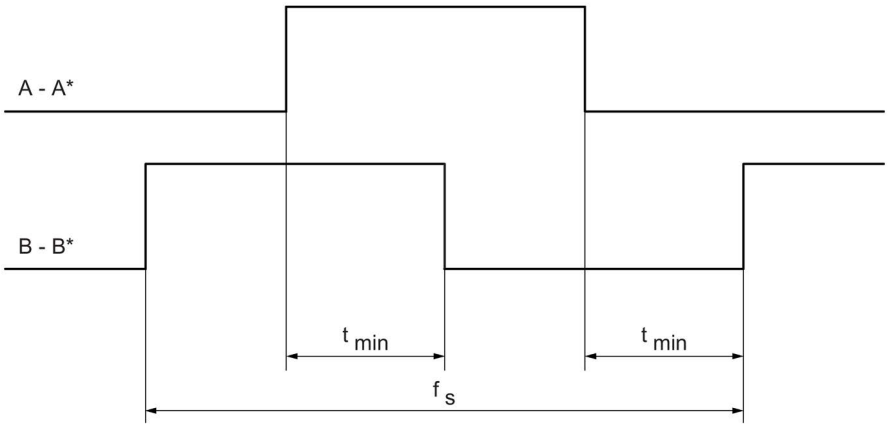


Figure 8-23 Signal characteristic of the A and B track between two edges: Time between two edges with pulse encoders

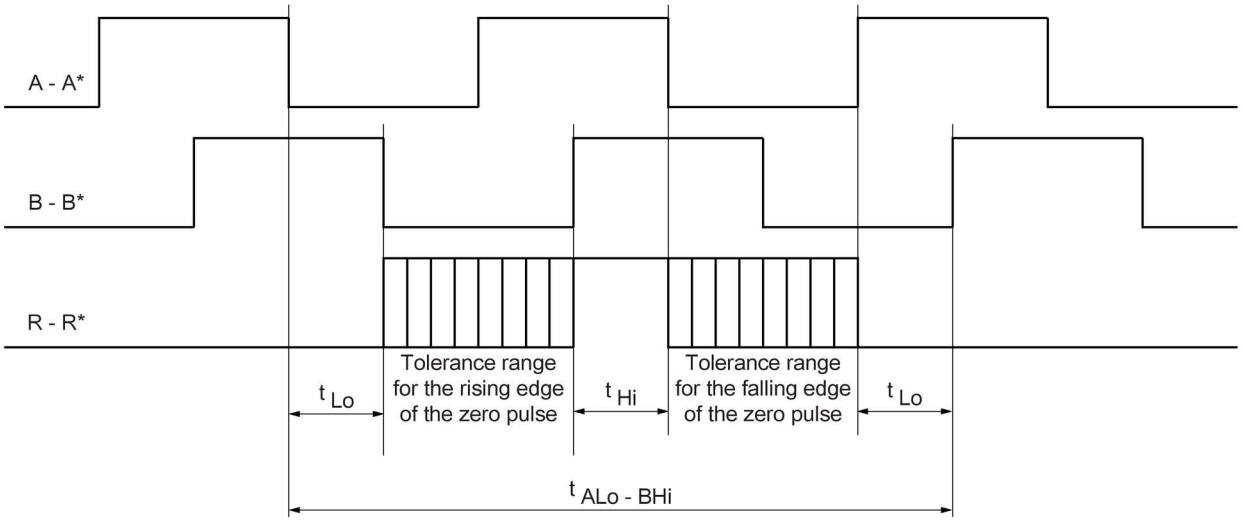


Figure 8-24 Position of the zero pulse to the track signals

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 with #20 AWG (0.5 mm²)):

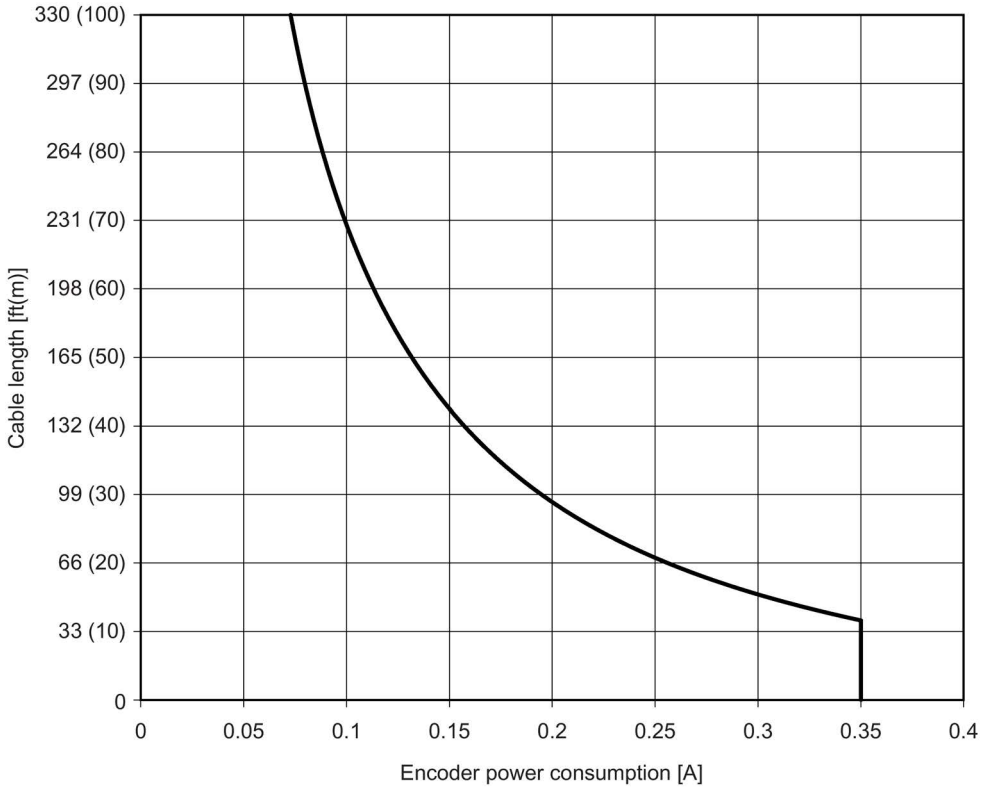


Figure 8-25 Signal cable length as a function of the encoder current consumption

For encoders without Remote Sense, the permissible cable length is restricted to 330 ft (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

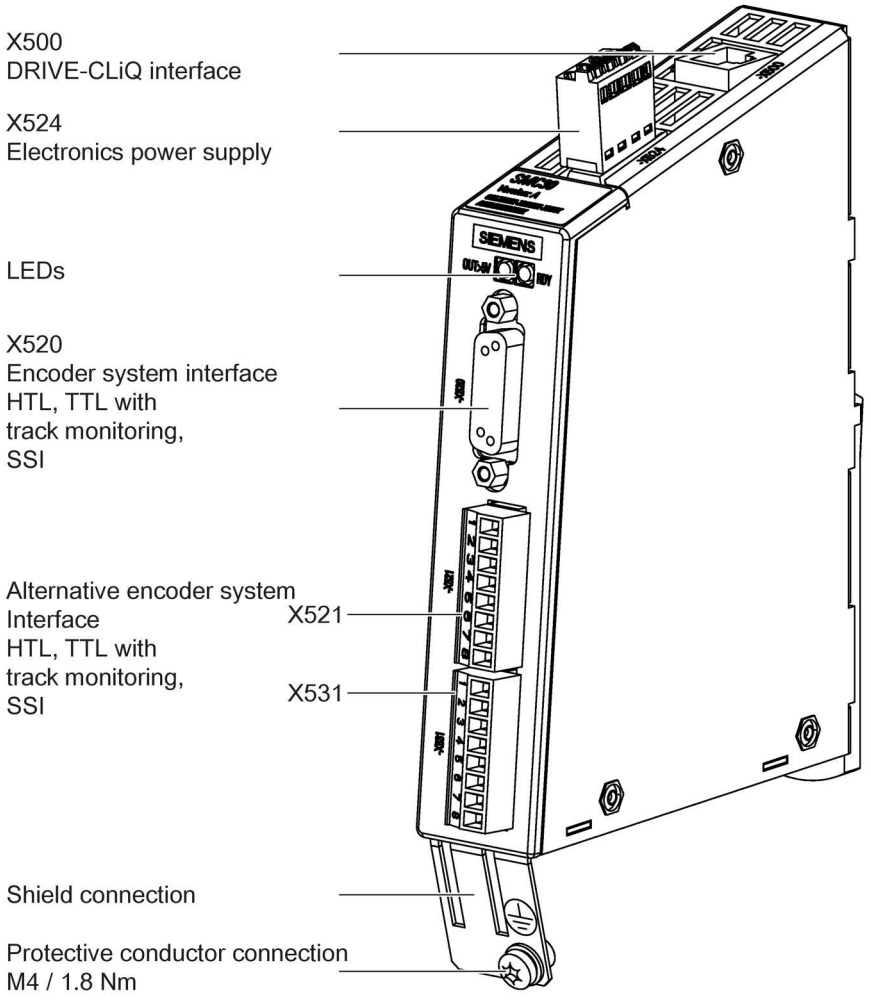
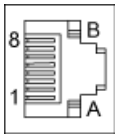


Figure 8-26 Interface overview for the SMC30

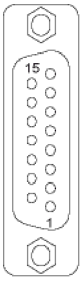
X500: DRIVE-CLiQ interface

Table 8- 29 DRIVE-CLiQ interface X500

Connector	Pin	Signal name	Technical data
	1	TXP	Send data +
	2	TXN	Send 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 supply
	5	P encoder 5 V/24 V	Encoder supply
	6	P sense	Sense input, encoder supply
	7	M encoder (M)	Ground, encoder supply
	8	-Temp [1]	Temperature sensor connection Pt1000 / PTC / KTY84-130 / bimetallic NC contact
	9	M sense	Ground, 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

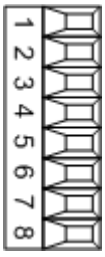
Damage to the encoder due to incorrect supply voltage

The encoder supply voltage can be assigned as 5 V or 24 V. Incorrect parameter assignment can cause damage to the encoder.

- 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

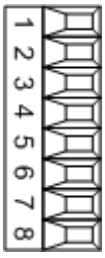
Connector	Terminal	Signal name	Technical data
	1	A	Incremental signal A
	2	A*	Inverted incremental signal A
	3	B	Incremental signal B
	4	B*	Inverted incremental signal B
	5	R	Reference signal R
	6	R*	Inverted reference signal R
	7	CTRL	Control signal
	8	M	Ground
Max. connectable cross-section #16 AWG (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 supply
	2	M encoder	Ground, encoder 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 #16 AWG (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 supply voltage can be assigned as 5 V or 24 V. Incorrect parameter assignment can cause damage to the encoder.

- 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

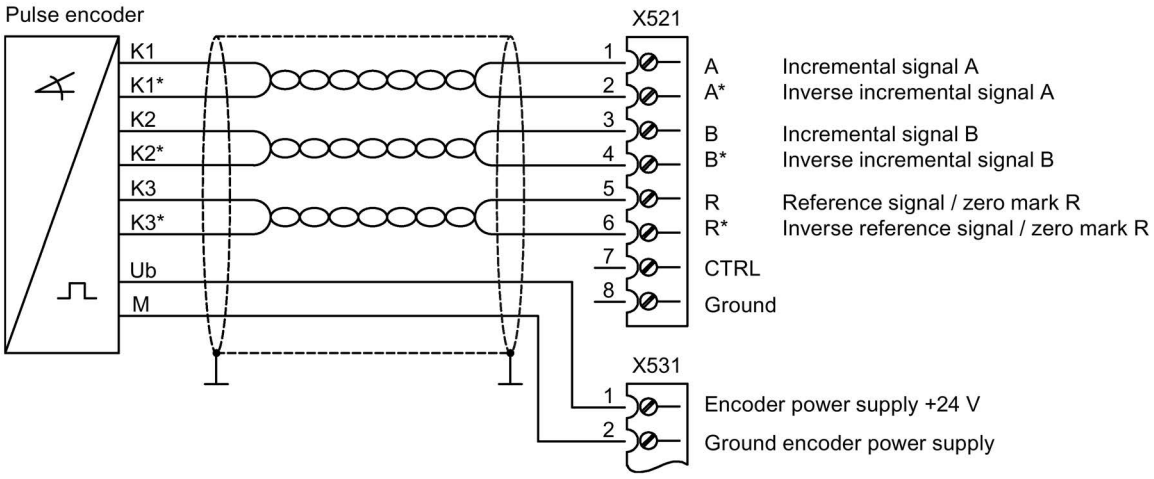


Figure 8-27 Connection example 1: HTL encoder with reference signal, bipolar connection

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

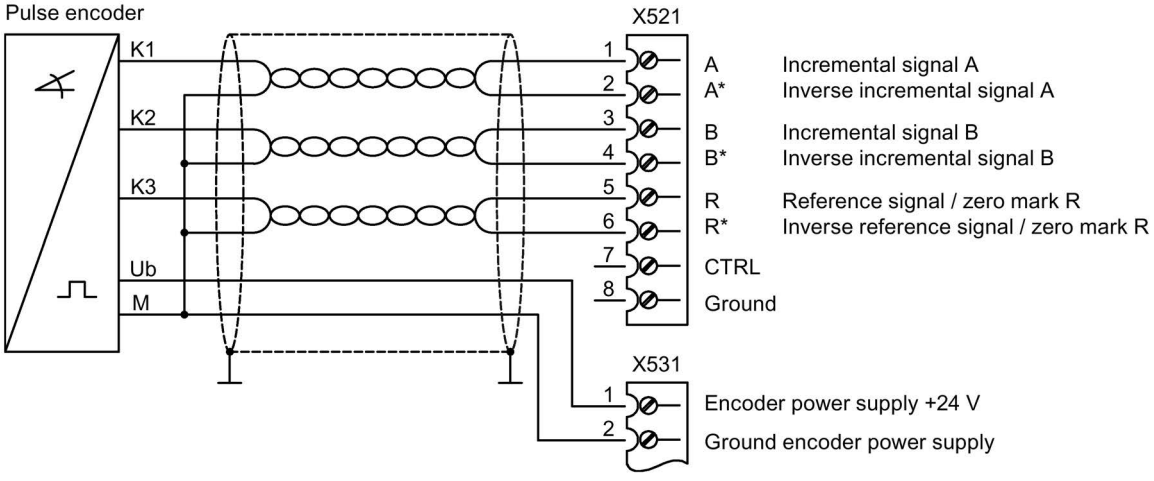


Figure 8-28 Connection example 2: HTL encoder with reference signal, unipolar connection including the encoder ground

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

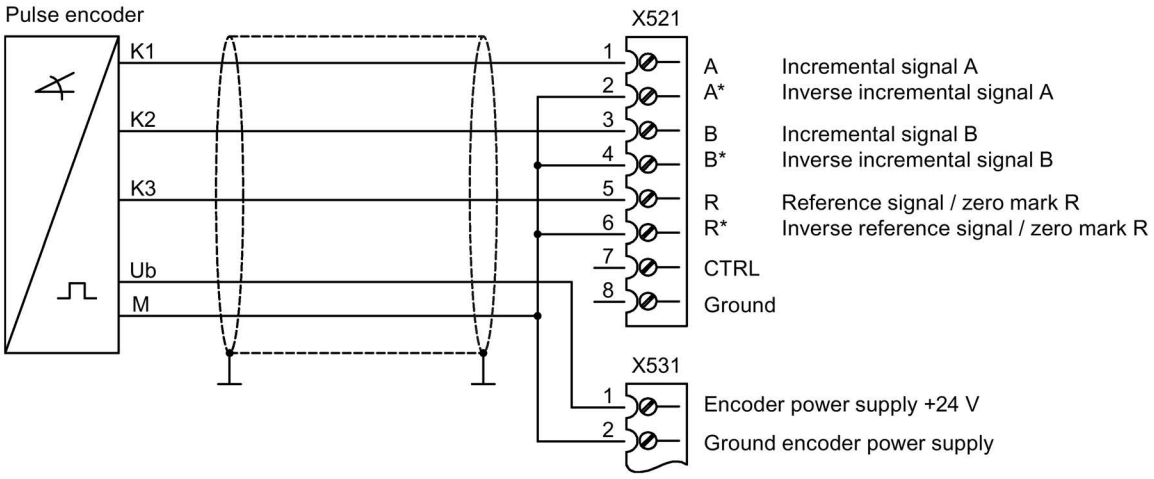


Figure 8-29 Connection example 3: HTL encoder with reference signal, unipolar connection without the encoder ground

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

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:

- Operating 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

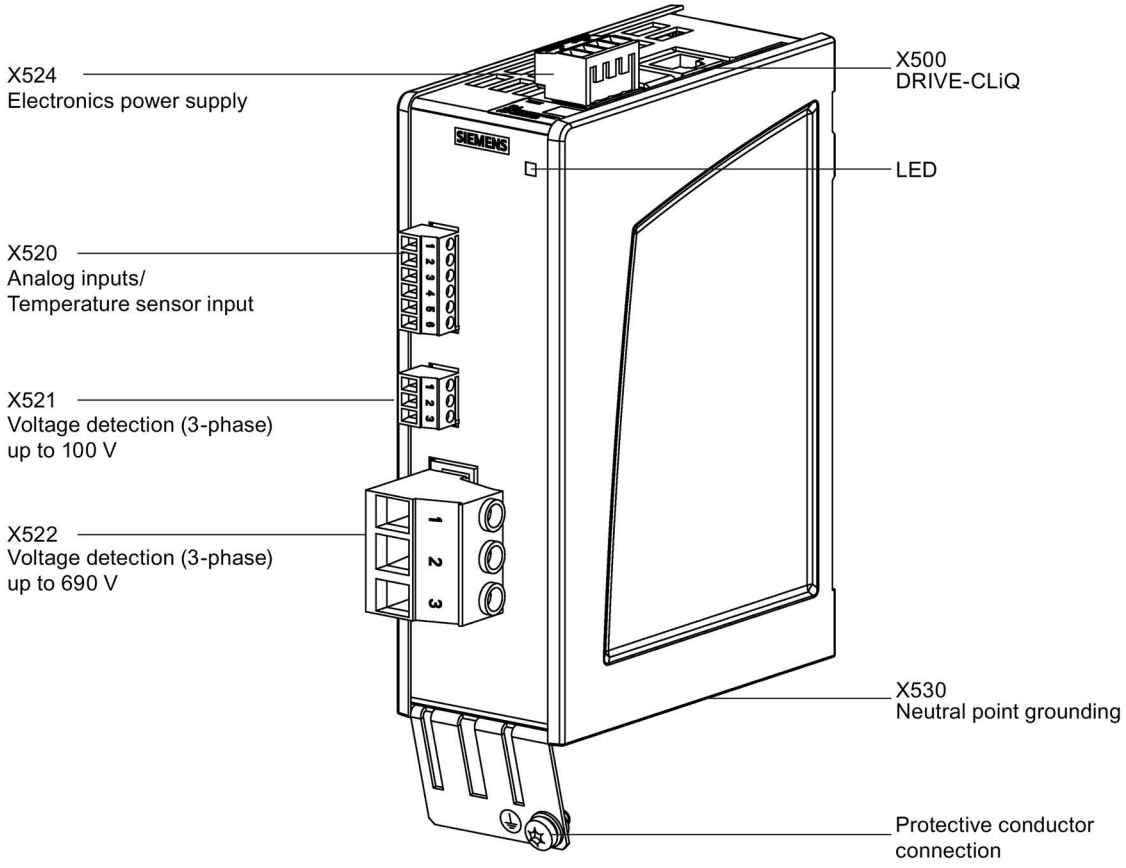


Figure 8-30 Interface overview for the Voltage Sensing Module (option K51)

Removing the connector jumper in the VSM10 Voltage Sensing Module

If a device is operated on a non-grounded line supply (IT supply system), the connector jumper in terminal X530 on the bottom of the component must be removed from the Voltage Sensing Module (VSM10).

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

	
Terminal X530 with connector jumper	Relieve the springs and pull 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 supply system) can cause false tripping in case of sensitive IT supply system monitoring.

- For a non-grounded line supply (IT supply 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

Description

With option K50, the cabinet unit contains an SMC30 Sensor Module. An additional SMC30 Sensor Module enables safe actual value acquisition when Safety Integrated Extended Functions are used.

Note

Safety Integrated Function Manual

A detailed description of the complete principle of operation of Safety Integrated functions and their handling is given in the associated Function Manual, 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

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 to 480 V or 500 to 690 V
  possible tap for the following Line Connection Modules:
  - Line Connection Module with rated current up to 800 A: 28 ... 40 A
  - Line Connection Module with rated current greater than 800 A: 60 A
- 230 V AC (poss. tap approx. 4 ... 6 A)
- 24 V DC (poss. tap approx. 20 ... 40 A)

The auxiliary voltages in the Line Connection Module are connected to the auxiliary power module therefore supplying 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 3 cables on site.

Depending on the version, the power loss is approx. 100 W.

Adapting the auxiliary power supply (-T10)

A transformer is integrated in the Line Connection Module (-T10) for the 230 V AC auxiliary voltage supply of 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 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 tables.

Table 8- 33 Line voltage assignment for the internal power supply (3 AC 380 ... 480 V)

Line 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 assignments for the internal power supply (3 AC 500 ... 690 V)

Line 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

Property damage due to voltage set too high

If the terminals are not reconnected to the actual line voltage, this can result in damage to the device when 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

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 Safety Integrated functions and their handling is given in the associated Function Manual, 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

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 V DC switching output, a ground switching output, and a digital input for checking the switching state. A fail-safe digital input comprises two digital inputs.

Note

Rated values of the F-DO

The rated values of the F-DO meet the requirements of IEC 61131-2 for digital DC outputs with 0.5 A rated current.

The operating ranges of the F-DI meet the requirements of IEC 61131-2 for type 1 digital inputs.

Note

Shielding cables

Please note that the F-DIs must take the form of shielded cables if they are > 98 ft (30 m) in length.

Note

Safety Integrated Function Manual

A detailed description of the complete principle of operation of Safety Integrated functions and their handling is given in the associated Function Manual, 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

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 using spring force. The brake is released when current flows (=low active).

The maximum brake current is 2 A.

The Safe Brake Adapter 230 V AC is installed in the cabinet unit in the factory. An infeed is connected to terminal -X12 on the Safe Brake Adapter to provide the necessary power. For control, a connection is established between the Safe Brake Adapter and the Control Interface Module using a cable harness installed in the factory.

For controlling the brake, a connection must be established on the plant side between terminal -X14 on the Safe Brake Adapter and the rectifier of the brake. It is not permissible that AC brakes are directly controlled.

NOTICE

Device failure as a 24 V DC brake has been connected

Connection of a 24 V DC brake to option K88 (Safe Brake Adapter 230 V AC) can cause damage to the Safe Brake Adapter and even failure (closing of the brake is not indicated via an LED, the fuse can be tripped, the contact service life of the relay is reduced).

- Do not connect a 24 V DC brake to the Safe Brake Adapter 230 V AC.

Note

Maximum cable length of the brake control

The maximum permissible cable length of 980 ft (300) m between the Safe Brake Adapter 230 V AC and the brake must be observed. To accurately calculate the maximum cable length, see the SINAMICS - Low Voltage Engineering Manual, included in the device documentation provided.

Fast de-energization

Some brake rectifier types are equipped with two additional connections for switching the brake load on the DC side. This allows the brake coil to be quickly deenergized, i.e. braking starts earlier.

The Safe Brake Adapter supports such fast de-energization using the two additional connections -X15:1 and -X15:2. This function does not belong to safe brake control.

Notes

Note

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 Safety Integrated functions and their handling is given in the associated Function Manual, 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
- Booksize Cabinet Kits
- Motor Modules in chassis 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 assumes communication, open-loop and closed-loop control functions for up to 4 Motor Modules, plus 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 unit can communicate with other nodes via PROFIBUS or the DRIVE-CLiQ interface, see "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

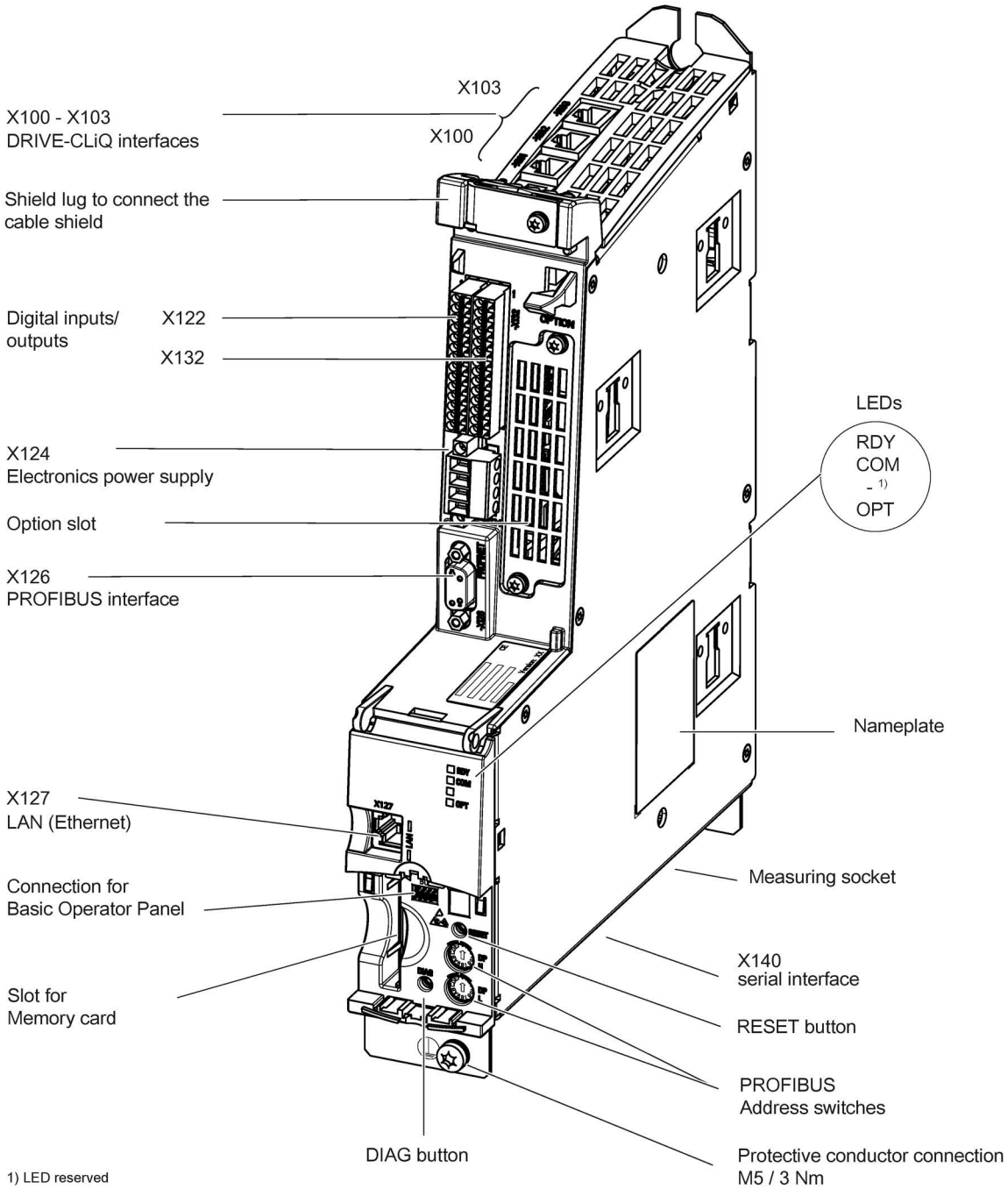


Figure 8-32 Connection overview of the CU320-2 DP Control Unit (without cover)

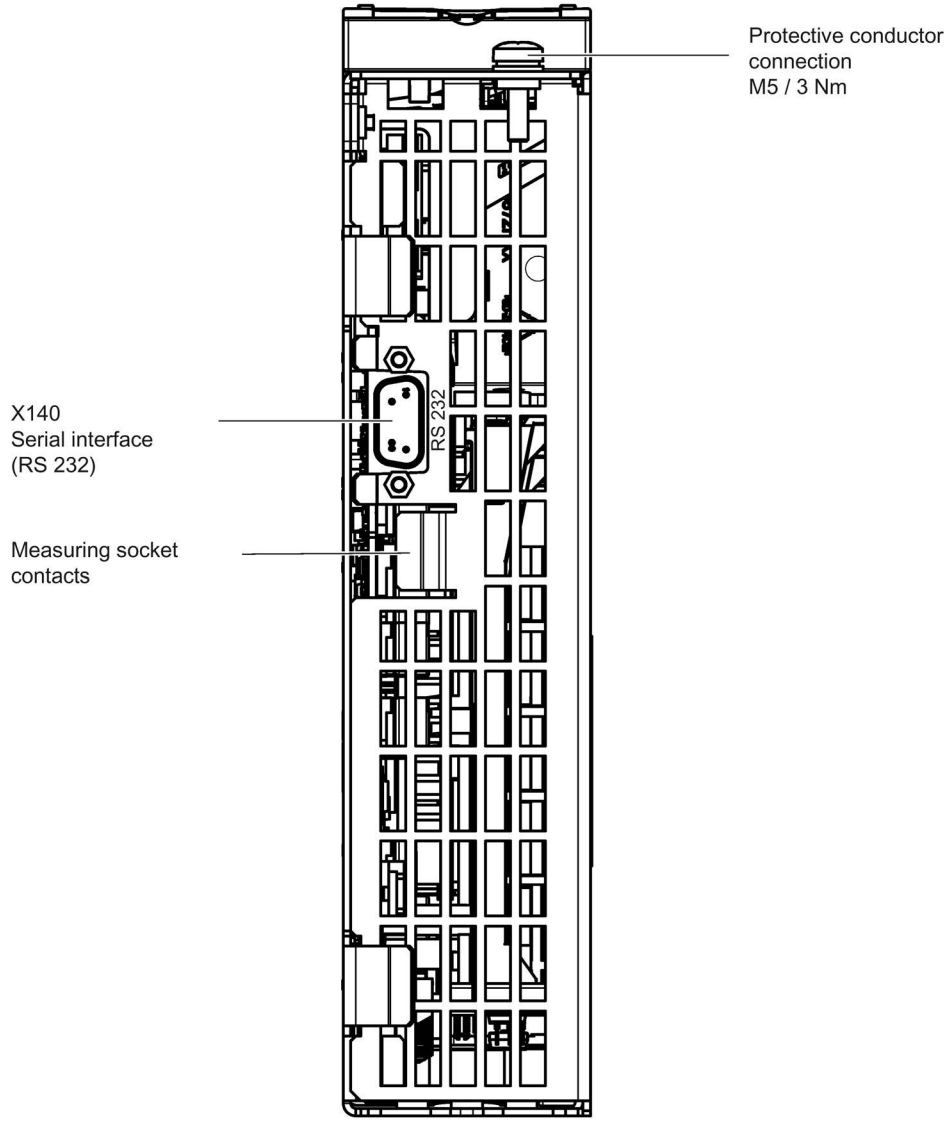


Figure 8-33 Interface X140 and measuring sockets T0 to T2 - CU320-2 DP (view from below)

NOTICE
Malfunctions or damage to the option board by inserting and withdrawing in operation Withdrawing and inserting the option board in operation can damage it or cause it to malfunction. • Only withdraw or insert the Option Board when the Control Unit is in a no-current condition.

8.23.3 Connection example

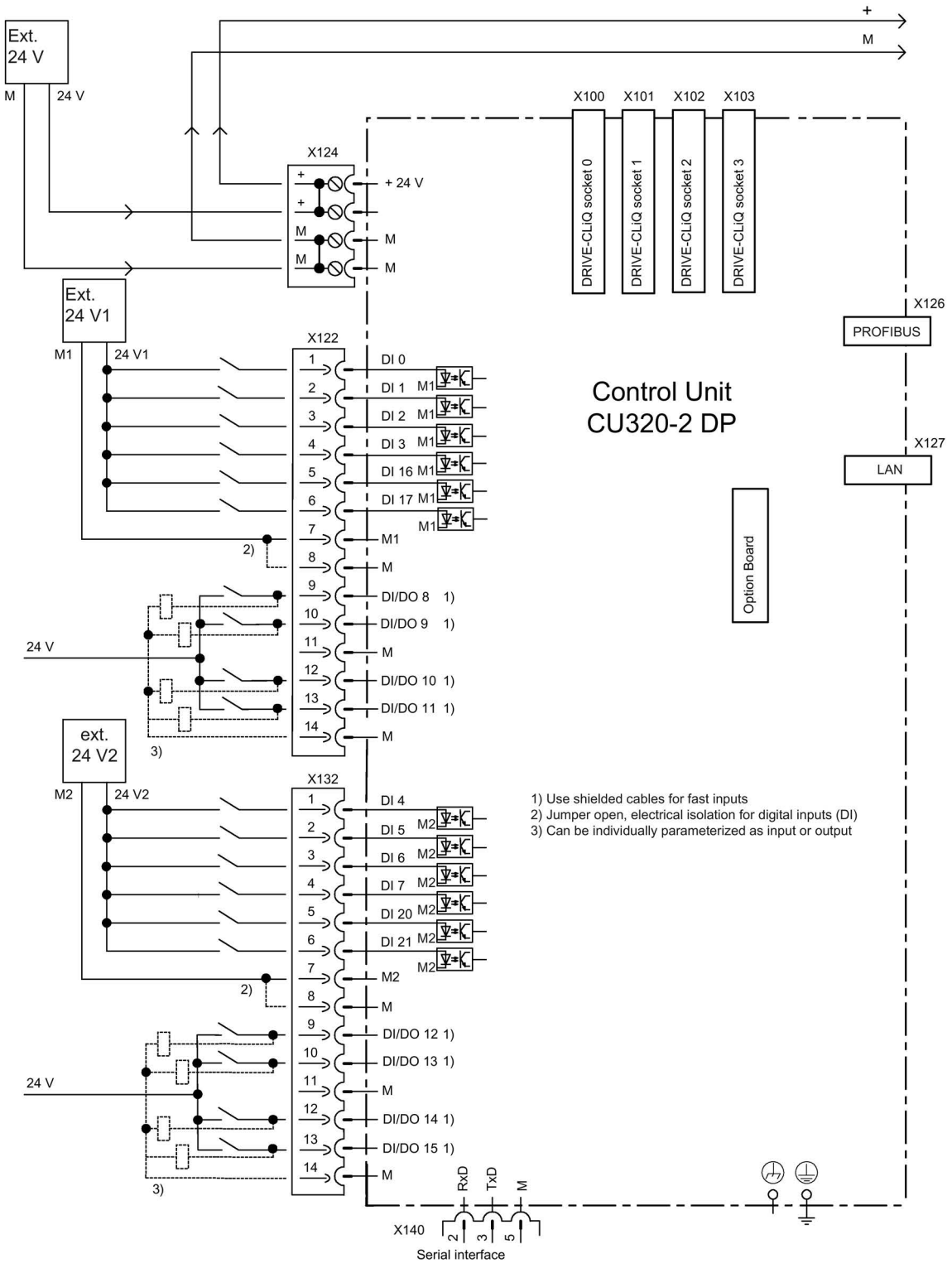


Figure 8-34 Connection example of CU320-2 DP

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 block

8.23.4.1 Overview

Description

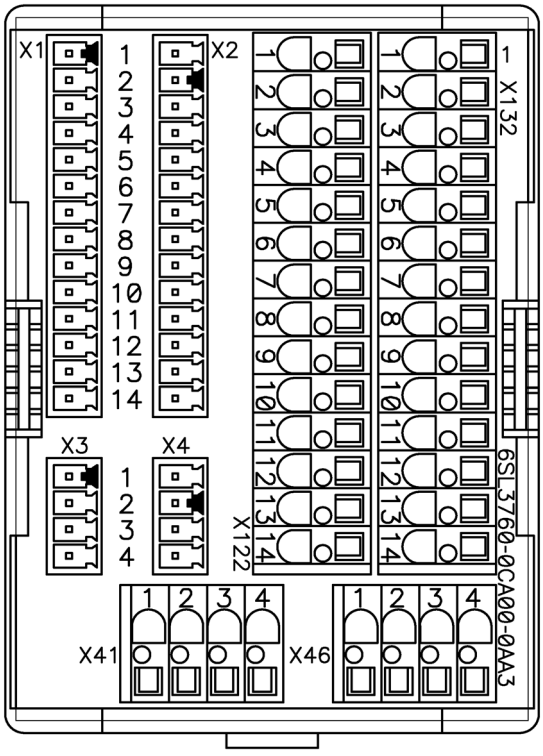


Figure 8-35 Customer terminal strip -X55

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

Note

Customer terminal strip is standard

The customer terminal strip is a standard component in the cabinet with the Motor Module Cabinet Module (chassis format). The digital inputs/outputs of the CU320-2 Control Unit on terminal strips -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

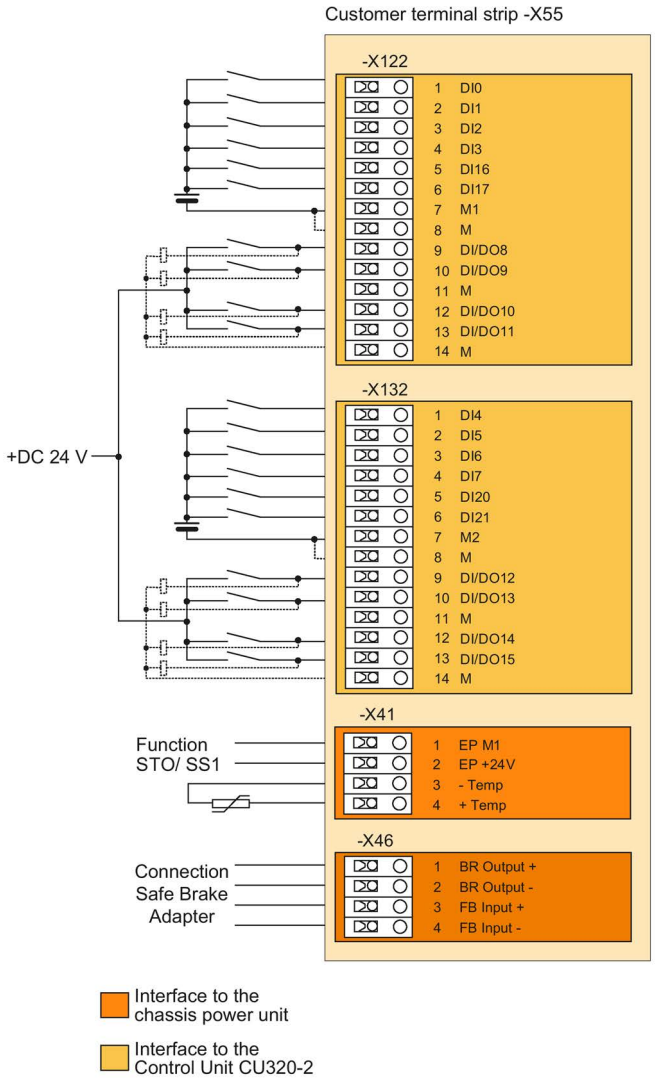
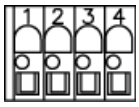


Figure 8-36 Pin assignment of customer terminal strip -X55 (example: Motor Module Cabinet Module (chassis format))

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 (enable pulses)	Supply voltage: 24 V DC (20.4 ... 28.8 V) Current consumption: 10 mA The pulse inhibit function is only available when the "Safety Integrated Basic Functions via onboard terminals" is enabled in the software.
	2	EP +24 V (enable pulses)	
	3	- Temp	Temperature sensor connection for motor temperature measurement: KTY84-1C130, PTC, PT100, PT1000, bimetallic temperature switch with NC contact
	4	+ Temp	
Max. connectable cross-section: #14 AWG (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 electrical separation.
- 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 due to 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 twisted-pair, separately-shielded cables.
- Connect the cable shield at both ends to ground potential over a large surface area.

NOTICE

Damage to the motor when the KTY temperature sensor is connected incorrectly

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.

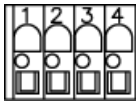
Note

Safety Integrated Function Manual

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

8.23.4.3 X46 Brake control and monitoring

Table 8- 37 Terminal strip X46 on the customer terminal strip X55

Connector	Terminal	Function	Technical data
	1	BR output +	Brake connection
	2	BR output -	Supply voltage: 24 V DC Max. load current: 200 mA
	3	FB input +	Internal feedback signal from the Safe Brake Adapter
	4	FB input -	
Max. connectable cross-section: #14 AWG (2.5 mm^2)			

Note

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

⚠ WARNING

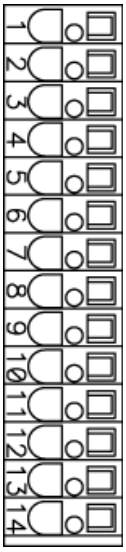
Fire hazard due to overheating when permissible connection cable lengths are exceeded

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

- Limit the connected cable lengths to a maximum of 35 ft (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 strip X122 on the customer terminal strip X55

Connector	Terminal	Designation [1]	Technical data
	1	DI 0	Voltage (max.): -3 ... +30 V DC Typical current consumption: 9 mA at 24 V Electrical isolation: reference potential is terminal M1 Level (including ripple) High level: 15 ... 30 V Low level: -3 ... +5 V Input delay (typ.): For "0" → "1": 50 µs For "1" → "0": 150 µs
	2	DI 1	
	3	DI 2	
	4	DI 3	
	5	DI 16	
	6	DI 17	
	7	M1	Reference potential for terminal 1 ... 6
	8	M	Electronics ground
	9	DI/DO 8	**As input**: Voltage: -3 ... +30 V DC Current consumption, typical: 9 mA at 24 V Level (including ripple) High level: 15 ... 30 V Low level: -3 ... +5 V DI/DO 8, 9, 10, and 11 are "high-speed inputs" [2] Input delay (typ.): For "0" → "1": 5 µs For "1" → "0": 50 µs **As output**: Voltage: 24 V DC Max. load current per output: 500 mA Continuous short-circuit proof Output delay (typ./max.): [3] For "0" → "1": 150 µs / 400 µs For "1" → "0": 75 µs / 100 µs Switching frequency: for resistive load: Max. 100 Hz For inductive load: Max. 0.5 Hz For lamp load: Max. 10 Hz Maximum lamp load: 5 W
	10	DI/DO 9	
	11	M	
	12	DI/DO 10	
	13	DI/DO 11	
	14	M	
Max. connectable cross-section: #14 AWG (2.5 mm^2)			

[1] DI: Digital input; DI/DO: bidirectional digital input/output; M: Electronics ground; M1: reference potential

[2] The rapid inputs can be used as probe inputs or as inputs for the external zero mark

[3] Data for: V_{cc} = 24 V; load 48 Ω; high ("1") = 90 % V_{out}; low ("0") = 10 % V_{out}

The maximum cable length that can be connected is 99 ft (30 m).

Note

Ensuring the function of digital inputs

An open input is interpreted as "low".

Terminal M1 must be connected so that the digital inputs (DI) can function.

This is achieved through one of the following measures:

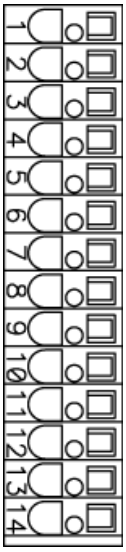
1. Route the reference ground of the digital inputs
2. A jumper to terminal M. (**Note:** This removes the electrical isolation for these digital inputs.)

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 strip X132 on the customer terminal strip X55

Connector	Terminal	Designation [1]	Technical data
	1	DI 4	Voltage (max.): -3 ... +30 V DC Current consumption, typical: 9 mA at 24 V Electrical isolation: reference potential is terminal M2 Level (including ripple) High level: 15 ... 30 V Low level: -3 ... +5 V Input delay (typ.): For "0" → "1": 50 µs For "1" → "0": 150 µs
	2	DI 5	
	3	DI 6	
	4	DI 7	
	5	DI 20	
	6	DI 21	
	7	M2	Reference potential for terminal 1 ... 6
	8	M	Electronics ground
	9	DI/DO 12	**As input**: Voltage: -3 ... +30 V DC Current consumption, typical: 9 mA at 24 V Level (including ripple) High level: 15 ... 30 V Low level: -3 ... +5 V DI/DO 12, 13, 14, and 15 are "rapid inputs" [2] Input delay (typ.): For "0" → "1": 5 µs For "1" → "0": 50 µs **As output**: Voltage: 24 V DC Max. load current per output: 500 mA Continuous short-circuit proof Output delay (typ./max.): [3] For "0" → "1": 150 µs / 400 µs For "1" → "0": 75 µs / 100 µs Switching frequency: for resistive load: Max. 100 Hz For inductive load: Max. 0.5 Hz For lamp load: Max. 10 Hz Maximum lamp load: 5 W
	10	DI/DO 13	
	11	M	
	12	DI/DO 14	
	13	DI/DO 15	
	14	M	
Max. connectable cross-section: #14 AWG (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 99 ft (30 m).

Note

Ensuring the function of digital inputs

An open input is interpreted as "low".

Terminal M2 must be connected so that the digital inputs (DI) can function.

This is achieved through one of the following measures:

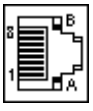
1. Route the reference ground of the digital inputs
2. A jumper to terminal M. (**Note:** This removes the electrical isolation for these digital inputs.)

Note

If the 24 V supply is briefly interrupted, then the digital outputs are deactivated during this time.

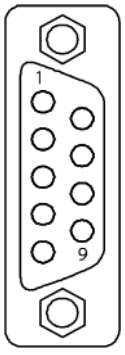
8.23.5 X100 - X103 DRIVE-CLiQ interface

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 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 mm² 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.

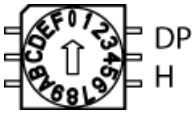
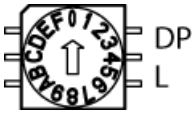
The bus terminating resistors are activated in the connector.

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		
		21dec	**35dec**	**126dec**
		15hex	**23hex**	**7Ehex**
	$16^1 = 16$	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

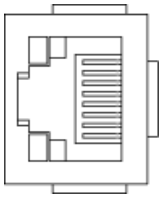
Ethernet interface X127 is intended for commissioning and diagnostics, which means that it must always be accessible (e.g. for service).

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 28)").

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:

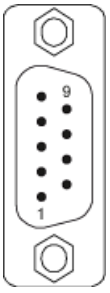
Table 8- 44 LED statuses for the X127 LAN interface

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			

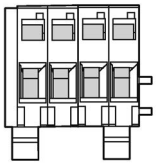
Note

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 Resolution: 8 bits Load current: max. 3 mA Continuous short-circuit proof The reference potential is terminal M
	T0	Measuring terminal 0	
	T1	Measuring terminal 1	
	T2	Measuring terminal 2	
PCB plug connector from Phoenix Contact, type: ZEC 1.0/ 4-ST-3.5 C1 R1.4, order number: 1893708			

Note

Cable cross-section

The measuring socket contacts are only suitable for cable cross-sections of 0.2 mm^2 to 1 mm^2.

Note

Using the measuring socket contacts

The measuring socket contacts support commissioning and diagnostic functions. It must not be connected for normal operation.

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, CU320-2 PN Control Unit

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
- Booksize Cabinet Kits
- Motor Modules in chassis 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 assumes communication, open-loop and closed-loop control functions for up to 4 Motor Modules, plus 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 unit can communicate with other nodes via PROFIBUS or the DRIVE-CLiQ interface, see "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

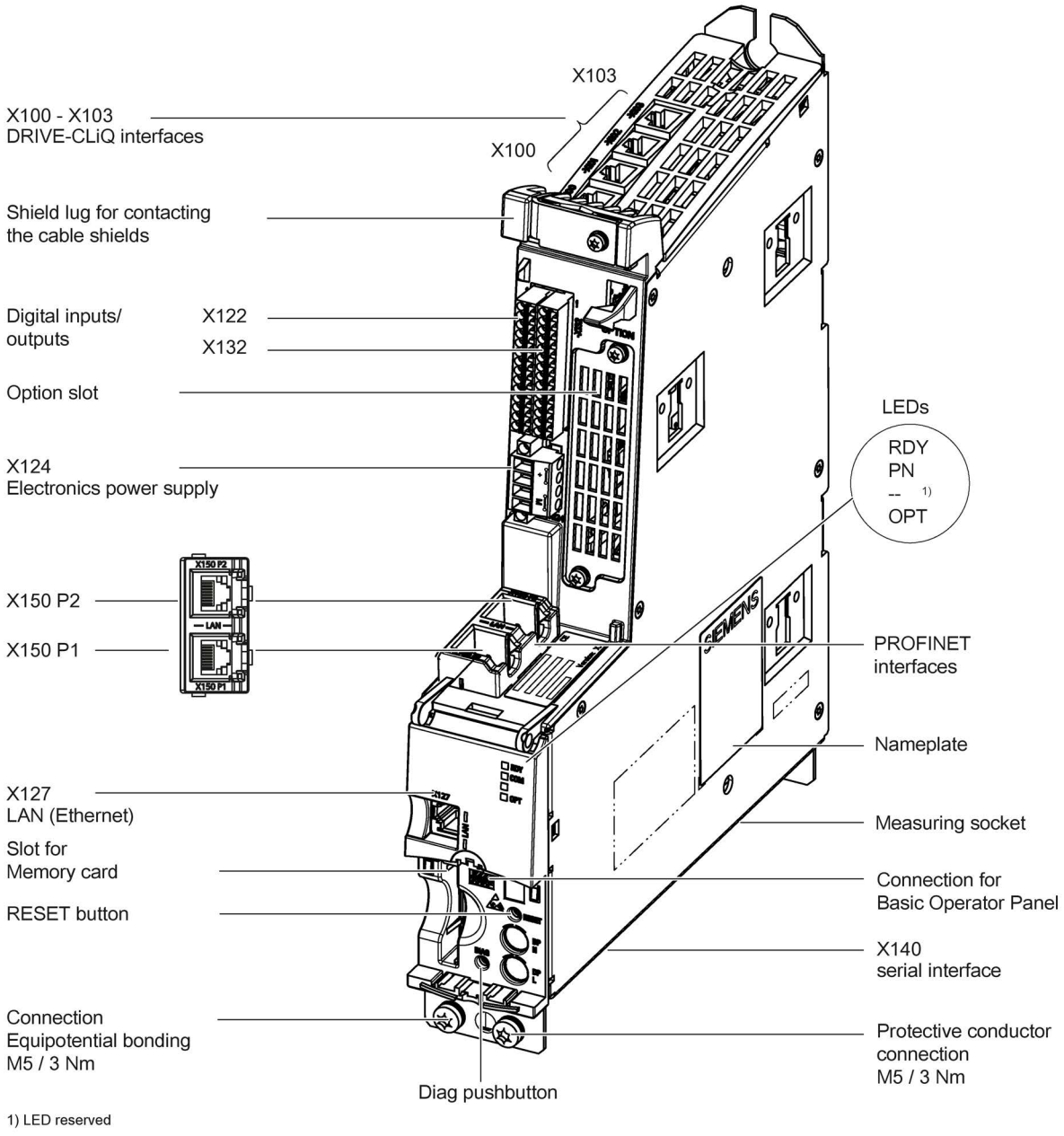


Figure 8-38 Overview of connections for the CU3202 PN Control Unit (without cover)

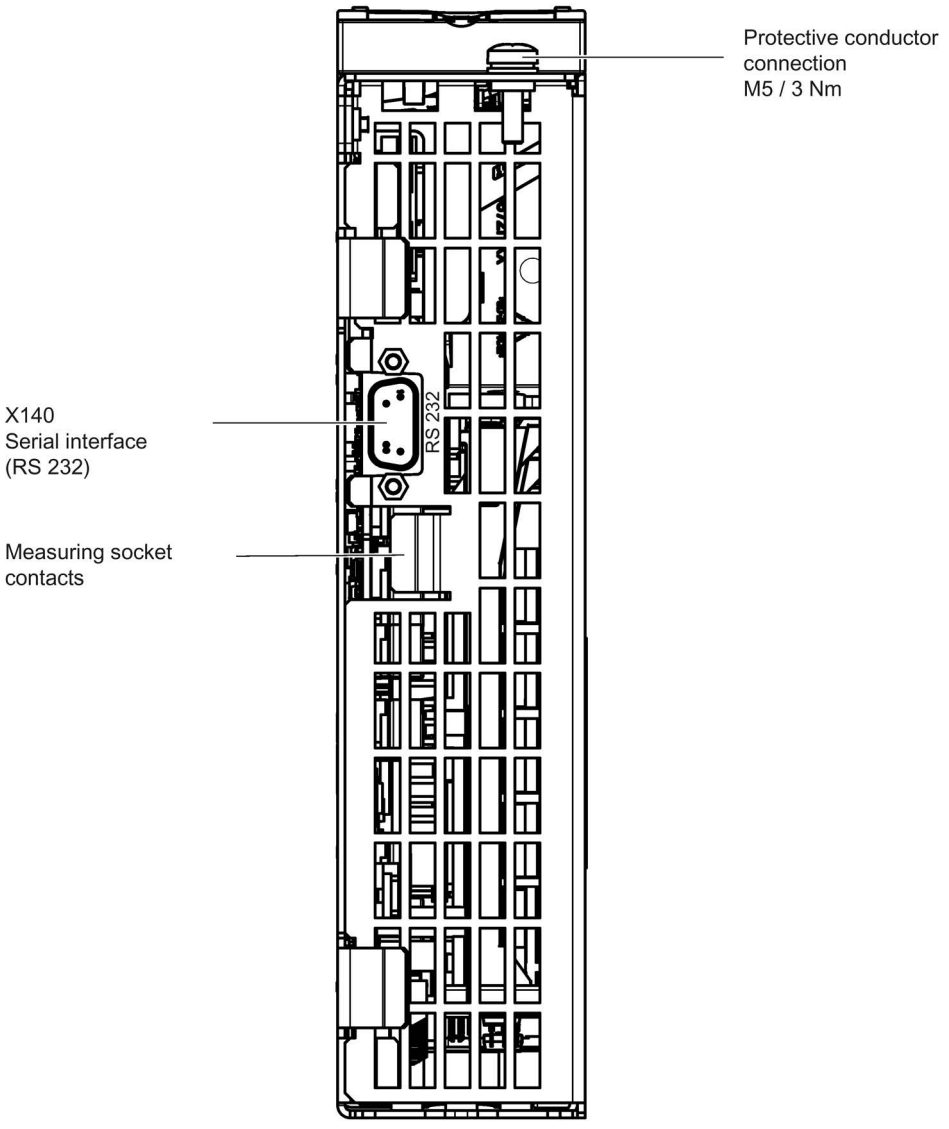


Figure 8-39 Interface X140 and measuring sockets T0 to T2 - CU320-2 PN (view from below)

NOTICE
Malfunctions or damage to the option board by inserting and withdrawing in operation Withdrawing and inserting the option board in operation can damage it or cause it to malfunction. • Only withdraw or insert the Option Board when the Control Unit is in a no-current condition.

8.25.3 Connection example

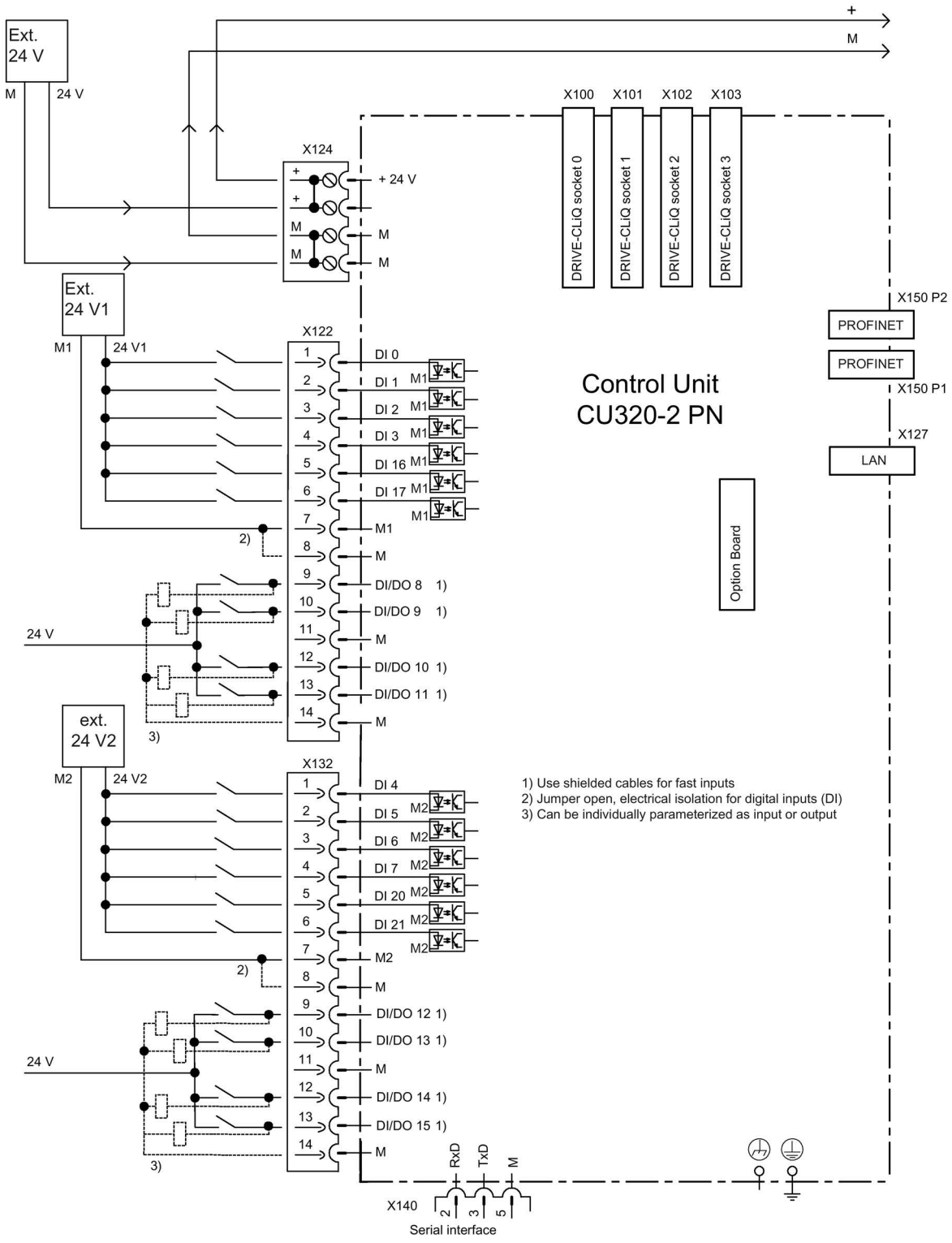


Figure 8-40 Connection example, CU320-2 PN

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

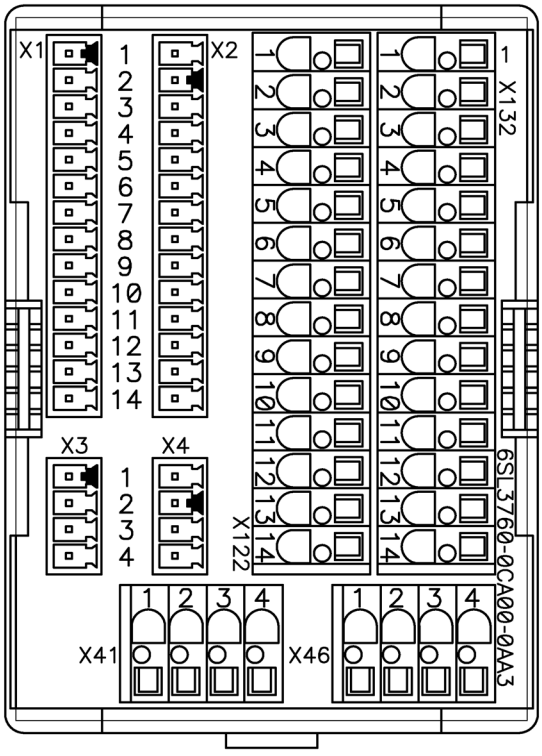


Figure 8-41 Customer terminal strip -X55

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

Note

Customer terminal strip is standard

The customer terminal strip is a standard component in the cabinet with the Motor Module Cabinet Module (chassis format). The digital inputs/outputs of the CU320-2 Control Unit on terminal strips -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

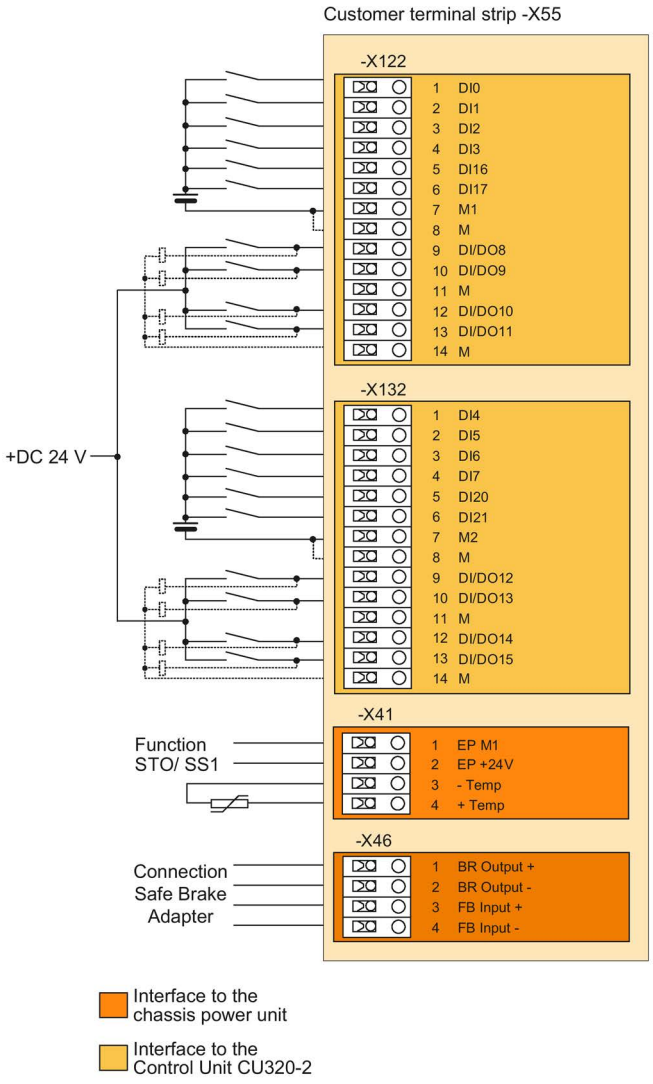
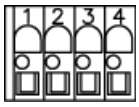


Figure 8-42 Pin assignment of customer terminal strip -X55 (example: Motor Module Cabinet Module (chassis format))

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 (enable pulses)	Supply voltage: 24 V DC (20.4 ... 28.8 V) Current consumption: 10 mA The pulse inhibit function is only available when the "Safety Integrated Basic Functions via onboard terminals" is enabled in the software.
	2	EP +24 V (enable pulses)	
	3	- Temp	Temperature sensor connection for motor temperature measurement: KTY84-1C130, PTC, PT100, PT1000, bimetallic temperature switch with NC contact
	4	+ Temp	
Max. connectable cross-section: #14 AWG (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 electrical separation.
- 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 due to 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 twisted-pair, separately-shielded cables.
- Connect the cable shield at both ends to ground potential over a large surface area.

NOTICE

Damage to the motor when the KTY temperature sensor is connected incorrectly

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.

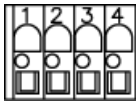
Note

Safety Integrated Function Manual

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

8.25.4.3 X46 Brake control and monitoring

Table 8- 48 Terminal strip X46 on the customer terminal strip X55

Connector	Terminal	Function	Technical data
	1	BR output +	Brake connection
	2	BR output -	Supply voltage: 24 V DC Max. load current: 200 mA
	3	FB input +	Internal feedback signal from the Safe Brake Adapter
	4	FB input -	
Max. connectable cross-section: #14 AWG (2.5 mm^2)			

Note

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

WARNING

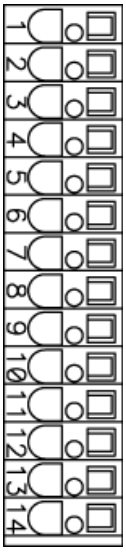
Fire hazard due to overheating when permissible connection cable lengths are exceeded

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

- Limit the connected cable lengths to a maximum of 35 ft (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 strip X122 on the customer terminal strip X55

Connector	Terminal	Designation [1]	Technical data
	1	DI 0	Voltage (max.): -3 ... +30 V DC Typical current consumption: 9 mA at 24 V Electrical isolation: reference potential is terminal M1 Level (including ripple) High level: 15 ... 30 V Low level: -3 ... +5 V Input delay (typ.): For "0" → "1": 50 µs For "1" → "0": 150 µs
	2	DI 1	
	3	DI 2	
	4	DI 3	
	5	DI 16	
	6	DI 17	
	7	M1	Reference potential for terminal 1 ... 6
	8	M	Electronics ground
	9	DI/DO 8	**As input**: Voltage: -3 ... +30 V DC Current consumption, typical: 9 mA at 24 V Level (including ripple) High level: 15 ... 30 V Low level: -3 ... +5 V DI/DO 8, 9, 10, and 11 are "high-speed inputs" [2] Input delay (typ.): For "0" → "1": 5 µs For "1" → "0": 50 µs **As output**: Voltage: 24 V DC Max. load current per output: 500 mA Continuous short-circuit proof Output delay (typ./max.): [3] For "0" → "1": 150 µs / 400 µs For "1" → "0": 75 µs / 100 µs Switching frequency: for resistive load: Max. 100 Hz For inductive load: Max. 0.5 Hz For lamp load: Max. 10 Hz Maximum lamp load: 5 W
	10	DI/DO 9	
	11	M	
	12	DI/DO 10	
	13	DI/DO 11	
	14	M	
Max. connectable cross-section: #14 AWG (2.5 mm^2)			

[1] DI: Digital input; DI/DO: bidirectional digital input/output; M: Electronics ground; M1: reference potential

[2] The rapid inputs can be used as probe inputs or as inputs for the external zero mark

[3] Data for: V_{cc} = 24 V; load 48 Ω; high ("1") = 90 % V_{out}; low ("0") = 10 % V_{out}

The maximum cable length that can be connected is 99 ft (30 m).

Note

Ensuring the function of digital inputs

An open input is interpreted as "low".

Terminal M1 must be connected so that the digital inputs (DI) can function.

This is achieved through one of the following measures:

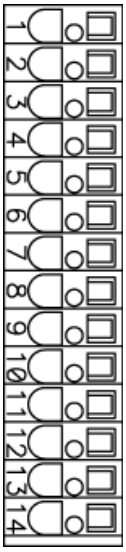
1. Route the reference ground of the digital inputs
2. A jumper to terminal M. (**Note:** This removes the electrical isolation for these digital inputs.)

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 strip X132 on the customer terminal strip X55

Connector	Terminal	Designation [1]	Technical data
	1	DI 4	Voltage (max.): -3 ... +30 V DC Current consumption, typical: 9 mA at 24 V Electrical isolation: reference potential is terminal M2 Level (including ripple) High level: 15 ... 30 V Low level: -3 ... +5 V Input delay (typ.): For "0" → "1": 50 µs For "1" → "0": 150 µs
	2	DI 5	
	3	DI 6	
	4	DI 7	
	5	DI 20	
	6	DI 21	
	7	M2	Reference potential for terminal 1 ... 6
	8	M	Electronics ground
	9	DI/DO 12	**As input**: Voltage: -3 ... +30 V DC Current consumption, typical: 9 mA at 24 V Level (including ripple) High level: 15 ... 30 V Low level: -3 ... +5 V DI/DO 12, 13, 14, and 15 are "rapid inputs" [2] Input delay (typ.): For "0" → "1": 5 µs For "1" → "0": 50 µs **As output**: Voltage: 24 V DC Max. load current per output: 500 mA Continuous short-circuit proof Output delay (typ./max.): [3] For "0" → "1": 150 µs / 400 µs For "1" → "0": 75 µs / 100 µs Switching frequency: for resistive load: Max. 100 Hz For inductive load: Max. 0.5 Hz For lamp load: Max. 10 Hz Maximum lamp load: 5 W
	10	DI/DO 13	
	11	M	
	12	DI/DO 14	
	13	DI/DO 15	
	14	M	
Max. connectable cross-section: #14 AWG (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 99 ft (30 m).

Note

Ensuring the function of digital inputs

An open input is interpreted as "low".

Terminal M2 must be connected so that the digital inputs (DI) can function.

This is achieved through one of the following measures:

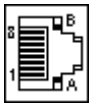
1. Route the reference ground of the digital inputs
2. A jumper to terminal M. (**Note:** This removes the electrical isolation for these digital inputs.)

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 Blanking plate for DRIVE-CLiQ interfaces (50 units) Article number: 6SL3066-4CA00-0AA0			

8.25.6 X127 LAN (Ethernet)

Note

Use

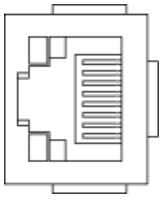
Ethernet interface X127 is intended for commissioning and diagnostics, which means that it must always be accessible (e.g. for service).

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 28)").

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:

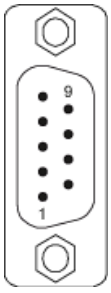
Table 8- 53 LED statuses for the X127 LAN interface

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			

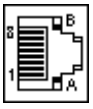
Note

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 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.

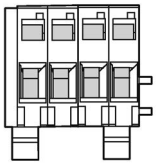
For diagnostic purposes, the two PROFINET interfaces are each equipped with a green and a yellow LED. These LEDs indicate the following status information:

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 Resolution: 8 bits Load current: max. 3 mA Continuous short-circuit proof The reference potential is terminal M
	T0	Measuring terminal 0	
	T1	Measuring terminal 1	
	T2	Measuring terminal 2	
PCB plug connector from Phoenix Contact, type: ZEC 1.0/ 4-ST-3.5 C1 R1.4, order number: 1893708			

Note

Cable cross-section

The measuring socket contacts are only suitable for cable cross-sections of 0.2 mm^2 to 1 mm^2.

Note

Using the measuring socket contacts

The measuring socket contacts support commissioning and diagnostic functions. It must not be connected for normal operation.

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 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 Modules chassis 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 are reduced when long motor cables are used.

In addition, a motor reactor must be used for parallel connection of Motor Modules in 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- 58 Maximum motor cable lengths when using motor reactors for Booksize Cabinet Kits

Article No. 6SL3720-	Power in kW (HP)	Current in A	Max. motor cable length in ft (m)					
			Without motor reactors		With 1 motor reactor (L08)		With 2 motor reactors (L09)	
			Shielded	Unshielded	Shielded	Unshielded	Shielded	Unshielded
1TE21-0AU3	4.8 (5)	9	165 (50)	250 (75)	443 (135)	660 (200)	-	-
1TE21-8AU3	9.7 (10)	18	230 (70)	330 (100)	525 (160)	788 (240)	1050 (320)	1575 (480)
1TE23-0AU3	16 (20)	30	330 (100)	490 (150)	623 (190)	919 (280)	1230 (375)	1837 (560)
1TE24-5AU3	24 (30)	45	330 (100)	490 (150)	660 (200)	980 (300)	1320 (400)	1969 (600)
1TE26-0AU3	32 (40)	60	330 (100)	490 (150)	660 (200)	980 (300)	1320 (400)	1969 (600)
1TE28-5AU3	46 (60)	85	330 (100)	490 (150)	660 (200)	980 (300)	1320 (400)	1969 (600)
1TE31-3AU3	71 (100)	132	330 (100)	490 (150)	660 (200)	980 (300)	1320 (400)	1969 (600)

Note

Maximum motor cable length

When motor reactors are used, the maximum motor cable length for Motor Modules in the chassis format is 980 ft (300 m) (shielded) or 1480 ft (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- 59 Maximum conductor cross-section when using motor reactors for Booksize Cabinet Kits

Article No. 6SL3720-	Power in kW (HP)	Maximum conductor cross-section in mm² (AWG)
1TE21-0AU3	4.8 (5)	6 (10)
1TE21-8AU3	9.7 (10)	6 (10)
1TE23-0AU3	16 (20)	6 (10)
1TE24-5AU3	24 (30)	16 (6)
1TE26-0AU3	32 (40)	16 (6)
1TE28-5AU3	46 (60)	35 (2)
1TE31-3AU3	71 (100)	95 (4/0)

8.27 L10, dv/dt filter plus Voltage Peak Limiter

Availability of option

This option is available for the following S120 Cabinet Modules:

- Motor Modules in chassis 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 used 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 $\hat{U}_{LL}$ for rated line voltages to the following values (for motor cable lengths < 980 ft (300 m) for frame sizes FX, GX, HX or < 490 ft (150 m) for frame size JX):

< 1000 V at U_{line} < 575 V

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

Option L10 is installed in an additional cabinet with a width of 23.6 inches (600 mm) that is located on the right-hand side of the Motor Module.

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 cable: Max. 980 ft (300 m) (frame sizes FX, GX, HX) / 490 ft (150 m) (frame size JX)
  - Unshielded cable: Max. 1480 ft (450 m) (frame sizes FX, GX, HX) / 738 ft (225 m) (frame size JX)

NOTICE

Damage to the dv/dt filter from 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 from 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 via parameter p0230 = 2.

NOTICE

Damage to the dv/dt filter when a motor is not connected

dv/dt filters that 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 of 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 used. When doing so, take into account the "Current derating as a function of the pulse frequency"; refer to the Technical specifications.

Table 8- 60 Maximum permissible motor cable lengths for the DC link voltage 510 - 720 V DC

Frame sizes FX, GX, HX Shielded cable max. 980 ft (300 m) or unshielded cable max. 1480 ft (450 m)	Frame size JX Shielded cable max. 490 ft (150 m) or unshielded cable max. 738 ft (225 m)
6SL3720-1TE32-1AU3	6SL3720-1TE41-0AU3
6SL3720-1TE32-6AU3	6SL3720-1TE41-2AU3
6SL3720-1TE33-1AU3	6SL3720-1TE41-4AU3
6SL3720-1TE33-8AU3	-
6SL3720-1TE35-0AU3	-
6SL3720-1TE36-1AU3	-
6SL3720-1TE37-5AU3	-
6SL3720-1TE38-4AU3	-

Table 8- 61 Maximum permissible motor cable lengths for the DC link voltage 675 - 1035 V DC

Frame sizes FX, GX, HX Shielded cable max. 980 ft (300 m) or unshielded cable max. 1480 ft (450 m)	Frame size JX Shielded cable max. 490 ft (150 m) or unshielded cable max. 738 ft (225 m)
6SL3720-1TG28-5AU3	6SL3720-1TG37-4AU3
6SL3720-1TG31-0AU3	6SL3720-1TG38-1AU3
6SL3720-1TG31-2AU3	6SL3720-1TG38-8AU3
6SL3720-1TG31-5AU3	6SL3720-1TG41-0AU3
6SL3720-1TG31-8AU3	6SL3720-1TG41-3AU3
6SL3720-1TG32-2AU3	-
6SL3720-1TG32-6AU3	-
6SL3720-1TG33-3AU3	-
6SL3720-1TG34-1AU3	-
6SL3720-1TG34-7AU3	-
6SL3720-1TG35-8AU3	-

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.

8.28 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 circuit breaker 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 to 480 V 3 ph. AC) or < 575 A (500 to 690 V 3 ph. AC), 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 ... bis 480 V) or 575 A and 730 A (3 AC 500 ... 690 V), option L13 (main contactor) is included as a standard feature in the Line Connection Module.
  - For a rated current > 605 A (380 to 480 V 3 ph. AC) or > 730 A (500 to 690 V 3 ph. AC), 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
Property damage due to switching the main contactor under load The switching of the main contactor under load may result in increased wear and premature failure of the main contactor. • Always switch the main contactor in current-free state.

X50 Main contactor checkback contact

Table 8- 62 Terminal block X50 "Main contactor" checkback contact

Terminal	Designation [1]	Technical specifications
4	NO	Max. load current: 10 A Max. switching voltage: 250 V AC Max. contact rating: 250 VA Required minimum load: ≥1 mA
5	NC	
6	COM	
Max. connectable cross-section #12 AWG (4 mm²)		

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

8.29 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.

8.30 L25, circuit breaker in withdrawable unit design

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules

Description

The circuit breaker in withdrawable unit design is available as an option for Line Connection Modules with rated currents > 800 A. This breaker replaces the standard built-in circuit breaker.

The withdrawable circuit breaker features a visible isolating distance.

X50 "circuit breaker" checkback contact

Table 8- 63 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 #14 AWG (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 how it is handled, as well as options integrated in the factory are given in the associated operating instructions, which are included in the device documentation provided.

8.31 L37, DC coupling, incl. pre-charging input circuit of the associated DC link capacitance

8.31.1 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 assembly while the other Motor Modules and Line Modules remain in operation, this can be accomplished via the DC interface.

8.31.2 DC interface incl. pre-charging for Booksize Cabinet Kits

8.31.2.1 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!

8.31.2.2 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.

8.31.2.3 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.

8.31.2.4 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.

8.31.3 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.

8.31.3.1 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.

8.31.3.2 Accessibility of the DC connection to the Motor Module

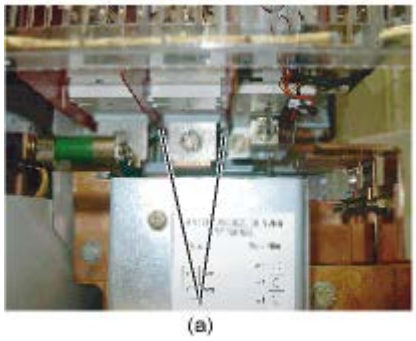


Figure 8-44 Front view



Figure 8-45 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.

8.31.3.3 Measuring points for verifying isolation from supply

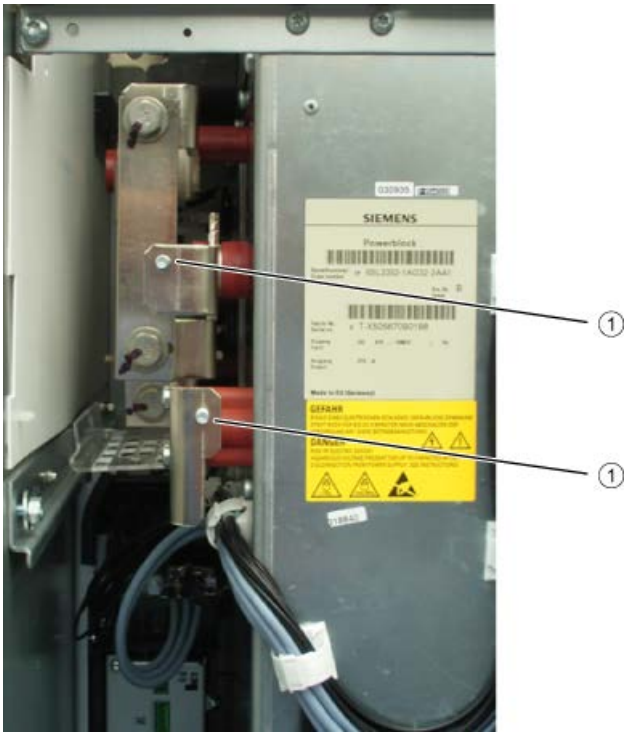


Figure 8-46 Measuring points at top, example for frame sizes FX and GX

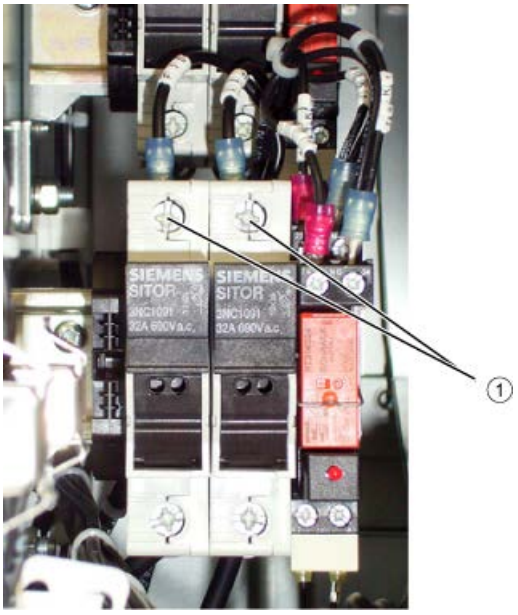


Figure 8-47 Measuring point, auxiliary power supply, fan supply bottom, frame sizes FX and GX

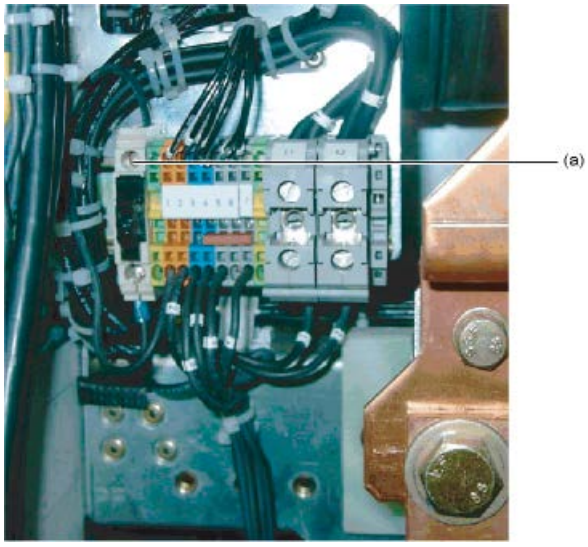


Figure 8-48 Measuring point, 24 VDC auxiliary power supply, frame sizes FX and GX

Take into account other voltages on optional components and refer to the circuit diagrams.

8.31.3.4 DC interface, principle of operation

Table 8- 64 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. 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). 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". 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"!

8.31.3.5 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.

8.31.3.6 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.

8.32 L41, current transformer upstream of main switch

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules

Description

If current transformers are used for measuring or monitoring purposes, they are installed in the Line Connection Modules with option L41. The current transformers are included in all three supply phases of the infeed.

The transformers have an accuracy class of 1.0. The secondary current is maximum 5 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 Nos. of the Line Connection Modules to the ratios of the current transformers are listed in the following table.

Table 8- 65 Transformation ratios of the current transformers

Article No.	V_{IN}	Transformation ratio
6SL3700-0LE32-5AU3	380 ... 480 V 3 AC	800/5
6SL3700-0LE34-0AU3	380 ... 480 V 3 AC	800/5
6SL3700-0LE36-3AU3	380 ... 480 V 3 AC	800/5
6SL3700-0LE38-0AU3	380 ... 480 V 3 AC	800/5
6SL3700-0LE41-0AU3	380 ... 480 V 3 AC	2000/5
6SL3700-0LE41-3AU3	380 ... 480 V 3 AC	2000/5
6SL3700-0LE41-6AU3	380 ... 480 V 3 AC	2000/5
6SL3700-0LE42-0AU3	380 ... 480 V 3 AC	4000/5
6SL3700-0LE42-0BU3	380 ... 480 V 3 AC	4000/5
6SL3700-0LE42-5BU3	380 ... 480 V 3 AC	4000/5
6SL3700-0LE43-2BU3	380 ... 480 V 3 AC	4000/5
6SL3700-0LG32-8AU3	500 ... 690 V 3 AC	800/5
6SL3700-0LG34-0AU3	500 ... 690 V 3 AC	800/5
6SL3700-0LG36-3AU3	500 ... 690 V 3 AC	800/5
6SL3700-0LG38-0AU3	500 ... 690 V 3 AC	800/5
6SL3700-0LG41-0AU3	500 ... 690 V 3 AC	2000/5
6SL3700-0LG41-3AU3	500 ... 690 V 3 AC	2000/5
6SL3700-0LG41-6AU3	500 ... 690 V 3 AC	2000/5
6SL3700-0LG42-0BU3	500 ... 690 V 3 AC	4000/5
6SL3700-0LG42-5BU3	500 ... 690 V 3 AC	4000/5
6SL3700-0LG43-2BU3	500 ... 690 V 3 AC	4000/5

X60 line current transformer

Table 8- 66 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 #14 AWG (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.

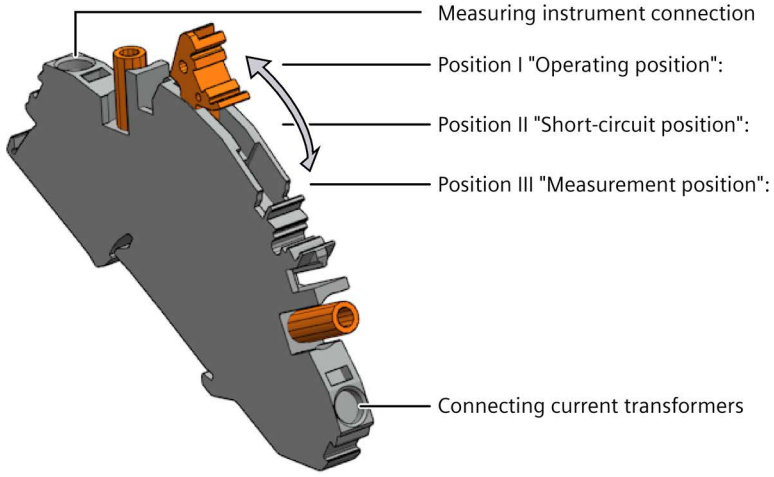


Figure 8-49 Lever positions at the current transformer terminal

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.

8.33 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.

8.34 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

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 strip. From here, the EMERGENCY OFF pushbutton can be integrated into the plant-side EMERGENCY OFF chain.

Note

Ensure 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- 67 Terminal block X120

Terminal	Designation [1]	Technical data
1	NC	Feedback contacts of the EMERGENCY OFF button in the cabinet door max. load current: 10 A Max. switching voltage: 250 V AC Max. contact rating: 250 VA Required minimum load: ≥1 mA
2		
3	NC (internal)	
4		
Max. connectable cross-section #12 AWG (4 mm²)		

[1] NC: NC contact

8.35 L50, Cabinet lighting with service socket

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules

Description

With option L50, cabinet lighting and an additional service socket outlet is included for grounding plug (connector type F) according to CEE 7/4. Power is supplied for the cabinet lighting and the service socket from an external source and must be provided with a max. 10 A fuse.

The cabinet lighting consists of an LED handheld light with on/off switch and magnetic fasteners and an approx. 3 m long connecting cable. The lamp is factory-positioned in the cabinet door at a defined marking, and the connecting cable is wound on the associated mount.

Note

During operation of the cabinet unit, the cabinet lighting must be mounted at the designated position on the cabinet door. A sticker marks the position on the cabinet door. The connecting cable must be wound on the associated mount.

Connecting

Table 8- 68 Terminal block X390 – Connection for cabinet lighting with service socket

Terminal	Designation	Technical data
1	L1	230 V AC Power supply
2	N	
3	PE	Protective conductor
Max. connectable cross-section #12 AWG (4 mm²)		

8.36 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
- Booksize base cabinets
- Motor Modules chassis format
- Auxiliary Power Supply Modules
- Extension Modules

Description

The cabinet anti-condensation heating can be used at low ambient temperatures and high levels of humidity to prevent the formation of condensation.

A 100 W heater (-E240) is used for 15.8 inch (400 mm) and 23.6 inch (600 mm) cabinets. Two 100 W heaters (-E240, -E241) are used for cabinet widths of 31.5 inch (800 mm) or higher.

The supply voltage (110 to 230 V AC) must be provided externally and protected with a fuse with max. 16 A.

X240 connection for cabinet anti-condensation heating

Table 8- 69 Terminal block X240

Terminal	Designation	Technical data
1	L1	110 to 230 V AC voltage supply
2	N	Current demand: - min.: approx. 0.43 A (for 230 V AC, 100 W) - max.: approx. 1.8 A (for 110 V AC, 200 W)
3	PE	Protective conductor
Max. connectable cross-section #12 AWG (4 mm²)		



⚠ WARNING

Dangerous electrical voltage as a result of external auxiliary supplies

When an external supply voltage for the cabinet anti-condensation heating is connected, hazardous voltages continue to be present in the cabinet unit even when the main switch is switched off. Death or serious injury can result when live parts are touched.

- Observe the general safety instructions when working on the device.

⚠ CAUTION

Burns caused by hot surfaces of the cabinet anti-condensation heating

During operation, the cabinet anti-condensation heating can reach high temperatures and 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

Providing supply voltage with temperature control

The supply voltage can be provided by means of a temperature control, to avoid unnecessary operation of the anti-condensation heating at higher ambient temperatures.

8.37 L61/L62, L64/L65, braking units

8.37.1 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.

8.37.2 Interfaces

Connection for the braking resistor

The connection is directly to terminal -X5.

Table 8- 70 Connection for the braking resistor

Terminal	Designation
-X5:1	Braking resistor connection R+
-X5:2	Braking resistor connection R-

Recommended conductor cross-sections:

- For option L61/L64 (25 kW): #2 AWG (35 mm^2)
- For option L62/L65 (50 kW): #1 AWG (50 mm^2)

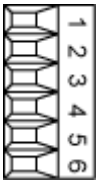
Note

Strain relief

For strain relief, the cables must be clamped to the cable C-type mounting bar.

X21 digital inputs/outputs

Table 8- 71 Terminal strip X21

Connector	Terminal	Designation [1]	Technical data
	1	Shield	Shield connection for terminals 2 to 6
	2	0 V	High signal level: +15 ... 30 V Current drawn: 2 ... 15 mA Low signal level: -3 ... 5 V
	3	DI inhibit input	
	4	0 V	High signal: No fault Low signal: Fault present Voltage: 24 V DC Load current: 0.5 ... 0.6 A
	5	DO fault output	
	6	+24 V	Voltage: +18 ... 30 V Typical current consumption (intrinsic current consumption): 10 mA at 24 V DC
Max. connectable cross-section: #16 AWG (1.5 mm^2)			

[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 V DC 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/configuration

If a Control Unit is not available (option K90/K95), then the four signals of terminal strip -X55-X132 must be wired to the corresponding Control Unit or to the customer interface -X55.

8.37.3 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- 72 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 $(673/774)^2 = 0.75$. 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 $(841/967)^2 = 0.75$. 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 $(1070/1158)^2 = 0.85$. 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).

8.37.4 Braking Module

Braking Module for frame sizes FX, FB

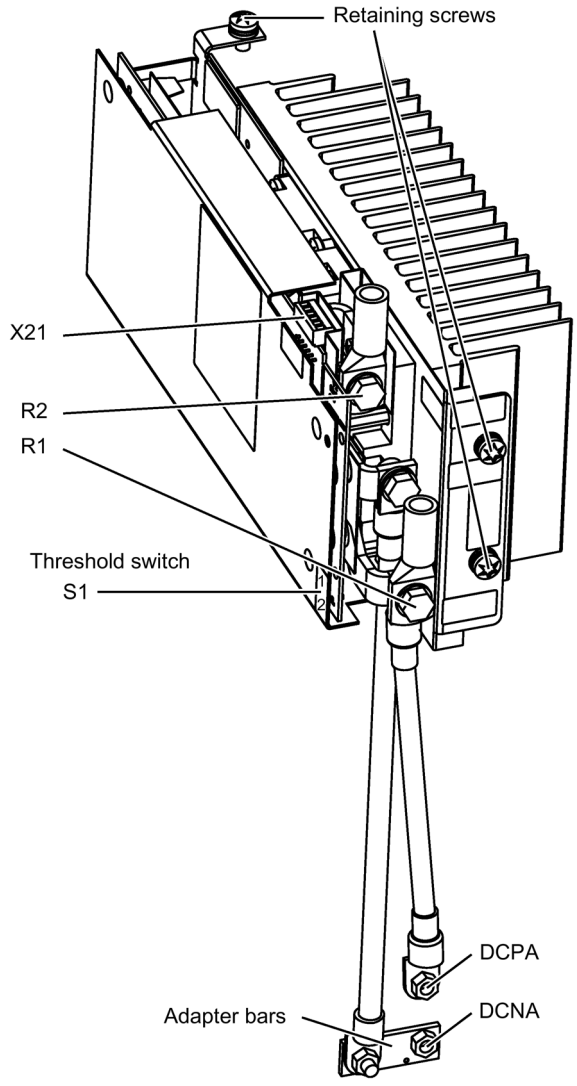


Figure 8-50 Braking Module for Active Line Module / Motor Module, frame size FX and for Basic Line Module, frame size FB

Note

Connecting interfaces

With this Braking Module, the R1 and DCPA interfaces use the same connection.

Braking Module for frame sizes GX, GB

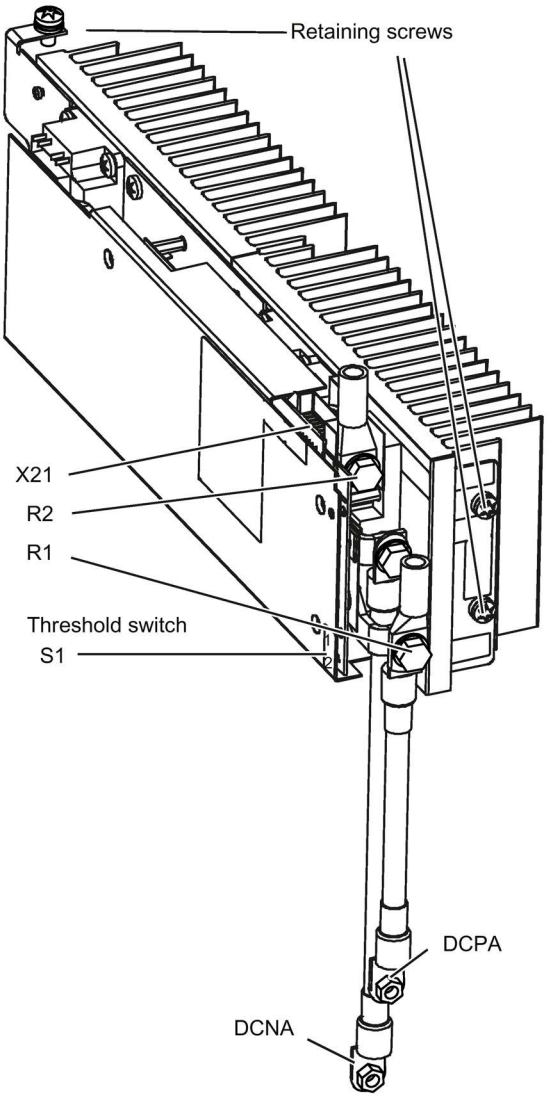


Figure 8-51 Braking Module for Smart Line Module / Active Line Module / Motor Module, frame size GX and for Basic Line Module, frame size GB

Note

Connecting interfaces

With this Braking Module, the R1 and DCPA interfaces use the same connection.

Braking Module for frame sizes HX and JX

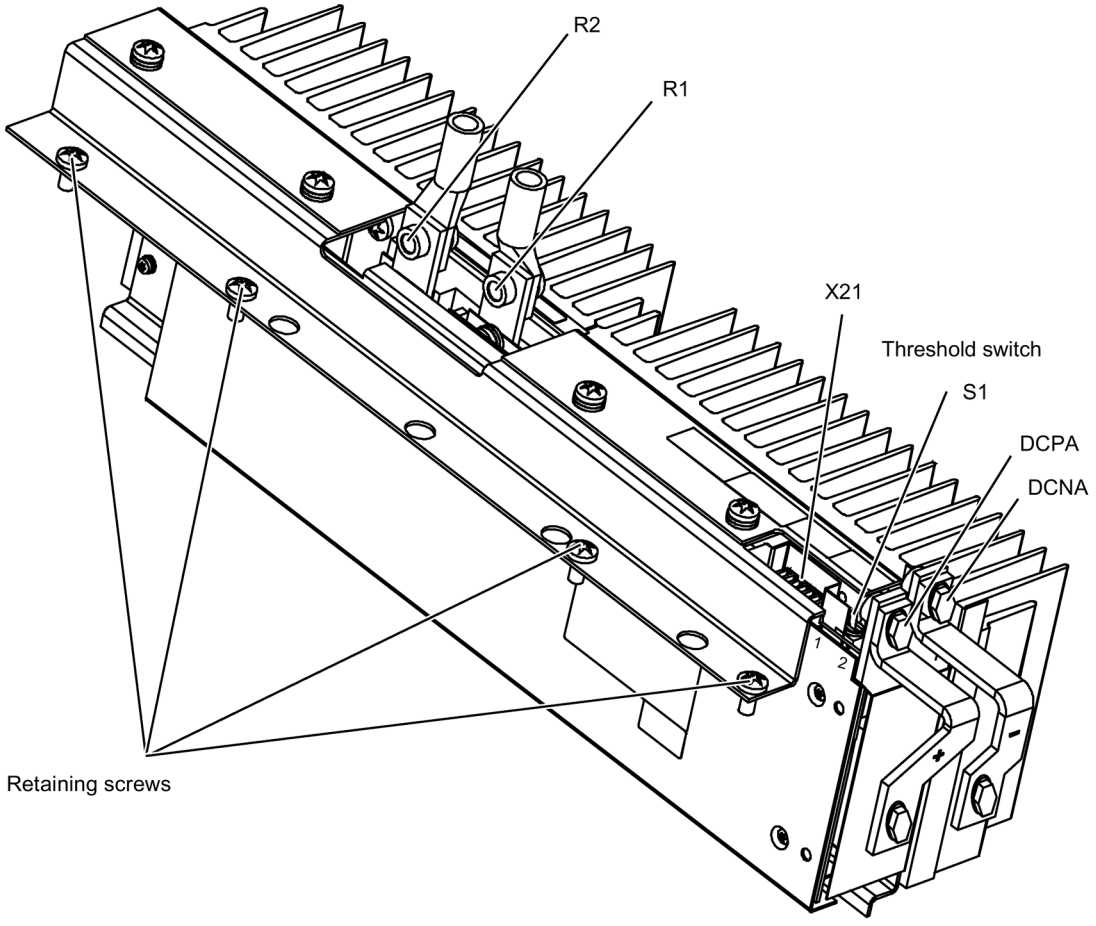


Figure 8-52 Braking Module for Smart Line Module / Active Line Module / Motor Module, frame sizes HX and JX

8.37.5 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.

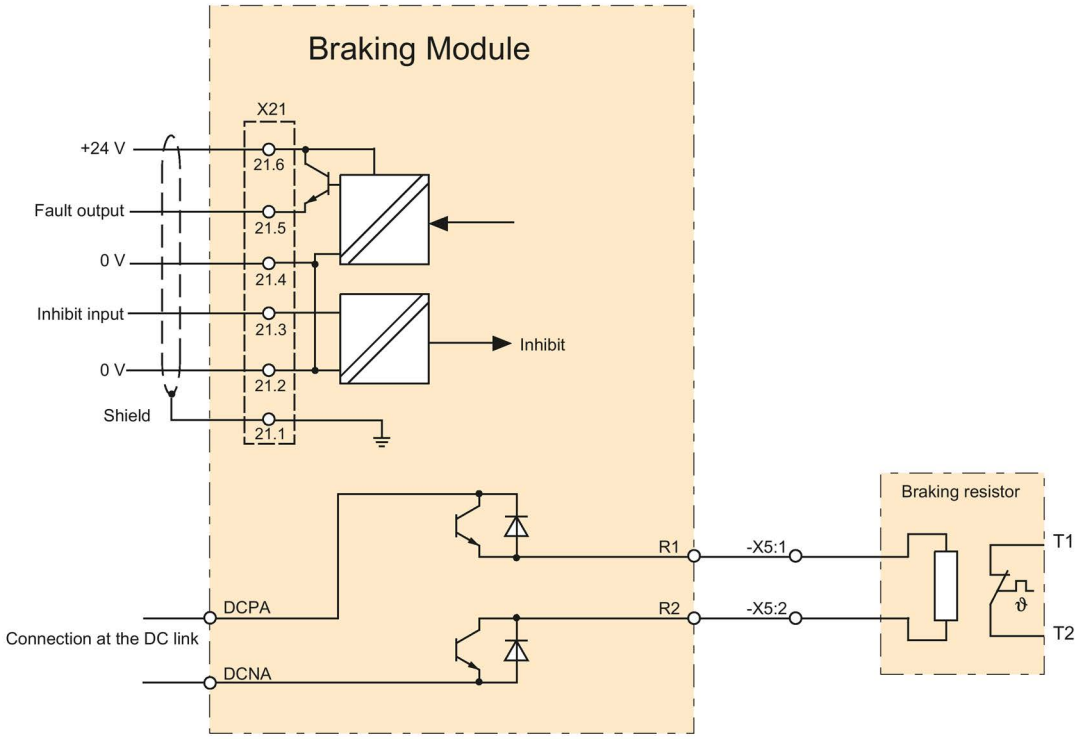


Figure 8-53 Example connection of Braking Module

8.37.6 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.

Dimension drawings

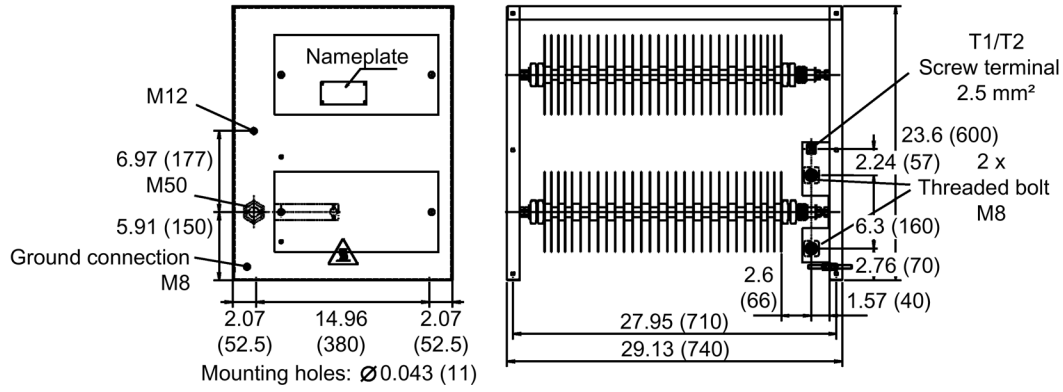


Figure 8-54 Dimension drawing for braking resistor 25 kW, 125 kW (option L61 / L64) - data in inches (mm)

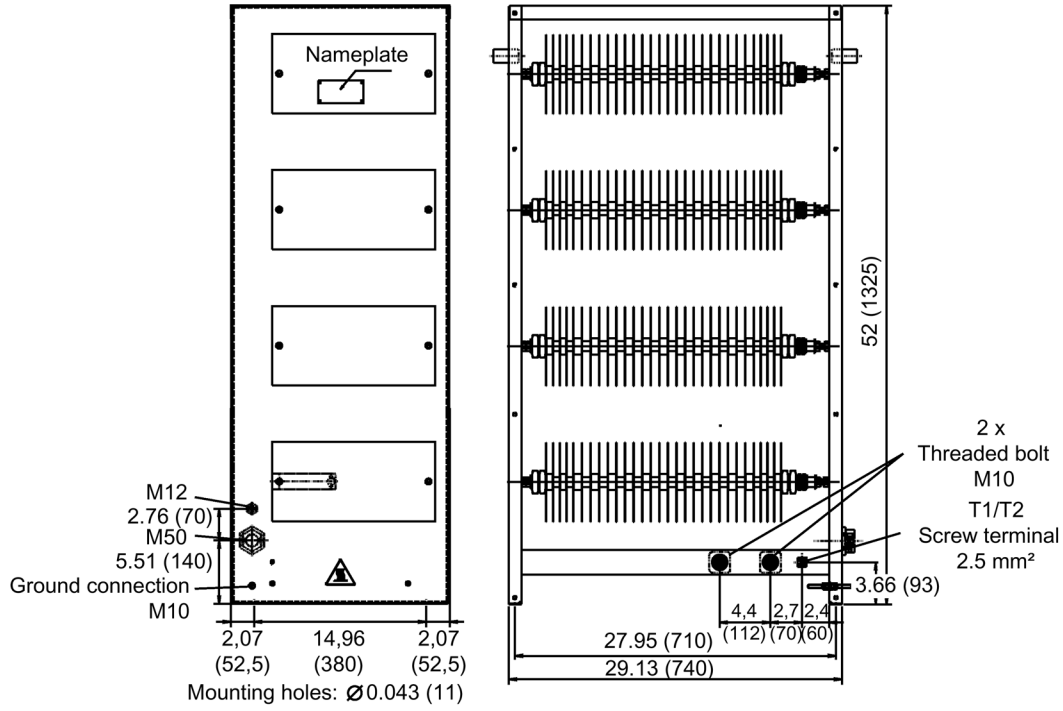


Figure 8-55 Dimension drawing for braking resistor 50 kW, 250 kW (option L62 / L65) - data in inches (mm)

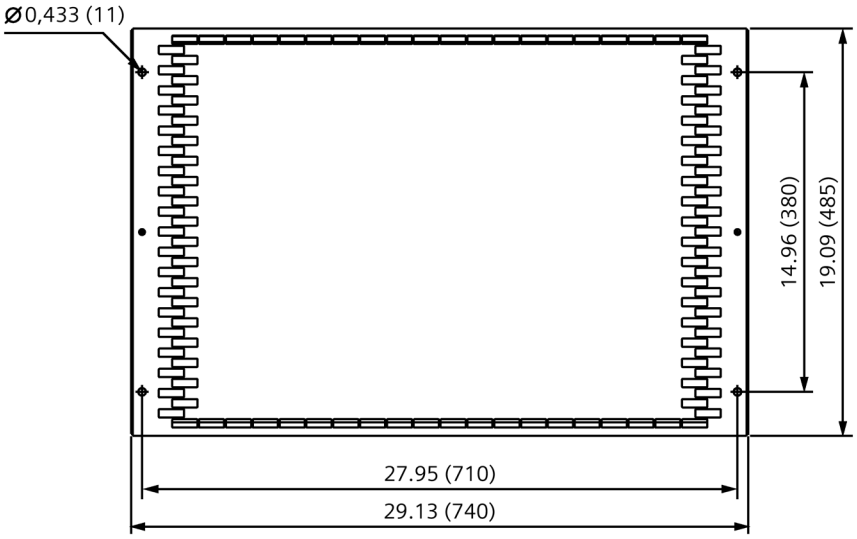


Figure 8-56 Fixing dimensions of the braking resistors - specified in inches (mm)

Safety instructions

WARNING

Fire for an inadequate installation

When installation is inadequate (failure to observe the cooling clearances or insufficient distances from combustible objects), there is a risk of fire leading to death or serious injury.

- Maintain a cooling clearance of 7.8 inches (200 mm) on all sides of the braking resistor with ventilation grilles.
- Maintain a sufficient distance from combustible objects.

CAUTION

Burns caused by hot surfaces of the braking resistor

During operation, the braking resistor can reach high temperatures and 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-fused connections to the braking resistor can cause fire with smoke generation in the event of a short-circuit or ground fault and cause serious injuries or death.

- Install the connections to the braking resistor in such a way that a ground fault or short-circuit can be excluded.
- Comply with local installation regulations, which allow this fault to be ruled out.
- Protect the cables from mechanical damage.
- Take one of the following measures:
  - Use cables with double insulation.
  - Observe adequate clearances, e.g. through the use of spacers.
  - Route the cables in separate cable ducts or pipes.

NOTICE

Property damage resulting from exceeding the maximum permitted cable length

Exceeding the maximum permitted cable length to the braking resistor can cause property damage due to component failure.

- Comply with the maximum cable length between the cabinet unit and the braking resistor of 330 ft (100 m).

Thermostatic switch

Table 8- 73 Thermostatic switch connection

Terminal	Description of function	Technical data
T1	Thermostatic switch connection	Voltage: 240 V AC Load current: Max. 10 A
T2	Thermostatic switch connection	

Max. connectable cross-section #14 AWG (2.5 mm²)

⚠ WARNING

Fire when the thermostatic switch is not evaluated

When evaluation of the thermostatic switch is not available, there is a risk of fire leading to death or serious injury.

- If you evaluate the thermostatic switch by the Control Unit or a higher-level controller, a shut down must be performed, if necessary.

8.37.7 Technical specifications

Load data for the braking units

Table 8- 74 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- 75 Dimensions of the braking resistors

	Unit	25 kW resistor (option L61/L64)	50 kW resistor (option L62/L65)
Width	inch (mm)	19 (485)	19 (485)
Height	inch (mm)	24 (605)	52 (1325)
Depth	inch (mm)	29 (740)	32 (810)

Duty cycle

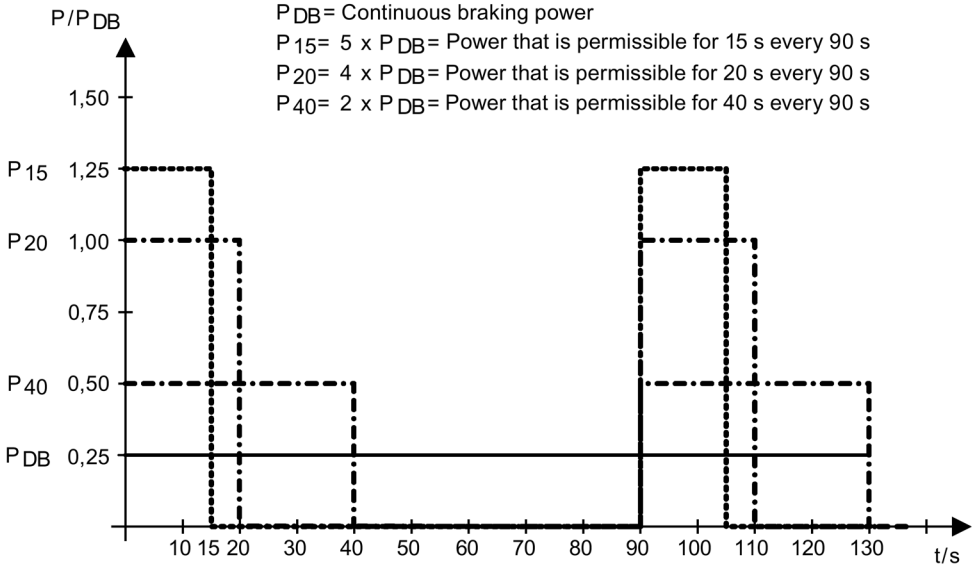


Figure 8-57 Duty cycle for braking resistors

8.38 L87, insulation monitoring

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules

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 detected in the Cabinet Modules. Two response values can be separately set (between 1 kΩ ...10 MΩ). If a set response value for alarm 1 and/or alarm 2 is fallen below, then the associated alarm relays switch, LEDs "ALARM 1" and/or "ALARM 2" light up and the LC display shows the measured value.

Note

Number of insulation monitors

Only one insulation monitor can be used within one 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 is removed in the factory in the following Cabinet Modules and placed loose in the cabinet unit:

- Basic Line Modules
- Smart Line Modules (the connection clip is located behind the fan for frame sizes HX and JX) including a Voltage Sensing Module VSM10
- Active Line Modules (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 101)".

Commissioning

When the Cabinet Module is delivered, the plant configuration (one or several loads in one electrically-connected line) and the protection strategy (immediate shutdown in the event of an insulation fault or restricted continued motion) are not known. The signaling relays of the insulation monitor must be integrated into the fault and alarm circuit by the customer.

The insulation monitoring device is adapted to the plant requirements using the commissioning Wizard.

Additional information

Note

Additional information

A detailed description of the complete principle of operation of the insulation monitor and how it is handled is given in the operating instructions, which are included in the device documentation provided.

8.39 M06, base 4" (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
- Booksize base cabinets
- Motor Modules chassis format
- Auxiliary Power Supply Modules
- Extension Modules

Description

Because it is raised 4" (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 has color RAL 9005.

Table 8- 76 Components of the cabinet base

Component	Connection element	Fixing elements
1 x base element (rear) 1 x base element (front) Base covers (option M26/M27 only) 4 x cover caps		On the cabinet: The cabinet base is shipped pre-assembled. On the foundation: The holes are in line with the holes in the cabinet (see dimension drawings).

Connection to the foundation

To connect the cable marshalling compartment to the foundation, four holes for M12 screws are provided. These are in line with the holes in the cabinet. The fixing dimensions are specified on the associated dimension drawings.

Connection for side-by-side installation of cabinet units

The individual bases are not connected for cabinet units installed in a side-by-side configuration. The connection from the base to the cabinet and between the cabinet units ensures sufficient stability.

Note

In transport units, the base covers inside the transport unit are only secured at the bottom and are folded down parallel to the ground.

8.40 M07, cable marshalling compartment 8" (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
- Booksize base cabinets
- Motor Modules chassis format
- Auxiliary Power Supply Modules
- Extension Modules

Description

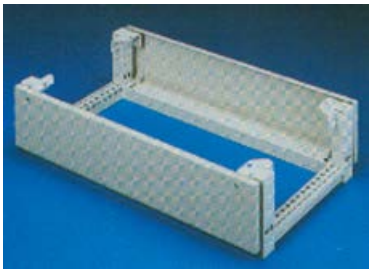
Because it is raised 8" (200 mm), the supplementary cable marshalling compartment made of stable sheet steel allows for greater bending radii for cables (cable inlet from below) and cable routing within the cable marshalling compartment.

The cable marshalling compartment comes completely assembled and has color RAL 7035 as standard.

Note

The cable marshalling compartment increases the cabinet height by 8" (200 mm).

Table 8- 77 Components of the cable marshalling compartment

Component	Connection element	Fixing elements
1 x cable marshalling compartment element		On the cabinet: The cabinet's cable marshalling compartment is shipped pre-assembled.
Side shutters (not shown) for the cable marshalling compartment (option M26/M27 only).		On the foundation: The holes are in line with the holes in the cabinet (see dimension drawings).

Connection to the foundation

To connect the cable marshalling compartment to the foundation, four holes for M12 screws are provided. These are in line with the holes in the cabinet. The fixing dimensions are specified on the associated dimension drawings.

Connection for side-by-side installation of cabinet units

The individual cable marshalling compartments are not connected for cabinet units installed in a side-by-side configuration. The connection from the cable marshalling compartments to the cabinet and between the cabinet units ensures sufficient stability.

Side shutters for cable marshalling compartments

When the cabinet units are installed in a side-by-side configuration, the side shutters can be folded inward and upward.

8.41 M21, enclosure IP21

8.41.1 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
- Booksize base cabinets
- Motor Modules chassis format
- 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 0.5" (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 10" (250 mm) above the top cover of the cabinet. The canopy increases the height of a cabinet unit by 10" (250 mm), as shown in the diagram below (number (1)).

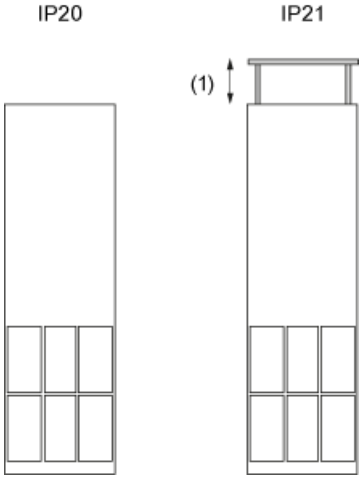


Figure 8-58 Cabinet with canopy is 10" (250 mm) higher

Note

Installing the canopy or top hat at an early stage

We recommended that you attach the canopy or top hat at an early stage to prevent foreign bodies from entering the cabinet units.

8.41.2 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.

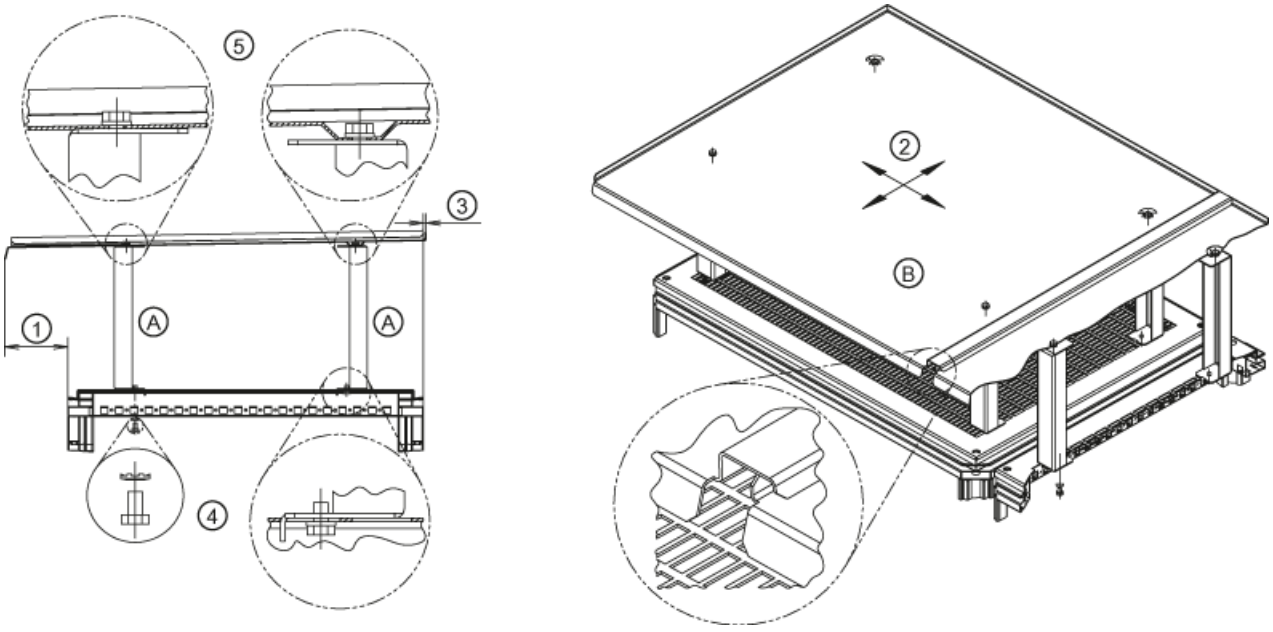


Figure 8-59 Fitting a canopy

8.42 M23/M43/M54, enclosure IP23 (NEMA1 filtered)/IP43/IP54 (NEMA12 ventilated)

8.42.1 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
- Booksize base cabinets
- Motor Modules chassis format
- Auxiliary Power Supply Modules
- Extension Modules

Description

The table below explains the properties of the various enclosures that are available.

Table 8- 78 Degrees of protection

Degree of protection	Protection against contact	Protection against water
NEMA1 filtered IP23	Protection against the ingress of solid foreign bodies with a diameter > 0.5" (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 > 0.04" (1 mm)	Protection against spraying water (up to 60° against the vertical)
NEMA12 (ventilated) IP54	Complete shock protection Protection against damaging internal dust deposits	Protects against splash water from all sides

Note

Top hats (1) increase the height of the cabinet units by 16" (400 mm).

For degree of protection NEMA12 ventilated (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 top hat for enclosure NEMA1 filtered (IP23), IP43 and NEMA12 ventilated (IP54).

Note

Installing the canopy or top hat at an early stage

We recommended that you attach the canopy or top hat at an early stage to prevent foreign bodies from entering the cabinet units.

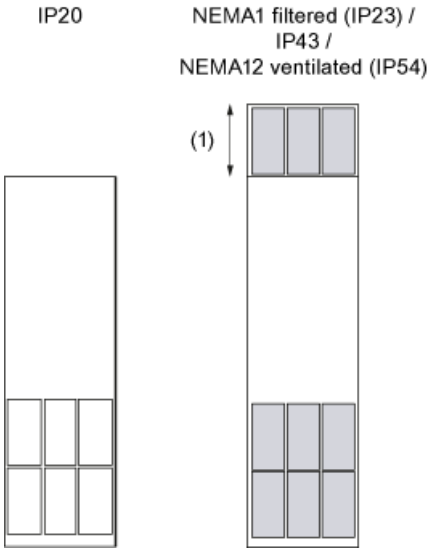


Figure 8-60 Cabinet with top hat is 16" (400 mm) higher

If the degree of protection of the Cabinet Modules is to be increased, the additional top hats 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 top hats are easily installed 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.

8.42.2 Installation

Preparatory steps

- Remove the crane transport aids if installed
  (-> see the section "Mechanical installation").
- Remove the perforated roof plate on the upper side of the cabinet (if installed).

Attaching the hood

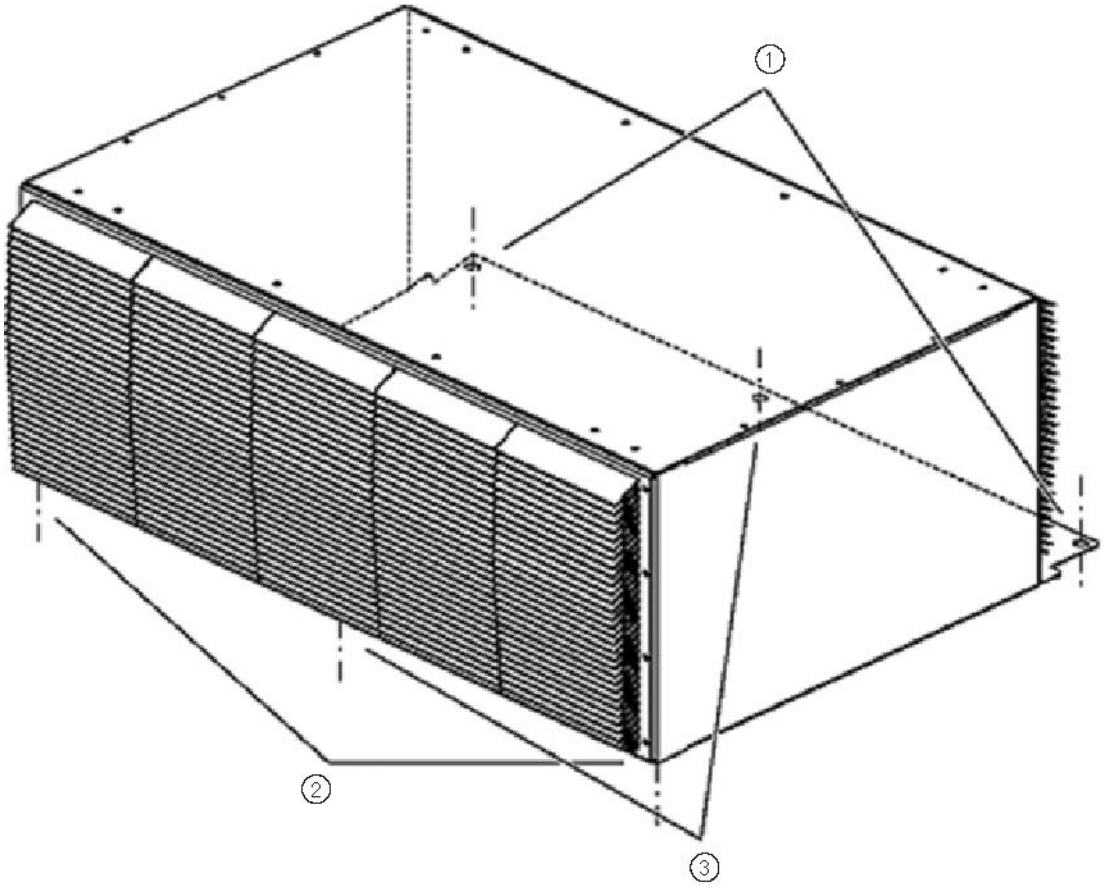


Figure 8-61 Installed hood

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 8-62 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 and so the opening of the doors blocked.



Figure 8-63 Attaching the washers

3. Fit the top hat to the top of the cabinet at the positions specified (fixing points of the crane transport aid).
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 8-64 View with opened cabinet door



Figure 8-65 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 the section "Maintenance and servicing", "Replacing the filter mats" section.

8.43 M26/M27, side panels installed 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
- Booksize base cabinets
- Motor Modules chassis format
- Auxiliary Power Supply Modules
- Extension Modules

Description

The side panels (option M26 = right side panel; option M27 = left side panel) are installed 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 install 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.

8.44 M51, Motor reactor terminal connection

Availability of option

This option is available for the following S120 Cabinet Modules:

- Booksize Cabinet Kits

Description

In connection 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- 79 Maximum conductor cross-section when using motor reactors for Booksize Cabinet Kits

Article No. 6SL3720-	Power in kW (HP)	Maximum conductor cross-section in mm² (AWG)
1TE21-0AU3	4.8 (5)	6 (10)
1TE21-8AU3	9.7 (10)	6 (10)
1TE23-0AU3	16 (20)	6 (10)
1TE24-5AU3	24 (30)	16 (6)
1TE26-0AU3	32 (40)	16 (6)
1TE28-5AU3	46 (60)	35 (2)
1TE31-3AU3	71 (100)	95 (4/0)

8.45 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
- Booksize base cabinets
- Motor Modules chassis format
- Auxiliary Power Supply Modules
- Extension Modules

Description

The standard cabinet units are supplied with integrated ventilation grills 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 (NEMA1 filtered) / IP43 / IP54 (NEMA12 ventilated) and with option L37 (DC interface including pre-charging input circuit), the door opening angle is only 110 °.

8.46 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 contact elements) are installed 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!

8.47 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
- Booksize base cabinets
- Motor Modules chassis format
- 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.

8.48 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
- Booksize base cabinets
- Motor Modules chassis format
- 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.

8.49 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
- Booksize base cabinets
- Motor Modules chassis format
- 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 bracket 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.

8.50 M70, EMC shield bus

8.50.1 General information

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- 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").

8.50.2 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 2" (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.

8.51 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 / two 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- 80 Conductor cross-section when connecting motor cables directly to the Booksize Motor Module

Article No. 6SL3720-	Power in kW (HP)	Conductor cross-section in mm² (AWG)
1TE21-0AU3	4.8 (5)	1.5 ... 6 (16 ... 10)
1TE21-8AU3	9.7 (10)	1.5 ... 6 (16 ... 10)
1TE23-0AU3	16 (20)	1.5 ... 6 (16 ... 10)
1TE24-5AU3	24 (30)	6 ... 50 (10 ... 1)
1TE26-0AU3	32 (40)	6 ... 50 (10 ... 1)
1TE28-5AU3	46 (60)	16 ... 120 (6 ... 5/0)
1TE31-3AU3	71 (100)	25 ... 120 (3 ... 5/0)

8.52 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
- Booksize base cabinets
- Motor Modules chassis format
- Auxiliary Power Supply Modules
- Extension Modules

Description

The DC busbar connects the DC voltage across the drive assembly. The DC busbar 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 8-66 M80 - M87, DC busbar

8.53 M90, crane transport aid (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
- Booksize base cabinets
- Motor Modules chassis format
- Auxiliary Power Supply Modules
- Extension Modules

Description

A top-mounted crane transport aid can be ordered as an option for Cabinet Modules.

Depending on the width of the module, the crane transport aid consists of either transport eyebolts (for cabinet width ≤ 31.5" (800 mm)) or transport rails (for cabinet width > 31.5" (800 mm)).

Note

A crane transport aid is included if transport units are supplied (option Y11).

After installing Cabinet Modules at the final installation location, crane transport aids must be removed, see also Chapter "Disassembling the crane transport assembly (Page 62)".

Safety instructions

⚠ WARNING

Incorrect handling of the mounting rail

Improper handling of the heavy mounting rails during disassembly can cause injuries or property damage.

- Ensure careful handling of the mounting rails during disassembly.
- Prevent screws from falling into the device during disassembly and causing property damage during operation.

8.54 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.

8.55 P10, measuring instrument for line values (installed in the cabinet doors)

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules

Description

Measuring instrument "DIRIS A-30" with display, installed in the cabinet door of the Line Connection Module, acquires measured variables of the power supply.

The measuring instrument has a serial RS485 interface with JBUS/MODBUS® that enables 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

For the cable routing and the EMC-compliant mounting of the communication connection, orient yourself to the corresponding descriptions in Chapter "Cable routing (Page 112)".

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".

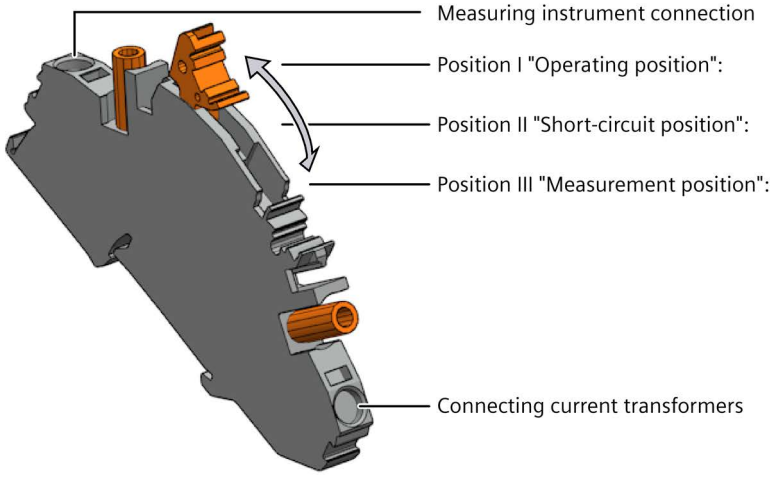


Figure 8-67 Lever positions at the current transformer terminal

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.

8.56 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

Description

A measuring instrument "SENTRON PAC3220" with graphic display, installed in the cabinet door of the Line Connection Module, acquires measured variables of the power supply.

The measuring instrument has a PROFIBUS interface that enables a data transfer rate of up to 12 Mbit/s.

The following functions belong to the standard scope of the device:

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, which 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
- Determination and storage of the last demand period mean value for active power and reactive power to simply generate load profiles using software.
  Programmable measuring periods from 1 to 60 min
- Daily energy counter for active energy for each day of the last 2 months
- Monthly energy counter for active energy for each month of the last 2 years
- Configurable universal counter for counting limit value violations and status changes at the digital input or output or for indicating the active energy or reactive energy of 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

For the cable routing and the EMC-compliant mounting of the communication connection, orient yourself to the corresponding descriptions in Chapter "Cable routing (Page 112)".

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".

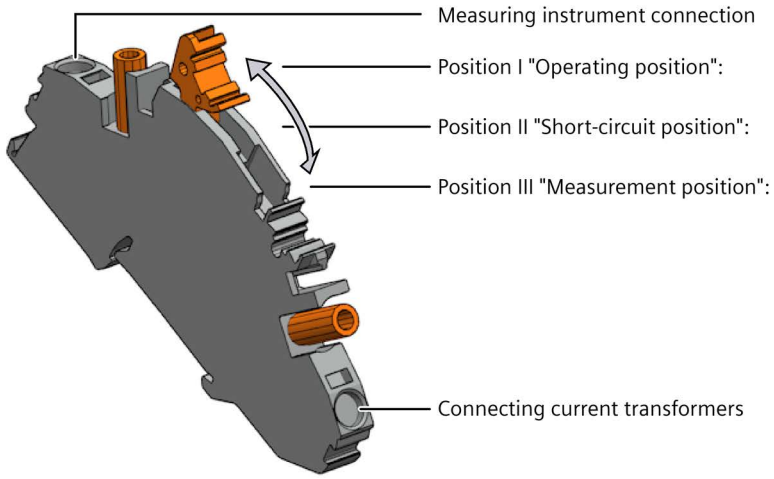


Figure 8-68 Lever positions at the current transformer terminal

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.

8.57 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

Description

A measuring instrument "SENTRON PAC3220" with graphic display, installed in the cabinet door of the Line Connection Module, acquires measured variables of the power supply.

The measuring instrument has a PROFINET interface that enables a data transfer rate of 10/100 Mbit/s.

The following functions belong to the standard scope of the device:

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, which 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
- Determination and storage of the last demand period mean value for active power and reactive power to simply generate load profiles using software.
  Programmable measuring periods from 1 to 60 min
- Daily energy counter for active energy for each day of the last 2 months
- Monthly energy counter for active energy for each month of the last 2 years
- Configurable universal counter for counting limit value violations and status changes at the digital input or output or for indicating the active energy or reactive energy of 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

For the cable routing and the EMC-compliant mounting of the communication connection, orient yourself to the corresponding descriptions in Chapter "Cable routing (Page 112)".

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".

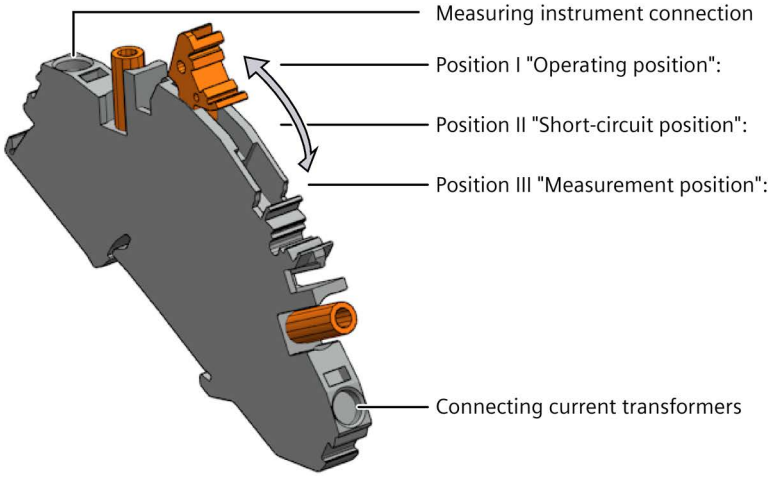


Figure 8-69 Lever positions at the current transformer terminal

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.

8.58 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 enables a data transfer rate of 10/100 Mbit/s.

The following functions belong to the standard scope of the device:

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 component
- 4-quadrant measurement (import and export)

- Generation of the mean value of all measured values directly in the device in two independent stages, which 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 over 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 % referred 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 (for example from electricity, gas or water meters). The pulse shape and time response must correspond to the signal waveshape according to IEC 62053-31.
- Operating hours counter for monitoring the operating time of a connected load. Only 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 for acquiring the power consumption of a manufacturing process. The process energy counters can be started and stopped using the digital inputs available.
- 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

For the cable routing and the EMC-compliant mounting of the communication connection, orient yourself to the corresponding descriptions in Chapter "Cable routing (Page 112)".

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".

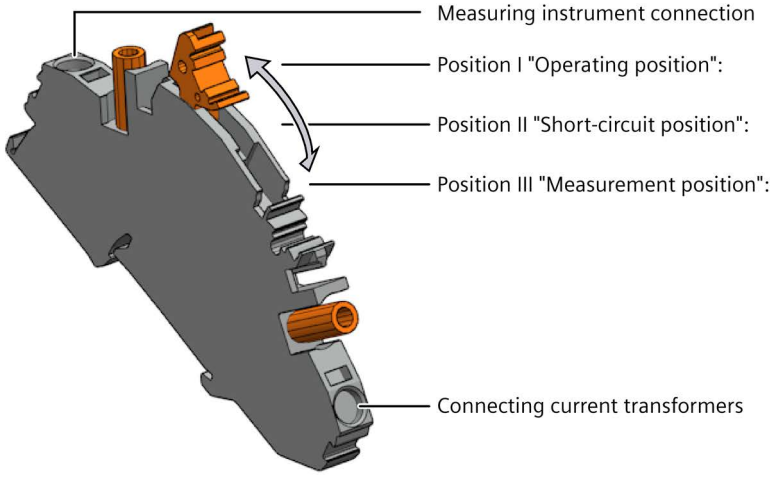


Figure 8-70 Lever positions at the current transformer terminal

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.

8.59 U90, UL listing per UL 508A

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
- Booksize base cabinets
- Motor Modules in chassis format
- Auxiliary Power Supply Modules

Description

The Cabinet Module is supplied with a test label in accordance with the UL listing per UL 508A.

8.60 U91, cUL listing for Canada per UL 508A

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
- Booksize base cabinets
- Motor Modules in chassis format
- Auxiliary Power Supply Modules

Description

The Cabinet Module is supplied with a test label in accordance with the cUL listing for Canada per UL 508A.

8.61 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
- Booksize base cabinets
- Motor Modules chassis format
- Auxiliary Power Supply Modules
- Extension Modules

Description

Cabinet Modules can be ordered as factory-assembled transport units with a maximum width of up to 94.5" (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 used to interconnect the cabinets.

When transport units are used for delivery, a crane transport aid in the form of a transport rail is already included.

Table 8- 81 Installation sequence of the transport unit

Plain text required to order	TE 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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