SINAMICS S120 Cabinet Modules

Manual· 05/2010

SINAMICS

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SINAMICS

S120
Cabinet Modules

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

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

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

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

Qualified Personnel

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

Proper use of Siemens products

Note the following:

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

Trademarks

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

Disclaimer of Liability

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

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Preface

Information on the SINAMICS S120 documentation

The SINAMICS S120 documentation is subdivided into the following levels:

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

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

Please contact your local Siemens office 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.

Audience

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

Objective

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

Technical support

If you have any questions, please contact our hotline:

Time zone Europe and Africa	
Phone	+49 (0) 911 895 7222
Fax	+49 (0) 911 895 7223
Internet	http://www.siemens.com/automation/support-request

Time zone America	
Phone	+1 423 262 2522
Fax	+1 423 262 2200
E-mail	techsupport.sea@siemens.com

Time zone Asia/Pacific	
Phone	+86 1064 757 575
Fax	+86 1064 747 474
E-mail	support.asia.automation@siemens.com

Note

Country-specific telephone numbers for technical support are provided at the following Internet address:

http://www.automation.siemens.com/partners

Internet addresses

Up-to-date information about our products can be found on the Internet at the following address:
http://www.siemens.com

Information about SINAMICS S120 Cabinet Modules can be found under:
http://www.siemens.com/sinamics-s120-cabinet-modules

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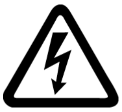
Safety information 1

1.1 Requirements



⚠ DANGER
The cabinet units described in this manual are used in industrial high-voltage installations. During operation, this equipment contains rotating and live, bare parts. For this reason, it could cause severe injury or significant material damage if the required covers are removed without authorization, if the equipment is used or operated incorrectly, or if it has not been properly maintained. When the machines are used in non-industrial areas, the installation location must be protected against unauthorized access (by protective fencing, for example) and appropriate signs must be displayed.

The persons responsible for the safety of the plant are under an obligation to ensure that:

- The basic planning work for the plant and the transport, assembly, installation, commissioning, maintenance, and repair work is carried out by qualified personnel and/or checked by the experts responsible.
- All the documentation for the plant is always readily at hand.
- The technical data and specifications regarding the applicable installation, connection, environmental, and operating conditions are always observed.
- The plant-specific assembly and safety guidelines are observed and personal protection equipment is used.
- No work whatsoever is carried out by unqualified personnel either on this equipment or in its vicinity.

These instructions are intended for qualified personnel and only contain information and notes relating to the intended purpose of the machines.

The operating instructions and the machine documentation are available in the languages specified in the supply contracts.

Note

We recommend engaging the support and services of your local Siemens service center for all planning, installation, commissioning, and maintenance work.

1.2 Electrostatic sensitive devices (ESD)

CAUTION
The Cabinet Modules contain electrostatic sensitive devices. These components can be easily destroyed if not handled properly. Observe the following notes if you nevertheless have to work with electronic modules: • You should only touch electronic modules if absolutely necessary. • If you do have to touch modules, your body must be electrically discharged first. For this purpose, you are advised to wear a grounded ESD wristband. • Modules must not come into contact with highly insulating materials (such as plastic parts, insulated desktops, articles of clothing manufactured from man-made fibers). • Modules must only be set down on conductive surfaces. • Modules and components should only be stored and transported in conductive packaging (such as metalized plastic boxes or metal containers). • If the packaging is not conductive, the modules must be wrapped with a conductive packaging material (such as conductive foam rubber or household aluminum foil), prior to placing them in the packaging.

The necessary ESD protective measures are elucidated once again in the following illustration:

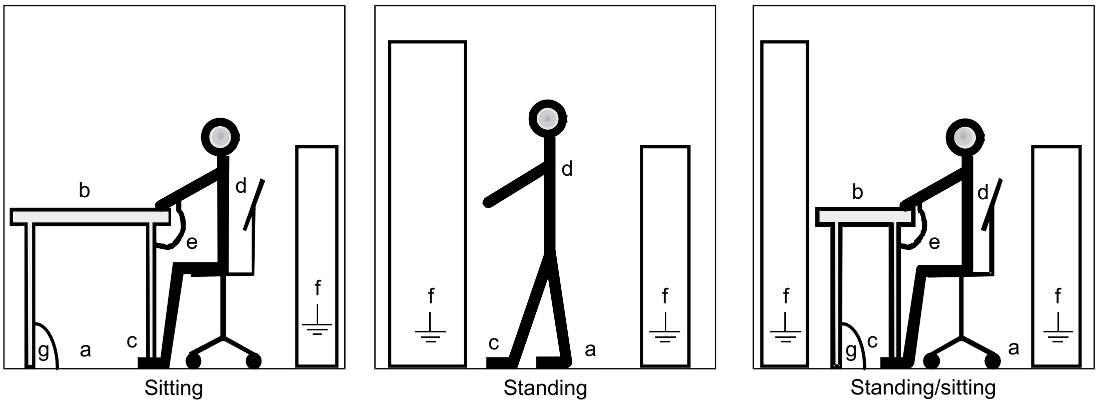


Figure 1-1 ESD protective measures

- a = conductive floor surface
- b = ESD table
- c = ESD shoes
- d = ESD overall
- e = ESD wristband
- f = ground connection for cabinet units
- g = connection to conductive floor

1.3 Safety information

DANGER

SINAMICS S120 Cabinet Modules must only be commissioned by suitably qualified personnel.

The personnel must take into account the information provided in the technical customer documentation for the product, and be familiar with and observe the specified danger and warning notices.

Operational electrical equipment and motors have parts and components which are at hazardous voltage levels.

When the machine or system is operated, hazardous axis movements can occur.

All work on the electrical system must be carried out when the system has been disconnected from the power supply and is in a de-energized condition.

Note

Machinery directive (2006/42/EC)

When the European common market was launched, a decision was made that the domestic Standards and regulations of all of the EU Member States relating to the technical implementation of machines would be harmonized. This meant that, as an internal market Directive, the content of the Machinery Directive had to be implemented by the individual member states as national legislation. For the Machinery Directive, this was realized with the aim of achieving standard protective goals and, in turn, removing technical trade barriers. In accordance with the definition of a machine ("an assembly of linked parts or components, at least one of which moves"), this Directive is extremely extensive. The revised version from 2006, which shall be binding as of Dec. 29, 2009 without transistional period, has expanded its area of application and now includes "Logic units to ensure safety functions".

The machinery directive involves the implementation of machines. It has 28 Articles and 12 Annexes. The basic safety and health requirements specified in Annex I of the Directive must be fulfilled for the safety of machines.

The protective goals must be implemented responsibly to ensure compliance with the Directive.

Manufacturers of a machine must verify that their machine complies with the basic requirements. This verification is facilitated by means of harmonized standards.

DANGER

Five safety rules

When carrying out any kind of work on electrical devices, the following "five safety rules" must always be observed in accordance with EN 50110-1 and EN 50110-2:

- Disconnect from power supply.
- Protect against reconnection.
- Make sure that the equipment is de-energized.
- Ground and short-circuit.
- Cover or enclose adjacent components that are still live.

⚠ WARNING

Safe, problem-free operation of SINAMICS S120 Cabinet Modules requires proper transportation, storage, setup, and installation, as well as careful operation and maintenance.

The details in the catalogs and proposals also apply to the design of special equipment versions.

In addition to the danger and warning information provided in the technical customer documentation, the applicable national, local, and plant-specific regulations and requirements must be taken into account.

Only protective extra-low voltages (PELV) that comply with EN 60204-1 may be connected to any connections and terminals that are intended for the voltage range between 0 V and 48 V.

CAUTION

As part of routine tests, SINAMICS S120 Cabinet Modules undergo a voltage test in accordance with EN 61800-5-1. Prior to performing the voltage test for electrical equipment of industrial machines in accordance with EN 60204-1, Section 18.4, all connections of the Cabinet Modules must be disconnected/removed to prevent the units from being damaged.

Motors must be connected according to the circuit diagrams provided.

Note

When operated in dry operating areas, SINAMICS S120 Cabinet Modules with three-phase induction motors conform to Low Voltage Directive 2006/95/EC.

SINAMICS S120 Cabinet Modules with three-phase induction motors conform to EMC Directive 2004/108/EC in the configurations specified in the associated EC Declaration of Conformity, provided that the configuration guidelines and actions are consistently applied.

CAUTION

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

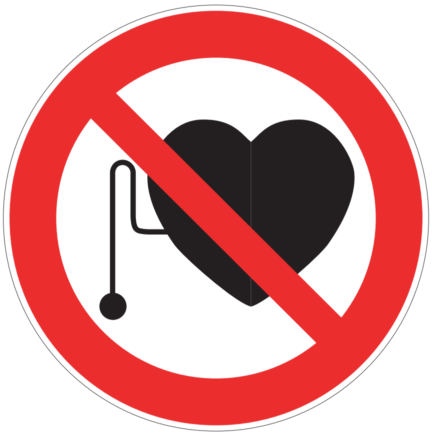
1.4 Residual risks

Residual risks of power drive systems

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

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

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

> ⚠ WARNING
>
> **Electromagnetic fields "electro smog"**
>
> Electromagnetic fields are generated by the operation of electrical power engineering installations such as transformers, converters or motors.
>
> Electromagnetic fields can interfere with electronic devices, which could cause them to malfunction. For example, the operation of pacemakers can be impaired, potentially leading to damage to a person's health or even death. It is therefore forbidden for persons with pacemakers to enter these areas.
>
> The plant operator is responsible for taking appropriate measures (labels and hazard warnings) to adequately protect operating personnel and others against any possible risk.
>
> - Observe the relevant nationally applicable health and safety regulations. In Germany, "electromagnetic fields" are subject to regulations BGV B11 and BGR B11 stipulated by the German statutory industrial accident insurance institution.
> - Display adequate hazard warning notices.
>
> 
>
> - Place barriers around hazardous areas.
> - Take measures, e.g. using shields, to reduce electromagnetic fields at their source.
> - Make sure that personnel are wearing the appropriate protective gear.

System overview 2

2.1 Overview

SINAMICS S120 Cabinet Modules are the components of a modular cabinet unit system for multi-axis drives with a central supply infeed and a common DC link busbar, as typically found in paper-making machines, roller mills, test stands, or hoisting gear.

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

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

The main components of the system are as follows:

- Line Connection Modules with line-side components such as contactors, fuses, and circuit breakers, as well as line reactors for Basic Line Modules and Smart Line Modules.
- Line Modules for the infeed in the following variations:
  - Basic Line Modules for 2-quadrant operation
  - Smart Line Modules for 4-quadrant operation
  - Active Line Modules for 4-quadrant operation with negligible line harmonic distortions
- Central Braking Modules for short-term braking
- The following types of Motor Module:
  - Booksize Cabinet Kits
  - Chassis format
- Auxiliary Power Supply Modules to supply the auxiliary power supply system
- Control Units

Standardized interfaces for both the power and the control connections facilitate configuration and installation. Communication between the power modules and the central Control Unit takes place via DRIVE-CLiQ, the internal drive serial interface.

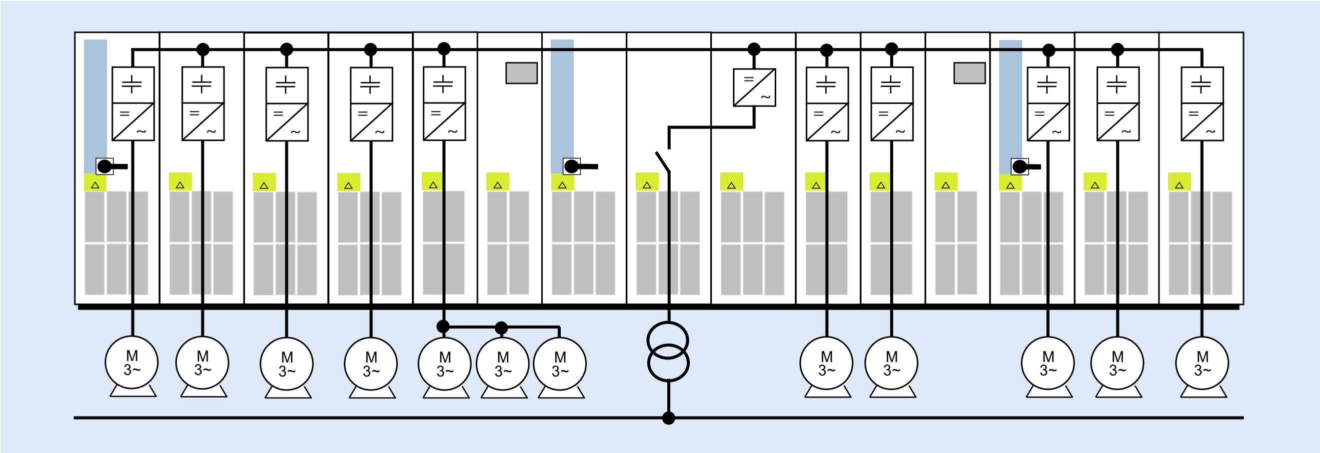


Figure 2-1 Example of a drive line-up with SINAMICS S120 Cabinet Modules for a multi-motor drive

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

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

	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 ... 3200 A 280 ... 3200 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 … 1700 A 550 … 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 … 720 V 750 … 1035 V	235 … 1574 A 644 … 1422 A		132 ... 900 kW 560 ... 1400 kW
Motor Modules Booksize	(380 ... 480 V)		510 ... 750 V	3.6 to 200 A	3 to 200 A	1.6 ... 107 kW
Motor Modules Chassis 1)	(380 ... 480 V) (500 ... 690 V)		510 ... 750 V 675 ... 1080 V	252 … 1686 A 102 … 1524 A	210 … 1405 A 85 … 1270 A	110 ... 800 kW 75 ... 1200 kW
Central Braking Modules 1)	(380 ... 480 V) (500 ... 600 V) (660 ... 690 V)		510 ... 750 V 675 ... 940 V 890 ... 1080 V			500 ... 1000 kW 550 ... 1100 kW 630 ... 1200 kW
Auxiliary Power Supply Module	380 ... 690 V	125 ... 250 A				

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

2.2 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:

- Paper-making machines
- Roller mills
- Hoisting gear
- Test stands

Moreover, 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 interface, an optional PROFINET interface and various analog and digital interfaces allow them to be easily integrated into automation solutions.
  - Vector control ensures that they fulfill the most exacting requirements regarding the accuracy and dynamic response of drives.
- High level of reliability and availability:
  - Individual modules and power components can be replaced quickly and easily, which ensures a higher level of plant availability.
- Energy savings during operation:
  - If the drive system includes both motorized and regenerative motors, they can be coupled by means of a common DC link in such a way that allows mutual energy exchange to take place. This allows for additional energy savings and the reduction of line harmonic distortions.
  - In certain cases, the supply infeed of the drive line-up can even be designed to supply less voltage than the total power of the individual Motor Modules operated on the common DC link would require.
- Cost minimization during operation, maintenance, and service:
  - Simple commissioning thanks to the menu-driven "STARTER" commissioning tool.
  - Optional menu-driven AOP30 advanced operator panel with a plain-text 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 grounded (TN, TT) and non-grounded (IT) systems.

The Line Modules are connected to the incoming supply via Line Connection Modules and are equipped with a radio interference suppression filter in accordance with EN 61800-3, Category C3 as a standard feature.

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 drives brake, it must be converted to heat by means of a supplementary Braking Module and a braking resistor.

When a Basic Line Module is used as the infeed, a line reactor is included. If, for example, the infeed takes place by means of a converter transformer in 12-pulse operation, it is possible to omit the line reactor.

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. Line-side fuses are installed for selective protection of the individual Basic Line Modules.

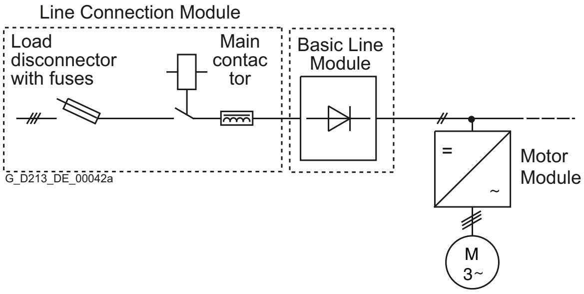


Figure 2-2 Line Connection Module with Basic Line Module ≤ 800 A

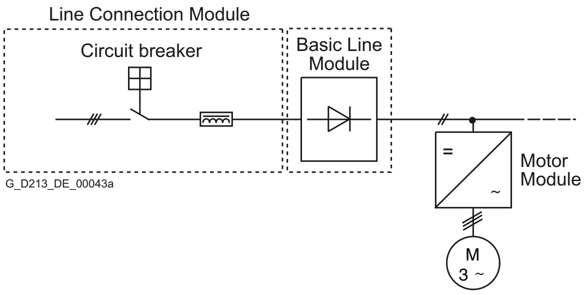


Figure 2-3 Line Connection Module with Basic Line Module > 800 A

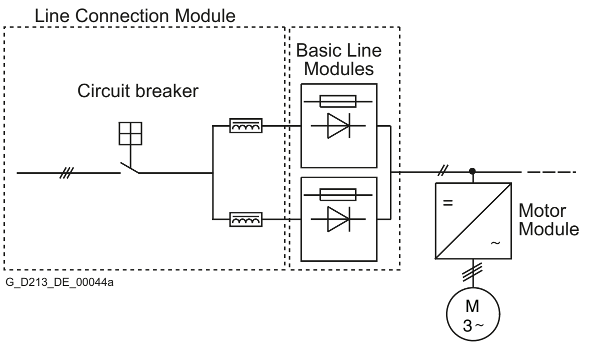


Figure 2-4 Line Connection Module with Basic Line Modules connected in parallel

2.4.3 Smart Line Modules

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

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

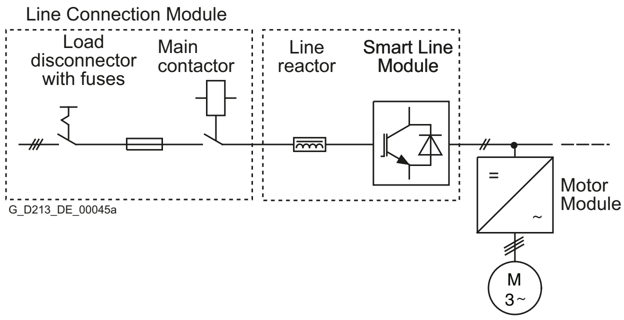


Figure 2-5 Line Connection Module with Smart Line Module

2.4.4 Active Line Modules

Active 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 fed back to the supply).

In contrast to Basic Line Modules and Smart Line Modules, however, Active Line Modules generate a regulated DC voltage, which remains constant despite fluctuations in the line voltage. In this case, the line voltage must remain within the permissible tolerance range. Active Line Modules draw a virtually sinusoidal current from the supply system and cause virtually no line harmonic distortions.

Active Line Modules are always used in conjunction with an Active Interface Module. Active Interface Modules include the required pre-charging input circuit for the Active Line Module, in addition to a Clean Power Filter.

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

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

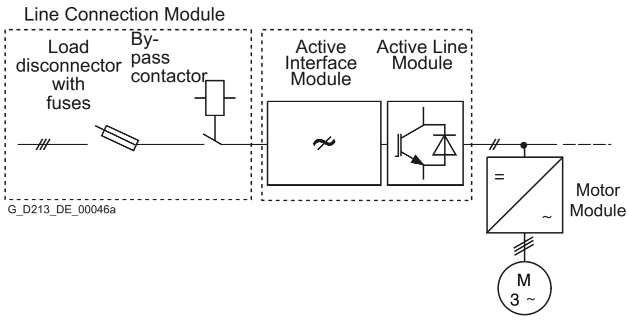


Figure 2-6 Line Connection Module with Active Interface Module and Active Line Module ≤ 800 A, example frame size HX + HI

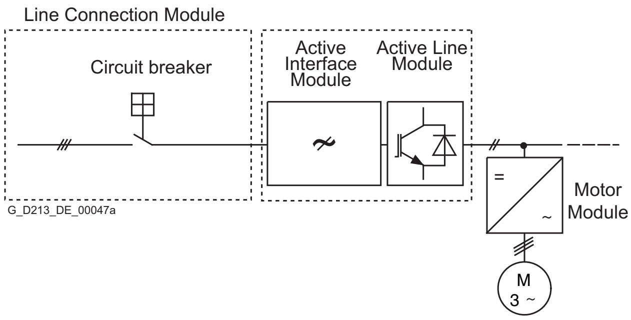


Figure 2-7 Line Connection Module with Active Interface Module and Active Line Module > 800 A

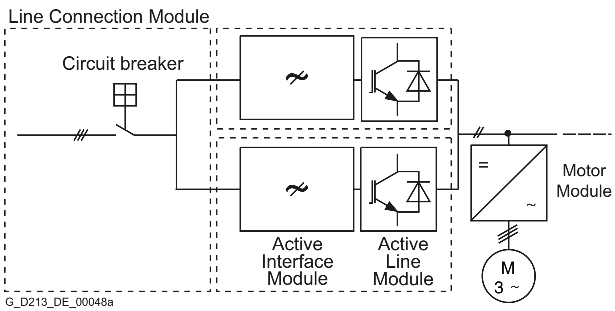


Figure 2-8 Line Connection Module with Active Interface Modules and Active Line Modules connected in parallel

2.5 DC link components

Braking Modules enable braking resistors to absorb the regenerative energy produced during drive deceleration, which is then converted into heat.

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

2.5.1 Braking Modules as an option for a Motor Module or a Line Module

For smaller drive 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.

2.5.2 Central Braking Modules

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

2.6 Motor Modules

There are two different types of Motor Module 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 (1.6 to 107 kW) can be configured as Booksize Cabinet Kits installed in Booksize Base Cabinets. Booksize Cabinet Kits are also available as Double Motor Modules in the 1.6 to 9.7 kW power range.

2.6.2 Chassis Cabinets

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

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

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 electronics modules with external 24 V DC. This is required when the DC link is not charged in order, for example, to maintain PROFIBUS communication.

2.8 Overview of options

Table 2- 2 Overview of options

Option code	Brief description of option
B70	Sector-specific version Cranes
D02	Customer documentation (circuit diagram, terminal diagram, layout diagram) in DXF format
D14	Draft of customer documentation
D58	Documentation language: English/French
D60	Documentation language: English/Spanish
D80	Documentation language: English/Italian
F03	Unit acceptance in presence of customer: Visual acceptance
F71	Unit acceptance in presence of customer: Function test with no motor connected
F75	Unit acceptance in presence of customer: Function test with test bay motor (no load)
F97	Unit acceptance in presence of customer: Customer-specific acceptance inspections (on request)
G20	CBC10 Communication Board
G33	CBE20 Communication 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
K76	Auxiliary voltage 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
K90	Control Unit CU320-2 PROFIBUS
K94	Performance extension 1 for CU320-2
L00	Use in the first environment to EN61800-3, category C2 (TN/TT line supplies)
L01	Clean Power version with integrated Line Harmonics Filter
L07	dv/dt filter compact plus Voltage Peak Limiter
L08	Motor reactor
L09	2 motor reactors connected in series
L10	dv/dt filter plus Voltage Peak Limiter
L13	Main contactor
L22	Line reactor not included in scope of delivery
L25	Circuit breaker in withdrawable unit design
L34	Output-side circuit breaker
L37	DC interface incl. pre-charging input circuit of the associated DC link capacitance
L41	Current transformer upstream of main breaker

Option code	Brief description of option
L42	Line Connection Module for Active Line Modules
L43	Line Connection Module for Basic Line Modules
L44	Line Connection Module for Smart Line Modules
L45	EMERGENCY OFF pushbutton installed in the cabinet door
L46	Grounding switch upstream of main breaker
L47	Grounding switch downstream of main breaker
L51	Holder for ARC detector
L55	Cabinet anti-condensation heating
L61	25 / 125 kW braking unit for line voltages of 380 ... 480 V and 660 ... 690 V
L62	50 / 250 kW braking unit for line voltages of 380 ... 480 V and 660 ... 690 V
L64	25 / 125 kW braking unit for line voltages of 500 ... 600 V
L65	50 / 250 kW braking unit for line voltages of 500 ... 600 V
L87	Insulation monitoring
M06	Base 100 mm high, RAL 7022
M07	Cable-marshaling compartment 200 mm high, RAL 7035
M13	Line connection from above
M21	IP21 degree of protection
M23	IP23 degree of protection
M26	Side panel (right)
M27	Side panel (left)
M43	IP43 degree of protection
M54	IP54 degree of protection
M59	Closed cabinet door (air inlet from below through floor opening)
M60	Additional shock protection
M70	EMC shield bus
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 assembly (top-mounted)
N52	DC link fuses for Basic Line Module
P10	Measuring instrument for line values (installed in the cabinet door)
P11	Measuring instrument for line variables with PROFIBUS 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
Y09	Special paint finish for cabinet
Y11	Factory assembly into transport units

Option code	Brief description of option
Y31	One-line label for plant identification, 40 x 80 mm
Y32	Two-line label for plant identification, 40 x 180 mm
Y33	Four-line label for plant 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.

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 Module and Motor Module, and other active SINAMICS components takes place via DRIVE-CLiQ connections.

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

As an option, Cabinet Modules can be delivered in preconfigured transport units with a total width of up to 2,400 mm each. This option is recommended in particular for Line Modules together with Line Connection Modules since, in this case, the Line Connection Module must be equipped with a pre-charging DC link or line reactors (depending on the type of Line Module), in addition to the electrical interface (mounted on a busbar).

2.10 System data

General technical system data

Electrical data			
Line voltages and power ranges	380 ... 480 V 3 AC, ±10 % (-15 % < 1 min), 1.6 ... 800 kW 1) 500 ... 690 V 3 AC, ±10 % (-15 % < 1 min), 55 ... 1200 kW 1)		
Line system configurations	TN/TT supplies or isolated-neutral supplies (IT supplies)		
Line frequency	47 ... 63 Hz		
Output frequency	0 ... 300 Hz (>100 / 160 Hz, take derating into account)		
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 %	> 97.0 %
Control method	Servo control, vector control with and without encoder or V/f control		
Fixed speeds	15 fixed speeds plus 1 minimum speed, programmable		
Skipped speed ranges	4, parameterizable		
Braking operation	With regenerative feedback or by additional Braking Modules and braking resistors		

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

Mechanical data	
Degree of protection	IP20, IP21, IP23, IP43 and IP54 (with options M26 and M27, side panels on the right and left respectively)
Safety class	Safety class I acc. to EN 61800-5-1
Cooling method	Forced air cooling AF to EN 60146
Shock protection	BGV A 3 acc. to EN 50274
Cabinet system	Rittal TS 8, doors with double-bit key, tripartite base plates for cable inlet
Paint finish	RAL 7035 (indoor requirements)

Compliance with standards	
Standards	EN 50274, EN 60146-1, EN 60204-1, EN 60529, EN 61800-2, EN 61800-3, EN 61800-5-1
CE marking	To EMC Directive No. 2004/108/EC and Low-Voltage Directive No. 2006/95/EC
RFI suppression	To EMC product standard for variable-speed drives (EN 61800-3); second environment (first environment on request)

Ambient conditions			
	In operation	During storage	During transport
Ambient temperature	*0 °C* [2] ... +40 °C to +50 °C see derating data	-25 °C to +55 °C	-25 °C to +70 °C from *-40 °C* [2] for 24 hours
Relative humidity (non-condensing) corresponds to class	5 % ... *95 %* [2] 3K3 to IEC 60 721-3-3	*5 %* [2]... *95 %* [2] 1K4 to IEC 60 721-3-1	5 % ... 95 % at 40 °C 2K3 to IEC 60 721-3-2
Installation altitude	• Cabinet Modules: up to 2000 m above sea level - no derating, > 2000 m - see characteristics/derating data • Motor Modules, Booksize Cabinet Kit format: up to 1000 m above sea level - no derating, > 1000 m - see characteristics/derating data		

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

Mechanical stability			
	In operation	During storage	During transport
Vibrational load - Displacement - Acceleration - Corresponds to class	 0.075 mm at 10 ... 58 Hz 9.8 m/s² at >58 ... 200 Hz -	 1.5 mm at *5 Hz* [3] ... 9 Hz 5 m/s² at > 9 ... 200 Hz 1M2 to IEC 60721-3-1	 3.1 mm at *5 Hz* [3] ... 9 Hz 10 m/s² at > 9 ... 200 Hz 2M2 to IEC 60721-3-2
Shock load - Acceleration - Corresponds to class	 100 m/s² for 11 ms 3M4 to IEC 60721-3-3	 40 m/s² for 22 ms 1M2 to IEC 60721-3-1	 100 m/s² for 11 ms 2M2 to IEC 60721-3-2

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

Note

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

2.11 Derating data

2.11.1 Derating data for chassis format

2.11.1.1 General

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

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

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

Permissible output current as a function of the ambient temperature

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

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

Installation altitude above sea level in m	Current derating factor at an ambient temperature (air intake temperature) of						
	20 °C	25 °C	30 °C	35 °C	40 °C	45 °C	50 °C
0 ... 2000	100 %	100 %	100 %	100 %	100 %	93.3 %	86.0 %

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

Installation altitude above sea level in m	Current derating factor at an ambient temperature (air intake temperature) of						
	20 °C	25 °C	30 °C	35 °C	40 °C	45 °C	50 °C
0 ... 2000	100 %	100 %	100 %	100 %	93.3 %	86.7 %	80.0 %

Installation altitudes greater than 2000 to 5000 m above sea level

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

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

2.11.1.2 Derating measures

Installation altitudes greater than 2000 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
(3 AC 380 to 480 V and 3 AC 500 to 690 V).
- Drives with Smart Line Modules in all voltage levels
(3 AC 380 to 480 V and 3 AC 500 to 690 V).
- Drives with Active Line Modules in the voltage level 3 AC 380 to 480 V
(drives with Active Line Modules for 3 AC 500 to 690 V on request).

Reducing the ambient temperature and the output current

As a result of the lower cooling effect, on one hand, the ambient temperature must be reduced, and on the other hand, the power loss in the Cabinet Module must also be reduced by reducing the output current; whereby ambient temperatures less than 40 °C can be factored in as countermeasure for compensation. The following tables specify the permissible output currents as a function of the installation altitude and ambient temperature for the various degrees of protection. The specified values already take into account the permissible compensation between installation altitude and ambient temperature less than 40 °C (air intake temperature where the air enters the Cabinet Module). The values apply under the precondition that the cooling air flow through the devices – as specified in the technical data – is guaranteed as a result of the cabinet installation.

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

Installation altitude above sea level in m	Current derating factor at an ambient temperature (air intake temperature) of						
	20 °C	25 °C	30 °C	35 °C	40 °C	45 °C	50 °C
0 ... 2000	100 %	100 %	100 %	100 %	100 %	93.3 %	86.0 %
... 2500	100 %	100 %	100 %	100 %	96.3 %		
... 3000	100 %	100 %	100 %	98.7 %			
... 3500	100 %	100 %	100 %				
... 4000	100 %	100 %	96.3 %				
... 4500	100 %	97.5 %					
... 5000	98.2 %						

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

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

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

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

- The isolation transformer must be fed from a low-voltage 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 line supplies with grounded star point (no grounded phase conductor).
  - IT line supplies (operation with a short circuit must be restricted to the absolutely shortest possible time).
- The following line supply types are permissible for drives equipped with Active Line Modules:
  - TN line supplies with grounded star point (no grounded phase conductor, no IT line supplies).

2.11.2 Derating data for booksize format

SINAMICS S120 Cabinet Modules with power units, booksize format, and the associated system components are dimensioned for an ambient temperature of 40 °C and installation altitudes up to 1000 m above sea level. If SINAMICS S120 Cabinet Modules with power units in the booksize format are operated at ambient temperatures higher than 40 °C and/or installation altitudes higher than 1000 m above sea level, then the corresponding derating factors must be taken into account as a function of the ambient temperature and/or the installation altitude. These derating factors 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, IP43 and IP54.

3 Mechanical installation

3.1 Important notes

Transport

⚠ WARNING

Please note the following when transporting the cabinet units:

- The cabinet units are heavy. Their center of gravity is displaced, and they can be top heavy.
- Ensure that the ground at the installation location is strong enough to bear the weight of the cabinet units.
- Suitable hoisting gear operated by trained personnel is also required due to the weight of the cabinet units.
- The cabinet units must always be transported in the upright position indicated. The cabinet units must not be tipped and transported in a horizontal position.
- Transport units comprise several cabinet units. Due to their weight and length, transport units must only be transported with the transport rails mounted on top and the wooden pallets attached.

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

Note

Notes on transportation:

- The cabinet units are packaged by the manufacturer in accordance with the climatic conditions and stresses encountered during transit and in the recipient country.
- The notes on the packaging relating to transportation, storage, and proper handling must be observed.
- The cabinet units must be carried on a wooden pallet when transported with fork-lift trucks.
- NOTICE:
  Cabinet units must not be disassembled while still on wooden pallets and awaiting transport.
- If required, cabinet units can be delivered in transport units. When a crane is used to move the cabinet units, a crane transport assembly is provided for the transport unit.
- Permissible ambient temperatures during transport:
  - -25 °C to +70 °C class 2K3 to IEC 60721-3-2
  - briefly up to -40 °C for max. 24 hours

Note

Notes regarding damage in transit:

- Carry out a thorough visual inspection of the SINAMICS S120 Cabinet Modules before accepting the delivery from the shipping 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 shipping company immediately and ask them to examine the cabinet.
- If you fail to contact them immediately, you may lose your right to claim compensation for the defects and damage.
- If necessary, you can request the support of your local Siemens office.

WARNING

Damage in transit indicates that the cabinet was subject to unreasonable stress. The electrical safety of the cabinet can no longer be ensured. It must not be connected until a thorough high-voltage test has been carried out.

Death, serious injury, or substantial material damage can result if these factors are not taken into account.

WARNING

Inform Technical Support (hotline)

Commissioning must not be carried out, if an indicator has tripped. Please contact Technical Support immediately.

If commissioning is carried out without prior inspection of the indicators, safe operation of the converter cannot be guaranteed. This can result in death, serious personal injury or material damage.

Storage

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

If the cabinet 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.

⚠ WARNING
The cabinet unit should not be stored for more than two years. If the cabinet unit is stored for more than two years, the DC link capacitors of the power units must be reformed during commissioning. The reforming procedure is described in this Manual in the chapter titled "Maintenance and servicing", section "Reforming the DC link capacitors".

CAUTION
Do not apply mechanical loads to the hoods! The hoods (option M23, M43 or M54) are delivered separately and must be installed on site. Therefore the hoods must not be subjected to mechanical loads, otherwise they could be destroyed.

3.2 Mechanical installation: Checklist

Important safety precautions

DANGER

To ensure that the SINAMICS S120 Cabinet Modules operate safely and reliably, they must be properly installed and commissioned by qualified personnel, taking into account all the warning notices provided.

In particular, the general and national installation and safety guidelines for high-voltage installations (e.g. VDE – the Union of German Technical Engineers) as well as the guidelines relating to the proper use of tools and personal protective equipment must be observed.

Death, serious injury, or substantial material damage can result if these guidelines are not observed.

Checklist

Use the following checklist to guide you through the mechanical installation procedure for the cabinet/transport unit. Read the chapter titled "Safety information" before you start working on the cabinet.

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

Note

Check the boxes accordingly in the right-hand column if the activity applies to the cabinet unit in your scope of delivery. 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	Activity	Applicable?/Completed?	
1	Check the transport indicators prior to installation. (→ See the section below titled "Installation/preparation", in section "Transport indicators")		
2	Check the center of gravity label on the cabinet unit		
3	The ambient conditions must be permissible. (→ See general technical data in section "System data" in chapter "System overview")		
4	The load-carrying capacity and properties of the ground must fulfill the requirements for installation of the Cabinet Modules. (→ See the chapter titled "Cabinet Modules" in the technical data for the relevant Cabinet Modules) (→ See Chapter "Mechanical installation", in Section "Preparation")		

Item	Activity	Applicable?/Completed?	
5	The crane transport assembly (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 the subchapter below titled "Installation", in section "Disassembling the crane transport assembly")		
6	Before the cabinet units are finally installed, the wooden pallets supplied with the transport unit must be removed properly. (→ See the following subchapter titled "Installation", in section "Lifting from the transport pallet and installing the cabinet units")		
7	The minimum ceiling height required (for unhindered air discharge) must be observed. The cooling air supply and exhaust must not be obstructed and must be available in sufficient quantity. (→ See the following subchapter titled "Installation", in 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 the following subchapter titled "Installation", section "Connection for side-by-side installation of cabinet units")		
9	The following optional components, which are supplied separately for transport reasons, must be assembled by the customer. This applies to the following options: • IP21 degree of protection with canopy (option M21) • IP23/IP43/IP54 degrees of protection with hood or filter elements (options M23, M43, M54) (→ See Chapter "Options", in section "M21, degree of protection IP21 " and "M23 / M43 / M54, degrees of protection IP23 / IP43 / IP54" under Installation.)		
10	If it is possible to enter the area underneath the cabinet units, plant-side shock protection must be provided for this area.		
11	The handle must be mounted for option L37 (DC interface including pre-charging input circuit). (→ See the chapter titled "Options", subsection "DC interface including pre-charging input circuit")		
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" in section "M26 / M27, side panels mounted to the right or left".)		
13	All shock protection measures (guards, plates) in and on the cabinet units must be installed before commissioning.		
14	The clearance around an open control cabinet door (escape route) specified in the applicable accident prevention guidelines must be observed.		

3.3 Installation

3.3.1 Important safety precautions

⚠ DANGER
To ensure that the cabinet units operate safely and reliably, they must be properly installed and commissioned by qualified personnel, taking into account all the warning notices provided. In particular, the general and national installation and safety guidelines for high-voltage installations (e.g. VDE – the Union of German Technical Engineers) as well as the guidelines relating to the proper use of tools and personal protective equipment must be observed. Death, serious injury, or substantial material damage can result if these guidelines are not observed.

3.3.2 Preparatory steps

3.3.2.1 On-site requirements

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

The operating areas must be dry and free of dust. The air supplied must not contain any electrically conductive gas, vapors, or dust, which could impair operation. It may be necessary to filter the air supplied to the installation room. If the air contains dust, filter mats (option M54) can be installed in front of the ventilation grilles in the cabinet doors and also in front of the hoods, if necessary. Option M54 offers additional protection against water sprayed against the housing from any direction and corresponds to degree of protection IP54.

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

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

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

CAUTION
Cabinet Modules do not fulfill the requirements for IP20 until they have been closed off by installing a side panel on the right (option M26) and a side panel on the left (option M27).

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

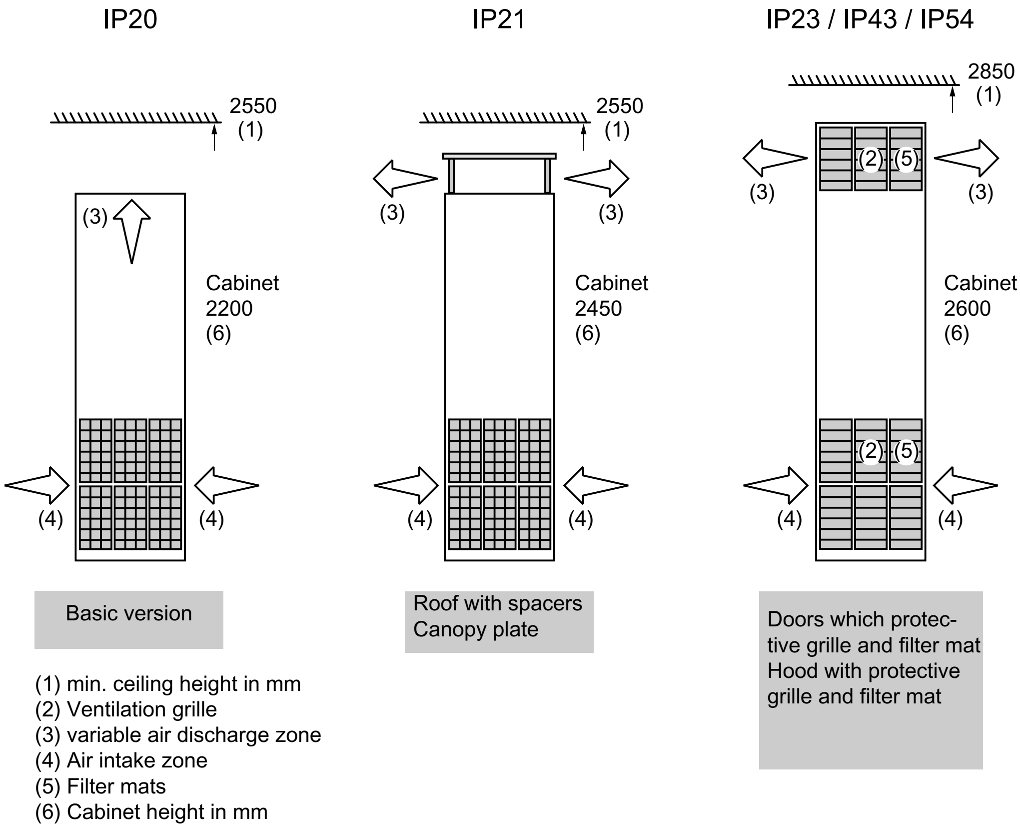


Figure 3-1 Required room height for different degrees of protection

Note

Further dimensions can be found in the relevant dimension drawings on the customer DVD supplied with the device.

The cooling air for the power unit is drawn in from the front through the ventilation grilles in the lower part of the cabinet doors. The warmed air is discharged through the perforated top cover or the ventilation grilles in the hood (with options M23/M43/M54 for degrees of protection IP23/IP43/IP54). Cooling air can also be supplied from below through raised floors or air ducts, for example. To allow this, you have to create openings in the sectioned base plate.

⚠ WARNING

In a residential environment this product can cause high-frequency disturbances, which may make interference-suppression measures necessary.

3.3.2.2 Requirements on the levelness of the floor

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

- Care must be taken to ensure that the doors can be opened and closed and that 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.

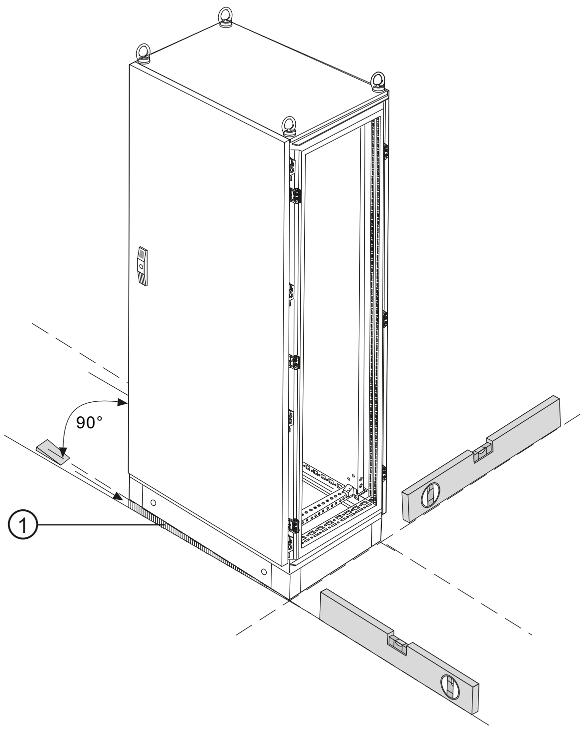


Figure 3-2 Requirements on the levelness of the floor

The following points must be observed to ensure full functionality of the cabinet units:

- The foundation must be level.
- Irregularities must be leveled out.
- Gaps where air can enter caused by leveling measures (e.g.: ① in the diagram) must be 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.

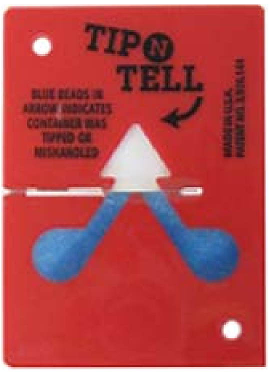


Figure 3-3 Tilt indicator

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.

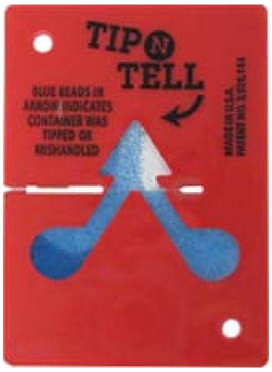


Figure 3-5 Tilt indicator tripped

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**
>
> **Inform Technical Support (hotline)**
>
> Commissioning must not be carried out, if an indicator has tripped. Please contact Technical Support immediately.
>
> If commissioning is carried out without prior inspection of the indicators, safe operation of the converter cannot be guaranteed. This can result in death, serious personal injury or material damage.

Removing the shipping and handling indicators prior to commissioning

CAUTION
The shipping and handling indicators must be removed before commissioning the converter. If this is not observed, the transport indicators can cause damage in the unit when the converter is operated.

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:

- Spanner or socket spanner (width across flats 10)
- Spanner or socket spanner (width across flats 13)
- Spanner or socket spanner (width across flats 16/17)
- Spanner or socket spanner (width across flats 18/19)
- Hexagon-socket spanner (size 8)
- Torque wrench up to 50 Nm
- Screwdriver (size 2)
- Screwdriver Torx T20
- Screwdriver Torx T30

A socket-spanner case with two long extensions is recommended.

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 fixing screws on the transport pallet can be removed from the pallet base without having to raise the cabinet unit. The positions of the fixing screws are indicated by red markings on the outside of the pallets.

⚠ WARNING

The weight specified on the packaging and the designated center of gravity must always be taken into account when the cabinet is lifted or transported.

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 the cabinet is lifted and installed.

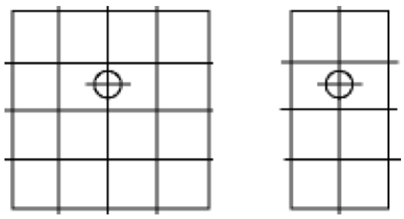


Figure 3-7 Center of gravity of the cabinet

Note

A sticker showing the precise specifications regarding the center of gravity of the cabinet is attached to all cabinets/transport units.

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.

Dismantling

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
The support rails are heavy and must be removed very carefully. Screws can fall into the unit as it is disassembled and cause serious damage when the equipment is started up.

3.3.5 Connection to the foundation

Preparatory steps

- Disconnect the cabinet units to be installed from the power supply.
- Allow unimpeded access to the holes at the bottom of the cabinet units (if necessary, remove 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 ground. The fixing dimensions are specified on the associated dimension drawings.

Note

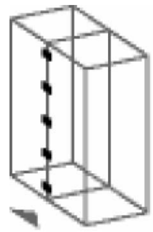
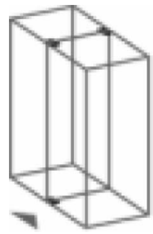
Further dimensions can be found in the relevant dimension drawings on the customer DVD supplied with the device.

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 and the fixing points for connecting the cabinet units.

Table 3- 2 Content of the accessories kit and recommended fixing points

Quantity	Connectors	Fixing points	
4 x	Row clamps (incl. fixing accessories)		
3 x	Row connectors (incl. fixing accessories)		

Preparatory steps

- Disconnect the cabinet units from the power supply.
- Allow unimpeded access to the profiles in the cabinet interior (if necessary, remove the side panels, doors, and protective covers).

Assembling

1. Attach the row clamps/row connectors to the appropriate profiles (as shown in the figures above).
2. Insert and tighten the screws and washers.
3. If necessary, reattach the protective covers and doors.

Note

Installing the top cover or the hood to increase the degree of protection

It makes sense to only increase the degree of protection after installation work has been completed, as in some cases, it is easier to access individual elements from the top, with the top cover removed or with the hood removed than from the front.

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

Electrical installation 4

4.1 Safety information

Required safety precautions before installation work is carried out

⚠ DANGER

The Cabinet Modules are used in industrial high-voltage installations. During operation, this Cabinet Module contains rotating and live parts. For this reason, there is a risk of severe injury or significant material damage if the required covers are removed without authorization, if it is used or operated incorrectly, or if it has not been properly maintained.

You must read and comply with the safety information provided in this Manual.

When carrying out any kind of work on electrical devices, the following five safety rules must always be observed in accordance with EN 50110-1 and EN 50110-2:

- Disconnect from power supply.
- Protect against reconnection.
- Make sure that the equipment is de-energized.
- Ground and short-circuit.
- Cover or enclose adjacent components that are still live.

Note

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 Electrical installation: Checklist

Important safety precautions

⚠ DANGER
The cabinet units are operated with high voltages. All connection work must be carried out when the cabinet is de-energized. All work on the unit must be carried out by trained personnel only. Work on an open unit must be carried out with extreme caution because external supply voltages may be present. The power and control terminals may be live even when the motor is not running. Dangerously high voltage levels are still present in the unit up to 5 minutes after it has been disconnected due to the DC link capacitors. For this reason, the unit should not be opened until a reasonable period of time has elapsed. The user is responsible for ensuring that the motor, cabinet units, and other components are installed and connected in accordance with the recognized technical rules in the country of installation and with other applicable regional regulations. Special attention should be paid to cable dimensioning, fuses, grounding, shutdown, disconnection, and overcurrent protection. If an item of protective gear trips in a branch circuit, a leakage current may have been disconnected. To reduce the risk of fire or an electric shock, the current-carrying parts and other components in the cabinet should be inspected and damaged parts replaced. When an item of protective gear trips, the cause of the trip must be identified and rectified.

CAUTION
Reforming the DC link capacitors The cabinet unit should not be stored for more than two years. If the device is stored for more than two years, its DC link capacitors must be reformed during commissioning. The reforming procedure is described in this Manual in the chapter titled "Maintenance and servicing", section "Reforming the DC link capacitors".

Checklist

Use the checklist below to guide you through the electrical installation procedure for the cabinet. Read all the safety information in the section "Safety information" before carrying out any work on the unit.

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

Table 4- 1 Electrical installation: Checklist

Item	Activity		Applicable?/Completed?	
General information				
1	For strain relief, the cables must be clamped on the cable propping bar (C-type mounting bar).			
2	When EMC-shielded cables are used, screwed glands that connect the shield to ground with the greatest possible surface area must be provided on the motor terminal box. In the cabinet, the cable shields must be secured to the shield buses/plates with the fixing accessories provided to ensure proper EMC.			
3	PE busbar	The PE busbar between the cabinet units or transport units must be linked. A connection with the ground for the entire system must also be established. (→ See the section titled "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 the section titled "DC busbar")		
5	Auxiliary power supply system	The auxiliary power 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 the following section titled "Auxiliary voltage 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	When the Cabinet Modules are operated on an isolated-neutral supply system (IT system), the integrated EMC filters must be deactivated by unscrewing a connection clamp. (→ See the section titled "Operating Cabinet Modules on an isolated-neutral supply system (IT system)"			
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 the following section titled "Connecting the motor cables") (→ See the chapter titled "Cabinet Modules", section "Motor Modules in booksize format") (→ See the chapter titled "Cabinet Modules", section "Motor Modules in chassis format")			
9	When connecting the braking resistor, the maximum permissible cable lengths between Central Braking Module and the associated braking resistor must be observed. The thermal contact of the braking resistor must be wired up and its signal evaluated by the Control Unit or the control. (→ See the chapter titled "Cabinet Modules", section "Central Braking Module")			

Item	Activity	Applicable?/Completed?	
10	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 at terminals R1 and R2 on the Braking Module. The thermal contact of the braking resistor must be wired up and its signal evaluated by the controller. (→ See the chapter titled "Options", section "L61/L62, L64/L65, braking units")		
11	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 the chapter titled "Cabinet Modules", section "Motor Modules in chassis format")		
12	The DC coupling – including the pre-charging 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 parameterized. (→ See the chapter titled "Options" under "L37, "DC interface including pre-charging circuit of the associated DC link capacitance" in section "Commissioning the DC interface")		
13	The cable shields must be properly applied.		
14	The circuit breaker's tripping current must be set in accordance with the specific plant conditions. (→ See the chapter titled "Cabinet Modules", section "Line Connection Modules")		
15	The correct operating voltage must be 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 chassis format. Fine tuning to the relevant line voltage is performed by reconnecting the transformer taps. (→ See the chapter titled "Electrical installation" in section "Adjusting the fan voltage")		
16	The correct internal power supply must be 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 the chapter titled "Cabinet Modules", section "Line Connection Modules") (→ See the chapter titled "Cabinet Modules", section "Auxiliary Power Supply Module")		
17	Adapt the fuse protection for the transformer in the Auxiliary Power Supply Module for a line supply voltage in the 3 AC 380 to 480 V voltage range. (→ See the chapter titled "Cabinet Modules", section "Auxiliary Power Supply Module")		
18	When the degree of protection is increased > IP21, the installed fan in the Line Connection Module with option L43 must be supplied with 230 V AC from the auxiliary power module of the Motor Module. (→ See the chapter titled "Options", Section "L43 Line Connection Modules for Basic Line Modules")		

Item	Activity		Applicable?/Completed?	
19	The date of manufacture can be determined from the rating plates 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 initial commissioning or the downtime of the power components is shorter than 2 years, the DC link capacitors do not have to be reformed. If the unit has not been operational for longer than 2 years, then the DC link capacitors must be reformed as described in this Manual in the Chapter titled "Maintenance and servicing", section "Reforming the DC link capacitors".			
Signal connections				
20	Cabinet operation by higher-level controller/control room. The control cables must be connected in accordance with the interface assignment and the shield applied. To prevent interference, the control cables must be laid separately from the power cables. Cabling and connections must always comply with the relevant EMC guidelines. (→ See the chapter titled "Electrical installation")			
21	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				
22	G30, CBC10 Communication Board	The supplied CBC10 may only be inserted when the Control Unit is disconnected from the power supply. (→ See the chapter titled "Options", section "G30, CBC10 Communication Board")		
23	G33, CBE20 Communication Board	The supplied CBE20 may only be inserted when the Control Unit is disconnected from the power supply. Note the MAC address before inserting! (→ See the chapter titled "Options", section "G33, CBE20 Communication Board")		
24	K01 - K05, Safety license for 1 - 5 axes	Activating the safety licenses. (→ See Chapter "Options" in Section "K01 - K05, Safety license for 1 - 5 axes")		
25	K46, SMC10 Sensor Module	The SMC10 Sensor Module is used for detecting the actual motor speed and the rotor position angle. The following encoders are supported by the SMC10 Sensor Module: • Resolver, 2 pole • Resolver, multi-pole (→ See the chapter titled "Options", section "K46, SMC10 Sensor Module for detecting the actual motor speed and the rotor position angle")		

Item	Activity		Applicable?/Completed?	
26	K48, SMC20 Sensor Module	The SMC20 Sensor Module is used for detecting the actual motor speed and the path length. The following encoders are supported by the SMC20 Sensor Module: • Incremental sin/cos 1Vpp • EnDat absolute encoder • SSI encoder (→ See the chapter titled "Options", section "K48, SMC20 Sensor Module for detecting the actual motor speed and the path length")		
27	K50, SMC30 Sensor Module	The SMC30 Sensor Module is used for detecting the actual motor speed. The following encoders are supported by the SMC30 Sensor Module: • TTL encoder • HTL encoder • SSI encoder (→ See the chapter titled "Options", section "K50, SMC30 Sensor Module for detecting the actual motor speed")		
28	K76, auxiliary voltage generation in the Line Connection Module	In order to supply the auxiliary voltage 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 the chapter titled "Options", section "K76, auxiliary voltage generating unit in the Line Connection Module")		
29	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 the chapter titled "Electrical installation", in the section "Cable routing for the "Safe Torque Off" and "Safe STOP 1" functions") (→ See the Chapter titled "Options", in Section "K82, terminal module for activating safety functions "Safe Torque Off" and "Safe STOP 1"")		
30	K87, Terminal Module TM54F	Establish the connection according to "Cable routing for the functions TM54F". (→ See the chapter titled "Electrical installation" in section "Cable routing for the Terminal Module TM 54F") (→ See the chapter titled "Options", in section "K87, Terminal Module TM54F")		
31	L25, circuit breaker in withdrawable unit design	Wire up the checkback contact. (→ See the chapter titled "Options", section "L25, circuit breaker in withdrawable unit design")		
32	L45, EMERGENCY OFF pushbutton in the cabinet door	Include the option in the EMERGENCY OFF chain. (→ See the chapter titled "Options", section "L45, EMERGENCY OFF pushbutton in the cabinet door")		

Item	Activity		Applicable?/Completed?	
33	L46, grounding switch upstream of circuit breaker	The interlock for the upstream, plant-side main breaker must be ensured. (→ See the chapter titled "Options", section "L46/L47, grounding switch upstream/downstream of circuit breaker")		
34	L47, Grounding switch downstream of circuit breaker	The main breaker cannot be closed when the grounding switch is closed. (→ See the chapter titled "Options", section "L46/L47, grounding switch upstream/downstream of circuit breaker")		

4.3 EMC-compliant design

For detailed configuration instructions regarding the EMC-compliant design of drives and control cabinet configuration, refer to the "SINAMICS Low Voltage Configuration Manual" provided on the customer DVD supplied with the unit.

4.4 Connections

4.4.1 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 have already been established in the 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 individual connections that have to be established are defined in the system planning and configuring phases. See the system circuit diagram and layout plan.

Table 4- 2 Connection overview for Cabinet Modules

Connection	Required connections for Cabinet Modules								
	Line Connection Module	Basic Line Module	Smart Line Module	Active Line Module	Booksize Base Cabinet	Booksize Cabinet Kit	Motor Module Chassis format	Central Braking Module	Auxiliary Power Supply Module
PE busbar	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
DC busbars between the Cabinet Modules	*	Yes	Yes	Yes	Yes	No	Yes	Yes	*
Auxiliary power supply system	No	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Line connection	Yes	No	No	No	No	No	No	No	Yes
Motor cables	No	No	No	No	No	Yes	Yes	No	No
Braking resistor	No	*	*	*	No	No	*	Yes	No

* optional

4.4.2 PE busbar

4.4.2.1 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
- Chassis format Motor Modules
- Central Braking Modules
- Auxiliary Power Supply Modules

Description

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

Note

When connecting the ground connections to the PE busbar, make sure that the cabinet doors will still close. Additional wiring in the cabinets is not required.

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

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

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).

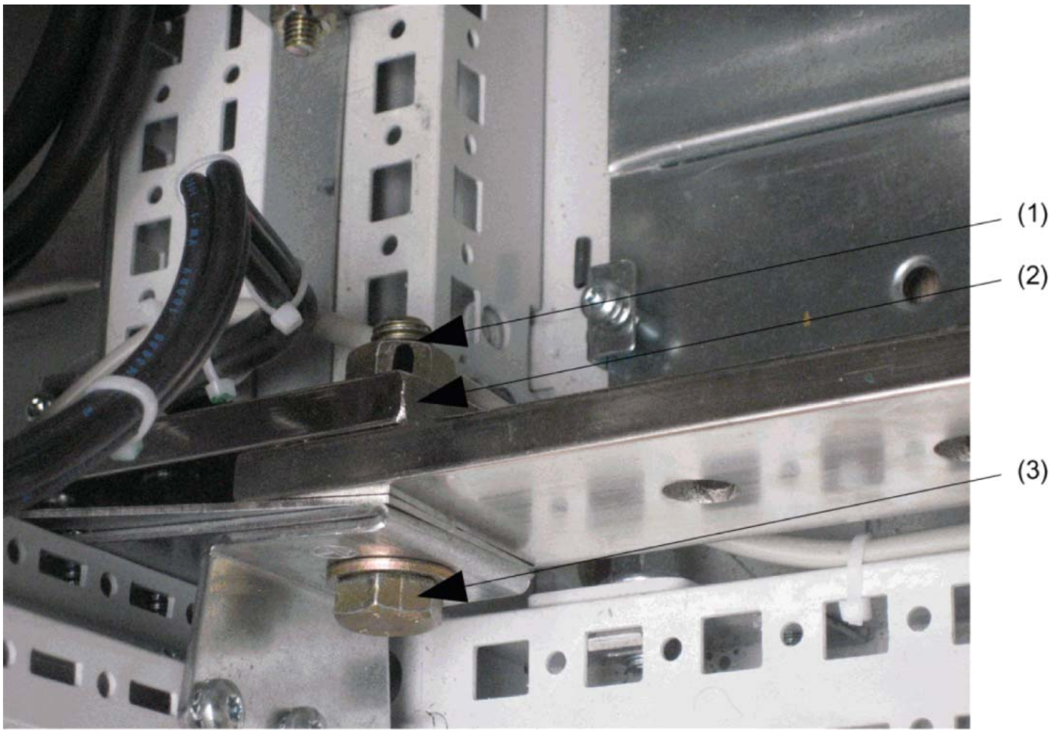


Figure 4-1 Connecting the PE busbar when cabinet units are installed side-by-side

Establishing the connection

1. Loosen the 1 x M12 nut of the PE busbar on the 1st cabinet.
2. Remove the nut, washer (1), 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 nuts (tightening torque: 50 Nm).

4.4.2.3 Connection according to the system-side grounding concept

⚠ DANGER
Once you have established the connections to the PE busbar in the cabinet and/or established the connections to the PE busbar across more than one cabinet unit, you must establish a connection to the central ground of the entire system.

4.4.2.4 Connecting external cables to the PE busbar

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

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.
- Observe the "five safety rules".
- Allow unimpeded access to the PE busbar of the cabinet units (if necessary, remove the protective covers during installation work).

Establishing the connection

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

4.4.3 DC busbar

4.4.3.1 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
- Chassis format Motor Modules
- Central Braking Modules

Description

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

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

- Line Connection Module
- Auxiliary Power Supply Module

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

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Note

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 variants as well.

For the other available variants, the number of jumpers used 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 each DC busbar for 2 x nn x 10 busbars (options M83 to M85)
- 3 jumpers for each DC busbar for 3 x nn x 10 busbars (options M86 and M87)

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

Preparatory steps

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

Note

Connecting the DC busbar 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.

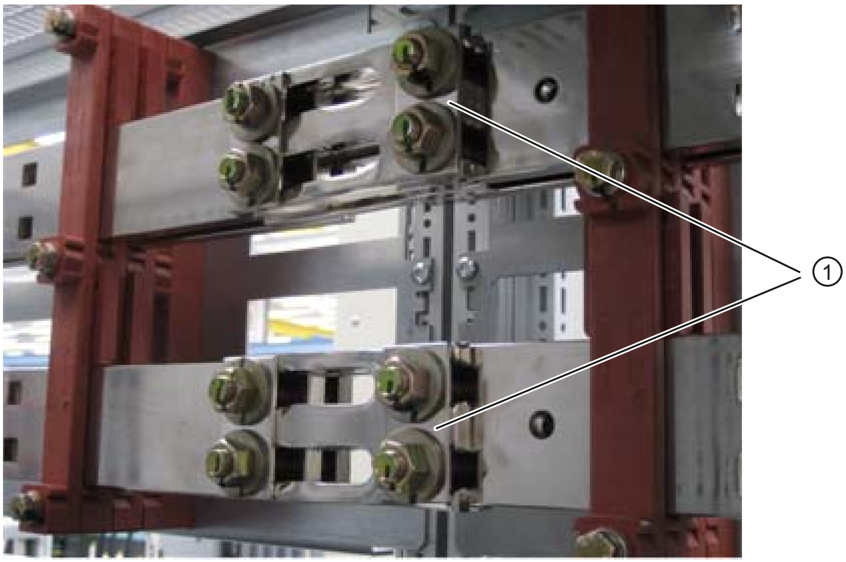


Figure 4-2 Connecting the DC busbar when cabinet units are installed side-by-side

Establishing the connection

1. Loosen the 2 x M12 nuts on the upper DC busbar (DC P) on the right side of the first cabinet.
2. Loosen the 2 x M12 nuts on the DC busbar on the left side of the second cabinet.
3. Withdraw jumper ① from the DC busbar in the first cabinet and slide it into the DC busbar of the second cabinet as far as it will go
4. Re-tighten the nuts on the DC busbar in both cabinet units
   (torque: 50 Nm).
5. Repeat steps 1 to 4 for the lower DC busbar (DC N).

CAUTION
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. All jumpers of the DC busbar must always be connected in busbar systems. 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

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.

4.4.4 Auxiliary power supply system

4.4.4.1 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
- Chassis format Motor Modules
- Central Braking Modules

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 is to use option K76 "Auxiliary voltage generating unit in the Line Connection Module" or to feed the auxiliary voltages to the auxiliary power supply system from an external source.

The maximum load-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.

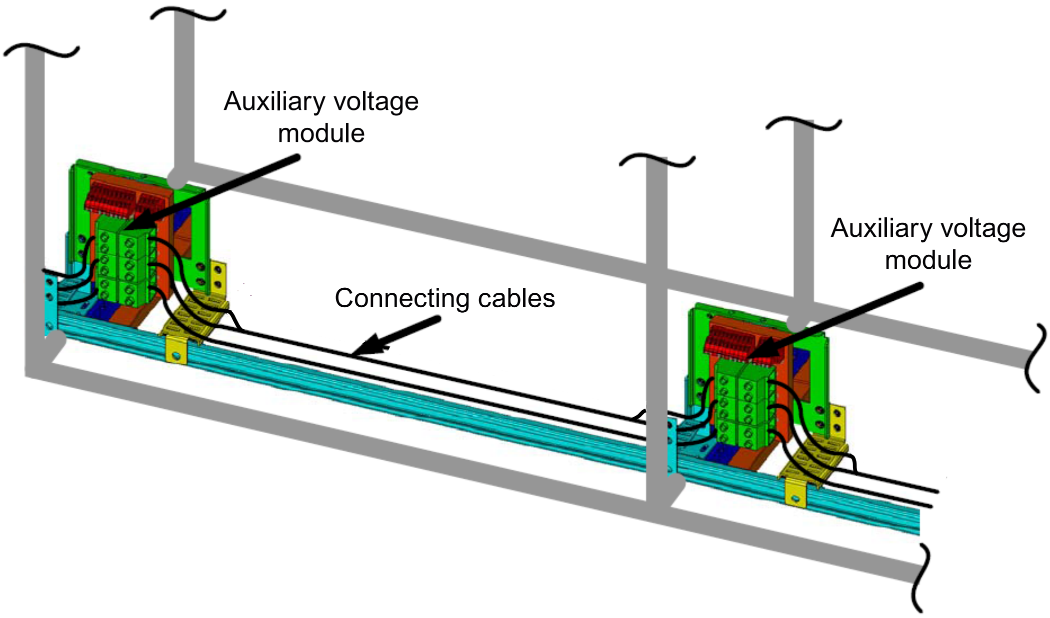


Figure 4-3 Auxiliary power supply system for voltage distribution

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 power supply (1, 2) and for 230 V AC (3, 4), and an additional screened 2-phase cable for 24 V DC (1, 2).

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

Auxiliary power module

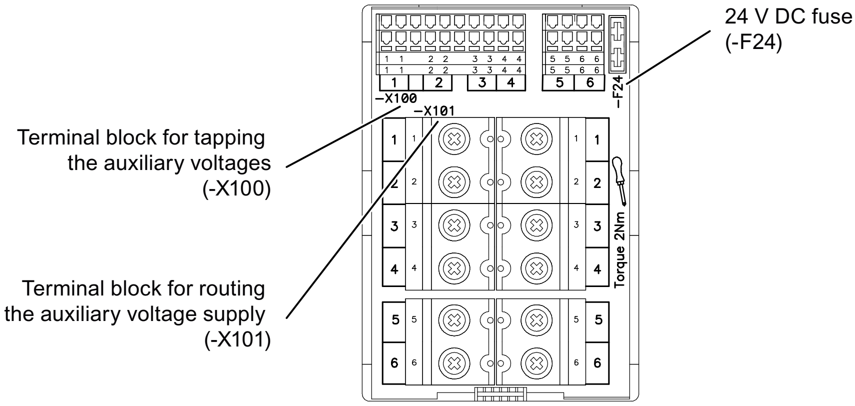
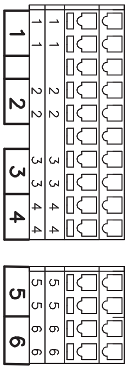


Figure 4-4 Auxiliary power module with terminal blocks -X100, -X101 and 24 V DC fuse

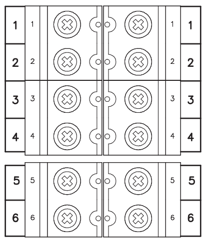
Table 4- 3 X100, terminal block for tapping the auxiliary voltages

	Terminal	Designation	Voltage tap	Rated current
	1	L1	Line voltage (for fan supply via transformer): • 380 to 480 V 2 AC or • 500 to 690 V 2 AC (max. 759 V AC)	max. 16 A 1)
	2	L2		
	3	L1	230 V 1 AC (max. 265 V AC)	max. 16 A 1)
	4	N		
	5	P24	24 V DC for the electronics power supply (max. 30 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). Spring-loaded terminal, conductor cross section: single-wire and flexible cables 0.08 to 2.5 mm^2				

1) Max. total current of all tapping terminals available

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

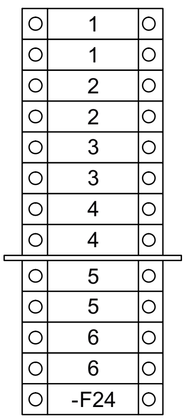
Table 4- 4 X101, terminal block for routing the auxiliary voltage connecting cables

	Terminal	Designation	Assigned voltages	Rated current
	1	L1	Line voltage (for fan supply via transformer): • 380 to 480 V 2 AC or • 500 to 690 V 2 AC (max. 759 V AC)	Max. 80 A
	2	L2		
	3	L1	230 V 1 AC (max. 265 V AC)	Max. 80 A
	4	N		
	5	P24	24 V DC for the electronics power supply (max. 30 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). Conductor cross section: single-wire and flexible cables 0.5 to 35 mm^2 Tightening torque: 2 Nm				

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.

Table 4- 5 X100, terminal block in the Line Connection Module for routing the auxiliary voltages

	Terminal	Voltage tap	Rated current
	1	Line voltage: • 380 to 480 V 2 AC or • 500 to 690 V 2 AC (max. 759 V AC)	Max. 80 A
	1		
	2		
	2		
	3	230 V 1 AC (max. 265 V AC)	Max. 80 A
	3		
	4		
	4		
	5	24 V DC for the electronics power supply (max. 30 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). Conductor cross section: single-wire and flexible cables 2.5 to 16 mm^2 Tightening torque: 2 Nm			

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

Fuse

A 10 A-fuse is incorporated in the auxiliary power modules to protect the 24 V DC-auxiliary voltage. The order number for this fuse as a spare part is 6SL3760-0BG0-0AA0.

Connecting cables

Table 4- 6 Voltage assignment for connecting cables

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

> **DANGER**
>
> When establishing connections to the auxiliary power supply system, you must ensure that you do not mix up the power supplies. Errors or carelessness can result in serious injury or damage to the components or system.

4.4.4.2 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)

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

Description

Prefabricated cables for connecting the auxiliary power 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

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

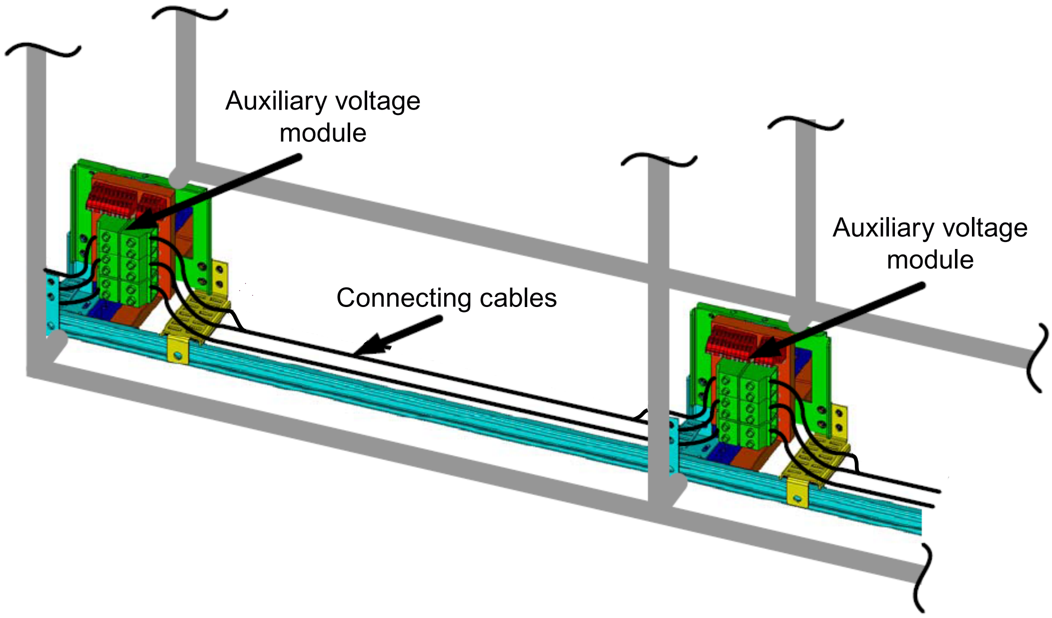


Figure 4-5 Terminal block -X101, Connection of the auxiliary power supply system when cabinet units are installed side-by-side

Establishing the connection

> ⚠ CAUTION
>
> Take care not to cut yourself on the sharp edges inside the cabinet when connecting the auxiliary power supply system.

1. Disconnect the cabinet from the power supply.
2. Observe the "five safety rules".
3. Fasten the cables to terminal block -X101 of the next module:
   4-phase cable (1-2): for line voltage to terminals 1 and 2
   4-phase cable (3-4): for 230 V AC to terminals 3 and 4
   2-phase cable (1-2): for 24 V DC to terminals 5 and 6

Note

Establishing the connection for Basic Line Modules

Basic Line Modules do not contain auxiliary power modules. The 24 V DC voltage supply is provided by connecting the 2-phase cable included in the Basic Line Module to the auxiliary power module of the adjacent cabinet unit.

> ⚠ DANGER
>
> When establishing connections to the auxiliary power supply system, you must ensure that you do not mix up the power supplies. Errors or carelessness can result in serious injury or damage to the components or system.

4.4.4.4 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.

4.4.5 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.
- Observe the "five safety rules".

DANGER

When connecting permanently excited synchronous machines, you must ensure that the motor is shut down or electrically isolated (option L34); otherwise, the voltage generated can be lethal.

Motor Modules Booksize Cabinet Kit

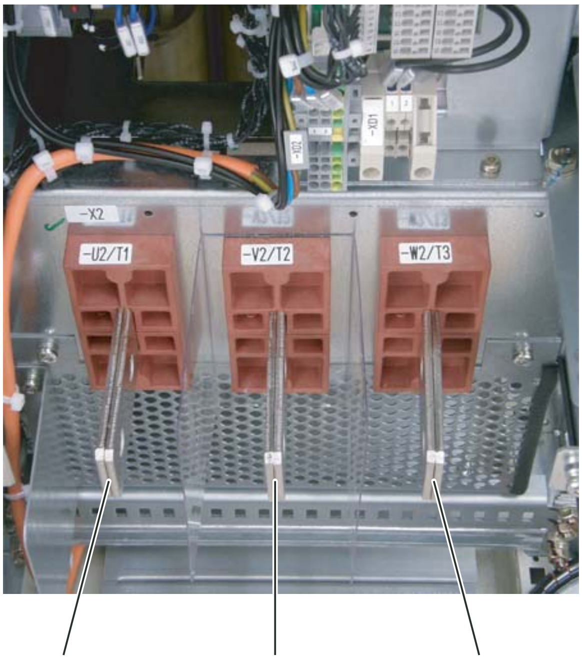
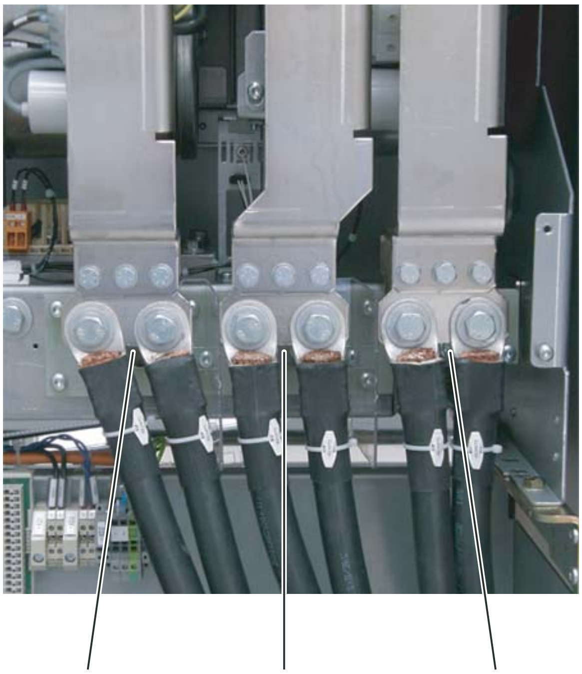
Table 4- 7 Motor connection, Motor Modules

Terminals	Technical data
DCP, DCN DC power input	Voltage: 510 ... 750 V DC
U2/T1, V2/T2, W2/T3 3 AC power output	Voltage: 0 V 3 AC to 0.72 x DC link voltage Terminals: 6 ... 95 mm² (→ see technical data)

Chassis format Motor Modules

Table 4- 8 Motor connection, Motor Modules

Terminals	Technical data
DCP, DCN DC power input	Voltage: 510 ... 750 V DC 675 ... 1080 V DC
U2/T1, V2/T2, W2/T3 3 AC power output	Voltage: 0 V 3 AC to 0.72 x DC link voltage Connection: M12 / 50 Nm for ring cable lugs to DIN 46234

<table>
<tr><th colspan="3">Frame sizes FX and GX</th><th colspan="3">Frame sizes HX and JX</th></tr>
<tr><td colspan="3">
</td><td colspan="3"></td></tr>
<tr><td>-U2/-T1</td><td>-V2/-T2</td><td>-W2/-T3</td><td>-U2/-T1</td><td>-V2/-T2</td><td>-W2/-T3</td></tr>
</table>

Connecting the motor cables

1. Open the cabinet and remove the covers in front of the connection panel for motor cables (terminals U2/T1, V2/T2, W2/T3; X2).
2. Move or remove the base plate below the connection panel through which the motor cables are fed.
3. Screw the protective earth (PE) onto the PE busbar at the specified points in the cabinet (50 Nm with M12).
4. Screw the motor cables onto the terminals.
   Make sure that the conductors have been connected properly (U2/T1, V2/T2, W2/T3).

CAUTION
Tighten the screws with the appropriate torque (50 Nm with M12), otherwise the terminal contacts could heat up excessively during operation.

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

For the position of the connections for motor cables, see the layout diagrams included on the customer DVD supplied with the device.

The motor ground should be fed back directly to the cabinet (PE busbar) and connected.

Connection cross sections

Refer to the "Technical data" for the Motor Modules, "Cabinet Modules" chapter for the maximum connection cross sections.

Direction of motor rotation

In the case of three-phase induction motors with a clockwise phase sequence (looking at the drive shaft), the motor must be connected to the cabinet unit as follows.

Table 4- 9 Cabinet and motor connection terminals

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

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

Note

If an incorrect phase sequence was connected when the cables were routed, and the phase sequence cannot be corrected by subsequently swapping the motor cables, it can be corrected by means of a negative setpoint entry or by changing a parameter.

With motors that can be operated in a star/delta configuration, the windings must be checked to ensure that they have been connected properly. Please refer to the relevant documentation for the motor and note the permissible insulation voltage when connecting the motor to a converter.

4.4.6 Line supply connections

Line Connection Modules

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

Table 4- 10 Line supply connection, Line Connection Modules

Terminals	Technical data
U1/L1, V1/L2, W1/L3 3 AC power input	Voltage: 3 AC 380 V -10 % to 3 AC 480 V +10 % (-15 % < 1 min) 3 AC 500 V -10 % to 3 AC 690 V +10 % (-15 % < 1 min) Connecting thread: M12/50 Nm for ring cable lugs to DIN 46234

4.4.7 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 fans. The locations of the transformers are indicated in the layout diagrams supplied.

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

Note

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

Note

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

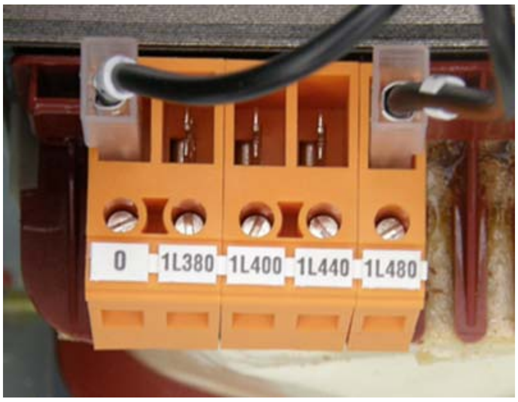


Figure 4-6 Setting terminals for the fan transformers (380 to 480 V 2 AC)

Figure 4-7 Setting terminals for the fan transformers (500 to 690 V 2 AC)

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

⚠ CAUTION

If the terminals are not reconnected to the actual line voltage:

- The required cooling capacity cannot be provided because the fan rotates too slowly;
- The fan fuses may blow due to an overcurrent.

Note

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

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

Table 4- 11 Line voltage assignments for setting the fan transformer (380 to 480 V 2 AC)

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

Table 4- 12 Line voltage assignments for setting the fan transformer (500 to 690 V 2 AC)

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

4.4.8 Operating Cabinet Modules on an isolated-neutral supply system (IT system)

When the Cabinet Modules are operated on an isolated line supply system (IT system), the integrated EMC filters must be deactivated by unscrewing a connection bar in the following Cabinet Modules:

- Basic Line Modules
- Smart Line Modules
  (on frame sizes HX and JX, the connection bar is located behind the fan)
- Active Line Modules (connection bar in the Active Interface Module)

⚠ WARNING
Failing to remove the connection bar to the EMC filter on a non-grounded line supply/IT line supply can cause significant damage to the device.

Basic Line Modules

When a Basic Line Module is operated from an isolated line supply (IT line supply), the connection bar for the interference-suppression capacitor must be removed.

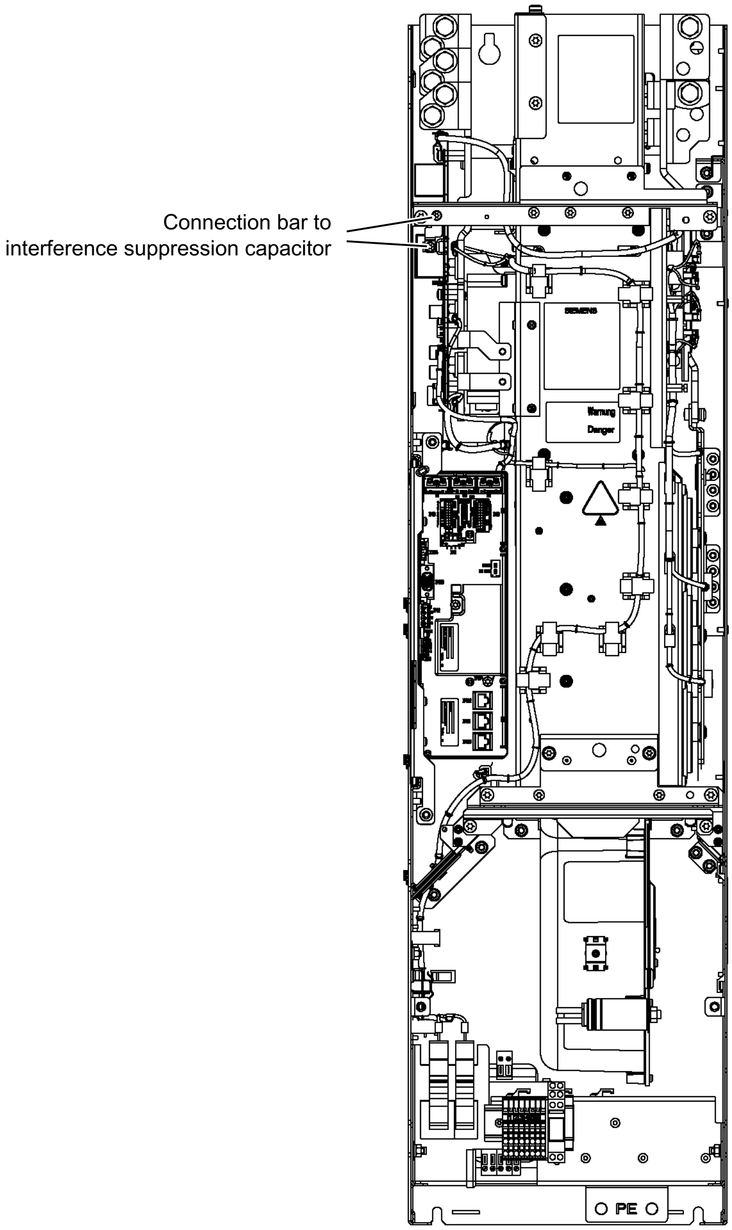


Figure 4-8 Removing the connection bar to the interference suppression capacitor in the Basic Line Module for frame size FB

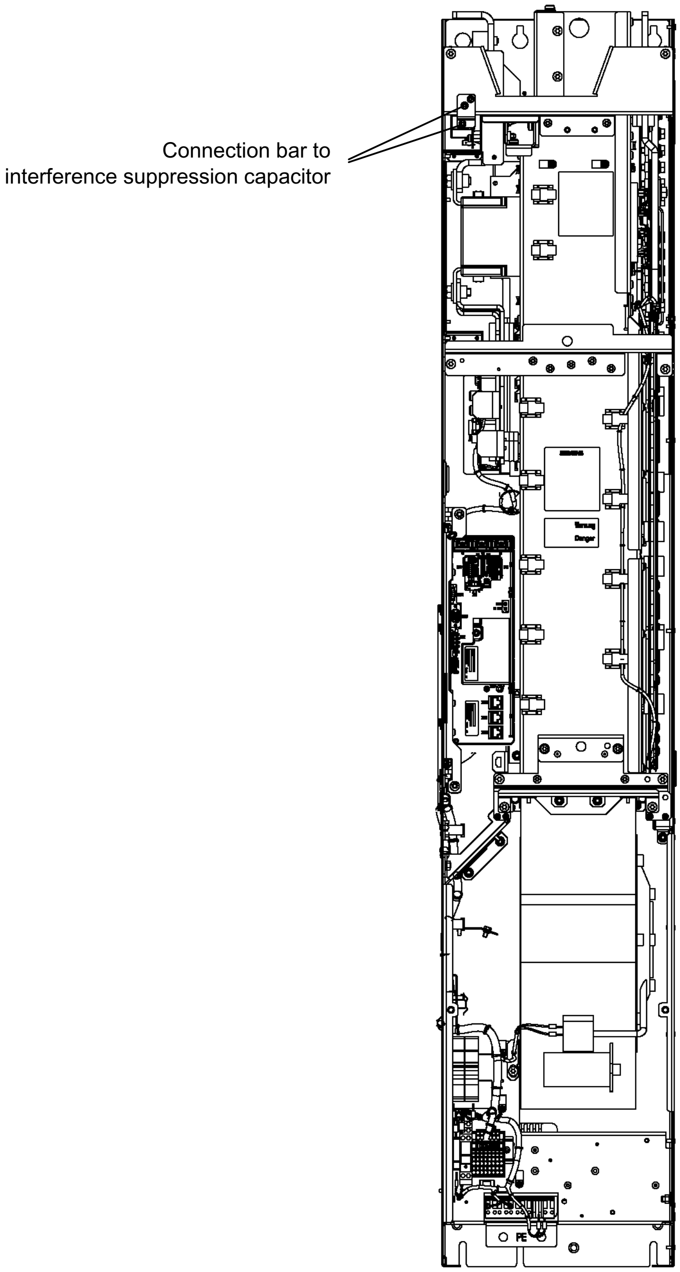


Figure 4-9 Removing the connection bar to the interference suppression capacitor in the Basic Line Module for frame size GB

Smart Line Modules

When the device is operated on an isolated line supply (IT line supply), the connection bar to the interference suppression capacitor must be removed (e.g.: "1" in figure below).

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

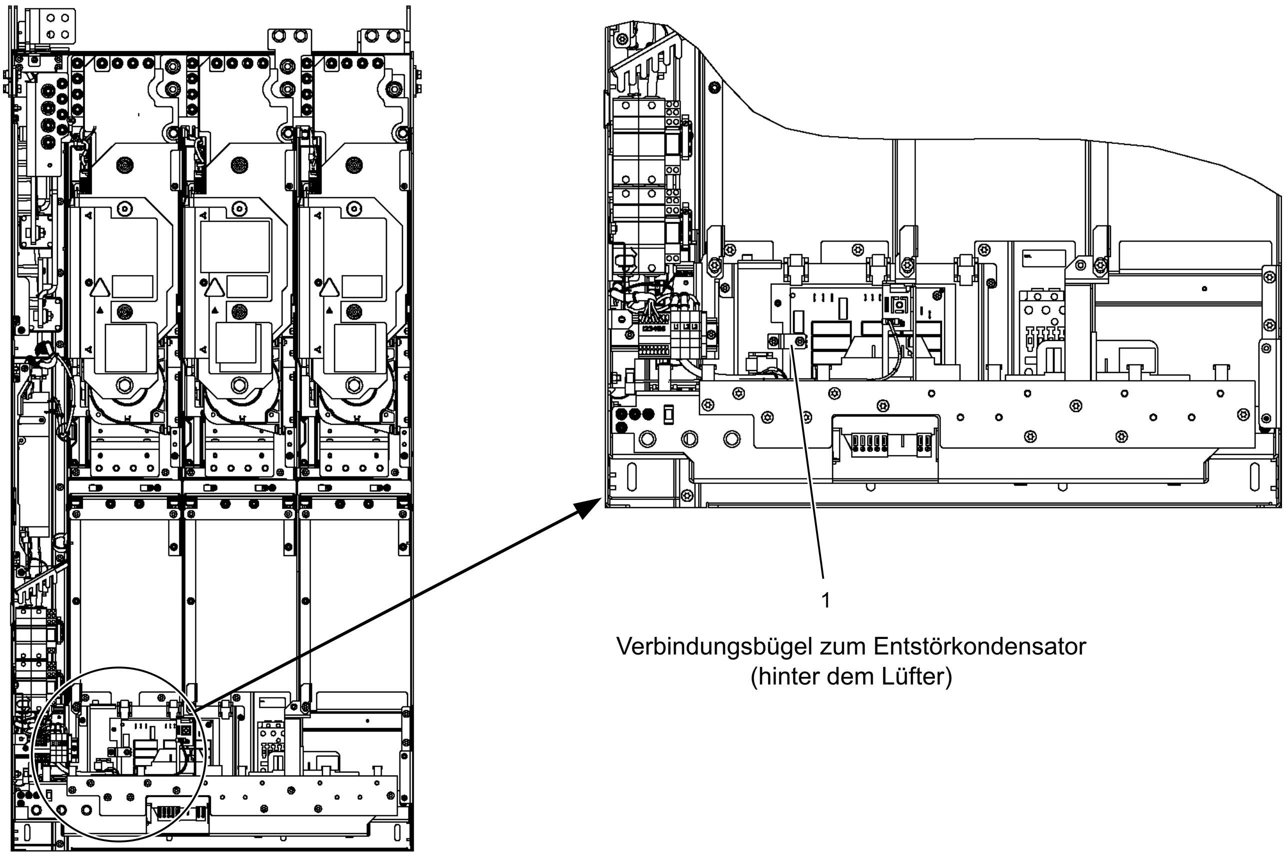


Figure 4-10 Removing the connection bar to the interference suppression capacitor in the Smart Line Module for frame size JX

Active Line Modules

If the cabinet unit is operated on an ungrounded line supply/IT line supply, the connection bar for the interference suppression capacitor of the Active Interface Module (-A2) must be removed.

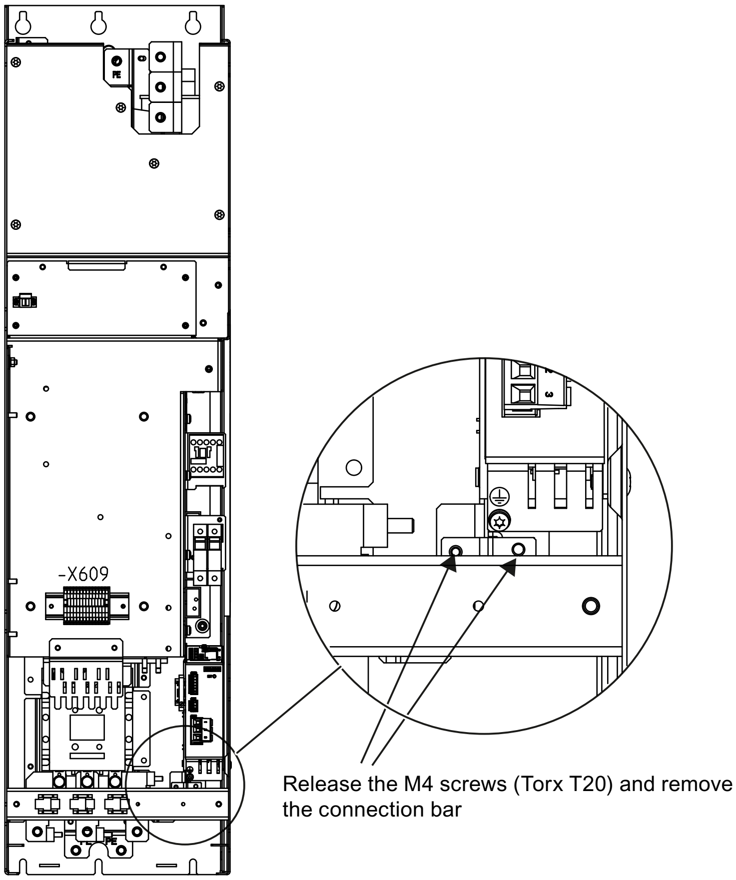


Figure 4-11 Removing the connection bar to the interference suppression capacitor in the Active Interface Module for frame size FX

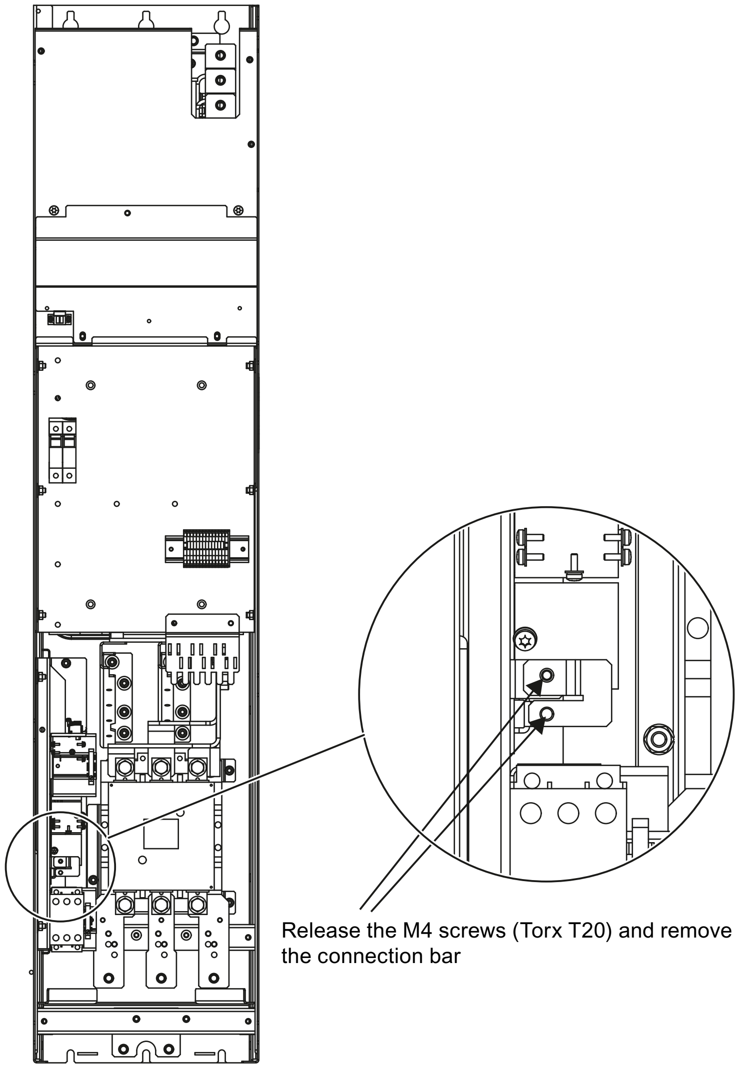


Figure 4-12 Removing the connection bar to the interference suppression capacitor in the Active Interface Module for frame size GX

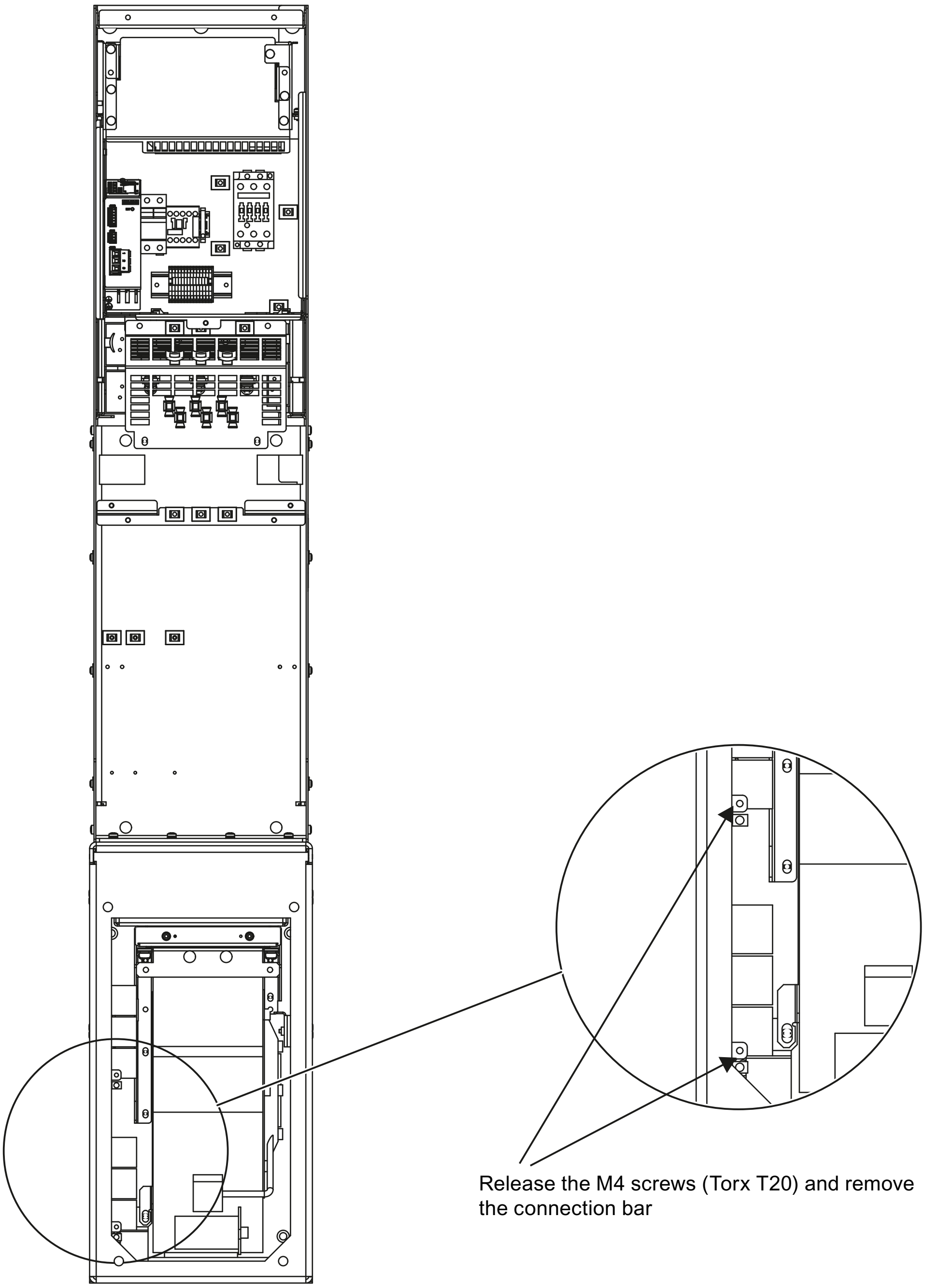


Figure 4-13 Removing the connection bar to the interference suppression capacitor in the Active Interface Module for frame size HX

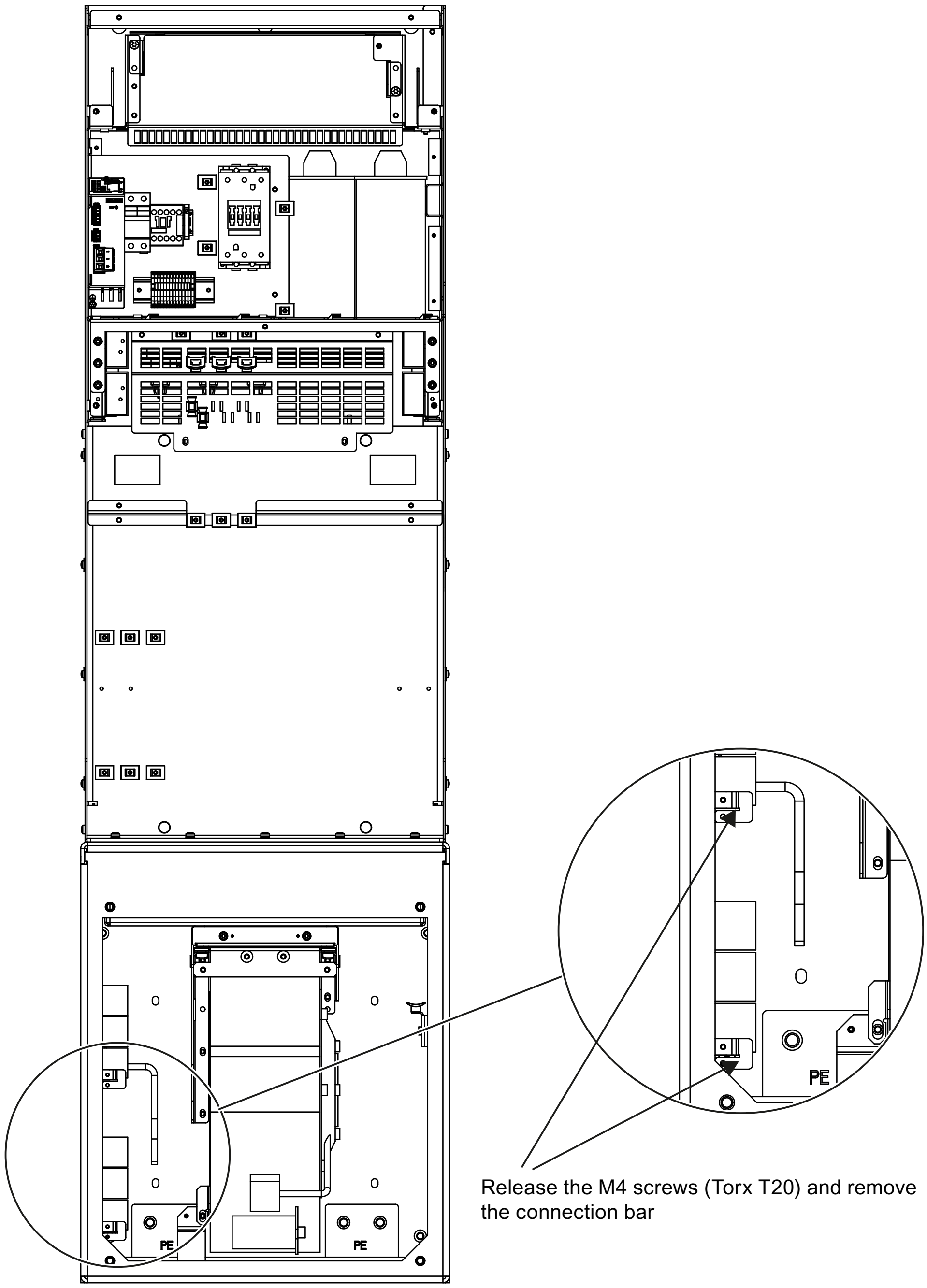


Figure 4-14 Removing the connection bar to the interference suppression capacitor in the Active Interface Module for frame size JX

4.4.9 Signal connections

Note

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.

4.4.10 Other connections

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

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

4.4.11 Cable routing

4.4.11.1 General information

⚠ DANGER

The work described in this section is carried out in cabinets that are operated in industrial high-voltage installations. During operation, this cabinet contains rotating and live parts. For this reason, there is a risk of severe injury or significant material damage if the required covers are removed without authorization, if it is used or operated incorrectly, or if it has not been properly maintained.

You must read the safety information and application notes.

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.
- Observe the "five safety rules".
- Allow unimpeded access to the necessary components in the Cabinet Module (if necessary, remove the covers).

Safety and EMC

⚠ DANGER
All covers removed while the cables were being routed must be replaced before the Cabinet Module is commissioned!

NOTICE
When routing cables, utmost care must be taken not to change the internal cabinet wiring!

NOTICE
The shield plates must be replaced before the cabinet is commissioned, in order to ensure that shielding is EMC-compliant! The motor cable shields must be secured to the EMC shield bus (option M70) and the PE cables to the PE busbar!

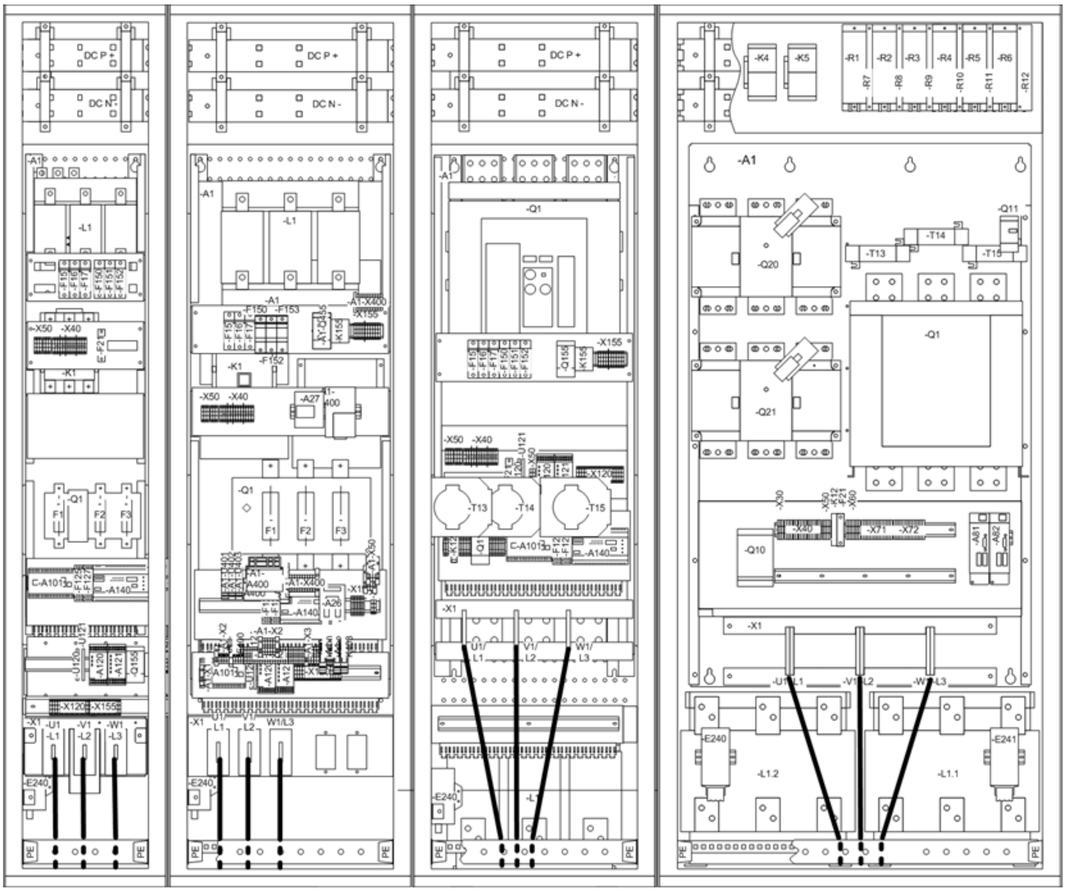
4.4.11.2 Cable routing for Line Connection Modules

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

Table 4- 13 Checklist for cabling or connection work for Line Connection Modules

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

Cable routing for connecting to the supply infeed

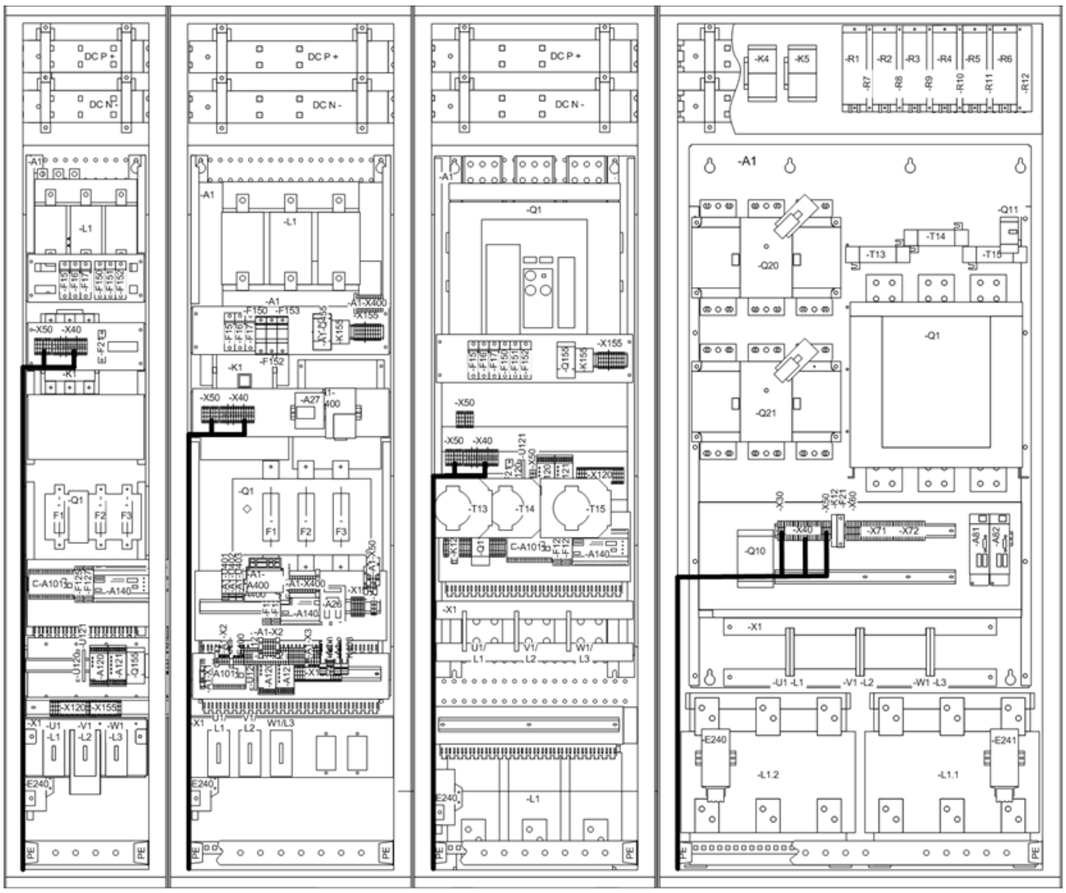


1. Feed the infeed cable into the cabinet from the bottom.
2. Connect the PE cable to the grounding bar.
3. Feed the cable up through the cabinet to terminal block -X1.
4. Secure the cable at suitable points.
5. Connect the cable to the terminal block.

Signal cables

Frame size:

FL GL/HL JL KL/LL



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.

4.4.11.3 Cable routing for Basic Line Modules

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

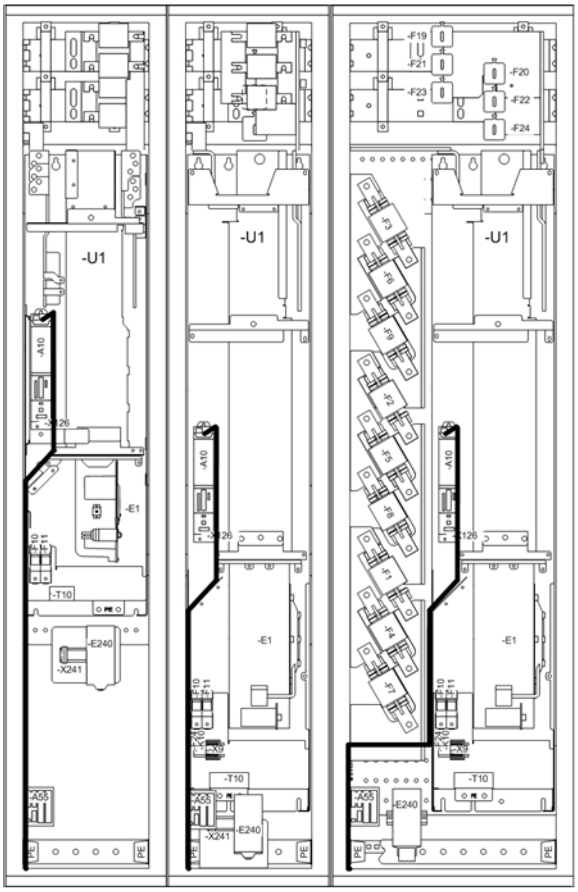
Table 4- 14 Checklist for cabling or connection work for Basic Line Modules

Cable routing	Completed?
PROFIBUS cables to the Control Unit	
DRIVE-CLiQ connections / signal cables to the Control Unit	
Signal cables to the customer terminal block –X55	
Notice: 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 connection to the Control Unit

Frame size:

FB GB GD

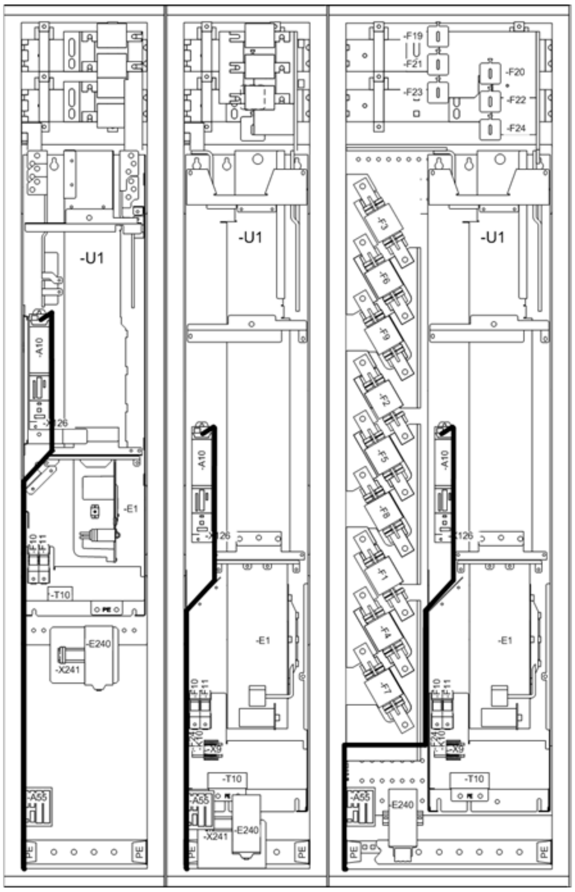


1. Feed the cable for the Control Unit into the cabinet from the bottom left.
2. Remove approx. 3 cm of the cable insulation at the level of the shield plate in the lower part of the cabinet and attach the cable.
3. To secure the cable in accordance with EMC requirements, snap the clip onto the shield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

Cable routing for DRIVE-CLiQ connections and signal cables

Frame size:

FB GB GD

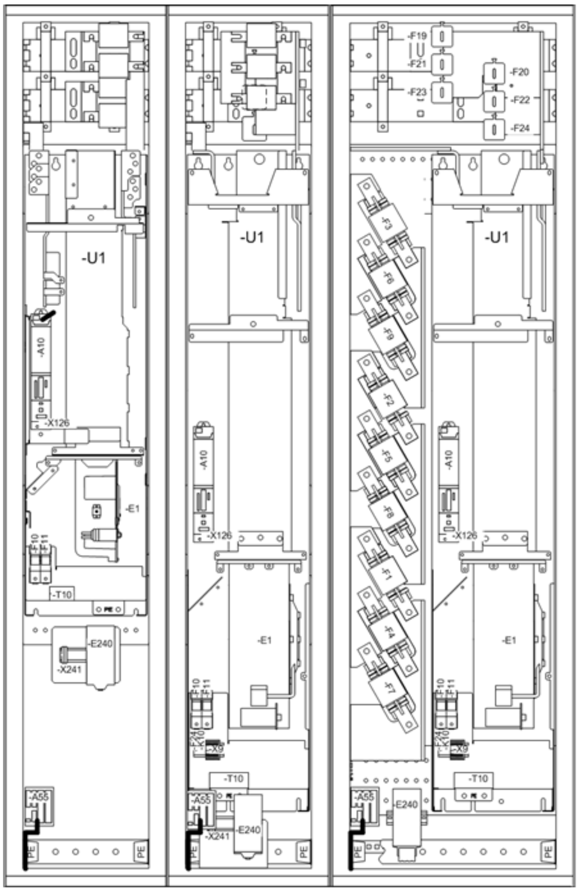


1. Feed the DRIVE-CLiQ/signal cable into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Feed the cable up through the cabinet and, when it reaches the Control Unit, guide it up and to the right towards the Control Unit. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
4. Use cable ties to secure the cable at suitable points.
5. Connect DRIVE-CLiQ/signal cable to the Control Unit.

Cable routing to the customer terminal block -X55

Frame size:

FB GB GD



1. Feed the cable for the customer terminal block into the cabinet from the bottom left.
2. Remove approx. 3 cm of the cable insulation at the level of the shield plate in the lower part of the cabinet and attach the cable.
3. To secure the cable in accordance with EMC requirements, snap the clip onto the shield plate.
4. Use cable ties to secure the cable at suitable points.
5. Guide the cable further up into the cabinet and, when it reaches customer terminal block -X55, guide it to the left or right to -X55. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
6. Use cable ties to secure the cable at suitable points.
7. Connect the cables to the customer terminal block -X55.

4.4.11.4 Cable routing for Smart Line Modules

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

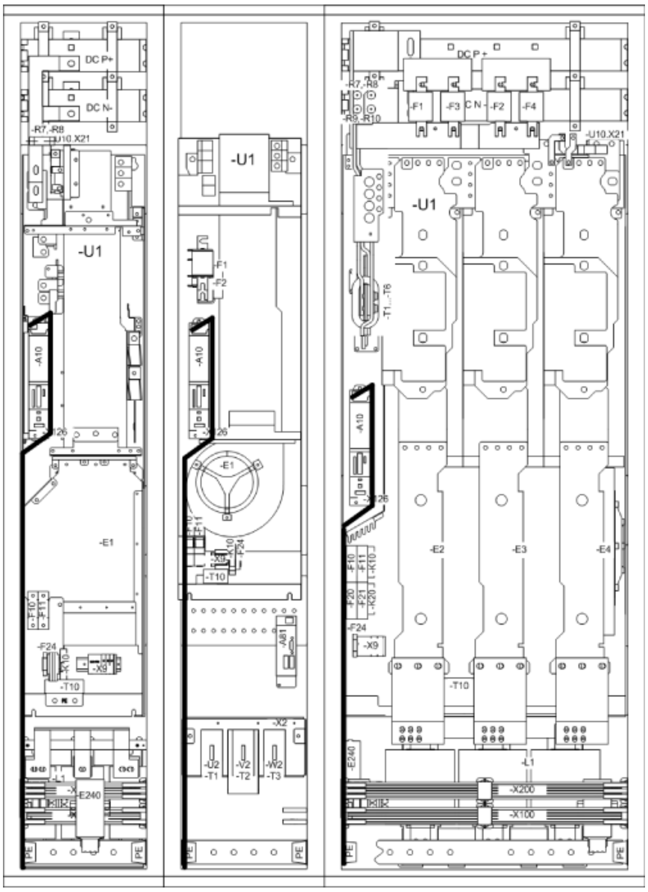
Table 4- 15 Checklist for cabling or connection work for Smart Line Modules

Cable routing	Completed?
PROFIBUS cables to the Control Unit	
DRIVE-CLiQ connections / signal cables to the Control Unit	
Signal cables to the customer terminal block –X55	
Notice: 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 connection to the Control Unit

Frame size:

GX HX JX

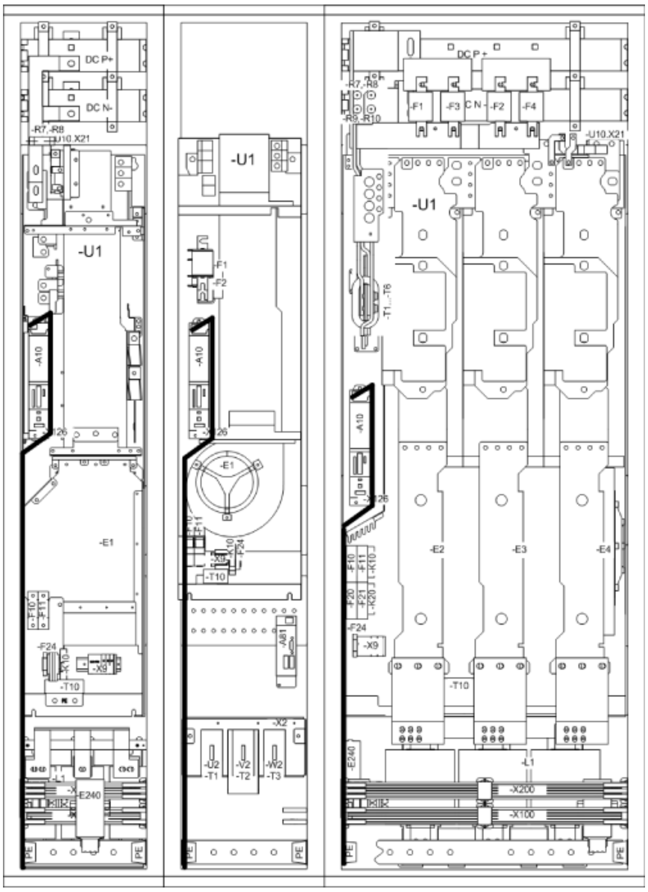


1. Feed the cable for the Control Unit into the cabinet from the bottom left.
2. Remove approx. 3 cm of the insulation at the level of the shield plate in the lower part of the cabinet and attach the cable.
3. To secure the cable in accordance with EMC requirements, snap the clip onto the shield plate.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

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

Frame size:

GX HX JX

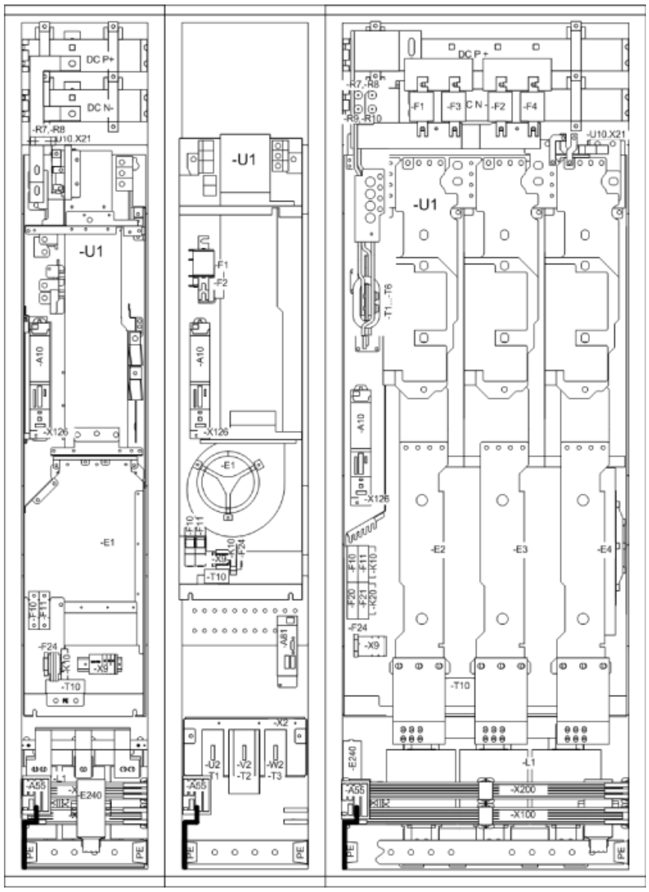


1. Feed the DRIVE-CLiQ/signal cable into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Feed the cable up through the cabinet and, when it reaches the Control Unit, guide it up and to the right towards the Control Unit. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
4. Use cable ties to secure the cable at suitable points.
5. Connect DRIVE-CLiQ/signal cable to the Control Unit.

Cable routing to the customer terminal block -X55

Frame size:

GX HX JX



1. Feed the cable for the customer terminal block into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Guide the cable further up into the cabinet and, when it reaches customer terminal block -X55, guide it to the left or right to -X55. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
4. Use cable ties to secure the cable at suitable points.
5. Connect the cables to the customer terminal block -X55.

4.4.11.5 Cable routing for Active Line Modules

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

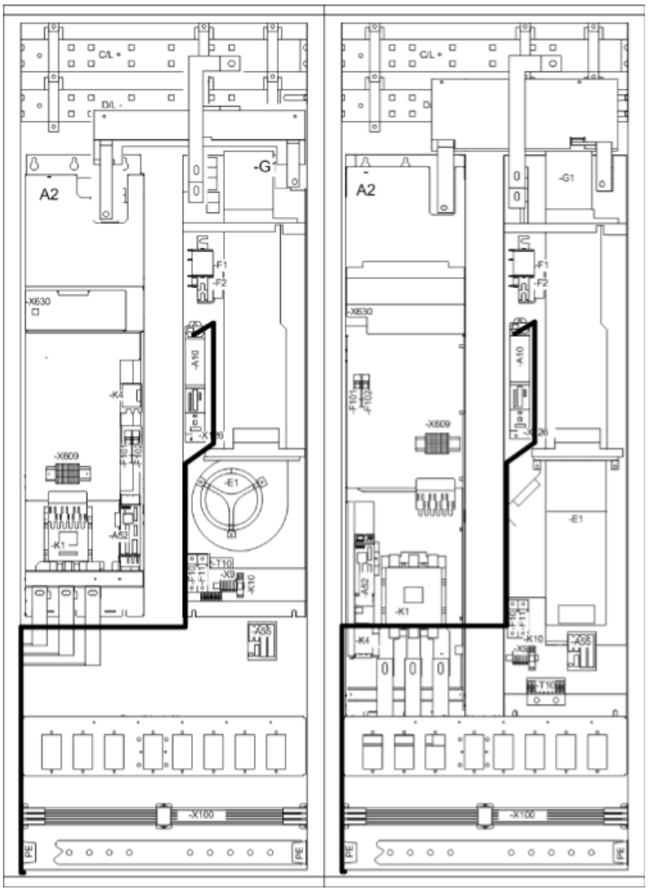
Table 4- 16 Checklist for cabling or connection work for Active Line Modules

Cable routing	Completed?
PROFIBUS cables to the Control Unit	
DRIVE-CLiQ connections / signal cables to the Control Unit	
Signal cables to the customer terminal block –X55	
Notice: 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 connection to the Control Unit, frame sizes FX+FI and GX+GI

Frame size:

FX+FI GX+GI

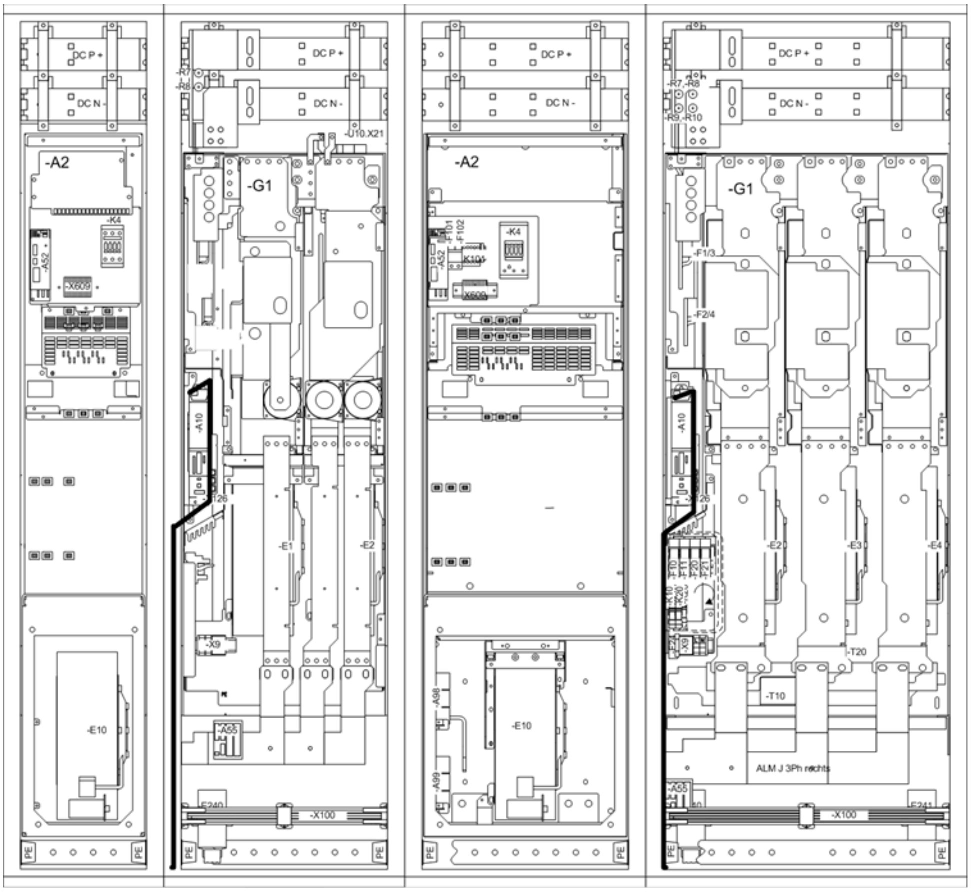


1. Feed the cable for the Control Unit into the cabinet from the bottom left.
2. Remove approx. 3 cm of the insulation at the level of the shield plate in the lower part of the cabinet and attach the cable.
3. To secure the cable in accordance with EMC requirements, snap the clip onto the shield plate.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

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

Frame size

HX+HI JX+JI

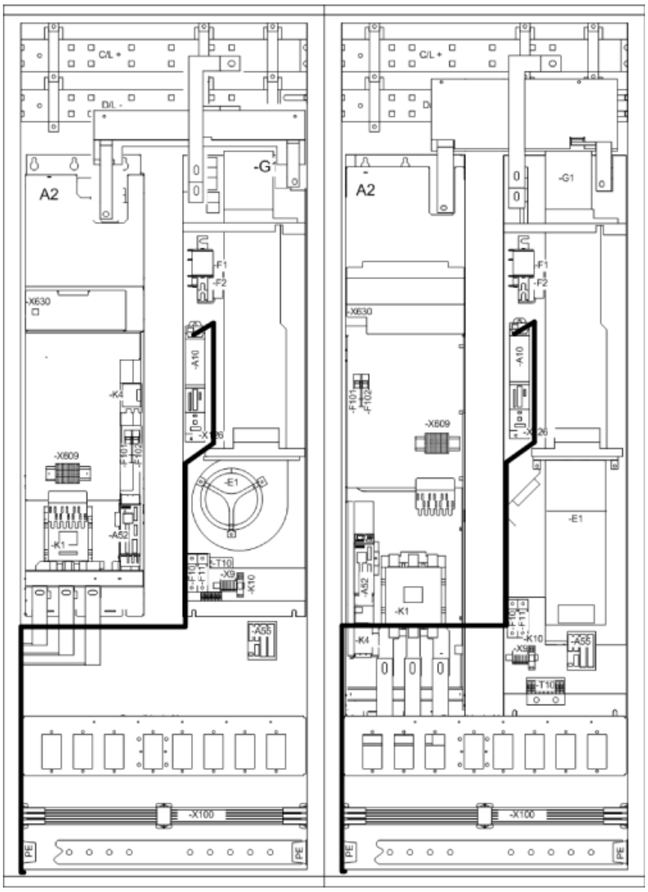


1. Feed the cable for the Control Unit into the cabinet from the bottom left.
2. Remove approx. 3 cm of the insulation at the level of the shield plate in the lower part of the cabinet and attach the cable.
3. To secure the cable in accordance with EMC requirements, snap the clip onto the shield plate.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

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

Frame size:

FX+FI GX+GI

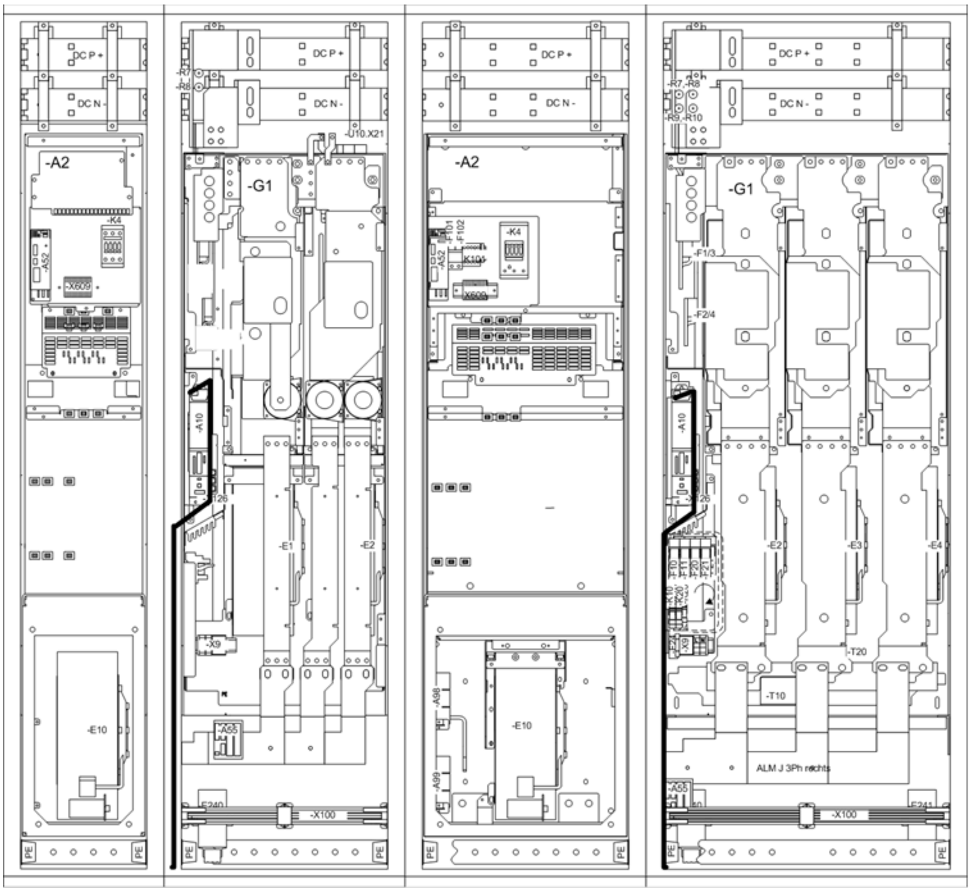


1. Feed the cable for the DRIVE-CLiQ/signal cables into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Feed the cable up through the cabinet and, when it reaches the Control Unit, guide it up and to the right towards the Control Unit. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
4. Use cable ties to secure the cable at suitable points.
5. Connect DRIVE-CLiQ or signal cable to the Control Unit.

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

Frame size:

HX+HI JX+JI

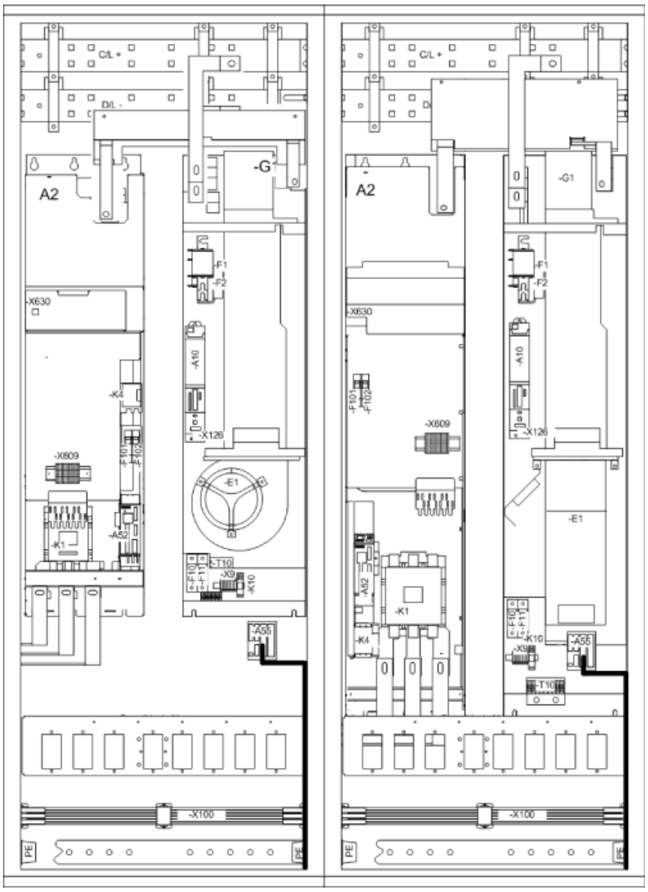


1. Feed the cable for the DRIVE-CLiQ/signal cables into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Feed the cable up through the cabinet and, when it reaches the Control Unit, guide it up and to the right towards the Control Unit. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
4. Use cable ties to secure the cable at suitable points.
5. Connect DRIVE-CLiQ or signal cable to the Control Unit.

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

Frame size:

FX+FI GX+GI

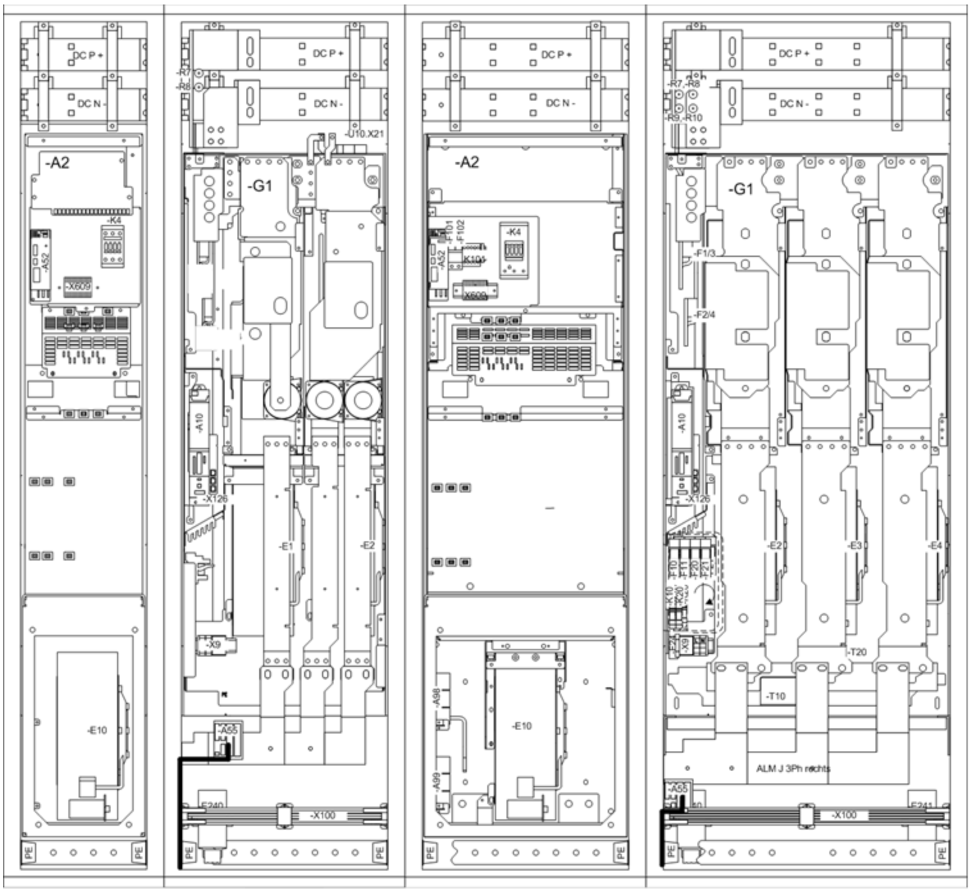


1. Feed the cable for the customer terminal block into the cabinet from the bottom right (frame size FX+FI) or bottom left (frame size GX+GI).
2. Use cable ties to secure the cable at suitable points.
3. Guide the cable further up into the cabinet and, when it reaches customer terminal block -X55, guide it to the left or right to -X55. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
4. Use cable ties to secure the cable at suitable points.
5. Connect the cables to the customer terminal block -X55.

Cable routing for customer terminal block –X55, frame sizes HX+HI and JX+JI

Frame size:

HX+HI JX+JI



1. Feed the cable for the customer terminal block into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Guide the cable further up into the cabinet and, when it reaches customer terminal block -X55, guide it to the left or right to -X55. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
4. Use cable ties to secure the cable at suitable points.
5. Connect the cables to the customer terminal block -X55.

4.4.11.6 Cable routing for Booksize Base Cabinets and Booksize Cabinet Kit

Note

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

Cable routing of motor cable

Note

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

4.4.11.7 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:

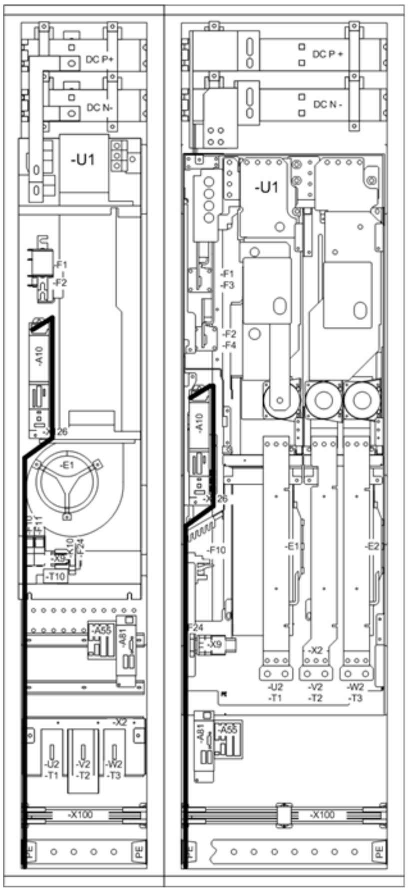
Table 4- 17 Checklist for cabling or connection work for Motor Modules in the chassis format

Cable routing	Completed?
PROFIBUS cables to the Control Unit	
DRIVE-CLiQ connections / signal cables to the Control Unit	
Signal cables to the customer terminal block –X55	
Option K82, terminal module for controlling safety functions "Safe Torque Off" and "Safe Stop 1"	
Option K87, Terminal Module TM54F	
Signal cables to Sensor Modules SMC10/20/30 (-B81/-B82/-B83)	
Cable connection between motor and Motor Module	
Notice: 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 connection to the Control Unit

Frame size:

FX+GX HX+JX

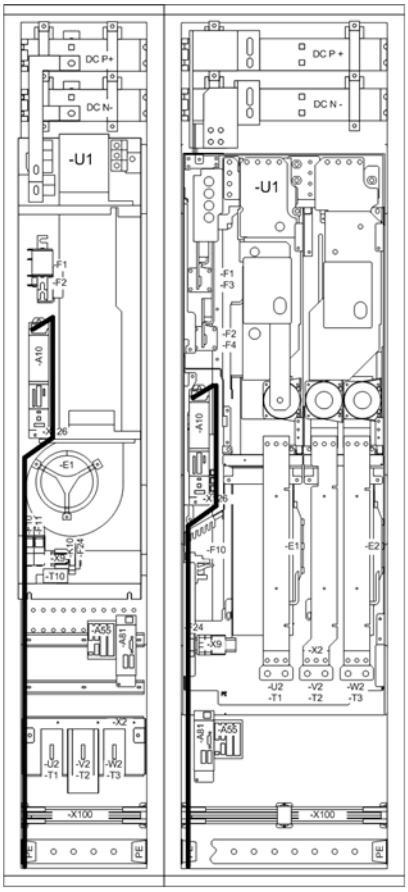


1. Feed the cable for the Control Unit into the cabinet from the bottom left.
2. Remove approx. 3 cm of the insulation at the level of the shield plate in the lower part of the cabinet and attach the cable.
3. To secure the cable in accordance with EMC requirements, snap the clip onto the shield plate.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

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

Frame size:

FX+GX HX+JX

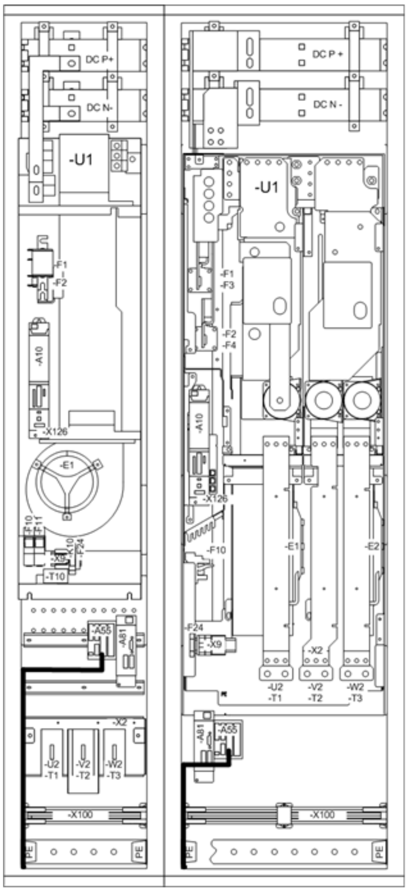


1. Feed the DRIVE-CLiQ/signal cable into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Feed the cable up through the cabinet and, when it reaches the Control Unit, guide it up and to the right towards the Control Unit. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
4. Use cable ties to secure the cable at suitable points.
5. Connect DRIVE-CLiQ/signal cable to the Control Unit.

Cable routing of signal cables to the customer terminal block –X55

Frame size:

FX+GX HX+JX



1. Feed the cable for the customer terminal block into the cabinet from the bottom left.
2. Use cable ties to secure the cable at suitable points.
3. Guide the cable further up into the cabinet and, when it reaches customer terminal block -X55, guide it to the left or right to -X55. When doing so, route the cable in a similar manner to the standard cables that have already been installed in the cabinet.
4. Use cable ties to secure the cable at suitable points.
5. Connect the cables to the customer terminal block -X55.

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

Note

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

Connect the cable to the terminals to control the functions.

(→ See the chapter titled "Options", section "K82, terminal module for activating "Safe Torque Off" and "Safe Stop 1"")

Cable routing for the Terminal Module TM54F

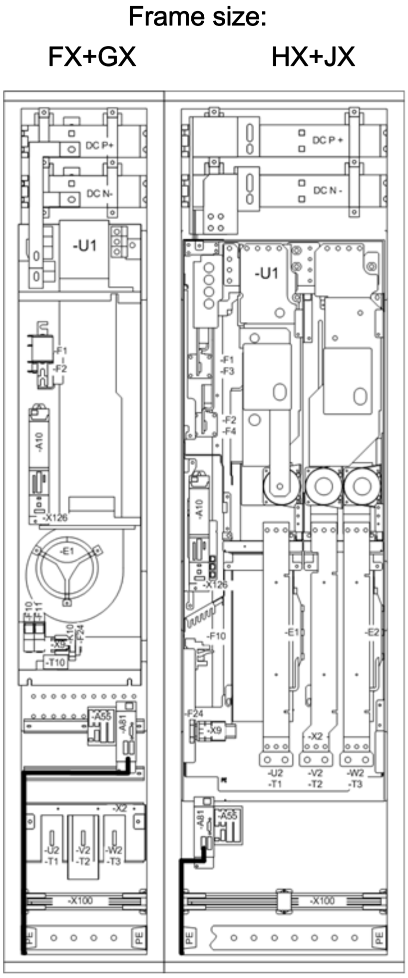
Note

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

Connect the cable to the terminals to control the functions.

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

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

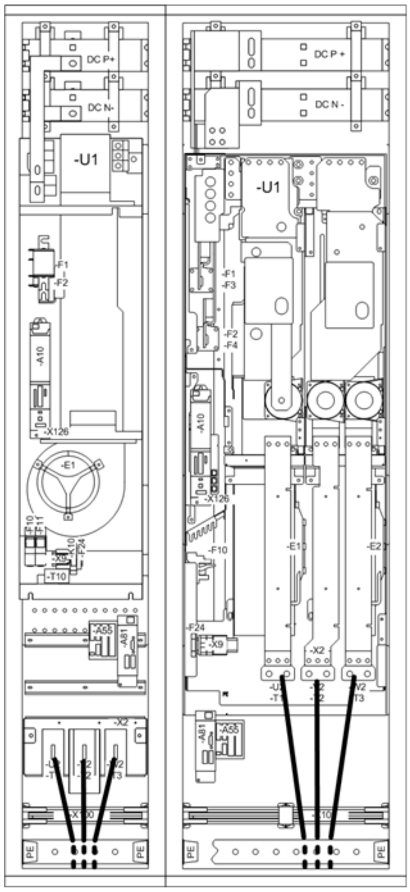


1. Feed the cable for the customer terminal block into the cabinet from the bottom left.
2. Remove approx. 3 cm of the insulation at the level of the shield plate in the lower part of the cabinet and attach the cable.
3. To secure the cable in accordance with EMC requirements, snap the clip onto the 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 to the SMC10/20/30 Sensor Module (-B81/-B82/-B83).
   (→ See the chapter titled "Options", K46, K48 and K50 (Sensor Module Cabinet-Mounted SMC 10, 20 and 30)

Cable routing for motor connection

Frame size:

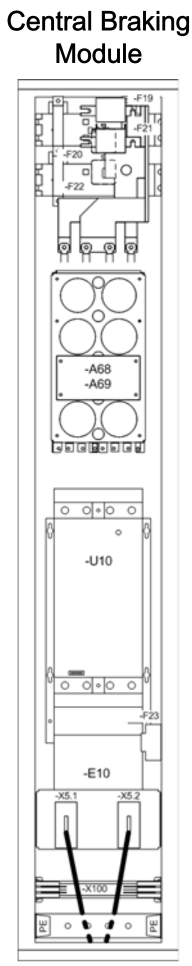
FX+GX HX+JX



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. Connect the cable to the connections.

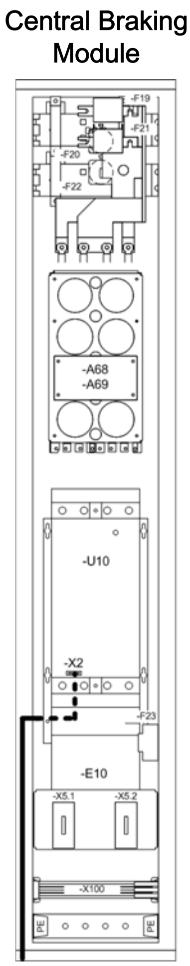
4.4.11.8 Cable routing for Central Braking Modules

Cable routing to the braking resistor



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

Cable routing to terminal block -X2

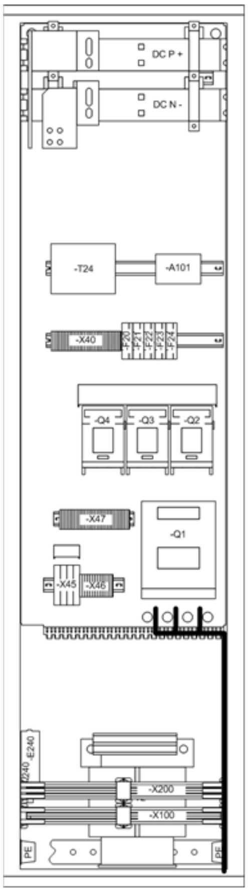


1. Feed the cable into the cabinet from the bottom left.
2. Guide the cable up and, when it reaches the level of terminal -X2, guide it to the right.
3. Continue to feed the cable upwards, securing it at suitable points using cable ties.
4. Connect the cable to terminals -X2.

4.4.11.9 Cable routing for Auxiliary Power Supply Modules

Cable routing for connecting to the supply infeed

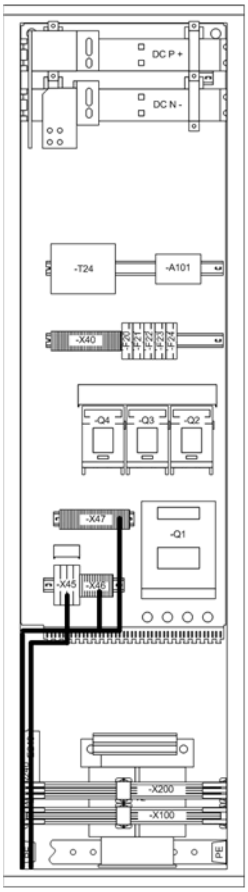
Auxiliary Power
Supply Module



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. Secure the cable at suitable points.
4. Connect the cable to the line terminals.

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

Auxiliary Power Supply Module



1. Feed the cable into the cabinet from the bottom left.
2. Guide the cable up and, when it reaches the terminal blocks, to the right.
3. Secure 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 General information

DANGER

Hazardous voltages are present in certain parts of this equipment during operation of the cabinet unit.
Only qualified personnel may work on the cabinet.
Such personnel must be thoroughly familiar with all the warnings and maintenance procedures for the cabinet described in the documentation provided.

The successful and safe operation of this cabinet is dependent on correct transport, proper storage and installation, as well as careful operation and maintenance.
National safety regulations must be observed.

5.1.2 Description

Note

Refer to the layout diagrams and circuit diagrams provided on the customer DVD supplied with the device for the arrangement of components and interfaces, and for wiring.

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 grounded (TN, TT) and non-grounded (IT) systems. The Line Modules are connected to the incoming supply via Line Connection Modules and are equipped with a radio interference suppression filter in accordance with EN 61800-3, Category C3 as a standard feature.

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

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

Input voltage	Input current
3 AC 380 ... 480 V	250 ... 3200 A
3 AC 500 ... 690 V	280 ... 3200 A

Table 5- 1 X1 terminals for the supply infeed

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

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

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

Configuration

Note

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.

Refer to the layout diagrams (AO) on the customer DVD for the precise order-specific location of the components.

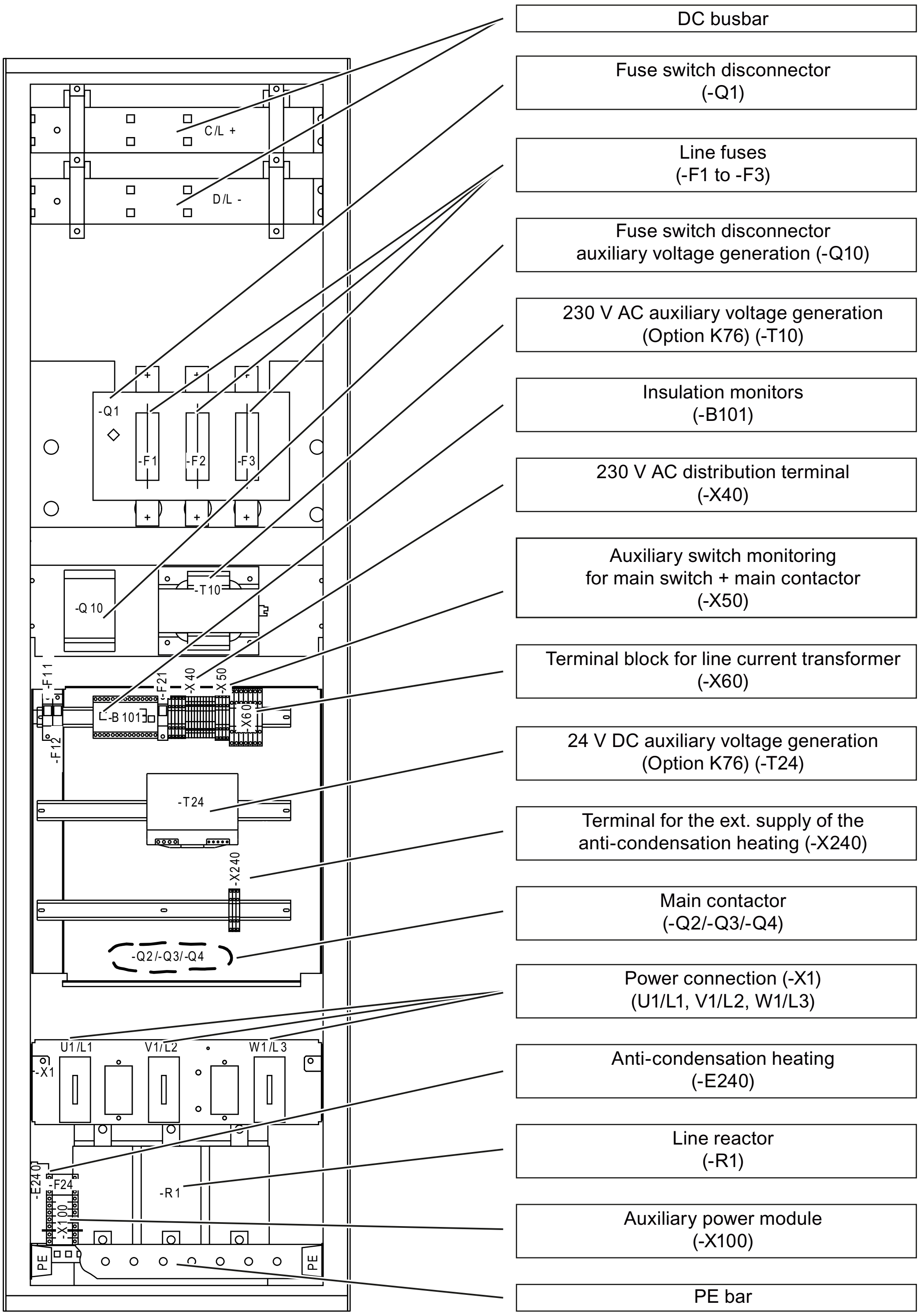


Figure 5-1 Configuration example for Line Connection Modules (frame size HL)

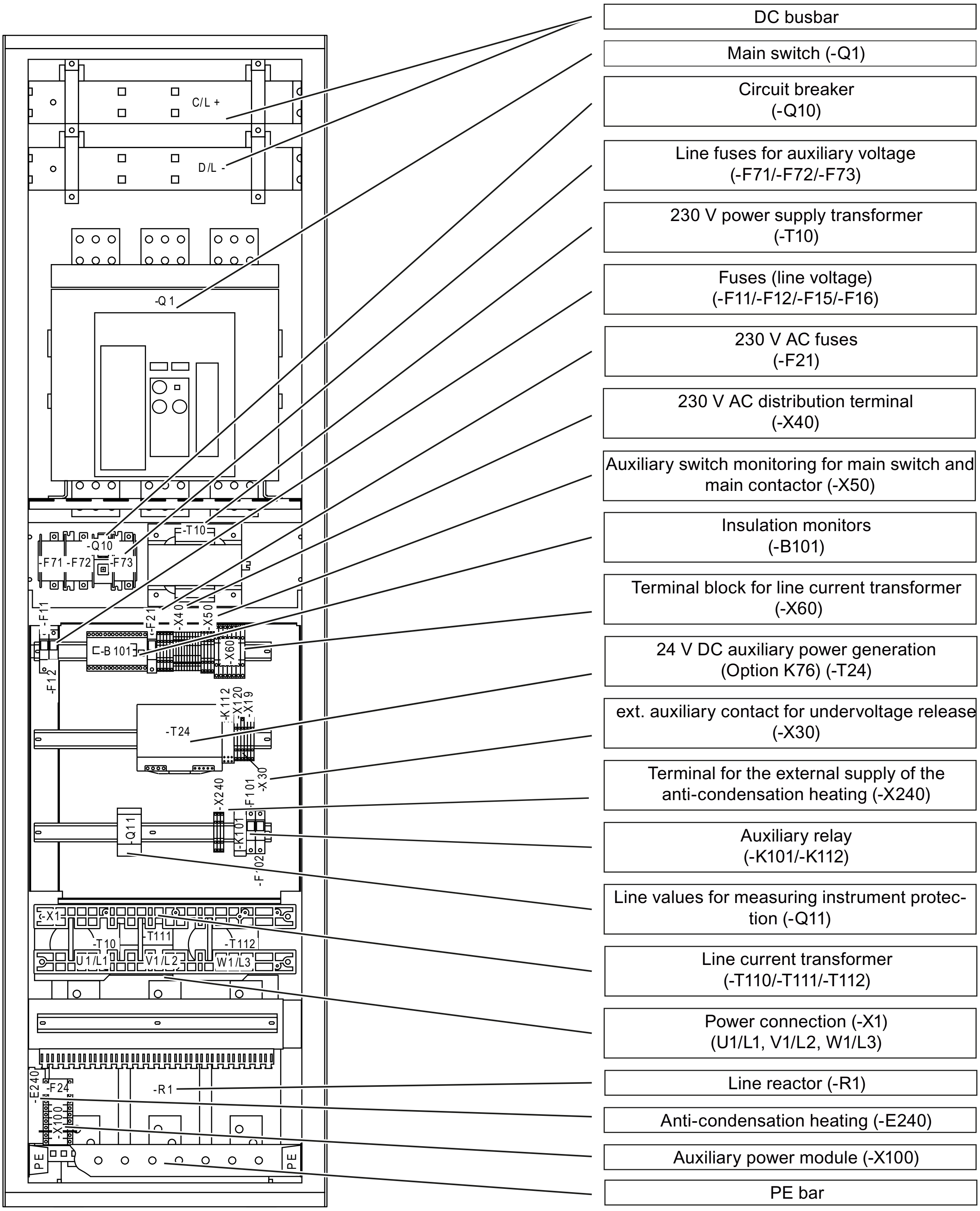


Figure 5-2 Configuration example for Line Connection Modules (frame size JL)

5.1.2.1 Fuse switch disconnector (input current ≤ 800 A)

Up to 800 A, a switch disconnector with integrated fuses is incorporated.

X50 "Fuse switch disconnector" checkback contact

Table 5- 2 Terminal block X50 "Fuse switch disconnector" checkback contact

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

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

5.1.2.2 Circuit breaker (input current > 800 A)

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

The tripping current on the line-side must be set according to the conditions of the system.

The tripping current is set as follows in the default factory setting:

Table 5- 3 Factory setting of the overcurrent release on Line Connection Modules for Basic Line Modules

Order number Line Connection Module	Order number Basic Line Module	Input current Line Module	Overload trip (L)	Short-time delayed short-circuit release (S)	Short-circuit release delay (tsd)
6SL3700-0LE41-3AA3	6SL3730-1TE41-2AA3	1010 A	0.9	2	0
6SL3700-0LE41-6AA3	6SL3730-1TE41-5AA3	1265 A	0.9	2	0
6SL3700-0LE42-0AA3	6SL3730-1TE41-8AA3	1630 A	0.9	2	0
6SL3700-0LE42-0BA3	6SL3730-1TE41-2Bx3	2x 935 A	1.0	2	0
6SL3700-0LE42-5BA3	6SL3730-1TE41-5Bx3	2x 1170 A	1.0	2	0
6SL3700-0LE43-2BA3	6SL3730-1TE41-8Bx3	2x 1508 A	1.0	2	0
6SL3700-0LG41-0AA3	6SL3730-1TH41-1AA3	925 A	1.0	2	0
6SL3700-0LG41-3AA3	6SL3730-1TH41-4AA3	1180 A	1.0	2	0
6SL3700-0LG41-6AA3	6SL3730-1TH41-8AA3	1580 A	1.0	2	0
6SL3700-0LG42-0BA3	6SL3730-1TH41-1Bx3	2 x 855 A	0.9	2	0
6SL3700-0LG42-5BA3	6SL3730-1TH41-4Bx3	2 x 1092 A	0.9	2	0
6SL3700-0LG43-2BA3	6SL3730-1TH41-8Bx3	2 x 1462 A	1.0	2	0

Table 5- 4 Factory setting of the overcurrent release on Line Connection Modules for Smart Line Modules

Order number Line Connection Module	Order number Smart Line Module	Input current Line Module	Overload trip (L)	Short-time delayed short-circuit release (S)	Short-circuit release delay (tsd)
6SL3700-0LE41-0AA3	6SL3730-6TE41-1AA3	883 A	1.0	2	0
6SL3700-0LE41-3AA3	6SL3730-6TE41-3AA3	1093 A	1.0	2	0
6SL3700-0LE41-6AA3	6SL3730-6TE41-7AA3	1430 A	1.0	2	0
6SL3700-0LE42-0BA3	6SL3730-6TE41-1Bx3	2 x 817 A	0.9	2	0
6SL3700-0LE42-5BA3	6SL3730-6TE41-3Bx3	2 x 1011 A	0.9	2	0
6SL3700-0LE43-2BA3	6SL3730-6TE41-7Bx3	2 x 1323 A	0.9	2	0
6SL3700-0LG41-3AA3	6SL3730-6TG41-2AA3	1009 A	0.9	2	0
6SL3700-0LG41-6AA3	6SL3730-6TG41-7AA3	1430 A	1.0	2	0
6SL3700-0LG42-0BA3	6SL3730-6TG38-8Bx3	2 x 700 A	0.8	2	0
6SL3700-0LG42-0BA3	6SL3730-6TG41-2Bx3	2 x 934 A	1.0	2	0
6SL3700-0LG43-2BA3	6SL3730-6TG41-7Bx3	2 x 1323 A	0.9	2	0

Table 5- 5 Factory setting of the overcurrent release on Line Connection Modules for Active Line Modules

Order number Line Connection Module	Order number Active Line Module	Input current Line Module	Overload trip (L)	Short-time delayed short-circuit release (S)	Short-circuit release delay (tsd)
6SL3700-0LE41-0AA3	6SL3730-7TE38-4BA3	840 A	1.0	2	0
6SL3700-0LE41-3AA3	6SL3730-7TE41-0BA3	985 A	0.9	2	0
6SL3700-0LE41-6AA3	6SL3730-7TE41-4BA3	1405 A	1.0	2	0
6SL3700-0LE42-0BA3	6SL3730-7TE41-0Bx3	2 x 936 A	1.0	2	0
6SL3700-0LE43-2BA3	6SL3730-7TE41-4Bx3	2 x 1335 A	0.9	2	0
6SL3700-0LG41-3AA3	6SL3730-7TG41-0BA3	1025 A	0.9	2	0
6SL3700-0LG41-6AA3	6SL3730-7TG41-3BA3	1270 A	0.9	2	0
6SL3700-0LG42-0BA3	6SL3730-7TG37-4Bx3	2 x 698 A	0.7	2	0
6SL3700-0LG42-0BA3	6SL3730-7TG41-0Bx3	2 x 974 A	1.0	2	0
6SL3700-0LG42-5BA3	6SL3730-7TG41-3Bx3	2 x 1206 A	1.0	2	0

Note

Detailed and comprehensive instructions and information for the circuit breaker as well as the standard and additional options can be found in the accompanying operating instructions, These operating instructions are available as additional documentation on the customer DVD supplied with the device.

X50 "circuit breaker" checkback contact

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

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

1) NC: Normally-closed contact, NO: Normally-open contact, COM: Center contact

X30 looping in an external EMERGENCY OFF

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

Table 5- 7 Terminal block X30 "Fuse switch disconnector" checkback contact

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

5.1.2.3 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 data
1	L1	Factory-installed jumper to terminal 2; this jumper must be removed if an external infeed is used.
2	L1	Connection of external 230 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: 2.5 mm²		

5.1.3 Versions of Line Connection Modules

Different versions to suit specific input currents are available:

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

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

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

5.1.3.1 Version L42 for Active Line Modules

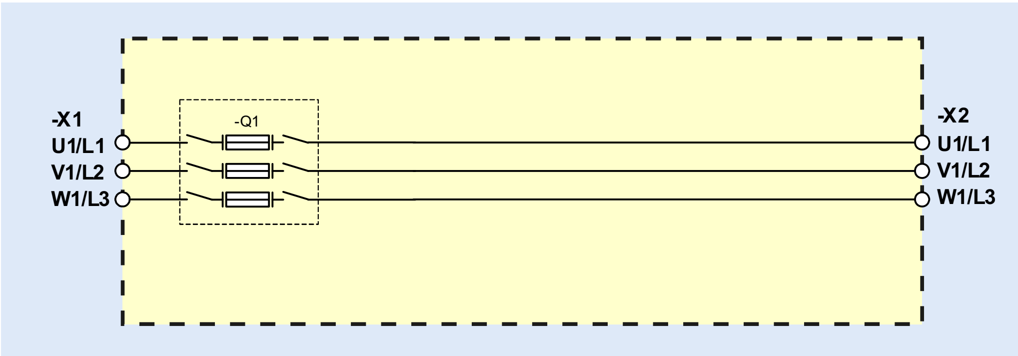


Figure 5-3 Connection example: Line Connection Module ≤800 A for connection to Active Line Modules, option L42

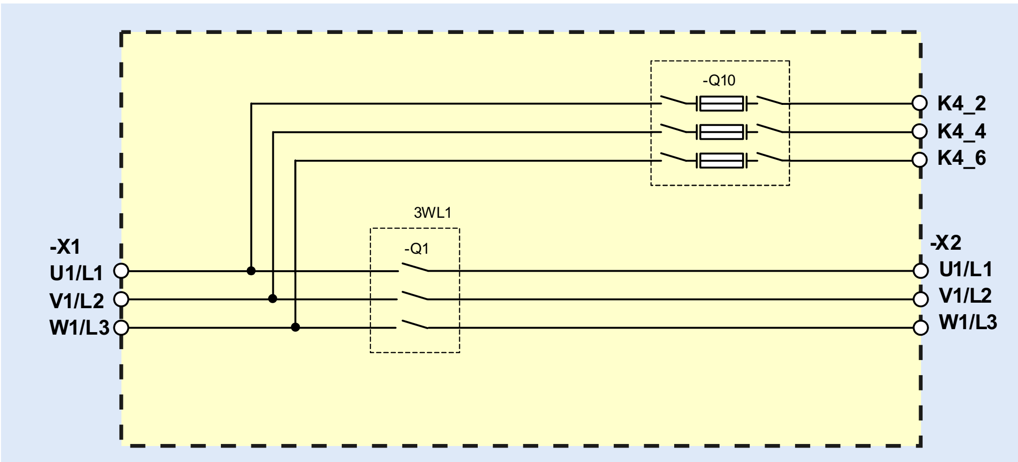


Figure 5-4 Connection example: Line Connection Module >800 A for connection to Active Line Modules, option L42

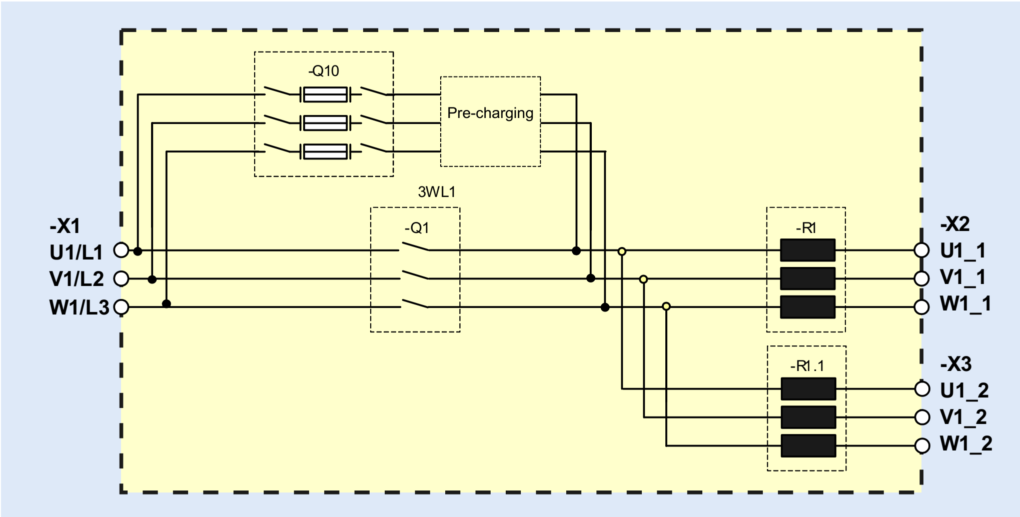


Figure 5-5 Connection example: Line Connection Module ≥2000 A for connection to Active Line Modules in parallel connection, option L42

5.1.3.2 Version L43 for Basic Line Modules

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

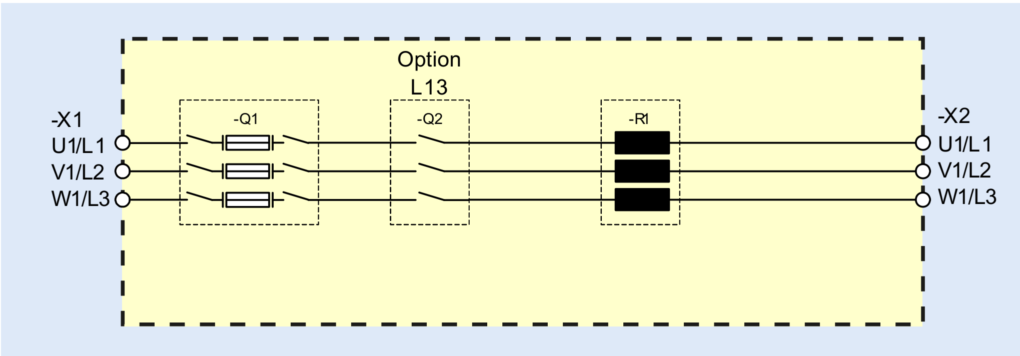


Figure 5-6 Connection example: Line Connection Module ≤ 800 A for connection to Basic Line Modules, options: L43, L13

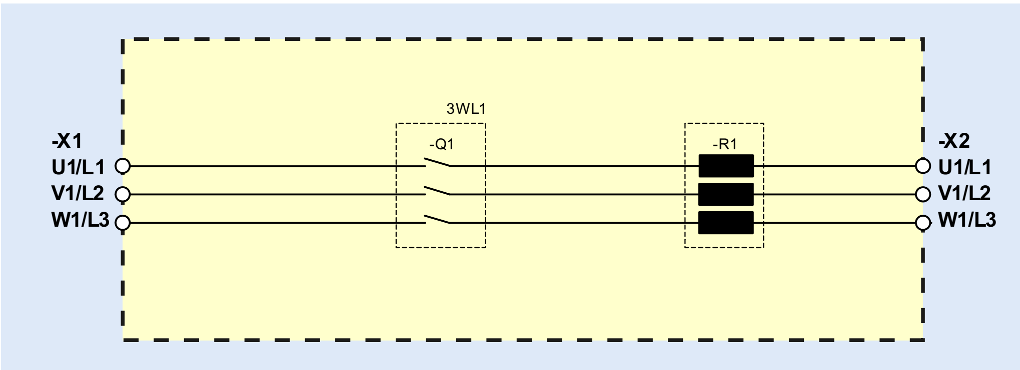


Figure 5-7 Connection example: Line Connection Module >800 A, <1800 A for connection to Basic Line Modules, option L43

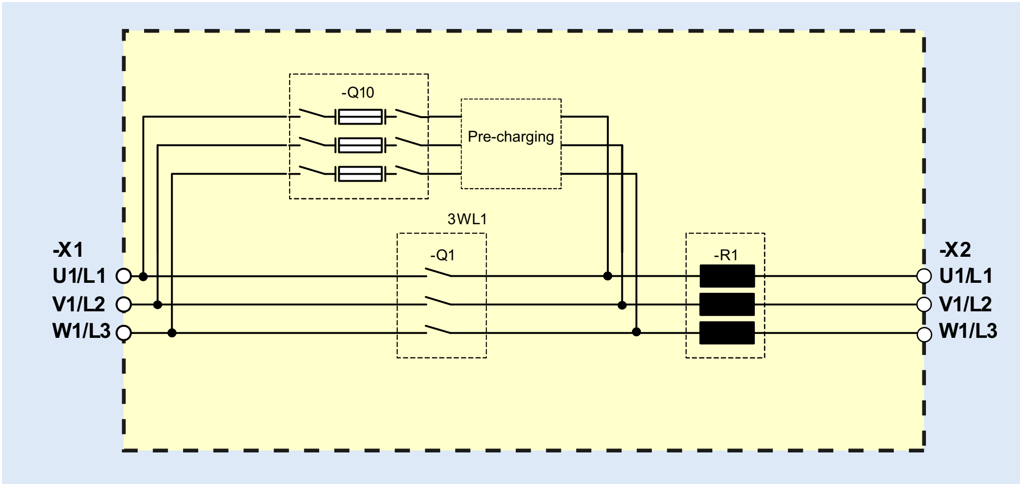


Figure 5-8 Connection example: Line Connection Module >1800 A, <2000 A for connection to Basic Line Modules, option L43

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.

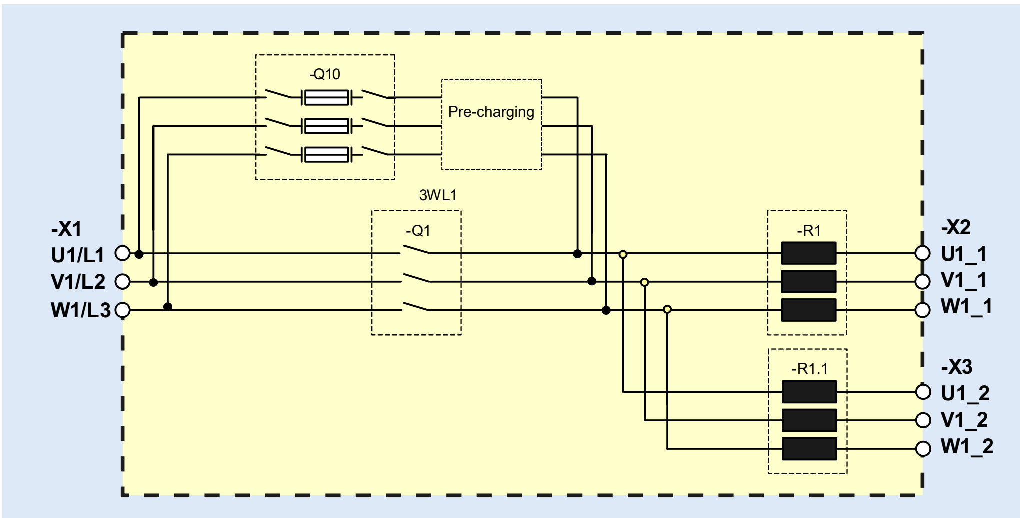


Figure 5-9 Connection example: Line Connection Module ≥2000 A for connection to Basic Line Modules, option L43

Note

The 24 V DC and 230 V AC connections to the auxiliary power supply must be established in accordance with the circuit diagram.

A fan is incorporated in the Line Connection Module for degree of protection IP23, IP43, and IP54. The power is supplied using a connecting cable that must be connected to the auxiliary power module on the plant side.

5.1.3.3 Version L44 for Smart Line Modules

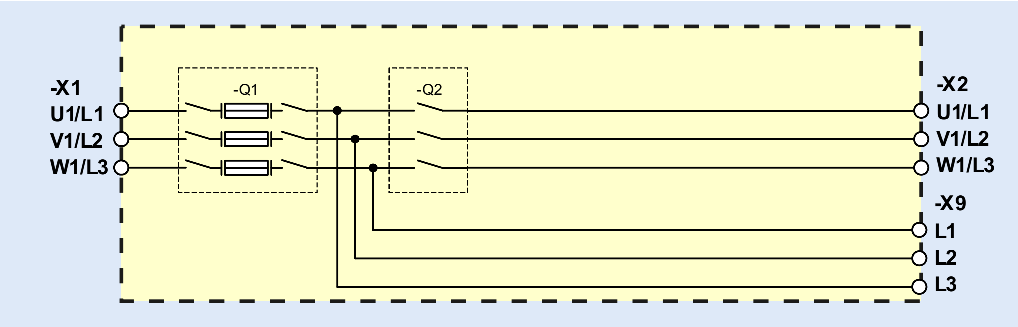


Figure 5-10 Connection example: Line Connection Module ≤800 A for connection to Smart Line Modules, option L44

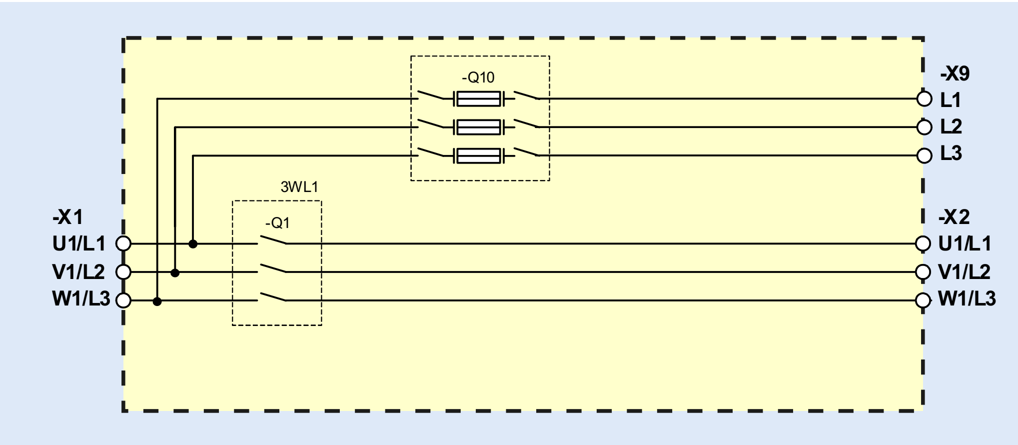


Figure 5-11 Connection example: Line Connection Module >800 A for connection to Smart Line Modules, option L44

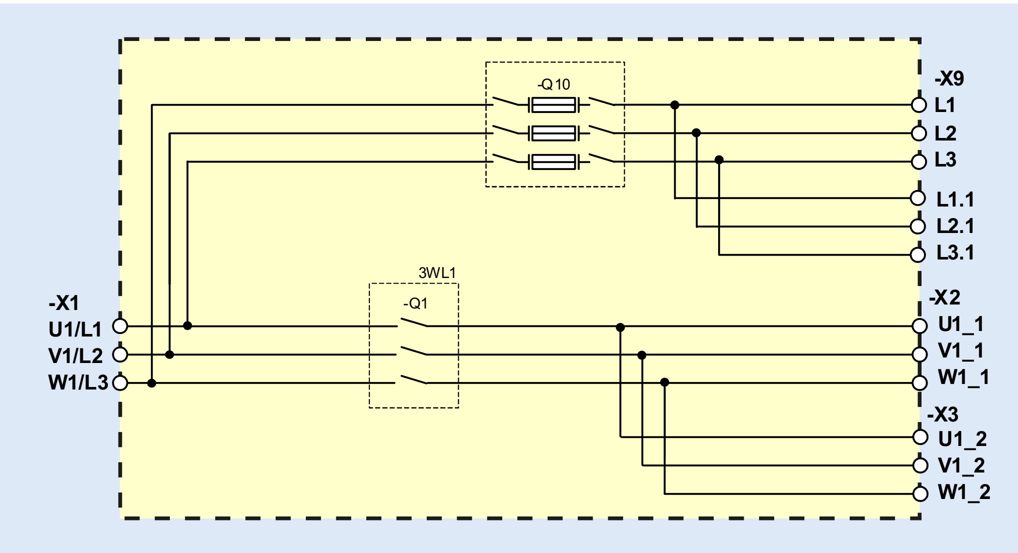


Figure 5-12 Connection example: Line Connection Module >1600 A for connection to Smart Line Modules, option L44

5.1.4 Options

Note

The individual options are described in the chapter titled "Options".

Electrical options

Component	Option
Main contactor (for Line Connection Modules ≤ 800 A)	L13
No line reactor for Basic Line Modules	L22
Draw-out circuit breaker (for Line Connection Modules > 800 A)	L25
Line current transformer	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 STOP pushbutton in cabinet door	L45
Grounding switch upstream of circuit breaker	L46
Grounding switch downstream of circuit breaker	L47
Holder for ARC detector	L51
Cabinet anti-condensation heating	L55
Insulation monitoring	L87
Measuring instrument for line values (installed in the cabinet door)	P10
Measuring instrument for line variables with PROFIBUS connection, installed in the cabinet door	P11

Mechanical options

Component	Option
Base 100 mm high, RAL 7035	M06
Cable-marshaling compartment 200 mm high	M07
IP21 degree of protection	M21
IP23/IP43/IP54 degree of protection	M23, M43, M54
Side panels (left)	M27
Closed cabinet door	M59
Additional shock protection	M60
EMC shield bus	M70
DC busbar	M80 ... M87
Crane transport assembly (top-mounted)	M90

5.1.5 Technical data

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

Order no.	6SL3700-	0LE32-5AA3	0LE34-0AA3	0LE36-3AA3	0LE38-0AA3	0LE41-0AA3
Infeed/regenerative feedback current - Rated current $I_{N E}$	 A	 250	 380	 600	 770	 1000
Power demand 230 V AC 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) **with 50 Hz 400 V** - option L42/L44 - option L43 **with 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 - Power demand 230 V AC - Cooling air requirement 3) - Sound pressure level L_{PA} (1 m) with 50/60 Hz	 A m^3/s dB(A)	 -- -- --	 -- -- --	 -- -- --	 -- -- --	 1.07 0.36 68/70
Line connection L1, L2, L3 - Connection cross section, max (IEC)	 mm²	2/M12 2 x 150	2/M12 2 x 150	2/M12 4 x 240	2/M12 8 x 240	5/M12 + 4/M16 8 x 240
PE/GND connection - Busbar cross section - Connection cross section, max. (IEC)	 mm² mm²	PE busbar 600 240				
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - width - height 4) - depth	 mm mm mm	 400 x 2200 x 600	 400 x 2200 x 600	 600 x 2200 x 600	 600 x 2200 x 600	 600 x 2200 x 600
Weight - Option L42, L44 - option L43	 kg kg	 210 --	 230 --	 310 360	 340 420	 450 --
Frame size		FL	FL	GL	HL	JL

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

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

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

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

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

Order no.	6SL3700-	0LE41-3AA3	0LE41-6AA3	0LE42-0AA3	0LE42-0BA3 5)	0LE42-5BA3 5)	0LE43-2BA3 5)
Infeed/regenerative feedback current - Rated current $I_{N\ E}$	A	1250	1600	2000	2000	2500	3200
Power demand 230 V AC 1) - Inrush current - Holding current	 A A	 0.5 0.06	 0.5 0.06	 0.5 0.06	 0.5 0.06	 0.5 0.06	 0.5 0.04
Power loss, max. 2) **with 50 Hz 400 V** - Option L42/L44 - Option L43 **with 60 Hz 460 V** - Option L42/L44 - Option L43	 kW kW kW kW	 0.29 0.787 0.29 0.787	 0.41 1.186 0.41 1.186	 0.6 1.366 0.6 1.366	 0.6 1.594 0.6 1.594	 0.95 2.502 0.95 2.502	 0.95 2.482 0.95 2.482
Fan - Power demand 230 V AC - Cooling air requirement 3) - Sound pressure level L_{PA} (1 m) with 50/60 Hz	 A m^3/s dB(A)	 1.07 0.36 68/70	 1.07 0.36 68/70	 2.14 0.72 70/72	 2.14 0.72 70/72	 2.14 0.72 70/72	 2.14 0.72 70/72
Line connection L1, L2, L3		5/M12 + 4/M16					
- Conductor cross section, max. (IEC)	mm^2	8 x 240	10 x 24	10 x 240	10 x 240	10 x 240	10 x 300
PE/GND connection - Busbar cross section - Connection cross section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240					
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - width - height 4) - depth	 mm mm mm	 600 x 2200 x 600	 600 x 2200 x 600	 1000 x 2200 x 600	 1000 x 2200 x 600	 1000 x 2200 x 600	 1000 x 2200 x 600
Weight - Option L42, L44 - option L43	 kg kg	 470 570	 490 650	 600 760	 620 820	 620 900	 720 1000
Frame size		JL	JL	KL	KL	KL	LL

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

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

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

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

5) Ready to connect to parallel Line Modules.

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

Order no.	**6SL3700-**	**0LG32-8AA3**	**0LG34-0AA3**	**0LG36-3AA3**	**0LG38-0AA3**	**0LG41-0AA3**
Infeed/regenerative feedback current - Rated current $I_{N E}$	 A	 280	 380	 600	 780	 1000
Power demand 230 V AC [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)] **with 50 Hz 500/690 V** - option L42/L44 - option L43 **with 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 - Power demand 230 V AC - Cooling air requirement [3)] - Sound pressure level L_{PA} (1 m) with 50/60 Hz	 A m^3/s dB(A)	 -- -- --	 -- -- --	 -- -- --	 -- -- --	 1.07 0.36 68/70
Line connection L1, L2, L3 - Connection cross section, max (IEC)	 mm^2	2/M12 2 x 150	2/M12 2 x 150	2/M12 4 x 240	2/M12 8 x 240	5/M12 + 4/M16 8 x 240
PE/GND connection - Busbar cross section - Connection cross section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240				
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - width - height [4)] - depth	 mm mm mm	 400 2200 600	 600 2200 600	 600 2200 600	 600 2200 600	 600 2200 600
Weight - Option L42, L44 - option L43	 kg kg	 220 260	 230 310	 310 400	 340 --	 450 650
Frame size		FL	FL	GL	HL	JL

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

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

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

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

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

Order no.	**6SL3700-**	**0LG41-3AA3**	**0LG41-6AA3**	**0LG42-0BA3** [5)]	**0LG42-2BA3** [5)]	**0LG42-5BA3** [5)]
Infeed/regenerative feedback current - Rated current I_{NE}	 A	 1250	 1600	 2000	 2500	 3200
Power demand 230 V AC [1)] - Inrush current - Holding current	 A A	 0.5 0.06	 0.5 0.06	 0.5 0.06	 0.5 0.06	 0.5 0.06
Power loss, max. [2)] **with 50 Hz 500/690 V** - Option L42/L44 - Option L43 **with 60 Hz 575 V** - Option L42/L44 - Option L43	 kW kW kW kW	 0.29 1.073 -- --	 0.41 1.387 -- --	 0.6 2.166 -- --	 0.6 2.166 -- --	 0.95 2.894 -- --
Fan - Power demand 230 V AC - Cooling air requirement [3)] - Sound pressure level L_{PA} (1 m) with 50/60 Hz	 A m^3/s dB(A)	 1.07 0.36 68/70	 1.07 0.36 68/70	 2.14 0.72 70/72	 2.14 0.72 70/72	 2.14 0.72 70/72
Line connection L1, L2, L3		5/M12 + 4/M16				
- Conductor cross section, max. (IEC)	mm^2	8 x 240	8 x 240	10 x 240	10 x 240	10 x 240
PE/GND connection - Busbar cross section - Connection cross section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240				
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - Width - Height [4)] - Depth	 mm mm mm	 600 2200 600	 600 2200 600	 1000 2200 600	 1000 2200 600	 1000 2200 600
Weight - Option L42, L44 - Option L43	 kg kg	 470 670	 490 680	 600 980	 620 1000	 720 1080
Frame size		JL	JL	KL	KL	LL

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

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

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

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

5) Ready to connect to parallel Line Modules.

5.2 Basic Line Modules

5.2.1 General information

DANGER

Hazardous voltages are present in certain parts of this equipment during operation of the cabinet unit.
Only qualified personnel may work on the cabinet.
Such personnel must be thoroughly familiar with all the warnings and maintenance procedures for the cabinet described in the documentation provided.

The successful and safe operation of this cabinet is dependent on correct transport, proper storage and installation, as well as careful operation and maintenance.
National safety regulations must be observed.

5.2.2 Description

Note

Refer to the layout diagrams (AO) and circuit diagrams (SP) provided on the customer DVD supplied with the device for the arrangement of components and interfaces, and for wiring.

Basic Line Modules are compact supply infeeds for 2-quadrant operation (i.e. no regenerative feedback).

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

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

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

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

Line voltage	Rated power
3 AC 380 ... 480 V	200 ... 900 kW
3 AC 500 ... 690 V	250 ... 1500 kW

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

Integration

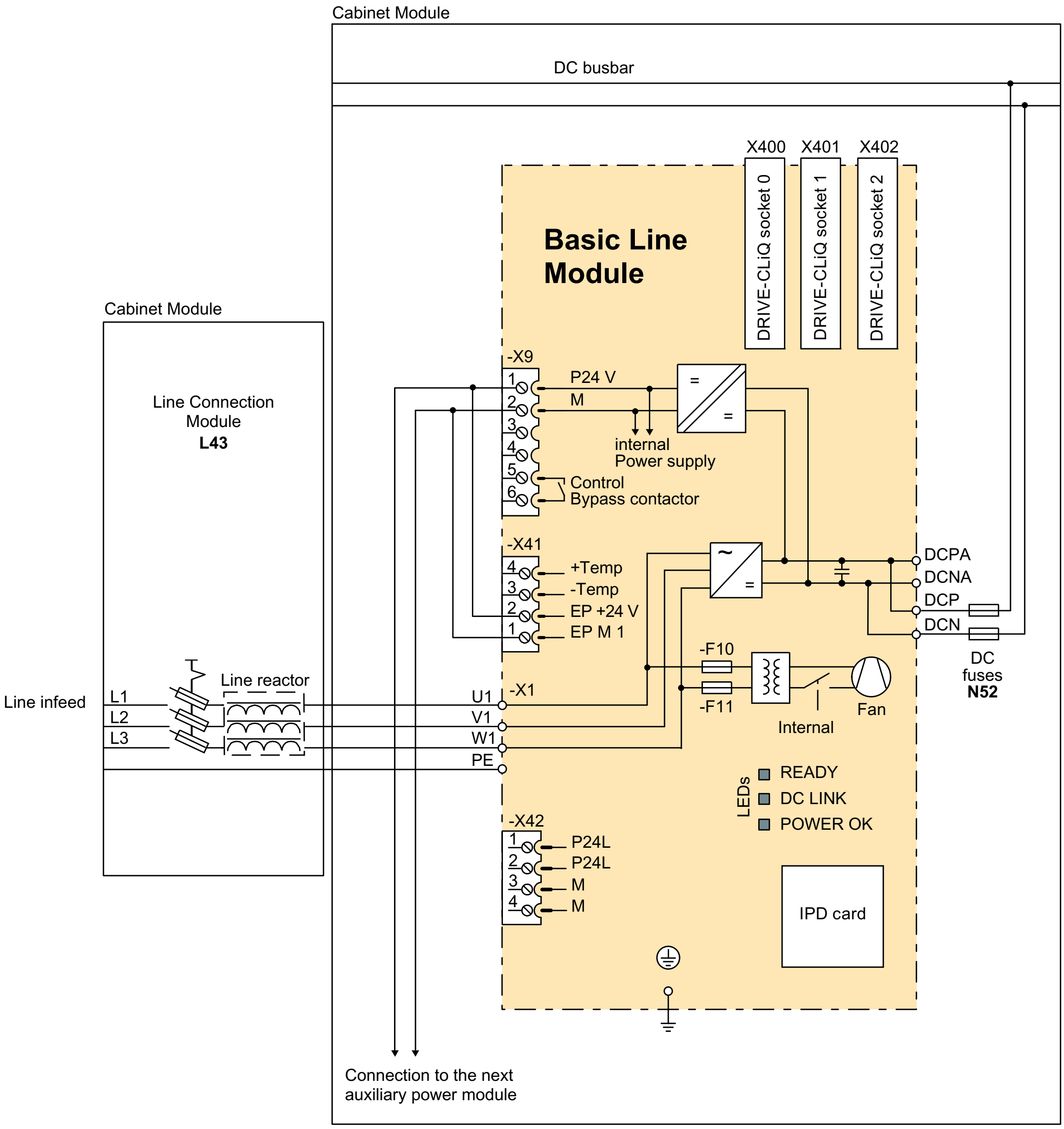


Figure 5-13 Connection example for Basic Line Modules (frame size FB and GB)

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

The configuration examples of the individual Basic 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.

Refer to the layout diagrams (AO) on the customer DVD for the precise order-specific location of the components.

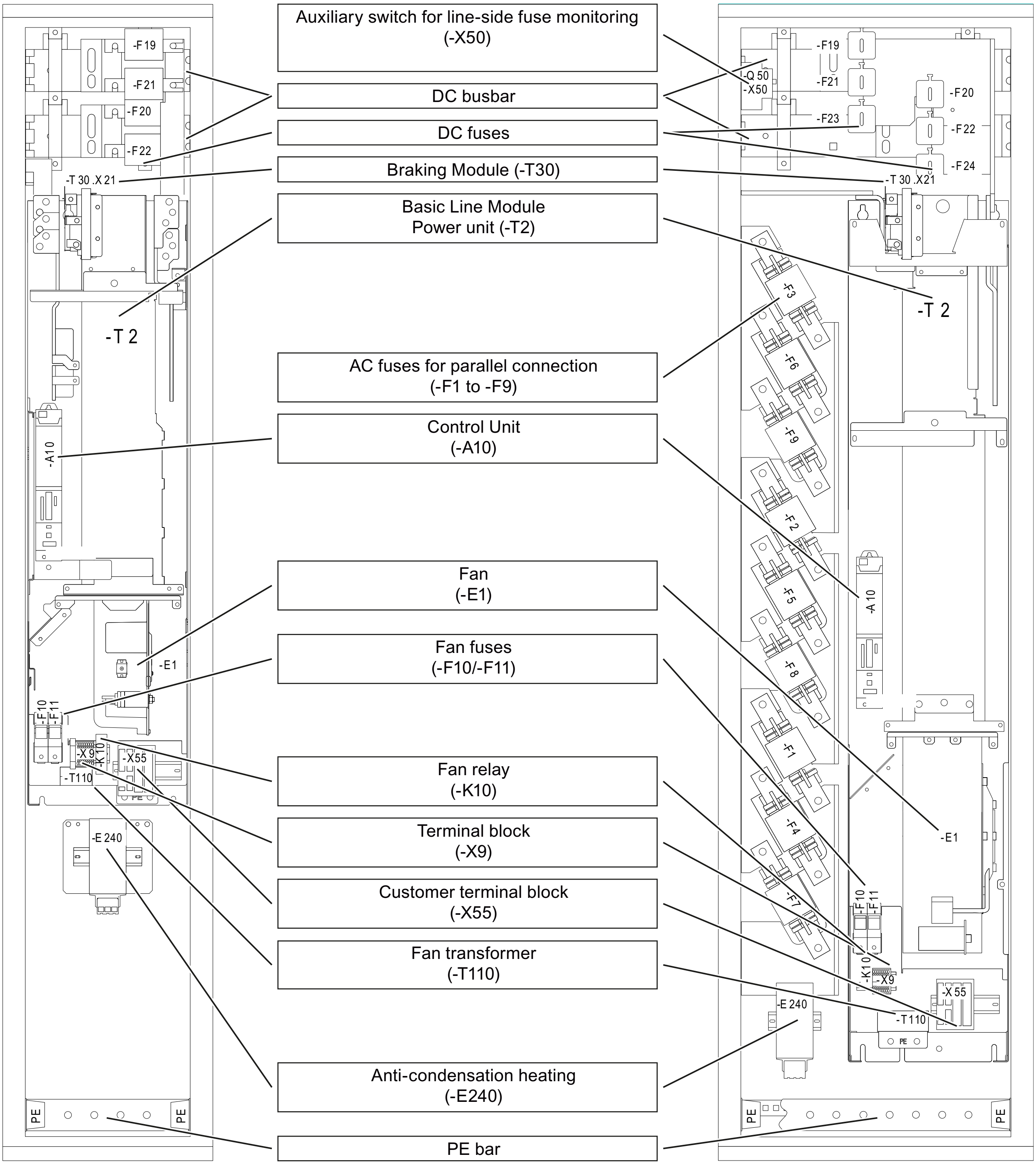


Figure 5-14 Configuration example for Basic Line Modules (frame size FB and GD)

Parallel connection of Basic Line Modules to increase power rating

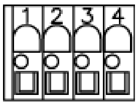
A pair of Basic Line Modules is available for creating drive line-ups with more power. These modules can be operated on a common Line Connection Module and are arranged to the right and left of the Line Connection Module. The power connections on the Basic Line Module on the left of the Line Connection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

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

- Up to 4 identical Basic Line Modules can be connected in parallel.
- A common Control Unit is required whenever the modules are connected in parallel.
- Special Line Connection Modules are available for connecting the modules in parallel.
- With multiple infeeds, power must be supplied to the systems from a common infeed point (i.e. the modules cannot be operated on different supplies).
- A derating factor of 7.5% must be taken into consideration, regardless of the number of modules connected in parallel.

5.2.3 Interfaces

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

	Terminal	Function	Technical data
	1	EP M1 (Enable Pulses)	Supply voltage: 24 V DC (20.4 ... 28.8 V) Current consumption: 10 mA
	2	EP +24 V (Enable Pulses)	
	3	- Temp	Temperature sensor connection: KTY84-1C130 / PTC
	4	+ Temp	
Max. connectable cross-section 1.5 mm²			

Note

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

⚠ DANGER

Risk of electric shock!

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

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

Note

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

CAUTION

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

NOTICE

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

5.2.4 Options

Note

The individual options are described in the chapter titled "Options".

Electrical options

Component	Option
CBC10 Communication Board	G20
CBE20 Communication Board	G33
AOP30 operator panel	K08
Control Unit CU320-2 PROFIBUS	K90
Performance extension 1 for CU320-2	K94
Use in the first environment to EN 61800-3, category C2 (TN/TT line supplies)	L00
Holder for ARC detector	L51
Cabinet anti-condensation heating	L55
25/125 kW braking unit	L61/L64
50/250 kW braking unit	L62/L65
DC fuses	N52

Mechanical options

Component	Option
Base 100 mm high	M06
Cable-marshaling compartment 200 mm high	M07
IP21 degree of protection	M21
IP23/IP43/IP54 degree of protection	M23, M43, M54
Side panels (right/left)	M26, M27
Closed cabinet door	M59
Additional shock protection	M60
DC busbar	M80 ... M87
Crane transport assembly (top-mounted)	M90

5.2.5 Technical data

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

Order no.	6SL3730-	1TE34-2AA3	1TE35-3AA3	1TE38-2AA3	1TE41-2AA3	1TE41-5AA3	1TE41-8AA3
for parallel connection, - attached to Line Connection Module on right side - attached to Line Connection Module on left side		 -- --	 -- --	 -- --	 ...-2BA3 ...-2BC3	 ...-5BA3 ...-5BC3	 ...-8BA3 ...-8BC3
Rated output - for $I_{N\ DC}$ (50 Hz 400 V) - for I_{HDC} (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
Power demand - Auxiliary supply 24 V DC - 400 V AC 2)	 A A	 1.1 internal					
DC link capacitance - Basic Line Module - Drive line-up, 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	m^3/s	0.17	0.17	0.17	0.36	0.36	0.36
Sound pressure level L_{pA} **(1 m) at 50/60 Hz**	dB(A)	66/68	66/68	66/68	71/73	71/73	71/73
PE/GND connection - Busbar cross section - Connection cross section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240					
Cable length, max. 4) - shielded - unshielded	 m m	 2600 3900	 2600 3900	 2600 3900	 4000 6000	 4000 6000	 4000 7200
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - Width - Height 5) - Depth	 mm mm mm	 400 2200 600	 400 2200 600	 400 2200 600	 400/600/600 2200 600		

Order no.	6SL3730-	1TE34-2AA3	1TE35-3AA3	1TE38-2AA3	1TE41-2AA3	1TE41-5AA3	1TE41-8AA3
Weight (standard version)	kg	166	166	166	320/440/480		
Frame size		FB	FB	FB	GB	GB	GD

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 supply input voltage.

3) The specified power loss equals the maximum value at 100 % capacity 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.

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

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

Order no.	6SL3730-	1TG33- 0AA3	1TG34- 3AA3	1TG36- 8AA3	1TG41- 1AA3	1TG41- 4AA3	1TG41- 8AA3
for parallel connection, - Attached to Line Connection Module on right side - Attached to Line Connection Module on left side		-- --	-- --	-- --	...-2BA3 ...-2BC3	...-4BA3 ...-4BC3	...-8BA3 ...-8BC3
Rated output - 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
Power demand - Auxiliary supply 24 V DC - 500/690 V AC [2)]	 A A	 1.1 internal					
DC link capacitance - Basic Line Module - Drive line-up, 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	m^3/s	0.17	0.17	0.17	0.36	0.36	0.36
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	66/68	66/68	66/68	71/73	71/73	71/73
PE/GND connection - Busbar cross section - Connection cross section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240					
Cable length, max. [4)] - shielded - unshielded	 m m	 1500 2250	 1500 2250	 1500 2250	 2250 3375	 2250 3375	 2250 3375
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - Width - Height [5)] - Depth	 mm mm mm	 400 2200 600	 400 2200 600	 400 2200 600	 400/600/600 2200 600		

Order no.	6SL3730-	1TG33-0AA3	1TG34-3AA3	1TG36-8AA3	1TG41-1AA3	1TG41-4AA3	1TG41-8AA3
Weight (standard version)	kg	166	166	166	320/440/480		
Frame size		FB	FB	FB	GB	GB	GD

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

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

3) The specified power loss equals the maximum value at 100 % capacity 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.

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

5.3 Smart Line Modules

5.3.1 General information

DANGER

Hazardous voltages are present in certain parts of this equipment during operation of the cabinet unit.
Only qualified personnel may work on the cabinet.
Such personnel must be thoroughly familiar with all the warnings and maintenance procedures for the cabinet described in the documentation provided.

The successful and safe operation of this cabinet is dependent on correct transport, proper storage and installation, as well as careful operation and maintenance.
National safety regulations must be observed.

5.3.2 Description

Note

Refer to the layout diagrams (AO) and circuit diagrams (SP) provided on the customer DVD supplied with the device for the arrangement of components and interfaces, and for wiring.

Smart Line Modules are 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 grounded (TN, TT) and non-grounded (IT) supply systems. The following voltages and power ratings are available:

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

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

Integration

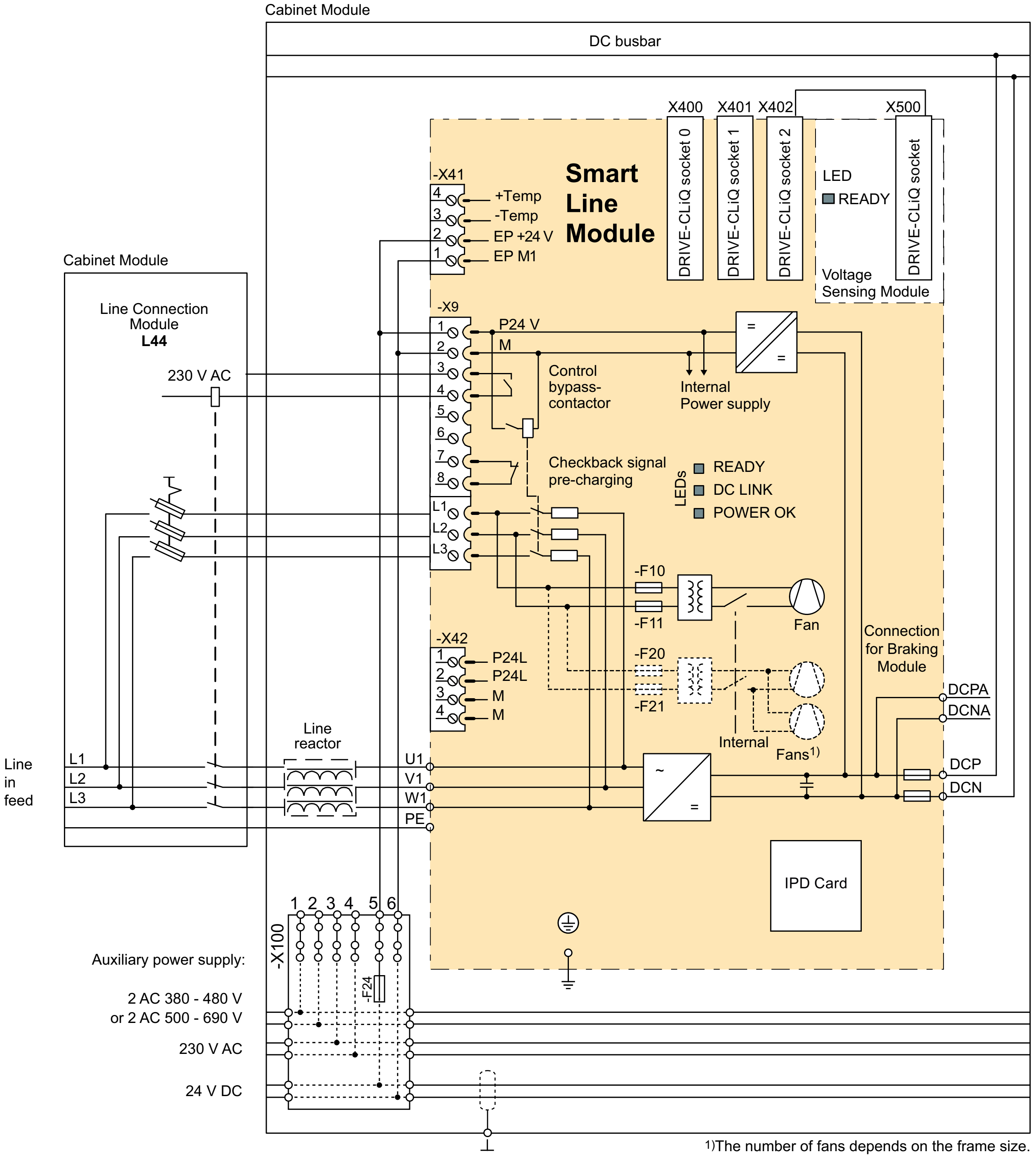


Figure 5-15 Connection example for Smart Line Modules

Configuration

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

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

Smart Line Modules do not require a line-side filter. A line reactor (4% u_k) is included in the standard package. The unit has a built-in 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

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.

Refer to the layout diagrams (AO) on the customer DVD for the precise order-specific location of the components.

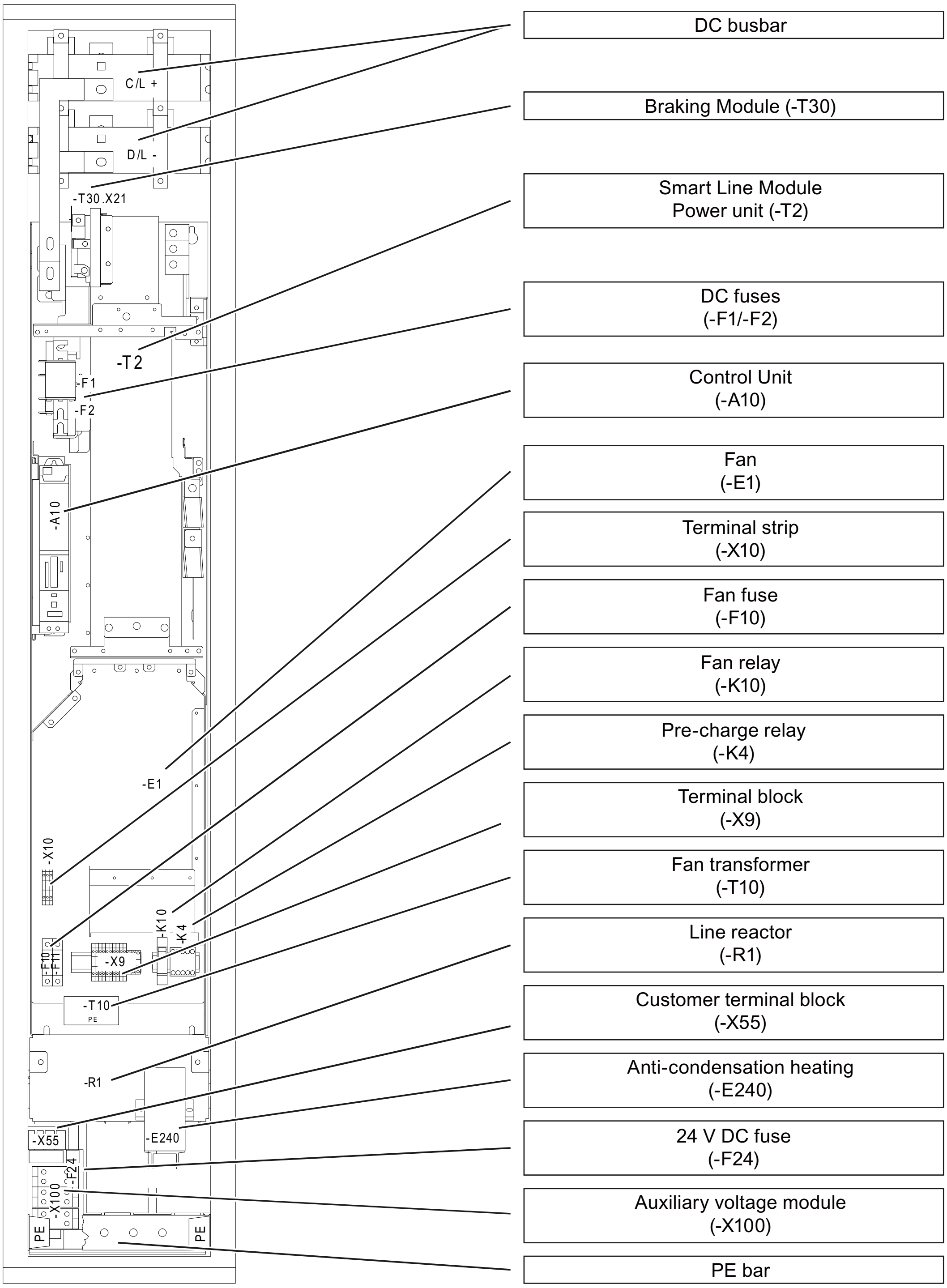


Figure 5-16 Configuration example for Smart Line Modules (frame size GX)

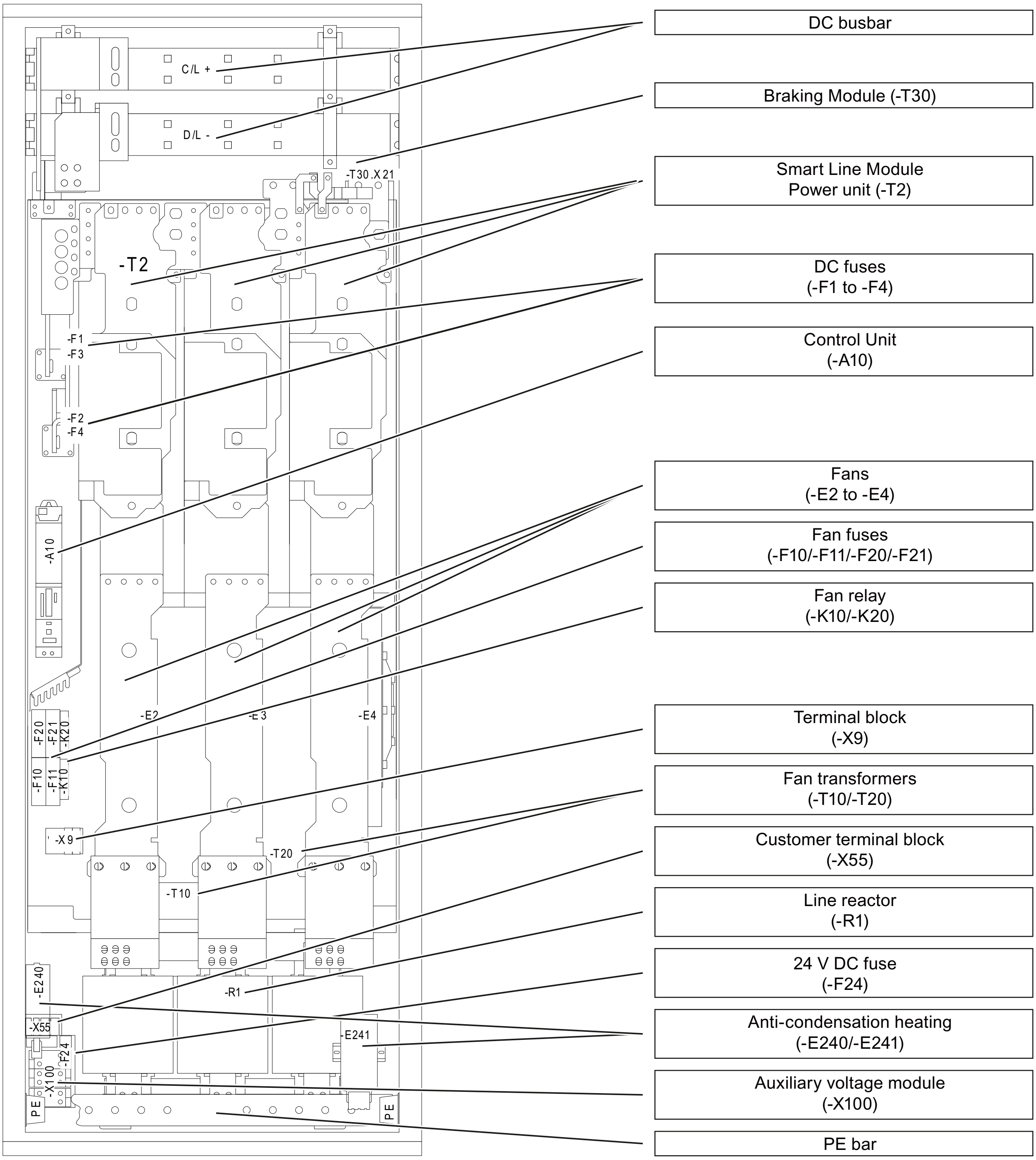


Figure 5-17 Configuration example for Smart Line Modules (frame size JX)

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.

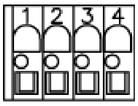
Smart Line Modules with "mirror-image" power connections enable the parallel connection of these modules in a compact configuration. Order numbers for devices that are arranged to the left of the Line Connection Module have a "C" in the next-to-last position, example: 6SL3730-6TE41-1BC3.

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

- Up to 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.
- With multiple infeeds, power must be supplied to the systems from a common infeed point (i.e. the modules cannot be operated on different supplies).
- A derating factor of 7.5% must be taken into consideration, regardless of the number of modules connected in parallel.

5.3.3 Interfaces

Table 5- 16 Terminal strip X41 EP terminals / temperature sensor connection

	Terminal	Function	Technical data
	1	EP M1 (Enable Pulses)	Supply voltage: 24 V DC (20.4 V – 28.8 V) Current consumption: 10 mA
	2	EP +24 V (Enable Pulses)	
	3	- Temp	Temperature sensor connection: KTY84-1C130 / PTC
	4	+ Temp	
Max. connectable cross-section 1.5 mm^2			

Note

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

DANGER

Risk of electric shock!

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

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

Note

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

CAUTION

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

NOTICE

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

5.3.4 Options

Note

The individual options are described in the chapter titled "Options".

Electrical options

Component	Option
CBC10 Communication Board	G20
CBE20 Communication Board	G33
AOP30 operator panel	K08
Control Unit CU320-2 PROFIBUS	K90
Performance extension 1 for CU320-2	K94
Use in the first environment to EN 61800-3, category C2 (TN/TT line supplies)	L00
Without line reactor	L22
Holder for ARC detector	L51
Cabinet anti-condensation heating	L55
50/250 kW braking unit	L62/L65

Mechanical options

Component	Option
Base 100 mm high	M06
Cable-marshaling compartment 200 mm high	M07
IP21 degree of protection	M21
IP23/IP43/IP54 degree of protection	M23, M43, M54
Side panels (right/left)	M26, M27
Closed cabinet door	M59
Additional shock protection	M60
EMC shield bus	M70
DC busbar	M80 ... M87
Crane transport assembly (top-mounted)	M90

5.3.5 Technical data

Table 5- 17 Technical data for Smart Line Modules, 3 AC 380 ... 480 V

Order no.	6SL3730-	6TE35-5AA3	6TE37-3AA3	6TE41-1AA3	6TE41-3AA3	6TE41-7AA3
for parallel connection, - attached to Line Connection Module on right side - attached to Line Connection Module on left side		-- --	-- --	...-1BA3 ...-1BC3	...-3BA3 ...-3BC3	...-7BA3 ...-7BC3
Rated output - for $I_{N\,DC}$ (50 Hz 400 V) - for I_{HDC} (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 current - Rated current $I_{N\,E}$ - Maximum current $I_{max\,E}$	 A A	 463 694	 614 921	 883 1324	 1093 1639	 1430 2145
Power 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 line-up, 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	m^3/s	0.36	0.36	0.78	1.08	1.08
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	69/73	69/73	70/73	70/73	70/73
PE/GND connection - Busbar cross section - Connection cross section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240				
Cable length, max. 4) - shielded - unshielded	 m m	 4000 6000	 4000 6000	 4800 7200	 4800 7200	 4800 7200
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - Width - Height 5) - Depth	 mm mm mm	 400 2200 600	 400 2200 600	 600 2200 600	 800 2200 600	 800 2200 600

Order no.	6SL3730-	6TE35-5AA3	6TE37-3AA3	6TE41-1AA3	6TE41-3AA3	6TE41-7AA3
Weight (standard version)	kg	270	270	490	775	775
Frame size		GX	GX	HX	JX	JX

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 supply input voltage.

3) The specified power loss equals the maximum value at 100 % capacity 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 Configuration Manual on the customer DVD supplied with the device.

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

Table 5- 18 Technical data for Smart Line Modules, 3 AC 500 ... 690 V

Order no.	6SL3730-	6TG35-5AA3	6TG38-8AA3	6TG41-2AA3	6TG41-7AA3
for parallel connection, - Attached to Line Connection Module on right side - Attached to Line Connection Module on left side		-- --	...-8BA3 ...-8BC3	...-2BA3 ...-2BC3	...-7BA3 ...-7BC3
Rated output - 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 current - Rated current $I_{N\,E}$ - Maximum current $I_{max\,E}$	 A A	 463 694	 757 1135	 1009 1513	 1430 2145
Power 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 line-up, 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	m^3/s	0.36	0.78	1.08	1.08
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	69/73	70/73	70/73	70/73
PE/GND connection - Busbar cross section - Connection cross section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240			
Cable length, max. 4) - shielded - unshielded	 m m	 2250 3375	 2750 4125	 2750 4125	 2750 4125
Degree of protection (standard version)		IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - Width - Height 5) - Depth	 mm mm mm	 400 2000 600	 600 2000 600	 800 2000 600	 800 2000 600

Order no.	6SL3730-	6TG35-5AA3	6TG38-8AA3	6TG41-2AA3	6TG41-7AA3
Weight (standard version)	kg	340	550	795	795
Frame size		GX	HX	JX	JX

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

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

3) The specified power loss equals the maximum value at 100 % capacity 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 Configuration Manual on the customer DVD supplied with the device.

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

5.4 Active Line Modules

5.4.1 General information

DANGER

Hazardous voltages are present in certain parts of this equipment during operation of the cabinet unit.
Only qualified personnel may work on the cabinet.
Such personnel must be thoroughly familiar with all the warnings and maintenance procedures for the cabinet described in the documentation provided.

The successful and safe operation of this cabinet is dependent on correct transport, proper storage and installation, as well as careful operation and maintenance.
National safety regulations must be observed.

5.4.2 Description

Note

Refer to the layout diagrams (AO) and circuit diagrams (SP) provided on the customer DVD supplied with the device for the arrangement of components and interfaces, and for wiring.

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

Active Line Modules generate a regulated DC voltage that is kept consistent regardless of fluctuations in the line voltage (the line voltage must range within the permissible tolerances).

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

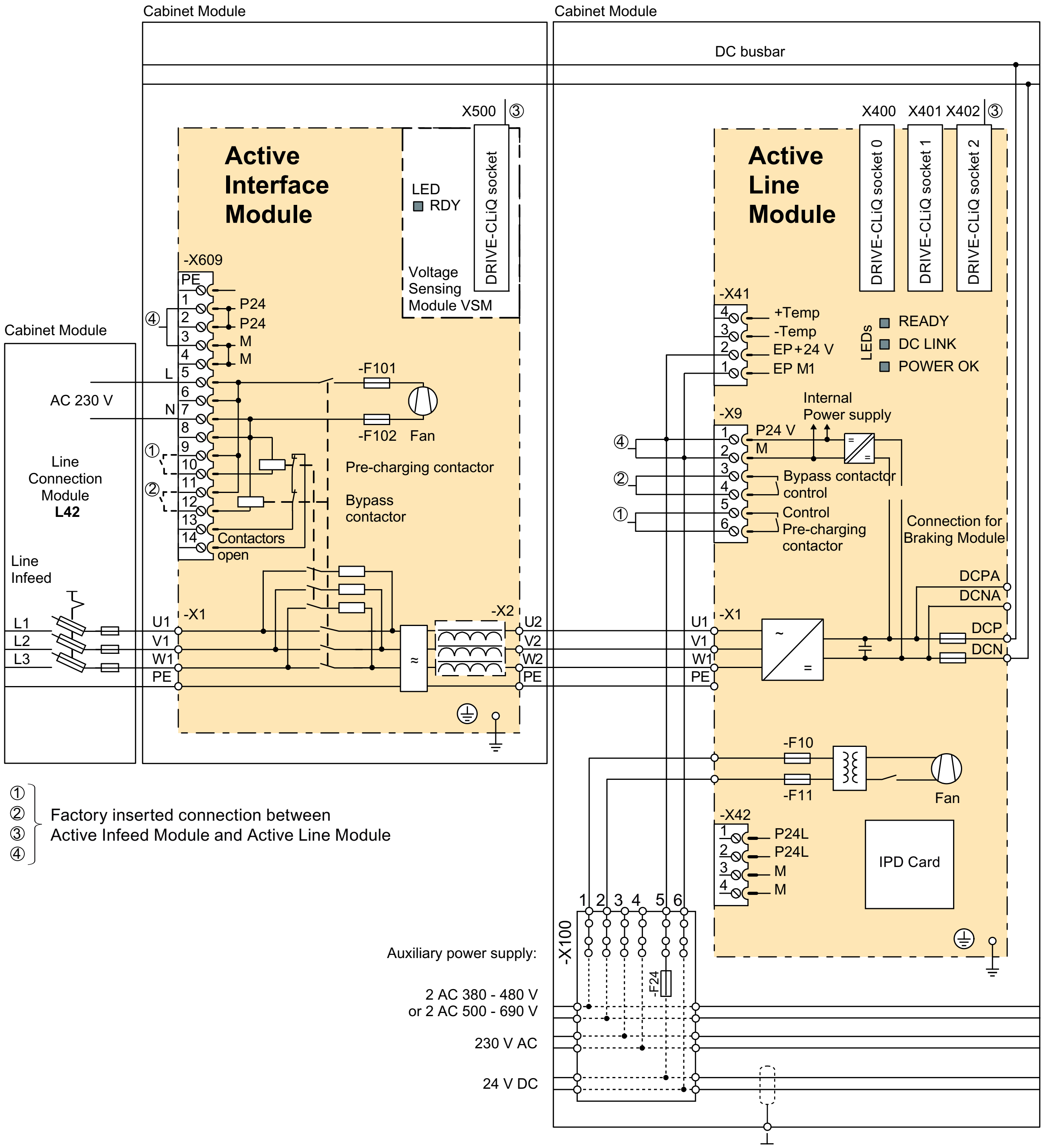
Active Line Modules draw a virtually sinusoidal current from the supply system and cause virtually no line harmonic distortions.

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

Line voltage	Rated power
3 AC 380 … 480 V	132 ... 900 kW
3 AC 500 ... 690 V	560 ... 1400 kW

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

Integration



①
②
③
④
Factory inserted connection between Active Infeed Module and Active Line Module

Figure 5-18 Connection example for Active Line Modules (frame size FI/FX and GI/GX)

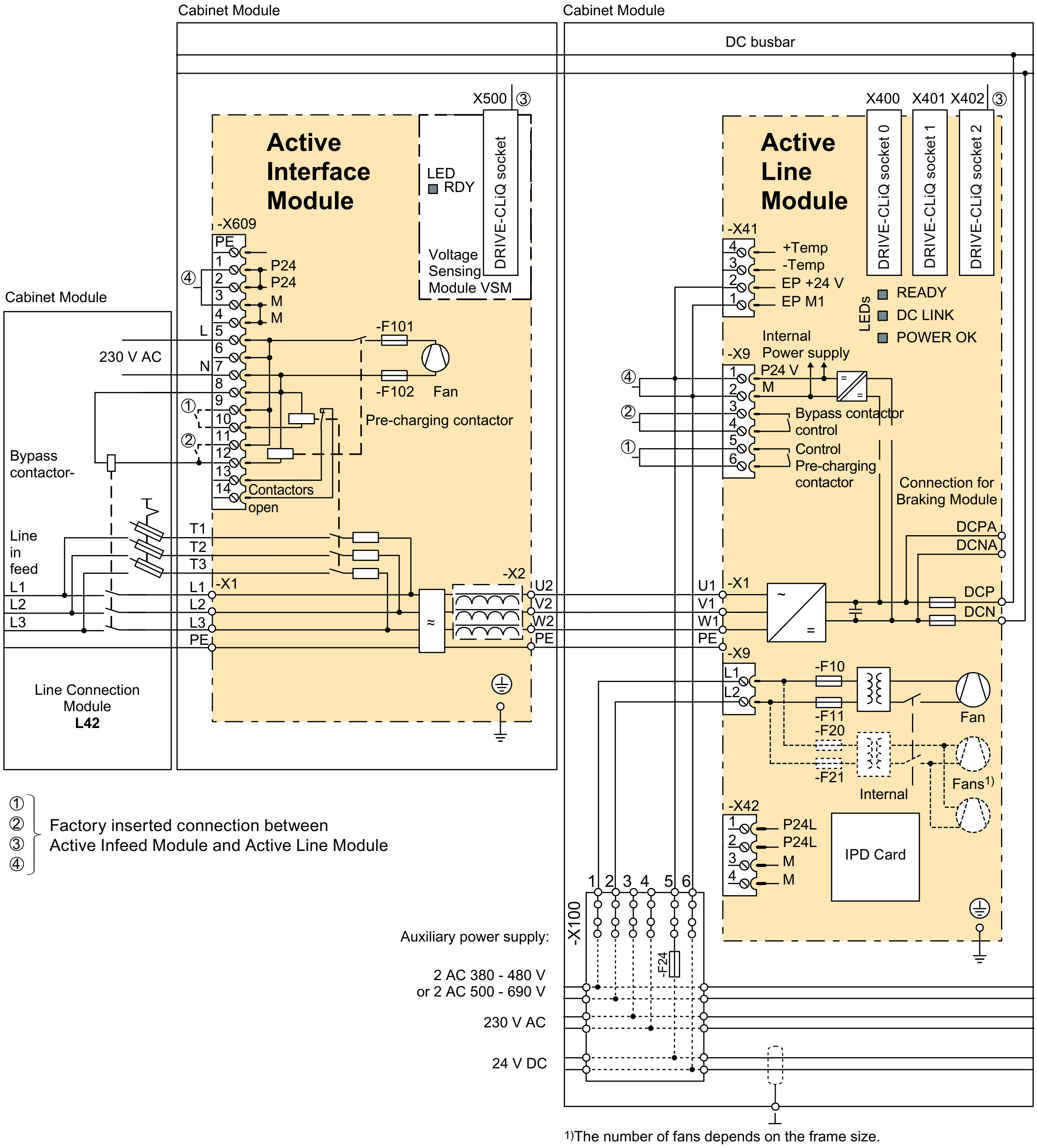


Figure 5-19 Connection example for Active Line Modules (frame size HI/HX and JI/JX)

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 for the "second environment".

Note

The configuration examples of the individual Active 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.

Refer to the layout diagrams (AO) on the customer DVD for the precise order-specific location of the components.

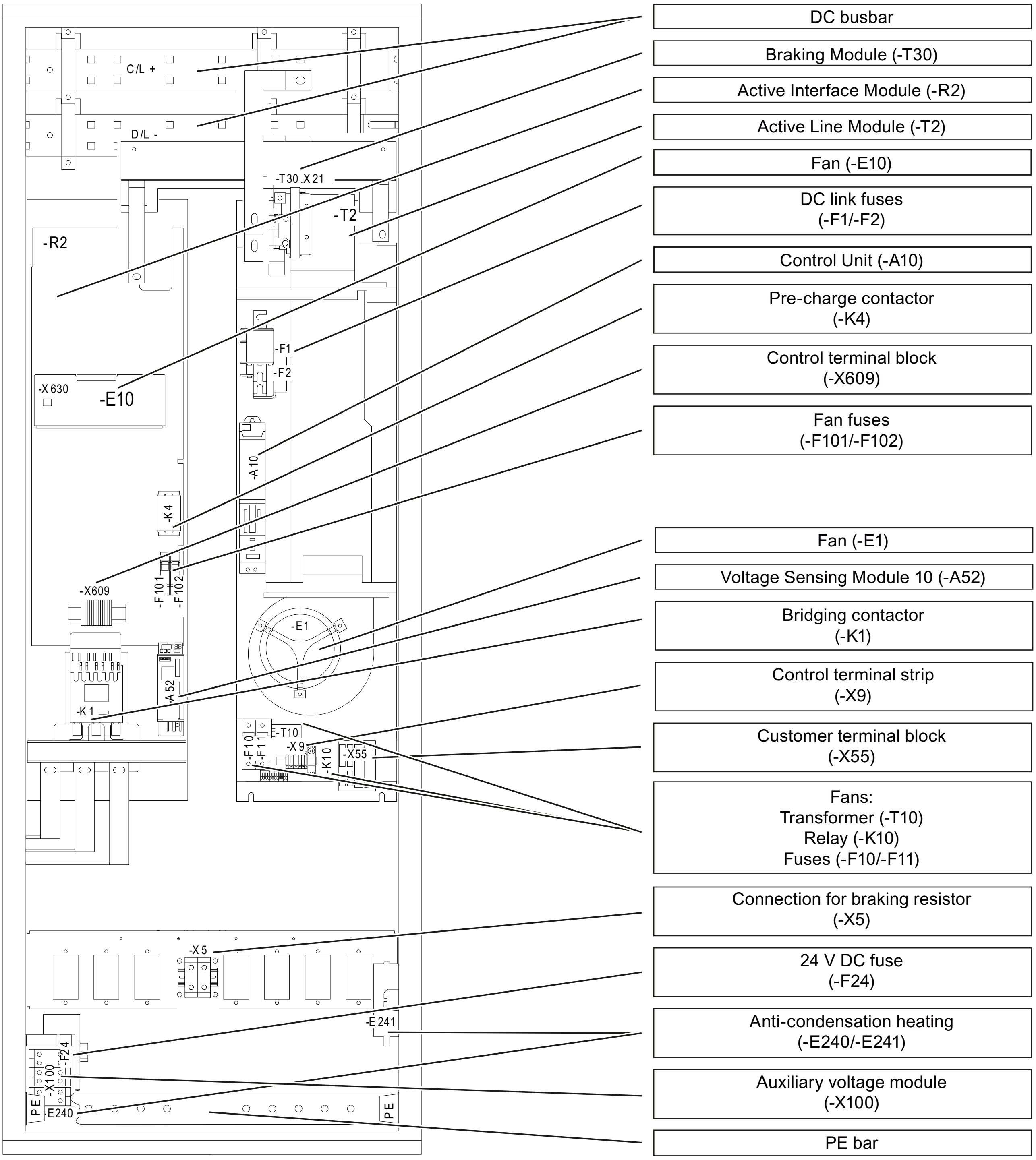


Figure 5-20 Configuration examples for Active Line Modules (frame size FX+FI)

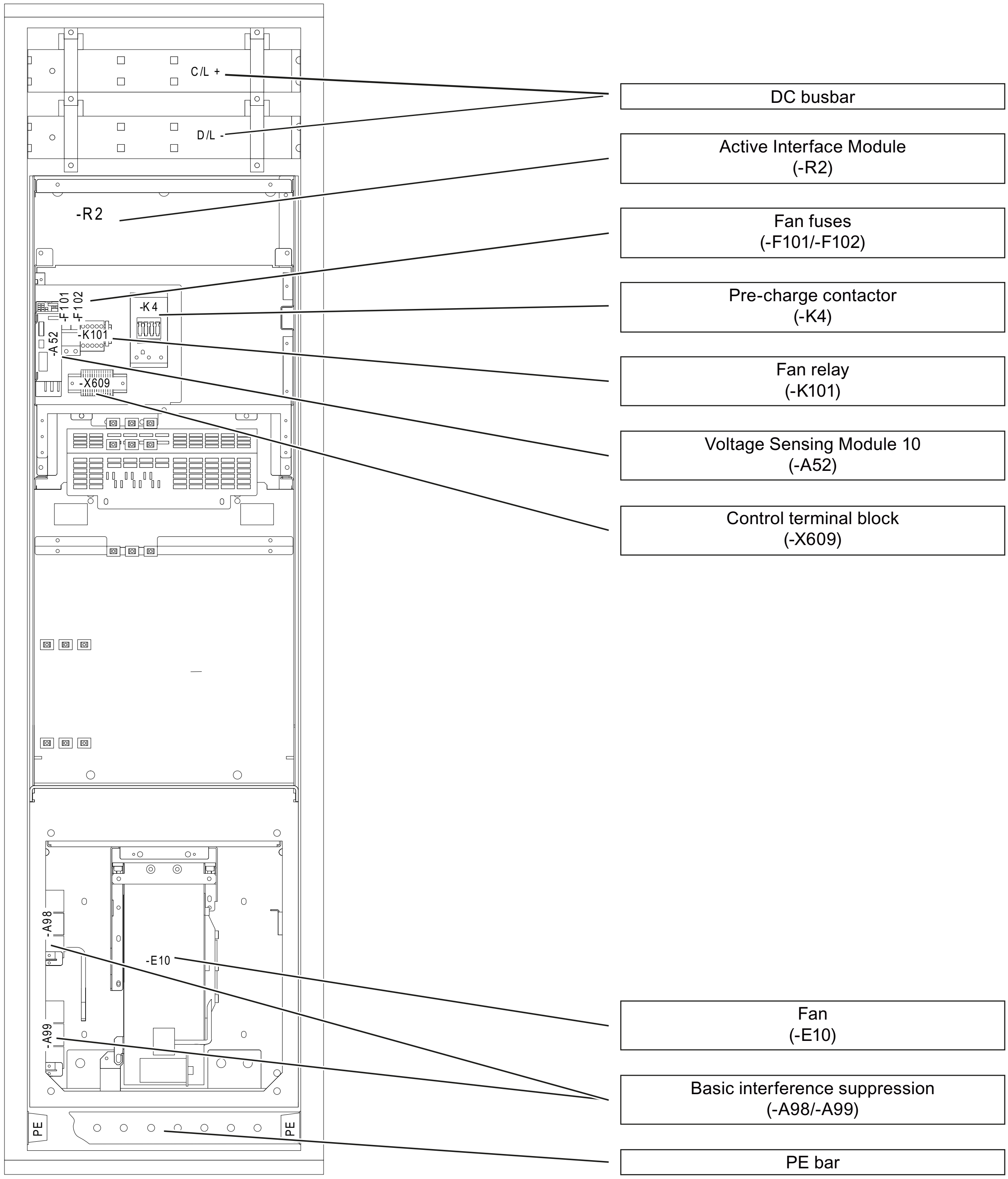


Figure 5-21 Configuration examples for Active Interface Modules (frame size JI)

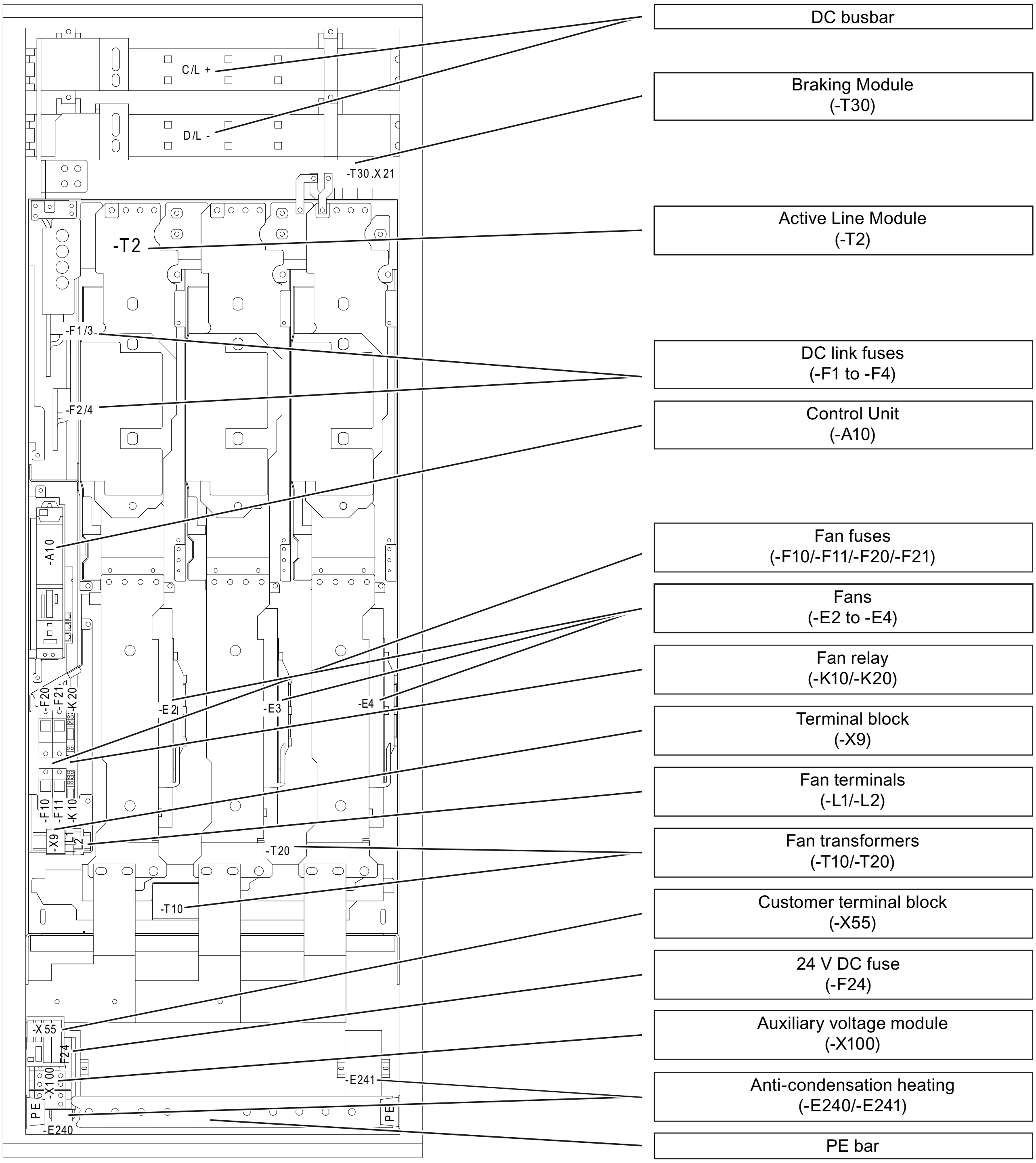


Figure 5-22 Configuration examples for Active Line Modules (frame size JX)

Parallel connection of Active Line Modules to increase power rating

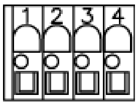
Active Line Modules are available for creating drive line-ups with more power. These modules can be operated in parallel on a common Line Connection Module and are arranged to the right and left of the Line Connection Module. The power connections on the Active Line Module on the left of the Line Connection Module are a mirror image (device order number with C in the next-to-last position, example: 6SL3730-7Tx41x-xBC3a), which produces a very compact design for the supply infeed.

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

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

5.4.3 Interfaces

Table 5- 19 Terminal strip X41 EP terminals / temperature sensor connection

	Terminal	Function	Technical data
	1	EP M1 (Enable Pulses)	Supply voltage: 24 V DC (20.4 V – 28.8 V) Current consumption: 10 mA
	2	EP +24 V (Enable Pulses)	
	3	- Temp	Temperature sensor connection: KTY84-1C130 / PTC
	4	+ Temp	
Max. connectable cross-section 1.5 mm^2			

Note

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

⚠ DANGER

Risk of electric shock!

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

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

Note

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

CAUTION

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

NOTICE

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

5.4.4 Options

Note

The individual options are described in the chapter titled "Options".

Electrical options

Component	Option
CBC10 Communication Board	G20
CBE20 Communication Board	G33
AOP30 operator panel	K08
Control Unit CU320-2 PROFIBUS	K90
Performance extension 1 for CU320-2	K94
Use in the first environment to EN 61800-3, category C2 (TN/TT line supplies)	L00
Holder for ARC detector	L51
Cabinet anti-condensation heating	L55
25/125 kW braking unit	L61/L64
50/250 kW braking unit	L62/L65

Mechanical options

Component	Option
Base 100 mm high	M06
Cable-marshaling compartment 200 mm high	M07
IP21 degree of protection	M21
IP23/IP43/IP54 degree of protection	M23, M43, M54
Side panels (right/left)	M26, M27
Closed cabinet door	M59
Additional shock protection	M60
DC busbar	M80 ... M87
Crane transport assembly (top-mounted)	M90

5.4.5 Technical data

Table 5- 20 Technical data for Active Line Modules (including Active Interface Module), 3 AC 380 ... 480 V, part I

Order No.	6SL3730-	7TE32-1BA3	7TE32-6BA3	7TE33-8BA3	7TE35-0BA3
for parallel connection, - attached to Line Connection Module on left side		--	--	--	--
Rated output - for $I_{N\ DC}$ (50 Hz 400 V) - for I_{HDC} (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 current - Rated current $I_{N\ E}$ - Maximum current $I_{max\ E}$	 A A	 210 315	 260 390	 380 570	 490 735
Power demand - Auxiliary supply 24 V DC - 400 V AC 2)	 A A	 1.27 internal	 1.27 internal	 1.52 internal	 1.52 internal
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	m^3/s	0.47	0.47	0.83	0.83
Sound pressure level L_{pA} (1 m) at 50/60 Hz 4)	dB(A)	74/76	75/77	76/78	76/78
PE/GND connection - Busbar cross section - Connection cross section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240			
Cable length, max. 5) - shielded - unshielded	 m m	 2700 4050	 2700 4050	 2700 4050	 2700 4050
Degree of protection (standard version)		IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - Width - Height 6) - Depth	 mm mm mm	 800 2200 600	 800 2200 600	 800 2200 600	 800 2200 600

Order No.	**6SL3730-**	**7TE32-1BA3**	**7TE32-6BA3**	**7TE33-8BA3**	**7TE35-0BA3**
Weight (standard version)	kg	380	380	530	530
Frame size		FX + FI	FX + FI	GX + GI	GX + GI

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 supply input voltage.

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

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

5) Total of all motor cables and DC link. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low-Voltage Configuration Manual on the customer DVD supplied with the device.

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

Table 5- 21 Technical data for Active Line Modules (including Active Interface Module), 3 AC 380 ... 480 V, part II

Order no.	6SL3730-	7TE36-1BA3	7TE38-4BA3	7TE41-0BA3	7TE41-4BA3
for parallel connection, - attached to Line Connection Module on left side		---	---	...-0BC3	...-4BC3
Rated output - for $I_{N\,DC}$ (50 Hz 400 V) - for I_{HDC} (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 current - Rated current $I_{N\,E}$ - Maximum current $I_{max\,E}$	 A A	 605 907	 840 1260	 985 1260	 1405 2107
Power demand - Auxiliary supply 24 V DC - 400 V AC 2)	 A A	 1.57 internal	 1.57 internal	 1.67 internal	 1.67 internal
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	m^3/s	1.18	1.18	1.48	1.48
Sound pressure level L_{pA} (1 m) at 50/60 Hz 4)	dB(A)	78/80	78/80	78/80	78/80
PE/GND connection - Busbar cross section - Connection cross section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240			
Cable length, max. 5) - shielded - unshielded	 m m	 3900 5850	 3900 5850	 3900 5850	 3900 5850
Degree of protection (standard version)		IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - Width - Height 6) - Depth	 mm mm mm	 1000 2200 600	 1000 2200 600	 1400 2200 600	 1400 2200 600
Weight (standard version)	kg	930	930	1360	1360
Frame size		HX + HI	HX + HI	JX + JI	JX + JI

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 supply input voltage.

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

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

5) Total of all motor cables and DC link. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low-Voltage Configuration Manual on the customer DVD supplied with the device.

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

Table 5- 22 Technical data for Active Line Modules (including Active Interface Module), 3 AC 500 ... 690 V

Order no.	6SL3730-	7TG35-8BA3	7TG37-4BA3	7TG41-0BA3	7TG41-3BA3
for parallel connection, - Attached to Line Connection Module on left side		--	...-4BC3	...-0BC3	...-3BC3
Rated output - 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 current - Rated current $I_{N\ E}$ - Maximum current $I_{max\ E}$	 A A	 575 862	 735 1102	 1025 1537	 1270 1905
Power demand - Auxiliary supply 24 V DC - 500/690 V AC 2)	 A A	 1.57 internal	 1.67 internal	 1.87 internal	 1.87 internal
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	m^3/s	1.18	1.48	1.48	1.48
Sound pressure level L_{pA} (1 m) at 50/60 Hz 4)	dB(A)	78/80	78/80	78/80	78/80
PE/GND connection - Busbar cross section - Connection cross section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240			
Cable length, max. 5) - shielded - unshielded	 m m	 2250 3375	 2250 3375	 2250 3375	 2250 3375
Degree of protection (standard version)		IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - Width - Height 6) - Depth	 mm mm mm	 1000 2200 600	 1400 2200 600	 1400 2200 600	 1400 2200 600

Order no.	6SL3730-	7TG35-8BA3	7TG37-4BA3	7TG41-0BA3	7TG41-3BA3
Weight (standard version)	kg	930	1360	1360	1360
Frame size		HX + HI	JX + JI	JX + JI	JX + JI

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

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

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

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

5) Total of all motor cables and DC link. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low-Voltage Configuration Manual on the customer DVD supplied with the device.

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

5.5 Booksize format Motor Modules

5.5.1 General information

DANGER

Hazardous voltages are present in certain parts of this equipment during operation of the cabinet unit.
Only qualified personnel may work on the cabinet.
Such personnel must be thoroughly familiar with all the warnings and maintenance procedures for the cabinet described in the documentation provided.

The successful and safe operation of this cabinet is dependent on correct transport, proper storage and installation, as well as careful operation and maintenance.
National safety regulations must be observed.

WARNING

Do not switch off the fuse switch disconnector under load.
Restarting the fuse switch disconnector when the DC busbar is live can cause damage to the device. You can only restart the fuse switch disconnector with the option L37 (DC interface).

5.5.2 Description

Note

Refer to the layout diagrams (AO) and circuit diagrams (SP) provided on the customer DVD supplied with the device for the arrangement of components and interfaces, and for wiring.

Motor Modules are also available in a Booksize Cabinet Kit version for power ratings from 1.6 to 107 kW in voltage class 380 to 480 V (DC link voltage 510 to 720 V).

Single Motor Modules are available for connection of one motor, and Double Motor Modules (in power rating range 1.6 to 9.7 kW) are available for connection of two motors.

Integration

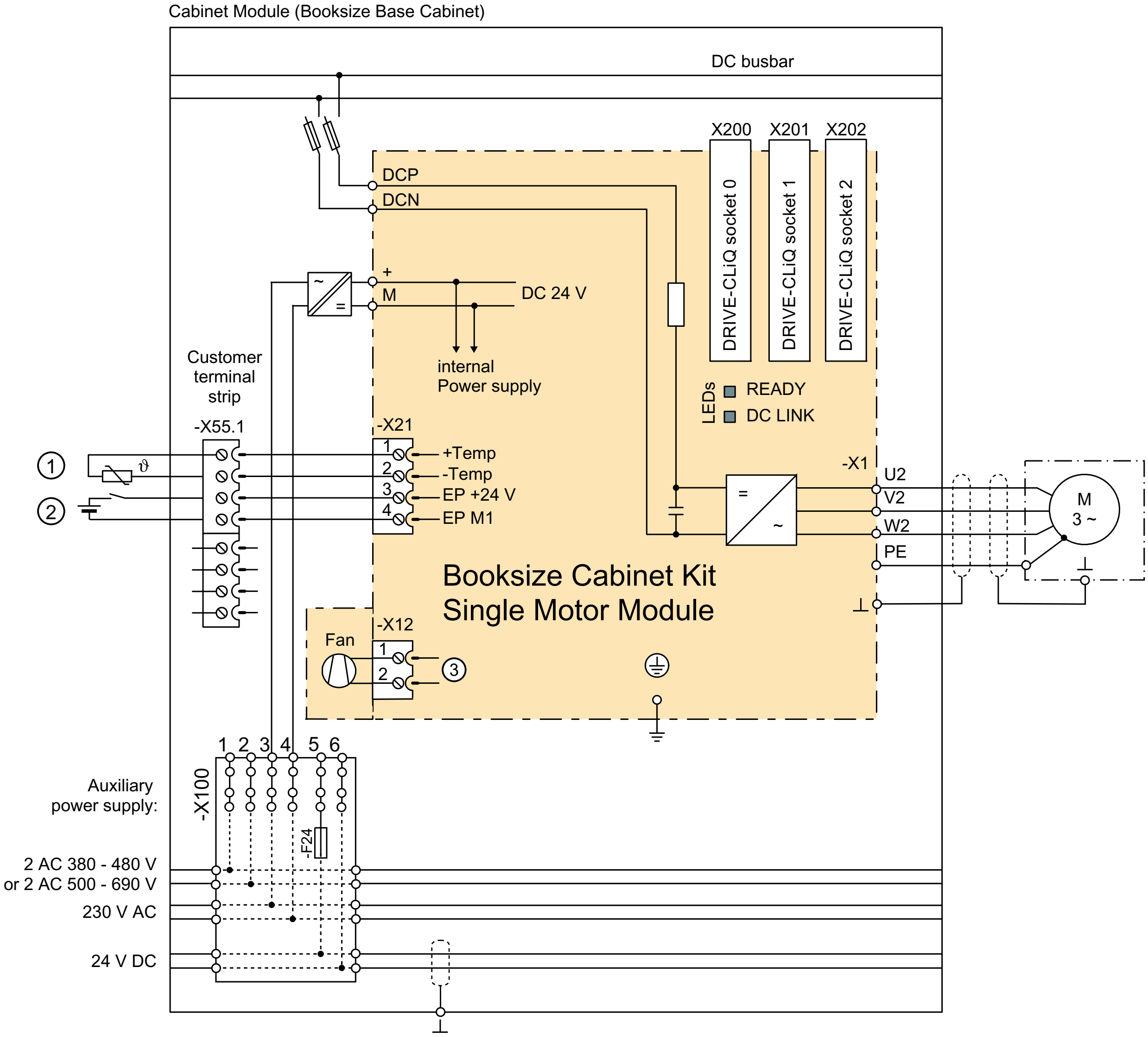


Figure 5-23 Connection example for Single Motor Modules in Booksize Cabinet Kit format

① Temperature sensor connection for motors without DRIVE-CLiQ interface
② Required for Safety Integrated
③ Fan module for rated output currents from 132 A and 200 A

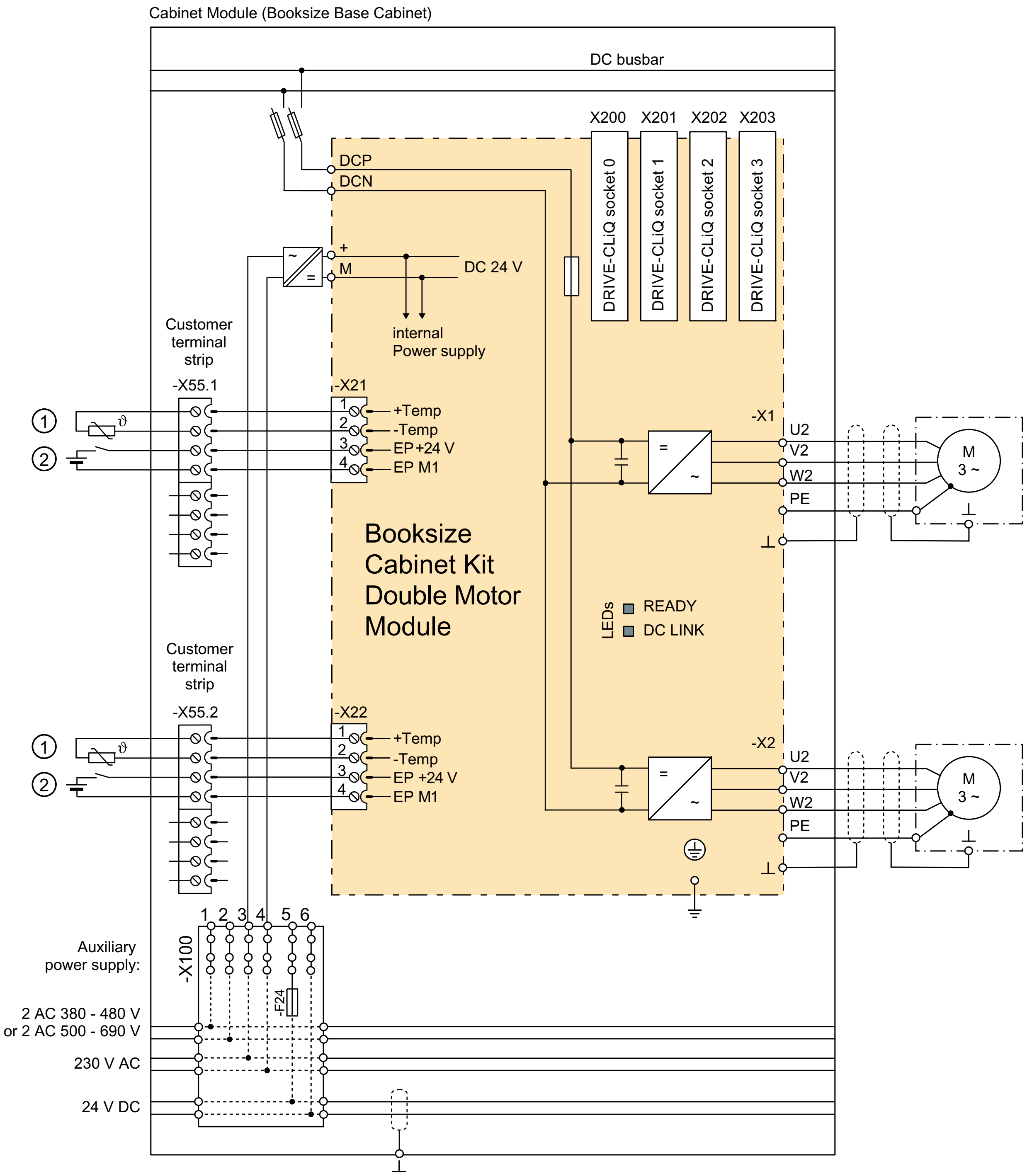


Figure 5-24 Connection example for Double Motor Modules in Booksize Cabinet Kit format

① Temperature sensor connection for motors without a DRIVE-CLiQ interface
② Required for Safety Integrated

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.

Multiple Booksize Cabinet Kits can be installed in one Base Cabinet, depending on the mounting width requirements, which in turn depend on the power. Each Motor Module is connected separately to the DC busbar of the Cabinet Modules via a separate fuse switch disconnector. The DC link rail integrated in the devices is not used. As a 24 V DC supply buffered by the DC link is not possible with booksize, a dedicated SITOP is used to provide the 24 V DC required for the Booksize Cabinet Kit.

Note

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.

Refer to the layout diagrams (AO) on the customer DVD for the precise order-specific location of the components.

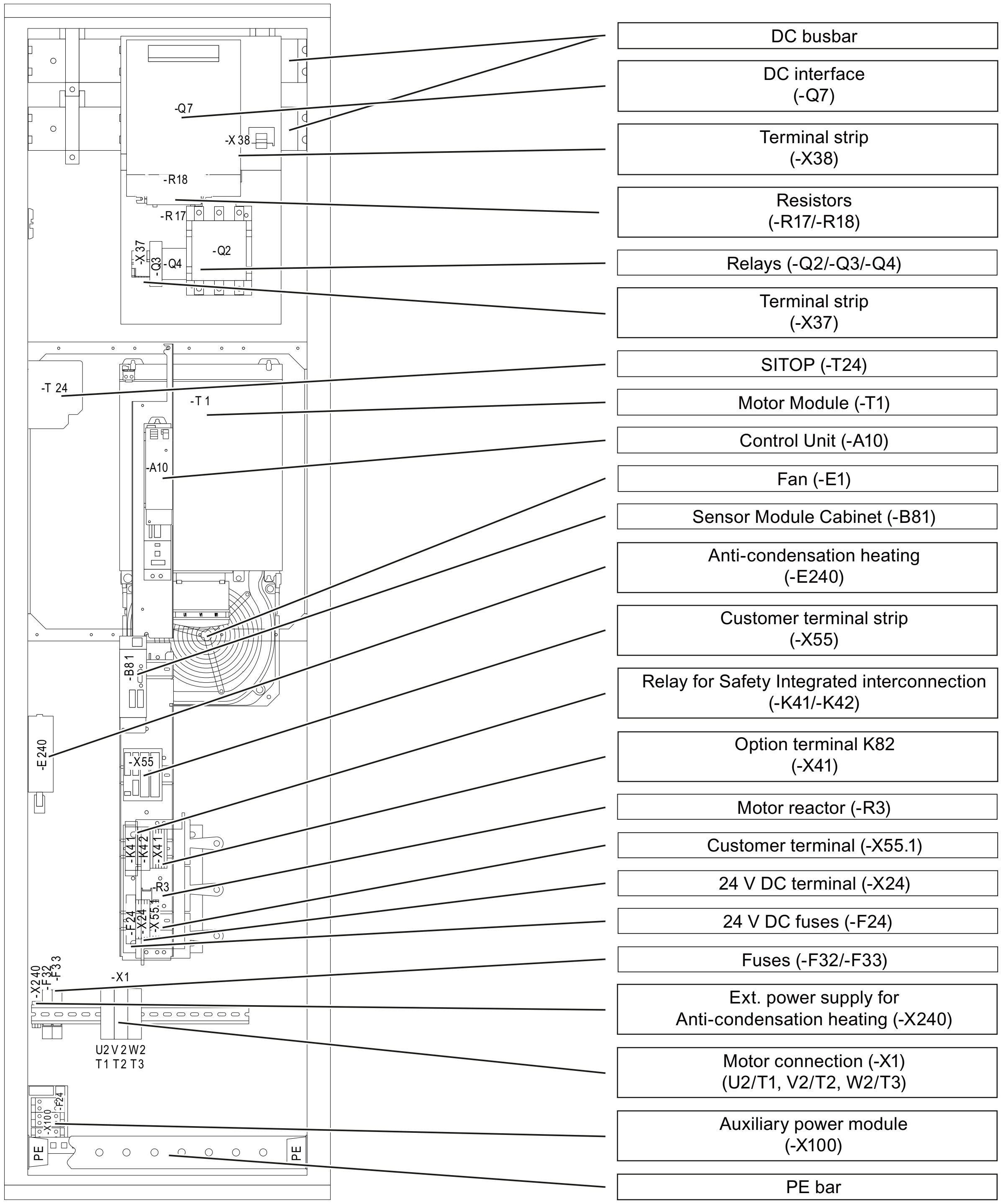


Figure 5-25 Configuration example for Motor Modules in Booksize Cabinet Kit format

Mounting grid arrangement in the cabinet

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

- 100 mm
- 200 mm
- 300 mm

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

Table 5- 23 The assignment of the Motor Modules according to grid width

Grid width	Assignment of Motor Modules (see the section titled "Technical data")
100 mm	3 to 30 A Single Motor Modules
200 mm	45 to 85 A Single Motor Modules, 3 to 18 A Double Motor Modules
300 mm	132 ... 200 A Single Motor Module

Note

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

5.5.3 X55.1 Customer interface

Description

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

Note

All other cabinet interfaces and connections are explained in the circuit and terminal diagrams on the customer DVD supplied.

X55.1 Customer terminal

Table 5- 24 Customer terminal X55.1

Terminal	Designation	Technical data
1	+ Temp	Temperature sensor connection KTY84-1C130/PTC
2	- Temp	
3	EP +24 V Enable Pulses	Supply voltage: 24 V DC (20.4 V - 28.8 V) Current consumption: 10 mA
4	EP M1 Enable Pulses	Isolated input Signal propagation times: L → H: 100 μs H → L: 1000 μs The pulse inhibit function is only available when Safety Integrated Basic Functions are enabled.
Max. connectable cross-section: 2.5 mm²		

DANGER

Risk of electric shock!

Only temperature sensors that meet the safety isolation specifications stipulated in EN 61800-5-1 may be connected to terminals "+Temp" and "-Temp".

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

Note

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

NOTICE

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

NOTICE

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

Note

Safety Integrated Function Manual

Detailed and comprehensive instructions and information for the Safety Integrated functions can be found in the associated Function Manual. This manual is available as additional documentation on the customer DVD supplied with the device.

5.5.4 Options

Note

The individual options are described in the chapter titled "Options".

Electrical options for Booksize Base Cabinets

Component	Option
Holder for ARC detector	L51
Cabinet anti-condensation heating	L55

Mechanical options for Booksize Base Cabinets

Component	Option
Base 100 mm high	M06
Cable-marshaling compartment 200 mm high	M07
IP21 degree of protection	M21
IP23/IP43/IP54 degree of protection	M23, M43, M54
Side panels (right/left)	M26, M27
Closed cabinet door	M59
EMC shield bus	M70
DC busbar	M80 ... M87
Crane transport assembly (top-mounted)	M90

Electrical options for Booksize Cabinet Kits

Component	Option	Note
CBC10 Communication Board	G20	
CBE20 Communication Board	G33	
Safety license for 1... 5 axes	K01 ... K05	
AOP30 operator panel	K08	1 x also for Double Motor Module
SMC 10/20/30 Sensor Modules	K46, K48, K50	2 x for Double Motor Module
Terminal module for activating "Safe Torque Off" and "Safe STOP 1"	K82	2 x for Double Motor Module
Terminal Module TM54F	K87	1 x also for Double Motor Module
Control Unit CU320-2 PROFIBUS	K90	1 x also for Double Motor Module
Performance extension 1 for CU320-2	K94	1 x also for Double Motor Module
Motor reactor	L08/L09	2 x for Double Motor Module
DC interface, including pre-charging input circuit	L37	1 x also for Double Motor Module

5.5.5 Technical data

Table 5- 25 Technical data for Booksize Base Cabinet

Order No.	6SL3720-	1TX38-0AA3	1TX41-2AA3
Usable installation width	mm	600	1000
Weight (standard version)	kg	185	270
Dimensions (standard version, IP20) - width - height - depth	 mm mm mm	 800 2200 600	 1200 2200 600

Table 5- 26 Technical data for Motor Modules in Booksize Cabinet Kit format, Single Motor Modules, line voltage 3 AC 380 ... 480 V, DC link voltage 510 ... 720 V DC, part I

Order no.	6SL3720-	1TE13-0AB3	1TE15-0AB3	1TE21-0AB3	1TE21-8AB3
Unit rating					
- at $I_{N\,DC}$ (50 Hz 400 V) [1]	kW	1.6	2.7	4.8	9.7
- at $I_{H\,DC}$ (50 Hz 400 V) [1]	kW	1.4	2.3	4.1	8.2
- at $I_{N\,DC}$ (60 Hz 460 V) [2]	hp	1.5	3	5	10
- at $I_{H\,DC}$ (60 Hz 460 V) [2]	hp	1	2	5	10
Output current					
- Rated current $I_{N\,A}$	A	3	5	9	18
- Base load current I_H [3]	A	2.3	4.3	7.7	15.3
- Maximum current $I_{max\,A}$	A	6	10	18	36
DC link current I_d [4]	A	3.6	6	11	22
Power demand					
- 24 V DC, max.	A	0.85	0.85	0.85	0.85
DC link capacitance	μF	110	110	110	220
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	0.035	0.055	0.08	0.165
- at 60 Hz 460 V	kW	0.035	0.055	0.08	0.165
Cooling air requirement	m^3/s	0.008	0.008	0.008	0.008
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	<60	<60	<60	<60
Motor connection U2, V2, W2		Terminal			
- Connection cross section, max. (IEC)	mm^2	6			
Cable length, max. [7]					
- shielded	m	50	50	50	70
- unshielded	m	75	75	75	100
PE/GND connection		PE busbar			
- Busbar cross section	mm^2	600			
- Connection cross section, max. (IEC)	mm^2	240			
Degree of protection		IP20	IP20	IP20	IP20
Weight, approx.	kg	20.1	20.1	20	20
Installation width	mm	100	100	100	100

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

2) Rated output 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 160% for 10 s with a duty cycle duration of 300 s.

4) For a DC link voltage of 600 V DC.

5) For the interdependency of pulse frequency and max. output current/output frequency, see SINAMICS - Low-Voltage Configuration Manual on the customer DVD supplied with the device.

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

7) Total of all motor cables. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low-Voltage Configuration Manual on the customer DVD supplied with the device.

Table 5- 27 Technical data for Motor Modules in Booksize Cabinet Kit format, Single Motor Modules, line voltage 3 AC 380 ... 480 V, DC link voltage 510 ... 720 V DC, part II

Order no.	6SL3720-	1TE23-0AB3	1TE24-5AB3	1TE26-0AB3	1TE28-5AB3	1TE31-3AB3	1TE32-0AB3
Unit rating							
- at $I_{N\,DC}$ (50 Hz 400 V) 1)	kW	16	24	32	46	71	107
- at $I_{H\,DC}$ (50 Hz 400 V) 1)	kW	13.7	21	28	37	57	76
- at $I_{N\,DC}$ (60 Hz 460 V) 2)	hp	20	30	40	60	100	150
- at $I_{H\,DC}$ (60 Hz 460 V) 2)	hp	15	25	40	50	75	100
Output current							
- Rated current $I_{N\,A}$	A	30	45	60	85	132	200
- Base load current I_H 3)	A	25.5	38	52	65	105	141
- Maximum current $I_{max\,A}$	A	56	85	113	141	210	282
DC link current I_d 4)	A	36	54	72	102	158	200
Power demand							
- 24 V DC, max.	A	0.9	1.2	1.2	1.5	1.5	1.5
DC link capacitance	µF	710	1175	1410	1880	2820	3995
Pulse frequency 5)							
- Rated frequency	kHz	4	4	4	4	4	4
- Pulse frequency, max. with current derating	kHz	16	16	16	16	16	16
Power loss, max. 6)							
- at 50 Hz 400 V	kW	0.29	0.43	0.59	0.75	1.25	2.05
- at 60 Hz 460 V	kW	0.29	0.43	0.59	0.75	1.25	2.05
Cooling air requirement	m^3/s	0.016	0.031	0.031	0.044	0.144	0.144
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	<60	<60	<60	<60	<60	<60
Motor connection U2, V2, W2		Terminal					
- Connection cross section, max. (IEC)	mm^2	6	16	16	35	70	95
Cable length, max. 7)							
- shielded	m	100	100	100	100	100	100
- unshielded	m	150	150	150	150	150	150
PE/GND connection		PE busbar					
- Busbar cross section	mm^2	600					
- Connection cross section, max. (IEC)	mm^2	240					
Degree of protection		IP20	IP20	IP20	IP20	IP20	IP20
Weight, approx.	kg	21.9	27	27	33	41	41
Installation width	mm	100	200	200	200	300	300

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

2) Rated output 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 160% for 10 s with a duty cycle duration of 300 s.

4) For a DC link voltage of 600 V DC.

5) For the interdependency of pulse frequency and max. output current/output frequency, see SINAMICS - Low-Voltage Configuration Manual on the customer DVD supplied with the device.

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

7) Total of all motor cables. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low-Voltage Configuration Manual on the customer DVD supplied with the device.

Table 5- 28 Technical data for Motor Modules in Booksize Cabinet Kit format, Double Motor Modules, line voltage 3 AC 380 ... 480 V, DC link voltage 510 ... 720 V DC

Order no.	6SL3720-	2TE13-0AB3	2TE15-0AB3	2TE21-0AB3	2TE21-8AB3
Unit rating - at $I_{N\ DC}$ (50 Hz 400 V) [1] - at $I_{H\ DC}$ (50 Hz 400 V) [1] - at $I_{N\ DC}$ (60 Hz 460 V) [2] - at $I_{H\ DC}$ (60 Hz 460 V) [2]	 kW kW hp hp	 2 x 1.6 2 x 1.4 2 x 1.5 2 x 1	 2 x 2.7 2 x 2.3 2 x 3 2 x 2	 2 x 4.8 2 x 4.1 2 x 5 2 x 5	 2 x 9.7 2 x 8.2 2 x 10 2 x 10
Output current - Rated current $I_{N\ A}$ - Base load current I_H [3] - Maximum current $I_{max\ A}$	 A A A	 2 x 3 2 x 2.6 2 x 6	 2 x 5 2 x 4.3 2 x 10	 2 x 9 2 x 7.7 2 x 18	 2 x 18 2 x 15.3 2 x 36
DC link current I_d [4]	A	7.2	12	22	43
Power demand - 24 V DC, max.	 A	 0.85	 0.85	 0.85	 0.85
DC link capacitance	µF	110	220	220	710
Pulse frequency [5] - Rated frequency - Pulse frequency, max. with current derating	 kHz kHz	 4 16	 4 16	 4 16	 4 16
Power loss, max. [6] - at 50 Hz 400 V - at 60 Hz 460 V	 kW kW	 0.07 0.07	 0.11 0.11	 0.16 0.16	 0.32 0.32
Cooling air requirement	m^3/s	0.008	0.008	0.008	0.016
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	<60	<60	<60	<60
Motor connection U2, V2, W2 - Connection cross section, max. (IEC)	 mm^2	Terminal 6			
Cable length, max. [7] - shielded - unshielded	 m m	 50 75	 50 75	 50 75	 70 100
PE/GND connection - Busbar cross section - Connection cross section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240			
Degree of protection		IP20	IP20	IP20	IP20
Weight, approx.	kg	23.3	23.3	23.3	24.8
Installation width	mm	200	200	200	200

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

2) Rated output 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 160% for 10 s with a duty cycle duration of 300 s.

4) For a DC link voltage of 600 V DC.

5) For the interdependency of pulse frequency and max. output current/output frequency, see SINAMICS - Low-Voltage Configuration Manual on the customer DVD supplied with the device.

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

7) Total of all motor cables. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low-Voltage Configuration Manual on the customer DVD supplied with the device.

5.5.6 Overload capability

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

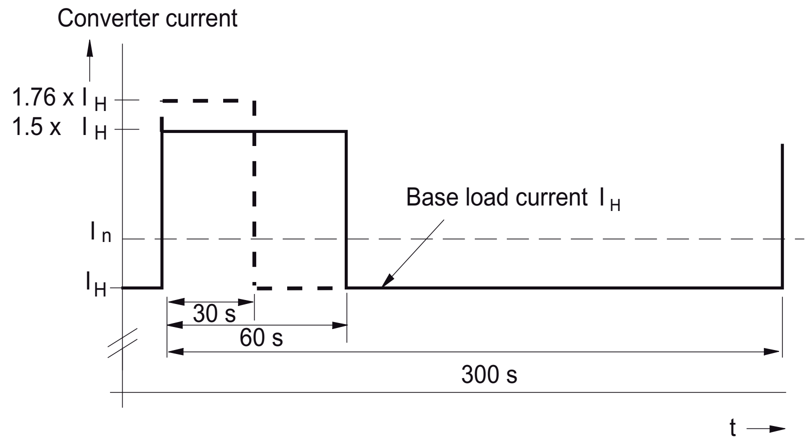


Figure 5-26 Duty cycle with 30 s and 60 s overload with a duty cycle duration of 300 s

5.5.7 Derating data

Current derating as a function of the installation altitude and ambient temperature

If the cabinet units are operated at an installation altitude > 2000 m above sea level, the maximum permissible output current can be calculated using the following table. The installation altitude and ambient temperature are compensated here. The degree of protection selected for the cabinet units must also be taken into account.

Table 5- 29 Current derating as a function of ambient temperature (inlet air temperature at the air inlet of the cabinet unit) and installation altitude for cabinet units with degree of protection IP20/IP21/IP23/IP43 and IP54

Installation altitude above sea level in m	Ambient temperature in °C						
	20	25	30	35	40	45	50
0 to 1000	100 %					86 %	73 %
up to 1500	92 %	92 %	92 %	92 %	92 %	79 %	67 %
up to 2000	84 %	84 %	84 %	84 %	84 %	72 %	61 %
up to 2500	79 %	79 %	79 %	79 %	79 %	68 %	57 %
up to 3000	75 %	75 %	75 %	75 %	75 %	65 %	54 %
up to 3500	66 %	66 %	66 %	66 %	66 %	56 %	48 %
up to 4000	63 %	63 %	63 %	63 %	63 %	54 %	46 %

Voltage derating as a function of the installation altitude

In addition to current derating, voltage derating must also be considered at installation altitudes > 2000 m above sea level.

Table 5- 30 Voltage derating as a function of the installation altitude (380 to 480 V 3 AC)

Installation altitude above sea level in m	Rated converter input voltage					
	380 V	400 V	420 V	440 V	460 V	480 V
0 to 2000	100 %					
up to 2250	100 %					96 %
up to 2500	100 %				98 %	94 %
up to 2750	100 %			98 %	94 %	90 %
up to 3000	100 %			95 %	91 %	88 %
up to 3250	100 %		97 %	93 %	89 %	85 %
up to 3500	100 %	98 %	93 %	89 %	85 %	82 %
up to 3750	100 %	95 %	91 %	87 %	83 %	79 %
up to 4000	96 %	92 %	87 %	83 %	80 %	76 %

5.6 Chassis format Motor Modules

5.6.1 General information

⚠ DANGER

Hazardous voltages are present in certain parts of this equipment during operation of the cabinet unit.
Only qualified personnel may work on the cabinet.
Such personnel must be thoroughly familiar with all the warnings and maintenance procedures for the cabinet described in the documentation provided.

The successful and safe operation of this cabinet is dependent on correct transport, proper storage and installation, as well as careful operation and maintenance.
National safety regulations must be observed.

5.6.2 Description

Note

Refer to the layout diagrams and circuit diagrams provided on the customer DVD supplied with the device for the arrangement of components and interfaces, and for wiring.

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

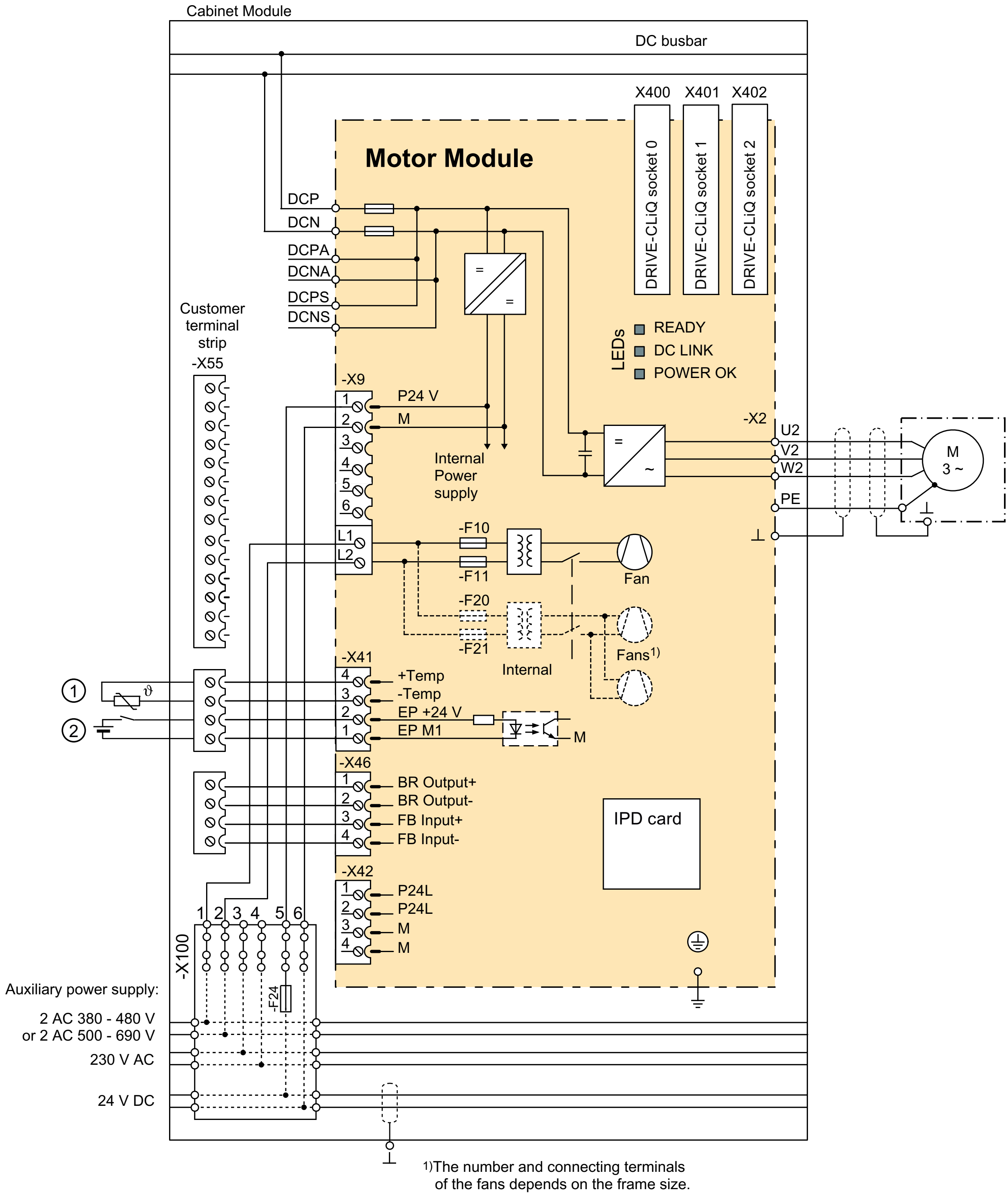
Line voltage	DC link voltage	Unit rating
3 AC 380 … 480 V	DC 510 ... 750 V	110 ... 800 kW
3 AC 500 ... 690 V	DC 675 ... 1080 V	75 ... 1200 kW

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

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

Integration



1)The number and connecting terminals of the fans depends on the frame size.

Figure 5-27 Connection example for Motor Modules in chassis format

① Temperature sensor connection for motors without a DRIVE-CLiQ interface
② Required for Safety Integrated

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 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-pole auxiliary voltage supply, including auxiliary power module and cables for looping through to the next Cabinet Module
- PE busbar (60 x 10 mm), including jumper for looping through to the next Cabinet Module.
- EMC-compliant design thanks to additional shielding measures and appropriate laying of cables.

Note

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.

Refer to the layout diagrams (AO) on the customer DVD for the precise order-specific location of the components.

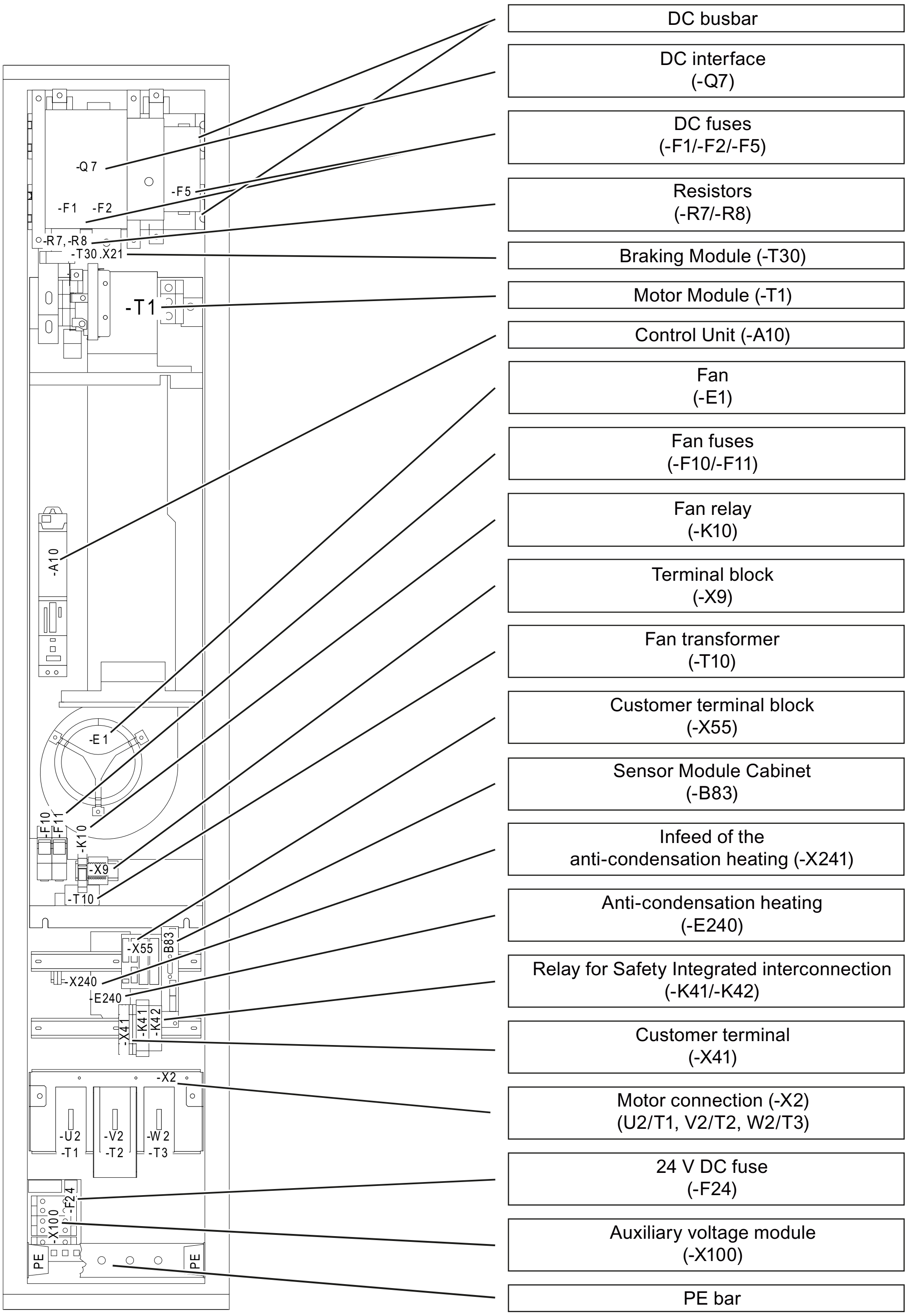


Figure 5-28 Configuration of Motor Modules in chassis format (frame size FX)

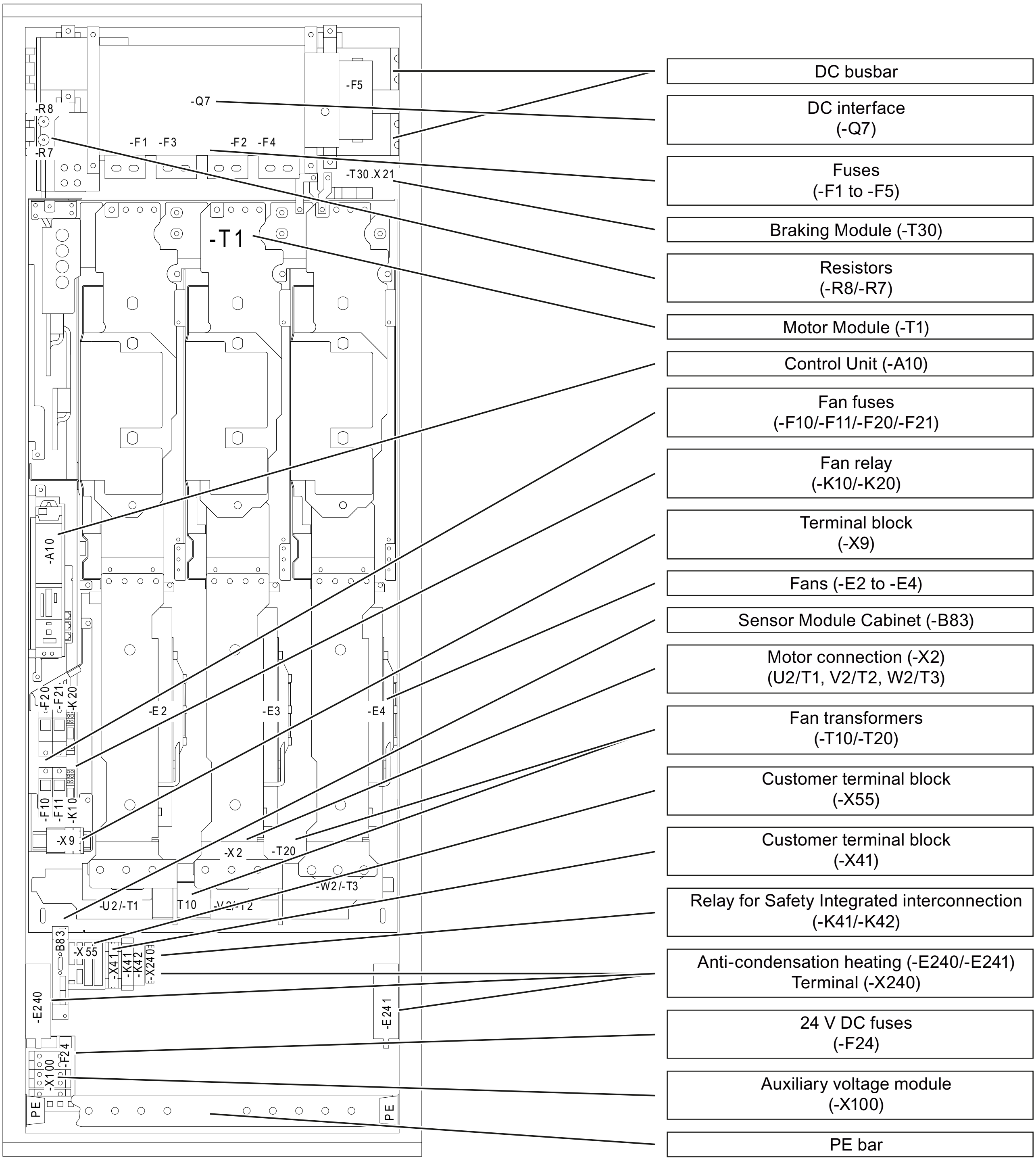


Figure 5-29 Configuration of Motor Modules in chassis format (frame size JX)

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 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.

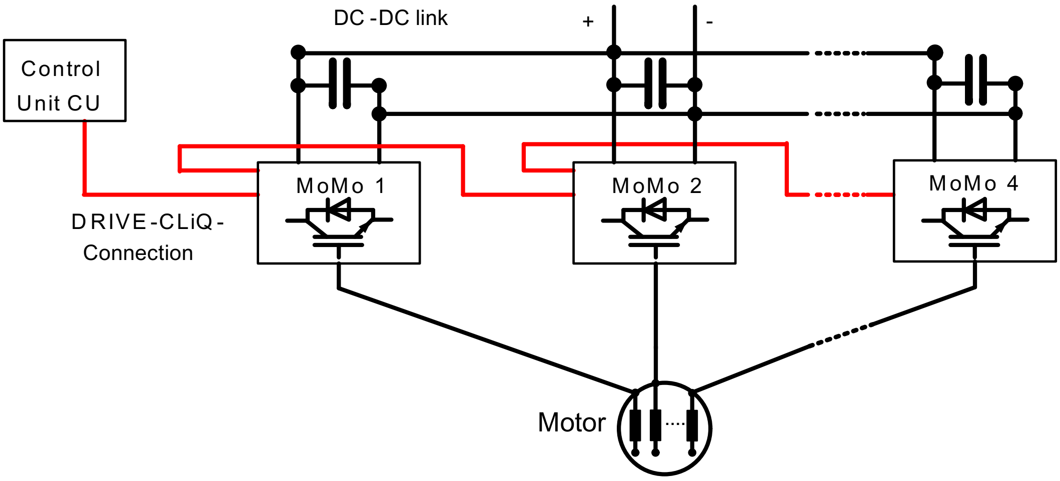


Figure 5-30 Motor with electrically isolated winding systems supplied by a parallel connection of S120 Motor Modules

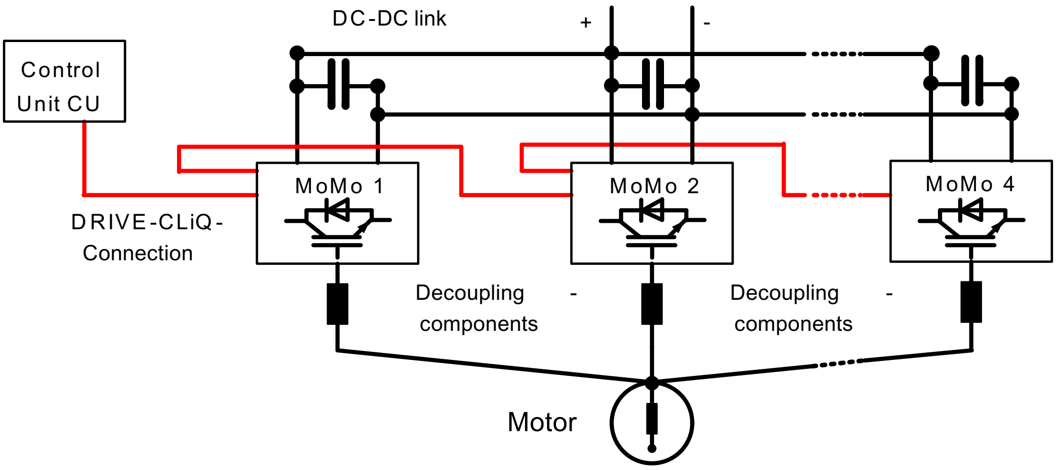


Figure 5-31 Motor with common winding system supplied by a parallel connection of S120 Motor Modules

Note

It is only possible to connect identical power units in parallel if both power units have the same hardware version. Mixed operation between a power unit with Control Interface Module and a power unit with Control Interface Board is not possible.

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

NOTICE
The minimum cable lengths specified in the 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. If the cable length required cannot be achieved in the application, provision must be made for a motor reactor (option L08).

Table 5- 31 Motor Modules, 510 ... 750 V DC

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

Table 5- 32 Motor Modules, 675 ...1080 V DC

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

5.6.3 X55 customer terminal strip

5.6.3.1 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

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 diagrams and terminal diagrams on the customer DVD supplied with the device.

Description

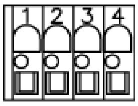
The customer interface -X55 is installed in the cabinet independently of the CU320-2 Control Unit. As standard, terminal strips -X41 and -X46 are occupied.

For option K90, in addition, terminal strips -X122 and -X132 are completely occupied.
(→ see Chapter "Options" in Section "K90, Control Unit CU320-2 PROFIBUS")

NOTICE
Interfaces -X1, -X2, -X3 and -X4 are wired in the cabinet and are not available for customer connections! If the customer terminal block is ever replaced, connectors -X1 and -X2 must not be mixed up! Otherwise, the "Safe Torque Off" and "Safe Stop 1" safety functions will malfunction.

5.6.3.2 X41 EP terminal / temperature sensor connection

Table 5- 33 Terminal strip X41 EP terminals / temperature sensor connection

	Terminal	Function	Technical data
	1	EP M1 (Enable Pulses)	Supply voltage: 24 V DC (20.4 V - 28.8 V) Current consumption: 10 mA Signal propagation times: L → H: 100 μs; H → L: 1000 μs The pulse inhibit function is only available when Safety Integrated Basic Functions are enabled.
	2	EP +24 V (Enable Pulses)	
	3	- Temp	Temperature sensor connection for motor temperature measurement: KTY84-1C130, PTC, PT100
	4	+ Temp	
Max. connectable cross-section 2.5 mm^2			

DANGER

Risk of electric shock!

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

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

Note

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

CAUTION

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

NOTICE

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

Note

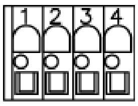
Safety Integrated Function Manual

Detailed and comprehensive instructions and information for the Safety Integrated functions can be found in the associated Function Manual. This manual is available as additional documentation on the customer DVD supplied with the device.

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

5.6.3.3 X46 Brake control and monitoring

Table 5- 34 Terminal strip X46 brake control and monitoring

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

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

5.6.4 Options

Note

The individual options are described in the chapter titled "Options".

Electrical options

Component	Option
CBC10 Communication Board	G20
CBE20 Communication Board	G33
Safety license for 1 to 5 axes	K01 ... K05
AOP30 operator panel	K08
SMC 10/20/30 Sensor Modules	K46, K48, K50
Terminal module for activating "Safe Torque Off" and "Safe STOP 1"	K82
Terminal Module TM54F	K87
Control Unit CU320-2 PROFIBUS	K90
Performance extension 1 for CU320-2	K94
dv/dt filter compact plus Voltage Peak Limiter	L07
Motor reactor	L08
dv/dt filter plus Voltage Peak Limiter	L10
Output-side circuit breaker (motorized)	L34
DC interface, including pre-charging input circuit	L37
Holder for ARC detector	L51
Cabinet anti-condensation heating	L55
25/125 kW braking unit	L61/L64
50/250 kW braking unit	L62/L65

Mechanical options

Component	Option
Base 100 mm high	M06
Cable-marshaling compartment 200 mm high	M07
IP21 degree of protection	M21
IP23/IP43/IP54 degree of protection	M23, M43, M54
Side panels (right/left)	M26, M27
Closed cabinet door	M59
Additional shock protection	M60
EMC shield bus	M70
DC busbar	M80 ... M87
Crane transport assembly (top-mounted)	M90

5.6.5 Technical data

Table 5- 35 Technical data for Motor Modules in chassis format, line voltage 3 AC 380 ... 480 V, DC link voltage 510 ... 750 V DC, part I

Order no.	6SL3720-	1TE32-1AA3	1TE32-6AA3	1TE33-1AA3	1TE33-8AA3	1TE35-0AA3	1TE36-1AA3
Unit 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	500
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 supplied 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 supplied 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 supplied via:							
- Basic/Smart Line Module	A	224	277	331	405	523	646
- Active Line Module	A	202	250	298	365	470	581
Power 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 [5]							
- 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	7.5
Power loss, max. [6]							
- at 50 Hz 400 V	kW	1.86	2.5	2.96	3.67	4.28	5.84
- at 60 Hz 460 V	kW	1.94	2.65	3.1	3.8	4.5	6.3
Cooling air requirement	m^3/s	0.17	0.23	0.36	0.36	0.36	0.78
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	67	69	69	69	69	72
Motor connection U2, V2, W2							
- Screws		2/M12	2/M12	2/M12	2/M12	2/M12	2/M12
- Connection cross section, max. (IEC)	mm^2	2 x 185	2 x 185	2 x 240	2 x 240	2 x 240	4 x 240
Cable length, max. [7]							
- shielded	m	300	300	300	300	300	300
- unshielded	m	450	450	450	450	450	450
PE/GND connection		PE busbar					
- Busbar cross section	mm^2	600					
- Connection cross section, max. (IEC)	mm^2	240					
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20	IP20

Order no.	6SL3720-	1TE32-1AA3	1TE32-6AA3	1TE33-1AA3	1TE33-8AA3	1TE35-0AA3	1TE36-1AA3
Dimensions (standard version, IP20) - Width[8)] - Height[9)] - Depth	 mm mm mm	 400 2200 600	 400 2200 600	 400 2200 600	 400 2200 600	 400 2200 600	 600 2200 600
Weight, approx. (standard version)	kg	145	145	286	286	286	490
Frame size		FX	FX	GX	GX	GX	HX

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

2) Rated output 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) For the interdependency of pulse frequency and max. output current/output frequency, see SINAMICS - Low-Voltage Configuration Manual on the customer DVD supplied with the device.

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

7) Total of all motor cables. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low-Voltage Configuration Manual on the customer DVD supplied with the device.

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

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

Table 5- 36 Technical data for Motor Modules in chassis format, line voltage 3 AC 380 ... 480 V, DC link voltage 510 ... 750 V DC, part II

Order no.	6SL3720-	1TE37-5AA3	1TE38-4AA3	1TE41-0AA3	1TE41-2AA3	1TE41-4AA3
Unit 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	1000
- 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 supplied 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 supplied 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 supplied via:						
- Basic/Smart Line Module	A	795	897	1051	1345	1500
- Active Line Module	A	716	807	946	1211	1350
Power 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 [5]						
- 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. [6]						
- at 50 Hz 400 V	kW	6.68	7.15	9.5	11.1	12
- at 60 Hz 460 V	kW	7.3	7.8	10.2	12.0	13
Cooling air requirement	m^3/s	0.78	0.78	1.08	1.08	1.08
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	72	72	72	72	72
Motor connection U2, V2, W2						
- Screws		2/M12	2/M12	3/M12	3/M12	3/M12
- Connection cross section, max. (IEC)	mm^2	4 x 240	4 x 240	6 x 240	6 x 240	6 x 240
Cable length, max. [7]						
- shielded	m	300	300	300	300	300
- unshielded	m	450	450	450	450	450
PE/GND connection		PE busbar				
- Busbar cross section	mm^2	600				
- Connection cross section, max. (IEC)	mm^2	240				
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20)						
- Width[8]	mm	600	600	800	800	800
- Height[9]	mm	2200	2200	2200	2200	2200
- Depth	mm	600	600	600	600	600

Order no.	6SL3720-	1TE37-5AA3	1TE38-4AA3	1TE41-0AA3	1TE41-2AA3	1TE41-4AA3
Weight, approx. (standard version)	kg	490	490	700	700	700
Frame size		HX	HX	JX	JX	JX

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

2) Rated output 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) For the interdependency of pulse frequency and max. output current/output frequency, see SINAMICS - Low-Voltage Configuration Manual on the customer DVD supplied with the device.

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

7) Total of all motor cables. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low-Voltage Configuration Manual on the customer DVD supplied with the device.

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

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

Table 5- 37 Technical data for Motor Modules in chassis format, line voltage 3 AC 500 ... 690 V, DC link voltage 675 ... 1080 V DC; part I

Order no.	**6SL3720-**	**1TG28-5AA3**	**1TG31-0AA3**	**1TG31-2AA3**	**1TG31-5AA3**	**1TG31-8AA3**	**1TG32-2AA3**
Unit 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 supplied 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 supplied 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 supplied via:							
- Basic/Smart Line Module	A	90	106	128	160	186	229
- Active Line Module	A	81	96	115	144	168	206
Power 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 5)							
- 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. 6)							
- at 50 Hz 690 V	kW	1.17	1.43	1.89	1.8	2.67	3.09
- at 60 Hz 575 V	kW	1.1	1.3	1.77	1.62	2.5	2.91
Cooling air requirement	m^3/s	0.17	0.17	0.17	0.17	0.36	0.36
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	67	67	67	67	69	69
Motor connection U2, V2, W2							
- Screws		2/M12	2/M12	2/M12	2/M12	2/M12	2/M12
- Connection cross section, max. (IEC)	mm^2	2 x 185	2 x 185	2 x 185	2 x 185	2 x 240	2 x 240
Cable length, max. 7)							
- shielded	m	300	300	300	300	300	300
- unshielded	m	450	450	450	450	450	450
PE/GND connection		PE busbar					
- Busbar cross section	mm^2	600					
- Connection cross section, max. (IEC)	mm^2	240					
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20	IP20

Order no.	6SL3720-	1TG28-5AA3	1TG31-0AA3	1TG31-2AA3	1TG31-5AA3	1TG31-8AA3	1TG32-2AA3
Dimensions (standard version, IP20) - Width8) - Height9) - Depth	 mm mm mm	 400 2200 600	 400 2200 600	 400 2200 600	 400 2200 600	 400 2200 600	 400 2200 600
Weight, approx. (standard version)	kg	145	145	145	145	286	286
Frame size		FX	FX	FX	FX	GX	GX

1) Rated output 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 output 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) For the interdependency of pulse frequency and max. output current/output frequency, see SINAMICS - Low-Voltage Configuration Manual on the customer DVD supplied with the device.

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

7) Total of all motor cables. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low-Voltage Configuration Manual on the customer DVD supplied with the device.

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

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

Table 5- 38 Technical data for Motor Modules in chassis format, line voltage 3 AC 500 ... 690 V, DC link voltage 675 ... 1080 V DC; part II

Order no.	6SL3720-	1TG32-6AA3	1TG33-3AA3	1TG34-1AA3	1TG34-7AA3	1TG35-8AA3
Unit 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 supplied 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 supplied 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 supplied via:						
- Basic/Smart Line Module	A	277	352	437	496	614
- Active Line Module	A	250	316	394	446	552
Power 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 [5)]						
- 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. [6)]						
- at 50 Hz 690 V	kW	3.62	4.34	6.13	6.8	10.3
- at 60 Hz 575 V	kW	3.38	3.98	5.71	6.32	9.7
Cooling air requirement	m^3/s	0.36	0.36	0.78	0.78	0.78
Sound pressure level L_{pA}(1 m) at 50/60 Hz	dB(A)	69/73	69/73	70/73	70/73	70/73
Motor connection U2, V2, W2						
- Screws		2/M12	2/M12	2/M12	2/M12	2/M12
- Connection cross section, max. (IEC)	mm^2	2 x 240	2 x 240	4 x 240	4 x 240	4 x 240
Cable length, max. [7)]						
- shielded	m	300	300	300	300	300
- unshielded	m	450	450	450	450	450
PE/GND connection		PE busbar				
- Busbar cross section	mm^2	600				
- Connection cross section, max. (IEC)	mm^2	240				
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20

Order no.	6SL3720-	1TG32-6AA3	1TG33-3AA3	1TG34-1AA3	1TG34-7AA3	1TG35-8AA3
Dimensions (standard version, IP20) - Width[8)] - Height[9)] - Depth	 mm mm mm	 400 2200 600	 400 2200 600	 600 2200 600	 600 2200 600	 600 2200 600
Weight, approx. (standard version)	kg	286	286	490	490	490
Frame size		GX	GX	HX	HX	HX

1) Rated output 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 output 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) For the interdependency of pulse frequency and max. output current/output frequency, see SINAMICS - Low-Voltage Configuration Manual on the customer DVD supplied with the device.

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

7) Total of all motor cables. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low-Voltage Configuration Manual on the customer DVD supplied with the device.

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

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

Table 5- 39 Technical data for Motor Modules in chassis format, line voltage 3 AC 500 ... 690 V, DC link voltage 675 ... 1080 V DC; part III

Order no.	6SL3720-	1TG37-4AA3	1TG38-1AA3	1TG38-8AA3	1TG41-0AA3	1TG41-3AA3
Unit 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	675	724	814	917	1136
- Maximum current $I_{max\,A}$	A	1065	1185	1320	1500	1845
Dc link current						
- Rated current $I_{N\,DC}$ when supplied 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 supplied 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 supplied via:						
- Basic/Smart Line Module	A	784	865	971	1094	1356
- Active Line Module	A	706	778	874	985	1221
Power 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 5)						
- 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. 6)						
- at 50 Hz 690 V	kW	10.9	11.5	11.7	13.2	16.0
- at 60 Hz 575 V	kW	10	10.5	10.6	12.0	14.2
Cooling air requirement	m^3/s	1.08	1.08	1.08	1.08	1.08
Sound pressure level L_{pA} (1 m) at 50/60 Hz	dB(A)	71/73	71/73	71/73	71/73	71/73
Motor connection U2, V2, W2						
- Screws		3/M12	3/M12	3/M12	3/M12	3/M12
- Connection cross section, max. (IEC)	mm^2	6 x 240	6 x 240	6 x 240	6 x 240	6 x 240
Cable length, max. 7)						
- shielded	m	300	300	300	300	300
- unshielded	m	450	450	450	450	450
PE/GND connection		PE busbar				
- Busbar cross section	mm^2	600				
- Connection cross section, max. (IEC)	mm^2	240				
Degree of protection (standard version)		IP20	IP20	IP20	IP20	IP20

Order no.	6SL3720-	1TG37-4AA3	1TG38-1AA3	1TG38-8AA3	1TG41-0AA3	1TG41-3AA3
Dimensions (standard version, IP20) - Width[8)] - Height[9)] - Depth	 mm mm mm	 800 2200 600	 800 2200 600	 800 2200 600	 800 2200 600	 800 2200 600
Weight, approx. (standard version)	kg	700	700	700	700	700
Frame size		JX	JX	JX	JX	JX

1) Rated output 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 output 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) For the interdependency of pulse frequency and max. output current/output frequency, see SINAMICS - Low-Voltage Configuration Manual on the customer DVD supplied with the device.

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

7) Total of all motor cables. Longer cable lengths for specific configurations are available on request, see SINAMICS - Low-Voltage Configuration Manual on the customer DVD supplied with the device.

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

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

5.6.6 Overload capability

The Motor Modules in the chassis format are equipped with an overload reserve to handle breakaway torques, for example.

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

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

Small 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 period of 300 s.

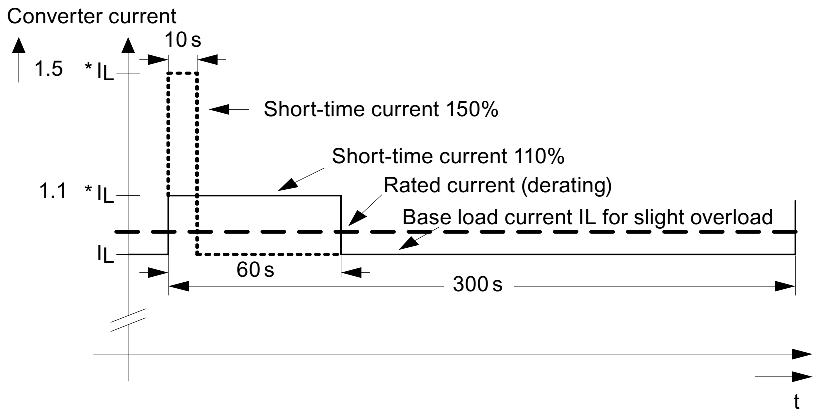


Figure 5-32 Small overload

High overload

The base load current I_H is based on a load cycle of 150 % for 60 s or 160 % for 10 s with a load cycle period of 300 s.

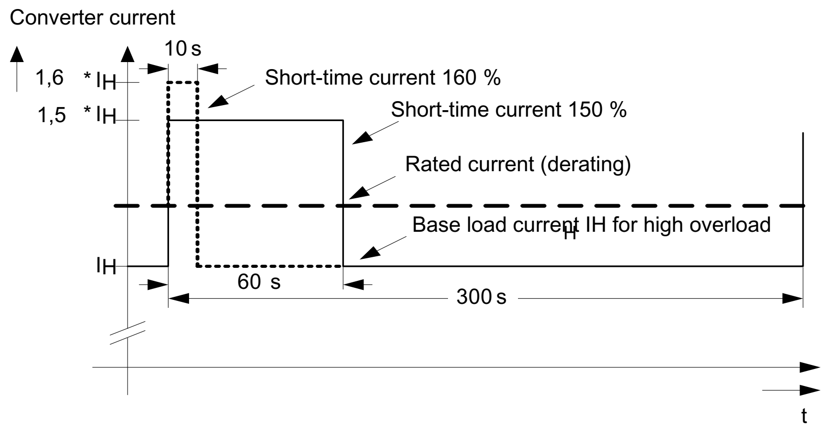


Figure 5-33 High overload

5.7 Central Braking Modules

5.7.1 General information

DANGER

Hazardous voltages are present in certain parts of this equipment during operation of the cabinet unit.
Only qualified personnel may work on the cabinet.
Such personnel must be thoroughly familiar with all the warnings and maintenance procedures for the cabinet described in the documentation provided.

The successful and safe operation of this cabinet is dependent on correct transport, proper storage and installation, as well as careful operation and maintenance.
National safety regulations must be observed.

5.7.2 Description

Note

Refer to the layout diagrams and circuit diagrams provided on the enclosed customer DVD for the arrangement of components and interfaces, and for wiring.

Central Braking Modules limit the DC link voltage at a central location in the drive line-up when the motors are operated in regenerative mode and energy recovery to the supply system is not possible. If, in regenerative mode, the voltage of the DC busbar exceeds a limit value, an externally installed braking resistor is switched in, thus restricting the voltage from increasing further. The regenerative energy is converted to heat loss. The braking resistor is switched in by the Braking Module inside the Cabinet Module.

Central Braking Modules are an alternative to the optional Braking Modules (option L61/L62 or L64/L65) and are particularly suitable when high braking power is required in a drive line-up.

Central Braking Modules operate as fully stand-alone modules. They only require a connection to the DC link. An external control voltage is not required.

The capacitor module in the Central Braking Module is an extension of the DC link capacitance for the safe functioning of the Braking Module.

The built-in fan means that Central Braking Modules are also suitable for high continuous power systems.

Braking resistors corresponding to the rated powers are available for the Central Braking Modules.
Braking resistors which are suitable for other applications are available on request.

⚠ WARNING

The fan is switched on and off by means of a temperature control, which prevents it from running unnecessarily.

The fan can start up on its own.

⚠ WARNING

The Braking Module incorporated into the Central Braking Module is able to support a higher braking power than standard braking resistors.

The braking resistor is only designed for occasional regenerative operation in accordance with the specified duty cycles.

If the braking resistor does not meet your particular requirements, an appropriate braking resistor must be requested on an order-specific basis.

Central Braking Modules are available for the following voltages and power ratings:

Line voltage	Rated power
3 AC 380 … 480 V	500/1000 kW
500 to 600 V AC, 3-phase	550/1100 kW
660 to 690 V AC, 3-phase	630/1200 kW

The braking power can be increased by connecting Central Braking Modules in parallel.

Integration

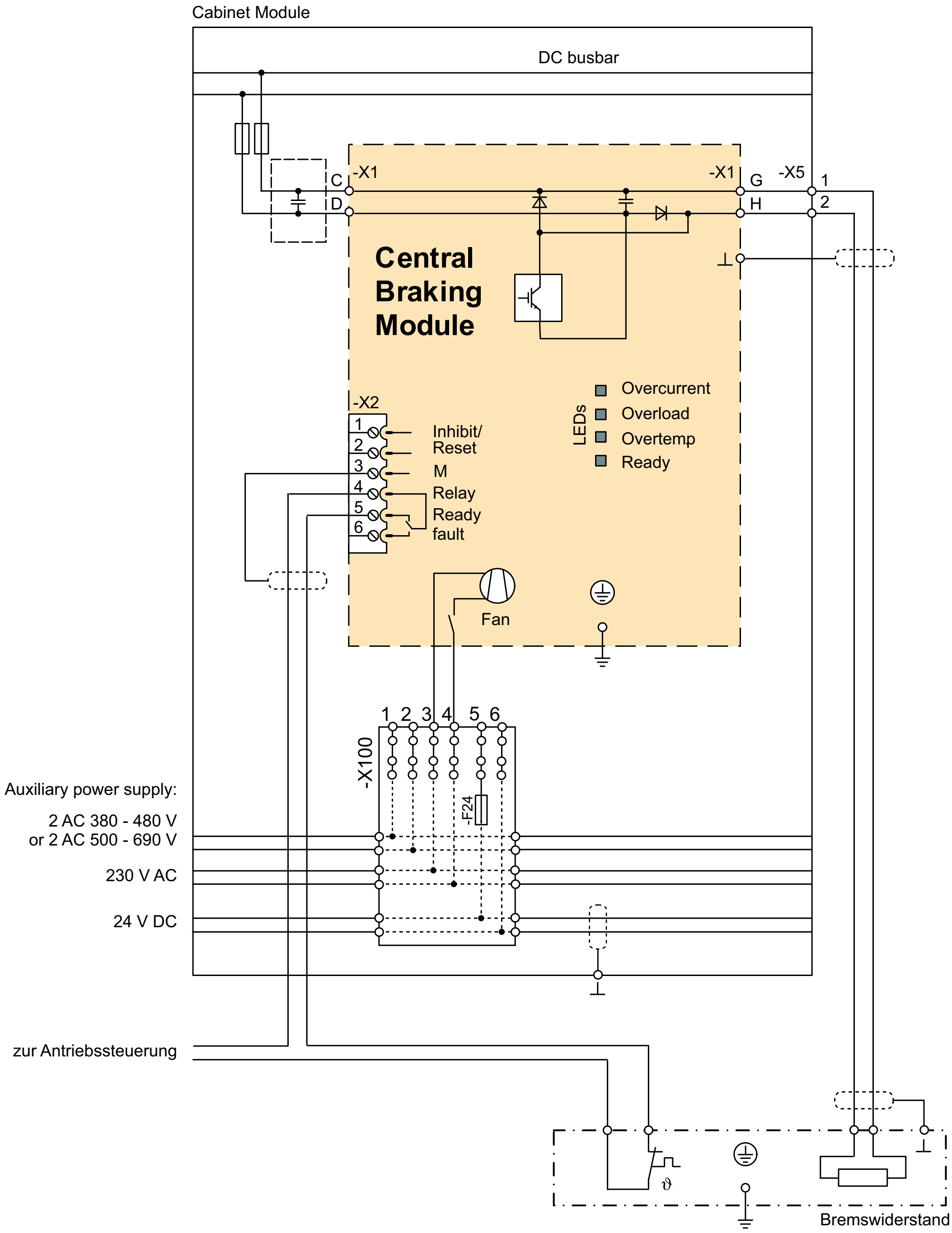


Figure 5-34 Connection example for Central Braking Modules

Configuration

Central Braking Modules are designed in a 400 mm wide Cabinet Module. The Central Braking Modules are connected to the overhead DC busbar using fuses.

The Central Braking Module comprises:

- Braking Module
- Capacitor module
- 230 V AC connection with fuses
- Covers
- Braking resistor connection

Note

The configuration example of the Central Braking Module is 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.

Refer to the layout diagrams (AO) on the customer DVD for the precise order-specific location of the components.

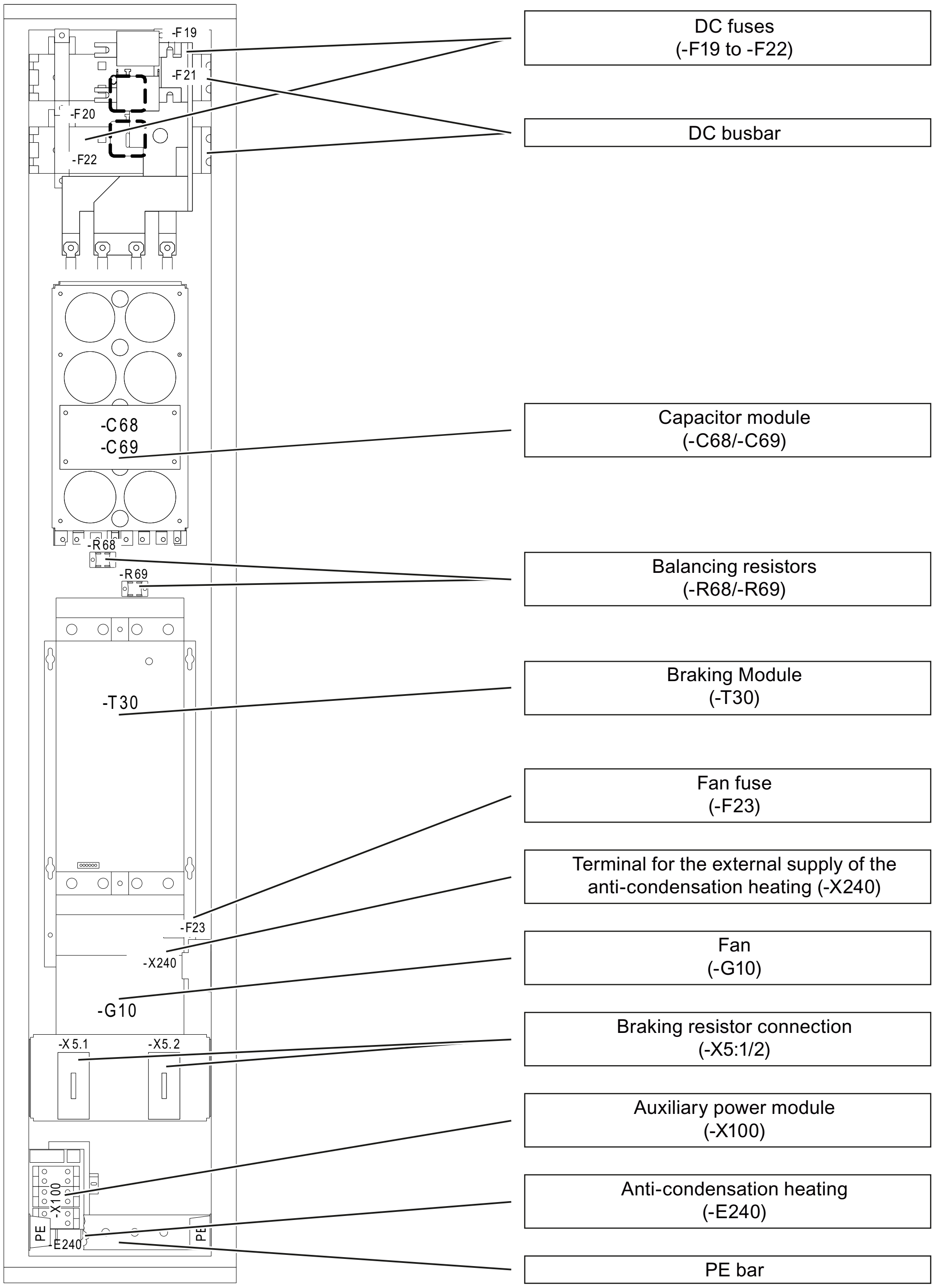


Figure 5-35 Configuration of Central Braking Modules

Parallel connection of Central Braking Modules

To increase the braking power, it is permissible for Central Braking Modules to be connected in parallel under the following conditions:

- A separate braking resistor must be connected to each Central Braking Module.
- Only Central Braking Modules of the same rating may be connected in parallel.
- Asymmetric load distribution (possibly tolerance-related) will result in a drop of 10% in terms of the total braking power provided by the Central Braking Modules that are connected in parallel.

5.7.3 Interfaces

Description

The Central Braking Module has the following interfaces:

- Control terminals (Disable/Reset, Ready, Fault)
- Braking resistor connection
- Reset key
- Threshold switch
- Braking resistor monitoring
- Switch-on ratio of the braking resistor

Interface overview

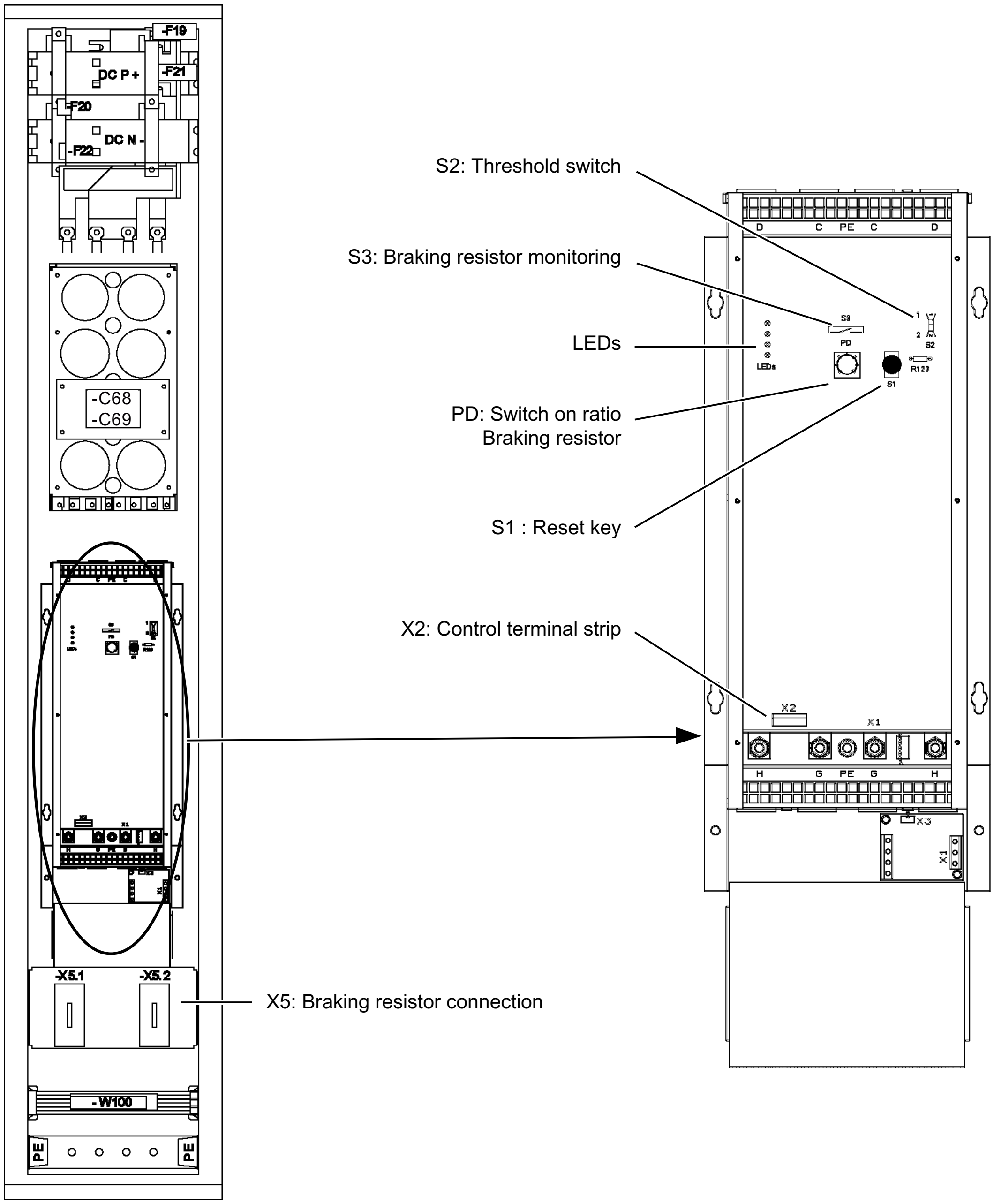
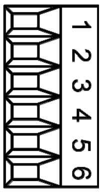


Figure 5-36 Interface overview for the Central Braking Module

X2 control terminals

Table 5- 40 Terminal strip X2 control terminals

	Terminal	Function	Meaning	Technical data
	1 2	DI 24V ground	0 = Normal operation 1 = Disable, reset	24 V AC/V DC, input load approximately 10 mA (connection not required)
	3	Ground	Ground	
	4	DO.COM [1]	Center contact	Centralized fault indication for: No DC link voltage, overtemperature, overload, short circuit/ground fault. Switching capacity: 250 V, 2 A, 250 VA AC voltage
	5	DO.NO [1]	0 = Fault 1 = Ready	
	6	DO.NC [1]	0 = Ready 1 = Fault	
Max. connectable cross-section 2.5 mm²				

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

X5 Braking resistor connection

Table 5- 41 Terminal strip X5 braking resistor

Terminal	Function
1	Braking resistor connection
2	Braking resistor connection

S1 reset key

Table 5- 42 Reset key S1

Function	Meaning
Reset key	0 = Normal operation 1 = Disable, reset

The key performs the same function as control terminal -X2:1/2.

S2 threshold switch

Table 5- 43 Threshold switch S2

Item	Function
1	Upper switching threshold (factory setting)
2	Lower switching threshold

The response threshold at which the Braking Module is activated and the resulting activated DC link voltage for braking mode are specified in the following table.

WARNING

The threshold switch must only be switched over when the cabinet unit is disconnected from the power supply and the DC link capacitors are discharged.

Table 5- 44 Response thresholds of the Braking Module

Rated voltage	Response threshold	Switch position	Comments
380 to 480 V	774 V	1	774 V is the default factory setting. With line voltages of between 380 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 possible braking power is, therefore, 75%.
	673 V	2	
500 to 600 V	967 V	1	967 V is the default factory setting. With a line voltage of 500 V, the response threshold can be set to 841 V to reduce the voltage stress on the motor and converter. This does, however, reduce the possible braking power with the square of the voltage $(841/967)^2 = 0.75$. The maximum possible braking power is, therefore, 75%.
	841 V	2	
660 to 690 V	1158 V	1	1158 V is the default factory setting. With a line voltage of 660 V, the response threshold can be set to 1070 V to reduce the voltage stress on the motor and converter. This does, however, reduce the possible braking power with the square of the voltage $(1070/1158)^2 = 0.85$. The maximum possible braking power is, therefore, 85%.
	1070 V	2	

S3 braking resistor monitoring

Table 5- 45 Braking resistor monitoring S3

Function	Meaning
Braking resistor monitoring	0 (open) = Monitoring active 1 (closed) = Monitoring disabled

When monitoring is activated, the switch-on ratio (ratio between ON time and OFF time) set for the braking resistor on potentiometer "PD" is evaluated electronically.

If the set switch-on ratio is exceeded, the "MUL - Overload message" LED will be activated and at the same time the centralized fault indication will be triggered at terminal -X2:4/5,6. The fault message can be used by a higher-level controller to ensure timely shutdown, thereby preventing damage to the connected braking resistor.

CAUTION

Monitoring is carried out solely on the basis of the switch-on ratio that has been set on potentiometer PD, which means that the actual temperature of the braking resistor is not monitored.

PD, switch-on ratio of the braking resistor

The braking resistor's switch-on ratio (ratio between ON time and OFF time) is set via potentiometer PD. The setting made is only evaluated when activated via the S3 switch. The adjustable values for the switch-on ratio at potentiometer PD correspond to the graphic below. A value of "40%" is used for the default factory setting.

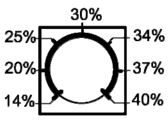


Figure 5-37 Setting of the switch-on ratio

Brake type	Description	PD setting
P_{15}	Power that is permissible for 15 s every 600 s	14 % (min.)
P_{150}	Power that is permissible for 150 s every 600 s	23 %
P_{270}	Power that is permissible for 270 s every 600 s	12 %
P_{DB}	Continuous braking power	40 % (max)

5.7.4 Options

Note

The individual options are described in the chapter titled "Options".

Electrical options

Component	Option
Holder for ARC detector	L51
Cabinet anti-condensation heating	L55

Mechanical options

Component	Option
Base 100 mm high	M06
Cable-marshaling compartment 200 mm high	M07
IP21 degree of protection	M21
IP23/IP43/IP54 degree of protection	M23, M43, M54
Side panels (right/left)	M26, M27
Closed cabinet door	M59
DC busbar	M80 ... M87
Crane transport assembly (top-mounted)	M90

5.7.5 Technical data

Table 5- 46 Technical data for Central Braking Modules

Order no.	6SL3700-	1AE35-0AA3	1AE41-0AA3	1AF35-5AA3	1AF41-1AA3	1AH36-3AA3	1AH41-2AA3
Line voltage	V	380 ... 480		500 ... 600		660 ... 690	
Supply voltage	V_{DC}	510 ... 750		675 ... 900		890 ... 1080	
Braking power P_{150}	kW	500	1000	550	1100	630	1200
Continuous braking power P_{DB}	kW	200	370	220	420	240	460
Braking power P_{15}	kW	730	1380	830	1580	920	1700
Braking power P_{270}	kW	300	580	340	650	380	720
Braking current for P_{150}	A	650	1200	580	1100	520	1000
Braking current for P_{DB}	A	260	480	230	430	210	400
Braking current for P_{15}	A	950	1800	870	1650	800	1500
Braking current for P_{270}	A	400	750	350	680	330	630
Power demand 1) 2 AC 230 V	A	0.4	0.4	0.4	0.4	0.4	0.4
Power loss, max. 2) at 50 Hz 400/500/690 V	kW	0.8	1.5	0.8	1.5	0.8	1.5
DC link capacitance	µF	8160	9720	7640	8680	7640	8680
Connectable resistance							
- for braking power P_{150}							
S2:1	Ω	1.2	0.65	1.65	0.87	2.2	1.15
S2:2	Ω	1.0	0.56	1.45	0.77	2.05	1.05
- for braking power P_{DB}							
S2:1	Ω	3.0	1.6	4.2	2.25	5.5	2.9
S2:2	Ω	2.6	1.4	3.65	2.0	5.1	2.7
- for braking power P_{15}							
S2:1	Ω	0.8	0.43	1.1	0.58	1.45	0.8
S2:2	Ω	0.7	0.37	1.0	0.51	1.35	0.7
- for braking power P_{270}							
S2:1	Ω	1.9	1.0	2.7	1.58	3.5	1.8
S2:2	Ω	1.6	0.9	2.4	1.2	3.3	1.7
Cooling demand	m^3/s	0.14	0.14	0.14	0.14	0.14	0.14
Sound pressure level L_{PA} (1 m) at 50/60 Hz	dB(A)	55	55	55	55	55	55
Braking resistor connection - Connection cross section, max. (IEC)	mm^2	M12 2 x 240	M12 2 x 240	M12 2 x 240	M12 2 x 240	M12 2 x 240	M12 2 x 240
PE/GND connection - Busbar cross section - Connection cross section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240					
Degree of protection (standard version)	---	IP20	IP20	IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - width - height 3) - depth	 mm mm mm	 400 2200 600	 400 2200 600	 400 2200 600	 400 2200 600	 400 2200 600	 400 2200 600

Order no.	6SL3700-	1AE35-0AA3	1AE41-0AA3	1AF35-5AA3	1AF41-1AA3	1AH36-3AA3	1AH41-2AA3
Weight, approx. (standard version)	kg	230	230	230	230	230	230
Frame size	mm	400	400	400	400	400	400

1) Power demand of fans.

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

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

Duty cycle

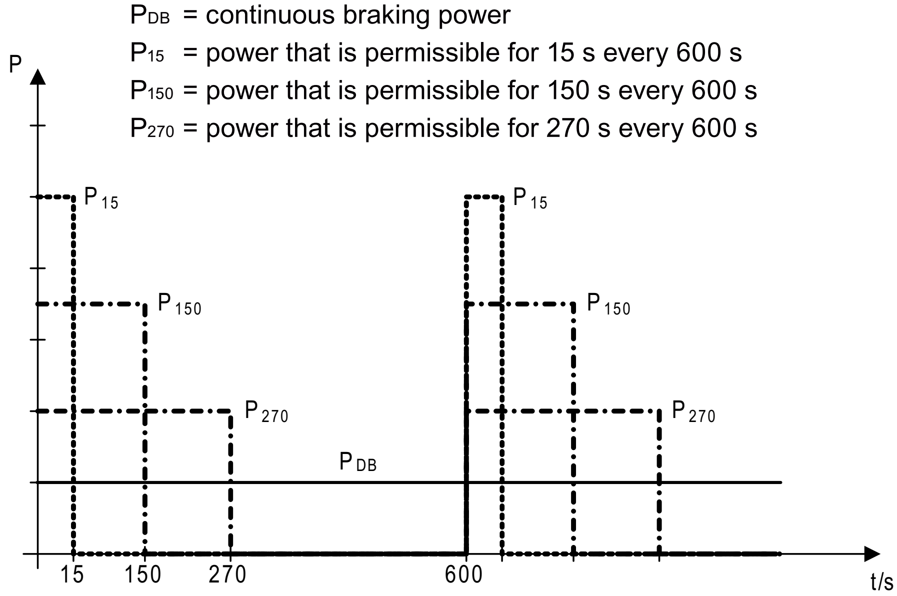


Figure 5-38 Duty cycle of the Central Braking Modules

5.7.6 Derating data

The units have an integrated temperature monitoring function. A fan included as standard supports the power unit cooling. The fan is switched on and off by means of a temperature control, which prevents it from running unnecessarily. The permissible ambient temperature is from 0 °C to 40 °C. For temperatures between 40 °C and 50 °C, the power must be reduced according to the following formula:

- $P = [1 - 0.025 \times (T - 40\ °C)] \times P_n$

The installation altitude above sea level can be up to 2000 m. The power must be reduced for altitudes above 1000 m (derating). In this case, the derating is 1.5 % per 100 m.

5.7.7 Braking resistor

5.7.7.1 Description

The regenerative energy of the drive line-up is dissipated via the braking resistor. The braking resistor is connected to a Braking Module. The braking resistor is positioned outside the cabinet or switchgear room. This enables the resulting heat loss to be dissipated, thereby reducing the amount of air conditioning required.

A thermostat monitors the braking resistor for overheating and, if the limit value is exceeded, it is signaled via a floating contact. The tripping temperature is 120 °C; this corresponds to a surface temperature on the resistor elements of approximately 400 °C.

Only one braking resistor may be connected to a Central Braking Module.

The power of the braking resistors is matched to the rated braking power of the Central Braking Modules; however, operation is restricted to a reduced duty cycle of 15 seconds every 20 minutes.

WARNING

The thermostat contact must be connected on the plant side so that the signal can be evaluated in the Control Unit or in a higher-level controller; see the section titled "Configuring the overtemperature checkback signal".

5.7.7.2 Safety information

CAUTION

The surface temperature of the braking resistors may exceed 80 °C.

CAUTION

A cooling clearance of 200 mm must be maintained on all sides of the component (with ventilation grilles).

CAUTION

The cables for the braking resistor must be routed to prevent short-circuits and ground faults in accordance with IEC 61800-5-2:2007, Table D.1.

This can be accomplished, for example, by:

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

NOTICE
A maximum cable length of 300 m is permissible between the Central Braking Module and the braking resistor.

Note

Sufficient space must be available for dissipating the energy converted by the braking resistor.

A sufficient distance from flammable objects must be ensured.

The braking resistor must be installed as a free-standing unit.

Objects must not be placed on or anywhere above the braking resistor.

The braking resistor should not be installed underneath fire-detection systems, since these could be triggered by the resulting heat.

For outdoor installation, a hood should be provided to protect the braking resistor from precipitation (in accordance with degree of protection IP21).

5.7.7.3 Duty cycle

The following duty cycle applies only to the braking resistors that are described in this Chapter.

Duty cycle

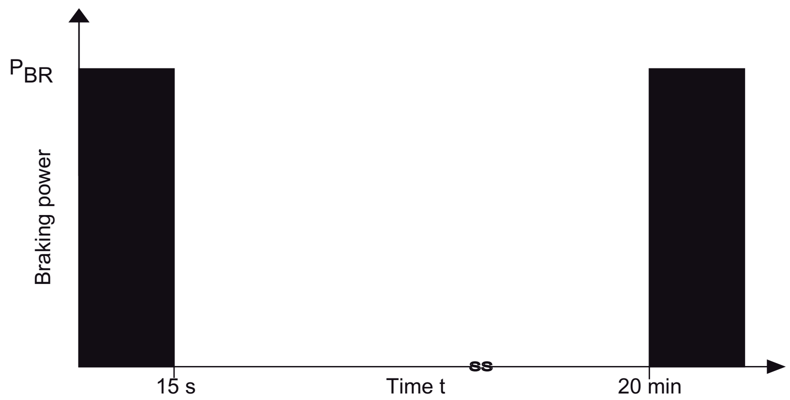


Figure 5-39 Duty cycle for braking resistor

Note

For other duty cycles, the braking resistors must be requested on an order-specific basis.

5.7.7.4 Interfaces on the braking resistor

Power connections on the braking resistor

Table 5- 47 Power connections on the braking resistor

Terminal	Function
1	Connection to the Central Braking Module: -X5
2	Connection to the Central Braking Module: -X5
PE	PE connection
Max. connectable cross-section: 2 x 240 mm²	

Cables are always entered from below; a cable propping fixture must be provided by the customer.

X10 thermostatic switch checkback contact

Table 5- 48 Terminal strip X10 thermostatic switch checkback contact

Terminal	Function
1	Thermostatic switch checkback contact Normally-closed contact, 250 V AC, max. 1 A
2	
Max. connectable cross-section: 1.5 mm²	

5.7.7.5 Configuring the "Overtemperature" checkback

The checkback contact of the braking resistor thermostatic switch must be wired to a digital input so that the drive is shut down in the event of a malfunction.

- Assumption 1:
  Thermostatic switch checkback contact is wired to digital input 3 (DI3) of CU320-2 (-X55-X4:4)
- Assumption 2:
  Once the thermostatic switch trips, "External Fault 3" (F7862) is triggered and the drive is shut down with OFF2.
- Setting required:
  (Drive) p2108 = (CU320-2) 0722.3

Control engineering measures must also be implemented to prevent the drive from starting up again before the braking resistor has had a chance to cool down properly.

5.7.7.6 Technical data

Table 5- 49 Technical data of the braking resistors

Order no.	6SL3000-	1BE35-0AA0	1BE41-0AA0	1BF35-5AA0	1BF41-1AA0	1BH36-3AA0	1BH41-2AA0
Line voltage	V	380 ... 480		500 ... 600		600 ... 690	
Supply voltage	V_{DC}	510 ... 720		675 ... 900		890 ... 1035	
Braking power P_{BR} 1)	kW	500	1000	550	1100	630	1200
Continuous braking power P_{DB}	kW	23.8	58.65	34.8	62	42.5	75.6
Resistance value	Ω	0.95	0.49	1.35	0.69	1.8	0.95
I_{max}	A	766	1518	672	1343	643	1232
Degree of protection		IP21	IP21	IP21	IP21	IP21	IP21
Dimensions - Width - Height - Depth	 mm mm mm	 960 790 620	 960 1430 620	 960 1110 620	 960 1430 620	 960 1110 620	 960 1430 620
Weight	kg	82	170	110	180	124	196

1) Valid for specified duty cycle of 15 s (load) with a duty cycle duration of 20 min.

Table 5- 50 Assignments between braking resistors and dimension drawings below

Braking resistor	Dimension drawing, type
380 ... 480 V supply voltage	
6SL3000-1BE35-0AA0	Type 1
6SL3000-1BE41-0AA0	Type 3
500 ... 600 V supply voltage	
6SL3000-1BF35-5AA0	Type 2
6SL3000-1BF41-1AA0	Type 3
500 ... 690 V supply voltage	
6SL3000-1BH36-3AA0	Type 2
6SL3000-1BH41-2AA0	Type 3

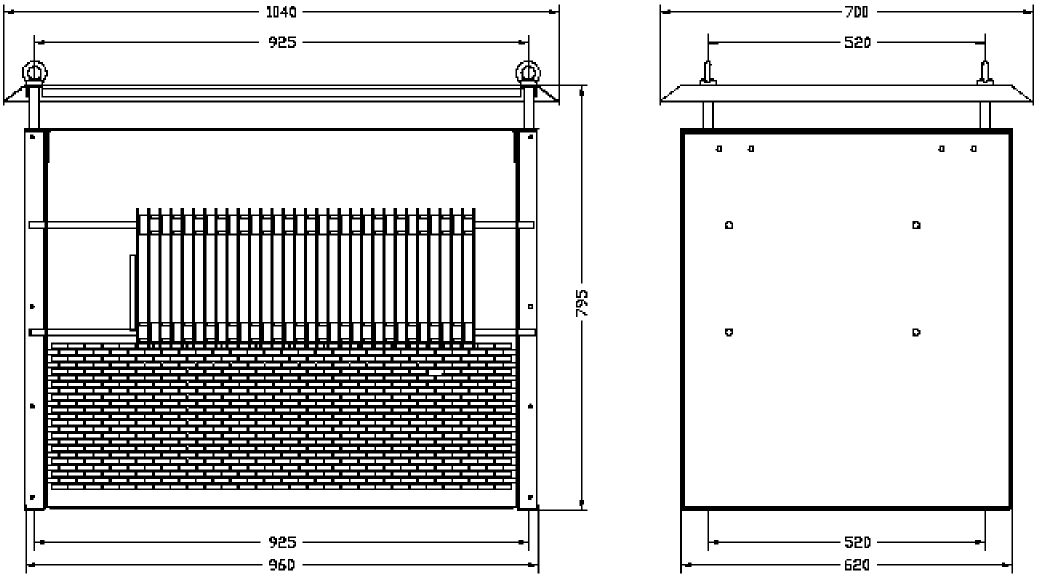


Figure 5-40 Dimension drawing type 1

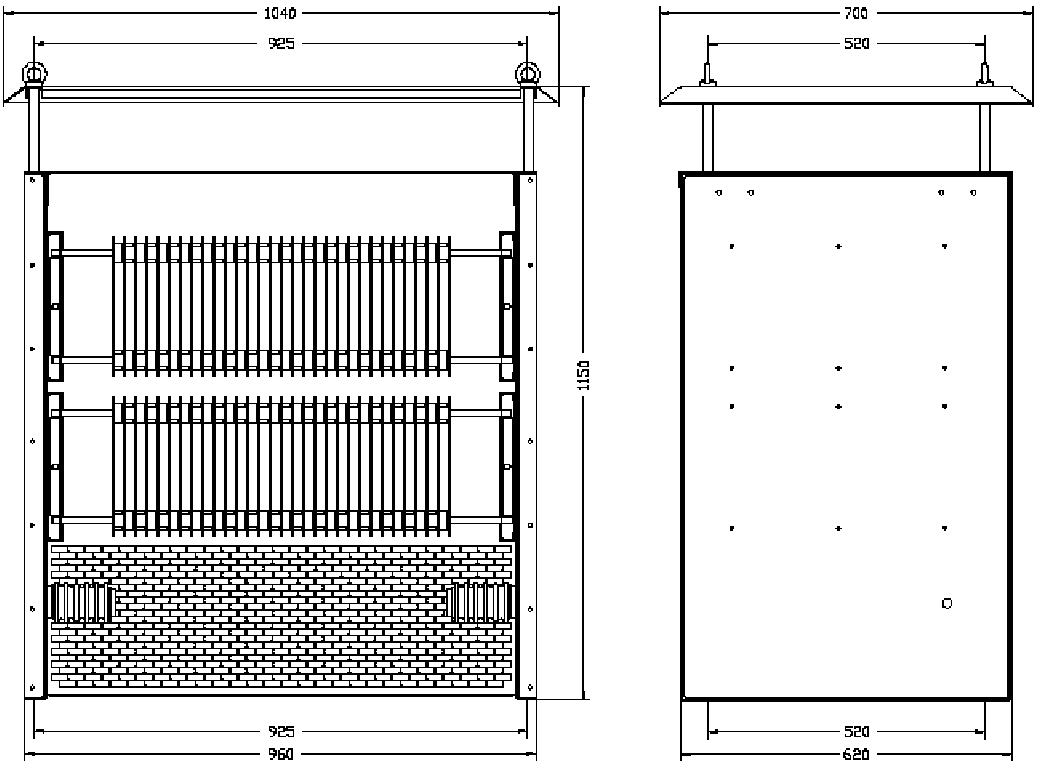


Figure 5-41 Dimension drawing type 2

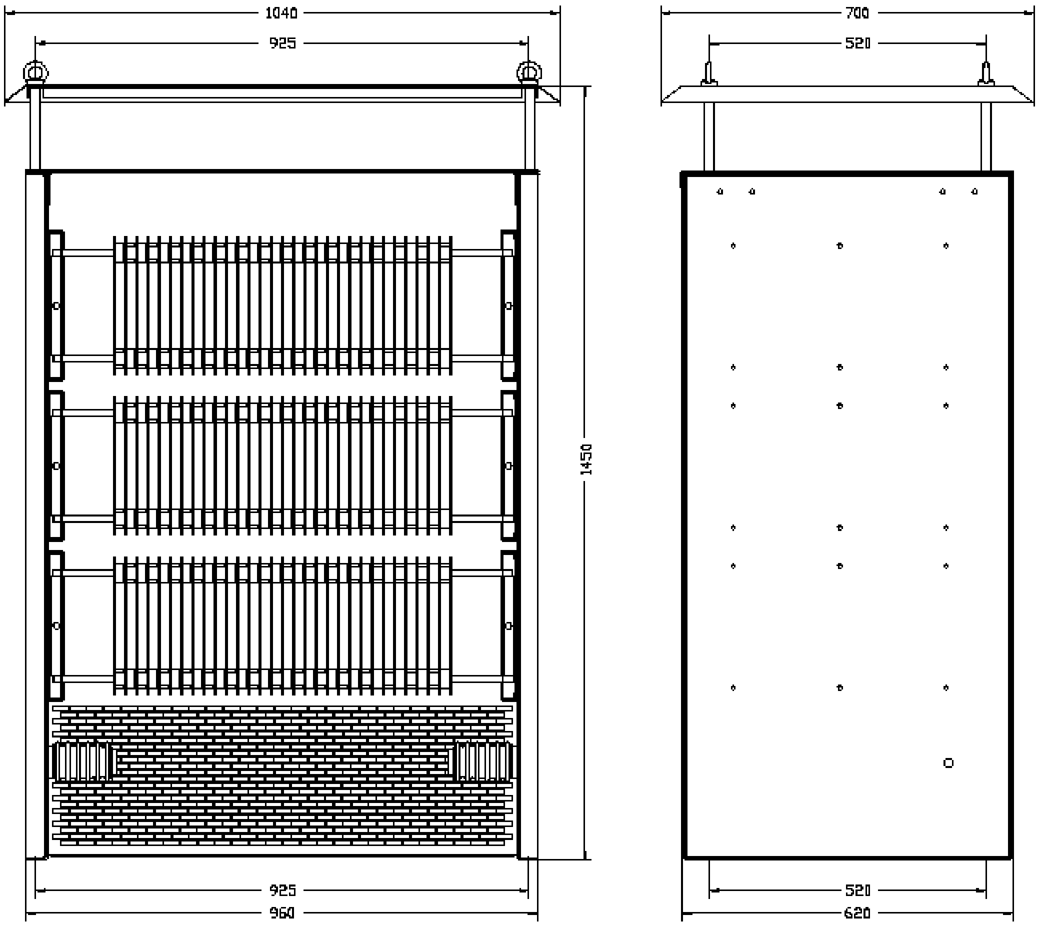


Figure 5-42 Dimension drawing type 3

5.8 Auxiliary Power Supply Modules

5.8.1 General information

DANGER

Hazardous voltages are present in certain parts of this equipment during operation of the cabinet unit.
Only qualified personnel may work on the cabinet.
Such personnel must be thoroughly familiar with all the warnings and maintenance procedures for the cabinet described in the documentation provided.

The successful and safe operation of this cabinet is dependent on correct transport, proper storage and installation, as well as careful operation and maintenance.
National safety regulations must be observed.

5.8.2 Description

Note

Refer to the layout diagrams and circuit diagrams provided on the enclosed customer DVD for the arrangement of components and interfaces, and for wiring.

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. Among other things, the fans of the SINAMICS S120 devices installed in the Cabinet Modules are connected to this busbar system. In addition, the auxiliary power supply system supplies the electronics modules with external 24 V DC. This is required when the DC link is not charged in order, for example, to maintain PROFIBUS communication.

The 230 V AC power supply can also be fed in externally via an uninterruptible power supply (UPS) and terminal -X46.

NOTICE
The same rated voltage must be fed into the supply infeed of the Auxiliary Power Supply Module as for the connected Cabinet Modules, as the voltage fed into the Auxiliary Power Supply Module supplies the entire system with auxiliary voltage via the auxiliary power supply system. If a different voltage than that of the connected Cabinet Modules is 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

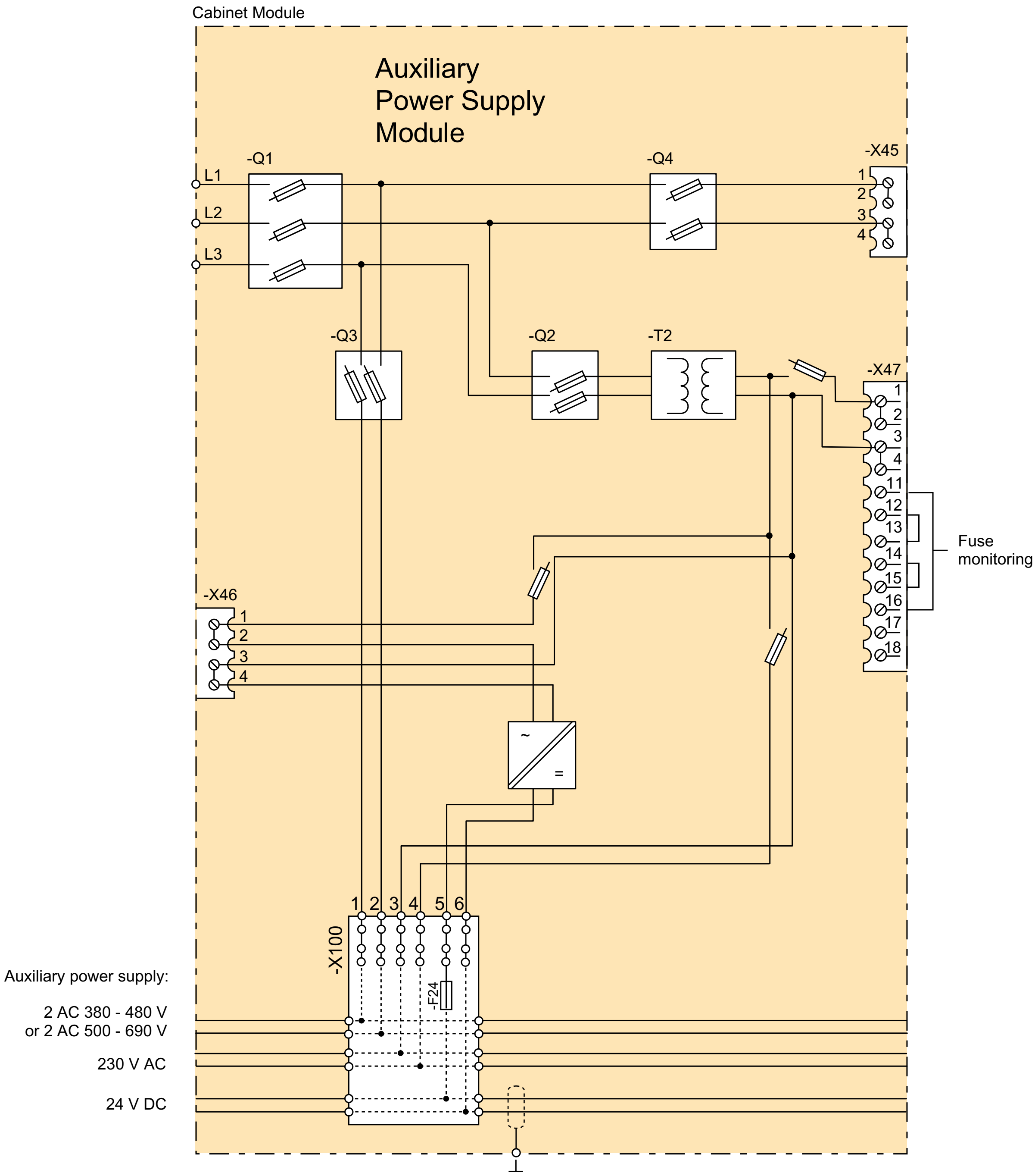


Figure 5-43 Connection example for Auxiliary Power Supply Modules

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:

- Fuse switch disconnector with fuse monitoring for external evaluation
- Supply of auxiliary power system with 3 auxiliary voltages:
  - 24 V DC for the electronics power supply
  - 230 V 1 AC for supply of 230 V AC loads
  - 380 to 690 V 2 AC for supply of device fans (corresponding to the respective rated device voltage)
- Transformer with output voltage 230 V 1 AC
- SITOP power supply 24 V DC
- PE busbar, nickel-plated (60 x 10 mm), including jumper for looping through to the next Cabinet Module.

Note

The configuration example of the Auxiliary Power Supply Module is 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.

Refer to the layout diagrams (AO) on the customer DVD for the precise order-specific location of the components.

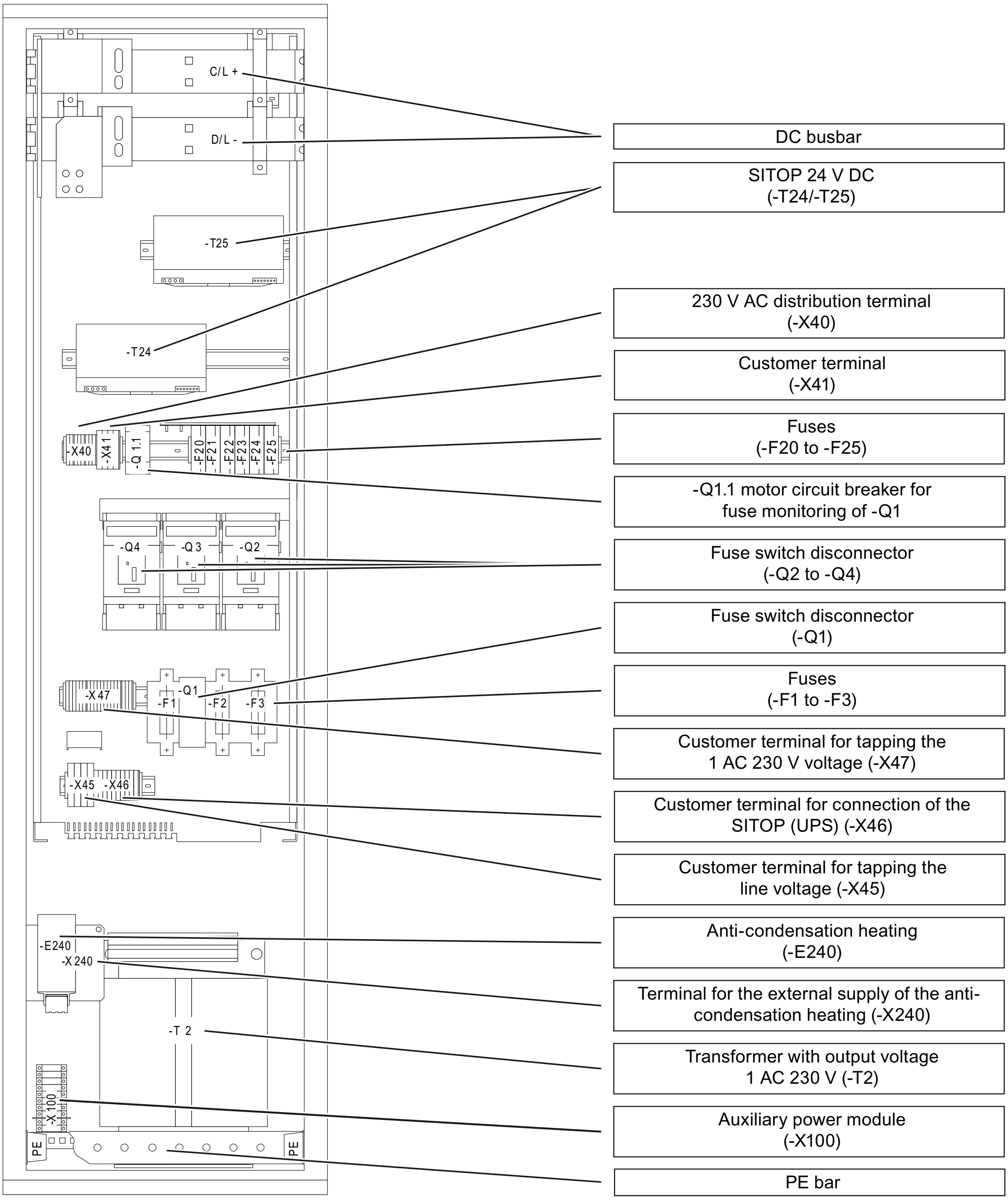


Figure 5-44 Configuration example for Auxiliary Power Supply Modules

5.8.3 Fuse switch disconnector (-Q1)

The customer feeds power to the Auxiliary Power Supply Module on the fuse switch disconnector (-Q1). The plant-side power demand indicated in the table "Technical data" varies according to the version of the Cabinet Module used.

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

A transformer is incorporated to generate the 230 V AC, 2-phase voltage. This voltage is made available in order to supply the auxiliary power system and the SITOP power supply.

When delivered, the taps are always set to the highest level. The line-side terminals of the transformer may need to be reconnected to the existing line voltage.

The line voltage assignments for making the appropriate setting on the transformer for the internal power supply are indicated in the following table.

NOTICE
The terminals must be reconnected to the actual line voltage so that the 230 V AC, 2-phase voltage required in the system is provided correctly.

⚠ WARNING
Reconnect the terminals only when the cabinet unit is disconnected from the power supply.

Table 5- 51 Assignment of the available line voltage for generating the 230 V AC, 2-phase voltage

Tap	Taps of voltage adaptation transformer (T2) L_A – L_B
380 V	3 - 4
400 V	2 – 4
415 V	1 – 4
440 V	3 – 5
460 V	2 – 5
480 V	1 – 5
500 V	3 – 6
525 V	2 – 6
550 V	1 – 6
575 V	3 – 7
600 V	2 – 7
660 V	3 – 8
690 V	1 – 8

Fuse adaptation (-Q2) for transformer (-T2)

Two LV HRC fuses (-Q2:-F1/-F2) are installed upstream of the transformer (-T2) to protect it.

Fuses rated for a line supply of between 500 V to 690 V are fitted at the factory. For supply voltages in the range from 380 V to 480 V, the customer must replace the fuses on the plant side. The required fuses are supplied as accessories with the Auxiliary Power Supply Module.

CAUTION

If the customer fails to replace the fuses when the system is connected to a supply voltage in the 380 to 480 V range, there is a risk of fuse overloading in the low voltage range (380 V to 480 V) so that the fuses will need to be replaced by new ones.

WARNING

It is essential to disconnect the unit from the power supply while the fuses are being replaced.

Note

A fuse grip must always be used to replace the fuses.

If necessary, the fuse grip can be ordered from Siemens.

Table 5- 52 Overview of fuses for the transformer (-T2) in the Auxiliary Power Supply Module

Auxiliary Power Supply Module Order no. 6SL3700-	0MX14-0AA3	0MX16-3AA3	0MX21-0AA3	0MX21-4AA3
LV HRC fuse for voltage range 380 to 480 V 3 AC				
Fuse protection in A	gG 20	gG 25	gG 35	gG 50
Fuse MLFB	3NA3807-6	3NA3810-6	3NA3814-6	3NA3820-6
LV HRC fuse for voltage range 500 to 690 V 3 AC (fitted at factory)				
Fuse protection in A	gG 16	gG 20	gG 32	gG 40
Fuse MLFB	3NA3805-6	3NA3807-6	3NA3812-6	3NA3817-6

5.8.5 Auxiliary power supply system

Description

The auxiliary power supply system is used to distribute the available voltages (line voltage for device fans, 230 V AC, 2-phase 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 available only via the auxiliary power supply system.

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

Table 5- 53 Overview of the fuses for the auxiliary power supply system in the Auxiliary Power Supply Module

Order no. 6SL3700-	0MX14-0AA3	0MX16-3AA3	0MX21-0AA3	0MX21-4AA3
Fuse protection in A				
380 to 690 V 2 AC (depending on the rated device voltage)	63	80	100	100
230 V 1 AC	6	10	10	20
24 V DC	20	40	80	80

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

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

Note

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 on the customer DVD supplied.

Table 5- 54 Overview of customer terminals in the Auxiliary Power Supply Module

Cabinet Module Order no. 6SL3700-	0MX14-0AA3	0MX16-3AA3	0MX21-0AA3	0MX21-4AA3
Customer terminal -X45 for tapping the line voltage (380 to 480 V 3 AC or 500 to 690 V 3 AC)				
Fuse protection in A	50	63	80	80
Max. connection cross section in mm^2	16	16	16	16
Customer terminal -X46 for connection of an uninterruptible power supply for SITOP [1)]				
Fuse protection in A [2)]	10	20	35	35
Max. connection cross section in mm^2	6	6	6	6
Customer terminal -X47 for tapping the 230 V AC, 1-phase voltage				
Fuse protection in A	8	10	10	20
Max. connection cross section in mm^2	2.5	2.5	2.5	2.5

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

2) The customer is responsible for providing external fuse protection for the uninterruptible power supply according to the specifications for the 24 V DC power supply used.

5.8.7 Options

Note

The individual options are described in the chapter titled "Options".

Electrical options

Component	Option
Holder for ARC detector (arc sensor)	L51
Cabinet anti-condensation heating	L55

Mechanical options

Component	Option
Base 100 mm high	M06
Cable-marshaling compartment 200 mm high	M07
IP21 degree of protection	M21
IP23/IP43/IP54 degree of protection	M23, M43, M54
Side panels (right/left)	M26, M27
Closed cabinet door	M59
EMC shield bus	M70
DC busbar	M80 to M87
Crane transport assembly (top-mounted)	M90

5.8.8 Technical data

Table 5- 55 Technical data for the Auxiliary Power Supply Modules

Order No.	**6SL3700-**	**0MX14-0AA3**	**0MX16-3AA3**	**0MX21-0AA3**	**0MX21-4AA3**
Plant infeed voltage **380 ... 690 V 3 AC**	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 ... 690 V AC - at the auxiliary power supply system - 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	 100 80 10 10 80	 100 80 20 20 80
Cable cross section, max. - Connection -X45 - Connection -X47	 mm^2 mm^2	 16 2.5	 16 2.5	 16 2.5	 16 2.5
PE/GND connection - Busbar cross section - Connection cross section, max. (IEC)	 mm^2 mm^2	PE busbar 600 240			
Cooling air requirement		Natural convection			
Degree of protection (standard version)		IP20	IP20	IP20	IP20
Dimensions (standard version, IP20) - width - height [1)] - depth	 mm mm mm	 600 2200 600	 600 2200 600	 600 2200 600	 600 2200 600
Weight, approx. (standard version)	kg	170	180	210	240

1) The cabinet height increases by 250 mm with IP21 degree of protection, and by 400 mm with IP23, IP24 and IP54 degrees of protection.

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
- Reforming the DC link capacitors

⚠ DANGER

Before carrying out maintenance or repair work on the de-energized cabinet, wait for 5 minutes after switching off the power supply. This allows the capacitors to discharge to a harmless level (< 25 V) after the line voltage has been switched off.

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

When the external power supply (e.g. option L55) or the external 230 V auxiliary infeed or supply infeed is connected, dangerous voltages are still present in the cabinet even when the main breaker is open.

Beware of any residual rotation of the fan.

6.2 Cleaning the cabinet

The cabinet comprises mostly electronic components. Apart from the fan(s), therefore, it contains hardly any components that are subject to wear or that require maintenance or servicing. The purpose of maintenance is to preserve the specified condition of the cabinet. 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, along with dry compressed air (max. 1 bar) for areas that cannot be easily reached.

Ventilation

The ventilation openings in the cabinet must never be obstructed. The fan must be checked to make sure that it is functioning correctly.

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:

- Spanner or socket spanner (width across flats 10)
- Spanner or socket spanner (width across flats 13)
- Spanner or socket spanner (width across flats 16/17)
- Spanner or socket spanner (width across flats 18/19)
- Hexagon-socket spanner (size 8)
- Torque wrench up to 50 Nm
- Screwdriver (size 1/2)
- Screwdriver Torx T20
- Screwdriver Torx T30

A socket-spanner case with two long extensions is recommended.

Tightening torques for connecting current-conducting parts

When securing connections for current-conducting parts (DC link/motor connections, busbars), you must observe the following tightening torques.

Table 6- 1 Tightening torques for connecting current-conducting parts

Screw	Torque
M6	6 Nm
M8	13 Nm
M10	25 Nm
M12	50 Nm

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

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.

6.4 Replacing components

6.4.1 General information

This chapter deals with replacing components that may need to be exchanged when the cabinet units require maintenance or service. Other components are not normally subject to wear and tear and are, therefore, not covered in this chapter.

Note

The order numbers for spare parts are listed on the supplied customer DVD in the spare parts list.

6.4.2 Safety information

Required safety precautions to be taken before carrying out maintenance and servicing

DANGER

You must read and observe the "Safety information" chapter in this Manual.

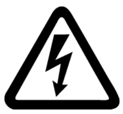
When carrying out any kind of work on electrical devices, the following "five safety rules" must always be observed in accordance with EN 50110-1 and EN 50110-2:

- Disconnect from power supply.
- Protect against reconnection.
- Make sure that the equipment is de-energized.
- Ground and short-circuit.
- Cover or enclose adjacent components that are still live.

DANGER

The following must be taken into account when the devices are transported:

- Some of the devices are heavy or top heavy.
- Due to their weight, the devices must be handled with care by trained personnel.
- Serious injury or even death and substantial material damage can occur if the devices are not lifted or transported properly.



WARNING

The cabinet units are operated with high voltages.
All connection work must be carried out when the cabinet is de-energized.
All work on the cabinet must be carried out by trained personnel only.

Work on an open cabinet must be carried out with extreme caution because external supply voltages may be present. The power and control terminals may be live even when the motor is not running.
Dangerously high voltage levels are still present inside the cabinet up to 5 minutes after it has been disconnected due to the DC link capacitors. For this reason, the cabinet should not be opened until a reasonable period of time has elapsed.

6.4.3 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

Order number for the installation device

The order number for the installation device is 6SL3766-1FA00-0AA0.

6.4.4 Replacing the filter mats

Replacing the filter mats (for IP23/IP43/IP54)

The filter mats must be checked at regular intervals. If the mats are too dirty to allow the air supply to flow normally, they must be replaced.

Note

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

DANGER

You must read and observe all safety information provided in this manual and comply with the "five safety rules" for all work on electrical devices.

- Observe the "five safety rules".
- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Allow unimpeded access to the grille area of the doors.

Note

The cabinet must be disconnected from the power supply to prevent the fans from drawing in contaminated external air. If an external power supply for the fans is used, take the coasting-down period of the fan into account or switch off the power supply.

Removing/Installing filter mats from/in the cabinet doors (IP23/IP43/IP54)

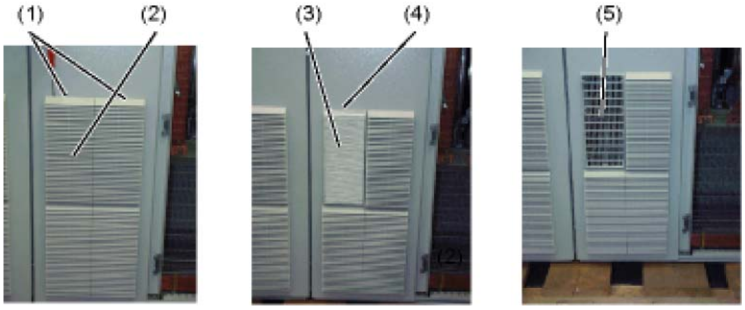


Figure 6-2 Removing/Installing filter mats (IP23/IP43/IP54)

1. Insert the screwdriver into the cut-out sections provided (1) and gently push the grille cover (2) down and forwards, then remove it.
2. Remove the filter mat (3).
3. Clean the ventilation grille (5).
4. Insert the new filter mat.
5. Replace the grille cover and gently snap it back into position in the cut-out sections.
6. Repeat the procedure for all filter mats that need to be replaced.

CAUTION
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). If you do not do this, the specified degree of protection IP23/IP43/IP54 will not be achieved. When disposing of old filter mats, observe the applicable legal requirements!

6.4.5 Replacing power units

The components required for connecting the DC busbars to the power unit are supplied as standard. If a components is replaced, you may have to restore these connections. The connection procedure is described in the following section.

Preparatory steps:

- Observe the "five safety rules".
- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- The cabinet units must be installed and securely mounted
- Allow unimpeded access to the DC busbars
(if necessary, remove the protective covers during installation work)

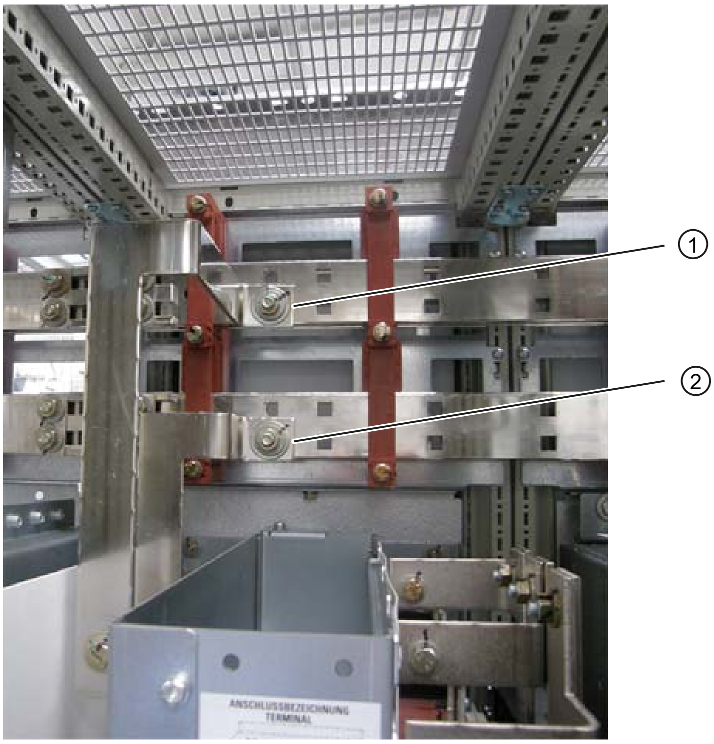


Figure 6-3 Connection to the DC busbar on the Basic Line Module, Smart Line Module, Active Line Module and Motor Module in the chassis format

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

⚠ WARNING
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 on 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 on 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).

6.4.6 Replacing the Motor Module, booksize format

Preparatory steps

- Observe the "five safety rules".
- 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 V 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

For installation, carry out the above steps in reverse order.

6.4.7 Replacing the power block, chassis format

6.4.7.1 Replacing the power block, frame size FB

Replacing the power block

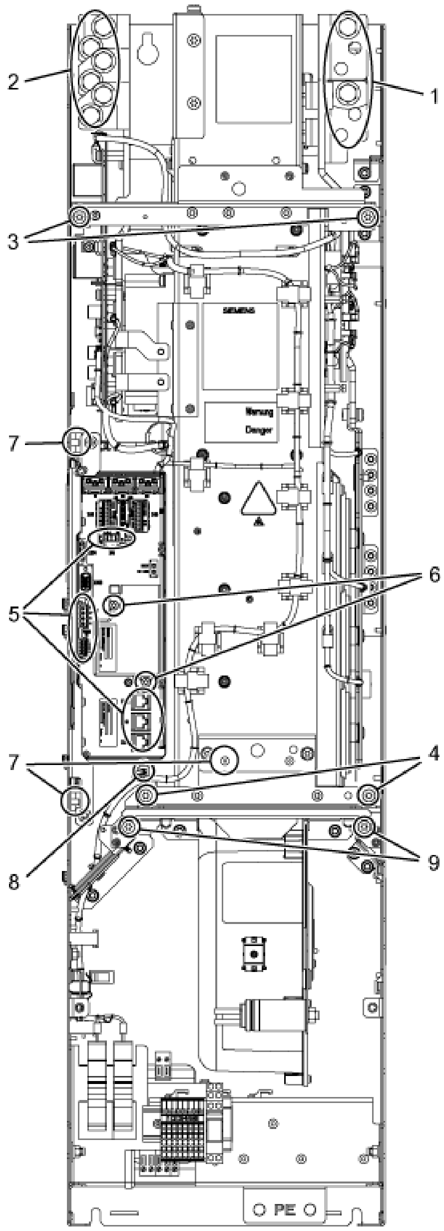


Figure 6-4 Replacing the power block, Basic Line Module, frame size FB

Preparatory steps

- Observe the "five safety rules".
- 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 titled "Installation device for power blocks").

Removal steps

The removal steps are numbered in accordance with the figure above.

1. Unscrew the connection to the DC link (4 screws).
2. Unscrew the connection to the line connection (6 screws).
3. Remove the retaining screws at the top (2 screws).
4. Remove the retaining screws at the bottom (2 screws).
5. Remove the DRIVE-CLiQ cables and connections on -X41 / -X42 / -X46 (6 plugs).
6. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from plug -X45 on the Control Interface Module.
7. Remove the mounts for the Control Interface Module (1 screw and 2 nuts) and carefully pull out the Control Interface Module.

   When removing the Control Interface Module, you have to disconnect 5 further plugs one after the other (2 at the top, 3 below).
8. Disconnect the plug for the thermocouple.
9. Unscrew the 2 retaining screws for the fan and attach the tool for de-installing the power block at this position.

You can now remove the power block.

Installation steps

Installing is the same as removing, however in the reverse order.

CAUTION
When removing the power block, ensure that you do not damage any signal cables.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. Carefully establish the plug connections and then ensure that they are secure. The screw connections for the protective covers may only be tightened by hand.

6.4.7.2 Replacing the power block, frame sizes GB and GD

Replacing the power block

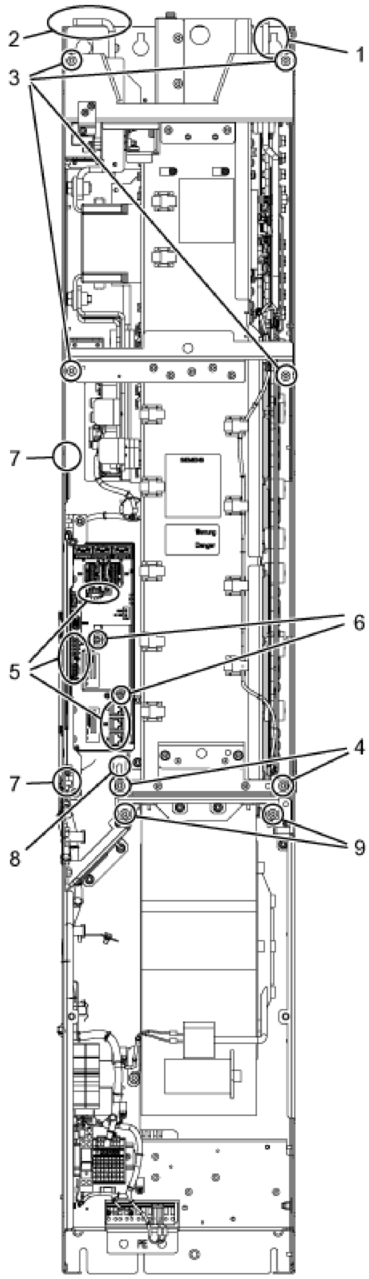


Figure 6-5 Replacing the power block, Basic Line Module, frame sizes GB and GD

Preparatory steps

- Observe the "five safety rules".
- 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 titled "Installation device for power blocks").

Removal steps

The removal steps are numbered in accordance with the figure above.

1. Unscrew the connection to the DC link (6 screws).
2. Unscrew the connection to the line connection (9 screws).
3. Remove the retaining screws at the top (4 screws).
4. Remove the retaining screws at the bottom (2 screws).
5. Remove the DRIVE-CLiQ cables and connections on -X41 / -X42 / -X46 (6 plugs).
6. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from plug -X45 on the Control Interface Module.
7. Remove the mounts for the Control Interface Module (2 nuts) and carefully pull out the Control Interface Module.

   When removing the Control Interface Module, you have to disconnect 5 further plugs one after the other (2 at the top, 3 below).
8. Disconnect the plug for the thermocouple.
9. Unscrew the 2 retaining screws for the fan and attach the tool for de-installing the power block at this position.

You can now remove the power block.

CAUTION
When removing the power block, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. Carefully establish the plug connections and then ensure that they are secure. The screw connections for the protective covers may only be tightened by hand.

6.4.7.3 Replacing the power block, frame size FX

Replacing the power block

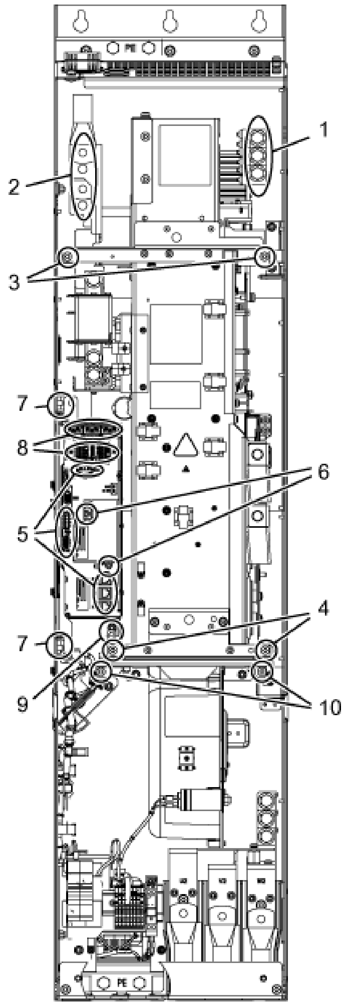


Figure 6-6 Replacing the power block, Active Line Module, and Motor Module, frame size FX

Preparatory steps

- Observe the "five safety rules".
- 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 titled "Installation device for power blocks").

Removal steps

The removal steps are numbered in accordance with the figure.

1. Unscrew the connection to the line or to the motor (3 screws).
2. Unscrew the connection to the DC link (4 screws).
3. Remove the retaining screws at the top (2 screws).
4. Remove the retaining screws at the bottom (2 screws).
5. Remove the DRIVE-CLiQ cables and connections on -X41 / -X42 / -X46 (6 plugs).
6. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from plug -X45 on the Control Interface Module.
7. Remove the mounts for the Control Interface Module (2 nuts) and carefully pull out the Control Interface Module.

   When removing the Control Interface Module, you have to disconnect 5 further plugs one after the other (2 at the top, 3 below).
8. Disconnect the plug-in connections for the fiber optic cables and signal cables (5 connectors).
9. Disconnect the plug for the thermocouple.
10. Unscrew the 2 retaining screws for the fan and attach the tool for de-installing the power block at this position.

You can now remove the power block.

⚠ DANGER
Up to 1200 V may still be present on the DC busbars even after the DC interface (option L37) has been switched off. For this reason, take particular care to avoid coming into contact with the DC busbar when replacing a power block!

CAUTION
When removing the power block, ensure that you do not damage any signal cables. The second plug connection for the fiber optic cables cannot be disconnected until the power block has been pulled out slightly (see Step 7).

Installation steps

Installing is the same as removing, however in the reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. Carefully establish the plug connections and then ensure that they are secure. The fiber optic cable plugs must be remounted at their original slot. Fiber optic cables and sockets are accordingly labeled for correct assignment (U11, U21, U31). The screw connections for the protective covers may only be tightened by hand.

6.4.7.4 Replacing the power block, frame size GX

Replacing the power block

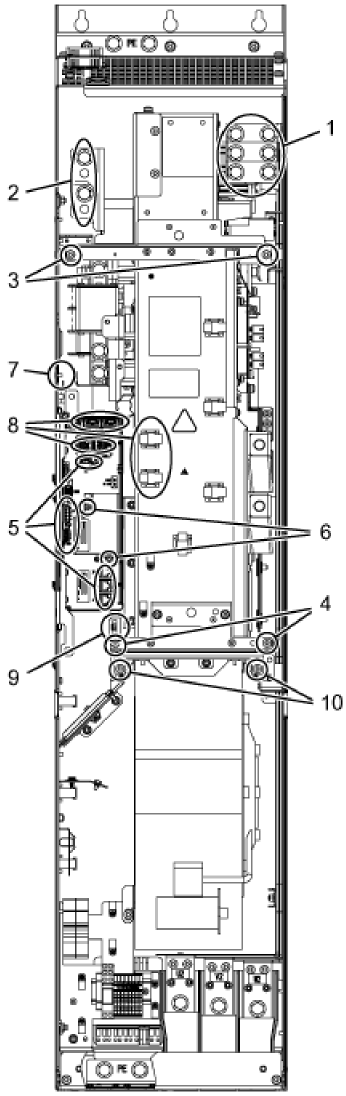


Figure 6-7 Replacing the power block, Smart Line Module, Active Line Module, and Motor Module, frame size GX

Preparatory steps

- Observe the "five safety rules".
- 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 titled "Installation device for power blocks").

Removal steps

The removal steps are numbered in accordance with the figure.

1. Unscrew the connection to the line or to the motor (3 screws).
2. Unscrew the connection to the DC link (4 screws).
3. Remove the retaining screws at the top (2 screws).
4. Remove the retaining screws at the bottom (2 screws).
5. Remove the DRIVE-CLiQ cables and connections on -X41 / -X42 / -X46 (6 plugs).
6. Take out the retaining screws for the IPD card (2 screws) and remove the IPD card from plug -X45 on the Control Interface Module.
7. Remove the mount for the Control Interface Module (1 nut) and carefully pull out the Control Interface Module.

   When removing the Control Interface Module, you have to disconnect 5 further plugs one after the other (2 at the top, 3 below).
8. Disconnect the plug 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 tool for de-installing the power block at this position.

You can now remove the power block.

DANGER

Up to 1200 V may still be present on the DC busbars even after the DC interface (option L37) has been switched off. For this reason, take particular care to avoid coming into contact with the DC busbar when replacing a power block!

CAUTION

When removing the power block, ensure that you do not damage any signal cables.

The second plug connection for the fiber optic cables cannot be disconnected until the power block has been pulled out slightly (see Step 7).

Installation steps

Installing is the same as removing, however in the reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. Carefully establish the plug connections and then ensure that they are secure. The fiber optic cable plugs must be remounted at their original slot. Fiber optic cables and sockets are accordingly labeled for correct assignment (U11, U21, U31). The screw connections for the protective covers may only be tightened by hand.

6.4.7.5 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

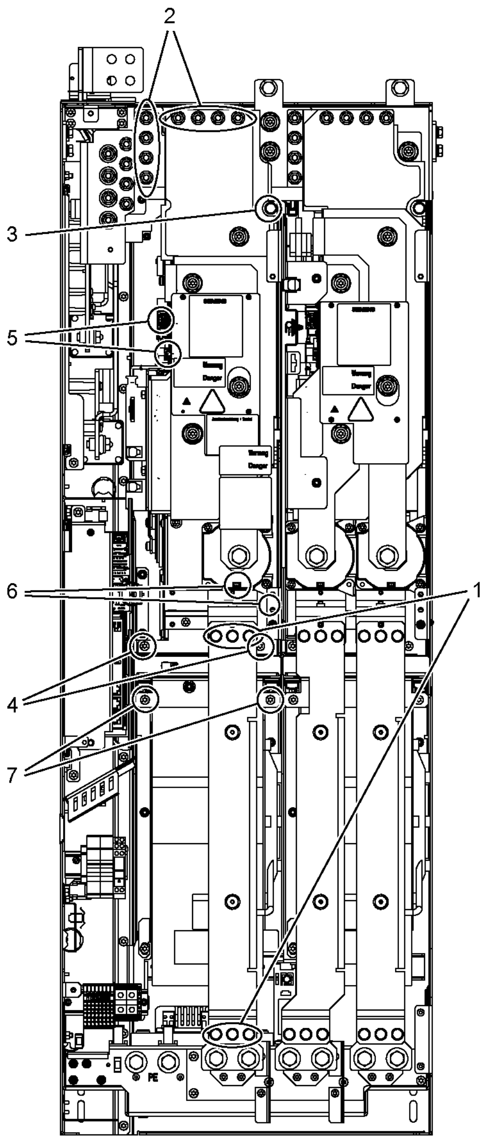


Figure 6-8 Replacing the power block, Smart Line Module, Active Line Module, and Motor Module, frame size HX – left power block

Preparatory steps

- Observe the "five safety rules".
- 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 titled "Installation device for power blocks").

Removal steps

The removal steps are numbered in accordance with the figure above.

1. Remove the busbar (6 screws).
2. Unscrew the connection to the DC link (8 nuts).
3. Remove the retaining screw at the top (1 screw).
4. Remove the retaining screws at the bottom (2 screws).
5. Disconnect the plug connections for the fiber optic cables and signal cables (2 plugs).
6. Remove the connection for the current transformer and associated PE connection (1 plug).
7. Unscrew the 2 retaining screws for the fan and attach the installation device for the power block at this position.

You can now remove the power block.

⚠ DANGER
Up to 1200 V may still be present on the DC busbars even after the DC interface (option L37) has been switched off. For this reason, take particular care to avoid coming into contact with the DC busbar when replacing a power block!

CAUTION
When removing the power block, ensure that you do not damage any signal cables. The second plug connection for the fiber optic cables cannot be disconnected until the power block has been pulled out slightly (see Step 5).

Installation steps

Installing is the same as removing, however in the reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. Carefully establish the plug connections and then ensure that they are secure. The fiber optic cable plugs must be remounted at their original slot. Fiber optic cables and sockets are accordingly labeled for correct assignment (U11, U21, U31). The screw connections for the protective covers may only be tightened by hand.

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

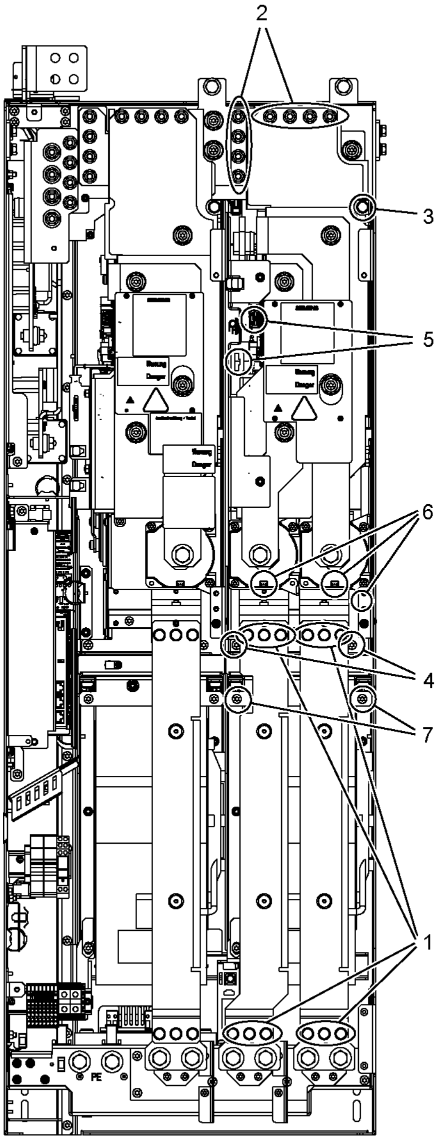


Figure 6-9 Replacing the power block, Smart Line Module, Active Line Module, and Motor Module, frame size HX - right power block

Preparatory steps

- Observe the "five safety rules".
- 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 titled "Installation device for power blocks").

Removal steps

The removal steps are numbered in accordance with the figure above.

1. Remove the busbars (12 screws).
2. Unscrew the connection to the DC link (8 nuts).
3. Remove the retaining screw at the top (1 screw).
4. Remove the retaining screws at the bottom (2 screws).
5. Disconnect the plug connections for the fiber optic cables and signal cables (2 plugs). The second plug connection for the fiber optic cables cannot be disconnected until the power block has been pulled out slightly.
6. Remove the connection for the current transformer and associated PE connection (2 connectors).
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
Up to 1200 V may still be present on the DC busbars even after the DC interface (option L37) has been switched off. For this reason, take particular care to avoid coming into contact with the DC busbar when replacing a power block!

CAUTION
When removing the power block, ensure that you do not damage any signal cables. The second plug connection for the fiber optic cables cannot be disconnected until the power block has been pulled out slightly (see Step 5).

Installation steps

Installing is the same as removing, however in the reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. Carefully establish the plug connections and then ensure that they are secure. The fiber optic cable plugs must be remounted at their original slot. Fiber optic cables and sockets are accordingly labeled for correct assignment (U11, U21, U31). The screw connections for the protective covers may only be tightened by hand.

6.4.7.6 Replacing the power block, frame size JX

Replacing the power block

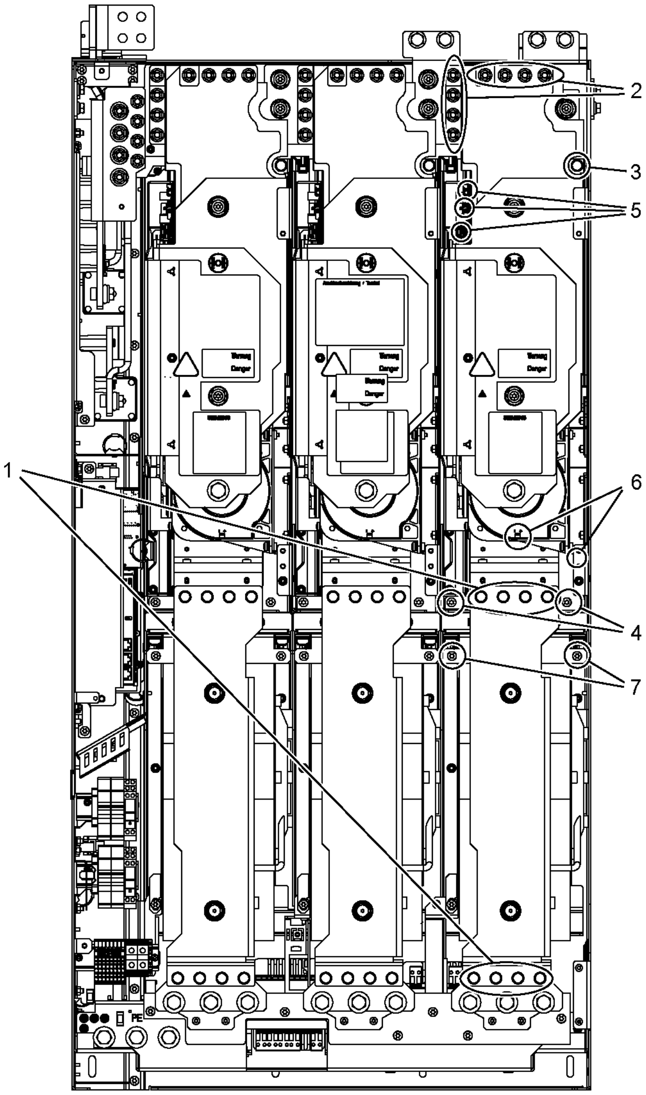


Figure 6-10 Replacing the power block, Active Line Module, Smart Line Module, and Motor Module, frame size JX

Preparatory steps

- Observe the "five safety rules".
- 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 titled "Installation device for power blocks").

Removal steps

The removal steps are numbered in accordance with the figure above.

1. Remove the busbar (8 screws).
2. Unscrew the connection to the DC link (8 nuts).
3. Remove the retaining screw at the top (1 screw).
4. Remove the retaining screws at the bottom (2 screws).
5. Disconnect the plug connections for the fiber optic cables and signal cables (2 plugs).
6. Remove the connection for the current transformer and associated PE connection (1 plug).
7. Unscrew the 2 retaining screws for the fan and attach the installation device for the power block at this position.

You can now remove the power block.

DANGER
Up to 1200 V may still be present on the DC busbars even after the DC interface (option L37) has been switched off. For this reason, take particular care to avoid coming into contact with the DC busbar when replacing a power block!

CAUTION
When removing the power block, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. Carefully establish the plug connections and then ensure that they are secure. The fiber optic cable plugs must be remounted at their original slot. Fiber optic cables and sockets are accordingly labeled for correct assignment (U11, U21, U31). The screw connections for the protective covers may only be tightened by hand.

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.

6.4.8 Replacing the Control Interface Module

6.4.8.1 Replacing the Control Interface Module, frame size FX

Replacing the Control Interface Module

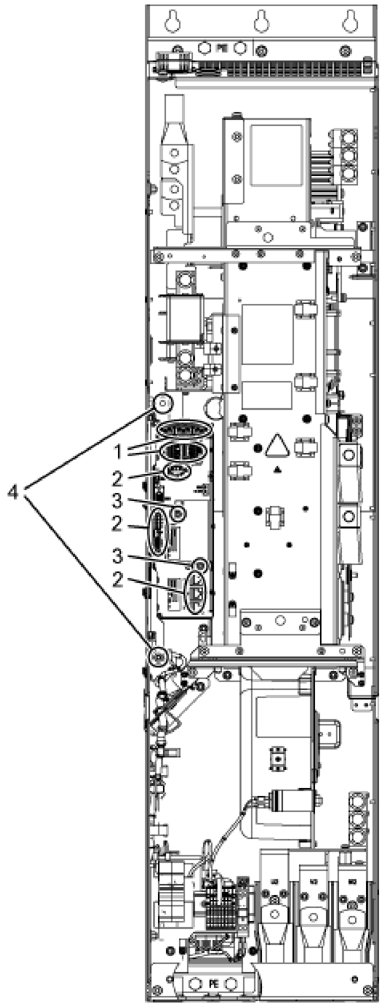


Figure 6-11 Replacing the Control Interface Module, Motor Module, frame size FX

Preparatory steps

- Disconnect the drive line-up from the power supply so that it is in a no-voltage condition.
- Allow unimpeded access.
- Remove the front cover

Removal steps

The removal steps are numbered in accordance with the figure.

1. Disconnect the plug-in connections for the fiber optic cables and signal cables (5 connectors).
2. Remove 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 plug -X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (2 screws).

When removing the Control Interface Module, you have to disconnect 5 further plugs one after the other (2 at the top, 3 below).

CAUTION
When withdrawing it, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. Carefully establish the plug connections and then ensure that they are secure. The fiber optic cable plugs must be remounted at their original slot. Fiber optic cables and sockets are accordingly labeled for correct assignment (U11, U21, U31).

Note

It is only possible to connect identical power units in parallel if both power units have the same hardware version. Mixed operation between a power unit with Control Interface Module and a power unit with Control Interface Board is not possible.

6.4.8.2 Replacing the Control Interface Module, frame size GX

Replacing the Control Interface Module

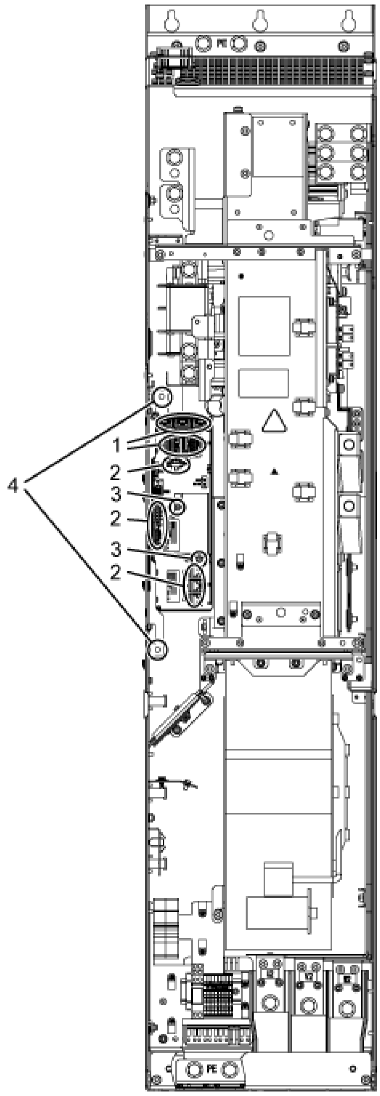


Figure 6-12 Replacing the Control Interface Module, Motor Module, frame size GX

Preparatory steps

- Disconnect the drive line-up from the power supply so that it is in a no-voltage condition.
- Allow unimpeded access.
- Remove the front cover

Removal steps

The removal steps are numbered in accordance with the figure.

1. Disconnect the plug-in connections for the fiber optic cables and signal cables (5 connectors).
2. Remove 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 plug -X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (2 screws).

When removing the Control Interface Module, you have to disconnect 5 further plugs one after the other (2 at the top, 3 below).

CAUTION
When withdrawing it, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. Carefully establish the plug connections and then ensure that they are secure. The fiber optic cable plugs must be remounted at their original slot. Fiber optic cables and sockets are accordingly labeled for correct assignment (U11, U21, U31).

Note

It is only possible to connect identical power units in parallel if both power units have the same hardware version. Mixed operation between a power unit with Control Interface Module and a power unit with Control Interface Board is not possible.

6.4.8.3 Replacing the Control Interface Module, frame size HX

Replacing the Control Interface Module

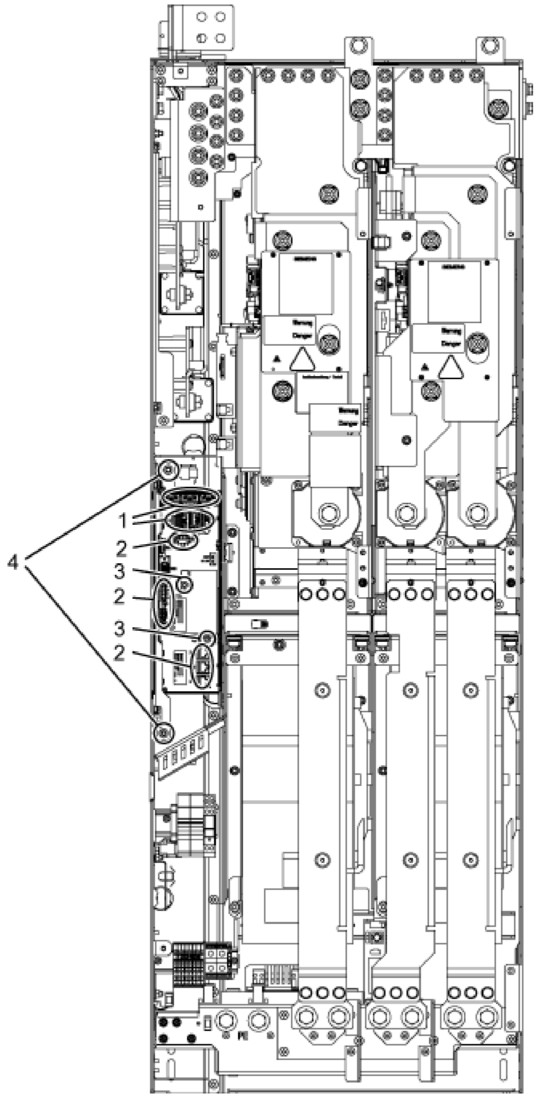


Figure 6-13 Replacing the Control Interface Module, Motor Module, frame size HX

Preparatory steps

- Disconnect the drive line-up from the power supply so that it is in a no-voltage condition.
- Allow unimpeded access.
- Remove the protective cover.

Removal steps

The removal steps are numbered in accordance with the figure.

1. Disconnect the plug-in connections for the fiber optic cables and signal cables (5 connectors).
2. Remove 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 plug -X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (2 screws).

When removing the Control Interface Module, you have to disconnect 5 further plugs one after the other (2 at the top, 3 below).

CAUTION
When withdrawing it, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. Carefully establish the plug connections and then ensure that they are secure. The screw connections for the protective covers may only be tightened by hand. The fiber optic cable plugs must be remounted at their original slot. Fiber optic cables and sockets are accordingly labeled for correct assignment (U11, U21, U31).

Note

It is only possible to connect identical power units in parallel if both power units have the same hardware version. Mixed operation between a power unit with Control Interface Module and a power unit with Control Interface Board is not possible.

6.4.8.4 Replacing the Control Interface Module, frame size JX

Replacing the Control Interface Module

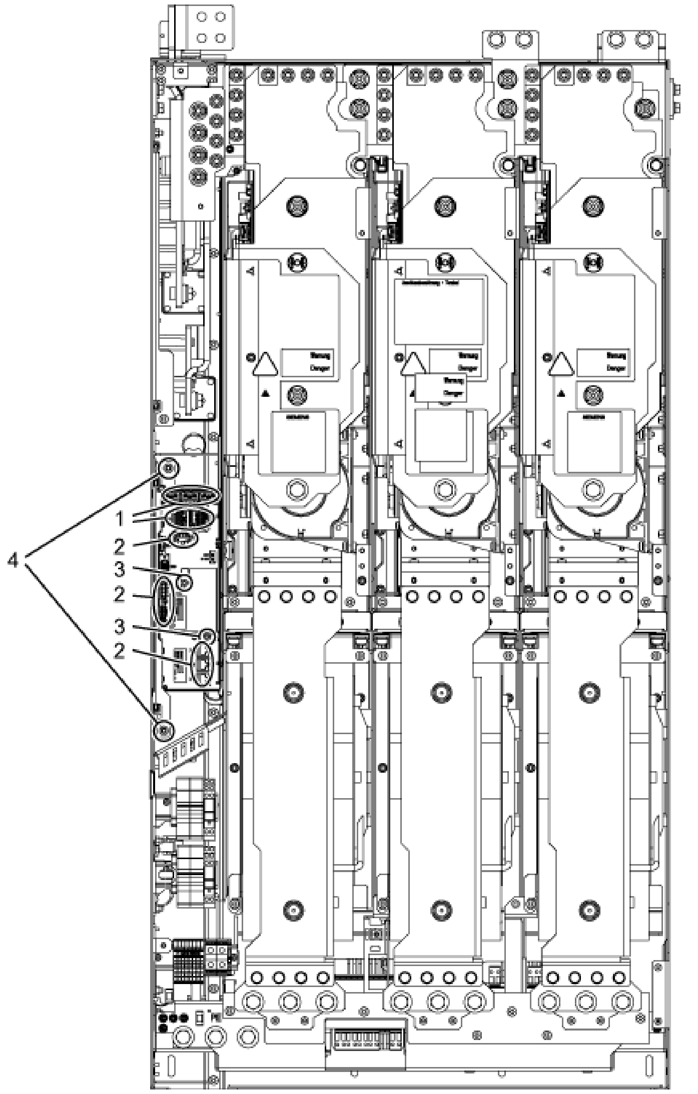


Figure 6-14 Replacing the Control Interface Module, Motor Module, frame size JX

Preparatory steps

- Disconnect the drive line-up from the power supply so that it is in a no-voltage condition.
- Allow unimpeded access.
- Remove the protective cover.

Removal steps

The removal steps are numbered in accordance with the figure.

1. Disconnect the plug-in connections for the fiber optic cables and signal cables (5 connectors).
2. Remove 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 plug -X45 on the Control Interface Module.
4. Remove the retaining screws for the Control Interface Module (2 screws).

When removing the Control Interface Module, you have to disconnect 5 further plugs one after the other (2 at the top, 3 below).

CAUTION
When withdrawing it, ensure that you do not damage any signal cables.

Installation steps

Installing is the same as removing, however in the reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. Carefully establish the plug connections and then ensure that they are secure. The screw connections for the protective covers may only be tightened by hand. The fiber optic cable plugs must be remounted at their original slot. Fiber optic cables and sockets are accordingly labeled for correct assignment (U11, U21, U31).

Note

It is only possible to connect identical power units in parallel if both power units have the same hardware version. Mixed operation between a power unit with Control Interface Module and a power unit with Control Interface Board is not possible.

6.4.9 Replacing the Control Unit

The Control Unit is mounted on a slide-in unit that can be pulled out by removing a screw on the top left ① if the Control Unit needs to be replaced.

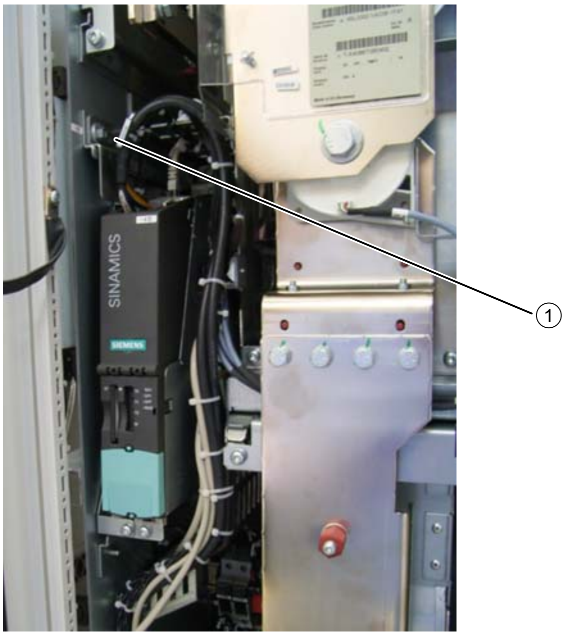


Figure 6-15 Replacing the Control Unit

Preparatory steps

- Observe the "five safety rules".
- Remove the protective cover.
- Allow unimpeded access.

Removal steps

1. Release nut ①
2. Before pulling out the Control Unit on the slide-in unit completely, remove all cables connected to the Control Unit.
3. Pull out the Control Unit on the slide-in unit and install the new one.

CAUTION
When removing the Control Unit, ensure that you do not damage any cables.

Note

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

6.4.10 Replacing the fans

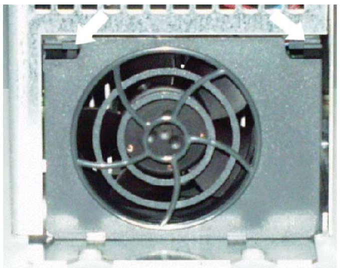
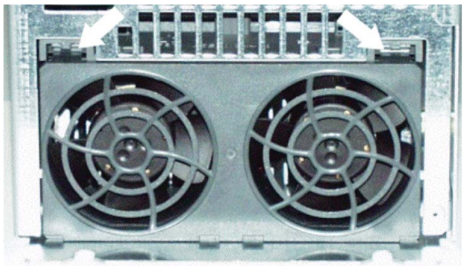
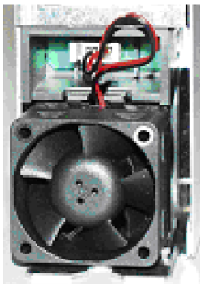
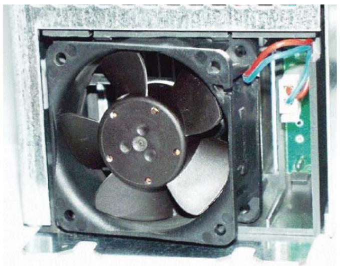
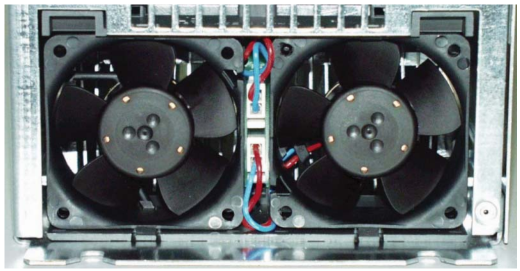
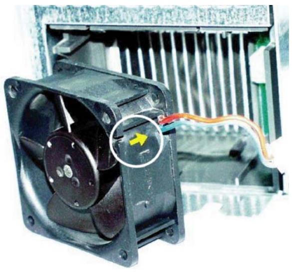
6.4.10.1 Replacing the fan, Booksize Cabinet Kit

Preparatory steps

- Observe the "five safety rules".
- Remove the protective cover.
- Allow unimpeded access.

Removing the fan, width 50 to 200 mm

Table 6- 2 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 component from the drive line-up. 3. Open the fan cover		
Module width: 50 mm	**Module width: 100 mm**	**Module width: 150 mm and 200 mm**
		
1. Remove the fan. 2. Remove the connector.		
		
		

CAUTION
When withdrawing it, ensure that you do not damage any signal cables.

NOTICE
Take care not to cut yourself on the sharp edges inside the cabinet.

Installation steps for the fan, width 50 to 200 mm

1. Before installing the fan, check the air flow direction
   (the arrow on the fan must point towards the cooling fins).
2. Insert the connector until it fully engages.
3. Insert the fan until it latches into place.
   Do not pinch the connecting cables.
4. Close the fan cover.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. The screw connections for the protective covers may only be tightened by hand.

Removing the fan, width 300 mm

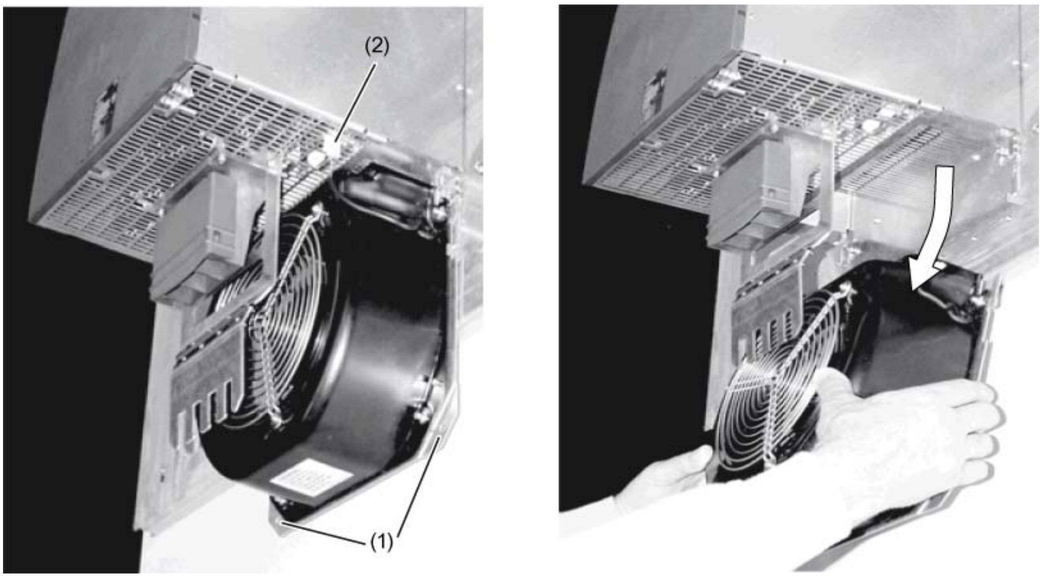


Figure 6-16 Removing the 300mm fan

1. Undo the M6 / 6 Nm screws (1)
2. Disconnect the power supply for the fan (2)
3. The fan can now be removed

CAUTION
When withdrawing it, ensure that you do not damage any signal cables.

NOTICE
Take care not to cut yourself on the sharp edges inside the cabinet.

Installation steps for the fan, width 300 mm

Installing is the same as removing, however in the reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. The screw connections for the protective covers may only be tightened by hand.

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

Replacing the fan

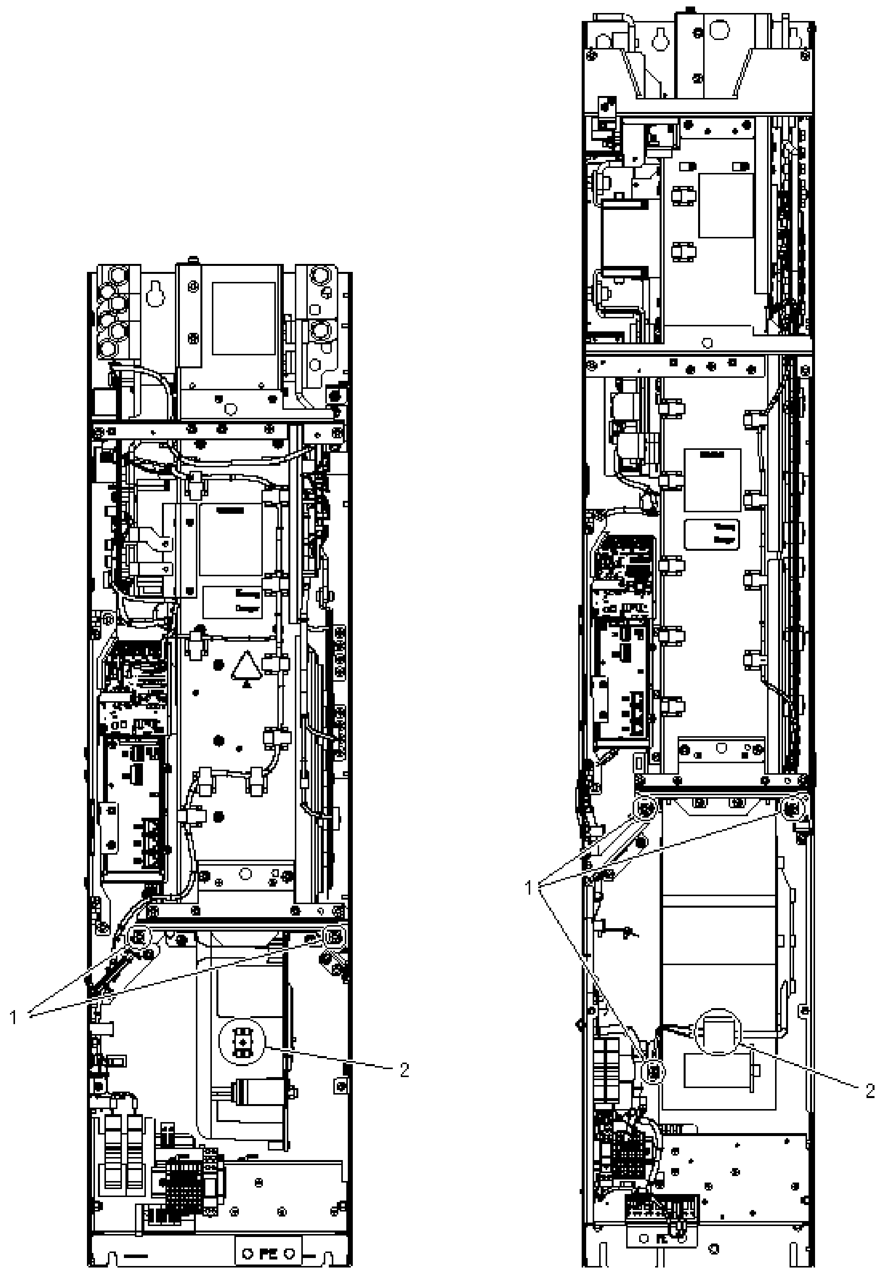


Figure 6-17 Replacing the fan, Basic Line Module, frame sizes FB, GB, and GD

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

- Observe the "five safety rules".
- 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.

CAUTION
When removing the fan, ensure that you do not damage any signal cables.

NOTICE
Take care not to cut yourself on the sharp edges inside the cabinet.

Installation steps

For installation, carry out the above steps in reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. The screwed connections for the protective covers must only be tightened by hand.

6.4.10.3 Replacing the fan, sizes FX and GX

Replacing the fan

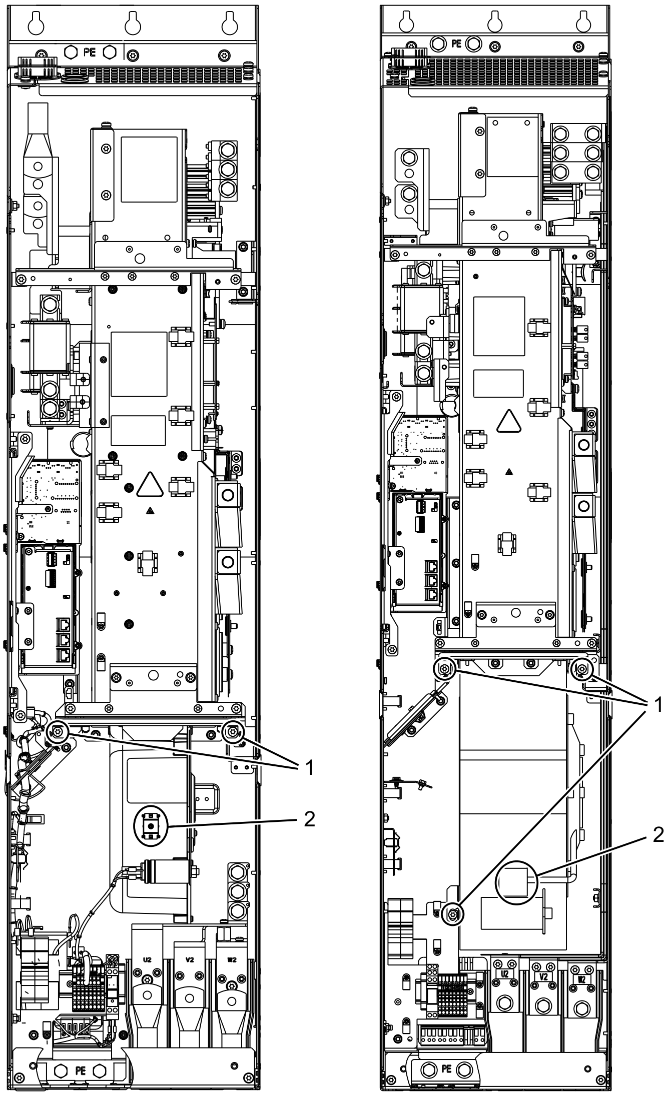


Figure 6-18 Replacing the fan, Smart Line Module, Active Line Module, and Motor Module, frame sizes FX and GX

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

- Observe the "five safety rules".
- 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.

CAUTION
When removing the fan, ensure that you do not damage any signal cables.

NOTICE
Take care not to cut yourself on the sharp edges inside the cabinet.

Installation steps

For installation, carry out the above steps in reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. The screwed connections for the protective covers must only be tightened by hand.

6.4.10.4 Replacing the fan, size HX

Replacing the fan, left power block

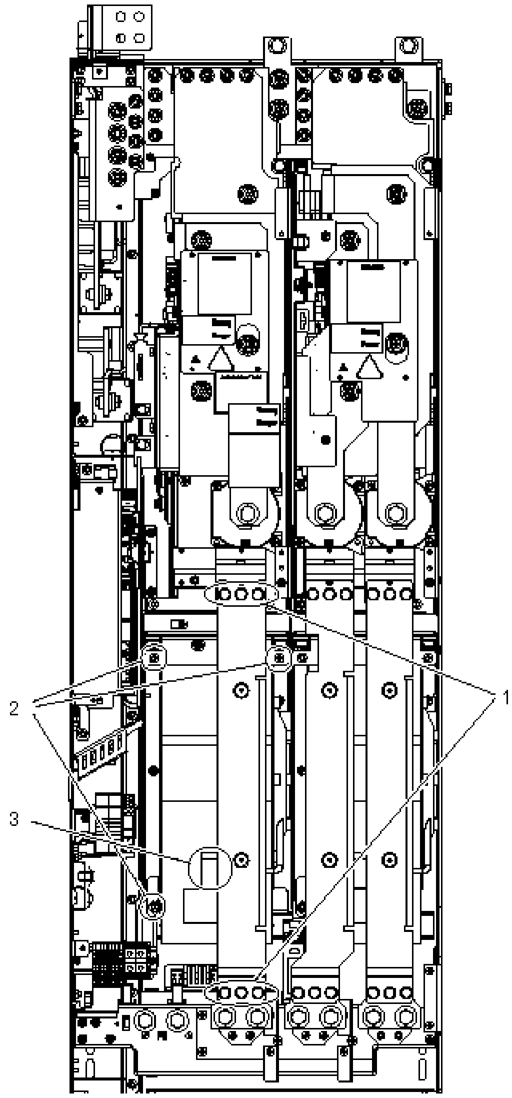


Figure 6-19 Replacing the fan, Active Line Module, Smart Line Module, and Motor Module, frame size HX - left power block

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

- Observe the "five safety rules".
- 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.

CAUTION
When withdrawing it, ensure that you do not damage any signal cables.

NOTICE
Take care not to cut yourself on the sharp edges inside the cabinet.

Installation steps

Installing is the same as removing, however in the reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. The screw connections for the protective covers may only be tightened by hand.

Replacing the fan, right power block

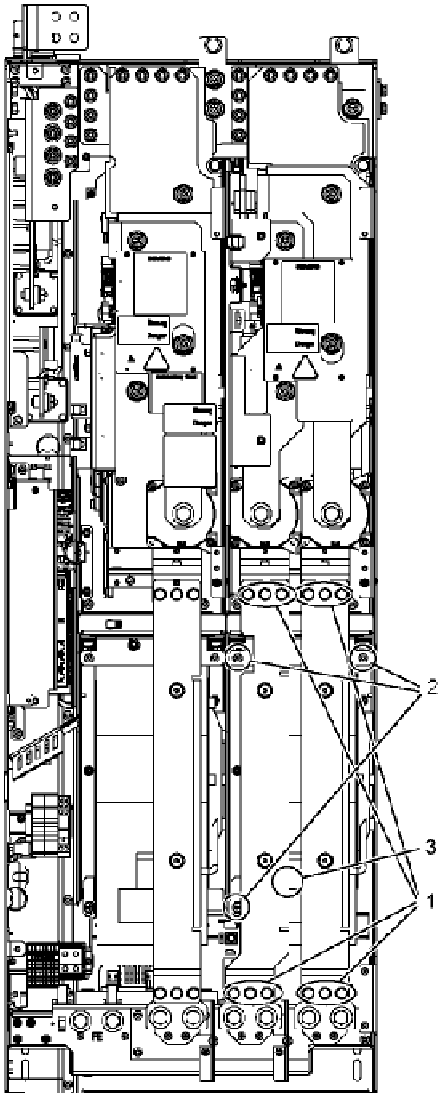


Figure 6-20 Replacing the fan, Active Line Module, Smart Line Module, and Motor Module, frame size HX - right power block

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

- Observe the "five safety rules".
- 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.

CAUTION
When withdrawing it, ensure that you do not damage any signal cables.

NOTICE
Take care not to cut yourself on the sharp edges inside the cabinet.

Installation steps

Installing is the same as removing, however in the reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. The screw connections for the protective covers may only be tightened by hand.

6.4.10.5 Replacing the fan, frame size JX

Replacing the fan

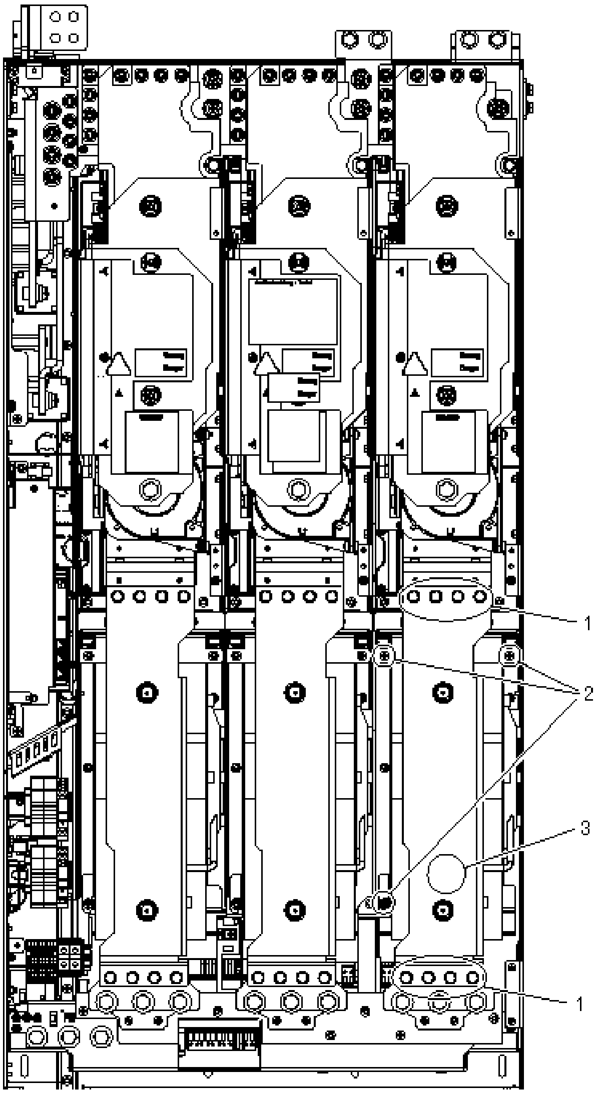


Figure 6-21 Replacing the fan, Active Line Module, Smart Line Module, and Motor Module, frame size JX

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

- Observe the "five safety rules".
- 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.

CAUTION
When removing the unit, ensure that you do not damage any signal cables.

NOTICE
Take care not to cut yourself on the sharp edges inside the cabinet.

Installation steps

For installation, carry out the above steps in reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. The screw connections for the protective covers must only be tightened by hand.

6.4.10.6 Replacing the fan, frame size FI

Replacing the fan

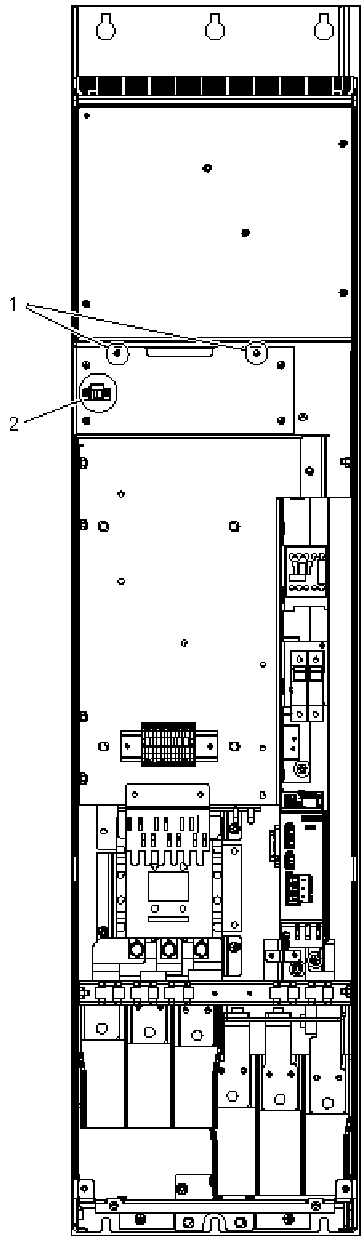


Figure 6-22 Replacing the fan, Active Interface Module, frame size FI

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

- Observe the "five safety rules".
- 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.

CAUTION
When removing the fan, ensure that you do not damage any signal cables.

NOTICE
Take care not to cut yourself on the sharp edges inside the cabinet.

Installation steps

For installation, carry out the above steps in reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. Carefully establish the plug connections and ensure that they are secure. The screwed connections for the protective covers must only be tightened by hand.

6.4.10.7 Replacing the fan, frame size GI

Replacing the fan

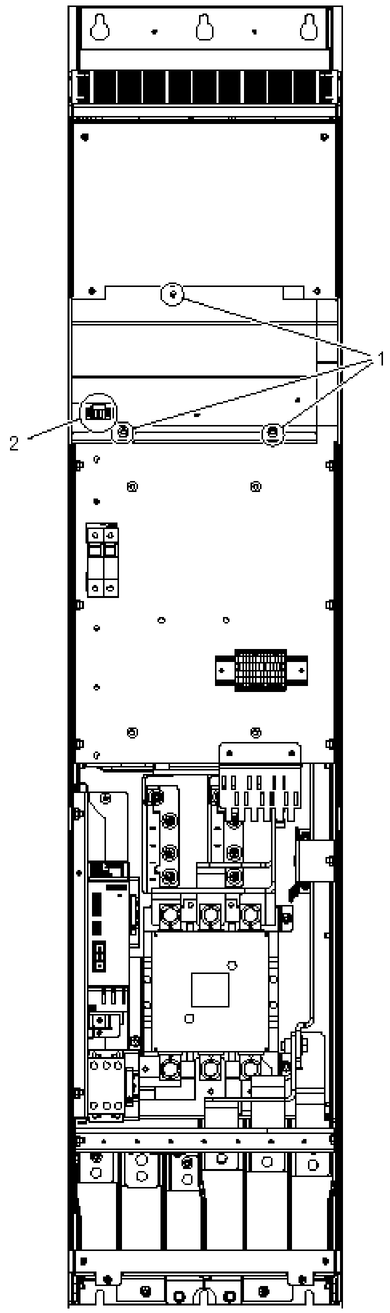


Figure 6-23 Replacing the fan, Active Interface Module, frame size GI

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

- Observe the "five safety rules".
- 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.

CAUTION
When removing the fan, ensure that you do not damage any signal cables.

NOTICE
Take care not to cut yourself on the sharp edges inside the cabinet.

Installation steps

For installation, carry out the above steps in reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. Carefully establish the plug connections and ensure that they are secure. The screwed connections for the protective covers must only be tightened by hand.

6.4.10.8 Replacing the fan, frame size HI

Replacing the fan

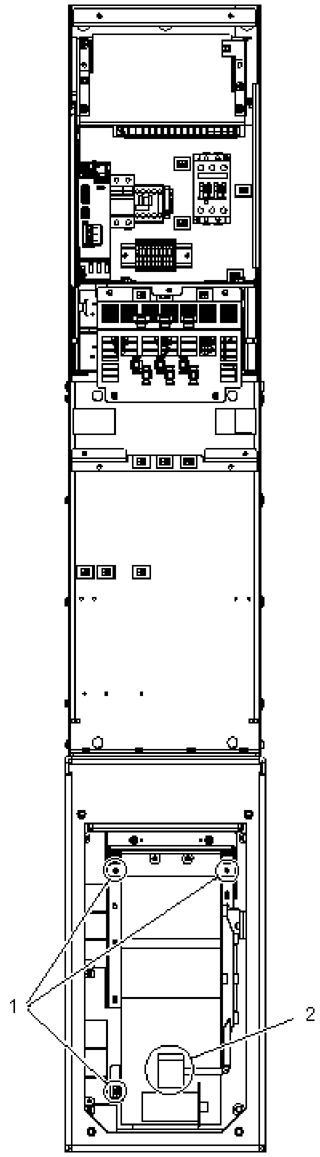


Figure 6-24 Replacing the fan, Active Interface Module, frame size HI

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

- Observe the "five safety rules".
- 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.

CAUTION
When removing the fan, ensure that you do not damage any signal cables.

NOTICE
Take care not to cut yourself on the sharp edges inside the cabinet.

Installation steps

For installation, carry out the above steps in reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. The screwed connections for the protective covers must only be tightened by hand.

6.4.10.9 Replacing the fan, frame size JI

Replacing the fan

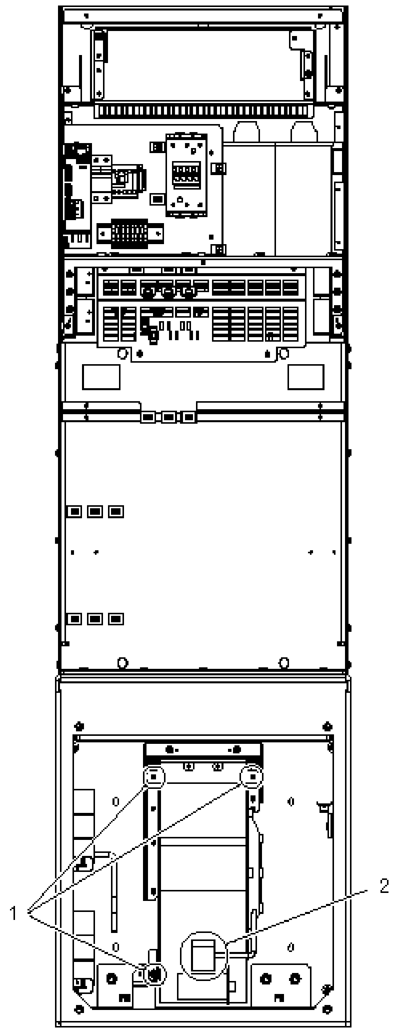


Figure 6-25 Replacing the fan, Active Interface Module, frame size JI

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

- Observe the "five safety rules".
- 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.

CAUTION
When removing the fan, ensure that you do not damage any signal cables.

NOTICE
Take care not to cut yourself on the sharp edges inside the cabinet.

Installation steps

For installation, carry out the above steps in reverse order.

CAUTION
The tightening torques specified in the table "Tightening torques for connecting current-conducting parts" must be observed. The screwed connections for the protective covers must only be tightened by hand.

6.4.11 Replacing the fuses

Replacement fuses

You can find the order numbers for replacing auxiliary power supply fuses that have blown in the spare parts list.

> **⚠ WARNING**
>
> When replacing fuses, you must take the following points into account:
> 1. Observe the "five safety rules".
> 2. Disconnect the cabinet from the power supply (do not forget the external power supplies).
> 3. Then rectify the cause of the fault.
> 4. Install a new fuse once the cause of the fault has been rectified.

6.4.11.1 Replacing the fuses for the auxiliary power supply

Replacement fuses

You can find the order numbers for replacing auxiliary power supply fuses that have blown in the spare parts list.

> **⚠ WARNING**
>
> When replacing fuses, you must take the following points into account:
> 1. Observe the "five safety rules".
> 2. Disconnect the cabinet from the power supply (do not forget the external power supplies).
> 3. Then rectify the cause of the fault.
> 4. Install a new fuse once the cause of the fault has been rectified.

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

Preparatory steps

- Observe the "five safety rules".
- 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.

6.4.11.3 Replacing fuses in the fuse switch disconnector for Booksize Cabinet Kit

Preparatory steps

- Observe the "five safety rules".
- 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.

6.4.11.4 Replacing the DC fuses for the Motor Module, chassis format

Replacing the DC fuses, frame sizes FX and GX

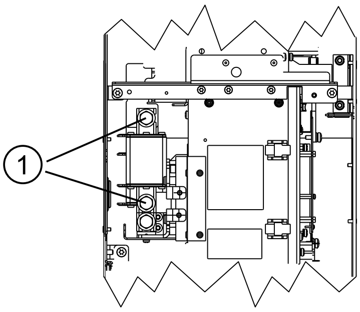


Figure 6-26 Replacing the DC fuses, frame sizes FX and GX

Preparatory steps

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

⚠ CAUTION
The DC voltage may still be present for up to 5 minutes.

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.

Note

If you order a complete power unit as a replacement, make sure that only DC fuses are used. If option L37 (DC interface with pre-charging input circuit) is installed in your cabinet, the DC fuses of the spare part must be replaced with the lugs of the existing power unit.

Replacing the DC fuses, frame sizes HX and JX

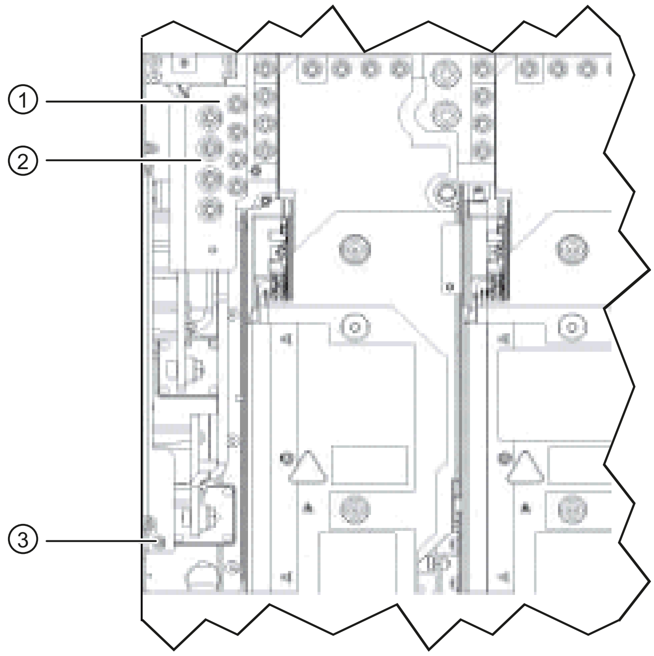


Figure 6-27 Replacing the DC fuses, frame sizes HX and JX

Preparatory steps

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

⚠ CAUTION
The DC voltage may still be present for up to 5 minutes.

Replacement steps

1. Remove the nuts (x 4).
2. Remove the nuts (x 4).
3. Remove the nut (x 1).

The slide-in unit with the DC fuses can now be withdrawn completely.

Note

The slide-in unit with the DC fuses must be pulled out completely and placed down so that it cannot topple over.

The screws and nuts must now be unscrewed and removed from the DC fuses as necessary in order to change the relevant DC fuses.

Note

Frame size HX contains **two DC fuses** and **frame size JX**contains **four DC fuses**.

If you order a complete power unit as a replacement, make sure that only DC fuses are used. If option L37 (DC interface with pre-charging input circuit) is installed in your cabinet, the DC fuses of the spare part must be replaced with the lugs of the existing power unit.

6.4.11.5 Replacing the encapsulated fuses

Preparatory steps

- Observe the "five safety rules".
- 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.

6.4.11.6 Replacing the LV HRC fuses

Preparatory steps

- Observe the "five safety rules".
- Disconnect the cabinet from the power supply (do not forget the external power supplies).
- Have the fuse grip ready.

Replacement steps

1. Open the cabinet.
2. Attach the fuse grip to the fuse.
3. Remove the defective fuse.
4. Press the yellow button on the fuse grip to release the defective fuse from it.
5. Attach the new fuse onto the grip.
6. Place the new fuse in the fuse holder in the cabinet.
7. Press the yellow button on the fuse grip to release the new fuse from it.
8. Close the cabinet.

Note

If necessary, the fuse grip can be ordered from Siemens.

6.4.12 Replacing the DC interface (option L37)

Preparatory steps

- Observe the "five safety rules".
- 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 V DC 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.

CAUTION
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 to secure the cable to the DC rectifier adapter.

6.4.13 Replacing the pre-charging resistors of the DC interface (option L37)

Preparatory steps

- Observe the "five safety rules".
- Disconnect the cabinet from the power supply (do not forget the external power supplies).

Removal

1. Remove the DC interface (see the section titled "Replacing the DC interface for Booksize Cabinet Kit").
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.

6.4.14 Replacing the backup battery for the cabinet operator panel

Replacing the backup battery

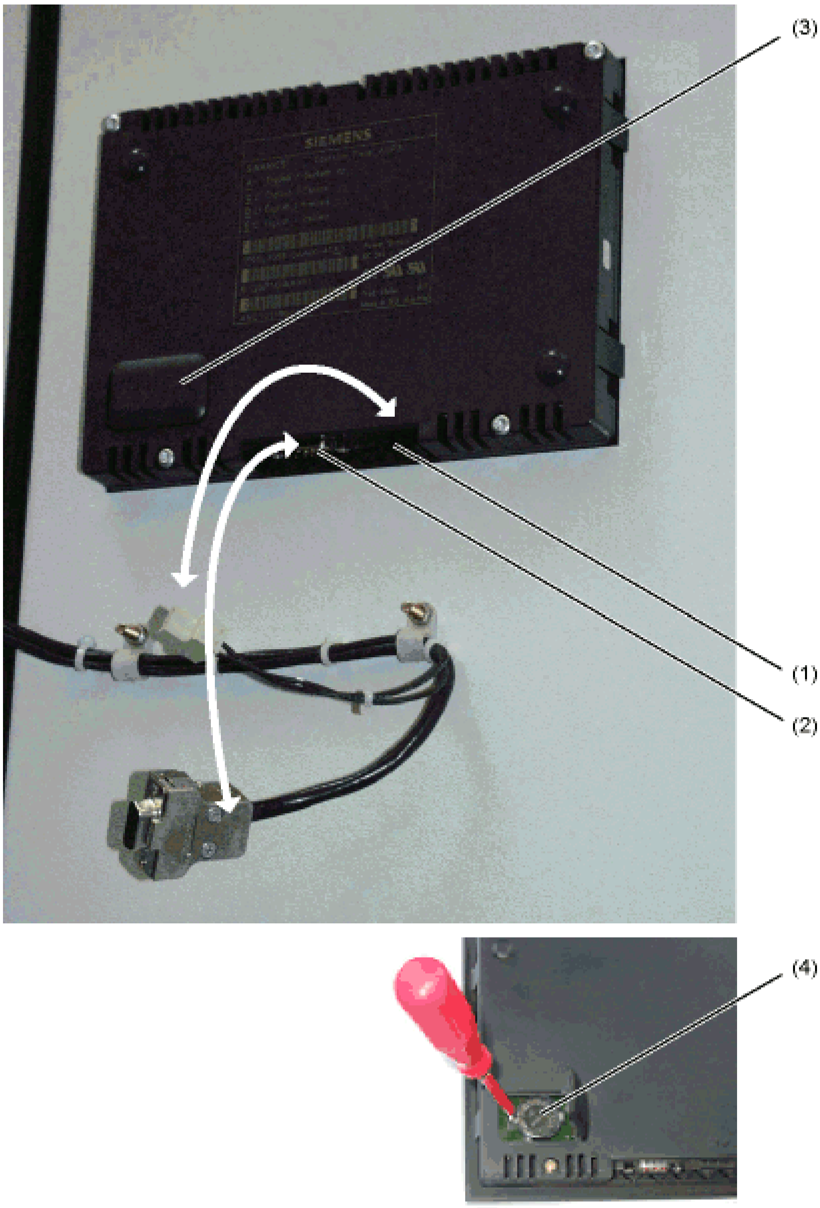


Figure 6-28 Replacing the backup battery

Preparatory steps

- Observe the "five safety rules".
- Disconnect the cabinet from the power supply (do not forget the external power supplies).

Replacing

1. Disconnect the 24 V DC power-supply cable.
2. Disconnect the communication cable on the operator panel.
3. Open the cover of the battery compartment.
4. Remove the old battery.
5. Insert the new battery.
6. Complete the procedure by carrying out the above actions in reverse order.

Table 6- 3 Technical data for the backup battery

Type	CR2032 3 V lithium battery
Vendor	Maxell, Sony, Panasonic
Rated capacity	220 mAh
Maximum permissible charging current	10 mA (restricted to < 2 mA in 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

NOTICE
You must replace the battery within a period of one minute. If the process takes longer than a minute, this can result in data being lost. The battery must be disposed of in accordance with the applicable country-specific guidelines and regulations.

6.5 Reforming the DC link capacitors

Description

If the Basic Line Modules, Smart Line Modules, Active Line Modules, and Motor Modules have not been used for more than two years, the DC link capacitors must be reformed. If this is not carried out, the units could be damaged when the line voltage is connected.

If the cabinet is commissioned within two years of its date of manufacture, the DC link capacitors do not need to be reformed. The date of manufacture can be taken from the factory serial number on the rating plate.

Note

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

Procedure

The DC link capacitors are reformed by applying the rated voltage line-side to the power block within the chassis without load for at least 30 minutes at room temperature.

Note

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

Rating plate

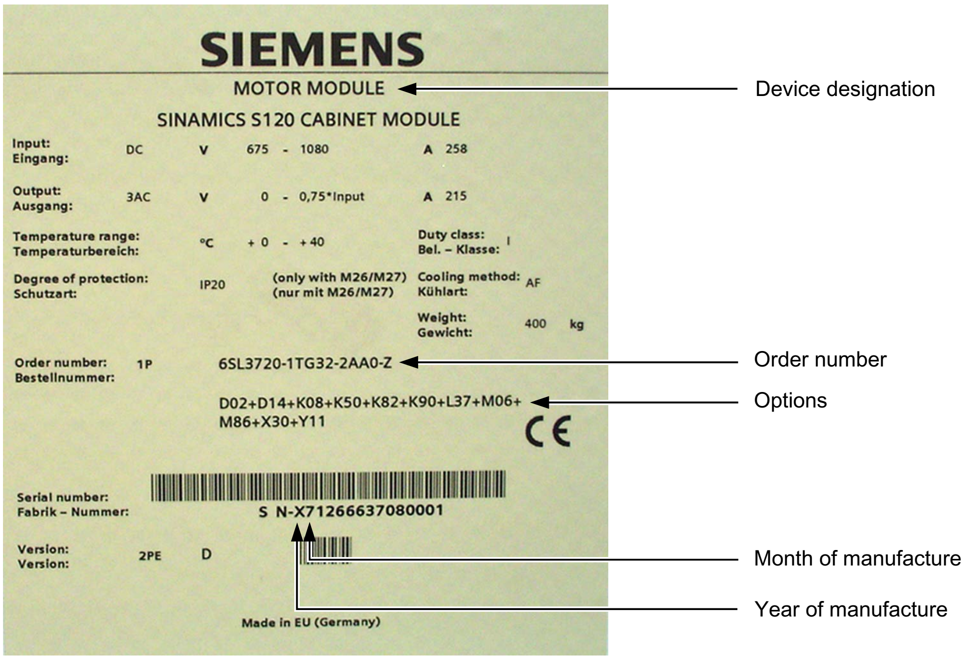


Figure 6-29 Rating plate using a Motor Module as example

Date of manufacture

The date of manufacture can be determined as follows:

Table 6- 4 Year and month of manufacture

Character	Year of manufacture	Character	Month of manufacture
S	2004	1 to 9	January to September
T	2005	O	October
U	2006	N	November
V	2007	D	December
W	2008		
X	2009		
A	2010		
B	2011		

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 provided either in this Manual or in the additional documentation on the customer DVD supplied with the device.

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 that arise when booting are indicated using the 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 accordingly via the LEDs.
- Once the unit has been successfully booted, all the LEDs are switched off briefly.
- Once the unit has been booted, the LEDs are driven via the loaded software.

Behavior of the LEDs during booting

Table 7- 1 Load software

LED			State	Comments
RDY	DP	OPT		
Red	Orange	Orange	Reset	Hardware reset RDY LED lights up red, all other LEDs light up orange
Red	Red	Off	BIOS loaded	–
Red 2 Hz	Red	Off	BIOS error	• Error occurred while loading the BIOS
Red 2 Hz	Red 2 Hz	Off	File error	• CompactFlash card not inserted or defective • Software has not been installed on the CompactFlash card or is defective
Red	Off	Off	Firmware loaded	–
Off	Red	Off	FW checked (no CRC error)	
Red 0.5 Hz	Red 0.5 Hz	Off	FW checked (CRC error)	• CRC error
Orange	Off	Off	Start of DRIVE-CLiQ communication	

Table 7- 2 Firmware

LED			State	Comments
RDY	DP	OPT		
Off	Off	Off	Initializing	–
alternating			Running	See the table below

Response 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 light 0.5 Hz	Commissioning / reset	–
		Flashing light 2 Hz	Writing to CompactFlash card	–
	Red	Flashing light 2 Hz	General errors	Check parameterization / configuration data

LED	Color	State	Description, cause	Remedy
	Red/ green	Flashing light 0.5 Hz	Control Unit is ready for operation. However, there are no software licenses.	Obtain licenses
	Orange	Flashing light 0.5 Hz	Updating the firmware of the DRIVE-CLiQ components	–
		Flashing light 2 Hz	DRIVE-CLiQ component firmware update completed. Wait for POWER ON for the components in question.	Carry-out POWER ON for the components in question
	Green/ orange or red/ orange	Flashing light 1 Hz	Component detection via LED is activated (p0124[0]). **Note**: Both options depend on the LED status when component detection is activated via p0124[0] = 1.	–
DP PROFIdrive cyclic operation	–	Off	Cyclic communication has not (yet) taken place. **Note:** PROFIdrive is ready to communicate when the Control Unit is ready to operate (see LED RDY).	–
	Green	Steady light	Cyclic communication is taking place.	–
		Flashing light 0.5 Hz	Full cyclic communication is not yet taking 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 incorrect 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	Remove fault
OPT (OPTION)	–	Off	The electronics power supply is missing or outside the permissible tolerance range. Component is not ready. Option Board not installed or no associated drive object has been created.	Check power supply and/or component
	Green	Steady light	Option Board is ready.	–
		Flashing light 0.5 Hz	Depends on the Option Board used.	–
	Red	Steady light	At least one fault is present in this component. Option board not ready (e.g. after switch on).	Remove and acknowledge fault
RDY and DP	Red	Flashing light 2 Hz	Bus error - communication has been interrupted	Remove fault

7.3 LEDs on the CBE20 Communication Board

Table 7- 4 Meanings of the LEDs on the CBE20 Communication Board

LED	Color	Status	Description
Link port	-	Off	The electronics power supply is missing or outside the permissible tolerance range.
	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.
	Yellow	Steady light	Data is being received or sent at port x.
Fault	–	Off	If the link port LED is green: The CBE20 is operating normally, data is being exchanged with the configured IO controller.
	Red	Flashing	• The response monitoring interval has elapsed. • Communication is interrupted. • The IP address is incorrect. • Incorrect or no configuration • Incorrect parameter settings • Incorrect or missing device name • IO Controller not connected/switched off, although an Ethernet connection has been established. • 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	The Control Unit task system has synchronized with the IRT clock cycle and data is being exchanged.
		Steady light	Task system and MC-PLL synchronized with the IRT clock.
OPT on the Control Unit	–	Off	The electronics power supply is missing or outside the permissible tolerance range. Communication Board either defective or not inserted.
	Green	Steady light	Communication Board is ready and cyclic communication is taking place.
		Flashing light 0.5 Hz	The Communication Board is ready, but cyclic communication is not yet taking place. Possible causes: • At least one fault is present. • Communication is being established.
	Red	Steady light	Cyclic communication via PROFINET has not yet been established. However, acyclic communication is possible. SINAMICS waits for a parameterizing/configuration telegram

LED	Color	Status	Description
		Flashing light 0.5 Hz	The firmware has not been successfully downloaded to the CBE20 (error). Possible causes: • The CBE20 is defective. • The memory card for the Control Unit is defective. In this state CBE20 cannot be used.
		Flashing light 2.5 Hz	Communication between the Control Unit and CBE20 is faulty. Possible causes: • The board was withdrawn after power up. • The board is defective.
	Orange	Flashing light 2.5 Hz	Firmware is being downloaded.

7.4 LEDs on the Control Interface Module in the Basic Line Module

Table 7- 5 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	Off	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is present.
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is too high.
Orange	Orange	DRIVE-CLiQ communication is being established.
Red	---	At least one fault is present in this component. **Note:** The LED is activated regardless of whether the corresponding messages have been reconfigured.
Flashing, 0.5 Hz: Green / Red	---	Firmware is being downloaded.
Flashing, 2 Hz: Green / Red	---	Firmware download is complete. Wait for POWER ON.
Flashing, 2 Hz: Green / Orange or Red / Orange	---	Component detection using LED is activated (p0124). **Note:** Both options depend on the LED status when component recognition is activated via p0124 = 1.

Table 7- 6 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

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

7.5 LEDs on the Control Interface Module in the Smart Line Module

Table 7- 7 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	Off	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is present.
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is too high.
Orange	Orange	DRIVE-CLiQ communication is being established.
Red	---	At least one fault is present in this component. Note: The LED is activated regardless of whether the corresponding messages have been reconfigured.
Flashing, 0.5 Hz: Green / Red	---	Firmware is being downloaded.
Flashing, 2 Hz: Green / Red	---	Firmware download is complete. Wait for POWER ON.
Flashing, 2 Hz: Green / Orange or Red / Orange	---	Component detection using LED is activated (p0124). Note: Both options depend on the LED status when component recognition is activated via p0124 = 1.

Table 7- 8 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

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

The warning information on the component must be carefully observed.

7.6 LEDs on the Control Interface Module in the Active Line Module

Table 7- 9 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	Off	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is present.
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is too high.
Orange	Orange	DRIVE-CLiQ communication is being established.
Red	---	At least one fault is present in this component. **Note:** The LED is activated regardless of whether the corresponding messages have been reconfigured.
Flashing, 0.5 Hz: Green / Red	---	Firmware is being downloaded.
Flashing, 2 Hz: Green / Red	---	Firmware download is complete. Wait for POWER ON.
Flashing, 2 Hz: Green / Orange or Red / Orange	---	Component detection using LED is activated (p0124). **Note:** Both possibilities depend on the LED status when activated using p0124 = 1.

Table 7- 10 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

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

The warning information on the component must be carefully observed.

7.7 LEDs on the Control Interface Module in the Motor Module in the chassis format

Table 7- 11 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	Off	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is present.
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is too high.
Orange	Orange	DRIVE-CLiQ communication is being established.
Red	---	At least one fault is present in this component. **Note:** The LED is activated regardless of whether the corresponding messages have been reconfigured.
Flashing, 0.5 Hz: Green / red	---	Firmware is being downloaded.
Flashing, 2 Hz: Green / red	---	Firmware download is complete. Wait for POWER ON.
Flashing, 2 Hz: Green / orange or red / orange	---	Component detection using LED is activated (p0124). **Note:** Both options depend on the LED status when component recognition is activated via p0124 = 1.

Table 7- 12 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

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

The warning information on the component must be carefully observed.

7.8 LEDs on the Motor Module in the booksize format

Table 7- 13 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	Off	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is present.
	Red	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place. The DC link voltage is too high.
Orange	Orange	DRIVE-CLiQ communication is being established.
Red	---	At least one fault is present in this component. Note: The LED is activated regardless of whether the corresponding messages have been reconfigured.
Flashing, 0.5 Hz: Green / Red	---	Firmware is being downloaded.
Flashing, 2 Hz: Green / Red	---	Firmware download is complete. Wait for POWER ON.
Flashing, 2 Hz: Green / Orange or Red / Orange	---	Component detection using LED is activated (p0124). Note: Both possibilities depend on the LED status when activated using p0124 = 1.

⚠ WARNING

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

The warning information on the component must be carefully observed.

7.9 LEDs on the Central Braking Module

Table 7- 14 Meaning of the LEDs on the Braking Module in the Central Braking Module

LED	Status	Description
ME - "Ready" message	Off	U_{DC} missing Overtemperature Maximum control setting
	Steady light	Ready
MUI - "Overcurrent" message	Off	Normal status
	Steady light	Short circuit/ground fault
MUL - "Overload" message	Off	Normal status
	Steady light	Overload: Set brake ON time exceeded
MUT - "Overtemperature" message	Off	Normal status
	Steady light	Overtemperature

7.10 LEDs on the Voltage Sensing Module (VSM) in the Active Interface Module

Table 7- 15 Meaning of the LEDs on the Voltage Sensing Module in the Active Interface Module

LED	Color	Status	Description
RDY (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	At least one fault is present in this component. Note: LED is driven irrespective of the corresponding messages being reconfigured.
	Green/ red	Flashing light 0.5 Hz	Firmware is being downloaded.
		Flashing light 2 Hz	Firmware download is being completed. Waiting for POWER ON.
	Green/ orange or red/ orange	Flashing light 2 Hz	Component recognition via LED is activated (p0144). Note: Both possibilities depend on the LED status when activated via p0144 = 1.

7.11 LEDs on the SMC10 Sensor Module

Table 7- 16 Meaning of the LEDs on the SMC10 Sensor Module

LED	Color	Status	Description
RDY (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	At least one fault is present in this component. Note: LED is driven irrespective of the corresponding messages being reconfigured.
	Green/ red	Flashing light 0.5 Hz	Firmware is being downloaded.
		Flashing light 2 Hz	Firmware download is being completed. Waiting for POWER ON.
	Green/ orange or red/ orange	Flashing light 2 Hz	Component recognition via LED is activated (p0144). Note: Both possibilities depend on the LED status when activated via p0144 = 1.

7.12 LEDs on the SMC20 Sensor Module

Table 7- 17 Meaning of the LEDs on the SMC20 Sensor Module

LED	Color	Status	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	At least one fault is present in this component. **Note:** The LED is activated regardless of whether the corresponding messages have been reconfigured.
	Green/ red	Flashing 0.5 Hz	Firmware is being downloaded.
		Flashing 2 Hz	Firmware download is being completed. Waiting for POWER ON.
	Green/ orange or red/ orange	Flashing	Component recognition via LED is activated (p0144). **Note:** Both options depend on the LED status when component recognition is activated via p0144 = 1.

7.13 LEDs on the SMC30 Sensor Module

Table 7- 18 Meaning of the LEDs on the SMC30 Sensor Module

LED	Color	Status	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	At least one fault is present in this component. **Note:** The LED is activated regardless of whether the corresponding messages have been reconfigured.
	Green/ red	Flashing 0.5 Hz	Firmware is being downloaded.
		Flashing 2 Hz	Firmware download is being completed. Waiting for POWER ON.
	Green/ orange or red/ orange	Flashing	Component recognition via LED is activated (p0144). **Note:** Both options depend on the LED status when component recognition is activated via p0144 = 1.
OUT > 5 V	-	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 TM54F Terminal Module

Table 7- 19 Description of the LEDs on the Terminal Module TM54F

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	At least one fault is present in this component. **Note:** The LED is activated regardless of whether the corresponding messages have been reconfigured.
	Green / Red	0.5 Hz flashing light	Firmware is being downloaded.
		2 Hz flashing light	Firmware download is complete. Waiting for POWER ON
	Green / Orange or Red / Orange	Flashing light	Detection of the components via LED is activated (p0154). **Note:** Both options depend on the LED status when module recognition is activated via p0154 = 1.

7.15 LEDs on the SITOP power supply unit

Table 7- 20 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

⚠ DANGER
You must read and observe the "Safety information" chapter in this Manual. When carrying out any kind of work on electrical devices, the following five safety rules must always be observed: 1. Disconnect from power supply. 2. Protect against reconnection. 3. Make sure that the equipment is de-energized. 4. Ground and short-circuit. 5. Cover or enclose adjacent components that are still live.

⚠ DANGER
The cabinet units are operated with high voltages. All connection work must be carried out when the cabinet is de-energized. All work on the unit must be carried out by trained personnel only. Work on an open cabinet must be carried out with extreme caution because external supply voltages may be present. The power and control terminals may be live even when the motor is not running. Dangerously high voltage levels are still present in the unit up to 5 minutes after it has been disconnected due to the DC link capacitors. For this reason, the cabinet should not be opened until a reasonable period of time has elapsed. The user is responsible for ensuring that the motor, inverter, and other devices are installed and connected in accordance with the recognized technical rules in the country of installation and with other applicable regional regulations. Special attention should be paid to cable dimensioning, fuses, grounding, shutdown, disconnection, and overcurrent protection. If an item of protective gear trips in a branch circuit, a leakage current may have been disconnected. To reduce the risk of fire or an electric shock, the current-conducting parts and other components in the cabinet should be inspected and damaged parts replaced. When an item of protective gear trips, the cause of the trip must be identified and rectified.

Note

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.

8.2 B70, Cranes sector version

Note

Manual for SINAMICS S120 Cabinet Modules System supplementary product range

Option B70 for SINAMICS S120 Cabinet Modules is described in detail in the SINAMICS S120 Cabinet Modules System Manual - supplementary product range.

8.3 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 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.

8.4 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
- Chassis format Motor Modules

Description

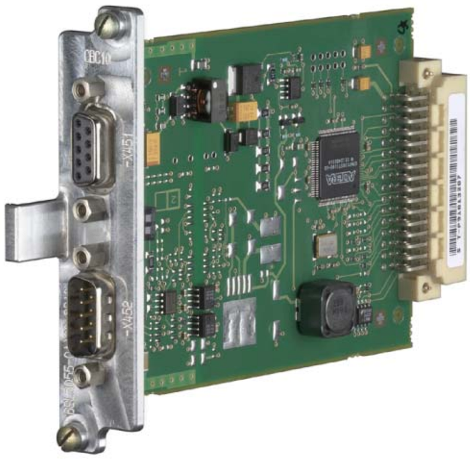


Figure 8-1 CAN CBC10 Communication Board

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.

CAUTION
The Option Board should only be inserted and removed when both the Control Unit and Option Board are disconnected from the power supply. The CBC10 must only be operated by qualified personnel. The ESD notices must be observed.

Note

Detailed and comprehensive instructions and information for the CBC10 Communication Board can be found in the accompanying operating instructions, These operating instructions are available as additional documentation on the customer DVD provided.

Interface overview

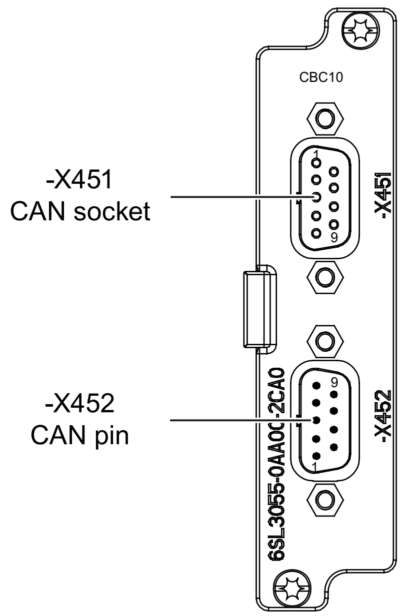
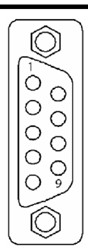


Figure 8-2 CAN CBC10 Communication Board, interface overview

X451 CAN bus interface

CAN bus interface -X451 features the following socket assignments:

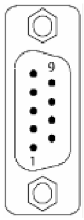
Table 8- 1 CAN bus interface X451

	Pin	Designation	Technical data
	1	Reserved	
	2	CAN_L	CAN signal (dominant low)
	3	CAN_GND	CAN ground
	4	Reserved	
	5	CAN_SHLD	Optional shield
	6	GND	CAN ground
	7	CAN_H	CAN signal
	8	Reserved	
	9	Reserved	
Type: 9-pin sub D socket			

X452 CAN bus interface

CAN bus interface -X452 features the following socket assignments:

Table 8- 2 CAN BUS interface X452

	Pin	Designation	Technical data
	1	Reserved	
	2	CAN_L	CAN signal (dominant low)
	3	CAN_GND	CAN ground
	4	Reserved	
	5	CAN_SHLD	Optional shield
	6	GND	CAN ground
	7	CAN_H	CAN signal
	8	Reserved	
	9	Reserved	
Type: 9-pin sub D pin			

8.5 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
- Chassis format Motor Modules

Description

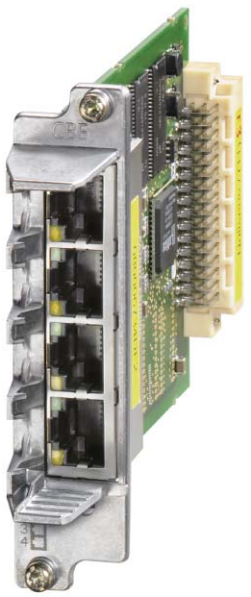


Figure 8-3 CBE20 Ethernet Communication Board

Interface module CBE20 is used for communication via PROFINET.

The module is delivered mounted in a supplementary pack on the CU320-2 Control Unit and must be installed on the plant side in the option slot of the CU320-2 Control Unit.

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

Interface overview

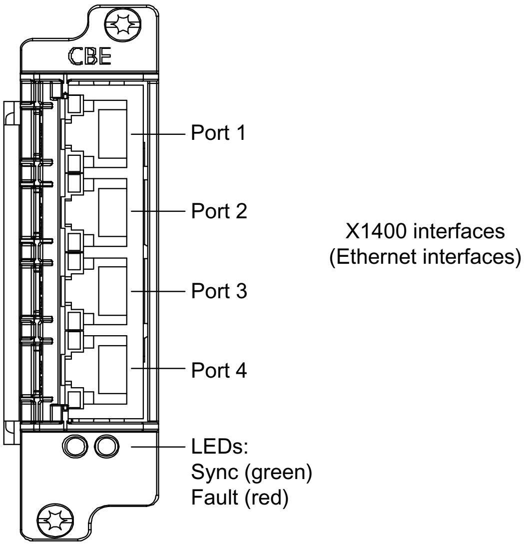


Figure 8-4 CBE20 Ethernet Communication Board, interface overview

MAC address

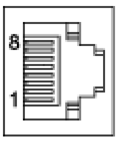
The MAC address of the Ethernet interfaces is indicated on the upper side of the CBE20. The label is only visible before the board is installed.

Note

Please note the MAC address prior to installing the board so that it is available to you during subsequent commissioning.

X1400 Ethernet interface

Table 8- 3 Connector X1400, port 1 - 4

	Pin	Signal name	Technical data
	1	RX+	Receive data +
	2	RX-	Receive data -
	3	TX+	Transmit data +
	4	---	Reserved, do not use
	5	---	Reserved, do not use
	6	TX-	Transmit data -
	7	---	Reserved, do not use
	8	---	Reserved, do not use
	Screened backshell	M_EXT	Shield, permanently connected

Installation

CAUTION
The Option Board should only be inserted and removed when both the Control Unit and Option Board are disconnected from the power supply.

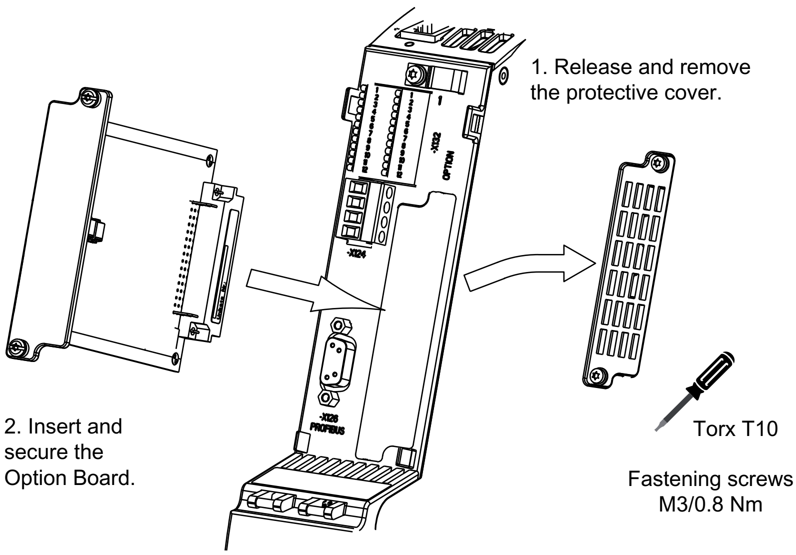


Figure 8-5 Installing the CBE20

8.6 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
- Chassis format Motor Modules

Description

The Safety Integrated Basic functions do not require a license. A license is, however, required for each axis with safety functions in the case of Safety Integrated Extended functions. It is irrelevant which safety functions are used and how many.

In this case, option K01 is for 1 axis, option K02 for 2 axes etc. - up to option K05 for 5 axes.

- K01: Safety license for 1 axis
- K02: Safety license for 2 axes
- K03: Safety license for 3 axes
- K04: Safety license for 4 axes
- K05: Safety license for 5 axes

Note

Presently, a maximum of 5 safety axes with Safety Integrated Extended functions are possible on a Control Unit CU320-2.

Licenses

The required licenses can be optionally ordered together with the CompactFlash Card.

Subsequent licensing is realized in the Internet using the "WEB License Manager" by generating a license key:
http://www.siemens.com/automation/license

Note

The generation of the license key is described in detail in the SINAMICS S120 Function Manual, Chapter "Basics of the drive system" under "Licensing".

Activation

The associated license key is entered into parameter p9920 in the ASCII code. The license key can be activated via parameter p9921=1.

Diagnostics

An insufficient license is indicated via the following alarm and LED:

- Alarm A13000 → License not sufficient
- LED READY → Flashes green/red at 0.5 Hz

Note

Safety Integrated Function Manual

Detailed and comprehensive instructions and information for the Safety Integrated functions can be found in the associated Function Manual. This manual is available as additional documentation on the customer DVD supplied with the device.

8.7 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
- Chassis format Motor Modules

Note

Option K08 is only available in conjunction with the CU320-2 Control Unit (option K90).

Description

Figure 8-6 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
- 4 LEDs indicate the operating condition of the drive unit:
  RUN, green
  ALARM, yellow
  FAULT, red
  LOCAL/REMOTE, green

Note

Additional documents

Detailed and comprehensive instructions and information for the AOP30 Advanced Operator Panel can be found in the relevant operating instructions. These operating instructions are available as additional documentation on the customer DVD supplied with the device.

→ See additional documentation "SINAMICS S120 Cabinet Module AOP30"

8.8 K46, Sensor Module Cabinet-Mounted SMC10

8.8.1 General information

Availability of option

This option is available for the following S120 Cabinet Modules:

- Booksize Cabinet Kits
- Chassis format Motor Modules

Description

The SMC10 Sensor Module is used for detecting the actual motor speed and the rotor position angle. The signals emitted by the resolver are converted here and made available to the closed-loop controller via the DRIVE-CLiQ interface for evaluation purposes.

The following encoders can be connected to the SMC10 Sensor Module:

- Resolver, 2-pole
- Resolver, multi-pole

The motor temperature can also be detected using KTY84-130 temperature sensors or PTC thermistors.

Table 8- 4 SMC10 specification

	Value
Transmission ratio of the resolver	ü = 0.5
Excitation voltage on the SMC10 when ü = 0.5	4.1 V_{rms}
Amplitude monitoring threshold (secondary tracks) of the SMC10	1 V_{rms}

The maximum encoder cable length is 130 m.

The excitation voltage is 4.1 V_{rms} and cannot be parameterized.

The excitation frequency is synchronized to the current-controller clock cycle and lies in the range between 5 kHz and 10 kHz.

The ratio between ohmic resistance R and inductance L determines whether the resolver can be evaluated with the SMC10 (see diagram below).

Note

The Booksize Cabinet Kit with Double Motor Module has two of these Sensor Modules built in. It must be ensured that the installation of the encoder ground connection is insulating.

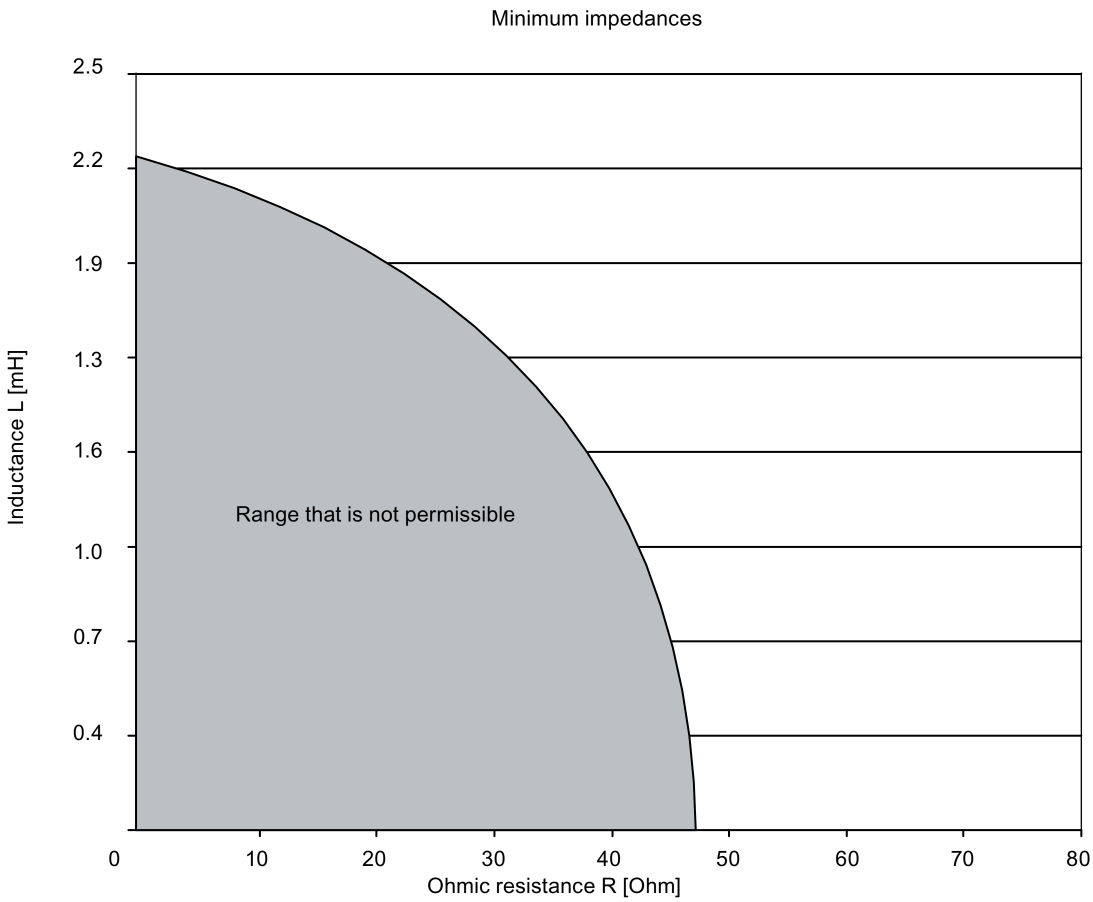


Figure 8-7 Connectable impedances with an excitation frequency f = 5000 Hz

8.8.2 Safety information

NOTICE
Only one measuring system can be connected to each Sensor Module.

Note

There must be no electrical connection between the encoder housing and the motor (this requirement is fulfilled for most encoder systems).

If this is not carefully observed, under certain circumstances the system will not be able to reach the required noise immunity (there is then a danger of equalization currents flowing through the electronic ground).

CAUTION
Connecting cables to sensors must always be installed with shielding. The cable shield must be connected to the ground potential at both ends over a large surface area. Connecting cables that are routed together with the motor cable must be twisted in pairs and shielded separately.

8.8.3 Interfaces

Overview

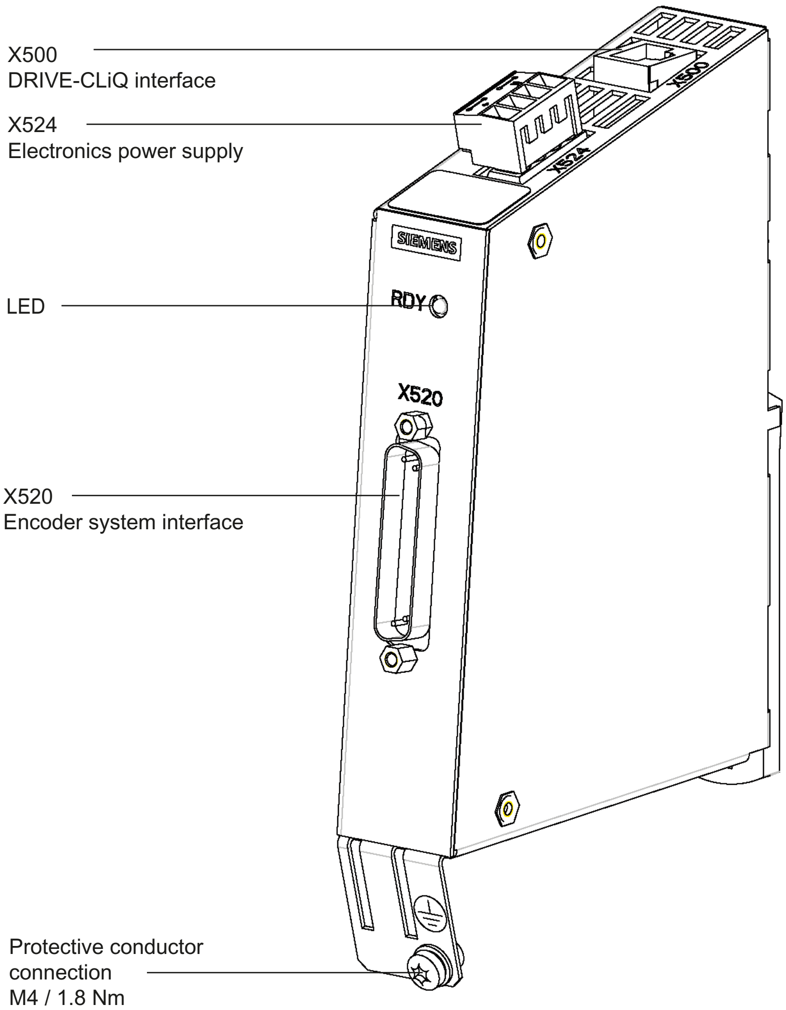
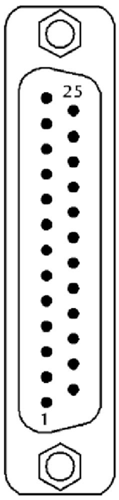


Figure 8-8 Interface overview for the SMC10

X520 encoder interface

Table 8- 5 Encoder interface X520

	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	Motor temperature measurement KTY84-1C130 (KTY+) Temperature sensor KTY84-1C130 / PTC
	14	Reserved, do not use	
	15	Reserved, do not use	
	16	Reserved, do not use	
	17	Reserved, do not use	
	18	Reserved, do not use	
	19	Reserved, do not use	
	20	Reserved, do not use	
	21	Reserved, do not use	
	22	Reserved, do not use	
	23	Reserved, do not use	
	24	Ground	Ground (for internal shield)
	25	- Temp	Motor temperature measurement KTY84-1C130 (KTY-) Temperature sensor KTY84-1C130 / PTC
Connector type: 25-pin sub D connector (pin)			

⚠ DANGER

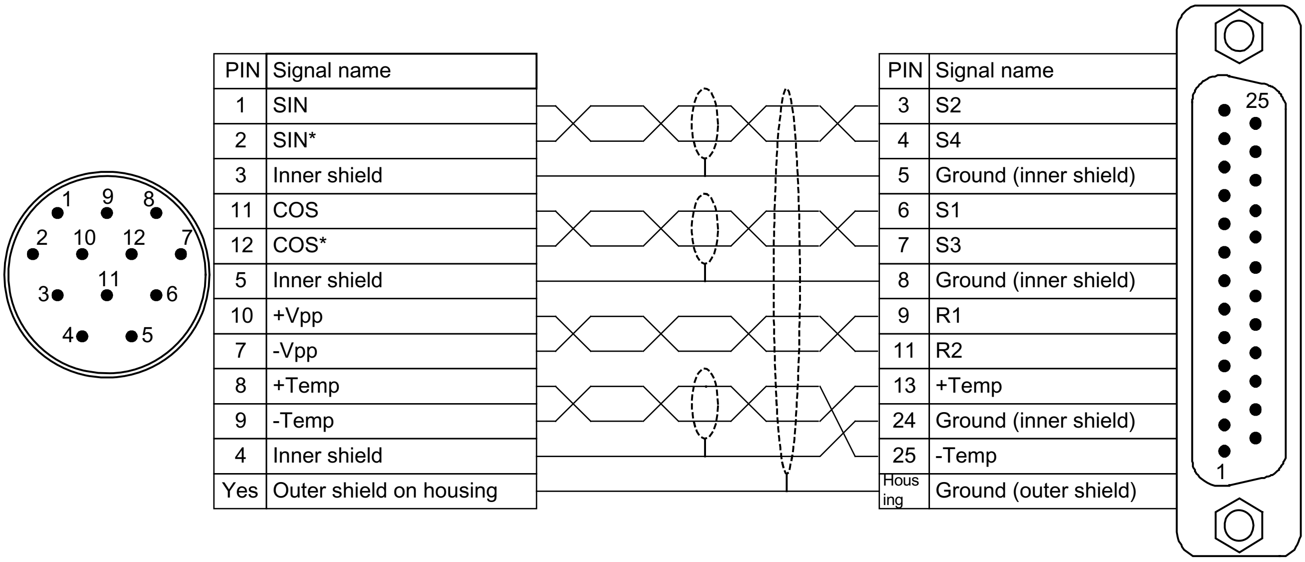
Risk of electric shock!

Only temperature sensors that meet the safety isolation specifications contained in EN 61800-5-1 may be connected to terminals "+Temp" and "-Temp".

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

8.8.4 Connection example

Connection example: Resolver, 8-pole



PIN	Signal name
1	SIN
2	SIN*
3	Inner shield
11	COS
12	COS*
5	Inner shield
10	+Vpp
7	-Vpp
8	+Temp
9	-Temp
4	Inner shield
Yes	Outer shield on housing

PIN	Signal name
3	S2
4	S4
5	Ground (inner shield)
6	S1
7	S3
8	Ground (inner shield)
9	R1
11	R2
13	+Temp
24	Ground (inner shield)
25	-Temp
Housing	Ground (outer shield)

Figure 8-9 Connection example: Resolver, 8-pole

8.9 K48, Sensor Module Cabinet-Mounted SMC20

8.9.1 General information

Availability of option

This option is available for the following S120 Cabinet Modules:

- Booksize Cabinet Kits
- Chassis format Motor Modules

Description

The SMC20 Sensor Module is used to simultaneously detect the actual motor speed and the path length. 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 V_{pp}
- EnDat and SSI absolute encoders

The motor temperature can also be detected using KTY84-130 temperature sensors or PTC thermistors.

The maximum encoder cable length is 100 m.

Note

The Booksize Cabinet Kit with Double Motor Module has two of these encoder modules built in.

8.9.2 Safety information

NOTICE
Only one measuring system can be connected to each Sensor Module.

Note

There must be no electrical connection between the measuring system housing and the measuring system electronics (this requirement is fulfilled for most encoder systems).

If this is not carefully observed, under certain circumstances the system will not be able to reach the required noise immunity (there is then a danger of equalization currents flowing through the electronic ground).

CAUTION
Connecting cables to sensors must always be installed with shielding. The cable shield must be connected to the ground potential at both ends over a large surface area. Connecting cables that are routed together with the motor cable must be twisted in pairs and shielded separately.

8.9.3 Interfaces

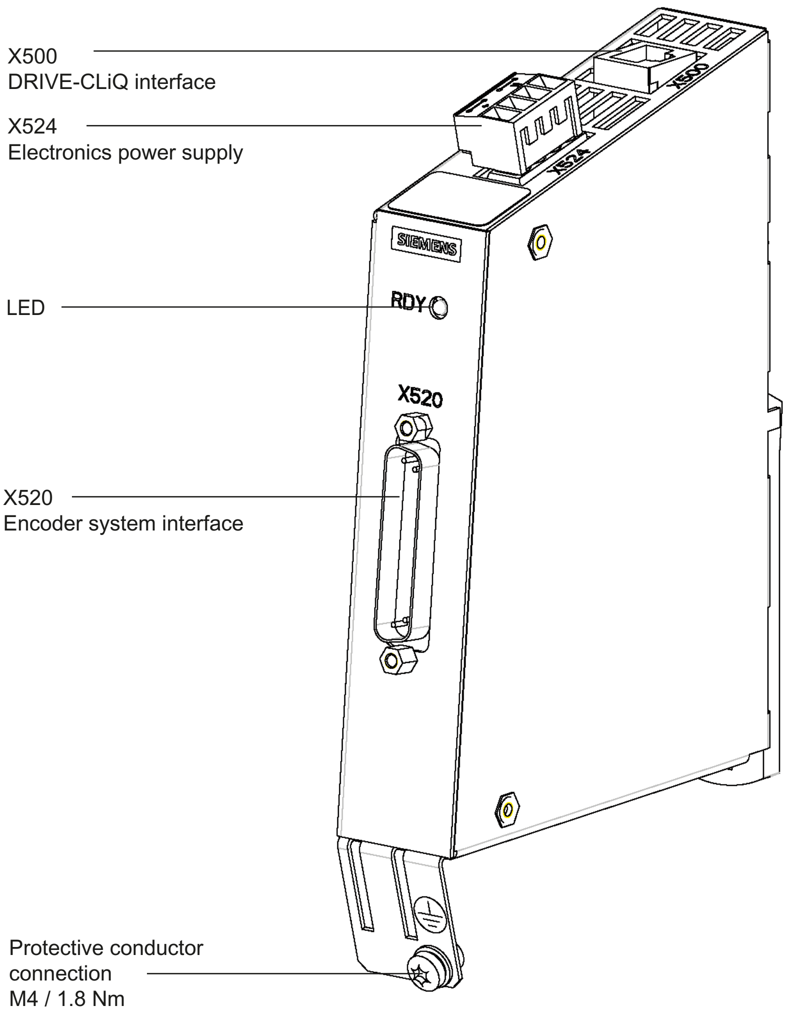
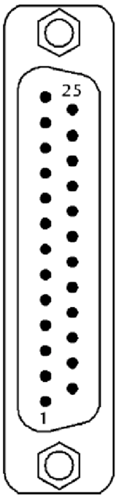


Figure 8-10 Interface overview for the SMC20

X520 encoder interface

Table 8- 6 Encoder interface X520

	Pin	Signal name	Technical data
	1	P encoder	Encoder power supply
	2	M encoder	Ground for encoder power supply
	3	A	Incremental signal A
	4	A*	Inverted incremental signal A
	5	Ground	Ground (for internal shield)
	6	B	Incremental signal B
	7	B*	Inverted incremental signal B
	8	Ground	Ground (for internal shield)
	9	Reserved, do not use	
	10	Clock	Clock, EnDat interface, SSI clock
	11	Reserved, do not use	
	12	Clock*	Inverted clock, EnDat interface, inverted SSI clock
	13	+ Temp	Motor temperature measurement KTY84-1C130 (KTY+) Temperature sensor KTY84-1C130 / PTC
	14	P sense	Sense input for encoder power supply
	15	Data	Data, EnDat interface, SSI data
	16	M sense	Ground for sense input for encoder power supply
	17	R	Reference signal R
	18	R*	Inverted reference signal R
	19	C	Absolute track signal C
	20	C*	Inverted absolute value signal C
	21	D	Absolute track signal D
	22	D*	Inverted absolute track signal D
	23	Data*	Inverted data, EnDat interface, inverted SSI data
	24	Ground	Ground (for internal shield)
	25	- Temp	Motor temperature measurement KTY84-1C130 (KTY-) Temperature sensor KTY84-1C130 / PTC
Connector type: 25-pin sub D connector (pin)			

⚠ DANGER

Risk of electric shock!

Only temperature sensors that meet the safety isolation specifications contained in EN 61800-5-1 may be connected to terminals "+Temp" and "-Temp".

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

8.9.4 Connection example

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

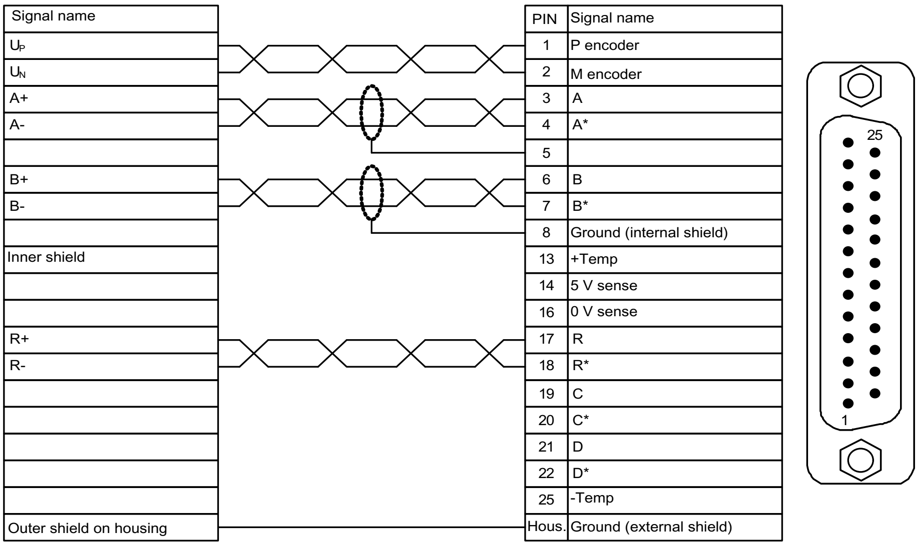


Figure 8-11 K48, connection example: Incremental encoder sin/cos 1 Vpp, 2,048

8.10 K50, Sensor Module Cabinet-Mounted SMC30

8.10.1 General information

Availability of option

This option is available for the following S120 Cabinet Modules:

- Booksize Cabinet Kits
- Chassis format Motor Modules

Description

The SMC30 Sensor Module is used for detecting the actual motor speed. The signals emitted by the rotary pulse encoder are converted here and made available to the closed-loop controller via the DRIVE-CLiQ interface for evaluation purposes.

The following encoders can be connected to the SMC30 Sensor Module:

- TTL encoder
- HTL encoder
- SSI encoder
- KTY or PTC temperature sensor

Table 8- 7 Connectable encoders with supply voltage

Encoder type	X520 (D-Sub)	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- 8 Maximum encoder cable length

Encoder type	Maximum signal cable length in m
TTL	100
HTL unipolar	100
HTL bipolar	300
SSI	100

Note

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

The Booksize Cabinet Kit with Double Motor Module has two of these encoder modules built in.

Table 8- 9 Specification of measuring systems that can be connected

Parameter	Designation	Threshold	Min.	Max.	Unit
High signal level (TTL bipolar at X520 or X521/X531) 1)	U_{Hdiff}		2	5	V
Low signal level (TTL bipolar at X520 or X521/X531) 1)	U_{Ldiff}		-5	-2	V
High signal level (HTL unipolar)	U_H 4)	High	17	V_{CC}	V
		Low	10	V_{CC}	V
Low signal level (HTL unipolar)	U_L 4)	High	0	7	V
		Low	0	2	V
High signal level (HTL bipolar) 2)	U_{Hdiff}		3	V_{CC}	V
Low signal level (HTL bipolar) 2)	U_{Ldiff}		$-V_{CC}$	-3	V
High signal level (SSI bipolar at X520 or X521/X531) 1)	U_{Hdiff}		2	5	V
Low signal level (SSI bipolar at X520 or X521/X531) 1)	U_{Ldiff}		-5	-2	V
Signal frequency	f_S		-	300	kHz
Edge clearance	t_{min}		100	-	ns
Zero pulse inactive time (before and after A=B=high)	t_{Lo}		640	$(t_{ALo-BHi} - t_{Hi})/2$ 3)	ns
Zero pulse active time (while A=B=high and beyond)	t_{Hi}		640	$t_{ALo-BHi} - 2 \times t_{Lo}$ 3)	ns

1) Other signal levels according to the RS 422 standard.

2) The absolute level of the individual signals varies between 0 V and V_{CC} of the measuring system.

3) $t_{ALo-BHi}$ is not a specified value, but is the time between the falling edge of track A and the next but one rising edge of track B.

4) The threshold can be set via p0405.04 (switching threshold); the setting when delivered is "Low".

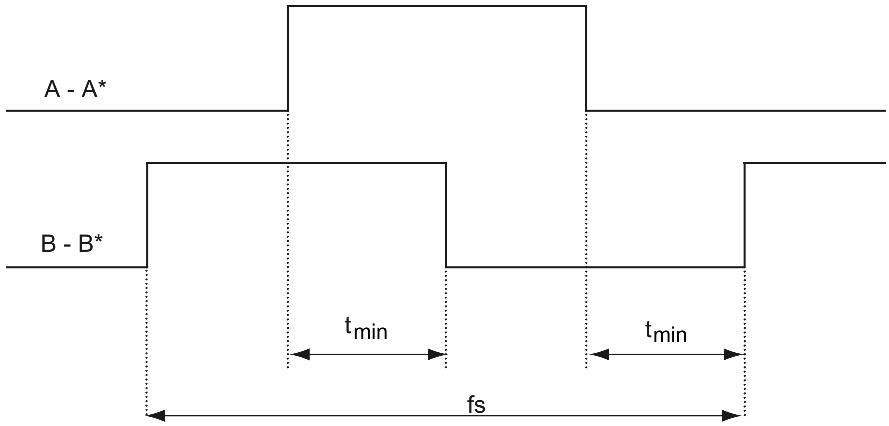


Figure 8-12 Signal characteristic of the A and B track between two edges: Time between two edges with pulse encoders

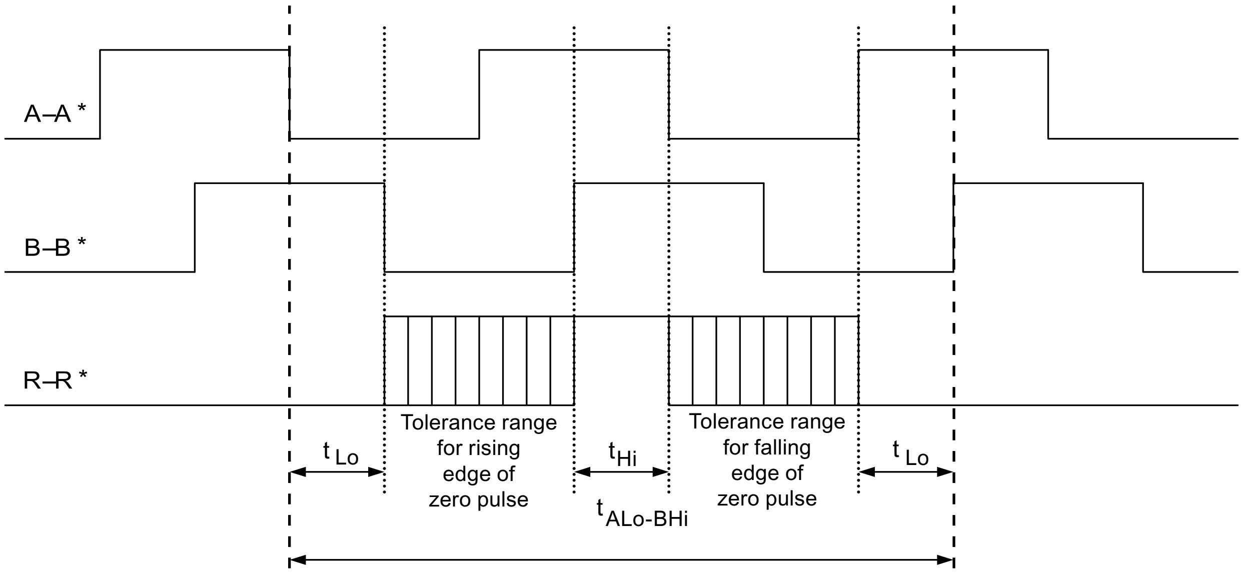


Figure 8-13 Position of the zero pulse to the track signals

For encoders with a 5 V supply at X521/X531, the cable length is dependent on the encoder current (this applies to cable cross-sections of 0.5 mm²):

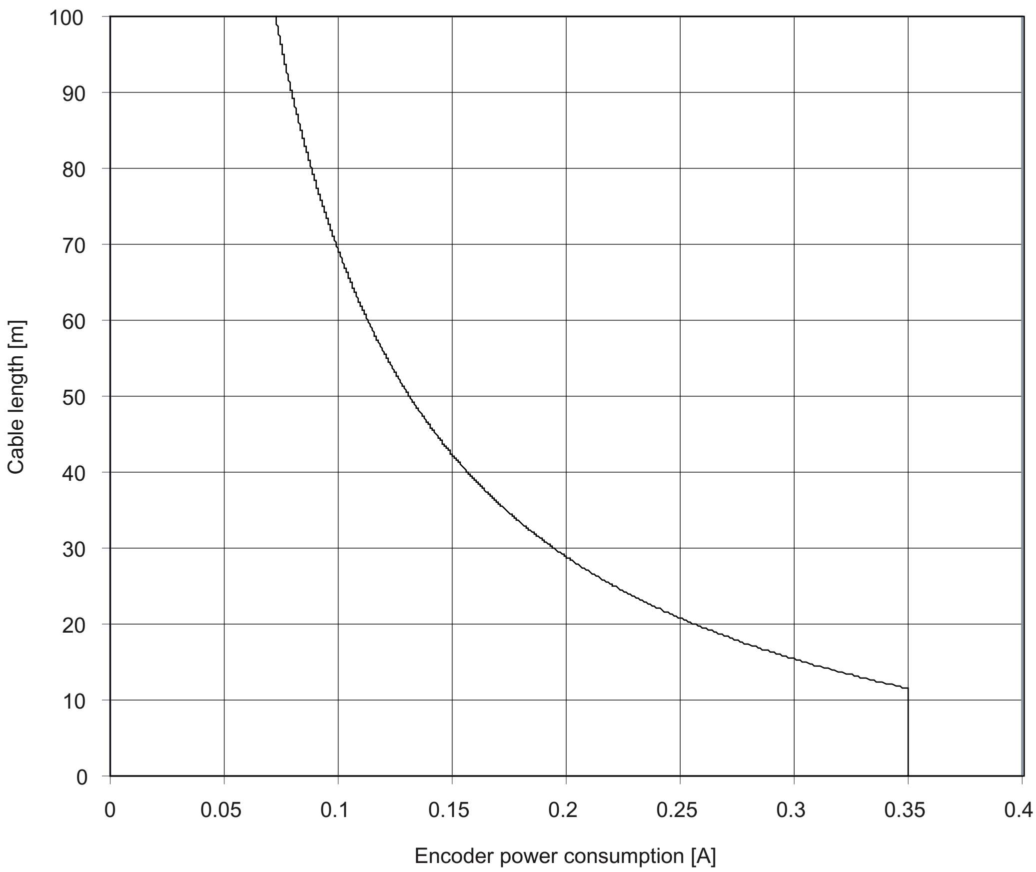


Figure 8-14 Signal cable length as a function of the encoder current consumption

For encoders without Remote Sense the permissible cable length is restricted to 100 m (reason: The voltage drop depends on the cable length and the encoder current).

8.10.2 Safety information

NOTICE
Only one measuring system can be connected to each Sensor Module.

Note

There must be no electrical connection between the measuring system housing and the measuring system electronics (this requirement is fulfilled for most encoder systems). If this is not carefully observed, under certain circumstances the system will not be able to reach the required noise immunity (there is then a danger of equalization currents flowing through the electronic ground).

CAUTION
If screw terminals are used, the signal cable must be shielded and connected to the shield contact provided over a large surface area.

CAUTION
Connecting cables to sensors must always be installed with shielding. The cable shield must be connected to the ground potential at both ends over a large surface area. Connecting cables that are routed together with the motor cable must be twisted in pairs and shielded separately.

8.10.3 Interfaces

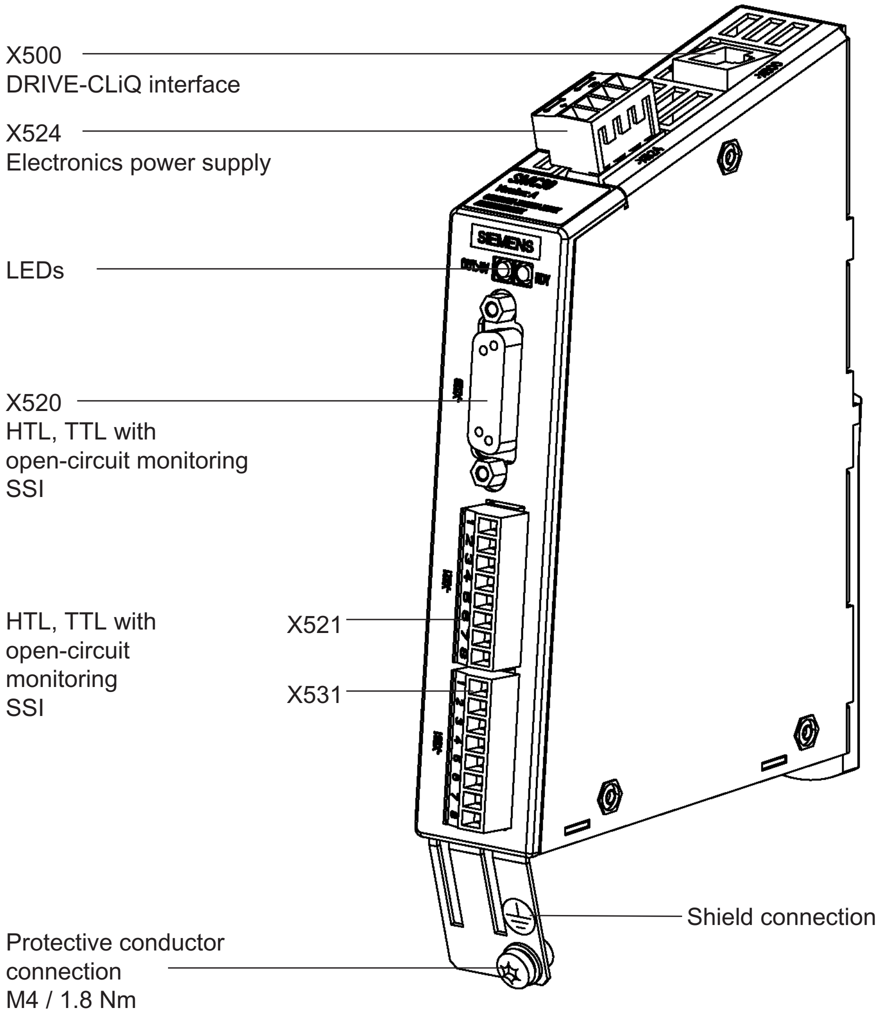
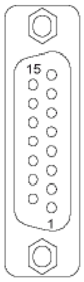


Figure 8-15 Interface overview for the SMC30

X520 encoder connection 1 for HTL/TTL/SSI encoder with open-circuit monitoring

Table 8- 10 Encoder connection X520

	Pin	Signal name	Technical data
	1	+Temp	Temperature sensor connection KTY84-1C130/PTC
	2	Clock	SSI clock
	3	Clock*	Inverted SSI clock
	4	P encoder 5 V / 24 V	Encoder power supply
	5	P encoder 5 V / 24 V	Encoder power supply
	6	P sense	Sense input for encoder power supply
	7	M encoder (M)	Ground for encoder power supply
	8	-Temp	Temperature sensor connection KTY84-1C130/PTC
	9	M sense	Ground for sense input
	10	R	Reference signal R
	11	R*	Inverted reference signal R
	12	B*	Inverted incremental signal B
	13	B	Incremental signal B
	14	A*/data*	Inverted incremental signal A/inverted SSI data
	15	A/data	Incremental signal A/SSI data
Connector type: 15-pin socket			

CAUTION

The encoder power supply can be parameterized to 5 V or 24 V. The encoder may be destroyed if you enter the wrong parameter.

NOTICE

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

⚠ DANGER

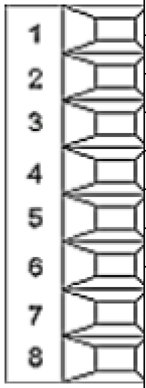
Risk of electric shock!

Only temperature sensors that meet the safety isolation specifications contained in EN 61800-5-1 may be connected to terminals "+Temp" and "-Temp".

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

X521/X531 encoder connection 2 for HTL/TTL/SSI encoder with open-circuit monitoring

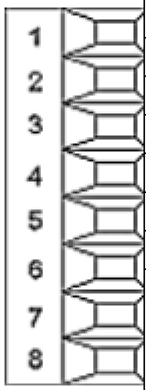
Table 8- 11 Encoder connection X521

	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 via inductance
Max. connectable cross-section: 1.5 mm²			

Note

When unipolar HTL encoders are used, terminal block A*, B*, and R* must be jumpered with M encoder (-X531).

Table 8- 12 Encoder connection X531

	Terminal	Signal name	Technical data
	1	P encoder 5 V / 24 V	Encoder power supply
	2	M encoder	Ground for encoder power supply
	3	-Temp	Temperature sensor connection KTY84-1C130/PTC
	4	+Temp	
	5	Clock	SSI clock
	6	Clock*	Inverted SSI clock
	7	Data	SSI data
	8	Data*	Inverted SSI data
Max. connectable cross-section: 1.5 mm²			

Note

Note that when the encoder is connected via terminals, the cable shield must be applied to the module.

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

DANGER
Risk of electric shock! Only temperature sensors that meet the safety isolation specifications contained in EN 61800-5-1 may be connected to terminals "+Temp" and "-Temp". If these instructions are not complied with, there is a risk of electric shock!

8.10.4 Connection example

Connection example 1: HTL encoder, bipolar, without zero mark -> p0405 = 9 (hex)

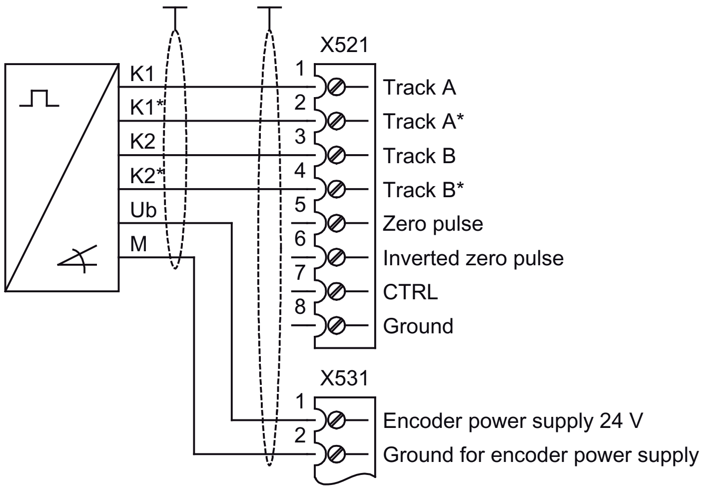


Figure 8-16 Connection example 1: HTL encoder, bipolar, without zero mark

Note

Alternatively, a temperature measurement function is also available on customer terminal block -X55.

Connection example 2: TTL encoder, unipolar, without zero track -> p0405 = A (hex)

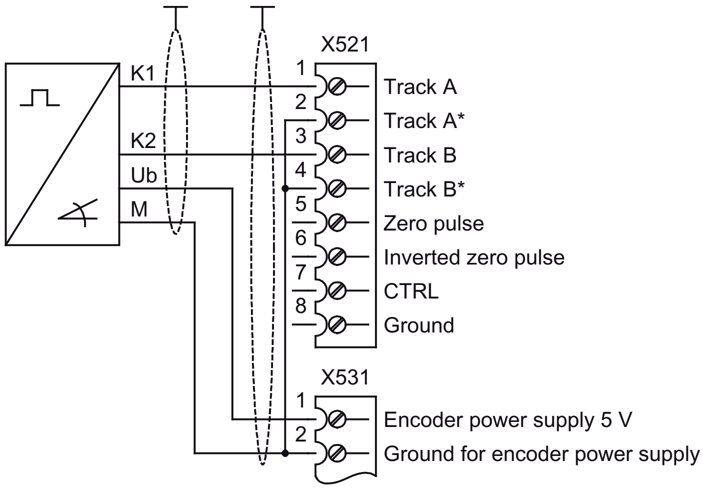


Figure 8-17 Connection example 2: TTL encoder, unipolar, without zero track

8.11 K51, VSM10 Voltage Sensing Module Cabinet-Mounted

Availability of option

This option is available for the following S120 Cabinet Modules:

- Chassis format Motor Modules

Description

Voltage recording module VSM10 is used to operate a permanent-field synchronous machine without encoder with the requirement for switching to a machine which is already running (flying restart function).

The terminals on the Voltage Sensing Module (-T1-B51) are pre-assigned in the factory and must not be changed by the customer.

To commission the function, the permanent-field synchronous machine without encoder must be input and "Flying restart" activated with p1200.

Interfaces

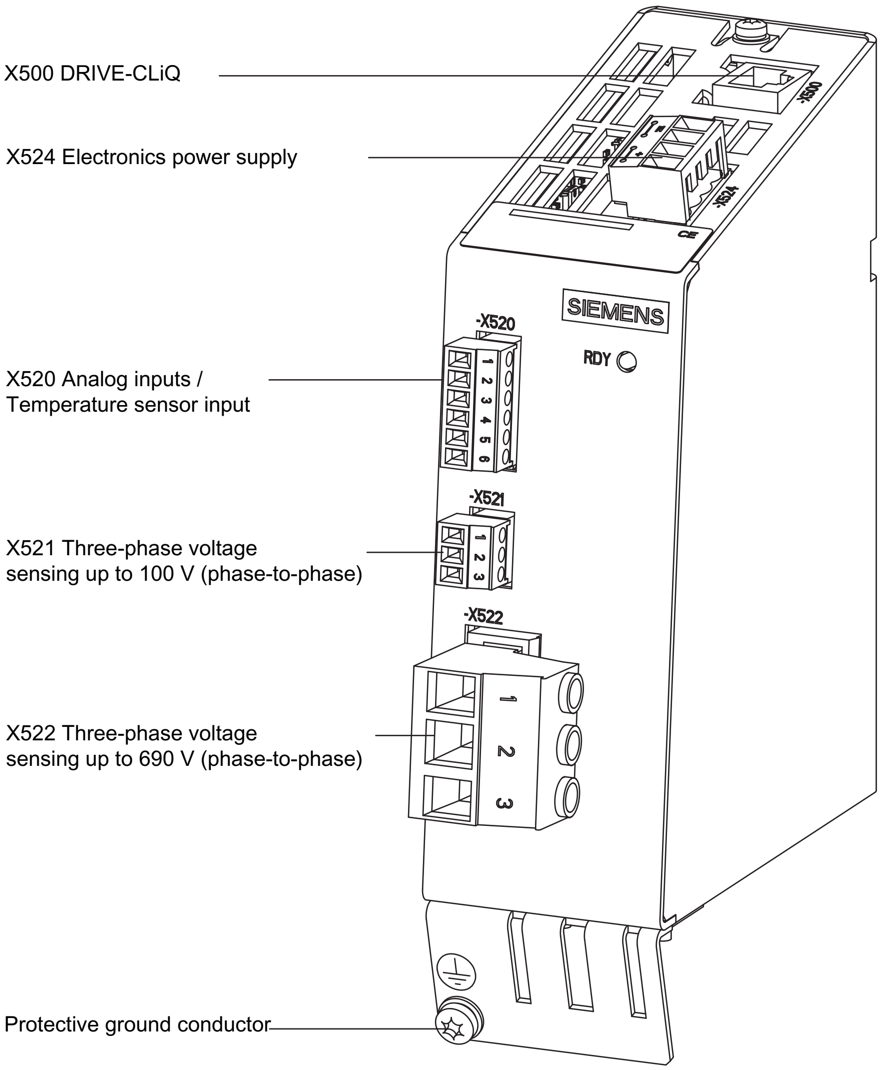


Figure 8-18 Interface overview for the Voltage Sensing Module (option K51)

8.12 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 ... 480 V or 500 ... 690 V (poss. tap approx. 80 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 can be 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 voltage interface must be installed with 3 cables on site.

Adapting the auxiliary power supply (-T10)

A transformer is installed in the Line Connection Module (-T10) for the 230 V AC auxiliary power supply for the cabinet. The location of the transformer is indicated in the layout diagrams supplied.

When delivered, the taps are always set to the highest level. The line-side terminals of the transformer may need to be reconnected to the existing line voltage.

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

Table 8- 13 Line voltage assignments for the internal power supply (380 to 480 V 3 AC)

Line supply voltage range	Tap	Taps of the voltage matching transformer (-T10) LH1 – LH2
342 to 390 V	380 V	1 - 2
391 to 410 V	400 V	1 – 3
411 to 430 V	415 V	1 – 4
431 to 450 V	440 V	1 – 5
451 to 470 V	460 V	1 – 6
471 to 528 V	480 V	1 – 7

Table 8- 14 Line voltage assignments for the internal power supply (500 to 690 V 3 AC)

Line supply voltage range	Tap	Taps of the voltage matching transformer (-T10) LH1 – LH2
450 to 515 V	500 V	1 - 8
516 to 540 V	525 V	1 – 9
541 to 560 V	550 V	1 – 10
561 to 590 V	575 V	1 – 11
591 to 630 V	600 V	1 – 12
631 to 680 V	660 V	1 to 14, terminals 12 and 13 are jumpered
681 to 759 V	690 V	1 to 15, terminals 12 and 13 are jumpered

NOTICE
If the terminals are not reconnected to the actual supply voltage, the internal power supply will not be correct.

8.13 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
- Chassis format Motor Modules

Description

The option K82 (terminal module for activating "Safe Torque Off" and "Safe STOP 1") is used for isolated activation via a variable control voltage range of the safety functions already present in the standard, which can also be used without option K82.

Use option K82 to activate the following Safety Integrated functions (terminology according to draft IEC 61800-5-2):

- Safe Torque Off (STO)
- Safe Stop 1 (SS1, time-controlled)

Note

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 EN 61800-5-2, EN 60204-1 and DIN EN ISO 13849-1 category 3 (formerly EN 954-1), as well as the requirements for Performance Level (PL) d and IEC 61508 SIL2.

In combination with the option K82, the requirements specified in EN 61800-5-2, EN 60204-1 as well as in DIN EN ISO 13849-1 category 3 (formerly EN954-1) are satisfied for Performance Level (PL) d and IEC 61508 SIL2.

Note

Safety Integrated Function Manual

Detailed and comprehensive instructions and information for the Safety Integrated functions can be found in the associated Function Manual. This manual is available as additional documentation on the customer DVD supplied with the device.

8.14 K87, Terminal Module TM54F

8.14.1 General information

Figure 8-19 Option K87, Terminal Module TM54F

Availability of option

- Booksize Cabinet Kits
- Chassis format Motor Modules

Description

The TM54F Terminal Module is a terminal expansion module with safe digital inputs and outputs for controlling the Safety Integrated functions of SINAMICS.

The TM54F must be directly connected to a Control Unit via DRIVE-CLiQ. Motor Modules or Line Modules must not be connected to a TM54F.
Precisely one TM54F can be assigned to each Control Unit.

TM54F features the following interfaces:

Table 8- 15 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 comprises a 24V DC switching output, a ground-switching output and a digital input to monitor the switching state. A fail-safe digital input comprises two digital inputs.

Note

The rated values of the F-DO meet the requirements of EN 61131-2 for digital DC outputs with 0.5 A rated current.

The operating ranges of the F-DI meet the requirements of EN 61131-2 for Type 1 digital inputs.

Note

Please note that the F-DIs must take the form of shielded cables if they are > 30 m in length.

8.14.2 Safety information

⚠ WARNING

The ventilation spaces of 50 mm above and below the component must be observed.

8.14.3 Interface description

8.14.3.1 Overview

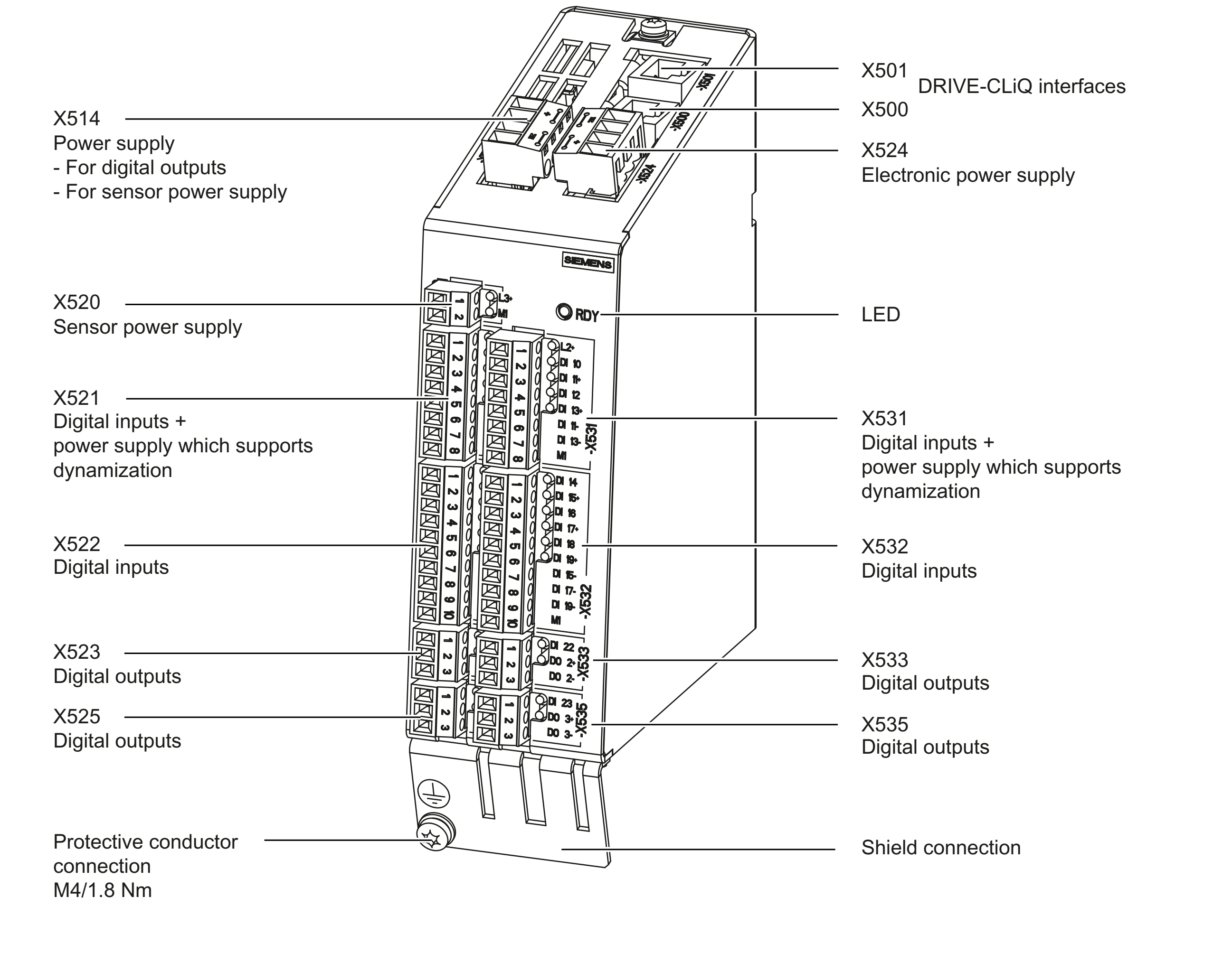


Figure 8-20 Interface description of the TM54F

8.14.3.2 Example connection

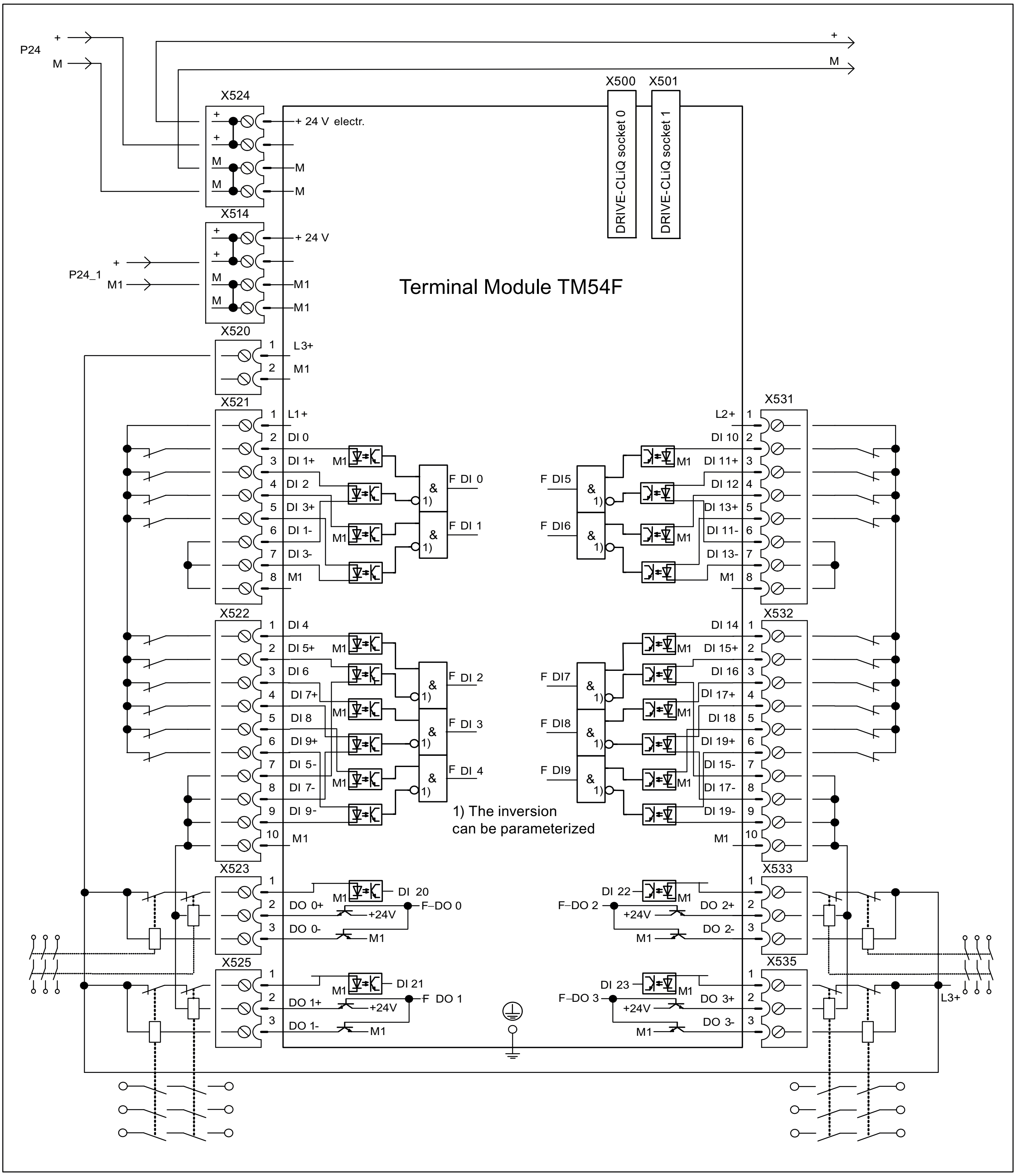


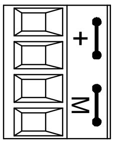
Figure 8-21 Example connection of TM54F

Additional circuit examples are included in:

- SINAMICS S120 Safety Integrated Function Manual

8.14.3.3 X514 power supply for digital outputs and sensors

Table 8- 16 Terminals for the power supply X514

	Terminal	Designation	Technical data
	+	Power supply	Voltage: 24 V DC (20.4 V – 28.8 V) Current consumption: max. 4 A [1)] Max. current via jumper in connector: 20 A at 55°C
	+	Power supply	
	M1	Electronics ground	
	M1	Electronics ground	
Max. connectable cross-section: 2.5 mm² Type: Screw terminal 2 (see Appendix A)			

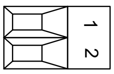
1) including the current consumption for the digital outputs and to supply the sensor.

Note

The two "+" and "M1" terminals are jumpered in the connector. This ensures the supply voltage is looped through.

8.14.3.4 X520 sensor power supply

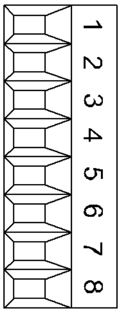
Table 8- 17 Terminals X520

	Terminal	Designation	Technical data
	1	L3	500 mA, 24 V
	2	M1	

Without forced dormant error detection

8.14.3.5 X521 digital inputs and dynamically adjustable power supply

Table 8- 18 Screw terminal X521

	Terminal	Designation [1]	Technical data
	1	L1+	Voltage: +24 V DC Max. total load current: 500 mA
	2	DI 0	Voltage: - 3 V to +30 V Typical current consumption: 3.2 mA at 24 V DC Electrical isolation: Reference potential, refer to terminals 6, 7, 8 All digital inputs are electrically isolated. Input delay [2]: - for "0" to "1": 30 µs (100 Hz) - for "1" to "0": 60 µs (100 Hz) Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to +5 V
	3	DI 1+	
	4	DI 2	
	5	DI 3+	
	6	DI 1-	Reference potential for DI 1+
	7	DI 3-	Reference potential for DI 3+
	8	M1	Reference potential for DI 0, DI 2, L1+
An F-DI comprises a digital input and a 2nd digital input where, in addition, the cathode of the optocoupler is fed-out. F-DI 0 = terminals 2, 3 and 6 F-DI 1 = terminals 4, 5 and 7			
Max. connectable cross-section: 1.5 mm² Type: Screw terminal 1 (see Appendix A)			

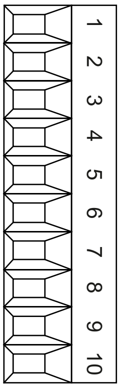
[1] DI: digital input; M1: ground reference

[2] Pure hardware delay

NOTICE
For the digital inputs DIx+ to function, the reference potential must be connected to input DIx- in each case. This is achieved by: 1. Providing the ground reference of the digital inputs, or 2. a jumper between DIx and terminal M1.

8.14.3.6 X522 digital inputs

Table 8- 19 Screw terminal X522

	Terminal	Designation [1]	Technical data
	1	DI 4	Voltage: - 3 V to +30 V Typical current consumption: 3.2 mA at 24 V DC Electrical isolation: Reference potential, refer to terminals 7, 8, 9, 10 All digital inputs are electrically isolated. Input delay [2]: - for "0" to "1": 30 μs (100 Hz) - for "1" to "0": 60 μs (100 Hz) Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to +5 V
	2	DI 5+	
	3	DI 6	
	4	DI 7+	
	5	DI 8	
	6	DI 9+	
	7	DI 5-	Reference potential for DI 5+
	8	DI 7-	Reference potential for DI 7+
	9	DI 9-	Reference potential for DI 9+
	10	M1	Reference potential for DI 4, DI 6 and DI 8
An F-DI comprises a digital input and a 2nd digital input where, in addition, the cathode of the optocoupler is fed-out. F-DI 2 = terminals 1, 2 and 7 F-DI 3 = terminals 3, 4 and 8 F-DI 4 = terminals 5, 6 and 9			
Max. connectable cross-section: 1.5 mm² Type: Screw terminal 1 (see Appendix A)			

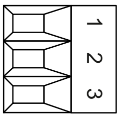
1) DI: Digital input; M1:Ground reference

2) Pure hardware delay

NOTICE
For the digital inputs DIx+ to function, the reference potential must be connected to input DIx- in each case. This is achieved by: 1. Providing the ground reference of the digital inputs, or 2. a jumper between DIx and terminal M1.

8.14.3.7 X523 digital outputs

Table 8- 20 Screw terminal X523

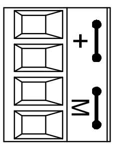
	Terminal	Designation [1]	Technical data
	1	DI 20	Voltage: - 3 V to +30 V Typical current consumption: 3.2 mA at 24 V DC Electrical isolation: Reference potential is Terminal M1 The digital input is electrically isolated. Input delay [2]: - for "0" to "1": 30 µs (100 Hz) - for "1" to "0": 60 µs (100 Hz) Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to 5 V
	2	DO 0+	0.5 A Reference potential is terminal M1
	3	DO 0-	0.5 A Reference potential is L1+, L2+ or L3+ Output delay:[2] - for "0" to "1": 300 µs - for "1" to "0": 350 µs Total current consumption of all DOs: 2 A Max. leakage current: < 0.5 mA 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
An F-DO comprises two digital outputs and a digital input to feed back the signal F-DO 0 = terminals 1, 2 and 3 Max. connectable cross-section: 1.5 mm² Type: Screw terminal 1 (see Appendix A)			

[1] DI: digital input; DO: digital output

[2] Pure hardware delay

8.14.3.8 X524 Electronics power supply

Table 8- 21 Terminals X524

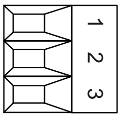
	Terminal	Designation	Technical data
	+	Electronics power supply	Voltage: 24 V DC (20.4 V – 28.8 V) Current consumption: Max. 0.7 A Max. current via jumper in connector: 20 A
	+	Electronics power supply	
	M	Electronics ground	
	M	Electronics ground	
Max. connectable cross-section: 2.5 mm² Type: Screw terminal 2 (see Appendix A)			

Note

The two "+" and "M" terminals are jumpered in the connector. This ensures that the supply voltage is looped through.
The current consumption increases by the value for the DRIVE-CLiQ node.

8.14.3.9 X525 digital outputs

Table 8- 22 Screw terminal X525

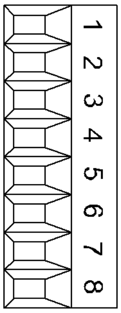
	Terminal	Designation [1]	Technical data
	1	DI	Voltage: - 3 V to +30 V Typical current consumption: 3.2 mA at 24 V DC Electrical isolation: Reference potential is terminal M1 The digital input is electrically isolated. Input delay [2]: - for "0" to "1": 30 µs (100 Hz) - for "1" to "0": 60 µs (100 Hz) Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to 5 V
	2	DO 1+	0.5 A Reference potential is terminal M1
	3	DO 1-	0.5 A Reference potential is terminal L1+, L2+ or L3+ Output delay [2]: - for "0" to "1": 300 µs - for "1" to "0": 350 µs Total current consumption of all DOs: 2 A Max. leakage current: < 0.5 mA 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
An F-DO comprises two digital outputs and a digital input F-DO 1 = terminals 1, 2 and 3:			
Max. connectable cross-section: 1.5 mm² Type: Screw terminal 1 (see Appendix A)			

1) DI: Digital input; DO: Digital output

2) Pure hardware delay

8.14.3.10 X531 digital inputs and dynamically adjustable power supply

Table 8- 23 Screw terminal X531

<table>
<tr><th></th><th>Terminal</th><th>Designation [1)]</th><th>Technical data</th></tr>
<tr><td rowspan="8">
</td><td>1</td><td>L 2+</td><td>Voltage: +24 V DC
Max. total load current: 500 mA</td></tr>
<tr><td>2</td><td>DI 10</td><td rowspan="4">Voltage: - 3 V to +30 V
Typical current consumption: 3.2 mA at 24 V DC
Electrical isolation: Reference potential, refer to terminals 6, 7, 8
All digital inputs are electrically isolated.
Input delay [2)]:
- for "0" to "1": 30 µs (100 Hz)
- for "1" to "0": 60 µs (100 Hz)
Level (incl. ripple)
High level: 15 V to 30 V
Low level: -3 V to 5 V</td></tr>
<tr><td>3</td><td>DI 11+</td></tr>
<tr><td>4</td><td>DI 12</td></tr>
<tr><td>5</td><td>DI 13+</td></tr>
<tr><td>6</td><td>DI 11-</td><td>Reference potential to DI 11+</td></tr>
<tr><td>7</td><td>DI 13-</td><td>Reference potential to DI 13+</td></tr>
<tr><td>8</td><td>M1</td><td>Reference potential to DI 10, DI 12, L2+</td></tr>
<tr><td colspan="4">An F-DI comprises a digital input and a 2nd digital input where, in addition, the cathode of the optocoupler is fed-out.
F-DI 5 = terminals 2, 3 and 6
F-DI 6 = terminals 4, 5 and 7</td></tr>
<tr><td colspan="4">Max. connectable cross-section: 1.5 mm²
Type: Screw terminal 1 (see Appendix A)</td></tr>
</table>

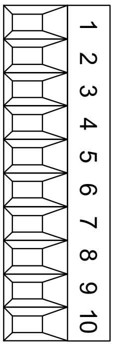
1) DI: Digital input; M1: Ground reference

2) Pure hardware delay

NOTICE
For the digital inputs DIx+ to function, the reference potential must be connected to input DIx- in each case. This is achieved by: 1. Providing the ground reference of the digital inputs, or 2. a jumper between DIx and terminal M1.

8.14.3.11 X532 digital inputs

Table 8- 24 Screw terminal X532

	Terminal	Designation [1]	Technical data
	1	DI 14	Voltage: - 3 V to +30 V Typical current consumption: 3.2 mA at 24 V DC Electrical isolation: Reference potential, refer to terminals 7, 8, 9, 10. All digital inputs are electrically isolated. Input delay [2]: - for "0" to "1": 30 µs (100 Hz) - for "1" to "0": 60 µs (100 Hz) Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to +5 V
	2	DI 15+	
	3	DI 16	
	4	DI 17+	
	5	DI 18	
	6	DI 19+	
	7	DI 15-	Reference potential to DI 15+
	8	DI 17-	Reference potential to DI 17+
	9	DI 19-	Reference potential to DI19+
	10	M1	Reference potential to DI14, DI16, DI18
An F-DI comprises a digital input and a 2nd digital input where, in addition, the cathode of the optocoupler is fed out. F-DI 7 = terminals 1, 2 and 7 F-DI 8 = terminals 3, 4 and 8 F-DI 9 = terminals 5, 6 and 9 Max. connectable cross-section: 1.5 mm² Type: Screw terminal 1 (see Appendix A)			

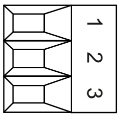
[1] DI: Digital input; M1: Ground reference

[2] Pure hardware delay

NOTICE
For the digital inputs DIx+ to function, the reference potential must be connected to input DIx- in each case. This is achieved by: 1. Providing the ground reference of the digital inputs, or 2. a jumper between DIx and terminal M1.

8.14.3.12 X533 digital outputs

Table 8- 25 Screw terminal X533

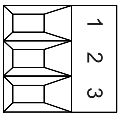
	Terminal	Designation [1]	Technical data
	1	DI 22	Voltage: - 3 V to +30 V Typical current consumption: 3.2 mA at 24 V DC Electrical isolation: Reference potential is terminal M1 The digital input is electrically isolated. Input delay [2]: - for "0" to "1": 30 µs (100 Hz) - for "1" to "0": 60 µs (100 Hz) Level (incl. ripple) High level: 15 V to 30 V Low level: -3 V to 5 V
	2	DO+	0.5 A Reference potential is terminal M1 0.5 A Reference potential is terminal L1+, L2+ or L3+ Output delay [2]: - for "0" to "1": 300 µs - for "1" to "0": 350 µs Total current consumption of all DOs: 2 A Max. leakage current: < 0.5 mA 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
	3	DO-	
An F-DO comprises two digital outputs and a digital input for the feedback signal F-DO 2 = terminals 1, 2 and 3 Max. connectable cross-section: 1.5 mm² Type: Screw terminal 1 (see Appendix A)			

[1] DI: Digital input; DO: Digital output

[2] Pure hardware delay

8.14.3.13 X535 digital outputs

Table 8- 26 Terminals X535

<table>
<tr><th></th><th>Terminal</th><th>Designation [1)]</th><th>Technical data</th></tr>
<tr><td rowspan="3"></td><td>1</td><td>DI 23</td><td>Voltage: - 3 V to +30 V
Typical current consumption: 3.2 mA at 24 V DC
Electrical isolation: Reference potential is terminal M1
The digital input is electrically isolated.
Input delay [2)]:
- for "0" to "1": 30 µs (100 Hz)
- for "1" to "0": 60 µs (100 Hz)
Level (incl. ripple)
High level: 15 V to 30 V
Low level: -3 V to 5 V</td></tr>
<tr><td>2</td><td>DO 3+</td><td rowspan="2">0.5 A
Reference potential is terminal M1
0.5 A
Reference potential is terminal L1+, L2+ or L3+
Output delay [2)]:
- for "0" to "1": 300 µs
- for "1" to "0": 350 µs
Total current consumption of all DOs: 2 A
Max. leakage current: < 0.5 mA
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</td></tr>
<tr><td>3</td><td>DO 3-</td></tr>
<tr><td colspan="4">An F-DO comprises two digital outputs and a digital input for the feedback signal
F-DO 3 = terminals 1, 2 and 3
Max. connectable cross-section: 1.5 mm²
Type: Screw terminal 1 (see Appendix A)</td></tr>
</table>

1) DI: Digital input; DO: Digital output

2) Pure hardware delay

8.14.4 Technical data

Table 8- 27 Technical data

6SL3055-0AA00-3BAx	Unit	Value
Current requirement (X524 at 24 V DC) without DRIVE-CLiQ supply	mA	160
Current requirement (X514 at 24 V DC) without digital outputs and sensor power supply	mA	38
Sensor power supply with and without forced dormant error detection (L1+, L2+, L3+) • Voltage • Max. load current per output	 V A	 24 0.5
- cable length for the 24 V power supply: - For longer cable lengths, the "Weidmüller Type No. PU DS 24 16A" surge protector must be used.	m	< 30
• Fail-safe digital inputs (F-DI) (with electrical isolation) • Fail-safe digital outputs (F-DO) (with electrical isolation) • Standard digital inputs (with electrical isolation)		10 4 4
Fail-safe digital inputs (F-DI) and standard digital inputs • Voltage • Low-level (an open digital input is interpreted as "low") • High level • Current consumption (at 24 V DC) • Input delay[1)] – for "0" to "1" – for "1" to "0"	V V V mA µs µs	0 to 30 -3 to +5 15 to 30 >2 approx. 30 (100 Hz) approx. 60 (100 Hz)
Fail-safe digital outputs (F-DO), continuous short-circuit proof • Voltage • Max. load current per digital output • Output delay[1)] – for "0" to "1" – for "1" to "0"	V A µs µs	24 0.5 300 350
Power loss	W	4.5 at 24 V
PE/ground connection		On housing with M4 screw
Weight	kg	approx. 0.9

1) Pure hardware delay

8.15 K90, Control Unit CU320-2 PROFIBUS

8.15.1 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
- Chassis format Motor Modules

Note

For Double Motor Modules in the booksize format, only one shared CU320-2 Control Unit is available for both Motor Modules.

Description

With option K90, a CU320-2 Control Unit is installed in the Line Modules and Motor Modules of the drive line-up; the CU320-2 assumes the functions of communication, open-loop control, and closed-loop control for up to 4 Motor Modules, in addition to 1 Line Module.

The connection to the relevant modules and any additional I/O modules is established via DRIVE-CLiQ. A standard PROFIBUS interface is available for higher-level communication.

The unit can communicate with other nodes via PROFIBUS or the DRIVE-CLiQ interface, see SINAMICS Low-Voltage Configuration Manual on the customer DVD supplied with the device.

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 expansion 1

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 on systems with performance expansion 1.

8.15.2 X55 customer terminal strip

8.15.2.1 Overview

Description

Diagram of the customer terminal strip –X55 is generated

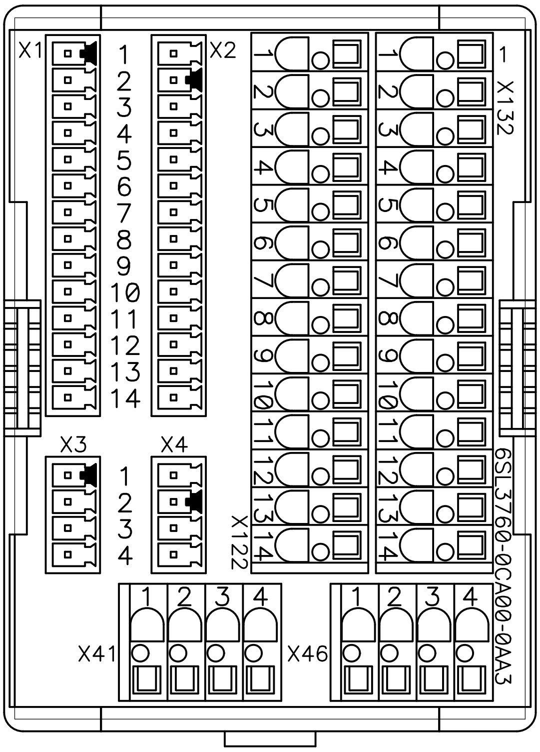


Figure 8-22 Customer terminal strip -X55

Diagram of the customer terminal strip –X55 is generated

The customer terminal strip -X55 is installed in the cabinet together with option K90 (CU320-2 Control Unit PROFIBUS). The digital inputs/outputs of the CU320-2 Control Unit can be used via terminal strips -X55-X122 and -X55-X132.

NOTICE
Interfaces -X1, -X2, -X3 and -X4 are wired in the cabinet and are not available for customer connections! If the customer terminal block is ever replaced, connectors -X1 and -X2 must not be mixed up! Otherwise, "Safe Torque Off" and "Safe Stop 1" will malfunction!

Note

The customer terminal block is a standard component of the Motor Module (chassis format) Cabinet Module. The digital inputs/outputs of the CU320-2 Control Unit on terminal blocks -X55-X122 and -X55-X132 can only be used with the K90 option (CU320-2 Control Unit PROFIBUS).

Note

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 (ground reference M1 or M2). To close the circuit when the internal 24 V supply is used, the ground references 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

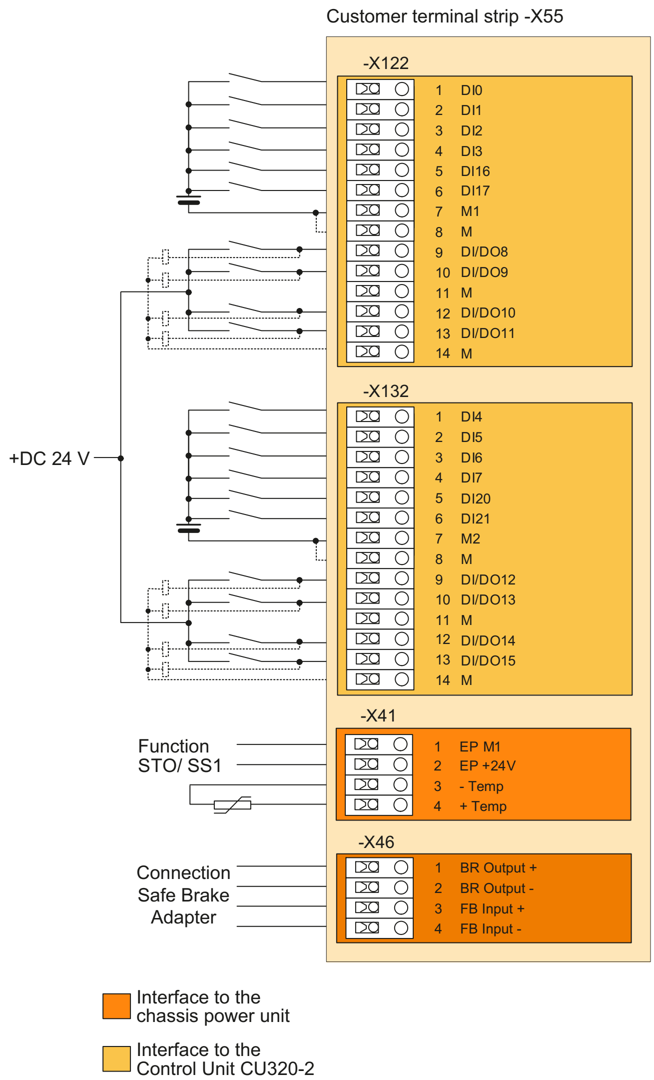
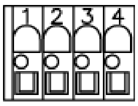


Figure 8-23 Pin assignment of customer terminal strip –X55

8.15.2.2 X41 EP terminal / temperature sensor connection

Table 8- 28 Terminal strip X41

	Terminal	Function	Technical data
	1	EP M1 (Enable Pulses)	Supply voltage: 24 V DC (20.4 V - 28.8 V) Current consumption: 10 mA Signal propagation times: L → H: 100 μs; H → L: 1000 μs The pulse inhibit function is only available when Safety Integrated Basic Functions are enabled.
	2	EP +24 V (Enable Pulses)	
	3	- Temp	Temperature sensor connection for motor temperature measurement: KTY84-1C130, PTC, PT100
	4	+ Temp	
Max. connectable cross-section 2.5 mm²			

DANGER

Risk of electric shock!

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

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

Note

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

CAUTION

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

NOTICE

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

Note

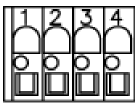
Safety Integrated Function Manual

Detailed and comprehensive instructions and information for the Safety Integrated functions can be found in the associated Function Manual. This manual is available as additional documentation on the customer DVD supplied with the device.

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

8.15.2.3 X46 Brake control and monitoring

Table 8- 29 Terminal strip X46 brake control and monitoring

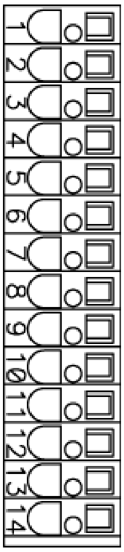
	Terminal	Function	Technical data
	1	BR output +	This interface is intended for the connection of the Safe Brake Adapter.
	2	BR output -	
	3	FB input +	
	4	FB input -	
Max. connectable cross-section 1.5 mm²			

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

8.15.2.4 X122 digital inputs/outputs

X122 digital inputs/outputs

Table 8- 30 Terminal block X55 X122

	Terminal	Designation [1]	Technical data
	1	DI 0	Voltage: -30 V to +30 V DC Typical current consumption: 9 mA at 24 V Electrical isolation: reference potential is M1 terminal Level (incl. ripple) High level: 15 V to 30 V Low level: -30 V to +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 terminals 1 to 6
	8	M	Ground
	9	DI/DO 8	**As input**: Voltage: -30 V to +30 V DC Typical current consumption: 9 mA at 24 V Level (incl. ripple) High level: 15 V to 30 V Low level: -30 V to +5 V DI/DO 8, 9, 10, and 11 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 9	
	11	M	
	12	DI/DO 10	
	13	DI/DO 11	
	14	M	
Max. connectable cross-section: 1.5 mm²			

1) DI: Digital input; DI/DO: Bidirectional digital input/output; M: Electronic ground; M1: Ground reference

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}

NOTICE
An open input is interpreted as "low". To enable the digital inputs (DI) to function, terminal M1 must be connected. This is achieved by: 1. Providing the ground reference of the digital inputs, or 2. a jumper to terminal M. Notice! This removes the electrical isolation for these digital inputs.

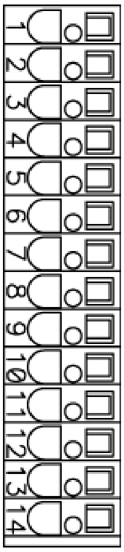
Note

If a momentary interruption in the voltage occurs in the 24 V supply, the digital outputs are deactivated until the interruption has been rectified.

8.15.2.5 X132 digital inputs/outputs

X132 digital inputs/outputs

Table 8- 31 Terminal strip X55 X132

	Terminal	Designation [1]	Technical data
	1	DI 4	Voltage: -30 V to +30 V DC Typical current consumption: 9 mA at 24 V Electrical isolation: reference potential is M2 terminal Level (incl. ripple) High level: 15 V to 30 V Low level: -30 V to +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 terminals 1 to 6
	8	M	Ground
	9	DI/DO 12	As input: Voltage: -30 V to +30 V DC Typical current consumption: 9 mA at 24 V Level (incl. ripple) High level: 15 V to 30 V Low level: -30 V to +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: 1.5 mm²			

1) DI: Digital input; DI/DO: Digital input/output; M: Electronics ground; M2: Ground reference

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}

NOTICE
An open input is interpreted as "low". To enable the digital inputs (DI) to function, terminal M2 must be connected. This is achieved by: 1. Providing the ground reference of the digital inputs, or 2. a jumper to terminal M. Notice! This removes the electrical isolation for these digital inputs.

Note

If a momentary interruption in the voltage occurs in the 24 V supply, the digital outputs are deactivated until the interruption has been rectified.

8.15.3 CompactFlash 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 CompactFlash 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 CompactFlash card and the order number of the firmware option to be enabled. 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 CompactFlash card declared and cannot be transferred to other CompactFlash cards.

CAUTION
Handle the CompactFlash card with care. The data stored on the CompactFlash card must not be changed manually. Only the STARTER program can modify the data. If you do not do this, all the data on the CompactFlash card will be lost (parameters, software license, etc.). The CompactFlash card may only be inserted or removed after the Control Unit CU320-2 has been switched off.

8.15.3.1 Using the memory card

Description

The STARTER commissioning tool is used to store configuration data centrally on the CompactFlash 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 CompactFlash 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

The following minimum hardware requirements must be complied with:

- PG or PC Pentium III min. 800 MHz (recommended > 1 GHz)
- 512 MB main memory (1 GB recommended)
- Screen resolution 1024 × 768 pixels, 16-bit color depth
- Free hard disk memory: min. 2 GB;

The following minimum software requirements apply when using STARTER without STEP 7 having been installed:

- Microsoft Windows 2000 SP4
- Microsoft Windows 2003 Server SP1, SP2
- Microsoft Windows XP Professional SP2, SP3
- Microsoft Windows VISTA Business SP1 *)
- Microsoft Windows VISTA Ultimate SP1 *)
- Microsoft Internet Explorer V6.0 or higher

*) DCC cannot be used.

STARTER can be used on these operating systems only if it does not include the DCC option.

Note

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
- CD-ROM drive (for installing the driver for the card reader)

8.15.3.2 Data functions

Once a card reader has been connected and successfully installed, the data on the CompactFlash 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 CompactFlash card must first be removed from the Control Unit CU320-2 and inserted in the card reader connected to the PC.

The actual procedure for accessing the CompactFlash card data depends on the operating system used.

CAUTION
The data stored on the CompactFlash card must not be changed manually. Only the STARTER program can modify the data. If you do not do this, all the data on the CompactFlash card will be lost (parameters, software license, etc.).

8.15.3.3 Saving the memory card parameter settings

Following commissioning, it is advisable to back up the data on the CompactFlash card to an external storage medium (hard disk, data carrier, etc.).

To do this, the CompactFlash card is read via a card reader connected to a PC. Ensure that all the files and directories are stored in the same form as on the CompactFlash card.

If necessary, the device status following commissioning of the drive can be restored by uploading the saved data to the CompactFlash card.

CAUTION
The CompactFlash card may only be inserted or removed after the Control Unit CU320-2 has been switched off. If you do not do this, all the data on the CompactFlash card will be lost (parameters, software license, etc.). If you remove the CompactFlash Card in operation, alarm A01100 "CU: CompactFlash card removed" is output.

8.16 K94, Performance extension 1 for CU320-2

Availability of option

This option is available for the following options:

- Option K90, Control Unit CU320-2 PROFIBUS

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 on systems with performance expansion 1.

In addition to the firmware, the CompactFlash Card also contains licensing codes, which are required to enable firmware options (such as performance expansion 1 and the Safety Integrated Extended functions).

8.17 L00, Used in the first environment to EN61800-3, category C2 (TN/TT line supplies)

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Modules
- Smart Line Modules
- Active Line Modules

Description

To limit the emitted interference, the drive converters are equipped as standard with a radio interference suppression filter that conforms to the limits defined in Category C3. By using the optional line filter (option L00) and additional measures performed in the factory - which are required in the cabinets - then SINAMICS S120 Cabinet Modules also comply with the limit values for use in the first environment (category C2) according to EN 61800-3.

The line filters are designed for connection to grounded line supplies (TN or TT line supplies).

Restrictions

Note

Option L00, use in the first environment (category C2) according to EN 61800-3, is not available for Line Modules in a parallel connection.

Note

The measures required on the customer's side, which must be performed to fulfill the limit values for use in the first environment (category C2) according to EN61800-3, are listed in the "Configuration Manual SINAMICS Low Voltage" on the customer DVD supplied with the device.

Note

The optional line filter must always be combined with a line reactor, otherwise it cannot achieve its full filter effect.

Note

To allow the power cable shield to be connected in conformance with EMC requirements, an additional EMC shield bus (M70 option) is factory fitted at the converter input and output.

Note

It is not possible to use the insulation monitoring function (option L87) in conjunction with the optional line filter.

8.18 L07, dv/dt filter compact plus Voltage Peak Limiter

Availability of option

This option is available for the following S120 Cabinet Modules:

- Chassis format Motor Modules

Description

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

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

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

Note

Operation of standard motors with standard insulation and without insulated bearing possible on SINAMICS converters up to line connection voltages of 690 V.

Restrictions

The following constraints should be noted when a dv/dt filter compact plus Voltage Peak Limiter is used:

- The output frequency is limited to no more than 150 Hz.
- Maximum permissible motor cable lengths:
  - Shielded cables: max. 100 m (e.g. Protodur NYCWY)
  - Unshielded cables: max. 150 m (e.g. Protodur NYY)

WARNING

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

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

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

WARNING

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

Note

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

Table 8- 32 Max. pulse frequency when a dv/dt filter compact plus VPL is used in units with a rated pulse frequency of 2 kHz

Order no. 6SL3720-...	Unit rating [kW]	Output current for a pulse frequency of 2 kHz [A]	Max. pulse frequency when a dv/dt filter is used
Line voltage 380 – 480 V 3 AC (DC link voltage 510 - 750 V DC)			
1TE32-1AAx	110	210	4 kHz
1TE32-6AAx	132	260	4 kHz
1TE33-1AAx	160	310	4 kHz
1TE33-8AAx	200	380	4 kHz
1TE35-0AAx	250	490	4 kHz

Table 8- 33 Max. pulse frequency when a dv/dt filter compact plus VPL is used in units with a rated pulse frequency of 1,25 kHz

Order no. 6SL3720-...	Unit rating [kW]	Output current for a pulse frequency of 1.25 kHz [A]	Max. pulse frequency when a dv/dt filter is used
Line voltage 380 – 480 V 3 AC (DC link voltage 510 - 750 V DC)			
1TE36-1AAx	315	605	2.5 kHz
1TE37-5AAx	400	745	2.5 kHz
1TE38-4AAx	450	840	2.5 kHz
1TE41-0AAx	560	985	2.5 kHz
1TE41-2AAx	710	1260	2.5 kHz
1TE41-4AAx	800	1405	2.5 kHz
Line voltage 500 – 690 V 3 AC (DC link voltage 675 - 1080 V DC)			
1TG28-5AAx	75	85	2.5 kHz
1TG31-0AAx	90	100	2.5 kHz
1TG31-2AAx	110	120	2.5 kHz
1TG31-5AAx	132	150	2.5 kHz
1TG31-8AAx	160	175	2.5 kHz
1TG32-2AAx	200	215	2.5 kHz
1TG32-6AAx	250	260	2.5 kHz
1TG33-3AAx	315	330	2.5 kHz
1TG34-1AAx	400	410	2.5 kHz
1TG34-7AAx	450	465	2.5 kHz
1TG35-8AAx	560	575	2.5 kHz
1TG37-4AAx	710	735	2.5 kHz
1TG38-1AAx	800	810	2.5 kHz
1TG38-8AAx	900	910	2.5 kHz
1TG41-0AAx	1000	1025	2.5 kHz
1TG41-3AAx	1200	1270	2.5 kHz

Commissioning

During commissioning, the dv/dt filter compact plus Voltage Peak Limiter must be logged on using STARTER or via the AOP30 operator panel (p0230 = 2).

Note

Parameter p0230 is reset when the factory setting is established. The parameter has to be reset when recommissioning.

8.19 L08/L09, motor reactor/2 motor reactors in series

Availability of option

This option is available for the following S120 Cabinet Modules:

- Booksize Cabinet Kits (L08/L09)
- Motor Module in 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 when long motor cables are used are reduced.

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.

CAUTION

The surface temperature of the motor reactors can exceed 80 °C.

Note

Due to limited space, only one motor reactor can be used for the Booksize Cabinet Kits with Double Motor Modules.

Motor cable lengths

Table 8- 34 Maximum motor cable lengths when using motor reactors for Booksize Cabinet Kits

Order no. 6SL3720-	Power in kW	Current in A	Maximum motor cable length in m					
			Without motor reactors		With 1 motor reactor (L08)		With 2 motor reactors (L09)	
			Shielded	Unshielded	Shielded	Unshielded	Shielded	Unshielded
2TE13-0AB0	2 x 1.6	2 x 3	50	75	100	150	-	-
2TE15-0AB0	2 x 2.7	2 x 5	50	75	100	150	-	-
2TE21-0AB0	2 x 4.8	2 x 9	50	75	135	200	-	-
2TE21-8AB0	2 x 9.7	2 x 18	50	75	160	240	-	-
1TE13-0AB0	1.6	3	50	75	100	150	-	-
1TE15-0AB0	2.7	5	50	75	100	150	-	-
1TE21-0AB0	4.8	9	50	75	135	200	-	-
1TE21-8AB0	9.7	18	70	100	160	240	320	480
1TE23-0AB0	16	30	100	150	190	280	375	560
1TE24-5AB0	24	45	100	150	200	300	400	600
1TE26-0AB0	32	60	100	150	200	300	400	600
1TE28-5AB0	46	85	100	150	200	300	400	600
1TE31-3AB0	71	132	100	150	200	300	400	600
1TE32-8AB0	107	200	100	150	200	300	400	600

Note

When motor reactors are used, the maximum motor cable lengths for Motor Modules in chassis format is 300 m (shielded) or 450 m (unshielded).

Motor connection

On Booksize Cabinet Kits with option L08 / L09 installed, the motor cables are connected to terminal block -X1 (for a Double Motor Module: -X1, -X2).

Table 8- 35 Maximum conductor cross section when using motor reactors for Booksize Cabinet Kits

Order no. 6SL3720-	Power in kW	Maximum connection cross section
2TE13-0AB0	2 x 1.6	6 mm²
2TE15-0AB0	2 x 2.7	6 mm²
2TE21-0AB0	2 x 4.8	6 mm²
2TE21-8AB0	2 x 9.7	6 mm²
1TE13-0AB0	1.6	6 mm²
1TE15-0AB0	2.7	6 mm²
1TE21-0AB0	4.8	6 mm²
1TE21-8AB0	9.7	6 mm²
1TE23-0AB0	16	6 mm²
1TE24-5AB0	24	16 mm²
1TE26-0AB0	32	16 mm²
1TE28-5AB0	46	35 mm²
1TE31-3AB0	71	95 mm²
1TE32-8AB0	107	95 mm²

8.20 L10, dv/dt filter plus Voltage Peak Limiter

Availability of option

This option is available for the following S120 Cabinet Modules:

- Chassis format Motor Modules

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 gradient to values < 500 V/µs and the typical voltage peaks to the values below (with motor cable lengths of < 300 m or < 150 m):

< 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 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 no more than 150 Hz.
- Maximum permissible motor cable lengths:
  - Shielded cables: max. 300 m/150 m
  - Unshielded cables: max. 450 m/225 m

Table 8- 36 Maximum permissible motor cable lengths for the DC link voltage 510 - 720 V DC

Shielded cable max. 300 m or unshielded cable max. 450 m	Shielded cable max. 150 m or unshielded cable max. 225 m
6SL3720-1TE32-1AA0	6SL3720-1TE41-0AA0
6SL3720-1TE32-6AA0	6SL3720-1TE41-2AA0
6SL3720-1TE33-1AA0	6SL3720-1TE41-4AA0
6SL3720-1TE33-8AA0	-
6SL3720-1TE35-0AA0	-
6SL3720-1TE36-1AA0	-
6SL3720-1TE37-5AA0	-
6SL3720-1TE38-4AA0	-

Table 8- 37 Maximum permissible motor cable lengths for the DC link voltage 675 - 1035 V DC

Shielded cable max. 300 m or unshielded cable max. 450 m	Shielded cable max. 150 m or unshielded cable max. 225 m
6SL3720-1TG28-5AA0	6SL3720-1TG37-4AA0
6SL3720-1TG31-0AA0	6SL3720-1TG38-1AA0
6SL3720-1TG31-2AA0	6SL3720-1TG38-8AA0
6SL3720-1TG31-5AA0	6SL3720-1TG41-0AA0
6SL3720-1TG31-8AA0	6SL3720-1TG41-3AA0
6SL3720-1TG32-2AA0	-
6SL3720-1TG32-6AA0	-
6SL3720-1TG33-3AA0	-
6SL3720-1TG34-1AA0	-
6SL3720-1TG34-7AA0	-
6SL3720-1TG35-8AA0	-

Commissioning

During commissioning, the dv/dt filter must be logged on using STARTER or via the AOP30 operator panel (p0230 = 2).

Note

Parameter p0230 is reset when the factory setting is established. The parameter has to be reset when recommissioning.

8.21 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 manual fuse switch disconnector as a standard feature for rated currents up to 800 A. Option L13 is needed if a switching element is also required for disconnecting the cabinet from the infeed. In this case, the contactor is activated from the connected Line Module.

- In conjunction with option L42 (for Active Line Module):
  - For a rated current < 605 A (380 to 480 V 3 AC) or < 575 A (500 to 690 V 3 AC), the main contactor is a standard feature in the Active Interface Module of the Active Line Module.
  - For a rated current of 605 A (380 to 480 V 3 AC) or 575 A and 730 A (500 to 690 V 3 AC), option L13 (main contactor) is a standard feature in the Line Connection Module.
  - For a rated current > 605 A (380 to 480 V 3 AC) or > 730 A (500 to 690 V 3 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.

⚠ WARNING
Do not switch the main contactor unless it is disconnected from the power supply.

X50 "main contactor" checkback contact

Table 8- 38 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. switching capacity: 250 VA Required minimum load: ≥ 1 mA
5	NC	
6	COM	
Max. connectable cross-section: 4 mm²		

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

8.22 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.

8.23 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 draw-out circuit breaker features a visible isolating distance.

X50 "circuit breaker" checkback contact

Table 8- 39 Terminal block X50 "Circuit-breaker" checkback contact

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

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

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Note

Detailed and comprehensive instructions and information for the circuit breaker, as well as the factory-installed options, can be found in the accompanying operating instructions, These operating instructions are available as additional documentation on the customer DVD supplied with the device.

8.24 L34, output-side circuit breaker

8.24.1 General information

Availability of option

This option is available for the following S120 Cabinet Modules:

- Chassis format Motor Modules

Description

The option L34 (output-side circuit breaker) can be used to disconnect the motor terminals from the converter.

It is pre-wired and installed in a separate cabinet.

WARNING

At the motor terminals, a rotating, permanent-field synchronous motor generates a voltage that is proportional to the speed. The motor terminal voltage is always applied to the converter output terminals, the DC link and the connected components. Option L34 can be used to isolate a circuit in the event of a fault, or for maintenance work.

Note

Detailed and comprehensive instructions and information for the circuit breaker can be found in the supplementary option description. This description is available as additional documentation on the customer DVD supplied with the device.

The Option L34 (output-side circuit breaker) is required in the following applications where permanent-field motors are used:

- Drives with a high moment of inertia, which require a longer period of time to coast down and generate a voltage at the motor terminals during this time.
- Mechanically coupled auxiliary drives, which can be driven together by a main drive.
- When carrying out maintenance and repairs on a converter if the motor cannot be stopped safely (e.g. using a mechanical brake).
- During high field weakening in conjunction with a suitable level of overvoltage protection, which suppresses the applied overvoltage effectively until the switch trips.

Features

Option L34 is completely pre-wired. It is controlled using a built-in TM31 Terminal Module. To control this, the parameterization specified in the following Chapter "Parameterization" must be made during commissioning.

Note

After setting the parameters, the user must ensure that the switch is operating correctly.

For this reason, the output-side breaker is automatically controlled via the converter.

To close the output-side breaker, the following conditions must be fulfilled:

Note

The "ON" pushbutton directly located on the output switch is only available with the full functional scope, if:

- There is no alarm or fault available, and
- The customer remote-OFF is set to enable.

- There must be no faults on the Motor Module.
- There must be no OFF command active on the Motor Module.
- The Motor Module must receive an ON command.
- Pre-charging of the Motor Module must be complete.

The output-side breaker is opened under the following conditions:

- There is an active fault on the Motor Module.
- The power supply at the auxiliary power system for option L34 (230 V AC/24 V DC) fails.
- The local “OFF” button on the output-side breaker is pressed.

Note

Pressing the “OFF” button directly on the output-side breaker will switch the Motor Module off (pulse suppression). The converter displays "External fault 3". The breaker can be closed again only by sending a new ON command via the Motor Module.

Note

To reduce the number of switching cycles, the output-side breaker will not open if the Motor Module receives an “OFF” command (OFF1, OFF2, OFF3).

If they are available, remote off switches (for optional use by customers) for disconnecting the output-side breaker must be connected accordingly via the undervoltage coil.

WARNING

The user should note and monitor the permissible number of switching cycles specified for the output-side breaker. Once the permissible number of switching cycles has been reached, it is imperative that breaker maintenance be carried out. Otherwise, it can no longer be guaranteed that the breaker will function properly in the event of a fault.

8.24.2 Switching cycles for the output-side circuit breaker

Table 8- 40 Switching cycles for the output-side circuit breaker, 510 V - 750 V DC

Order number 6SL3720-	Unit rating [kW]	Rated output current [A]	Switching cycles with pulse inhibit	Switching cycles under load (without pulse inhibit)
1TE32-1AAx	110	210	20000	10000
1TE32-6AAx	132	260	20000	10000
1TE33-1AAx	160	310	20000	10000
1TE33-8AAx	200	380	20000	10000
1TE35-0AAx	250	490	10000	5000
1TE36-1AAx	315	605	10000	5000
1TE37-5AAx	400	745	10000	3000
1TE38-4AAx	450	840	3000	1500
1TE41-0AAx	560	985	3000	1500
1TE41-2AAx	720	1260	3000	1500
1TE41-4AAx	800	1405	3000	1500

Table 8- 41 Switching cycles for the output-side circuit breaker, 675 V - 1080 V DC

Order number 6SL3720-	Unit rating [kW]	Rated output current [A]	Switching cycles with pulse inhibit	Switching cycles under load (without pulse inhibit)
1TH28-5AAx	75	85	20000	10000
1TH31-0AAx	90	100	20000	10000
1TH31-2AAx	110	120	20000	10000
1TH31-5AAx	132	150	20000	10000
1TH31-8AAx	160	175	20000	10000
1TH32-2AAx	200	215	20000	10000
1TH32-6AAx	250	260	20000	10000
1TH33-3AAx	315	330	20000	10000
1TH34-1AAx	400	410	10000	5000
1TH34-7AAx	450	465	10000	5000
1TH35-8AAx	560	575	10000	5000
1TH37-4AAx	710	735	10000	3000
1TH38-1AAx	800	810	3000	1500
1TH38-8AAx	900	910	3000	1500
1TH41-0AAx	1000	1025	3000	1500
1TH41-3AAx	1200	1270	3000	1500

8.24.3 Overview diagram of option L34

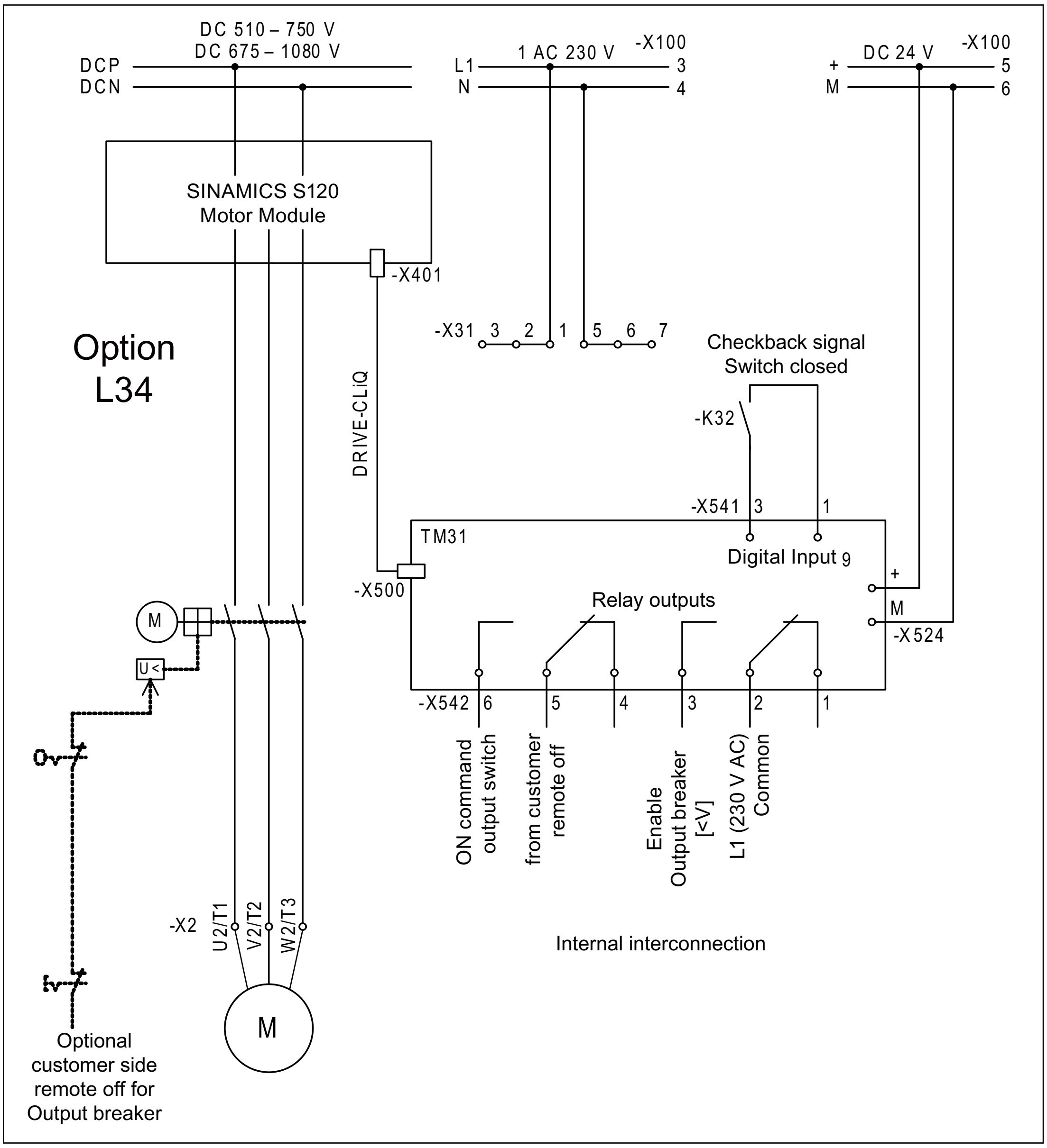


Figure 8-24 Overview diagram of option L34

8.24.4 Parameter assignment

8.24.4.1 Parameterization with script

A script can be used for the automatic parameterization, which automatically makes the parameter settings in STARTER. The script and the handling instructions for executing the script are provided on the customer DVD, which is supplied with the device when it is shipped.

Note

Script

The script and the handling instructions for executing the script are provided on the customer DVD in folder "99 SOFTWARE\SCRIPT_option_L34". The customer DVD is supplied with the device when it is shipped.

8.24.4.2 Parameterization with free function blocks

The free function blocks are used for the parameterization described in this section. You must start by activating them.

Activating the free function blocks

To be able to work with the free function blocks, they must first be activated/enabled:

- If you are not certain that the project in the STARTER corresponds to the drive configuration, you should start with an upload (load data to PG).
- In Offline mode -> Right-click the drive object -> Properties -> Activate the “Free function blocks” in the “Drive Properties” interactive screenform under “Select function modules”.
- You will then need to perform a download (load data to the target device) so that the “Free function blocks” function module is activated in the drive.

Setting the sampling time for run-time group 0 of the free function blocks

To activate the interconnection, parameterization (in the expert list) must be carried out as follows (in this example, it has been assumed that the drive is called “Drive_1” in the project navigator):

Table 8- 42 Setting the sampling time for run-time group 0 of the free function blocks

Parameterization	Description
(Drive_1) p20000[0] = 3	The sampling time of the free function blocks run-time group 0 is classified as 3 (= 3 x r20002).

Interconnection for “Enable output-side breaker”

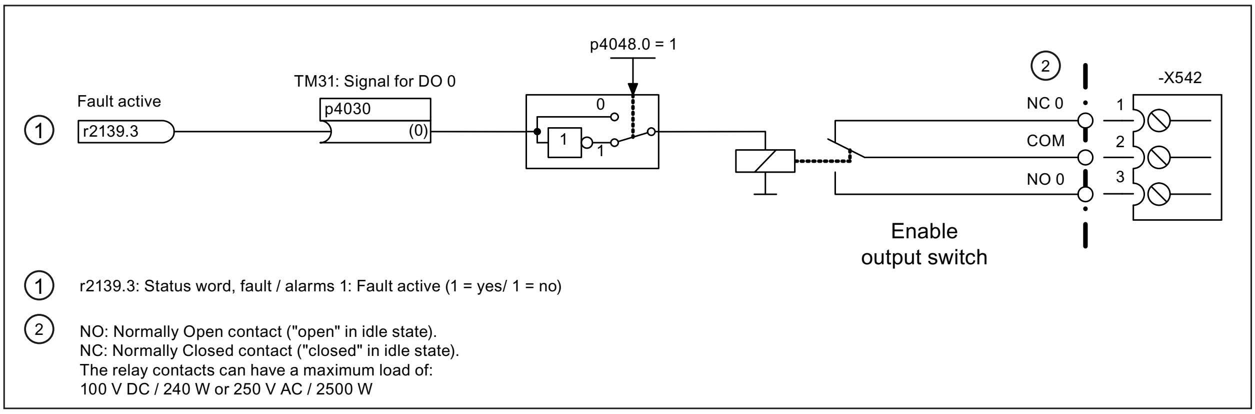


Figure 8-25 Interconnection for “Enable output-side breaker”

The breaker must also trip in the event of a converter fault. This is achieved using the specified interconnection.

To activate the interconnection, parameterization (in the expert list) must be carried out as follows (in this example, it has been assumed that the drive is called “Drive_1” in the project navigator):

Table 8- 43 Parameterization for the interconnection for "Enable output-side breaker"

Parameterization	Description
(TM31) p4030 = (Drive_1) r2139.3	The "Fault active" drive signal is output at digital output 0 (DO 0) of the TM31.
(TM31) p4048.0 = 1 = inverted	Digital output 0 (DO 0) is inverted.

Interconnection for “Enable operation”

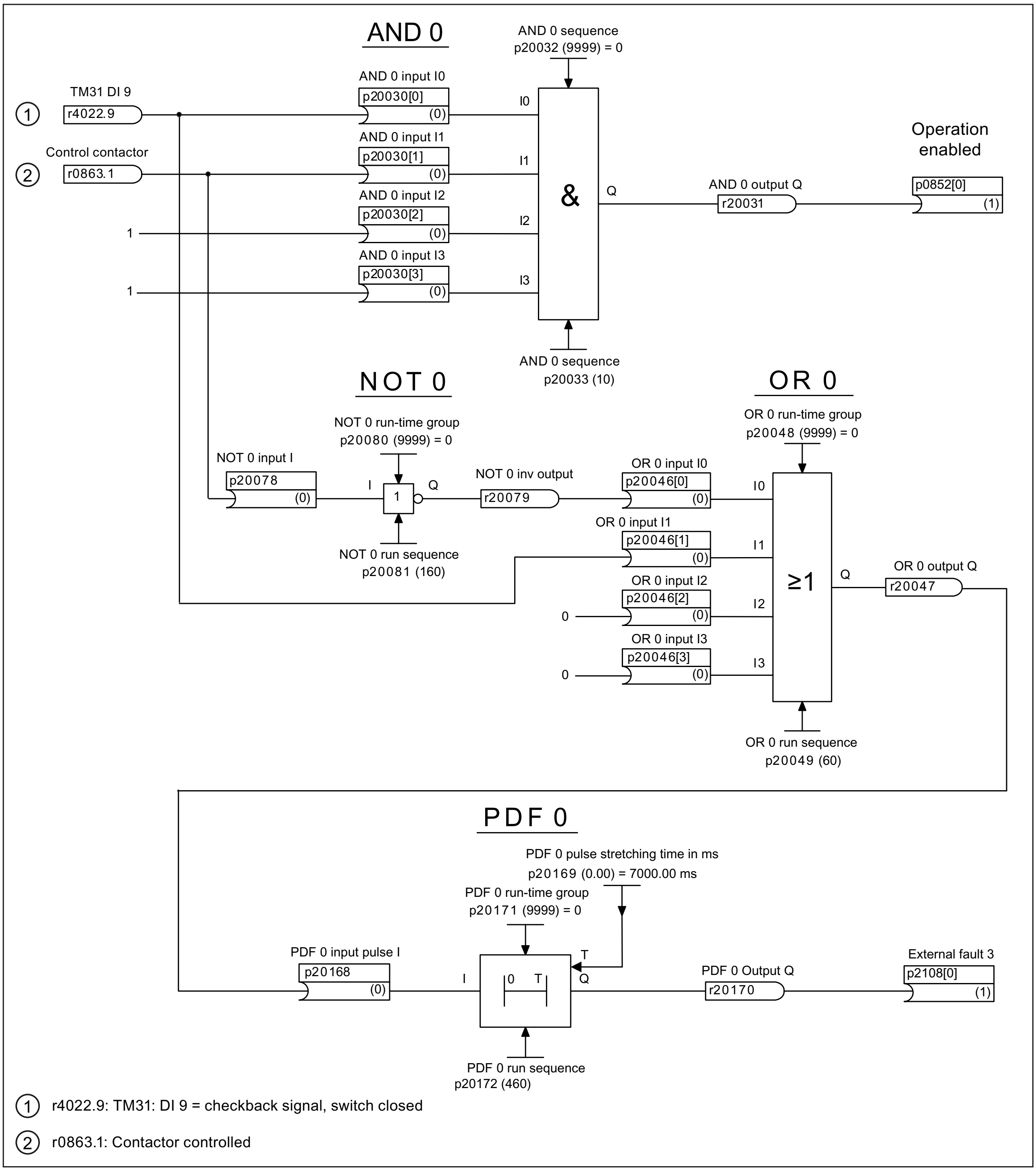


Figure 8-26 Interconnection for “Enable operation”

You must make sure that the converter only enables the pulses when the breaker is closed. This is achieved using the specified interconnection.

To activate the interconnection, parameterization (in the expert list) must be carried out as follows (in this example, it has been assumed that the drive is called “Drive_1” in the project navigator):

Table 8- 44 Parameterization for the interconnection for "Operation enabled"

Parameterization	Description
(Drive_1) p20161 = 0	The "switch on delay 0 (PDE 0)" function block is assigned to run-time group 0.
(Drive_1) p20158 = (Drive_1) r0863.1	Input pulse I of the function block "Switch on delay 0 (PDE 0)" of the drive is interconnected using the "control contactor" drive signal.
(Drive_1) p20159 = 4000.00	The pulse delay time of function block "Switch on delay 0 (PDE 0) of the drive is set to 4000.00 ms.
(Drive_1) p20146 = 0	The "Pulse generator 1 (MFP 1)" function block is assigned to run-time group 0.
(Drive_1) p20143 = (Drive_1) r20160	Input pulse I of function block "Pulse generator 1 (MFP 1)" is interconnected with output Q of function block "Switch on delay 0 (PDE 0)".
(Drive_1) p20144 = 5000.00	The pulse duration of the "Pulse generator 1 (MFP 1)" function block is set to 5000.00 ms.
(Drive_1) p20048 = 0	The "OR 0" function block is assigned to run-time group 0.
(Drive_1) p20046[0] = (Drive_1) r20145	Output pulse Q of function block "Pulse generator 1 (MFP 1)" of the drive is interconnected at input I0 of the "OR 0" function block.
(Drive_1) p20046[1] = (TM31) r4022.9	Input signal DI9, terminal X541.3 of TM31 is interconnected at input I1 of function block "OR 0".
(Drive_1) p20046[2] = 0	A "0" signal is interconnected at input I2 of function block "OR 0"
(Drive_1) p20046[3] = 0	A "0" signal is interconnected at input I3 of function block "OR 0".
(Drive_1) p20032 = 0	The "AND 0" function block is assigned to run-time group 0.
(Drive_1) p20030[0] = (Drive_1) r20047	Output signal Q of function block "OR 0" of the drive is interconnected at input I0 of function block "AND 0" of the drive.
(Drive_1) p20030[1] = (Drive_1) r0863.1	The "control contactor" signal of the drive is interconnected at input I1 of the "AND 0" function block of the drive.
(Drive_1) p20030[2] = 1	A "1" signal is interconnected at input I2 of function block "AND 0" of the drive.
(Drive_1) p20030[3] = 1	A "1" signal is interconnected at input I3 of function block "AND 0" of the drive.
(Drive_1) p0860[0] = (Drive_1) r20031	The output signal of the "AND 0" function block of the drive is used for the "Line contactor feedback" signal of the drive.
(Drive_1) p0852[0] = (TM31) r4022.9	Input signal DI9, terminal X541.3 of TM31 is used for the signal "enable operation" of the drive.
(Drive_1) p0861 = 5000	The monitoring time of the line contactor is set to 5000 ms.

Interconnection for “ON command”

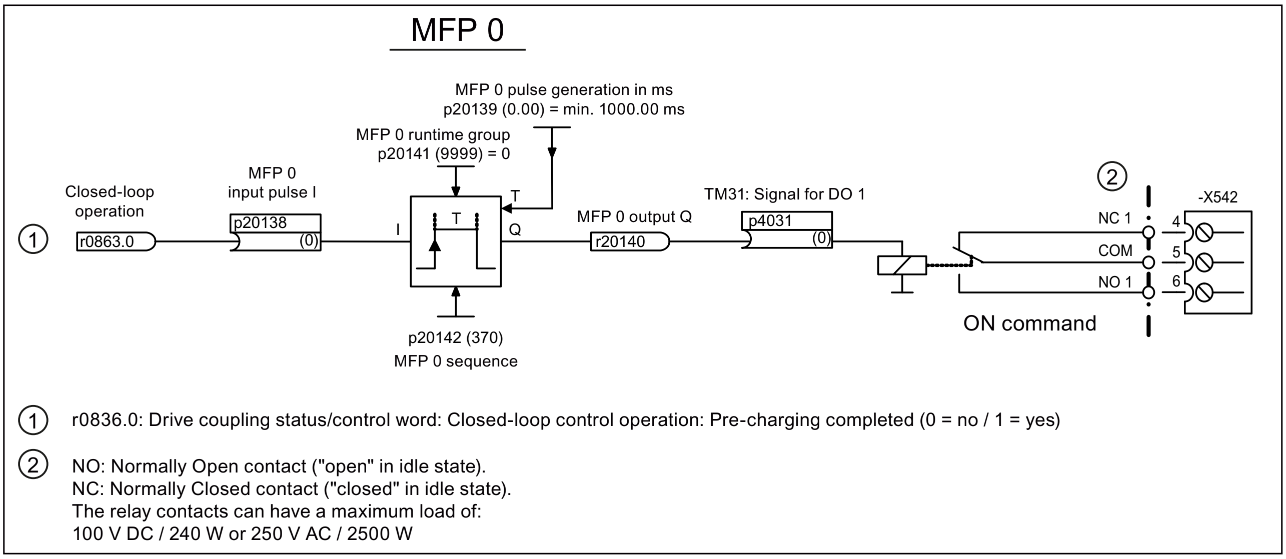


Figure 8-27 Interconnection for “ON command”

The drive must only be switched on when a DC link voltage is available. This is achieved using the specified interconnection.

To activate the interconnection, parameterization (in the expert list) must be carried out as follows (in this example, it has been assumed that the drive is called “Drive_1” in the project navigator):

Table 8- 45 Parameterization for the interconnection for “On command”

Parameterization	Description
(Drive_1) p20141 = 0	The "Pulse generator 0 (MFP 0)" function block is assigned to run-time group 0.
(Drive_1) p20138 = (Drive_1) r0863.0	The "Control operation" signal of the drive is interconnected at the input of the “Pulse generator 0 (MFP 0)” function block.
(Drive_1) p20139 = 5000.00	The pulse duration of the "Pulse generator 0 (MFP 0)" function block is set to 5000.00 ms.
(TM31) p4031 = (Drive_1) r20140	The output signal of the “Pulse generator 0 (MPF 0)” function block of the drive is output to digital output 1 (DO 1) of the TM31.

8.24.4.3 Parameterization with DCC (Drive Control Chart)

The parameter settings described in section "Parameterization with free function blocks" can also be achieved using DCC. For this purpose the interconnections shown must be simulated with the corresponding DCC blocks.

8.25 L37, DC interface incl. pre-charging input circuit for the relevant DC link capacitance

8.25.1 General information

Availability of option

This option is available for the following S120 Cabinet Modules:

- Booksize Cabinet Kits
- Chassis format Motor Modules

Description

If the Motor Module is to be disconnected or reconnected to the DC link of a drive line-up while the other Motor Modules and Line Modules remain in operation, this can be accomplished via the DC interface.

8.25.2 DC interface incl. pre-charging for Booksize Cabinet Kits

8.25.2.1 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:

DANGER

Once the DC busbar and the Motor Module in booksize format have been disconnected by means of the fuse switch disconnector (-Q7), the following 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 V AC via the auxiliary power supply system or via direct infeed for SITOP and fan supply
- 24 V DC on the auxiliary power supply system (electronics power supply)
- On the motor connection (e.g. regenerative voltage due to residual speed)

⚠ WARNING

The cabinet units are operated with high voltages.

All connection work must be carried out when the cabinet is de-energized.

All work on the cabinet must be carried out by trained personnel only.

Work on an open cabinet must be carried out with extreme caution because external supply voltages may be present. The power and control terminals may be live even when the motor is not running.

Due to the DC link capacitors, dangerously high voltage levels are still present inside the cabinet up to 5 minutes after it has been disconnected. For this reason, the cabinet should not be opened until a reasonable period of time has elapsed.

For this reason, you must take the following safety precautions when carrying out work on the Cabinet Module after the DC interface has been switched off:

- Observe the "five safety rules" for all electrical work.
- Only commission qualified specialists to carry out the work.
- Ensure that no voltage is present at the measuring points provided in the cabinet.
- Check that there is no voltage on 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 V DC power supply.

NOTICE

You must observe the applicable legal regulations when carrying out all work.

⚠ DANGER

The following voltages are normally present on the auxiliary power supply system:

- 380 to 480 V 2 AC for fan supply
- 230 V 1 AC
- 24 V DC for electronics power supply

8.25.2.2 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.

⚠ CAUTION
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.

8.25.2.3 Commissioning the DC interface when option K90 is being used

With option K90, a checkback contact from the fuse switch disconnector is factory-linked to digital input 3 of the Control Unit.

CAUTION
If changes are made to the factory-set parameters, you must verify that the "Infeed ready" checkback signal is connected to digital input 3 on the Control Unit (p0864 = r722.3). If parameter p0864 is not wired to the checkback signal, it is possible to operate the switch under load. This can shorten the service life of the switch.

8.25.2.4 Commissioning the DC interface without option K90

If the cabinet does not contain a Control Unit (option K90), 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 24 V DC supply for the checkback 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:

[Drive_1] p0864 = [CU] r722.3

The interconnection can be made with the STARTER commissioning tool or the AOP30 operator panel (option K08).

CAUTION
If parameter p0864 is not wired to the checkback signal, it is possible to operate the switch under load. This can shorten the service life of the switch.

Note

The digital input parameter assignment is described in the List Manual and S120 Commissioning Manual.

8.25.3 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.

Block diagram

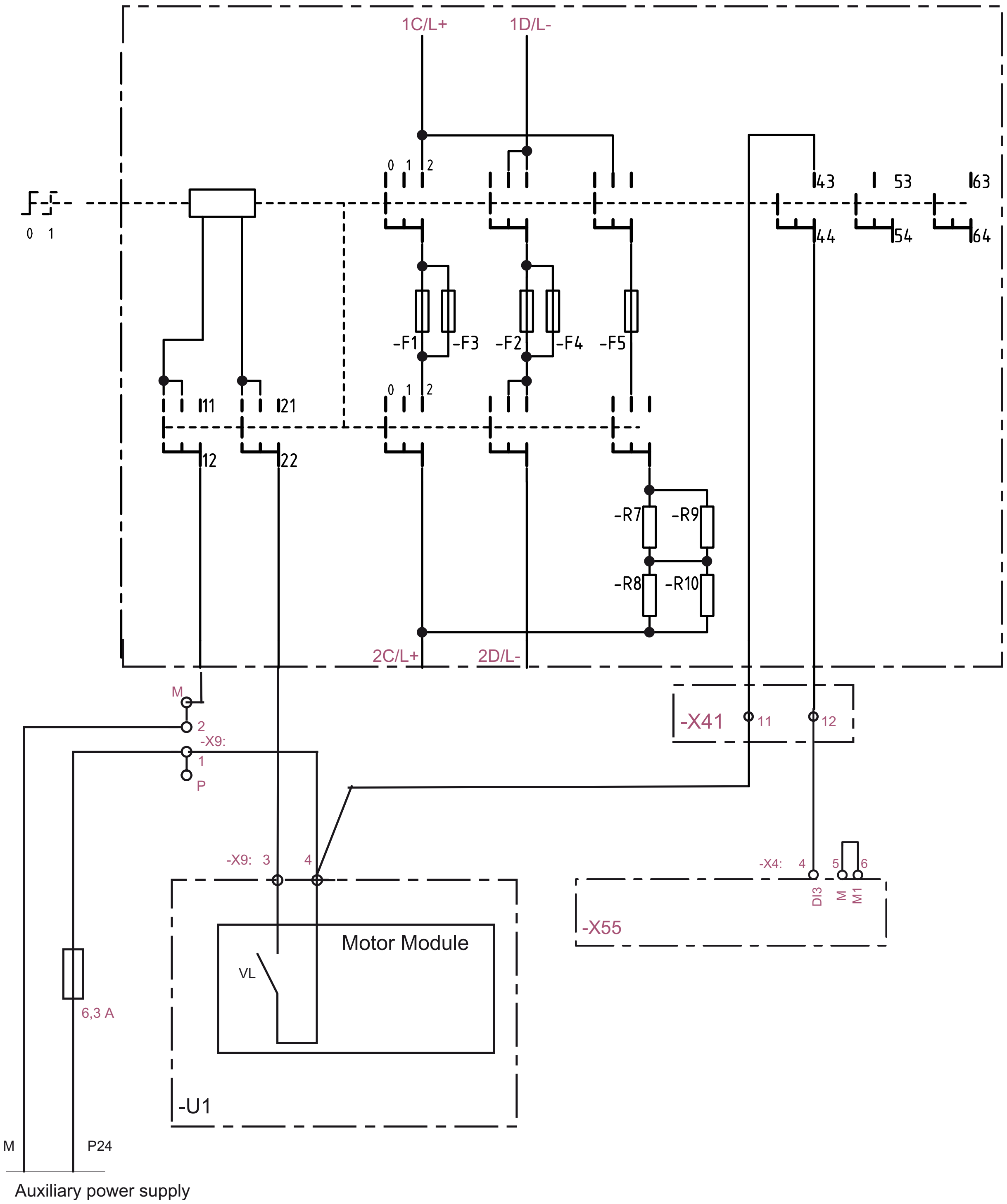


Figure 8-28 Block diagram, example for frame size JX

This block diagram shows the DC interface embedded in a Cabinet Module in chassis format. 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.

The circuit diagram shows the wiring without additional options.

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.

8.25.3.1 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:

⚠ DANGER

Once the DC busbar and the Motor Module have been disconnected using the DC interface (-Q7), the following voltages may be present in the Cabinet Module:

- Up to 1200 V on the DC busbar (protected against accidental contact)
- Line voltage (3 AC 380 V ... 480 V or 500 V ... 690 V) on the auxiliary power supply system or 2 AC 230 V downstream of the transformers for the fan supply
- Up to 230 V AC on the optional mounting locations
- 24 V DC on the auxiliary power supply system (electronics power supply)
- On motor connection -X2 (e.g. regenerative voltage due to residual speed)

⚠ WARNING

The cabinet units are operated with high voltages.
All connection work must be carried out when the cabinet is de-energized.
All work on the cabinet must be carried out by trained personnel only.

Work on an open cabinet must be carried out with extreme caution because external supply voltages may be present. The power and control terminals may be live even when the motor is not running.

Due to the DC link capacitors, dangerously high voltage levels are still present inside the cabinet up to 5 minutes after it has been disconnected. For this reason, the cabinet should not be opened until a reasonable period of time has elapsed.

For this reason, you must take the following safety precautions when carrying out work on the Cabinet Module after the DC interface has been switched off:

- Observe the "five safety rules" for all electrical work:
  - Disconnect from power supply.
  - Protect against reconnection.
  - Make sure that the equipment is de-energized.
  - Ground and short-circuit.
  - Cover or enclose adjacent components that are still live.
- Only commission qualified specialists to carry out the work.
- Verify that the equipment is de-energized at the measuring points provided in the cabinet (see figures below).
- Check that there is no voltage on the motor connections.
- You must avoid coming into contact with the DC busbar when replacing a power block.
- When replacing components, make sure that no screws or small parts fall into the cabinet.
- Remove the fan fuse and fuse for the 24 V DC power supply.

NOTICE
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.

8.25.3.2 Accessibility of the DC connection to the Motor Module

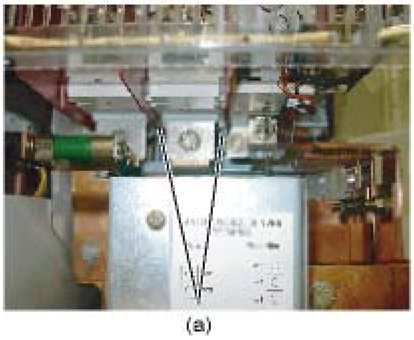


Figure 8-29 Front view

Figure 8-30 Side view (no 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.

8.25.3.3 Measuring points for verifying isolation from supply

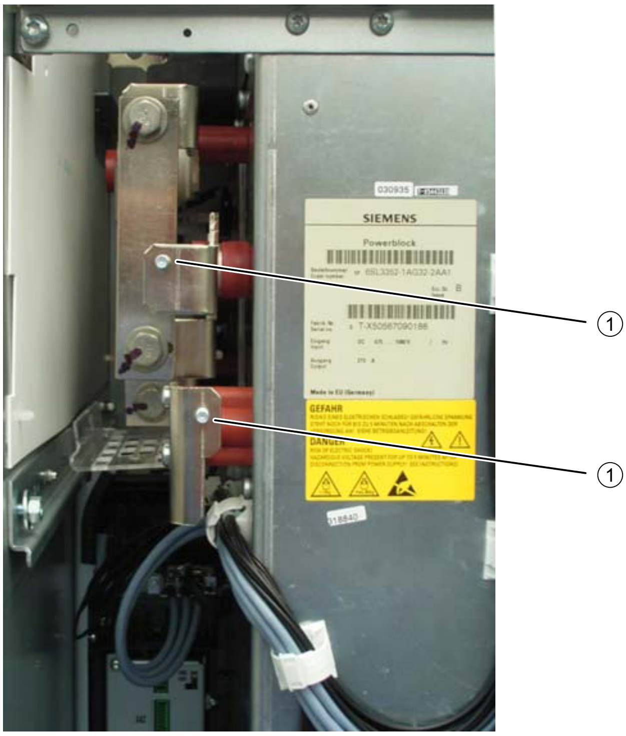


Figure 8-31 Measuring points at top, example for frame sizes FX and GX

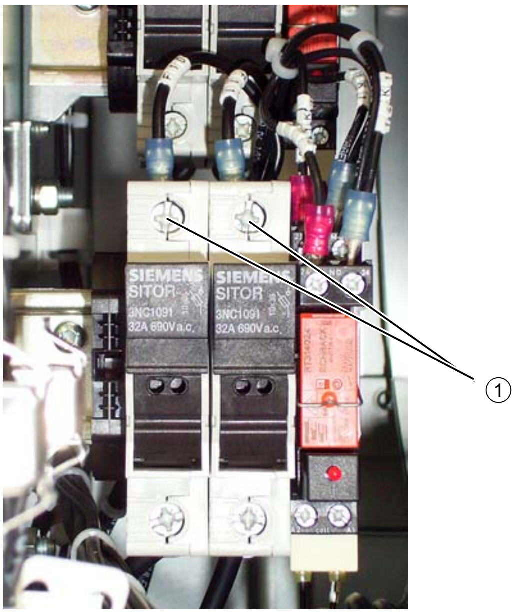


Figure 8-32 Measuring point, auxiliary power supply, fan supply bottom, frame sizes FX and GX

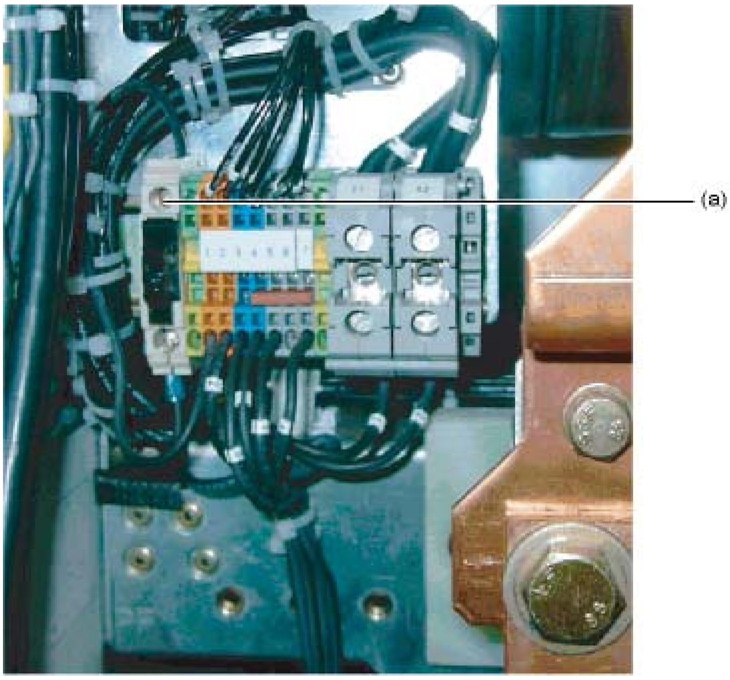


Figure 8-33 Measuring point, 24 V DC auxiliary power supply, frame sizes FX and GX

Take into account other voltages on optional components and refer to the circuit diagrams.

DANGER
The following voltages are normally present on the auxiliary voltage busbar system: • 380 to 480 V 2 AC or 500 to 690 V 2 AC for fan supply • 230 V 1 AC • 24 V DC for electronics power supply

8.25.3.4 Installation

The DC interface is pre-connected and installed at the factory. Only the handle is supplied with the cabinet and must be mounted before commissioning the DC interface.

- Open the cabinet door.
- Insert the handle for the DC interface in the cut-out section provided in the cabinet door.
- From the inside of the door, screw the four screws provided into the holes.

CAUTION
The screws must only be tightened by hand. If the screws are too tight, this will prevent the handle from working properly.

8.25.3.5 DC interface, principle of operation

Table 8- 46 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.
Pre-charging	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.

NOTICE

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"!

8.25.3.6 Commissioning the DC interface when option K90 is being used

With option K90, a checkback contact from the switch is factory-linked to digital input 3 of the Control Unit.

CAUTION
If changes are made to the factory-set parameters, you must verify that the "Infeed ready" checkback signal is connected to digital input 3 on the Control Unit (p0864 = r722.3). If parameter p0864 is not wired to the checkback signal, it is possible to operate the switch under load. This can shorten the service life of the switch.

8.25.3.7 Commissioning the DC interface without option K90

If the cabinet does not contain a Control Unit (option K90), 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).

CAUTION
If parameter p0864 is not wired to the checkback signal, it is possible to operate the switch under load. This can shorten the service life of the switch.

NOTICE
To switch from the "Pre-charging" to the "1 (Operation)" position, a switching current of 4 A/24 V DC is required for 30 ms. This must be provided via the auxiliary power supply and taken into account during dimensioning (see the block diagram above).

Note

When activating digital inputs, note the guidelines provided in the List Manual and S120 Commissioning Manual.

8.26 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 installed upstream of the main breaker in all three line phases of the infeed.

The transformers have an accuracy class of 1.0. The secondary current is 1 A maximum.

The measuring connections for the current transformers are routed in the Line Connection Module to terminal block -X60.

Transformation ratio of the current transformer in the Line Connection Module

The assignment of the order numbers of the Line Connection Modules to the transformation ratios of the current transformers is shown in the following table.

Order No.	V_{IN}	Transformation ratio
6SL3700-0LE32-5AA3	380 … 480V AC	400/1
6SL3700-0LE34-0AA3	380 … 480V AC	400/1
6SL3700-0LE36-3AA3	380 … 480V AC	800/1
6SL3700-0LE38-0AA3	380 … 480V AC	800/1
6SL3700-0LE41-0AA3	380 … 480V AC	2000/1
6SL3700-0LE41-3AA3	380 … 480V AC	2000/1
6SL3700-0LE41-6AA3	380 … 480V AC	2000/1
6SL3700-0LE42-0AA3	380 … 480V AC	4000/1
6SL3700-0LE42-0BA3	380 … 480V AC	4000/1
6SL3700-0LE42-5BA3	380 … 480V AC	4000/1
6SL3700-0LE43-2BA3	380 … 480V AC	4000/1
6SL3700-0LG32-8AA3	500 … 690V AC	400/1
6SL3700-0LG34-0AA3	500 … 690V AC	800/1
6SL3700-0LG36-3AA3	500 … 690V AC	800/1
6SL3700-0LG38-0AA3	500 … 690V AC	800/1
6SL3700-0LG41-0AA3	500 … 690V AC	2000/1
6SL3700-0LG41-3AA3	500 … 690V AC	2000/1
6SL3700-0LG41-6AA3	500 … 690V AC	2000/1
6SL3700-0LG42-0BA3	500 … 690V AC	4000/1
6SL3700-0LG42-5BA3	500 … 690V AC	4000/1
6SL3700-0LG43-2BA3	500 … 690V AC	4000/1

X60 line current transformer

Table 8- 47 Terminal block X60

Terminal	Designation	Technical specifications
1	-T110: k/S1	Current transformer on phase U1/L1
2	-T110: l/S1	
3	-T111: k/S1	Current transformer on phase V1/L2
4	-T111: l/S1	
5	-T112: k/S1	Current transformer on phase W1/L3
6	-T112: l/S1	
Max. connectable cross-section: 2.5 mm²		

8.27 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 means that the Line Connection Module is adjusted for connection to an Active Line Module.

If a main contactor (option L13) is required for correct functioning in the Line Connection Module, this contactor is automatically included.

Option L43, Line Connection Module for Basic Line Modules

This option means that the Line Connection Module is 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 (option L13) is required for correct functioning in the Line Connection Module, this contactor is automatically included.

8.28 L45, EMERGENCY STOP pushbutton 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 block. From here, the EMERGENCY OFF pushbutton can be integrated into the plant-side EMERGENCY OFF chain.

Note

The EMERGENCY OFF function must be ensured on the plant side.

X120 checkback contact "EMERGENCY OFF pushbutton in the cabinet door"

Table 8- 48 Terminal block X120

Terminal	Designation [1)]	Technical data
1	NC	Checkback contacts of EMERGENCY OFF pushbutton in the cabinet door max. load current: 10 A Max. switching voltage: 250 V AC Max. switching capacity: 250 VA Required minimum load: ≥ 1 mA
2		
3	NC (internal)	
4		
Max. connectable cross-section: 4 mm²		

[1)] NC: NC contact

8.29 L46/L47, grounding switch upstream/downstream of main breaker

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules (frame sizes KL and LL)

Description

The grounding switch short-circuits the incoming supply line to ground for servicing. It is engaged manually by means of a rotary actuator and ensures, for example, safe isolation from supply in the Cabinet Module during servicing.

Two versions are available and can be supplied at the same time. Version 1 establishes a ground connection for the connected power lines, and Version 2 grounds the cabinet's internal components located downstream of the circuit breaker.

8.29.1 Grounding switch upstream of main breaker (option L46)

The grounding switch upstream of the internal main breaker shorts the supply network to ground.

DANGER

Plant-side measures must be taken to prevent the grounding switch from engaging when the voltage is applied. For this purpose, the checkback signal "Interruption of higher-level switches" must be connected to the higher-level switching equipment and must trigger immediate opening of the upstream main breaker, if necessary.

When the grounding switch is engaged, it must not be possible to switch in the power supply.

Note

The signals required for interlocking are available on the terminal block.

X70 "Grounding switch upstream of internal main breaker"

Table 8- 49 Terminal block X70

Terminal	Designation [1)]	Technical data
1	L1	Grounding switch enable 230 V AC / 0.1 A
2	N	
3	NC	"Interruption of higher-level switches" checkback signal Leading contact Max. load current: 3 A Max. switching voltage: 250 V AC
4	NO	
5	COM	
6	NC	"Switch actuated" checkback signal Max. load current: 3 A Max. switching voltage: 250 V AC
7	NO	
8	COM	
Max. connectable cross-section: 2.5 mm²		

1) NC: Normally-closed contact, NO: Normally-open contact, COM: Center contact

8.29.2 Grounding switch downstream of main breaker (option L47)

The grounding switch downstream of the internal main breaker shorts the supply network to ground.

⚠ DANGER

In this case, the grounding switch and the main breaker of the Line Connection Module are interlocked electrically. This ensures that when the main breaker is closed, it is opened again when the grounding switch is switched on.

If the grounding switch is engaged, it is interlocked to ensure that the main breaker cannot be switched in.

X71 terminal block "Grounding switch downstream of internal main breaker"

Table 8- 50 Terminal block X71

Terminal	Designation [1]	Technical data
1	L1	Grounding switch enable 230 V AC / 0.1 A
2	N	
3	NC (reserved, do not use)	Circuit breaker interlock ("Grounding switch open")
4	NC (reserved, do not use)	
5	COM (reserved, do not use)	
6	NC	"Switch actuated" checkback signal
7	NO	Max. load current: 3 A
8	COM	Max. switching voltage: 250 V AC
Max. connectable cross-section: 2.5 mm²		

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

8.30 L51, holder for ARC detector

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
- Chassis format Motor Modules
- Central Braking Modules
- Auxiliary Power Supply Modules

Description

Special holders have been developed to enable monitoring of the cabinet system for arcing faults. The VA1DA1 arc systems from Vamp Ldt. as well as TVOC from ABB are supported by these holders.

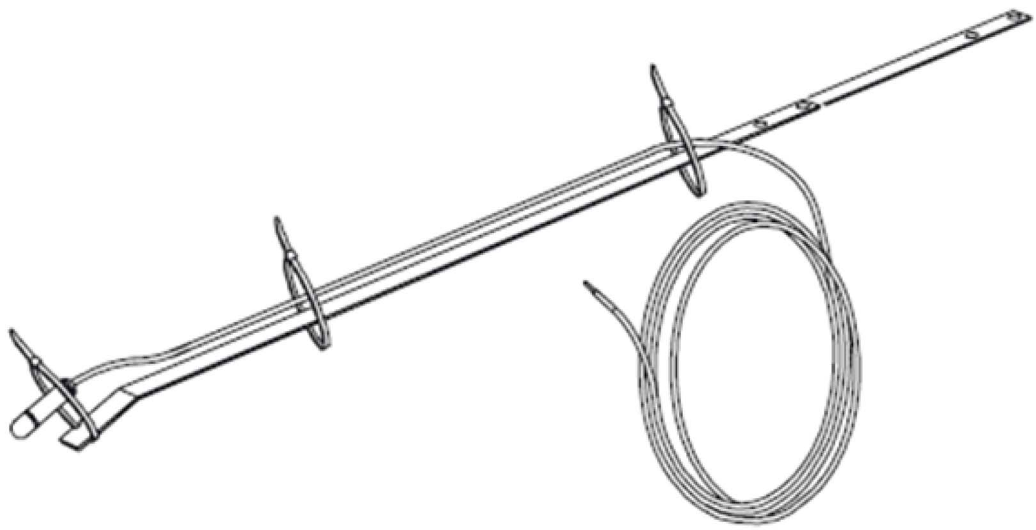


Figure 8-34 Option L51, holder for arc sensor (ARC detection)

If ARC detectors are to be used, factory-fitted holding plates are installed in the cabinet at points defined during configuration.

The ARC processing units should preferably be centrally mounted. Line Connection Modules or variable units are ideal for this.

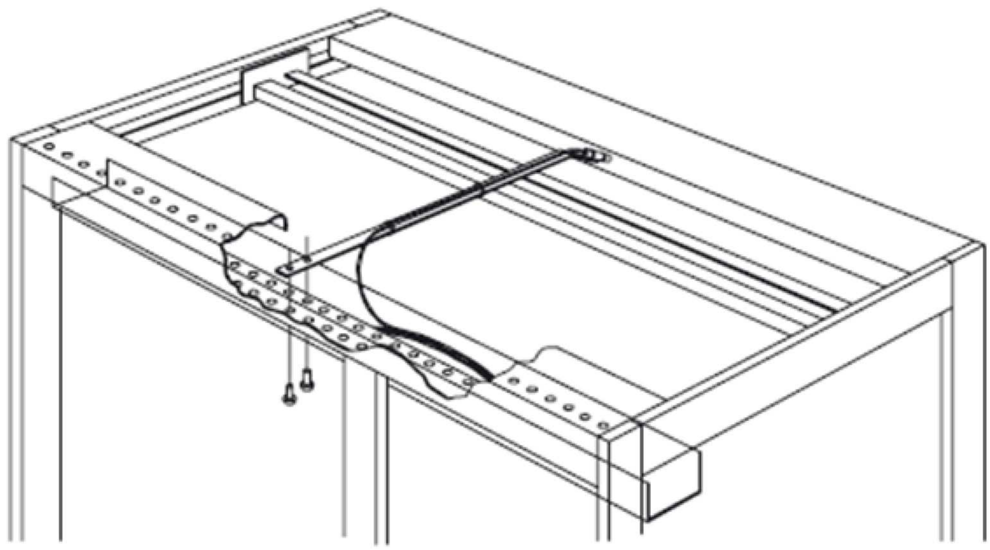


Figure 8-35 Option L51, holder for arc sensor secured in the cabinet

8.31 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
- Chassis format Motor Modules
- Auxiliary Power Supply 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 400 mm and 600 mm cabinets. Two 100 W heaters (-E240, -E241) are used for cabinet widths of 800 mm or higher.

The power supply (110 to 230 V AC) must be provided externally and protected with a fuse of up to 10 A.

X240 connection for cabinet anti-condensation heating

Table 8- 51 Terminal block X240

Terminal	Designation	Technical data
1	L1	110 to 230 V AC voltage supply Current demand: - min.: approx. 0.43 A (for 230 V AC, 100 W) - max.: approx. 1.8 A (for 110 V AC, 200 W)
2	N	
3	PE	Protective conductor
Max. connectable cross-section: 4 mm²		

⚠ DANGER
Since the voltage is supplied from an external source, voltage may still be present in the cabinets even when the main breakers in all units are open. You must observe the "five safety rules" when carrying out maintenance work.

8.32 L61/L62, L64/L65, braking units

8.32.1 General information

Availability of option

This option is available for the following S120 Cabinet Modules:

- Basic Line Modules
- Smart Line Modules
- Active Line Modules
- Chassis format Motor Modules

Description

Braking units may be required for drives that support regenerative operating conditions 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.

8.32.2 Interfaces

Connection for the braking resistor

The braking resistor is connected directly to the Braking Module in the Motor Module, Basic Line Module, Smart Line Module and Active Line Module.

Table 8- 52 Connection for the braking resistor

Terminal	Designation
R1	Braking resistor connection R+
R2	Braking resistor connection R-

Recommended connection cross sections:

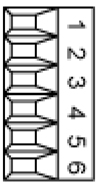
- For option L61/L64 (25 kW): 35 mm²
- For option L62/L65 (50 kW): 50 mm²

Note

For strain relief, the cables must be clamped on the cable propping bar (C-type mounting bar).

X21 digital inputs/outputs

Table 8- 53 Terminal strip X21

	Terminal	Designation [1)]	Technical data
	1	Shield	Shield connection for terminals 2 to 6
	2	0 V	High signal level: +15 to 30 V Current consumption: 2 to 15 mA Low signal level: -3 V to 5 V
	3	DI inhibit input	
	4	0 V	Voltage: 24 V DC Load current: 0.5 mA to 0.6 mA
	5	DO fault output	
	6	+24 V	Voltage: +18 to 30 V Typical current consumption (intrinsic consumption): 10 mA at 24 V DC
Max. connectable cross-section 1.5 mm^2			

1) DI: digital input; DO: digital output

The signals for terminal block -X21 are routed at the factory to customer interface -X55 (maximum connectable cross section 2.5 mm^2):

- Jumper from -X21:2 to -X55-X5:12 (ground)
- Jumper from -X21:3 to -X55-X5:10 (DI/DO14)
- Jumper from -X21:5 to -X55-X5:1 (DI4)
- Jumper from -X21:6 to -X55-X5:7 (DI/DO12)

Note

Applying a high signal level to "DI inhibit input" inhibits the Braking Module. On a falling edge, pending error messages are acknowledged.

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.

8.32.3 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

The threshold switch position may be changed only when the Basic Line, Smart Line, Active Line, or Motor Module are switched off and the DC link capacitors are discharged.

Table 8- 54 Response thresholds of the Braking Modules

Rated voltage	Response threshold	Switch position	Comments
380 V – 480 V	673 V	1	774 V is the default factory setting. With line voltages of between 380 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 possible braking power is, therefore, 75%.
	774 V	2	
500 V – 600 V	841 V	1	967 V is the default factory setting. With a line voltage of 500 V, the response threshold can be set to 841 V to reduce the voltage stress on the motor and converter. This does, however, reduce the possible braking power with the square of the voltage $(841/967)^2 = 0.75$. The maximum possible braking power is, therefore, 75%.
	967 V	2	
660 V – 690 V	1070 V	1	1158 V is the default factory setting. With a line voltage of 660 V, the response threshold can be set to 1070 V to reduce the voltage stress on the motor and converter. This does, however, reduce the possible braking power with the square of the voltage $(1070/1158)^2 = 0.85$. The maximum possible braking power is, therefore, 85%.
	1158 V	2	

Note

The threshold switches of the Braking Modules are positioned on the panel as follows:

- 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

CAUTION
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" error. This can occur, for example, in cases where there is too much regenerative energy for the available braking power. To prevent a shutdown with the "Overvoltage" error, the V_{dc} max controller must be enabled (p1240 = 1) and the device connection voltage set accordingly (p0210).

8.32.4 Braking Module

Braking Module for frame sizes FX, FB

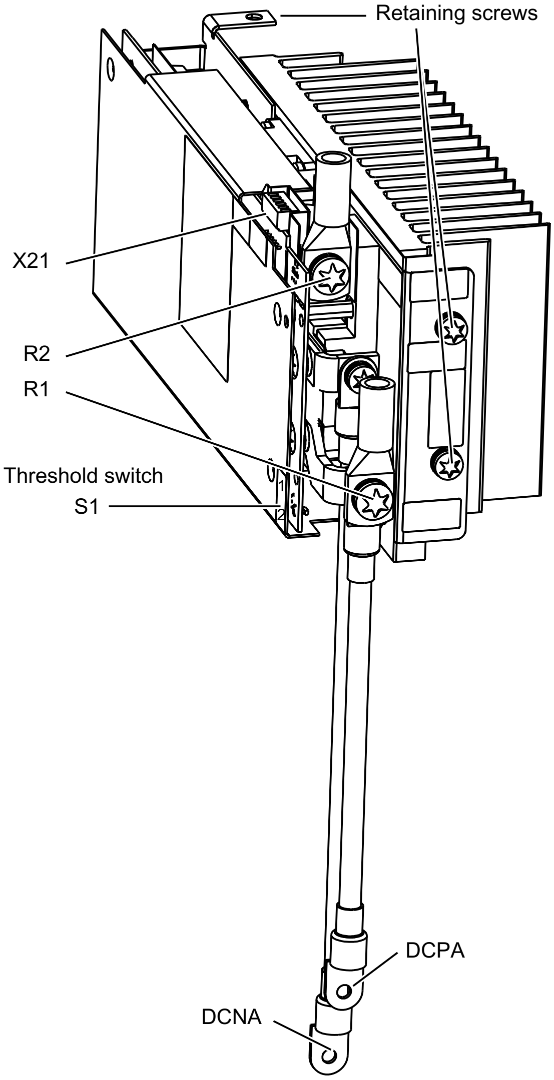


Figure 8-36 Braking Module for Active Line Module / Motor Module, frame size FX and for Basic Line Module, frame size FB

Note

With this Braking Module, the R1 and DCPA interfaces use the same connection.

Braking Module for frame sizes GX, GB

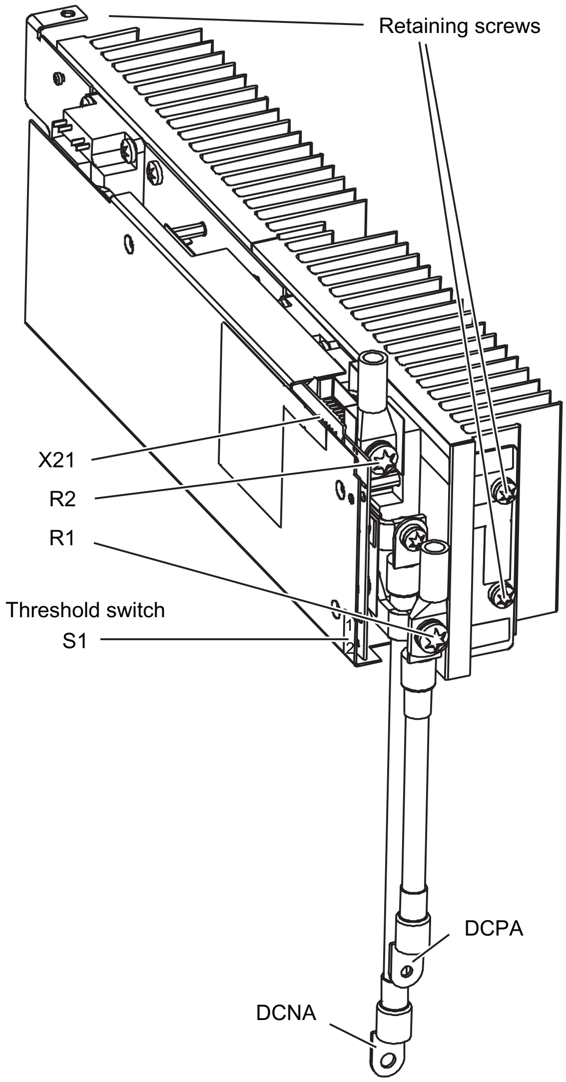


Figure 8-37 Braking Module for Smart Line Module / Active Line Module / Motor Module, frame size GX and for Basic Line Module, frame size GB

Note

With this Braking Module, the R1 and DCPA interfaces use the same connection.

Braking Module for frame sizes HX and JX

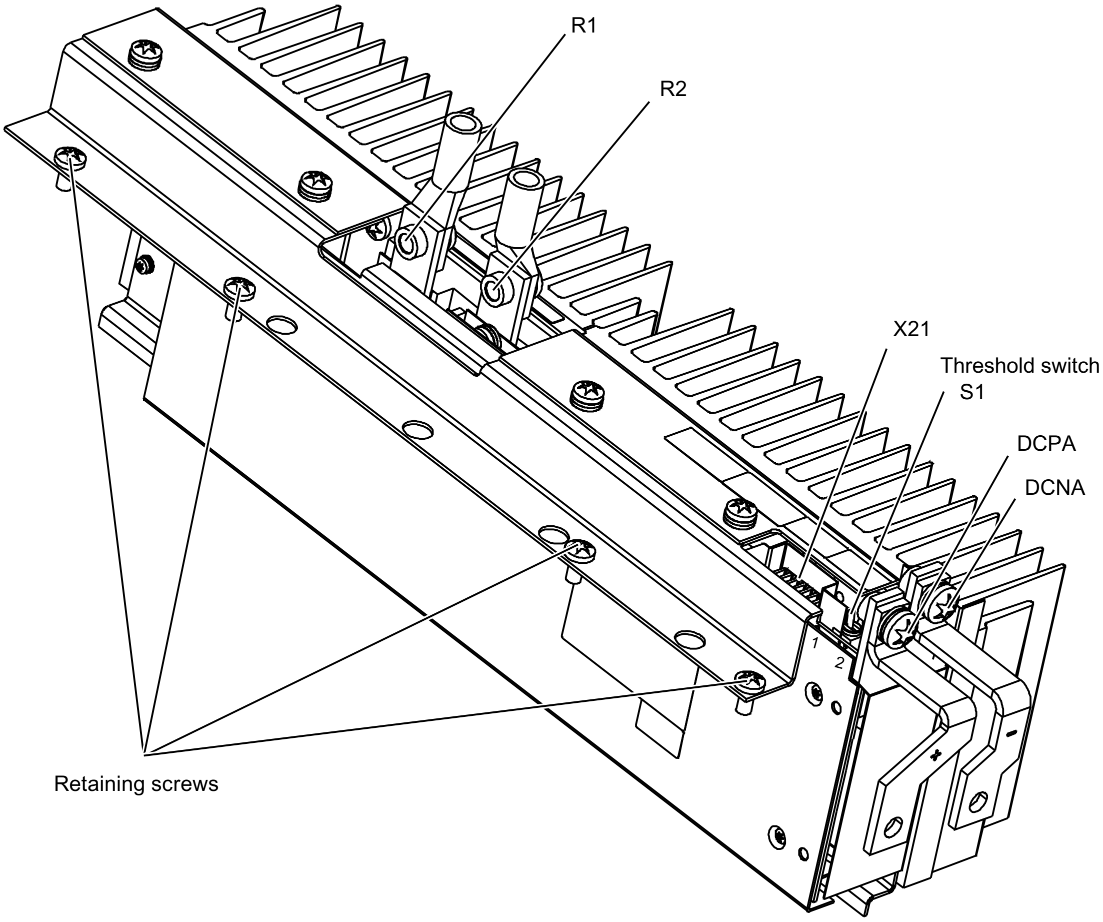


Figure 8-38 Braking Module for Smart Line Module / Active Line Module / Motor Module, frame sizes HX and JX

8.32.5 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 connection between the braking resistor on the Braking Module and R1 / R2 must be made by the customer.

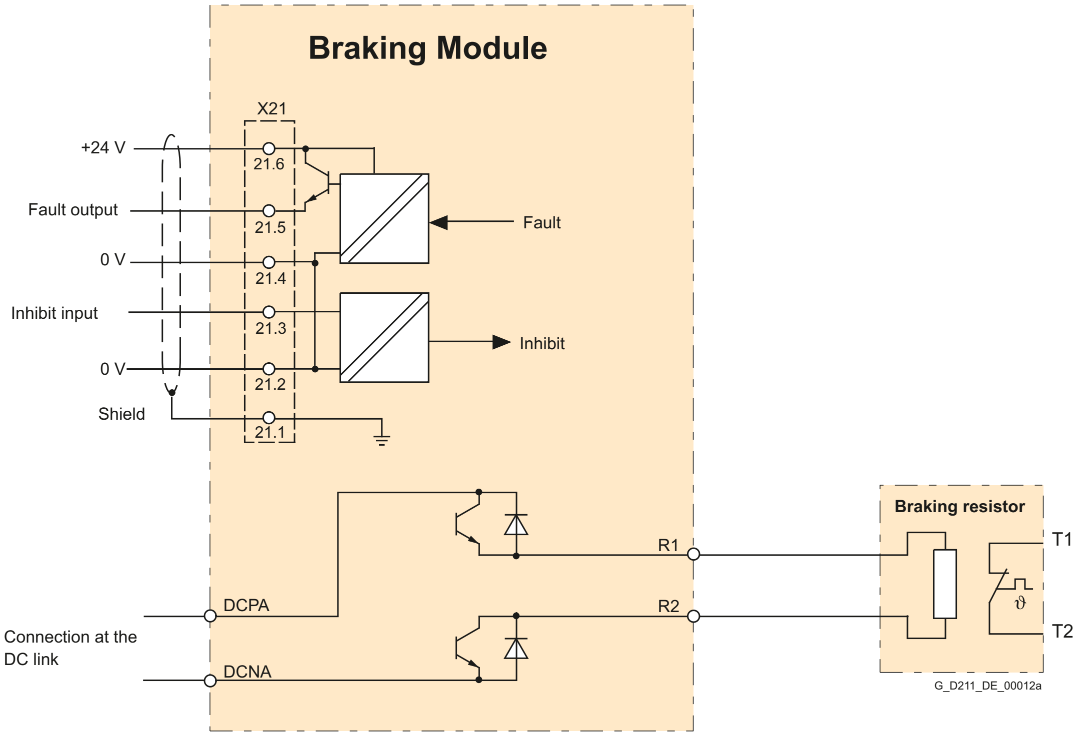


Figure 8-39 Example connection of Braking Module

8.32.6 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.

⚠ WARNING
The thermostatic switch must be evaluated by the Control Unit or a higher-level controller, and a shutdown must be carried out if necessary. These braking resistors are not the same as the components described in the "Central Braking Module" Cabinet Module and must not be connected to this Cabinet Module. Otherwise, there is a risk of overheating and subsequent damage (such as a fire).

Dimension drawings

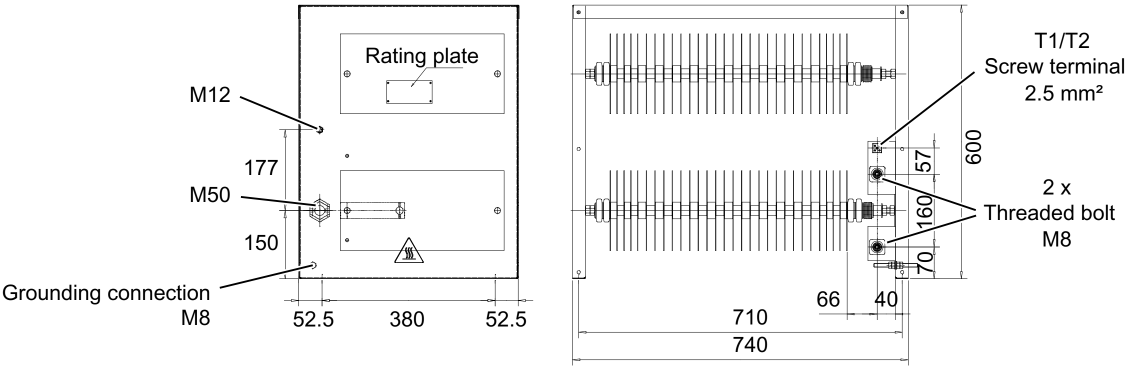


Figure 8-40 Dimension drawing for braking resistor 25 kW, 125 kW (option L61 / L64)

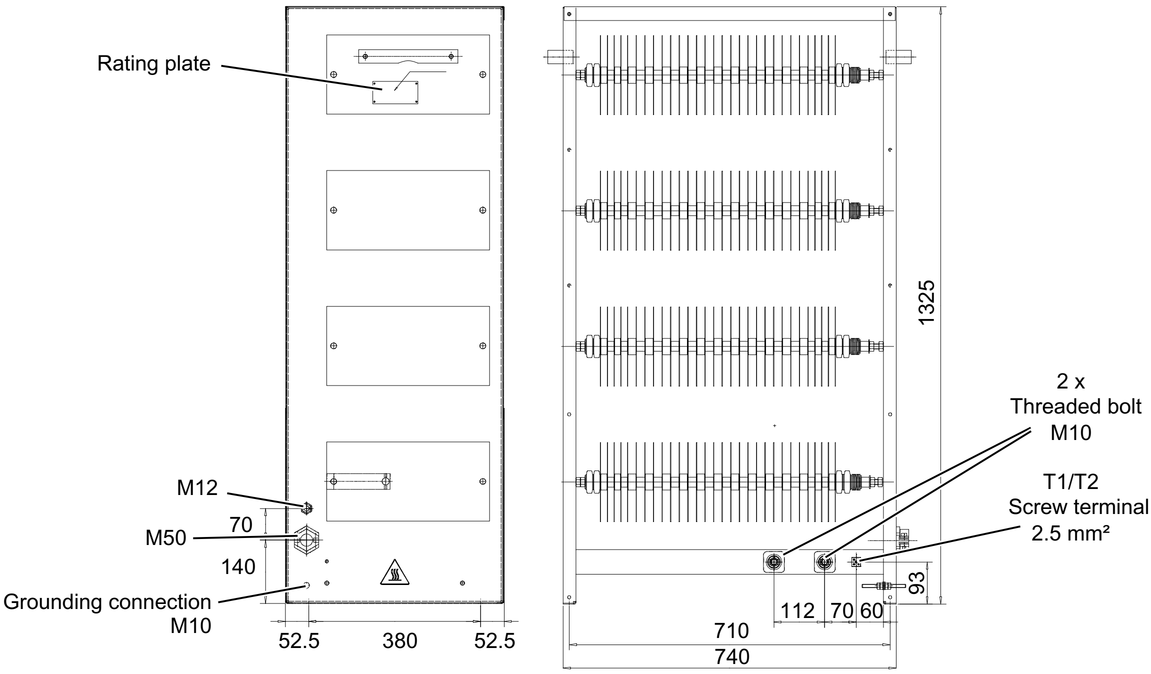


Figure 8-41 Dimension drawing for braking resistor 50 kW, 250 kW (option L62 / L65)

Safety information

CAUTION

A cooling clearance of 200 m must be maintained on all sides of the component (with ventilation grilles).

CAUTION

The surface temperature of the braking resistors may exceed 80 °C during operation.

CAUTION

The cables for the braking resistor must be routed to prevent short-circuits and ground faults in accordance with IEC 61800-5-2:2007, Table D.1.

This can be accomplished, for example, by:

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

Note

The connecting cables to the Braking Module in the Basic Line Module, Smart Line Module, Active Line Module, or Motor Module must be kept as short as possible (maximum of 100 m).

The braking resistors are only suitable for floor mounting.

The maximum cable length between the cabinet unit and braking resistor is 100 m.

Sufficient space must be available for dissipating the energy converted by the braking resistor.

A sufficient distance from flammable objects must be ensured.

The braking resistor must be installed as a free-standing unit.

Objects must not be placed on or anywhere above the braking resistor.

The braking resistor should not be installed underneath fire-detection systems, since these could be triggered by the resulting heat.

For outdoor installation, a hood should be provided to protect the braking resistor against precipitation (in accordance with degree of protection IP20).

Connecting the braking resistor

⚠ WARNING
The Braking Module must only be connected when the Basic Line Module, Smart Line Module, Active Line Module, or Motor Module has been disconnected from the power supply and the DC link has been discharged.

CAUTION

The cables for the braking resistor must be routed to prevent short-circuits and ground faults in accordance with IEC 61800-5-2:2007, Table D.1.

This can be accomplished, for example, by:

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

Note

The length of the connecting cables between the Braking Module and external braking resistor must not exceed 100 m.

Braking resistor connection

The connection between the braking resistor on the Braking Module and R1 / R2 must be made by the customer.

Table 8- 55 Connection for external braking resistor

Terminal	Function
R1	Braking resistor connection
R2	Braking resistor connection
Max. connectable cross-section: 50 mm²	

Recommended connection cross sections:

- For option L61/L64 (25 kW): 35 mm²
- For option L62/L65 (50 kW): 50 mm²

To relieve the strain on the cables from the Braking Module to the external braking resistor, they must be propped on the cable propping bar (C-type mounting bar) above the Braking Modules.

Thermostatic switch

Table 8- 56 Thermostatic switch connection

Terminal	Function
T1	Thermostatic switch connection
T2	Thermostatic switch connection
Max. connectable cross-section: 1.5 mm²	

⚠ WARNING

The thermostatic switch must be evaluated by the Control Unit or a higher-level controller, and a shutdown must be carried out if necessary.

8.32.7 Technical data

Load data for the braking units

Table 8- 57 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 to 480 V	25 kW	125 kW	100 kW	50 kW	4.4 Ω ± 7.5%	189 A
380 to 480 V	50 kW	250 kW	200 kW	100 kW	2.2 Ω ± 7.5%	378 A
500 to 600 V	50 kW	250 kW	200 kW	100 kW	3.4 Ω ± 7.5%	306 A
660 to 690 V	25 kW	125 kW	100 kW	50 kW	9.8 Ω ± 7.5%	127 A
660 to 690 V	50 kW	250 kW	200 kW	100 kW	4.9 Ω ± 7.5%	255 A

Dimensions of the braking resistors

Table 8- 58 Dimensions of the braking resistors

	Unit	25 kW resistor (Option L61/L64)	50 kW resistor (Option L62/L65)
Width	mm	485	485
Height	mm	605	1325
Depth	mm	740	810

Duty cycle

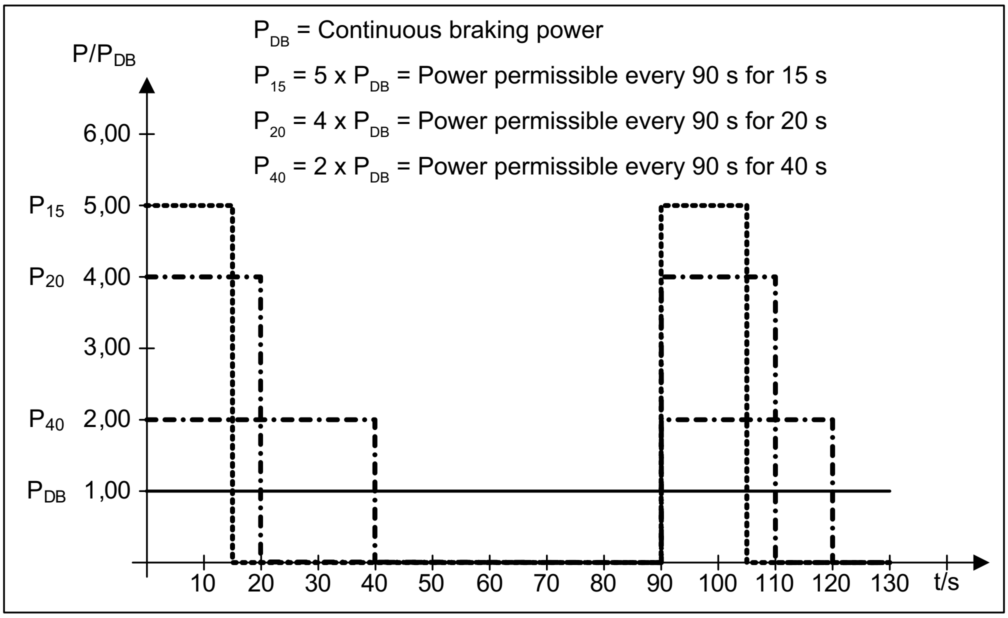


Figure 8-42 Duty cycle for braking resistors

8.33 L87, insulation monitoring

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules

Description

In non-grounded systems (IT systems), the insulation monitor checks the entire electrically-connected circuit for insulation faults. It measures the insulation resistance as well as all insulation faults in the Cabinet Modules, from the supply infeed to the motors. Two response values (between 1 kΩ and 10 MΩ) can be set. If a response value is undershot, a warning is output to the terminal. System errors are output via the signaling-relay system.

When the Cabinet Module is delivered, the plant configuration (one or several loads in one electrically-connected network) and the protection philosophy (immediate shutdown in the event of an insulation fault or restricted continued motion) can vary. This means that the signaling relays of the insulation monitor must be integrated by the customer in the fault and warning sequence.

Safety information

NOTICE
Only one insulation monitor can be used within the same electrically-connected network.

Note

When using the insulation monitor, you must remove the connection clamp for the noise suppression capacitor (in the Active Interface Module of the Active Line Module, Basic Line Module, or Smart Line Module).

See the chapter titled "Connections: Operating Cabinet Modules on an isolated-neutral supply system (IT system)".

Controls and displays on the insulation monitor

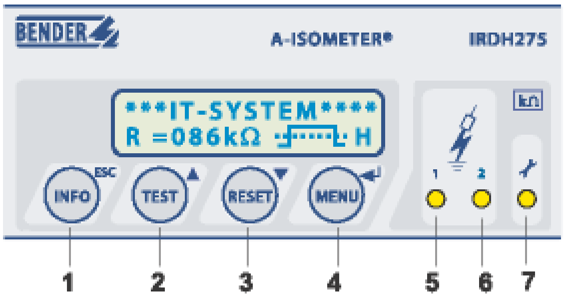


Figure 8-43 Controls and displays on the insulation monitor

Table 8- 59 Meaning of the controls and displays on the insulation monitor

Item	Meaning
1	INFO key: To request standard information/ ESC key: Back menu function
2	TEST key: Call up self-test/ Arrow key up: Parameter change, scrolling
3	RESET button: Delete insulation and error messages (A-Isometer only) Arrow key down: Parameter change, scrolling
4	Menu key: Call up menu system/ Enter key: Confirm parameter change
5	Alarm LED 1 lights up: Insulation fault, first alarm threshold reached
6	Alarm LED 2 lights up: Insulation fault, second alarm threshold reached
7	LED lights up: System error present

Connection

Table 8- 60 Connections on insulation monitor

Terminal	Technical data
A1	Voltage supply via non-replaceable fusing 6 A:
A2	88...264 V AC, 77...286 V DC
L1	Connection of the 3 AC system to be monitored
L2	
AK	Connection to coupling device
KE	PE connection
T1	External test button
T2	External test button
R1	External reset button (NC contact or wire jumper, otherwise the error message is not stored)
R2	External reset button (NC contact or wire jumper)
F1	STANDBY with aid of F1, F2 function input:
F2	No insulation measurement when the contact is closed
M+	External kΩ display, analog output (0 to 400 μA)
M-	External kΩ display, analog output (0 to 400 μA)
A	Serial interface RS 485
B	(termination by means of 120 ohm resistor)
11	Signaling relay ALARM 1 (mid-position contact)
12	Signaling relay ALARM 1 (NC contact)
14	Signaling relay ALARM 1 (NO contact)
21	Signaling relay ALARM 2 (mid-position contact)
22	Signaling relay ALARM 2 (NC contact)
24	Signaling relay ALARM 2 (NO contact)
Max. connectable cross-section: 2.5 mm²	

Note

Detailed and comprehensive instructions and information for the insulation monitor can be found in the accompanying operating instructions, These operating instructions are available as additional documentation on the customer DVD supplied with the device.

8.34 M06, base 100 mm high, RAL 7022

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
- Chassis format Motor Modules
- Central Braking Modules
- Auxiliary Power Supply Modules

Description

Because it is raised 100 mm, the supplementary cabinet base allows for greater bending radii for cables (cable inlet from below) and cable routing within the base.

The cabinet base comes completely assembled and is usually color RAL 7022.

Table 8- 61 Components of the cabinet base

Component	Connection element	Fixing elements
1 x base element (rear)		On the cabinet: The cabinet base is shipped pre-assembled.
1 x base element (front)		
Base covers (option M26/M27 only)		On the foundation: The holes are in line with the holes in the cabinet (see dimension drawings).
4 x cover caps		

Connection to the foundation

To connect the cable marshalling compartment to the foundation, four holes for M12 screws are provided. These are in line with the holes in the cabinet. The fixing dimensions are specified on the associated dimension drawings.

Connection for side-by-side installation of cabinet units

The individual bases are not connected for cabinet units installed in a side-by-side configuration. The connection from the base to the cabinet and between the cabinet units ensures sufficient stability.

Note

In transport units, the base covers inside the transport unit are only secured at the bottom and are folded down parallel to the ground.

8.35 M07, cable-marshalling compartment 200 mm high, RAL 7035

Availability of option

This option is available for the following S120 Cabinet Modules:

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

Description

Because it is raised 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 200 mm.

Table 8- 62 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.

8.36 M13, Line connection from above

Description

For option M13 the cabinet unit is equipped with an additional hood. The connection lugs for the power cables, the clamping bar for mechanically securing the cables, an EMC shield bus, and a PE busbar are located within the hood.

The roof cover increases the cabinet height by 405 mm. The busbars for connection from above are already installed when the system is delivered. For transport reasons, the hoods are delivered separately and have to be assembled at the plant. With options M23, M43 and M54, plastic ventilation grilles and filter mats are also supplied.

A 5 mm aluminum mounting plate (with no holes) is fitted in the roof of the cover for feeding in the cables. Depending on the number of cables and the cross-sections used, holes for attaching cable glands for feeding in the cables must be drilled in this mounting plate on site.

Note

The control cable and optional brake resistors are always connected from below.

Attaching the hood

1. Remove the crane transport assemblies (if fitted).
2. Options M43 and M54 only:
   Use the sealing tape provided to attach the contact surfaces of the hood to the top of the cabinet.
3. Fit the hood to the top of the enclosure at the positions specified (fixing points for the crane transport assemblies).
4. To secure the power cables, remove the front panel of the hood.

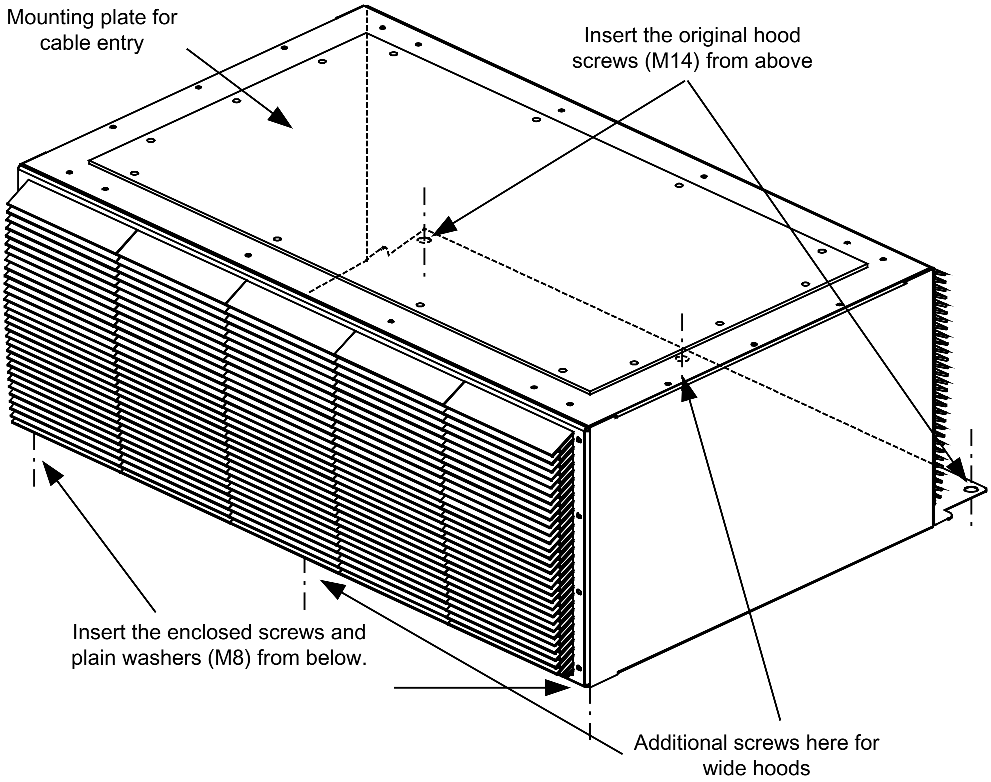


Figure 8-44 Mounting the hood for M13

8.37 M21, degree of protection IP21

8.37.1 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
- Chassis format Motor Modules
- Central Braking Modules
- Auxiliary Power Supply Modules

Description

To increase the degree of protection of the cabinet units from IP20 (standard) to IP21, additional canopies are supplied.

Increasing the degree of protection in this way ensures that not only is the cabinet unit protected against the ingress of foreign bodies with a diameter of 12.5 mm and above (IP20, protection level provided as standard), but also against the ingress of water droplets falling vertically from above (IP21).

The canopy is mounted using spacers at a distance of 250 mm above the top cover of the cabinet. The canopy increases the height of a cabinet unit by 250 mm, as shown in the diagram below (number (1)).

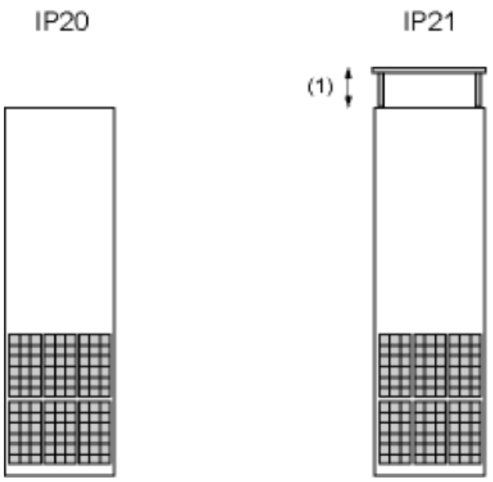


Figure 8-45 Cabinet with canopy (250 mm higher)

NOTICE
Only the protective requirements described above can be fulfilled with IP21. For more stringent requirements, you must select the corresponding IP degree of protection (for example, IP23 for additional protection against spraying water).

8.37.2 Mounting

Mounting a canopy to increase the degree of protection to IP21 (option M21)

The canopy 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 produces an adjustable protrusion of the canopy at the front ① and rear ③.
In this way, it is possible to have a circumferential protrusion of the canopy, or direct contact with the wall or between the canopies in back-to-back installation. 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 grille for installation.
  Install the screws ④ with contact washer from below through the perforated protective grille (tightening torque: 13 Nm for M6).
- Mount the canopy (B) on the spacers.
  Attach the screw ⑤ with contact washer from above through the canopy (tightening torque: 13 Nm for M6).

NOTICE
In order to prevent water dripping into the spaces between the cabinet units connected in series, there are overlaps on the sides of the canopies. When fitting the canopies, make sure that the overlaps interlock.

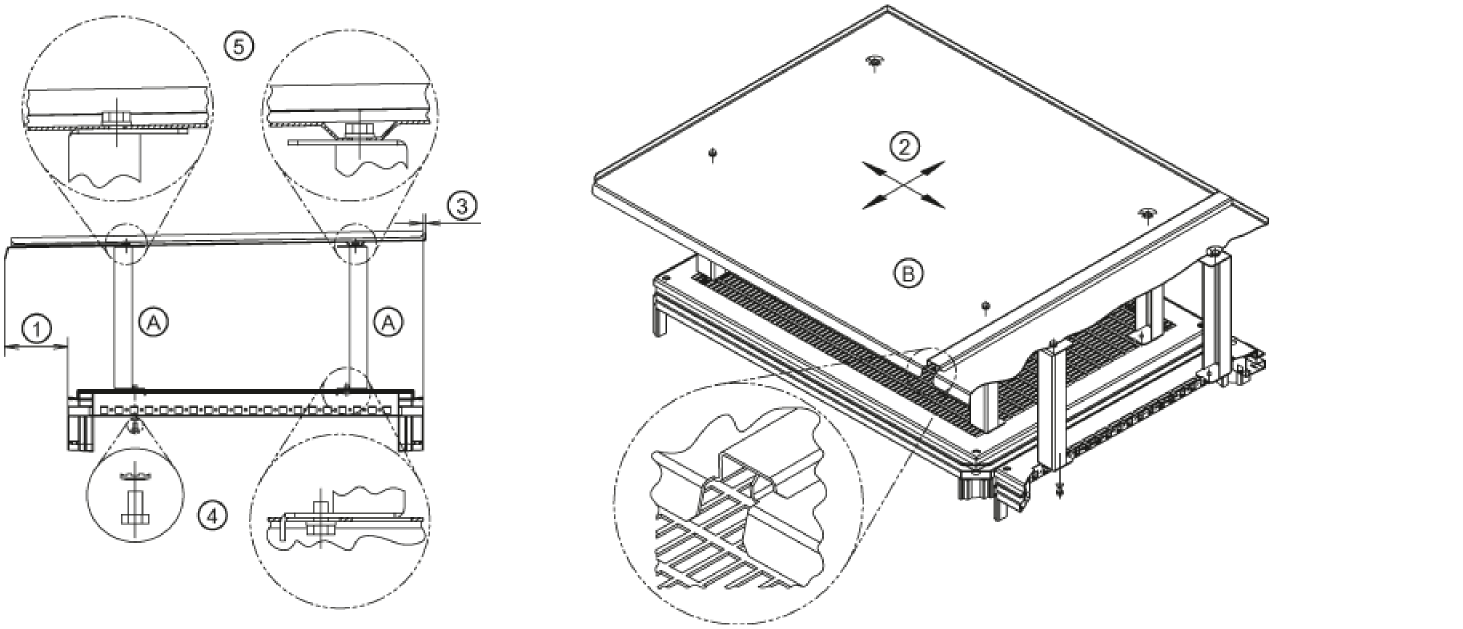


Figure 8-46 Mounting a canopy

8.38 M23/M43/M54, degree of protection IP23/IP43/IP54

8.38.1 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
- Chassis format Motor Modules
- Central Braking Modules
- Auxiliary Power Supply Modules

Description

The table below explains the differences between the various degrees of protection that are available.

Table 8- 63 Degrees of protection

Degree of protection	Protection against contact	Protection against water
IP23	Protection against the ingress of solid foreign bodies with a diameter > 12.5 mm	Protection against spraying water (up to 60☐° against the vertical)
IP43	Protection against the ingress of solid foreign bodies with a diameter > 1 mm	Protection against spraying water (up to 60☐° against the vertical)
IP54	Complete shock protection Protection against damaging internal dust deposits	Protection against all-round splash water

Note

Hoods (1) increase the height of the cabinet units by 400 mm.

For degree of protection IP54, the derating values of the relevant Cabinet Modules must be observed.

Note

In the Line Connection Module with option L43 and in the Booksize Base Cabinet, a fan is installed in the hood for degrees of protection IP23, IP43, and IP54.

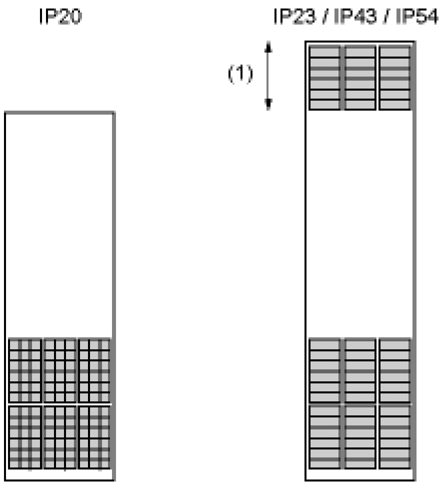


Figure 8-47 Cabinet with hood (400 mm higher)

If the degree of protection of the Cabinet Modules is to be increased, the additional hoods and filter media are delivered separately.

The hoods are flush with the cabinets at the side and front and have a recess at the rear so that air can escape even if the cabinet is wall mounted. Air escapes from the front and back.

The hoods are easily fitted and filter media easily changed from outside the cabinet. Air escapes from the front and back. Compliance with the increased degree of protection requires intact filter media, which must be replaced on a regular basis according to the prevailing environmental conditions.

8.38.2 Mounting

Preparatory steps

- Remove the crane transport assemblies (if fitted)
  (-> see the chapter titled "Mechanical installation").
- Observe the "five safety rules".
- Remove the perforated cover on the top of the cabinet (if fitted).

Attaching the hood

The numbers in parentheses in the installation steps refer to the diagram below.

1. Options M43 and M54 only:
   Secure the contact surfaces of the hood on top of the cabinet using the sealing tape provided.
2. Fit the hood to the roof of the cabinet at the positions specified (fixing points for the crane transport assembly).
3. Attach original M12 roof screws ① from above.
4. M6 screw and washers (order: Attach the screw, spring-lock element, small washer, large washer) ② from below.
5. If the hood is very wide, use additional screws ③.

Note

If cabinet units are installed in a side-by-side configuration, the hoods must be flush-mounted in a line across the cabinet units.

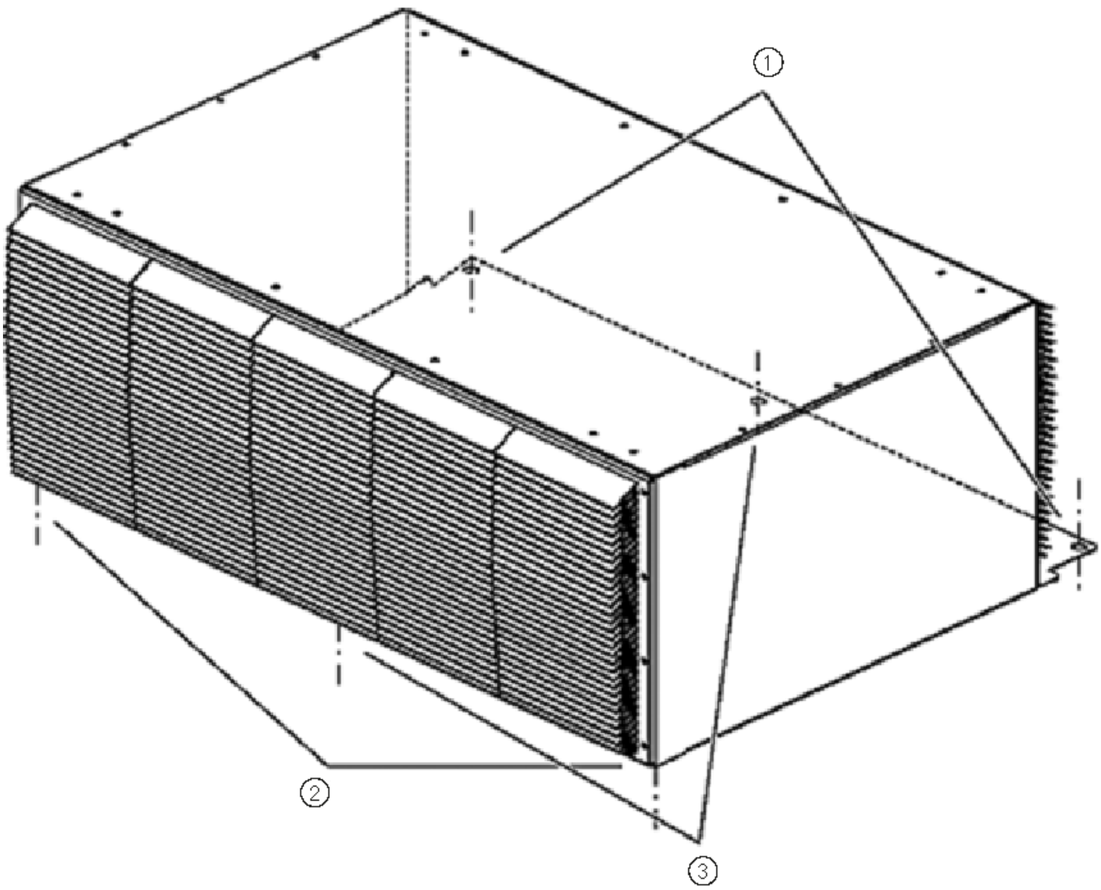


Figure 8-48 Mounted hood

Note

See also the chapter titled "Maintenance and servicing", "Replacing the filter mats" section.

8.39 M26/M27, side panels mounted on right and left

Availability of option

This option is available for the following S120 Cabinet Modules:

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

Description

The side panels (option M26 = side panel mounted on the right; option M27 = side panel mounted on the left) are fitted at either end of a side-by-side cabinet unit configuration.

With the option M26, the Cabinet Module is fitted with a side panel on the right.

With the option M27, the Cabinet Module is fitted with a side panel on the left.

DANGER

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

For Cabinet Modules that are delivered with a side panel, the DC connection clamp is omitted from the side panel. If the installation sequence is modified and the side panel removed, then a DC connection clamp must be inserted!

8.40 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
- Central Braking Modules
- Booksize Base Cabinets
- Chassis format Motor Modules
- Auxiliary Power Supply Modules

Description

The standard cabinet units are supplied with integrated ventilation grilles in the bottom of the doors as standard.

With option M59, the Cabinet Modules are delivered with closed doors.

Safety information

⚠ WARNING

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 mounted.

Note

The door opening angle with free-standing cabinet units is 180°.

With a side-by-side configuration of the cabinet units, this opening angle is 130°.

For degrees of protection IP23/IP43/IP54 and with option L37 (DC interface incl. pre-charging input circuit), the door opening angle is only 110°☐.

8.41 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
- Chassis format Motor Modules

Description

The standard Cabinet Modules are designed according to BGV A 3. With option M60, additional covers (out of reach of accessible control and contact elements) are installed upstream of the power unit.

Safety information

Note

The additional shock protection (option M60) is not a substitute for the cabinet door(s). Cabinets must not be operated **without** cabinet door(s).

8.42 M70, EMC shield bus

8.42.1 General information

Availability of option

This option is available for the following S120 Cabinet Modules:

- Line Connection Modules
- Booksize Base Cabinets
- Chassis format Motor Modules
- Auxiliary Power Supply Modules

Description

With option M70, an EMC shield bus is incorporated for the use of shielded power cables for power cables and motor supply cables.

The cable shields for the cables routed to the cabinet must be connected to the EMC shield bus in accordance with EMC guidelines.

8.42.2 Connecting the cables to the EMC shield bus

Preparatory steps

- Observe the "five safety rules".
- Allow unimpeded access to the EMC shield bus (if necessary, remove the protective covers during installation work)

Securing the cables to the shield bus

1. Remove approximately 5 cm of the protective sheath of the cable around the shield bus.
2. Place the shielded cable on the shield bus.
3. Snap the clip into the opening provided and tighten it.

8.43 M80 to M87, DC busbar system

8.43.1 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
- Central Braking Modules
- Auxiliary Power Supply Modules

Description

The DC busbar connects the DC voltage across the drive line-up. The DC busbar comprises an upper busbar (DC P) and a lower busbar (DC N).

The following optional DC busbars are available:

- 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

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 8-49 M80 - M87, DC busbar

8.43.2 Safety information

CAUTION
With a side-by-side configuration of the cabinet units, the DC busbars of the individual cabinet units must be connected to each other.

8.44 M90, crane transport assembly (top-mounted)

Availability of option

This option is available for the following S120 Cabinet Modules:

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

Description

A top-mounted crane transport assembly can be ordered as an option for Cabinet Modules.

Depending on the width of the module, the crane transport assembly consists of either transport eyebolts (for cabinet width ≤ 800 mm) or transport rails (for cabinet width > 800 mm).

Note

A crane transport assembly is included if transport units are supplied (option Y11).

Safety information

⚠ WARNING
The transport rails are heavy and must be removed very carefully.

8.45 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.

8.46 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

The measuring instrument "DIRIS A40" with display, installed in the cabinet door of the Line Connection Module, acquires measured values of the power supply. In addition to these measured values, additional plant values (such as power and power factor, etc.) are calculated from the measured values using powerful, state-of-the art microprocessors. The instrument is equipped with a serial RS485 interface with JBUS/MODBUS ®, which supports a max. transmission rate of 38.4 kbaud.

The device can measure the following as standard:

- Actual currents per phase and actual currents of the neutral conductor
- Average currents and maximum currents over programmable time intervals from 8 to 30 min.
- Phase-to-neutral voltages and phase-to-phase voltages
- Frequency (Hz)
- Four-quadrant measurement of the actual, average, and maximum active power (+/-), reactive power (+/-) and apparent power per phase and in total over programmable time intervals from 8 to 30 min.
- Display of active energy in kWh.
- Power factor (PF) per phase and in total with the specifications "L" for inductive and "C" for capacitive

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Note

Detailed and comprehensive instructions and information regarding the "DIRIS A40" measuring instrument can be found in the accompanying operating instructions, These operating instructions are available as additional documentation on the customer DVD supplied with the device.

Note

Current transformers are required in the Line Connection Module to measure line currents. The L41 option (line current transformer) is included in the P10 option. The measuring instrument "DIRIS A40" is wired according to connection type 3NBL/4NBL in the factory.

The current transformers must not be operated unloaded.

8.47 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 PAC3200" with display, installed in the cabinet door of the Line Connection Module, acquires measured values of the power supply. In addition to these measured values, additional plant values (such as power and power factor, etc.) are calculated from the measured values using powerful, state-of-the art microprocessors. The measuring instrument has a PROFIBUS interface that enables a transfer rate of up to 12 Mbit/s.

The device can measure the following as standard:

- Actual currents per phase and actual currents of the neutral conductor
- Average currents and maximum currents over programmable time intervals from 1 to 60 min.
- Phase-to-neutral voltages and phase-to-phase voltages
- Frequency (Hz)
- Four-quadrant measurement of the actual, average, and maximum active power (+/-), reactive power (+/-) and apparent power (+/-) per phase and in total over programmable time intervals from 1 to 60 min.
- Display of active energy in kWh
- Power factor (PF) per phase and in total with the specifications "L" for inductive and "C" for capacitive

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Note

Current transformers are required in the Line Connection Module to measure line currents. Option L41 (line current transformer) is included in option P11. The measuring instrument "SENTRON PAC3200" is wired according to connection type 3P3W in the factory.

The current transformers must not be operated unloaded.

Note

Detailed and comprehensive instructions and information regarding the "SENTRON PAC3200" measuring instrument can be found in the accompanying operating instructions, These operating instructions are available as additional documentation on the customer DVD supplied with the device.

8.48 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
- Chassis format Motor Modules
- Central Braking Modules
- Auxiliary Power Supply Modules

Description

Cabinet Modules can be ordered as factory-assembled transport units with a maximum width of up to 2400 mm. In this case, the relevant modules are shipped as interconnected units (both electrically and mechanically).

Note

No additional wiring between the Cabinet Modules is required, with the exception of the DRIVE-CLiQ connections used to interconnect the cabinets.

A crane transport assembly in the form of a crane transport rail is already included if transport units are supplied.

Table 8- 64 Installation sequence of the transport unit

Plain text required to order	TU 1 - 1...6
Transport unit	TU
Consecutive number of the transport unit	1 -
Position of the Cabinet Module within the transport unit	1 ... 6

Appendix A

A

A.1 Connectable conductor cross-sections for screw terminals

The type of screw terminal can be taken from the interface description of the particular component.

Table A- 1 Screw terminals

Screw terminal type			
1	Connectable conductor cross-sections	Rigid, flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.08 mm^2 to 1.5 mm^2 0.25 mm^2 to 1.5 mm^2 0.25 mm^2 to 0.5 mm^2
	Stripped length	7 mm	
	Tool	Screwdriver 0.4 x 2.0 mm	
	Tightening torque	0.22 to 0.25 Nm	
2	Connectable conductor cross-sections	Rigid, flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.08 mm^2 to 2.5 mm^2 0.5 mm^2 to 2.5 mm^2 0.5 mm^2 to 1.5 mm^2
	Stripped length	7 mm	
	Tool	Screwdriver 0.6 x 3.5 mm	
	Tightening torque	0.5 to 0.6 Nm	
3	Connectable conductor cross-sections	Flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.2 mm^2 to 2.5 mm^2 0.25 mm^2 to 1 mm^2 0.25 mm^2 to 1 mm^2
	Stripped length	9 mm	
	Tool	Screwdriver 0.6 x 3.5 mm	
	Tightening torque	0.5 to 0.6 Nm	
4	Connectable conductor cross-sections	Flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.2 mm^2 to 4 mm^2 0.25 mm^2 to 4 mm^2 0.25 mm^2 to 4 mm^2
	Stripped length	7 mm	
	Tool	Screwdriver 0.6 x 3.5 mm	
	Tightening torque	0.5 to 0.6 Nm	
5	Connectable conductor cross-sections	Flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.5 mm^2 to 6 mm^2 0.5 mm^2 to 6 mm^2 0.5 mm^2 to 6 mm^2
	Stripped length	12 mm	
	Tool	Screwdriver 1.0 x 4.0 mm	
	Tightening torque	1.2 to 1.5 Nm	
6	Connectable conductor cross-sections	Flexible With wire end ferrule, without plastic sleeve With wire end ferrule, with plastic sleeve	0.5 mm^2 to 10 mm^2 0.5 mm^2 to 10 mm^2 0.5 mm^2 to 10 mm^2
	Stripped length	11 mm	
	Tool	Screwdriver 1.0 x 4.0 mm	

Screw terminal type		
	Tightening torque	1.5 to 1.8 Nm
7	Connectable conductor cross-sections	0.5 mm² to 16 mm²
	Stripped length	14 mm
	Tool	Screwdriver 1.0 x 4.0 mm
	Tightening torque	1.5 to 1.7 Nm

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