Equipment Manual 12/2004 Edition

sinamics

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SINAMICS S120
Chassis Power Sections

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Equipment manual

(GH3), Edition 12.2004
6SL3097-2AE00-0BP0

Safety guidelines

This manual contains information that you must observe for your personal safety and to avoid material damage. Notices which are relevant to your own personal safety are highlighted by a safety alert symbol; notices which are relevant only to equipment and property damage have no safety alert symbol. The warnings are shown below in decreasing order of danger.

Danger

"Danger" indicates that death or severe personal injury **will** result if proper precautions are not taken.

Warning

"Warning" indicates that death or severe personal injury **can** result if proper precautions are not taken.

Caution

“Caution” with a warning triangle indicates that minor personal injury can result if proper precautions are not taken.

Caution

"Caution" without a warning triangle indicates that material damage can result if proper precautions are not taken.

Important

“Important” indicates that an unwanted result or situation can result if the appropriate advice is not taken into account.

If more than one danger level is applicable, the highest level in each case is specified. If a warning with a warning triangle warns of personal injury, an additional note warning of material damage can also be included in the same warning.

Qualified Personnel

The device/system must only be set up and operated in accordance with this documentation. The device/system must only be commissioned and operated by **qualified personnel**. For the purpose of the safety information in this documentation, a "qualified person" is someone who is authorized to operate, ground, and tag devices, systems, and circuits in accordance with established safety procedures.

Proper use

Note the following information:

Warning

The device must only be used for the applications specified in the catalog and in the technical description. The device must only be used in conjunction with external devices and components recommended or approved by Siemens. The successful and safe operation of this device depends on correct transport, proper storage and installation, as well as careful operation and maintenance.

Trademarks

All designations with the trademark symbol ® are registered trademarks of Siemens AG. Other designations in this documentation may be trademarks whose use by third parties for their own purposes may infringe the rights of the owner.

Exclusion of Liability
We have checked that the contents of this document correspond to the hardware and software described. Since deviations cannot be precluded entirely, we cannot guarantee complete conformance. The data in this manual is reviewed regularly, however, and any necessary corrections included in subsequent editions.

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Contents

System Overview

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1.1 The SINAMICS Range of Drives

Application

SINAMICS is the new range of converters from Siemens designed for industrial mechanical and plant engineering applications. SINAMICS offers solutions for all drive tasks:

- Simple pump and fan applications in the process industry.
- Complex individual drives in centrifuges, presses, extruders, elevators, as well as conveyor and transport systems.
- Drive line-ups in textile, plastic film, and paper machines, as well as in rolling mill plants.
- Highly dynamic servo drives for machine tools, as well as packaging and printing machines.

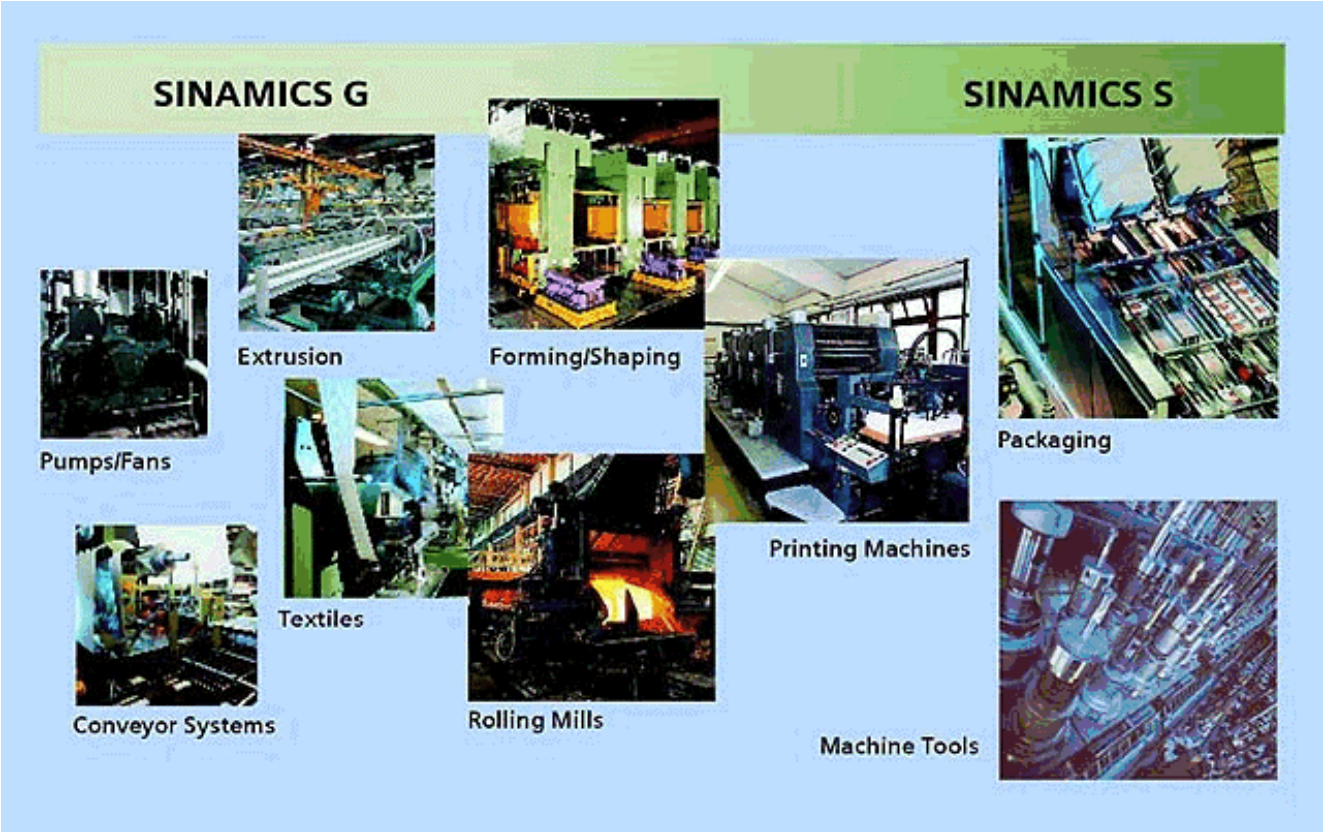


Fig. 1-1 SINAMICS applications

Versions

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

- SINAMICS G is designed for standard applications with induction motors. These applications have less stringent requirements regarding the dynamics and accuracy of the motor speed.
- SINAMICS S handles complex drive tasks with synchronous/induction motors and fulfills stringent requirements regarding:
  - Dynamics and accuracy
  - Integration of extensive technological functions in the drive control system

Platform concept and Totally Integrated Automation

All SINAMICS versions are based on a platform concept. Joint hardware and software components, as well as standardized tools for design, configuration, and commissioning tasks ensure high-level integration across all components. SINAMICS handles a wide variety of drive tasks with no system gaps. The different SINAMICS versions can be easily combined with each other.

SINAMICS is part of the Siemens "Totally Integrated Automation" concept. Integrated SINAMICS systems covering configuration, data storage, and communication at automation level ensure low-maintenance solutions with SIMATIC and SIMOTION.

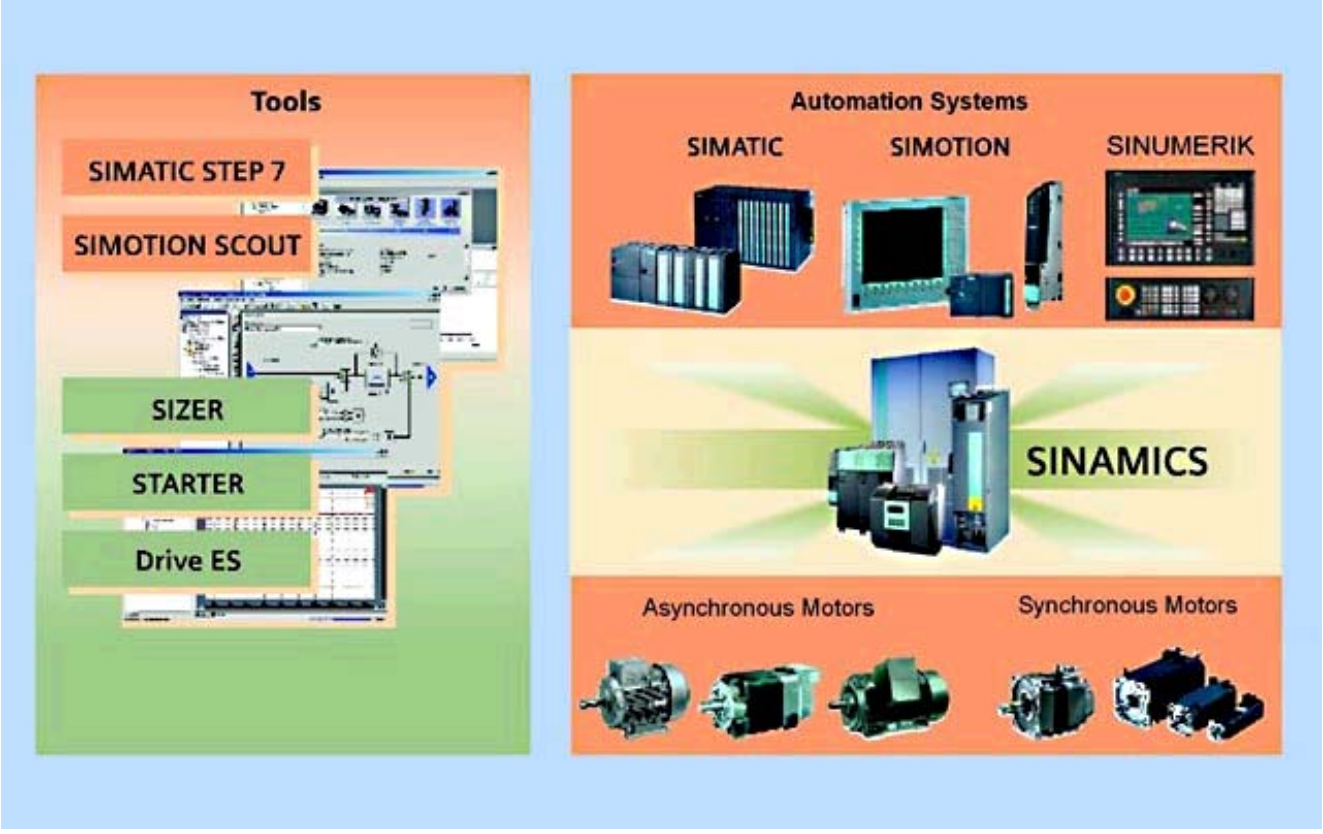


Fig. 1-2 SINAMICS as part of the Siemens modular automation concept

Quality to DIN EN ISO 9001

SINAMICS conforms with the most exacting quality requirements. Comprehensive quality assurance measures in all development and production processes ensure a consistently high level of quality.

Of course, our quality assurance system is certified by an independent authority to DIN EN ISO 9001.

Universal applications

SINAMICS fulfills all the relevant international standards and guidelines – from EN European standards to IEC and cULus.

1.2 The SINAMICS S120 Drive System

Modular system for complex drive tasks

SINAMICS S120 solves complex drive tasks for a wide range of industrial applications and is, therefore, designed as a modular system. Users can choose from many different harmonized components and functions to create a solution that best meets their requirements. SIZER, a high-performance configuration tool, makes it easier to choose and determine the optimum drive configuration. SINAMICS S120 is enhanced by a wide range of motors. Whether synchronous or asynchronous, all motor types are supported by SINAMICS S120.

Particularly suitable for multi-axis applications

Coordinated drives that carry out drive tasks together are used in many mechanical and plant engineering applications, including running gears in gantry cranes, stretching systems in the textile industry, or paper machines and rolling mills. These require drives with a connected DC link, which allows cost-saving energy balancing between braking and driving axes.

SINAMICS S120 features Line Modules (formerly infeed modules) and Motor Modules (formerly inverter modules) that cover a broad output range, are designed for seamless integration, and enable space-saving, multi-axis drive configurations.

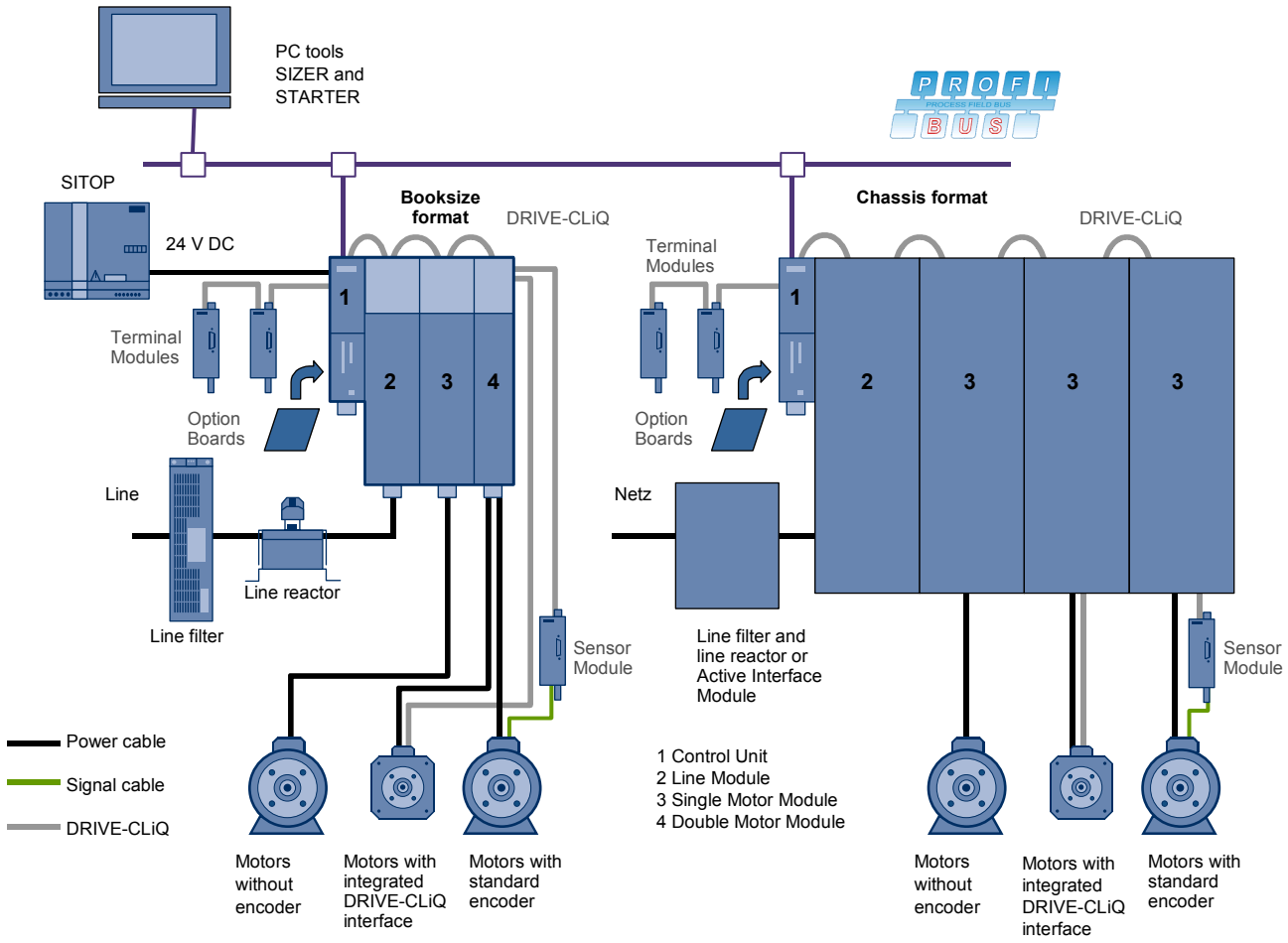


Fig. 1-3 Overview of the SINAMICS S120 system

New system architecture with a central Control Unit

With individual drives, higher-level controllers operate the drives to achieve the required coordinated movement. This requires cyclic data exchange between the controller and all the drives. This exchange always had to take place via a field bus, which required a great deal of time and effort for installation and configuration. SINAMICS S120 takes a different approach. A central Control Unit controls the drive for all connected axes and also establishes the technological links between the drives and axes. Since all the required data is stored in the central Control Unit, it does not need to be transferred. Cross-axis connections can be established within a Control Unit and easily configured in the STARTER commissioning tool using a mouse.

Simple technological tasks can be carried out automatically by the SINAMICS S120 Control Unit. For complex technological tasks, the user-programmable modules in the SIMOTION D product spectrum are used instead.

DRIVE-CLiQ – a digital interface between all components

All SINAMICS S120 components, including the compact asynchronous motors and encoders, are interconnected via a joint serial interface called DRIVE-CLiQ. The standardized cables and connectors reduce the variety of different parts and cut storage costs.
Converter boards (sensor modules) for converting standard signals to DRIVE-CLiQ are available for motors without an integrated DRIVE-CLiQ interface.

Electronic type plates in all components

All SINAMICS S120 components with a DRIVE-CLiQ interface have an electronic type plate that contains all the relevant data about that particular component. In the compact asynchronous motors, for example, this data includes the parameters of the electric equivalent circuit diagram and the built-in motor encoder. The Control Unit records this data automatically via DRIVE-CLiQ so that it does not need to be entered during commissioning or if the equipment is replaced.

In addition to the technical data, the type plate includes logistical data (manufacturer ID, order number, and globally unique ID). Since this data can be called up electronically on site or remotely, all the components used in a machine can always be individually identified, which helps simplify servicing.

SINAMICS S120 components

The SINAMICS S120 components are primarily used for multi-axis drive tasks.

The following power components are available:

- **Line-side power components**, such as fuses, contactors, reactors, and filters for switching the power supply and meeting EMC requirements.
- **Line Modules**, which supply power centrally to the DC link.
- **DC link components** (optional), which stabilize the DC link voltage.
- **Motor Modules**, which act as inverters, receive power from the DC link, and supply the connected motors.

To carry out the required functions, SINAMICS S120 is equipped with:

- A **Control Unit** that carries out all drive and technological functions across all axes.
- **Additional system components** that enhance functionality and offer different interfaces for encoders and process signals.

The SINAMICS S120 components were developed for installation in cabinets. They have the following features and characteristics:

- Easy to handle, simple installation and wiring
- Practical connection system, cable routing in accordance with EMC requirements
- Standardized design, seamless integration
- Internal ventilators (other cooling methods available on request).

1.3 Technical Specifications

Technical specifications

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

Table 1-1 General technical specifications

Electrical data	
Line connection voltage	• 380 3AC –10% to 480 3AC +10% (-15% < 1 min) • 660 3AC –10% to 690 3AC +10% (-15% < 1 min)
Line frequency	47 Hz to 63 Hz
Output voltage	0 to line connection voltage (depending on the infeed type)
Output frequency	0 Hz to 300 Hz
Electronics power supply	24 V DC (20.4 V - 28.8 V)
Radio interference suppression	
• Standard • With line filter	• Category C3 (environment 2) to EN 61800-3 • Category C2 (environment 1) to EN 61800-3
Overvoltage category	Class III to EN 60664-1
Mechanical data	
Vibratory load • Transportation [1] • Operation	 • EN 60721-3-2, class 2M2 • EN 60721-3-3, class 3M4
Shock load • Transportation [1] • Operation	 • EN 60721-3-2, class 2M1 • EN 60721-3-3, class 3M4
Ambient conditions	
Degree of protection	IP 00 or IP 20 to EN 60529
Protection class	Class I (with protective conductor system) and class III (PELV) to EN 61800-5-1
Cooling method	Internal ventilator, power sections with increased air cooling by in-built fans
Permissible ambient and coolant temperature (air) during operation for line-side components, Line Modules, and Motor Modules	0°C to +40°C without derating, >40°C to +55°C (see derating characteristics)
Permissible ambient and coolant temperature (air) during operation for DC link and motor-side power components	0°C to +55°C to 2000 m above sea level

[1] in packaging for transportation

Climatic ambient conditions	
• Storage [1] • Transportation [1] • Operation	• Class 1K3 to EN 60721-3-1, temperature –40°C to +70°C • Class 2K4 to EN 60721-3-2, temperature –40°C to +70°C, max. humidity: 95% at +40°C • Class 3K3 to EN 60721-3-3, relative humidity 5% to 65% (annual average), ≤ 80% above the maximum for 2 months a year Avoid splashing water and do not allow condensation or ice to form (EN 60204, Part 1).
Environmental class/harmful chemical substances	
• Storage [1] • Transportation [1] • Operation	• Class 1C2 to EN 60721-3-1 • Class 2C2 to EN 60721-3-2 • Class 3C2 to EN 60721-3-3
Organic/biological influences	
• Storage [1] • Transportation [1] • Operation	• Class 1B1 to EN 60721-3-1 • Class 2B1 to EN 60721-3-2 • Class 3B1 to EN 60721-3-3
Degree of contamination	2 to EN 61800-5-1
Installation altitude	• ≤ 2000 m above sea level without derating • > 2000 m above sea level (see derating characteristics)
Certificates	
Conformity	CE (low-voltage and EMC Directives)
Approbation (for 380 V 3AC to 480 V range)	cULus (file nos.: E192450, E164110, E70122)
Certification	Safety Integrity Level (SIL) 2 to IEC 61508, control category 3 to EN 954-1 for Safety Integrated – safe standstill (SH) and safe brake control (SBC)

[1] in packaging for transportation

1.4 Derating Factors

1.4.1 Derating Factors as a Function of the Site Altitude and Ambient Temperature

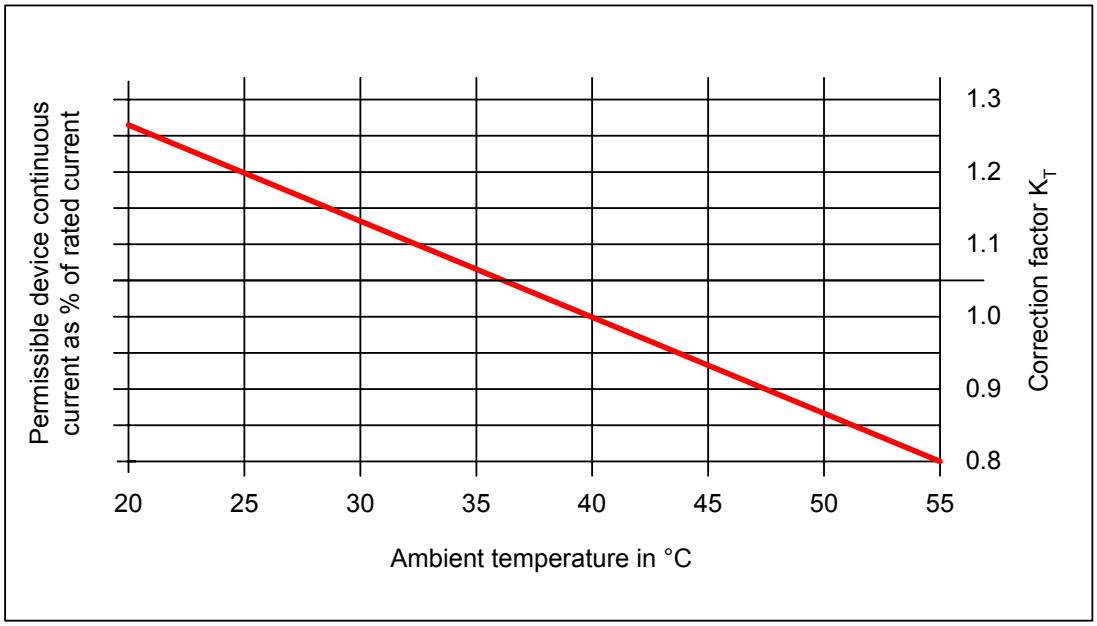


Fig. 1-4 Current correction factor K_T as a function of the cooling air temperature

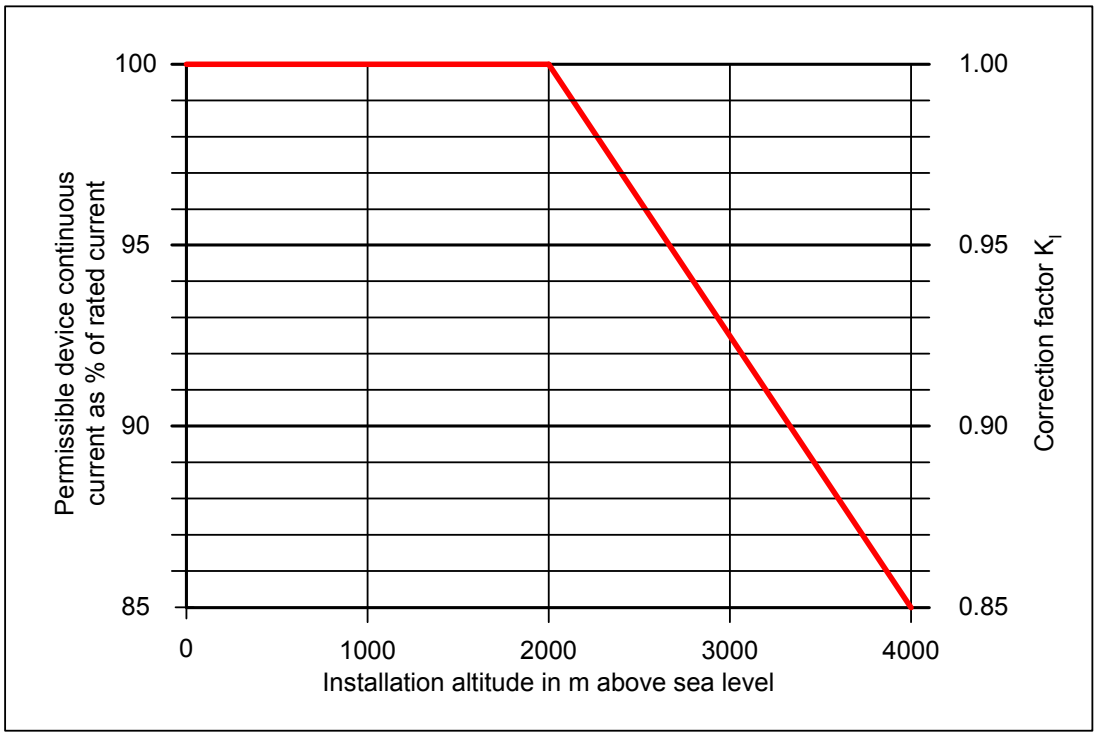


Fig. 1-5 Current correction factor K_I as a function of the installation altitude

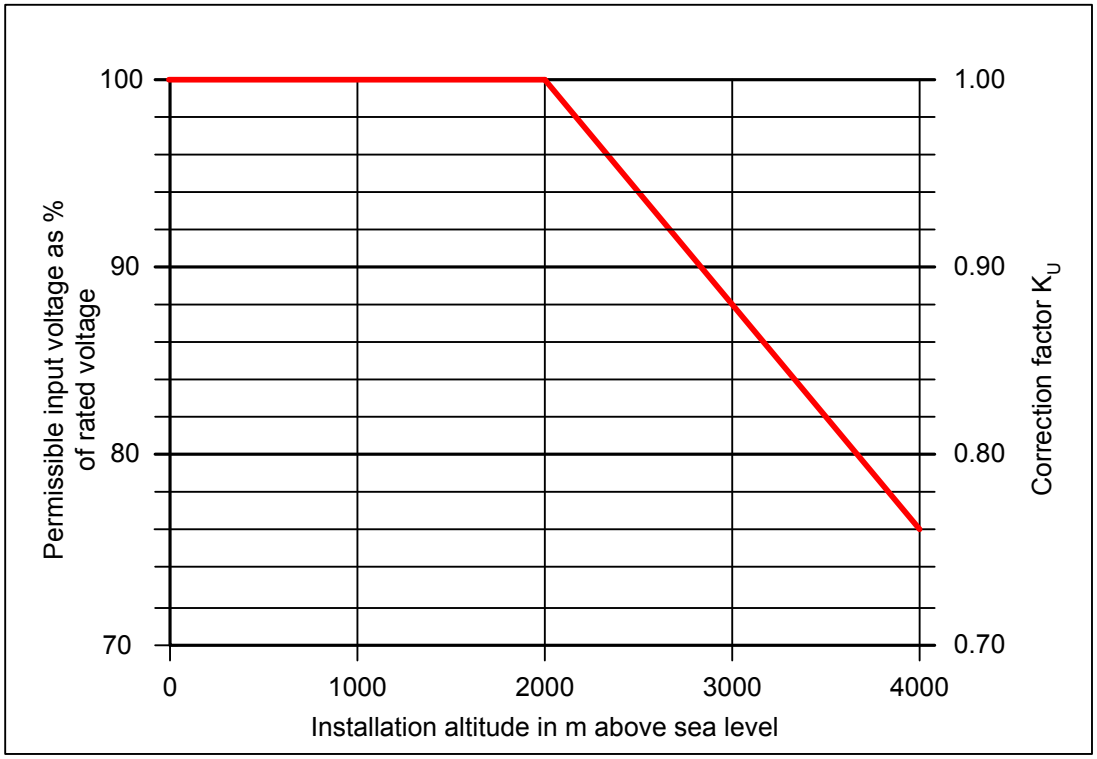


Fig. 1-6 Voltage correction factor K_U as a function of the installation altitude

1.4.2 Correction Factors with Higher Ambient Temperatures and Installation Altitudes

If the Line Modules and Motor Modules are operated in ambient temperatures of > 40°C and at installation altitudes of > 2000 m, the derating characteristics for the permissible output power and the output current must be taken into account.

A voltage reduction (K_U) must also be taken into account at installation altitudes of > 2000 m (to IEC 60664-1). Due to their narrow voltage range, modules with a voltage range of between 660 V - 690 V 3AC cannot be used at altitudes of above 3500 m.

Example 1

A drive system comprising line and Motor Modules is to be operated at an altitude of 2500 m in a maximum ambient temperature of 30°C.

Since the ambient temperature is below 40°C, a compensation calculation (installation altitude/ambient temperature) can be carried out.

Background:

If the modules are operated at altitudes of between 2000 and 4000 m, the air density and, in turn, the cooling capacity of the devices, which undergo forced cooling, decreases. Since ambient temperatures at the installation site are often rather low, however, a compensation calculation can be carried out for the devices. The current reduction can be offset with the correction factor (K_T) shown in Fig. 1-4. If the result of multiplying correction factor K_T by correction factor K_I is greater than 1, the rated current can be used in the calculation. If the result is <1, the rated current must be multiplied by this value to yield the maximum permissible continuous current.

The following formula is used:

$I \leq I_N \times K_I \times K_T$, $I \leq I_N$ (I = permissible continuous current, I_N = rated current)

Installation altitude: 2500 m; max. ambient temperature: 30°C

- Correction factor $K_I = 0.965$
- Correction factor $K_T = 1.133$
- Correction factor $K_U = 0.94$

$I \leq I_N \times K_I \times K_T$

$I \leq I_N \times 0.965 \times 1.133$

$I \leq I_N \times 1.094$

however $I \leq I_N$

Result:

- Since the result yields a factor of > 1, the current does not have to be reduced.
- At installation altitudes of > 2000 m, however, the voltage must be reduced (to IEC 60 664-1).
- Devices in the voltage range 380 V - 480 V 3AC can be operated with a maximum voltage of 0.94 x 480 V = 451 V.
- Devices in the voltage range 660 V – 690 V 3AC can be operated with a maximum voltage of 0.94 x 690 V = 648 V.

Example 2

When a drive line-up is configured, a Motor Module with the order number 6SL3320-1TE32-1AA0 is selected. The drive line-up is to be operated at an altitude of 3000 m where ambient temperatures could reach 35°C as a result of the installation conditions.

The following formula is used:

$I \leq I_N \times K_I \times K_T$, $I \leq I_N$ (I = permissible continuous current, I_N = rated current)

Installation altitude: 3000 m; max. ambient temperature: 35°C; output voltage of the Motor Module: 380 V to 480 V, 110 kW / 210 A

- Correction factor $K_I = 0.925$
- Correction factor $K_T = 1.066$
- Correction factor $K_U = 0.88$

$I \leq I_N \times K_I \times K_T$

$I \leq I_N \times 0.925 \times 1.066$

$I \leq I_N \times 0.987$

Result:

- Since the result yields a factor of < 1, the current must be reduced (210 A x 0.987 = 207 A).
- At installation altitudes of > 2000 m, however, the voltage must be reduced (to IEC 60 664-1).
  The selected Motor Module in the voltage range 380 V - 480 V 3AC can be operated up to a voltage of 0.88 x 480 V = 422 V, that is, a 400 V asynchronous motor can be operated here without any restrictions. Due to the installation altitude, however, derating must be taken into account for the asynchronous motor.
- Due to the voltage reduction, however, the Motor Module must only be operated with an output voltage of 400 V.

1.5 Structure of a Drive System with SINAMICS S120

1.5.1 Regulated Infeed

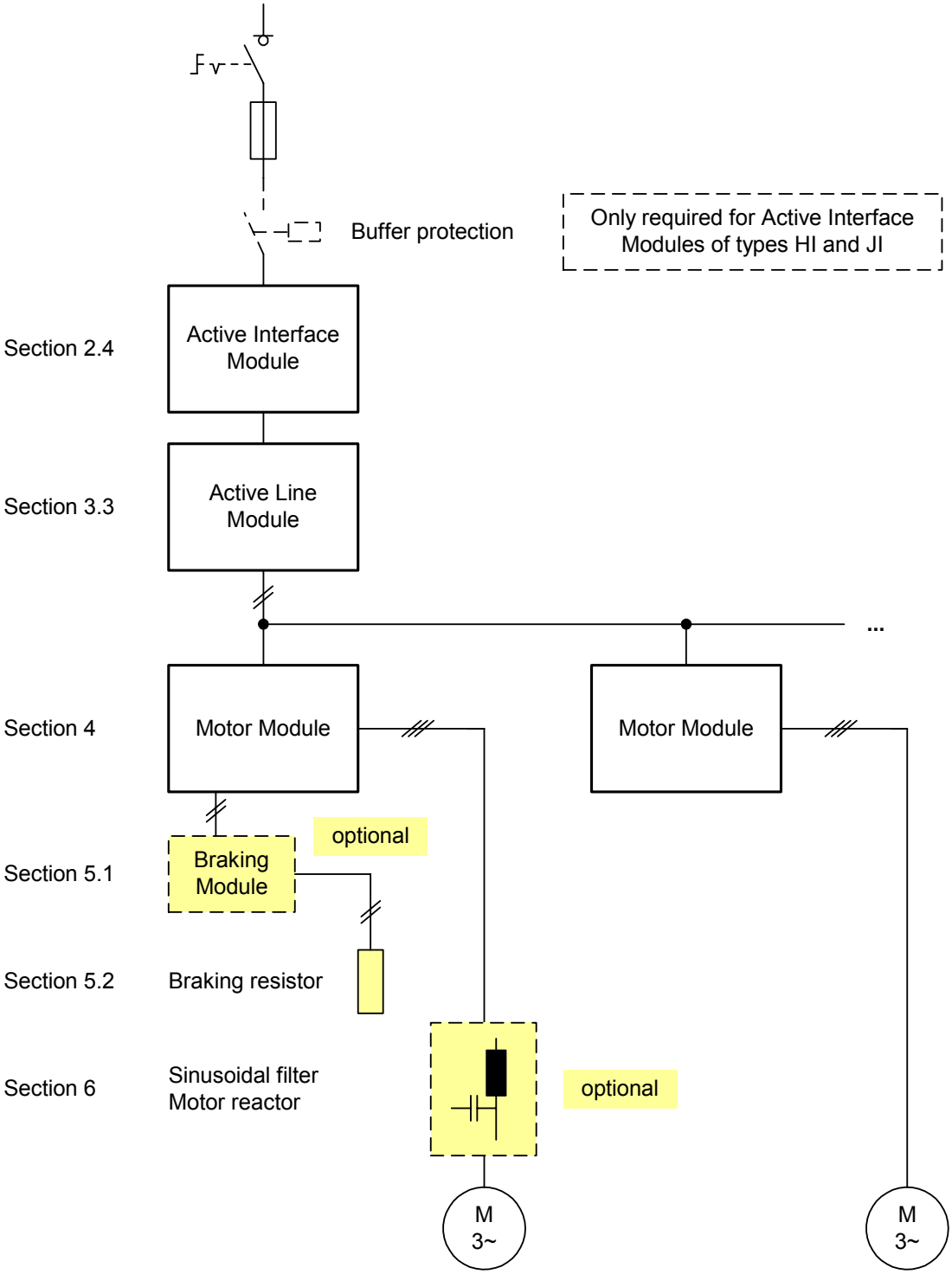


Fig. 1-7 Structure of a drive system with SINAMICS S120 (regulated infeed)

1.5.2 Unregulated Infeed

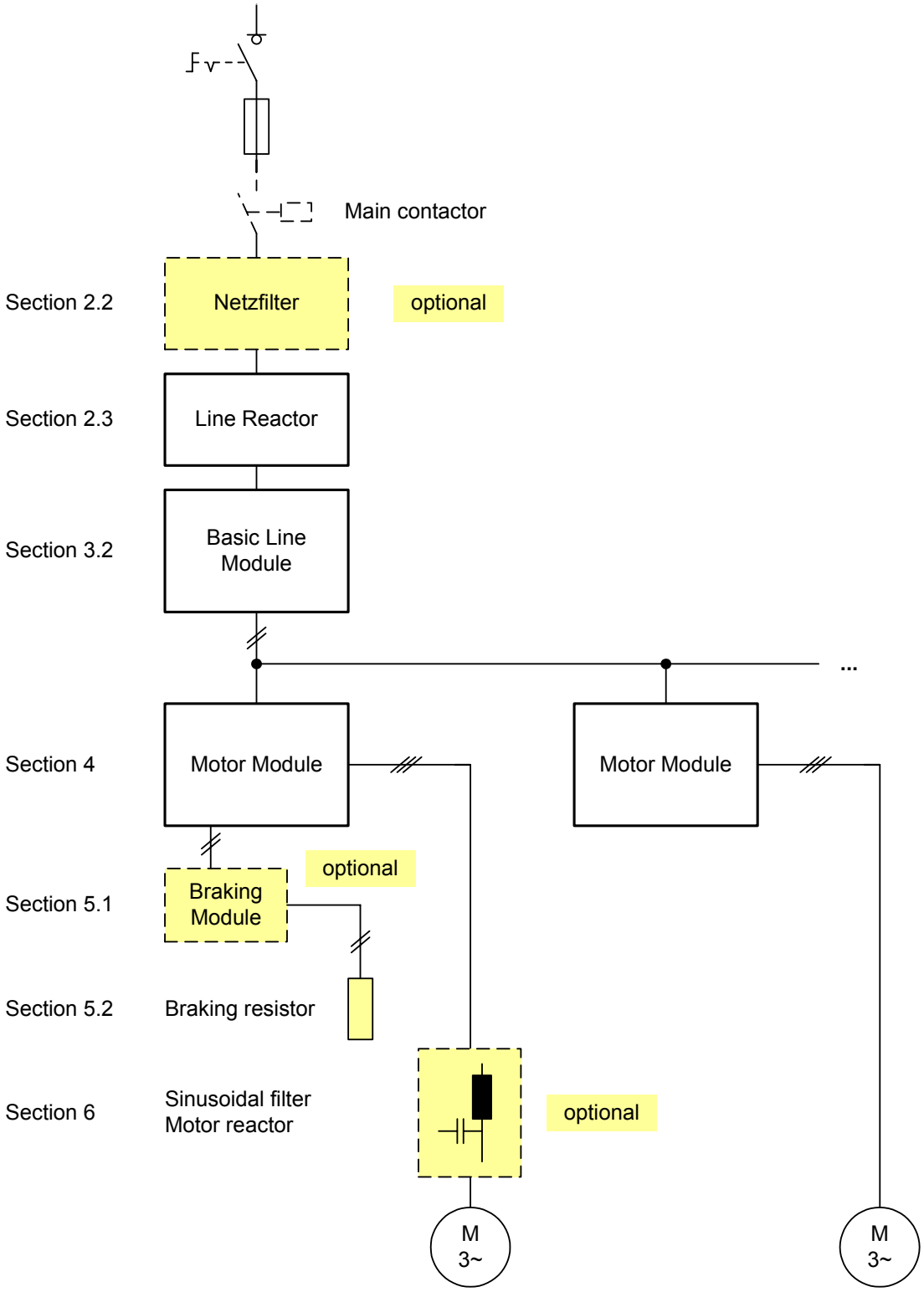


Fig. 1-8 Structure of a drive system with SINAMICS S120 (unregulated infeed)

Line-Side Power Components

2

2.1 General

Line-side power components protect the connected components against temporary or permanent voltage rises and ensure compliance with the specified limit values.

2.2 Line Filters

2.2.1 Description

In conjunction with line reactors and a systematic plant configuration, line filters limit the conducted interference emitted by the power modules at the installation location to permissible values for industry.

2.2.2 Safety Information

Caution

Line filters are only suitable for direction connection to TN systems.

Danger

The 100 mm clearances above and below the components must be observed. This prevents thermal overload of the filter.

Caution

The terminals must be correctly connected:

- Incoming line cable to LINE/NETZ L1, L2, L3

- Outgoing cable to the reactor to LOAD/LAST L1', L2', L3'

Non-observance may damage the line filter.

Caution

The line filters listed conduct a high leakage current via the PE conductor. Because of the high leakage current of the line filters, a permanent PE connection of the line filter or switching cabinet is required.

Measures according to EN 50178, Part 5.3.2.1 must be taken, e.g.:

- Protective conductor ($\geq$10 mm² Cu), or
- Laying of a second conductor, electrically parallel to the PE conductor, via separate terminals.

This conductor must also fully meet the requirements for PE conductors according to IEC 60364-5-54.

Note

If the high-voltage test is carried out with alternating voltage, the line filter must be disconnected to obtain an accurate measurement result.

If a high-voltage test is carried out with direct voltage, the interference-suppression capacitor must also be disconnected (for the Active Interface Module and Basic Line Module).

Caution

Using line filters not released by SIEMENS for SINAMICS can lead to line reactions that can damage or destroy other loads powered from the network.

2.2.3 Dimension Drawing

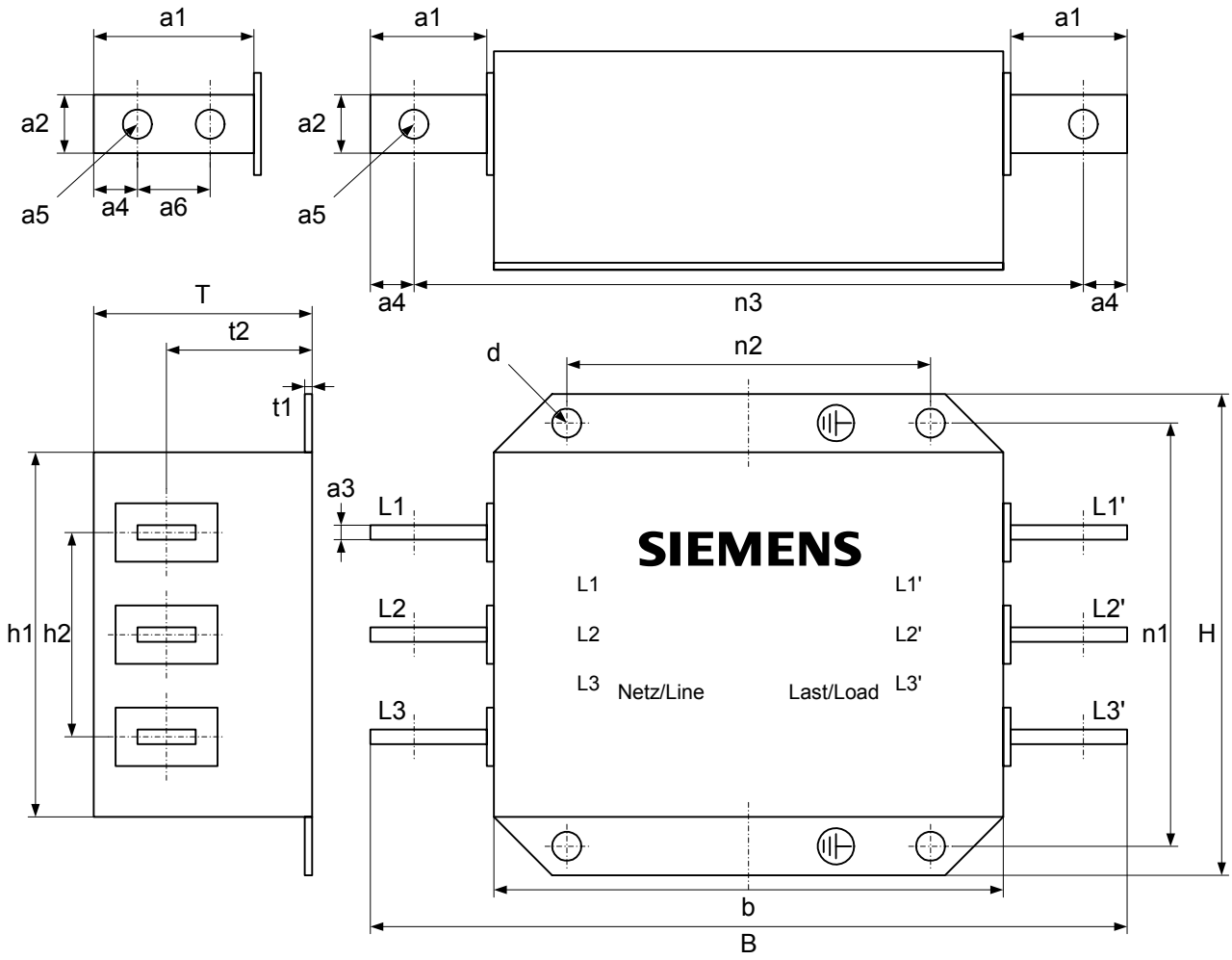


Fig. 2-1 Dimension drawing of line filter

Table 2-1 Dimensions of the line filter (all specifications in mm)

6SL3000-	0BE34-4AA0 0BG34-4AA0	0BE36-0AA0 0BG36-0AA0	0BE41-2AA0 0BG41-2AA0	0BE41-6AA0
B	360	400	425	505
H	240	265	265	265
T	116	140	145	145
a1	40	40	50	90
a2	25	25	50	50
a3	5	8	10	15
a4	15	15	20	20
a5	11	11	14	14
a6	-	-	-	40
b	270	310	315	315
h1	200	215	215	215
h2	100	120	142	142
t1	2	2.5	2.5	2.5
t2	78.2	90	91	91
n1 [1)]	220	240	240	240
n2 [1)]	210	250	255	255
n3	330	370	385	465
d	9	12	12	12
[1)] Dimensions n1 and n2 correspond to the drill hole spacing				

2.2.4 Technical Specifications

Table 2-2 Technical specifications for line filters (380 V – 480 V 3AC)

Order number	6SL3000-	0BE34-4AA0	0BE36-0AA0	0BE41-2AA0	0BE41-2AA0	0BE41-6AA0
Suitable for Basic Line Module	6SL3330-	1TE34-2AA0	1TE35-3AA0	1TE38-2AA0	1TE41-2AA0	1TE41-5AA0
Rated power of the Basic Line Module	kW	200	250	400	560	710
Rated voltage	V	380 3AC –10% to 480 3AC +10% (-15% < 1 min)				
Rated current	A	440	600	1200	1200	1600
Power loss	kW	0.049	0.055	0.137	0.137	0.182
Line/load connection L1, L2, L3, L1', L2', L3'		Connection lugs M10	Connection lugs M10	Connection lugs M12	Connection lugs M12	Connection lugs M12
PE connection		M8	M10	M10	M10	M10
Dimensions Length Width Height	 mm mm mm	 360 240 116	 400 265 140	 425 265 145	 425 265 145	 505 265 145
Weight	kg	12.3	19.0	25.2	25.2	28.8

Table 2-3 Technical specifications for line filters (660 V – 690 V 3AC)

Order number	6SL3000-	0BG34-4AA0	0BG34-4AA0	0BG36-0AA0	0BG41-2AA0	0BG41-2AA0
Suitable for Basic Line Module	6SL3330-	1TH33-3AA0	1TH34-3AA0	1TH36-8AA0	1TH41-1AA0	1TH41-4AA0
Rated power of the Basic Line Module	kW	250	355	560	900	1100
Rated voltage	V	380 3AC –10% to 480 3AC +10% (-15% < 1 min)				
Rated current	A	440	440	600	1200	1200
Power loss	kW	0.049	0.049	0.055	0.137	0.137
Line/load connection L1, L2, L3, L1', L2', L3'		Connection lugs M10	Connection lugs M10	Connection lugs M10	Connection lugs M12	Connection lugs M12
PE connection		M8	M8	M10	M10	M10
Dimensions Length Width Height	 mm mm mm	 360 240 116	 360 240 116	 400 265 140	 425 265 145	 425 265 145
Weight	kg	12.3	12.3	19.0	25.2	25.2

2.3 Line Reactors

2.3.1 Description

Line reactors limit low-frequency line reactions to permissible values. For this reason, line reactors must always be provided when Basic Line Modules are used.

2.3.2 Safety Information

Caution

The 100 mm clearances above and below the components must be observed.

Note

The connection lines to the Line Module must be kept as short as possible (max. 5 m).

Caution

The terminals must be correctly connected:

- Incoming line cable to 1U1, 1V1, 1W1, and
- Outgoing cable to the load 1U2, 1V2, 1W2.

Non-observance may damage the line reactor.

Caution

Using line reactors not approved by SIEMENS for SINAMICS:

- Can damage/destroy Line Modules.
- Can cause line reactions that may interfere with or damage other loads powered from the same network.

Caution

The surface temperature of the line reactors may exceed 80°C.

2.3.3 Dimension Drawing

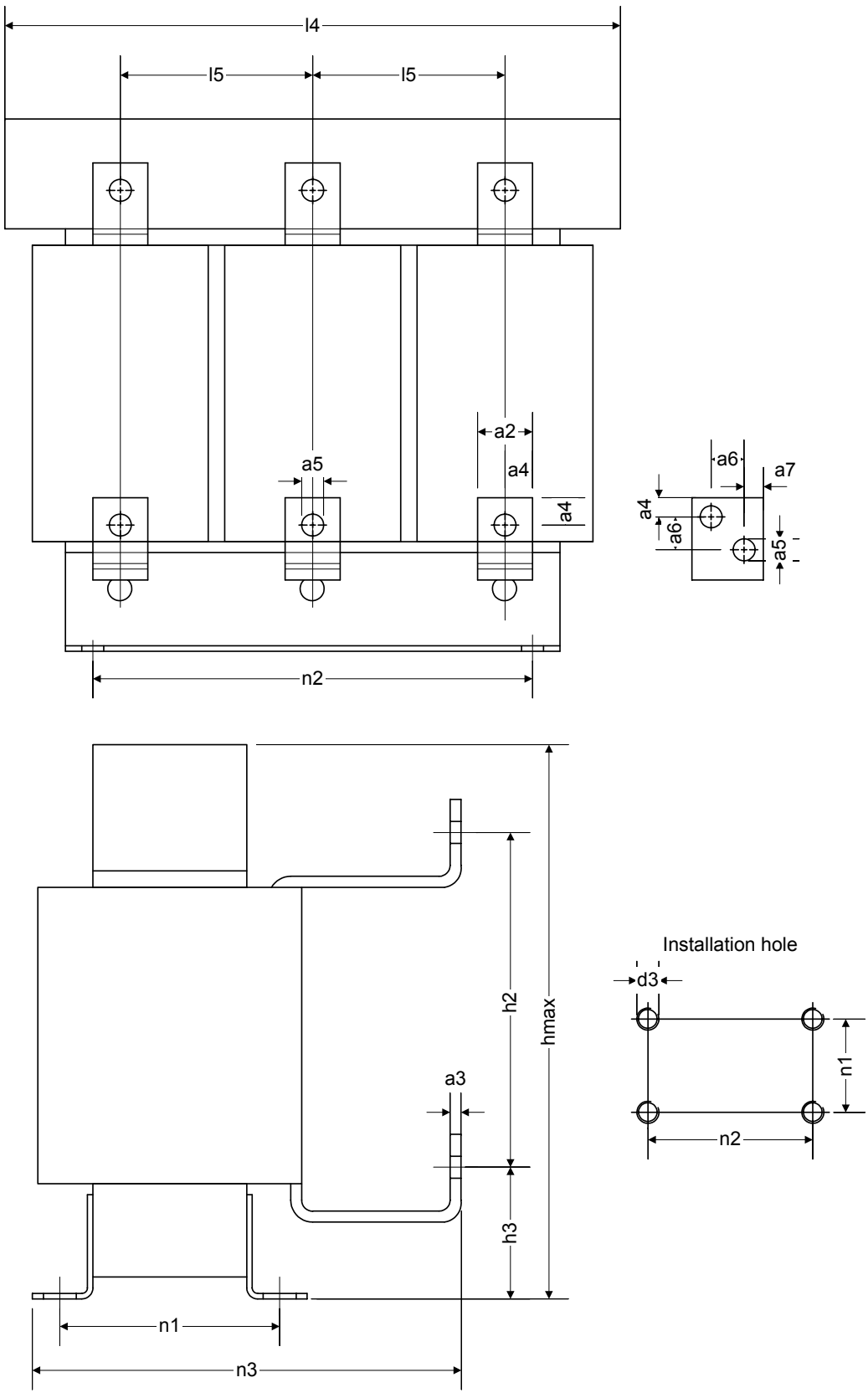


Fig. 2-2 Dimension drawing of line reactor

Table 2-4 Dimensions of line reactors (380 V – 480 V 3AC) (all specifications in mm)

6SL3000-	0CE35-1AA0	0CE37-7AA0	0CE41-0AA0	0CE41-5AA0
a2	30	30	50	60
a3	6	6	8	12
a4	15	15	25	25
a5	14	14	14	14
a6	-	-	-	26
a7	-	-	-	17
l4	300	300	350	460
l5	100	100	120	152.5
hmax	269	269	321	435
h2	180	180	252	278
h3	60	60	120	120
n1 [1)]	118	118	138	155
n2 [1)]	224	224	264	356
n3	212.5	212.5	211.5	235
d3	M8	M8	M8	M12
[1)] Dimensions n1 and n2 correspond to the drill hole spacing				

Table 2-5 Dimensions of line reactors (660 V – 690 V 3AC) (all specifications in mm)

6SL3000-	0CH32-7AA0	0CH34-8AA0	0CH36-0AA0	0CH38-4AA0	0CH41-2AA0
a2	25	30	30	40	60
a3	5	6	6	8	12
a4	12.5	15	15	20	25
a5	11	14	14	14	14
a6	-	-	-	-	26
a7	-	-	-	-	17
l4	270	350	350	410	460
l5	88	120	120	135	152.5
hmax	248	321	321	385	435
h2	150	198	198	252	278
h3	60	75	75	120	120
n1 [1)]	101	138	138	141	155
n2 [1)]	200	264	264	316	356
n3	200	232.5	232.5	224	235
d3	M8	M8	M8	M10	M12
[1)] Dimensions n1 and n2 correspond to the drill hole spacing					

2.3.4 Technical Specifications

Table 2-6 Technical specifications for line reactors (380 V – 480 V 3AC)

Order number	6SL3000-	0CE35-1AA0	0CE35-1AA0	0CE37-7AA0	0CE41-0AA0	0CE41-5AA0
Suitable for Basic Line Module	6SL3330-	1TE34-2AA0	1TE35-3AA0	1TE38-2AA0	1TE41-2AA0	1TE41-5AA0
Rated power of the Basic Line Module	kW	200	250	400	560	710
Rated voltage	V	380 3AC –10% to 480 3AC +10% (-15% < 1 min)				
Rated current	A	380	490	745	985	1405
I_{thmax}	A	508	508	773	1022	1458
Power loss 50/60 Hz	kW	0.323/0.365	0.323/0.365	0.310/0.351	0.441/0.498	0.687/0.776
Line/load connection		Connection lugs M12	Connection lugs M12	Connection lugs M12	Connection lugs M12	Connection lugs M12
Degree of protection		IP 00	IP 00	IP 00	IP 00	IP 00
Dimensions Width Height Depth	 mm mm mm	 300 269 212.5	 300 269 212.5	 300 269 212.5	 350 321 211.5	 460 435 235
Weight	kg	38	38	51.3	69.6	118

Table 2-7 Technical specifications for line reactors (660 V – 690 V 3AC)

Order number	6SL3000-	0CH32-7AA0	0CH34-8AA0	0CH36-0AA0	0CH38-4AA0	0CH41-2AA0
Suitable for Basic Line Module	6SL3330-	1TH33-0AA0	1TH34-3AA0	1TH36-8AA0	1TH41-1AA0	1TH41-4AA0
Rated power of the Basic Line Module	kW	250	365	560	900	1100
Rated voltage	V	660 3AC –10% to 690 3AC +10% (-15% < 1 min)				
Rated current	A	260	465	575	810	1125
I_{thmax}	A	270	482	597	840	1167
Power loss 50/60 Hz	kW	0.245/0.277	0.424/0.478	0.430/0.485	0.547/0.618	0.693/0.783
Line/load connection		Connection lugs M10	Connection lugs M12	Connection lugs M12	Connection lugs M12	Connection lugs M12
Degree of protection		IP 00	IP 00	IP 00	IP 00	IP 00
Dimensions Width Height Depth	 mm mm mm	 270 248 200	 350 321 232.5	 350 321 232.5	 410 385 224	 460 435 235
Weight	kg	27.9	55.6	63.8	98.0	147

2.4 Active Interface Modules

2.4.1 Description

Active Interface Modules are used in conjunction with Active Line Modules in chassis format. They contain the components required for operating the Active Line Modules, such as line reactors, voltage sensing modules (VSM), monitoring sensors, and a pre-charging input circuit. Active Interface Modules of types FI and GI also feature buffer protection. This must be provided separately for types HI and JI.
The integrated Clean Power Filter suppresses any remaining line harmonics to the greatest possible extent.

The Active Interface Module and the Active Line Module together form an Active Infeed, which acts as a self-commutating Line Infeed unit. It is characterized by its infeed/regenerative feedback capability, its constant and controlled DC link voltage (even when the supply voltage fluctuates), its high dynamic response, and a high operational reliability.

The Active Interface Module contains:

- Clean Power Filter
- Line reactor
- Pre-charging input circuit
- Buffer protection (types FI/GI)
- Voltage sensing module (VSM)
- Fan

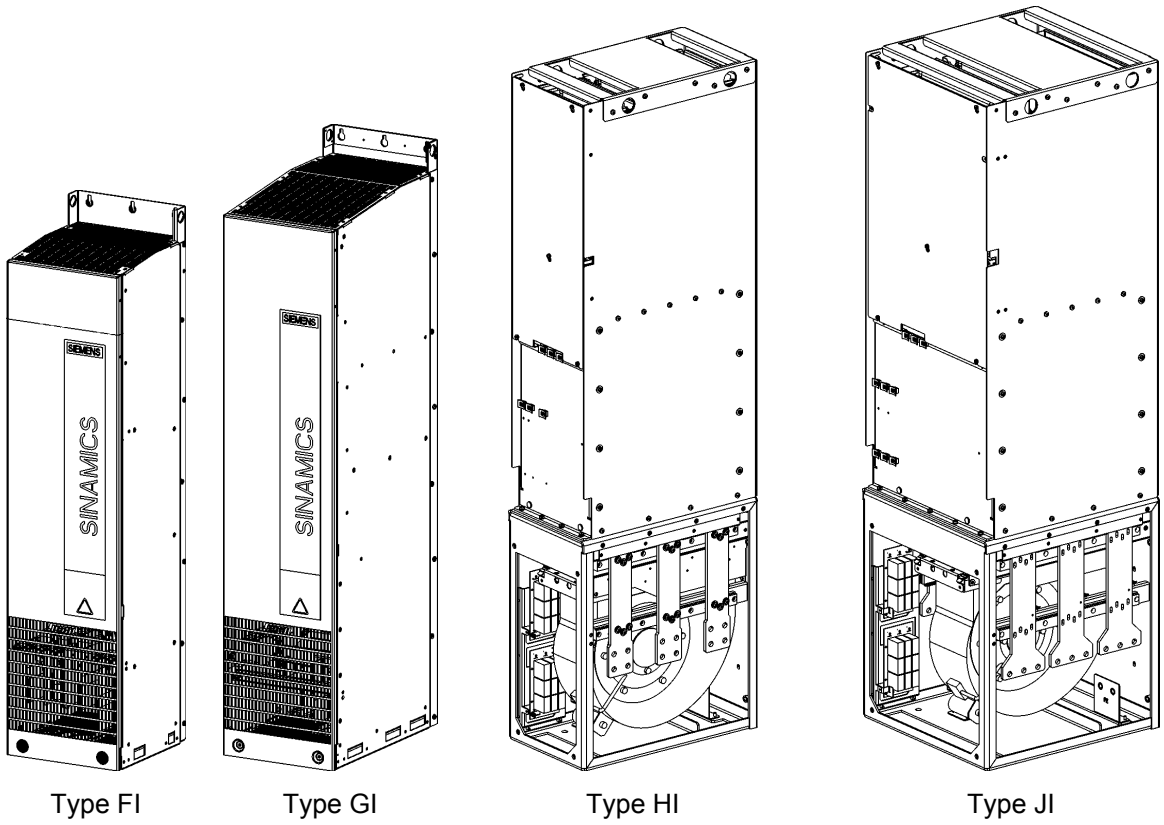


Fig. 2-3 Active Interface Module (types FI / GI / HI / JI)

2.4.2 Interface Description

2.4.2.1 Overview

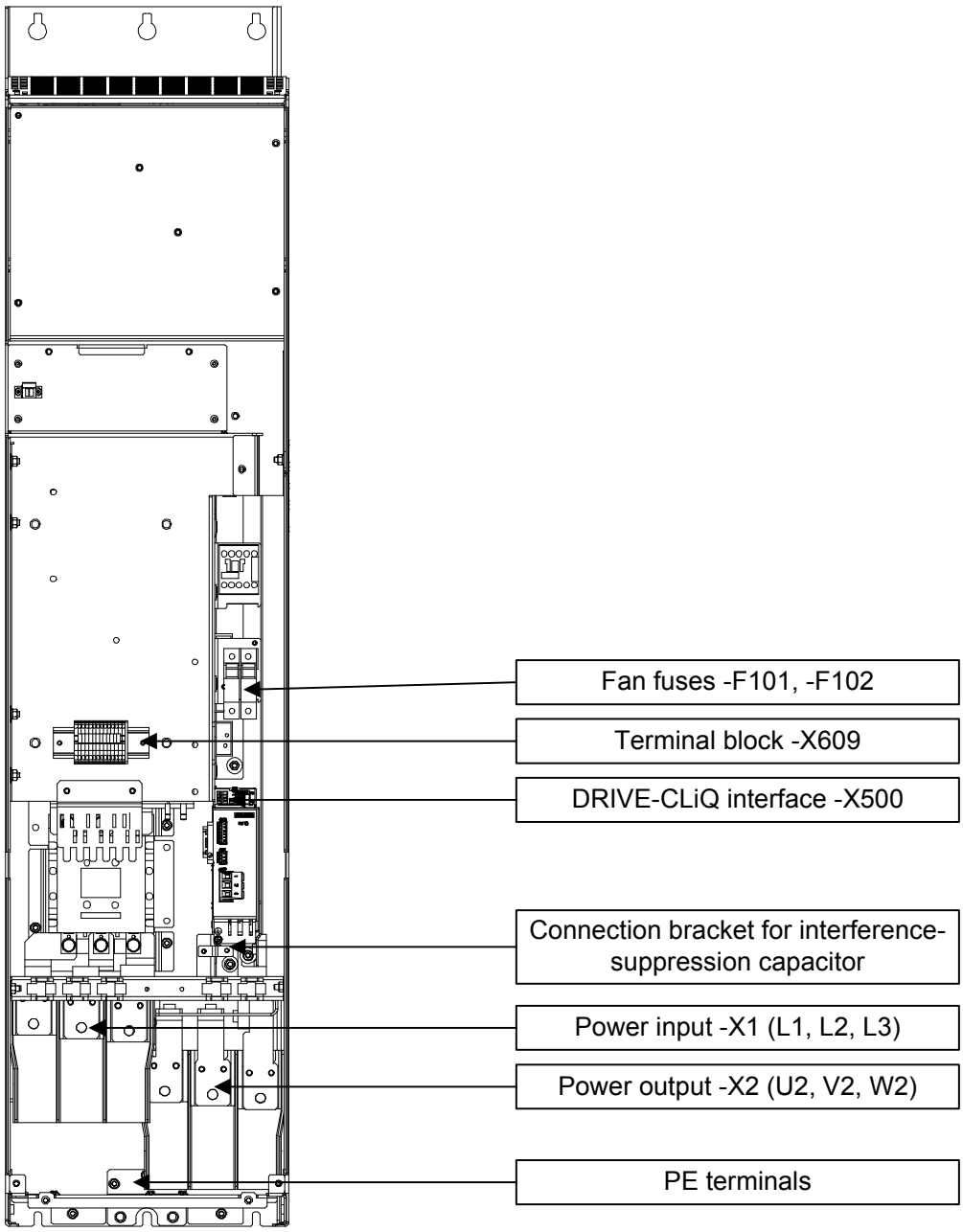


Fig. 2-4 Overview of the Active Interface Module interfaces (type FI)

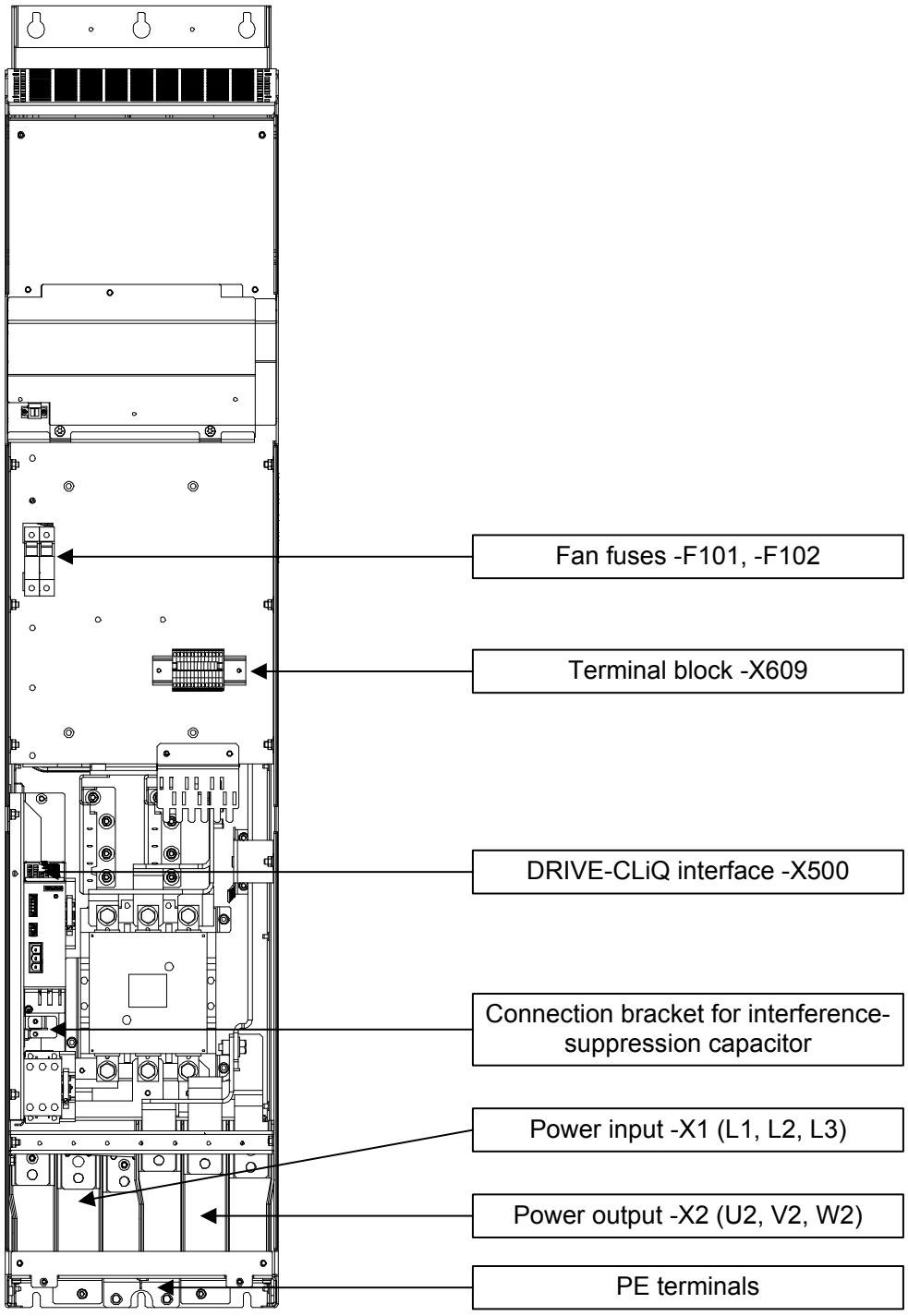


Fig. 2-5 Overview of the Active Interface Module interfaces (type GI)

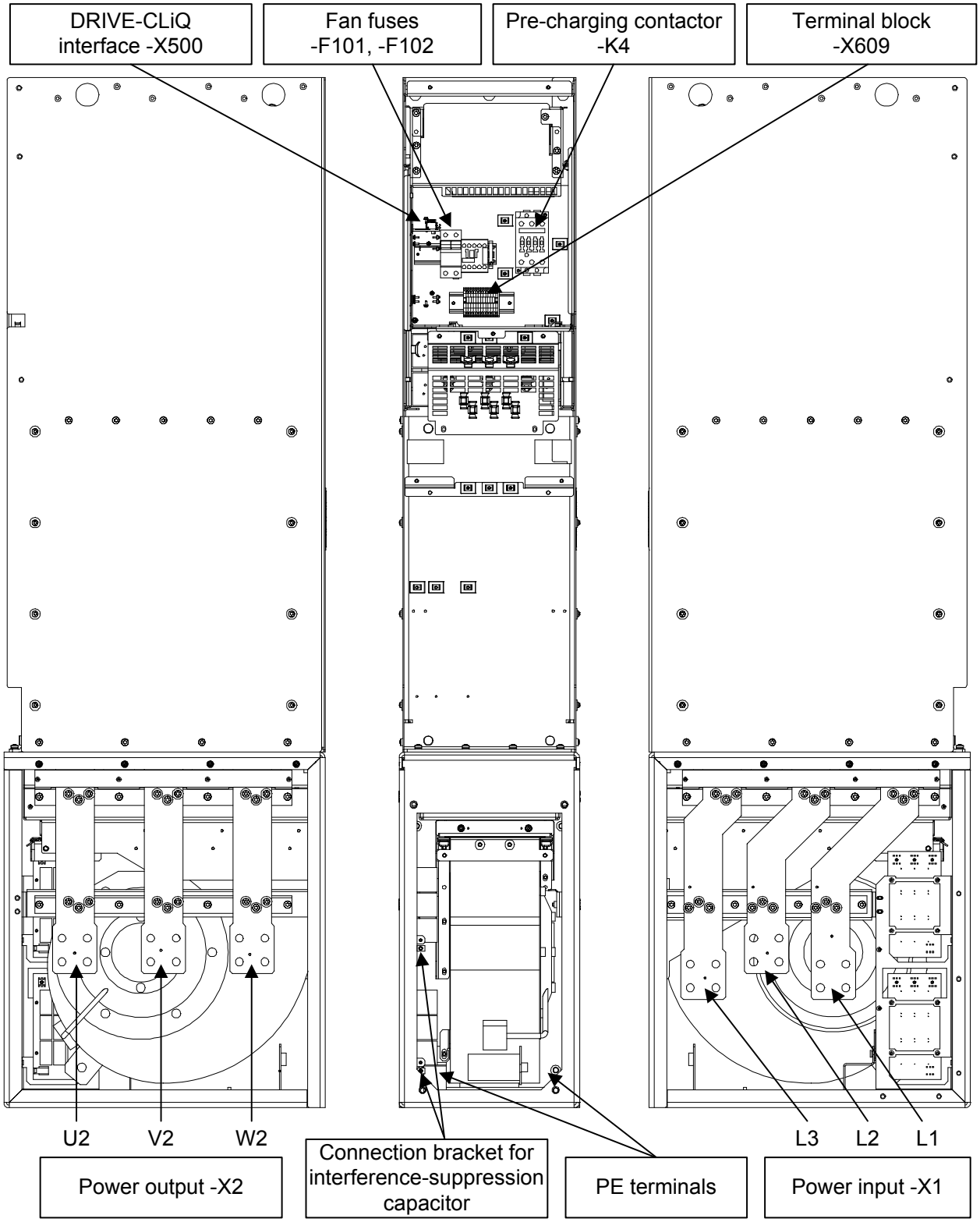


Fig. 2-6 Overview of the Active Interface Module interfaces (type HI)

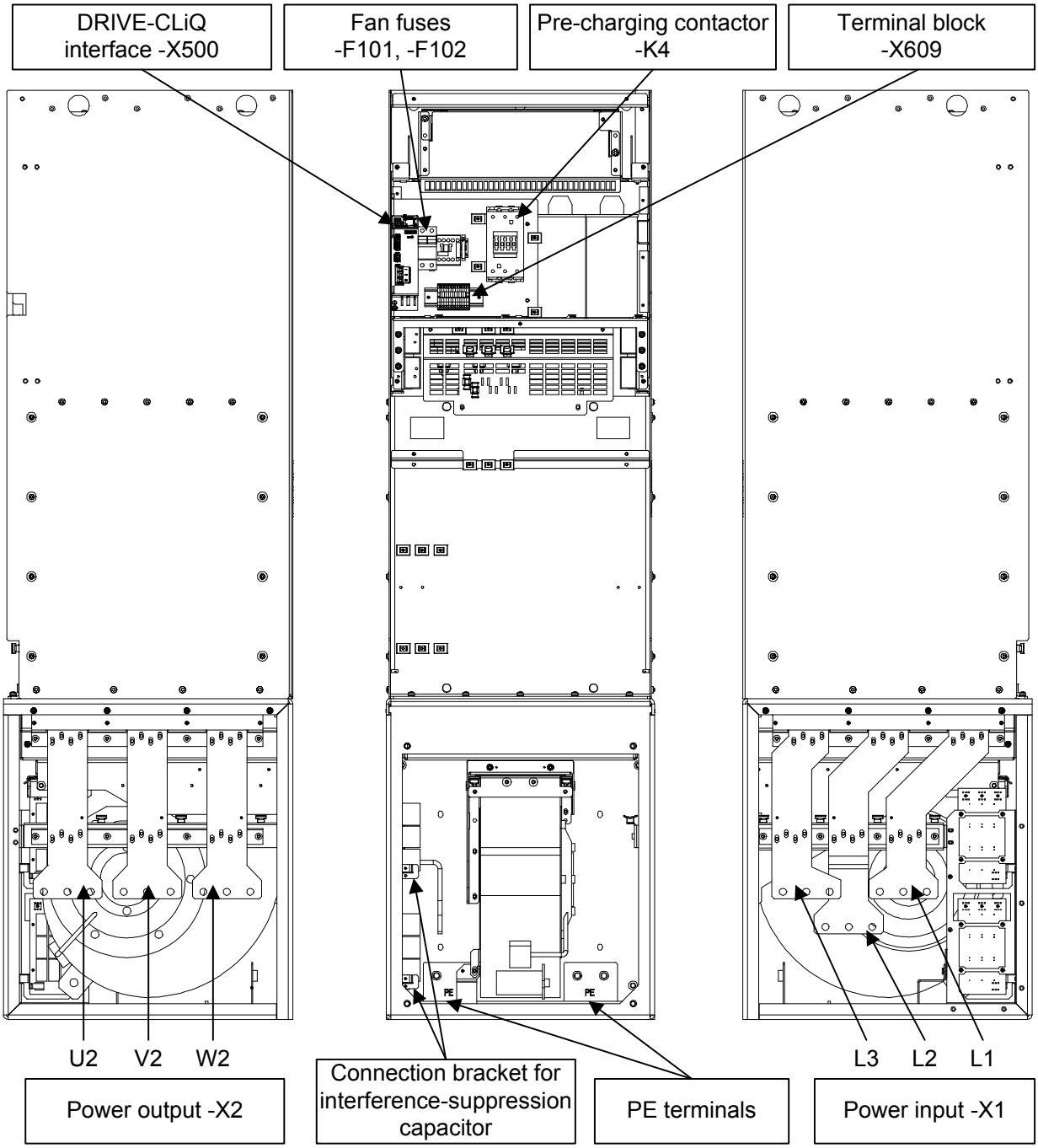


Fig. 2-7 Overview of the Active Interface Module interfaces (type JI)

2.4.2.2 Connection Example

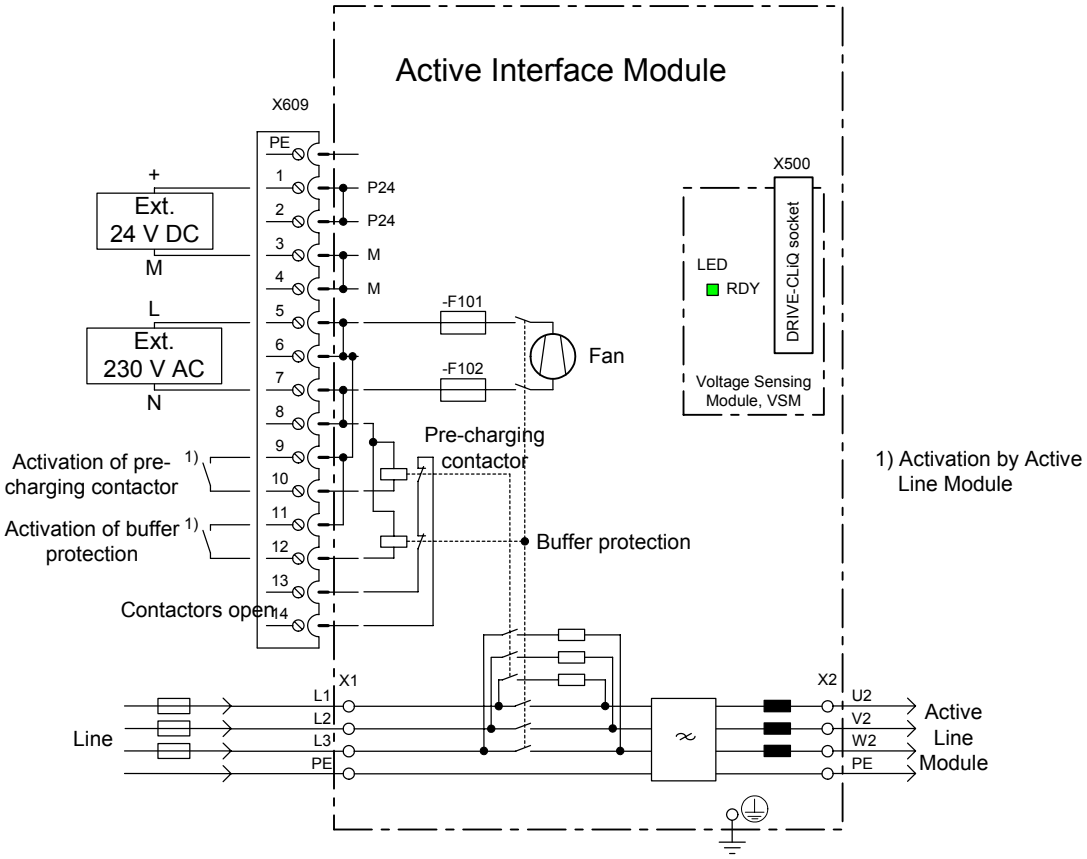


Fig. 2-8 Connection example for the Active Interface Module (types FI / GI)

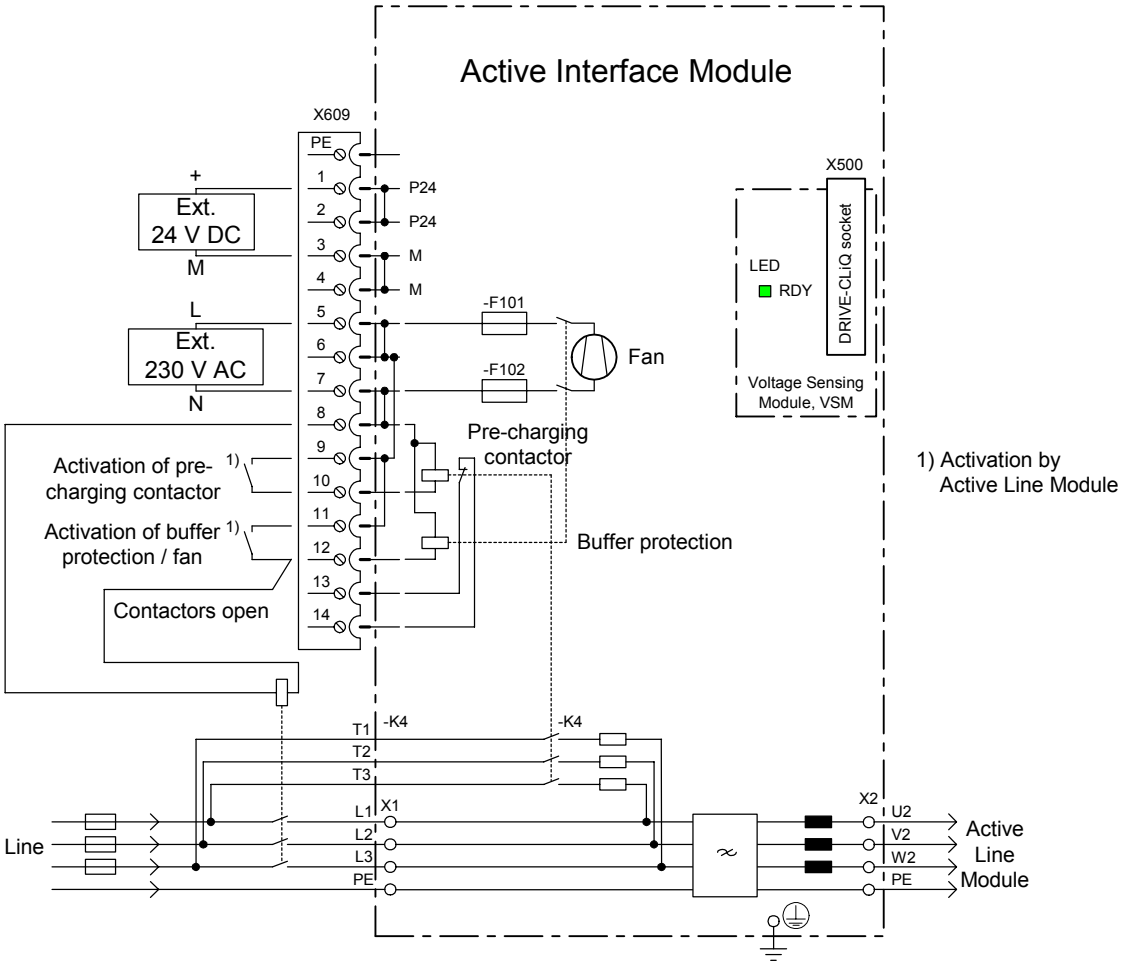


Fig. 2-9 Connection example for the Active Interface Module (types HI / JI)

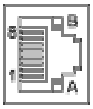
2.4.2.3 X1, X2 Line/Load Connection

Table 2-8 Connections for the Active Interface Module

Terminals	Designations
X1: L1, L2, L3, PE X2: U2, V2, W2, PE	Voltage: • 380 V 3AC – 10% to 480 V 3AC +10% (-15% < 1 min) • 660 V 3AC – 10% to 690 V 3AC +10% (-15% < 1 min) Frequency: 47 Hz to 63 Hz Connection lugs: • Types FI / GI: d = 11 mm (M10 / 25 Nm) for ring cable lugs to DIN 46234 • Types HI / JI: d = 13 mm (M12 / 50 Nm) for ring cable lugs to DIN 46234
K4: T1, T2, T3 (types HI / JI only)	Connection for pre-charging input circuit directly on pre-charging contactor Connection lugs: • Type HI: max. 2 x 16 mm² (3RT1034) • Type JI: max. 2 x 35 mm² (3RT1044)

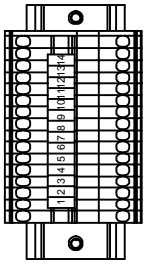
2.4.2.4 DRIVE-CLiQ Interface X500

Table 2-9 DRIVE-CLiQ interface X500

	PIN	Signal name	Technical specifications
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	24 V power supply
	B	GND (0 V)	Electronic ground
Blanking plate for DRIVE-CLiQ interface: Tyco, order no.: 969556-5			

2.4.2.5 Terminal Block X609

Table 2-10 Terminal block X609

	Terminal	Designation	Technical specifications	
	1	P24	Voltage: 24 V DC (20.4 V – 28.5 V) Current input: max. 0.25 A	
	2	P24		
	3	M		
	4	M		
	5	L	Voltage: 230 V AC (195.5 V – 264.5 V) Current input: max. 10 A For the fan operating currents, see Table 2-12 to Table 2-14.	
	6	L		
	7	N		
	8	N		
	9	Pre-charging contactor –A1*	Voltage: 230 V AC (195.5 V – 264.5 V) Current input: max. 4 A	To Active Line Module, X9:5
	10	Pre-charging contactor –A2*		To Active Line Module, X9:6
	11	Buffer protection –A1*	Voltage: 230 V AC (195.5 V – 264.5 V) Current input: max. 6 A	To Active Line Module, X9:3
	12	Buffer protection –A2*		To Active Line Module, X9:4
	13	Contactor feedback 1*	Voltage: 230 V AC (195.5 V – 264.5 V) Max. permissible current: 6 A	
	14	Contactor feedback 2*		

* Series connection: NO contact, pre-charging contactor, and buffer protection

Caution

Active Interface Modules of types HI and JI require a signal on terminal X609:11 and 12 to activate the fans. If this signal is not present during operation, the fans do not rotate and the module is switched off due to overtemperature.

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

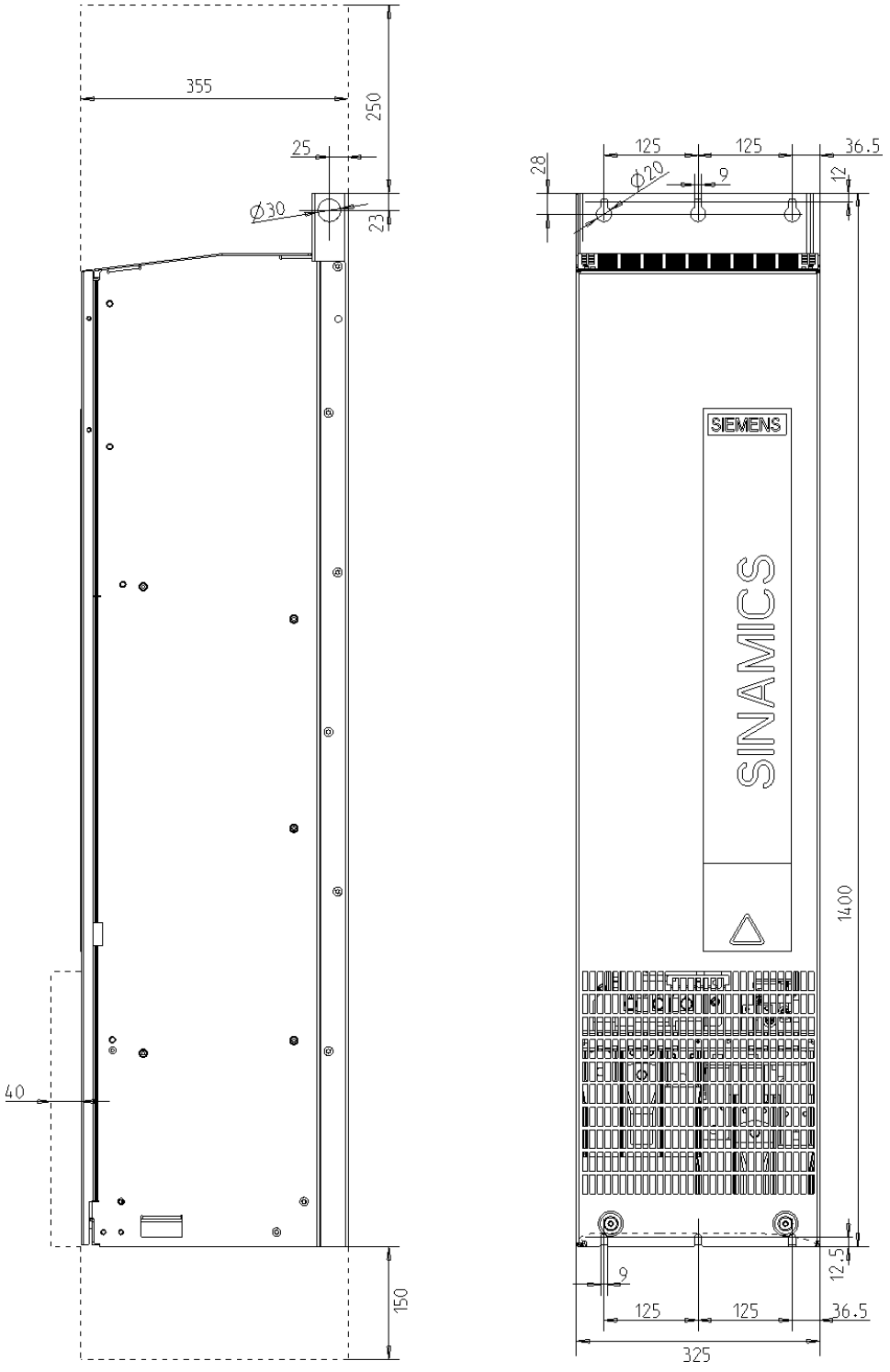
Table 2-11 Description of the LED on the voltage sensing module (VSM) in the Active Interface Module

LED	Color	Status	Description
RDY	---	OFF	Electronics power supply outside permissible tolerance range
	Green	Continuous	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Red	Continuous	At least one fault is present in this component.

2.4.3 Dimension Drawing

Dimension drawing (type FI)

The clearances to be observed are indicated by the dotted line.

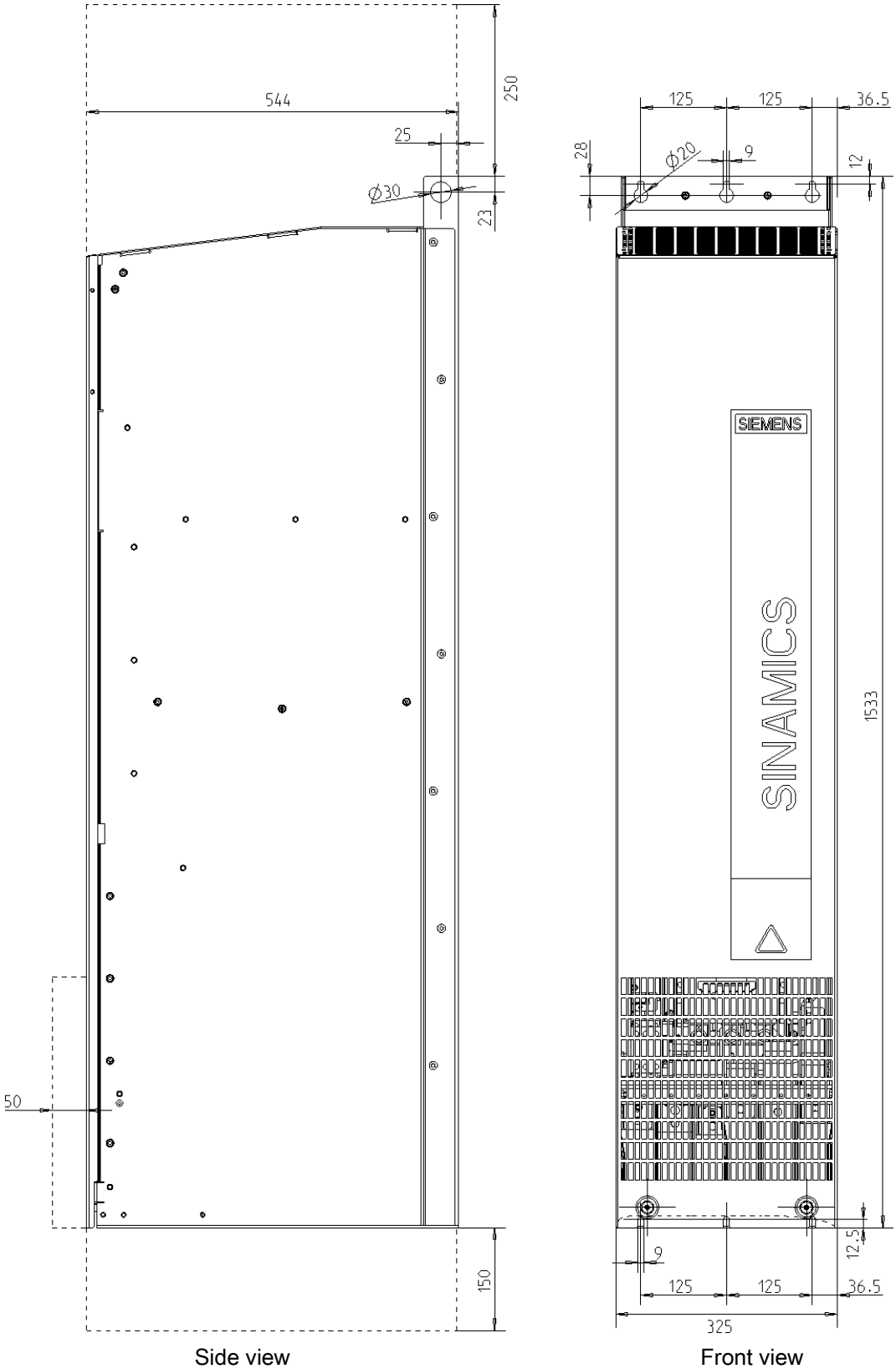


Side view Front view

Fig. 2-10 Dimension drawing of the Active Interface Module (type FI)

Dimension drawing (type GI)

The clearances to be observed are indicated by the dotted line.

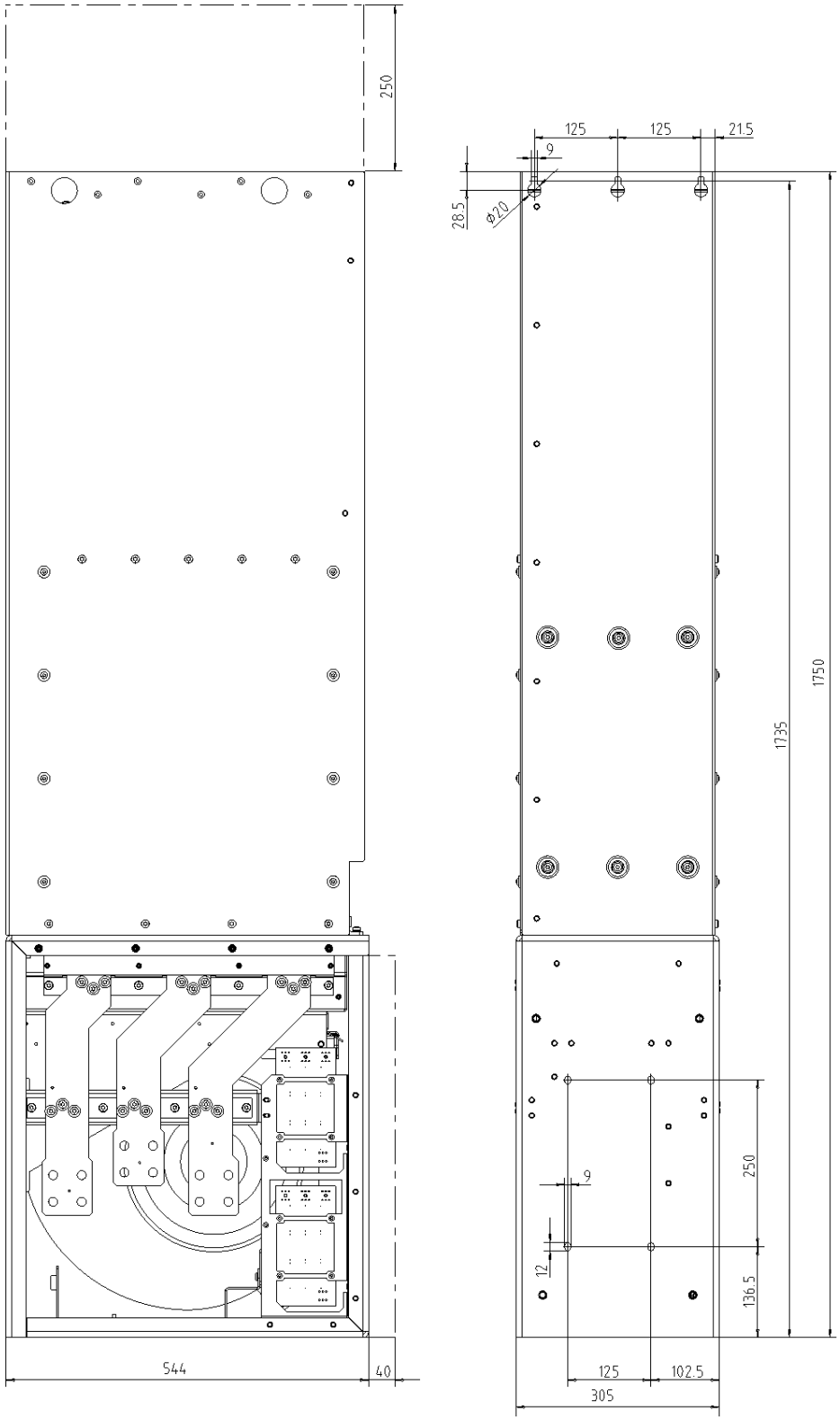


Side view Front view

Fig. 2-11 Dimension drawing of the Active Interface Module (type GI)

Dimension drawing (type HI)

The clearances to be observed are indicated by the dotted line.

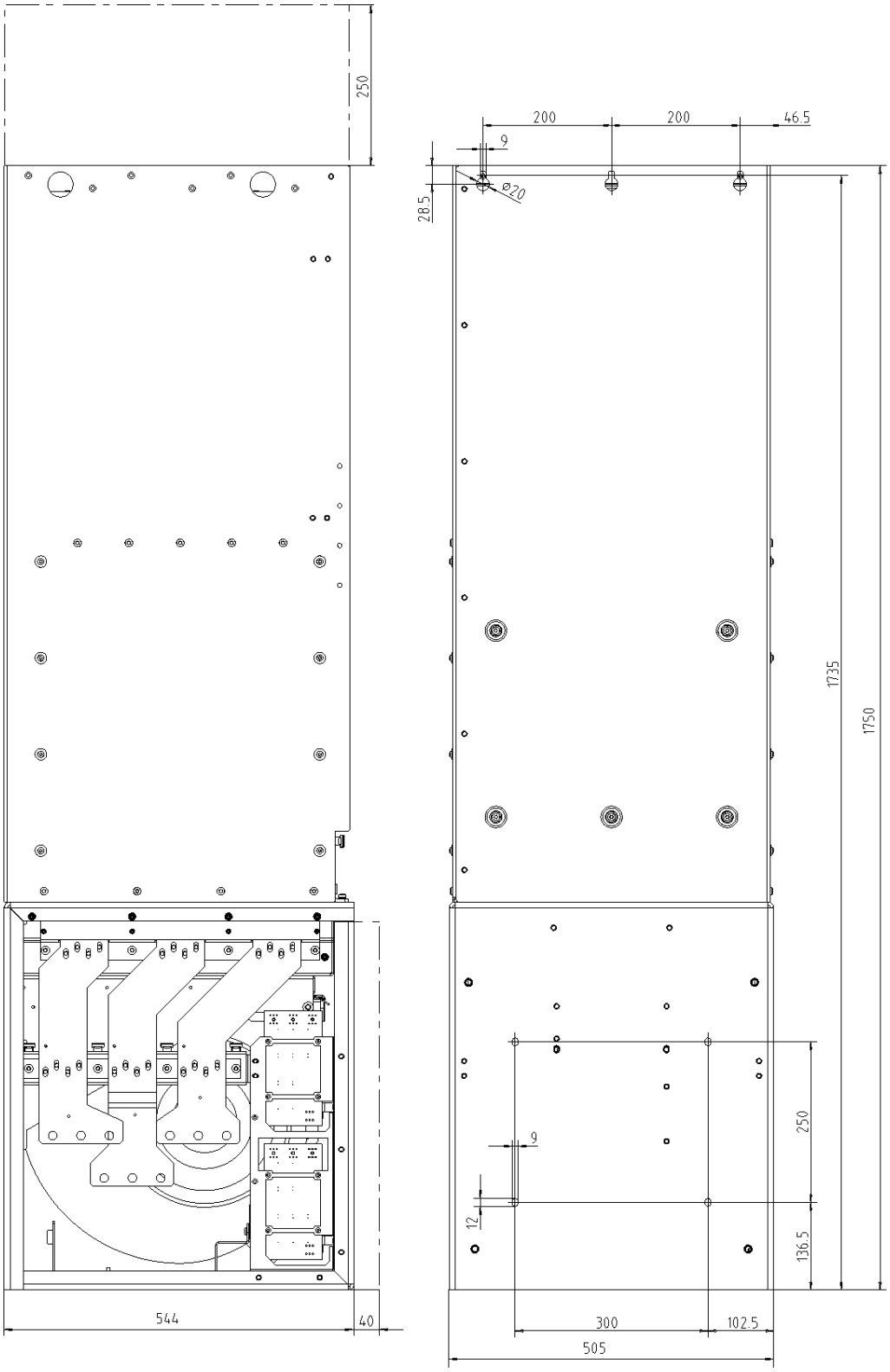


Side view Rear view

Fig. 2-12 Dimension drawing of the Active Interface Module (type HI)

Dimension drawing (type JI)

The clearances to be observed are indicated by the dotted line.



Side view Rear view

Fig. 2-13 Dimension drawing of the Active Interface Module (type JI)

2.4.4 Electrical Connection

The Active Interface Module is electrically connected in accordance with the connection examples shown in section 2.4.2.2.

Operating an Active Interface Module on an insulated network (IT)

When the device is operated on an insulated network (IT), the connection bracket for the interference-suppression capacitor must be removed (e.g.: "1" in Fig. 2-14).

The interface overview in section 2.4.2 shows the position of the connection brackets on the different types.

With devices of types HI and JI, two connection brackets must be removed.

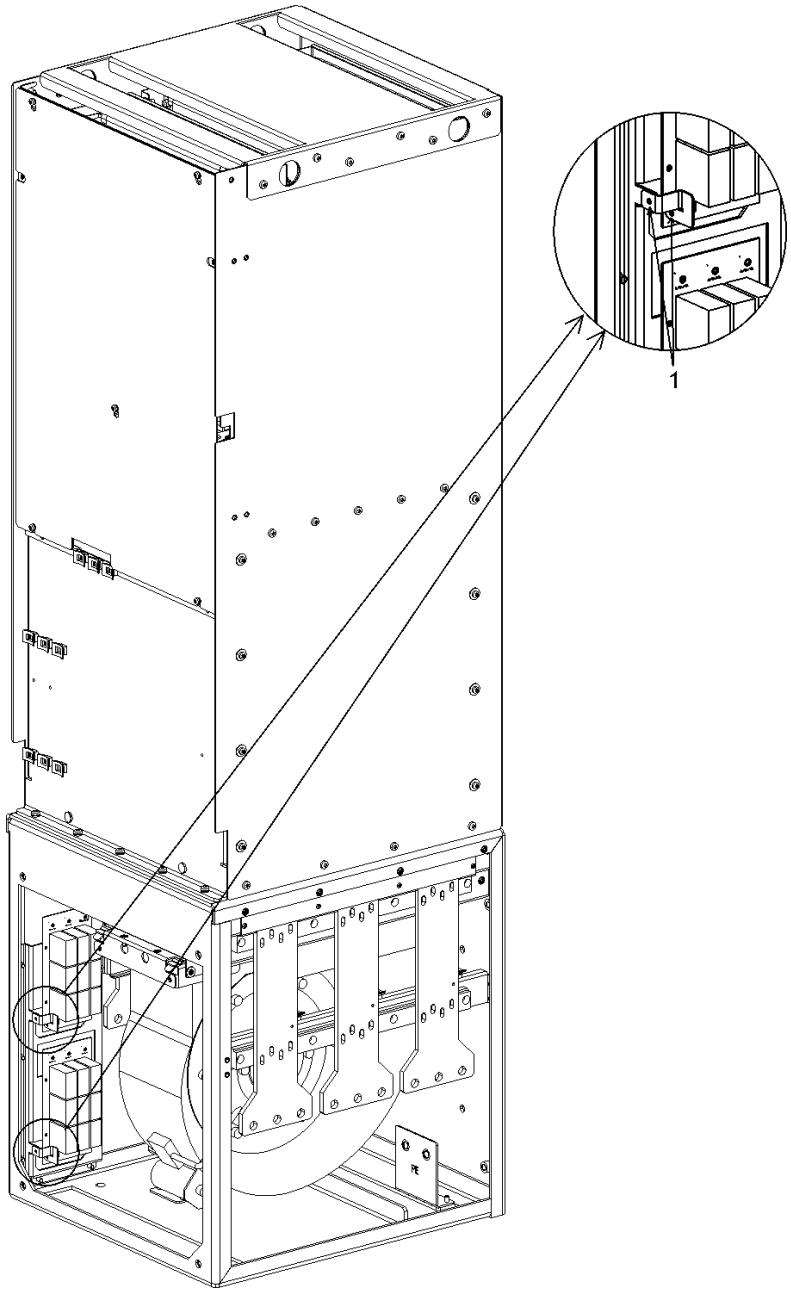


Fig. 2-14 Removing the connection bracket for the interference-suppression capacitor (here: type JI)

2.4.5 Technical Specifications

Table 2-12 Technical specifications for the Active Interface Module (380 – 480 V 3AC) (part 1)

Order number	6SL3300–	7TE32–6AA0	7TE32–6AA0	7TE33–8AA0	7TE35–0AA0
Suitable for Active Line Module	6SL3330-	7TE32-1AA0	7TE32-6AA0	7TE33-8AA0	7TE35-0AA0
Infeed/feedback: Rated power Peak power	 kW (Pn) kW (Pmax)	 132 198	 160 240	 235 352.5	 300 450
Rated current	A	210	260	380	490
Connection voltages: - Line voltage - Line frequency - Electronics power supply - Fan supply voltage	 V_{Aceff} Hz V_{DC} V_{AC}	 380 3AC –10% to 480 3AC +10% (-15% < 1 min) 47 to 63 Hz 24 (20.4 – 28.8) 230 (195.5 – 264.5)			
Electronics current consumption 24 V DC	A_{DC}	0.17	0.17	0.17	0.17
Max. fan power consumption (230 V AC)	A_{AC}	0.6	0.6	1.2	1.2
Current consumption of buffer protection (230 V AC)	A	0.6	0.6	1.2	1.2
Max. ambient temperature: Without derating With derating	 °C °C	 40 55	 40 55	 40 55	 40 55
Efficiency	η	0.99	0.99	0.99	0.99
Power loss	kW	2.1	2.2	3.0	3.9
Cooling air requirement	m³/s	0.24	0.24	0.47	0.47
Sound pressure level at 50/60 Hz [1]	dB(A)	74 / 76	75 / 77	76 / 78	76 / 78
Line/load connection		Flange connection with screws M10	Flange connection with screws M10	Flange connection with screws M10	Flange connection with screws M10
Degree of protection		IP20	IP20	IP20	IP20
Dimensions Width Height Depth	 mm mm mm	 325 1400 355	 325 1400 355	 325 1533 544	 325 1533 544
Type		FI	FI	GI	GI
Weight	kg	135	135	190	190

[1] Sound pressure level of Active Interface Module and Active Line Module

Table 2-13 Technical specifications for the Active Interface Module (380 – 480 V 3AC) (part 2)

Order number	**6SL3300–**	**7TE38–4AA0**	**7TE38–4AA0**	**7TE41–4AA0**	**7TE41–4AA0**
Suitable for Active Line Module	6SL3330-	7TE36-1AA0	7TE38-4AA0	7TE41-0AA0	7TE41-4AA0
Infeed/feedback: Rated power Peak power	 kW (Pn) kW (Pmax)	 380 570	 500 750	 630 945	 900 1350
Rated current	A	604	840	985	1405
Connection voltages: - Line voltage - Line frequency - Electronics power supply - Fan supply voltage	 V_{Aceff} Hz V_{DC} V_{AC}	 380 3AC –10% to 480 3AC +10% (-15% < 1 min) 47 to 63 Hz 24 (20.4 – 28.8) 230 (195.5 – 264.5)			
Electronics current consumption 24 V DC	A_{DC}	0.17	0.17	0.17	0.17
Max. fan power consumption (230 V AC)	A_{AC}	4.6	4.6	4.9	4.9
Buffer protection		3RT1476-6AP36	3WL1110-2BB34-4AN2-Z Z=C22	3WL1112-2BB34-4AN2-Z Z=C22	3WL2226-2BB34-4AN2-Z Z=C22
Max. ambient temperature: Without derating With derating	 °C °C	 40 55	 40 55	 40 55	 40 55
Efficiency	η	0.99	0.99	0.99	0.99
Power loss	kW	5.5	6.1	7.5	8.5
Cooling air requirement	m³/s	0.40	0.40	0.40	0.40
Sound pressure level at 50/60 Hz [1]	dB(A)	78 / 80	78 / 80	78 / 80	78 / 80
Line/load connection		Flange connection with screws M12	Flange connection with screws M12	Flange connection with screws M12	Flange connection with screws M12
Degree of protection		IP00	IP00	IP00	IP00
Dimensions Width Height Depth	 mm mm mm	 305 1750 545	 305 1750 545	 505 1750 545	 505 1750 545
Type		HI	HI	JI	JI
Weight	kg	390	390	620	620

[1] Sound pressure level of Active Interface Module and Active Line Module

Table 2-14 Technical specifications for the Active Interface Module (660 V – 690 V 3AC)

Order number	**6SL3300–**	**7TH35–8AA0**	**7TH37–4AA0**	**7TH41–3AA0**	**7TH41–3AA0**
Suitable for Active Line Module	6SL3330-	7TH35-8AA0	7TH37-4AA0	7TH41-0AA0	7TH41-3AA0
Infeed/feedback: Rated power Peak power	 kW (Pn) kW (Pmax)	 560 840	 800 1200	 1100 1650	 1400 2100
Rated current	A	575	735	1025	1270
Connection voltages: - Line voltage - Line frequency - Electronics power supply - Fan supply voltage	 V_{Aceff} Hz V_{DC} V_{AC}	 660 3AC –10% to 690 3AC +10% (-15% < 1 min) 47 to 63 Hz 24 (20.4 – 28.8) 230 (195.5 – 264.5)			
Electronics current consumption 24 V DC	A_{DC}	0.17	0.17	0.17	0.17
Max. fan power consumption (230 V AC)	A_{AC}	4.6	4.9	4.9	4.9
Buffer protection		3RT1476-6AP36	3RT1466-6AP36 3 times	3WL1212-4BB34-4AN2-Z Z=C22	3WL1216-4BB34-4AN2-Z Z=C22
Max. ambient temperature: Without derating With derating	 °C °C	 40 55	 40 55	 40 55	 40 55
Efficiency	η	0.99	0.99	0.99	0.99
Power loss	kW	6.8	9.0	9.6	9.6
Cooling air requirement	m³/s	0.40	0.40	0.40	0.40
Sound pressure level at 50/60 Hz [1]	dB(A)	78 / 80	78 / 80	78 / 80	78 / 80
Line/load connection		Flange connection with screws M12	Flange connection with screws M12	Flange connection with screws M12	Flange connection with screws M12
Degree of protection		IP00	IP00	IP00	IP00
Dimensions Width Height Depth	 mm mm mm	 305 1750 545	 505 1750 545	 505 1750 545	 505 1750 545
Type		HI	JI	JI	JI
Weight	kg	390	620	620	620

[1] Sound pressure level of Active Interface Module and Active Line Module

Line Modules 3

3.1 Introduction

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

Line Infeeds generate a DC voltage from the connected supply voltage that is then used to power the Motor Modules.

The Line and Interface Modules are suitable for direct operation on TN, IT, and TT systems.

General characteristics of Line Modules

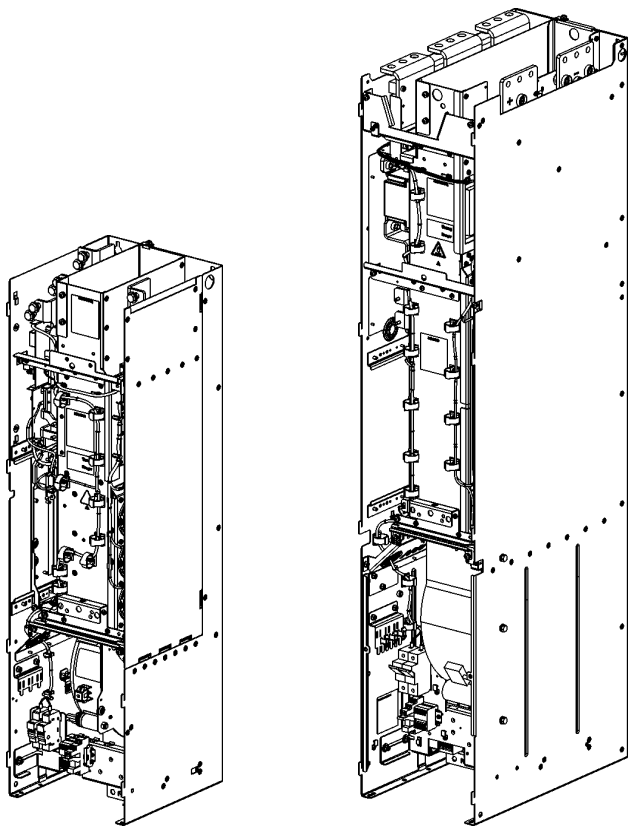
- Supply voltage:
  380 V 3AC –10% to 480 V 3AC +10% (-15% < 1 min) (47 to 63 Hz)
  660 V 3AC –10% to 690 V 3AC +10% (-15% < 1 min) (47 to 63 Hz)
- Suitable for TN, TT, and IT supply systems
- Operating status and errors displayed via LEDs

3.2 Basic Line Modules

3.2.1 Description

Basic Line Modules supply power to the DC link.

They are suitable for applications in which no regenerative energy is present or in which energy is exchanged between the motor-side and regenerative axes in the DC link.



Type FB Type GB

Fig. 3-1 Overview of Basic Line Modules

Basic Infeed components

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

Operating principle

One or more Motor Modules can be connected to the power supply network via the Basic Line Module. The Basic Line Module provides the DC link voltage for the Motor Modules.

The Basic Line Module is suitable for direct operation on TN, IT, and TT systems.

The ratio of line short-circuit power to rated power must be ≥ 20.

3.2.2 Safety Information

Alarm

A hazardous voltage will be present in the component for a further 5 minutes after the system has been shutdown. Work cannot be carried out until this time has elapsed.

Before starting work, you should also measure the voltage after the 5 minutes have elapsed. The voltage can be measured on DC link terminals DCP and DCN.

Caution

The DC link discharge time hazard warning must be affixed to the component in the local language.

Important

The clearances above, below, and in front of the component, which are specified in the dimension drawings, must be observed.

3.2.3 Interface Description

3.2.3.1 Overview

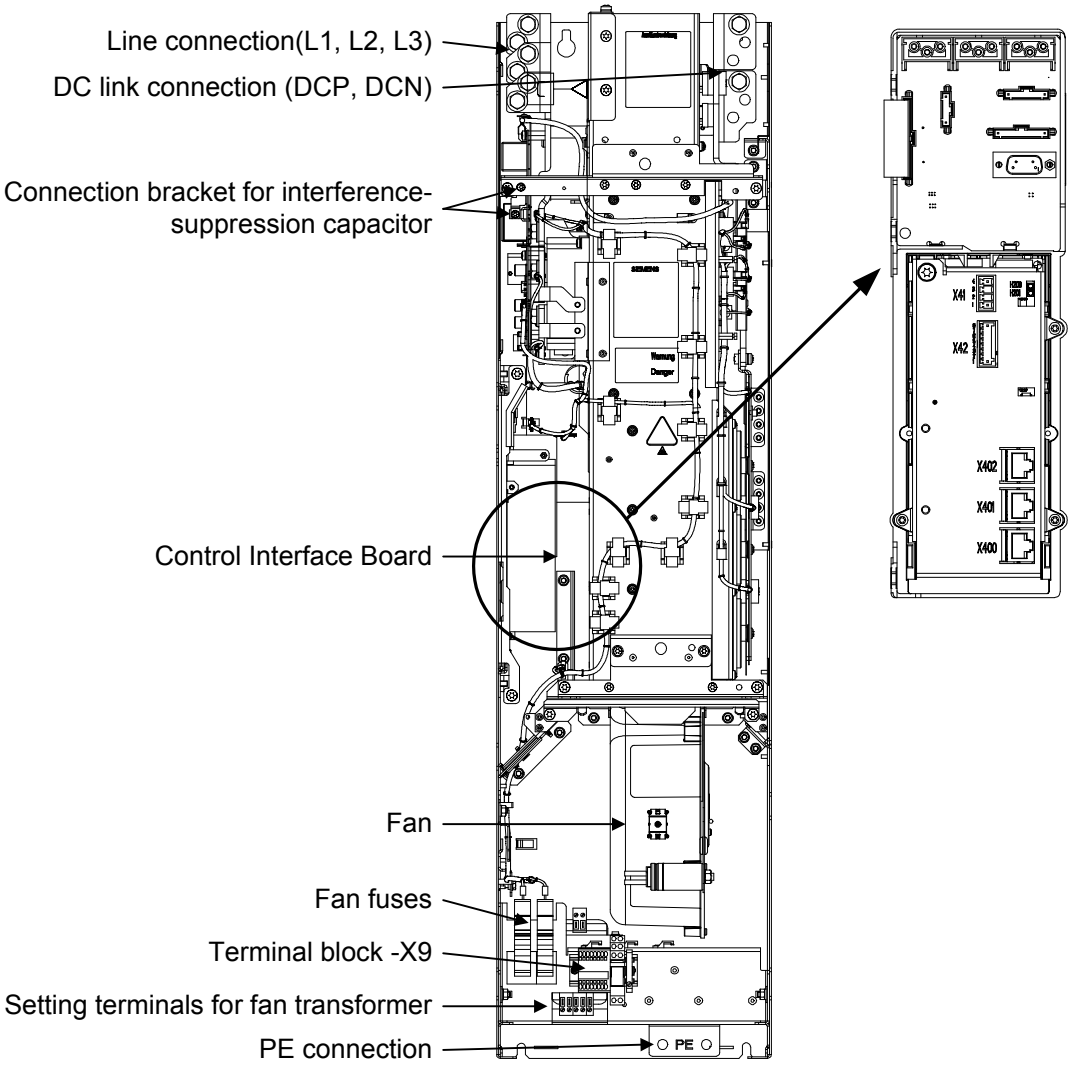


Fig. 3-2 Basic Line Module (type FB)

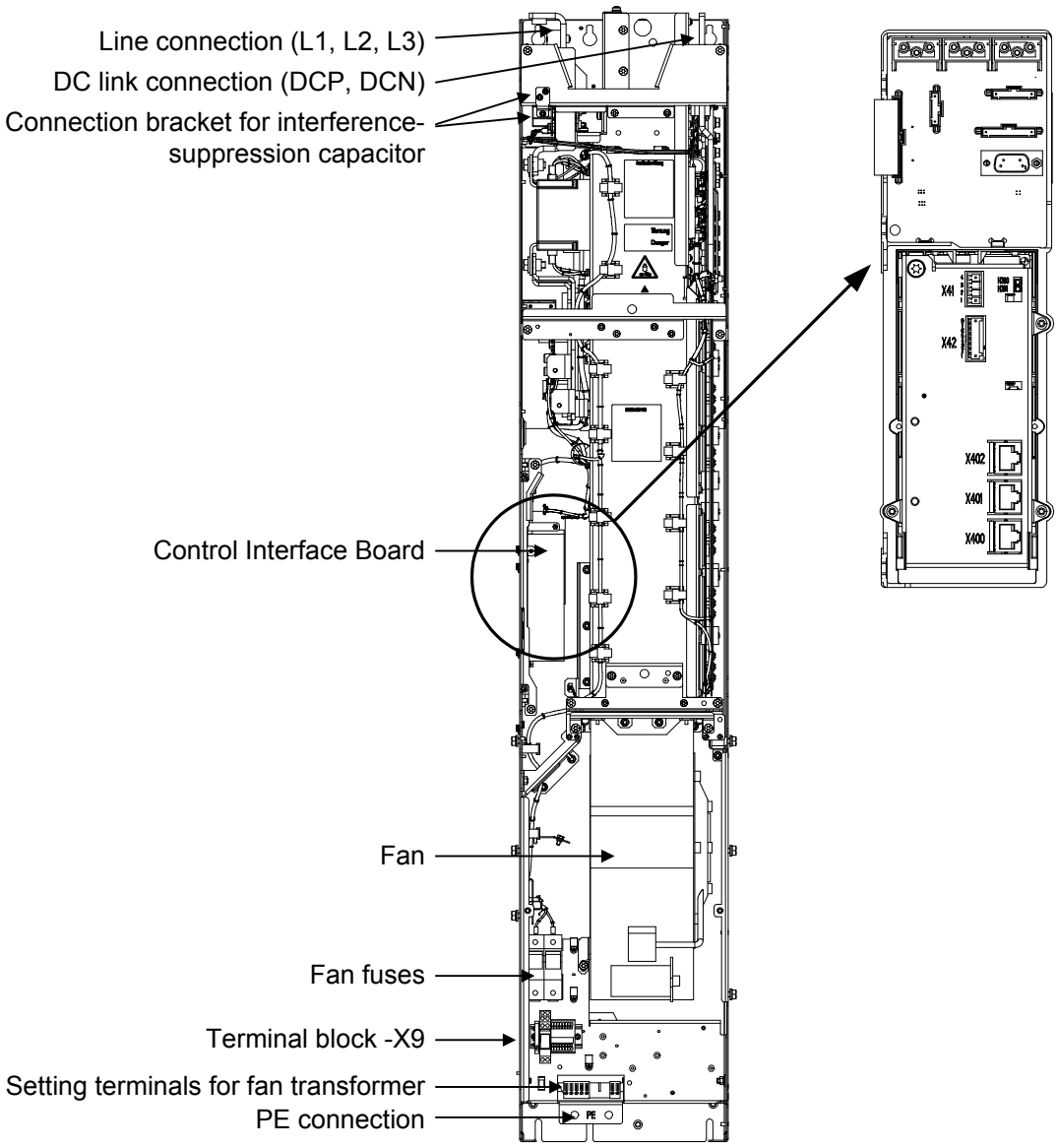


Fig. 3-3 Basic Line Module (type GB)

3.2.3.2 Connection Example

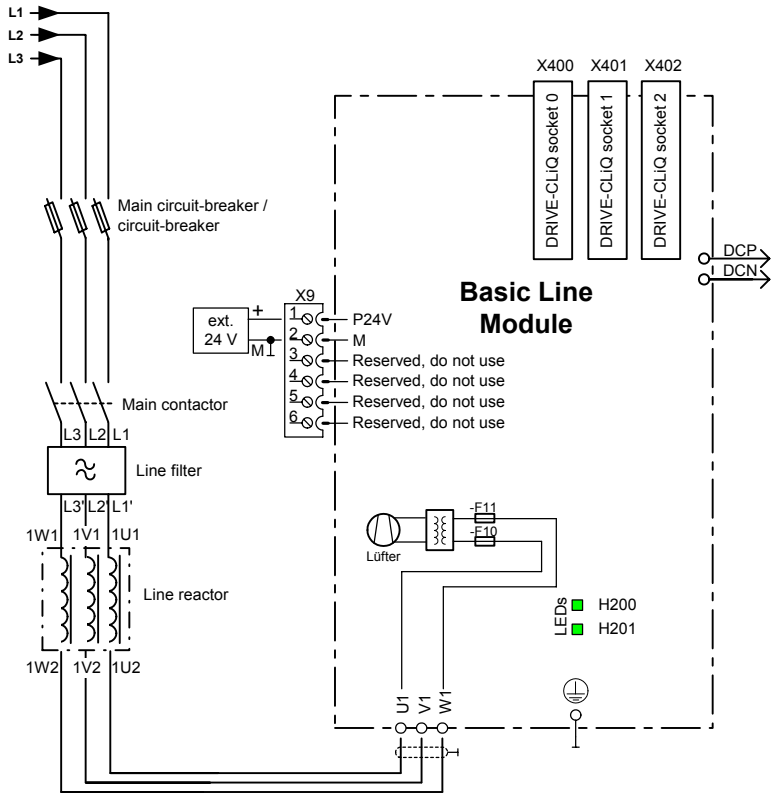


Fig. 3-4 Wiring diagram for the Basic Line Module

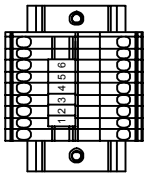
3.2.3.3 Line/Load Connection

Table 3-1 Line/load connection for the Basic Line Module

Terminals	Technical specifications
U1, V1, W1, PE 3AC power input	Voltage: • 380 V 3AC – 10% to 480 V 3AC +10% (-15% < 1 min) • 500 V 3AC – 10% to 690 V 3AC +10% (-15% < 1 min) Frequency: 47 Hz to 63 Hz Connection lugs: d = 11 mm (M10 / 25 Nm) for ring cable lugs to DIN 46234
DCP, DCN, PE DC power output	Voltage: • 513 V to 648 V DC • 675 V to 932 V DC Connection lugs: d = 11 mm (M10 / 25 Nm) for ring cable lugs to DIN 46234

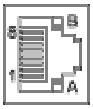
3.2.3.4 Terminal Block X9

Table 3-2 Terminal block X9

	Terminal	Signal name	Technical specifications
	1	P24V	Voltage: 24 V DC (20.4 V – -28.8 V) Current input: max. 1.1 A
	2	M	
	3	Reserved, do not use	
	4		
	5	Reserved, do not use	
	6		

3.2.3.5 DRIVE-CLiQ Interfaces X400, X401, X402

Table 3-3 DRIVE-CLiQ interfaces X400, X401, X402

	PIN	Signal name	Technical specifications
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	24 V power supply
	B	GND (0 V)	Electronic ground
Blanking plate for DRIVE-CLiQ interface: Tyco, order no.: 969556-5			

3.2.3.6 Meaning of the LEDs on the Control Interface Board in the Basic Line Module

Table 3-4 Meaning of the LEDs on the control interface board in the Basic Line Module

LED	Color	Status	Description
H200 (Ready)	---	OFF	Electronics power supply outside permissible tolerance range
	Green	Continuous	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	Continuous	DRIVE-CLiQ communication is being established.
	Red	Continuous	At least one fault is present in this component.
	Green/red	Flashing 2 Hz	Firmware is being downloaded.
	Green / orange or Red / orange	Flashing 2 Hz	Component recognition via LED is activated (p0124). Note: Both options depend on the LED status when module recognition is activated via p0124 = 1.
H201 (DC link)	---	OFF	Electronics power supply outside permissible tolerance range
	Orange	Continuous	DC link voltage within permissible tolerance range (only when ready for operation)
	Red	Continuous	DC link voltage outside permissible tolerance range (only when ready for operation)

Cause and rectification of faults

The following reference contains information about the cause and rectification of faults:

Reference: /IH1/ SINAMICS S120 Installation and Start-Up Manual

3.2.4 Dimension Drawing

Dimension drawing (type FB)

The clearances to be observed are indicated by the dotted line.

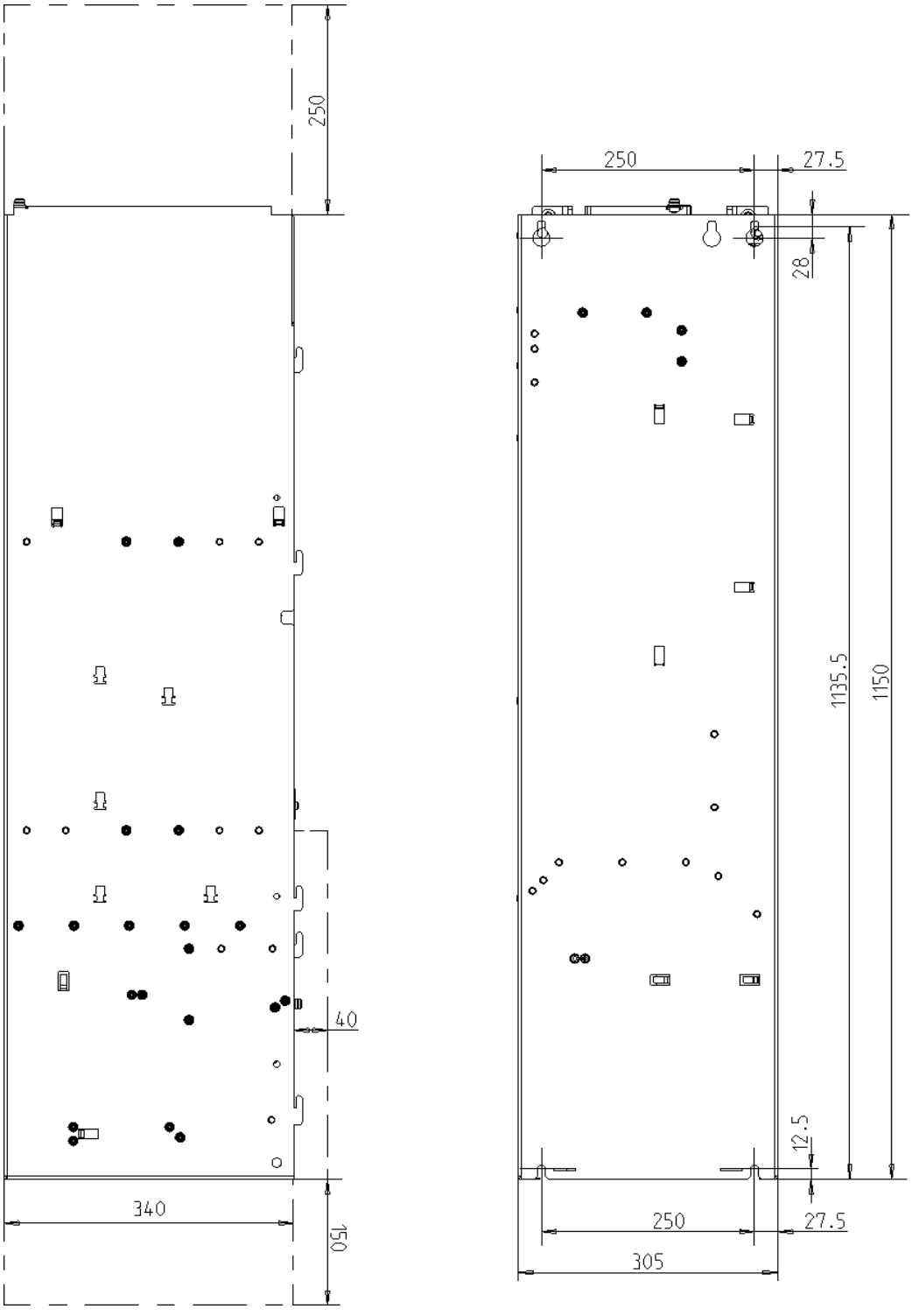
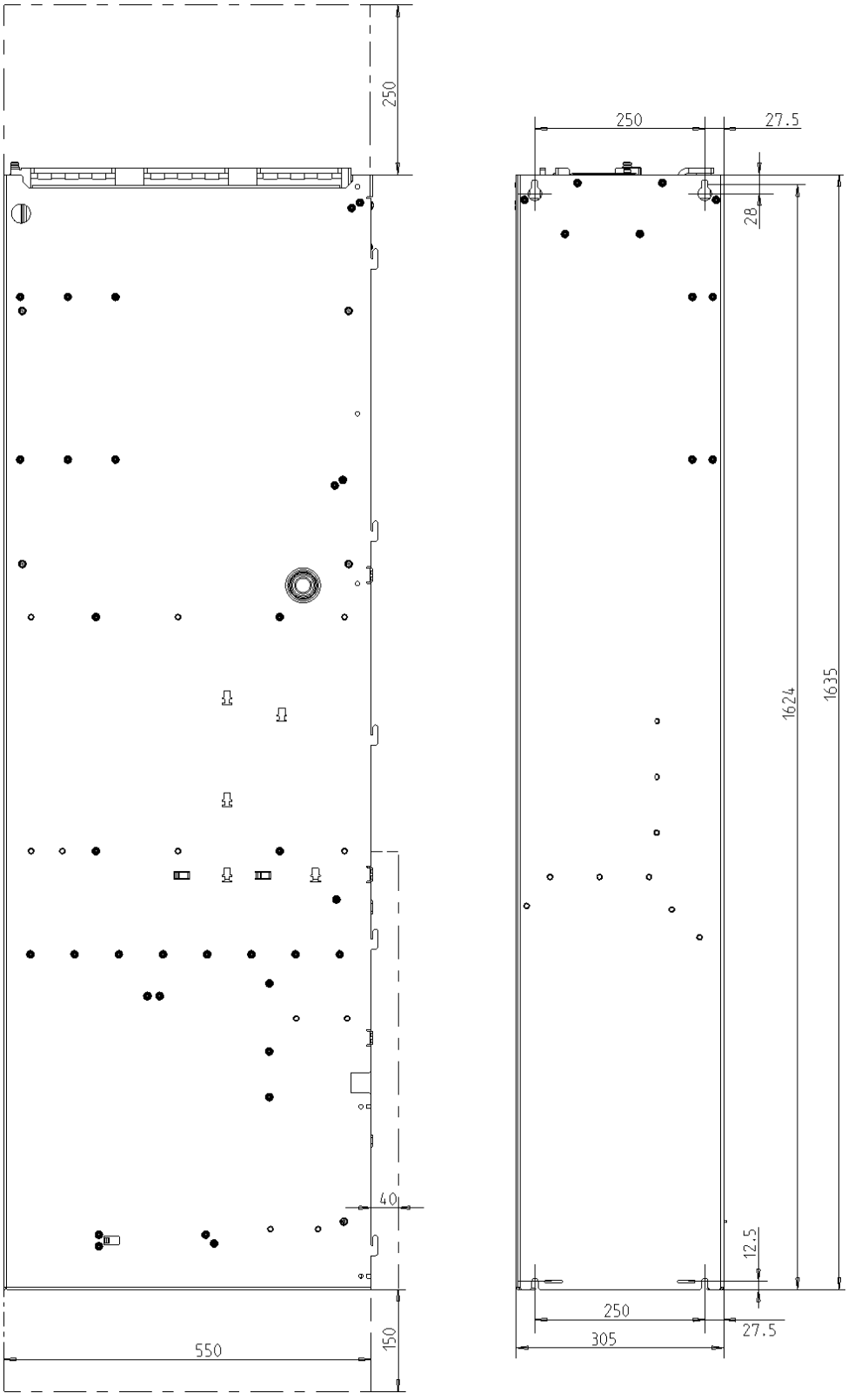


Fig. 3-5 Dimension drawing of Basic Line Module (type FB)

Dimension drawing (type GB)

The clearances to be observed are indicated by the dotted line.



Side view Rear view

Fig. 3-6 Dimension drawing of Basic Line Module (type GB)

3.2.5 Electrical Connection

Operating a Basic Line Module on an insulated network (IT)

When the device is operated on an insulated network (IT), the connection bracket for the interference-suppression capacitor must be removed (e.g.: "1" in Fig. 3-7).

The interface overview in section 3.2.3 shows the position of the connection brackets on the different types.

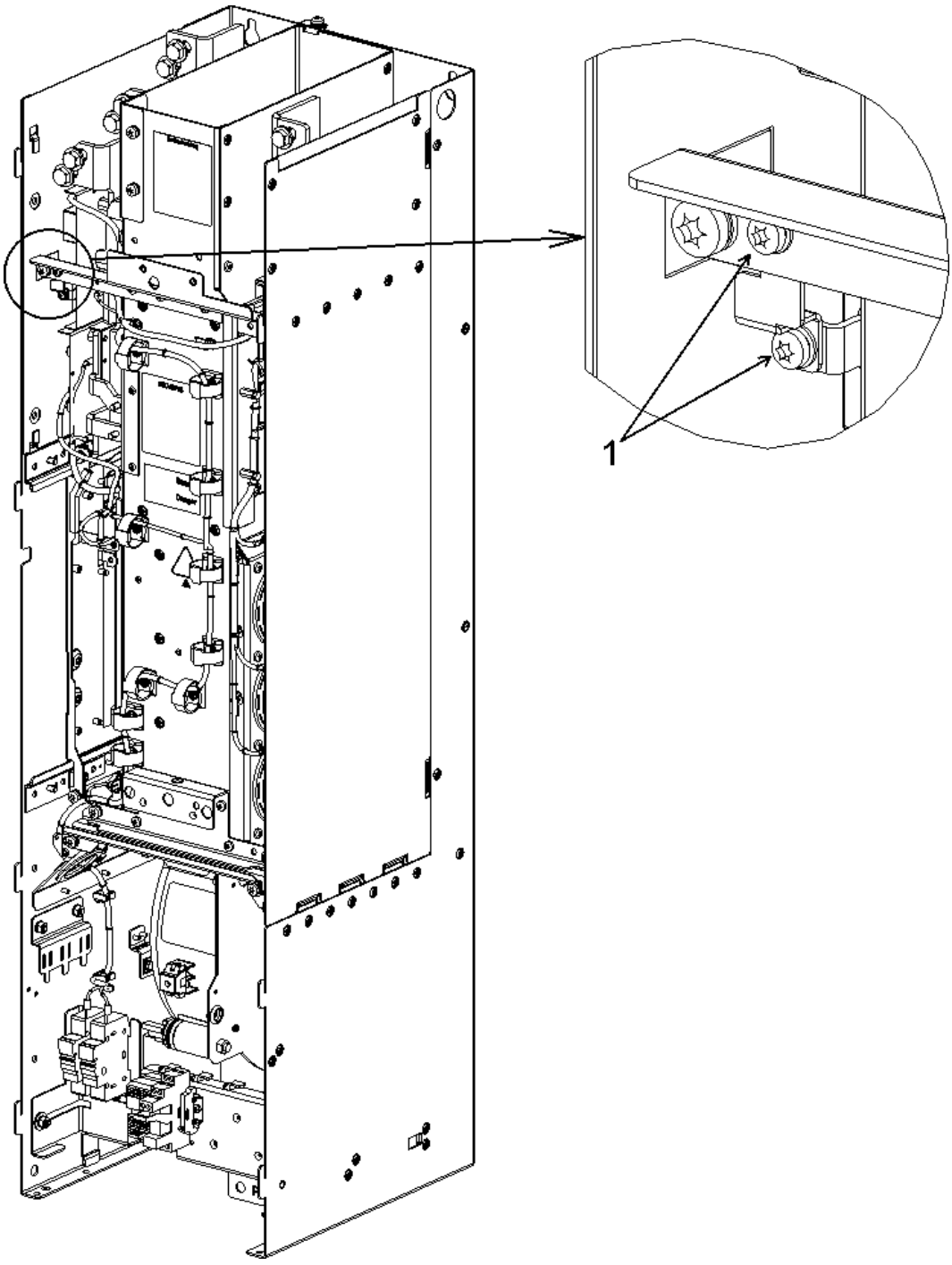


Fig. 3-7 Removing the connection bracket for the interference-suppression capacitor (here: type GB)

Adjusting the fan voltage (-T10)

The power supply for the device fans (230 V 1AC) in the Basic Line Module (-T10) is generated from the main supply system by means of transformers. The locations of the transformers are indicated in the interface descriptions.
The transformers are fitted with primary taps so that they can be fine-tuned to the rated line supply voltage When delivered, the taps are always set to the highest level. With a low supply voltage, the appropriate transformer tap must be activated.
The terminals on the setting terminals must be connected to "0" and the supply voltage.

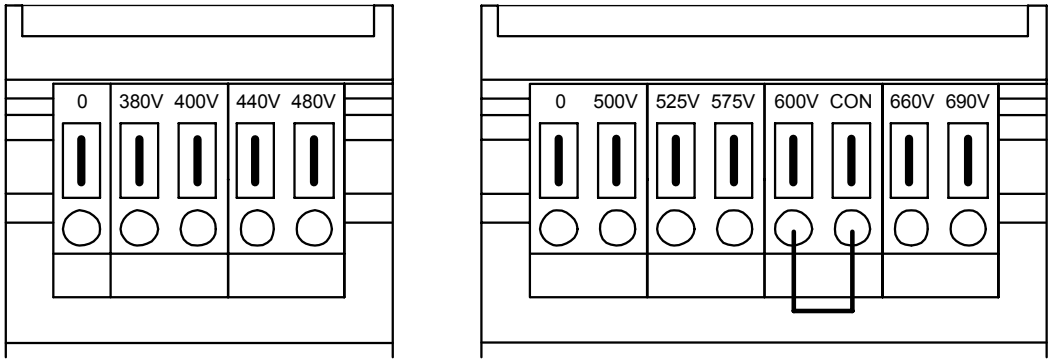


Fig. 3-8 Setting terminals for the fan transformers (380 V – 480 V 3AC / 500 V – 690 V 3AC)

The supply voltage assignments for making the appropriate setting on the fan transformer are indicated in Table 3-5 and Table 3-6 (factory setting: 480 V/0 V and 690 V/0 V).

Note

With the 500 V – 690 V 3AC fan transformer, a jumper is inserted between terminal "600 V" and terminal "CON". Terminals "600V" and "CON" are for internal use.

Important

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

- The required cooling is not provided (risk of overheating).
- The fan fuses may blow (overload).

Table 3-5 Supply voltage assignments for setting the fan transformer (380 V – 480 V 3AC)

Line voltage	Fan transformer tap (-T10)
380 V ± 10%	380 V
400 V ± 10%	400 V
440 V ± 10%	440 V
480 V ± 10%	480 V

Table 3-6 Supply voltage assignments for setting the fan transformer (500 V – 690 V 3AC)

Line voltage	Fan transformer tap (-T10)
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

3.2.6 Technical Specifications

Table 3-7 Technical specifications for the Basic Line Module (380 – 480 V 3AC) (part 1)

Order number	6SL3330–	1TE34–2AA0	1TE35–3AA0	1TE38–2AA0	1TE41–2AA0
Rated infeed power	kW (Pn)	200	250	400	560
Max. infeed power	kW (Pmax)	300	375	600	840
Rated infeed current	A	365	460	710	1010
Max. infeed current	A	547	690	1065	1515
Rated DC link current	A	420	530	820	1200
Connection voltages: - Line voltage - Line frequency - Electronics power supply - Fan supply voltage	 VAceff Hz VDC VAC	 380 3AC –10% to 480 3AC +10% (-15% < 1 min) 47 to 63 Hz 24 (20.4 – 28.8) 230 (195.5 – 264.5)			
DC link voltage Overvoltage tripping Undervoltage tripping	VDC VDC VDC	1.35 x V_{Line} 820 ± 2% 424			
Electronics current consumption (24 V DC)	A	1.1	1.1	1.1	1.1
Fan power consumption (230 V AC)	A	1.1	1.1	1.1	4.5
Max. ambient temperature: Without derating With derating	 °C °C	 40 55	 40 55	 40 55	 40 55
DC link capacitance	µF	7200	9600	14600	23200
Charging limit	µF	43200	57600	87600	139200
Efficiency	η	0.991	0.992	0.992	0.992
Power loss	kW	1.9	2.1	3.2	4.6
Cooling air requirement	m3/s	0.17	0.17	0.17	0.36
Sound pressure level	dB(A)	< 68	< 68	< 68	< 73
Line/load connection		Flange connection with screws M10	Flange connection with screws M10	Flange connection with screws M10	Flange connection with screws M12
Max. connection cross-section Line connection (U1, V1, W1) DC link connection (DCP, DCN) PE connection	 mm² mm² mm²	 2 x 185 2 x 185 2 x 185	 2 x 185 2 x 185 2 x 185	 2 x 185 2 x 185 2 x 185	 6 x 240 2 x 240 2 x 240
Degree of protection		IP00	IP00	IP00	IP00
Dimensions Width Height Depth	 mm mm mm	 305 1160 351	 305 1160 351	 305 1160 351	 305 1650 550
Type		FB	FB	FB	GB
Weight	kg	86	86	86	214

Table 3-8 Technical specifications for the Basic Line Module (380 – 480 V 3AC) (part 2)

Order number	**6SL3330–**	**1TE41–5AA0**			
Rated infeed power	kW (Pn)	710			
Max. infeed power	kW (Pmax)	1065			
Rated infeed current	A	1265			
Max. infeed current	A	1897			
Rated DC link current	A	1500			
Connection voltages: - Line voltage - Line frequency - Electronics power supply - Fan supply voltage	 V_{Aceff} Hz V_{DC} V_{AC}	 380 3AC –10% to 480 3AC +10% (-15% < 1 min) 47 to 63 Hz 24 (20.4 – 28.8) 230 (195.5 – 264.5)			
DC link voltage Overvoltage tripping Undervoltage tripping	V_{DC} V_{DC} V_{DC}	1.35 x V_{Line} 820 ± 2% 424			
Electronics current consumption (24 V DC)	A	1.1			
Fan power consumption (230 V AC)	A	4.5			
Max. ambient temperature: Without derating With derating	 °C °C	 40 55			
DC link capacitance	µF	29000			
Charging limit	µF	174000			
Efficiency	η	0.992			
Power loss	kW	5.5			
Cooling air requirement	m³/s	0.36			
Sound pressure level	dB(A)	< 73			
Line/load connection		Flange connection with screws M12			
Max. connection cross-section Line connection (U1, V1, W1) DC link connection (DCP, DCN) PE connection	 mm² mm² mm²	 6 x 240 2 x 240 2 x 240			
Degree of protection		IP00			
Dimensions Width Height Depth	 mm mm mm	 305 1650 550			
Type		GB			
Weight	kg	214			

Table 3-9 Technical specifications for the Basic Line Module (500 – 690 V 3AC) (part 1)

Order number	6SL3330–	1TH33–0AA0	1TH34–3AA0	1TH36–8AA0	1TH41–1AA0
Rated infeed power (at 690 V 3AC)	kW (Pn)	250	355	560	900
Max. infeed power	kW (Pmax)	375	532.5	840	1350
Rated infeed current	A	260	375	575	925
Max. infeed current	A	390	562.5	862.5	1387.5
Rated DC link current	A	300	430	680	1100
Connection voltages: - Line voltage - Line frequency - Electronics power supply - Fan supply voltage	 V_{Aceff} Hz V_{DC} V_{AC}	 500 3AC –10% to 690 3AC +10% (-15% < 1 min) 47 to 63 Hz 24 (20.4 – 28.8) 230 (195.5 – 264.5)			
DC link voltage Overvoltage tripping Undervoltage tripping	V_{DC} V_{DC} V_{DC}	$1.35 \times V_{Line}$ 1220 ± 2% 737			
Electronics current consumption (24 V DC)	A	1.1	1.1	1.1	1.1
Fan power consumption (230 V AC)	A	1.1	1.1	1.1	4.5
Max. ambient temperature: Without derating With derating	 °C °C	 40 55	 40 55	 40 55	 40 55
DC link capacitance	µF	3200	4800	7300	11600
Charging limit	µF	19200	28800	43800	69600
Efficiency	η	0.994	0.994	0.995	0.994
Power loss	kW	1.5	2.1	3.0	5.4
Cooling air requirement	m³/s	0.17	0.17	0.17	0.36
Sound pressure level	dB(A)	< 68	< 68	< 68	< 73
Line/load connection		Flange connection with screws M10	Flange connection with screws M10	Flange connection with screws M10	Flange connection with screws M12
Max. connection cross-section Line connection (U1, V1, W1) DC link connection (DCP, DCN) PE connection	 mm² mm² mm²	 2 x 185 2 x 185 2 x 185	 2 x 185 2 x 185 2 x 185	 2 x 185 2 x 185 2 x 185	 6 x 240 6 x 240 4 x 240
Degree of protection		IP00	IP00	IP00	IP00
Dimensions Width Height Depth	 mm mm mm	 305 1160 351	 305 1160 351	 305 1160 351	 305 1650 550
Type		FB	FB	FB	GB
Weight	kg	86	86	86	214

Table 3-10 Technical specifications for the Basic Line Module (500 – 690 V 3AC) (part 2)

Order number	**6SL3330–**	**1TH41–4AA0**			
Rated infeed power (at 690 V 3AC)	kW (Pn)	1100			
Max. infeed power	kW (Pmax)	1650			
Rated infeed current	A	1180			
Max. infeed current	A	1770			
Rated DC link current	A	1400			
Connection voltages: - Line voltage - Line frequency - Electronics power supply - Fan supply voltage	 V_{Aceff} Hz V_{DC} V_{AC}	 500 3AC –10% to 690 3AC +10% (-15% < 1 min) 47 to 63 Hz 24 (20.4 – 28.8) 230 (195.5 – 264.5)			
DC link voltage Overvoltage tripping Undervoltage tripping	V_{DC} V_{DC} V_{DC}	1.35 x V_{Line} 1220 ± 2% 737			
Electronics current consumption (24 V DC)	A	1.1			
Fan power consumption (230 V AC)	A	4.5			
Max. ambient temperature: Without derating With derating	 °C °C	 40 55			
DC link capacitance	µF	15470			
Charging limit	µF	93000			
Efficiency	η	0.995			
Power loss	kW	5.8			
Cooling air requirement	m³/s	0.36			
Sound pressure level	dB(A)	< 73			
Line/load connection		Flange connection with screws M12			
Max. connection cross-section Line connection (U1, V1, W1) DC link connection (DCP, DCN) PE connection	 mm² mm² mm²	 6 x 240 6 x 240 2 x 240			
Degree of protection		IP00			
Dimensions Width Height Depth	 mm mm mm	 305 1650 550			
Type		GB			
Weight	kg	214			

3.3 Active Line Modules

3.3.1 Description

The self-commutating feed/feedback units act as step-up converters and generate a stabilized DC link voltage that is 1.5 x greater than the rated line supply voltage. In this way, the connected Motor Modules are isolated from the supply voltage. This improves the dynamic response and control quality because line tolerances and fluctuations do not affect the motor voltage.

If required, the Active Line Modules can also provide reactive power compensation.

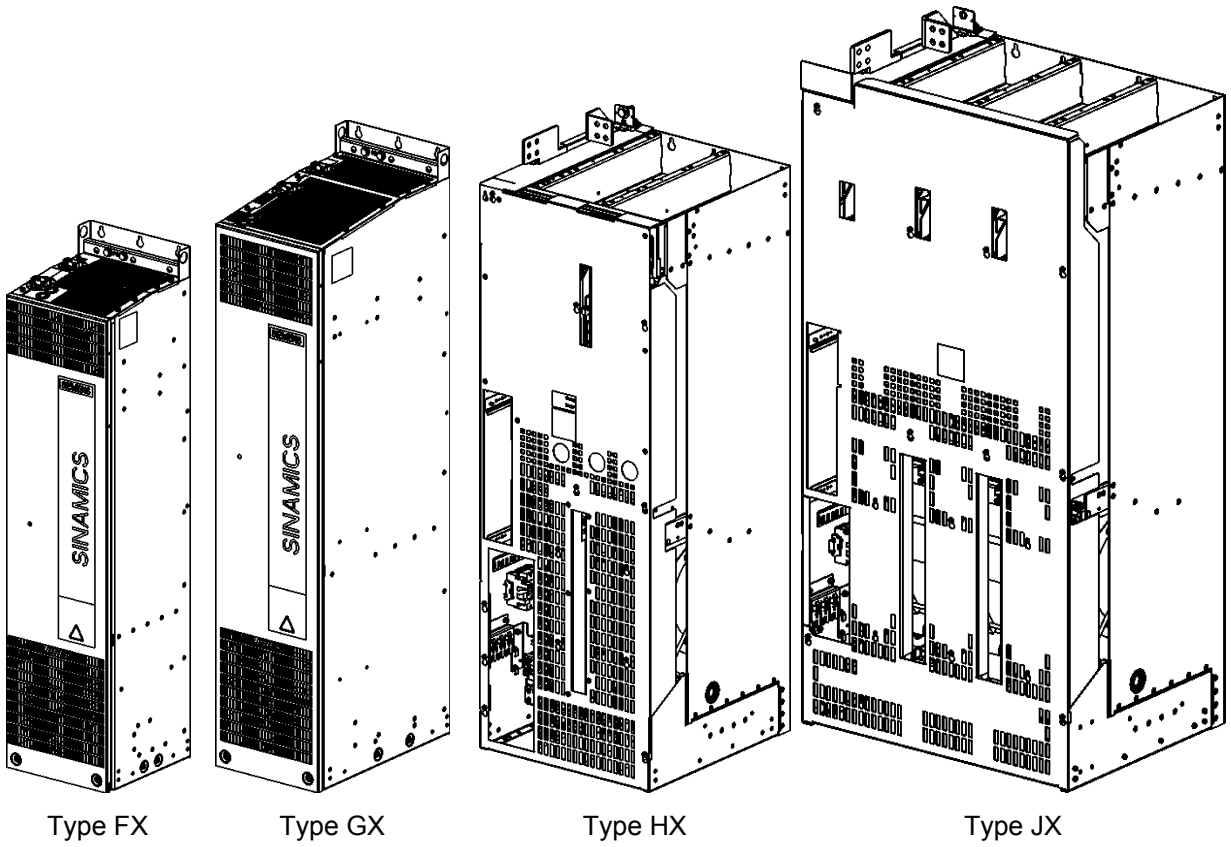


Fig. 3-9 Overview of Active Line Modules

Active Infeed components

An Active Infeed comprises an Active Interface Module and an Active Line Module.

In the case of an Active Infeed with an Active Line Module of type FX or GX, buffer protection is provided in the associated Active Interface Module. The Active Interface Modules and Active Line Modules of these types have degree of protection IP 20.

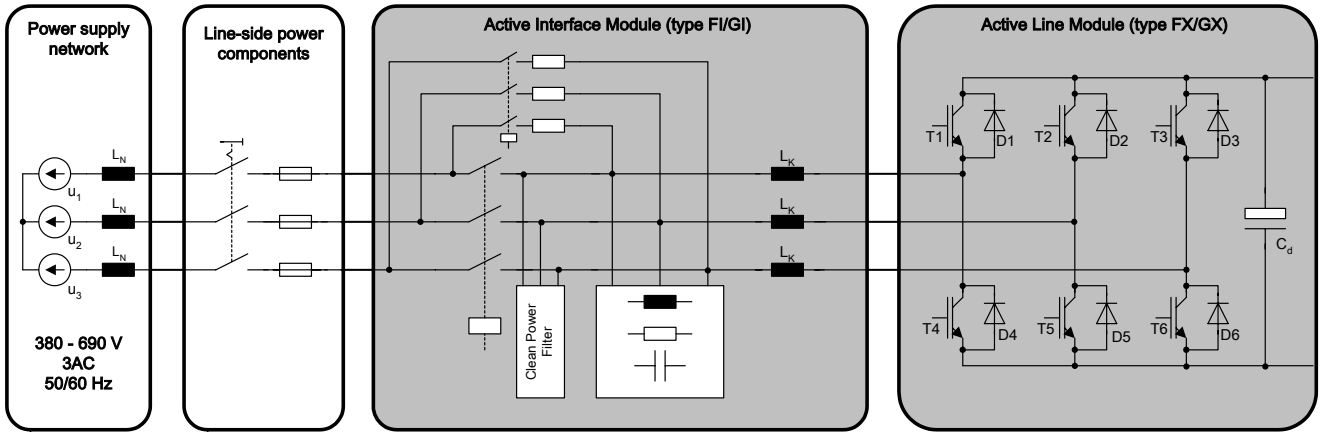


Fig. 3-10 Overview of Active Infeed (types FI and GI)

In the case of an Active Infeed with an Active Line Module of type HX or JX, buffer protection must be provided separately in the associated Active Interface Module. The Active Interface Modules of these types have degree of protection IP 00.

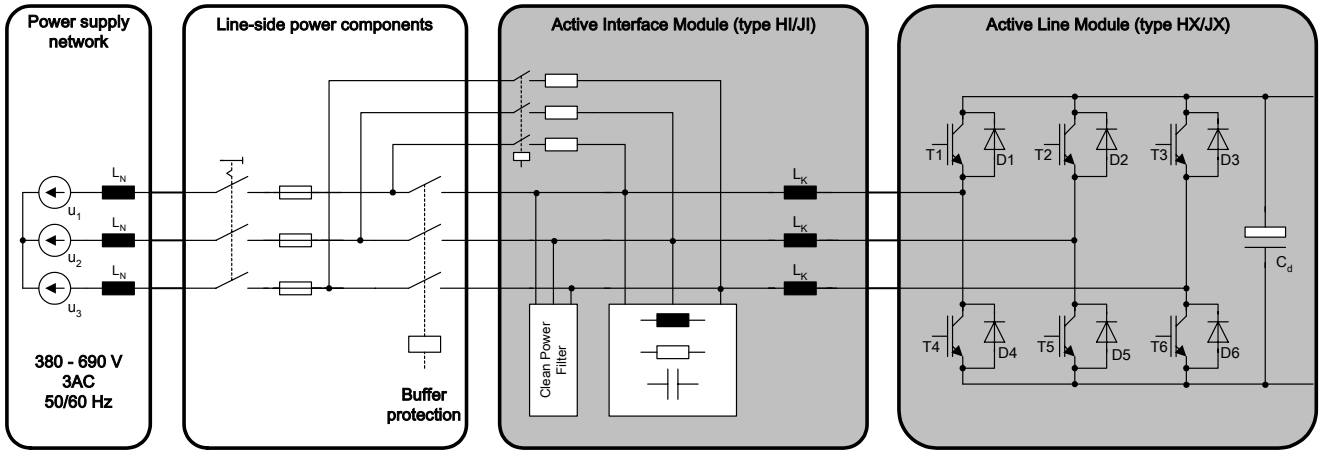


Fig. 3-11 Overview of Active Infeed (types HI and JI)

Operating principle

One or more Motor Modules can be connected to the power supply network via the Active Line Module. The Active Line Module provides a constant DC link voltage for the Motor Modules. This ensures that they are not influenced by network fluctuations. The regenerative feedback capability of the Active Line Module can be deactivated by parameterization.

The Active Line Module is suitable for direct operation both on TN and on IT and TT systems.

In generator mode, the Active Line Module feeds regenerative energy into the supply network.

The Active Line Module is used for:

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

The ratio of line short-circuit power to rated power must be ≥ 20.

3.3.2 Safety Information

Warning

A hazardous voltage will be present in the component for a further 5 minutes after the system has been shutdown. Work cannot be carried out until this time has elapsed.

Before starting work, you should also measure the voltage after the 5 minutes have elapsed. The voltage can be measured on DC link terminals DCP and DCN.

Caution

The DC link discharge time hazard warning must be affixed to the component in the local language.

Important

The clearances above, below, and in front of the component, which are specified in the dimension drawings, must be observed.

Caution

In a supply system without regenerative capability (e.g. diesel generator), the regenerative feedback capability of the Active Line Module must be deactivated via a parameter (see Description of Functions). The braking energy must then be dissipated via an additional Braking Module with a braking resistor in the drive line-up.

3.3.3 Interface Description

3.3.3.1 Overview

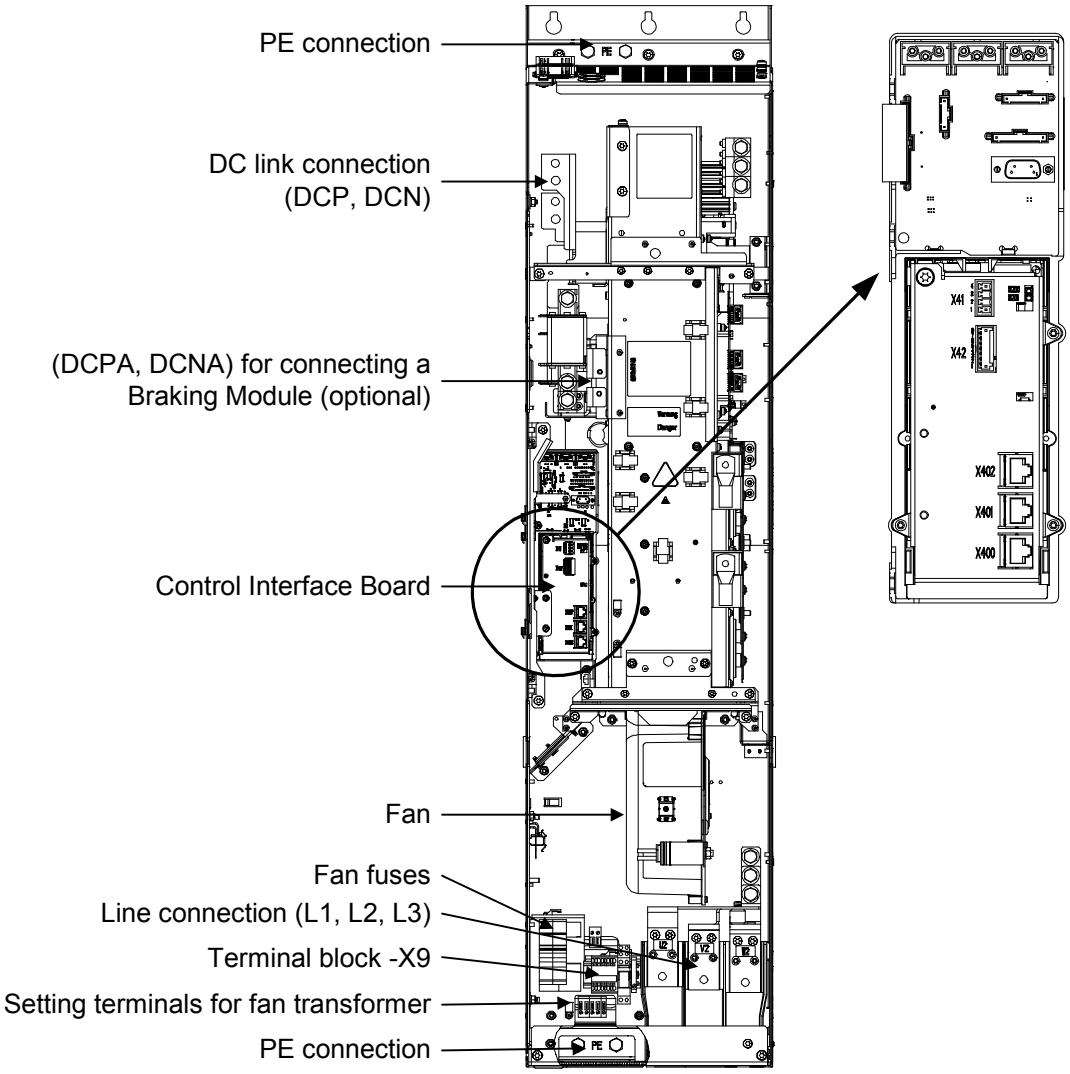


Fig. 3-12 Active Line Module (type FX)

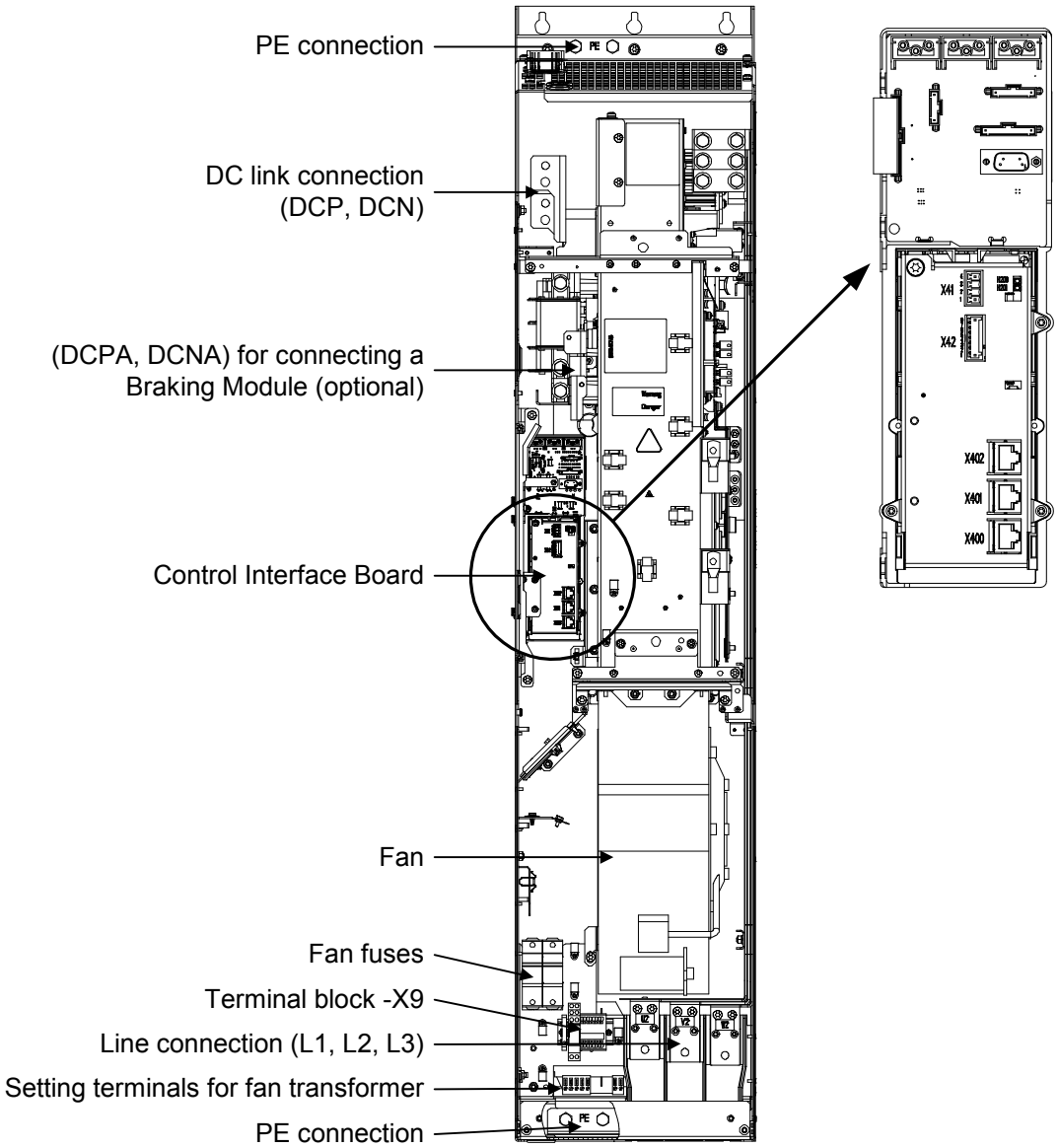


Fig. 3-13 Active Line Module (type GX)

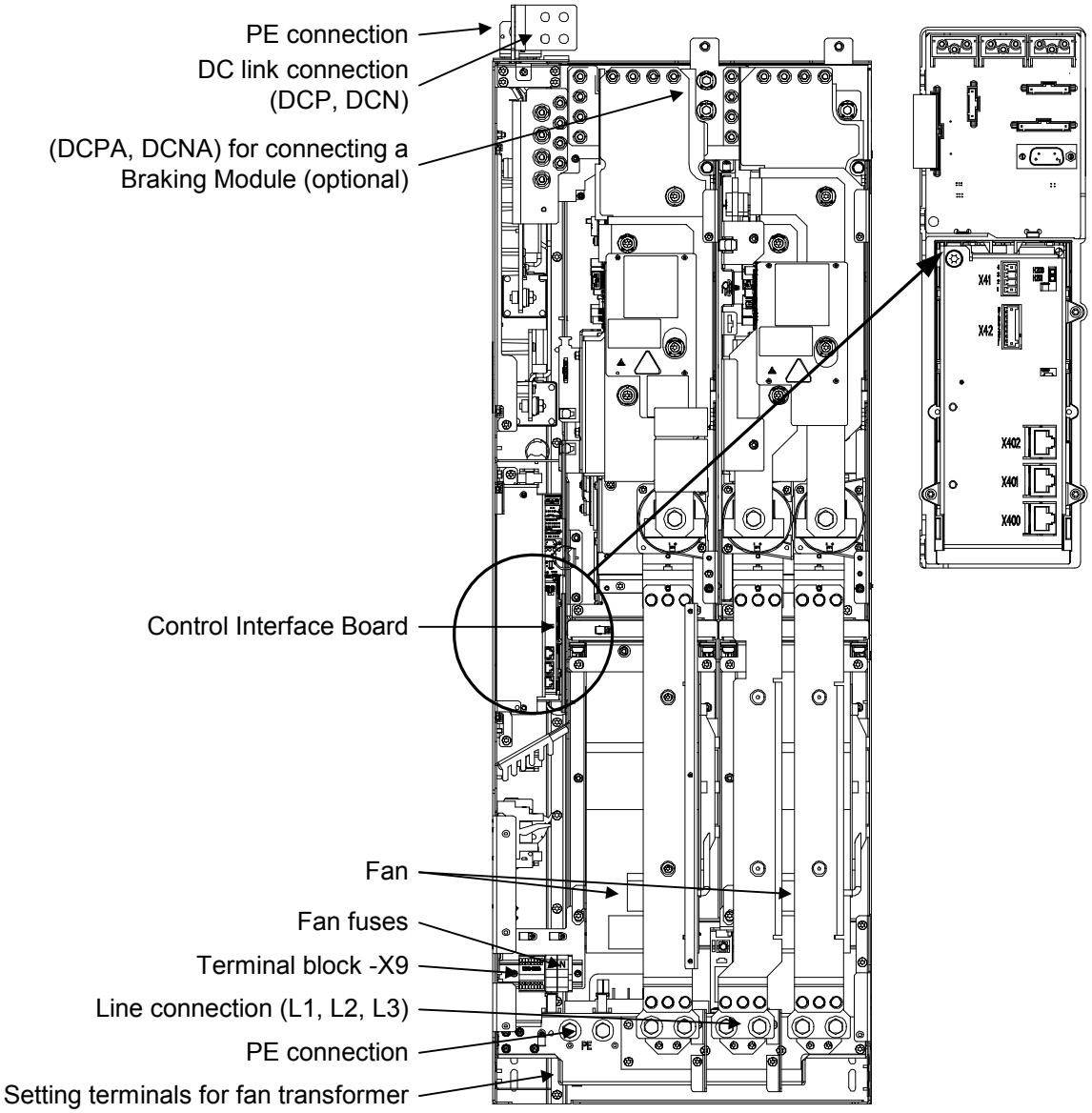


Fig. 3-14 Active Line Module (type HX)

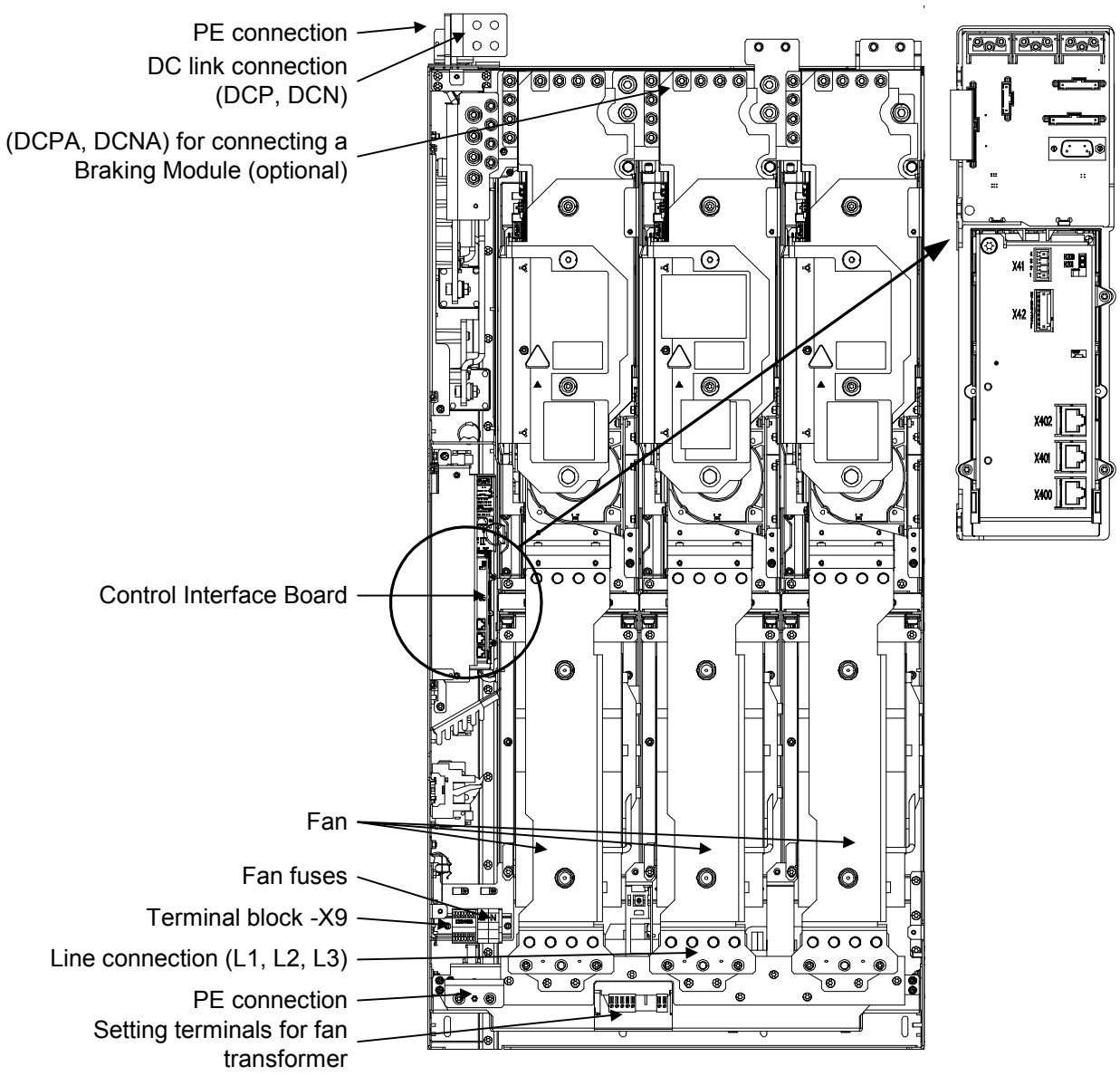


Fig. 3-15 Active Line Module (type JX)

3.3.3.2 Connection Example

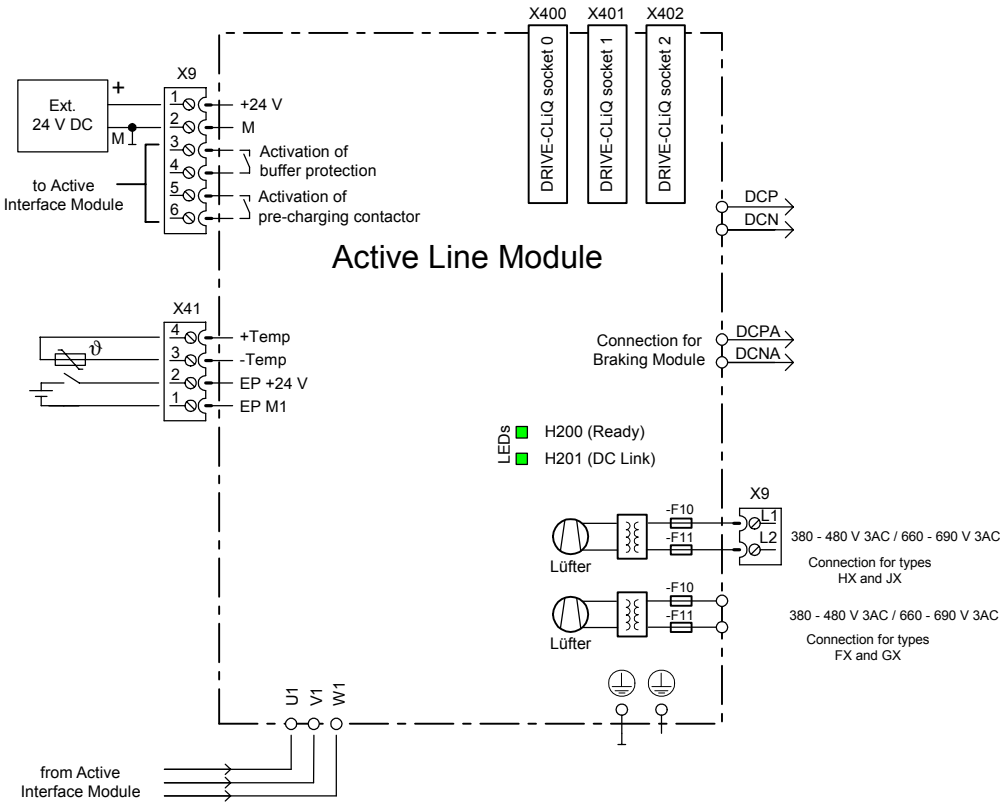


Fig. 3-16 Wiring diagram for the Active Line Module

3.3.3.3 Line/Load Connection

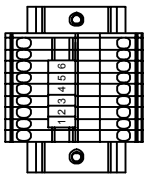
The Active Line Module is rated for a voltage range of 380 V 3AC -10% to 480 V 3AC +10% (-15% <1 min) at 47 Hz to 63 Hz.

Table 3-11 Line/load connection for the Active Line Module

Terminals	Technical specifications
U1, V1, W1, PE 3AC power input	Voltage: • 380 V 3AC – 10% to 480 V 3AC +10% (-15% < 1 min) • 660 V 3AC – 10% to 690 V 3AC +10% (-15% < 1 min) Frequency: 47 Hz to 63 Hz Connection lugs: • Types FI / GI: d = 11 mm (M10 / 25 Nm) for ring cable lugs to DIN 46234 • Types HI / JI: d = 13 mm (M12 / 50 Nm) for ring cable lugs to DIN 46234
DCP, DCN, PE DC power output	Voltage: • 570 V to 720 V DC • 990 V to 1035 V DC Connection lugs: • Types FI / GI: d = 11 mm (M10 / 25 Nm) for ring cable lugs to DIN 46234 • Types HI / JI: Flange connection for busbar connection
DCPA, DCNA Connection for Braking Module	Voltage: • 570 V to 720 V DC • 990 V to 1035 V DC Connection lugs: • Types FI / GI: d = 11 mm (M10 / 25 Nm) for ring cable lugs to DIN 46234 • Types HI / JI: Flange connection for busbar connection

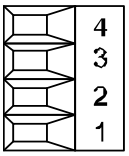
3.3.3.4 Terminal Block X9

Table 3-12 Terminal block X9

	Terminal	Signal name	Technical specifications
	1	P24V	Voltage: 24 V DC (20.4 V – -28.8 V) Current input: max. 1.7 A
	2	M	
	3	Activation of buffer protection	To Active Interface Module, X609:11
	4		To Active Interface Module, X609:12
	5	Activation of pre-charging contactor	To Active Interface Module, X609:9
	6		To Active Interface Module, X609:10

3.3.3.5 EP Terminal X41 / Temperature Sensor Connection

Table 3-13 Terminal block X41

	Terminal	Function	Technical specifications
	4	+Temp	Temperature sensor connection KTY84–1C130
	3	-Temp	
	2	EP +24 V (Enable Pulses)	Supply voltage: 24 V DC (20.4 V – 28.8 V) Current input: 10 A Signal propagation times: L → H: 100 µs H → L: 1000 µs
	1	EP M1 (Enable Pulses)	
Max. connectable cross-section 1.5 mm²			

Important

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

Note

The temperature sensor connection is required for motors where the temperature is not transmitted via DRIVE-CLiQ.

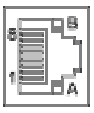
For operation, 24 V DC must be connected to terminal 3 and ground to terminal 4. Upon removal, pulse inhibit is activated.

3.3.3.6 Terminal Block X42

Reserved, do not use!

3.3.3.7 DRIVE-CLiQ Interfaces X400, X401, X402

Table 3-14 DRIVE-CLiQ interfaces X400, X401, X402

	PIN	Signal name	Technical specifications
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	24 V power supply
	B	GND (0 V)	Electronic ground
Blanking plate for DRIVE-CLiQ interface: Tyco, order no.: 969556-5			

3.3.3.8 Meaning of the LEDs on the Control Interface Board in the Active Line Module

Table 3-15 Meaning of the LEDs on the Control Interface Board in the Active Line Module

LED	Color	Status	Description
H200 (Ready)	---	OFF	Electronics power supply outside permissible tolerance range
	Green	Continuous	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	Continuous	DRIVE-CLiQ communication is being established.
	Red	Continuous	At least one fault is present in this component.
	Green Red	Flashing 2 Hz	Firmware is being downloaded.
	Green / orange or Red / orange	Flashing 2 Hz	Component recognition via LED is activated (p0124). Note: Both options depend on the LED status when module recognition is activated via p0124 = 1.
H201 (DC link)	---	OFF	Electronics power supply outside permissible tolerance range
	Orange	Continuous	DC link voltage within permissible tolerance range (only when ready for operation)
	Red	Continuous	DC link voltage outside permissible tolerance range (only when ready for operation)

Cause and rectification of faults

The following reference contains information about the cause and rectification of faults:

Reference: /IH1/ SINAMICS S120 Installation and Start-Up Manual

3.3.4 Dimension Drawing

Dimension drawing (type FX)

The clearances to be observed are indicated by the dotted line.

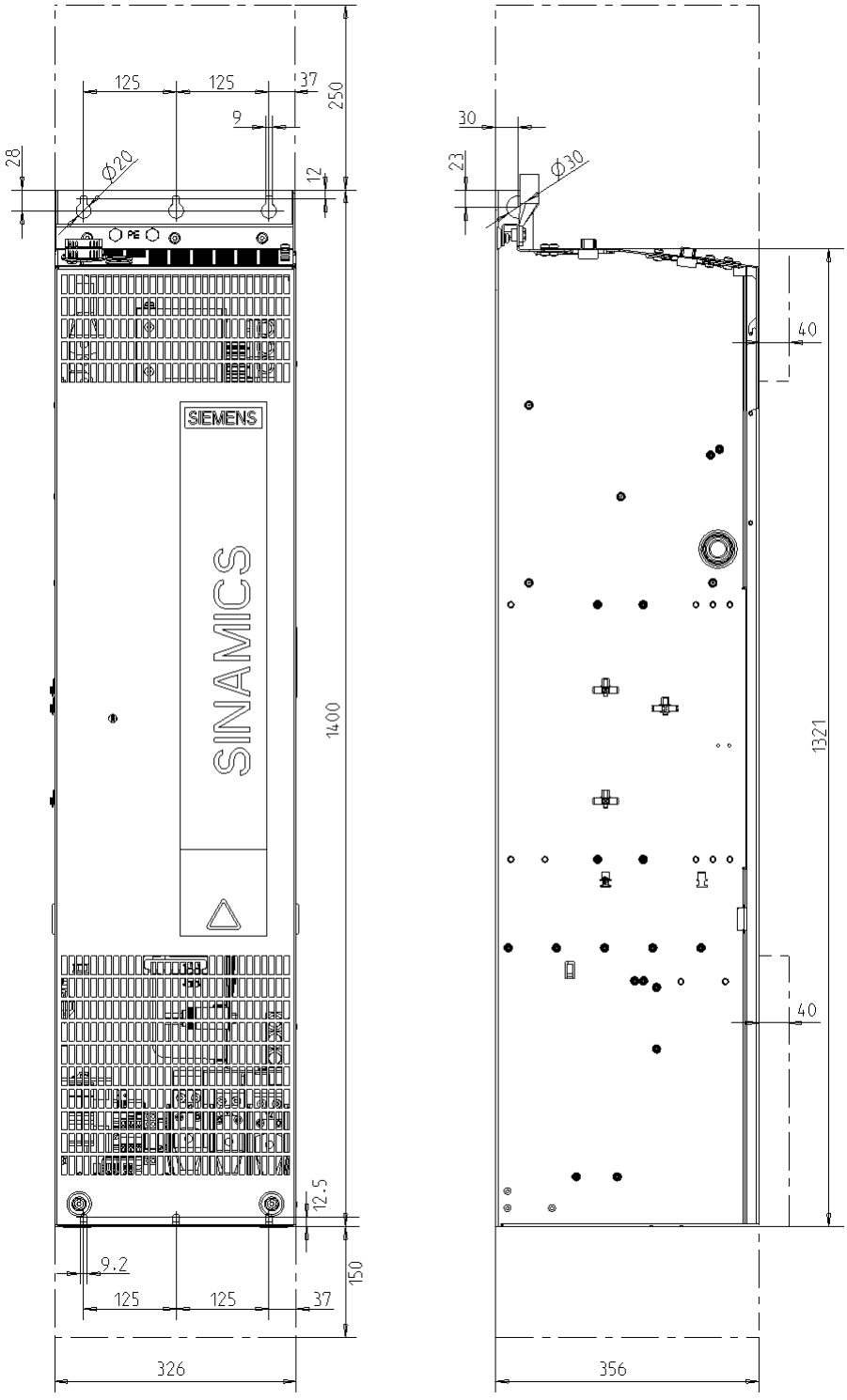
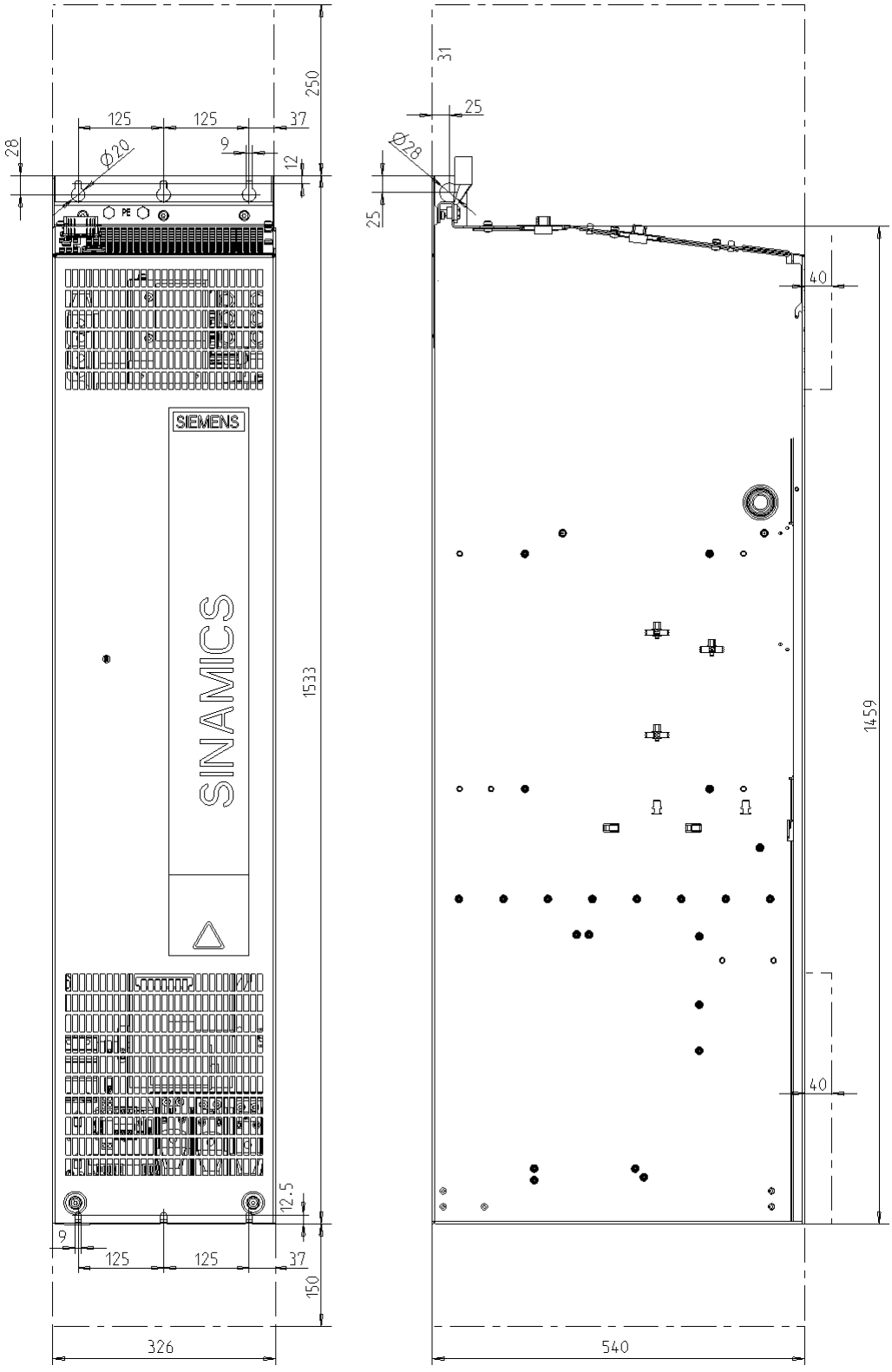


Fig. 3-17 Dimension drawing of Active Line Module (type FX)

Dimension drawing (type GX)

The clearances to be observed are indicated by the dotted line.

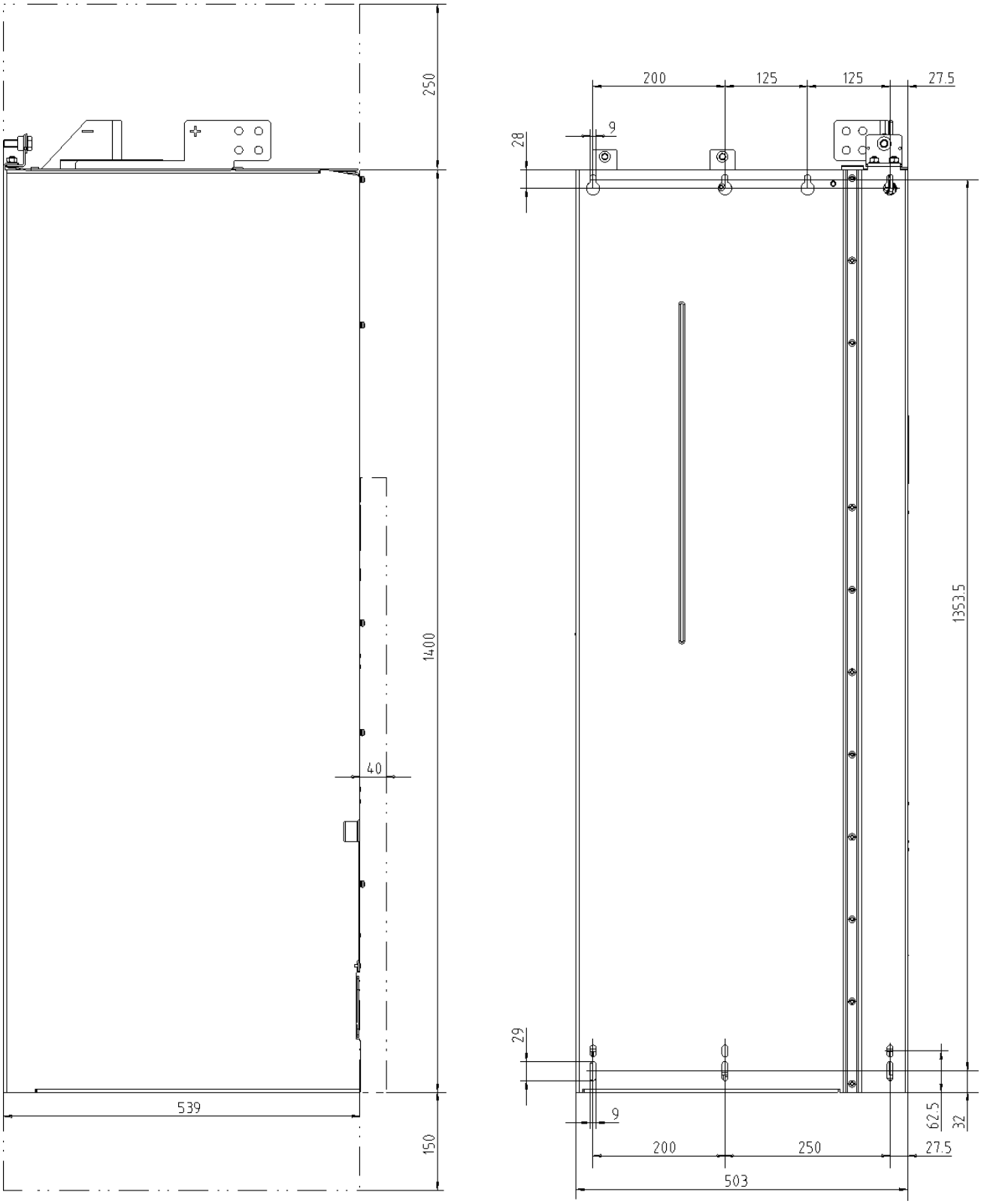


Front view Side view

Fig. 3-18 Dimension drawing of Active Line Module (type GX)

Dimension drawing (type HX)

The clearances to be observed are indicated by the dotted line.

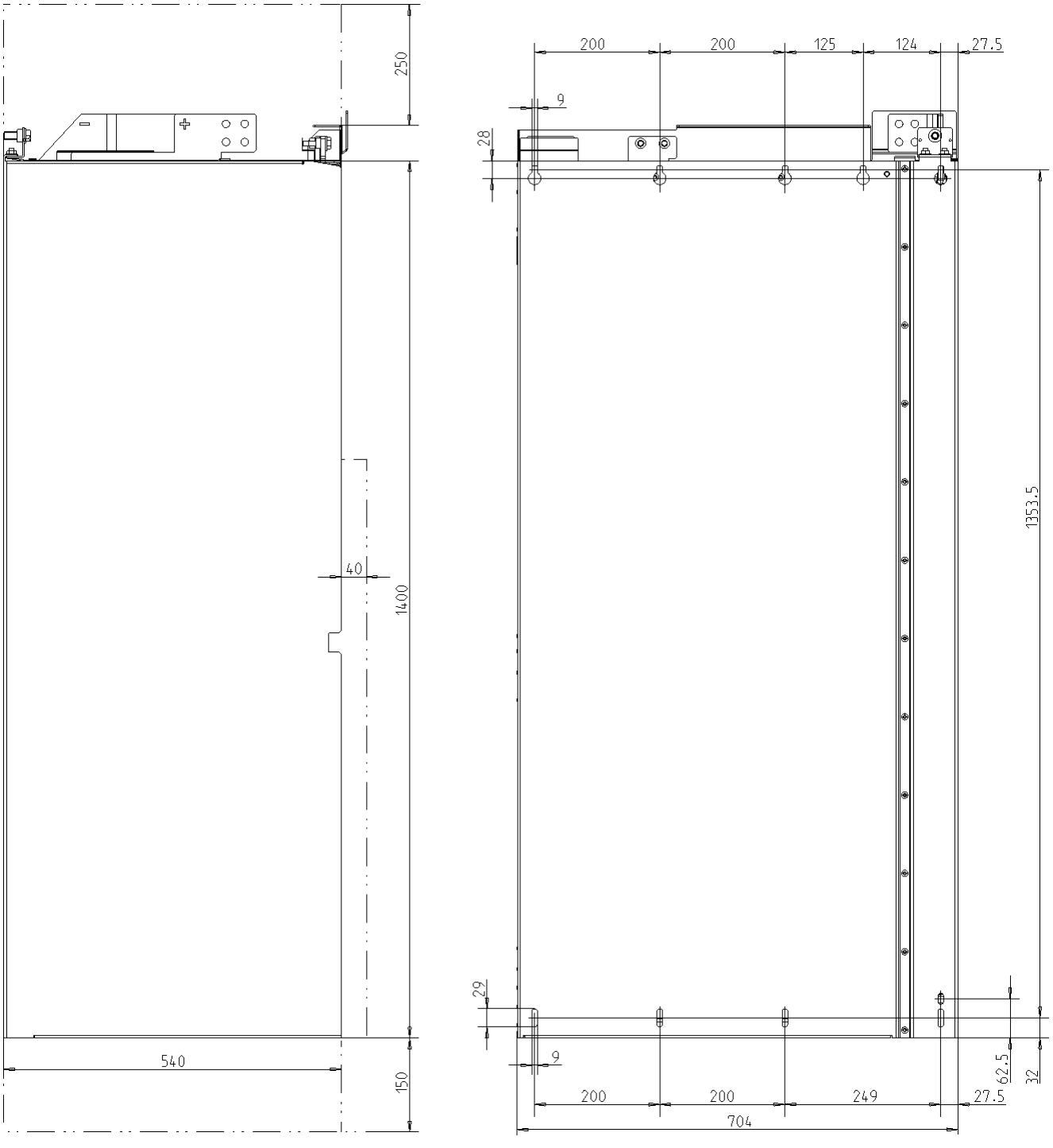


Side view Rear view

Fig. 3-19 Dimension drawing of Active Line Module (type HX)

Dimension drawing (type JX)

The clearances to be observed are indicated by the dotted line.



Side view Rear view

Fig. 3-20 Dimension drawing of Active Line Module (type JX)

3.3.5 Electrical Connection

Adjusting the fan voltage (-T10)

The power supply for the device fans (230 V 1AC) in the Active Line Module (-T10) is generated from the main supply system by means of transformers. The locations of the transformers are indicated in the interface descriptions.
The transformers are fitted with primary taps so that they can be fine-tuned to the rated line supply voltage When delivered, the taps are always set to the highest level. With a low supply voltage, the appropriate transformer tap must be activated.

Note

Two transformers (–T10 and –T20) are installed for Active Line Modules with a minimum output of 315 kW at 380 – 480 V 3AC and 400 kW at 660 – 690 V 3AC. The two primary terminals on each of these devices must be set together.

The terminals on the setting terminals must be connected to "0" and the supply voltage.

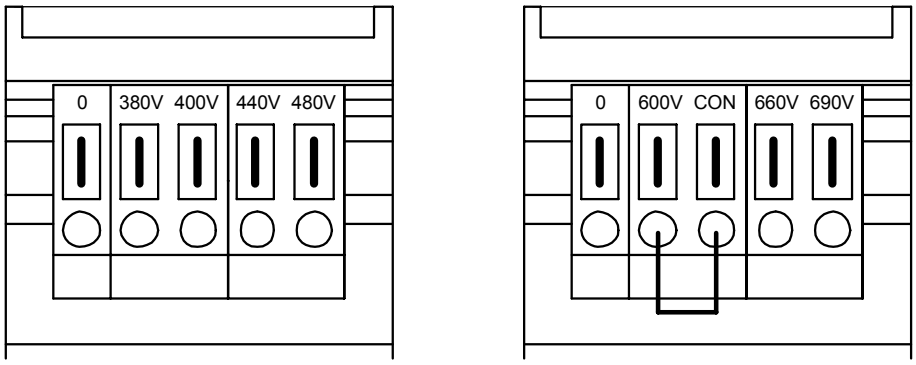


Fig. 3-21 Setting terminals for the fan transformers (380 V – 480 V 3AC / 660 V – 690 V 3AC)

The supply voltage assignments for making the appropriate setting on the fan transformer are indicated in Table 3-16 and Table 3-17 (factory setting: 480 V/0 V and 690 V/0 V).

Note

With the 660 V – 690 V 3AC fan transformer, a jumper is inserted between terminal "600 V" and terminal "CON". Terminals "600V" and "CON" are for internal use.

Important

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

- The required cooling is not provided (risk of overheating).
- The fan fuses may blow (overload).

Table 3-16 Supply voltage assignments for setting the fan transformer (380 V – 480 V 3AC)

Line voltage	Fan transformer tap (-T10)
380 V ± 10%	380 V
400 V ± 10%	400 V
440 V ± 10%	440 V
480 V ± 10%	480 V

Table 3-17 Supply voltage assignments for setting the fan transformer (660 V – 690 V 3AC)

Line voltage	Fan transformer tap (-T10)
660 V ± 10%	660 V
690 V ± 10%	690 V

3.3.6 Technical Specifications

Table 3-18 Technical specification for the Active Line Modules (380 – 480 V 3AC) (part 1)

Order number	6SL3330–	7TE32–1AA0	7TE32–6AA0	7TE33–8AA0	7TE35–0AA0
Infeed/feedback:					
Rated power	kW (Pn)	132	160	235	300
Peak power	kW (Pmax)	198	240	352.5	450
Rated infeed current	A	210	260	380	490
Max. infeed current	A	315	390	570	735
Rated DC link current	A	235	291	425	549
Connection voltages:					
- Line voltage	V_{Aceff}	380 3AC –10% to 480 3AC +10% (-15% < 1 min)			
- Line frequency	Hz	47 to 63 Hz			
- Electronics power supply	V_{DC}	24 (20.4 – 28.8)			
DC link voltage	V_{DC}	1.5 x V_{Line}			
Overvoltage tripping	V_{DC}	820 ± 2%			
Undervoltage tripping	V_{DC}	424			
Electronics current consumption (24 V DC)	A	1.1	1.1	1.35	1.35
Fan power consumption (400 V AC)	A	0.63	2	2.6	2.6
Max. ambient temperature: Without derating With derating	 °C °C	 40 55	 40 55	 40 55	 40 55
DC link capacitance	µF	4200	5200	7800	9600
Charging limit	µF	16800	20800	31200	38400
Power factor	cosφ	1	1	1	1
Efficiency	η	0.98	0.98	0.98	0.98
Power loss	kW	2.2	2.7	3.9	4.8
Cooling air requirement	m³/s	0.17	0.23	0.36	0.36
Sound pressure level at 50/60 Hz	dB(A)	74 / 76	75 / 77	76 / 78	76 / 78
Line/load connection		Flange connection with screws M10	Flange connection with screws M10	Flange connection with screws M10	Flange connection with screws M10
Max. connection cross-section					
Line connection (U1, V1, W1)	mm²	2 x 185	2 x 185	2 x 185	2 x 185
DC link connection (DCP, DCN)	mm²	2 x 185	2 x 185	2 x 185	2 x 185
PE connection PE1 PE2	mm² mm²	1 x 185 2 x 185	1 x 185 2 x 185	1 x 185 2 x 185	1 x 185 2 x 185
Degree of protection		IP20	IP20	IP20	IP20
Dimensions Width Height Depth	 mm mm mm	 326 1400 356	 326 1400 356	 326 1400 356	 326 1400 356
Type		FX	FX	GX	GX
Weight	kg	98	98	132	132

Table 3-19 Technical specifications for the Active Line Module (380 – 480 V 3AC) (part 2)

Order number	6SL3330–	7TE36–1AA0	7TE38–4AA0	7TE41–0AA0	7TE41–4AA0
Infeed/feedback:					
Rated power	kW (Pn)	380	500	630	900
Peak power	kW (Pmax)	570	750	945	1350
Rated infeed current	A	605	840	985	1405
Max. infeed current	A	907	1260	1477	2107
Rated DC link current	A	678	940	1103	1574
Connection voltages:					
- Line voltage	V_{Aceff}	380 3AC –10% to 480 3AC +10% (-15% < 1 min)			
- Line frequency	Hz	47 to 63 Hz			
- Electronics power supply	V_{DC}	24 (20.4 – 28.8)			
DC link voltage	V_{DC}	1.5 x V_{Line}			
Overvoltage tripping	V_{DC}	820 ± 2%			
Undervoltage tripping	V_{DC}	424			
Electronics current consumption (24 V DC)	A	1.4	1.4	1.5	1.7
Fan power consumption (400 V AC)	A	5.2	5.2	7.8	7.8
Max. ambient temperature: Without derating With derating	 °C °C	 40 55	 40 55	 40 55	 40 55
DC link capacitance	µF	12600	16800	18900	28800
Charging limit	µF	50400	67200	75600	115200
Power factor	cosφ	1	1	1	1
Efficiency	η	0.98	0.98	0.98	0.98
Power loss	kW	6.2	7.7	10.1	13.3
Cooling air requirement	m³/s	0.78	0.78	1.08	1.08
Sound pressure level at 50/60 Hz	dB(A)	78 / 80	78 / 80	78 / 80	78 / 80
Line/load connection		Flange connection with screws M12	Flange connection with screws M12	Flange connection with screws M12	Flange connection with screws M12
Max. connection cross-section					
Line connection (U1, V1, W1)	mm²	4 x 240	4 x 240	6 x 240	6 x 240
DC link connection (DCP, DCN)	mm²	Busbar	Busbar	Busbar	Busbar
PE connection PE1 PE2	mm² mm²	1 x 240 2 x 240	1 x 240 2 x 240	1 x 240 2 x 240	1 x 240 2 x 240
Degree of protection		IP00	IP00	IP00	IP00
Dimensions Width Height Depth	 mm mm mm	 503 1475 540	 503 1475 540	 704 1475 540	 704 1475 540
Type		HX	HX	JX	JX
Weight	kg	290	290	450	450

Table 3-20 Technical specifications for the Active Line Module (660 V – 690 V 3AC)

Order number	6SL3330–	7TH35–8AA0	7TH37–4AA0	7TH41–0AA0	7TH41–3AA0
Infeed/feedback:					
Rated power	kW (Pn)	560	800	1100	1400
Peak power	kW (Pmax)	840	1200	1650	2100
Rated infeed current	A	575	735	1025	1270
Max. infeed current	A	862	1102	1537	1905
Rated DC link current	A	644	823	1148	1422
Connection voltages:					
- Line voltage	V_{Aceff}	660 3AC –10% to 690 3AC +10% (-15% < 1 min)			
- Line frequency	Hz	47 to 63 Hz			
- Electronics power supply	V_{DC}	24 (20.4 – 28.8)			
DC link voltage	V_{DC}	1.5 x V_{Line}			
Overvoltage tripping	V_{DC}	1220 ± 2%			
Undervoltage tripping	V_{DC}	737			
Electronics current consumption (24 V DC)	A	1.4	1.5	1.7	1.7
Max. ambient temperature: Without derating With derating	 °C °C	 40 55	 40 55	 40 55	 40 55
DC link capacitance	µF	7400	11100	14400	19200
Charging limit	µF	29600	44400	57600	76800
Power factor	cosφ	1	1	1	1
Efficiency	η	0.98	0.98	0.98	0.98
Power loss	kW	6.8	10.2	13.6	16.5
Cooling air requirement	m³/s	0.78	1.1	1.1	1.1
Sound pressure level at 50/60 Hz	dB(A)	/	/	/	/
Line/load connection		Flange connection with screws M12	Flange connection with screws M12	Flange connection with screws M12	Flange connection with screws M12
Max. connection cross-section					
Line connection (U1, V1, W1)	mm²	4 x 240	6 x 240	6 x 240	6 x 240
DC link connection (DCP, DCN)	mm²	Busbar	Busbar	Busbar	Busbar
PE connection PE1 PE2	mm² mm²	1 x 240 2 x 240	1 x 240 2 x 240	1 x 240 2 x 240	1 x 240 2 x 240
Degree of protection		IP00	IP00	IP00	IP00
Dimensions Width Height Depth	 mm mm mm	 503 1475 540	 704 1475 540	 704 1475 540	 704 1475 540
Type		HX	JX	JX	JX
Weight	kg	290	450	450	450

Motor Modules

4

4.1 Description

A Motor Module is a power unit (DC-AC inverter) that provides the power supply for the connected motor. Power is supplied by means of the DC link of the drive unit. A Motor Module must be connected to a Control Unit via DRIVE-CLiQ. The open-loop and closed-loop control functions are stored in the Control Unit.

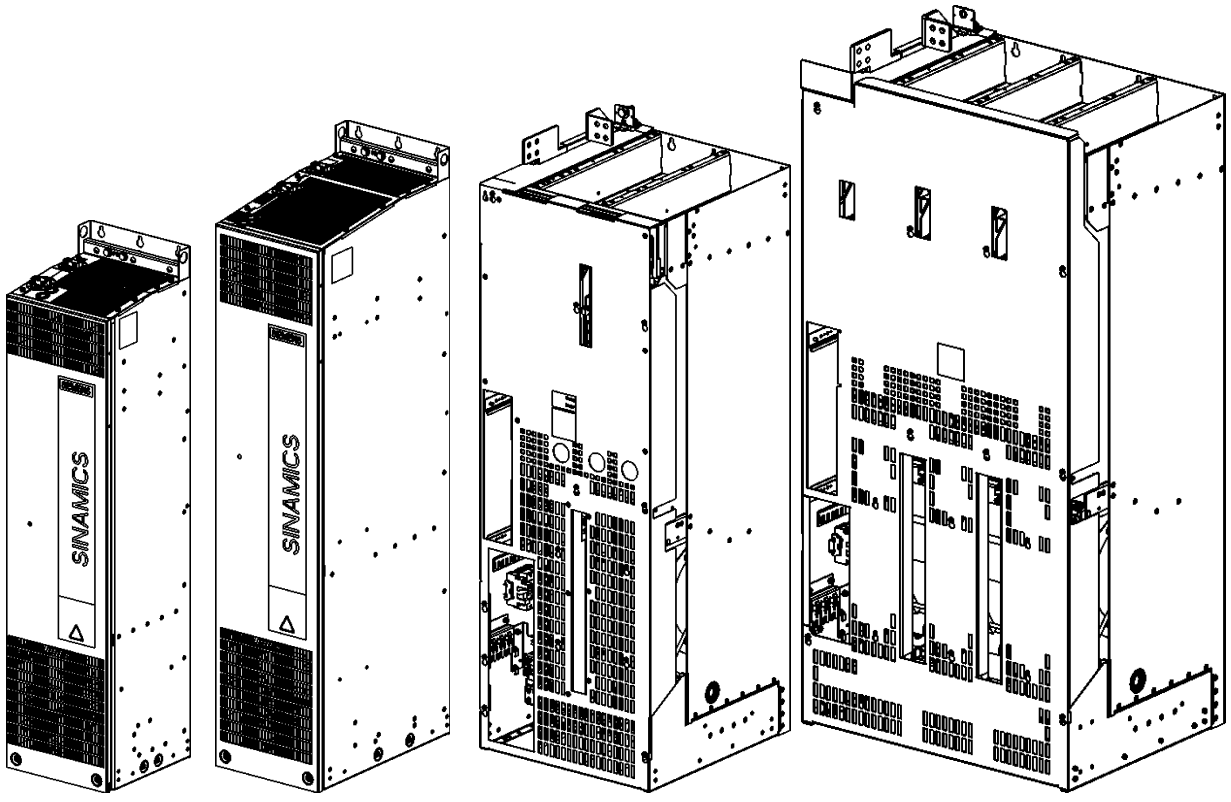


Fig. 4-1 Overview of Motor Modules (chassis)

Characteristics of the Motor Modules

- Version for 510 V DC to 750 V DC from 210 A to 1405 A
  Version for 890 V DC to 1035 V DC from 85 A to 1270 A
- Internal air cooling
- Short-circuit/ground-fault-proof
- Electronic type plate
- Operating status and error status via LEDs
- DRIVE-CLiQ interface for communication with the Control Unit and/or other components in the drive line-up.
- Integration in system diagnostics

4.2 Safety Information

Warning

After disconnecting all the supply voltages, a hazardous voltage will be present in all components for another 5 minutes. Work cannot be carried out until this time has elapsed.

Before starting work, you should also measure the voltage after the 5 minutes have elapsed. The voltage can be measured on DC link terminals DCP and DCN.

Caution

The DC link discharge voltage hazard warning must be affixed to the modules in the local language.

Important

The clearances above, below, and in front of the component, which are specified in the dimension drawings, must be observed.

Warning

Cable shields and unused power cable conductors must be connected to PE potential to prevent capacitive cross-talk charges.

Non-observance can cause lethal shock voltages.

4.3 Interface Description

4.3.1 Overview

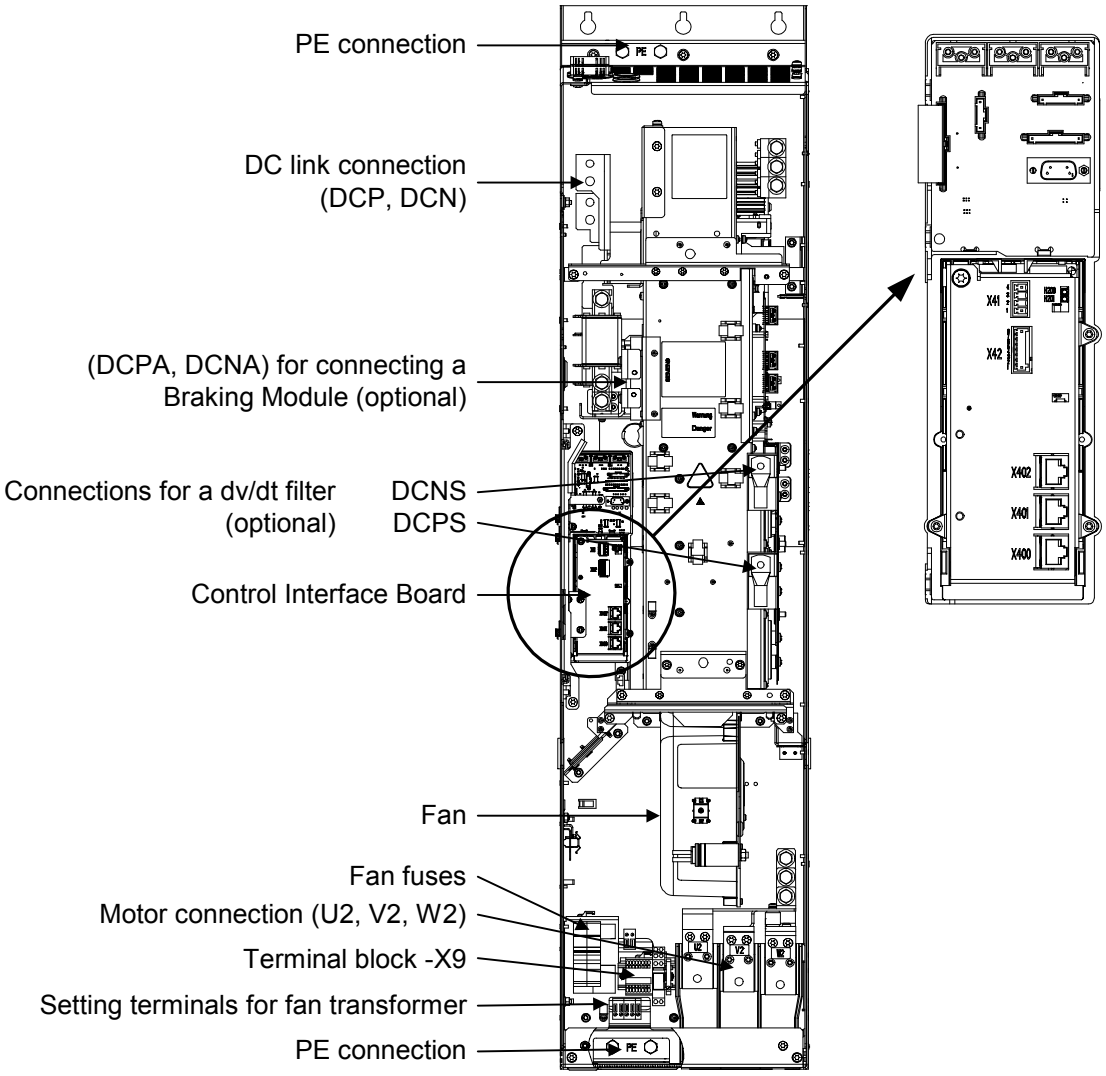


Fig. 4-2 Motor Module (type FX)

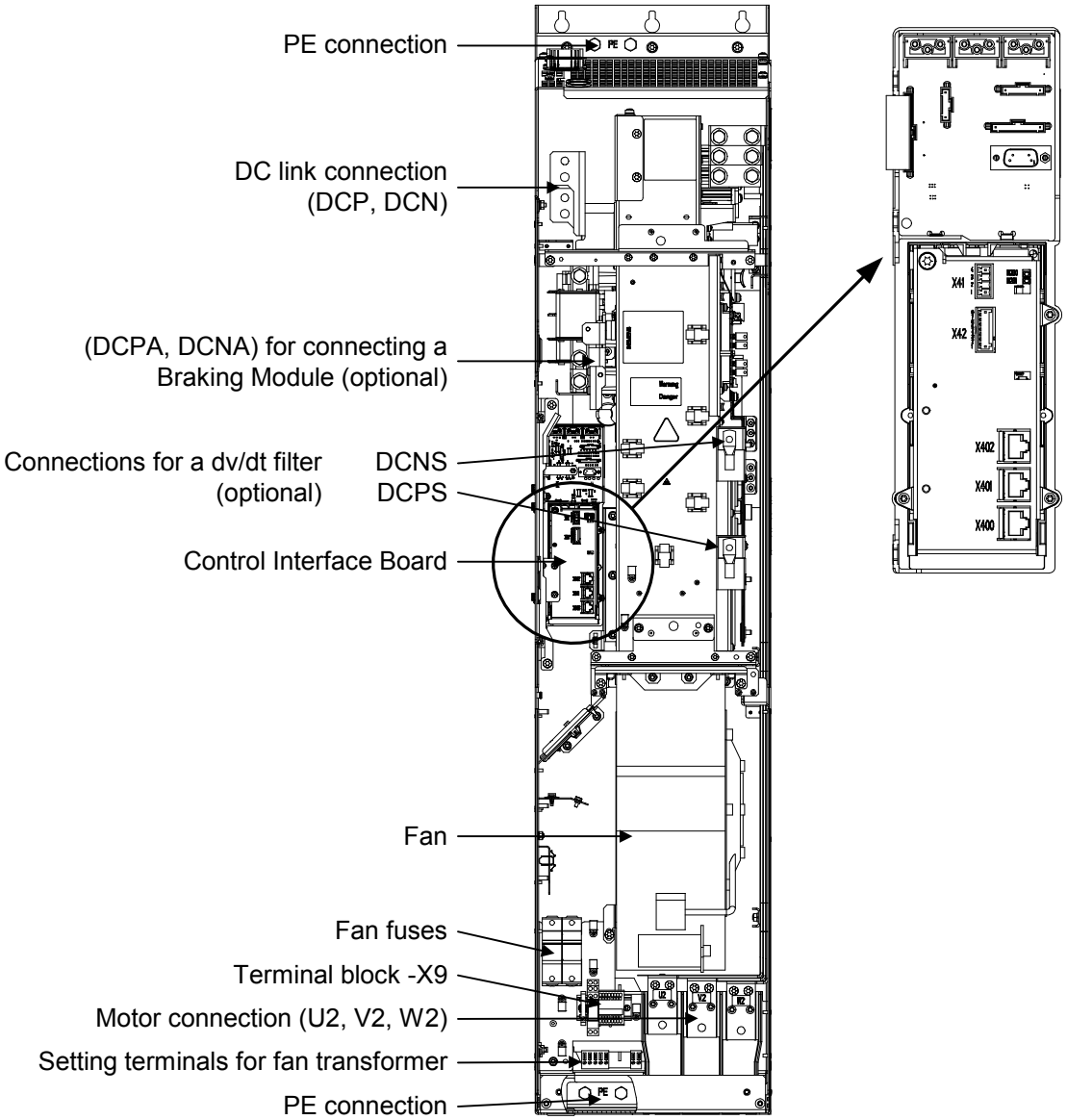


Fig. 4-3 Motor Module (type GX)

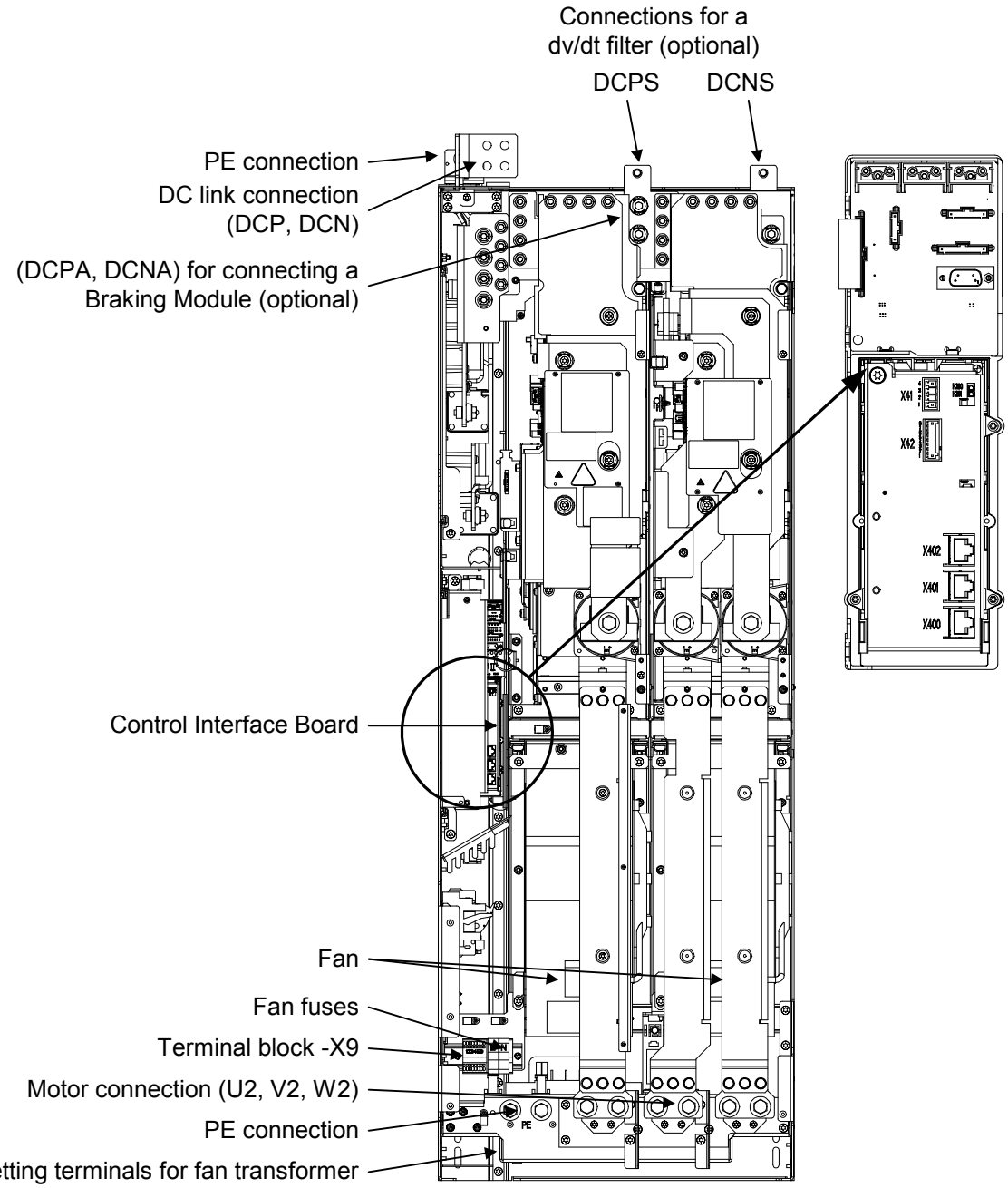


Fig. 4-4 Motor Module (type HX)

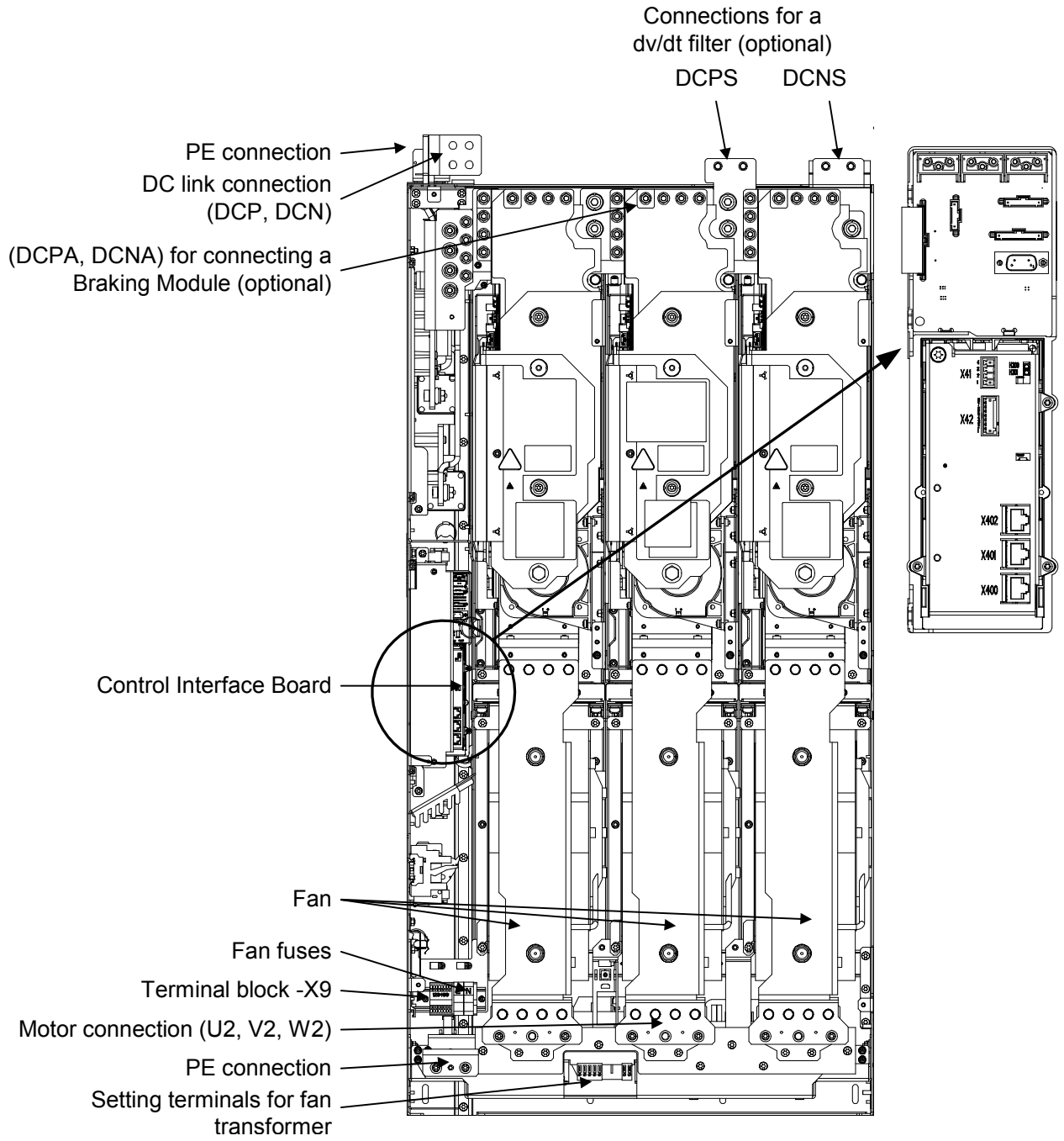


Fig. 4-5 Motor Module (type JX)

4.3.2 Connection Example

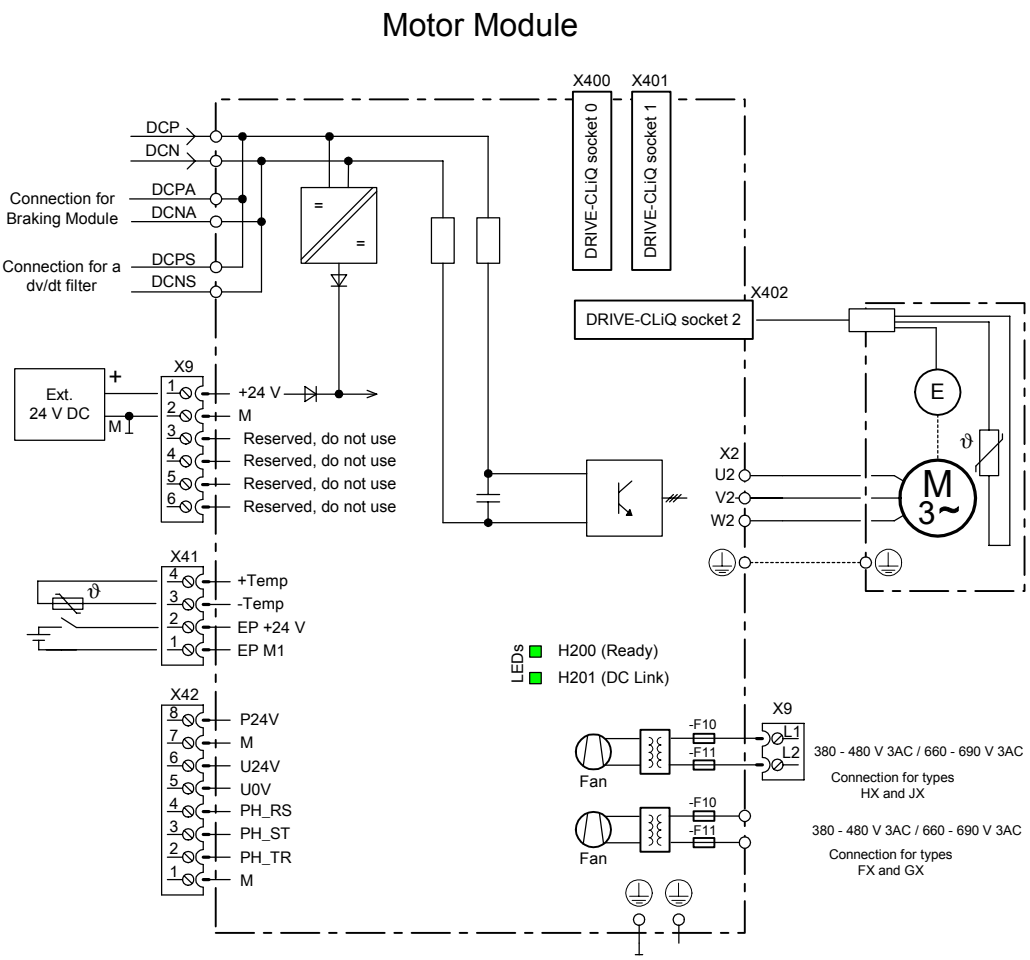
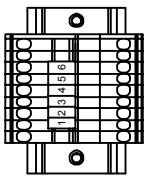


Fig. 4-6 Connection example for Motor Module (chassis)

4.3.3 Terminal Block X9

Table 4-1 Terminal block X9

	Terminal	Signal name	Technical specifications
	1	P24V	Voltage: 24 V DC (20.4 V – -28.8 V) Current input: max. 1.4 A
	2	M	
	3	Reserved, do not use	
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	Reserved, do not use	

4.3.4 DCPS, DCNS connection for a dv/dt filter

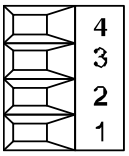
Table 4-2 DCPS, DCNS

Size	Connectable cross-section	Terminal screw
FX	1 x 35 mm²	M8
GX	1 x 70 mm²	M8
HX	1 x 185 mm²	M10
JX	2 x 185 mm²	M10

In the case of sizes FX and GX the connection cables are routed out downwards through the Motor Module.

4.3.5 EP Terminal X41 / Temperature Sensor Connection

Table 4-3 Terminal block X41

	Terminal	Function	Technical specifications
	4	+Temp	Temperature sensor connection KTY84–1C130
	3	-Temp	
	2	EP +24 V (Enable Pulses)	Supply voltage: 24 V DC (20.4 V – 28.8 V) Current input: 10 mA Signal propagation times: L → H: 100 µs H → L: 1000 µs
	1	EP M1 (Enable Pulses)	
Max. connectable cross-section 1.5 mm2 Type: Screw terminal 1			

Important

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

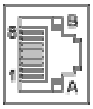
Note

The temperature sensor connection can be used for motors that are equipped with a KTY84-1C130 measurement sensor in the stator windings.

For operation, 24 V DC must be connected to terminal 3 and ground to terminal 4. Upon removal, pulse inhibit is activated.

4.3.6 DRIVE-CLiQ Interface X400-X402

Table 4-4 DRIVE-CLiQ interface X400-X402: Motor Module

	Pin	Name	Technical specifications
	1	TXP	Transmit data +
	2	TXN	Transmit data -
	3	RXP	Receive data +
	4	Reserved, do not use	
	5	Reserved, do not use	
	6	RXN	Receive data -
	7	Reserved, do not use	
	8	Reserved, do not use	
	A	+ (24 V)	Power supply
	B	GND (0 V)	Electronic ground

4.3.7 Meaning of the LEDs on the Control Interface Board in the Motor Module

Table 4-5 Meaning of the LEDs on the Control Interface Board in the Motor Module

LED	Color	Status	Description
H200 (Ready)	---	OFF	Electronics power supply outside permissible tolerance range
	Green	Continuous	The component is ready for operation and cyclic DRIVE-CLiQ communication is taking place.
	Orange	Continuous	DRIVE-CLiQ communication is being established.
	Red	Continuous	At least one fault is present in this component.
	Green / red	Flashing 2 Hz	Firmware is being downloaded.
	Green / orange or Red / orange	Flashing 2 Hz	Component recognition via LED is activated (p0124). Note: Both options depend on the LED status when module recognition is activated via p0124 = 1.
H201 (DC link)	---	OFF	Electronics power supply outside permissible tolerance range
	Orange	Continuous	DC link voltage within permissible tolerance range (only when ready for operation)
	Red	Continuous	DC link voltage outside permissible tolerance range (only when ready for operation)

Cause and rectification of faults

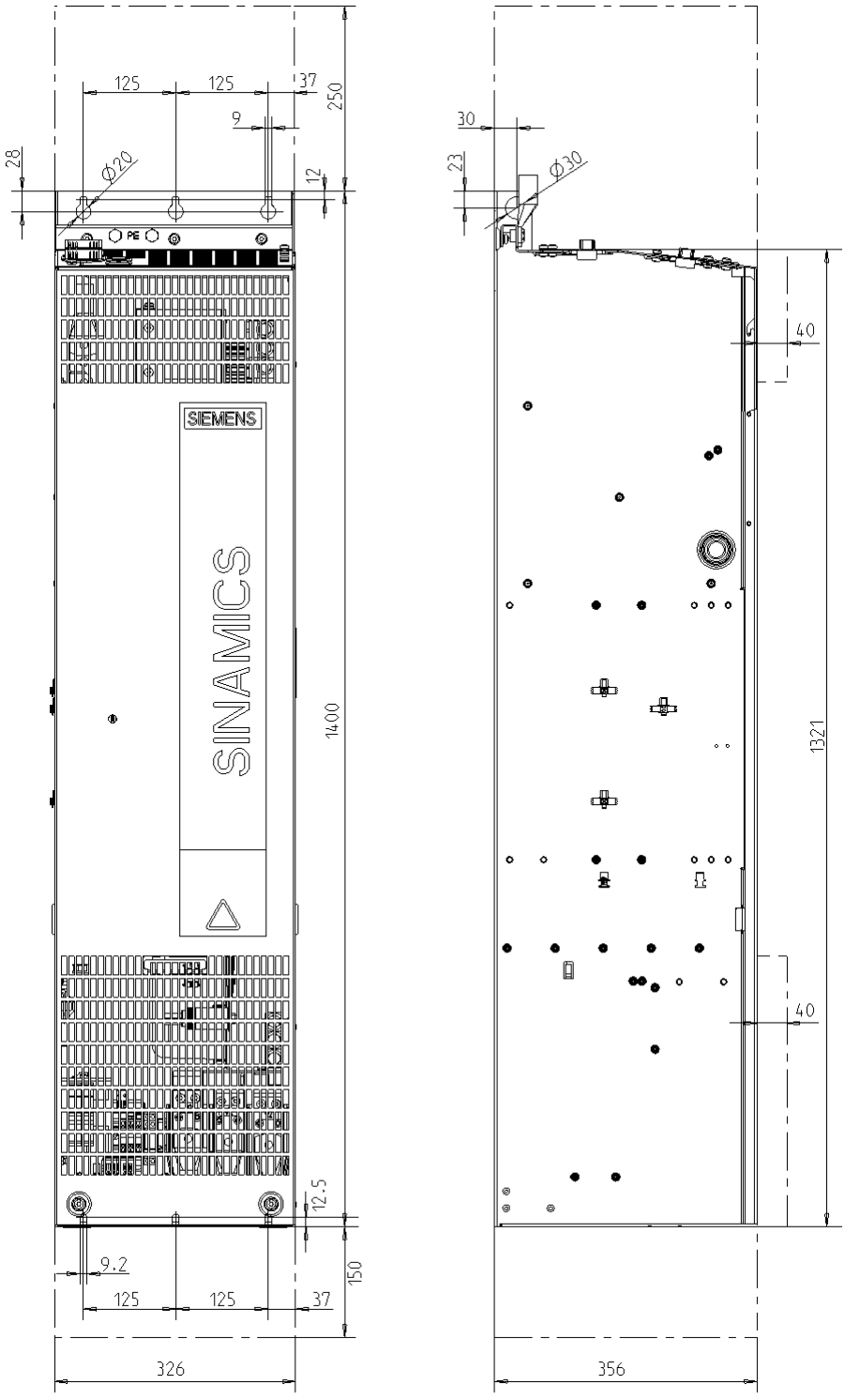
The following reference contains information about the cause and rectification of faults:

Reference: /IH1/ SINAMICS S120 Installation and Start-Up Manual

4.4 Dimension Drawing

Dimension drawing (type FX)

The clearances to be observed are indicated by the dotted line.

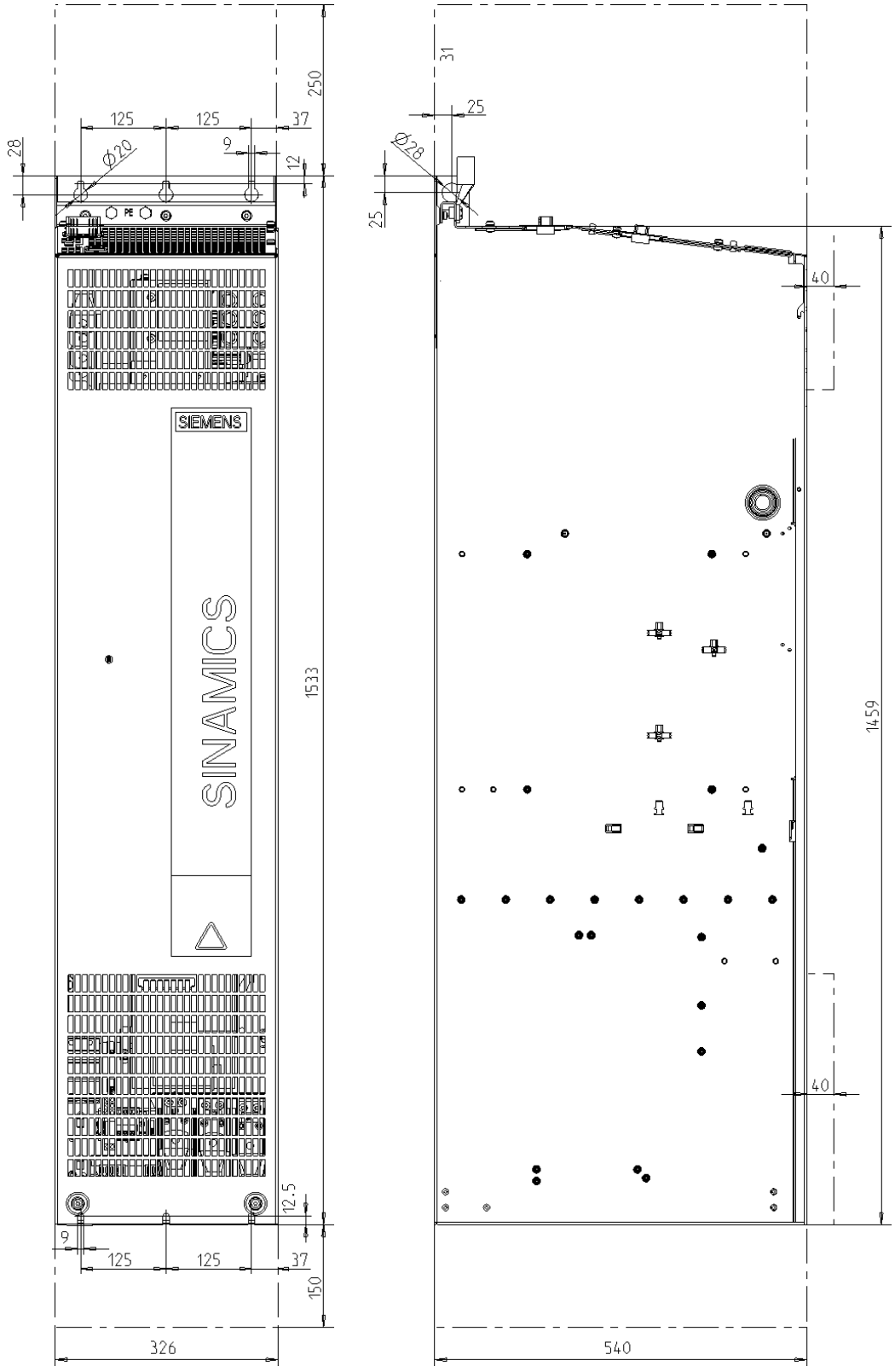


Front view Side view

Fig. 4-7 Dimension drawing of Motor Module (type FX)

Dimension drawing (type GX)

The clearances to be observed are indicated by the dotted line.

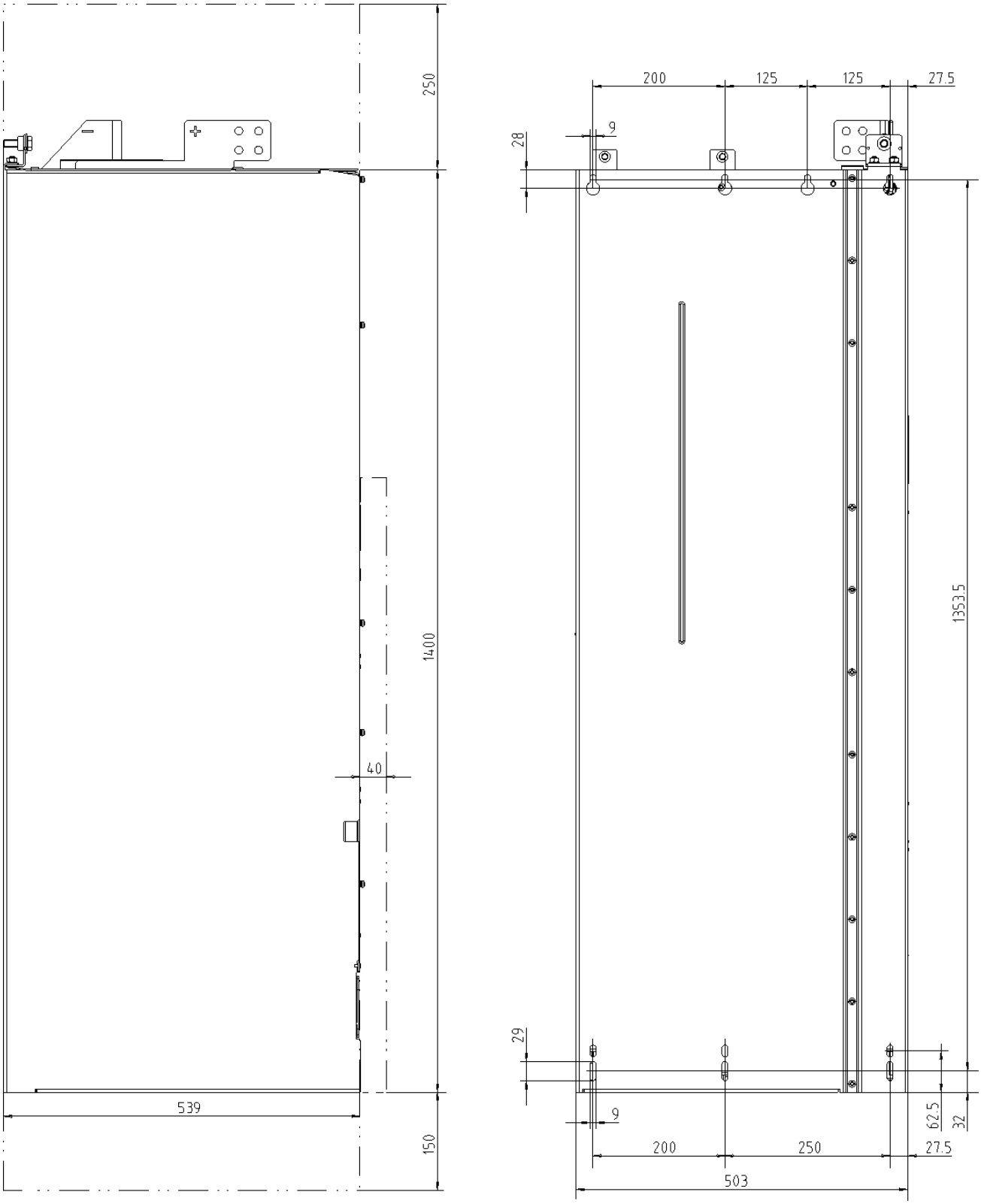


Front view Side view

Fig. 4-8 Dimension drawing of Motor Module (type GX)

Dimension drawing (type HX)

The clearances to be observed are indicated by the dotted line.

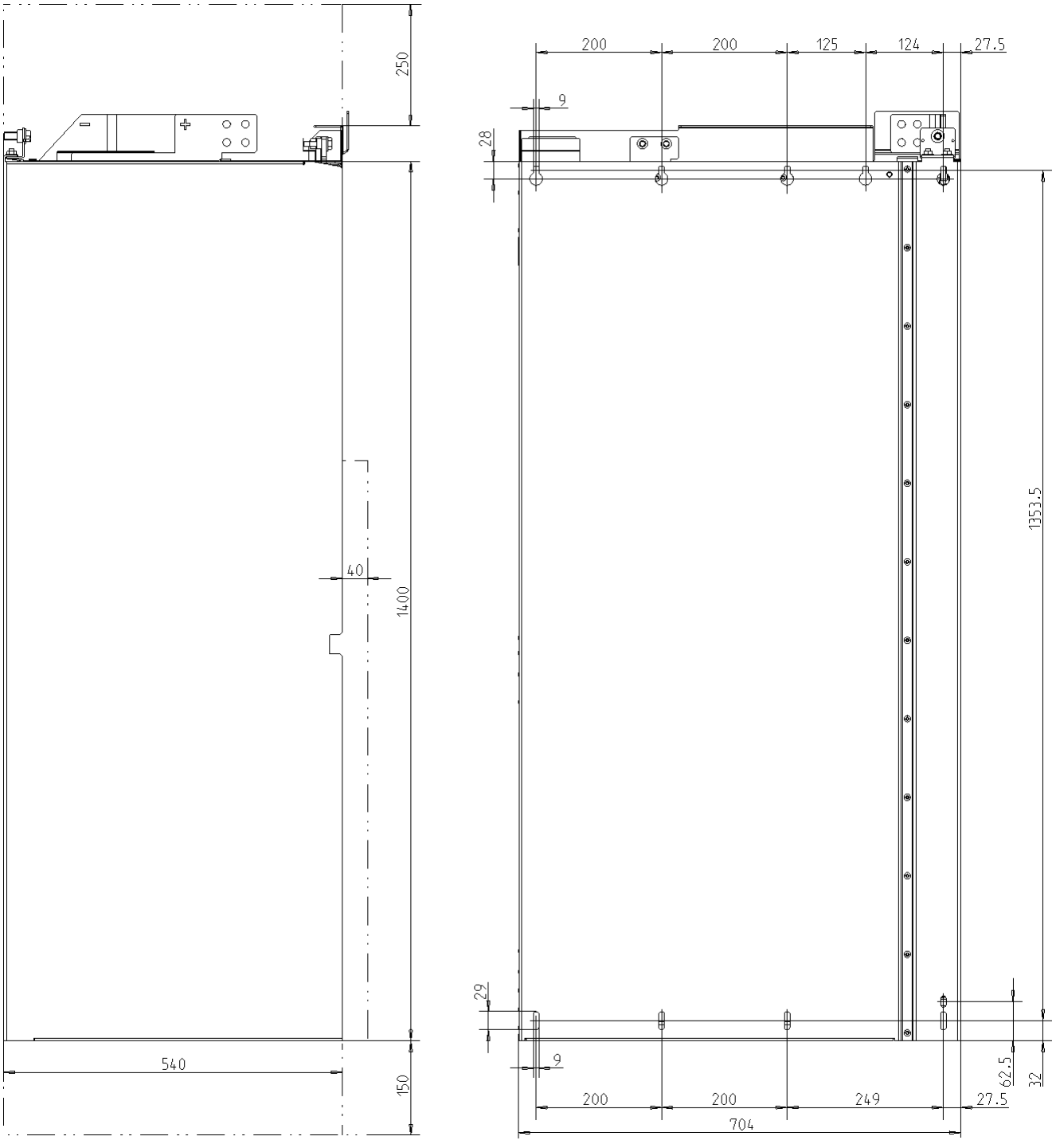


Side view Rear view

Fig. 4-9 Dimension drawing of Motor Module (type HX)

Dimension drawing (type JX)

The clearances to be observed are indicated by the dotted line.



Side view Rear view

Fig. 4-10 Dimension drawing of Motor Module (type JX)

4.5 Electrical Connection

Adjusting the fan voltage (-T10)

The power supply for the device fans (230 V 1AC) in the Motor Module (-T10) is generated from the main supply system by means of transformers. The locations of the transformers are indicated in the interface descriptions.
The transformers are fitted with primary taps so that they can be fine-tuned to the rated line supply voltage When delivered, the taps are always set to the highest level. With a low supply voltage, the appropriate transformer tap must be activated.

Note

For Motor Modules with a minimum output of 315 kW at 380 – 480 V 3AC and 400 kW at 660 – 690 V 3AC, two transformers (–T10 and –T20) are installed. The two primary terminals on each of these devices must be set together.

The terminals on the setting terminals must be connected to "0" and the supply voltage.

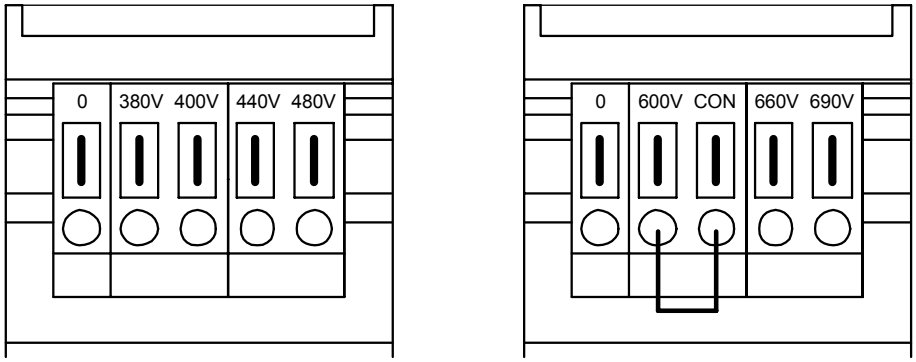


Fig. 4-11 Setting terminals for the fan transformers (380 V – 480 V 3AC / 660 V – 690 V 3AC)

The supply voltage assignments for making the appropriate setting on the fan transformer are indicated in Table 4-6 and Table 4-7 (factory settings: 480 V/0 V and 690 V/0 V).

Note

With the 660 V – 690 V 3AC fan transformer, a jumper is inserted between terminal "600 V" and terminal "CON". Terminals "600V" and "CON" are for internal use.

Important

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

- The required cooling is not provided (risk of overheating)
- The fan fuses may blow (overload).

Table 4-6 Supply voltage assignments for setting the fan transformer (380 V – 480 V 3AC)

Line voltage	Fan transformer tap (-T10)
380 V ± 10%	380 V
400 V ± 10%	400 V
440 V ± 10%	440 V
480 V ± 10%	480 V

Table 4-7 Supply voltage assignments for setting the fan transformer (660 V – 690 V 3AC)

Line voltage	Fan transformer tap (-T10)
660 V ± 10%	660 V
690 V ± 10%	690 V

4.6 Technical Specifications

510 V DC – 750 V DC Motor Modules

Table 4-8 Technical specifications for Motor Module (510 V – 750 V DC) (part 1)

Order number	6SL3320–	1TE32–1AA0	1TE32–6AA0	1TE33–1AA0	1TE33–8AA0
Rated output current In	A	210	260	310	380
Base load current IL	A	205	250	302	370
Base load current IH	A	178	233	277	340
Max. output current Imax	A	307	375	453	555
Rated power	kW	110	132	160	200
Power on basis of IH	kW	90	110	132	160
Base load current IH(S)	A	154	193	243	296
Max. output current Imax(S)	A	258	324	408	496
DC link current	A	252	312	372	456
Connection voltages - DC link voltage - Electronics power supply Overvoltage tripping Undervoltage tripping	 V_{DC} V_{DC} V_{DC} V_{DC}	 510 to 750 24 (20.4 – 28.8) 820 ± 2% 424			
Output voltage	V_{ACeff}	0 to 0.72 x DC link voltage			
Rated pulse frequency	kHz	2	2	2	2
Max. pulse frequency without derating	kHz	2	2	2	2
Max. pulse frequency with derating	kHz	8	8	8	8
Max. ambient temperature: Without derating With derating	 °C °C	 40 55	 40 55	 40 55	 40 55
DC link capacitance	µF	4200	5200	6300	7800
Electronics current consumption (24 V DC)	A	0.8	0.8	0.9	0.9
Fan power consumption (400 V 2AC)	A	0.6	1.2	1.6	1.6
Efficiency (at rated pulse frequency)	η	0.986	0.986	0.986	0.986
Power loss (at rated pulse frequency)	kW	1.86	2.5	2.96	3.67
Cooling air requirement	m³/s	0.17	0.23	0.36	0.36
Sound pressure level at 50/60 Hz	dB(A)	66 / 67	68 / 72	68 / 72	68 / 72
DC link/motor connection		Flange connection with screws M10	Flange connection with screws M10	Flange connection with screws M10	Flange connection with screws M10
Max. connection cross-section DC link connection (DCP, DCN) Motor connection (U2, V2, W2) PE connection	 mm² mm² mm²	 2 x 185 2 x 185 2 x 185	 2 x 185 2 x 185 2 x 185	 2 x 185 2 x 185 2 x 185	 2 x 185 2 x 185 2 x 185
Max. cable length shielded / unshielded	 m	 300 / 450	 300 / 450	 300 / 450	 300 / 450
Degree of protection		IP 20	IP 20	IP 20	IP 20
Dimensions Width Height Depth	 mm mm mm	 326 1400 356	 326 1400 356	 326 1533 545	 326 1533 545
Type		FX	FX	GX	GX
Weight	kg	95	95	136	136

Table 4-9 Technical specifications for the Motor Module (510 V – 750 V DC) (part 2)

Order number	6SL3320–	1TE35–0AA0	1TE36–1AA0	1TE37–5AA0	1TE38–4AA0
Rated output current In	A	490	605	745	840
Base load current IL	A	477	590	725	820
Base load current IH	A	438	460	570	700
Max. output current Imax	A	715	885	1087	1230
Rated power	kW	250	315	400	450
Power on basis of IH	kW	200	250	315	400
Base load current IH(S)	A	340	389	477	590
Max. output current Imax(S)	A	570	652	800	990
DC link current	A	588	726	894	1008
Connection voltages - DC link voltage - Electronics power supply Overvoltage tripping Undervoltage tripping	 V_{DC} V_{DC} V_{DC} V_{DC}	510 to 750 24 (20.4 – 28.8) 820 ± 2% 424			
Output voltage	V_{ACeff}	0 to 0.72 x DC link voltage			
Rated pulse frequency	kHz	2	1.25	1.25	1.25
Max. pulse frequency without derating	kHz	2	1.25	1.25	1.25
Max. pulse frequency with derating	kHz	8	5	5	5
Max. ambient temperature: Without derating With derating	 °C °C	 40 55	 40 55	 40 55	 40 55
DC link capacitance	µF	9600	12600	15600	16800
Electronics current consumption (24 V DC)	A	0.9	1.0	1.0	1.0
Fan power consumption (400 V 2AC)	A	1.6	3.2	3.2	3.2
Efficiency (at rated pulse frequency)	η	0.986	0.986	0.986	0.986
Power loss (at rated pulse frequency)	kW	4.28	5.84	6.68	7.15
Cooling air requirement	m³/s	0.36	0.78	0.78	0.78
Sound pressure level at 50/60 Hz	dB(A)	68 / 72	69 / 72	69 / 72	69 / 72
DC link/motor connection		Flange connection with screws M10	Flange connection with screws M12	Flange connection with screws M12	Flange connection with screws M12
Max. connection cross-section DC link connection (DCP, DCN) Motor connection (U2, V2, W2) PE connection (PE1/PE2)	 mm² mm² mm²	 2 x 185 2 x 185 2 x 185	 Busbar 4 x 240 1x240 / 2x240	 Busbar 4 x 240 1x240 / 2x240	 Busbar 4 x 240 1x240 / 2x240
Max. cable length shielded / unshielded	 m	 300 / 450	 300 / 450	 300 / 450	 300 / 450
Degree of protection		IP 20	IP 00	IP 00	IP 00
Dimensions Width Height Depth	 mm mm mm	 326 1533 545	 503 1475 540	 503 1475 540	 503 1475 540
Type		GX	HX	HX	HX
Weight	kg	136	290	290	290

Table 4-10 Technical specifications for the Motor Module (510 V – 750 V DC) (part 3)

Order number	**6SL3320–**	**1TE41–0AA0**	**1TE41–2AA0**	**1TE41–4AA0**	
Rated output current In	A	985	1260	1405	
Base load current IL	A	960	1230	1370	
Base load current IH	A	860	1127	1257	
Max. output current Imax	A	1440	1845	2055	
Rated power	kW	560	710	800	
Power on basis of IH	kW	450	560	710	
Base load current IH(S)	A	769	984	1193	
Max. output current Imax(S)	A	1290	1650	2000	
DC link current	A	1182	1512	1686	
Connection voltages - DC link voltage - Electronics power supply Overvoltage tripping Undervoltage tripping	 V_{DC} V_{DC} V_{DC} V_{DC}	 510 to 750 24 (20.4 – 28.8) 820 ± 2% 424			
Output voltage	V_{ACeff}	0 to 0.72 x DC link voltage			
Rated pulse frequency	kHz	1.25	1.25	1.25	
Max. pulse frequency without derating	kHz	1.25	1.25	1.25	
Max. pulse frequency with derating	kHz	5	5	5	
Max. ambient temperature: Without derating With derating	 °C °C	 40 55	 40 55	 40 55	
DC link capacitance	µF	18900	26100	28800	
Electronics current consumption (24 V DC)	A	1.25	1.4	1.4	
Fan power consumption (400 V 2AC)	A	4.7	4.7	4.7	
Efficiency (at rated pulse frequency)	η	0.986	0.986	0.986	
Power loss (at rated pulse frequency)	kW	9.5	11.1	12.0	
Cooling air requirement	m³/s	1.1	1.1	1.1	
Sound pressure level at 50/60 Hz	dB(A)	71 / 72	71 / 72	71 / 72	
DC link/motor connection		Flange connection with screws M12	Flange connection with screws M12	Flange connection with screws M12	
Max. connection cross-section DC link connection (DCP, DCN) Motor connection (U2, V2, W2) PE connection (PE1/PE2)	 mm² mm² mm²	 Busbar 6 x 240 1x240 / 2x240	 Busbar 6 x 240 1x240 / 2x240	 Busbar 6 x 240 1x240 / 2x240	
Max. cable length shielded / unshielded	 m	 300 / 450	 300 / 450	 300 / 450	
Degree of protection		IP 00	IP 00	IP 00	
Dimensions Width Height Depth	 mm mm mm	 704 1475 540	 704 1475 540	 704 1475 540	
Type		JX	JX	JX	
Weight	kg	450	450	450	

890 V DC – 1035 V DC Motor Modules

Table 4-11 Technical specifications for the Motor Module (890 V DC – 1035 V DC) (part 1)

Order number	6SL3320–	1TH28–5AA0	1TH31–0AA0	1TH31–2AA0	1TH31–5AA0
Rated output current In	A	85	100	120	150
Base load current IL	A	80	95	115	142
Base load current IH	A	76	89	107	134
Max. output current Imax	A	120	142	172	213
Rated power	kW	75	90	110	132
Power on basis of IH	kW	55	75	90	110
DC link current	A	102	120	144	180
Connection voltages - DC link voltage - Electronics power supply Overvoltage tripping Undervoltage tripping	 V_{DC} V_{DC} V_{DC} V_{DC}	 890 to 1035 24 (20.4 – 28.8) 1220 ± 2% 737			
Output voltage	V_{ACeff}	0 to 0.72 x DC link voltage			
Rated pulse frequency	kHz	1.25	1.25	1.25	1.25
Max. pulse frequency without derating	kHz	1.25	1.25	1.25	1.25
Max. pulse frequency with derating	kHz	5	5	5	5
Max. ambient temperature: Without derating With derating	 °C °C	 40 55	 40 55	 40 55	 40 55
DC link capacitance	µF	1200	1200	1600	2800
Electronics current consumption (24 V DC)	A	0.8	0.8	0.8	0.8
Fan power consumption (690 V 2AC)	A	0.4	0.4	0.4	0.4
Efficiency (at rated pulse frequency)	η	0.988	0.988	0.986	0.989
Power loss (at rated pulse frequency)	kW	1.17	1.43	1.89	1.80
Cooling air requirement	m³/s	0.17	0.17	0.17	0.17
Sound pressure level at 50/60 Hz	dB(A)	66 / 67	66 / 67	66 / 67	66 / 67
DC link/motor connection		Flange connection with screws M10	Flange connection with screws M10	Flange connection with screws M10	Flange connection with screws M10
Max. connection cross-section DC link connection (DCP, DCN) Motor connection (U2, V2, W2) PE connection (PE1/PE2)	 mm² mm² mm²	 2 x 185 2 x 185 2x185 / 2x185	 2 x 185 2 x 185 2x185 / 2x185	 2 x 185 2 x 185 2x185 / 2x185	 2 x 185 2 x 185 2x185 / 2x185
Max. cable length shielded / unshielded	 m	 300 / 450	 300 / 450	 300 / 450	 300 / 450
Degree of protection		IP 20	IP 20	IP 20	IP 20
Dimensions Width Height Depth	 mm mm mm	 326 1400 356	 326 1400 356	 326 1400 356	 326 1400 356
Type		FX	FX	FX	FX
Weight	kg	95	95	95	95

Table 4-12 Technical specifications for the Motor Module (890 V DC – 1035 V DC) (part 2)

Order number	6SL3320–	1TH31–8AA0	1TH32–2AA0	1TH32–6AA0	1TH33–3AA0
Rated output current In	A	175	215	260	330
Base load current IL	A	170	208	250	320
Base load current IH	A	157	192	233	280
Max. output current Imax	A	255	312	375	480
Rated power	kW	160	200	250	315
Power on basis of IH	kW	132	160	200	250
DC link current	A	210	258	312	396
Connection voltages - DC link voltage - Electronics power supply Overvoltage tripping Undervoltage tripping	 V_{DC} V_{DC} V_{DC} V_{DC}	 890 to 1035 24 (20.4 – 28.8) 1220 ± 2% 737			
Output voltage	V_{ACeff}	0 to 0.72 x DC link voltage			
Rated pulse frequency	kHz	1.25	1.25	1.25	1.25
Max. pulse frequency without derating	kHz	1.25	1.25	1.25	1.25
Max. pulse frequency with derating	kHz	5	5	5	5
Max. ambient temperature: Without derating With derating	 °C °C	 40 55	 40 55	 40 55	 40 55
DC link capacitance	µF	2800	2800	3900	4200
Electronics current consumption (24 V DC)	A	0.9	0.9	0.9	0.9
Fan power consumption (690 V 2AC)	A	0.94	0.94	0.94	0.94
Efficiency (at rated pulse frequency)	η	0.987	0.988	0.988	0.987
Power loss (at rated pulse frequency)	kW	2.67	3.09	3.62	4.34
Cooling air requirement	m³/s	0.36	0.36	0.36	0.36
Sound pressure level at 50/60 Hz	dB(A)	68 / 72	68 / 72	68 / 72	68 / 72
DC link/motor connection		Flange connection with screws M10	Flange connection with screws M10	Flange connection with screws M10	Flange connection with screws M10
Max. connection cross-section DC link connection (DCP, DCN) Motor connection (U2, V2, W2) PE connection (PE1/PE2)	 mm² mm² mm²	 2 x 185 2 x 185 2x185 / 2x185	 2 x 185 2 x 185 2x185 / 2x185	 2 x 185 2 x 185 2x185 / 2x185	 2 x 185 2 x 185 2x185 / 2x185
Max. cable length shielded / unshielded	 m	 300 / 450	 300 / 450	 300 / 450	 300 / 450
Degree of protection		IP 20	IP 20	IP 20	IP 20
Dimensions Width Height Depth	 mm mm mm	 326 1533 545	 326 1533 545	 326 1533 545	 326 1533 545
Type		GX	GX	GX	GX
Weight	kg	136	136	136	136

Table 4-13 Technical specifications for the Motor Module (890 V DC – 1035 V DC) (part 3)

Order number	6SL3320–	1TH34–1AA0	1TH34–7AA0	1TH35–8AA0	1TH37–4AA0
Rated output current In	A	410	465	575	735
Base load current IL	A	400	452	560	710
Base load current IH	A	367	416	514	657
Max. output current Imax	A	600	678	840	1065
Rated power	kW	400	450	560	710
Power on basis of IH	kW	315	400	450	630
DC link current	A	492	558	690	882
Connection voltages - DC link voltage - Electronics power supply Overvoltage tripping Undervoltage tripping	 V_{DC} V_{DC} V_{DC} V_{DC}	 890 to 1035 24 (20.4 – 28.8) 1220 ± 2% 737			
Output voltage	V_{ACeff}	0 to 0.72 x DC link voltage			
Rated pulse frequency	kHz	1.25	1.25	1.25	1.25
Max. pulse frequency without derating	kHz	1.25	1.25	1.25	1.25
Max. pulse frequency with derating	kHz	5	5	5	5
Max. ambient temperature: Without derating With derating	 °C °C	 40 55	 40 55	 40 55	 40 55
DC link capacitance	µF	7400	7400	7400	11100
Electronics current consumption (24 V DC)	A	1.0	1.0	1.0	1.25
Fan power consumption (690 V 2AC)	A	1.84	1.84	2.74	2.74
Efficiency (at rated pulse frequency)	η	0.987	0.985	0.988	0.988
Power loss (at rated pulse frequency)	kW	6.13	6.80	10.3	10.9
Cooling air requirement	m³/s	0.78	0.78	0.78	1.474
Sound pressure level at 50/60 Hz	dB(A)	69 / 72	69 / 72	69 / 72	71 / 72
DC link/motor connection		Flange connection with screws M12	Flange connection with screws M12	Flange connection with screws M12	Flange connection with screws M12
Max. connection cross-section DC link connection (DCP, DCN) Motor connection (U2, V2, W2) PE connection (PE1/PE2)	 mm² mm² mm²	 Busbar 4 x 240 1x240 / 2x240	 Busbar 4 x 240 1x240 / 2x240	 Busbar 4 x 240 1x240 / 2x240	 Busbar 4 x 240 1x240 / 2x240
Max. cable length shielded / unshielded	 m	 300 / 450	 300 / 450	 300 / 450	 300 / 450
Degree of protection		IP 00	IP 00	IP 00	IP 00
Dimensions Width Height Depth	 mm mm mm	 503 1475 540	 503 1475 540	 503 1475 540	 704 1475 540
Type		HX	HX	HX	JX
Weight	kg	290	290	290	450

Table 4-14 Technical specifications for the Motor Module (890 V DC – 1035 V DC) (part 4)

Order number	6SL3320–	1TH38–1AA0	1TH38–8AA0	1TH41–0AA0	1TH41–3AA0
Rated output current In	A	810	910	1025	1270
Base load current IL	A	790	880	1000	1230
Base load current IH	A	724	814	917	1136
Max. output current Imax	A	1185	1320	1500	1845
Rated power	kW	800	900	1000	1200
Power on basis of IH	kW	710	800	900	1000
DC link current	A	972	1092	1230	1524
Connection voltages - DC link voltage - Electronics power supply Overvoltage tripping Undervoltage tripping	 V_{DC} V_{DC} V_{DC} V_{DC}	 890 to 1035 24 (20.4 – 28.8) 1220 ± 2% 737			
Output voltage	V_{ACeff}	0 to 0.72 x DC link voltage			
Rated pulse frequency	kHz	1.25	1.25	1.25	1.25
Max. pulse frequency without derating	kHz	1.25	1.25	1.25	1.25
Max. pulse frequency with derating	kHz	5	5	5	5
Max. ambient temperature: Without derating With derating	 °C °C	 40 55	 40 55	 40 55	 40 55
DC link capacitance	µF	11100	14400	14400	19200
Electronics current consumption (24 V DC)	A	1.25	1.4	1.4	1.4
Fan power consumption (690 V 2AC)	A	2.74	2.74	2.74	2.74
Efficiency (at rated pulse frequency)	η	0.988	0.989	0.989	0.989
Power loss (at rated pulse frequency)	kW	11.5	11.7	13.2	16.0
Cooling air requirement	m³/s	1.474	1.474	1.474	1.474
Sound pressure level at 50/60 Hz	dB(A)	71 / 72	71 / 72	71 / 72	71 / 72
DC link/motor connection		Flange connection with screws M12	Flange connection with screws M12	Flange connection with screws M12	Flange connection with screws M12
Max. connection cross-section DC link connection (DCP, DCN) Motor connection (U2, V2, W2) PE connection (PE1/PE2)	 mm² mm² mm²	 Busbar 6 x 240 1x240 / 2x240	 Busbar 6 x 240 1x240 / 2x240	 Busbar 6 x 240 1x240 / 2x240	 Busbar 6 x 240 1x240 / 2x240
Max. cable length shielded / unshielded	 m	 300 / 450	 300 / 450	 300 / 450	 300 / 450
Degree of protection		IP 00	IP 00	IP 00	IP 00
Dimensions Width Height Depth	 mm mm mm	 704 1475 540	 704 1475 540	 704 1475 540	 704 1475 540
Type		JX	JX	JX	JX
Weight	kg	450	450	450	450

4.6.1.1 Overload Capability

SINAMICS S120 Motor Modules are equipped with an overload reserve to deal with breakaway torques, for example.

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

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

Small overload

The base load current for a small overload (I_L) is based on a duty cycle of 110% for 60 s or 150% for 10 s.

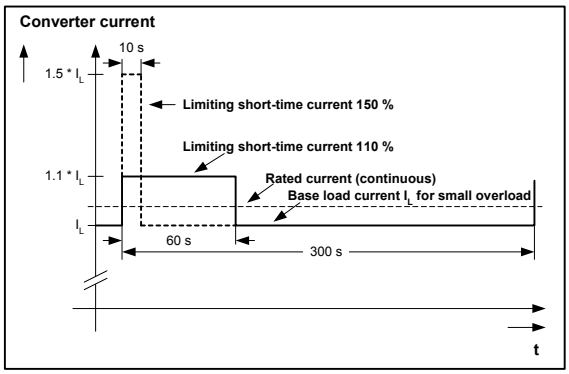


Fig. 4-12 Small overload

High overload

The base load current for a high overload (I_H) is based on a duty cycle of 150% for 60 s or 160% for 10 s.

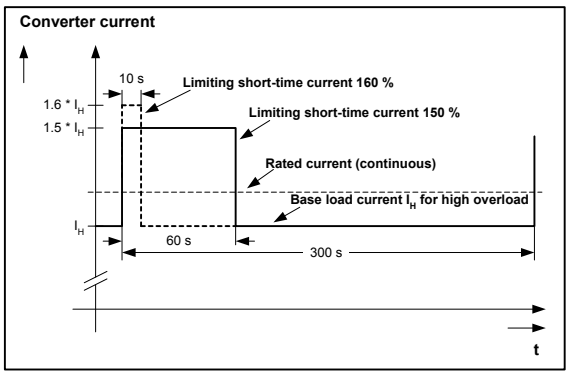


Fig. 4-13 High overload

High overload (servo)

The base load current for high overload $I_{H(S)}$ is based on a duty cycle of 150% for 60 s or 160% for 10 s, whereby the pulse frequency of the Motor Module has been increased to 4 kHz or 2.5 kHz for servo applications.

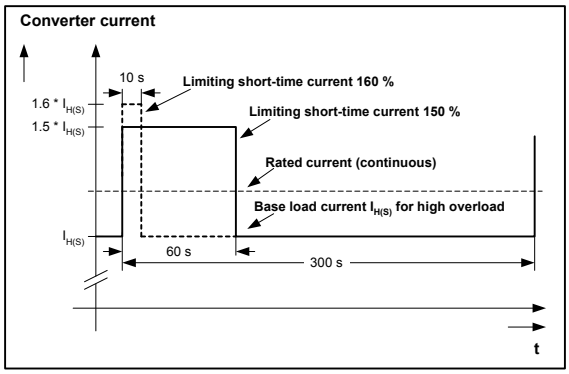


Fig. 4-14 High overload (servo)

4.6.1.2 Current Reduction as a Function of the Pulse Frequency

When the pulse frequency is increased, the derating factor of the output current must be taken into account.
This derating factor must be applied to the currents specified in the technical specifications in Table 4-8 to Table 4-14.

Table 4-15 Derating factor of the output current as a function of the pulse frequency for devices with a rated pulse frequency of 2 kHz

Order no. 6SL3320-...	Power [kW]	Output current at pulse frequency of 2 kHz [A]	Derating factor at pulse frequency of 4 kHz	Derating factor at pulse frequency of 8 kHz
Connection voltage: 510 – 750 V DC				
1TE32-1AA0	110	210	82%	50%
1TE32-6AA0	132	260	83%	50%
1TE33-1AA0	160	310	88%	50%
1TE33-8AA0	200	380	87%	50%
1TE35-0AA0	250	490	78%	50%

Table 4-16 Derating factor of the output current as a function of the pulse frequency for devices with a rated pulse frequency of 1.25 kHz

Order no. 6SL3320-...	Power [kW]	Output current at pulse frequency of 1.25 kHz [A]	Derating factor at pulse frequency of 2.5 kHz	Derating factor at pulse frequency of 5 kHz
Connection voltage: 510 – 750 V DC				
1TE36-1AA0	315	605	72%	40%
1TE37-5AA0	400	745	72%	40%
1TE38-4AA0	450	840	79%	40%
1TE41-0AA0	560	985	87%	50%
1TE41-2AA0	710	1260	87%	50%
1TE41-4AA0	800	1405	95%	50%
Connection voltage: 890 – 1035 V DC				
1TH28-5AA0	75	85	89%	40%
1TH31-0AA0	90	100	88%	40%
1TH31-2AA0	110	120	88%	40%
1TH31-5AA0	132	150	84%	35%
1TH31-8AA0	160	175	87%	40%
1TH32-2AA0	200	215	87%	40%
1TH32-6AA0	250	260	88%	40%
1TH33-3AA0	315	330	82%	40%
1TH34-1AA0	400	410	82%	35%
1TH34-7AA0	450	465	87%	35%
1TH35-8AA0	560	575	85%	35%
1TH37-4AA0	710	735	79%	35%
1TH38-1AA0	800	810	95%	35%
1TH38-8AA0	900	910	87%	33%
1TH41-0AA0	1000	1025	86%	30%
1TH41-3AA0	1200	1270	79%	25%

Maximum Output Frequencies with Increase in Pulse Frequency

By multiplying the rated pulse frequency (with integers), the following output frequencies can be achieved (taking into account the derating factors in Table 4-15 and Table 4-16):

Table 4-17 Maximum output frequencies achieved by increasing the pulse frequency

Pulse frequency [kHz]	Maximum output frequency [Hz]
1.25	100
2	160
2.5	200
4	320 [1)]
5	400 [1)]

[1)] The maximum output frequency is limited to 300 Hz due to the closed-loop control.

DC Link Components

5

5.1 Braking Module

5.1.1 Description

A Braking Module (and an external braking resistor) is required to bring drives to a controlled standstill in the event of a power failure (e.g. emergency retraction or EMERGENCY OFF category 1) or limit the DC link voltage if the generator is operated for a short period of time (e.g. when the regenerative feedback capability of the Line Module is deactivated). The Braking Module contains the power electronics and the associated control.

During operation, the DC link energy is converted to heat loss in an external braking resistor. Braking Modules function autonomously. Several Braking Modules can be operated in parallel. In this case, each Braking Module must have its own braking resistor.

Depending on the size of the Active Line Module or Motor Module, up to 3 mounting locations are available:

- Type FX, GX: 1 mounting location
- Type HX: 2 mounting locations
- Type JX: 3 mounting locations

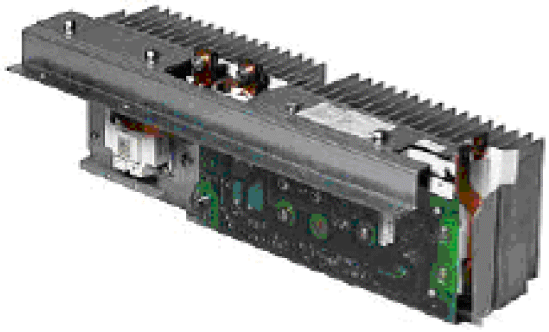


Fig. 5-1 Braking Module

Structure

The Braking Module in chassis format is inserted in a mounting location inside the Motor Module or Active Line Module, the fan of which ensures forced cooling. The supply voltage for the electronics is drawn from the DC link. The Braking Module is connected to the DC link by means of busbar sets or flexible cables, which are supplied as standard.

The Braking Module has the following standard interfaces:

- DC link connection via busbars or flexible cables
- Connection terminal for external braking resistor
- 1 digital input (inhibit Braking Module with high signal/acknowledge error with negative edge high low)
- 1 digital output (Braking Module defective)

5.1.2 Safety Information

Warning

After disconnecting all the supply voltages, a hazardous voltage will be present in all components for another 5 minutes. Work cannot be carried out on the components until this time has elapsed.

Before starting work, you should also measure the voltage after the 5 minutes have elapsed. The voltage can be measured on DC link terminals DCP and DCN.

Caution

The DC link discharge voltage hazard warning must be affixed to the modules in the local language.

Caution

The connection with the braking resistors must be short-circuit/ground-fault proof.

Note

Using braking resistors not approved by SIEMENS for SINAMICS can destroy them.

5.1.3 Interface Description

5.1.3.1 Braking Module for Type FX

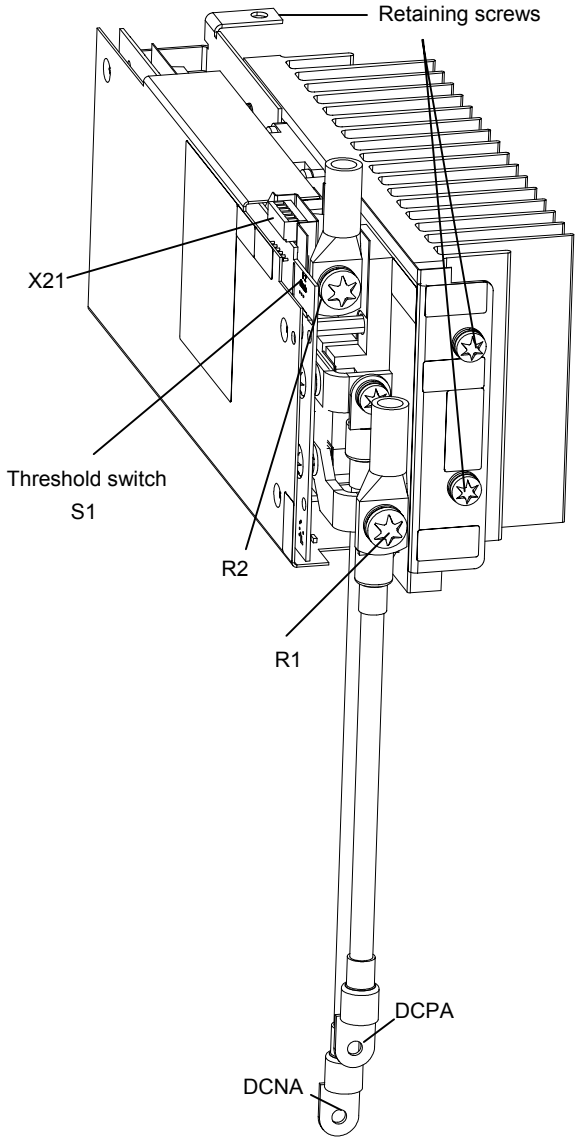


Fig. 5-2 Braking Module for Active Line Module / Motor Module (type FX)

5.1.3.2 Braking Module for Type GX

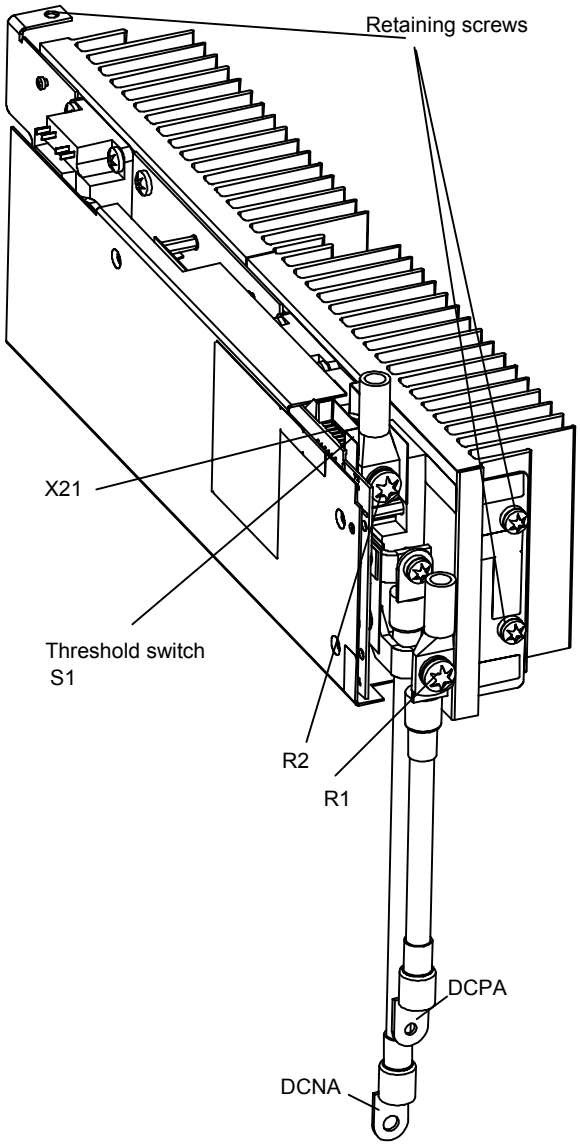


Fig. 5-3 Braking Module for Active Line Module / Motor Module (type GX)

5.1.3.3 Braking Module for Types HX / JX

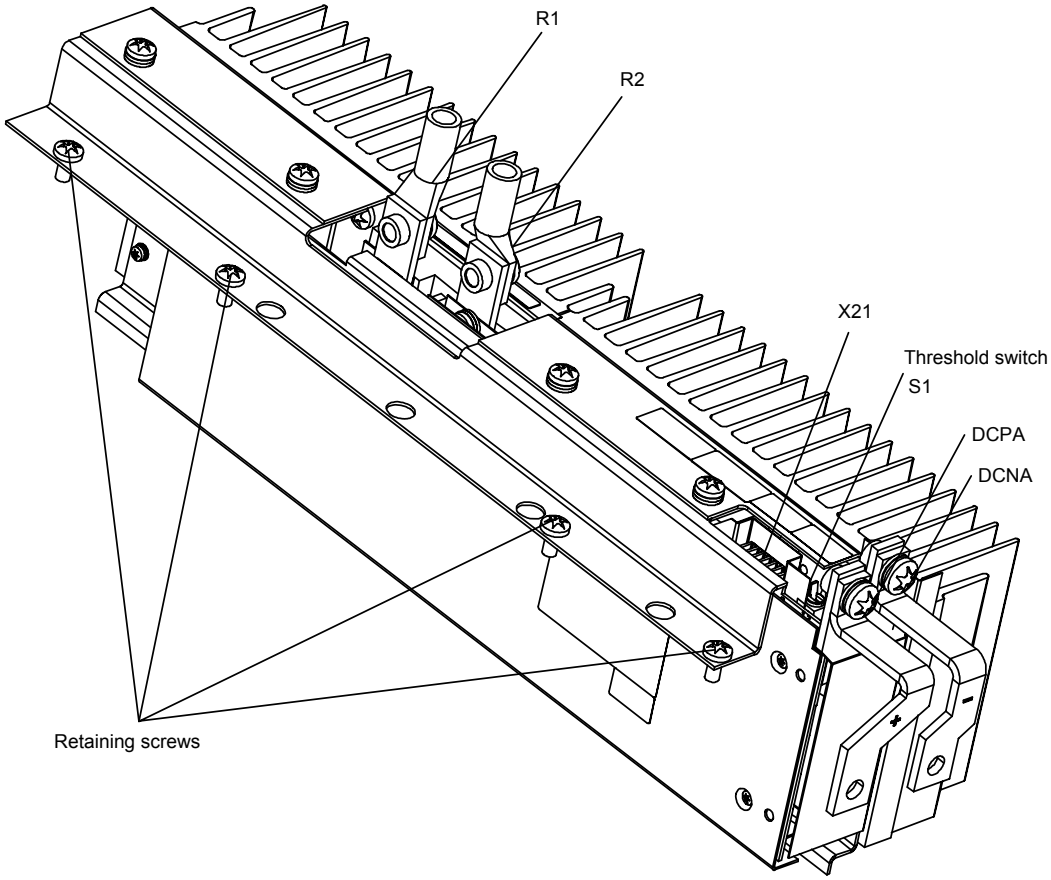


Fig. 5-4 Braking Module for Active Line Module / Motor Module (types HX / JX)

5.1.3.4 Connection Example

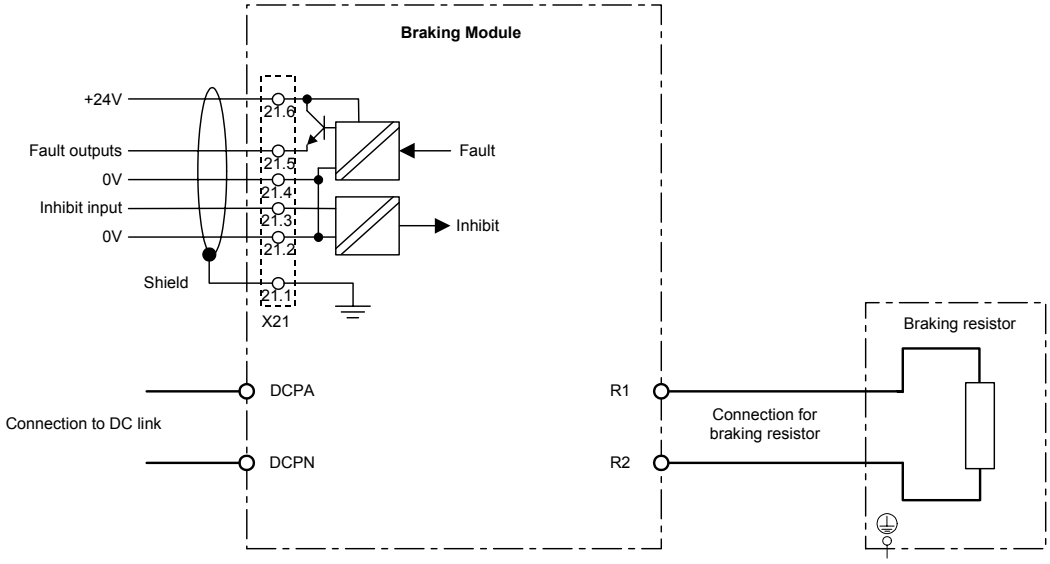


Fig. 5-5 Connection example for Braking Module

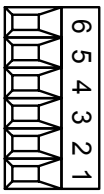
5.1.3.5 Connecting the Braking Resistor

Table 5-1 Connecting the braking resistor

Terminal	Designation
R1	Braking resistor connection R+
R2	Braking resistor connection R-
Max. connectable cross-section: 50 mm²	

5.1.3.6 X21 Digital Inputs/Outputs

Table 5-2 Terminal block X21

	Terminal	Designation [1]	Technical specifications
	6	+24 V	Voltage: +18 V to 30 V Typical current consumption (induced current consumption): 10 mA at 24 V DC
	5	DO fault output	Voltage: 24 V DC 0.5 mA to 0.6 mA
	4	0 V	
	3	DI inhibit input	High level: +15 V to 30 V Current consumption: 2 mA to 15 mA Low level: -3 V to 5 V
	2	0 V	
	1	Shield	Shield connection for terminals 2 ... 6
Max. connectable cross-section 1.5 mm²			

[1] DI: digital input; DO: digital output

Note

Applying a high signal to terminal X21.3 inhibits the Braking Module. On a falling edge, pending error signals are acknowledged.

The prewarning for I*t monitoring is output as a high level when 80% of the maximum braking resistor ON time is reached.

5.1.3.7 S1 Threshold Switch

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

Warning

The threshold switch must only be used when the Active Line or Motor Module is switched off and the DC link capacitors are discharged.

Table 5-3 Response thresholds for the Braking Modules

Voltage	Response threshold	Switch position	Comments
380 V – 480 V 3AC	774 V	1	774 V is the default factory setting. With supply voltages of between 380 V and 400 V 3AC, 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 peak power (P_{15}) with the square of the voltage $(677/774)^2 = 0.75$. The possible peak power is, therefore, max. 75% of P_{15}.
	673 V	2	
660 V – 690 V 3AC	1158 V	1	1158 V is the default factory setting. With a supply voltage of 660 V 3AC, 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 peak power (P_{15}) with the square of the voltage $(1070/1158)^2 = 0.85$. The possible peak power is, therefore, max. 85% of P_{15}.
	1070 V	2	

5.1.4 Installation

5.1.4.1 Installing a Braking Module in an Active Line Module or a Motor Module (Type FX)

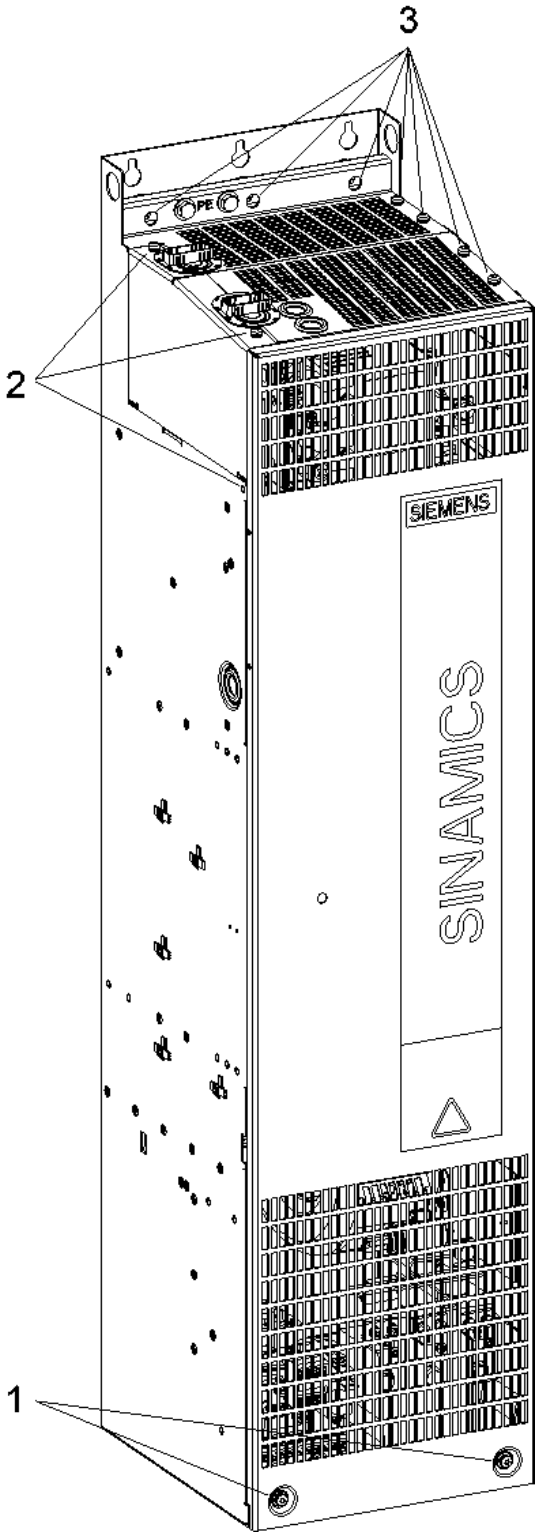


Fig. 5-6 Installing a Braking Module in an Active Line Module or a Motor Module (type FX) – steps 1 - 3

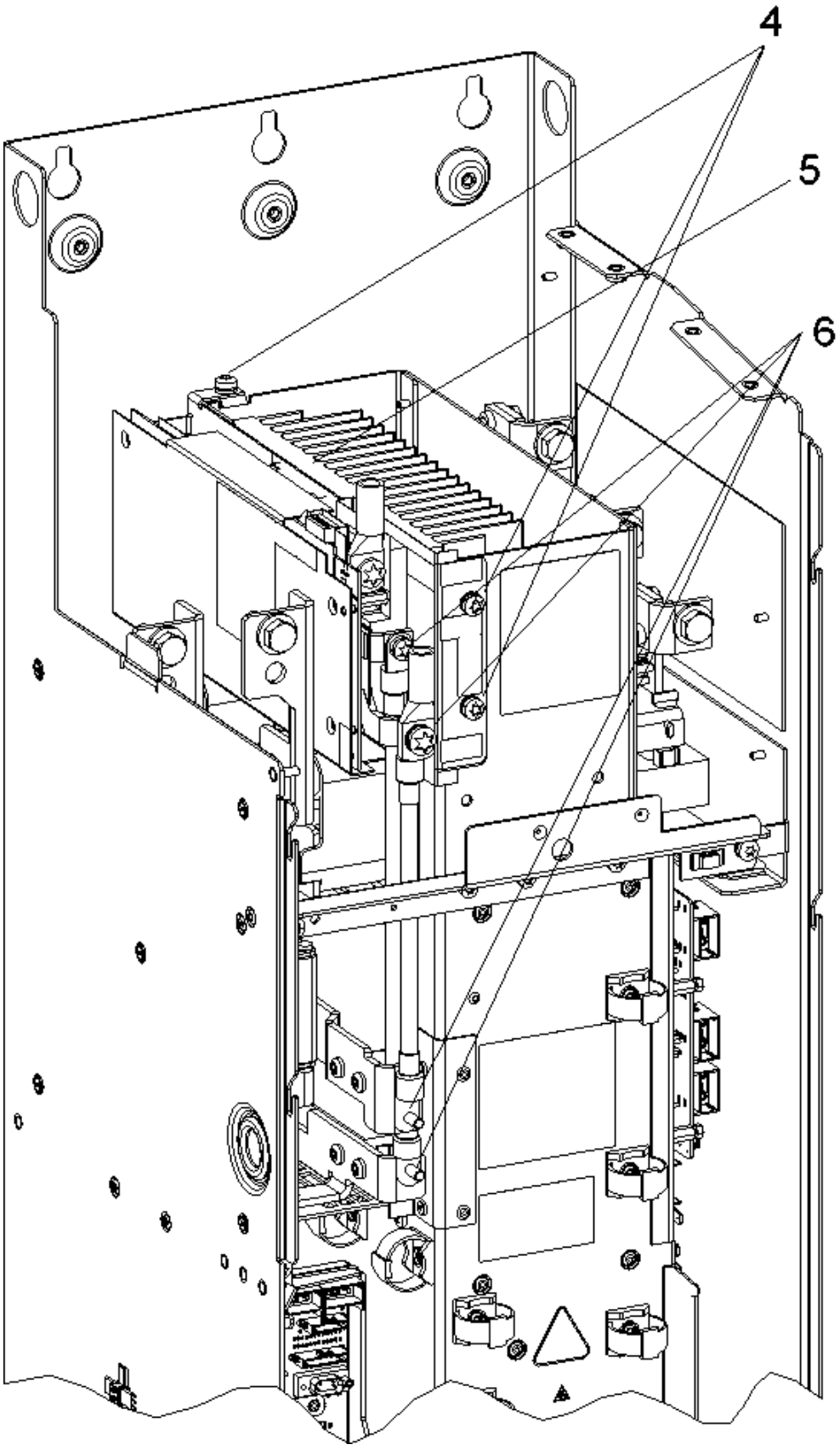


Fig. 5-7 Installing a Braking Module in an Active Line Module or a Motor Module (type FX) – steps 4 -6

Installing the Braking Module

The steps for the installation procedure are numbered in accordance with Fig. 5-6 and Fig. 5-7.

1. Unscrew the 2 M6 screws from the front cover and lift off the cover.
2. Unscrew the 2 screws from the upper cover plate.
   Unscrew the 1 M6 nut on the left-hand side.
   Remove the left-hand cover.
3. Unscrew the 4 screws from the upper cover plate.
   Unscrew the 3 screws from the rear cut-out sections.
   Remove the top cover.
4. Unscrew the 3 screws for the blanking plate.
   Remove the plate.
5. Insert the Braking Module where the cover used to be and secure it using the 3 screws (step 4).
6. Secure the connection cable to the DC link with 2 screws (Braking Module connection) and 2 nuts (DC link connection).

Carry out the subsequent steps in reverse order from steps 1 – 3.

An opening above the connections for the braking resistor (R1, R2) is provided in the cover for connecting the cable to the braking resistor.

Caution

The tightening torques specified in table Table 8-1 must be observed.

5.1.4.2 Installing a Braking Module in an Active Line Module or a Motor Module (Type GX)

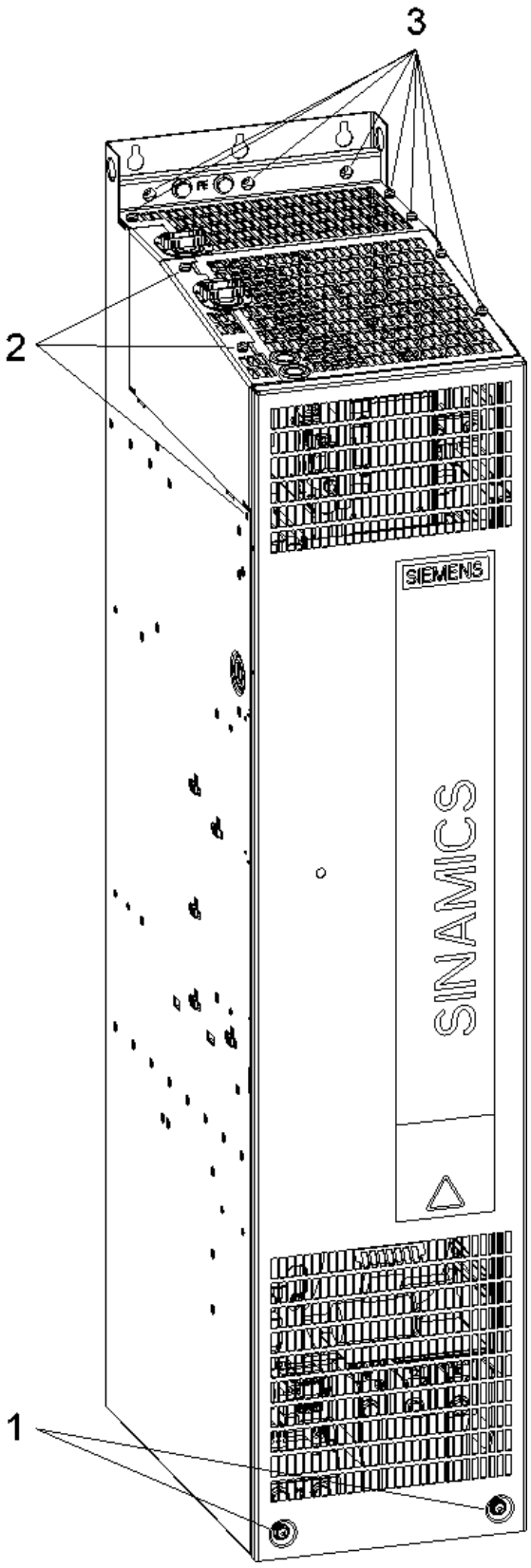


Fig. 5-8 Installing a Braking Module in an Active Line Module or a Motor Module (type GX) – steps 1 - 3

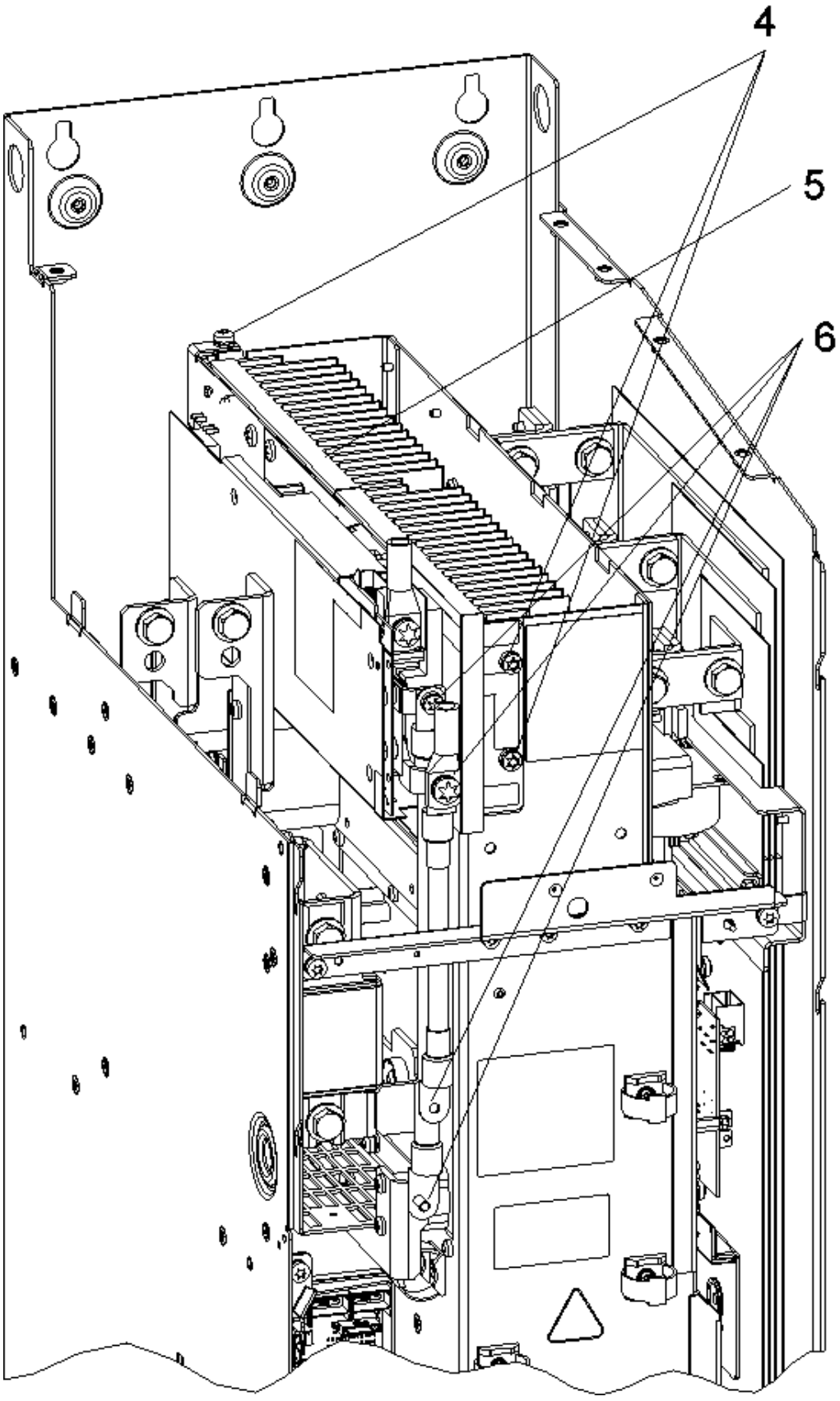


Fig. 5-9 Installing a Braking Module in an Active Line Module or a Motor Module (type GX) – steps 4 - 6

Installing the Braking Module

The steps for the installation procedure are numbered in accordance with Fig. 5-8 and Fig. 5-9.

1. Unscrew the 2 M6 screws from the front cover and lift off the cover.
2. Unscrew the 2 screws from the upper cover plate.
   Unscrew the 1 M6 nut on the left-hand side.
   Remove the left-hand cover.
3. Unscrew the 4 screws from the upper cover plate.
   Unscrew the 3 screws from the rear cut-out sections.
   Remove the top cover.
4. Unscrew the 3 screws for the blanking plate.
   Remove the plate.
5. Insert the Braking Module where the cover used to be and secure it using the 3 screws (step 4).
6. Secure the connection cable to the DC link with 2 screws (Braking Module connection) and 2 nuts (DC link connection).

Carry out the subsequent steps in reverse order from steps 1 – 3.

An opening above the connections for the braking resistor (R1, R2) is provided in the cover for connecting the cable to the braking resistor.

Caution

The tightening torques specified in Table 8-1 must be observed.

Installing a Braking Module in an Active Line Module or a Motor Module (type HX)

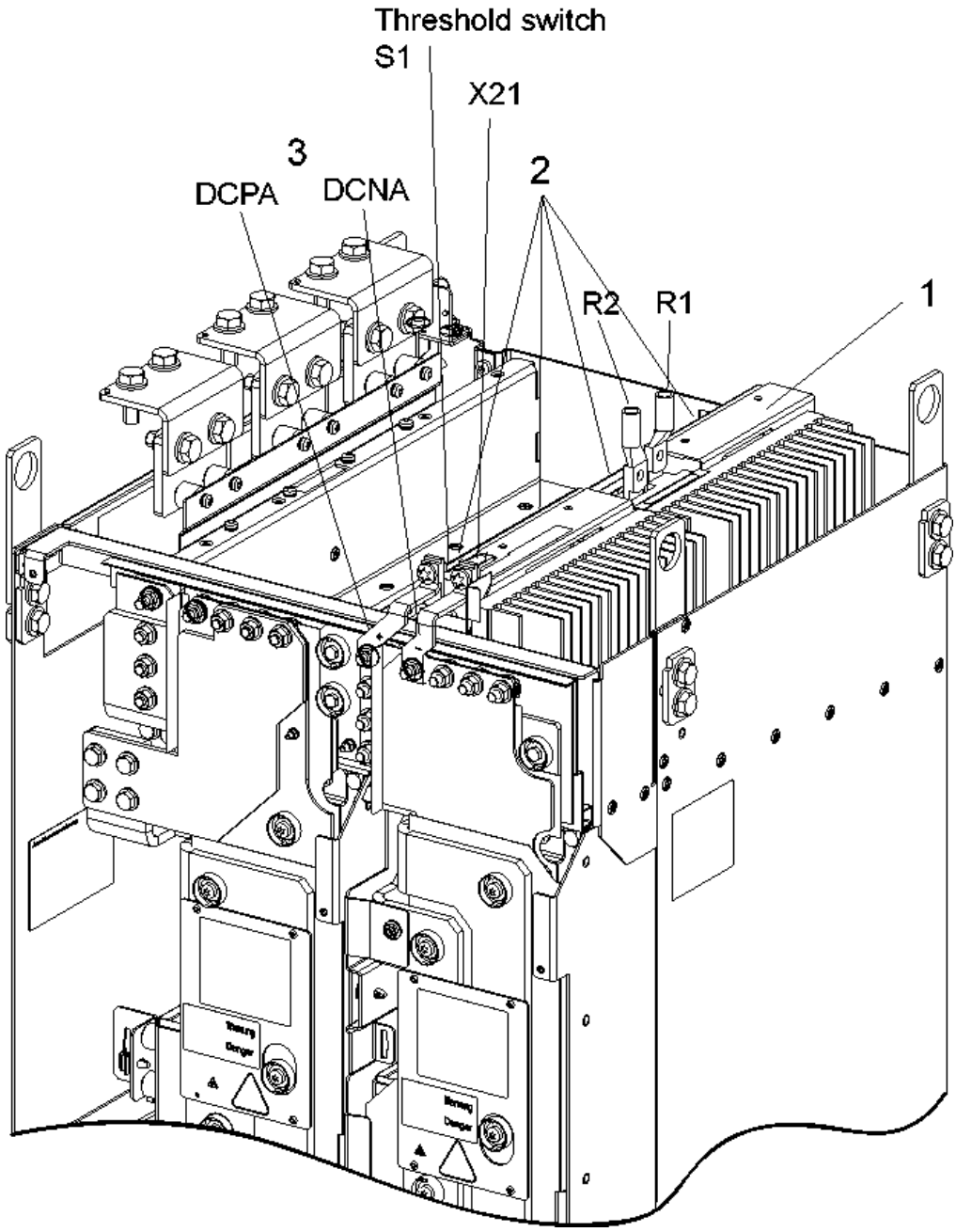


Fig. 5-10 Installing a Braking Module in an Active Line Module or a Motor Module (type HX)

Installing the Braking Module

The steps for the installation procedure are numbered in accordance with Fig. 5-10.

1. Insert the Braking Module.
2. Screw in the 4 retaining screws for securing the Braking Module.
3. Install the connection bracket for the DC link (DCPA/DCNA).

Caution

The tightening torques specified in Table 8-1 must be observed.

Installing a Braking Module in an Active Line Module or a Motor Module (type JX)

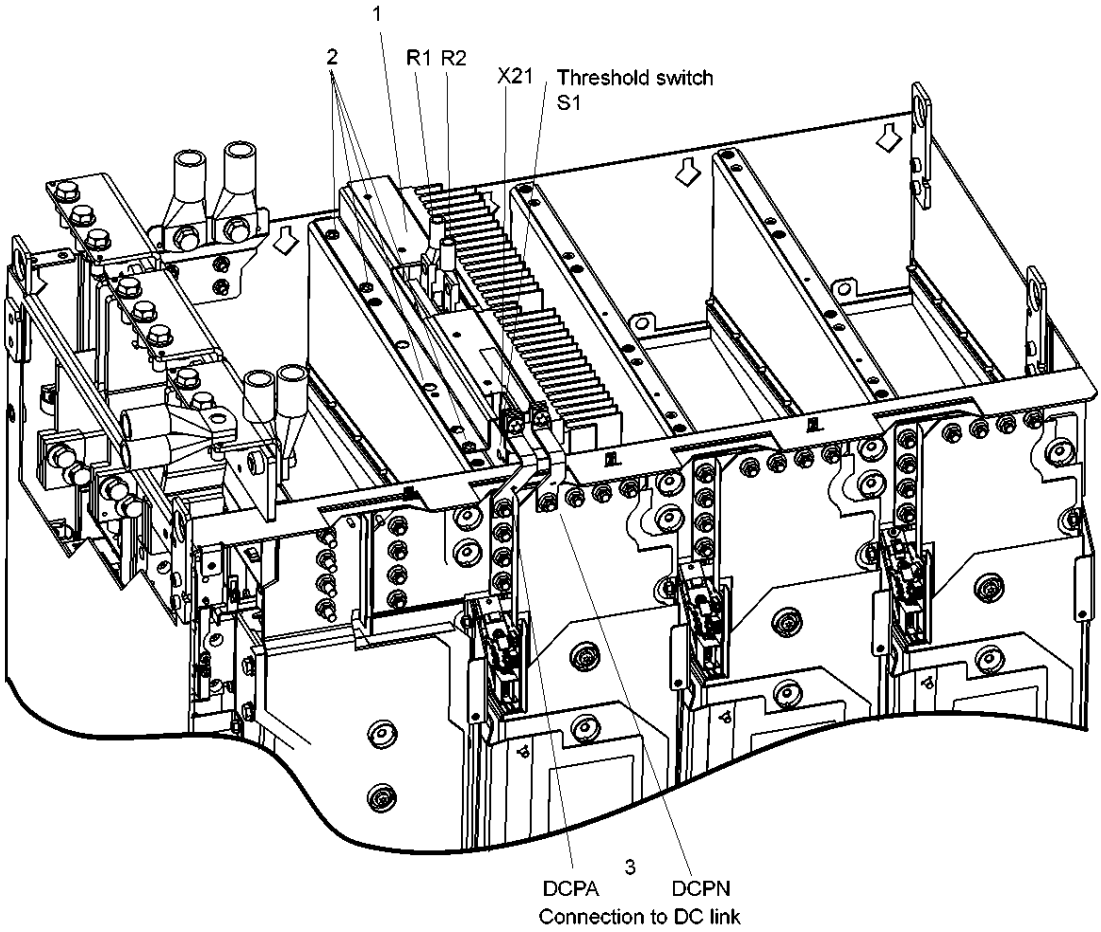


Fig. 5-11 Installing a Braking Module in an Active Line Module or a Motor Module (type JX)

Installing the Braking Module

The steps for the installation procedure are numbered in accordance with Fig. 5-11.

1. Insert the Braking Module.
2. Screw in the 4 retaining screws for securing the Braking Module.
3. Install the connection bracket for the DC link (DCPA/DCNA).

Caution

The tightening torques specified in Table 8-1 must be observed.

5.1.5 Technical Specifications

Table 5-4 Technical specifications for the Braking Module (380 V – 480 V 3AC)

Braking Module 6SL3300-	1AE31-3AA0	1AE32-5AA0	1AE32-5BA0
Suitable for installation in Active Line Module / Motor Module:	FX	GX	HX / JX
P_{DB} power (rated power)	25 kW	50 kW	50 kW
P_{15} power (peak power)	125 kW	250 kW	250 kW
P_{20} power	100 kW	200 kW	200 kW
P_{40} power	50 kW	100 kW	100 kW
Variable response thresholds	774 V (673 V)		
Digital input			
Voltage	-3 V to 30 V		
Low level (an open digital input is interpreted as "low")	-3 V to 5 V		
High level	15 V to 30 V		
Current consumption (at 24 V DC)	10 mA		
Max. connectable cross-section	1.5 mm² (AWG 14)		
Digital output (continued-short-circuit-proof)			
Voltage	24 V DC		
Max. load current of the digital output	500 mA		
Max. connectable cross-section	1.5 mm² (AWG 14)		
DC link busbar current capacity	189 A	378 A	378 A
R1/R2 connection	M8 screw	M8 screw	M8 screw
Max. connection cross-section R1/R2	35 mm²	50 mm²	50 mm²
Approx. weight	3.6 kg	7.3 kg	7.5 kg

Table 5-5 Technical specifications for the Braking Module (660 V – 690 V 3AC)

Braking Module 6SL3300-	1AH31-3AA0	1AH32-5AA0	1AH32-5BA0
Suitable for installation in Active Line Module / Motor Module:	FX	GX	HX / JX
P_{DB} power (rated power)	25 kW	50 kW	50 kW
P_{15} power (peak power)	125 kW	250 kW	250 kW
P_{20} power	100 kW	200 kW	200 kW
P_{40} power	50 kW	100 kW	100 kW
Variable response thresholds	1158 V (1070 V)		
Digital input			
Voltage	-3 V to 30 V		
Low level (an open digital input is interpreted as "low")	-3 V to 5 V		
High level	15 V to 30 V		
Current consumption (at 24 V DC)	10 mA		
Max. connectable cross-section	1.5 mm² (AWG 14)		
Digital output (continued-short-circuit-proof)			
Voltage	DC 24 V		
Max. load current of digital output	500 mA		
Max. connectable cross-section	1.5 mm² (AWG 14)		
DC link busbar current capacity	125 A	255 A	255 A
R1/R2 connection	M8 screw	M8 screw	M8 screw
Max. connection cross-section R1/R2	35 mm²	50 mm²	50 mm²
Approx. weight	3.6 kg	7.3 kg	7.5 kg

5.2 Braking Resistors

5.2.1 Description

The braking resistor reduces the excess energy in the DC link.

The braking resistor is connected to the Braking Module. The braking resistor is positioned outside the cabinet or switchgear room. This enables the resulting heat loss around the Active Line Modules or Motor Modules to be dissipated, thereby reducing the amount of air conditioning required.

Resistors with a rated power of 25 kW and 50 kW are available.

To boost performance, Braking Modules and braking resistors can be connected in parallel. In this case, the Braking Modules are installed in the outlet air duct of the Active Line Module or Motor Module. Depending on the size of the Active Line Module or Motor Module, up to three mounting locations are available.

Since the braking resistors can be used in converters with a wide voltage range, the voltage can be adjusted (e.g. to reduce the voltage stress on the motor and converter) by setting the response thresholds on the Braking Module.

A thermostat monitors the braking resistor for overtemperature and issues a signal on a floating contact if the limit value is exceeded.

5.2.2 Safety Information

Caution

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

Caution

The braking resistor cables must be laid in such a way that they are short-circuit and ground-fault proof!

Information

The connection cables to the Braking Module in the Active Line Module or Motor Module must be kept as short as possible (max. 50 m).

The braking resistors are only suitable for vertical installation (not on a wall).

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

A sufficient distance from flammable objects must be maintained.

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.

Caution

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

5.2.3 Dimension Drawing

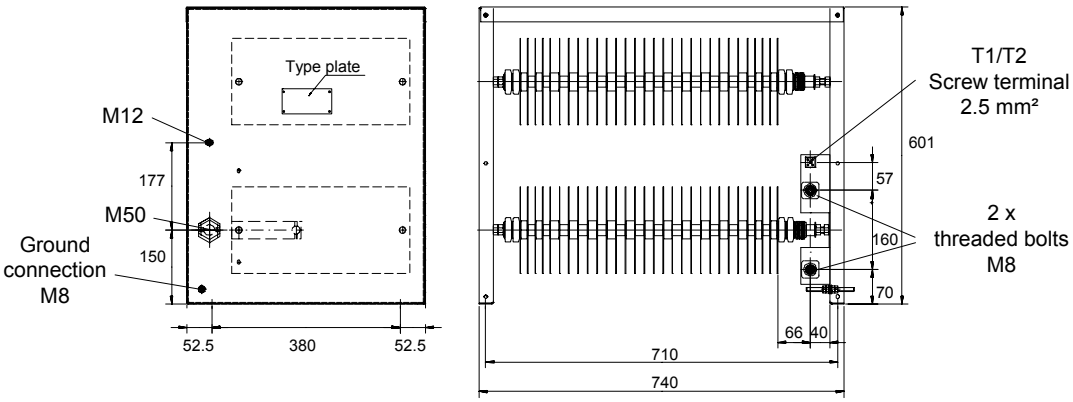


Fig. 5-12 Dimension drawing of the braking resistor (25 kW / 125 kW)

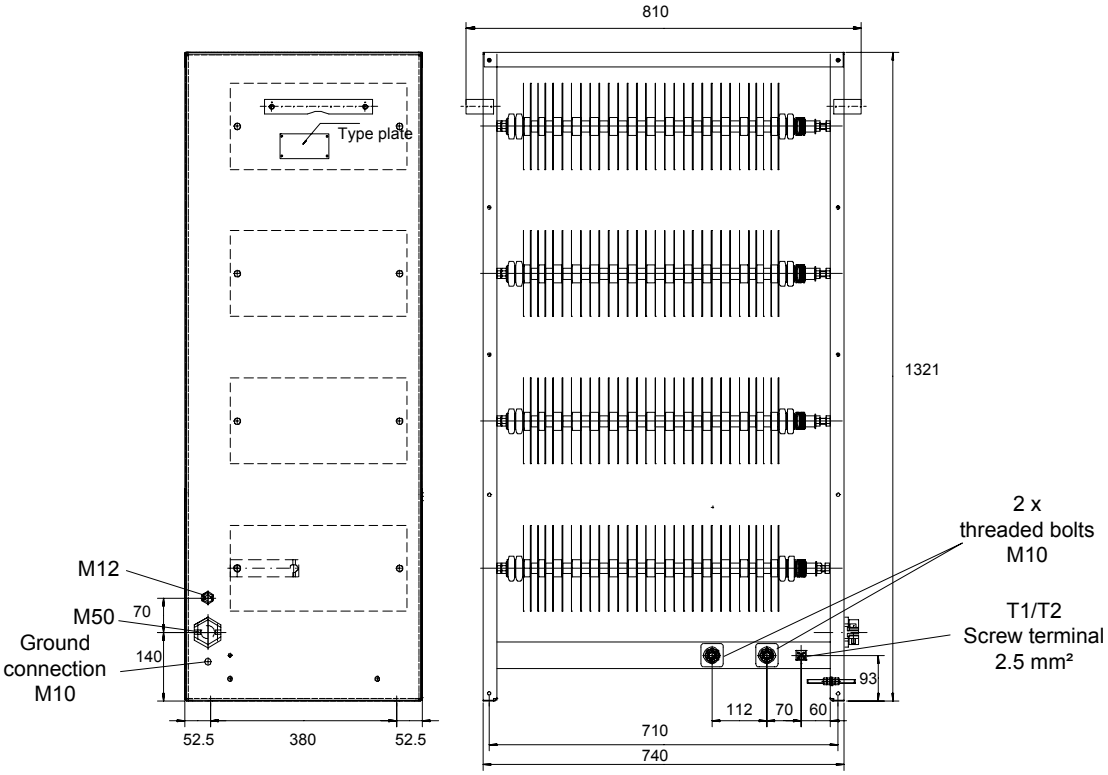


Fig. 5-13 Dimension drawing of the braking resistor (50 kW / 250 kW)

5.2.4 Electrical Connection

Warning

The Braking Module must only be connected when the Active Line Module or Motor Module has been disconnected from the power supply and the DC link capacitors have been discharged.

Caution

The braking resistor cables must be laid in such a way that they are short-circuit and ground-fault proof!

The length of the connection cables between the Braking Module and external braking resistor must not exceed 50 m.

Recommended connection cross-section: 50 mm² (AWG 00)

Thermostat

A thermostat is installed to protect the braking resistor against overload. Its floating contacts must be integrated in the fault chain on the system side.

Table 5-6 Connecting the thermostat

Terminal	Function
T1	Thermostat connection
T2	Thermostat connection

Max. connectable cross-section: 2.5 mm² (AWG 12)

5.2.5 Technical Specifications

Table 5-7 Technical specifications for the braking resistor (380 V – 480 V 3AC)

Order number	Unit	6SL3000-1BE31-3AA0	6SL3000-1BE32-5AA0
P_{DB} (rated power)	kW	25	50
P_{15} (peak power)	kW	125	250
Max. current	A	189	378
Cable entry		Via cable gland M50	Via cable gland M50
Power connection		Via stud terminal M10	Via stud terminal M10
Max. connectable cable cross-section	mm²	50	70
Degree of protection		IP20	IP20
Width x height x depth	mm	740 x 605 x 485	810 x 1325 x 485
Approx. weight	kg	50	120

Table 5-8 Technical specifications for the braking resistor (660 V – 690 V 3AC)

Order number	Unit	6SL3000-1BH31-3AA0	6SL3000-1BH32-5AA0
P_{DB} (rated power)	kW	25	50
P_{15} (peak power)	kW	125	250
Max. current	A	125	255
Cable entry		Via cable gland M50	Via cable gland M50
Power connection		Via stud terminal M10	Via stud terminal M10
Max. connectable cable cross-section	mm²	50	70
Degree of protection		IP20	IP20
Width x height x depth	mm	740 x 605 x 485	810 x 1325 x 485
Approx. weight	kg	50	120

Duty cycle

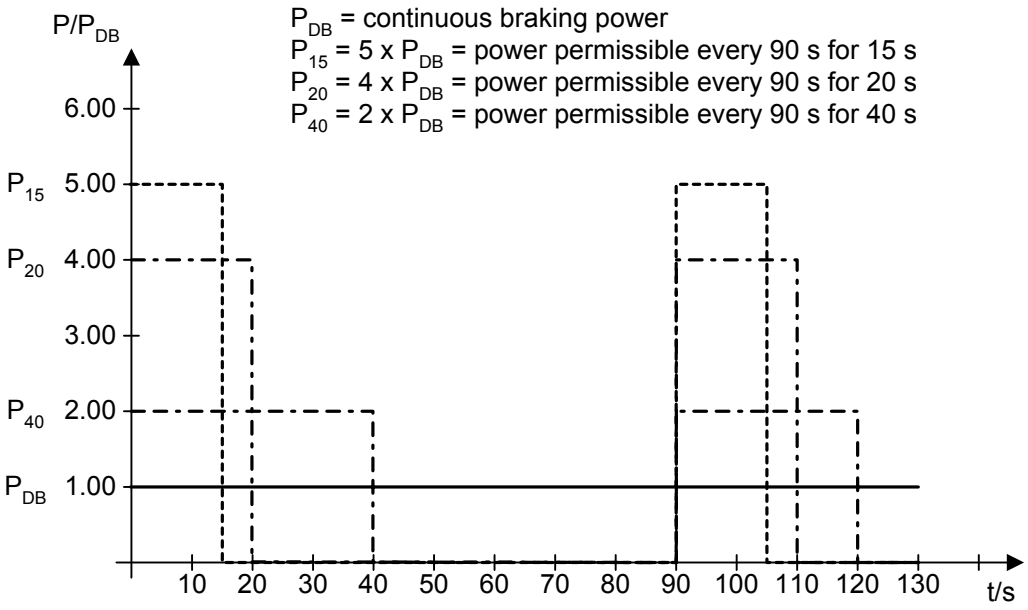


Fig. 5-14 Duty cycle for braking resistors

Motor-Side Power Components

6

6.1 Sinusoidal Filter

6.1.1 Description

The sinusoidal filter on the output of the Motor Module supplies voltages that are virtually sinusoidal on the motor, thereby enabling standard motors to be used without shielded cables and without the need to reduce the power. Unshielded cables can be used and, if long motor supply cables are used, no additional motor reactors are required.

Sinusoidal filters with an output of up to 200 kW are available.

The pulse frequency of the Motor Modules must be set to 4 kHz for the sinusoidal filters. This reduces the output current of the Motor Module (see section 4.6.1.2).

When a sinusoidal filter is used, the available output voltage decreases by 10%.

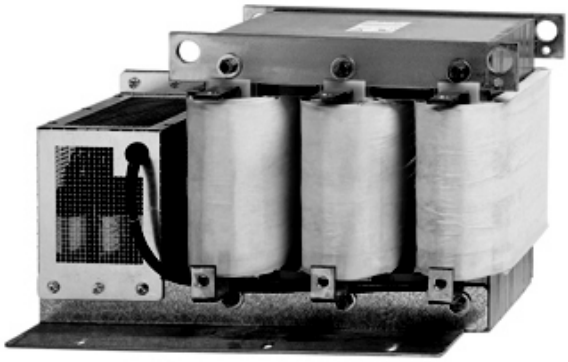


Fig. 6-1 Sinusoidal filter

6.1.2 Safety Information

Caution

The 100 mm clearances above and below the components must be observed.

Note

The connection lines to the Motor Module must be kept as short as possible (max. 5 m).

Caution

Using sinusoidal filters not approved by SIEMENS for SINAMICS can:

- Damage/destroy the Motor Modules.

- Cause line harmonics that may interfere with or damage other loads powered from the same network.

Caution

The surface temperature of the sinusoidal filters may exceed 80°C.

6.1.3 Dimension Drawing

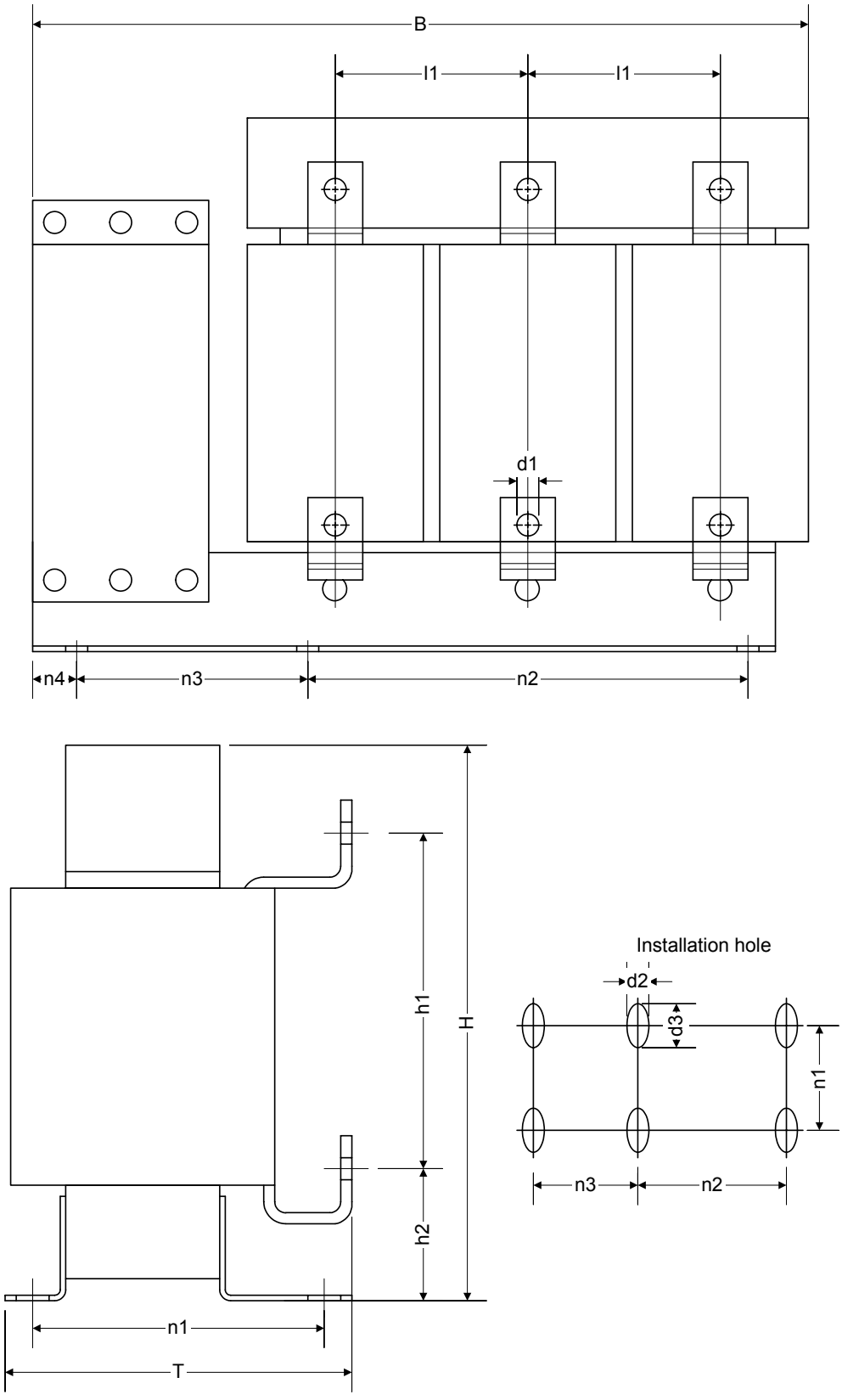


Fig. 6-2 Dimension drawing of sinusoidal filter

Table 6-1 Dimensions of the sinusoidal filter (all specifications in mm)

6SL3000-	2CE32-3AA0	2CE32-8AA0	2CE33-3AA0	2CE34-1AA0
B	620	620	620	620
H	320	320	360	360
T	300	300	370	370
I1	140	140	140	140
h1	180	180	220	220
h2	65	65	65	65
n1 [1)]	280	280	320	320
n2 [1)]	150	150	150	150
n3 [1)]	225	225	225	225
n4	105	105	105	105
d1	12	12	12	12
d2	11	11	11	11
d3	22	22	22	22
[1)] Lengths n1, n2, and n3 correspond to the drill hole spacing				

6.1.4 Technical Specifications

Table 6-2 Technical specifications for the sinusoidal filter

Order number	6SL3000-	2CE32-3AA0	2CE32-3AA0	2CE32-8AA0	2CE33-3AA0	2CE34-1AA0
Suitable for Motor Module	6SL3320-	1TE32-1AA0	1TE32-6AA0	1TE33-1AA0	1TE33-8AA0	1TE35-0AA0
Power of Motor Module at pulse frequency of 4 kHz	kW	90	110	132	160	200
Output current at pulse frequency of 4 kHz	A	225	225	276	333	408
Power loss - at 50 Hz - at 150 Hz	 kW kW	 0.35 0.6	 0.35 0.6	 0.4 0.69	 0.245 0.53	 0.38 0.7
Connections - To Motor Module - Load		Connection lugs M10 Connection lugs M10				
Degree of protection		IP 00	IP 00	IP 00	IP 00	IP 00
Dimensions Width Height Depth	 mm mm mm	 620 300 320	 620 300 320	 620 300 320	 620 370 360	 620 370 360
Weight	kg	124	124	127	136	198

6.2 Motor Reactors

6.2.1 Description

Motor reactors reduce the voltage load on the motor windings by reducing the voltage gradients on the motor terminals generated when the converter is used. 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.

6.2.2 Safety Information

Caution

The 100 mm clearances above and below the components must be observed.

Note

The connection lines to the Motor Module must be kept as short as possible (max. 5 m).

Caution

Using motor reactors not approved by SIEMENS for SINAMICS can result in thermal damage to the reactor.

Caution

The surface temperature of the motor reactors may exceed 80°C.

Caution

The maximum permissible output frequency when motor reactors are used is 150 Hz.

6.2.3 Dimension Drawing

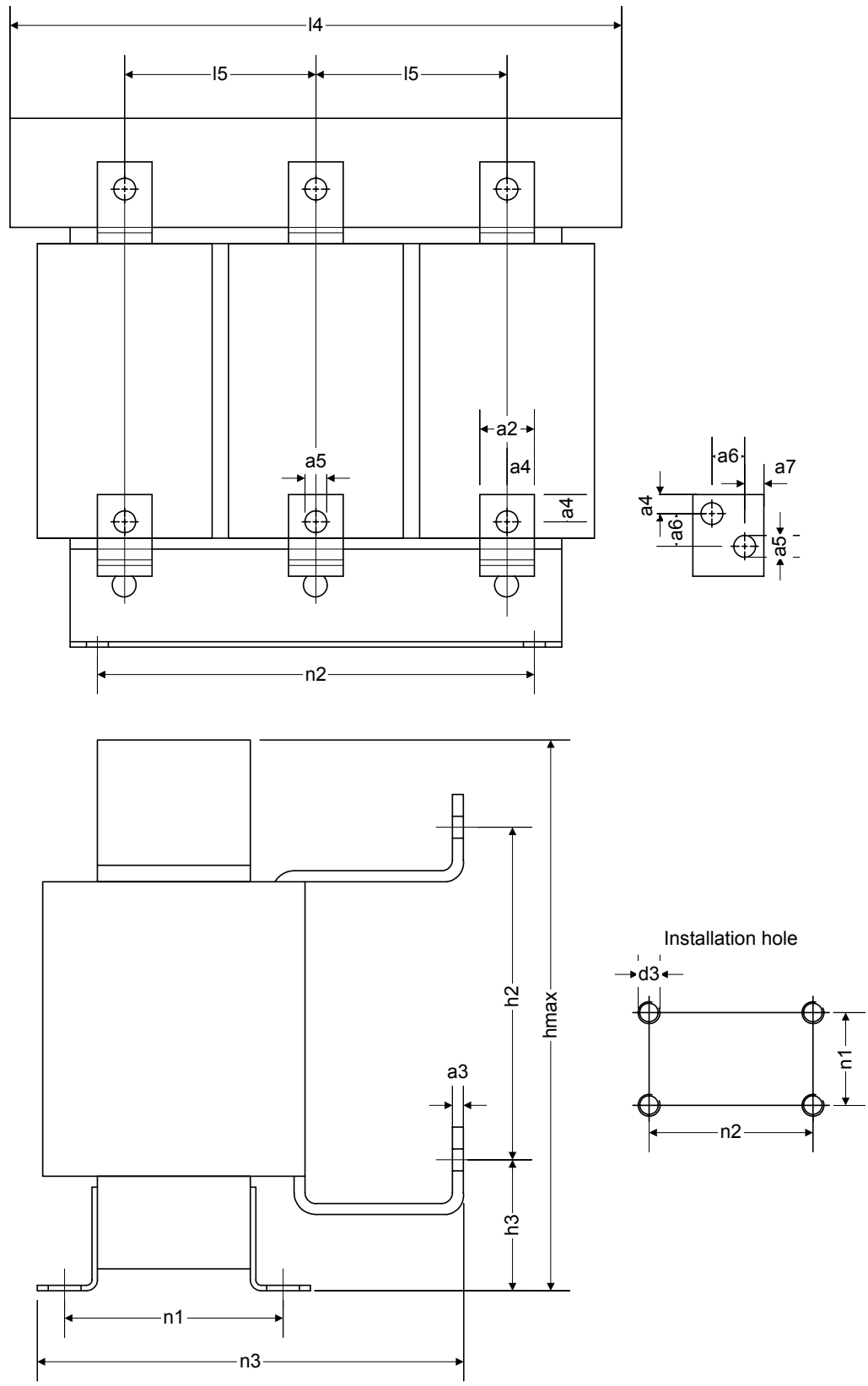


Fig. 6-3 Dimension drawing of motor reactor

Table 6-3 Dimensions of motor reactors (380 V – 480 V 3AC) (all specifications in mm)

6SL3000-	0CE35-1AA0	0CE37-7AA0	0CE41-0AA0	0CE41-5AA0
a2	30	30	50	60
a3	6	6	8	12
a4	15	15	25	25
a5	14	14	14	14
a6	-	-	-	26
a7	-	-	-	17
l4	300	300	350	460
l5	100	100	120	152.5
hmax	269	269	321	435
h2	180	180	252	278
h3	60	60	120	120
n1 [1)]	118	118	138	155
n2 [1)]	224	224	264	356
n3	212.5	212.5	211.5	235
d3	M8	M8	M8	M12
[1)] Dimensions n1 and n2 correspond to the drill hole spacing				

Table 6-4 Dimensions of motor reactors (660 V – 690 V 3AC) (all specifications in mm)

6SL3000-	0CH32-7AA0	0CH34-8AA0	0CH36-0AA0	0CH38-4AA0	0CH41-2AA0
a2	25	30	30	40	60
a3	5	6	6	8	12
a4	12.5	15	15	20	25
a5	11	14	14	14	14
a6	-	-	-	-	26
a7	-	-	-	-	17
l4	270	350	350	410	460
l5	88	120	120	135	152.5
hmax	248	321	321	385	435
h2	150	198	198	252	278
h3	60	75	75	120	120
n1 [1)]	101	138	138	141	155
n2 [1)]	200	264	264	316	356
n3	200	232.5	232.5	224	235
d3	M8	M8	M8	M10	M12
[1)] Dimensions n1 and n2 correspond to the drill hole spacing					

6.2.4 Technical Specifications

Table 6-5 Technical specifications for motor reactors (380 V – 480 V 3AC) (part 1)

Order number	6SL3000-	2BE32-1AA0	2BE32-6AA0	2BE33-2AA0	2BE33-8AA0
Suitable for Motor Module	6SL3320-	1TE32-1AA0	1TE32-6AA0	1TE33-1AA0	1TE33-8AA0
Rated power of Motor Module	kW	110	132	160	200
Rated current	A	210	260	310	380
Power loss	kW	0.486	0.5	0.47	0.5
Connections - To Motor Module - Load - PE		 M10 M10 M8	 M10 M10 M8	 M10 M10 M8	 M10 M10 M8
Degree of protection		IP 00	IP 00	IP 00	IP 00
Dimensions Width Height Depth	 mm mm mm	 300 285 257	 300 315 277	 300 285 257	 300 285 277
Approx. weight	kg	60	66	62	73

Table 6-6 Technical specifications for motor reactors (380 V – 480 V 3AC) (part 2)

Order number	6SL3000-	2BE35-0AA0	2AE36-1AA0	2AE38-4AA0	2AE38-4AA0
Suitable for Motor Module	6SL3320-	1TE35-0AA0	1TE36-1AA0	1TE37-5AA0	1TE38-4AA0
Rated power of Motor Module	kW	250	315	400	450
Rated current	A	490	605	745	840
Power loss	kW	0.5	0.9	0.83	0.943
Connections - To Motor Module - Load - PE		 M12 M12 M8	 M12 M12 M8	 M12 M12 M10	 M12 M12 M10
Degree of protection		IP 00	IP 00	IP 00	IP 00
Dimensions Width Height Depth	 mm mm mm	 300 365 277	 410 392 292	 410 329 292	 410 392 292
Approx. weight	kg	100	130	140	140

Table 6-7 Technical specifications for motor reactors (380 V – 480 V 3AC) (part 3)

Order number	**6SL3000-**	**2AE41-0AA0**	**2AE41-4AA0**	**2AE41-4AA0**	
Suitable for Motor Module	6SL3320-	1TE41-0AA0	1TE41-2AA0	1TE41-4AA0	
Rated power of Motor Module	kW	560	710	800	
Rated current	A	985	1260	1405	
Power loss	kW	1.062	0.962	1.054	
Connections - To Motor Module - Load - PE		 M12 M12 M10	 2 x M12 2 x M12 M10	 2 x M12 2 x M12 M10	
Degree of protection		IP 00	IP 00	IP 00	
Dimensions Width Height Depth	 mm mm mm	 410 392 302	 460 392 326	 460 392 326	
Approx. weight	kg	146	179	179	

Table 6-8 Technical specifications for motor reactors (660 V – 690 V 3AC) (part 1)

Order number	**6SL3000-**	**2AH31-0AA0**	**2AH31-0AA0**	**2AH31-0AA0**	**2AH31-0AA0**
Suitable for Motor Module	6SL3320-	1TH28-5AA0	1TH31-0AA0	1TH31-2AA0	1TH31-5AA0
Rated power of Motor Module	kW	75	90	110	132
Rated current	A	85	100	120	150
Power loss	kW	0.257	0.3	0.318	0.335
Connections - To Motor Module - Load - PE		 M10 M10 M6	 M10 M10 M6	 M10 M10 M6	 M10 M10 M6
Degree of protection		IP 00	IP 00	IP 00	IP 00
Dimensions Width Height Depth	 mm mm mm	 270 248 200	 270 248 200	 270 248 200	 270 248 200
Approx. weight	kg	25	25	25	25

Table 6-9 Technical specifications for motor reactors (660 V – 690 V 3AC) (part 2)

Order number	6SL3000-	2AH31-8AA0	2AH32-4AA0	2AH32-6AA0	2AH33-6AA0
Suitable for Motor Module	6SL3320-	1TH31-8AA0	1TH32-2AA0	1TH32-6AA0	1TH33-3AA0
Rated power of Motor Module	kW	160	200	250	315
Rated current	A	175	215	260	330
Power loss	kW	0.4	0.425	0.44	0.45
Connections - To Motor Module - Load - PE		 M10 M10 M6	 M10 M10 M6	 M10 M10 M6	 M10 M10 M6
Degree of protection		IP 00	IP 00	IP 00	IP 00
Dimensions Width Height Depth	 mm mm mm	 300 285 212	 300 285 212	 300 285 212	 300 285 212
Approx. weight	kg	33	35	40	43

Table 6-10 Technical specifications for motor reactors (660 V – 690 V 3AC) (part 3)

Order number	6SL3000-	2AH34-5AA0	2AH34-7AA0	2AH35-8AA0	2AH38-1AA0
Suitable for Motor Module	6SL3320-	1TH34-1AA0	1TH34-7AA0	1TH35-8AA0	1TH37-4AA0
Rated power of Motor Module	kW	400	450	560	710
Rated current	A	410	465	575	735
Power loss	kW	0.545	0.62	0.8	0.96
Connections - To Motor Module - Load - PE		 M12 M12 M8	 M12 M12 M8	 M12 M12 M8	 M12 M12 M8
Degree of protection		IP 00	IP 00	IP 00	IP 00
Dimensions Width Height Depth	 mm mm mm	 350 330 215	 410 392 292	 410 392 292	 410 392 279
Approx. weight	kg	56	80	80	146

Table 6-11 Technical specifications for motor reactors (660 V – 690 V 3AC) (part 4)

Order number	**6SL3000-**	**2AH38-1AA0**	**2AH41-0AA0**	**2AH41-1AA0**	**2AH41-3AA0**
Suitable for Motor Module	6SL3320-	1TH38-1AA0	1TH38-8AA0	1TH41-0AA0	1TH41-3AA0
Rated power of Motor Module	kW	800	900	1000	1200
Rated current	A	810	910	1025	1270
Power loss	kW	1.0	0.97	1.05	0.95
Connections - To Motor Module - Load - PE		 M12 M12 M8	 M12 M12 M8	 M12 M12 M8	 M12 M12 M8
Degree of protection		IP 00	IP 00	IP 00	IP 00
Dimensions Width Height Depth	 mm mm mm	 410 392 279	 410 392 279	 410 392 317	 410 392 296
Approx. weight	kg	146	146	163	166

Cabinet Design and EMC

7

7.1 Information

7.1.1 General

The modular concept of SINAMICS S120 allows a wide range of potential device combinations. For this reason, it is impossible to describe each individual combination. This section instead aims to provide some basic information and general rules on the basis of which special device combinations can be physically constructed and to ensure electromagnetic compatibility.

The SINAMICS S120 components are designed for installation in housing, which generally refers to cabinet units or switching boxes made of steel that provide protection against shock and other environmental influences. These are also integrated in the EMC concept.

7.1.2 Safety Information

Note

When installing the cabinet unit, make sure that no foreign bodies – especially metallic objects, such as drill swarf, wire end ferrules, or cable cut-offs – fall into the device. If necessary, cover the ventilation slots.

Note

Safety regulations governing shock protection must be observed (see also EN 60204-1).

Caution

To ensure that the entire system works properly, you are advised to use the original Siemens accessories in catalog D21.2.

Before commissioning, check the tightening torque of all the terminal screws.

Warning

Cable shields and unused conductors of power cables must be connected to PE potential.

Non-observance can cause lethal shock voltages.

7.1.3 Standards and Guidelines

The table below shows some important standards and guidelines that must be observed to ensure safe, EMC-compliant installation. The standards and guidelines apply to installations in industrial environments (other conditions apply to installations in public networks.

Table 7-1 Guidelines

Guideline	Description
73/23/EEC	Directive of the Council of February 19, 1973, on the approximation of the laws of the member states relating to electrical equipment designed for use within certain voltage limits Low-Voltage Directive
98/37/EC	Directive of the Council of June 22, 1998, on the approximation of laws of the member states relating to machinery Machine Directive
93/68/EEC	Directive of the Council of August 30, 1993 on the approximation of laws of the member states relating to electromagnetic compatibility EMC Directive

The table below lists some application-relevant standards.

Table 7-2 Standards

Standard	Description
EN 292–1	Safety of machinery General principles for design Part 1: Basic terminology, methodology
EN 292–2	Safety of machinery General principles for design Part 2: General requirements
EN 954–1	Safety of machinery General principles for design Part 1: Safety-related parts of control systems
EN 1037	Safety of machinery Prevention of unexpected startup
EN 1921	Safety of integrated manufacturing systems
EN 50178	Electronic equipment for use in power installations
EN 60204–1	Safety of machinery Electrical equipment of machines Part 1: General requirements
EN 60439–1	Low-voltage switchgear and controlgear assemblies Part 1: Type-tested and partially type-tested assemblies
EN 60529	Degrees of protection provided by enclosures (IP code)
EN 61800–3	Adjustable speed electrical power drive systems Part 3: EMC product standard including specific test methods
UL 508C	Power conversion equipment

7.2 Basic Information About EMC

7.2.1 Introduction to EMC

EMC stands for "electromagnetic compatibility" and, according to EMV Directive §2(7), describes "the capability of a device to function satisfactorily in an electromagnetic environment without itself causing interference unacceptable for other devices in the environment."

EMC, therefore, represents a quality standard for the following:

- Internal noise immunity: resistance against internal electrical disturbances
- External noise immunity: resistance against external electromagnetic disturbances
- Interference: environmental effects caused by electromagnetic emissions

To ensure that the chassis unit functions satisfactorily in the system, the environment subject to interference must also be taken into consideration.

7.2.2 Interference and Noise Immunity

The EMC depends on two aspects of the devices in question: interference and noise immunity. Electrical devices include noise sources (transmitters) and potentially susceptible equipment (receivers). A device can be both a noise source (power section of a converter) and potentially susceptible (control section of a converter) at the same time. Electromagnetic compatibility is ensured when the existing noise sources do not impair the function of potentially susceptible equipment.

Measures must be taken by the converter manufacturer and the operator to ensure the greatest possible level of operational reliability and noise immunity within the entire system (converters, automation systems, drive motors, and so on). Only when all of these measures have been taken are the satisfactory function of the converter and compliance with the legal requirements (89/336/EEC) ensured.

Interference caused by frequency converters is covered by European standard EN 61800-3, whereby conducted interference on the line connection is measured as a radio interference voltage under standardized conditions. Radio interference emission in the form of electromagnetic emissions. The standard defines limit values for "environment 1" (public networks) and "environment 2" (industrial networks).

Noise immunity describes the behavior of a device under the influence of electromagnetic interference. Product standard EN 61800-3 outlines the EMC requirements for "variable-speed drive systems". It specifies requirements for converters with operating voltages of less than 1000 V. Different environments and categories are defined depending on where the system is installed.

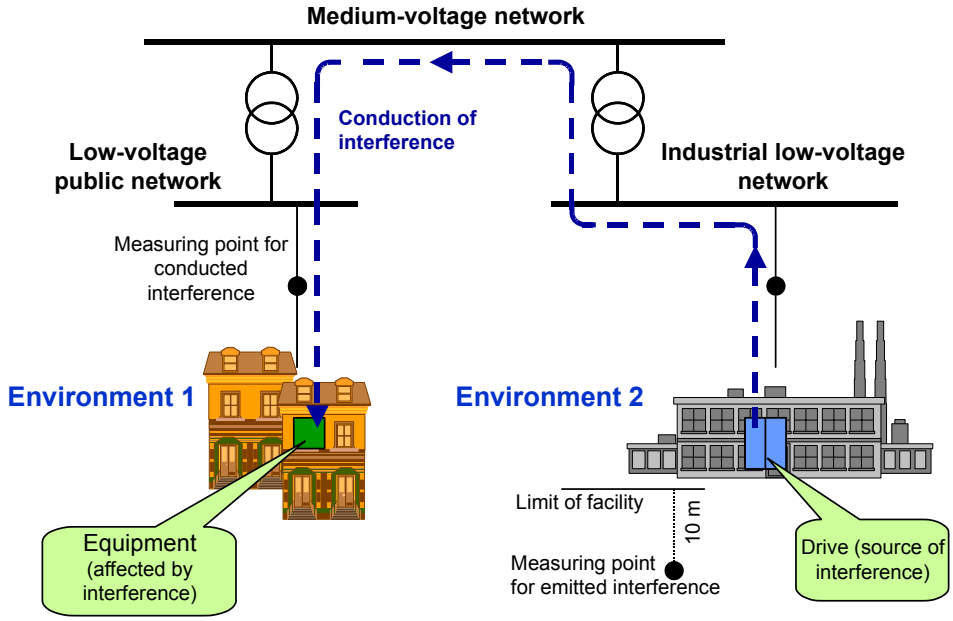


Fig. 7-1 Definition of environments 1 and 2

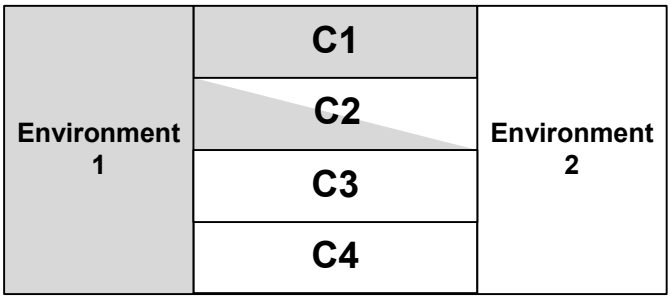


Fig. 7-2 Definition of categories C1 to C4

Definition of environments 1 and 2

- Environment 1:
  Residential buildings or locations at which the drive system is connected to a public low-voltage supply without a transformer.
- Environment 2:
  Industrial locations supplied by a medium-voltage network via a separate transformer.

Definition of categories C1 to C4

- Category C1:
  Rated voltage <1000 V; unrestricted use in environment 1
- Category C2:
  Rated voltage for stationary drive systems <1000 V; for use in environment 2 For use in environment 1 only when sold and installed by skilled personnel.
- Category C3:
  Rated voltage <1000 V; use in environment 2 only
- Category C4:
  Rated voltage ≥1000 V or for rated currents ≥400 A in complex systems in environment 2.

7.3 EMC-Compliant Drive Installation

7.3.1 General

For information about EMC requirements, see EN 61800-3, EN 60439-1, and the recommendations in EN 60204-1. When components are installed in cabinets, the following aspects must also be taken into account to ensure compliance with the EMC Directive:

- Use of recommended power and signal cables.
- Observance of information about cable shielding and equipotential bonding

7.3.2 EMC Planning

The Active Interface Modules for supply from the network or feedback into the network during drive braking operation have a Clean Power Filter and a line reactor. These ensure compliance with the interference limit values to EN 61800-3 for environment 2 (industry). The Clean Power Filter suppresses any remaining line harmonics to the greatest possible extent, which ensures compliance with the class 3 limit values to IEC 61000-2-4. No further line-side interference suppression measures are generally required.

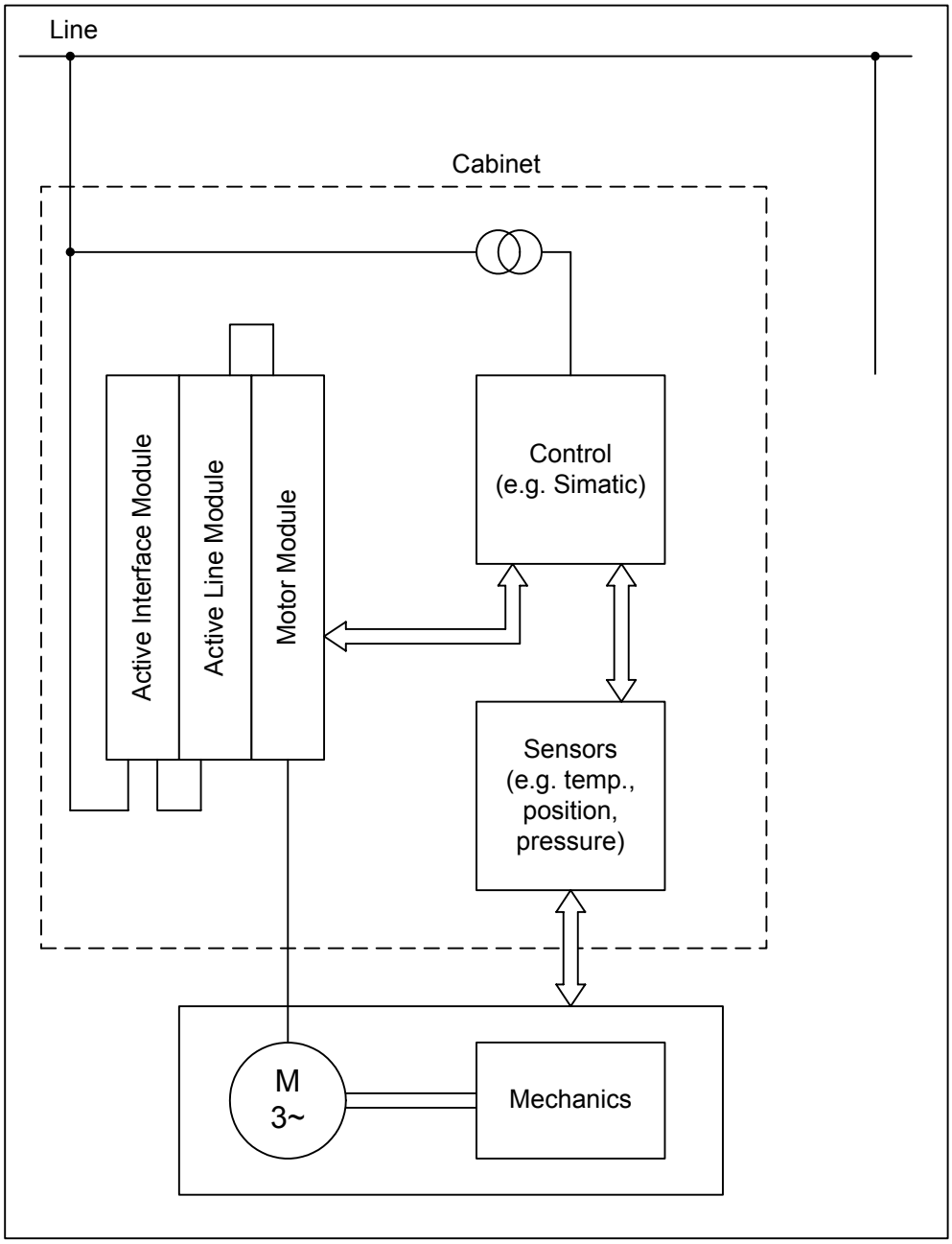


Fig. 7-3 Diagram of a drive system

The unit comprising the Active Interface Module, Active Line Module, and the Motor Modules is located in the cabinet along with the associated control and sensor systems.

EMC measures address not only environmental influences outside the cabinet but also the effect of the devices within the cabinet.

7.3.3 The Zone Concept

The most cost-effective method of implementing EMC interference suppression measures within the cabinet is to ensure that noise sources and potentially susceptible equipment are kept physically separate from each other. This can be considered during the planning phase. A distinction is made here between noise sources (e.g. Active Line Modules, Motor Modules) and potentially susceptible equipment (e.g. automation devices, sensors, encoders).

The system is then divided into different EMC zones to which the devices are assigned. Different requirements regarding interference and noise immunity apply within each zone. When the cabinet is designed, the individual zones must be kept physically separate from each other. They can be separated by means of metal housing or – within a cabinet – by means of grounded separators. Filters may have to be installed at the zone interfaces. Unshielded cables can be used within a zone. All bus and signal cables that leave the cabinet must be shielded.

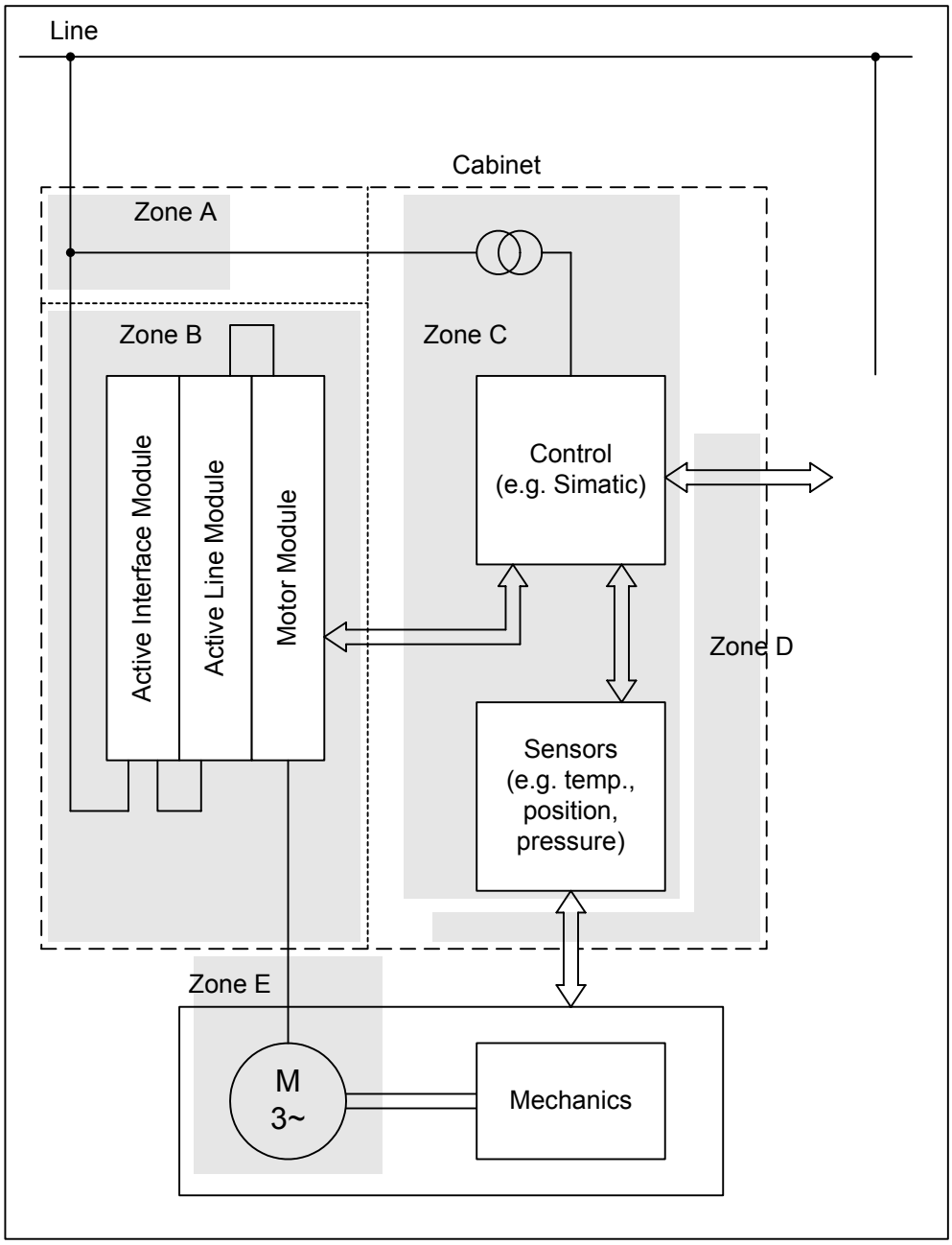


Fig. 7-4 Dividing a drive system into zones

- Zone A is the line connection for the cabinet. Interference in this zone should not exceed defined limits.
- Zone B contains the Active Interface Module, the Active Line Module, and the Motor Modules.
- Zone C contains potentially susceptible equipment (e.g. control and sensor systems).
- Zone D is the interface between the signal/control cables and the peripherals. A defined noise immunity level is required here.
- Zone E contains the AC motor and the motor cable.

7.3.4 Wiring and Shielding

To ensure compliance with EMC requirements, different types of cable must be routed with sufficient distance from other cables. To fulfill these requirements, the following cables must be shielded:

- Supply lines between the line power outlet and the Active Interface Module
- All motor cables (brake cables can also be part of the motor cable)
- Cables for digital and analog inputs and outputs
- Signal cables for encoders, resolvers, or tachometers
- Cables for temperature sensors and other sensors

Power and signal cables must not be routed directly next to each other and, therefore, must be kept physically separate from each other (min. distance: of 20 cm). If this is not possible, separators must be installed between the signal and power cables. The separators must be grounded with the greatest possible surface area. If it cannot be avoided that signal and power cables cross, make sure that they cross at right angles only.

To prevent external interference from infiltrating the cabinet, the shields for the cables used must be grounded with the greatest possible surface area as close as possible to the cabinet inlet. Suitable shield buses or comb bars can be used here. The busbars must be connected conductively with the cabinet housing over the greatest possible surface area.

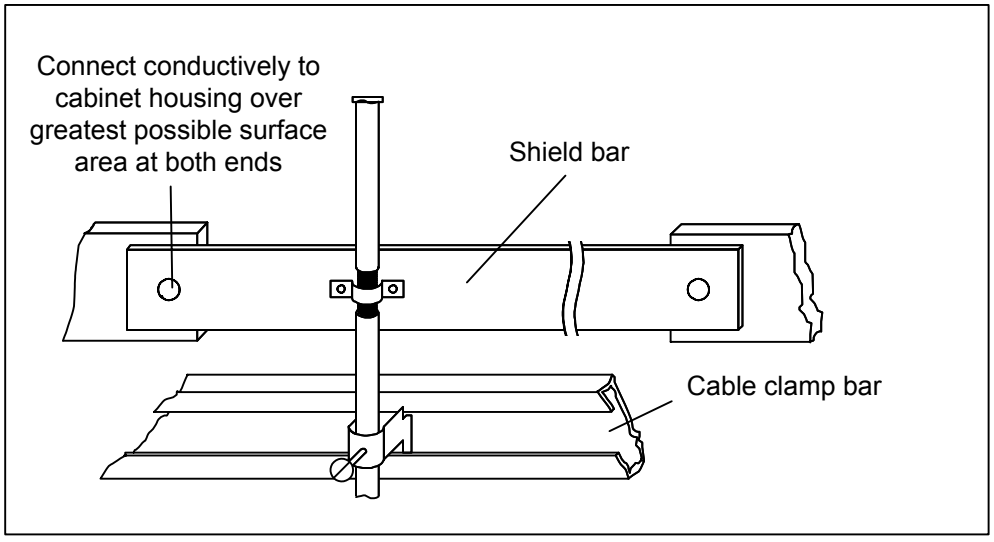


Fig. 7-5 Shield connection for motor cable at cabinet inlet

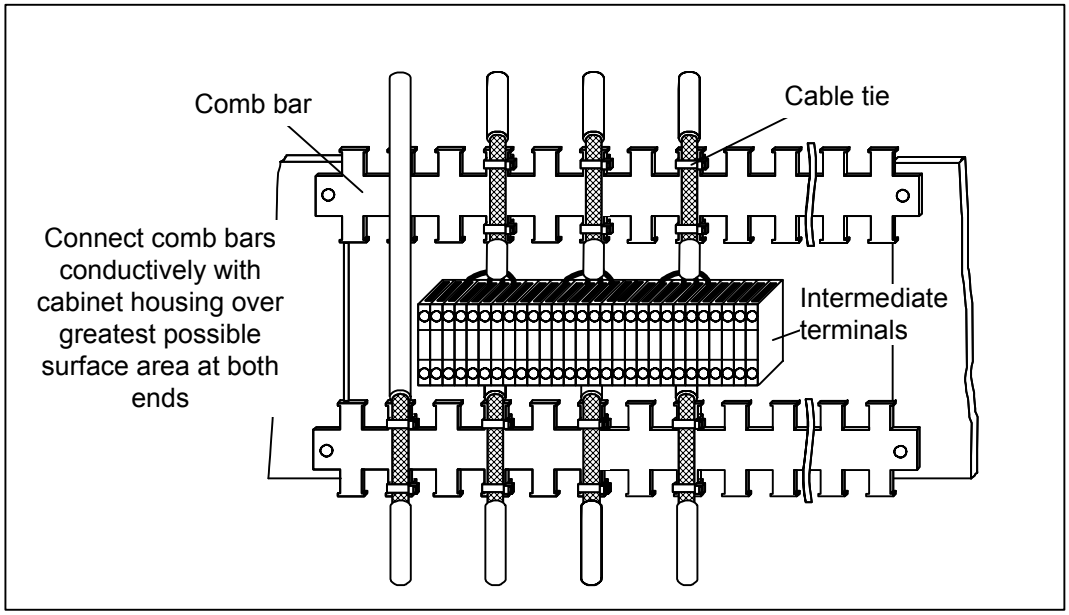


Fig. 7-6 Shield connection for the signal cables in the cabinet

All cables inside the cabinet must be connected as closely as possible to parts connected (grounded) to the cabinet ground, such as a mounting plate or cabinet wall. This also applies to reserve cables.

With good equipotential bonding (all metallic parts in the cabinet are connected conductively with each other over the greatest possible surface area), the shields for analog signal cables must be connected to ground at both ends. If low-frequency interference occurs on analog cables, the shield only needs to applied at one end on the converter. The other end of the shield should be grounded via a capacitor (e.g. 10 nF/100 V, type MKT).

In the case of digital signal cables, the shields must be applied at both ends (transmitter and receiver) to establish a good conductive connection over the greatest possible surface area. The shields can be applied more than once inside and outside the cabinet. An equalizing conductor of at least 10 mm² must be routed in parallel with the shield if the equipotential bonding is not sufficient.

Whenever possible, cables should only be fed into the cabinet from one side.

Encoder, resolver, or tachometer cables must have a shield. The shield must be applied with the greatest possible surface area on the tachometer, resolver, or encoder, as well as on the Motor Module, and must not contain any gaps. Prefabricated cables with multiple shielding must be used for the encoder and resolver (see catalog D21.1).

Unshielded cables should not routed in the direct vicinity of noise sources (e.g. transformers). Signal cables (shielded and unshielded) must be kept at a good distance from strong external magnetic fields (e.g. transformers, reactors). In both cases, a minimum distance of 30 cm must be maintained.

Unshielded cables in the same circuit (outgoing/incoming conductors) must be twisted to prevent unnecessary frame antenna.

To reduce coupling capacitance and inductance, cables must not be unnecessarily long. Shielding effects can also be achieved by grounding reserve cores at both ends.

If the SINAMICS S120 chassis components are supplied externally with 230 V AC and 24 V DC, these supplies must not be used for multiple consumers that are physically separated from each other in different cabinets.

Caution

Connected power and signal cables must not cover any ventilation openings.

Signal cables must not be routed in parallel with power cables.

Table 7-3 Max. cable lengths

Type	Maximum length [m]
Power supply cables (24 V DC)	10
Power cable between Motor Module and motor	300 (shielded) 450 (unshielded)
DRIVE-CLiQ cables • Inside cabinet unit e.g. connection between CU320 and the first Motor Module or between the Motor Modules • DRIVE-CLiQ MOTION CONNECT Connection cables for external components	 70 100
Power cable between Braking Module and braking resistor	50

7.3.5 Design

All metallic parts in the cabinet must be connected conductively with each other (not paint on paint) over the greatest possible surface area. Suitable contact or toothed lock washers may have to be used. Cabinet doors must be connected to the cabinet by means of ground strips, which should be as short as possible.

Note

Systems/machines are grounded primarily for safety reasons, although this does affect the interference and noise immunity of drives. A drive system can be grounded in a radial or lattice manner. Lattice grounding is recommended for drives, that is, all the parts to be grounded are connected to each other in a lattice manner.

If the drive line-up is arranged on a common unpainted metal-surfaced mounting plate (e.g. with a galvanized surface) or if several mounting plates are connected conductively with each other over the greatest possible surface area, no additional equipotential bonding is needed within the drive line-up because all parts of the switchgear assembly are connected to the protective conductor system.

The mounting plates are connected to the external protective conductor system by means of a finely-stranded copper conductor with a cross-section of 16 mm², including the outer conductor. As of a cross-section of 25 mm² copper, the outer cross-section of the finely-stranded conductor is halved.

If the devices are installed in the cabinet in any other way, equipotential bonding for each individual component must be carried out separately. Ensure that the cross-section of the outer conductor is sufficient.

Contactors, relays, solenoid valves, electrical operating hour counters, and so on in the cabinet must be connected to anti-interference elements. RC elements, diodes, or varistors can be used for this purpose. They must be connected on the appropriate coil.

The shielding between the motor and the Motor Module must not be interrupted by additional components (e.g. fuses, contactors, reactors, or filters).

Automation devices and SINAMICS S120 devices should be connected to different power supply networks. If only a joint supply is available, the automation devices used should be isolated from the supply by means of isolating transformers.

Devices for controlling and monitoring the drives should be set up separately. A separate cabinet that is separated from the drive cabinet by means of a partition is recommended here. If this is not possible, suitable steel plates can be used.

7.4 Overview of Devices Required for Operation

7.4.1 General

The following components are required for connection to the power supply network:

- Line disconnecting device
- Line fuse
- Line contactor (required with electrical isolation)
- Line filter (with Basic Line Module only; see section 2.2)
- Line reactor (with Basic Line Module only; see section 2.3)
- Active Interface Module (see section 2.4)

7.4.2 Line Disconnecting Devices

A line disconnecting device for the electrical equipment may be used for correct isolation of the drive line-up from the power supply. This line isolation device must be for electrical equipment of machinery in conformance with the requirements of EN 60204-1, Section 5.3. The relevant technical specifications of the devices used must be taken into account during selection. All consumers of the electrical equipment that are located downstream of the line disconnecting devices must be included in the selection.

7.4.3 Overcurrent Protection by Line Fuse or Circuit-Breaker

The cables for the drive line-up power supply must be protected against overcurrent. NH, D, and DO-type fuses with a gL characteristics or suitable circuit-breakers can be used for this purpose.

7.4.4 Line Contactor

Line contactors are required for electrical isolation of the drive line-up from the power supply network.

For selection of the line contactor, the characteristic values in the technical specifications apply. The cable routing, the bundling factor, and the factor for the ambient temperature according to EN 60204-1 must be taken into account when the conductors to be connected are rated.

Caution

Line contactors must not be switched under load.

If the digital output of the Active Interface Module is used to control the line contactor, its make/break capacity must be taken into account. If this is insufficient, an interface element must be used.

To limit the opening overvoltage, the contactor coils should be connected to an overvoltage limiter (e.g. flywheel diode or varistor).

7.5 Arrangement of Components and Equipment

7.5.1 General

The arrangement of the components in the cabinet takes the following into account:

- Space requirements
- Cable routing
- Air conditioning
- EMC

7.5.2 Drive Line-Up

The components must be arranged primarily in accordance with their function and the current capacity of the DC link.
The following criteria must be taken into account when the drive line-up for devices in chassis format is designed:

- Depending on the required Motor Modules, the Line Module must be positioned centrally.
- Only one Line Module can be used in a drive line-up.
- The Motor Modules must be positioned to the left or right of the Line Module with decreasing rated currents (i.e. the Motor Module with the highest rated current is positioned next to the Line Module on the left or right, while the Motor Module with the lowest rated current is at the end). When laying the cables or busbar for the DC link, you must ensure that the cable/busbar is compatible with the current-carrying capacity of all the connected Motor Modules.
- The drive line-ups must be configured in such a way that all the power cables for motor supply cables and power supply cables that should preferably be shielded do not exceed the lengths specified in Table 7-3.

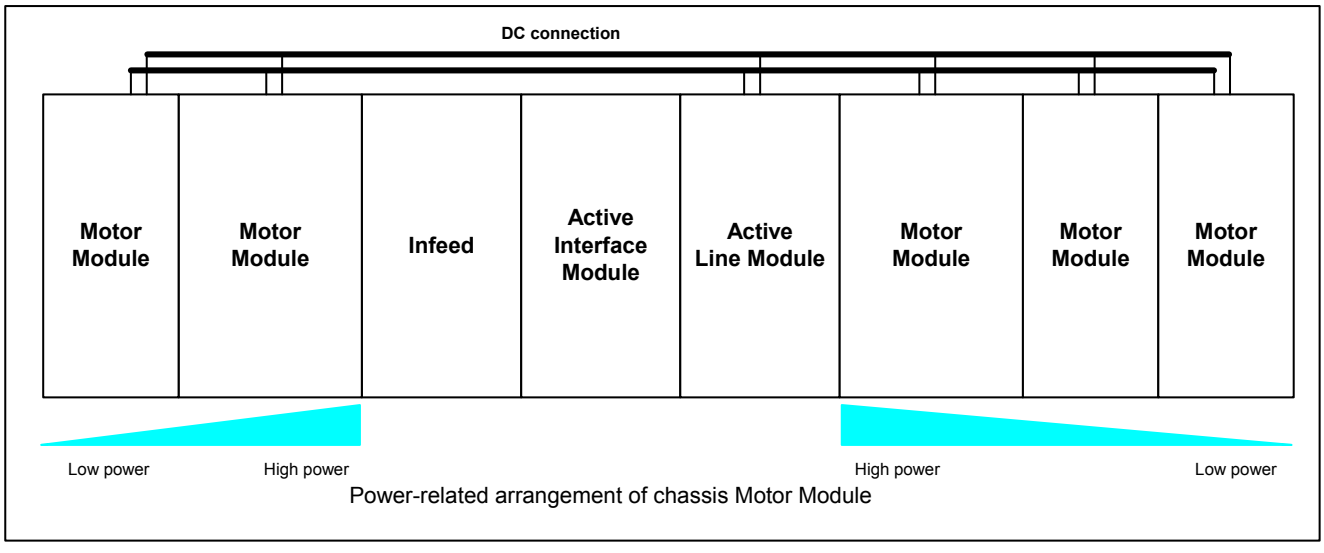


Fig. 7-7 Example of a drive line-up

All the components in the drive line-up should preferably be installed on a conductive mounting surface to minimize the impedance between the component and the mounting surface. If the mounting surface comprises more than one mounting plate, these must be connected conductively over the greatest possible surface area. If the components are installed individually, they must be grounded individually too.

7.6 Cabinet Air Conditioning

7.6.1 General

The minimum dimensions listed below for ventilation clearances must be observed. No other components or cables must be located in these areas.

Caution

If the guidelines for installing SINAMICS S120 chassis equipment are not observed, this can significantly reduce the service life of the equipment and result in premature component failure.

You must take into account the following specifications when installing a SINAMICS S120 chassis drive line-up:

- Ventilation clearance
- Cable routing
- Air guidance

Table 7-4 Ventilation clearances for the components

Component	Type	Clearance (front) [mm]	Clearance (above) [mm]	Clearance (below) [mm]
Basic Line Module	FB, GB	40 1	250	150
Active Interface Module	FI	40 1	250	150
Active Interface Module	GI	50 1	250	150
Active Interface Module	HI, JI	40 1	250	0
Active Line Module	FX, GX, HX, JX	40 1	250	150
Motor Module	FX, GX, HX, JX	40 1	250	150

1 The clearances refer to the area around the ventilation slots on the front cover.

Note

The dimensions refer to the outer edges of the devices.

Dimension drawings are available in the relevant chapters.

7.6.2 Ventilation

The SINAMICS S120 chassis devices undergo forced cooling by means of integrated fans. To ensure an adequate air supply, suitable openings for the inlet air (e.g. ventilation slots in the cabinet door) and outlet air (e.g. by means of a hood) must be provided.

The cool air must flow through the components vertically from the bottom (cold region) to the top (region heated by operation).

You must ensure that the air is flowing in the right direction. You must also ensure that the warm air can escape at the top. The ventilation clearances specified in Table 7-4 must be observed.

Note

Cables must not be routed directly on the components and the ventilation grilles must not be covered.

Cold air must not be allowed to blow directly onto electronic equipment.

Caution

The air guidance, as well as the arrangement of and settings for the cooling equipment, must be chosen in such a way as to prevent condensation even with the highest relative humidity that can be expected.

If necessary, cabinet enclosure heating may have to be installed.

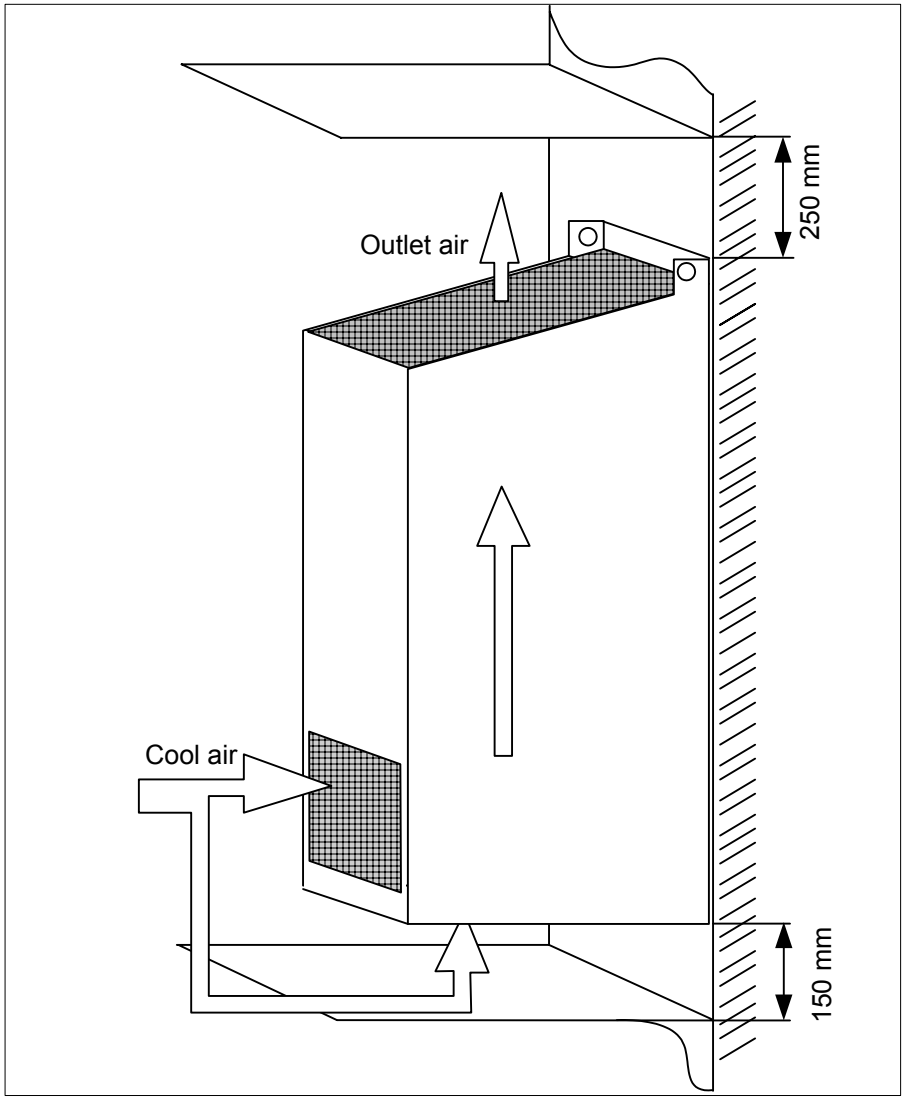


Fig. 7-8 Air guidance for Active Interface Module (types FI, GI)

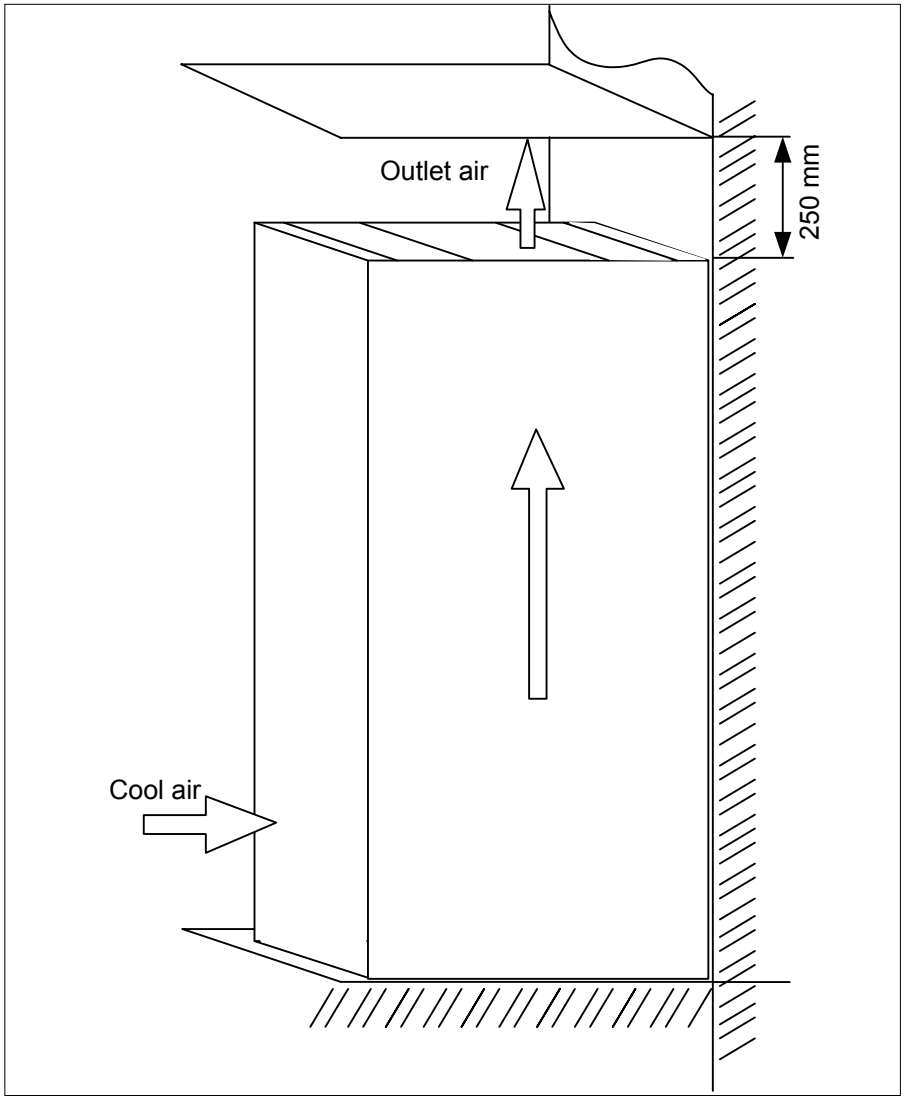


Fig. 7-9 Air guidance for Active Interface Module (types HI, JI)

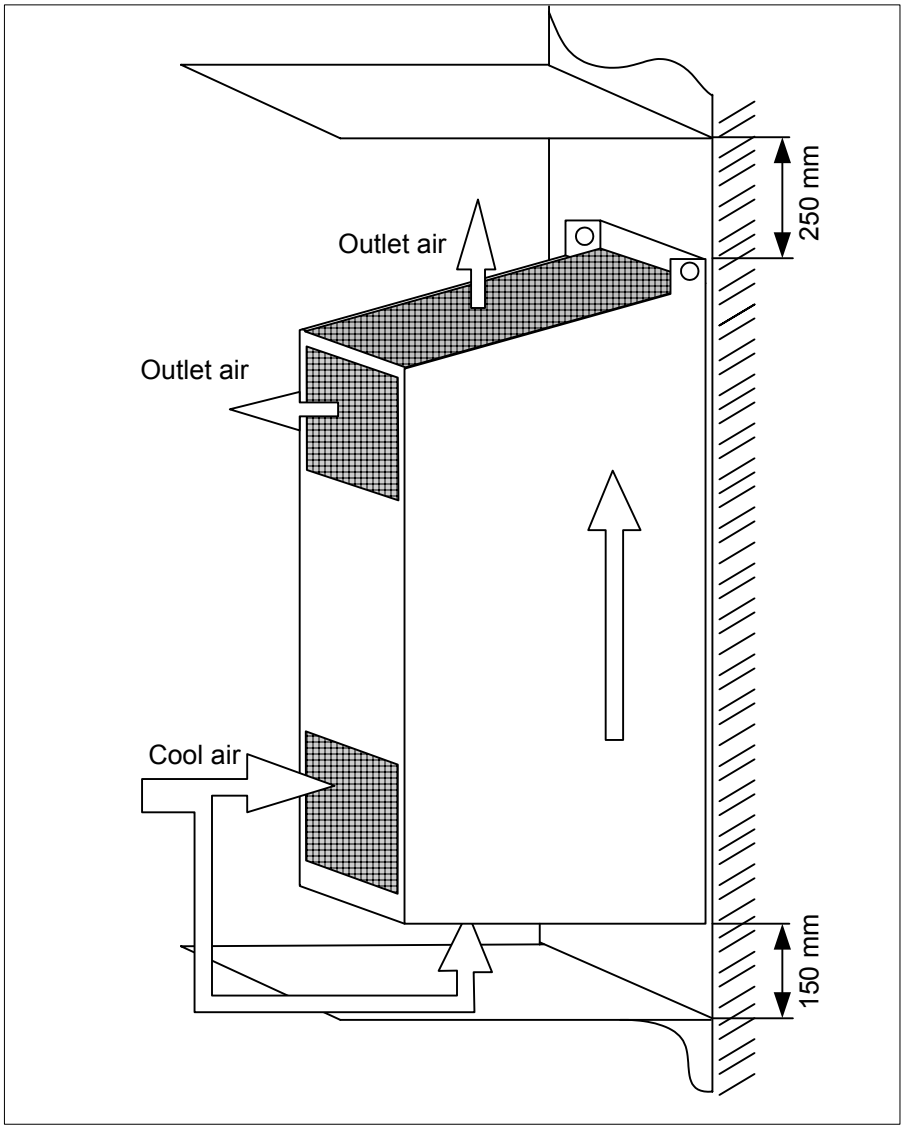


Fig. 7-10 Air guidance for Active Line Module, Motor Module (types FX, GX)

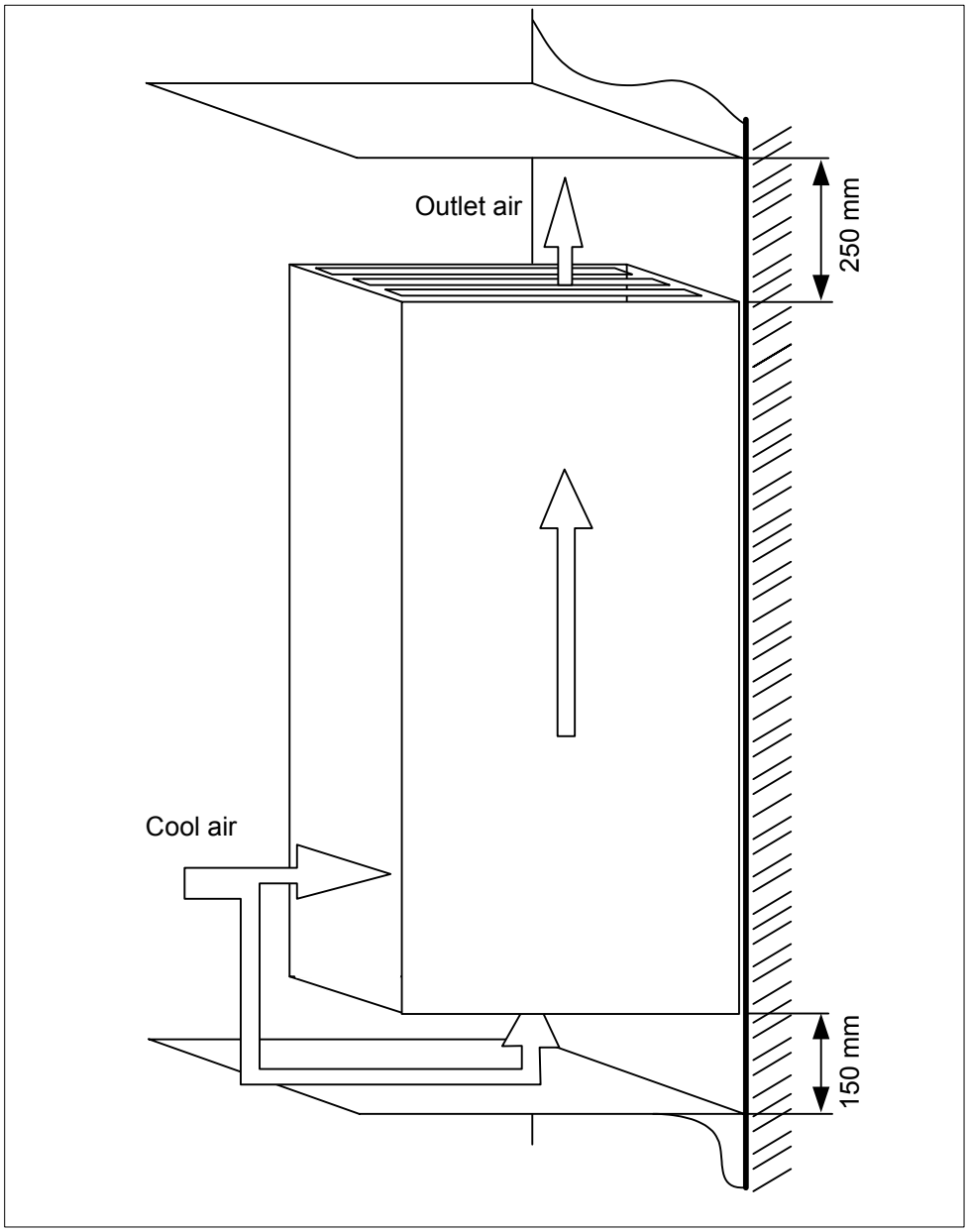


Fig. 7-11 Air guidance for Active Line Module, Motor Module (types HX, JX)

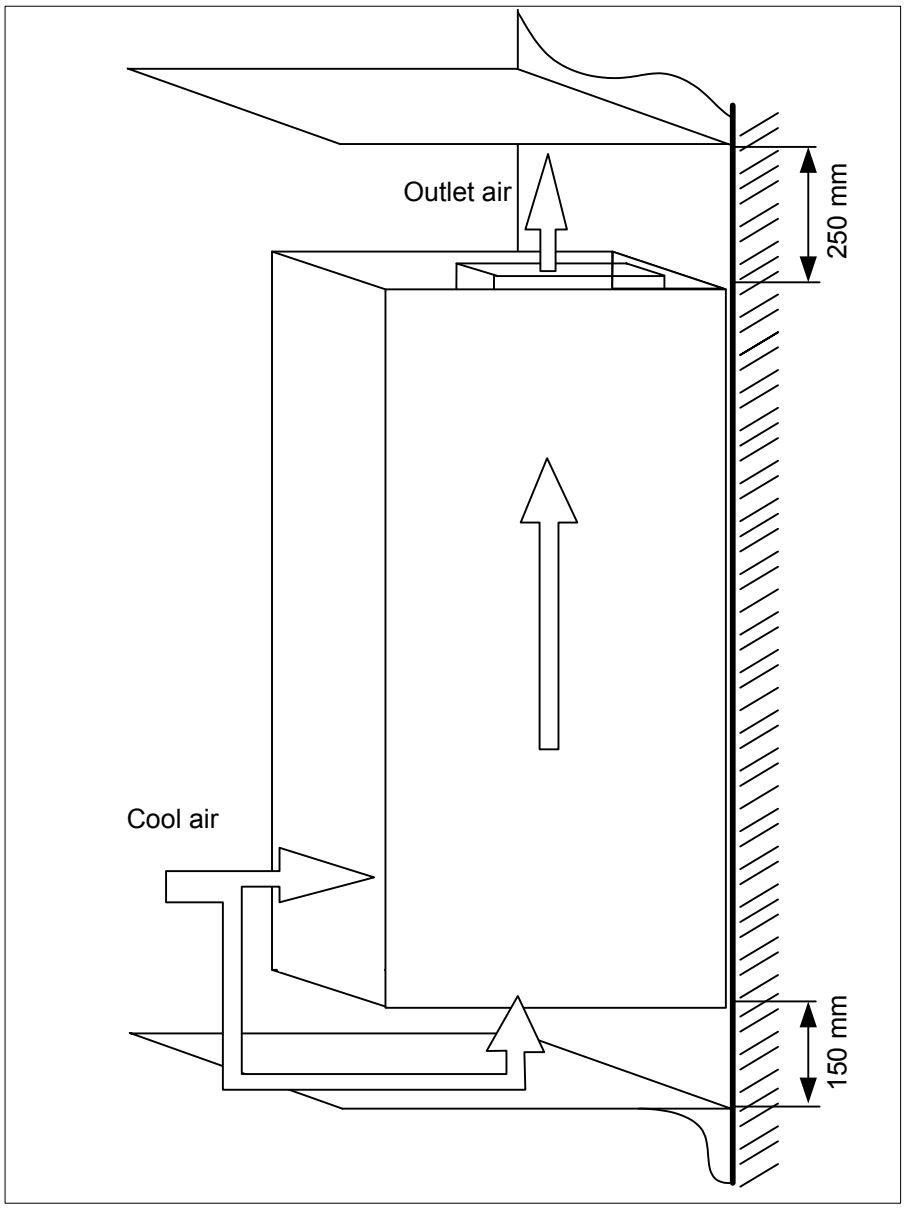


Fig. 7-12 Air guidance for Basic Line Module (type FB, GB)

Devices must not be operated in an "air short-circuit", since this can damage equipment or cause it to fail.

The pull of the fan leads to underpressure at the ventilation openings in the cabinet doors. This depends on the volume flow rate and the hydraulic cross-section of the openings.

The air that blows out of the top of the device accumulates under the top cover/hood, resulting in overpressure.

The difference between the overpressure at the top of the cabinet and the underpressure at the bottom creates an air current (air short-circuit). This can vary in strength depending on the cross-section of the door and cover openings, as well as the volume flow rate of the air.

Due to the flow of air within the cabinet, the device fan draws in pre-heated air. This heats up the components considerably and the ventilator does not function effectively.

Caution

Devices must not be operated in an "air short-circuit", since this can damage equipment or cause it to fail.

Suitable barriers must be in place to prevent an air short-circuit.

Barriers must be installed in such a way that no air can flow along the outer sides on the top and bottom of the devices. In particular, air must be prevented from flowing from the top (warm outlet air) to the bottom (cold cooling air). Suitable plates can be used as barriers, for example, which must reach up to the side panels or cabinet doors. It must be set up in such a way that the outgoing air current is not forced into the cabinet cross-beams but is instead diverted around them. Barriers must be in place for all degrees of protection higher than IP20.

Barriers must also be in place for the cabinets adjacent to the converter cabinets.

To ensure sufficient ventilation for the devices, the opening cross-sections (minimum values) specified in the following table must be observed.

The specified opening cross-sections comprise several small openings. To ensure that pressure loss is kept to a minimum and that the flow resistance does not become too great, the cross-sectional area of each opening must be at least 280 mm² (e.g. 7 mm x 40 mm).

To ensure long-term operation of the devices, you must take measures to prevent the ingress of dirt and dust. Wire lattices (wire cloth DIN 4189-St-vzk-1x0.28) or filter mats (min. filter class G2) must be used for this purpose. Your choice of filter mats depends on the required degree of protection and the ambient conditions. If cabinets are installed in an environment containing fine dust particles or oil vapors, micro-filter mats must be used to prevent the devices from becoming contaminated.

If dirt filters are used, the specified opening cross-sections and the filter areas must be increased.

Caution

If dirt filters are used, the specified replacement intervals must be observed.

If the filter mats are heavily contaminated, the volume of air drawn is reduced due to the increased flow resistance. This can cause the fans integrated in the devices to overload, or it could cause the devices themselves to overheat and become damaged.

The opening cross-sections specified in the table refer in each case to one device. If more than one device is installed in a cabinet, the opening cross-section increases accordingly. If the required openings in the cabinet cannot be made, the devices must be distributed across several devices, which are separated from each other by means of partitions.

The warm outlet air must be dissipated via the top cover/hood or via side openings in the cabinet at the level of the top of the device. The size of the opening cross-section must also be taken into account here.

With degrees of protection higher than IP20 and if a hood is used, an "active" hood may have to be used. An "active" hood contains ventilators that blow the air current forwards. Apart from the air outlet, the hood is otherwise closed.

When choosing an "active" hood, you must ensure that the ventilators are sufficiently powerful to prevent air from accumulating in the cabinet. If air accumulates, the cooling capacity is reduced. This can overheat and destroy the devices. The air capacity of the ventilators should at least correspond with the device fan data.

Table 7-5 Volume flow rate, opening cross-sections

Active Interface Module							
Order number	6SL3300-	7TE32-6AA0	7TE33-8AA0 7TE35-0AA0	7TE38-4AA0 7TE41-4AA0 7TH35-8AA0 7TH37-4AA0 7TH41-3AA0			
Cooling air requirement	[m³/s]	0.24	0.47	0.4			
Min. opening cross-section in cabinet Inlet Outlet	 [m²] [m²]	 0.1 0.1	 0.20 0.20	 0.16 0.16			
Basic Line Module							
Order number	6SL3330-	1TE34-2AA0 1TE35-3AA0 1TE38-2AA0 1TH33-0AA0 1TH34-3AA0 1TH36-8AA0	1TE41-2AA0 1TE41-5AA0 1TH41-1AA0 1TH41-4AA0				
Cooling air requirement	[m³/s]	0.17	0.36				
Min. opening cross-section in cabinet Inlet Outlet	 [m²] [m²]	 0.1 0.1	 0.16 0.16				
Active Line Module							
Order number	6SL3330-	7TE32-1AA0	7TE32-6AA0	7TE33-8AA0 7TE35-0AA0	7TE36-1AA0 7TE38-4AA0 7TH35-8AA0	7TE41-0AA0 7TE41-4AA0	7TH37-4AA0 7TH41-0AA0 7TH41-3AA0
Cooling air requirement	[m³/s]	0.17	0.23	0.36	0.78	1.08	1.1
Min. opening cross-section in cabinet Inlet Outlet	 [m²] [m²]	 0.1 0.1	 0.1 0.1	 0.16 0.16	 0.28 0.28	 0.4 0.4	 0.4 0.4
Motor Module							
Order number	6SL3320-	1TE32-1AA0 1TH28-5AA0 1TH31-0AA0 1TH31-2AA0 1TH31-5AA0	1TE32-6AA0	1TE33-1AA0 1TE33-8AA0 1TE35-0AA0 1TH31-8AA0 1TH32-2AA0 1TH32-6AA0 1TH33-3AA0	1TE36-1AA0 1TE37-5AA0 1TE38-4AA0 1TH34-1AA0 1TH34-7AA0 1TH35-8AA0	1TE41-0AA0 1TE41-2AA0 1TE41-4AA0	1TH37-4AA0 1TH38-1AA0 1TH38-8AA0 1TH41-0AA0 1TH41-3AA0
Cooling air requirement	[m³/s]	0.17	0.23	0.36	0.78	1.1	1.474
Min. opening cross-section in cabinet Inlet Outlet	 [m²] [m²]	 0.1 0.1	 0.1 0.1	 0.16 0.16	 0.28 0.28	 0.4 0.4	 0.55 0.55

Maintenance and Servicing

8

8.1 Chapter Content

This chapter provides information on the following:

- Maintenance and servicing procedures that have to be carried out on a regular basis to ensure the availability of the components.
- Exchanging device components when the unit is serviced
- Reforming the DC link capacitors

Danger

Before carrying out any maintenance or repair work on the de-energized device, wait for 5 minutes after switching off the supply voltage. This allows the capacitors to discharge to a harmless level (< 25 V) after the supply voltage has been switched off.

Before starting work, you should also measure the voltage after the 5 minutes have elapsed. The voltage can be measured on DC link terminals DCP and DCN.

Danger

When the external power supply or the external 230 V AC auxiliary supply is connected, dangerous voltages are still present in the components even when the main circuit-breaker is open.

8.2 Maintenance

The devices comprise mostly electronic components. Apart from the fan(s), therefore, they contain 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 devices. Dirt and contamination must be removed regularly and parts subject to wear replaced.

The following points must generally be observed.

8.2.1 Cleaning

Dust Deposits

Dust deposits inside the device must be removed at regular intervals (or at least once a year) by qualified personnel in line with the relevant safety regulations. The unit must be cleaned using a brush and vacuum cleaner, and dry compressed air (max. 1 bar) for areas that cannot be easily reached.

Ventilation

The ventilation openings in the device must never be obstructed. The fans must be checked to make sure that they are functioning correctly.

Cable and Screw Terminals

Cable and screw terminals must be checked regularly to ensure that they are secure 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.

8.3 Servicing

Servicing involves activities and procedures for maintaining and restoring the operating condition of the devices.

Required tools

The following tools are required for replacing components:

- Spanner or socket spanner (w/f 10)
- Spanner or socket spanner (w/f 13)
- Spanner or socket spanner (w/f 16/17)
- Spanner or socket spanner (w/f 18/19)
- Hexagon-socket spanner (size 8)
- Torque spanner, max. 50 Nm
- Screwdriver size 1 / 2
- Screwdriver Torx T20
- Screwdriver Torx T30

Tightening torques for current-carrying parts

When securing connections for current-carrying parts (DC link, motor connections, busbars), you must observe the following tightening torques.

Table 8-1 Tightening torques for connecting current-carrying parts

Screw	Torque
M8	13 Nm
M10	25 Nm
M12	50 Nm

8.3.1 Installation Device

Description

The installation device is used for installing and removing the power blocks for the Basic Line Modules, Active Line Modules, and Motor Modules in chassis format.

It is used as an installation aid, which is placed in front of and secured to the module. The telescopic guide support allows the withdrawable device to be adjusted according to the height at which the power blocks are installed. Once the mechanical and electrical connections have been removed, the power block can be removed from the module, whereby the power block is guided and supported by the guide rails on the withdrawable devices.

Fig. 8-1 Installation Device

Order number

Order number for the installation device: 6SL3766-1FA00-0AA0.

8.4 Replacing Components

Warning

When transporting the devices and replacing components, note the following:

- Some of the devices and components 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 devices are operated with high voltages.
All connection procedures must be carried out with the cabinet de-energized.
All work on the units must be carried out by trained personnel only. Death, serious injury, or substantial material damage can result if these warnings are not taken into account.
Work on an open device 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 cabinet up to five minutes after it has been disconnected due to the DC link capacitors. For this reason, the cabinet should not be opened until after a reasonable period of time has elapsed.

8.4.1 Replacing the Power Block, Active Line Module and Motor Module (Type FX)

Replacing the power block

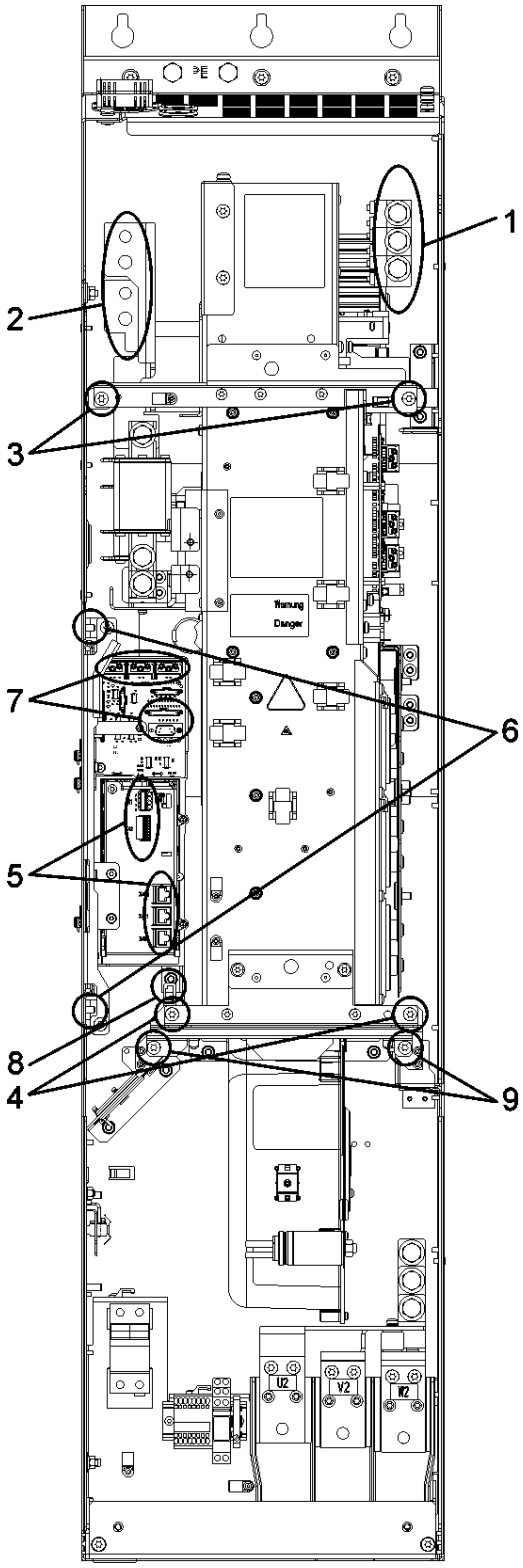


Fig. 8-2 Replacing the power block, Active Line Module and Motor Module (type FX)

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access to the power block.
- Remove the front cover.

Removal

The steps for the removal procedure are numbered in accordance with Fig. 8-2.

1. Unscrew the connection to the power supply or motor connection (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 (5 plugs).
6. Remove the mounts for the slide-in electronics unit (2 nuts) and carefully remove the slide-in electronics unit.
   When removing the slide-in electronics unit, you have to disconnect 5 further plugs one after the other (2 at the top, 3 below).
7. Disconnect the plugs for the fiber optic cables and signal cables (5 plugs).
8. Disconnect the plug for the thermocouple.
9. Unscrew the two retaining screws for the fan and attach the installation device for 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

To re-install the power block, carry out the above steps in reverse order.

Caution

The tightening torques specified in Table 8-1 must be observed.

Carefully re-establish the plug connections and ensure that they are secure.

8.4.2 Replacing the Power Block, Active Line Module and Motor Module (Type GX)

Replacing the power block

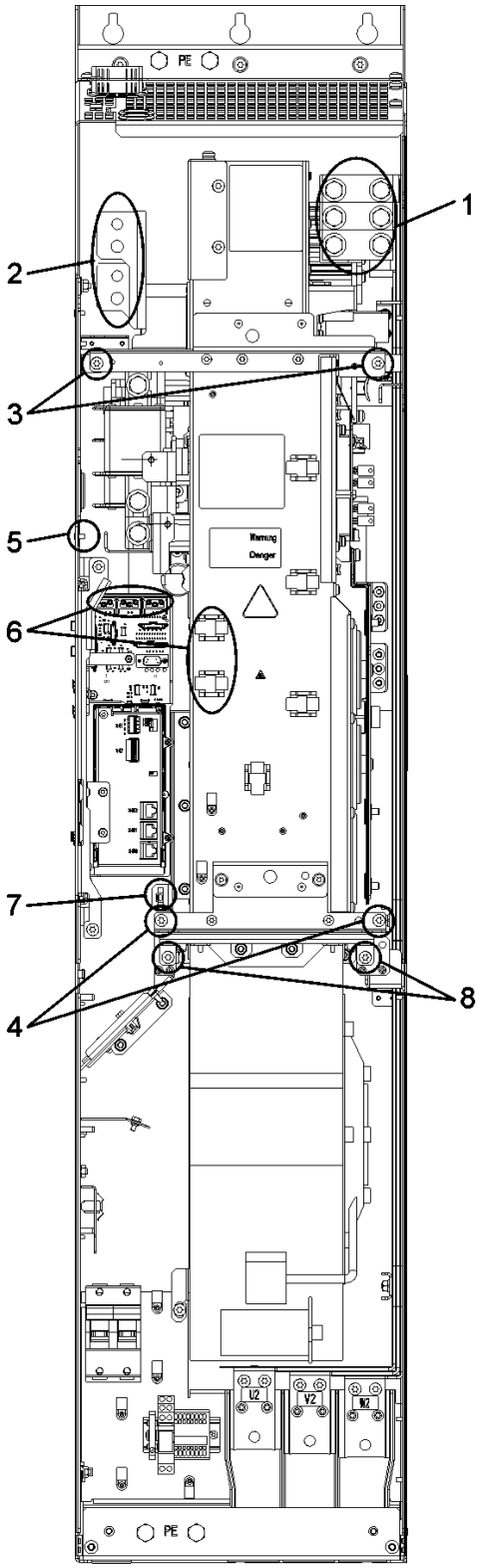


Fig. 8-3 Replacing the power block, Active Line Module and Motor Module (type GX)

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access to the power block.
- Remove the front cover.

Removal

The steps for the removal procedure are numbered in accordance with Fig. 8-3.

1. Unscrew the connection to the power supply or motor connection (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 mount for the slide-in electronics unit (1 nut) and carefully pull out the slide-in electronics unit.
   When removing the slide-in electronics unit, you have to disconnect 5 further plugs one after the other (2 at the top, 3 below).
6. Disconnect the plugs for the fiber optic cables (5 plugs) and release the cable connection for the signal cables (2 connectors).
7. Disconnect the plug for the thermocouple.
8. Unscrew the two retaining screws for the fan and attach the installation device for 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

To re-install the power block, carry out the above steps in reverse order.

Caution

The tightening torques specified in Table 8-1 must be observed.

Carefully re-establish the plug connections and ensure that they are secure.

8.4.3 Replacing the Power Block, Active Line Module and Motor Module (Type HX)

Replacing the left-hand power block

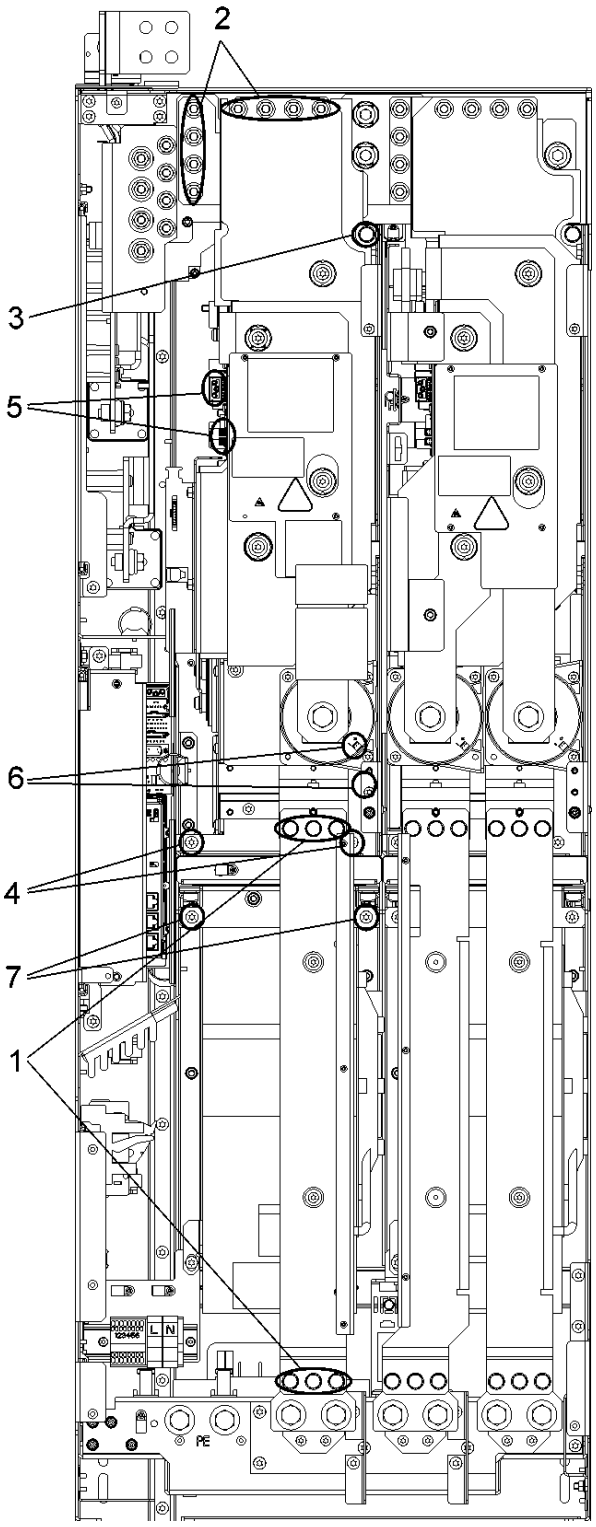


Fig. 8-4 Replacing the power block, Active Line Module and Motor Module (type HX) (left-hand power block)

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access to the power block.
- Remove the protective cover.

Removal

The steps for the removal procedure are numbered in accordance with Fig. 8-4.

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 plugs 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 two retaining screws for the fan and attach the installation device for 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

To re-install the power block, carry out the above steps in reverse order.

Caution

The tightening torques specified in Table 8-1 must be observed.

Carefully re-establish the plug connections and ensure that they are secure.

The screwed connections for the protective covers must only be tightened by hand.

Replacing the right-hand power block

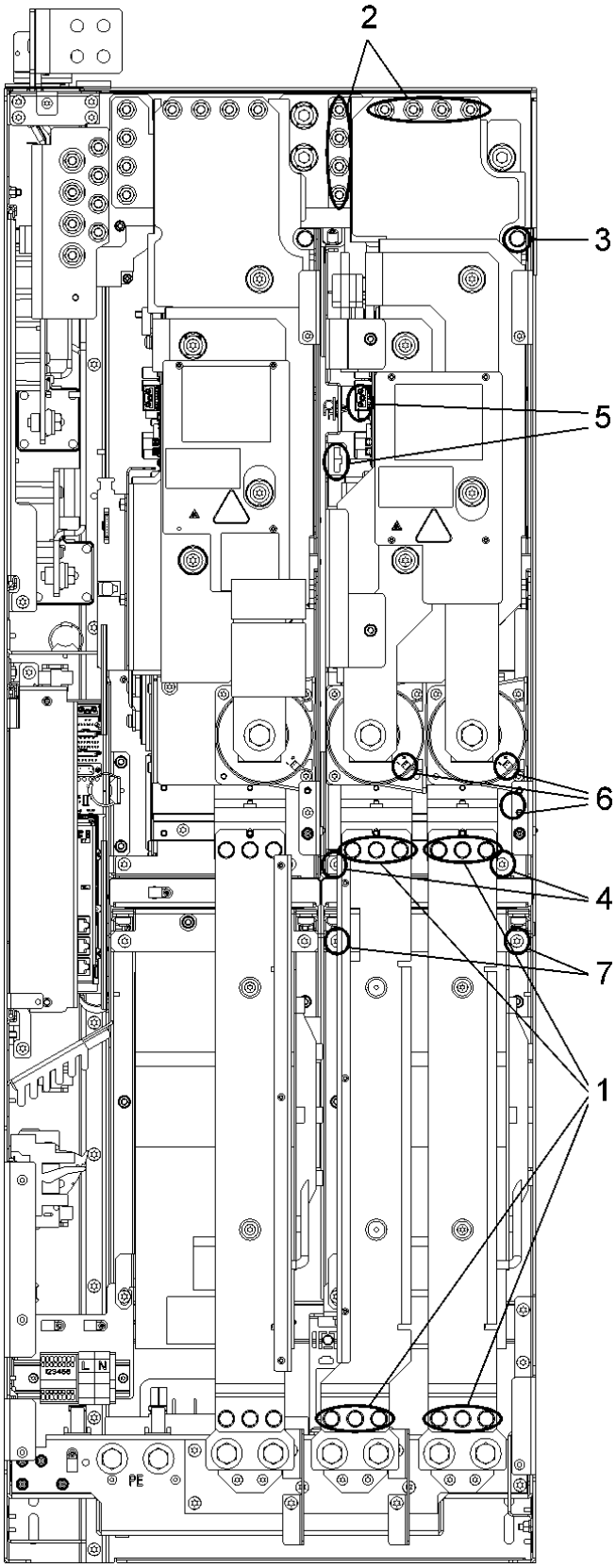


Fig. 8-5 Replacing the power block, Active Line Module and Motor Module (type HX) (right-hand power block)

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access to the power block.
- Remove the protective cover.

Removal

The steps for the removal procedure are numbered in accordance Fig. 8-5.

1. Remove the busbar (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 plugs for the fiber optic cables and signal cables (2 plugs).
   The second plug for the fiber optic cables cannot be disconnected until the power block has been pulled out slightly.
6. Remove the connection for the current transformer and associated PE connection (2 plugs).
7. Unscrew the two retaining screws for the fan and attach the installation device for 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.

The second plug for the fiber optic cables cannot be disconnected until the power block has been pulled out slightly (see step 5).

Installation

To re-install the power block, carry out the above steps in reverse order.

Caution

The tightening torques specified in Table 8-1 must be observed.

Carefully re-establish the plug connections and ensure that they are secure.

The screwed connections for the protective covers must only be tightened by hand.

8.4.4 Replacing the Power Block, Active Line Module and Motor Module (Type JX)

Replacing the power block

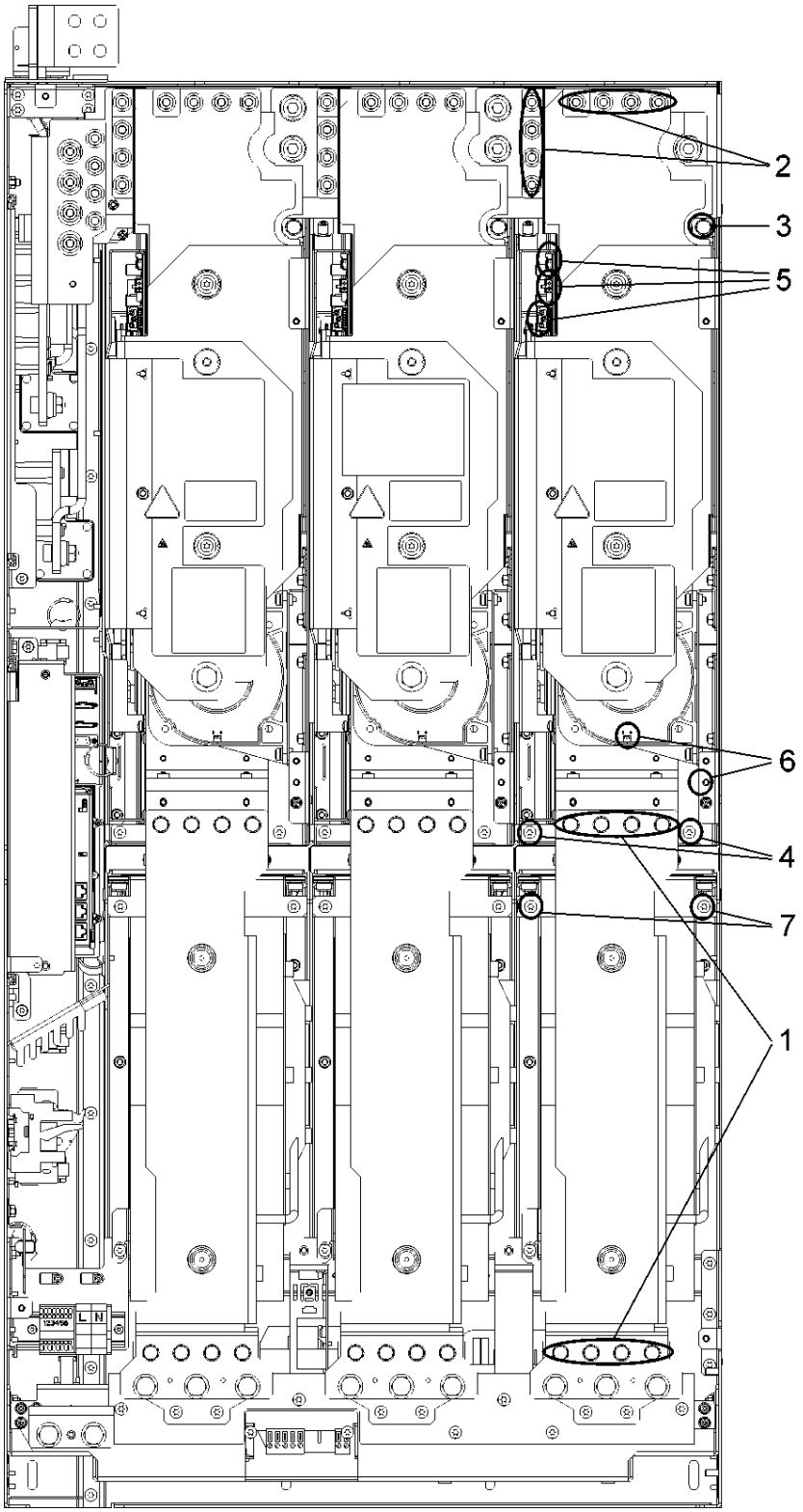


Fig. 8-6 Replacing the power block, Active Line Module and Motor Module (type JX)

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access to the power block.
- Remove the protective cover.

Removal

The steps for the removal procedure are numbered in accordance with Fig. 8-6.

1. Unscrew the connection to the power supply or motor connection (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 plugs for the fiber optic cables and signal cables (3 plugs).
6. Remove the connection for the current transformer and associated PE connection (1 plug).
7. Unscrew the two retaining screws for the fan and attach the installation device for 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

To re-install the power block, carry out the above steps in reverse order.

Caution

The tightening torques specified in Table 8-1 must be observed.

Carefully re-establish the plug connections and ensure that they are secure.

The screwed connections for the protective covers must only be tightened by hand.

8.4.5 Replacing the Power Block, Basic Line Module (Type FB)

Replacing the power block

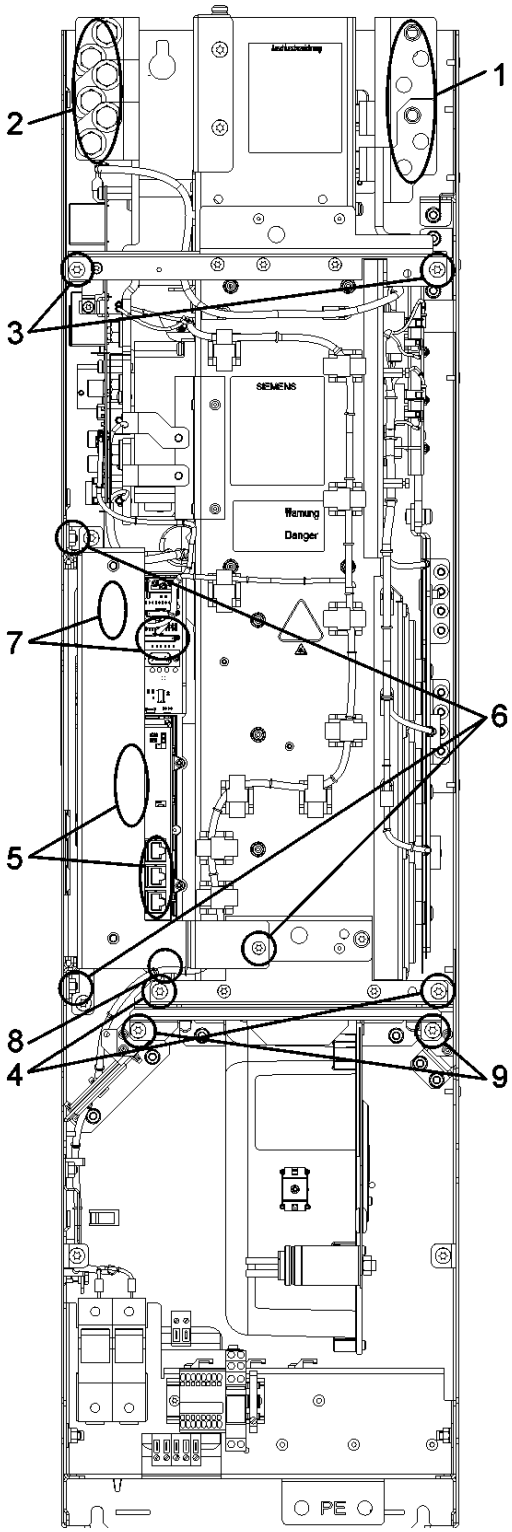


Fig. 8-7 Replacing the power block, Basic Line Module (type FB)

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access to the power block.
- Remove the protective cover.

Removal

The steps for the removal procedure are numbered in accordance with Fig. 8-7.

1. Unscrew the connection to the DC link (8 screws).
2. Unscrew the connection to the power supply network (8 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 (5 plugs).
6. Remove the mounts for the control interface board (1 screw and 2 nuts) and carefully pull out the control interface board.
7. Disconnect the plugs for the signal cables (2 plugs).
8. Disconnect the plug for the thermocouple.
9. Unscrew the two retaining screws for the fan and attach the installation device for 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

To re-install the power block, carry out the above steps in reverse order.

Caution

The tightening torques specified in Table 8-1 must be observed.

Carefully re-establish the plug connections and ensure that they are secure.

The screwed connections for the protective covers must only be tightened by hand.

8.4.6 Replacing the Power Block, Basic Line Module (Type GB)

Replacing the power block

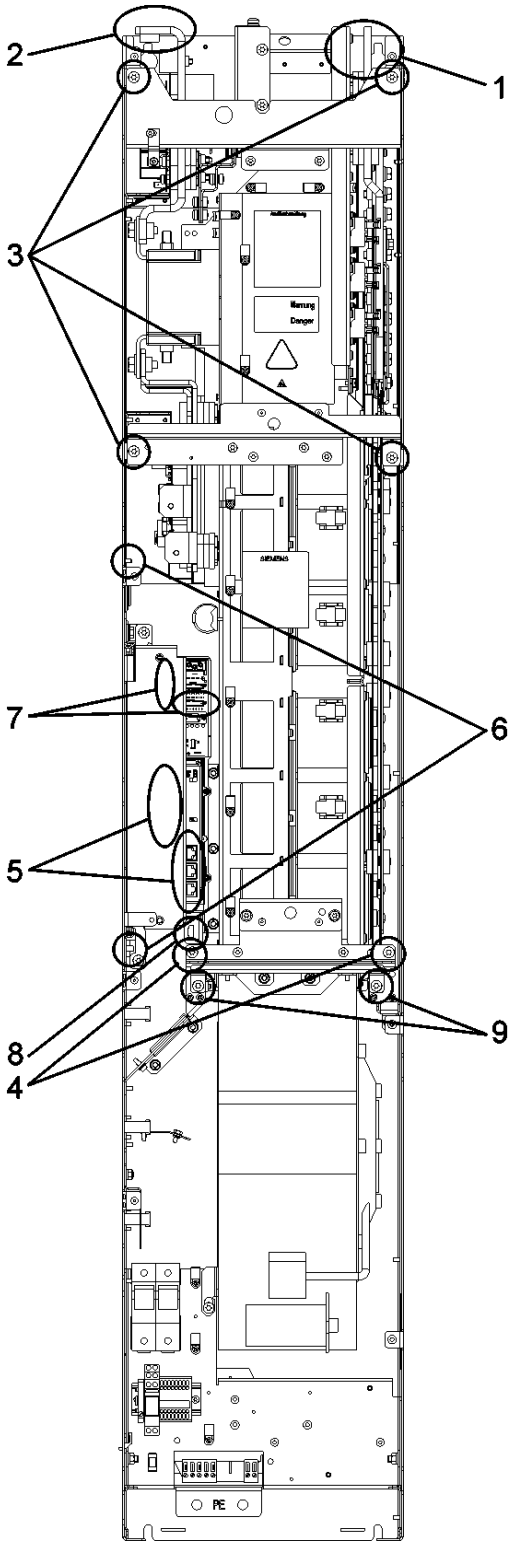


Fig. 8-8 Replacing the power block, Basic Line Module (type GB)

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access to the power block.
- Remove the protective cover.

Removal

The steps for the removal procedure are numbered in accordance with Fig. 8-8.

1. Unscrew the connection to the DC link (6 screws).
2. Unscrew the connection to the power supply network (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 (5 plugs).
6. Remove the mounts for the control interface board (2 nuts) and carefully pull out the control interface board.
7. Disconnect the plugs for the signal cables (2 plugs).
8. Disconnect the plug for the thermocouple.
9. Unscrew the two retaining screws for the fan and attach the installation device for 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

To re-install the power block, carry out the above steps in reverse order.

Caution

The tightening torques specified in Table 8-1 must be observed.

Carefully re-establish the plug connections and ensure that they are secure.

The screwed connections for the protective covers must only be tightened by hand.

8.4.7 Replacing the Control Interface Board, Active Line Module and Motor Module (Type FX)

Replacing the control interface board

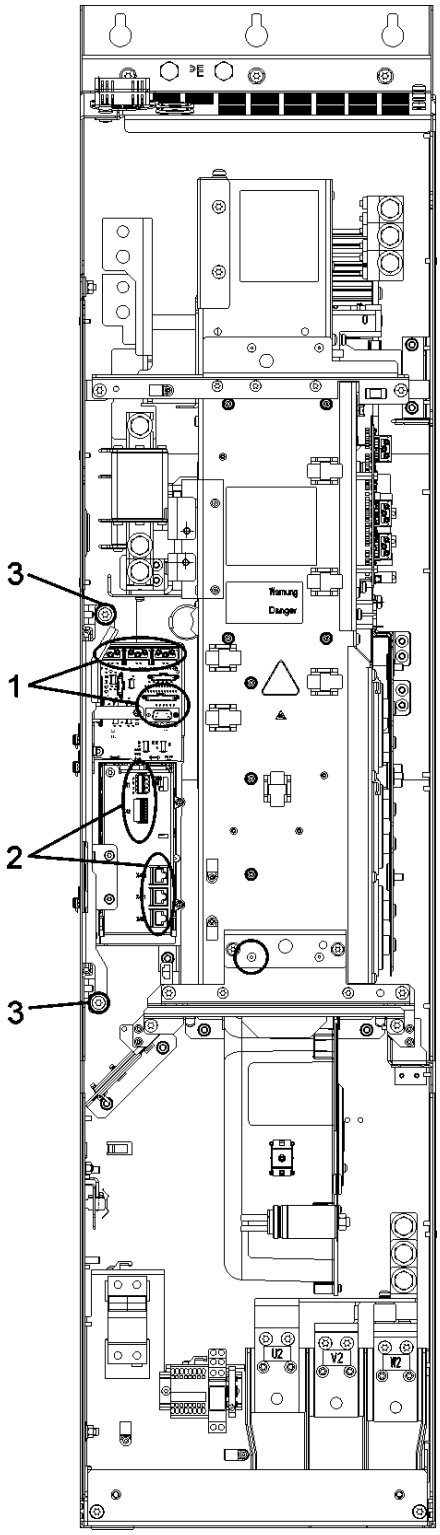


Fig. 8-9 Replacing the control interface board (type FX)

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access to the fan.
- Remove the front cover.

Removal

The steps for the removal procedure are numbered in accordance with Fig. 8-9.

1. Disconnect the plugs for the fiber optic cables and signal cables (5 plugs).
2. Remove the DRIVE-CLiQ cables and connections on –X41 / –X42 (5 plugs).
3. Remove the retaining screws for the slide-in electronics unit (2 screws).
   When removing the slide-in electronics unit, you have to disconnect 5 further plugs one after the other (2 at the top, 3 below).

Caution

When removing the slide-in electronics unit, ensure that you do not damage any signal cables.

4. The control interface board can then be removed from the electronics slide-in unit.

Installation

To re-install the control interface board, carry out the above steps in reverse order.

Caution

The tightening torques specified in Table 8-1 must be observed.

Carefully re-establish the plug connections and ensure that they are secure.

8.4.8 Replacing the Control Interface Board, Active Line Module and Motor Module (Type GX)

Replacing the control interface board

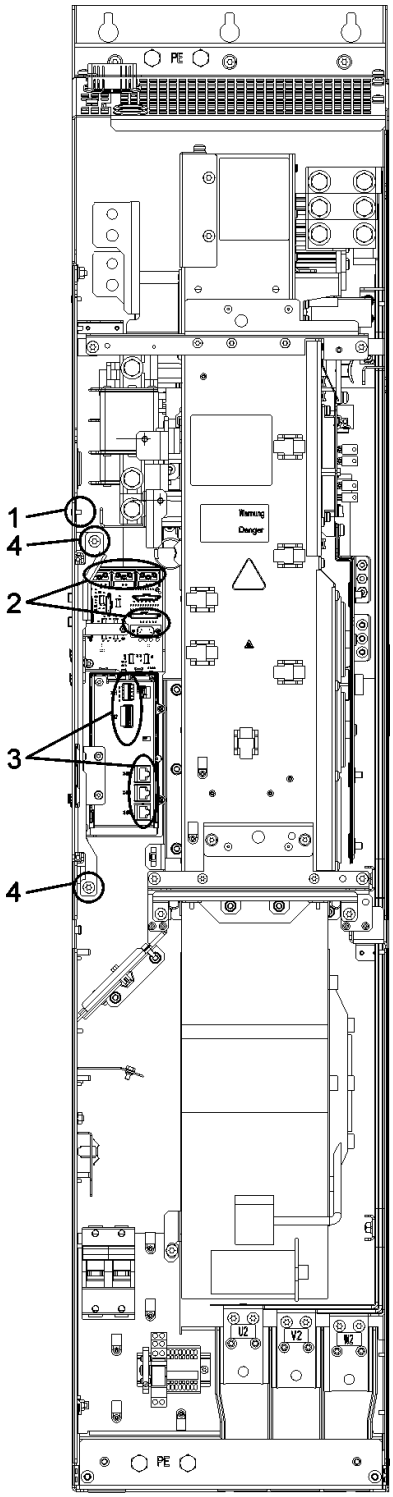


Fig. 8-10 Replacing the control interface board (type GX)

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access to the fan.
- Remove the front cover.

Removal

The steps for the removal procedure are numbered in accordance with Fig. 8-10.

1. Remove the CU320 mount (1 nut).
2. Disconnect the plugs for the fiber optic cables and signal cables (5 plugs).
3. Remove the DRIVE-CLiQ cables and connections on –X41 / –X42 (5 plugs).
4. Remove the retaining screws for the slide-in electronics unit (2 screws).
   When removing the slide-in electronics unit, you have to disconnect 5 further plugs one after the other (2 at the top, 3 below).

Caution

When removing the slide-in electronics unit, ensure that you do not damage any signal cables.

5. The control interface board can then be removed from the electronics slide-in unit.

Installation

To re-install the control interface board, carry out the above steps in reverse order.

Caution

The tightening torques specified in Table 8-1 must be observed.

Carefully re-establish the plug connections and ensure that they are secure.

8.4.9 Replacing the Control Interface Board, Active Line Module and Motor Module (Type HX)

Replacing the control interface board

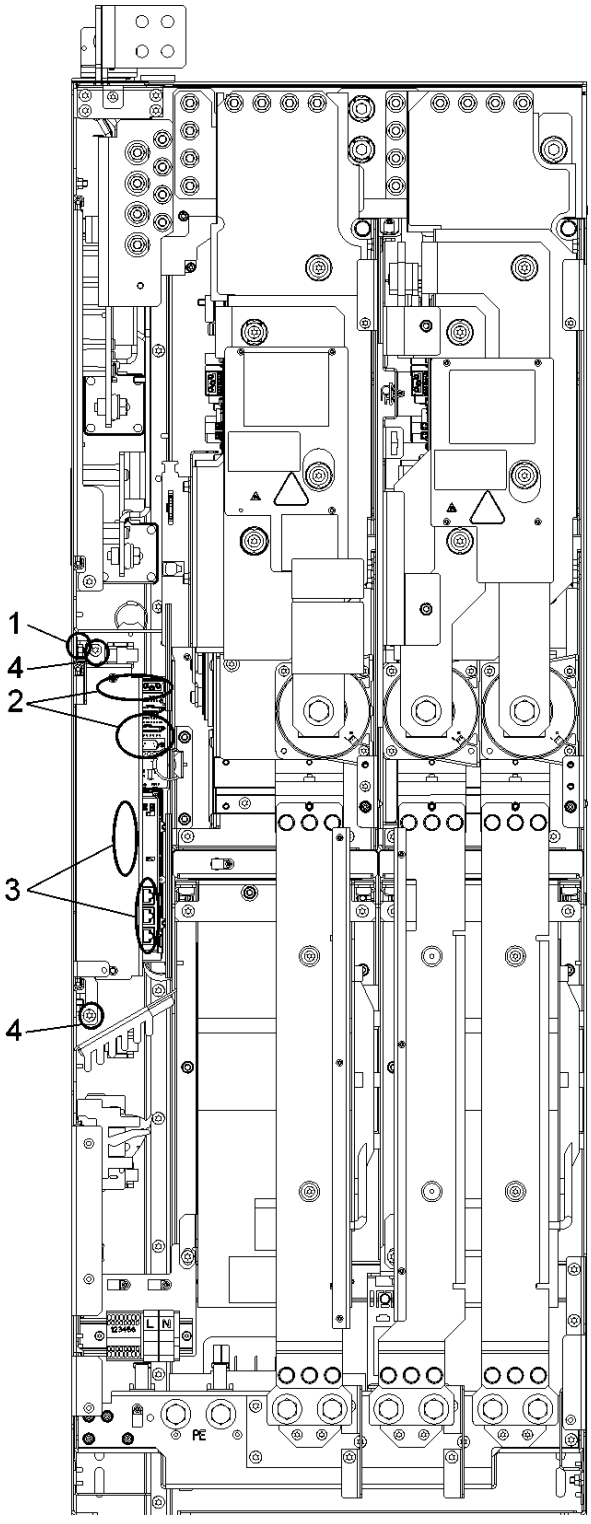


Fig. 8-11 Replacing the control interface board (type HX)

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access to the fan.
- Remove the protective cover.

Removal

The steps for the removal procedure are numbered in accordance with Fig. 8-11.

1. Remove the CU320 mount (1 nut).
2. Disconnect the plugs for the fiber optic cables and signal cables (5 plugs).
3. Remove the DRIVE-CLiQ cables and connections on –X41 / –X42 (5 plugs).
4. Remove the retaining screws for the slide-in electronics unit (2 screws).
   When removing the slide-in electronics unit, you have to disconnect 5 further plugs one after the other (2 at the top, 3 below).

Caution

When removing the slide-in electronics unit, ensure that you do not damage any signal cables.

5. The control interface board can then be removed from the electronics slide-in unit.

Installation

To re-install the control interface board, carry out the above steps in reverse order.

Caution

The tightening torques specified in Table 8-1 must be observed.

Carefully re-establish the plug connections and ensure that they are secure.

The screwed connections for the protective covers must only be tightened by hand.

8.4.10 Replacing the Control Interface Board, Active Line Module and Motor Module (Type JX)

Replacing the control interface board

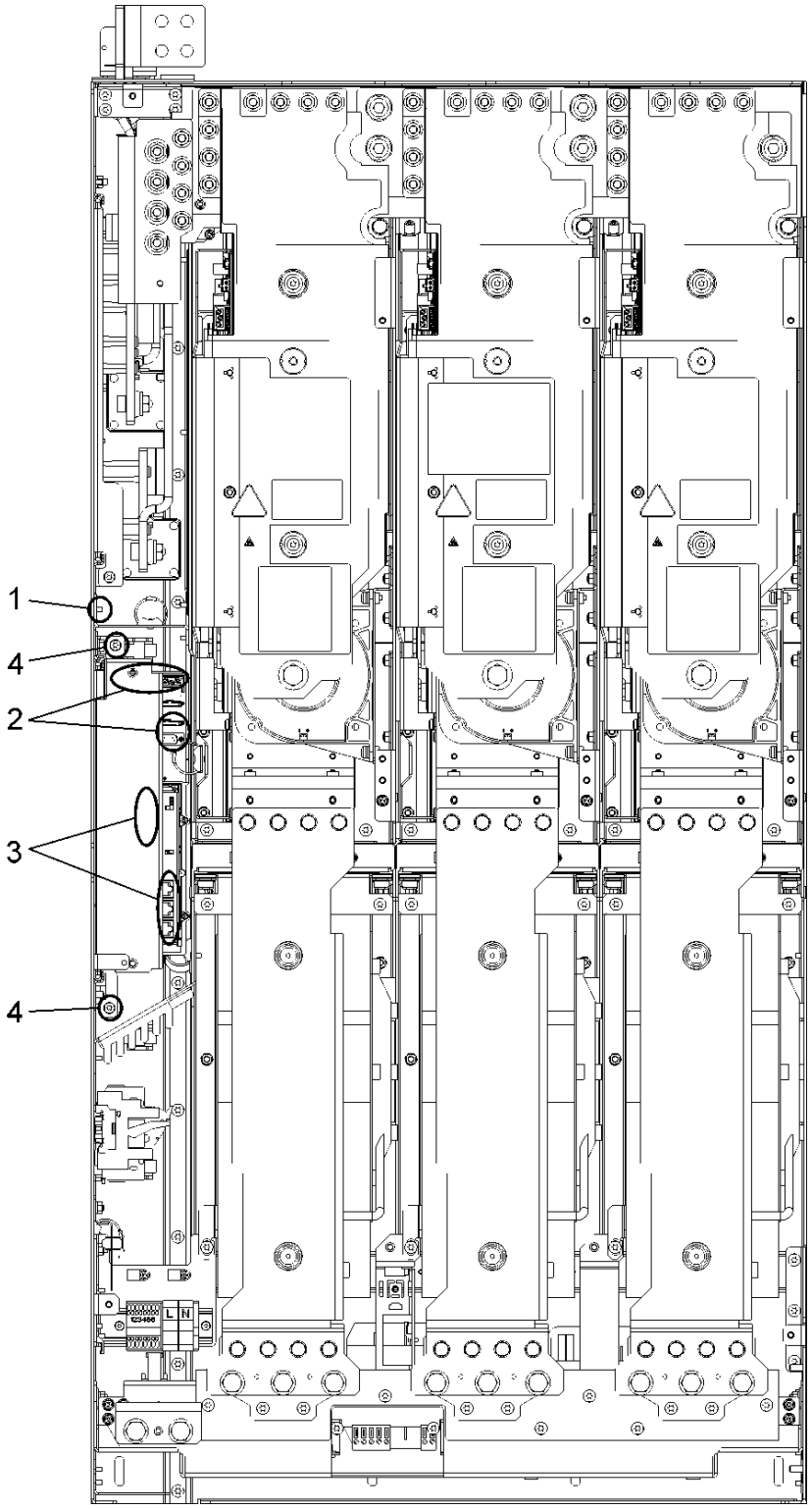


Fig. 8-12 Replacing the control interface board (type JX)

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access to the fan.
- Remove the protective cover.

Removal

The steps for the removal procedure are numbered in accordance with Fig. 8-12.

1. Remove the CU320 mount (1 nut).
2. Disconnect the plugs for the fiber optic cables and signal cables (5 plugs).
3. Remove the DRIVE-CLiQ cables and connections on –X41 / –X42 (5 plugs).
4. Remove the retaining screws for the slide-in electronics unit (2 screws).
   When removing the slide-in electronics unit, you have to disconnect 5 further plugs one after the other (2 at the top, 3 below).

Caution

When removing the slide-in electronics unit, ensure that you do not damage any signal cables.

5. The control interface board can then be removed from the electronics slide-in unit.

Installation

To re-install the control interface board, carry out the above steps in reverse order.

Caution

The tightening torques specified in Table 8-1 must be observed

Carefully re-establish the plug connections and ensure that they are secure.

The screwed connections for the protective covers must only be tightened by hand.

8.4.11 Replacing the Fan, Active Line Module and Motor Module (Types FX, GX)

Replacing the fan

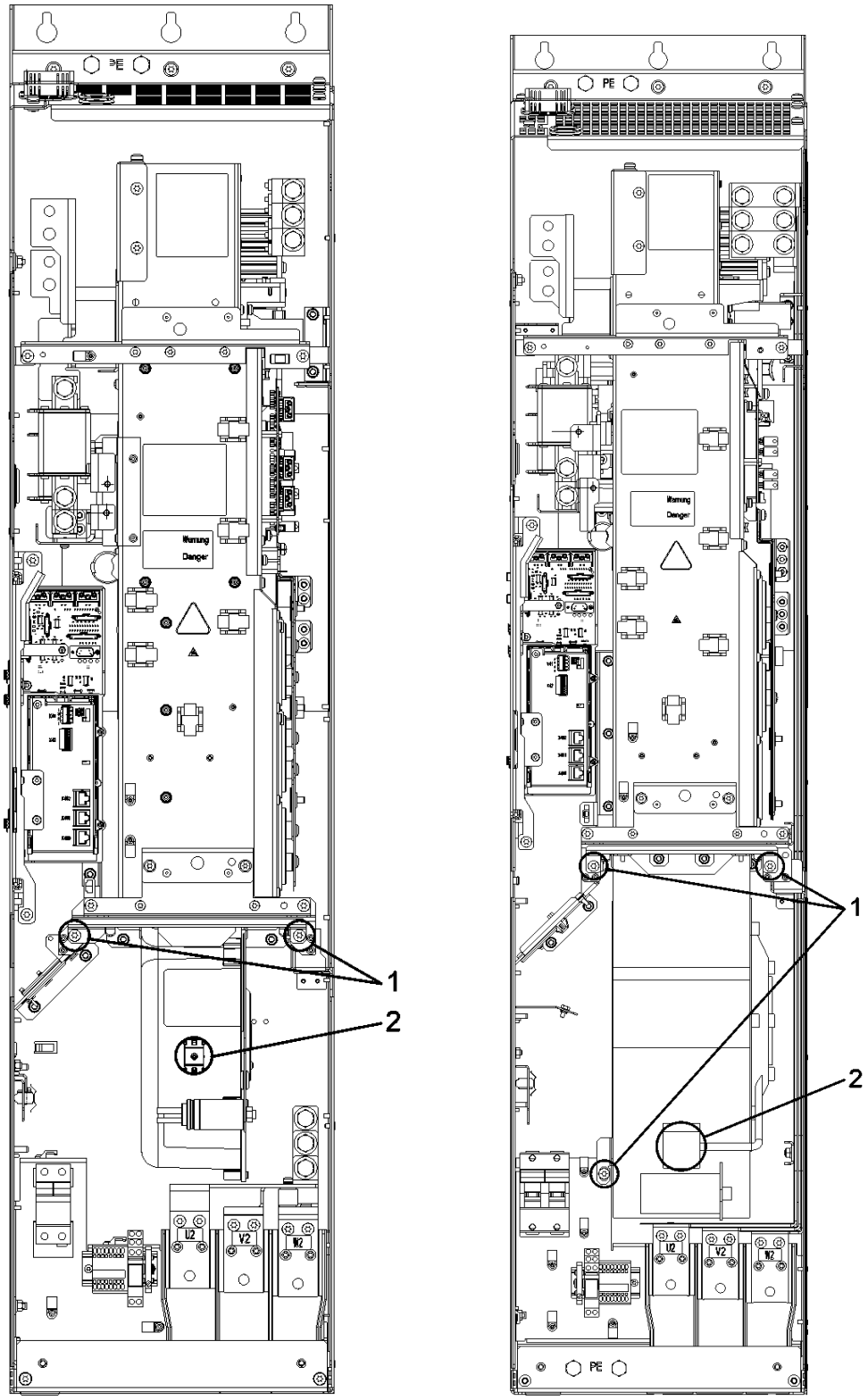


Fig. 8-13 Replacing the fan, Active Line Module and Motor Module (types FX and GX)

Description

The average service life of the device fans is 50,000 hours. In practice, however, the service life depends on other variables, including ambient temperature and the degree of cabinet protection and, therefore, may deviate from this value.

The fans must be replaced in good time to ensure that the device is available.

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access to the fan.
- Remove the front cover.

Removal

The steps for the removal procedure are numbered in accordance with Fig. 8-13.

1. Remove the retaining screws for the fan (2 for FX; 3 for GX).
2. Disconnect the supply cables (1x "L", 1X "N").
   You can now carefully remove the fan.

Caution

When removing the fan, ensure that the cables are not damaged.

Installation

To re-install the fan, carry out the above steps in reverse order.

Caution

The tightening torques specified in Table 8-1 must be observed

Carefully re-establish the plug connections and ensure that they are secure.

The screwed connections for the protective covers must only be tightened by hand.

8.4.12 Replacing the Fan, Active Line Module and Motor Module (Type HX)

Replacing the fan (left-hand power block)

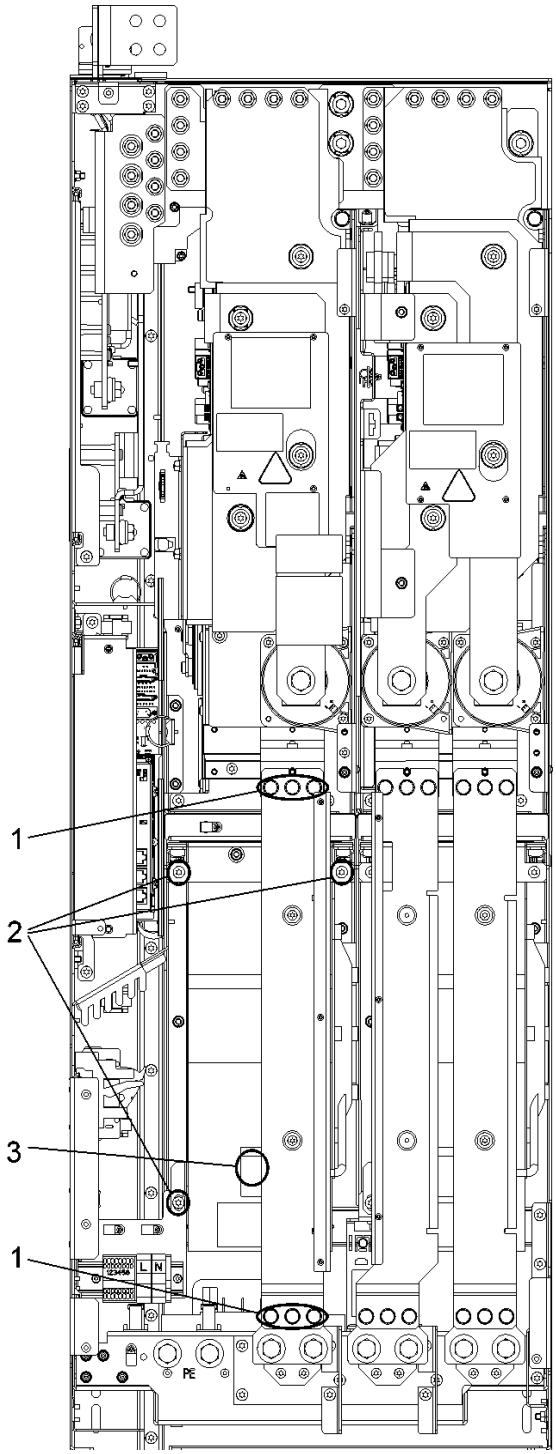


Fig. 8-14 Replacing the fan, Active Line Module and Motor Module (type HX) (left-hand power block)

Description

The average service life of the device fans is 50,000 hours. In practice, however, the service life depends on other variables, including ambient temperature and the degree of cabinet protection and, therefore, may deviate from this value.

The fans must be replaced in good time to ensure that the device is available.

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access to the fan.
- Remove the protective cover.

Removal

The steps for the removal procedure are numbered in accordance with Fig. 8-14.

1. Remove the copper bars (6 screws).
2. Remove the retaining screws for the fan (3 screws).
3. Disconnect the supply cables (1 x "L", 1 x "N").

Caution

When removing the fan, ensure that the cables are not damaged.

Installation

To re-install the fan, carry out the above steps in reverse order.

Caution

The tightening torques specified in Table 8-1 must be observed.

Carefully re-establish the plug connections and ensure that they are secure.

The screwed connections for the protective covers must only be tightened by hand.

Replacing the fan (right-hand power block)

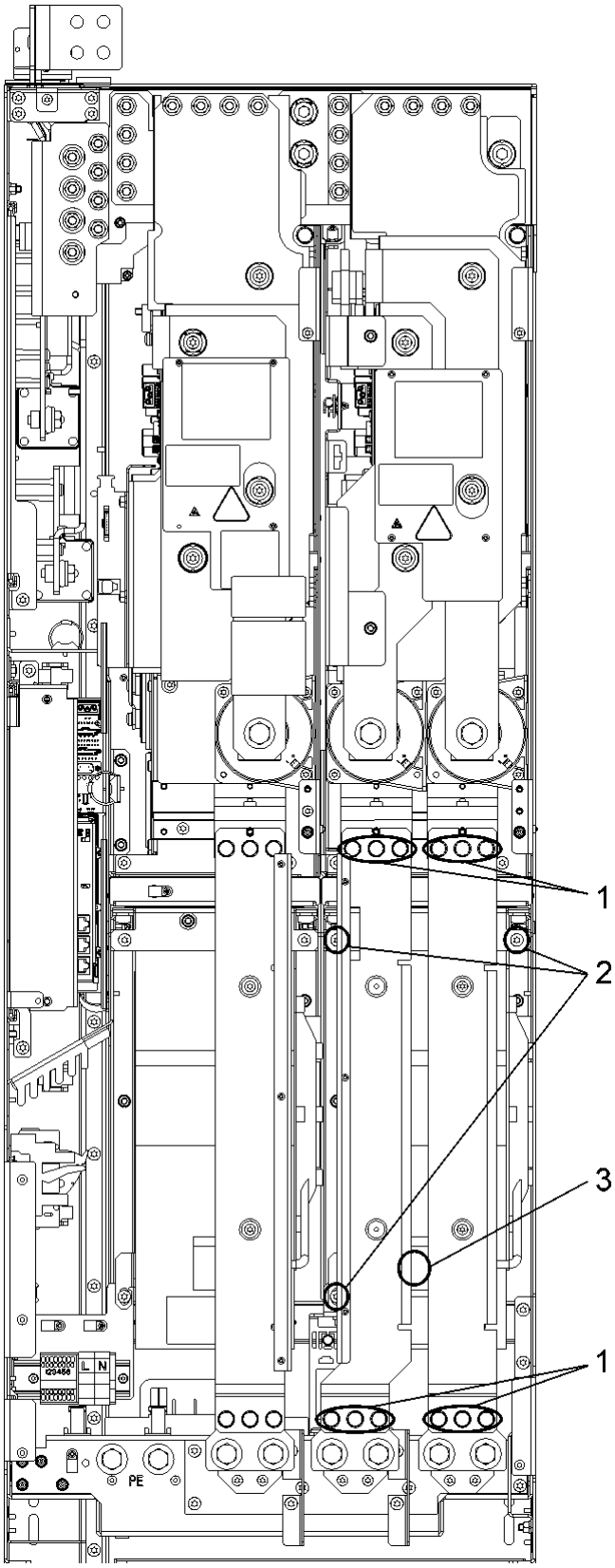


Fig. 8-15 Replacing the fan, Active Line Module and Motor Module (type HX) (right-hand power block)

Description

The average service life of the device fans is 50,000 hours. In practice, however, the service life depends on other variables, including ambient temperature and the degree of cabinet protection and, therefore, may deviate from this value.

The fans must be replaced in good time to ensure that the device is available.

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access to the fan.
- Remove the protective cover.

Removal

The steps for the removal procedure are numbered in accordance Fig. 8-15.

1. Remove the copper bars (12 screws).
2. Remove the retaining screws for the fan (3 screws).
3. Disconnect the supply cables (1 x "L", 1 x "N").

Caution

When removing the fan, ensure that the cables are not damaged.

Installation

To re-install the fan, carry out the above steps in reverse order.

Caution

The tightening torques specified in Table 8-1 must be observed.

Carefully re-establish the plug connections and ensure that they are secure.

The screwed connections for the protective covers must only be tightened by hand.

8.4.13 Replacing the Fan, Active Line Module and Motor Module (Type JX)

Replacing the fan

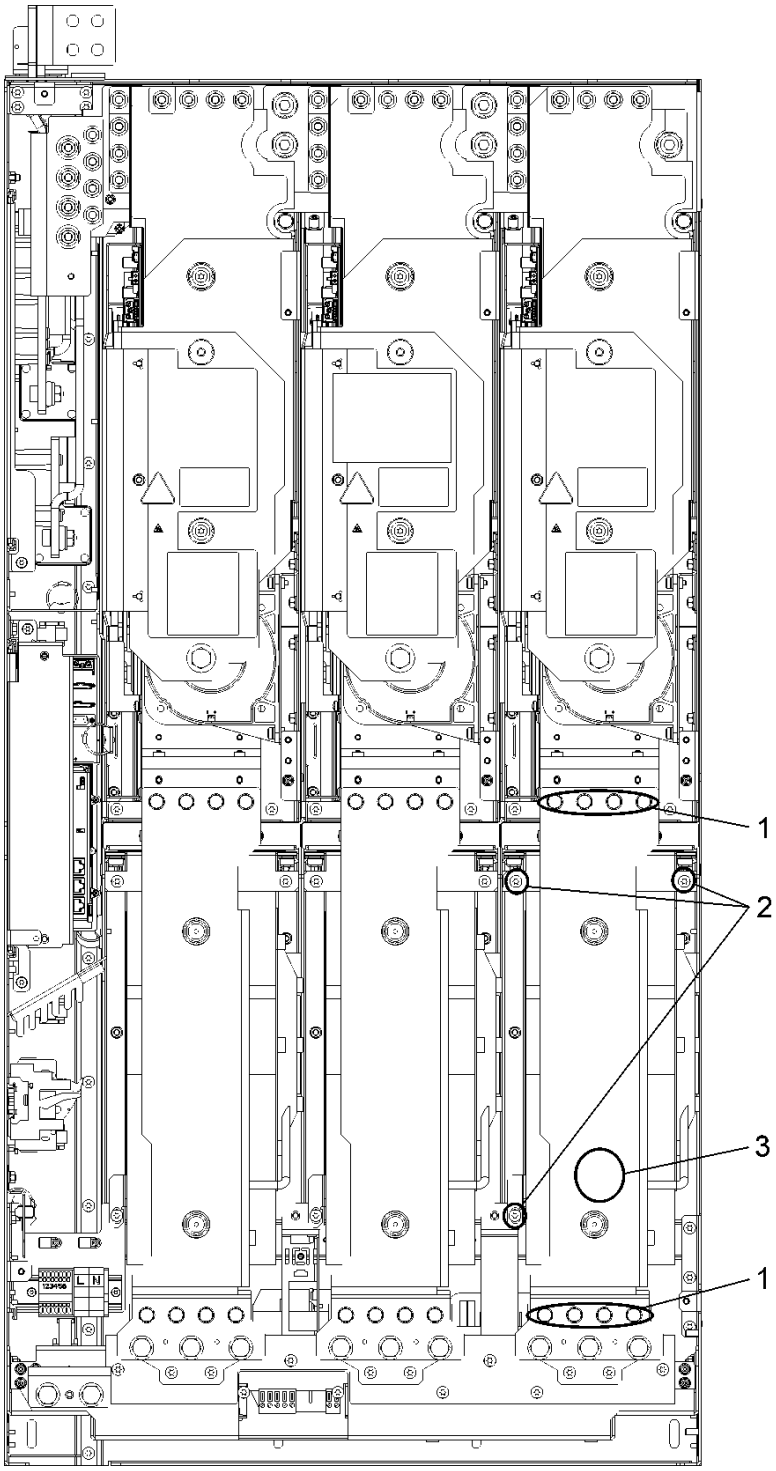


Fig. 8-16 Replacing the fan, Active Line Module and Motor Module (type JX)

Description

The average service life of the device fans is 50,000 hours. In practice, however, the service life depends on other variables, including ambient temperature and the degree of cabinet protection and, therefore, may deviate from this value.

The fans must be replaced in good time to ensure that the device is available.

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access to the fan.
- Remove the protective cover.

Removal

The steps for the removal procedure are numbered in accordance with Fig. 8-16.

1. Remove the copper bars (8 screws).
2. Remove the retaining screws for the fan (3 screws).
3. Disconnect the supply cables (1 x "L", 1 x "N").

Caution

When removing the fan, ensure that the cables are not damaged.

Installation

To re-install the fan, carry out the above steps in reverse order.

Caution

The tightening torques specified in Table 8-1 must be observed.

Carefully re-establish the plug connections and ensure that they are secure.

The screwed connections for the protective covers must only be tightened by hand.

8.4.14 Replacing the Fan, Active Interface Module (Type FI)

Replacing the fan

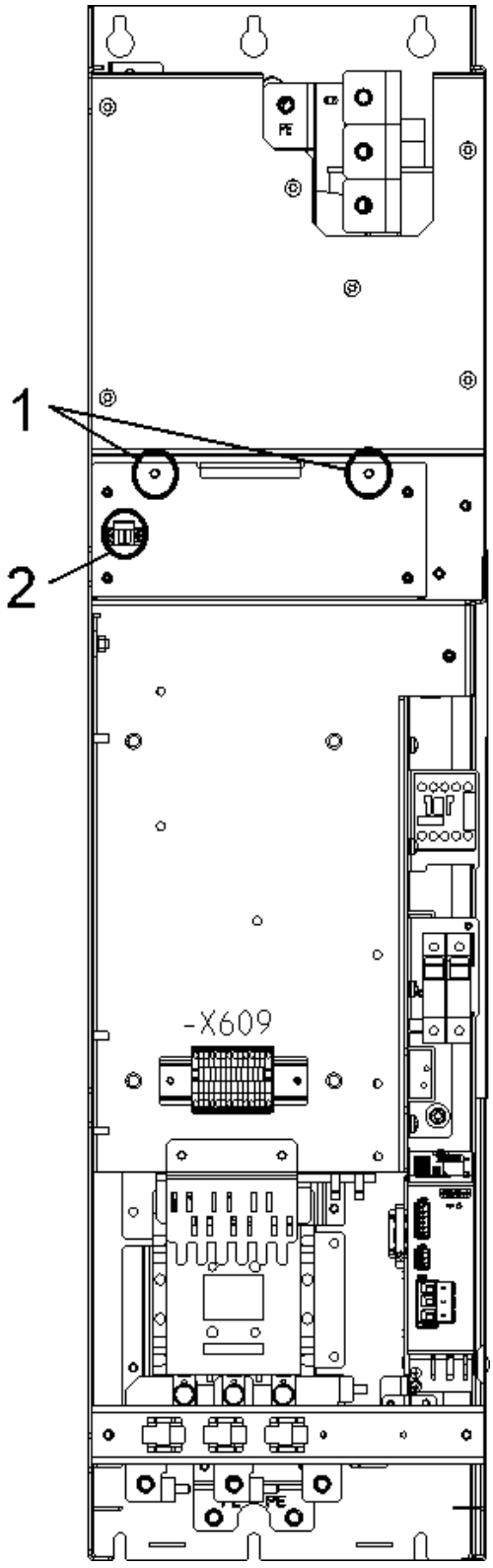


Fig. 8-17 Replacing the fan, Active Interface Module (type FI)

Description

The average service life of the device fans is 50,000 hours. In practice, however, the service life depends on other variables, including ambient temperature and the degree of cabinet protection and, therefore, may deviate from this value.

The fans must be replaced in good time to ensure that the device is available.

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access to the fan.
- Remove the protective cover.

Removal

The steps for the removal procedure are numbered in accordance with Fig. 8-17.

1. Remove the retaining screws for the fan unit (2 screws).
2. Unplug connector –X630.

Caution

When removing the fan, ensure that the cables are not damaged.

Installation

To re-install the fan, carry out the above steps in reverse order.

Caution

The tightening torques specified in Table 8-1 must be observed.

Carefully re-establish the plug connections and ensure that they are secure.

The screwed connections for the protective covers must only be tightened by hand.

8.4.15 Replacing the Fan, Active Interface Module (Type GI)

Replacing the fan

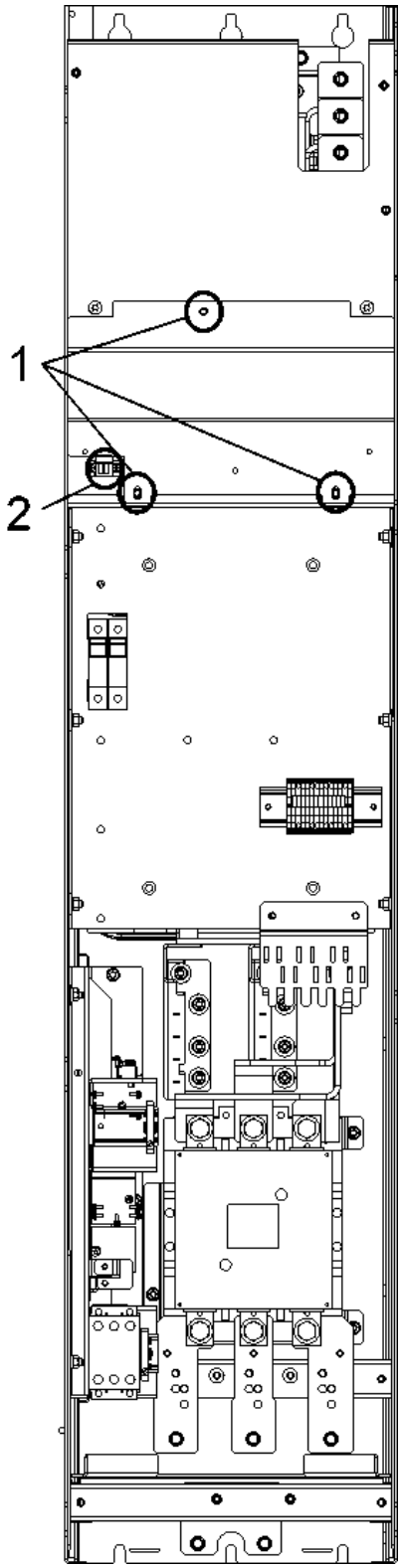


Fig. 8-18 Replacing the fan, Active Interface Module (type GI)

Description

The average service life of the device fans is 50,000 hours. In practice, however, the service life depends on other variables, including ambient temperature and the degree of cabinet protection and, therefore, may deviate from this value.

The fans must be replaced in good time to ensure that the device is available.

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access to the fan.
- Remove the protective cover.

Removal

The steps for the removal procedure are numbered in accordance with Fig. 8-18.

1. Remove the retaining screws for the fan unit (3 screws).
2. Unplug connector –X630.

Caution

When removing the fan, ensure that the cables are not damaged.

Installation

To re-install the fan, carry out the above steps in reverse order.

Caution

The tightening torques specified in Table 8-1 must be observed.

Carefully re-establish the plug connections and ensure that they are secure.

The screwed connections for the protective covers must only be tightened by hand.

8.4.16 Replacing the Fan, Active Interface Module (Type HI)

Replacing the fan

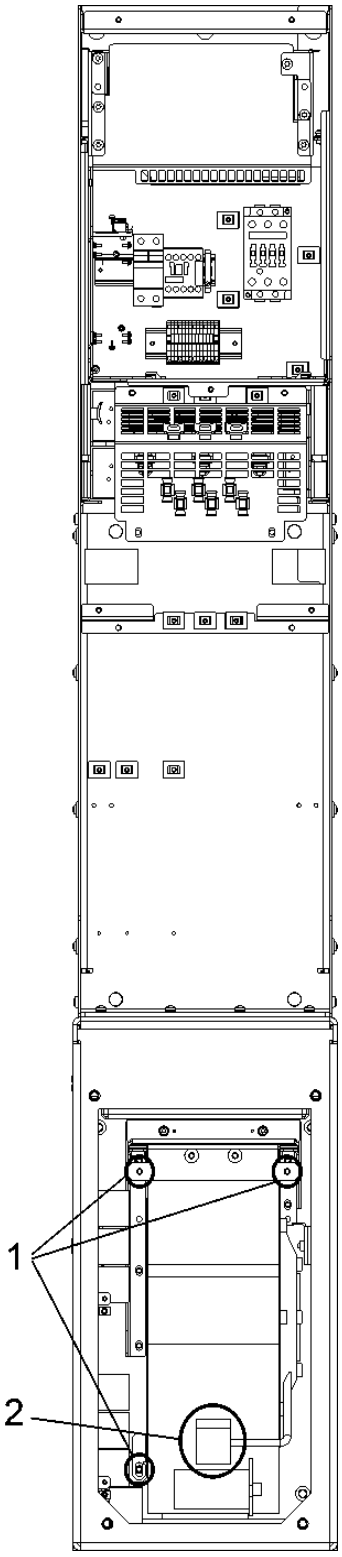


Fig. 8-19 Replacing the fan, Active Interface Module (type HI)

Description

The average service life of the device fans is 50,000 hours. In practice, however, the service life depends on other variables, including ambient temperature and the degree of cabinet protection and, therefore, may deviate from this value.

The fans must be replaced in good time to ensure that the device is available.

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access to the fan.
- Remove the protective cover.

Removal

The steps for the removal procedure are numbered in accordance with Fig. 8-19.

1. Remove the retaining screws for the fan unit (3 screws).
2. Disconnect the supply cables (1 x "L", 1 x "N").

Caution

When removing the fan, ensure that the cables are not damaged.

Installation

To re-install the fan, carry out the above steps in reverse order.

Caution

The tightening torques specified in Table 8-1 must be observed.

Carefully re-establish the plug connections and ensure that they are secure.

The screwed connections for the protective covers must only be tightened by hand.

8.4.17 Replacing the Fan, Active Interface Module (Type JI)

Replacing the fan

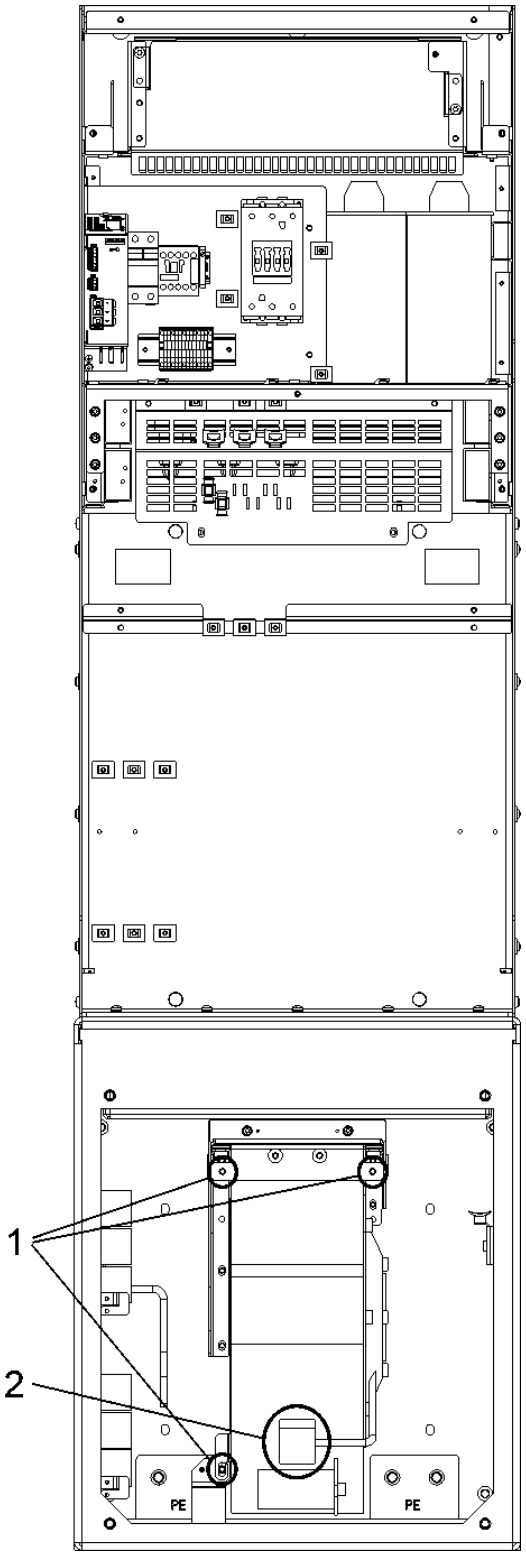


Fig. 8-20 Replacing the fan, Active Interface Module (type JI)

Description

The average service life of the device fans is 50,000 hours. In practice, however, the service life depends on other variables, including ambient temperature and the degree of cabinet protection and, therefore, may deviate from this value.

The fans must be replaced in good time to ensure that the device is available.

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access to the fan.
- Remove the protective cover.

Removal

The steps for the removal procedure are numbered in accordance with in Fig. 8-20.

1. Remove the retaining screws for the fan unit (3 screws).
2. Disconnect the supply cables (1 x "L", 1 x "N").

Caution

When removing the fan, ensure that the cables are not damaged.

Installation

To re-install the fan, carry out the above steps in reverse order.

Caution

The tightening torques specified in Table 8-1 must be observed.

Carefully re-establish the plug connections and ensure that they are secure.

The screwed connections for the protective covers must only be tightened by hand.

8.4.18 Replacing the Fan, Basic Line Module (Types FB, GB)

Replacing the fan

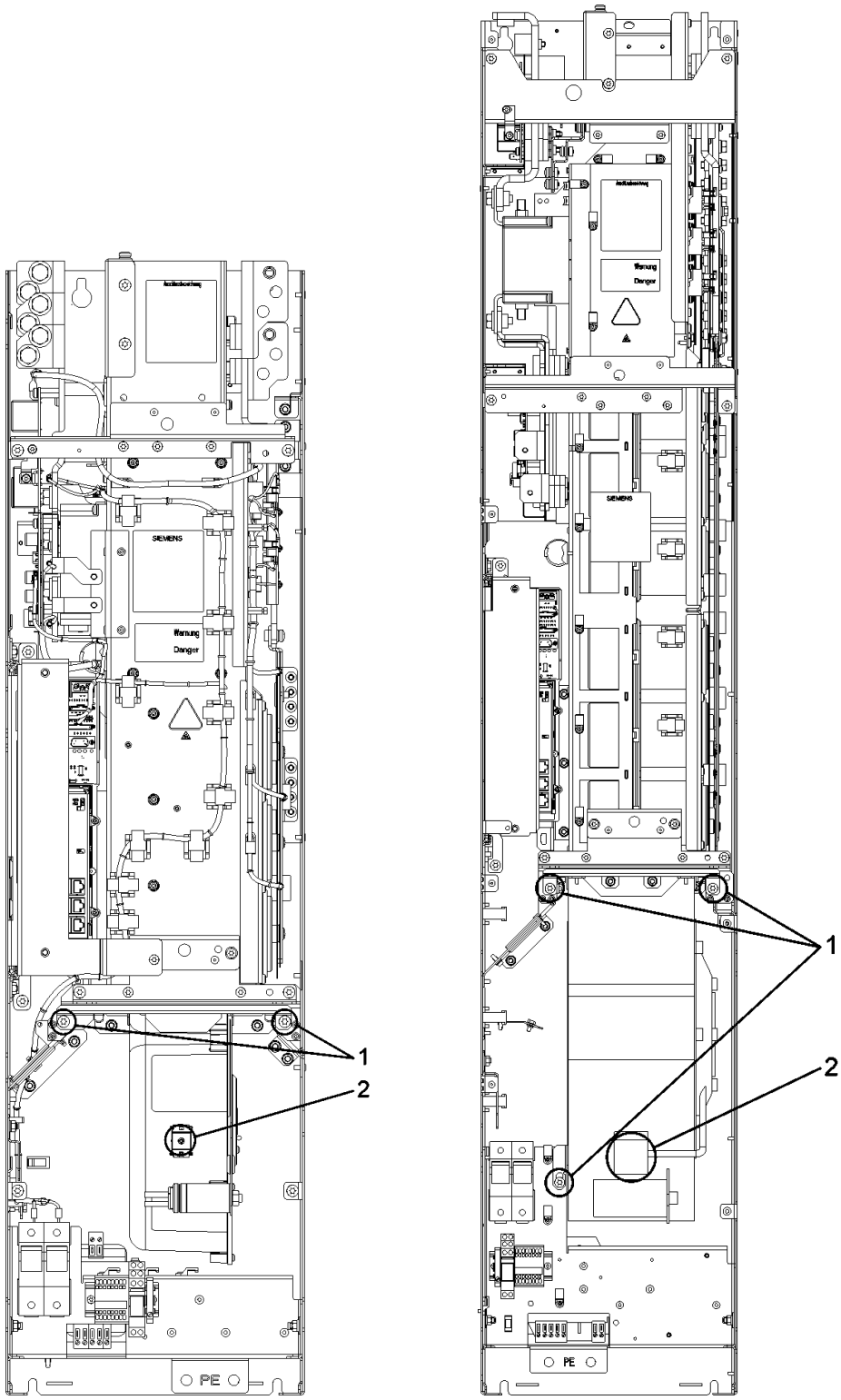


Fig. 8-21 Replacing the fan, Basic Line Module (types FB and GB)

Description

The average service life of the device fans is 50,000 hours. In practice, however, the service life depends on other variables, including ambient temperature and the degree of cabinet protection and, therefore, may deviate from this value.

The fans must be replaced in good time to ensure that the device is available.

Preparatory steps

- Disconnect the drive line-up from the power supply.
- Allow unimpeded access to the fan.
- Remove the front cover.

Removal

The steps for the removal procedure are numbered in accordance with Fig. 8-21.

1. Remove the retaining screws for the fan (2 for FB; 3 for GB).
2. Disconnect the supply cables (1x "L", 1X "N").

Caution

When removing the fan, ensure that the cables are not damaged.

Installation

To re-install the fan, carry out the above steps in reverse order.

Caution

The tightening torques specified in Table 8-1 must be observed.

Carefully re-establish the plug connections and ensure that they are secure.

The screwed connections for the protective covers must only be tightened by hand.

8.4.19 Replacing the Fan Fuses (-F10/-F11)

The order numbers for replacement fan fuses can be found in the spare parts list.

Warning

Make sure that the cause of the fault is found before the fuse is replaced.

8.5 Reforming the DC Link Capacitors

Description

If the Basic Line Module, Active Line Module, and Motor Module are kept in storage for more than two years, the DC link capacitors have to be reformed. If this is not carried out, the devices may be damaged when the supply voltage is switched on.

If the devices are commissioned within two years of their date of manufacture, the DC link capacitors do not need to be reformed. The date of manufacture is indicated in the serial number on the type plate (see "Technical Specifications").

Note

It is important that the period of storage is calculated as of the date of manufacture and not as of the delivery date.

Procedure

The DC link capacitors are reformed by applying the rated voltage without load for at least 30 minutes at room temperature.

Type plate

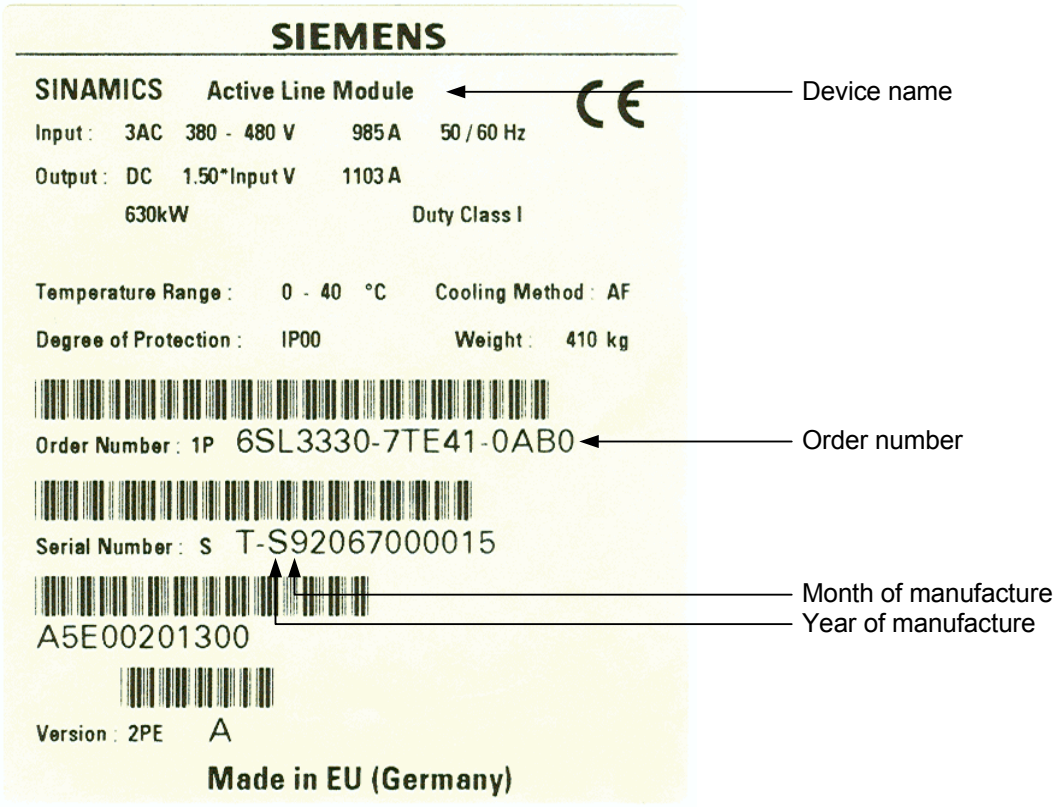


Fig. 8-22 Type plate for an Active Line Module

Date of manufacture

The date of manufacture can be ascertained as follows:

Table 8-2 Year and month of manufacture

Letter	Year of manufacture		Letter / number	Month of manufacture
S	2004		1 to 9	January to September
T	2005		O	October
U	2006		N	November
Y	2007		D	December

List of Abbreviations

9

9.1 List of Abbreviations

Table 9-1 List of abbreviations

Abbreviation	German	English
A		
A...	Warnung	Alarm
AC	Wechselstrom	Alternating Current
ADC	Analog-Digital-Konverter	Analog Digital Converter
AI	Analogeingang	Analog Input
AO	Analogausgang	Analog Output
AOP	Advanced Operator Panel	Advanced Operator Panel
ASCII	Amerikanische Code-Norm für den Informationsaustausch	American Standard Code for Information Interchange
B		
BB	Betriebsbedingung	Operating condition
BERO	Firmenname für einen Näherungsschalter	Tradename for a type of proximity switch
BI	Binektoreingang	Binector Input
BIA	Berufsgenossenschaftliches Institut für Arbeitssicherheit	Berufsgenossenschaftliches Institut für Arbeitssicherheit (German Institute for Occupational Safety)
BICO	Binektor-Konnektor-Technologie	Binector Connector Technology
BOP	Basic Operator Panel	Basic Operator Panel
C		
C	Kapazität	Capacity
CAN	Serielles Bussystem	Controller Area Network
CBC	Kommunikationsbaugruppe CAN	Communication Board CAN
CBP	Kommunikationsbaugruppe PROFIBUS	Communication Board PROFIBUS
CD	Compact Disc	Compact Disc
CDS	Befehlsdatensatz	Command Data Set
CI	Konnektoreingang	Connector Input
CIB	Control Interface Board	Control Interface Board
CNC	Computerunterstützte numerische Steuerung	Computer Numerical Control
CO	Konnektorausgang	Connector Output
CO/BO	Konnektor-/Binektorausgang	Connector/Binector Output
COM	Mittelkontakt eines Wechselkontaktes	Medium contact of a change-over contact
CP	Kommunikationsprozessor	Communications Processor

Abbreviation	German	English
CPU	Zentralbaugruppe	Central Processing Unit
CRC	Checksummenprüfung	Cyclic Redundancy Check
CT	Konstantes Drehmoment	Constant Torque
CU	Control Unit	Control Unit
D		
DAC	Digital-Analog-Konverter	Digital Analog Converter
DC	Gleichstrom	Direct Current
DCN	Gleichstrom negativ	Direct current negative
DCNA	Gleichstrom negativ Zusatzanschluss	Direct current negative auxiliary
DCP	Gleichstrom positiv	Direct current positive
DCPA	Gleichstrom positiv Zusatzanschluss	Direct current positive auxiliary
DDS	Antriebsdatensatz	Drive Data Set
DI	Digitaleingang	Digital Input
DI/DO	Digitaleingang/-ausgang bidirektional	Bidirectional Digital Input/Output
DMC	DRIVE-CLiQ Module Cabinet (Hub)	DRIVE-CLiQ Module Cabinet (Hub)
DO	Digitalausgang	Digital Output
DO	Antriebsobjekt	Drive Object
DPRAM	Speicher mit beidseitigem Zugriff	Dual Ported Random Access Memory
DRAM	Dynamischer Speicher	Dynamic Random Access Memory
DRIVE-CLiQ	Drive Component Link with IQ	Drive Component Link with IQ
DSC	Dynamic Servo Control	Dynamic Servo Control
E		
EDS	Geberdatensatz	Encoder Data Set
EGB	Elektrostatisch gefährdete Baugruppen	Electrostatic Sensitive Devices (ESD)
EMV	Elektromagnetische Verträglichkeit	Electromagnetic Compatibility (EMC)
EN	Europäische Norm	European Standard
EnDat	Geber-Schnittstelle	Encoder-Data-Interface
EP	Impulsfreigabe	Enable Pulses
ES	Engineering System	Engineering System
F		
F ...	Störung	Fault
FAQ	Häufig gestellte Fragen	Frequently Asked Questions
FCC	Function Control Chart	Function Control Chart
FCC	Flussstromregelung	Flux Current Control
FEPROM	Schreib- und Lesespeicher nichtflüchtig	Flash-EPROM
FG	Funktionsgenerator	Function Generator
FI	Fehlerstrom-Schutzschalter	Earth Leakage Circuit-Breaker (ELCB)
Float	Gleitkommazahl	Floating Point
FP	Funktionsplan	Function diagram
FW	Firmware	Firmware
G		
GCP	Global-Control-Telegramm (Broadcast-Telegramm)	Global Control Telegram (Broadcast-Telegramm)
GSD	Gerätestammdatei: beschreibt die Merkmale eines PROFIBUS-Slaves	Device master file: describes the features of a PROFIBUS slave

Abbreviation	German	English
H		
HLG	Hochlaufgeber	Ramp-function generator
HMI	Mensch-Maschine-Schnittstelle	Human Machine Interface
HTL	Hochpegellogik	High Threshold-Logic
HW	Hardware	Hardware
I		
i. V.	in Vorbereitung: diese Eigenschaft steht zur Zeit nicht zur Verfügung	in preparation: this feature is currently not available
IBN	Inbetriebnahme	Commissioning
I/O	Eingang/Ausgang	Input/Output
ID	Identifizierung	Identifier
IEC	Internationale Norm in der Elektrotechnik	International Electrotechnical Commission
IGBT	Bipolartransistor mit isolierter Steuerelektrode	Insulated Gate Bipolar Transistor
IT	Drehstromversorgungsnetz ungeerdet	three-phase supply network, ungrounded
J		
JOG	Tippen	Jogging
K		
KDV	Kreuzweiser Datenvergleich	Data cross-checking
KIP	Kinetische Pufferung	Kinetic buffering
KTY	Spezieller Temperatursensor	Special temperature sensor
L		
L	Induktivität	Inductance
LED	Leuchtdiode	Light Emitting Diode
LSB	Niederwertigstes Bit	Least Significant Bit
M		
M	Masse	reference potential, zero potential
MB	Megabyte	Megabyte
MCC	Motion Control Chart	Motion Control Chart
MDS	Motordatensatz	Motor Data Set
MLFB	Maschinenlesbare Fabrikatebezeichnung	machine-readable product designation
MMC	Mensch Maschine Kommunikation	Man-Machine Communication
MSB	Höchstwertigstes Bit	Most significant Bit
MSCY_C1	Zyklische Kommunikation zwischen Master (Klasse 1) und Slave	Master Slave Cycle Class 1
N		
NC	Öffner	Normaly Closed contact
NC	Numerische Steuerung	Numerical Control
NEMA	Normengremium in USA (United States of America)	National Electrical Manufacturers Association
NM	Nullmarke	Zero Mark
NO	Schliesser	Normaly Open contact
O		
OEM	Original Equipment Manufacturer	Original Equipment Manufacturer
OLP	Busstecker für Lichtleiter	Optical Link Plug
OMI	Option Module Interface	Option Module Interface

Abbreviation	German	English
P		
p ...	Einstellparameter	Adjustable parameter
PDS	Leistungsteildatensatz	Power Module Data Set
PE	Schutzerde	Protective Earth
PELV	Schutzkleinspannung	Protective Extra Low Voltage
PG	Programmiergerät	Programming terminal
PI	Proportional Integral	Proportional Integral
PLC	Speicherprogrammierbare Steuerung (SPS)	Programmable Logical Controller
PLL	Baustein zur Synchronisierung	Phase locked Loop
PNO	PROFIBUS Nutzerorganisation	PROFIBUS user organisation
PRBS	Weißes Rauschen	Pseudo Random Binary Signal
PROFIBUS	Serieller Datenbus	Process Field Bus
PS	Stromversorgung	Power Supply
PTC	Positiver Temperaturkoeffizient	Positive Temperature Coeffizient
PTP	Punkt zu Punkt	Point to Point
PWM	Pulsweitenmodulation	Pulse Width Modulation
PZD	PROFIBUS Prozessdaten	PROFIBUS Process data
Q		
R		
r ...	Beobachtungsparameter (nur lesbar)	Display Parameter (read only)
RAM	Speicher zum lesen und schreiben	Random Access Memory
RCD	Fehlerstrom-Schutzschalter	Residual Current Device
RJ45	Norm. Beschreibt eine 8-polige Steckverbindung mit Twisted-Pair Ethernet.	Standard. Describes an 8-pole plug connector with twisted pair Ethernet.
RO	Nur lesbar	Read Only
RS232	Serielle Schnittstelle	Serial Interface
RS485	Norm. Beschreibt die Physik einer digitalen seriellen Schnittstelle.	Standard. Describes the physical characteristics of a digital serial interface.
S		
S1	Dauerbetrieb	Continuous operation
S3	Aussetzbetrieb	periodic duty
SBC	Sichere Bremsenansteuerung	Safe Brake Control
SGE	Sicherheitsgerichtetes Eingangssignal	Safe input signal
SH	Sicherer Halt	Safe Standstill
SI	Safety Integrated	Safety Integrated
SIL	Sicherheitsintegritätsgrad	Safety Integrity Level
SLVC	Geberlose Vektorregelung	Sensorless Vector Control
SM	Sensor Module	Sensor Module
SMC	Sensor Module Cabinet	Sensor Module Cabinet
SME	Sensor Module External	Sensor Module External
SPS	Speicherprogrammierbare Steuerung	Programmable Logic Controller (PLC)
STW	PROFIBUS Steuerwort	PROFIBUS controlword
T		
TB	Terminal Board	Terminal Board
TIA	Totally Integrated Automation	Totally Integrated Automation

Abbreviation	German	English
TM	Terminal Module	Terminal Module
TN	Drehstromversorgungsnetz geerdet	Three-phase supply network, grounded
TT	Drehstromversorgungsnetz geerdet	Three-phase supply network, grounded
TTL	Transistor-Transistor-Logik	Transistor-Transistor-Logik
U		
UL	Underwriters Laboratories Inc.	Underwriters Laboratories Inc.
V		
VC	Vektorregelung	Vector Control
Vdc	Zwischenkreisspannung	DC link voltage
VDE	Verband Deutscher Elektrotechniker	Association of German Electrical Engineers
VDI	Verein Deutscher Ingenieure	Association of German Engineers
VSM	Voltage Sensing Module	Voltage Sensing Module
VT	Variables Drehmoment	Variable Torque
W		
WZM	Werkzeugmaschine	Machine tool
X		
XML	Erweiterbare Auszeichnungssprache (Standardsprache für Web-Publishing und Dokumentenmanagement)	Extensible Markup Language
Y		
Z		
ZK	Zwischenkreis	DC link
ZSW	PROFIBUS Zustandswort	PROFIBUS statusword

References

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10.1 References

SINAMICS Documentation

Catalogs

/D11.1/ SINAMICS G110 Converter Chassis Units 0.12 kW to 3 kW
Order no.: E86060-K5511-A111-A1-7600, edition: 12/2003

/D11/ SINAMICS G130 Converter Chassis Units, SINAMICS G150 Converter Cabinet Units
Order no.: E86060-K5511-A101-A2-7600, edition: 07/2004

/D21.1/ SINAMICS S120 Vector Control Drive System
Order no.: E86060-K5521-A111-A1-7600, edition: 01/2005

/D21.2/ SINAMICS S120 Servo Control Drive System
Order no.: E86060-K5521-A121-A1-7600, edition: 04/2004

/D21.3/ SINAMICS S150 Converter Cabinet Units 75 kW to 1200 kW
Order no.: E86060-K5521-A131-A1-7600, edition: 05/2004

Related catalogs

/ST70/ SIMATIC Products for Totally Integrated Automation, Catalog ST70
Order no.: E86060-K4670-A111-A9-7600, edition: 10/2004

/PM10/ SIMOTION Motion Control System, Catalog PM10
Order no.: E86060-K4910-A101-A4-7600, edition: 04/2003

Interactive catalogs

/CA01/ The Offline Mall from Automation and Drives
CD-ROM
Order no.: E86060-D4001-A100-C3-7600, edition: 10/2004

/Mall/ A&D Mall, Catalog and Online Order System
http://www.siemens.com/automation/mall

Electronic documentation

/CD2/ SINAMICS
The SINAMICS System
Order no.: 6SL3097-2CA00-0YG1, edition: 12/2004

User documentation

/BA1/ SINAMICS G150
Operating Instructions
Order no.: on request, edition: 12/2004

/BA2/ SINAMICS G130
Operating Instructions
Order no.: on request, edition: 12/2004

/BA3/ SINAMICS S150
Operating Instructions
Order no.: on request, edition: 12/2004

/GH1/ SINAMICS S120
Equipment Manual Control Units and Additional System Components
Order no.: 6SL3097-2AH00-0BP1, edition: 12/2004

/GH2/ SINAMICS S120
Equipment Manual Booksize Power Sections
Order no.: 6SL3097-2AC00-0BP1, edition: 12/2004

/GH3/ SINAMICS S120
Equipment Manual Chassis Power Sections
Order no.: 6SL3097-2AE00-0BP0, edition: 12/2004

/GH4/ SINAMICS S120
Equipment Manual Booksize Power Sections Cold Plate
Order no.: 6SL3097-2AJ00-0BP1, edition: 12/2004

/GS1/ SINAMICS S120
Getting Started
Order no.: 6SL3097-2AG00-0BP1, edition: 12/2004

/IH1/ SINAMICS S120
Installation and Start-Up Manual
Order no.: 6SL3097-2AF00-0BP2, edition: 12/2004

/FH1/ SINAMICS S120
Function Manual
Order no.: 6SL3097-2AA00-0BP1, edition: 12/2004

/LH1/ SINAMICS S120
List Manual
Order no.: 6SL3097-2AP00-0BP2, edition: 12/2004

Further supplementary documentation

DRIVE ES Basic V5.1
Description of Functions
Engineering System for drives from the Siemens A&D Product Range
Order no.: 6SW1 700-0JA00-0AA0, edition 08/2001

SIMOTION Engineering System
Use
Order no.: 6AU1900-1AB31-0AA0, edition: 01/2004

PROFIBUS documentation

/P1/ PROFIBUS-DP/DPV1 IEC 61158
Basic Information, Tips and Tricks for Users
Hüthig; Manfred Popp; 2nd edition
ISBN 3-7785-2781-9

/P2/ PROFIBUS-DP, Getting Started
PROFIBUS User Organization; Manfred Popp
Order no.: 4.071

/P3/ Decentralization with PROFIBUS-DP
Architecture and Fundamentals, Configuration and Use of PROFIBUS-DP with SIMATIC S7
SIEMENS; Publicis MCD Verlag; Josef Weigmann, Gerhard Kilian
Order no.: A19100-L531-B714
ISBN 3-89578-074-X

/P4/ Manual for PROFIBUS Networks, SIEMENS
Order no.: 6GK1970-5CA20-0AA0

/P5/ PROFIBUS Profile PROFIdrive Profile Drive Technology
PROFIBUS User Organization
Haid- und Neu-Straße 7, D-76131 Karlsruhe
Order no.: 3.172 Version 3.1 November 2002

/IKPI/ SIMATIC NET, Industrial Communication and Field Devices
Catalog
Order no.: E86060-K6710-A101-B4, edition: 2005

/PDP/ PROFIBUS Installation Guideline
Installation Guideline for PROFIBUS-FMS/DP
Installation and Wiring Recommendation for RS 485 Transmission
Order no. 2.111 (German), Version 1.0
Order no. 2.112 (English), Version 1.0

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Germany

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Bestell-Nr.: 6SL3097-2AE00-0BP0

Printed in Germany