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Inverter SINAMICS G120

Power Modules PM240-2, IP20 / Push Through Technology (PT)

Hardware Installation Manual

Edition 01/2015

Answers for industry.

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SINAMICS G120
Power Module PM240-2

Hardware Installation Manual

01/2015

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A5E33294624B AB

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

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

⚠WARNING
indicates that death or severe personal injury **may** result if proper precautions are not taken.

⚠CAUTION
indicates that minor personal injury can result if proper precautions are not taken.

NOTICE
indicates that property damage can result if proper precautions are not taken.

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

Qualified Personnel

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

Proper use of Siemens products

Note the following:

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

Trademarks

Disclaimer of Liability

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

Siemens AG
Division Digital Factory
Postfach 48 48
90026 NÜRNBERG
GERMANY

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Changes in this manual

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With respect to the PM240-2 Power Modules Manual, Edition 01/2014

The description of the Power Modules has been revised, and the new FSD up to FSE Power Modules inserted.

The new PM240-2 FSD … FSE Power Modules differ from the PM240 devices both regarding the dimensions as well as the connection system. The braking resistor and the DC link are connected at the top.

Further, frame sizes FSD … FSE are equipped with the STO safety-related function, independent of the Control Unit.

Fundamental safety instructions 2

2.1 General safety instructions

⚠ DANGER

Danger to life due to live parts and other energy sources

Death or serious injury can result when live parts are touched.

- Only work on electrical devices when you are qualified for this job.
- Always observe the country-specific safety rules.

Generally, six steps apply when establishing safety:

1. Prepare for shutdown and notify all those who will be affected by the procedure.
2. Disconnect the machine from the supply.
   - Switch off the machine.
   - Wait until the discharge time specified on the warning labels has elapsed.
   - Check that it really is in a no-voltage condition, from phase conductor to phase conductor and phase conductor to protective conductor.
   - Check whether the existing auxiliary supply circuits are de-energized.
   - Ensure that the motors cannot move.
3. Identify all other dangerous energy sources, e.g. compressed air, hydraulic systems, or water.
4. Isolate or neutralize all hazardous energy sources by closing switches, grounding or short-circuiting or closing valves, for example.
5. Secure the energy sources against switching on again.
6. Ensure that the correct machine is completely interlocked.

After you have completed the work, restore the operational readiness in the inverse sequence.

⚠ WARNING

Danger to life through a hazardous voltage when connecting an unsuitable power supply

Touching live components can result in death or severe injury.

- Only use power supplies that provide SELV (Safety Extra Low Voltage) or PELV- (Protective Extra Low Voltage) output voltages for all connections and terminals of the electronics modules.

⚠WARNING

Danger to life when live parts are touched on damaged devices

Improper handling of devices can cause damage.

For damaged devices, hazardous voltages can be present at the enclosure or at exposed components; if touched, this can result in death or severe injury.

- Ensure compliance with the limit values specified in the technical data during transport, storage and operation.
- Do not use any damaged devices.

⚠WARNING

Danger to life through electric shock due to unconnected cable shields

Hazardous touch voltages can occur through capacitive cross-coupling due to unconnected cable shields.

- As a minimum, connect cable shields and the conductors of power cables that are not used (e.g. brake cores) at one end at the grounded housing potential.

⚠WARNING

Danger to life due to electric shock when not grounded

For missing or incorrectly implemented protective conductor connection for devices with protection class I, high voltages can be present at open, exposed parts, which when touched, can result in death or severe injury.

- Ground the device in compliance with the applicable regulations.

⚠WARNING

Danger to life due to electric shock when opening plug connections in operation

When opening plug connections in operation, arcs can result in severe injury or death.

- Only open plug connections when the equipment is in a no-voltage state, unless it has been explicitly stated that they can be opened in operation.

⚠WARNING

Danger to life due to fire spreading if housing is inadequate

Fire and smoke development can cause severe personal injury or material damage.

- Install devices without a protective housing in a metal control cabinet (or protect the device by another equivalent measure) in such a way that contact with fire is prevented.
- Ensure that smoke can only escape via controlled and monitored paths.

⚠WARNING

Danger to life through unexpected movement of machines when using mobile wireless devices or mobile phones

Using mobile wireless devices or mobile phones with a transmit power > 1 W closer than approx. 2 m to the components may cause the devices to malfunction, influence the functional safety of machines therefore putting people at risk or causing material damage.

- Switch the wireless devices or mobile phones off in the immediate vicinity of the components.

⚠WARNING

Danger to life due to the motor catching fire in the event of insulation overload

There is higher stress on the motor insulation through a ground fault in an IT system. If the insulation fails, it is possible that death or severe injury can occur as a result of smoke and fire.

- Use a monitoring device that signals an insulation fault.
- Correct the fault as quickly as possible so the motor insulation is not overloaded.

⚠WARNING

Danger to life due to fire if overheating occurs because of insufficient ventilation clearances

Inadequate ventilation clearances can cause overheating of components with subsequent fire and smoke. This can cause severe injury or even death. This can also result in increased downtime and reduced service lives for devices/systems.

- Ensure compliance with the specified minimum clearance as ventilation clearance for the respective component.

⚠WARNING

Danger of an accident occurring due to missing or illegible warning labels

Missing or illegible warning labels can result in accidents involving death or serious injury.

- Check that the warning labels are complete based on the documentation.
- Attach any missing warning labels to the components, in the national language if necessary.
- Replace illegible warning labels.

NOTICE

Device damage caused by incorrect voltage/insulation tests

Incorrect voltage/insulation tests can damage the device.

- Before carrying out a voltage/insulation check of the system/machine, disconnect the devices as all converters and motors have been subject to a high voltage test by the manufacturer, and therefore it is not necessary to perform an additional test within the system/machine.

⚠WARNING

Danger to life when safety functions are inactive

Safety functions that are inactive or that have not been adjusted accordingly can cause operational faults on machines that could lead to serious injury or death.

- Observe the information in the appropriate product documentation before commissioning.
- Carry out a safety inspection for functions relevant to safety on the entire system, including all safety-related components.
- Ensure that the safety functions used in your drives and automation tasks are adjusted and activated through appropriate parameterizing.
- Perform a function test.
- Only put your plant into live operation once you have guaranteed that the functions relevant to safety are running correctly.

Note

Important safety notices for Safety Integrated functions

If you want to use Safety Integrated functions, you must observe the safety notices in the Safety Integrated manuals.

2.2 Safety instructions for electromagnetic fields (EMF)

⚠WARNING

Danger to life from electromagnetic fields

Electromagnetic fields (EMF) are generated by the operation of electrical power equipment such as transformers, converters or motors.

People with pacemakers or implants are at a special risk in the immediate vicinity of these devices/systems.

- Ensure that the persons involved are the necessary distance away (minimum 2 m).

2.3 Handling electrostatic sensitive devices (ESD)

Electrostatic sensitive devices (ESD) are individual components, integrated circuits, modules or devices that may be damaged by either electric fields or electrostatic discharge.

NOTICE

Damage through electric fields or electrostatic discharge

Electric fields or electrostatic discharge can cause malfunctions through damaged individual components, integrated circuits, modules or devices.

- Only pack, store, transport and send electronic components, modules or devices in their original packaging or in other suitable materials, e.g conductive foam rubber of aluminum foil.
- Only touch components, modules and devices when you are grounded by one of the following methods:
  - Wearing an ESD wrist strap
  - Wearing ESD shoes or ESD grounding straps in ESD areas with conductive flooring
- Only place electronic components, modules or devices on conductive surfaces (table with ESD surface, conductive ESD foam, ESD packaging, ESD transport container).

2.4 Industrial security

Note

Industrial security

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, solutions, machines, equipment and/or networks. They are important components in a holistic industrial security concept. With this in mind, Siemens' products and solutions undergo continuous development. Siemens recommends strongly that you regularly check for product updates.

For the secure operation of Siemens products and solutions, it is necessary to take suitable preventive action (e.g. cell protection concept) and integrate each component into a holistic, state-of-the-art industrial security concept. Third-party products that may be in use should also be considered. For more information about industrial security, visit Hotspot-Text (http://www.siemens.com/industrialsecurity).

To stay informed about product updates as they occur, sign up for a product-specific newsletter. For more information, visit Hotspot-Text (http://support.automation.siemens.com).

⚠WARNING

Danger as a result of unsafe operating states resulting from software manipulation

Software manipulation (e.g. by viruses, Trojan horses, malware, worms) can cause unsafe operating states to develop in your installation which can result in death, severe injuries and/or material damage.

- Keep the software up to date.

  You will find relevant information and newsletters at this address (http://support.automation.siemens.com).
- Incorporate the automation and drive components into a holistic, state-of-the-art industrial security concept for the installation or machine.

  You will find further information at this address (http://www.siemens.com/industrialsecurity).
- Make sure that you include all installed products into the holistic industrial security concept.

2.5 Residual risks of power drive systems

The control and drive components of a drive system are approved for industrial and commercial use in industrial line supplies. Their use in public line supplies requires a different configuration and/or additional measures.

These components may only be operated in closed housings or in higher-level control cabinets with protective covers that are closed, and when all of the protective devices are used.

These components may only be handled by qualified and trained technical personnel who are knowledgeable and observe all of the safety instructions on the components and in the associated technical user documentation.

When assessing the machine's risk in accordance with the respective local regulations (e.g., EC Machinery Directive), the machine manufacturer must take into account the following residual risks emanating from the control and drive components of a drive system:

1. Unintentional movements of driven machine components during commissioning, operation, maintenance, and repairs caused by, for example,
   - Hardware and/or software errors in the sensors, control system, actuators, and cables and connections
   - Response times of the control system and of the drive
   - Operation and/or environmental conditions outside the specification
   - Condensation/conductive contamination
   - Parameterization, programming, cabling, and installation errors
   - Use of wireless devices/mobile phones in the immediate vicinity of the control system
   - External influences/damage
2. In the event of a fault, exceptionally high temperatures, including an open fire, as well as emissions of light, noise, particles, gases, etc. can occur inside and outside the inverter, e.g.:
   - Component failure
   - Software errors
   - Operation and/or environmental conditions outside the specification
   - External influences/damage

   Inverters of the Open Type/IP20 degree of protection must be installed in a metal control cabinet (or protected by another equivalent measure) such that contact with fire inside and outside the inverter is not possible.

3. Hazardous shock voltages caused by, for example,
   - Component failure
   - Influence during electrostatic charging
   - Induction of voltages in moving motors
   - Operation and/or environmental conditions outside the specification
   - Condensation/conductive contamination
   - External influences/damage
4. Electrical, magnetic and electromagnetic fields generated in operation that can pose a risk to people with a pacemaker, implants or metal replacement joints, etc., if they are too close
5. Release of environmental pollutants or emissions as a result of improper operation of the system and/or failure to dispose of components safely and correctly

Note

The components must be protected against conductive contamination (e.g. by installing them in a control cabinet with degree of protection IP54 according to IEC 60529 or NEMA 12).

Assuming that conductive contamination at the installation site can definitely be excluded, a lower degree of cabinet protection may be permitted.

For more information about residual risks of the components in a drive system, see the relevant sections in the technical user documentation.

Introduction 3

Overview

The PM240-2 Power Modules belong to the modular family of SINAMICS G120 inverters. A G120 inverter comprising Control Unit and Power Module.

Depending on the power rating in frame sizes FSA … FSE, the following Power Module versions are supplied:

- 1 AC 200 V 0.55 kW … 4 kW for line voltages from 1 AC 200 V … 240 V
- 3 AC 200 V 0.55 kW … 30 kW for line voltages from 3 AC 200 V … 240 V
- 3 AC 400 V 0.55 kW … 55 kW for line voltages from 3 AC 380 V … 480 V
- 3 AC 690 V 11 kW … 55 kW for line voltages from 3 AC 500 V … 690 V

You can operate the Power Modules, frame sizes FSA …FSC, with the following Control Units from firmware version 4.4 and higher.

For the FSD and FSE Power Modules, you require a Control Unit with firmware version 4.7. HF8 or higher.

- CU230P-2
- CU240B-2
- CU240E-2
- CU250S-2

Note

Commissioning the inverter

You must first commission the inverter before you can use it. Commissioning is described in the operating instructions of the relevant Control Unit. Please refer to the List Manual of the Control Unit for additional information on the inverter. See also Manuals for your inverter (Page 111)

STO independent of the Control Unit

Using the PM240-2 Power Modules, frame sizes FSD and FSE, you can implement the "Safe Torque Off" safety function (STO), corresponding to PL e according to EN 13849-1 and SIL 3 according to IEC61508. For details, see STO via Power Module terminals (Page 42).

3.1 Component specification according to UL

The components of the SINAMICS G120 product family are UL-certified. The certification is indicated on the products using the UL Listing Mark. You can find proof of the certification on the Internet UL certificates (http://www.ul.com) under "Tools / Online Certifications Directory" by entering the file number or the "Name".

The UL file number for the Power Modules of the SINAMICS G120 product family is:

- E121068 for FSA, FSB and FSC
- E192450 for FSD and FSE

3.2 Permissible power range of the motors

For the 200 V Power Modules, induction motors are permissible in the range from 25 % … 150 % of the inverter power without any restrictions.

For the 400 V Power Modules, induction motors are permissible in the range from 25 % … 150 % of the inverter power without any restrictions.

For the 690 V Power Modules, induction motors are permissible in the range from 50 % … 150 % of the inverter power without any restrictions.

Installing/mounting

4

4.1 Installation conditions

When installing the Power Modules carefully observe the conditions listed below in order to guarantee reliable, continuous and disturbance-free operation.

- The Power Module is designed for installation in a control cabinet.
- The Power Module is certified for use in environments with degree of pollution 2
- The Power Modules fulfill degree of protection IP20.
- When dimensioning the conductor cross-sections take into account the clamping area of the connecting terminals, see Cable cross-sections and tightening torques (Page 61) .
- For EMC-compliant installation, please observe Section EMC-compliant installation (Page 43).

Inverters for systems in the United States / Canada (UL/cUL)

- For configurations in conformance with UL/cUL, use the UL/cUL-approved fuses, Class J or semiconductor fuses, type Siemens 3NE1, which are specified in this manual.

  Fuse types and characteristic values are described in Sections Specific technical data, 200 V inverters (Page 64), Specific technical data, 400 V inverters (Page 70) and Specific technical data, 690 V inverters (Page 76).

  Only use copper cables rated for 60°C or 75°C.
- The integrated semiconductor short-circuit protection does not provide cable protection. On the system side, provide cable protection in conformance with NEC or CEC, Part 1 and the local regulations.
- The inverters provide internal motor overload protection corresponding to UL61800-5-1. The protection threshold is 115 % of the inverter full load current. When commissioning, you can adapt the motor overload protection using parameter p0640.

Additional requirements for CSA compliance:

- Overvoltage category OVC III must be ensured for all connections of the power circuit. This can mean that a surge suppressor must connected upstream on the line side. The rated voltage of the surge suppressor must not exceed the line voltage, and must guarantee the limit values (VPR) specified here.

Line voltage		Phase to ground		Phase to phase	
		Rated voltage	VPR	Rated voltage	VPR
3 AC 200 V … 240 V	Grounded neutral conductor	139 V	2.5 kV	240 V	4 kV
	Grounded line conductor	240 V	4 kV	240 V	4 kV
3 AC 380 V … 480 V	Grounded neutral conductor	277 V	4 kV	480 V	4 kV
	Grounded line conductor	480 V	6 kV	480 V	4 kV
3 AC 500 V … 690 V	Grounded neutral conductor	347 V	6 kV	600 V	4 kV
	Grounded line conductor	600 V	6 kV	600 V	4 kV

4.2 Power losses and air cooling requirements

Cooling requirements

Depending on the power loss of the individual components, the control cabinet will require a cooling airflow to prevent the components from overheating.

Formula for calculating the cooling airflow:

$$\text{Air flow [l/s]} = \frac{\text{Power loss [W]}}{\Delta T\ [K]} * 0.86$$

- Power loss: Total of the power losses of the individual components.
- Δ T Permissible temperature rise in the electrical cabinet

Measures in order to ensure that the components are adequately cooled

1. Add the power losses of the individual components.
   - For the Power Module, apply the data in Section "Technical data (Page 59)".
   - The power loss of the CU is less than 0.04 kW.
   - Use the manufacturers data for components, for example reactors or filters
2. Calculate the air flow required, using the formula above.
3. Ensure that the control cabinet is appropriately ventilated and equipped with suitable air filters.
4. Ensure that the components have the specified clearances with respect to one another.

5. Ensure that the components are provided with adequate cooling air through the cooling openings.
6. Use the appropriate air barriers to prevent cooling air short circuits

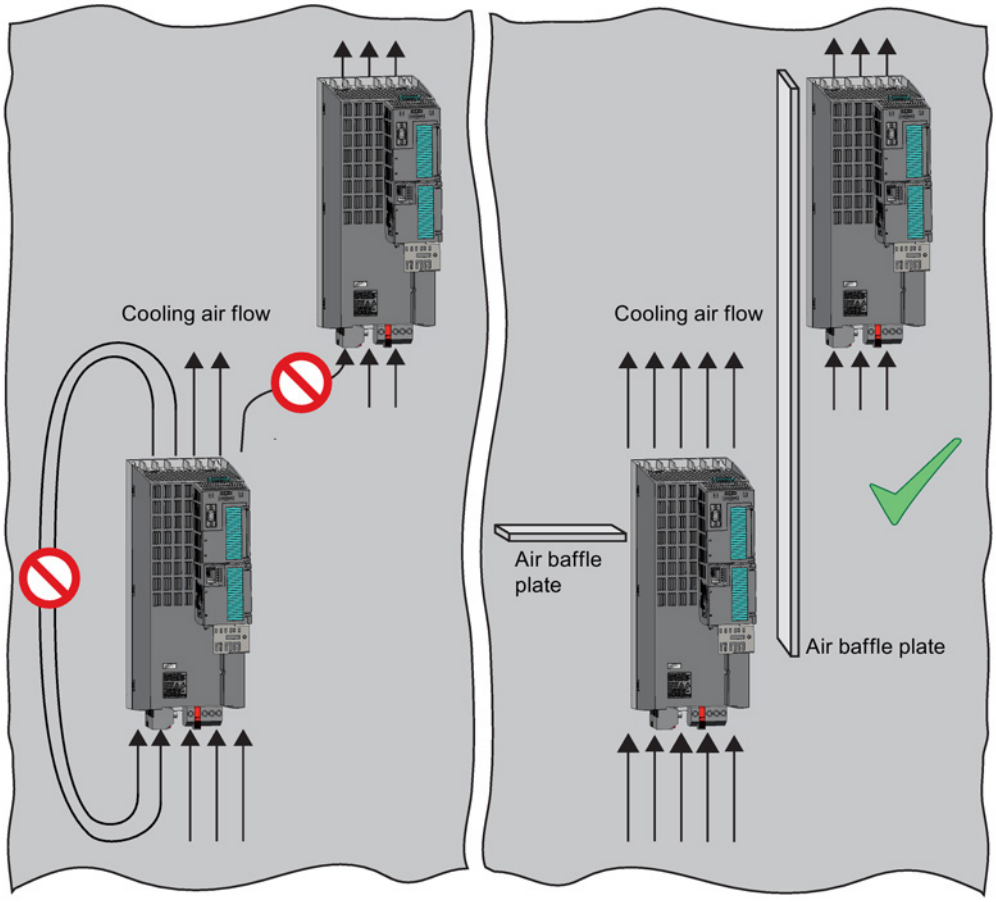


Figure 4-1 Air barriers for avoiding cooling air short circuits

The power loss values specified in the technical data refer to the values specified for an output frequency of 50 Hz.

Special features of Power Modules with push-through technology (PT Power Modules)

When you use PT Power Modules, the majority of the power loss is dissipated through the heatsink located outside the control cabinet.

The following losses occur in the cabinet

- FSA: 0.02 kW
- FSB: 0.045 kW
- FSC: 0.075 kW

4.3 Mounting the Power Modules

4.3.1 Installing Power Modules

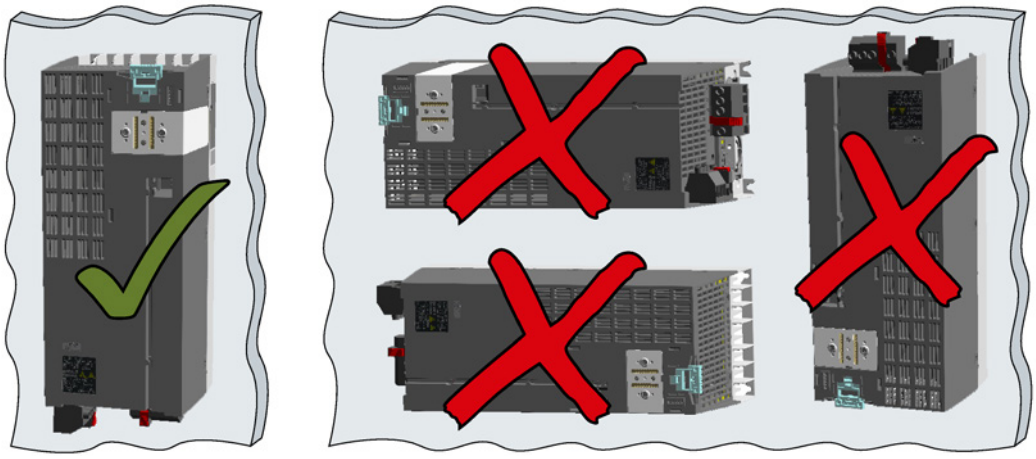
Mounting Power Modules with degree of protection IP20

Procedure

1
2

Proceed as follows to correctly mount the Power Module:

1. Mount the Power Module in a control cabinet.
2. Maintain the minimum clearances to other components in the control cabinet, which are specified in the following sections.
3. Install the Power Modules vertically with the line and motor connections facing downwards. It is not permissible to install them in any other position.



4. Position the Power Module in the control cabinet so that the cables for the motor and line supply are connected in accordance with the terminal layout.
5. Use the mounting devices specified below.
6. Comply with the torques of the mounting devices specified below.

You have correctly mounted the Power Module.

Mounting Power Modules using push-through technology

We recommend that you use the optionally available mounting frame to mount the push-through unit in a control cabinet. This mounting frame includes the necessary seals and frame to ensure compliance with degree of protection IP54.

If you do not use the optional mounting frames, then you must ensure that the required degree of protection is complied with using other appropriate measures.

You must mount the inverter on unpainted metal surfaces in order to comply with EMC requirements.

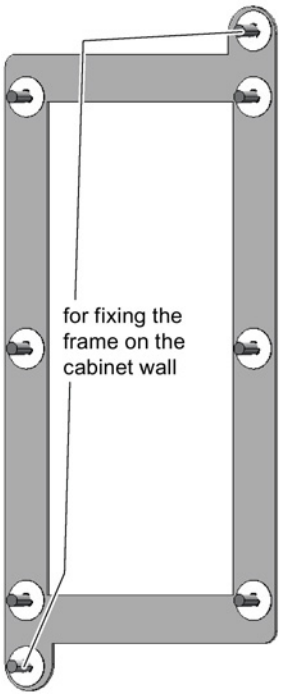
Procedure

1
2

Proceed as follows to correctly mount the Power Module:

1. Prepare the cutout and the mounting holes for the Power Module and the mounting frame corresponding to the dimension drawings of the mounting frame.

   Also note that the PT Power Modules must be vertically mounted with the line and motor connections facing downwards.
2. Position the mounting frame at the rear of the control cabinet and attach it to the control cabinet by tightening the corresponding screws by hand.
3. Attach the seal to the inner side of the control cabinet.
4. Mount the frequency inverter and initially tighten all of the mounting screws by hand.
5. Tighten the screws with a torque of 3.5 Nm.



Mounting frame

You have correctly mounted the Power Module.

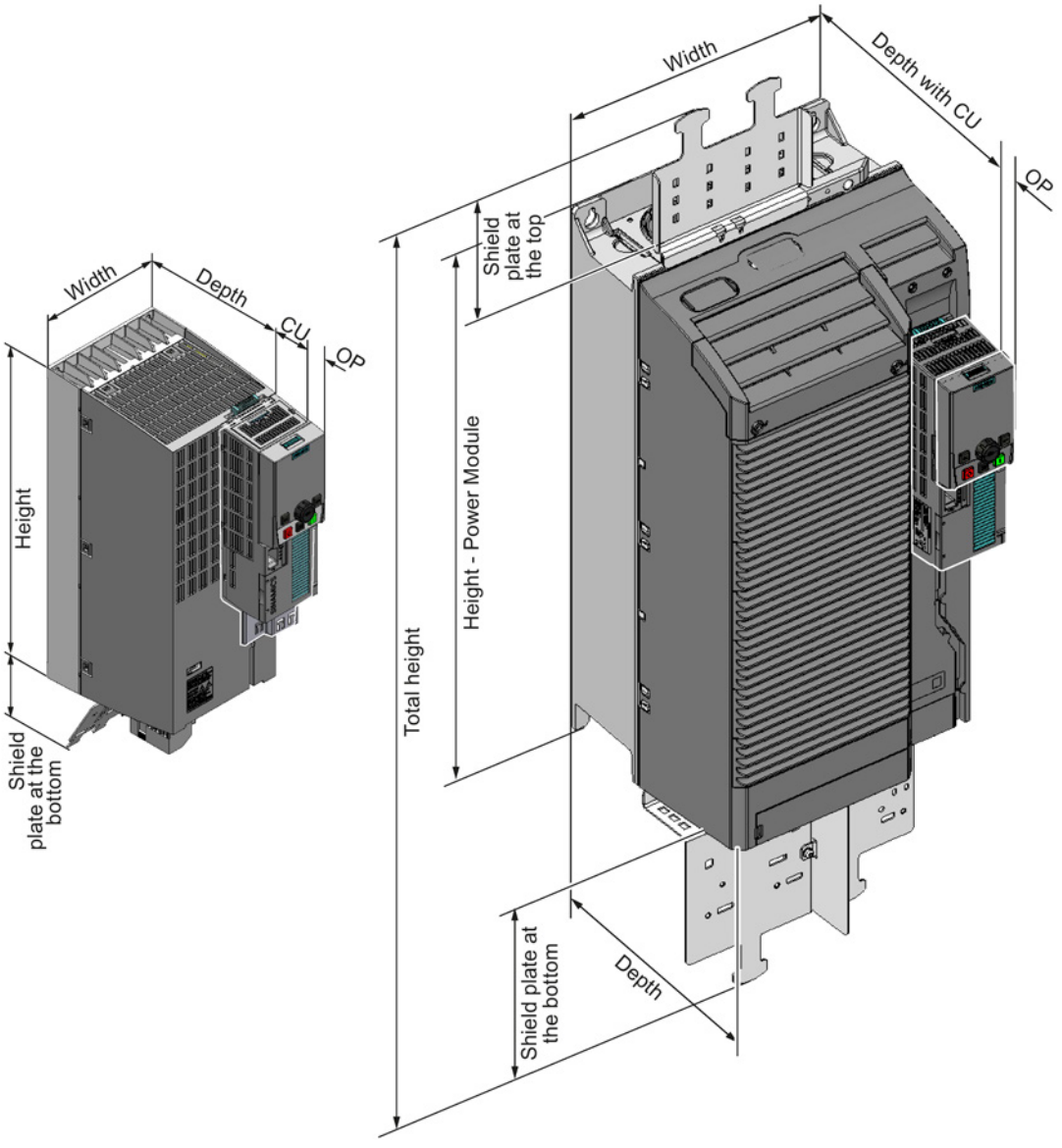
4.3.2 Dimension drawings and drilling dimensions for IP20 Power Modules

Note

Dimension drawings and drilling patterns

The following dimension drawings and drilling patterns are not to scale.

Mounting dimensions for IP20 Power Modules



Lifting equipment for frame sizes FSD and FSE

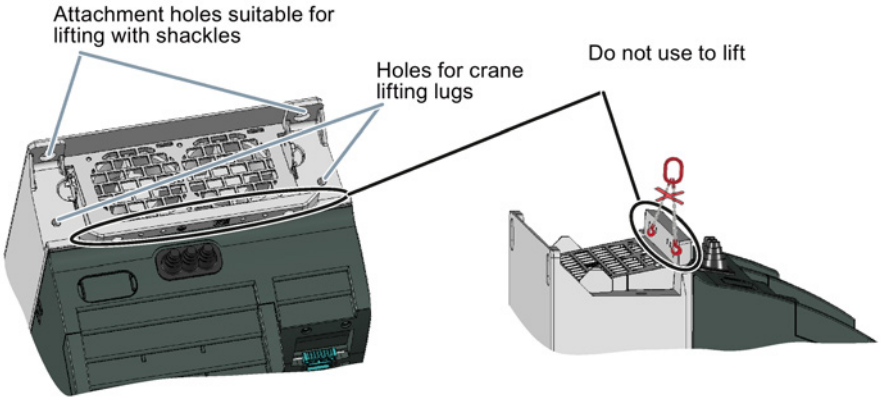


Table 4- 1 Dimensions and weights

Frame size	Width [1] (mm)	Height (mm)				Depth (mm)			Weight (kg) [3]
		Total	Shield plate at the top	Power Module	Shield plate at the bottom	without CU	with CU230 [2] / CU250 [2]	with CU240 [2]	
FSA	73	276	---	196	80	165	228	206	1.6
FSB	100	370	---	291	79	165	228	206	3.3
FSC	140	432	---	355	77	165	228	206	5.4
FSD	200	707.5	83.5	472	152	237	255.5	237	15.6
FSE	275	850	122.5	551	177	237	255.5	237	22.6

[1] The Power Modules can be mounted and operated side-by-side. For tolerance reasons, we recommend a lateral clearance of approx. 1 mm.

[2] Plus 11 mm with a BOP-2 or a blanking cover
plus 22 mm with an IOP

[3] The precise weights are provided in the Technical Data.

Drilling dimensions and cooling air clearances

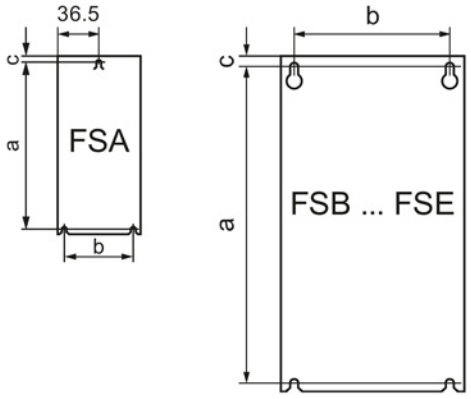
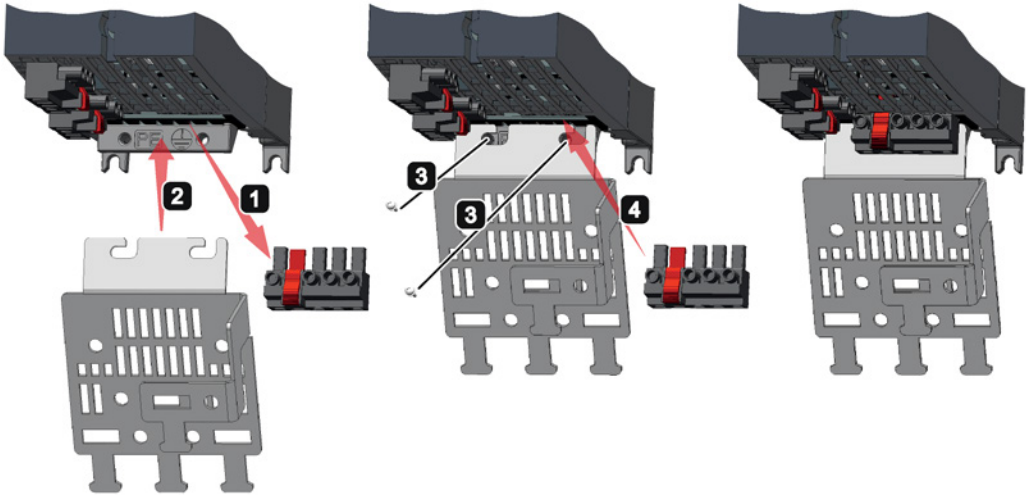


Table 4- 2 Drilling dimensions, cooling clearances and fixing

Frame size	Drilling dimensions (mm)			Cooling air clearances (mm)			Fixing	
	a	b	c	Top	Bottom	Front	Screws	Torque (Nm)
FSA	186	62,3	6	80	100	100	M4	2,5
FSB	281	80	6	80	100	100	M4	2,5
FSC	343	120	6	80	100	100	M5	3,0
FSD	430	170	7	300	350	100	M5	6,0
FSE	509	230	8,5	300	350	100	M6	10

Mounting the shielding plate



4.3.3 Dimension drawings and drilling dimensions for PT Power Modules

Mounting dimensions for Power Modules with PT technology

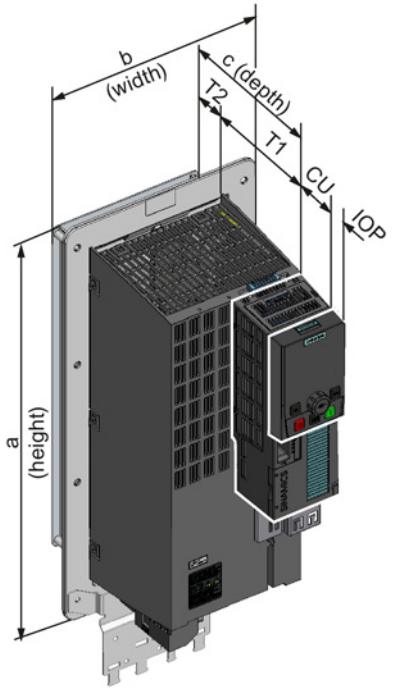


Table 4- 3 Dimensions and clearances

Frame size	Dimensions (mm)					
	Height		Width[1]	Depth[2]	T1	T2
	None Shield plate	with Shield plate				
FSA	238	322	126	171	117,7	53,1
FSB	345	430	154	171	117,7	53,1
FSC	411	500	200	171	117,7	53,1

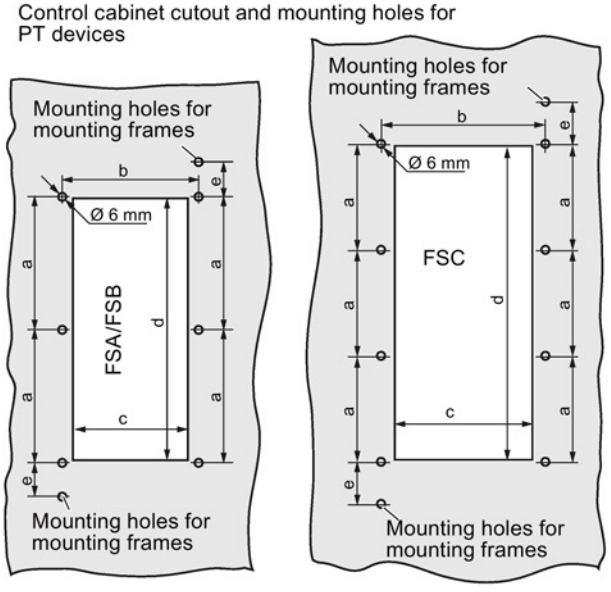
1) The Power Modules can be mounted side-by-side. For tolerance reasons, we recommend a lateral clearance of 1mm.

2) For PT modules, the maximum wall thickness of the control cabinet is 3.5 mm

Table 4- 4 Depth with Control Unit and operator panel

Control Unit	Power Module + Control Unit (mm)		Power Module + Control Unit + IOP (mm)		Power Module + Control Unit + BOP (mm)	
	Total	in the cabinet	Total	in the cabinet	Total	in the cabinet
CU230P-2	231	177,7	253	199,7	244	190,7
CU240B-2 / CU240E-2	212	158,7	234	180,7	225	171,7
CU250S-2	234	180,7	256	202,7	247	193,7

Drilling dimensions and cooling air clearances



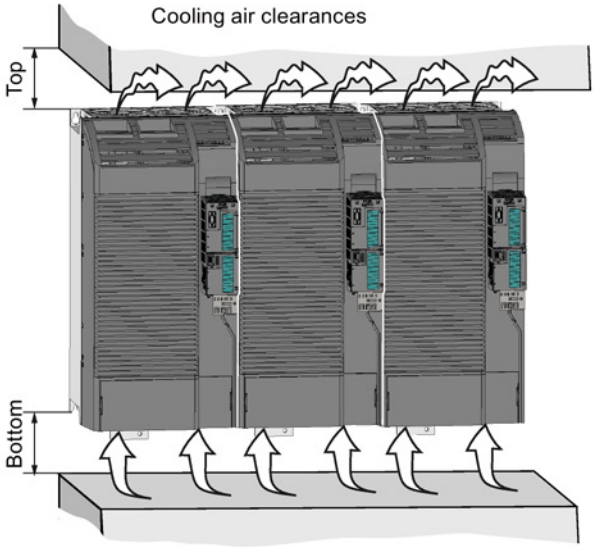


Table 4- 5 Drilling dimensions, cooling clearances and fixing

Frame size	Dimensions (mm)					Clearances (mm)		Fixing	
	a	b	c	d	e	Top	Bottom	Screw size	Tightening torque (Nm)
FSA	103	106	88	198	27	80	100	M5	3,5
FSB	147,5	134	116	304	34,5	80	100	M5	3,5
FSC	123	174	156	365	30,5	80	100	M5	3,5

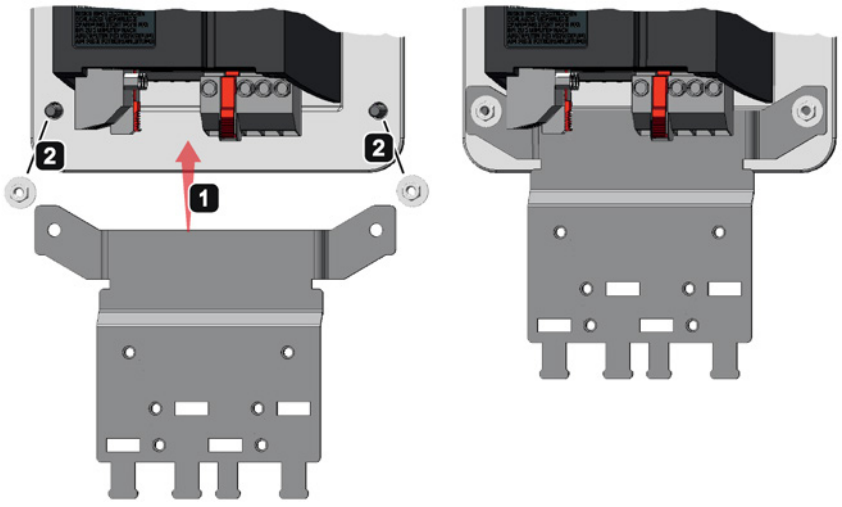
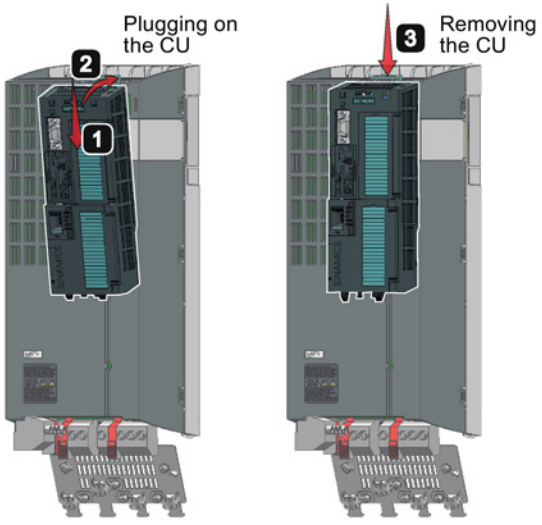


Figure 4-2 Mounting the shielding plate

4.4 Control Unit installation

The Control Unit is snapped onto the Power Module as shown in the figure. To disconnect the CU push the release button on top of the PM.

The process of fitting the Control Unit onto the Power Module is the same technique independent of the type of Control Unit or Power Module.



Fitting the Control Unit onto the Power Module

4.5 Installing supplementary components

The following supplementary components may be required depending on the Power Modules and the particular application:

- Line reactors
- Filter
- Braking resistors
- Brake relay

Information about mounting these components is provided in the instructions supplied.

Connecting-up

5

Preconditions

You can establish the line and motor connections once the inverter has been properly installed. Note the following:

- The "Fundamental safety instructions (Page 9)"
- The note "To protect against indirectly touching part of the motor circuit of an inverter and to automatically shut down in the case of a fault according to DIN EN 60364-4-41 (VDE 0100-410). (http://support.automation.siemens.com/WW/view/en/103474630)"
- The local regulations for erecting low-voltage systems
- The notes listed below

DANGER

Danger to life through electric shock due to the residual charge of the DC link capacitors

Because of the DC link capacitors, a hazardous voltage is present for up to 5 minutes after the power supply has been switched off.

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

- Do not open the protective cover of the device until 5 minutes have elapsed.
- Before starting any work, check that the system is in a voltage-free state by measuring all terminals, also to ground.
- Ensure that the associated warning plate in the appropriate language is attached.

WARNING

Danger to life through interruption of the external protective conductor due to high leakage currents

The drive components conduct a high leakage current via the protective conductor. Touching conductive parts when the protective conductor is interrupted can result in death or serious injury.

- Ensure that the external protective conductor satisfies at least one of the following conditions:
  - It has been laid so that it is protected against mechanical damage.[1)]
  - If it is a single conductor, it has a cross-section of at least 10 mm² Cu.
  - If it is a conductor of a multi-conductor cable, it has a cross-section of at least 2.5 mm² Cu.
  - It has a second protective conductor in parallel with the same cross-section.
  - It complies with the local regulations for equipment with increased leakage current.

[1)] Cables laid within control cabinets or closed machine housings are considered to be adequately protected against mechanical damage.

⚠WARNING

Danger to life for an excessively high line voltage

If the line voltage is excessively high, this can destroy the inverter and there is a risk of electric shock.

Ensure that the line voltage is in compliance with the inverter supply voltage. It is not permissible to connect higher line voltages!

Note

Operating displays for inverter operation

If, when switching over a function from ON to OFF, an LED or other similar display is not lit or not active; this does not indicate that the device is switched-off or in a no-current condition.

Note

Circuit breakers/fuses

Ensure that the appropriate circuit breakers or fuses with the specified LO output current are connected between the power supply and the drive. The technical data contain information about the circuit breaker and fuses (see Specifications).

⚠WARNING

Danger to life due to fire or electric shock when using unsuitable residual current protection devices

The inverter can cause a current to flow in the protective conductor. This current can cause the residual current device (RCD) or residual current monitoring (RCM) to incorrectly trip (nuisance trip). In the case of a fault (ground fault), the fault current can contain a DC component, which prevents the RCD/RCM from tripping, with the risk of subsequent fault or electric shock.

- Use the protection and monitoring devices recommended in the documentation.

⚠CAUTION

Risk of injury due to hot surfaces

During operation and for a short time after the inverter shuts down, the surface of the device can reach a high temperature.

- During this time, avoid any direct contact with the surface of the inverter.

Protection and monitoring equipment

One of the following measures is suitable in order to ensure touch protection for the inverter:

- formats FSA … FSE: Disconnect the inverter from the line supply using a transformer
- Formats, FSA … FSC: Residual current device (RCD) or residual current monitoring (RCM) with the following properties and secondary conditions:
  - You are using a super-resistant RCD/RCM, type B with a tripping current of 300 mA. e.g. a SIQUENCE circuit breaker from Siemens.
  - Only one inverter is supplied from each RCD/RCM
  - The motor cables are shielded and are not longer than 50 m. You can find additional information on the motor cables in Motor cable length (Page 38)

Note

Fuses and residual current devices and/or monitoring devices

A residual current device (RCD) or residual current monitoring (RCM) does not replace the fuses listed in the Technical data.

5.1 Line and motor connection

Inverter terminal layout see Line and motor terminals (Page 39).

For all connections, carefully observe the regulations relating to electromagnetic compatibility, also see EMC-compliant installation (Page 43).

5.1.1 Permissible line supplies

Note

Restrictions for installation altitudes above 2000 m

Above an installation altitude of 2000 m, the permissible line supplies are restricted. See also: Restrictions for special ambient conditions (Page 78).

Note

Line requirement

The machine manufacturer must ensure that in operation the voltage drop between the transformer input terminals and the inverter with rated values is less than 4 %.

The inverter is designed for the following power distribution systems according to IEC 60364-1 (2005).

TN line system

A TN line system transfers the PE protective conductor to the installed plant or system using a cable.

Generally, in a TN line system the neutral point is grounded. There are versions of a TN line supply with a grounded line the conductor, e.g. with grounded L1.

A TN line system can transfer the neutral conductor N and the PE protective conductor either separately or combined.

Preconditions and restrictions when connecting an inverter to a TN line system

- Inverter with integrated or external line filter:
  - Operation on TN line supply systems with grounded neutral point permissible.
    Operation on TN line supply systems with grounded line conductor not permissible.
- Inverter without line filter:
  - Operation permissible on all TN line supplies.

    Restriction for 690 V Power Modules: When connected to line supplies with grounded line conductor, line voltages up to 600 V are permissible. Operation on line supplies with grounded line conductor is not permissible for higher voltages.

Examples for Power Modules connected to a TN line supply

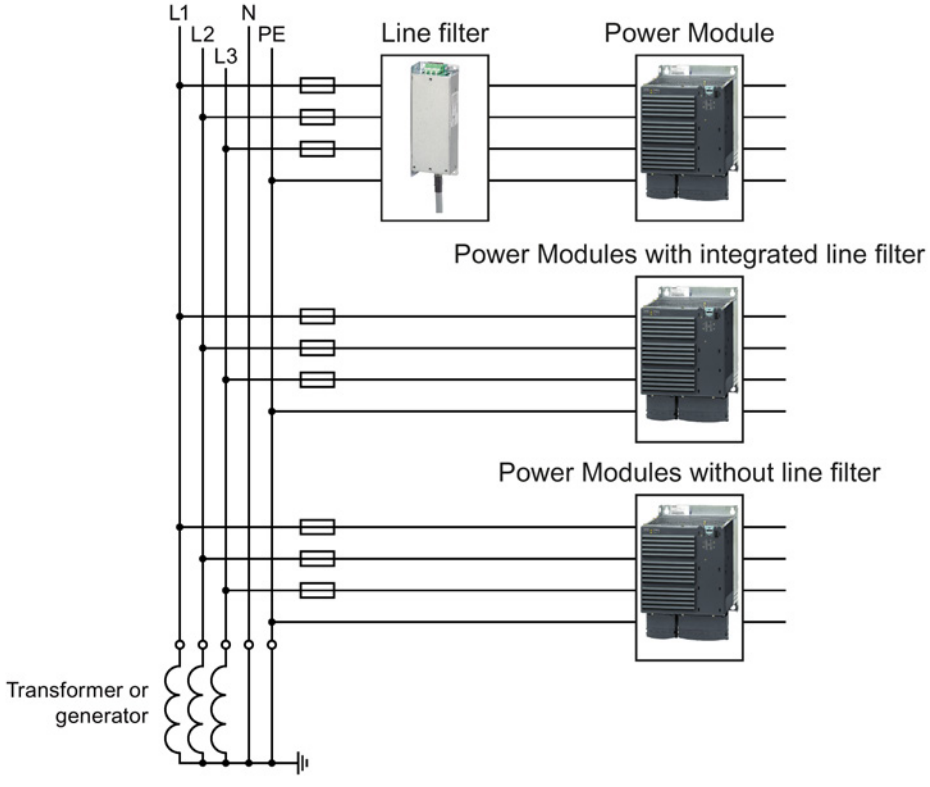


Figure 5-1 TN line supply with separate transfer of N and PE and with a grounded neutral point

TT system

In a TT line system, the transformer grounding and the installation grounding are independent of one another.

There are TT line supplies where the neutral conductor N is either transferred – or not.

Preconditions and restrictions when connecting an inverter to a TT line system

- Inverter with integrated or external line filter:
  - Operation on TT line supply systems with grounded neutral point permissible.
  - Operation on TT line systems without grounded neutral point not permissible.
- Inverter without line filter:
  - Operation on all TT line systems is permissible.

    Restriction for 690 V Power Modules: When connected to line supplies with grounded line conductor, line voltages up to 600 V are permissible. Operation on line supplies with grounded line conductor is not permissible for higher voltages.

Examples for Power Modules connected to a TT line supply

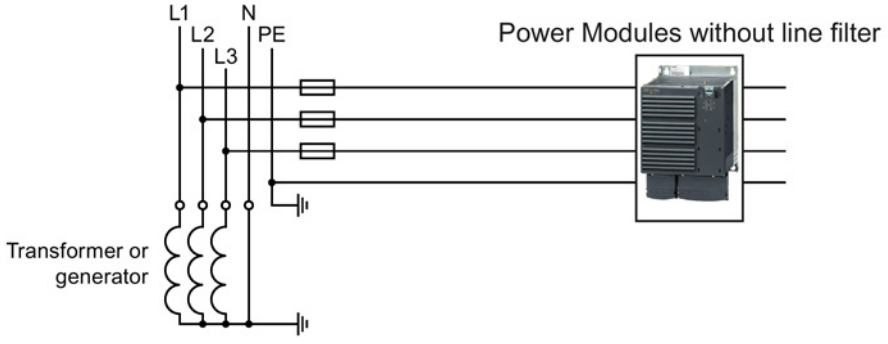


Figure 5-2 TT line system where the neutral conductor N is transferred

IT system

In an IT line system, all of the conductors are insulated with respect to the PE protective conductor – or connected to the PE protective conductor through an impedance.

There are IT line supplies where the neutral conductor N is either transferred – or not.

Preconditions and restrictions when connecting an inverter to an IT line system

- Inverters with integrated line filter:
  - Operation on IT line systems is not permissible.
- Inverter without line filter:
  - Operation on IT line systems is permissible.

Examples for Power Modules connected to an IT line supply

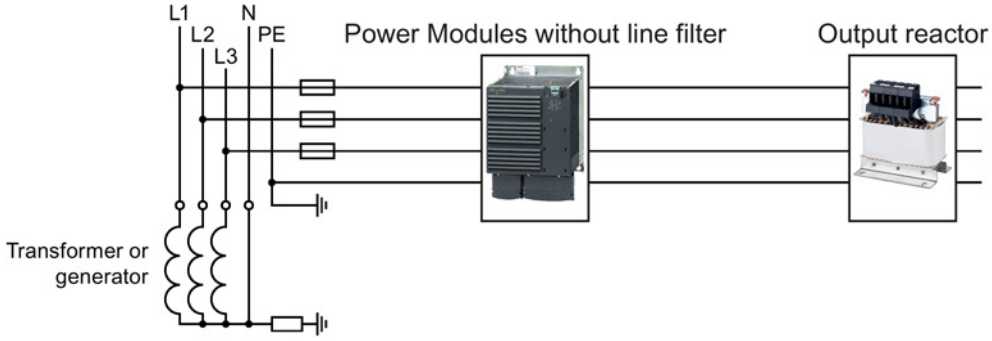


Figure 5-3 IT line supply where the neutral conductor N is transferred and with impedance with respect to the PE protective conductor

Behavior of the inverter when a ground fault occurs

In some instances, even for a ground fault, the inverter should still remain functional. In cases such as these, you must install an output reactor. This prevents an overcurrent trip or damage to the drive.

5.1.2 Connection overview for PM240-2

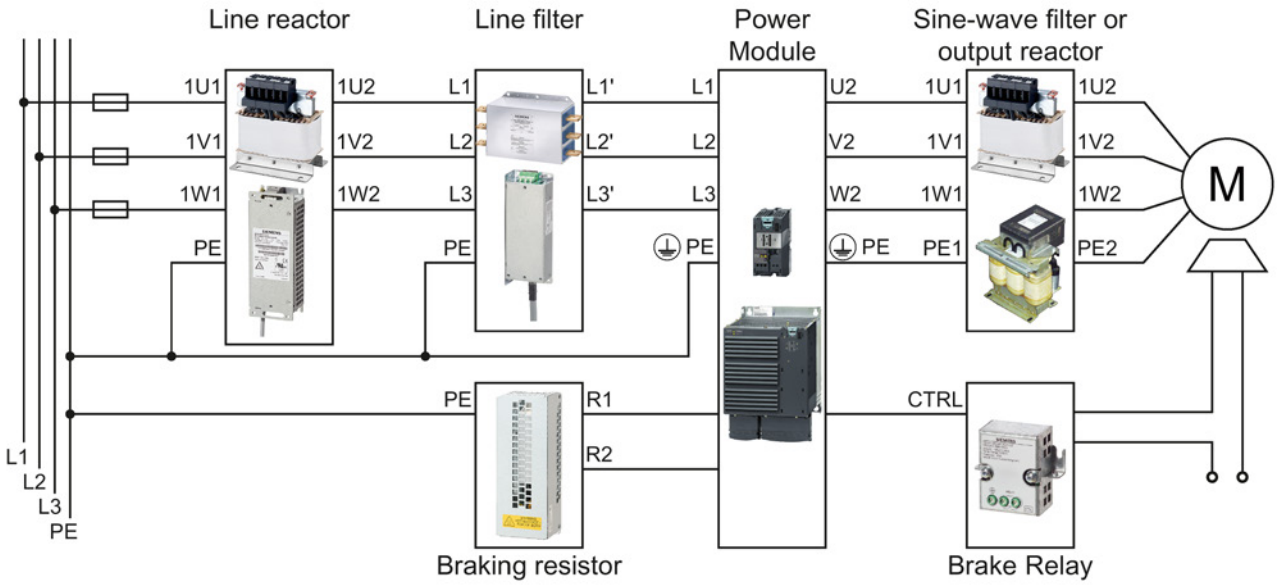


Figure 5-4 Connecting PM240-2 Power Modules, 3 AC 200 V / 400 V /690 V

Note

Line reactor

A line reactor is not required for the Power Modules FSD … FSE.

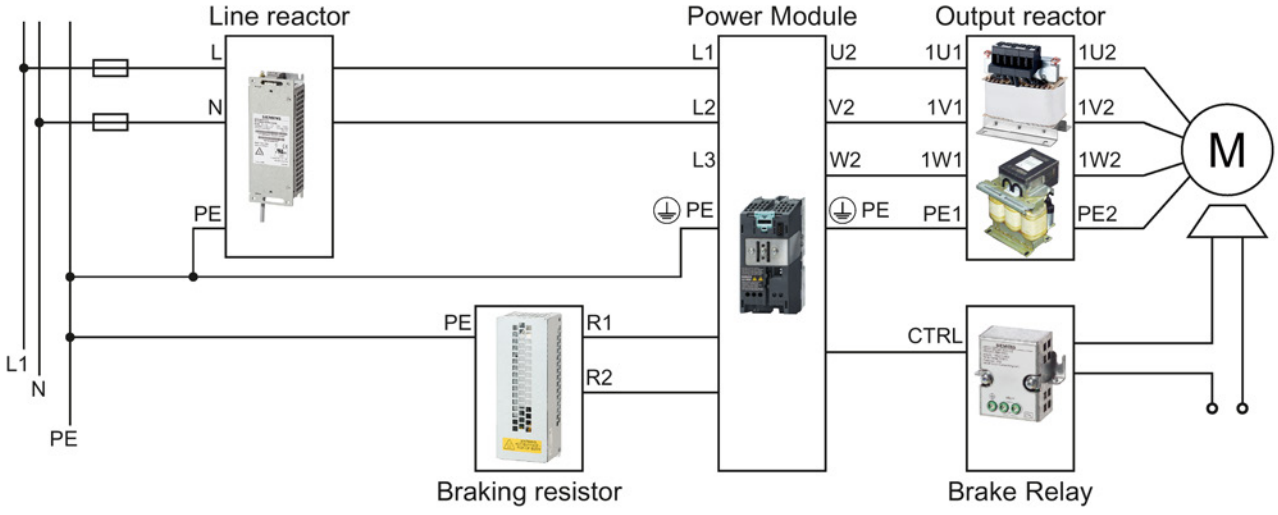


Figure 5-5 Connecting PM240-2 Power Modules, 200 V to 1 AC - only FSA ... FSC

Note

Connecting PM240-2 Power Modules, 200 V to 1 AC - only FSA ... FSC

For the 200 V versions and single-phase line systems, connect the phase conductor and neutral conductor to any two of the terminals L1, L2, L3.

Power Modules are available with and without integrated Class A line filters. You require an external Class B line filter for increased EMC requirements.

When connecting up, please refer to the notes in Section EMC-compliant installation (Page 43).

5.1.3 Motor cable length

The permissible length of the motor cable depends on the quality of the motor cable and the inverter pulse frequency. The values specified below are applicable for high-quality cables – for example MOTION-CONNECT cables – and for the factory set pulse frequencies (Page **Fehler! Textmarke nicht definiert.**).

If you set other pulse frequencies, then you must ensure that the EMC category is complied with on the plant or system side.

Frame size		Maximum permissible motor cable length (m) for Power Modules			
		with filter and shielded cable		with or without filter	
		First/second environment, EMC Category C2	Second environment, EMC category C3	No EMC category,	
				Shielded cable	Unshielded cable
FSA	200 V / 400 V	50	50	50	100
FSB	200 V / 400 V	50	50	50	100
FSC	200 V / 400 V	50	50	50	100
FSD	200 V / 400 V	150	150	200	300
	690V	100	100		
FSE	200 V / 400 V	150	150	200	300
	690V	100	100		

Note

Longer cable lengths for Power Modules FSA …FSC, still maintaining EMC category C2, second environment

For frame sizes FSA … FSC, motor cable lengths up to 150 m are permissible if you use a non-filtered Power Module with an external Class B line filter and an output reactor.

Note

Using the inverter in the first environment

For use in the first environment, see Section Electromagnetic compatibility of the inverter (Page 82)

5.1.4 Motor connection

Star and delta connection

Siemens motors have a diagram inside the terminal box showing both connection methods:

- Star connection (Y)
- Delta connection (Δ)

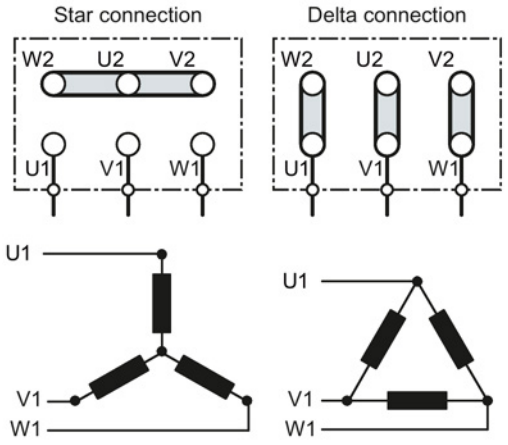
The motor rating plate provides data about the correct connection.

Connecting the motor

Connect the protective conductor of the motor to the ⏚ terminal of the inverter.

Connect the motor cable to terminals U2, V2 and W2.

Close the terminal covers of the inverter. There are no terminal covers for FSA … FSC.



Star connection / delta connection

5.1.5 Connection terminals at the inverter

Table 5- 1 Connection type, cable cross sections and tightening torques

Inverters	Connection	Cross-section and tightening torque		Strip lengths
		Metric	Imperial	
FSA	Line, motor cable, DC link and braking resistor	1.5 … 2.5 mm²: 0.5 Nm	16 … 14 AWG: 4.5 lbf in	8 mm
FSB	Line, motor cable, DC link and braking resistor	1.5 … 6 mm²: 0.6 Nm	16 … 10 AWG: 5.5 lbf in	8 mm
FSC	Line, motor cable, DC link and braking resistor	6 …16 mm: 1.3 Nm	10 … 6 AWG: 12 lbf in	10 mm
FSD	Line, motor cable and DC link	1.5 …25 mm²: 2.5 Nm 35 mm²: 4.5 Nm	16 … 4 AWG: 22 lbf in 2 AWG: 40 lbf in	18 mm
	Braking resistor	1.5 … 16 mm²: 1.5 Nm	16 … 6 AWG: 13 lbf in	10 mm
FSE	Line, motor cable and DC link	16 … 95 mm²: 10 Nm	6 … 3/0 AWG: 89 lbf in	25 mm
	Braking resistor	1.5 …25 mm²: 2.5 Nm 35 mm²: 4.5 Nm	16 … 4 AWG: 22 lbf in 2 AWG: 40 lbf in	18 mm

Connecting terminals FSA, FSB, FSC

The Power Modules are equipped with withdrawable connectors.

You can withdraw the connector by pressing the red lever to release the interlock.

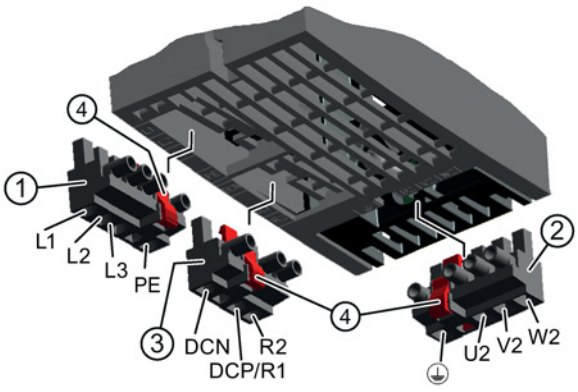
The connectors are designed so that they cannot be accidentally interchanged.

① Line connectors

② Motor connection plug

③ Connection plug for a braking resistor

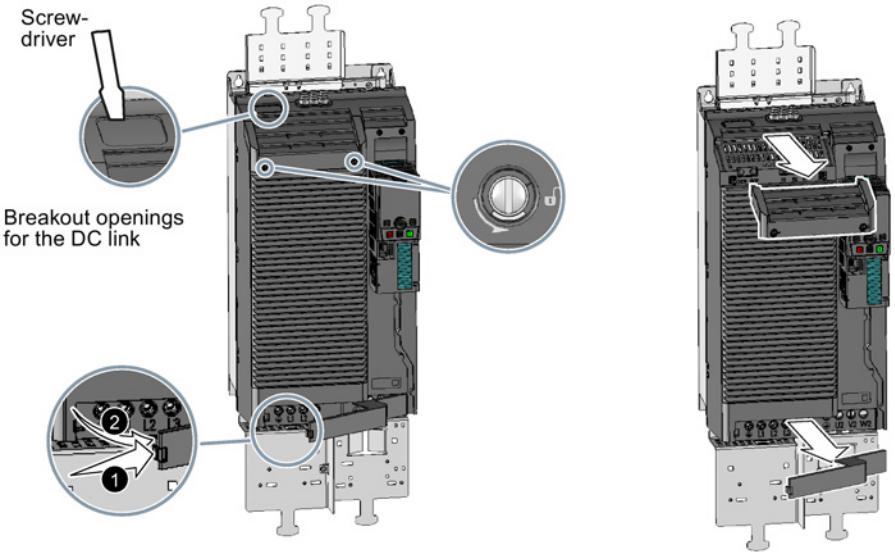
④ Release lever



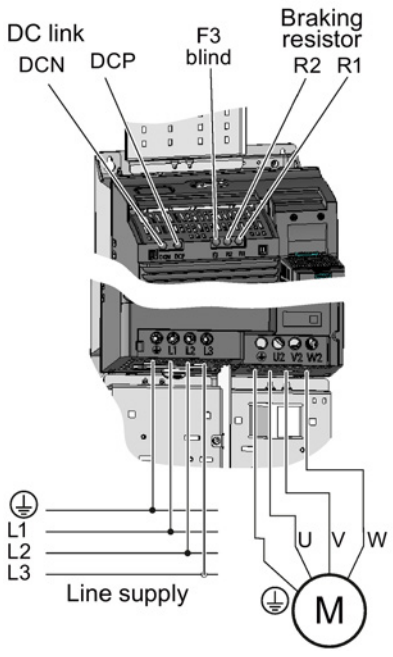
Connecting terminals for FSD … FSE

Covers protect the connections for the line supply, motor, DC link and braking resistor and coming into contact with live components. The following diagram shows how you can remove the covers. The covers are attached in the inverse order.

Removing covers



Terminal arrangement

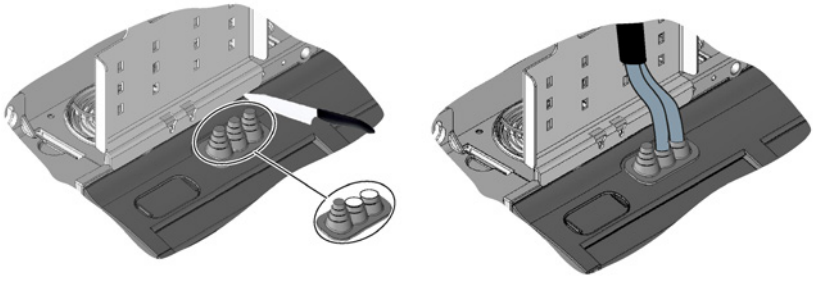


Connecting DC link or braking resistor

You can use rubber cable glands when connecting the DC link and braking resistor.

A cable gland is already integrated to connect the braking resistor. For the DC link connection, open the knockout opening and insert the cable gland.

Using a sharp knife, cut the cap of the cable gland corresponding to the diameter of your cable and establish the connections.



Establishing connections

Procedure

1
2

Proceed as follows to establish the connections:

1. Ensure that the device is in a no-voltage condition and the DC link is discharged.
2. When available, remove the covers.
3. Establish the connections.
4. Reattach the covers before you connect the power.

You have established the connections.

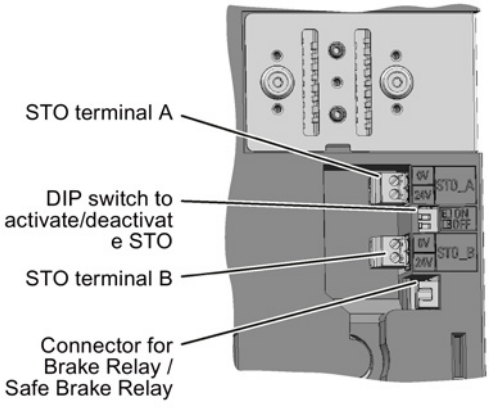
5.2 STO via Power Module terminals

Safe Torque Off (STO) for the PM240-2

Using the PM240-2 Power Modules, frame sizes FSD and FSE, you can implement the "Safe Torque Off" safety function (STO), corresponding to PL e according to EN 13849-1 and SIL 3 according to IEC61508.

You have two terminal blocks - STO(A) and STO(B) - and two DIP switches at the front of the Power Module.

To be able to use the safety functions, you must enable the terminals; you do this by setting the two DIP switches to "1". You can only use the safety function if both DIP switches are set to "1".



Set both DIP switches to "0" if you do not wish to use STO. If one switch is set to 0 and the other to 1, the inverter interprets this as an error and will not start.

The terminals are low active.

You can find additional information and wiring examples in the Safety Integrated Function Manual, see Manuals for your inverter (Page 111)

STO connection

Use a shielded cable, cross-section 0.5 mm^2 to 1.5 mm^2 (20 … 16 AWG) with conductor sleeves, with a maximum length of 30 m, tightening torque 0.25 Nm (2.2 lbf in). Stripped length 7 mm Attach the shield to the shield plate of the Control Unit through the largest possible surface area.

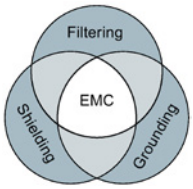
Note

Safety functions via the Control Unit

You can implement the safety functions via the Control Unit independent of the safety function "STO via the Power Module terminals".

5.3 EMC-compliant installation

5.3.1 Avoiding electromagnetic interference



Only the concurrent use of filtering, grounding and shielding ensure an installation in accordance with the EMC requirements.

The next sections cover all of the most important rules for the installation of inverter and drive systems.

5.3.2 Avoiding electromagnetic influence (EMI)

The inverters are designed for operation in industrial environments where high values of EMI are expected. Safe, reliable and disturbance-free operation is only guaranteed if the devices are installed by appropriately trained and qualified personnel.

Control cabinet design

- Connect the metallic parts and components of the control cabinet to the frame of the cabinet through a good electrical connection.
  - Side panels
  - Rear panels
  - Cover plate
  - Base plates

  Use the largest possible contact area or many individual screw connections.
- Connect the PE busbar and EMC shielding bus to the control cabinet frame using a good electrical connection established through the largest possible surface area.
- Connect all metal enclosures of the devices installed in the control cabinet (such as the inverter and line filter) to the control cabinet frame through a good electrical connection established through the largest possible surface area.

  We recommend that these devices are mounted on a bare metal plate with good conducting properties.
- For screw connections onto painted or anodized surfaces, establish a good conductive contact using one of the following methods:
  - Use special (serrated) contact washers that cut through the painted or anodized surface.
  - Remove the insulating coating at the contact locations.

- Equip the following components with interference suppression elements:
  - Coils of contactors
  - Relays
  - Solenoid valves
  - Motor holding brakes

  Interference suppression elements include RC elements or varistors for AC-operated coils and freewheeling diodes for DC-operated coils.

  Connect the interference suppression element directly at the coil.

Cable routing and shielding

- Route all inverter power cables (line supply cables, connecting cables between the braking module and the associated braking resistance as well as the motor cables) separately away from signal and data cables. Maintain a minimum clearance of 25 cm. If cables can be separately routed, use metal partitions that have a good electrical connection to the mounting plate.
- Route the cables from the line supply to the line filter separately away from the following cables:
  - Cables between the line filter and inverter
  - Connecting cables between the braking module and associated braking resistor
  - Motor cables
- Signal and data cables as well as filtered line supply cables may only cross non-filtered power cables at right angles.
- Keep all cables as short as possible.
- Always route signal lines, data cables, and the associated potential equalizing cables in parallel with the shortest possible clearance between them
- Use shielded motor cables.
- Route the shielded motor cable separately from the cables to the motor temperature sensors (PTC/KTY).
- Use shielded signal and data cables.
- Connect the shields to the grounded enclosure at both ends with a good electrical connection through the largest possible surface area
- Connect the cable shields as closely as possible to the point where the cable enters the control cabinet.
- Use EMC shielded busbars for power cables.

  Use the shield connection elements in the inverter for signal and data cables.
- Do not interrupt any cable shields by using intermediate terminals.
- Use the appropriate EMC terminals for cable shields.

  The EMC terminals connect the cable shield with the EMC shielded busbar or with the shield connection element through a large conductive surface.

5.3.3 Installing the converter in compliance with EMC rules

Rules for EMC-compliant cable routing

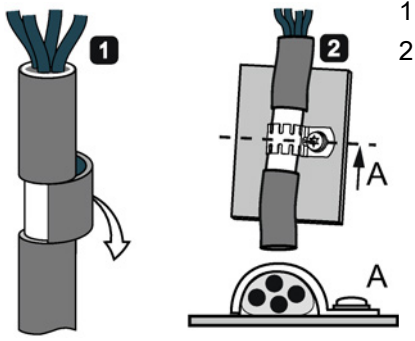
Preconditions

- The inverter is mounted on a metal mounting plate. The mounting plate is unpainted and has good electrical conductivity.
- Use shielded cables for the following connections:
  - Motor and motor temperature sensor
  - Braking resistor (not available for all inverters)
  - Fieldbus
  - Inputs and outputs of the terminal strip

Procedure

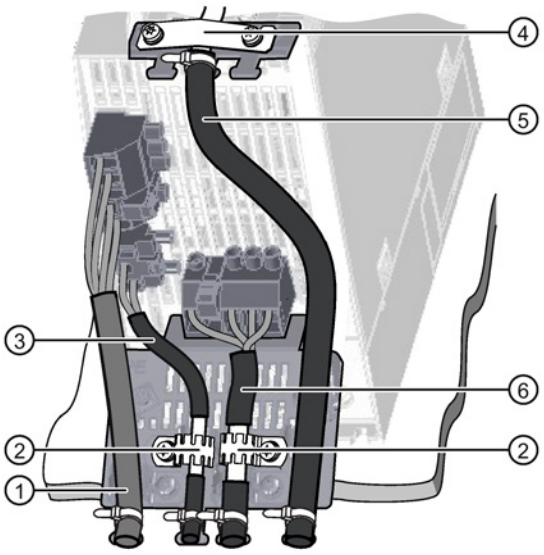
1
2

To install the inverter cables in compliance with EMC rules, proceed as follows:



1. Expose the shields of the shielded cables.
2. Place the shields on the mounting plate or on the inverter shield plate using EMC clamps.

You have wired the inverter in an EMC-compliant fashion.



EMC-compliant wiring shown using the example of a frame size A inverter

① Unshielded line supply cable

② EMC clamps (serrated rails) on the shield plate of the Power Module

③ Shielded cable to the braking resistor (not available for all inverters)

④ EMC clamp for the cable to the terminal strip on the shield plate of the CU

⑤ Shielded cable to the terminal strip

⑥ Shielded motor cable

5.3.4 EMC-compliant cabinet design

The most cost-effective method of implementing interference suppression measures within the control cabinet is to ensure that interference sources and interference sinks are spatially separated.

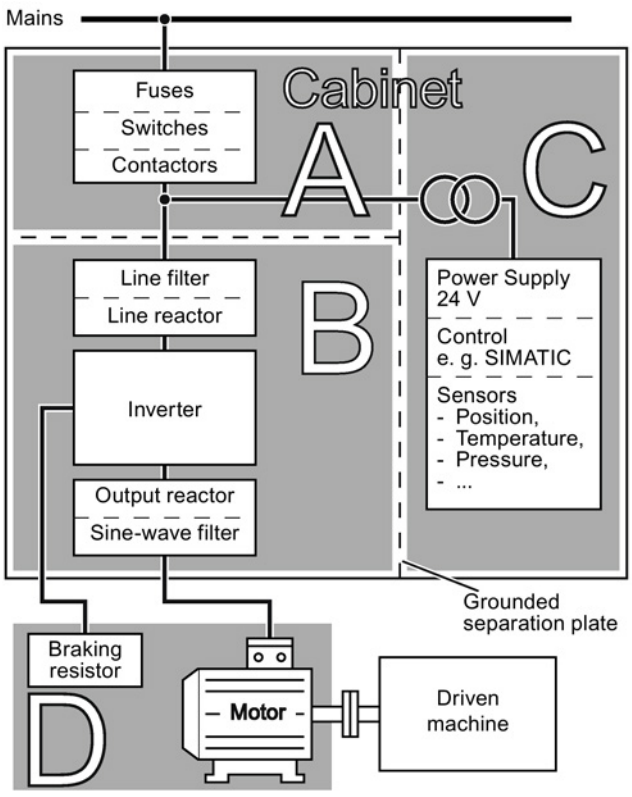
EMC zone concept within the control cabinet

Split up the complete control cabinet into EMC zones. Electromagnetically decouple the zones from one another, either using large clearances (approximately 25 cm) – or using a separate metal enclosure or sheet metal partition with a large surface area. Assign the various devices to zones in the control cabinet.

Non-shielded cables can be used within a zone. It is not permissible to route cables of various zones in common cable harnesses or common cable ducts.

If necessary, you must use filters and/or coupling modules at the interfaces of the zones.

Use shielded cables for all communication and signal cables that exit the control cabinet. Connect the shields to the cabinet ground through a large surface area and low ohmic connection. Ensure that there are no potential differences between these zones, to avoid inadmissibly high equalization currents flowing through the cable shields.



- **Zone A:**
  Line supply connection
  Limit values for conducted interference emission and interference immunity must not be exceeded.
- **Zone B:**
  Power electronics
  Sources of interference
- **Zone C:**
  Controller and sensors
  Interference sinks

  Zone D:
  Motor, braking resistor and corresponding cables
  Sources of interference

Classification of the control cabinet or the drive system into EMC zones

Control cabinet design

- All connections should be durable.
- Connect all the metallic parts of the control cabinet (doors, rear panels, side, top section and base plates) to the frame of the cabinet so that there is a good electrical connection.
- For screw connections at painted or anodized metal parts, either use special serrated washers, which penetrate the insulating surface – or remove the insulating surface at the contact locations in order to establish a good contact between the metals.
- Connect the PE bar and the EMC shield bar to the control cabinet frame through a good electrical connection established through a large surface area.
- Connect all metal enclosures of the components installed in the cabinet with the control cabinet frame through a large surface area to ensure a good electrical connection. To achieve this, mount the components on a bare metal surface and mounting plate with good conductivity, which you then connect to the control cabinet frame through the largest possible surface area to establish a good connection, especially with the PE and EMC shield bars.

Radio interference suppression

- Connect interference suppressors to all contactors, relays, solenoid valves and motor holding brakes directly at the coil in order to dampen high-frequency radiation when these devices are switched off. Use RC elements or varistors for AC-operated coils and freewheeling diodes or varistors for DC-operated coils.

5.3.5 Cabling

Cable routing inside the cabinet

- Route the power cables of the drive so that there is a minimum clearance of 25 cm to signal and data cables. Power cables are line, DC link and motor cables – as well as connecting cables between the Braking Module and braking resistor. Alternatively, the separation can be realized using metal partitions connected to the mounting plate through a good electrical connection.
- Route power cables with low noise levels separately from power cables with high noise levels
  - Power cables with low noise level:
    - line cables from the line to the line filter
  - Power cables with high noise level:
    - cables between the line filter and inverter
    - DC link cables
    - cables between the Braking Module and braking resistor
    - motor cables
- Route the cables so that signal and data cables as well as power cables with low noise level only cross power cables with a high noise level at right angles.
- Keep the cables as short as possible.
- Route the cables as close as possible to grounded enclosure parts such as mounting plates or the cabinet frame.
- Route signal and data cables as well as the associated equipotential bonding cables parallel and as close to one another as possible.
- Route incoming and outgoing cables/conductors within a zone (where unshielded single-conductor cables are used), twisted or in parallel and as close to one another as possible.
- Ground any unused conductors of signal and data cables at both ends.
- Signal and data cables should enter the cabinet only at one point (e.g. from below).

Cables outside the control cabinet

- Route the power cables of the drive so that there is a minimum clearance of 25 cm to signal and data cables.
- Use shielded motor cables.
- Use shielded signal and data cables.

Cable shields

- For shielded cables, only use cables with finely-stranded, braided shields.
- Connect the shield at the grounded enclosure as well as at the EMC shield bar.
  - Connect the shields to the grounded enclosures through a large surface area at both ends of the cables to establish a low ohmic connection. Attach the shields to the appropriate EMC shield bars.
  - Immediately after the cable enters the cabinet, connect the cable shields to the EMC shield bar through a larger surface area to establish a low ohmic conduction.
- If possible, always route the cable shields without any interruptions.
- Only use metallic or metallized connectors for the plug connections for shielded data cables (e.g. PROFIBUS connection).

5.3.6 Equipotential bonding

Grounding measures

Proceed as follows to ground the drive system:

- For several cabinets, install a common PE bar for all cabinet elements
- Connect all of the drive system components to the PE conductor
- Connect the PE conductor to the PE bar of the control cabinet.

Measures for high frequency equipotential bonding

Proceed as follows, to ensure high-frequency equipotential bonding:

- Connect the metallic components in the control cabinet to the PE bar and the EMC bar through a larger surface area so that a good electrical connection is established.
  - Either through a large surface area between the metal contact surfaces of the cabinet components with a minimum cross-section of several cm² for each contact location.
  - Or, alternatively using short, finely stranded, braided copper wires with cross-sections ≥ 95 mm² / 000 (3/0) (-2) AWG.
- In plants and systems with several cabinet elements, screw the frames of the individual cabinet elements at several locations to one another using serrated washers to establish a good electrical connection.
- In plants and systems with very long rows of cabinets, which are installed in two groups back to back, connect the PE bars of the two cabinet groups at as many locations as possible.
- Therefore, connect the protective ground conductor and the cable shield to the motor and the inverter.

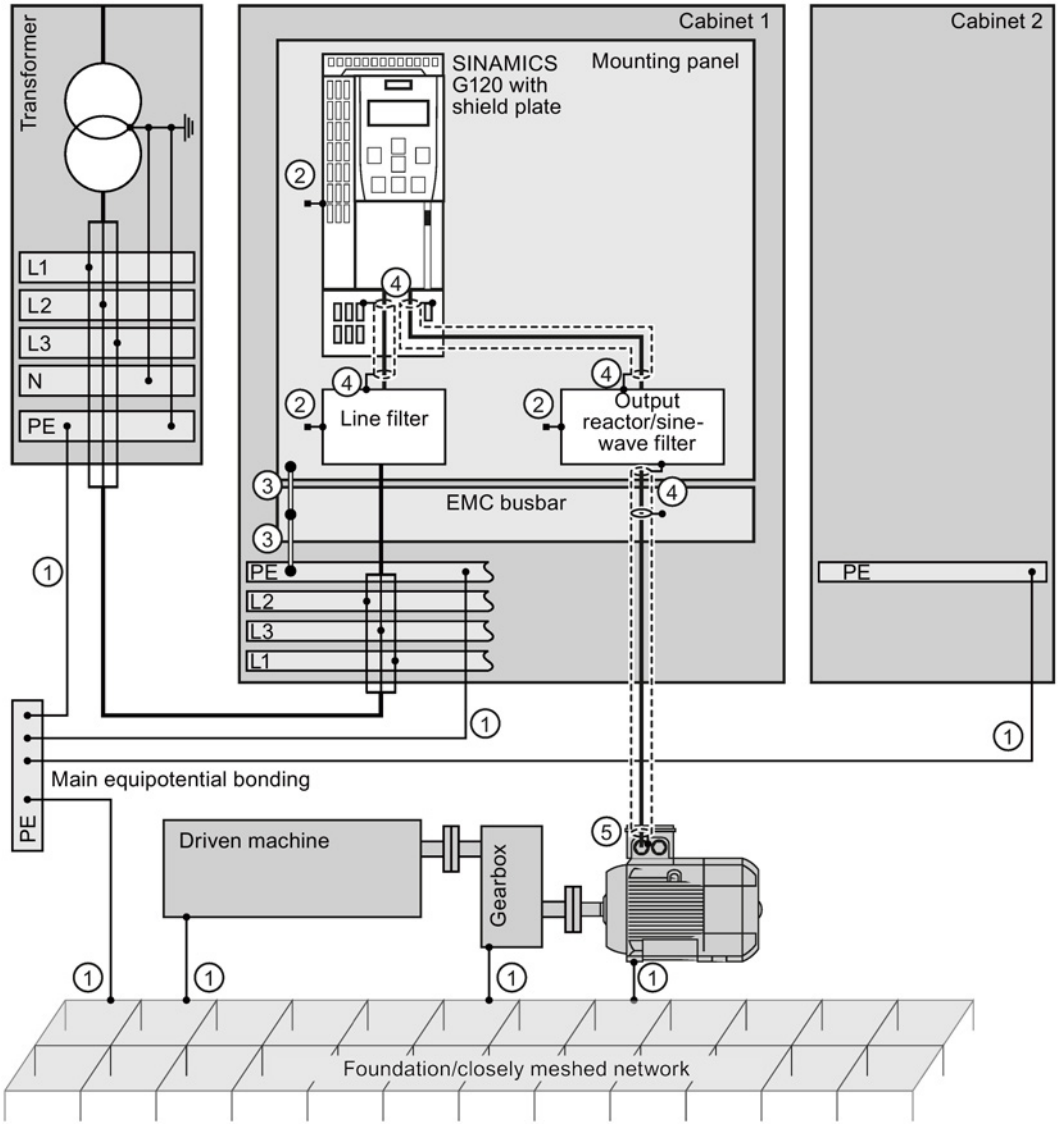
Additional measures for high frequency equipotential bonding

Route finely stranded or braided copper conductors in parallel to the motor cable with the shortest possible distance between them:

- in older systems with already existing unshielded cables
- for cables with poor high-frequency properties of the shield
- for poor grounding systems

Diagrams for grounding and high-frequency equipotential bonding measures

The following diagram illustrates all grounding and high-frequency equipotential bonding measures using the example of a cabinet with a SINAMICS G120.



Grounding measures

① Conventional grounding without any special HF properties

High-frequency equipotential bonding measures

② Electrically conductive connection to the mounting panel through the largest possible surface

③ HF equipotential bonding

④ Connect the shield through a large contact surface and ground

⑤ Connect the shield through an electrically conductive heavy-gauge threaded joint (gland) and ground

Figure 5-6 Grounding and high-frequency equipotential bonding measures in the drive system and in the plant

The following diagram shows the additional measures for high-frequency equipotential bonding

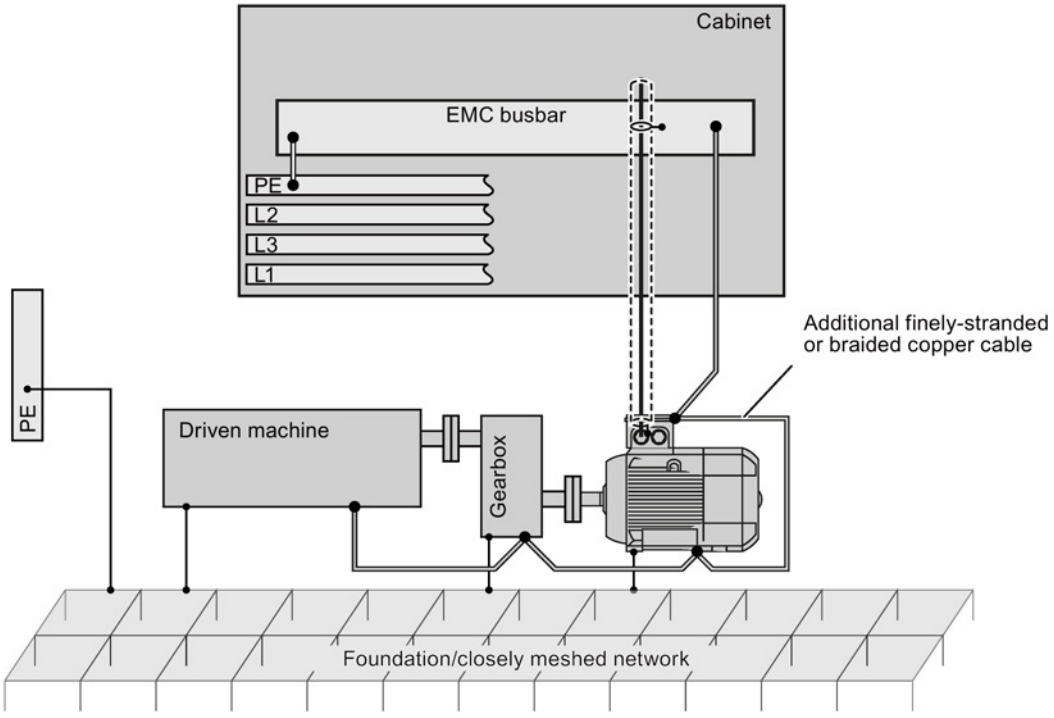


Figure 5-7 Additional measures for high frequency equipotential bonding of the drive system

Service and maintenance

6

⚠WARNING

Risk of fire or electric shock as a result of defective components

If a cable protection element responds, this can indicate that a fault current was interrupted.

Check the circuit components and all of the components of the inverter and replace defective parts and components to reduce the risk of a fire or an electric shock.

Repair

⚠WARNING

Danger due to incorrect repair

Repairs may only be carried out by Siemens Service, by repair centers authorized by Siemens or by authorized personnel who are thoroughly acquainted with all the warnings and operating procedures contained in this manual.

- Only use original spare parts when carrying out repairs.

6.1 Maintenance

The purpose of maintenance is to maintain the specified condition of the Power Module. Regularly remove dirt and pollution, and replace the fan in plenty of time. See also Section Replacing a fan (Page 56)

Also observe the following points.

Cleaning

Inverters with IP20 degree of protection

Clean the inverter with an anti-static brush, a vacuum cleaner and areas that are difficult to access, using dry compressed air (max. 1 bar).

Inverter with through-hole technology (degree of protection IP54, UL type 12 at the rear panel of the control cabinet)

Clean the heatsink at regular intervals. If necessary, remove the air deflection plate at the rear. Use a torque of 2 Nm when reconnecting. The fans must be installed if you clean the heatsink using water.

Ventilation

The devices must be installed in a cabinet. Ensure that the cabinet's ventilation slots are not blocked. Check that the fan is functioning correctly.

Cables and screw terminals

Regularly check the cables for damage, and immediately replace any defective parts.

Regularly check that the screw terminals have been correctly tightened. Retighten the screws if necessary.

Note

The actual maintenance intervals depend on the installation and operating conditions.

Siemens offers its customers support in the form of service contracts. For further information, contact your Siemens regional office or sales office.

6.2 Commissioning after a long storage time

If the inverter was not operational for a longer period of time, it may be necessary to form the DC link capacitors before switching on.

You must form the DC link capacitors in the following cases:

- If the inverter was not operational for longer than one year.
- If, when commissioning the drive system for the first time, the date of manufacture of the inverter was more than one year ago. The date of manufacture is coded in the serial number (see the next paragraph).

You form the DC link capacitors by connecting power to the inverters as shown below.

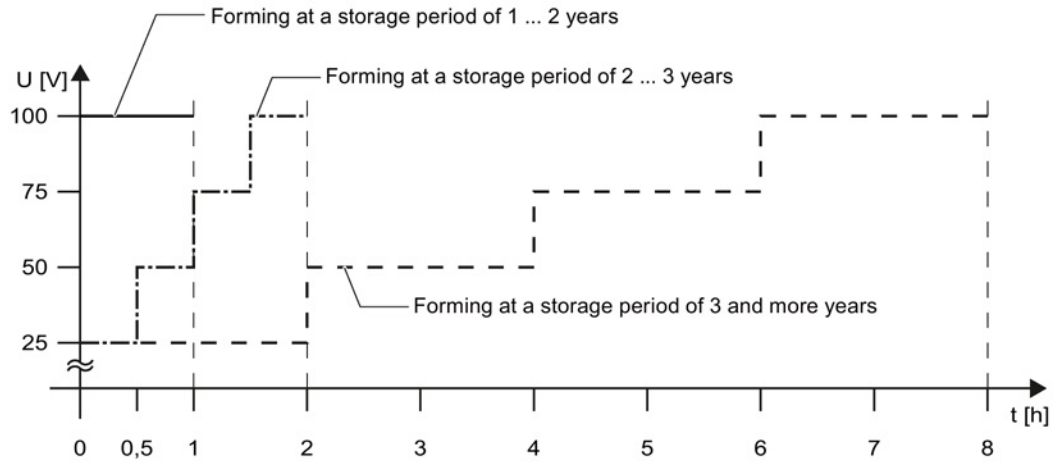


Figure 6-1 Measures when forming the DC link capacitors

Code to encrypt the date of manufacture

The date of manufacture is encrypted in positions 3 - 6 of the serial number.

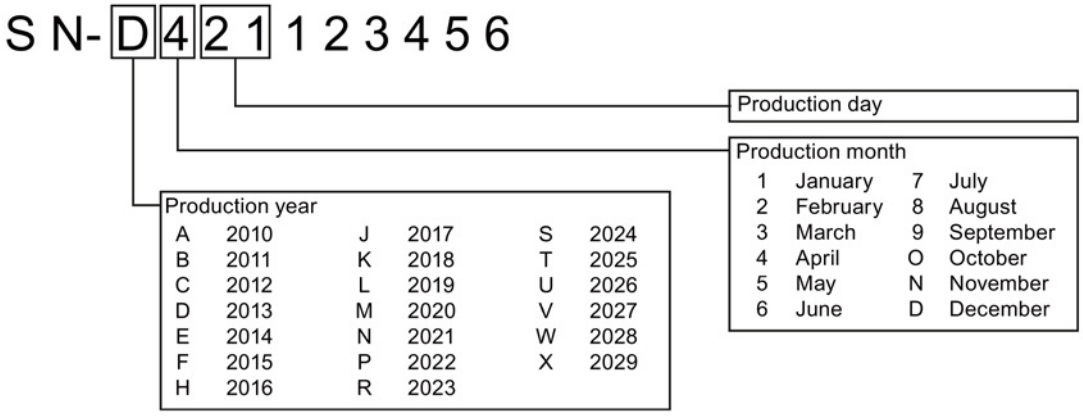


Figure 6-2 Code to encrypt the date of manufacture

In this example, the date of manufacture is April 21, 2013

6.3 Replacing a fan

6.3.1 Fan replacement - general

For frame sizes FSA … FSC the fan module is installed at the bottom. For frame sizes FSD … FSE it is located at the top.

Tools are not required to replace a fan. The electrical connections are disconnected or established by withdrawing or inserting the fan module.

For frame sizes FSA and FSB the fan module has one fan, for frame sizes FSC to FSE, two fans.

Service life of the fan

The average service life of the fan is 40,000 hours. In practice, however, the service life may deviate from this value. Especially a dusty environment can block up the fan.

The fan must be replaced in good time to ensure that the inverter is ready for operation.

⚠DANGER

Danger to life through electric shock due to the residual charge of the DC link capacitors

Because of the DC link capacitors, a hazardous voltage is present for up to 5 minutes after the power supply has been switched off.

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

- Do not open the protective cover of the device until 5 minutes have elapsed.
- Before starting any work, check that the system is in a voltage-free state by measuring all terminals, also to ground.
- Ensure that the associated warning plate in the appropriate language is attached.

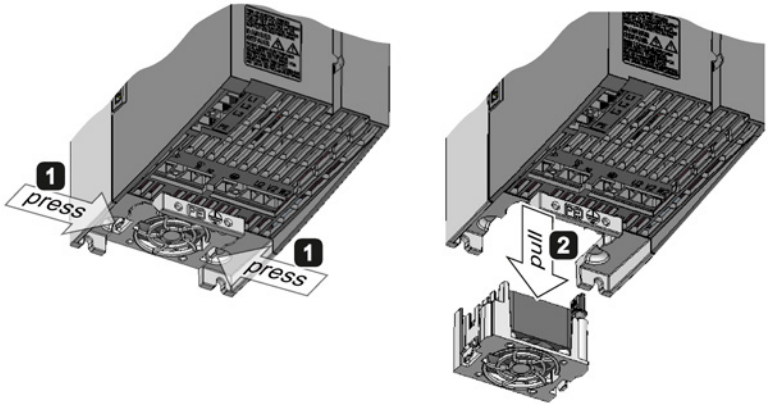
Fan replacement FSA … FSC

Procedure when replacing fan modules FSA … FSC

Proceed as follows to replace a fan module:

1. Switch-off the inverter, and wait 5 minutes until the DC link capacitors have been discharged.
2. Withdraw the line and motor cable connectors and, if available, remove the braking resistor from the Power Module.
3. Remove the shield plate from the Power Module.

4. Remove the fan module from the Power Module as shown in the diagram.



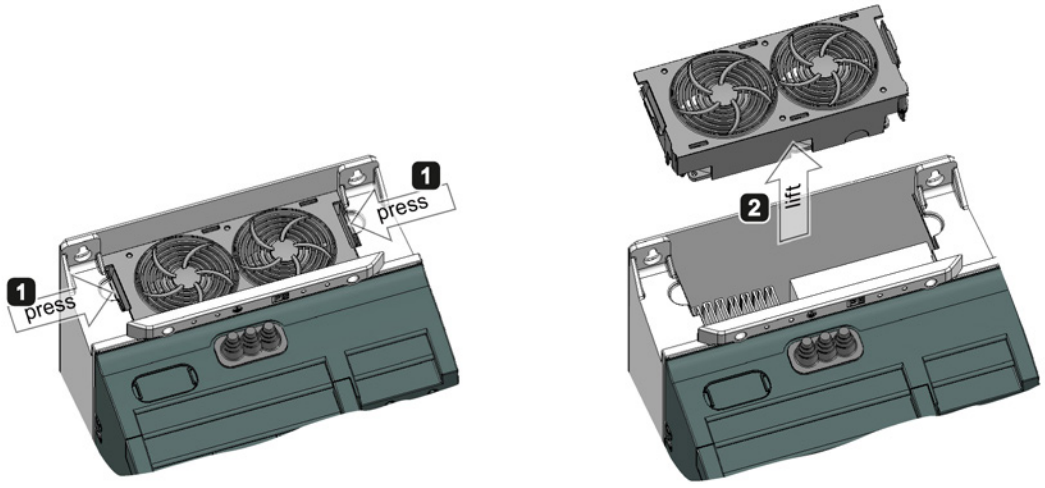
5. Install the new fan module in the inverse sequence.

You have replaced the fan module.

Procedure for frame sizes FSD ... FSE

Proceed as follows to replace a fan module:

1. Switch-off the inverter, and wait 5 minutes until the DC link capacitors have been discharged.
2. Remove the fan module from the Power Module as shown in the diagram.



3. Install the new fan module in the inverse sequence.

You have replaced the fan module

Technical data

7

Permissible shock and vibration values

Vibration load

- Long-term storage in the transport packaging according to Class 1M2 to EN 60721-3-1
- Transport in the transport packaging according to Class 2M3 to EN 60721-3-2

Shock load

- Long-term storage in the transport packaging according to Class 1M2 to EN 60721-3-1
- Transport in the transport packaging according to Class 2M3 to EN 60721-3-2

Inverters for systems in the United States / Canada (UL/cUL)

In order to ensure that the system is UL/cUL-compliant, use UL/cUL-certified J-type fuses. Only use copper cables/wires rated for 60 °C or 75 °C.

Additional requirements for CSA compliance:

Install the inverter with an external suppression device with the following properties:

- Surge protection device with the appropriate certification (category checking numbers VZCA and VZCA7)
- Rated supply voltage
  - 240 V (phase with respect to ground), 240 V (phase to phase) for 230 V inverters
  - 480 V (phase with respect to ground), 480 V (phase to phase) for 400 V inverters
- Terminal voltage, V_{PR} = 2000 V
- Suitable for SPD applications, type 1 or type 2

Alternatively, use a surge protection device, article number 5SD7 424-1 from Siemens AG.

Power loss for Power Modules FSD and FSE

Note

Power loss for Power Modules FSD and FSE

The values specified for the power loss are typical values at 90% of the rated speed and 100% of the load corresponding to Low Overload.

7.1 High overload - low overload PM240-2

Permissible inverter overload

Depending on the utilization level expected, you can select the inverter based on the following load cycles.

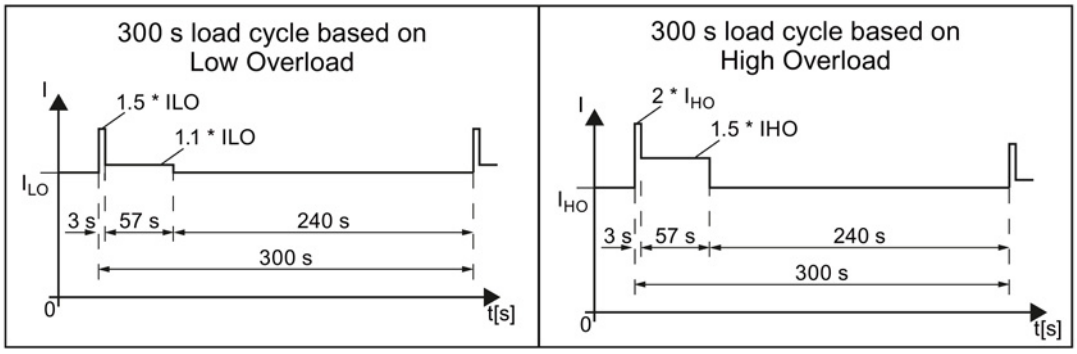


Figure 7-1 "High Overload" and "Low Overload" load cycles

Note

Please note that the base load current I_{HO} for "High Overload" is less than the base load current I_{LO} for "Low Overload".

The load cycles shown in the diagram are examples. We recommend the "SIZER" engineering software to select the inverter based on duty cycles. See Configuring support (Page 112).

Definitions

- **LO base load input current**

  Permissible inverter input current resulting from the Low Overload load cycle.

- **LO base load output current**

  Rated current at the output terminals for a load cycle according to Low Overload

- **LO base load power**

  Permissible inverter power that includes the overload defined in the associated Low Overload load cycle.

- **HO base load input current**

  Permissible inverter input current resulting from the High Overload load cycle.

- **HO base load output current**

  Rated current at the output terminals for a load cycle according to High Overload

- **HO base load power**

  Permissible inverter power that includes the overload defined in the associated High Overload load cycle.

If not specified otherwise, the power and current data always refer to a load cycle according to Low Overload.

7.2 Cable cross-sections and tightening torques

Table 7- 1 Connection type, cable cross sections and tightening torques

Inverters	Connection	Cross-section and tightening torque		Strip lengths
		Metric	Imperial	
FSA	Line, motor cable, DC link and braking resistor	1.5 … 2.5 mm^2: 0.5 Nm	16 … 14 AWG: 4.5 lbf in	8 mm
FSB	Line, motor cable, DC link and braking resistor	1.5 … 6 mm^2: 0.6 Nm	16 … 10 AWG: 5.5 lbf in	8 mm
FSC	Line, motor cable, DC link and braking resistor	6 …16 mm: 1.3 Nm	10 … 6 AWG: 12 lbf in	10 mm
FSD	Line, motor cable and DC link	1.5 …25 mm^2: 2.5 Nm 35 mm^2: 4.5 Nm	16 … 4 AWG: 22 lbf in 2 AWG: 40 lbf in	18 mm
	Braking resistor	1.5 … 16 mm^2: 1.5 Nm	16 … 6 AWG: 13 lbf in	10 mm
FSE	Line, motor cable and DC link	16 … 95 mm^2: 10 Nm	6 … 3/0 AWG: 89 lbf in	25 mm
	Braking resistor	1.5 …25 mm^2: 2.5 Nm 35 mm^2: 4.5 Nm	16 … 4 AWG: 22 lbf in 2 AWG: 40 lbf in	18 mm

7.3 Technical data, 200 V inverters

For the 200 V Power Modules, induction motors are permissible in the range from 25 % … 150 % of the inverter power without any restrictions.

Use motors for inverter operation or with higher insulation levels.

7.3.1 General data, 200 V inverters

If not specified otherwise, the data listed here apply up to installation altitudes of 2000 m above sea level.
You can find the values for higher installation altitudes under "Restrictions for special ambient conditions (Page 78)".

Property	Version		
Line voltage	FSA … FSC	200 V … 240 V 1-ph. AC ± 10 %	for LO base load power 0.55 kW … 4 kW for HO base load power 0.37 kW … 3 kW
		200 V … 240 V 3-ph. AC ± 10 %	for LO base load power 0.55 kW … 7.5 kW for HO base load power 0.37 kW … 5.5 kW
	FSD … FSE	200 V … 240 V 3-ph. AC -20 % / + 10 %	
Output voltage	3 AC 0 V … 0.95 * input voltage (max.)		
Input frequency	50 Hz … 60 Hz, ± 3 Hz		
Output frequency	0 … 550 Hz, depending on the control mode		
Line impedance	FSA … FSC: Uk ≥ 2 %, for lower values, we recommend a line reactor, or a Power Module with the next higher power rating. Not applicable for FSD and FSE		
Power factor λ	FSA … FSC	0.7 without line reactor for Uk ≥ 2 % 0.85 with line reactor for Uk < 2%	
	FSD … FSE	0.95 line reactor is not required	
Inrush current	< LO base load input current		
Overvoltage category acc. to EN 60664-1	The inverter insulation is designed for surge voltages according to overvoltage Category III.		
Pulse frequency	4 kHz (factory setting), Can be set in 2 kHz steps in the range from 2 kHz … 16 kHz The output current is reduced if you increase the pulse frequency.		
Short-circuit current rating (SCCR)	≤ 65 kA rms When protected with a fuse corresponding to Section Specific technical data, 200 V inverters (Page 64)		
Electromagnetic compatibility according to IEC/EN 61800-3	Devices with integrated filter are suitable for Category C2 environments. Details are provided in Sections Electromagnetic compatibility of the inverter (Page 82) and Motor cable length (Page 38).		
Braking methods	DC braking, compound braking, dynamic braking with integrated braking chopper		
Degree of protection according to EN 60529	Chassis devices	IP20	Must be installed in a control cabinet
	PT devices	IP20, IP54	Must be installed in a control cabinet at the control cabinet panel

Property	Version	
Ambient temperature for	LO base load power without derating: HO base load power without derating: LO/HO base load power with derating:	-20 °C … +40 °C -20 °C … +50 °C -20 °C … + 60° C
	Details see Section Restrictions for special ambient conditions (Page 78). For the maximum permissible ambient temperature, also observe the permissible ambient temperatures for the Control Unit and possibly operator panel (IOP or BOP-2) Manuals for your inverter (Page 111).	
Ambient conditions according to EN 60721-3-3	FSA … FSC:	Protected against damaging chemical substance, according to environmental Class 3C2
	FSD … FSE	Protected against damaging chemical substance, according to environmental Class 3C3
Temperature during storage according to EN 60721-3-3	-40 °C … +70 °C	
Cooling air	clean and dry air	
Relative humidity	< 95% - condensation not permissible	
Pollution according to EN 61800-5-1	suitable for environments with degree of pollution 2	
Shocks and vibration according to EN 60721-3-1	• Long-term storage in the transport packaging according to Class 1M2 • Transport in the transport packaging according to Class 2M3 • Vibration in operation according to Class 3M2	
Installation altitude	without derating with derating	up to 1000 m above sea level up to 4000 m above sea level
	Details see Section Restrictions for special ambient conditions (Page 78).	
Approvals	FSA … FSC	cULus, CE, C-tick, KCC
	FSD … FSE	cULus, CE, C-tick, SEMI F47, KCC,WEEE, RoHS, EAC

7.3.2 Specific technical data, 200 V inverters

Table 7- 2 PM240-2, IP20, frame sizes A, 1 AC / 3 AC 200 V … 240 V

Article No. - without filter **Article No. - with filter**	**6SL3210…** **6SL3210…**	**…1PB13-0UL0** **…1PB13-0AL0**	**…1PB13-8UL0** **…1PB13-8AL0**
LO base load power		0.55 kW	0.75 kW
LO base load input current 1 AC		7.5 A	9.6 A
LO base load input current 3 AC		4.2 A	5.5 A
LO base load output current		3.2 A	4.2 A
HO base load power		0.37 kW	0.55 kW
HO base load input current 1 AC		6.6 A	8.4 A
HO base load input current 3 AC		3.0 A	4.2 A
HO base load output current		2.3 A	3.2 A
Fuse according to IEC Fuse according to UL		3NA3 803 (10 A) 15 A Class J	3NA3 805 (16 A) 15 A Class J
Power losses without filter Power losses with filter		0.04 kW 0.04 kW	0.04 kW 0.04 kW
Required cooling air flow		5 l/s	5 l/s
Weight without filter Weight with filter		1.4 kg 1.6 kg	1.4 kg 1.6 kg

Table 7- 3 PM240-2, PT, frame sizes A, 1 AC / 3 AC 200 V … 240 V

Article No. - without filter **Article No. - with filter**	**6SL3211…** **6SL3211…**	**…1PB13-8UL0** **…1PB13-8AL0**
LO base load power		0.75 kW
LO base load input current 1 AC		9.6 A
LO base load input current 3 AC		5.5 A
LO base load output current		4.2 A
HO base load power		0.55 kW
HO base load input current 1 AC		8.4 A
HO base load input current 3 AC		4.2 A
HO base load output current		3.2 A
Fuse according to IEC Fuse according to UL		3NA3 805 (16 A) 15 A Class J
Power losses without filter Power losses with filter		0.04 kW 0.04 kW
Required cooling air flow		5 l/s
Weight without filter Weight with filter		1.8 kg 2.0 kg

Table 7- 4 PM240-2, IP20, frame sizes B, 1 AC / 3 AC 200 V … 240 V

Article No. - without filter	**6SL3210…**	**…1PB15-5UL0**	**…1PB17-4UL0**	**…1PB21-0UL0**
Article No. - with filter	**6SL3210…**	**…1PB15-5AL0**	**…1PB17-4AL0**	**…1PB21-0AL0**
LO base load power		1.1 kW	1.5 kW	2.2 kW
LO base load input current 1 AC		13.5 A	18.1 A	24.0 A
LO base load input current 3 AC		7.8 A	9.7 A	13.6 A
LO base load output current		6 A	7.4 A	10.4 A
HO base load power		0.75 kW	1.1 kW	1.5 kW
HO base load input current 1 AC		11.8 A	15.8 A	20.9 A
HO base load input current 3 AC		5.5 A	7.8 A	9.7 A
HO base load output current		4.2 A	6 A	7.4 A
Fuse according to IEC		3NE 1814-0 (20 A)	3NE 1815-0 (25 A)	3NE 1803-0 (35 A)
Fuse according to UL		35 A Class J	35 A Class J	35 A Class J
Power losses without filter		0.05 kW	0.07 kW	0.12 kW
Power losses with filter		0.05 kW	0.07 kW	0.12 kW
Required cooling air flow		9.2 l/s	9.2 l/s	9.2 l/s
Weight without filter		2.8 kg	2.8 kg	2.8 kg
Weight with filter		3.1 kg	3.1 kg	3.1 kg

Table 7- 5 PM240-2, PT, frame sizes B, 1 AC / 3 AC 200 V … 240 V

Article No. - without filter	**6SL3211…**	**…1PB21-0UL0**
Article No. - with filter	**6SL3211…**	**…-1PB21-0AL0**
LO base load power		2.2 kW
LO base load input current 1 AC		24.0 A
LO base load input current 3 AC		13.6 A
LO base load output current		10.4 A
HO base load power		1.5 kW
HO base load input current 1 AC		20.9 A
HO base load input current 3 AC		9.7 A
HO base load output current		7.4 A
Fuse according to IEC		3NE 1803-0 (35 A)
Fuse according to UL		35 A Class J
Power losses without filter		0.12 kW [1)]
Power losses with filter		0.12 kW [1)]
Required cooling air flow		9.2 l/s
Weight without filter		3.4 kg
Weight with filter		3.7 kg

1) approx. 0.08 through the heatsink

Table 7- 6 PM240-2, IP 20, frame sizes C, 1 AC / 3 AC 200 V … 240 V

Article No. - without filter	**6SL3210…**	**...1PB21-4UL0**	**…1PB21-8UL0**
Article No. - with filter	**6SL3210…**	**…1PB21-4AL0**	**...1PB21-8AL0**
LO base load power		3 kW	4 kW
LO base load input current 1 AC		35.9 A	43.0 A
LO base load input current 3 AC		17.7 A	22.8 A
LO base load output current		13.6 A	17.5 A
HO base load power		2.2 kW	3 kW
HO base load input current 1 AC		31.3 A	37.5 A
HO base load input current 3 AC		13.6 A	17.7 A
HO base load output current		10.4 A	13.6 A
Fuse according to IEC		3NE 1817-0 (50 A)	3NE 1818-0 (63 A)
Fuse according to UL		50 A Class J	50 A Class J
Power losses without filter		0.14 kW	0.18 kW
Power losses with filter		0.14 kW	0.18 kW
Required cooling air flow		18.5 l/s	18.5 l/s
Weight without filter		5.0 kg	5.0 kg
Weight with filter		5.2 kg	5.2 kg

Table 7- 7 PM240-2, PT, frame sizes C, 1 AC / 3 AC 200 V … 240 V

Article No. - without filter	**6SL3211…**	**...1PB21-8UL0**
Article No. - with filter	**6SL3211…**	**…1PB21-8AL0**
LO base load power		4 kW
LO base load input current 1 AC		43.0 A
LO base load input current 3 AC		22.8 A
LO base load output current		17.5 A
HO base load power		3 kW
HO base load input current 1 AC		37.5 A
HO base load input current 3 AC		17.7 A
HO base load output current		13.6 A
Fuse according to IEC		3NE 1818-0 (63 A)
Fuse according to UL		50 A Class J
Power losses without filter		0.18 kW [1)]
Power losses with filter		0.18 kW [1)]
Required cooling air flow		18.5 l/s
Weight without filter		5.9 kg
Weight with filter		6.2 kg

1) approx. 0.09 through the heatsink

Table 7- 8 PM240-2, IP 20, frame sizes C, 3 AC 200 V … 240 V

Article No. - without filter	**6SL3210…**	**...1PC22-2UL0**	**…1PC22-8UL0**
Article No. - with filter	**6SL3210…**	**…1PC22-2AL0**	**...1PC22-8AL0**
LO base load power		5.5 kW	7.5 kW
LO base load input current		28.6 A	36.4 A
LO base load output current		22.0 A	28.0 A
HO base load power		4 kW	5.5 kW
HO base load input current		22.8 A	28.6 A
HO base load output current		17.5 A	22.0 A
Fuse according to IEC		3NE 1802-0 (40 A)	3NE 1817-0 (50 A)
Fuse according to UL		50 A Class J	50 A Class J
Power losses without filter		0.2 kW	0.26 kW
Power losses with filter		0.2 kW	0.26 kW
Required cooling air flow		18.5 l/s	18.5 l/s
Weight without filter		5.0 kg	5.0 kg
Weight with filter		5.2 kg	5.2 kg

Table 7- 9 PM240-2, IP20, FSD, 3 AC 200 V … 240 V

Article No. - without filter	**6SL3210-…**	**…1PC24-2UL0**	**…1PC25-4UL0**	**…1PC26-8UL0**
LO base load power		11 kW	15 kW	18.5 kW
LO base load input current		40 A	51 A	64 A
LO base load output current		42 A	54 A	68 A
HO base load power		7.5 kW	11 kW	15 kW
HO base load input current		36 A	43 A	56 A
HO base load output current		35 A	42 A	54 A
Siemens fuse according to IEC/UL		3NE1818-0 / 63A	3NE1 820-0 / 80A	3NE1 021-0 / 100A
Fuse according to IEC/UL, Class J		60 A	80A	90 A
Power loss, see note (Page 59)		0.42 kW	0.57 kW	0.76 kW
Required cooling air flow		55 l/s	55 l/s	55 l/s
Weight		17 kg	17 kg	17 kg

Table 7- 10 PM240-2, IP20, FSE, 3 AC 200 V … 240 V

Article No. - without filter	**6SL3210-…**	**…1PC28-8UL0**	**…1PC31-1UL0**
LO base load power		22 kW	30 kW
LO base load input current		76 A	98 A
LO base load output current		80 A	104 A
HO base load power		18.5 kW	22 kW
HO base load input current		71 A	83 A
HO base load output current		68 A	80 A
Siemens fuse according to IEC/UL		3 NE1 021-0 / 100A	3 NE1 224-0 / 160A
Fuse according to IEC/UL, Class J		100 A	150 A
Power loss, see note (Page 59)		0.85 kW	1.20 kW
Required cooling air flow		83 l/s	83 l/s
Weight		26 kg	26 kg

7.4 Technical data, 400 V inverters

For the 400 V Power Modules, induction motors are permissible in the range from 25 % … 150 % of the inverter power without any restrictions.

Use motors for inverter operation or with higher insulation levels.

7.4.1 General data, 400 V inverters

If not specified otherwise, the data listed here apply up to installation altitudes of 2000 m above sea level.
You can find the values for higher installation altitudes under "Restrictions for special ambient conditions (Page 78)".

Property	Version		
Line voltage	FSA … FSC	380 V … 480 V 3-ph. AC ± 10 %	
	FSD … FSE	3 AC 380 V … 480 V -20 %, +10 %	
Output voltage	3 AC 0 V … 0.95 * input voltage (max.)		
Input frequency	50 Hz … 60 Hz, ± 3 Hz		
Output frequency	0 … 550 Hz, depending on the control mode		
Line impedance	Uk ≥ 1 %, for lower values, we recommend a line reactor, or a Power Module with the next higher power rating.		
Power factor λ	FSA … FSC	0.7 without line reactor for Uk ≥ 1 % 0.85 with line reactor for Uk < 1 %	
	FSD … FSE	0.95 (line reactor not required)	
Inrush current	< LO base load input current		
Overvoltage category acc. to EN 60664-1	The inverter insulation is designed for surge voltages according to overvoltage Category III.		
Pulse frequency	4 kHz (factory setting) Can be adjusted in 2 kHz steps in the range from 2 kHz … 16 kHz. Restriction: from a LO base load power of 55 kW up to 8 kHz. The output current is reduced if you increase the pulse frequency.		
Short-circuit current rating (SCCR)	≤ 65 kA rms When protected with a fuse corresponding to Section Specific technical data, 400 V inverters (Page 70)		
Electromagnetic compatibility according to IEC/EN 61800-3	Devices with integrated filter are suitable for Category C2 environments. Details are provided in Sections Electromagnetic compatibility of the inverter (Page 82) and Motor cable length (Page 38).		
Braking methods	DC braking, compound braking, dynamic braking with integrated braking chopper		
Degree of protection according to EN 60529	Chassis devices	IP20	Must be installed in a control cabinet
		IP20, IP54	Must be installed in a control cabinet
	PT devices		at the control cabinet panel
Ambient temperature for	LO base load power without derating:		-20 °C … +40 °C
	HO base load power without derating:		-20 °C … +50 °C
	LO/HO base load power with derating:		-20 °C … + 60° C

Property	Version	
	Details see Section Restrictions for special ambient conditions (Page 78). For the maximum permissible ambient temperature, also observe the permissible ambient temperatures for the Control Unit and possibly operator panel (IOP or BOP-2) Manuals for your inverter (Page 111).	
Ambient conditions according to EN 60721-3-3	FSA … FSC:	Protected against damaging chemical substance, according to environmental Class 3C2
	FSD … FSE	Protected against damaging chemical substance, according to environmental Class 3C3
Temperature during storage according to EN 60721-3-3	-40 °C … +70 °C	
Cooling air	clean and dry air	
Relative humidity	< 95% - condensation not permissible	
Pollution according to EN 61800-5-1	suitable for environments with degree of pollution 2	
Shocks and vibration according to EN 60721-3-1	• Long-term storage in the transport packaging according to Class 1M2 • Transport in the transport packaging according to Class 2M3 • Vibration in operation according to Class 3M2	
Installation altitude	without derating: with derating:	up to 1000 m above sea level up to 4000 m above sea level
	Details see Section Restrictions for special ambient conditions (Page 78).	
Approvals	FSA … FSC	cULus, CE, C-tick, KCC
	FSD … FSE	cULus, CE, C-tick, SEMI F47, KCC,WEEE, RoHS, EAC

7.4.2 Specific technical data, 400 V inverters

Table 7- 11 PM240-2, IP20, frame sizes A, 3-ph. 380 V AC… 480 V

Article No. - without filter **Article No. - with filter**	**6SL3210…** **6SL3210…**	**…1PE11-8UL1** **…1PE11-8AL1**	**…1PE12-3UL1** **…1PE12-3AL1**	**…1PE13-2UL1** **…1PE13-2AL1**
LO base load power		0.55 kW	0.75 kW	1.1 kW
LO base load input current		2.3 A	2.9 A	4.1 A
LO base load output current		1.7 A	2.2 A	3.1 A
HO base load power		0.37 kW	0.55 kW	0.75 kW
HO base load input current		2.0 A	2.6 A	3.3 A
HO base load output current		1.3 A	1.7 A	2.2 A
Fuse according to IEC Fuse according to UL		3NA3 804 (4 A) 10 A Class J	3NA3 804 (4 A) 10 A Class J	3NA3 801 (6 A) 15 A Class J
Power loss		0.04 kW	0.04 kW	0.04 kW
Required cooling air flow		5 l/s	5 l/s	5 l/s
Weight without filter Weight with filter		1.3 kg 1.5 kg	1.3 kg 1.5 kg	1.3 kg 1.5 kg

Table 7- 12 PM240-2, IP20, frame sizes A, 3-ph. 380 V AC… 480 V

Article No. - without filter **Article No. - with filter**	**6SL3210…** **6SL3210…**	**…1PE14-3UL1** **…1PE14-3AL1**	**…1PE16-1UL1** **…1PE16-1AL1**	**…1PE18-0UL1** **…1PE18-0AL1**
LO base load power		1.5 kW	2.2 kW	3.0 kW
LO base load input current		5.5 A	7.7 A	10.1 A
LO base load output current		4.1 A	5.9 A	7.7 A
HO base load power		1.1 kW	1.5 kW	2.2 kW
HO base load input current		4.7 A	6.1 A	8.8 A
HO base load output current		3.1 A	4.1 A	5.9 A
Fuse according to IEC Fuse according to UL		3NA3 803 (10 A) 20 A Class J	3NA3 803 (10 A) 30 A Class J	3NA3 805 (16 A) 30 A Class J
Power loss		0.07 kW	0.1 kW	0.12 kW
Required cooling air flow		5 l/s	5 l/s	5 l/s
Weight without filter Weight with filter		1.4 kg 1.6 kg	1.4 kg 1.6 kg	1.4 kg 1.6 kg

Table 7- 13 PM240-2, PT, frame sizes A, 3-ph. 380 V AC… 480 V

Article No. - without filter **Article No. - with filter**	**6SL3211…** **6SL3211…**	**…1PE18-0UL1** **…1PE18-0AL1**
LO base load power LO base load input current LO base load output current		3.0 kW 10.1 A 7.7 A
HO base load power HO base load input current HO base load output current		2.2 kW 8.8 A 5.9 A
Fuse according to IEC Fuse according to UL		3NA3 805 (16 A) 30 A Class J
Power loss without filter		0.12 kW [1)]
Required cooling air flow		7 l/s
Weight without filter Weight with filter		1.8 kg 2.0 kg

1) approx. 0.1 kW through the heatsink

Table 7- 14 PM240-2, IP20, frame sizes B, 3-ph. 380 V AC… 480 V

Article No. - without filter **Article No. - with filter**	**6SL3210…** **6SL3210…**	**…1PE21-1UL0** **…1PE21-1AL0**	**…1PE21-4UL0** **…1PE21-4AL0**	**…1PE21-8UL0** **…1PE21-8AL0**
LO base load power LO base load input current LO base load output current		4.0 kW 13.3 A 10.2 A	5.5 kW 17.2 A 13.2 A	7.5 kW 22.2 A 18.0 A
HO base load power HO base load input current HO base load output current		3.0 kW 11.6 A 7.7 A	4.0 kW 15.3 A 10.2 A	5.5 kW 19.8 A 13.2 A
Fuse according to IEC Fuse according to UL		3NE 1814-0 (20 A) 35 A Class J	3NE 1815-0 (25 A) 35 A Class J	3NE 1803-0 (35 A) 35 A Class J
Power loss		0.11 kW	0.15 kW	0.2 kW
Required cooling air flow		9.2 l/s	9.2 l/s	9.2 l/s
Weight without filter Weight with filter		2.9 kg 3.1 kg	2.9 kg 3.1 kg	3.0 kg 3.2 kg

Table 7- 15 PM240-2, PT, frame sizes B, 3-ph. 380 V AC… 480 V

Article No. - without filter	**6SL3211…**	**...1PE21-8UL0**
Article No. - with filter	**6SL3211…**	**...1PE21-8AL0**
LO base load power		7.5 kW
LO base load input current		22.2 A
LO base load output current		18.0 A
HO base load power		5.5 kW
HO base load input current		19.8 A
HO base load output current		13.7 A
Fuse according to IEC		3NE 1803-0 (35 A)
Fuse according to UL		35 A Class J
Power loss		0.2 kW 1)
Required cooling air flow		9.2 l/s
Weight without filter		3.6 kg
Weight with filter		3.9 kg

1) approx. 0.16 kW through the heatsink;

Table 7- 16 PM240-2, IP20, frame sizes C, 3-ph. 380 V AC… 480 V

Article No. - without filter	**6SL3210…**	**…1PE22-7UL0**	**…1PE23-3UL0**
Article No. - with filter	**6SL3210…**	**…1PE22-7AL0**	**…1PE23-3AL0**
LO base load power		11.0 kW	15.0 kW
LO base load input current		32.6 A	39.9 A
LO base load output current		26.0 A	32.0 A
HO base load power		7.5 kW	11.0 kW
HO base load input current		27.0 A	36.0 A
HO base load output current		18.0 A	26.0 A
Fuse according to IEC		3NE 1817-0 (50 A)	3NE 1817-0 (50 A)
Fuse according to UL		50 A Class J	50 A Class J
Power loss		0.3 kW	0.37 kW
Required cooling air flow		18.5 l/s	18.5 l/s
Weight without filter		4.7 kg	4.8 kg
Weight with filter		5.3 kg	5.4 kg

Table 7- 17 PM240-2, PT, frame sizes C, 3 AC 380 V … 480 V

Article No. - without filter	**6SL3211…**	**...1PE23-3UL0**
Article No. - with filter	**6SL3211…**	**...1PE23-3AL0**
LO base load power		15.0 kW
LO base load input current		39.9 A
LO base load output current		32.0 A
HO base load power		11.0 kW
HO base load input current		36.0 A
HO base load output current		26.0 A
Fuse according to IEC		3NE 1817-0 (50 A)
Fuse according to UL		50 A Class J
Power loss		0.37 kW [1)]
Required cooling air flow		18.5 l/s
Weight without filter		5.8 kg
Weight with filter		6.3 kg

1) approx. 0.3 kW through the heatsink;

Table 7- 18 PM240-2, IP20, FSD, 3 AC 380 V … 480 V

Article No. - without filter	**6SL3210-…**	**…1PE23-8UL0**	**…1PE24-5UL0**	**…1PE26-0UL0**
Article No. - with filter	**6SL3210-…**	**…1PE23-8AL0**	**…1PE24-5AL0**	**…1PE26-0AL0**
LO base load power		18.5 kW	22 kW	30 kW
LO base load input current		36 A	42 A	57 A
LO base load output current		38 A	45 A	60 A
HO base load power		15 kW	18.5 kW	22 kW
HO base load input current		33 A	38 A	47 A
HO base load output current		32 A	38 A	45 A
Siemens fuse according to IEC/UL		3NE1 818-0 / 63 A	3NE1 820-0 / 80 A	3NE1 021-0 / 100A
Fuse according to IEC/UL, Class J		60 A	70 A	90 A
Power losses without filter		0.55 kW	0.68 kW	0.76 kW
Power losses with filter see note (Page 59)		0.56 kW	0.68 kW	0.77 kW
Required cooling air flow		55 l/s	55 l/s	55 l/s
Weight without filter		16 kg	16 kg	17 kg
Weight with filter		17.5 kg	17.5 kg	18.5 kg

Table 7- 19 PM240-2, IP20, FSD, 3 AC 380 V … 480 V

Article No. - without filter **Article No. - with filter**	**6SL3210-…** **6SL3210-…**	**…1PE27-5UL0** **…1PE27-5AL0**
LO base load power LO base load input current LO base load output current		37 kW 70 A 75 A
HO base load power HO base load input current HO base load output current		30 kW 62 A 60 A
Siemens fuse according to IEC/UL Fuse according to IEC/UL, Class J		3NE1 021-0 / 100 A 100 A
Power losses without filter Power losses with filter see note (Page 59)		1.01 kW 1.02 kW
Required cooling air flow		55 l/s
Weight without filter Weight with filter		17 kg 18.5 kg

Table 7- 20 PM240-2, IP20, FSE, 3 AC 380 V … 480 V

Article No. - without filter **Article No. - with filter**	**6SL3210-…** **6SL3210-…**	**…1PE28-8UL0** **…1PE28-8AL0**	**…1PE31-1UL0** **…1PE31-1AL0**
LO base load power LO base load input current LO base load output current		45 kW 86 A 90 A	55 kW 104 A 110 A
HO base load power HO base load input current HO base load output current		37 kW 78 A 75 A	45 kW 94 A 90 A
Siemens fuse according to IEC/UL Fuse according to IEC/UL, Class J		3NE1 022-0 / 125A 125 A	3NE1 224-0 / 160A 150 A
Power losses without filter Power losses with filter see note (Page 59)		1.19 kW 1.2 kW	1.54 kW 1.55 kW
Required cooling air flow		83 l/s	83 l/s
Weight without filter Weight with filter		26kg 28 kg	26 kg 28 kg

7.5 Technical data, 690 V inverters

For the 690 V Power Modules, induction motors are permissible in the range from 50 % … 150 % of the inverter power without any restrictions.

Use motors for inverter operation or with higher insulation levels.

7.5.1 General data, 690 V inverters

If not specified otherwise, the data listed here apply up to installation altitudes of 2000 m above sea level.
For higher installation altitudes, please observe Section "Restrictions for special ambient conditions (Page 78)".

Property	Version
Line voltage	3 AC 500 V … 690 V -20% … +10 %
Output voltage	3 AC 0 V … 0.95 * input voltage (max.)
Input frequency	50 Hz … 60 Hz, ± 3 Hz
Output frequency	0 … 550 Hz, depending on the control mode
Power factor λ	> 0,9
Inrush current	< LO base load input current
Overvoltage category acc. to EN 60664-1	The inverter insulation is designed for surge voltages according to overvoltage Category III.
Pulse frequency	2 kHz (factory setting), can be adjusted to 4 kHz The output current is reduced if you increase the pulse frequency.
Short-circuit current rating (SCCR)	≤ 65 kA rms When protected with a fuse corresponding to Section Specific technical data, 690 V inverters (Page 76)
Electromagnetic compatibility according to IEC/EN 61800-3	Devices with integrated filter are suitable for Category C2 environments. You can find details about this in section Assigning the inverter to EMC categories (Page 84).
Braking methods	DC braking, compound braking, dynamic braking with integrated braking chopper
Degree of protection according to EN 60529	IP20; must be installed in a control cabinet
Ambient temperature for	LO base load power without derating: -20 °C … +40 °C HO base load power without derating: -20 °C … +50 °C LO/HO base load power with derating: -20 °C … + 60° C
	Details see Section Restrictions for special ambient conditions (Page 78). For the maximum permissible ambient temperature, also observe the permissible ambient temperatures for the Control Unit and possibly operator panel (IOP or BOP-2) Manuals for your inverter (Page 111).
Ambient conditions according to EN 60721-3-3	Protected against damaging chemical substance, according to environmental Class 3C3
Temperature during storage according to EN 60721-3-3	-40 °C … +70 °C
Cooling air	clean and dry air

Property	Version	
Relative humidity	< 95% - condensation not permissible	
Pollution according to EN 61800-5-1	suitable for environments with degree of pollution 2	
Shocks and vibration according to EN 60721-3-1	• Long-term storage in the transport packaging according to Class 1M2 • Transport in the transport packaging according to Class 2M3 • Vibration in operation according to Class 3M2	
Installation altitude	without derating: with derating:	up to 1000 m above sea level up to 4000 m above sea level
	Details see Section Restrictions for special ambient conditions (Page 78).	
Approvals	cULus, CE, C-tick, SEMI F47, KCC,WEEE, RoHS, EAC	

7.5.2 Specific technical data, 690 V inverters

Table 7- 21 PM240-2, IP20, FSD, 3 AC 500 V … 690 V

Article No. - without filter	6SL3210-…	…1PH21-4UL0	…1PH22-0UL0	…1PH22-3UL0
Article No. - with filter	6SL3210-…	…1PH21-4AL0	…1PH22 -0AL0	…1PH22 -3AL0
LO base load power		11 kW	15 kW	18.5 kW
LO base load input current		14 A	18 A	22 A
LO base load output current		14 A	19 A	23 A
HO base load power		7.5 kW	11 kW	15 kW
HO base load input current		11 A	14 A	20 A
HO base load output current		11 A	14 A	19 A
Siemens fuse according to IEC/UL		3NE1 815-0 / 25 A	3NE1 815-0 / 25 A	3NE1 803-0 / 32 A
Fuse according to IEC/UL, Class J		20 A	25 A	30 A
Power losses without filter		0.32 kW	0.41 kW	0.48 kW
Power losses with filter see note (Page 59)		0.32 kW	0.41 kW	0.48 kW
Required cooling air flow		55 l/s	55 l/s	55 l/s
Weight without filter		17 kg	17 kg	17 kg
Weight with filter		18.5 kg	18.5 kg	18.5 kg

Table 7- 22 PM240-2, IP20, FSD, 3 AC 500 V … 690 V

Article No. - without filter **Article No. - with filter**	**6SL3210-…** **6SL3210-…**	**…1PH22-7UL0** **…1PH22 -7AL0**	**…1PH23-5UL0** **…1PH23 -5AL0**	**…1PH24-2UL0** **…1PH24 -2AL0**
LO base load power		22 kW	30 kW	37 kW
LO base load input current		25 A	33 A	40 A
LO base load output current		27A	35 A	42 A
HO base load power		18.5 kW	22 kW	30 kW
HO base load input current		24 A	28 A	36 A
HO base load output current		23 A	27 A	35 A
Siemens fuse according to IEC/UL		3NE1 803 / 35 A	3NE1 817 / 50 A	3NE1 818 / 63 A
Fuse according to IEC/UL, Class J		35 A	45 A	60 A
Power losses without filter		0.56 kW	0.72 kW	0.88kW
Power losses with filter see note (Page 59)		0.56 kW	0.73kW	0.88 kW
Required cooling air flow		55 l/s	55 l/s	55 l/s
Weight without filter		17 kg	17 kg	17 kg
Weight with filter		18.5 kg	18.5 kg	18.5 kg

Table 7- 23 PM240-2, IP20, FSE, 3 AC 500 V … 690 V

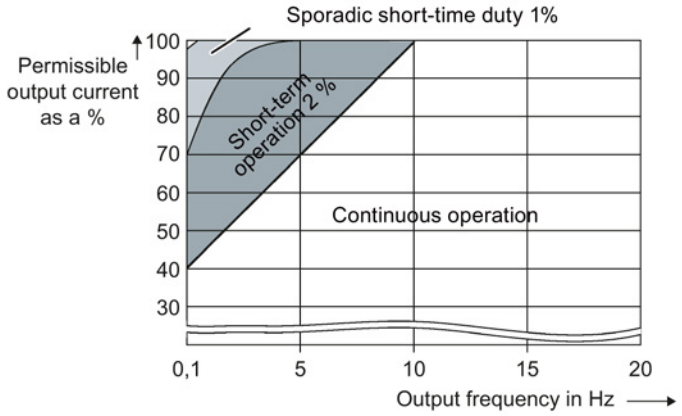
Article No. - without filter **Article No. - with filter**	**6SL3210-…** **6SL3210-…**	**…1PH25-2UL0** **…1PH25-2AL0**	**…1PH26-2UL0** **…1PH26 -2AL0**
LO base load power		45 kW	55 kW
LO base load input current		50 A	59 A
LO base load output current		52 A	62A
HO base load power		37 kW	45 kW
HO base load input current		44 A	54 A
HO base load output current		42 A	52 A
Siemens fuse according to IEC/UL		3NA1 820 / 80A	3NE1 820 / 80A
Fuse according to IEC/UL, Class J		80 A	80 A
Power losses without filter		1.00 kW	1.21 kW
Power losses with filter see note (Page 59)		1.00 kW	1.22 kW
Required cooling air flow		83 l/s	83 l/s
Weight without filter		26 kg	26 kg
Weight with filter		28 kg	28 kg

7.6 Restrictions for special ambient conditions

Maximum current at low speeds

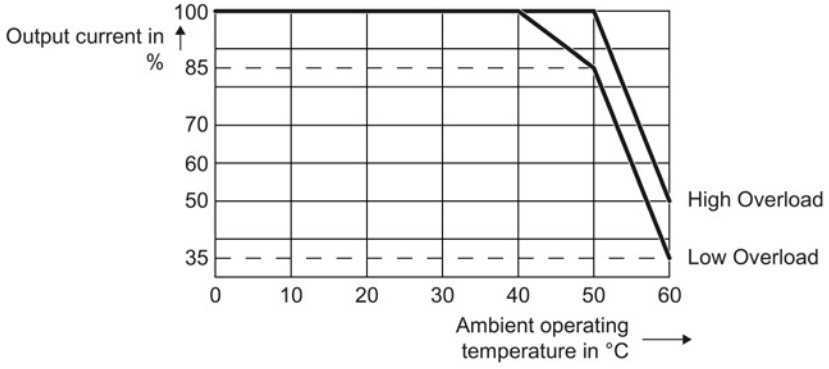
At low speeds, the inverter can only briefly supply the base load output current.

The operating conditions shown in the following diagram are possible without having a negative impact on the inverter service life.



- Continuous operation: permissible operating state for the complete operating time
- Short-time duty operating state permissible for less than 2% of the operating time
- sporadic short-time duty operating state only permissible for less than 1 % of the operating time

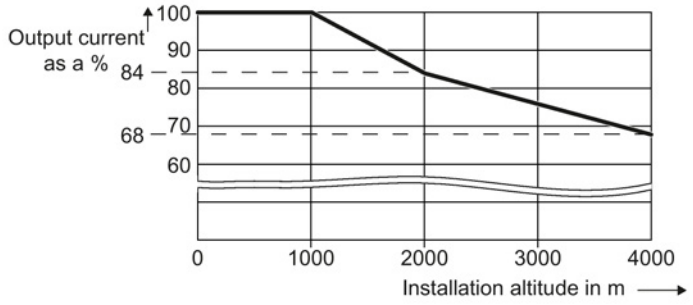
Current de-rating depending on the ambient operating temperature



The Control Unit and operator panel can restrict the maximum permissible operating ambient temperature of the Power Module.

Current derating depending on the installation altitude

Above 1000 m above sea level you must reduce the inverter output current as a result of the lower cooling capability of the air.



Permissible line supplies depending on the installation altitude

- Installation altitude up to 2000 m above sea level
  - Connection to every supply system permitted for the inverter.
- Installation altitudes between 2000 m and 4000 m above sea level
  - Connection to a TN system with grounded neutral point.
  - TN systems with grounded line conductor are not permitted.
  - The TN line system with grounded neutral point can also be supplied using an isolation transformer.
  - The phase-to-phase voltage does not have to be reduced.

Note

690 V Power Modules

For 690 V Power Modules, the TN line system must be established with grounded neutral point through an isolating transformer.

Current derating depending on the pulse frequency

Current derating depending on the pulse frequency [1] for 200 V devices

Article number	LO base load output current for a pulse frequency of … [A]						
	4 kHz	**6 kHz**	**8 kHz**	**10 kHz**	**12 kHz**	**14 kHz**	**16 kHz**
6SL3210-1PB13-0❒L0	**3.2**	2.6	2.1	1.8	1.5	1.4	1.2
6SL321❒-1PB13-8❒L0	**4.2**	3.3	2.7	2.3	2.0	1.8	1.6
6SL3211-1PB15-5❒L0	**6.0**	4.7	3.9	3.3	2.8	2.5	2.2
6SL3210-1PB17-4❒L0	**7.4**	6.3	5.2	4.4	3.7	3.3	3.0
6SL321❒-1PB21-0❒L0	**10.4**	8.8	7.3	6.2	5.2	4.7	4.2
6SL3210-1PB21-4❒L0	**13.6**	11.6	9.5	8.2	6.8	6.1	5.4
6SL321❒-1PB21-8❒L0	**17.5**	14.9	12.3	10.5	8.8	7.9	7.0
6SL3210-1PC22-2❒L0	**22.0**	18.7	15.4	13.2	11.0	9.9	8.8
6SL3210-1PC22-8❒L0	**28.0**	23.8	19.6	16.8	14.0	12.6	11.2
6SL3210-1PC24-2❒L0	**42**	35.7	29.4	25.2	21.0	18.9	16.8
6SL3210-1PC25-4❒L0	**54**	45.9	37.8	32.4	27.0	24.3	21.6
6SL3210-1PC26-8❒L0	**68**	57.8	47.6	40.8	34.0	30.6	27.2
6SL3210-1PC28-8❒L0	**80**	68.0	56.0	48.0	40.0	36.0	32.0
6SL3210-1PC31-1❒L0	**104**	88.4	72.8	62.4	52.0	46.8	41.6

[1] The permissible motor cable length also depends on the cable type and the selected pulse frequency.

Current derating depending on the pulse frequency [1] for 400 V devices

Article number	LO base load output current for a pulse frequency of … [A]						
	4 kHz	**6 kHz**	**8 kHz**	**10 kHz**	**12 kHz**	**14 kHz**	**16 kHz**
6SL3210-1PE11-8❒L1	**1.7**	1.4	1.2	1.0	0.9	0.8	0.7
6SL3210-1PE12-3❒L1	**2.2**	1.9	1.5	1.3	1.1	1.0	0.9
6SL3211-1PE13-2❒L1	**3.1**	2.6	2.2	1.9	1.6	1.4	1.2
6SL3210-1PE14-3❒L1	**4.1**	3.5	2.9	2.5	2.1	1.8	1.6
6SL3210-1PE16-1❒L1	**5.9**	5.0	4.1	3.5	3.0	2.7	2.4
6SL321❒-1PE18-0❒L1	**7.7**	6.5	5.4	4.6	3.9	3.5	3.1
6SL3210-1PE21-1❒L0	**10.2**	8.7	7.1	6.1	5.1	4.6	4.1
6SL3210-1PE21-4❒L0	**13.2**	11.2	9.2	7.9	6.6	5.9	5.3
6SL321❒-1PE21-8❒L0	**18.0**	15.3	12.6	10.8	9.0	8.1	7.2
6SL3210-1PE22-7❒L0	**26.0**	22.1	18.2	15.6	13.0	11.7	10.4
6SL321❒-1PE23-3❒L0	**32.0**	27.2	22.4	19.2	16	14.4	12.8
6SL3210-1PE23-8❒L0	**38**	32.3	26.6	22.8	19.0	17.1	15.2
6SL3210-1PE24-5❒L0	**45**	38.3	31.5	27.0	22.5	20.3	18.0
6SL3210-1PE26-0❒L0	**60**	51.0	42.0	36.0	30.0	27.0	24.0
6SL3210-1PE27-5❒L0	**75**	63.8	52.5	45.0	37.5	33.8	30.0
6SL3210-1PE28-8❒L0	**90**	76.5	63.0	54.0	45.0	40.5	36.0
6SL3210-1PE31-1❒L0	**110**	93.5	77.0	66.0	55.0	49.5	44.0

[1] The permissible motor cable length also depends on the cable type and the selected pulse frequency.

Current derating depending on the pulse frequency [1] for 690 V devices

Article number	LO base load output current for a pulse frequency of … [A]	
	2 kHz	4 kHz
6SL3210-1PH21-4❒L0	**14**	8.4
6SL3210-1PH22-0❒L0	**19**	11.4
6SL3210-1PH22-3❒L0	**23**	13.8
6SL3210-1PH22-7❒L0	**27**	16.2
6SL3210-1PH23-5❒L0	**35**	21
6SL3210-1PH24-2❒L0	**42**	25.2
6SL3210-1PH25-2❒L0	**52**	31.2
6SL3210-1PH26-2❒L0	**62**	37.2
[1] The permissible motor cable length also depends on the cable type and the selected pulse frequency.		

7.7 Electromagnetic compatibility of the inverter

The electromagnetic compatibility refers to both the immunity and the emitted interference of a device.

The following disturbance variables must be taken into consideration when evaluating the electromagnetic compatibility:

- Conducted low-frequency disturbance variables (harmonics)
- Conducted high-frequency disturbance variables
- Field-based, low-frequency disturbance variables
- Field-based, high-frequency disturbance variables

The permitted limit values are defined in the EMC product standard EN 61800-3 in EMC categories C1 to C4.

Below you will find some key definitions relating to this.

Classification of EMC behavior

The EMC environment and the EMC Categories are defined in the EMC product standard EN 61800-3 as follows:

Environments:

First environment (public systems)

An environment that includes domestic premises and establishments that are connected directly to a public low-voltage line supply without the use of an intermediate transformer.

Example: Houses, apartments, commercial premises, or offices in residential buildings.

Second environment (industrial systems)

An environment that includes all other establishments which are not connected directly to a public low-voltage line supply.

Example: Industrial areas and technical areas of buildings that are supplied by an assigned transformer.

Categories

Category C4

Drive systems with a rated voltage ≥ 1,000 V, with an LO output current ≥ 400 A, or for use in complex systems in the second environment

Drive systems which correspond to category C4 may only be installed in the second environment.

Category C3

Drive systems with a rated voltage < 1,000 V, which are intended for use in the second environment and not for use in the first environment.

Drive systems which correspond to category C3 may only be installed in the second environment.

Category C2

Drive systems with a rated voltage < 1,000 V, which are neither plug-in devices nor moveable devices and which, when used in the first environment, are only intended to be installed and commissioned by an expert.

Drive systems which correspond to category C2 may only be used in the first environment if they are installed by an expert, with limit values for electromagnetic compatibility observed.

Category C1

Drive systems with a rated voltage < 1000 V, which are intended for use in the first environment.

Drive systems which correspond to category C1 can be installed in the first environment without restrictions.

Note

Expert

An expert is a person or organization with the necessary experience for installing and/or commissioning drive systems (Power Drive Systems - PDS), including the associated EMC aspects.

7.7.1 Assigning the inverter to EMC categories

The inverters have been tested in accordance with the EMC product standard EN 61800-3.

You can find the declaration of conformity in the Internet at: Declaration of Conformity (http://support.automation.siemens.com/WW/view/en/58275445)

Requirements for electromagnetic compatibility

To comply with the requirements of EN 61800-3, all drives must be installed in accordance with the manufacturer's instructions and EMC directives. See also: EMC installation guideline (http://support.automation.siemens.com/WW/view/en/58275445).

The inverter must be permanently installed on the basis of the leakage currents (> 3.5 mA).

In particular, installation must be carried out by an expert who has the necessary experience for installing and/or commissioning power drives, included the associated EMC aspects.

Second environment - category C4

The unfiltered inverters correspond to category C4.

EMC measures in the second environment, category C4, are carried out on the basis of an EMC plan on the system level. See also EMC-compliant installation (Page 43).

Second environment - category C3

Immunity

With respect to their immunity, the inverters are suitable for the second environment, Category C3.

Interference emission for filtered inverters

Inverters with integrated filter are suitable for use in the second environment, Category C3.

Interference emission for unfiltered inverters

If you are using unfiltered inverters in an industrial plant, you must either use an external filter for the converter or install corresponding filters on the system level (conducted high-frequency disturbance variables).

When installed professionally in accordance with EMC guidelines, the converters fulfill the requirements of the standard in relation to category C3 (field-based high-frequency disturbance variables).

Second environment - category C2

Inverters with integrated filter are suitable for use in the second environment, Category C2.

First environment - category C2

Frame sizes FSA … FSC

Inverters with integrated filter are suitable for use in the first environment, Category C2 if you additionally install high-frequency filters or 4% reactors on the line side.

Frame sizes FSD, FSE

Inverters with integrated filter are suitable for use in the first environment, Category C2.

Note

Requirements placed on the short-circuit power (fault level) of the line supply

The inverters are compliant with IEC 61000-3-12 under the assumption that the short-circuit power (fault level) Ssc at the connection point of the customers system with the public grid is greater than or equal to 120.

The installation company or company operating the device is responsible for ensuring that this device is only connected at a connection point with a short-circuit power (fault level) SSC that is greater than or equal to 120. If necessary, the utility company must be contacted and the situation discussed.

7.7.2 Harmonics

Table 7- 24 Typical harmonic currents as a % referred to the LO input current for U_K 1%

Harmonic number	5.	7.	11.	13.	17.	19.	23.	25.
Value as % for FSA … FSC	54	39	11	5.5	5	3	2	2

Table 7- 25 Typical harmonic currents as a %

Harmonic number	5.	7.	11.	13.	17.	19.	23.	25.
Value as % for FSD … FSE, 200 V	28	14	8	6	5	4	3	3
Value as % for FSD … FSE, 400 V	37	21	7	5	4	3	3	2
Value as % for FSD … FSE, 690 V	34	18	8	5	4	3	3	2

7.7.3 EMC limit values in South Korea

Is applicable for filtered 400 V inverters, frame sizes FSD and FSE.

All other inverters do not comply with the limit values.

이 기기는 업무용(A 급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.
For sellers or users, please keep in mind that this device is an A-grade electromagnetic wave device. This device is intended to be used in areas other than home.

The EMC limit values to be complied with for South Korea correspond to the limit values of the EMC product standard for variable-speed electric drives EN 61800-3, Category C2 or limit value class A, Group 1 according to EN55011. By applying suitable supplementary measures, the limit values according to Category C2 or according to limit value class A, Group 1 are maintained. Further, additional measures may be required, for instance, using an additional radio interference suppression filter (EMC filter). The measures for EMC-compliant design of the system are described in detail in this manual respectively in the Installation Guideline EMC.

Please note that the final statement on compliance with the standard is given by the respective label attached to the individual unit.

You can find the Configuration Manual "EMC installation guideline" here (http://support.automation.siemens.com/WW/view/en/60612658)

Accessories

8

Which components are available?

- Push-through mounting frames - only frame sizes FSA … FSC
- Line reactor - only frame sizes FSA … FSC
- Line filter
- Braking resistor
- Brake Relay and Safe Brake Relay
- Output reactors

Connection components

A connection overview for the electrical components is provided in Section Introduction (Page 17).

8.1 Mounting frames for PT devices

Article numbers

- FSA: 6SL3260-6AA00-0DA0
- FSB: 6SL3260-6AB00-0DA0
- FSC: 6SL3260-6AC00-0DA0

The supplementary package contains all the necessary nuts and seals.

The tightening torque to attach the mounting frame and inverter is 3.5 Nm for all mounting frames.

NOTICE
Degree of protection is only guaranteed for Siemens mounting frames
The IP55 degree of protection for the PT devices can only be guaranteed, if the applicable Siemens mounting frame is used and this is correctly installed. The specified tightening torque for the fixing screws (3.5 Nm) is also only valid for Siemens mounting frames.

Dimension drawings

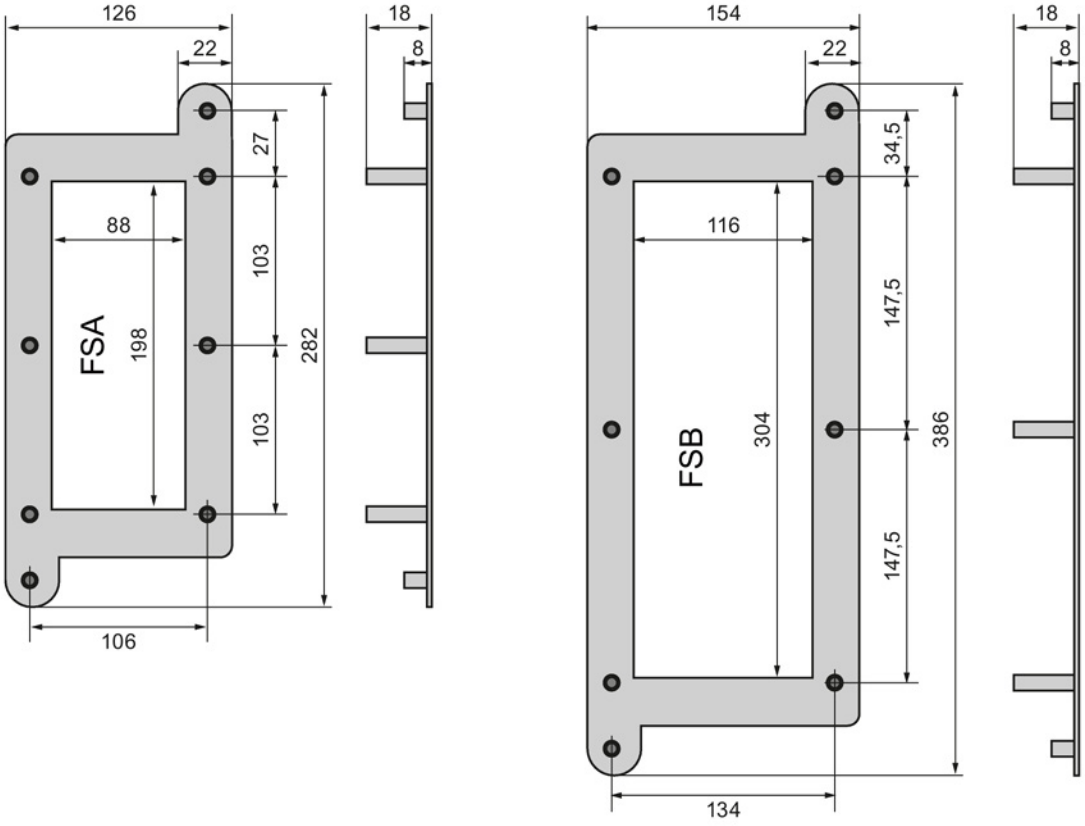


Figure 8-1 Mounting frames_FSA - FSB

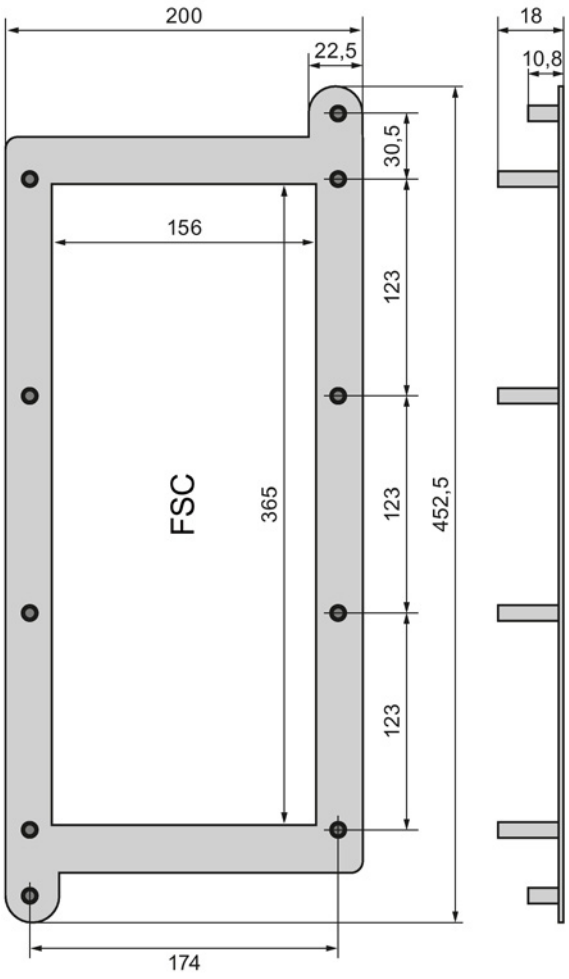


Figure 8-2 Mounting frames_FSC

8.2 Line reactor

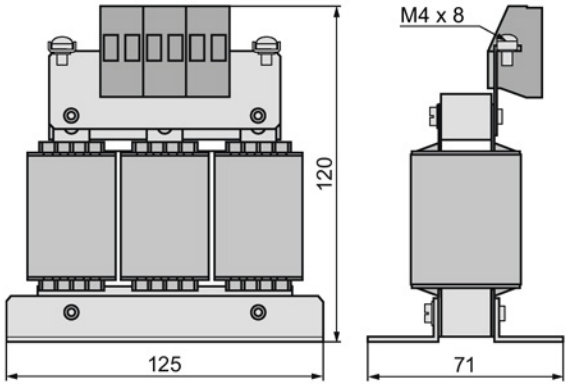
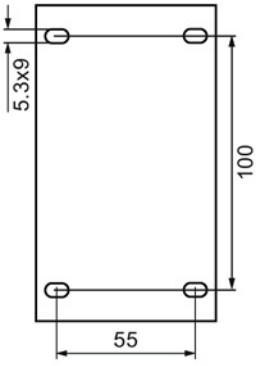
A line reactor protects the inverter when connected to dirty line supplies. A line reactor supports the overvoltage protection, smooths the harmonics in the line supply and buffers commutation dips.

If the line impedance is below 1%, you must install a line reactor to achieve the optimum service life of your inverter.

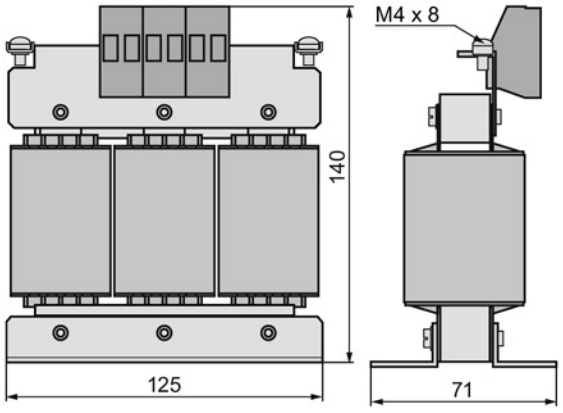
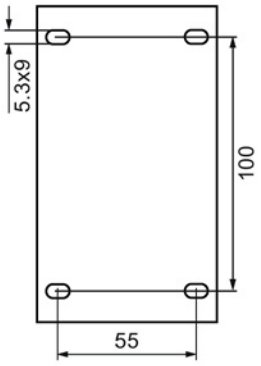
8.2.1 Line reactors for PM240-2, 400 V

Dimensions and drilling patterns

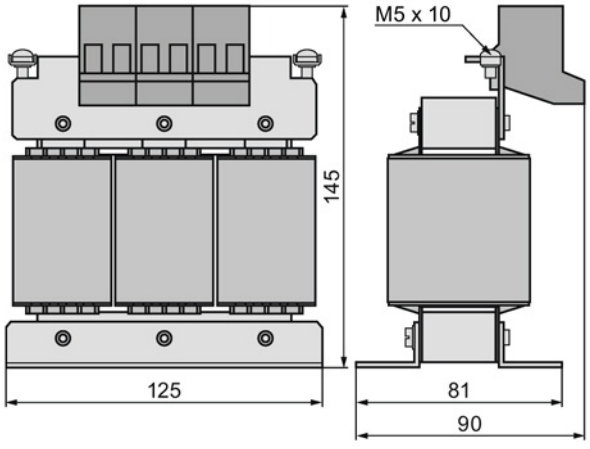
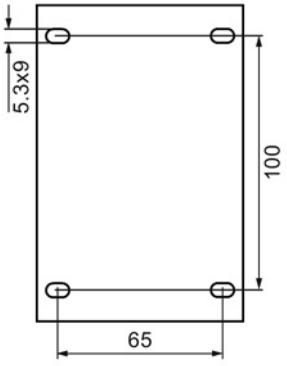
Frame size A, 0.55 kW ... 1.1 kW

Dimensions [mm]	Drilling pattern [mm]
	 Fixings: 4 x M5 bolts 4 x M5 nuts 4 x M5 washers Tightening torque: 6 Nm

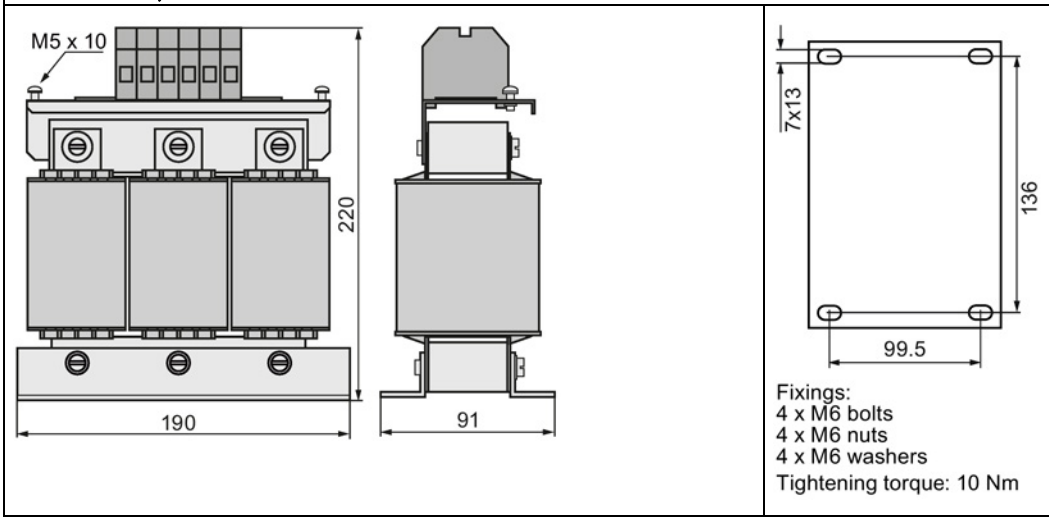
Frame size A, 1.5 kW … 4.0 kW

Dimensions [mm]	Drilling pattern [mm]
	 Fixings: 4 x M5 bolts 4 x M5 nuts 4 x M5 washers Tightening torque: 6 Nm

Frame size B, 5.5 kW … 7.5 kW

	 Fixings: 4 x M5 bolts 4 x M5 nuts 4 x M5 washers Tightening torque: 6 Nm

Frame size C, 11 kW … 18.5 kW



Clearances to other devices

For a line reactor, a minimum clearance to other devices must be maintained on all sides.

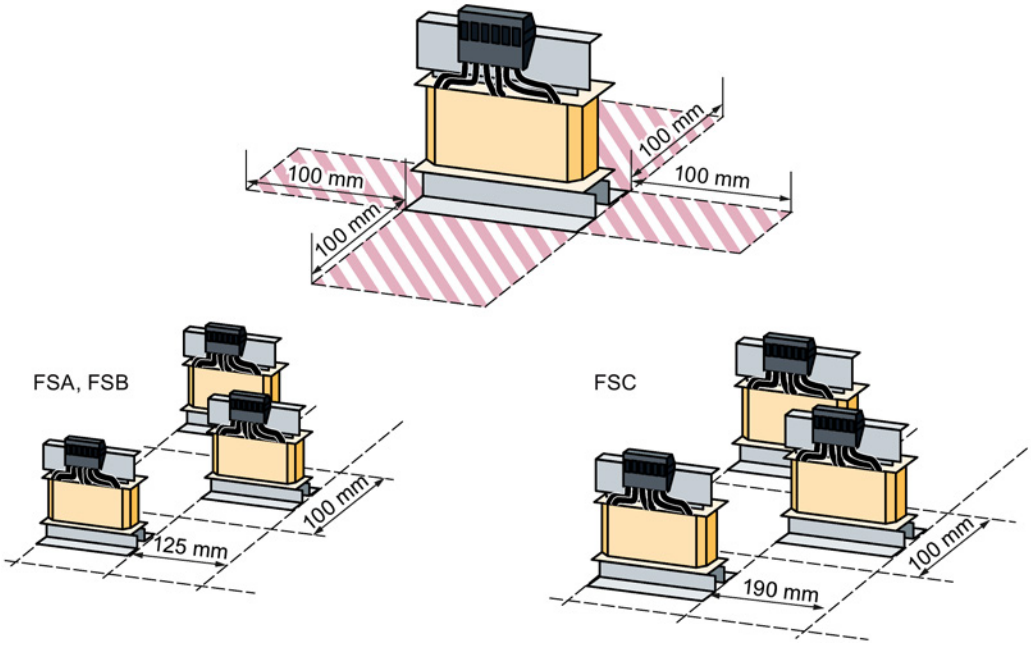


Figure 8-3 Clearances between the line reactors and other devices, examples for space-saving installation

Table 8- 1 Technical data of the line reactors

Article number	6SL3203-0CE13-2AA0	6SL3203-0CE21-0AA0	6SL3203-0CE21-8AA0	6SL3203-0CE23-8AA0
Inductance	2.5 mH	1 mH	0.5 mH	0.3mH
Line/load connection	2.5 mm^2 / 14 AWG 0.8 Nm / 7 lbf in	2.5 mm^2 / 14 AWG 0.8 Nm / 7 lbf in	6 mm^2 / 10 AWG 1.8 Nm / 15.9 lbf in	16 mm^2 / 6 AWG 4.0 Nm / 35.4 lbf in
PE connection	M4 (3 Nm / 26.5 lbf in)	M4 (3 Nm / 26.5 lbf in)	M5 (5 Nm / 44.3 lbf in)	M5 (5 Nm / 44.3 lbf in)
Degree of protection	IP20	IP20	IP20	IP20
Weight	1.1 kg	2.1 kg	2.95 kg	7.80 kg

Table 8- 2 Assignment table

Line reactors	Power Module	
	400 V devices	200 V devices
6SL3203- 0CE13-2AA0	6SL3210-1PE11-8□L1, 6SL3210-1PE12-3□L1 6SL3210-1PE13-2□L1	6SL3210-1PB13-0□L0, 6SL3210-1PB13-8□L0
6SL3203- 0CE21-0AA0	6SL3210-1PE14-3□L1, 6SL321□-1PE16-1□L1 6SL321□-1PE18-0□L1	6SL3210-1PB15-5□L0, 6SL3210-1PB17-4□L0 6SL321□-1PB21-0□L0
6SL3203- 0CE21-8AA0	6SL3210-1PE21-1□L0, 6SL3210-1PE21-4□L0 6SL321□-1PE21-8□L0	6SL3210-1PB21-4□L0 6SL321□-1PB21-8□L0
6SL3203- 0CE23-8AA0	6SL3210-1PE22-7□L0, 6SL321□-1PE23-3□L0	6SL321□-1PC22-2□L0 6SL3210-1PC22-8□L0

8.2.2 Line reactors for PM240-2, 200 V

We recommend the following or similar products as line reactors for inverters with input voltages 1 AC 200 V:

- FSA:
  NKE 10 / 2.93 (Block company)
- FSB
  NKE 25 / 1.17 (Block company)
- FSC
  NKE 35 / 1.46 (Block company)

The technical properties and statements made by the manufacturer apply.

8.3 Line filter

Dimensions for mounting the line filter

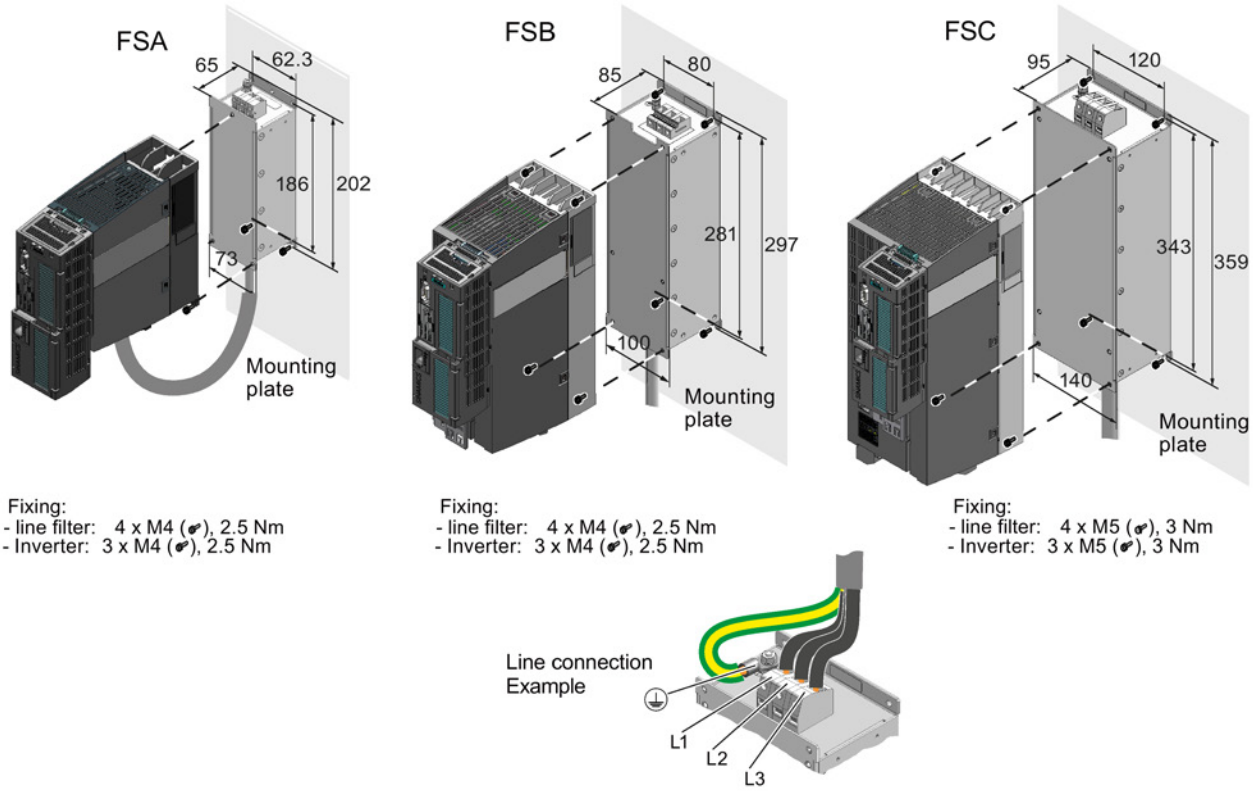


Table 8- 3 Technical data of the line filter (Class B)

Article number	6SL3203-0BE17-7BA0	6SL3203-0BE21-8BA0	6SL3203-0BE23-8BA0
Power loss	13 W	22 W	49.4 W
Line/load connection	2.5 mm^2 / 14 AWG 0.8 Nm / 7 lbf in	6 mm^2 / 10 AWG 1.8 Nm / 15.9 lbf in	16 mm^2 / 6 AWG 4.0 Nm / 35.4 lbf in
PE connection	2.5 mm^2 / 14 AWG 2 Nm / 17.7 lbf in	2.5 mm^2 / 14 AWG 2 Nm / 17.7 lbf in	16 mm^2 / 6 AWG 3 Nm / 26.5 lbf in
Degree of protection	IP20	IP20	IP20
Weight	1.75 kg	4.0 kg	7.3 kg

Table 8- 4 Assignment table

Line filter (Class B)	Power Module - 440 V devices		
6SL3203-0BE17-7BA0	6SL3210-1PE11-8UL1 6SL3210-1PE14-3UL1	6SL3210-1PE12-3UL1 6SL3210-1PE16-1UL1	6SL3210-1PE13-2UL1 6SL321□-1PE18-0UL1
6SL3203-0BE21-8BA0	6SL3210-1PE21-1UL0	6SL3210-1PE21-4UL0	6SL321□-1PE21-8UL0
6SL3203-0BE23-8BA0	6SL3210-1PE22-7UL0	6SL321□-1PE23-3UL0	

□ stands for 1 or 2: 1: Chassis device 2: Push-through device

8.4 Braking resistor

The braking resistor enables loads with a large moment of inertia to be braked quickly. During braking of the motor and the load, excess energy is fed back to the converter. This causes the voltage to rise in the DC link. The converter transfers the excess energy to the externally mounted braking resistor.

Mounting position

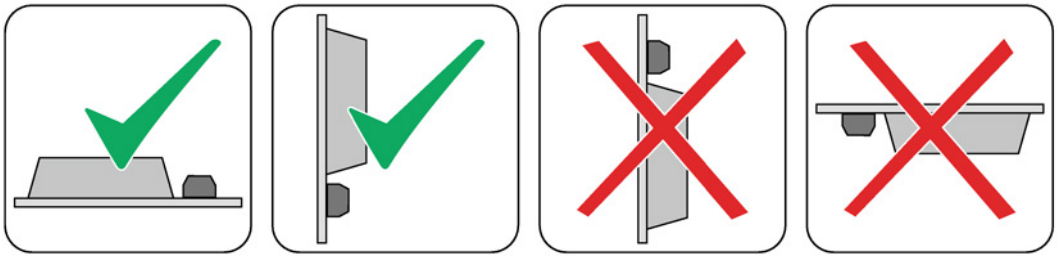


Figure 8-4 Permissible mounting position of the braking resistor

Clearances to other devices

Keep shaded areas free of any devices and components.

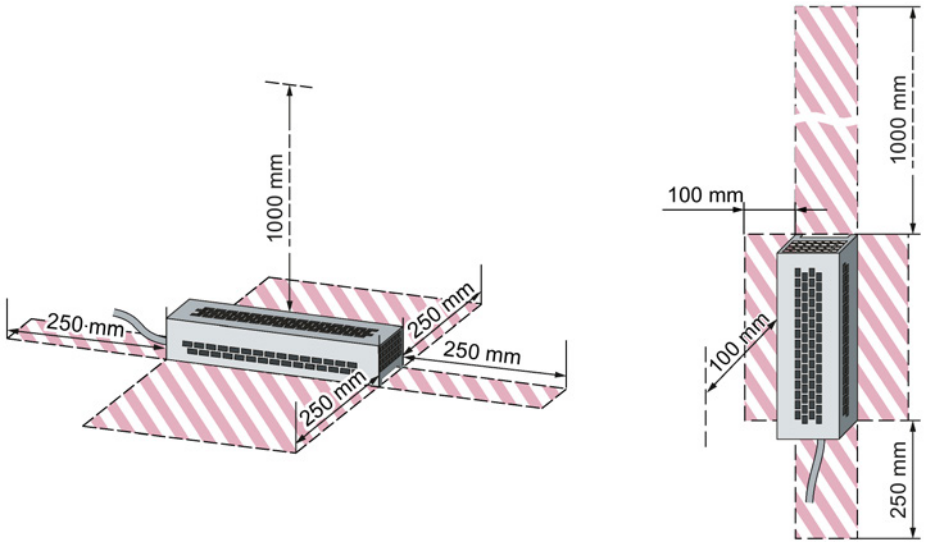
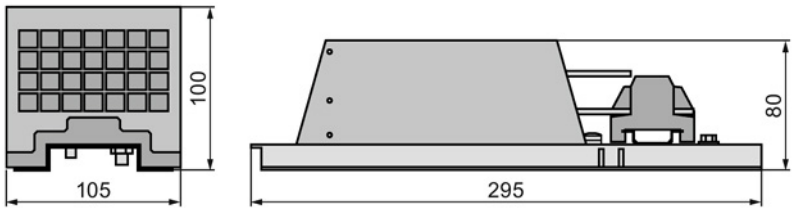
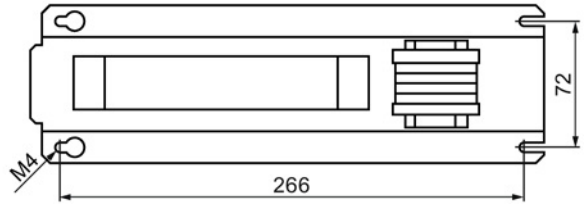


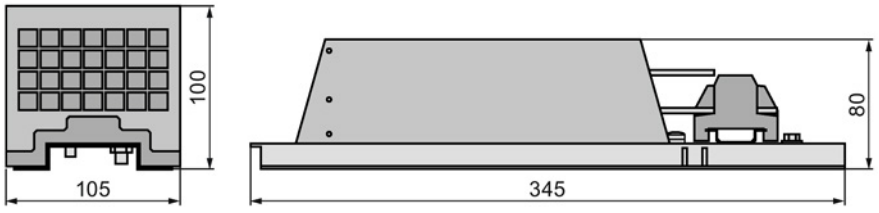
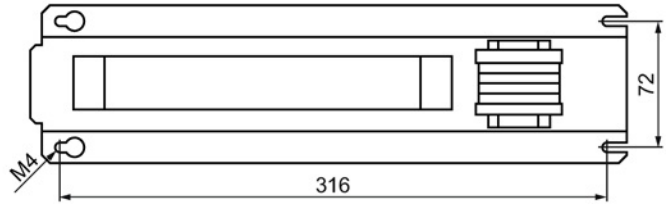
Figure 8-5 Minimum clearances for the braking resistor when mounting on a flat surface and for wall/panel mounting

Mount the resistor on a heat resistant surface with a high thermal conductivity.

Do not cover the ventilation openings of the braking resistor.

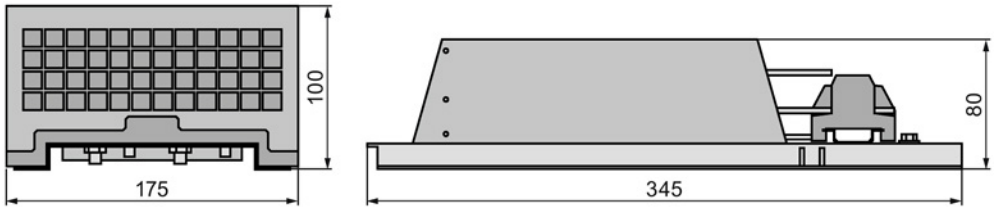
Dimensions and drilling patterns

Frame size A, 0.55 kW … 1.5 kW	
Dimensions [mm]	
	
Drilling pattern [mm]	
	Fixing: 4 × M4 screws 4 × M4 nuts 4 × M4 washers tightening torque 3 Nm

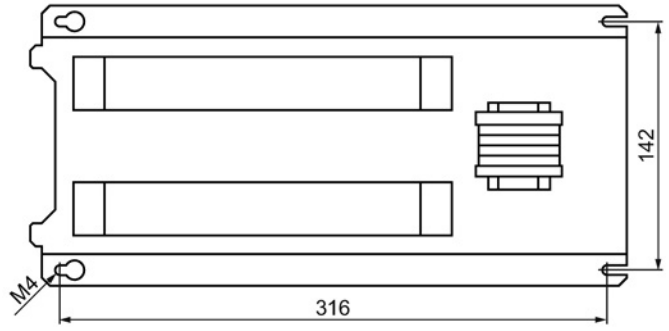
Frame size A, 2.2 kW … 4.0 kW	
Dimensions [mm]	
	
Drilling pattern [mm]	
	Fixing: 4 × M4 screws 4 × M4 nuts 4 × M4 washers tightening torque 3 Nm

Frame size B, 5.5 kW … 7.5 kW

Dimensions [mm]



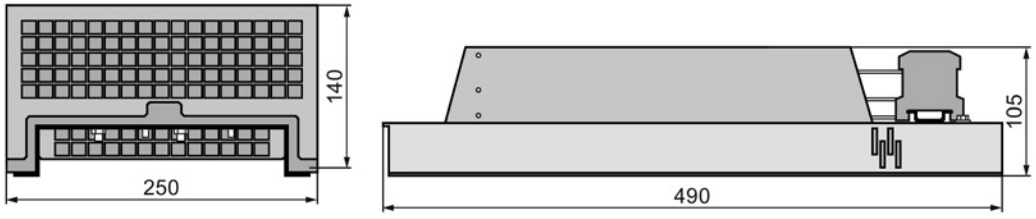
Drilling pattern [mm]



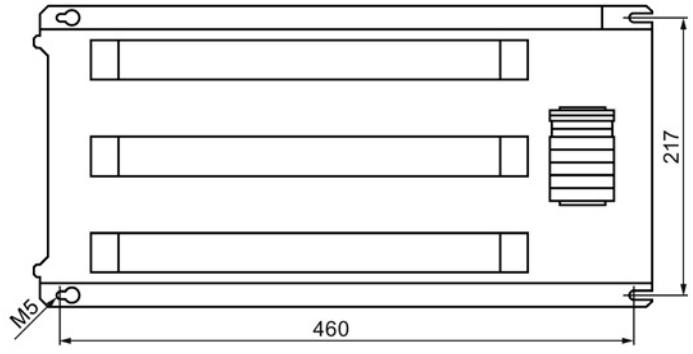
Fixing:
4 × M4 screws
4 × M4 nuts
4 × M4 washers
tightening torque 3 Nm

Frame size C, 11 kW … 18.5 kW

Dimensions [mm]



Drilling pattern [mm]



Fixing:
4 × M5 screws
4 × M5 nuts
4 × M5 washers
tightening torque 6 Nm

WARNING

Danger to life due to fire spreading because of an unsuitable or improperly installed braking resistor

Fire and smoke development can cause severe personal injury or material damage.

Using an unsuitable braking resistor can cause fires and smoke to develop. Possible consequences are severe personal injury or material damage.

- Only use braking resistors that are approved for the inverter.
- Install the braking resistor in accordance with regulations.
- Monitor the temperature of the braking resistor.

CAUTION

Risk of burns due to touching hot surfaces

The temperature of braking resistors increases substantially during operation.

- Do not touch the braking resistor during operation.

Procedure

To connect the braking resistor and monitor the temperature of the braking resistor, proceed as follows:

1. Connect the braking resistor to terminals R1 and R2 of the inverter.
2. Ground the braking resistor directly to the control cabinet's grounding bar. The braking resistor must not be grounded via the PE terminals on the inverter.
3. If you have to fulfill EMC requirements, observe the rules for shielding.

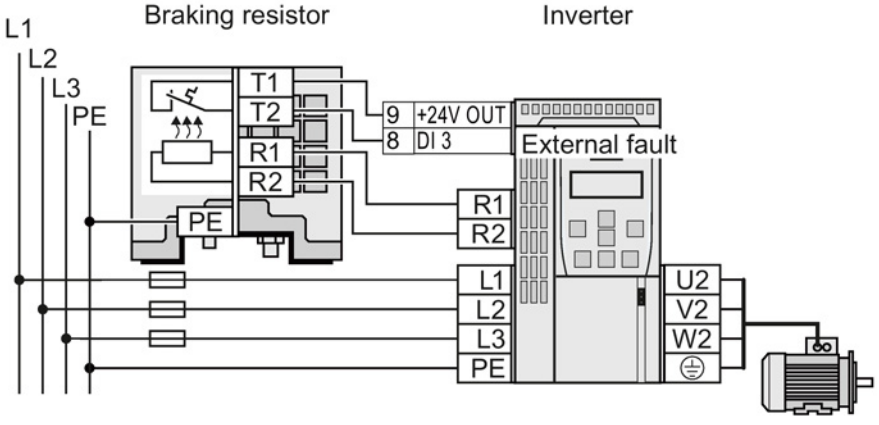


Figure 8-6 Braking resistor connections (example: temperature monitoring via DI 3)

4. Connect the temperature monitoring system of the braking resistor (terminals T1 and T2 on the braking resistor) to a free digital input of your choice at the Control Unit of the inverter. Define the function of this digital input as external fault, e.g. for digital input DI 3: p2106 = 722.3.

You have connected the braking resistor and ensured that temperature monitoring is set up.

For the inverters, use the following or comparable braking resistors. The technical properties and statements made by the manufacturer apply.

Note

Braking resistors FSD … FSE

Only use braking resistors that are UL approved, and have successfully passed the "Abnormal Operation Test" according to UL 508.

Braking resistors for PM240-2, 200 V, FSA … FSC

Table 8- 5 Technical data

Designation of the manufacturer	GWHS 167-60x30-K IP20 200. ±7% 37.5W TS KA 100cm	GWHS 217-60x30-K IP20 68. ±7% 110W TS KA 100cm	GWHS 337-60x30-K IP20 37. ±7% 200W TS KA 100cm	GWHS 337-120x30-K IP20 20. ±7% 375W TS KA 100cm
Article number of the manufacturer	JJY:023146720008	JJY:023151720007	JJY:02 3163720018	JJY:023433720001
Resistance	200 Ω	68 Ω	37 Ω	20 Ω
Peak power, P_{max}	0.75 kW	2.2 kW	4 kW	7.5 kW
Rated power, P_{db}	37.5 W	110 W	200 W	375 W
Degree of protection	IP20	IP20	IP20	IP20

Table 8- 6 Assignment table

Braking resistor	Article numbers of the Power Modules		
GWHS 167-60x30-K	6SL3210-1PB13-0❒L0	6SL321❒-1PB13-8❒L0	
GWHS 217-60x30-K	6SL3210-1PB15-5❒L0	6SL3210-1PB17-4❒L0	6SL321❒-1PB21-0❒L0
GWHS 337-60x30-K	6SL3210-1PB21-4❒L0	6SL321❒-1PB21-8❒L0	
GWHS 337-120x30-K	6SL3210-1PC22-2❒L0	6SL3210-1PC22-8❒L0	

Braking resistors for PM240-2, 200 V, FSD … FSE

Table 8- 7 Technical data

Article number	6SE6400-4BC18-0DA0	6SE6400-4BC21-2EA0	6SE6400-4BC22-5FA0
Pulse power	16 kW	24 kW	50 kW
Rated power	0.8 kW	1.2 kW	2.5 kW
Resistance	10 Ω	6.8 Ω	3.3 Ω
Degree of protection	IP20	IP20	IP20
Weight	7.4 kg	10.6	16.7

Table 8- 8 Assignment table

Braking resistor	Article numbers of the Power Modules
6SE6400-4BC18-0DA0	6SL3210-1PC24-2❒L0 6SL3210-1PC25-4❒L0
6SE6400-4BC21-2EA0	6SL3210-1PC26-8❒L0 6SL3210-1PC28-8❒L0
6SE6400-4BC22-5FA0	6SL3210-1PC31-1❒L0

Braking resistors for PM240-2, 400 V, FSA … FSC

Table 8- 9 Technical data

Article number	6SL3201-0BE14-3AA0	6SL3201-0BE21-0AA0	6SL3201-0BE21-8AA0	6SL3201-0BE23-8AA0
Pulse power	1.5 kW	4 kW	7.5 kW	18.5 kW
Rated power	75 W	200 W	375 W	925 W
Resistance	370 Ω	140 Ω	75 Ω	30 Ω
R1/R2 connection	2.5 mm² / 14 AWG 0.5 Nm / 4.57 lbf in	2.5 mm² / 14 AWG 0.5 Nm / 4.57 lbf in	4 mm² / 10 AWG 0.7 Nm / 6.2 lbf in	6 mm² / 10 AWG 3 Nm / 26.5 lbf in
Temperature contact connection	2.5 mm² / 14 AWG 0.5 Nm / 4.5 lbf in	2.5 mm² / 14 AWG 0.5 Nm / 4.5 lbf in	2.5 mm² / 14 AWG 0.5 Nm / 4.5 lbf in	2.5 mm² / 14 AWG 0.5 Nm / 4.5 lbf in
Degree of protection	IP20	IP20	IP20	IP20
Weight	1.5 kg	1.8 kg	2.7 kg	6.2 kg

Table 8- 10 Assignment table

Braking resistor	Article numbers of the Power Modules
6SL3201-0BE14-3AA0	6SL3210-1PE11-8❒L1 6SL3210-1PE12-3❒L1 6SL3210-1PE13-2❒L1 6SL3210-1PE14-3❒L1
6SL3201-0BE21-0AA0	6SL321❒-1PE16-1❒L1 6SL321❒-1PE18-0❒L1
6SL3201-0BE21-8AA0	6SL3210-1PE21-1❒L0 6SL3210-1PE21-4❒L0 6SL321❒-1PE21-8❒L0
6SL3201-0BE23-8AA0	6SL3210-1PE22-7❒L0 6SL321❒-1PE23-3❒L0

Braking resistors for PM240-2, 400 V, FSD … FSE

Table 8- 11 Technical data

Article number	6SE6400-4BD21-2DA0	6SE6400-4BD22-2EA0	6SE6400-4BD24-0FA0
Pulse power	24 kW	44 kW	80 Ω
Rated power	1.2 kW	2.2 kW	4 kW
Resistance	27 Ω	15 Ω	8.2 Ω
Degree of protection	IP20	IP20	IP20
Weight	7.4 kg	10.6 kg	16.7 kg

Table 8- 12 Assignment table

Braking resistor	Article numbers of the Power Modules
6SE6400-4BD21-2DA0	6SL3210-1PE23-8❒L0 6SL3210-1PE24-5❒L0
6SE6400-4BD22-2EA0	6SL3210-1PE26-0❒L0 6SL3210-1PE27-5❒L0
6SE6400-4BD24-0FA0	6SL3210-1PE28-8❒L0 6SL3210-1PE31-1❒L0

Braking resistors for PM240-2, 690 V, FSD … FSE

Table 8- 13 Technical data

Article number	type R16	type R26
Pulse power	37 kW	55 kW
Rated power	1.85 kW	2.75 kW
Resistance	31 Ω	21 Ω
Degree of protection	IP20	IP20
Weight	7.4 kg	10.6 kg

Table 8- 14 Assignment table

Braking resistor	Article numbers of the Power Modules
type R16	6SL3210-1PH21-4❒L0 6SL3210-1PH22-0❒L0 6SL3210-1PH22-3❒L0 6SL3210-1PH22-7❒L0 6SL3210-1PH23-5❒L0 6SL3210-1PH24-2❒L0
type R26	6SL3210-1PH25-2❒L0 6SL3210-1PH26-2❒L0

Load cycles for the braking resistors

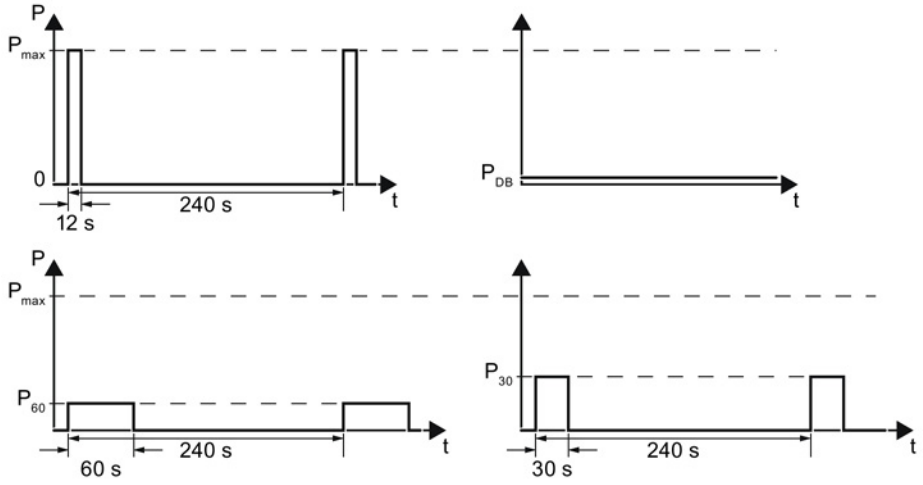


Figure 8-7 Pulse power, rated power and duty cycle examples for the braking resistor

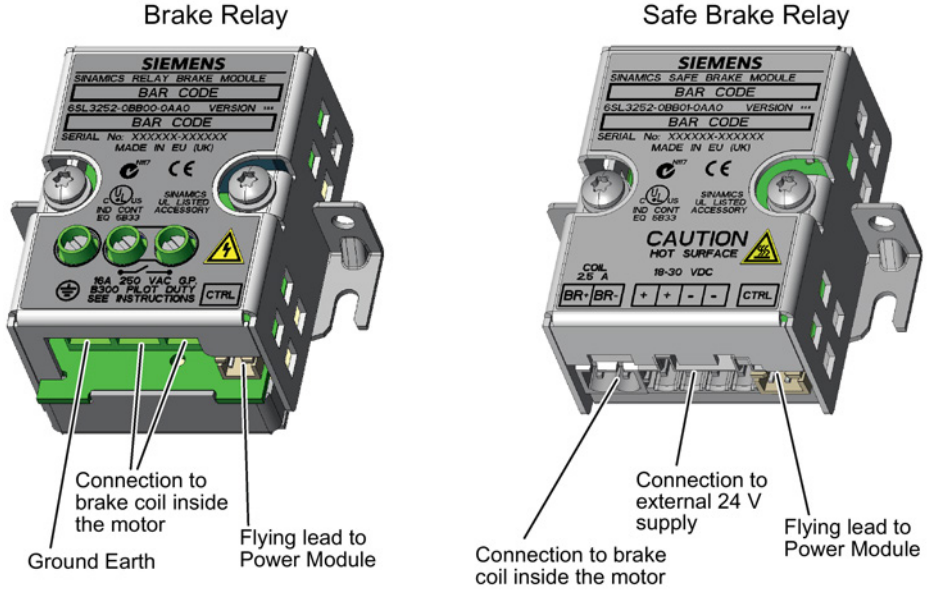
8.5 Brake relay

The Brake Relay is designed to provide the interface between the Power Module and the brake solenoid of a motor. There are two types of Brake Relays:

- Brake Relay – this provides the basic braking control function.
- Safe Brake Relay – this provides for the braking control function within a safety integrated system. To adhere to the requirements of a safety integrated system, the Safe Brake Relay has been designed to allow a variable voltage to be given to the Safe Brake Relay to allow the system to determine if the Safe Brake Relay is functioning correctly without actually activating the braking function.

Mounting the brake relay

Connect one end of the cable harness to the brake relay.
Two cable harnesses of different lengths are supplied with the brake relay. Select the appropriate cable length for the mounting location of the brake relay.



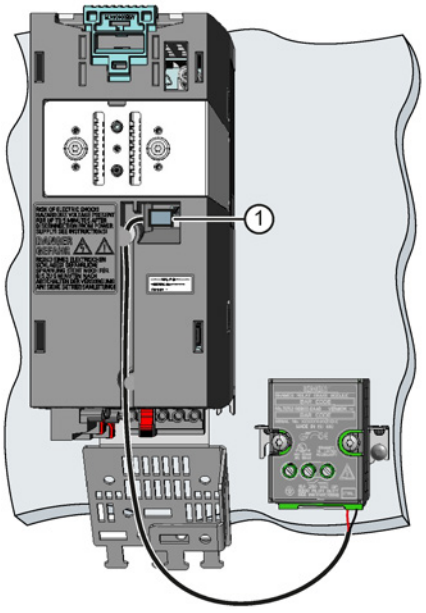
The brake relay control connection is labeled "CTRL".

Connect the other end of the cable harness to the Power Module.

Mounted the brake relay for frame sizes FSA … FSC next to the Power Modules, as shown in the diagram.

For frame sizes FSD and FSE, the brake relay is mounted on the lower shield plate.

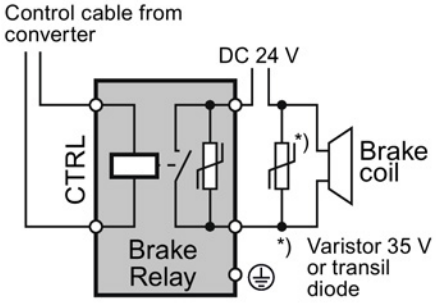
The control connection of the brake relay is located at the front of the Power Module. The Power Module has a cable entry for the control cable



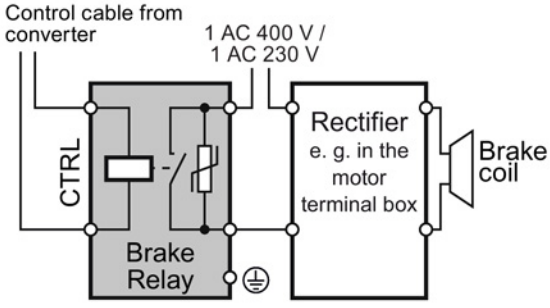
Brake relay connection at the Power Module

Connecting the brake relay to the motor brake

The brake relay must be connected to protective ground if the motor brake is supplied from a PELV circuit.



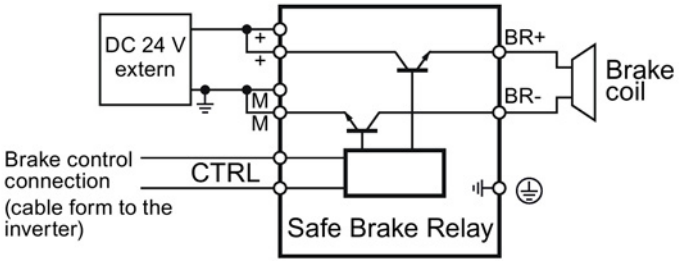
24 V brake connection



440V brake connection

Connecting the Safe Brake Relay to the motor brake

The Safe Brake Relay can only control 24 V motor brakes.



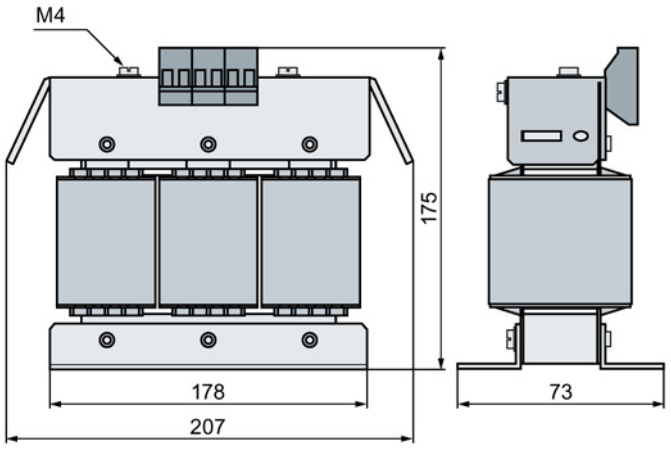
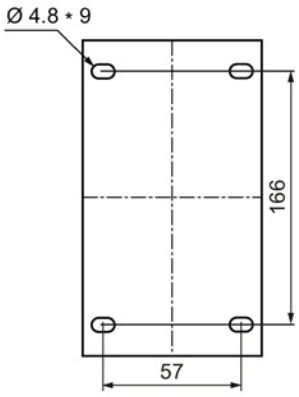
Safe Brake Relay connection

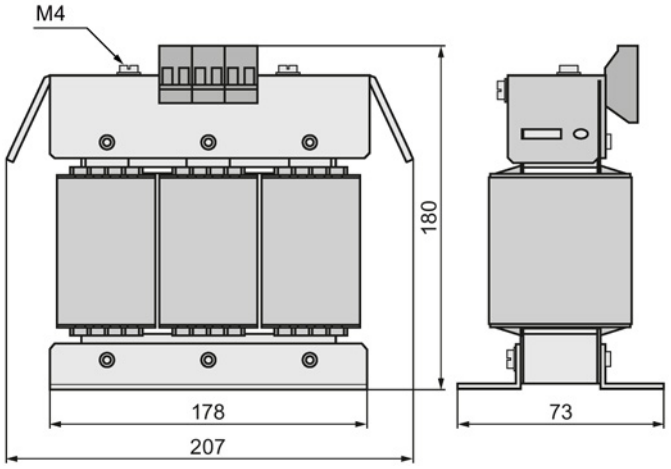
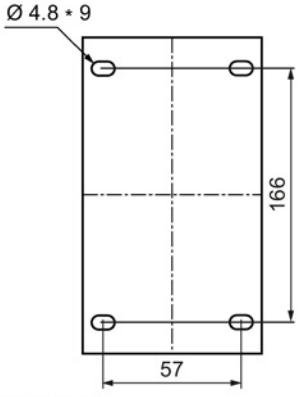
	Brake Relay	Safe Brake Relay
Input voltage	connected to the internal power supply of the Power Module	DC 20.4 ... 28.8 V 1)
Input current		Max. 2.5 A
Max. conductor cross-section	2.5 mm²	2.5 mm²
Degree of protection	IP20	IP20
Switching capacity of the NO contact	1 AC 440 V, 3.5 A 1 DC 30 V DC, 12 A	-
Output voltage	-	24 V
Output current	-	max. 2 A
1) External controlled power supply is necessary. Recommended voltage: DC 26 V		

8.6 Output reactor

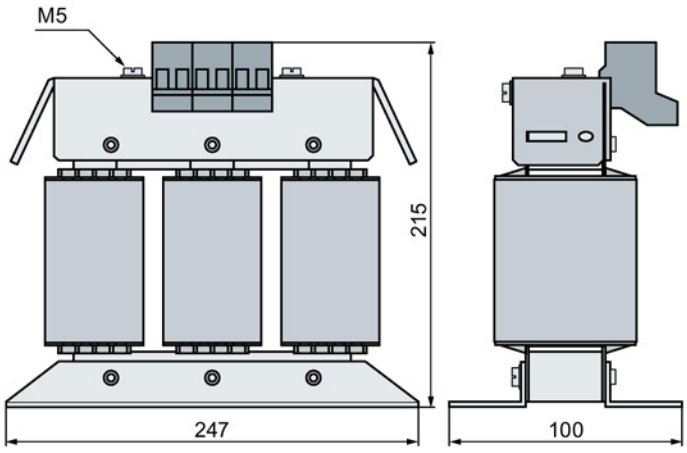
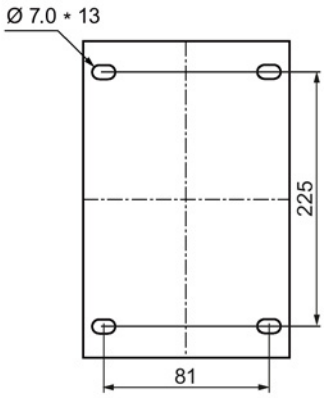
8.6.1 Mounting the output reactor

Dimensions and drilling patterns

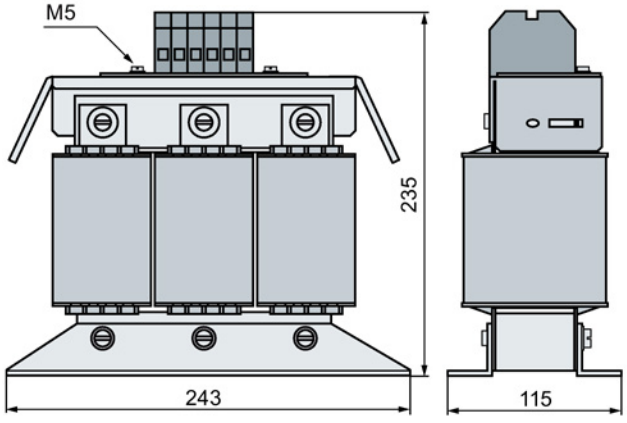
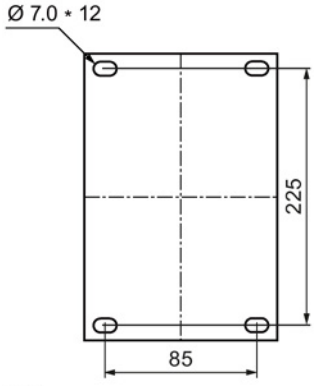
Frame size A, 0.55 kW … 2.2 kW	
Dimensions [mm]	Drilling pattern [mm]
	 Mounting: 4 * M4 bolts 4 * M4 nuts 4 * M4 washers Tightening torque: 3 Nm

Frame size A, 3.0 kW … 4.0 kW	
Dimensions [mm]	Drilling pattern [mm]
	 Mounting: 4 * M4 bolts 4 * M4 nuts 4 * M4 washers Tightening torque: 3 Nm

Frame size B, 5.5 kW … 7.5 kW

Dimensions [mm]	Drilling pattern [mm]
	 Fixing: 4 * M5 bolts 4 * M5 nuts 4 * M5 washers Tightening torque: 6 Nm

Frame size C, 11 kW … 18.5 kW

Dimensions [mm]	Drilling pattern [mm]
	 Fixing: 4 * M5 bolts 4 * M5 nuts 4 * M5 washers Tightening torque: 5 Nm

Clearances to other devices

Keep shaded areas free of any devices and components.

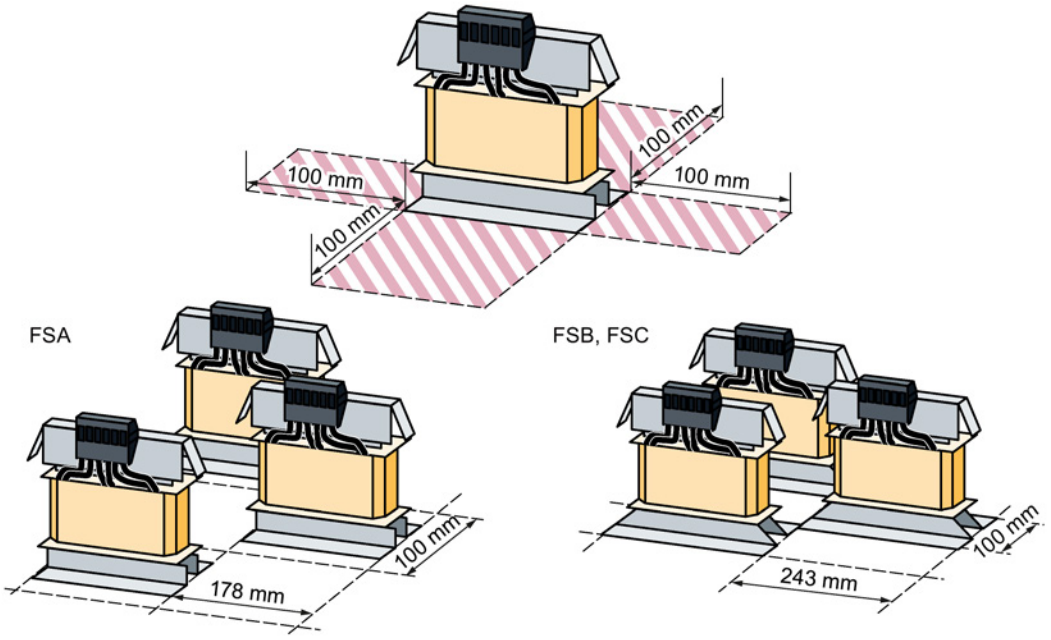


Figure 8-8 Minimum clearances of the output reactor to other devices, space-saving mounting examples

Table 8- 15 Technical data of the output reactors

Article number	6SL3202-0AE16-1CA0	6SL3202-0AE18-8CA0	6SL3202-0AE21-8CA0	6SL3202-0AE23-8CA0
Inductance	2.5 mH	1.3 mH	0.54 mH	0.26 mH
Degree of protection	IP20	IP20	IP20	IP20
Weight	3.4 kg	3.9 kg	10.1 kg	11.2 kg

Table 8- 16 Assignment table

Output reactor	Power Module - 440 V devices	
	400 V devices	200 V devices
6SL3202-0AE16-1CA0	6SL3210-1PE11-8□L1 6SL3210-1PE12-3□L1 6SL3210-1PE13-2□L1 6SL3210-1PE14-3□L1 6SL3210-1PE16-1□L1	6SL3210-1PB13-0□L0 6SL321□-1PB13-8□L0 6SL3210-1PB15-5□L0
6SL3202-0AE18-8CA0	6SL321□-1PE18-0UL1	6SL3210-1PB17-4□L0
6SL3202-0AE21-8CA0	6SL3210-1PE21-1□L0 6SL3210-1PE21-4□L0 6SL321□-1PE21-8□L0	6SL321□-1PB21-0□L0 6SL3210-1PB21-4□L0 6SL321□-1PB21-8□L0
6SL3202-0AE23-8CA0	6SL3210-1PE22-7□UL0 6SL321□-1PE23-3□L0	6SL321□-1PC22-2□L0 6SL3210-1PC22-8□L0

Appendix

A

A.1 Manuals and technical support

A.1.1 Manuals for your inverter

Table A- 1 Manuals for your inverter

Depth of the information	Manual	Contents	Available languages	Download or article number
+	**Getting Started** Control Units CU230P-2; CU240B-2; CU240E-2	Installing and commissioning the inverter.	English, German, Italian, French, Spanish	Download: (http://support.automation.siemens.com/WW/view/en/22339653/133300) **SINAMICS Manual Collection** Documentation on DVD, article number 6SL3097-4CA00-0YG0
++	**Operating instructions** for SINAMICS G120 inverters with Control Units CU230P-2, CU240E-2, CU240E-2 and CU250S-2	Installing and commissioning the inverter. Description of the inverter functions.		
+++	**Function Manual for Safety Integrated** for the SINAMICS G110M, G120, G120C, G120D inverters and SIMATIC ET 200pro FC-2 converters	Configuring PROFIsafe. Installing, commissioning and operating fail-safe functions of the inverter.	English, German	
+++	**Fieldbus Function Manual** for the SINAMICS G120, G120C and G120D inverters	Configuring fieldbuses.		
+++	**List Manual** Control Units CU240B-2; CU240E-2	Graphic function block diagrams. Complete list of all parameters, alarms and faults.		
+++	**Operating instructions** for the following Operator Panels: • BOP-2 • IOP	Operating operator panels, installing door assembly kit for IOP.		
+++	**Hardware Installation Manual** Power Module PM240-2	(this manual)		
+	**Compact operating instructions** for SINAMICS G120 Power Modules:	Installing the Power Module.	English	
+	**Installation instructions** for reactors, filters and braking resistors	Installing components.		

A.1.2 Configuring support

Table A- 2 Support when configuring and selecting the inverter

Manual or tool	Contents	Available languages	Download or article number
Catalog D 31	Ordering data and technical information for SINAMICS G inverters	English, German, Italian, French, Spanish	All about SINAMICS G120 (www.siemens.com/sinamics-g120)
Online catalog (Industry Mall)	Ordering data and technical information for all SIEMENS products	English, German	
SIZER	The overall configuration tool for SINAMICS, MICROMASTER and DYNAVERT T drives, motor starters, as well as SINUMERIK, SIMOTION controls and SIMATIC Technology	English, German, Italian, French	You obtain SIZER on a DVD (Article number: 6SL3070-0AA00-0AG0) and in the Internet: Download SIZER (http://support.automation.siemens.com/WW/view/en/10804987/130000)

A.1.3 Product Support

You can find additional information on the product and more in the Internet under: Product support (http://www.siemens.com/automation/service&support).

In addition to our documentation, under this address we offer our complete knowledge base online: You can find the following information:

- Actual product information (Update), FAQ (frequently asked questions), downloads.
- The Newsletter contains the latest information on the products you use.
- The Knowledge Manager (Intelligent Search) helps you find the documents you need.
- Users and specialists from around the world share their experience and knowledge in the Forum.
- You can find your local representative for Automation & Drives via our contact database under "Contact & Partner".
- Information about local service, repair, spare parts and much more can be found under "Services".

European Low Voltage Directive

The SINAMICS G120 product series meets the requirements of the Low-Voltage Directive 2006/95/EC. The devices are certified that they comply with the following standards:

- EN 61800-5-1 - Electrical power drive systems with adjustable speed

European Machinery Directive

Power Modules FSA … FSC in conjunction with Control Units, which support safety functions, as well as the FSD … FSE Power Modules, comply with the requirements of machinery directive 2006/42/EC.

European EMC directive 2004/108/EG

When installed according to the recommendations described in this manual, the inverters fulfill all requirements of the EMC Directive as defined by the EMC Product Standard for Power Drive Systems EN 61800-3.

ISO 9001

Siemens I DT MC operates a quality management system which complies with the requirements of ISO 9001.

Underwriters Laboratories

The device is listed by UL and CUL for power conversion in an environment with the pollution degree 2.

The inverters are UL approved (Underwriters Laboratories).
Frame sizes FSA … FSC are tested according to standards UL508C and CSA22.2 No. 14.
Frame sizes FSD … FSE are tested according to standards UL61800-5-1 and CSA 22.2 No. 274.

SEMI F47

Specification for semiconductor process equipment voltage drop immunity

SINAMICS G120 Power Modules PM240-2 meet the requirements of the standard SEMI F47-0706.

KC (Korea)

Inverters with the KC marking satisfy EMC requirements for South Korea. For details, see EMC limit values in South Korea (Page 86).

CM (Australia)

Inverters, frame sizes FSD … FSE with integrated filter satisfy the EMC requirements for Australia.

Download certificates

Certificates can be downloaded from the internet under the following link: Certificates (http://support.automation.siemens.com/WW/view/en/22339653/134200)

A.2 Abbreviations

Abbreviation	State
AC	Alternating current
CE	Communauté Européenne
CU	Control Unit
DC	Direct current
DI	Digital input
DIP	DIP switch
DO	Digital output
ECD	Equivalent circuit diagram
EEC	European Economic Community
ELCB	Earth leakage circuit breaker
EMC	Electromagnetic compatibility (EMC)
EMI	Electromagnetic interference
FS…	Frame size ...
GSG	Getting Started Guide
HO	High overload
I/O	Input/Output
IGBT	Insulated gate bipolar transistor
LED	Light emitting diode
LO	Low overload
NC	NC contact
NEMA	National Electrical Manufacturers Association
NO	NO contact
OPI	Operating instructions
PELV	Protective extra low voltage
PM	Power Module
PPE	Personnel protective equipment
PT	Push-through technology
RCCB	Residual-current operated circuit breaker
RCD	Residual current device
RFI	Radio frequency interference
SELV	Safety extra-low voltage
VT	Variable torque

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Additional information

SINAMICS inverters:
www.siemens.com/sinamics

Siemens AG
Digital Factory
Motion Control
Postfach 3180
91050 ERLANGEN
GERMANY

Scan the QR code for additional information on SINAMICS G120.

www.siemens.com/drives