SIEMENS


# SINAMICS

## SINAMICS G120 inverters

### PM230 Power Modules, IP55

Hardware Installation Manual

Edition 12/2016

SIEMENS

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# SINAMICS G120P
# PM230 Power Module, IP55

Hardware Installation Manual




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A5E35319202B 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

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

## Disclaimer of Liability

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

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℗ 01/2017 Subject to change

# Table of contents

# Changes in this manual

# 1

## Changes with respect to the manual, edition 06/2014

The new Power Modules with frame sizes FSA, FSB and FSC support STO.

How can you identify a Power Module of the new series?

From the article number. The devices belonging to the new series have a "G" instead of an "A" at the last but one position. Otherwise, the article numbers are identical.

# 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 through electric shock due to the residual charge of the power component capacitors**

Because of the capacitors, a hazardous voltage is present for up to 5 minutes after the power supply has been switched off. Contact with live parts can result in death or serious injury.

- Wait for 5 minutes before you check that the unit really is in a no-voltage condition and start work.

NOTICE

**Material damage due to loose power connections**

Insufficient tightening torques or vibrations can result in loose electrical connections. This can result in damage due to fire, device defects or malfunctions.

- Tighten all power connections with the specified tightening torques, e.g. line supply connection, motor connection, DC link connections.
- Check all power connections at regular intervals. This applies in particular after transport.

⚠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 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 particular risk in the immediate vicinity of this equipment.

- If you have a heart pacemaker or implant, maintain a minimum distance of 2 m from electrical power equipment.

⚠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 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).

## 2.3 Industrial security

**Note**

**Industrial security**

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens products and solutions only represent one component of such a concept.

The customer is responsible for preventing unauthorized access to its plants, systems, machines and networks. Systems, machines and components should only be connected to the enterprise network or the internet if and to the extent necessary and with appropriate security measures (e.g. use of firewalls and network segmentation) in place.

Additionally, Siemens' guidance on appropriate security measures should be taken into account. For more information about industrial security, please visit:

Industrial security (http://www.siemens.com/industrialsecurity).

Siemens' products and solutions undergo continuous development to make them more secure. Siemens strongly recommends to apply product updates as soon as available and to always use the latest product versions. Use of product versions that are no longer supported, and failure to apply latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed at:

Industrial security (http://www.siemens.com/industrialsecurity).

**⚠WARNING**

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

Software manipulations (e.g. viruses, trojans, malware or worms) can cause unsafe operating states in your system that may lead to death, serious injury, and property damage.

- Keep the software up to date.
- Incorporate the automation and drive components into a holistic, state-of-the-art industrial security concept for the installation or machine.
- Make sure that you include all installed products into the holistic industrial security concept.
- Protect files stored on exchangeable storage media from malicious software by with suitable protection measures, e.g. virus scanners.

## 2.4 Residual risks of power drive systems

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

1. Unintentional movements of driven machine or system 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 electronic components
   - External influences/damage
   - X-ray, ionizing radiation and cosmic radiation
2. Unusually high temperatures, including open flames, as well as emissions of light, noise, particles, gases, etc., can occur inside and outside the components under fault conditions caused by, for example:
   - Component failure
   - Software errors
   - Operation and/or environmental conditions outside the specification
   - External influences/damage
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
6. Influence of network-connected communication systems, e.g. ripple-control transmitters or data communication via the network

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

# Launch 3

## Overview

The PM230 Power Modules belong to the modular family of SINAMICS G120 inverters. A modular inverter comprises Control Unit and Power Module.

PM230 Power Modules have been specifically designed for pump and fan drives in industrial HVAC applications for a mains voltage range of 3 AC 380 V … 480 V.

They are available with a category C1 or C2 filter in the following frame sizes:

| | | | |
|---|---|---|---|
| • FSA | C1 | C2 | 0.37 kW … 3 kW |
| • FSB | C1 | C2 | 4 kW … 7.5 kW |
| • FSC | C1 | | 11 kW … 15 kW |
| • FSC | | C2 | 11 kW … 18.5 |
| • FSD | C1 | | 18.5 kW … 30 kW |
| • FSD | | C2 | 22 kW … 30 kW |
| • FSE | C1 | C2 | 37 kW … 45 kW |
| • FSF | C1 | C2 | 55 kW … 90 kW |

The specified power ratings refer to Low Overload operation.

## Control Units for the Power Modules

You can operate the Power Modules with a Control Unit from one of the following listed families from firmware version 4.4 and higher.

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

Operation with Control Units other than those listed above is not permitted.

**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.

Manuals for your inverter (Page 67).

### STO with PM230 and CU240

The PM230 FSA … FSC Power Modules have been technically revised. Together with CU240 Control Units, software version 4.7 SP3 and higher, they support the STO safety function.

You can identify the new series of Power Modules from the article number. The article numbers of the new Power Modules have a "G" instead of an "A" in the last but one position. Otherwise, the article numbers are identical.

## 3.1 Component specification according to UL

The FSA ... FSC inverters are UL approved acc. to UL508C and CSA C22.2 No.274-13.

The FSD ... FSF inverters are TÜV approved acc. to UL508C.

Further information and a link for downloading the appropriate certificates can be found in the following Section:

Directives and standards (Page 70)

## 3.2 Permissible motors

**Note**

**Motors for inverter operation**

Only use motors that are suitable for operation with inverters with a DC link.

**Permissible motors**

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

# Installing/mounting

# 4

## 4.1 Installation conditions

### General installation conditions

When installing the Power Modules, carefully observe the following sections in Chapter Technical data (Page 47) in order to guarantee reliable, continuous and disturbance-free operation.

- Cable cross-sections and tightening torques
- Electromagnetic compatibility
- Ambient conditions
- General technical specifications
- The permissible fuses, power loss and the required cooling air quantities are listed in the specific technical specifications.

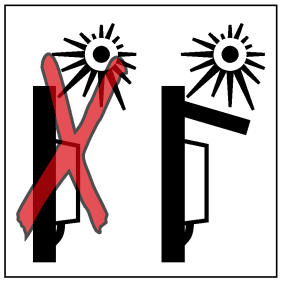
The EMC-compliant connection is described in Section:
EMC compliant installation of a machine or system (Page 21).

The Power Module is intended for wall mounting. If the Power Module is not mounted on a wall, the rear panel of the heat sink must be covered with a plate.

Do not expose the inverter to direct sunlight.

To comply with protection class IP55, either an operator panel or a dummy cover is required for operating the inverter.

"Installing the operator panel or dummy cover (Page 28)".



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

- To ensure a design that is in conformance with UL/cUL, only use the approved fuses specified in Section
   Specific technical data (Page 53).
- Always use copper cables approved for 75 °C for Power Modules, frame sizes FSD … FSF.
- The inverter provides internal motor overload protection in accordance with UL508C. The protection threshold is 115% of the inverter full load current. When commissioning, you can adapt the motor overload protection using parameter p0640.
- Suitable for overvoltage category III

## Additional requirements for CSA compliance

### Frame sizes FSA … FSC

- Rated voltage 480 V (phase to ground), 480 V (phase to phase)
- Suitable for SPD applications, type 1 or type 2
- Terminal voltage, VPR = 2,000 V

# 4.2 EMC compliant installation of a machine or system

## EMC compliant connection of a Power Module

The following diagram shows the EMC compliant installation of a Power Module with degree of protection IP55.

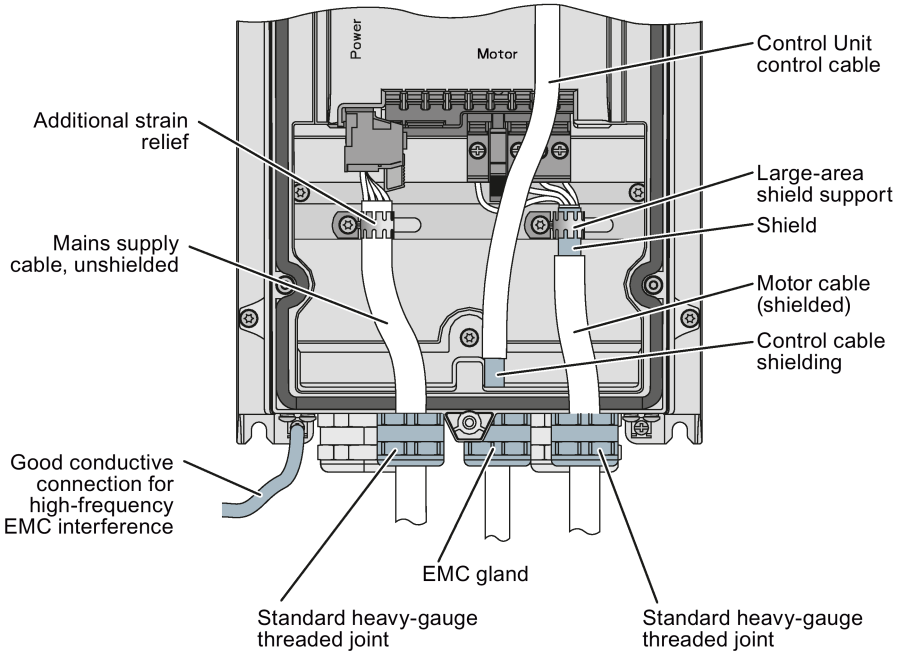



Figure 4-1 EMC-compliant connection of an PM230 Power Module, degree of protection IP55

**Note**

You must use a shielded cable if you use the control terminals of the Control Unit. Connect the shield to the gland plate via an EMC screw.

## 4.2.1 Cables

Cables with a high level of interference and cables with a low level of interference are connected to the inverter:

- Cables with a high level of interference:
  - Cable between the line filter and inverter
  - Motor cable
  - Cable on the inverter DC link connection
  - Cable between the inverter and braking resistor
- Cables with a low level of interference:
  - Cable between the mains and the line filter
  - Signal and data cables

### Routing cables outside the control cabinet

- Maintain a minimum clearance of 25 cm between cables with a high level of interference and cables with a low level of interference.
- Use shielded cables for the following connections:
  - Inverter motor cable
  - Cable between the inverter and braking resistor
  - Signal and data cables
- Connect the motor cable shield to the motor enclosure using a PG heavy-gauge threaded joint that establishes a good electrical connection.

### Requirements relating to shielded cables

- Use cables with finely-stranded, braided shields.
- Connect the shield to at least one end of the cable.

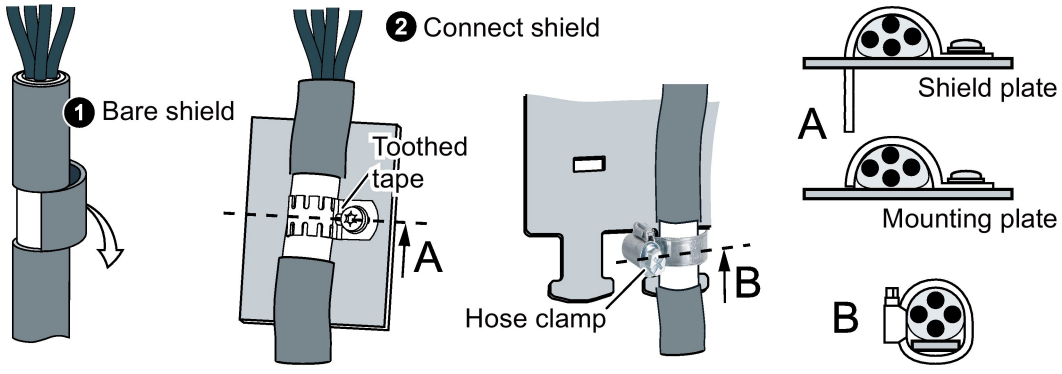



Figure 4-2 Examples for EMC compliant shield support

- Attach the shield to the shield support directly after the cable enters the cabinet.

- Do not interrupt the shield.
- Only use metallic or metallized plug connectors for shielded data cables.

### 4.2.2 Electromechanical components

#### Radio interference suppression

- Connect interference suppression elements to the following components:
  - Coils of contactors
  - Relays
  - Solenoid valves
  - Motor holding brakes
- Connect the interference suppression element directly at the coil.
- Use RC elements or varistors for AC-operated coils and freewheeling diodes or varistors for DC-operated coils.

#### Further information

For further information about EMC compliant installation, click:

EMC installation guideline
(https://support.industry.siemens.com/cs/ww/de/view/60612658/en)

# 4.3 Installing the Power Modules

Table 4- 1 Dimensions and clearances to other devices

| Frame size | Dimensions (mm) | | | Drilling dimensions (mm) | | Mounting | Clearances to other devices (mm) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Width (W) | Height (H) | Depth[1] (D) | b | h | Screws/torque (Nm) | Top | Bottom | Lateral |
| FSA | 154 | 460 | 249 | 132 | 445 | 4 x M4 / 2.5 | 100 | 100 | 0 |
| FSB | 180 | 540 | 249 | 158 | 524 | 4 x M4 / 2.5 | 100 | 100 | 0 |
| FSC | 230 | 620 | 249 | 208 | 604 | 4 x M5 / 3 | 125 | 125 | 0 |
| FSD | 320 | 640 | 329 | 285 | 600 | 4 x M8 / 13 | 300 | 300 | 50 |
| FSE | 320 | 751 | 329 | 285 | 710 | 4 x M8 / 13 | 300 | 300 | 50 |
| FSF | 410 | 915 | 416 | 370 | 870 | 4 x M8 / 13 | 350 | 350 | 50 |

1) With an IOP, the depth increases by 17 mm; with the BOP-2, or a dummy cover, it increases by 7 mm.

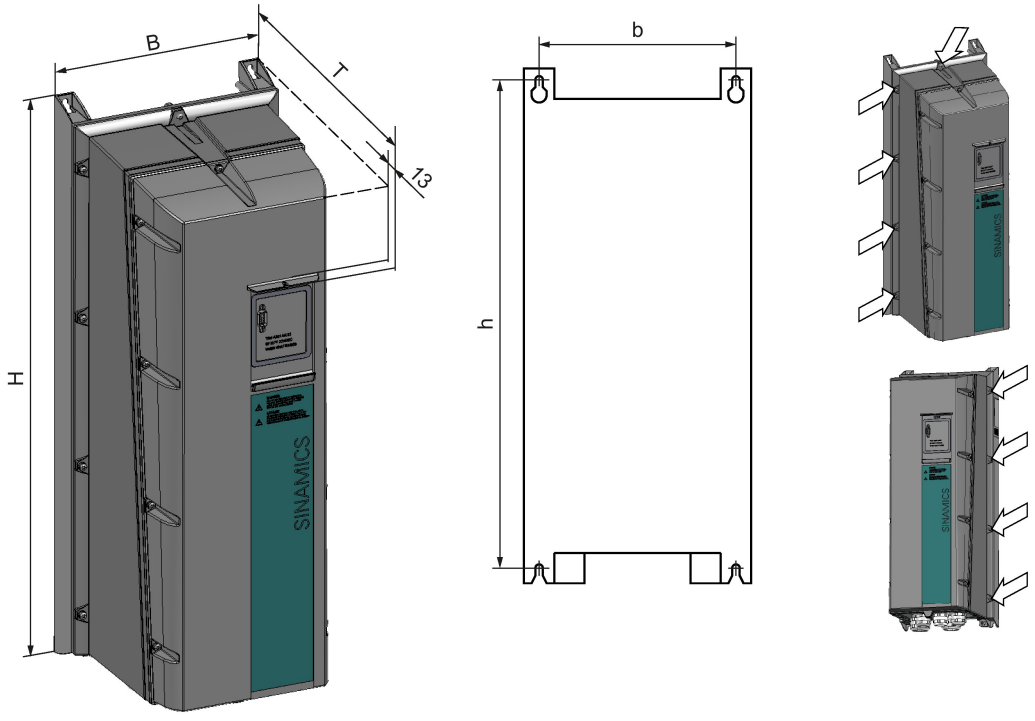



Figure 4-3 Dimension drawing FSA ... FSC

The screws marked with arrows connect the heat sink with the inverter enclosure. They must not be loosened or removed!

- For the FSA, this means six screws, three on the left and three on the right.
- For the FSB and FSC, there are nine screws; four on the left, four on the right, and one on the top.

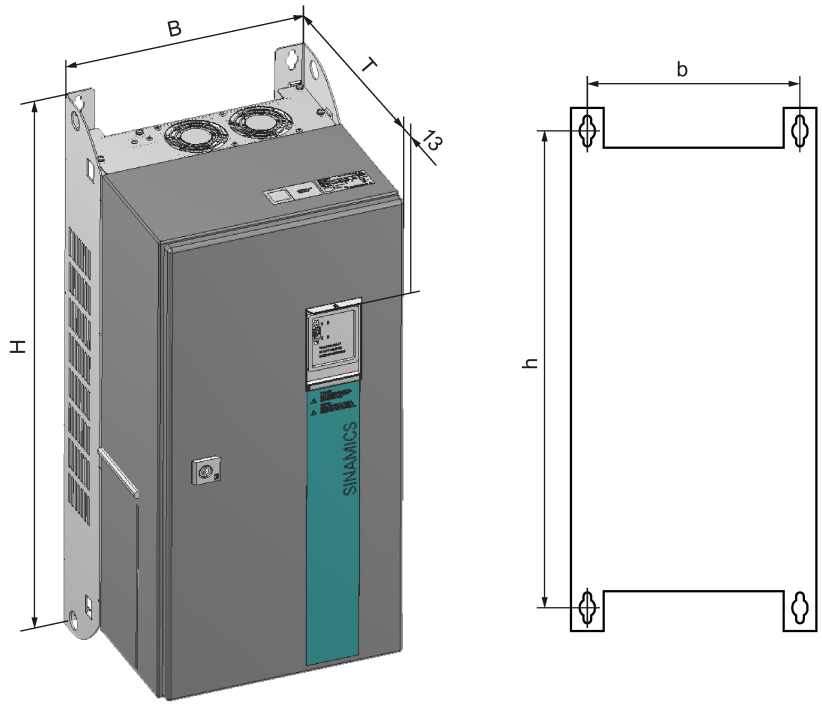



Figure 4-4 Dimension drawing FSD … FSF

# 4.4 Installing the Control Unit and Operator Panel

## 4.4.1 Installing the Control Unit

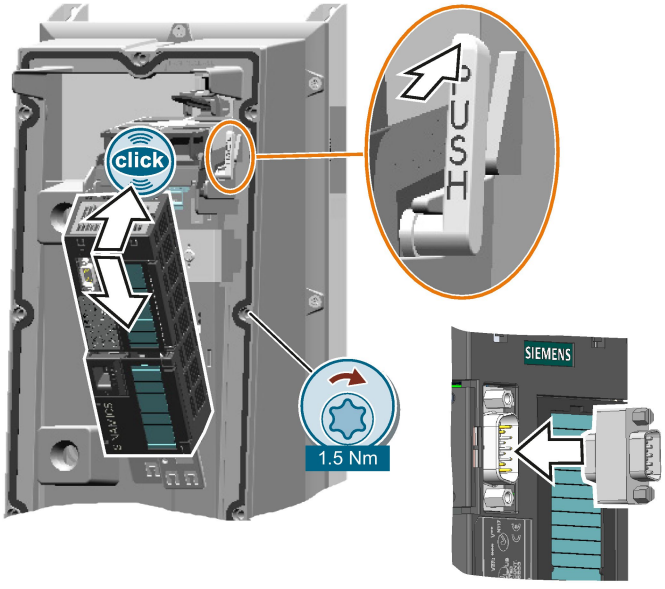
### Installing the Control Unit, PM230 IP55 - FSA … FSC

To insert or detach the Control Unit, you must release eight or ten fixing screws of the cover and then remove the cover.

Insert the lugs on the rear panel of the Control Unit into the appropriate recesses of the Power Module. Snap in the Control Unit as shown in the illustration.

To remove, loosen the Control Unit from the Power Module by pressing the release lever.

Reinstall the cover before you commission the inverter. Do not damage the seal of the cover when attaching it.




#### Using the operator panel with a CU230P-2 Control Unit

If you use an operator panel, connect the adapter provided to the Control Unit as shown in the illustration.

#### Using the operator panel with a CU240B/E-2 Control Unit

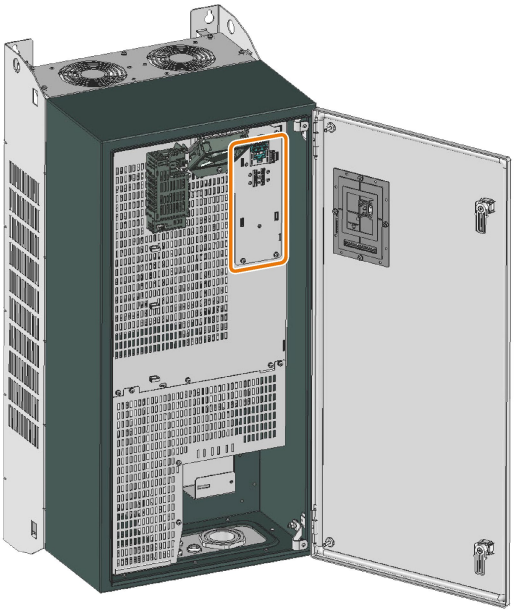
With a CU240B/E-2, you will need an adapter from KnorrTec instead of the adapter provided.

Accessories (Page 66)

## Installing the Control Unit, PM230 IP55 - FSD … FSF

To insert or detach the Control Unit, you must open the front door of the Power Module.

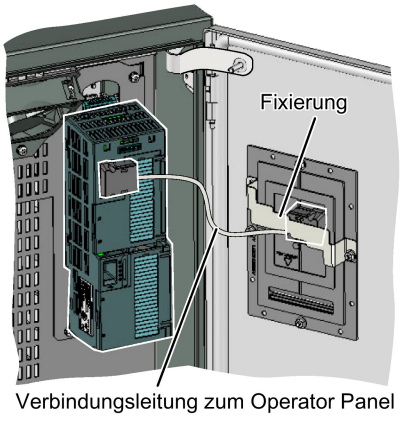
Close the door before you commission the inverter. Check to ensure that the seals are not damaged.



### Operation with operator panel

To connect the operator panel to the Control Unit, you have to plug in the supplied connecting cable to the Control Unit and the operator panel.

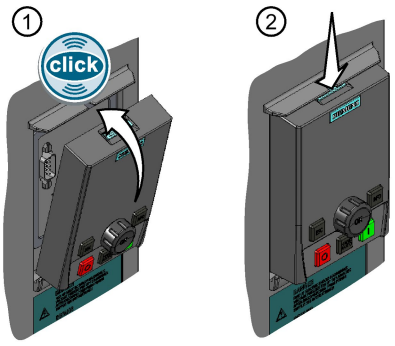
Fasten the plug connector in the door with the supplied clamp.



## 4.4.2 Installing the operator panel or dummy cover

### Mounting the operator panel or dummy cover on the IP55 Power Module

Either an operator panel or the dummy cover must be plugged on for the inverter to achieve degree of protection IP55.




① Attaching the operator panel or dummy cover:
Press the operator panel or dummy cover onto the inverter as shown until you hear it click into place.

② Removing the operator panel or dummy cover:
Use a suitable screwdriver to press the interlock downwards.

Accessories (Page 66)

# Connecting

# 5

Install the inverters so that you are compliant with local regulations for erecting and installing low voltage systems.

**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 covers or the terminal covers 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.

**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**

**Safety devices**

Install suitable protective equipment between the line supply and inverter.

Specific technical data (Page 53)

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)

**⚠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.

**⚠WARNING**

**Danger to life through electric shock as well as fire hazard due to protective devices that either do not trip or trip too late**

Overcurrent protective equipment that trips too late or not all can cause electric shock or fire.

- In the case of a conductor-conductor or conductor-ground short-circuit, ensure that the short-circuit current at the point where the inverter is connected to the line supply corresponds as a minimum to the requirements of the protective equipment used.
- You must additionally use a residual-current protective device (RCD) if, for a conductor-ground short circuit, the required short-circuit current is not reached. Especially for TT line systems, the required short-circuit can be too low.
- It is not permissible that the short-circuit current exceeds the SCCR or the $I_{CC}$ of the inverter and the disconnecting capacity of the protective equipment.

## Protection and monitoring equipment

To provide protection against short-circuit, use the overcurrent devices listed in Technical data (fuses, circuit breakers etc.).

If the apparent impedance of the line supply at the infeed point is not suitable, so that fuses do not rupture in the specified time in the case of insulation failure (ground fault, fault to frame), then you must use additional fault current protective devices RCD (RCCB or MRCD), type B.

In order that an RCD does not unnecessarily trip as a result of operational leakage currents, the following preconditions must be fulfilled:

- The neutral point of the line supply is grounded.
- For inverters with rated input currents ≤ 125 A referred to LO, use an RCCB type B with a response limit current of 300 mA. Connect the RCCB in series with the overcurrent protective devices.
- For inverters with rated input currents> 125 A referred to LO, use a type B MRCD (for example, from the Bender company).
  An MRCD comprises an RCM (differential current monitoring device), a measuring current transducer and a circuit breaker with additional undervoltage release, listed in the Technical data. An example of an MRCD design is provided in the following diagram.

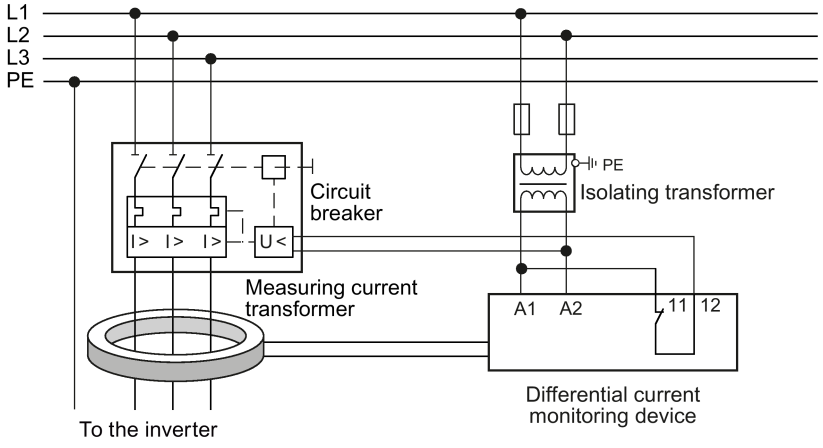


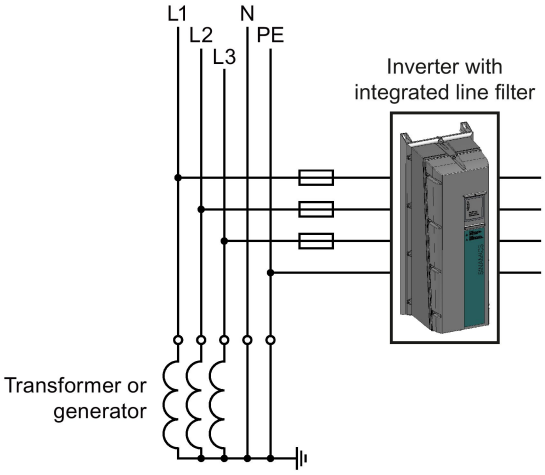

Figure 5-1 MRCD

- A dedicated RCD is used for every inverter.
- The motor cables are shorter than 50 m (164 ft) shielded, or 100 m (328 ft) unshielded.
  Additional information about motor cables
  Length of motor cable (Page 38)

## 5.1 Permissible line supplies

The Power Modules have built-in filters and can therefore only be operated on TN line systems with a grounded neutral point.

Operating the Power Modules without protective grounding is not permitted under any circumstances.




## 5.2 Protective conductor

**WARNING**

**Danger to life caused by high leakage currents when the protective conductor is interrupted**

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.

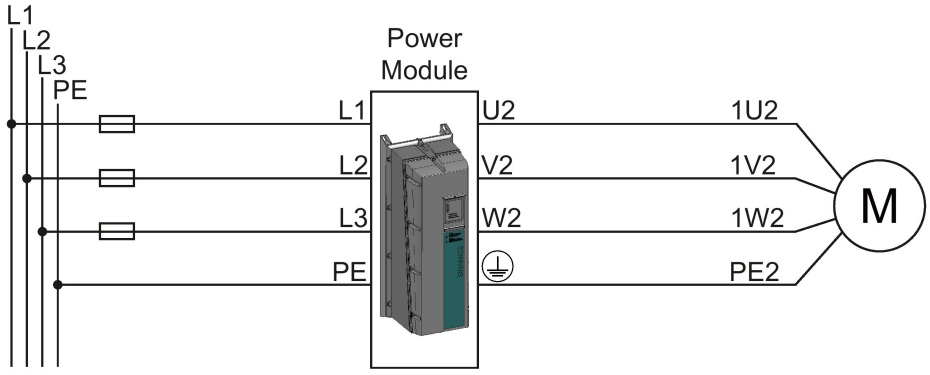
- Lay the protective conductor as specified.

### Dimensioning the protective conductor

- In a multi-core cable, the protective conductor has a cross-section ≥ 2.5 mm² Cu.
- Observe the local regulations for protective conductors subject to an increased leakage current at the site of operation.
  - In IEC areas, observe IEC 60264-5-54, Table 52.2.
  - In the USA, observe the NFPA 70 NEC Specifications, Article 250, Table 250.122, and in Canada, the CEC Canadian Electrical Code specifications.

# 5.3 Connecting the line and motor cable at the inverter

## 5.3.1 Connection overview




**Note**

**Symbol for PE**

The sign "⏚" is equivalent to the designation "PE".

Table 5- 1 Connection types, maximum conductor cross-sections and tightening torques

| Inverters | Connection | Cross-section / tightening torque | |
|---|---|---|---|
| **FSA** | Terminal | 1 … 2.5 mm² / 0.5 Nm | 18 … 14 AWG / 4.4 lbf in |
| **FSB** | Terminal | 2.5 … 6 mm² / 0.6 Nm | 14 … 10 AWG, 5.3 lbf in |
| **FSC** | Terminal | 6 …16 mm² / 1.5 Nm | 10 … 5 AWG / 13.3 lbf in |
| **FSD** | Cable lug | 10 … 35 mm² / 6 Nm | 5 … 2 AWG / 53 lbf in |
| **FSE** | Cable lug | 25 … 50 mm² / 6 Nm | 3 … 2 AWG / 53 lbf in |
| **FSF** | Cable lug | 35 … 120 mm² / 13 Nm | 2 … 4/0 AWG, 115 lbf in |

## 5.3.2 Establishing a line and motor connection

### EMC cable glands

To meet the requirements of degree of protection IP55/UL, type 12, and to fulfill EMC requirements, adhere to the following:

- Use EMC cable glands for the control cables.
- Make sure that the cable glands match the drill holes in the plate.


Figure 5-2 Example of an EMC cable gland (Blueglobe)

The EMC cable glands are not included in the scope of supply of the inverter. Rubber sleeves for unused drill holes in the cable cover plate are included in the scope of supply.

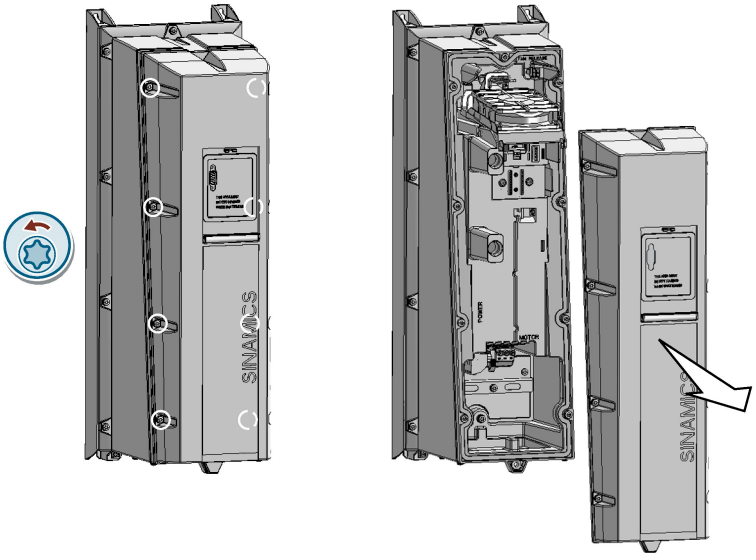
### Connecting the mains supply and motor, frame sizes FSA ... FSC

**Procedure**

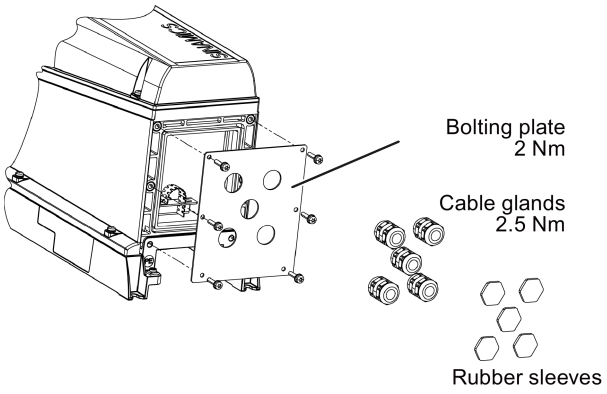
1.
2.

To connect the mains supply and motor to FSA … FSC Power Modules, proceed as follows:

1. Remove the front cover of the Power Module.



2. Remove the cable gland plate from the bottom of the inverter.

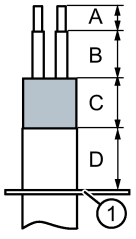



Diameters of the drill holes in the cable gland plates:

| | |
|---|---|
| 20.5 mm | Control cables |
| 20.5 mm | Mains and motor cables, FSA |
| 25.5 mm | Mains and motor cables, FSB |
| 32.5 mm | Mains and motor cables, FSC |

Figure 5-3 Bolting plates for PM230, FSA to FSC

3. Prepare the mains and motor cables for connection in accordance with the table below.

| Inverter | Connection | Dimensions | | | | Explanation |
|---|---|---|---|---|---|---|
| | | A | B | C [1] | D | |
| FSA | Mains cable | 10 mm | 60 mm | - | 90 mm |  |
| | Motor cable | 10 mm | 60 mm | 10 mm | 60 mm | |
| FSB | Mains cable | 10 mm | 60 mm | - | 50 mm | |
| | Motor cable | 10 mm | 50 mm | 10 mm | 40 mm | |
| FSC | Mains cable | 10 mm | 50 mm | - | 70 mm | |
| | Motor cable | 10 mm | 50 mm | 10 mm | 40 mm | |



[1] Cable shield

① Bolting plate

4. Assemble the cable glands with the prepared cables and EMC cable glands for the control cables.
5. Seal any unused bushings with a rubber sleeve.
6. Secure the bolting plate to the inverter enclosure. Tightening torque: 2 Nm

   Make sure that the seal of the bolting plate is not damaged.

7. Where necessary, fit the supplied ferrite ring onto the motor cable.

   Ferrite rings are required to be able to comply with the limit values of IEC 61800-3, Category C1 with reference to grid-bound interference voltages when using Power Modules with integrated line filters.

   If you use cables > 25 m, the requirements of Category C1 are no longer satisfied.

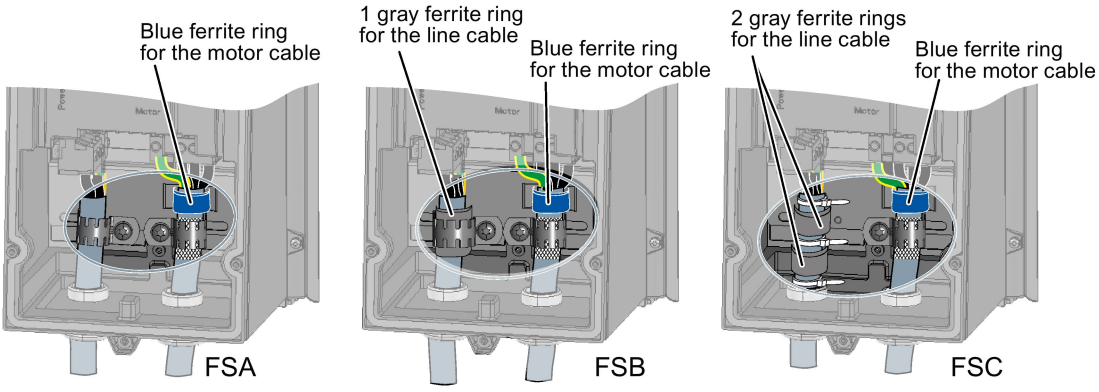



Figure 5-4 Ferrite rings for the mains and motor cables

8. Connect the mains supply and the motor.

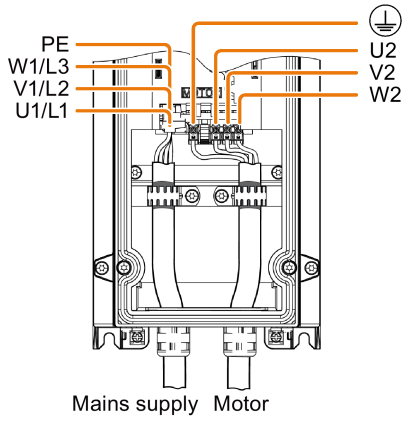



Figure 5-5 Connections for PM230 Power Modules, FSA … FSC

   The Power Modules are equipped with removable plug connectors that cannot be inadvertently interchanged. To remove the connectors, press the red lever to release the interlock.

9. Fit the front cover of the Power Module.

   Make sure that the seal of the front cover is not damaged.

☐ You have now connected both the mains supply and the motor to a FSA … FSC Power Module.

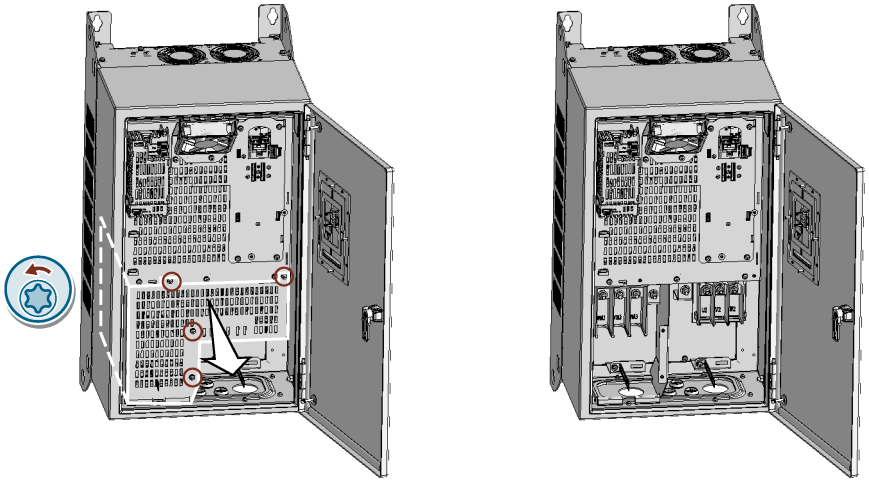
## Connecting the mains supply and motor, frame sizes FSD … FSF

### Procedure

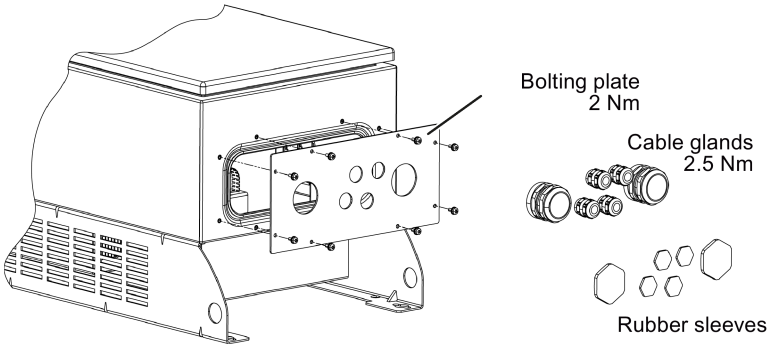
1.
2.

To connect the mains supply and motor to FSD … FSF Power Modules, proceed as follows:

1. Open the door of the Power Module.
2. Remove the terminal cover.



3. Remove the cable gland plate from the bottom of the inverter.




Diameters of the drill holes in the cable gland plates:

| | |
|---|---|
| 20.5 mm | Control cables |
| 40.5 mm | Mains and motor cables, FSD |
| 50.5 mm | Mains and motor cables, FSE |
| 63.5 mm | Mains and motor cables, FSF |

Figure 5-6 Bolting plates for PM230 FSD … FSF Power Modules

4. Assemble the cable glands with the prepared cables and EMC cable glands for the control cables.
5. Seal any unused bushings with a rubber sleeve.
6. Secure the bolting plate to the inverter enclosure. Tightening torque 2 Nm.

   Make sure that the seal of the bolting plate is not damaged.

7. Connect the mains supply and the motor.

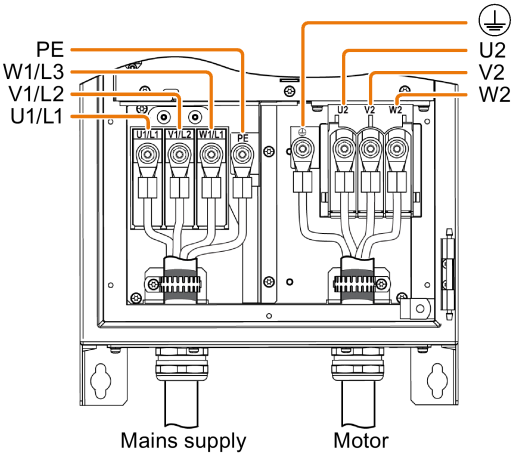



Figure 5-7 Connections for PM230 Power Modules, FSD … FSF

8. Close the door of the Power Module.

   Make sure that the door seal of the Power Module is not damaged.

Now you have connected both the mains supply and the motor to the FSD … FSF Power Module.

## 5.3.3 Length of motor cable

Always dimension the motor cable such that the ohmic losses are less than 5% of the inverter power rating.

The permissible length of the motor cable also depends on the quality of the motor cable and the inverter pulse frequency. The values specified below are applicable for high quality cables, such as CY100 or similar, and for the factory-set pulse frequencies.

Current reduction depending on pulse frequency (Page 58)

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

To be able to comply with the EMC category specified in the table below, EMC-compliant wiring is required.

EMC compliant installation of a machine or system (Page 21)

Furthermore, you must use EMC cable glands for the motor connection and connections of the Control Unit.


Establishing a line and motor connection (Page 34)

Table 5- 2 Permissible cable lengths

| Cable length | Inverter, motor cable | EMC |
|---|---|---|
| 25 m | • Inverters with Category C2 filters<br>• Shielded motor cable | First Environment, Category C2 |
| | • Inverters with Category C1 filters<br>• Shielded motor cable | First Environment, Category C1 (in relation to the harmonic currents) *) |
| 50 m | • Inverters with Category C2 filters<br>• Shielded motor cable | Second Environment, Category C3 |
| | • Inverters with Category C1 filters<br>• Shielded motor cable | Second Environment, Category C2<br>Valid for FSA … FSC |
| 100 m | • Inverters with Category C2 filters<br>• Unshielded motor cable | No EMC category |
| | • Inverters with Category C1 filters<br>• UNshielded motor cable | No EMC category |

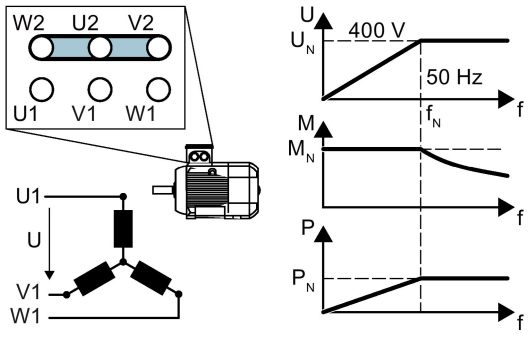
*) Ferrite cores required


Need for ferrites (Page 34)

## 5.3.4 Connecting the motor to the inverter in a star or delta connection

Standard induction motors with a rated power of approximately ≤ 3 kW are normally connected in a star/delta connection (Y/Δ) at 400 V/230 V. For a 400-V line supply, you can connect the motor to the inverter either in a star or in a delta connection.

### Operating the motor in a star connection

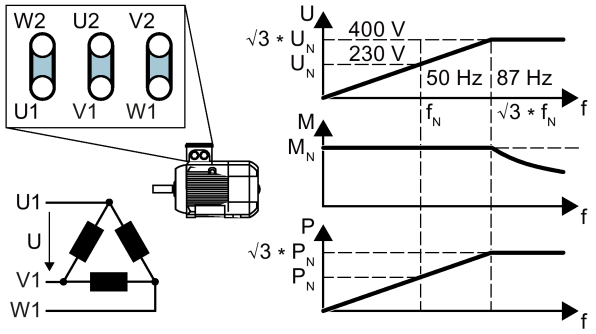



In a star connection, the motor can provide its rated torque $M_N$ in the range 0 … rated frequency $f_N$.

Rated voltage $U_N$ = 400 V is available at a rated frequency $f_N$ = 50 Hz.

The motor goes into field weakening above the rated frequency. In field weakening, the available motor torque decreases linearly with 1/f. In field weakening, the available power remains constant.

### Operating the motor in a delta connection with 87 Hz characteristic




In a delta connection, the motor is operated with a voltage and frequency above its rated values. As a consequence, the motor power is increased by a factor √3 ≈ 1.73.

In the range f = 0 … 87 Hz, the motor can output its rated torque $M_N$.

The maximum voltage U = 400 V is available at a frequency of f = √3 × 50 Hz ≈ 87 Hz.

The motor only goes into field weakening above 87 Hz.

The higher motor power when operated with an 87 Hz characteristic has the following disadvantages:

- The inverter must supply approximately 1.73x current. Select an inverter based on its rated current - and not its rated power.
- The motor temperature increases more significantly than when operated with f ≤ 50 Hz.
- The motor must have windings that are approved for a voltage > rated voltage $U_N$.
- As the fan impeller rotates faster, the motor has a higher noise level than operation with f ≤ 50 Hz.

# Service and maintenance

# 6

**⚠WARNING**

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

If an overcurrent protection device 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.

You must replace the complete overload relay if the current carrying element of the relay has burnt through.

## 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.  Replacing fans (Page 42)

## 6.1.1 Cleaning

### Ventilation

Make sure that the inverter'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.

## 6.1.2 Replacing fans

The Power Modules have two fans, an external fan and an internal fan. The external one is in the heat sink, the internal one is in the enclosure of the Power Module.

### 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.

### 6.1.2.1 Replacement of the fans for the frame sizes FSA ... FSC

## Replacement of the external fan FSA … FSC

Tools are not required to replace a fan.

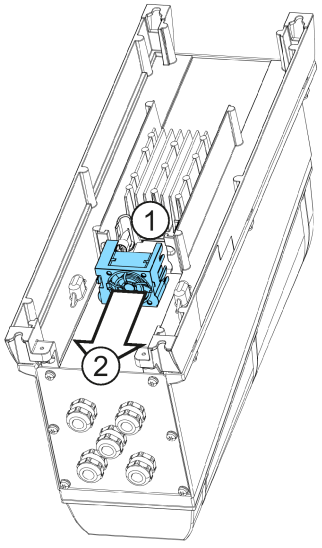
**Preparation**

1. Switch off the inverter.
2. Wait at least 5 minutes until the Power Module has fully discharged.

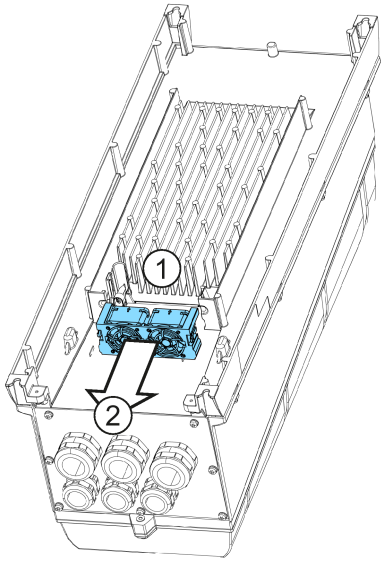
**Procedure**

1. Remove the front cover of the inverter.
2. Remove the operator panel from the Power Module.
3. Disconnect all the cables from the Power Module.
4. Place the Power Module down on a clean and secure surface with the front side facing downwards.
5. Using your fingers, grip inside the two recesses of the fan enclosure (① in the illustration below).
6. Press your fingers together to release the holding clips of the fan module.
7. Pull out the fan module (for direction of removal, see ② in the illustration below).
8. Install the new fan in reverse sequence.

Now you have changed the fan.




FSA/FSB




FSC

### Changing the internal fan FSA … FSC

No tools are required to change the fan.

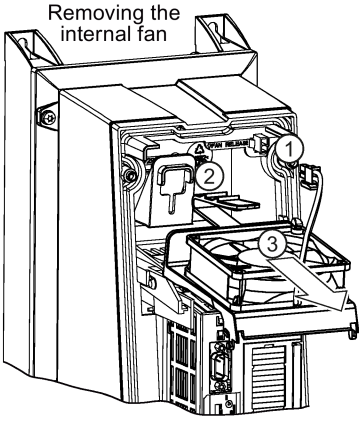
**Preparation**

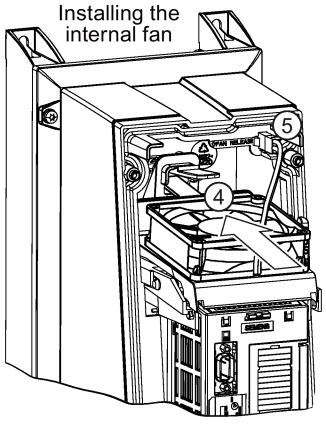
1. Switch off the inverter.
2. Wait at least 5 minutes until the Power Module has fully discharged.
3. Remove the front cover of the inverter.

**Procedure**

1. Remove the power plug of the fan ①.
2. Press the holding clips of the fan module downward ②.
3. Remove the fan module from the guide rail ③.
4. Insert the new fan module until the holding clip locks in with a click ④.
5. Insert the power plug of the fan module ⑤.
6. Re-attach the front cover of the inverter.

Now you have changed the fan.




## 6.1.2.2 Replacement of the fans for the frame sizes FSD ... FSF

### Changing the external fan FSD … FSF

To change the fan, you will need a Torx screwdriver, size 20.

**Preparation**

1. Switch off the inverter.
2. Wait at least 5 minutes until the Power Module has fully discharged.

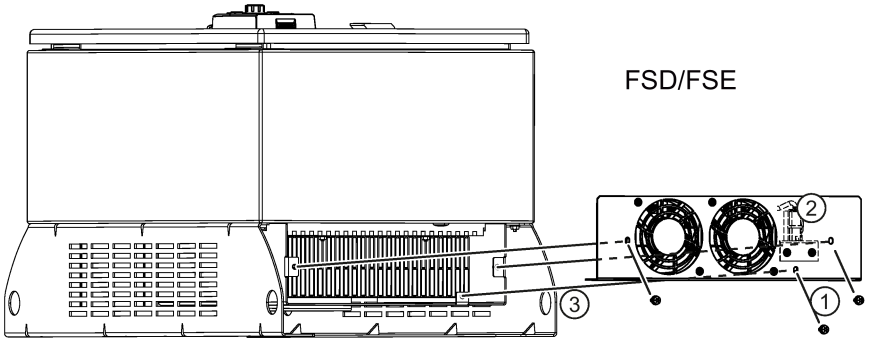
**Procedure**

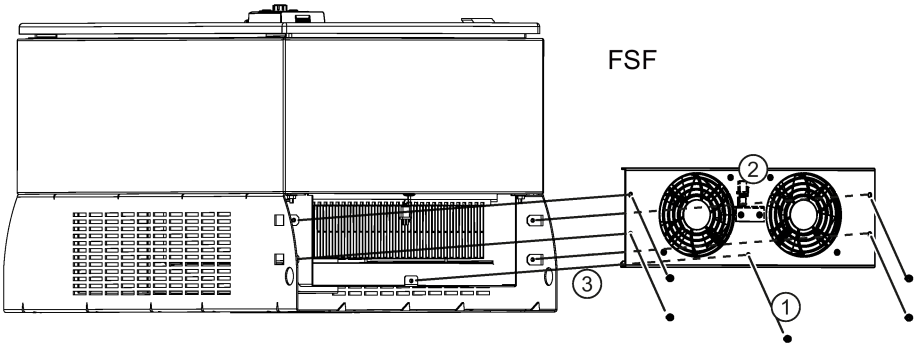
1. Open the front door of the inverter
2. Remove the operator panel from the Power Module.
3. Disconnect all the cables from the Power Module.
4. Place the Power Module down on a clean and secure surface with the front side facing downwards.
5. Use the Torx screwdriver to loosen the fixing screws of the fan ①.
6. Move the fan forward and loosen the power supply connection ②.

   For the frame sizes FSD/FSE, the power supply connection is located to the right, next to the fans on the rear side of the fan enclosure plate.

   For the frame size FSF, the power supply connection is located between the two fans on the rear side of the fan enclosure plate. The connection is shown with cross-hatching, because it is not visible from the front of the fan enclosure plate.
7. Pull the fan out ③.
8. Install the new fan in reverse order.
   It is imperative to use the new screws and secure them using the screw retainer varnish delivered with the fan.

Now you have changed the fan.



## Changing the internal fan FSD … FSF

You require a Pozidriv screwdriver to change the fan.

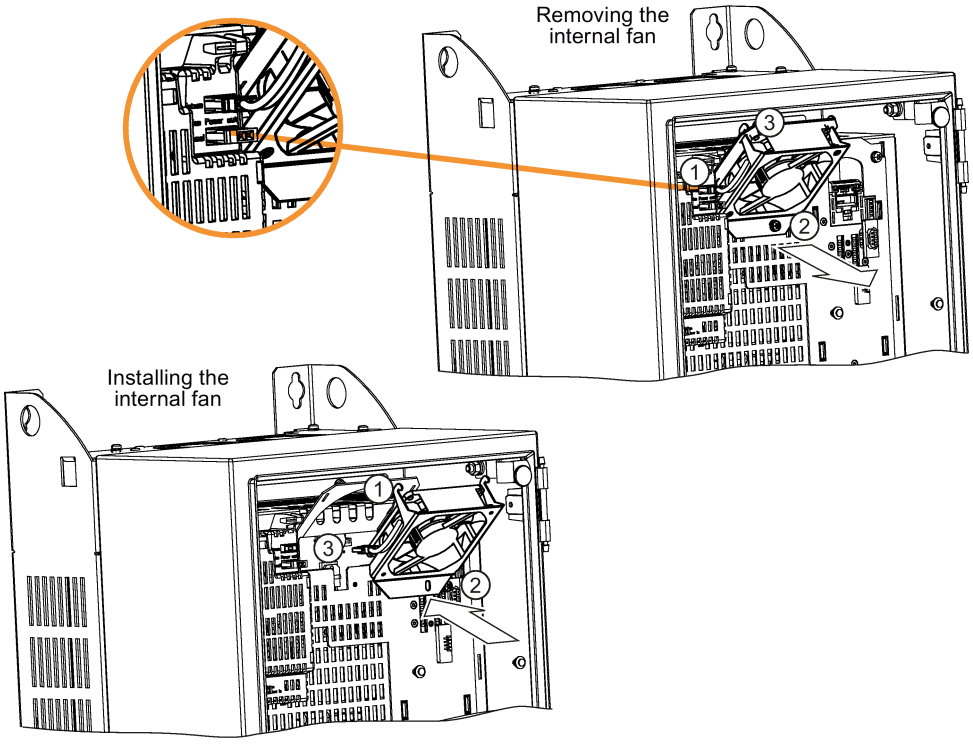
### Preparation

1. Switch off the inverter
2. Wait at least 5 minutes until the Power Module has fully discharged.
3. Open the enclosure door.

### Procedure

1. Remove the power plug of the fan ①.
2. Loosen the fixing screw of the fan ②.
3. Unhook the fan from the holding plate and remove it from the enclosure ③.
4. Hook the new fan into the holding plate ① and secure it with the fixing screw.
5. Insert the power plug of the fan module ③.
6. Close the enclosure door.

Now you have changed the fan.



# Technical data

# 7

### Permissible motors

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

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**Note**

**Motors for inverter operation**

Only use motors that are suitable for operation with inverters with a DC link.

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# 7.1 Overload capability of the inverter

Overload capability is the property of the inverter to temporarily supply a current that is higher than the rated current to accelerate a load. Two typical load cycles are defined to clearly demonstrate the overload capability: "Low Overload" and "High Overload"

## Definitions

### Base load

Constant load between the accelerating phases of the drive

### Low Overload

- **LO base load input current**
  Permissible input current for a "Low Overload" load cycle
- **LO base load output current**
  Permissible output current for a "Low Overload" load cycle
- **LO base load power**
  Rated power based on the LO base load output current

### High Overload

- **HO base load input current**
  Permissible input current for a "High Overload" load cycle
- **HO base load output current**
  Permissible output current for a "High Overload" load cycle
- **HO base load power**
  Rated power based on the HO base load output current

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

We recommend the "SIZER" engineering software to select the inverter.

You will find additional information about SIZER on the Internet: Download SIZER (http://support.automation.siemens.com/WW/view/en/10804987/130000).

## Load cycles and typical applications:

### "Low Overload" load cycle

The "Low Overload" load cycle assumes a uniform base load with low requirements placed on brief accelerating p phases. Typical applications when designing according to "Low Overload" include:

- Pumps, fans and compressors
- Wet or dry blasting technology
- Mills, mixers, kneaders, crushers, agitators
- Basic spindles
- Rotary kilns
- Extruders

### "High Overload" load cycle

The "High Overload" load cycle permits, for reduced base load, dynamic accelerating phases. Typical applications when designing according to "High Overload" include:

- Horizontal and vertical conveyor technology (conveyor belts, roller conveyors, chain conveyors)
- Centrifuges
- Escalators/moving stairways
- Lifters/Lowerers
- Elevators
- Gantry cranes
- Cable railways
- Storage and retrieval machines

## Typical inverter load cycles

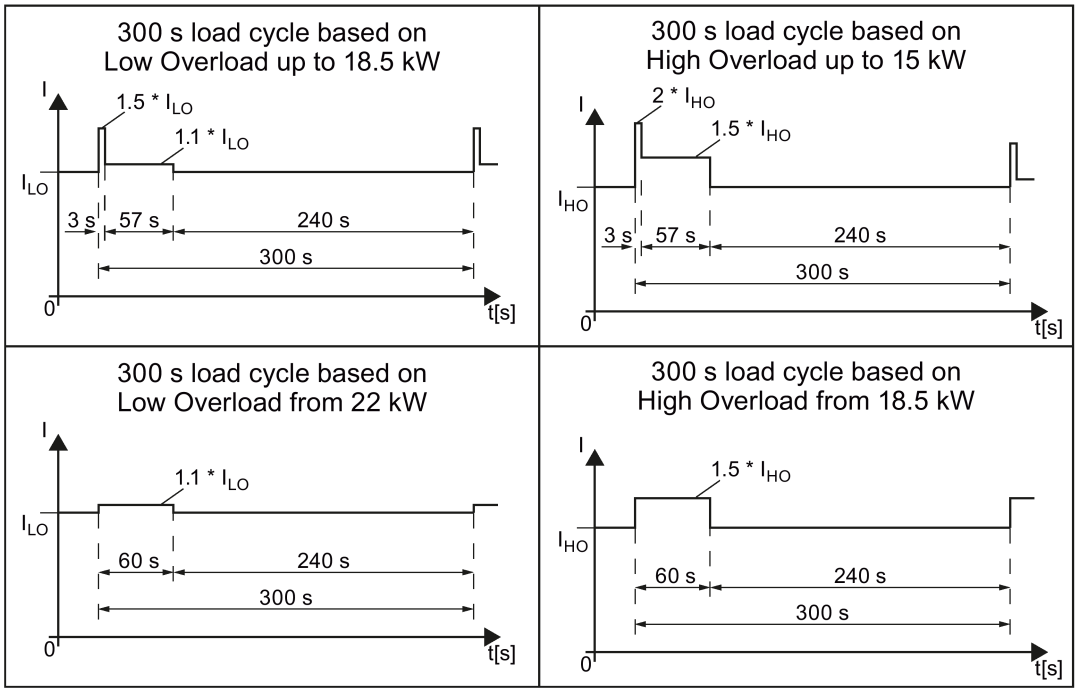



Figure 7-1 Duty cycles, "High Overload" and "Low Overload"

## 7.2 Cable cross-sections and tightening torques

Table 7- 1 Connection types, maximum conductor cross-sections and tightening torques

| Inverters | Connection | Cross-section / tightening torque | |
|---|---|---|---|
| **FSA** | Terminal | 1 … 2.5 $mm^2$ / 0.5 Nm | 18 … 14 AWG / 4.4 lbf in |
| **FSB** | Terminal | 2.5 … 6 $mm^2$ / 0.6 Nm | 14 … 10 AWG, 5.3 lbf in |
| **FSC** | Terminal | 6 …16 $mm^2$ / 1.5 Nm | 10 … 5 AWG / 13.3 lbf in |
| **FSD** | Cable lug | 10 … 35 $mm^2$ / 6 Nm | 5 … 2 AWG / 53 lbf in |
| **FSE** | Cable lug | 25 … 50 $mm^2$ / 6 Nm | 3 … 2 AWG / 53 lbf in |
| **FSF** | Cable lug | 35 … 120 $mm^2$ / 13 Nm | 2 … 4/0 AWG, 115 lbf in |

## 7.3 Electromagnetic compatibility - Overview

### Electromagnetic compatibility according to EN61800-3

| Property | Version | |
|---|---|---|
| Interference immunity | The inverters are suitable for use in First and Second Industrial Environments. | |
| Interference emission - First Environment | Category C1 | For inverters with integrated radio interference suppression filter acc. to C1 |
| Interference emission - Second Environment | Category C2 | For inverters with integrated radio interference suppression filter acc. to C2 |

For further information, refer to the following Section:

Electromagnetic compatibility of variable-speed drives (Page 59).

# 7.4 Ambient conditions

| Property | Version |
|---|---|
| **Ambient conditions for transport in the transport packaging** | |
| Climatic ambient conditions | - 25 °C … + 55 °C, Class 1K3 according to EN 60721-3-1 |
| Mechanical ambient conditions | Shock and vibration permissible, Class 2M3 according to EN 60721-3-2 |
| Protection against chemical substances | Protected according to Class 2C2 to EN 60721-3-2 |
| Biological environmental conditions | Suitable according to Class 2B1 to EN 60721-3-2 |
| **Ambient conditions for long-term storage in the product packaging** | |
| Climatic ambient conditions | - 40 °C … + 70 °C, Class 2K4 according to EN 60721-3-2<br>Maximum humidity 95% at 40 °C |
| Mechanical ambient conditions | Shock and vibration permissible, Class 1M2 according to EN 60721-3-1 |
| Protection against chemical substances | Protected according to Class 1C2 to EN 60721-3-1 |
| Biological environmental conditions | Suitable according to Class 1B1 according to EN 60721-3-1 |
| **Ambient conditions in operation** | |
| Installation altitude | Up to 1,000 m above sea level without derating,<br>> 1,000 m Restrictions for special ambient conditions (Page 57) |
| Climatic ambient conditions [1] | • Temperature range without derating [2]<br>– LO base load power: -10 °C ... 40 °C<br>– HO base load power: -10 °C ... 50 °C<br>For higher temperatures.<br>Restrictions for special ambient conditions (Page 57)<br>• Relative humidity: 5 … 95%, condensation not permitted<br>• Oil mist, salt mist, ice formation, condensation, dripping water, spraying water, splashing water and water jets are not permitted |
| Mechanical ambient conditions | Shock and vibration permissible, Class 3M2 according to EN 60721-3-3 |
| Protection against chemical substances | Protected acc. to Class 3C2 to EN 60721-3-3 |
| Biological environmental conditions | Suitable for Class 3B1 according to EN 60721-3-3 |
| Pollution | Suitable for environments with degree of pollution 2 according to EN 61800-5-1<br>Protected from contact with dangerous parts, dust, spray water and water jets |
| Cooling | Forced air cooling AF, according to EN 60146 |
| Cooling air | Clean and dry air |

[1] Increased ruggedness regarding temperature range and relative humidity; therefore better than Class 3K3 to EN 60721-3-3

[2] Observe the permissible ambient temperatures for the Control Unit and possibly the operator panel (IOP or BOP-2).

# 7.5 General technical data

| Feature | Version |
|---|---|
| Mains voltage | 380 … 480 V 3 AC ± 10% |
| Output voltage | 0 V 3 AC … input voltage x 0.95 (max.) |
| Input frequency | 50 Hz … 60 Hz, ± 3 Hz |
| Output frequency | 0 Hz … 550 Hz, depending on the control mode |
| Power factor λ | 0.9 |
| Line impedance | Uk ≤ 1%, no line reactor permitted |
| Starting current | Low LO base load input current |
| Pulse frequency (factory setting) | 4 kHz<br>The pulse frequency can be increased in 2 kHz steps up to 16 kHz (up to 8 kHz for 75 kW and 90 kW). An increase in the pulse frequency results in a lower output current. |
| Braking methods | DC braking |
| Degree of protection IP55 | To comply with this degree of protection requires the following:<br>• Operation with operator panel or dummy cover<br>• Connections for control cables are made properly using EMC cable glands.<br>Establishing a line and motor connection (Page 34) |
| Rated short-circuit current | When fused using a type J or 3NE1 fuse, rated voltage 480 VAC<br>with the rated current of the specific inverter.<br>FSA ... FSC: 40 kA<br>FSD ... FSF: 65 kA |

# 7.6 Specific technical data

**Note**

**Values for Low Overload and High Overload**

The values for Low Overload (LO) are identical with those of the rated values.

**Power loss of the Power Modules**

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

Table 7- 2 PM230, IP55, frame size A, 380 V ... 480 V 3 AC

| **Article No. with filter, C2**<br>**Article No. with filter, C1** | **6SL3223-0DE13-7AG1**<br>**6SL3223-0DE13-7BG1** | **6SL3223-0DE15-5AG**<br>**6SL3223-0DE15-5BG1** | **6SL3223-0DE17-5AG1**<br>**6SL3223-0DE17-5BG1** |
|---|---|---|---|
| LO base load power | 0.37 kW | 0.55 kW | 0.75 kW |
| LO base load input current | 1.3 A | 1.8 A | 2.3 A |
| LO base load output current | 1.3 A | 1.7 A | 2.2 A |
| HO base load power | 0.25 kW | 0.37 kW | 0.55 kW |
| HO base load input current | 0.9 A | 1.3 A | 1.8 A |
| HO base load output current | 0.9 A | 1.3 A | 1.7 A |
| Fuse according to IEC<br>Fuse according to UL, class J | 3NA3803<br>10 A | 3NA3803<br>10 A | 3NA3803<br>10 A |
| Power loss | 0.06 kW | 0.06 kW | 0.06 kW |
| Required cooling air flow | 7 l/s | 7 l/s | 7 l/s |
| Weight | 4.3 kg | 4.3 kg | 4.3 kg |

Table 7- 3 PM230, IP55, frame size A, 380 V ... 480 V 3 AC

| **Article No. with filter, C2**<br>**Article No. with filter, C1** | **6SL3223-0DE21-1AG1**<br>**6SL3223-0DE21-1BG1** | **6SL3223-0DE21-5AG1**<br>**6SL3223-0DE21-5BG1** | **6SL3223-0DE22-2AG1**<br>**6SL3223-0DE22-2BG1** |
|---|---|---|---|
| LO base load power | 1.1 kW | 1.5 kW | 2.2 kW |
| LO base load input current | 3.2 A | 4.2 A | 6.1 A |
| LO base load output current | 3.1 A | 4.1 A | 5.9 A |
| HO base load power | 0.75 kW | 1.1 kW | 1.5 kW |
| HO base load input current | 2.3 A | 3.2 A | 4.2 A |
| HO base load output current | 2.2 A | 3.1 A | 4.1 A |
| Fuse according to IEC<br>Fuse according to UL, class J | 3NA3803<br>10 A | 3NA3803<br>10 A | 3NA3803<br>10 A |
| Power loss | 0.07 kW | 0.08 kW | 0.1 kW |
| Required cooling air flow | 7 l/s | 7 l/s | 7 l/s |
| Weight | 4.3 kg | 4.3 kg | 4.3 kg |

| **Article No. with filter, C2**<br>**Article No. with filter, C1** | **6SL3223-0DE23-0AG1**<br>**6SL3223-0DE23-0BG1** |
|---|---|
| LO base load power | 3 kW |
| LO base load input current | 8.0 A |
| LO base load output current | 7.7 A |
| HO base load power | 2.2 kW |
| HO base load input current | 6.1 A |
| HO base load output current | 5.9 A |
| Fuse according to IEC<br>Fuse according to UL, class J | 3NA3803<br>10 A |
| Power loss | 0.12 kW |
| Required cooling air flow | 7 l/s |
| Weight | 4.3 kg |

Table 7- 4 PM230, IP55, frame size B, 380 V … 480 V 3 AC

| **Article No. with filter, C2**<br>**Article No. with filter, C1** | **6SL3223-0DE24-0AG1**<br>**6SL3223-0DE24-0BG1** | **6SL3223-0DE25-5AG1**<br>**6SL3223-0DE25-5BG1** | **6SL3223-0DE27-5AG1**<br>**6SL3223-0DE27-5BG1** |
|---|---|---|---|
| LO base load power | 4 kW | 5.5 kW | 7.5 kW |
| LO base load input current | 10.5 A | 13.6 A | 18.6 A |
| LO base load output current | 10.2 A | 13.2 A | 18 A |
| HO base load power | 3 kW | 4 kW | 5.5 kW |
| HO base load input current | 8.0 A | 10.5 A | 13.6 A |
| HO base load output current | 7.7 A | 10.2 A | 13.2 A |
| Fuse according to IEC<br>Fuse according to UL, class J | 3NA3805<br>16 A | 3NA3807<br>25 A | 3NA3810<br>35 A |
| Power loss | 0.14 kW | 0.18 kW | 0.24 kW |
| Required cooling air flow | 9 l/s | 9 l/s | 9 l/s |
| Weight | 6.3 kg | 6.3 kg | 6.3 kg |

Table 7- 5 PM230, IP55, frame size C, 380 V AC … 480 V 3 AC

| **Article No. with filter, C2**<br>**Article No. with filter, C1** | **6SL3223-0DE31-1AG1**<br>**6SL3223-0DE31-1BG1** | **6SL3223-0DE31-5AG1**<br>**6SL3223-0DE31-5BG1** | **6SL3223-0DE31-8AG1**<br>**---** |
|---|---|---|---|
| LO base load power | 11 kW | 15 kW | 18.5 kW |
| LO base load input current | 26.9 A | 33.1 A | 39.2 A |
| LO base load output current | 26 A | 32 A | 38 A |
| HO base load power | 7.5 kW | 11 kW | 15 kW |
| HO base load input current | 18.6 A | 26.9 A | 33.1 A |
| HO base load output current | 18 A | 26 A | 32 A |
| Fuse according to IEC<br>Fuse according to UL, class J | 3NA3814<br>40 A | 3NA3820<br>50 A | 3NA3820<br>50 A |
| Power loss | 0.32 kW | 0.39 kW | 0.46 kW |
| Required cooling air flow rate | 20 l/s | 20 l/s | 20 l/s |
| Weight | 9.5 kg | 9.5 kg | 9.5 kg |

Table 7- 6 PM230, IP55, frame size D, 380 V … 480 V 3 AC

| **Article No. with filter, C2**<br>**Article No. with filter, C1** | **- 6SL3223-0DE31-8BG0** | **6SL3223-0DE32-2AG0**<br>**6SL3223-0DE32-2BG0** | **6SL3223-0DE33-0AG0**<br>**6SL3223-0DE33-0BG0** |
|---|---|---|---|
| LO base load power | 18.5 kW | 22 kW | 30 kW |
| LO base load input current | 39.2 A | 42 A | 56 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 | 33.1 A | 36 A | 42 A |
| HO base load output current | 32 A | 38 A | 45 A |
| Fuse according to IEC<br>Fuse according to UL, class J | 3NA3820<br>50 A | 3NA3822<br>63 A | 3NA3824<br>80 A |
| Power loss | 0.46 kW | 0.52 kW | 0.68 kW |
| Required cooling air flow rate | 20 l/s | 39 l/s | 39 l/s |
| Weight | 30.2 kg | 30.2 kg | 30.2 kg |

Table 7- 7 PM230, IP55, frame size E, 380 V … 480 V 3 AC

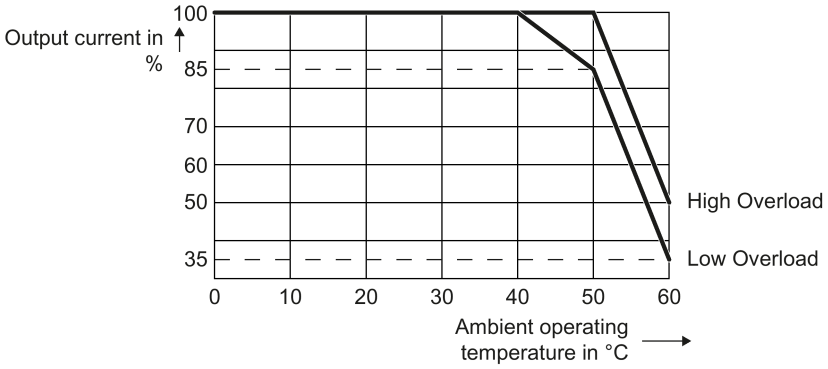
| **Article No. with filter, C2**<br>**Article No. with filter, C1** | **6SL3223-0DE33-7AG0**<br>**6SL3223-0DE33-7BG0** | **6SL3223-0DE34-5AG0**<br>**6SL3223-0DE34-5BG0** |
|---|---|---|
| LO base load power | 37 kW | 45 kW |
| LO base load input current | 70 A | 84 A |
| LO base load output current | 75 A | 90 A |
| HO base load power | 30 kW | 37 kW |
| HO base load input current | 56 A | 70 A |
| HO base load output current | 60 A | 75 A |
| Fuse according to IEC<br>Fuse according to UL, class J | 3NA3830<br>100 A | 3NA3832<br>125 A |
| Power loss | 0.99 kW | 1.2 kW |
| Required cooling air flow rate | 39 l/s | 39 l/s |
| Weight | 35.8 kg | 35.8 kg |

Table 7- 8 PM230, IP55, frame size F, 380 V … 480 V 3 AC

| **Article No. with filter, C2**<br>**Article No. with filter, C1** | **6SL3223-0DE35-5AG0**<br>**6SL3223-0DE35-5BG0** | **6SL3223-0DE37-5AG0**<br>**6SL3223-0DE37-5BG0** | **6SL3223-0DE38-8AG0**<br>**6SL3223-0DE38-8BG0** |
|---|---|---|---|
| LO base load power | 55 kW | 75 kW | 90 kW |
| LO base load input current | 102 A | 135 A | 166 A |
| LO base load output current | 110 A | 145 A | 178 A |
| HO base load power | 45 kW | 55 kW | 75 kW |
| HO base load input current | 84 A | 102 A | 135 A |
| HO base load output current | 90 A | 110 A | 145 A |
| Fuse according to IEC<br>Fuse according to UL, class J | 3NA3836<br>160 A | 3NA3140<br>200 A | 3NA3144<br>250 A |
| Power loss | 1.4 kW | 1.9 kW | 2.3 kW |
| Required cooling air flow | 117 l/s | 117 l/s | 117 l/s |
| Weight | 70.0 kg | 70.0 kg | 70.0 kg |

# 7.7 Restrictions for special ambient conditions

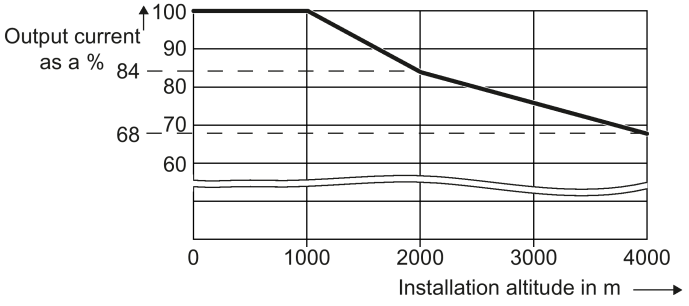
## Current de-rating depending on the ambient operating temperature



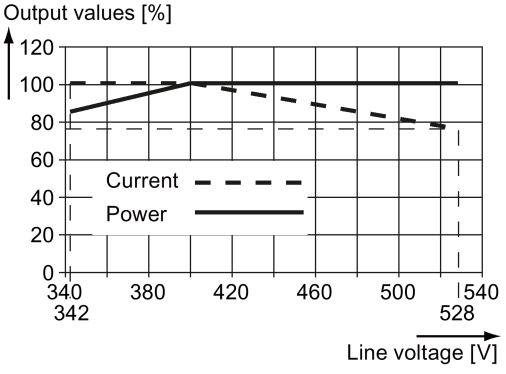

The Control Unit and operator panel can restrict the maximum permissible operating ambient temperature of the Power Module.

## 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.




## Current and power limiting depending on the line voltage



# 7.8 Current reduction depending on pulse frequency

## Current derating depending on the pulse frequency

| LO base load | Output base-load current at a pulse frequency of | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 2 kHz | 4 kHz | 6 kHz | 8 kHz | 10 kHz | 12 kHz | 14 kHz | 16 kHz |
| kW | A | A | A | A | A | A | A | A |
| 0.37 | -- | 1.30 | 1.11 | 0.91 | 0.78 | 0.65 | 0.59 | 0.52 |
| 0.55 | -- | 1.70 | 1.45 | 1.19 | 1.02 | 0.85 | 0.77 | 0.68 |
| 0.75 | -- | 2.20 | 1.87 | 1.54 | 1.32 | 1.10 | 0.99 | 0.88 |
| 1.1 | -- | 3.10 | 2.64 | 2.17 | 1.86 | 1.55 | 1.40 | 1.24 |
| 1.5 | -- | 4.10 | 3.49 | 2.87 | 2.46 | 2.05 | 1.85 | 1.64 |
| 2.2 | -- | 5.90 | 5.02 | 4.13 | 3.54 | 2.95 | 2.66 | 2.36 |
| 3.0 | -- | 7.70 | 6.55 | 5.39 | 4.62 | 3.85 | 3.47 | 3.08 |
| 4.0 | -- | 10.20 | 8.67 | 7.14 | 6.12 | 5.10 | 4.59 | 4.08 |
| 5.5 | -- | 13.20 | 11.22 | 9.24 | 7.92 | 6.60 | 5.94 | 5.28 |
| 7.5 | -- | 18.00 | 15.30 | 12.60 | 10.80 | 9.00 | 8.10 | 7.20 |
| 11.0 | -- | 26.00 | 22.10 | 18.20 | 15.60 | 13.00 | 11.70 | 10.40 |
| 15.0 | -- | 32.00 | 27.20 | 22.40 | 19.20 | 16.00 | 14.40 | 12.80 |
| 18.5 | -- | 38.00 | 32.30 | 26.60 | 22.80 | 19.00 | 17.10 | 15.20 |
| 22 | -- | 45.00 | 38.25 | 31.50 | 27.00 | 22.50 | 20.25 | 18.00 |
| 30 | -- | 60.00 | 51.00 | 42.00 | 36.00 | 30.00 | 27.00 | 24.00 |
| 37 | -- | 75.00 | 63.75 | 52.50 | 45.00 | 37.50 | 33.75 | 30.00 |
| 45 | -- | 90.00 | 76.50 | 63.00 | 54.00 | 45.00 | 40.50 | 36.00 |
| 55 | -- | 110.0 | 93.50 | 77.00 | 66.00 | 55.00 | 49.50 | 44.00 |
| 75 | -- | 145.0 | 123.3 | 101.5 | -- | -- | -- | -- |

The permissible cable length to the motor also depends on the cable type and the selected pulse frequency.

# 7.9 Electromagnetic compatibility of variable-speed drives

EMC (electromagnetic compatibility) means that the devices function satisfactorily without interfering with other devices and without being disrupted by other devices. This is true when the emitted interference (emission level) and the interference immunity are matched with each other.

The product standard IEC/EN 61800-3 describes the EMC requirements placed on "Variable-speed drive systems".

A variable-speed drive system (or Power Drive System PDS) consists of the inverter as well as the associated electric motors and encoders including the connecting cables.

The inverter comprises the Control Unit and Power Module.

The driven machine is not part of the drive system.

**Note**

**PDS as component of machines or systems**

When you integrate PDS into machines or systems, additional measures may be required so that the product standards of these machines or systems is complied with. The machine or system builder is responsible for taking these measures.

## Environments and categories

### Environments

IEC/EN 61800-3 makes a distinction between the first and second environments - and defines different requirements for these environments.

- **First environment:**
  Residential buildings or locations at which the drive system is directly connected to a public low-voltage supply without intermediate transformer.
- **Second environment:**
  All locations that are connected to the public grid through their own, dedicated transformer. These are essentially industrial plants and systems.

### Categories

IEC/EN 61800-3 makes a distinction between four drive system categories:

- **Category C1:**
  Drive systems for rated voltages < 1000 V for unrestricted use in the first environment
- **Category C2:**
  Stationary drive systems for rated voltages < 1000 V for operation in the second environment.

  The drive system must be installed by appropriately qualified and trained personnel.

  Additional measures are required for operation in the first environment.
- **Category C3:**
  Drive systems for rated voltages < 1000 V - only for operation in the second environment.
- **Category C4:**
  Drive systems for IT line supplies for operation in complex systems in the second environment.

  An EMC plan must be created.

**Note**

**Appropriately trained and qualified personnel**

An appropriately trained and qualified person has the necessary experience for installing and/or commissioning drive systems (Power Drive Systems - PDS), including the associated EMC aspects.

## 7.9.1 Inverter applications

Inverters involve equipment used on a professional basis, deployed in certain areas of business and industry - and are not operated in the general public domain.

For an EMC-compliant installation, observe the information provided in the Configuration manual: EMC installation guideline (http://support.automation.siemens.com/WW/view/en/60612658).

The Power Modules described here are intended for operation in the first and second environments. Conditions for operation in the respective environment are subsequently listed.

## 7.9.2 Operation in the Second Environment

### Interference immunity

You do not have to take any additional measures regarding interference immunity.

### Interference emission - operation in the second environment, Category C2

The drive system must comply with the following conditions in order to comply with the limit values of the second environment, Category C2:

- The drive system is installed by appropriately qualified personnel in compliance with EMC regulations - and the installation notes provided in the manual.
- You use a shielded motor cable with low capacitance.
- The pulse frequency is not higher than the value set in the factory.
- The drive system is connected to a TN system.
- The permissible motor cable length is complied with.
- The current is not higher than the LO input current of the inverter (high-frequency, cable-conducted interference voltages).

Specific technical data (Page 53).

## 7.9.3 Operation in the First Environment

### Interference immunity

You do not have to take any additional measures regarding interference immunity.

### Interference emission - operation in the first environment, Category C2

In order that you may operate the drive system in the first environment, Category C2, then in addition to the requirements for use in the second environment, you must also observe the limit values related to harmonic currents.

**Note**

**Maintaining the limit values for harmonic currents**

With respect to the compliance with limits for harmonic currents, the EMC product standard EN61800-3 for PDS refers to compliance with standards EN 61000-3-2 and EN 61000-3-12.

**Inverter with an LO base load power ≤ 1 kW:**

It cannot be guaranteed that the limit values are complied with corresponding to IEC 61000-3-2. The installation person/company or company operating the professionally used device must obtain authorization from the grid operator to connect the device regarding the harmonic currents.

Harmonic currents (Page 64)

**Inverters with an LO base load input current ≤ 16 A:**

These devices are not subject to any limit values, and as a consequence can be connected to the public low-voltage grid without any prior consultation.

- **Inverters with an LO base load input current > 16 A and ≤ 75 A**

  The drive system is in compliance with IEC/EN 61000-3-12 under the following precondition:

  – Short-circuit power $S_{SC}$ at the connection point of the customer's system to the public grid, is not greater or is equal to the value according to the following formula:

    $S_{SC} \geq 120 \bullet \sqrt{3} \bullet U_{in} \bullet$ LO base load input current

    The installation company or company operating the drive system is responsible for ensuring that this device is only connected at a connection point with an appropriate short-circuit power (fault level).

    **Example:** FSD inverter, 400 V, input current, 42 A:

    $S_{SC} \geq 120 \bullet \sqrt{3} \bullet 400\ V \bullet 42\ A$
    This corresponds to a low-voltage transformer with an apparent power rating of approximately 160 kVA … 200 kVA with 4 % … 6 % $U_k$

  If these preconditions do not apply, then the installation company or company operating the device must obtain authorization from the grid operator to connect the device regarding the harmonic currents.

  Harmonic currents (Page 64)

- **Inverters with an LO base load current > 75A**

  There are no standard-related requirements for installing devices such as these. However, it is recommended to inform the grid operator when connecting such a device.

## Interference emission - Operation in the First Environment, Category C1

Inverters of Category C1 (Class B) with integrated filters comply with the requirements of the First Environment, Category C1, with reference to interference emission under the following conditions:

- The drive system is installed by appropriately qualified personnel in compliance with EMC regulations and the installation notes provided in the manual.
- The current is not higher than the LO input current of the inverter (high-frequency, cable-conducted interference voltages).

  Specific technical data (Page 53)

## 7.9.4 Harmonic currents

Table 7- 9 Typical harmonic currents (%) of the inverter

| Inverter | Harmonic number | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 5th | 7th | 11th | 13th | 17th | 19th | 23rd | 25th |
| FSA … FSC [1)] | 20 | 14 | 9.1 | 7.7 | 5.9 | 5.3 | 4.3 | 4 |
| FSD … FSF [1)] | 21 | 15 | 10 | 9 | 7 | 6 | 6 | 5 |

[1)] Values referred to the LO input current

## 7.9.5 EMC limit values in South Korea

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 observed for Korea correspond to the limit values of the EMC product standard for variable-speed electric drives EN 61800-3 of category C2 or the limit value class A, Group 1 to KN11.

By implementing appropriate additional measures, the limit values according to category C2 or limit value class A, Group 1, are observed.

Additional measures, such as the use of an additional RFI suppression filter (EMC filter), may be necessary.

In addition, measures for EMC-compliant configuration of the plant or system are described in detail in this manual and in the Configuration manualEMC installation guideline (http://support.automation.siemens.com/WW/view/en/60612658).

The final statement on compliance with the applicable standard is given by the respective label attached to the individual device.

# Spare parts and accessories

# 8

## 8.1 Spare parts

### Continuous development within the scope of product maintenance

Inverter components are being continuously developed within the scope of product maintenance. Product maintenance includes, for example, measures to increase the ruggedness or hardware changes which become necessary as components are discontinued.

These further developments are "spare parts-compatible" and do not change the article number.

In the scope of such spare parts-compatible ongoing development, plug connector or connection positions are sometimes slightly modified. This does not cause any problems when the components are properly used. Please take this fact into consideration in special installation situations (e.g. allow sufficient reserve regarding the cable length).

### Spare parts list

| | |
|---|---|
| External fan FSA | 6SL3200-0SF21-0AA1 |
| External fan FSB | 6SL3200-0SF22-0AA1 |
| External fan FSC up to 15 kW | 6SL3200-0SF23-0AA1 |
| External fan FSC up to 18.5 kW | 6SL3200-0SF23-0AA0 |
| External fan FSD | 6SL3200-0SF24-0AA0 |
| External fan FSE | 6SL3200-0SF24-0AA0 |
| External fan FSF | 6SL3200-0SF26-0AA0 |
| Internal fan FSA, FSB, FSC | 6SL3200-0SF31-0AA0 |
| Internal fan FSD, FSE, FSF | 6SL3200-0SF32-0AA0 |

# 8.2 Accessories

## Accessories supplied

### Accessory kit

The accessory kit contains the parts required for shielding and for connecting the Power Module - except cables and tools. It comprises the following items:

- Plug connector for the mains connection (FSA ... FSC only)
- Plug connector for the motor connection (FSA ... FSC only)
- Shield clamps
- Rubber sleeves for unused cable glands in the bolting plate
- Adapter between CU230P-2 Control Unit and operator panel (FSA ... FSC only)
- Connecting cable between Control Unit and operator panel (FSD ... FSF only)
- Cap screws (M4x20, T20)
- Screws for output line terminals (M4)
- Ferrite rings (suitable for all frame sizes)
- Extended USB cable (FSA ... FSC only)

Article numbers

- FSA: 6SL3200-0SK02-0AA0
- FSB: 6SL3200-0SK03-0AA0
- FSC: 6SL3200-0SK04-0AA0
- FSD: 6SL3200-0SK05-0AA0
- FSE: 6SL3200-0SK06-0AA0
- FSF: 6SL3200-0SK07-0AA0

## Optional accessories

### Dummy cover

Article number: 6SL3256-1BA00-0AA0

The dummy cover is required to achieve degree of protection IP55/UL type 12 if you operate the inverter without BOP-2 or IOP.

**Operator panel, BOP-2,** Article number: 6SL3255-0AA00-4CA1

**Operator panel, IOP,** Article number: 6SL3255-0AA00-4JA1

### Adapter for CU240E-2 Control Unit

KnorrTec Article No.: 10055500
The adapter is required when operating a Power Module of frame size FSA ... FSC with a CU240B/E-2 and an operator panel.

# Appendix

# A

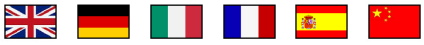
## A.1 Manuals and technical support

### A.1.1 Manuals for your inverter

**Manuals with additional information that can be downloaded: EMC-compliant electrical cabinet design**

- PM230, IP55 Hardware Installation Manual
  (https://support.industry.siemens.com/cs/ww/de/view/109217849/en)
  Installing Power Modules, reactors and filters. Technical specifications, maintenance (this manual)

  
- CU230P-2 Compact Operating Instructions
  (https://support.industry.siemens.com/cs/ww/en/view/109477360)
  Commissioning the inverter.

  
- CU230P-2 operating instructions
  (https://support.industry.siemens.com/cs/ww/en/view/109478827)
  Installing, commissioning and maintaining the inverter. Advanced commissioning

  
- CU230P-2 List Manual (https://support.industry.siemens.com/cs/ww/en/view/109477248)
  Parameter list, alarms and faults. Graphic function diagrams

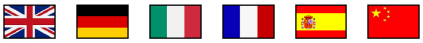
  
- CU240B/E-2 Compact Operating Instructions
  (https://support.industry.siemens.com/cs/ww/en/view/109477361)
  Commissioning the inverter.

  
- CU240B/E-2 operating instructions
  (https://support.industry.siemens.com/cs/ww/en/view/109478828)
  Installing, commissioning and maintaining the inverter. Advanced commissioning

  
- CU240B/E-2 List Manual
  (https://support.industry.siemens.com/cs/ww/en/view/109477251)
  Parameter list, alarms and faults. Graphic function diagrams

- EMC installation guideline
  (http://support.automation.siemens.com/WW/view/en/60612658)
  EMC-compliant control cabinet design, potential equalization and cable routing

  
- Accessories manual (https://support.industry.siemens.com/cs/ww/en/ps/13225/man)
  Installation descriptions for inverter components, e.g. line reactors and line filters. The printed installation descriptions are supplied together with the components.

## A.1.2 Configuring support

### Catalog

Ordering data and technical information for SINAMICS G inverters.

Catalog D31 for download or online catalog (Industry Mall):

All about SINAMICS G120 (www.siemens.com/sinamics-g120)

### SIZER

The configuration tool for SINAMICS, MICROMASTER and DYNAVERT T drives, motor starters, as well as SINUMERIK, SIMOTION controllers and SIMATIC technology

SIZER on DVD:

Article number: 6SL3070-0AA00-0AG0

Download SIZER (http://support.automation.siemens.com/WW/view/en/10804987/130000)

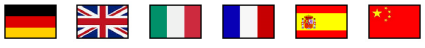
### EMC (electromagnetic compatibility) technical overview

Standards and guidelines, EMC-compliant control cabinet design

EMC overview (https://support.industry.siemens.com/cs/ww/en/view/103704610)

### EMC Guidelines configuration manual

EMC-compliant control cabinet design, potential equalization and cable routing



EMC installation guideline (http://support.automation.siemens.com/WW/view/en/60612658)

### Safety Integrated for novices technical overview

Application examples for SINAMICS G drives with Safety Integrated

Safety Integrated for novices
(https://support.industry.siemens.com/cs/ww/en/view/80561520)

## A.1.3 Product Support

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

This address provides the following:

- Actual product information (product memorandums), FAQs (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".

# A.2 Directives and standards

## Relevant directives and standards

The following directives and standards are relevant for the inverters:

### European Low Voltage Directive

The inverters fulfil the requirements stipulated in Low Voltage Directive 2014/35/EU insofar as they are covered by the scope of application of this Directive.

### European Machinery Directive

The inverters fulfil the requirements stipulated in Machinery Directive 2006/42//EU insofar as they are covered by the scope of application of this Directive.

Use of the inverters in a typical machine application has been fully assessed for compliance with the main regulations in this Directive concerning health and safety.

### European EMC Directive

By completely complying with IEC/EN 61800-3, it has been proven that the inverter is in compliance with Directive 2004/108/EC or 2014/30/EU.

### Underwriters Laboratories (North American market)

Inverters bearing one of the certification marks shown on the left meet the requirements for the North American market as a component of drive applications and are listed correspondingly.

### EMC requirements for South Korea

The inverters with the KC marking on the rating plate satisfy the EMC requirements for South Korea.

### Eurasian conformity

The inverters comply with the requirements of the Russia/Belarus/Kazakhstan customs union (EAC).

### Australia and New Zealand (RCM formerly C-Tick)

The inverters bearing the certification mark shown here meet the EMC requirements for Australia and New Zealand.

#### Specification for semiconductor process equipment voltage drop immunity

The inverters comply with the requirements of standard SEMI F47-0706.

#### Quality systems

Siemens AG employs a quality management system that meets the requirements of ISO 9001 and ISO 14001.

## Certificates for download

- EC Declaration of Conformity:

  (https://support.industry.siemens.com/cs/ww/en/view/58275445)

- Certificates for the relevant directives, prototype test certificates, manufacturers declarations and test certificates for functions relating to functional safety ("Safety Integrated"):

  (http://support.automation.siemens.com/WW/view/en/22339653/134200)

- Certificates of UL certified products:

  (http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.html)

  – FSA, FSB, FSC: UL file E121068

- Certificates of TÜV SÜD certified products:

  (https://www.tuev-sued.de/industry_and_consumer_products/certificates)

  – FSD, FSE, FSF:

  U7 11 04 20078 011

  U7 11 04 20078 009

  U7 11 04 20078 010

## Standards that are not relevant

#### China Compulsory Certification

The inverters do not fall in the area of validity of the China Compulsory Certification (CCC).

# A.3 Abbreviations

| Abbreviation | Explanation |
|---|---|
| AC | Alternating current |
| CE | Communauté Européenne |
| CU | Control Unit |
| DC | Direct current |
| DI | Digital input |
| DIP switch | DIP switches are small switches, found mostly on PBCs, for making basic device settings |
| 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 ... |
| 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 |
| VPL | Voltage Peak Limiter; component for limiting voltage peaks |

# Index

## Q



## S



## T



## U

## Further information

SINAMICS inverters:
**www.siemens.com/sinamics**

Siemens AG
Digital Factory
Motion Control
Postfach 3180
91050 ERLANGEN
GERMANY



Scan the QR code for further information on SINAMICS G120P.

**www.siemens.com/drives**