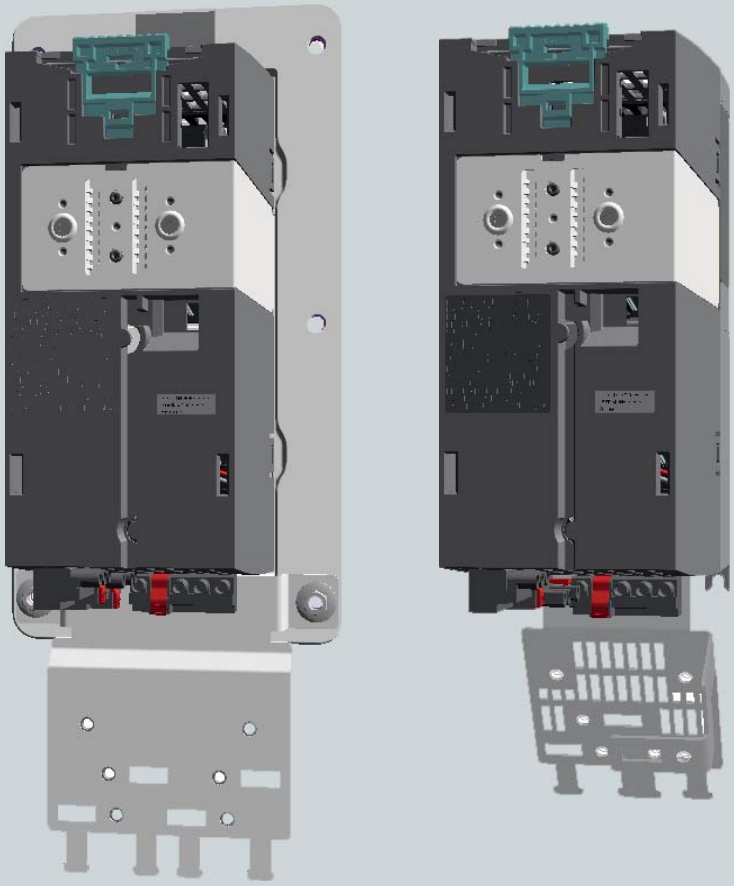
SINAMICS G120

Power Module PM240-2

Hardware Installation Manual · 01/2012



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SINAMICS G120
Power Module PM240-2

Hardware Installation Manual

01/2012

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Legal information

Warning notice system

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

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

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

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

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

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

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

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, 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.

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Disclaimer of Liability

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

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GERMANY

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Introduction

1

Power Modules PM240-2

The Power Module PM240-2 is part of the modular inverter family SINAMICS G120.

The PM240-2 are Power Modules with braking capacity (resistor braking).

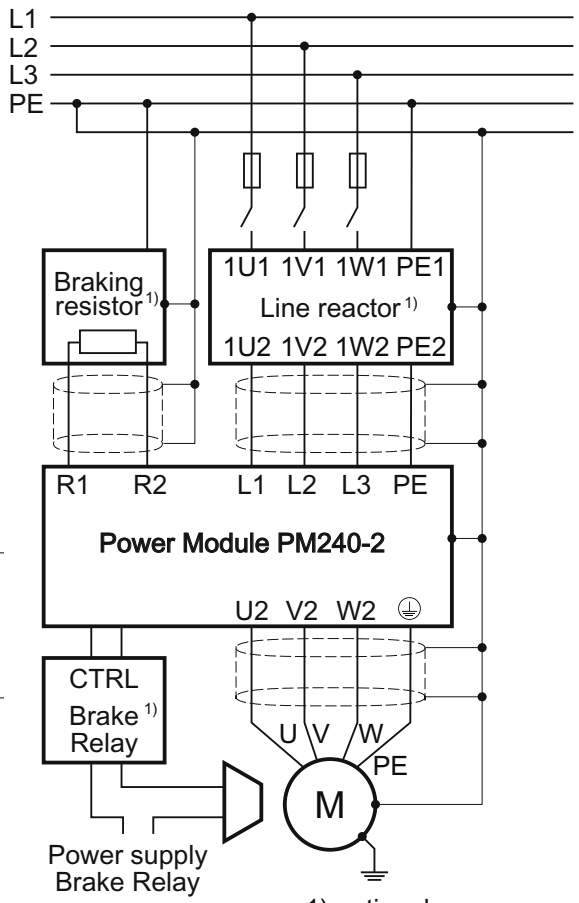
They are available with class-A filter or unfiltered in a rated-power range from 0.55 kW … 3 kW and a line voltage range from 3 AC 380 V … 480 V.

In the design of the Power Modules the following power distribution systems have been considered:

- TN
- TT (only unfiltered Power Modules)
- IT (only unfiltered Power Modules)

Note

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



1) optional accessory

Block diagram PM240-2

The Power Modules can be used with the following Control Units, both Standard and Safety variants, including all communication variants with firmware version 4.4 or higher.

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

Operation with any other Control Units as listed above is not permitted.

Safety notes

2

It has to be ensured by the machine manufacturer, that the line-side overcurrent protection equipment interrupts within 5 s (immovable equipment and modules in immovable equipment) in the case of minimum fault current (current on complete insulation failure to accessible conductive parts that are not live during operation and maximum current loop resistance).

General

⚠ WARNING

This equipment controls potentially dangerous rotating mechanical parts.

Protection in case of direct contact by means of SELV / PELV is only permissible in areas with equipotential bonding and in dry indoor rooms. If these conditions are not fulfilled, other protective measures against electric shock must be applied e.g. protective insulation.

The converter must always be grounded.

Install the converter on a metal mounting plate in a control cabinet. The mounting plate has to be unpainted and with a good electrical conductivity.

It is strictly prohibited for any mains disconnection to be performed on the motor-side of the system, if the converter is in operation and the output current is not zero.

Take particular notice of the general and regional installation and safety regulations regarding work on dangerous voltage installations (e.g. 61800-5-1) as well as the relevant regulations regarding the correct use of tools and personal protective equipment (PPE).

⚠ CAUTION

Static discharges on surfaces or interfaces (e.g. terminal or connector pins) can cause malfunctions or defects. Therefore, when working with converters or converter components, ESD protective measures should be observed.

⚠ DANGER

Dangerous voltage!

Hazardous voltage is still present for up to 5 minutes after the power supply has been switched off. Do not to carry out any installation work before this time has expired!

⚠ WARNING

Protective earthing conductor current

As the earth leakage for the inverter can be greater than AC 3.5 mA, a fixed earth connection is required and the minimum size of the protective earth conductor shall comply with the local safety regulations for high leakage current equipment.

The inverter can cause a DC current in the protective earthing conductor. Where a residual current-operated protective (RCD) or monitoring (RCM) device is used for protection in case of direct or indirect contact, only an RCD or RCM of Type B superresistant is allowed on the supply side of the inverter.

Transport and storage

⚠ CAUTION

Don't drop the converter or converter components during transport and storage. Protect the equipment from water (rainfall) and excessive temperatures.

Installation and Commissioning

⚠ WARNING

Wherever faults occurring in the control equipment can lead to substantial material damage or even grievous bodily injury (that is, potentially dangerous faults), additional external precautions must be taken or facilities provided to ensure or enforce safe operation, even when a fault occurs (e.g. independent limit switches, mechanical interlocks, etc.).

Operation

⚠ DANGER

Operating the converter outside the scope of the specification given in the technical specifications may cause malfunction or damage to the converter components. In exceptional cases there is the potential to cause overheating, danger of fire, damage to property, personal injury or loss of life.

⚠ WARNING

Emergency stop facilities according to EN 60204, IEC 204 (VDE 0113) must remain operative in all operating modes of the control equipment. Any disengagement of the emergency stop facility must not lead to an uncontrolled or an undefined restart of the equipment.

⚠ WARNING

Use of mobile radio devices (e.g. telephones, walkie-talkies) in the immediate vicinity of the devices (< 1.8 m) can interfere with the functioning of the equipment.

⚠ WARNING

Filtered drives can only be used on power systems with grounded neutral point.

⚠ WARNING

During operation and for a short time after switching-off the converter, the surfaces of the converter can reach a high temperature. Avoid coming into direct contact with the converter surface.

⚠ WARNING

Risk of fire

If an unsuitable braking resistor is used, this could result in a fire and severely damage, people, property and equipment. Use the adequate braking resistor and install it correctly.

The temperature of a braking resistor increases significantly during operation. Avoid coming into direct contact with braking resistors.

⚠ CAUTION

This equipment is suitable for use in a power system up to 65,000 symmetrical amperes (rms), for the maximum rated voltage + 10 % when protected by an appropriate standard fuse (refer to the catalogue for the type of fuse).

Repair

⚠ WARNING

Repairs on equipment 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.

Any defective parts or components must be replaced using parts contained in the relevant spare parts list.

Dismantling and disposal

CAUTION
The packaging of the inverter is re-usable. Retain the packaging for future use. Easy-to-release screw and snap connectors allow you to break the unit down into its component parts. You can recycle these component parts, dispose of them in accordance with local requirements or return them to the manufacturer.

Residual risks

The control and drive components of a power drive system (PDS) 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 information and instructions on the components and in the associated technical user documentation.

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

1. Unintentional movements of driven machine components during commissioning, operation, maintenance, and repairs caused by, for example:
   - Hardware defects and/or software errors in the sensors, controllers, actuators, and connection technology
   - Response times of the controller and drive
   - Operating and/or ambient conditions not within the scope of the specification
   - Condensation / conductive contamination
   - Parameterization, programming, cabling, and installation errors
   - Use of radio devices / cellular phones in the immediate vicinity of the controller
   - External influences / damage
2. Exceptional temperatures as well as emissions of noise, particles, or gas caused by, for example:
   - Component malfunctions
   - Software errors
   - Operating and/or ambient conditions not within the scope of the specification
   - External influences / damage

3. Hazardous shock voltages caused by, for example:
   - Component malfunctions
   - Influence of electrostatic charging
   - Induction of voltages in moving motors
   - Operating and/or ambient conditions not within the scope of the specification
   - Condensation / conductive contamination
   - External influences / damage
4. Electrical, magnetic and electromagnetic fields generated in operation that can pose a risk to people with a pacemaker, implants or metal replacement joints, etc. if they are too close.
5. Release of environmental pollutants or emissions as a result of improper operation of the system and/or failure to dispose of components safely and correctly.

Installing/Mounting 3

3.1 Installation conditions

General rules for the environmental protection of the Power Modules

To ensure that the power module is installed in the correct environmental conditions, please ensure that you adhere to the following guidelines:

- The Power Modules are designed
  - to be installed in an electrical cabinet
  - with protection against the ingress of solid foreign objects ≥ 12.5 mm
  - without protection against the ingress of water

  Note

  Push through units

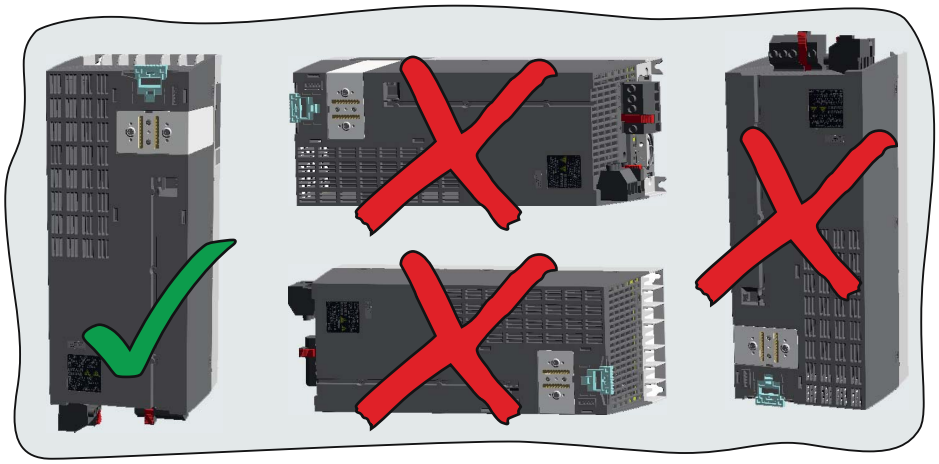
  The Power Module as a whole is IP20 rated.

  If it is installed in a cabinet which is IP54 rated, the Push through units can maintain the IP54 protection rating of the cabinet, if the appropriate seals are used when mounting the rear of the Power Module through the back of the cabinet.

  According to UL the Push through units only fulfill the requirements of an open type component.

- Furthermore take care of the following conditions:
  - Keep it free from dust and dirt
  - Keep it away from water, solvents and chemicals
    Take care to site it away from potential water hazards, for example, do not install it beneath pipes that are subject to condensation. Avoid installing it where excessive humidity and condensation may occur
  - Keep it within the maximum and minimum operating temperatures
  - Ensure that the correct level of ventilation and air flow is provided
  - Ensure that earthing and grounding practices for each Power Module and the cabinet follows the guidelines given in section Connecting (Page 23).

The Power Module must only be installed in vertical direction as shown in the figure.



⚠ WARNING

To ensure the safe operation of the equipment, it must be installed and commissioned by qualified personnel in full compliance with the warnings laid down in this manual.

Take particular note of the general and regional installation and safety regulations regarding work on dangerous voltage installation (e.g. EN 61800-5-1) as well as the relevant regulations regarding the correct use of tools and personal protective equipment (PPE).

3.2 Power losses and air cooling requirements

Cooling requirements

Depending on the power losses of the various components a specific cooling air flow is required to protect the components from overheating. The following procedure shows how to calculate the required air flow.

1. Add the power losses of the respective components
2. Calculate the airflow required, using the formula

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

ΔT: allowable temperature rise in the cabinet

3. Ensure that no equipment is installed that has a negative influence on the flow of the cooling air.
4. Ensure that the cooling vents in the Power Module are positioned correctly to allow the free movement of air.

5. Avoid short circuits of the cooling air using air barriers, if necessary

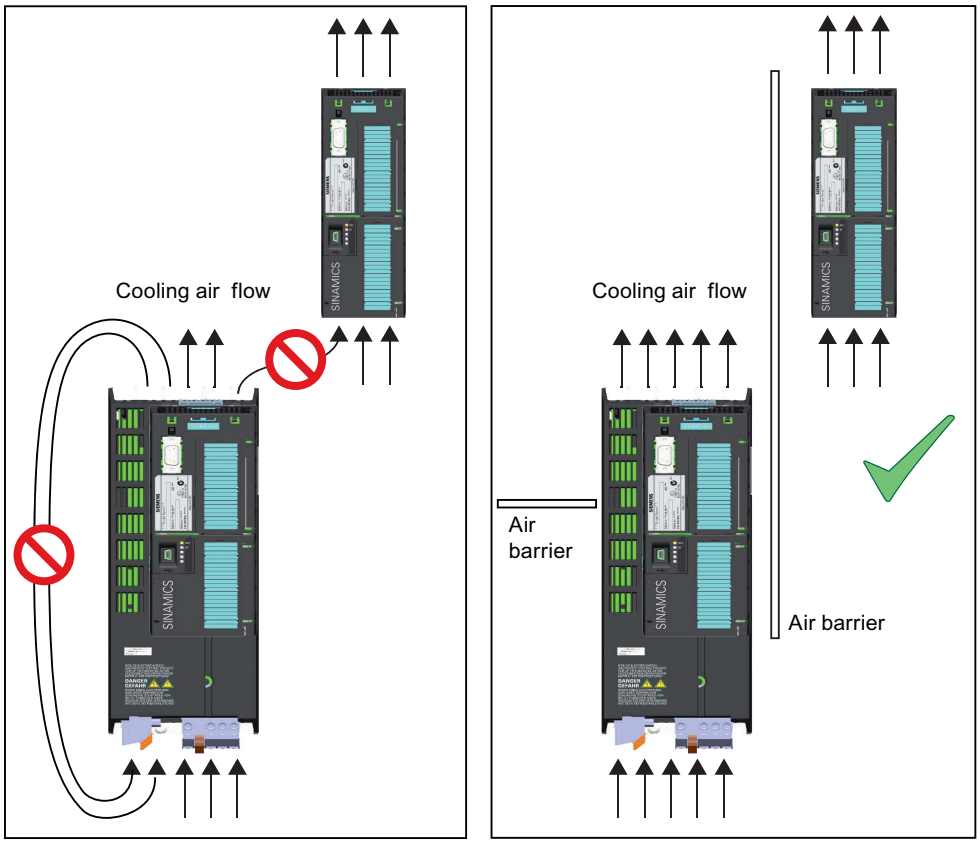


Figure 3-1 Air barriers for avoiding cooling air short circuits

6. Provide an adequate cabinet with sufficient ventilation and suitable air filters.

The power losses and the required air flow of the Power Modules are given in the section Specifications (Page 40) of this Manual. The maximum power losses of the CU are less than 0.04 kW.

The values are valid for:

- Rated output current
- 50 Hz output frequency
- 4 kHz pulse frequency

If you use Push through units, you should calculate with losses of 0.02 kW inside the cabinet. Take care that the losses outside the cabinet do not cause overheating of the Power Modules.

For other components like reactors or filters use the values given by the manufacturer and calculate the required airflow using the formula given in this section.

3.3 Mounting the Power Module

The Power Modules are designed to be mounted in accordance with the dimensional drawings, in a cabinet using bolts, nuts and washers.

Note

EMC

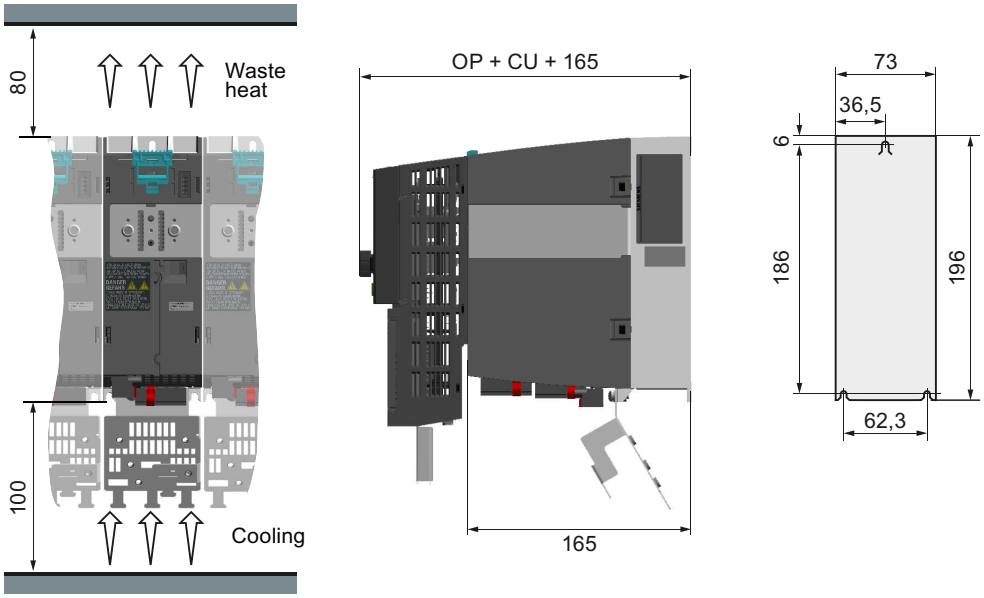
- Due to EMC, it is recomended to fix the inverter on an electrically conductive cabinet wall. In case of a Push through unit the electrical connection is achieved by fixing the Power Module with the recommended bolts and screws on the electrical conductive cabinet wall.

Dimensions drawings

- The dimension drawings shown in the following figures are not true to scale.

3.3.1 Built-in Power Modules (Built-in units) (IP20)

Drill patterns, dimensions and distances of Power Modules PM240-2, IP20



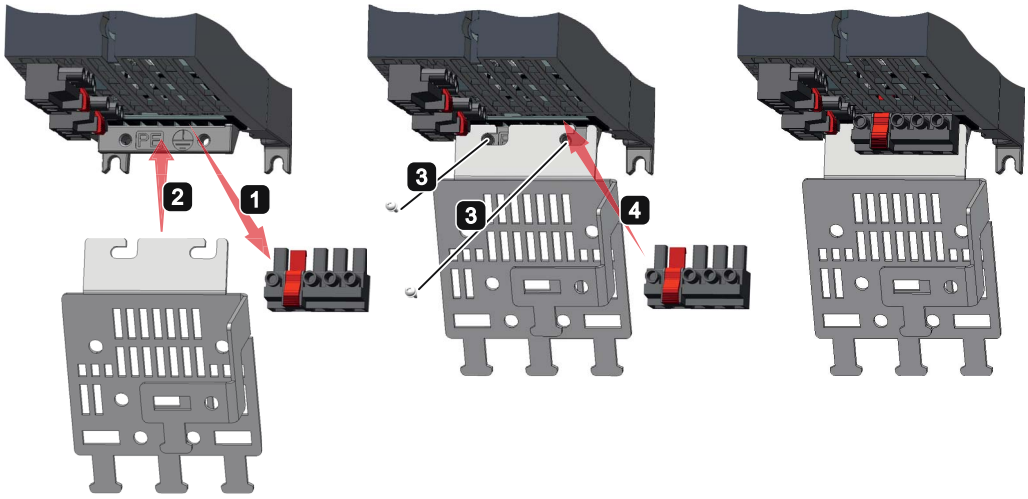
For fixing: Screws M4, 2.5 Nm

CU = 58 mm using a CU230
= 40 mm using a CU240

OP = 10 mm using a BOP-2
= 25 mm using an IOP

The Power Modules can be mounted side-by-side. Due to tolerance reasons, we recommend a lateral distance of about 1 mm.

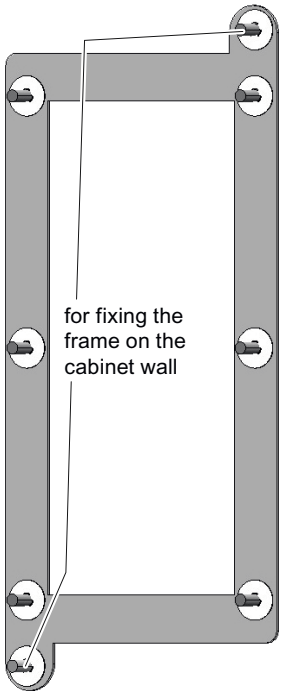
Mounting the shielding plate



3.3.2 Push-through Power Modules (Push-through units) (IP54)

Mounting Frame

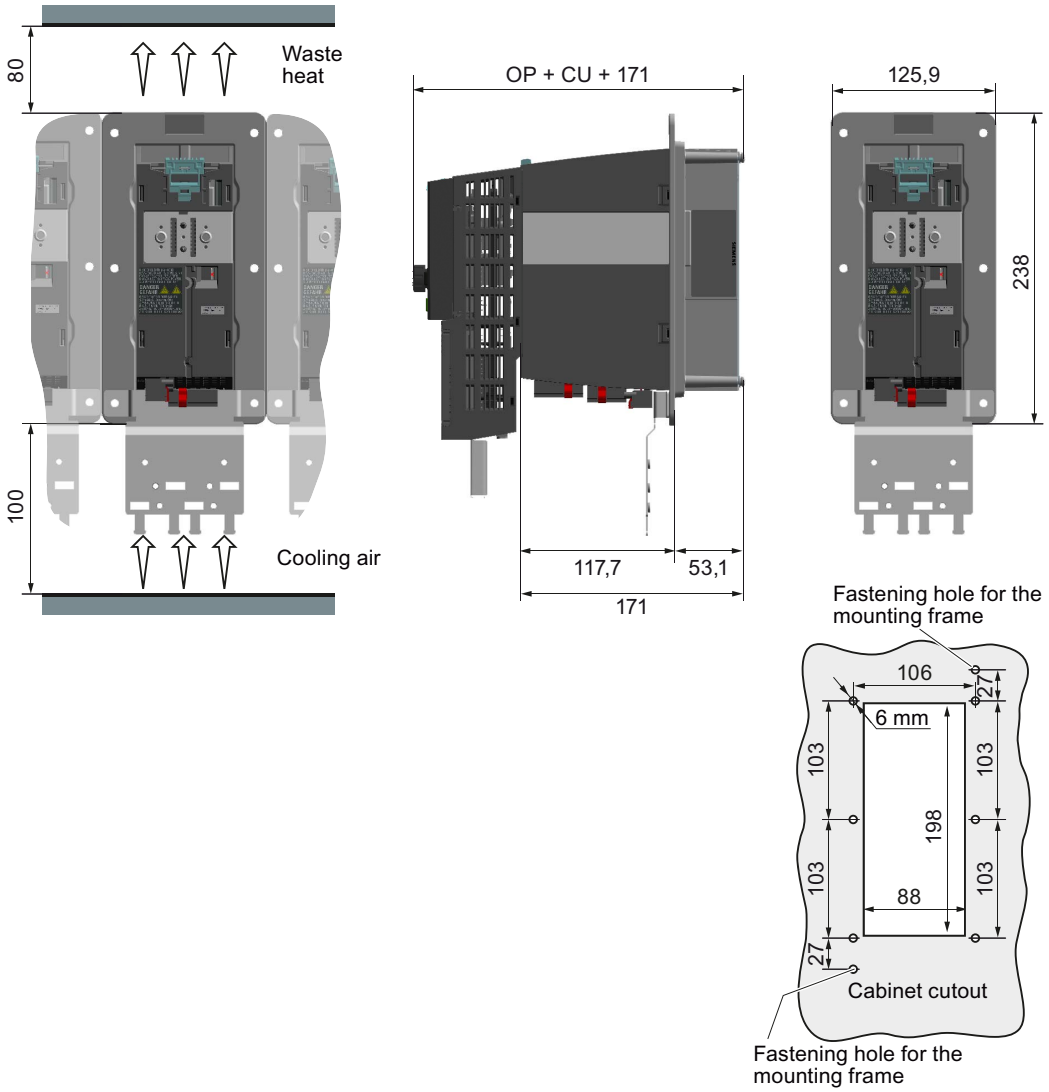
It is recommended that the optional mounting frame is used to install the Push through unit in a cabinet. The mounting frame contains the necessary seals and frame to maintain an IP54 rating. If the Power Module is mounted without using the optional mounting frame, it is the user's responsibility to ensure the correct IP protection rating is reached.



Mounting the Inverter with Mounting Frame

1. Prepare the cut-out and the fixing holes for the Power Module and the mounting frame in accordance with the dimensional drawing of the Mounting Frame.
2. Apply the mounting frame to the rear of the cabinet wall and fix it by hand into the cabinet using the appropriate bolts.
3. Attach the gasket on the inside surface of the cabinet.
4. Attach the inverter and fix it first by hand with all fixing screws.
5. Tighten the screws with a torque of 3 Nm.
6. To fulfill the EMC requirements it is essential that the inside cabinet wall is bare metal

Drill patterns, dimensions and distances of Power Modules PM240-2, PT



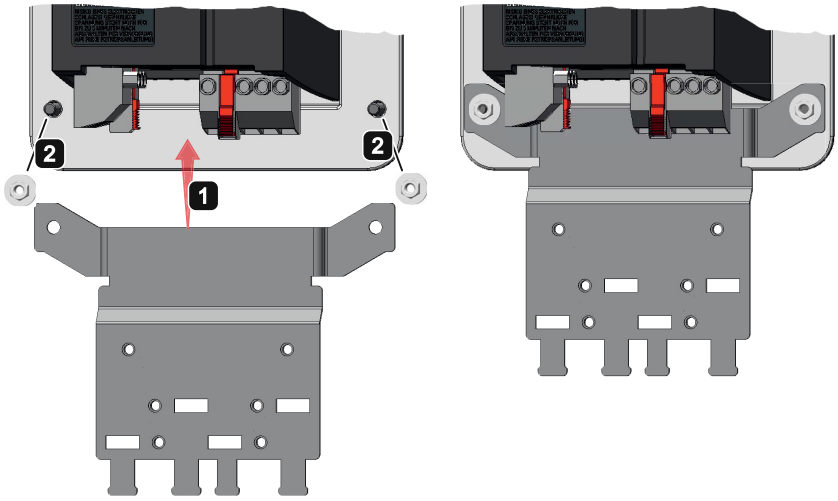
For fixing: Screws M4, 2.5 Nm

CU = 58 mm using a CU230
= 40 mm using a CU240

OP = 10 mm using a BOP-2
= 25 mm using an IOP

The Power Modules can be mounted side-by-side. Due to tolerance reasons, we recommend a lateral distance of about 1 mm.

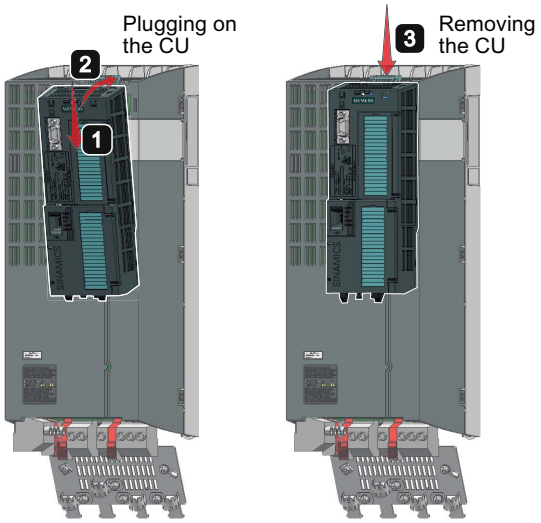
Mounting the shielding plate



3.4 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 to the Power Module is the same technique independent from the type of Control Unit or Power Module.



Fitting the Control Unit to the Power Module

Connecting

4

Prerequisites

If the inverter is installed properly, mains and motor connections can be established. It is urgently requiered to comply with the following notes:

⚠ WARNING

Mains and motor connections

A fixed location, non varying connection is necessary because of a leakage current.

Isolate the mains electrical supply before making or changing connections to the unit.

The terminals of the Inverter can carry dangerous voltages even if the inverter is inoperative. Wait at least 5 minutes to allow the unit to discharge after switching off the mains supply before carrying out any installation work.

When connecting the mains supply to the inverter, make sure that the terminal case of the motor is closed.

When changing from the ON to OFF-state of an operation if an LED or other similar display is not lit or active; this does not indicate that the unit is switched-off or powered-down.

Ensure that the line voltage corresponds to the inverter input voltage – the inverter must not be connected to a higher line voltage.

Grounding and Protective earthing conductor current

The inverter must always be grounded. If it is not grounded correctly, extremely dangerous conditions may arise which could prove potentially fatal.

As the earth leakage for the inverter can be greater than AC 3.5 mA, a fixed earth connection is required and the minimum size of the protective earth conductor shall comply with the local safety regulations for high leakage current equipment.

In the case of doubt, use for grounding the same cable cross section as for the power cable, but at least 2.5 mm^2.

⚠ CAUTION

Operation with ungrounded (IT) supplies

Inverters with built-in filters or external filters can only be used in power systems with grounded starpoint and must not be used with IT or TT supplies.

If the inverter, connected to an IT supply, is required to remain operational if an output phase is connected to ground, the output reactor must be fitted to prevent overcurrent tripping or damage to the drive. The probability of overcurrent tripping without output reactor increases with the size of the IT supply.

⚠ CAUTION

Operation with Residual Current Devices (RCD) or Monitoring (RCM) - only for FSA / FSB

The inverter can cause a DC current in the protective earthing conductor.

If an RCD - residual current-operated protective device (also referred to as an ELCB or a RCCB) or an RCM - residual current-operated monitoring device - is fitted for protection in case of direct or indirect contact, the inverter will operate without nuisance tripping provided that:

- An RCD/RCM type B superresistant is used (e.g. a SIQUENCE circuit breaker by Siemens).
- The trip limit of the RCD/RCM is 300 mA
- The neutral of the supply is grounded
- Only one inverter is supplied from each RCD/RCM
- The output cables are less than 50 m screened

If no RCD/RCM is used, the touch protection can be achieved by double insulation or by separating the inverter from the mains system using a transformer.

Note

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

4.1 Mains and Motor Connection

Inverter terminal layout see Mains and Motor Terminals (Page 26).

For all connections carefully observe the regulations for EMC compliant connection (Page 27).

Mains connection

If available, open the terminal covers of the inverter.

Connect the protective conductor of the power supply cable to terminal PE of the inverter.

Connect the power supply cable to terminals U1/L1, V1/L2 and W1/L3.

Note

Unfiltered inverters can be connected to grounded (TN, TT) and non-grounded (IT) power supply systems.

Inverters with a line filter - internal or external - are suitable only for connection to TN power supply systems.

Motor cable length

The inverters will operate at full specification with cable lengths as follows:

Table 4- 1 Permissible cable length, depending on the EMI level

Using	Maximum cable length	EMI Level
Screened cables, filtered units (class A)	50 m	Second Environment, C2
Screened cables, unfiltered units,	50 m	EMI Standard not fullfilled
Unscreened cables, filtered or unfiltered units	100 m	EMI Standard not fullfilled

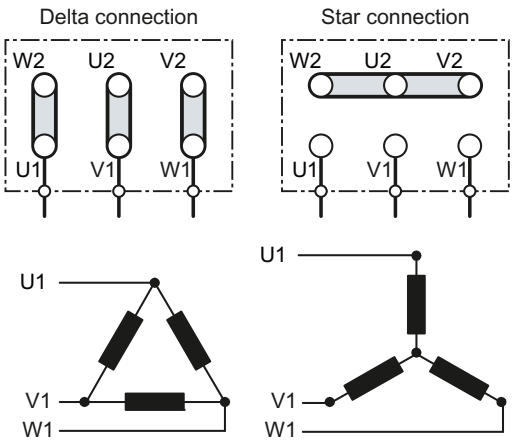
4.1.1 Motor connection

Star and delta connection

Siemens motors show on the inside of the terminal box a diagram of both connection methods:

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

The motor rating plate provides information about the correct connection data.



Connecting the motor

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

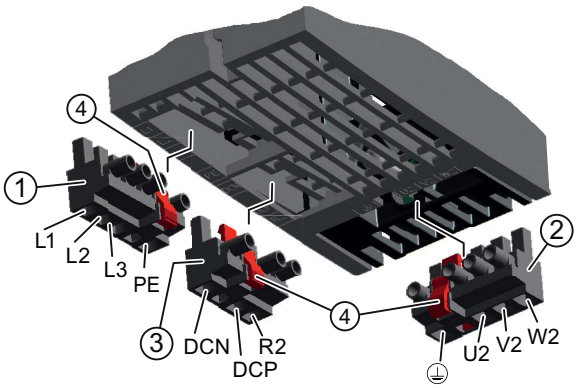
Connect the motor cable to terminals U2, V2 and W2.
If available, close the terminal covers of the inverter.

4.1.2 Mains and Motor Terminals

The figure shows the layout of mains and motor terminals.

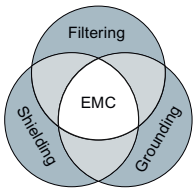
The Power Modules are fitted with two-part-connectors. The removable part of the connector can be unplugged from the power module by pressing the release catch. The connectors cannot be interchanged.

- Tightening torque
  0.4 Nm … 0.5 Nm (4 lbf in)



① Detachable mains connector
② Detachable motor connector
③ Detachable connector for a brake resistor
④ Release catch

4.2 EMC compliant connection



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.

4.2.1 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 potentially susceptible equipment are installed separately from each other. This must be taken into account already during the planning phase.

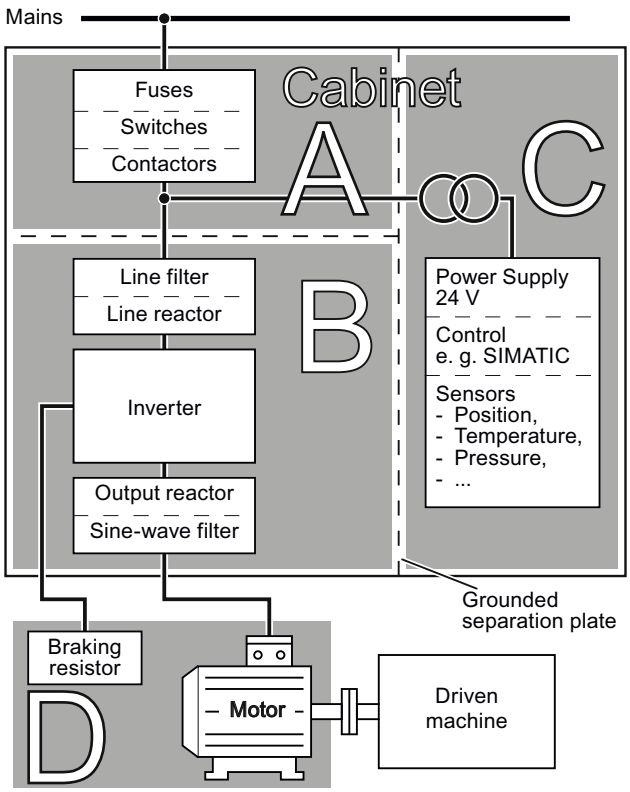
EMC-zone concept within the control cabinet

The control cabinet has to be divided into EMC zones and the devices within the control cabinet have to be assigned to these zones. The example below illustrates this zone concept in greater detail.

The different zones must be electromagnetically decoupled. One method is to ensure that the zones are not positioned directly next to each other (minimum distance app. 25 cm / 9.84 in). A better, more compact method, however, is to use separate metallic housings or separation plates with large surface areas.

Cables within each zone can be unshielded. Cables connecting different zones must be separated and must not be routed within the same cable harness or cable channel. If necessary, filters and/or coupling modules should be used at the interfaces of the zones. Coupling modules with electrical isolation are an effective means of preventing interference from spreading from one zone to another.

All communication and signal cables leaving the cabinet must be shielded. For longer, analog signal cables isolating amplifiers should be used. Sufficient space for bonding the cable shields must be provided, whereby the braided cable shield must be connected to the cabinet ground with excellent electrical conductivity and with a large contact area. Differences in the ground potential between the zones must be avoided to ensure that impermissible, high compensating currents are kept away from the cable shields.



- **Zone A:**
  Supply connection
  Limit values for conducted interference emissions and conducted interference immunity must not be exceeded
- **Zone B:**
  Power electronics
  Sources of interference
- **Zone C:**
  Controller and sensors
  Potentially susceptible equipment

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

Division of the cabinet and installation into different EMC zones

4.2.2 Cabinet design

Control cabinet design

- All metallic components of the cabinet (side panels, back walls, roof plates, and floor plates) must be connected to the cabinet frame with excellent electrical conductivity, ideally with a large contact area or by means of several point-like screwed connections (i.e. to create a Faraday cage).
- The cabinet doors must be connected to the cabinet frame with excellent electrical conductivity by means of short, finely stranded, braided grounding strips, which are ideally placed at the top, in the middle, and at the bottom of the doors.
- The PE busbar and EMC shield busbar must be connected to the cabinet frame with excellent electrical conductivity with a large contact area.
- All metallic housings of devices and additional components integrated in the cabinet (such as converter or line filter) must be connected to the cabinet frame with excellent electrical conductivity and with a large contact area. The best option here is to mount devices and additional components on a bare metal mounting plate (back plane) with excellent electrical conductivity. This mounting plate must be connected to the cabinet frame and, in particular, to the PE and EMC shield busbars with excellent electrical conductivity and a large contact area.

- All connections should be made so that they are permanent. Screwed connections on painted or anodized metal components must be made either by means of special contact washers, which penetrate the isolating surface and establish a metallically conductive contact, or by removing the isolating surface on the contact points.
- Contactor coils, relays, solenoid valves, and motor holding brakes must have interference suppressors to reduce high-frequency radiation when the contacts are opened (RC elements or varistors for AC currentoperated coils, and freewheeling diodes for DC current-operated coils). The interference suppressors must be connected directly on each coil.

4.2.3 Cabling

Cables inside the cabinet

- All power cables of the drive (line supply cables, cables to braking resistors, as well as motor cables) must be routed separately from signal and data cables. The minimum distance should be approximately 25 cm / 9.84 in. Alternatively decoupling in the cabinet can be implemented by means of separation plates connected to the mounting plate (back plane) with excellent electrical conductivity.
- Line supply cables running between the supply system and the line filter must be routed separately from non-filtered power cables (cables to braking resistors as well as motor cables).
- Signal and data cables, as well as filtered line supply cables, may only cross non-filtered power cables at right angles of 90° to minimize coupled-in interference.
- All cable lengths must be minimized (excessive cable lengths must be avoided).
- All cables must be routed as closely as possible to grounded housing components, such as mounting plates or the cabinet frame. This reduces interference radiation as well as coupled-in interference.
- Signal and data cables, as well as their associated equipotential bonding cables, must always be routed in parallel and with as short a distance as possible.
- When unshielded single-wire cables are used within a zone, the feed and return lines must be either routed in parallel with the minimum possible distance between them, or twisted with one another.
- Spare wires for signal and data cables must be grounded at both ends to create an additional shielding effect.
- Signal and data cables should enter the cabinet only at one point (e.g. from below).

Cables outside the cabinet

- All power cables (line supply cables, cables to braking resistors, as well as motor cables) must be routed seperately from signal and data cables. The minimum distance should be approximately 25 cm / 9.84 in.
- The power cable between converter and motor must be shielded. A symmetrical, 3-wire, three-phase cable should be used here. Shielded cables with symmetrical three-phase conductors (L1, L2, and L3) and an integrated, 3-wire, and symmetrically arranged PE conductor are ideal for this purpose.
- The shielded power cable to the motor must be routed separately from the cables to the motor temperature sensors (PTC/KTY) and the cable to the encoder, since the latter two are treated as signal cables.
- Signal and data cables must be shielded to minimize coupled-in interference with respect to capacitive, inductive, and radiative coupling.
- Particularly sensitive signal cables, such as setpoint and actual value cables and, in particular, encoder cables must be routed with optimum shield bonding at both ends and without any interruptions of the shield.

Cable shields

- Shielded cables must have finely stranded braided shields. Foil shields are not suitable since they are much less effective.
- Shields must be connected to the grounded housings at both ends with excellent electrical conductivity and a large contact area. Only when this method is used coupled-in interference with respect to capacitive, inductive, and radiative coupling can be minimized.
- Bonding connections for the cable shields should be established, where ever possible, directly behind the cable entry into the cabinet. For power cables the EMC shield busbars should be used. For signal and data cables the shield bonding options provided in the cabinet units should be used.
- Cable shields should not be interrupted, wherever possible, by intermediate terminals.
- In the case of both, the power cables and the signal and data cables, the cable shields should be connected by means of suitable EMC shield clips. These must connect the shields to either the EMC shield busbar or the shield bonding options for signal cables with excellent electrical conductivity and a large contact area.
- As plug connectors for shielded data cables (e. g. PROFIBUS cables) only metallic or metallized connector housings should be used.

4.2.4 Equipotential bonding

Equipotential bonding

- Equipotential bonding within a cabinet element has to be established by means of a suitable mounting plate (back plane), to which all metallic housings of the devices and additional components integrated in the cabinet element (e. g. converter or line filter) are connected. The mounting plate has to be connected to the cabinet frame and to the PE or EMC busbar of the cabinet element with excellent electrical conductivity and a large contact area.
- Equipotential bonding between several cabinet elements has to be established by means of a PE busbar which runs through all the cabinet elements. In addition, the frames of the individual cabinet elements must be screwed together multiple times with sufficient electrical conductivity by means of special contact washers. If extremely long rows of cabinets are installed in two groups back to back, the two PE busbars of the cabinet groups must be connected to each other wherever possible.
- Equipotential bonding within the drive system has to be established by connecting all electrical and mechanical drive components (transformer, cabinet, motor, gearbox, and driven machine) to the grounding system. These connections are established by means of standard heavy-power PE cables, which do not need to have any special high-frequency properties. In addition to these connections, the converter (as the source of the high-frequency interference) and all other components in each drive system (motor, gearbox, and driven machine) must be interconnected with respect to the high-frequency point of view. For this purpose cables with good high-frequency properties must be used.

Grounding and high-frequency equipotential bonding measures

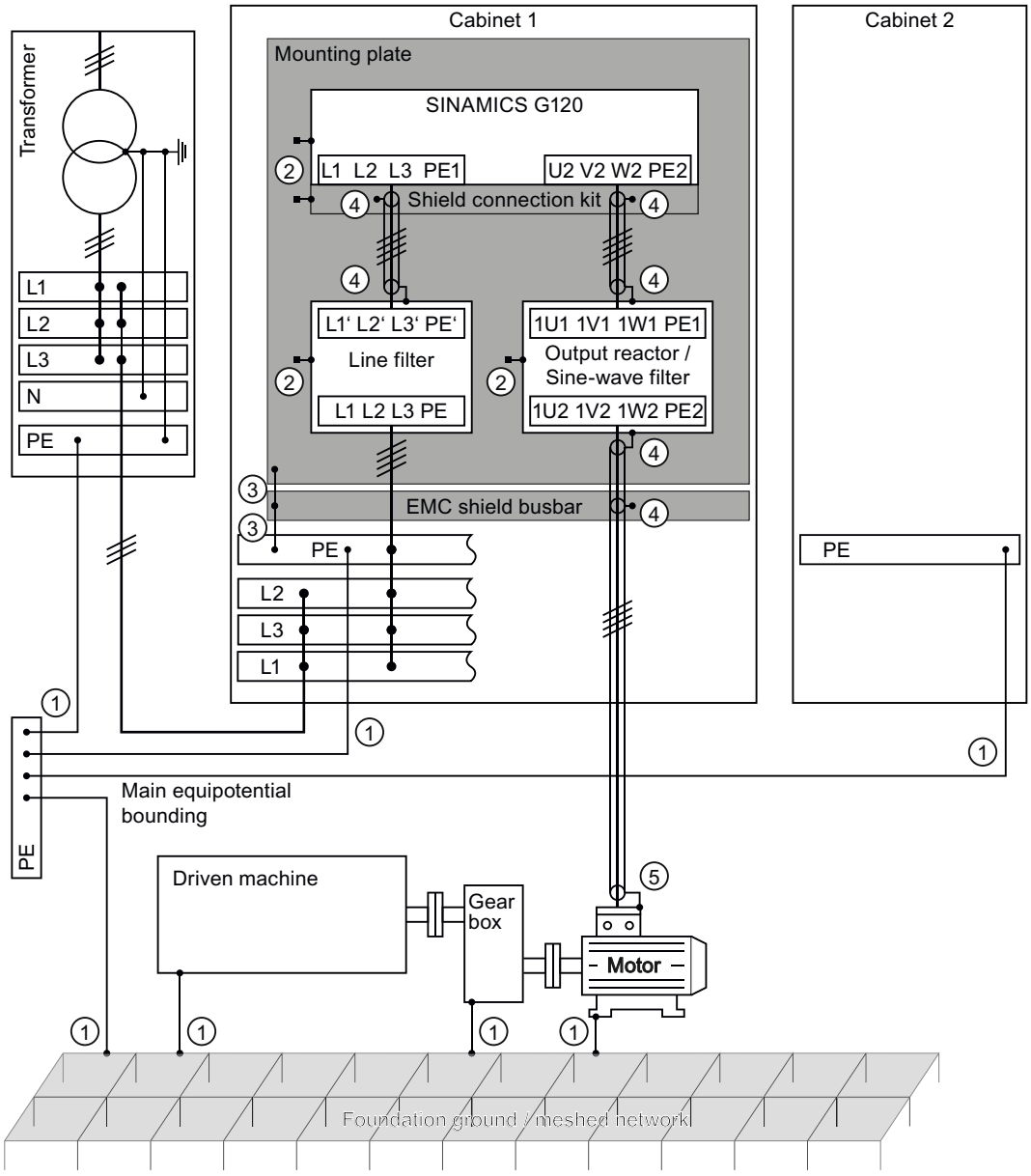
The following figure illustrates all grounding and high-frequency equipotential bonding measures using the example of a cabinet with a SINAMICS G120.

The ground connections ① represent the conventional grounding system for the drive components.

They are made with standard, heavy-power PE conductors without special high-frequency properties and ensure low frequency equipotential bonding as well as protection against injury.

The connections ② inside the cabinet provide solid bonding for high-frequency currents between the metal housings of the integrated components and the EMC shield busbar of the cabinet. These internal connections should be made via a large area using non-isolated metal construction components of the cabinet. In this case, the contact surface must be bare metal and each contact area must have a minimum cross-section of several cm². Alternatively, these connections can be made with short, finely stranded, braided copper wires with a large cross-section (≥ 95 mm² / 000 (3/0) (-2) AWG) between the integrated components and the EMC shield busbar.

The shielded motor cable provides high-frequency equipotential bonding between the converter and the motor terminal box.



① Conventional grounding system without special high-frequency properties
② Electrically conductive connection to the mounting plate through the largest possible surface area
③ High-frequency equipotential bonding
④ Connect shield with a large contact area
⑤ Connect shield via electrically conductive PG gland

Figure 4-1 Grounding and high-frequency equipotential bonding measures in the drive system and in the plant

Additional measures

Finely stranded, braided copper cables have to be routed in parallel with the cable shields in the following cases:

- Old installations with already existing unscreened cables
- Cables with poor high-frequency properties
- Installations with bad grounding systems

The connections in the figure below provide a solid, high-frequency bonding between the motor housing, the motor terminal box, the gearbox, the driven machine and the EMC busbar.

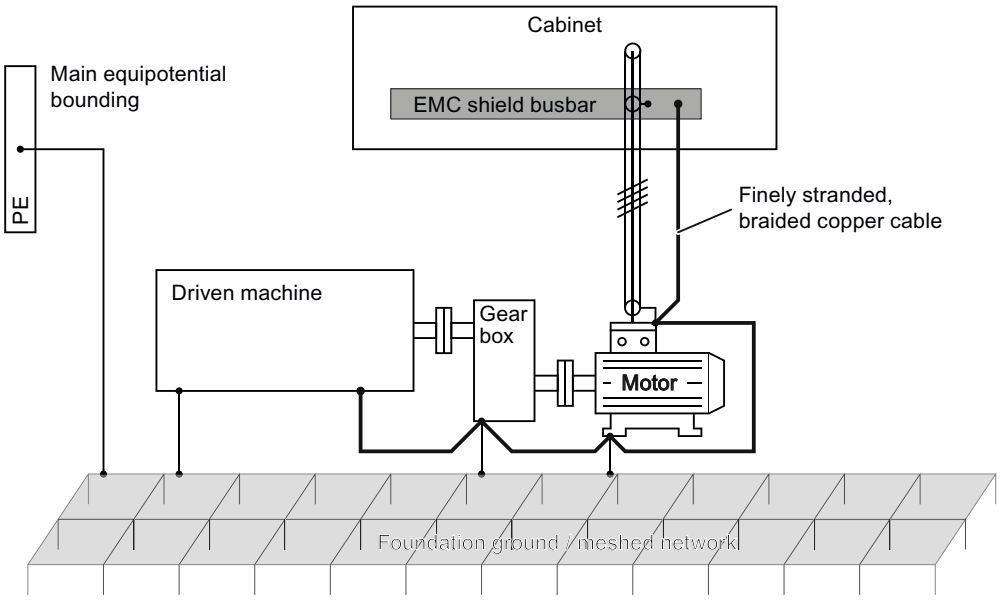


Figure 4-2 Additional high-frequency bonding of the drive system

Screening methods

The following illustration shows an example with and without Shielding Plate.

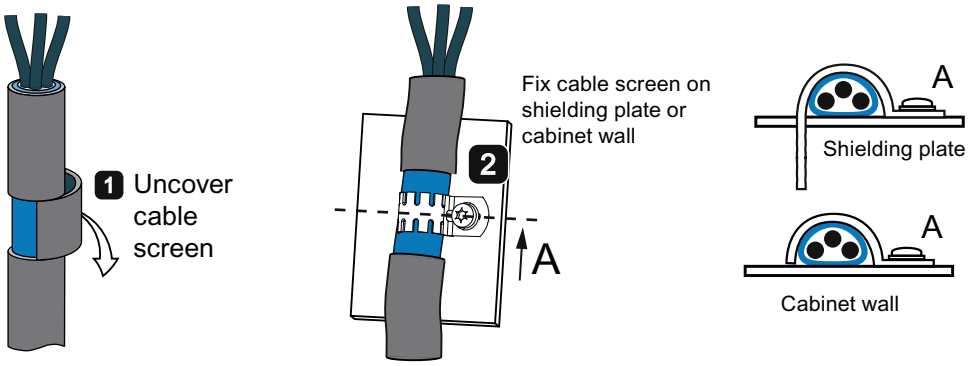


Figure 4-3 Shield

Note

Use an unshielded cable for the mains connection of Power Modules with integrated filter. Power Modules, which are connected to the line supply via an external filter, require a shielded cable between the line filter and Power Module.

Note

Shielding the control cable

The control cable shield must be connected as well with the CU screening plate as with the Power Module screening plate.

Service and maintenance 5

5.1 Maintenance

The purpose of maintenance is to preserve the specified condition of the Power Module. Dirt and contamination must be removed regularly and parts subject to wear replaced. The Power Module comprises mostly electronic components. Apart from the fan(s), the unit, therefore, contains hardly any components that are subject to wear or that require maintenance or servicing.

The following points must generally be observed.

Dust deposits

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

Ventilation

When installing the devices in a cabinet, make sure that the cabinet ventilation slots are not obstructed. The fan must be checked to make sure that it is functioning correctly.

Cable and screw terminals

Cable and screw terminals must be checked regularly to ensure that they are secure in position, and if necessary, retightened. Cabling must be checked for defects. Defective parts must be replaced immediately.

Note

The actual intervals at which maintenance procedures are to be performed depend on the installation conditions and the operating conditions.

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

Technical specifications

6

FSA … FSC inverters for United States / Canadian installations (UL/cUL)

In order that the system is UL/cUL-compliant, use UL/cUL-certified J-type fuses. Use class 1 75° C copper wire only.

Additional requirements for CSA compliance:

Install the inverter with any external recommended suppressor with the following features:

- Surge-protective devices; device shall be a Listed Surge-protective device (Category code VZCA and VZCA7)
- Rated nominal voltage 480/277 V_{AC}, 50/60 Hz, 3-phase
- Clamping voltage V_{PR} = 2000 V, I_N = 3 kA min, MCOV = 550 V_{AC}, SCCR = 65 kA
- Suitable for Type 1 or Type 2 SPD application
- Clamping shall be provided between phases and also between phase and ground

Alternatively a surge protective device, part Nr. 5SD7 424-1 from Siemens AG can be used to fulfill CSA compliance.

Common performance ratings of the Power Module

Feature	Specification
Line voltage	3 AC 380 V … 480 V ± 10%
Output voltage	3 AC 0 V … input voltage * 0.93 (max.)
Input frequency	50 Hz … 60 Hz, ± 3 Hz
Output frequency	0 Hz … 650 Hz, depending on the control mode
Power factor λ	0.7 without line reactor; 0.85 with line reactor
Line impedance	Uk ≥ 1 %, for lower values, a line reactor must be used.
Inrush current	Less than rated input current
Pulse frequency (factory setting)	4 kHz Can be increased in 2 kHz steps up to 16 kHz. Increasing the pulse frequencies leads to an output current reduction.
Electromagnetic compatibility	The devices are suitable for environmental classes category C2 in accordance with IEC61800-3. For details, see the Hardware Installation Manual, Appendix A2.
Braking methods	DC braking, Compound braking, Dynamic braking with integrated chopper
Protection level	Built-in units: IP20 Push-through units IP54
Storage temperature	-40 °C … +70 °C (-40 °F … 158 °F)
Operational temperature	see Derating Data (Page 42)
Operational altitude	see Derating Data (Page 42)
Humidity	< 95% RH - non-condensing
Environmental requirements	Protected according to environmental class 3C2 to EN 60721-3-3 against damaging chemical substances
Pollution	According pollution degree level 2 Do not install the inverter in an environment which contains atmospheric pollutants such as dust and/or corrosive gases.
Shock and vibration	Do not drop the inverter or expose to sudden shock. Do not install the inverter in an area where it is likely to be exposed to constant vibration. See also Permissible shock and vibration values (Page 43).
Electromagnetic radiation	Do not install the inverter near sources of electromagnetic radiation.
Short Circuit Current Rating (SCCR)	65 kA
Over-voltage category	Supply circuits: Over-voltage category III non-supply circuits: Over-voltage category II

Permissible converter overload

The converters have different power ratings "High Overload" and "Low Overload" depending on the expected load.

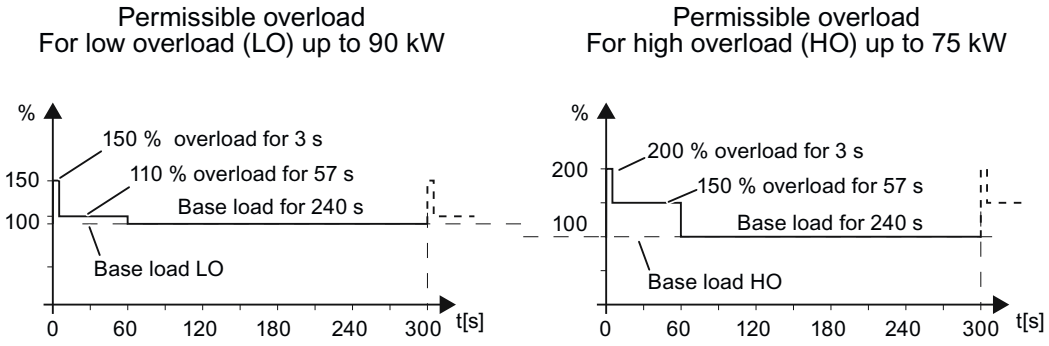


Figure 6-1 Duty cycles, "High Overload" and "Low Overload"

Note

Please note the base load (100 % power or current) for Low Overload is higher than the base load for High Overload.

The load characteristics shown in the diagram are only examples. We recommend the use of the "SIZER" engineering software to select the appropriate Power Modules using duty cycles. See Sizer download (http://support.automation.siemens.com/WW/view/en/10804987/130000).

Definitions

- **LO input current** 100 % of the permissible input current with a load cycle according to Low Overload.
- **LO output current** 100 % of the permissible output current with a load cycle according to Low Overload.
- **LO power** Power of the Unit at LO output current.
- **HO input current** 100 % of the permissible input current with a load cycle according to High Overload.
- **HO output current** 100 % of the permissible output current with a load cycle according to High Overload.
- **HO power** Power of the Unit at HO output current.

6.1 Specifications

Table 6- 1 PM240-2, IP20, Frame Sizes A, 3 AC 380 V … 480 V

Order No. - Unfiltered	**6SL3210…**	**…1PE11-8UL0**	**…1PE12-3UL0**	**…1PE13-2UL0**
Order No. - Filtered	**6SL3210…**	**…1PE11-8AL0**	**…1PE12-3AL0**	**…1PE13-2AL0**
LO power		0.55 kW	0.75 kW	1.1 kW
LO input current		2.3 A	2.9 A	4.1 A
LO output current		1.7 A	2.2 A	3.1 A
HO power		0.37 kW	0.55 kW	0.75 kW
HO input current		2 A	2.6 A	3.3 A
HO output current		1.3 A	1.7 A	2.2 A
Fuse according to IEC		3NA3 801 (6 A)	3NA3 801 (6 A)	3NA3 801 (6 A)
Fuse according to UL		10 A class J	10 A class J	10 A class J
Power losses, unfiltered		0.04 kW	0.04 kW	0.04 kW
Power losses, filtered		0.04 kW	0.04 kW	0.04 kW
Required cooling air flow		5 l/s	5 l/s	5 l/s
Cross section of line and motor cable		1 … 2.5 mm^2 18 … 14 AWG	1 … 2.5 mm^2 18 … 14 AWG	1 … 2.5 mm^2 18 … 14 AWG
Tightening torque for line and motor cable		0.5 Nm / 4 lbf in	0.5 Nm / 4 lbf in	0.5 Nm / 4 lbf in
Weight, unfiltered		1.4 kg	1.4 kg	1.4 kg
Weight, filtered		1.5 kg	1.5 kg	1.5 kg

Table 6- 2 PM240-2, IP20, Frame Sizes A, 3 AC 380 V … 480 V

Order No. - Unfiltered	**6SL3210…**	**…1PE14-3UL0**	**…1PE16-1UL0**	**…1PE18-0UL0**
Order No. - Filtered	**6SL3210…**	**…1PE14-3AL0**	**…1PE16-1AL0**	**---**
LO power		1.5 kW	2.2 kW	3 kW
LO input current		5.5 A	7.7 A	10.1 A
LO output current		4.1 A	5.9 A	7.7 A
HO power		1.1 kW	1.5 kW	2.2 kW
HO input current		4.7 A	6.1 A	8.8 A
HO output current		3.1 A	4.1 A	5.9 A
Fuse according to IEC		3NA3 803 (10 A)	3NA3 803 (10 A)	3NA3 805 (16 A)
Fuse according to UL		10 A class J	10 A class J	15 A class J
Power losses, unfiltered		0.07 kW	0.1 kW	0.12 kW
Power losses, filtered		0.07 kW	0.1 kW	0.12 kW
Required cooling air flow		5 l/s	5 l/s	5 l/s
Cross section of line and motor cable		1 … 2.5 mm^2 18 … 14 AWG	1.5 … 2.5 mm^2 16 … 14 AWG	1.5 … 2.5 mm^2 16 … 14 AWG
Tightening torque for line and motor cable		0.5 Nm / 4 lbf in	0.5 Nm / 4 lbf in	0.5 Nm / 4 lbf in
Weight, unfiltered		1.4 kg	1.4 kg	1.4 kg
Weight, filtered		1.5 kg	1.5 kg	---

Table 6- 3 PM240-2, PT, Frame Sizes A, 3 AC 380 V … 480 V

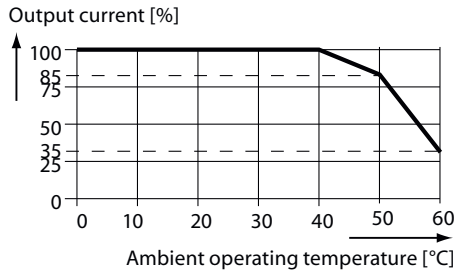
Order No. - Unfiltered	**6SL3211…**	**---**	**…1PE18-0UL0**
Order No. - Filtered	**6SL3211…**	**…1PE16-1AL0**	**__**
LO power		2.2 kW	3 kW
LO input current		7.7 A	10.1 A
LO Output current		5.9 A	7.7 A
HO power		1.5 kW	2.2 kW
HO input current		6.1 A	8.8 A
HO output current		4.1 A	5.9 A
Fuse according to IEC		3NA3 803 (10 A)	3NA3 805 (16 A)
Fuse according to UL		10 A class J	15 A class J
Power losses, unfiltered		0.1 kW 1)	0.12 kW 2)
Power losses, filtered		0.1 kW 1)	0.12 kW 2)
Required cooling air flow		7 l/s	7 l/s
Cross section of line and motor cable		1.5 … 2.5 mm^2 16 … 14 AWG	1.5 … 2.5 mm^2 16 … 14 AWG
Tightening torque for line and motor cable		0.5 Nm / 4 lbf in	0.5 Nm / 4 lbf in
Weight, unfiltered		---	1.7 kg
Weight, filtered		1.8 kg	---

1) 0.08 kW via heat sink;

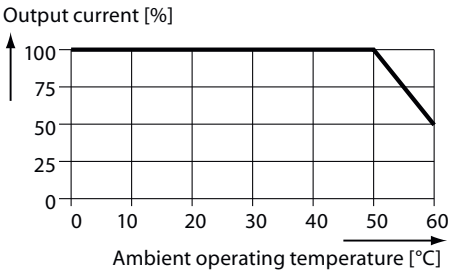
2) 0.1 kW via heat sink

6.2 Derating Data

Low Overload



High Overload



Voltage

The clearance within the converter can isolate surge voltages in accordance with overvoltage category III in compliance with the EN 60664-1 regulation up to 2000m above sea level.

At altitudes above 2000 m and below 4000 m above sea level, at least one of the following conditions must be fulfilled:

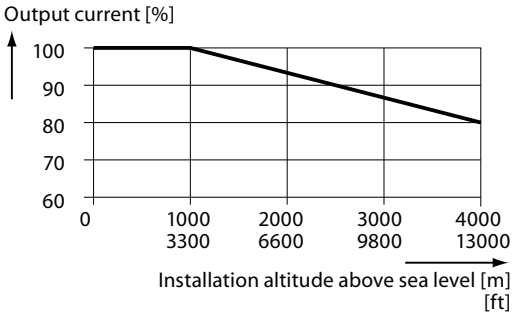
The converter is connected to:

- a TN-network with isolated star-point (not an external grounded connector) or,
- through an isolating transformer that provides a TN-network with grounded a grounded star-point.

A reduction of the line voltage is not necessary.

Note: The connected engines and power components must be considered separately.

Current



Relationship between pulse frequency and output base-load current reduction

Table 6- 4 Current reduction depending on pulse frequency[1]

Rated power	Rated current	Output current at pulse frequency of					
	4 kHz	6 kHz	8 kHz	10 kHz	12 kHz	14 kHz	16 kHz
kW	A	A	A	A	A	A	A
0.55	1,7	1,4	1,2	1,0	0,9	0,8	0,7
0.75	2,2	1,9	1,5	1,3	1,1	1,0	0,9
1.1	3,1	2,6	2,2	1,9	1,6	1,4	1,2
1.5	4,1	3,5	2,9	2,5	2,1	1,8	1,6
2.2	5,9	5,0	4,1	3,5	3,0	2,7	2,4
3.0	7,7	6,5	5,4	4,6	3,9	3,5	3,1

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

6.3 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
- Operation test according to EN 61800-5-1
  - Frequency range 10 Hz to 58 Hz with constant deflection of 0.075 mm
  - Frequency range 58 Hz to 200 Hz with constant acceleration of 1 g
  - 10 sweep cycles in each axis, sweep rate 1 octave / min

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
- Operation test according to EN60068-2-27
  - peak amplitude 15g, duration 11ms
  - 3 half-sine shocks in each direction

Accessories

7

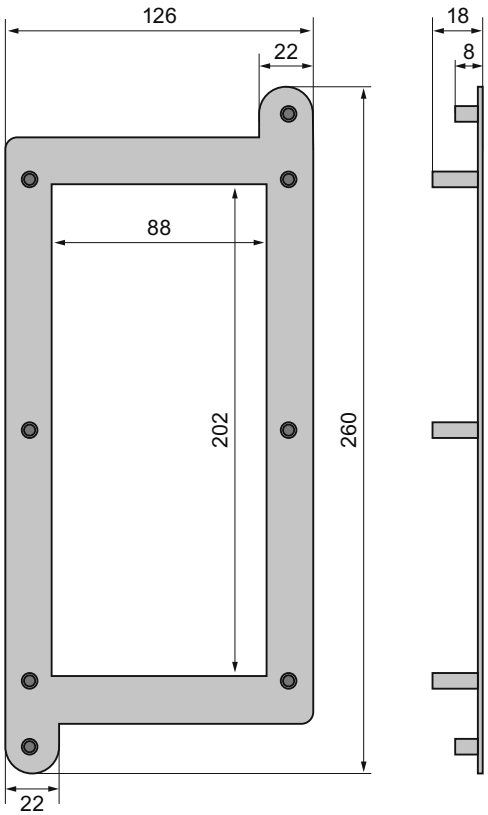
Which components are available?

- Mounting frame
- Line reactor
- Braking resistor
- Brake Relay and Safe Brake Relay

Connecting components

The order how to connect components is shown in section Introduction (Page 7).

7.1 Mounting Frame



Order no: 6SL3260-6AA00-0DA0

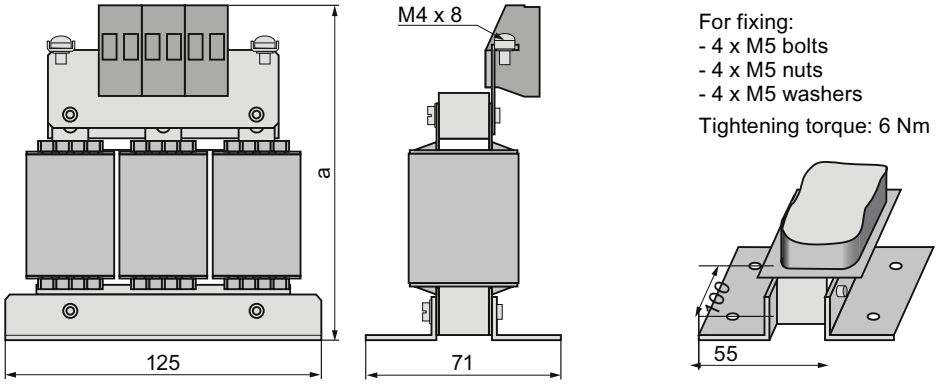
Tightening torque 3 Nm.

7.2 Line reactor

A line reactor protects the converter from the characteristics of rough industrial line systems. A line reactor supports the overvoltage protection, smoothes harmonics and bridges commutation notches.

If the line impedance is smaller than 1 %, you have to install a line reactor in order to ensure the optimal lifetime of your converter.

Dimensions and drill patterns



a = 120 mm for Low output Power 0.55 kW ... 1.5 kW
a = 140 mm for Low output Power 2.2 kW ... 3.0 kW

Figure 7-1 Dimensiones and drill patterns [mm]

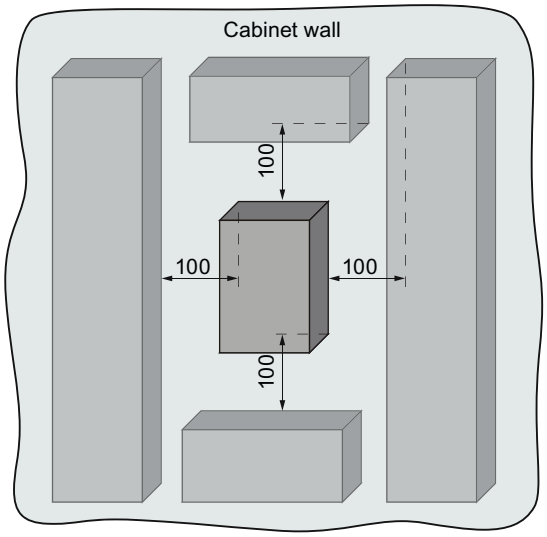


Figure 7-2 Distances to other equipment [mm]

7.2.1 Technical specifications of the line reactor

The major electrical specifications and the admissible ambient conditions of the line reactors are the same as for the suitable converter.

Table 7- 1 Technical specifications of the line reactors

Feature	Suitable for converters FSA with rated power of	
	0.55 kW ... 1.5 kW	2.2 kW ... 3.0 kW
Order number	6SL3203-0CE13-2AA0	6SL3203-0CE21-0AA0
Order number of the suitable converter	6SL321□-1PE11-8 □ L0 6SL321□-1PE12-3 □ L0 6SL321□-1PE13-2 □ L0 6SL321□-1PE14-3 □ L0	6SL321□-1PE16-1 □ L0 6SL321□-1PE18-0 □ L0
Inductance	2.5 mH	1 mH
Power loss at 50/60 Hz	25 W	40 W
Cable cross section Tightening torque	2.5 mm^2 / 14 AWG 0.6 … 0.8 Nm / 5 … 7 lbf in	2.5 mm^2 / 14 AWG 0.6 … 0.8 Nm / 5 … 7 lbf in
PE connection	M4 (3 Nm / 26.5 lbf in)	M4 (3 Nm / 26.5 lbf in)
Degree of protection	IP20	IP20
Weight	1.1 kg	2.1 kg

7.3 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 orientation

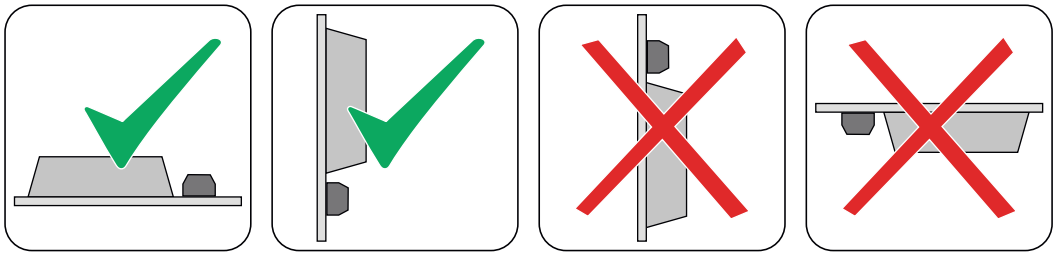
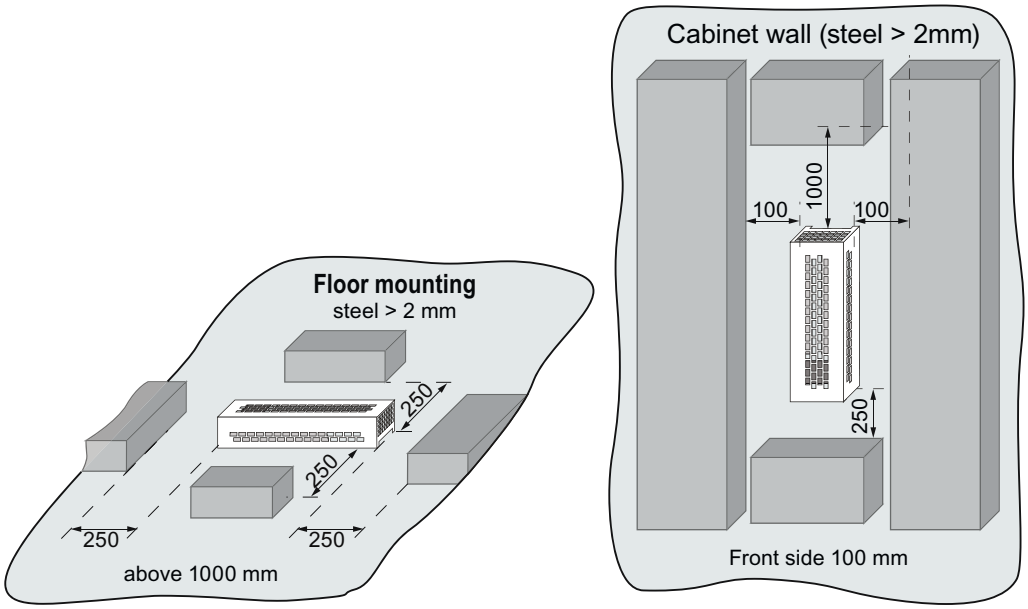


Figure 7-3 Permissible mounting orientation of the braking resistor

⚠ CAUTION

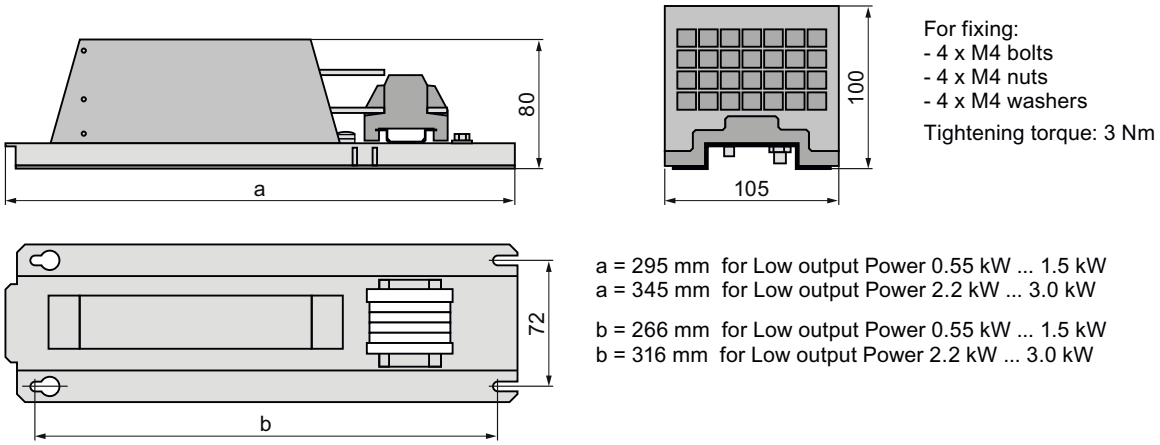
The operation of the braking resistor without housing is not permitted.

Distances to other equipment



Mount the resistor on a heat resistant surface with a high thermal conductivity. Do not install devices that could impede the flow of cooling air in this area. Do not cover the ventilation openings of the braking resistor.

Dimensions and drill patterns



For fixing:
- 4 x M4 bolts
- 4 x M4 nuts
- 4 x M4 washers

Tightening torque: 3 Nm

a = 295 mm for Low output Power 0.55 kW ... 1.5 kW
a = 345 mm for Low output Power 2.2 kW ... 3.0 kW

b = 266 mm for Low output Power 0.55 kW ... 1.5 kW
b = 316 mm for Low output Power 2.2 kW ... 3.0 kW

Figure 7-4 Dimensiones and drill patterns [mm]

Connecting the braking resistor

1. Connect the braking resistor to terminals R1 and R2 on the converter.
2. Ground the braking resistor directly to the control cabinet's grounding bar. The braking resistor must not be grounded using the PE terminals on the converter.
3. If you have to comply with EMC requirements, observe the rules for shielding.
4. Connect the braking resistor's temperature monitoring (terminals T1 and T2 on the braking resistor) with a free digital input of your choice on the converter. Set the function of this digital input to the OFF2 command.

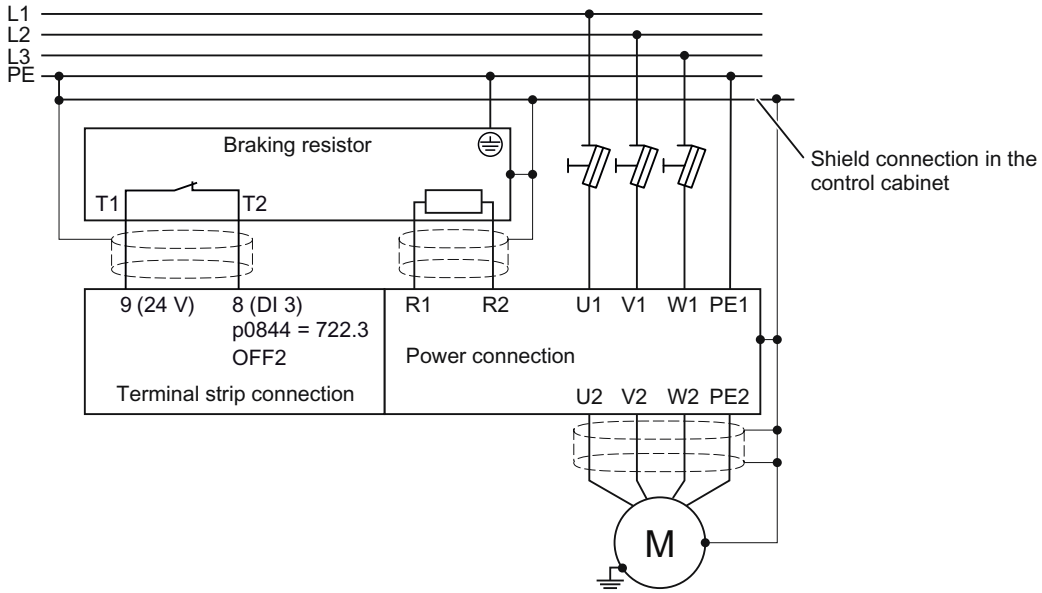


Figure 7-5 Braking resistor connections (Example: temperature monitoring via DI 3)

CAUTION
Without temperature monitoring the resistor might get damaged.

⚠ WARNING
Risk of fire, severe personal and property damage If an unsuitable braking resistor is used, this could result in a fire and severely damage, people, property and equipment. It is essential that not only the correct braking resistor is used, but it is installed correctly according to the instructions delivered with the braking resistor. The temperature of braking resistors increases significantly during operation. For this reason, avoid coming into direct contact with braking resistors. Maintain sufficient clearances around the braking resistor and ensure that there is adequate ventilation.

7.3.1 Technical specifications of the Braking resistor

The major electrical specifications and the admissible ambient conditions of the breaking resistors are the same as for the suitable converter.

Table 7- 2 Technical specifications of the breaking resistors

Feature	Suitable for inverter with rated power of	
	0.55 kW ... 1.5 kW	2.2 kW ... 3.0 kW
Order number	6SL3201-0BE14-3AA0	6SL3201-0BE21-0AA0
Order number of the suitable converter	6SL321□-1PE11-8 □ L0 6SL321□-1PE12-3 □ L0 6SL321□-1PE13-2 □ L0 6SL321□-1PE14-3 □ L0	6SL321□-1 PE16-1 □ L0 6SL321□-1PE18-0 □ L0
Pulse power 5 % (cycle time 240 s)	1.5 kW	4 kW
Permanent power	75 W	200 W
Resistance	370 Ω	140 Ω
Cable cross section resistor Tightening torque	2.5 mm² / 14 AWG 0.5 Nm / 4.5 lbf in	2.5 mm² / 14 AWG 0.5 Nm / 4.5 lbf in
Cable cross section temperature contact Tightening torque	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
Weight	1.5 kg	1.8 kg

7.4 Brake Relay

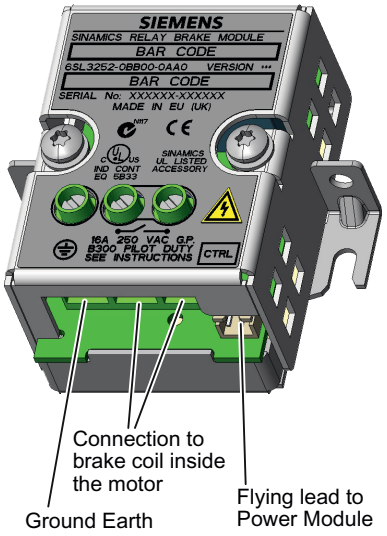
The Brake Relay is designed to provide the interface between the Power Module and the brake solenoid of a motor. There are two types of Brake Relays:

- 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.

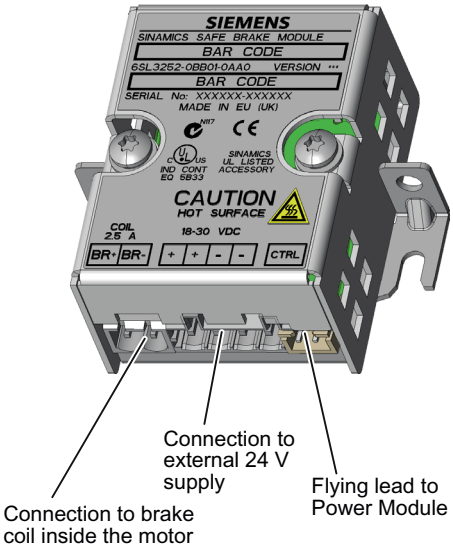
Mounting the Brake Relay

Connect one end of the cable form to the Brake Relay.
Two cable form with different lengths are provided with the Brake Relay. Choice the adequate length of the cable depending on the mounting location of the Brake Relay.

Brake Relay



Safe Brake Relay

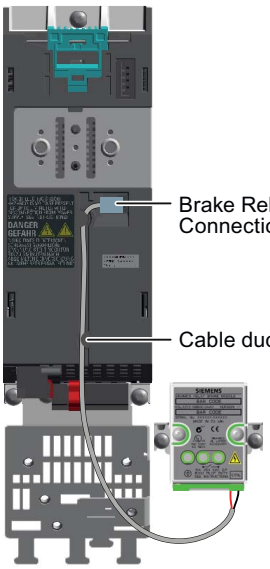


The Brake Relay control connector is marked as "CTRL"

Connect the other end of the cable form to the Power Module

The Brake Relay has to be mounted as shown in the figure.

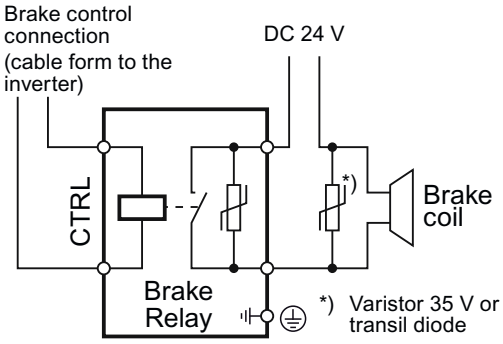
The Brake Relay control connector is located on the front of the Power Module. The Power Module provides a cable duct for the control cable.



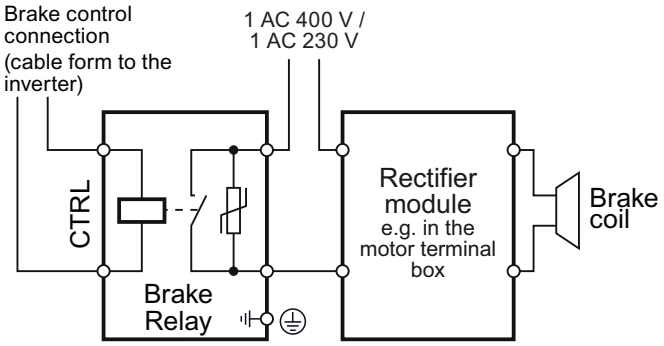
Brake Relay connector at the Power Module

Connecting the Brake Relay to the motor brake

The Brake Relay has to be connected to protective earth, if the motor brake is supplied by a PELV circuit.



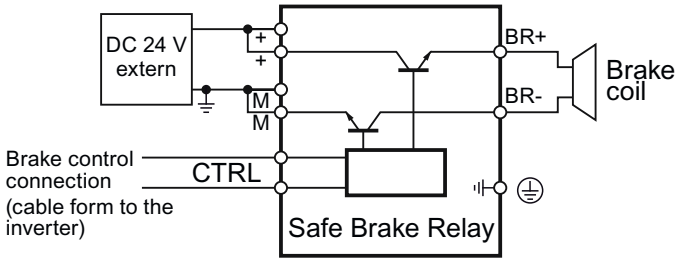
Brake Relay connection 24 V



Brake Relay connection 440 V

Connecting the Safe Brake Relay to the motor brake

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



Safe Brake Relay connection

7.4.1 Technical specifications of the Brake Relay

	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		

Appendix

A

A.1 Further information on your inverter

A.1.1 Manuals for your inverter

Table A- 1 Manuals for your inverter

Depth of the information	Manual	Contents	Available languages	Download or order 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, order number 6SL3097-4CA00-0YG0
+	**Getting Started** SINAMICS G120 Power Module	Installing the Power Module		
++	**Operating instructions**	(this manual)		
+++	**Function Manual for Safety Integrated**	Configuring PROFIsafe. Installing, commissioning and operating fail-safe functions of the inverter.	English, German	
+++	**Parameter Manual** Control Units CU240B-2; CU240E-2	Graphic function block diagrams. Complete list of all parameters, alarms and faults.		
+++	**Hardware Installation Manual** • PM240 Power Module • PM250 Power Module • PM260 Power Module	Installing power modules, reactors and filters. Maintaining power modules.		
+++	**Operation and installation instructions**	For inverter accessories, e.g. operator panel, reactors or filters.		

A.1.2 Configuring support

Table A- 2 Support when configuring and selecting the converter

Manual or tool	Contents	Languages	Download or order number
Catalog D 31	Ordering data and technical information for the standard SINAMICS G converters	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 (Order number: 6SL3070-0AA00-0AG0) and in the Internet: Download SIZER (http://support.automation.siemens.com/WW/view/en/10804987/130000)
Configuration Manual	Selecting geared motors, motors, converters and braking resistor based on calculation examples	English, German	Engineering Manual Standard Drives (http://support.automation.siemens.com/WW/view/en/37728795)

A.1.3 Product Support

If you have further questions

You can find additional information on the product and more in the Internet under: Product support (http://support.automation.siemens.com/WW/view/en/4000024).

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".

A.2 Electromagnetic compatibility

The SINAMICS G120 drives have been tested in accordance with the EMC Product Standard EN 61800-3:2004.

Details see declaration of conformity

A.2.1 Definition of the EMC Environment and Categories

Classification of EMC performance

The EMC environment and categories are defined within the EMC Product Standard EN 61800-3:2004., as follows:

Environments

First Environment

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

- For example: houses, apartments, commercial premises or offices in a residential building.

Second Environment

An environment that includes industrial premises and establishments that are not connected directly to a public low-voltage power supply network.

- For example: industrial and technical areas of buildings fed from a dedicated transformer.

Categories

Category C1

Power Drive System (PDS) of rated voltage less than 1000 V intended for use in the First (Domestic) Environment.

Category C2

Power Drive System (PDS) of rated voltage less than 1000 V, which is neither a plug in device nor a movable device, and when used in the First (Domestic) Environment, is only intended to be installed and commissioned by a professional.

Note

A professional is a person or an organization having necessary skills in installing and/or commissioning a Power Drive System (PDS), including their EMC aspects.

Category C3

Power Drive System (PDS) of rated voltage less than 1000 V intended for use in the Second (Industrial) Environment and not intended for use within the First (Domestic) Environment.

A.2.2 Compliance with EMC Environment and Categories

EMC Emissions

Note

To fulfill the requirements of EN 61800 3:2004 all drives have to be installed in accordance with the manufacturer's guidelines and in accordance with good EMC practices. See also: EMC compliant connection (Page 27)

Table A- 3 Conducted emissions (disturbance voltage) and radiated emissions

Category C1 – Frist Environment • The Power Modules are not intended for use within Category C1 - First Environment. To use the Power Modules within Category C1 - First Environment, additional measures e. g. filters are required.
Category C2 - First Environment, Professional use The Power Modules with integrated class A filters, order number: **6SL3210-1PE1*-*AL0** • fulfil the requirements for conducted emissions (disturbance voltage), – if you use a screened cable, low capacity, – the current does not exceed the LO input current (see Specifications (Page 40)), – the pulse frequency does not exceed 4 kHz and – the cable length is less than 50 m. • may cause radio interference in which case supplementary mitigation measures may be required to fulfill the requirements for Radiated emissions. **Note**: Units installed within Category C2 - First environment - Professional use - require installation by a professional, having necessary skills in installing and/or commissioning power drive systems, including their EMC aspects.
Category C2 - Second Environment The Power Modules with integrated class A filters, order number: **6SL3210-1PE**-*AL0** • fulfil the requirements for conducted emissions (disturbance voltage), – if you use a screened cable, low capacity, – the current does not exceed the LO input current (see Specifications (Page 40)), – the pulse frequency does not exceed 4 kHz and – the cable lenght is less than 50 m. • may cause radio interference in which case supplementary mitigation measures may be required to fulfill the requirements for Radiated emissions.
Category C3 – Second (industrial) Environment • Filtered Power Modules, order number **6SL321*-1PE**-*AL0**, can be installed within category C3 - Second Environment without restrictions and do not require connection approval. • The use of unfiltered Power Modules, order number **6SL321*-1PE**-*UL0,** within an industrial plant is only possible if it forms part of a system which includes additional power-line filtering at the "system level". Alternatively, filtered Power Modules can be used.

EMC Immunity

The Power Modules have been tested in accordance with the immunity requirements of category C3 - Second Environment and fulfill the requirements according 61000-3-12 second edition.

Note

The immunity requirements apply equally to both filtered and unfiltered Power Modules.

Harmonic Currents

Typical Harmonic Current (% of rated input current) at U_K 1 %)							
5th	**7th**	**11th**	**13th**	**17th**	**19th**	**23rd**	**25th**
54	39	11	5.5	5	3	2	2

A.2.3 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 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.

A.3 Standards

European Low Voltage Directive

The SINAMICS G120 product range complies with the requirements of the Low Voltage Directive 2006/95/EC. The units are certified for compliance with the following standards:

- EN 61800-5-1 — Semiconductor inverters – General requirements and line commutated inverters
- EN 60204-1 — Safety of machinery – Electrical equipment of machines

European Machinery Directive

The inverters are suitable for installation in machines. Compliance with the Machinery Directive requires a separate certificate of conformity. This must be provided by the plant construction company or the organization marketing the machine.

European EMC Directive

When installed according to the recommendations described in this manual, the SINAMICS G120 fulfils 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

UL and CUL LISTED POWER CONVERSION EQUIPMENT for use in a pollution degree 2 environment.

SEMI F47

Specification for Semiconductor Process Equipment Voltage Sag Immunity

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

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.4 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
EMI	Electromagnetic interference
FS…	Frame size …
GSG	Getting Started Guide
HO	High Overload
I/O	In-/output
IGBT	Insulated gate bipolar transistor
LED	Light emitting diode
LO	Light Overload
NC	Normally closed
NEMA	National Electrical Manufacturers Association
NO	Normally open
OPI	Operating Instructions
PELV	Protection by extra low voltage
PM	Power Module
PPE	Personal protective equipment
RCCB	Residual current circuit breaker
RCD	Residual current device
RFI	Radio frequency interference
SELV	Safety extra low voltage
VT	Variable torque

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P

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S

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U

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