SIEMENS

SINAMICS

SINAMICS G120P

PM330 Power Modules

Hardware Installation Manual

Edition 11/2013

Answers for industry.

SIEMENS

SINAMICS

SINAMICS G120P Power Module PM330

Hardware Installation Manual

FW4.6

11/2013

A5E32844552B AA

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.

Siemens AG
Industry Sector
Postfach 48 48
90026 NÜRNBERG
GERMANY

A5E32844552B AA
℗ 10/2013 Technical data subject to change

Table of contents

Safety instructions

1

1.1 General safety instructions

⚠DANGER

Danger to life when live parts are touched

Touching live parts can result in death or severe injury.

- Only work on electrical equipment if you are appropriately qualified.
- Always observe the country-specific safety rules for all work.

Generally, six steps apply when establishing safety:

1. Prepare for shutdown and notify team members 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 zero-voltage state, from phase conductor to phase conductor and phase conductor to protective conductor.
   - Check that every auxiliary circuit is 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. Take measures to prevent reconnection of the energy sources.
6. Make sure that the machine is completely locked out ... and that you have the right machine.

After you have completed the work, restore the operational readiness by following the above steps in the reverse order.

⚠WARNING

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

In the event of a fault, touching live parts 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.

Hazardous voltages can be present at the housing or exposed components on damaged devices.

- Ensure compliance with the limit values specified in the technical data during transport, storage and operation.
- Do not use any damaged devices.
- Protect the components against conductive pollution, e.g. by installing them in a cabinet with IP54 degree of protection according to EN 60529. Provided conductive pollution can be prevented at the installation site, the degree of protection for the cabinet can be decreased accordingly.

⚠WARNING

Danger of fire spreading due to inadequate housing

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 inside and outside the device is prevented.

⚠WARNING

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

Using mobile radios 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.

- When close to components, switch off all wireless devices and mobile phones.

⚠WARNING

Fire hazard for the motor due to overload of the insulation

There is a greater load on the motor insulation through a ground fault in an IT system. A possible result is the failure of the insulation with a risk for personnel through smoke development 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

Risk of fire through overheating if there are insufficient ventilation clearances

Inadequate ventilation clearances can cause overheating with a risk for personnel through smoke development and fire. 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. They can be found in the dimension drawings or in the "Product-specific safety instructions" at the start of the respective section.

⚠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 cores of power cables that are not used (e.g. brake cores) at one end at the grounded housing potential.

1.2 Safety instructions for electromagnetic fields (EMF)

⚠WARNING

Danger to life from electromagnetic fields

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

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

- Keep a distance of at least 2 m.

1.3 Handling electrostatic sensitive devices (ESD)

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

NOTICE

Damage caused by electric fields or electrostatic discharge

Electric fields or electrostatic discharge can result in malfunctions as a result of damaged individual parts, 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 if you are first grounded by applying one of the following measures:
  - 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).

1.4 Residual risks of power drive systems

Residual risks of power drive systems

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

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

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

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

1. Unintentional movements of driven machine components during commissioning, operation, maintenance, and repairs caused by, for example:
   - Hardware 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. In the event of a fault, exceptionally high temperatures, including open fire, as well as emissions of light, noise, particles, gases, etc. can occur inside and outside the converter, e.g.:
   - Component malfunctions
   - Software errors
   - Operating and/or ambient conditions not within the scope of the specification
   - External influences/damage

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

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

Note

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

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

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

Introduction

2

Power Module - PM330

The PM330 Power Module is a part of the modular family of SINAMICS G120 inverters.

PM330 Power Modules have been specifically optimized for driving pumps, fans, blowers and compressors with square-law load characteristic for use in HVAC applications. This Power Module is not suitable for operating compressors with a constant torque load characteristic. The Power Module is available with the "internal air cooling" cooling method.

The Power Modules are available for a rated power range of 160 kW … 200 kW and line voltages 3 AC 380 V … 480 V.

The Power Modules can be connected to the following line supply systems:

- TN system
- TT system
- IT system

As standard, a line reactor ($u_k \geq 2$ %) must be provided at the line input (see the following diagram).

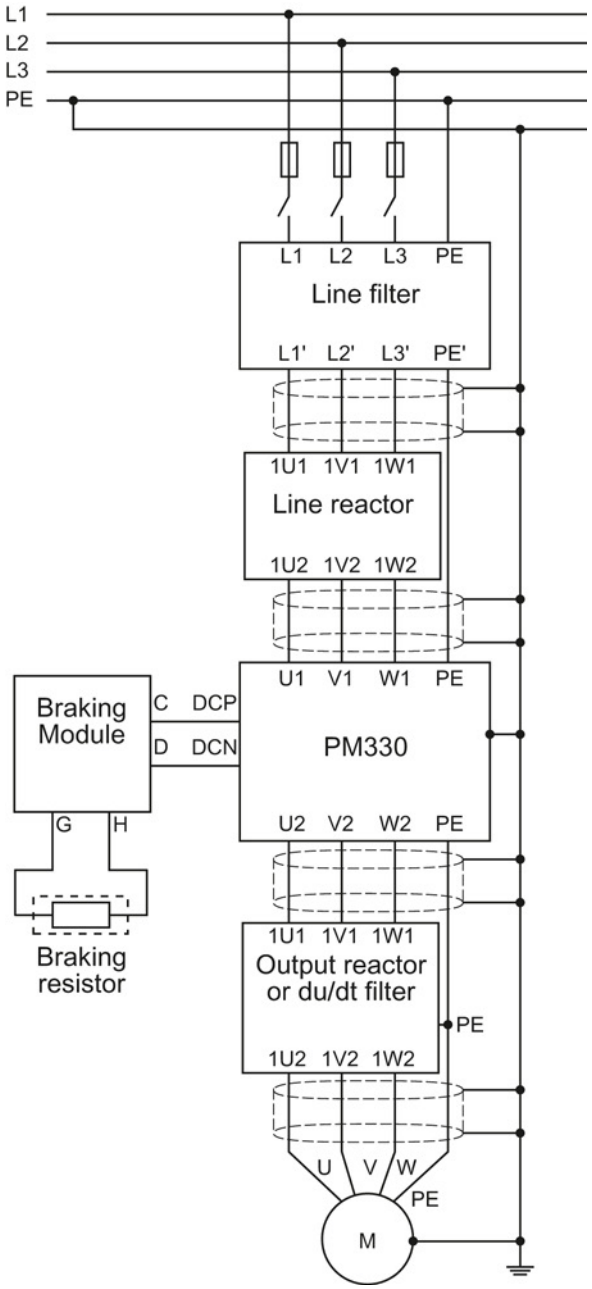


Figure 2-1 PM330 block diagram

The Power Modules can be used with the following Control Units, including all communication versions with firmware version 4.6 HF7 or higher.

- CU230P-2 PN 6SL3243-0BB30-1FAx
- CU230P-2 DP 6SL3243-0BB30-1PAx
- CU230P-2 HVAC 6SL3243-0BB30-1HAx
- CU230P-2 CAN 6SL3243-0BB30-1CAx

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

Installing/Mounting 3

3.1 Installation conditions

Unpacking and disposal

Note

The converter packaging can be reused. Store the packaging carefully for re-use.

The individual components of the packaging can be recycled or disposed of in compliance with local regulations.

General rules for protecting Power Modules against environmental effects

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
- Furthermore, observe the following conditions:
  - Keep it free from dust and dirt.
  - Keep the unit away from water, solvents and chemicals
    Take care to install 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.
  - Fast temperature changes of the air drawn in (e.g. by using cooling units) are not permitted due to the danger of condensation. Condensation is not permissible when switching on.
  - Ensure that all Power Modules and the cabinet are grounded according to the guidelines given in this chapter (see Chapter Connecting (Page 21)).

It is only permissible that the Power Module is installed in a vertical position.

⚠WARNING

Danger to life due to voltage

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 equation shows you how to calculate the required air flow.

1. Add the power losses of the individual components.
2. Calculate the air flow 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 mounted that has a negative influence on the cooling air flow.
4. Ensure that the cooling vents in the Power Module are free of any obstructions to allow the air to flow freely.
5. Avoid short circuits of the cooling air using partitions, if necessary.
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 provided in Chapter Specific technical data (Page 57).

The values are valid for:

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

3.3 Mounting the Power Modules

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

⚠ CAUTION

Pay attention to cooling clearances!

The cooling clearances above, below, next to and in front of the Power Module (dotted lines), which are specified in the dimension drawings, must be observed.

If these clearances are not observed, this can result in a thermal overload of the power module.

Note

EMC

- To comply with EMC specifications, it is recommended to mount the converter on an electrically conductive mounting panel in the cabinet. This mounting panel should be connected to the cabinet PE.

Note

Fixing elements used

The following fixing elements are used:

- M8 screw
- Washer according to DIN EN ISO 7093-1 and locking element

Tightening torque: 13 Nm ±15 %

Lifting Power Modules

The Power Modules can be lifted using the lifting eyebolts provided. A lifting harness with a vertical ropes or chains must, however, be used. The device must not be lifted at an angle because this can damage the housing. Rope spreaders may have to be used.

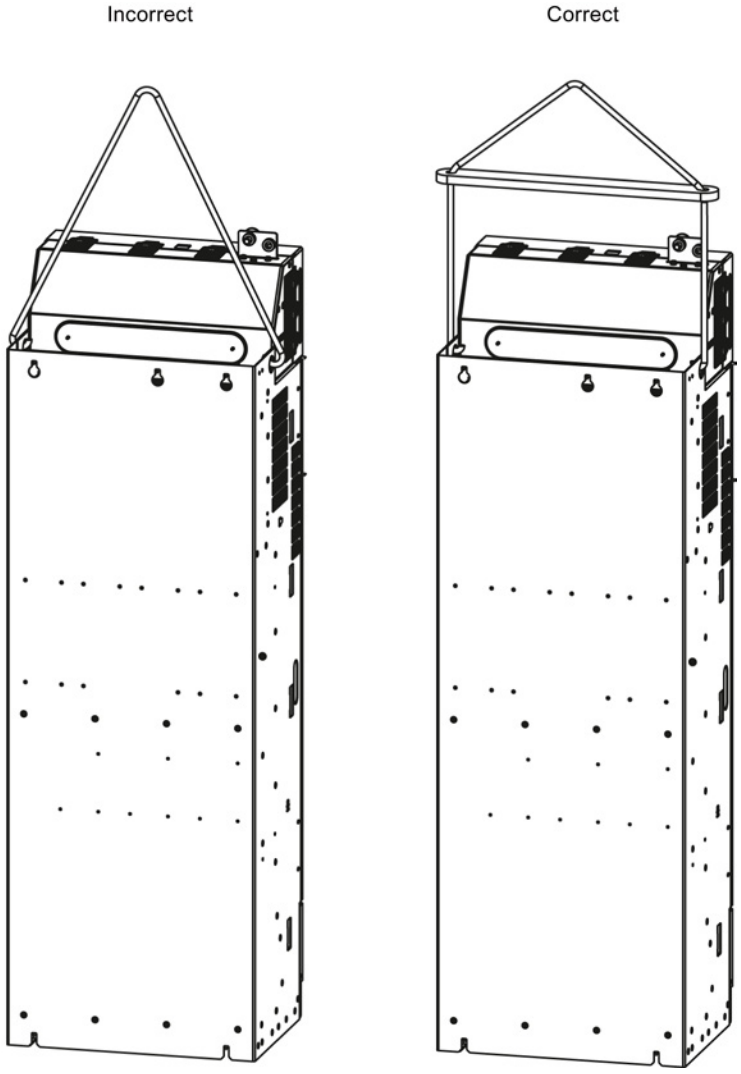


Figure 3-1 Lifting Power Modules

3.3.1 Chassis units

Drilling patterns, dimensions and clearances

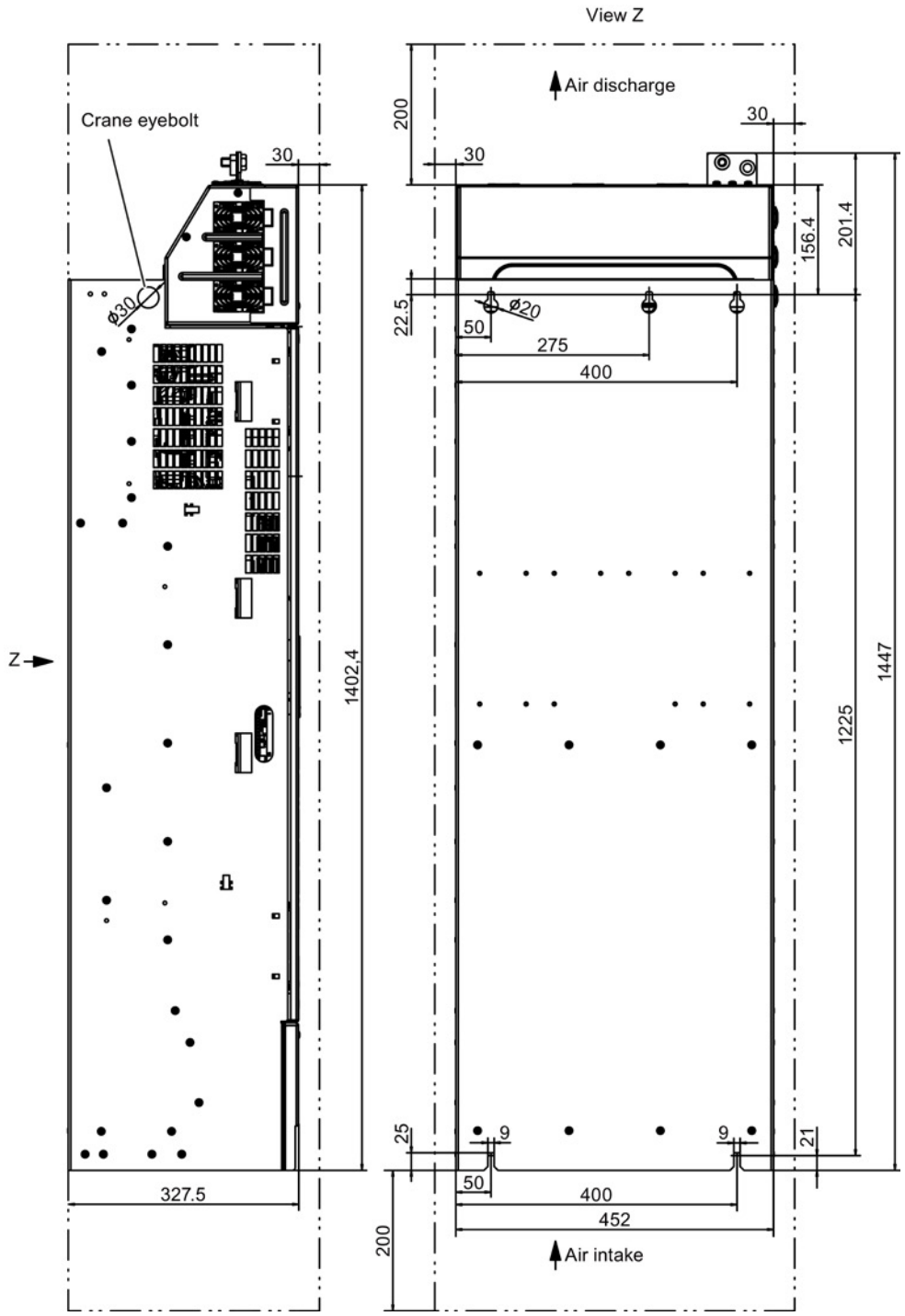


Figure 3-2 Dimension drawing PM330 frame size GX, view from the side, view from the rear

3.4 Control Unit installation

After opening the left-hand housing flap, the Control Unit is plugged onto the Power Module. To remove the Control Unit, press the blue release knob at the top of the Control Unit.

The Control Unit is always attached to the Power Module in the same fashion, irrespective of the type of Control Unit and Power Module.

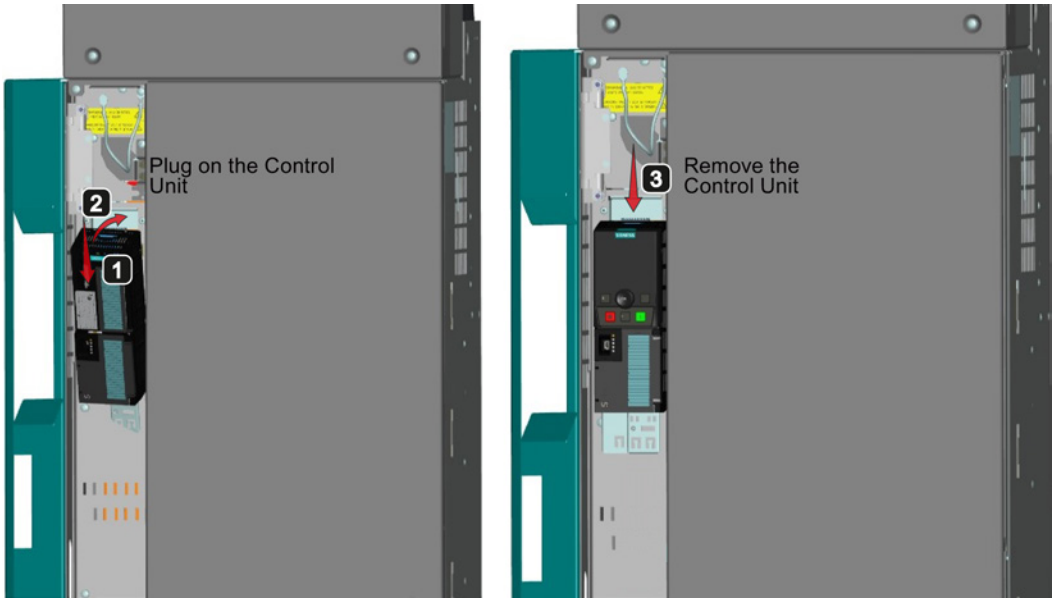


Figure 3-3 Mounting and removing the Control Unit

NOTICE
Close the housing flap when in operation In operation, the left-hand housing flap must be closed, otherwise this could lead to failure through the Control Unit overheating.

Connecting

4

Preconditions

Line and motor connections can be established once the converter has been properly installed. It is crucial that the following notes are observed.

⚠ DANGER

Safety extra-low voltages at connections and terminals

At all DVC A connections and terminals of the electronic modules, only safety extra low voltage (SELV; protection class III) or protective extra-low voltages (PELV) with a maximum of 60 V may be connected.

These voltages must be safely isolated from all hazardous voltages.

⚠ WARNING

Line and motor connections

As a result of the leakage current, a constant connection with a fixed position is required.

Disconnect the line supply from the device before establishing or changing connections to it.

The terminals of the converter can be at hazardous voltage levels even if the converter is not operational. After disconnecting the line supply, wait at least 5 minutes until the device has discharged itself. Only then, carry out any installation and mounting work.

When connecting the line supply to the converter, ensure that the motor terminal box is closed.

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

Ensure that the line voltage is in compliance with the converter supply voltage. It is not permissible that the converter is connected to a higher line voltage.

⚠WARNING

Grounding and current flowing in the protective grounding conductor

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

As the leakage current for this converter is higher than 3.5 mA AC, a fixed ground connection is required; further, the minimum size of the protective ground conductor must comply with the local safety regulations for equipment with high leakage currents.

In the case of doubt, for grounding use the same cable cross section as for the power cable (minimum cross-sections for the protective conductor, according to 60204-1).

⚠WARNING

Residual current devices

Generally, residual current devices (ground-fault circuit interrupters) - to provide protection against indirect contact – cannot be used for the converters.

The converters generate capacitive discharge currents, which can cause the residual current devices to undesirably trip.

Protection against indirect contact must be implemented so that in the case of a ground fault, a sufficiently high field current flows, which causes the protective device to trip (e.g. fuse, tripping the converter with "overcurrent").

The following is recommended: Protective conductor cross-section = phase conductor cross-section.

⚠CAUTION

Operation with ungrounded line supplies (IT systems)

Converters with external filters can only be connected to line supplies with grounded neutral point – and it is not permissible that they are connected to IT or TT supply systems.

Note

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

⚠CAUTION

Overvoltage protection

To protect the units against line-side surge voltages, you are advised to install an overvoltage protection device directly at the infeed point (upstream of the main switch).

4.1 Cable lugs

Cable lugs

The cable connections on the devices are designed for cable lugs according to DIN 46234 or DIN 46235.

For connection of alternative cable lugs, the maximum dimensions are listed in the table below.
These cable lugs are not to exceed these dimensions, as mechanical fastening and adherence to the voltage distances is not guaranteed otherwise.

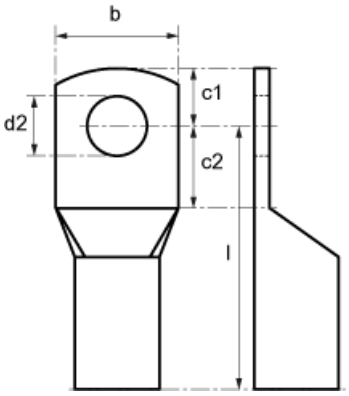


Figure 4-1 Dimensions of the cable lugs

Table 4- 1 Dimensions of the cable lugs

Screw / bolts	Connection cross-section [mm²]	d2 [mm]	b [mm]	l [mm]	c1 [mm]	c2 [mm]
M8	70	8.4	24	55	13	10
M10	185	10.5	37	82	15	12
M10	240	13	42	92	16	13
M12	95	13	28	65	16	13
M12	185	13	37	82	16	13
M12	240	13	42	92	16	13
M16	240	17	42	92	19	16

The cable lugs can be attached as shown in the following diagram if, at one connection per phase, two cable lugs can be connected.

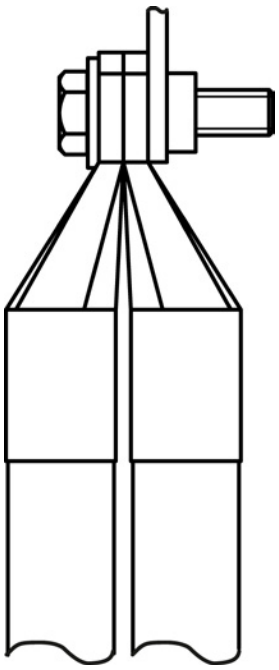


Figure 4-2 2 cable lugs per connection

4.2 Mains and Motor Connection

Arrangement of the converter terminals, see Access to power and motor terminals (Page 27).

For all connections, carefully observe EMC regulations, see EMC compliant connection (Page 38).

4.2.1 Line connection

Open the terminal covers of the converter.

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

Connect the power supply cable to terminals U1, V1 and W1.

When using copper busbars, the same cross-sections should be used as the connecting busbars of the device itself:

- Frame size GX: 52 mm x 4 mm

4.2.2 Length of motor cables

With the following cable lengths, the inverters operate according to the datasheet specifications:

Table 4- 2 Permissible cable length depending on the EMC category

Cable used	Maximum cable lengths	EMC category (according to EN 61800-3)
Shielded cable, devices with external line filter	100 m	C2 *)
Shielded cable, devices without external line filter	100 m	C3 *)

*) EMC-compliant connection required, also see EMC compliant connection (Page 38)

Table 4- 3 Maximum cable lengths

Cable used	Maximum cable lengths	Output filter
Shielded cable, devices without output filter	100 m	--
Unshielded cable, devices without output filter	200 m	--
Shielded cable, devices with output filter	300 m 100 m	Output reactor, du/dt filter du/dt filter compact
Unshielded cable, devices with output filter	450 m 150 m	Output reactor, du/dt filter du/dt filter compact

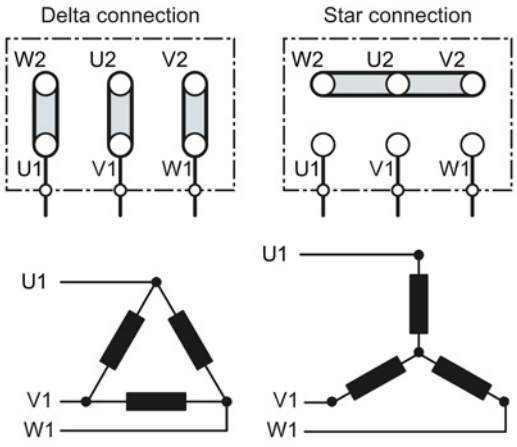
4.2.3 Motor connection

Star and delta connection

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

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

The motor rating plate provides data about the correct connection.



Connecting the motor to the converter

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

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

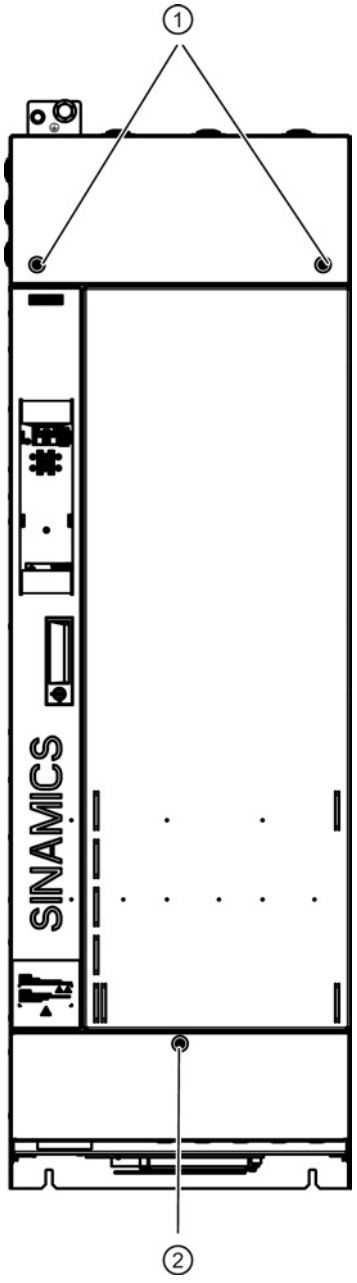
4.2.4 Access to power and motor terminals

Access to line and motor terminals

Observe the following steps when accessing the line and motor terminals:

1. Release the 2 screws from the cover of the line connection terminals and remove the cover towards the front.
2. Release the screw from the cover of the motor connection terminals and remove the cover towards the front.

The tightening torque of the screws for the covers is 6 Nm.



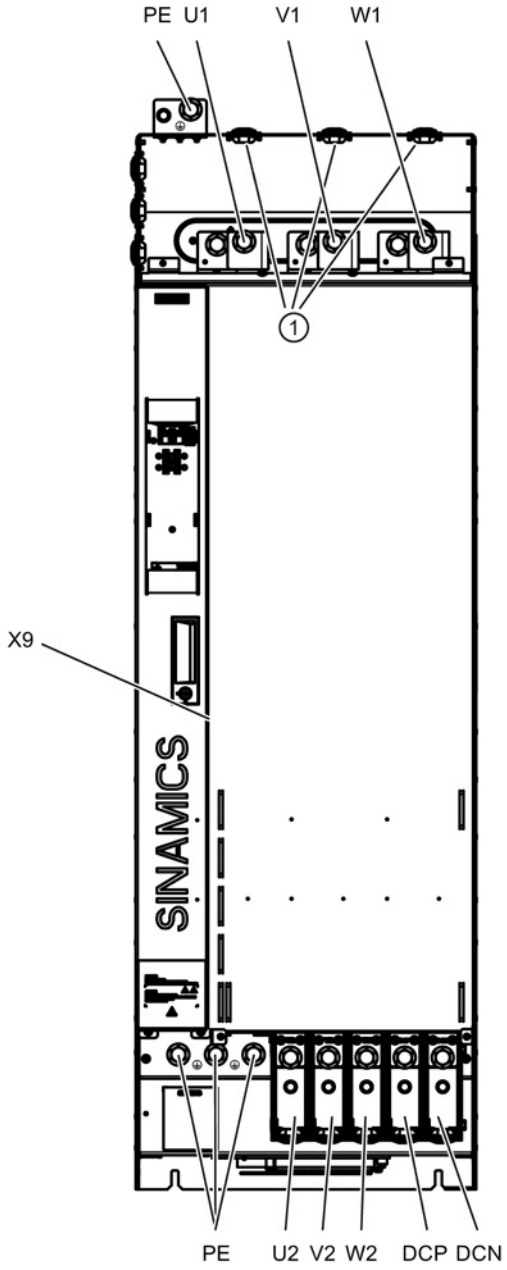
Line and motor terminals

The diagram shows the layout of line and motor terminals and terminal strip X9.

Optionally, the line connection can be established using the "Installation set for line-side cable connection, left", see Installation set for line-side cable connection, left (Page 32)

Tightening torques for the line, motor and PE terminals (M12): 50 Nm

The cable entry protection (①) must be broken out corresponding to the diameter of the cable to be introduced.



⚠CAUTION

IP20 degree of protection when the cable entry protection is correct

Degree of protection IP20 can only be guaranteed when the cable entry protection is correctly broken out.

4.2.5 DC link connection for Braking Modules

The PM330 Power Modules allow an external Braking Module to be connected via the DC link connecting terminals DCP and DCN.

Data of the connecting terminals:

- Supply voltage: up to 780 V DC
- Current carrying capacity:
  - 65 A continuous
  - 260 A for 22 % mark to space ratio (20 s on, 70 s off)

4.3 Open the connection to the basic interference suppression module for operation on an ungrounded line supply (IT system)

If the built-in unit is operated from a non-grounded supply (IT system), the connection to the basic interference suppression module of the Power Module must be opened.

⚠ WARNING
Consequences if the connection is not opened when connecting to an IT supply system
Failure to open the connection to the basic interference suppression module on a non-grounded line supply (IT system) can cause significant damage to the device.

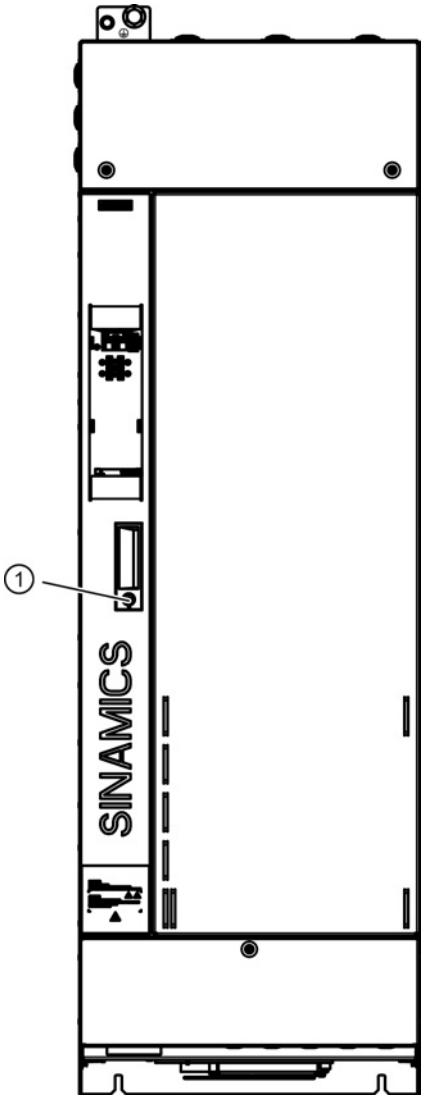


Figure 4-3 Opening the left-hand housing flap

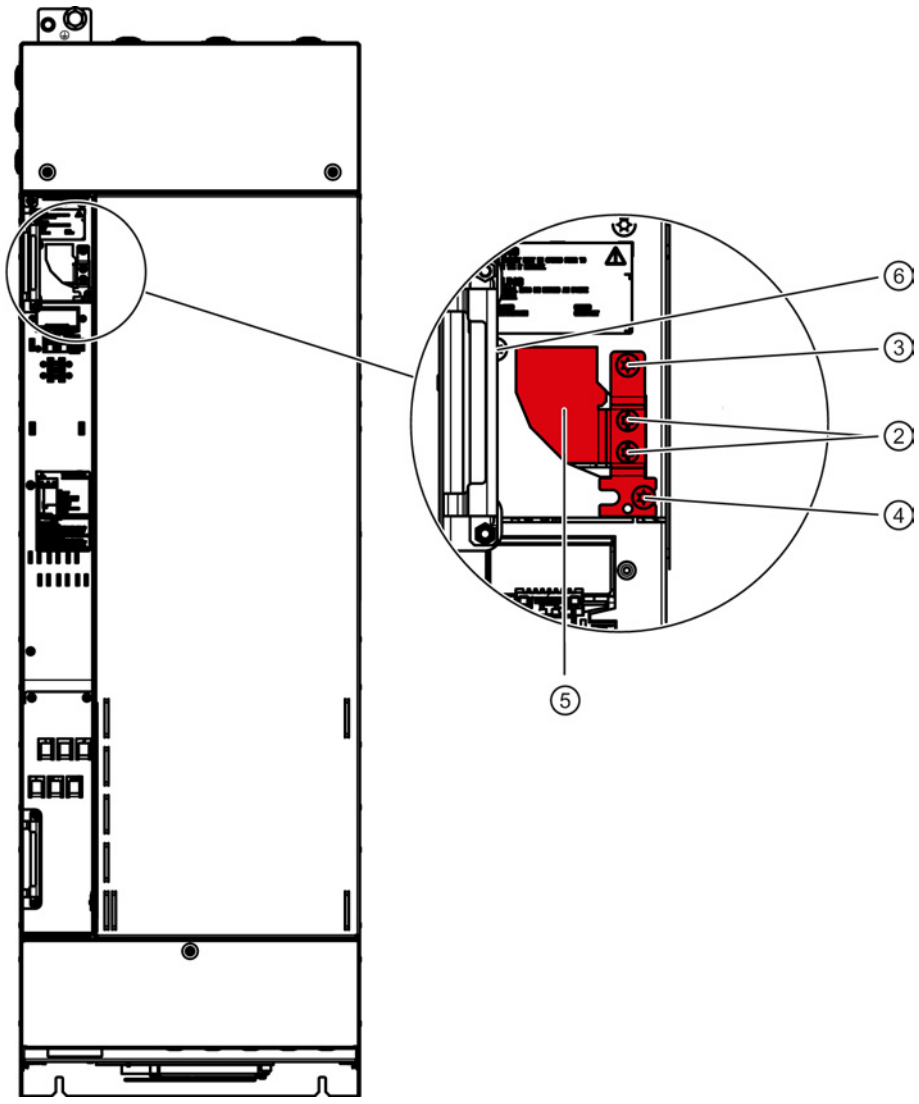


Figure 4-4 Opening the connection to the basic interference suppression module, frame size GX

The connection is opened as follows:

1. Release the left-hand housing flap by rotating latch ① and opening the housing flap.
2. Release the two screws ②; they are captive.
3. Release screws ③ and ④; however, do not remove the screws.
4. Swivel the connection clip ⑤ around the axis of rotation of screw ③ towards the left, until the connection clip can be fastened using screw ⑥.
5. Tighten screws ③ and ⑥ with 6 Nm.

4.4 Installation set for line-side cable connection, left

Description

Alternatively, the line connection can be established using the "Installation set for line-side cable connection, left". As a consequence, it is possible to mount the Power Module in the cabinet without any clearance to the top. This means that it is possible to dissipate the power loss from the Power Module from the cabinet with low design overhead.

Mounting the "Installation set for line-side cable connection left" 6SL3366-1LG00-0PA0

The installation set is mounted in 4 steps:

1. Remove the busbar adapter for the cable outlet towards the top ①.

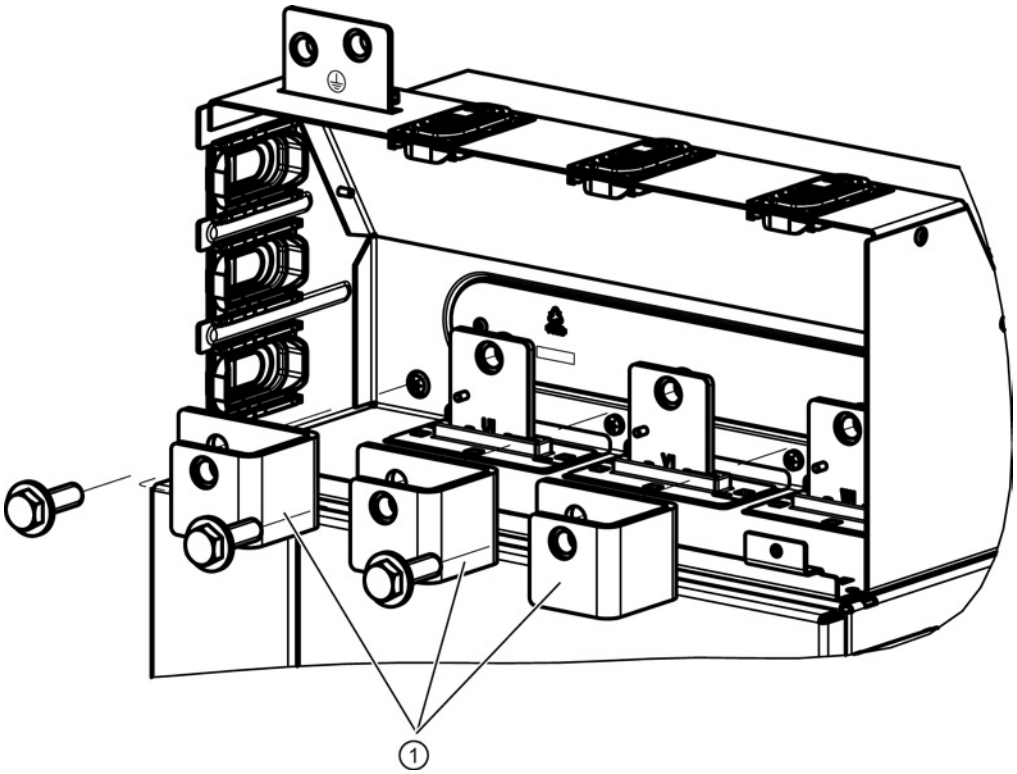


Figure 4-5 Mounting the installation set, step 1

2. Mount the installation set ②, tightening torque: 50 Nm ±15 %.

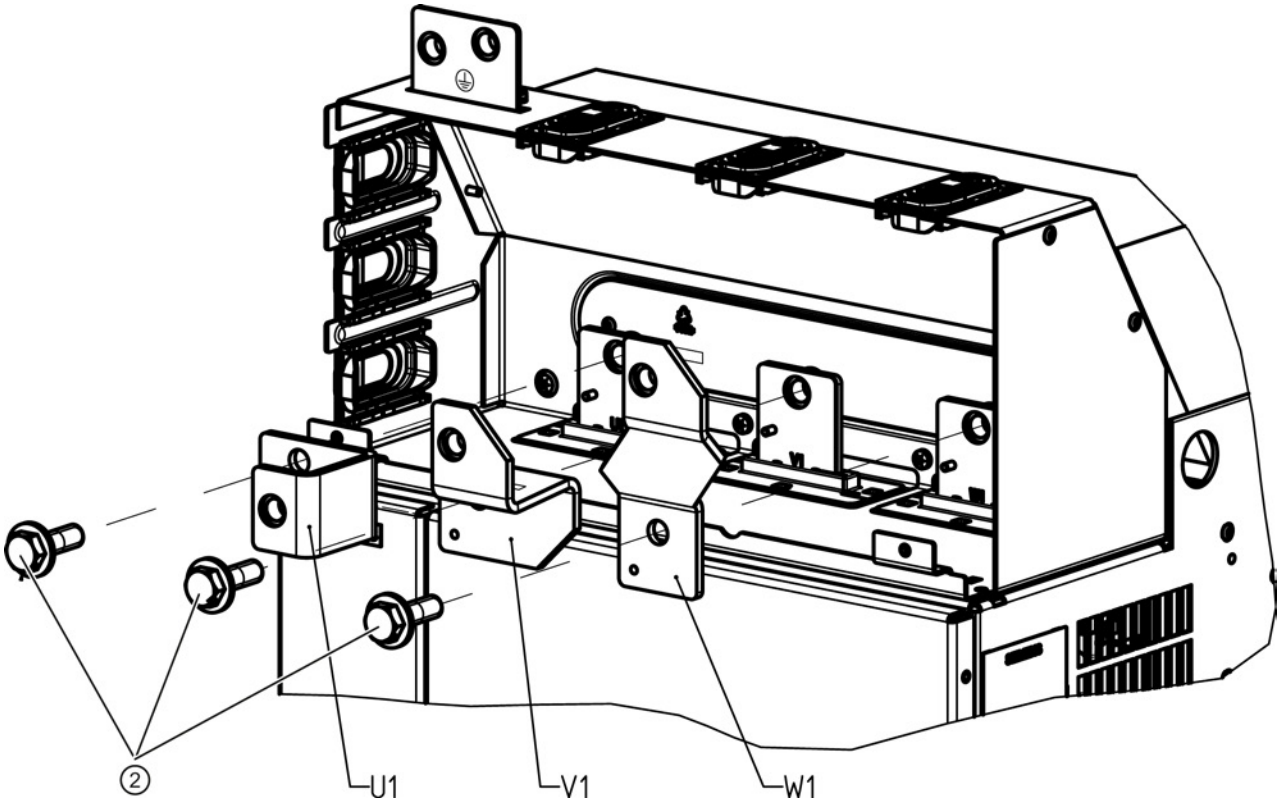


Figure 4-6 Mounting the installation set, step 2

3. Final state with mounted installation set, tightening torque for the fixing screws ③: 50 Nm ±15 %.

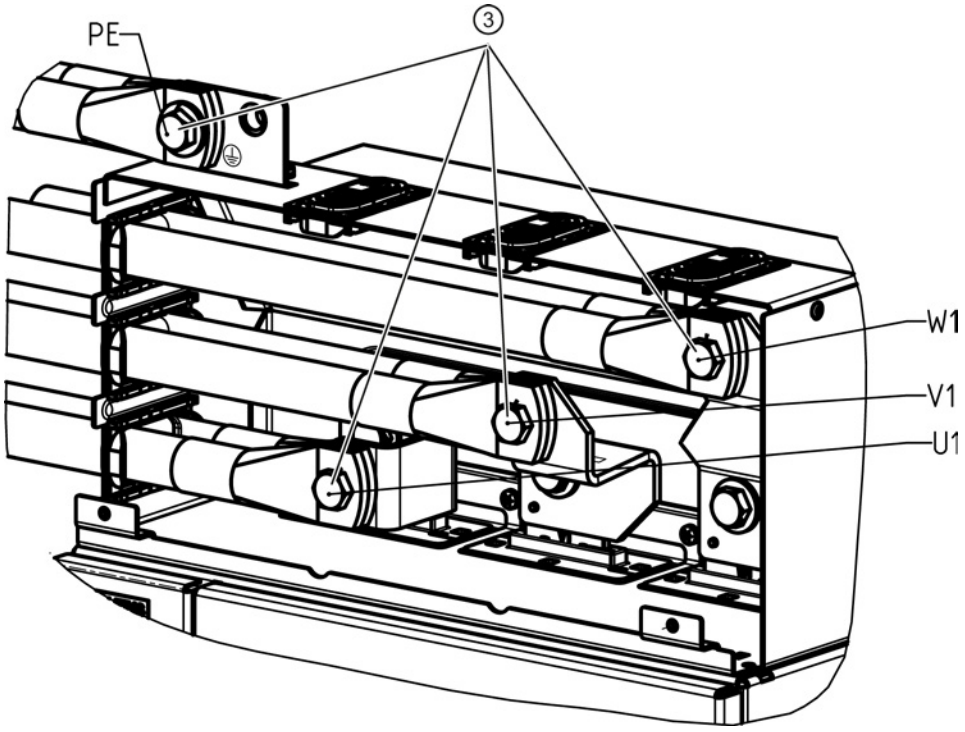


Figure 4-7 Mounting the installation set, step 3

4. The cable entry protection ④ must be broken out corresponding to the diameter of the cable to be introduced.

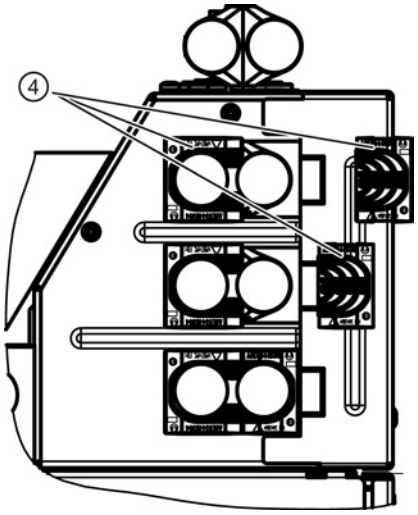


Figure 4-8 Mounting the installation set, step 4

4.5 Terminal X9

Terminal strip X9 is used to connect an external 24 V DC power supply and to connect a main or bypass contactor.

Fault and alarm signals can be connected to the digital inputs. The digital output allows, for example, an external rectifier to be controlled.

The external 24 V DC power supply must be connected if the inverter is connected to the line supply via a main contactor (to start the Control Unit).

The power supply should be located directly next to the inverter (e.g. in the same cabinet) and the cable length to terminal X9 should not exceed 5 m.

Terminal	Name	Meaning	Input/ output	Technical data
1	P24	External power supply	Input	24 V DC (20.1 ... 28.8 V) Current consumption: max. 2 A
2	M	Electronics ground	Reference	
3	External alert	External alarm	Input	Voltage: -3 V ... +30 V Current drain: 6.4 mA at 24 V DC 1.3 mA at <5 V 4 mA at >15 V 8 mA at 30 V Level (including ripple): High level: 15 V ... 30 V Low level: -3 V ... +5 V
4	External fault	External fault	Input	
5	Stop 0	Emergency Stop, Category 0	Input	
6	Stop 1	Emergency Stop category 1	Input	
7	M		Reference	
8	DC link charged	Enable signal "$U_{DC\ link}$ charged"	Output	Voltage: 24 V DC Max. load current: 500 mA Continuously short-circuit proof The output current is taken from the supply at X9, terminal 1.
9	NC	Not connected		
10	NC	Not connected		
11	Activation line contactor	Line contactor control	Output	Contact type: NO contact Maximum load current: 4 A, 230 V AC, cosφ = 0.6
12	Activation line contactor	Line contactor control	Output	Floating A device to protect against overload and short-circuit is required to supply the unprotected output. Surge suppressors must be connected to the excitation coil of the main contactor (e.g. RC element). To control the main contactor, the following contact characteristic values of the relay according to UL apply: • 250 V AC, 10 A (NC and NO), general purpose, 85 °C, • 24 V DC, 10 A (NC and NO), general purpose, 85 °C, • 30 V DC, 8 A (NO), 6 A (NC), general purpose, 85 °C • B300 (NC and NO), pilot duty, 85 °C • R300 (NC and NO), pilot duty, 85 °C • 24 V AC, 2.0 A (NC and NO), pilot duty, 85 °C

Maximum connection cross section: 2.5 mm²

Minimum connection cross section: 0.2 mm²

Maximum tightening torque: 0.5 Nm (4.5 ... 5 lb.in)

Note

Inputs are low active.

All signal inputs are low active (wire-break-proof).

Note

If terminals 3 ... 6 are not used, then you must connect 24 V DC to these.
To do this, use an external power supply or terminal 9 on the Control Unit.

The reference potential is connected to terminal X9:2, 7 and terminal 28 on the Control Unit.

⚠ CAUTION

Protective extra-low voltages according to EN 60204-1

Only protective extra-low voltages (DVC A) that comply with EN 60204-1 may be connected to all connections and terminals between 0 and 48 VDC.

These voltages must be safely isolated from all hazardous voltages.

Note

Line contactor control

When supplying the main contactor via terminals 11 and 12, separation from the line supply using a control transformer is not required. A 250 V/8 A fuse in compliance with UL must be used as protection.

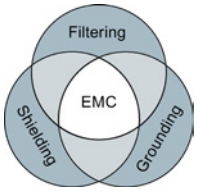
Note

Insulated end sleeves

Insulated end sleeves according to DIN 46228-4 must be used.

4.6 EMC compliant connection

4.6.1 Avoiding electromagnetic interference



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

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

4.6.2 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 separation must be taken into account already during the planning phase.

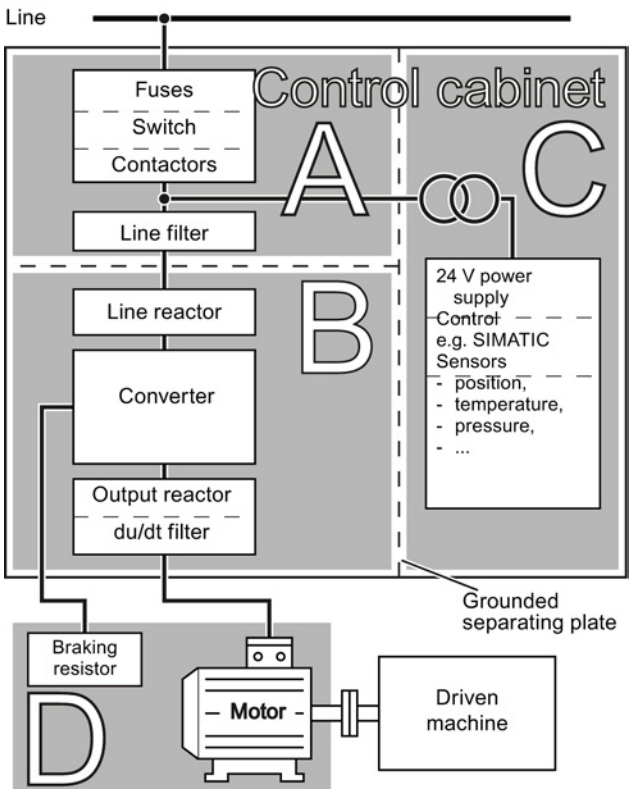
EMC zone concept within the control cabinet

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 following example explains the zone concept in greater detail.

The zones must be decoupled electromagnetically. This decoupling can, for example, be achieved with large physical separations (approx. 25 cm). Better and space-saving is decoupling using separate metal enclosures or large metal partitions.

Cables within each zone can be unshielded. Cables of different zones must be separated and must not be laid in shared cable harnesses or cable ducts. Where necessary, filters and/or coupler blocks must be deployed at the zone interfaces. Coupler blocks with electrical isolation can effectively prevent the interference propagation between the zones.

All communication and signal cables that exit the control cabinet must be shielded. Additional isolation amplifiers must be used for longer analog signal cables. Sufficient space for connecting 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. Care must be taken to prevent any potential differences regarding the ground potential between the zones. These must be avoided to protect the cable shields from excessively high equalizing currents.



- **Zone A:**
  Line connection
  Limit values for conducted interference emissions and conducted interference immunity must not be exceeded
- **Zone B:**
  Power electronics
  Sources of interference
- **Zone C:**
  Control and sensors
  Potentially susceptible equipment (noise sinks)

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

Division of the cabinet and the drive system into different EMC zones

4.6.3 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.

4.6.4 Cabling

Routing cables inside the cabinet

- All power cables for the drive (line cables, DC link cables, connecting cables between the Braking Module and the associated braking resistor as well as motor cables) must be routed separately from signal and data cables. The minimum distance should be approximately 25 cm. Alternatively, the decoupling can be realized in the control cabinet using metal partitions (separating elements) connected to the mounting plate through a good electrical connection.
- Filtered line cables with a low noise level, i.e. line cables from the line supply to the line filter, must be separately routed away from non-filtered power cables with high noise levels (line cables between the line filter and rectifier, DC link cables, connecting cables between the Braking Module and the associated braking resistor 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 to minimize coupled-in interference.
- Cables should be kept as short as possible, unnecessary 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 the shortest distance possible between them.
- When unshielded single-conductor 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 conductors 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).
- The shields of the signal cables at the Control Unit must be connected at the Power Module below the mounted Control Unit at the slots provided using the shield connection terminals supplied.
  The signal cables are mechanically attached (strain relief) using cable ties, also attached below the mounted Control Unit at the locations provided below the slots for attaching the shield connection terminals.

Cables outside the cabinet

- All power cables (line cables, DC link cables, connecting cables between the Braking Module and the associated braking resistor as well as motor cables) must be routed separately from signal and data cables. The minimum distance should be approximately 25 cm.
- To achieve categories C2 and C3 according to EN 61800-3, a shielded cable must be used between the inverter and motor, and for higher power ratings a symmetrical, 3-conductor three-phase cable should be used. Shielded cables with symmetrical three-phase conductors (L1, L2, and L3) and an integrated, 3-conductor, and symmetrically arranged PE conductor are ideal for this purpose.
- The shielded cable to the motor must be routed separately from the cables to the motor temperature sensors (PTC/KTY); this is because the cables to the motor temperature sensors should be treated as signal cables.
- Signal and data cables must be shielded to minimize coupled-in interference (capacitive, inductive, and radiated).
- Especially sensitive signal cables - such as setpoint and actual value cables - should be routed without any interruption with optimum shield support at both ends

Cable shields

- Shielded cables must have finely stranded braided shields. Shields that are not as finely braided, such as the concentric conductors used in Protodur NYCWY cables, do not have such an effective shielding effect. Foil shields have a significantly poorer shielding effect and are therefore unsuitable.
- 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 can coupled-in interference be minimized (capacitive, inductive, radiated).
- Wherever possible, cable shields should be connected directly after they enter the cabinet. The EMC shield bars should be used for power cables; the shield connection options provided in the built-in and cabinet units should be used for signal and data cables.
- Wherever possible, cable shields should not be interrupted by using 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. The shield clips must connect the shield through a large surface area with low associated inductance to the EMC shield bar or the shield connection option for signal cables.
- Only metal or metallized plug housings should be used for plug-in connections for shielded data cables (e.g. PROFIBUS cables).

4.6.5 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 are screwed together several times with good conductivity ensured through the use of 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 PE power 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.

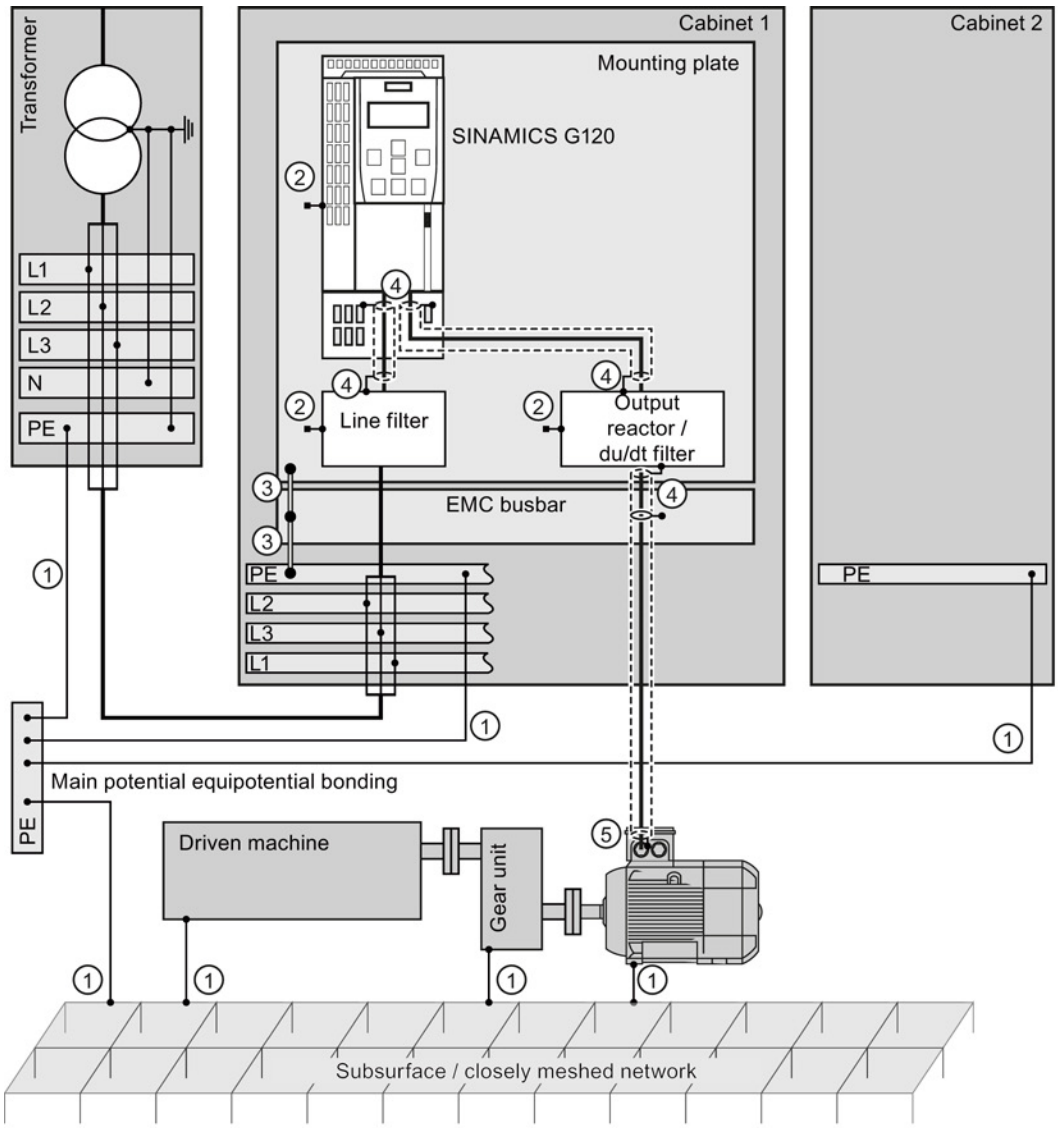
The ground connections represent the conventional grounding system for the drive components.

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

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

The shield and the protective ground conductor of the motor cable provide the high-frequency equipotential bonding between the converter and the motor terminal box.

Therefore, connect the protective ground conductor and the cable shield to the motor and to the converter.



(1) Conventional grounding without special HF properties
(2) Electrically conductive connection to the mounting plate through the largest possible surface area
(3) HF equipotential bonding
(4) Connect the shield through a large contact surface and connect the protective ground conductor
(5) Connect the shield through a conductive heavy-gauge threaded joint and connect the protective ground conductor

Figure 4-9 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 existing unscreened cables
- Cables with poor high-frequency properties of the shield
- Installations with bad grounding systems

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

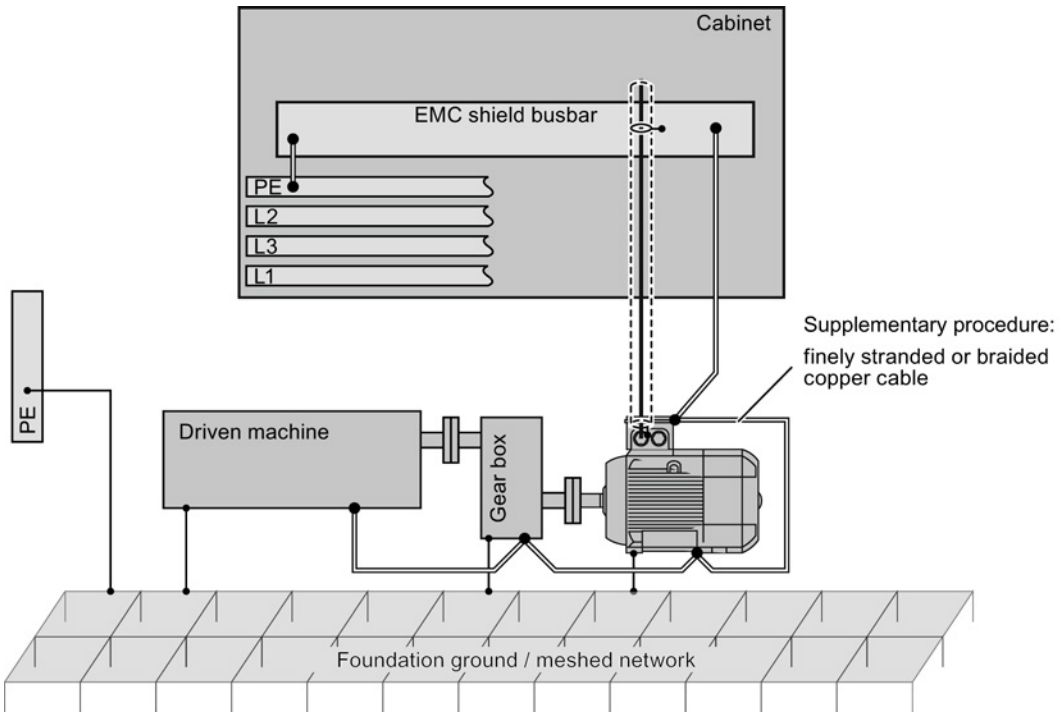


Figure 4-10 Additional high-frequency bonding of the drive system

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.

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

Cables and screw terminals

Cables and screw terminals must be checked regularly to ensure that they are secure, and if necessary, retightened. Retighten if necessary. The wiring must be checked for damage. Defective parts must be replaced immediately.

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.

Safety instructions for maintenance and repair work

⚠DANGER

Discharging the capacitors

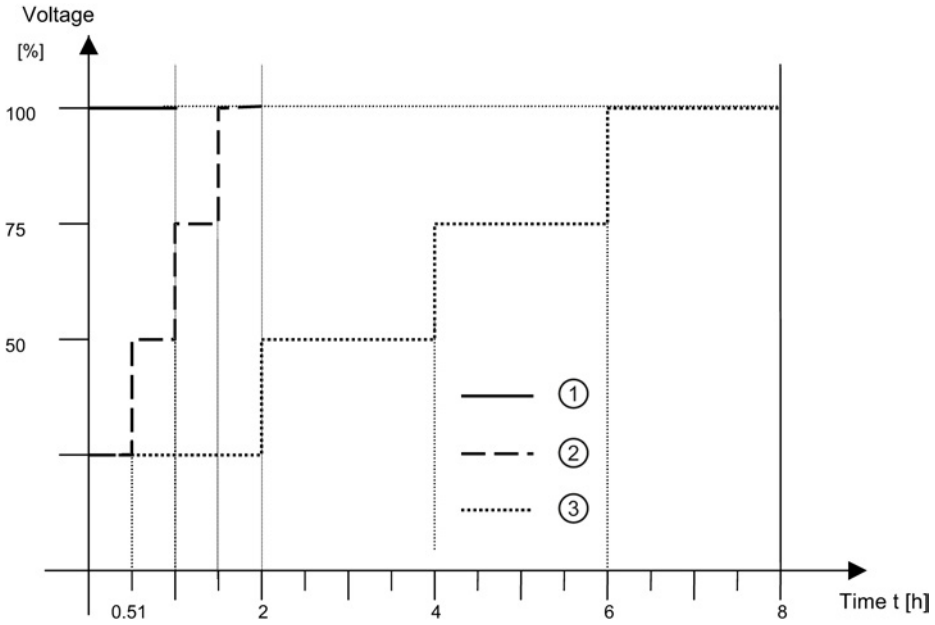
Before carrying out any maintenance or repair work on the de-energized unit, you must wait for 5 minutes after switching off the supply voltage. This allows the capacitors to discharge to a non-hazardous level (< 60 V) after the line voltage has been switched off.

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

5.2 Forming

Forming the DC link capacitors

If inverters are not operational for a longer period of time, then the DC link capacitors must be formed. The date of manufacture and therefore the storage time can be determined based on the Power Module serial number. You can take the details about the measures required when forming from the following diagram.



Storage times less than 1 year: No measures required

① Storage times of between 1 and 2 years: Connect voltage for one hour before switching on

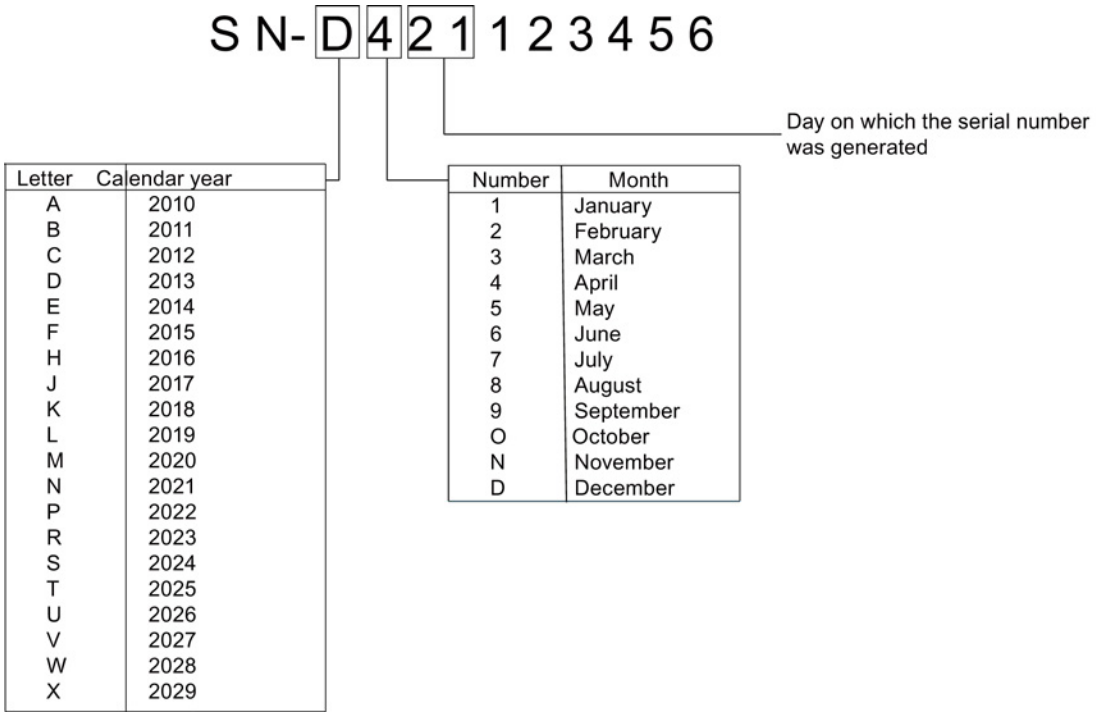
② Storage times of between 2 and 3 years: Form corresponding to the curve before switching on

③ Storage times of 3 and more years: Form corresponding to the curve before switching on

Figure 5-1 Measures when forming the DC link capacitors

Code to encrypt the date of manufacture

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



Letter	Calendar year
A	2010
B	2011
C	2012
D	2013
E	2014
F	2015
H	2016
J	2017
K	2018
L	2019
M	2020
N	2021
P	2022
R	2023
S	2024
T	2025
U	2026
V	2027
W	2028
X	2029

Number	Month
1	January
2	February
3	March
4	April
5	May
6	June
7	July
8	August
9	September
O	October
N	November
D	December

Figure 5-2 Code to encrypt the date of manufacture

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

5.3 Replacing the cooling fan

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 in order to ensure that the drive remains ready for operation.

Note

Operating hours counter for the fan

The number of total operating hours are indicated in parameter p0251; alarm A30042 is output 500 hours before reaching and when reaching the end of the service life.

Fan replacement for frame size GX

Removal

1. Switch off the converter.
2. Release the retaining screws (①). The screws are captive.
3. Shift the fan unit to the right, from position "2" to position "1" (this is marked on the housing).
   The connector is simultaneously released.
4. Remove the cooling fan out from the converter (②).

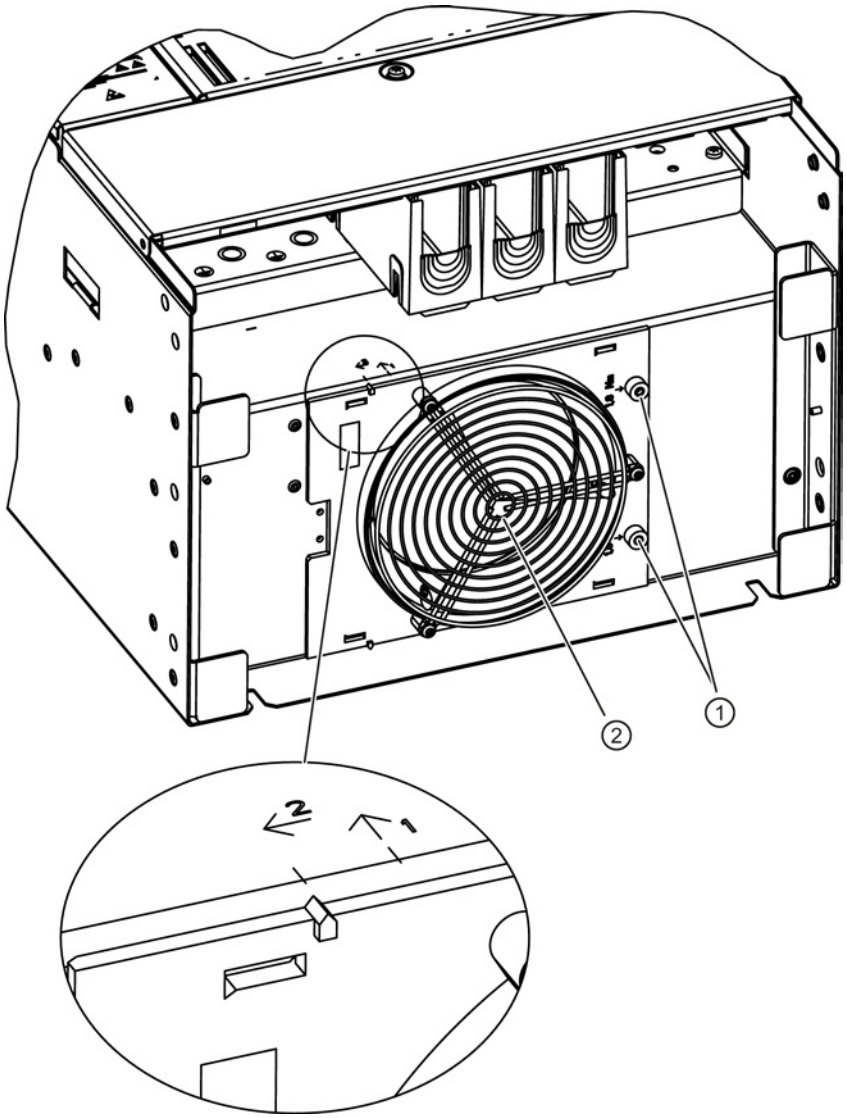


Figure 5-3 Fan removal for frame size GX, view from below

Installation

For re-installation, carry out the above steps in reverse order.

Tightening torque for the captive fixing screws: 1.8 Nm.

Technical specifications

6

Converters for installation in the US (UL) and in Canada (cUL):

In order that the system is cULus-compliant, use cUL-certified fuses type J or Siemens fuses of the 3NE1 type. Use only copper wire approved for 75°C .

UL certified ring cable lugs must be used for the input and output terminals (UL Category ZMVV) for min. 480 V, and the appropriate current carrying capacity (min. 125 % of the input/output current).

When connecting converter 6SL3310-1PE3.-.... (Power Modules PM330) to the line supply, the terminals must be introduced into the terminal box from above.

The converter can be connected to line supplies with overvoltage category III.

In conjunction with the Control Units, the converter provides integrated motor overload protection.
The overload protection responds at 115 % of the set rated motor current.
Refer to the associated operating instructions for additional details on the parameterization of the Control Units.

Note

The short-circuit protection integrated in the converter for the motor outputs does not provide any cable protection. Cable protection must be ensured according to the requirements of this manual, the National Electrical Code as well as additional local specifications and regulations.

Note regarding installations in Canada (cUL):

Overvoltage protection devices must be connected upstream from the line-side converter connection.

Rated values:

- 480 V (phase - ground)
- 480 V (phase - phase)
- Overvoltage category III
- Voltage limit 6 kV (phase - ground) and 4 kV (phase - phase).
- Suitable for type 1 or type 2 SPD application
- A clamping circuit should be provided between the phases and also between phase and ground.

See also

Specific technical data (Page 57)

6.1 General technical data

Table 6- 1 General technical data

Electrical data	
Line system configurations	Grounded TN/TT systems and non-grounded IT systems
Line requirement	A line reactor (2 % u_k) must be connected in series
Line voltage	380 V (-10 %) ... 480 V (+10 %)
Line frequency	47 ... 63 Hz
Output frequency	0 ... 100 Hz
Displacement factor cos φ power factor λ	0.96 0.75 ... 0.93 (with line reactor u_k = 2 %)
Inverter efficiency	> 98 %
Short-circuit current rating per IEC, in conjunction with the specified fuses	110 ... 200 kW: 100 kA
Short-circuit current rating per UL508C (up to 480 VAC), in conjunction with the specified fuses	110 ... 200 kW: 100 kA Can be used on supply systems that cannot supply more than 100 kA symmetrically for a maximum voltage of 480 VAC when they are protected with the listed fuses of type Class J or approved semi-conductor fuses specified in the "Technical Data" section of this manual.
Overvoltage category	III according to EN 61800-5-1
Mechanical data	
Degree of protection	IP20
Protection class	according to EN 61800-5-1: Class I (with protective conductor system) and Class III (PELV)
Cooling method	Forced air cooling AF according to EN 60146
Sound pressure level L_{PA} (1 ma)	≤ 71 dB(A)
Touch protection	according to EN 61800-5-1: For the intended purpose
Compliance with standards	
Standards	EN 60146-1-1, EN 61800-2, EN 61800-3, EN 61800-5-1, EN 60204-1, EN 60529, UL508C, CSA 22.2 No. 14-13
CE marking	According to EMC Directive No. 2004/108/EC and Low-Voltage Directive No. 2006/95/EC and Machinery Directive No. 2006/42/EC
Radio interference suppression	In accordance with the EMC product standard for variable-speed drives EN 61800-3, "second environment" [1]. Application in "first environment" possible with line filters.
Approval	cULus (File No.: E192450), CE, c-Tick, GOST-R, KC

Electrical data			
Ambient conditions	**During storage** [2]	**During transport** [2]	**During operation**
Ambient temperature	-25 ... +55° C	-25 ... +70° C above –40° *C* for 24 hours	0 ... +40° C up to +50° C with derating
Relative humidity (no condensation) Corresponds to class	*5 to 95%* 1K4 according to EN 60721-3-1	5 ... 95% at 40° C 2K3 according to EN 60721-3-2	5 ... 95 % 3K3 according to EN 60721-3-3
Environmental class / harmful chemical substances	1C2 according to EN 60721-3-1	2C2 according to EN 60721-3-2	3C2 according to EN 60721-3-3
Organic/biological influences	1B1 according to EN 60721-3-1	2B1 according to EN 60721-3-2	3B1 according to EN 60721-3-3
Pollution degree	2 according to EN 61800-5-1		
Installation altitude	Up to 1000 m above sea level without derating, > 1000 m above sea level with derating (see "Derating data")		
Mechanical strength	**During storage** [2]	**During transport** [2]	**During operation**
Vibrational load - Displacement - Acceleration	Fc test according to EN 60068-2-6 ±1.5 mm for 5 ... 9 Hz 0.5 g for 9 ... 200 Hz	Fc test according to EN 60068-2-6 ±1.5 mm for 5 ... 9 Hz 0.5 g for 9 ... 200 Hz	Fc test according to EN 60068-2-6 0.075 mm for 10 ... 58 Hz 9.81 ma/s² (1 x g) for > 58 ... 200 Hz
Shock load - Displacement - Acceleration		Fc test according to EN 60068-2-6 ±1.5 mm for 5 ... 9 Hz 0.5 g for 9 ... 200 Hz	Test according to EN 60068-2-27 (EA shock type) 49 ma/s² (5 x g)/30 ms 147 ma/² (15 x g)/11 ms

Deviations from the defined classes are shown in *italics*.

[1] Standard construction: Devices installed in the switch cabinet with EMC-conform construction, line reactor uk = 2%, shielded motor cable (e.g. Protoflex EMC) with max. 100 m cable length,
line perturbations according to EN 61000-2-4: Class 2, THD(U) total = 8 % for typical line conditions (RSC > 30 ... 50); THD(I) total: typical 30 … 45 % (15 < RSC < 50);

[2] In transport packaging

See also

Derating factor of the output current as a function of the operating temperature (Page 59)

Derating as a function of the installation altitude (Page 60)

Derating factor of the output current as a function of the line voltage (Page 61)

Electromagnetic compatibility (Page 65)

Permissible inverter overload

The inverters have different load capabilities, "High Overload" and "Low Overload", depending on the expected.

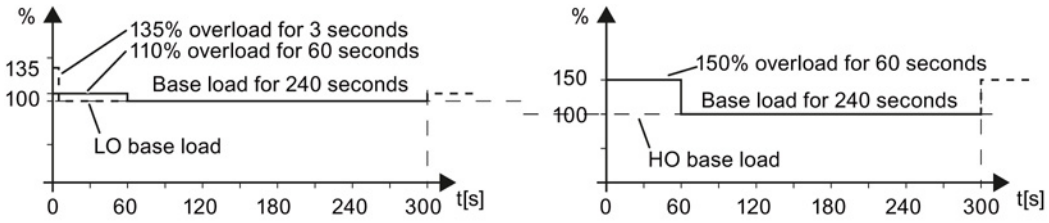


Figure 6-1 Load cycles, Low Overload" and "High Overload"

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 based on the load situation. 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.
- **Rated current I_N** Continuous current at the type rating, overload not possible

6.2 Specific technical data

Note

Recommended connection cross-sections

The recommended connection cross-sections are determined for copper cables at 40° C (104° F) ambient temperature and cables with a permitted operating temperature on the conductor for 70° C (laying type C - factor for bundling 0.75 considered) according to DIN VDE 0298-4/08.03).

Protective conductor cross-section (S: Cross-section of the supply connection phase conductor, MS: Cross-section of the external protective conductor):

Minimum cross-sections:

- S ≤ 16 mm² -> MS = S
- 16 mm²≤ S ≤ 35 mm² -> MS = 16 mm²
- S > 35 mm² -> MS = 0.5 x S

Recommended cross-sections:

- MS ≥ S

PM330 frame sizes GX, 3-ph. 380 VAC… 480 VAC

Table 6- 2 PM330 frame sizes GX, 3-ph. 380 VAC… 480 VAC

Order no.	6SL3310…	…1PE33-0AA0	…1PE33-7AA0
Rated input current			
- for 380/400 V, 40° C		317 A	375 A
- for 480 V, 40° C		262 A	314 A
- for 380/400 V, 50° C		269 A	319 A
- for 480 V, 50° C		220 A	266 A
Rated output current I_N			
- for 380/400 V, 40° C		300 A	370 A
- for 480 V, 40° C		245 A	308 A
- for 380/400 V, 50° C		255 A	315 A
- for 480 V, 50° C		208 A	262 A
LO power		160 kW	200 kW
LO input current		314 A	369 A
LO output current		290 A	360 A
HO power		132 kW	160 kW
HO input current		257 A	302 A
HO output current		240 A	296 A
Fuse according to IEC manufacturer:		3NE1333-2 Siemens AG	3NE1334-2 Siemens AG
Maximum permissible line short-circuit current I_{kmax}		≤ 100 kA	≤ 100 kA
Minimum permissible line short-circuit current I_{kmin}		> 4.4 kA	> 5.2 kA
Fuse according to UL [1]		Class J 400 A / 600 V e.g. DF J-400	Class J 500 A / 600 V e.g. DF J-500
Heat loss, for I_N, 40° C		3.23 kW	4.0 kW
Required cooling air flow		210 l/s	210 l/s
Maximum connectable cross-section of the line, motor and DC-link cable		2 x 240 mm² 2 x 500 kcmil	2 x 240 mm² 2 x 500 kcmil
Recommended cable cross-section for 380/400 V - power cable - motor cable		2 x 120 mm² 2 x 95 mm²	2 x 120 mm² 2 x 95 mm²
Recommended cable cross-section for 480 V - power cable - motor cable		2 x 95 mm² 2 x 70 mm²	2 x 120 mm² 2 x 95 mm²
Tightening torque for line, motor and ground cable		50 Nm / 443 lbf in	50 Nm / 443 lbf in
Weight		101 kg	102 kg

[1] When semi-conductor fuses are used, they must be mounted in the same lower-level construction as the inverter.

6.3 Derating data

6.3.1 Derating factor of the output current as a function of the operating temperature

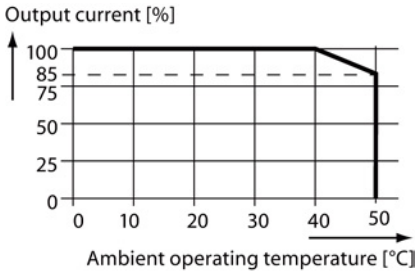


Figure 6-2 Derating factor of the output current as a function of the operating temperature

6.3.2 Derating as a function of the installation altitude

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 2000 m above sea level.

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

By using the isolating transformer, overvoltage category III is reduced to overvoltage category II. As a result, the requirements placed on the insulating capability of air are reduced. An additional (input) voltage derating is not necessary if the following basic conditions are met:

- The isolation transformer must be fed from a low-voltage or medium-voltage network; it must not be supplied directly from a high-voltage network.
- The isolating transformer may be connect to one or more converters.
- The cables between the isolating transformer and the converters must be routed in such a manner as to rule out direct lightening strike, i.e. it is not permissible that overland lines are used.
- The following supply system types are permissible:
  - TN supply systems with grounded star point (no grounded phase conductor)
  - IT supply systems (operation with a ground fault must be limited to the shortest time possible)

Note

The connected motors and power components must be considered separately.

Current

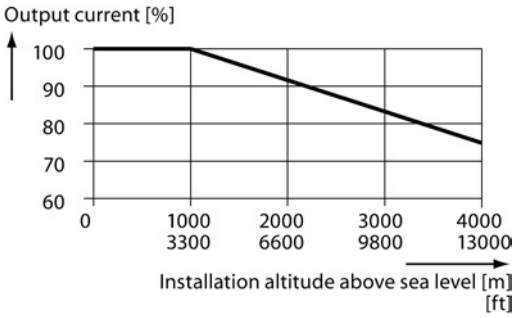


Figure 6-3 Derating of the output current as a function of the installation altitude

6.3.3 Derating factor of the output current as a function of the line voltage

Table 6- 3 Derating factor of the output current as a function of the line voltage

Power Module	Rated output current I_N at 380 V/400 V	380 V	400 V	415 V	460 V	480 V
6SL3310-1PE33-0AA0	300 A	100 %	100 %	96.6 %	86.2 %	81.6 %
6SL3310-1PE33-7AA0	370 A	100 %	100 %	96.9 %	87.8 %	83.7 %

6.3.4 Derating of the output current as a function of the pulse frequency

Table 6- 4 Derating of the output current as a function of the pulse frequency

LO base load (400 V)	Output base-load current at a pulse frequency of	
	2 kHz	4 kHz
kW	A	A
160	290	232
200	360	288

Appendix

A

A.1 Further information on your converter

A.1.1 Manuals for your inverter

Table A- 1 Manuals for your converter

Depth of the information	Manual	Contents	Languages	Download or order number
+	**Getting Started** Control Units CU230P-2; CU240B-2; CU240E-2	Installing the converter and commissioning.	English, German, Italian, French, Spanish	Download manuals (http://support.automation.siemens.com/WW/view/en/22339653/133300) **SINAMICS Manual Collection** Documentation on DVD, order number 6SL3097-4CA00-0YG1
+	**Getting Started** SINAMICS G120 Power Module	Installing the Power Module		
++	**Operating Instructions** Control Units • CU230P-2	Installing and commissioning the converter, adapting fieldbus interfaces, description of the converter functions, data backup and series commissioning, service and maintenance		
+++	**Hardware Installation Manual**	This manual		
+++	**Operating and installation instructions**	For converter accessories, e.g. operator panel, reactors or filter.		
+++	**List Manual** Control Units • CU230P-2	Graphic function block diagrams. List of all parameters, alarms and faults.	German, English	

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 35	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.

For precise data, refer to the declaration conformity

A.2.1 Definition of the EMC Environment and Categories

Classification of EMC behavior

The EMC environment and categories are defined in 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 line supply without the use of an intermediate transformer.

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

Second environment

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

- 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 Environment, is only intended to be installed and commissioned by a professional.

Note

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

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 (residential) environment.

A.2.2 Compliance with EMC Environment and Categories

EMC interference emission

Note

To comply with the requirements of EN 61800-3:2004, all drives must be installed in accordance with the manufacturer's instructions and EMC directives. See also: EMC compliant connection (Page 38).

Cable-conducted (interference voltage) and interference emissions

Category C1 – First environment

- The Power Modules are not intended for use in Category C1, the first environment. In order to be able to use Power Modules in Category C1 – first environment – the following additional measures must be applied (e.g. filter).

Category C2 – First environment - commercial use

Power Modules with additional line filter

- fulfill the requirements relating to cable-conducted noise interference emission (interference), if
  - a shielded cable with low capacitance is used,
  - the current does not exceed the rated input current (see Specific technical data (Page 57)),
  - the pulse frequency does not exceed 4 kHz, and
  - the cable is not longer than 100 m.
- can cause high-frequency disturbances. In this case, damping measures may be required in order that the requirements relating to radiated noise interference can be fulfilled.

Note

Devices for use in Category C2 – first environment, commercial use – must be installed by a specialist with the appropriate experience for installing and/or commissioning power drive systems, including their EMC aspects.

Category C2 – Second environment

Power Modules with additional line filter

- fulfill the requirements relating to cable-conducted noise interference emission (interference), if
  - a shielded cable with low capacitance is used
  - the current does not exceed the rated input current (see Specific technical data (Page 57)),
  - the pulse frequency does not exceed 4 kHz, and
  - the cable is not longer than 100 m.
- can cause high-frequency disturbances. In this case, damping measures may be required in order that the requirements relating to radiated noise interference can be fulfilled.

Category C3 – Second (industrial) environment

- Power Modules can be installed without any restrictions in Category C3 – second environment – and do not require any authorization for connection.

EMC / Immunity

The Power Modules have been tested in accordance with the immunity requirements of category C3 – Second Environment – and fulfill the requirements according EN 61800-3.

Note

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

Harmonic currents

Table A- 3 Typical harmonic currents of a 6-pulse rectifier with line reactor u_k = 2 %

Typical harmonic current (% of rated input current) with line reactor u_K 2 %										
Line supply with average, relative short-circuit power (RSC = 50), u_k = 2 %, with line reactor u_k = 2 %										
h	1	5	7	11	13	17	19	23	25	THD(I)
I_h	100 %	37.1 %	12.4 %	6.9 %	3.2 %	2.8 %	1.9 %	1.4 %	1.3 %	40.0 %
Line supply with low relative short-circuit power (RSC < 15): "Weak line supply", uk = 6 %, with line reactor uk = 2 %										
h	1	5	7	11	13	17	19	23	25	THD(I)
I_h	100 %	22.4 %	7.0 %	3.1 %	2.5 %	1.3 %	1.0 %	0.8 %	0.7 %	23.8 %

h: Harmonic order number

Note

Installation of Power Modules in an environment of category C2

Power Modules, which are installed in an environment of category C2, require a connection approval for the low-voltage supply system. Contact your local supply system operator in this case.

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 observed for South 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 according to EN 55011. With suitable 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 are described in this Manual and/or the Configuration Manual "EMC Installation Guidelines".

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

A.3 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

Index

Q

R

S

T

U

Additional information

www.siemens.com/sinamics-g120p

Siemens AG
Industry Sector
P.O. Box 48 48
90026 NUREMBERG
GERMANY

www.siemens.com/automation