SIEMENS

Operating instructions

SINAMICS

G130

Braking Module / braking resistor

Edition 11/2017

www.siemens.com/drives

SIEMENS

SINAMICS

SINAMICS G130
Braking Module / braking resistor

Operating Instructions

Firmware version V5.1

11/2017

A5E00331454A

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
Division Process Industries and Drives
Postfach 48 48
90026 NÜRNBERG
GERMANY

A5E00331454A
℗ 03/2018 Subject to change

Table of contents

Safety information

1

1.1 General safety instructions

⚠WARNING

Electric shock and danger to life due to other energy sources

Touching live components can result in death or serious injury.

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

Generally, the following steps apply when establishing safety:

1. Prepare for disconnection. Notify all those who will be affected by the procedure.
2. Isolate the drive system from the power supply and take measures to prevent it being switched back on again.
3. Wait until the discharge time specified on the warning labels has elapsed.
4. Check that there is no voltage between any of the power connections, and between any of the power connections and the protective conductor connection.
5. Check that every auxiliary circuit is de-energized.
6. Ensure that the motors cannot move.
7. Identify all other dangerous energy sources, e.g. compressed air, hydraulic systems or water. Switch the energy sources to a safe state.
8. Check that the correct drive system is completely locked.

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

⚠WARNING

Electric shock due to connection to an unsuitable power supply

When equipment is connected to an unsuitable power supply, exposed components may carry a hazardous voltage that might result in serious injury or death.

- 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

Electric shock due to equipment damage

Improper handling may cause damage to equipment. For damaged devices, hazardous voltages can be present at the enclosure or at exposed components; if touched, this can result in death or severe injury.

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

⚠WARNING

Electric shock due to unconnected cable shield

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

- Connect cable shields and unused conductors of power cables (e.g. brake conductors) at least on one side to the grounded housing potential.

⚠WARNING

Electric shock if there is no ground connection

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

- Ground the device in compliance with the applicable regulations.

⚠WARNING

Arcing when a plug connection is opened during operation

Opening a plug connection when a system is in operation can result in arcing that may cause serious injury or death.

- Only open plug connections when the equipment is in a voltage-free state, unless it has been explicitly stated that they can be opened in operation.

NOTICE

Property damage due to loose power connections

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

- Tighten all power connections to the prescribed torque.
- Check all power connections at regular intervals, particularly after equipment has been transported.

⚠WARNING

Spread of fire from built-in devices

In the event of fire outbreak, the enclosures of built-in devices cannot prevent the escape of fire and smoke. This can result in serious personal injury or property damage.

- Install built-in units in a suitable metal cabinet in such a way that personnel are protected against fire and smoke, or take other appropriate measures to protect personnel.
- Ensure that smoke can only escape via controlled and monitored paths.

⚠WARNING

Failure of pacemakers or implant malfunctions due to 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 in the immediate vicinity of this equipment are at particular risk.

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

⚠WARNING

Unexpected movement of machines caused by radio devices or mobile phones

When radio devices or mobile phones with a transmission power > 1 W are used in the immediate vicinity of components, they may cause the equipment to malfunction. Malfunctions may impair the functional safety of machines and can therefore put people in danger or lead to property damage.

- If you come closer than around 2 m to such components, switch off any radio devices or mobile phones.
- Use the "SIEMENS Industry Online Support App" only on equipment that has already been switched off.

⚠WARNING

Motor fire in the event of insulation overload

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

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

⚠WARNING

Fire due to inadequate ventilation clearances

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

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

⚠WARNING

Unrecognized dangers due to missing or illegible warning labels

Dangers might not be recognized if warning labels are missing or illegible. Unrecognized dangers may cause accidents resulting in serious injury or death.

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

NOTICE

Device damage caused by incorrect voltage/insulation tests

Incorrect voltage/insulation tests can damage the device.

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

⚠WARNING

Unexpected movement of machines caused by inactive safety functions

Inactive or non-adapted safety functions can trigger unexpected machine movements that may result in serious injury or death.

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

Note

Important safety instructions for Safety Integrated functions

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

1.2 Handling electrostatic sensitive devices (ESD)

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

NOTICE

Damage through electric fields or electrostatic discharge

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

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

The necessary ESD protective measures are clearly illustrated in the following diagram:

- a = conductive floor surface
- b = ESD table
- c = ESD shoes
- d = ESD overall
- e = ESD wristband
- f = cabinet ground connection
- g = contact with conductive flooring

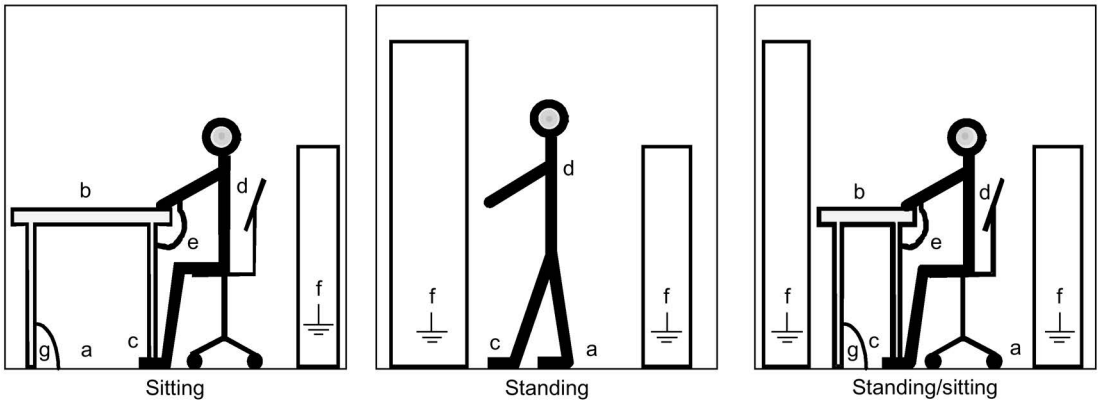


Figure 1-1 ESD protective measures

General

2

⚠WARNING

Non-observance of the fundamental safety instructions and residual risks

The non-observance of the fundamental safety instructions and residual risks stated in Chapter 1 can result in accidents with severe injuries or death.

- Adhere to the fundamental safety instructions.
- When assessing the risk, take into account residual risks.

⚠WARNING

Fire and device damage as a result of ground fault/short-circuit

Inadequate installation of the cables to the braking resistor can result in a ground fault/short-circuit and place persons at risk as a result of the associated smoke and fire.

- Comply with local installation regulations that enable this fault to be ruled out.
- Protect the cables from mechanical damage.
- In addition, apply one of the following measures:
  - Use cables with double insulation.
  - Maintain adequate clearance, e.g. by using spacers.
  - Lay the cables in separate cable ducts or conduits.

⚠WARNING

Fire due to overheating when the total length of the connecting cables is exceeded

Excessively long Braking Module connection cables can cause components to overheat with the associated risk of fire and smoke.

- The Braking Module connecting cables may not be longer than 100 m.

⚠WARNING

Fire through overheating due to 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 failures and reduced service lives of braking resistors.

- It is essential that you maintain a ventilation clearance of 200 mm on all sides of the component with ventilation grilles.

NOTICE
Material damage due to loose power connections Insufficient tightening torques or vibration can result in faulty electrical connections. This can cause fire damage or malfunctions. • Tighten all power connections with the specified tightening torques, e.g. line supply connection, motor connection, DC-link connections. • Check the tightening torques of all power connections at regular intervals and tighten them when required. This applies in particular after transport.

NOTICE
Damage through the use of non-released braking resistors Braking resistors can be damaged when using braking resistors other than those specified in this manual. • Only use braking resistors released by Siemens.

2.1 Braking Module

Description

A Braking Module (and an external braking resistor) is required in certain cases when the drive is to be braked or brought to a standstill (e.g. EMERGENCY STOP category 1). The Braking Module contains the power electronics and the associated Control Unit. The supply voltage for the electronics is drawn from the DC link.

During operation, the DC-link energy is converted to heat loss in an external braking resistor.

The Braking Module functions independently of the converter closed-loop controller. In the case of Power Modules with frame sizes HX and JX, it is possible to operate several Braking Modules in parallel in order to enhance performance. In this case, each Braking Module must be fitted with its own braking resistor.

Structure

The Braking Module is inserted in a slot inside the Power Module, the fan of which ensures forced cooling. The Braking Module is connected to the DC link by means of the busbar sets and flexible cables, which are supplied as standard.

Assignment of Braking Module and Power Module

Table 2- 1 Assignment of Braking Module and Power Module

Power Module	Unit rating of the Power Module	Suitable Braking Module	Rated power output of the Braking Module	Suitable brake resistance
Line voltage 3-phase 380 – 480 VAC				
6SL3310-1GE32-1AA3	110 kW	6SL3300-1AE31-3AA0	25 kW	6SL3000-1BE31-3AA0
6SL3310-1GE32-6AA3	132 kW	6SL3300-1AE31-3AA0	25 kW	6SL3000-1BE31-3AA0
6SL3310-1GE33-1AA3	160 kW	6SL3300-1AE32-5AA0	50 kW	6SL3000-1BE32-5AA0
6SL3310-1GE33-8AA3	200 kW	6SL3300-1AE32-5AA0	50 kW	6SL3000-1BE32-5AA0
6SL3310-1GE35-0AA3	250 kW	6SL3300-1AE32-5AA0	50 kW	6SL3000-1BE32-5AA0
6SL3310-1GE36-1AA3	315 kW	6SL3300-1AE32-5BA0	50 kW	6SL3000-1BE32-5AA0
6SL3310-1GE37-5AA3	400 kW	6SL3300-1AE32-5BA0	50 kW	6SL3000-1BE32-5AA0
6SL3310-1GE38-4AA3	450 kW	6SL3300-1AE32-5BA0	50 kW	6SL3000-1BE32-5AA0
6SL3310-1GE41-0AA3	560 kW	6SL3300-1AE32-5BA0	50 kW	6SL3000-1BE32-5AA0
Line voltage 3-phase 500 – 600 VAC				
6SL3310-1GF31-8AA3	110 kW	6SL3300-1AF32-5AA0	50 kW	6SL3000-1BF32-5AA0
6SL3310-1GF32-2AA3	132 kW	6SL3300-1AF32-5AA0	50 kW	6SL3000-1BF32-5AA0
6SL3310-1GF32-6AA3	160 kW	6SL3300-1AF32-5AA0	50 kW	6SL3000-1BF32-5AA0
6SL3310-1GF33-3AA3	200 kW	6SL3300-1AF32-5AA0	50 kW	6SL3000-1BF32-5AA0
6SL3310-1GF34-1AA3	250 kW	6SL3300-1AF32-5BA0	50 kW	6SL3000-1BF32-5AA0
6SL3310-1GF34-7AA3	315 kW	6SL3300-1AF32-5BA0	50 kW	6SL3000-1BF32-5AA0
6SL3310-1GF35-8AA3	400 kW	6SL3300-1AF32-5BA0	50 kW	6SL3000-1BF32-5AA0
6SL3310-1GF37-4AA3	450 kW	6SL3300-1AF32-5BA0	50 kW	6SL3000-1BF32-5AA0
6SL3310-1GF38-1AA3	560 kW	6SL3300-1AF32-5BA0	50 kW	6SL3000-1BF32-5AA0
Line voltage 3-phase 660 – 690 VAC				
6SL3310-1GH28-5AA3	75 kW	6SL3300-1AH31-3AA0	25 kW	6SL3000-1BH31-3AA0
6SL3310-1GH31-0AA3	90 kW	6SL3300-1AH31-3AA0	25 kW	6SL3000-1BH31-3AA0
6SL3310-1GH31-2AA3	110 kW	6SL3300-1AH31-3AA0	25 kW	6SL3000-1BH31-3AA0
6SL3310-1GH31-5AA3	132 kW	6SL3300-1AH31-3AA0	25 kW	6SL3000-1BH31-3AA0
6SL3310-1GH31-8AA3	160 kW	6SL3300-1AH32-5AA0	50 kW	6SL3000-1BH32-5AA0
6SL3310-1GH32-2AA3	200 kW	6SL3300-1AH32-5AA0	50 kW	6SL3000-1BH32-5AA0
6SL3310-1GH32-6AA3	250 kW	6SL3300-1AH32-5AA0	50 kW	6SL3000-1BH32-5AA0
6SL3310-1GH33-3AA3	315 kW	6SL3300-1AH32-5AA0	50 kW	6SL3000-1BH32-5AA0
6SL3310-1GH34-1AA3	400 kW	6SL3300-1AH32-5BA0	50 kW	6SL3000-1BH32-5AA0
6SL3310-1GH34-7AA3	450 kW	6SL3300-1AH32-5BA0	50 kW	6SL3000-1BH32-5AA0
6SL3310-1GH35-8AA3	560 kW	6SL3300-1AH32-5BA0	50 kW	6SL3000-1BH32-5AA0
6SL3310-1GH37-4AA3	710 kW	6SL3300-1AH32-5BA0	50 kW	6SL3000-1BH32-5AA0
6SL3310-1GH38-1AA3	800 kW	6SL3300-1AH32-5BA0	50 kW	6SL3000-1BH32-5AA0

2.2 Braking resistor

Description

In converters with no regenerative feedback capability, the energy that occurs in the drive train under regenerative conditions is fed back to the DC link where it is reduced via braking resistors.

The braking resistor is connected to the Braking Module. The distance between the Braking Module and braking resistor must not exceed 100 m. This enables the resulting heat loss to be dissipated outside the switchgear room.

Resistors with rated powers of 25 kW and 50 kW are available.

To boost performance, Braking Modules and braking resistors can be connected in parallel. In this case, the Braking Modules are installed in the discharged air ducts of the Power Module. Depending on the size of the Power Module, overall up to 3 slots are available:

- Frame size FX: 1 mounting location
- Frame size GX: 1 mounting location
- Frame size HX: 2 mounting locations
- Frame size JX: 3 mounting locations

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

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

Mechanical installation 3

3.1 General

Tightening torques for screw connections

The following tightening torques apply when tightening current-conducting connections (DC-link connections, motor connections, busbars, lugs) and other connections (ground connections, protective conductor connections, steel threaded connections).

Table 3- 1 Tightening torques for screw connections

Thread	Ground connections, protective conductor connections, steel threaded connections	Aluminum threaded connections, plastic, busbars, lugs
M3	1.3 Nm	0.8 Nm
M4	3 Nm	1.8 Nm
M5	6 Nm	3 Nm
M6	10 Nm	6 Nm
M8	25 Nm	13 Nm
M10	50 Nm	25 Nm
M12	88 Nm	50 Nm
M16	215 Nm	115 Nm

Note

Screw connections for protective covers

The threaded connections for the protective covers made of Makrolon may only tightened with 2.5 Nm.

3.2 Braking Modules: overview

Braking Module for frame size FX

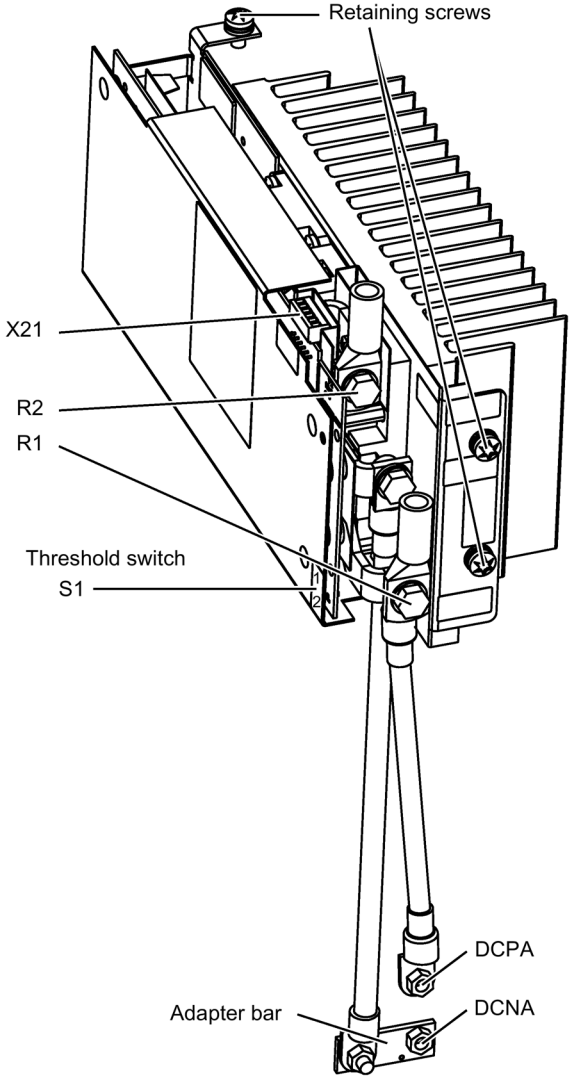


Figure 3-1 Braking Module for Power Module, frame size FX

Note

Common connection for the R1 and DCPA

With this Braking Module, the R1 and DCPA interfaces use the same connection.

Braking Module for frame size GX

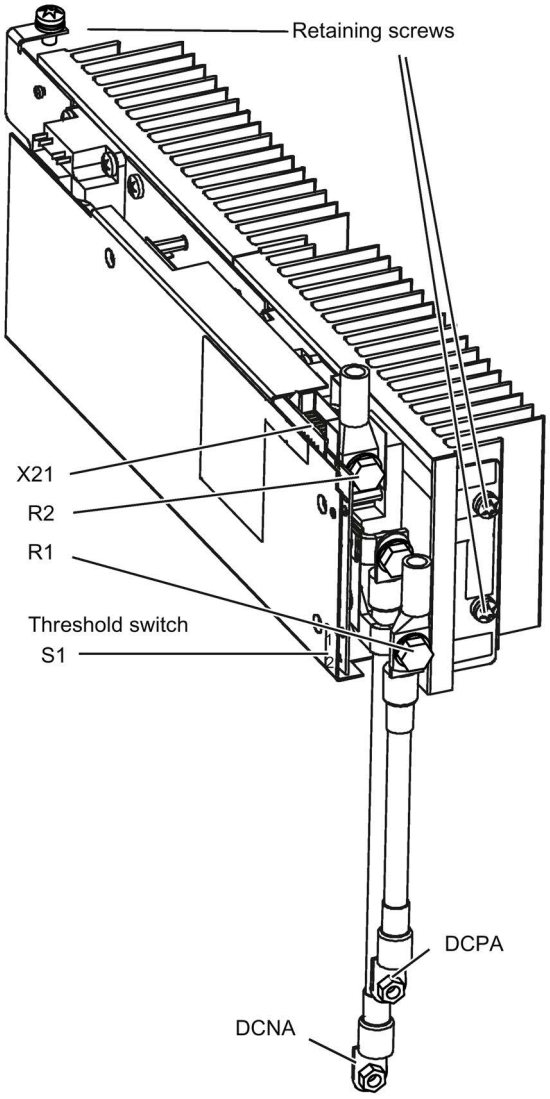


Figure 3-2 Braking Module for Power Module, (frame size GX)

Note

Common connection for the R1 and DCPA

With this Braking Module, the R1 and DCPA interfaces use the same connection.

Braking Module for frame size HX/JX

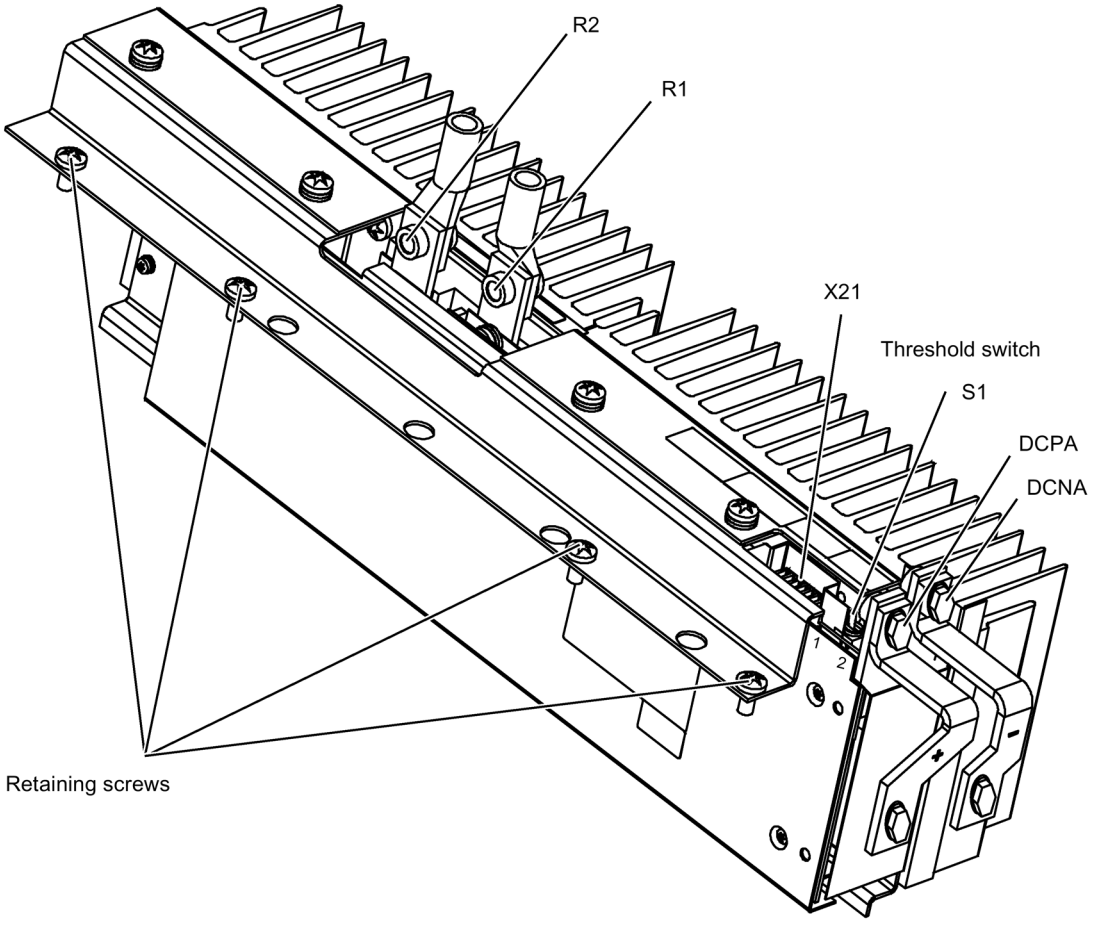


Figure 3-3 Braking Module for Power Module, frame size HX/JX

3.3 Installing the Braking Module

3.3.1 Installing the Braking Module in a Power Module, frame size FX

Figure 3-4 Installing the Braking Module in a Power Module, frame size FX – steps 1 - 3

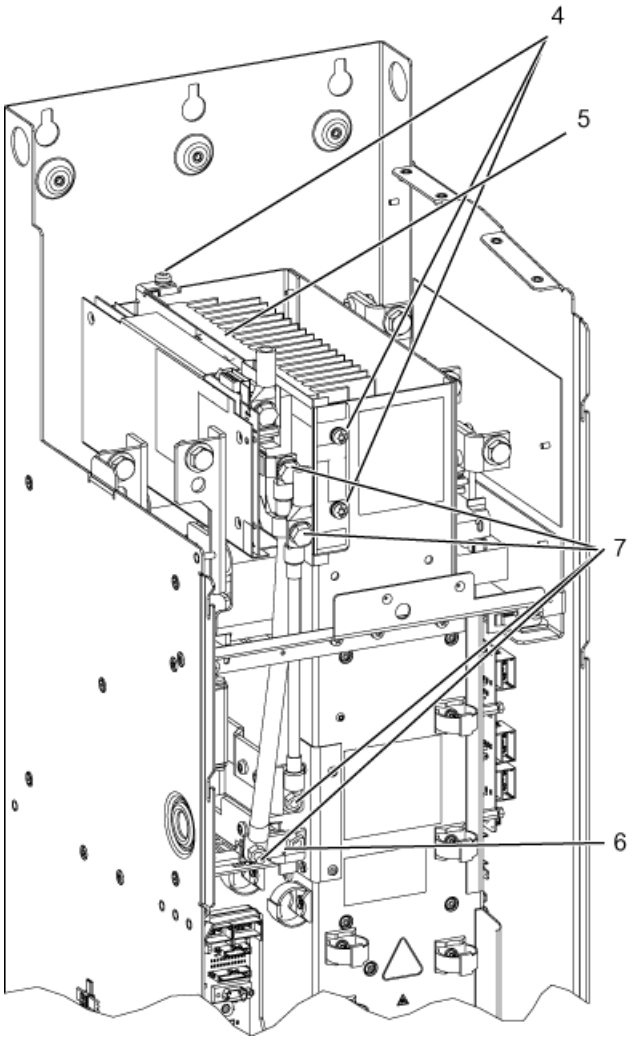


Figure 3-5 Installing the Braking Module in a Power Module, frame size FX – steps 4 - 7

Installing the Braking Module

The steps for the installation procedure are numbered in accordance with the figures in the diagrams.

1. Unscrew the 2 M6 screws from the front cover and lift off the cover.
2. Unscrew the 2 screws from the upper cover plate.
   Unscrew the M6 nut on the left-hand side and remove the front cover.
3. Unscrew the 4 screws from the upper cover plate.
   Unscrew the 3 screws from the rear cut-out sections and remove the rear cover.
4. Unscrew the 3 screws for the blanking plate and remove the plate.
5. Insert the Braking Module where the cover used to be and secure it using the 3 screws (from step 4).

6. Attach the adapter bar to the DCNA using a nut, so that the busbar cannot be twisted. For this purpose, a small bolt is attached to the adapter bar, which must be located on the lower side of the DCNA connection.
7. Secure the connecting cable to the DC link with 2 screws (Braking Module connection) and 2 nuts (DC-link connection).

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

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

Note

Pay attention to the tightening torques

You must observe the tightening torques. Information on this can be found in the table in the "Mechanical installation" section

3.3.2 Installing the Braking Module in a Power Module frame size GX

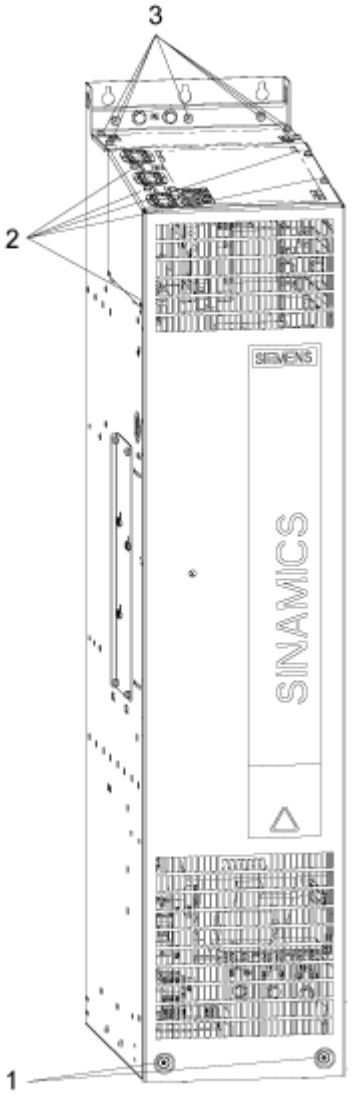


Figure 3-6 Installing the Braking Module in a Power Module frame size GX – steps 1 - 3

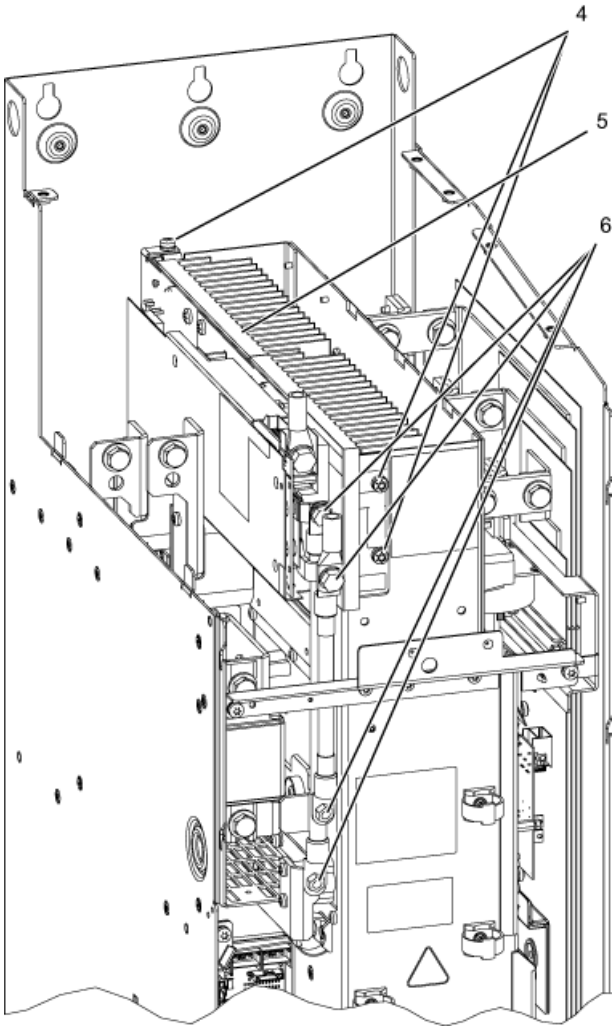


Figure 3-7 Installing the Braking Module in a Power Module frame size GX – steps 4 - 6

Installing the Braking Module

The steps for the installation procedure are numbered in accordance with the figures in the diagrams.

1. Unscrew the 2 M6 screws from the front cover and lift off the cover.
2. Unscrew the 4 screws from the upper cover plate.
   Unscrew the M6 nut on the left-hand side and remove the front cover.
3. Unscrew the 4 screws from the upper cover plate.
   Unscrew the 3 screws from the rear cut-out sections and remove the rear cover.
4. Unscrew the 3 screws for the blanking plate and remove the plate.

5. Insert the Braking Module where the cover used to be and secure it using the 3 screws (from step 4).
6. Secure the connecting cable to the DC link with 2 screws (Braking Module connection) and 2 nuts (DC-link connection).

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

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

Note

Pay attention to the tightening torques

You must observe the tightening torques. Information on this can be found in the table in the "Mechanical installation" section

3.3.3 Installing the Braking Module in a Power Module frame size HX

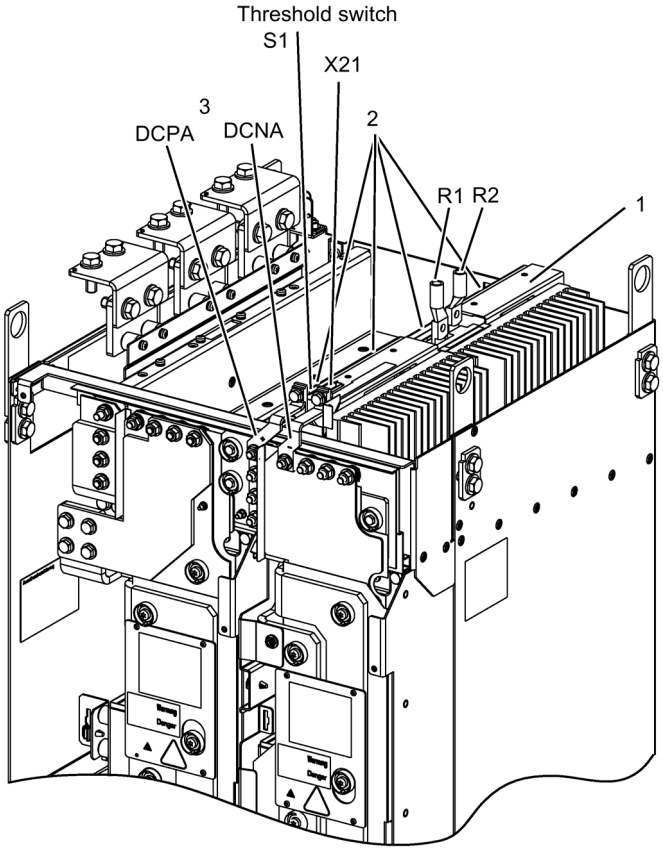


Figure 3-8 Installing the Braking Module in a Power Module frame size HX

Installing the Braking Module

The steps for the installation procedure are numbered in accordance with the figures in the diagram.

1. Insert the Braking Module.
2. Screw in the 4 retaining screws for securing the Braking Module.
3. Secure the connection clip to the DC link (DCPA/DCNA) with two screws (Braking Module connection) and two nuts (DC-link connection).

Note

Pay attention to the tightening torques

You must observe the tightening torques. Information on this can be found in the table in the "Mechanical installation" section

3.3.4 Installing the Braking Module in a Power Module frame size JX

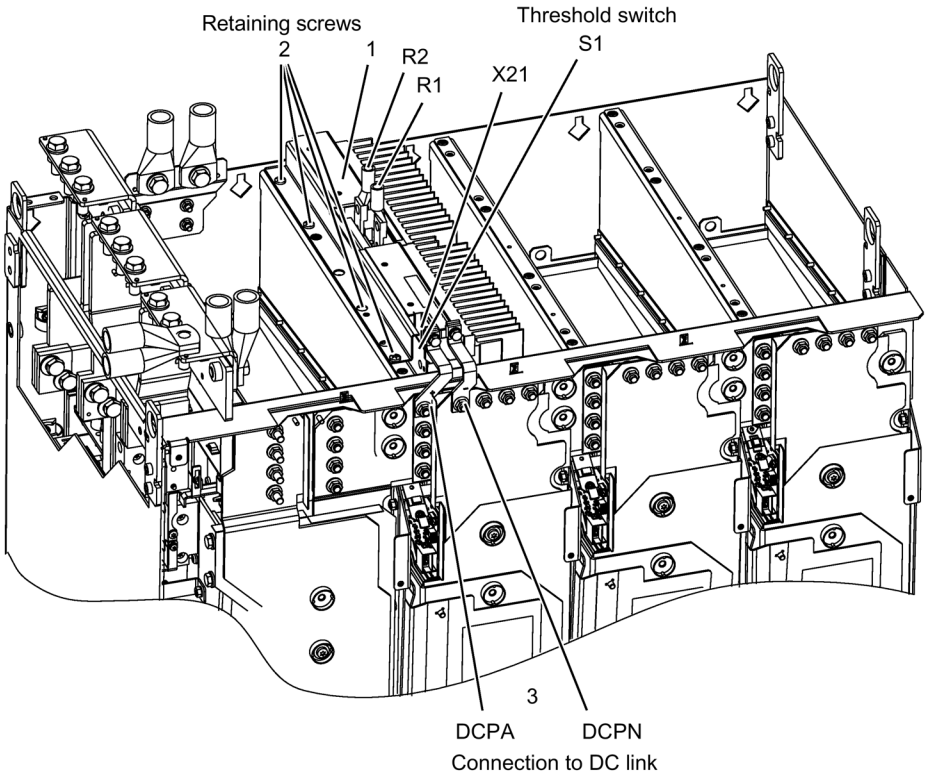


Figure 3-9 Installing the Braking Module in a Power Module frame size JX

Installing the Braking Module

The steps for the installation procedure are numbered in accordance with the figures in the diagram.

1. Insert the Braking Module.
2. Screw in the 4 retaining screws for securing the Braking Module.
3. Secure the connection clip to the DC link (DCPA / DCNA) with 2 screws (Braking Module connection) and 2 nuts (DC-link connection).

Note

Pay attention to the tightening torques

You must observe the tightening torques. Information on this can be found in the table in the "Mechanical installation" section

3.4 Installing the braking resistor

The braking resistor should not be installed in the vicinity of the converter. The following points must be taken into account:

- The braking resistors are only suitable for floor mounting.
- The maximum cable length between the Braking Module and braking resistor is 100 m.
- Sufficient space must be available for dissipating the energy converted by the braking resistor.
- A sufficient distance from flammable objects must be maintained.
- The braking resistor must be installed as a free-standing unit.
- Objects must not be placed on or anywhere above the braking resistor.
- The braking resistor should not be installed underneath fire detection systems, since these could be triggered by the resulting heat.
- For outdoor installation, a hood must be provided to protect the braking resistor from precipitation (in accordance with degree of protection IP20).

⚠WARNING

Fire as a result of inadequate installation

If incorrectly installed (non-observance of the cooling clearances or inadequate clearances to flammable objects), there is the danger of fire damage with death or severe injury.

- It is essential that you maintain a cooling clearance of 200 mm on all sides of the braking resistor with ventilation grills.
- Maintain sufficient clearance to objects that can burn.

⚠CAUTION

Burns due to a high surface temperature at the braking resistor

In operation, the braking resistor can reach high temperatures, which can cause burns if touched.

- Allow the braking resistor to cool down before starting any work.
- Use the appropriate personnel protection equipment, e.g. gloves.

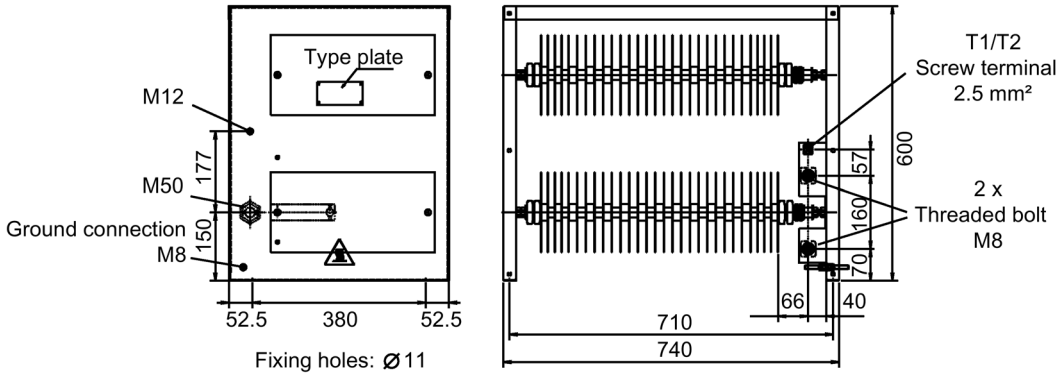


Figure 3-10 Dimension drawing for braking resistor (25 kW)

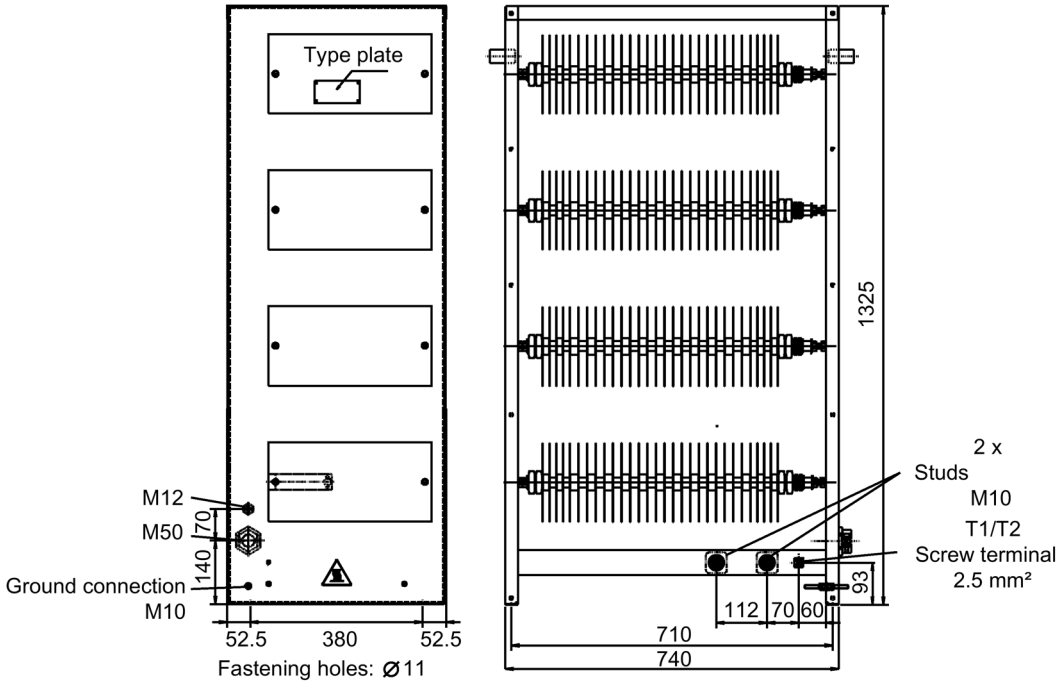


Figure 3-11 Dimension drawing for braking resistor (50 kW)

Connection

4

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.

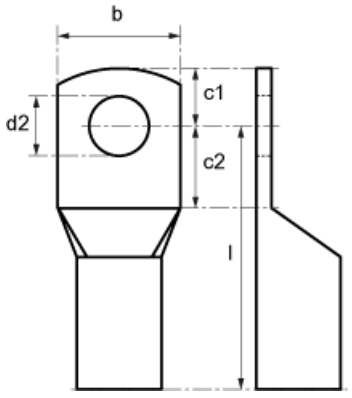


Figure 4-1 Dimensions of the cable lugs

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

4.2 Connecting the Braking Module

Interface overview

The Braking Module has the following interfaces:

- DC-link connection via flexible cables or a fixed busbar
- Braking resistor connection via flexible cables or a fixed busbar
- 1 digital input (inhibit Braking Module with high signal/acknowledge error with negative edge high -> low)
- 1 digital output (Braking Module defective / high signal = no fault)
- PE/protective conductor connection

Connection overview

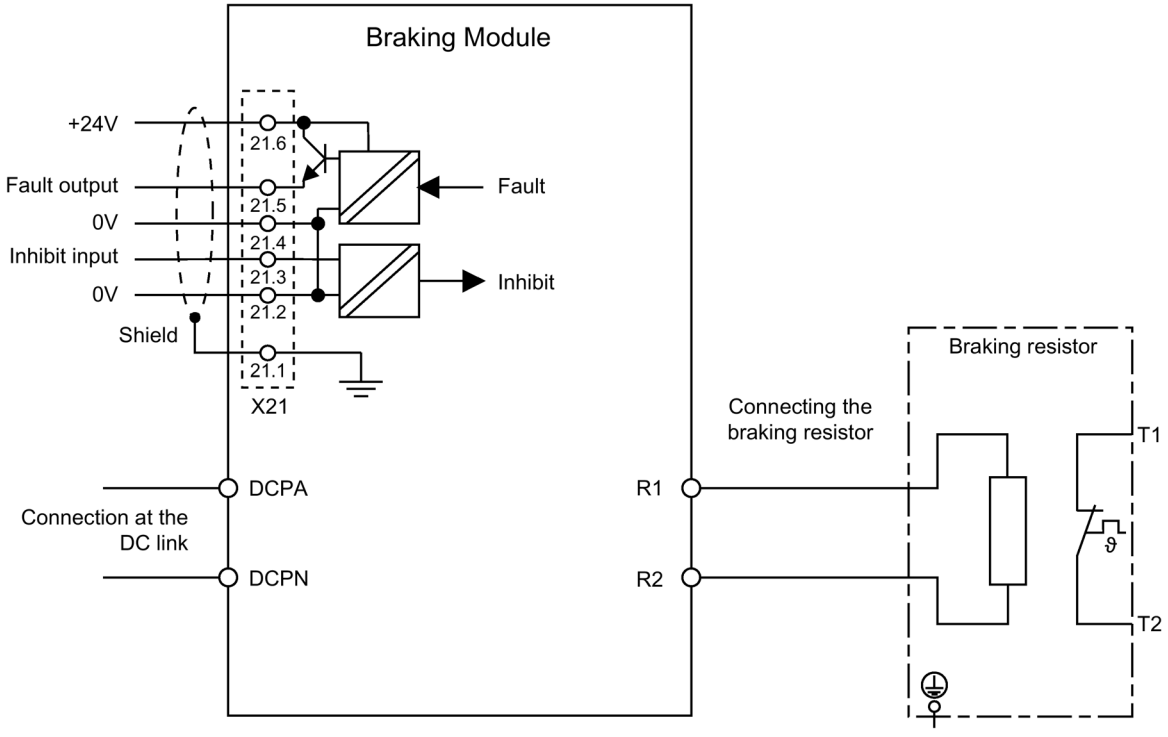


Figure 4-2 Connection overview for the Braking Module

Note

Common connection for the R1 and DCPA for sizes FX and GX

With Braking Modules for Power Modules of the sizes FX and GX, the interfaces R1 and DCPA are implemented via a shared connection.

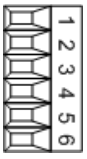
Braking resistor connection

Table 4- 2 Braking resistor connection

Terminal	Designation
R1	Braking resistor connection R+
R2	Braking resistor connection R-
Recommended connection cross-sections: For 25/125 kW: 35 mm², for 50/250 kW: 50 mm²	

Digital inputs/outputs X21

Table 4- 3 Terminal block X21

	Terminal	Designation [1]	Technical specifications
	1	Shield	Shield connection for terminals 2 ... 6
	2	0 V	High level: +15 V to 30 V Current consumption: 2 mA to 15 mA Low level: -3 V to 5 V
	3	DI inhibit input	
	4	0 V	High signal: No fault Low signal: Fault present Voltage: 24 VDC Load current: 0.5 A to 0.6 A
	5	DO fault output	
	6	+24 V	Voltage: +18 V to +30 V Typical current consumption (induced current consumption): 10 mA at 24 VDC
Max. connectable cross-section 1.5 mm²			

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

Note

Position of the terminals

When the Braking Module is installed, the individual terminals on its X21 terminal block are positioned as follows: terminal "1" is at the rear, terminal "6" at the front.

Note

Signal characteristics of terminal X21.3

Applying a high signal to terminal X21.3 inhibits the Braking Module. With a falling edge, pending fault codes are acknowledged.

Note

The Braking Module requires DC-link voltage so that the "No fault" message can be issued correctly.

Recommended connection for terminal strip X21

The signals of terminal strip X21 can be freely used corresponding to the line-side requirements.

In connection with the system components used and the default settings of the command sources during commissioning, the following recommendations for the wiring of the signals apply.

- X21:2 to CU X132:14 (mass)
- X21:3 on CU X132:9 (DO12 = acknowledge fault)
- X21:5 on CU X132:1 (DI4 = external fault 3)
- X21:6 on CU X132:13 (DO15 = P24V)

Parameterization

Table 4- 4 Parameterization

Sink			Source		
Parameters	**Description**	**DO**	**Parameters**	**Description**	**DO**
p1240	Vdc controller or Vdc monitoring configuration	Vector	0	Inhibit Vdc ctrl	
p2108	Ext. fault_3	Vector	r0722.4	DI 4 (X132.1)	CU
p3111	BI: External fault 3 enable	Vector	r0899.2	Operation enabled	Vector
p0728.12	Sets CU input or output: DI/DO 12 (X132.9)	CU	1	Sets DI/DO12 as output (corresponds to the default setting after commissioning and selection of p0700)	
p0742	BI: CU signal source for terminal DI/DO 12 (X132.9)	CU	r2138.7	Acknowledges the fault (corresponds to the default setting after commissioning and selection of p0700)	Vector

Note

Fault acknowledged with r2138.7 for the recommended wiring

If, during operation, an "Acknowledge fault" signal is initiated via terminal X21.3 in the braking chopper, without there being a fault in the Braking Module, then this initiates an external fault 3.

You can prevent this response by applying the following measures:

- Link the "Acknowledge fault" signal with status bit 3 "Fault active" of status word ZSW1 (r2139.3).
- If a fault is not active, then do not initiate an "Acknowledge fault" signal.

Threshold switch

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

⚠WARNING

Electric shock when operating the threshold switch

Operating the threshold switch when a voltage is present can cause death or serious injury.

- Only operate the threshold switch when the Power Module is switched off and the DC-link capacitors are discharged.

Table 4- 5 Response thresholds of the Braking Modules

Voltage	Response threshold	Switch position	Comment
3-phase 380 ... 480 VAC	673 V	1	774 V is the default factory setting. For line voltages of between 3-phase 380 and 400 VAC, the response threshold can be set to 673 V to reduce the voltage stress on the motor and converter. This does, however, reduce the possible braking power with the square of the voltage (673/774)² = 0.75. The maximum possible braking power is, therefore, 75%.
	774 V	2	
3-phase 500 ... 600 VAC	841 V	1	967 V is the default factory setting. With a supply voltage of 3-phase 500 VAC, the response threshold can be set to 841 V to reduce the voltage stress on the motor and converter. This does, however, reduce the possible braking power with the square of the voltage (841/967)² = 0.75. The maximum possible braking power is, therefore, 75%.
	967 V	2	
3-phase 660 ... 690 VAC	1070 V	1	1158 V is the default factory setting. With a supply voltage of 3-phase 660 VAC, the response threshold can be set to 1070 V to reduce the voltage stress on the motor and converter. This does, however, reduce the possible braking power with the square of the voltage (1070/1158)² = 0.85. The maximum possible braking power is, therefore, 85 %.
	1158 V	2	

Note

Positions of the threshold switches

The switch positions of the threshold switches of the Braking Modules are positioned on the panel as follows:

- Braking Modules for frame sizes FX and GX: position "1" is up; position "2" is down
- Braking Modules for frame sizes HX and JX: position "1" is back; position "2" is front

Note

"Overvoltage" fault

Even when the response threshold is set to a low value, the DC-link voltage can still reach the maximum voltage value (hardware shutdown threshold), thus triggering the "Overvoltage" fault. This can occur, for example, in cases where there is too much regenerative energy for the available braking power.

To prevent the DC-link voltage from exceeding the threshold, the Vdc-max controller must be enabled (p1240) and the device supply voltage set accordingly (p0210).

4.3 Connecting the braking resistor

⚠DANGER

Electric shock caused by the connected voltage and residual charge of the DC link capacitors on the braking module

Contact with live connections on the Braking Module can result in death or serious injury.

- Only connect the Braking Module after the Power Module has been disconnected from the power supply.
- Only connect the Braking Module after 5 minutes have elapsed. Measure the voltage before starting work on the DCP and DCN DC-link terminals.

⚠WARNING

Fire caused by ground fault / short-circuit for non-protected connections to the braking resistor

Inadequate installation of the cables to the braking resistor can result in a ground fault/short-circuit and place persons at risk as a result of the associated smoke and fire.

- Comply with local installation regulations that enable this fault to be ruled out.
- Protect the cables from mechanical damage.
- In addition, apply one of the following measures:
  - Use cables with double insulation.
  - Maintain adequate clearance, e.g. by using spacers.
  - Lay the cables in separate cable ducts or conduits.

NOTICE
Material damage when exceeding the maximum permitted cable length Exceeding the maximum permitted cable length to the braking resistor can cause material damage in the event of component failure. • The braking resistor connecting cables may not be longer than 100 m.

Recommended connection cross-sections:

- For 25/125 kW: 35 mm²
- For 50/250 kW: 50 mm²

Thermostatic switch

A thermostatic switch is installed to protect the braking resistor against overload. Its floating contacts must be integrated in the fault chain on site.

Table 4- 6 Thermostatic switch connection

Terminal	Description of function	Technical specifications
T1	Thermostatic switch connection	Voltage: 240 VAC Load current: Max. 10 A
T2	Thermostatic switch connection	

Max. connectable cross-section: 2.5 mm²

Integration of the thermostatic switch as release for switch-off via OFF2

The thermostatic switch must be connected to a free digital input of the SINAMICS G130 so that the converter is safely disconnected from the power supply if the braking resistor overheats. A digital input on the TM31 Terminal Module, on the TB30 Terminal Board or on the Control Unit can be used for this.

Subsequently the digital input must be used as release for a switch-off with OFF2. External fault 2). The interconnection can be made with the STARTER or via the AOP30.

Table 4- 7 Parameterizing the connection of the thermostatic switch at digital input 16 at the CU320-2 Control Unit

Sink			Source		
Parameter	**Description**	**DO**	**Parameter**	**Description**	**DO**
p2107	BI: External fault 2	Vector	r0722.16	CU digital inputs DI 16 (X122.5 / X120.3)	CU

Table 4- 8 Parameterizing the connection of the thermostatic switch at digital input 11 at Terminal Module TM31

Sink			Source		
Parameter	**Description**	**DO**	**Parameter**	**Description**	**DO**
p2107	BI: External fault 2	Vector	r4022.11	TM31 digital inputs DI/DO 11 (X541.5)	TM31

4.4 Disabling the Vdc-max controller

The Vdc-max controller must be switched off (p1240 = 0) when a brake chopper is used.

Maintenance and servicing

5

Maintenance and servicing are not carried out for the Braking Module and braking resistor. If a fault occurs, the Braking Module and/or braking resistor must be replaced.

Technical specifications

6

General technical data

Table 6- 1 General technical data

Product standard	EN 61800-5-1		
Ambient conditions	Storage	Transport	Operation
Ambient temperature	-25 ... +70 °C	-25 ... +70 °C	0 ... +50 °C
Relative air humidity [1] (condensation not permissible) corresponds to class	5 ... *95 %* 1K4 acc. to EN 60721-3-1	5 ... 95% at 40 °C 2K3 to EN 60721-3-2	5 ... *95 %* 3K3 to EN 60721-3-3
Mechanical strength	Storage	Transport	Operation
Vibrational load [1] - Displacement - Acceleration corresponds to class	 1.5 mm at *5* ... 9 Hz 5 m/s² at > 9 ... 200 Hz 1M2 to EN 60721-3-1	 3.5 mm at *5* ... 9 Hz 10 m/s² at > 9 ... 200 Hz 2M2 to EN 60721-3-2	 0.075 mm at 10 ... 58 Hz 10 m/s² at >58 ... 200 Hz -
Shock load [1] - Acceleration corresponds to class	 40 m/s² at 22 ms 1M2 to EN 60721-3-1	 100 m/s² at 11 ms 2M2 to EN 60721-3-2	 100 m/s² at 11 ms 3M4 to EN 60721-3-3

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

[1] The EN standards specified are the European editions of the international IEC standards with the same designations.

Detailed technical specifications for the Braking Module

Table 6- 2 Technical specifications of Braking Module, 380 V – 480 V 3 AC

Braking Module 6SL3300-	1AE31-3AA0	1AE32-5AA0	1AE32-5BA0
P_{DB} power (rated power)	25 kW	50 kW	50 kW
P_{15} power	125 kW	250 kW	250 kW
P_{20} power	100 kW	200 kW	200 kW
P_{40} power	50 kW	100 kW	100 kW
Variable response thresholds	774 V (673 V)	774 V (673 V)	774 V (673 V)
Digital input			
Voltage	-3 V to 30 V		
Low level (an open digital input is interpreted as "low")	-3 V to 5 V		
High level	15 V to 30 V		
Typical current consumption (at 24 V DC)	10 mA		
Max. connectable cross-section	1.5 mm²		
Digital output (continuously short-circuit proof)			
Voltage	24 V DC		
Max. load current of the digital output	500 mA		
Max. connectable cross-section	1.5 mm²		
Version in acc. with:	UL and IEC	UL and IEC	UL and IEC
R1/R2 connection	M8 screw	M8 screw	M8 screw
Max. connection cross-section R1/R2	35 mm²	50 mm²	50 mm²
Suitable for installation in a Power Module with frame size	FX	GX	HX/JX
Weight, approx.	3.6 kg	7.3 kg	7.5 kg

Table 6- 3 Technical specifications of Braking Module, 500 V – 600 V 3 AC

Braking Module 6SL3300-	**1AF32-5AA0**	**1AF32-5BA0**
P_{DB} power (rated power)	50 kW	50 kW
P_{15} power	250 kW	250 kW
P_{20} power	200 kW	200 kW
P_{40} power	100 kW	100 kW
Variable response thresholds	967 V (841 V)	967 V (841 V)
Digital input		
Voltage	-3 V to 30 V	
Low level (an open digital input is interpreted as "low")	-3 V to 5 V	
High level	15 V to 30 V	
Typical current consumption (at 24 V DC)	10 mA	
Max. connectable cross-section	1.5 mm²	
Digital output (continuously short-circuit proof)		
Voltage	24 V DC	
Max. load current of the digital output	500 mA	
Max. connectable cross-section	1.5 mm²	
Version in acc. with:	UL and IEC	UL and IEC
R1/R2 connection	M8 screw	M8 screw
Max. connection cross-section R1/R2	50 mm²	50 mm²
Suitable for installation in a Power Module with frame size	GX	HX/JX
Weight, approx.	7.3 kg	7.5 kg

Table 6- 4 Technical specifications of Braking Module, 660 V – 690 V 3 AC

Braking Module 6SL3300-	1AH31-3AA0	1AH32-5AA0	1AH32-5BA0
P_{DB} power (rated power)	25 kW	50 kW	50 kW
P_{15} power	125 kW	250 kW	250 kW
P_{20} power	100 kW	200 kW	200 kW
P_{40} power	50 kW	100 kW	100 kW
Variable response thresholds	1,153 V (1,070 V)	1,153 V (1,070 V)	1,153 V (1,070 V)
Digital input			
Voltage	-3 V to 30 V		
Low level (an open digital input is interpreted as "low")	-3 V to 5 V		
High level	15 V to 30 V		
Typical current consumption (at 24 V DC)	10 mA		
Max. connectable cross-section	1.5 mm²		
Digital output (continuously short-circuit proof)			
Voltage	24 V DC		
Max. load current of the digital output	500 mA		
Max. connectable cross-section	1.5 mm²		
Version in acc. with:	IEC	IEC	IEC
R1/R2 connection	M8 screw	M8 screw	M8 screw
Max. connection cross-section R1/R2	35 mm²	50 mm²	50 mm²
Suitable for installation in a Power Module with frame size	FX	GX	HX/JX
Weight, approx.	3.6 kg	7.3 kg	7.5 kg

Detailed technical specifications for the braking resistor

Table 6- 5 Technical specifications of braking resistor, 380 V – 480 V 3 AC

Braking resistor	6SL3000-1BE31-3AA0	6SL3000-1BE32-5AA0
P_{DB} power (rated power)	25 kW	50 kW
P_{15} power	125 kW	250 kW
P_{20} power	100 kW	200 kW
P_{40} power	50 kW	100 kW
Resistance	4,4 Ω (± 7.5%)	2.2 Ω (± 7.5%)
Maximum current	189 A	378 A
Max. connectable cross-section	50 mm²	70 mm²
Cable entry	Via M50 cable gland	Via M50 cable gland
Power connection	Via M8 bolt-type screw terminal	Via M10 bolt-type screw terminal
Degree of protection	IP20	IP20
Width x height x depth	740 x 605 x 485 mm	810 x 1325 x 485 mm
Weight, approx.	50 kg	120 kg

Table 6- 6 Technical specifications of braking resistor, 500 V – 600 V 3 AC

Braking resistor	6SL3000-1BF31-3AA0	6SL3000-1BF32-5AA0
P_{DB} power (rated power)	25 kW	50 kW
P_{15} power	125 kW	250 kW
P_{20} power	100 kW	200 kW
P_{40} power	50 kW	100 kW
Resistance	6.8 Ω (±7.5%)	3.4 Ω (± 7.5%)
Maximum current	153 A	306 A
Max. connectable cross-section	50 mm²	70 mm²
Cable entry	Via M50 cable gland	Via M50 cable gland
Power connection	Via M8 bolt-type screw terminal	Via M10 bolt-type screw terminal
Degree of protection	IP20	IP20
Width x height x depth	740 x 605 x 485 mm	810 x 1325 x 485 mm
Weight, approx.	50 kg	120 kg

Table 6- 7 Technical specifications of braking resistor, 660 V – 690 V 3 AC

Braking resistor	6SL3000-1BH31-3AA0	6SL3000-1BH32-5AA0
P_{DB} power (rated power)	25 kW	50 kW
P_{15} power	125 kW	250 kW
P_{20} power	100 kW	200 kW
P_{40} power	50 kW	100 kW
Resistance	9.8 Ω (±7.5%)	4.9 Ω (± 7.5%)
Maximum current	127 A	255 A
Max. connectable cross-section	50 mm²	70 mm²
Cable entry	Via M50 cable gland	Via M50 cable gland
Power connection	Via M8 bolt-type screw terminal	Via M10 bolt-type screw terminal
Degree of protection	IP20	IP20
Width x height x depth	740 x 605 x 485 mm	810 x 1325 x 485 mm
Weight, approx.	50 kg	120 kg

Duty cycle

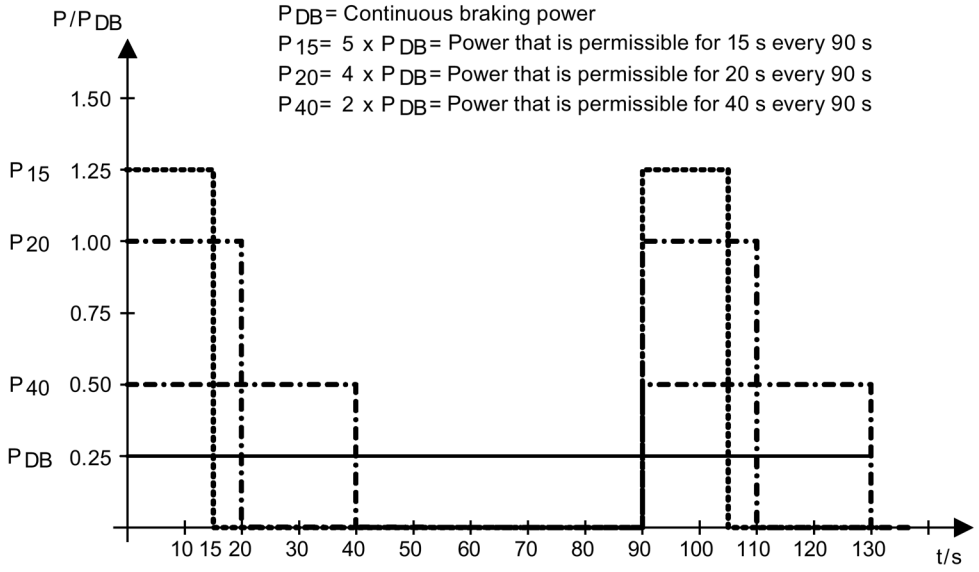


Figure 6-1 Duty cycles for braking resistors

Additional information

Siemens:
www.siemens.com

Industry Online Support (service and support):
www.siemens.com/online-support

IndustryMall:
www.siemens.com/industrymall

Siemens AG
Process Industries and Drives
Large Drives
Postbox 4743
90025 Nuremberg
Germany

Scan the QR-Code for product information