



## **Hardware and Engineering**

### **DE 4-BU4-1 Brake Unit**

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#### **03/98 AWB 823-1291 GB**

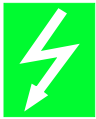
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**Caution!**

**Dangerous Electrical Voltage!**

### **Before commencing the installation**

- Disconnect the power supply of the device.
- Ensure that devices cannot be accidentally restarted.
- Verify isolation from the supply.
- Earth and short circuit.
- Cover or enclose neighbouring units that are live.
- Follow the engineering instructions (AWA) of the device concerned.
- Only suitably qualified personnel may work on this device/system.
- Before installation and before touching the device ensure that you are free of electrostatic charge.
- Connecting cables and signal lines should be installed so that inductive or capacitive interference do not impair the automation functions.
- Install automation devices and related operating elements in such a way that they are well protected against unintentional operation.
- Suitable safety hardware and software measures should be implemented for the I/O interface so that a line or wire breakage on the signal side does not result in undefined states in the automation devices.
- Ensure a reliable electrical isolation of the low voltage for the 24 volt supply. Only use power supply units complying with IEC 60 364-4-41 or HD 384.4.41 S2.
- Deviations of the mains voltage from the rated value must not exceed the tolerance limits given in the specifications, otherwise this may cause malfunction and dangerous operation.
- Emergency stop devices complying with IEC/EN 60 204-1 must be effective in all operating modes of the automation devices. Unlatching the emergency-stop devices must not cause uncontrolled operation or restart.
- Devices that are designed for mounting in housings or control cabinets must only be operated and controlled after they have been installed with the housing closed. Desktop or portable units must only be operated and controlled in enclosed housings.
- Measures should be taken to ensure the proper restart of programs interrupted after a voltage dip or failure. This should not cause dangerous operating states even for a short time. If necessary, emergency-stop devices should be implemented.
- According to their degree of protection frequency inverters may feature during operation live, bright metal, or possibly moving, rotating parts or hot surfaces.
- The impermissible removal of the necessary covers, improper installation or incorrect operation of motor or frequency inverter may cause the failure of the device and may lead to serious injury or damage.
- The relevant national regulations apply to all work carried on live frequency inverters.
- The electrical installation must be carried out in accordance with the relevant regulations (e. g. with regard to cable cross sections, fuses, PE).

- All work relating to transport, installation, commissioning and maintenance must only be carried out by qualified personnel. (IEC 60 364 and HD 384 and national work safety regulations).
- Installations fitted with frequency inverters must be provided with additional monitoring and protective devices in accordance with the relevant safety regulations etc. Modifications to the frequency inverters using the operating software are permitted.
- All shrouds and doors must be kept closed during operation.
- In order to reduce hazards to persons or equipment, the user must include in the machine design measures that restrict the consequences of a malfunction or failure of the drive (increased motor speed or sudden standstill of motor). These measures include:
  - Other independent devices for monitoring safety-related variables (speed, travel, end positions etc.)
  - Electrical or non-electrical system related measures (interlocks or mechanical interlocks).
  - Live parts or cable connections of the frequency inverter must not be touched after it has been disconnected from the power supply due to the charge in capacitors. Appropriate warning signs must be provided.

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## About This Manual

This manual contains the information you need to install, connect up and operate the brake unit DE 4-BU4-1.

The information in this manual only applies to the specified hardware versions.

The manual uses the following abbreviations and symbols:

Drive system:

Variable speed drive system which contains a brake unit and other Moeller drive components.



This symbol refers to interesting tips and additional information.

- ▶ This symbol indicates steps of work that you need to carry out.



### **Attention!**

This symbol warns you about instructions which should be observed to avoid possible damage to equipment, other items in the vicinity or data.



### **Warning!**

This symbol warns you about instructions which should be observed to avoid possible severe damage to or destruction of equipment, other items in the vicinity or data. It also refers to information which should be observed to avoid possible serious injury or death to operating personnel.



# 1 About This Product

## System overview

The brake unit DE 4-BU4-1 is an optional accessory for the DF 4 series frequency inverters.

The generic type code for brake units shows its position among the Moeller family of products:

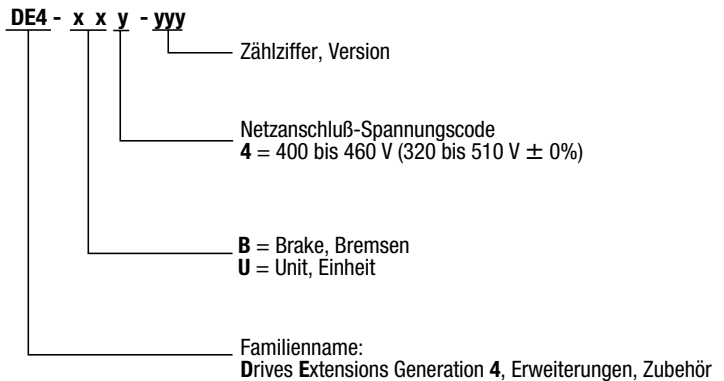


Figure 1: Type code for brake units

In generator mode, i.e. when braking, the frequency-controlled motor feeds energy back to the frequency inverter's internal DC bus. This increases the DC bus voltage  $U_{ZK}$ . If the maximum admissible DC bus voltage is exceeded, the frequency inverter triggers the controller inhibit and the motor can no longer be braked in a controlled way.



## About This Product

This can be avoided by connecting a brake unit in parallel with the frequency inverter's internal DC bus. The external high-power resistor of the DE 4-BU4-1 brake unit converts braking energy to heat. This prevents overvoltage in the DC bus and allows the motor to be braked in a controlled way.

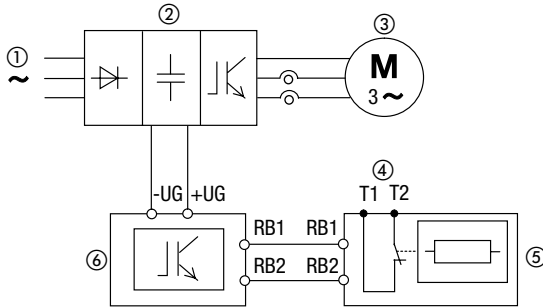


Figure 2: Block diagram of the brake unit

- ① Mains input voltage ( $U_{LN}$ )
- ② Frequency inverter DF 4
- ③ Variable speed motor
- ④ Temperature monitoring switch for the braking resistor
- ⑤ External braking resistor
- ⑥ Brake unit DE 4-BU4-1

**Features of the brake unit**

The brake unit DE 4-BU4-1 has the following features:

<b>DE 4-</b>	<b>-BU4-1</b>
Compact design	✓
Simple assembly	yes
Operating status LEDs	2
Temperature monitoring switch	✓
Braking resistor	external
Very short braking times possible	✓
Usable for: Braking with high peak braking power Braking with high continuous braking power	✓ ✓
Switching point configurable with internal switches for: mains input voltage 230 V AC mains input voltage 400 to 460 V AC mains input voltage 480 V AC	✓ ✓ ✓
Parallel operation of several brake units	✓
Synchronisation of several brake units connected in parallel via built-in interface	✓
UL approval UL 508, File No. 132659 (listed)	✓

**Admissible environmental conditions**

**Installation height:**

Can be operated at full rated power up to 1000 m above sea level; from 1000 m to 4000 m the rated power drops by 5% per 1000 m additional height.

**Moisture:**

Moisture class F non-condensing (average relative humidity 85%)

**Protection class:**

IP 10

IP 20 with terminal cover fitted

NEMA 1: protection against electric shock

## About This Product

### **Degree of pollution:**

VDE 0110 part 2 degree of pollution 2

### **Insulation class:**

Overvoltage category III to VDE 0110

### **Temperature:**

Operation     $T = 0\text{ }^{\circ}\text{C}$  to  $+40\text{ }^{\circ}\text{C}$  at rated power; above  $+40\text{ }^{\circ}\text{C}$  to  $T_{\text{max}} = +50\text{ }^{\circ}\text{C}$  the rated power drops by 2 % per  $^{\circ}\text{C}$  temperature increase.

Storage       $T = -25\text{ }^{\circ}\text{C}$  to  $+70\text{ }^{\circ}\text{C}$

Transport     $T = -25\text{ }^{\circ}\text{C}$  to  $+70\text{ }^{\circ}\text{C}$

## **Intended use**

Brake units are electrical components for installation in closed equipment rooms or switchgear cabinets and meet the protection requirements of the EU Low-Voltage Directive.

The brake unit DE 4-BU4-1 may be used as an accessory for the DF 4 series frequency inverters.

Drive systems with the DE 4-BU4-1 brake unit meet the requirements of the EU EMC Directive if they are installed as described under “EMC measures” in the manual for the DF-4 series frequency inverters.

Brake units are components

to install in a machine

to assemble with other components to form a machine.

The DE 4-BU4-1 brake unit:

is not a household device but is a component which is solely for use in commercial applications;

is not a machine as covered by the EU Machine Directive.

The brake unit may only be used when it is in perfect working order.

Any changes or modifications to the brake unit are forbidden.

You may only use the brake unit under the specified conditions of use which are described in this manual.

The manual must be made available to operating personnel in its entirety and should be in good readable condition.

During operation of the equipment, the manual should always be available in the vicinity of the brake unit for reference by operating personnel.

All personnel who work on or with the brake unit must have ready access to the manual during their work.

Read the entire manual carefully before starting the work and observe the relevant information and warnings.

## About This Product

Suitable measures should be provided to ensure that there is no danger to operating personnel or risk of damage to equipment if a failure of the brake unit should occur.

The user of the equipment is responsible for ensuring that the machine application complies with the relevant EU Directives.

All other usage is forbidden.

### **Persons responsible for safety**

At the timepoint of initial delivery, the brake unit complies with the current state of the art and is safe to use without exception.

The brake unit can present a hazard if:

- unskilled persons work on or with the brake unit;
- The brake unit is improperly used.

### **Operator**

The operator is any natural or legal person that uses the brake unit or for whom the brake unit is used on his/her order.

The operator and/or his/her safety officer must ensure that

- all regulations, warnings and national laws are observed;
- only qualified personnel are allowed to work on or with the brake unit;
- this manual is available to operating personnel during all phases of work;
- unauthorised persons are prevented from accessing and working on or with the brake unit.

### **Qualified personnel**

Qualified personnel includes persons who, as a result of their training, experience and instruction and their knowledge of the relevant standards, regulations, safety standards and the operational environment have been authorised by the person responsible for the safety of the equipment to perform the required work and are able to recognise and avoid potential dangers (definition of qualified operators from VDE 105 or IEC 364).

Please contact the relevant Moeller Branch Office if you have any questions or problems.

### **Transport, recycling**

The DE 4-BU4-1 brake unit has been carefully packed and prepared for shipment.

After receiving the delivery,

- check whether the packaging has been damaged externally;

- check whether the details on the delivery note match your original order

Open the packaging with suitable tools and check whether:

- parts have been damaged during transport;

- the equipment corresponds to the model which you ordered;

- the assembly instructions are also present.

In case of damage, incomplete or incorrect shipment, please make your claim directly to the sales office which is responsible.

## About This Product

The brake unit is manufactured from a variety of materials.

The following materials can be recycled:

metal;

plastic;

assembly Instructions



The assembled printed circuit boards are manufactured from materials which need to be recycled separately.

## 2 Engineering



The process engineering information and example circuit diagrams described in this manual are suggestions. Their suitability for the respective application must be checked by the user.

Engineering considerations for the brake unit should ensure that it meets its intended function when the equipment operates correctly and that it does not present any danger to operating personnel when:

- it is correctly installed,

- it is used as intended,

- it functions correctly together with the rest of the equipment.

You should limit the consequences of malfunction to minimise the danger to operating personnel and the risk of damage to equipment by:

- providing additional, independent devices which carry out the same function as the brake unit in case of malfunction,

- installing electrical and mechanical protective devices (interlocks, mechanical locks,...) for the drive system,

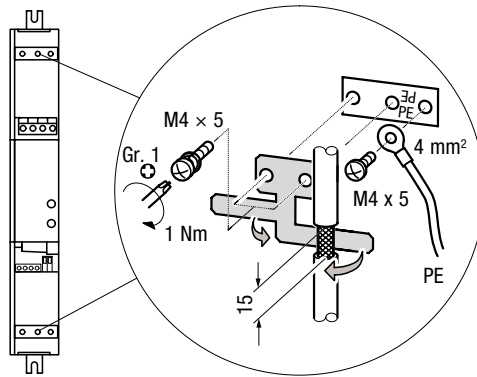
- implementing safety measures for the overall system.



The cables must be screened:

in order to satisfy the relevant standards,  
if radio interference suppression is required to  
EN 55011 (limiting class A or B).

The effectiveness of cable screening depends on  
a good earth connection to the screening and  
a low screen impedance.



Connect the screening of the cable between the  
frequency inverter and the brake unit to the mounting  
plate at both ends of the cable using a large-area  
contact surface.

Only use screens with tinned or nickel plated copper  
braiding; screens from steel braiding are unsuitable.  
The degree of cover of the screen braiding must be  
at least 70% to 80% and the braiding angle should  
be 90°.

## Cable cross-sections and cable lengths

The cable types used must comply with the appropriate regulations at the installation site.



Always observe the regulations on the minimum cross-section of the PE cables to use. The cross-section of the PE conductor must be at least as large as that of the power cables.

The information on cable cross-sections applies to:  
installation in switchgear cabinets and machines,  
cable installation in cable ducts,  
maximum ambient temperature +40 °C.

Choose the cable cross-sections in order to satisfy the relevant regulations.



The recommended cable cross-section for the feed cables +UG and -UG for the DE 4-BU4-1 brake unit is 6 mm<sup>2</sup>.

The user is responsible for satisfying further standards (e.g. VDE 0113, VDE 0289).

The maximum admissible length of the cables between the frequency inverter and the brake unit is 2 m.



If the brake unit is connected directly to the frequency inverter and the cable lengths are < 0.5 m, the connections can be made using unshielded single-core cable.

**Fuses**

The provision of fuses for the DC bus is recommended (see Figure 8 on page 23 for an example). The rated voltages of the fuses must be chosen according to the DC bus voltage. If fuses are used, they should meet the following specifications.

Type	DE 4-BU4-1
Safety fuses	VDE 50 A (UL 40 A K5)
Cable cross-section	6 mm <sup>2</sup> (AWG 10)

**Temperature monitoring**

The temperature switch of the external high-power braking resistor operates as soon as the maximum admissible temperature of the resistor has been exceeded. The temperature switch should be used e.g. to disconnect the frequency inverter from the power supply if the maximum admissible temperature has been exceeded or to trigger controller inhibit for all connected frequency inverters.



**Attention!**

The temperature monitoring is necessary to ensure that the frequency inverter is shut down correctly in case of a fault. Otherwise, the frequency inverter will trigger the controller inhibit due to overvoltage and the motor will coast to a halt without being braked in a controlled way.

The external high-power braking resistor can get very hot in case of faults; in extreme cases it may burn out, for example as a result of:

- mains supply overvoltage,
- application-specific overload, or
- an internal fault.

Mount the braking resistor in such a way that surrounding equipment is not damaged if very high temperatures are reached.

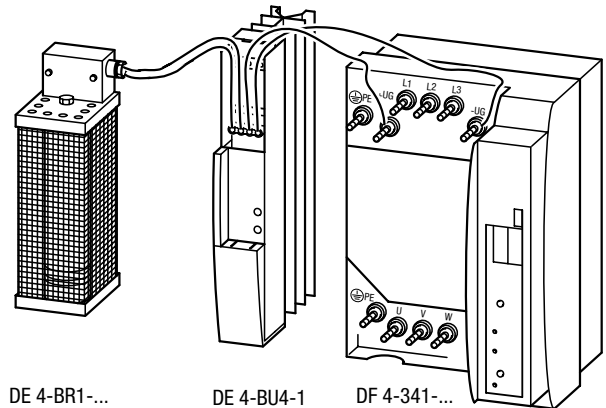


Figure 3: Arrangement of brake unit, external high-power braking resistor and frequency inverter

## Standard installation



The screening and the installation must be EMC compliant as described under “EMC measures” in the manual for the DF-4 series frequency inverters.



**Warning!**

S1 and S2 inside the DE4-BU4-1 carry lethal voltages. Wait at least 3 minutes after switching off the power before operating these switches. There is a risk of fatal injury if this precaution is not observed.

Required settings of S1 and S2 inside the DE4-BU4-1 :

Mains feed	230 V
Switching point	375 V
S 1	OFF
S 2	OFF

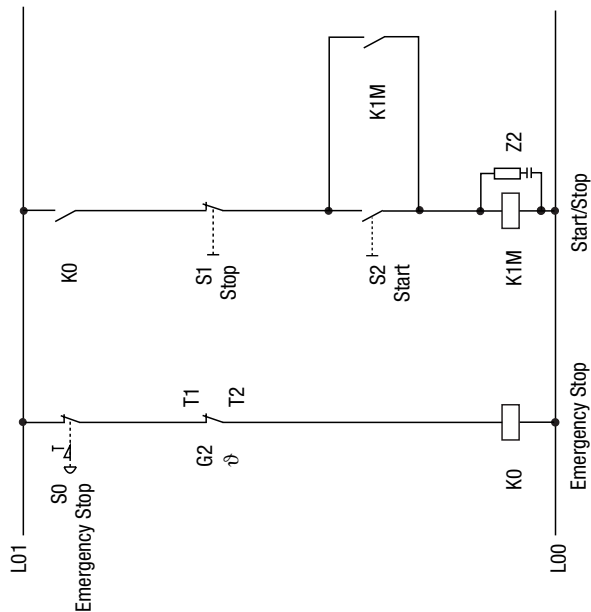
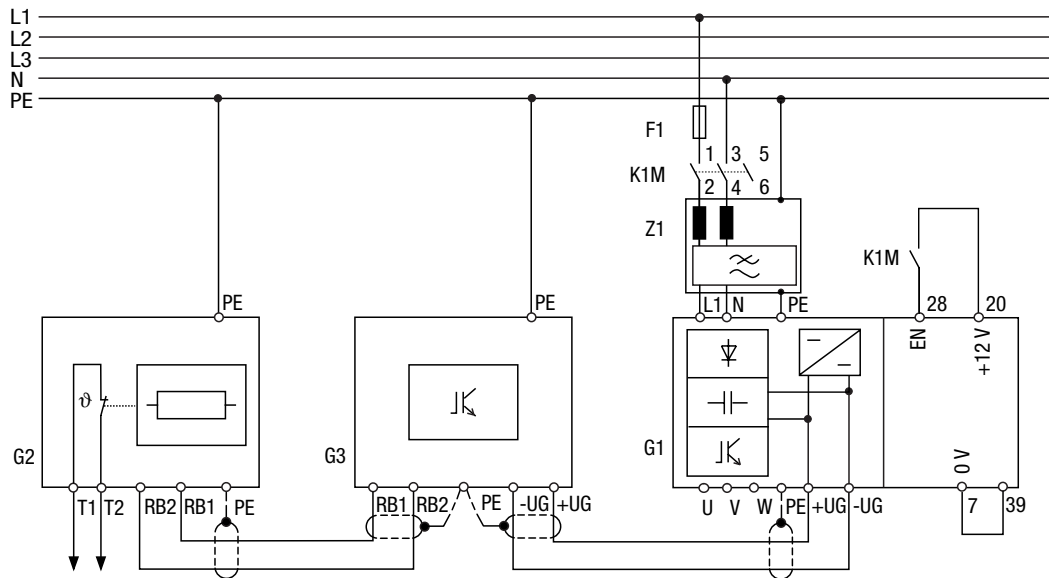


Figure 4: Control wiring of the DE 4-BU4-1 brake unit with the DF 4-120 frequency inverter

Figure 5: Power wiring of the DE 4-BU4-1 brake unit



- |                        |                      |
|------------------------|----------------------|
| G2: Braking resistor   | F1: Mains fuse       |
| G3: Brake unit         | K1M: Mains contactor |
| G1: Frequency inverter | Z1: Mains filter     |

Standard installation



The screening and the installation must be EMC compliant as described under “EMC measures” in the manual for the DF-4 series frequency inverters.



**Warning!**

S1 and S2 inside the DE4-BU4-1 carry lethal voltages. Wait at least 3 minutes after switching off the power before operating these switches. There is a risk of fatal injury if this precaution is not observed.

Required settings of S1 and S2 inside the DE4-BU4-1:

Mains feed	400 to 460 V	480 V
Switching point	725 V	765 V
S1	ON	ON
S2	OFF	ON

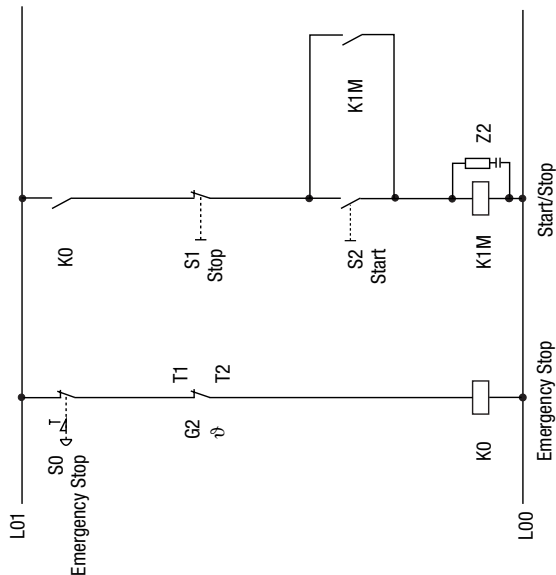
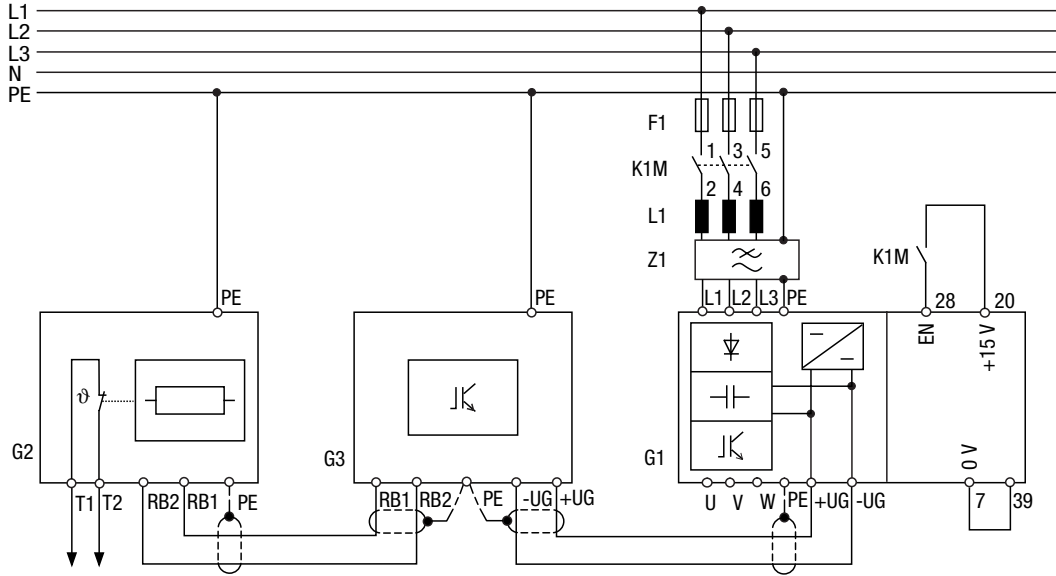


Figure 6: Control wiring of the DE 4-BU4-1 brake unit with the DF 4-34x series frequency inverters

Figure 7: Power wiring of the DE 4-BU4-1 brake unit with the DF 4-34x series frequency inverters



- |  |                                 |
|--|---------------------------------|
| G2: Braking resistor                   | K1M: Mains contactor            |
| G3: Brake unit                         | L1: Mains choke                 |
| G1: Frequency inverter<br>interference | Z1: Radio<br>suppression filter |
| F1: Mains fuses                        |                                 |



## Parallel connection of brake units

You can connect two or more DE 4-BU4-1 brake units in parallel if the power rating of a single brake unit is insufficient for the required braking power.

Each brake unit to be operated in parallel is connected to the +UG and –UG terminals of the frequency inverter. No cable screening is required if the total length of the cables is  $< 0,5$  m.

You must connect a braking resistor to the RB1 and RB2 terminals of each brake unit.

Connect the temperature monitoring terminals T1, T2 for all braking resistors in series and connect them to the controller inhibit terminal of the frequency inverter (see Figure 8 on page 23).



If you connect braking resistors in parallel, make sure that you do not exceed the specifications for minimum braking resistor value (see “Specifications” on page 39)

If you connect brake units in parallel, make sure that you connect them such that they will be switched on and off simultaneously.



### Attention!

Interconnect the synchronisation terminals and set the switching points of all brake units.

Interconnect the synchronisation terminals of all brake units as follows:

Connect synchronisation output A1 to synchronisation input E1 of the next brake unit

Connect synchronisation output A2 to synchronisation input E2 of the next brake unit

See Figure 10 on page 25 for an example of interconnecting the synchronisation terminals.



**Warning!**

S1 and S2 inside the DE 4-BU-1 carry lethal voltages. Wait at least 3 minutes after switching off the power before operating these switches. There is a risk of fatal injury if this precaution is not observed.

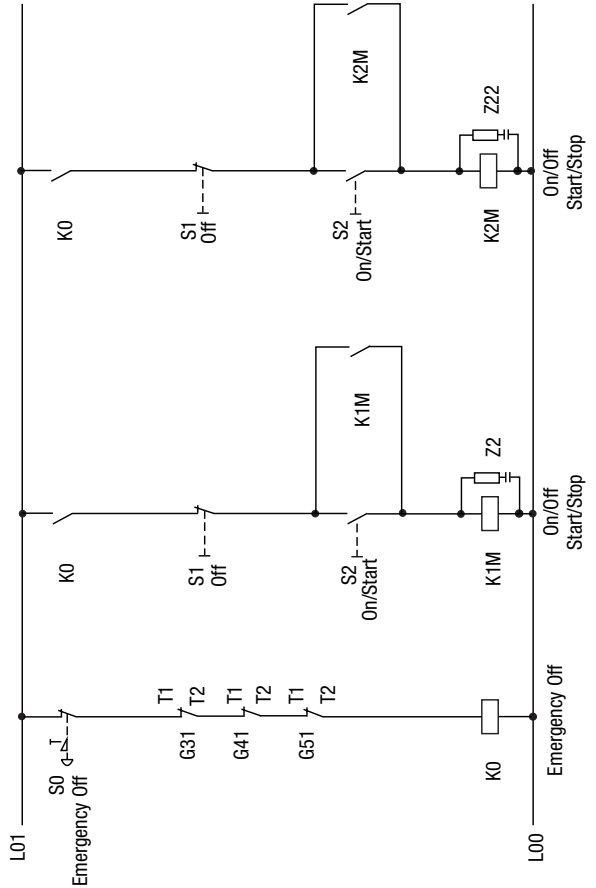


Figure 8: Control wiring with brake units in parallel and frequency inverters with interconnected DC bus

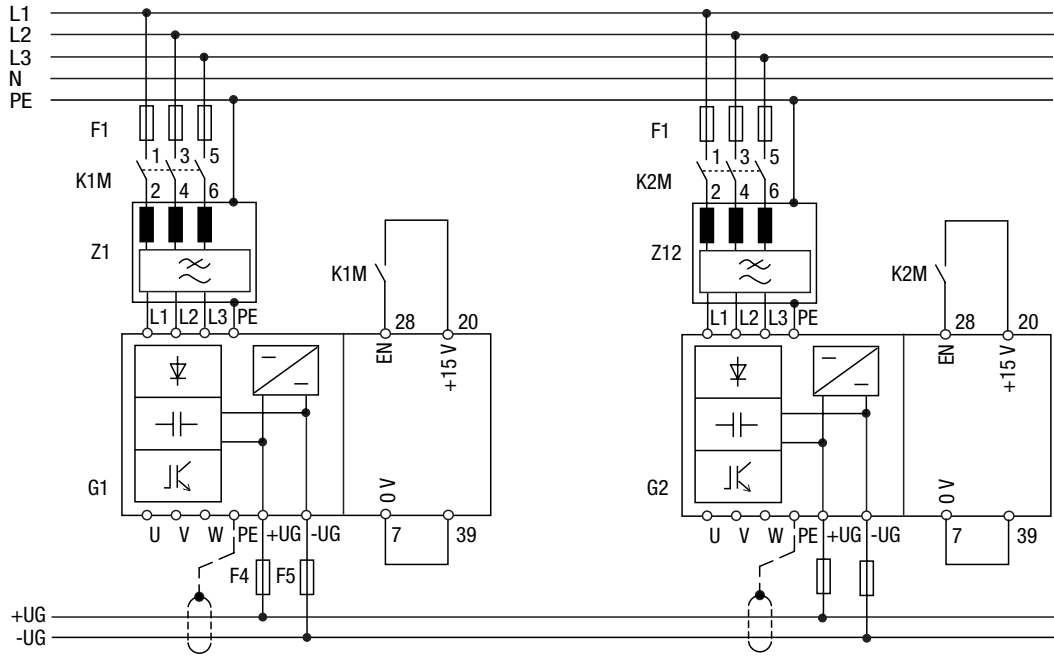


Figure 9: Power wiring for frequency inverters with interconnected DC bus

- G1, G2, Frequency inverter
- F1 Mains fuses for the frequency inverters
- F4, F5 DC bus fuses (recommended)
- K1M, K2M Mains contactors for the frequency inverters
- Z1, Z12 Mains filter (choke with integrated radio interference suppression filter)

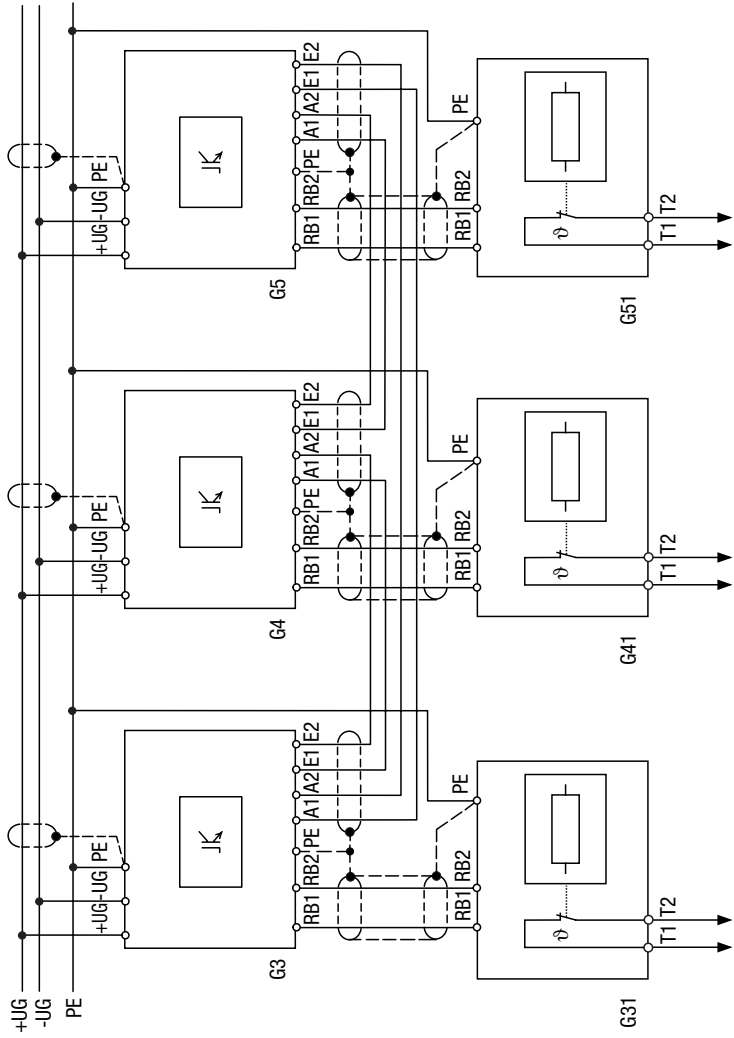


Figure 10: Power wiring for brake units connected in parallel

G3, G4, G5 Brake units  
G31, G41, G51 Braking resistors



### 3 Assembly/Installation

#### Scope of delivery

After receiving the equipment, check immediately whether the delivered items match the delivery documents. Moeller cannot be responsible for guarantee claims made at a later date.

The following components are supplied with the brake unit:

- DE 4-BU4-1 brake unit
- plug-in screw terminal
- mounting strips (one pair)
- assembly instructions with the reference number AWA 823-1569

#### Making claims:

If there is any visible transport damage, please contact the supplier immediately.

If there are any visible faults or if some of the items are missing, please contact your local Moeller agent immediately.

#### Installation in a switchgear cabinet



If the brake unit is installed at locations which are subject to continuous vibration or mechanical shock, you should consider the use of vibration damping devices

## Assembly/Installation

In order to avoid overheating:

- ensure that the cooling air supply and the cooling air exhaust can flow freely without obstruction;
- do not install other equipment which generates large amounts of heat close to the brake unit;
- ensure that there is a clearance of 100 mm above and below the brake unit since otherwise the temperature of the cooling air can increase to over 40 °C.

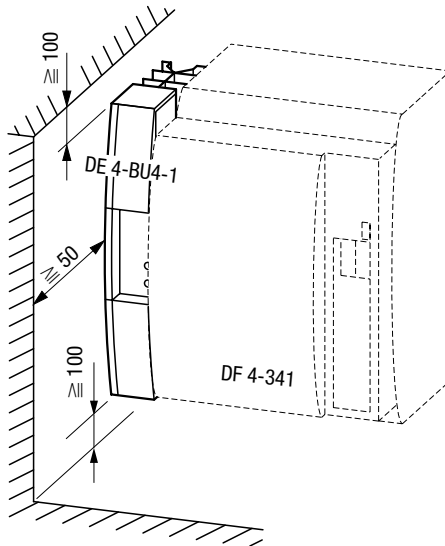


Figure 11: Necessary clearances for the brake unit



**Attention:**

Only install the brake unit as a complete unit; do not dismantle.

Provide appropriate countermeasures in the case of:

- cooling air which is polluted with dust, fluff or fat. This can cause short-circuits on the printed circuit board (install filters, use a separate ventilation air supply),
- aggressive gases. They can etch the tracks on printed circuit boards (install filters, use a separate ventilation air supply), and
- dirty filters. This can lead to overheating (clean all filters regularly)

**Mounting angle**

The maximum admissible angle of tilt for the brake unit is 30°.

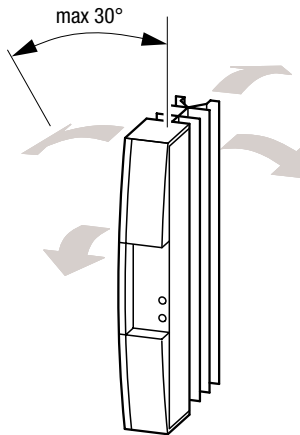


Figure 12: Mounting angle of the brake unit



### Mounting the brake unit

The brake unit can be attached to a mounting plate in the switchgear cabinet.

The brake unit should be mounted vertically with the power connections at the top (see also Figure 3 on page 17).

In order to attach the brake unit to a mounting plate, use the supplied pair of mounting strips.

- ▶ Slide each mounting strip into the guide at the rear of the brake unit until it engages with an audible click.

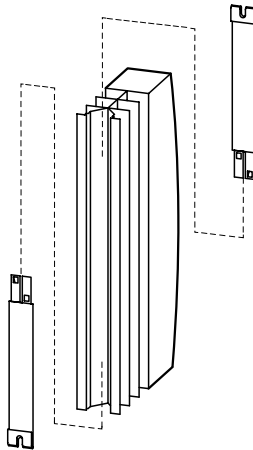


Figure 13: Inserting the mounting strips

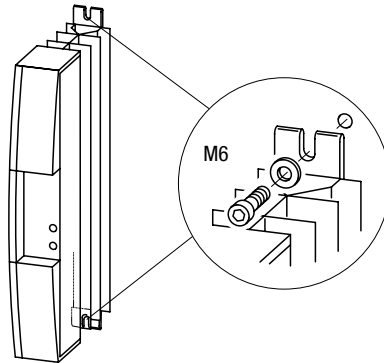


Figure 14: Attaching to the mounting plate

- Use M 6 screws and washers to attach the brake unit to the mounting plate.

## Connections



### Attention!

The electrical installation and commissioning work may only be carried out by suitably qualified personnel. They are responsible for ensuring that appropriate earthing and line protection is provided in accordance with currently valid local and national regulations.



### Warning!

All terminals (+UG, -UG and RB1, RB2) of the brake unit carry dangerous voltages. Always wait at least 3 minutes after switching off the power before working on the terminals or within the unit. There is a risk of serious injury or death if this precaution is not observed.



**Attention!**

This device contains components which can be damaged by electrostatic charges (ESD). Discharge any electrostatic charges from the body before undertaking installation or service work in the vicinity of the terminals by touching a PE mounting screw or another earthed metal surface within the switchgear cabinet.

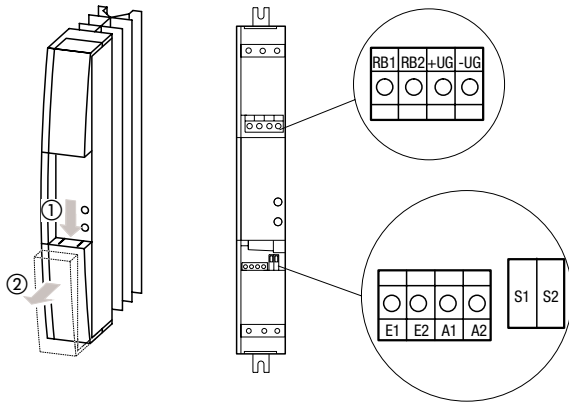


Figure 15: Removing the cover to access the terminals

You must removing two covers to access the terminals.

Attach the cable between the brake unit and the frequency inverter to the terminals +UG and –UG.

The values below for tightening torque and cable cross-section in the table below apply to the +UG, –UG, RB1 and RB2 terminals of the DE 4-BU4-1 brake unit:

<b>Terminals</b>	6 mm <sup>2</sup>	0.5 to 0.6 Nm (4.4 to 5.3 lbf·in)
<b>PE connection</b>	4 mm <sup>2</sup>	3.4 Nm (30 lbf·in)

## Setting the switching point

The required switching point of the brake unit is dependent on the mains feed voltage. The switching point specifies the DC bus voltage above which the braking resistor is connected to the bus. Switches S1 and S2 are used to configure the switching point for the respective mains feed voltage of the frequency inverter.



### Warning!

S1 and S2 carry lethal voltages. Wait at least 3 minutes after switching off the power before operating these switches. There is a risk of serious injury if this precaution is not observed.



For several brake units connected in parallel, set the same switching point for all of them.

Proceed as follows to configure the switching point for the braking resistor:

- ▶ Switch off the power feed for the frequency inverter and wait at least 3 minutes for the DC bus capacitors to discharge.
- ▶ Remove the lower cover from the brake unit (see Figure 15 on page 32).
- ▶ Configure S1 and S2 as follows:

<b>Mains feed voltage</b>	230 V	400 to 460 V	480 V (FS) <sup>1)</sup>
<b>Switching point</b>	375 V	725 V	765 V (FS) <sup>1)</sup>
<b>S1</b>	OFF	ON	ON (FS) <sup>1)</sup>
<b>S2</b>	OFF	OFF	ON (FS) <sup>1)</sup>

<sup>1)</sup> (FS = factory setting)

- ▶ Press the covers back onto the brake unit until they engage with an audible click.



## 4 Operation/Diagnostics

### Commissioning

The green LED lights up when the brake unit is supplied with power and is ready for use.



#### **Attention!**

The electrical installation and commissioning work may only be carried out by suitably qualified personnel. They are responsible for ensuring that appropriate earthing and line protection is provided in accordance with currently valid local and national regulations.



#### **Warning!**

Before applying power to the equipment, check whether the cables +UG and –UG are connected to the right brake unit terminals. If these cables are reversed, the brake unit and all connected components can be destroyed.



#### **Attention!**

Before power is applied to the equipment, make sure that the admissible ambient conditions are not exceeded and that no moisture is present within the brake unit. Moisture can be present if the brake unit has been stored in a cold place. If moisture has entered the device, it must be dried out completely before use.

## Operation

The brake unit has two LEDs to indicate the operating status:

The green LED lights up when the brake unit is supplied with power and is ready for use.

The yellow LED lights up when the brake unit is operating in braking.

The yellow LED lights with reduced intensity at a low braking power, short braking times or when operating with the switching point set to 375 V.



### **Warning!**

During use, the outside surfaces of the brake unit can reach a temperature of 130 °C. Take care - there is a risk of severe burns.



### **Attention!**

All terminals can carry dangerous voltages during braking even after switching off the power (e.g. with large rotating masses, test rig operation). Accordingly, before working on the equipment you should set controller inhibit for all connected frequency inverters and wait for at least 3 minutes for the internal DC bus voltage to discharge.

## Diagnostics

When switching off the equipment in order to work on it, please note that:

when using frequency inverters in parallel, you should first set controller inhibit for all frequency inverters before disconnecting them from the power supply;

when using single frequency inverters, dangerous voltages can be present on all terminals for up to 3 minutes after switching off the power.



### **Attention!**

This device contains components which can be damaged by electrostatic charges (ESD). Discharge any electrostatic charges from the body before undertaking installation or service work in the vicinity of the terminals by touching a PE mounting screw or another earthed metal surface within the switchgear cabinet.



**Error messages and remedies**

<b>Error</b>	<b>Cause</b>	<b>Remedy</b>
Green LED does not light up	No voltage on +UG, -UG	<ul style="list-style-type: none"> <li>- Switch on power</li> <li>- Connect brake unit to frequency inverter +UG, -UG</li> </ul>
Yellow LED does not light up with controller inhibited despite overvoltage warning during braking	Brake unit not connected to frequency inverter +UG, -UG	Connect brake unit to frequency inverter +UG, -UG
	Switching point for brake unit set incorrectly (switches S1 and S2)	Set brake unit switching point acc. to the respective mains feed voltage of the frequency inverter.
Braking time of frequency inverter is too long; frequency inverter sets controller inhibit and outputs overvoltage warning	Power fed back from motor to brake unit during braking is higher than the maximum admissible power rating of the internal braking resistor	<ul style="list-style-type: none"> <li>- Increase -a (deceleration time)</li> <li>- Increase -a<sub>Quick</sub> (quickstop time)</li> <li>- Use a braking resistor with a lower resistance value (if admissible)</li> </ul>
With parallel operation of several brake units, the braking resistors do not all heat up to the same extent	The brake units to be operated in parallel are not all connected to the +UG, -UG terminals of all frequency inverter(s)	Connect all brake units to the +UG, -UG terminals of the frequency inverter(s); see Figure 10 on page 25
	Braking resistor not connected	Connect up all braking resistors
	Synchronisation terminals not connected up correctly	Connect up synchronisation terminals correctly (see "Parallel connection of brake units" on page 22)
	Switching points of all brake units to be operated in parallel are not set to the same value (switches S1 and S2)	Set all brake unit switching points acc. to the respective mains feed voltage of the frequency inverter(s)
Yellow LED lights continuously, braking resistor overheats	Switching point for brake unit set incorrectly (switches S1 and S2)	Set brake unit switching point acc. to the respective mains feed voltage of the frequency inverter
Braking resistor overheats	Incorrect specification of braking resistor	Specify braking resistor to match motor drive rating
	Switching point for brake unit set incorrectly (switches S1 and S2)	Set brake unit switching point acc. to the respective mains feed voltage of the frequency inverter

## Appendix

### Specifications

Type	DE 4-BU4-1	
Supply voltage $U_N$	270 to 775 V DC	
Switching point $U_{ZK}$ <sup>1)</sup>	375, 725, 765 V DC	
Peak current	42 A DC	
Max. continuous current	25 A DC	
Peak braking power at $U_{ZK}$		
375 V DC	(230 V) <sup>2)</sup>	15 kW
725 V DC	(400 – 460 V) <sup>2)</sup>	30 kW
765 V DC	(480 V) <sup>2)</sup>	32 kW
Cont. braking power at $U_{ZK}$		
375 V DC	(230 V) <sup>2)</sup>	9 kW
725 V DC	(400 – 460 V) <sup>2)</sup>	18 kW
765 V DC	(480 V) <sup>2)</sup>	19 kW
Min. braking resistor value		
375 V DC	(230 V) <sup>2)</sup>	9 Ω ± 10%
725 V DC	(400 – 460 V) <sup>2)</sup>	18 Ω ± 10%
765 V DC	(480 V) <sup>2)</sup>	18 Ω ± 10%
Braking resistor	external	
Peak energy	dependent on external braking resistor	
Weight	2.2 kg	

1) configurable with switches S1 and S2

2) Mains feed voltage for the frequency inverter

### Choice of braking resistor values

Braking resistor values are chosen according to motor power. The values in the table below are recommendations for  $U_{ZK} = 725 \text{ V}$  or  $765 \text{ V}$ . The values for peak and continuous braking power are different at  $U_{ZK} = 375 \text{ V}$ .

The specified values apply to the following braking cycle:

- max. 15 s braking at peak braking power
- min. 150 s cooling period after braking

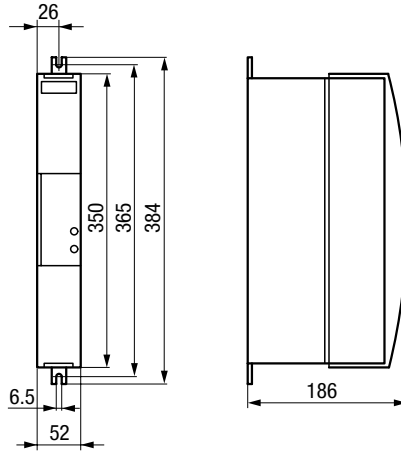
Motor power [kW]	Resistor value [ $\Omega$ ]	Peak braking power [kW]	Cont. braking power [kW]	Heat capacity [kWs]	e.g. from GINO company <sup>1)</sup>	L × W × H
< 2.6	180	3.0	0.3	45	D1Z145306T180R	390 × 90 × 90
< 5.2	82	6.0	0.6	90	D1Z165406T82R	490 × 90 × 120
< 7.4	68	8.0	0.8	120	D1Z185406T68R	490 × 120 × 145
< 11.0	47	12.0	1.2	180	D1Z185606T47R	690 × 120 × 145
< 13.2	33	17.0	2.0	300	D1Z265606T33R	690 × 180 × 120
< 20.3	22	26.0	3.0	450	B1G13208T22R	330 × 490 × 300
< 30.0	18	32.5	3.0	450	B1G13208T18R	330 × 490 × 300

<sup>1)</sup> GINO Gielen + Nothnagel GmbH, Friedrich-Wöhler-Str. 6  
D-53117 Bonn, Tel.: +49-228-98986-0, Fax: -34

Braking resistors are available as wire-wound, cement-bonded tubular resistors or in a metal grid design for higher power ratings. They are provided with two standard or M6 screw terminals and have two terminals for the built-in overtemperature trip (230 V, 1 A, AC-1).

Case: hot galvanized steel sheet; case to protection class IP 20.

**Dimensions**



*Figure 16: Dimensions of DE 4-BU4-1 brake unit*



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