

# Operation manual

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**be in motion** **be in motion**

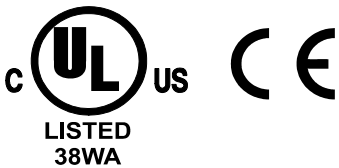


**BAUMÜLLER**

**b maXX 4100**

**Active mains inverter (NWR)**

POWER CONVERSION EQUIPMENT



**E** 5.04052.09

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# 1

## GENERAL

### 1.1 Information on the instruction handbook

---

This instruction handbook provides important information on handling the device. A prerequisite for safe work is compliance with all specified safety notes and procedural instructions.

Additionally, the valid accident prevention regulations and general safety regulations applicable to the scope of application the device must be complied with.

Read the instruction handbook, particularly the safety notes chapter, completely before beginning any work on the device. The instruction handbook is part of the product and must be kept accessible to personnel at all times in the immediate vicinity of the device.

### 1.2 Key to symbols

#### Warning notes

Warning notes are identified by symbols in these instruction handbook. The notes are introduced by signal words that express the extent of the danger.

It is imperative that these notes be complied with and are conscientiously regarded in order to prevent accidents, personal injury and material damage.



#### **DANGER!**

....points out an immediately dangerous situation that will lead to severe injuries or death if not avoided.



#### **WARNING!**

....points out a potentially dangerous situation that could lead to severe injuries or death if not avoided.



#### **CAUTION!**

....points out a potentially dangerous situation that could lead to minor or slight injuries if not avoided.



#### **NOTICE!**

....points out a potentially dangerous situation that could lead to material damage if not avoided.

#### Recommendations



#### **NOTE!**

....highlights useful tips and recommendations, as well as information for efficient and problem-free use.



### 1.3 Limitation of liability

All specifications and notes in these instruction handbook were compiled taking into account the applicable standards and regulations, the state of the art and our knowledge and experience of many years.

The manufacturer assumes no liability for damages due to:

- noncompliance with the instruction handbook
- usage for other than the intended purpose
- usage by untrained personnel

The actual scope of delivery can vary in case of optional equipment, laying claim to additional order options, or on account of the latest technical changes to the explanations and representations described herein.

The user bears the responsibility for performing service and initial operation in accordance with the safety regulations of the applicable standards and all other relevant governmental or local regulations concerning the dimensioning and protection of conductors, grounding, disconnectors, overcurrent protection, etc.

The person who carried out the mounting or installation is liable for any damage incurred when assembling or connecting the device.

### 1.4 Copyright protection

The instruction handbook must be treated confidentially. It is to be used exclusively by personnel who work with the device. The consignment of the instruction handbook to third persons without the written permission of the manufacturer is prohibited.



#### NOTE!

The specific contents, text, drawings, images and other representations are copyrighted and subject to industrial property rights. Any prohibited usage is punishable by law.

**b maXX®** is a registered trademark of Baumüller Nürnberg GmbH

### 1.5 Other applicable documents

Components of other manufacturers are integrated into the device. For these purchased parts, hazard assessments have been performed by the respective manufacturers. The compliance of the design construction with the applicable European and national regulations has been declared for the components by the respective manufacturers.

### 1.6 Disposal

Insofar as no take-back or disposal agreement has been made, please disassemble units correctly and properly recycle the constituent parts.

See also [►Disposal◄](#) on page 131.

### 1.7 Spare parts



**WARNING!**

**False or flawed spare parts can lead to damage, malfunction or complete failure, thus endangering safety.**

Therefore:

- Only use original spare parts of the manufacturer.

Procure spare parts through an authorized dealer or directly from the manufacturer.

See also [▶Accessories and Spare Parts◀](#) from page 111.

### 1.8 Guarantee provisions

The guarantee provisions are stated in a separate document of the sales documents.

The devices described herein may only be operated in accordance with the stipulated methods, procedures and conditions. Anything else not presented here, including the operation of devices in mounted positions, is not permitted and must be cleared with the plant on a case-by-case basis. If the devices are operated in any other manner than as described within these instruction handbook, then all guarantee and warranty rights are rendered null and void.

### 1.9 Customer service

Our customer service is available to provide you with technical information.

Info on the responsible contact persons is available at all times via telephone, fax, mail or the Internet.

### 1.10 Terms used

The term „device“ or the item designation BM4XXX are also used in this documentation for this Baumüller product. A list of the abbreviations used can be found in [▶Appendix A - Abbreviations◀](#) from page 133.

### 1.11 List of other applicable documents

#### Parameter hand-book

	Doc No.	Part No. German	Part No. English
Parameter manual basic unit b maXX b maXX 4100 mains inverter	5.04054	<b>392423</b>	<b>392424</b>

# 2

## SAFETY

This section provides an overview of all of the important safety aspects for optimum protection of personnel as well as for the safe and problem-free operation.

### 2.1 Contents of the instruction handbook

---

Each person who is tasked with performing work on or with the device must have read and understood the instruction handbook before working with the device. This also applies if the person involved with this kind of device or a similar one, or has been trained by the manufacturer.

### 2.2 Changes and modifications to the device

---

In order to prevent hazards and to ensure optimum performance, no changes, additions or modifications may be undertaken on the device that have not been explicitly approved by the manufacturer.

### 2.3 Usage for the intended purpose

The device is conceived and constructed exclusively for usage compliant with its intended purpose described in these instruction handbook.

The devices of the model series **BM4100 (NWR)** is used exclusively as an active mains rectifier.

A device is considered as being used compliant with its intended purpose if all notes and information of these instruction handbook are adhered to.



#### **WARNING!**

##### **Danger arising from usage for an unintended purpose!**

Any usage that goes beyond the intended purpose and/or any non-compliant use of the device can lead to dangerous situations.

Therefore:

- Only use the device compliant with its intended purpose.
- Observe all specifications of these instruction handbook.
- Ensure that only qualified personnel work with/on this device.
- When configuring, ensure that the device is always operated within its specifications.
- Mount the device on a wall that can sufficiently bear the load.
- The device must always be operated within a control cabinet.
- Ensure that the power supply complies with the stipulated specifications.
- The device may only be operated in a technically flawless condition.
- Only operate the device in combination with components approved by Baumüller Nürnberg GmbH.
- The device has been developed in such a manner that it fulfills the requirements of the category C3 according to IEC 61800-3:2005.
- The device is not intended to be connected to the public power supply system. To operate the device in primary surroundings of the category C2/C1 (residential, business and commercial areas, directly on a public low-voltage power supply without an intermediate transformer), special measures to reduce the transient emissions (line-internal and radiated) must be provided for and certifiable by the system builder. Otherwise, EMC interference could occur without such additional measures.

## 2.4 Responsibility of the operating company

The device will be used in commercial areas. Thus, the proprietor of the device is subject to the legal work safety regulations.

Along with the notes on work safety in these instruction handbook, the safety, accident prevention and environmental protection regulations valid for the area of application of this device must be complied with. Whereby:

- The operating company must inform himself about the applicable work health and safety regulations and ascertain, in a hazard assessment, any additional hazards that could arise from the special working conditions in the use area of the device. These must then be implemented in the form of instruction handbook for operation of the device.
- These instruction handbook must be kept accessible to personnel working with the device at all times in the immediate vicinity of the device.
- The specifications of the instruction handbook must be adhered to completely and without exception.
- The device may only be operated in a technically faultless and operationally safe condition.

## 2.5 Protective devices

The devices BM4135 and BM4145 meet the international protection IP10. BM4163 meets the international protection IP00. All mentioned devices have to be installed into a suitable control cabinet to meet the international protections required by the EN 61800-5-1, chapter 4.2.3.3. (IP30: only upper, horizontally surfaces; IP20: all other surfaces).



### **DANGER!**

#### **Risk of fatal injury from electrical current!**

There is an immediate risk of fatal injury if live electrical parts are contacted.

Therefore:

- The device must be in operated inside of a control cabinet that provides protection against direct contact of the devices and at least meets the requirements of EN 61800-5-1, Chapter 4.2.3.3.

### 2.6 Training of the personnel

---



**WARNING!**

**Risk of injury due to insufficient qualifications!**

Improper handling can lead to significant personal injury and material damage.

Therefore:

- Certain activities can only be performed by the persons stated in the respective chapters of these instruction handbook.

In these instruction handbook, the following qualifications are stipulated for various areas of activity:

- **Operating personnel**

- The drive system may only be operated by persons who have been specially trained, familiarized and authorized.
- Troubleshooting, maintenance, cleaning, maintenance and replacement may only be performed by trained or familiarized personnel. These persons must be familiar with the instruction handbook and act accordingly.
- Initial operation and familiarization may only be performed by qualified personnel.

- **Qualified personnel**

- Electrical engineers authorized by Baumüller Nürnberg GmbH, and qualified electricians of the customer or a third party who have learned to install and maintain Baumüller drive systems and are authorized to ground and identify electrical power circuits and devices in accordance with the safety engineering standards of the company.
- Qualified personnel have had occupational training or instruction in accordance with the respective locally applicable safety engineering standards for the upkeep and use of appropriate safety equipment.

## 2.7 Personal protective equipment

The wearing of personal protective equipment is required when working in order to minimize health and safety risks.

- The protective equipment necessary for each respective type of work shall always be worn during work.
- The personal safety signs present in each working area must be observed.



### Protective work clothing

should be snug-fitting work clothes, with low tearing resistance, narrow sleeves and with no extending parts. It serves to primarily protect against...

No rings or chains should be worn.



### Hard hat

to protect against falling down and flying around objects.



### Safety shoes

to protect against heavy objects falling down.



### Protective gloves

to protect hands against friction, abrasion, puncturing or more severe injuries, as well as contact with hot objects.

**Wear for special work.**



### Protective eye wear


to protect the eyes against flying around objects and sprayed liquids.

### 2.8 Special hazards


In the following section, the remaining marginal risks will be stated that have been identified as a result of the hazard analysis.

Observe the safety notes listed here and the warning notes in the further chapters of this Operation manual to reduce health risks and dangerous situations.

#### Electrical current

	<p><b>DANGER!</b></p> <p><b>Risk of fatal injury from electrical current!</b></p> <p>There is an immediate risk of fatal injury if live electrical parts are contacted. Damage to the insulation or individual components can be life-threatening.</p> <p>Therefore:</p> <ul style="list-style-type: none"><li>• Switch off the electrical power immediately in case of damage to the power supply insulation.</li><li>• Only allow work on the electrical system to be performed by qualified personnel.</li><li>• Switch off the current when any kind of work is being performed on the electrical system and ensure safety before switching on again.</li></ul>
---	---

#### Danger from residual energy

	<p><b>DANGER!</b></p> <p><b>Risk of fatal injury from electrical current!</b></p> <p>Stored electric charge.</p> <p>Discharge time of the rack system = discharge time of the device with the longest DC link discharge time in the rack system.</p> <p>See <a href="#">▶Electrical data◀</a> ab Seite 30.</p> <p>Therefore:</p> <ul style="list-style-type: none"><li>• Do not touch electrically live parts before taking into account the discharge time of the capacitors.</li><li>• Pay attention to the corresponding notes on the device.</li><li>• If additional capacitors are connected to the DC link, the DC link discharge can take a much longer time. In this case, the necessary waiting period must itself be determined or a measurement made as to whether the equipment is de-energized. This discharge time must be posted, together with an IEC 60417-5036 (2002-10) warning symbol, on a clearly visible location of the control cabinet.</li></ul>
---	--



## Moving components



### WARNING!

#### Risk of injury from moving components!

Rotating components and/or components moving linearly can result in severe injury.

Therefore:

- Do not touch moving components during operation.
- Do not open any covering during operation.
- The amount of residual mechanical energy depends on the application. Powered components still turn/move for a certain length of time even after the power supply has been switched off. Ensure that adequate safety measures are taken.

## 2.9 Fire fighting



### DANGER!

#### Risk of fatal injury from electrical current!

There is a risk of electric shock if an electrically-conductive, fire-extinguishing agent is used.

Therefore:

- Use the following fire-extinguishing agent:



ABC powder / CO<sub>2</sub>

### 2.10 Safety equipment

---



#### **WARNING!**

#### **Risk of fatal injury due to non-functional safety equipment!**

Safety equipment provides for the highest level of safety in a facility. Even if safety equipment makes work processes more awkward, under no circumstances may they be circumvented. Safety can only be ensured by intact safety equipment.

Therefore:

- Before starting to work, check whether the safety equipment is in good working order and properly installed.

### 2.11 Conduct in case of danger or accidents

---

#### **Preventive measures**

- Always be prepared for accidents or fire!
- Keep first-aid equipment (e.g. first-aid kits, blankets, etc.) and fire extinguishers readily accessible.
- Familiarize personnel with accident alarm, first aid and rescue equipment.

#### **And if something does happen: respond properly.**

- Stop operation of the device immediately with an EMERGENCY Stop.
- Initiate first aid measures.
- Evacuate persons from the danger zone.
- Notify the responsible persons at the scene of operations.
- Alarm medical personnel and/or the fire department.
- Keep access routes clear for rescue vehicles.

## 2.12 Signs and labels

The following symbols and information signs are located in the working area. They refer to the immediate vicinity in which they are affixed.



### **WARNING!**

#### **Risk of injury due to illegible symbols!**

Over the course of time, stickers and symbols on the device can become dirty or otherwise unrecognizable.

Therefore:

- Maintain all safety, warning and operating labels on the device in easily readable condition.



### **Electrical voltage**

Only qualified personnel may work in work areas that identified with this.

Unauthorized persons may not touch working materials marked correspondingly.



### **DANGER!**

#### **Risk of fatal injury from electrical current!**

Stored electric charge.




Discharge time of the rack system = discharge time of the device with the longest DC link discharge time in the rack system.

See [▶Electrical data◀](#) ab Seite 30.

Therefore:

- Do not touch before taking into account the discharge time of the capacitors and electrically live parts.
- Heed corresponding notes on the equipment.
- If additional capacitors are connected to the DC link, the DC link discharge can take a much longer time. In this case, the necessary waiting period must itself be determined or a measurement made as to whether the equipment is de-energized. This discharge time must be posted, together with an IEC 60417-5036 (2002-10) warning symbol, on a clearly visible location of the control cabinet.

## 2.12 Signs and labels

	<p><b>CAUTION!</b>  <b>Risk of injury due to hot surface!</b></p> <p>Therefore:</p> <ul style="list-style-type: none"> <li>• Wear protective gloves</li> </ul> 
	<p><b>NOTE!</b>          When in operation, the top of the device can heat up to temperatures &gt; 70 °C!</p>

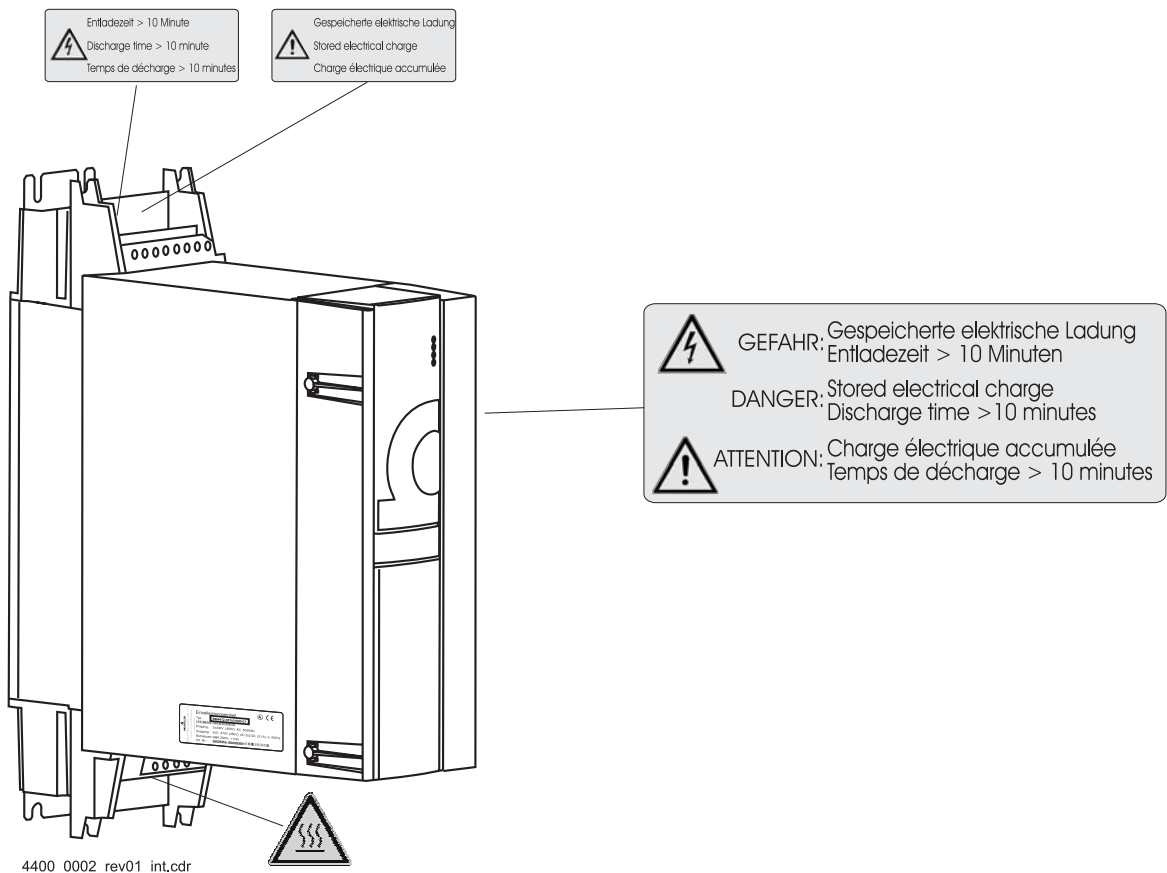


Figure 1: Signs and labels BM413X/BM414X

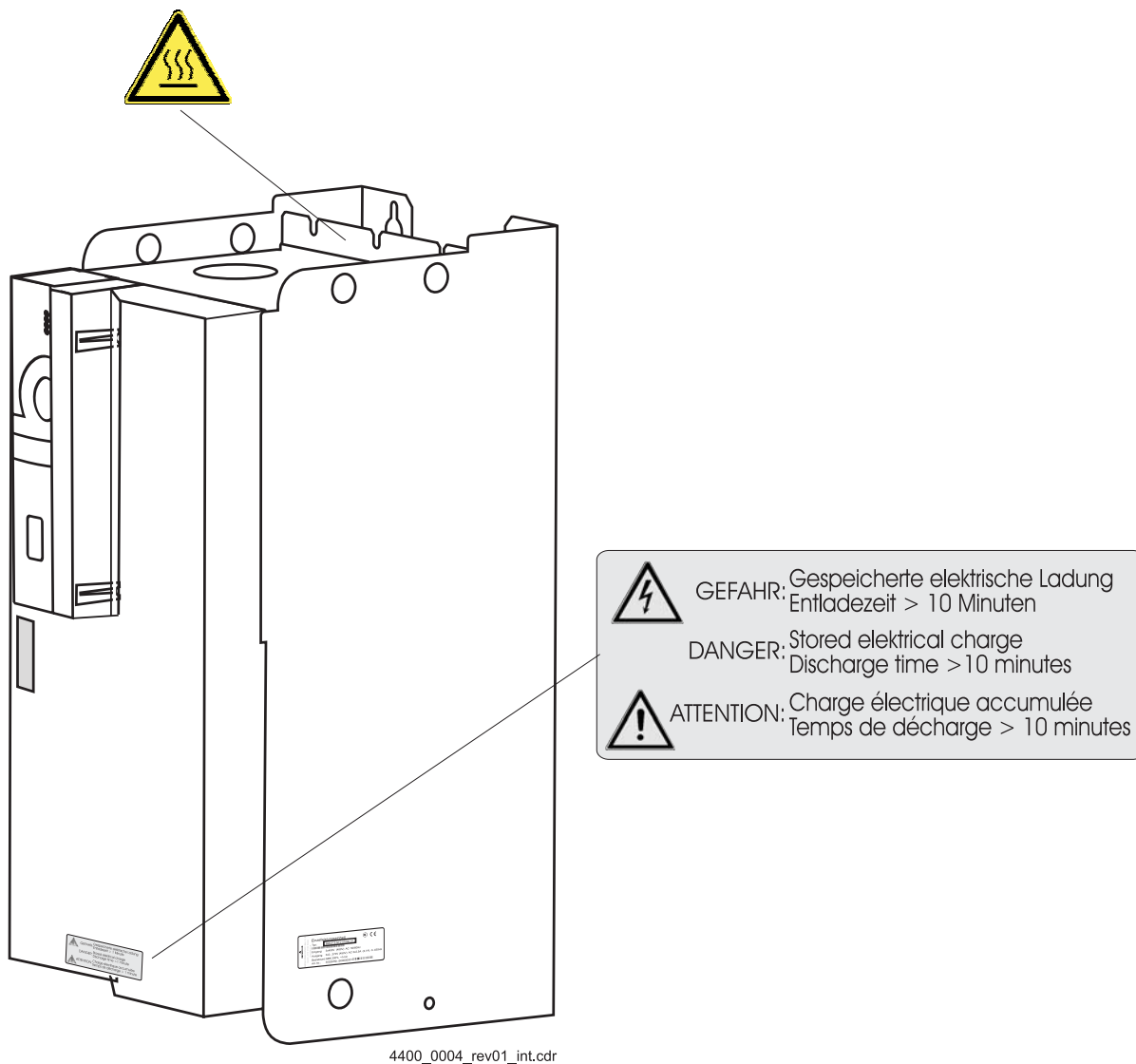
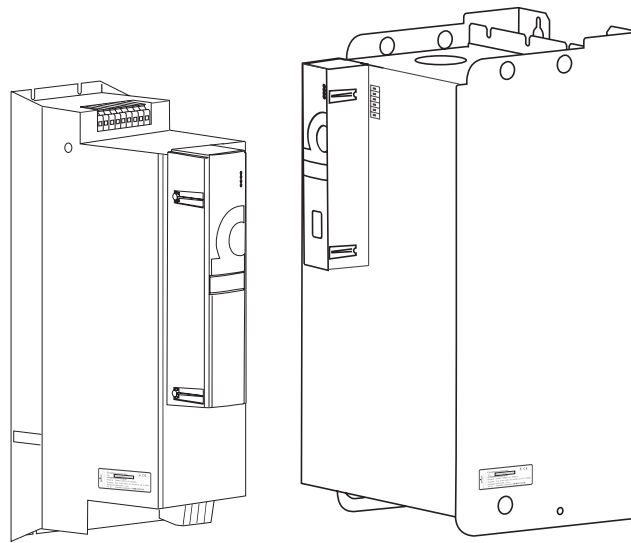
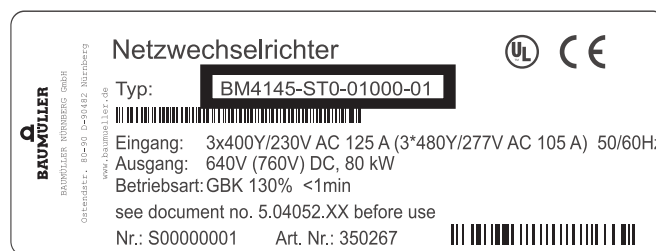


Figure 2: Signs and labels BM416X

On the type plate (label) you will find, besides others, the type key of the device.



4100\_0030\_rev01\_int.cdr



4100\_0071\_rev01\_int.cdr

Figure 3: Position of type key label

## TECHNICAL DATA

### 3.1 Dimensions

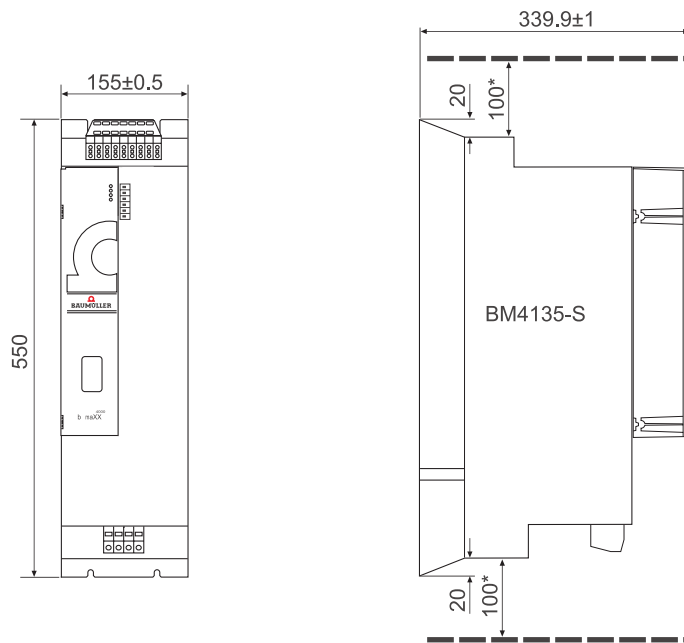
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The following dimension drawings show the main dimensions of the devices. By means of the dimension drawings the space requirements within the control cabinet are determined. The dimension drawings in [▶Drilling patterns◀](#) from page 53 must be used in order to do the required drilling / segments.

**NOTE!**

All dimensions in mm.

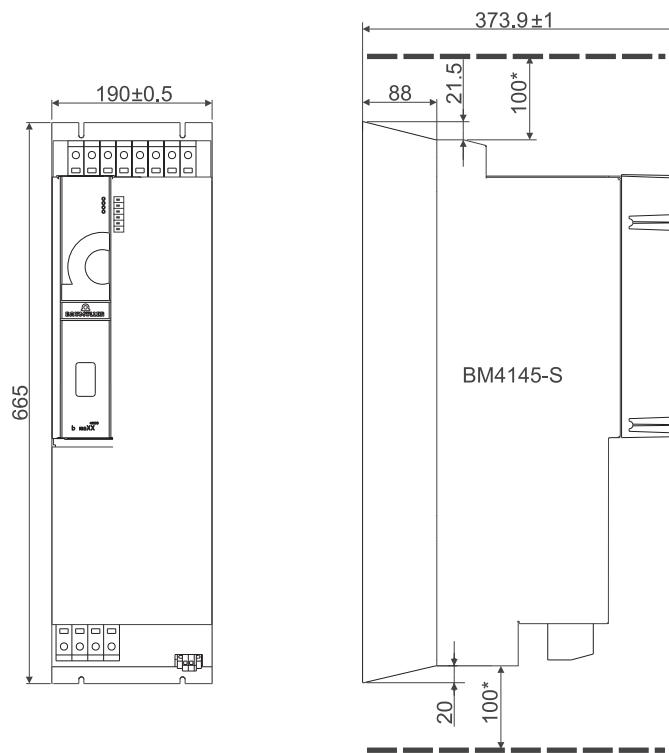
# 3.1 Dimensions



4100\_0032\_rev02\_int.cdr

\*: min. expansion space, also consider [►Cooling◄](#) on page 29

Figure 4: Installation space BM4135-S

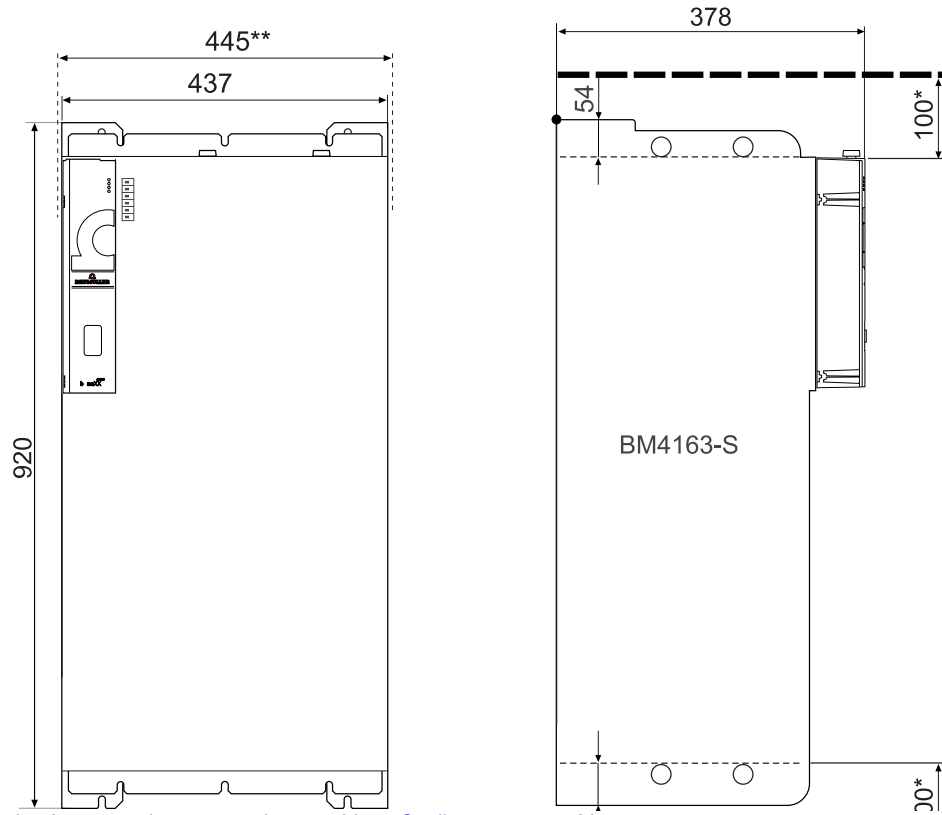


4100\_0035\_rev02\_int.cdr

\*: min. expansion space, also consider [►Cooling◄](#) on page 29

Figure 5: Installation space BM4145-S





\*: min. expansion space, also consider [►Cooling◄](#) on page 29  
 \*\*: width inclusively bolt heads

Figure 6: Installation space BM4163-S/Z

\_0039\_rev02\_int.cdr

### 3.2 Weight

Device	Dimensions (B x H x T)	Weight with controller, without plug-in module
BM4135	155 x 540 x 340 mm	16,4 kg
BM4145	190 x 665 x 374 mm	26,1 kg
BM4163	437 x 920 x 380 mm	68,5 kg

### 3.3 Operating requirements

#### 3.3.1 System types

There are three basic types of the current supply systems regarding the grounding, which conform with DIN VDE0100 part 300 and IEC 60364:

- The TN system has a directly grounded point (system grounding). The cabinet of the electrical installation is connected via the protective conductors and PE conductors with this point.
- The TT system has a directly grounded point (system grounding). The cabinet of the electrical installation is connected with grounding electrodes. The grounding electrodes are separated from system grounding.
- The IT system has no direct connection between the active conductors (L1, L2, L3, N) and grounded parts (PE). The cabinet of the electrical installation is grounded. The separation is reached by using an isolating transformer or an independent current source (generator, battery).

If the low-impedance ground fault is adequate, an upstream fuse within the TN system or the TT system responds. At a high-impedance ground fault a fuse does not respond. This ground current (residual currents) can be dangerous. Therefore sensitive circuit breakers are used for residual current monitoring.

At a ground fault in an IT system there is no ground current. The upstream fuses do not respond. Therefore the operation procedure is maintained. A second ground fault at another phase leads to residual currents. This can initiate a fuse. In order to detect the first ground fault a ground leakage monitor is required. In order to detect the second ground fault a residual current monitoring is required.

#### Supported system types



#### NOTICE!

The operation of the **BM4100 (NWR)** is only possible at TN / TT systems.

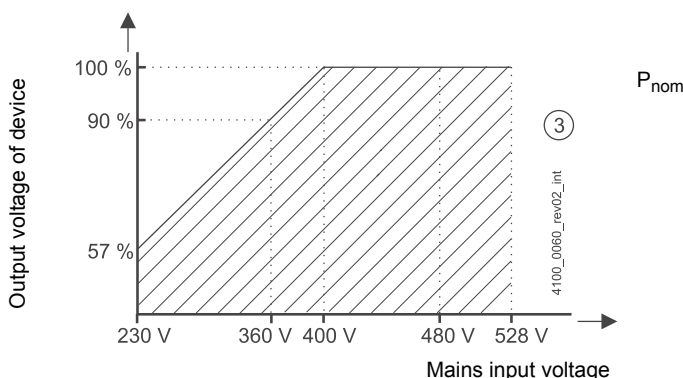
3.3.2 Requirements to the energy supply / supply system

Mains supply (see ▶ <a href="#">System types</a> ◀ from page 26)	BM41XX - XTX	Industrial mains with direct or low impedance earthed star point (TN net or TT net)
Max. short circuit voltage mains at power terminal		$u_k = 4 \%$
Mains choke inductance	BM4135	1,0 mH
	BM4145	0,48 mH
	BM4163	0,36 mH
Rated supply voltage/-frequency <sup>1) 2)</sup> ( $U_{AC}$ ) device		3 x 400 V 50/60 Hz
Absolute minimum supply voltage device <sup>1) 2)</sup> ( $U_{AC}$ )		3 x 207 V / 50/60 Hz
Absolute maximum supply voltage device <sup>1) 2)</sup> ( $U_{AC}$ )		3 x 528 V / 50/60 Hz
Absolute minimum frequency <sup>5)</sup>		47 Hz
Absolute maximum frequency <sup>5)</sup>		63 Hz
Overvoltage category EN 61800-5-1, chapt. 4.3.6		III
Harmonics (power supply voltage) EN 61800-3, Kap. 5.2.1, Klasse 3		$THD_U \leq 10 \%$
Unbalanced power supply voltage EN 61000-2-4, Tab. 1, class 3		max. 3 %
Commutating dips EN 61800-3, chapter 5.2.1, class 3		Depth of dip < 40 %, area < 250 % x degrees
Voltage dips EN 61200-2-1		10 % to 100 % <sup>1)</sup>
Voltage variations/-fluctuations EN 61200-2-4, class 3		+/-10 % +10 % to -15 % at a period of $\leq 1$ min
Short Circuit Current Rating (SCCR) <sup>4)</sup>		65 kA
Control voltage <sup>3)</sup> ( $U_{DC}$ ) EN 61131-2:1994, table 7		+ 24 V -15 % / +20 %

1) The error 'power supply not ready-to-operate' is generated if the supply voltage falls below  $U_{ACmin}$  for  $t > 0.1$  s.

2) Rated voltage is 400 V.

If mains input voltage is lower than 400 V the output power of the device is reduced (see characteristic curves).



③ If you multiply the input current with the input voltage you will get the input power of the device. To get the output power you must subtract the power loss.

$$P_{out} = U_{input} \times I_{input} \times \sqrt{3} - P_{loss}$$

In order to receive the specified curve/area, it is necessary, that the output current is reduced between 400 V and 528 V.

The characteristic curves „output current in dependence of supply voltage“ you will find in the electrical data of the individual devices from ▶[Page 30](#)◀.

3) The control voltage must accord to PELV (EN 61800-5-1, chapter 3.21) or SELV (EN 61800-5-1, chap. 3.35).

At control voltage of < 24 V the ventilation power output is reduced. Therefore, it may be necessary, to reduce the output currents as well.

4) Required for UL 508C, only.

5) Rate of change of the power supply frequency 1 Hz/s at a maximum (EN 61000-2-4, class 3).

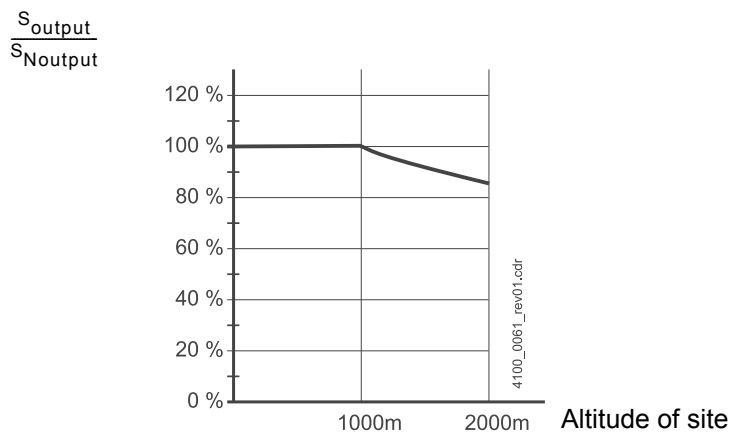
## 3.3 Operating requirements

### 3.3.3 Required environmental conditions

Transport temperature range	- 25 °C to + 70 °C
Transport climatic category EN 60721-3-2	2 K 3
Storage temperature range	- 25 °C to + 55 °C
Storage climatic class EN 60721-3-1	1 K 4
Operation environment	industrial system <sup>1)</sup>
Operation temperature range	min. 5 °C to max. 55 °C (rated temperature 40 °C)
Operation climatic class EN 60721-3-3	3 K 3
Mounting height <sup>2)</sup>	absolute altitude up to 2000 m
Humidity (operation) EN 60721-3-3	relative humidity: 5 % to 85 % no condensation and absolute humidity: 1 g/m <sup>3</sup> to 25 g/m <sup>3</sup>
Ionizing and non-ionizing radiation	measurable range
Vibration, shock and repetitive shock EN 61800-5-1, section 5.2.6.4 Vibration test	max. 0.5 g during operation
Degree of pollution EN 61800-5-1, table 6, Tab. 2	2

<sup>1)</sup> For the operation in an environment of category C2 according to IEC 61800-3:2005, additional measures may be required. The manufacturer of the installation / user must provide the following evidence in this case: The additional measures are effective. The specified limit values of category C2, which are described in IEC 61800-3, are complied with.

<sup>2)</sup> Characteristic curve: Power output of the device in dependence on the altitude of site at normal pressure



#### NOTICE!

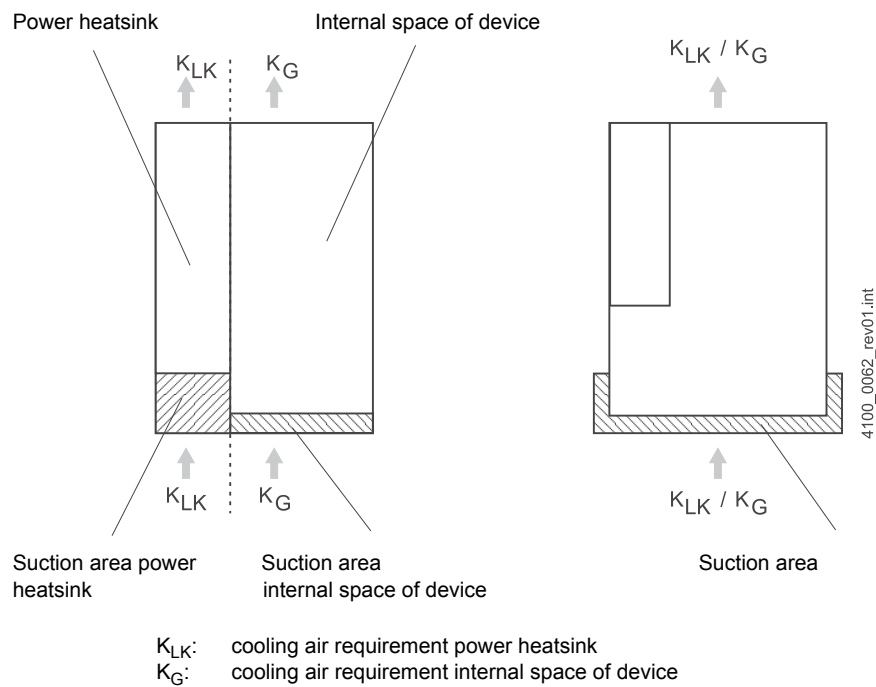
Normally, non-conductive pollution occurs. Conductive pollution is unacceptable. Conductive pollution can lead to the destruction of the device. The customer is responsible for destructions, which were caused by pollution due to conductive materials or components.

3.3.4 Cooling

Cooling air temperature <sup>1)</sup>	min. 0 °C to max. 55 °C (rated temperature: 40 °C)
Cooling air requirement <sup>2)</sup>	See <a href="#">▶Electrical data◀</a> from page 30

1) Air temperature in the entire suction area of the device.

2) The cooling air requirement corresponds at least to that of a free-blowing device. Free-blowing means, that the air inlet and the air outlet operates unrestricted. With the mounting of the device into a control cabinet it therefore can be necessary to use additional fans, so that the necessary cooling air requirement is covered. If the necessary cooling air requirement of the power heatsink is not provided, then the output power of the device has to be reduced.



## 3.4 Electrical data

### 3.4 Electrical data

#### 3.4.1 Electrical data - BM4135

	BM4135
Input rated power <sup>1)</sup>	38 kVA
Input rated current ( $I_{\text{eff}}$ ) <sup>1) 2) 3) 4)</sup>	55 A
Input peak current ( $I_{\text{eff}}$ ) <sup>1) 2) 4) 5)</sup>	82,5 A
PWM switching frequency	8 kHz
DC link voltage	640 V <sub>DC</sub> to 760 V <sub>DC</sub>
DC link capacity (internal)	2000 µF
DC link discharging time (internal DC link capacity)	430 s
DC link capacity (external), permitted	max. 18 mF
Output power DC link <sup>1) 6)</sup>	max. 35 kW
Peak power DC link <sup>7)</sup>	52 kW
Max. peak power time <sup>5)</sup>	60 s
Power factor (only inductive)	0,9 to 1,0
Switch-on frequency	≥ 2 min, see ▶Power on switching frequency◀ from page 83
Max. charging time	≤ 30 s
Fast discharge	≤ 5 s
Chopper current, permitted ( $\hat{I}$ )	max. 50,0 A
Chopper resistor external	≥ 16 Ω
Chopper on voltage ( $\hat{U}$ )	814 V
Chopper peak power	40 kW
Permitted chopper continuous power	10 kW
Power loss related to mains connection <sup>8)</sup>	1020 W
Power loss related to control voltage	max. 88 W

<sup>1)</sup> All rated values refer to a mains input voltage of 400 V / 50 Hz and a control voltage of 24 V.

<sup>2)</sup> Effective value at an environmental temperature of 40 °C.

<sup>3)</sup> Between 40 °C and 55 °C the output current must be reduced.  
The permitted output current ( $I_0$ ) is calculated with the following formula:

$$I_0 = I_{0(40^\circ\text{C})} \cdot \left( 1 - \left( \frac{\text{Coolant temperature} - 40^\circ\text{C}}{^\circ\text{C}} \cdot 0,03 \right) \right)$$

- 4) At rated input voltage the device supplies the rated/maximum output currents. At input voltages above the rated input voltage the output currents must be reduced accordingly at constant output power.

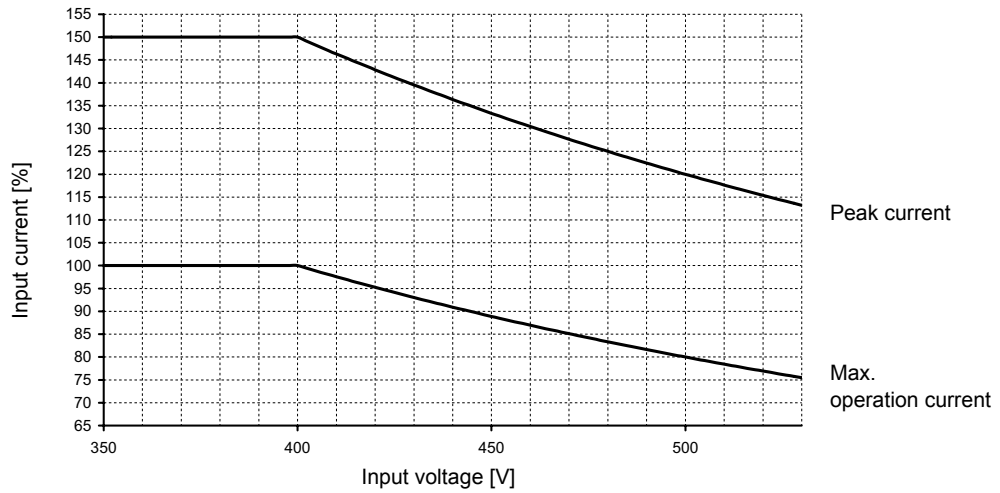


Figure 7: Derating curve input current BM4135

- 5) This overload time is dependent on the motor current and of the heatsink temperature and is determined by the Ixt-monitoring of the device.
- 6) The mains current is reduced by  $\frac{400}{480} = 0,833$  at mains voltage of e.g. 480 V<sub>AC</sub> and permitted output power DC link (instead of 55 A<sub>AC</sub> the mains current is 45,8 A<sub>AC</sub>). When selecting the connected drives ensure that the output power of the DC link is not exceeded.

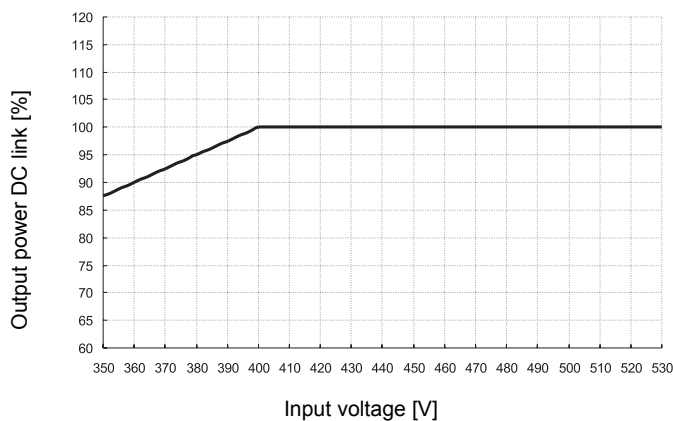


Figure 8: Derating curve output power DC link BM4135

- 7) This power output is only permitted for short periods of time (max. 60 s). This must be ensured by parametrization of the connected drives.
- 8) Inclusive loss of the mains choke

## 3.4 Electrical data

### 3.4.2 Electrical data - BM4145

	BM4145
Input rated power <sup>1)</sup>	86 kVA
Input rated current ( $I_{\text{eff}}$ ) <sup>1)2)3)4)</sup>	125 A
Input peak current ( $I_{\text{eff}}$ ) <sup>1)2)4)5)</sup>	162,5 A
PWM switching frequency	8 kHz
DC link voltage	640 V <sub>DC</sub> to 760 V <sub>DC</sub>
DC link capacity (internal)	3055 μF
DC link capacity (external), permitted	max. 17 mF
DC link discharging time (internal DC link capacity)	70 s
Output power DC link <sup>1)6)</sup>	max. 80 kW
Peak power DC link <sup>7)</sup>	104 kW
Max. peak power time <sup>5)</sup>	60 s
Power factor (only inductive)	0,9 to 1,0
Switch-on frequency	≥ 2 min, see <a href="#">▶Power on switching frequency◀</a> from page 83
Max. charging time	≤ 30 s
Fast discharge	≤ 5 s
Chopper current, permitted ( $\hat{I}$ )	max. 100 A
Chopper resistor external	≥ 8 Ω
Chopper on voltage ( $\hat{U}$ )	814 V
Chopper peak power	80 kW
Permitted chopper continuous power	58 kW
Power loss related to mains connection <sup>8)</sup>	2040 W
Power loss related to control voltage	max. 75 W
Power loss of fan related to 230 V <sub>AC</sub> <sup>9)</sup>	87 W
Cooling air requirement power heatsink BM4145-S / BM4145-A	260 / 210 m <sup>3</sup> /h <sup>10)</sup>
Cooling air requirement internal space of device	60 m <sup>3</sup> /h

<sup>1)</sup> All rated values refer to a mains input voltage of 400 V / 50 Hz and a control voltage of 24 V.

<sup>2)</sup> Effective value at an environmental temperature of 40 °C.

<sup>3)</sup> Between 40 °C and 55 °C the output current must be reduced.  
The permitted output current ( $I_0$ ) is calculated with the following formula:

$$I_0 = I_{0(40^\circ\text{C})} \cdot \left( 1 - \left( \frac{\text{Coolant temperature} - 40^\circ\text{C}}{^\circ\text{C}} \cdot 0,03 \right) \right)$$



- 4) At rated input voltage the device supplies the rated/maximum output currents. At input voltages above the rated input voltage the output currents must be reduced accordingly at constant output power.

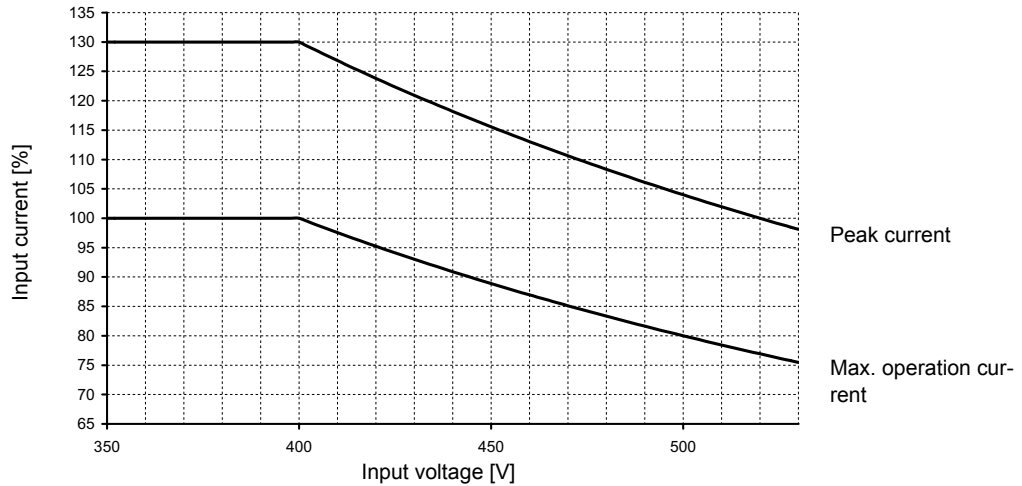


Figure 9: Derating curves input current BM4145

- 5) This overload time is dependent on the motor current and of the heatsink temperature and is determined by the Ixt-monitoring of the device.
- 6) The mains current is reduced by  $\frac{400}{480} = 0,833$  at mains voltage of e.g. 480 V<sub>AC</sub> and permitted output power DC link (instead of 125 A<sub>AC</sub> the mains current is 104,2 A<sub>AC</sub>). When selecting the connected drives ensure that the output power of the DC link is not exceeded.

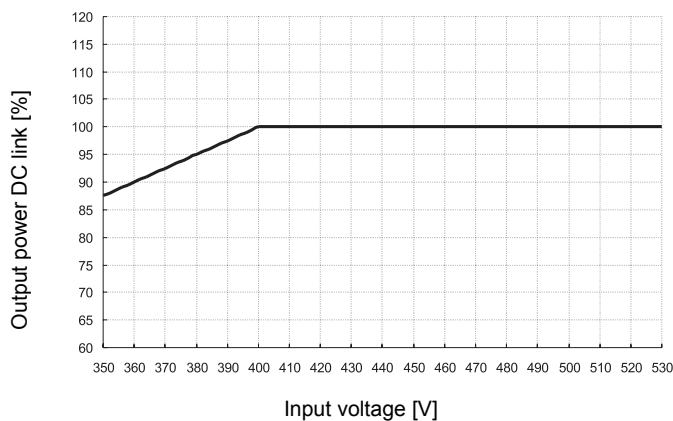


Figure 10: Derating curve output power DC link BM4145

- 7) This power output is only permitted for short periods of time (max. 60 s). This must be ensured by parametrization of the connected drives.
- 8) Incl. mains chokes
- 9) Only valid for cooling variant S.
- 10) The cooling air requirement corresponds is at least to that of a free-blowing device. Free-blowing means, that the air inlet and the air outlet takes place unrestricted. With the mounting of the device into a control cabinet it therefore can be necessary to use additional fans, so that the necessary cooling air requirement is covered. If the necessary cooling air requirement of the power heat sink is not provided, then the output power of the device has to be reduced.

## 3.4 Electrical data

### 3.4.3 Electrical data - BM4163

	BM4163
Input rated power <sup>1)</sup>	162 kVA
Input rated current <sup>1)2)3)4)</sup> ( $I_{\text{eff}}$ )	235 A
Input peak current ( $I_{\text{eff}}$ ) <sup>1)2)4)5)</sup>	305 A
PWM switching frequency	8 kHz
DC link voltage	640 V <sub>DC</sub> to 760 V <sub>DC</sub>
DC link capacity (internal)	6000 µF
DC link capacity (external), permitted	max. 14 mF
DC link discharging time (internal DC link capacity)	130 s
Output power DC link <sup>1)6)</sup>	max. 150 kW
Peak power DC link <sup>7)</sup>	195 kW
Max. peak power time <sup>5)</sup>	60 s
Power factor (only inductive)	0,9 to 1,0
Switch-on frequency	≥ 2 min, see <a href="#">►Power on switching frequency◀</a> from page 83
Max. charging time	≤ 30 s
Fast discharge	≤ 5 s
Chopper current, permitted ( $\hat{I}$ )	max. 230 A
Chopper resistor external	≥ 3,4 Ω
Chopper on voltage ( $\hat{U}$ )	814 V
Chopper peak power	179 kW
Permitted chopper continuous power	130 kW
Power loss related to mains connection <sup>8)</sup>	5300 W
Power loss related to control voltage	max. 80 W
Power loss of fan related to 230 V <sub>AC</sub> <sup>9)</sup>	174 W
Cooling air requirement power heatsink	400 m <sup>3</sup> /h
Cooling air requirement internal space of device	200 m <sup>3</sup> /h

<sup>1)</sup> All rated values refer to a mains input voltage of 400 V / 50 Hz and a control voltage of 24 V.

<sup>2)</sup> Effective value at an environmental temperature of 40 °C.

<sup>3)</sup> Between 40 °C and 55 °C the output current must be reduced.  
The permitted output current ( $I_0$ ) is calculated with the following formula:

$$I_0 = I_{0(40^\circ\text{C})} \cdot \left( 1 - \left( \frac{\text{Coolant temperature} - 40^\circ\text{C}}{^\circ\text{C}} \cdot 0,03 \right) \right)$$

- 4) At rated input voltage the device supplies the rated/maximum output currents. At input voltages above the rated input voltage the output currents must be reduced accordingly at constant output power.

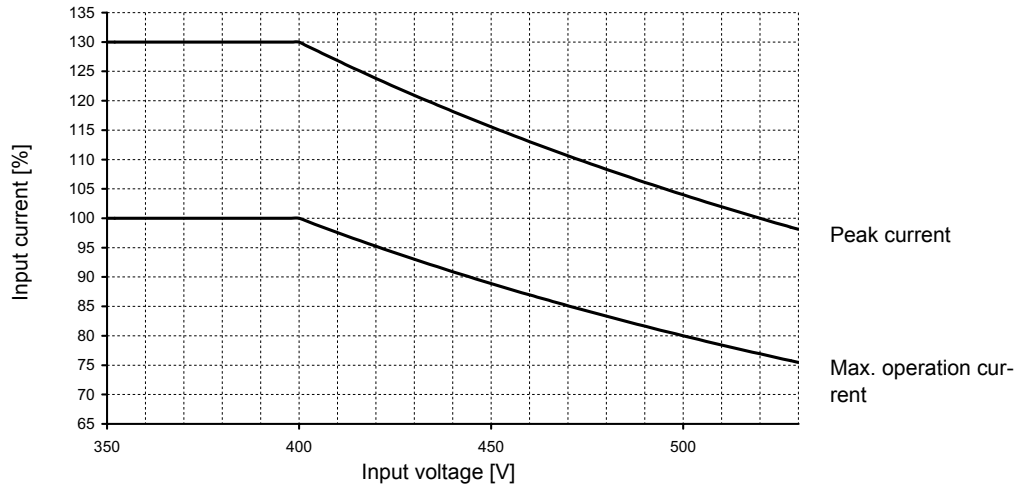


Figure 11: Derating curves input current BM4163

- 5) This overload time is dependent on the motor current and of the heatsink temperature and is determined by the Ixt-monitoring of the device.
- 6) The mains current is reduced by  $\frac{400}{480} = 0,833$  at mains voltage of e.g. 480 V<sub>AC</sub> and permitted output power DC link (instead of 235 A<sub>AC</sub> the mains current is 195,8 A<sub>AC</sub>). When selecting the connected drives ensure that the output power of the DC link is not exceeded.

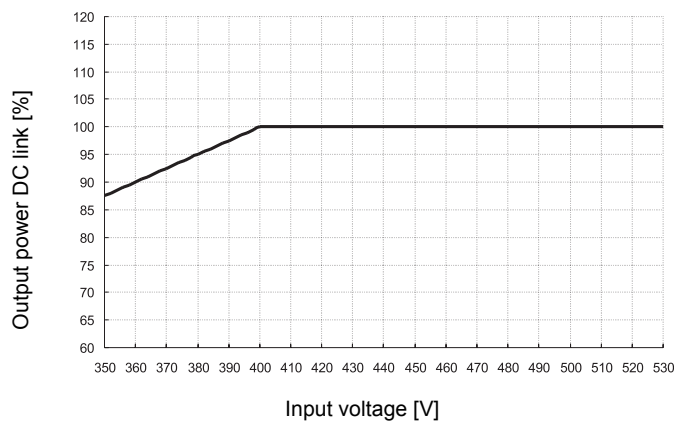


Figure 12: Derating curve output power DC link BM4163

- 7) This power output is only permitted for short periods of time (max. 60 s). This must be ensured by parametrization of the connected drives.
- 8) Incl. mains chokes
- 9) Only valid for cooling variant S.

## 3.4 Electrical data

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### 3.4.4 Electrical data BM4-F-SEA

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	<b>SEA-01</b>	<b>SEA-02</b>
Min. supply voltage	110 V <sub>AC</sub> -10 % / 50/60 Hz	24 V <sub>DC</sub> -15 %
Max. supply voltage	230 V <sub>AC</sub> +10 % / 50/60 Hz	24 V <sub>DC</sub> +20 %
Max. switching current	8 A	8 A

### 3.4.5 Electrical data BM4-F-SRM

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	<b>SRM-01</b>	<b>SRM-02</b>
Min. supply voltage	110 V <sub>AC</sub> -10 % / 50/60 Hz	24 V <sub>DC</sub> -15 %
Max. supply voltage	230 V <sub>AC</sub> +10 % / 50/60 Hz	24 V <sub>DC</sub> +20 %
Max. switching current	15 mA	10 mA

## DESIGN AND OPERATION

### 4.1 Structure

The devices of the **b maXX 4100** series are mains inverters of Baumüller Nürnberg GmbH. The devices convert power drawn from the mains and supply the power module(s) connected via the DC link.

Also the devices can convert mechanical brake energy, supplied from the power modules via the DC link, to feed it back to the mains.

The devices consist of a power unit with an integrated charging circuit and an integrated slot for the controller cartridge. The controller cartridges itself contain, besides the firmly installed controller (slot F), the voltage sensing module (slot A), the contactor monitoring module (slot B), the contactor control module (slot C) and the digital I/O module (slot D) still a few slots, which optional can be equipped.

The rated current of the devices reach from 55 A to 235 A. The devices differ in size, power, equipment (hard- and software) and cooling types.

This information you will find in the type key (see [▶Type code◀](#) on page 42).

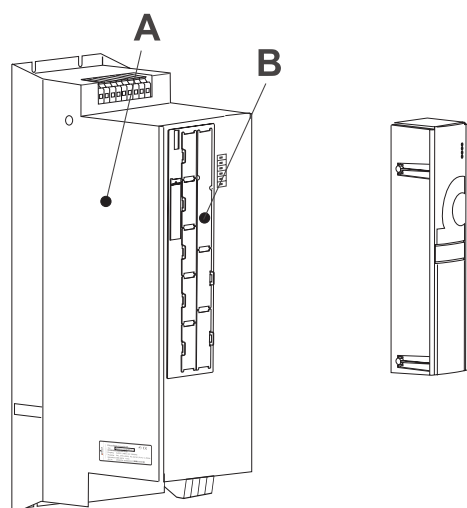


Figure 13: Power unit (A) - controller unit (B)

4100\_0027\_rev01\_int.cdr

## 4.2 Controller unit variants

A device of the series **b maXX 4100** consists of the following parts:

**A:** Power unit  
(converter)

This part is a power converter combination which is build up with power semiconductor components. The feeding in and feeding back is implemented with a B6-IGBT transistor circuit, which has an HF mains choke connected to. The power factor on the mains side is in each operation point  $\cos \varphi = 1$ . The DC link voltage supplying the power module connected to the DC link is 640 (760) V ( $U_{DC}$ ). Permanent part of power unit is a charging circuit. Without taking actions at switching on the mains connection the DC link capacitors lead to invalid high charge surge currents from the mains. In order to avoid these charging surge currents the starting current is limited by a charging circuit. Therefore a buck converter is integrated, which is limited to charging current to charge current to about 1,5 A.

**B:** Controller unit

At reaching a DC link voltage of 500 V ( $U_{DC}$ ) when mains voltage is 400 V and the decrease of the charge current to zero the buck converter is switched off, the main contactor release is generated and the main contactor is switched on by the function module BM4-F-SEA-XX (to slot C). The monitoring signal of the main contactor is transmitted by the function module BM4-F-SRM-XX (to slot B) to the controller. Then the message „Ready-to-operate drive“ is generated via the function module BM4-F-DIO-01/02 (digital I/O to slot D).

For synchronization and mains voltage monitoring a function module BM4-F-UME-01 is used.

The controller unit controls the power unit and all functional modules. You can operate the controller part either with the operating software ProDrive (PC) or via a SPS (BM4-O-PLC-OX), which is deliverable as an option module.

## 4.2 Controller unit variants

There are two variants of the controller unit:

**1-rowed**



This variant is a 1-row equipable controller unit in a 2-rowed installation space. This controller unit is available for every **BM4100**.

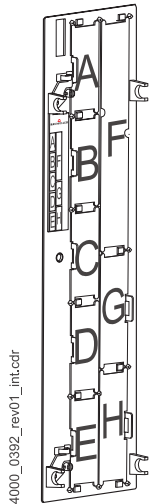
**2-rowed**



This variant is a 2-row equipable controller part in a 2-rowed installation space. This controller unit is available for every **BM4100**.

4.2.1 Slots

In slots of the controller unit function or option modules are plugged, which extend the functional range of the controller unit. Every slot is clearly identified by a code letter.



1- and 2-rowed	A	
	B	Function modules, permanently installed
	C	
	D	With this plug-in module in this slot the controller communicates via a function module bus.
	E	Option modules can <b>not</b> be inserted into these slots.
	F	Controller module, permanently installed.
2-rowed	G	With plug-in modules in these slots the controller communicates via the BACI bus.
	H	In these slots option modules can be inserted. Function modules can <b>not</b> be inserted into these slots.

Each plug-in module in den slots D, E, G and H is delivered with an accordant manual. In the manual of the module amongst other things the mounting and the installation of the module is described.



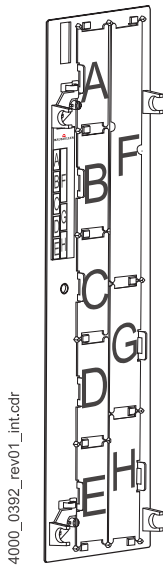
**CAUTION!**

Modules of other manufacturers can damage/destroy the device.  
Only use BM4-F-XXX- and BM4-O-XXX-plug-in modules.

Dependable of the on your device existing controller unit variant you can retrofit optional plug-in modules (function modules and option modules). The slots differ in size and function.

## 4.2 Controller unit variants

### 4.2.1.1 Combination possibilities plug-in module-controller slots



	Function modules								Option modules													
	BM4-F-JME-01, installed permanently	BM4-F-SRM-XX, installed permanently	BM4-F-SEA-XX, installed permanently	BM4-F-DIO-XX (digital I/O), installed permanently	BM4-F-FIO-XX (fast digital I/O)	BM4-F-AIO-01 (analog I/O)	BM4-F-AIO-02/03 (analog I/O)	BM4-O-SER-XX (Sercos slave)	BM4-O-PRO-01 (Profibus slave)	BM4-O-CAN-03 (CANopen slave)	BM4-O-ECT-01 (EtherCAT slave) for controller	BM4-O-PLK-01 (POWERLINK Controlled Node) for controller	BM4-O-EIP-01 (Ethernet-IP) for controller	BM4-O-PLC-XX (SPS)	BM4-O-CAN-04* (CANopen master)	BM4-O-IEI-XX* (incremental encoder emulation)	BM4-O-ETH-01* (Ethernet)	BM4-O-ETH-02* (Ethernet + CANopen Master)	BM4-O-ECT-01* (EtherCAT Slave) for PLC	BM4-O-ECT-02* (Ethernet + EtherCAT master)	BM4-O-ECT-03* (Ethernet + EtherCAT cluster)	
<b>A</b>	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>B</b>	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>C</b>	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>D</b>	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>E</b>	-	-	-	o	o	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>F Controller permanently installed</b>																						
<b>G</b>	-	-	-	-	-	-	-	o	o	o	o	o	o	o	X	X	X	X	X	X	X	X
<b>H</b>	-	-	-	-	-	-	-	X	X	X	X	X	X	X	o	o	o	-	-	-	-	-

- +: Permanently installed function module at this slot
- X: Preferred slot  
Baumüller Nürnberg GmbH recommends, in order to reach the highest functional range, to insert the plug-in modules into this slot.
- o: Possible slot  
only if the preferred slot is occupied, we recommend in order to reach the highest functional range, to insert the plug-in module into this slot.
- : Not possible - card doesn't work in this slot.
- \* Precondition for these cards is an inserted PLC-module (SPS).

Figure 14: Slot combinations



#### NOTE

In case you insert a BM4X-X-XXX plug-in module into an unsuitable slot, it will not operate. We have made sure, that neither the module nor the device are damaged.



### 4.3 Connecting devices

The device is part of the Baumüller series **BM4100 (NWR)** and can be connected together with some, but not all Baumüller devices.

The combination with:

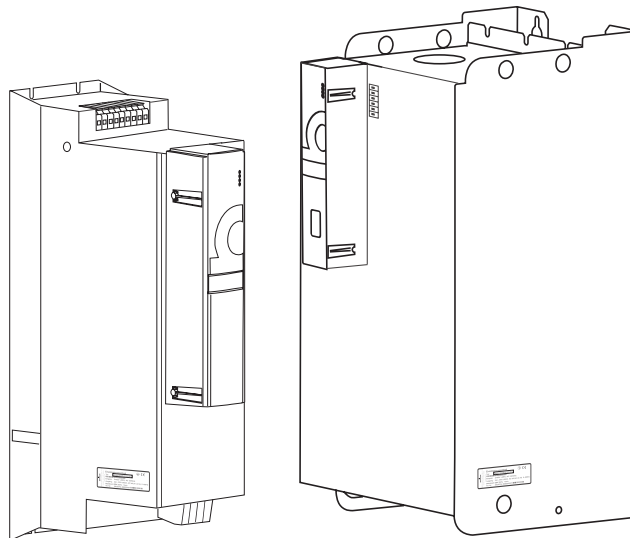
- BM44XX power modules, see operation manual (Document no. 5.12008)

Definitely prohibited is the combination with following devices with a common DC link:

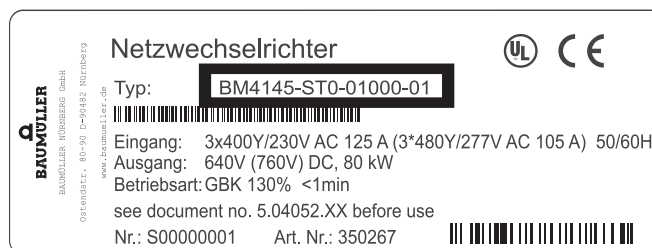
- other BM41XX mains inverter
- all BM44XX basic units, in particular BM441X and BM447X

### 4.4 Type plate

On the type plate (label) you will find, besides others, the type key of the device.



4100\_0030\_rev01\_int.cdr



4100\_0071\_rev01\_int.cdr

Figure 15: Position of type key label

### 4.5 Type code

The type key has the form: BM4XXX - XXX - XXXXX - XX. Directly behind the type key is the design code (- XXXX - XXXX). The design code contains information, which only is important to Baumüller Nürnberg GmbH. That's why in the following table only the type key is explained.

BM4XXX - XXX - XXXXX - XX	Device generation
BM4X <sup>u</sup> XX - XXX - XXXXX - XX	Controller type 1: Vector controller for mains converter
BM4XX <sup>u</sup> X - XXX - XXXXX - XX	Size of cabinet 3 to 6
BM4XXX <sup>u</sup> - XXX - XXXXX - XX	Current grading (output rated current)
BM4XXX - X <sup>u</sup> XX - XXXXX - XX	Cooling type S: air-cooled with air supply and with air outlet in the control cabinet
BM4XXX - XX <sup>u</sup> X - XXXXX - XX	Mains type T: TN- or TT-mains
BM4XXX - XX <sup>u</sup> - XXXXX - XX	Safety relay 0: no module
BM4XXX - XXX - X <sup>u</sup> XXXX - XX	Hardware type X <sup>u</sup> XXXX: Power unit construction XX <sup>u</sup> XXX: Controller unit variants X0XXX: Modules in slots A to E pluggable X1XXX: Modules in slots A to H pluggable XX <sup>u</sup> XXX: internal information via Baumüller Nürnberg GmbH.
BM4XXX - XXX - XXXXX - XX <sup>u</sup>	State of software controller (hardware) 03: Series version 3.x



#### NOTE

This type key is only for the basic device without the plug-in modules. Every plug-in module (except the controller) has its own type key.

## 4.6 Marking of the function modules - type key

On the front sheet you will find the type key of the plug-in module.



### NOTE

This type key is valid only for permanently installed function modules of the series **b maXX 4100**. Other plug-in modules have an own type key.

<u>BM4</u> - F - XXX - XX	Device family, in which the plug-in module can be build in
BM4 - <u>E</u> - XXX - XX	Plug-in module type (function module)
BM4 - F - <u>XXX</u> - XX	Plug-in module identification
SEA:	Main contactor control module
SRM:	Main contactor monitoring module
UME:	Mains voltage sensing module
DIO:	Digital I/O module

## 4.7 UL notes

- [►Requirements to the connecting cables◄](#) on page 62
  - Use 60 °C/75 °C copper wire only for all devices
  - Use Class 1 wire only.
- [►Connection diagrams◄](#) from page 71
  - Note tightening torque for connection terminals.
- [►Required environmental conditions◄](#) on page 28
  - Use the device only in a pollution degree 2 environment
  - Observe the maximum environmental temperature and the derating
- [►Requirements to the energy supply / supply system◄](#) on page 27
  - For use on a solidly grounded wye source only
  - The control circuit shall be supplied by an isolated power supply or control transformer rated max. 42.4 V peak, 10,000 VA.
- [►Fuses◄](#) from page 116
  - BM4135 may also be protected with Type E self protected combination motor controller, sized based on the rated current
  - Converters may be used with listed fuses or listed circuit breakers DIVQ as overcurrent protection.

### cUL notes

Additional only for Canada:



### NOTE

Overvoltage Protection Device have to be installed in front of the input circuit of the device to limit the maximum overvoltage peak to 2.5 kV.

### 4.8 Display and operation elements

#### 4.8.1 LEDs

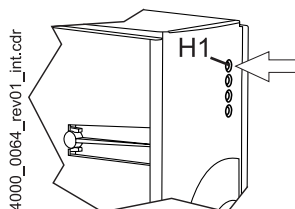
On the front side of the device there are six LEDs. Both of the upper LEDs (UH1 and UH2) are freely programmable. The four lower LEDs (H1 to H4) show information about the operational status and are also emulated in ProDrive.

##### Freely programmable LED (UH1, UH2)

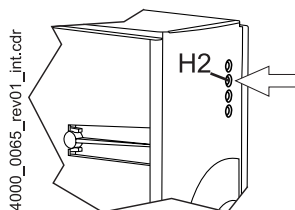
Both LEDs UH1 and UH2 are not led through to the design cover.

##### Operating condition (H1, H2)

Both of the upper LEDs (H1 and H2) indicate, how the device is working at the time.



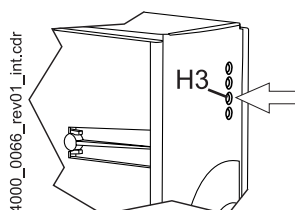
green: DC-link voltage regulated, supply  
orange: DC-link voltage regulated, feedback



green: Pulse enable. DC-link voltage is regulated.  
orange: Power ON, the device is ready-for-use. In case the LED lights up orange colored during operation, maybe the pulse enable is missing.  
green with orange-colored flashing or orange with short green flashing:  
Memory operation active in the EEPROM,  
if possible do not switch off the device in this phase.

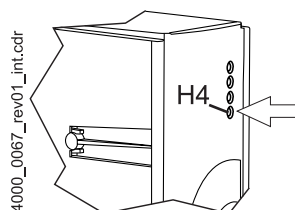
##### Current limit (H3)

The third LED (H-3) indicates whether the current limit has been reached.



red: adjusted current limit of the controller has been reached.  
▶ Adapt application or „no reaction“.

##### Error (H4)



The LED does not light up: the internal monitoring have not found an error.  
Red, continuously: Error.

▶ Remove the error with help of the operating program ProDrive. Further information is to be found in ▶ [Troubleshooting and fault correction](#) ◀ from page 85.

Red, flashing: Warning.

▶ Warnings you are able to see in the device manager of the operating program ProDrive. Warnings do not affect operation of the device. Further information is to be found in ▶ [Troubleshooting and fault correction](#) ◀ from page 85.

4.8.2 Display

The 7-segment-display in normal operation shows the operation status. In case of error the error number is shown.

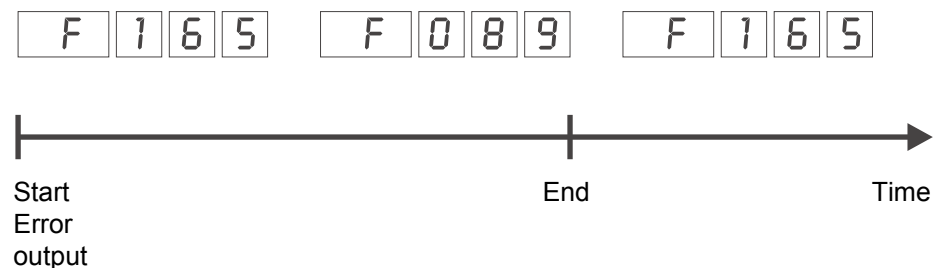
Display	Status	Meaning
0	Not ready to operate	Initialization phase, pulses inhibited.
1	Switch-on inhibit	Pulses inhibited, initialization completed error-free.
A	Main contactor ready for switch on	Complete pre-charging successfully
2	Ready to operate	Pulses inhibited, main contactor switched on
3	Switched on	Pulse enabled
4	Operation enabled	U <sub>DC-link</sub> regulated, ready-for-use for the drive is enabled
C	Operation enabled	U <sub>DC-link</sub> not regulated, ready-for-use for the drive is enabled
F	Fault	Pulses inhibited, error status In the display the error number is shown.

The single statuses are specified in chapter device management in parameter manual 5.04054.

In the status error the error numbers are shown in the display. Only the errors are shown, which enable an error reaction in the drive or have enabled one. Errors without reaction and also warnings are not displayed.

Therewith the display of the error number begins that for about 1.5 s „F“ is shown. Then the three digits of the error code are displayed. The single digits thereby accordingly are shown for about 0.8 s, interrupted by a short break. If there are further errors, the other errors are shown according to the same principle. The procedure is repeated, as soon as all errors have been shown.

Example: Error 165 and 89 are present:



4-100\_0056\_rev01\_int.cdr



# TRANSPORT AND PACKAGING

## 5.1 Safety notes for transport

---

**NOTICE!****Damage due to unauthorized transport!**

Transport handled by untrained personnel can lead to a substantial amount of material damage.

Therefore:

- The unloading of the packages upon delivery as well as the in-house transport should only be done by trained personnel.
- Contact Baumüller Nürnberg GmbH sales office if necessary.

**WARNING!****Danger of mechanical hazard!**

Secure devices against falling down.

Therefore:

- Take suitable measures, such as supports, hoists, straps, etc., to ensure that devices cannot fall down.
- Use appropriate handling material.

## 5.2 What to observe when transporting

---

For initial transport of the device, it is packed at the manufacturer. If the device is to be further transported, ensure that the following conditions are met throughout the entire transport:

- Climate class 2 K 3 as per EN 60721-3-2
- Temperature range - 30 °C up to + 70 °C
- Vibration, shock, continuous shock class 2 M 1 as in EN 60721-3-2

### 5.3 Transport inspection

Upon receiving the delivered goods, immediately examine them for completeness and transport damage.

If there is outwardly visible transport damage, proceed as follows:

- Do not accept the delivery or conditionally accept it with reservations.
- Note the extent of the damage on the transport documents or on the delivery note of the transport agent.
- Immediately file a complaint with the freight carrier. Have the complaint confirmed in writing and immediately contact the responsible representative of Baumüller Nürnberg GmbH.



**NOTE!**

The device may not be operated if there is visible transport damage!

### 5.4 Unpacking

After having received the still packaged device:

- Avoid transport shocks and hard jolts, e.g. when putting an item down.

If no transport damage is visible:

- Open the packaging of the device.
- Verify the delivery scope based on the delivery note.

File a claim with the responsible Baumüller representative if the delivery is incomplete.



**NOTE!**

Claim each individual deficiency as soon as it has been detected. Damage claims can only be validly asserted within the claim registration period.

### 5.5 Disposal of the packaging

The packaging consists of cardboard, plastic, metal parts, corrugated cardboard and/or wood.

- When disposing of the packaging, comply with the national regulations.



# 6

## MOUNTING

The device is designed for mounting in a control cabinet.

Mounting consists of the following steps:

- 1 Prepare mounting  
(for drill holes/cut-out segments, see [▶Drilling patterns◀](#) from page 53)
- 2 Install  
(fixing see [▶Mounting instructions◀](#) on page 55)

### 6.1 Safety notes

---



#### **NOTE!**

Mounting shall only be performed by employees of the manufacturer or by other qualified personnel.

Qualified personnel are persons who – on account of their occupational training, experience, instruction and knowledge of relevant standards and stipulations, accident prevention regulations and operating conditions – are authorized by the persons responsible for the safety of the facilities to perform the respective activities that are necessary, while at the same time recognizing and preventing any potential risks. The qualifications necessary for working with the device are, for example:

- Occupational training or instruction in accordance with the standards of safety engineering for the care and use of appropriate safety equipment.



### **WARNING!**

#### **Danger as a result of faulty mounting!**

The mounting requires qualified personnel with adequate experience. Faulty mounting can lead to life-threatening situations or substantial material damage.

Therefore:

- Only allow mounting to be performed by employees of the manufacturer or by other qualified personnel.



### **WARNING!**

#### **Danger of mechanical impact!**

Secure devices against falling down.

Therefore:

- Take suitable measures, such as supports, hoists and assisting personnel, to ensure that device cannot fall down.
- Use appropriate means of transport.



### **NOTICE!**

#### **Danger due to electrostatic discharge.**

The connecting terminals of the device are partially at risk due from ESD.

Therefore:

Please heed the respective notes.

**CAUTION!****Danger due to sharp edges.**

If the device is lifted with unprotected hands during mounting, palms or fingers can be cut. If the device falls, feet could be injured.

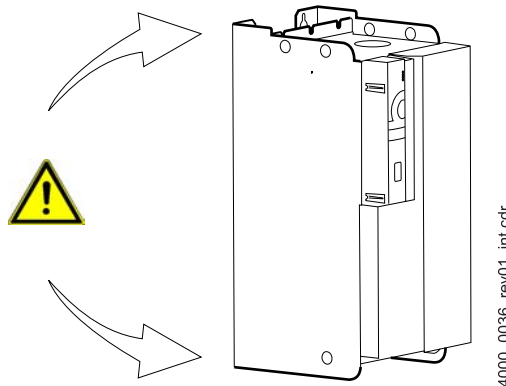


Figure 16: Danger area near the mechanical mounting

Therefore:

- Ensure that only qualified personnel, who are familiar with the safety notes and assembly instructions, mount this device.



Wear safety gloves.



Wear safety shoes.

### 6.2 Preparing for mounting

Based on the planning documents and the drilling pattern (see [▶Drilling patterns◀](#) from page 53), the cutout sections and the positions of the attachment drill holes can be determined.



#### **NOTICE!**

##### **Property damage due to conductive contamination.**

Therefore:

- When performing installation work of any kind, it must be ensured that no foreign material (e.g. drill shavings, copper strands, etc.) gets into the device as a result.
- If possible, the drilling of the holes should be done before mounting the device and the configuring of the cables should take place outside of the control cabinet. If this is not possible, the device must be appropriately covered. Remove this covering again prior to start!



#### **CAUTION!**

##### **Eye injury due to flung particles.**

Metal particles are flung when making the drill holes and the cutout sections.

Therefore:



Wear protective eye wear!

- Preparing drill holes and cutout sections.

6.2.1 Drilling patterns

Use the drilling pattern to make the necessary drill holes/cutout sections.



**NOTE!**

Consider the minimum clearances for cooling when making the drill holes.

All dimensions in millimeters [mm].

Further notes see [►Dimensions◄](#) from page 23 and [►Cooling◄](#) from page 29.

How to determine the required space in the control cabinet, see [►Dimensions◄](#) from page 23.

**Tolerance specifications**

Drill hole dimensioning	±0.2 mm
Dimensioning openings	+1.0 mm
Relative tolerance of discretionary divisions	±0.1 mm

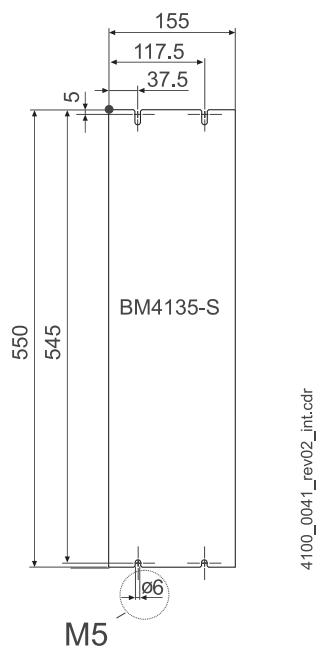


Figure 17: Drilling pattern BM4135

## 6.2 Preparing for mounting

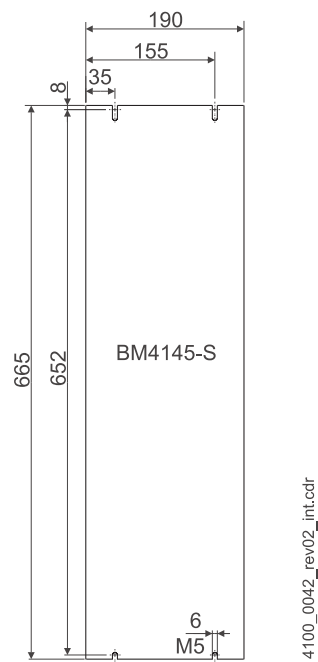


Figure 18: Drilling pattern BM4145

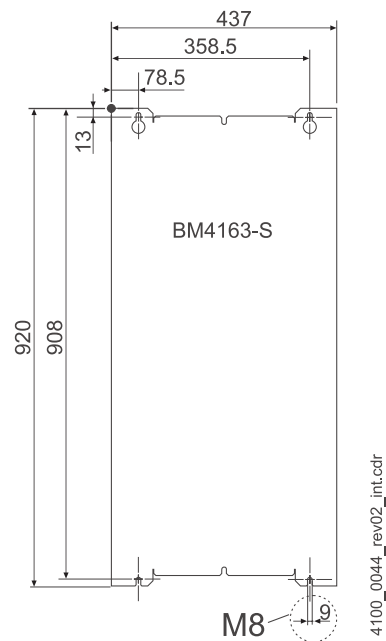


Figure 19: Drilling pattern BM4163

### 6.3 Mounting instructions

---

There are different kinds of mounting.

Each mounting method is shown in a graphic (see [▶Figure 20◀](#) on page 56 to [▶Figure 21◀](#) on page 57)

The screws and washers required for mounting are listed beneath the respective graphic.

Carry out mounting as follows:

- 1 Provide suitable transport/lifting equipment as needed.
- 2 Keep suitable fastening components readily available.
- 3 Mount the device.

## 6.3 Mounting instructions

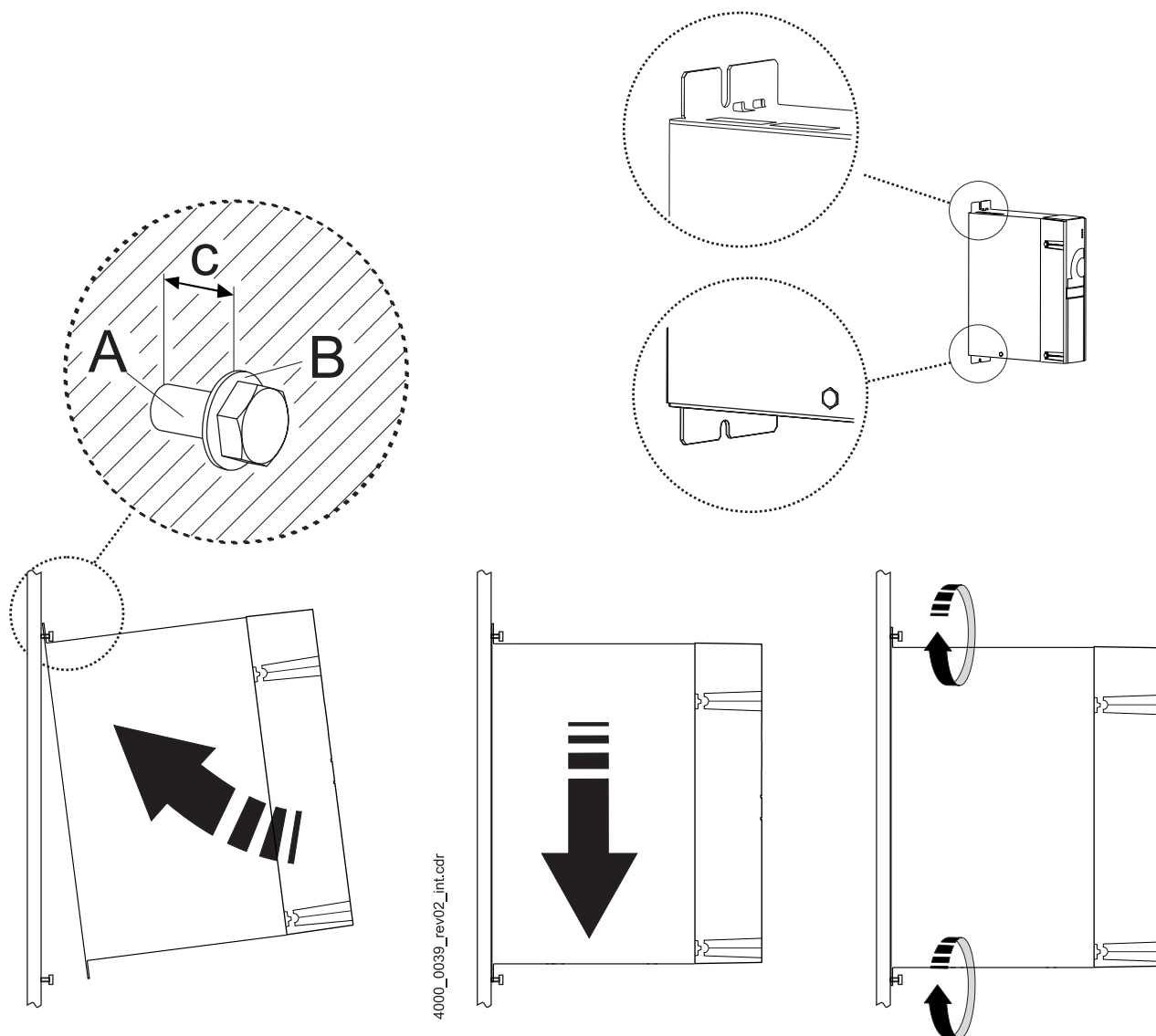
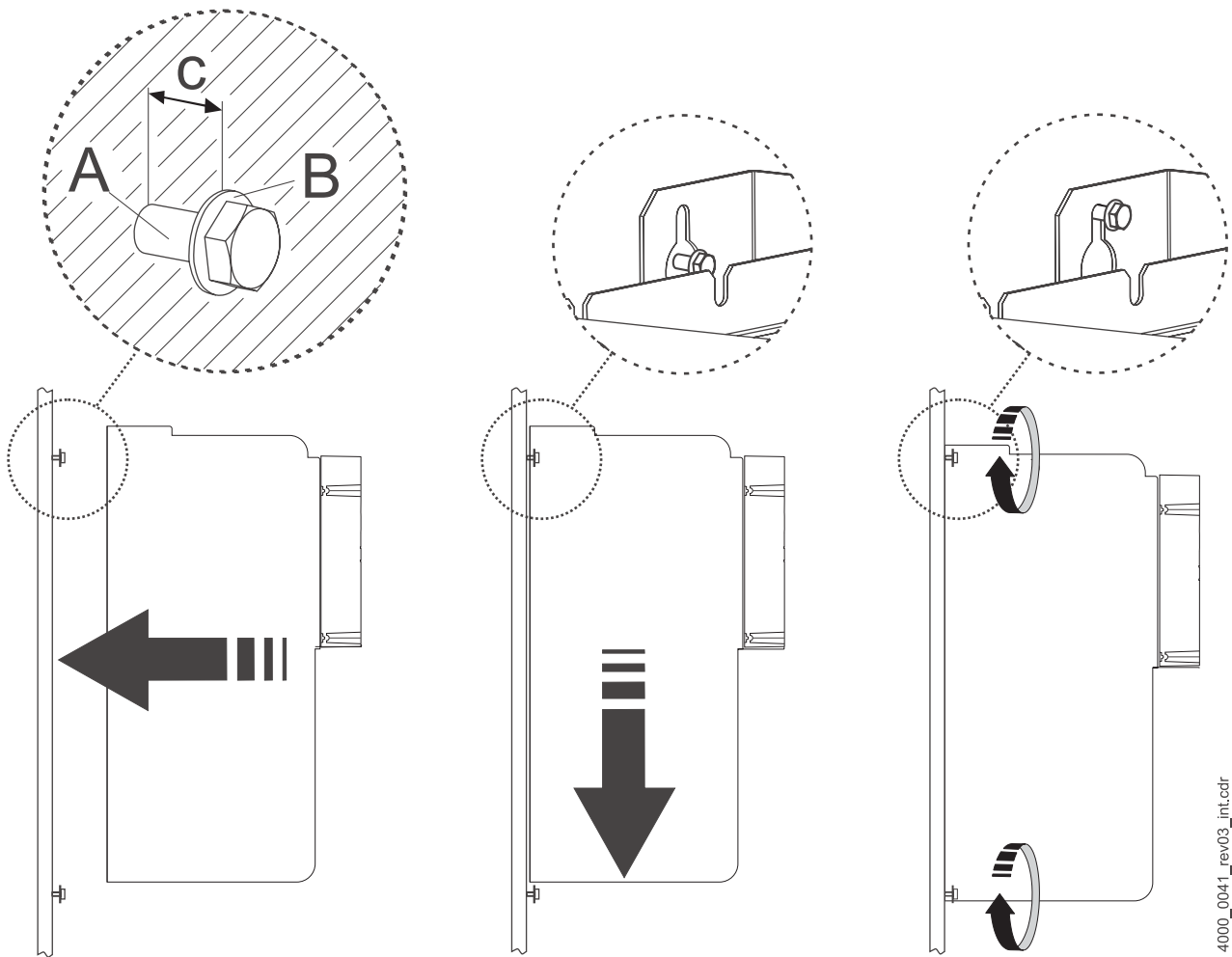


Figure 20: Mounting instruction BM4135-S and BM4145-S

Device	<b>BM4135-S</b>	<b>BM4145-S</b>
A - screws	4 x M5	4 x M5
B - washers	4 x (5,3 x 10)	4 x (5,3x15)
c - mounting space	c = 5 mm	c = 5 mm





4000\_0041\_rev03\_int.cdr

Figure 21: Mounting instruction BM4163-S

Device	<b>BM4163-S</b>
A - screws	4 x M8
B - washers	4 x (8,4 x 17)
c - mounting space	c = 0,7 mm



# 7

## INSTALLATION

This chapter describes the electrical installation of the device. The mechanical mounting is described in [▶Mounting◀](#) from page 49.

Initial commissioning is described in the **Parameter manual b maXX 4100** in chapter Commissioning.

Prior to installation, ensure that the technical prerequisites have been fulfilled:

- 1 Check the demands on the electrical power supply.
- 2 Check the requirements for the electrical cables and the provision of corresponding cables.
- 3 Check the properties of the connections and the specified configuration of the respective cables.

### 7.1 Safety notes

---



#### NOTE!

Installation shall only be performed by employees of the manufacturer or by other qualified personnel.

Qualified personnel are persons who – on account of their occupational training, experience, instruction and knowledge of relevant standards and stipulations, accident prevention regulations and operating conditions – are authorized by the persons responsible for the safety of the facilities to perform the respective activities that are necessary, while at the same time recognizing and preventing any potential risks. The qualifications necessary for working with the device are, for example:

- Occupational training or instruction, and the authorization to commission, ground and mark electrical power circuits and devices in accordance with the standards of the safety engineering.
- Occupational training or instruction, in accordance with the standards of work safety, for the care and use of appropriate safety equipment.



### WARNING!

#### Danger because of faulty installation and initial commissioning!

Installation and commissioning require qualified personnel with adequate experience. A installation fault can cause danger situations or large damage of property.

Therefore:

- Only personnel from manufacturer or qualified personnel operate while installation and initial commissioning



### DANGER!

#### Risk of fatal injury from electrical current!

Inevitably, when operating this electrical device, certain parts of it are energized with hazardous voltage.

Therefore:

- Pay heed to areas on the device that could be dangerous during the electrical installation.
- Pay heed to areas on the device that could still be electrically energized after operation.

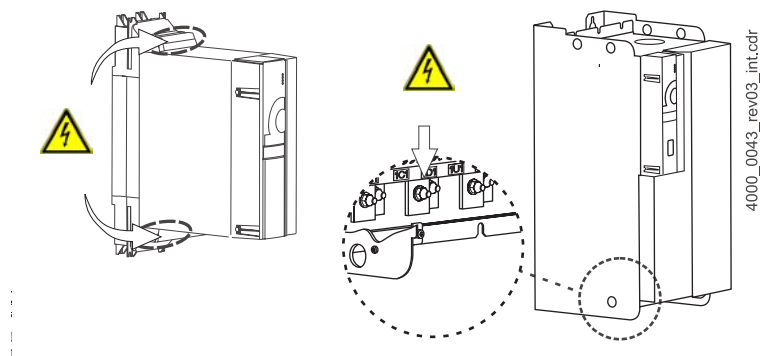


Figure 22: Hazard areas during electrical installation

### Danger from residual energy

**DANGER!****Risk of fatal injury from electrical current!**

Stored electric charge.

Discharge time of the system = discharge time of the device with the longest DC link discharge time in the DC link connection.

Refer to [►Electrical data◄](#) from page 30.

Therefore:

- Do not touch before taking into account the discharge time of the capacitors and electrically live parts.
- Heed corresponding notes on the equipment.
- If additional capacitors are connected to the DC link, the DC link discharge can take a much longer time. In this case, the necessary waiting period must be determined or a measurement made as to whether the equipment is de-energized. This discharge time must be posted, together with an IEC 60417-5036 (2002-10) warning symbol, on a clearly visible location of the control cabinet.

## 7.2 Voltage test

**DANGER!****Risk of fatal injury from electrical current!**

During the routine test of these devices, a voltage test is performed by Baumüller Nürnberg GmbH in accordance with EN 61800-5-1, Section 5.2.3.2. It is thus unnecessary for the customer to do this.

Therefore:

- Subsequent tests of the devices using high voltages may only be performed by Baumüller Nürnberg GmbH.
- Disconnect the converter from the system during high-voltage testing!

### 7.3 Demands on the power supply

---

For all important data, see [►Requirements to the energy supply / supply system◄](#) from page 27.

Minor deviations from requirements in the power supply can lead to malfunctioning of the device. If the power supply deviates too much from the requirements, the device can be destroyed.

The devices may only be operated in industrial networks.

The destruction of the device can cause personal injury.



#### **DANGER!**

#### **Risk of fatal injury from electrical current!**

If the requirements for the power supply are not complied, the device can be damaged or destroyed, thereby greatly endangering individuals.

Therefore:

- Prior to installation, ensure that the demands for power supply have been fulfilled.

### 7.4 Requirements to the connecting cables

---

- Take into account IEC/EN 60204-1, Chapter 13 when selecting the cable.
- The protective ground cross-section of the cable must be compliant with IEC/EN 60204-1, Section 5.2, Tab. 1.
- A fixed connection for the protective ground conductor is mandatorily specified for operation of the device.
- Use copper cable approved for a minimum of 60 °C (drives < 3 x 100 A) or 75 °C (drives ≥ 3 x 100 A), if comply with UL 508C.

For further details (e.g. maximum permitted length), see [►Cabling◄](#) from page 112.

### 7.5 Protection of the device and the cable

---

Fuses must be installed to protect this device and the cables against overload and possible damage/destruction through the electrical power supply. For data on the required fuses, see [►Fuses◄](#) from page 116.

## 7.6 PE connection and RCD compatibility

Depending on the functional principle, leakage current  $>3.5 \text{ mA}_{AC}$  or  $>10 \text{ mA}_{DC}$  can flow through the protective ground conductor. Consequently, a stationary ground conductor connection in accordance with EN 61800-5-1 is required.



### **DANGER!**

#### **Risk of fatal injury from electrical current!**

This product can cause direct and/or alternating current in the protective ground conductor.

The leakage current, due to the functional principle of the device, can lead to premature triggering of the fault current protective device or generally prevent triggering of it.

Therefore:

- Wherever a differential current device (RCD) is used for protection in case of direct or indirect contact, only an RCD of the type B is permitted on the power supply side of the device.
- Otherwise a different protective measure must be utilized, such as separation from the surroundings by means of double or enhanced isolation, or separation from the power supply system by means of an isolating transformer, for example.

## 7.7 Installation requirements with regard to EMC



### **NOTE!**

The emission of radio frequency interference (RFI) is to a great extent dependent on the wiring, spatial expansiveness and the arrangement of the components in the system. Ensuring electromagnetic compatibility compliance in accordance with legal requirements is therefore only possible on the completely assembled system and is thus the responsibility of the system manufacturer or proprietor (re Art. 6, Par. 9 of the EMVG; European EMC law).



### **NOTE!**

The important information on EMC-compliant installation can be found in these instruction handbook. Additional notes on building a CE-compliant system, that are imperative to take heed of, can be found in the Baumüller manual „Mains filter BFN“, 5.09010. This manual can be obtained from Baumüller Nürnberg GmbH.

## 7.8 Mains filter and surge-protection module

---

In order to have EMC-compliant and problem-free use within the framework of the legislation, the following aspects must be taken into account.

In case of any questions, please contact Sales or the Applications department of Baumüller Nürnberg GmbH.

- Use Baumüller components.
- Use a suitable mains filter
- Mount all components to a single mounting board with well electroconductive surface (e. g. galvanized steel plate).
- Carry out the earth connection converter/earth plate as short as possible (< 30 cm) with fine-wired cables and a big cross section (> 10 mm<sup>2</sup>).
- When installing, attend to the correct order:  
mains - fuse - filter - choke - **BM4100 (NWR)**.
- Run the cables directly on the surface of the earthed mounting board.  
(smallest possible effective aerial height).
- Keep a minimum clearance of 20 cm between signal and control wires towards electric power cables at parallel laying.
- Cross cables with different EMC categories (signal cables - mains cables) only in a 90° angle.
- Contact external cable screens when executing through-hole mounting, which separate the different EMC ranges.
- Connect the shield of the cables of the **b maXX**-devices plane on both ends and highly conductive with earth.

## 7.8 Mains filter and surge-protection module

---

The use of the mains filters mentioned in the manual is mandatory. The requested filters are UL-listed, see [►Mains filters◄](#) on page 118.

When using a mains filter an surge-protection module is necessary, refer to [►Surge protection module◄](#) on page 118.



### NOTE!

The assembly of mains inverter - choke - filter must be built up more compact in order to reduce EMC interferences.

## 7.9 Main contactor and charge contactor

---

In order to control the pre-charge and the main operation a main contactor as well as a charge contactor must be used as a component of the mains inverter in the control cabinet. The data of the main contactor and of the charge contactor is to be found in [►Main contactor and charge contactor◄](#) on page 124.

## 7.10 HF mains choke

---

Because of the working principle of the mains inverter an HF mains choke is necessary. Data of HF mains chokes are to be found in [►Power chokes◄](#) from page 123.



## 7.11 Installation procedure



### **DANGER!**

#### **Risk of fatal injury from electrical current!**

Electrically live parts are life-threatening.

Therefore:

- Make certain that the parts to be mounted (e.g. power supply cables) and the mounting areas are de-energized for the entire duration of mounting the device.

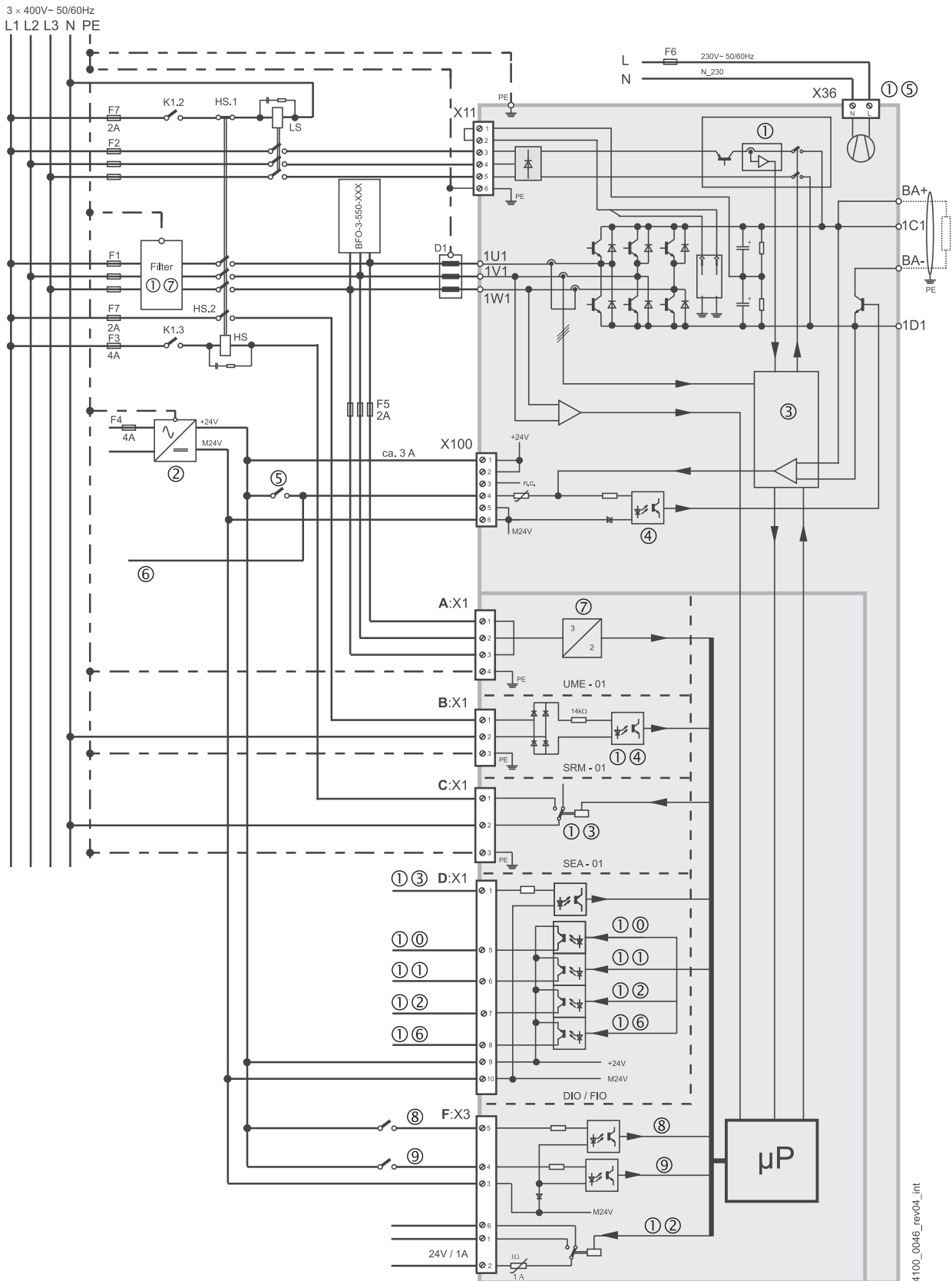
- Lay all cables EMC-compatible.
- Connect cables (see [▶Connection diagram with SEA-01 / SRM-01◀](#) from page 66). (Observe the torques!)

The following steps must be carried out at installation:

- 1 connect the fuses (F1).  
(in case you consider UL 508 C: use UL-listed fuses, see chapter [▶Fuses◀](#) from page 116.)
- 2 connect the mains filter
- 3 connect the main contactor to the mains filter.
- 4 connect the surge-protection module.
- 5 connect the choke (D1) to the main contactor output.
- 6 connect the device via the mains input terminals 1U1, 1V1 and 1W1 to the mains choke output.
- 7 close the protective conductor at the terminal PE (a permanent protective conductor connection is imperatively required).
- 8 connect the fuses (F2).
- 9 connect the charging conductor.
- 10 connect the device via the pre-charge terminals X11/1, X11/2 and X11/3 at the pre-charge contactor.
- 11 connect the 24 V supply via terminals X100-1/2, X100-5/6.  
in case you consider UL 508 C: limit the current to 4 A).
- 12 connect the mains voltage sensing module.
- 13 connect the motor via main contactor monitoring module.
- 14 connect the motor main contactor release module 1U1, 1V1, 1W1, PE.
- 15 connect the digital I/O module.
- 16 connect the DC link via 1C1 and 1D1.
- 17 perhaps connect dependent on the application via the terminals Ba+ and Ba-/1C1 a quick discharging resistor.

### 7.12 Connection diagram with SEA-01 / SRM-01

①	Charge circuit
②	Power supply unregulated 24 V ± 10 % with secure electrical separation (PELV) accordant EN 50178
③	DC link voltage monitoring
④	Chopper resistor control
⑤	Chopper resistor ON
⑥	Chopper resistor bus
⑦	Mains voltage monitoring
⑧	Pulse enable
⑨	Reset error memory
①⑩	Ready for pulse enable
①①	Power limit reached
①②	Ready-for-operate drive (additional signal for compatibility with former devices), either signal ①⑩ or signal ①② can be used (we recommend signal ①⑩)
①③	Main contactor ON
①④	Monitoring signal main contactor
①⑤	Fan for power unit (only for BM4145 upwards)
①⑥	Ready for main contactor ON
①⑦	Mains filter, see <a href="#">►Mains filters◄</a> on page 118
BFO	Surge protections module, see <a href="#">►Surge protection module◄</a> on page 118
BA-...1D1	see <a href="#">►Figure 29◄</a> on page 71 and the following
L / N (X36)	Connections for fan (only from BM4145 upwards)
1U1, 1V1, 1W1	see <a href="#">►Figure 29◄</a> on page 71 and the following
D1	HF mains choke
F1, F2, F3, F7	Fuse, see <a href="#">►Fuses◄</a> on page 116
LS	Charging contactor
HS	Main contactor
X11	see <a href="#">►Figure 29◄</a> on page 71 and the following.
X100	see <a href="#">►Figure 32◄</a> on page 74
A:X1	see <a href="#">►Figure 34◄</a> on page 76
B:X1	see <a href="#">►Figure 34◄</a> on page 76
C:X1	see <a href="#">►Figure 34◄</a> on page 76
D:X1	see <a href="#">►Figure 34◄</a> on page 76



4100\_0046\_rev04\_int

Figure 23: Connection diagram

### 7.13 Proposal control power on/off

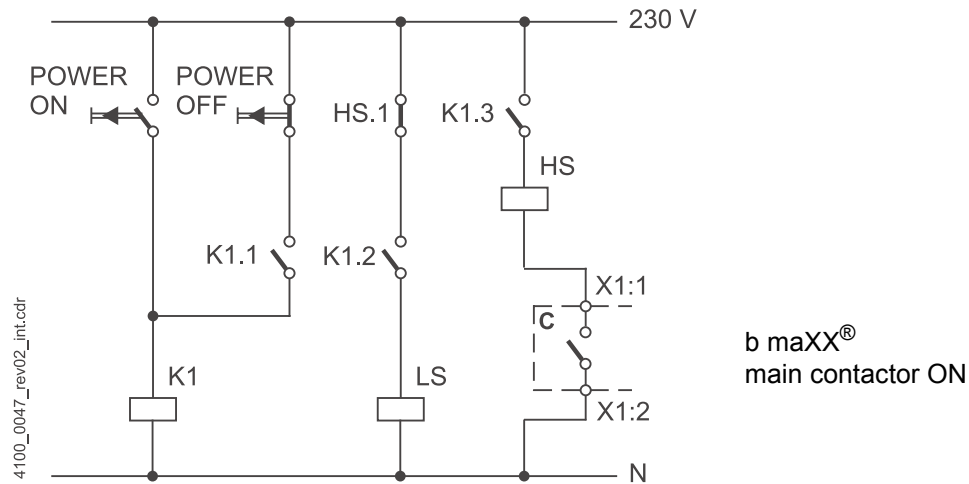


Figure 24: Proposal control power On/Off

### 7.14 Proposal main contactor control

The main contactor can be controlled via ProDrive/BACI or via the digital inputs of the Digital IO module.

- Control via ProDrive /BACI
  - Page Device manager in ProDrive  
Select control „via ProDrive“ and/or „via BACI“
  - The main contactor can be switched on or off with the command „On“ and „Off“.
- Control via the Digital IO module
  - Page Drive manager in ProDrive  
Select control „only via pulse enable“
  - Following is set on default:  
Pin 8 (output 4): Ready for main contactor ON  
Pin 1 (input 1): Main contactor ON  
Following connection is recommended (the main contactor is switched-on automatically by the device):

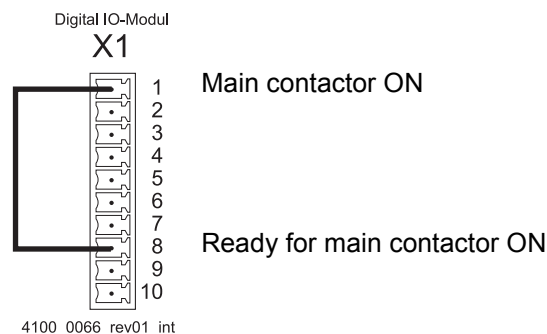


Figure 25: Connection main contactor control via Digital IO module

### 7.15 Proposal controlling pulse enable

A time delay of 500 ms is required between ready for pulse enable (D:X1-5) and pulse enable.

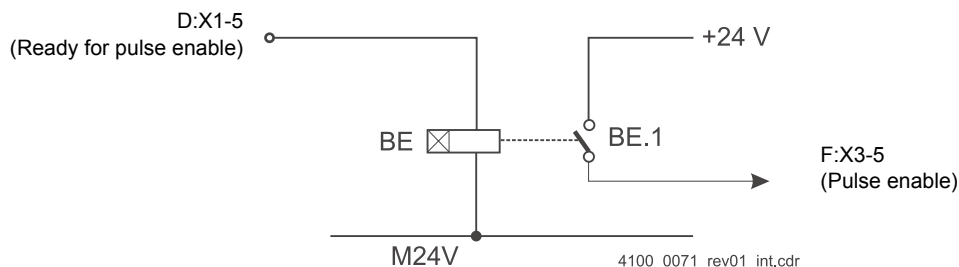


Figure 26: Proposal controlling pulse enable

### 7.16 Discharge DC-link / chopper resistor control

#### Discharge DC-link

At applying a 24 V control voltage at the terminal X100-4 the chopper resistor transistor is switched on independent of the amplitude of the DC-link voltage and without interlocking by the controller due to the discharging of the DC-link. Therefore it has to be considered, that the switching input is only activated at inhibited controller and a main contactor, which is switched off.

#### Chopper resistor control

Independent of the switching of the input „Discharge DC-link“ X100-4 from a DC link voltage greater than 814 V on the chopper resistor is automatically switched on. As soon as the DC link voltage falls below 795 V, the chopper resistor is switched off.

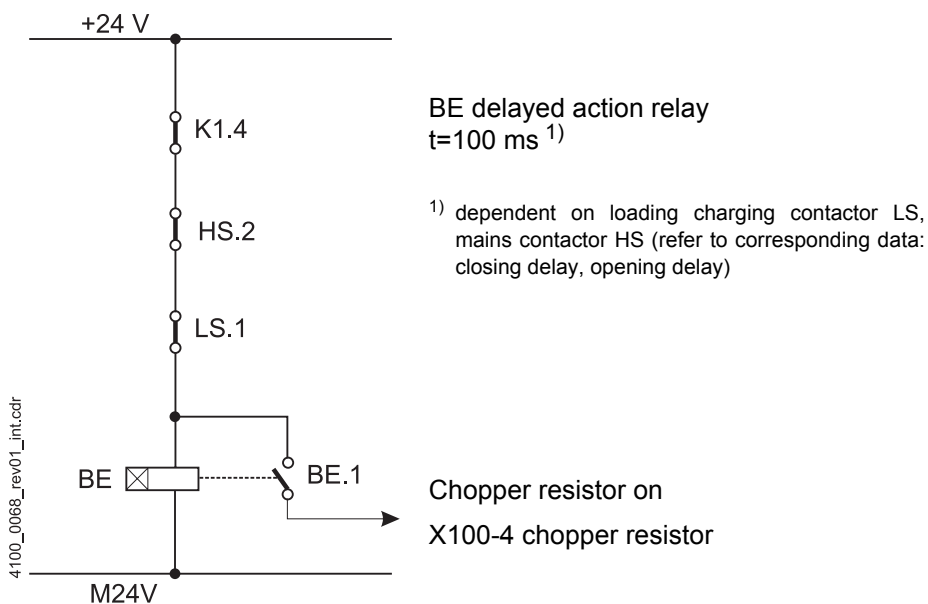


Figure 27: Recommended chopper resistor control

### 7.17 Proposal against system reactions

An additional HF mains choke (see [▶Figure 28◀](#)) can reduce the system reactions, if the reaction to switching frequencies on the mains because of defects within the mains supply is too high.

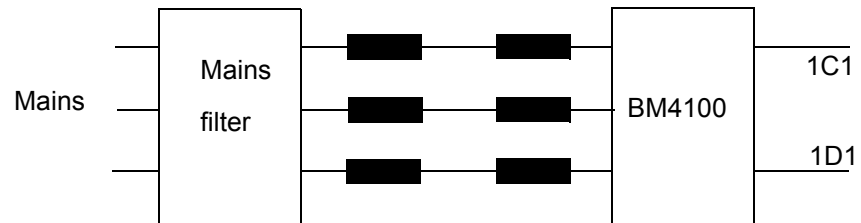


Figure 28: Proposal against system reactions

7.18 Connection diagrams

The figures from >Page 71< to >Page 73< show the connections for protective conductor, mains, chopper resistor, DC link. >Figure 32< on page 74 shows the connection of control voltage and the connections of the controller unit. >Figure 34< on page 76 shows the connections of the function modules in the slots A to D.

The electrical connections for the device **BM4135** are shown in the following figure:

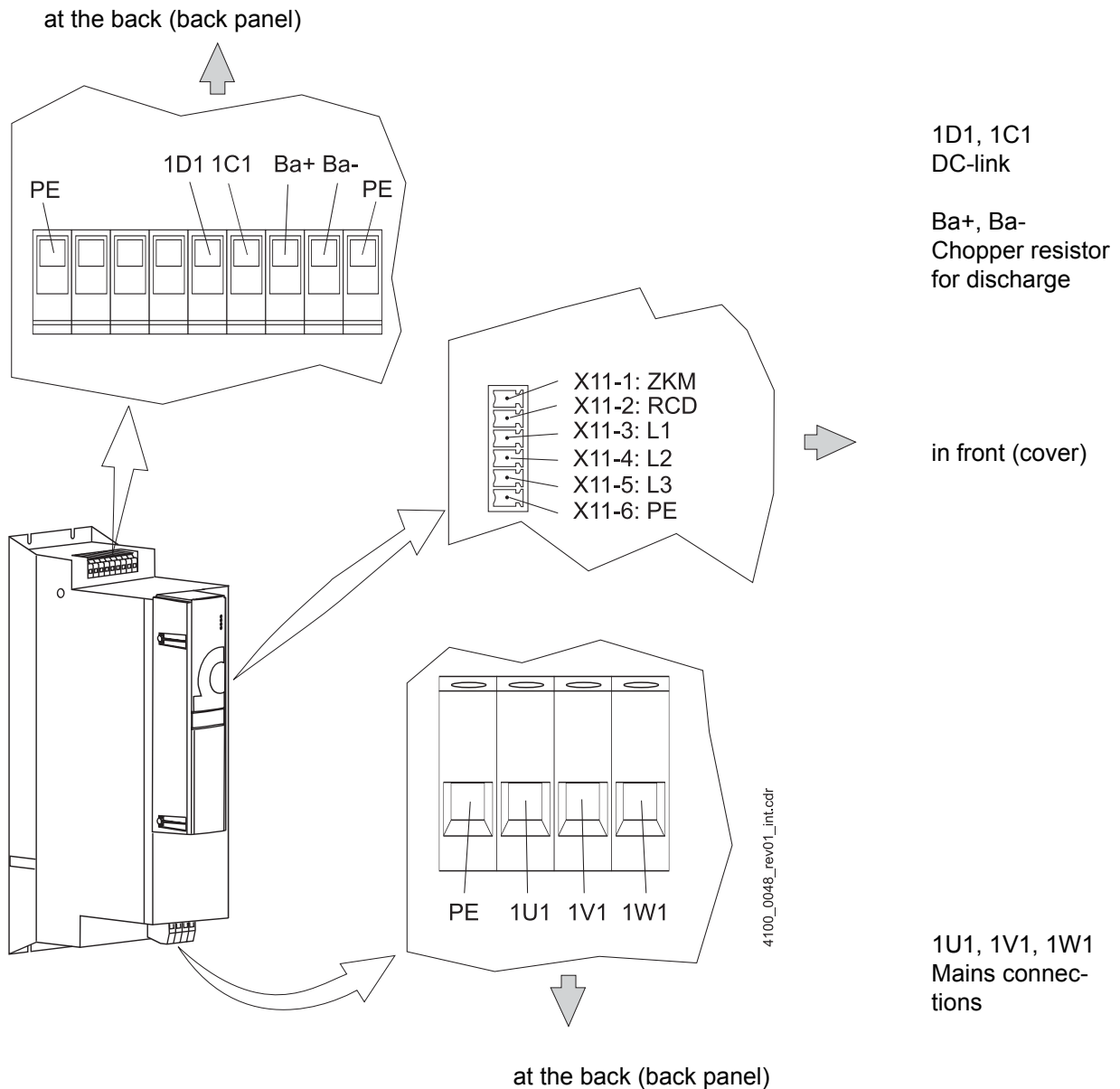


Figure 29: Electrical connections for mains, DC-link, upon others for BM4135

**NOTE**



X11-1 (ZKM) and X11-2 (RCD) must be short-circuited with a cable adapted for the mains voltage.

## 7.18 Connection diagrams

The electrical connections for device **BM4145** are shown in the following figure:

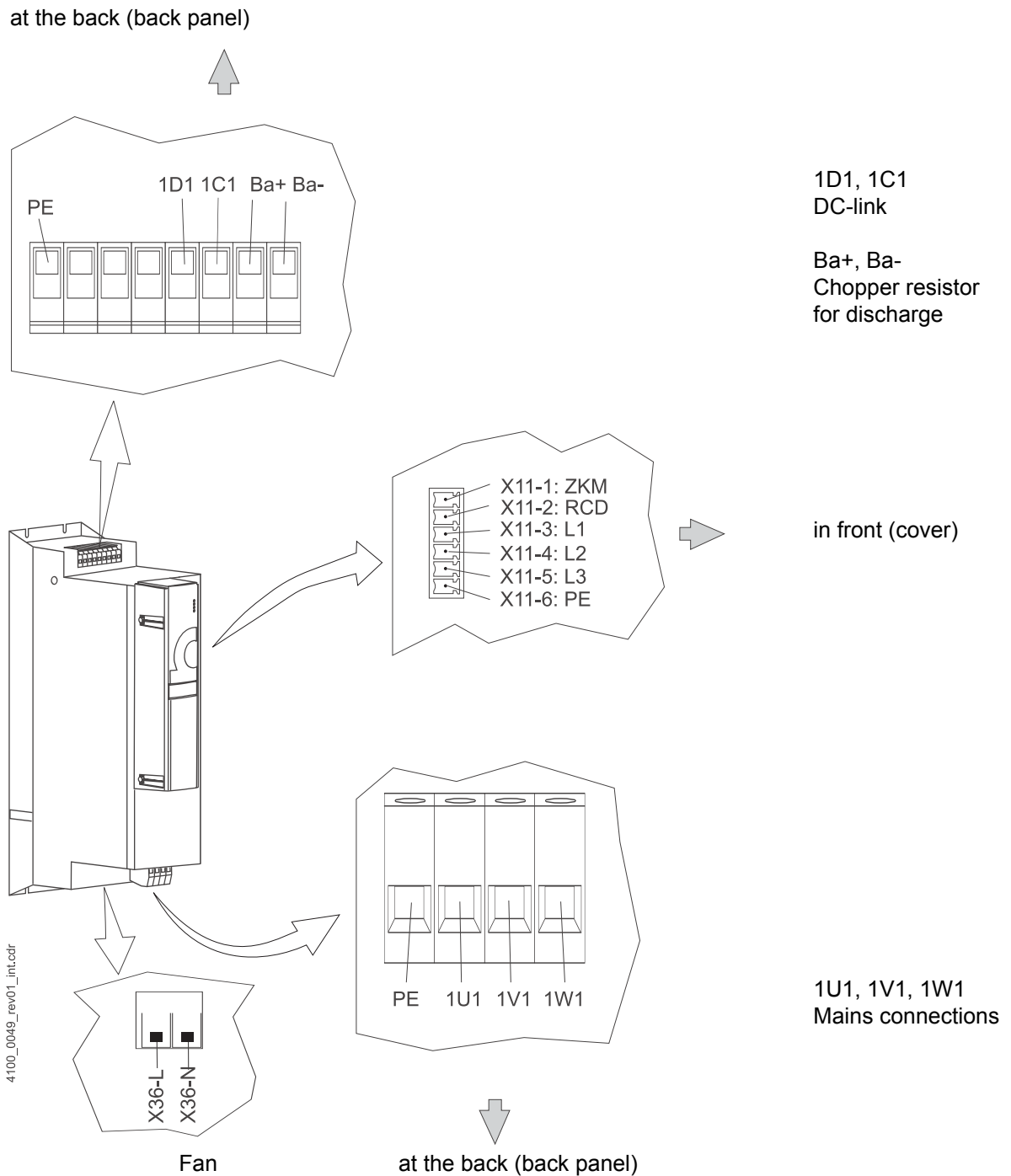


Figure 30: Electrical connections for mains, DC-link, upon others for BM4145

### NOTE

X11-1 (ZKM) and X11-2 (RCD) must be short-circuited with a cable adapted for the mains voltage.





The electrical connections for device **BM4163** are shown in the following figure:

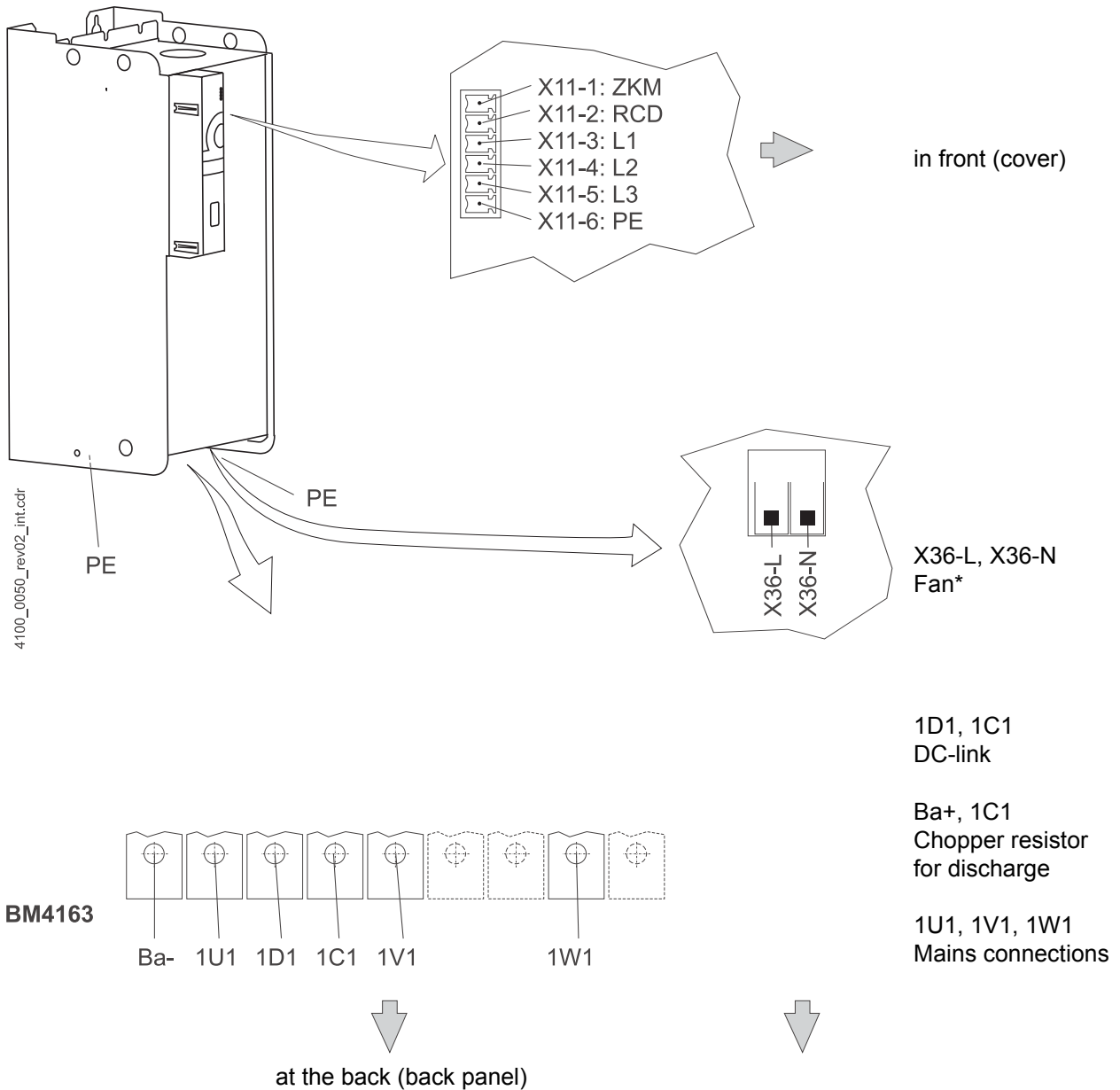


Figure 31: Electrical connections for mains, DC-link, upon others for BM4163

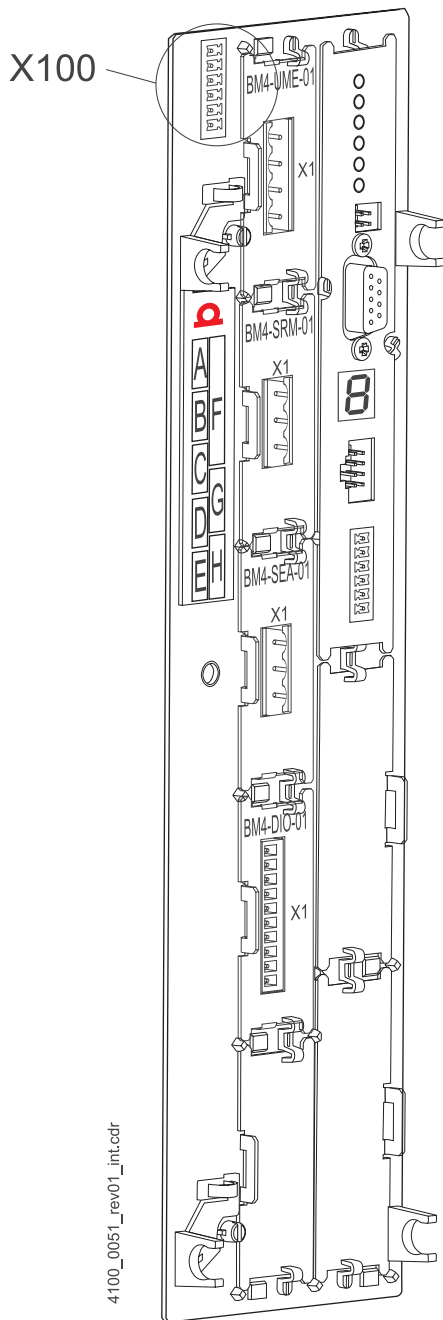
**NOTE**



The chopper resistor is connected at the device BM4163 between Ba- and 1C1. See also ►Figure 23◄ on page 67.

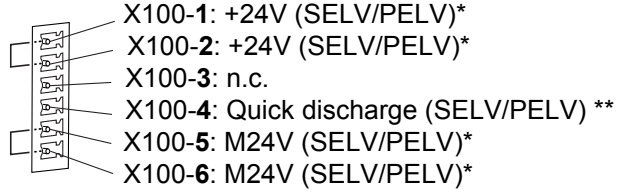
X11-1 (ZKM) and X11-2 (RCD) must be short-circuited with a cable adapted for the mains voltage.

## Electrical connections of the controller unit



4100\_0051\_rev01\_int.cdr

4000\_0057\_rev02\_int.cdr



Do not connect X100-3. This is different to BM44XX-devices.

Figure 32: Connection X100

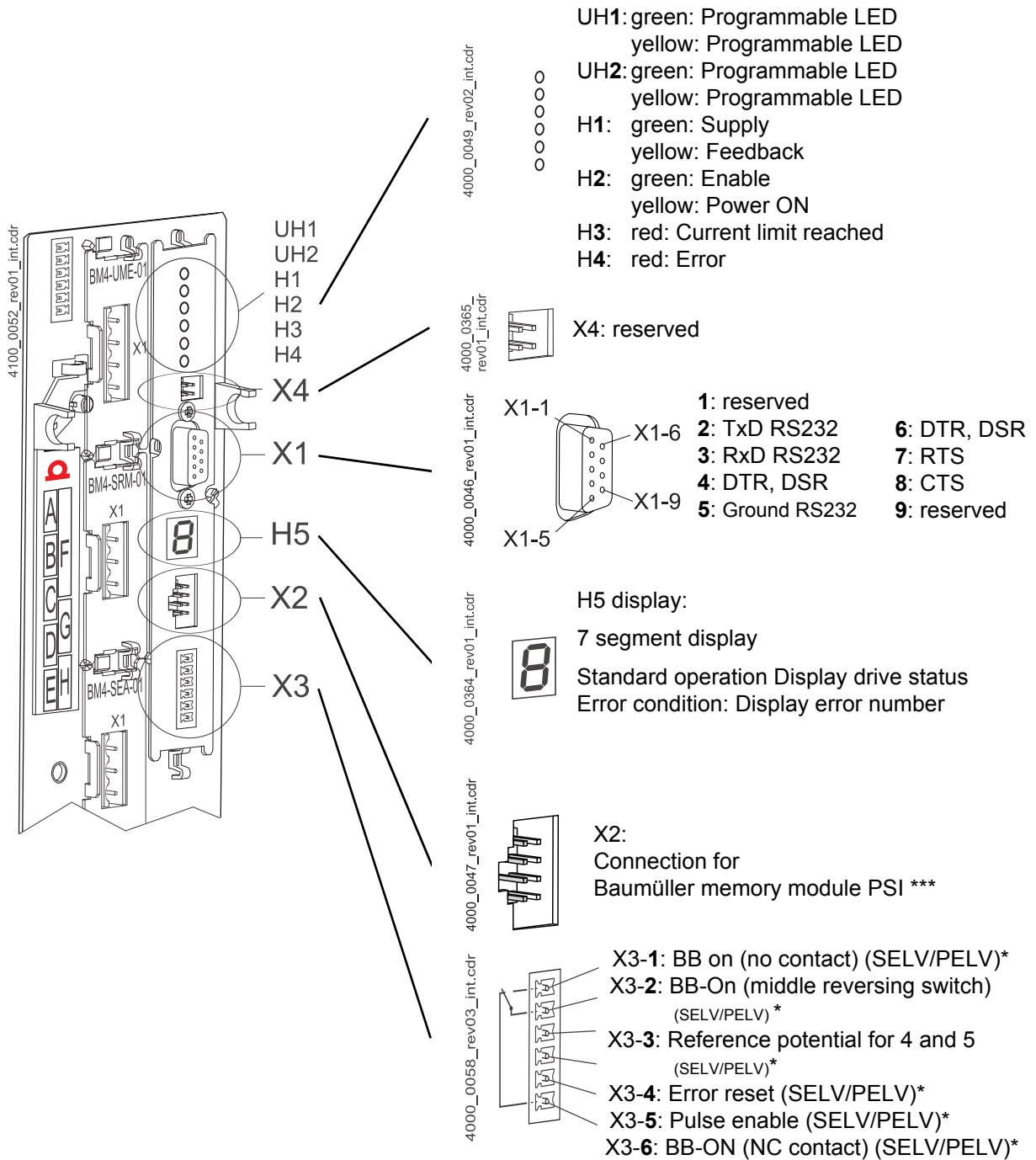


Figure 33: Connections of the controller part

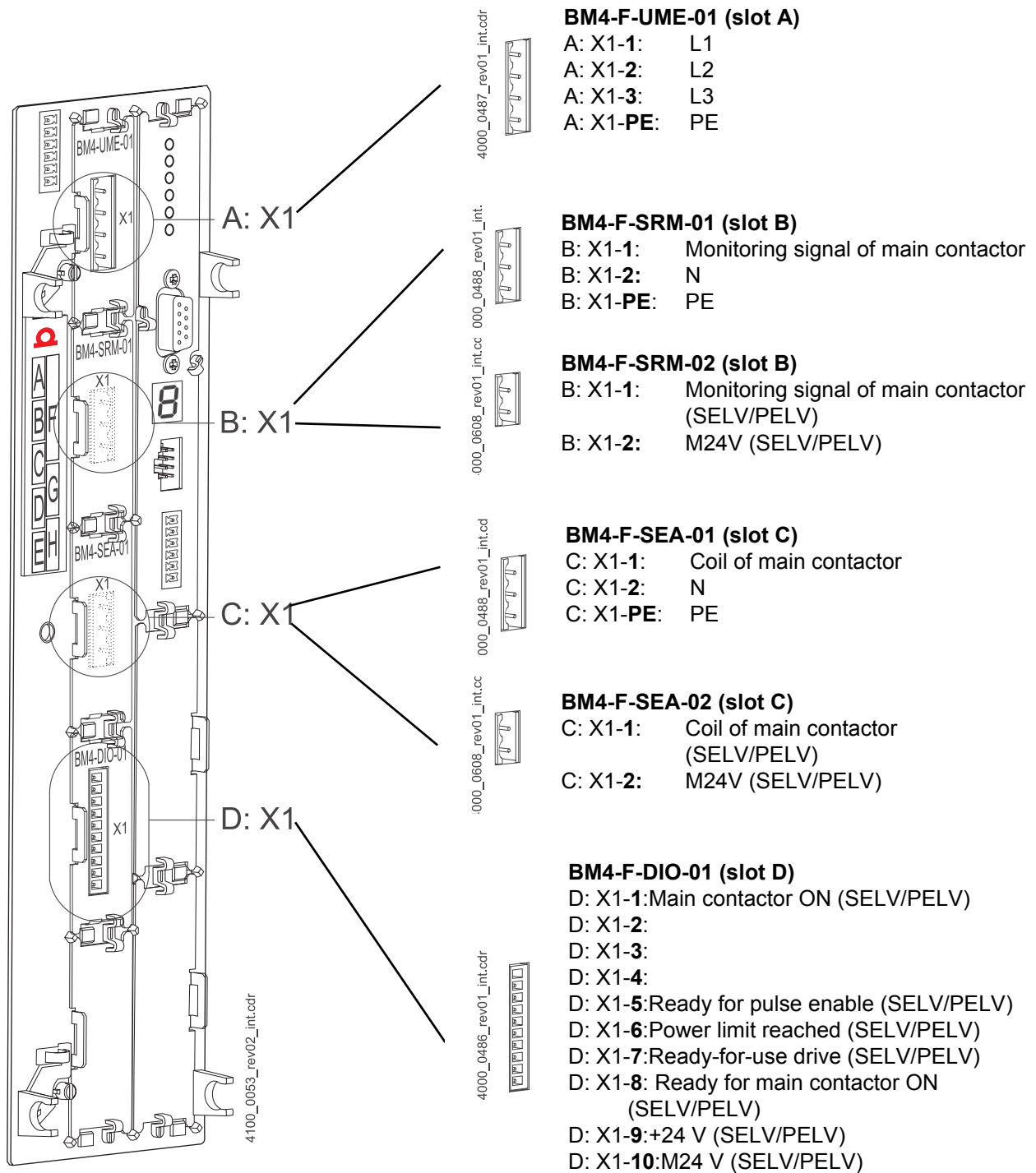


Figure 34: Connections of b maXX BM4100 (NWR)-function modules

Main contactor control with SEA-01 and SRM-01

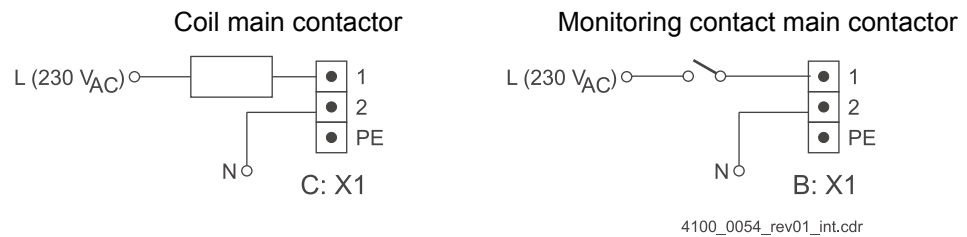


Figure 35: Connection main contactor SEA-01 and SRM-01

Main contactor control with SEA-02 and SRM-02

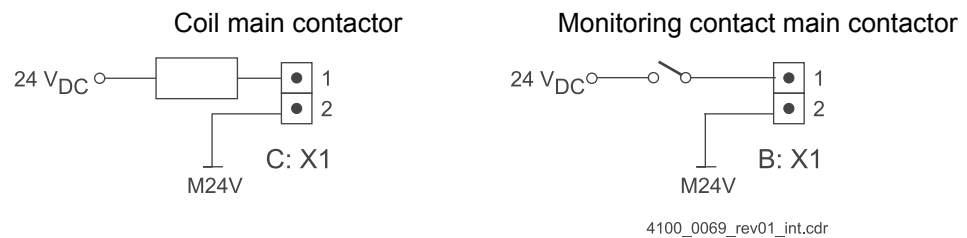


Figure 36: Connection main contactor SEA-02 and SRM-02



**NOTE**

The maximal switching current of SEA is 8 A.



**NOTE**

\* in case you consider UL 508 C: limit the current to 4 A.

\*\* do not provide the terminals X100-3 or X100-4 with voltage, if the device is not supplied with voltage via X100-1/2.

(the signals "mains on" and "chopper resistor" are internal digital control signals of the system

b maXX<sup>®</sup>. They are used at applications with DC link connection.)

\*\*\* The PSI module may not be attached or withdrawn, if the b maXX<sup>®</sup> device is switched on. Beforehand switch off the device.

Further notes for the usage of the PSI module are to be found in parameter manual

## 7.18 Connection diagrams

### 7.18.1 Connector data of connections

#### Mains 1U1, 1V1, 1W1, PE

	AWG	Max. cross-section connection	Connection technology	Torque
BM4135	AWG 6	16 mm <sup>2</sup>	Screw terminals	1.2 to 1.5 Nm
BM4145	AWG 1/0	50 mm <sup>2</sup>	Screw terminals	6 to 8 Nm
BM4163		2 x 150 mm <sup>2</sup> 2) 3)	Cable lug for M10	20 Nm

1) The cable lug may be 25 mm wide at most. The maximum cable diameter is dependent on the cable lug. In case the cable lug, which you use, can safely clamp a stronger cable than 95 mm<sup>2</sup>, you may also use stronger cables than 95 mm<sup>2</sup>. See also [Cables power supply-device](#) on page 112.

2) The cable lug may be 35 mm wide at most. The maximum cable diameter is dependent on the cable lug. In case the cable lug, which you use, can safely clamp a stronger cable than 185 mm<sup>2</sup>, you may also use stronger cables than 185 mm<sup>2</sup>. See also [Cables power supply-device](#) on page 112.

3) One cable of the mentioned cross section is sufficient for the operation.

#### DC-link 1C1 and 1D1 <sup>2)</sup> Chopper resistor Ba+ and Ba- <sup>1)</sup>

	AWG	Max. cross-section connection	Connection technology	Torque	Charge capacity 1C1 and 1D1 <sup>2)</sup> Ba+ and Ba- <sup>3)</sup>
BM4135	AWG 6	16 mm <sup>2</sup>	Screw terminals	1.2 to 1.5 Nm	see <a href="#">Electrical data - BM4135</a> on page 30.
BM4145	AWG 1/0	50 mm <sup>2</sup>	Screw terminals	6 to 8 Nm	see <a href="#">Electrical data - BM4145</a> on page 32
BM4163		2 x 150 mm <sup>2</sup> 5) 6)	Cable lug for M10	20 Nm	see <a href="#">Electrical data - BM4163</a> on page 34

1) Not short-circuit-proof, consider maximum load! See „Chopper resistor external“ in chapter [Technical Data](#) from page 23.

2) See „connected load DC-link“ [Technical Data](#) from page 23.

3) See „permissible chopper resistor continuous power“ [Technical Data](#) from page 23.

4) The cable lug may be 25 mm wide at most. The maximum cable diameter is dependent on the cable lug. In case the cable lug, which you use, can safely clamp a stronger cable than 95 mm<sup>2</sup>, you may also use stronger cables than 95 mm<sup>2</sup>.

5) The cable lug may be 35 mm wide at most. The maximum cable diameter is dependent on the cable lug. In case the cable lug, which you use, can safely clamp a stronger cable than 185 mm<sup>2</sup>, you may also use stronger cables than 185 mm<sup>2</sup>.

6) One cable of the mentioned cross section is sufficient for the operation.

**X1 (RS 232)**

	Recom- mended con- nection cable	Connection technology	Note
BM4135 BM4145 BM4163	LIYCY 6x2x0.14 mm <sup>2</sup>	SUB-D, 9-pin	available as cable set: see <a href="#">►Interface cable RS232◄</a> on page 115.



**WARNING!**

**Risk of injury because of mechanical hazard!**

If a PC is not connected via an isolated transformer, the machine can do unexpected actions.

Therefore:

Connect the PC via an isolated transformer or use a battery operated PC (e. g. lap-top, notebook) without connecting a charger.



**NOTE!**

In case you don't use an optically decoupled interface cable, the cable shield has only to be connected to the connector housing at the controller connector.

The company Baumüller Nürnberg GmbH recommends the usage of optically decoupled transmitters (e.g. from the company Ratioplast part No. 901SV232C6095 and part No. 901SV232T6095)

Refer to [►Interface cable RS232◄](#) on page 248, if the cable is made by the customer.

**X3 (SELV/PELV) <sup>1)</sup>**

	Max. cable-Ø	Connection technology	Load capacity
BM4135 BM4145 BM4163	1.5 mm <sup>2</sup>	plug-in contact	X3-1, X3-2 and X3-6: <b>4.0 A</b> in case you consider UL 508 C: max. <b>1.0 A</b>

<sup>1)</sup> X3-1 and X3-2: not short-circuit proof

**X100 (SELV/PELV) <sup>1)</sup>**

	max. cable-Ø	Connection technology	Load capacity
BM4135 BM4145 BM4163	1.5 mm <sup>2</sup>	plug-in contact	X100-1, X100-2, X100-5 and X100-6: <b>4.0 A</b>

<sup>1)</sup> X100-3 and X100-4: limited short-circuit proof, in case of short-circuit a current flow of 10 mA is possible

## 7.18 Connection diagrams

### X11

	Max. cable-Ø	Connection technology	Loading
BM4135 BM4145 BM4163	1.5 - 2.5 mm <sup>2</sup>	plug-in contact	X11-1 to X11-5: H07 to 1000 V see <a href="#">►Pre-charge protection◄</a> on page 117

### A: X1 to C: X1 <sup>1)</sup>

	Cable-Ø	Connection technology	Load capacity
BM4135 BM4145 BM4163	0.75 - 2.5 mm <sup>2</sup>	plug-in contact	X1-1, X1-2 and X1-3: H07 to 1000 V max. <b>1.0 A</b>

### D: X1

(SELV/PELV)

	Cable-Ø	Connection technology	Load capacity
BM4135 BM4145 BM4163	0.75 - 1.5 mm <sup>2</sup>	plug-in contact	X1-5 to X1-10: in case you consider UL 508 C: max. <b>1.0 A</b>



#### NOTE

Further information according the function module BM4-F-DIO/FIO-xx are to be taken from the manual BM4-F-DIO/FIO-xx.

### 7.18.2 Requirements for the screwing (UL)

in case you consider UL 508 C: refer to the torques specified in [►Connector data of connections◄](#) from page 78.



# OPERATION

## 8.1 Safety notes

---

### Basic information

**WARNING!****Risk of injury due to improper operation!**

Improper operation can lead to severe personal injury or material damage.

Therefore:

- Perform all operational steps according to the details of these instruction handbook.
- Before beginning any work, ensure that all coverings and protective devices are installed and are functioning properly.
- The control cabinet in which the device is installed should be protected against contact with electrically live parts.  
Keep all doors of the control cabinet closed during operation.

**NOTICE!****Environmental conditions that do not meet the requirements.**

Environmental conditions that are non-compliant can lead to property damage.

Therefore:

- Ensure that the environmental conditions are kept compliant during operation (see [►Required environmental conditions◄](#) on page 28).



### WARNING!

#### Risk of injury due to insufficient qualifications!

Inevitably, when operating this electrical device, certain parts of this device are energized with hazardous voltage. Improper handling can lead to significant personal injury and material damage.

Therefore:

- Only qualified personnel may work on this device!

## 8.2 Operating concept

After the device has been commissioned it is parameterized (i.e. adapted to the application). Once parameterization has been completed, the device can be operated with one of the two following operation systems:

### System 1

- Two enable signals (see [▶Enable signals◀](#) on page 82) via digital inputs/outputs

### System 2

- Two enable signals (see [▶Enable signals◀](#) on page 82) via digital inputs/outputs
- Higher level control, which controls the two enable signals and in addition give commands via digital inputs/outputs and/or e.g. the field bus.

The operating software ProDrive is not necessary during operation.

The operating software ProDrive is only necessary, if an error occurs or if parameters have to be changed. In case of an error the service engineer can, with the help of ProDrive determine the error.

### 8.2.1 Enable signals

These signals must have a signal level of 24 V (DC) and must be connected to the terminals X3-4 and X3-5 ([▶Figure 23◀](#) on page 67).

#### Pulse enable

During operation the signal 'pulse enable' must constantly be available, so that the device supplies power. Additionally the pulse enable has to be generated by the controller. Both signals are AND-linked, so the failure of one of these signals results in impulse inhibit of the power unit.

#### Quick stop

Disable the signal 'quick stop' only, if you must stop the installation/device as quick as possible.

During operation the signal 'quick stop' must be available, so that the device supplies power.

### 8.3 Power on switching frequency

The device may not be switched on and off as often as you like. Between two switch-on-sequences there should be a certain time period (at least 2 min.), in order to protect the devices/fuses (see [► Technical Data ◀](#) from page 23).

From model code

BM4135-XXX-XXXXX-XX-3006-X-XXX-XXX

BM4145-XXX-XXXXX-XX-4008-X-XXX-XXX

BM4163-XXX-XXXXX-XX-6006-X-XXX-XXX

onwards there is no restriction of the switch-on frequency.

### 8.4 Notes for operation status „unregulated DC link voltage“

There is a new operation status „unregulated DC link voltage“ from firmware version FW 03.07 upwards.

The controller is able to block the IGBTs if a mains fault (but no mains power failure) occurs. The device operates only with free-wheeling diodes. Therefore the DC link is not regulated.

The function module DIO generates a signal as soon as the controller unit recognizes a mains fault. In order that all power modules reduce the output power.

This status is displayed via the 7-segment display.

For further information refer to parameter manual **b maXX 4100**.



#### NOTE

In operation status „unregulated DC link voltage“ and if all 3 phases still available the device can supply only max. 85 % of the nominal power. The device power supply decreases to 35 % nominal power if a phase loss occurred.

A generating operation is in operation status „unregulated DC link voltage“ not possible.

### 8.5 Monitoring

---

The controller unit monitors the device during the operation. If the controller unit recognizes a status, which deviates from normal operation, the device either issues a warning or an error message.

**Warning** If the controller unit recognizes an operating condition, which is close to an error condition, an accordant warning message is shown in ProDrive and by the control respectively. The most important warning (current limit reached) the device also shows via the LED H3 (see [▶Current limit \(H3\)◀](#) on page 44).

**Error message** The controller unit recognizes, that the device is not error-free, this is shown via the LED H4 (see [▶Error \(H4\)◀](#) on page 44) and via the 7-segment-display. Furthermore an according error text is shown from ProDrive or the control can read out an error code from the device.

Further information is to be found in chapter ([▶Troubleshooting and fault correction◀](#) from page 85).

# TROUBLESHOOTING AND FAULT CORRECTION

## 9.1 Behavior in case of malfunctions

---

### Basic information

**DANGER!****Risk of fatal injury from electrical current!**

Inevitably, when operating this electrical device, certain parts of it are energized with hazardous voltage.

Therefore:

- Pay heed to areas on the device that could be dangerous.

**WARNING!****Risk of injury due to improper fault correction!**

Therefore:

- Only qualified personnel may work on this device!
- Personnel that work with the **b maXX** device must be trained in the safety regulations and the handling of the device, and be familiar with the correct operation of it. In particular, reacting to error indications and conditions requires that the operator must have special knowledge.

### 9.2 Monitoring functions

A survey of the most important monitoring functions and of the from the monitoring functions generated warning-/error messages you will find in the following table. How to recognize the errors we have explained in [▶Fault detection◀](#) from page 89.

Monitoring function	Warning/error	Warning	Error	Threshold adjustable	Reaction adjustable	Reaction	Adjusting of Limit in parameters	Activation by Parameters
Mains voltage	Mains undervoltage		X	-	-	IS	-	-
		X		X			P1354	
	Mains overvoltage		X	-	-	IS	-	-
		X		X			P1355	
Phase monitoring	Phase failure	X	X	-	-	IS	-	-
	Mains failure	X	X	-	-	IS <sup>1)</sup>	-	-
Frequency monitoring	Frequency range	X	X	-	-	IS	-	-
	Frequency change	X	X	-	-	IS	-	-
Earth fault	Fault current to earth	-	X	-	-	IS	-	-
Overcurrent	Overcurrent of the device	-	X	-	-	IS	-	-
DC-link	DC-link overvoltage	-	X	-	-	IS	-	-
	DC-link undervoltage	X	X	-	-	IS	-	-
Ixt-threshold	Peak current e. g. not possible	X	X	X	-	IS	-	-
Temperature heatsink	Temperature > threshold 1	X	-	X	-	-	P0018	-
	Temperature > shutdown threshold	-	X	-	-	IS	P0019	-
Temperature device interior space	Temperature > threshold 1	X	-	X	-	-	P0016	-
	Temperature > shutdown threshold	-	X	-	-	IS	P0017	-
Synchronization		-	X	-	-	IS	-	-
Connection monitoring		-	X	-	-	IS	-	-
Main contactor	Damaged	-	X	-	-	IS	-	-
	Timeout	-	X	-	-	IS	-	-
Digital output	Short-circuit digital output	-	X	-	-	-	-	-

IS: Pulse inhibit

- 1) Pulse inhibit operates according to adjustable time
- 2) Four function modules are necessary for the mains inverter
- 3) Adjustable with P0299
- 4) Adjustable with P0298

Monitoring function	Warning/error	Warning	Error	Threshold adjustable	Reaction adjustable	Reaction	Adjusting of Limit in parameters	Activation by Parameters
Controller synchronizing	Controller not synchronous with ext. signal	X	X	X	X	<sup>3)</sup>	P0533	P0299
Module monitoring <sup>2)</sup>	Wrong module	-	X	-	-	IS	-	-
	Module is missing	-	X	-	-	IS	-	-
	Wrong slot	-	X	-	-	IS	-	-
Ramp-up option modules	Error at module initialization	-	X	X	-	IS	P0838	P0838
Cyclical set point transmission to the optional modules	Transmission timeout	-	X	X	X	<sup>4)</sup>	P0839	P0298
Monitoring current limit	Current limit reached	-	X	X	-	IS	P1260	P1260
Monitoring signal main contactor	no monitoring signal main contactor	-	X	X	-	IS	P1356	P1356

IS: Pulse inhibit

1) Pulse inhibit operates according to adjustable time

2) Four function modules are necessary for the mains inverter

3) Adjustable with P0299

4) Adjustable with P0298

## 9.2.1 Monitoring functions - explanations

### Mains voltage

Warning:

This monitoring function checks, if the mains voltage has a value within the adjusted voltage range. If the value is lower than the set value in P1354, the warning „mains undervoltage“ is generated. If the value is higher than the set value in P1355, the warning „mains overvoltage“ is generated.

Error:

If the value is lower than an intern set value, the error „mains undervoltage“ is generated. If the value is higher than an intern set value, the error „mains overvoltage“ is generated. In released status an immediate pulse inhibit result from an error message mains overvoltage or mains undervoltage.

### Phase monitoring

This monitoring function checks the three phases of the mains voltage. If an outer conductor is missing, the warning „Phase failure“ is reported.

If all three phases are missing, the warning „mains failure“ is indicated to the controller.

### Mains frequency monitoring

This monitoring function checks the following:

- If the mains frequency value is within the permissible frequency range. If the value is lower or higher the controller generates an error message „Frequency range error“ and an immediate pulse inhibit occurs.
- If the mains frequency change is too high. If the mains frequency change is > 5 Hz/s the controller generates an error message „Frequency change error“ and immediately a pulse inhibit occurs.

## 9.2 Monitoring functions

---

<b>Earth fault</b>	This monitoring function checks, if a short-circuit is existing between the mains terminals and earth. If a short-circuit is ascertained, pulse enable immediately occurs.
<b>Overcurrent</b>	This monitoring function checks, if the mains current is greater than 1.3 x input peak current. It serves as „Disaster prevention“ in case of an output-sided short-circuit.
<b>DC-link</b>	This monitoring function checks, if the DC-link voltage has a value within the adjusted voltage range. If the value is lower, the warning/the error "DC-link undervoltage" is indicated. If the value is higher the warning "overvoltage mains" is indicated. As long as the device has not yet been released, an over-/undervoltage always is signaled by "warning" In released status an over-/undervoltage is signaled as "error" and an immediate pulse inhibit occurs.
<b>Ixt-threshold</b>	This monitoring function checks the heatsink temperature as well as the current load thereupon, if the power unit at the time can supply the peak current or the maximum nominal current. In case the peak current is not possible, the message "Ixt-threshold 1 exceeded" occurs.
<b>Temperature device interior space</b>	This monitoring function checks the temperature in the interior space of the device. <ul style="list-style-type: none"><li>• In case the temperature is higher than the warning threshold, the controller gives a warning.</li><li>• In case the temperature is too high, immediately a pulse inhibit occurs.</li></ul>
<b>Temperature heatsink</b>	This monitoring function checks the temperature of the heatsink. <ul style="list-style-type: none"><li>• In case the temperature is higher than the warning threshold, the controller gives a warning.</li><li>• In case the temperature is too high, immediately a pulse inhibit occurs.</li></ul>
<b>Connection monitoring</b>	This monitoring checks if the connections at the mains and at BM4F-UME-01 are in phase. If the phases are not in phase, the controller generates the error message "connection error" and an immediate pulse inhibit occurs.
<b>Monitoring of the main contactor</b>	This monitoring function checks, if the main contactor is functional. If there is an error the controller either signals the error „error main contactor“ or „error monitoring signal“, depending if the main contactor has been switched on or not.
<b>Sensing of function modules</b>	This monitoring function checks, if the function modules, which are necessary for the mains inverter are plugged into the correct slots. If one or more function modules are in the wrong slot, the controller generates the error message "function module error" and an immediate pulse inhibit occurs.
<b>Monitoring current limit</b>	This monitoring function checks the mains current. If, for the period of time "power limit monitoring time" the following requirement is fulfilled, the error "current limit reached" is signaled to the controller and an immediate pulse inhibit occurs. <ul style="list-style-type: none"><li>• The current, which is supplied from the device is the same as the limit current (current limit), which was set.</li></ul>
<b>Monitoring signal main contactor</b>	This monitoring function checks the main contactor. If, for the period of time „monitoring time“ no monitoring signal is detected from the controller, the error „no monitoring signal main contactor“ is generated by the controller and an immediate pulse inhibit occurs. If the monitoring time is set to zero, the monitoring is disabled.



9.3 Fault detection

The fault can be caused by mechanical or electrical malfunctions.

LED H4

The occurrence of an error state is signaled by the lighting up of the red LED H4 on the front side of the housing.



**NOTE!**

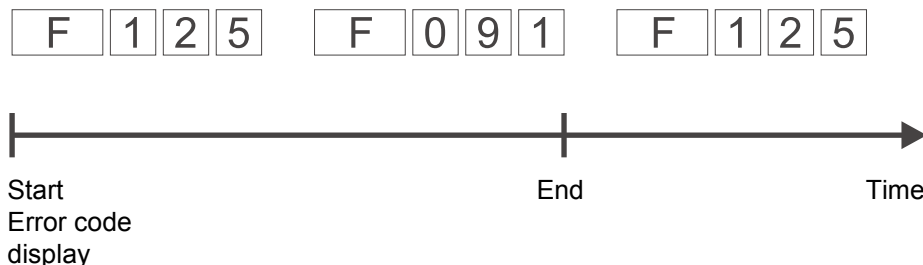
If warnings or errors occur without error reaction the LED H4 'error' *flashes*. Only error messages with error reaction are displayed *by constantly lighting up*.

**7-segment display** Additionally the error code is shown via the 7-segment display on the front side of the housing (not BM4XXX - XXX - XX0XX and BM4XXX - XXX - XX1XX).

By the displayed code the error message can be determined with help of [Error parameters, error messages, error reactions](#) from page 95. The displayed error is without exception an LEVEL 2 error (P0201 - P0216).

The display of an error code starts therewith, that „F“ is displayed for 1.5 s. Then the four characters of the error code are displayed. The separate characters are displayed for about 0.8 s, interrupted by a short break. If there are other errors, these are displayed in the same manner. The procedure is repeated as soon as all errors were displayed.

Example: Error 125 and 91 are generated:



4000\_0386\_rev01\_int.cdr

Figure 37: Error messages 7-segment display

### Operating software ProDrive

Furthermore the error message is shown in the operating software:

- Start the operating program ProDrive (from FW 3.07), if it isn't running yet.



#### NOTE!

The controller software version and the operating software version must be compatible to use ProDrive with all functions.

In case the software version of the controller and the ProDrive version is not compatible, following message is displayed (also see online help ProDrive):

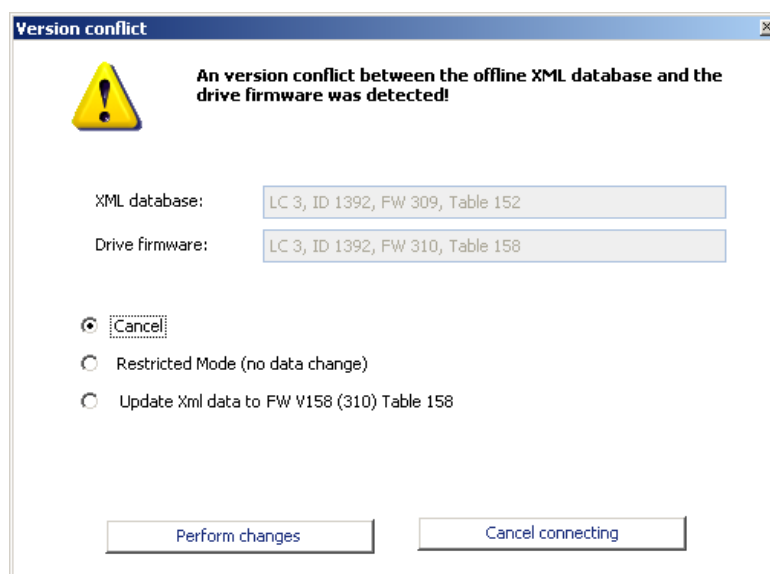


Figure 38: ProDrive version conflict



#### NOTE!

Please contact Baumüller Nürnberg GmbH or visit our website [www.baumueller.de](http://www.baumueller.de) for download the latest version of ProDrive, if the controller software version is not available in your ProDrive version.

Start screen

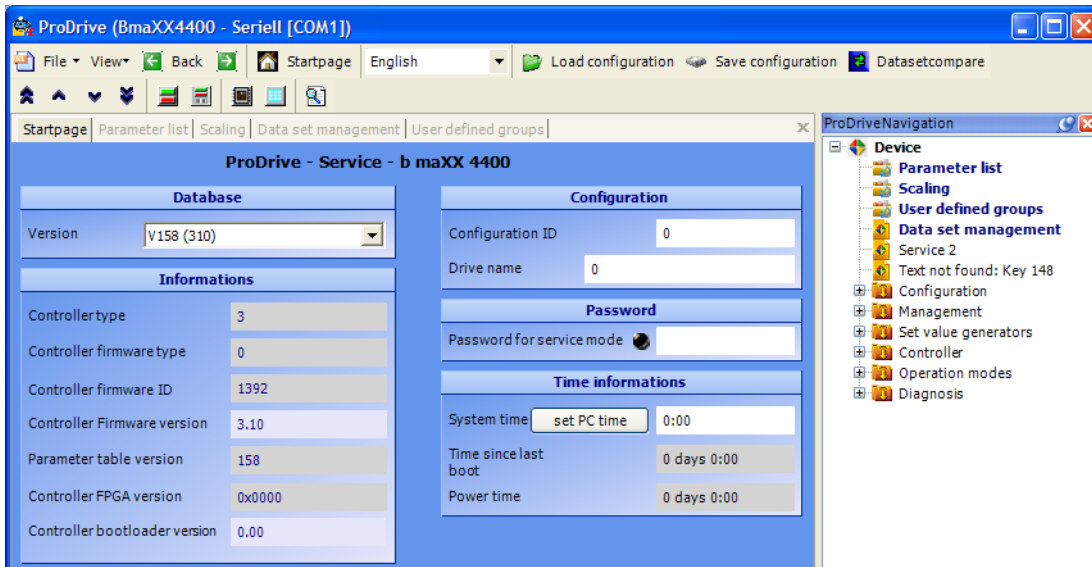


Figure 39: ProDrive start screen

Display the „error message“ in ProDrive.

- Open navigation with click on + in front of „Management“.

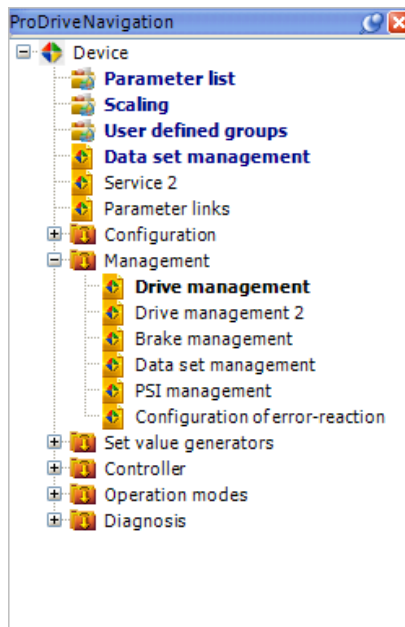


Figure 40: Project navigation in ProDrive

## 9.3 Fault detection

### ► Select „Drive management“

The window „Drive manager“ opens, see below with an exemplary (error) message. Before the communication between controller and PC/laptop is started, the messages in this list have been arranged in numerical order. The newly occurring messages are added to the end of the list, when communication is active.

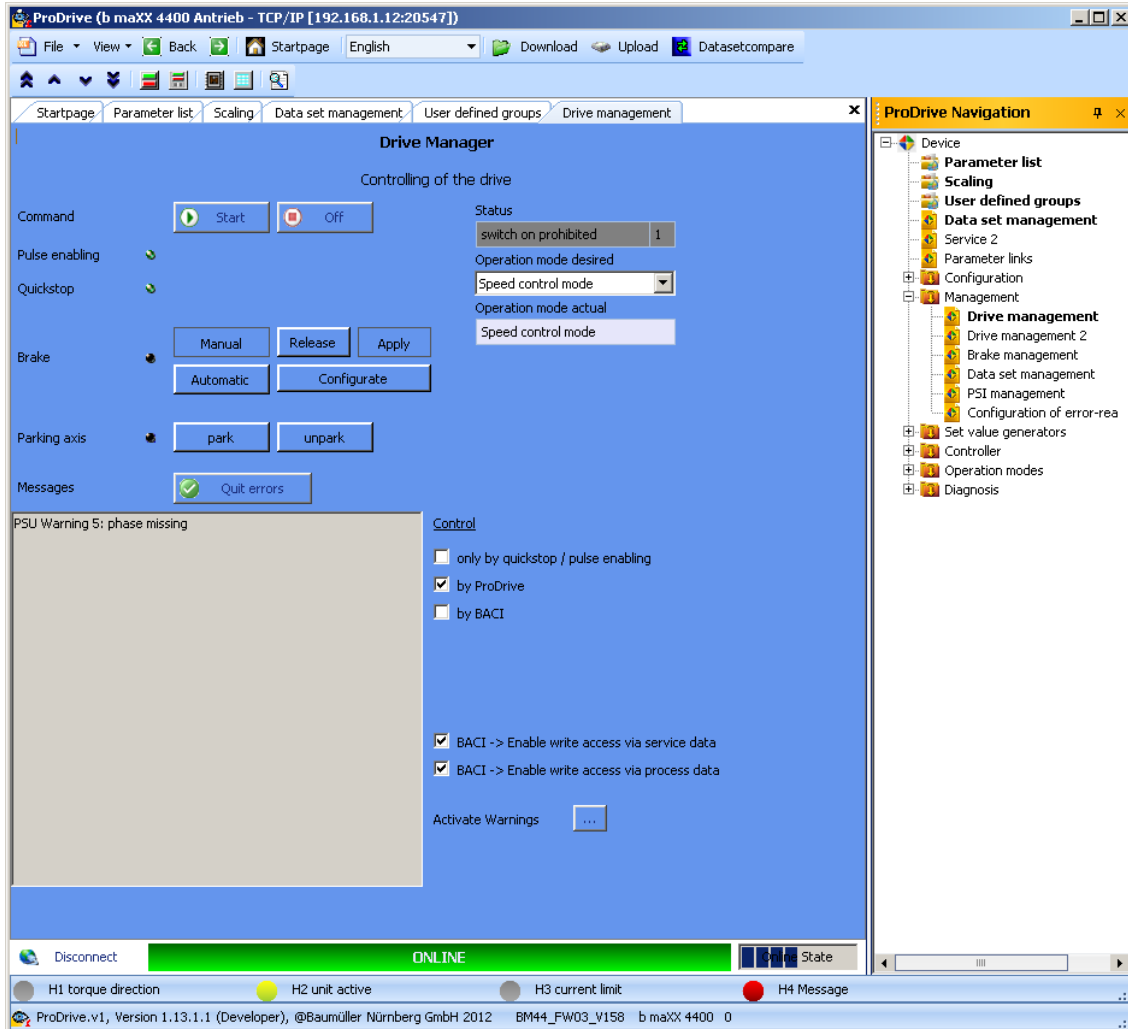


Figure 41: Drive manager ProDrive



### NOTE

If you are not able to start the motor, although the red LED H4 is not lighting up and although the LED H2 is lighting up green, check the parameterization of the **b maXX 4000** with the parameter list in ProDrive.

Error possibilities are e. g.: torque limit = 0 has been set or notch position is not correct (also see parameter manual **b maXX 4000**).

If no LEDs are lighting up on the front side of the device, check the 24V supply.

## 9.4 Error handling

The error messages in the system are built up hierarchically

An error message can result from a beneath in the hierarchic arranged error message. This is why the message 'Error' (level 1) can base on an error, which e. g. has appeared in „ModuleError“ (level 2)., because there is a failure in „Function module1“ (level 3, e. g. Sincos-encoder module).

### Error memory

From firmware V03.11 onwards an internal error memory exists to read out errors by a higher-level open-loop control. All occurrent errors which lead to an error response of the drive are saved chronologically in this error memory.

A read access to the error memory is done element by element with an index parameter (P0258) and a value parameter (P0259).

The error memory will be deleted completely at error acknowledgment (Bit 7 = 1 in control word).

For a further description see parameter P0257 in the Parameter Manual.

### Error display

If an error appears, the according definite error message is displayed within a short time in ProDrive in the menu „device manager‘ and on the 7-segment display.



#### NOTE!

The device is provided with predefined error reactions. You are able to set the error reaction of the device in 'Depending on settings' in the column 'Reaction' marked error messages. An exception here are errors, which have to have an immediate pulse inhibit as a consequence. These can not be changed due to safety reasons.

### 9.4.1 Error reset

If the red error LED is lighting up, there is at least one error.

There are several methods to reset errors:

- Via ProDrive (from FW 3.07):  
Button “Quit errors” (either in the dialog box “Device manager” or on the page “Device manager”).  
That means, that you inform the device, that you have noted the error, that you have removed it or that you want to pass over it. Due to error reset all error messages are reset. An individual error reset is not possible. The button Quit errors causes a resetting of the error, in case the cause for the error message exists no longer.

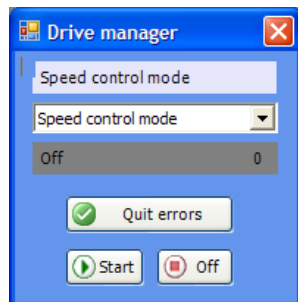


Figure 42: ProDrive Drive manager

- Via writing access to control word (P0300):  
Here a rising edge must be generated in bit 7 (generated by the control system or by operating software via input to parameter list).  
Note: The drive control must be active (see parameter P1001 Communication source) for the selected communication source.
- Via a digital input:  
A digital input of a DIO module can be selected via parameter P0575 digital input for error acknowledgement can be selected for error reset. A rising edge on this input resets the error messages.
- Via the pulse enable input:  
Precondition is, that the drive is only controlled via the hardware inputs (that means that the motor guide is neither set via the operating software nor via another communication source). Furthermore the option “Quit error via pulse enable” in parameter P1002 Options device manager must be active. With the first rising edge of pulse enable the errors then are reset. But the drive still does not start. Therefore you then need a second rising edge for the enable.

Additional data according the subject resetting of error messages is available in the ‘parameter manual’.

## 9.4.2 Error parameters, error messages, error reactions

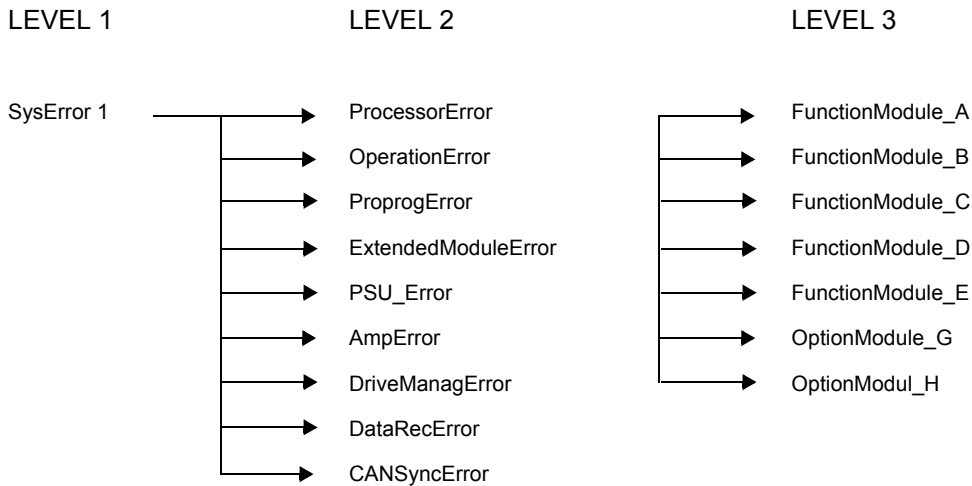


Figure 43: Structure of the error list - survey

### 1st level

1st level errors are only interesting for the access to errors via parameters, to be used without ProDrive, e. g. at Field bus communication. This errors are not shown in ProDrive/ 7-segment display.

Bit mapping see description of the parameter P0200 in the parameter manual.

### 2nd level

Order of the error messages see survey ([▶Figure 43◀](#) on page 95).

### 3rd level

2nd level error messages are displayed on the 7-segment display in ProDrive.

## 9.4 Error handling

### 9.4.2.1 Error messages (2nd level)

In the column 'Reaction' the reaction of the system to the error is shown:

- „IS“ = pulse inhibit;
- „adjustable“ = the error reaction can be set via ProDrive (Window „Drive management“, toolbar button „Error reaction“).
- „no reaction“ means, the drive is continuing to work and the red error LED is blinking.

#### P0201 Error processor

Error No.	Meaning	Reaction	Troubleshooting
0	reserved		
1	Watchdog error	IS	Restart <b>BM4100 (NWR)</b>
2	Incorrect or unexpected interrupt has occurred	IS	
3	NMI Interrupt / bus error	IS	
4 to 15	reserved, not assigned = 0		

#### P0202 Error operating system

Error No.	Meaning	Reaction	Troubleshooting
16	Boot error	IS	Restart <b>BM4100 (NWR)</b>
17	Software error	IS	
18	Time slot configuration	IS	
19	Time slot - time error	IS	Restart <b>BM4100 (NWR)</b> ; Change configuration of the time slice operation system
20	1 = no free memory	IS	Restart <b>BM4100 (NWR)</b>
21	Invalid error code	IS	
22	invalid warning code	IS	
23	incorrect FPGA version	IS	Contact Baumüller Nürnberg GmbH
24 to 31	reserved, not assigned = 0		



## P203 Error Proprog communication

Error No.	Meaning	Reaction	Troubleshooting
32	Timeout protocol	adjustable	Restart <b>BM4100 (NWR)</b>
33	Protocol structure	adjustable	
34	Wrong module type	adjustable	Contact Baumüller Nürnberg GmbH
35	Too many data in the telegram	adjustable	
36	Not enough data in telegram	adjustable	
37	Invalid operand	adjustable	
38	Invalid memory type	adjustable	Test RAM
39	Invalid operand address	adjustable	Enter valid address
40	Value less than the minimum value	adjustable	Check and adjust data set
41	Value greater than the maximum value	adjustable	
42	Parameter is write-protected	adjustable	
43	Parameters in this operation state not writable	adjustable	Check operating condition and parameterization
44	Invalid parameter value	adjustable	Enter with a valid value
45	Communication error ProDrive ↔ controller	adjustable	Establish connection again or set parameter P0290 to 0.
46 to 47	reserved, not assigned = 0		

## P0204 Error in function or option modules

Error No.	Meaning	Reaction	Troubleshooting
48	Error in function module A	3rd level error	see <a href="#">▶Error in function module A to E◀</a> on page 101 (= 3rd level)
49	Error in function module B		
50	Error in function module C		
51	Error in function module D		
52	Error in function module E		
53	Error in option module G		
54	Error in option module H		
55 to 58	reserved, not assigned = 0		
59	Timeout when waiting for the RST signal of the slaves	IS	Restart <b>BM4100 (NWR)</b>
60	CRC error in SPI transmission Module ▶ controller	adjustable	Error indicates high EMC interferences; please reduce these. Contact Baumüller Nürnberg GmbH.
61	CRC error in SPI transmission Controller ▶ module	adjustable	
62 to 63	reserved, not assigned = 0		

### P0205 Error power supply

Error No.	Meaning	Reaction	Troubleshooting
64	Power supply failure	adjustable	Connect the power supply system
65	Phase failure	IS	Check if all phases are correctly connected and voltage-carrying
66	Undervoltage power supply, BM4100 only	IS	Assure the compliance with the power supply specifications (see <a href="#">►Requirements to the energy supply / supply system◄</a> on page 27)
67	Overvoltage power supply, BM4100 only	IS	
68	Undervoltage 24 V	IS	
69	Phase sequence identification error	IS	Check if all phases have been correctly connected to the BM4-F-UME-01 and if they are energized.
70	Frequency change	IS	Assure the compliance with the power supply specifications (see <a href="#">►Requirements to the energy supply / supply system◄</a> on page 27)
71	Frequency range error	IS	
72	Error of main contactor	IS	Check the connections of the main contactor and of the function module BM4-F-SEA-xx
73	No monitoring signal from the main contactor	IS	Check the connections of the main contactor and of the function module BM4-F-SRM-xx
74	Error at pre-charge	IS	Check if all phases have been correctly connected to X11 and are energized
75	Undervoltage U DC link	IS	Check power connections
76	Mains connection error	IS	Check the terminals at BM4-F-UME-01 and at the mains terminals
77	Current limit reached	IS	Reduce the power output of the power modules
78	Synchronization errors	IS	Check power connections
79	reserved, not assigned = 0		

## P0206 Error power unit

Error No.	Meaning	Reaction	Troubleshooting
80	Communication error according Hiperface <sup>®</sup> -specification	IS	see <a href="#">►Error power unit - serial interface◄</a> on page 101 (= 3rd level)
81	Heat sink temperature	IS	Let the device cool down and/or reduce the load
82	Overvoltage Uz <sub>k</sub>	IS	Reduce the DC link voltage
83	Overcurrent	IS	Reduce the load and check the current controller settings as well as the cabling and the motor
84	Ground current	IS	Check installation of the device and check the motor for ground fault
85	Device internal temperature too high	IS	Make sure of a sufficient ventilation in the device and/or check the temperature of cooling air
86	Cable break internal temperature sensor or internal temperature < 5 °C	IS	Make sure the environmental temperature (or heat sink temperature of the device) is ≥ 5 °C. If the error occurs even at a heat sink temperature ≥ 5 °C pass on the device for repair
87	Safety relay off (or defect)	IS	Check safety relay, change on request
88	Bridge short-circuit	IS	Restart <b>BM4100 (NWR)</b> . At recurring error messages exchange the controller
89	Up to FW 03.08 power unit not ready-to-operate From FW 03.09 reserved	IS	Make sure that the power unit is ready-to-operate. Check the rotating field of the power supply
90 to 95	reserved, not assigned = 0		



### NOTE

The device has no protective function against ground current.

## P0211 Error drive management

Error No.	Meaning	Reaction	Troubleshooting
160	Timeout communication	adjustable	Remove the timeout of the Proprog communication
161	Timeout BACI	adjustable	Remove the timeout of the BACI communication option module
162	Timeout cyclic communication	adjustable	Remove the timeout of the Cyclic communication:
163	Timeout service data	adjustable	
164	Field bus error	adjustable	Check the field bus communication
165	Controller not synchronous to external signal	adjustable	Set the Sync offset and/or Sync tolerance
166 to 175	reserved, not assigned = 0		

## 9.4 Error handling

### P0212 Error data set management

Error No.	Meaning	Reaction	Troubleshooting
176	EEPROM copy error	adjustable	Copy the data set once more
177	Write timeout EEPROM	adjustable	The data in the EEPROM are invalid, please safe all data sets
178	Checksum error EEPROM	IS	EEPROM faulty or described faulty
179	No boot data set	IS	The data in the EEPROM are invalid, please safe all data records
180	Incompatible software	IS	
181	There is no data set	adjustable	
182	Checksum error im PSI module	adjustable	PSI EEPROM faulty or write faulty
183	PSI is reset	adjustable	Please save all data records
184	PSI data invalid	adjustable	The data in the PSI are invalid, please save all data sets
185 to 191	reserved, not assigned = 0		

### P0216 Error CANsync

Error No.	Meaning	Reaction	Troubleshooting
240 to 255	reserved, not assigned = 0		
246	Wrong adjustment of DIP switch	adjustable	Correct the wrong adjustment of the DIP switches on the module
240 to 255	reserved, not assigned = 0		

## 9.4.2.2 Sub-error messages (3rd level)



### NOTE!

3rd level errors are only displayed in ProDrive separated by a decimal point from the corresponding 2nd level error (see [►Figure 43◄](#) on page 95).

### P0233 Error power unit - serial interface

Error power unit 80: Communication error

Error code	Meaning	Troubleshooting
6	Data overflow	Error indicates high EMC problems; please reduce these. Contact Baumüller Nürnberg GmbH
7	Bit frame error	
8	Invalid command state	
9	Parity error	
10	Checksum error	
11	Unknown error code	
12	Data number error	
13	Invalid argument	
14	Data field is write protected	
15	Invalid access code	
16	Data field is not changeable in its size	
17	Word address outside of data field	
18	Data field is nonexistent	
36	Wrong data checksum	
37	No response	

### P0240 to P0244 Error in function module A to E

Error code	Meaning	Reaction	Troubleshooting
0	reserved		
1	Module not recognized	no reaction	Check if you have plugged in the right module at the right position
2	Recognized module not permitted at this position		
3	Digital output short-circuited or 24 V supply not connected at DIO module	no reaction	Check the cabling of the digital outputs
4	Invalid target parameter value by digital input	no reaction	Check the parameterization of the input channel
5	Direct PLC I/O access for this module not permitted.	no reaction	Don't select the module
6	Required module is missing, only for <b>BM4100 (NWR)</b> active mains rectifier unit	IS	Connect the required module for active mains rectifier unit operation - see Operation Manual BM4100 Active Mains Rectifier Unit
7	Module must not be used for actual active mains rectifier unit mode or controller mode	no reaction	
8 to 15	reserved		

## 9.4 Error handling

### P0245 to P0250 Error im option module G to H

Error code	Meaning	Reaction	Troubleshooting	
4096	Wrong parameter No. at set value parameter 1	adjustable	Check the corresponding set value parameter	
4097	Wrong parameter No. at set value parameter 2	adjustable		
4098	Wrong parameter No. at set value parameter 3	adjustable		
4099	Wrong parameter No. at set value parameter 4	adjustable		
4100	Wrong parameter No. at set value parameter 5	adjustable		
4101	Wrong parameter No. at set value parameter 6	adjustable		
4102	Wrong parameter No. at set value parameter 7	adjustable		
4103	Wrong parameter No. at set value parameter 8	adjustable		
4104	Wrong parameter No. at set value parameter 9	adjustable		
4105	Wrong parameter No. at set value parameter 10	adjustable		
4106	Wrong parameter No. at set value parameter 11	adjustable		
4107	Wrong parameter No. at set value parameter 12	adjustable		
4108	Wrong parameter No. at set value parameter 13	adjustable		
4109	Wrong parameter No. at set value parameter 14	adjustable		
4110	Wrong parameter No. at set value parameter 15	adjustable		
4111	Wrong parameter No. at set value parameter 16	adjustable		
4112	Wrong parameter No. at actual value parameter 1	adjustable		
4113	Wrong parameter No. at actual value parameter 2	adjustable		
4114	Wrong parameter No. at actual value parameter 3	adjustable		
4115	Wrong parameter No. at actual value parameter 4	adjustable		
4116	Wrong parameter No. at actual value parameter 5	adjustable		
4117	Wrong parameter No. at actual value parameter 6	adjustable		
4118	Wrong parameter No. at actual value parameter 7	adjustable		
4119	Wrong parameter No. at actual value parameter 8	adjustable		
4120	Wrong parameter No. at actual value parameter 9	adjustable		
4121	Wrong parameter No. at actual value parameter 10	adjustable		
4122	Wrong parameter No. at actual value parameter 11	adjustable		
4123	Wrong parameter No. at actual value parameter 12	adjustable		
4124	Wrong parameter No. at actual value parameter 13	adjustable		
4125	Wrong parameter No. at actual value parameter 14	adjustable		
4126	Wrong parameter No. at actual value parameter 15	adjustable		
4127	Wrong parameter No. at actual value parameter 16	adjustable		
4128	Invalid value at set value parameter No. 1	adjustable		Check the set values in relation to the permitted value range
4129	Invalid value at set value parameter No. 2	adjustable		
4130	Invalid value at set value parameter No. 3	adjustable		
4131	Invalid value at set value parameter No. 4	adjustable		
4132	Invalid value at set value parameter No. 5	adjustable		
4133	Invalid value at set value parameter No. 6	adjustable		
4134	Invalid value at set value parameter No. 7	adjustable		
4135	Invalid value at set value parameter No. 8	adjustable		
4136	Invalid value at set value parameter No. 9	adjustable		
4137	Invalid value at set value parameter No. 10	adjustable		

Error code	Meaning	Reaction	Troubleshooting
4138	Invalid value at set value parameter No. 11	adjustable	Check the set values in relation to the permitted value range
4139	Invalid value at set value parameter No. 12	adjustable	
4140	Invalid value at set value parameter No. 13	adjustable	
4141	Invalid value at set value parameter No. 14	adjustable	
4142	Invalid value at set value parameter No. 15	adjustable	
4143	Invalid value at set value parameter No. 16	adjustable	
4144	Invalid value for set value period	adjustable	
4145	Invalid value for actual value period	adjustable	
4146	Incorrect value for cycle offset set values	adjustable	
4147	Incorrect value for cycle offset actual values	adjustable	
4148	BACI timeout at cyclic data	adjustable	Check communication rate and set timeout P0839
4149	BACI timeout at service data	adjustable	
4150	Check results in faulty checksum	IS	Restart by switching off and on
4151	Ramp-up timeout when waiting for the slave type or when waiting for the resetting of config pending flag	adjustable	
4152	Invalid data transfer structure type	adjustable	Contact Baumüller Nürnberg GmbH
4153	Internal error: Incorrect BACI status	adjustable	
4154	Access conflicts with slave at cyclic communication	adjustable	
4155	Error cyclic communication: Parameter value wrong	adjustable	Check the value of the transmitted parameter
4156	Error cyclic communication: Alive counter conflict	adjustable	Check if option module and controller are synchronous
4157	Cmd interface: Channel number wrong (0 or > 6)	adjustable	Contact Baumüller Nürnberg GmbH
4158	Cmd interface: Selected channel not available	adjustable	
4159	Cmd interface: Internal error - wrong pointer	adjustable	
4160	Cmd interface: Internal error - wrong state	adjustable	
4161	Cmd interface: Wrong package No.	adjustable	
4162	Cmd interface: Wrong command No.	adjustable	
4163	Cmd interface: Wrong state at package handling	adjustable	
4164	Cmd interface: Timeout at command processing	adjustable	
4165	Cmd interface: Wrong package length	adjustable	
4166	Cmd interface: Descriptor not available	adjustable	
4167	Cmd interface: Wrong package type	adjustable	
4168	Cmd interface: Checksum error	adjustable	
4169	Module identification: PCI error at reading	adjustable	Check option module for correct operation
4170	Module identification: PCI error at writing	adjustable	
4171	Module identification: General error at reading	adjustable	
4172	Module identification: General error at writing	adjustable	
4173	Internal error	adjustable	Contact Baumüller Nürnberg GmbH
4174	Configuration cyclic services: Parameters are not cyclic writable	adjustable	Select another parameter
4175	Configuration cyclic services: Invalid parameter No.	adjustable	
4176	Wrong option module error code	adjustable	Contact Baumüller Nürnberg GmbH
4177 to 8192	reserved		

## 9.4 Error handling

### 9.4.3 Warnings

#### P0261 Warning power supply

Warning No.	Meaning	Troubleshooting
0	not assigned = 0	
1	Undervoltage 24 V	Assure the compliance with the specifications
2	Undervoltage power supply	Assure the compliance with the specifications (see <a href="#">►Requirements to the energy supply / supply system◄</a> on page 27)
3	Overvoltage power supply	
4	Power failure	Power supply troubleshooting
5	Phase failure	Check if all phases are correctly connected and voltage-carrying
6	Phase sequence identification	Check if all phases have correctly connected to the BM4-F-UME-01 - module and are carrying voltage
7	Frequency change	Assure the compliance with the specifications (see <a href="#">►Requirements to the energy supply / supply system◄</a> on page 27)
8	Frequency range	
9	Mains connections	Check the connections of BM4-F-UME-01 module and of the mains terminals
10	Pre-charge is running	Wait until the pre-charging has been completed, check if the mains voltage is connected
11	Undervoltage U DC link	Check power connections
12	Synchronization	Check power connections
13	Exceeding the set power capacity	Reduce power
14 to 15	not assigned = 0	

#### P0262 Warnings power unit

Warning No.	Meaning	Troubleshooting
16	Internal temperature of device	Establish the specified environmental conditions, assure correct ventilation conditions
17	Heat sink temperature	Reduce the power output, check the fans of the device
18 to 23	reserved warning	
24	lxt threshold 1 exceeded	Reduce power drain
25 to 31	not assigned = 0	



# MAINTENANCE

## 10.1 Safety notes

### Basic information



#### **DANGER!**

#### **Risk of fatal injury from electrical current!**

Inevitably, when operating this electrical device, certain parts of it are energized with hazardous voltage.

Therefore:

- Pay heed to areas on the device that could be dangerous during the electrical installation.
- Pay heed to areas on the device that could still be electrically energized after operation.

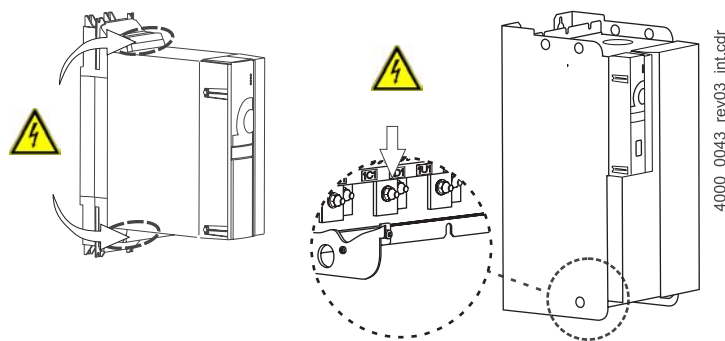


Figure 44: Hazard areas during electrical installation



### **WARNING!**

#### **Risk of injury due to improperly performed maintenance work!**

Improper maintenance can lead to severe personal injury and material damage.

Therefore:

- Before beginning work, make sure that there is enough space for mounting.
- Make sure that the mounting area is kept clean and orderly. Parts and tools that are loosely stacked or lying around are a potential accident source.

## 10.2 Environmental condition

---

If the prescribed environmental conditions are adhered to, then the device is maintenance-free. For the prescribed environmental conditions see [►Required environmental conditions◄](#) on page 28.

The most important prescribed environmental conditions are:

- Dust-free environmental air
- Temperature: Min. 5 °C to max. +55 °C
- Relative humidity: 5% to 85%, no condensation
- Installation altitude: From 1000 m and higher derating

## 10.3 Inspection intervals - maintenance notes

---

Preventive maintenance is prescribed to keep the device in an optimum operating condition and ensure a long service life. It is recommended to have inspections performed regularly by qualified personnel.

### **Daily inspection:**

Basic check points as to whether discrepancies have occurred during operation:

- Does the motor work as desired?
- Is the operating environment normal?
- Is the cooling system working normally?
- If an unusual vibration or noise is noticed during operation.
- Does the motor overheat during operation?

### **Regularly scheduled inspection:**

Before checking, switch off the input voltage and wait until the device's capacitors have discharged.

**DANGER!****Risk of fatal injury from electrical current!**

Therefore:

- Switch off voltage before performing work!
- Only qualified personnel may mount, install and maintain the devices.
- Please remove all metallic objects worn, such as watches or rings, for example, before beginning to work on the device.
- Only insulated tools are permitted.

**DANGER!****Risk of fatal injury from electrical current!**

Stored electric charge.

Discharge time of the system = discharge time of the device with the longest DC link discharge time in the DC link connection.

Refer to [▶Electrical data◀](#) from page 30.

Therefore:

- Do not touch before taking into account the discharge time of the capacitors and electrically live parts.
- Heed corresponding notes on the equipment.
- If additional capacitors are connected to the DC link, the DC link discharge can take a much longer time. In this case, the necessary waiting period must be determined or a measurement made as to whether the equipment is de-energized. This discharge time must be posted, together with an IEC 60417-5036 (2002-10) warning symbol, on a clearly visible location of the control cabinet.

## 10.3 Inspection intervals - maintenance notes

### 10.3.1 Periodic maintenance

- Environmental condition

Check points	Methods and criteria	Inspection intervals		
		Daily	Semi-annually	Annually
Check environmental temperature, humidity and vibrations. Check whether dust, oil or drops of water appear.	Visual inspection and measurement of the environmental conditions, comparison with standard values.	○		
Check whether there are hazardous objects in the vicinity.	Visual inspection	○		

- Voltage

Check points	Methods and criteria	Inspection intervals		
		Daily	Semi-annually	Annually
Check the voltage of the power supply system and the control circuits	Measurement and comparison with standard values.	○		

- Mechanical parts

Check points	Methods and criteria	Inspection intervals		
		Daily	Semi-annually	Annually
Are there any abnormal noises or vibrations?	Visual and audio check		○	
Are there any loose screws?	Tighten the screws.		○	
Are there any bent or damaged parts?	Visual inspection		○	
Have there been any color changes due to overheating?	Visual inspection		○	
Are there any dust or dirt deposits?	Visual inspection		○	

- Power supply

Check points	Methods and criteria	Inspection intervals		
		Daily	Semi-annually	Annually
Are there any missing or loose screws?	Replace the screws or, respectively, tighten them.		○	
Is there any deformation, cracking, damage or color change on the device as a result of overheating or aging?	Visual inspection		○	
Are there any dust or dirt deposits?	Visual inspection		○	

- Connections and circuitry of the mains power supply

Check points	Methods and criteria	Inspection intervals		
		Daily	Semi-annually	Annually
Does the wiring indicate any color or shape changes due to overheating?	Visual inspection		○	
Is the wiring insulation damaged or is it discolored?	Visual inspection		○	
Is there any damage?	Visual inspection		○	

- Transformer and chokes in the main circuit

Check points	Methods and criteria	Inspection intervals		
		Daily	Semi-annually	Annually
Are there any abnormal vibrations or noticeable odors?	Visual inspection, audio check and odor check		○	

- Solenoid switch and relay in the power supply circuit

Check points	Methods and criteria	Inspection intervals		
		Daily	Semi-annually	Annually
Are there any loose screws?	Visual and audio check Tighten screws, if necessary.	○		
Do the switches function correctly?	Visual inspection	○		

- Plug connectors in the power supply circuit

Check points	Methods and criteria	Inspection intervals		
		Daily	Semi-annually	Annually
Are there any loose screws or connectors?	Tighten screws and firmly stick in plug connector.		○	
Are there any noticeable odors or color changes?	Visual inspection and odor check		○	
Is there any cracking, damage, deformation or corrosion?	Visual inspection		○	
Is there any leaking fluid or deformation of the capacitors?	Visual inspection		○	

## 10.4 Repairs

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- Cooling system fans

Check points	Methods and criteria	Inspection intervals		
		Daily	Semi-annually	Annually
Are there any abnormal noises or vibrations?	Visual and audio check			○
Are there any loose screws?	Tighten the screws.			○

- Cooling system ventilation duct

Check points	Methods and criteria	Inspection intervals		
		Daily	Semi-annually	Annually
Are there any obstructions in the heat sink, air supply or air outlet?	Visual inspection	○		

## 10.4 Repairs

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In case of device damage, please inform your sales office or:

### **Baumüller Nürnberg GmbH**

Ostendstr. 80 - 90  
90482 Nuremberg  
Germany

Tel. +49 9 11 54 32 - 0  
Fax: +49 9 11 54 32 - 1 30

Mail: [mail@baumueller.de](mailto:mail@baumueller.de)  
Internet: [www.baumueller.de](http://www.baumueller.de)



## ACCESSORIES AND SPARE PARTS

Accessories/spare parts for devices of the **b maXX** series are listed in this appendix. Product management is happy to handle any queries and suggestions on accessory parts.

## 11.1 Cabling

### 11.1.1 Cables power supply-device

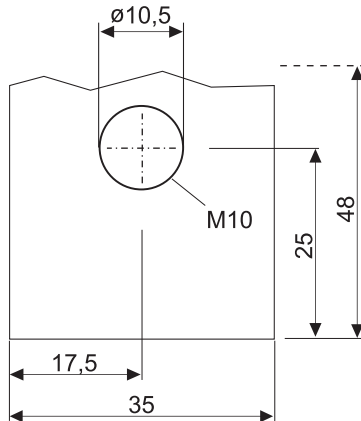
Device	Cross section <sup>1)</sup>	Connection to the device
BM4135	4 x 6 mm <sup>2</sup> to 4 x 16 mm <sup>2</sup>	flexible cable with wire end ferrule (screw terminal)
BM4145	4 x 16 mm <sup>2</sup> to 4 x 50 mm <sup>2</sup>	
BM4163	4 x 25 mm <sup>2</sup> to 4 x 150 mm <sup>2</sup>	cable lug max. width 35 mm current bar <sup>2)</sup>

<sup>1)</sup> Possible cross section

Use a shielded Baumüller cable, optical shield overlap > 85 %.

For UL conform machines/installation you must use UL certified circuit cables.

<sup>2)</sup>



4000\_0029\_rev01\_int.cdr

Connection lugs (current bars). Position see [▶Figure 31◀](#) on page 73

Screw maximum two cable lugs to the current bar - one on the front side, one on the reverse side of the bar.



## 11.1.2 Cables device (DC link) - axis

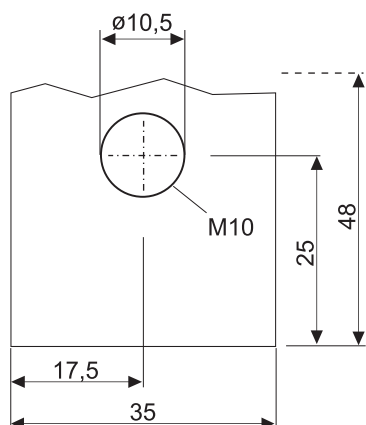
Device	Cross section <sup>1)</sup>	Connection to the device
BM4135	2 x 6 mm <sup>2</sup> to 2 x 16 mm <sup>2</sup>	male cable lug according DIN46230 <sup>2)</sup> (screw terminal)
BM4145	2 x 16 mm <sup>2</sup> to 2 x 50 mm <sup>2</sup>	flexible cable with/without wire end ferrule (screw terminal)
BM4163	2 x 25 mm <sup>2</sup> to 2 x 150 mm <sup>2</sup>	cable lug max. width 35 mm current bar <sup>3)</sup>

1) Possible cross section

Use a screened circuit Baumüller-line, optical shield coverage > 85%. Do not use single conductors.  
For UL conform machines/installations you must use UL certified circuit cables.

2) A cable with a 16 mm cross section must be used for BUM4135. The DC link terminals at BUM4135 are intended for a cross section till 10 mm, therefore at the BM4135 e. g. male cable lugs according to DIN46230 must be used.

3)



4000\_0029\_rev01\_int.cdr

Connection lugs (current bars). Position see [▶ Figure 31 ◀](#) on page 73  
Screw maximum two cable lugs to the current bar - one on the front side, one on the reverse side of the bar.

## 11.1.3 PE connector

- Cross section:  
min. 10 mm<sup>2</sup> copper or 16 mm<sup>2</sup> aluminium conductor
- Both connection terminals for the PE connector have an identical cross section like the original PE connector

## 11.1.4 Cable mains - function module (UME, SRM and SEA)

Cross section <sup>1)</sup>	≤ 1,5 mm <sup>2</sup>
Maximum length <sup>2)</sup>	user-defined
Connection to the device	without/with wire end ferrules (plug-in terminal)

<sup>1)</sup> Possible cross section

Use a shielded Baumüller cable, optical shield overlap > 85 %.

For UL conform machines/installation you must use UL certified circuit cables.

<sup>2)</sup> Only with Baumüller cables with this maximum length and when using a Baumüller mains filter you can assume, that the compliance with the EMC regulation is fulfilled.

## 11.1.5 Cable mains - charge circuit

Cross section <sup>1)</sup>	1.0 - 1,5 mm <sup>2</sup>
Maximum length <sup>2)</sup>	user-defined
Connection to the device	without/with wire end ferrules (plug-in terminal)

<sup>1)</sup> Possible cross section

Use a shielded Baumüller cable, optical shield overlap > 85 %.

For UL conform machines/installation you must use UL certified circuit cables.

<sup>2)</sup> Only with Baumüller cables with this maximum length and when using a Baumüller mains filter you can assume, that the compliance with the EMC regulation is fulfilled.

## 11.1.6 Cable control voltage supply/signals

Cross section <sup>1)</sup>	≤ 1.5 mm <sup>2</sup>
Maximum length <sup>2)</sup>	user-defined
Connection to device	with /without wire end ferrules (plug-in terminal)

<sup>1)</sup> The installing of the cables is user-defined.

<sup>2)</sup> The length of the cable has no influence on the compliance to the EMC regulation.

## 11.1.7 Cable - signals X100-3 and X100-4

Cross section	≤ 1,5 mm <sup>2</sup>
Maximum length <sup>1)</sup>	3 m
Connection to the device	without/with wire end ferrules (plug-in terminal)

<sup>1)</sup> Cables longer than 3 m must be screened.

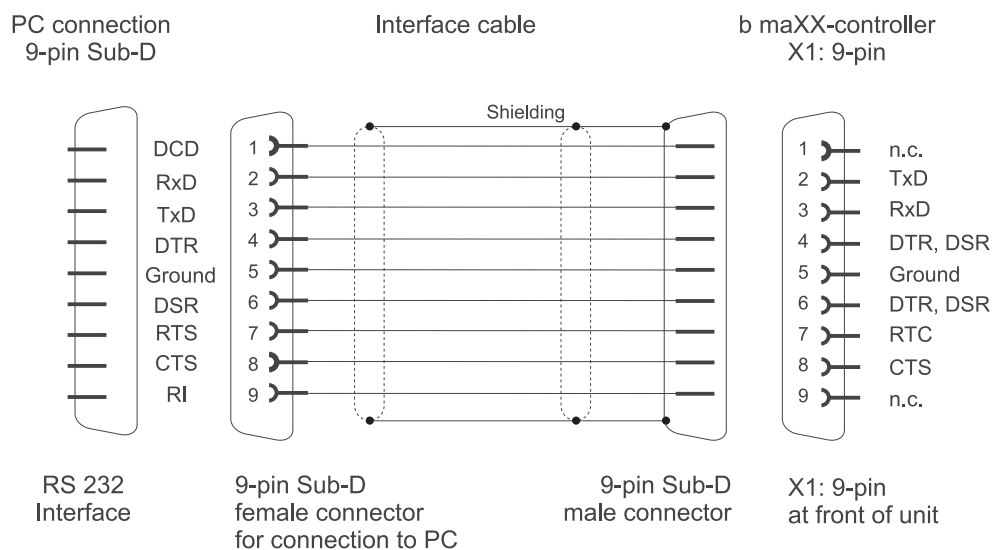
## 11.1.8 Interface cable RS232

A pre-assembled cable is available as a spare part, see [▶Cable RS232◀](#) on page 124.

1 Use the following materials:

- Cable: LIYCY 6x2x0.14 mm<sup>2</sup>
- Sub-D connectors, 9-pole, female, cabinet plastics metallized
- Sub-D connector, 9-pole, male, cabinet plastics metallized

2 connect the cable shield with the cabinet and with the shield of the Sub-D connector



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Figure 45: Interface cable RS 232

## 11.2 Fuses

A distinction is made between protecting the power supply cables and protecting the device. To fulfill CE specifications – here in particular EN 60204-1 – fuse the power supply cables.



**NOTE!**

Approved, UL-listed safety fuses and/or circuit breakers must be used in UL-authorized systems.

**Cable protection**

Use safety fuses of the operating class gL DIN VDE 0636-201 / IEC 60269-2-1 / HD 630.2.1 54 or circuit breaker triggering characteristic K, in accordance with DIN VDE 0636-201 / IEC 60269-2-1 / HD 630.2.1 54, to protect the cable. These fuses protect against overloads and consequential damage from defects, for example as a result of fire. However, they cannot prevent a device from being extensively destroyed in case of a short circuit or ground fault in the DC link.

Carry out the fusing in accordance with EN 60204-1 („Electrical Equipment of Machines“). Dimension the cable fuse based on the cross-section of the power supply cable used, and in accordance with the respective applicable national standards and local regulations.

The current-carrying capacity of the cables is specified in Table 5 of EN 60204-1. For your application, the corresponding value must still be determined based on the standard itself, i.e. taking into account the cable routing:

Cable cross section	Fuse nominal current
1,0 mm <sup>2</sup>	11,5 A
1,5 mm <sup>2</sup>	16,1 A
2,5 mm <sup>2</sup>	22 A
4 mm <sup>2</sup>	30 A
6 mm <sup>2</sup>	37 A
10 mm <sup>2</sup>	52 A
16 mm <sup>2</sup>	70 A

Cable cross section	Fuse nominal current
25 mm <sup>2</sup>	88 A
35 mm <sup>2</sup>	114 A
50 mm <sup>2</sup>	123 A
70 mm <sup>2</sup>	155 A
95 mm <sup>2</sup>	192 A
120 mm <sup>2</sup>	221 A

Use appropriate fuses with triggering characteristic gL or gR or use a corresponding automatic circuit breaker.

### 11.2.1 Pre-charge protection

See F2 in [▶Figure 23◀](#) on page 67.

**Pre-charge fuse** The pre-charge circuit is short-circuit proof between ZK+ (DC link +) and ZK- (DC link -). To protect the pre-charge circuit in case of a short-circuit between ZK (DC link) and PE use the following fuse element:

**3-phase cable protection,  $I_n = 2\text{ A}$ ,**

e.g.

G fuse cartridge (fast-acting), 2 A made by SIBA

Type: 171530

Fuse terminal block for cartridge fuse insert made by Phoenix Contact

Part no.: 3004100, part name: UK 5-HESI.



#### NOTE

The device is not operated correctly and any kind of claim to warranty will expire, if the fuse element is not installed.

### 11.2.2 24V extra-low voltage protection

In case you refer to UL 508 C:

Assure, that all marked e.l.v. connections (24 V) at the device have a maximum voltage of  $30\text{ V}_{\text{DC}}$ . Additionally these connections must be protected with fuses which are in accordance with UL 248 with a triggering current of maximum 4 A.



#### HINWEIS!

If the current consumption is lower than 4 A, several connections can be protected together with a UL-listed fuse (release current max. 4 A).

## 11.3 Mains filters

Each device needs a mains filter to comply with the recommended limit values of the EMC regulation.

Device	Input rated current	Input peak current	Schaffner filter <a href="http://www.schaffner.com">www.schaffner.com</a>
BM4135	55 A	82,5 A	FN 3120H-80-35
BM4145	125 A	162,5 A	FN 3120H-150-40
BM4163	300 A	340 A	FN 3100-300-99

## 11.4 Surge protection module

A surge protection module BFO-3-550-00 (article number 386058) is mandatory in every application .

The module must be connected as follows:

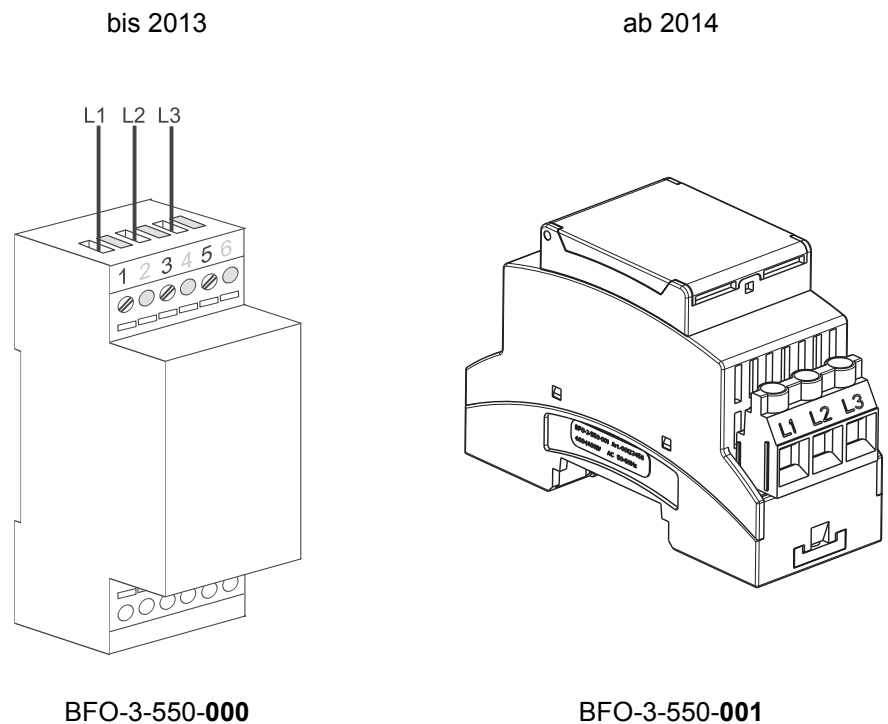


Figure 46: Connection surge protection module

**NOTE**

If the surge protection module BFO-3-550-00X is not used or not connected according connection diagram any kind of claim to warranty will expire for the **b maXX 4100** active mains converter.

**NOTE**

The surge protection module BFO-3-550-00X must be also used in UL certified applications. The surge protection module is a mandatory component of the UL file relating to the **BM4100** active mains inverter.

The surge protection module limits the phase-to-phase voltage to 550 V.

In operation overvoltages can be expected in case of mains failure. Because the detection of a mains failure is delayed and it takes time for identifying a mains failure the mains inverter continues to work a few 10 ms normally. In this case an oscillating circuit consisting of a series connection of mains filter (and its capacitors) with the commutating choke and the IGBTs plus the DC capacitors is formed. The surge protection module limits the peak voltages of this oscillating circuit.

The surge protection module is an integral part of the BM4100's protection against overvoltage from the mains as well as against overvoltage in case of mains failure in combination with the required mains filter and the required commutating choke.

**NOTE**

It can be assumed that the surge protection module is damaged or thermal destroyed if it is stressed with voltages of 550 V and higher over a longer period (several seconds or even constantly).

We request our customers to change the surge protection module in case of above mentioned overvoltage for their customers by way of precaution

## 11.4 Surge protection module

### 11.4.1 Maintenance/inspection of surge protection modules



#### WARNING!

##### Risk of injury due to insufficient qualifications!

The maintenance/inspection of surge protection modules may only be carried out by qualified personnel.

#### Procedure BFO-3-550-000:

- 1 Switch off machine / switch to neutral



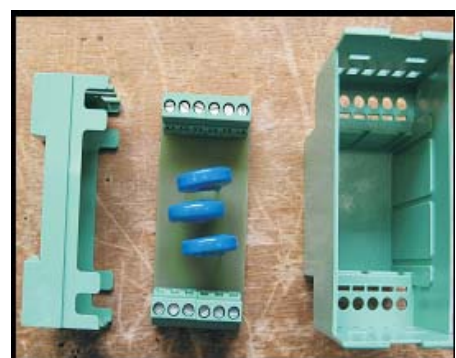
#### DANGER!

##### Risk of fatal injury from electrical current!

Assure, that when working in the control cabinet, that all devices in the control cabinet are off-circuit and are safe against re-starting.

Await the discharge of the DC-link, before you install the safety relay. The capacitors which are used in the device are **10 min.** after interruption of the supply voltage automatically discharge so far, that the connections can be demounted without danger. If you have additional capacitors connected to the DC-link, the DC-link discharging also can last much longer. In this case you must determine the necessary waiting time yourself and you must verify the isolation from supply at all terminals of the device (also see [►Danger from residual energy◄](#) on page 16).

- 2 Disconnect terminals L1, L2, L3
- 3 Dismantle the surge protection module
- 4 Open the housing of surge protection modul



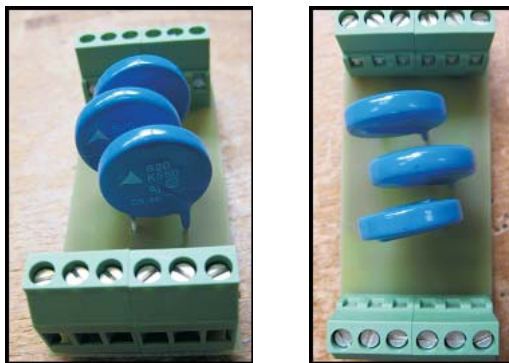
A total of 4 plastic clips on the lower and upper side of the module must be pressed by e.g. a screwdriver to remove the cover. After that the PCB can be dismantled.



## 5 Visual inspection

Surge protection module without damage

- no staining



The surge protection module can be assembled and installed again.

Surge protection module damaged,  
phase to phase voltage > 550 V over a longer period

- Varistors stained
- Varistors black
- Varistors exploded



A new surge protection module must be installed.

**Procedure** 1 Switch off machine / switch to neutral  
**BFO-3-550-001:**



### **DANGER!**

#### **Risk of fatal injury from electrical current!**

Assure, that when working in the control cabinet, that all devices in the control cabinet are off-circuit and are safe against re-starting.

Await the discharge of the DC-link, before you install the safety relay. The capacitors which are used in the device are **10 min.** after interruption of the supply voltage automatically discharge so far, that the connections can be demounted without danger. If you have additional capacitors connected to the DC-link, the DC-link discharging also can last much longer. In this case you must determine the necessary waiting time yourself and you must verify the isolation from supply at all terminals of the device (also see ►[Danger from residual energy](#)◄ on page 16).

2 Open cover of the BFO-3-550-001

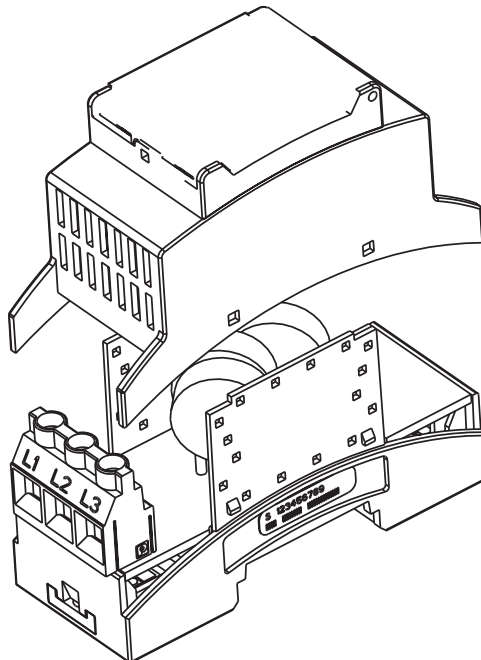


Figure 47: Remove cover of BFO-3-550-001

3 Visual inspection, see BFO-3-550-000 ►[Visual inspection](#)◄ on page 121

11.5 Power chokes

- Jacke (not UL-listed)

Device	Name	Inductance	Part number
BM4135	BL-3-060-000	1,0 mH	388168
BM4145	BL-3-130-000	0,48 mH	388741
BM4163	BL-3-240-000	0,36 mH	396302

The listed chokes are specified for the operation at 400 V / 50 Hz or 480 V / 60 Hz.

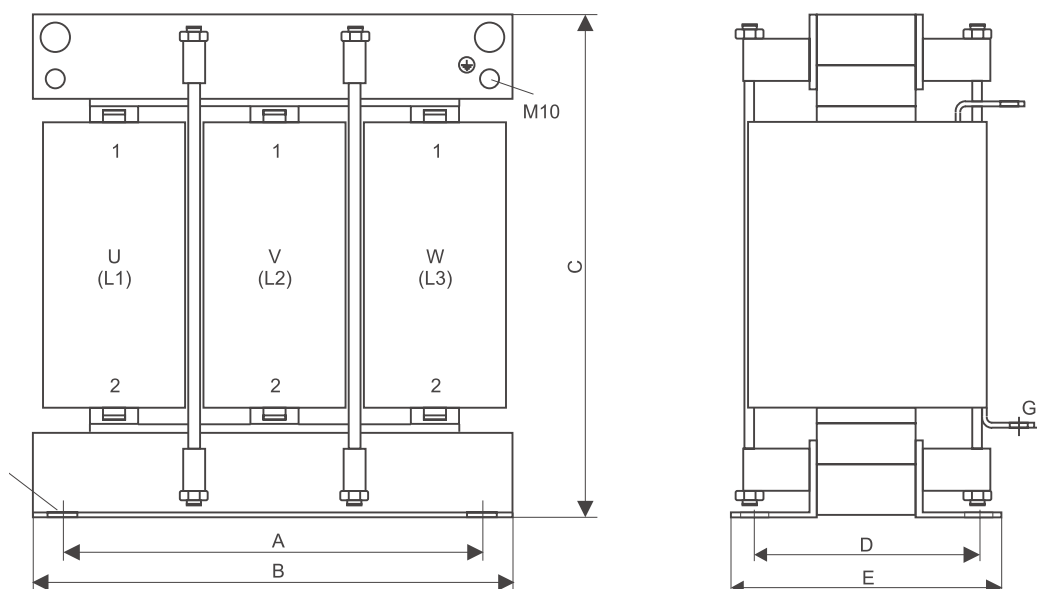


Figure 48: Figure mains choke

Table with dimensions of the mains chokes:

Type	A	B	C	D	E	F	G	Connection	Fixing
BM4135	260	300	306	110	140	9x13	∅8,5	bar with hole M8	M8
BM4145	300	360	330	110	140	9x13	∅8,5	bar with hole M8	M8
BM4163	430	480	420	160	220	13x26	∅11	bar with hole M10	M12

- Tramag (UL-listed)

Device	Name	Inductance	Part number
BM4135	BL-3-060-001	1,0 mH	415096
BM4145	BL-3-130-001	0,48 mH	415097
BM4163	BL-3-240-001	0,36 mH	415099

## 11.6 Main contactor and charge contactor

### 11.6 Main contactor and charge contactor

Use a main contactor and a charge contactor with a contact load capacity shown in the table below.

Device	Main contactor	Charge contactor
BM4135	60 A / 400 V or 60 A / 480 V	6 A / 400 - 480 V
BM4145	130 A / 400 V or 130 A / 480 V	6 A / 400 - 480 V
BM4163	250 A / 400 V or 250 A / 480 V	6 A / 400 - 480 V

### 11.7 Baumüller accessories

#### 11.7.1 Shielding clamp

Type	Part No.
Width 11 mm, for cable diameter up to 8 mm	00312171
Width 19 mm, for cable diameter 7 mm to 16 mm	00397366
Width 27 mm, for cable diameter 6 mm to 24 mm	00397375
Width 43 mm, for cable diameter 22 mm to 40 mm	00397376

#### 11.7.2 Cable RS232



#### NOTE!

In case you don't use an optically decoupled interface cable, the cable shield has only to be connected to the connector housing at the controller connector.

The company Baumüller Nürnberg GmbH recommends the usage of optically decoupled transmitters (e.g. from the company Ratioplast part no. 901SV232C6095 and part no. 901SV232T6095)

Optically decoupled interface cable

Interface	Name	Length	Part No.
X1 (RS 232)	Programming cable	3 m	on request

Further lengths on request.

## 11.7.3 Design cover and connectors

	BM4135	BM4145	BM4463	Part No.
<b>Design cover (yellow) narrow</b>	X	X	X	351209
<b>Connector X11</b> Phoenix: GMSTB 2,5HCV/6-ST- 7,62 1714317	X	X	X	409624
<b>Connector X3</b> Phoenix: FK-MCP 1,5/6-ST-3,81 1851083	X	X	X	354874
<b>Connector X100</b> Wieland: 8513 BFK, 25.630.3653.0	X	X	X	354810
<b>Connector A: X1</b> Phoenix: GMSTB 2,5HCV/4-ST- 7,62 1714294	X	X	X	409625
<b>Connector B: X1, C: X1 for version 01</b> Phoenix: FRONT-GMSTB 2,5/3-ST- 7,62 1806122	X	X	X	385623
<b>Connector B: X1, C: X1 vor version 02</b> Phoenix: FRONT-GMSTB 2,5/2-ST- 7,62 1766990	X	X	X	396131
<b>Connector D: X1</b> Wieland: 8513 BFK, 25.630.4053.0	X	X	X	354815



## SHUTDOWN, STORAGE

In this chapter we describe, how you decommission and store the device.

### 12.1 Safety instructions

- Refer to [►Safety◄](#) from page 11 and the information in [►Transport and Packaging◄](#) from page 47.

The shutdown of the device may only be carried out by for this qualified personnel.



#### **DANGER!**

#### **Risk of fatal injury from electrical current!**

Stored electric charge.

Discharge time of the system = discharge time of the device with the longest DC link discharge time.

Therefore:

- Do not touch electrically live parts before taking into account the discharge time of the capacitors.
- Assure, that all electric connections are current-free and are safe against switch-on.
- Before working, check at the electrical connections with suitable measuring devices, that the connections are off-circuit.
- Remove the connections not until the safe isolation from supply has been checked.
- If additional capacitors are connected to the DC link, the DC link discharge can take a much longer time. In this case, the necessary waiting period must itself be determined or a measurement made as to whether the equipment is de-energized. This discharge time must be posted, together with an IEC 60417-5036 (2002-10) warning symbol, on a clearly visible location of the control cabinet.

### 12.2 Requirements to the executing personnel

The personnel, who is appointed to setting out of operation, must have the required knowledge and instructions, which is necessary for an execution according to the rules. Select the personnel in such a way, that the safety instructions, which are mounted to the device and its parts as well as to the connections, are understood and applied to.

### 12.3 Shutdown

Execute the setting out of operation as follows:

- 1 put the device off-circuit and assure the device against unintentional restart.
- 2 check the isolation from supply of all connections (earliest 10 minutes after switching off).
- 3 demount the connections and protect the connections according to the safety instructions.
- 4 document the shut down setting.

### 12.4 Demounting

The demounting assumes a completed, documented setting out of operation.



#### NOTICE!

##### Note sharp edges.

In case, while installing, you lift a device with unprotected hands, fingers/palm can be cut. If the device falls off, your feet can be cut up.

Therefore:

Therefore:

- Ensure that only qualified personnel, who are familiar with the safety notes and assembly instructions, demount this device.



Wear safety gloves.



- Wear safety shoes.

- 1 secure the device against falling off/out.
- 2 loosen all mechanical connections.
- 3 lift the device out of the control cabinet.
- 4 store the device in a suitable packing.
- 5 at transportation pay attention to, that the device is not damaged by wrong storage or severe shocks, also see [▶What to observe when transporting◀](#) auf Seite 47.



In case you want to dispose the device, additional data is available in chapter [►Disposal◄](#) from page 131.

## 12.5 Storage conditions

The device is maintenance-free. If you keep to the environmental conditions during the entire period of storage, you can assume, that the device will not be damaged. In case the environmental conditions during storage are not kept, you should assume that the device is damaged after storage.



### CAUTION!

#### Property damage because of incorrect storage conditions

Incorrect storage can damage/destroy the device.

Therefore:

Assure, that the environmental conditions are kept during the entire period of storage:

- Climatic category 1K4
- Temperature range -25 °C to +55 °C



### CAUTION!

#### Recommissioning without forming of the capacitors.

From six months storage period on, the capacitors are destroyed during commissioning, if they are not formed beforehand

- Reform the DC link capacitors:
  - by supplying the device ready-to-operate for at least one hour with supply voltage
  - but do not transmit a pulse enable during this time.
- Consider, that it is imperative, to connect the accordingly prescribed line commutating reactor for this forming procedure. Devices, where no line commutating reactor is necessary can directly be supplied with mains voltage.

### 12.6 Recommissioning

---

Execute commissioning as with a new device, see  
[►Mounting◄](#) from page 49, [►Installation◄](#) from page 59.



#### **CAUTION!**

##### **Recommissioning without forming of the capacitors.**

From six months storage period on, the capacitors are destroyed during commissioning, if they are not formed beforehand

- Reform the DC link capacitors:
  - by supplying the device ready-to-operate for at least one hour with supply voltage
  - but do not transmit a pulse enable during this time.
- Consider, that it is imperative, to connect the accordingly prescribed line commutating reactor for this forming procedure. Devices, where no line commutating reactor is necessary can directly be supplied with mains voltage.

## DISPOSAL



### NOTE!

Baumüller products are not subject to the scope of application of the EU's Waste Electrical and Electronic Equipment Directive (WEEE, 2002/96/EC). Hence, Baumüller is not obligated to bear any costs for taking back and disposing of old devices.

### 13.1 Safety notes

---



### DANGER!

#### Risk of fatal injury from electrical current!

Stored electric charge.

Discharge time of the system = discharge time of the device with the longest DC link discharge time in the DC link connection.

Refer to [►Electrical data◄](#) from page 30.

Therefore:

- Do not touch before taking into account the discharge time of the capacitors and electrically live parts.
- Heed corresponding notes on the equipment.
- If additional capacitors are connected to the DC link, the DC link discharge can take a much longer time. In this case, the necessary waiting period must be determined or a measurement made as to whether the equipment is de-energized. This discharge time must be posted, together with an IEC 60417-5036 (2002-10) warning symbol, on a clearly visible location of the control cabinet.



### **NOTICE!**

#### **Avoid polluting the environment as a result of improper disposal.**

Therefore:

- Only dispose in compliance with the health and safety regulations.
- Take heed of any special local regulations. If you are unable to directly ensure safe disposal yourself, commission a suitable disposal contractor.
- In the event of a fire, hazardous substances could possibly be generated or released.
- Do not expose electronic components to high temperatures.
- Beryllium oxide is used as inner insulation, for example for various power semiconductors. The beryllium dust that is generated upon opening is injurious to the health.  
Do not open electronic components.
- Dispose of capacitors, semiconductor modules and electronic scrap as special waste.



### **WARNING!**

#### **Danger as a result of faulty deinstallation!**

The deinstallation and disposal requires qualified personnel with adequate experience.

Therefore:

- Only allow deinstallation and disposal to be performed by qualified personnel.

## 13.2 Disposal facilities/authorities

---

Ensure that the disposal is handled in compliance with the disposal policies of your company, as well as with all national regulations of the responsible disposal facilities and authorities. In case of doubt, consult the bureau of commerce or environmental protection authority responsible for your company.



## APPENDIX A - ABBREVIATIONS

<b>A</b>	Ampere	<b>HSF</b>	Main contactor enable
<b>AC</b>	Alternating current	<b><math>\hat{I}</math></b>	Peak current, curve shape not defined
<b>AIO</b>	Function module analog input/output	<b><math>I_{AC}</math></b>	Effective value, alternating current
<b>ASCII</b>	American Standard Code for Information Interchange	<b><math>I_{Aist}</math></b>	Armature current actual value
<b>BACI</b>	Baumüller drives communication interface	<b><math>I_{DC}</math></b>	Effective value, direct current
<b>BB</b>	Ready-to-operate	<b><math>I_{eff}</math></b>	Effective value, alternating current
<b>BBext</b>	Ready-to-operate (external)	<b>IF</b>	Pulse enable
<b>BBint</b>	Ready-to-operate (internal)	<b>ID No.</b>	Identification number
<b>BSA</b>	Reference potential analog	<b>Ink</b>	PPR count of incremental encoder
<b>BSD</b>	Reference potential digital	<b>IS</b>	Impulse inhibit
<b>CAN</b>	Network for controller ambience	<b>ISO</b>	International Organization for Standardization
<b>CiA</b>	CAN in Automation	<b><math>I_{set}</math></b>	Current set value
<b>CPU</b>	Central processing unit	<b>LT</b>	Power unit
<b>DC</b>	Direct current	<b>M24</b>	Reference potential 24 V
<b>DIN</b>	Deutsches Institut für Normung e.V. (German Institute for Standardization)	<b>MR1</b>	Torque direction 1
<b>DIO</b>	Function module digital input/output	<b>MR2</b>	Torque direction 2
<b>EDS</b>	Electronic data sheet	<b><math>n = 0</math></b>	Speed = 0
<b>EMF</b>	Electromotive force	<b><math>n_{ist}</math></b>	Speed actual value
<b>EMC</b>	Electromagnetic compatibility	<b><math>n_{max}</math></b>	Maximum speed
<b>EN</b>	European standard	<b><math>n_{min}</math></b>	Minimum speed
<b>ENC</b>	Function module incremental encoder	<b>NN</b>	Altitude over sea level
<b>ESD</b>	Electrostatic discharge	<b><math>n_{soll}</math></b>	Speed set value
<b>EXT, ext</b>	external	<b>PE</b>	Protective conductor
<b>FI</b>	Residual current	<b>PELV</b>	Protective extra-low voltage with safety separation, earthed
<b>HS</b>	Main contactor	<b>PSI</b>	Program Storage Interface
<b>HSE</b>	Main contactor on	<b>PZD</b>	Process data
		<b>RF</b>	Controller enable
		<b>SELV</b>	Safety extra-low voltage with safety separation

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<b>SH</b>	Quick stop
<b>SM</b>	Synchronous motor
<b>SYNC</b>	Synchronization message
<b>TM</b>	Motor temperature sensor
<b>U</b>	Voltage
<b><math>\hat{U}</math></b>	Peak voltage
<b><math>U_A</math></b>	Armature voltage
<b><math>U_{AC}</math></b>	Effective value, alternating voltage
<b><math>U_{DC}</math></b>	Effective value, direct-current voltage
<b><math>U_{eff}</math></b>	Effective value, alternating voltage
<b><math>U_{ZK}</math></b>	DC-link voltage
<b>V</b>	Volt
<b>VDE</b>	Association for Electrical, Electronic & Information Technologies
<b>ZK</b>	DC-link



# APPENDIX B - DECLARATION OF CONFORMITY

## B.1 Declaration of conformity

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**EG - Declaration of Conformity**

**Date: 28.11.2007**

**according to EMC Directive 2004/108/EC and Low Voltage Directive 2006/95/EC**

The Manufacturer: Baumüller Nürnberg GmbH  
Ostendstraße 80-90  
90482 Nürnberg, Germany

declares, that the products:

Designation: b maXX 4100 active mains inverter  
Type: BM4135 - XXX - 0XXXX - XX,  
BM4145 - XXX - 0XXXX - XX,  
BM4163 - XXX - 0XXXX - XX

manufactured since: 11.2007

are developed, designed and manufactured in accordance with the EMC Directive 2004/108/EC and the Low Voltage Directive 2006/95/EC.

Applied harmonized standards:

Standard	Title
DIN EN 61800-5-1	Adjustable speed electrical power drive systems. Part 5-1: Safety requirements: Electrical, thermal and energetic requirements
DIN EN 61800-3	Adjustable speed electrical power drive systems. Part 3: EMC requirements and specific test methods

Attention should be paid to the safety instructions in the manual.

Nuremberg / 28.11.2007

Location / Date

Subject to change of this declaration of EC conformity without notice. Actual valid edition on request.





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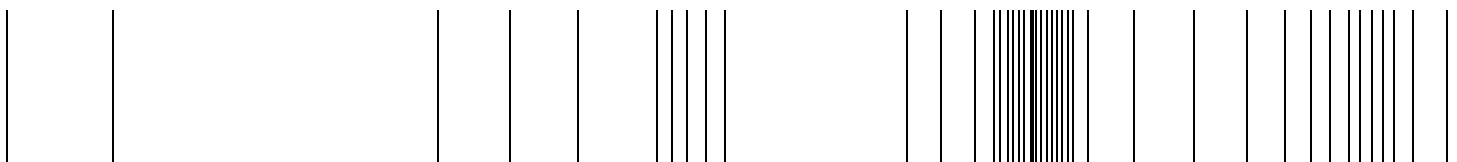
## Overview of Revisions

Version	Status	Changes
5.04052.09	27-Feb-2014	new layout, new BFO module





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