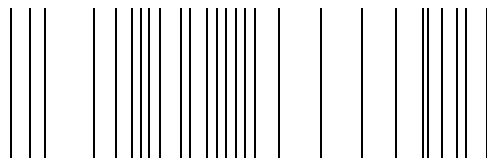
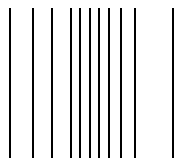


**be in motion** **be in motion**



POWER CONVERSION EQUIPMENT



LISTED  
38WA



**b maXX<sup>®</sup> BM4400**

**Basic unit**

**Manual**

**E**

5.04043.06



|              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Title        | Manual                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Product      | <b>b maXX® BM4400</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Version      | 5.04043.06                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Part No.     | 384209                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Status       | 13.11.2007                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Copyright    | <p>These operating instructions may be copied by the owner in any quantity but only for internal use. For other purposes these operating instructions and extracts thereof must not be copied or reproduced.</p> <p>Use and disclosure of information contained in these operating instructions are not permitted.</p> <p>Designations and company marks contained in these operating instructions may be brand names, the use of which by third parties for their own purposes may violate the rights of the holders.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Obligatory   | <p>These operating instructions are part of the equipment/machine. These operating instructions must be available to the operator at all times and must be in a legible condition. If the equipment/machine is sold or moved to a different location these operating instructions must be passed on by the owner together with the equipment/machine.</p> <p>After any sale of the equipment/machine this original and all copies must be handed over to the buyer. After disposal or any other end of use this original and all copies must be destroyed.</p> <p>When the present operating instructions are handed over, corresponding sets of operating instructions of a previous version are automatically invalidated. Please notice that specifications/data/information are <b>current values according to the printing date</b>. These statements are <b>not legally binding</b> according to the measurement, computation and calculations.</p> <p>Baumüller Nürnberg GmbH reserves the right, in developing its products further, to change the technical specifications and the handling of the products concerned without prior notice.</p> <p>No liability can be accepted concerning the correctness of the operating instructions unless otherwise specified in the General Conditions of Sale and Delivery.</p> |
| Manufacturer | <p>Baumüller Nürnberg GmbH<br/>Ostendstr. 80 - 90<br/>D-90482 Nürnberg<br/>Germany<br/>Tel. +49 9 11 54 32 - 0 Fax: +49 9 11 54 32 - 1 30<br/><a href="http://www.baumueller.de">www.baumueller.de</a></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |



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# INTRODUCTION

This manual is an important part of your **b maXX® BM4400** appliance; Please, therefore completely read this manual, before starting operation, last but not least on behalf of your own security.

In this chapter we describe the first steps, which have to be done after you have received the device. Terms are defined, which are continuously used in this manual. We will inform you about duties, which must be considered when using this device.

## 1.1 Validity of this manual

---

This manual is valid for **b maXX® BM4400** devices with the below mentioned type keys and replaces manual 5.01040:

BM44XX - xxx - XX0XX[Ryy] - XX (without 7-segment display)

BM44XX - xxx - XX1XX[Ryy] - XX (without 7-segment display)

BM44XX - xxx - XX2XX[Ryy] - XX (with 7-segment display)

BM44XX - xxx - XX3XX[Ryy] - XX (with 7-segment display)

**b maXX® BM4400** power module type codes:

BM44XX - XXX - 2XXXX[Ryy] - XX

## 1.2 Survey of the appliance series **b maXX® BM4400**

---

An appliance of the series **b maXX® BM4400** consists of a power unit and a controller cartridge, which are in a common cabinet. The controller part is permanently installed into the controller cartridge. The controller cartridge has slots and can be extended with plug-in modules. The appliances are available in graded construction- and capacity sizes.

In this manual we will describe the Baumüller device series '**b maXX® BM4400**', the connection and the commissioning.



### WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury
- death

All persons, who work on and with devices of the series bmaXX<sup>®</sup>, must have this manual available at their work place and must obey the instructions and notes contained therein - especially the safety instructions.

---

## 1.3 First steps

---

- Check delivery, see [►Transportation and packing◄](#) from page 25.
- Provide for qualified personnel for the mounting, installation and commissioning.
- Hand over this manual to the personnel for mounting, installation and commissioning. Assure that especially the safety instructions are understood and obeyed.

## 1.4 Used terms

---

In this manual we will also use the term 'device' for the Baumüller product '**b maXX<sup>®</sup>**'. A list of the abbreviations which are used are to be found in [►Appendix A - Abbreviations◄](#) from page 151.

## 1.5 Copyright and trade mark

---

b maXX<sup>®</sup> is a registered trade mark of Baumüller Nürnberg GmbH  
HIPERFACE<sup>®</sup> is a registered trade mark of SICK/Stegmann

# FUNDAMENTAL SAFETY INSTRUCTIONS

## 2.1 General notes

---

In this chapter dangers are described, arising when working with the Baumüller-device. Dangers are pointed up with symbols (icons). All symbols that are used in this manual are listed and explained.

How you can protect yourself against the single dangers in the concrete case, we will not explain in this chapter. This chapter contains only general protective measures. The concrete protective measures we will always give directly after the note to the danger.

The operation of the described devices is permissible, if the mentioned methods/procedures/measures are obeyed to. Everything else, that means also the operation of devices in installations, which are not shown here, is not permitted and must be checked with the company in each particular case. Any kind of claim to warranty will expire, if the devices are operated other than here described.



---

### WARNING

The following **may occur**, if you do not observe this warning information:

- serious personal injury
- death

The hazard information is showing you the hazards which can lead to injury or even to death.

**Always observe the hazard information given in this documentation.**

---

### 2.2 Hazard information and commands

---

Each hazard is classified in one of three different hazard classes. Every hazard class has one of the following characteristic signal words:

#### **DANGER**

- serious property damage
- serious personal injury
- death - **will** occur

#### **WARNING**

- serious property damage
- serious personal injury
- death - **may** occur

#### **CAUTION**

- minor to medium personal injury or
- environmental pollution or
- property damage - **may** occur

## 2.2.1 Hazard information structure

The following two examples show you how the hazard informations are constructed. The triangle is used when indicating a hazard for human beings. When there is a circle instead of the triangle, the hazard information is only for possible property damage.



A triangle indicates hazard for human beings.  
The shade of grey of the outline reflects the severity of the hazard - darker grey means rising hazard.



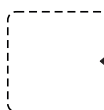
The icon within the square illustrates the hazard.  
The outline's shade of grey reflects the severity of the hazard - darker grey means rising hazard. (Not every hazard information has a square representing the hazard, so we have shown it as draft here)



The icon in the circle represents a command.  
(Not every hazard information has a circle representing the hazard, so we have shown it as draft here)



The circle indicates hazard for property.



The icon within the square illustrates the hazard.  
The outline's shade of grey reflects the severity of the hazard - darker grey means rising hazard. (Not every hazard information has a square representing the hazard, so we have shown it as draft here)

The text beneath the icons is constructed as follows:

**HERE STANDS THE SIGNAL WORD WHICH INDICATES THE DEGREE OF THE HAZARD**

Here we tell if one or more of the consequences described lower will occur if this hazard information is not observed.

- here we describe the possible consequences. The worst consequence stands on the right side.

*Here we describe the hazard.*

Here we describe what you can do to avoid this hazard.

## 2.2.2 Form of the hazard sign (triangular or round)

If there is a triangle like or or in front of the signal word, the hazard information is referring to personal damage.

If there is a round hazard signal like in front of the signal word, the hazard information is referring to property damage.

## 2.2 Hazard information and commands

---

### 2.2.2.1 Hazard information on personal injury

---

To distinguish each class of hazard information, we use a characteristic outline for both the triangular hazard signs and the square-form icons

For the hazard class **DANGER** the  danger sign is used. The hazard information of this hazard class used in this documentation is listed below:



#### **DANGER**

The following **will occur**, if you do not observe this danger information:

- serious personal injury
- death

*The hazard is: **electricity**. Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.



#### **DANGER**

The following **will occur**, if you do not observe this danger information:

- serious personal injury
- death

*The hazard is: **mechanical influence**. Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.



For the hazard class **WARNING** the warning sign  is used. The following hazard information of this hazard class is used in this documentation.

## WARNING



The following **may occur**, if you do not observe this warning information:

- serious personal injury
- death



*The hazard is: **electricity**. Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.

## WARNING



The following **may occur**, if you do not observe this warning information:

- serious personal injury
- death



*The hazard is: **mechanical influence**. Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.

## WARNING



The following **may occur**, if you do not observe this warning information:

- serious personal injury
- death



*The hazard is: **electro-conductive liquid together with electricity**. Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.



## WARNING



The following **may occur**, if you do not observe this warning information:

- serious personal injury
- death



*The hazard is: **electro-magnetic radiation**. Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.

## 2.2 Hazard information and commands

---



### WARNING

The following **may occur**, if you do not observe this warning information:

- serious personal injury
- death



*The hazard is: **liquid coolant**. Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.

---

For the hazard class **CAUTION** the caution sign  is used when there is hazard for persons or of environmental pollution. The following hazard information of this hazard class is used in this documentation.

## CAUTION



The following **may occur**, if you do not observe this caution information:

- minor to medium personal injury.

*The hazard is: **hot surface**. Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.



## CAUTION



The following **may occur**, if you do not observe this caution information:

- minor to medium personal injury.

*The hazard is: **sharp edges**. Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.



## CAUTION



The following **may occur**, if you do not observe this caution information:

- minor to medium personal injury.

*The hazard is: **rotating parts**. Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.



## CAUTION



The following **may occur**, if you do not observe this caution information:

- minor to medium personal injury.

*The hazard is: **injury of the eye caused by ricochetting particles**. Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.



## 2.2 Hazard information and commands

---



### CAUTION

The following **may occur**, if you do not observe this caution information:

- minor to medium personal injury.

*The hazard is: **noise**. Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.

---



### CAUTION

The following **may occur**, if you do not observe this caution information:

- minor to medium personal injury.

*The hazard is: **hazard of sliding caused by liquid**. Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.

---



### CAUTION

The following **may occur**, if you do not observe this danger information:

- environmental pollution.

*The hazard is: **unadequate disposal**. Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.

---

## 2.2.2.2 Hazard information on property damage

If there is a round caution sign ⓘ in front of the signal word, the safety information refers to property damage.



### CAUTION

The following **may occur**, if you do not observe this caution information:

- property damage.

*The hazard is: **electro-static discharge**. Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.



### CAUTION

The following **may occur**, if you do not observe this caution information:

- property damage.

*The hazard is: **damage of the coolant hose**. Here the hazard may be described in detail.*

Here is described what you can do to avoid the hazard.



## 2.2.2.3 Command signs used



wear safety gloves



wear safety shoes



wear eye protection



wear ear protection



Use this fire extinguishing agent:  
„fire extinguishing agent“

### 2.3 Information sign



#### NOTE

This note is a very important information.

### 2.4 Legal instructions

This documentation is addressed to technical qualified personnel, who is specifically skilled and who is thoroughly familiar with all warnings and maintenance procedures.

The devices are made according to the state-of-the-art technology and are fail-safe. They can be installed safe, can be put into operation and they function without problems, if it is assured, that the instructions of the documentation are followed.

The user is responsible for the execution of service and commissioning according to the safety instructions of the prevailing standards and other relevant national and local instructions concerning conductor dimensioning and protection, earthing, disconnector, overcurrent protection and so on.

For damages, which result from the mounting or from the connection, the one is liable, who has carried out the mounting or the installation.

### 2.5 Appropriate use

Always use the device according to the terms. Stated below we have carried a few important notes together. The notes stated below shall give you a feeling for the according to the terms usage of the device. We do not raise any claim for the completion of the notes stated below - follow all instructions given in this operating instruction.

- project the application in such a way, that you always operate the device within its specification.
- use this device only as converter for three-phase drives.
- make sure, that only qualified personnel work with/at this device.
- install this device only on an adequate carrying wall.
- install this device in the way as it is described in the documentation.
- make sure, that the mains/power supply unit always applies to the predetermined specifications.
- only operate the device, if it is technical faultlessly.
- operate this device only in combination with released components of the company Baumüller Nürnberg GmbH.
- always operate the device in an area as it is instructed in the "Technical data".
- Operate the device in environments of second mode (industrial environment). The device was developed in such a way, that it meets the requirements of the category C3 according to IEC 61800-3:2005. The device is not provided for the connection to the public network. The operation of the device in an environment of the first mode of category C2/C1 (living-, business and industry area without intermediate transformer directly at a public secondary distribution system), in order to reduce the RFI-emission

(cable-guided and blasted) special measures must be provided for and must be proved by the control cabinet manufacturer, because EMC-interferences can occur, if no additional measures have been taken. If a device, which was described here, reaches the category C2/C1, even with additional measures, can not be ensured.

- always operate the device in serialized condition.  
Due to safety reasons you must not rebuild the device.
- consider all instructions referring to this, if you intend to store the device.

You are using the device according to the terms, as soon as you regard all notes and information in this operating manual.

## 2.6 Inappropriate use

Listed below you will find some examples of non-appropriate application. The information below is intended to give you some impression of what non-appropriate application is. However we cannot state all possible non-appropriate applications here. All applications, where the notes and information given in this documentation is disregarded, are non-appropriate and therefore forbidden.

Examples:

- You disregarded the notes in this manual.
- The device has not been specifically applied as a converter in order to control a motor.
- The device has been
  - mounted incorrectly,
  - connected incorrectly,
  - commissioned incorrectly,
  - operated incorrectly,
  - mounted, connected, commissioned, operated and/or maintained by not qualified or inadequately qualified personnel,
  - inappropriately maintained or not maintained  
(also consider the descriptions of the components),
  - overloaded it,
  - operated
    - with defective safety devices,
    - with incorrectly mounted safety devices or without safety devices,
    - with incorrectly working safety- and protection devices,
    - outside the specified environmental conditions.
- You have modified the device.
- You have insufficiently monitored the parts, which are subject to a wearing.
- You have improperly carried out a repair.
- You have combined the device with improper products, which are not enabled for devices described in this manual.
- You have combined the device with faulty and/or faulty documented products of other manufacturers.
- The device has been operated in an explosive environment.

### 2.7 Safety equipment

The devices BM441X, BM442X and BM443X comply with the protection class IP 20. The devices BM443X and BM444X comply with the protection class IP20, if the power connections are performed safe-to-touch according to IP20, otherwise IP10. BM445X, BM446X and BM447X comply with the protection class IP 00. The mentioned device types must be built into a suitable control cabinet, in order to comply with the required protection classes in EN61800-5-1, chapter 4.2.3.3 (IP30: only the upper horizontal surfaces; IP20: all the other surfaces).



#### WARNING

The following **may occur**, if you do not observe this warning information:

- serious personal injury
- death



*The danger is: **electricity**. The device cabinet complies with IP 00.*

Operate the device in a control cabinet, which provides a protection against a direct touching of the devices and fulfills at least the demands of the EN 50178 chapter 5.2.4.

### 2.8 Training of the personnel



#### WARNING

The following **may occur**, if you do not observe this warning information:

- serious personal injury
- death

Devices of the company Baumüller Nürnberg GmbH may only be assembled, installed, operated and maintained by qualified personnel.

Qualified personnel (professionals) is defined below:

Qualified personnel

Authorized electronic engineers and skilled persons of the customer or third persons, who have learned the installation and commissioning of Baumüller drive systems and who are authorized, to put circuits and devices into operation according to the standards of the safety technology, to ground and to label.

Qualified personnel has a training or an instruction due to the local valid standards of the safety technique in maintenance and usage of an adequate safety equipment.

Requirements to the operating personnel

The operating of the drive system must only be executed by persons, who have had a training, who have been instructed and who have been authorized for this.

Fault clearance, servicing, cleaning, maintenance and exchange must only be carried out by skilled or instructed personnel. These persons must know the operating manual and must act according to this.

The commissioning as well as the instruction must only be carried out by qualified personnel.

## 2.9 Safety precautions in normal operation

- at the location of your appliance regard the safety regulations for the plant, into which the appliance has been built in.
- if safety regulations require additional monitoring or safety devices supply your appliance with them.

## 2.10 Dangers due to residual energy

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Electrical residual energy | After separation of the device from the mains parts under voltage as e. g. power connections may be only then touched if the capacitors in the device are discharged (see „discharging time“ in <a href="#">►D.6 Electrical data - BM441X basic unit◄</a> on page 167 to <a href="#">►D.11 Electrical data - BM446X basic unit◄</a> on page 182). Also pay regard to the instructions on the device. 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 on yourself or measure whether the device is off-circuit. |
| Mechanical residual energy | The mechanical residual energy is dependent upon the application. As we don't know the application, we cannot make any exact statements. Driven parts also rotate/move after disconnection of the mains supply for a certain time. Please, provide adequate safety arrangements.                                                                                                                                                                                                                                                                                                                                                         |

## 2.11 Disposal of the device

The accurate disposal of the device is described in [►12 Disposal◄](#) on page 147.

## 2.12 Fire fighting

### WARNING

The following **may occur**, if you do not observe this warning information:

- serious personal injury
- death

*The danger is: **Electricity when using a conductive fire fighting appliance.***



Use this fire extinguishing agent:  
ABC powder / CO<sub>2</sub>

### 2.13 Responsibility and liability

---

To be able to work as safe as possible with this device, you must know and follow the danger notes as well as the safety instructions.

#### 2.13.1 Observing the safety notes and safety instructions

---

In this manual we use visually unified safety instructions, which are intended to prevent from personal injury or damage to property.



##### **WARNING**

The following **may occur**, if you do not observe this warning information:

- serious personal injury
- death

All persons, who work with this device, must know and regard the safety notes and the safety instructions in this manual.

Apart from this, any and all persons who work on this device must additionally know and regard to all regulations and instructions, that are valid at the location.

---

#### 2.13.2 Dangers when handling this device

---

The device „**b maXX**®“ was developed and manufactured according to the state-of-the-art technology and in compliance with the valid regulations and standards. It is still possible that dangers can arise during use. An overview of possible dangers is to be found in chapter [►Fundamental safety instructions◄](#) from page 11.

We warn you against the acute danger at the respective places in this manual.

#### 2.13.3 Warranty and Liability

---

All information in this manual is non-binding customer information; it is subject to ongoing further development and is updated on a continuous basis by our revision service.

Warranty- and liability claims against Baumüller Nürnberg GmbH are excluded if in particular one or more of the causes listed in [►Inappropriate use◄](#) from page 21 has/have caused the damage.

## TRANSPORTATION AND PACKING

In this chapter we describe, which conditions have to be adhered to at transportation, how you check the device after receipt and what you should have to consider, if you dispose the packing.

### 3.1 To be considered by transportation

---

For the first transportation of the device, the device was packed in the manufacturer company. In case you transport the device, assure, that the following conditions are fulfilled during the whole transportation:

- 2 K 3 (climatic category) <sup>1)</sup>
- - 30 °C bis + 70 °C (temperature range)
- max. 1 g (vibration, shock, repetitive shock)

<sup>1)</sup> EN 50178, table 7

### 3.2 Unpacking

---

After receipt of the device, which is still packed:

- Avoid strong transportation vibrations and severe hits, e.g. when setting down.
- Check, if transportation damages are visible!

If so:

- Immediately complain to the deliverer. Let the claim be confirmed in writing and immediately contact the substitution of Baumüller Nürnberg GmbH, which is in charge for your company.

### 3.3 Dispose packing

---



#### WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury
- death



*The danger is: **electricity**.*

Do not operate the device, if you have recognized a transportation damage or if you assume this. In this case immediately contact Baumüller Nürnberg GmbH

If there is no transportation damage recognizable:

- Open the packing of the device.
- Check the scope of supply with the help of the delivery note.

The minimum scope of supply is:

- **b maXX<sup>®</sup> BM4400**
- This manual inclusively the copy of the declaration of conformity/declaration of manufacturer
- Claim at the Baumüller substitution, which is in charge, in case the delivery is not complete.

### 3.3 Dispose packing

---

The packing is made of cardboard, plastics, metal parts, corrugated cardboard and/or wood.

- Regard the local disposal instructions, in case you dispose the packing.

## DESCRIPTION OF THE DEVICES

In this chapter the basic construction of the devices **b maXX® BM4400** and the slots of the controller cartridge are described and the type key on the devices is explained.



### NOTE

The devices of the **b maXX® BM4400**-series are provided for the operation in the 'second environment' (industrial environment) according to EN 61800-3. At connection to the public mains EMC problems can appear. Also see [►Appropriate use◄](#) from page 20.



### NOTE

A correct operation of **b maXX® BM4400 power modules** can only be assured in combination with Baumüller power converters or mains inverters.

### 4.1 Structure

The devices of the b maXX<sup>®</sup>-series are servo converters of Baumüller Nürnberg GmbH. The devices consist of a power unit with an integrated slot for the controller cartridge (narrow or wide). The controller cartridge itself possess, besides a firmly installed controller (slot F), rows of slots, that can be filled with optional modules.

The rated current of the devices reach from 2,5 A to 600 A. The devices differ in size, power, equipment (hard- and software) and cooling types.

This data is available in the type key (see ► [Marking of the device - type key](#) ◄ on page 34).

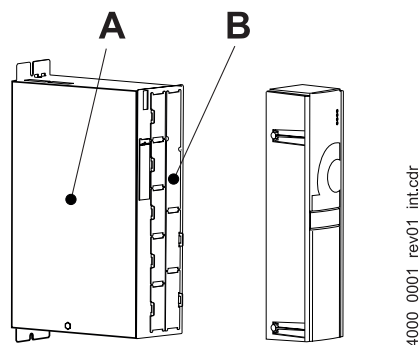


Figure 1: Power unit (A) - controller unit (B)

A device of the series **b maXX<sup>®</sup> BM4400** consists of the following parts:

**A:** Power unit (converter)

This part is a power semiconductor converter combination which is build up with power semiconductor components.

#### **b maXX<sup>®</sup> BM4400**

The present alternating voltage at the three-phase system is converted into direct voltage by the input sided rectifier. The DC link capacitors smooth this DC link direct voltage. The output sided inverter generates a three-phase system from the direct voltage with variable frequency and voltage for the supply of the connected motor.

Alternatively you can draw d. c. from the device via the DC link connections.

#### **b maXX<sup>®</sup> BM4400 power module**

The output sided inverter generates via the DC link connection a three-phase system from the direct voltage with variable frequency and voltage for the supply of the connected motor.

**B:** Controller unit

The controller unit controls the power unit. You can operate the controller part either with the operating software WinBASS II (PC) or via a PLC or via a field bus and PLC. PLC and field bus interface are available as plug-in module.

## 4.2 Controller unit versions

There are three versions of the controller unit:

### single row



4000\_0467\_rev01\_int.cdr

This version is a 1-row equipped controller unit in a 3-rowed installation space.

This controller unit is available for every b maXX® BM4400 except for the BM441X-XXX-X0 and the BM441X-XXX-X1.



4000\_0468\_rev01\_int.cdr

This version is a 1-row equipped controller unit in a 2-rowed installation space. This controller unit is available only in the BM441X-XXX-X0.

### 2-rowed



4000\_0010\_rev01\_int.cdr

This version is a 2-row equipped controller unit in a 3-rowed installation space.

This controller unit is available for every b maXX® BM4400 except for the BM441X-XXX-X0 and the BM441X-XXX-X1.



4000\_0009\_rev01\_int.cdr

This version is a 2-row equipped controller unit in a 2-rowed installation space. This controller unit is available only in the BM441X-XXX-X1.

### 3-rowed



4000\_0011\_rev01\_int.cdr

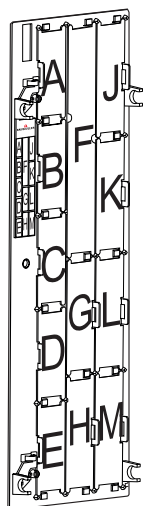
This version is a 3-row equipped controller unit in a 3-rowed installation space. This controller unit is available for every b maXX® BM4400.

In case you order a b maXX® 441X with this controller unit, you will receive the device BM441X-XXX-X2.

## 4.2 Controller unit versions

### 4.2.1 Slots

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



|                    |          |                                                                                                                                                                                                |
|--------------------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1-, 2- and 3-rowed | <b>A</b> | The controller communicates via a functional module bus with plug-in modules in these slots.                                                                                                   |
|                    | <b>B</b> | Slot D is interrupt-capable. Therewith slot D is particularly suitable for modules e. g. measurement sensing.                                                                                  |
|                    | <b>C</b> | In these slots functional modules can be inserted.                                                                                                                                             |
|                    | <b>D</b> | Optional modules can <b>not</b> be inserted into these slots.                                                                                                                                  |
|                    | <b>E</b> | Controller module, permanently installed.                                                                                                                                                      |
| 2- and 3-rowed     | <b>F</b> | The controller communicates via the BACI-bus with plug-in modules in these slots. In these slots option modules can be inserted. Function modules can <b>not</b> be inserted into these slots. |
|                    | <b>G</b> |                                                                                                                                                                                                |
| 3-rowed            | <b>H</b> |                                                                                                                                                                                                |
|                    | <b>J</b> | With plug-in modules in these slots the controller communicates via the BACI-bus. In these slots option modules can be inserted. Function modules can <b>not</b> be inserted into these slots. |
|                    | <b>K</b> |                                                                                                                                                                                                |
|                    | <b>L</b> |                                                                                                                                                                                                |
|                    | <b>M</b> |                                                                                                                                                                                                |

Every plug-in module is delivered with an appropriate manual. In the manual of the module amongst other things the mounting and the installation of the module is described.



#### CAUTION

The following **may occur**, if you disregard these safety notes:

- Property damage

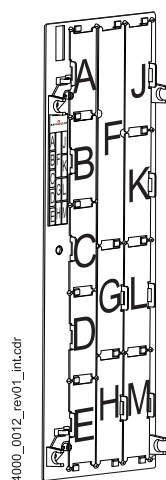


**The danger is: Plug-in module, which has not been manufactured from Baumüller Nürnberg GmbH. Modules of other manufacturers can damage/destroy the device.**

Only use BM4-F-XXX- and BM4-O-XXX-plug-in modules.

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

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



Steckkarten\_Rev14\_e

|   | Function modules                                       |                          |                           |                              |                            |                                 |                                              |                                          |                                       | Option modules              |                              |                               |                              |                                     |                    |                                |                                |                                               |                          |                                           |                               |  |
|---|--------------------------------------------------------|--------------------------|---------------------------|------------------------------|----------------------------|---------------------------------|----------------------------------------------|------------------------------------------|---------------------------------------|-----------------------------|------------------------------|-------------------------------|------------------------------|-------------------------------------|--------------------|--------------------------------|--------------------------------|-----------------------------------------------|--------------------------|-------------------------------------------|-------------------------------|--|
|   | BM4-F-ENC-XX (encoder 1 for motor control recommended) | BM4-F-ENC-XX (encoder 2) | BM4-F-AIO-01 (analog I/O) | BM4-F-AIO-02/03 (analog I/O) | BM4-F-DIO-XX (digital I/O) | BM4-F-FIO-XX (fast digital I/O) | BM4-F-IEE-XX (incremental encoder emulation) | BM4-F-SIE-XX (SSI-SSI encoder emulation) | BM4-F-CAN-01 (CANsync slave) in prep. | BM4-O-SER-XX (Sercos slave) | BM4-O-CAN-05 (CANsync slave) | BM4-O-PRO-01 (Profibus slave) | BM4-O-CAN-03 (CANopen slave) | BM4-O-DNT-XX (DISC-NT slave module) | BM4-O-PLC-XX (SPS) | BM4-O-CAN-06* (CANsync master) | 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) |  |
| A | X                                                      | -                        | -                         | -                            | o                          | o                               | -                                            | o                                        | -                                     | -                           | -                            | -                             | -                            | -                                   | -                  | -                              | -                              | -                                             | -                        | -                                         |                               |  |
| B | -                                                      | X                        | -                         | -                            | o                          | o                               | -                                            | X                                        | -                                     | -                           | -                            | -                             | -                            | -                                   | -                  | -                              | -                              | -                                             | -                        | -                                         |                               |  |
| C | -                                                      | -                        | -                         | -                            | o                          | o                               | X                                            | -                                        | X                                     | -                           | -                            | -                             | -                            | -                                   | -                  | -                              | -                              | -                                             | -                        | -                                         |                               |  |
| D | -                                                      | -                        | -                         | -                            | X                          | X                               | -                                            | -                                        | -                                     | -                           | -                            | -                             | -                            | -                                   | -                  | -                              | -                              | -                                             | -                        | -                                         |                               |  |
| E | -                                                      | -                        | X                         | X                            | o                          | o                               | -                                            | -                                        | -                                     | -                           | -                            | -                             | -                            | -                                   | -                  | -                              | -                              | -                                             | -                        | -                                         |                               |  |
| F | Controller unit, permanently installed                 |                          |                           |                              |                            |                                 |                                              |                                          |                                       |                             |                              |                               |                              |                                     |                    |                                |                                |                                               |                          |                                           |                               |  |
| G | -                                                      | -                        | -                         | -                            | -                          | -                               | -                                            | -                                        | -                                     | o                           | o                            | o                             | o                            | o                                   | o                  | X                              | X                              | X                                             | X                        | X                                         | o                             |  |
| H | -                                                      | -                        | -                         | -                            | -                          | -                               | -                                            | -                                        | -                                     | X                           | X                            | X                             | X                            | X                                   | X                  | o                              | o                              | o                                             | o                        | o                                         | X                             |  |
| J | -                                                      | -                        | -                         | -                            | -                          | -                               | -                                            | -                                        | -                                     | -                           | P                            | P                             | P                            | -                                   | -                  | o                              | o                              | o                                             | o                        | o                                         | P                             |  |
| K | -                                                      | -                        | -                         | -                            | -                          | -                               | -                                            | -                                        | -                                     | -                           | P                            | P                             | P                            | -                                   | -                  | o                              | o                              | o                                             | o                        | o                                         | P                             |  |
| L | -                                                      | -                        | -                         | -                            | -                          | -                               | -                                            | -                                        | -                                     | -                           | P                            | P                             | P                            | -                                   | -                  | o                              | o                              | o                                             | o                        | o                                         | P                             |  |
| M | -                                                      | -                        | -                         | -                            | -                          | -                               | -                                            | -                                        | -                                     | -                           | P                            | P                             | P                            | -                                   | -                  | o                              | o                              | o                                             | o                        | o                                         | P                             |  |

X: preferred slot

Baumüller Nürnberg GmbH recommends, in order to reach the highest functional range, to insert the plug-in modules into these slots.

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 modules into this slot.

P: only possible, if on slot G or H a PLC module (PLC) is plugged and the PLC (and not the controller) executes the communication to the field bus slave module.

-: not possible - card doesn't work in this slot.

\* Precondition for these cards is an inserted PLC module (PLC).

Figure 2: 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 Interconnect the devices

The device is part of the Baumüller series **b maXX<sup>®</sup> BM4400** and can be connected together with other Baumüller devices.

### 4.4 Overview of dangerous areas

The following overview shows the existing danger areas on the particular device. Use this survey for an overview of the existing danger areas, if you incorporate into the handling of this device. The explanation of the symbols, which are used you will find in [►Hazard information and commands◄](#) from page 12.

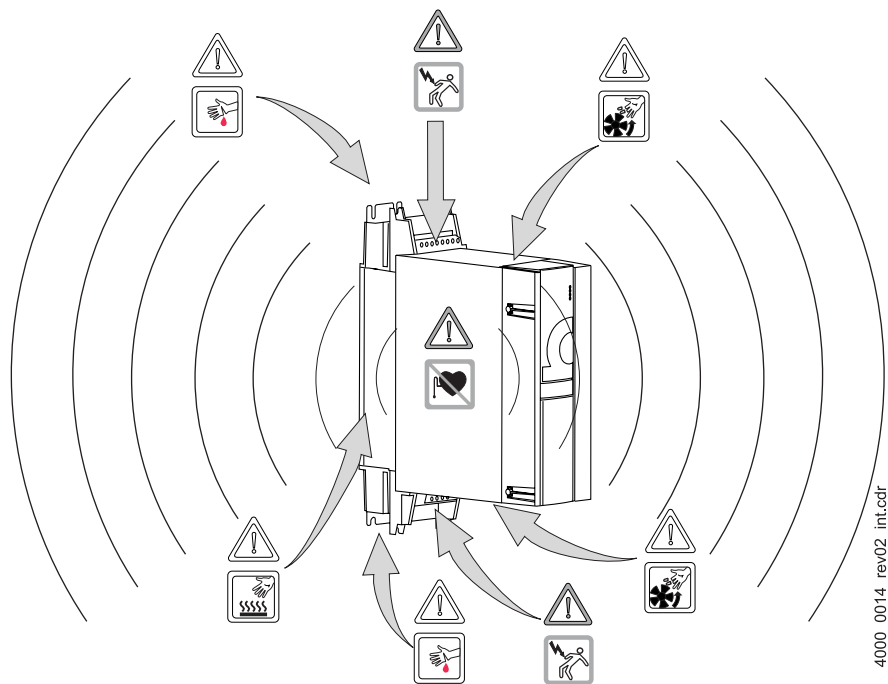


Figure 3: Danger areas BM441X, BM442X, BM443X and BM444X

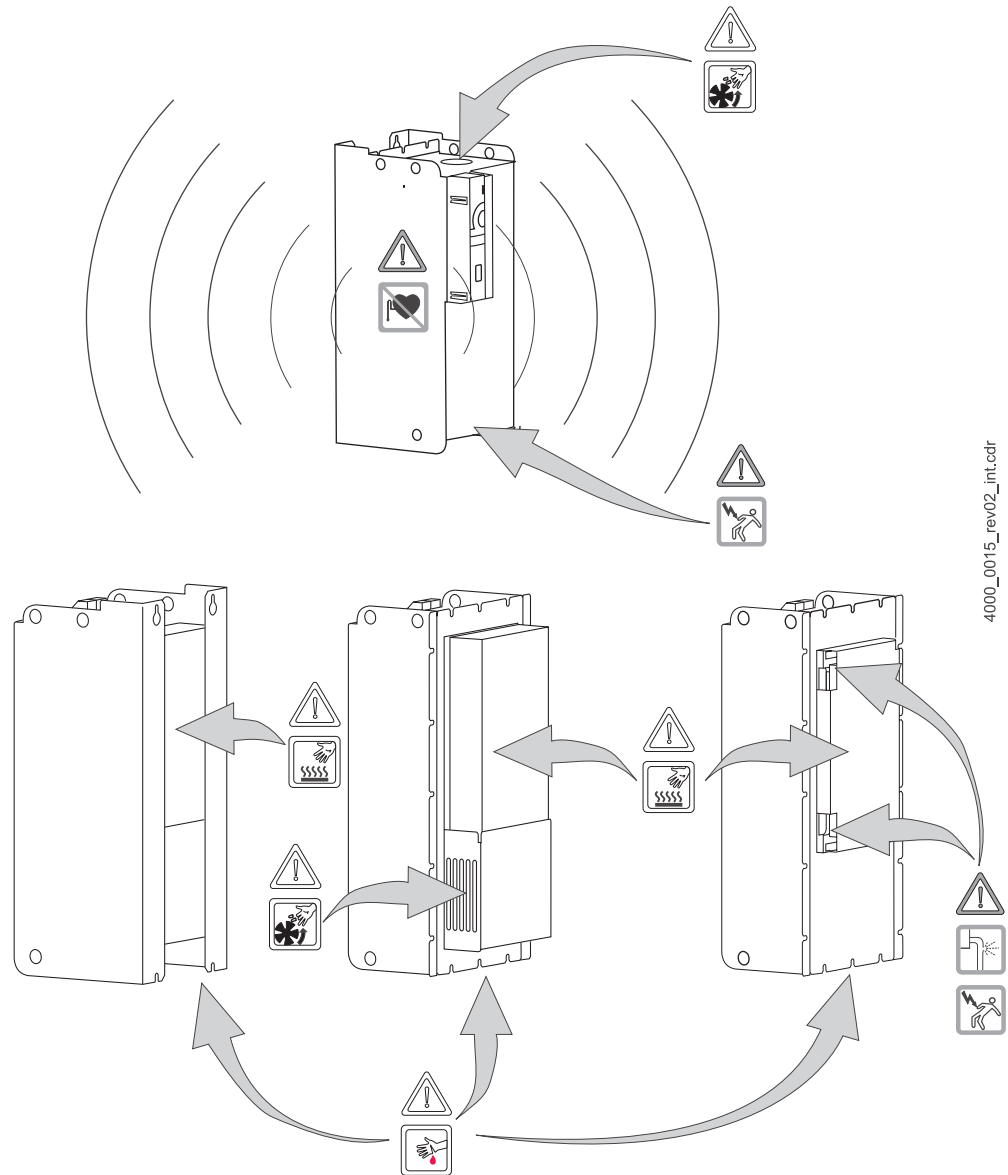


Figure 4: Danger areas BM445X, BM446X and BM447X

## 4.5 Marking of the device - type key

### 4.5 Marking of the device - type key

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

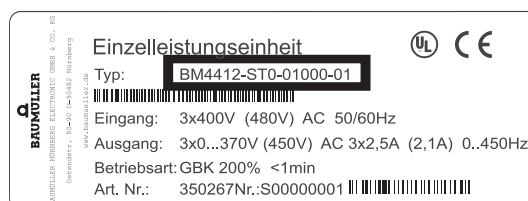
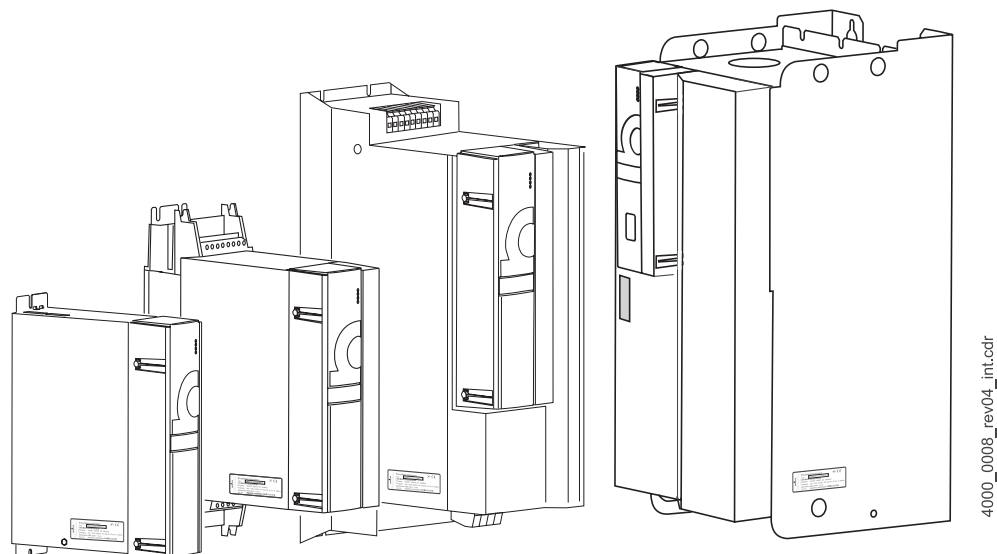


Figure 5: Position of type key label

The type key has the form: BM4XXX - XXX - XXXXX[Ryy] - XX. Directly behind the type key is the design code (-XXXX - X - XXX - XXX).

In the following table the type key is explained.

|                                |                                                                                                                                                                                                                                                                                                                                                            |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| BM4XXX - XXX - XXXXX[Ryy] - XX | Device generation                                                                                                                                                                                                                                                                                                                                          |
| BM4XXX - XXX - XXXXX[Ryy] - XX | Controller type                                                                                                                                                                                                                                                                                                                                            |
|                                | 4: Vector controller with and without encoder feedback (closed loop / open loop)                                                                                                                                                                                                                                                                           |
| BM4XXX - XXX - XXXXX[Ryy] - XX | Size of cabinet                                                                                                                                                                                                                                                                                                                                            |
|                                | 1 to 7 (from cabinet size 1 there are two different wide versions)                                                                                                                                                                                                                                                                                         |
| BM4XXX - XXX - XXXXX[Ryy] - XX | Current grading (output rated current)                                                                                                                                                                                                                                                                                                                     |
|                                | 2 to 6 (current value is dependent on the cabinet size), see appendix D                                                                                                                                                                                                                                                                                    |
| BM4XXX - XXX - XXXXX[Ryy] - XX | Cooling type                                                                                                                                                                                                                                                                                                                                               |
|                                | S: air-cooled with air supply and with air outlet in the control cabinet<br>A: air-cooled with air supply and with air outlet outside the control cabinet<br>Z: water-cooled with water cooler in the control cabinet<br>F: water-cooled with water cooler outside the control cabinet<br>C: (cold plate) cooling via mounting wall of the control cabinet |
| BM4XXX - XXX - XXXXX[Ryy] - XX | Mains type                                                                                                                                                                                                                                                                                                                                                 |
|                                | T: TN- or TT-mains<br>I: IT-mains and 'grounded delta'                                                                                                                                                                                                                                                                                                     |
| BM4XXX - XXX - XXXXX[Ryy] - XX | Safety relay                                                                                                                                                                                                                                                                                                                                               |
|                                | 0: no module<br>1: Module with one relay and high power current contacts<br>2: Module with two relays and high power current contacts<br>3: Module with one relay and low current contacts<br>4: Module with two relays and low current contacts                                                                                                           |
| BM4XXX - XXX - XXXXX[Ryy] - XX | Hardware type/power unit type                                                                                                                                                                                                                                                                                                                              |
|                                | 0: Rectifier and inverter with chopper resistor transistor $U_{DC} = 540 \text{ V}$<br>1: Rectifier and inverter with chopper resistor transistor<br>$U_{Mains} = 230 \text{ V} \pm 10 \%$ , $U_{DC} = 310 \text{ V}$<br>2: Power module (only output sided inverter). Operation as power module, $U_{DC} = 540 \text{ V}$                                 |
| BM4XXX - XXX - XXXXX[Ryy] - XX | Hardware type/controller unit versions                                                                                                                                                                                                                                                                                                                     |
|                                | 1: Module in slots A to H pluggable<br>2: Modules in slots A to M pluggable                                                                                                                                                                                                                                                                                |
| BM4XXX - XXX - XXXXX[Ryy] - XX | Hardware type (internal information via Baumüller Nürnberg GmbH.                                                                                                                                                                                                                                                                                           |
|                                | 0XX: Controller without 7-segment display (RS 485 interface)<br>1XX: Controller without 7-segment display (RS 485 interface)<br>2XX: Controller with 7-segment display (RS 485 interface)<br>3XX: Controller with 7-segment display (Ethernet interface)                                                                                                   |

## 4.5 Marking of the device - type key

---

BM4XXX - XXX - XXXXX[Ryy] - XX Optional chopper resistor

R16: Chopper resistor with 16  $\Omega$

R10: Chopper resistor with 10  $\Omega$

R05: Chopper resistor with 5  $\Omega$

R03: Chopper resistor with 3  $\Omega$

BM4XXX - XXX - XXXXX[Ryy] - XX State of software controller (firmware)

01: Series version 1.x

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.

---

## MOUNTING

In this chapter we describe the mechanical mounting of the device into a control cabinet. Data about the installation space is available in this manual (see [►Installation space◄](#) from page 39).

Mounting consists of the following steps:

- 1 Prepare mounting (drill holes/cut-out segments)
- 2 Install device



### WARNING

The following **may occur**, if you do not observe this warning information:

- serious personal injury
- death

*At execution of any mounting workings it must be assured that no strange substances (e.g. drilling chips, copper wire etc.) get into the device. If possible the drillings should be done before mounting the device and the assembling of the cables should be done outside the control cabinet. If this is not possible, the device must be covered accordingly.*

## 5.1 General safety instructions



### CAUTION

The following **may occur**, if you disregard these safety notes:

- Property damage



*The danger is: **electrostatic discharge**. Connections of the device sometimes are dangerous to ESD.*

Regard the corresponding notes.

- Please regard to the information in chapter [►Fundamental safety instructions◄](#) from page 11.

## 5.2 Requirements to the executing personnel

- Pay attention to all areas at the device, which could be dangerous for you while mounting. Use this survey only for the mechanical mounting. Dangers, which, for example, result from electricity are not shown here.

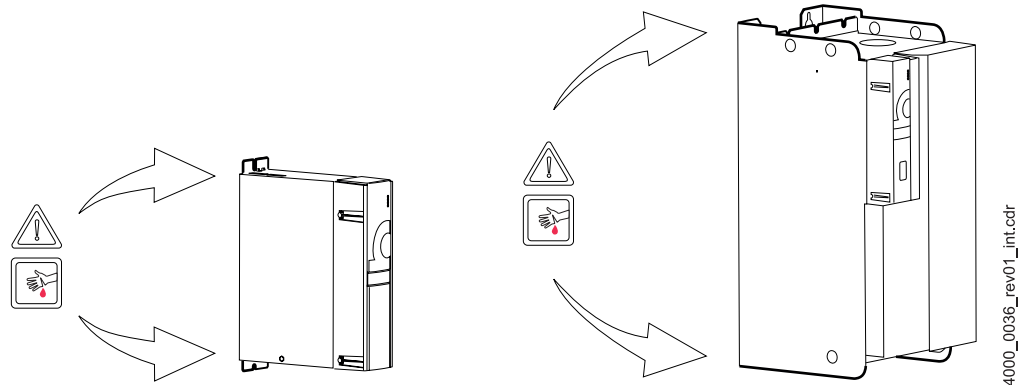


Figure 6: Danger areas by the mechanical mounting

## 5.2 Requirements to the executing personnel



### CAUTION

The following **can occur**, if you disregard this warning instruction:

- minor to medium personal injury.

*The danger is: **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.*

Make sure, that only qualified personnel, who is familiar with the safety- as well as with mounting instructions, works on this unit.



Wear safety gloves



Wear safety shoes

Qualified personnel are persons, who have been instructed by the responsible person, based on their training, experience, the instructions they were given as well as their knowledge about relevant standards and instructions, knowledge of the accident prevention instructions and of the company, to execute the necessary operations and thereby are able to recognize and avoid the dangers which could happen. The required qualifications for the work with this unit are for example:

- Training or instruction due to the standards of the safety engineering in maintenance and use of appropriate safety equipment.

## 5.3 Prepare mounting

You can prepare the mounting with the configuring manual for your installation. With the project manual and the drill figures (see [▶Drilling patterns◀](#) from page 49) you can determine the dimensions for the cut-outs and for the fastening drills.

### CAUTION

The following **can occur**, if you disregard this warning instruction:

- minor to medium personal injury.

*The danger is: **Eye injury due to catapulting particles.** While executing the drillings and the cut-out metal particles are catapulted.*



Wear eye protection

- Execute the drilling and if necessary the cut-outs.

## 5.4 Installation space

The following drawings show the main dimensions of the devices in mm. Use these drawings, in order to determine the required space in the control cabinet. For the construction of the necessary drilling/cut-outs use the drawings in [▶Drilling patterns◀](#) from page 49.

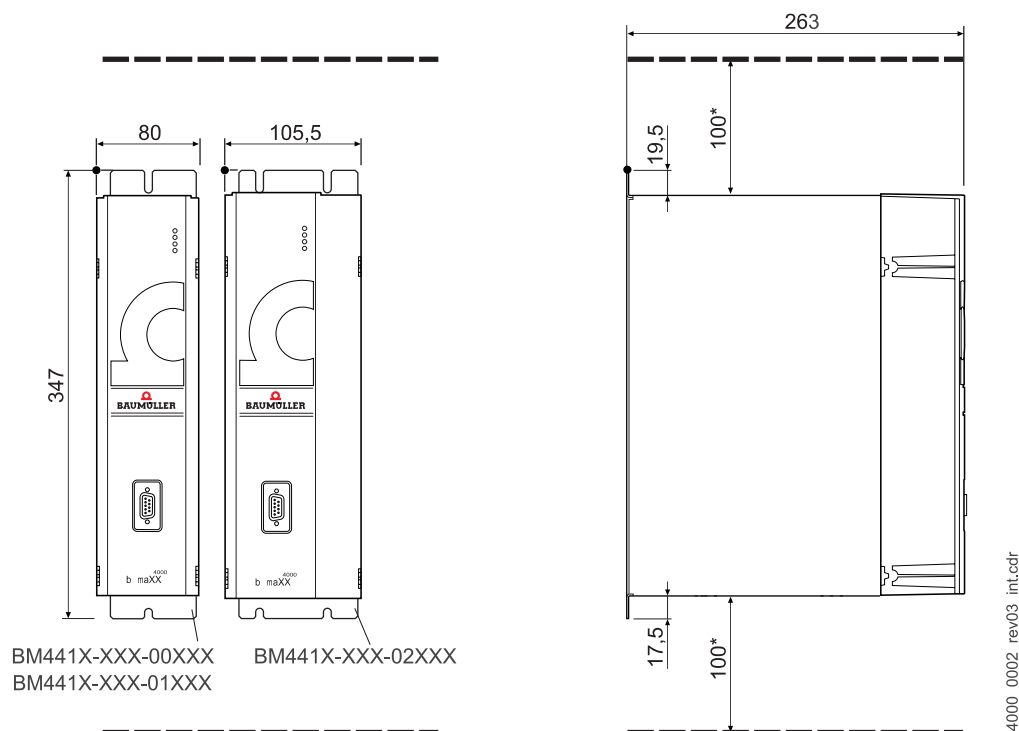


Figure 7: Installation space BM441X

\*: min. expansion space, also consider [▶Cooling◀](#) on page 165

## 5.4 Installation space

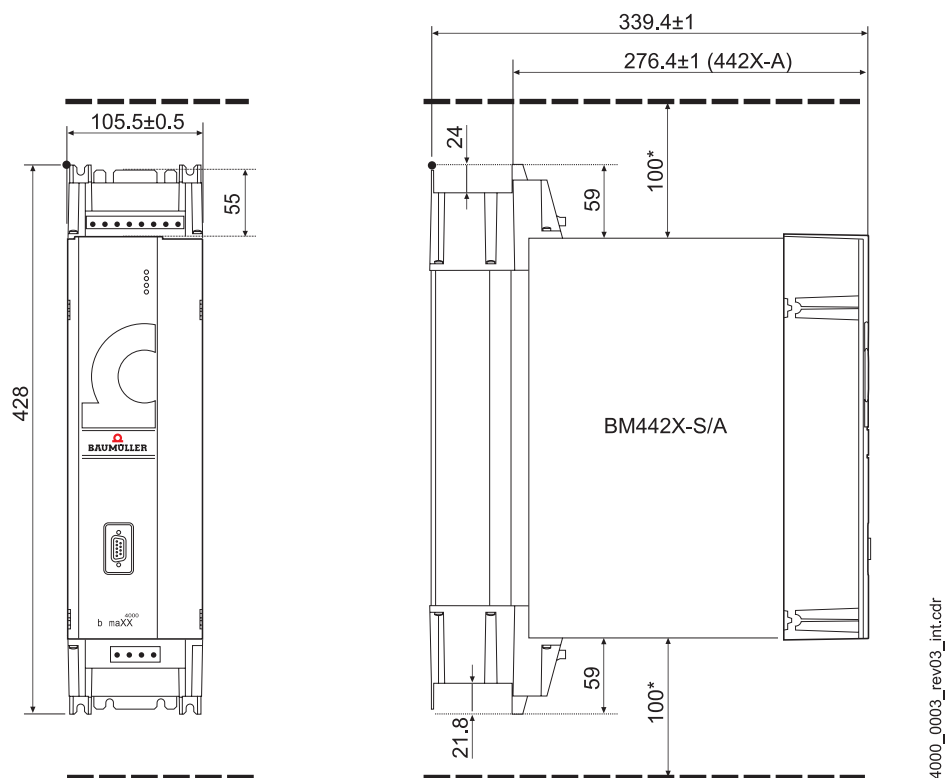


Figure 8: Installation space BM442X-S/A \*: min. expansion space, also consider [►Cooling◄](#) on page 165

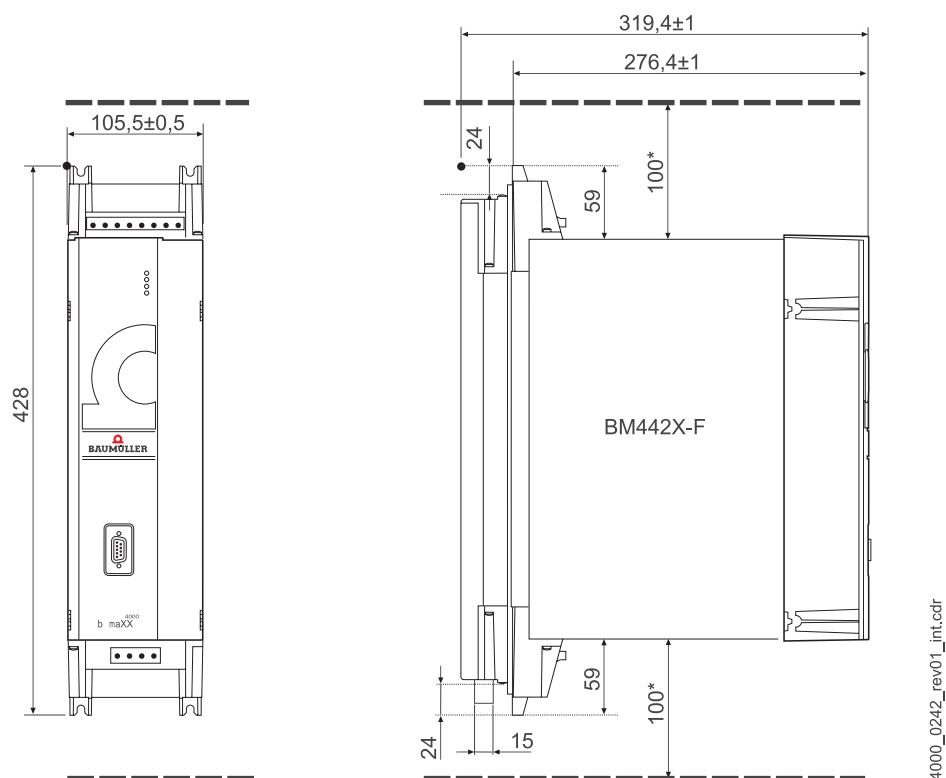


Figure 9: Installation space BM442X-F \*: min. Expansion space, also consider [►Cooling◄](#) on page 165

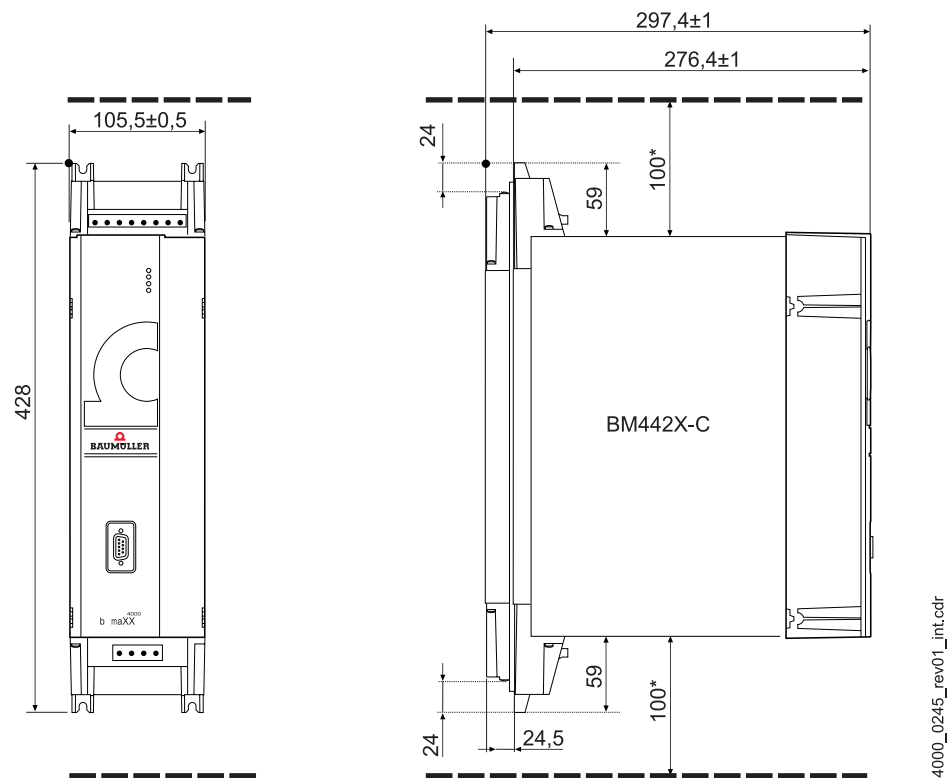


Figure 10: Installation space BM442X-C

\*: min. expansion space, also consider [Cooling](#) on page 165

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## 5.4 Installation space

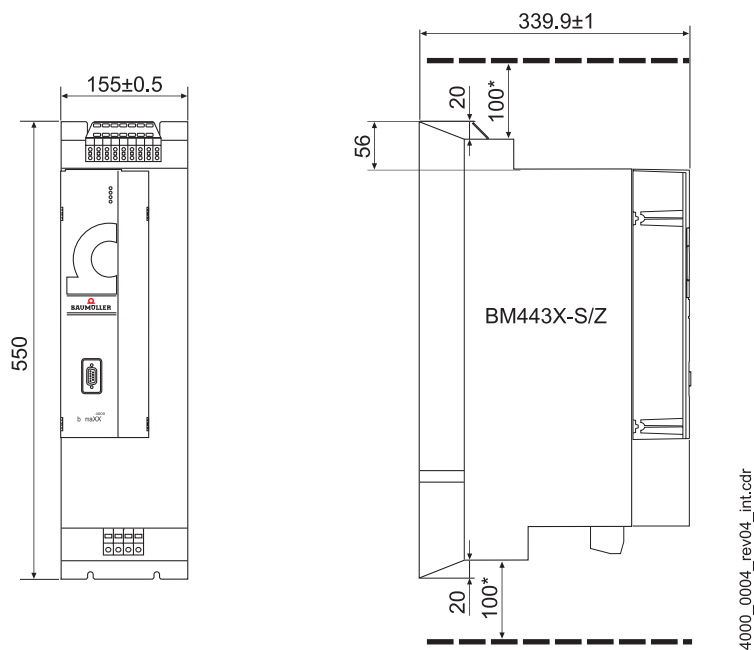


Figure 11: Installation space BM443X-S/Z

\*: min. expansion space, also consider [▶Cooling◀](#) on page 165

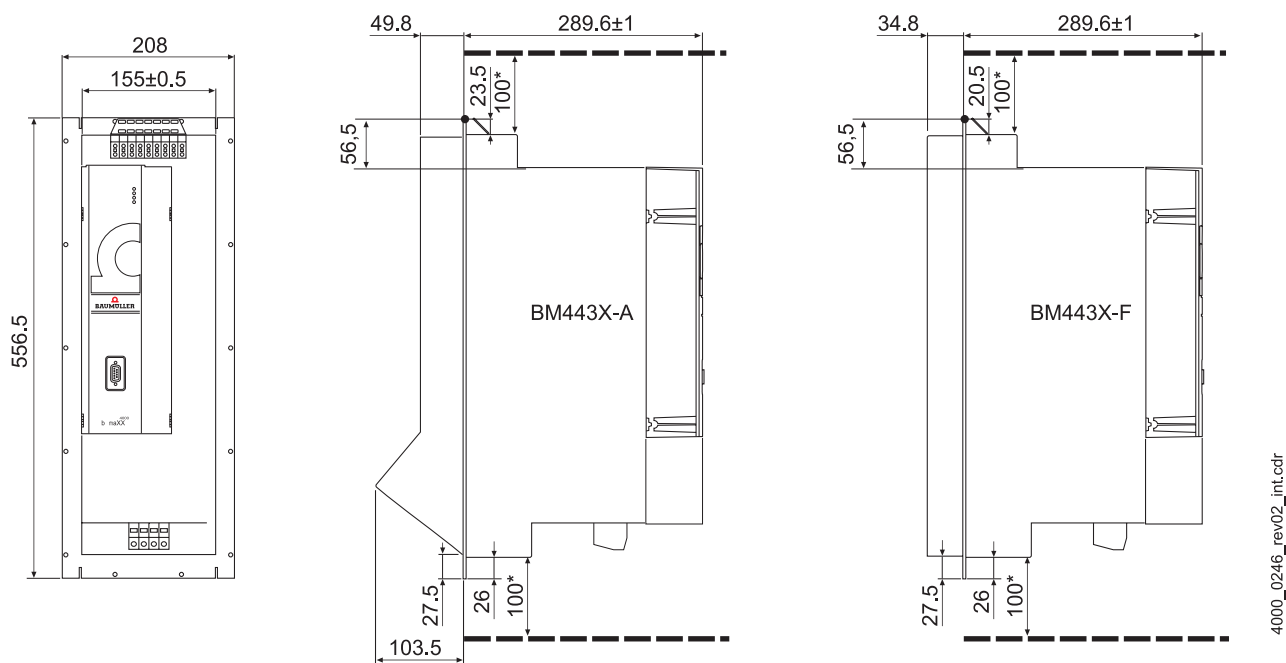


Figure 12: Installation space BM443X-A/F

\*: min. expansion space, also consider [▶Cooling◀](#) on page 165

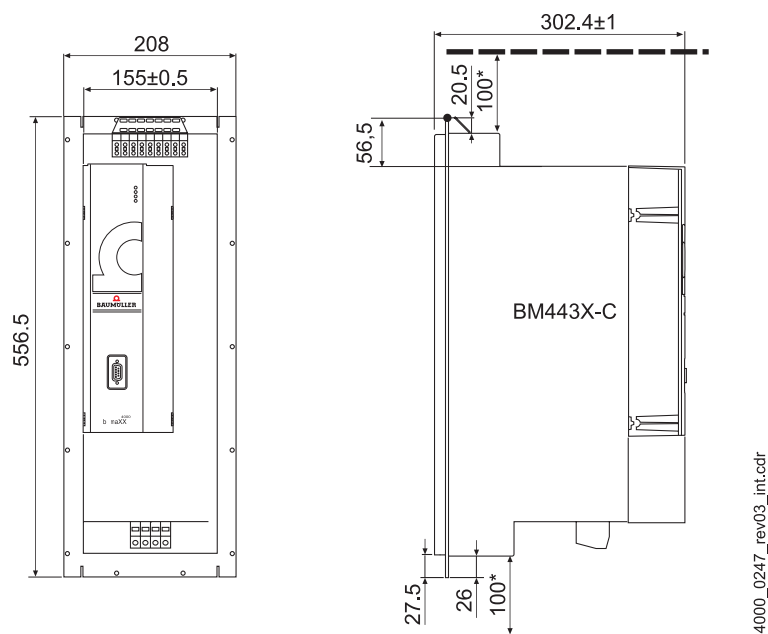


Figure 13: Installation space BM443X-C

\*: min. expansion space, also consider ►Cooling◄ on page 165

## 5.4 Installation space

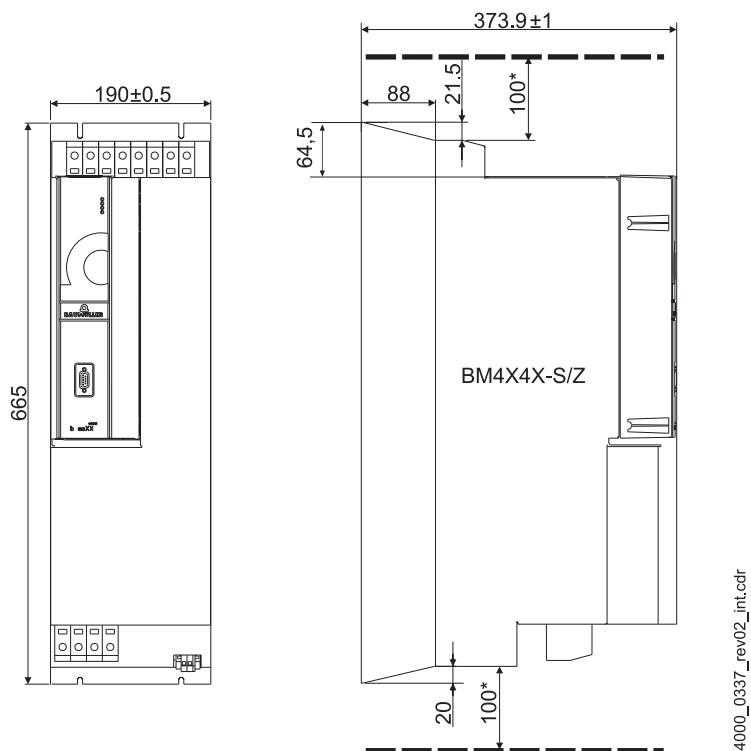


Figure 14: Installation space BM444X-S/Z

\*: min. expansion space, also consider [►Cooling◄](#) on page 165

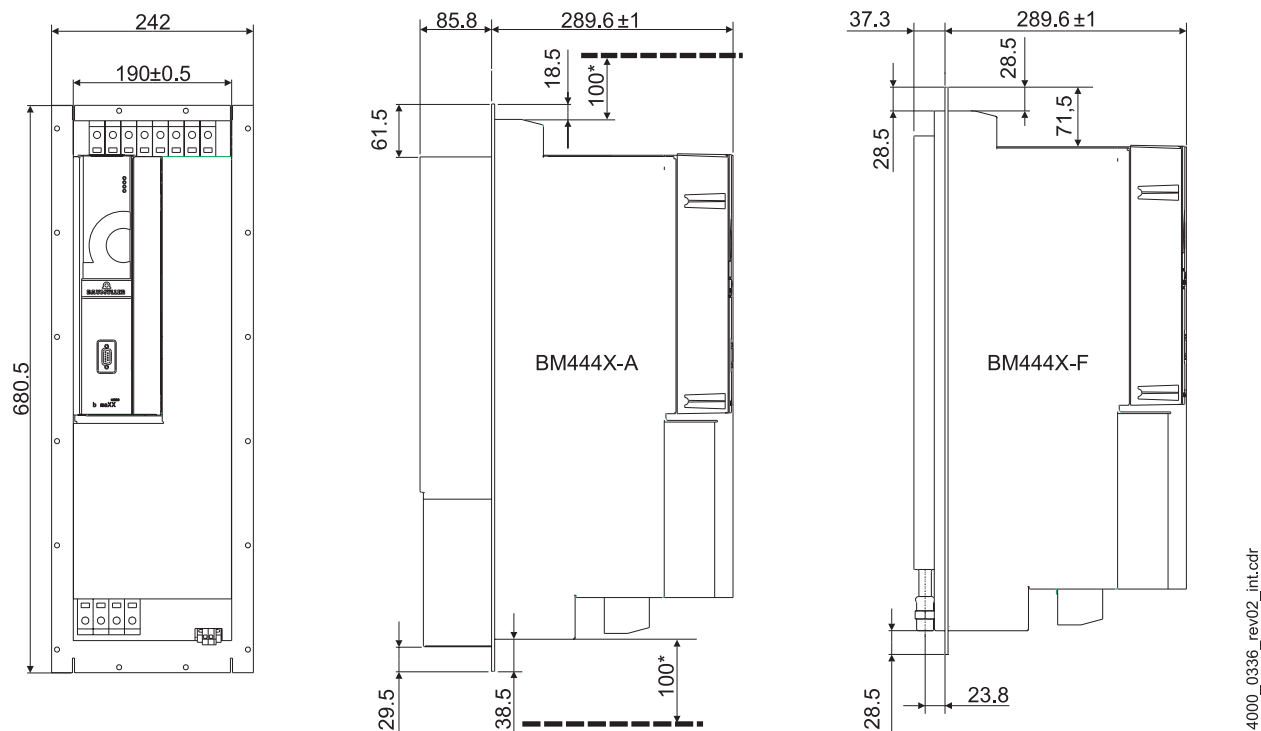


Figure 15: Installation space BM444X-A/F

\*: min. expansion space, also consider [►Cooling◄](#) on page 165

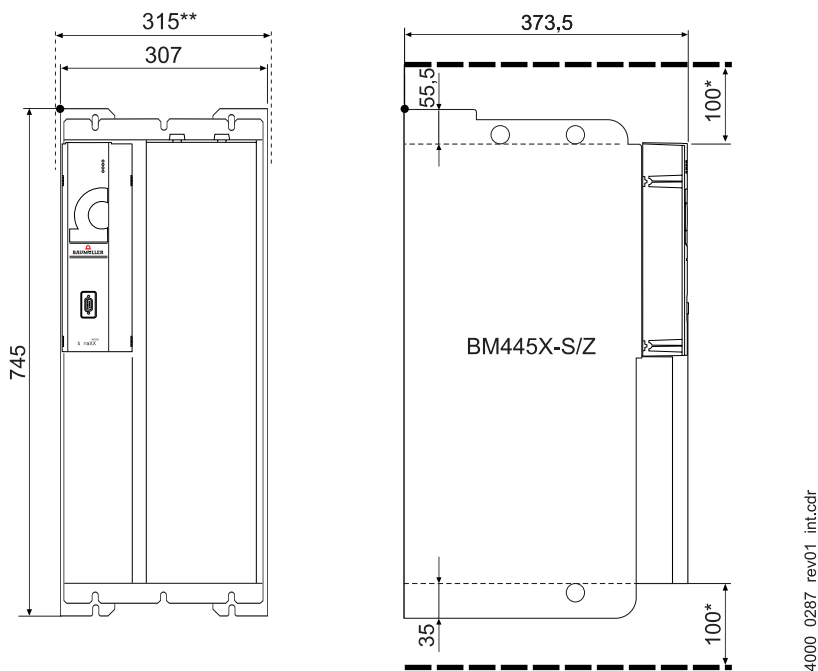


Figure 16: Installation space BM445X-S/Z

\*: min. expansion space, also consider ►Cooling◄ on page 165

\*\* : width inclusively bolt heads

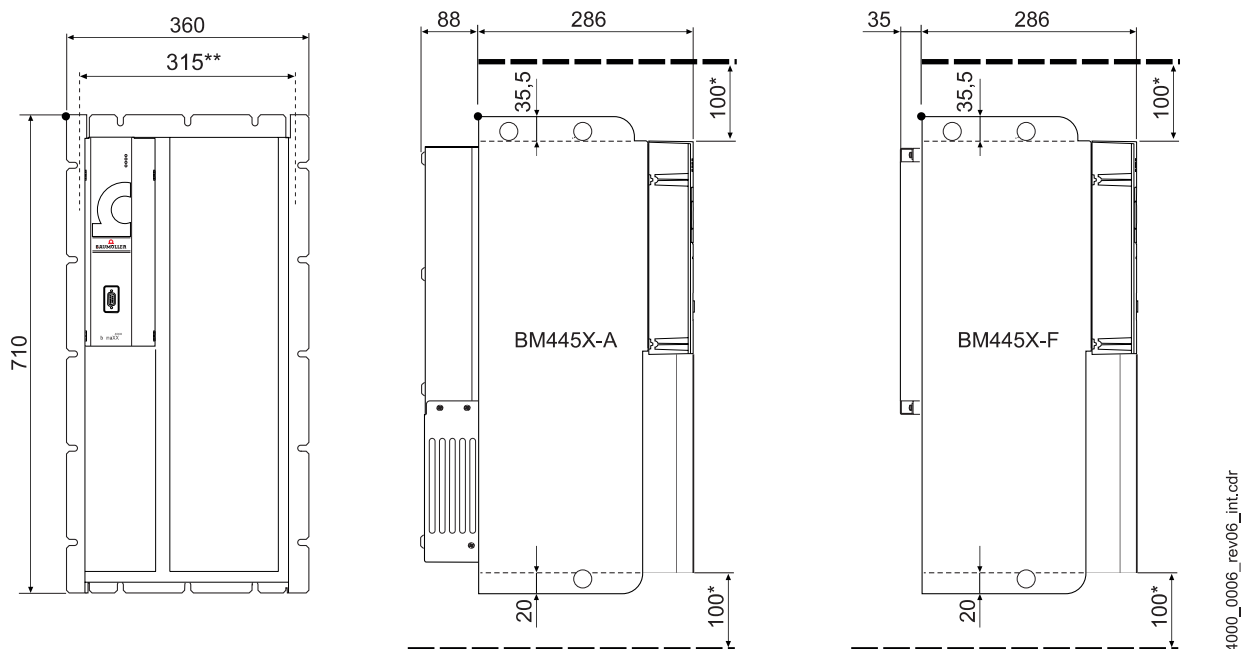


Figure 17: Installation space BM445X-A/F

\*: min. Expansion space, also consider ►Cooling◄ on page 165

\*\* : width inclusively bolt heads

## 5.4 Installation space

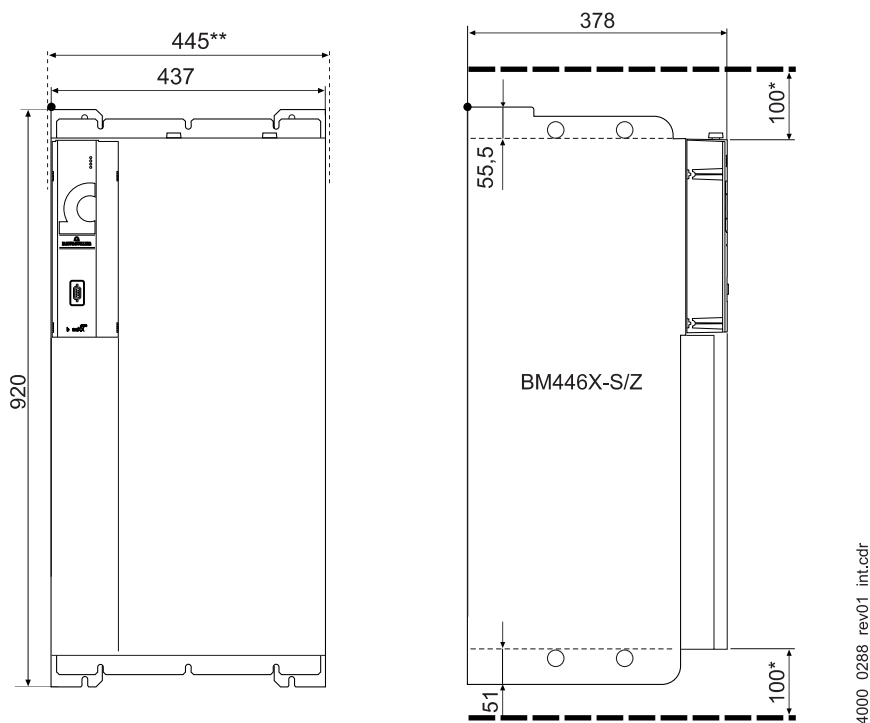


Figure 18: Installation space BM446X-S/Z

\*: min. expansion space, also consider ►Cooling◄ on page 165  
 \*\*: width inclusively bolt heads

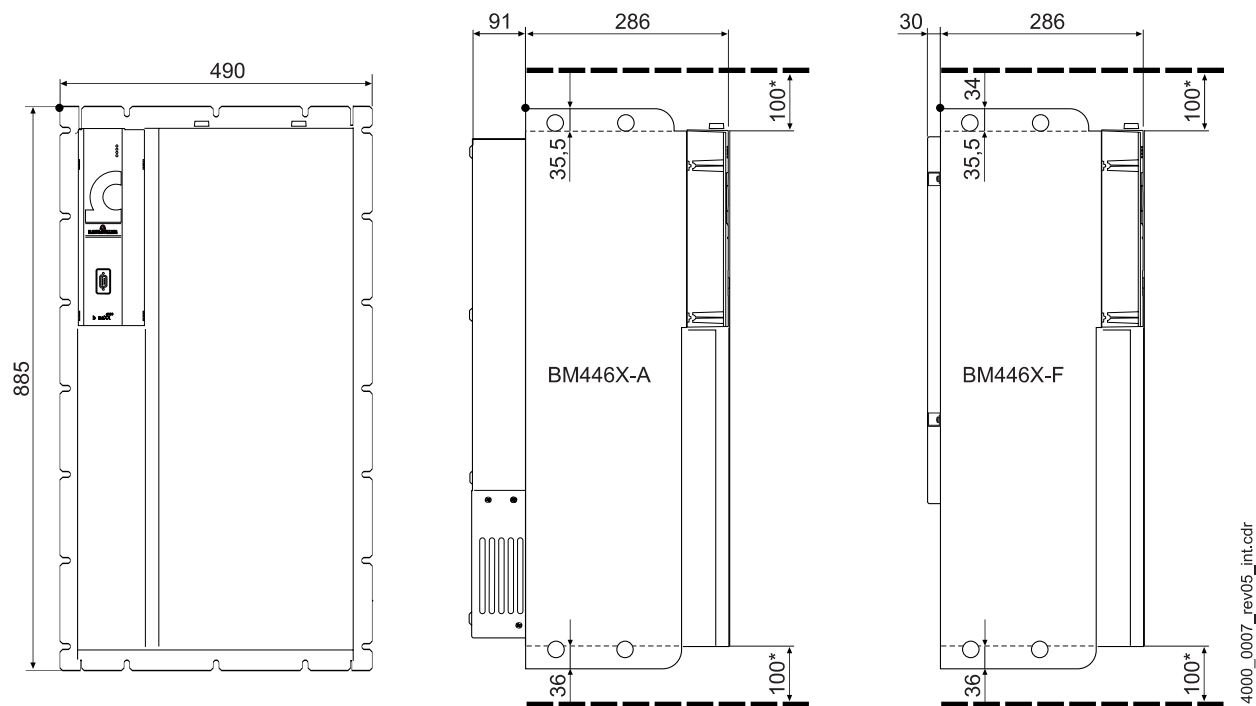


Figure 19: Installation space BM446X-A/F

\*: min. expansion space, also consider ►Cooling◄ on page 165  
 \*\*: width inclusively bolt heads

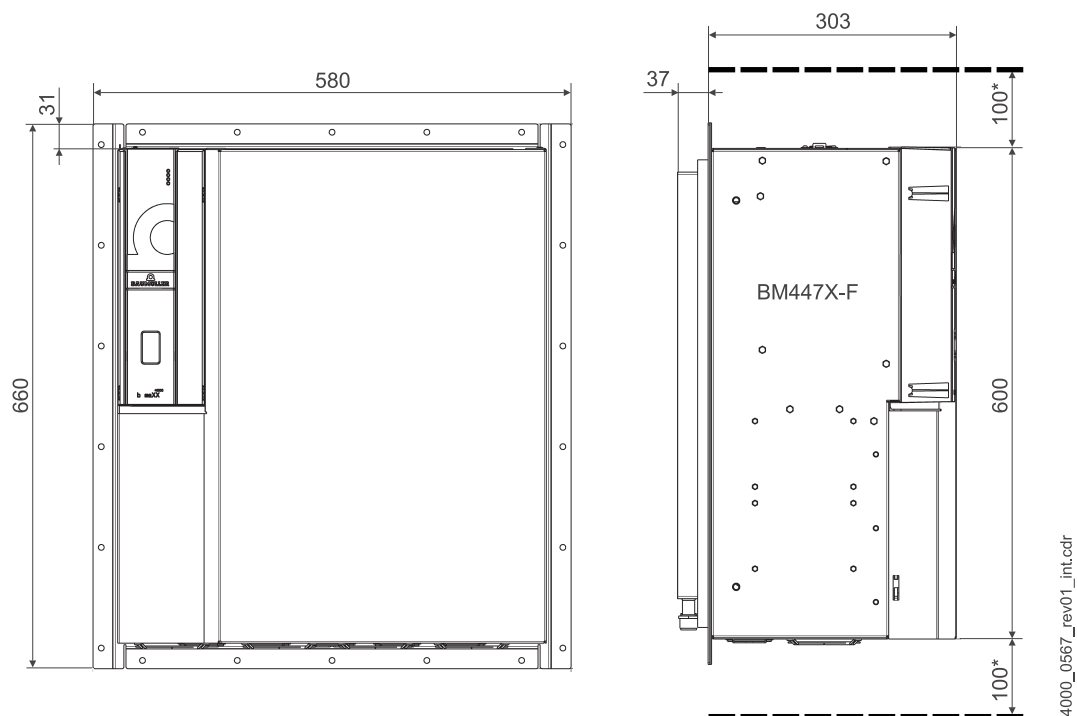


Figure 20: Installation space BM4-47X-F

\*: min. expansion space, also consider [►Cooling◀](#) on page 165

## 5.4 Installation space

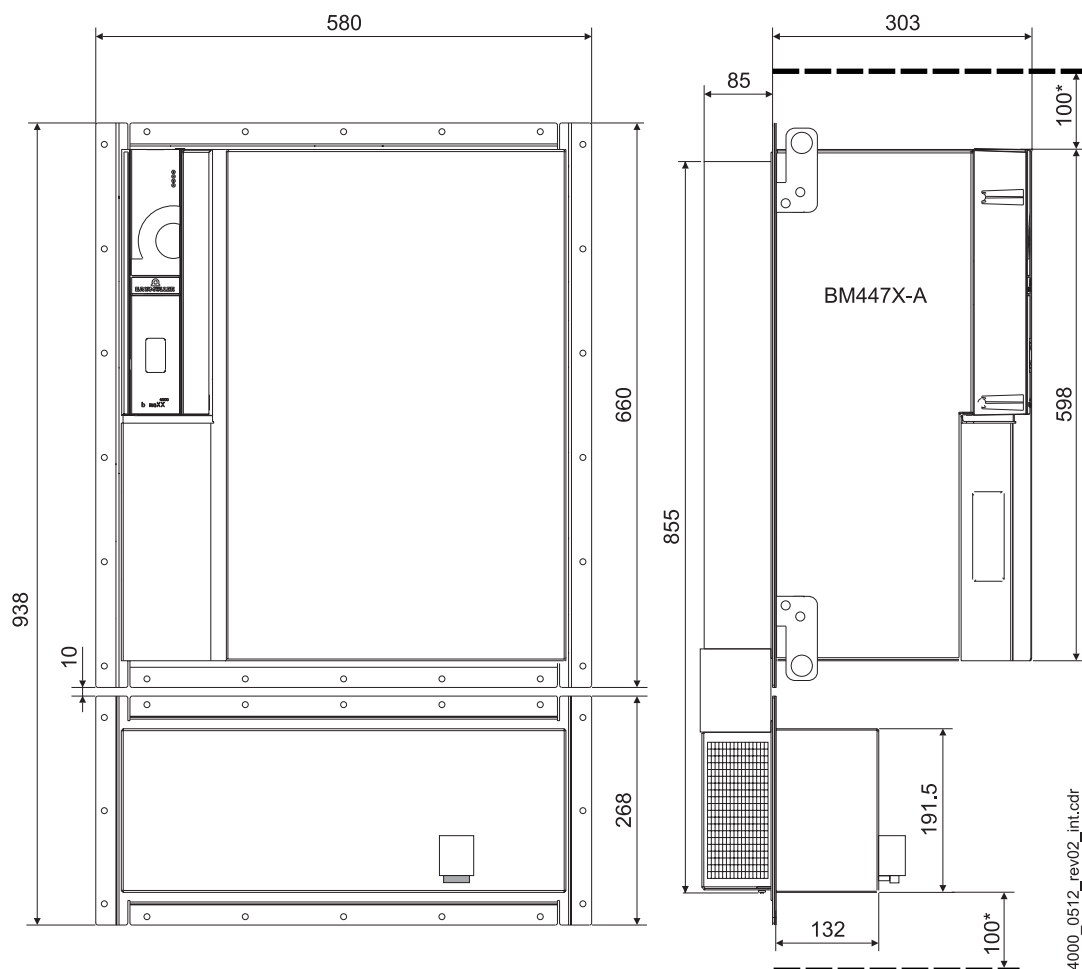


Figure 21: Installation space BM447X-A

\*: min. expansion space, also consider [►Cooling◄](#) on page 165

## 5.5 Drilling patterns

The following drawings show the drilling patterns of the devices. Use these drawings, to prepare the necessary drilling/cut-outs. Use the drawings under [►Installation space◄](#) from page 39, to determine the required space in the control cabinet.

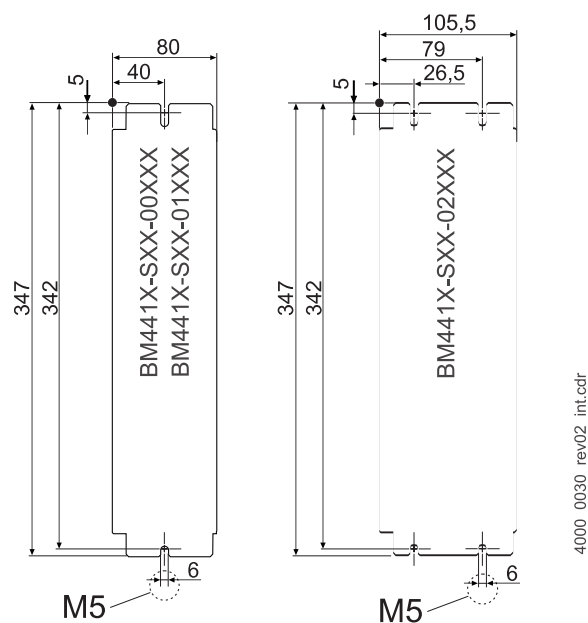


Figure 22: Drilling pattern BM441X

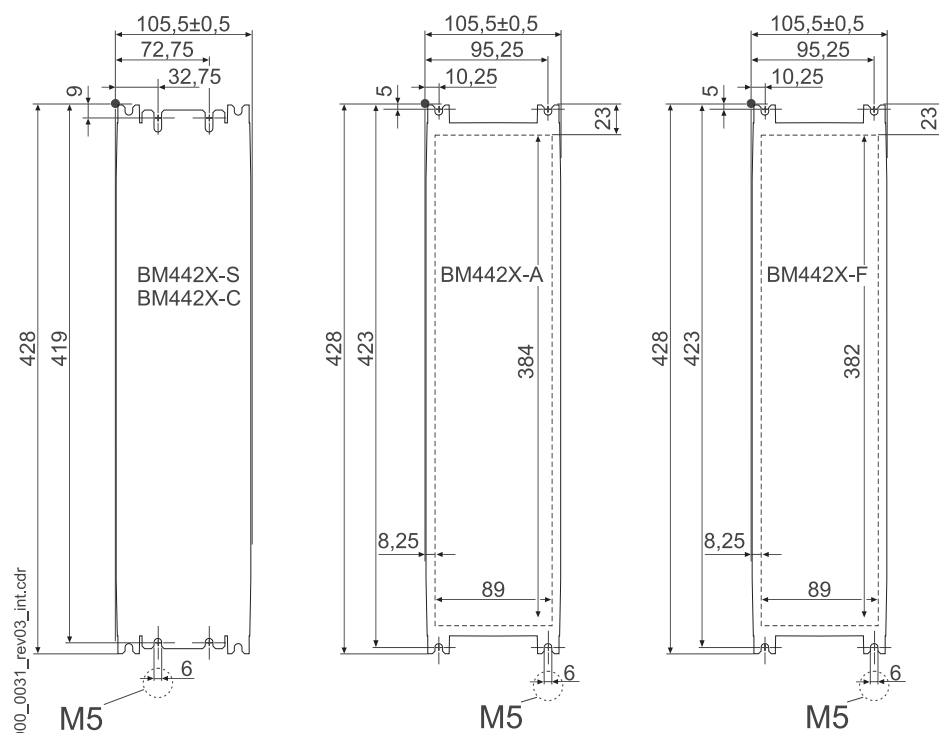


Figure 23: Drilling pattern BM442X

## 5.5 Drilling patterns

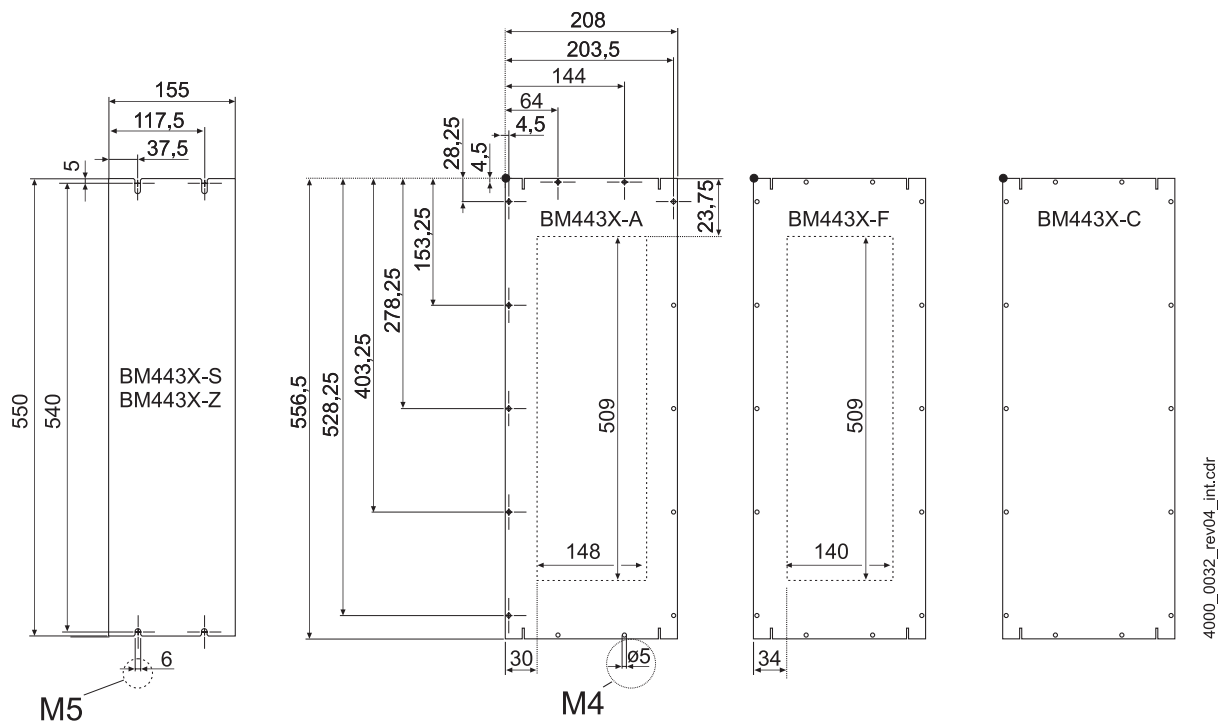


Figure 24: Drilling pattern BM443X

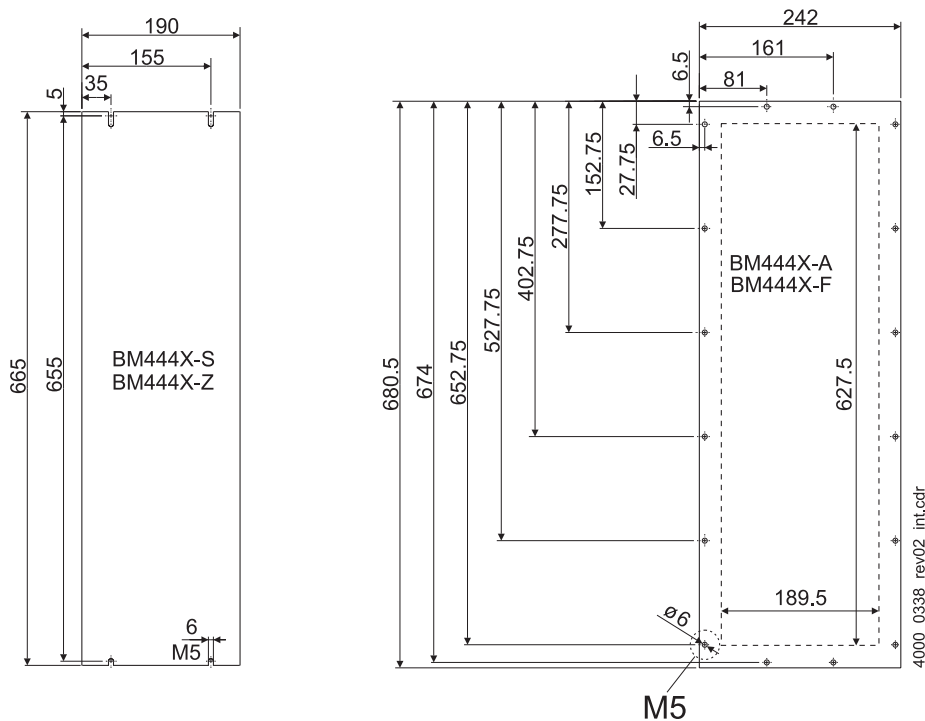


Figure 25: Drilling pattern BM444X

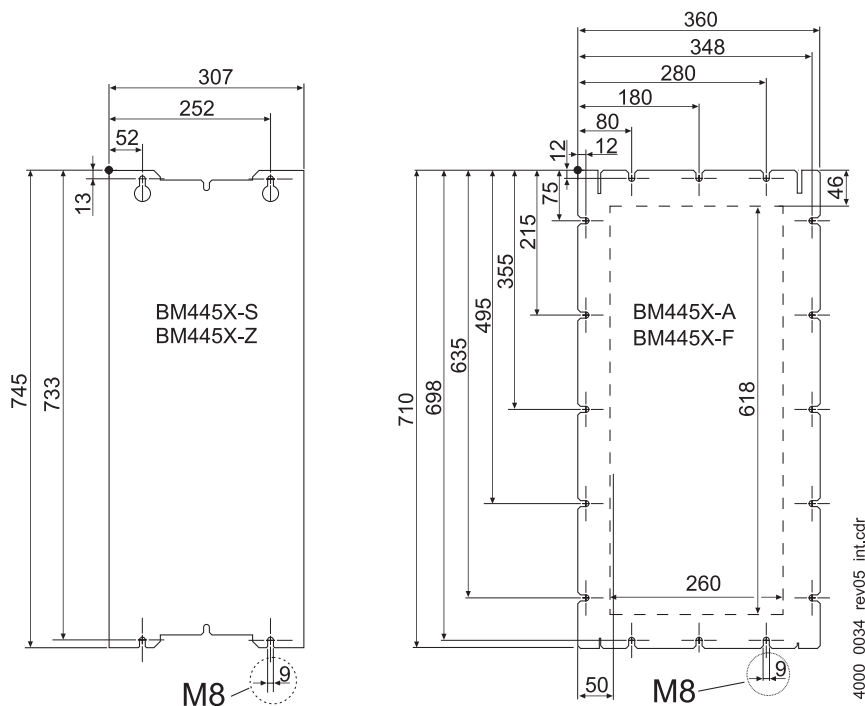


Figure 26: Drilling pattern BM445X

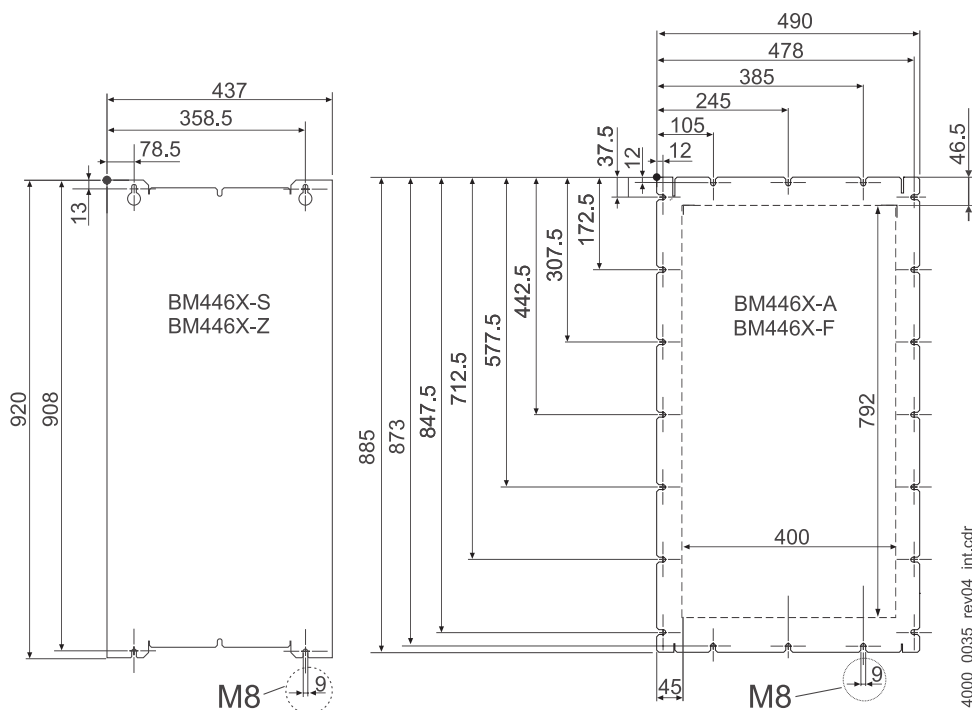


Figure 27: Drilling pattern BM446X

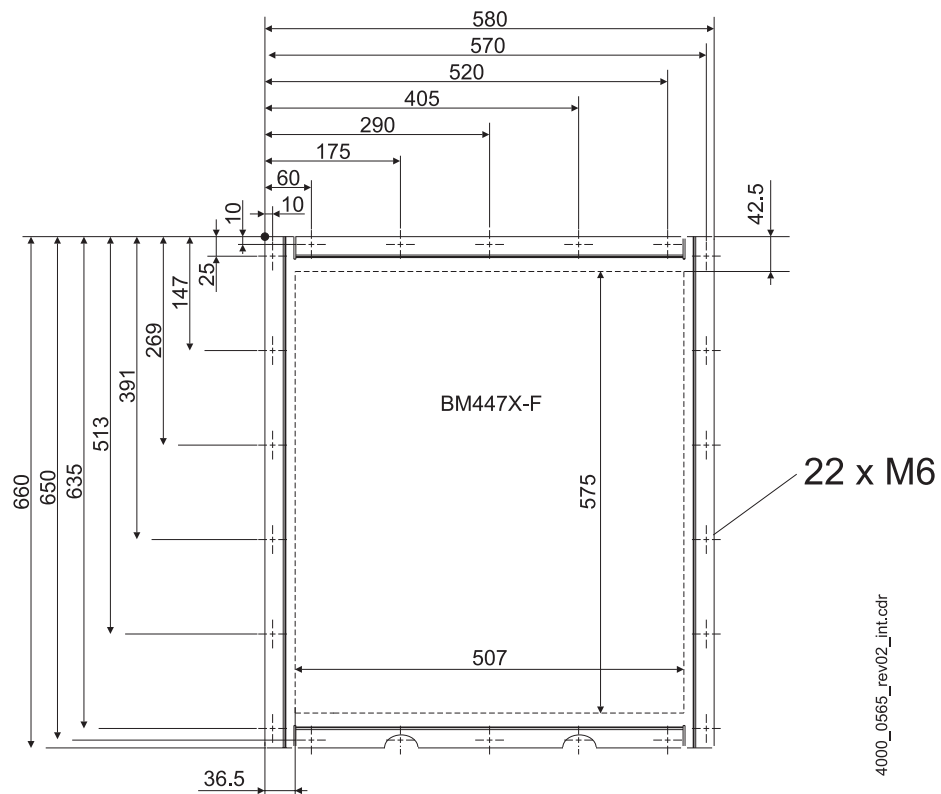


Figure 28: Drilling pattern BM447X-F

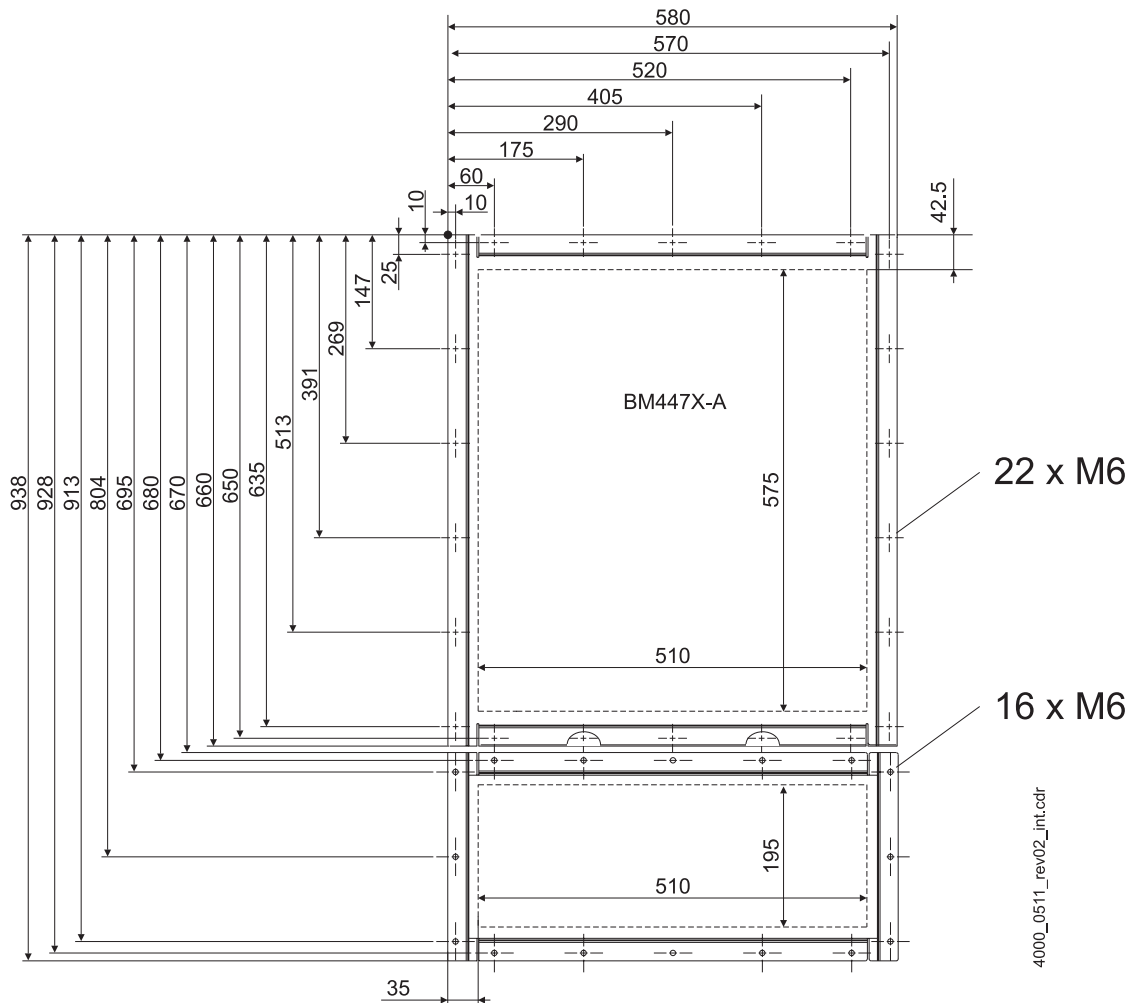


Figure 29: Drilling pattern BM447X-A

## 5.6 Mounting instructions

There are different mounting technics. Every mounting procedure is shown as a chart (see ▶[Figure 30](#)◀ on page 55 to ▶[Figure 33](#)◀ on page 58. Below the chart is the list of the devices, for which the particular instruction is to be used. The screws and washers you need for mounting are to be found below the particular chart.

## WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury • death

*The danger is: **mechanical effects**. A device of the size 446X weighs about 70,0 kg and can seriously injure, if it falls off.*

Transport the device in a way, so that it cannot drop. Use an appropriate lift when mounting it.



## 5.6 Mounting instructions

---



### CAUTION

The following **may occur**, if you disregard these safety notes:

- minor to medium personal injury.

*The danger is: **sharp edges**. In case, while installing, you lift a device with unprotected hands, fingers/palm can be cut. If the device falls off, the feet can be cut.*



Wear safety gloves



Wear safety shoes

---

Complete the mounting in the following way:

- 1 if necessary, provide a suitable transportation-/lift equipment
- 2 provide suitable mounting accessories
- 3 mount the device.



Figure 30: Mounting instruction BM441X, BM442X-S, BM443X-S/Z, BM444X-S/Z

| Device            | <b>BM441X-XXX<br/>-X0<br/>-X1</b> | <b>BM441X-XXX<br/>-X2</b> | <b>BM442X-S</b> | <b>BM443X-S/Z</b> | <b>BM444X-S/Z</b> |
|-------------------|-----------------------------------|---------------------------|-----------------|-------------------|-------------------|
| A - screws        | 2 x M5                            | 4 x M5                    | 4 x M5          | 4 x M5            | 4 x M5            |
| B - washers       | 2 x (5.3 x 10)                    | 4 x (5.3 x 10)            | 4 x (5.3 x 10)  | 4 x (5.3 x 10)    | 4 x (5.3 x 15)    |
| c - mount spacing | c = 5 mm                          | c = 5 mm                  | c = 5 mm        | c = 5 mm          | c = 5 mm          |

## 5.6 Mounting instructions

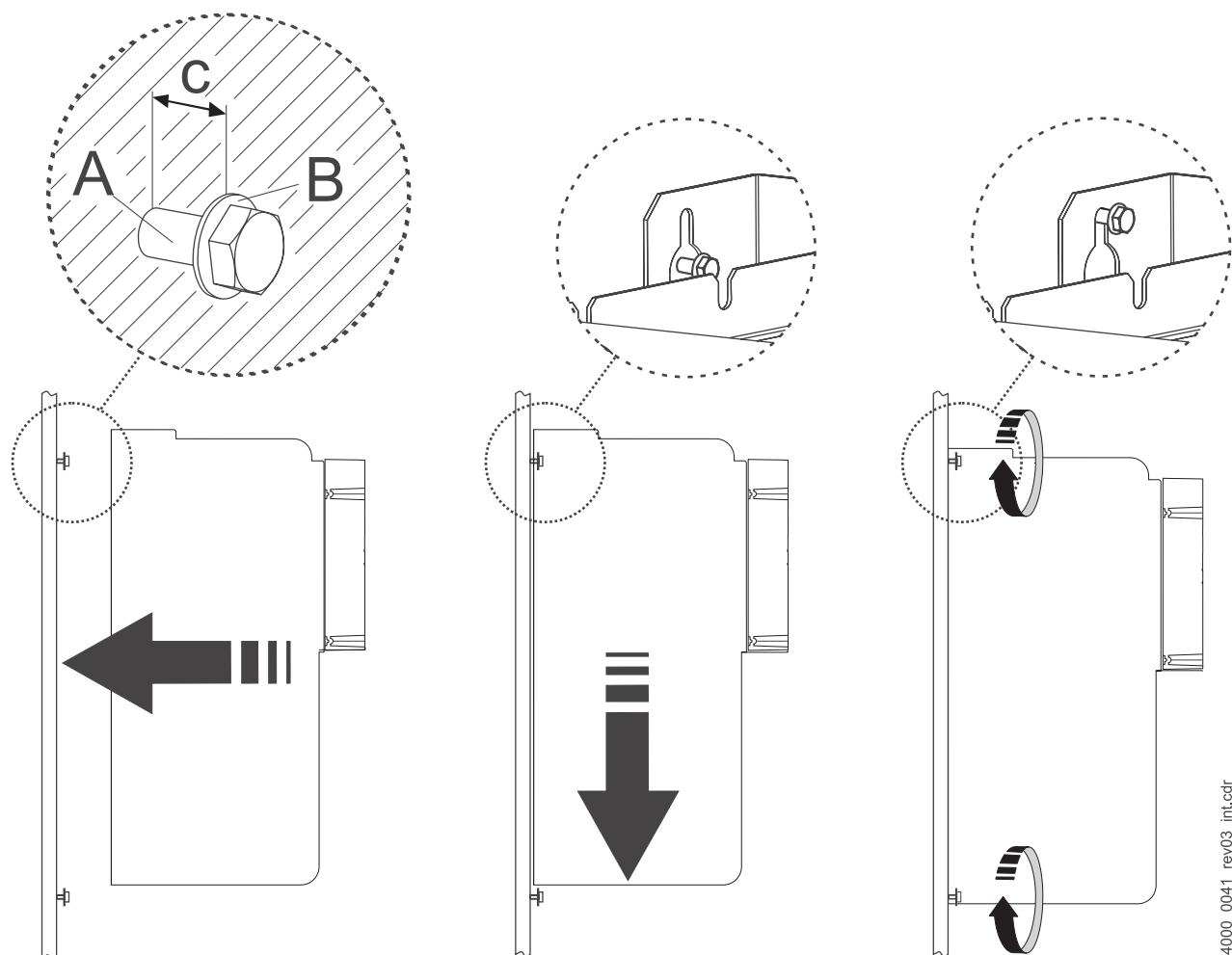
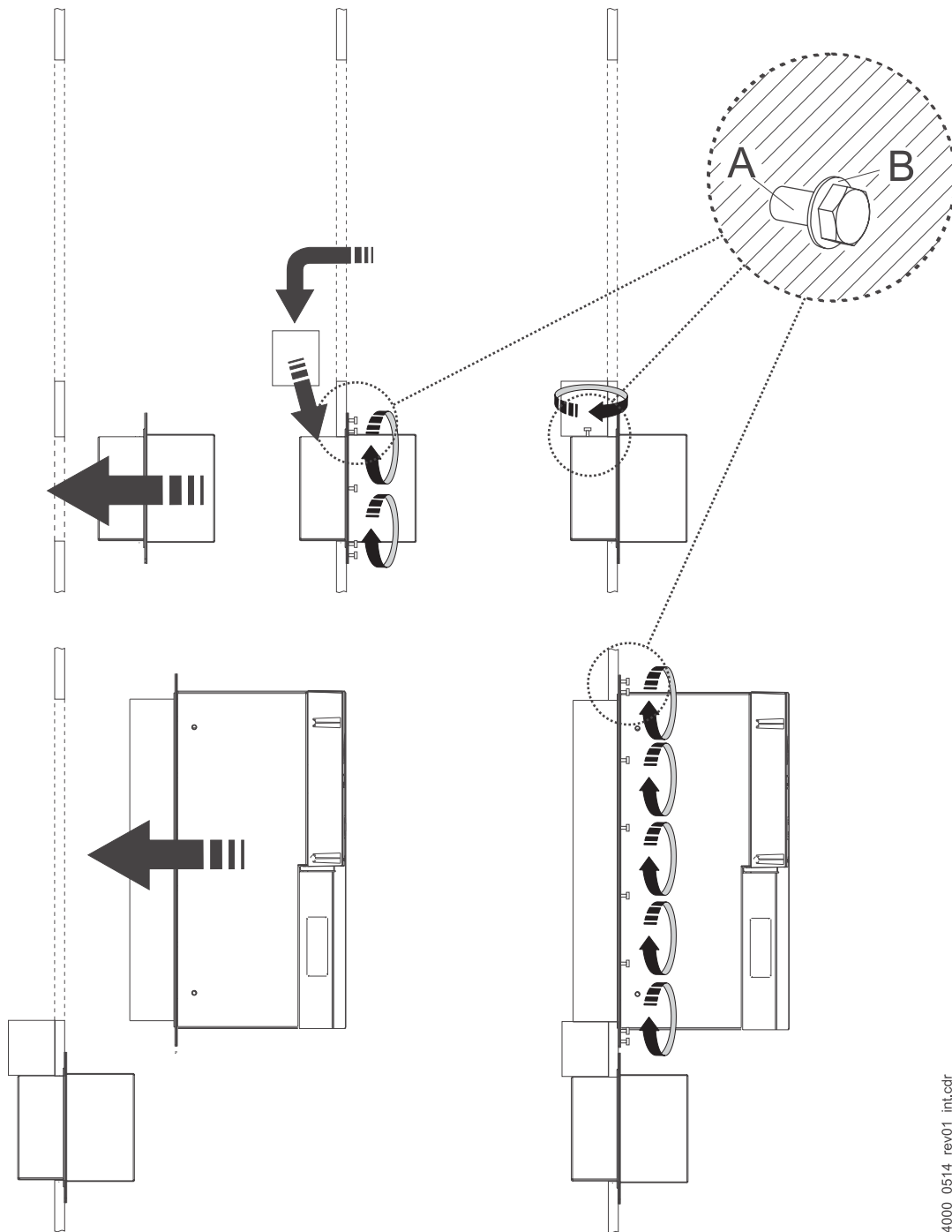


Figure 31: Mounting instruction BM445X-S/Z and BM446X-S/Z

| Device            | <b>BM445X-S/Z</b> | <b>BM446X-S/Z</b> |
|-------------------|-------------------|-------------------|
| A - screws        | 4 x M8            | 4 x M8            |
| B - washers       | 4 x (8.4 x 17)    | 4 x (8.4 x 17)    |
| c - mount spacing | c = 7 mm          | c = 7 mm          |



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Figure 32: Mounting instruction BM447X-A/F

| Device             | BM447X-S/A         | BM447X-F           |
|--------------------|--------------------|--------------------|
| A - screws         | 38 x M6            | 22 x M6            |
| B - spring washers | 38 x DIN6796-6-FST | 22 x DIN6796-6-FST |
| C - washers        | 38 x (6.4 x 12.5)  | 22 x (6.4 x 12.5)  |

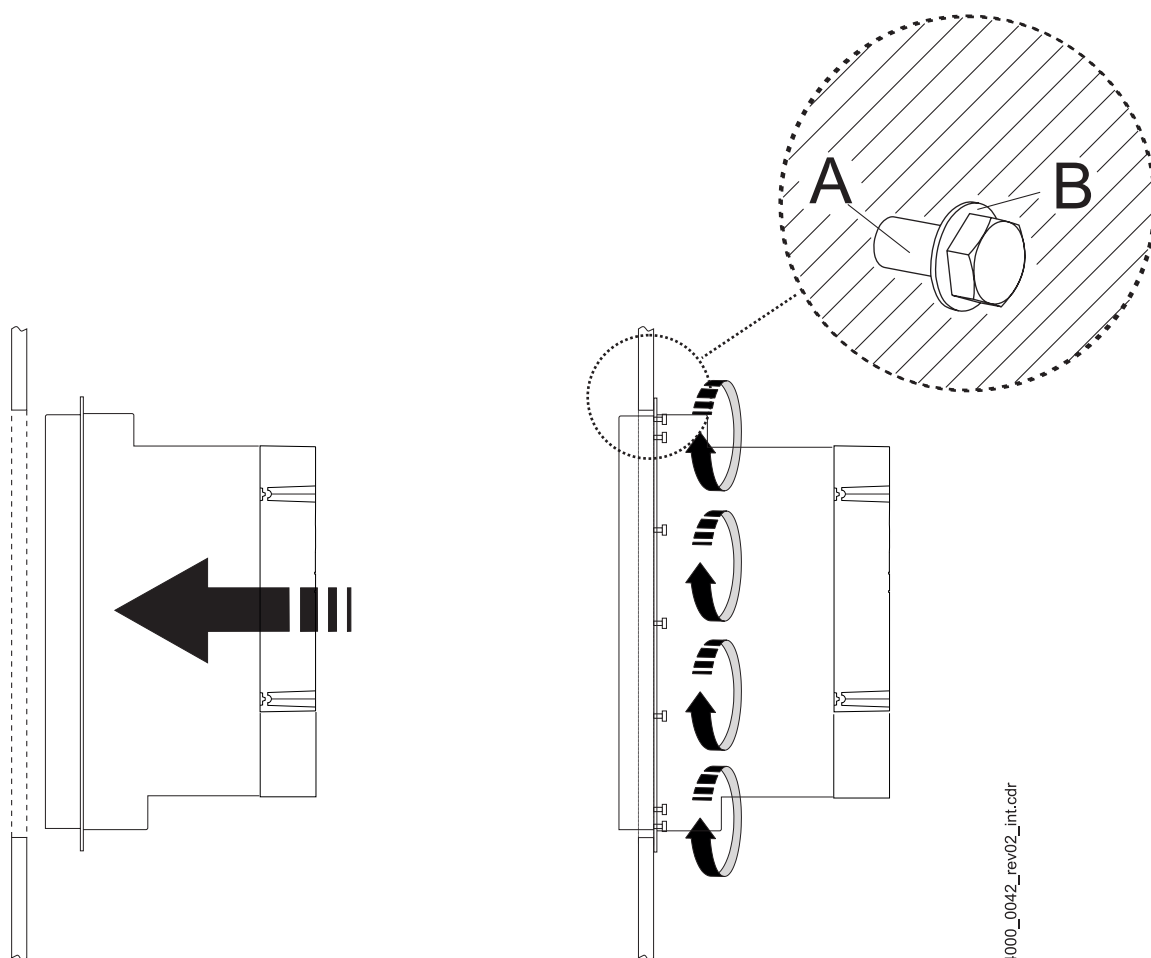


Figure 33: Mounting instruction 'miscellaneous'

| Device      | BM454X-A/F/Z/C | BM443X-A/F/C   | BM444X-A/F      | BM445X-A/F      | BM446X-A/F      |
|-------------|----------------|----------------|-----------------|-----------------|-----------------|
| A - screws  | 4 x M5         | 14 x M4        | 16 x M5         | 16 x M8         | 20 x M8         |
| B - washers | 4 x (5.3 x 10) | 14 x (4.3 x 9) | 16 x (5.3 x 15) | 16 x (8.4 x 17) | 20 x (8.4 x 17) |

### WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury • death

*The danger is: **conductive fluid in connection with electricity**. The mounting drills are outside of the gasket. With non-waterproof fastening holes, e. g. the liquid coolant can enter the control cabinet.*

Seal the mountings against water. Use, e.g., waterproof draw-in bolts and sealants between screws and bolts.



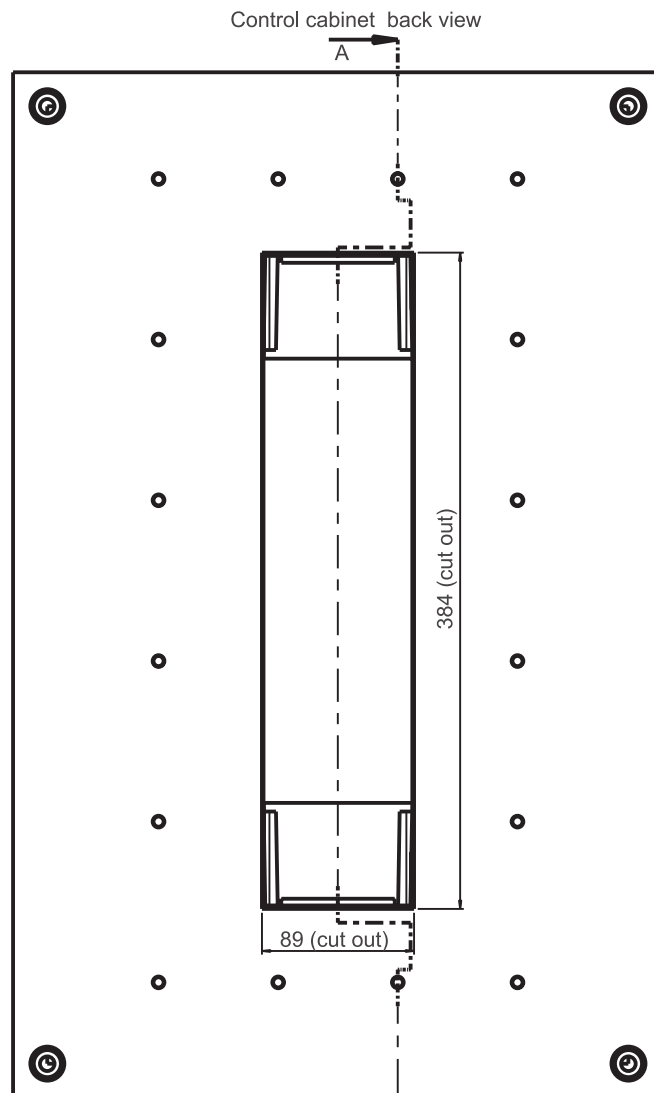
## Type of protection: control cabinet with built in through-hole devices BM442X-A/F



### NOTE

The following required control cabinet mounting is only valid for control cabinets with protection class IP54 or higher.

- ☐ IP protection class for air-cooled through-hole devices: IP44
- ☐ IP protection class for air-cooled through-hole devices: IP54



## 5.6 Mounting instructions

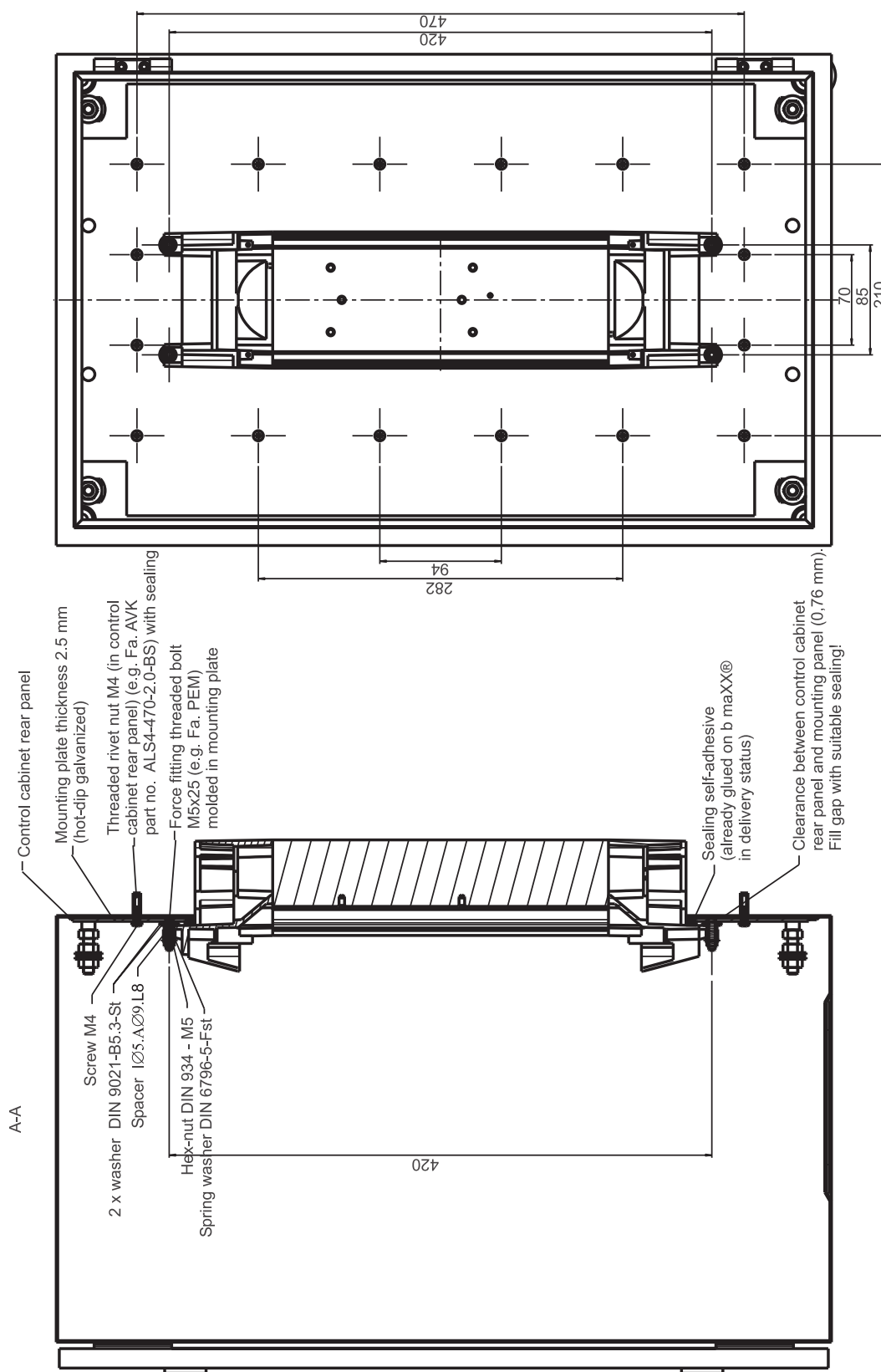


Figure 34: Control cabinet mounting BM442X-A/F

## 5.7 Connecting the water cooler

With water cooled devices (BM44XX-F and BM44XX-Z) you connect the coolant circulation before you install the electric. The water cooler has on its bottom side two pressfitting-transition pieces 15mm x R 1/2 ' AG for flat washers.

- Connect the cooling circulation to the water cooler.

| Device   | Tube material | outer tube-Ø | Screwing                |
|----------|---------------|--------------|-------------------------|
| BM442X-F | VA            | 15 mm        | 1/2' AG for flat washer |
| BM443X-F | VA            | 15 mm        | 1/2' AG for flat washer |
| BM443X-Z | VA            | 15 mm        | 1/2' AG for flat washer |
| BM444X-F | VA            | 15 mm        | 1/2' AG for flat washer |
| BM444X-Z | VA            | 15 mm        | 1/2' AG for flat washer |
| BM445X-F | VA            | 15 mm        | 1/2' AG for flat washer |
| BM445X-Z | VA            | 15 mm        | 1/2' AG for flat washer |
| BM446X-F | VA            | 15 mm        | 1/2' AG for flat washer |
| BM446X-Z | VA            | 15 mm        | 1/2' AG for flat washer |
| BM447X-F | VA            | 15 mm        | 1/2' AG for flat washer |

In case you refer to UL 508 C: There must be a pressure-relief valve with a threshold pressure of maximum 6 bar in the cooling circulation.



# INSTALLATION

In this chapter we describe the electric installation of the device. The mechanical installation is described in [►Mounting◄](#) from page 37.

Before installing assure, that the technical preconditions are fulfilled:

- 1 Check the requirements to the electrical mains and check if the existing mains is suitable.
- 2 Check the requirements to the electrical cables and provide the according cables.
- 3 Check the characteristics of the connections and configure the connections accordingly.

## 6.1 General safety instructions

- Pay attention to the information in the chapters [►Fundamental safety instructions◄](#) from page 11.
- Pay attention to all areas at the device, which could be dangerous for you during the electrical installation.

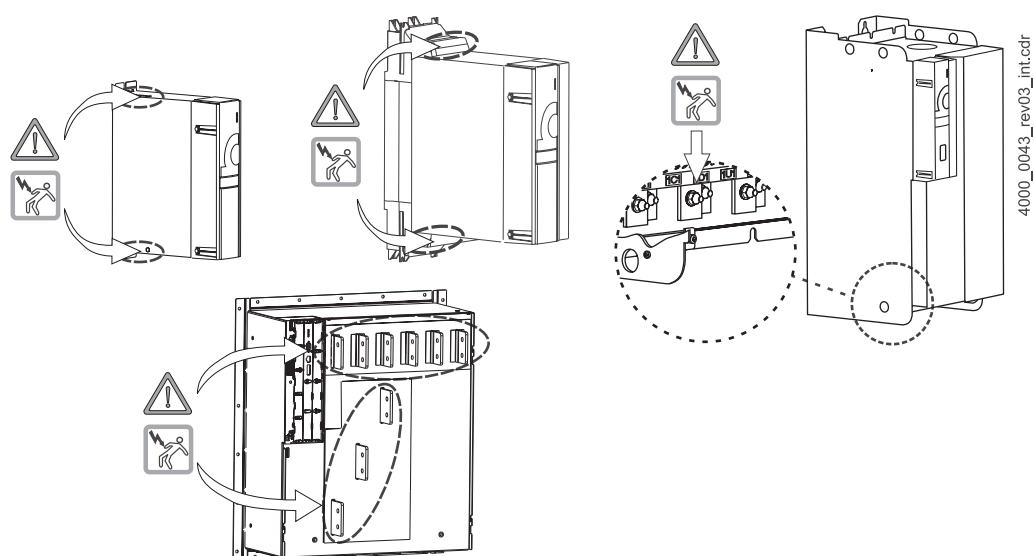


Figure 35: Danger areas at the electrical installation

### 6.2 Requirements to the executing personnel



#### WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury • death



*The danger is: **electricity**. When operating with this electrical unit, inevitably certain parts of this unit are under dangerous voltage.*

Make sure, that only qualified personnel, who are familiar with the safety- as well as with mounting-, operating- and maintenance instructions, work on this unit.

At each case qualified personnel are persons, who are authorized by the responsible persons, to execute necessary actions and who recognize the possible dangers and who are able to avoid these dangers. They have had the training, the experience, they were given instructions as well as knowledge about the relevant standards and instructions, they have knowledge of the accident prevention regulations and of the operating environments. The required qualifications for the work with this unit are for example:

- Education or instruction or to have the authorization to put into operation, ground and label circuits and devices according to the standards of safety engineering.
- Training or instruction due to the standards of the safety engineering in maintenance and use of appropriate safety equipment.

### 6.3 Voltage check

At routine test of these units a voltage check is executed acc. to EN 50178/VDE 0160, paragraph 9.4.5 by Baumüller Nürnberg GmbH.



#### WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury • death



*The danger is: **electricity**.*

Subsequent checks of unit with high voltages must be made only by Baumüller Nürnberg GmbH.

## 6.4 Requirements to the electrical mains

All important data is to be found in [►D.1 Requirements on the power supply◄](#) on page 162. Small deviations of the electrical mains from the requirements can lead to malfunctions of the device. In case the mains deviates strongly from the requirements, the device can be destroyed. **b maXX® BM4400**-devices must not be operated in low-voltage mains in order to supply buildings in residential areas. The destruction of the device can cause personnel injury.

### WARNING



The following **may occur**, if you disregard these safety notes:

- serious personal injury • death



*The danger is: **electricity**. In case you do not ensure the requirements to the electrical mains, the device can be damaged/destroyed and can thereby endanger persons severely.*

Assure before installation, that the requirements of the electrical mains are fulfilled.

- Connection instructions at special mains situations  
(is not valid for **b maXX®** power modules)
  - Single phase connection (BM441X)

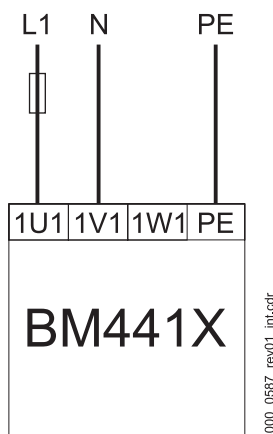


Figure 36: Single phase connection BM441X

## 6.4 Requirements to the electrical mains

- Connection to single phase grounded mains, is not valid for **b maXX®** power modules (BM442X for IT systems, BM443X ... BM447X)

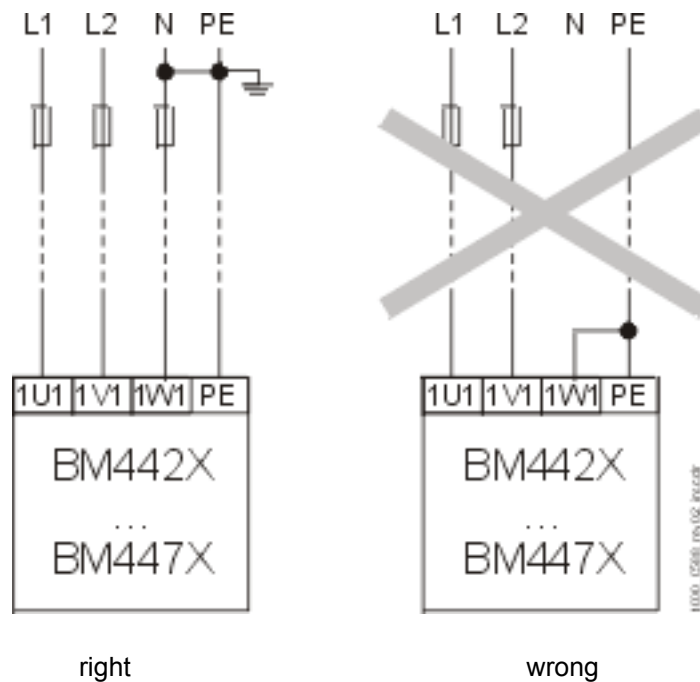


Figure 37: Connection to single phase grounded mains (BM443X ... BM447X, without power modules)

- Connection to single phase grounded mains with isolated transformer for the following cases
  - 1) BM441X, BM442X except for IT systems, without power modules
  - 2) BM443X ... BM447X at operating altitude > 2000 m, without power modules

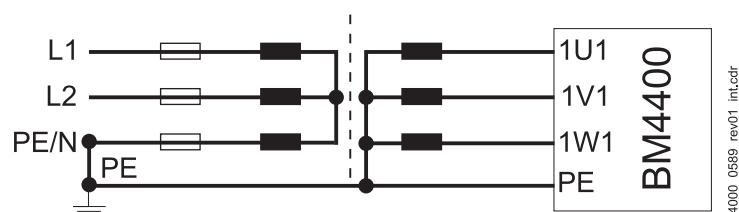


Figure 38: Connection to single phase grounded mains with an isolated transformer

## 6.5 Requirements to the connecting cables

- You must consider IEC/EN 60204-1, chapter 13 at selection of connection cables.
- The protective conductor cross section of the cable must be executed accordant to IEC/EN 60204-1, section 5.2, tab. 1.
- The permanent connection of the protective conductor is imperatively regulated for the operation of the device.
- Use a copper cable for at least 60°C (drives < 3 x 100 A) or 75°C (drives ≥ 3 x 100 A) incase you consider UL 508 C.

Additional data (e.g. maximum permissible length) is available in [►D.21 Cables mains-device◄](#) from page 213 to [►D.22 Cables device-motor◄](#) on page 215.

## 6.6 Protection of the device and of the cable respectively

In order to protect the device or the cables against damage/destruction by the mains, you must install fuses. Data of the necessary fuses are to be found in [►D.20 Fuse protection◄](#) from page 198.

### WARNING



The following **may occur**, if you disregard these safety notes:

- serious personal injury • death



*The danger is: **electricity**. Parts, which are under tension are perilous.*

The use of semiconductor fuses is obligatory at the mains connection of BM447X devices. Semiconductor fuses are required in the chopper resistor connection except the user assures the short-circuit protection of resistor and cable.

## 6.7 PE connection and RCD compatibility

Due to the operating principle leakage current can flow via the protective conductor > 3.5 mA<sub>AC</sub> or > 10 mA<sub>DC</sub>. On this account a permanent protective conductor is prescribed. In addition to the plugged protective connection, the screw terminal, which is marked with „PE“ must be connected to the PE (see [►Figure 45◄](#) on page 80).

### WARNING



The following **may occur**, if you disregard these safety notes:

- serious personal injury • death

*This product can cause direct current in the protective conductor. If, in case of a direct or indirect contact a residual-current-operated protective device (RCD) is used, then a RCD of type B is permitted on the power supply side only. Otherwise other safety precautions must be made as e. g. environmental separation with a double or strengthened insulation or by the separation of the power supply with an isolated transformer.*

Due to high leakage currents, which arise due to the operating principle of the device, can result in an early enabling of the RCD or generally can avoid an enable.

### 6.8 Requirements on the laying (EMC notes device)



#### NOTE

The emission of radio interferences is to a high level dependent on the wiring, the volume expansion and the arrangement of the components in the installation. That is why the assurance of the electromagnetic compatibility according to the statutory provisions only is possible on the completed installation and therefore is in the responsibility range of the manufacturer of the installation or of the operating authority (EMVG § 6, sec. 9).



#### NOTE

In this Manual the most important information for an EMC-compatible installation is available. Further notes, which necessarily have to be considered in order to mount a CE-conform installation are to be found in the manual 'filters for mains applications'.

- Use Baumüller motor cables and Baumüller components.
- Use a suitable mains filter of Baumüller Nürnberg GmbH
- Mount all components to one single mounting board with well electroconductive surface (e. g. galvanized steel plate).
- Execute the ground connection converter/ground plane as short as possible (< 30 cm) with fine-wired cables and a great cross section (> 10 mm<sup>2</sup>).
- When installing, attend to the correct order:  
Mains - fuse - filter - choke - (ferrite core) - **BM4400** - motor.  
Choke is not necessary for BM441X and BM442X (except BM4426)
- Assure, that the motor cables always consist of one piece.  
Do not interrupt the motor cables e. g. by terminals, contactors, fuses a.s.o.
- Run the cables directly on the surface of the grounded 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 - supply cables or motor cables) only in a 90° angle.
- Contact the external cable screens when passing through walls, which separate different EMC ranges.
- Connect the cable shields of the **b maXX**<sup>®</sup>-devices plane on both ends and highly conductive with ground.

### 6.9 Requirements to the temperature sensor of the motor

In order to protect the motor against unacceptable overheating a motor-temperature-sensor can be connected to the **b maXX**<sup>®</sup>-device. When exceeding an adjusted limit temperature the converter switches off the motor. Requirements to the temperature sensor you will find in [►Temperature sensors of the motor◄](#) on page 219.

**NOTE**

The motor temperature sensor is to be executed in such a way, that the electrical separation is guaranteed. The motor temperature sensors, which are build in at Baumüller correspond to these requirements. At connection of an external motor the operator has to assure, that the motor temperature sensor, which was installed into the motor of the external manufacturer complies with the function Electrical separation.

## 6.10 Operating sequence of installation

**WARNING**

The following **may occur**, if you disregard these safety notes:

- serious personal injury • death



*The danger is: **electricity**. Parts, which are under tension are perilous.*

Assure, that during the entire mounting the device, the parts, which must be mounted (e. g. supply cables) and the mounting range are off-circuit.

**NOTE**

Steps which are not necessary for the installation of **b maXX<sup>®</sup> 4400 power modules** are marked.

The following steps must be carried out at installation:

- 1 Lay all cables EMC-compatible.
- 2 Connect cables (see [►Connection diagrams◄](#) from page 78) (refer to the permissible torque).
  - Connect the motor via the terminals 1U2, 1V2, 1W2, PE. Attend to the in-phase connection (rotational direction). (refer to the permissible torque.)
  - Connect the fuses (S1) - not necessary for power modules. (in case you consider UL 508 C: use the semiconductor- or total-range-fuses, which are UL-listed in chapter [►D.20 Fuse protection◄](#) from page 198.)
  - Connect the mains filter (L2) - not necessary for power modules.
  - Connect the choke (L1) at the mains filter output (for BM441X, BM442X (except BM4426) and for power modules not necessary) .
  - Connect the device via the mains input terminals 1U1, 1V1 and 1W1 to the mains choke output - not necessary for power modules.
  - Connect the protective conductor to the terminal PE (a permanent PE connection is required imperatively).
  - 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).

- Connect the encoder (see manual of the encoder modules).

---

### NOTE



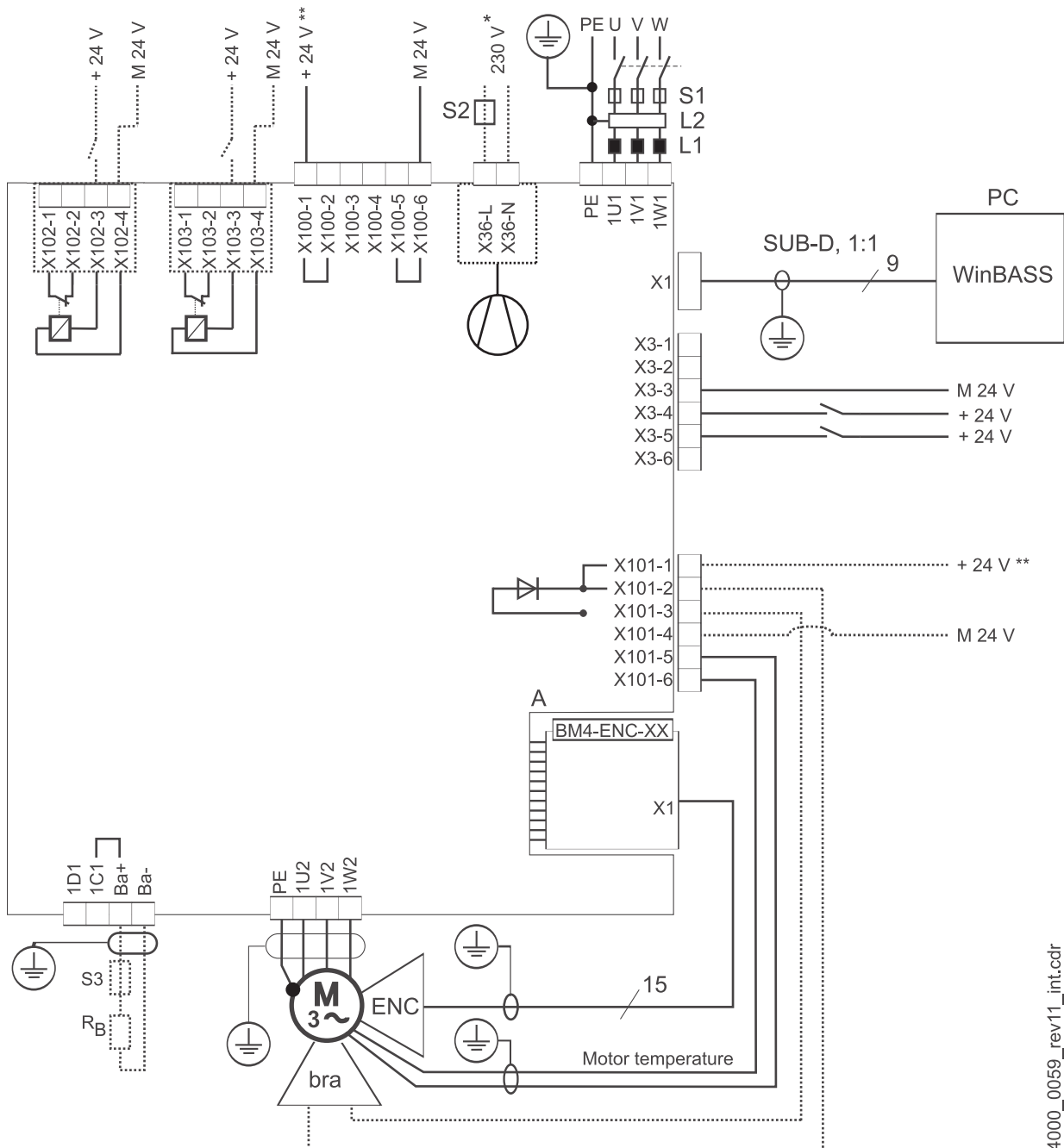
The plugging and pulling of the encoder cable is not permissible under voltage.

---

- Connect the temperature sensor of the motor.
- Connect a signal encoder for the pulse enable via terminals X3-5, X3-3.
- Connect a signal encoder for the quickstop via the terminals X3-4, X3-3.
- Perhaps connect (dependent on the application - not necessary for power modules) a chopper resistor ( $R_B$ ) via terminals Ba+, Ba-.
- Perhaps connect the brake of the motor via the terminals X101-1/2 and X101-3/4.
- Connect the safety relay (if existing) via X102-3 and X102-4 as well as X103-3 and X103-4 (connection data safety relay also see [►E.7 Technical data safety relay module◄](#) on page 235).

## 6.11 Connection diagrams

### 6.11.1 b maXX® 44XX (without power modules)



4000\_0059\_rev11\_int.cdr

Figure 39: Connection diagram with a directly controlled motor brake - without power modules

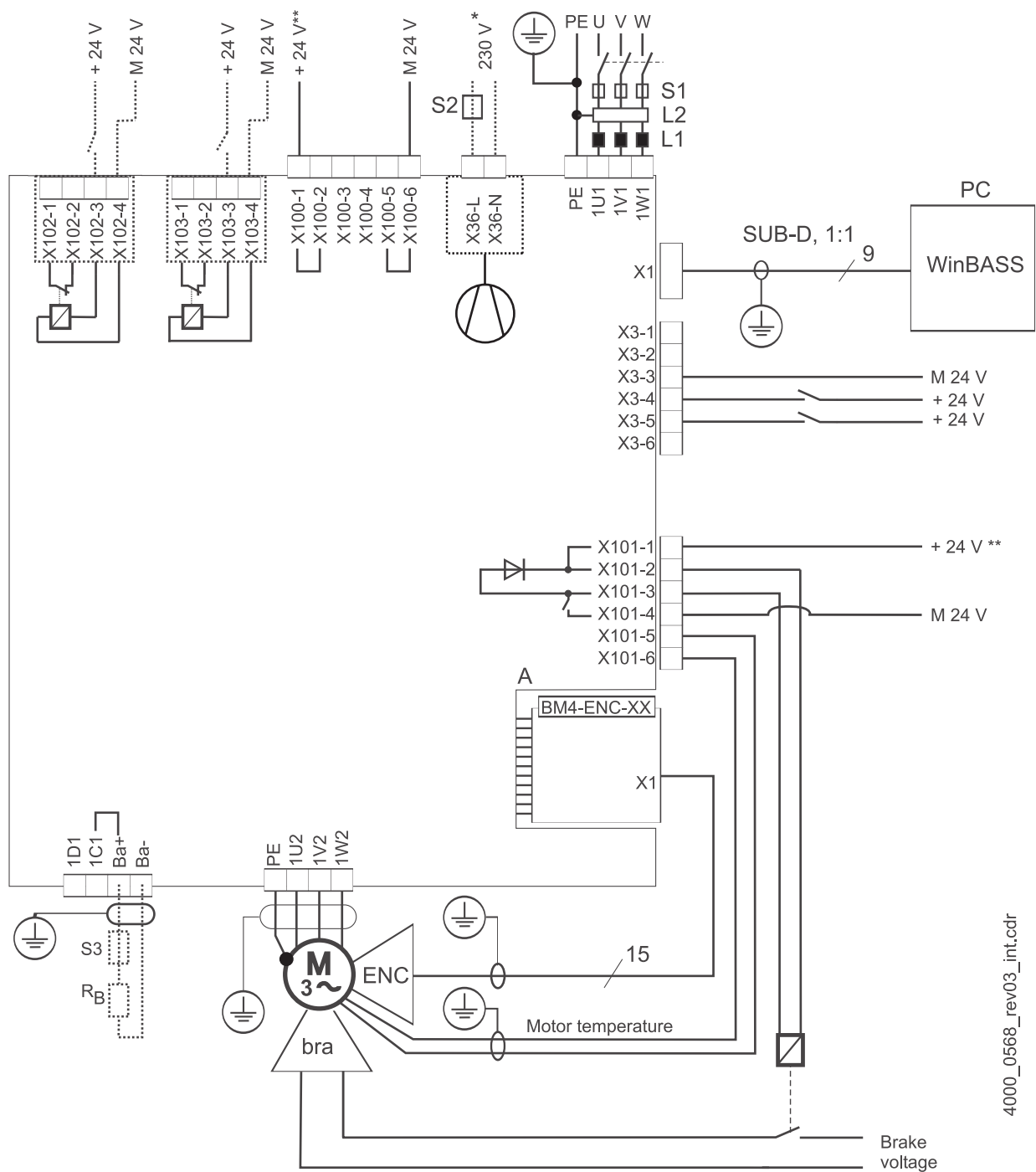


### NOTE

If the motor brake is connected directly via X101-2 and X101-3 (see [►Figure 39◄](#) on page 71) the shown direct installation is allowed only. It is not allowed within a multi-axis installation e.g. to connect the plus and ground connections of all motor brakes with each other.

---

An additional relay is necessary, if the voltage of the brake is  $\neq 24V$ , or if the current of the brake is greater than the switching capacity of X101 (see [►X101 \(SELV/PELV\)◄](#) on page 94) or if you consider UL508C and the current of the brake is greater 4 A.  
Perhaps consider a limited operating voltage range of the brake because of the internal voltage drop up to max. 2.6 V.

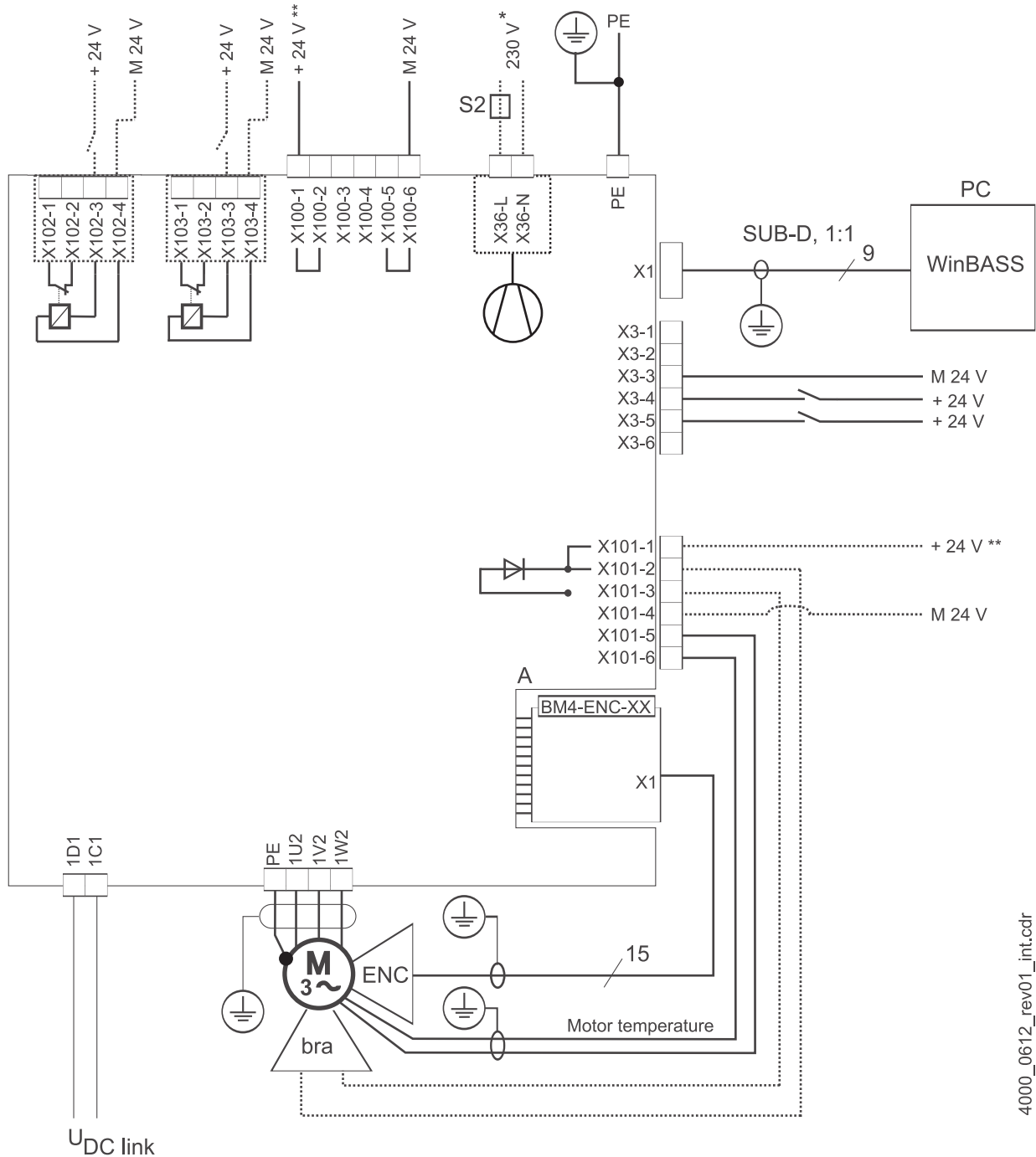


4000\_0568\_rev03\_int.cdr

Figure 40: Connection diagram with motor brake controlled via an additional relay - without power modules

## 6.11 Connection diagrams

### 6.11.2 b maXX® 44XX power modules



Connection to other  
BM41XX or BM44XX units

Figure 41: Connection diagram with a directly controlled motor brake - power modules

4000\_0612\_rev01\_int.cdr

**NOTE**

If the motor brake is connected directly via X101-2 and X101-3 (see ► [Figure 39](#)◄ on page 71) the shown direct installation is allowed only. It is not allowed within a multi-axis installation e.g. to connect the plus and ground connections of all motor brakes with each other.

An additional relay is necessary, if the voltage of the brake is  $\neq 24V$ , or if the current of the brake is greater than the switching capacity of X101 (see ► [X101 \(SELV/PELV\)](#)◄ on page 94) or if you consider UL508C and the current of the brake is greater 4 A.  
Perhaps consider a limited operating voltage range of the brake because of the internal voltage drop up to max. 2.6 V.



Figure 42: Connection diagram with motor brake controlled via an additional relay - power modules

- \* is only valid for BM444X, BM445X and BM446X accordingly the cooling versions S and A, for BM447X cooling version -A:

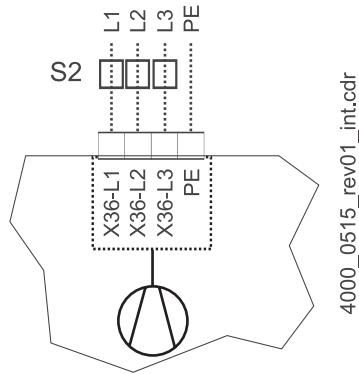


Figure 43: Connection fan BM447X-A

- \*\* The power supply at X100 or X101 must externally be protected. At selection of the fuse you must consider the cross-section of the connecting cable and the maximum allowable load capacity (for X100: see X100 on [Page 93](#), for X101: see X101 on [Page 94](#)). In case you consider UL 508 C, you must limit the power supply to 100 W or fuse it with a UL-listed 4 A fuse.

- Ba- ... 1D1 Connections for chopper resistor and DC link, see [Figure 44](#) on page 79 and the following.
- R<sub>B</sub> Chopper resistor
- PE....1W1 Mains connection, see [Figure 44](#) on page 79 ff.
- S1 Fuses (circuit cable + device)
- S2 Fuse (fan) \*)
- S3 Fuse chopper resistor connection (required for BM447X), see [D.20.22 Semiconductor fuses aR \(device\) 447X, model NH](#) on page 212.
- L1 Mains choke (not necessary for BM441X and BM442X except BM4426)
- L2 Mains filter
- X1 Serial interface (RS 232), see [Figure 51](#) on page 87.
- X3 Connections for ready-for-use, quickstop, pulse enable, see [Figure 51](#) on page 87.
- X36 Connections for fan (only BM444X-S/-A, BM445X-S/-A, BM446X-S/-A, BM447X-A)
- X100 Connections for 24 V power supply, additional data see [Figure 51](#) on page 87 (SELV/PELV) and table [X100 \(SELV/PELV\)](#) on page 93.
- X101 Connections for brake, motor temperature, see [Figure 44](#) on page 79 and the following (SELV/PELV) and table X101 from [Page 79](#).
- X102 Connections of the safety relay, see [Figure 44](#) on page 79 and the following (SELV/PELV) and table [X102 \(option\) Safety relay](#) on page 94.
- X103 Terminals of the optional, second safety relay (only BM443X-BM447X), see [Figure 47](#) on page 82 and the following (SELV/PELV) and table [X103 \(option\) Safety relay](#) on page 94.

|           |                                                                   |
|-----------|-------------------------------------------------------------------|
| A:X1      | Encoder module, see manual 5,01042 (SELV/PELV)                    |
| ENC       | Encoder                                                           |
| BRE       | Brake                                                             |
| PE....1W2 | Connections for motor, see <a href="#">▶Figure 44◀</a> on page 79 |

### 6.12 Connection diagrams

[▶Figure 44◀](#) on page 79 and the following show the connections for protective conductors, mains, motor, chopper resistor, DC-link, safety relays and motor temperature sensor (X101). [▶Figure 51◀](#) on page 87 shows the control voltage and the connections of the controller unit.

#### NOTE



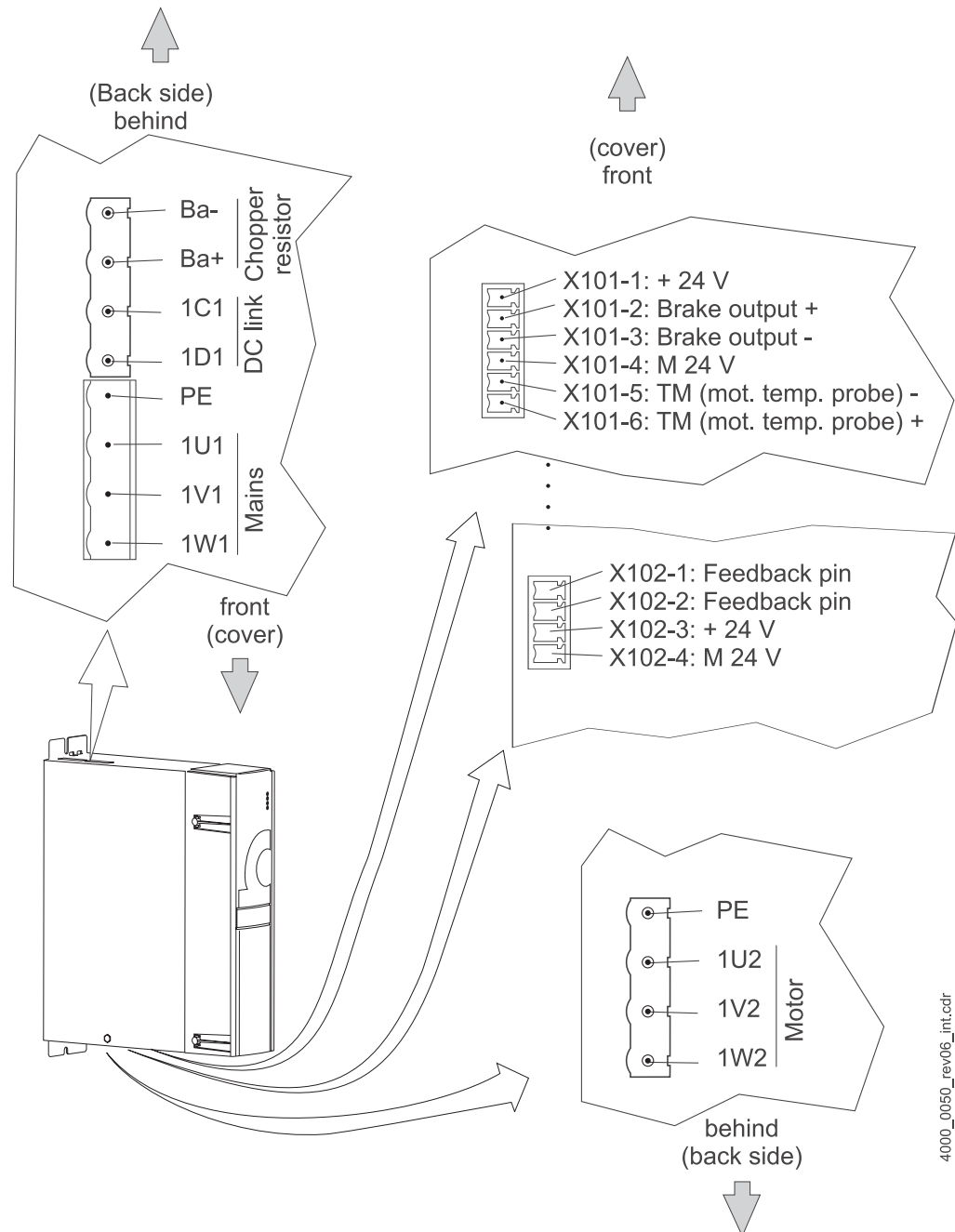
When having a switched off safety relay it is not possible at BM441X and BM442X to use a chopper resistor.

#### NOTE



The characterization 1C1 and 1D1 is from the standard DIN EN 60445.  
1C1 is the connection to the positive DC link cable/current bar and was labeled with ZK+ by Baumüller in the past.  
1D1 is the connection to the negative DC link cable/current bar and was labeled with ZK- by Baumüller in the past.

The electrical connections for devices **BM4412** and **BM4413** are shown in the following figure:



4000\_0050\_rev06\_int.cdr

Figure 44: Electrical connections for mains, motor, upon others for BM4412 and BM4413

## 6.12 Connection diagrams

The electrical connections for device **BM4414** are shown in the following figure:

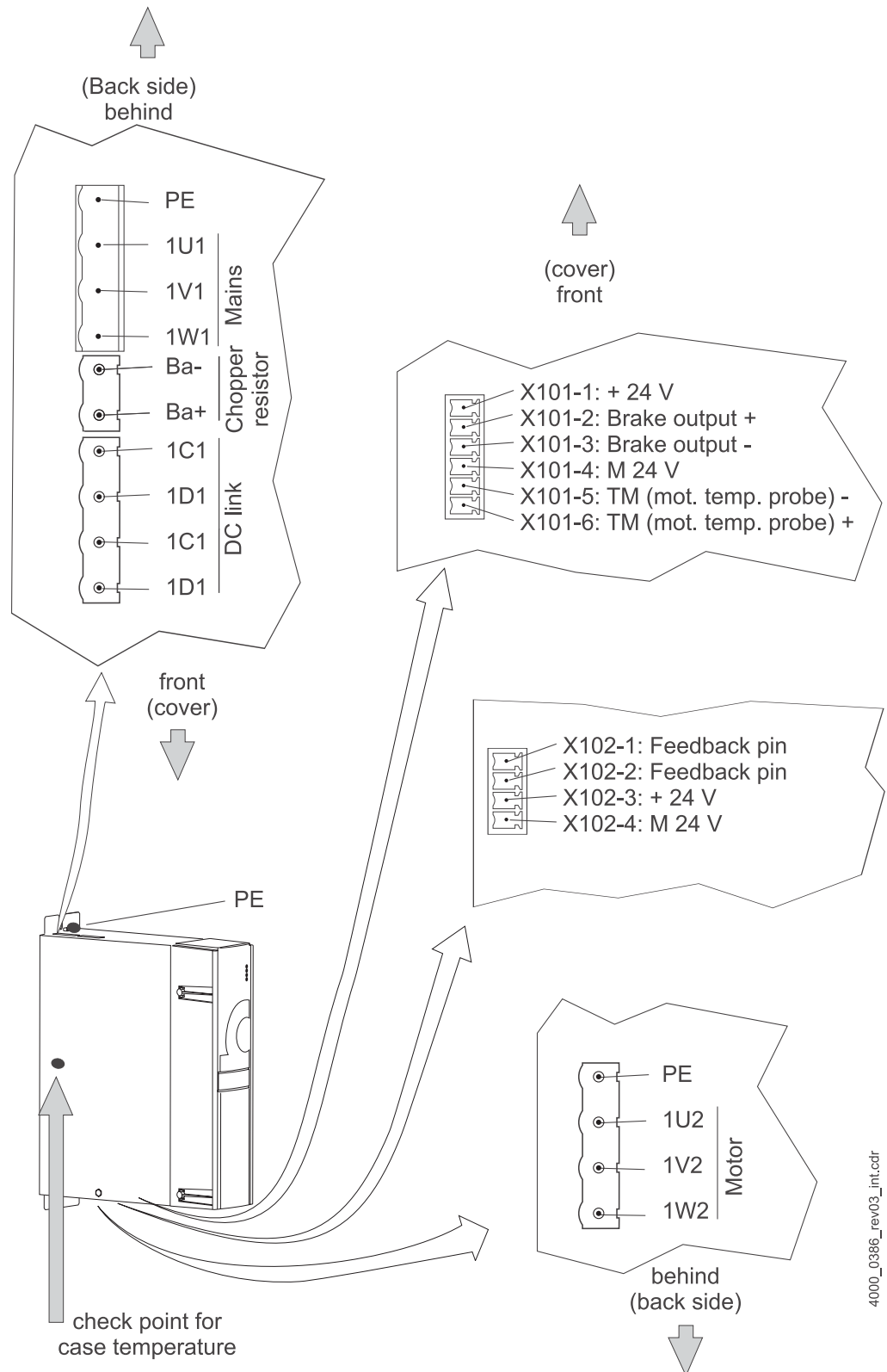
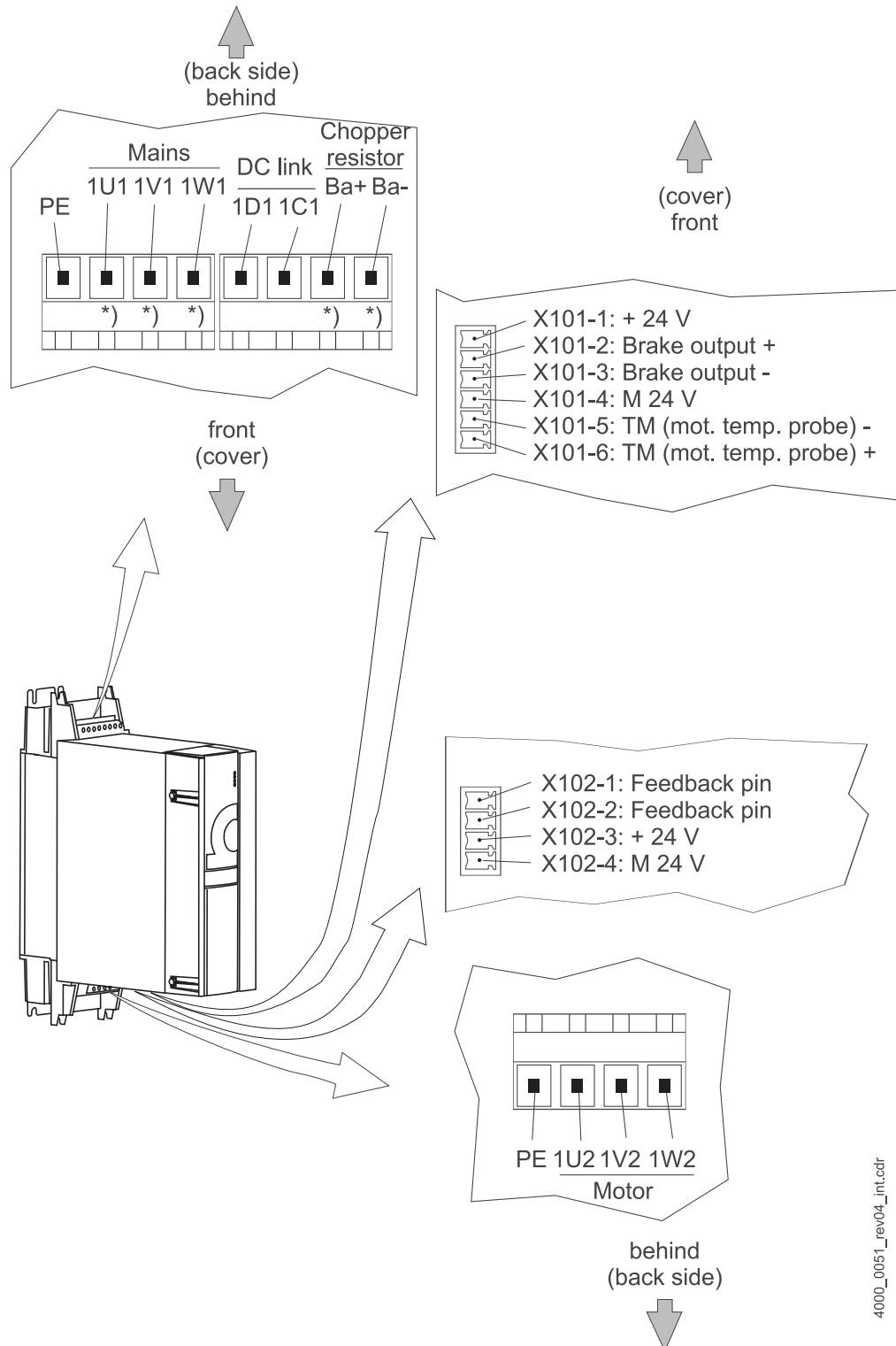


Figure 45: Electrical connections for mains, motor, upon others for BM4414

The electrical connections for device **BM442X** are shown in the following figure:



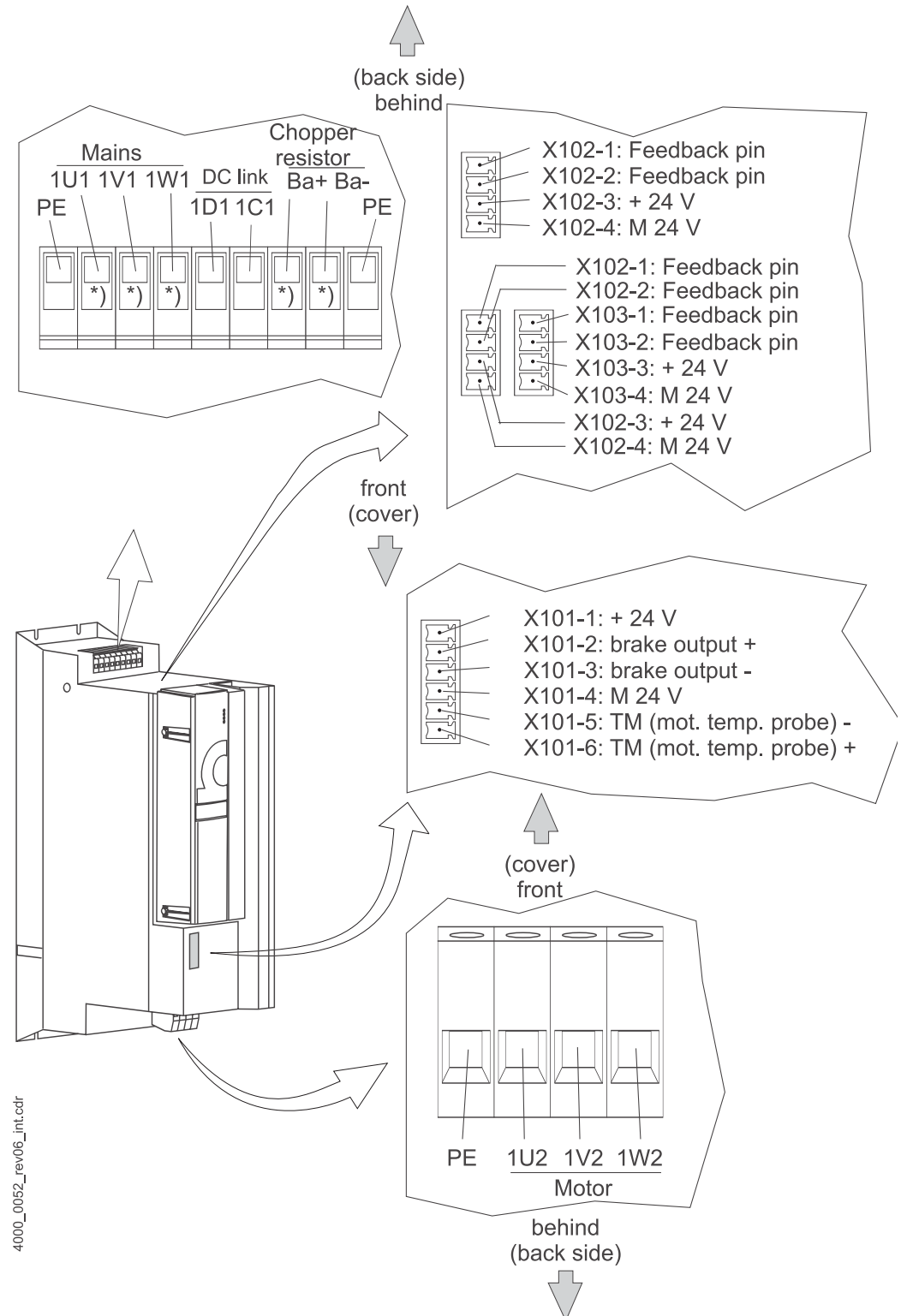
4000\_0051\_rev04\_int.cdr

\*) Do not apply terminals when using a power module!

Figure 46: Electrical connections for mains, motor, upon others for BM442X

## 6.12 Connection diagrams

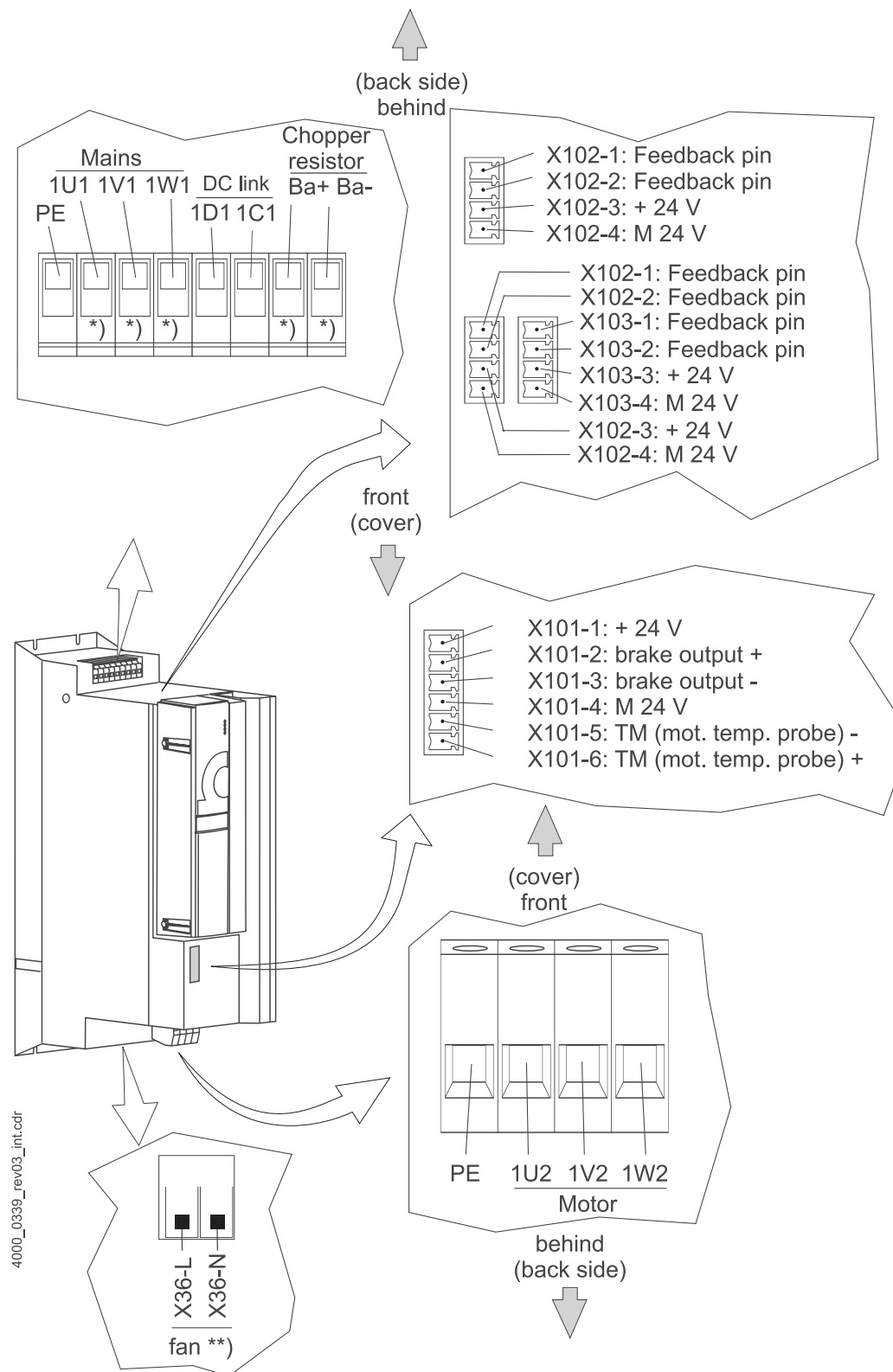
The electrical connections for device **BM443X** are shown in the following figure:



\*) Do not apply terminals when using a power module!

Figure 47: Electrical connections for mains, motor, upon others for BM443X

The electrical connections for device **BM444X** are shown in the following figure:

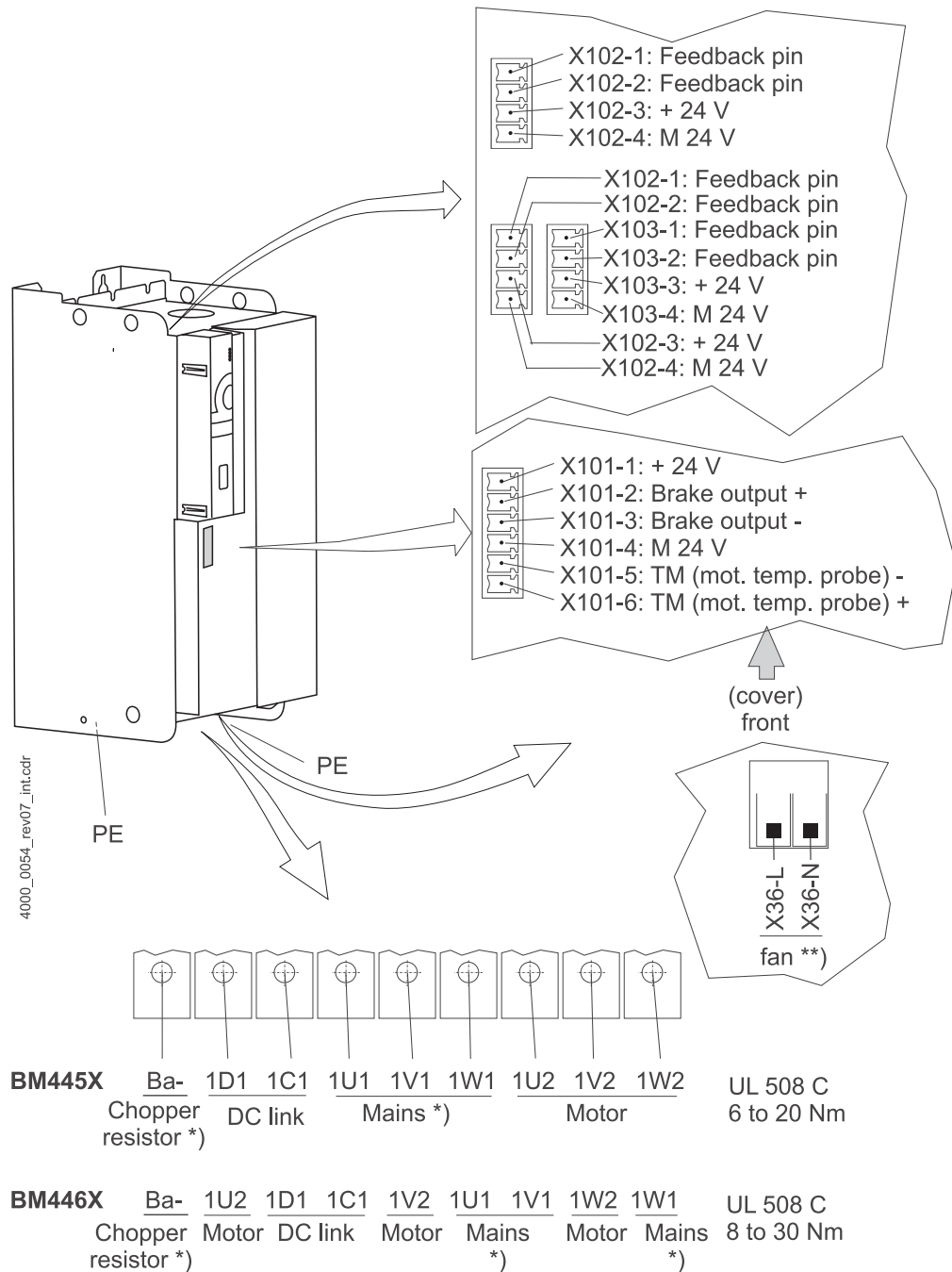


\*) Do not apply terminals when using a power module!

\*\*) only BM444X-S/-A

Figure 48: Electrical connections for mains, motor, upon others for BM444X

The electrical connections for the devices **BM445X** and **BM446X** are shown here:



\*) Do not apply terminals when using a power module!

\*\*) only BM445X-S/-A and BM446X-S/-A

Figure 49: Electrical connections for mains, motor, upon others for BM445X and BM446X



### NOTE

The chopper resistor is connected at the devices BM445X and BM446X between Ba- and 1C1.  
Also see ►Figure 39◄ on page 71.





### NOTE

The chopper resistor is connected at the devices BM447X and BM1X between Ba- and 1C1. Also see [►Figure 39◄](#) on page 71.



### WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury
- death



*The danger is: **electricity**. Parts, which are under tension are perilous.*

After attaching all power cables to the device BM447X, screw on the cover careful to all screwing points by using the enclosed screws (6xM4X12) and washers. The cover only must be able to be removed from the device with use of tools.

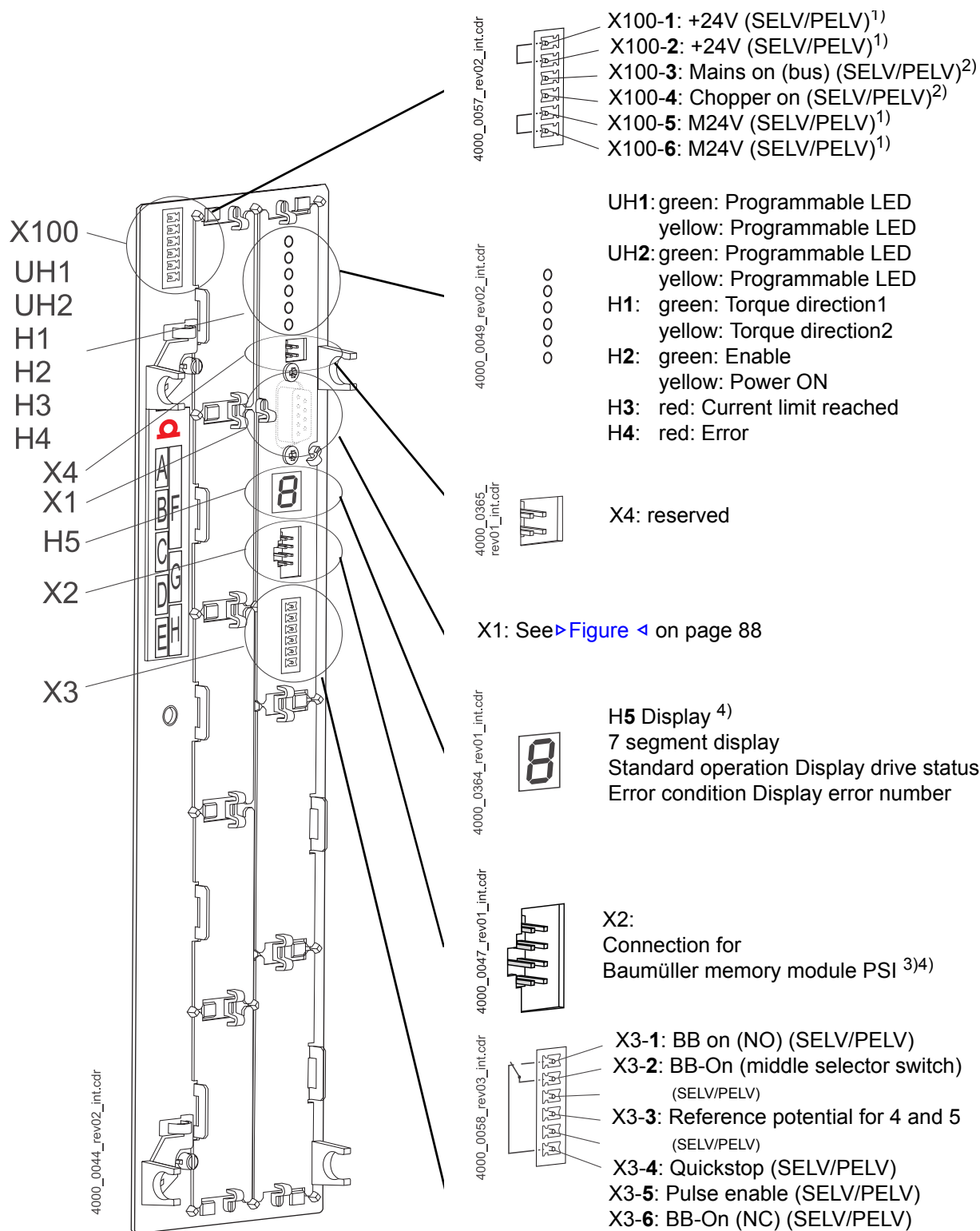
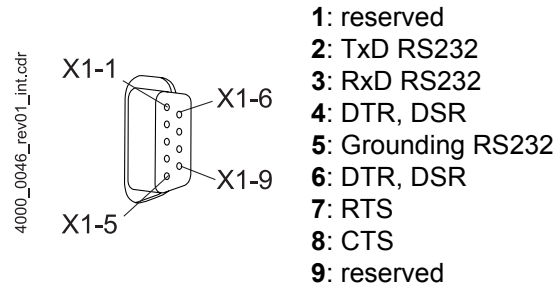


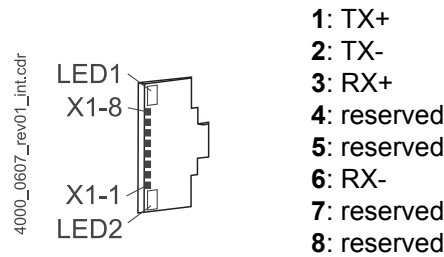
Figure 51: Connection X100 and connections of the controller unit

X1: According to controller type

BM44XX - XXX - XX0XX[Ryy] - XX (with RS 485 interface)  
 BM44XX - XXX - XX1XX[Ryy] - XX (with RS 485 interface)  
 BM44XX - XXX - XX2XX[Ryy] - XX (with RS 485 interface)



BM44XX - XXX - XX3XX[Ryy] - XX (with Ethernet interface)



| LED1   |             | LED2   |               |
|--------|-------------|--------|---------------|
| Color  | Meaning     | Color  | Meaning       |
| off    | no activity | off    | no connection |
| yellow | half duplex | yellow | 10 Mbs        |
| green  | full duplex | green  | 100 Mbs       |

### NOTE

- <sup>1)</sup> in case you consider UL 508 C: limit the current to 4 A.
- <sup>2)</sup> Do not apply voltage to the terminals X100-3 or X100-4, if the device is not supplied via X100-1/2 with voltage.  
 (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.)
- <sup>3)</sup> The PSI-module may not be attached or withdrawn, if the b maXX<sup>®</sup> device 24 V power supply is ON. Beforehand switch off the device.  
 Further notes for the usage of the PSI module are to be found in parameter manual.
- <sup>4)</sup> not BM44XX - XXX - XX0XX and BM44XX - XXX - XX1XX



## 6.12.1 Connection data of the connections

**Mains**  
**1U1, 1V1, 1W1, PE**

not valid for  
power modules

|        | Max. connection cross-section                           | Connection technology | Torque     | Load capacity                                  |
|--------|---------------------------------------------------------|-----------------------|------------|------------------------------------------------|
| BM441X | 2,5 mm <sup>2</sup>                                     | plug-in contact       | -          | see<br>►D.20 Fuse protection◄<br>from page 198 |
| BM442X | 4,0 mm <sup>2</sup>                                     | screw terminals       | 0.6 Nm     |                                                |
| BM443X | 10 mm <sup>2</sup>                                      | screw terminals       | 1.5 Nm     |                                                |
| BM444X | 50 mm <sup>2</sup>                                      | screw terminals       | 8 Nm       |                                                |
| BM445X | 2 x 95 mm <sup>2</sup> 1)3)                             | cable lug for M8      | 6 to 20 Nm |                                                |
| BM446X | 2 x 185 mm <sup>2</sup> 2)3)                            | cable lug for M10     | 8 to 30 Nm |                                                |
| BM447X | 2 x 185 mm <sup>2</sup> 2)<br>4 x 95 mm <sup>2</sup> 1) | cable lug for M10     | 8 to 30 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>. Also see ►Cables mains-device◄ on page 213.

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>. Also see ►Cables mains-device◄ on page 213.

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

## 6.12 Connection diagrams

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

|                      | Max. connection cross-section | Connection technology | Torque     | Load capacity 1C1 and 1D1 <sup>2)</sup> Ba+ and Ba- <sup>3)</sup>                            |
|----------------------|-------------------------------|-----------------------|------------|----------------------------------------------------------------------------------------------|
| BM441X               | 2,5 mm <sup>2</sup>           | plug-in contact       | -          | see <a href="#">►D.6 Electrical data - BM441X basic unit◄</a> on page 167 and the following. |
| BM442X               | 4,0 mm <sup>2</sup>           | Screw terminals       | 0.6 Nm     |                                                                                              |
| BM443X               | 10 mm <sup>2</sup>            | Screw terminals       | 1.5 Nm     |                                                                                              |
| BM444X               | 50 mm <sup>2</sup>            | Screw terminals       | 8 Nm       |                                                                                              |
| BM445X               | 2 x 95 mm <sup>2 4)6)</sup>   | Cable lug for M8      | 6 to 20 Nm |                                                                                              |
| BM446X               | 2 x 185 mm <sup>2 5)6)</sup>  | Cable lug for M10     | 8 to 30 Nm |                                                                                              |
| BM447X <sup>7)</sup> | 2 x 185 mm <sup>2 5)</sup>    | Cable lug for M10     | 8 to 30 Nm |                                                                                              |

<sup>1)</sup> not short-circuit-proof, consider maximum load! See 'Chopper resistor external' in chapter [►Technical data◄](#) from page 161.

<sup>2)</sup> not short-circuit-proof, consider maximum load! See 'connected load DC link' in chapter [►Technical data◄](#) from page 161.

<sup>3)</sup> See 'permissible chopper resistor continuous power' in chapter [►Technical data◄](#) from page 161.

<sup>4)</sup> 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>.

<sup>5)</sup> 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>.

<sup>6)</sup> One cable of the mentioned cross section is sufficient for the operation.

<sup>7)</sup> A Semiconductor fuse is required in case of using no short-circuit-proof cables and resistors.

**Motor**  
**1U2, 1V2, 1W2, PE**

|        | Max. connection cross-section                                                 | Connection technology | Torque     | Load capacity                                                                                    |
|--------|-------------------------------------------------------------------------------|-----------------------|------------|--------------------------------------------------------------------------------------------------|
| BM441X | 2,5 mm <sup>2</sup>                                                           | plug-in contact       | -          | is limited by the device<br>Also see <a href="#">►Appendix D - Technical data</a> from page 161. |
| BM442X | 4,0 mm <sup>2</sup>                                                           | screw terminals       | 0.6 Nm     |                                                                                                  |
| BM443X | 16 mm <sup>2</sup>                                                            | screw terminals       | 4.5 Nm     |                                                                                                  |
| BM444X | 50 mm <sup>2</sup>                                                            | screw terminals       | 8 Nm       |                                                                                                  |
| BM445X | 2 x 95 mm <sup>2</sup> <sup>1)</sup>                                          | cable lug for M8      | 6 to 20 Nm |                                                                                                  |
| BM446X | 2 x 185 mm <sup>2</sup> <sup>2)3)</sup>                                       | cable lug for M10     | 8 to 30 Nm |                                                                                                  |
| BM447X | 2 x 185 mm <sup>2</sup> <sup>2)</sup><br>4 x 95 mm <sup>2</sup> <sup>1)</sup> | cable lug for M10     | 8 to 30 Nm |                                                                                                  |

<sup>1)</sup> 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>. Also see [►Cables device-motor](#) on page 215.

<sup>2)</sup> 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>. Also see [►Cables device-motor](#) on page 215.

<sup>3)</sup> One cable of the mentioned cross section is sufficient for the operation.

**Fan**  
**X36**

|                                                         | max. connection cross section | Connection technology | Loading                         |
|---------------------------------------------------------|-------------------------------|-----------------------|---------------------------------|
| BM444X-S/-A<br>BM445X-S/-A<br>BM446X-S/-A<br>BM447X-S/A | 4.0 mm <sup>2</sup>           | spring clip           | max. <b>1.0 A</b> <sup>1)</sup> |

<sup>1)</sup> For fuse protection a fuse with the tripping characteristic 'delayed' must be used.

X1 (RS 232)

|                  | Recommended connection cable   | Connection technology | Note                                                                           |
|------------------|--------------------------------|-----------------------|--------------------------------------------------------------------------------|
| BM441X to BM447X | LIYCY 6x2x0.14 mm <sup>2</sup> | SUB-D, 9-pin          | Available as cable sets: see <a href="#">►B.1 Interface cable◄</a> on page 153 |



### WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury
- death



*The danger is: **mechanical effects**. If a PC is not connected via an isolated transformer, the machine can run unexpected actions.*

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



### NOTE

Screening of the interface cables, which are used may only be connected to the controller side with the connector housing.

The cable connector can be obtained as an accessory from Baumüller Nürnberg GmbH (see [►B.1 Interface cable◄](#) on page 153). At the cable set the cable screen connection must be interrupted with the PC-sided Sub-D-plug connector housing.

In case the cable is produced self, please use the instructions stated below:

**1** Use the following materials:

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

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

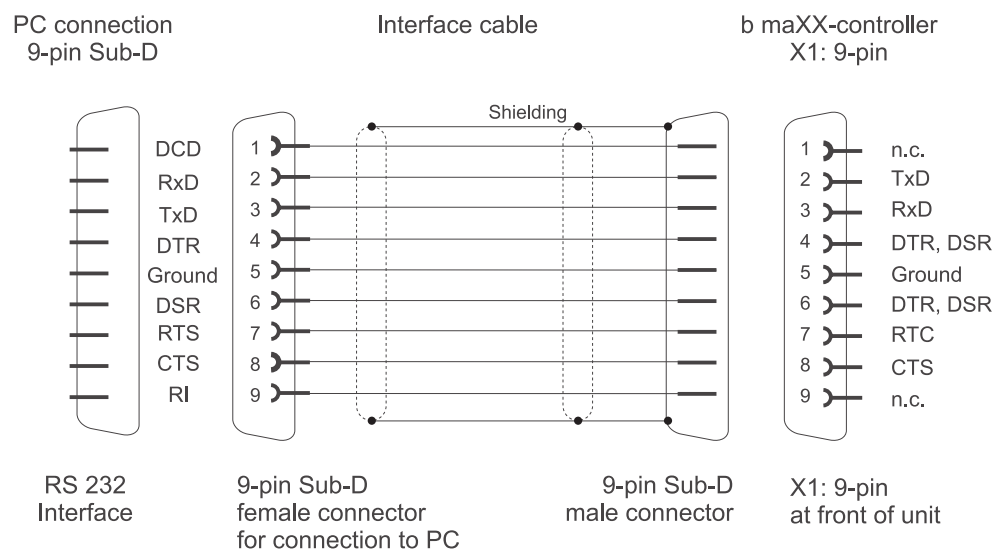


Figure 52: Interface cable RS 232

**X3 (SELV/PELV)**  
BB-On  
Quickstop  
Pulse enable

|                  | Max. connection cross-section | Connection technology | Load capacity<br>Voltage level                                                       |
|------------------|-------------------------------|-----------------------|--------------------------------------------------------------------------------------|
| BM441X to BM447X | 1.5 mm <sup>2</sup>           | plug-in contact       | BB-On; X3-1, X3-2 and X3-6:<br>max <b>1.0 A</b>                                      |
|                  |                               |                       | Quickstop X3-4<br>Pulse enable; X3-5:<br>0 (Low) 0 V to 5 V<br>1 (High) 12 V to 28 V |

**X100 (SELV/PELV)**

24 V power supply

|                  | Max. connection cross-section | Connection technology | Load capacity                                                                             |
|------------------|-------------------------------|-----------------------|-------------------------------------------------------------------------------------------|
| BM441X to BM447X | 1.5 mm <sup>2</sup>           | plug-in contact       | X100-1, X100-2, X100-5 and X100-6: max. <b>8.0 A</b> , if you consider UL508C: max. 4.0 A |

## 6.12 Connection diagrams

| <b>X101 (SELV/PELV)</b> |                            | Max. connection cross-section | Connection technology | Load capacity                                                                                                  |
|-------------------------|----------------------------|-------------------------------|-----------------------|----------------------------------------------------------------------------------------------------------------|
| Brake                   | BM4412<br>BM4413<br>BM442X | 1.5 mm <sup>2</sup>           | plug-in contact       | X101-1 to X101-4:<br>min. <b>0.1</b> A, max. <b>0.5</b> A                                                      |
|                         | BM4414<br>BM443X           | 1.5 mm <sup>2</sup>           | plug-in contact       | X101-1 to X101-4:<br>min. <b>0.1</b> A, max. <b>1.0</b> A                                                      |
|                         | BM444X                     | 1.5 mm <sup>2</sup>           | plug-in contact       | X101-1 to X101-4:<br>min. <b>0.1</b> A, max. <b>4.0</b> A                                                      |
|                         | BM445X<br>BM446X<br>BM447X | 1.5 mm <sup>2</sup>           | plug-in contact       | X101-1 to X101-4:<br>min. <b>0.1</b> A, max. <b>8.0</b> A<br>In case you refer to<br>UL508C: max. <b>4.0</b> A |

| <b>X102 (option)</b><br>Safety relay<br>(SELV/PELV) |  | Max. connection cross-section | Connection technology | Load capacity<br>Voltage level                                              |
|-----------------------------------------------------|--|-------------------------------|-----------------------|-----------------------------------------------------------------------------|
| BM441X<br>to<br>BM447X                              |  | 1.5 mm <sup>2</sup>           | plug-in contact       | See<br><a href="#">►E.7 Technical data safety relay module◄</a> on page 235 |

| <b>X103 (option)</b><br>Safety relay<br>(SELV/PELV) |  | Max. connection cross-section | Connection technology | Load capacity<br>Voltage level                           |
|-----------------------------------------------------|--|-------------------------------|-----------------------|----------------------------------------------------------|
| BM443X<br>to<br>BM447X                              |  | 1.5 mm <sup>2</sup>           | plug-in contact       | See<br><a href="#">►B.1 Interface cable◄</a> on page 153 |

### 6.12.2 Requirements for the screwing



#### NOTE

Follow the mentioned torques in [►Figure 49◄](#) on page 84 and [►Figure 50◄](#) on page 85 to ensure an adequate conductivity.

## OPERATION

In this chapter we describe, how the device works during operation and how you handle the device during operation.

### 7.1 Safety instructions

- Refer to the safety instructions from the chapter [Fundamental safety instructions](#) from page 11.



#### CAUTION

The following **may occur**, if you disregard these safety notes:

- Property damage

*The danger is: **Environmental conditions, that do not refer to the demands.***

Assure, that the environmental conditions are referred to during operation (see [D.3 Required environmental conditions](#) on page 164).



#### WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury • death

*The danger is: **electricity.** The control cabinet, in which the device is built in, shall protect against contacts with parts, which are under voltage.*

Assure, that during operation all doors of the control cabinet are closed.

Assure, that during operation all safety devices work.

### 7.2 Requirements to the executing personnel



#### WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury • death

*The danger is: **electricity**. When operating with this electrical unit, inevitably certain parts of this unit are under dangerous voltage.*

Assure, that only qualified personnel work on this unit.

At each case qualified personnel are persons, who are authorized by the responsible persons, to execute necessary actions and who recognize the possible dangers and who are able to avoid these dangers. They have had the training, the experience, they were given instructions as well as knowledge about the relevant standards and instructions, they have knowledge of the accident prevention regulations and of the operating environments. The required qualifications for the work with this unit are for example:

- Education or instruction or to have the authorization to put into operation, ground and label circuits and devices according to the standards of safety engineering.
- Training or instruction due to the standards of the safety engineering in maintenance and use of appropriate safety equipment.

### 7.3 Operating concept

After the device has been taken into operation, it is parametrized (adjusted to the application). When the parameterization is completed, you can operate the device with one of the following systems:

#### System 1

- two enable signals (see [▶Enable signals◀](#) on page 97).
- I/Os (see manuals to the I/O plug-in modules)

#### System 2

- two enable signals (see [▶Enable signals◀](#) on page 97).
- I/Os (see manuals to the I/O plug-in modules)
- superimposed control, which controls the two enable signals and the I/Os

The operating software WinBASS II is not necessary during operation. The operating software WinBASS II 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 WinBASS II, determine, which error has occurred.

### 7.3.1 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 51◄ on page 87).

|                     |                                                                                                                                                                                                               |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Pulse enable</b> | During operation the signal 'pulse enable' must constantly be created, so that the device supplies power.                                                                                                     |
| <b>Quickstop</b>    | <p>Disable the signal 'quickstop' only, if you must stop the installation/device as quick as possible.</p> <p>During operation the signal 'quickstop' must be applied, so that the device supplies power.</p> |

## 7.4 Mains-switch-on frequency/DC-link charging

The mains voltage may not be switched on and off arbitrarily. Between two switch-on-sequences there should be a certain time period, in order to protect the devices/fuses.

### NOTE



Imperative for the devices **BM441X** and **BM442X** is:

Between two switch-on-sequences of mains voltage at least **60 seconds must** have passed<sup>1)</sup>.

Imperative for the devices **BM443X**, **BM444X**, **BM445X**, **BM446X** and **BM447X** is:

**A delay time must not be complied with.**

<sup>1)</sup> Shorter delay times can shorten the service life of the devices. By the connection of an external DC-link capacity at the DC-link terminals the prescribed minimum delay time increases to 90 seconds. The maximum allowable external DC-link capacity is dependent of the mains voltage (see ►Figure 61◄ on page 170 and ►Figure 63◄ on page 174).

## 7.5 Display elements - LED

BM44XX - XXX - XX0XX and BM44XX - XXX - XX1XX:

On the front side of the device there are 4 LEDs. The 4 LEDs (H1 to H4) show information about the operating status and are also displayed in WinBASS II.

BM44XX - XXX - XX2XX:

On the front side of the device there are 6 LEDs. Both upper LEDs (UH1 and UH2: 2) are freely programmable. The four lower LEDs (H1 to H4) show information about the operating status and are also displayed in WinBASS II.

►Figure 51◄ on page 87 shows the position of the display elements.

### 7.5.1 Freely programmable LED (UH1, UH2)\*):

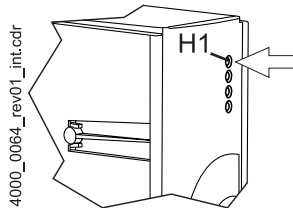
\*): not BM44XX - XXX - XX0XX and BM44XX - XXX - XX1XX

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

## 7.5 Display elements - LED

### 7.5.2 Operating condition (H1, H2)

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

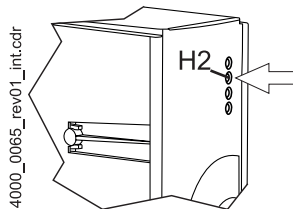


green: the motor rotates, torque direction 1.  
orange: the motor rotates, torque direction 2.

#### NOTE



The LED H1 cannot be taken as rotational direction indicator. It only shows the torque directions.



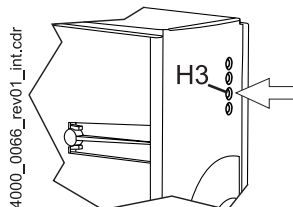
green: Pulse enable. The motor is power supplied by the power unit.  
orange: Power ON, the device is ready-to-operate. In case the LED lights up orange colored during operation, maybe the pulse enable is missing or the quickstop was activated.

Flashing in turn green/orange:  
Pulses for field generation at asynchronous machines enabled.  
No torque enable yet.

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.

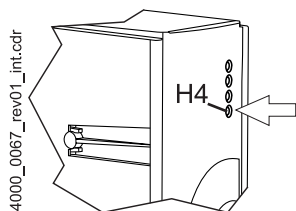
### 7.5.3 Current limit (H3)

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



red: adjusted current limit of the controller has been reached.  
● Application is adapted or 'no reaction'.

### 7.5.4 Error (H4)



LED doesn't light up: the internal monitoring have not found an error.

Red, continuously: Error.

- Remove the error with help of the operating program WinBASS II. Additional data is available in [Error detection and troubleshooting](#) from page 101.

red, flashing: Warning.

- Warnings you are able to see in the device manager of the operating program WinBASS II. Warnings do not affect operation of the device. Additional data is available in [Error detection and troubleshooting](#) from page 101.

### 7.5.5 Display (not BM44XX - XXX - XX0XX and BM44XX - XXX - XX1XX)

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

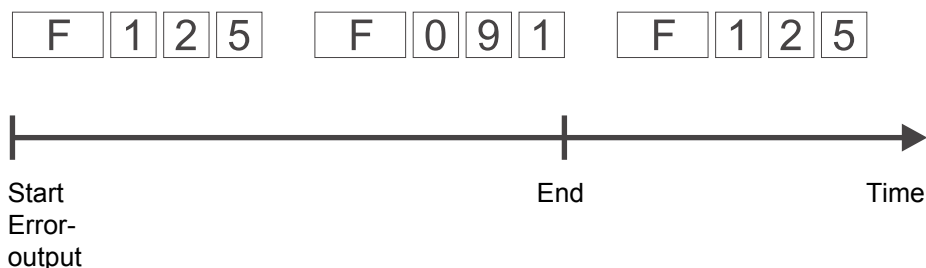
| Display | Status                   | Meaning                                                                                 |
|---------|--------------------------|-----------------------------------------------------------------------------------------|
| 0       | NOT READY TO START       | Initialization phase, pulses inhibited.                                                 |
| 1       | INHIBIT START            | Pulses inhibited, initialization completed error-free.                                  |
| 2       | READY-TO-START           | Pulses inhibited                                                                        |
| 3       | SWITCHED ON              | Pulses for field generation at asynchronous machines enabled, no torque generation yet. |
| 4       | OPERATION ENABLED        | Pulses enabled, drive function enabled                                                  |
| 5       | Inhibit operation active | Pulses enabled, braking procedure active                                                |
| 6       | Shutdown active          | Pulses enabled, braking procedure active                                                |
| 7       | QUICKSTOP ACTIVE         | Pulses enabled, braking procedure active                                                |
| E       | ERROR REACTION ACTIVE    | Pulses enabled, braking procedure active                                                |
| F       | ERROR                    | Pulses inhibited, error status<br>In the display the error number is shown.             |

The single drive statuses are specified in chapter device management in parameter manual 5.03039.

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.

The display of error No. starts therewith, that „F“ is shown for 1.5 s. Then the three error code positions are displayed. The separate figures are displayed for about 0.8 s, interrupted by a short pause. 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 existing:



4000\_0366\_rev01\_int.cdr

## 7.6 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 WinBASS II and by the control resp. The device shows the most important warning (current limit reached) also via the LED H3 (see [►Current limit \(H3\)◄](#) on page 98).

### Error message

If the controller recognizes that the device is not working error-free, this is displayed via the LED H4 (see [►Error \(H4\)◄](#) on page 99) and via the 7-segment display. Either an error text is displayed by WinBASS II or the control is able to read out the error code from the device.

Additional data is available in chapter ([►Error detection and troubleshooting◄](#) from page 101).

## 7.7 Maintenance

Maintenance is first of all the monitoring of the environmental conditions. With accordant projection of your installation you can execute the monitoring of the environmental conditions in the running operation and don't have to interrupt the operation for the maintenance.

Additional data is available in [►Maintenance◄](#) from page 137.

# ERROR DETECTION AND TROUBLE-SHOOTING

In this chapter the error messages of the device are described: Error- and warning messages, their meanings and how you can react.

## 8.1 Safety instructions

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► Refer to ► [Fundamental safety instructions](#) ◀ from page 11.

## 8.2 Requirements to the executing personnel

---

The personnel, who works with the **b maXX®** device, must be introduced in the safety instructions and in the operation of the device and must be familiar with the accurate operating of the device. Especially the reaction to failure indications and -conditions requires special knowledge, which the operator must have.

### 8.3 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 is explained in [►Error detection◄](#) from page 105.

| Monitoring function               | Warning/error                                        | Warning | Error | Threshold adjustable | Reaction adjustable | Reaction         | Adjusting of Limit in parameters | Activation by parameter |
|-----------------------------------|------------------------------------------------------|---------|-------|----------------------|---------------------|------------------|----------------------------------|-------------------------|
| Mains voltage                     | Mains undervoltage                                   | X       | X     | -                    | -                   | IS               | -                                | -                       |
|                                   | Mains overvoltage                                    | X       | X     | -                    | -                   | IS               | -                                | -                       |
| Phase monitoring                  | Phase error                                          | X       | X     | -                    | -                   | IS               | -                                | -                       |
|                                   | Mains failure                                        | X       | X     | X                    | -                   | IS <sup>2)</sup> | P0486                            | P0486                   |
| Ground fault <sup>1)</sup>        | Fault current to ground                              | -       | X     | -                    | -                   | IS               | -                                | -                       |
| Overcurrent                       | Overcurrent motor                                    | -       | X     | -                    | -                   | IS               | -                                | -                       |
| DC                                | DC link overvoltage                                  | -       | X     | -                    | -                   | IS               | -                                | -                       |
|                                   | DC-link-undervoltage relative                        | X       | -     | -                    | -                   | -                | -                                | -                       |
| Ixt-threshold                     | Peak current not possible at the moment              | X       | X     | X                    | -                   | IS               | -                                | -                       |
| Temperature heat sink             | 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                            | -                       |
| Temperature motor                 | I <sup>2</sup> t-threshold exceeded                  | -       | X     | -                    | -                   | IS               | P0073                            | P0093                   |
|                                   | Threshold 1 exceeded <sup>3)</sup>                   | X       | -     | X                    | -                   | -                | P0088                            | P0093                   |
|                                   | Threshold 2 exceeded <sup>3)</sup>                   | X       | -     | X                    | -                   | -                | P0089                            | P0093                   |
|                                   | Short circuit sensor or temp. < -30 °C <sup>3)</sup> | -       | X     | -                    | -                   | -                | -                                | P0093                   |
|                                   | Sensor not connected or temp. > 250 °C <sup>3)</sup> | -       | X     | -                    | -                   | -                | -                                | P0093                   |
|                                   | Maximum temperature exceeded <sup>3)</sup>           | -       | X     | X                    | -                   | IS               | P0090                            | P0093                   |

<sup>1)</sup> nonexistent at BM441X and BM442X

<sup>2)</sup> Pulse inhibit operates according to adjustable time

<sup>3)</sup> only when using the KTY sensor

<sup>4)</sup> adjustable with P0299

<sup>5)</sup> adjustable with P0298

<sup>6)</sup> nonexistent at power modules

IS: Pulse inhibit  
SH: Quickstop  
X: Implemented  
-: not possible

| Monitoring function                                     | Warning/error                                    | Warning | Error | Threshold adjustable | Reaction adjustable | Reaction      | Adjusting of Limit in parameters | Activation by parameter |
|---------------------------------------------------------|--------------------------------------------------|---------|-------|----------------------|---------------------|---------------|----------------------------------|-------------------------|
| Position controller                                     | Position deviation dynamic                       | -       | X     | X                    | -                   | SH            | P1054                            | P1050                   |
|                                                         | Position deviation static                        | -       | X     | X                    | -                   | SH            | P1055                            | P1050                   |
| Digital output                                          | Short-circuit digital output                     | -       | X     | -                    | -                   | -             | -                                | -                       |
| Controller synchronizing                                | Controller not synchronous with ext. Signal      | X       | X     | X                    | X                   | <sup>4)</sup> | P0533                            | P0299                   |
| Encoder 1                                               | Cable break                                      | -       | X     | -                    | -                   | IS            | -                                | -                       |
|                                                         | Cable break ( $\sin^2 + \cos^2$ )                | -       | X     | -                    | -                   | IS            | -                                | -                       |
|                                                         | Overspeed                                        | -       | X     | X                    | -                   | IS            | P1072                            | -                       |
| Encoder                                                 | Cable break                                      | -       | X     | -                    | -                   | IS            | -                                | -                       |
|                                                         | Cable break ( $\sin^2 + \cos^2$ )                | -       | X     | -                    | -                   | IS            | -                                | -                       |
|                                                         | Overspeed                                        | -       | X     | X                    | -                   | IS            | P1082                            | -                       |
| 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>5)</sup> | P0839                            | P0298                   |
| Safety relay                                            | Supply voltage is missing or safety relay faulty | -       | X     | -                    | -                   | IS            | -                                | -                       |
| Safety relay                                            | Safety relay - warning                           | X       | -     | -                    | -                   | -             | -                                | -                       |
| Block monitoring                                        | Drive blocked                                    | -       | X     | X                    | -                   | IS            | P1260                            | P1260                   |

<sup>1)</sup> nonexistent at BM441X and BM442X

<sup>2)</sup> Pulse inhibit operates according to adjustable time

<sup>3)</sup> only when using the KTY sensor

<sup>4)</sup> adjustable with P0299

<sup>5)</sup> adjustable with P0298

<sup>6)</sup> nonexistent at power modules

IS: Pulse inhibit

SH: Quickstop

X: Implemented

-: not possible

### 8.3.1 Monitoring functions - explanations

**Mains voltage** - nonexistent at power modules  
This monitoring function checks, if the mains voltage has a value within the adjusted voltage range. If the value is lower, the warning 'undervoltage mains' is indicated. If the value is higher the warning 'overvoltage mains' is indicated.

**Phase monitoring** - nonexistent at power modules  
This monitoring function checks the three phases of the mains voltage. If an outer conductor is missing, the warning 'Phase failure' is reported after >4s.  
If all of the three outer conductors are missing the warning 'Mains failure' is reported >4s to the controller. After reaching the adjusted delay time by parameter P0486 the controller generates the error message 'mains failure'.

#### NOTE



If you work without the mains filter the mains and phase failure-recognition takes place within 100 ms. If the device is operated with the mains filter the mains and phase failure can be detected after about 5 s. According to load state the failure can also be detected considerably earlier.

**Ground fault** This monitoring function checks, if there is a short-circuit between the motor terminals and the ground. If a short-circuit occurs, there is immediately a pulse enable.  
This monitoring function doesn't exist by BM441X and BM442X.

**Overcurrent** This monitoring function checks, if the motor current is greater than 1.3 x output peak current. It serves as 'Disaster prevention' in case of an output-sided short-circuit.

**DC** This monitoring function checks the voltage of the. In case the voltage sinks below a value, which was internally specified (about 50 V under the setpoint), the DC link undervoltage is signaled from the controller and a warning is generated. In case the voltage exceeds an adjusted value about 820 V), the error 'DC link overvoltage' is signaled from the controller and an immediate pulse inhibit operates.

**Ixt-threshold** This monitoring function checks the heat sink temperature as well as the current load thereupon, if the power unit can enable the peak current or the maximum nominal current. In case the peak current is not possible, the message 'Ixt-threshold 1 exceeded' is displayed.

**Temperature device interior space** This monitoring function checks the temperature in the internal space of the device.  

- In case the temperature is higher than the warning threshold, the controller gives a warning.
- In case the temperature is too high, immediately an pulse inhibit operates.

**Temperature heat sink** This monitoring function checks the temperature of the heat sink.  

- In case the temperature is higher than the warning threshold, the controller gives a warning.
- In case the temperature is too high, immediately an pulse inhibit operates.

**Temperature motor** This monitoring function checks the temperature of the motor. In case the  $I^2t$ -threshold is exceeded, the error ' $I^2t$ -overload' is given from the controller.

only by  
KTY84-  
Sensor  
In case the adjusted temperature threshold 1 is exceeded, the warning 'temperature threshold 1 exceeded' is signaled from the controller.  
In case the adjusted temperature threshold 2 is exceeded, the warning 'temperature threshold 2 exceeded' is signaled from the controller.  
The KTY84-sensor has a minimal measuring value of about -30°C. If the temperature falls below

if there is a short-circuit at the sensor, the error 'short-circuit temperature sensor' is signaled. The KTY84-sensor has a maximum measuring value of 250 °C. In case this temperature is exceeded, or in case the sensor is not connected, the error 'temperature sensor not connected' is signaled from the controller.

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>At all sensors</b>      | In case the threshold (depending on the model), which is determined in the temperature switch or in the PTC-sensor is exceeded, the error 'overtemperature' is given from the controller and immediately an pulse inhibit operates.                                                                                                                                                                                                                                                             |
| <b>Position controller</b> | This monitoring function checks the position deviation limit statical/dynamical. In case the position deviation error is statical/dynamical greater than the adjusted position deviation error limit, there is an error message 'position deviation error statical' and 'position deviation error dynamical'. After monitoring time (position deviation time), additionally an error message is given an immediate pulse inhibit operates.                                                      |
| <b>Safety relay</b>        | This monitoring function checks if the safety relay functions and if the control voltage in order to activate the safety relay is connected. In case of an error the controller either signals an error or a warning, depending on, if the pulse enable is active or not.                                                                                                                                                                                                                       |
| <b>Block-monitoring</b>    | <p>This monitoring function checks the motor speed and the motor current.</p> <p>If, for the period of time 'block monitoring time', the following two conditions are fulfilled, the error/warning 'drive blocked' is given to the controller and an immediate pulse inhibit takes place.</p> <ul style="list-style-type: none"> <li>• Motor speed = 0</li> <li>• the motor current which is supplied by the device is the same as the adjusted motor limit current (current limit).</li> </ul> |

## 8.4 Error detection

In the following we will inform you about the different errors and the consequential error messages. The errors can either be of mechanical or of electrical causes. The devices of the series b maXX® 4400 signal an error status via the lighting up of the lowest red LED H4 on the front side of the cabinet. Additionally the error No. is shown via the 7-segment display on the front side of the cabinet (not BM44XX - XXX - XX0XX and BM44XX - XXX -XX0XX). By the error number the error message can be determined with help of the error list in this manual. Furthermore the error message is shown in the operating software WinBASS II:

- Start the operating program WinBASS II, if it isn't running yet.

### NOTE



In order to work with WinBASS II, the software version of the controller and the WinBASS II version must comply with one another.

In case the software version of the controller and the WinBASS II version do not comply with one another, you will receive the following message:



A further working in this condition is not possible, break up your work and contact Baumüller Nürnberg GmbH in order to receive the right version.

**Only max. 3 LEDs light up**

The meaning of the specific LEDs we explain in [►Figure 51◄](#) on page 87. Here mainly the lowest red LED H4 'Error' is of importance. If this LED lights up, also in WinBASS II at least one error message has been generated.

### NOTE



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

The error message signaled with 'error' is in WinBASS II:

- Open a list in the project tree by clicking on the + in front of 'Management'.

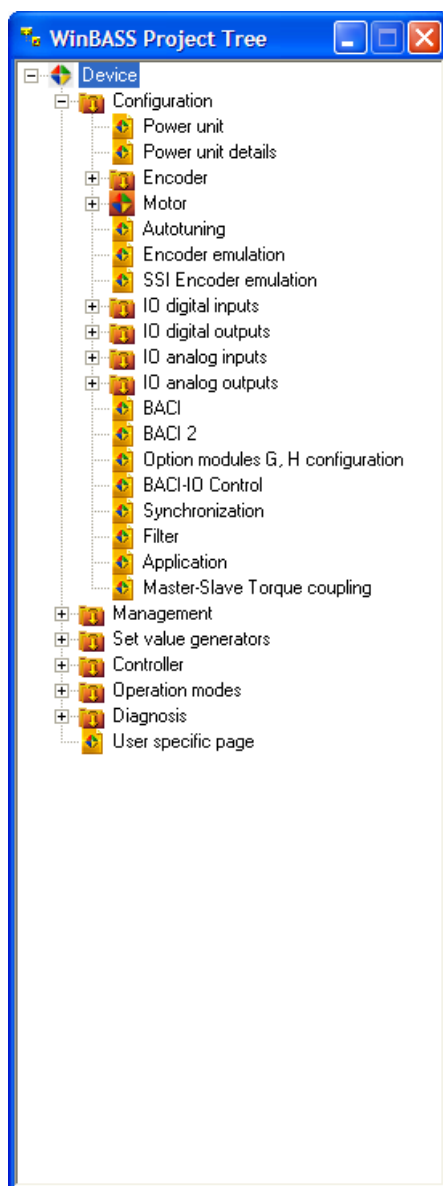


Figure 53: Project tree in WinBASS II

- Select from this list 'Device management'.

In the ►Figure 54◄ on page 108 there is the window 'Device manager' with a few exemplary (error-) messages. The messages in this window demonstrate an internal list, before the communication between controller and pc/laptop with WinBASS II begins, which is arranged according to the error numbers. After take-up of communication the newly occurring messages are added onto the end of the list.

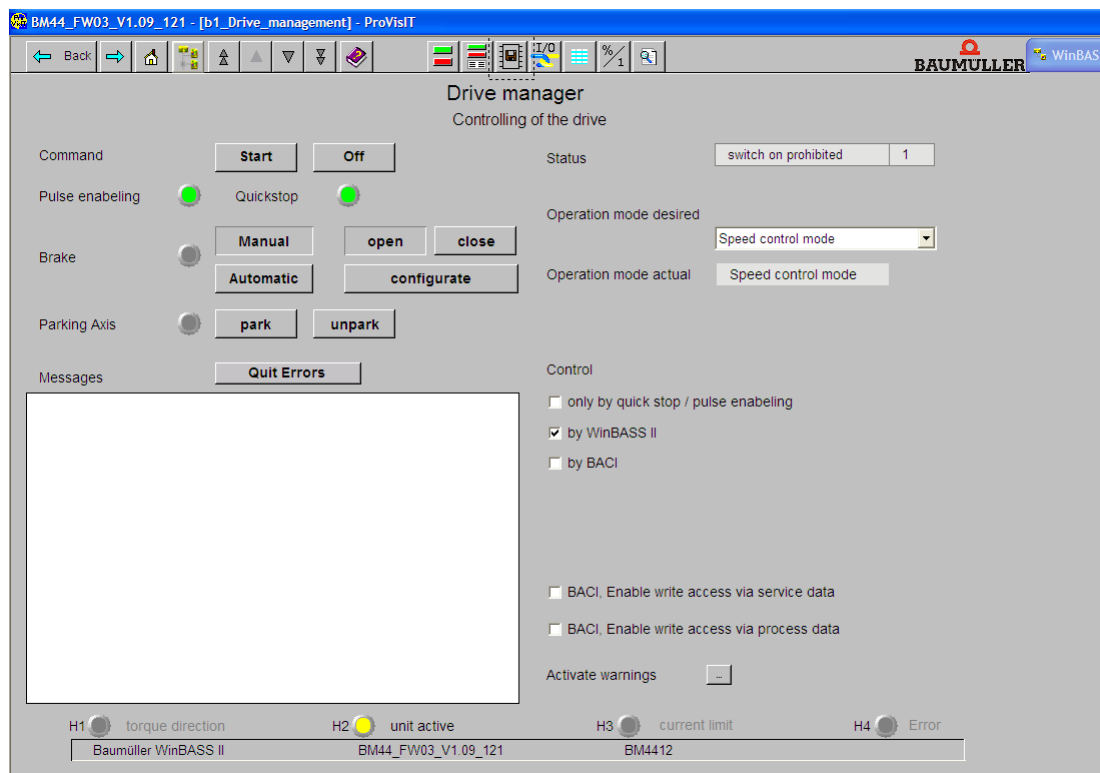


Figure 54: Device manager in WinBASSII

### NOTE



If you are not able to start the motor, although the red LED H4 isn't lighting up and although the LED H2 is lighting up green, check the parameterization of the b maXX4400 with the parameter list in WinBASS II.

Error possibilities are e. g.: torque limit = 0 has been set or notch position is not correct (also see parameter manual b maXX 4400).

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

For troubleshooting you must however know, that the error messages in the system are built up hierarchically, see ►Figure 55◄ on page 109. An error message can result from a beneath in the hierarchic arranged error message. This is why the message 'SysError1' (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 e. g. Sincos-encoder module). This is why you always have to track an error to the lowest level, in order to detect/remove it.

## 8.4.1 Structure of the error list - survey of the error parameter names

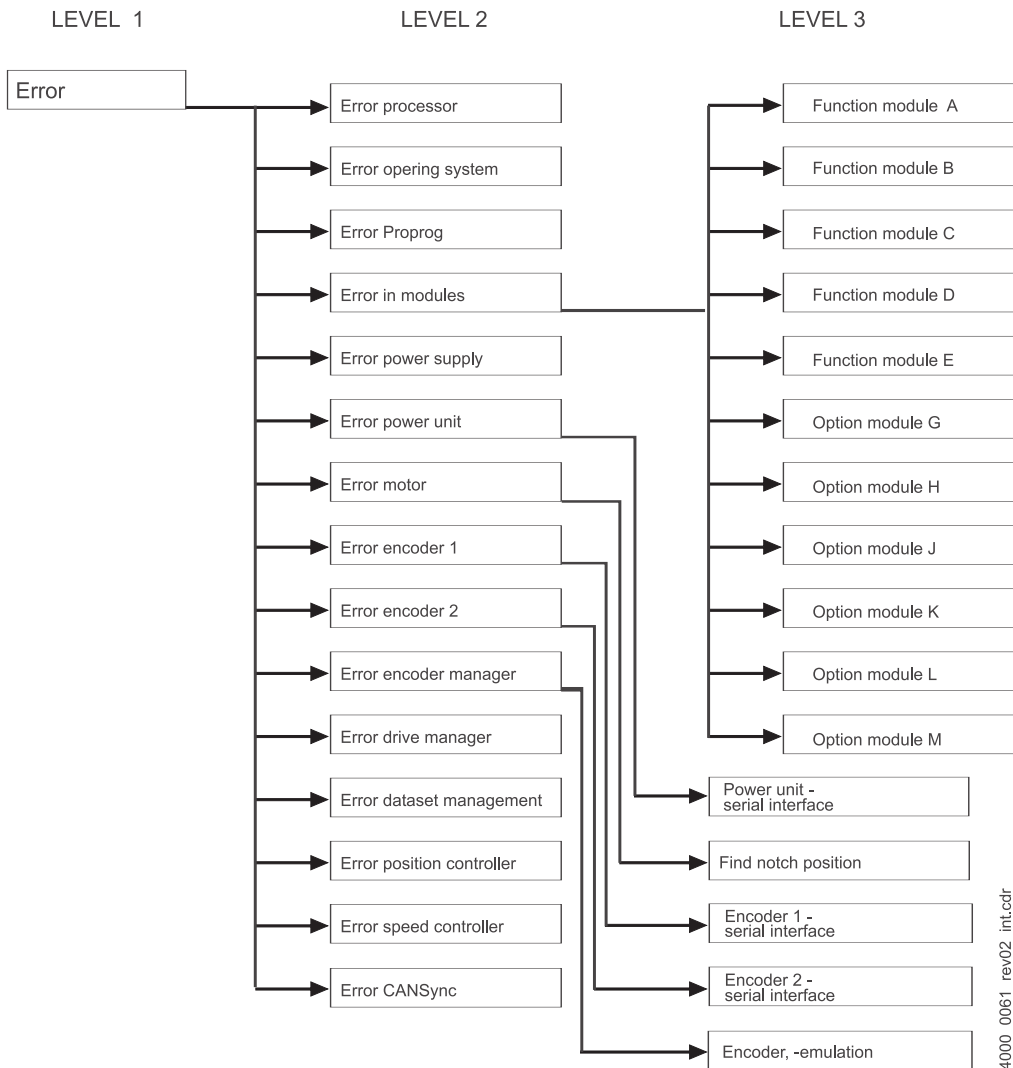


Figure 55: Structure of the error list - survey

## 8.5 Troubleshooting

The error messages are based on the troubleshooting in the b maXX<sup>®</sup> devices, which also are termed as error lists (see [Error parameters - error messages \(error list\) - error reactions](#) from page 111). If an error appears, the according definite error message is displayed within a short time in WinBASS II in the menu „device manager‘, whose meaning you can look up in the error list.

### NOTE



The device is delivered 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.

### 8.5.1 Reset errors

If the red error LED is lighting up, there is at least one error. You can react upon this, by 'resetting' the error in WinBASS II, 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 acceptance causes a resetting of the error, in case the reset was possible due to the error situation.

There are four methods to reset errors:

- Via WinBASS II:  
Use the button "Acknowledge errors" (either in the dialog box "Device manager" or on the page "Device manager"  
Note: If errors shall be acknowledged via WinBASS, the control for WinBASS must be active in parameter Communication source.
- Via writing access to control word (P0300):  
Here a rising edge must be generated in bit 7 (of the control or per input to parameter list of WinBASS II).  
Note For the according communication source the drive control must be active (see parameter P1001 Communication source).



- Via a digital input:  
Via the parameter P0575 digital input for error acknowledge a digital input of a DIO-module can be selected. With the rising edge at this input the errors are acknowledged.
- 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 WinBASS II nor via another communication source). Furthermore the option "Acknowledge 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 acknowledged. 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'.

## 8.5.2 Error parameters - error messages (error list) - error reactions

In the following you will find all error messages. An (error) message is shown in WinBASS II in the window 'device manager'. In the list field „Messages“ you find the (abbreviated) error name, at Hiperface®-errors also the device unit, the error number (not at errors after Hiperface®-specification) and, separated by a colon, the meaning of this error, e. g. „MotorError 96: „Short circuit temperature sensor“. At Hiperface®-errors e. g.: „Encoder 1 communication: „Parity error“.

**1st Level** **SysError1**, only interesting for the access to errors via parameters, to be used without WinBASS II, e. g. at Field bus communication. This error is not shown in WinBASS II.

Bit mapping see description of the parameter P0200.

**2. Level** Next level below SysError1. Here you find errors, which you can remove directly with help of the displayed information or also information on the next level in which the error could be.

We have arranged the error messages according to the survey [► Structure of the error list - survey](#) from page 109.

In the column you find 'Reaction' the reaction of the system to the error:

- 'IS' = pulse inhibit;
- „Adjustable“ = You can set the error reaction via WinBASS II (page „Device manager 2, toolbar button „Error reaction“).
- 'no reaction' means, the drive is continuing to work and the red error LED is blinking.
- In the column 'troubleshooting' you will find hints for troubleshooting:  
Details on this you will find in the 'parameter manual'.

### Error processor P0201

| Error no. | Meaning                                        | Reaction | Troubleshooting                   |
|-----------|------------------------------------------------|----------|-----------------------------------|
| 0         | reserved                                       |          |                                   |
| 1         | Watchdog-Error                                 | IS       | Execute a restart of b maXX® 4400 |
| 2         | Incorrect or unexpected interrupt has occurred | IS       | Execute a restart of b maXX® 4400 |
| 3         | NMI interrupt/bus error                        | IS       | Execute a restart of b maXX® 4400 |
| 4 to 15   | reserved<br>Not assigned = 0                   |          |                                   |

### Error operating system P0202

| Error no. | Meaning                      | Reaction | Troubleshooting                                                                               |
|-----------|------------------------------|----------|-----------------------------------------------------------------------------------------------|
| 16        | Errors while booting         | IS       | Execute a restart of b maXX® 4400                                                             |
| 17        | Software error:              | IS       | Execute a restart of b maXX® 4400                                                             |
| 18        | Time slot configuration      | IS       | Execute a restart of b maXX® 4400                                                             |
| 19        | Time slot - time error       | IS       | Execute a restart of b maXX® 4400;<br>Change configuration of the time slice operation system |
| 20        | 1 = No free memory           | IS       | Execute a restart of b maXX® 4400                                                             |
| 21        | Invalid error code           | IS       | Execute a restart of b maXX® 4400                                                             |
| 22        | Invalid warning code         | IS       | Execute a restart of b maXX® 4400                                                             |
| 23        | False FPGA version           | IS       | Contact Baumüller                                                                             |
| 24 to 31  | reserved<br>Not assigned = 0 |          |                                                                                               |

## Error Proprog communication P203

| Error no. | Meaning                                           | Reaction   | Troubleshooting                                         |
|-----------|---------------------------------------------------|------------|---------------------------------------------------------|
| 32        | Timeout protocol                                  | Adjustable | Execute a restart of b maXX® 4400                       |
| 33        | Protocol structure                                | Adjustable | Execute a restart of b maXX® 4400                       |
| 34        | Wrong module type                                 | Adjustable | Contact Baumüller                                       |
| 35        | too many data in the telegram                     | Adjustable | Contact Baumüller                                       |
| 36        | Not enough data in telegram                       | Adjustable | Contact Baumüller                                       |
| 37        | Invalid operand                                   | Adjustable | Contact Baumüller                                       |
| 38        | Invalid memory type                               | Adjustable | test RAM                                                |
| 39        | Invalid operand address                           | Adjustable | enter a valid address                                   |
| 40        | Value less than the minimum value                 | Adjustable | Check data set and adjust                               |
| 41        | Value greater than the maximum value              | Adjustable | Check data set and adjust                               |
| 42        | Parameter is write-protected                      | Adjustable | Check data set and adjust                               |
| 43        | Parameters in this operation status not writeable | Adjustable | Check operating condition and parameterization          |
| 44        | Invalid parameter value                           | Adjustable | Enter with a valid value                                |
| 45        | Communication error WinBASS controller            | Adjustable | Establish connection again or set parameter P0290 to 0. |
| 46 to 47  | reserved<br>Not assigned = 0                      |            |                                                         |

### Error in function or option modules P0204

| Error no. | Meaning                                               | Reaction      | Troubleshooting                                                                            |
|-----------|-------------------------------------------------------|---------------|--------------------------------------------------------------------------------------------|
| 48        | Error in Function module A                            | Level 3 error | see <a href="#">►Error function module A to E P0240 to P0244◄</a> on page 129 (= 3. level) |
| 49        | Error in Function module B                            | Level 3 error | see <a href="#">►Error function module A to E P0240 to P0244◄</a> on page 129 (= 3. level) |
| 50        | Error in Function module C                            | Level 3 error | see <a href="#">►Error function module A to E P0240 to P0244◄</a> on page 129 (= 3. level) |
| 51        | Error in Function module D                            | Level 3 error | see <a href="#">►Error function module A to E P0240 to P0244◄</a> on page 129 (= 3. level) |
| 52        | Error in Function module E                            | Level 3 error | see <a href="#">►Error function module A to E P0240 to P0244◄</a> on page 129 (= 3. level) |
| 53        | Error in Option module G                              | Level 3 error | see <a href="#">►Error option module G to M P0245 to P0250◄</a> on page 130 (= 3. level)   |
| 54        | Error in Option module H                              | Level 3 error | see <a href="#">►Error option module G to M P0245 to P0250◄</a> on page 130 (= 3. level)   |
| 55        | Error in Option module J                              | Level 3 error | see <a href="#">►Error option module G to M P0245 to P0250◄</a> on page 130 (= 3. level)   |
| 56        | Error in Option module K                              | Level 3 error | see <a href="#">►Error option module G to M P0245 to P0250◄</a> on page 130 (= 3. level)   |
| 57        | Error in Option module L                              | Level 3 error | see <a href="#">►Error option module G to M P0245 to P0250◄</a> on page 130 (= 3. level)   |
| 58        | Error in Option module M                              | Level 3 error | see <a href="#">►Error option module G to M P0245 to P0250◄</a> on page 130 (= 3. level)   |
| 59        | Timeout when waiting for the RST signal of the slaves | IS            | Execute a restart                                                                          |
| 60        | CRC error in SPI transmission module ► controller     | Adjustable    | Error indicates high EMC interferences; please reduce these.<br>Contact Baumüller.         |
| 61        | CRC error in SPI transmission Controller ► module     | Adjustable    | Error indicates high EMC interferences; please reduce these.<br>Contact Baumüller.         |
| 62 to 63  | reserved<br>Not assigned = 0                          |               |                                                                                            |

## Error power supply P0205

| Error no. | Meaning                      | Reaction   | Troubleshooting                                                          |
|-----------|------------------------------|------------|--------------------------------------------------------------------------|
| 64        | Mains failure                | Adjustable | Restore the connection to the power supply                               |
| 65        | Phase failure                | IS         | Check if all phases are correctly connected and voltage-carrying         |
| 66        | Mains undervoltage           | IS         | Assure the compliance with the mains specifications (see techn. data)    |
| 67        | Mains overvoltage            | IS         | Assure the compliance with the mains specifications (see technical data) |
| 68        | Undervoltage 24V             | IS         | Assure the compliance with the mains specifications (see technical data) |
| 68 to 79  | reserved<br>Not assigned = 0 |            |                                                                          |

## Error power unit P0206

| Error no. | Meaning                                                        | Reaction | Troubleshooting                                                                                           |
|-----------|----------------------------------------------------------------|----------|-----------------------------------------------------------------------------------------------------------|
| 80        | Communication error after HIPERFACE <sup>®</sup> specification | IS       | see <a href="#">►Error power unit - serial interface P0233◄</a> on page 124 (= 3. level)                  |
| 81        | Heat sink temperature                                          | IS       | Let the device cool down and/or reduce the load                                                           |
| 82        | U DC link overvoltage                                          | 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 the installation of the device (from b maXX <sup>®</sup> 443x) and check the motor for ground fault |
| 85        | Device internal overtemperature                                | IS       | Make sure of a sufficient ventilation in the device and/or check the temperature of cooling air           |
| 86        | Cable break temperature sensor                                 | IS       | Pass on the device for repair                                                                             |
| 87        | Safety relay off (or defect)                                   | IS       | Check the safety relay, exchange it for a new                                                             |
| 88        | Bridge short-circuit                                           | IS       | Execute a restart. At recurring error messages renew the controller cartridge                             |
| 89        | Power unit not ready-to-operate                                | IS       | Complete the operational readiness to the power unit                                                      |
| 90        | Phase failure                                                  | IS       | Check if all phases are correctly connected and voltage-carrying                                          |

| Error no. | Meaning                      | Reaction | Troubleshooting                                                         |
|-----------|------------------------------|----------|-------------------------------------------------------------------------|
| 91        | Mains failure                | IS       | Restore the mains supply                                                |
| 92        | Mains undervoltage           | IS       | Assure the compliance with the mains specification (see technical data) |
| 93        | Mains overvoltage            | IS       | Assure the compliance with the mains specification (see technical data) |
| 94        | Undervoltage $U_{DC}$ link   | IS       | Check the power connections                                             |
| 95        | reserved<br>Not assigned = 0 |          |                                                                         |

### Error motor P0207

| Error no.  | Meaning                                                             | Reaction   | Troubleshooting                                                                    |
|------------|---------------------------------------------------------------------|------------|------------------------------------------------------------------------------------|
| 96         | Short-circuit temperature sensor ( $T_M \leq -30\text{ °C}$ )       | Adjustable | Remove the short-circuit in the temperature sensor                                 |
| 97         | Temperature sensor - motor not connected ( $T_M > +300\text{ °C}$ ) | Adjustable | Remove open circuit in the temperature sensor circuit                              |
| 98         | Motor overtemperature                                               | IS         | Remove motor over temperature by cooling down and/or reducing the load             |
| 99         | Error $I^2t > 100\%$                                                | IS         | Leave drive in inhibited status until $I^2t$ -actual value decreases under 100 %   |
| 100        | Power unit maximal current > motor maximal current                  | Adjustable | Set power unit maximal current P1241 lower than motor maximal current P0069        |
| 101        | reserved<br>Not assigned = 0                                        |            |                                                                                    |
| 102        | Collective error finding notch position                             | IS         | see <a href="#">►Error finding notch position P0237◄</a> on page 129 (= 3rd level) |
| 103 to 111 | reserved<br>Not assigned = 0                                        |            |                                                                                    |

## Error Encoder1 P0208

| Error no.  | Meaning                                                            | Reaction   | Troubleshooting                                                                                       |
|------------|--------------------------------------------------------------------|------------|-------------------------------------------------------------------------------------------------------|
| 112        | Communication error (Hiperface®-Specification)                     | IS         | see encoder 1 (Hiperface®) P0234 (= 3rd level)                                                        |
| 113        | reserved                                                           |            |                                                                                                       |
| 114        | Error at overwriting of Encoder position information               | IS         | Execute the command again. If the error occurs again, contact Baumüller Nürnberg GmbH.                |
| 115        | Cable break encoder 1                                              | IS         | Remove the cable break in the encoder cable of encoder 1 or check the assignment of the encoder cable |
| 116        | Overspeed encoder 1                                                | IS         | Check the allowable rotational speed for encoder 1                                                    |
| 117        | Amplitude limit exceeded                                           | IS         | Use another encoder                                                                                   |
| 118        | Encoder type unknown                                               | IS         | Check if the correct encoder is connected or use another encoder                                      |
| 119        | Invalid data field for motor data                                  | IS         | Use another encoder                                                                                   |
| 120        | Incorrect motor data                                               | IS         | Use another encoder                                                                                   |
| 121        | Saving error of motor data                                         | IS         | Use another encoder                                                                                   |
| 122        | Motor data write-protected. (is not valid for BM motors)           | IS         | Use another encoder                                                                                   |
| 123        | Field angle error                                                  | IS         | Check the shielding of the encoder cable                                                              |
| 124        | Encoder without temperature measuring                              | Adjustable | Use an encoder module with temperature measuring                                                      |
| 125        | Memory capacity in the encoder for electronic type plate too small | Adjustable | Use another encoder with a greater memory                                                             |
| 126 to 127 | reserved<br>not assigned = 0                                       |            |                                                                                                       |

### Error encoder 2 P0209

| Error no.   | Meaning                                                | Reaction    | Troubleshooting                                                                                 |
|-------------|--------------------------------------------------------|-------------|-------------------------------------------------------------------------------------------------|
| 128         | Communication error (hiperface specification)          | IS          | See encoder 2 (hiperface) P0235 (= 3rd level)                                                   |
| 129         | Module code invalid                                    | IS          | Use a different encoder                                                                         |
| 130         | reserved                                               |             |                                                                                                 |
| 131         | Cable break encoder 2                                  | IS          | Remove the cable break in encoder encoder cable of encoder 2, check assignment of encoder cable |
| 132         | Overspeed encoder 2                                    | IS          | Check the permissible speed for encoder 2                                                       |
| 133         | Amplitude limit exceeded                               | IS          | Use a different encoder                                                                         |
| 134         | Unknown encoder type                                   | IS          | Check, if the correct encoder is connected or use a different encoder                           |
| 135         | Invalid data field for motor data                      | IS          | Use a different encoder                                                                         |
| 136         | Invalid motor data                                     | IS          | Use a different encoder                                                                         |
| 137         | Error at storage of motor data                         | IS          | Use a different encoder <sup>^</sup>                                                            |
| 138         | Motor data write protected.<br>(invalid for BM motors) | IS          | Use a different encoder                                                                         |
| 139         | Field angle error                                      | IS          | Check the screening of the encoder cables                                                       |
| 140         | Encoder without temperature measuring                  | no reaction | Use an encoder module with temperature measuring                                                |
| 141 bis 143 | reserved<br>not assigned = 0                           |             |                                                                                                 |

## Error encoder manager P0210

| Error no. | Meaning                                                                        | Reaction   | Troubleshooting                                                                                                                                                              |
|-----------|--------------------------------------------------------------------------------|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 144       | Absolute position of encoder 1 unknown                                         | IS         | Use another encoder                                                                                                                                                          |
| 145       | Absolute position of encoder 2 unknown                                         | IS         | Use another encoder                                                                                                                                                          |
| 146       | Encoder module 1 is missing                                                    | IS         | Check, if the right encoder is connected to module position A                                                                                                                |
| 147       | Encoder module 2 is missing                                                    | IS         | Check, if the right encoder is connected to module position B                                                                                                                |
| 148       | Encoder module for measured value storage is missing                           | IS         | Install the encoder module                                                                                                                                                   |
| 149       | At resolver no measured value storage possible                                 | IS         | Use a SinCos- or incremental encoder                                                                                                                                         |
| 150       | Triggering not possible, because no incremental encoder                        | IS         | Use for this option an Incremental encoder                                                                                                                                   |
| 151       | Digital I/O-module is missing                                                  | IS         | Install the digital I/O-Module                                                                                                                                               |
| 152       | Incremental encoder emulation module is necessary and is missing               | IS         | Install the incremental encoder-emulation module                                                                                                                             |
| 153       | Encoder module 1 is necessary for incremental encoder emulation and is missing | IS         | Install the encoder module to slot A                                                                                                                                         |
| 154       | Encoder module 2 is necessary for incremental encoder emulation and is missing | IS         | Install encoder module to slot B                                                                                                                                             |
| 155       | Initialization error of the incremental encoder-emulation module               | IS         | Restart system                                                                                                                                                               |
| 156       | Overfrequency of the incremental encoder-emulation module                      | Adjustable | Reduce the speed of the IEE setpoint source or reduce the no. of increments of the IEE module                                                                                |
| 157       | Configuration error of the incremental encoder-emulation module                | IS         | Use for this option an incremental encoder as setpoint source (start of the emulation) or choose the option „zero pulse simultaneously with trace A=1 and B=1“ (only IEE-02) |
| 158       | SSI encoder emulation module is missing                                        | IS         | Install the SSI-encoder-emulation module                                                                                                                                     |
| 159       | reserved<br>not assigned = 0                                                   |            |                                                                                                                                                                              |

### Error device manager P0211

| 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 required data                               | Adjustable | Remove the timeout of the required data communication                                                                   |
| 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        | Error at brake control                              | IS         | Check the wiring and the function of the brake                                                                          |
| 167        | No release of holding brake when starting the drive | IS         | Check the holding brake                                                                                                 |
| 168        | No closing of holding brake at stopping of drive    | Adjustable | Check the holding brake                                                                                                 |
| 169        | Error holding brake status (cyclic monitoring)      | Adjustable | Check the holding brake                                                                                                 |
| 170        | Error holding brake lining                          | Adjustable | Check the holding brake                                                                                                 |
| 171        | Initialize holding brake error                      | IS         | Check, if there is a DIO module, if it is in the correct position and if it is correctly parameterized (also see P0883) |
| 172        | Error holding brake: holding torque not reached     | IS         | Ensure that the torque limits are not set too small<br> P1402  < Min ( P1036 ,  P1037 ,  P1038 )                        |
| 173 to 175 | reserved<br>Not assigned = 0                        |            |                                                                                                                         |

## Error data record manager P0212

| 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 save all data records |
| 178        | Checksum error EEPROM        | IS         | EEPROM faulty or described faulty                                |
| 179        | No boot data set             | IS         | The data in the EEPROM are invalid, please save all data records |
| 180        | Incompatible software        | IS         | The data in the EEPROM are invalid, please save all data records |
| 181        | There is no data set         | Adjustable | The data in the EEPROM are invalid, please save all data records |
| 182        | Checksum error im PSI module | Adjustable | PSI EEPROM faulty or described 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 records    |
| 185        | Autotuning tables invalid.   | Adjustable | Restart autotuning                                               |
| 186        | A/D correction table invalid | Adjustable | Replace the controller cartridge                                 |
| 187        | EEPROM is reset              | IS         | The data in the EEPROM are invalid, please save all data records |
| 188 to 191 | reserved<br>Not assigned = 0 |            |                                                                  |

### Error position controller P0213

| Error no.  | Meaning                                                                                                                                                 | Reaction   | Troubleshooting                                                                               |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----------------------------------------------------------------------------------------------|
| 192        | Position deviation dynamic                                                                                                                              | Adjustable | Remove the dynamical position deviation error                                                 |
| 193        | Position deviation static                                                                                                                               | Adjustable | Remove the statical position deviation error                                                  |
| 194        | Encoder 1 is used for position control, but is inactive.<br>This error is also shown, if the faulty positioning is in one of the inactive data records. | IS         | activate encoder 1                                                                            |
| 195        | Encoder 2 is used for position control, but is inactive.<br>This error is also shown, if the faulty positioning is in one of the inactive data records. | IS         | Activate encoder 2                                                                            |
| 196        | Software limit switch 1 exceeded                                                                                                                        | Adjustable | Check the target position with the by the limit switch enabled travelling range               |
| 197        | Software limit switch 2 exceeded                                                                                                                        | Adjustable | Check the target position with the by the limit switch enabled travelling range               |
| 198        | Hardware limit switch 1 exceeded                                                                                                                        | Adjustable | Check the target position with the by the limit switch enabled travelling range               |
| 199        | Hardware limit switch 2 exceeded                                                                                                                        | Adjustable | Check the target position with the by the limit switch enabled travelling range               |
| 200        | Homing necessary and not yet executed                                                                                                                   | Adjustable | Execute homing                                                                                |
| 201        | Setpoint in mode<br>Set-of-setpoints didn't arrive in time                                                                                              | Adjustable | Assure, that positioning data and handshake take place in time<br>(also see parameter manual) |
| 202 to 207 | Not assigned = 0                                                                                                                                        |            |                                                                                               |

## Error speed controller P0214

| Error no.  | Meaning                                                                                                                                                                                       | Reaction | Troubleshooting                                                                                                                                          |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| 208        | Drive blocked                                                                                                                                                                                 | IS       | Remove the blockade of the drive                                                                                                                         |
| 209        | Encoder 1 is parameterized as encoder for the motor control, but the evaluation is not activated. This error is also shown, if the faulty positioning is in one of the inactive data records. | IS       | You have got to either activate the encoder in the encoder 1 (mode P0150) or you set the encoder 2 as encoder for the position control (parameter P1030) |
| 210        | Encoder 2 is parameterized as encoder for the motor control, but the evaluation is not activated. This error is also shown, if the faulty positioning is in one of the inactive data records. | IS       | You either have got to activate the encoder in the encoder 2 (P0160) or you set the encoder 1 as encoder for the position control (parameter P1030)      |
| 211        | Overspeed<br>Open loop                                                                                                                                                                        | IS       | Check parameterization and reduce speed                                                                                                                  |
| 212 to 223 | Not assigned = 0                                                                                                                                                                              |          |                                                                                                                                                          |

## Error CANsync P0216

| Error no.  | Meaning                     | Reaction             | Troubleshooting                                                            |
|------------|-----------------------------|----------------------|----------------------------------------------------------------------------|
| 240 to 245 | Not assigned = 0            | No reaction          | Check the parameterization of the DC link parameters, see parameter manual |
| 246        | Invalid DIP switch settings | according to setting | Correct the wrong setting of DIP switches on the module                    |
| 247 to 255 | Not assigned = 0            |                      |                                                                            |

### 3. Level Error power unit - serial interface P0233

(communication error to the power unit)

| Error code | Meaning                                  | Troubleshooting                                                              |
|------------|------------------------------------------|------------------------------------------------------------------------------|
| 6          | Data overflow                            | Error indicates high EMC problems; please reduce these.<br>Contact Baumüller |
| 7          | Bit frame error                          | Error indicates high EMC problems; please reduce these.<br>Contact Baumüller |
| 8          | Invalid command state                    | Contact Baumüller                                                            |
| 9          | Parity error                             | Restart of b maXX®                                                           |
| 10         | Checksum error                           | Error indicates high EMC problems; please reduce these.<br>Contact Baumüller |
| 11         | Unknown error code                       | Error indicates high EMC problems; please reduce these.<br>Contact Baumüller |
| 12         | Data number error                        | Error indicates high EMC problems; please reduce these.<br>Contact Baumüller |
| 13         | Invalid argument                         | Error indicates high EMC problems; please reduce these.<br>Contact Baumüller |
| 14         | Data field is write protected            | Error indicates high EMC problems; please reduce these.<br>Contact Baumüller |
| 15         | Invalid access code                      | Error indicates high EMC problems; please reduce these.<br>Contact Baumüller |
| 16         | Data field is not changeable in its size | Error indicates high EMC problems; please reduce these.<br>Contact Baumüller |
| 17         | Word address outside of data field       | Error indicates high EMC problems; please reduce these.<br>Contact Baumüller |
| 18         | Data field is nonexistent                | Error indicates high EMC problems; please reduce these.<br>Contact Baumüller |

| Error code | Meaning             | Troubleshooting                                                              |
|------------|---------------------|------------------------------------------------------------------------------|
| 36         | Wrong data checksum | Error indicates high EMC problems; please reduce these.<br>Contact Baumüller |
| 37         | No response         | Error indicates high EMC problems; please reduce these.<br>Contact Baumüller |
| 66         | Invalid response    | Restart of b maXX®                                                           |

2 encoders can be connected to a b maXX® 4400 at most. Accordingly maximum errors can appear in function module 1 and function module 2. The term 'encoder 1' or 'encoder 2' in the column 'device part' stands for one of the five currently existing encoder module types.

### Error encoder 1 - serial interface P0234

### Error encoder 2 - serial interface P0235

(communication error after Hiperface specification in the encoder 1 /encoder 2)

| Error code | Meaning                                     | Troubleshooting                                                          |
|------------|---------------------------------------------|--------------------------------------------------------------------------|
| 1          | Analog signals outside specification        | Check the encoder cable and if the encoder has been connected correctly. |
| 2          | Error in internal angle offset              | Check the encoder cable and if the encoder has been connected correctly. |
| 3          | Data field partitioning table destroyed     | Check the encoder cable and if the encoder has been connected correctly. |
| 4          | Analog limit values not available           | Check the encoder cable and if the encoder has been connected correctly. |
| 5          | Internal I <sup>2</sup> C-bus not operative | Check the encoder cable and if the encoder has been connected correctly. |
| 6          | Internal checksum error                     | Check the encoder cable and if the encoder has been connected correctly. |
| 7          | Internal watchdog error - encoder reset     | Check the encoder cable and if the encoder has been connected correctly. |
| 8          | Overflow of the counter                     | Check the encoder cable and if the encoder has been connected correctly. |
| 9          | Parity error                                | Check the encoder cable and if the encoder has been connected correctly. |
| 10         | Checksum error                              | Check the encoder cable and if the encoder has been connected correctly. |
| 11         | Unknown error code                          | Check the encoder cable and if the encoder has been connected correctly. |
| 12         | Data number error                           | Check the encoder cable and if the encoder has been connected correctly. |
| 13         | Invalid argument                            | Check the encoder cable and if the encoder has been connected correctly. |
| 14         | Data field is write protected               | Check the encoder cable and if the encoder has been connected correctly. |
| 15         | Invalid access code                         | Check the encoder cable and if the encoder has been connected correctly. |
| 16         | Data field is not changeable in its size    | Check the encoder cable and if the encoder has been connected correctly. |
| 17         | Word address outside of data field          | Check the encoder cable and if the encoder has been connected correctly. |
| 18         | Data field is nonexistent                   | Check the encoder cable and if the encoder has been connected correctly. |

| Error code | Meaning                                          | Troubleshooting                                                          |
|------------|--------------------------------------------------|--------------------------------------------------------------------------|
| 19 to 27   | reserved                                         |                                                                          |
| 28         | Absolute monitoring of the analog signals        | Check the encoder cable and if the encoder has been connected correctly. |
| 29         | Transmission current critical                    | Check the encoder cable and if the encoder has been connected correctly. |
| 30         | Encoder temperature critical                     | Check the motor temperature                                              |
| 31         | Speed too high - no position generation possible | Check the encoder cable and if the encoder has been connected correctly. |
| 32         | Position singleturn unreliable                   | Internal encoder error<br>Contact Baumüller                              |
| 33         | Multiturn position error                         | Internal encoder error<br>Contact Baumüller                              |
| 34         | Multiturn position error                         | Internal encoder error<br>Contact Baumüller                              |
| 35         | Multiturn position error                         | Internal encoder error<br>Contact Baumüller                              |
| 36         | Invalid power unit data checksum                 | Check the encoder cable and if the encoder has been connected correctly. |
| 37         | No response from encoder                         | Check the encoder cable and if the encoder has been connected correctly. |
| 38         | Encoder address unknown                          | Check the encoder cable and if the encoder has been connected correctly. |
| 39         | Error reading the absolute angle position        | Check the encoder cable and if the encoder has been connected correctly. |
| 40         | Invalid checksum of received data                | Check the encoder cable and if the encoder has been connected correctly. |
| 41         | Unknown encoder type                             | Check the encoder cable and if the encoder has been connected correctly. |
| 42 to 63   | reserved                                         |                                                                          |
| 64         | No response of Hiperface® encoder                | Check the encoder cable and if the encoder has been connected correctly. |
| 65         | No response from EnDat encoder                   | Check the encoder cable and if the encoder has been connected correctly. |
| 66         | Useless response to encoder command              | Check the encoder cable and if the encoder has been connected correctly. |
| 67 to 79   | reserved                                         |                                                                          |
| 80         | CRC has determined an error                      | Check the encoder cable and if the encoder has been connected correctly. |

| Error code | Meaning                                                                                    | Troubleshooting                                                          |
|------------|--------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| 81         | Invalid command                                                                            | Check the encoder cable and if the encoder has been connected correctly. |
| 82         | Error in response telegram                                                                 | Check the encoder cable and if the encoder has been connected correctly. |
| 83         | Alarm bit is set                                                                           | Restart the system                                                       |
| 84         | Memory is occupied                                                                         | Check the encoder cable and if the encoder has been connected correctly. |
| 85         | Incorrect data checksum                                                                    | Check the encoder cable and if the encoder has been connected correctly. |
| 86         | Motor data length and/or data version of encoder and controller firmware are not identical | Check the encoder cable and if the encoder has been connected correctly. |
| 87         | No EnDat interface                                                                         | Check the encoder cable and if the encoder has been connected correctly. |
| 88         | Exceeding of transmission format which is able to be evaluated                             | Use another Length measuring system type                                 |
| 89         | Exceeding of the evaluable measuring step                                                  | Use another Length measuring system type                                 |
| 90         | Signal period length < measuring step length                                               | Use another Length measuring system type                                 |
| 91 to 95   | reserved                                                                                   |                                                                          |
| 96         | Error lighting                                                                             | Exchange encoder                                                         |
| 97         | Error signal amplitude                                                                     | Exchange encoder                                                         |
| 98         | Error position value                                                                       | Exchange encoder                                                         |
| 99         | Error overvoltage                                                                          | Exchange the encoder module                                              |
| 100        | Error undervoltage                                                                         | Exchange the encoder module                                              |
| 101        | Error overcurrent                                                                          | Exchange the encoder module                                              |
| 102        | Error battery                                                                              | Exchange encoder                                                         |

## Error finding notch position P0237

| Error code | Meaning             | Troubleshooting                                                                                                                                                                                                  |
|------------|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0          | Overcurrent step 1  | Method 2:<br>Increase maximum current P1241,<br>decrease voltage amplitude P2122                                                                                                                                 |
| 1          | Overcurrent step 2  | Method 2:<br>Increase maximum current P1241,<br>decrease voltage amplitude P2122                                                                                                                                 |
| 2          | Plausibility step 1 | Method 0:<br>Check direction of rotation P0087,<br>current is too low or shaft is not free enough to move<br><br>Method 2:<br>Increase voltage amplitude P2122                                                   |
| 3          | Plausibility step 2 | Method 2:<br>Increase voltage amplitude P2123.<br>If P2123 is already at its maximum, decrease the current frequency P2121<br>(only values = $15,625 \text{ Hz} \cdot 2^n$ with $n = 1,2,3,4,5,6$ are permitted) |
| 15 ... 4   | Not assigned = 0    |                                                                                                                                                                                                                  |

## Error function module A to E P0240 to P0244

| Error code | Meaning                                              | Reaction   | Troubleshooting                                                     |
|------------|------------------------------------------------------|------------|---------------------------------------------------------------------|
| 0          | reserved error                                       |            |                                                                     |
| 1          | Module not recognized                                | Adjustable | Check if you have plugged in the right module at the right position |
| 2          | Module not permitted at this position                | Adjustable | Check if you have plugged in the right module at the right position |
| 3          | 24 V missing or output short-circuited               | Adjustable | Check the cabling of the digital outputs                            |
| 4          | Invalid target parameter value by digital input      | Adjustable | Check the parameterization of the input channel                     |
| 5          | Direct PLC-I/O access for this module not permitted. | Adjustable | Don't select the module                                             |
| 6          | reserved error                                       |            |                                                                     |
| 7          | Module in controller not permitted                   | IS         | Remove the module                                                   |
| 8 to 15    | reserved error                                       |            |                                                                     |

### Error option module G to M P0245 to P0250

| Error code | Meaning                                         | Reaction   | Troubleshooting                            |
|------------|-------------------------------------------------|------------|--------------------------------------------|
| 4096       | Wrong parameter no. at setpoint parameter 1     | Adjustable | Check the according setpoint parameter     |
| 4097       | Wrong parameter no. at setpoint parameter 2     | Adjustable | Check the according setpoint parameter     |
| 4098       | Wrong parameter no. at setpoint parameter 3     | Adjustable | Check the according setpoint parameter     |
| 4099       | Wrong parameter no. at setpoint parameter 4     | Adjustable | Check the according setpoint parameter     |
| 4100       | Wrong parameter no. at setpoint parameter 5     | Adjustable | Check the according setpoint parameter     |
| 4101       | Wrong parameter no. at setpoint parameter 6     | Adjustable | Check the according setpoint parameter     |
| 4102       | Wrong parameter no. at setpoint parameter 7     | Adjustable | Check the according setpoint parameter     |
| 4103       | Wrong parameter no. at setpoint parameter 8     | Adjustable | Check the according setpoint parameter     |
| 4104       | Wrong parameter no. at setpoint parameter 9     | Adjustable | Check the according setpoint parameter     |
| 4105       | Wrong parameter no. at setpoint parameter 10    | Adjustable | Check the according setpoint parameter     |
| 4106       | Wrong parameter no. at setpoint parameter 11    | Adjustable | Check the according setpoint parameter     |
| 4107       | Wrong parameter no. at setpoint parameter 12    | Adjustable | Check the according setpoint parameter     |
| 4108       | Wrong parameter no. at setpoint parameter 13    | Adjustable | Check the according setpoint parameter     |
| 4109       | Wrong parameter no. at setpoint parameter 14    | Adjustable | Check the according setpoint parameter     |
| 4110       | Wrong parameter no. at setpoint parameter 15    | Adjustable | Check the according setpoint parameter     |
| 4111       | Wrong parameter no. at setpoint parameter 16    | Adjustable | Check the according setpoint parameter     |
| 4112       | Wrong parameter no. at actual value parameter 1 | Adjustable | Check the according actual value parameter |
| 4113       | Wrong parameter no. at actual value parameter 2 | Adjustable | Check the according actual value parameter |

| Error code | Meaning                                          | Reaction   | Troubleshooting                                                              |
|------------|--------------------------------------------------|------------|------------------------------------------------------------------------------|
| 4114       | Wrong parameter no. at actual value parameter 3  | Adjustable | Check the according actual value parameter                                   |
| 4115       | Wrong parameter no. at actual value parameter 4  | Adjustable | Check the according actual value parameter                                   |
| 4116       | Wrong parameter no. at actual value parameter 5  | Adjustable | Check the according actual value parameter                                   |
| 4117       | Wrong parameter no. at actual value parameter 6  | Adjustable | Check the according actual value parameter                                   |
| 4118       | Wrong parameter no. at actual value parameter 7  | Adjustable | Check the according actual value parameter                                   |
| 4119       | Wrong parameter no. at actual value parameter 8  | Adjustable | Check the according actual value parameter                                   |
| 4120       | Wrong parameter no. at actual value parameter 9  | Adjustable | Check the according actual value parameter                                   |
| 4121       | Wrong parameter no. at actual value parameter 10 | Adjustable | Check the according actual value parameter                                   |
| 4122       | Wrong parameter no. at actual value parameter 11 | Adjustable | Check the according actual value parameter                                   |
| 4123       | Wrong parameter no. at actual value parameter 12 | Adjustable | Check the according actual value parameter                                   |
| 4124       | Wrong parameter no. at actual value parameter 13 | Adjustable | Check the according actual value parameter                                   |
| 4125       | Wrong parameter no. at actual value parameter 14 | Adjustable | Check the according actual value parameter                                   |
| 4126       | Wrong parameter no. at actual value parameter 15 | Adjustable | Check the according actual value parameter                                   |
| 4127       | Wrong parameter no. at actual value parameter 16 | Adjustable | Check the according actual value parameter                                   |
| 4128       | Invalid value at setpoint parameter no. 1        | Adjustable | Make sure that you have got correct values within the permitted value range. |
| 4129       | Invalid value at setpoint parameter no. 2        | Adjustable | Make sure that you have got correct values within the permitted value range. |
| 4130       | Invalid value at setpoint parameter no. 3        | Adjustable | Make sure that you have got correct values within the permitted value range. |
| 4131       | Invalid value at setpoint parameter no. 4        | Adjustable | Make sure that you have got correct values within the permitted value range. |
| 4132       | Invalid value at setpoint parameter no. 5        | Adjustable | Make sure that you have got correct values within the permitted value range. |

| Error code | Meaning                                                                                                  | Reaction   | Troubleshooting                                                              |
|------------|----------------------------------------------------------------------------------------------------------|------------|------------------------------------------------------------------------------|
| 4133       | Invalid value at setpoint parameter no. 6                                                                | Adjustable | Make sure that you have got correct values within the permitted value range. |
| 4134       | Invalid value at setpoint parameter no. 7                                                                | Adjustable | Make sure that you have got correct values within the permitted value range. |
| 4135       | Invalid value at setpoint parameter no. 8                                                                | Adjustable | Make sure that you have got correct values within the permitted value range. |
| 4136       | Invalid value at setpoint parameter no. 9                                                                | Adjustable | Make sure that you have got correct values within the permitted value range. |
| 4137       | Invalid value at setpoint parameter no. 10                                                               | Adjustable | Make sure that you have got correct values within the permitted value range. |
| 4138       | Invalid value at setpoint parameter no. 11                                                               | Adjustable | Make sure that you have got correct values within the permitted value range. |
| 4139       | Invalid value at setpoint parameter no. 12                                                               | Adjustable | Make sure that you have got correct values within the permitted value range. |
| 4140       | Invalid value at setpoint parameter no. 13                                                               | Adjustable | Make sure that you have got correct values within the permitted value range. |
| 4141       | Invalid value at setpoint parameter no. 14                                                               | Adjustable | Make sure that you have got correct values within the permitted value range. |
| 4142       | Invalid value at setpoint parameter no. 15                                                               | Adjustable | Make sure that you have got correct values within the permitted value range. |
| 4143       | Invalid value at setpoint parameter no. 16                                                               | Adjustable | Make sure that you have got correct values within the permitted value range. |
| 4144       | Invalid value for Setpoint period                                                                        | Adjustable | Make sure that you have got correct values within the permitted value range. |
| 4145       | Invalid value for Actual value period                                                                    | Adjustable | Make sure that you have got correct values within the permitted value range. |
| 4146       | False value for Cycle offset setpoints                                                                   | Adjustable | Make sure that you have got correct values within the permitted value range. |
| 4147       | False value for Cycle offset actual values                                                               | Adjustable | Make sure that you have got correct values within the permitted value range. |
| 4148       | BACI timeout at cyclic data                                                                              | Adjustable | Check the communication rate with the adjusted timeout P0839                 |
| 4149       | BACI timeout at Service data                                                                             | Adjustable |                                                                              |
| 4150       | Check results in faulty checksum                                                                         | IS         | Execute a restart by switching on and off                                    |
| 4151       | ramp-up Timeout when waiting for the slave type or when waiting for the resetting of config-pending-flag | Adjustable | Execute a restart by switching on and off                                    |
| 4152       | Invalid data transfer structure type                                                                     | Adjustable | Contact Baumüller                                                            |

| Error code | Meaning                                                       | Reaction   | Troubleshooting                                                |
|------------|---------------------------------------------------------------|------------|----------------------------------------------------------------|
| 4153       | Internal error: Wrong BACI status                             | Adjustable | Contact Baumüller                                              |
| 4154       | Access conflicts with slave at cyclic Communication:          | Adjustable | Contact Baumüller                                              |
| 4155       | Error cyclic Communication: Parameter value wrong             | Adjustable | Contact Baumüller                                              |
| 4156       | Error cyclic Communication: Alive-counter conflict            | Adjustable | Check the value of the transmitted parameter                   |
| 4157       | Cmd interface: Channel number wrong (0 or > 6)                | Adjustable | Check if the option module and the controller are synchronous. |
| 4158       | Cmd interface: The channel which was indicated does not exist | Adjustable | Contact Baumüller                                              |
| 4159       | Cmd interface: Internal error - wrong pointer                 | Adjustable | Contact Baumüller                                              |
| 4160       | Cmd interface: Internal error - wrong status                  | Adjustable | Contact Baumüller                                              |
| 4161       | Cmd interface: Wrong package number                           | Adjustable | Contact Baumüller                                              |
| 4162       | Cmd interface: Wrong command number                           | Adjustable | Contact Baumüller                                              |
| 4163       | Cmd interface: Wrong status when handling the package         | Adjustable | Contact Baumüller                                              |
| 4164       | Cmd interface: Timeout at command processing                  | Adjustable | Contact Baumüller                                              |
| 4165       | Cmd interface: Wrong package length                           | Adjustable | Contact Baumüller                                              |
| 4166       | Cmd interface: Descriptor not available                       | Adjustable | Contact Baumüller                                              |
| 4167       | Cmd interface: Wrong package type                             | Adjustable | Contact Baumüller                                              |
| 4168       | Cmd interface: Checksum error                                 | Adjustable | Contact Baumüller                                              |
| 4169       | Module identification: PCI-error when reading                 | Adjustable | Check the reliability performance of the option module         |
| 4170       | Module identification: PCI-error when writing                 | Adjustable | Check the reliability performance of the option module         |
| 4171       | Module identification: general Reading error                  | Adjustable | Check the reliability performance of the option module         |
| 4172       | Module identification: general Error at writing               | Adjustable | Check the reliability performance of the option module         |
| 4173       | Internal error                                                | Adjustable | Contact Baumüller                                              |

| Error code   | Meaning                                                            | Reaction   | Troubleshooting                                                                                                                |
|--------------|--------------------------------------------------------------------|------------|--------------------------------------------------------------------------------------------------------------------------------|
| 4174         | Configuration cyclic services: Parameters are not cyclic writeable | Adjustable | Select another parameter                                                                                                       |
| 4175         | Configuration cyclic services: Invalid parameter number            | Adjustable | Select another parameter                                                                                                       |
| 4176         | Wrong option module error code                                     | Adjustable | Contact Baumüller                                                                                                              |
| 4177 to 8191 | reserved                                                           |            |                                                                                                                                |
| 8192         | Error CANopen timeout on CAN bus                                   | Adjustable | Error node guarding<br>Additional data is available in the programming manual CANopen Slave for b maXX <sup>®</sup> controller |

### 8.5.3 Parameter description – warnings (warning bit list)

#### Warning power supply P0261

| Warning no. | Meaning            | Troubleshooting                                                                                                           |
|-------------|--------------------|---------------------------------------------------------------------------------------------------------------------------|
| 0           | not used = 0       |                                                                                                                           |
| 1           | Undervoltage 24V   | Assure the compliance with the specification<br>(see ► <a href="#">Appendix D - Technical data</a> ◄ from page 161)       |
| 2           | Mains undervoltage | Assure the compliance with the mains specification<br>(see ► <a href="#">Appendix D - Technical data</a> ◄ from page 161) |
| 3           | Mains overvoltage  | Assure the compliance with the mains specification<br>(see ► <a href="#">Appendix D - Technical data</a> ◄ from page 161) |
| 4           | Mains failure      | Restore the mains supply                                                                                                  |
| 5           | Phase failure      | Check if all phases are correctly connected and voltage-carrying                                                          |
| 6 to 15     | not used = 0       |                                                                                                                           |

## Warnings power unit P0262

| Warning no. | Meaning                                       | Troubleshooting                                                                                                                |
|-------------|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| 16          | Inside 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          | Timeout charge process DC link                | Check the correct order of mains phases (clockwise rotating field!) and avoid that the DC link supplies energy while charging. |
| 19          | not used = 0                                  |                                                                                                                                |
| 20          | Safety relay not controlled                   | Check the cabling of the safety relay                                                                                          |
| 21 to 22    | reserved warning                              |                                                                                                                                |
| 23          | Difference of voltage<br>Mains DC link > 40 V | Check the power connections                                                                                                    |
| 24          | Ixt-threshold 1 is exceeded                   | Take steps, so that the Ixt actual value doesn't exceed 100%                                                                   |
| 25 to 31    | not used = 0                                  |                                                                                                                                |

## Warnings motor P0263

| Warning no. | Meaning                             | Troubleshooting                      |
|-------------|-------------------------------------|--------------------------------------|
| 32          | Temperature threshold 1 exceeded    | Reduce the power output of the motor |
| 33          | Temperature threshold 2 exceeded    | Reduce the power output of the motor |
| 34          | I <sup>2</sup> t threshold exceeded | Reduce the power output of the motor |
| 35 to 47    | not used = 0                        |                                      |



# MAINTENANCE

In this chapter we describe, how you can safely maintain your device.

## 9.1 Safety instructions

- Refer to ► [Fundamental safety instructions](#) ◀ from page 11.
- Refer to the danger areas of the devices.

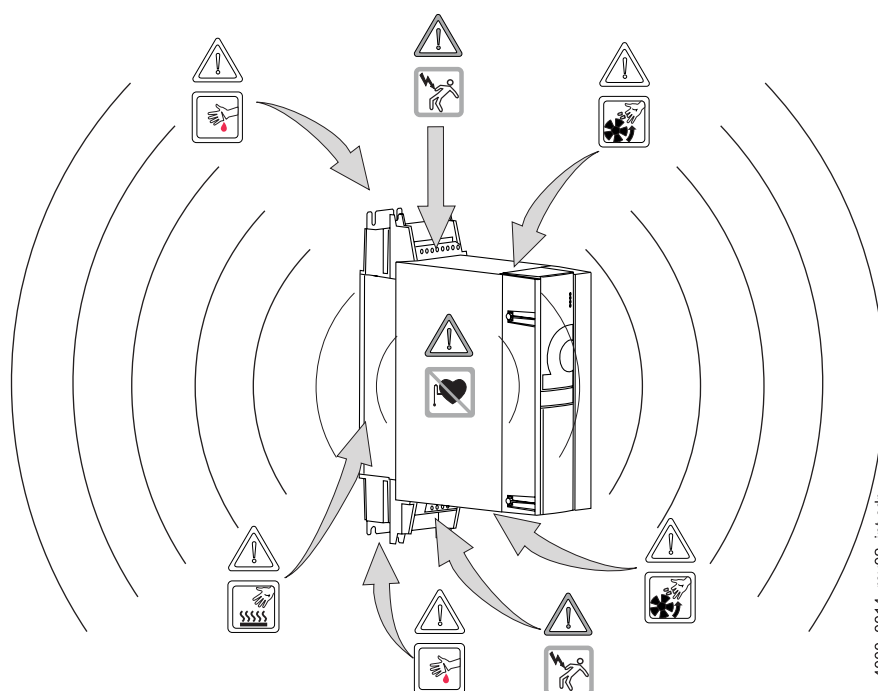


Figure 56: Danger areas BM441X, BM442X, BM443X and BM444X

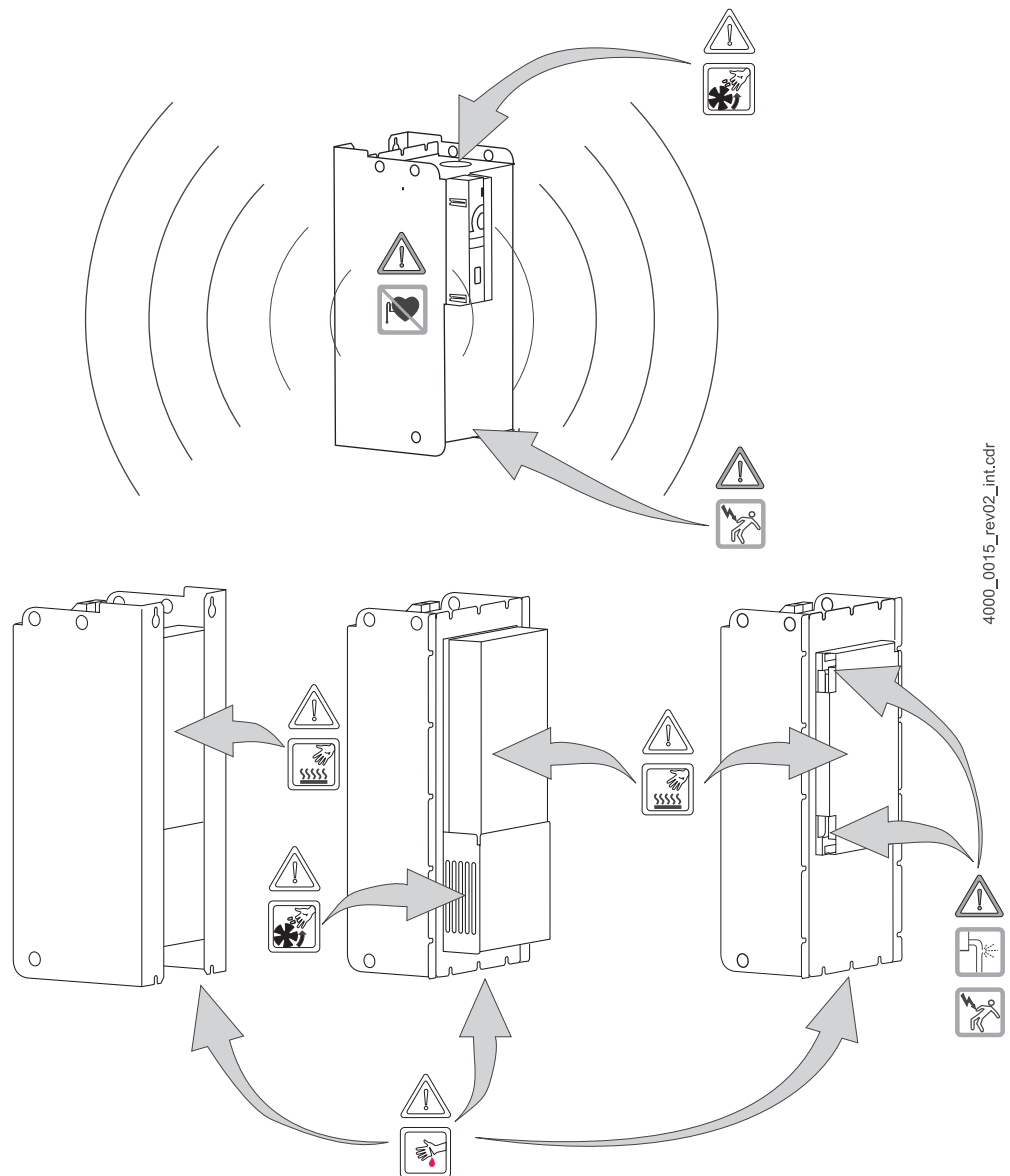


Figure 57: Danger areas BM445X, BM446X and BM447X

## 9.2 Environmental conditions

If the prescribed environmental conditions are complied with, the device is maintenance-free. The prescribed environmental conditions are to be found in chapter [►Appendix D - Technical data◄](#) from page 161. The most important prescribed environmental conditions are:

- dustless ambient air
- Temperature: min. 5 °C bis max. 55 °C (pay attention to the over 40 °C derating!)
- Relative air humidity: 5% to 85%, no condensation

### 9.3 Inspection intervals - maintenance notes

Baumüller Nürnberg GmbH recommends a steady checking of the environmental conditions. Thus you will receive the possibility, to react immediately, in case the actual conditions deviate from the prescribed conditions.

#### WARNING



The following **may occur**, if you disregard these safety notes:

- serious personal injury • death



*The danger is: **electricity**. The unit carries dangerous voltages and currents, as well as residual charges in the DC link.*

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 discharging of the DC link, before maintenance work is carried out. The capacitors, which are used in the device of the DC link are **10 min.** after interruption of the supply voltage discharge so far, that the connections can be demounted without danger. If you have additional capacitors connected to the DC link, the discharging of the DC link also can last much longer. In this case you must determine the necessary delay time yourself and you must determine the deenergization at all terminals of the device (also see [►Dangers due to residual energy◄](#) on page 23).

- Check at least once a day the equipment at the control cabinet, which ensure the required environmental air (e.g. air filters).
- Maintain the air filters according to the indications of the manufacturer.

In the case of polluted environmental air, the required cooling air rate can not be reached anymore, if dirt deposits narrow/block up the ventilation slots. If the devices are dirty, contact Baumüller Nürnberg GmbH, in order to initiate a servicing or send the device to the company for inspection.

#### WARNING



The following **may occur**, if you disregard these safety notes:

- serious personal injury • death



*The danger is: **electricity**. The device can be damaged by incorrect maintenance in such a way, that a safe operating isn't possible anymore.*

Do not maintain the device yourself.

Never remove dirt deposits especially in the inside of the device with sharp objects like screwdrivers or by the usage of e. g. compressed air, steam jet appliances/high pressure cleaners.



## REPAIR

In this chapter we describe, where the devices are repaired.

### WARNING



The following **may occur**, if you disregard these safety notes:

- serious personal injury • death



*The danger is: **electricity**. After a faulty repair the device doesn't fulfill the safety instructions anymore.*

Have the devices be commissioned only by  
Baumüller Nürnberg GmbH or the authorized service points.



# SHUTDOWN, STORAGE

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

## 11.1 Safety instructions

- Refer to [►Fundamental safety instructions◄](#) from page 11 and the information in [►Transportation and packing◄](#) from page 25.

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



### DANGER

**The following** will occur, if you disregard this safety note:

- serious personal injury • death

*The danger is: **Electricity and electrical charge, which was saved.** Electrical connections, which are not in a current-free state, carry hazardous voltage levels. The modules in the device (e. g. capacitors) also can carry hazardous charges after it was switched off!*

Assure, that all electric connections are current-free and are safe against re-start.

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.

The capacitors which are used in the device are **10 min.** after interruption of supply voltage discharged so far, that the connections can be demounted without danger. Dependent on the size of the device there are different discharging times. These you find from [►D.6 Electrical data - BM441X basic unit◄](#) from page 167. If you have additional capacitors connected to the DC link, the discharging of the DC link also can last much longer. In this case you must determine the necessary delay time self (also see [►Dangers due to residual energy◄](#) on page 23).

### 11.2 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.

### 11.3 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.

### 11.4 Demounting

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

#### CAUTION

The following **may occur**, if you disregard these safety notes:

- minor to medium personal injury.

*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.*



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 [►To be considered by transportation◄](#) on page 25.

In case you want to dispose the device, additional data is available in chapter [►Disposal◄](#) from page 147.

## 11.5 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

The following **can occur**, if you disregard this warning instruction:

- Property damage

*The danger is: **incorrect environmental conditions**. Incorrect storage can damage/destroy the device.*

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

- Climatic category 1 K 4
- Temperature range - 30 °C bis + 70 °C

*The danger is: **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.

## 11.6 Recommissioning

Execute commissioning as with a new device, see  
[►Mounting◄](#) from page 37, [►Installation◄](#) from page 63



*The danger is: **recommissioning without forming of the capacitors**. From six months storage period on, the capacitors can be destroyed during commissioning, if they are not formed beforehand.*

- Form 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

In this chapter we describe the correct and safe disposal of the devices of the series **b maXX®**. During the disposal you will mainly get metal parts (iron- and non-iron metal), electronic scrap and plastics.

### NOTE



Baumüller products do not belong to the scope of the EU guideline for the disposal of electrical and electronics devices (WEEE, 2002/96/EG). Therefore, no costs are to be carried by Baumüller for the canceling and disposal of old devices.

### 12.1 Safety instructions

► Refer to ► [Fundamental safety instructions](#) ◄ from page 11.

### DANGER



The following **will occur**, if you disregard this safety note:

- serious personal injury • death



*The danger is: **electricity**. The containing components in the device (e. g. capacitors) can contain dangerous charges! The capacitors used in the device are after **10 min.** automatically so far discharged, that they can be demounted without danger.*

If you have additional capacitors connected to the DC link, the discharging of the DC link also can last much longer. In this case you must determine the necessary delay time self (also see ► [Dangers due to residual energy](#) ◄ on page 23).

Demount the capacitors only then, if you have verified yourself of the isolation from supply.



### CAUTION

The following **may occur**, if you disregard these safety notes:

- minor to medium personal injury.

*The danger is: **sharp edges**. The components of the device, sheet metal components, heat sinks and so on can have sharp edges!*

*In case you lift a device during demounting with non-protected hands, your fingers/palms can be cut. If the device falls off, your feet can be cut up.*



Wear safety gloves



Wear safety shoes



### WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury • death

*The danger is: **mechanical effects**. A device of the size 446X weighs 70,0 kg and can injure you seriously or even kill you, if it falls off.*

Assure, that the device cannot fall off, by appropriate actions like supports, cranes, helpers.



### CAUTION

The following **can occur**, if you disregard this warning instruction:

- Environmental pollution

*The danger is: **incorrect disposal**.*

You may only dispose under consideration of the safety instructions. If necessary, also refer to the local regulations. In case you cannot execute a secure disposal, contact a certified disposal business.

*Dangerous materials may result or may be set free from a fire.*

Do not expose electronic components to high temperatures.

*The inner insulation e. g. various power semiconductors hold beryllium oxide. When opened, the beryllium dust is dangerous to your health.*

Do not open the electronical components.

## 12.2 Requirements to the executing personnel

The personnel, whom you instruct to dispose/demount the device must have the knowledge and training to execute these works properly. The personnel is to be selected in such a way, that the safety instructions on the device and its parts is understood and referred to by the personnel.

## 12.3 Disposal instructions

### Preconditions

- The device has already properly been demounted.
- All technical appliances for demounting are prepared and are technically in good order and condition.

### 12.3.1 Modules

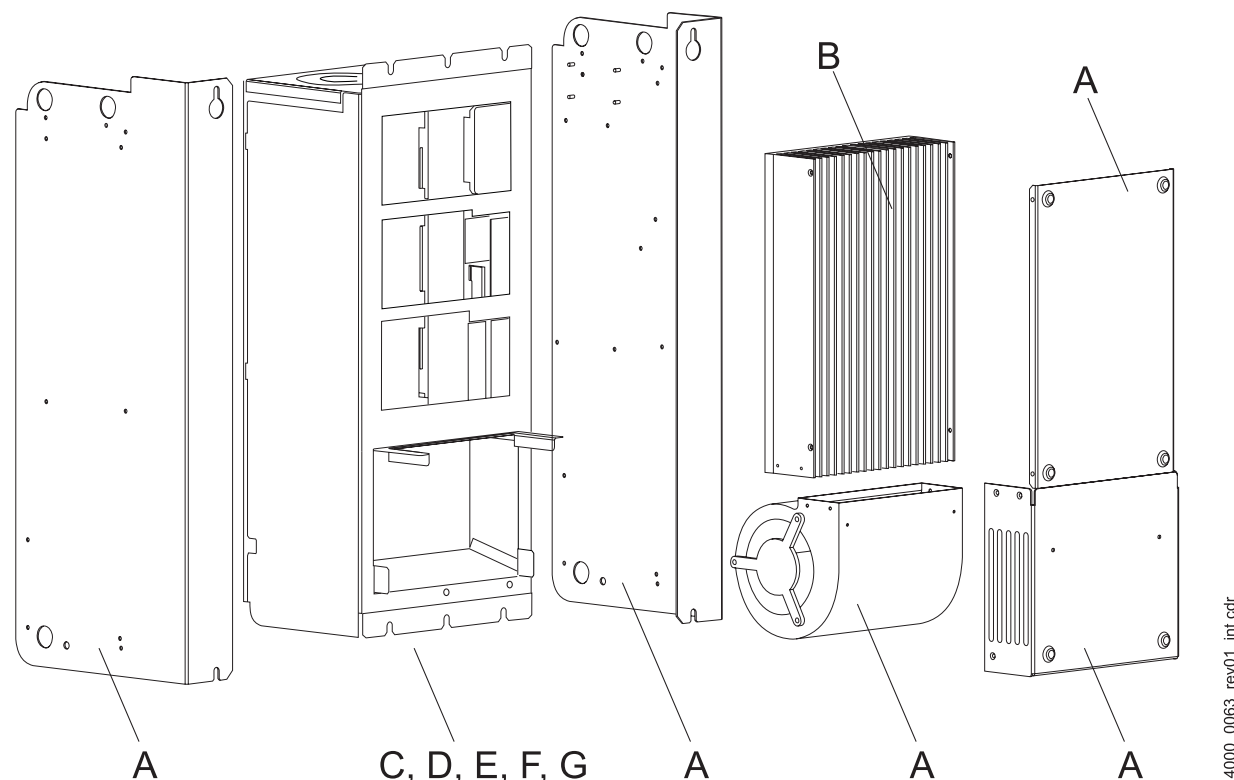


Figure 58: Demounting scheme

The components/modules given in round brackets you will find in the above figure.

#### Sheet steel

(A) Sheet steel must be given to the iron metal recycling.

#### Aluminium

(B) Aluminium must be given to the non-iron metal recycling.

#### Aluminium/copper compound

(C) Aluminium/copper compound must be given to the non-iron metal recycling.

#### Plastics

(D) The plastic parts of the housing as well as the plastic covers and further small plastic parts must be given to the plastics recycling.



### CAUTION

The following **can occur**, if you disregard this warning instruction:

- Environmental pollution

*The danger is: **incorrect disposal**.*

Capacitors, semiconductor modules and electronic scrap is to be recycled as special waste.

---

|                              |                                                                                                                                                              |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Capacitors</b>            | <b>(E)</b> Capacitors are to be recycled as special waste. Thereby refer to the relevant instructions.                                                       |
| <b>Semiconductor modules</b> | <b>(F)</b> Semiconductor modules are to be recycled as special waste. Thereby refer to the relevant instructions.                                            |
| <b>Electronic scrap</b>      | <b>(G)</b> The electronic scrap from PCBs, which no further can be demounted, must be recycled as special waste. Thereby refer to the relevant instructions. |

## 12.4 Recycling plants/offices

---

Assure, that the disposal is carried out according to your company's regulations and the regulations of the disposal companies and official administrations. In case of doubt, contact the local business administration, which is responsible for your company or the environmental office.



## APPENDIX A - ABBREVIATIONS

|               |                                                                            |                          |                                                |
|---------------|----------------------------------------------------------------------------|--------------------------|------------------------------------------------|
| <b>A</b>      | Ampere                                                                     | <b>EXT, ext</b>          | external                                       |
| <b>AC</b>     | Alternating current                                                        | <b>FI</b>                | Residual current                               |
| <b>AIO</b>    | Function module analog input/output                                        | <b>FIO</b>               | Function module fast digital input output      |
| <b>ASCII</b>  | American Standard Code for Information Interchange                         | <b>GL</b>                | Synchronous operation                          |
| <b>BACI</b>   | Baumüller drives communication interface                                   | <b>HLG</b>               | Ramp function generator                        |
| <b>BB</b>     | Ready-to-operate                                                           | <b>HS</b>                | Main contactor                                 |
| <b>BBext</b>  | Ready-to-operate (external)                                                | <b>HSE</b>               | Main contactor on                              |
| <b>BBint</b>  | Ready-to-operate (internal)                                                | <b>HSF</b>               | Main contactor enable                          |
| <b>BCC</b>    | Block Check Character                                                      | <b>î</b>                 | Peak current, curve shape not defined          |
| <b>BSA</b>    | Reference potential analog                                                 | <b>I2t</b>               | Function module overload monitoring            |
| <b>BSD</b>    | Reference potential digital                                                | <b>I<sub>AC</sub></b>    | Effective value, alternating current           |
| <b>CAL</b>    | CAN Application Layer                                                      | <b>I<sub>Aist</sub></b>  | Armature current actual value                  |
| <b>CAN</b>    | Network for controller ambience                                            | <b>I<sub>DC</sub></b>    | Effective value, direct current                |
| <b>CiA</b>    | CAN in Automation                                                          | <b>I<sub>eff</sub></b>   | Effective value, alternating current           |
| <b>COB-ID</b> | Identification for CAN object                                              | <b>IF</b>                | Impulse enable                                 |
| <b>CPU</b>    | Central processing unit                                                    | <b>I<sub>F</sub></b>     | Field current                                  |
| <b>DC</b>     | Direct current                                                             | <b>I<sub>Fmax</sub></b>  | Maximum field current (nominal current)        |
| <b>DIN</b>    | Deutsches Institut für Normung e.V. (German Institute for Standardization) | <b>I<sub>Fmin</sub></b>  | Minimum field current                          |
| <b>DIO</b>    | Function module digital input/output                                       | <b>I<sub>Fsoll</sub></b> | Field current setpoint value                   |
| <b>DSV</b>    | Data set manager                                                           | <b>IEE</b>               | Function module incremental encoder emulation  |
| <b>EDS</b>    | Electronic data sheet                                                      | <b>ID-no.</b>            | Identification number                          |
| <b>EMF</b>    | Electromotive force                                                        | <b>Inc</b>               | Counting unit of position                      |
| <b>EMC</b>    | Electromagnetic compatibility                                              | <b>Ink</b>               | PPR count of incremental encoder               |
| <b>EN</b>     | European standard                                                          | <b>IS</b>                | Impulse inhibit                                |
| <b>ENC</b>    | Function module incremental encoder                                        | <b>ISO</b>               | International Organization for Standardization |
| <b>ESD</b>    | Electrostatic discharge                                                    | <b>I<sub>soll</sub></b>  | Armature current setpoint                      |
|               |                                                                            | <b>IW</b>                | Actual value                                   |

|                         |                                                              |            |                                                                   |
|-------------------------|--------------------------------------------------------------|------------|-------------------------------------------------------------------|
| <b>IWK</b>              | Actual value channel                                         | <b>VDE</b> | Association for Electrical, Electronic & Information Technologies |
| <b>LT</b>               | Power unit                                                   | <b>VE</b>  | Logic element                                                     |
| <b>M24</b>              | Reference potential 24 V                                     | <b>ZK</b>  | DC-link                                                           |
| <b>MR1</b>              | Torque direction 1                                           |            |                                                                   |
| <b>MR2</b>              | Torque direction 2                                           |            |                                                                   |
| <b>n = 0</b>            | Speed = 0                                                    |            |                                                                   |
| <b>n<sub>ist</sub></b>  | Speed actual value                                           |            |                                                                   |
| <b>n<sub>max</sub></b>  | Maximum speed                                                |            |                                                                   |
| <b>n<sub>min</sub></b>  | Minimum speed                                                |            |                                                                   |
| <b>NN</b>               | Altitude over sea level                                      |            |                                                                   |
| <b>n<sub>soll</sub></b> | Speed setpoint value                                         |            |                                                                   |
| <b>PDO</b>              | Process data object                                          |            |                                                                   |
| <b>PE</b>               | Protective conductor                                         |            |                                                                   |
| <b>PELV</b>             | Protective extra-low voltage with safety separation, earthed |            |                                                                   |
| <b>POS</b>              | Positioning                                                  |            |                                                                   |
| <b>PSI</b>              | Program Storage Interface                                    |            |                                                                   |
| <b>PWM</b>              | Function module pulse-width modulation                       |            |                                                                   |
| <b>PZD</b>              | Process data                                                 |            |                                                                   |
| <b>R<sub>A</sub></b>    | Armature resistance                                          |            |                                                                   |
| <b>RF</b>               | Controller enable                                            |            |                                                                   |
| <b>SDO</b>              | Service data object                                          |            |                                                                   |
| <b>SELV</b>             | Safety extra-low voltage with safety separation              |            |                                                                   |
| <b>SIE</b>              | Function module SSI encoder emulation                        |            |                                                                   |
| <b>SM</b>               | Synchronous motor                                            |            |                                                                   |
| <b>SR</b>               | Safety relay                                                 |            |                                                                   |
| <b>SW</b>               | Setpoint value, software                                     |            |                                                                   |
| <b>SWG</b>              | Setpoint value generator                                     |            |                                                                   |
| <b>SYNC</b>             | Synchronization message                                      |            |                                                                   |
| <b>TM</b>               | Motor temperature sensor                                     |            |                                                                   |
| <b>U</b>                | Voltage                                                      |            |                                                                   |
| <b>Ū</b>                | Peak voltage                                                 |            |                                                                   |
| <b>U<sub>A</sub></b>    | Armature voltage                                             |            |                                                                   |
| <b>U<sub>AC</sub></b>   | Effective value, alternating voltage                         |            |                                                                   |
| <b>U<sub>DC</sub></b>   | Effective value, direct-current voltage                      |            |                                                                   |
| <b>U<sub>eff</sub></b>  | Effective value, alternating voltage                         |            |                                                                   |
| <b>U<sub>ZK</sub></b>   | DC-link voltage                                              |            |                                                                   |
| <b>V</b>                | Volt                                                         |            |                                                                   |
| <b>VBG</b>              | German Ministerial Occupation Co-operative                   |            |                                                                   |



## APPENDIX B - SPARE PARTS AND ACCESSORIES

In this appendix we are listing the spare-/accessory parts for the devices of the series **b maXX®**. In case you have questions and suggestions according the accessories, do not hesitate to contact our product management.

### B.1 Interface cable



#### NOTE

Screening of the interface cables, which are used may only be connected to the controller side with the connector housing.

In case the interface cable set for **b maXX®** is used, the connection of cable screen with the Sub-D-plug housing must be interrupted PC-sided. (also see [►X1 \(RS 232\)◄](#) on page 92).

| Interface   | Identification     | Length | Item number |
|-------------|--------------------|--------|-------------|
| X1 (RS 232) | Interface cable PC | 3 m    | 213 846     |
| X1 (RS 232) | Interface cable PC | 5 m    | 213 283     |
| X1 (RS 232) | Interface cable PC | 15 m   | 231 086     |

Other lengths on request.

### B.2 Dust cover and connector

|                                                                                                    | 4412<br>4413 <sup>1)</sup> | 4412<br>4413 <sup>2)</sup> | 4414 <sup>1)</sup> | 4414 <sup>2)</sup> | 442X | 443X | 444X | 445X | 446X | 447X | Part no. |
|----------------------------------------------------------------------------------------------------|----------------------------|----------------------------|--------------------|--------------------|------|------|------|------|------|------|----------|
| <b>Dust cover (yellow) narrow</b>                                                                  | X                          | -                          | X                  | -                  | -    | -    | -    | -    | -    | -    | 351209   |
| <b>Dust cover (yellow) wide</b>                                                                    | -                          | X                          | -                  | X                  | X    | X    | X    | X    | X    | X    | 351210   |
| <b>Connector 'Motor'</b><br>Phoenix: GIC 2.5/4-ST-7.62, 1828825                                    | X                          | X                          | X                  | X                  | -    | -    | -    | -    | -    | -    | 354746   |
| <b>Connector „1C1/1D1“ or „1C1/1D1/Ba“</b><br>Phoenix: GIC 2.5/4-ST-7.62, 1828825                  | X                          | X                          | X                  | X                  | -    | -    | -    | -    | -    | -    | 354746   |
| <b>Connector '1C1/1D1/Ba'</b><br>Phoenix: GIC 2.5/2-ST-7.62                                        | -                          | -                          | X                  | X                  | -    | -    | -    | -    | -    | -    | 381872   |
| <b>Connector 'mains'</b><br>Phoenix: GMSTB 2.5/4-ST-1766903<br>Wieland: 8313B/4 OBG, 25.360.3453.7 | X                          | X                          | X                  | X                  | -    | -    | -    | -    | -    | -    | 309377   |
| <b>Connector X3</b><br>Phoenix: FK-MCP 1.5/6-ST-3.81, 1851083                                      | X                          | X                          | X                  | X                  | X    | X    | X    | X    | X    | X    | 354874   |
| <b>Connector X100 and X101</b><br>Wieland: 8513 BFK - 25.630.3653.0                                | X                          | X                          | X                  | X                  | X    | X    | X    | X    | X    | X    | 354810   |
| <b>Connector X102<sup>3)4)</sup></b><br>Phoenix: FK-MCP 1.5/4-ST-3.81, 1851067                     | -                          | -                          | -                  | -                  | -    | X    | X    | X    | X    | X    | 363845   |
| Wieland: 8513 BFK, 25.630.3453.7                                                                   | X                          | X                          | X                  | X                  | X    | -    | -    | -    | -    | -    | 354809   |
| <b>Connector X103<sup>4)</sup></b><br>Phoenix: FK-MCP 1.5/4-ST-3.81, 1851067                       | -                          | -                          | -                  | -                  | -    | X    | X    | X    | X    | X    | 363845   |

<sup>1)</sup> BM441X - XXX - 01

<sup>2)</sup> BM441X - XXX - 02

<sup>3)</sup> BM44XX - XX1, BM44XX - XX3

<sup>4)</sup> BM44XX - XX2, BM44XX - XX4



## APPENDIX C - DECLARATION OF CONFORMITY/ BY MANUFACTURER, UL - CERTIFICATION

In this section we provide general information about EU directives, the CE symbol and the Declaration of Conformity/by Manufacturer.

### C.1 What is an EU directive?

---

EU directives specify requirements. The directives are written by the relevant bodies within the EU and are implemented by all the member countries of the EU in national law. In this way the EU directives guarantee free trade within the EU.

An EU directive only contains essential minimum requirements. You will find detailed requirements in standards, to which references are made in the directive.

### C.2 What the CE symbol indicates

---

*a) The CE marking symbolizes conformity to all the obligations incumbent on manufacturers for the product by virtue of the Community directives providing for its affixing.*

...

*b) The CE marking affixed to industrial products symbolizes the fact that the natural or legal person having affixed or been responsible for the affixing of the said marking has verified that the product conforms to all the Community total harmonization provisions which apply to it and has been the subject of the appropriate conformity evaluation procedures.*

...

*Council Decision 93/465/EEC, Annex I B. a) + c)*

We affix the CE mark to the equipment and to the documentation as soon as we have established that we have satisfied the requirements of the relevant directives.

All converters and control systems supplied by the Baumüller Nürnberg GmbH satisfy the requirements of 73/23/EEC (Low Voltage Directive).

As all converters and control systems comply with the requirements of the harmonized standards EN50178, EN 60204-1, EN 60529 and HD625.1 S1, the protection targets of 73/23/EEC are reached.

With specified application of this Baumüller equipment in your machinery, you can act on the assumption that the equipment satisfies the requirements of 98/37/EG (machinery directive). Therefore the equipment is developed and constructed in such a way, that the requirements of the harmonized standard EN 60204-1 can be met by the electrical installation.

Compliance with 89/336/EEC (EMC Directive) depends on how the equipment is installed. Since you are performing installation yourself, it is you who are responsible for complying with 89/336/EEC.

A declaration of conformity on the EMC directive therefore cannot be issued.

We will provide you with support in the form of EMC information. You will find this information in the operating manual and in "filters for main applications". When you have complied with all the requirements we impose in this documentation, you can assume that the drive satisfies the requirements of the EMC Directive.

The limit values and requirements for variable-speed electrical drives are determined in the harmonized product standard EN 61800-3. If you are erecting an installation, for which a declaration of conformity on the EMC directive must be generated, it may be necessary to specify several harmonized standards, which you have used for the compliance of the protection targets of the directive. The harmonized product standard EN 61800-3 has to be used with electrical drives.

To enable you to market your machine within the EU, you must be in possession of the following:

- Conformity mark (CE mark)
- Declaration(s) of Conformity regarding the directive(s) relevant to the machine

---

### **C.3 Definition of the term Declaration of Conformity**

---

A Declaration of Conformity as defined by this documentation is a declaration that the electrical equipment brought into circulation conforms to all the relevant fundamental safety and health requirements.

By issuing the Declaration of Conformity in this section the Baumüller Nürnberg GmbH declares that the equipment conforms to the relevant fundamental safety and health requirements resulting from the directives and standards which are listed in the Declaration of Conformity.

---

### **C.4 Definition of the term Manufacturer's Declaration**

---

A Declaration by Manufacturer as defined by this documentation is a declaration that the machine/safety component brought into circulation conforms to all the relevant fundamental safety and health requirements.

By issuing the Declaration of Conformity in this section the Baumüller Nürnberg GmbH declares that the equipment conforms to the relevant fundamental safety and health requirements resulting from the directives and standards which are listed in the Declaration of Conformity.

The Baumüller equipment is integrated into a machine. For health and safety, of the users for example, it is important for the entire machine to conform to all the relevant fundamental safety and health requirements. For this reason the Baumüller Nürnberg GmbH draws attention in the Declaration by Manufacturer to the fact that it is prohibited to put the machine as a whole into operation before it has been declared that the machine conforms to the provisions of the Machinery Directive.

## C.5 Declaration of Conformity

### EU-Konformitätserklärung

#### Declaration of Conformity

gemäß EG-Richtlinie 2006/95/EG (Niederspannungsrichtlinie) vom 12.12.2006

in accordance with EC directive 2006/95/EG (low voltage directive) dated 12.12.2006

BM441X - XTX - 0XXXX - XX  
 BM442X - XTX - XXXXX - XX  
 BM443X - XXX - XXXXX - XX  
 BM444X - XXX - XXXXX - XX  
 BM445X - XXX - XXXXX - XX  
 BM446X - XXX - XXXXX - XX  
 BM447X - XXX - 0XXXX - XX

Das obige Gerät wurde entwickelt und konstruiert sowie anschließend gefertigt in alleiniger Verantwortung von:

The unit specified above was developed and constructed as well as manufactured under liability of:

**Baumüller Nürnberg GmbH, Ostendstr. 80 - 90, D-90482 Nürnberg**

Berücksichtigte Normen - used standards:

Norm / standard

|              |                                                                                                                        |
|--------------|------------------------------------------------------------------------------------------------------------------------|
| EN 61800-3   | EMV-Anforderung für drehzahlveränderbare elektrische Antriebe<br>EMC requirements for speed variable electrical drives |
| EN 61800-5-1 | Sicherheit für drehzahlveränderbare elektrische Antriebe<br>Safety requirements for speed variable electrical drives   |

Nürnberg, 24.10.2007

  
 ppa. Dr. Peter Heidrich  
 Entwicklungsleiter  
 Head of development

  
 i.A. Olaf Köslich  
 Gruppenleiter Entwicklung  
 Team manager development

**C.6 Declaration by Manufacturer**

---

## EU-Herstellererklärung

### Declaration by Manufacturer

gemäß EU-Richtlinie 89/336/EWG (EMV) vom 03.05.1989

in accordance with EC directive 89/336/EWG (EMC) dated 03.05.1989

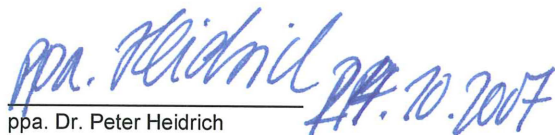
**BM441X - XTX - 0XXXX - XX**  
**BM442X - XTX - XXXXX - XX**  
**BM443X - XXX - XXXXX - XX**  
**BM444X - XXX - XXXXX - XX**  
**BM445X - XXX - XXXXX - XX**  
**BM446X - XXX - XXXXX - XX**  
**BM447X - XXX - 0XXXX - XX**

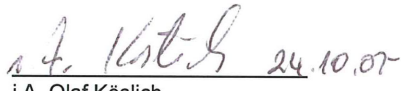
Die Inbetriebnahme der Maschine, in die dieses Gerät eingebaut wird, ist untersagt bis die Konformität der Maschine mit der obengenannten Richtlinie erklärt ist.

The machinery into which this unit is to be incorporated must not be put into service until the machinery has been declared in conformity with the provisions of the directive mentioned.

**Baumüller Nürnberg GmbH, Ostendstr. 80 - 90, D- 90482 Nürnberg**

Nürnberg, 24.10.2007

  
ppa. Dr. Peter Heidrich  
Entwicklungsleiter  
Head of development

  
i.A. Olaf Köslich  
Gruppenleiter Entwicklung  
Team manager development

## C.7 UL-certification

UL is a mark of conformity, which is assigned from **Underwriters Laboratories Inc.** ([www.ul.com](http://www.ul.com)), an American company. The UL-certification is not statutory regulated, but takes place voluntarily.

In order to be allowed to mark equipments and components with the UL-mark of conformity, tests must have to be done, which are attended and documented by an UL-inspector. Only if all necessary tests have been passed and regular product monitoring at the production process of the equipment or the components has been passed without objections, the UL-mark of conformity may be attached to the equipment under test.

Line filters of the company Baumüller Nürnberg GmbH are checked in accordance of the UL-standard UL 508C (UL-Standard for Safety for Power Conversion Equipment) and are recorded under the category control number NMMS. The product- and test description is recorded under file-no. E179860.

Only if all necessary tests have been completely carried out the -mark may be attached to the equipments or components. If single tests have not already taken place at the manufacturer's, but are carried out not until at the user's, then only the -mark may be attached.

With products of the Baumüller Nürnberg GmbH all tests are already completed at the UL-certification process, so that they may be marked with the -mark.

In case with the UL-certification process also standards of the CSA (**C**anadian **S**tandard **A**ssociation) are considered, then instead of the - or -mark the  or -mark may be attached to the product.

With products of the company Baumüller Nürnberg GmbH the CSA-standard Norm C 22.2 was considered, that's why they are marked with the -mark.

If products of Baumüller Nürnberg GmbH are mounted into an UL-certified installation, then certain application-, mounting- and installation notices must be considered, which are upon the functioning of the device. We have marked these notes in the manual with „UL 508C ...“. Only if you follow these notes and apply to them you may go by it, that the installation has been mounted UL-conform.

The converters of the b maXX<sup>®</sup> line listed below are accredited and carry the -mark:

BM4412-XXX-XXXX-XX,  
BM4413-XXX-XXXX-XX

BM4432-XXX-XXXX-XX,  
BM4433-XXX-XXXX-XX,  
BM4434-XXX-XXXX-XX,  
BM4435-XXX-XXXX-XX

BM4422-XXX-XXXX-XX,  
BM4423-XXX-XXXX-XX,  
BM4424-XXX-XXXX-XX,  
BM4425-XXX-XXXX-XX,  
BM4426-XXX-XXXX-XX

BM4452-XXX-XXXX-XX,  
BM4453-XXX-XXXX-XX,  
BM4454-XXX-XXXX-XX

BM4443-XXX-XXXX-XX,  
BM4444-XXX-XXXX-XX,  
BM4445-XXX-XXXX-XX

BM4462-XXX-XXXX-XX,  
BM4463-XXX-XXXX-XX





## APPENDIX D - TECHNICAL DATA

In this chapter you find the detailed technical data for all sizes of the device series **b maXX® BM4400**.

## D.1 Requirements on the power supply

### D.1 Requirements on the power supply

|                                                                                                                                                    |                                          |                                                                                                                                                                                                    |
|----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Mains                                                                                                                                              | BM44XX - XTX <sup>12)</sup>              | Industrial system with direct or low impedance grounded star point (TN-mains or TT-mains)                                                                                                          |
|                                                                                                                                                    | BM44XX - XIX                             | Industrial supply network with a grounded star point (IT-system), which has no or high impedance<br>Industrial system with direct or low impedance earthed junction of phases (grounded delta wye) |
| Inductance<br>(sum of mains inductance and mains choke inductance)                                                                                 | BM441X, BM442X                           | min. $u_k = 0,4\%$ max. $u_k = 4\%$                                                                                                                                                                |
|                                                                                                                                                    | BM4426, BM443X, BM444X                   | min. $u_k = 2,4\%$ max. $u_k = 4\%$                                                                                                                                                                |
|                                                                                                                                                    | BM445X, BM446X, BM447X                   | min. $u_k = 4\%$ max. $u_k = 6\%$                                                                                                                                                                  |
| Rated mains input voltage/-frequency <sup>1) 8)</sup> ( $U_{AC}$ ) device                                                                          |                                          | 3 x 400 V<br>50/60 Hz                                                                                                                                                                              |
| Absolute minimum supply voltage device <sup>1) 8)</sup> ( $U_{ACmin}$ )<br>Absolute maximum supply voltage device <sup>1) 8)</sup> ( $U_{ACmax}$ ) |                                          | 3 x 207 V / 50/60 Hz<br>3 x 528 V / 50/60 Hz                                                                                                                                                       |
| Absolute minimum frequency <sup>9)</sup><br>Absolute maximum frequency <sup>9)</sup>                                                               |                                          | 47 Hz<br>63 Hz                                                                                                                                                                                     |
| Harmonics (mains voltage)                                                                                                                          |                                          | $THD_U \leq 10\%$ <sup>2)</sup>                                                                                                                                                                    |
| Unbalanced mains voltage                                                                                                                           |                                          | max. 3% <sup>3)</sup>                                                                                                                                                                              |
| Commutating dip                                                                                                                                    |                                          | Depth of dip < 40%, area < 250% x degree <sup>2)</sup>                                                                                                                                             |
| Voltage dip                                                                                                                                        |                                          | 10% to 100% <sup>11) 1)</sup>                                                                                                                                                                      |
| Voltage variations/-fluctuations                                                                                                                   |                                          | +/-10% <sup>10)</sup><br>+10% to -15% at duration $\leq 1$ min <sup>10)</sup>                                                                                                                      |
| Max. short-circuit current mains <sup>7)</sup>                                                                                                     |                                          | 18000 A                                                                                                                                                                                            |
| Rated mains input voltage<br>-frequency ( $U_{AC}$ ) fan <sup>6)</sup>                                                                             | BM444X-S/A,<br>BM445X-S/A,<br>BM446X-S/A | 230 V $\pm 10\%$<br>50/60 Hz                                                                                                                                                                       |
|                                                                                                                                                    | BM447X-S/A                               | 3 x 400 V $\pm 10\%$<br>50/60 Hz                                                                                                                                                                   |
| Control voltage <sup>4)</sup> ( $U_{DC}$ )                                                                                                         |                                          | + 24 V -15% / +20% <sup>5)</sup>                                                                                                                                                                   |

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

<sup>2)</sup> EN 61800-3, chapter 5.2.1, class 3

<sup>3)</sup> EN 61000-2-4, tab. 1, class 3

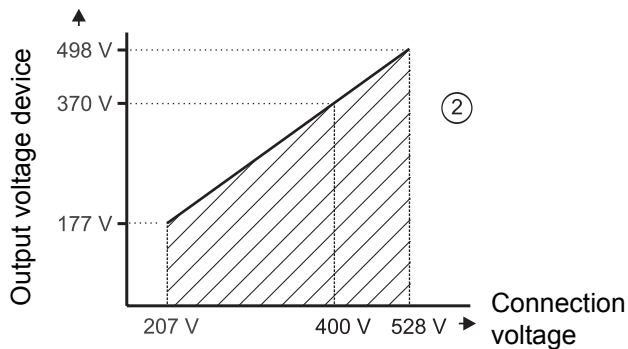
<sup>4)</sup> The control voltage must accord to PELV (EN 61800-5-1, chapter 3.2.14) or SELV (EN 61800-5-1, chap. 3.2.28).  
At control voltage of < 24 V the ventilation power output is reduced. It, therefore, may be necessary, to reduce the output currents as well.  
In case you refer to UL508C: limit the current to 4 A with UL-listed fuses and to a voltage of max. 30 V<sub>DC</sub>.

<sup>5)</sup> Referring to EN61131-2:1994, table 7. Output power of the power supply unit: see 'power loss referring to control voltage' in 'electrical data - BM44XX'.

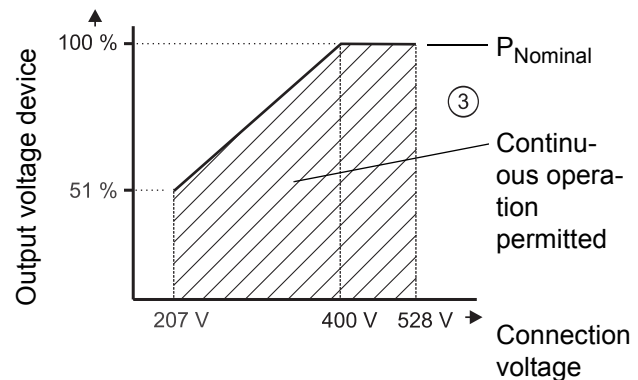
<sup>6)</sup> Is only valid for BM444X/BM445X/BM446X cooling versions S and A and BM447X cooling version A.

<sup>7)</sup> Only necessary in order to comply with UL508C.

- 8) The rated voltage is 400 V.  
At mains input voltage is below 400 V the output power of the device reduces (see curves).
- 9) Change rate of mains frequency max. 1 Hz/s (EN 61000-2-4, class 3)
- 10) EN 61200-2-4, class 3
- 11) EN 61200-2-1
- 12) The connection or operation of a device with the marking BM44XX-XTX at an IT system or at a grounded delta wye is not permissible.



② Curve 'output voltage'



- ③ If you multiply the output current with the output voltage you will get the output power of the device.

$$S_{\text{output}} = U_{\text{output}} \times I_{\text{output}} \times \sqrt{3}$$

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

The characteristic curves 'Output current in dependence of the supply voltage' you will find in the electrical data of the individual devices from [▶Page 167◀](#).

## D.2 Requirements to the motor

The b maXX<sup>®</sup> 4400 is dimensioned for the operation of three-phase motors with a mains voltage of 3 x 400 V and a nominal DC link voltage of  $\geq 540$  V.

The use of the devices also is possible with a lower-rated voltage, e.g. 3 x 230 V. This however requires that the used three-phase motors are enabled for the operation at the inverters with a DC link voltage of up to 800 V, because the chopper start-up voltage (see [▶D.6 Electrical data - BM441X basic unit◀](#) from page 167 and the following) remain unchanged. Therewith only three-phase motors with  $U_{\text{DC link, nominal}} \geq 540$  V is used.

### D.3 Required environmental conditions

|                                         |                                         |
|-----------------------------------------|-----------------------------------------|
| Transportation temperature range        | - 30 °C bis + 70 °C                     |
| Transportation climatic category        | 2 K 3 <sup>1)</sup>                     |
| Storage temperature range               | - 30 °C bis + 70 °C                     |
| Storage climatic class                  | 1 K 4 <sup>1)</sup>                     |
| Operation electrical environment        | Industrial supply network <sup>2)</sup> |
| Operation temperature range             | min. 5 °C bis max. 55 °C <sup>3)</sup>  |
| Operation climatic class                | 3 K 3 <sup>1)</sup>                     |
| Mounting height <sup>4)</sup>           | absolute altitude up to 2000 m          |
| Relative humidity (operation)           | 5% to 85% no condensation <sup>1)</sup> |
| Vibration, shock and repetitive shock   | max 1 g <sup>5)</sup>                   |
| Degree of pollution                     | 2 <sup>6)</sup>                         |
| Environmental conditions (EN 60721-3-3) | 3 K 3, 3 B 1                            |

<sup>1)</sup> EN 50178, table 7

<sup>2)</sup> For the operation in an environment of category C1/C2 according to IEC 61800-3:2005, with the utmost probability additional measures will be required. The plant manufacturer/user must, in this case, provide evidence, that these additional measures are successful and that the specified limit values of category C1/C2, which are described in IEC 61800-3, are adhered to.

<sup>3)</sup> Rated temperature = 40° C

<sup>4)</sup> Characteristic curve: Output apparent power  $S$  compared with the rated apparent power  $S_{\text{Rating}}$  of unit in dependence of installation altitude at standard air pressure

Note

Baumüller devices, which are provided for the operation at grounded delta systems or IT supply systems, at these systems only may have an operating altitude of 2000 m. If the altitude is higher than 2000 m these devices must be operated at TN systems and TT systems. Such systems, e. g. can be achieved with an isolating transformer with a secondary-sided star point.

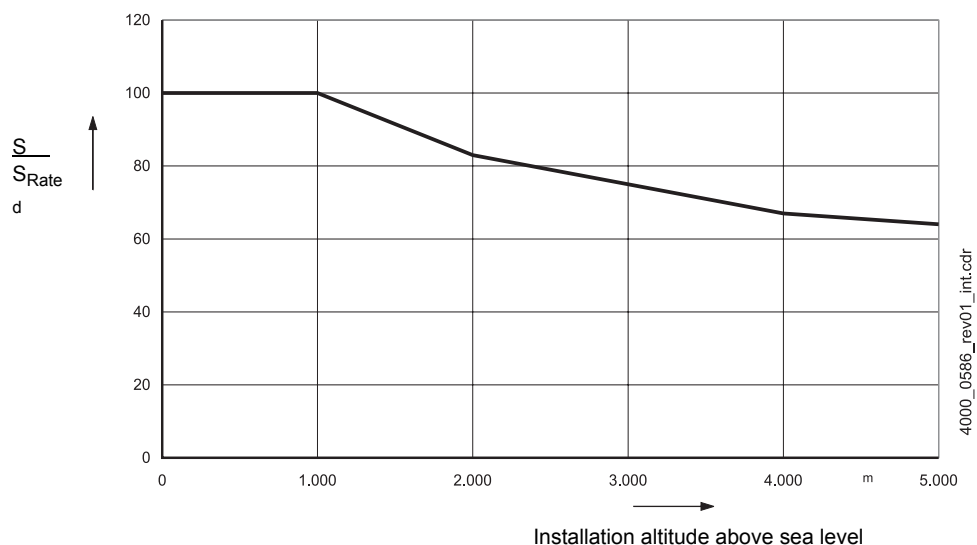


Figure 59: Derating of output apparent power against the installation altitude.

<sup>5)</sup> EN 50178, chapter 9.4.3.2

<sup>6)</sup> EN 50178, table 2

#### NOTE



Normally only a non-conductive pollution occurs. Any conductive pollution (for a short period or continuous) is not permitted and can lead to the destruction of the device. The customer is responsible for destructions based on pollution with conductive substance or materials.

### D.4 Cooling

|                                                                               |                                                                                                                                               |
|-------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Cooling air temperature <sup>1)</sup>                                         | min. 5 °C to max. 55 °C <sup>2)</sup>                                                                                                         |
| Cooling air requirement <sup>3)</sup>                                         | see electrical data                                                                                                                           |
| Cooling water temperature <sup>4)5)9)</sup>                                   | min. 'Cooling air temperature' <sup>1)</sup><br>to max 60 °C<br>(to max. 40 °C at BM447X)                                                     |
| Cooling water flow rate <sup>4)5)8)</sup>                                     | min. 4 l/min. to max. 15 l/min.<br>BM 447X-FXX: min. 10 l/min. to max. 15 l/min.                                                              |
| Cooling water pressure <sup>4)5)</sup>                                        | max. 6 bar <sup>6)</sup>                                                                                                                      |
| Cooling water hysteresis                                                      | max. 5 K in the static and in the dynamic operation                                                                                           |
| Hot water generation<br>(cooling water inlet to -outlet) <sup>4) 5)</sup> [K] | $< 14,35 \left[ \frac{\text{l/min}}{\text{kW}} \cdot \text{K} \right] \cdot \frac{\text{power loss [kW]}}{\text{cooling water flow [l/min]}}$ |
| Pressure loss at water cooler <sup>4)5)</sup>                                 | 0.5 bar at 10 l/min                                                                                                                           |
| Mounting board temperature <sup>7)</sup>                                      | min. 'Cooling air temperature' <sup>1)</sup> to max 55 °C <sup>2)</sup>                                                                       |

<sup>1)</sup> Air temperature in the entire suction area of the device.

<sup>2)</sup> Rated temperature = 40° C

<sup>3)</sup> 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 heat sink is not provided, then the output power of the device has to be reduced.

<sup>4)</sup> only by BM44XX - FXX and BM44XX - ZXX

<sup>5)</sup> Rated flow = 10 l/min

With other cooling water flow rates as mentioned above please contact Baumüller Nürnberg.

The cooling water must meet the following requirements:

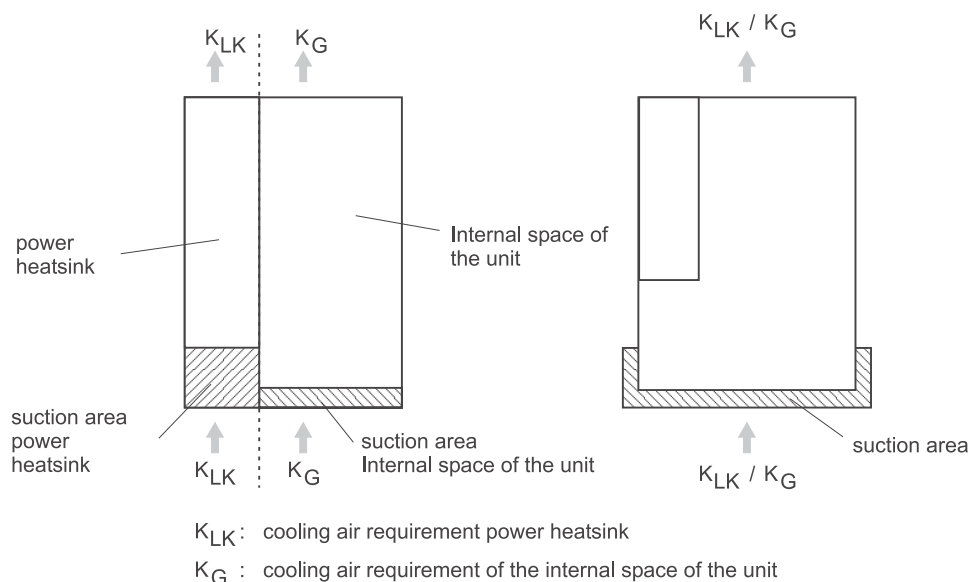
|                                               |                 |
|-----------------------------------------------|-----------------|
| pH-value                                      | 6.5... 9.5      |
| Conductivity                                  | 50... 600 µS/cm |
| Water hardness (inclusive CaCO <sub>3</sub> ) | < 100 ppm       |
| Suspended matters                             | < 10 ppm        |
| Particle size                                 | < 100 µm        |
| Ryznar Stability Index (RSI)                  | 5.0 ... 6.0     |

|                                          |            |
|------------------------------------------|------------|
| Manganese (Mn)                           | < 0.05 ppm |
| Copper (Cu)                              | < 0.1 ppm  |
| Chlorine (Cl <sub>2</sub> )              | < 1 ppm    |
| Chloride (Cl <sup>-</sup> )              | < 500 ppm  |
| Sulfate (SO <sub>4</sub> <sup>2-</sup> ) | < 500 ppm  |

The corrosion-resistant compared with further materials you can take from the DECHEMA-material tables.

Use a corrosion-resistant and a closed cooling circuit.

- 6) In case you refer to UL508C: max. 3 bar. There must be a pressure-relief valve with a threshold pressure of maximum 6 bar in the cooling circulation.
- 7) only by BM44XX - CXX
- 8) Recommendation:  
In order to avoid dew, the temperature of the water inlet is greater or equal to the interior temperature of the device.  
With other cooling water temperatures as mentioned above please contact Baumüller Nürnberg.



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## D.5 Non-electrical data

| Device                 | Dimensions<br>(W x H x D)                | Weight with controller,<br>without plug-in modules | Noise<br>development        |
|------------------------|------------------------------------------|----------------------------------------------------|-----------------------------|
| BM441X <sup>2)</sup> : | 80 x 347 x 263 mm / 105,5 x 347 x 263 mm | 4,0/4,4 kg                                         | max. 80 db(A) <sup>1)</sup> |
| BM442X <sup>3)</sup> : | 105,5 x 428 x 340 mm                     | 7,0 kg                                             | max. 80 db(A) <sup>1)</sup> |
| BM443X <sup>3)</sup> : | 155 x 540 x 340 mm                       | 15,7 kg                                            | max. 80 db(A) <sup>1)</sup> |
| BM444X <sup>3)</sup> : | 190 x 665 x 374 mm                       | 26,4 kg                                            | max. 80 db(A) <sup>1)</sup> |
| BM445X <sup>3)</sup> : | 304 x 745 x 380 mm                       | 50,0 kg                                            | max. 80 db(A) <sup>1)</sup> |
| BM446X <sup>3)</sup> : | 437 x 920 x 380 mm                       | 70,0 kg                                            | max. 80 db(A) <sup>1)</sup> |
| BM447X <sup>4)</sup> : | 580 x 660 x 340 mm                       | 82,0 kg                                            | max. 80 db(A) <sup>1)</sup> |

<sup>1)</sup> 98/37/EG, appendix I, chapter 1.7.4.f, paragraph 8

<sup>2)</sup> The first value provides the measurements of the device BM441X - XXX - 00XXX - XX and BM441X - XXX - 01XXX - XX. The second value specifies the dimensions of the device BM441X - XX - 02XX - XX.

<sup>3)</sup> Predetermined are the dimensions for the devices BM44XX-S. The dimensions for BM44XX-A..., BM44XX-C..., BM44XX-F... and BM44XX-Z...-devices are to be found in [Installation space](#) from page 39.

<sup>4)</sup> Specified are the dimensions for the device BM447X-F, the specified depth is the total depth of the device. Also see [Figure 20](#) on page 47.

## D.6 Electrical data - BM441X basic unit

|                                                                          |                        | BM4412                      | BM4413     |
|--------------------------------------------------------------------------|------------------------|-----------------------------|------------|
| Input rated power <sup>1)</sup>                                          |                        | 1.9 kVA                     | 3.3 kVA    |
| Input rated current <sup>1)</sup> (I <sub>eff</sub> )                    |                        | 2.8 A                       | 4.8 A      |
| Distortion factor of the input current <sup>1)</sup> (THD <sub>I</sub> ) |                        | 119%                        | 110%       |
| Input current max. (I <sub>eff</sub> )                                   |                        | 5.2 A                       | 9.0 A      |
| DC-link rated voltage <sup>1)</sup> (U <sub>DC</sub> )                   |                        | 540 V <sub>DC</sub>         |            |
| DC link capacity (internal)                                              |                        | 110 μF                      | 240 μF     |
| DC link discharging time (internal DC link capacity)                     |                        | 80 s                        | 175 s      |
| DC link capacity (external), permitted                                   |                        | see ►Figure 61◄ on page 170 |            |
| Delay time mains off ⇒ mains on <sup>11)</sup>                           |                        | at least 60 s               |            |
| Output voltage <sup>1)</sup> (U <sub>AC</sub> )                          |                        | 3 x 0 V to 3 x 370 V        |            |
| Output frequency                                                         |                        | 0 Hz to 450 Hz              |            |
| Output rated current <sup>1)4)5)6)</sup> (I <sub>AC</sub> )              | at 4 kHz <sup>3)</sup> | max. 2.5 A                  | max. 4.5 A |
| Output rated current <sup>1)4)5)6)</sup> (I <sub>AC</sub> )              | at 8 kHz <sup>3)</sup> | max. 2.5 A                  | max. 4.5 A |
| Output peak current <sup>1)4)5)7)</sup> (I <sub>AC</sub> )               | at 4 kHz <sup>3)</sup> | max. 5.0 A                  | max. 9.0 A |
| Output peak current <sup>1)4)5)7)</sup> (I <sub>AC</sub> )               | at 8 kHz <sup>3)</sup> | max. 5.0 A                  | max. 9.0 A |
| Max. peak current time <sup>7)</sup>                                     |                        | 60 s                        |            |
| Output power DC link terminals <sup>10)</sup>                            |                        | max. 2.0 kW                 |            |
| Chopper current, permissible (Î)                                         |                        | max. 5.9 A                  |            |
| Chopper resistor external                                                |                        | ≥ 130 Ω                     |            |
| Chopper start-up voltage (Û)                                             |                        | 780 V                       |            |
| Chopper peak power                                                       |                        | 4.5 kW                      | 5.0 kW     |
| Permissible chopper continuous power                                     |                        | 1.0 kW                      | 1.5 kW     |
| Power loss referring to mains voltage                                    |                        | 33 W                        | 60 W       |
| Power loss referring to control voltage                                  |                        | max. 60 W                   |            |
| Current of the integrated brake interface                                |                        | max. 0.5 A                  |            |

Footnotes see following page.

|                                                                          |                        | BM4414-STx <sup>9)</sup>    | BM4414-CTx <sup>8)9)</sup> |
|--------------------------------------------------------------------------|------------------------|-----------------------------|----------------------------|
| Input rated power <sup>1)</sup>                                          |                        | 5.1 kVA                     | 6.9 kVA                    |
| Input rated current <sup>1)</sup> (I <sub>eff</sub> )                    |                        | 7.3 A                       | 10.0 A                     |
| Distortion factor of the input current <sup>1)</sup> (THD <sub>I</sub> ) |                        | 109%                        | 113%                       |
| Input current max. (I <sub>eff</sub> )                                   |                        | 20.0 A                      | 20.0 A                     |
| DC-link rated voltage <sup>1)</sup> (U <sub>DC</sub> )                   |                        | 540 V <sub>DC</sub>         |                            |
| DC link capacity (internal)                                              |                        | 330 µF                      | 330 µF                     |
| DC link discharging time (internal DC link capacity)                     |                        | 240 s                       | 240 s                      |
| DC link capacity (external), permitted                                   |                        | see ►Figure 61◄ on page 170 |                            |
| Delay time mains off ⇒ mains on <sup>12)</sup>                           |                        | at least 60 s               |                            |
| Output voltage <sup>1)</sup> (U <sub>AC</sub> )                          |                        | 3 x 0 V to 3 x 370 V        |                            |
| Output frequency                                                         |                        | 0 Hz to 450 Hz              |                            |
| Output rated current <sup>1)4)5)6)</sup> (I <sub>AC</sub> )              | at 4 kHz <sup>3)</sup> | max. 5.5 A                  | max. 7.5 A                 |
| Output rated current <sup>1)4)5)6)</sup> (I <sub>AC</sub> )              | at 8 kHz <sup>3)</sup> | max. 5.0 A                  | max. 5.0 A                 |
| Output peak current <sup>1)4)5)7)</sup> (I <sub>AC</sub> )               | at 4 kHz <sup>3)</sup> | max. 20.0 A                 | max. 20.0 A                |
| Output peak current <sup>1)4)5)7)</sup> (I <sub>AC</sub> )               | at 8 kHz <sup>3)</sup> | max. 12.0 A                 | max. 12.0 A                |
| Max. peak current time <sup>7)</sup>                                     |                        | 1 s                         |                            |
| Output power DC link terminals <sup>10)</sup>                            |                        | max. 3.0 kW                 | max. 4.3 kW                |
| Chopper current, permissible (Î)                                         |                        | max. 12.0 A                 |                            |
| Chopper resistor external                                                |                        | ≥ 65 Ω                      |                            |
| Chopper start-up voltage (Û)                                             |                        | 780 V                       |                            |
| Chopper peak power                                                       |                        | 9.4 kW                      | 9.4 kW                     |
| Permissible chopper continuous power                                     |                        | 3.0 kW                      | 3.0 kW                     |
| Power loss referring to mains voltage                                    |                        | 80 W                        | 102 W                      |
| Power loss referring to control voltage                                  |                        | max. 60 W                   |                            |
| Current of the integrated brake interface                                |                        | max. 1.0 A                  |                            |

<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> The output voltage is a pulsed d.c. voltage. The operating range refers to the RMS of the fundamental wave.

<sup>3)</sup> Switching frequency of the inverter (adjustable).

<sup>4)</sup> RMS at an environmental temperature of 40 °C.

- 5) At rated input supply voltage the device enables the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced.

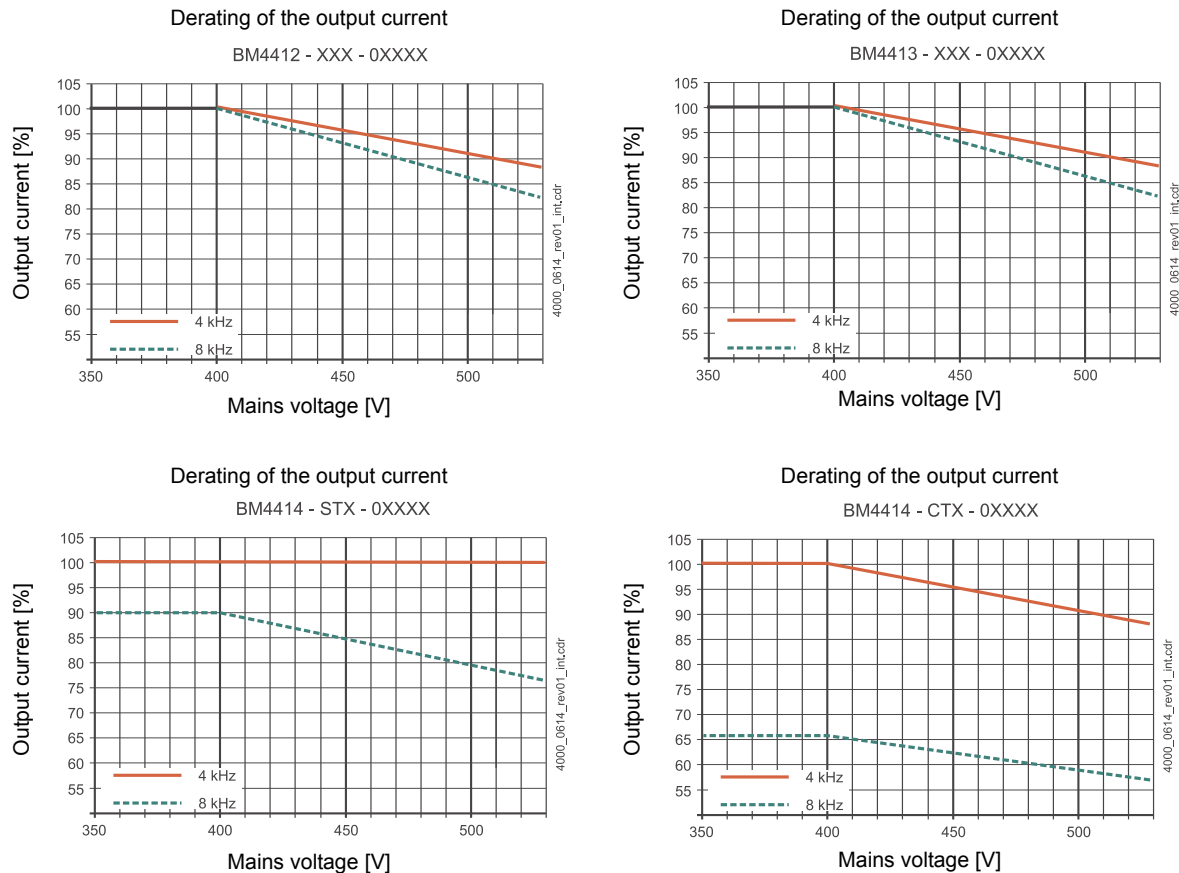


Figure 60: Derating of the output current BM 441X basic unit

- 6) Between 40° C and 55° C the output current must be reduced.  
The allowable output current ( $I_o$ ) is calculated with the following formula:

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

- 7) This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.  
8) Values are valid at mounting on a heat-conducting surface with a thermal resistance of 0.115 K/W. The maximum allowable length case temperature at the measuring point, see [Figure 45](#) on page 80, is 75° C.  
9)

## NOTE



For the BM4414 further limitation are valid for peak current at braking operation only.  
The possible peak currents are: 15 A at 4 kHz and 10 A at 8 kHz switch frequency.

- 10) The sum of the average active power, which was transmitted via the DC link terminals and of the average active power transmitted to the motor terminals may not exceed 3.0 kW (BM4414-STx) or 4.3 kW (BM4414-CTx).

<sup>11)</sup> The specified value is only valid, if there is no additional DC link capacity connected to the DC link terminals. Also see [►Mains-switch-on frequency/DC-link charging◄](#) on page 97 and [►Figure 61◄](#) on page 170.

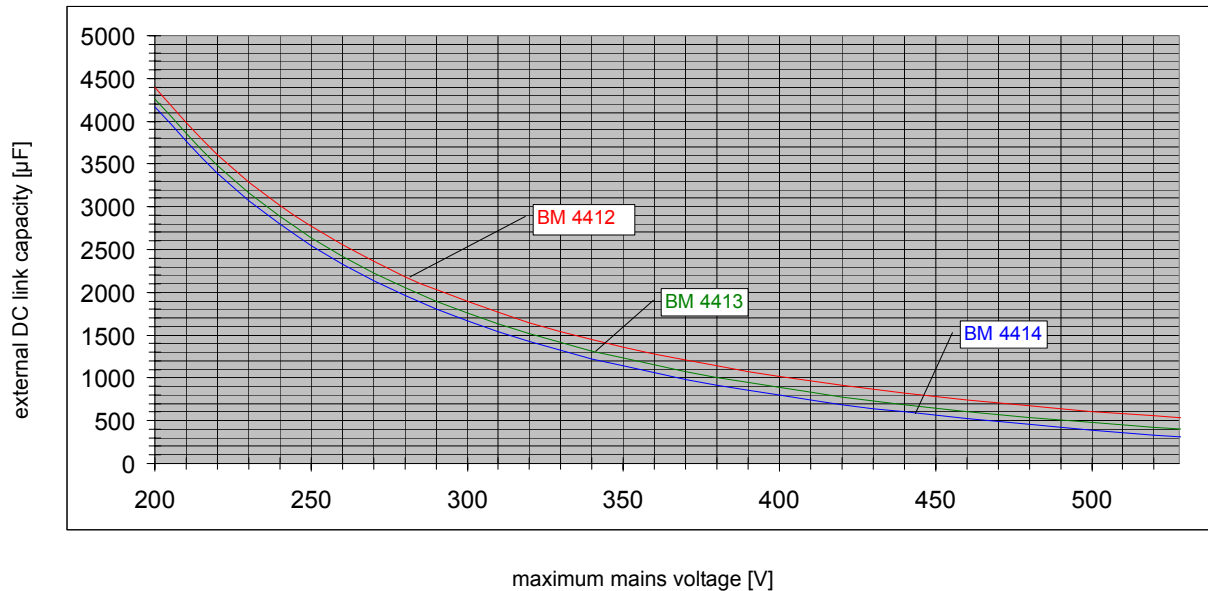


Figure 61: Maximum external DC link capacity BM441X

## D.7 Electrical data - BM442X basic unit

|                                                                                     | BM4422                                    | BM4423            | BM4424            |
|-------------------------------------------------------------------------------------|-------------------------------------------|-------------------|-------------------|
| Input rated power <sup>1)</sup>                                                     | 5.6 kVA                                   | 8.6 kVA           | 11.8 kVA          |
| Input rated current <sup>1)</sup> ( $I_{\text{eff}}$ )                              | 8.1 A                                     | 12.4 A            | 17.0 A            |
| Distortion factor of the input current ( $\text{THD}_I$ ) <sup>1)</sup>             | 107 %                                     | 109 %             | 109 %             |
| Input current, max. ( $I_{\text{eff}}$ )                                            | 15.1 A                                    | 23.2 A            | 31.8 A            |
| DC-link rated voltage <sup>1)</sup> ( $U_{\text{DC}}$ )                             | 540 V <sub>DC</sub>                       |                   |                   |
| DC link capacity (internal)                                                         | 470 $\mu\text{F}$                         | 470 $\mu\text{F}$ | 705 $\mu\text{F}$ |
| DC link discharging time (internal DC link capacity)                                | 340 s                                     | 340 s             | 510 s             |
| DC link capacity (external), permitted                                              | see <a href="#">Figure 63</a> on page 174 |                   |                   |
| Delay time mains off $\Rightarrow$ mains on <sup>9)</sup>                           | at least 60 s                             |                   |                   |
| Output voltage <sup>1)3)</sup> ( $U_{\text{AC}}$ )                                  | 3 x 0 V to 3 x 370 V                      |                   |                   |
| Output frequency                                                                    | 0 Hz to 450 Hz                            |                   |                   |
| Derating at static output frequency                                                 | there is no derating required             |                   |                   |
| Output rated current <sup>1)5)6)7)</sup> ( $I_{\text{AC}}$ ) at 4 kHz <sup>4)</sup> | max. 7.5 A                                | max. 11.0 A       | max. 15.0 A       |
| Output rated current <sup>1)5)6)7)</sup> ( $I_{\text{AC}}$ ) at 8 kHz <sup>4)</sup> | max. 6.0 A                                | max. 8.8 A        | max. 12.0 A       |
| Output peak current <sup>1)5)6)8)</sup> ( $I_{\text{AC}}$ ) at 4 kHz <sup>4)</sup>  | max. 15.0 A                               | max. 22.0 A       | max. 30.0 A       |
| Output peak current <sup>1)5)6)8)</sup> ( $I_{\text{AC}}$ ) at 8 kHz <sup>4)</sup>  | max. 12.0 A                               | max. 17.6 A       | max. 24.0 A       |
| Max. peak current time <sup>8)</sup>                                                | 60 s                                      |                   |                   |
| Output power DC link terminals <sup>10)</sup>                                       | max. 5.0 kW                               |                   |                   |
| Chopper current, permissible ( $\hat{I}$ )                                          | max. 9.0 A                                | max. 13.0 A       | max. 18.0 A       |
| Chopper resistor external                                                           | $\geq 86 \Omega$                          | $\geq 60 \Omega$  | $\geq 44 \Omega$  |
| Chopper start-up voltage ( $\hat{U}$ )                                              | 780 V                                     |                   |                   |
| Chopper peak power                                                                  | 7 kW                                      | 10 kW             | 14 kW             |
| Permissible chopper continuous power                                                | 3.4 kW                                    | 5 kW              | 6.8 kW            |
| Power loss referring to mains voltage                                               | 102 W                                     | 150 W             | 204 W             |
| Power loss referring to control voltage                                             | max. 63 W                                 |                   |                   |
| Current of the brake control                                                        | max. 0.5 A                                |                   |                   |

Footnotes see following page.

|                                                                          |                        | BM4425                                      | BM4426                         |
|--------------------------------------------------------------------------|------------------------|---------------------------------------------|--------------------------------|
| Input rated power <sup>1)</sup>                                          |                        | 11.8 kVA                                    | 13.2 kVA                       |
| Input rated current <sup>1)</sup> (I <sub>eff</sub> )                    |                        | 17.0 A                                      | 19,0 A <sup>2)</sup>           |
| Distortion factor of the input current (THD <sub>I</sub> ) <sup>1)</sup> |                        | 109%                                        | 54% <sup>2)</sup>              |
| Input current, max. (I <sub>eff</sub> )                                  |                        | 34.0 A                                      | 37.0 A <sup>2)</sup>           |
| DC-link rated voltage <sup>1)</sup> (U <sub>DC</sub> )                   |                        | 540 V <sub>DC</sub>                         |                                |
| DC link capacity (internal)                                              |                        | 705 μF                                      | 705 μF                         |
| DC link discharging time (internal DC link capacity)                     |                        | 510 s                                       | 510 s                          |
| DC link capacity (external), permitted                                   |                        | see <a href="#">►Figure 63◄</a> on page 174 |                                |
| Delay time mains off ⇒ mains on <sup>9)</sup>                            |                        | at least 60 s                               |                                |
| Output voltage <sup>1)</sup> (U <sub>AC</sub> )                          |                        | 3 x 0 V to 3 x 370 V                        |                                |
| Output frequency                                                         |                        | 0 Hz to 450 Hz                              |                                |
| Derating at static output frequency                                      |                        | there is no derating required               | see <a href="#">►Page 197◄</a> |
| Output rated current <sup>1)5)6)7)</sup> (I <sub>AC</sub> )              | at 4 kHz <sup>4)</sup> | max. 15.0 A                                 | max. 22.5 A                    |
| Output rated current <sup>1)5)6)7)</sup> (I <sub>AC</sub> )              | at 8 kHz <sup>4)</sup> | max. 12.0 A                                 | max. 18.0 A                    |
| Output peak current <sup>1)5)6)8)</sup> (I <sub>AC</sub> )               | at 4 kHz <sup>4)</sup> | max. 40.0 A                                 | max. 45.0 A                    |
| Output peak current <sup>1)5)6)8)</sup> (I <sub>AC</sub> )               | at 8 kHz <sup>4)</sup> | max. 32.0 A                                 | max. 36.0 A                    |
| Max. peak current time <sup>8)</sup>                                     |                        | 1 s                                         |                                |
| Output power DC link terminals <sup>10)</sup>                            |                        | max. 5.0 kW                                 |                                |
| Chopper current, permissible (Î)                                         |                        | max. 25.0 A                                 |                                |
| Chopper resistor external                                                |                        | ≥ 32 Ω                                      |                                |
| Chopper start-up voltage (Û)                                             |                        | 780 V                                       |                                |
| Chopper peak power                                                       |                        | 20 kW                                       |                                |
| Permissible chopper continuous power                                     |                        | 6.8 kW                                      |                                |
| Power loss referring to mains voltage                                    |                        | 204 W                                       | 300 W                          |
| Power loss referring to control voltage                                  |                        | max. 63 W                                   |                                |
| Current of the brake control                                             |                        | max. 0.5 A                                  |                                |

<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> In case you use the commutation choke with the part No. 00368377 at a mains with  $u_{K,\text{mains}} = 0.4 \%$

<sup>3)</sup> The output voltage is a pulsed d.c. voltage. The operating range refers to the RMS of the fundamental wave.

<sup>4)</sup> Switching frequency of the inverter (adjustable).

<sup>5)</sup> RMS at an environmental temperature of 40 °C.

<sup>6)</sup> At rated input supply voltage the device supplies the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced.

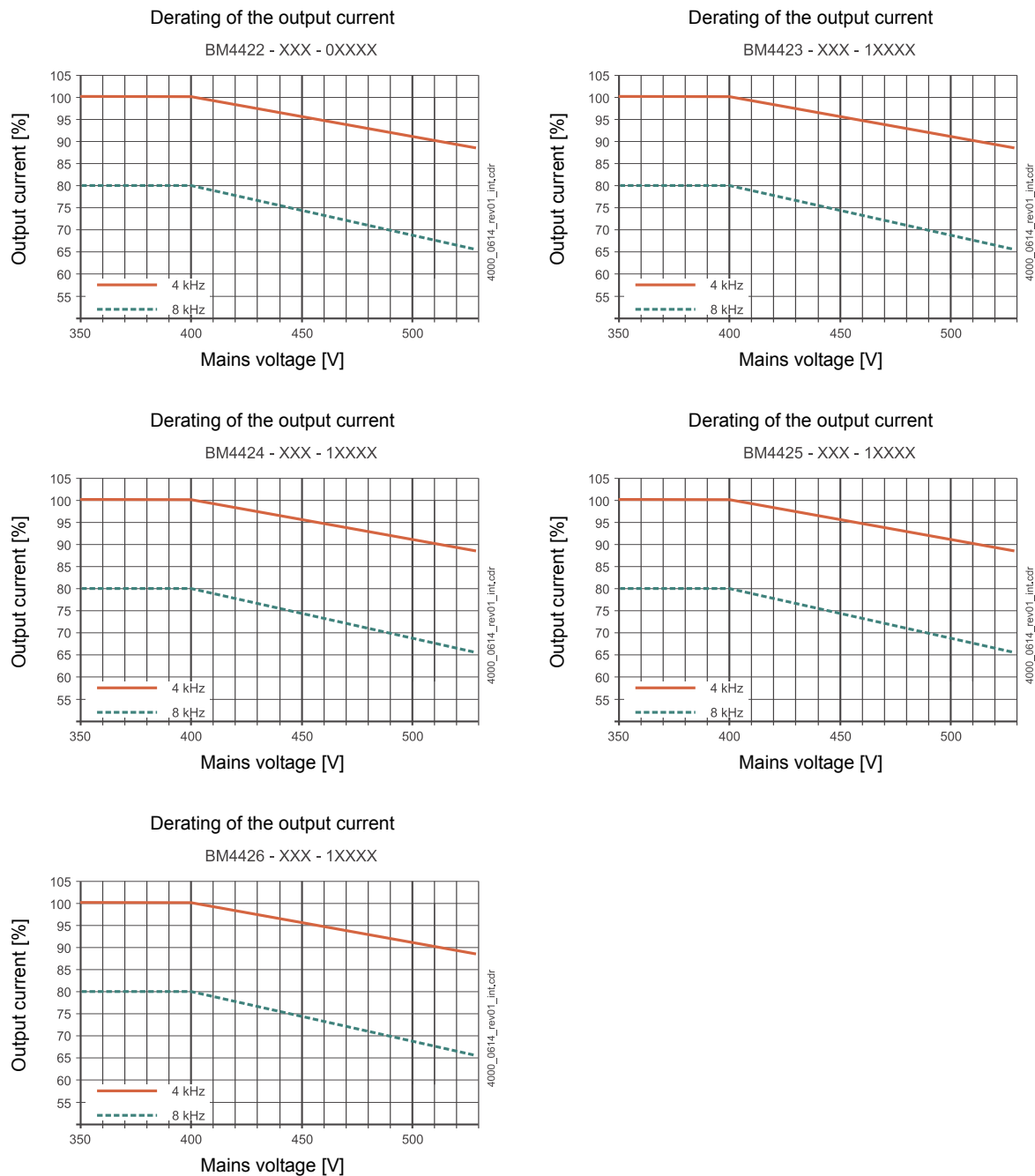


Figure 62: Derating of the output current BM 442X basic unit

- 7) Between 40° C and 55° C the output current must be reduced.  
The allowable output current ( $I_o$ ) is calculated with the following formula:

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

- 8) This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.

- 9) The specified value is only valid, if there is no additional DC link capacity connected to the DC link terminals. Also see [►Mains-switch-on frequency/DC-link charging◄](#) on page 97 and [►Figure 63◄](#) on page 174.
- 10) The sum of the transferred average effective power via the DC link terminals and the transferred average effective power via the motor terminals must not exceed the specified value permanently.

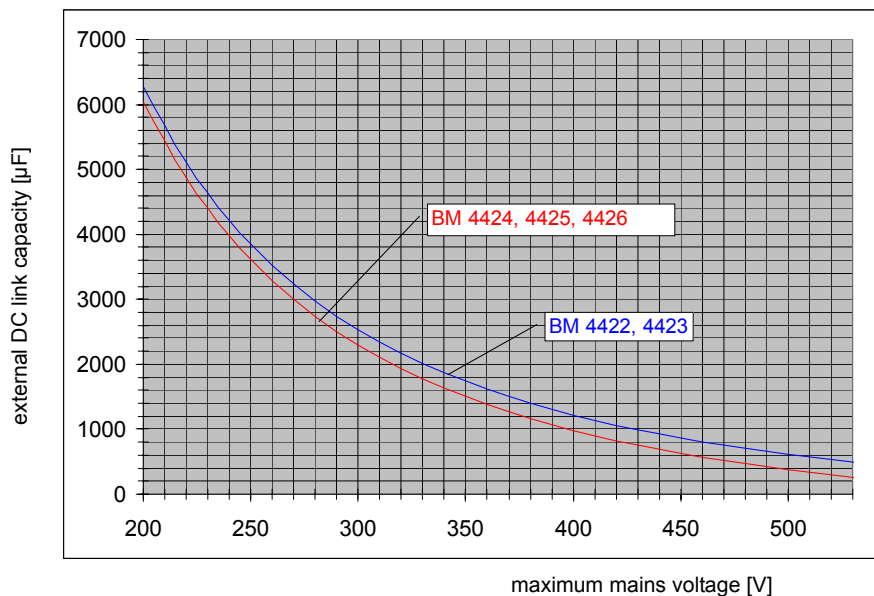


Figure 63: Maximum external DC link capacity BM442X

## D.8 Electrical data - BM443X basic unit

|                                                                           |                        | BM4432               | BM4433             |
|---------------------------------------------------------------------------|------------------------|----------------------|--------------------|
| Input rated power <sup>1)2)</sup>                                         |                        | 13.3 kVA             | 16.8 kVA           |
| Input rated current <sup>1)2)</sup> ( $I_{\text{eff}}$ )                  |                        | 19.2 A               | 24.2 A             |
| Distortion factor of the input current <sup>1)2)</sup> ( $\text{THD}_I$ ) |                        | 60%                  | 54%                |
| Input current, max. <sup>2)</sup> ( $I_{\text{eff}}$ )                    |                        | 37.0 A               | 45.0 A             |
| DC-link rated voltage <sup>1)</sup> ( $U_{\text{DC}}$ )                   |                        | 540 V <sub>DC</sub>  |                    |
| DC link capacity (internal)                                               |                        | 820 $\mu\text{F}$    | 1230 $\mu\text{F}$ |
| DC link discharging time (internal DC link capacity)                      |                        | 123 s                | 185 s              |
| DC link capacity (external), permitted                                    |                        | max. 18.5 mF         |                    |
| Delay time mains off $\Rightarrow$ mains on                               |                        | none                 |                    |
| Output voltage <sup>1)3)</sup> ( $U_{\text{AC}}$ )                        |                        | 3 x 0 V to 3 x 370 V |                    |
| Output frequency                                                          |                        | 0 Hz to 450 Hz       |                    |
| Output rated current <sup>1)5)6)7)</sup> ( $I_{\text{AC}}$ )              | at 4 kHz <sup>4)</sup> | max. 22.5 A          | max. 30.0 A        |
| Output rated current <sup>1)5)6)7)</sup> ( $I_{\text{AC}}$ )              | at 8 kHz <sup>4)</sup> | max. 18.0 A          | max. 24.0 A        |
| Output peak current <sup>1)5)6)8)</sup> ( $I_{\text{AC}}$ )               | at 4 kHz <sup>4)</sup> | max. 45.0 A          | max. 60.0 A        |
| Output peak current <sup>1)5)6)8)</sup> ( $I_{\text{AC}}$ )               | at 8 kHz <sup>4)</sup> | max. 36.0 A          | max. 48.0 A        |
| Max. peak current time <sup>8)</sup>                                      |                        | 60 s                 |                    |
| Output power DC link terminals <sup>9)</sup>                              |                        | max. 10.0 kW         |                    |
| Chopper current, permissible ( $\hat{I}$ )                                |                        | max. 36.0 A          |                    |
| Chopper resistor external                                                 |                        | $\geq 22 \Omega$     |                    |
| Chopper start-up voltage ( $\hat{U}$ )                                    |                        | 780 V                |                    |
| Chopper peak power                                                        |                        | 29 kW                |                    |
| Permissible chopper continuous power                                      |                        | 10 kW                |                    |
| Power loss referring to mains voltage                                     |                        | 300 W                | 390 W              |
| Power loss referring to control voltage                                   |                        | max. 88 W            |                    |
| Current of the brake control                                              |                        | max. 1.0 A           |                    |

Footnotes see following page.

|                                                                            |                        | BM4434               | BM4435      |
|----------------------------------------------------------------------------|------------------------|----------------------|-------------|
| Input rated power <sup>1)2)</sup>                                          |                        | 26.3 kVA             | 36.7 kVA    |
| Input rated current <sup>1)2)</sup> (I <sub>eff</sub> )                    |                        | 38.0 A               | 53.0 A      |
| Distortion factor of the input current <sup>1)2)</sup> (THD <sub>I</sub> ) |                        | 57%                  | 57%         |
| Input current, max. <sup>2)</sup> (I <sub>eff</sub> )                      |                        | 71.0 A               | 71.0 A      |
| DC-link rated voltage <sup>1)</sup>                                        |                        | 540 V <sub>DC</sub>  |             |
| DC link capacity (internal)                                                |                        | 1640 µF              | 2000 µF     |
| DC link discharging time (internal DC link capacity)                       |                        | 250 s                | 300 s       |
| DC link capacity (external), permitted                                     |                        | max. 20 mF           |             |
| Output voltage <sup>1)</sup> (U <sub>AC</sub> )                            |                        | 3 x 0 V to 3 x 370 V |             |
| Output frequency                                                           |                        | 0 Hz to 450 Hz       |             |
| Output rated current <sup>1)5)6)7)</sup> (I <sub>AC</sub> )                | at 4 kHz <sup>4)</sup> | max. 45.0 A          | max. 60.0 A |
| Output rated current <sup>1)5)6)7)</sup> (I <sub>AC</sub> )                | at 8 kHz <sup>4)</sup> | max. 36.0 A          | max. 48.0 A |
| Output peak current <sup>1)5)6)8)</sup> (I <sub>AC</sub> )                 | at 4 kHz <sup>4)</sup> | max. 90.0 A          | max. 90.0 A |
| Output peak current <sup>1)5)6)8)</sup> (I <sub>AC</sub> )                 | at 8 kHz <sup>4)</sup> | max. 72.0 A          | max. 72.0 A |
| Max. peak current time <sup>8)</sup>                                       |                        | 60 s                 |             |
| Output power DC link terminals <sup>9)</sup>                               |                        | max. 10.0 kW         |             |
| Chopper current, permissible (Î)                                           |                        | max. 50.0 A          |             |
| Chopper resistor external                                                  |                        | ≥ 16 Ω               |             |
| Chopper start-up voltage (Û)                                               |                        | 780 V                |             |
| Chopper peak power                                                         |                        | 40 kW                |             |
| Permissible chopper continuous power                                       |                        | 10 kW                |             |
| Power loss referring to mains voltage                                      |                        | 600 W                | 840 W       |
| Power loss referring to control voltage                                    |                        | max. 88 W            |             |
| Current of the brake control                                               |                        | max. 1.0 A           |             |

<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> In case you use the following commutation chokes at a mains with  $u_{K,\text{mains}}=0.4\%$ :  
BM4432 Part no. 00368377, BM4433: Part no. 00368377, BM4434: Part no. 00368378, BM4435: Part no. 00368379.

<sup>3)</sup> The output voltage is a pulsed d.c. voltage. The operating range refers to the RMS of the fundamental wave.

<sup>4)</sup> Switching frequency of the inverter (adjustable).

<sup>5)</sup> RMS at an environmental temperature of 40 °C.

<sup>6)</sup> At rated input supply voltage the device enables the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced

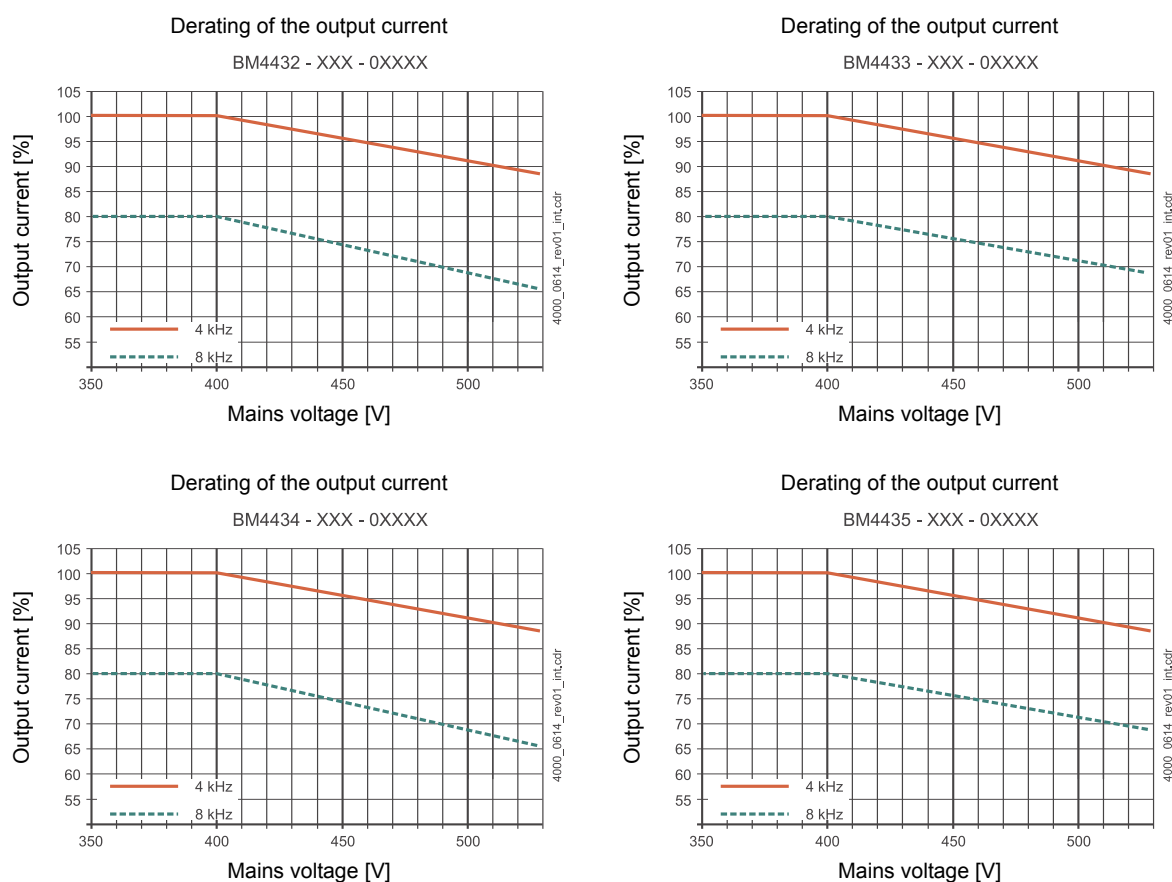


Figure 64: Derating of the output current BM 443X basic unit

- 7) Between 40° C and 55° C the output current must be reduced.  
The allowable output current ( $I_o$ ) is calculated with the following formula:

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

- 8) This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.

## D.9 Electrical data - BM444X basic unit

|                                                                             |                        | BM4443               | BM4444     | BM4445     | BM4446 <sup>12)</sup><br>(preliminary) |
|-----------------------------------------------------------------------------|------------------------|----------------------|------------|------------|----------------------------------------|
| Input rated power <sup>1)2)</sup>                                           |                        | 49 kVA               | 58 kVA     | 73 kVA     | 94 kVA                                 |
| Input rated current <sup>1)2)</sup> (I <sub>eff</sub> )                     |                        | 70,0 A               | 84 A       | 105 A      | 136 A                                  |
| Distortion factor of the input current <sup>1)2)</sup> (THD <sub>I</sub> )  |                        | 60 %                 | 59 %       | 45 %       | 38 %                                   |
| Input current, max. <sup>2)</sup> (I <sub>eff</sub> )                       |                        | 105 A                | 105 A      | 133 A      | 187 A                                  |
| DC-link rated voltage <sup>1)</sup>                                         |                        | 540 V <sub>DC</sub>  |            |            |                                        |
| DC link capacity (internal)                                                 |                        | 1880 µF              | 2350 µF    | 3055 µF    | 3760 µF                                |
| DC link capacity (external), permitted                                      |                        | max. 20 mF           |            |            |                                        |
| DC link discharging time (internal DC link capacity)                        |                        | 43 s                 | 54 s       | 70 s       | 86 s                                   |
| Delay time mains off ⇒ mains on                                             |                        | no                   |            |            |                                        |
| Output voltage <sup>1)3)</sup> (U <sub>AC</sub> )                           |                        | 3 x 0 V to 3 x 370 V |            |            |                                        |
| Output frequency                                                            |                        | 0 Hz to 450 Hz       |            |            |                                        |
| Output rated current <sup>1)5)6)7)</sup> (I <sub>AC</sub> )                 | at 4 kHz <sup>4)</sup> | max. 80 A            | max. 100 A | max. 130 A | max. 150 A                             |
| Output rated current <sup>1)5)6)7)</sup> (I <sub>AC</sub> )                 | at 8 kHz <sup>4)</sup> | max. 75 A            | max. 72 A  | max. 94 A  | max. 105 A                             |
| Output peak current <sup>1)5)6)8)</sup> (I <sub>AC</sub> )                  | at 4 kHz <sup>4)</sup> | max. 120 A           | max. 130 A | max. 170 A | max. 200 A                             |
| Output peak current <sup>1)5)6)8)</sup> (I <sub>AC</sub> )                  | at 8 kHz <sup>4)</sup> | max. 90 A            | max. 94 A  | max. 130 A | max. 150 A                             |
| Max. peak current time <sup>8)9)</sup>                                      |                        | 60 s                 |            |            |                                        |
| Output power DC link terminals <sup>11)</sup>                               |                        | max. 90 kW           |            |            |                                        |
| Chopper current, permissible (Î)                                            |                        | max. 67 A            | max. 100 A |            |                                        |
| Chopper resistor external                                                   |                        | ≥ 12 Ω               | ≥ 8 Ω      |            |                                        |
| Chopper start-up voltage (Û)                                                |                        | 780 V                |            |            |                                        |
| Chopper peak power                                                          |                        | 53 kW                | 80 kW      |            |                                        |
| Permissible chopper continuous power                                        |                        | 36 kW                | 45 kW      | 58 kW      | 75 kW                                  |
| Power loss referring to mains voltage                                       |                        | 1080 W               | 1350 W     | 1740 W     | 2000 W                                 |
| Power loss referring to control voltage                                     |                        | max. 75 W            |            |            |                                        |
| Power loss of equipment fan according to 230 V <sub>AC</sub> <sup>10)</sup> |                        | 87 W                 |            |            |                                        |
| Current of the brake control                                                |                        | max. 4,0 A           |            |            |                                        |
| Cooling air requirement of power heat sink                                  |                        | 260 m³/h             |            | 210 m³/h   |                                        |
| Cooling air requirement of the interior space of device                     |                        | 60 m³/h              |            |            |                                        |

Footnotes see following page.

- 1) All rated values refer to a mains input voltage of 400 V/50 Hz and a control voltage of 24 V.
- 2) In case you use the following commutation chokes at a mains with  $u_{K, mains}=0.4\%$ :  
BM4443 Part no. 00368380, BM4444: Part no. 00368381, BM4445: Part no. 00368381.
- 3) The output voltage is a pulsed d.c. voltage. The operating range refers to the RMS of the fundamental wave.
- 4) Switching frequency of the inverter (adjustable).
- 5) RMS at an environmental temperature of 40 °C.
- 6) At rated input supply voltage the device enables the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced.

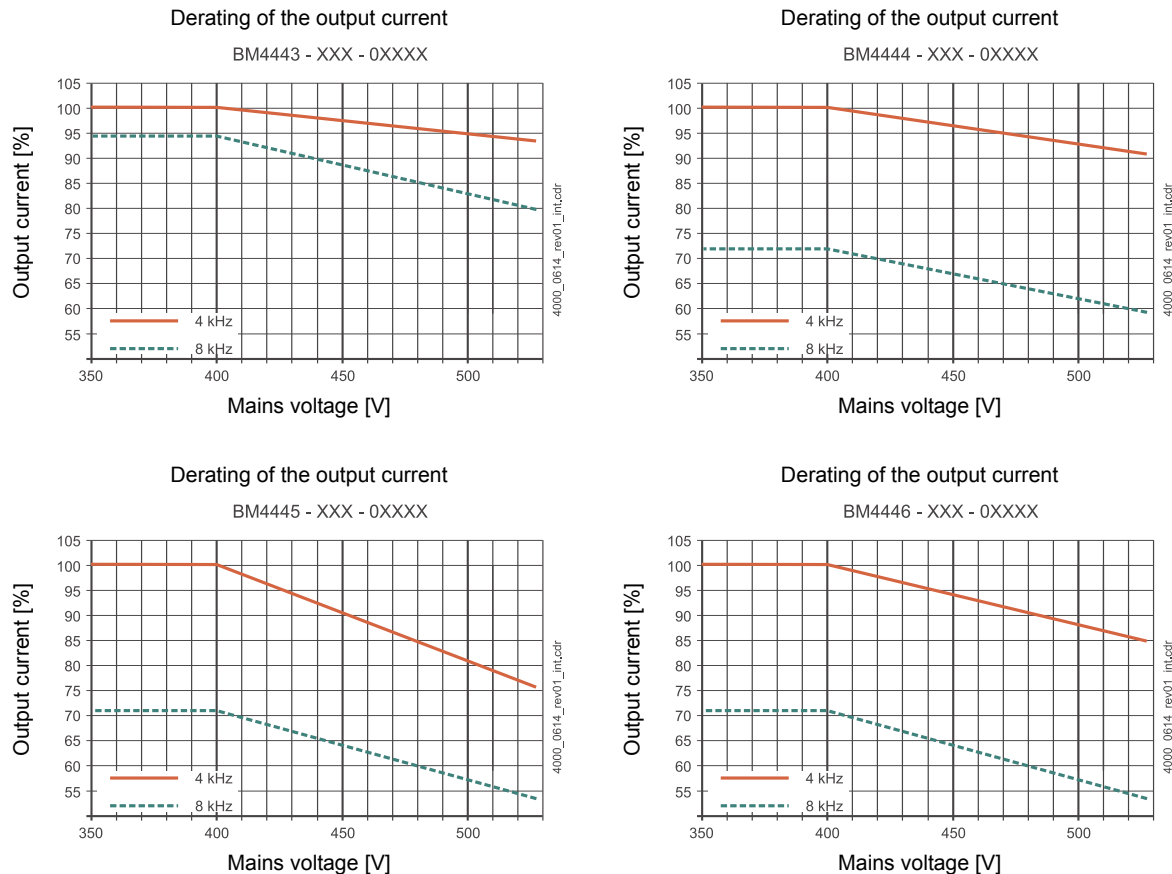


Figure 65: Derating of the output current BM 444X basic unit

- 7) Between 40° C and 55° C the output current must be reduced.  
The acceptable output current ( $I_o$ ) is calculated with the following formula:

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

- 8) This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.
- 9) The peak current can only be achieved at a heat sink temperature of <75 °C (BM4443) or <80 °C (BM4444).  
If the heat sink temperature threshold is exceeded, then the output current is automatically reduced to the rated current.
- 10) This is only valid for cooling versions S and A.
- 11) The sum of the transferred average effective power via the DC link terminals and the transferred average effective power via the motor terminals must not exceed the specified value permanently.
- 12) Only available at devices with type code BM44XX-XXX-XX3XX-03-yyy, whereas yyy > 024 is and the controller firmware is 3.09 or newer.

## D.10 Electrical data - BM445X basic unit

|                                                                            | BM4452                    | BM4453                | BM4454                |
|----------------------------------------------------------------------------|---------------------------|-----------------------|-----------------------|
| Input rated power <sup>1)2)</sup>                                          | 75.5 kVA                  | 94.2 kVA              | 138.6 kVA             |
| Input rated current <sup>1)2)</sup> ( $I_{\text{eff}}$ )                   | 109 A                     | 136 A                 | 200 A                 |
| Distortion factor of the input current <sup>1)2)</sup> (THD <sub>I</sub> ) | 42%                       | 38%                   | 38%                   |
| Input current, max. <sup>2)</sup> ( $I_{\text{eff}}$ )                     | 146 A                     | 182 A                 | 270 A                 |
| DC-link rated voltage <sup>1)</sup>                                        | 540 V <sub>DC</sub>       |                       |                       |
| DC link capacity (internal)                                                | 3000 µF                   | 3000 µF               | 6600 µF               |
| DC link capacity (external), permitted                                     | max. 20 mF                |                       |                       |
| DC link discharging time (internal DC link capacity)                       | 63 s                      | 63 s                  | 139 s                 |
| Delay time Mains Off ⇒ Mains On                                            | none                      |                       |                       |
| Output voltage <sup>1)</sup> ( $U_{\text{AC}}$ )                           | 3 x 0 V to 3 x 370 V      |                       |                       |
| Output frequency                                                           | 0 Hz to 450 Hz            |                       |                       |
| Derating at static output frequency                                        | see ▶Page 197◀            |                       | <sup>12)</sup>        |
| Output rated current <sup>1)5)6)7)</sup> ( $I_{\text{AC}}$ )               | at 4 kHz <sup>4)</sup>    | max. 120 A            | max. 150 A            |
| Output rated current <sup>1)5)6)7)</sup> ( $I_{\text{AC}}$ )               | at 8 kHz <sup>4)</sup>    | max. 96 A             | max. 116 A            |
| Output peak current <sup>1)5)6)8)</sup> ( $I_{\text{AC}}$ )                | at 4 kHz <sup>4)</sup>    | max. 180 A            | max. 195 A            |
| Output peak current <sup>1)5)6)8)</sup> ( $I_{\text{AC}}$ )                | at 8 kHz <sup>4)</sup>    | max. 144 A            | max. 150 A            |
| Max. peak current time <sup>8)</sup>                                       | 60 s                      |                       |                       |
| Output power DC link terminals                                             | max. 110 kW               |                       |                       |
| Chopper current, permissible ( $\hat{I}$ )                                 | max. 150 A                |                       |                       |
| Chopper resistor external                                                  | ≥ 5.2 Ω                   |                       |                       |
| Chopper start-up voltage ( $\hat{U}$ ) <sup>11)</sup>                      | 780 V                     |                       |                       |
| Chopper peak power                                                         | 117 kW                    |                       |                       |
| Permissible chopper continuous power                                       | 78 kW                     |                       |                       |
| Power loss referring to mains voltage                                      | 1800 W                    | 2250 W                | 3300 W                |
| Power loss referring to control voltage                                    | max. 75 W                 |                       |                       |
| Power loss of equipment fan according to 230 V <sub>AC</sub> <sup>9)</sup> | 190 W                     |                       |                       |
| Current of the brake control                                               | max. 8.0 A <sup>10)</sup> |                       |                       |
| Cooling air requirement of power heat sink                                 | 450 m <sup>3</sup> /h     | 450 m <sup>3</sup> /h | 400 m <sup>3</sup> /h |
| Cooling air requirement of the interior space of device                    | 135 m <sup>3</sup> /h     | 135 m <sup>3</sup> /h | 135 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> In case you use the following commutation chokes at a mains with  $u_{K,\text{mains}}=0.4\%$ :  
BM4452: Part no. 00368381, BM4453: Part no. 00368382, BM4454: Part no. 00368384.

<sup>3)</sup> The output voltage is a pulsed d.c. voltage. The operating range refers to the RMS of the fundamental wave.

<sup>4)</sup> Switching frequency of the inverter (adjustable).

<sup>5)</sup> RMS at an environmental temperature of 40 °C.

- 6) At rated input supply voltage the device enables the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced.

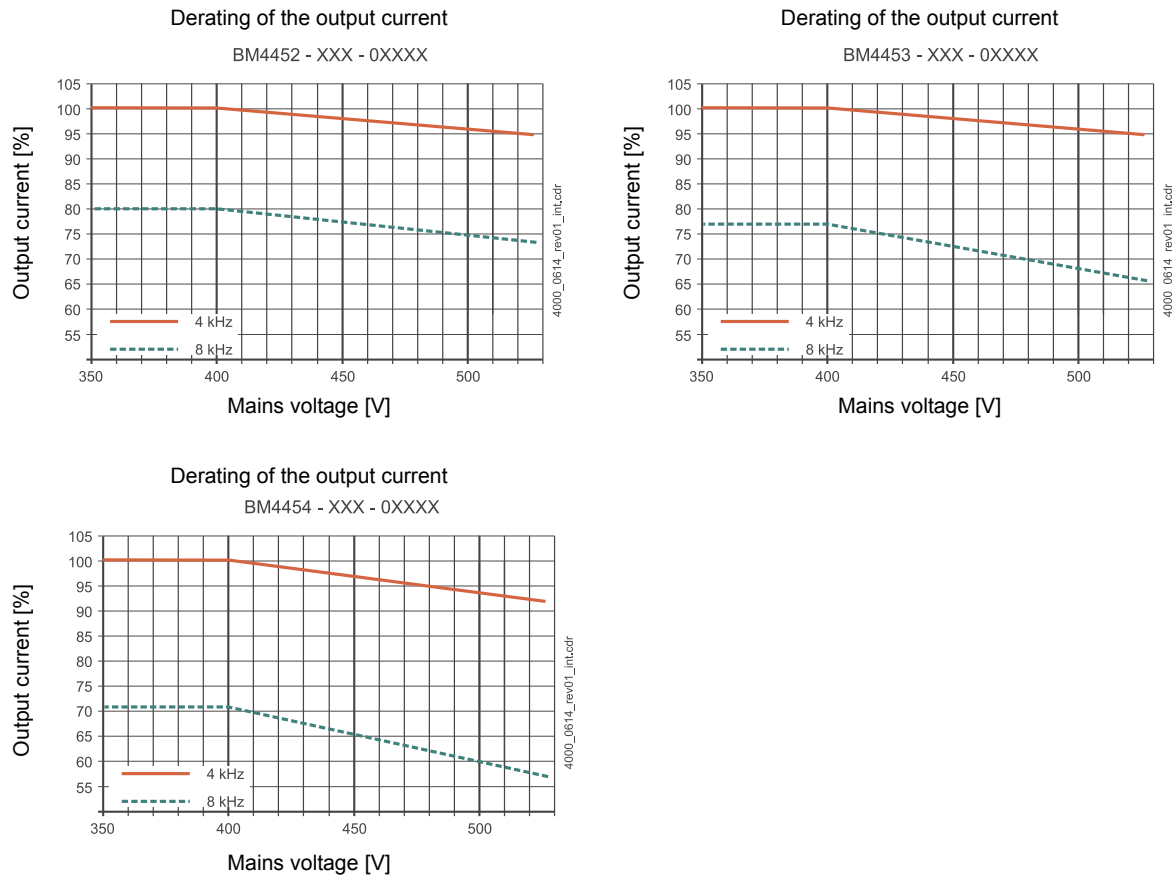


Figure 66: Derating of the output current BM 445X basic unit

- 7) Between 40° C and 55° C the output current must be reduced.  
The acceptable output current ( $I_o$ ) is calculated with the following formula

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

- 8) This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.
- 9) This is only valid for cooling versions S and A.
- 10) In case you refer to UL508C: max. 4.0 A
- 11) Also refer to [D.2 Requirements to the motor](#) on page 163.
- 12) An output current of max. 80 % of the output rated current is allowed at output frequencies lower than 0.5 Hz.

## D.11 Electrical data - BM446X basic unit

|                                                                                |                        | BM4462                    | BM4463     | BM4466<br>(preliminary) |
|--------------------------------------------------------------------------------|------------------------|---------------------------|------------|-------------------------|
| Input rated power <sup>1)2)</sup>                                              |                        | 164 kVA                   | 204 kVA    | 238 kVA                 |
| Input rated current <sup>1)2)</sup> (I <sub>eff</sub> )                        |                        | 237 A                     | 295 A      | 344 A                   |
| Distortion factor of the input current <sup>1)2)</sup> (THD <sub>I</sub> )     |                        | 43%                       | 50%        | 50%                     |
| Input current max. <sup>2)</sup> (I <sub>eff</sub> )                           |                        | 320 A                     | 395 A      | 455 A                   |
| DC-link rated voltage <sup>1)</sup>                                            |                        | 540 V <sub>DC</sub>       |            |                         |
| DC link capacity (internal)                                                    |                        | 6000 µF                   | 6000 µF    | 13200 µF                |
| DC link capacity (external), permitted                                         |                        | max. 20 mF                |            | max. 12 mF              |
| DC link discharging time (internal DC link capacity)                           |                        | 126 s                     | 126 s      | 277 s                   |
| Delay time mains off ⇒ mains on                                                |                        | none                      |            |                         |
| Output voltage <sup>1)</sup> (U <sub>AC</sub> )                                |                        | 3 x 0 V to 3 x 370 V      |            |                         |
| Output frequency                                                               |                        | 0 Hz to 450 Hz            |            |                         |
| Output rated current <sup>1)5)6)7)</sup> (I <sub>AC</sub> )                    | at 4 kHz <sup>4)</sup> | max. 250 A                | max. 300 A | max. 350 A              |
| Output rated current <sup>1)5)6)7)</sup> (I <sub>AC</sub> )                    | at 8 kHz <sup>4)</sup> | max. 200 A                | max. 240 A | max. 240 A              |
| Output peak current <sup>1)5)6)8)</sup> (I <sub>AC</sub> )                     | at 4 kHz <sup>4)</sup> | max. 325 A                | max. 390 A | max. 450 A              |
| Output peak current <sup>1)5)6)8)</sup> (I <sub>AC</sub> )                     | at 8 kHz <sup>4)</sup> | max. 260 A                | max. 312 A | max. 312 A              |
| Max. peak current time <sup>8)</sup>                                           |                        | 60 s                      |            |                         |
| Output power DC link terminals                                                 |                        | max. 160 kW               |            |                         |
| Chopper current, permissible (Î)                                               |                        | max. 230 A                |            | max. 236 A              |
| Chopper resistor external                                                      |                        | ≥ 3.4 Ω                   |            | ≥ 3.33 Ω                |
| Chopper start-up voltage (Û) <sup>11)</sup>                                    |                        | 780 V                     |            |                         |
| Chopper peak power                                                             |                        | 179 kW                    |            | 183 kW                  |
| Permissible chopper continuous power                                           |                        | 130 kW                    |            | 5 kW                    |
| Power loss referring to mains voltage                                          |                        | 3960 W                    | 4800 W     |                         |
| Power loss referring to control voltage                                        |                        | max. 80 W                 |            |                         |
| Power loss of the equipment fan according to 230 V <sub>AC</sub> <sup>9)</sup> |                        | 174 W                     |            |                         |
| Current of the brake control                                                   |                        | max. 8.0 A <sup>10)</sup> |            |                         |
| Cooling air requirement of power heat sink                                     |                        | 400 m³/h                  |            |                         |
| Cooling air requirement of the interior space of device                        |                        | 200 m³/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> In case you use the following commutation chokes at a mains with  $u_{K,mains}=0.4\%$ :  
BM4462: Part no. 00368384, BM4463: Part no. 00368385.

<sup>3)</sup> The output voltage is a pulsed d.c. voltage. The operating range refers to the RMS of the fundamental wave.

<sup>4)</sup> Switching frequency of the inverter (adjustable).

- 5) RMS at an environmental temperature of 40 °C.
- 6) At rated input supply voltage the device enables the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced.

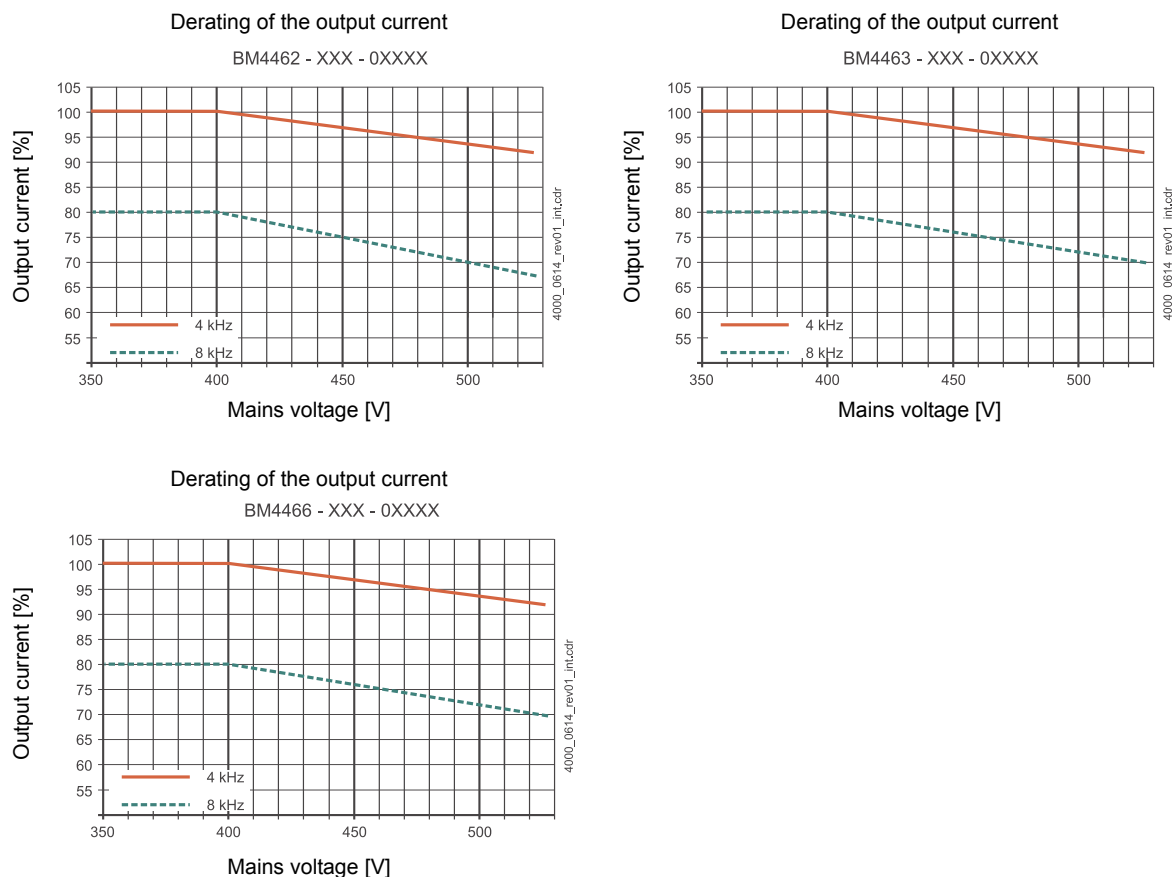


Figure 67: Derating of the output current BM 446X basic unit

- 7) Between 40° C and 55° C the output current must be reduced.  
The acceptable output current ( $I_o$ ) is calculated with the following formula

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

- 8) This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.
- 9) This is only valid for cooling versions S and A.
- 10) In case you refer to UL508C: max. 4.0 A
- 11) Also refer to [D.2 Requirements to the motor](#) on page 163.

## D.12 Electrical data - BM447X basic unit

|                                                                           |                        | BM4472 - A/FIX            | BM4473 - A/FIX |
|---------------------------------------------------------------------------|------------------------|---------------------------|----------------|
| Input rated power <sup>1)2)</sup>                                         |                        | 328 kVA                   | 412 kVA        |
| Input rated current <sup>1)2)</sup> ( $I_{\text{eff}}$ )                  |                        | 474 A                     | 594 A          |
| Distortion factor of the input current <sup>1)2)</sup> ( $\text{THD}_I$ ) |                        | 54%                       | 54%            |
| Input current max. <sup>2)</sup> ( $I_{\text{eff}}$ )                     |                        | 602 A                     | 760 A          |
| DC-link rated voltage <sup>1)</sup>                                       |                        | 540 V <sub>DC</sub>       |                |
| DC link capacity (internal)                                               |                        | 9 mF                      | 19.8 mF        |
| DC link capacity (external), permitted                                    |                        | 11 mF                     | 0 mF           |
| DC link discharging time (internal DC link capacity)                      |                        | 95 s                      | 138 s          |
| Delay time mains off $\Rightarrow$ mains on                               |                        | none                      |                |
| Output voltage <sup>1)3)</sup> ( $U_{\text{AC}}$ )                        |                        | 3 x 0 V to 3 x 370 V      |                |
| Output frequency <sup>1)2)</sup>                                          |                        | 0 Hz to 450 Hz            |                |
| Output rated current <sup>1)5)6)7)13)</sup> ( $I_{\text{AC}}$ )           | at 4 kHz <sup>4)</sup> | max. 450 A                | max. 600 A     |
| Output rated current <sup>1)5)6)7)13)</sup> ( $I_{\text{AC}}$ )           | at 8 kHz <sup>4)</sup> | max. 338 A                | max. 450 A     |
| Output peak current <sup>1)5)6)8)</sup> ( $I_{\text{AC}}$ )               | at 4 kHz <sup>4)</sup> | max. 585 A                | max. 780 A     |
| Output peak current <sup>1)5)6)8)</sup> ( $I_{\text{AC}}$ )               | at 8 kHz <sup>4)</sup> | max. 439 A                | max. 585 A     |
| Max. peak current time <sup>9)</sup>                                      |                        | 60 s                      |                |
| Output power DC link terminals                                            |                        | max. 250 kW               | max. 315 kW    |
| Chopper current, permissible ( $\hat{I}$ )                                |                        | max. 300 A                |                |
| Chopper resistor external                                                 |                        | $\geq 2.6 \Omega$         |                |
| Chopper start-up voltage ( $\hat{U}$ ) <sup>12)</sup>                     |                        | 780 V                     |                |
| Chopper peak power                                                        |                        | 234 kW                    |                |
| Permissible chopper continuous power                                      |                        | 180 kW                    |                |
| Power loss referring to mains voltage                                     |                        | 4700 W                    | 6450 W         |
| Power loss referring to control voltage                                   |                        | max. 170 W                |                |
| Power loss of the device fans according to 400 V <sub>AC</sub>            |                        | max. 540 W                |                |
| Current of the brake control                                              |                        | max. 8.0 A <sup>11)</sup> |                |

<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> In case you use the following commutation chokes at a mains with  $u_{K,\text{mains}}=0.4\%$ :  
BM4472: Part no. 368388, BM4473: Part no. 368390.

<sup>3)</sup> The output voltage is a pulsed d.c. voltage. The operating range refers to the RMS of the fundamental wave.

<sup>4)</sup> Switching frequency of the inverter (adjustable).

<sup>5)</sup> RMS at an environmental temperature of 40 °C.

- 6) At rated input supply voltage the device enables the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced.

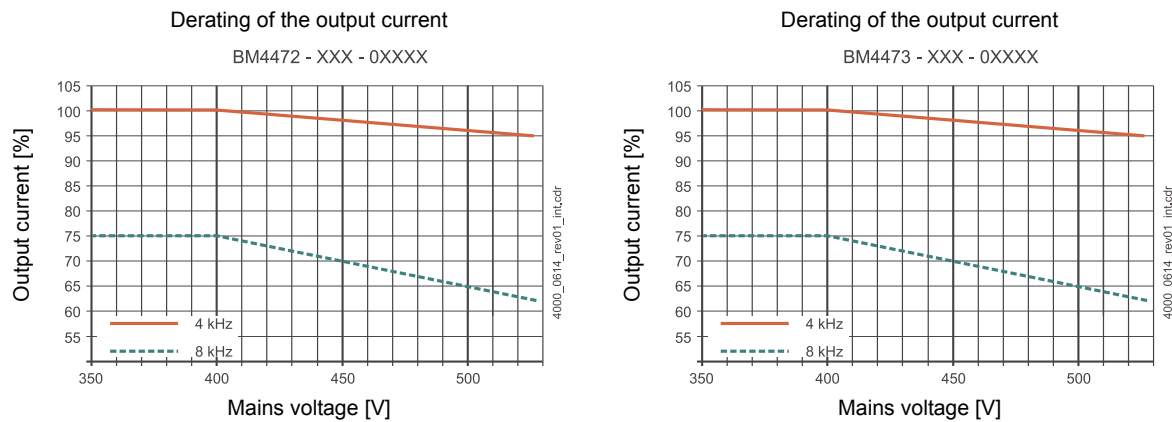


Figure 68: Derating of the output current BM 447X basic unit

- 7) The output current must be reduced between 40° C and 55° C.  
The allowable output current ( $I_o$ ) is calculated with the following formula:

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

- 8) Possibly there are two temperature values (cooling air, which flows through the inner space of the device/cooling air which flows through the heat sink).  
Here use the higher value.

Example: output rated current) = 150 A, environmental temperature = 46° C

$$I_o = 150\text{ A} \cdot \left( 1 - \left( \frac{46^\circ\text{C} - 40^\circ\text{C}}{^\circ\text{C}} \cdot 0,03 \right) \right) = 150\text{ A} \cdot 0,03$$

Therewith the output current must be reduced: 123 A

- 9) This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.
- 10) The sum of the immediately via the DC link terminals taken power and at the same time the power, which is picked up from the motor (motor power/motor efficiency) may not exceed the maximum output power of 250 kW or 315 kW.
- 11) In case you refer to UL508C: max. 4.0 A
- 12) Also refer to [D.2 Requirements to the motor](#) on page 163.
- 13) In case you refer to UL508C:  
The maximum permitted typical motor power is limited to 295 kW.  
Therefore the device BM4473 belongs to the category < 400 HP, < 298 kW ratings according table 45.1 of UL508C and the short circuit test can be done with 18 kA. Baumüller offers no devices for the class up to 600 HP, 447 kW with 30 kA short circuit current according UL508C.

## D.12.1 BM447X, additional information to EMC

### Considered standard:

EN 61800-3:2005, within environments of second mode for PDS of category C3 with rated currents above 100 A.

... it can be assumed, that the EMC product standard EN 61800-3:2005 is observed, if the device is operated normally and the installation is done with exclusive use of the required (EMC)-components and EMC installation notes by the manufacturer .

## D.13 Electrical data - BM442X power module

### D.13 Electrical data - BM442X power module

|                                                               |                        | BM4422-<br>XXX -<br>2XXXX | BM4423 -<br>XXX -<br>2XXXX | BM4424 -<br>XXX -<br>2XXXX | BM4425 -<br>XXX -<br>2XXXX |
|---------------------------------------------------------------|------------------------|---------------------------|----------------------------|----------------------------|----------------------------|
| Input rated power <sup>1)</sup>                               |                        | 4,3 kW                    | 6,2 kW                     | 8,2 kW                     | 8,2 kW                     |
| Input rated current <sup>1)</sup> (I <sub>eff</sub> )         |                        | 7,8 A                     | 11,5 A                     | 15,2 A                     | 15,2 A                     |
| Input current, max. (I <sub>eff</sub> )                       |                        | 15,5 A                    | 23,0 A                     | 30,4 A                     | 40,6 A                     |
| DC link rated voltage <sup>1)</sup> (U <sub>DC</sub> )        |                        | 540 V <sub>DC</sub>       |                            |                            |                            |
| DC link capacity (internal)                                   |                        | 470 µF                    |                            | 705 µF                     |                            |
| DC link discharging time<br>(internal DC link capacity)       |                        | 260 s                     |                            | 390 s                      |                            |
| Output voltage <sup>1)2)</sup> (U <sub>AC</sub> )             |                        | 3 x 0 V to 3 x 370 V      |                            |                            |                            |
| Output frequency <sup>3)</sup>                                |                        | 0 Hz to 450 Hz            |                            |                            |                            |
| Derating at static output frequency                           |                        | no derating               |                            |                            |                            |
| Output rated current <sup>1)4)5)6)</sup> (I <sub>AC</sub> )   | at 4 kHz <sup>3)</sup> | max.<br>7,5 A             | max.<br>11,0 A             | max.<br>15,0 A             | max.<br>15,0 A             |
| Output rated current <sup>1)4)5)6)</sup> (I <sub>AC</sub> )   | at 8 kHz <sup>3)</sup> | max.<br>6,0 A             | max.<br>8,8 A              | max.<br>12,0 A             | max.<br>12,0 A             |
| Output peak current <sup>1)4)5)7)</sup><br>(I <sub>AC</sub> ) | at 4 kHz <sup>3)</sup> | max.<br>15,0 A            | max.<br>22,0 A             | max.<br>30,0 A             | max.<br>40,0 A             |
| Output peak current <sup>1)4)5)7)</sup><br>(I <sub>AC</sub> ) | at 8 kHz <sup>3)</sup> | max.<br>12,0 A            | max.<br>17,6 A             | max.<br>24,0 A             | max.<br>32,0 A             |
| Max. peak current time <sup>7)</sup>                          |                        | 60 s                      |                            |                            | 1 s                        |
| Power loss referring to mains voltage                         |                        | 102 W                     | 150 W                      | 204 W                      |                            |
| Power loss referring to control voltage                       |                        | max. 63 W                 |                            |                            |                            |
| Current of the brake control                                  |                        | max. 0,5 A                |                            |                            |                            |

<sup>1)</sup> All rated values refer to a DC link voltage of 540 V<sub>DC</sub> and a control voltage of 24 V.

<sup>2)</sup> The output voltage is a pulsed d.c. voltage. The operating range refers to the RMS of the fundamental wave.

<sup>3)</sup> Switching frequency of the inverter (adjustable)

<sup>4)</sup> RMS at an environmental temperature of 40 °C.

- 5) At rated input supply voltage the device enables the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced.

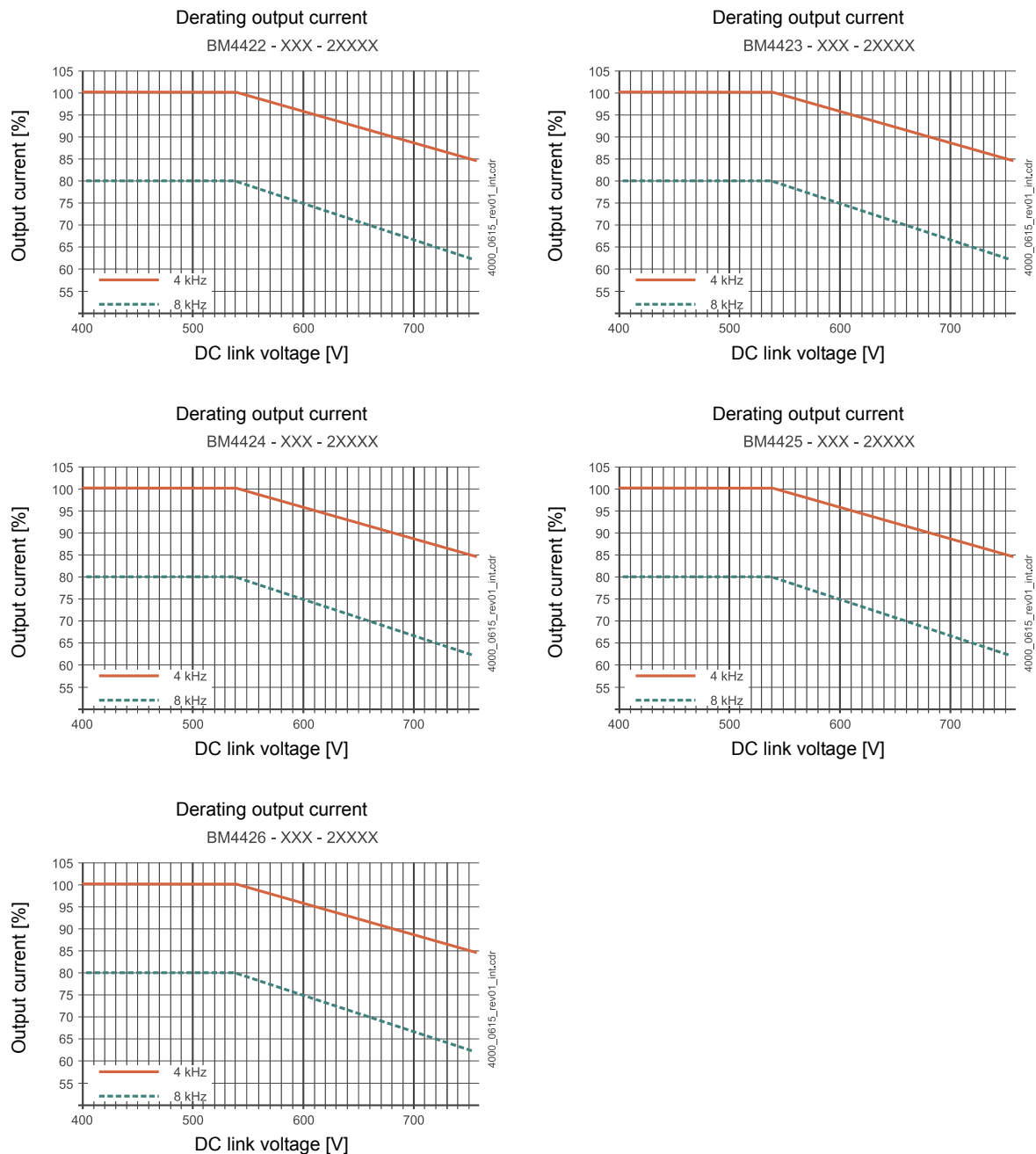


Figure 69: Derating output current BM 442X power modules

- 6) The output current must be reduced between 40° C and 55° C.  
The allowable output current ( $I_o$ ) is calculated with the following formula:

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

- 7) This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.

## D.14 Electrical data - BM443X power module

|                                                             |                        | BM4432-<br>XXX -<br>2XXXX | BM4433 -<br>XXX -<br>2XXXX | BM4434 -<br>XXX -<br>2XXXX | BM4435 -<br>XXX -<br>2XXXX |
|-------------------------------------------------------------|------------------------|---------------------------|----------------------------|----------------------------|----------------------------|
| Input rated power <sup>1)</sup>                             |                        | 12,0 kW                   | 15,3 kW                    | 23,3 kW                    | 32,3 kW                    |
| Input rated current <sup>1)</sup> (I <sub>eff</sub> )       |                        | 22,3 A                    | 28,4 A                     | 43,2 A                     | 59,8 A                     |
| Input current, max. (I <sub>eff</sub> )                     |                        | 44,7 A                    | 56,8 A                     | 86,4 A                     | 89,7 A                     |
| DC link rated voltage <sup>1)</sup> (U <sub>DC</sub> )      |                        | 540 V <sub>DC</sub>       |                            |                            |                            |
| DC link capacity (internal)                                 |                        | 820 µF                    | 1230 µF                    | 1640 µF                    | 2000 µF                    |
| DC link discharging time<br>(internal DC link capacity)     |                        | 138 s                     | 207 s                      | 276 s                      | 336 s                      |
| Output voltage <sup>1)2)</sup> (U <sub>AC</sub> )           |                        | 3 x 0 V to 3 x 370 V      |                            |                            |                            |
| Output frequency <sup>3)</sup>                              |                        | 0 Hz to 450 to            |                            |                            |                            |
| Output rated current <sup>1)4)5)6)</sup> (I <sub>AC</sub> ) | at 4 kHz <sup>3)</sup> | max. 22,5 A               | max. 30,0 A                | max. 45,0 A                | max. 60,0 A                |
| Output rated current <sup>1)4)5)6)</sup> (I <sub>AC</sub> ) | at 8 kHz <sup>3)</sup> | max. 18,0 A               | max. 24,0 A                | max. 36,0 A                | max. 48,0 A                |
| Output peak current <sup>1)4)5)7)</sup> (I <sub>AC</sub> )  | at 4 kHz <sup>3)</sup> | max. 45,0 A               | max. 60,0 A                | max. 90,0 A                | max. 90,0 A                |
| Output peak current <sup>1)4)5)7)</sup> (I <sub>AC</sub> )  | at 8 kHz <sup>3)</sup> | max. 36,0 A               | max. 48,0 A                | max. 72,0 A                | max. 72,0 A                |
| Max. peak current time <sup>7)</sup>                        |                        | 60 s                      |                            |                            |                            |
| Power loss referring to mains voltage                       |                        | 300 W                     | 390 W                      | 600 W                      | 840 W                      |
| Power loss referring to control voltage                     |                        | max. 88 W                 |                            |                            |                            |
| Current of the brake control                                |                        | max. 1,0 A                |                            |                            |                            |

<sup>1)</sup> All rated values refer to a DC link voltage of 540 V<sub>DC</sub> and a control voltage of 24 V.

<sup>2)</sup> The output voltage is a pulsed d.c. voltage. The operating range refers to the RMS of the fundamental wave.

<sup>3)</sup> Switching frequency of the inverter (adjustable)

<sup>4)</sup> RMS at an environmental temperature of 40 °C.

- 5) At rated input supply voltage the device enables the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced.

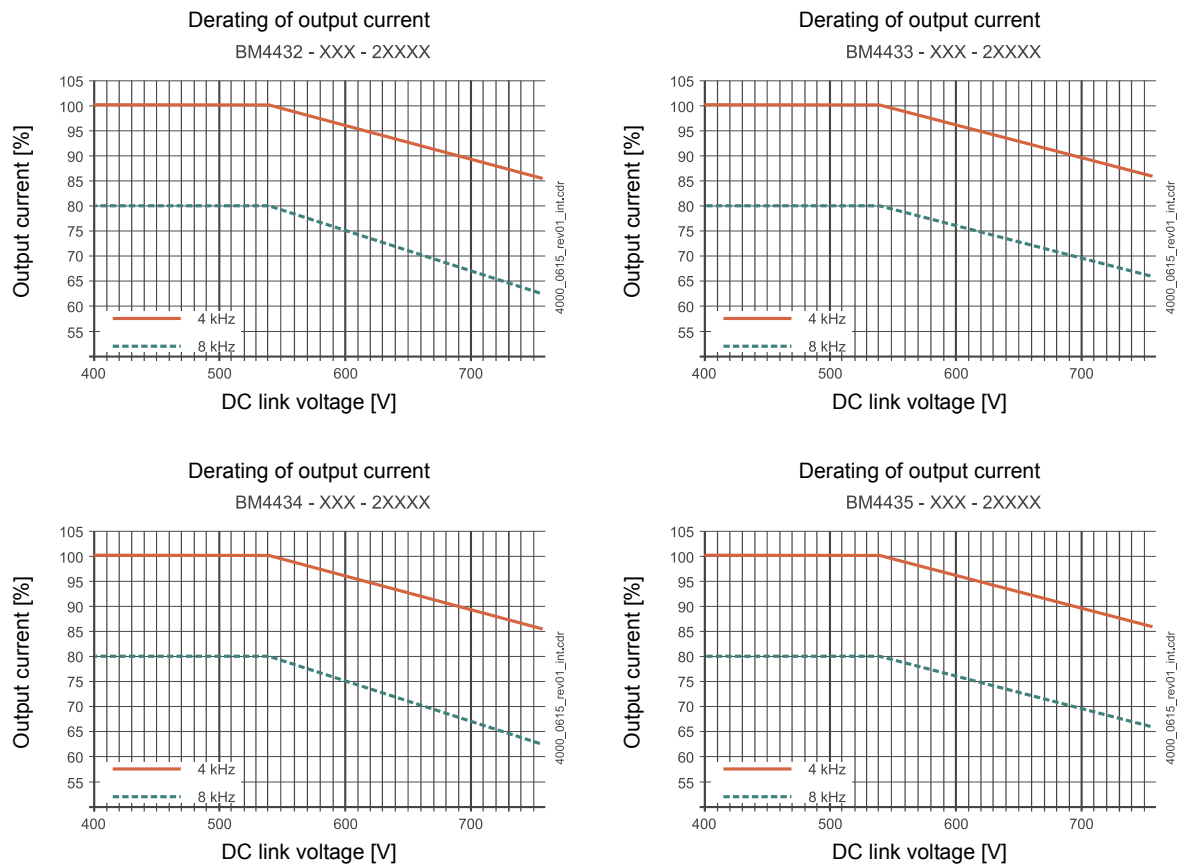


Figure 70: Derating of output current BM 443X power modules

- 6) The output current must be reduced between 40° C and 55° C.  
The allowable output current ( $I_O$ ) is calculated with the following formula:

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

- 7) This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.

## D.15 Electrical data - BM444X power module

|                                                                               |                        | BM4443-<br>XXX -<br>2XXXX | BM4444-<br>XXX -<br>2XXXX | BM4445 -<br>XXX -<br>2XXXX | BM4446 -<br>XXX -<br>2XXXX <sup>9)</sup><br>(Preliminary) |
|-------------------------------------------------------------------------------|------------------------|---------------------------|---------------------------|----------------------------|-----------------------------------------------------------|
| Input rated power <sup>1)</sup>                                               |                        | 41 kW                     | 50 kW                     | 64 kW                      | 84 kW                                                     |
| Input rated current <sup>1)</sup> (I <sub>eff</sub> )                         |                        | 76 A                      | 93 A                      | 119 A                      | 155 A                                                     |
| Input current, max. (I <sub>eff</sub> )                                       |                        | 113 A                     | 120 A                     | 155 A                      | 207 A                                                     |
| DC link rated voltage <sup>1)</sup> (U <sub>DC</sub> )                        |                        | 540 V <sub>DC</sub>       |                           |                            |                                                           |
| DC link capacity (internal)                                                   |                        | 1880 µF                   |                           | 2350 µF                    |                                                           |
| DC link discharging time<br>(internal DC link capacity)                       |                        | 43 s                      | 54 s                      | 70 s                       | 86 s                                                      |
| Output voltage <sup>1)2)</sup> (U <sub>AC</sub> )                             |                        | 3 x 0 V to 3 x 370 V      |                           |                            |                                                           |
| Output frequency <sup>3)</sup>                                                |                        | 0 Hz to 450 Hz            |                           |                            |                                                           |
| Output rated current <sup>1)4)5)6)</sup> (I <sub>AC</sub> )                   | at 4 kHz <sup>3)</sup> | max. 80 A                 | max. 100 A                | max. 130 A                 | max. 150 A                                                |
| Output rated current <sup>1)4)5)6)</sup> (I <sub>AC</sub> )                   | at 8 kHz <sup>3)</sup> | max. 75 A                 | max. 72 A                 | max. 94 A                  | max. 105 A                                                |
| Output peak current <sup>1)4)5)7)</sup> (I <sub>AC</sub> )                    | at 4 kHz <sup>3)</sup> | max. 120 A                | max. 130 A                | max. 170 A                 | max. 200 A                                                |
| Output peak current <sup>1)4)5)7)</sup> (I <sub>AC</sub> )                    | at 8 kHz <sup>3)</sup> | max. 90 A                 | max. 94 A                 | max. 130 A                 | max. 150 A                                                |
| Max. peak current time <sup>7)</sup>                                          |                        | 60 s                      |                           |                            |                                                           |
| Power loss referring to mains voltage                                         |                        | 800 W                     | 1000 W                    | 1300 W                     | 1400 W                                                    |
| Power loss referring to control voltage                                       |                        | max. 75 W                 |                           |                            |                                                           |
| Power loss of equipment fan according to<br>230 V <sub>AC</sub> <sup>8)</sup> |                        | 87 W                      |                           |                            |                                                           |
| Current of the brake control                                                  |                        | max. 4,0 A                |                           |                            |                                                           |
| Cooling air requirement of power heat sink                                    |                        | 260 m³/h                  |                           | 210 m³/h                   |                                                           |
| Cooling air requirement of the interior space of<br>device                    |                        | 60 m³/h                   |                           |                            |                                                           |

<sup>1)</sup> All rated values refer to a DC link voltage of 540 V<sub>DC</sub> and a control voltage of 24 V.

<sup>2)</sup> The output voltage is a pulsed d.c. voltage. The operating range refers to the RMS of the fundamental wave.

<sup>3)</sup> Switching frequency of the inverter (adjustable)

<sup>4)</sup> RMS at an environmental temperature of 40 °C.

- 5) At rated input supply voltage the device enables the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced.

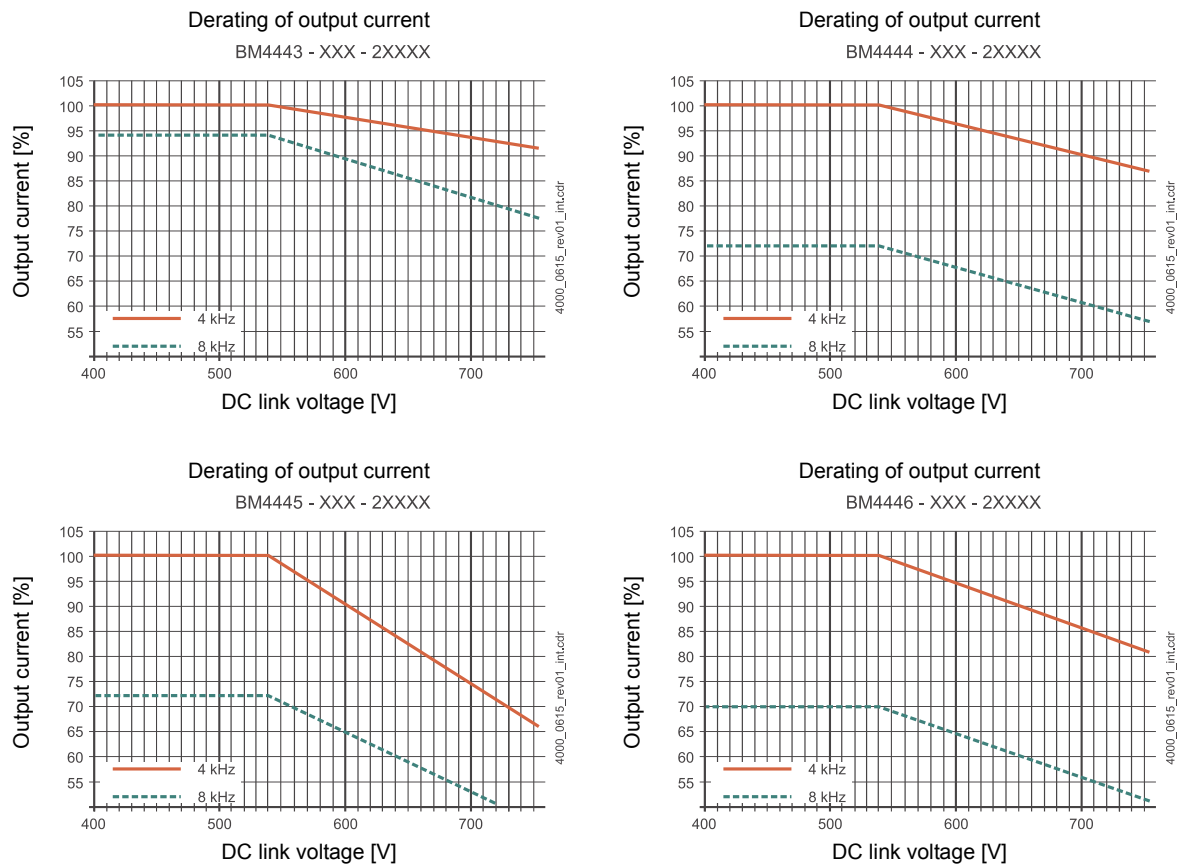


Figure 71: Derating of output current BM 444X power modules

- 6) The output current must be reduced between 40° C and 55° C.  
The allowable output current ( $I_o$ ) is calculated with the following formula:

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

- 7) This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.
- 8) This is only valid for cooling versions S and A.
- 9) Only available at devices with controller type code BM44XX-XXX-XX3XX-03-4-yyy, whereas yyy > 024 is **and** the controller firmware is 3.09 or newer.

## D.16 Electrical data - BM445X power module

|                                                                               |                        | BM4453- XXX - 2XXXX      |
|-------------------------------------------------------------------------------|------------------------|--------------------------|
| Input rated power <sup>1)</sup>                                               |                        | 85 kW                    |
| Input rated current <sup>1)</sup> (I <sub>eff</sub> )                         |                        | 158 A                    |
| Input current, max. (I <sub>eff</sub> )                                       |                        | 206 A                    |
| DC link rated voltage <sup>1)</sup> (U <sub>DC</sub> )                        |                        | 540 V <sub>DC</sub>      |
| DC link capacity (internal)                                                   |                        | 3000 µF                  |
| DC link discharging time<br>(internal DC link capacity)                       |                        | 75 s                     |
| Output voltage <sup>1)2)</sup> (U <sub>AC</sub> )                             |                        | 3 x 0 V to 3 x 370 V     |
| Output frequency <sup>3)</sup>                                                |                        | 0 Hz to 450 Hz           |
| Output rated current <sup>1)4)5)6)</sup> (I <sub>AC</sub> )                   | at 4 kHz <sup>3)</sup> | max. 150 A               |
| Output rated current <sup>1)4)5)6)</sup> (I <sub>AC</sub> )                   | at 8 kHz <sup>3)</sup> | max. 116 A               |
| Output peak current <sup>1)4)5)7)</sup><br>(I <sub>AC</sub> )                 | at 4 kHz <sup>3)</sup> | max. 195 A               |
| Output peak current <sup>1)4)5)7)</sup><br>(I <sub>AC</sub> )                 | at 8 kHz <sup>3)</sup> | max. 150 A               |
| Max. peak current time <sup>7)</sup>                                          |                        | 60 s                     |
| Power loss referring to mains voltage                                         |                        | 800 W                    |
| Power loss referring to control voltage                                       |                        | max. 75 W                |
| Power loss of equipment fan according to<br>230 V <sub>AC</sub> <sup>8)</sup> |                        | 190 W                    |
| Current of the brake control                                                  |                        | max. 8,0 A <sup>9)</sup> |
| Cooling air requirement of power heat sink                                    |                        | 450 m³/h                 |
| Cooling air requirement of the interior space of<br>device                    |                        | 135 m³/h                 |

<sup>1)</sup> All rated values refer to a DC link voltage of 540 V<sub>DC</sub> and a control voltage of 24 V.

<sup>2)</sup> The output voltage is a pulsed d.c. voltage. The operating range refers to the RMS of the fundamental wave.

<sup>3)</sup> Switching frequency of the inverter (adjustable)

<sup>4)</sup> RMS at an environmental temperature of 40 °C.

- 5) At rated input supply voltage the device enables the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced.

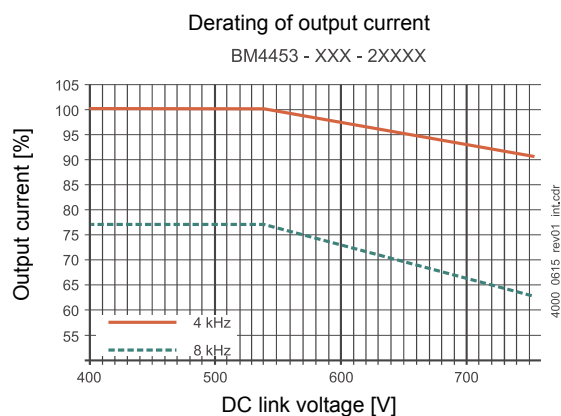


Figure 72: Derating of output current BM 445X power modules

- 6) The output current must be reduced between 40° C and 55° C.  
The allowable output current ( $I_o$ ) is calculated with the following formula:

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

- 7) This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.
- 8) This is only valid for cooling versions S and A.

## D.17 Electrical data - BM446X power module

|                                                                               |                        | BM4462- XXX - 2XXXX      | BM4463- XXX - 2XXXX |
|-------------------------------------------------------------------------------|------------------------|--------------------------|---------------------|
| Input rated power <sup>1)</sup>                                               |                        | 150 kW                   | 180 kW              |
| Input rated current <sup>1)</sup> (I <sub>eff</sub> )                         |                        | 278 A                    | 335 A               |
| Input current, max. (I <sub>eff</sub> )                                       |                        | 392 A                    | 436 A               |
| DC link rated voltage <sup>1)</sup> (U <sub>DC</sub> )                        |                        | 540 V <sub>DC</sub>      |                     |
| DC link capacity (internal)                                                   |                        | 6000 µF                  |                     |
| DC link discharging time<br>(internal DC link capacity)                       |                        | 150 s                    |                     |
| Output voltage <sup>1)2)</sup> (U <sub>AC</sub> )                             |                        | 3 x 0 V to 3 x 370 V     |                     |
| Output frequency <sup>3)</sup>                                                |                        | 0 Hz to 450 Hz           |                     |
| Output rated current <sup>1)4)5)6)</sup> (I <sub>AC</sub> )                   | at 4 kHz <sup>3)</sup> | max. 300 A               | max. 350 A          |
| Output rated current <sup>1)4)5)6)</sup> (I <sub>AC</sub> )                   | at 8 kHz <sup>3)</sup> | max. 240 A               | max. 240 A          |
| Output peak current <sup>1)4)5)7)</sup><br>(I <sub>AC</sub> )                 | at 4 kHz <sup>3)</sup> | max. 390 A               | max. 450 A          |
| Output peak current <sup>1)4)5)7)</sup><br>(I <sub>AC</sub> )                 | at 8 kHz <sup>3)</sup> | max. 312 A               | max. 312 A          |
| Max. peak current time <sup>7)</sup>                                          |                        | 60 s                     |                     |
| Power loss referring to mains voltage                                         |                        | 3960 W                   | 4800 W              |
| Power loss referring to control voltage                                       |                        | max. 80 W                |                     |
| Power loss of equipment fan according to<br>230 V <sub>AC</sub> <sup>8)</sup> |                        | 174 W                    |                     |
| Current of the brake control                                                  |                        | max. 8,0 A <sup>9)</sup> |                     |
| Cooling air requirement of power heat sink                                    |                        | 400 m³/h                 |                     |
| Cooling air requirement of the interior space of<br>device                    |                        | 200 m³/h                 |                     |

<sup>1)</sup> All rated values refer to a DC link voltage of 540 V<sub>DC</sub> and a control voltage of 24 V.

<sup>2)</sup> The output voltage is a pulsed d.c. voltage. The operating range refers to the RMS of the fundamental wave.

<sup>3)</sup> Switching frequency of the inverter (adjustable)

<sup>4)</sup> RMS at an environmental temperature of 40 °C.

- 5) At rated input supply voltage the device enables the rated-/maximum output currents. At input voltages above the rated supply voltage the output currents at constant output power have to accordingly be reduced.

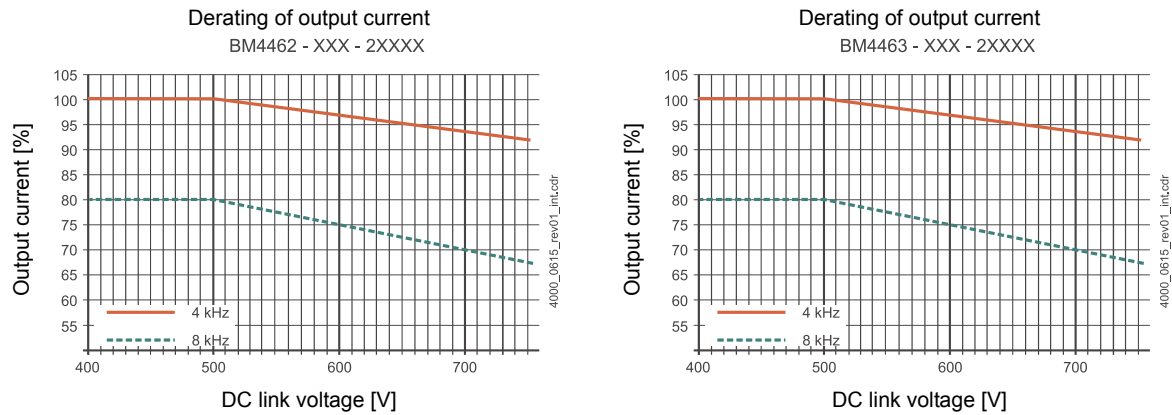


Figure 73: Derating of output current BM 446X power modules

- 6) The output current must be reduced between 40° C and 55° C.  
The allowable output current ( $I_o$ ) is calculated with the following formula:

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

- 7) This overload time is dependent on the motor current and of the heat sink temperature and is determined by the Ixt-monitoring of the device.
- 8) This is only valid for cooling versions S and A.
- 9) In case you refer to UL508C: max. 4.0 A

## D.18 Additional data BM44XX with water-cooled chopper resistors

Technical data of water-cooled chopper resistors:

| Type of device                                                                | Chopper resistor | Chopper resistor current | Peak power | Continuous output <sup>2)</sup> | Depth of device <sup>1)</sup> |
|-------------------------------------------------------------------------------|------------------|--------------------------|------------|---------------------------------|-------------------------------|
| BM4434-ZIX/FIX-XXXXXR16<br>BM4435-ZIX/FIX-XXXXXR16                            | 16 $\Omega$      | 49 A                     | 38 kW      | 2 kW                            | + 20 mm                       |
| BM4444-ZIX/FIX-XXXXXR10<br>BM4445-ZIX/FIX-XXXXXR10<br>BM4446-ZIX/FIX-XXXXXR10 | 10 $\Omega$      | 78 A                     | 61 kW      | 1.5 kW                          | + 35 mm                       |
| BM445X-ZIX/FIX-XXXXXR05                                                       | 5 $\Omega$       | 156 A                    | 122 kW     | 3 kW                            | + 35 mm                       |
| BM446X-ZIX/FIX-XXXXXR03                                                       | 3.33 $\Omega$    | 234 A                    | 183 kW     | 5 kW                            | + 35 mm                       |
| BM447X-FIX-XXXXXR03                                                           | 3.33 $\Omega$    | 234 A                    | 183 kW     | 3.5 kW                          | + 35 mm                       |

<sup>1)</sup> The total depth of the device in cooling version F increases by the specified value (also see [Installation space](#) from page 39). The device measurements of cooling version Z do not change.

<sup>2)</sup> The mentioned continuous output are only then achieved, if the water flow rate is at least 10 l/min. and if the inlet temperature does not exceed 45°C.

At flow temperatures >45°C to <60°C the chopper resistor dissipation decreases from the nominal value to zero.

## NOTE



Although the water-cooled chopper resistors provide an optimum according to the amount of heat to be dissipated at a minimum volume, about 10 % of the chopper resistor power is not dissipated via the cooling water but is given off to the ambient air.

At operation with nominal power, therewith the chopper resistors reach temperatures of max. 200°C on the reverse side.

For the devices of cooling version F (through-hole devices) this means:

Make sure, that there is a sufficient protection against contact, e. g. by the mounting of lattice around the heat sink and the resistors. Assure, that the air can circulate and that no heat accumulation can occur under the protective cover.

For the devices of cooling version Z (mounting in control cabinet) this means:

Mount the devices in the control cabinet, so that there is no heat accumulation above the devices. Air circulation must be possible. Take into consideration, that, although there is air circulation, that there can be an increase of temperature above the devices. Do not lay cables or cable channels in the area above the devices. The connecting cables at the devices BM443X and BM444X must be installed in such a way, that they do not run directly above the devices, and therewith in the area of the hot ascending air at the mounting board.

At dimensioning of control cabinet cooling, take into consideration, that 10% of the chopper resistor power is not dissipated via the cooling water, but heats up the cabinet as an additional power loss. Make sure that there is a sufficient ventilation in the device.

## D.19 Output-frequency-dependent current-derating

All Baumüller devices were developed in such a way, that the specified output-measuring currents are continuously, i. e. in the S1 operation, that they are permissible from an electric output frequency of more than 15 Hz. If the static converter output frequency is less than 15 Hz and if the frequency lasts longer than 5 seconds between 0 and 15 Hz, the continuously permissible output current must be reduced according to the following characteristic curve.

For example the following are concerned (but not exclusively):

- Applications with speed control without positioning or
- Applications, where, at standstill, you must apply current in order to hold the torque/to hold the power or
- Applications, where a mechanic blocking can occur, e. g. when starting cold extruders.

Consequential the following applications are not concerned:

- Typical positioning applications
- Applications with motors, which have an operational brake at standstill.
- Applications, where the higher-level control contains a standstill- and a block monitoring.

Provided that the derating area is quickly passed through, the application of  $I_{rated}$  is permitted. Hereby, to pass through quickly means, that the frequency change is  $\geq 15 \text{ Hz/s}$ .

Derating of the motor-sided inverter output current  $I$  against the dimensioning output current  $I_{rated}$  in dependence of the static inverter output frequency  $f$ .

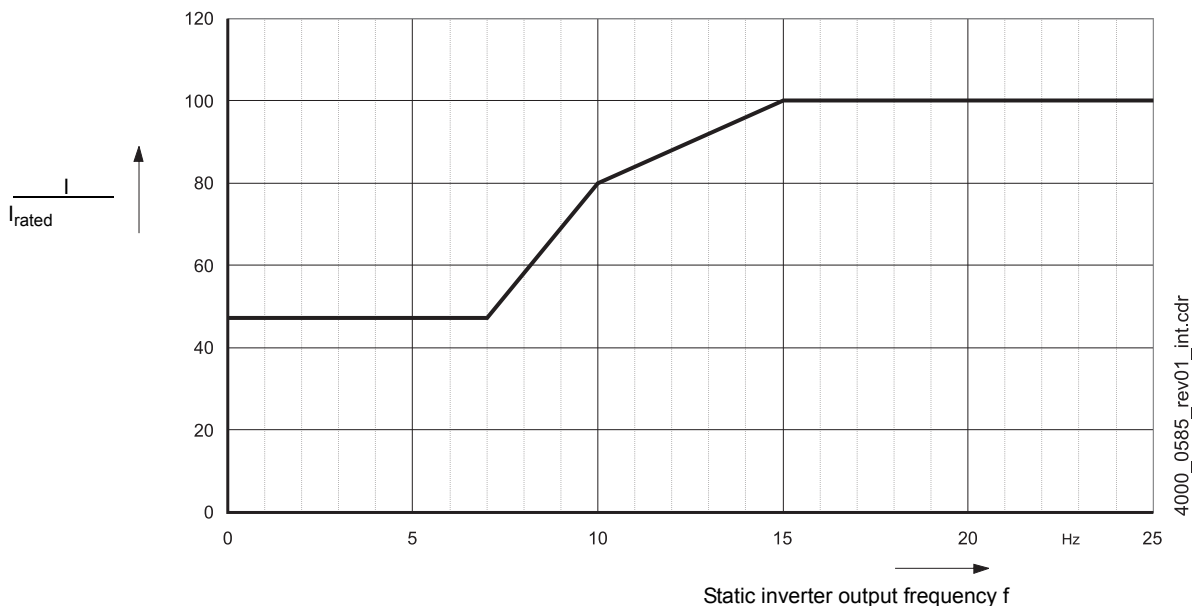


Figure 74: Derating at static inverter frequency < 15 Hz

If there is another derating at a certain device, this can be taken from the section „Electrical data“. Otherwise the derating is valid, which is specified here.

### D.20 Fuse protection

We differ between the protection of the supply cables and the protection of the device. In order to fulfill the CE specifications - here especially EN60204-1 - you have to protect the supply cables.

Protect the device in UL-certified installations with suitable semiconductor- or total range fuses.

#### NOTE



In UL-certificated installations you must place the UL-listed fuses or „Circuit breaker“.

#### Cable protection

Place in safety fuses of the operation class gL DIN VDE 0636-201 / IEC 60269-2-1 / HD 630.2.1 54 or cable protection switches with the triggering characteristic K referring to DIN VDE 0636-201 / IEC 60204-1 60269-2-1 / HD 630.2.1 54, to protect the cables. These fuses protect against overloading and from consequential damages from faults e. g. by fire. You cannot prevent, that the device is extensively destroyed, if a short circuit or an ground fault occurs in the DC link.

Execute the protection according to EN 60204-1 ('Electrical equipment of machines'). Dimension the cable protection fuses, dependent on the used cross section according to the, at the time, valid, national standards and local regulations.

#### Device protection

Place in semiconductor fuses with the triggering characteristic aR DIN VDE 0636-201 / IEC 60269-2-1 HD 630.2.1 54. Switch these in series to the cable protection fuses. These protect the input-sided rectifier-triggering, in case of a short circuit, against completely destruction, so that a repair of the device is possible.

Dimension the suitable device protection fuses, dependent on the peak current and the under [►Device protection◄](#) on page 199 required limit load integral  $i^2t_{\text{OFF}}$ .

#### Cable protection + device protection

You have two possibilities to protect the cable and the device:

- connect fuses and semiconductors in series
- use whole range fuses with trigger characteristic gR (DIN VDE 0636-201/IEC 60269-2-1/HD 630.2.154)

Dimension the suitable cable and device protection fuses dependent on the used cross section of the used mains line, from the peak current and the under [►Device protection◄](#) on page 199 demanded limit load integral  $i^2t_{\text{OFF}}$ .

Deviant to the fuses these devices and supply systems also may also assure be UL-listed „Circuit breaker“ (DIVQ).

Permitted are only „Circuit breaker“ without tripping delay. Circuit breakers with a thermal tripping characteristic are not checked and therewith not approved. In case of an error it must be considered, that the device is not protected against destruction, but only is protected against fire danger.

Dimension the suitable „Circuit breaker“ dependent of the cross section of the inserted supply system, as well as from the nominal- and peak current of the converter.

### D.20.1 Cable protection

The current-carrying capacity of conductors is determined in table 5 of EN60204-1. For your operation you must determine the accordant value in the standard yourself, by taking into consideration, amongst other things the cable mounting. Here you will find an extraction for the laying of PVC- isolated cables on open cable racks:

| Cable cross section | Fuse-Rated current | Cable cross section                       | Fuse-Rated current |
|---------------------|--------------------|-------------------------------------------|--------------------|
| 1.5 mm <sup>2</sup> | 16.1 A             | 25 mm <sup>2</sup>                        | 88 A               |
| 2.5 mm <sup>2</sup> | 22 A               | 35 mm <sup>2</sup>                        | 114 A              |
| 4 mm <sup>2</sup>   | 30 A               | 50 mm <sup>2</sup>                        | 123 A              |
| 6 mm <sup>2</sup>   | 37 A               | 70 mm <sup>2</sup>                        | 155 A              |
| 10 mm <sup>2</sup>  | 52 A               | 95 mm <sup>2</sup>                        | 192 A              |
| 16 mm <sup>2</sup>  | 70 A               | 120 mm <sup>2</sup>                       | 221 A              |
|                     |                    | 150 mm <sup>2</sup> / 185 mm <sup>2</sup> | 355 A              |

Use suitable fuses with the enable characteristic gL or gR.

### D.20.2 Device protection

| Device  | Maximum load value <sup>1)</sup>     |
|---------|--------------------------------------|
| BM4412: | $\leq 310 \text{ A}^2\text{s}$       |
| BM4413: | $\leq 310 \text{ A}^2\text{s}$       |
| BM4414: | $\leq 325 \text{ A}^2\text{s}$       |
| BM4422: | $\leq 400 \text{ A}^2\text{s}$       |
| BM4423: | $\leq 450 \text{ A}^2\text{s}$       |
| BM4424: | $\leq 800 \text{ A}^2\text{s}$       |
| BM4425: | $\leq 800 \text{ A}^2\text{s}$       |
| BM4426: | $\leq 800 \text{ A}^2\text{s}$       |
| BM443X: | $\leq 1.500 \text{ A}^2\text{s}$     |
| BM444X: | $\leq 15,000 \text{ A}^2\text{s}$    |
| BM445X: | $\leq 97,000 \text{ A}^2\text{s}$    |
| BM446X: | $\leq 245,000 \text{ A}^2\text{s}$   |
| BM447X: | $\leq 1,125,000 \text{ A}^2\text{s}$ |

<sup>1)</sup> Use fuses in the **operating point** of the BM4400-device, which fall below the stated tripping integral ( $i^2t_{\text{off}}$ ).

### D.20.3 Cable protection + device protection

Consider by your choice of the whole range fuses the current-carrying capacity of the, to the device connected mains cables and the allowable maximum load of the device.

### D.20.4 Whole range fuses gR (device and cable) BM4412X, BM4413, model NH

|          |     |                                                                                                                          |                                                                                                        |
|----------|-----|--------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| Bussmann | 000 | 16A/690V: 170M1559                      | 20A/690V: 170M1560  |
|          |     | 25A/690V: 170M1561                      |                                                                                                        |
| SIBA     | 000 | 16A/690V: 2047734/16A c  <sub>US</sub> |                                                                                                        |
|          | 00  | 20A/690V: 2047720/20A                                                                                                    | 25A/690V: 2047720/25A                                                                                  |
|          | 0   | 16A/1000V: 2038404/16A                                                                                                   | 20A/1000V: 2038404/20A                                                                                 |
|          |     | 25A/1000V: 2038404/25A                                                                                                   | 32A/1000V: 2038404/32A                                                                                 |
| Siemens  | 000 | 16A/690V: 3NE1 813-0 c  <sub>US</sub>  |                                                                                                        |
|          | 00  | 25A/690V: 3NE8 015-1 c  <sub>US</sub>  | 20A/690V: 3NE8 714-1                                                                                   |
|          |     | 25A/690V: 3NE8 715-1                                                                                                     |                                                                                                        |
|          | 0   | 32A/1000V: 3NE4 101                                                                                                      |                                                                                                        |

Size 

### D.20.5 Semiconductors aR (device) BM4412, BM4413, model NH

|                |     |                              |                              |
|----------------|-----|------------------------------|------------------------------|
| Bussmann       | 00  | 20A/1000V: 170M2673          | 25A/1000V: 170M2674          |
|                | 1   | 40A/690V: 170M3808           |                              |
| Ferraz Shawmut | 000 | 16A/690V: 6.9 URD 000 PV 016 | 20A/690V: 6.9 URD 000 PV 020 |
|                |     | 25A/690V: 6.9 URD 000 PV 025 |                              |
|                | 00  | 20A/690V: 6.9 URD 00 PV 020  | 25A/690V: 6.9 URD 00 PV 025  |
|                |     | 32A/690V: 6.9 URD 00 PV 032  |                              |
|                | 0   | 32A/690V: 6.9 URD 0 PV 032   | 40A/690V: 6.9 URD 0 PV 040   |

Size 

### D.20.6 Whole range fuses gR (device and cable) BM4414, model NH

|                |     |                                                                                                           |                                                                                                             |
|----------------|-----|-----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| Bussmann       | 000 | 25A/690V: 170M1561                                                                                        | 32A/690V: 170M1562                                                                                          |
| Ferraz Shawmut | 000 | 16A/690V: 6.9 GGR 000 PV 016                                                                              | 20A/690V: 6.9 GGR 000 PV 020                                                                                |
|                | 00  | 16A/690V: 6.9 GGR 00 PV 016                                                                               |                                                                                                             |
| SIBA           | 000 | 16A/690V: 2047734/16A                                                                                     | 20A/690V: 2047734/20A                                                                                       |
|                | 00  | 35A/690V: 2047720/35A                                                                                     |                                                                                                             |
|                | 0   | 16A/1000V: 2038404/16A                                                                                    | 25A/1000V: 2038404/25A                                                                                      |
|                |     | 32A/1000V: 2038404/32A                                                                                    | 40A/1000V: 2038404/40A                                                                                      |
| Siemens        | 000 | 16A/690V: 3NE1 813-0  US | 20A/690V: 3NE1 814-0  US |
|                | 00  | 25A/690V: 3NE8 015-1  US | 35A/690V: 3NE8 003-1  US |
|                |     | 25A/690V: 3NE8 715-1  US | 32A/690V: 3NE8 701-1  US |
|                | 0   | 32A/1000V: 4NE4 101                                                                                       | 40A/1000V: 4NE4 102                                                                                         |

Size 

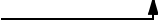
### D.20.7 Semiconductors aR (device) BM4414, model NH

|                |     |                              |                              |
|----------------|-----|------------------------------|------------------------------|
| Bussmann       | 00  | 20A/1000V: 170M2673          | 25A/1000V: 170M2674          |
|                |     | 32A/1000V: 170M2675          | 35A/1000V: 170M2676          |
|                | 1   | 40A/690V: 170M3808           |                              |
| Ferraz Shawmut | 000 | 20A/690V: 6.9 URD 000 PV 020 | 25A/690V: 6.9 URD 000 PV 025 |
|                |     | 32A/690V: 6.9 URD 000 PV 032 | 40A/690V: 6.9 URD 000 PV 040 |
|                | 00  | 25A/690V: 6.9 URD 00 PV 025  | 32A/690V: 6.9 URD 00 PV 032  |
|                |     | 40A/690V: 6.9 URD 00 PV 040  |                              |
|                | 0   | 32A/690V: 6.9 URD 0 PV 032   | 40A/690V: 6.9 URD 0 PV 040   |

Size 

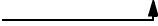
## D.20.8 Whole range fuses gR (device and cable) BM4422X, model NH

|          |     |                                                                                                               |                                                                                                        |
|----------|-----|---------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| Bussmann | 000 | 16A/660V: 170M1559           | 20A/660V: 170M1560  |
|          |     | 25A/660V: 170M1561           | 32A/660V: 170M1562  |
|          | 00  | 16A/690V: 170 m                                                                                               | 20A/690V: 170 m                                                                                        |
|          |     | 25A/690V: 170 m                                                                                               | 32A/690V: 170 m                                                                                        |
| SIBA     | 000 | 16A/690V: 2047734/16A c  US |                                                                                                        |
|          | 00  | 20A/690V: 2047720/20A                                                                                         | 25A/690V: 2047720/25A                                                                                  |
| Siemens  | 00  | 16A/690V: 3NE1 813-0 c  US  | 20A/660V: 3NE8 714                                                                                     |
|          |     | 25A/660V: 3NE8 715                                                                                            | 25A/660V: 3NE8 015                                                                                     |
|          |     | 32A/660V: 3NE8 701                                                                                            |                                                                                                        |
|          | 0   | 32A/1000V: 3NE4 101 c  US   |                                                                                                        |

Size 

## D.20.9 Semiconductors aR (device) BM4422, model NH

|                |     |                              |                              |
|----------------|-----|------------------------------|------------------------------|
| Bussmann       | 00  | 20A/1000V: 170M2673          | 25A/1000V: 170M2674          |
|                |     | 32A/1000V: 170M2675          |                              |
|                | 1   | 40A/660V: 170M3808           |                              |
| Ferraz Shawmut | 000 | 16A/690V: 6.9 URD 000 PV 016 | 20A/690V: 6.9 URD 000 PV 020 |
|                |     | 25A/690V: 6.9 URD 000 PV 025 | 32A/690V: 6.9 URD 000 PV 032 |

Size 

# D.20.10 Whole range fuses gR (device and cable) BM4423X, model NH

|                |     |                                                                                                              |                                                                                                               |
|----------------|-----|--------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| Bussmann       | 000 | 20A/660V: 170M1560          | 25A/660V: 170M1561         |
|                |     | 32A/660V: 170M1562          |                                                                                                               |
|                | 00  | 20A/690V: 170M2693                                                                                           | 25A/690V: 170M2694                                                                                            |
|                |     | 32A/690V: 170M2695                                                                                           |                                                                                                               |
| Ferraz Shawmut | 000 | 20A/690V: 6.9 GGR 000 PV 020                                                                                 |                                                                                                               |
|                | 00  | 20A/690V: 6.9 GGR 00 PV 020                                                                                  |                                                                                                               |
| SIBA           | 000 | 20A/690V: 2047734/20A c  US |                                                                                                               |
|                | 00  | 20A/690V: 2047720/20A                                                                                        | 25A/690V: 2047720/25A                                                                                         |
| Siemens        | 00  | 20A/660V: 3NE8 714                                                                                           | 20A/690V: 3NE8 814-0 c  US |
|                |     | 25A/660V: 3NE8 715                                                                                           | 25A/660V: 3NE8 015                                                                                            |
|                |     | 32A/660V: 3NE8 701                                                                                           |                                                                                                               |
|                | 0   | 32A/1000V: 3NE4 101 c  US  |                                                                                                               |

Size 

# D.20.11 Semiconductors aR (device) BM4423, model NH

|                |     |                              |                              |
|----------------|-----|------------------------------|------------------------------|
| Bussmann       | 00  | 20A/1000V: 170M2673          | 25A/1000V: 170M2674          |
|                |     | 32A/1000V: 170M2675          |                              |
|                | 1   | 40A/660V: 170M3808           |                              |
| Ferraz Shawmut | 000 | 20A/690V: 6.9 URD 000 PV 020 | 25A/690V: 6.9 URD 000 PV 025 |
|                |     | 32A/690V: 6.9 URD 000 PV 032 | 40A/690V: 6.9 URD 000 PV 040 |

Size 

### D.20.12 Whole range fuses gR (device and cable) BM4424, BM4425 and BM4426, model NH

|                |     |                                                                                                               |                                                                                                        |
|----------------|-----|---------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| Bussmann       | 000 | 25A/660V: 170M1561           | 32A/660V: 170M1562  |
|                | 00  | 25A/690V: 170M2694                                                                                            | 32A/690V: 170M2695                                                                                     |
| Ferraz Shawmut | 000 | 25A/690V: 6.9 GGR 000 PV 025                                                                                  |                                                                                                        |
|                | 00  | 25A/690V: 6.9 GGR 00 PV 025                                                                                   |                                                                                                        |
| SIBA           | 000 | 25A/690V: 2047734/25A c  US |                                                                                                        |
|                | 00  | 25A/690V: 2047720/25A                                                                                         |                                                                                                        |
| Siemens        | 00  | 25A/660V: 3NE8 715                                                                                            | 25A/660V: 3NE8 015                                                                                     |
|                |     | 25A/690V: 3NE1 815-0 c  US   | 32A/660V: 3NE8 701                                                                                     |
|                | 0   | 32A/1000V: 3NE4 101 c  US    |                                                                                                        |

Size  ↑

### D.20.13 Semiconductors aR (device) BM4424, BM4425 and BM4426, model NH

|                |     |                              |                              |
|----------------|-----|------------------------------|------------------------------|
| Bussmann       | 00  | 25A/1000V: 170M2674          | 32A/1000V: 170M2675          |
|                |     | 40A/1000V: 170M2676          |                              |
|                | 1   | 40A/660V: 170M3808           | 50A/660V: 170M3809           |
|                |     | 63A/660V: 170M3810           |                              |
| Ferraz Shawmut | 000 | 25A/690V: 6.9 URD 000 PV 025 | 32A/690V: 6.9 URD 000 PV 032 |
|                |     | 40A/690V: 6.9 URD 000 PV 040 | 50A/690V: 6.9 URD 000 PV 050 |
| Siemens        | 00  | 660V/40A: 3NE8 702           |                              |

Size  ↑

#### D.20.14 Whole range fuses gR (device and cable) BM443X model NH

|          |     |                                                                                                                          |                                                                                                        |
|----------|-----|--------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| Bussmann | 000 | 50A/660V: 170M1564                      | 63A/660V: 170M1565  |
|          | 00  | 50A/690V: 170M2697                                                                                                       | 63A/690V: 170M2698                                                                                     |
|          | 1   | 50A/690V: 170M4176                                                                                                       | 63A/690V: 170M4177                                                                                     |
| SIBA     | 00  | 63A/690V: 2047720/63A                                                                                                    |                                                                                                        |
|          | 1   | 63A/690V: 2021120/63A                                                                                                    |                                                                                                        |
| Siemens  | 00  | 63A/660V: 3NE8 018-1  <small>US</small> |                                                                                                        |
|          | 0   | 50A/1000V: 3NE4 117                                                                                                      |                                                                                                        |

Size 

#### D.20.15 Semiconductors aR (device) BM443X, model NH

|          |    |                                                                                                                           |                        |
|----------|----|---------------------------------------------------------------------------------------------------------------------------|------------------------|
| Bussmann | 00 | 50A/1000V: 170M2678                                                                                                       | 63A/1000V: 170M2679    |
|          | 1  | 63A/690V: 170M3810                                                                                                        | 80A/690V: 170M3811     |
| SIBA     | 0  | 63A/1000V: 2038404/63A                                                                                                    | 80A/1000V: 2038404/80A |
| Siemens  | 00 | 50A/660V: 3NE8 717                                                                                                        | 63A/660V: 3NE8 718     |
|          | 0  | 63A/1000V: 3NE4 118  <small>US</small> |                        |

Size 

## D.20.16 Full-range fuses gR, gRL, gR/gS, gGR (device and cable) BM444X, model NH

|                |     |                                                                                                            |                                                                                                                              |
|----------------|-----|------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| Bussmann       | 00  | 80A/690V: 170M2699                                                                                         | 100A/690V: 170M2700                                                                                                          |
|                |     | 125A/690V: 170M2701 <sup>1)</sup>                                                                          |                                                                                                                              |
|                | 1   | 80A/690V: 170M4178                                                                                         | 100A/690V: 170M4179                                                                                                          |
|                |     | 125A/690V: 170M4180                                                                                        | 160A/690V: 170M4181                                                                                                          |
| Ferraz Shawmut | 000 | 80A/690V: 6.9 GGR 000 PV 080/<br>6,9 GGR 000 D08L 080                                                      |                                                                                                                              |
|                | 00  | 80A/690V: 6.9 GGR 00 PV 080/<br>6,9 GGR 00 D08L 080                                                        |                                                                                                                              |
| SIBA           | 1   | 80A/690V: 2021120-80A                                                                                      | 100A/690V: 2021120-100A                                                                                                      |
|                |     | 80A/690V: 2021134-80A  US | 100A/690V: 2021134-100A<br> <sup>1)</sup> |
| Siemens        | 000 | 80A/690V: 3NE1 820-0  US  |                                                                                                                              |

Size 

<sup>1)</sup> For the connection of an additional DC link capacity or the parallel operation of up to five devices suitable, that means the DC link of several devices is connected with at the same time existent mains connection of every device.

## D.20.17 Semiconductors aR (device) BM444X, model NH

|          |     |                                                                                                               |                                                                                                                            |
|----------|-----|---------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Bussmann | 000 | 80A/690V: 170M1566 c  US     | 100A/690V: 170M1567 c  US               |
|          |     | 125A/690V: 170M1568 c  US    | 160A/690V: 170M1569 c  US               |
|          | 00  | 80A/1000V: 170M2680                                                                                           | 100A/1000V: 170M2681                                                                                                       |
|          |     | 125A/1000V: 170M2682                                                                                          |                                                                                                                            |
|          | 1   | 80A/690V: 170M3811 c  US     | 100A/690V: 170M3812 c  US               |
|          |     | 125A/690V: 170M3813 c  US    | 160A/690V: 170M3814 c  US <sup>1)</sup> |
| SIBA     | 1   | 125A/690V: 2021120/125A <sup>1)</sup>                                                                         |                                                                                                                            |
| Siemens  | 000 | 80A/690V: 3NE8 720-1 c  US   | 100A/690V: 3NE8 721-1 c  US             |
|          |     | 125A/690V: 3NE8 722-1 c  US  | 160A/690V: 3NE8 724-1 c  US             |
|          | 00  | 80A/690V: 3NE8 020-1 c  US   | 100A/690V: 3NE8 021-1 c  US             |
|          |     | 125A/690V: 3NE8 022-1 c  US  | 160A/690V: 3NE8 024-1 c  US             |
|          | 0   | 80A/1000V: 3NE4 120 c  US    | 100A/1000V: 3NE4 121 c  US              |
|          |     | 125A/1000V: 3NE4 122 c  US  |                                                                                                                            |
|          | 1   | 100A/1000V: 3NE3 221 c  US | 125A/1000V: 3NE3 222 c  US            |
|          |     | 160A/1000V: 3NE3 224 c  US |                                                                                                                            |

Size 

<sup>1)</sup> For the connection of an additional DC link capacity or the parallel operation of up to five devices suitable, that means the DC link of several devices is connected with at the same time existent mains connection of every device.

## D.20.18 Whole range fuses gR (device and cable) BM445X model NH

|                |     |                                                                                                                                         |                                                                                                                                          |
|----------------|-----|-----------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Bussmann       | 00  | 100A/690V: 170M2700                                                                                                                     | 125A/690V: 170M2701                                                                                                                      |
|                |     | 160A/690V: 170M2702                                                                                                                     |                                                                                                                                          |
|                | 1   | 125A/690V: 170M4180                                                                                                                     | 160A/690V: 170M4181                                                                                                                      |
|                |     | 200A/690V: 170M4182 <sup>1)</sup>                                                                                                       | 250A/690V: 170M4183 <sup>1)</sup>                                                                                                        |
|                | 2   | 200A/690V: 170M5881                                                                                                                     | 250A/690V: 170M5882 <sup>1)</sup>                                                                                                        |
|                |     | 315A/690V: 170M5883 <sup>1)</sup>                                                                                                       |                                                                                                                                          |
|                | 3   | 350A/690V: 170M6080 <sup>1)</sup>                                                                                                       |                                                                                                                                          |
| Ferraz Shawmut | 000 | 100A/690V: 6.9 GGR 000 PV 100                                                                                                           |                                                                                                                                          |
|                | 00  | 100A/690V: 6.9 GGR 00 PV 100                                                                                                            |                                                                                                                                          |
|                |     | 125A/690V: 6.9 GGR 00 PV 125 <sup>1)</sup>                                                                                              |                                                                                                                                          |
|                |     | 160A/690V: 6.9 GGR 00 PV 160 <sup>1)</sup>                                                                                              |                                                                                                                                          |
| SIBA           | 00  | 100A/690V: 2020934/100A <sub>c</sub>                  | 125A/690V: 2020934/125A <sub>c</sub>  <sup>1)</sup>   |
|                | 1   | 100A/690V: 2021134/100A <sub>c</sub>                | 125A/690V: 2021134/125A <sub>c</sub>  <sup>1)</sup> |
|                |     | 160A/690V: 2021134/160A <sub>c</sub>  <sup>1)</sup> | 200A/690V: 2021134/200A <sub>c</sub>  <sup>1)</sup> |
|                | 2   | 160A/690V: 2021234/160A <sub>c</sub>  <sup>1)</sup> | 200A/690V: 2021234/200A <sub>c</sub>  <sup>1)</sup> |
| Siemens        | 00  | 100A/690V: 3NE1 021-0 c                             | 125A/690V: 3NE1 022-0 c  <sup>1)</sup>              |
|                | 1   | 160A/690V: 3NE1 224-0 c  <sup>1)</sup>              | 200A/690V: 3NE1 225-0 c  <sup>1)</sup>              |

Size 

<sup>1)</sup> For the connection of an additional DC link capacity or the parallel operation of up to five devices suitable, that means the DC link of several devices is connected with at the same time existent mains connection of every device.

# D.20.19 Semiconductors aR (device) BM445X, model NH

|                |     |                                                                                                                                          |                                                                                                                                          |
|----------------|-----|------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Bussmann       | 000 | 125A/660V: 170M1568                                     | 160A/660V: 170M1569                                   |
|                |     | 200A/660V: 170M1570                                     | 250A/660V: 170M1571  <sup>1)</sup>                    |
|                |     | 315A/660V: 170M1572  <sup>1)</sup>                      |                                                                                                                                          |
|                | 00  | 125A/1000V: 170M2682                                                                                                                     | 160A/1000V: 170M2683 <sup>1)</sup>                                                                                                       |
|                |     | 200A/900V: 170M2684 <sup>1)</sup>                                                                                                        | 225A/900V: 170M2685 <sup>1)</sup>                                                                                                        |
|                | 1   | 160A/660V: 170M3814                                                                                                                      | 200A/660V: 170M3815                                                                                                                      |
|                |     | 250A/660V: 170M3816                                                                                                                      | 315A/660V: 170M3817 <sup>1)</sup>                                                                                                        |
|                |     | 350A/660V: 170M3818 <sup>1)</sup>                                                                                                        | 400A/660V: 170M3819 <sup>1)</sup>                                                                                                        |
|                | 2   | 400A/660V: 170M5808 <sup>1)</sup>                                                                                                        | 450A/660V: 170M5809 <sup>1)</sup>                                                                                                        |
|                | 3   | 500A/660V: 170M6808 <sup>1)</sup>                                                                                                        |                                                                                                                                          |
| Ferraz Shawmut | 000 | 125A/690V: 6.9 URD 000 PV 0125                                                                                                           |                                                                                                                                          |
|                |     | 160A/690V: 6.9 URD 000 PV 0160                                                                                                           |                                                                                                                                          |
|                |     | 200A/690V: 6.9 URD 000 PV 0200                                                                                                           |                                                                                                                                          |
|                |     | 250A/690V: 6.9 URD 000 PV 0250 <sup>1)</sup>                                                                                             |                                                                                                                                          |
|                |     | 315A/690V: 6.9 URD 000 PV 0315 <sup>1)</sup>                                                                                             |                                                                                                                                          |
| Siemens        | 00  | 125A/660V: 3NE8 022 c  <sub>US</sub>                  | 125A/660V: 3NE8 722                                                                                                                      |
|                |     | 160A/660V: 3NE8 024                                                                                                                      | 160A/660V: 3NE8 724                                                                                                                      |
|                |     | 200A/660V: 3NE8 725                                                                                                                      | 250A/660V: 3NE8 727 <sup>1)</sup>                                                                                                        |
|                |     | 315A/660V: 3NE8 731 <sup>1)</sup>                                                                                                        |                                                                                                                                          |
|                | 0   | 100A/1000V: 3NE4 121 c  <sub>US</sub>                 | 125A/1000V: 3NE4 122 c  <sub>US</sub>               |
|                |     | 160A/1000V: 3NE4 124 c  <sub>US</sub>                 |                                                                                                                                          |
|                | 1   | 125A/1000V: 3NE3 222 c  <sub>US</sub>                 | 160A/1000V: 3NE3 224 c  <sub>US</sub>               |
|                |     | 200A/1000V: 3NE3 225 c  <sub>US</sub>                 | 250A/1000V: 3NE3 227 c  <sub>US</sub> <sup>1)</sup> |
|                |     | 315A/1000V: 3NE3 230-0Bc  <sub>US</sub> <sup>1)</sup> | 350A/1000V: 3NE3 231 c  <sub>US</sub> <sup>1)</sup> |
|                |     | 400A/1000V: 3NE3 232-0Bc  <sub>US</sub> <sup>1)</sup> |                                                                                                                                          |
|                | 2   | 400A/1000V: 3NE3 332-0Bc  <sub>US</sub> <sup>1)</sup> |                                                                                                                                          |

Size 

<sup>1)</sup> For the connection of an additional DC link capacity or the parallel operation of up to five devices suitable, that means the DC link of several devices is connected with at the same time existent mains connection of every device.

## D.20.20 Whole range fuses gR (device and cable) BM446X model NH

|          |   |                                                                                                                                      |                                                                                                                                      |
|----------|---|--------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Bussmann | 1 | 250A/690V: 170M4183                                                                                                                  | 315A/690V: 170M4184 <sup>1)</sup>                                                                                                    |
|          |   | 350A/690V: 170M4185 <sup>1)</sup>                                                                                                    | 400A/690V: 170M4186 <sup>1)</sup>                                                                                                    |
|          | 2 | 250A/690V: 170M5882                                                                                                                  | 315A/690V: 170M5883 <sup>1)</sup>                                                                                                    |
|          |   | 350A/690V: 170M5884 <sup>1)</sup>                                                                                                    | 400A/690V: 170M5885 <sup>1)</sup>                                                                                                    |
|          |   | 450A/690V: 170M5886 <sup>1)</sup>                                                                                                    |                                                                                                                                      |
|          | 3 | 350A/690V: 170M6080 <sup>1)</sup>                                                                                                    | 400A/690V: 170M6081 <sup>1)</sup>                                                                                                    |
|          |   | 450A/690V: 170M6082 <sup>1)</sup>                                                                                                    |                                                                                                                                      |
| SIBA     | 1 | 250A/690V: 2021134/250A <sub>c</sub>  <sup>1)</sup> | 315A/690V: 2021134/315A <sub>c</sub>  <sup>1)</sup> |
|          | 2 | 250A/690V: 2021234/250A <sub>c</sub>  <sup>1)</sup> | 315A/690V: 2021234/315A <sub>c</sub>  <sup>1)</sup> |
|          |   | 350A/690V: 2021234/350A <sub>c</sub>  <sup>1)</sup> |                                                                                                                                      |
|          | 3 | 315A/690V: 2021334/315A <sup>1)</sup>                                                                                                | 350A/690V: 2021334/350A <sup>1)</sup>                                                                                                |
| Siemens  | 1 | 250A/690V: 3NE1 227-0 c  <sup>1)</sup>             | 315A/690V: 3NE1 230-0 c  <sup>1)</sup>             |

Size 

<sup>1)</sup> For the connection of an additional DC link capacity or the parallel operation of up to five devices suitable, that means the DC link of several devices is connected with at the same time existent mains connection of every device.

## D.20.21 Semiconductor fuses aR (device) 446X, model NH

|          |     |                                                                                                         |                                                                                                         |
|----------|-----|---------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| Bussmann | 000 | 250A/660V: 170M1571  | 315A/660V: 170M1572  |
|          | 00  | 225A/900V: 170M2685 <sup>1)</sup>                                                                       |                                                                                                         |
|          | 1   | 250A/660V: 170M3816                                                                                     | 315A/660V: 170M3817                                                                                     |
|          |     | 350A/660V: 170M3818                                                                                     | 400A/660V: 170M3819 <sup>1)</sup>                                                                       |
|          | 2   | 400A/660V: 170M5808                                                                                     | 450A/660V: 170M5809 <sup>1)</sup>                                                                       |
|          |     | 500A/660V: 170M5810 <sup>1)</sup>                                                                       | 550A/660V: 170M5811 <sup>1)</sup>                                                                       |
|          |     | 630A/660V: 170M5812 <sup>1)</sup>                                                                       |                                                                                                         |
|          | 3   | 500A/660V: 170M6808                                                                                     | 550A/660V: 170M6809 <sup>1)</sup>                                                                       |
|          |     | 630A/660V: 170M6810 <sup>1)</sup>                                                                       | 700A/660V: 170M6811 <sup>1)</sup>                                                                       |

Size 

|                |     |                                                                                                                           |                                                                                                                             |
|----------------|-----|---------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Ferraz Shawmut | 000 | 250A/690V: 6.9 URD 000 PV 0250                                                                                            |                                                                                                                             |
|                |     | 315A/690V: 6.9 URD 000 PV 0315                                                                                            |                                                                                                                             |
|                | 00  | 250A/690V: 6.9 URD 00 PV 0250                                                                                             | 315A/690V: 6.9 URD 00 PV 0315                                                                                               |
|                | 0   | 250A/690V: 6.9 URD 0 PV 0250                                                                                              | 315A/690V: 6.9 URD 0 PV 0315                                                                                                |
|                | 1   | 250A/690V: 6.9 URD 1 PV 0250                                                                                              | 315A/690V: 6.9 URD 1 PV 0315                                                                                                |
|                |     | 350A/690V: 6.9 URD 1 PV 0350                                                                                              | 400A/690V: 6.9 URD 1 PV 0400 <sup>1)</sup>                                                                                  |
|                | 2   | 250A/690V: 6.9 URD 2 PV 0250                                                                                              | 315A/690V: 6.9 URD 2 PV 0315                                                                                                |
|                |     | 350A/690V: 6.9 URD 2 PV 0350                                                                                              | 400A/690V: 6.9 URD 2 PV 0400                                                                                                |
|                |     | 450A/690V: 6.9 URD 2 PV 0450 <sup>1)</sup>                                                                                | 500A/690V: 6.9 URD 2 PV 0500 <sup>1)</sup>                                                                                  |
|                |     | 560A/690V: 6.9 URD 2 PV 0560 <sup>1)</sup>                                                                                | 630A/690V: 6.9 URD 2 PV 0630 <sup>1)</sup>                                                                                  |
|                | 3   | 315A/690V: 6.9 URD 3 PV 0315                                                                                              | 350A/690V: 6.9 URD 3 PV 0350                                                                                                |
|                |     | 400A/690V: 6.9 URD 3 PV 0400                                                                                              | 450A/690V: 6.9 URD 3 PV 0450                                                                                                |
|                |     | 500A/690V: 6.9 URD 3 PV 0500 <sup>1)</sup>                                                                                | 560A/690V: 6.9 URD 3 PV 0560 <sup>1)</sup>                                                                                  |
|                |     | 630A/690V: 6.9 URD 3 PV 0630 <sup>1)</sup>                                                                                | 700A/690V: 6.9 URD 3 PV 0700 <sup>1)</sup>                                                                                  |
| Siemens        | 00  | 250A/660V: 3NE8 727                                                                                                       | 315A/660V: 3NE8 731                                                                                                         |
|                | 1   | 250A/1000V: 3NE3 227                   | 315A/1000V: 3NE3 230-0B                |
|                |     | 350A/1000V: 3NE3 231  <sup>1)</sup>    | 400A/1000V: 3NE3 232-0B  <sup>1)</sup> |
|                |     | 450A/1000V: 3NE3 233  <sup>1)</sup>    |                                                                                                                             |
|                | 2   | 400A/1000V: 3NE3 332-0B  <sup>1)</sup> | 450A/1000V: 3NE3 333  <sup>1)</sup>    |
|                |     | 500A/1000V: 3NE3 334-0B  <sup>1)</sup> | 560A/1000V: 3NE3 335  <sup>1)</sup>    |

Size 

<sup>1)</sup> For the connection of an additional DC link capacity or the parallel operation of up to five devices suitable, that means the DC link of several devices is connected with at the same time existent mains connection of every device.

### D.20.22 Semiconductor fuses aR (device) 447X, model NH



#### WARNING

The following **may occur**, if you disregard these safety notes:

- serious personal injury
- death

*The danger is: **electricity**. Parts, which are under tension are perilous.*

The use of semiconductor fuses is obligatory at the mains connection of BM447X devices. Semiconductor fuses are required in the chopper resistor connection except the user assures the short-circuit protection of resistor and cable.

BM4472:

|         |   |                                                                                                          |   |
|---------|---|----------------------------------------------------------------------------------------------------------|---|
| Siemens | 2 | 630A/1000V: 3NE3 337-8  |   |
| Size    |   |                                                                                                          | ↑ |

BM4473:

|         |   |                                                                                                          |   |
|---------|---|----------------------------------------------------------------------------------------------------------|---|
| Siemens | 2 | 800A/800V: 3NA3 338-8  |   |
| Size    |   |                                                                                                          | ↑ |

BM447X UL fuse in the chopper resistor circuit:

|         |   |                                                                                                          |   |
|---------|---|----------------------------------------------------------------------------------------------------------|---|
| Siemens | 1 | 350A/1000V: 3NE3 231  |   |
| Size    |   |                                                                                                          | ↑ |

### D.20.23 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 V<sub>DC</sub>. Additionally these connections must be protected with fuses which are in accordance with UL 248 with a triggering current of maximum 4 A.

#### NOTE



Several connections can be protected together with a UL-listed fuse (release current max. 4 A).

## D.21 Cables mains-device

| Device | Cross section <sup>1)</sup>                                     | Maximum length <sup>2)</sup>                                                              | Connection to device <sup>3)</sup>                                         |
|--------|-----------------------------------------------------------------|-------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| BM441X | 4 x 0.5 to 2,5 mm <sup>2</sup><br>(AWG 16 - 12)                 | mains to mains filter: user-defined<br>mains filter to mains choke/<br>device: max. 30 cm | flexible cable<br>with/without wire end ferrule<br>(plug-in terminal)      |
| BM442X | 4 x 0.5 to 4 mm <sup>2</sup><br>(AWG 24 - 10)                   |                                                                                           | flexible cable with wire end ferrule<br>(screw terminal)                   |
| BM443X | 4 x 0.5 to 10 mm <sup>2</sup> (AWG<br>20 - 6) <sup>4)</sup>     |                                                                                           | flexible cable with wire end ferrule<br>(screw terminal)                   |
| BM4435 |                                                                 |                                                                                           | Pin-cable-lugs according to DIN<br>46230 <sup>4)</sup><br>(screw terminal) |
| BM444X | 4 x 16 to 50 mm <sup>2</sup><br>(AWG 6 -0)                      |                                                                                           | flexible cable with wire end ferrule<br>(screw terminal)                   |
| BM445X | 4 x 25 to ca. 185 mm <sup>2</sup>                               |                                                                                           | Cable lug max. Width: 25 mm (cur-<br>rent bar) <sup>5)</sup>               |
| BM446X |                                                                 |                                                                                           | Cable lug max. Width: 35 mm (cur-<br>rent bar) <sup>6)</sup>               |
| BM447X | 4 x (4 x 95 mm <sup>2</sup> )<br>2 x (4 x 185 mm <sup>2</sup> ) |                                                                                           | Cable lug max. Width: 25 mm or 35<br>mm (bus-bar) <sup>7)</sup>            |

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

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

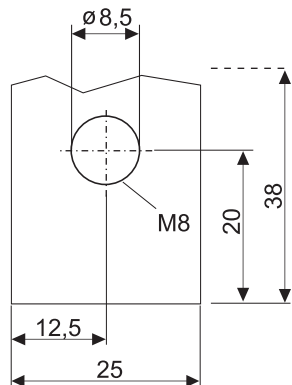
<sup>2)</sup> The length of the cable between mains filter and mains is not of importance for the compliance to the EMC regulation.

<sup>3)</sup> The installing of the cables is user-defined.

<sup>4)</sup> Information according the technical data of the BM4435:

The BM4435 has an input current of 53 A, the appropriate mains filter (BFN3-1-42-001) has a rated current of 56 A. 63 A-fuses must be provided for the cable protection and a cable with 16 mm<sup>2</sup> cross section must be used. The terminals at the BM4435 are provided for cross sections up to 10 mm<sup>2</sup>, therefore at the BM4435 e. g. pin-cable-lugs according to DIN 46230 must be used.

5)

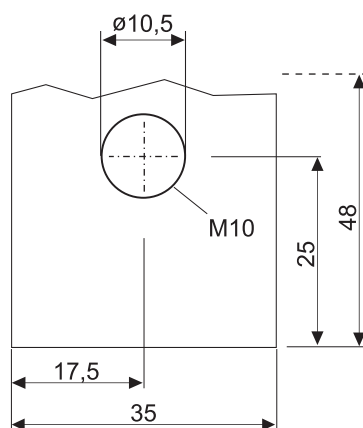


4000\_0028\_rev01\_int.cdr

Connection lugs (current bars). Position see [▶Figure 49◀](#) on page 84.

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

6)

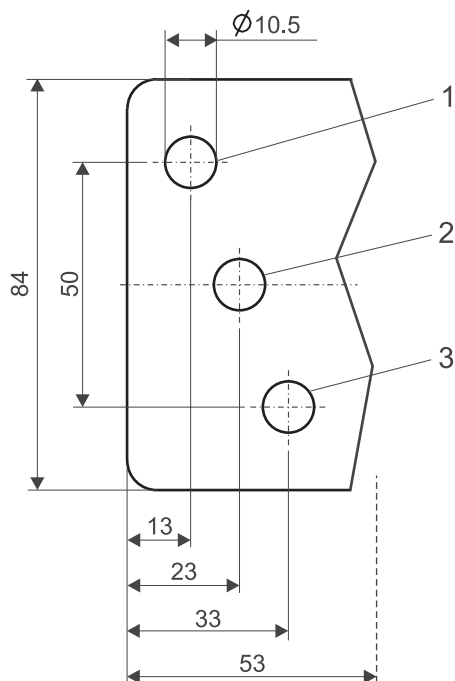


4000\_0029\_rev01\_int.cdr

Connection lugs (current bars). Position see [▶Figure 49◀](#) on page 84

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

7)



4000\_0569\_rev01\_int.cdr

Connection lugs (current bars). Position see [▶Figure 50◀](#) on page 85

At connection cross-section 95 mm<sup>2</sup>, Cable lug width max. 25 mm:

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

At connection cross-section 185 mm<sup>2</sup>, Cable lug width max. 35 mm:

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

## D.22 Cables device-motor

| Device               | Cross section <sup>1)</sup>                                     | maximum length <sup>2)3)</sup>                                              | Connection to device                                            |
|----------------------|-----------------------------------------------------------------|-----------------------------------------------------------------------------|-----------------------------------------------------------------|
| BM441X               | 4 x (1 to 2,5 mm <sup>2</sup> )<br>(AWG 16 - 12)                | dependent on the used cross section:                                        | flexible cable with/without wire end ferrule (plug-in terminal) |
| BM442X               | 4 x (0.2 to 4 mm <sup>2</sup> )<br>(AWG 24 - 10)                | 4 x 1.5 to 2,5 mm <sup>2</sup> (AWG 16 - 12): 100m                          | flexible cable with wire end ferrule (screw terminal)           |
| BM443X               | 4 x (4 to 16 mm <sup>2</sup> ) (AWG 20 - 4)                     | 4 x 4 to 25 mm <sup>2</sup> (AWG 10-3): 60m                                 |                                                                 |
| BM444X               | 4 x (16 to 50 mm <sup>2</sup> )<br>(AWG 6 - 0)                  | 4 x 35 mm <sup>2</sup> (AWG 1): 50m                                         |                                                                 |
| BM445X               | 4 x (20 to ca. 185 mm <sup>2</sup> )                            | ≥ 4 x 50 mm <sup>2</sup> (AWG 1/0): 15m                                     | Cable lug max. Width: 25 mm (current bar) <sup>4)</sup>         |
| BM446X               |                                                                 |                                                                             | Cable lug max. Width: 35 mm (current bar) <sup>5)</sup>         |
| BM447X <sup>6)</sup> | 4 x (4 x 95 mm <sup>2</sup> )<br>4 x (2 x 185 mm <sup>2</sup> ) | up to 2 x 185 mm <sup>2</sup> : 30 m<br>up to 4 x 95 mm <sup>2</sup> : 15 m | Cable lug max. Width: 25 mm or 35 mm (bus-bar) <sup>6)</sup>    |

1) Possible cross section

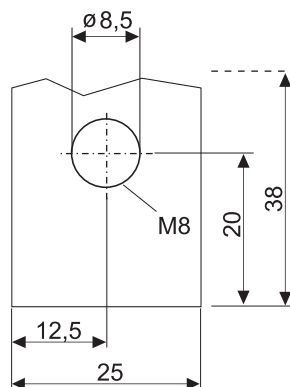
Use a screened circuit Baumüller-line, optical shield coverage > 85%. Do not use single conductors.

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

2) Only for Baumüller cables with this maximum length and by usage of a Baumüller mains filter you can assume, that the limit values of the EMC product standard EN 61800-3 are complied with.

3) In case you use parallel-installed motor cables, the maximum length is to be reduced by the factor 1/n.

4)



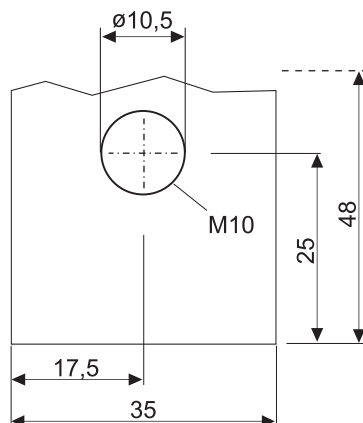
4000\_0028\_rev01\_int.cdr

Connection lugs (current bars). Position see [Figure 49](#) on page 84.

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

## D.23 Cable control voltage supply/signals

5)

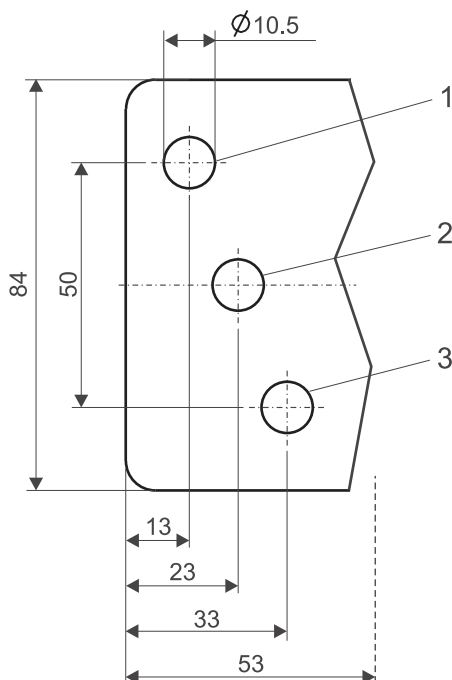


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Connection lugs (current bars). Position see ►Figure 49◄ on page 84

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

6)



4000\_0569\_rev01\_int.cdr

Connection lugs (current bars). Position see ►Figure 50◄ on page 85

At a connection cross-section of 95 mm<sup>2</sup>, cable lug width max. 25 mm:

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

At a connection cross-section of 185 mm<sup>2</sup>, cable lug width max. 35 mm:

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

### D.23 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.

## D.24 Type of protection

| Type of protection        |                                                                        |
|---------------------------|------------------------------------------------------------------------|
| BM 441X, BM 442X          | IP 20                                                                  |
| BM 443X, BM 444X          | IP 20, if safe-to-touch connection according to IP 20, otherwise IP 10 |
| BM 445X, BM 446X, BM 447X | IP 00                                                                  |

## D.25 Fire fighting appliances

|                 |            |
|-----------------|------------|
| Fight fire with | ABC-Pulver |
|-----------------|------------|

## D.26 Mains filters BM441X to BM447X

In order to comply with the required limit values of the EMC product standard a mains filter is necessary for each device.

Insert in proportion of the application a mains filter from the following table.

TN-mains

| I <sub>Bem AC</sub> <sup>1)</sup> | Type                | Item number |
|-----------------------------------|---------------------|-------------|
| 7 A                               | BFN 3-1 - 7 - 001   | 314277      |
| 16 A                              | BFN 3-1 - 16 - 001  | 314278      |
| 30 A                              | BFN 3-1 - 30 - 001  | 314279      |
| 42 A                              | BFN 3-1 - 42 - 001  | 314280      |
| 56 A                              | BFN 3-1 - 56 - 001  | 314281      |
| 75 A                              | BFN 3-1 - 75 - 001  | 314282      |
| 100 A                             | BFN 3-1 - 100 - 001 | 314283      |
| 130 A                             | BFN 3-1 - 130 - 001 | 314284      |
| 180 A                             | BFN 3-1 - 180 - 001 | 314285      |
| 250 A                             | BFN 3-1 - 250 - 001 | 373891      |
| 320 A                             | BFN 3-1 - 320 - 001 | 373896      |
| 400 A                             | BFN 3-1 - 400 - 001 | 373900      |
| 600 A                             | BFN 3-1 - 600 - 001 | 373901      |

<sup>1)</sup> Rated temperature = 40° C

## IT-mains

| $I_{\text{Bem AC}}^{1)}$ | Type                | Item number |
|--------------------------|---------------------|-------------|
| 250 A                    | BFN 3-1 - 250 - 002 | 373620      |
| 320 A                    | BFN 3-1 - 320 - 002 | 373894      |
| 400 A                    | BFN 3-1 - 400 - 002 | 373898      |
| 600 A                    | BFN 3-1 - 600 - 002 | 373902      |

<sup>1)</sup> Rated temperature = 40° C

## D.27 Mains chokes

For the devices BM441X, BM4422, BM4423, BM4424 and BM4425 mains chokes are not necessary.

**Current** Select the mains chokes depending on their application on the basis of the input rated current. Take into account that the max. input current may not bring the choke into saturation.

**Inductance** Furthermore, chose the mains chokes dependent on the short circuit voltage of the mains, so that the demanded mains inductance, under [►Requirements on the power supply◄](#) on page 162, is complied with.

## NOTE



at 60 Hz there is another short-circuit voltage with the same choke as with 50 Hz; with the formula  $u_k = (\omega L \times I_N \times \sqrt{3}) / U_N$  (with  $\omega = 2\pi \times f$ ) you can calculate the short-circuit voltage at another mains frequency.

| $I_{\text{rated AC}}$ | Inductance  | Type designation | Part No.<br>Type -001,<br>Connection<br>copper conductor bar | Part No.<br>Type -002,<br>Connection<br>terminal |
|-----------------------|-------------|------------------|--------------------------------------------------------------|--------------------------------------------------|
| 25 A                  | 1,18 mH     | BK3-0025/0030    | 368377                                                       | 399136                                           |
| 40 A                  | 0,72 mH     | BK3-0040/0050    | 368378                                                       | 399137                                           |
| 65 A                  | 0,45 mH     | BK3-0065/0080    | 368379                                                       | 399138                                           |
| 80 A                  | 0,36 mH     | BK3-0080/0100    | 368380                                                       | 399139                                           |
| 115 A                 | 0,26 mH     | BK3-0115/0140    | 368381                                                       | 399140                                           |
| 165 A                 | 0,18 mH     | BK3-0165/0200    | 368382                                                       | 399141                                           |
| 195 A                 | 0,15 mH     | BK3-0195/0240    | 368383                                                       | -                                                |
| 275 A                 | 105 $\mu$ H | BK3-0275/0340    | 368384                                                       | -                                                |
| 365 A                 | 80 $\mu$ H  | BK3-0365/0450    | 368385                                                       | -                                                |
| 450 A                 | 65 $\mu$ H  | BK3-0450/0550    | 368386                                                       | -                                                |

| $I_{\text{rated AC}}$ | Inductance         | Type designation | Part No.<br>Type -001,<br>Connection<br>copper conductor bar | Part No.<br>Type -002,<br>Connection<br>terminal |
|-----------------------|--------------------|------------------|--------------------------------------------------------------|--------------------------------------------------|
| 530 A                 | 55 $\mu\text{H}$   | BK3-0530/0650    | 368387                                                       | -                                                |
| 615 A                 | 48 $\mu\text{H}$   | BK3-0615/0750    | 368388                                                       | -                                                |
| 750 A                 | 39 $\mu\text{H}$   | BK3-0750/0920    | 368389                                                       | -                                                |
| 920 A                 | 32,6 $\mu\text{H}$ | BK3-0900/1100    | 368390                                                       | -                                                |
| 1020 A                | 28 $\mu\text{H}$   | BK3-1020/1250    | 395020                                                       | -                                                |

The listed chokes are specified for the operation at 400 V / 50 Hz or 480 V / 60 Hz.  
At a mains voltage of 400 V and a frequency of 50 Hz at rated current the chokes have a short-circuit voltage of 4% of the mains voltage.

## D.28 Temperature sensors of the motor

| Type                     | additional requirements                                                          | Insulation |
|--------------------------|----------------------------------------------------------------------------------|------------|
| KTY84                    | -                                                                                | SELV/PELV  |
| MSKL <sup>1)</sup> (PTC) | $R = 1\text{K}\Omega$ at $T_{\text{protection}}$ , $I_{\text{max}} < 2\text{mA}$ | SELV/PELV  |

<sup>1)</sup> Motor protection PTC according to DIN 44080-082

### NOTE



The motor temperature sensor is to be executed in such a way, that the electrical separation (EN 61800-5-1) is guaranteed. The motor temperature sensors, which are build in at Baumüller motors correspond to these requirements. When connecting an motor produced by an external manufacturer, the operator has to assure, that the motor temperature sensor, which was installed into the motor complies with the function electrical separation.





## APPENDIX E - SAFE STOP

In this chapter we describe the safety function „Safe stop“.

### E.1 Methods to avoid an unexpected starting

---

In order to avoid danger for persons, for example operators, service- and maintenance technics, the machine has to be kept in a safe state (safe stop), while taking action in the dangerous area of the machine. Therefore a reliable prevention of a unexpected starting is demanded (Machine Directive 89/392/EEG, attachment I, 1.6.3, last paragraph; EN 292-2, 4.1.4; EN 60204-1, 5.4). Unexpected starting is each starting, which causes a risk for persons by its unexpected occurrence (EN 292-1). Moreover, besides the transition of the enable- to the operating state of the machine also the unexpected ramp-up of the machine, this means the transition from the safe stop into an unsafe moving has to be considered. This is necessary, because the unexpected ramp-up usually is to be led back to an interruption of the control loop of the machine. In this case the drive is, because of its control system, anxious to achieve highest speed at maximum acceleration. If an unexpected starting occurs, the operator therefore doesn't have the possibility anymore to remove himself or his hand from the danger area. This is why the drive has to be stopped and has to be kept safe in its 'off-position', when having opened, electrical interlocked safety devices. The motor may not have torque and thus cannot generate a dangerous movement.

The prevention of an unexpected starting of the machine can be reached by electrical separated safety devices, e.g. contactors. By some machine types it has to be done without the isolation of the electrical connection of the drive to the mains, if e. g. a drive supplied by a power converter is often stopped and started again. The constant dis- and re-charging of the DC link represents a great stress for the concerned parts and often leads to disturbing delays and failures of these parts.

The precondition of starting an three-phase motor is the generation of a rotating field, which drives the inductor of the motor. When having variable-speed three-phase current drives, usually in the micro-processors a complex pulse pattern is generated, then the pulses are amplified and are used for the switching of the power semiconductors. If either no defined pulse pattern is available or the amplifying connection is interrupted, e. g. by switching off of the power supply with a relay (safety relay), no rotary field can be generated. An error at the pulse pattern generation therefore cannot lead to a starting of the motor, as long as the second precondition, namely the interruption of the amplifying power supply is available and contrary. The protection against unexpected starting is reached by an electromechanical method which is superior to the electronics. It is reached by a safe isolation - elsewhere than in the load circuit.

The power supply to the windings of the motor is reached at a stoppage by inhibiting the power semiconductor. As semiconductors possibly can fail or be started, because of electromagnetic interferences, the behavior of the shut down drive has to be considered if such an error scenario arises. The breakdown or 'accidental' turning on of a single or of several power semiconductors at the same DC-link pole does not lead to an uncontrollable starting, as no current flow is accomplished. Not until additionally a further power semiconductor is enabled at another pole, current is able to flow through the motor. If, thereby the is directly short-circuited, the fuses which are upstreamed to the converter are tripped, the motor doesn't start. If the is 'short-circuited' over a winding of the motor, a magnetic field can be set up in the motor. If it is an asynchronous motor, then the generated d. c. magnetic properties cannot cause a lurch of the inductor. By the permanent-magnetic synchronous motor the inductor will rotate into a notch position. The there-with angular movement which is covered is dependable of the inductor's position and the number of pole pairs of the motor. It amounts to maximum  $180^\circ/\text{number of pole pairs}$ . Subsequently the enabled DC link operates like a brake, this means after the ending of the lurching movement the drive is in a blocked state. A starting of the drive is impossible. If a machine with a synchronous motor is planned, the possible sudden movement must be considered, because it can lead to a dangerous movement. Therefore the machinist must carry out a safety evaluation for the residual movement.

#### NOTE



The function of the safety relay is limited to the prevention of an unexpected starting. The switching of the safety relay, while the inductor of the motor is rotating, causes an uncontrolled 'coasting' of the machine, a braking with help of the converter is not possible anymore.

#### WARNING



The following **may occur**, if you disregard these safety notes:

- serious personal injury • death



*The danger is: **electricity**. Both on the motor and at the unit there can be mains voltage although safety relay is switched off.*

If required, switch the appliance off-circuit like an appliance without a safety relay - the safety relay does not switch the appliance and the motor **off- circuit!**

Switching off the safety relay has no isolation from the supply system as a consequence. Therefore, mains potential can be both at the converter and at the motor. In the case of maintenance-, service- and repair- works on electrical components of the drive system, the protection against dangers must be provided by other means (e. g. main switch).

#### NOTE



When having a switched off safety relay it is not possible at BM441X and BM454X to use of a chopper resistor.

## E.2 Safety categories according to EN 954-1

Dependent on the possible dangers (these are rated due to the consideration of the severity of the injuries, the frequency of the length of stay within the danger area and possibilities in order to prevent dangers) safety-related components of machines must meet certain safety criteria. The requirements to safety-based parts are divided into five categories in the standard EN 954-1.

In category B basic demands, in 1 additionally safety-technical checked components and principles are claimed. In category 2 an error between inspection intervals can lead to a loss of the safety function.

**Category 3** accords to the level 'the single-error-certainty to recognize errors partially'. The safety-related components must be in such a way, that a single error doesn't lead to a loss of the safety function, whereat not the complete possible errors can be self-contained recognized by the system. Therefore an accumulation of unrecognized errors can lead to a loss of the safety function.

**Category 4** accords to the level 'Self-monitoring'. This component recognizes self-contained possible errors and signals these in time of the loss of the safety function. Also if up to three from one another independent errors arise the safety function is always maintained.

The Baumüller converter of series b maXX (BM443X-XX2, BM444X-XX2, BM445X-XX2, BM446X-XX2, BM447X-XX2), which can be carried out optional with two safety relays (BM4XXX-XX2), comply with the requirements of **category 4** as well as with **category 3** (EN 954-1) for the safety function „Safe stop“.

The Baumüller converter of series b maXX (BM441X-XX1, BM442X-XX1, BM443X-XX1, BM444X-XX1, BM445X-XX1, BM446X-XX1, BM447X-XX1), which are optional carried out with one safety relay (BM4XXX-XX1), comply with the requirements of **category 3** (EN 954-1) for the safety function „Safe stop“.

### E.3 The safety relay

The function of the safety relay is executed in fail-safe-technic, also named closed-circuit principle. The safety function 'Safe stop' is active, as long as no voltage is applied to the input terminals (X102-3/4; X103-3/4). Consequently the functioning of the safety function is guaranteed if power failure operates. In order to deactivate 'Safe stop' a voltage of 24 V must be applied to the terminals, which are concerned (X102-3/4; X103-3/4).

For external monitoring of the safety relay the present state signal can be scanned at its positively-driven status signal contacts (X102-1/2; X103-1/2). In case there is no voltage applied to the safety relay (X102-3/4; X103-3/4), that means during the 'Safe stop', then the status signal contacts are closed (NC contact). Also a parting of a cable can thusly be recognized as an error.

If the voltage at the input terminals of the relay (X102-3/4; X103-3/4) is switched off, the converter either generates the message "Power unit warning 20: Undervoltage safety relay" or the message "Power unit Error 87: Error safety relay". At inhibited pulse enable the warning message (warning will not be saved) is generated and at a given pulse enable the fault indication or error message (error message will be saved) is generated. A commissioning or an enable of the drive is only possible, if there is no error in the error storage. This error storage can, for example, be reset over the digital input X1/1 of the function module DIO-01. For this the input X1/1 accordingly must be configured. The switch-on pulse length at X1/1 must be 5 ms minimum.

#### E.3.1 Principle sketch safety relay

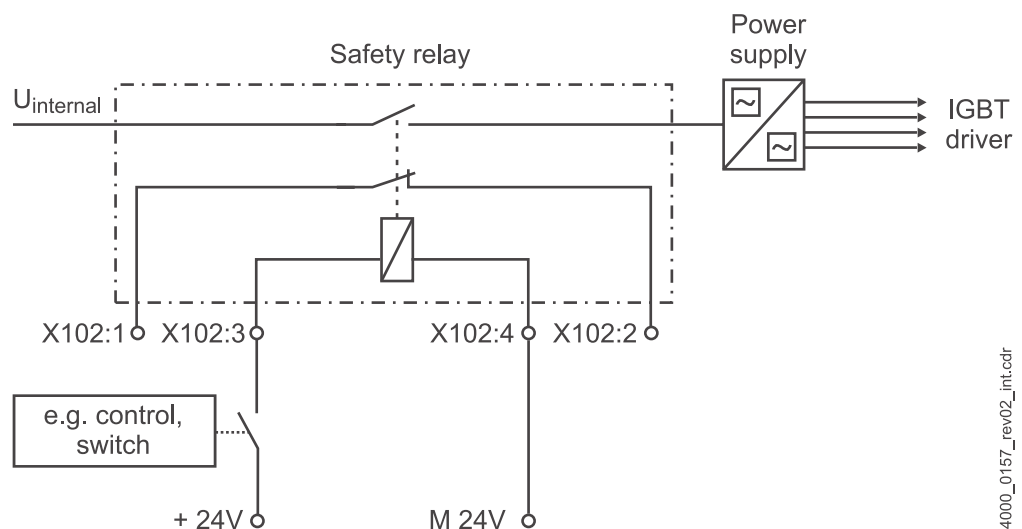


Figure 75: Principle sketch safety relay

#### NOTE



The switch-on and switch-off sequence of the enable signals as well as of the safety relay must be considered in order to assure an operation of the drive without trouble. See [►Figure 76◄](#) on page 225.

## E.3.2 Sequence diagram

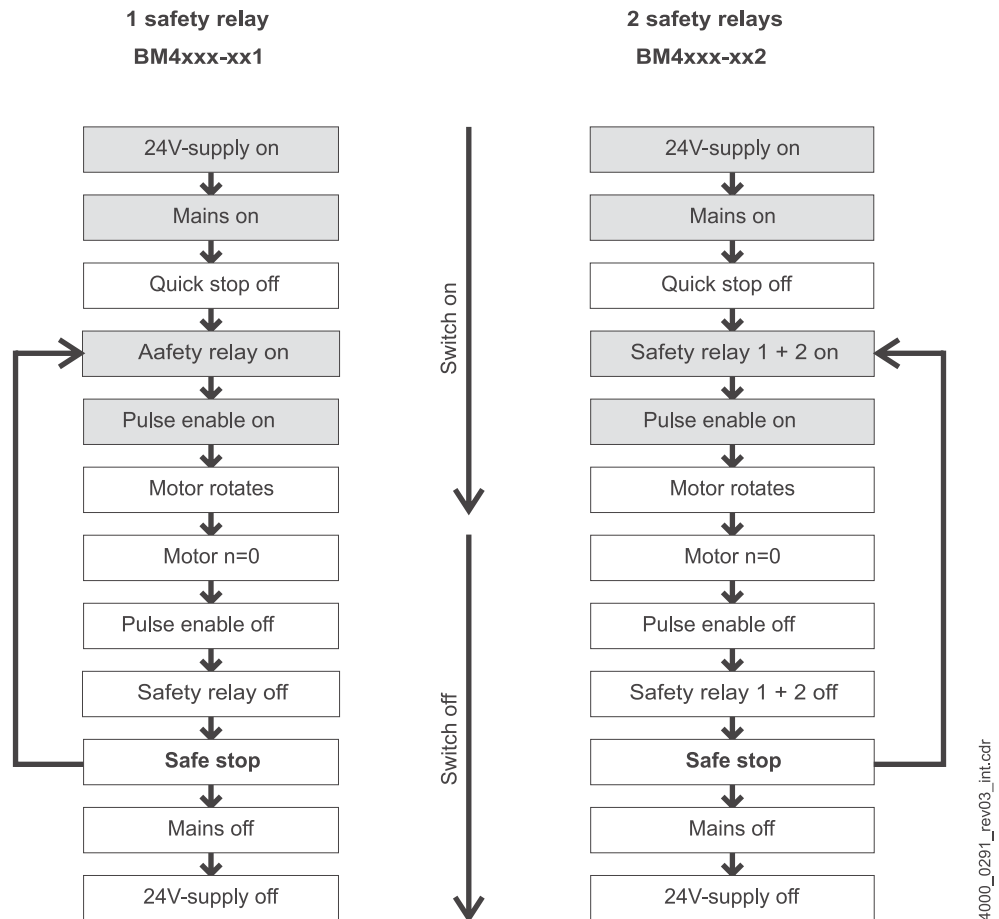


Figure 76: Sequence diagram for one or two safety relays

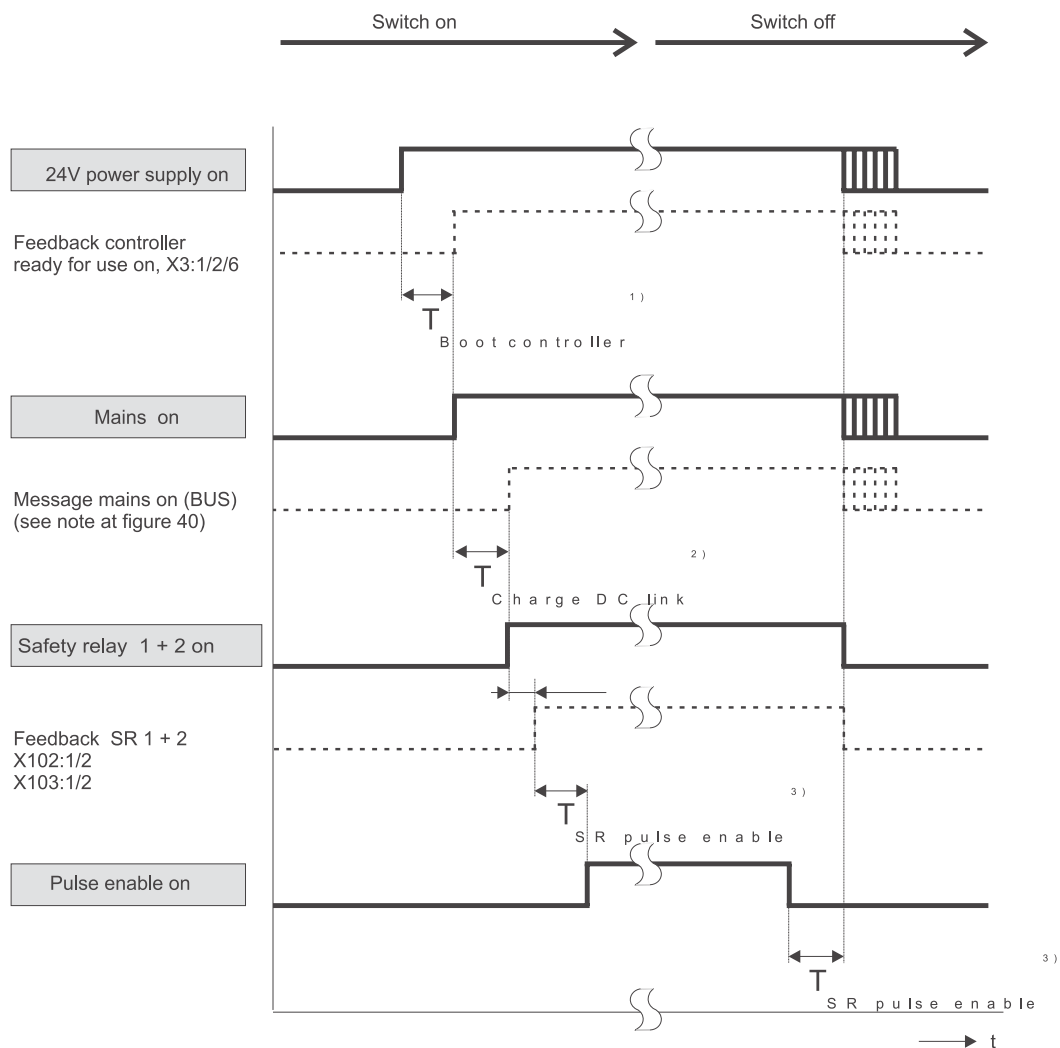


Figure 77: Time diagram: Recommended switch on/switch off sequence (4)

- (1)  $T_{\text{Boot controller}}$  dependent of the option module, which is used (from firmware version 03.05) about 5 s.
- (2)  $T_{\text{charge DC}}$ : 1.5 s (exception b maXX443X: 6 s).
- (3)  $T_{\text{SR pulse enable}}$ : 20 ms (exception b maXX 442X: 200 ms).
- (4) Deviant switch on- and switch off sequence possible. See table [►Deviant switch on-/switch off possibilities BM441x to BM446x◀](#) on page 227.

## Deviant switch on-/switch off possibilities BM441x to BM446x

| Switch on- and switch off requirement                                      | BM441x | BM442x           | BM443x | BM444x | BM445x | BM446x | BM447x |
|----------------------------------------------------------------------------|--------|------------------|--------|--------|--------|--------|--------|
| Auxiliary supply (24 V) and safety relay 1 + 2 and mains simultaneously ON | yes    | yes              | yes    | yes    | yes    | yes    | yes    |
| Auxiliary supply (24 V) and safety relay 1 + 2 simultaneously ON           | yes    | yes              | yes    | yes    | yes    | yes    | yes    |
| Mains „OFF“ → mains „ON“ at pulse inhibit                                  | yes    | yes              | yes    | yes    | yes    | yes    | yes    |
| Pulse enable „ON“ at safety relay, which is activated already              | yes    | yes              | yes    | yes    | yes    | yes    | yes    |
| Pulse enable and safety relay 1 + 2 simultaneously „ON“                    | no     | no               | no     | no     | no     | no     | no     |
| Pulse enable and safety relay 1 + 2 simultaneously „OFF“                   | no     | no               | no     | no     | no     | no     | no     |
| Safety relay 1 + 2 „ON“ 20 ms <b>before</b> pulse enable                   | yes    | no <sup>1)</sup> | yes    | yes    | yes    | yes    | yes    |
| Safety relay 1 + 2 „OFF“ 20 ms <b>after</b> pulse enable                   | yes    | no <sup>1)</sup> | yes    | yes    | yes    | yes    | yes    |

<sup>1)</sup> „yes“, if  $T_{SR \text{ pulse enable}} = 200 \text{ ms}$

Baumüller devices of the series b maXX, which are made with **one** safety relay (optional, BMXXX-XX1), comply with the requirements of **category 3** (EN 954-1) for the safety function 'Safe stop' and the safety-related usage 'Protection against unexpected starting', if the configuring and installation instructions are complied with.

Baumüller-devices of the series b maXX®, which have **two** safety relays (optional, BM4XXX-XX2), comply with the requirements of **category 4** as well as with **category 3** (EN 954-1) for the safety function „Safe stop“ and the safety and the safety-related function “Protection against unexpected starting”, if the configuring and installation instruction are observed.

Before the commissioning of the machine, in which the converter with the safety relay is built in, the safety function 'protection against unexpected starting' must be checked. For that purpose a safety device must be released (e. g. door contact). The motor must now be zero-torque.

If the reliability performance of the 'protection of unexpected starting' once has been determined, then this safety function of the converter doesn't have to be checked by an external monitoring, as the device checks itself on possible errors and if necessary displays a message as well as switches off the drive.

## E.4 Application example for machine of category 3

Exemplary, the following diagram shows the usage and cabling of a Baumüller converter of the series b maXX in a machine tool, at which the safe taking of work pieces at opened cover is possible according to category 3 (EN 954-1).

- Application example for machine of category 3 with two switch-off channels:  
Pulse enable and einem safety relay.

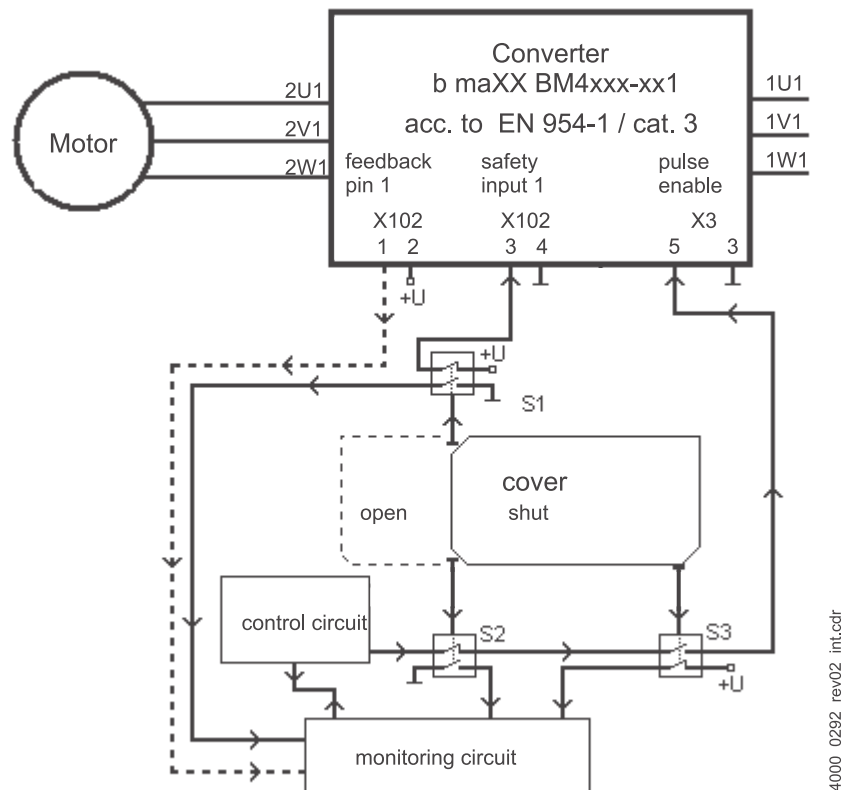


Figure 78: Version with one safety relay (BM4XXX-XX1)

The switching-off of the electrical drive motor operates dual-ported.

- S2 (NC contact) and S3 (NO contact) effectuate the pulse enable input of the converter by hardware (X3-5). Only if S2 and S3 display a closed cover (and therewith a safe state) voltage is being applied to the pulse enable input of the converter.
- S1 (NC contact) has hardware effects on the safety relay of the converter. Only if S1 shows a closed cover (and therewith a safe state) there is voltage at the safety relay input (X102: 3) and therewith a torque is possible to be generated at the shaft of the motor. The NO contact of S1 is connected with the monitoring circuit.
- The monitoring circuit, a fail-safe monitoring control of the category 3 (EN 954-1), checks on its own the directly connected switching contacts of the position switch S1 (NO contact), S2 (NO contact) and S3 (NC contact). The control circuit will not receive an enable signal from the monitoring circuit, if the cover is not completely closed or if there is a theoretically impossible state of the position switch contacts (e. g. if S1 and S2 are showing a differing switch state or if S2 and S3 are showing the same switch state). A missing enable signal of the monitoring device leads to a direct switching off of the converter by means of the control circuit. If

the monitoring circuit has recognized an error (for example different switch state of S1 and S2), this is displayed to the operator and a commissioning of the drive is not possible until the error has been repaired.

- The status signal contact of the safety relay (X102:1; NC contact) can additionally be evaluated by the monitoring circuit (not imperative).
- The position switches, which are used, must unavoidable have actuated and mechanical connected contacts as well as a dual-port connection (NC contact/ NO contact). The mechanical operating at the safety device must take place unavoidable, that means tamper-resistant.

The connection cables between the safety relay input (X102-3/4) and the control as well as between the pulse enable input at the converter (X3-5) and the control must not be installed outside the control cabinet in a common cable channel.

### E.5 Application example for machine of category 4

The diagram shows exemplary the usage and cabling of a Baumüller converter of the series b maXX (BM443X-XX2, BM444X-XX2, BM445X-XX2, BM446X-XX2, BM447X-XX2) of a machine tool, at which the safe taking of work pieces at opened cover according to category 4 (EN 954-1) is possible.

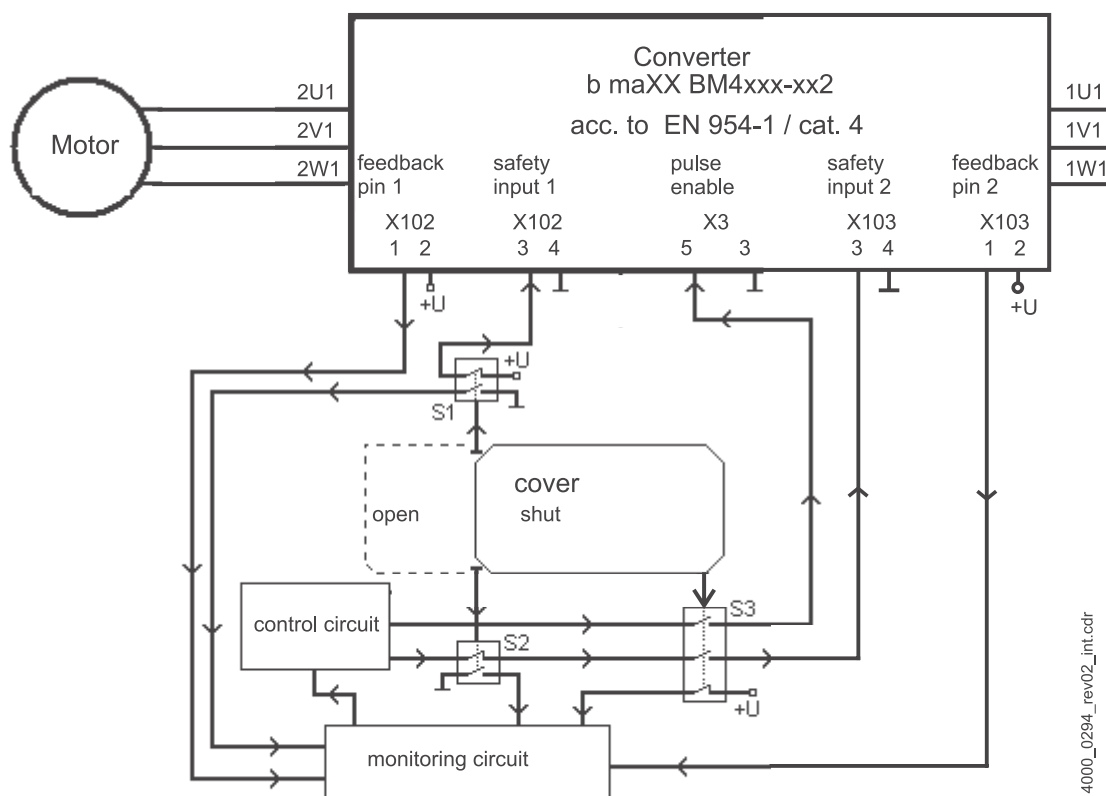


Figure 79: Version with two safety relays (BM4XXX-XX2)

The switching-off of the electrical drive motor takes place with three channels.

- S1 (NC contact) has hardware effects on the safety relay of the converter. Only if S1 shows a closed cover (and therewith a safe state) there is voltage at the safety relay input (X102: 3) and therewith a torque is possible to be generated at the shaft of the motor. The NO contact of S1 is connected with the monitoring circuit.
- S2 (NC contact) and S3 (NO contact) effectuate the safety relay of the converter. Only if S2 and S3 display a closed cover (and therewith a safe state) there is voltage at the safety relay input (X103: 3) and therewith makes a generation of a torque possible at the shaft of the motor.
- S3 (NO contact) has hardware effects on the pulse enable input of the converter (X3: 5). Only if S3 displays a closed barrier (and therewith a safe state) voltage is applied to the pulse enable input of the converter.

- The monitoring circuit, a fail-safe monitoring control of the category 4 (EN 954-1), checks on its own the directly connected switch contacts of the position switches S1 (NO contact), S2 (NO contact), S3 (NC contact) and the status signal contacts of the safety relay (X102: 1/2 NC contact, X103: 1,2 NC contact) as well as the contactor K1 (NO contact). X103-1/2 NC contact). If the cover is not completely closed or if there is a theoretically impossible state of the position switch contacts (e. g. S1 and S2 display a differing switch state or if S2 and S3 display the same switch state or if the status signal contact of the safety relay is opened/closed, although the status signal contact of S1 is opened/closed), the control circuit does not receive an enable signal from the monitoring circuit. A missing enable signal of the monitoring device leads to a direct switching off of the converter by means of the control circuit. If the monitoring circuit has recognized an error (for example different switch condition of S1 and S2), this is displayed to the operator and the commissioning of the drive is not possible until the error has been repaired.
- The position switches, which are used, must unavoidable have actuated and mechanical connected contacts as well as a dual-port connection (NC contact/ NO contact). The mechanical operating at the safety device must take place unavoidable, that means tamper-resistant.

The connection cables between the safety relay inputs (X102-3/4; X103-3/4) as well as between the pulse enable input (X3-5) and the control circuit may not be run together in a cable channel outside the control cabinet.

All information given in the manual for the converter, especially the chapters safety instructions, installation and commissioning, must absolutely be observed.

For the use and the installation of the safety devices the relevant legal and official requirements of the Safety Authorities and of the EU Directives for safety-engineering regulations at installations and machines (for example EN 60204-1, security of machines, electric equipment and EN 292-2, security of machines - general configuration guidelines).

## E.6 Application upgrade

At the converter of series b maXX (BM443X-XX2 to BM447X-XX2) the safety function „Safe stop“ is achieved via three independent switch off channels and a hardware pulse enable input (category 4 acc. to EN 954-1).

However, in many ranges it is not necessary, that the „Safe Stop“ is executed in category 4.

In the following, application examples are viewed, at which only two of the three switch off channels are used.

### • Application example 1

Application example for machine of category 3 with hardwired pulse enable input and process data communication via a field bus.

Switching off occurs by means of safety relay 1 and safety relay 2.

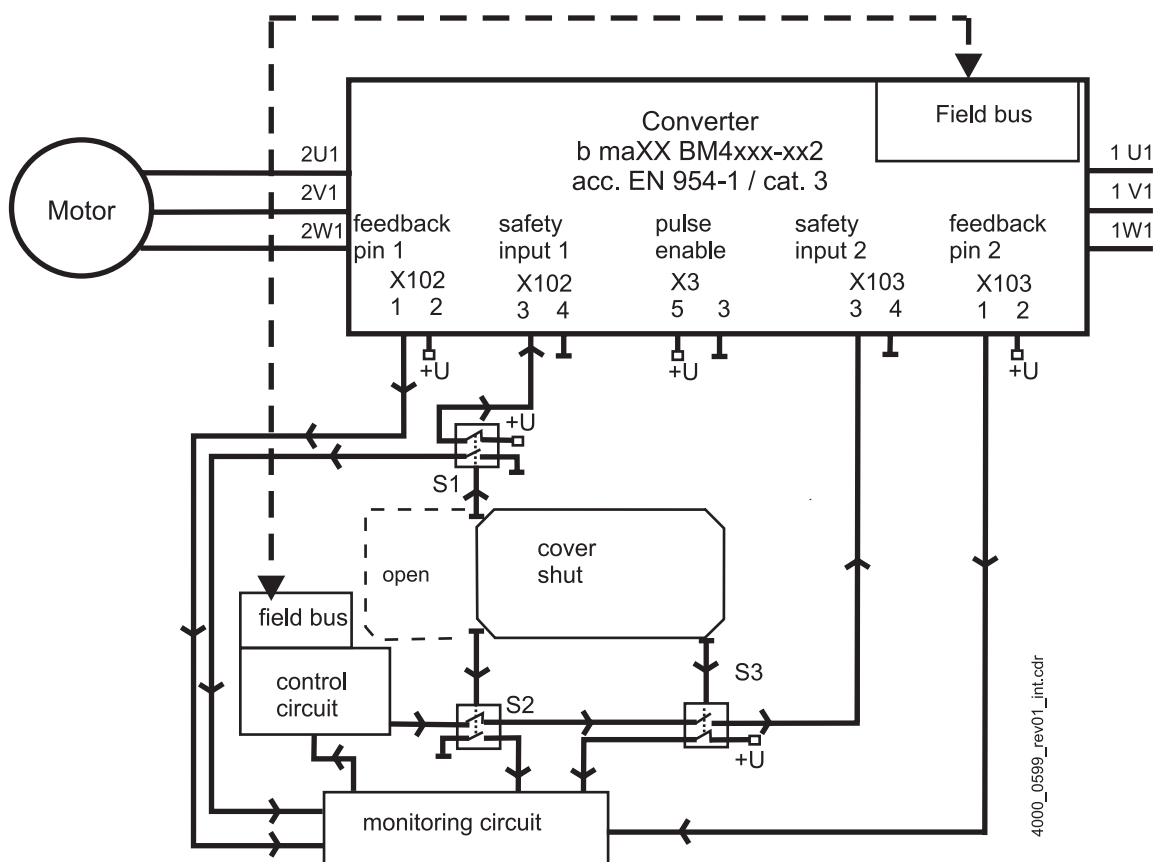


Figure 80: Version with two safety relays (BM4XXX-XX2)

At this sample the hardware pulse enable input (X3:5) is hardwired. The activation of the „Safe Stop“ occurs with two channels via the safety relay 1 and 2 (X102:3 / X103:3).

The release of the converter and the process data communication occurs via field bus.

- **Application example 2**

Application example for machine of category 3 with two switch off channels:

Pulse enable and a second common switch off channel for safety relay 1 and safety relay 2.

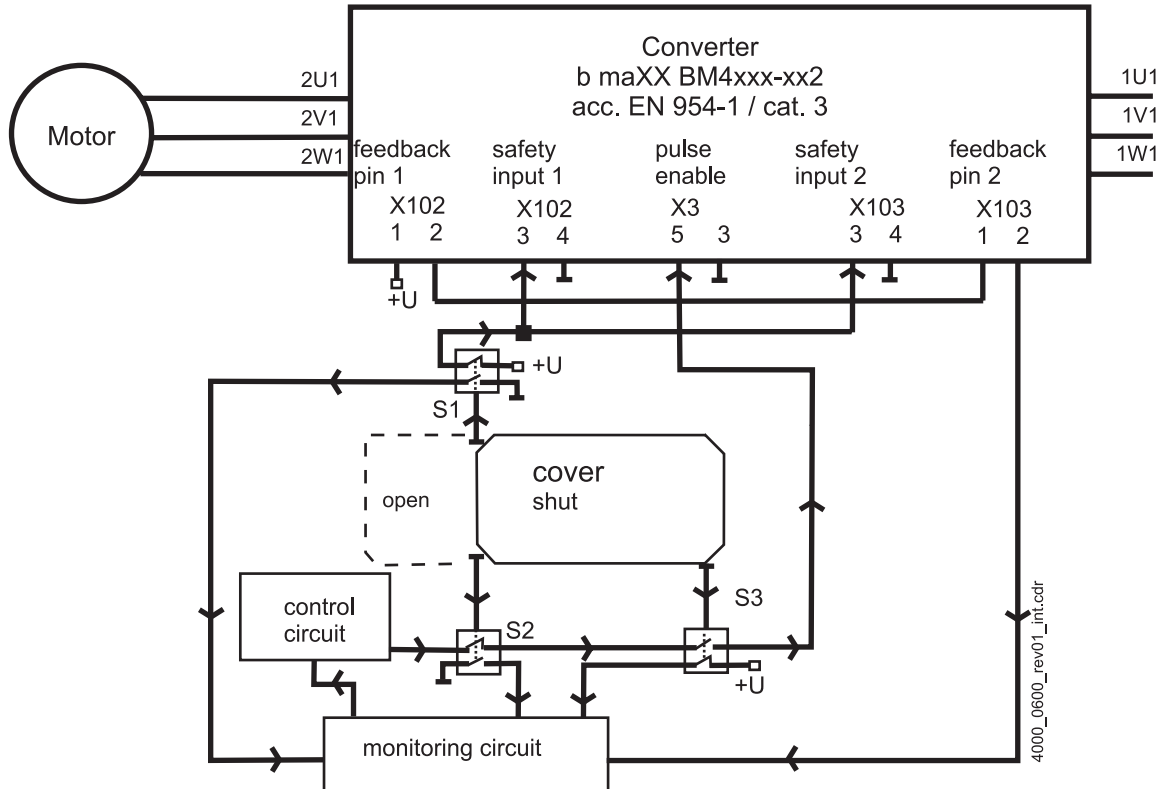


Figure 81: Version with two safety relays (BM4XXX-XX2)

At this example the safety relays 1 and 2 of a position switch are set and together form the first channel. The hardware pulse enable input forms the second channel, which is set, independent of the safety relay.

- **Application example 3**  
Pulse enable and only one safety relay

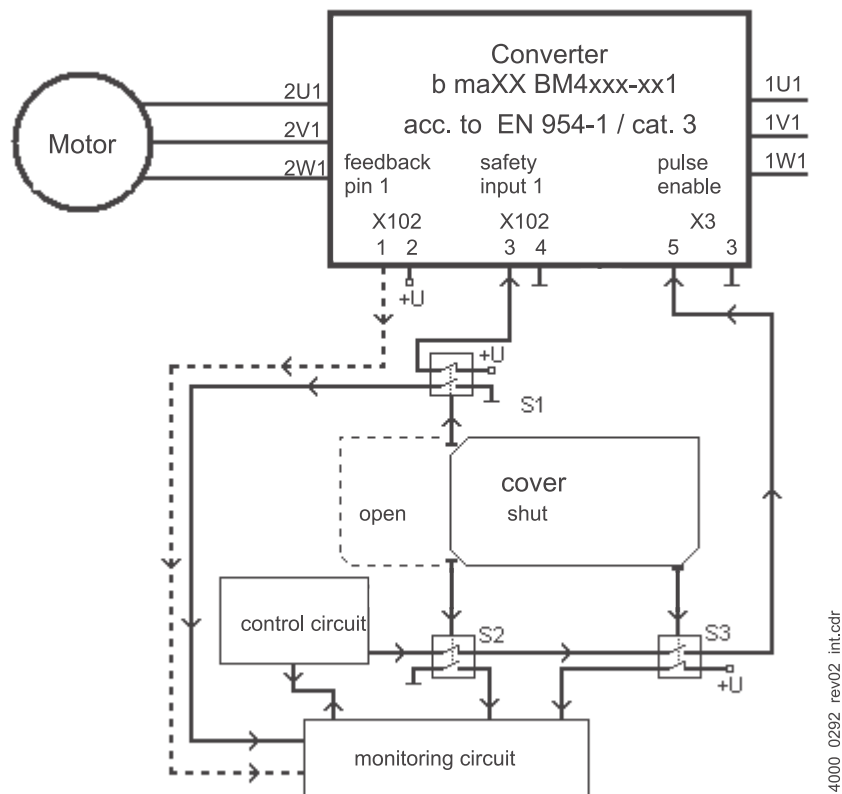


Figure 82: Version with a safety relay (BM4XXX-XX1)

This version of converter b maXX is equipped with one safety relay only. The hardware is identical with the other converters of this series - only the second relay is not equipped. The internal relay switch off paths are combined and together form the first channel.

The second channel forms a hardware pulse enable input, which is set independent of the safety relay.

## E.7 Technical data safety relay module

**WARNING**

The following **may occur**, if you disregard these safety notes:

- serious personal injury • death



The danger is: **mechanical influence** by failure of safety relay.

Assure, the minimum current of the contacts X102-1 and X102-2 (or X103-1 and X103-2) not falling below during operation. Operate the safety relay within the specification.

|                                                              | BM4XXX-XX1-XXXXX-XX<br>BM4XXX-XX2-XXXXX-XX<br>Safety relay module with<br>high power current contacts | BM4XXX-XX3-XXXXX-XX<br>BM4XXX-XX4-XXXXX-XX<br>Safety relay module with low<br>power current contacts <sup>1)</sup> |
|--------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| <b>Coil side</b><br>(X102-3, X102-4, X103-3, X103-4)         |                                                                                                       |                                                                                                                    |
| Nominal voltage $U_{DC}$                                     | 24 V                                                                                                  | 24 V                                                                                                               |
| Operating voltage range                                      | -15% / +20%                                                                                           | -15 % / +20 %                                                                                                      |
| Control current $I_{DC}$                                     | max. 70 mA                                                                                            | max. 70 mA                                                                                                         |
| <b>Status signal contact (NC contact)</b><br>(X102-1, X X X) |                                                                                                       |                                                                                                                    |
| Switching voltage $U_{DC}$                                   | 24 V                                                                                                  | 24 V                                                                                                               |
| Switching current $I_{DC}$                                   | 10 mA to 4 A <sup>2)</sup>                                                                            | 10 mA to 300 mA <sup>2)</sup>                                                                                      |
| Switch-on frequency                                          | max. 6/min                                                                                            | max. 10/s                                                                                                          |
| Activation delay time at nominal voltage $U_{DC}$            | max. 25 ms                                                                                            | max. 15 ms                                                                                                         |
| Deactivation delay time                                      | max. 15 ms                                                                                            | max. 12 ms                                                                                                         |
| Electrical durability                                        | at least $10^5$ operating cycles                                                                      | at least $10^5$ operating cycles                                                                                   |
| Mechanical durability                                        | at least $1 \times 10^7$ switching<br>cycles                                                          | at least $5 \times 10^7$ switching<br>cycles                                                                       |

<sup>1)</sup> only customer-specific versions  
Please contact Baumüller Nürnberg GmbH before using this version.

<sup>2)</sup> A current on contact of at least 20 mA is recommended. If the load is below 20 mA the current on contact can be increased (see ►Figure 83◄ on page 236).

- Installation of the feedback contact with permanent load

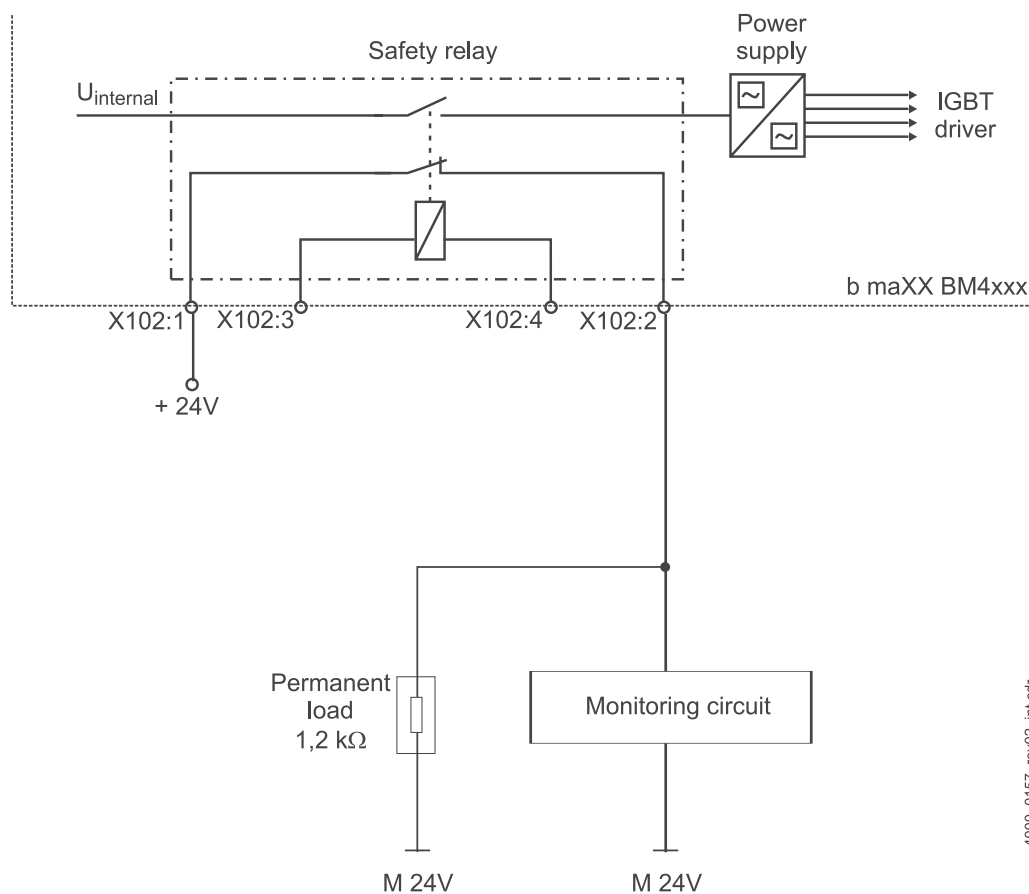


Figure 83: Installation of the feedback contact with permanent load

Permanent load e.g.:

|                    |                                                      |
|--------------------|------------------------------------------------------|
| Housing:           | Phoenix Contact, EMG12-B2<br>Part No.: 2948306       |
| Transparent cover: | Phoenix Contact, BMG12-H 7,5 mm<br>Part No.: 2947116 |
| Resistor:          | 1,2 kΩ / 1 W at $T_U = 70\text{ °C}$                 |

## E.8 Prototype Test Certificate BGIA

Prüf- und Zertifizierungsstelle  
im BG-PRÜFZERT



**BGIA**  
Berufsgenossenschaftliches  
Institut für Arbeitsschutz

Hauptverband der gewerblichen  
Berufsgenossenschaften

## Baumusterprüfbescheinigung

06 06008

Bescheinigungs-Nummer

Name und Anschrift des  
Bescheinigungsinhabers:  
(Auftraggeber) Baumüller Nürnberg GmbH  
Ostendstraße 80-90, 90482 Nürnberg

Name und Anschrift des  
Herstellers: Baumüller Nürnberg GmbH  
Ostendstraße 80-90, 90482 Nürnberg

Zeichen des Auftraggebers:

Zeichen der Prüf- und Zertifizierungsstelle:  
Apf/Köh VE-Nr. 2005 23714

Ausstellungsdatum:  
18.05.2006

Produktbezeichnung: Frequenzumrichter mit integrierter Sicherheitsfunktion

Typ: Servoumrichter: **b maXX® BM4400**  
Baugrößen: 1 und 2  
Typenreihe: BM441x, BM442x

Bestimmungsgemäße  
Verwendung: Realisierung der Sicherheitsfunktion „Sicherer Halt“

Prüfgrundlage: EN 954-1, 1997-03,  
EN ISO 13849-2; 2003-12,  
EN 61800-3, 2001-02,  
EN 61800-5-1, 2003-09,  
IEC 61800-5-2, CDV:2006

Zugehöriges Prüfzeugnis: Nr.: 2005 23714 vom 18.05.2006

Bemerkungen: Die vorgestellten Baumuster der Servoumrichter b maXX® BM4400 in den Baugrößen 1 und 2 erfüllen die Anforderungen der Prüfgrundlagen. Bei einer Beschaltung entsprechend dem Applikationsbeispiel, wird für die Sicherheitsfunktion die Steuerungskategorie 3 nach DIN EN 954-1 erreicht.

Das geprüfte Baumuster entspricht den einschlägigen Bestimmungen der Richtlinie 98/37/EG (Maschinen).

Diese Bescheinigung wird spätestens ungültig am:

31.05.2011

Weitere Bedingungen regelt die Prüf- und Zertifizierungsordnung vom April 2004.

Leiter der Zertifizierungsstelle

  
(Prof. Dr. rer. nat. Dietmar Reinert)

Fachzertifizierer

  
(Dipl.-Ing. R. Apfeld)

PZB10D  
06.02



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Prüf- und Zertifizierungsstelle  
im BG-PRÜFZERT



**BGIA**  
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Institut für Arbeitsschutz

Hauptverband der gewerblichen  
Berufsgenossenschaften

### Zeichengenehmigung

06 03005

Bescheinigungs-Nummer

Name und Anschrift des  
Bescheinigungsinhabers:  
(Auftraggeber) Baumüller Nürnberg GmbH  
Ostendstraße 80-90, 90482 Nürnberg

Name und Anschrift des  
Herstellers: Baumüller Nürnberg GmbH  
Ostendstraße 80-90, 90482 Nürnberg

Zeichen des Auftraggebers:

Zeichen der Prüf- und Zertifizierungsstelle:  
Apf/Köh VE-Nr. 2005 23714

Ausstellungsdatum:  
18.05.2006

Produktbezeichnung: Frequenzumrichter mit integrierter Sicherheitsfunktion

Typ: Servoumrichter: **b maXX® BM4400**  
Baugrößen: 1 und 2  
Typenreihe: BM441x, BM442x

Zugehöriges Prüfzeugnis: Nr.: 2005 23714 vom 18.05.2006

Bestimmungsgemäße  
Verwendung: Realisierung der Sicherheitsfunktion „Sicherer Halt“



1)Bescheinigungs-Nummer

Der Inhaber dieser Zeichengenehmigung ist berechtigt, das nebenstehend abgebildete BG-PRÜFZERT-Zeichen an den mit dem geprüften Baumuster übereinstimmenden Produkten anzubringen.  
Die Berechtigung zum Anbringen des Zeichens erlischt spätestens am:

31.05.2011

Leiter der Zertifizierungsstelle

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## E.9 Supplement for the test certificate 2005 21349

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The series b maXX® (BM443X to BM446X) fulfills the requirements of the category 4 as well as the category 3 according to EN 954-1 provided that the circuit-technical implementation complies with the demands [►E.6 Application upgrade◄](#) from page 232.

### E.9.1 Supplement 2 for the test certificate

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The certification of the safety function "safe stop" in the servo inverter of the series b maXX® (BM443X to 446X) in the year 2005 still was made on the base of the position paper DKE AK 226.03. In these documents the requirements to safety-related functions of electric device systems in the machines were described.

The contents of this position paper especially the definition of the individual safety functions were used in making this new product standard IEC 61800-5-2. However the terms of the individual safety functions have been changed and have been adapted to the international linguistic usage.

The safety function "Safe stop" from the position paper in the IEC 61800-5-2 is defined as "Safe Torque Off". However the requirements have not changed.

"Safe stop" and "Safe torque off" are identic and describe the same safety function.

The type-examination certificate accordingly is adapted on this point.

Prüf- und Zertifizierungsstelle  
im BG-PRÜFZERT



**BGIA**  
Berufsgenossenschaftliches  
Institut für Arbeitsschutz

Hauptverband der gewerblichen  
Berufsgenossenschaften

## Baumusterprüfbescheinigung

05 06006

Bescheinigungs-Nummer

Name und Anschrift des  
Bescheinigungsinhabers:  
(Auftraggeber) Baumüller Nürnberg GmbH  
Ostendstraße 80-90, 90482 Nürnberg

Name und Anschrift des  
Herstellers: Baumüller Nürnberg GmbH  
Ostendstraße 80-90, 90482 Nürnberg

Zeichen des Auftraggebers:

Zeichen der Prüf- und Zertifizierungsstelle:  
Apf/Köh VE-Nr. 2005 21349

Ausstellungsdatum:  
19.03.2007

Produktbezeichnung: Frequenzumrichter mit integrierter Sicherheitsfunktion

Typ: Servoumrichter: **b maXX® BM4400**  
Baugrößen: 3 bis 6  
Typenreihe: BM443x, BM444x, BM445x, BM446x

Bestimmungsgemäße  
Verwendung: Realisierung der Sicherheitsfunktion „Sicherer Halt“, bzw. „Safe Torque Off“

Prüfgrundlage: EN 954-1, 1997-03,  
EN ISO 13849-2; 2003-12,  
EN 61800-3, 2001-02,  
EN 61800-5-1, 2003-09,  
IEC 61800-5-2, CDV:2006

Zugehöriges Prüfzeugnis: Nr.: 2005 21349 vom 04.07.2005

Bemerkungen: Die vorgestellten Baumuster der Servoumrichter b maXX® BM4400 in den Baugrößen  
3 bis 6 erfüllen die Anforderungen der Prüfgrundlagen.  
Bei einer Beschaltung entsprechend den Applikationsbeispielen, wird für die  
Sicherheitsfunktion die Steuerungskategorie 3 bzw. 4 nach DIN EN 954-1 erreicht.

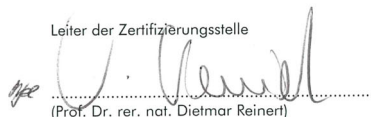
Das geprüfte Baumuster entspricht den einschlägigen Bestimmungen der Richtlinie 98/37/EG (Maschinen).

Diese Bescheinigung wird spätestens ungültig am:

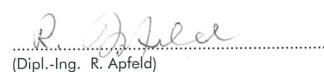
31.07.2010

Weitere Bedingungen regelt die Prüf- und Zertifizierungsordnung vom April 2004.

Leiter der Zertifizierungsstelle

  
(Prof. Dr. rer. nat. Dietmar Reinert)

Fachzertifizierer

  
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## Revision survey

| Version    | Version    | Changing                                                                                                                                                                                                                                                                                                                                                                  |
|------------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5.04043.03 | 28.07.2005 | Chapter Revision survey inserted, technical data safety relay, b maXX® 4472 / 4473, interface cable RS 232, additional data water-cooled chopper resistors, instructions on hardware types XX0XX, XX1XX, XX2XX, X0XXX, X1XXX and X2XXX (type key), prototype test certification in chapter E „Safe stop“, polarity temperature sensor changed in the connection diagrams. |
| 5.04034.04 | 02.05.2006 | Protection type BM443X, BM444X, Chapter Fuses revised, dimensions/drilling patterns updated, derating curves for the installation altitude/lower frequency range inserted, BM447X included, chapter „safe stop“ completed, technical data safety module changed                                                                                                           |
| 5.04034.05 | 03.08.2007 | Chapter Technical data updated, power modules added.                                                                                                                                                                                                                                                                                                                      |
| 5.04034.06 | 13.11.2007 | Chapter Fuses revised                                                                                                                                                                                                                                                                                                                                                     |





**be in motion**

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