BAUMÜLLER

be in motion be in motion

BUS64S/A/F

Power Module

Manual

E	5.02016.03

Title	Manual
Product	Power Module BUS64S/A/F
Version	5.02016.03
Status	2003-11-10

Obligatory

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.
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.

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 **current values according to the printing date**. These statements are **not legally binding** according to the measurement, computation and calculations.
Baumüller Nürnberg Electronic GmbH & Co. KG reserves the right, in developing its products further, to change the technical specifications and the handling of the products concerned without prior notice.

No liability can be accepted concerning the correctness of the operating instructions unless otherwise specified in the General Conditions of Sale and Delivery.

Manufacturer

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Hiermit zeigen wir an, dass die Baumüller Nürnberg Electronic GmbH & Co. KG im Wege der Verschmelzung mit Wirkung zum 01.12.2004 in der Baumüller Nürnberg GmbH aufgegangen ist. Ihr zukünftiger Ansprechpartner ist damit die

Baumüller Nürnberg GmbH, Ostendstrasse 80-90, 90482 Nürnberg.

Please notify that with effect from 01-12-2004 Baumüller Nürnberg Electronic GmbH & Co. KG merged with Baumüller Nürnberg GmbH. Your future business partner will be

Baumüller Nürnberg GmbH, Ostendstrasse 80-90, 90482 Nürnberg.

Par la présente, nous vous signalons qu'en voie de la fusion, la Baumüller Nürnberg Electronic GmbH & Co. KG a été intégrée à la Baumüller Nürnberg GmbH avec effet au 1 décembre 2004. Votre interlocuteur sera par conséquent la

Baumüller Nürnberg GmbH, Ostendstrasse 80 – 90, 90482 Nürnberg.

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1

INTRODUCTION

In this chapter we describe the first steps you should carry out after you have received your appliance. We will give you a definition of terms used throughout this documentation and we will give you information about what must be observed when using this appliance.

1.1 First steps

1 check the scope of delivery, see ▹Packing and Transport◃ from page 23.

2 pass on the supplied documentation to the respective departments

3 take care of suitable personnel for mounting, installation and commissioning.

4 hand over this manual to the personnel for mounting, installation and commissioning. Make sure, that particularly the safety information is understood and will be observed.

1.2 Terms used

In this documentation for the Baumüller product “Feed/Feed back unit“ we will also use the term "appliance". In the appendix you will find a list of all terms used, see ▹Appendix A - Abbreviations◃ from page 83

1.3 Obligation and liability

In order to enable you to run this appliance with maximum safety it is essential that you know and obey the danger- and safety information given in this documentation.

1.3.1 Observing danger- and safety information

To keep you from damage of personnel and property we will use unified danger information signs in this documentation.

WARNING

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

- serious personal injury
- death

All persons, who work at or with this appliance, must have knowledge of and observe all hazard and security information given in this manual.

Furthermore all persons who work with this appliance must in addition know and observe all local instructions and regulations.

1.3.2 Dangers when handling this appliance

This "Power module" appliance has been developed and produced according to the state-of-the-art technics also keeping the respective guidelines and standards. Still the handling of the appliance can hold dangers. An overview of possible dangers you will find in chapter ▷Fundamental security information◁ from page 11.
When there is a hazard you will always find a detailed security information at the respective location.

1.3.3 Guarantee and liability

The “Terms of sale and delivery“ of Baumüller Nürnberg Electronic GmbH & Co. KG are applied generally. These you have available at last since the contract was assured. Claims of guarantee or liability towards Baumüller Nürnberg Electronic GmbH & Co. KG are rejected if one or more of the examples listed below has/have been the cause of the damage/s:

- you have disregarded the information given in this manual
- you have used this appliance within a non-appropriate application
- this appliance you have
  - unskillfully mounted
  - unskillfully connected
  - unskillfully commissioned
  - unskillfully operated
  - unskillfully or not maintained
  - let be mounted, connected, commissioned, operated and/or maintained by not or not adequate qualified personnel
  - overloaded
  - operated it with
    - defective security devices
    - not properly mounted or without security devices
    - not efficient safety- and protection devices
    - environmental conditions being not within the specified values
- you have reconstructed this appliance without written permission of Baumüller Nürnberg Electronic GmbH & Co. KG.
- you have disregarded instructions concerning maintenance in the component manuals
- you have failed to monitor parts of wear and tear properly

- you have carried out a repair job unskillfully
- you have unskillfully combined the appliance with products of other manufacturers
- you have combined the drive system with defective and/or incorrectly documented products of other manufacturers

The “General terms of sale and delivery“ of Baumüller Nürnberg Electronic GmbH & Co. KG apply generally. Those you have available at least since the contract has been confirmed.

2

FUNDAMENTAL SECURITY INFORMATION

Every Baumüller appliance was constructed and produced under strict safety guidelines. Nevertheless working with the appliance can still be dangerous for you.

In this chapter we describe the possible dangers which may occur when you work with this Baumüller appliance. Dangers are indicated within this documentation by symbols (icons). All the symbols used in this documentation you will find listed and explained below.

How you can protect yourself against every single danger in detail, we however cannot state in this chapter. Here only information about general safety measures will be given to you. The respective safety measures against an occurring hazardous situation you will find in the following chapters always directly where the hazard arises.

2.1 Hazard information and commands

Hazard information shows you the dangers, which can cause injuries or even your death.

Please always consider the hazard information which is given to you in this documentation.

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

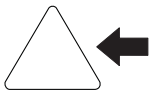
- serious property damage
- serious personal injury
- death - **may** occur

CAUTION

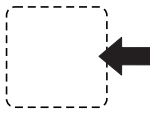
- minor to medium personal injury or
- environmental pollution or
- property damage - **may** occur

2.1.1 Hazard information structure

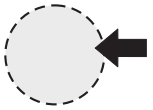
The following two examples show you how the hazard informations are constructed. The triangle is used when indicating a hazard for human beings. When there is a circle instead of the triangle, the hazard information is only for possible property damage.



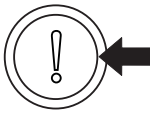
A triangle indicates hazard for human beings.
The shade of grey of the outline reflects the severity of the hazard - darker grey means rising hazard.



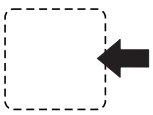
The icon within the square illustrates the hazard.
The outline´s shade of grey reflects the severity of the hazard - darker grey means rising hazard. (Not every hazard information has a square representing the hazard, so we have shown it as draft here)



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.

2.1.2 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.

2.1.2.1 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** we use the ⚠ danger sign. The hazard information of this hazard class we use 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 we describe 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 we describe what you can do to avoid the hazard.

For the hazard class **WARNING** we use the warning sign ⚠. The following hazard information of this hazard class we will use 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 we describe 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 we describe 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 we describe 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 we describe 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: **liquid coolant.** Here the hazard may be described in detail.*

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

For the hazard class **CAUTION** we use the caution sign ⚠ when there is hazard for persons or of environmental pollution. The following hazard information of this hazard class we will use 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 we describe 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 we describe what you can do to avoid the hazard.

CAUTION

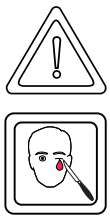
The following **may occur**, if you do not observe this caution information:

- minor to medium personal injury.

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

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

CAUTION

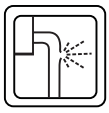
The following **may occur**, if you do not observe this caution information:

- minor to medium personal injury.

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

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

2.1.2.2 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 we describe what you can do to avoid the hazard.

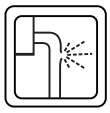
CAUTION

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 we describe what you can do to avoid the hazard.



2.1.2.3 Command signs used

carry safety gloves

carry safety shoes

carry eye protection

carry ear protection

Use this fire extinguishing agent:

ABC powder.

2.2 Information sign

NOTE

This note is a very important information.

2.3 Application according to the terms

You must always use this appliance properly. Listed below you will find some important information. The information given is intended to give you some impression on how to operate this appliance according to the terms. The information below is not a complete list; you must always observe the information given throughout this documentation.

- project this application in a way, that the appliance is run within its specifications.
- take care that only qualified personnel is working with or at this appliance.
- mount this appliance only at a reasonable steady wall.
- install this appliance according to the way shown in this documentation.
- take care that the power supply always meets the requested specifications.
- operate this appliance only if it is in a correct technical state.
- operate this appliance always in an environment according to the information given in the “Technical specifications“.
- operate this appliance always in the regular condition.
  For safety reasons you are not allowed to reconstruct this appliance.
- observe all respective information given if you want to store this appliance.

You are using this appliance according to the terms, if you observe all notes and information given in this operating manual.

2.4 Non-appropriate application

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 have disregarded the information given in this manual
- you have used this appliance within a non-appropriate application
- this appliance you have
  - unskillfully mounted
  - unskillfully connected
  - unskillfully commissioned
  - unskillfully operated
  - unskillfully or not maintained

  - let be mounted, connected, commissioned, operated and/or maintained by not or not adequate qualified personnel
  - overloaded
  - operated it with
    - defective security devices
    - not properly mounted or without security devices
    - not efficient safety- and protection devices
    - environmental conditions being not within the specified values
- you have reconstructed this appliance without written permission of Baumüller Nürnberg Electronic GmbH & Co. KG.
- you have disregarded instructions concerning maintenance in the component manuals
- you have failed to monitor parts of wear and tear properly
- you have carried out a repair job unskillfully
- you have unskillfully combined the appliance with products of other manufacturers
- you have combined the drive system with defective and/or incorrectly documented products of other manufacturers
- Education of the personnel

The appliances of Baumüller Nürnberg Electronic GmbH & Co. KG are only to be mounted, installed, operated and maintained by qualified personnel.

Qualified personnel

Qualified personnel are persons who have been authorized by the plant manager to carry out the activities required, who are able to recognize possible dangers and to avoid them. They must have the skills, experience, instruction and knowledge of the operational conditions and the respective standards, regulations and rules to detect and avoid accidents.

2.5 Reconstructing the appliance

Unauthorized reconstructions without written permission of Baumüller Nürnberg Electronic GmbH & Co. KG are not allowed.

2.6 Disposal of the appliance

The correct disposal of the appliance is described in ▹Disposal◃ from page 79.

2.7 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 extinguishing medium.***

Use this fire extinguishing agent:

ABC powder / CO_2

2.7 Fire fighting

3

PACKING AND TRANSPORT

Every Baumüller appliance we have packaged before shipping in a way, that makes becoming damaged while on transport very unlikely.

3.1 Transport

The units are packed at the factory in accordance with the order.

- avoid heavy shaking while on transport and severe bumping, e.g. when lowering, of the unit.

3.2 Unpacking

After delivery of the (still packaged) item:

- check if there are visible transportation damages!

if yes:

- report this to your deliverer. Request a written confirmation of your reclamation and make immediate contact with your local Baumüller Nürnberg Electronic GmbH & Co. KG representative.

if there is no transportation damage visible:

- open the packaging of the appliance.
- check the scope of delivery according to the delivery note.

The scope of delivery is:

- Product
- this operation manual including declaration of conformity/Declaration by manufacturer
- supplement and fixing material

- report a reclamation at your local Baumüller representative if the scope of delivery is incomplete or if there is a transportation damage.

WARNING

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

- serious personal injury
- death

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

Do not operate the appliance if you have detected or suppose a transportation damage.

In this case please contact Baumüller Nürnberg Electronic GmbH & Co. KG immediately.

3.3 Disposal of the packaging

The packaging consists of cardboard, plastics, metal pieces, corrugated cardboard and/ or wood.

➲ Observe the local regulations of disposal if you dispose the packaging.

3.4 Transportation precautions

For the first transport the appliance has been packaged by the manufacturer. If you intend to transport the appliance yourself, make sure that the following conditions are kept throughout the whole transport:

- climatic category: 2 K 3
- temperature range: -30 °C to +70 °C
- climatic category: 2 K 3
- temperature range: -30 °C to +70 °C
- maximum height of drop (packaged): 0.25 m.

4

DESCRIPTION OF THE UNIT

This device is a power converter (motor-sided power unit) for the high performance level. It converts the power input , which has been taken from the DC-link of a Baumüller-supply-unit (for example BUC/BUG)) and supplies the electronic motor which is connected to this device. For the controlling system exclusively plug-in controllers of the company Baumüller Nürnberg Electronic GmbH & Co. KG must be used, for example:

- BUS 6 V-controller for all applications in the mechanical engineering.

For this controller a separate description is available.

Dependant of the controller, which is used, asynchronous- as well as synchronous motors with different encoder systems at the single power modules BUS64S/A/F can be operated.

NOTE

Do not use this appliance in populated areas (see EN 61800-3, 6.4.2.1), because this unit may cause high frequency interference.

4.1 Variants

The BUS64 single power module is available in three variants, which differ in the cooling version (S/A/F):

- **S:** stands for **S**witching cabinet variant (air ventilation inside the switching cabinet)
- **A:** stands for window mounting variant (air ventilation outside the switching cabinet)
- **F:** stands for window mounting variant (water cooler outside the switching cabinet)

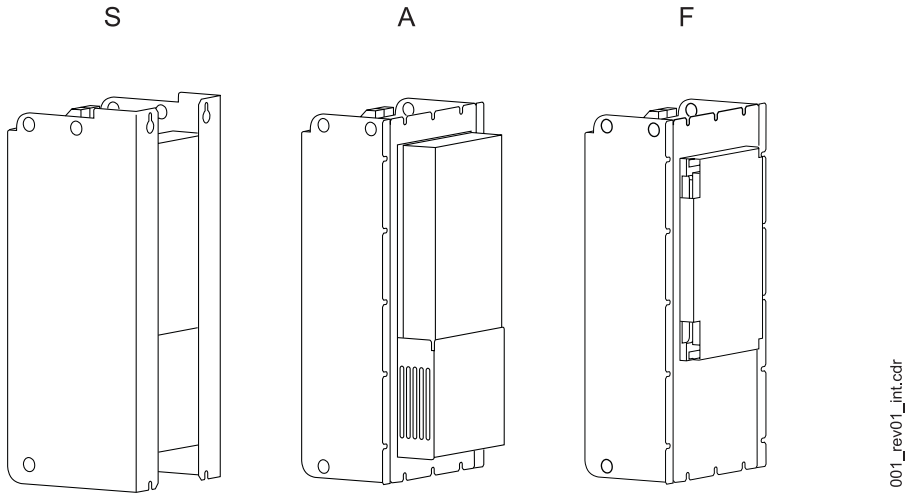


figure 1: Cooling variants

4.2 Overview of hazardous areas

The following figure shows the hazardous areas at each respective appliance. Use this overview to get informed about the existing hazardous areas when you learn to get familiar with this appliance.

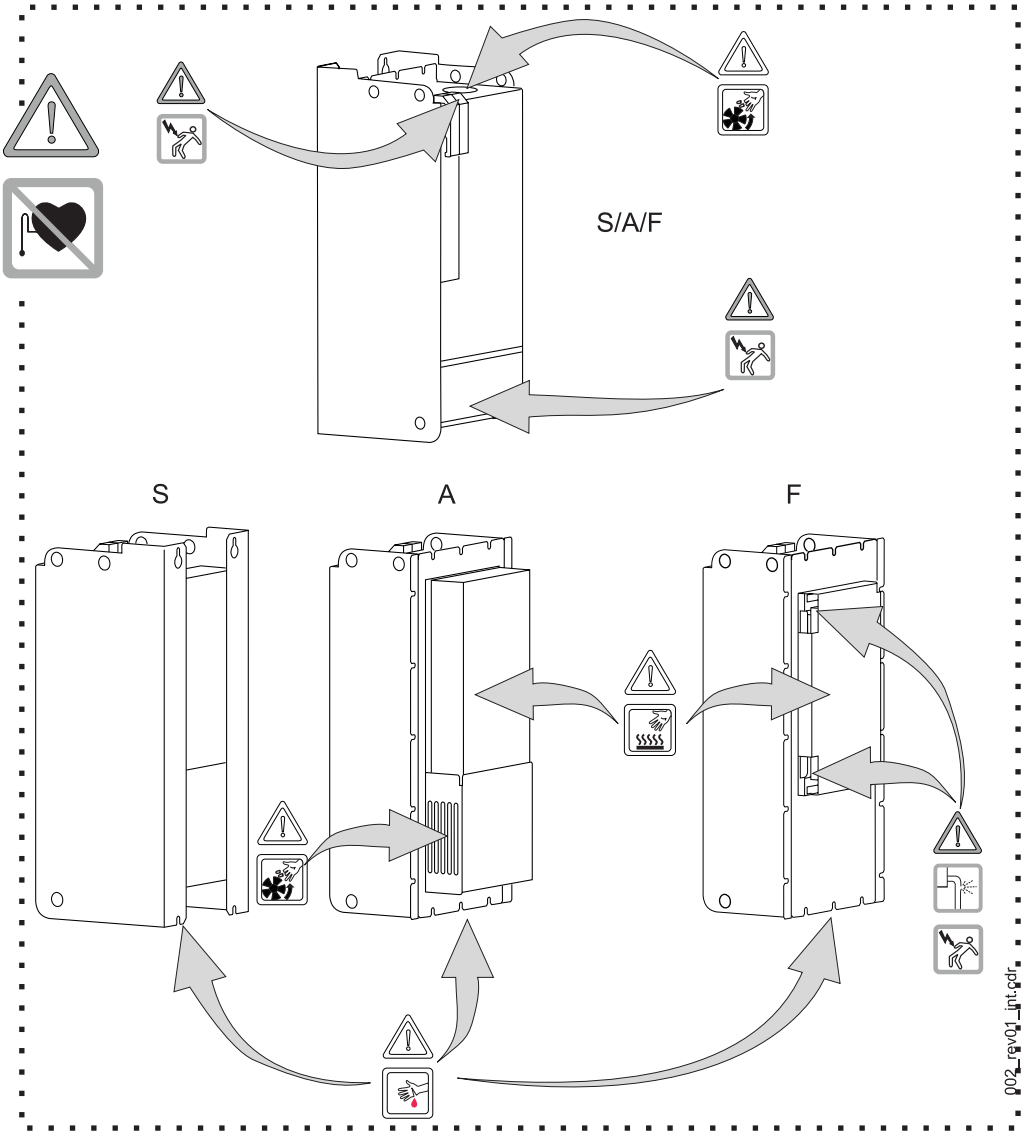


figure 2: hazardous areas

4.3 Characteristics of the unit - type key

On the type shield (positioned on the inner side, see figure below) you will find the type key and the serial number of the appliance.

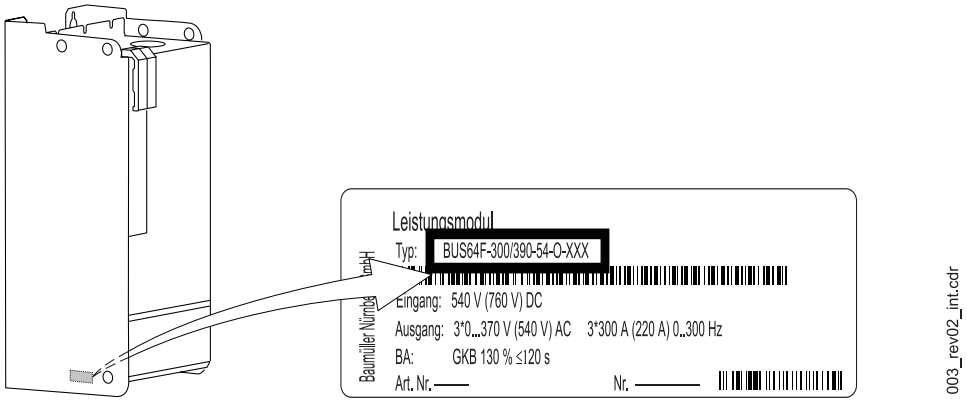


figure 3: type plate with type keyl

BUS64XX - XXX/XXX - XX - X - XXX	Baumüller converter power module
BUS6 4XX - XXX/XXX - XX - X - XXX	Type
BUS64 XX - XXX/XXX - XX - X - XXX	Size
BUS64 XX - XXX/XXX - XX - X - XXX	Model

-: Standard

BUS64X X - XXX/XXX - XX - X - XXX	Cooling variant

S: air ventilation with intake and outlet inside the switching cabinet
A: air ventilation with intake and outlet outside the switching cabinet
F: water-cooled with water cooler outside the switching cabinet

BUS64XX - XXX/XXX - XX - X - XXX	Output rated current in ampere at 40° C environmental- and coolant temperature and 4 kHz cycle frequency
BUS64XX - XXX/XXX - XX - X - XXX	Output peak current in ampere at 40° C environmental- and coolant temperature and 4 kHz cycle frequency, t ≤ 1 s
BUS64XX - XXX/XXX - XX - X - XXX	Rated DC link voltage x 10 [V]
BUS64XX - XXX/XXX - XX - X - XXX	Safety relay

O: without safety relay
M: with safety relay

BUS64XX - XXX/XXX - XX - X - XXX	Stage of development / model

On the type plate you will find only a part of the technical specifications. An overview of all technical specifications you will find in ▹Appendix D - Technical specifications◃ from page 91.

4.4 Block switching diagrams

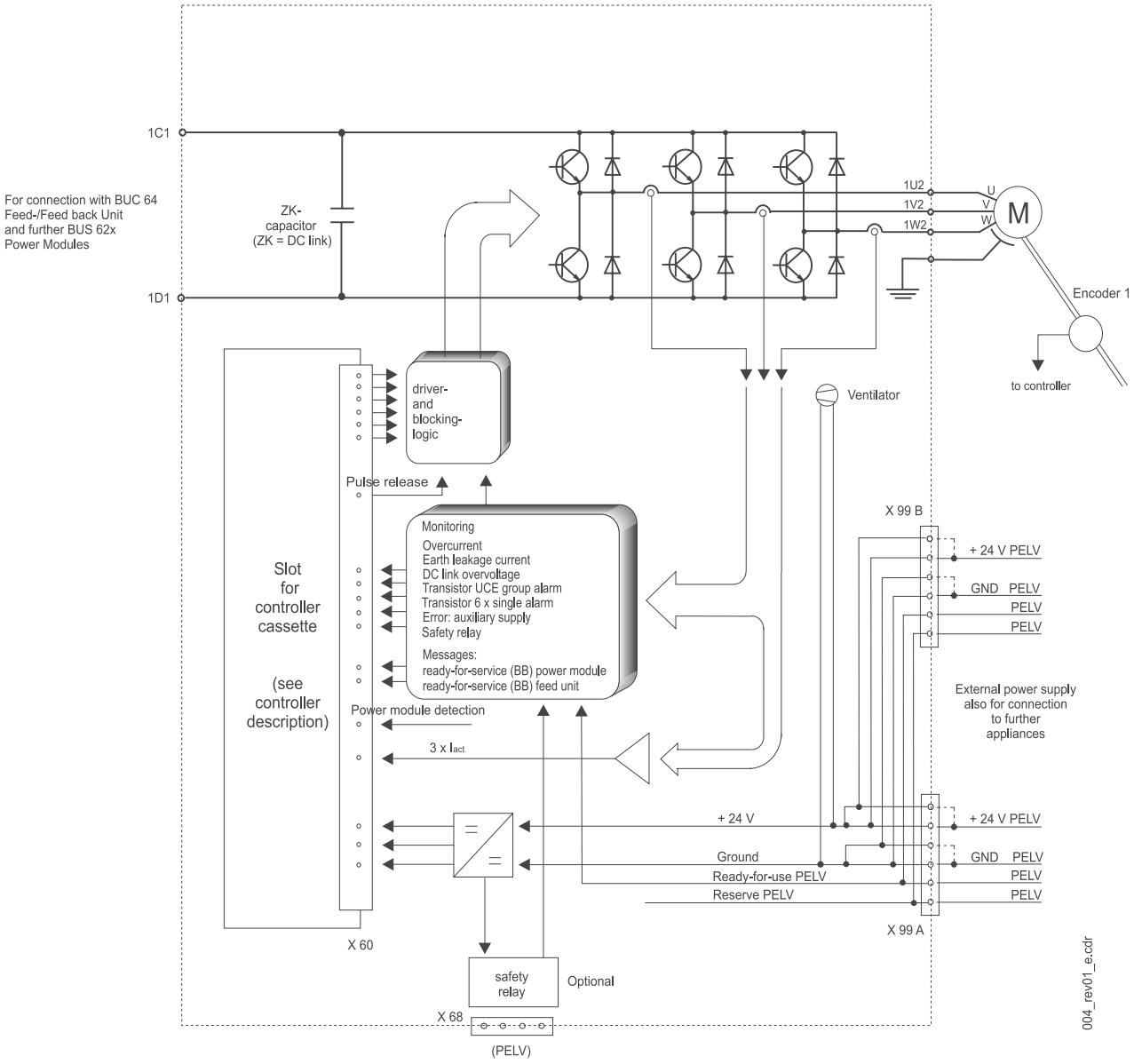


figure 4: Block switching diagram BUS64S/A/F

4.5 Construction diagram

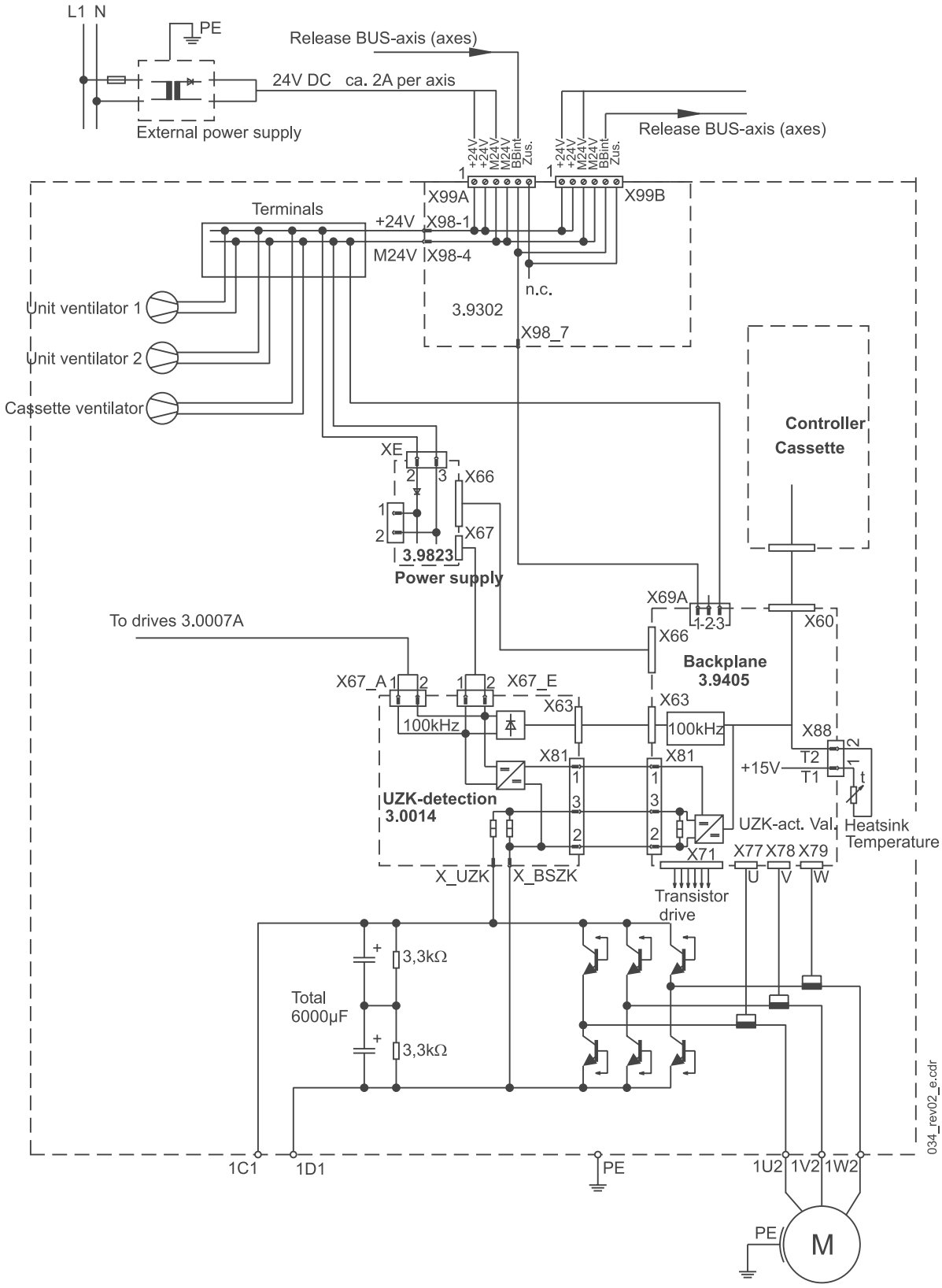


figure 5: Construction diagram BUS64-300A/390A part 1

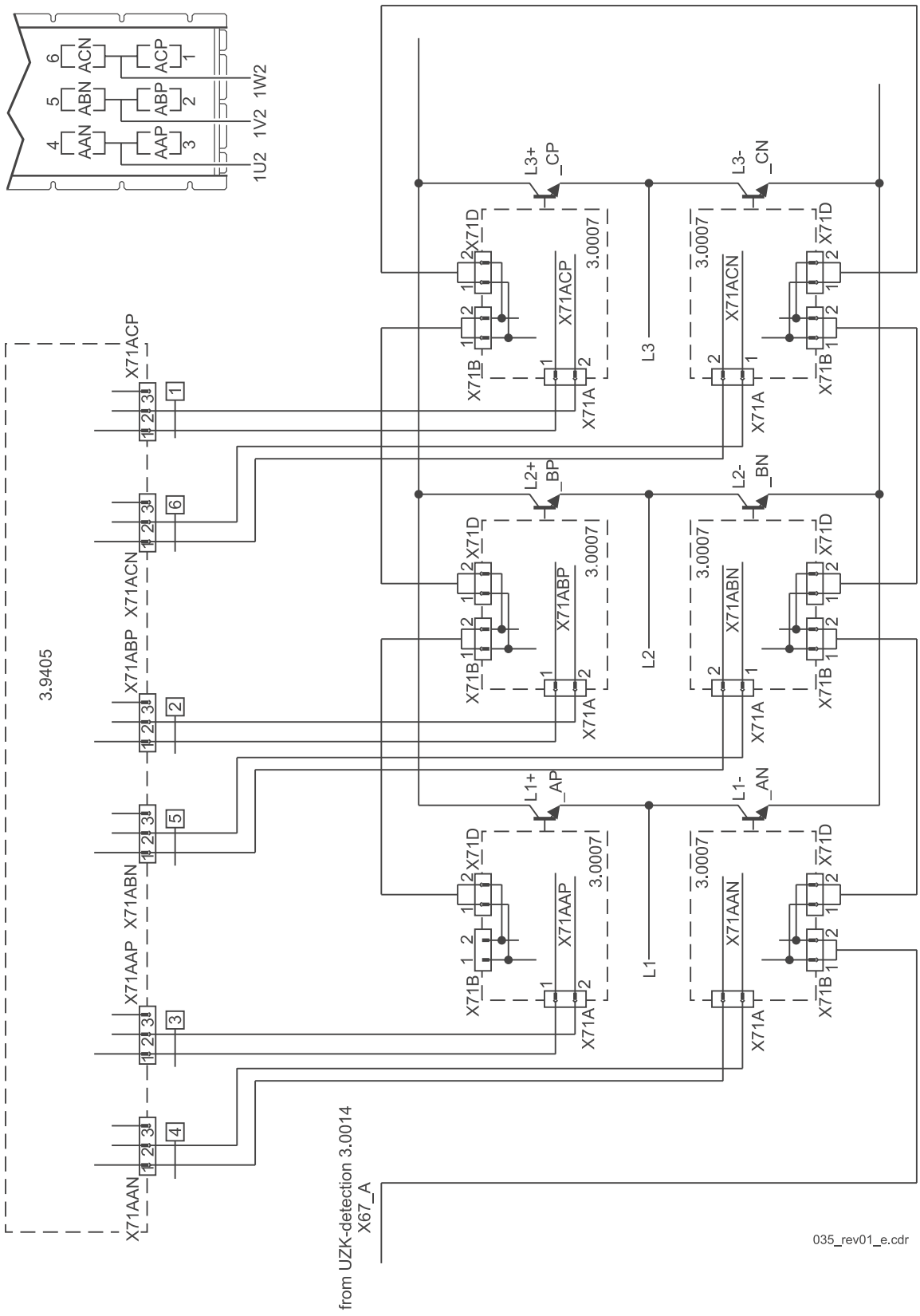


figure 6: Construction diagram BUS64-300A/390A part 2

4.5 Construction diagram

5

MOUNTING

If you intend to mount the appliances within closed electrical work shops according to EN 50178/ VDE 0160, section 5.2.7, you will in addition have to take care of extra messages so you meet the requirements of EN 50178/VDE 0160, section 5.2.4 and EN 60204-1/ VDE 0113 part 1, section 6.2.2.

5.1 Hazardous areas during mounting

The following overview shows you the hazardous areas at the appliance which are important for mounting.

Use this overview for the mechanical mounting only. hazards which are caused by electricity are not shown here. Hazards caused by electricity you will find under ▷6.2 Hazardous areas at installation◁ on page 45.

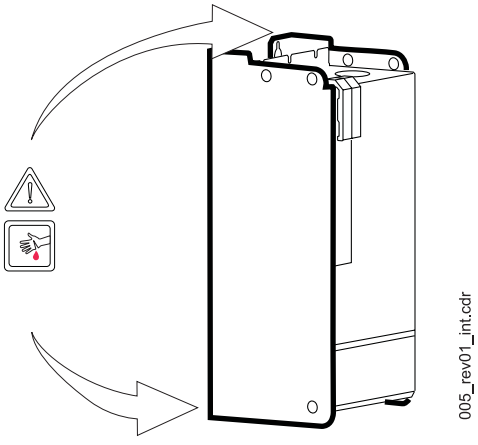


figure 7: Hazardous areas during mounting

5.2 Mounting steps

The mechanical mounting consists of the following steps:

- select the switching cabinet.
- produce the drill holes/threaded holes and the cut-out (variant A/F only).
- mount the unit.
- connect the coolant circulation (variant F only), test the tightness and perform a pressure test.

Further information concerning the single steps are given in the following sections.

5.2.1 Select a switching cabinet

BUS64S/A/Funits are build-in appliances with respect to EN 50178/VDE 0160 section 5.2.6. They are intended for mounting into ordinary switching cabinets, which meet the minimum requirements regarding the protection class stated in EN 50178/VDE 0160, section 5.2.4 (IP 2X, eventually also IP4X acc. to EN 60529/5.1).

WARNING

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

- serious personal injury
- death

The hazard is: ***mechanical influence.*** *The units weigh depending on the model approx. 60 to approx. 70 kilograms.*

select a switching cabinet, which permanently can bear this weight.

NOTE

- If you mount a window variant (F/A), the back side may only have a maximum thickness of 6 mm.

5.2.1.1 Space requirements - dimensional drawings

Use the following dimensional drawings to determine the space requirements in the switching cabinet.

CAUTION

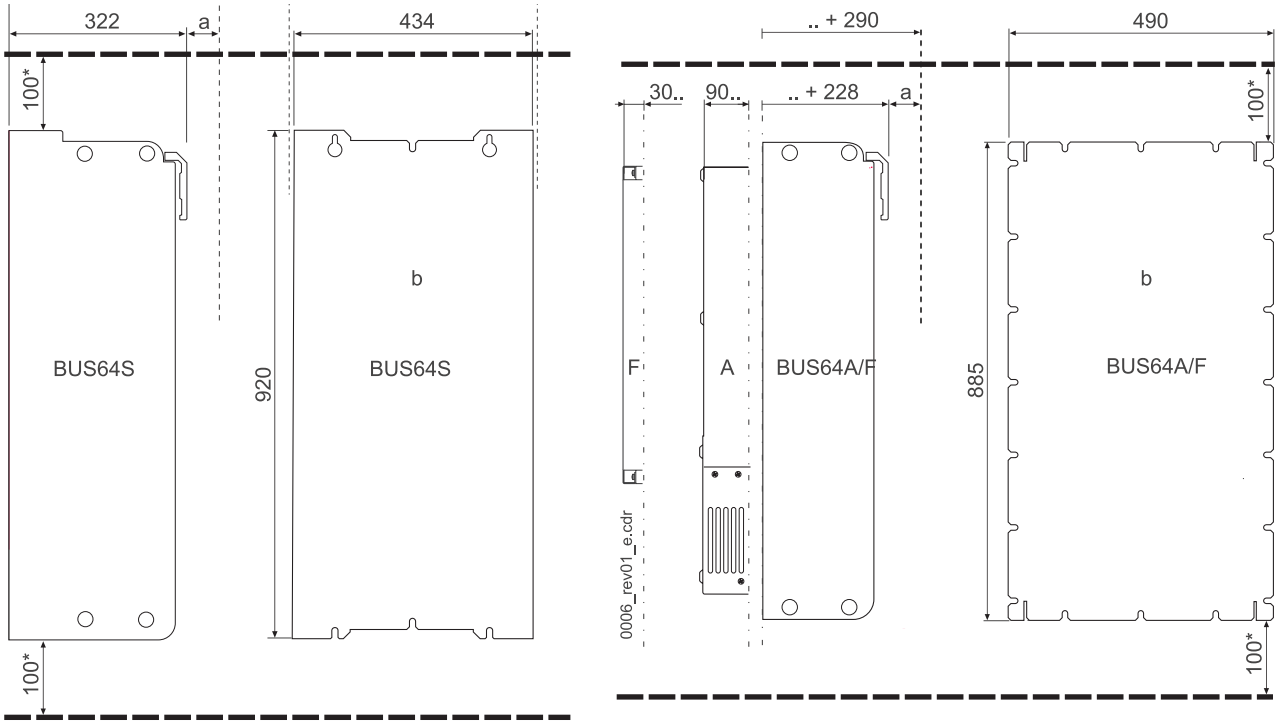
The following **may occur**, if you do not observe this caution information:

- property damage.

The hazard is: overheating of the appliance.

Take care of proper ventilation of the appliances exhaust air. Make sure that the coolant intake and outlet is not obstructed.

Observe the required coolant temperature and -amount (see ▹D.3 Required environmental conditions◃ on page 92). If necessary mount additional ventilators to the switching cabinet.

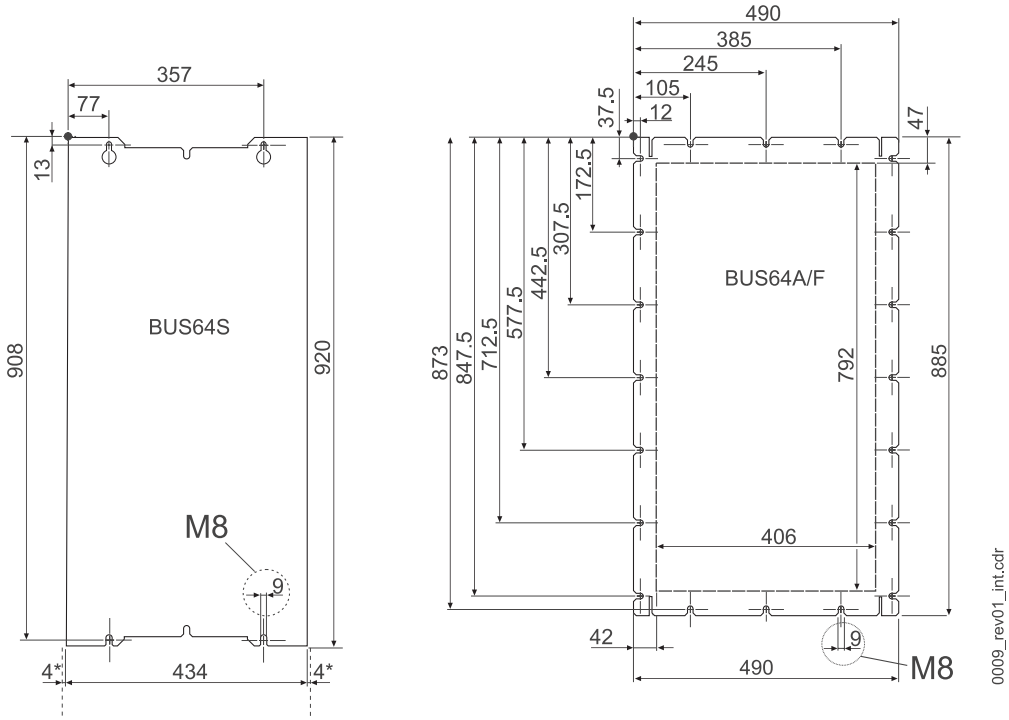


a: free space for controller, connector and cable approx. 60 mm
b: back side view
*: free space

figure 8: Dimensional drawing of BUS64S/A/F

5.3 Producing the drill holes/threaded holes and the cut-out

- produce the drill holes/threaded holes (variant A/F only) according to the drilling figures below.



* screw head

figure 9: Drilling figure of BUS64S/A/F

5.4 Mounting the unit

1 screw the back side of the unit to the rear wall of the switching cabinet.
2 mount all screws in order to secure EMC of the units.

5.4.1 BUS64S mounting

CAUTION

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

- minor to medium personal injury.

The hazard is: ***sharp edges.***

keep the unit's weight in mind - the appliance weighs approx. 70 kg.

lift the appliance only with suitable equipment and/or with the help of adequate qualified personnel.

carry safety gloves

screws (A)	4 x M8			
washers (B)	4 x (8.4 x 17)			
mounting distance (c)	c = 7 mm			

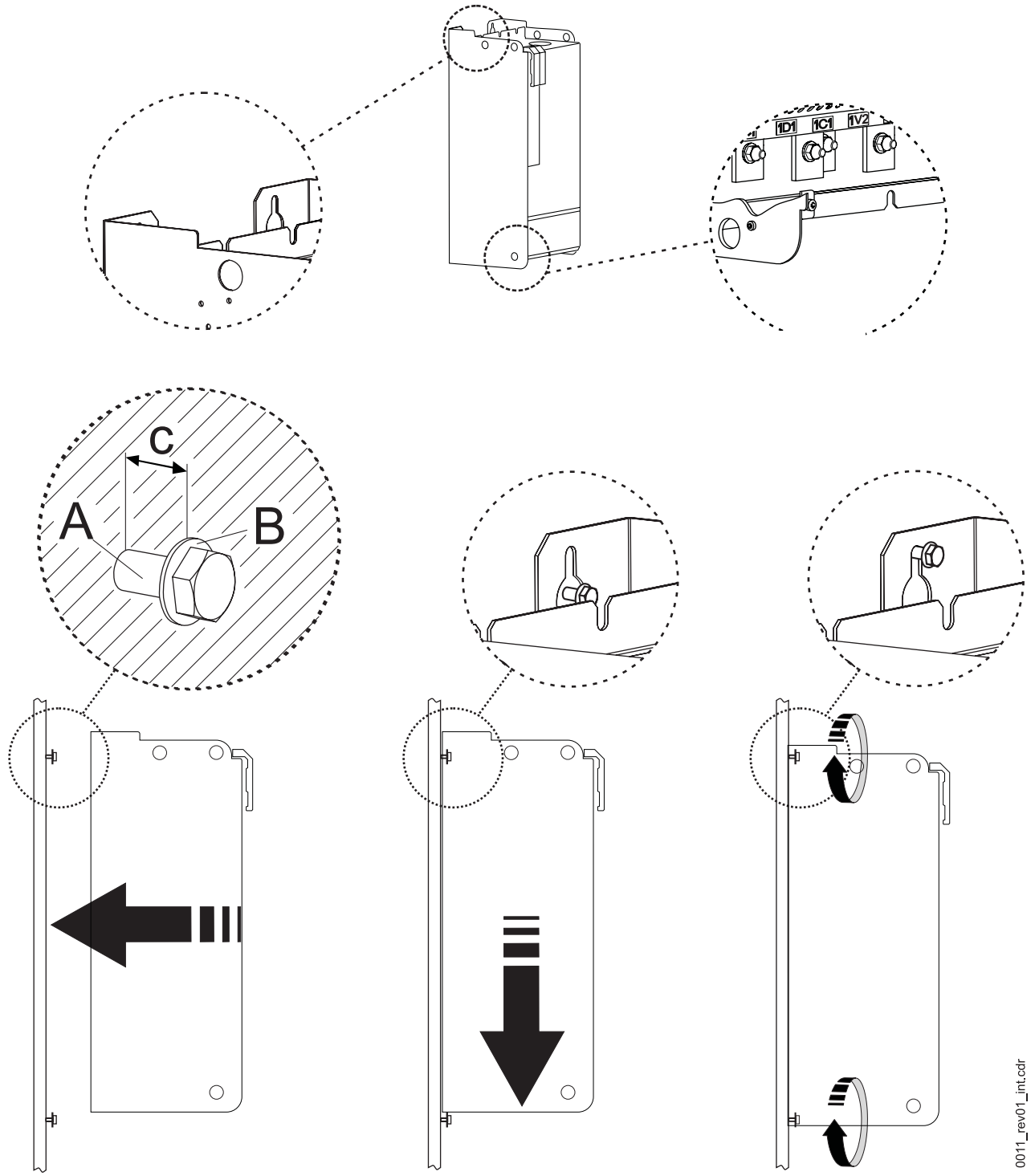


figure 10: Mounting instruction of BUS64S

5.4.2 Mounting BUS64 window variant A/F

CAUTION

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

- minor to medium personal injury.

*The hazard is: **sharp edges.***

keep the unit's weight in mind - the appliance weighs approx. 65 kg resp. approx. 60 kg.

lift the appliance only with suitable equipment and/or with the help of adequate qualified personnel.

carry safety gloves

WARNING

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

- serious personal injury
- death

*The hazard is: **electrical conductive liquid in contact with electricity.** When a water-cooled appliance is ejecting coolant water, the water can invade through defective sealings into the switching cabinet and make contact with parts which carry dangerous voltages.*

Make sure not to damage the sealing at the back side of the unit. Only mount the unit if the sealing is not damaged.

screws (A)	16 x M8				
washers	16 x (8.4 x 17)				
sealing	see accessories				

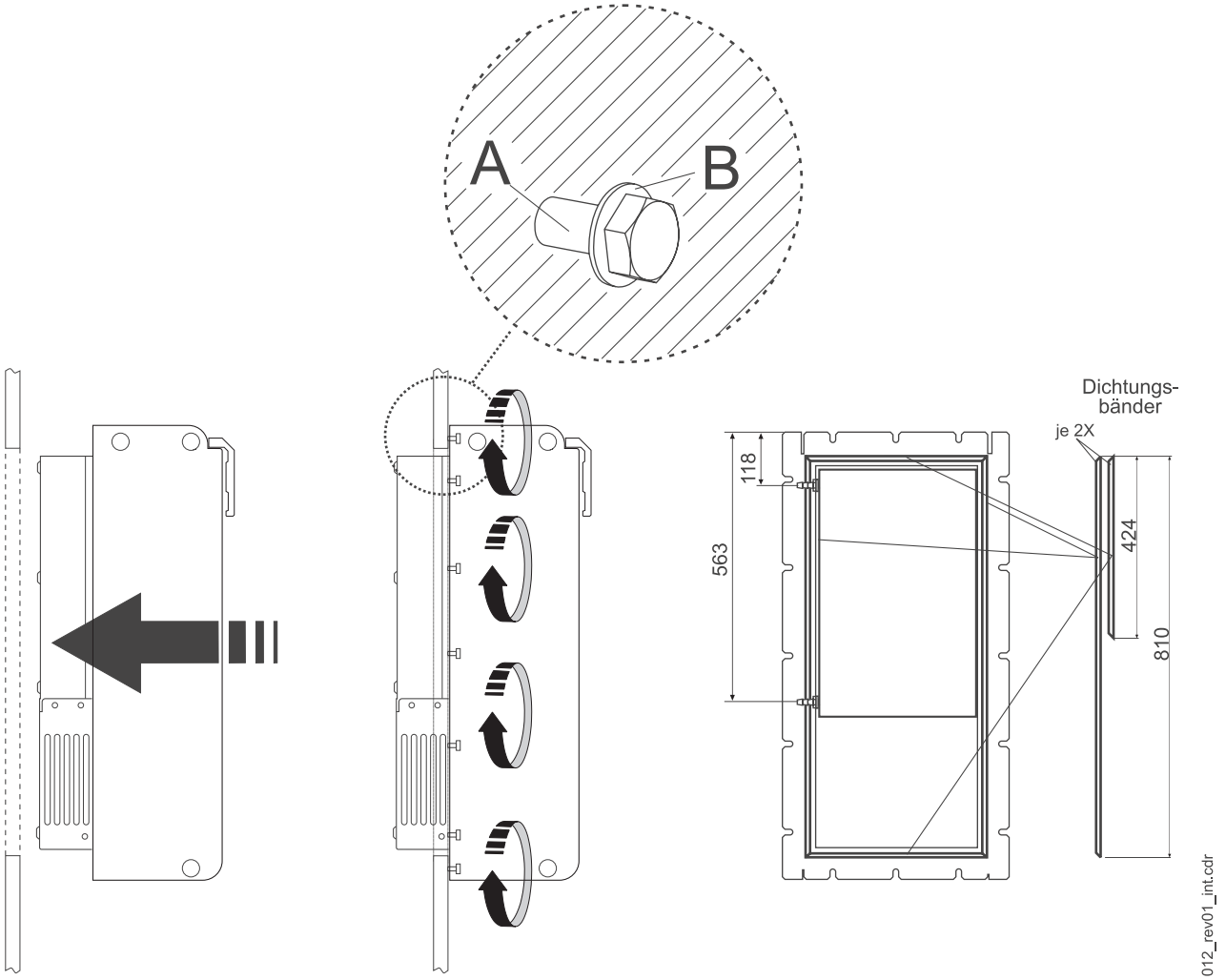


figure 11: Mounting instruction BUS64 window variant A/F

5.4.2.1 Coolant

The coolant must meet certain requirements. The requirements the coolant must have you will find in ▹D.3 Required environmental conditions◃ on page 92.

WARNING

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

- serious personal injury
- death

The hazard is: ***electrical conductive liquid in contact with electricity.*** *The heatsink can corrode and become leaky if the wrong coolant is used. When e.g. the heatsink is leaky, the cooling water can emerge the coolant circulation, invade into the switching cabinet and make contact with parts which carry dangerous voltages.*

Add an anticorrosion agent!

Under all circumstances keep the mixture ratio and test the mixture ratio within the stated maintenance intervals (see ▹Inspection interval◃ from page 73).

Observe the security information supplied by the anticorrosive manufacturer and the security data sheets according to EU-guideline 91/155/EEC or respective common national guidelines of the country where the appliance is in operation.

For disposal of the coolant observe the water endangerment classes (WGK) supplied by the manufacturer. Since May 17th 1999 there is no more class 0 within the VwVwS (German regulation about water endangering substances). Beginning from class 1 (weak endangering water, Germany) the water endangering rises with the number. In any case the disposal has to be carried out according to the regulations. The local waste water administration must be consulted. A disposal into the sewer - even thinned - is not allowed.

CAUTION

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

- property damage.

The hazard is: ***Damage of the coolant circulation.***

Do not use coolant lubricants from manufacturing processes as coolant!

Coolant circulations must be kept in a filled state using coolant-water mixtures in order to avoid corrosion at the transition between liquid and air.

Make sure, that there are no air reservoirs within the coolant circulation.

Remainders of coolant can act corrosive, lead to a lowering of the pH-value and act corrosive within the acid pH-value sector.

When exchanging or switching over from one coolant to another observe that the coolant circulation must be thoroughly rinsed with water several times.

If coolant circulations that have been filled with a coolant-water mixture must be emptied and cannot be refilled within a few days, it is essential, that they are rinsed repeatedly with water and after that be emptied completely.

5.4.2.2 Connecting the coolant circulation

The BUS64F unit has a pre-mounted heatsink at its back. The topmost and the lowest threaded hole (G1/8") in the heatsink are destined for the intake and outlet of a coolant circulation system. For the connection to the customer side of the coolant circulation use connectors with an outside thread G1/8". Onto these connectors the customers hoses for intake and outlet can be fitted.

First mount the BUS64F within the switching cabinet. Then mount the heatsink connections which are accessible at the back side of the appliance.

Mounting the heatsink connections:

1 supply suitable connectors (material: brass, G1/8“ outside thread)

2 clean the threaded holes and connectors

3 apply silicone sealant, e.g. Loctite 5331 onto a least one (clean!) thread winding. The silicone sealant prevents either corrosion between the different construction materials and improves also the security/tightness.

4 turn the connectors by hand into the threaded holes of the heatsink and tighten them with the maximum admissible torque.

CAUTION

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

- property damage.

The hazard is: damage of the connectors thread.

do not exceed the maximum torque (6 Nm) when you tighten the connectors.

5 connect the intake with one of the connectors.

6 connect the outlet with the other connector.

NOTE

You can choose any direction of flow.

7 check the tightness of the coolant circulation.

8 perform a leak test with the required pressure (6 bar).

6

INSTALLATION

In this chapter we describe the electrical installation of the appliance. About the mechanical mounting you have learned in ▸Mounting◂ on page 33.

The steps for installation are:

1 find out and check the required specifications of the power supply. Make sure the mains network meets the requirements.

2 find out what electrical wiring is required and supply the respective cables.

3 find out the characteristics of the connections and configure the cables respectively.

4 follow the EMC guidelines when routing the cables.

6.1 General hazard information

The BUS64S/A/F appliances are defined as working funds of protection class I in respect of HD366 S1 chapter 3.2, see also EN 50178/VDE 0160 sect. 5.2.9.

Working funds of class I are characterized by the fact, that the protection against dangerous body currents not only comes from the basic insulation. Furthermore they are equipped with additional safety precautions. This additional protection consists of the housing and other parts being supplied with a protective earth connection. So in case the basic insulation fails there is no risk of dangerous voltages. The insulation of the appliances is carried out across the total component at least in the basic insulation class according to EN 50178/VDE 0160, sect. 5.2.9.1. This applies to the insulation between current circuits and the environment.

The control connections of the appliance are secure isolated from the mains network. They are laid out for use of PELV-/SELV-circuits.

When determining the air- and creepage distances the following criteria have been considered:

- Soiling grade 2 acc. to EN 50178/VDE 0160, sect. 5.2.15.2, table 2, line 3: Normally only non-conducting pollutants are produced. When the units are out of service, brief conductivity can occur due to condensation.
- Overvoltage category III according to IEC 664-1, table 1 for the air clearances of mains circuits to their environment according to EN 50178/VDE 0160, sect. 5.2.16.1.

Series BUS64S/A/F units are conditional short-circuit-proof in the sense of EN 50178/ VDE 0160, sect. 6.3.4.

During operation, the principles on which the power converter and the motor work lead to leakage currents to earth occurring that may be dissipated by using the specified protective earth connections.

Protection against direct contact with the units is achieved by installing them in commercially available switching cabinets. Their degree of protection must meet at least the minimum requirements of EN 50178/VDE 0160, section 5.2.4 and EN 60204-1, chapter 12.4.

Plastic covers on the equipment provide additional protection against accidental contact when commissioning or in case of casual use of control elements located close to the equipment. For the power connection additional measures must be taken according to IEC 60536-2, chapter 5.1.1, German accident prevention directive “Electrical plants and working funds“ VBG4.

Essential for personal protection are the safety measures and security regulations according to DIN/VDE.

WARNING

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

- serious personal injury
- death

*The hazard is: **Electricity.***

Missing protective conductor connections at the unit or at the motor can lead to personal damage.

Connect the protective conductors.

Discharging time of voltage conducting parts is > 1 min.

Before working at voltage conducting parts check with adequate test equipment that the parts do no longer conduct voltage. Touch parts only after you have assured that they are voltage free and after unit and motor have been secured against reactivation.

6.1.1 Voltage test

Every of these Baumüller units has been voltage-tested according to EN 50178/VDE 0160, section 9.4.5.

WARNING

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

- serious personal injury
- death

*The hazard is: **Electricity.***

Subsequent high voltage tests are to be carried out by Baumüller Nürnberg Electronic GmbH & Co. KG only.

In case you want to check the complete switching cabinet installation without the Baumüller unit with high voltage, you must, before that, disconnect all cable connections from this.

6.2 Hazardous areas at installation

The following overview shows all areas at the unit, which can de dangerous at he electrical installation.

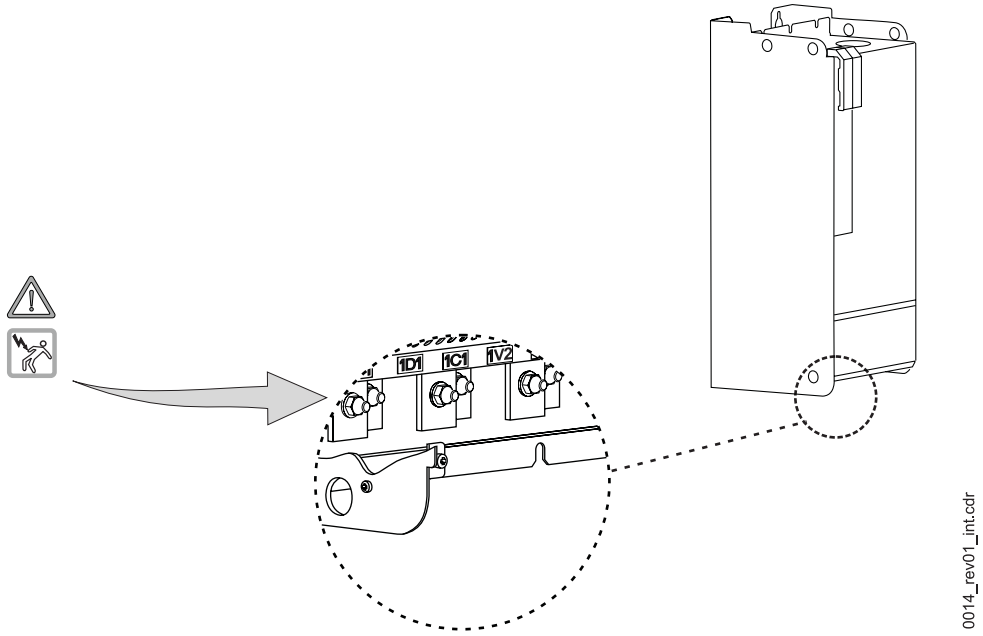


figure 12: Hazardous areas

6.3 Cable requirements

In ▹Appendix D - Technical specifications◃ from page 91 you will find data concerning e.g. environmental requirements, electrical connection specifications and other specifications which you must regard when you select the cables.

Further information you will find in Appendix D under ▹Cable for control voltage supply / signals◃ on page 95 and ▹Cable from appliance to motor◃ on page 96.

➲ make sure all cables used meet the requirements.

6.4 Connections

Here you will find detailed information about all the connections. A summary is to be found in ▹Connection diagram◃ on page 57.

6.4.1 Power terminals

The power terminals are located at the bottom side of the unit (see ▹figure 13◃ on page 46).

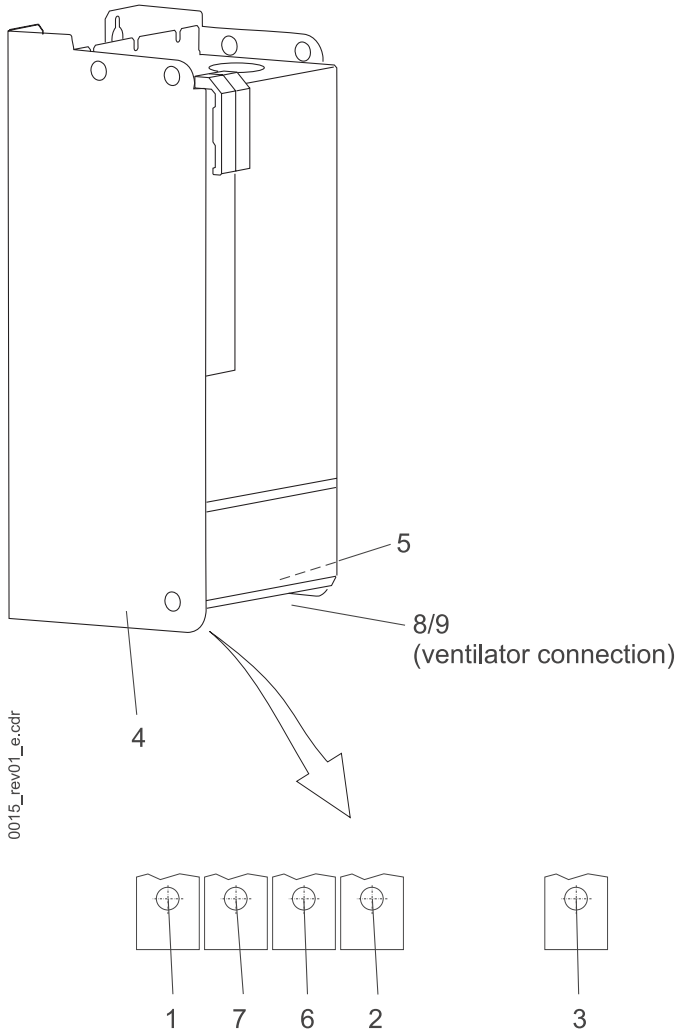


figure 13: Power terminals

terminal [1]	pos.[2)]	description	$U_{interval}$	$I_{interval}$
1U2	1	U phase motor terminal	562 V_{AC} (Û)	300 A_{AC}/390 A_{AC}
1V2	2	V phase motor terminal		
1W2	3	W phase motor terminal		
⏚	4	earth connection		
⏚	5	earth connection		
1C1	6	+ DC link connection	560 up to 760 V_{DC}	300 / 390 A_{DC}
1D1	7	- DC link connection		
X36:L	8	ventilator connection [3)]	230 V_{AC} +5% +10% 50 / 60 Hz	1 A_{AC}
X36:N	9			

1) the cross-sectional area of connecting cable you choose is dependant of the application case according to the valid standards (for example DIN VDE 0100-430). ▹Cable from appliance to motor◃ from page 96

2) position see ▹figure 13◃ on page 46

3) only true for the coolant variants S and A. The two-pole terminal X36/N and L for the connection of the ventilator to 230 V are to be found down to the right of the device in the area of the power terminals (see ▹figure 23◃ on page 58).

6.4.2 Control connections

WARNING

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

- serious personal injury
- death

*The hazard is: **Electricity.***

Do not overload the control connections. The permissible maximum current of 10 A per terminal must not be exceeded.

Make sure that, if there are higher current requirements, it is supplied multiple-isolated.

Make sure, that all applied control voltages meet the PELV or SELV requirements.

6.4.2.1 Control terminals X99A and X99B

Use the supplied screw type connectors to connect terminal X99A and X99B. If you need more screw type connectors please contact Baumüller Nürnberg Electronic GmbH & Co. KG or the manufacturer of the connectors directly (see ▹B.3 Connectors◃ on page 86).

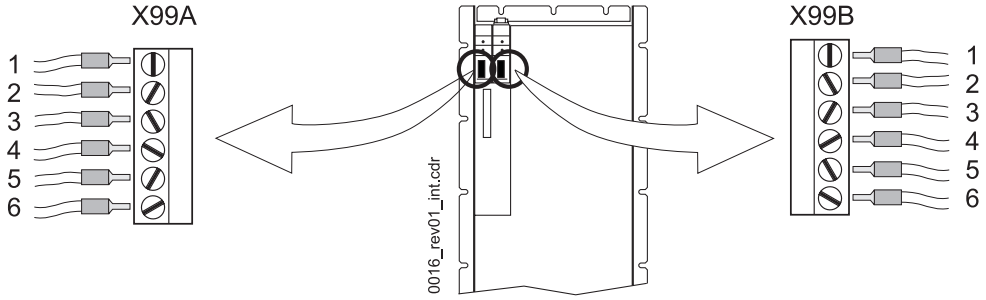


figure 14: Control terminal X99A / X99B

terminal [1]	pos.[2)]	description	$U_{interval}$	$I_{interval}$
+24 V	1	+ 24 V (PELV) [3)] terminal 1 and 2 are bridged internally	24 V_{DC} -10% +20%	2.5 A_{DC}
+24 V	2			
M 24 V	3	ground 24 V (PELV) terminal 3 and 4 are bridged internally (M = GND)		
M 24 V	4			
$BB_{int.}$	5	input "ready-for-use intern" [4)] 0 V: feed unit is not ready-for-use 24 V: feed unit is ready-for-use (BB = ready-for-use)	0 / 24 V_{DC}	6 mA
ZUS.	6	reserved	-	-

1) permissible cross-sectional area of connecting cable of the terminals: see ▹Cable for control voltage supply / signals◃ from page 95. During the connection you must consider the EMC-instructions: see ▹EMC requirements on cable routing (EMC information)◃ from page 50

2) position, see ▹figure 14◃ on page 48. All terminals of X99A are connected with the accordant terminals of X99B in the device. That means that X99A/1 is connected with X99B/1 and so on.

3)

WARNING
The following can occur, if you do not observe this warning information:
• serious personal injury • death
Each terminal is to be loaded with a maximum load of 10 A. If you require more current to be conducted, feed by use of 2 terminals. This way a total of 20 A is possible.

4) the BUS64S/A/F receives this message from the Baumüller supply unit.

6.4.2.2 Safety relay X68

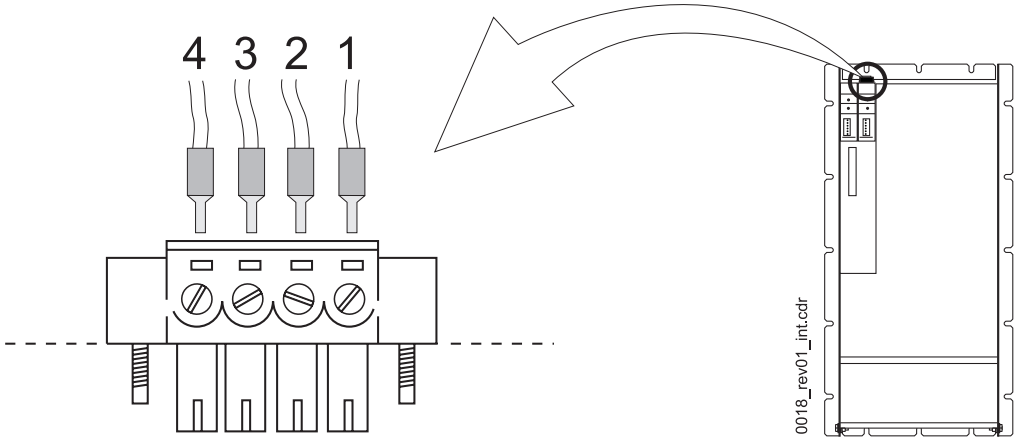


figure 15: Safety relay X68

terminal [1]	pos.[2)]	description	U_{range}	I_{range}
	1 2	Feedback, if the safety relay is supplied with 24 V	0 / 24 V_{DC}	0.5 A_{DC}
+24 V	3	+ 24 V- connection for safety relay (PELV)	24 V_{DC} -10% +20%	35 mA_{DC}
M 24 V	4	ground connection for safety relay (PELV)	0 V (U_{DC})	

1) cross-sectional area of the conductor: 0,14 mm^2 – 1,5 mm^2.

2) position see ▹figure 15◃ on page 49

NOTE

In the motor operation the terminals 3 with +24 V (U_{DC}) and 4 with 0 V (U_{DC}) must be connected.

“Safety relay OFF” is stored as message and must be reset over the controller.

With the safety relay the drive can be switched to a torque-free state. This is achieved by switching off +24 V at contacts 3 and 4.

Coil side	
rated voltage	24 V (SELV)
operating voltage	19 V to 37 V at T_u = 20 °C
coil resistance	660 Ω to 905 Ω
Contact side	
switching voltage U_{AC}	max. 25 V_{AC}
switching voltage U_{DC}	max. 60 V (SELV)
switching current	max. 5 A
continuous current	min. 10 mA up to max. 6 A
switching capacity P_{AC}	max. 150 VA
switching capacity P_{DC}	max. 30 W

WARNING

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

- serious personal injury
- death

The hazard is: ***mechanical influence*** *because of safety relay failure.*

Take care, that contacts 1 and 2 are loaded by a minimum current of 10 mA while in service. Operate the safety relay within its specifications.

6.5 EMC requirements on cable routing (EMC information)

In these devices semiconductors are inserted, which minimize, due to their quick switching, the power loss in the unit, and therewith make a small size possible. These semiconductors generate electromagnetic waves, due to their quick switching. That is why you must obey to certain preconditions, when you operate converters, in order to avoid electromagnetic influences due to switching operations.

Disturbances can arise in all areas of the drive system and can arise from the following:

- capacitive discharge current. The reason is the high rate of rise of voltages when connecting the semiconductors.
- high currents and rates of rise of voltage in the motor lines. The bounded fault energy in the magnetic fields reaches frequencies of a few hertz until to about 30 MHz. Because of the high rate of rise of voltages additionally electromagnetic fields with frequencies till about 600 MHz occur.
- high clock-pulse rates and quick logic circuits (electromagnetic field/16 MHz to 1 GHz).

6.5.1 German EMC law (EMVG)

This appliance complies with § 6 sect. 9 of EMVG dated 18.09.1998:

"Devices, systems and components in the sense of section 3, that are exclusively manufactured or stocked as vendor parts or spare parts for further processing by industrial companies or craftsmen or by other specialists in the field of electromagnetic compatibility do not need to comply with the protective requirements of § 4 sect. 1 no. 1 to 3 and 5."

EMC largely depends on how the individual components and units are assembled and interconnected within the switching cabinet. The information given on the next pages is intended to enable you to configure your plant according to the newest EMC knowledge. This way you can keep the respective legal regulations.

6.5.2 Measures to ensure EMC

To ensure EMC you should strictly keep to the following configuring information.

6.5.2.1 Cabling

- screen **all** cables connected, so the cables are kept free from perturbing radiation (see ▹Screening◃ from page 55). You can mount unscreened control cables, if the switching cabinet has a sufficiently high screen damping (see limit value for radio disturbance emission according to EMVG for your plant) and if the EMC compatibility inside the switching cabinet is guaranteed. (This you can assume, when you have observed all configuration instructions given in this documentation).

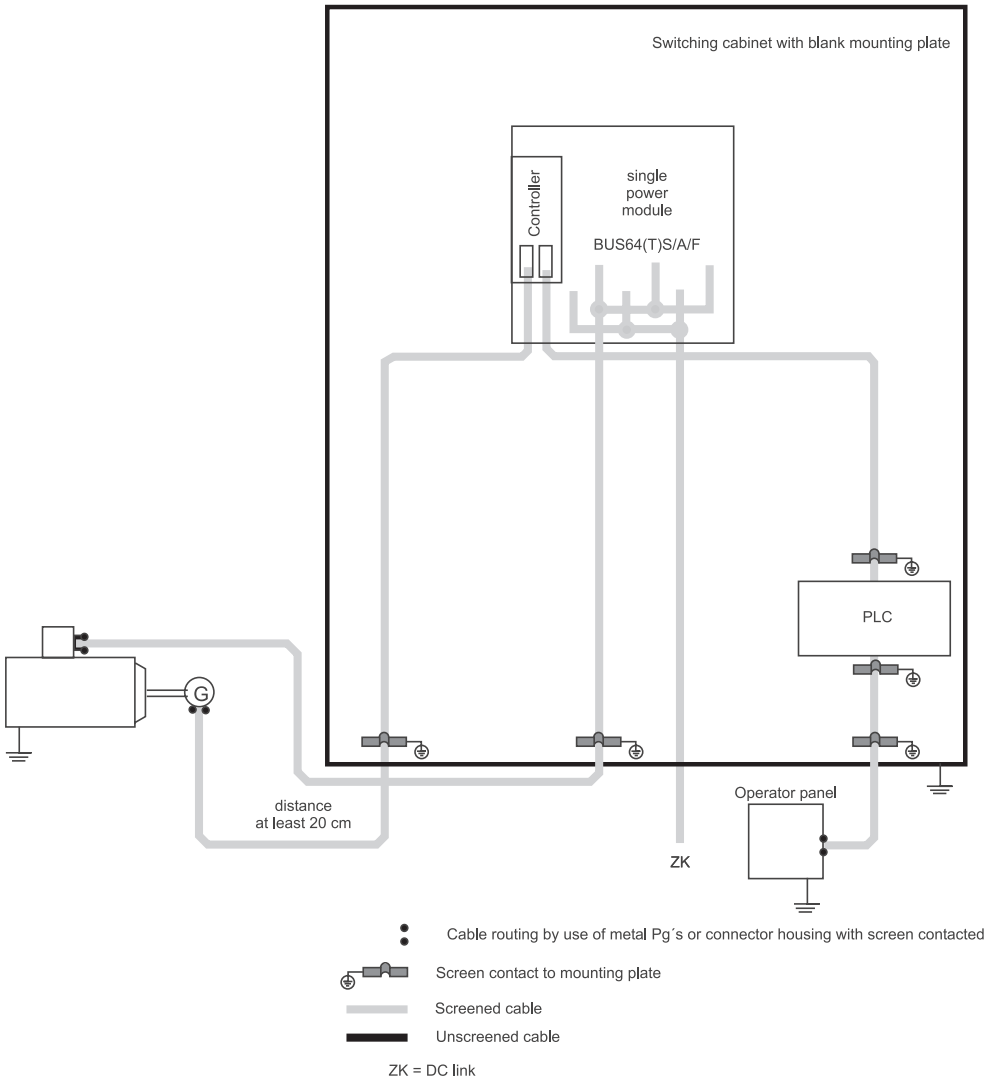


figure 16: Cabling suggestion for BUS64S/A/F

- If you use Baumüller motor cables you can assume, that the permissible limit values are not exceeded.
- The maximum length of the motor cable is limited. The length depends on the cross-section of the cable (e.g. 100 m for 1.5 mm^2, 30 m for 35 mm^2).
- The motor cable between converter and motor must consist of one single piece.
  Do not interrupt the cable by e.g. terminals, circuit breakers, fuses etc.

- You achieve the lowest possible effective antenna height by routing the cable directly alongside of a metallic surfaces.

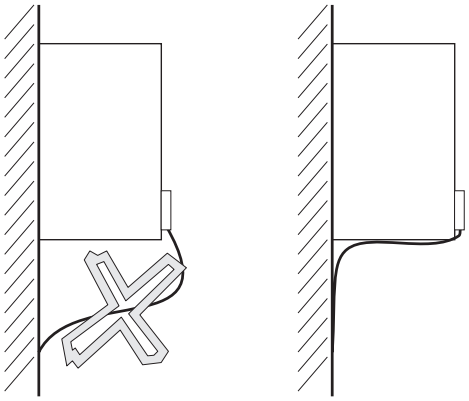


figure 17: reducing effective antenna height

- You should route all lines as close as possible to the conductors of the ground system to reduce the effective loop area for magnetic coupling.

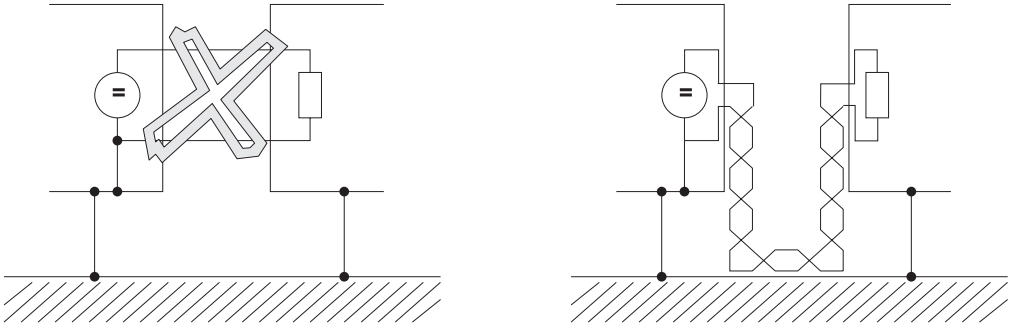


figure 18: reducing loop area

- at parallel laying of signal-/control-lines and power cables a minimum distance of 20 cm between the conductors has to be followed.
- Lines of different EMC categories should only cross at an angle of 90°.
- For symmetrical signal transmission form twisted pair cables and twist those against all other twisted pairs (e.g. for differential amplifier inputs used for speed setpoint value).
- The appliance-to-ground plate earth connection should be as short as possible (< 30 cm). Use large cross-sections (> 10 mm^2).
- keep a distance of at least 20 cm between the cabling of the converter and
  - interferences like contactors, transformers, inductors and
  - susceptibilite units like µPs, bus systems and so on.
- Avoid reserve loops on overlong cables.
- The grounding on reserve conductors in cables is mandatory (additional screening is achieved, you avoid capacitive coupled hazardous contact voltages coupled in).
- For each unit use a separate mains filter. If you must suppress all drives together - do not interrupt the screening between the converter and the motor.

6.5.2.2 Grounding

To meet EMC requirements, the classical star grounding is no longer sufficient to reduce the disturbance of high frequencies caused by converter operation. Better results can be achieved by a reference surface which must be linked to the unit's ground (e.g. bare metal mounting plate and housing parts).

- to avoid earth loops, position all ground conductors and screens as close as possible to ground.
- If it is possible to ground the controller reference potential of unit, form the connection with as large a cross-section as possible and short (< 30 cm) cable.
- remove insulating layers such as paint, adhesives etc. from the ground connections.
- if necessary, use serrated lock washers (DIN 6798) or similar measures to ensure a permanent, conductive contact.
- to prevent corrosion on ground connections, use suitable metal combinations (in the sense of the electrochemical series of metals).
- keep conductive electrolytes away from the connection by the use of protective coating (e.g. with grease).
- connect screens at both ends over a large contact surface and with good conductivity. Only this way you can suppress the effects of magnetic or high frequency disturbance.
- if earth loops occur (e.g. double insulation of the setpoint conductor screen), apply the receiver side galvanically and the sender side capacitively.
- when routing external cable screens through panels separating different EMC areas, ensure contact of the panels to the cable screens

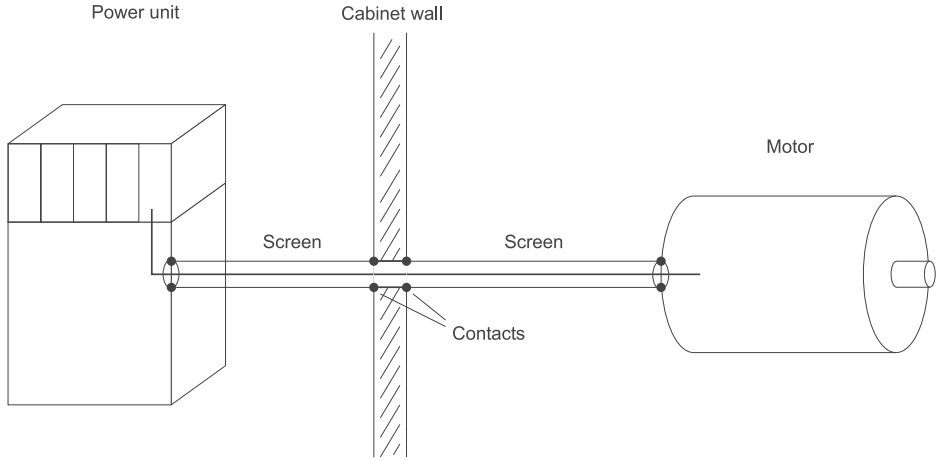


figure 19: contacting cable screens when routing through cabinet panels

Cables which are passed through the panels of screening housings without special measures (e.g. filtering), may impair the screening effect of these housings.

- form a good conductive connection of the cable screens where the cable enters the housing.

- take care that the distance of the last screen contact point to the exit of the cabinet must be as short as possible.

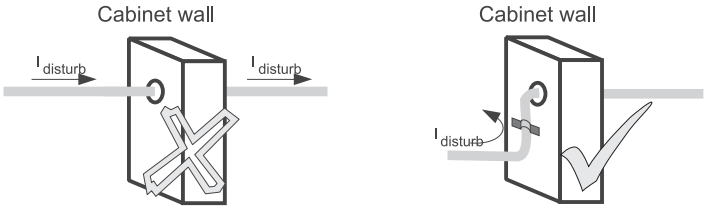


figure 20: cable screening when exiting a cabinet

6.5.2.3 Screening

The screening is effective against magnetic fields if the screen is connected to ground on both ends.

With electrical fields, the screen is effective when it is connected to ground at only one end.

- always place the shield against both sides, if you have fields with high frequencies (independent from the line length), no matter if it concerns an electrical or a magnetical field.

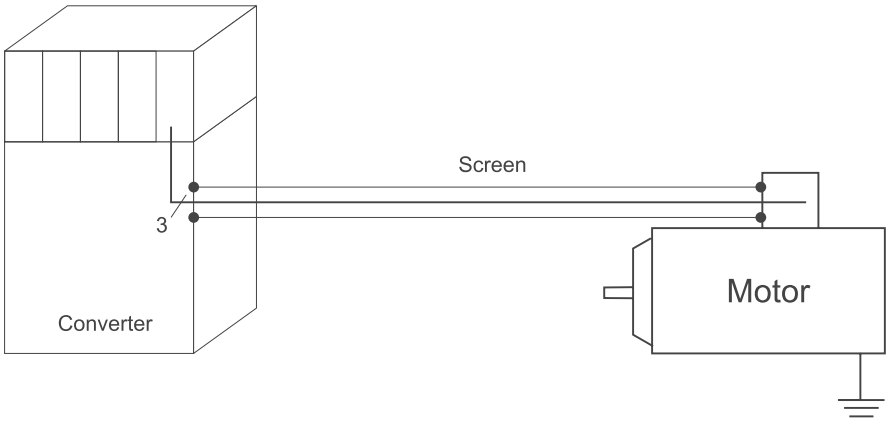


figure 21: screen contact on both sides of a line

With the laying of the shield on earth on both sides you achieve, that the shielding of the system (motor/converter) is not interrupted.

Grounding of conductor screens on both sides does not entirely rule out the influence of earth circuits (potential differences on the ground system). Those are very rare, if you carry out the measures described in the previous sections entitled (▹Cabling◃ from page 51) and (▹Grounding◃ from page 54).

You can also form a capacitive RF connection of a screen to ground. This prevents low-frequency interference due to earth circuits.

- screened cables that are routed through different EMC areas must not be interrupted at terminals, since screen damping would otherwise be reduced considerably.
- if possible, run the cables without interruption to the next module.
- carry out the screen connection low-impedant and use a wide surface.

Cable tails that are only 3 cm long (1 cm of wire = 10 nH) reduce the screening effect in the megahertz range by up to 30 dB!

NOTE

The screen braiding must have a coverage of at least 85%.

The following cables have a particularly high interference potential:

- motor cable
- cable to external ballast resistors
- cable between mains filter and converter

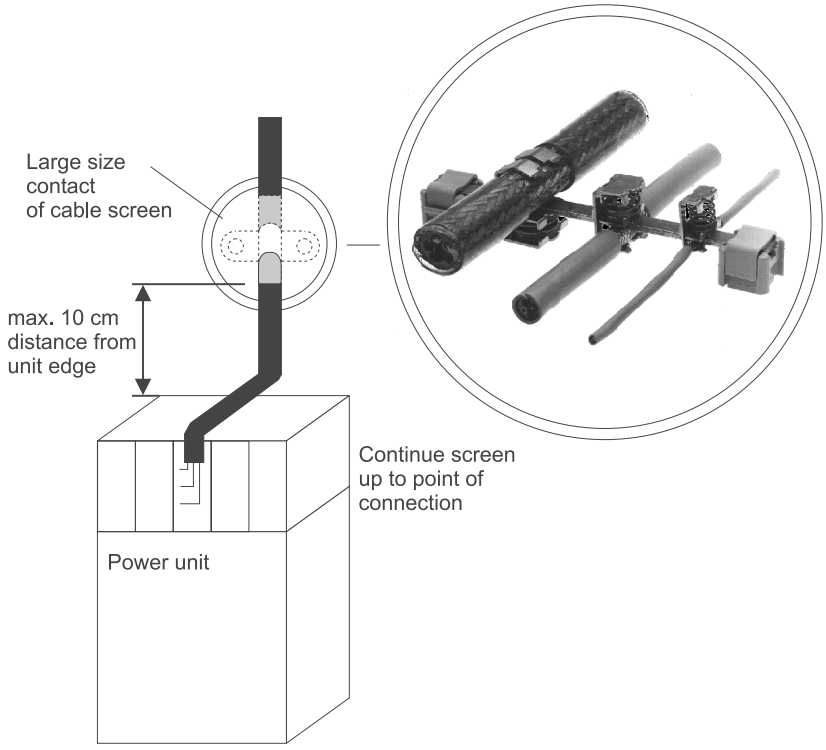


figure 22: Proposal for the screen connection

Screen terminals available from Baumüller Nürnberg Electronic GmbH & Co. KG you will find in (▷B.1 EMC accessories◁ on page 85).

6.5.2.4 Discharge currents

Due to the principle of operation, parasitic capacities in the power unit, motor cable and motor windings can add to discharge currents of 100 mA or higher.

This means that converters may be incompatible with earth leakage circuit-breakers!

- In this context observe the safety information given in the EN 50178/VDE 0160 sect. 5.2.11.2. standard.

6.6 Connection diagram

- run the cables according to EMC rules and connect them as shown in the connection diagram.

WARNING

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

- serious personal injury
- death

The hazard is: ***Electricity.***

Take care that the permissible connected load (see ▹Electrical specifications◃ from page 94) is not exceeded!

Reinstall the coverages that came with the appliance and tighten the screws of the coverages after you have finished the power cable connection.

Further information is to be found in ▹Block switching diagram BUS64S/A/F◃ on page 29 and ▹Connection diagram BUS64S/A/F◃ on page 58.

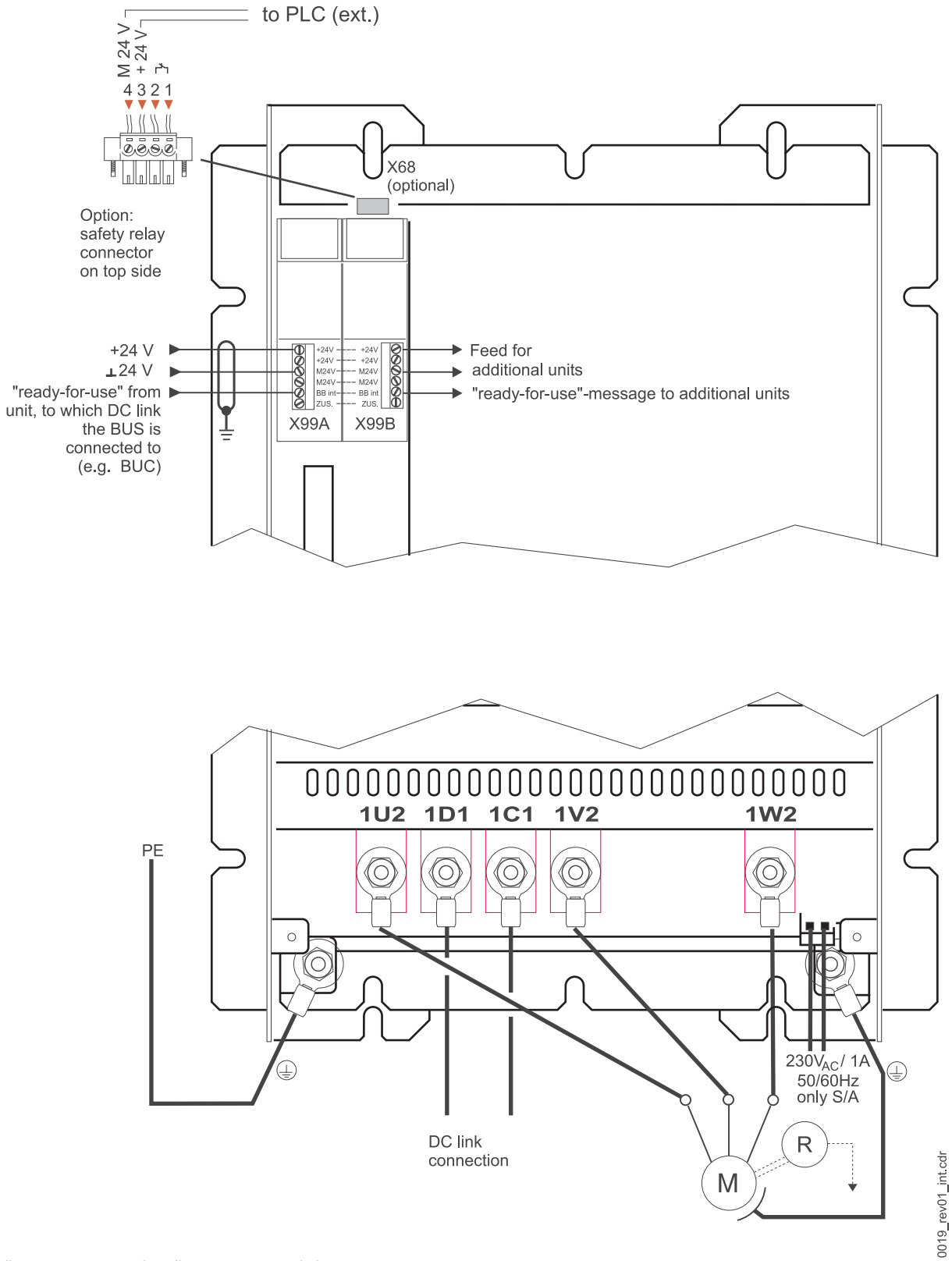


figure 23: Connection diagram BUS64S/A/F

Information about the respective connections you will find in section ▹Power terminals◃ from page 46.

Below we have listed more connection information

+ 24 V ⊥ 24V	24 V power supply with secure electrical isolation (PELV) according to IEC 61131-2; table 7 for supplying of the electronic section

6.6 Connection diagram

7

COMMISSIONING

The comissioning is devided into the following steps:

1 check mounting

2 check installation

3 check safety devices

4 check operating and display elements

Further information about these steps will be given in the following sections.

7.1 Requirements the executing personnel must meet

WARNING

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

- serious personal injury
- death

*The hazard is: **Electricity.** When this electrical appliance is in operation, certain parts of it conduct dangerous voltages.*

Assure, that only qualified personnel, who is familiar with the safety instructions as well as with the mounting-, operation – and maintenance-instructions, work with this device.

Qualified personnel are persons who have been authorized by the plant manager to carry out the activities required, who are able to recognize possible dangers and to avoid them. They must have the skills, experience, instruction and knowledge of the operational conditions and the respective standards, regulations and rules to detect and avoid accidents.

Examples of the qualifications to work with this appliance are:

- education, training or authorization to commission, ground and mark appliances according to safety technology standards.
- education or training in maintenance and use according of adequate safety equipment to safety technology standards.

7.2 Checking the mounting

- make sure, that the appliance is properly screwed to the switching cabinet.
- make sure, that the sealing has not been damaged (for window variants only).
- make sure, that the coolant circulation is tight (for variant F only).

7.3 Checking the installation

WARNING

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

- serious personal injury
- death

*The hazard is: **Electricity.** Voltage conducting parts must be protected against direct touch.*

This you can achieve by insulation, model, position, arrangement or firmly applied devices.

The power terminals of the power module hold potential!

Essential for personal security are the safety measures and safety regulations of the DIN/VDE standards. If protective conductor connections are missing at the appliance or at the motor you will have to face personal damage, because the surfaces may carry dangerous voltages.

The protective conductor connection is to be carried out according to DIN EN 60204/VDE 0113 part 1; section 8.2.2 regarding also EN 50178/VDE 0160, sections 5.3.2.1 and 8.3.4.4.

Under operation there always appear discharge currents in the power module and the motor. They are conducted by using the orderly protective conductor and can lead to premature response of a series fault current circuit breaker.

In case of a body contact or a earth fault a direct current component can appear within the fault current, which can complicate or keep a supervising fault current circuit breaker from responding.

Even after the action of the feed units main contactor the parts of the power module are carrying dangerous voltages.

- check, if the cables leading to the power terminals are routed and connected properly.
- check, if the cables leading to the signal (control-) terminals are routed and connected properly.

7.4 Checking the safety devices

WARNING

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

- serious personal injury
- death

This device is under hazardous voltage and contains dangerous rotating machine parts (ventilator by device version A/S)

Switching cabinets must be equipped with emergency stop devices who are able to cut off all voltages which can lead to hazards. Not included are appliances that would generate new hazards after being cut off. The release for the emergency stop device must be placed in a way that it is fast to reach in case of an emergency. If you carry out operations that hold higher hazard levels the presence of an additional person is required.

- before activating the drive check thoroughly the function of all supervisory safety devices in order to avoid personal hazard.
- before commissioning make sure, that all covers for the voltage conducting parts (power terminals) are in place and the ventilators have been covered with gratings.
- make sure, that the touch protection has been carried out according §4 section 4 VBG 4 (German regulation).

7.5 Appliance start-up

WARNING

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

- serious personal injury
- death

During the first commissioning the is no guarantee that the driven machine elements are not activated by fault or mistake. Therefore be extra careful during the first commissioning.

Extra care is to be taken when directly or indirectly touching the shaft. this is allowed only when the shaft is in stand still position and the power module is cut off from voltage. During operation free accessible machine parts such as shafts or ventilators must be covered.

When an error occurs the drive will be switched off current; the motor will run down without breaking. This circumstance must be regarded especially in transmission or hauling applications.

- make sure there are no persons present in the dangerous area of the machine driven.
- make sure the plant can be switched off immediately by emergency stop devices.
- switch on the appliance and be aware of faulty or uncontrolled conditions of the plant.

8

OPERATION

In this chapter we do not describe the operation but the monitoring, which is important for the operation. The device is operated only over the controller (see controller manual).

8.1 Safety instructions

WARNING

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

- serious personal injury
- death

Immediately report changes, which could affect the security.

In order to demount safety devices, to commission or to repair, set the machine/installation in exact accordance with the instructions out of operation.

Mount the safety devices again and assure their function directly after completion of commissioning or repairing it.

8.2 Monitoring functions and „ready-for-use“

Monitoring functions monitor the condition of the device. The monitoring functions affect the superordinate message „ready-for-use“ (see ▷figure 24◁ on page 66).

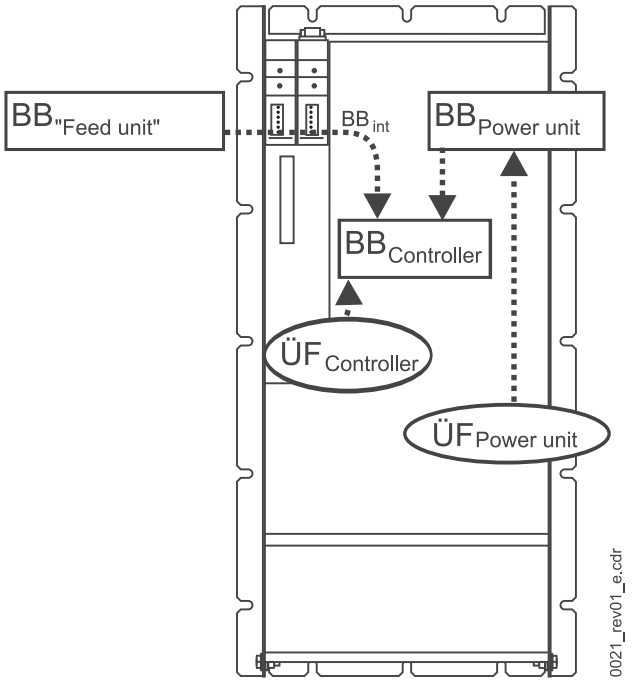


figure 24: Monitoring functions and „ready-for-use“

8.3 Monitoring functions

The following table is listing the monitoring functions. A declaration of every single monitoring function is to be found on the following pages.

Monitoring function		Relay	V-Controller	Reset
Supply (BUG/BUC)	„Supply device“ ready-for-use	-	F 0110[1)]	Controller [2)]
Motor-sided power unit (BUS)	Overcurrent (motor)	-	F 0202	Controller [2)]
	Earth current (short-circuit)	-	F 0203	Controller [2)]
	Overcurrent DC-link	-	F 0201	Controller [2)]
	Overtemperature heatsink	-	F 0205	Controller [2)]
	Internal auxiliary supply	-	F 0204	Controller [2)]
	Safety relay	X 68; 1.2 [3)]	F 0206	Controller [2) 3)]

[1)] The V-controller always displays this group error signal if an error appears in the supply unit. Which kind of error has arised is shown on the according LED on the front side of the „supply unit“.
In order to delete the error in the „supply unit“ you have two possibilities:
Select reset-input of the „supply unit“ (apply +24V and M24V to X99AB, optocoupler input)
or
switch off +24 supply voltage of the „supply unit“.
Therewith **every** message of the supply unit is deleted!

[2)] The message must be deleted by a reset of the controller.
Display and deleting of the message is described in the manual of the controller.

[3)] A message only then appears, if the safety relay is switched off. The safety relay is switched off then, if the +24V-supply voltage for the relay is inexistent.
Before you are able to delete the message by a reset of the controller, you must switch on the +24V-supply voltage again.

NOTE
Reset: In case you are not able to reset the message, the error still remains.

NOTE

The monitoring functions are only then active, if the +24V-supply voltage at X99A is present.

8.3.1 Monitoring functions supply (BUG/BUC)

The supply unit possesses own monitoring functions. Over the signal line „BBint“ (ready-for-use supply unit) these influence the axis (see ▹figure 23◃ on page 58).

8.3.2 Monitoring functions motor-sided power unit (BUS)

The "monitoring functions motor-sided power unit" influence the „$BB_{power\ unit}$“.

The following monitorings are existent in the power unit:

Overcurrent (motor)
Every of the three phase currents of the motor are monitored.
In case of an exceeding of the phase current of 30 % of the peak value of the permissible peak current the BUS64S/A/F generates this message. This message is stored in the BUS64S/A/F and is routed onto the controller.

NOTE

The overcurrent message and the consequential stopping of the drive protects this of damage/destruction. In order to avoid the message „overcurrent (motor)“, you must limit the permissible peak current of the motor phase currents by the control system.

Earth current (short-circuit)
Monitoring of the motor connection to earth fault.
The message is generated, if the error current exceeds 20 % of the permissible peak current of the power unit. This message is routed onto the controller.

Overcurrent DC-link
The level of the DC-link voltage is monitored.
If the DC-link reaches 840 V this message is generated and is routed to the controller.

NOTE

This message can also arise, if the drive brakes and no or a too low ballast interface connection at the DC-link is existing.

Overtemperature heatsink
Monitoring of the heatsink temperature.
On the heatsink there is a temperature sensor, whose measured value is routed onto the controller.

CAUTION

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

- property damage.

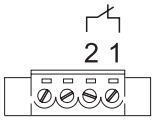
*The hazard is: **temperature of the device is too high.** The maximum allowable temperature of the heatsink is 90 °C - if there is a higher temperature the device can be destructed.*

Adjust the controller in such a way, that the error message is actuated below this temperature.

Internal auxiliary supply The voltage, which is necessary for the controlling of the power transistors is monitored. If the internal auxiliary supply is missing, this message is generated and is routed to the controller.

Safety relay The output condition of the safety relay is monitored.

8.3.3 Safety relay in the motor-sided power unit (BUS)

Plug-in terminal	Description
 figure 25: X68	With the safety relay you are able to switch off the supply voltage of the transistor control. After the switching-off the motor is zero-torque, but is isn´t isolated from the power module. Due to the fact that the motor is not isolated from the module, the motor is not off-circuit! A typical application for the safety relay is: ▸ very quick reuptake of the operation after switching off This is possible, because the DC link voltage is not switched off. Acknowledgement safety relay (safety relay is optional available) Contact **closed**: +24V-supply for the safety relay is missing. The output stage and accordingly the inverter is inhibited. Contact **open**: +24V-supply for the safety relay is existing. The output stage and accordingly the inverter can be controlled by the controller. If the +24V-supply for the safety relay is taken away, during the drive is running, then the drive is immediately switched zero-torque (this means the device doesn´t supply any power anymore). In order to start the drive again you must follow the following procedure: Switch on +24V supply for safety relay delete existing message by a reset of the controller

8.4 Ready-for-use

The message „ready-for-use“ is dependant of the monitoring functions (see ▹figure 24◃ on page 66). If a monitoring function generates a message which takes away the signal "ready-for use", the drive is switched off according to the parametrization of the controller (P189 when using the V-controller).

NOTE

After creating the +24V-supply voltage and the mains voltage, the device is ready-for-use after approximately 5 seconds.

The output signal „ready-for-use“ at the bus connection X26/11,12,13 of the V-controller is the linkage of the following monitoring functions:

1. "Ready-for-use supply" (BBint)
2. "Ready-for-use motor-sided power unit" ($BB_{Power\ unit}$)
3. "Ready-for-use controller" ($BB_{Controller}$)

9

MAINTENANCE

9.1 Inspection interval

By polluted ambient air the required coolant air flow rate cannot be reached anymore, if dirt deposits block up the ventilation slots (device version A/S).

Even before clusters of dirt inside the appliance can block the required heat dissipation. Layers of dirt on the ventilation grids are a warning signal which you should keep an eye on.

- check the devices (e.g. air filters) within the switching cabinet which ensure the required environmental conditions and be sure to keep the maintenance intervals given by the manufacturers.
- weekly check the specified environmental conditions.

The specified environmental conditions you will find in chapter ▹Appendix D - Technical specifications◃ from page 91.

- monthly check the mixture ratio of the anticorrosive (applies to window variant F only).

9.1 Inspection interval

10

REPAIR

DANGER

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

- serious personal injury
- death

Only Baumüller-personnel, that is familiar with safety notes and mounting-, operation- and maintenance instructions is allowed to repair this appliance.

This appliance conducts dangerous voltages - all repair jobs are to be done only when the appliance is in powerless state.

Begin to work at the DC link of the appliance only after it has been secured, that neither potential nor voltage (residual charge) is present.

Before demounting safety devices for commissioning or repair jobs, the machine/plant is to be put out of operation according exactly to the regulations. Right after the commissioning or repair job is done, all safety devices must be remounted and it must be made sure that they function correctly.

NOTE

The operator of the machine must carry out a complete drive acceptance procedure after every intervention in the drive, no matter if its the motor, the actual value encoder or the power module. Also this has to be written down in a chronological protocol (service note-book etc.) If this is disregarded, the operator runs the risk of liability consequences.

11

SETTING OUT OF OPERATION, STORAGE

In this chapter, we describe how the BUS64S/A/F is set out of operation and the storage after.

11.1 Demands on the personnel

The personnel that you order to set the appliance out of operation, must have the required knowledge and instructions to carry out these jobs properly. The personnel is to be chosen in a way that the safety information found on the appliance, its parts and its connections are understood and observed.

11.2 Safety regulations

The sense of the safety regulations during commissioning must be applied to the set-out-of-operation procedure as well.

DANGER

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

- serious personal injury
- death

*The hazard is: **Electricity.***

Make sure that all electrical connections are switched powerless and are secured against unauthorized reactivation.

*The modules inside the appliance (e.g. condensers) can hold dangerous charges! The capacitors used inside the appliance will take at least **10 min** to become discharged by themselves.*

Before working at electrical connections check with suitable test instruments that there is no more voltage at the terminals. Only demount connections after you are sure that they are completely powerless.

11.3 Setting out of operation

The setting out of operation has the following steps:

1 switch to powerless state and secure against unauthorized reactivation.

2 (approx. 10 min after switching off) test that the connections are voltage free.

3 demount the connections and secure them according to the safety regulations.

4 (if required: demount coolant circulation connections and seal them).

5 make a set-out-of-operation document.

11.4 Demounting

Prerequisite for demounting is a completely documented set-out-of-operation procedure.

For the demounting, observe the same regulations and safety information as for „mounting“. Observe in particular that a BUS64S/A/F weighs between approx. 60 kg and approx. 70 kg. Supply suitable transport devices (hoisting gear, cranes, transportation personnel etc.) for transport after demounting.

Disengage all mechanical connections to the switching cabinet only after the appliance has been secured against falling off/falling down.

Keep ready suitable packing material if you intend to store the appliances. If in doubt contact Baumüller Nürnberg Electronic GmbH & Co. KG During transport observe, that the appliance is not damaged by false supports or severe shocks, see also ▹Packing and Transport◃ from page 23.

11.5 Storage conditions

The duration of the storage is unlimited if you keep the storage conditions given below:

- climatic category: 1 K 4
- temperature range: - 30 °C to + 70 °C

11.6 Maintenance during the storage

During storage there is no maintenance necessary.

11.7 Re-commissioning

1 By the window variants A/F the sealing strips have got to be changed, see ▹Mounting instruction BUS64 window variant A/F◃ on page 40.

2 Carry out commissiong such as doing it with a new device (see chapter 5 to 8).

12

DISPOSAL

In this chapter we describe the correct and secure disposal of BUC64 S/A/F-appliances. During the disposal you will get mainly metal parts (iron- and non-iron metal), electronics scrap and plastics.

12.1 Safety regulations

The disposal is to be carried out only according to the safety regulations. Observe also particular local regulations. If you are unable carry out a proper disposal yourself, contact a certified disposal business.

CAUTION

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

- environmental pollution.

The hazard is: ***non-appropriate disposal.***

During a fire dangerous materials may be generated or set free.

Do not expose electronic modules to high temperature.

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

Do not open modules.

12.2 Demands on the personnel

The personnel which you instruct to dispose/demount the appliance must have the knowledge and training to carry out these jobs properly. Choose the personnel in a way that it is secured that safety information on the appliance and its parts are understood and observed.

12.3 Disposal instructions

Prerequisites

- The appliance has been properly demounted.
- All technical devices and tools required for demounting are ready-to-use and are in a good technical condition.

12.3.1 Modules

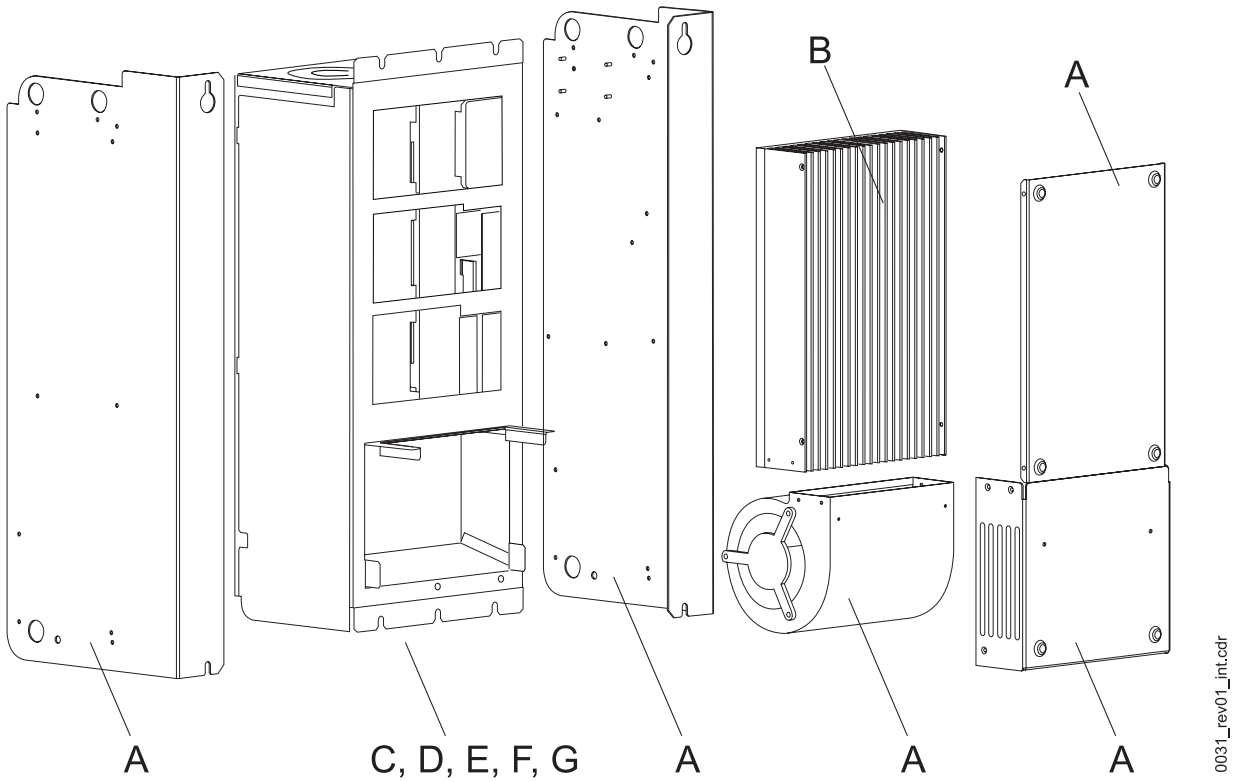


figure 26: Demounting scheme

The modules/units below given in brackets you will find in the figure above.

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, the plastic covers and other small parts made from plastic must be given to the plastics recycling.

CAUTION

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

- environmental pollution.

The hazard is: ***non-appropriate disposal.***

The following elements/modules must be handled as special waste.

condensers	**(E)** condensers must be disposed off as special waste. Observe the respective regulations.
semiconductor modules	**(F)** semiconductor modules must be disposed off as special waste. Observe the respective regulations.
electronic scrap	**(G)** the electronic scrap from PCBs, which cannot be demounted further, must be recycled as special waste. Observe the respective regulations.

12.4 Recycling plants / offices

Make sure, that the disposal is carried out according to your company's regulations and the regulations of the disposal companies and official administration. If in doubt, contact the local business administration, environmental office or other.

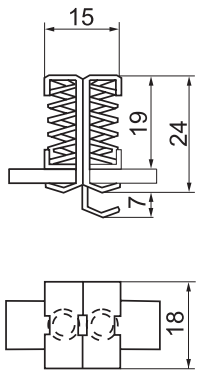
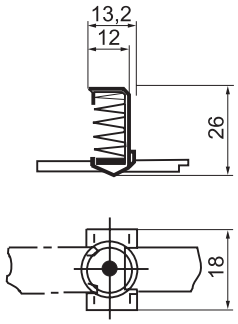
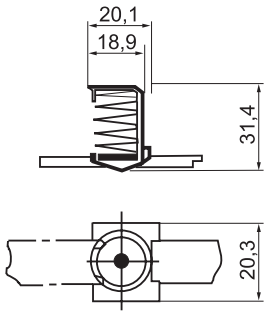
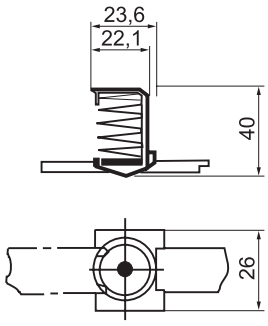
12.4 Recycling plants / offices

APPENDIX A - ABBREVIATIONS

Para.	Paragraph
AC	Alternating current
AM	▸ Asynchronous motor ▸ Function module drive manager
BB	Ready-for-use
BBext	Ready-for-use (external)
BBint	Ready-for-use (internal)
BSA	Reference potential analog
BSD	Reference potential digital
BSE	Reference external for 24V-control inputs
BUB	Ballast unit
BUC	Baumüller supply/recovery unit
BUG	Baumüller converter basic-supply-unit
BUM	Baumüller single-power-unit
BUS	Baumüller power module
DC	Direct current
DIN	Deutsches Institut für Normung e.V.
EMK	Electromagnetic constant
EMC	Electromagnetic compatibility
EN	European standard
EXT, ext	External
FI	Residual current
IPM	Intelligent power module (Intelligent Power Module)
IZK	Overcurrent in the DC-link
LED	Light-emitting diode
M24	Reference potential 24 V
mtr.	Medium time-lag
NN	Altitude
PELV	Protective extra-low voltage with safety separation, earthed
R	Reserved
RF	Controller release
RS	Controller inhibit
SE	Shield earth
SELV	Safety extra-low voltage with safety separation
SL	Protective conductor
SM	Synchronous motor
TBA	Overtemperature ballast resistor
TKK	Overtemperature heatsink
TM	Temperature motor
TMO	Overtemperature motor
U_{ZK}	DC-link voltage
VBG	German administerial occupation co-operative
VDE	German electrotechnical association
X	Terminal strip
ZK	DC-link

APPENDIX B - ACCESSORIES

B.1 EMC accessories

Screen terminals for grounding			
cable-∅ 2 x **2 - 6 mm** Article no. 226 752		cable-∅ **3 - 8 mm** Article no. 226 741	
cable-∅ **4 - 13.5 mm** Article no. 226 745		cable-∅ **10 - 20 mm** Article no. 226 749	

B.2 Safety switch (Option)

Coil side	
Nominal voltage	24 V (SELV)
Operating voltage	19 V to 37 V with T_u = 20 °C
Coil resistance	660 Ω to 905 Ω
Contact side	
Switching voltage U_{AC}	max. 25 V_{AC}
Switching voltage U_{DC}	max. 60 V (SELV)
Current switched	max. 5 A
Continuous current	max. 6 A
Switching capacity P_{AC}	max. 150 VA
Switching capacity P_{DC}	max. 30 W

B.3 Connectors

Article	**Article no.**	**Manufacturer - order no. / type**
male connector for X99A	00309455	Phoenix Contact - MVSTBW 2,5/6-ST
male connector for X99B	00309454	Phoenix Contact - MVSTBR 2,5/6-ST
male connector for safety relay	00309482	Phoenix Contact - MC 1,5/4-STF-3,81-BD:1-4

B.4 Water cooling

Sealing tape: article number 00350790

coupling (connection accessory): contact Baumüller Nürnberg Electronic GmbH & Co. KG

C

APPENDIX C - DECLARATION OF CONFORMITY / DECLARATION BY MANUFACTURER

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 company satisfy the requirements of 73/23/EEC (Low Voltage Directive).

Provide this Baumüller equipment is subjected to normal use in your machinery you can assume that the equipment satisfies the requirements of 73/23/EEC.

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.
We will provide you with support in the form of EMC information. You will find this information in section ▹EMC requirements on cable routing (EMC information)◃ ab Seite 50.
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.

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 Electronic GmbH & Co. KG company 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 Declaration by Manufacturer

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 by Manufacturer in this section the Baumüller Nürnberg Electronic GmbH & Co. KG company 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 by Manufacturer.

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 Electronic GmbH & Co. KG company 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 2003

Declaration of Conformity 2003

gemäß EU-Richtlinie 73/23/EG (Niederspannung) vom 19.02.1973
geändert durch: 93/68/EWG vom 22.07.1993

in accordance with EC directive 732/23/EG (low voltage) dated 19.02.1973
changed by: 93/68/EWG dated 22.07.1993

BUS64S/A/F BUS64X - XXX/X XX - XX - X - X - XXX

Das obige Gerät wurde entwickelt und konstruiert sowie anschließend gefertigt in Übereinstimmung mit o.g. EU-Richtlinie und u.g. Normen in alleiniger Verantwortung von:
the unit specified above was developed and constructed as well as manufactured in accordance with the above mentioned directive and the standards mentioned below under liability of:

Baumüller Nürnberg Electronic GmbH & Co. KG, Ostendstr. 80 - 90, D-90482 Nürnberg

Berücksichtigte Normen - standards complied with:

Norm / standard	
EN 50178	Ausrüstung von Starkstromanlagen mit elektrischen Betriebsmitteln Electronic equipment for use in power installations
EN 60204-1	Sicherheit von Maschinen - Elektrische Ausrüstung von Maschinen Safety of machinery - Electrical equipment of machines
EN 60529	Schutzarten durch Gehäuse (IP Code) Degrees of protection provided by enclosures (IP Code)
HD 625.1 51	Isolationskoordination für elektrische Betriebsmittel in Niederspannungsanlagen Insulation coordination for equipment within low-voltage systems

Nürnberg, 27.08.2003

Dr. Peter Kreisfeld
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i.V. Dr. Heidrich 27.8.2003

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C.6 Declaration by Manufacturer

EU-Herstellererklärung 2003

Declaration by Manufacturer 2003

gemäß EU-Richtlinie 98/37/EG (Maschinen) vom 22.06.1998
geändert durch: 98/79/EG vom 27.10.1998

in accordance with EC directive 98/37/EG (machinery) dated 22.06.1998
changed by: 98/79/EC dated 27.10.1998

BUS64S/A/F BUS64X - XXX/X XX - XX - X - X - XXX

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

Bei der Entwicklung und Konstruktion des Gerätes wurden folgende Normen beachtet:

The development and construction of the unit is complied with following standards:

Norm / standard	
EN 60204-1	Sicherheit von Maschinen - Elektrische Ausrüstung von Maschinen Safety of machinery - Electrical equipment of machines

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D

APPENDIX D - TECHNICAL SPECIFICATIONS

In this chapter you will find an overview of the technical specifications. Some of these data we have been using before in the previous chapters at the respective places.

D.1 Requirements on the power supply

Control voltage[1] (U_{DC})	+ 24 V DC -10 % / +20 % [2]

[1] The supply voltage must meet the requirements of PELV (EN 50178, chapter 3.49) or SELV (EN 50178, chapter 3.70).

[2] EN6 1131-2:1994, table 7

D.2 Burst immunity

Signal interfaces	1 kV
Power interfaces	2 kV

D.3 Required environmental conditions

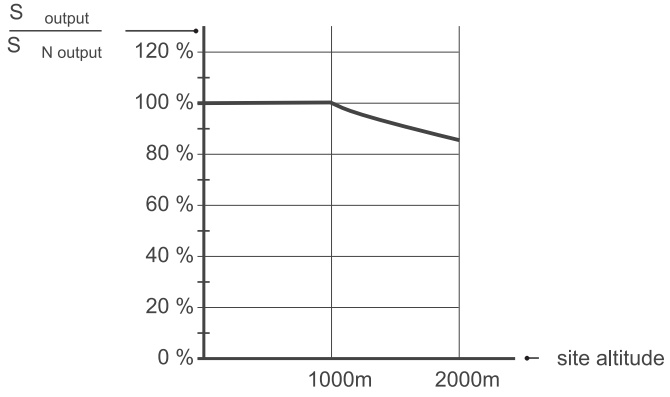
Transport temperature range	- 30 °C to + 70 °C
Transport climatic class	2 K 3 [1)]
Storage temperature range	- 30 °C to + 70 °C
Storage climatic class	1 K 4 [1)]
Operational surrounding	outside populated areas [2)]
Operation temperature range	min. 0 °C to max. 55 °C [2)]
Operation climatic class	3 K 3 [1)]
Mounting height [4)]	up to 1000 m above sea level (rated service)
Relative humidity (operation)	5 % to 85 % no condensation[1)]
Ionizing and non-ionizing radiation	no limits
Vibration, shock and continuous shock	max. 1 *g* [5)]
Degree of pollution	2 [6)]
Air ventilation temperature [8)] Water cooling temperature [7)]	min. 0 °C to max. 55 °C [3)] min. “Air ventilation temperature“ [9)] up to max. 60 °C
Air ventilation through appliance (without heatsink) Air ventilation through heatsink Cooling water flow rate [7)]	300 m^3 / h 800 m^3 / h min. 4 l/min. up to max. 10 l/min.
Cooling water pressure [7)]	max. 6 bar
Temperature difference (Coolant intake to -outlet)	4 K at 4 l/min in rated service
Pressure loss at water cooler [7) 10)]	1.15 bar at 4 l/min

[1)] EN 50178, table 7

[2)] when operated in populated areas you will have to experience high frequency disturbances (acc. to EN 61800-3, 6.4.2.1)

[3)] 40° is the rating temperature, for higher ambient temperatures the output current is to be reduced by 3 %/°C

[4)] characteristic curve: power output of appliance in dependence of mounting height at normal pressure



[5)] EN 50178, chapter 9.4.3.2

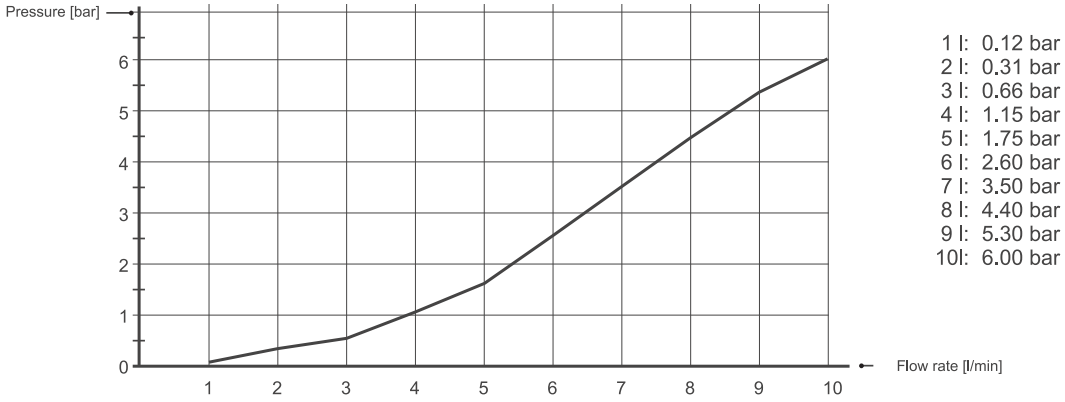
[6)] EN 50178, table 2

7) As coolant use clear, suspended matter- and dirt-free, desalinated and demineralized water. The water may hold a maximum of 100 ppm (0.01%) natrium chloride (salinity). Mix in an anticorrosive. The total water hardness must be between 8° and 14° dH (1° dH = 0.179 mmol Ca^{2+}/l). A pH-value between 6.5 and 7.5 must be kept. Use a closed loop coolant circulation!

8) Air inside and outside switching cabinet.

9) Air inside switching cabinet.

10)



D.4 Electrical specifications

		BUS64S/A/F
Input rated current 24 V		2.5 A
DC link rated voltage [1] (U_{DC}) DC link supply voltage (U_{DC})		560 V 480 to 760 V
DC link capacity (internal)		6000 µF/900 V
Output voltage [2] (U_{AC})		3 x 0 V to 3 x 0.74 x DC link supply voltage
Output frequency [3]		0 Hz to 300 Hz
Output power [1]	at 4 kHz [4]	205 kVA
Output power [1]	at 8 kHz [4]	148 kVA
Peak output power [7]	at 4 kHz [4]	267 kVA
Peak output power [7]	at 8 kHz [4]	192 kVA
Motor power, typical [1]	at 4 kHz [4]	160 kW
Motor power, typical [1]	at 8 kHz [4]	132 kW
Rated output current [1)5)6)] (I_{AC})	at 4 kHz [4]	315 A_{AC}
Output rated current [1)5)6)] (I_{AC})	at 8 kHz [4]	250 A_{AC}
Output peak current [1)5)7)] (I_{AC})	at 4 kHz [4]	390 A_{AC}
Output peak current [1)5)7)] (I_{AC})	at 8 kHz [4]	300 A_{AC}
DC link power supply (1C1 / 1D1)		165 kW
Ventilator power [8]		max. 200 W
Power dissipation “heatsink“ [1] Power dissipation “inside unit“ (with controller, without ventilator)		3000 W 250 W

[1] All rated values with respect to a DC link rated voltage of 560 V, rated output current (I_{AC}) and a switching frequency of 4 kHz.

[2] The output voltage is a pulsed DC voltage. The control range is related to the effective value of the basic curve.

[3] The frequency depends on the controller used.

[4] Switching frequency of the converter. See also in the controller manual.

[5] Effective value at environmental temperature of 40 °C.

[6] Between 40° C and 55°C the output power (DC link peak load) must be reduced (3% / °C).
The permissible output current (I_D) is calculated with the following formula:

$$I_o = I_{o\,(40\,°C)} \cdot \left(1 - \left(\frac{\text{Cooling air temperat.}^{*} - 40\,°C}{°C} \cdot 0.03\right)\right)$$

* There may be 2 temperature values (cooling air, that flows inside the appliance / cooling air that flows through the heatsink). Put in the higher value.

Example: Output rated current = 300 A, BUS64F with air/water cooling at 46° air temperature

$$I_o = 300\,A \cdot \left(1 - \left(\frac{46°\,C - 40°\,C}{°\,C} \cdot 0.03\right)\right) = 300\,A \cdot 0.82$$

The output current must be then reduced to: 245 A

[7] The output peak power and the output peak current will be supplied for max. 120 seconds. That period depends on the previous motor current and the temperature of the heatsink. See in the controller manual also.

[8] for cooling variants S and A only.

D.5 BUS64S - non-electrical data

Dimensions (W x H x D)	448 x 920 x 304 mm
Weight without controller	approx. 70 kg
Degree of protection	IP 00
Fight fire with	ABC-Powder

D.6 BUS64A - non-electrical data

Dimensions (W x H x D)	490 x 885 x (244+90) mm [1]
Weight without controller	approx. 65 kg
Degree of protection	IP 00/outside IP 44
Fight fire with	ABC-Powder

[1] The first value is the depth inside the switching cabinet. The second value is the depth outside the switching cabinet.

D.7 BUS64F - non-electrical data

Dimensions (W x H x D)	490 x 885 x (244+30)[1] mm
Weight without controller	approx. 60 kg
Degree of protection	IP 00/outside IP 54
Fight fire with	ABC-Powder

[1] The first value is the depth inside the switching cabinet. The second value is the depth outside the switching cabinet.

D.8 Cable for control voltage supply / signals

Cross-section	0.2 to 2.5 mm^2 (w/o end sleeve) 0.25 to 2.5 mm^2 (with end sleeve) (AWG 24 to 12)
Maximum length	any
End sleeve, connection to appliance	flexible, with or without end sleeve

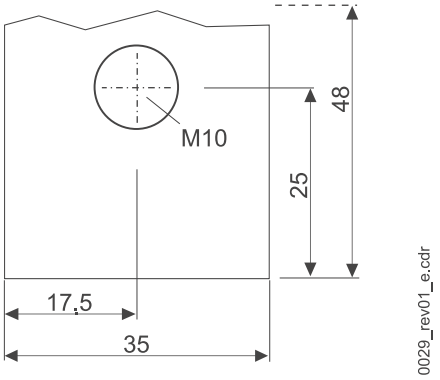
D.9 Cable from appliance to motor

Cross-section [1]	depending on connection
Cable type	screened, shield's degree of coverage > 85 %
Maximum length	40 m
Cable lug / end sleeve, connection to appliance [2]	cable lug

[1] EN 60204-1, tab. 5, attachment form C.

[2] Only with Baumüller cables with this maximum length you can assume, that the EMC regulations are kept.

[3]



Mount max. 2 cable lugs per power rail. Do not mount cable lugs onto each other, mount one on each side of the power rail.
Use cable lugs that have a maximum width of 35 mm.

D.10 Electrical motor to be connected

Motor type [1]	three-phase motor (synchronous, asynchronous)

[1] depends on the controller

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be in motion

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