

# Instruction Handbook

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**be in motion**    **be in motion**



**b maXX**

**BM4-F-ENC-XX  
ENC-XX**

Encoder module

**BM4400, BM4400 ES  
BM4600, BM4600 ES  
BM4700, BM4700 ES**

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# 1

## GENERAL

### 1.1 Information on this Instruction Handbook

---

The encoder module **ENC-XX** or **BM4-F-ENC-XX** can be operated in combination with a **b maXX 4000**, only.

Therefore this Instruction handbook is an addition to the Instruction handbook of **b maXX** BM4400, BM4400 ES, BM4600, BM4600 ES, BM4700, BM4700 ES (short **b maXX 4000**) 5.12008.

The basic prerequisite for safe working is compliance with all the safety and handling instructions stated in the instruction handbook **b maXX 4000**.

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

Read this Instruction handbook and the Instruction handbook **b maXX 4000**, particularly the safety notes chapter, completely before beginning any work on the device. This Instruction handbook is part of the product and must be kept accessible to personnel at all times in the immediate vicinity of the device.

### 1.2 Key to symbols

#### Warning notes

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

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



#### **DANGER!**

...this indicates a hazardous situation which, if not avoided, will result in death or serious injury.



#### **WARNING!**

...this indicates a hazardous situation which, if not avoided, could result in death or serious injury.



#### **CAUTION!**

...this indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.



#### **NOTICE!**

...indicates a hazardous situation which, if not avoided, may cause material damage.

#### Recommendations



#### **NOTE!**

...highlights useful hints and recommendations, as well as information for the efficient and trouble-free use.

### 1.3 Limitation of liability

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

The manufacturer assumes no liability for damages due to:

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

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

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

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

### 1.4 Copyright protection

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

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## 1.5 Other applicable documents

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### 1.5 Other applicable documents

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

### 1.6 Spare parts

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**WARNING!**

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

Therefore:

- Only use original spare parts of the manufacturer.

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

### 1.7 Disposal

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

See also **b maXX 4000** 5.12008, chapter Disposal.

### 1.8 Guarantee provisions

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

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

### 1.9 Customer service

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

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



## 1.10 Used terms

The term function module or the designation ENC-XX or BM4-F-ENC-XX is also used in this documentation for the Baumüller product „encoder module“. A list of the abbreviations used can be found in **b maXX 4000** 5.12008, Appendix A: Abbreviations.

## 1.11 List of associated documentations

### Instruction handbook

	Doc No.	Part No. German	Part No. English
Instruction Handbook basic unit b maXX 4400, 4600, 4700 (ES)	5.12008	444495	444496

### Parameter manual

	Doc No.	Part No. German	Part No. English
Parameter manual basic unit b maXX 4400, 4600, 4700 (ES)	5.03039	376339	377548

### Instruction handbook function modules

	Doc No.	Part No. German	Part No. English
Analog I/O module BM4-F-AIO-XX or AIO-XX	5.01045	354844	372665
Digital I/O module BM4-F-DIO/FIO-XX or DIO/FIO-XX	5.01046	354843	372666
Encoder module BM4-F-ENC-XX or ENC-XX	5.01042	354842	372861
Incremental encoder emulation module BM4-F-IEE-XX or IEE-XX	5.02020	354858	376728
SSI encoder emulation module BM4-F-SIE-XX or SIE-XX	5.03056	377123	379049

### Instruction handbook option modules

	Doc No.	Part No. German	Part No. English
DISC-NT slave BM4-O-DNT-XX	5.03007	367670	-
CANopen slave BM4-O-CAN-03	5.02014	368692	368693
CANopen slave programming handbook for controller	5.02065	368694	372860
CANopen over EtherCAT programming handbook	5.07017	413208	432414
CANopen slave for b maXX PLC application handbook	5.03057	376486	376487
b maXX drive PLC	5.01051	366197	354845
b maXX drive PLC application handbook	5.02004	366198	372017
BM4-O-ETH-01, BM4-O-ETH-02, BM4-O-CAN-04 for b maXX PLC	5.03001	366202	372042
BM4-O-ETH-01, BM4-O-ETH-02, BM4-O-CAN-04 CANopen master for b maXX PLC application handbook	5.03002	366203	372043
CANsync master for b maXX PLC	5.02056	366199	372025
CANsync slave for b maXX	5.02064	366201	372041
CANsync for b maXX PLC application handbook	5.02066	366200	372039
IEI for b maXX PLC	5.02013	366204	372044
PROFIBUS-DP slave for b maXX	5.03040	376488	376489
PROFIBUS-DP slave for b maXX PLC application handbook	5.03058	376490	376491
PROFIBUS-DP slave for b maXX controller programming handbook	5.03045	376757	377294
SERCOS slave module BM4-O-SER-01	5.04012	380910	381069

## 1.11 List of associated documentations

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	Doc No.	Part No. German	Part No. English
SERCOS slave module BM4-O-SER-01 parameter handbook	5.04013	<b>381652</b>	<b>381653</b>
EtherCAT slave module BM4-O-ECT-01/ECT-01	5.06003	<b>394953</b>	<b>394954</b>
Ethernet with EtherCAT master for b maXX drive PLC	5.07001	<b>407996</b>	<b>407997</b>
Ethernet with EtherCAT master for b maXX drive PLC application handbook	5.07002	<b>407998</b>	<b>407999</b>
Ethernet with EtherCAT for b maXX drive PLC	5.10018	<b>433997</b>	
POWERLINK Controlled Node BM4-O-PLK-01/PLK-01 ES	5.12072	<b>444497</b>	<b>444498</b>
POWERLINK Controlled Node BM4-O-PLK-01 ES application handbook	5.13013	<b>445131</b>	<b>445132</b>

# 2

## SAFETY

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

### 2.1 Contents of the Instruction Handbook

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Each person who is tasked with performing work on or with the device must have read and understood this Instruction Handbook and the Instruction Handbook of **b maXX 4000 5.12008** before working with the device. This also applies if the person involved with this kind of device or a similar one, or has been trained by the manufacturer.

### 2.2 Changes and modifications to the device

---

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

### 2.3 Use, compliant with intended purpose

---

The **BM4-F-ENC-XX** is used compliant with its intended purpose, if it is built-in/operated within **b maXX 4000** controller, only.

The **Encoder module** is considered as being used compliant with its intended purpose if all notes and information of this Instruction handbook and the Instruction handbook **b maXX 4000** 5.12008 are adhered to.



#### **WARNING!**

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

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

Therefore:

- Only use the device compliant with its intended purpose.
- Note all specifications of this Instruction handbook and the Instruction handbook **b maXX 4000** 5.12008.
- Ensure that only qualified personnel work with/on this device.
- When configuring, ensure that the device is always operated within its specifications.
- The device may only be operated in a technically flawless condition.
- Only operate the device in combination with components approved by Baumüller Nürnberg GmbH.

### 2.4 Responsibility of the operating company

---

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

Along with the notes on work safety in this Instruction handbook and the Instruction handbook **b maXX 4000** 5.12008, the safety, accident prevention and environmental protection regulations valid for the area of application of this device must be complied with. Whereby:

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

## 2.5 Training of the personnel

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

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

Therefore:

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

In this Instruction handbook, the following qualifications are stipulated for various areas of activity:

- **Operating personnel**

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

- **Qualified personnel**

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

### 2.6 Special hazards

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

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

#### Electrical current



#### **DANGER!**

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

There is an immediate risk of fatal injury if live electrical parts are contacted. Damage to the insulation or individual components can be life-threatening.

Therefore:

- Switch off the electrical power immediately in case of damage to the power supply insulation.
- Only allow work on the electrical system to be performed by qualified personnel.
- Switch off the current when any kind of work is being performed on the electrical system and ensure safety before switching on again.

#### Danger from residual energy



#### **DANGER!**

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

Stored electric charge.

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

See Instruction handbook **b maXX 4000** 5.12008, chapter Electrical Data.

Therefore:

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

## Moving components



### WARNING!

#### Risk of injury from moving components!

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

Therefore:

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

## 2.7 Fire fighting



### DANGER!

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

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

Therefore:

- Use the following fire-extinguishing agent:



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

### 2.8 Safety equipment

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#### **WARNING!**

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

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

Therefore:

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

### 2.9 Behavior in hazardous situations or at accidents

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#### **Preventive measures**

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

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

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



## 2.10 Signs and labels

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



### WARNING!

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

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

Therefore:

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



### Electrical voltage

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

Unauthorized persons may not touch working materials marked correspondingly.



### DANGER!

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

See [▶Danger from residual energy◀](#) auf Seite 14.



### CAUTION!

#### Risk of injury due to hot surface!

Therefore:

- Wear protective gloves





## TECHNICAL DATA

### 3.1 Operation conditions

The operation conditions of **b maXX 4000** are valid, see Instruction Handbook **b maXX 4000** 5.12008.

Transport temperature range	- 25 °C to + 70 °C
Transport climatic class EN 60721-3-2	2 K 3
Storage temperature range	- 25 °C to + 55 °C
Storage climatic class EN 60721-3-1	1 K 4



#### NOTICE!

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

## 3.2 Current consumption of encoder modules

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### 3.2 Current consumption of encoder modules

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Module type	Voltage	-15 V	+5,0 V	+15 V
BM4-F-ENC-01		24 mA		32 mA
BM4-F-ENC-11		23 mA		34 mA
BM4-F-ENC-21		24 mA		32 mA
BM4-F-ENC-02		24 mA	16 mA	13 mA
BM4-F-ENC-12		24 mA	16 mA	13 mA
BM4-F-ENC-03			54 mA	9 mA
BM4-F-ENC-04			50 mA	
BM4-F-ENC-05			60 mA	
BM4-F-ENC-06			75 mA	
BM4-F-ENC-07			60 mA	
BM4-F-ENC-17			75 mA	
BM4-F-ENC-27			70 mA	
BM4-F-ENC-08		48 mA	32 mA	26 mA

3.3 Information regarding maximum speed

**Maximum speed incremental encoder** The maximum possible encoder speed of an incremental encoder (sine-cosine) is calculated from the following formula:

$$\text{theoretical maximum speed [rpm]} = n_{\text{max, theoretical}} = \frac{200 \text{ kHz}}{\text{increments per revolution}} \cdot 60$$

Example:

Sine-cosine incremental encoder with 1024 inc.

$$n_{\text{max, theoretical}} = \frac{200 \text{ kHz}}{1024} \cdot 60 = 11700 \text{ rpm}$$

The maximum possible encoder speed of an incremental encoder (rectangle) is calculated from the following formula:

$$\text{theoretical maximum speed [rpm]} = n_{\text{max, theoretical}} = \frac{250 \text{ kHz}}{\text{increments per revolution}} \cdot 60$$

The maximum speed depends on the used encoder, too.

**Maximum speed resolver** Limitation by excitation frequency at resolver:

$$\text{theoretical maximum speed [rpm]} = n_{\text{max, theoretical}} = \frac{\text{excitation frequency}}{20} \cdot 60$$

Example:

Excitation frequency **b maXX** 4000: 4 kHz

$$n_{\text{max, theoretical}} = \frac{4 \text{ kHz}}{20} \cdot 60 = 12000 \text{ rpm}$$



**NOTE!**

The maximum speed depends on the used encoder and its number of pole pairs, too.

### 3.4 Specification of encoder modules



**NOTE!**

Some encoders are listed in [►Function◄](#) from page 28. All encoders, which comply to the following technical specifications, may also be used.

**BM4-F-ENC-01**  
**BM4-F-ENC-11**  
**BM4-F-ENC-21**

**for resolvers**

Frequency limit see [►Maximum speed resolver◄](#) on page 21.

**Number of pole pairs**

The ratio between the number of motor pole pairs and of the number of pole pairs of the encoder must be integer.<sup>1))</sup>

**Permitted current input**

max. 160 mA

**Excitation frequency**

4 kHz

**Excitation current**

160 mA

**Transmission ratio**

BM4-F-ENC-01, 21	0,5
BM4-F-ENC-11	0,28



**NOTE**

Resolvers are to be used only for motors with maximum ten pole pairs.

1)

Example:

Number of pole pairs of motor = 3  
 Number of pole pairs resolver = 1

$$\frac{3}{1} = 3 \text{ permitted}$$

Number of pole pairs of motor = 3  
 Number of pole pairs resolver = 2

$$\frac{3}{2} = 1,5 \text{ not permitted}$$

**BM4-F-ENC-02**  
**BM4-F-ENC-12**

**for sine cosine encoders with Hiperface®**

The sine-cosine encoder module provides a hiperface® interface.

<b>Power supply</b>	8 V <sub>DC</sub>
<b>Signal level</b>	Hiperface® specification of operation data channel (~1 V <sub>SS</sub> ; REFSIN/REFCOS 2,5V)
<b>Permitted current input of encoder</b>	max. 250 mA

**BM4-F-ENC-03**

**for 5V square wave incremental encoders**

Frequency limit see [▶Maximum speed incremental encoder◀](#) on page 21.

<b>Power supply</b>	5 V <sub>DC</sub>
<b>Signal level</b>	RS422 (TTL)
<b>Permitted current input of encoder</b>	max. 250 mA

**BM4-F-ENC-04**

**for sine cosine encoders with zero-point sensing**

<b>Power supply</b>	8 V <sub>DC</sub> , stabilized to + 5 V at the encoder
<b>Signal level</b>	~1 V <sub>SS</sub>
<b>Permitted current input of encoder</b>	max. 250 mA (max. 300 mA)



**NOTE!**

A broken wire of the zero point cable is not detected by the controller.

## 3.4 Specification of encoder modules

### BM4-F-ENC-05 for sine cosine encoders with EnDat<sup>®</sup> 2.1

The encoder module provides a bidirectional, synchronous-serial EnDat<sup>®</sup> interface, position data and parameter can be exchanged between controller and encoder with a maximum data transmission rate of 2 MBit/s.

<b>Power supply</b>	8 V <sub>DC</sub> , stabilized to + 5 V at the encoder
<b>Signal level</b>	~1 V <sub>SS</sub>
<b>Permitted current input of encoder</b>	max. 250 mA

### BM4-F-ENC-06 for encoders with EnDat<sup>®</sup> 2.2

The encoder module provides a bidirectional, synchronous-serial EnDat<sup>®</sup> interface, position data and parameter can be exchanged between controller and encoder with a maximum data transmission rate of 8 MBit/s.

<b>Power supply</b>	8 V <sub>DC</sub> , stabilized to + 5 V at the encoder
<b>Permitted current input of encoder</b>	max. 250 mA

### BM4-F-ENC-07 for sine cosine encoders with SSI interface without encoder supply

The encoder module provides a synchronous-serial SSI interface, position data and parameter can be exchanged between controller and encoder with a maximum data transmission rate of 2 MBit/s.

<b>Power supply</b>	external encoder supply
<b>Signal level</b>	~1 V <sub>SS</sub>

### BM4-F-ENC-17 for sine cosine encoders with SSI interface and 5V encoder supply

The encoder module provides a synchronous-serial SSI interface, position data and parameter can be exchanged between controller and encoder with a maximum data transmission rate of 2 MBit/s.

<b>Power supply</b>	8 V <sub>DC</sub> , stabilized to + 5 V at the encoder
<b>Signal level</b>	~1 V <sub>SS</sub>
<b>Permitted current input of encoder</b>	max. 250 mA



**BM4-F-ENC-27 for encoder with SSI interface and 24V encoder supply**

The encoder module provides a synchronous-serial SSI interface, position data and parameter can be exchanged between controller and encoder with a maximum data transmission rate of 1 MBit/s.

<b>Power supply</b>	24 V <sub>DC</sub> , according encoder specification +0,5 V external power supply 24 V
<b>Signal level</b>	digital differential
<b>Permitted current input of encoder</b>	max. 200 mA



**NOTE**

The availability of the 24V power supply is not checked and a broken wire is not detected by the controller.

**BM4-F-ENC-08 for sine cosine encoder with commutation**

To this encoder module you can connect sine-cosine encoders with sinusoidal commutation.

<b>Power supply</b>	8 V <sub>DC</sub> , stabilized to + 5 V at the encoder
<b>Signal level</b>	Incremental encoder signals (A and B) ~1V <sub>ss</sub> Commutation signals (C and D) ~1V <sub>ss</sub>
<b>Permitted current input of encoder</b>	max. 250 mA



**NOTE**

A broken wire of the reference signal cable [R+], [R-] or commutation signal cable [C+], [C-], [D+], [D-] is not detected by the controller.

## 3.4 Specification of encoder modules

---

## DESIGN AND OPERATION

A **b maXX BM4000** device consists of power unit and controller part

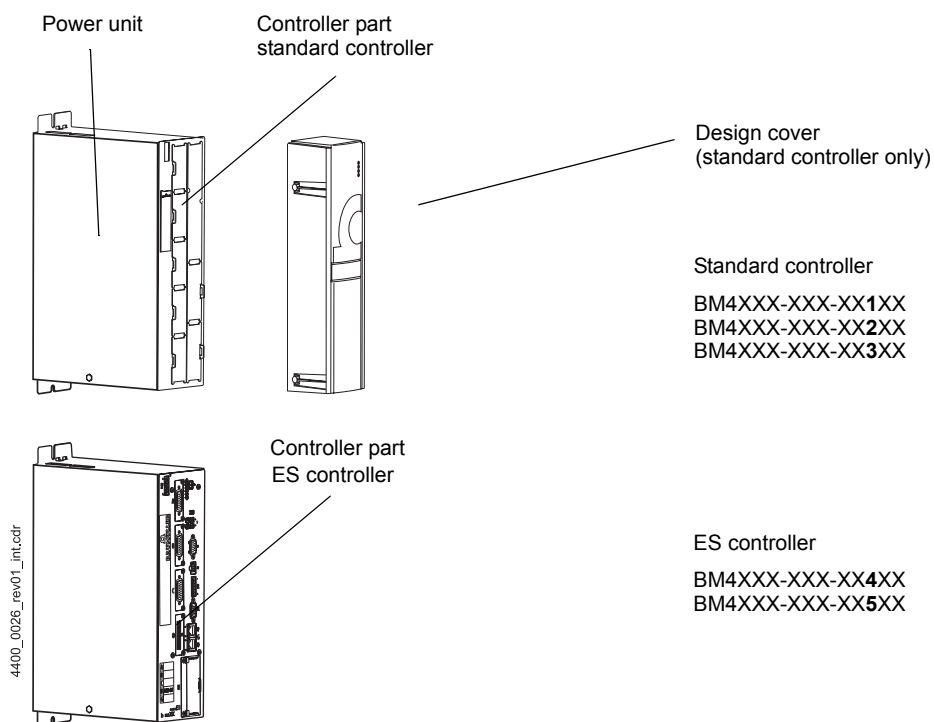


Figure 1: **b maXX BM4000**)

The **BM4-F-ENC-XX** is designed as plug-in module for standard controller and can be replaced or upgraded.

The **ENC-XX** is mounted stationary in the ES controller.



### NOTE!

The operation with ProDrive is described, only. Please contact Baumüller Nürnberg GmbH or visit our website [www.baumueller.de](http://www.baumueller.de) for download, if the software is not available.

## 4.1 Function

---

The signals of the encoder are transmitted over the cable to the plug-in module. The encoder module preprocesses the signals, and then routes them to the controller unit.

There are different encoder modules, in accordance to the common encoders on the market:

- Resolver
- Sine cosine encoder with Hiperface<sup>®</sup> interface
- 5V square wave incremental encoder
- 5V sine cosine incremental encoder
- 5V sine cosine incremental encoder with commutation
- Sine cosine encoder with EnDat<sup>®</sup> 2.1 interface
- Sine cosine encoder with SSI interface
- Encoder with EnDat<sup>®</sup> 2.2 interface
- further encoders in preparation/on request

The encoder modules can be distinguished by type code, see [▶Type code BM4-F-ENC-XX for standard controller](#) on page 33 and [▶Type code ENC-XX in ES controller](#) on page 36.

Here is a choice of encoder that can be connect to (BM4-F-)ENC-XX:

Type	For encoder	Encoder type	Connectable encoders examples	
<b>ENC-01</b> <b>BM4-F-ENC-01</b>	Resolver	Resolver, transmission ratio: 0,5		
<b>ENC-11</b> <b>BM4-F-ENC-11</b>	Resolver reduced level	Resolver, transmission ratio: 0,28		
<b>ENC-21</b> <b>BM4-F-ENC-21</b>	Resolver replaces BM4-F-ENC-01	Resolver, transmission ratio: 0,5		
<b>ENC-02</b> <b>BM4-F-ENC-02</b>	Sine cosine encoder with Hip- erface <sup>®</sup> interface	Sine cosine encoder single-turn	Stegmann SCS60/70	Stegmann SRS50/60
		Sine cosine encoder multi-turn	Stegmann SCM50/60	Stegmann SRM50/60
<b>ENC-12</b> <b>BM4-F-ENC-12</b>	Sine cosine encoder with Hiperface <sup>®</sup> interface without termination in communication	Sine cosine encoder single-turn	Stegmann SCS60/70	Stegmann SRS50/60
		Sine cosine encoder multi-turn	Stegmann SCM50/60	Stegmann SRM50/60
<b>ENC-03</b> <b>BM4-F-ENC-03</b>	5V square wave incremental encoder	5V square wave incremental encoder, RS422 output signals (TTL)	Heidenhain ROD 426	SickStegmann DRS60
<b>ENC-04</b> <b>BM4-F-ENC-04</b>	Sine cosine incremental encoder with zero-point sens- ing	5V sine cosine encoder, output signals ~1Vss	Heidenhain ROD 486	Hengstler RIS 58
<b>ENC-05</b> <b>BM4-F-ENC-05</b>	Sine cosine encoder with EnDat <sup>®</sup> 2.1 interface	Sine cosine encoder single-turn Sine cosine encoder multi-turn Length measurement systems	Heidenhain ECN 413 EQN 425 LC 481	Heidenhain ECN 113 EQN 1325 LC 181
<b>ENC-06</b> <b>BM4-F-ENC-06</b>	Encoder with EnDat <sup>®</sup> 2.2 inter- face	Encoder for absolute position sensing with EnDat <sup>®</sup> 2.2 interface	Heidenhain ECN 1325 single-turn	Heidenhain EQN 1337 multi-turn
<b>ENC-07</b> <b>BM4-F-ENC-07</b>	Sine cosine encoder with SSI interface	Sine cosine encoder, output signals ~1 Vss, external encoder supply	SIKO AEA111	
<b>ENC-17</b> <b>BM4-F-ENC-17</b>	Sine cosine encoder with SSI interface and 5 V encoder sup- ply	5V sine cosine encoder, output signals ~1 Vss	Baumer- Hübner MHGA400	
<b>ENC-27</b> <b>BM4-F-ENC-27</b>	Encoder with SSI interface and 24 V encoder supply	SSI encoder with digital output sig- nals and 24 V encoder supply	MTS-Sensors Temposonics	
<b>ENC-08</b> <b>BM4-F-ENC-08</b>	Sine cosine incremental encoder with commutation and zero-point sensing	5V sine cosine encoder, incremental signals ~1Vss, commutation signals ~1 Vss	Heidenhain ERN1185	Heidenhain ERN1387

## 4.2 BM4-F-ENC-XX for standard controller

### 4.2 BM4-F-ENC-XX for standard controller

The encoder module **BM4-F-ENC-XX** can be plugged in the standard controller of the **b maXX 4000**.

The **BM4-F-ENC-XX** is connected to the controller part with a connector on the back side. On the front side is a 15 pin Sub-D connector (female).

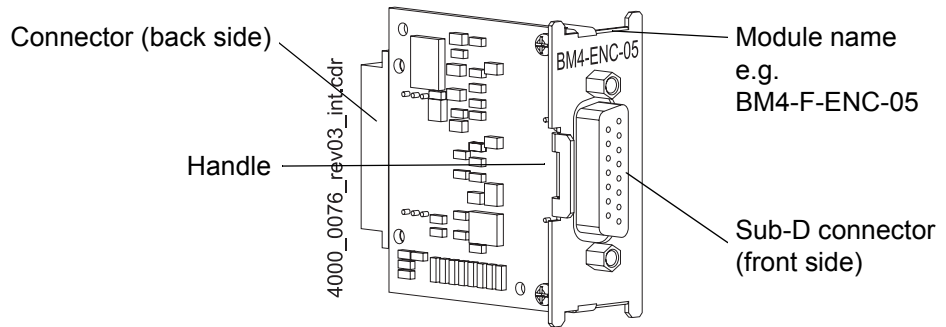
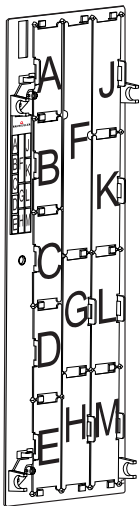


Figure 2: Encoder module for standard controller

#### 4.2.1 Slots BM4-F-ENC-XX for standard controller

Function and option modules can be plugged in the slots of the controller part. Each position is clearly identified by a character.

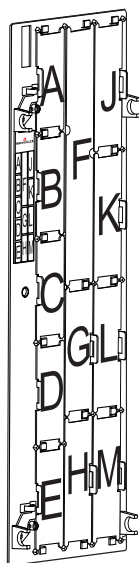
At the most 2 **encoder modules** can be plugged (slot **A** and **B**, unless they are not used). The slots with character A and B are equal. Prefer slot A for the drive control encoder.



<b>A</b>	<b>BM4-F-ENC-XX</b>
<b>B</b>	<b>BM4-F-ENC-XX</b>
<b>C</b>	
<b>D</b>	
<b>E</b>	
<b>F</b>	
<b>G</b>	
<b>H</b>	
<b>J</b>	
<b>K</b>	
<b>L</b>	
<b>M</b>	

Optional plug-in modules (function or option modules) can be upgraded dependent on the existing controller type.

Possible combinations function modules/option modules



	Function modules									Option modules														
	BM4-F-ENC-XX (encoder 1 for motor control recommended)	BM4-F-ENC-XX (encoder 2)	BM4-F-AIO-01 (analog I/O)	BM4-F-AIO-02/03/04 (analog I/O)	BM4-F-DIO-XX (digital I/O)	BM4-F-FIO-XX (fast digital I/O)	BM4-F-IEE-XX (incremental encoder emulation)	BM4-F-SIE-XX (SSI encoder emulation)	BM4-F-UME-XX (mains voltage measurement)	BM4-O-SER-XX (Sercos slave)	BM4-O-PRO-01 (Profibus slave)	BM4-O-CAN-03 (CANopen slave)	BM4-O-ECT-01 (EtherCAT slave) for controller	BM4-O-PLK-01 (POWERLINK Controlled Node) für Regler	BM4-O-EIP-01 (Ethernet-IP) für Regler	BM4-O-PLC-XX (SPS)	BM4-O-CAN-04* (CANopen master)	BM4-O-IEI-XX* (incremental counter module)	BM4-O-ETH-01* (Ethernet)	BM4-O-ETH-02* (Ethernet + CANopen master)	BM4-O-ECT-01* (EtherCAT slave) for PLC	BM4-O-ECT-02* (Ethernet + EtherCAT master)	BM4-O-ECT-03* (Ethernet + EtherCAT cluster)	
A	X	-	-	o	o	o	-	o	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B	-	X	-	o	o	o	-	X	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C	-	-	-	o	o	o	V	-	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
D	-	-	-	o	X	X	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E	-	-	X	X	o	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F	Controller unit																							
G	-	-	-	-	-	-	-	-	-	o	o	o	o	o	o	o	X	X	X	X	X	X	X	X
H	-	-	-	-	-	-	-	-	-	X	X	X	X	X	X	o	-	o	o	o	o	o	o	o
J	-	-	-	-	-	-	-	-	-	-	P	P	-	-	-	o	o	o	o	o	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	P	P	-	-	-	o	o	o	o	o	o	o	o	o
L	-	-	-	-	-	-	-	-	-	-	P	P	-	-	-	o	o	o	o	o	o	o	o	o
M	-	-	-	-	-	-	-	-	-	-	P	P	-	-	-	o	o	o	o	o	o	o	o	o

- X:** preferred slot  
Baumüller Nürnberg GmbH recommends, in order to reach the highest functional range, to insert the plug-in modules into these slots.
- o:** possible slot  
only if the preferred slot is occupied, we recommend in order to reach the highest functional range, to insert the plug-in modules into this slot.
- P:** only possible, if on slot G or H a PLC module (PLC) is plugged and the PLC (and not the controller) operates the communication to the field bus slave module.
- V:** dependent on controller hardware
- not possible - card doesn't work in this slot.
- \* precondition for these cards is an inserted PLC module.

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**NOTE!**

Only 2 analog outputs can be parametrized or linked even more than one AIO module is plugged.

## 4.2 BM4-F-ENC-XX for standard controller



### NOTE!

EtherCAT option modules **must not** be plugged in slot **J** of a 3-rowed controller unit, because the module can be damaged.

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

### 4.2.2 Type plate BM4-F-ENC-XX for standard controller

The type plate can be found on the connector on the back side of the **BM4-F-ENC-XX**. The type code and the serial No. are printed on the type plate.

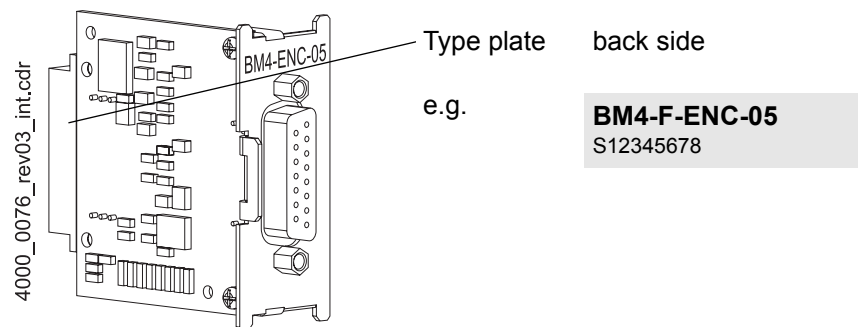


Figure 3: Type plate **BM4-F-ENC-XX** for standard controller



### 4.2.3 Type code BM4-F-ENC-XX for standard controller



#### NOTE!

This type code is valid for the encoder modules **BM4-F-ENC-XX** of series b maXX BM4000 exclusively. For other plug-in modules are different type codes available.

Type code:

<u>BM4</u> -F - ENC - XX	Device family, in which the plug-in module can be built in
BM4 - <u>F</u> - ENC - XX	Type of plug-in module (function module)
BM4 -F - <u>ENC</u> - XX	Name of plug-in module
BM4 -F - ENC - <u>XX</u>	Version plug-in module
	01: Resolver module
	11: Resolver module with reduces level
	21: Resolver module
	02: Sine cosine encoder module with hipurface® interface
	12: Sine cosine encoder module with hipurface® interface without termination in communication
	03: 5V square wave incremental encoder module
	05: Sine cosine encoder module with EnDat® 2.1-interface
	06: Encoder module with EnDat® 2.2-interface
	04: 5V sine cosine incremental encoder module with zero point sensing
	07: Sine cosine encoder module with SSI interface
	17: Sine cosine encoder module with SSI interface and 5 V power supply
	27: Sine cosine encoder module with SSI interface and 24 V power supply
	08: 5V sine cosine encoder module with commutation

### 4.2.4 Danger areas BM4-F-ENC-XX for standard controller

The **BM4-O-ENC-XX** can be operated in combination with **BM4000**, only. Please note all safety notes of the basic unit **b maXX BM4000**.

### 4.3 ENC-XX in ES controller

The encoder module **ENC-XX** is mounted stationary in the ES controller.

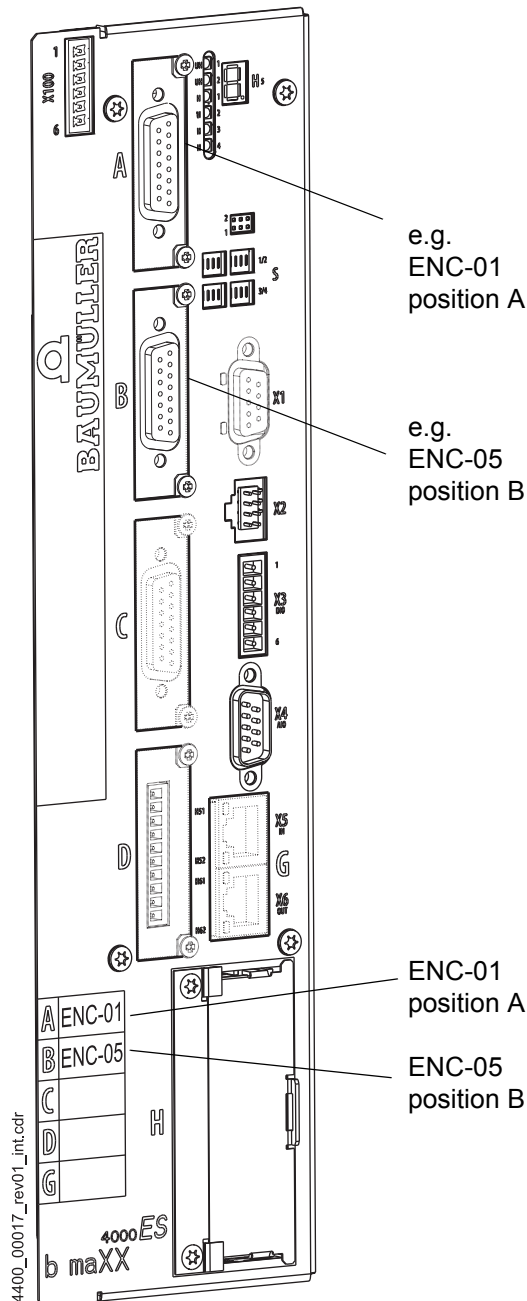
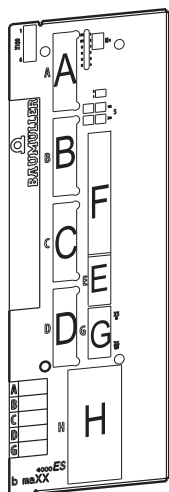


Figure 4: ENC-XX in the ES controller

The controller is ordered with the desired function/option modules, these are mounted stationary (exception slot H) and cannot be changed. Only the option module in slot H can be changed/added.

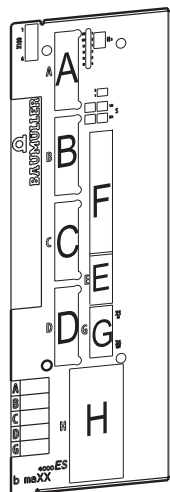
4.3.1 Position ENC-XX in the ES controller

Each position is clearly identified by a character.  
The ENC-XX can be used at the following position.



A	ENC-XX
B	ENC-XX
C	
D	
F	Controller
G	
H	

Combinations function modules/option modules



	Function modules								Option modules							
	BM4-F-ENC-XX (encoder 1) for motor control recommended	BM4-F-ENC-XX (encoder 2)	BM4-F-AIO-01 (analog I/O)	BM4-F-AIO-02/03/04 (analog I/O)	BM4-F-DIO-XX (digital I/O)	BM4-F-FIO-XX (fast digital I/O)	BM4-F-IEE-XX (incremental encoder emulation)	BM4-F-SJE-XX (SSI encoder emulation)	BM4-O-ECT-01 (EtherCAT slave) for controller	BM4-O-PLK-01 (POWERLINK Controlled Node) for controller	BM4-O-VAR-01 (VARAN slave) for controller	BM4-O-SER-XX (Sercos slave) for controller	BM4-O-PRO-XX (Profibus slave) for controller	BM4-O-CAN-03 (CANopen slave) for controller	BM4-O-EIP-01 (Ethernet-IP) for controller	BM4-O-PLC-XX (SPS)
A	X	-	-	o	o	o	-	o	-	-	-	-	-	-	-	-
B	-	X	-	o	o	o	-	X	-	-	-	-	-	-	-	-
C	-	-	-	o	o	o	X	-	-	-	-	-	-	-	-	-
D	-	-	-	X	X	X	-	-	-	-	-	-	-	-	-	-
E	-	-	F	-	-	-	-	-	-	-	-	-	-	-	-	-
F	Controller unit with RS232- or Ethernet interface															
G	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-
H	-	-	-	-	-	-	-	-	-	X	X	X	X	X	X	X

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- X: preferred slot
- F: permanently installed
- o: possible slot, only the preferred slot is occupied
- not possible

## 4.3 ENC-XX in ES controller



### NOTE!

Only 2 analog outputs can be parametrized or linked even more than one AIO module is available.

### 4.3.2 Type plate ENC-XX in ES controller

The type code of the **ENC-XX** is included in the type plate of the basic unit.

### 4.3.3 Type code ENC-XX in ES controller

The type code has the form:

BM4XXX - XXX - XXXXX[Ryy] - [XXXXXXXX] - [XXX] - XX.

Directly behind the type code is the version code

(- XXXX - X - XXX - XXX).

Only the shown section is valid for the **ENC-XX** in ES controller.

**BM4**XXX - XXX - XXXXX[Ryy] - [XXXXXXXX] - [XXX] - XX Device generation

BM4XXX - XXX - XXXXX[Ryy] - [XX**X**XXXXXXXX] - [XXX] - XX ES controller function module, position A

BM4XXX - XXX - XXXXX[Ryy] - [XXX**X**XXXXX] - [XXX] - XX ES controller function module, position B

0 no function module	
A Resolver	see ENC-21
B Sine cosine Hiperface®	see ENC-02
C Square wave incremental encoder	see ENC-03
D Sine cosine zero-point sensing	see ENC-04
E Sine cosine with EnDat® 2.1	see ENC-05
F Absolute value encoder with EnDat® 2.2	see ENC-06
G Sine cosine with SSI, 5 V external	see ENC-07
H Sine cosine with zero-point sensing	see ENC-08
I Sine cosine Hiperface® without termination in RS485 communication	see ENC-12
J Square wave incremental encoder without cable break recognition	see ENC-13
K Sine cosine with EnDat® 2.1 reference track	see ENC-15
L Sine cosine with SSI, 5 V internal	see ENC-17
W SSI encoder with 24 V	see ENC-27

#### 4.4 Display and operation elements

---

The encoder module provides neither operation nor display elements.

The LED H4 of the basic unit **b maXX BM4000** respectively the emulation of the LED in ProDrive displays all device errors, including the errors generated concerning the **encoder module**.



# TRANSPORT AND PACKAGING

## 5.1 What to observe when transporting

---

For initial transport the **BM4-F-ENC-XX** for standard controller is packed at the manufacturer. If the device is to be further transported, ensure that the following conditions are met throughout the entire transport:

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

## 5.2 Transport inspection

---

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

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

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

**NOTE!**

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

### 5.3 Unpacking

---

After having received the still packaged device:

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

If no transport damage is visible:

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

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



#### **NOTE!**

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

### 5.4 Disposal of the packaging

---

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

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



## MOUNTING

In this chapter we describe the mechanical mounting of the plug-in module **BM4-F-ENC-XX** for BM4400, BM4600, BM4700 with standard controller.



### NOTE!

The **encoder modules** are mounted stationary in the BM4400, BM4600, BM4700 with ES controller and cannot be changed, therefore no mounting is necessary!

### 6.1 Preparation of mounting

- Check the marking **ENC-XX**, whether the right plug-in module is available.

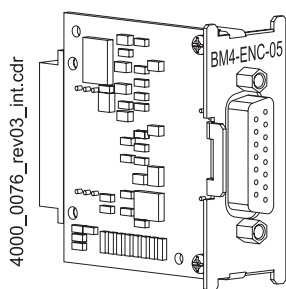


Figure 5: BM4-F-ENC-XX for standard controller

- Determine the suitable slot, slots A and B are possible (also refer to ►Slots [BM4-F-ENC-XX for standard controller](#)◀ on page 30).

### 6.2 Assembly



#### WARNING!

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

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

Therefore:

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

- 1 Switch off the **b maXX BM4000** and assure it against unintentional switching on during mounting.



#### DANGER!

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

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

Therefore:

- Switch off the current when any kind of work is being performed on the electrical system and ensure safety before switching on again.
- Pay attention to the relevant safety instructions when handling electrical equipment carrying high voltages.
- Do not touch electrically live parts before taking into account the discharge time of the capacitors

- 2 Pull off the design cover towards the front from the controller unit
- 3 Look at the controller unit for the provided slot

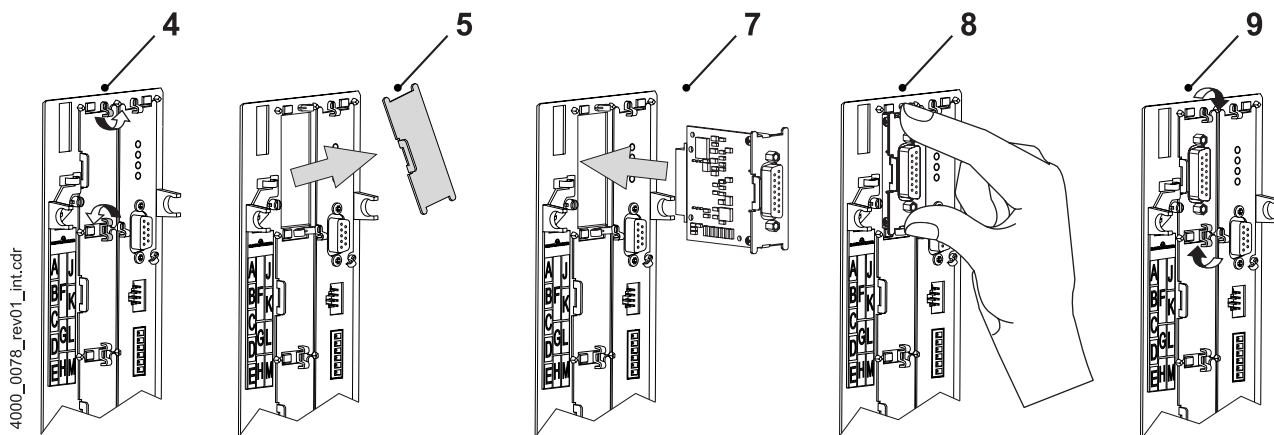


Figure 6: Mounting

- 4 Turn the twist lock beyond and beneath by 90°. The twist locks now are standing horizontally.
- 5 Take the front panel cover towards the front off. Keep this cover.

**NOTICE!**

Note **electrostatic discharge!**

The **BM4-F-ENC-XX** module contains ESD sensible parts.

Therefore:

- Regard the described ESD procedures when handling the plug-in module.
- Touch the plug-in module only at its handle.

- 6 Take the **BM4-F-ENC-XX** out of its transport packing. Avoid the contact with electronically parts of the plug-in module.
- 7 Plug the **BM4-F-ENC-XX** module into the guide supports of the slot. The handle must point to the same side as the other handles in this slot strip (here: right side).
- 8 Press with two fingers on the front panel until the **BM4-F-ENC-XX** module within the device sensible latches tightly into the end position.
- 9 Turn the twist lock beyond and beneath by 90° into the vertical position (locking position).
- 10 Connect cable of the **BM4-F-ENC-XX** module and tighten the connector.
- 11 Put the design cover on the device again.

**NOTE**

If you, within the scope of a repair of the **BM4-F-ENC-XX**, simply displace it by a similar plug-in module, you can shorten the further operation, installation, commissioning and so on. Then you simply must put on the connector to the plug-in module, put on the design cover again and you can turn on the device again.

Thus the mounting of the **BM4-F-ENC-XX** is completed.



# INSTALLATION

In this chapter we describe the electrical installation of the **ENC-XX** or **BM4-F-ENC-XX**. The mechanical mounting is described in [▶Mounting◀](#) from page 41 and not necessary for BM4400, BM4600 and BM4700 with ES controller.

## 7.1 Safety notes



### **DANGER!**

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

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

- Switch off the current when any kind of work is being performed on the electrical system and ensure safety before switching on again.
- Pay attention to the relevant safety instructions when handling electrical equipment carrying high voltages.
- Do not touch electrically live parts before taking into account the discharge time of the capacitors



### **WARNING!**

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

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

Therefore:

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

### 7.2 Requirements on the electrical connection



#### NOTICE!

The danger is: **Electricity.**

In case you do not ensure the requirements to the electrical connection of the **ENC-XX/BM4-F-ENC-XX**, it can be damaged/destroyed.

- 1 The **ENC-XX/BM4-F-ENC-XX** supplies the connected encoders with voltage and current. Exceptions are only possible, if this is mentioned in the specific module characterization.
- 2 Therefore it is forbidden to connect encoders to an external voltage supply, in particular when this external voltage supply is not the same supplying the **b maXX 4000** device. The product liability expires, if the encoders are not supplied with voltage and current by a **ENC-XX/BM4-F-ENC-XX** module; this is a forbidden and not designed use of the encoder systems.
- 3 Should alternative supply concepts be considered, please contact Baumüller in advance.

Use the recommended cables in order to comply with the standard EN 60 204-1 (Electrical Equipment of Machines). Short-circuits, external voltage etc. may occur, if the connectors are not fixed.



#### NOTE!

Pay attention to EMC compatible cabling, see instruction handbook **b maXX** BM4400, BM4400 ES, BM4600, BM4600 ES, BM4700, BM4700 ES (5.12008), chapter [Installation requirements with regard to EMC](#).

7.3 Connection diagrams

7.3.1 Connection BM4-F-ENC-XX standard controller

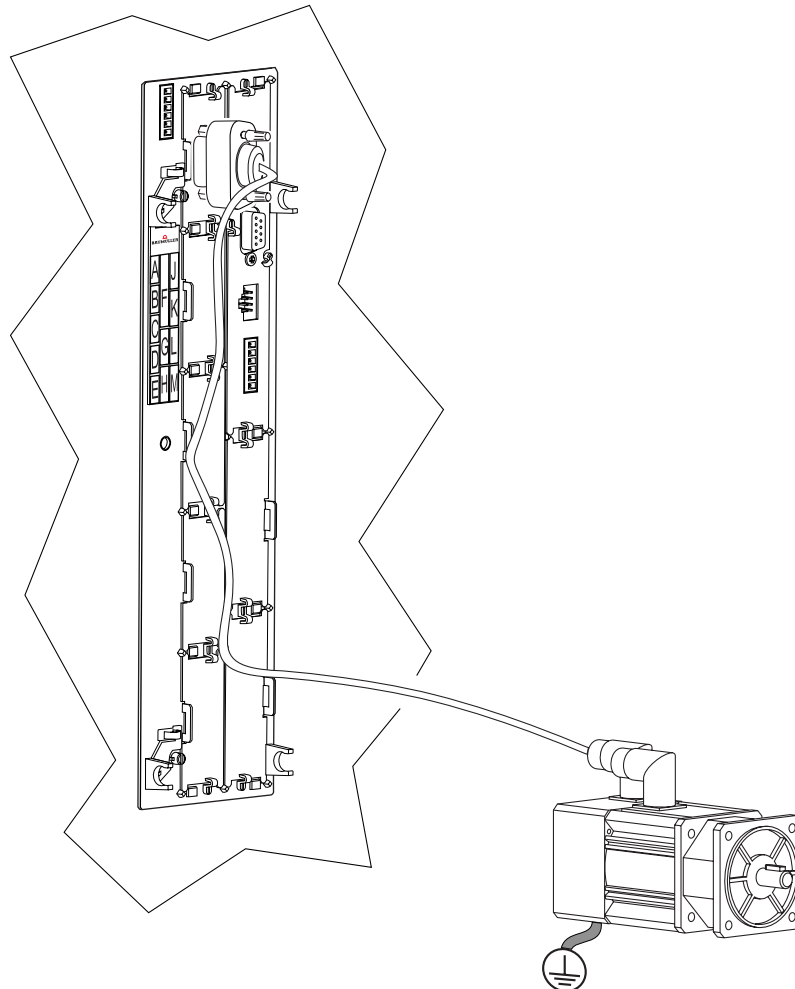


Figure 7: Connection diagram BM4-F-ENC-XX standard controller

4000\_0077\_rev01\_int.cdr

### 7.3.2 Connection ENC-XX ES controller

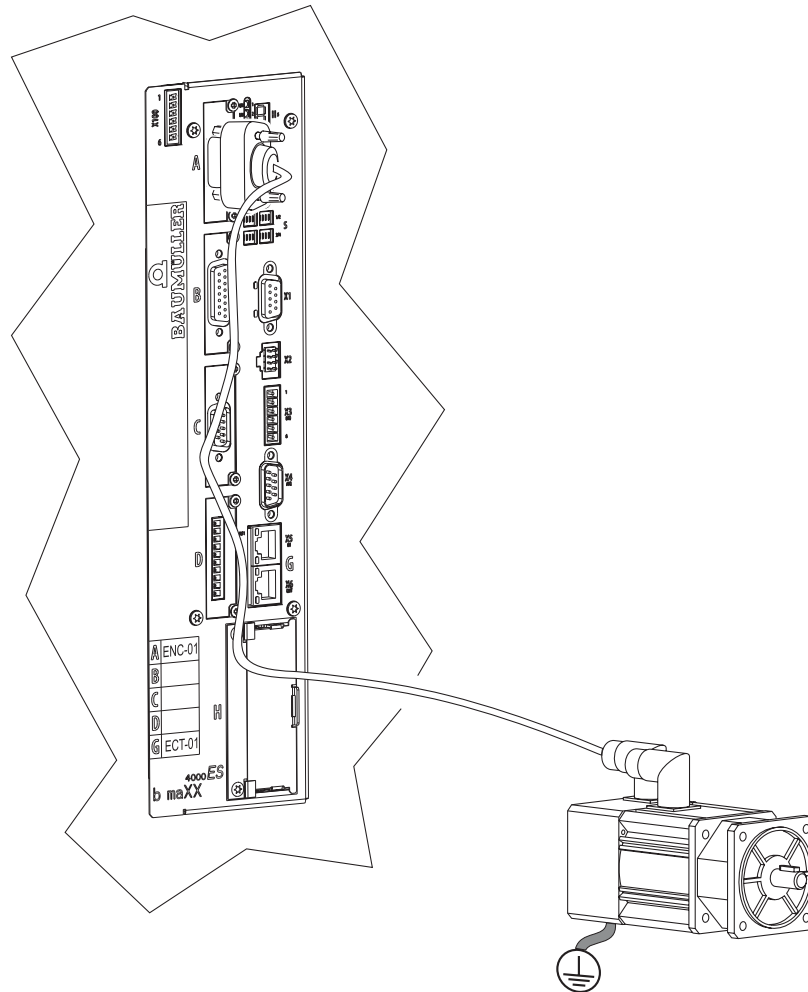


Figure 8: Connection diagram ENC-XX ES controller

4000\_0077\_rev01\_int.cdr



7.3.3 Pin assignment

Pin assignment (BM4-F-)ENC-01, (BM4-F-)ENC-11, (BM4-F-)ENC-21

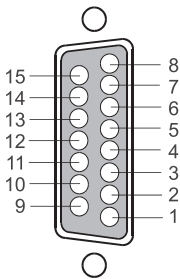
- for resolver



**NOTE!**

Resolvers are to be used only for motors with maximum ten pole pairs.

Pin assignment



Female Sub-D 15-pin

Pin No.	Definition
1	Resolver ref -
2	Resolver ref +
3	reserved*
4	reserved*
5	Resolver COS +
6	reserved*
7	Resolver SIN +
8	Resolver SIN -
9	Resolver COS -
10	reserved*
11	reserved*
12	reserved*
13	reserved*
14	Temperature sensor + <sup>1)</sup>
15	Temperature sensor - <sup>1)</sup>

\* do not connect

<sup>1)</sup> Requirements to the temperature sensor:

Type	Additional requirements	Insulation
KTY84	-	SELV/PELV
NTC (MSKL)	R = 1kΩ at T <sub>protection</sub> , I <sub>max</sub> < 2mA	SELV/PELV



**NOTE!**

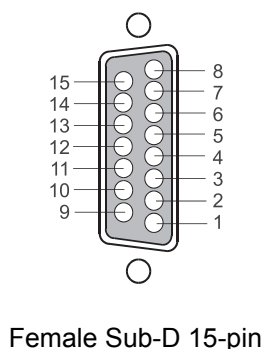
The connection cable is provided ready-for-use, see [►Encoder cable 12-wire◄](#) on page 90. Assembly see [►Construction guidance connection cable, 12-wire◄](#) on page 59.

## 7.3 Connection diagrams

### Pin assignment (BM4-F-)ENC-02, (BM4-F-)ENC-12

- for sine cosine encoder with Hiperface® interface

#### Pin assignment



Pin No.	Definition
1	GND encoder supply
2	+ 8V encoder supply
3	reserved*
4	reserved*
5	COS +
6	reserved*
7	SIN -
8	SIN +
9	COS -
10	Temperature sensor + <sup>1) 2)</sup>
11	Temperature sensor - <sup>1) 2)</sup>
12	RS485 +
13	reserved*
14	reserved*
15	RS485 -

\* do not connect

1) Requirements to the temperature sensor:

Type	Additional requirements	Insulation
KTY84	-	SELV/PELV
NTC (MSKL)	$R = 1k\Omega$ at $T_{\text{protection}}$ , $I_{\text{max}} < 2\text{mA}$	SELV/PELV



#### NOTE

At use of this encoder module in connection with Baumüller encoder cables the temperature sensor is not connected to the encoder cable!  
You can connect the temperature sensor separately at the encoder module (in the sub-D connector) or at the power unit.



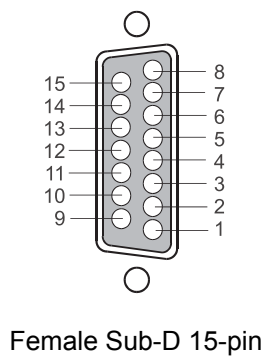
#### NOTE!

The connection cable is provided ready-for-use, see [►Encoder cable 12-wire◄](#) on page 90. Assembly see [►Construction guidance connection cable, 12-wire◄](#) on page 59.

**Pin assignment (BM4-F-)ENC-03**

- for 5V square wave incremental encoder

**Pin assignment**



Pin No.	Definition
1	GND encoder supply
2	+ 5 V encoder supply
3	RS422 incremental encoder track +0
4	RS422 incremental encoder track -0
5	RS422 incremental encoder track +B
6	reserved*
7	RS422 incremental encoder track -A
8	RS422 incremental encoder track +A
9	RS422 incremental encoder track -B
10	reserved*
11	reserved*
12	Sense + 5V encoder supply
13	Sense GND encoder supply
14	Temperature sensor +
15	Temperature sensor -

\* do not connect

1) Requirements to the temperature sensor:

Type	Additional requirements	Insulation
KTY84	-	SELV/PELV
NTC (MSKL)	$R = 1k\Omega$ at $T_{\text{protection}}$ ; $I_{\text{max}} < 2\text{mA}$	SELV/PELV



**NOTE!**

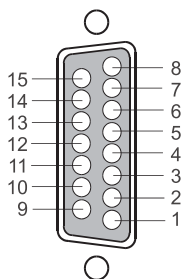
The connection cable is provided ready-for-use, see [Encoder cable 12-wire](#) on page 90. Assembly see [Construction guidance connection cable, 12-wire](#) on page 59.

## 7.3 Connection diagrams

### Pin assignment (BM4-F-)ENC-04

- for sine cosine encoder with zero-point sensing

#### Pin assignment



Female Sub-D 15-pin

Pin No.	Definition
1	GND encoder supply
2	+5 V encoder supply
3	Zero point +
4	Zero point -
5	SIN+ [B+]
6	reserved*
7	COS- [A-]
8	COS+ [A+]
9	SIN- [B-]
10	reserved*
11	reserved*
12	5 V sense
13	0 V sense
14	reserved*
15	reserved*

\* do not connect



#### NOTE

A broken wire of the zero point cable is not detected by the controller.



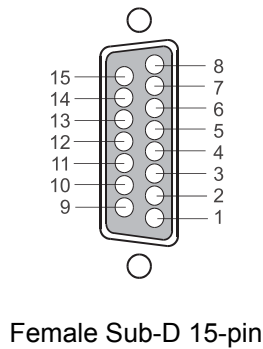
#### NOTE!

The connection cable is provided ready-for-use, see [►Encoder cable 12-wire◄](#) on page 90. Assembly see [►Construction guidance connection cable, 12-wire◄](#) on page 59.

**Pin assignment (BM4-F-)ENC-05**

- for sine cosine encoder with EnDat<sup>®</sup> 2.1 interface

**Pin assignment**



Pin No.	Definition
1	GND encoder supply
2	+5 V encoder supply
3	Temperature sensor + <sup>1)</sup>
4	Temperature sensor - <sup>1)</sup>
5	SIN+ [B+]
6	reserved*
7	COS- [A-]
8	COS+ [A+]
9	SIN- [B-]
10	Clock +
11	Clock -
12	5 V Sense
13	0 V Sense
14	Data +
15	Data -

\* do not connect

<sup>1)</sup> Requirements to the temperature sensor:

Type	Additional requirements	Insulation
KTY84	-	SELV/PELV
NTC (MSKL)	$R = 1\text{k}\Omega$ at $T_{\text{protection}}$ ; $I_{\text{max}} < 2\text{mA}$	SELV/PELV



**NOTE!**

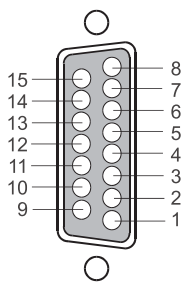
The connection cable is provided ready-for-use, see [►Encoder cable 12-wire◄](#) on page 90. Assembly see [►Construction guidance connection cable, 12-wire◄](#) on page 59.

## 7.3 Connection diagrams

### Pin assignment (BM4-F-)ENC-06

- for encoder with EnDat<sup>®</sup> 2.2 interface

#### Pin assignment



Female Sub-D 15-pin

Pin No.	Definition
1	reserved*
2	GND encoder supply
3	reserved*
4	+5 V encoder supply
5	DATA +
6	reserved*
7	reserved*
8	CLK +
9	reserved*
10	GND encoder supply
11	reserved*
12	+5 V encoder supply
13	DATA -
14	reserved*
15	CLK -

\* do not connect



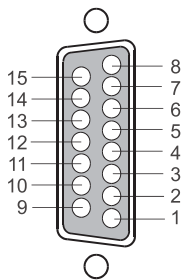
#### NOTE

Encoder cable for EnDat<sup>®</sup> 2.2 without incremental signals (original encoder cable of Heidenhain), see [▶EnDat<sup>®</sup> 2.2 encoder cable◀](#) on page 92

## Pin assignment (BM4-F-)ENC-07

- for sine cosine encoder with SSI interface, without encoder supply

## Pin assignment



Female Sub-D 15-pin

Pin No.	Definition
1	reserved*
2	reserved*
3	reserved*
4	reserved*
5	SIN + [B+]
6	reserved*
7	COS- [A-]
8	COS+ [A+]
9	SIN- [B-]
10	Clock +
11	Clock -
12	reserved*
13	A_GND
14	Data +
15	Data -

\* do not connect

**NOTE**

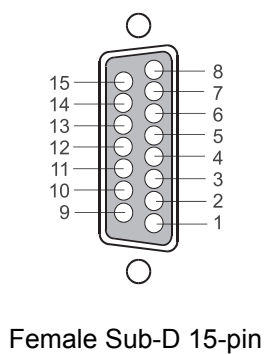
The connection cable is not offered by Baumüller Nürnberg GmbH and must be made by the user, see [►Construction guidance connection cable for \(BM4-F-\)ENC-07◀](#) on page 61.

## 7.3 Connection diagrams

### Pin assignment (BM4-F-)ENC-17

- for sine cosine encoder with SSI interface and 5V encoder supply

#### Pin assignment



Pin No.	Definition
1	GND encoder supply
2	+5 V encoder supply
3	reserved*
4	reserved*
5	SIN+ [B+]
6	reserved*
7	COS- [A-]
8	COS+ [A+]
9	SIN- [B-]
10	Clock +
11	Clock -
12	5 V Sense
13	0 V Sense
14	Data +
15	Data -

\* do not connect



#### NOTE

The connection cable is not offered by Baumüller Nürnberg GmbH and must be made by the user, see [Construction guidance connection cable for \(BM4-F-\)ENC-17](#) on page 62.

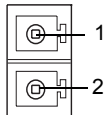


**Pin assignment (BM4-F-)ENC-27**

- for encoder with SSI interface and 24V encoder supply

**Pin assignment**

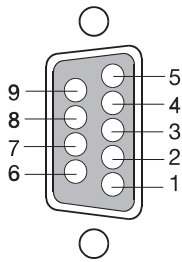
**Encoder supply**



X1 female connector 2-pin

Pin No.	Definition
1	+24 V DC
2	0 V

**Pin assignment encoder**



X2 female Sub-D 9-pin

Pin No.	Definition
1	Data -
2	Data +
3	reserved*
4	reserved*
5	reserved*
6	+24 V DC
7	0 V
8	Clock +
9	Clock -

\* do not connect



**NOTE**

The availability of the 24V power supply is not checked and a broken wire is not detected by the controller.



**NOTE**

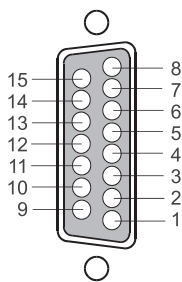
The connection cable is not offered by Baumüller Nürnberg GmbH and must be made by the user, see [Construction guidance connection cable for \(BM4-F-\)ENC-27](#) on page 63.

## 7.3 Connection diagrams

### Pin assignment (BM4-F-)ENC- 08

- for sine cosine encoder with commutation

#### Pin assignment



Female Sub-D 15-pin

Pin No.	Definition
1	GND encoder supply
2	+ 5 V encoder supply
3	Zero-point + [R+]
4	Zero-point - [R-]
5	COS+ [A+]
6	reserved*
7	SIN- [B-]
8	SIN+ [B+]
9	COS- [A-]
10	D -
11	D +
12	5 V Sense
13	0 V Sense
14	C +
15	C -

\* do not connect



#### NOTE

A broken wire of the reference signal cable [R+], [R-] or commutation signal cable [C+], [C-], [D+], [D-] is not detected by the controller.



#### NOTE

The connection cable is not offered by Baumüller Nürnberg GmbH and must be made by the user, see [Connection guidance connection cable for BM4-F-ENC-08](#) on page 64.

7.3.4 Construction guidance connection cables



**NOTE**

The connection cables must be made according to the following figures! In case there is another assignment of the pins, the cable will not operate and defects as well as at the encoder module and also at the encoder can be caused!

**Construction guidance connection cable, 12-wire**

The connection cable can be used for following encoder types:

- (BM4-F-)ENC-01, (BM4-F-)ENC-11, (BM4-F-)ENC-21 resolver
- (BM4-F-)ENC-03 5V square wave incremental encoder
- (BM4-F-)ENC-04 5V sine cosine incremental encoder with zero-point sensing
- (BM4-F-)ENC-02, (BM4-F-)ENC-12 sine cosine encoder with Hiperface®

The connection cable can be ordered from Baumüller Nürnberg GmbH (see [Encoder cable 12-wire](#) on page 90).

Construction guidance:

**1 Use the following materials:**

- Cable: LiYCY 5 x (2 x 0.14) + 2 x 0.5 mm<sup>2</sup>, Cu braiding with at least 85% opt. overlap
- Sub-D connector. 15-pin, male
- Circular connector: 12-pin, female (e.g. Interconnectron)

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

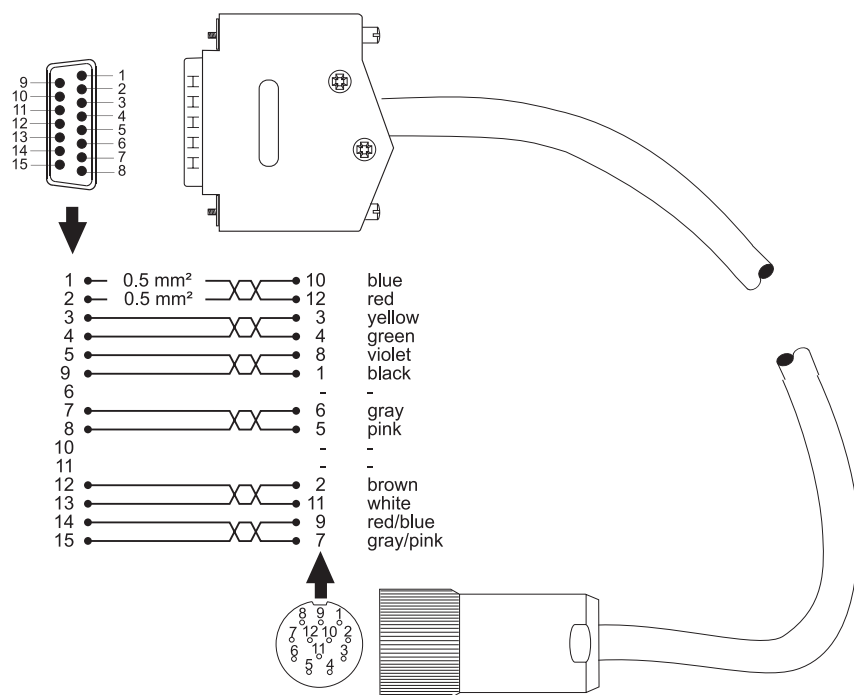


Figure 9: Connection cable, 12-wire

### Construction guidance connection cable for (BM4-F-)ENC-05

- Sine cosine incremental encoder with EnDat 2.1<sup>®</sup>-interface

The connection cable can be ordered from Baumüller Nürnberg GmbH (see [▶EnDat<sup>®</sup> 2.1 encoder cable](#) on page 91).

Construction guidance:

**1** Use the following materials:

- Cable: 14 wires (recommendation: 6 x (2 x 0.14 mm<sup>2</sup>) + 2 x 0.5 mm<sup>2</sup>), twisted pairs, pairs layer-twisted, tinned Cu transfer, Cu braiding with at least 85 % opt. overlap.
- Sub-D connector. 15-pin, male
- Circular connector: 17-pin, female (e. g. Interconnectron)

**2** Connect the cable shield lamina with the shield of the Sub-D connector.

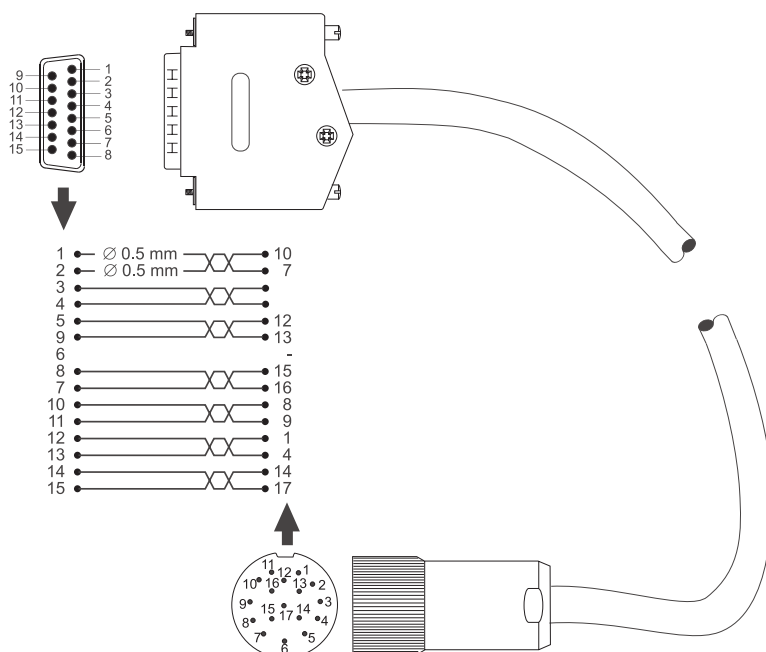


Figure 10: Connection cable for (BM4-F-)ENC-05

### Construction guidance connection cable for (BM4-F-)ENC-07

- sine cosine encoder with SSI interface, without encoder supply



#### NOTE

The connection cable is not offered by Baumüller Nürnberg GmbH and must be made by the user.

Construction guidance:

#### 1 Use the following materials:

- Cable: LiYCY 5 x (2 x 0.14) + 2 x 0.5 mm<sup>2</sup>, Cu braiding with at least 85 % opt. overlap
- Sub-D connector. 15-pole, male
- Suitable encoder plug

#### 2 Connect the cable shield with the cabinet of the circular connector and with the shield of the Sub-D connector

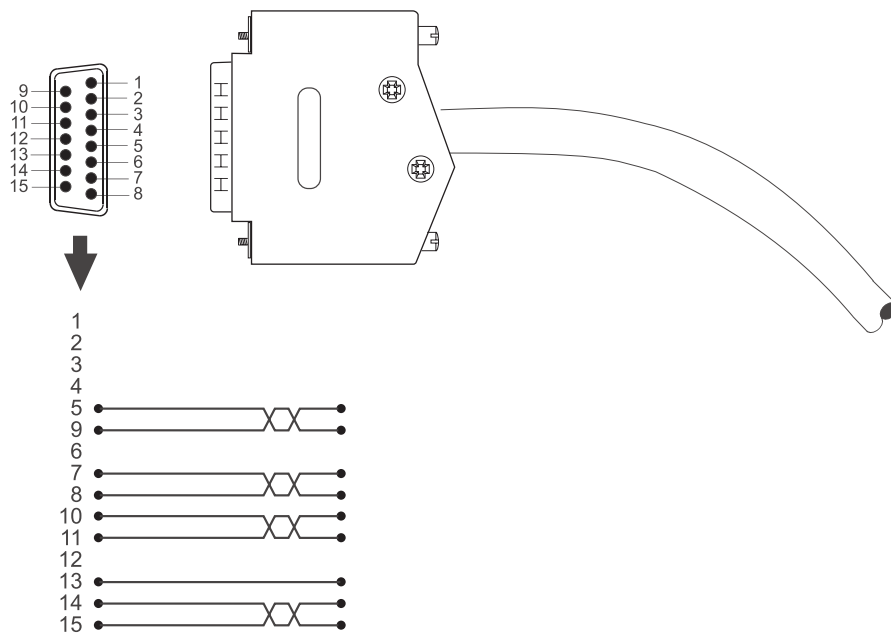


Figure 11: Connection cable BM4-F-ENC-07

## 7.3 Connection diagrams

### Construction guidance connection cable for (BM4-F-)ENC-17

- Sine cosine encoder with SSI interface and 5V encoder supply



#### NOTE

The connection cable is not offered by Baumüller Nürnberg GmbH and must be made by the user.

Construction guidance:

**1** Use the following materials:

- Cable: LiYCY 5 x (2 x 0.14) + 2 x 0.5 mm<sup>2</sup>, Cu braiding with at least 85 % opt. overlap
- Sub-D connector. 15-pin, male
- Suitable encoder plug

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

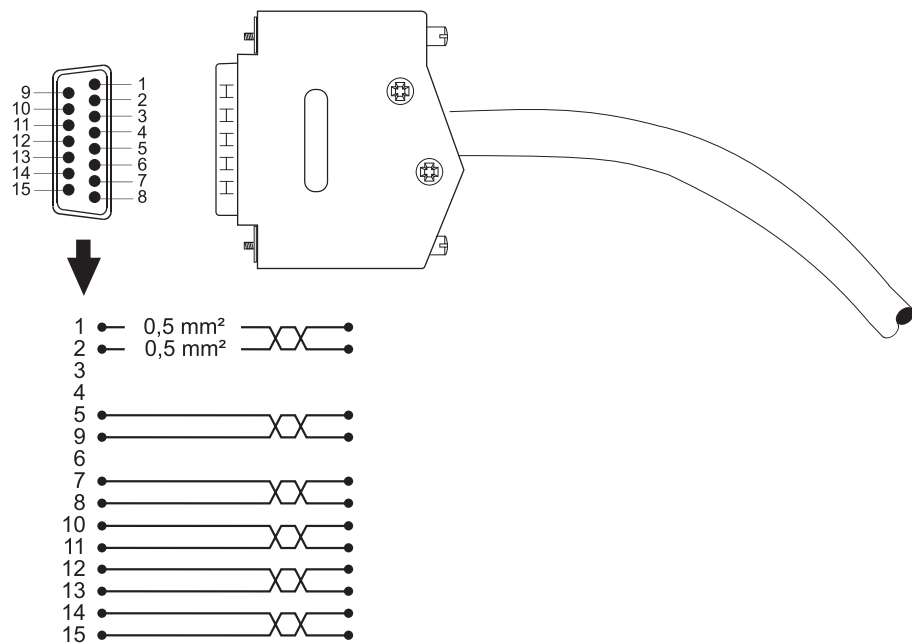


Figure 12: Connection cable (BM4-F-)ENC-17

### Construction guidance connection cable for (BM4-F-)ENC-27

- Encoder with SSI interface and 24V encoder supply



#### NOTE

The connection cable is not offered by Baumüller Nürnberg GmbH and must be made by the user.

Construction guidance:

Construction guidance:

#### 1 Use the following materials:

- Cable 6 wires: (recommended: 2 x (2 x 0.14) + 2 x 0.5 mm<sup>2</sup>, twisted pairs and shielded, tinned Cu transfer, Cu braiding with at least 85 % opt. overlap. Cu braiding with at least 85 % opt. overlap)
- Sub-D connector. 9-pin, male
- Suitable encoder plug, circular connector: 7-pin female

#### 2 Connect the cable shield with the cabinet of the circular connector and with the shield of the Sub-D connector

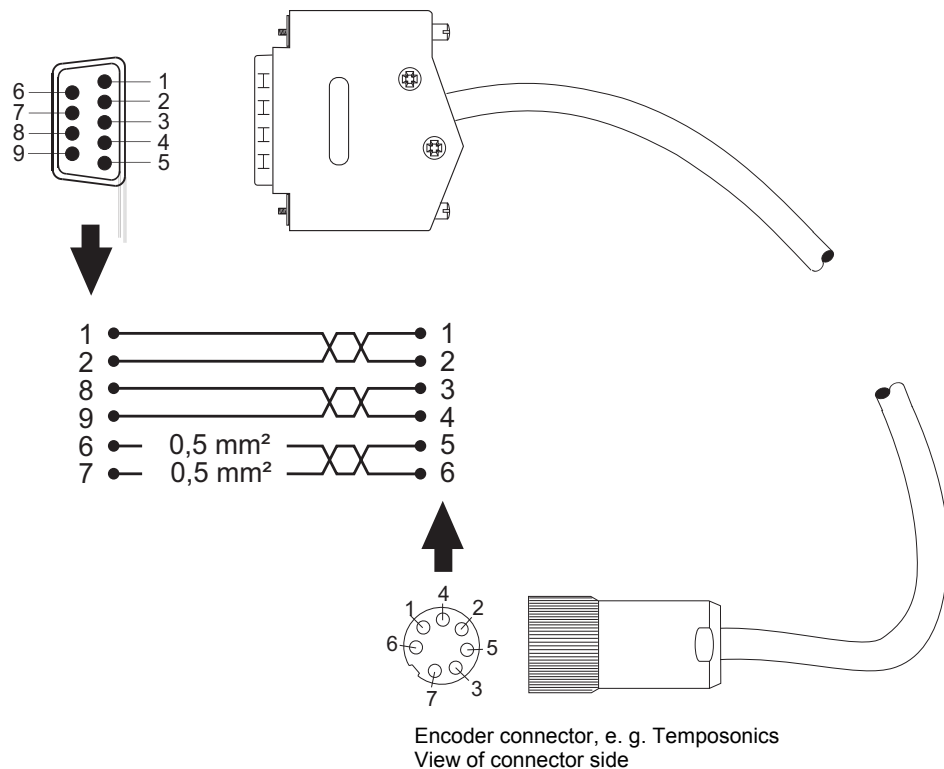


Figure 13: Connection cable (BM4-F-)ENC-27

## 7.3 Connection diagrams

### Connection guidance connection cable for BM4-F-ENC-08

- Sine cosine encoder with commutation



#### NOTE

A broken wire of the reference signal cable [R+], [R-] or commutation signal cable [C+], [C-], [D+], [D-] is not detected by the controller.



#### NOTE

The connection cable is not offered by Baumüller Nürnberg GmbH and must be made by the user.

Construction guidance:

- 1 Use the following materials:
  - Cable: 6 x (2 x 0.14) + 2 x 0.5 mm, Cu braiding with at least 85% opt. overlap
  - Sub-D connector. 15-pin, male
  - Suitable encoder plug
- 2 Connect the cable shield with the cabinet of the circular connector and with the shield of the Sub-D connector

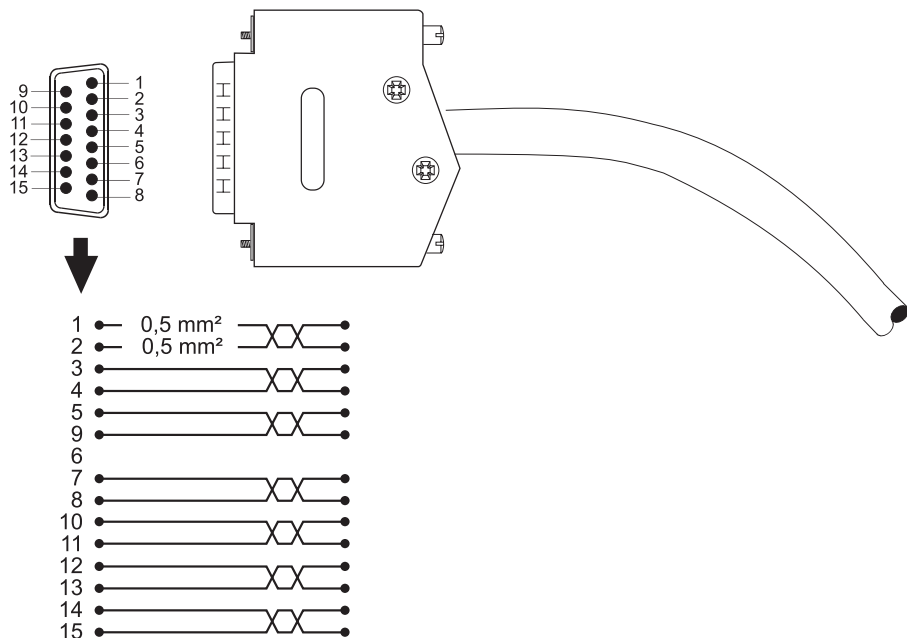


Figure 14: Connection cable (BM4-F-)ENC-08



## 7.4 Installation procedure

- 1 Switch off the b maXX 4400 device and assure it against unintentional switching on during mounting.



### **DANGER!**

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

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

- Switch off the current when any kind of work is being performed on the electrical system and ensure safety before switching on again.
- Pay attention to the relevant safety instructions when handling electrical equipment carrying high voltages.
- Do not touch electrically live parts before taking into account the discharge time of the capacitors.

- 2 Take off the cover from the controller unit (standard controller only)
  - Standard controller:  
The **BM4-F-ENC-XX** is located in slot A or B
  - ES controller:  
The **ENC-XX** is located in position A or B
- 3 Connect **(BM4-F-)ENC-XX** and motor (connection cables see [►Construction guidance connection cables◄](#) from page 59 or ready-for-use [►Connection cable◄](#) from page 90 (outgoing cable downwards).
- 4 Attach the cover to the device again (standard controller only)
- 5 Install the cables according to the instructions into the switching cabinet, see [►Requirements on the electrical connection◄](#) on page 46.



## COMMISSIONING/OPERATION

This test-commissioning assures, that the **(BM4-F-)ENC-XX** has been correctly recognized. Further information relating to commissioning and parameter settings of the encoder module can be found in parameter manual **b maXX 4000** 5.03039.

Assure, that before commissioning the following preconditions are fulfilled:

- 1 The **BM4-F-ENC-XX** is correctly mounted (standard controller only).
- 2 The encoder is correctly mounted at the motor.  
The encoder must be suitable for the encoder module, must be approved by Baumüller Nürnberg GmbH and must be correctly cabled.
- 3 The switching cabinet is properly closed and all safety devices are put into operation.
- 4 The **b maXX 4000** is ready-for-use.

### 8.1 Safety notes

---

#### Basics



#### **WARNING!**

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

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

Therefore:

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

Keep all doors of the control cabinet closed during operation.



### **NOTICE!**

#### **Environmental conditions that do not meet the requirements.**

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

Therefore:

- Ensure that the environmental conditions are kept compliant during operation (see instruction handbook **b maXX 4000**, operation conditions).



### **WARNING!**

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

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

Therefore:

- Only qualified personnel may work on this device!

## 8.2 Procedure of the test-commissioning

The test-commissioning is divided into the following sections:

- 1 recognition and
- 2 function test of the encoder module

### 8.2.1 Recognition of the encoder module

During of the ramp-up of the device the controller automatically reads out the identification of the encoder module/the encoder modules.

After that check with ProDrive if the **(BM4-F-)ENC-XX** has been correctly recognized.

- 1 Switch on **b maXX BM4000**
- 2 Wait until the system has started.

Delete upcoming errors/error messages at the device **b maXX 4000**.

These errors can be due to faulty mounting (e. g. defect cables) or faulty installation (e. g. missing power supply). Not until the errors have been removed, you may continue commissioning.

- 3 Open with ProDrive the window „**Diagnosis**“.

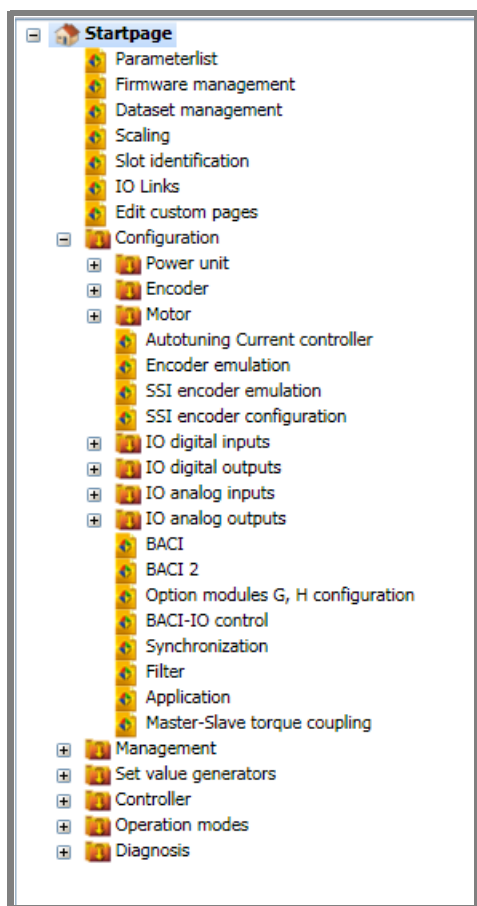


Figure 15: ProDrive navigation

## 8.2 Procedure of the test-commissioning

### 4 Choose sub-menu „Service“

Expectation:

- Module type: e.g. SinCos EnDat 2.1: (BM4-F-)ENC-05  
Resolver: (BM4-F-)ENC-21
- Hardware version: (dependent on order), e. g. „Version A“.

### 5 Decide on the basis of the display:

Slot	Module name	Module type	Hardware version	Wire break supervisi	RS-485	Temp.-acquis.
Slot A	SinCos EnDat 2.1	BM4-F-ENC-05	Version C	-	+	+
Slot B	Resolver	BM4-F-ENC-21	Version A	-	-	+
Slot C	Digital I/O 4 Input, 4 Output	BM4-F-DIO-01/11	Version B	-	-	-
Slot D	not used			-	-	-
Slot E	Analog IN 0/4-20 mA	BM4-F-AIO-04	Version A	-	-	-

Figure 16: ProDrive start screen

- If the **(BM4-F-)ENC-XX** has been correctly recognized, the commissioning can be continued, refer to Instruction Handbook b maXX 4000, 5.12008 or Parameter Manual b maXX 4000, 5.03039.
- If the **(BM4-F-)ENC-XX** has not been correctly recognized, turn off the device, check the mounting and the installation. After removing all errors, switch on the device again.
- If the **(BM4-F-)ENC-XX** has not been correctly recognized again, it is defect or the controller/controller slot (of standard controller) is defect. Contact Baumüller Nürnberg GmbH for replacement.

## 8.2.2 Further information on parameterization

The basic setting of the parameter „configuration encoder“ you will find in the following table:

(BM4-F-)ENC	Resolver -01, -11	Resolver -21	Sine cosine encoder with Hiperface® or Endat® and electronic type plate -02, -12, -05, -06	Sine cosine encoder with SSI interface with/without 5V encoder supply -07, -17	Encoder with SSI interface and 24V encoder supply -27	5V square wave incremental encoder -03	Sine cosine incremental encoder -04, -08
P0150 Encoder 1 mode P0160 Encoder 2 mode	0001 <sub>hex</sub>						
P0152 Encoder 1 PPR count P0162 Encoder 2 PPR count	1	1	automatic setting	encoder PPR count	dependent on encoder 1)	encoder PPR count	encoder PPR count
P1071 Encoder 1 smoothing time P1081 Encoder 2 smoothing time	3,0	1,0	Value depends on different factors, e.g. encoder PPR count, quality of sine-cosine-signals, analog or digital position transmission				
P1073 Encoder 1 N=0 threshold P1083 Encoder 2 N=0 threshold	1,00						
P1075 Encoder 1 N>Nx OFF threshold P1085 Encoder 2 N>Nx OFF threshold	96,00						
P1074 Encoder 1 N>Nx ON threshold P1084 Encoder 2 N>Nx ON threshold	100,00						
P1072 Encoder 1 overspeed P1082 Encoder 2 overspeed	115,0						

Figure 17: Parameter for configuration

1) Length measurement system: display only, value from P0574 and P0578  
 Rotary sensor/angle measurement system: PPR count encoder

## 8.2.3 Function test

The **(BM4-F-)ENC-XX** can only be tested in connection with the basic unit b maXX 4000, motor and encoder. Further information can be found in the Instruction Handbook and Parameter Manual b maXX 4000.





# MAINTENANCE

## 9.1 Safety notes

---

### Basic information

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

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

Therefore:

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

## 9.2 Environmental condition

---

If the prescribed environmental conditions are adhered to, then the device is maintenance-free. For the prescribed environmental conditions see Instruction handbook **b maXX BM4000**.

The most important prescribed environmental conditions are:

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

## 9.3 Inspection intervals - maintenance notes

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### 9.3 Inspection intervals - maintenance notes

---

Refer to Instruction handbook **b maXX 4000**, 5.12008.

### 9.4 Repairs

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

**Baumüller Nürnberg GmbH**

Ostendstr. 80 - 90  
90482 Nuremberg  
Germany

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

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

# TROUBLESHOOTING AND FAULT CORRECTION

## 10.1 Behavior in case of malfunctions

---

### Basic information

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

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

Therefore:

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

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

Therefore:

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

## 10.2 Fault detection

The fault can be caused by mechanical or electrical malfunctions.

### LED H4

The occurrence of an error state of a device **b maXX 4000** is signalled by the lighting up of the red LED H4 on the front side of the housing.



#### NOTE!

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

### 7-segment display

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

By the displayed code the error message can be determined. The displayed error is without exception an LEVEL 2 error (P0201 - P0216).

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

Example: Error 125 and 91 are generated:

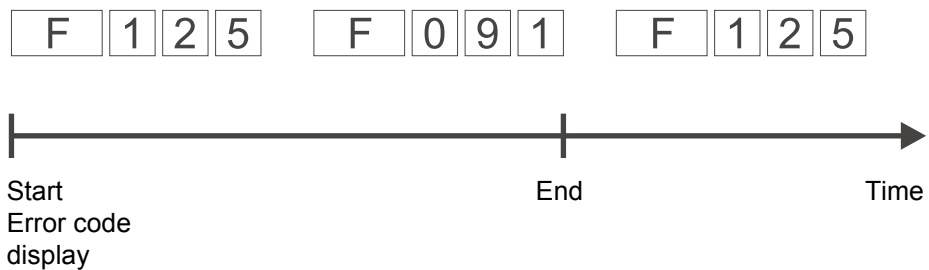


Figure 18: Error messages 7-segment display

4000\_0366\_rev01\_int.cdr

**Operating software ProDrive**

Furthermore the error message is shown in the operating software:

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



**NOTE!**

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

Display the „error message“ in ProDrive:

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

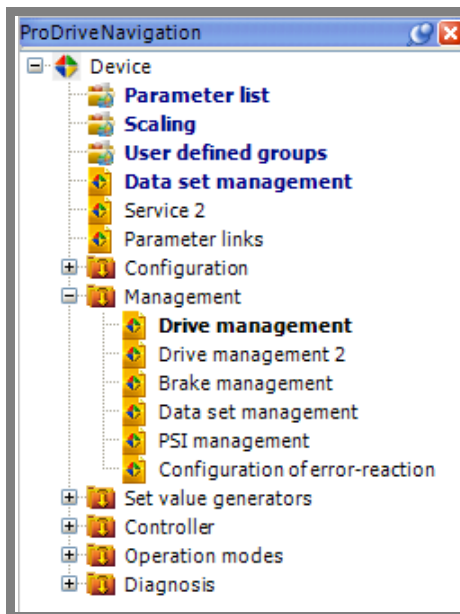


Figure 19: ProDrive navigation

► Select „Drive management“

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

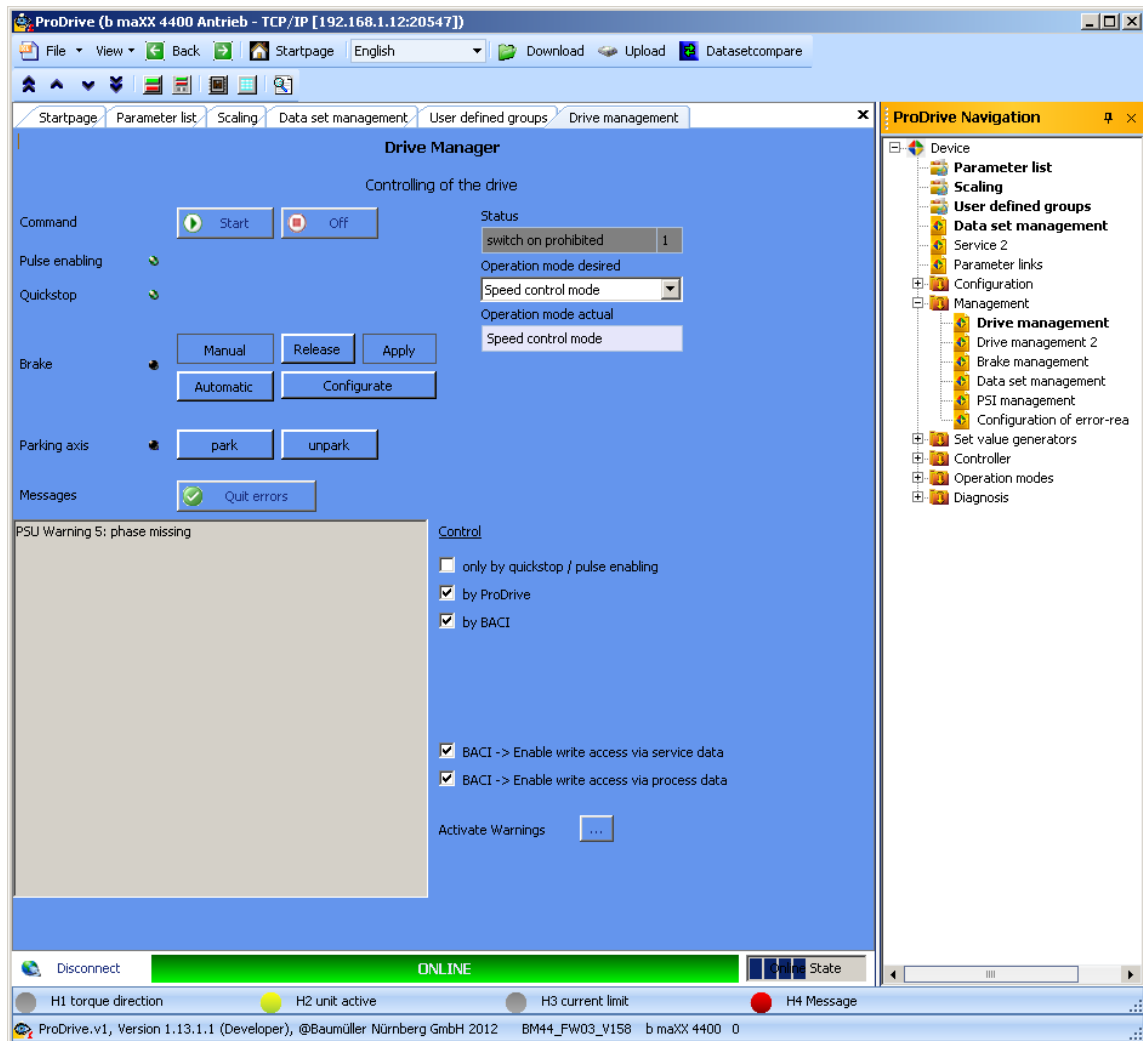


Figure 20: Drive manager ProDrive



### NOTE

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

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

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

## 10.3 Error handling

The error messages in the system are built up hierarchically.

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

### Error memory

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

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

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

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

### Error display

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



#### NOTE!

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

### 10.3.1 Error reset

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

There are several methods to reset errors:

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

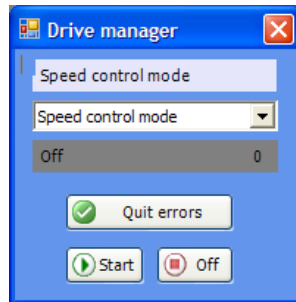


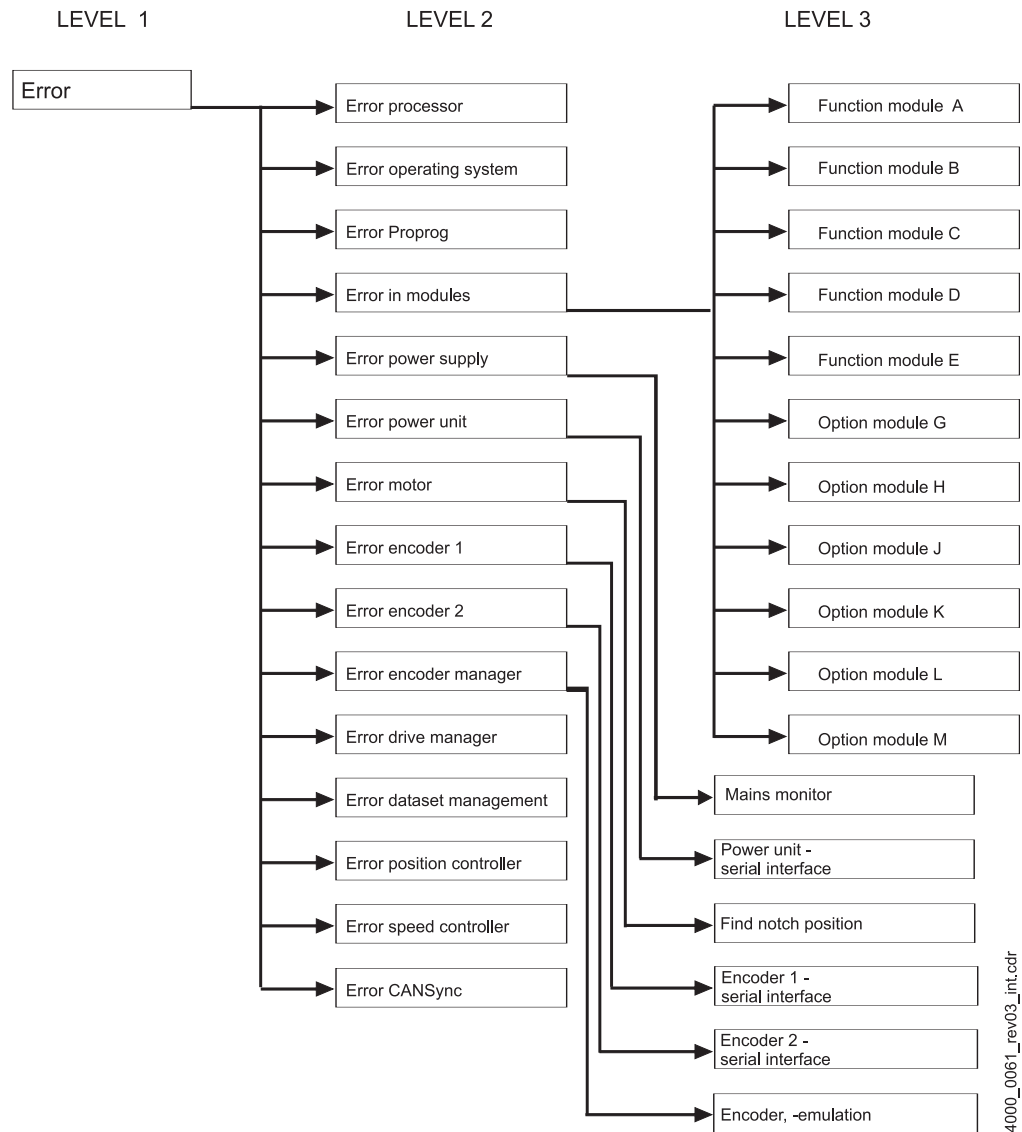
Figure 21: ProDrive Drive manager

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

Additional data according the subject resetting of error messages is available in the „Parameter manual“.



10.3.2 Error messages



4000\_0061\_rev03\_init.cdr

Figure 22: Survey error list

The (error) messages are displayed in ProDrive window „Drive manager“.

<b>1st level</b>	1st level errors are only interesting for the access to errors via parameters, to be used without ProDrive, e. g. at Field bus communication. This errors are not shown in ProDrive/ 7-segment display. Bit mapping see description of the parameter P0200 in the parameter manual.
<b>2nd level</b>	Order of the error messages see survey ( <a href="#">▶Figure 22◀</a> on page 81).
<b>3rd level</b>	2nd level error messages are displayed on the 7-segment display in ProDrive.



### NOTE!

3rd level errors are only displayed in ProDrive separated by a decimal point from the corresponding 2nd level error.

e.g.:

Motor error 102: Group error find notch position **(2nd level)**

Find notch position error 102.64: Drive moved more than 4 times delta angle. **(3rd level)**

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

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

## P0208 Error encoder 1 (level 2)

Error No.	Meaning	Reaction	Troubleshooting
112	Communication error (Hiperface® specification)	pulse stop	See <a href="#">►Error messages level 3◄</a> on page 85.
113	reserved		
114	Error at overwriting the encoder position information	pulse stop	Execute the command once again. If the error occurs repeatedly, contact Baumüller Nürnberg
115	Cable break encoder 1	pulse stop	Remove the cable break in encoder cable of encoder 1 and/or check assignment of encoder cable
116	Overspeed encoder 1	pulse stop	Check permissible speed of encoder 1
117	Amplitude limit exceeded	pulse stop	Check the encoder cable and the encoder function. Use a different encoder
118	Unknown encoder type	pulse stop	Check, if the correct encoder is connected or use a different encoder
119	Data field for motor data invalid	pulse stop	Use different encoder
120	Invalid motor data	pulse stop	
121	Error at storage of the motor data	pulse stop	
122	Motor data write protected (valid for motors not from Baumüller)	pulse stop	
123	Field angle error	pulse stop	Check the screening of the encoder cable
124	Encoder without temperature measuring	adjustable	Use an encoder module with temperature measuring
125	Encoder memory space for electronic type code too small	adjustable	Use a different encoder with more memory
126 to 127	reserved, not assigned = 0		

## P0209 Error encoder 2 (level 2)

Error No.	Meaning	Reaction	Troubleshooting
128	Communication error (Hiperface® specification)	pulse stop	See <a href="#">►Error messages level 3◄</a> on page 85.
129	reserved		
130	Error at overwriting the encoder position information	pulse stop	Execute the command once again. If the error occurs repeatedly, contact Baumüller Nürnberg
131	Cable break encoder 2	pulse stop	Remove the cable break in encoder cable of encoder 2 and/or check assignment of encoder cable
132	Overspeed encoder 2	pulse stop	Check permissible speed of encoder 2
133	Amplitude limit exceeded	pulse stop	Check the encoder cable and the encoder function. Use a different encoder
134	Unknown encoder type	pulse stop	Check, if the correct encoder is connected or use a different encoder
135	Data field for motor data invalid	pulse stop	Use different encoder
136	Invalid motor data	pulse stop	
137	Error at storage of the motor data	pulse stop	
138	Motor data write protected (valid for motors not from Baumüller)	pulse stop	
139	Field angle error	pulse stop	Check the screening of the encoder cable
140	Encoder without temperature measuring	adjustable	Use an encoder module with temperature measuring
141	Encoder memory space for electronic type code too small	adjustable	Use a different encoder with more memory
142 bis 143	reserved, not assigned = 0		

### P0210 Error encoder manager

Error No.	Meaning	Reaction	Troubleshooting
144	Absolute position of encoder 1 unknown	pulse stop	Use a different encoder If error occurs at sine incremental encoder, set P0150 bit 9 = 1 (error message „absolute position of encoder 1 unknown“ is suppressed)
145	Absolute position of encoder 2 unknown	pulse stop	
146	Encoder module 1 is missing	pulse stop	Check if the correct encoder is connected.
147	Encoder module 2 is missing	pulse stop	
148	Encoder module for measured value storage is missing	pulse stop	Install the encoder module
149	No measured value storage possible at the resolver	pulse stop	Use a sine cosine or incremental encoder
150	Triggering not possible, because no incremental encoder	pulse stop	Use for this option an incremental encoder
151	Digital I/O module is missing	pulse stop	Install the digital I/O module
152	Incremental encoder emulation module is necessary and is missing	pulse stop	Install the incremental encoder emulation module
153	Encoder module 1 is necessary for incremental encoder emulation and is missing	pulse stop	Install the encoder module on position A
154	Encoder module 2 is necessary for incremental encoder emulation and is missing	pulse stop	Install encoder module on position B
155	Inizialization error of the incremental encoder emulation module	pulse stop	Restart system
156	Incremental encoder emulation module (HW) signals error	pulse stop	Restart system, replace module (standard controller) or replace controller (ES controller) if error message is generated repeatedly
157	Error incremental encoder emulation module	pulse stop	Use for this option an incremental encoder
158	SSI encoder emulation module is missing	pulse stop	Install SSI encoder emulation module
159	Error in setpoint source encoder 1 or encoder 2	pulse stop	See encoder error message

## Error messages level 3



### NOTE!

3rd level errors are only displayed in ProDrive separated by a decimal point from the corresponding 2nd level error (refer to ▶Figure 22◀ on page 81).

e.g.:

Motor error 102: Group error find notch position **(2nd level)**

Find notch position error 102.64: Drive moved more than 4 times delta angle. **(3rd level)**

**P0234**  
**P0235**

**Error encoder 1 serial interface**  
**Error encoder 2 serial interface**

(communication error according Hiperface® specification in encoder 1/encoder 2)

Error code	Meaning	Troubleshooting
1	Analog signals outside the specification	Check encoder cable and assure the correct encoder installation
2	Internal angle offset error	
3	Data field partitioning table destroyed	
4	Analog threshold value not available	
5	Internal I <sup>2</sup> C-bus not functioning	
6	Internal checksum error	
7	Internal watchdog error - encoder reset	
8	Overflow counter	
9	Parity error	
10	Checksum error	
11	Unknown instruction code	
12	Wrong number of data	
13	Invalid argument	
14	Data field is write protected	
15	Wrong access code	
16	Data field size cannot be altered	
17	Stated word address outside data field	
18	Data field not existent	
19 bis 27	reserved	
28	Absolute value monitoring of analog signals	Check encoder cable and assure the correct encoder installation
29	Critical sending current	
30	Critical encoder temperature	Check motor temperature
31	Speed too high - position determination not possible	Check encoder cable and assure the correct encoder installation

## 10.3 Error handling

Error code	Meaning	Troubleshooting
32	Position single turn unreliable	Internal encoder error, contact Baumüller Nürnberg GmbH
33	Position error multi turn	
34	Position error multi turn	
35	Position error multi turn	
36	Wrong motor data checksum	
37	Absolutely no response from encoder	Check encoder cable and assure the correct encoder installation
38	Unknown encoder address	
39	Error reading absolute angle position	
40	Wrong checksum of received data	
41	Unknown encoder type	
42 bis 63	reserved	
64	No answer from Hiperface® encoder	Check encoder cable and assure the correct encoder installation
65	No answer from EnDat® encoder	
66	Impracticable answer to encoder command	Use another encoder type
67	Encoder type not supported	
68 bis 79	reserved	
80	CRC has located error	Check encoder cable and assure the correct encoder installation
81	Invalid command	
82	Error in response-message	
83	Alarm bit is set	Restart <b>b maXX 4000</b>
84	Memory is occupied	Check encoder cable and assure the correct encoder installation
85	Wrong data checksum	
86	Motor data-data length and/or data version of encoder and controller firmware is not identical	
87	No EnDat® interface	
88	Exceeding of evaluable transmission size	
89	Exceeding of the evaluable measuring step length	Use another type of length measurement system
90	Signal period length < measuring step length	
91	EnDat® 2.2: Error when initializing the master chip	
92	EnDat® 2.2: Timeout while measuring the run-time of the signal	Replace encoder cable resp. replace module (standard controller) or replace controller (ES controller)
93	EnDat® 2.2: Error - signal run-time compensation switched off	Replace module (standard controller) or replace controller (ES controller)
94	EnDat® 2.2: Encoder type doesn't support EnDat® 2.2 (commands, power supply, cycle clock)	Use compatible encoder type
95	EnDat® 2.2: RM bit is not set → absolute position of the encoder is not referenced	
96	Error lighting	Replace encoder
97	Error signal amplitude	
98	Error position value	
99	Error overvoltage	Replace module (standard controller) or replace controller (ES controller)
100	Error undervoltage	
101	Error overcurrent	
102	Error battery	Replace encoder
103 -111	reserved	

Error code	Meaning	Troubleshooting
112	Position error detected while multiple request	Check encoder cable and assure the correct encoder installation
113	Error initiated by additional info 1	See encoder dependent definition of additional info 1
114	Error initiated by additional info 2	See encoder dependent definition of additional info 2
115	Error initiated by additional info 3	See encoder dependent definition of additional info 3
116	Error initiated by additional info 4	See encoder dependent definition of additional info 4
117	Error initiated by additional info 5	See encoder dependent definition of additional info 5
118	Error initiated by additional info 6	See encoder dependent definition of additional info 6
119	Error initiated by additional info 7	See encoder dependent definition of additional info 7



**NOTE!**

Further details are to be found in the manual of the basic unit b maXX 4000.







## ACCESSORIES AND SPARE PARTS

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

### 11.1 Motor-side encoder connector

---

	Type	Part no.
Encoder plug	12-pole	245147
	12-pole SpeedTec	448729
	17-pole	362601
	17-pole SpeedTec	448730

### 11.2 Connection cable

- **Encoder cable 12-wire**

Encoder cable for resolver, sine cosine encoder with Hiperface® interface and square wave incremental encoder

ready-for-use - trailing cable available, length see below, further lengths on request

Length	not trailing cable Part no.	trailing cable Part no.	SpeedTec trailing cable Part no.
1 m	243601	-	448941
2 m	211338	-	448943
<b>3 m</b>	<b>219333</b>	<b>246658</b>	<b>448944</b>
4 m	231166	243379	448945
<b>5 m</b>	<b>209879</b>	<b>239540</b>	<b>448948</b>
6 m	220197	242954	448946
7 m	216455	-	448947
<b>8 m</b>	<b>220429</b>	<b>239541</b>	<b>448949</b>
<b>10 m</b>	<b>210052</b>	<b>239542</b>	<b>448956</b>
<b>15 m</b>	<b>215716</b>	<b>239543</b>	<b>448961</b>
<b>20 m</b>	<b>218568</b>	<b>239544</b>	<b>448967</b>
<b>25 m</b>	<b>218569</b>	<b>239545</b>	<b>448970</b>
<b>30 m</b>	<b>217094</b>	<b>239546</b>	<b>448971</b>
35 m	216444	239547	448973
40 m	217095	240520	448976
45 m	217567	240521	448978
50 m	217568	240522	448979
55 m	217569	244033	448981
60 m	217570	245484	448982
70 m	232088	-	-

**Bold:** preferred length

- **EnDat<sup>®</sup> 2.1 encoder cable**

ready-for-use - trailing cable available, length see below, further lengths on request

Length	not trailing cable Part no.	trailing cable Part no.	SpeedTec trailing cable Part no.
2 m	383152	393889	448816
<b>3 m</b>	<b>383923</b>	<b>369864</b>	<b>448817</b>
<b>5 m</b>	<b>393885</b>	<b>394014</b>	<b>448818</b>
7 m	389445	389807	448819
<b>8 m</b>	<b>380138</b>	<b>393890</b>	<b>448820</b>
9 m	389446	389808	448821
<b>10 m</b>	<b>393886</b>	<b>393891</b>	<b>448822</b>
<b>15 m</b>	<b>388505</b>	<b>393892</b>	<b>448823</b>
<b>17 m</b>	-	371494	<b>448824</b>
<b>20 m</b>	<b>388418</b>	<b>393893</b>	<b>448825</b>
<b>25 m</b>	<b>393887</b>	<b>393894</b>	<b>448826</b>
<b>30 m</b>	<b>393888</b>	<b>380358</b>	<b>448827</b>
35 m	387958	391216	448828
40 m	382006	382005	448830
50 m	388419	378022	-
70 m	384473	-	-
90 m	387391	-	-

**Bold:** preferred length



**NOTE**

No evaluation of the motor temperature sensor is possible with this encoder cable!

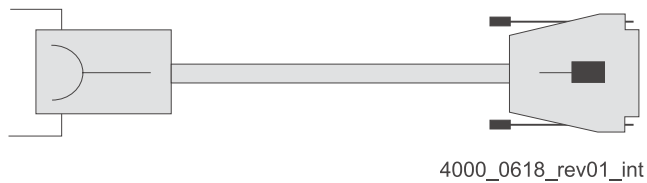
- **EnDat<sup>®</sup> 2.2 encoder cable**  
without incremental encoder signals

Original encoder cable of Fa. Heidenhain), lengths on request.

Cable with M12 connector 8-pin completely assembled with female connector and male Sub-D connector.

Order No. Fa. Heidenhain

**524599-xx** (xx: length)



# 12

## DISPOSAL



### NOTE!

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

### 12.1 Safety notes

---



### DANGER!

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

Stored electric charge.

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

Refer to Instruction handbook **b maXX BM4000**, Electrical data.

Therefore:

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



### **NOTICE!**

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

Therefore:

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

Do not open electronic components.

- Dispose of capacitors, semiconductor modules and electronic scrap as special waste.



### **WARNING!**

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

The deinstallation and disposal requires qualified personnel with adequate experience.

Therefore:

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

## 12.2 Disposal facilities/authorities

---

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



# **APPENDIX A - DECLARATION OF CONFORMITY**



**EC - Declaration of Conformity**

**Doc.-No.:** 5.13028.00  
**Date:** 18.10.2013

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

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

declares, that the product:

Designation: Encoder module for b maXX 4000 standard controller  
 Type: BM4-F-ENC-XX  
 Manufactured since: 18-Oct-2013

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

Applied harmonized standards:

Standard	Title
DIN EN 62061:2010-05	Safety of Machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems
DIN EN 61800-5-1:2008-04	Adjustable speed electrical power drive Part 5-1: Safety requirements - Electrical, thermal and energy
DIN EN 61800-5-2:2008-04	Adjustable speed electrical power drive Part 5-2: Safety requirements - Functional
DIN EN 61800-3:2005-07	Adjustable speed electrical power drive Part 3: EMC requirements and specific test methods

The mentioned devices cannot be operated without a BM4000 standard controller.

The products must be installed correctly and all notes and safety notes of the referring instruction handbooks BM4000 and the encoder module BM4-F-ENC-XX must be complied with, to guarantee the compliance to the guidelines.

The compliance to the guidelines was verified with a typical configuration of a BM4000 standard controller.

Nuremberg / 18.10.2013  
 Location/Date

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





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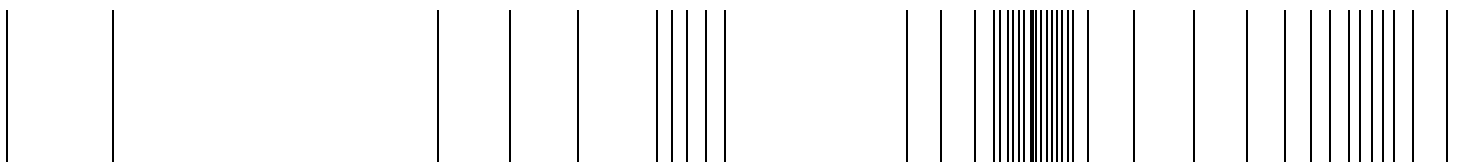
## Overview of Revisions

Version	Status	Changes
5.01042.11	18-Oct-2013	Revision because of ES controller
5.01042.12	15-Apr-2014	Additional encoder cables SpeedTec





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