Instruction handbook

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Read the Manual before starting any work!

b maXX

BM4-F-AIO-XX
AIO-XX

Analog IO module
BM4400, BM4400 ES
BM4600, BM4600 ES
BM4700, BM4700 ES
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Preliminary information

Warning Insofar as this document is identified as being preliminary information, the following applies:

This version is regarded as providing advance technical information to users of the described devices and their functions at an early enough time in order to adapt to any possible changes or expanded functionality.

This information must be regarded as being preliminary, as it has not yet passed through Baumüller’s internal review process. In particular, this information is still subject to changes, thus no legal liability can be derived from this preliminary information. Baumüller assumes no liability for damages that might arise from this possibly faulty or incomplete version.

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The conditions stipulated in the following section under „Obligatory“ are invalid in case of preliminary information.

Obligatory

This Instruction handbook are a part of the equipment/machine. This Instruction handbook must be available to the operator at all times and must be in legible condition. If the equipment/machine is sold or moved to another location, this Instruction handbook must be passed on by the owner together with the equipment/machine.

After any sale of the equipment/machine, this original and all copies must be handed over to the buyer. After disposal or any other end use, this original and all copies must be destroyed.

When the present Instruction handbook is handed over, corresponding sets of Instruction handbooks of a previous version are automatically invalidated.

Please note that the specifications/data/information are current values according to the printing date. These statements are not legally binding with regard to measurements, computation or calculations.

Baumüller Nürnberg GmbH reserves the right, in developing its products further, to change the technical specifications and handling of it products concerned without prior notice.

No liability can be accepted concerning the correctness of this Instruction handbook unless otherwise specified in the General Conditions of Sale and Delivery.

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Table of contents

1 General .................................................................................................................. 5
  1.1 Information on this Instruction handbook ......................................................... 5
  1.2 Key to symbols ..................................................................................................... 6
  1.3 Limitation of liability .......................................................................................... 7
  1.4 Copyright protection ......................................................................................... 7
  1.5 Other applicable documents ............................................................................. 8
  1.6 Spare parts ......................................................................................................... 8
  1.7 Disposal ............................................................................................................. 8
  1.8 Guarantee provisions ......................................................................................... 8
  1.9 Customer service .............................................................................................. 8
  1.10 Used terms ....................................................................................................... 9
  1.11 List of associated documentations ................................................................. 9

2 Safety ..................................................................................................................... 11
  2.1 Contents of the Instruction Handbook ............................................................... 11
  2.2 Changes and modifications to the device .......................................................... 11
  2.3 Use, compliant with intended purpose ............................................................... 12
  2.4 Responsibility of the operating company ......................................................... 12
  2.5 Training of the personnel .................................................................................. 13
  2.6 Special hazards .................................................................................................. 14
  2.7 Fire fighting ....................................................................................................... 15
  2.8 Safety equipment .............................................................................................. 16
  2.9 Behavior in hazardous situations or at accidents ............................................... 16
  2.10 Signs and labels ............................................................................................... 17

3 Technical Data ...................................................................................................... 19
  3.1 Electrical data .................................................................................................... 19
  3.2 Power input ....................................................................................................... 20
  3.3 Input linearity error ............................................................................................ 20
  3.4 Operation conditions ......................................................................................... 20

4 Design and Operation .......................................................................................... 21
  4.1 Function ............................................................................................................ 22
  4.2 BM-F-AIO-XX for standard controller ............................................................. 23
       4.2.1 Slots BM4-F-AIO-XX for standard controller ........................................... 23
       4.2.2 Type plate BM4-F-AIO-XX for standard controller ................................. 25
       4.2.3 Type code BM4-F-AIO-XX for standard controller ................................. 26
       4.2.4 Danger areas BM4-F-AIO-XX for standard controller ............................. 26
  4.3 AIO-XX in ES controller .................................................................................. 27
       4.3.1 Position AIO-XX in ES controller ............................................................ 28
       4.3.2 Type plate AIO-XX in ES controller ......................................................... 29
       4.3.3 Type code AIO-XX in ES controller ......................................................... 29
  4.4 Display and operation elements ................................................................------- 29

5 Transport and Packaging .................................................................................... 31
  5.1 What to observe when transporting ................................................................. 31
  5.2 Transport inspection ......................................................................................... 31
  5.3 Unpacking ......................................................................................................... 32
  5.4 Disposal of the packaging ................................................................................ 32
# Table of contents

6 Mounting ................................................................. 33  
6.1 Preparation of mounting ............................................. 33  
6.2 Assembly .............................................................. 34  
7 Installation .............................................................. 37  
7.1 Safety notes ........................................................... 37  
7.2 Requirements on the electrical connection ....................... 38  
7.3 Requirements for the connection cables .......................... 38  
7.4 Connection diagrams .................................................. 39  
7.5 Installation procedure ............................................... 40  
7.6 Internal circuit diagram .............................................. 41  
7.6.1 Internal circuit diagram of Analog-I0-Modules (BM4-F-)AIO-01/-02/-03  ........................................... 41  
7.6.2 Internal circuit diagram of Analog IO module (BM4-F-)AIO-04 .......................................................... 42  
8 Commissioning/Operation ............................................... 43  
8.1 Safety notes ........................................................... 43  
8.2 Procedure of the commissioning .................................... 44  
8.2.1 Recognition of the Analog IO module ............................ 44  
8.2.2 Testing of the Analog IO module ................................. 49  
8.2.2.1 Testing of inputs AIO-01, -02 and -03 ....................... 50  
8.2.2.2 Testing of inputs AIO-04 ...................................... 51  
8.2.2.3 Testing of outputs ............................................. 53  
8.2.3 Offset adjustment of an analog input channel ................ 55  
8.2.3.1 Offset adjustment of AIO-01, -02, -03 ....................... 55  
8.2.3.2 Offset adjustment AIO-04 ..................................... 57  
8.3 Operation ............................................................ 58  
9 Maintenance .............................................................. 61  
9.1 Safety notes ........................................................... 61  
9.2 Environmental condition ............................................. 61  
9.3 Inspection intervals - maintenance notes ........................ 62  
9.4 Repairs ............................................................... 62  
10 Troubleshooting and Fault correction ............................... 63  
10.1 Behavior in case of malfunctions .................................. 63  
10.2 Fault detection ........................................................ 64  
10.3 Error handling ........................................................ 67  
10.3.1 Error reset ....................................................... 68  
10.3.2 Error messages .................................................... 69  
11 Disposal ................................................................. 73  
11.1 Safety notes ........................................................... 73  
11.2 Disposal facilities/authorities ..................................... 74  
Appendix A - Declaration of Conformity .................................. 75  
Table of figures .......................................................... 77  
Index ................................................................. 79  
Overview of Revisions ................................................... 81
1.1 Information on this Instruction handbook

The AIO-XX or BM4-F-AIO-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.

**NOTE!**

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

**CANopen®** is a registered trademark of CAN in Automation e.V

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**SinCos®**

**NOTE!**

Please note, that BAUMÜLLER is not responsible to examine whether any (industrial property) rights of third parties are infringed by the application-specific use of the BAUMÜLLER products/components or the execution.
1.5 Other applicable documents

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

1.6 Spare parts

**WARNING!**
False or flawed spare parts can lead to damage, malfunction or complete failure, thus endangering safety.
Therefore:
- Only use original spare parts of the manufacturer.

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

1.7 Disposal

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

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

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 AIO-XX (ES controller) or BM4-F-AIO-XX (standard controller) is also used in this documentation for the Baumüller product „b maXX analog IO 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

<table>
<thead>
<tr>
<th>Instruction handbook</th>
<th>Doc No.</th>
<th>Part No. German</th>
<th>Part No. English</th>
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<tr>
<td>Instruction Handbook basic unit b maXX 4400, 4600, 4700 (ES)</td>
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<td>376339</td>
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<th>Part No. English</th>
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<td>372665</td>
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<tr>
<td>Digital IO module BM4-F-DIO/FIO-XX or DIO/FIO-XX</td>
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<td>354843</td>
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<tr>
<td>Encoder module BM4-F-ENC-XX or ENC-XX</td>
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<td>354842</td>
<td>372861</td>
</tr>
<tr>
<td>Incremental encoder emulation module BM4-F-IEE-XX or IEE-XX</td>
<td>5.02020</td>
<td>354858</td>
<td>376728</td>
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<tr>
<td>SSI encoder emulation module BM4-F-SIE-XX or SIE-XX</td>
<td>5.03056</td>
<td>377123</td>
<td>379049</td>
</tr>
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<th>Part No. German</th>
<th>Part No. English</th>
</tr>
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<td>5.03007</td>
<td>367670</td>
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<tr>
<td>CANopen slave BM4-O-CAN-03</td>
<td>5.02014</td>
<td>368692</td>
<td>368693</td>
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<td>CANopen slave programming handbook for controller</td>
<td>5.02065</td>
<td>368694</td>
<td>372860</td>
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<td>CANopen over EtherCAT programming handbook</td>
<td>5.07017</td>
<td>413208</td>
<td>432414</td>
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<td>CANopen slave for b maXX PLC application handbook</td>
<td>5.03057</td>
<td>376486</td>
<td>376487</td>
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<td>b maXX drive PLC</td>
<td>5.01051</td>
<td>366197</td>
<td>354845</td>
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<td>b maXX drive PLC application handbook</td>
<td>5.02004</td>
<td>366198</td>
<td>372017</td>
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<td>BM4-O-ETH-01, BM4-O-ETH-02, BM4-O-CAN-04 for b maXX PLC</td>
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<td>366202</td>
<td>372042</td>
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<td>BM4-O-ETH-01, BM4-O-ETH-02, BM4-O-CAN-04 CANopen master for b maXX PLC application handbook</td>
<td>5.03002</td>
<td>366203</td>
<td>372043</td>
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<td>CANsync master for b maXX PLC</td>
<td>5.02056</td>
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## List of associated documentations

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<td>SERCOS slave module BM4-O-SER-01 parameter handbook</td>
<td>5.04013</td>
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<td>EtherCAT slave module BM4-O-ECT-01/ECT-01</td>
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<td>Ethernet with EtherCAT master for b maXX drive PLC</td>
<td>5.07001</td>
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<td>5.07002</td>
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<td>Ethernet with EtherCAT for b maXX drive PLC</td>
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<tr>
<td>POWERLINK Controlled Node BM4-O-PLK-01/PLK-01 ES</td>
<td>5.12072</td>
<td>444497</td>
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<tr>
<td>POWERLINK Controlled Node BM4-O-PLK-01 ES application handbook</td>
<td>5.13013</td>
<td>445131</td>
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SAFETY

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

2.1 Contents of the Instruction Handbook

Each person who is tasked with performing work on or with the device must have read and understood this Instruction Handbook and the Instruction Handbook of b maXX 4000 5.12008 before working with the device. This also applies if the person who is 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-AIO-XX is used compliant with its intended purpose, if it is built-in/operated within b maXX 4000 controller, only.

The Analog IO 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 Analog IO module 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 Analog IO module.
- When configuring, ensure that the Analog IO module is always operated within its specifications.
- The Analog IO module may only be operated in a technically flawless condition.
- Only operate the Analog IO module in combination with components approved by Baumüller Nürnberg GmbH.

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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 / CO₂
### 2.8 Safety equipment

#### WARNING!

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

Safety equipment provides for the highest level of safety in a facility. Even if safety equipment makes work processes more awkward, under no circumstances may they be circumvented. Safety can only be ensured by intact safety equipment. Therefore:
- Before starting to work, check whether the safety equipment is in good working order and properly installed.

---

### 2.9 Behavior in hazardous situations or at accidents

**Preventive measures**

- Always be prepared for accidents or fire!
- Keep first-aid equipment (e.g. first-aid kits, blankets, etc.) and fire extinguishers readily accessible.
- Familiarize personnel with accident signaling 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
2.10 Signs and labels
### 3.1 Electrical data

<table>
<thead>
<tr>
<th></th>
<th>01</th>
<th>02</th>
<th>03</th>
<th>04</th>
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<td>Number of inputs</td>
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<td></td>
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<tr>
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<td>10 bit / 12 bit</td>
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<td>differential input circuit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input resistance</td>
<td>ca. 50 kΩ</td>
<td></td>
<td>ca. 100 Ω</td>
<td></td>
</tr>
<tr>
<td>Max. input current</td>
<td>200 µA</td>
<td></td>
<td>20 mA</td>
<td></td>
</tr>
<tr>
<td>Min. input current</td>
<td></td>
<td>-</td>
<td></td>
<td>4 mA</td>
</tr>
<tr>
<td>Sample rate inputs, one input used</td>
<td></td>
<td>125 µs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sample rate inputs, both inputs used</td>
<td></td>
<td>250 µs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. analog input voltage</td>
<td>- 10 V to + 10 V</td>
<td></td>
<td>2 V</td>
<td></td>
</tr>
<tr>
<td>Number of outputs</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of IO-output links</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. output current</td>
<td>1 mA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resolution</td>
<td>8 bit</td>
<td>16 bit</td>
<td>12 bit</td>
<td>16 bit</td>
</tr>
<tr>
<td>Update-rate fast outputs</td>
<td></td>
<td>125 µs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Update-rate slow outputs</td>
<td></td>
<td>8 ms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short-circuit protection output</td>
<td></td>
<td>limited short-circuit protection (max. 10 s)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analog output voltage</td>
<td></td>
<td>- 10 V to + 10 V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) The analog outputs can be changed from „fast output“ to „slow output“ and vice versa by the operation software.
3.2 Power input

<table>
<thead>
<tr>
<th>Voltage</th>
<th>01</th>
<th>02</th>
<th>03 up to (BM4-F-)AIO-03-00 version C*</th>
<th>03 from (BM4-F-)AIO-03-01 version D*</th>
<th>04</th>
</tr>
</thead>
<tbody>
<tr>
<td>5,0 V</td>
<td>0,2 mA</td>
<td>4 mA</td>
<td>10 mA</td>
<td>5 mA</td>
<td>4 mA</td>
</tr>
<tr>
<td>3,3 V</td>
<td>-</td>
<td>-</td>
<td>160 mA</td>
<td>40 mA</td>
<td>-</td>
</tr>
<tr>
<td>+15,0 V</td>
<td>27 mA</td>
<td>37 mA</td>
<td>20 mA</td>
<td>23 mA</td>
<td>37 mA</td>
</tr>
<tr>
<td>-15,0 V</td>
<td>26 mA</td>
<td>35 mA</td>
<td>19 mA</td>
<td>22 mA</td>
<td>35 mA</td>
</tr>
<tr>
<td>8,0 V</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

*: Displayed in ProDrive navigation „Service“

3.3 Input linearity error

<table>
<thead>
<tr>
<th></th>
<th>DNL min</th>
<th>DNL typ</th>
<th>DNL max</th>
<th>INL min</th>
<th>INL typ</th>
<th>INL max</th>
<th>Offset min</th>
<th>Offset typ</th>
<th>Offset max</th>
<th>Gain min</th>
<th>Gain typ</th>
<th>Gain max</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIO-01</td>
<td>0</td>
<td>2</td>
<td>6</td>
<td>0</td>
<td>2</td>
<td>5</td>
<td>0</td>
<td>3</td>
<td>6</td>
<td>0</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>AIO-02</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>0</td>
<td>3</td>
<td>6</td>
<td>0</td>
<td>3</td>
<td>6</td>
<td>0</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>AIO-03</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>0</td>
<td>8</td>
<td>16</td>
<td>0</td>
<td>15</td>
<td>50</td>
</tr>
<tr>
<td>AIO-04</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>0</td>
<td>3</td>
<td>6</td>
<td>0</td>
<td>3</td>
<td>6</td>
<td>0</td>
<td>3</td>
<td>6</td>
</tr>
</tbody>
</table>

Note:
The specifications are related to the LSB of the associated module. Tolerances of offset and gain can be adjusted within the controller.

3.4 Operation conditions

The operation conditions of the **b maXX 4000** 5.12008 are valid.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation temperature range</td>
<td>- 25 °C bis + 70 °C</td>
</tr>
<tr>
<td>Transportation climate classification EN 60721-3-2</td>
<td>2 K 3</td>
</tr>
<tr>
<td>Storage temperature range</td>
<td>- 25 °C bis + 55 °C</td>
</tr>
<tr>
<td>Storage climate classification EN 60721-3-1</td>
<td>1 K 4</td>
</tr>
</tbody>
</table>

**NOTICE!**
Normally, only non-conductive pollution occurs. Any conductive pollution, if for a short-term or permanently, is forbidden and can cause the destruction of the device. The customer is responsible for destructions, caused by conductive materials.
**DESIGN AND OPERATION**

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

The BM4-F-AIO-XX is designed as plug-in module within the standard controller and can be replaced or upgraded.

The AIO-XX is mounted stationary in the ES controller.
4.1 Function

The **Analog IO module** converts analog input signals in digital signals for control (e.g. set value generation) and/or makes available converted analog values (e.g. for RPM display) from internally processed digital signals.

Technical data of the **Analog IO module** can be found in **Technical Data** from page 19.

### Standard controller

with plug-in slots to enlarge the controller functionality with function and option modules, e.g. encoder modules, analog inputs/outputs or field bus connections.

### ES controller

with not exchangeable function and option modules.

The Analog IO module is available as plug-in module **BM4-F-AIO-XX** for standard controller and as **AIO-XX** built 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.

**NOTICE!**

Plug-in module, which has not been manufactured from Baumüller Nürnberg GmbH. Modules of other manufacturers can damage/destroy the device. Only use BM4-F-XXX- and BM4-O-XXX-plug-in modules.
4.2 BM-F-AIO-XX for standard controller

The BM4-F-AIO-XX is a plug-in module for the controller of b maXX 4000-series. The BM4-F-AIO-XX plug-in module is connected to the controller with a plug on its back. On the front is a 9-pin Sub-D connector (male).

![Diagram of BM4-F-AIO-XX](image)

Figure 2: Analog IO module for standard controller

4.2.1 Slots BM4-F-AIO-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.

The Analog IO module can be plugged in following slots:

| A | BM4-F-AIO-02 | BM4-F-AIO-03 | BM4-F-AIO-04 |
| B | BM4-F-AIO-02 | BM4-F-AIO-03 | BM4-F-AIO-04 |
| C | BM4-F-AIO-02 | BM4-F-AIO-03 | BM4-F-AIO-04 |
| D | BM4-F-AIO-02 | BM4-F-AIO-03 | BM4-F-AIO-04 |
| E | BM4-F-AIO-01 | BM4-F-AIO-02 | BM4-F-AIO-03 | BM4-F-AIO-04 |
| F |                  |                  |                |
| G |                  |                  |                |
| H |                  |                  |                |
| J |                  |                  |                |
| K |                  |                  |                |
| L |                  |                  |                |
| M |                  |                  |                |

**NOTE!**

At the most 2 Analog IO modules can be used.
Optional plug-in modules (function or option modules) can be upgraded dependent on the existing controller type.

Possible combinations function modules/option modules

<table>
<thead>
<tr>
<th>Function modules</th>
<th>Option modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>BM4-F-ENC-XX</td>
<td>BM4-O-PRO-01 (Profibus slave)</td>
</tr>
<tr>
<td>BM4-F-ENC-XX</td>
<td>BM4-O-EIP-01 (Ethernet)</td>
</tr>
<tr>
<td>BM4-F-AIO-01</td>
<td>BM4-O-PLC-XX (SPS)</td>
</tr>
<tr>
<td>BM4-F-AIO-02/03/04</td>
<td>BM4-O-ECT-01 (EtherCAT slave) for PLC</td>
</tr>
<tr>
<td>BM4-F-AIO-02/03/04</td>
<td>BM4-O-ECT-02 (Ethernet + EtherCAT master)</td>
</tr>
<tr>
<td>BM4-F-AIO-02/03/04</td>
<td>BM4-O-ECT-03 (Ethernet + EtherCAT cluster)</td>
</tr>
</tbody>
</table>

A: Optional plug-in modules (function or option modules) can be upgraded dependent on the existing controller type.
B: Possible combinations function modules/option modules
C: Function modules
D: Option modules
E: Controller unit
F: Controller unit
G: preferred slot
H: possible slot
J: 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.
K: dependent on controller hardware
L: 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.
M: precondition for these cards is an inserted PLC module.

Baumüller Nürnberg GmbH recommends, in order to reach the highest functional range, to insert the plug-in modules into these slots.
4.2.2 Type plate BM4-F-AIO-XX for standard controller

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

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

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.
4.2.3 Type code BM4-F-AIO-XX for standard controller

**NOTE!**
This type code is valid for the BM4-F-AIO-XX of series b maXX 4000 exclusively. For other plug-in modules different type codes are available.

Type code:

- **BM4 - F - AIO - XX - YY** Device family, in which the plug-in module can be built in
- **BM4 - F - AIO - XX - YY** Type of plug-in module (function module)
- **BM4 - F - AIO - XX - YY** Name of plug-in module (Analog IO module)
- **BM4 - F - AIO - XX - YY** Version plug-in module (No. of inputs/outputs)
  - 01: 2 x 10 bit input, 2 x 8 bit output
  - 02: 2 x 16 bit input, 2 x 16 bit output
  - 03: 2 x 12 bit input, 2 x 12 bit output
  - 04: 2 x 16 bit input 4 mA...20 mA, 2 x 16 bit output -10 V...+10 V
- **BM4 - F - AIO - 03 - YY** Version hardware (AIO-03 only)
  - 00: For BM4000 without Ethernet interface (BM44XX-XXX-XX2XX-03)
  - 01: For all BM4000 - with Ethernet interface, too (BM44XX-XXX-XXX3XX-03)

**NOTE!**
Please use in case of b maXX controller with Ethernet interface (type BM4XXX-XXX-XX3XX-03) only AIO-03 modules with type code BM4-F-AIO-03-01 and higher.

4.2.4 Danger areas BM4-F-AIO-XX for standard controller

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

The AIO-XX is mounted stationary 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 AIO-XX in ES controller

4.3.1 Position AIO-XX in ES controller

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

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AIO-02</td>
<td>AIO-03</td>
<td>AIO-04</td>
<td>AIO-01</td>
<td>Controller</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Combinations function modules/option modules

<table>
<thead>
<tr>
<th>Function modules</th>
<th>Option modules</th>
</tr>
</thead>
<tbody>
<tr>
<td>BM4-F-ENC-XX (encoder 1)</td>
<td>BM4-O-ECT-01 (EtherCAT slave) for controller</td>
</tr>
<tr>
<td>BM4-F-ENC-XX (encoder 2)</td>
<td>BM4-O-PLK-01 (POWERLINK Controlled Node) for controller</td>
</tr>
<tr>
<td>BM4-F-AIO-02/03/04 (analog I/O)</td>
<td>BM4-O-VAR-01 (VARAN slave) for controller</td>
</tr>
<tr>
<td>BM4-F-IEE-XX (incremental encoder emulation)</td>
<td>BM4-O-SER-XX (Sercos slave) for controller</td>
</tr>
<tr>
<td>BM4-F-IEE-XX (SSI encoder emulation)</td>
<td>BM4-O-PRO-XX (Profibus slave) for controller</td>
</tr>
<tr>
<td>BM4-F-IEE-XX (fast digital I/O)</td>
<td>BM4-O-CAN-03 (CANopen slave) for controller</td>
</tr>
<tr>
<td>BM4-F-DIO-XX (digital I/O)</td>
<td>BM4-O-CAN-01 (CANopen slave) for controller</td>
</tr>
<tr>
<td>BM4-F-FIO-XX (fast digital I/O)</td>
<td>BM4-O-PLC-XX (SPS) for controller</td>
</tr>
</tbody>
</table>

Stackkarten_ES_Rev02_e

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>-</td>
<td>-</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>-</td>
<td>o</td>
</tr>
<tr>
<td>B</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>o</td>
<td>o</td>
<td>o</td>
<td>X</td>
</tr>
<tr>
<td>C</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>o</td>
<td>o</td>
<td>0</td>
<td>X</td>
</tr>
<tr>
<td>D</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>E</td>
<td>-</td>
<td>-</td>
<td>F</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>F</td>
<td>Controller unit with RS232- or Ethernet interface</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>X</td>
<td>-</td>
</tr>
</tbody>
</table>
| H | - | - | - | - | - | - | X | X | X | X | X | X

X: preferred slot
F: permanently installed
o: possible slot, only the preferred slot is occupied
- not possible
4.3.2 Type plate AIO-XX in ES controller

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

4.3.3 Type code AIO-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).

A module AIO-01 is available in position E, always.

Only the shown section is valid for the AIO-02/03/04 in ES controller.

BM4XXX - XXX - XXXXX[Ryy] - [XXXXXX] - [XXX] - XX Device generation

BM4XXX - XXX - XXXXX[Ryy] - [XXX] - [XXX] - XX ES controller function module, position A
BM4XXX - XXX - XXXXX[Ryy] - [XXX] - [XXX] - XX ES controller function module, position B
BM4XXX - XXX - XXXXX[Ryy] - [XXX] - [XXX] - XX ES controller function module, position C
BM4XXX - XXX - XXXXX[Ryy] - [XXX] - [XXX] - XX ES controller function module, position D

O Analog IO (2 x IN, 2 x OUT), 16 bit see AIO-02
P Analog IO (2 x IN, 2 x OUT), 12 bit see AIO-03
Q Analog IO (2x input 16 bit, 4-20mA / see 2x output 16 bit) AIO-04

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 Analog IO module.
4.4 Display and operation elements
TRANSPORT AND PACKAGING

5.1 What to observe when transporting

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

**NOTE!**
The AIO-XX 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 AIO-XX, whether the right plug-in module is available.

![Figure 5: BM4-F-AIO-XX for standard controller](4000_0085_rev03_int.cdr)

- Determine the suitable slot
  (see Slots BM4-F-AIO-XX for standard controller on page 23).
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-AIO-XX 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-AIO-XX out of its transport packing. Avoid the contact with electronic parts of the plug-in module.
7 Plug the BM4-F-AIO-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-AIO-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-AIO-XX module with the Sub-D connector.
11 Put the design cover on the device again.

**NOTE**
If you, within the scope of a repair of the BM4-F-AIO-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-AIO-XX is completed.
6.2 Assembly
7 INSTALLATION

In this chapter we describe the electrical installation of the AIO-XX or BM4-F-AIO-XX. The mechanical mounting is described in Mounting from page 33 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. An 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 **Analog IO module**, it can be damaged/destroyed.

- Ensure that the electrical power connection parameters as specified in the technical data are adhered to and that the connections are made in accordance with the instructions.
- Avoid short circuit between input points and output points. In the event of a short circuit between input points and output points the **Analog IO module** may get destroyed.

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 Requirements for the connection cables

Following cables are authorized for use by Baumüller:
- Copper cable, screened with cross-section of min. 0,25 mm$^2$, screen connected on both sides

<table>
<thead>
<tr>
<th>Min. cross section</th>
<th>Type of connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>0,25 mm$^2$</td>
<td>Sub-D 9-pin female, metal or metallized</td>
</tr>
</tbody>
</table>
## 7.4 Connection diagrams

![Connection diagram Analog IO module](image)

**Figure 7:** Connection diagram Analog IO module

### Pin assignment

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Assignment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IN 1 +</td>
</tr>
<tr>
<td>2</td>
<td>IN 2 +</td>
</tr>
<tr>
<td>3</td>
<td>OUT 1 - , OUT 2 -</td>
</tr>
<tr>
<td>4</td>
<td>OUT 1 +</td>
</tr>
<tr>
<td>5</td>
<td>OUT 2 +</td>
</tr>
<tr>
<td>6</td>
<td>IN 1 -</td>
</tr>
<tr>
<td>7</td>
<td>IN 2 -</td>
</tr>
<tr>
<td>8</td>
<td>OUT 1 - , OUT 2 -</td>
</tr>
<tr>
<td>9</td>
<td>OUT 1 - , OUT 2 -</td>
</tr>
</tbody>
</table>
7.5 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.

The connection cable of the Analog IO module must be made by the user, refer to »Requirements for the connection cables« auf Seite 38.

2. Take off the cover from the controller unit (when necessary)
3. Connect the cable with the suitable connector of the Analog IO module (cable goes downwards)
4. Replace the cover again, if necessary
5. Laying of the cable in the control cabinet, refer to »Requirements on the electrical connection« auf Seite 38.
7.6 Internal circuit diagram

7.6.1 Internal circuit diagram of Analog-IO-Modules (BM4-F-)AIO-01/-02/-03

Figure 8: Internal circuit of Analog IO module (BM4-F-)AIO-01/-02/-03
7.6.2 Internal circuit diagram of Analog IO module (BM4-F-)AIO-04

Figure 9: Internal circuit diagram of Analog IO module (BM4-F-)AIO-04
COMMISSIONING/OPERATION

This commissioning assures, that the Analog IO module 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-AIO-XX is correctly mounted (standard controller only).
2. The Analog IO module is correctly mounted at the motor.
   - The analog IOs must be correctly cabled.
   - The connection must be suitable to the electrical specification of the Analog IO module.
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.
8.2 Procedure of the commissioning

8.2.1 Recognition of the Analog IO module

While starting, the control unit reads the identification of the Analog IO module automatically.

After that, check with the help of ProDrive, whether the Analog IO module has been correctly recognized:

1. Switch on the b maXX BM4000
2. Wait till the system has started

Eliminate any errors / error messages eventually existing in the b maXX BM4000. These errors might have been caused by faulty assembly (e.g. defective cable) or some mistake(s) in installation (e.g. supply voltage absent). Only after having corrected the errors the commissioning can be continued.

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!
3. Open with ProDrive the window "Diagnosis".

Figure 10: ProDrive navigation
4 Choose submenu „Service”
   This window shows the position/slot of the recognized Analog IO module.
   If the Analog IO module is available in position/slot D, then the following is displayed:
   „Slot D Analog IO 16 Bit Version X”.
   „X” shows the version of the module.

Always available with the ES controller is the module AIO-01 (position E), a further AIO-02/03/04 can be used additionally.

5 Decide on the basis of the display:

   Figure 11: ProDrive Service

   - If the Analog IO module 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 Analog IO module 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 Analog IO module 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.
6 Icon „ProDrive Navigation“

7 Configuration / submenu „IO analog inputs“

![Figure 12: ProDrive navigation, submenu „IO analog inputs“](image)

8 The submenu contains „Analog input link 1 and 2“
e.g. choose „Analog input link 1“

The window „Analog input link 1“ is opened. The inputs can be selected in the center of the window.
9 Choose „Input D.1“ in drop down list if the **Analog IO module** is used in position/slot D.

10 Check whether the text: „**module not existent**“ is displayed directly under the scale. In this case, the module was not recognized.

- Only if there is no message under the scale, the **AIO-XX** or **BM4-F-AIO-XX** is recognized properly and can be used.
- If the **AIO-XX** or **BM4-F-AIO-XX** is not recognized, then switch off the device and check the assembly/installation. After having removed all errors, restart the device for checking whether the plug-in module gets recognized properly now.
- If the **Analog IO module** is not recognized yet, then it is defective or the controller/controller slot. In that case, contact Baumüller Nürnberg GmbH for replacement.
- Once the **Analog IO module** has been recognized properly following with "**Testing of the Analog IO module**" from page 49.
8.2.2 Testing of the Analog IO module

Once the plug-in module has been recognized properly, then it can be checked whether the input and outputs are working correctly using ProDrive.

Pre-conditions

- Basic unit b maXX BM4000 has been commissioned,
- BM4-F-AIO-XX has been plugged in or AIO-XX is available (ES controller).
- Analog connections are available/connected and ready for use (pin assignment see Connection diagrams on page 39), in addition:
  - AIO-01, AIO-02, AIO-03
    Voltage range of +/−10 V<sub>DC</sub> can be set by a potentiometer.
  - AIO-04
    Current range of 0 ... 20 mA can be set by a current calibrator

- Motor for speed set (clockwise or counter-clockwise) has been connected; shaft ends are rotating freely.
- ProDrive Navigation „Diagnosis“, submenu „Service“.
- Check in the menu „Service“, whether the Analog-IO-Module has been correctly recognized, e.g. in the line for the slot D

NOTICE!

Notice electrostatic discharge

The BM4-F-AIO-XX or the b maXX BM4000 may get damaged if the module is plugged or pulled out when the b maXX BM4000 is energized.

If the plug-in module has still to be pulled out from the b maXX BM4000 due to an external action, switch off the b maXX BM4000.

Try then to push in the Analog IO module again as described in the chapter Mounting from page 33 and Installation from page 37.

Restart the b maXX BM4000 again and check for errors/error messages.
8.2 Procedure of the commissioning

8.2.2.1 Testing of inputs AIO-01, -02 and -03

1. ProDrive Navigation „IO analog inputs“.
2. Select „Analog input link 1“ in ProDrive.

![Analog input link 1, AIO-01, -02 and -03](image)

3. By clicking on the \(\text{-}\)-symbol, select the entry „Input D.1“ (\(\text{D} \Rightarrow\) module in position D, \(\text{1} \Rightarrow\) input 1) from the drop-down list.

![Input selection AIO-01, -02 and -03](image)

4. Enter in menu „analog input link 1“:
   - **Target parameter number**: „1171“, (ramp function generator input)
   - **Smoothing time**: „10 ms“,
   - **Scaling factor**: „1“,
   - **Offset**: „0“,
   - **Threshold**: „0“,

   A scale is displayed and shows the applied voltage (set by the potentiometer), e. g. +10 V.
5  Check the display in „Analog input link 1“. The RPM of the motor can be regulated now by potentiometer for instance within limits -10 V and +10 V (clockwise and counter-clockwise running).

NOTE!
If for example, the scale shows 0 V, even though there is an analog voltage applied on input 1 (see pin assignment on page 39), then the input is defective. When changing the analog input voltage, the relevant value of the voltage must be displayed on the scale.

6  Repeat the above steps for the input 2.

8.2.2.2 Testing of inputs AIO-04

1  ProDrive Navigation „IO analog inputs“.
2  Select „Analog input link 1“ in ProDrive.

Figure 17: Analog input link 1, AIO-04
3 By clicking on the \(\downarrow\)-symbol, select the entry „Input E.1“ („E“ \(\Rightarrow\) module in position E, „1“ \(\Rightarrow\) input 1) from the drop-down list.

![Input selection AIO-04](image)

Figure 18: Input selection AIO-04

4 Enter in menu „Analog input link 1“:
   - Target parameter number: „1171“, (ramp function generator input)
   - Smoothing time: „10 ms“,
   - Scaling factor: „1“,
   - Offset: „0“,
   - Threshold: „0“,

A scale is displayed and shows the applied current (set by the current calibrator), e. g. +12 mA.

5 Check the display in „Analog input link 1“.
   The RPM of the motor can be regulated now by the current calibrator.

**NOTE!**

If for example, the scale shows 0 mA, even though there is a current applied on input 1 (see pin assignment [Connection diagrams](#) on page 39), then the input is defective. When changing the applied current, the relevant value of the current must be displayed on the scale.

6 Repeat the above steps for the input 2.
8.2.2.3 Testing of outputs

Note the Pre-conditions on page 49.

1 Select in ProDrive „IO analog outputs“

2 Select submenu „Analog output link 1“.
3 By clicking on the ▼-symbol, select the entry „Output D.1“ (“D” ⇒ Analog IO module in position D, „1“ ⇒ output 1) from the drop-down list.

Figure 21: Output selection

4 Enter in menu Analog output link 1:
   • Source parameter: „1171“,  
   • Offset: „0 dig“,  
   • Shift factor: „0“,  
   • Scaling factor: „1638 Dig/V“.

The voltage at the output point D.1 (see pin-assignment, Connection diagrams on page 39) can be measured now by using the suitable measuring instrument. If +10 V has been applied at the input D.1, then there will also be an output voltage of +10 V at the analog output.

NOTE!
If no voltage can be measured at the output 1 (see pin assignment Connection diagrams on page 39), even though the voltage is changed at the input 1, then either the Analog-IO-Module or the controller/controller unit is defective.

5 Repeat the test for output 2
With that, testing of the Analog-IO-Module is complete.
8.2.3 Offset adjustment of an analog input channel

Pre-conditions
Basic unit b maXX BM4000 commissioning completed,
Analog IO module available.

8.2.3.1 Offset adjustment of AIO-01, -02, -03

Required accessory
- Voltmeter
- Voltage source (e.g. 9V monobloc battery)
  with Sub-D connector (9 pin) for analog inputs 1 and 2 and connection for the voltmeter
- Sub-D connector (9 pin) with inputs 1 and 2 short-circuited
  (Pin assignment see Connection diagrams on page 39)
- Computer with ProDrive

NOTE!
All settings must be done when controller state is disabled.

Offset adjustment within the analog input link

Set 16 Bit application parameter as target for the analog input link.
Example: Target parameter = P3333

Read the value in ProDrive while input is short-circuited.
Example: -179 increments

Offset adjustment: \[
\frac{\text{read value} \cdot (\frac{-100}{32767})}{32767}
\]

Example offset adjustment = \[
\frac{-179 \cdot (\frac{-100}{32767})}{32767} = 0.546
\]

⇒ value to be set: 0.55 %.
Gain adjustment within the analog input link

Connection and measurement of a reference voltage (e.g. 9V monobloc battery)
Measured voltage (voltmeter): 9,235 V
Read value in ProDrive: 29295
Conversion of read value into voltage: \[ \frac{\text{read value} \cdot 10 \ V}{32767} \]
\[ = \frac{29295 \cdot 10 \ V}{32767} = 8.940 \ V \]

Gain to be set
\[ = \frac{\text{connected (measured) voltage}}{\text{read voltage}} = \frac{9.235 \ V}{8.940 \ V} = 1.033 \]
\[ = 1.03 \]

Check
Input short-circuited ⇒ No. of increments < 20

Connect voltage supply
Convert connected voltage to increments:

No. of increments
\[ = \frac{32767 \cdot \text{connected (measured) voltage}}{10 \ V} = \frac{32767 \cdot 9.235 \ V}{10 \ V} = 30260 \]

The adjustment of an analog input channel of the AIO-01, AIO-02 and AIO-03 is completed now.
8.2.3.2 Offset adjustment AIO-04

Required accessory
- Current calibrator
- Computer with ProDrive
- Amperemeter

NOTE!
All settings must be done when controller state is disabled.

Offset adjustment within the analog input link

Set 16 Bit application parameter as target for the analog input link.
Example: Target parameter = P3333

Read the value in ProDrive while input is open (0 mA).
Example: -179 increments

Offset adjustment: \[
\text{offset adjustment} = \frac{\text{read value} \cdot (-100)}{65534}
\]

Example offset adjustment = \[
\frac{-179 \cdot (-100)}{65534} = 0.273
\]

⇒ value to be set: 0.273 %.

Gain adjustment within the analog input link

Connection 10 mA
Measured current (amperemeter): 10.000 mA
Read value in ProDrive: 32900
Conversion of read value into current: \[
\text{Gain to be set} = \frac{\text{connected (measured) voltage}}{\text{read voltage}} = \frac{9,235 \text{ V}}{8,940 \text{ V}} = 0.996
\]

\[
= 0.996
\]
8.3 Operation

Setting of parameters determines the reaction of the **Analog IO module** during operation. These parameters are set by the software ProDrive.

The procedure for “Analog input Link 1” is described below via an example. The procedure for “Analog output Link 2” and the analog outputs is similar.

1. Start ProDrive
2. Click „ProDrive Navigation“
3. Click on + „IO analog inputs“ (path: Device/configuration/IO analog inputs)

4. Click on „Analog input link 1“
5. Now open the menu „Analog input 1“ with the data for one of the analog inputs. In the icon bar the parameter list button can be found.
6 Click on for opening the parameter list.

7 Click on the + -symbol before “Configuration IO analog” in the window „Parameter-list“. The corresponding parameters of the Analog IO module are displayed.

Figure 23: Configuration, parameter list

NOTE!
The error parameters of the Analog-IO-Modules can be found in the chapter Error messages from page 69.
8.3 Operation
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

Refer to Instruction handbook b maXX 4000, 5.12008.

9.4 Repairs

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
Internet: www.baumueller.de
10 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 by displaying „F“ 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:

```
F 1 2 5  F 0 9 1  F 1 2 5
```

Figure 24: Error messages 7-segment display
Operating software ProDrive

Furthermore the error message is shown in the operating software:

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

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

Display the „error message“ in ProDrive:

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

Figure 25: ProDrive navigation
10.2 Fault detection

Select „Drive management“

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

![Figure 26: Drive manager ProDrive](image)

**NOTE**

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

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

If no LEDs are lighting up on the front side of the device, check the 24V supply.
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 are errors, which have to have an immediate pulse inhibit as a consequence. These can not be changed due to safety reasons.
### 10.3 Error handling

#### 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, 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.

![ProDrive Drive manager](image)

- **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“ 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

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

Figure 28: Survey error list
10.3 Error handling

1st level

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

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

2nd level

Order of the error messages see survey (Abbildung 28 auf Seite 69).

3rd level

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

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.

2nd level error messages

P0204 Error in function or option modules

<table>
<thead>
<tr>
<th>Error No.</th>
<th>Meaning</th>
<th>Reaction</th>
<th>Troubleshooting</th>
</tr>
</thead>
<tbody>
<tr>
<td>48</td>
<td>Error in function module A</td>
<td>3rd level error</td>
<td>see Error in function module A to E on page 71 (= 3rd level)</td>
</tr>
<tr>
<td>49</td>
<td>Error in function module B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>Error in function module C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>Error in function module D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>52</td>
<td>Error in function module E</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3rd level error messages

NOTE!
3rd level errors are only displayed in ProDrive separated by a decimal point from the corresponding 2nd level error (refer to Abbildung 28 auf Seite 69).
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)

P0240 to P0244 Error in function module A to E

<table>
<thead>
<tr>
<th>Error No.</th>
<th>Meaning</th>
<th>Reaction</th>
<th>Troubleshooting</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>reserved error</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Module not identified</td>
<td>no reaction</td>
<td>Check if the right module is plugged at the right position</td>
</tr>
<tr>
<td>2</td>
<td>Identified module is not permitted at this position</td>
<td>no reaction</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Digital output short-circuited or 24V supply not connected to the DIO module</td>
<td>no reaction</td>
<td>Check the cabling of the digital outputs</td>
</tr>
<tr>
<td>4</td>
<td>Invalid target parameter value caused by digital input</td>
<td>no reaction</td>
<td>Check the parameterization of the input channel</td>
</tr>
<tr>
<td>5</td>
<td>Direct PLC-IO access for this module not permitted</td>
<td>no reaction</td>
<td>Don’t select the module</td>
</tr>
<tr>
<td>6</td>
<td>Required module is missing, only for BM4100 active mains rectifier unit</td>
<td>Pulse stop</td>
<td>Connect the required module for operation with active mains rectifier - see operation handbook b maXX BM4100 active mains rectifier unit</td>
</tr>
<tr>
<td>7</td>
<td>Module must not be used for actual active mains rectifier unit mode or controller mode</td>
<td>no reaction</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Reserved</td>
<td>no reaction</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Too much Analog-IO-Modules connected</td>
<td>no reaction</td>
<td>More than 2 analog modules are not allowed</td>
</tr>
<tr>
<td>10</td>
<td>AIO-04: current &lt; 4 mA</td>
<td>no reaction</td>
<td>Current source not connected, disconnection or short-circuit</td>
</tr>
<tr>
<td>11</td>
<td>AIO-04: current &gt; 20 mA</td>
<td>no reaction</td>
<td>Current source impress too much current</td>
</tr>
</tbody>
</table>
10.3 Error handling
11 DISPOSAL

11.1 Safety notes

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.

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.
11.2 Disposal facilities/authorities

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.

11.2 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
EG - Declaration of Conformity

Doc.-No: 5.12050.00
Date: 25-Sep-2012

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

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

declares that the product:

Name: b maXX
Type: Analog IO module b maXX BM4000
BM4-F-AIO-01, BM4-F-AIO-02, BM4-F-AIO-03, BM4-F-AIO-04

From manufacturing date: 1-Oct-2012

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

Applied harmonized standards:

<table>
<thead>
<tr>
<th>Standard</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIN EN 62061:2010-05</td>
<td>Safety of Machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems</td>
</tr>
<tr>
<td>DIN EN 61800-5-1:2008-04</td>
<td>Variable-speed electrical power drives- Part 5-1: Safety requirements - Electrical, thermal and energy</td>
</tr>
<tr>
<td>DIN EN 61800-5-2:2008-04</td>
<td>Variable-speed electrical power drives Part 5-2: Safety requirements - Functional</td>
</tr>
<tr>
<td>DIN EN 61800-3:2005-07</td>
<td>Variable-speed electrical power drives Part 3: EMC-requirements and specific test methods</td>
</tr>
</tbody>
</table>

The listed devices cannot be operated without a basic controller unit. The compliance to the guidelines require a correct assembly of the products and the careful attention of the associated instruction handbooks of BM4000 and of BM4-F-AIO-XX Analog-IO-Module.

The compliance to the above mentioned guidelines are checked on the basis of typical BM4000 controller configurations.

Nürnberg / 25-Sep-2012
Place / Date

The content of the Declaration of Conformity is subject to change. The current version can be obtained on request.
Table of figures

<table>
<thead>
<tr>
<th>Table of figures</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>b maXX BM4000)</strong></td>
<td>21</td>
</tr>
<tr>
<td>Analog IO module for standard controller</td>
<td>23</td>
</tr>
<tr>
<td>Type plate <strong>BM4-F-AIO-XX</strong> for standard controller</td>
<td>25</td>
</tr>
<tr>
<td>AIO-XX for ES controller</td>
<td>27</td>
</tr>
<tr>
<td><strong>BM4-F-AIO-XX</strong> for standard controller</td>
<td>29</td>
</tr>
<tr>
<td>Mounting</td>
<td>33</td>
</tr>
<tr>
<td>Connection diagram Analog IO module</td>
<td>34</td>
</tr>
<tr>
<td>Internal circuit of Analog IO module (BM4-F-)AIO-01/-02/03</td>
<td>35</td>
</tr>
<tr>
<td>Internal circuit diagram of Analog IO module (BM4-F-)AIO-04</td>
<td>36</td>
</tr>
<tr>
<td>ProDrive navigation</td>
<td>37</td>
</tr>
<tr>
<td>ProDrive Service</td>
<td>38</td>
</tr>
<tr>
<td>ProDrive navigation, submenu „IO analog inputs“</td>
<td>39</td>
</tr>
<tr>
<td>Analog input link 1</td>
<td>40</td>
</tr>
<tr>
<td>Module not existent</td>
<td>40</td>
</tr>
<tr>
<td>Analog input link 1, AIO-01, -02 and -03</td>
<td>40</td>
</tr>
<tr>
<td>Input selection AIO-01, -02 and -03</td>
<td>40</td>
</tr>
<tr>
<td>Analog input link 1, AIO-04</td>
<td>41</td>
</tr>
<tr>
<td>Input selection AIO-04</td>
<td>41</td>
</tr>
<tr>
<td>Analog output link</td>
<td>42</td>
</tr>
<tr>
<td>Menu Analog output link 1</td>
<td>42</td>
</tr>
<tr>
<td>Output selection</td>
<td>42</td>
</tr>
<tr>
<td>ProDrive Navigation</td>
<td>43</td>
</tr>
<tr>
<td>Configuration, parameter list</td>
<td>44</td>
</tr>
<tr>
<td>Error messages 7-segment display</td>
<td>45</td>
</tr>
<tr>
<td>ProDrive navigation</td>
<td>46</td>
</tr>
<tr>
<td>Drive manager ProDrive</td>
<td>47</td>
</tr>
<tr>
<td>ProDrive Drive manager</td>
<td>48</td>
</tr>
<tr>
<td>Survey error list</td>
<td>49</td>
</tr>
</tbody>
</table>

**Note:** The table continues with more entries not visible in the image provided.
## Index

<table>
<thead>
<tr>
<th>A</th>
<th>Accidents</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Assembly</td>
<td>34</td>
</tr>
<tr>
<td>C</td>
<td>Caution</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Connecting cables, requirements</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>Customer service</td>
<td>8</td>
</tr>
<tr>
<td>D</td>
<td>Danger</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Danger areas</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>DC link discharge time</td>
<td>14, 73</td>
</tr>
<tr>
<td></td>
<td>Design cover</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>Diagnosis</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>Discharge, electrostatic</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>Disposal</td>
<td>8, 73</td>
</tr>
<tr>
<td></td>
<td>Drive management</td>
<td>66</td>
</tr>
<tr>
<td>E</td>
<td>Electrical connection, requirements</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>Electrical current, dangers of</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Error handling</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td>Error messages</td>
<td>69</td>
</tr>
<tr>
<td></td>
<td>Error reset</td>
<td>68</td>
</tr>
<tr>
<td></td>
<td>ES controller</td>
<td>21</td>
</tr>
<tr>
<td>F</td>
<td>Fault correction</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>Fault detection</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>Fire fighting</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Function modules</td>
<td>23</td>
</tr>
<tr>
<td>G</td>
<td>Guarantee provisions</td>
<td>8</td>
</tr>
<tr>
<td>H</td>
<td>Hazardous situations</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Hazards, special</td>
<td>14</td>
</tr>
<tr>
<td>I</td>
<td>Initial commissioning</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>Inspection</td>
<td>62</td>
</tr>
<tr>
<td></td>
<td>Inspection intervals</td>
<td>62</td>
</tr>
<tr>
<td></td>
<td>Installation</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>Installation, procedure</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Internal circuit diagram</td>
<td>41, 42</td>
</tr>
<tr>
<td>K</td>
<td>Key to symbols</td>
<td>6</td>
</tr>
<tr>
<td>L</td>
<td>LED H2</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>LED H4</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>Limitation of liability</td>
<td>7</td>
</tr>
<tr>
<td>M</td>
<td>Maintenance</td>
<td>61</td>
</tr>
<tr>
<td></td>
<td>Malfunctions, behavior</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>Modifications</td>
<td>11</td>
</tr>
<tr>
<td>N</td>
<td>Note</td>
<td>6</td>
</tr>
<tr>
<td>O</td>
<td>Operating instructions, contents</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Operating personnel</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Operation</td>
<td>43</td>
</tr>
<tr>
<td></td>
<td>Option modules</td>
<td>23</td>
</tr>
<tr>
<td>P</td>
<td>Packaging, disposal of</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>Parameter list</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>Parameterization</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>Personnel, qualified</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Personnel, training</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Pin assignment</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>Procedure of commissioning</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>ProDrive</td>
<td>49, 58, 66</td>
</tr>
<tr>
<td>R</td>
<td>Recognition of Analog IO module</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>Repairs</td>
<td>62</td>
</tr>
<tr>
<td></td>
<td>Residual energy, danger from</td>
<td>14</td>
</tr>
<tr>
<td>S</td>
<td>Safety equipment</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Scale</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>Spare parts</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Standard controller</td>
<td>21</td>
</tr>
</tbody>
</table>
## Index

### T
- Technical data
- Temperature range
- Testing of inputs
- Transport inspection
- Troubleshooting
- Twist lock
- Type code
  - ES controller
  - Standard controller
- Type of plug-in module
- Type plate
  - ES controller
  - Standard controller

### U
- Unpacking
- Use, compliant with indented purpose

### W
- Warning
- Warning notes
## Overview of Revisions

<table>
<thead>
<tr>
<th>Version</th>
<th>Status</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.01045.06</td>
<td>25.09.2012</td>
<td>Revision because of AIO-04, new design</td>
</tr>
<tr>
<td>5.01045.07</td>
<td>13.03.2014</td>
<td>Revision ES controller, troubleshooting</td>
</tr>
<tr>
<td>5.01045.08</td>
<td>12.12.2014</td>
<td>Troubleshooting</td>
</tr>
</tbody>
</table>
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