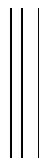**BAUMÜLLER**
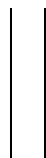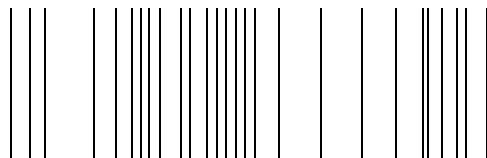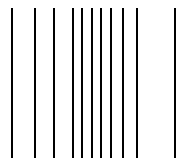
be in motion   be in motion

BM4-O-IEI-01

Option Module IEI for b maXX drive PLC

Operating Instructions

| E | 5.02013.02 |

BAUMÜLLER

Title	Operating Instructions
Product	Option Module IEI for b maXX drive PLC BM4-O-IEI-01
Last Revision	March 27, 2007
Art. no.	372044
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Binding nature	These Operating Instructions are a part of the unit/machine. These Operating Instructions must always be available to operators and be legible. If the unit/machine is sold, the owner must pass on these Operating Instructions together with the unit/machine. After selling the unit/machine you must pass on this original and all the copies that you made to the purchaser. After disposing of the machine in any way, you must destroy this original and all the copies that you made. When you pass on these Operating Instructions, all earlier revisions of the corresponding Operating Instructions are invalidated. Note that all the data/numbers/information that are quoted are **current values at the time of printing.** This information is **not legally binding** for dimensioning, calculation and costing. Within the scope of further-development of our products, Baumüller Nürnberg GmbH reserve the right to change their technical data and handling. We cannot guarantee these Operating Instructions are completely error-free unless this is expressly indicated in our General Conditions of Business and Delivery.
Manufacturer	Baumüller Nürnberg GmbH Ostendstr. 80 - 90 90482 Nuremberg Germany Tel. +49 9 11 54 32 - 0 Fax: +49 9 11 54 32 - 1 30 www.baumueller.de

1

INTRODUCTION

These operating instructions are an important component of your b maXX 4400; this means that you must thoroughly read this document, not least to ensure your own safety.

In this chapter, we will describe the first steps that you should carry out after getting this module. We will define terms that are used in this documentation on a consistent basis and will inform you about the topics that you must consider when using this module.

1.1   First Steps

- ◗ Check the shipment see ▷Packaging and transportation ◁ from page 15 onward.
- ◗ Pass on all the documentation that was supplied with the plug-in module to the appropriate departments in your company.
- ◗ Deploy suitable personnel for assembly and commissioning.
- ◗ Pass on these operating instructions to this personnel and ensure that they have read and understood the safety instructions and that they are following them.

1.2   Terms Used

The abbreviation IEI stands for **I**ncremental **E**ncoder **I**nterface).

In this documentation, we will also refer to Baumüller's "BM4-O-IEI-01" product as "module", "plug-in module", "IEI option module", "IEI" or "incremental encoder interface".

We will also refer to the "BM4-O-PLC-01" Baumüller product as "b maXX drive PLC" or "BM4-O-PLC" and we will use the term "b maXX" for the "b maXX 4400 basic unit".

For a list of the abbreviations that are used, refer to ▷Abbreviations ◁ from page 75 onward.

Operating Instructions Option Module IEI for b maXX drive PLC BM4-O-IEI-01

Document No.: 5.02013.02

Baumüller Nürnberg GmbH

BASIC SAFETY INSTRUCTIONS

We have designed and manufactured each Baumüller plug-in module in accordance with the strictest safety regulations. Despite this, working with the plug-in module can be dangerous for you.

In this chapter, we will describe the risks that can occur when working with a Baumüller plug-in module. Risks are illustrated by icons. All the symbols that are used in this documentation are listed and explained.

In this chapter, we cannot explain how you can protect yourself from specific risks in individual cases. This chapter contains only general protective measures. We will go into concrete protective measures in subsequent chapters directly after information about the individual risk.

2.1 Hazard information and instructions

WARNING

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

- serious personal injury   • death

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

Always observe the hazard information given in this documentation.

Hazards are always divided into three danger classifications. Each danger classification is identified by one of the following words:

DANGER

- Considerable damage to property   • Serious personal injury   • Death **will** occur

WARNING

- Considerable damage to property   • Serious personal injury   • Death **can** occur

CAUTION

- Damage to property • Slight to medium personal injury **can** occur

2.1.1 Structure of hazard information

The following two examples show how hazard information is structured in principle. A triangle is used to warn you about danger to living things. If there is no triangle, the hazard information refers exclusively to damage to property.
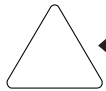
A triangle indicates that there is danger to living things.
The color of the border shows how severe the hazard is: the darker the color, the more severe the hazard is.

The icon in the rectangle represents the hazard.
The color of the border shows how severe the hazard is: the darker the color, the more severe the hazard is.

The icon in the circle represents an instruction. Users must follow this instruction.
(The circle is shown dashed, since an instruction is not available as an icon for each hazard advisory).

The circle shows that there is a risk of damage to property.

The icon in the rectangle represents the hazard.
The color of the border shows how severe the hazard is: the darker the color, the more severe the hazard is. (The rectangle is shown dashed, since the danger is not represented as an icon with every hazard advisory)

The text next to the icons is structured as follows:

THE SIGNAL WORD IS HERE THAT SHOWS THE DEGREE OF RISK

Here we indicate whether one or more of the results below occurs if you do not observe this warning.

- Here, we describe the possible results. The worst result is always at the extreme right.

Here, we describe the hazard.

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

2.1.2 Hazard advisories that are used

If a signal word is preceded by one of the following danger signs: ⚠ or ⚠ or ⚠ , the safety information refers to injury to people.

If a signal word is preceded by a round danger sign: ⓘ , the safety information refers to damage to property.

2.1.2.1 Hazard advisories about injuries to people

To be able to differentiate visually, we use a separate border for each class of hazard information with the triangular and rectangular pictograms.

For danger classification **DANGER,** we use the ⚠ danger sign. The following hazard information of this danger classification is used in this documentation.

DANGER

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

- serious personal injury   • death

*Danger from: **electricity.** The hazard may be described in more detail here.*

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

DANGER

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

- serious personal injury   • death

*Danger from: **mechanical effects.** The hazard may be described in more detail here.*

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

For danger classification **WARNING,** we use the ⚠ danger sign. The following hazard information of this danger classification is used in this documentation.

WARNING

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

- serious personal injury   • death

*Danger from: **electricity.**The hazard may be described in more detail here.*

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

For danger classification **CAUTION,** we use the ⚠ danger sign. The following hazard information of this danger classification is used in this documentation.

CAUTION

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

- minor to medium personal injury.

*Danger from: **sharp edges.** The hazard may be described in more detail here.*

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

CAUTION

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

- environmental pollution.

*Danger from: **incorrect disposal.** The hazard may be described in more detail here.*

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

2.1.2.2   Hazard advisories about damage to property

If a signal word is preceded by a round danger sign: ⓘ , the safety information refers to damage to property.

CAUTION

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

- property damage.

*Danger from: **electrostatic discharge.** The hazard may be described in more detail here.*

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

2.1.2.3   Instruction signs that are used

wear safety gloves

wear safety shoes

2.2 Information signs

NOTE

This indicates particularly important information.

2.3 Legal information

This documentation is intended for technically qualified personnel that has been specially trained and is completely familiar with all warnings and maintenance measures.

The equipment is manufactured to the state of the art and is safe in operation. It can be put into operation and function without problems if you ensure that the information in the documentation is complied with.

Operators are responsible for carrying out servicing and commissioning in accordance with the safety regulations, applicable standards and any and all other relevant national or local regulations with regard to cable rating and protection, grounding, isolators, over-current protection, etc.

Operators are legally responsible for any damage that occurs during assembly or connection.

2.4 Appropriate Use

You must always use the plug-in module appropriately. Some important information is listed below. The information below should give you an idea of what is meant by appropriate use of the plug-in module. The information below has no claim to being complete; always observe all the information that is given in these operating instructions.

- You must only install the plug-in module in series b maXX 4400 units.
- Configure the application such that the plug-in module is always operating within its specifications.
- Ensure that only qualified personnel works with this plug-in module.
- Mount the plug-in module only in the specified slot/slots.
- Install the plug-in module as specified in this documentation.
- Ensure that connections always comply with the stipulated specifications.
- Operate the plug-in module only when it is in technically perfect condition.
- Always operate the plug-in module in an environment that is specified in the technical data.
- Always operate the plug-in module in a standard condition.
  For safety reasons, you must not make any changes to the plug-in module.
- Observe all the information on this topic if you intend to store the plug-in module.

You will be using the plug-in module in an appropriate way if you observe all the comments and information in these operating instructions.

2.5   Inappropriate Use

Below, we will list some examples of inappropriate use. The information below should give you an idea of what is meant by inappropriate use of the plug-in module. We cannon, however, list all possible cases of inappropriate use here. Any and all applications in which you ignore the information in this documentation are inappropriate; particularly, in the following cases:

- You installed the plug-in module in units that are not Series b maXX 4400.
- You ignored information in these operating instructions.
- You did not use the plug-in module as intended.
  - You handled the plug-in module as follows
    - you mounted it incorrectly,
    - you connected it incorrectly,
    - you commissioned it incorrectly,
    - you operated it incorrectly,
    - you allowed non-qualified or insufficiently qualified personnel to mount the module, commission it and operate it,
    - you overloaded it,
      - You operated the module
        - with defective safety devices,
        - with incorrectly mounted guards or without guards at all,
        - with non-functional safety devices and guards
        - outside the specified environmental operating conditions
- You modified the plug-in module without written permission from Baumüller Nürnberg GmbH.
- You ignored the maintenance instructions in the component descriptions.
- You incorrectly combined the plug-in module with third-party products.
- You combined the drive system with faulty and/or incorrectly documented third-party products.
- Your self-written PLC software contains programming errors that lead to a malfunction.

Version 1.1 of Baumüller Nürnberg GmbH's General Conditions of Sale and Conditions of Delivery dated 2/15/02 or the respective latest version applies in all cases. These will have been available to you since the conclusion of the contract at the latest.

2.6   Protective equipment

In transit, the plug-in modules are protected by their packaging. Do not remove the plug-in module from its packaging until just before you intend to mount it.

The cover on the b maXX units' controller sections provides IP20 protection to the plug-in modules from dirt and damage due to static discharges from contact. This means that you must replace the cover after successfully mounting the plug-in module.

2.7 Personnel training

WARNING

The following **may occur**, if you do not observe this warning information:
- serious personal injury   • death

Only qualified personnel are allowed to mount, install, operate and maintain equipment made by Baumüller Nürnberg GmbH.

Qualified personnel (specialists) are defined as follows:

Qualified Personnel   Electrical engineers and electricians of the customer or of third parties who are authorized by Baumüller Nürnberg GmbH and who have been trained in installing and commissioning Baumüller drive systems and who are authorized to commission, ground and mark circuits and equipment in accordance with recognized safety standards.

Qualified personnel has been trained or instructed in accordance with recognized safety standards in the care and use of appropriate safety equipment.

Requirements of the operating staff   The drive system may only be operated by persons who have been trained and are authorized.

Only trained personnel are allowed to eliminate disturbances, carry out preventive maintenance, cleaning, maintenance and to replace parts. These persons must be familiar with the Operating Instructions and act in accordance with them.

Commissioning and instruction must only be carried out by qualified personnel.

2.8 Safety measures in normal operation

- At the unit's place of installation, observe the applicable safety regulations for the plant in which this unit is installed.
- Provide the unit with additional monitoring and protective equipment if the safety regulations demand this.
- Observe the safety measures for the unit in which the plug-in module is installed.

2.9 Responsibility and liability

To be able to work with this incremental encoder interface in accordance with the safety requirements, you must be familiar with and observe the hazard information and safety instructions in this documentation.

2.9.1 Observing the hazard information and safety instructions

In these operating instructions, we use visually consistent safety instructions that are intended to prevent injury to people or damage to property.

WARNING

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

- serious personal injury   • death

Any and all persons who work on and with Series b maXX units must always have available these Operating Instructions and must observe the instructions and information they contain – this applies in particular to the safety instructions.

Apart from this, any and all persons who work on this unit must be familiar with and observe all the rules and regulations that apply at the place of use.

2.9.2 Danger arising from using this module

The incremental encoder interface has been developed and manufactured to the state of the art and complies with applicable guidelines and standards. It is still possible that hazards can arise during use. For an overview of possible hazards, refer to the chapter entitled ▷Basic Safety Instructions ◁ from page 7 onward and to ▷Figure 3 on page 19.
We will also warn you of acute hazards at the appropriate locations in this documentation.

2.9.3 Warranty and Liability

All the information in this documentation is non-binding customer information; it is subject to ongoing further development and is updated on a continuous basis by our permanent change management system.

Warranty and liability claims against Baumüller Nürnberg GmbH are excluded; this applies in particular if one or more of the causes listed in ▷Inappropriate Use ◁ from page 12 onward or below caused the fault:

- Disaster due to the influence of foreign bodies or force majeure.

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of 90

Operating Instructions Option Module IEI for b maXX drive PLC BM4-O-IEI-01
Document No.: 5.02013.02   Baumüller Nürnberg GmbH

PACKAGING AND TRANSPORTATION

We package every Baumüller plug-in module before shipping such that it is highly unlikely that it will be damaged in transit.

3.1 Transportation

The plug-in modules are packed at the factory in accordance with the order.

○ Avoid vibrations during transportation and hard jolts.(Max. 1 *g*).

○ Avoid static discharges to the plug-in modules' electronic components.

○ Do not remove the plug-in module from its protective packaging until just before you intend to mount it.

3.2 Unpacking

After receiving the plug-in module while it is still packaged:

○ Check whether there is visible damage to the packaging!

If there is:

○ Complain to the delivery company. Have your complaint confirmed in writing and immediately contact your nearest Baumüller Nürnberg GmbH subsidiary.

CAUTION

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

- property damage.

*Danger from: **elecrostatic discharge**. If you touch the plug-in module, and especially its electronic components, and subject them to electrostatic discharges, the module can be damaged or even totally destroyed.*

When handling the plug-in module, always observe the regulations and information on handling electrostaticaly sensitive components.

If no damage is visible:

◘ Open the module's packaging.

◘ Check the scope of supply against the delivery note.

The scope of supply is:

● **BM4-O-IEI-01 (IEI option module for b maXX drive PLC)**

● these Operating Instructions including the declaration of conformity/manufacturer declaration

● additional material

◘ return the module to its packaging for transportation.

◘ complain to your local Baumüller subsidiary if you find damage or if the delivery is not complete.

3.3   Disposing of the packaging

The packaging consists of cardboard and plastic.

◘ Observe local disposal regulations if you intend to dispose of the packaging.

3.4   Observe during transportation

The module was packaged at the manufacturer's plant for initial transportation. If you have to transport the module at a later date, please note the following points:

◘ Use the original packaging material

or

◘ Use packaging that is suitable for electrostatic sensitive devices.

Ensure that the following conditions always apply during transportation:

● 2 K 3 (Climatic category)

● - 30 °C to + 70 °C (temperature range)

● Max. 1 *g* (Vibration, shock, repetitive shock)

4

DESCRIPTION OF THE IEI OPTION MODULE

In this chapter, we will describe the IEI option module and explain the type code on the plug-in module.

4.1   Structure
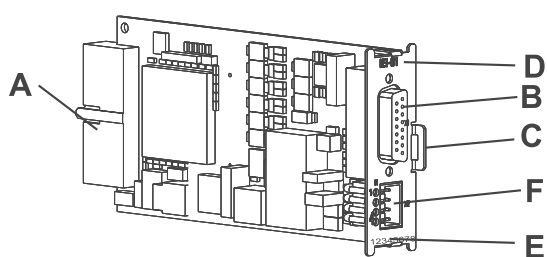
A = Plug connector (back-mounted)

B = 15-pin female Sub-D connector (front)

C = Grip

D = Short term

E = Type label

F = 8-pin plug-in connector

Figure 1:   BM4-O-IEI-01 option module

4.1.1 Slot for IEI option module

Slot **G** is provided for the IEI option module.
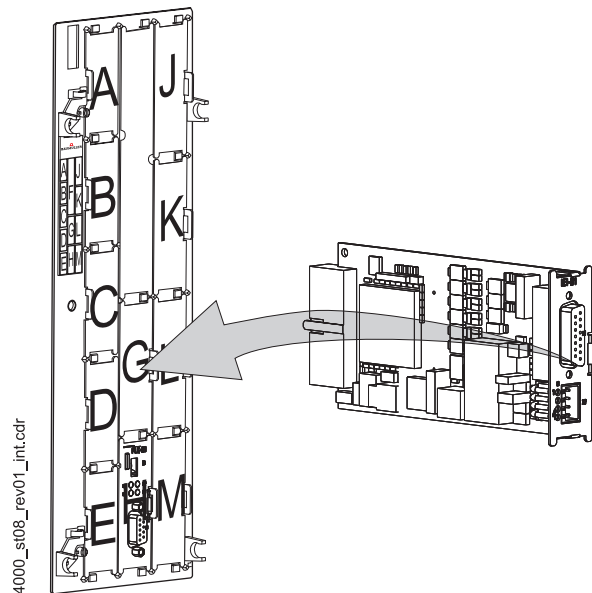
Figure 2:   Incremental encoder interface, slot G
             with b maXX drive PLC in slot H

NOTE

if you plug a plug-in module into an unsuitable slot, it does not function. We have taken measures to ensure that the plug-in module is not damaged if you do this.

4.2 Danger zones

The b maXX 4400 basic unit that is plugged into this module represents the greates hazard. Observe all the safety instructions of the b maXX 4400 basic unit. The illustration below gives you an overview of the danger zones in the plug-in module.
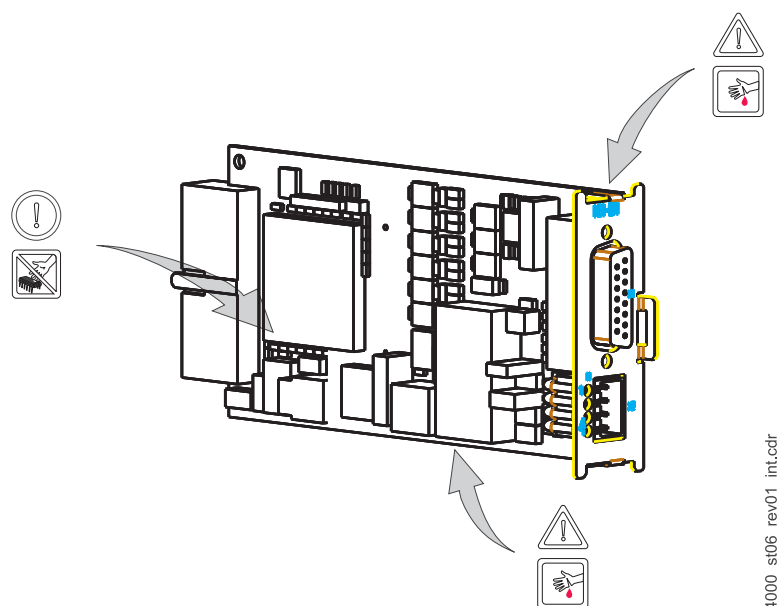
Figure 3: Danger zones

4.3 Labeling of the IEI option module type code

On the front panel, you will find the type code ("E" in ▷Figure 1 on page 17) of the plug-in module.

NOTE

This type code applies only to the IEI option module of series b maXX 4400. Other plug-in modules have their own type codes.

<u>BM4</u> - O - IEI - XX - YY - ZZ	Device generation in which you can install the plug-in module
BM4 - <u>O</u> - IEI - XX - YY - ZZ	Option module
BM4 - O - <u>IEI</u> - XX - YY - ZZ	Plug-in module type (b maXX IEI)
BM4 - O - IEI - <u>XX</u> - YY - ZZ	Version module
	01: Standard version
BM4 - O - IEI - XX - <u>YY</u> - ZZ	Version hardware
	00: Standard version
BM4 - O - IEI - XX - YY - <u>ZZ</u>	Version software
	00: Standard version

This type code is located on the type label on the front of the front panel. The type code contains the plug-in module's basic data. For a list of all the technical data, refer to Appendix D ▷Technical Data ◁ from page 83 onward.

ASSEMBLY AND INSTALLATION

In this chapter, we will describe mechanical assembly and electrical installation of the IEI option module.

Assembly/installation consists of the following steps:

1 Mount the plug-in module.

2 Connect the plug-in module to the signal cables.

5.1 General safety regulations

○ Observe the information in chapters ▷Basic Safety Instructions ◁ from page 7 onward.

○ Observe all areas on the b maXX 4400 unit that could be dangerous when you are carrying out assembly.

The figure below gives you an overview of the danger zones on the plug-in module.
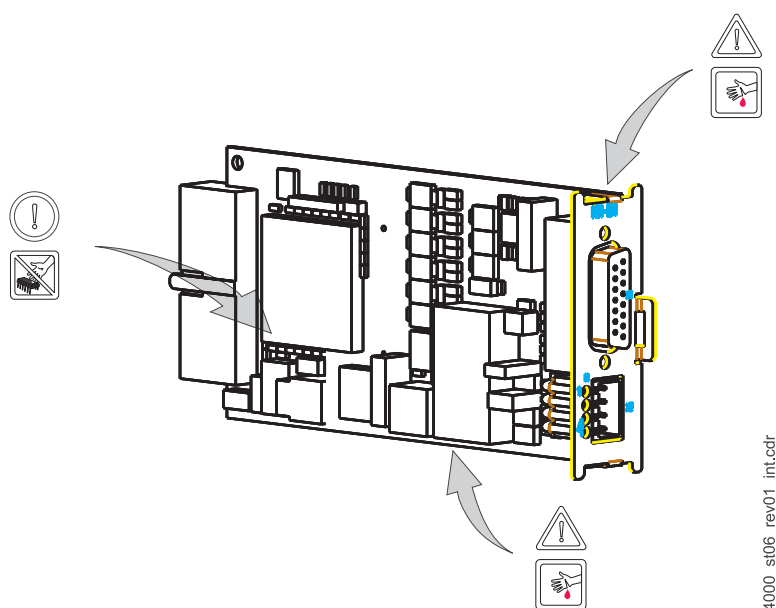
Figure 4:   Danger zones

5.2   Requirements of the personnel carrying out work

DANGER

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

- serious personal injury   • death

*Danger from: **electricity.** The unit and the vicinity of the control cabinet may carry dangerous voltages.*

Before starting any work, ensure that the unit and its vicinity are free of voltage.

Observe the relevant safety regulations when handling current-carrying units.

Ensure that only qualified personnel assembles and installs this plug-in module.

Qualified personnel is considered to be people whose training, experience and knowledge of relevant standards and regulations, accident prevention regulations and conditions in the plant has led to their being authorized by the plant safety manager to carry out activities that are needed in each case while recognizing and avoiding any possible hazards that might arise. The qualifications that are necessary for working with the unit include, for example:

- Trained or instructed in accordance with recognized safety standards in the care and use of appropriate safety equipment

5.3   Preparation

○ Consult the type code (see "D" in ▷Figure 5) to ensure that you have the correct plug-in module.
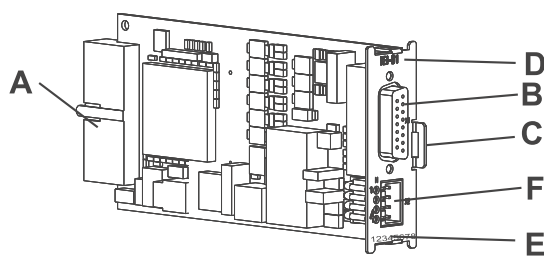
A = Plug connector (back-mounted)
B = 15-pin female Sub-D connector (front)
C = Grip
D = Short term
E = Type label
F = 8-pin plug-in connector

4000_st07_rev02_int.cdr

Figure 5:   IEI option module

○ Determine the correct slot (see ▷Figure 6 on page 23).
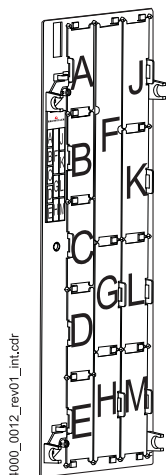
	Function modules									Option modules												
	BM4-F-ENC-XX (encoder 1 for motor control recommended)	BM4-F-ENC-XX (encoder 2)	BM4-F-AIO-01 (analog I/O)	BM4-F-AIO-02/03 (analog I/O)	BM4-F-DIO-XX (digital I/O)	BM4-F-FIO-XX (fast digital I/O)	BM4-F-IEE-XX (incremental encoder emulation)	BM4-F-SIE-XX (SSI-SSI encoder emulation)	BM4-F-CAN-01 (CANsync slave) in prep.	BM4-O-SER-XX (Sercos slave)	BM4-O-CAN-05 (CANsync slave)	BM4-O-PRO-01 (Profibus slave)	BM4-O-CAN-03 (CANopen slave)	BM4-O-DNT-XX (DISC-NT slave module)	BM4-O-PLC-XX (SPS)	BM4-O-CAN-06* (CANsync master)	BM4-O-CAN-04* (CANopen master)	BM4-O-IEI-XX* (incremental encoder emulation)	BM4-O-ETH-01* (Ethernet)	BM4-O-ETH-02* (Ethernet + CANopen master)	BM4-O-ECT-01 (EtherCAT slave)	BM4-O-ECT-02* (Ethernet with EtherCAT master)
A	X	-	-	-	o	o	-	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B	-	X	-	-	o	o	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C	-	-	-	-	o	o	X	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-
D	-	-	-	-	X	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
E	-	-	X	X	o	o	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
F Controller unit, permanently installed																						
G	-	-	-	-	-	-	-	-	-	o	o	o	o	o	o	X	X	X	X	X	o	x
H	-	-	-	-	-	-	-	-	-	X	X	X	X	X	X	o	o	o	o	o	X	-
J	-	-	-	-	-	-	-	-	-	-	P	P	P	-	-	o	o	o	o	o	P	o
K	-	-	-	-	-	-	-	-	-	-	P	P	P	-	-	o	o	o	o	o	P	o
L	-	-	-	-	-	-	-	-	-	-	P	P	P	-	-	o	o	o	o	o	P	o
M	-	-	-	-	-	-	-	-	-	-	P	P	P	-	-	o	o	o	o	o	P	o

X: preferred slot
Baumüllter 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 preffered slot is occupied, we recommend in order to reach the highest functional range, to insert the plug-in modules into this slot.

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

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

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

Figure 6:   Combinations of slots

5.4 Assembly

1 Switch off the b maXX 4400 basic unit and secure it from being unintentionally restarted during assembly.

DANGER

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

• serious personal injury   • death

*Danger from: **electricity.** The unit and the vicinity of the control cabinet may carry dangerous voltages.*

Before starting any work, ensure that the unit and its vicinity are free of voltage. Observe the relevant safety regulations when handling current-carrying units.

2 Pull the cover forward from the controller section: you can now see the slots.

3 Look for the intended slot (**G**) on the controller section.
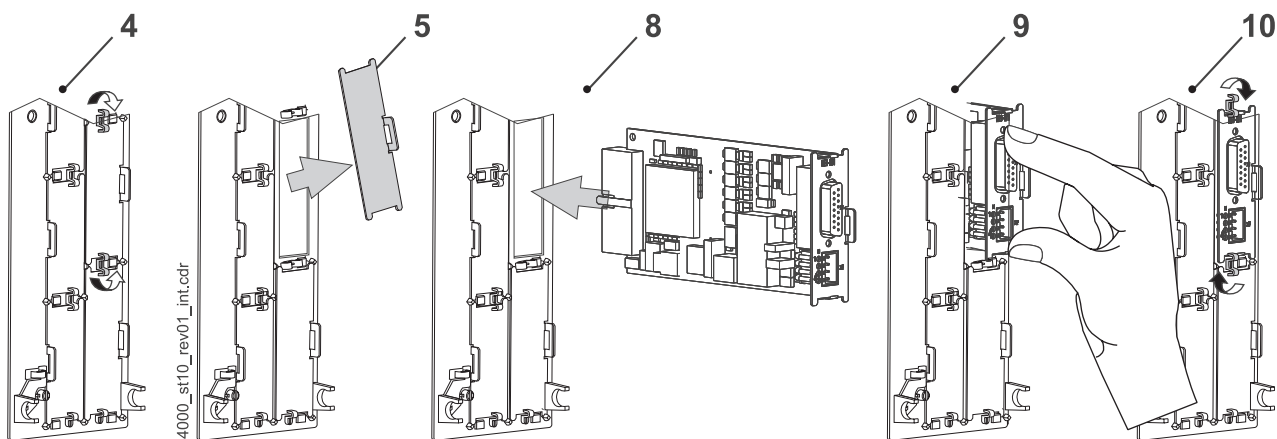
Figure 7:   Assembly

4 Turn the spagnolet locks above and below this slot by 90°. The spagnolet locks are now horizontal.

5 Take out the front panel cover forward. Keep this cover. If you remove plug-in cards, you must close the unit again using the cover.

CAUTION

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

• property damage.

*Danger from: **electrostatic discharge.** The *IEI-01 i*ncremental encoder interface contains ESD components.*

Observe the described ESD measures when handling the plug-in module.

Only hold the plug-in module by the gripping piece (see "C" in ▷Figure 5 on page 22).

6 Observe the described ESD measures when handling the modules.

7 Remove the IEI option module from the transportation packaging: Avoid contact with the plug-in module's electronic components.

8 Plug the IEI option module into the slot's guide rails. The gripping piece must face the same way as the other gripping pieces in this slot rail slot rail (in the case: the right-hand side).

9 Keep pressing two fingers on the front panel until you feel the card engage in the end position inside the unit.

10 Turn the spagnolet locks above and below this slot by 90° to the vertical position (locked position).

11 Remount the cover on the unit.

NOTE

If you only want to replace the IEI option module within the scope of repairs with a card of the same type, the rest of the procedure is considerably shorter. In this case, you only need to restore the connections to the module, put the front cover back on and switch the unit on again.

This completes assembly of the IEI option module. Connecting lines and commissioning is shown in the following sections.

5.5 Installation

At installation, cable the IEI option module.

5.5.1 Connection diagram

8	Encoder channel 1
15	Reserved
7	Encoder channel 1 inverted
14	Reserved
6	Reserved
13	Reserved
5	Encoder channel 2
12	Alarm, wire break
4	Encoder zero track inverted
11	Reserved
3	Encoder zero track
10	Reserved
2	+5 V (Supply of encoder)
9	Encoder channel 2 inverted
1	M5V (Ground supply of encoder)
1	+24V *)
2	M24V
3	Probe 1
4	Reserved
5	Probe 2
6	Reserved
7	Reference cam
8	Reserved

Figure 8: Connection diagram of IEI option module for b maXX drive PLC

NOTE

*) If you are taking into account UL 508 C: limit the current to 4 A.

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5.5.2 Requirements of electrical connection

CAUTION

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

- property damage.

Danger from: **electrical voltage.** *If you are not able to ensure the plug-in module's requirements of the electrical connection, the plug-in module can be damaged or destroyed.*

Ensure that you comply with the connection values that are specified in the technical data and that the connections were made in accordance with the stipulations.

Prevent short-circuits between inputs/outputs. In the case of a short-circuit between inputs/outputs, the plug-in module can be destroyed.

Prevent inverting of the polarity at the inputs.

To be able to comply with Standard EN 60 204-1 (Electrical Equipment of Machines), you must use the cables that are suggested in the standard. The connectors must not drop; otherwise, there is a risk of short-circuits or external voltages, etc.

◗ Ensure EMC-appropriate laying of the connection cables.

5.5.3 Requirements of the connection cable

Baumüller has released the following cables for use:

- BL-encoder connection 12/15-pole, LiYCY 5 * (2 * 0.14) + 2 * 0.5 mm Cu-braid (see ▷B.1 List of all accessories◁ from page 77 onward)
- Copper cable with maximum cross-section of 1.0 mm^2; for more information, refer to ▷Appendix D - Technical Data◁ on page 83.

5.5.4 Sequence of installation

◗ Ensure that the b maXX 4400 basic unit is deenergized

◗ Remove the front cover from the unit.

- The IEI option module is in slot G, see ▷Figure 6 on page 23.

◗ Connect the 15-pin female Sub-D connector on the front panel of the IEI option module to the connection cable on the encoder; for the connection assignment, see ▷Pin assignment of female Sub-D connector ◁ on page 85.

◗ On the supplied 8-pin plug-in connector, connect contacts 1 and 2 to a 24 V power supply; for the connection assignment, see ▷Pin assignment of 8-pin plug-in connector ◁ on page 87.

◗ Remount the cover on the unit.

◗ Lay the connecting lines as stipulated in the control cabinet

This completes installation.

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COMMISSIONING

In this chapter, we will describe how you commission the IEI option module that you just assembled and installed (see ▷Assembly and installation ◁ from page 21 onward). Commissioning ensures that the IEI option module functions correctly. For more information on programming, refer to the "b maXX drive PLC Application Manual".

Before starting commissioning, ensure that the following conditions have been met:

1 The plug-in module has been assembled correctly.

2 The plug-in module has been installed correctly.

3 The cabinet is closed correctly and all the safety devices have been started up.

4 The b maXX basic unit is ready for use.

6.1 General safety regulations

○ Observe the ▷Basic Safety Instructions ◁ from page 7 onward.

DANGER

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

- serious personal injury
- death

Danger from: **mechanical effects.** *At commissioning, the drive can rotate.*

Keep far enough the rotating parts. Note that when drives are starting up machine parts can be set in motion. In all cases, activate the machine's safety devices.

6.2 Requirements of the personnel carrying out work

Commissioning work must only be carried out by trained specialists who have understood the safety regulations and information and can implement them.

6.3 Description/inspection of the safety and monitoring systems

Before you commission the IEI option module, you must eliminate any errors/error messages that may be present on the b maXX 4400 basic unit. These errors may be due to

faulty assembly (e.g. defective cables) or faulty installation (e.g. no power supply). You must not continue with commissioning until you have eliminated the errors.

6.4 Description and inspection of the controls and displays

6.4.1 Sample configuration for encoder mode
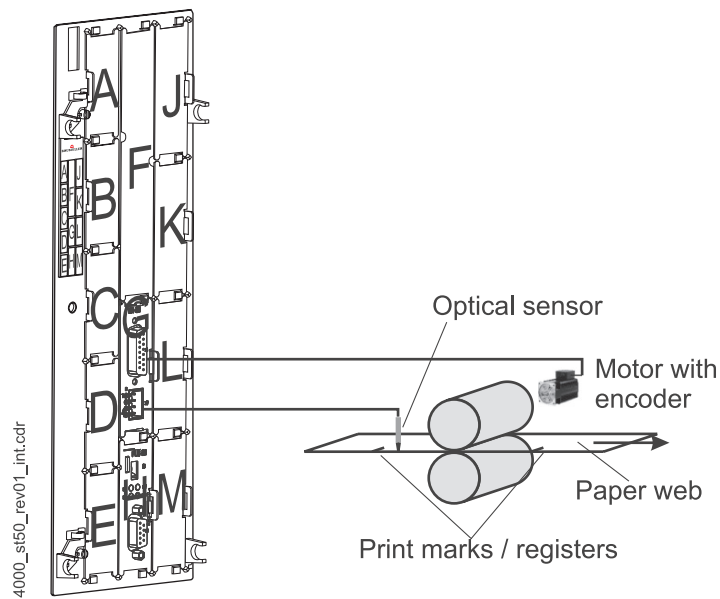
Figure 9:   Optically acquiring print marks (registers).
              The print marks have register control, for example.

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6.4.2   Sample configuration for probe mode
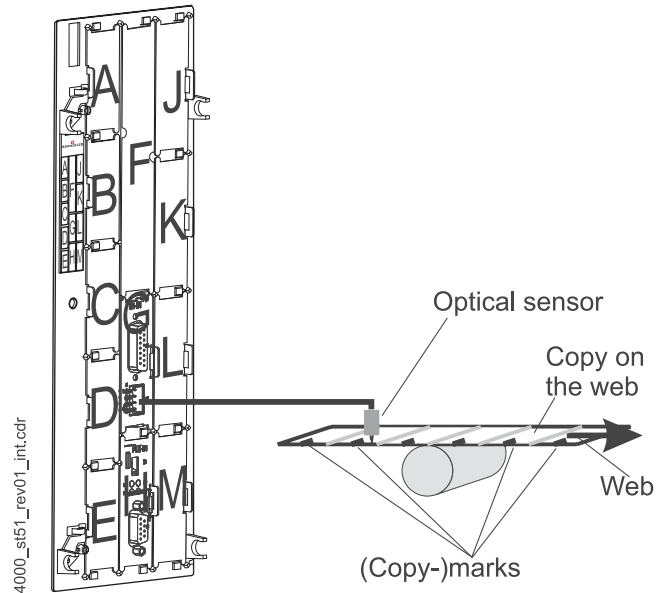
Figure 10:   Optically acquiring copies. You can count the number of copies.

6.4.3   LEDs

The IEI option module has four LEDs (H1 to H4) as display elements.

LED	Status	Meaning
H1	⊗ Green	Power supply
	⊗ Red	Counter disturbance
H2	⊗ Green	Latch display probe 1
	⊗ Red	Reserved
H3	⊗ Green	Latch display probe 2
	⊗ Red	Reserved
H4	⊗ Green	Latch display reference cams
	⊗ Red	Reserved

Figure 11:   LEDs of the IEI option module

After switching on the IEI option module, LED H4 (red) flashes briefly. This means that basic installation of the IEI option module is completed.

6.5 Commissioning sequence

Commissioning is divided into the following procedures:

1 Detecting the IEI option module

2 Testing the function.

6.5.1 Detecting the IEI option module

- Read and observe the ▷General safety regulations ◁ from page 29 onward.
- You must have carried out correctly section "Assembly and Installation".
- Switch on the b maXX 4400 basic unit.

NOTE

You must not remove or plug in the IEI option module while the b maXX basic unit is switched on. Switch the unit off first.

6.5.2 Testing the function

After switching on, LED H4 (red) flashes briefly as described in ▷LEDs ◁ on page 31.

Switch on the external 24 V power supply. For the connection, see ▷Sequence of installation ◁ on page 27 and ▷D.2.2 Pin assignment of 8-pin plug-in connector◁ on page 87.

LED H1 (green) indicates that 24 V is connected. This completes testing of functioning.

If a complete application is present, H2 (green) and H3 (green) indicate that probes 1 and 2 are switched on.

OPERATION

The **I**ncremental **E**ncoder **I**nterface (or IEI) makes possible rapid acquisition of digital signals. When doing this, the system uses an internal counter to count the signal edges.

The IEI option module offers two operating modes.
- IEI option module for position acquisition using a rectangle incremental encoder (encoder mode)
- IEI option module as a fast counter of a 24 V signal at input probe 1 (probe mode)

The IEI option module is configured by the application program on the b maXX drive PLC.

For guides to programming the b maXX drive PLC, refer to the b maXX drive PLC Application Manual and the PROPROG wt II Programming Manual (or ProProg wt III Online Help System). This chapter contains guides to configuring and operating the IEI option module.

7.1 General

Depending on the mode, the IEI option module uses an internal counter to count the signal edges of the rectangle incremental encoder or the signal edges of a 24 V signal at input probe 1.

For the contents of this internal counter to be copied synchronously to the b maXX drive PLC into communication RAM, you must set a trigger source. The trigger signal of this trigger source is latch condition 1. When this latch condition 1 occurs, the system stores the counter value to a register. See also ▷Synchronizing the IEI option module with the b maXX drive PLC ◁ from page 51 onward.

7.1.1 IEI option module for position acquisition using a rectangle incremental encoder (encoder mode)

In this mode, the system counts the signal edges of a rectangle incremental encoder in the internal counter. In addition, it is possible to save the counter value in the case of two different conditions (e.g. the rising and falling edge of a 24 V signal at input "probe 1"). These are latch conditions 2 and 3.

The internal counter can count signals at a frequency of up to 4 MHz. This means that it is also possible to evaluate high-resolution rectangle incremental encoders.

Below, we will also refer to this mode as encoder mode; it is often set for position acquisition, positioning and synchronous running tasks.

The following sample applications for position acquisition result, for example:

- as a real master axis for cam disks
- for position acquisition for positioning
- for position acquisition for web-cylinder register controllers
- for position acquisition for web-web register controllers
- for position acquisition for infeed tasks
- for format measurement

Example: A rectangle incremental encoder is connected to a motor. The signal edges (or the increments) of the rectangle incremental encoder are counted. This makes it possible to determine a real master axis for cam disks.

At a specific point in time, the second condition for saving the counter value occurs (e.g. a rising edge of the 24 V signal is latch condition 2). Now, the system saves the counter value to a register.

At a different point in time, the third condition for saving the counter value occurs (e.g. a falling edge of the 24 V signal is latch condition 3). Now, the system saves the counter value to a different register and you can evaluate these counter values at any time you like.

The signal edges (or increments) of the rectangle incremental encoder that the system counts between the two occurrences of latch condition 2 correspond to the format length, for example.

In encoder mode, when generating latch conditions 2 and 3 by means of mechanical pushbuttons ensure that the pushbuttons doe not bounce or prevent this by suitable interconnection of a capacitor.

7.1.2 IEI option module as a fast counter of a 24 V signal (probe mode)

In this mode, the system counts the signal edges of a 24 V signal (this signal is connected at the IEI option module's input probe 1).

The signal at input probe 1 can be evaluated at a frequency of up to 200 kHz. This means that you can carry out any counting procedures you like on 24 V industrial logic-based sensors.

Below, we will also refer to this mode as probe mode. One possible application is, for example, as a

- copy counter

Example: A printing press prints register marks at regular intervals on a paper web. The register marks are acquired optically and the system can count the resulting 24 V signal (at input probe 1) at high web speeds.

The number of counted signal edges matches the number of register marks and with this the number of (printed) copies on the paper web.

7.2 Configuring the IEI option module in the application program

Depending on the mode, the IEI option module uses an internal register to count the signal edges (or increments) of the rectangle incremental encoder or the edges of a 24 V signal.

For the contents of this register to be copied synchronously to the b maXX drive PLC into communication RAM, you must set a trigger source. In the case of the IEI option module, signal SYNC1 from the BACI is set as the trigger source (this signal is latch condition 1). On the b maXX drive PLC, you must ensure that this signal is available in the b maXX (see ▷Synchronizing the IEI option module with the b maXX drive PLC ◁ from page 51 onward).

At configuration of the IEI option module, you must make the following settings in dependence on the mode:

- encoder mode
  - ○ selection of multiplication of the encoder signal (single, double, quadruple)
  - ○ selection of latch condition 2
  - ○ selection of latch condition 3
  - ○ selection of the rectangle incremental encoder's direction of rotation

- Probe mode
  - ○ Selection of the edge of the 24 V signal that is to be evaluated
  - ○ Selection of the direction of counting (up/down)

FB IEI_INIT from library IEI_PLC01_20bd00 (PROPROG wt II) or IEI_PLC01_30bd00 (ProProg wt III) or above is available for configuring encoder mode or probe mode (see ▷Function block (FB) IEI_INIT ◁ from page 54 onward).

Using FB IEI_INIT, you set or select:

- encoder mode
  - ○ multiplication of the encoder signal (single, double, quadruple)
  - ○ the direction of rotation of the rectangle incremental encoder

or

- Probe mode
  - ○ the edge of the 24 V signal that is to be evaluated.
    The system sets the direction of counting externally via a signal at input "probe 2".
    If the signal at input "probe 2" is logically FALSE or physically LOW, the internal counter counts up.
    If the signal at input "probe 2" is logically TRUE or physically HIGH, the internal counter counts down.

In encoder mode, you must additionally set latch conditions 2 and 3 for taking the value of the internal counter in counter latch registers 2 and 3. This is carried out via the latch mode register (see ▷Latch conditions in encoder mode ◁ from page 36 onward and ▷Latch mode register ◁ from page 44 onward).

> **NOTE**
>
> You set latch conditions 2 and 3 via the latch mode register and not via FB IEI_INIT.

You can make further settings via the IEI option module's registers (see ▷Registers of the IEI option module ◁ from page 39 onward).

7.2.1 Latch conditions in encoder mode

In encoder mode, you can choose latch conditions 2 and 3 from the signals at inputs "probe 1", "probe 2" and "reference cam" of the IEI option module as well as from the "encoder zero track reached" signal of the rectangle incremental encoder on the IEI option module.

You make the selection via the latch mode register (see ▷Latch mode register ◁ from page 44 onward).

The signals are ANDed, which means that the respective latch condition is not met until the result of the logical AND operation has a rising or falling edge.

If, for example, the setting of latch condition 2 is such that the rising edge of "probe 1" AND "encoder zero track" must be reached, the system does not copy the IEI option module's internal counter to counter latch register 2 until the result of the logical AND operation changes from logically FALSE to TRUE.

If the rising edge of the reference cam is set as latch condition 2 or 3, the system copies the value of the IEI option module's internal counter to counter latch register 2 or 3 when the latch condition is reached and then zeroes the internal counter.

This is also the case if the reference cam is ANDed with the other signals as latch condition 2 or 3.

If the reference cam is NOT set as latch condition 2 or 3, the system copies the value of the IEI option module's internal counter to counter latch register 2 or 3 when the latch condition is reached. The internal counter is not zeroed; rather, it retains its value.

Below, we will explain the register structure of communication RAM between the b maXX drive PLC (BM4-O-PLC-01) and the IEI-01 option module (BM4-O-IEI-01).

To allow you to access registers of the communication RAM in the PROPROG wt project, data types are defined that map the register structure. The system uses these data types to declare variables that are assigned to the IEI option module's base address.

After this, it is possible to access the registers of communication RAM via the structure elements of the declared variables.

Structure IEI_PLC_BMSTRUCT is available for accessing the registers in communication RAM.

This structure is defined from library BM_TYPES_20bd03 (PROPROG wt II) / BM_TYPES_30bd01 (ProProg wt III) or higher onward. After you have integrated library BM_TYPES_20bd03 (PROPROG wt II) / BM_TYPES_30bd01 (ProProg wt III) in the project, the data type is available. This library is already integrated in template "BM4_O_PLC01".

These structures contain:

Data type	Short designation	Number of bits
BYTE	b	8
WORD	w	16
DWORD (double word)	d	32
SINT (short integer)	si	8
DINT (double integer)	di	32
USINT (unsigned short integer)	us	8
UINT (unsigned integer)	u	16
UDINT (unsigned double integer)	ud	32
STRUCT	_ (underline)	-
ARRAY	a	-

Other data types that are not used in the structures include:

Data type	Short designation	Number of bits
BOOL (bit)	x	1
TIME	t	-

7.2.2 Explanation of declaring the global variables:

For accessing communication RAM, global variables of data type `IEI_PLC_BMSTRUCT` are already declared for each option module slot in template "BM4_O_PLC01".

These are the following global variables (for example in PROPROG wt II):

```
_IEI_Ctrl_Slot_G  AT %MB3.2258000     : IEI_PLC_BMSTRUCT;

_IEI_Ctrl_Slot_H  AT %MB3.3258000     : IEI_PLC_BMSTRUCT;

_IEI_Ctrl_Slot_J  AT %MB3.4258000     : IEI_PLC_BMSTRUCT;

_IEI_Ctrl_Slot_K  AT %MB3.5258000     : IEI_PLC_BMSTRUCT;

_IEI_Ctrl_Slot_L  AT %MB3.6258000     : IEI_PLC_BMSTRUCT;

_IEI_Ctrl_Slot_M  AT %MB3.7258000     : IEI_PLC_BMSTRUCT;
```

If these variables are no longer in the PROPROG wt project, create – in dependence on the slot (G to M) – the global variable `_IEI_Ctrl_Slot_G` (to `_IEI_Ctrl_Slot_M`) of data type `IEI_PLC_BMSTRUCT`.

At declaration of the global variables, this variable must be connected to the base address of the BM4-O-IEI-01 option module.

The base address of the Incremental Encoder Interface (BM4-O-IEI-01) option module in dependence on the slot is as follows:

Slot	Base address of the BM4-O-IEI-01 option module
G	%MB3.2258000
H	%MB3.3258000
J	%MB3.4258000
K	%MB3.5258000
L	%MB3.6258000
M	%MB3.7258000

Example:

BM4-O-IEI-01 option module in slot G of the b maXX

`_IEI_Ctrl_Slot_G  AT  %MB3.2258000  :  IEI_PLC_BMSTRUCT;`

Where:

`_IEI_Ctrl_Slot_G`	is the variable name with the data type short designation "_" for Struct
`IEI_PLC_BMSTRUCT`	is the data type
`%MB3.2258000`	is the base address of the BM4-O-IEI-01 option module in slot G of the b maXX

NOTE

In the following tables, the variable name is replaced by an asterisk (*).

It is also assumed that the IEI option module for b maXX drive PLC is fitted in slot G.

This means that you access register *.ud_COUNTER_LATCH2 via

`_IEI_Ctrl_Slot_G.ud_COUNTER_LATCH2.`

Where:

`_IEI_Ctrl_Slot_G`	is the variable name with the data type short designation "_" for Struct
`ud_COUNTER_LATCH2`	is the register containing the counter value at the instant when latch condition 2 was reached.

7.3 Registers of the IEI option module

Register	Contents
*.w_RESERVED0	Reserved
*.w_LATCH_STATUS_REG	Latch status register
*.ud_COUNTER_LATCH1	Counter latch register 1
*.ud_COUNTER_LATCH2	Counter latch register 2
*.ud_COUNTER_LATCH3	Counter latch register 3
*.ud_COUNTER_PRELOAD	Counter preload register
*.w_RESERVED20	Reserved
*.w_RESERVED22	Reserved
*.w_RESERVED24	Reserved
*.w_RESERVED26	Reserved
*.w_LATCH3_DISABLE	Latch3 disable register
*.w_LATCH2_DISABLE	Latch2 disable register
*.w_LATCH3_ONCE	Latch3 once register
*.w_LATCH2_ONCE	Latch2 once register
*.w_RESERVED36	Reserved
*.w_RESERVED38	Reserved
*.w_LATCH_MODE	Latch mode register
*.w_COUNTER_MODE	Counter mode register
*.w_ESR2	Reserved
*.w_ESR1	Reserved
...	...
*._BASE_FPGA	Reserved

The individual registers are described in the text below:

7.3.1 Latch status register

Latch status register *.w_LATCH_STATUS_REG shows the current status of probes 1 and 2, of the reference cam and the encoder's sense line (e.g. for broken wire detection). In addition, it shows whether the encoder has reached the zero track.

It also shows

- encoder mode
  - whether latch conditions 2 and 3 have been met.

- Probe mode
  - whether the 24 V signal (at probe 1) whose edges are being counted is connected.
  - the direction of counting that is set (at probe 2)

Bit 0	Probe 1: 0: Probe 1 is logically FALSE (zero) or physically LOW. 1: Probe 1 is logically TRUE (one) or physically HIGH.
Bit 1	Probe 2: 0: Probe 2 is logically FALSE (zero) or physically LOW. 1: Probe 2 is logically TRUE (one) or physically HIGH.
Bit 2	Reference cam: 0: The reference cam is logically FALSE (zero) or physically LOW. 1: The reference cam is logically TRUE (one) or physically HIGH.
Bit 3	Sense line: 0: One encoder is connected. 1: **No** encoder is connected.
Bit 4	Encoder zero track: 0: The encoder zero track has not been reached. 1: The encoder zero track has been reached.
Bit 5	Encoder mode: Latch condition 2: 0: Latch condition 2 has not been met. 1: Latch condition 2 has been met. Probe mode: Reserved
Bit 6	Encoder mode: Latch condition 3: 0: Latch condition 3 has not been met. 1: Latch condition 3 has been met. Probe mode: Reserved
Bit 7 to bit 15	Reserved

Bit 0 - probe 1:

Bit 0 shows whether probe 1 is logically FALSE or TRUE or physically LOW or HIGH.

Bit 1 - probe 2:

Bit 1 shows whether probe 2 is logically FALSE or TRUE or physically LOW or HIGH.

Bit 2 - reference cam:

Bit 2 shows whether the reference cam is logically FALSE or TRUE or physically LOW or HIGH.

Bit 3 - sense line:

Bit 3 shows whether the sense line is physically LOW or HIGH.

The IEI option module supplies a high-resistance HIGH to the sense line. An encoder that supports the sense signal "pulls" this signal to LOW. This allows the IEI option module to detect whether an encoder is connected. If the encoder does not support the sense line, detection is not possible and bit 3 is TRUE.

Bit 4 - encoder zero track:

Bit 4 shows whether the encoder zero track is reached due to its rotation. Bit 4 is FALSE if the encoder zero track is not reached. If the encoder zero track is reached, Bit 4 switches to TRUE.

Bit 5 - latch condition 2:

Bit 5 only has a meaning in the IEI option module's encoder mode.

In this mode, bit 5 indicates by TRUE (1) that latch condition 2 has been met. The saved counter value of the rectangle incremental encoder is located in register *.ud_COUNTER_LATCH2. You can reset display of bit 5 by writing a value of 0 to register *.ud_COUNTER_LATCH2.

If latch condition 2 is not met, Bit 5 shows FALSE (0).

Bit 6 - latch condition 3:

Bit 6 only has a meaning in the IEI option module's encoder mode.

In this mode, bit 6 indicates by TRUE (1) that latch condition 3 has been met. The saved counter value of the rectangle incremental encoder is located in register *.ud_COUNTER_LATCH3. You can reset display of bit 6 by writing a value of 0 to register *.ud_COUNTER_LATCH3.

If latch condition 3 is not met, Bit 6 shows FALSE (0).

Bit 7 to bit 15 are reserved.

7.3.2 Counter latch register 1

Counter latch register 1 *.ud_COUNTER_LATCH1 shows the value of the IEI option module's internal counter. The way of counting depends on the IEI option module's mode.

- Encoder mode
  The rectangle incremental encoder's signals (or increments) are shown in counter latch register 1. If a rectangle incremental encoder rotates at 1024 increments/revolutions four times round its own axis, for example, the system displays in counter latch register 1 a value that is incremented (or decremented, depending on the direction of rotation) by 4096.
  The IEI option module uses an internal register to count the signals (or increments) of

the rectangle incremental encoder. The system copies this internal register to counter latch register 1 each time the BACI signal "Sync 1" occurs (this signal is latch condition 1; for more information on this topic, see also ▷Synchronizing the IEI option module with the b maXX drive PLC ◁ from page 51 onward).

- Probe mode
  The number of signal edges of a 24 V signal are shown in counter latch register 1. If the 24 V signal is activated and with this generates a signal edge, the system displays in counter latch register 1 a value that is incremented (or decremented, depending on the direction of counting) by 1.
  The IEI option module uses an internal register to count the signal edges of a 24 V signal. The system copies this internal register to counter latch register 1 each time the BACI signal "Sync 1" occurs (this signal is latch condition 1; for more information on this topic, see also ▷Synchronizing the IEI option module with the b maXX drive PLC ◁ from page 51 onward).

If counter latch register 1   *.ud_COUNTER_LATCH1   is written with any value, the system resets the display of bit 4 in the latch status register   *.w_LATCH_STATUS_REG.

7.3.3   Counter latch register 2

This register only has a meaning in the IEI option module's encoder mode.

Counter latch register 2   *.ud_COUNTER_LATCH2   shows the value of the internal counter at the instant of latch condition 2.

The difference between register   *.ud_COUNTER_LATCH2   and register *.ud_COUNTER_LATCH1   is proportional to the angle of rotation (or path) between when latch condition 2 occurs and the last occurrence of BACI signal "Sync 1" (latch condition 1).

If counter latch register 2   *.ud_COUNTER_LATCH2   is written with any value, the system resets the display of bit 5 in the latch status register   *.w_LATCH_STATUS_REG.

7.3.4   Counter latch register 3

This register only has a meaning in the IEI option module's encoder mode.

Counter latch register 3   *.ud_COUNTER_LATCH3   shows the counter value of the internal counter at the instant of latch condition 3.

The difference between register   *.ud_COUNTER_LATCH3   and register *.ud_COUNTER_LATCH1   is proportional to the angle of rotation (or path) between when latch condition 3 occurs and the last occurrence of BACI signal "Sync 1" (latch condition 1).

The difference between register   *.ud_COUNTER_LATCH3   and register *.ud_COUNTER_LATCH2   is proportional to the angle of rotation (or path) between when latch condition 3 occurs and the occurrence of latch condition 2.

If counter latch register 3   *.ud_COUNTER_LATCH3   is written with any value, the system resets the display of bit 6 in the latch status register   *.w_LATCH_STATUS_REG.

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7.3.5 Counter preload register

The contents of counter preload register *.ud_COUNTER_PRELOAD are applied in the IEI option module's internal counter if Bit 4 (Preload) is set in register *.w_COUNTER_MODE.

This makes it possible to write a start value to the internal counter.

7.3.6 Latch3 disable register

This register only has a meaning in the IEI option module's encoder mode.

Using Latch3 disable register *.w_LATCH3_DISABLE, you can disable copying of the IEI option module's internal counter to counter latch register 3 (*.ud_COUNTER_LATCH3) when latch condition 3 occurs.

This is necessary, for example, if you want to set or change latch condition 3 (in the latch mode register).

*.w_LATCH3_DISABLE = 16#0001 disables copying of the IEI option module's internal counter to counter latch register 3.

*.w_LATCH3_DISABLE = 16#0000 reenables copying of the IEI option module's internal counter to counter latch register 3.

The default setting is *.w_LATCH3_DISABLE = 16#0000, i.e. copying of the IEI option module's internal counter to counter latch register 3 is enabled.

7.3.7 Latch2 disable register

This register only has a meaning in the IEI option module's encoder mode.

Using Latch2 disable register *.w_LATCH2_DISABLE, you can disable copying of the IEI option module's internal counter to counter latch register 2 (*.ud_COUNTER_LATCH2) when latch condition 2 occurs.

This is necessary, for example, if you want to set or change latch condition 2 (in the latch mode register).

*.w_LATCH2_DISABLE = 16#0001 disables copying of the IEI option module's internal counter to counter latch register 2.

*.w_LATCH2_DISABLE = 16#0000 reenables copying of the IEI option module's internal counter to counter latch register 2.

The default setting is *.w_LATCH2_DISABLE = 16#0000, i.e. copying of the IEI option module's internal counter to counter latch register 2 is enabled.

7.3.8 Latch3 once register

This register only has a meaning in the IEI option module's encoder mode.

Using Latch3 once register *.w_LATCH3_ONCE, you can set copying once of the IEI option module's internal counter to counter latch register 3 (*.ud_COUNTER_LATCH3) when latch condition 3 occurs. The system does not evaluate any further occurrences of latch condition 3.

After counter latch register 3 has been overwritten with a value of 0 (*.ud_COUNTER_LATCH3 = 0), the system again copies the value of the internal counter to counter latch register 3 when latch condition 3 occurs.

*.w_LATCH3_ONCE = 16#0001   copies the IEI option module's internal counter to counter latch register 3 only once namely when latch condition 3 occurs.

*.w_LATCH3_ONCE = 16#0000   deactivates this function.

The default setting is   *.w_LATCH3_ONCE = 16#0000,   i.e. this function is deactivated.

7.3.9   Latch2 once register

This register only has a meaning in the IEI option module's encoder mode.

Using Latch2 once register   *.w_LATCH2_ONCE,   you can set copying once of the IEI option module's internal counter to counter latch register 2 (*.ud_COUNTER_LATCH3) when latch condition 2 occurs. The system does not evaluate any further occurrences of latch condition 2.

After counter latch register 2 has been overwritten with a value of 0 (*.ud_COUNTER_LATCH2 = 0), the system again copies the value of the internal counter to counter latch register 2 when latch condition 2 occurs.

*.w_LATCH2_ONCE = 16#0001   copies the IEI option module's internal counter to counter latch register 2 only once namely when latch condition 2 occurs.

*.w_LATCH2_ONCE = 16#0000   deactivates this function.

The default setting is   *.w_LATCH2_ONCE = 16#0000,   i.e. this function is deactivated.

7.3.10 Latch mode register

This register only has a meaning in the IEI option module's encoder mode.

Using latch mode register   *.w_LATCH_MODE, you set latch condition 2 and latch condition 3.

To do this, you choose which signal the latch condition supplies:
- Probe 1
- Probe 2
- Reference cam
- Zero track of the encoder

Here, you can specify several signals. The selected signals are ANDed.

In addition, you can choose the edge of the set signal with which the latch condition is met.

If the rising edge of the reference cam is set as the latch condition, the system copies the value of the IEI option module's internal counter to the respective counter latch register and then zeroes the internal counter when the latch condition is met.

This is also the case if the reference cam is ANDed with the other signals as the latch condition.

Example: The reference cam's rising edge is set as latch condition 2 with its falling edge being set as latch condition 3. When latch condition 2 is reached, the system copies the value of the internal counter to counter latch register 2 and then zeroes the internal counter. When latch condition 3 is reached, the system copies the value of the internal counter to counter latch register 3.

If the reference cam is NOT set as latch condition 2 or 3, the system copies the value of the IEI option module's internal counter to counter latch register 2 or 3 when the latch condition is reached. The internal counter is not zeroed; rather, it retains its value.

Bit 0	Probe 1 as latch condition 2: 0: Probe 1 is not evaluated for latch condition 2. 1: Probe 1 is evaluated for latch condition 2.
Bit 1	Probe 2 as latch condition 2: 0: Probe 2 is not evaluated for latch condition 2. 1: Probe 2 is evaluated for latch condition 2.
Bit 2	Reference cam as latch condition 2: 0: The reference cam is not evaluated for latch condition 2. 1: The reference cam is evaluated for latch condition 2.
Bit 3	Encoder zero track as latch condition 2: 0: The encoder zero track is not evaluated for latch condition 2. 1: The encoder zero track is evaluated for latch condition 2.
Bit 4	Edge selection for latch condition 2: 0: Latch condition 2 has been met if all the released signals from bit 0 to bit 3 have changed their status from logical FALSE to TRUE (or physical LOW to HIGH) (rising edge). 1: Latch condition 2 has been met if all the released signals from bit 0 to bit 3 have changed their status from logical TRUE to FALSE (or physical HIGH to LOW) (rising edge).
Bit 5 to bit 7	Reserved
Bit 8	Probe 1 as latch condition 3: 0: Probe 1 is not evaluated for latch condition 3. 1: Probe 1 is evaluated for latch condition 3.
Bit 9	Probe 2 as latch condition 3: 0: Probe 2 is not evaluated for latch condition 3. 1: Probe 2 is evaluated for latch condition 3.
Bit 10	Reference cam as latch condition 3: 0: The reference cam is not evaluated for latch condition 3. 1: The reference cam is evaluated for latch condition 3.
Bit 11	Encoder zero track as latch condition 3: 0: The encoder zero track is not evaluated for latch condition 3. 1: The encoder zero track is evaluated for latch condition 3.
Bit 12	Edge selection for latch condition 3: 0: Latch condition 3 has been met if all the released signals from bit 8 to bit 11 have changed their status from logical FALSE to TRUE (or physical LOW to HIGH) (rising edge). 1: Latch condition 3 has been met if all the released signals from bit 8 to bit 11 have changed their status from logical TRUE to FALSE (or physical HIGH to LOW) (rising edge).
Bit 13 to bit 15	Reserved

Bit 0 - Probe 1 as latch condition 2:

Using Bit 0, you select whether probe 1 affects latch condition 2.

Bit 1 - Probe 2 as latch condition 2:

Using Bit 1, you select whether probe 2 affects latch condition 2.

Bit 2 - Reference cam as latch condition 2:

Using Bit 2, you select whether the reference cam affects latch condition 2.

If the rising edge of the reference cam is set as latch condition 2, the system copies the value of the IEI option module's internal counter to counter latch register 2 and then zeroes the internal counter when latch condition 2 is met.

This is also the case if the reference cam is ANDed with the other signals as latch condition 2.

Bit 3 - Encoder zero track as latch condition 2:

Using Bit 3, you select whether the encoder zero track affects latch condition 2.

Bit 4 - Signal edge for latch condition 2:

Using bit 4, you choose which signal edge of the released and ANDed signals from bit 0 to bit 3 the system must detect for latch condition 2 to be met.

Bit 5 to bit 7 are reserved.

Bit 8 - Probe 1 as latch condition 3:

Using Bit 8, you select whether probe 1 affects latch condition 3.

Bit 9 - Probe 2 as latch condition 3:

Using Bit 9, you select whether probe 2 affects latch condition 3.

Bit 10 - Reference cam as latch condition 3:

Using Bit 10, you select whether the reference cam affects latch condition 3.

If the rising edge of the reference cam is set as latch condition 3, the system copies the value of the IEI option module's internal counter to counter latch register 3 and then zeroes the internal counter when latch condition 3 is met.

This is also the case if the reference cam is ANDed with the other signals as latch condition 3.

Bit 11 - Encoder zero track as latch condition 3:

Using Bit 11, you select whether the encoder zero track affects latch condition 3.

Bit 12 - Signal edge for latch condition 3:

Using bit 10, you choose which signal edge of the released and ANDed signals from bit 8 to bit 11 the system must detect for latch condition 3 to be met.

Bit 13 to bit 15 are reserved.

Example latch mode register:

Latch condition 2 is the rising edge of probe 1. Latch condition 3 is the falling edge of probe 1:

					Falling signal edge for latch condition 3	Encoder zero track not as latch condition 3:	Reference cam not as latch condition 3:	Probe 2 not as latch condition 3:	Probe 1 as latch condition 3:				Rising signal edge for latch condition 2	Encoder zero track not as latch condition 2:	Reference cam not as latch condition 2:	Probe 2 not as latch condition 2:	Probe 1 as latch condition 2:
		Reserved									Reserved							
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Binary value	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1
Hexadecimal value	1				1				0				1			
	16#1101															

The value 16#1101 is entered in the latch mode register (*.w_LATCH_MODE = 16#1101).

After activating the IEI option module, the latch mode register has the value 16#0000, i.e. no latch condition 2 and no latch condition 3 are selected.

7.3.11 Counter mode register

Using counter mode register *.w_COUNTER_MODE, you set the mode of the IEI option module.

- Encoder mode with
  - Single multiplication of the encoder signal,
  - Double multiplication of the encoder signal, or
  - Quadruple multiplication of the encoder signal,
- Probe mode with
  - Counting of the rising and falling edge of the 24 V signal that is connected at probe 1.
  - Counting of the rising edge of the 24 V signal that is connected at probe 1.

In addition, you can set the internal counter's direction of counting.

Bit 0	Function in encoder mode / probe mode:
	
	Encoder mode:
	  Bit1 Bit0
	  0 0 : Quadruple multiplication of the encoder signal
	  0 1 : Double multiplication of the encoder signal
	  1 0 : Single multiplication of the encoder signal
	  1 1 : Reserved

Bit 1	Probe mode:
	  Bit1 Bit0
	  0 0 : Counting of the rising and falling edge of the 24 V signal at probe 1
	  0 1 : Counting of the rising edge of the 24 V signal at probe 1
	  1 0 : Reserved
	  1 1 : Reserved

Bit 2	Selection of encoder mode / probe mode: 0: Encoder mode is selected 1: Probe mode is selected

Bit 3	Direction of counting (with encoder mode only):
	0: If the encoder rotates clockwise, the internal counter counts up
	   If the encoder rotates counterclockwise, the internal counter counts down
	1: If the encoder rotates clockwise, the internal counter counts down
	   If the encoder rotates counterclockwise, the internal counter counts up

Bit 4	Set preload value: 0: The system does not copy a preload value to the internal counter and counter latch registers 1, 2 and 3. 1: The system copies the preload value from the counter preload register to the internal counter and counter latch registers 1, 2 and 3.
Bit 5	Log control of the latch conditions (with encoder mode only): 0: Regardless of the order in which they occur, latch conditions 2 and 3 result in the system copying the internal counter to counter latch registers 2 and 3 1: Depending on the order in which they occur, latch conditions 2 and 3 result in the system copying the internal counter to counter latch registers 2 and 3
Bit 6 to bit 15	Reserved

Bits 0 and 1 - Function in encoder mode / probe mode

Using bits 0 and 1, you configure the mode you selected using bit 2.

Bit 2 - Selection of encoder mode / probe mode:

Using bit 2, you select the mode in which the IEI option module is to be operated.

Bit 3 - Direction of counting

Using bit 3, you select the internal counter's direction of counting.

Bit 4 - Set preload value

Using bit 4, you can set the internal counter to a predefined value.

Bit 5 - Sequence of latch conditions 2 and 3

Using bit 5, you select whether the system is to ignore the sequence in which latch condition 2 and latch condition 3 occur or not.

If bit 5 = FALSE, the sequence is ignored.

If bit 5 = TRUE, handles the sequence as follows:

If the encoder rotates clockwise, latch condition 2 must occur before latch condition 3 for the value of the internal counter to be copied to counter latch register 3.

If the encoder rotates counterclockwise, latch condition 3 must occur before latch condition 2 for the value of the internal counter to be copied to counter latch register 2.

Bit 6 to bit 15 are reserved.

Example counter mode register:

The IEI option module is being operated in encoder mode. Choose "single" as the multiplication of the encoder signal. If the encoder rotates clockwise, you want the internal counter to count up. No preload value is set. The order in which latch conditions 2 and 3 does not affect copying of the internal counter to counter latch registers 2 and 3:

											The sequence of latch conditions does not matter	Do not set a preload value	Incremental if encoder rotates clockwise	IEI in encoder mode	"Single" multiplication	
		Reserved														
Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Binary value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Hexadecimal value	0				0				0				2			
	16#0002															

The value 16#0002 is entered in the counter mode register
(*.w_COUNTER_MODE = 16#0002).

7.3.11.1 Example of initializing and operating the IEI option module in encoder mode

A rectangle incremental encoder is connected to a motor. The signals (or the increments) of the rectangle incremental encoder are counted on a "single" basis. The encoder rotates clockwise and the system counts up with this direction of rotation.

Apart from this, an encoder is connected to input probe 1. On the one hand, you want to store the counter value in the case of a rising edge of the probe. On the other hand, you want the system to also store the counter value in the case of the falling edge of the encoder.

You initialize the IEI option module as follows:

Disable copying of the internal counter to counter latch registers 2 and 3

Write 16#0001 to the Latch2 disable register and the Latch3 disable register:

*.w_LATCH2_DISABLE = 16#0001

*.w_LATCH3_DISABLE = 16#0001

Set counter mode

Write 16#0002 to the counter mode register (see the example ▷Counter mode register ◁ from page 47 onward)

*.w_COUNTER_MODE = 16#0002

Set latch mode

Write 16#1101 to the latch mode register (see the example ▷Latch mode register ◁ from page 44 onward)

*.w_LATCH_MODE = 16#1101

Enable copying of the internal counter to counter latch registers 2 and 3

Write 16#0000 to the Latch2 disable register and the Latch3 disable register:

*.w_LATCH2_DISABLE = 16#0000

*.w_LATCH3_DISABLE = 16#0000

From now on, the internal counter counts the encoder's increments. The system copies this counter value to counter latch register 1 when latch condition 1 (signal "Sync 1" from the BACI) occurs.

If latch condition 2 is met (a rising edge of the probe at input probe 1), the system copies the value of the internal counter to counter latch register 2.

If latch condition 3 is met (a falling edge of the probe at input probe 1), the system copies the value of the internal counter to counter latch register 3.

7.3.11.2 Example of initializing and operating the IEI option module in probe mode

A 24 V signal is connected at input probe 1. You want to count the rising edge of the 24 V signal.

You initialize the IEI option module as follows:

Set counter mode

Write 16#0005 to the counter mode register (see the example ▷Counter mode register ◁ from page 47 onward)

*.w_COUNTER_MODE = 16#0005

From now on, the internal counter counts the rising edges of the 24 V signal. The system copies the counter value to counter latch register 1 when latch condition 1 (signal "Sync 1" from the BACI) occurs.

After activating the IEI option module, the counter mode register has a value of 16#0000, i.e. no mode is selected for the IEI option module.

7.4 Synchronizing the IEI option module with the b maXX drive PLC

On the IEI option module, the system copies the value of the internal counter to counter latch register 1 on a regular basis. (In encoder mode, the internal counter is used to count the increments of rectangle incremental encoder; in probe mode, the system counts the edges of a 24 V signal at input probe 1.)

The internal counter is always copied to counter latch register 1 when the "Sync 1 signal" from the BACI occurs. This signal is set as the trigger source for the IEI option module. Users must ensure that the "Sync 1 signal" from the BACI is available as a trigger source.

If an option module in the b maXX system is already supplying the "Sync 1 signal" from the BACI, you do not need to make any more settings. Option modules that supply the "Sync 1 signal" on the BACI include the CANsync-Master option module (BM4-O-CAN-06) and the CANsync-Slave option module for b maXX drive PLC (BM4-O-CAN-05).

If there is no option module in the b maXX system that supplies the "Sync 1 signal" on the BACI, you must use FB TIMER_A_INIT from library SYSTEM1_PLC01_20bd00 (PROPROG wt II) or SYSTEM1_PLC01_30bd00 (ProProg wt III) or higher to make sure that this signal is available in the b maXX. For information on using FB TIMER_A_INIT, see also the b maXX drive PLC Application Manual.

Example 1: You have a b maXX 4400 basic unit with a b maXX drive PLC option module, with a CANsync-Master option module and an IEI option module.

The CANsync-Master option module supplies the "Sync 1 signal" on the BACI, the IEI option module is triggered by this signal and on the b maXX drive PLC this signal is assigned to an event task via Event 11 ("Sync Signal1 option module").

You do not need to make any further settings for the IEI option module.

The system copies the reading of the IEI option module's internal counter to counter latch register 1 each time the "Sync 1 signal" on the BACI occurs.

Example 2:   You have a b maXX unit with a b maXX drive PLC option module and an IEI option module.

In the b maXX drive PLC an event task is assigned to Event 8 ("BACI process data"). This event is triggered by signal "MasterCS_Actual1" on the BACI.

In the cold boot and warm restart task of the b maXX drive PLC, call FB TIMER_A_INIT twice after FB BACI_INIT.

At the first call, the "MasterCS_Actual1" signal is switched to the internal TA signal (us_SIGNAL = 2, x_EN = TRUE).

At the second call, the internal TA signal is switched to the "Sync 1 signal" on the BACI (x_MODE = TRUE, us_SIGNAL = 13, x_EN_SIGNAL_OUT = TRUE, x_EN = TRUE).
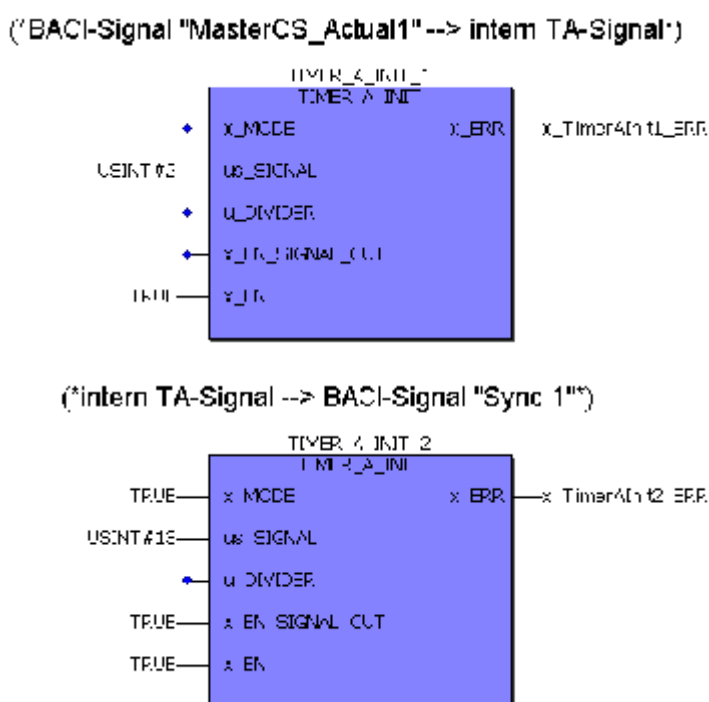

Figure 12:   Synchronizing the IEI option module with the b maXX drive PLC, example 2

From now on, the system copies the value of the IEI option module's internal counter to counter latch register 1 each time the "MasterCS_Actual1" signal occurs and, with this, the "Sync 1 signal" on the BACI.

7.5   Rectangle incremental encoder and signal multiplication

A rectangle incremental encoder generally has two encoder tracks (U1 and U2) that are offset by 90° as well as an encoder zero track (U0). The encoder tracks are output as differential signals (U1 and U1_, U2 and U2_ as well as U0 and U0_).

Depending on the evaluation of the signal edges of encoder tracks U1 and U2, there is multiplication of the encoder signal.

In the case of "single" multiplication, the system counts the rising edges of encoder track U1. In this case, encoder track U2 is for detecting the direction of rotation.

In the case of "double" multiplication, the system counts the rising and falling edges of encoder track U1. In this case, encoder track U2 is for detecting the direction of rotation.

In the case of "quadruple" the system counts the rising and falling edges of encoder tracks U1 and U2 (and uses them for detecting the direction of rotation). This is the highest resolution of the encoder signal.

With one rotation of the rectangle incremental encoder, the encoder zero track has exactly one pulse with approximately one half of the width of the pulses on encoder track U1 or U2.

NOTE

You should note that an encoder emulation does not necessarily respond like a real rectangle incremental encoder (as shown in simplified form in ▷Figure 13).
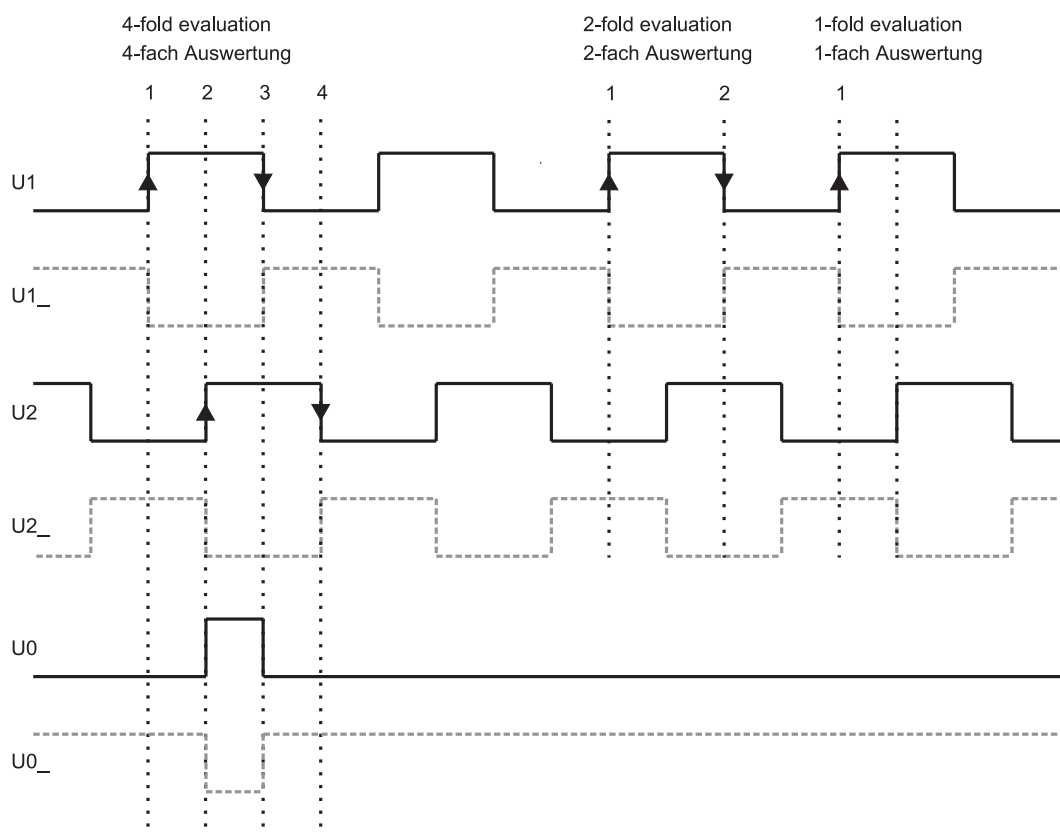

Figure 13:   Encoder evaluation in simplified form

7.6 Function block (FB) IEI_INIT

Function block IEI_INIT initializes the IEI option module (BM4-O-IEI-01). The system writes the configuration that was created at the input to the registers in communication RAM.

FB IEI_INIT needs library BM_TYPES_20bd03 (PROPROG wt II) or BM_TYPES_30bd01 (ProProg wt III) or above.

Parameter input	Data type	Description
_BASE	IEI_PLC_BMSTRUCT	Base address for the IEI option module
us_FACTOR	USINT 0, 1, 2, 4	Multiplication of evaluation of the counter
x_DIRECTION	BOOL	Counter's direction of rotation (clockwise or counterclockwise
us_TOUCH_PROBE_MODE	USINT 0, 1, 2	Setting of probe mode
x_EN	BOOL	Release

Parameter output	Data type	Description
_BASE	IEI_PLC_BMSTRUCT	Base address for the IEI option module
si_ER	SINT	Error number
x_ERR	BOOL	Error bit

Description

Function block IEI_INIT is for initializing the IEI option module. At its inputs, you set the IEI option module's mode (encoder or probe mode) using the corresponding configuration of the mode. You choose the mode by connecting valid values to inputs us_FACTOR or us_TOUCH_PROBE_MODE.

FB IEI_INIT makes these settings in the IEI option module's counter mode register.

Latch conditions 2 and 3 are set after calling FB IEI_INIT in encoder mode by writing to the latch mode register. Latch conditions 2 and 3 are NOT set via FB IEI_INIT.

Input/output **_BASE**:

At input/output _BASE, global variable _IEI_Ctrl_Slot_G (to _IEI_Ctrl_Slot_M) is connected in accordance with the slot (G to M) of the option module.

If this global variable is no longer in the PROPROG wt II project, create – in dependence on the slot (G to M) – the global variable _IEI_Ctrl_Slot_G (to _IEI_Ctrl_Slot_M) of data type IEI_PLC_BMSTRUCT.

At declaration of the global variables, this variable must be connected to the base address of the BM4-O-IEI-01 option module.

The base address of the IEI (BM4-O-IEI-01) option module in dependence on the slot is as follows:

Slot	Base address of the BM4-O-IEI-01 option module
G	%MB3.2258000
H	%MB3.3258000
J	%MB3.4258000
K	%MB3.5258000
L	%MB3.6258000
M	%MB3.7258000

Example:

BM4-O-IEI-01 option module in slot G of the b maXX

```
_IEI_Ctrl_Slot_G  AT  %MB3.2258000  :  IEI_PLC_BMSTRUCT;
```
Where:

`_IEI_Ctrl_Slot_G`	is the variable name with the data type short designation "_" for Struct
`IEI_PLC_BMSTRUCT`	is the data type
`%MB3.2258000`	is the base address of the BM4-O-IEI-01 option module in slot G of the b maXX

Input **us_FACTOR**:

At Input us_FACTOR, you state the multiplication of the encoder signal. Connecting a valid value initializes the IEI option module in encoder mode.

The IEI option module uses an internal counter to count the signals of a rectangle incremental encoder. At evaluation of the signals, you can set a multiplication factor.

You can set the following values:

us_FACTOR	Multiplication
0	No encoder mode
1	Single
2	Double
4	Quadruple

If a rectangle incremental encoder supplies 1024 increments with one revolution, with "quadruple" multiplication this yields a difference of 4096 (per revolution) in the IEI option module's internal counter.

Other values are not allowed and result in an error message at outputs si_ERR and x_ERR.

Input **x_DIRECTION**:

Input x_DIRECTION is only effective in encoder mode.

The IEI option module uses an internal counter to count the signals of a rectangle incremental encoder. You can use input x_DIRECTION to choose the direction of counting of this counter.

If x_DIRECTION = FALSE, the following applies:

If the encoder rotates clockwise, the internal counter counts up

If the encoder rotates counterclockwise, the internal counter counts down

If x_DIRECTION = TRUE, the following applies:

If the encoder rotates clockwise, the internal counter counts down

If the encoder rotates counterclockwise, the internal counter counts up

Input **us_TOUCH_PROBE_MODE**:

At input us_TOUCH_PROBE_MODE, you select the signal edges of a 24 V signal (that is connected at probe 1). Connecting a valid value initializes the IEI option module in probe mode.

The IEI option module uses an internal counter to count the signal edges of a 24 V signal (that is connected at probe 1). You can set whether the system is to count the rising and falling edge of the signal or just the rising edge.

You can set the following values:

us_TOUCH_PROBE_MODE	Selection
0	No probe mode
1	You want to count the rising and falling edge of the signal.
2	The system counts the rising edge of the signal.

Other values are not allowed and result in an error message at outputs si_ERR and x_ERR.

Input **x_EN**:

If input x_EN is set to TRUE the system enters the mode and the respective configurations of the mode in the corresponding register in the IEI option module's communication RAM. This completes initialization of the IEI option module.

If input x_EN is set to FALSE, the system does not enter data in the IEI option module's communication RAM.

NOTE

To configure functions of the BM4-O-IEI-01 option module for a register controller, you must use function block REG_CONTROL_INIT from library REGISTER_PLC01_20bd00 (PROPROG wt II) or REGISTER_PLC01_30bd00 (ProProg wt III) or above. FB IEI_INIT is a component of FB REG_CONTROL_INIT.

Outputs **si_ERR**, **x_ERR**:

If an error occurs, the system sets error bit x_ERR to TRUE and outputs error number si_ERR. If no error occurs, x_ERR stays FALSE and si_ERR = 0.

Error number si_ERR:

si_ERR	Meaning
-128 to -1	Reserved
0	No error
1	An invalid value for multiplication in encoder mode was entered at input us_FACTOR.
2	You did not state a valid encoder mode (us_FACTOR = 1, 2, 4) or a valid probe mode (us_TOUCH_PROBE_MODE = 1, 2).
3	You stated encoder mode (us_FACTOR = 1, 2, 4) and probe mode (us_TOUCH_PROBE_MODE = 1, 2).
4 to 127	Reserved

Example of initializing and operating the IEI option module in encoder mode

A rectangle incremental encoder is connected to a motor. The signal edges of the rectangle incremental encoder are counted on a single basis. The encoder rotates clockwise and the system counts up with this direction of rotation.

Apart from this, an encoder is connected to input probe 1. On the one hand, you want to save the counter value on the rising edge of the probe ($\rightarrow$ latch condition 2, result in counter latch register 2). On the other hand, you also want to save the counter value on the falling edge of the probe ($\rightarrow$ latch condition 3, result in counter latch register 3).

The example assumes that the IEI option module is fitted in slot G and that FB IEI_INIT is called in the cold boot and warm restart task.

You initialize the IEI option module as follows:

The global variable _IEI_Ctrl_Slot_G is connected at input _Base.

At input us_FACTOR, you connect USINT#1 for "single" multiplication.

At input x_DIRECTION, FALSE is connected for
          "If the encoder rotates clockwise, the internal counter counts up"
(alternatively, input x_DIRECTION is not assigned).

At input us_TOUCH_PROBE_MODE, USINT#0 is connected for "no probe mode" (alternatively, input us_TOUCH_PROBE_MODE is not assigned).

At input x_EN, TRUE is connected.

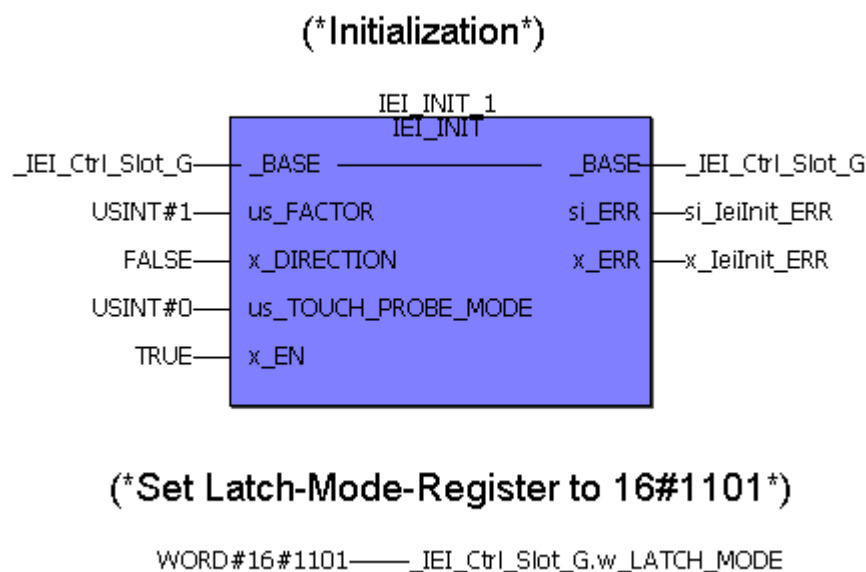After calling FB IEI_INIT, the latch mode register is set to a value of 16#1101.

(*Initialization*)

IEI_INIT_1
IEI_INIT

_IEI_Ctrl_Slot_G —— _BASE ———————— _BASE —— _IEI_Ctrl_Slot_G
USINT#1 —— us_FACTOR   si_ERR — si_IeiInit_ERR
FALSE —— x_DIRECTION   x_ERR — x_IeiInit_ERR
USINT#0 —— us_TOUCH_PROBE_MODE
TRUE —— x_EN

(*Set Latch-Mode-Register to 16#1101*)

WORD#16#1101 ——— _IEI_Ctrl_Slot_G.w_LATCH_MODE

Figure 14:   Example of initializing IEI option module in encoder mode

In this case, the internal counter counts the increments of the rectangle incremental encoder. The system copies this counter value to counter latch register 1 when latch condition (signal SYNC1 from the BACI) occurs.

If latch condition 2 is met (a rising edge of the probe at input probe 1), the system copies the value of the internal counter to counter latch register 2.

If latch condition 3 is met (a falling edge of the probe at input probe 1), the system copies the value of the internal counter to counter latch register 3.

Example of initializing and operating the IEI option module in probe mode

A 24 V primary detector is connected at input probe 1. You want to count the rising edge of the 24 V primary detector.

You initialize the IEI option module as follows:

The global variable _IEI_Ctrl_Slot_G is connected at input _Base.

At input us_FACTOR, USINT#0 is connected for "no encoder mode" (alternatively, input us_FACTOR stays not assigned).

At input x_DIRECTION, FALSE is connected (alternatively, input x_DIRECTION stays not assigned). The input is not evaluated in probe mode.

At input us_TOUCH_PROBE_MODE, USINT#2 is connected for "Counting the rising edge of the encoder at probe 1".

At input x_EN, TRUE is connected.

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Operating Instructions Option Module IEI for b maXX drive PLC BM4-O-IEI-01
Document No.: 5.02013.02   Baumüller Nürnberg GmbH

(*Initialization*)

IEI_INIT_1
IEI_INIT

_IEI_Ctrl_Slot_G —— _BASE ———————— _BASE —— _IEI_Ctrl_Slot_G
USINT#0 —— us_FACTOR   si_ERR —— si_IeiInit_ERR
FALSE —— x_DIRECTION   x_ERR —— x_IeiInit_ERR
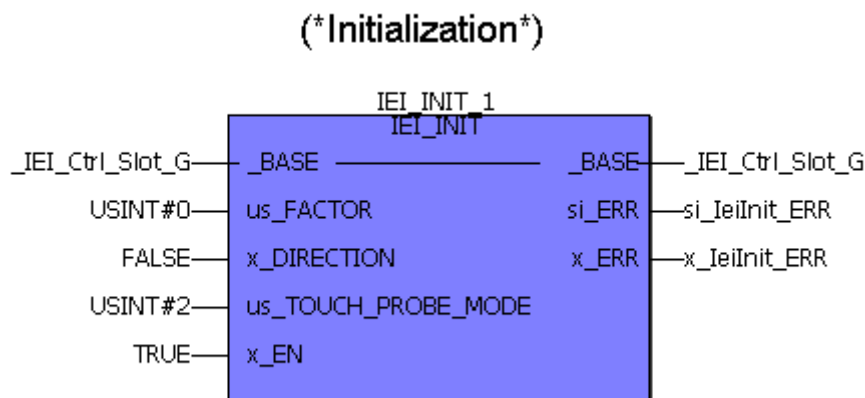USINT#2 —— us_TOUCH_PROBE_MODE
TRUE —— x_EN

Figure 15:   Example of initializing IEI option module in probe mode

The internal counter then counts the rising edges of the 24 V primary detector. The system copies the counter value to counter latch register 1 when latch condition (signal SYNC1 from the BACI) occurs. If you want the internal counter to count down, you must connect 24 V at the IEI option module's input "probe 2".

Synchronizing the IEI option module with the b maXX drive PLC

On the IEI option module, the system copies the value of the internal counter to counter latch register 1 on a regular basis. (In encoder mode, the internal counter is used to count the increments of rectangle incremental encoder; in probe mode, the system counts the edges of a 24 V signal at input probe 1.)

The internal counter is always copied to counter latch register 1 when the "Sync 1 signal" from the BACI occurs. This signal is set as the trigger source for the IEI option module. Users must ensure that the "Sync 1 signal" from the BACI is available as a trigger source.

If an option module in the b maXX system is already supplying the "Sync 1 signal" from the BACI, you do not need to make any more settings. Option modules that supply the "Sync 1 signal" on the BACI include the CANsync-Master option module (BM4-O-CAN-06) and the CANsync-Slave option module for b maXX drive PLC (BM4-O-CAN-05).

If there is no option module in the b maXX system that supplies the "Sync 1 signal" on the BACI, you must use FB TIMER_A_INIT from library SYSTEM1_PLC01_20bd00 (PROPROG wt II) or SYSTEM1_PLC01_30bd00 (ProProg wt III) or higher to make sure that this signal is available in the b maXX. For information on using FB TIMER_A_INIT, see also the b maXX drive PLC Application Manual.

Example 1:   You have a b maXX 4400 basic unit with a b maXX drive PLC option module, with a CANsync-Master option module and an IEI option module.

The CANsync-Master option module supplies the "Sync 1 signal" on the BACI, the IEI option module is triggered by this signal and on the b maXX drive PLC this signal is assigned to an event task via Event 11 ("Sync Signal1 option module").

You do not need to make any further settings for the IEI option module.

The system copies the value of the IEI option module's internal counter to counter latch register 1 each time the "Sync 1 signal" on the BACI occurs.

Example 2: You have a b maXX unit with a b maXX drive PLC option module and an IEI option module.
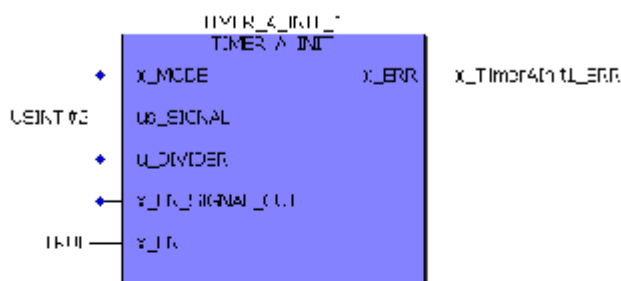
In the b maXX drive PLC an event task is assigned to Event 8 ("BACI process data"). This event is triggered by signal "MasterCS_Actual1" on the BACI.

In the cold boot and warm restart task of the b maXX drive PLC, call FB TIMER_A_INIT twice after FB BACI_INIT.

At the first call, the "MasterCS_Actual1" signal is switched to the internal TA signal (us_SIGNAL = 2, x_EN = TRUE).

At the second call, the internal TA signal is switched to the "Sync 1 signal" on the BACI (x_MODE = TRUE, us_SIGNAL = 13, x_EN_SIGNAL_OUT = TRUE, x_EN = TRUE).

Figure 16:   Synchronizing the IEI option module with the b maXX drive PLC, example 2

From now on, the system copies the value of the IEI option module's internal counter to counter latch register 1 each time the "MasterCS_Actual1" signal occurs and, with this, the "Sync 1 signal" on the BACI.

Rectangle incremental encoder and signal multiplication

A rectangle incremental encoder generally has two encoder tracks (U1 and U2) that are offset by 90° as well as an encoder zero track (U0). The encoder tracks are output as differential signals (U1 and U1_, U2 and U2_ as well as U0 and U0_).

Depending on the evaluation of the signal edges of encoder tracks U1 and U2, there is multiplication of the encoder signal.

In the case of "single" multiplication, the system counts the rising edges of encoder track U1. In this case, encoder track U2 is for detecting the direction of rotation.

In the case of "double" multiplication, the system counts the rising and falling edges of encoder track U1. In this case, encoder track U2 is for detecting the direction of rotation.

In the case of "quadruple" the system counts the rising and falling edges of encoder tracks U1 and U2 (and uses them for detecting the direction of rotation). This is the highest resolution of the encoder signal.

With one rotation of the rectangle incremental encoder, the encoder zero track has exactly one pulse with approximately one half of the width of the pulses on encoder track U1 or U2.

NOTE

You should note that an encoder emulation does not necessarily respond like a real rectangle incremental encoder (as shown in simplified form in ▷Figure 17).
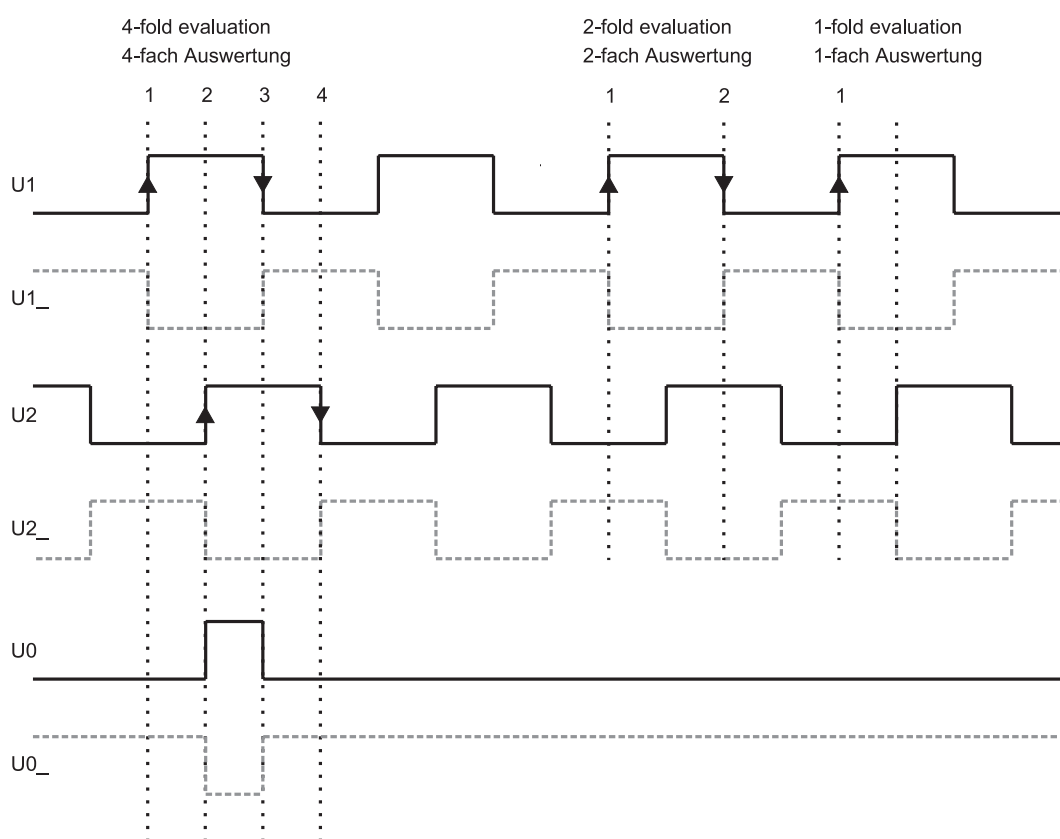

Figure 17:   Encoder evaluation in simplified form

FINDING AND ELIMINATING DISTURBANCES

In this chapter, we will describe disturbance displays on the IEI option module. We explain the meanings of each disturbance display and how you can respond to them.

8.1 Safety regulations

○ Observe the ▷Basic Safety Instructions ◁ from page 7 onward.

8.2 Requirements of the personnel carrying out work

The personnel who work with the b maXX unit must have been instructed in operating the unit and be familiar with correctly operating it. Responding to error displays and status conditions in particular requires special knowledge that operators must demonstrate. Below, we will inform you about the various disturbances and the error messages that result from them. These disturbances can have mechanical or electrical causes.

8.3 Error messages responses to errors

The IEI option module indicates an error by activating the red LED H1. You cannot eliminate an error in the IEI option module. Contact Baumüller Nürnberg GmbH.

In encoder mode, when generating latch conditions 2 and 3 by means of mechanical pushbuttons ensure that the pushbuttons doe not bounce or prevent this by suitable interconnection of a capacitor.

MAINTENANCE

If you comply with the specified environmental operating conditions, see ▷Technical Data ◁ from page 83 onward, the IEI option module is maintenance-free. If you find a defect in your IEI option module or think that it is defective, contact Baumüller Nürnberg GmbH.

OVERHAUL

You cannot overhaul a defective IEI option module, contact Baumüller Nürnberg GmbH to obtain a replacement.

DISMANTLING, STORAGE

In this chapter, we will describe how you decommission the IEI option module and store it.

11.1 Safety regulations

⊙ Observe the ▷Basic Safety Instructions ◁ from page 7 onward.

WARNING

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

- serious personal injury   • death

*Danger from: **electricity**.The unit carries dangerous voltage and current and residual charges in the intermediate circuit.*

Ensure that all the electrical connections have been deenergized and are secured against re-starting.

Wait until the intermediate circuit has discharged before starting any dismantling work. The capacitors that are used in the unit have discharged automatically **10 min.** after the supply voltage is switched off such that you can dismount the connections without any risk.

Before starting work on the electrical connections, use appropriate measuring equipment to ensure that the connections are dead.

Do not dismount the connections until you are certain that they are dead.

CAUTION

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

● property damage.

The danger is: **electrical destruction.** *The sub-asssembly may get destroyed electrically if it is removed with the supply voltage on .*

Ensure that all the electrical connections have been deenergized and are secured against restarting.

Wait until the intermediate circuit has discharged before starting any dismantling work. The capacitors that are used in the unit have discharged automatically **10 min**. after the supply voltage is switched off such that you can dismount the connections without any risk.

Before starting work on the electrical connections, use appropriate measuring equipment to ensure that the connections are dead.

Do not dismount the connections until you are certain that they are dead.

WARNING

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

● serious personal injury   ● death

The danger is: *Uncontrollable characteristics of the machine/system. Removal of the module with switched on supply voltage can change the characteristics of the machine/system.*

Ensure that all the electrical connections have been deenergized and are secured against restarting.

Wait until the intermediate circuit has discharged before starting any dismantling work. The capacitors that are used in the unit have discharged automatically **10 min**. after the supply voltage is switched off such that you can dismount the connections without any risk.

Before starting work on the electrical connections, use appropriate measuring equipment to ensure that the connections are dead.

Do not dismount the connections until you are certain that they are dead.

11.2 Requirements of the personnel carrying out work

The personnel that carries out dismantling must have the necessary knowledge and have been trained appropriately to carry out this work. Choose these persons such that they understand and can apply the safety instructions printed on the unit and parts of it and on the connections.

11.3 Dismantling

◖ Make available the following material before starting dismantling:

● Suitable packaging for the IEI option module; if possible, the original packaging.

● Cover plate to cover the slot.

Carry out dismantling in the following sequence:

1 Deenergize the b maXX 4400 basic unit and secure it from unintentional switch-on.

2 Wait ten minutes (the capacitors discharge).

3 Open the cabinet.

4 Remove the b maXX 4400 basic unit's cover.

5 Remove the male connectors from the sockets.

6 Turn the spagnolet locks above and below the IEI option module's front panel slot by 90° (in the horizontal position, they are unlocked).

CAUTION

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

● property damage.

*Danger from: **electrostatic discharge**. The electronic components on the PCB can be damaged or destroyed if you touch them with your hands.*

Only touch the IEI option module by the handle on the front panel.

CAUTION

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

● minor to medium personal injury.

*Danger from: **sharp edges**. The components of the IEI option module, sheet steel parts, PCBs can have sharp edges!*

Only touch the IEI option module by the handle on the front panel.

7 Pull the IEI option module by the handle forward out of the controller section.

8 Place the IEI option module in the prepared packaging – when doing this, only touch the plug-in module by the handle.

9 Now place a cover (or a new IEI option module) in the vacant slot (the holder must point toward the left-hand side of the unit).

10 Turn the spagnolet locks by 90° (in the vertical position the locks are fastened).

11 Plug the male connectors back into the sockets.

12 Remount the cover on the unit.

13 Close the cabinet.

14 Document dismantling (or replacing) the IEI option module.

You can now switch the unit back on. If you want to dispose of the IEI option module, refer to chapter ▷Disposal ◁ from page 73 onward for more information.

11.4 Storage conditions

Store the IEI option module in suitable packaging according to the storage conditions in ▷Technical Data ◁ from page 83 onward.

11.5 Recommissioning

If you want to recommission the IEI option module, observe the information in "Storage Conditions". Then, carry out commissioning again.

DISPOSAL

In this chapter, we will show you how to correctly and safely dispose of the IEI option module (BM4-O-IEI-01). For the most part, you must dispose of electronic scrap.

12.1 Safety regulations

◉ Observe the ▷Basic Safety Instructions ◁ from page 7 onward.

CAUTION

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

- minor to medium personal injury.

*Danger from: **sharp edges.** The components of the IEI option module, sheet steel parts, etc. can have sharp edges! If you do not hold an IEI option module by the handle, you can cut your fingers or the palm of your hand.*

You must only ever hold the IEI option module by the handle on the front panel.

CAUTION

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

- environmental pollution.

*Danger from: **incorrect disposal.***

You must only carry out disposal in accordance with the safety regulations. If necessary, you must also comply with any local regulations. If you cannot safely dispose of the unit yourself, commission a suitable disposal company to carry it out on your behalf.

In case of fire, dangerous compounds may result or hazardous materials may be released.

Do not subject electronic components to high temperatures.

Some high-performance semi-conductors, for example, use beryllium oxide as the internal insulation. The beryllium dust that results on opening is a health risk.

Do not open the electronic components.

12.2 Requirements of the personnel carrying out work

The personnel that carries out disposal/dismantling must have the necessary knowledge and have been trained appropriately to carry out this work. Choose these persons such that they understand and can apply the safety instructions printed on the b maXX 4400 basic unit and parts of it.

12.3 Disposal guide

Conditions
- The IEI option module has already been correctly dismantled.
- All the necessary technical aids for dismantling are ready for use and are in perfect technical condition.

Sheet steel   The front panel is made of galvanized sheet steel. Dispose of the sheet steel in your local reusable ferrous metal system.

Electronic scrap   You must dispose of the electronic scrap (PCB) that cannot be further dismantled as special waste. When doing this, observe the applicable regulations.

12.4 Disposal locations/official bodies

Ensure that you carry out disposal in accordance with your company's guidelines and with the regulations of the responsible disposal locations and official bodies. If in doubt, contact the Trade Supervisory Authority that is responsible for your company or the Environmental Protection Authorities.

APPENDIX A - ABBREVIATIONS

BACI	Baumüller Component Interface
BUB	Ballast unit
BUC	Baumüller feed/return feed unit
BUG	Baumüller converter basic feed unit
BUM	Baumüller individual power unit
BUS	Baumüller power module
CE	Communauté Européenne (European Community)
CPU	Central Processing Unit
DA	Digital/analog
DC	d.c. current
DIN	Deutsches Institut für Normung e.V. (German Standards Institute)
EMC	Electromagnetic compatibility
EN	European standard
ESD	Discharge of static electricity
FB	Function Block
IEI	Incremental Encoder Interface
I/O	Input/Output
ID-No.	Identification number
ISO	International Organization for Standardization
LED	Light Emitting Diode
16#	Prefix for hexadecimal numbers
mtr.	Medium time lag (fuse)
PELV	Protective Extra Low Voltage
R	Reserved
RAM	Random Access Memory
SELV	Safety Extra Low Voltage
VDE	Verband deutscher Elektrotechniker (German Association of Electrical Engineers)

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Document No.: 5.02013.02

Baumüller Nürnberg GmbH

APPENDIX B - ACCESSORIES

This appendix lists all the accessories that are available for Baumüller Nürnberg GmbH's IEI option module.

If you have any queries about accessories or suggestions for improvements, Baumüller's Product Management will be pleased to hear from you.

B.1 List of all accessories

B.1.1 Encoder connections available

The following cord set can be obtained for the connection of all encoder types.
BL-encoder connection 12/15-pole

Unit side, view onto male connector

Drive side, view onto connector
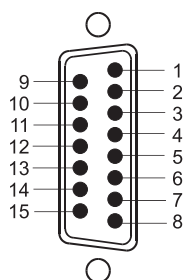
Figure 18:   SUB-D-connector, 15-pole
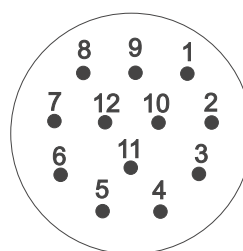
Figure 19:   Cicular connector, 12-pole, female (for example company Interkonnectron)

Cable: LiYCY 5 * (2 * 0,14) + 2 * 0,5 mm Cu-braid

The cable shield is connected with the shell of the circular connector and with the shield of the Sub-D-connector.

Type	Length in m	Art-No.
BL-encoder connection 12/15 pole	1	243601
	2	211338
	3	219333
	4	231166
	5	209879
	6	220197
	7	216455
	8	220429
	10	210052
	15	215716
	20	218568
	25	218569
	30	217094
	35	216444
	40	217095
	45	217567
	50	217568
	55	217569
	60	217570
	70	232088

Type	Length in m	Art-No.
Encoder connection, deviation-compatible 12/15 pole	3	246658
	4	243379
	5	239540
	6	242954
	8	239541
	10	239542
	15	239543
	20	239544
	25	239545
	30	239546
	35	239547
	40	240520
	45	240521
	50	240522
	55	244033
	60	245484

B.1.2 Plug-in connector

Order designation	Article number
8-pin plug-in connector	351520

APPENDIX C - MANUFACTURER DECLARATION

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

C.1 What is an EU directive?

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

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

C.2 What the CE symbol indicates

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

…

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

…

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

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

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

standards EN50178, EN 60204-1, EN 60529 and HD625.1 S1, the protection targets of 73/23/EWG are reached.

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

Compliance with 89/336/EEC (EMC Directive) depends on how the equipment is installed. Since you are performing installation yourself, it is you who are responsible for complying with 89/336/EEC.
A declaration of conformity on the EMC directive therefore cannot be issued.

We will provide you with support in the form of EMC information. You will find this information in the operating manual and in "filters for main applications". When you have complied with all the requirements we impose in this documentation, you can assume that the drive satisfies the requirements of the EMC Directive.
The limit values and requirements for variable-speed electrical drives are determined in the harmonized product standard EN61800-3. If you are erecting an installation, for which a declaration of conformity on the EMC directive must be generated, it may be necessary to specify several harmonized standards, which you have used for the compliance of the protection targets of the directive. The harmonized product standard EN 61800-3 has to be used with electrical drives.

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

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

C.3 Definition of the term Declaration by Manufacturer

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

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

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

EG-Herstellererklärung

Declaration by Manufacturer

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

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

Option module IEI for b maXX 4400   BM4-O-IEI-01

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

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

Berücksichtigte Normen - standards complied with:

Norm / standard

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

Die Inbetriebnahme der Maschine, in die dieses Gerät eingebaut wird, ist untersagt bis die Konformität
der Maschine mit der obengenannten Richtlinie erklärt ist.
The machinery into which this unit is to be incorporated must not be put into service until the machinery
has been declared in conformity with the provisions of the directive mentioned above.

Nürnberg, ___.___.2006

Andreas Baumüller   ppa. Dr. Peter Heidrich
Geschäftsführer   Entwicklungsleiter
Head Division   Head of development   Seite 1 von 1 / page 1 of 1

APPENDIX D - TECHNICAL DATA

This appendix lists the technical data for Baumüller Nürnberg GmbH's IEI option module (BM4-O-IEI-01).

D.1   Connection values

The IEI option module has the following properties:

- Encoder signals are rated for 5 V and are optically isolated.
- The two sensors for print mark acquisition are rated for 24 V and are separated from the system via an optocoupler.
- For multiturn paths, a reference cams is rated for 24 V and is separated from the system via an optocoupler. The reference cam zeroes the counter.
- LEDs also show the latch signals (probe 1, probe 2, reference cam).
- For potential decoupling, you need an external power supply of 24V.

Supply Voltage IEI Option Module	+5 V DC internal +24 V DC external (-15% / +20%) [1])
Current consumption IEI Option Module	max. 350 mA internal typ. 150 mA external

[1])   The control voltage must accord to PELV (EN 50178, chapter 3.49) and accordingly SELV (EN 50178, chapter 3.70). In case you refer to UL 508 C limit the current to 4 A.
Severity PS2 at break of the +24 V power supply direct at the 8-pin connector (pin 1 and 2, „F" in ▹Figure 1 on page 17).

Supply Voltage Encoder	+5 V DC (-2% / +2%)
Supply current of encoder	max. 350 mA (continous short-circuit proof)

Encoder input:
    Number
    Potential separation
    Signal level
    Input current
    Input frequency
	
	1
	HCPL 0601 optocouplers
	according to RS422
	max. 15 mA
	max. 4 MHz

Probe input
    Number
    Potential separation
    Signal nominal value
    Signal level 0 signal
                1 signal
	
	2 inputs [2])
	HCPL 0601 optocoupler
	+24 V DC [1]), [3])
	< +5 V DC, < 2 mA
	$\geq$ +11 V DC, $\geq$ 6 mA

Reference cam input
    Number
    Potential separation
    Signal nominal value
    Signal level 0 signal
                1 signal
	
	1 input [2])
	HCPL 0601 optocoupler
	+24 V DC [1]), [3])
	< +5 V DC, < 2 mA
	$\geq$ +11 V DC, $\geq$ 6 mA

Rapid counter via probe 1	Probe signal from +24 V [1]), [3]) to 200 kHz
Ambient Conditions	Same as b maXX 4400 basic unit
Storage Conditions	Same as b maXX 4400 basic unit
Transportation Conditions	Same as b maXX 4400 basic unit

[1])   The control voltage must accord to PELV (EN 50178, chapter 3.49) and accordingly SELV (EN 50178, chapter 3.70). In case you refer to UL 508 C limit the current to 4 A.
Severity PS2 at break of the +24 V power supply direct at the 8-pin connector (pin 1 and 2, „F" in ▷Figure 1 on page 17).

[2])   Type 2 according to IEC 61131-3,
            Delay time: 0 signal -> 1 signal: typ. 6 µs
                              1 signal -> 0 signal: typ. 6 µs

[3])   Common ground with +24 V power supply of the option module (X2-Pin2, see ▷D.2.2 Pin assignment of 8-pin plug-in connector◁ on page 87)

D.2   Front panel

IEI-01

X1

H1 ○
H2 ○
H3 ○
H4 ○

X2
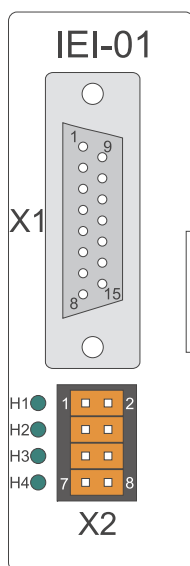
Figure 20:   BM4-O-IEI-01 front panel

D.2.1   Pin assignment of female Sub-D connector

Pin No.	Assignment
1	M5V (Ground supply of encoder)
2	+5 V (Supply of encoder)
3	Encoder zero track
4	Encoder zero track inverted
5	Encoder channel 2
6	Reserved
7	Encoder channel 1 inverted
8	Encoder channel 1
9	Encoder channel 2 inverted
10	Reserved
11	Reserved
12	Alarm, wire break
13	Reserved
14	Reserved
15	Reserved

BL-encoder connection 12/15-pole

Unit side, view onto male connector   **Drive side**, view onto connector
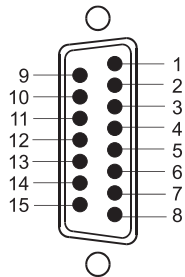
Figure 21:   SUB-D-connector, 15-pole   Figure 22:   Cicular connector, 12-pole, female (for example company Interkonnectron)
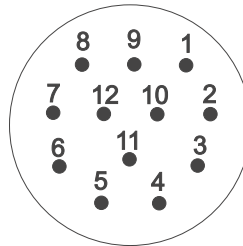
Pin-no.	Connection	Pin-no.
1	blue Ø 0.5 mm	10
2	red Ø 0.5 mm	12
3	yellow	3
4	green	4
5	violet	8
6		
7	grey	6
8	pink	5
9	black	1
10		
11		
12	brown	2
13	white	11
14	red/blue	9
15	grey/pink	7

Cable: LiYCY 5 * (2 * 0,14) + 2 * 0,5 mm Cu-braid

The cable shield is connected with the shell of the circular connector and with the shield of the Sub-D-connector.

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D.2.2   Pin assignment of 8-pin plug-in connector

Pin No.	Assignment
1	+24V
2	M24V
3	Probe 1
4	Reserved
5	Probe 2
6	Reserved
7	Reference cam
8	Reserved

Supplied plug-in connector:

Max. cable cross-section	Connection technology	Load carrying capacity
1.0 mm²	Cage clamp	7.5 A

7 mm

4000_st52_rev01_int.cdr
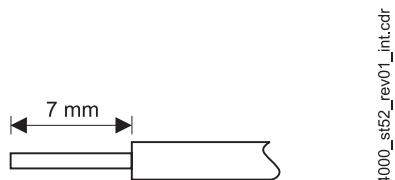
Figure 23:   Strip the 7-mm cable

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BAUMÜLLER

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