*B~IO*

# B~IO67
# Module Description

**Edition**

# 102

*B~IO*

**BOSCH**

**Automation**

*B~IO*

# B~IO67
# Module Description

1070 072 198-102 (00.11) GB

# Contents

# 1 Safety Instructions

Before you start working with the B~IO67 modules, we recommend that you thoroughly familiarize yourself with the contents of this manual. Keep this manual in a place where it is always accessible to all users.

## 1.1 Intended use

This manual contains a comprehensive set of instructions and information required for the standard operation of the described products. The described products serve as decentralized in- and output modules for the CANopen bus and the PROFIBUS-DP.

The described products

● were developed, manufactured, tested and documented in accordance with the relevant safety standards. Normally, the product does not present any danger for people or equipment provided that the specifications and safety instructions relating to project planning, installation, and normal operation of the product are observed.

● fully comply with the requirements of

 ● the EMC statute of 09-25-1998

 ● the harmonized standards EN 50 081-2, EN 50 082-2 and EN 61 131-2

● are designed for operation in an industrial environment (Class A emissions), i.e.

 ● direct connection to the public low-voltage power supply is not permitted;

 ● Connection to the medium and/or high-voltage system must be provided via transformer.

The following applies to the usage in residential settings, in business and commercial areas and in small-industry settings:

● Installation in an enclosure with high shield attenuation.

● Cables that exit the screened area must be provided with filtering or screening measures.

● The user will be required to obtain an individual operating license issued by the appropriate national authority or approval body. In Germany, this is the Regulierungsbehörde für Post und Telekommunikation (RegTP) (Regulatory Body for Post and Telecommunication), and/or its local offices.

☞ **This is a Class A device. In a residential setting, this device may cause radio interferences. In such a case, the user may be required to introduce suitable countermeasures at his own costs.**

Proper transport, handling and storage, placement and installation of the product are indispensable prerequisites for its correct and safe operation.

## 1.2     Qualified Personnel

The relevant requirements are based on the job specifications as outlined by the ZVEI and VDMA in Germany. Please refer to the following German-Language publication:

**Weiterbildung in der Automatisierungstechnik**
**Editor: ZVEI and VDMA**
**Maschinenbau Verlag**
**Postfach 71 08 64**
**60498 Frankfurt/Germany**

This instruction manual is specifically designed for design and project engineers who supply machines and systems with PLCs and for skilled personnel that installs and commissions such systems. They are required to have special knowledge of PLCs, the CANopen bus and the PROFIBUS-DP.

Interventions in the hardware and software of our products that are not described in this manual may only be performed by Bosch's own specifically trained personnel.

Unqualified interventions in the hardware or software or non-compliance with the warnings listed in this instruction manual or indicated on the product may result in serious personal injury or damage of the equipment.

Only trained electricians as per IEV 826-09-01 (modified) who are familiar with the contents of this manual may undertake installation and maintenance tasks regarding the described products.

These electricians

● are, due to their professional training, skills and experience and based upon their knowledge of and familiarity with applicable technical standards, capable of evaluating the work to be carried out, and of recognizing possible dangers.

● possess, based upon several years of working in a comparable field, a level of knowledge and skills that may be deemed equal to that after formal professional education.

With regard to the foregoing, please note our comprehensive training program. For further information, please call our training center
at (+49) (0 60 62) 78-258.

## 1.3    Safety Markings on Components

DANGER! High voltage!

CAUTION! Electrostatically sensitive components!

Lug for connecting PE protective earth conductor

Functional earthing or low-noise earth only!

Screened conductor only!

## 1.4        Safety Instructions in this Manual

**DANGEROUS ELECTRICAL VOLTAGE**
This symbol warns of the presence of **dangerous electrical voltage**. Insufficient or non-compliance with this warning can result in **personal injury**.

**DANGER**
This symbol is used whenever insufficient or non-compliance with instructions can result in **personal injury.**

**CAUTION**
This symbol is used whenever insufficient or non-compliance with instructions can result in **damage of equipment or data files.**

☞    This symbol is used to alert the user to an item of special interest.

★    This symbol indicates an activity to be performed by the user.

## 1.5      Safety Instructions for the Described Product

**DANGER**
**Life endangered by ineffective EMERGENCY-STOP devices!**
**EMERGENCY-STOP safety devices must remain effective and accessible during all operating modes of the system. Unlocking the EMERGENCY-STOP device must not cause an uncontrolled system restart! First, test the EMERGENCY-STOP sequence, then restore power!**

**DANGER**
**Danger for persons and equipment!**
**Before operating the system, test every new program!**

**DANGER**
**Retrofits or modifications may interfere with the safety of the described products!**

**The consequences may be severe personal injury or damage to the equipment or the environment. Therefore, any retrofitting or modification of the system utilizing components from other manufacturers does require approval by Bosch.**

**DANGEROUS ELECTRICAL VOLTAGE**
**Unless described otherwise, maintenance procedures must only be carried out when the system is turned off! During this process, the system must be safe from unauthorized or inadvertent restart.**

**If measuring or testing procedures must be carried out when the system is active, it must be done by trained electricians only.**

**CAUTION**
**Do not plug or unplug the module as long as the controller is switched on! The module could be destroyed. Turn off or unplug the controller's power supply module, the external power supply and the signal voltage first. Only then plug or unplug the module!**

**CAUTION**
**Please use only spare parts that are approved by Bosch!**

**CAUTION**
**Please comply with all ESD protection measures when using the module! Avoid electrostatic discharges!**

Please comply with the following protection measures for electrostatically endangered modules and components (EEM)!

- The employees responsible for storage, transport and handling must be trained in ESD protection.
- Store and transport EEMs in the specified protective packaging.
- Work with EEMs only at special ESD work stations equipped for this particular purpose.
- Employees, work surfaces and all devices and tools that could come into contact with EEMs must be on the same potential (e.g. earthed).
- An approved earthing wrist strap must be worn. It must be connected to the work surface via a cable with an integrated 1 MΩ resistor.
- EEMs must, under no circumstances, come into contact with objects susceptible to accumulating an electrostatic charge. Most items made of plastic belong to this category.
- When installing EEMs in or removing them from an electronic device, the power supply of the device must be switched OFF.

## 1.6       Documentation, Software Release and Trademarks

**Documentation**

This manual contains information about the operation and installation of the B~IO67 modules. General methods for project planning and installation of the CANopen bus and the PROFIBUS-DP are excluded.

Available manuals:

| Manuals | Language | Order no. |
|---|---|---|
| Catalogue Installation Engineering Bus Systems | English | 1070 072 190 |

**Trademarks**

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PROFIBUS® is a registered trademark of PROFIBUS Nutzerorganisation e.V.

HARAX® is a registered trademark of of Harting KGaA.

Notes:

# 2 System Overview

Die B~IO67 modules are decentralized terminal devices (slave connections) for programmable logic controllers (PLC), robot controls, or for computers assuming the function of controllers. Data transfer is handled via the Controller Area Network (CAN) bus or via the PROFIBUS-DP. The devices have been constructed according to degree of protection IP 67 and are available either as a PG version or a plug-in version.



## 2.1 Designations

The names of the devices are set up as follows:

| B~IO 67 P | - | DP | 8DI / 4DO |
|---|---|---|---|

| Bus Input Output | Connection system | Fieldbus | Number of digital in- and outputs |
|---|---|---|---|
| | P: PG-screw | DP: PROFIBUS-DP | DI: Inputs |
| | S: Plug | CAN: CANopen | DO: Outputs |
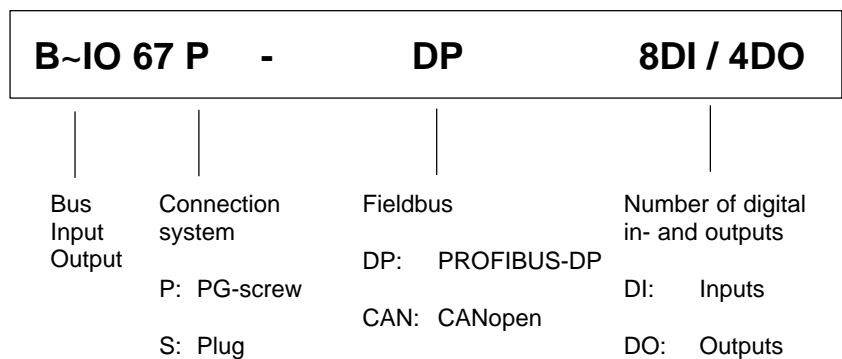
## 2.2      System Description

It is possible to connect several B~IO67s via the PROFIBUS-DP or CANopen bus cable. The sensors and actuators are connected directly with the B~IO67's corresponding terminals. The B~IO67 system offers the following advantages:

- B~IO67 can be connected to different control systems and

- stays in permanent contact with the primary controller via the PROFI-BUS-DP or the CANopen.

- The physical separation of controller and machine or its modules makes a clear system structure possible.

- The complexity of the wiring between controller and machine is reduced.

- Simple connection of sensors and actuators in 2-/ 3-/ or 4-wire connections without intermediate terminals.

- The modules provide 24 V for the sensors.

- B~IO67 processes the input signals of e.g. switches, photoelectric barriers, sensors and

- controls the connected small loads like e.g. valves, lamps and contactors.

- An exchange of defective modules is possible without new wiring (permanent wiring).

- Subsequent extensions are possible without any problems.

- By mounting the device directly to the machine, less space is required in the control cabinet.

- It saves in- and output modules in the controller.

- Error diagnosis becomes easier.

- Separate switching of loads is possible.

- The B~IO67 modules' power supply is provided by lines with a diameter of 2.5 mm$^2$.
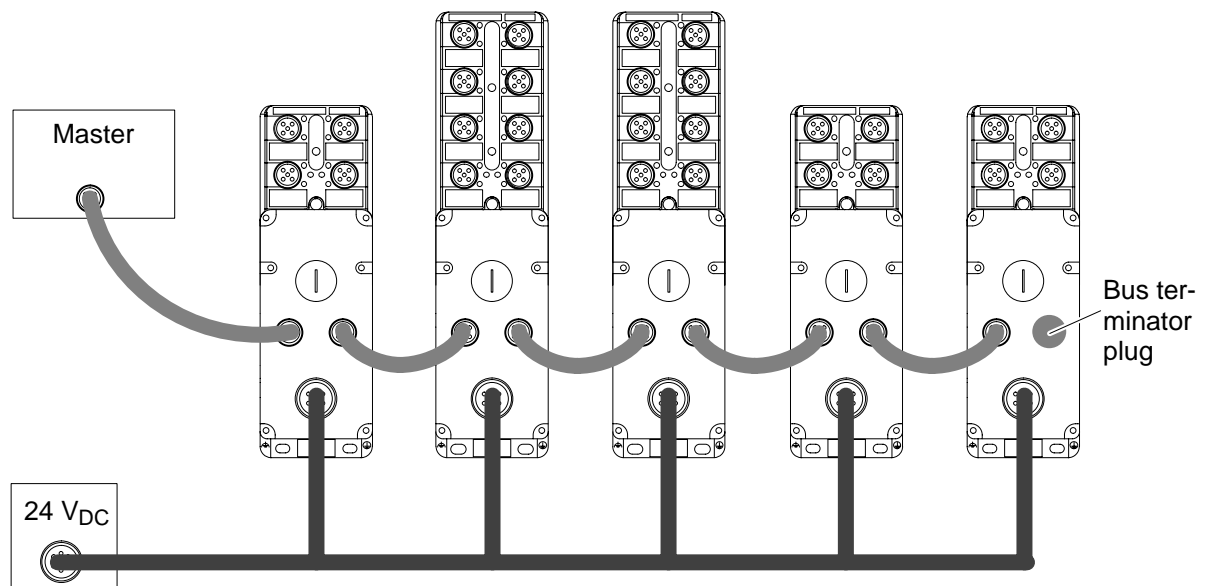
## 2.3 Hardware Configuration

All B~IO67s can be purchased either as a PG or a plug-in version. With the PG version, the bus and supply cables are connected via cable glands. With the plug-in version, the bus and supply lines are connected via plugs.

The controller – no matter which system – must be provided with a master connection for the PROFIBUS-DP or the CANopen bus.

**The B~IO67 Electronic System**

The B~IO67 electronic system contains:

- the bus connection
- the electronics for controlling the actuators and for scanning the sensors.



PG version

Plug-in version

**Plug-in version**
When using prefabricated wiring, we recommend the plug-in version.  It is provided with M23 plugs for the power supply and M12 plugs for the bus connection.

**PG version**
The PG version allows to connect the lines directly via screw terminals.

**I/O types for plug-in and PG version**
- 8 digital outputs
- 8 digital inputs and 4 digital outputs
- 8 digital inputs and 8 digital outputs
- 8 digital inputs
- 16 digital inputs

**The I/O Terminal Block**

The I/O terminal block provides the terminals for the actuators and sensors. The I/O terminal blocks differ from each other with regard to connection methods and style.

**Connection method**
- M12 plug-in connection
- IDC technique

**Styles**
- 8 I/O slots
- 4 I/O slots



## 2.4      GSD and EDS Files

In order to illustrate the slave connections, description files are used in the master. For the PROFIBUS-DP, this is the GSD file (German abbreviation for Device Data Base File DDBF), for the CANopen, it is the EDS file (Electronic Data Sheet).

The files are available on CD-ROM or can be downloaded from the **Internet**: **http://www.bosch.de/at**

# 3     I/O Terminal Block

## 3.1     I/O Connection Via M12 Plug-In Connection

The M12 socket contacts for the sensor and actuator lines are available as 4- or 5-pin models:

- one or two signal lines
- 24 V sensor power
- 0 V
- PE

**Assignment**



4-pin model

5-pin model
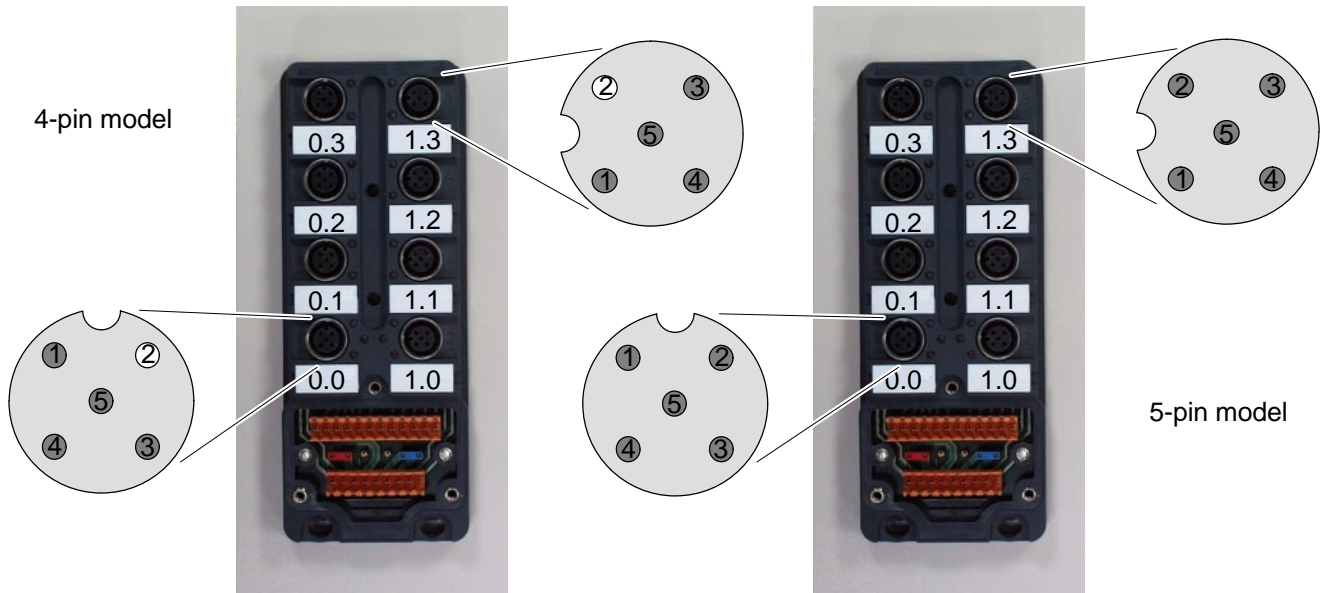
| Pin | Assignment of the sensor / actuator connections |
|-----|--------------------------------------------------|
| 1   | +24 $V_{DC}$ for sensors                          |
| 2   | In- or output, only with 5-pin version           |
| 3   | 0 V                                              |
| 4   | In- or output                                    |
| 5   | PE                                               |

### 3.1.1    8DO
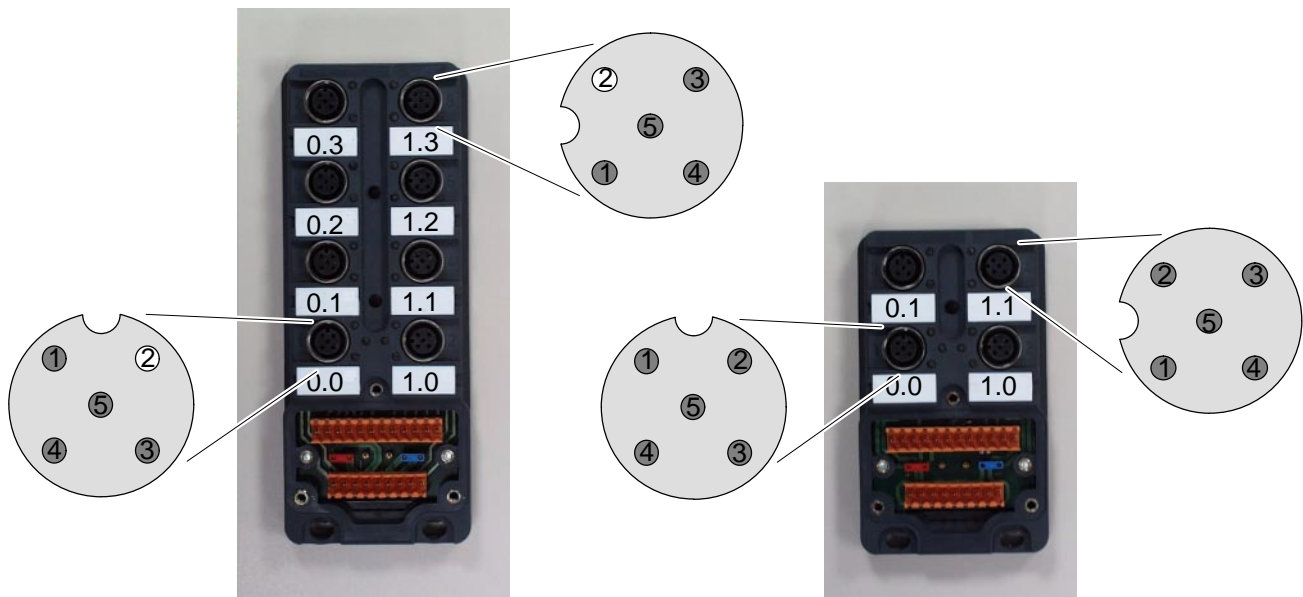


| I/O-I-8-M 4P M12 with 8 slots, 4-pin | | | I/O-I-4-M 5P M12 with 4 slots, 5-pin | | |
|---|---|---|---|---|---|
| Order number: 1070 920 837 | | | Order number: 1070 920 710 | | |
| Output | Slot | Pin | Output | Slot | Pin |
| O0 | 0.0 | 4 | O0 | 0.0 | 4 |
| O1 | 0.1 | 4 | O1 | 0.1 | 4 |
| O2 | 0.2 | 4 | O2 | 0.0 | 2 |
| O3 | 0.3 | 4 | O3 | 0.1 | 2 |
| O4 | 1.0 | 4 | O4 | 1.0 | 4 |
| O5 | 1.1 | 4 | O5 | 1.1 | 4 |
| O6 | 1.2 | 4 | O6 | 1.0 | 2 |
| O7 | 1.3 | 4 | O7 | 1.1 | 2 |

### 3.1.2　　8DI / 4DO



| I/O-I-8-M 5P M12 with 8 slots, 5-pin | | |
|---|---|---|
| **Order number: 1070 920 709** | | |
| **In- / Output** | **Slot** | **Pin** |
| I0 | 0.0 | 4 |
| I1 | 0.1 | 4 |
| I2 | 0.2 | 4 |
| I3 | 0.3 | 4 |
| I4 | 0.0 | 2 |
| I5 | 0.1 | 2 |
| I6 | 0.2 | 2 |
| I7 | 0.3 | 2 |
| O0 | 1.0 | 4 |
| O1 | 1.1 | 4 |
| O2 | 1.2 | 4 |
| O3 | 1.3 | 4 |

### 3.1.3     8DI / 8DO



| I/O-I-8-M 5P M12 with 8 slots, 5-pin | | |
|---|---|---|
| **Order number: 1070 920 709** | | |
| **In- / Output** | **Slot** | **Pin** |
| I0 | 0.0 | 4 |
| I1 | 0.1 | 4 |
| I2 | 0.2 | 4 |
| I3 | 0.3 | 4 |
| I4 | 0.0 | 2 |
| I5 | 0.1 | 2 |
| I6 | 0.2 | 2 |
| I7 | 0.3 | 2 |
| O0 | 1.0 | 4 |
| O1 | 1.1 | 4 |
| O2 | 1.2 | 4 |
| O3 | 1.3 | 4 |
| O4 | 1.0 | 2 |
| O5 | 1.1 | 2 |
| O6 | 1.2 | 2 |
| O7 | 1.3 | 2 |

### 3.1.4    8DI



| I/O-I-8-M 4P M12 with 8 slots, 4-pin | | | I/O-I-4-M 5P M12 with 4 slots, 5-pin | | |
|---|---|---|---|---|---|
| Order number: 1070 920 837 | | | Order number: 1070 920 710 | | |
| Input | Slot | Pin | Input | Slot | Pin |
| I0 | 0.0 | 4 | I0 | 0.0 | 4 |
| I1 | 0.1 | 4 | I1 | 0.1 | 4 |
| I2 | 0.2 | 4 | I2 | 0.0 | 2 |
| I3 | 0.3 | 4 | I3 | 0.1 | 2 |
| I4 | 1.0 | 4 | I4 | 1.0 | 4 |
| I5 | 1.1 | 4 | I5 | 1.1 | 4 |
| I6 | 1.2 | 4 | I6 | 1.0 | 2 |
| I7 | 1.3 | 4 | I7 | 1.1 | 2 |

### 3.1.5      16DI



| I/O-I-8-M 5P M12 with 8 slots, 5-pin | | |
|---|---|---|
| **Order number: 1070 920 709** | | |
| **In- / Output** | **Slot** | **Pin** |
| I0 | 0.0 | 4 |
| I1 | 0.1 | 4 |
| I2 | 0.2 | 4 |
| I3 | 0.3 | 4 |
| I4 | 1.0 | 4 |
| I5 | 1.1 | 4 |
| I6 | 1.2 | 4 |
| I7 | 1.3 | 4 |
| I8 | 0.0 | 2 |
| I9 | 0.1 | 2 |
| I10 | 0.2 | 2 |
| I11 | 0.3 | 2 |
| I12 | 1.0 | 2 |
| I13 | 1.1 | 2 |
| I14 | 1.2 | 2 |
| I15 | 1.3 | 2 |

### 3.1.6     Connecting Plug

| Designation | Order number |
|---|---|
| I/O connector, M12 plug, straight, 4-pin | 1 834 484 222 |
| I/O connector, M12 plug, right-angled, 4-pin | 1 834 484 223 |

★   Push the cable through part no. 1, 2, 3, and 4. 4A stands for the right-angled version, 4B for the straight version. Permissible diameter of cable: 4 to 6 mm.
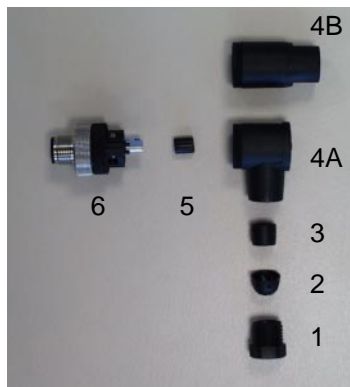


★   Strip the insulation off the cable and push the PE (Protective Earth) through part no. 5.

☞   **Do not tin-coat the litz wires. We recommend the usage of wire end ferrules.**
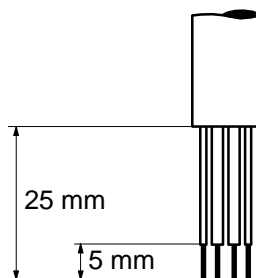


★   Screw the conductors to part no. 6.

★   Push part no. 5 onto part no. 6 via the terminal for the PE contact.

★   Assemble the plug in the illustrated order.

★   Tighten the union nut (part 1) and the knurled thumb screw on part 6.

☞   **The color of the conductors is determined in EN 60 947-5-2 or by the manufacturer.**

**Free I/O Slots**

★   Cover unused I/O slots with a protection cap. This guarantees the specified degree of protection.



| Designation | Order number |
|---|---|
| I/O protection cap, M12 | 1 823 312 001 |

## 3.2        I/O Connection Via Insulation Displacement Contact

The IDC technique minimizes the complexity of the installation. It provides you with the possibility to prepare individual sensor and actuator lines on location.

The socket contacts for the sensor and actuator lines are available either as 4- or 5-pin models:

- one or two signal lines
- 24 V sensor power
- 0 V

**Assignment**



4-pin model

5-pin model
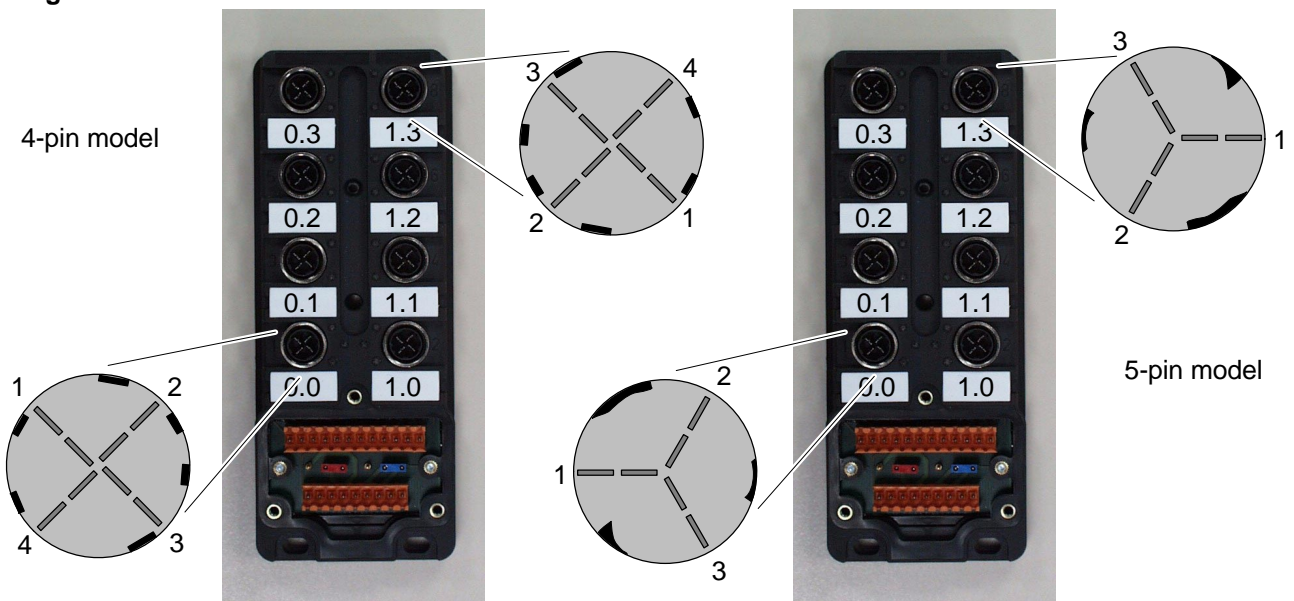
| Pin | ID | Assignment of the sensor / actuator connections, 4-pin |
|-----|-------|--------------------------------------------------------|
| 1 | brown | +24 $V_{DC}$ for sensors |
| 2 | white | In- or output |
| 3 | blue | 0 V |
| 4 | black | In- or output |

| Pin | ID | Assignment of the sensor / actuator connections, 3-pin |
|-----|-------|--------------------------------------------------------|
| 1 | ● | +24 $V_{DC}$ for sensors |
| 2 | ●● | In- or output |
| 3 | ●●● | 0 V |

☞ **The color of the conductors is determined in EN 60 947-5-2 or by the manufacturer.**

### 3.2.1        8DO
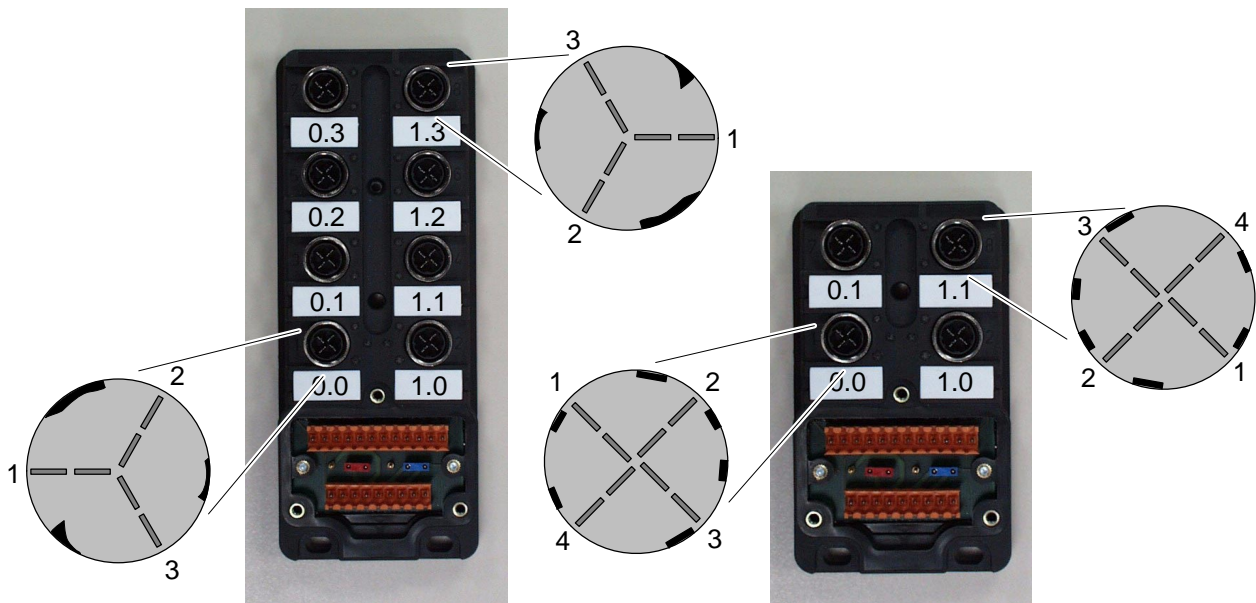


| I/O-I-8-M 3P IDC with 8 slots, 3-pin | | | I/O-I-4-M 4P IDC with 4 slots, 4-pin | | |
|---|---|---|---|---|---|
| Order number: 1070 920 839 | | | Order number: 1070 920 838 | | |
| Output | Slot | Pin | Output | Slot | Pin |
| O0 | 0.0 | 2 | O0 | 0.0 | 4 |
| O1 | 0.1 | 2 | O1 | 0.1 | 4 |
| O2 | 0.2 | 2 | O2 | 0.0 | 2 |
| O3 | 0.3 | 2 | O3 | 0.1 | 2 |
| O4 | 1.0 | 2 | O4 | 1.0 | 4 |
| O5 | 1.1 | 2 | O5 | 1.1 | 4 |
| O6 | 1.2 | 2 | O6 | 1.0 | 2 |
| O7 | 1.3 | 2 | O7 | 1.1 | 2 |

## 3.2.2    8DI / 4DO



| I/O-I-8-M 4P IDC with 8 slots, 4-pin | | |
|---|---|---|
| Order number: 1070 920 840 | | |
| In- / Output | Slot | Pin |
| I0 | 0.0 | 4 |
| I1 | 0.1 | 4 |
| I2 | 0.2 | 4 |
| I3 | 0.3 | 4 |
| I4 | 0.0 | 2 |
| I5 | 0.1 | 2 |
| I6 | 0.2 | 2 |
| I7 | 0.3 | 2 |
| O0 | 1.0 | 4 |
| O1 | 1.1 | 4 |
| O2 | 1.2 | 4 |
| O3 | 1.3 | 4 |

### 3.2.3    8DI / 8DO



| I/O-I-8-M 4P IDC with 8 slots, 4-pin | | |
|---|---|---|
| Order number: 1070 920 840 | | |
| In- / Output | Slot | Pin |
| I0 | 0.0 | 4 |
| I1 | 0.1 | 4 |
| I2 | 0.2 | 4 |
| I3 | 0.3 | 4 |
| I4 | 0.0 | 2 |
| I5 | 0.1 | 2 |
| I6 | 0.2 | 2 |
| I7 | 0.3 | 2 |
| O0 | 1.0 | 4 |
| O1 | 1.1 | 4 |
| O2 | 1.2 | 4 |
| O3 | 1.3 | 4 |
| O4 | 1.0 | 2 |
| O5 | 1.1 | 2 |
| O6 | 1.2 | 2 |
| O7 | 1.3 | 2 |

### 3.2.4    8DI



| I/O-I-8-M 3P IDC with 8 slots, 3-pin | | | I/O-I-4-M 4P IDC with 4 slots, 4-pin | | |
|---|---|---|---|---|---|
| Order number: 1070 920 839 | | | Order number: 1070 920 838 | | |
| Input | Slot | Pin | Input | Slot | Pin |
| I0 | 0.0 | 2 | I0 | 0.0 | 4 |
| I1 | 0.1 | 2 | I1 | 0.1 | 4 |
| I2 | 0.2 | 2 | I2 | 0.0 | 2 |
| I3 | 0.3 | 2 | I3 | 0.1 | 2 |
| I4 | 1.0 | 2 | I4 | 1.0 | 4 |
| I5 | 1.1 | 2 | I5 | 1.1 | 4 |
| I6 | 1.2 | 2 | I6 | 1.0 | 2 |
| I7 | 1.3 | 2 | I7 | 1.1 | 2 |

## 3.2.5 16DI



| I/O-I-8-M 4P IDC with 8 slots, 4-pin | | |
|---|---|---|
| **Order number: 1070 920 840** | | |
| **In- / Output** | **Slot** | **Pin** |
| I0 | 0.0 | 4 |
| I1 | 0.1 | 4 |
| I2 | 0.2 | 4 |
| I3 | 0.3 | 4 |
| I4 | 1.0 | 4 |
| I5 | 1.1 | 4 |
| I6 | 1.2 | 4 |
| I7 | 1.3 | 4 |
| I8 | 0.0 | 2 |
| I9 | 0.1 | 2 |
| I10 | 0.2 | 2 |
| I11 | 0.3 | 2 |
| I12 | 1.0 | 2 |
| I13 | 1.1 | 2 |
| I14 | 1.2 | 2 |
| I15 | 1.3 | 2 |

## 3.2.6     Connecting Plug

| Designation | Order number |
|---|---|
| I/O quick-connect terminal element, 3-pin | 1070 920 902 |
| I/O quick-connect terminal element, 4-pin | 1070 920 903 |



★    Remove the coating of the cable and push it through part no. 1 and part no. 2. Permissible diameter of cable: 4 to 5.1 mm.
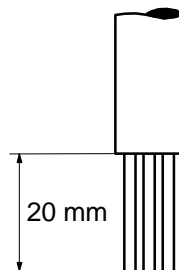


★    Pass the single conductors through the correct openings in part no. 3.

☞    **The color of the conductors is determined in EN 60 947-5-2 or by the manufacturer.**

★    Assemble the plug in the illustrated order and cut the overhanging conductors. Establish a contact by screwing the plug to the I/O slot.

☞    **If the connection is interrupted and supposed to be re-established, the used wire ends must be cut off.**

**Free I/O slots**

★    Cover unused I/O slots with a protection cap. This will guarantee the specified degree of protection.



| Designation | Order number |
|---|---|
| I/O protection cap, M12 | 1 823 312 001 |

# 3.3 Mounting the I/O terminal block

**Mounting Surface**

- The bottom must be flat so that the device will not be distorted.

  Further advantageous characteristics:
- Electric conductivity and grounding
- Good thermal conductivity

☞ **All specifications regarding the total current and the ambient temperature are dependent on a good heat-conducting mounting surface, e.g. one that is made of metal. If the device is installed on a surface that does not conduct heat well, e.g. one that is made of wood, the maximum ambient temperature is reduced by approximately 10 °C.**

**Mounting Position**

Basically, the I/O terminal block can be mounted in any position.

☞ **Because of thermal reasons, the distance between B~IO67 modules should be at least 20 mm.**

When mounting the device, make sure to relieve the plug of the cables' weight, refer to chapter 7.5.

**Drilling Pattern**

I/O terminal block, 8 slots, with B~IO67 Electronic System
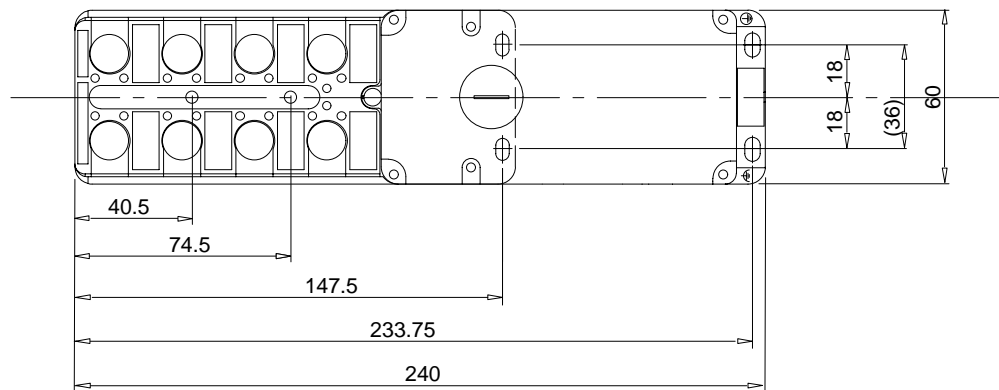


I/O terminal block, 4 slots, with B~IO67 Electronic System
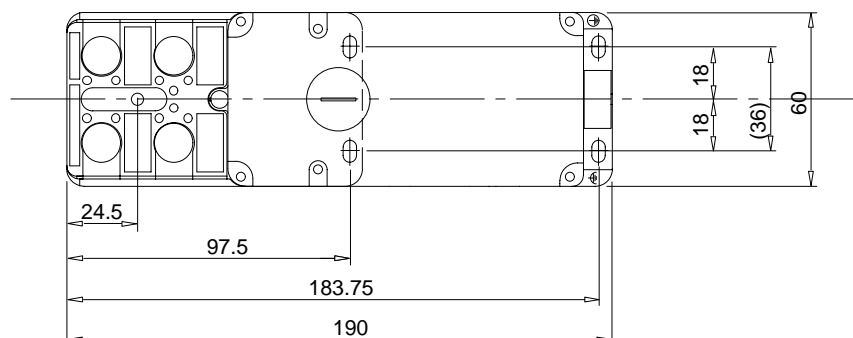


For mounting, we recommend the usage of M4 fillister head screws, property class 50, tightening torque 1 Nm.

## 3.4      LEDs on the I/O Terminal Block
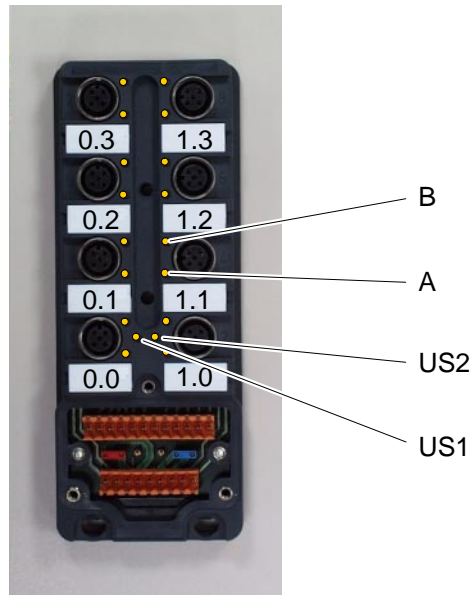


| LED | Status | Significance |
|-----|--------|--------------|
| A | off | Pin 4 of the corresponding slot is logic 0. |
|   | on | Pin 4 of the corresponding slot is logic 1. |
| B | off | Pin 2 of the corresponding slot is logic 0. |
|   | on | Pin 2 of the corresponding slot is logic 1. |
| US1 | off | The 0.X slots are not supplied with sensor voltage. |
|   | on | The 0.X slots are supplied with sensor voltage. |
| US2 | off | The 1.X slots are not supplied with sensor voltage. |
|   | on | The 1.X slots are supplied with sensor voltage. |

Notes:

# 4    Installation of the B~IO67 Electronic System on the I/O Terminal Block

After having mounted the I/O terminal block, put the B~IO67 electronic system on top of it. The electronic system is coded. Set the code of the I/O terminal block accordingly.

## 4.1    Coding the I/O Terminal Block

**CAUTION**
**The coding of the B~IO67 electronic system and the I/O terminal block prevents a false I/O connection in case an electronic system must be exchanged. This ensures the correct function of the system and protects it against destruction.**

When delivered, the B~IO67 electronic system is already provided with the corresponding coding. The corresponding code of the I/O terminal block is to be set by you. To do so, two coding pins are included in the package of the electronic system.
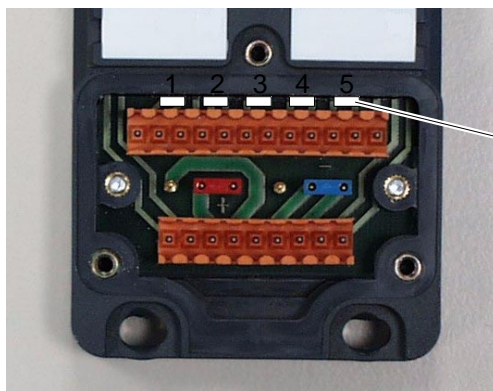


possible positions of the I/O terminal block's coding pins

★    Depending on the used I/O configuration, set both coding pins to the positions in the I/O terminal block as indicated in black in the illustration.
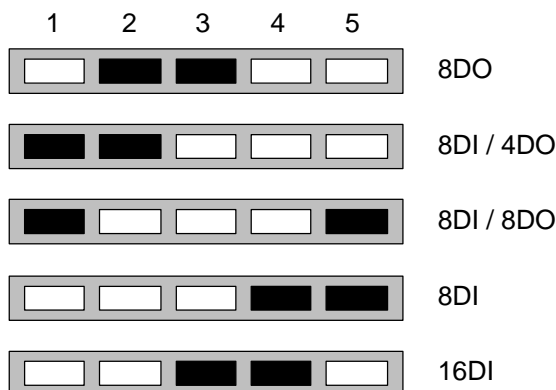
## 4.2    Installation

★    Check the position of the **red jumper** in the I/O terminal block. It must be positioned on the **right pins** and is, thus, out of function.

★    Check the position of the **blue jumper** in the I/O terminal block. It must be positioned on the **right pins** and distributes the current to two conductors. This way, the stress is taken from the conductors.



Position of the blue jumper (–)

Position of the red jumper (+)
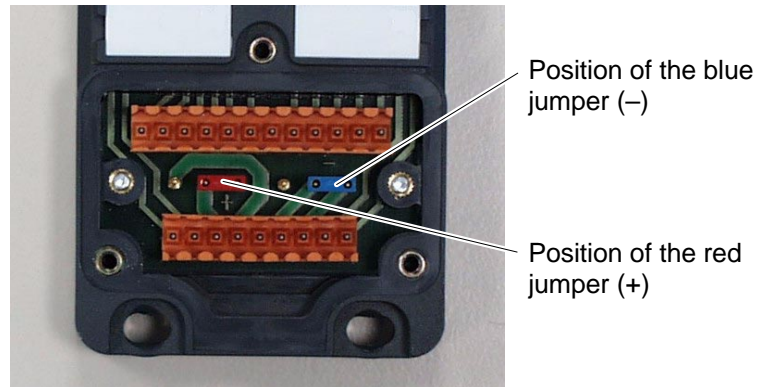
★    Check the seal on the B~IO67 electronic system and the mounting surface of the I/O terminal block. They must be clean and undamaged.



Seal
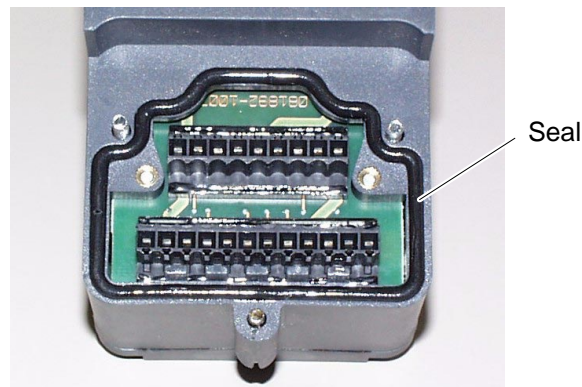
★    Put the electronic part on the I/O terminal block.

★    Screw in the three connecting screws. Tightening torque 0.7 Nm.



Connecting screws

★ Screw the electronic part onto the surface. In doing so, connect the earth. More information is available in chapter 7.2.7.

Functional earthing

PE connection
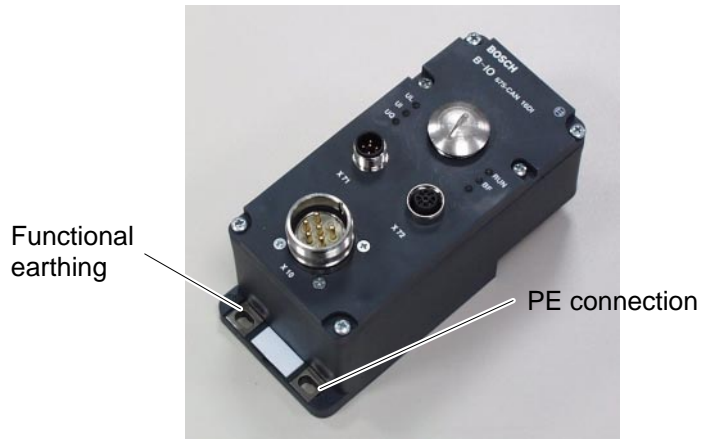
## Mounting depth (mm)

PG version

88.2

19.45

16.5

7.5

Plug-in version

19.45

16.5

7.5

60.7

78.7
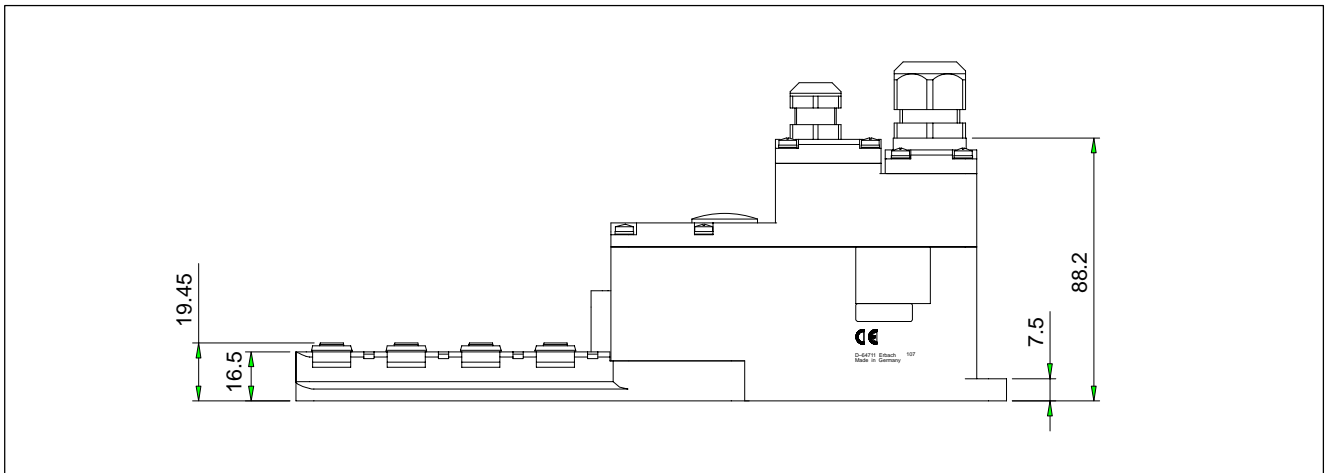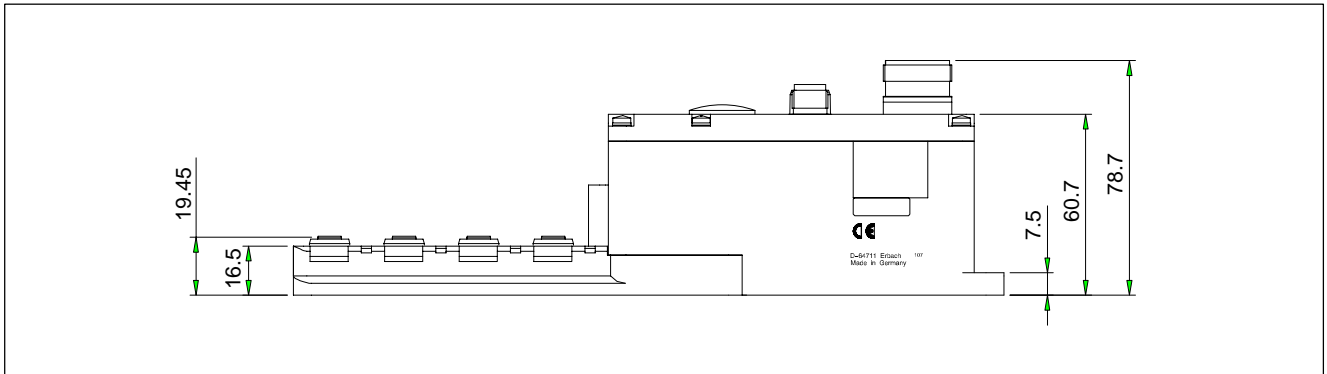
Notes:

# 5     B~IO67 Electronic System

The B~IO67 electronic system can be purchased either as a PG or a plug-in version. With the PG version, the bus and supply cables are connected via cable glands. With the plug-in version, the bus and supply lines are connected via plugs.

PG
version

Plug-in
version

## 5.1        Plug-in Version

## 5.1.1      Power Supply

The power supply systems for PROFIBUS-DP and CANopen are identical.

☞ **Further information regarding the electrical installation is available in chapter 7.**

**Assignment X10**
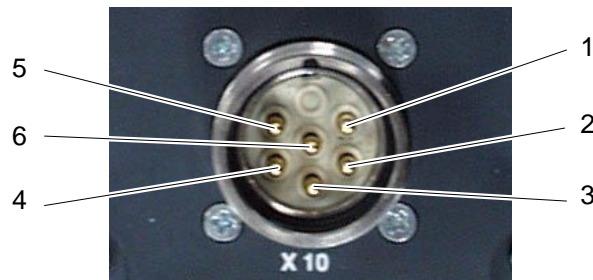


| Pin | Assignment |
|-----|------------|
| 1 | PE |
| 2 | UQ, +24 $V_{DC}$ load |
| 3 | MQ, 0 V load |
| 4 | UI, +24 $V_{DC}$ logic and sensors |
| 5 | MI, 0 V logic and sensors |
| 6 | not used |

☞ **Pin 2 and 3 of the 8DI and 16DI types are not used because a load voltage is not necessary.**

**CAUTION**
**Turn voltage off first, then plug in or unplug connection!**

**Plug assembly**

| Designation | Order number |
|-------------|--------------|
| Power connector, M23 socket | 1 824 484 030 |

★ Push adapter (part 1) and sealing element (part 3) with sealing ring (part 2) onto the cable. Select the sealing ring (part 2) according to the cable's diameter.

☞ **Required diameter of the sealing ring for cables with a diameter of 7 to 8 mm: 8.5 mm; required diameter of the sealing ring for cables with a diameter of 8.5 to 10 mm: 10.0 mm.**

★   Strip insulation off cable. Cut off foil, filler and inner insulation.

☞   **Do not tin-coat the litz wires. We recommend the usage of wire end fer-
     rules.**



70 mm

3.5 mm
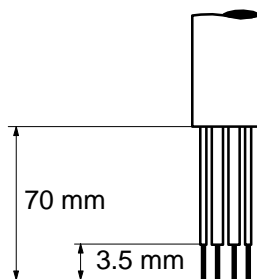
★   Draw cable unit through elbow (part 5).

★   Use screws (part 7) to screw litz wires to contacts. Recommended screw-
     driver 1.8x40 as per DIN 5264.
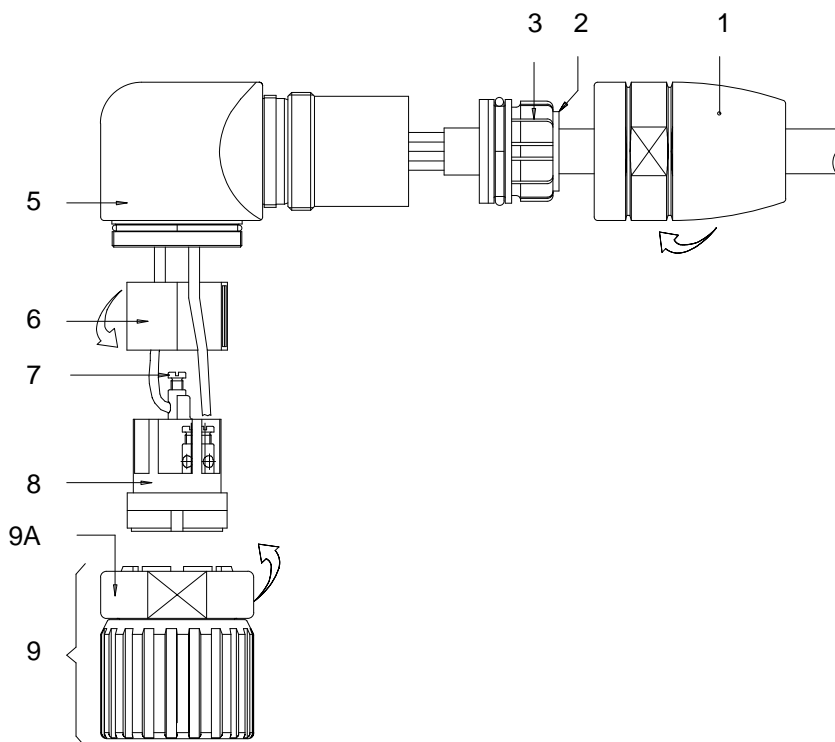


★   Put insert (part 8) and distance sleeve (part 6) into unit (part 9); make sure
     that the desired coding slot for the insert (part 8) is inserted in the coding ele-
     ment.

★   Insert the entire unit into the elbow (8 coding possibilities) and secure with
     nut (part 9A).

★   Push cable and sealing unit into elbow (part 5). The sealing element (part 3)
     must cover the outer diameter of the cable.

★   Screw adapter (part 1) to the end.
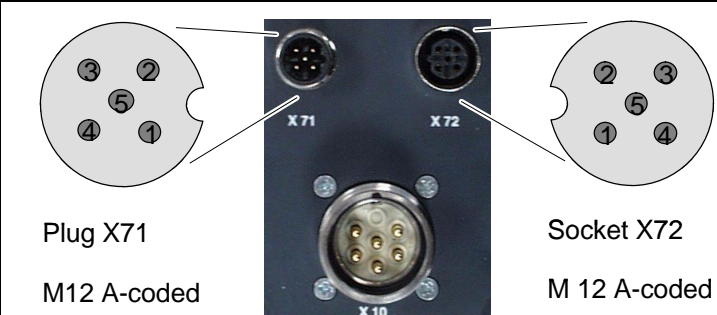
## 5.1.2   Bus Connection

**Assignment X71 and X72**

☞ **If you do not wish to route the bus, connect the bus terminator with X72.**
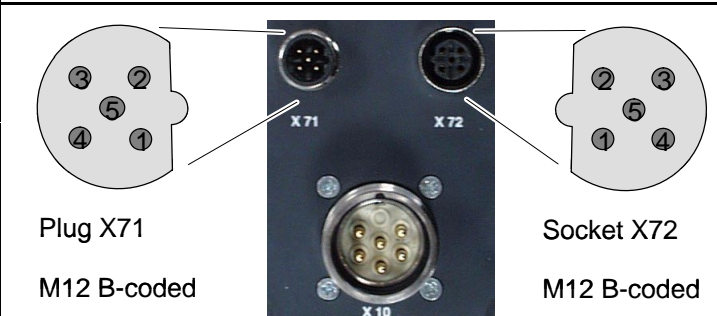
| Designation | Order number |
|---|---|
| Bus connector,  M 12 CAN socket | 1 824 484 029 |
| Bus connector,  M 12 CAN plug | 1 824 484 028 |
| Bus connector,  M 12 DP socket | 1 824 484 027 |
| Bus connector,  M 12 DP plug | 1 824 484 026 |
| Bus terminator, M12 CAN | 1070 921 001 |
| Bus terminator, M12 DP | 1070 921 000 |

**X71 and X72 for CANopen**



Plug X71

M12 A-coded

Socket X72

M 12 A-coded

| | Assignment | | |
|---|---|---|---|
| **Pin** | **Plug / Socket** | **Cable** | |
| 1 | Shield (optional) | | |
| 2 | not used | | |
| 3 | CAN_GND | X | |
| 4 | CAN_H | X | |
| 5 | CAN_L | X | |
| Enclosure | Shield | Shield | |

With a 3-core cable, only the pins 3, 4 and 5 are connected and the shield is connected via the enclosure.

**X71 and X72 for PROFIBUS-DP**



Plug X71

M12 B-coded

Socket X72

M12 B-coded

| | Assignment | | |
|---|---|---|---|
| **Pin** | **Plug / Socket** | **Cable** | |
| 1 | Supply voltage +5 V | | |
| 2 | A-line, RXD/TXD-N | green | |
| 3 | GND | | |
| 4 | B-line RXD/TXD-P | red | |
| 5 | Shield | | |
| Enclosure | Shield | Shield | |

With a 2-core cable, only the pins 2 and 4 are connected and the shield is connected via the enclosure.

**Plug assembly**

★ Push cable through parts 1 to 4. Permissible diameter of cable: 6 to 8 mm.
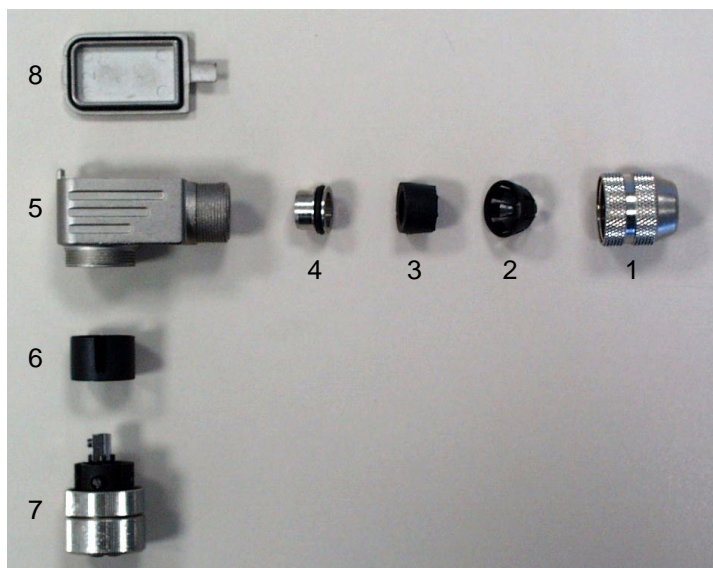


★ Strip off the insulation, expand the shield, wrap it around the grading ring (part 4) and cut off the overhanging braiding.

☞ **Do not tin-coat the litz wires. We recommend the usage of wire end ferrules.**
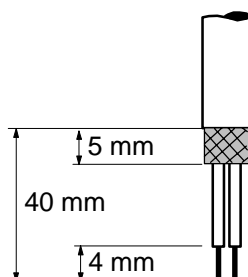


★ Push litz wires through the housing (part 5 and 6) and assemble grading ring (part 4), sealing ring (part 3), clamping element (part 2), and cap (part 8). Turn clamping screw (part 1) in order to fasten cable. Fasten litz wires with screws.

★ Assemble remaining parts according to illustration, and tighten clamping screw (part 1) and knurled thumb screw to part 7.

## 5.2        PG Version

### 5.2.1      Power Supply

The power supply systems for PROFIBUS-DP and CANopen are identical.

☞ **Further information regarding the electrical installation is available in chapter 7.**

You have three options at your disposal to connect the power supply:
● Logic, in- and outputs together
● Logic/inputs and outputs separate
● Logic, in- and outputs together and routing of power supply

★     In order to connect the supply lines, you must untie the four screws on top of the housing.



Screws
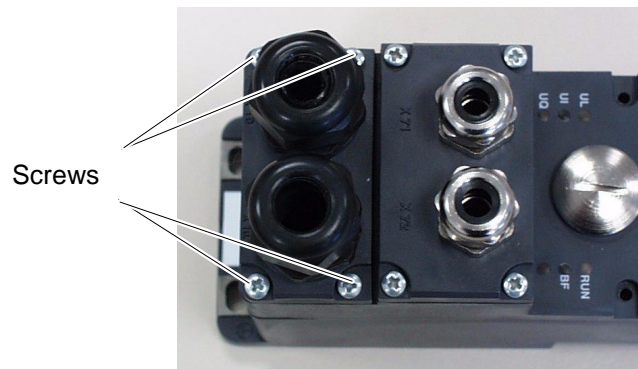
★     Remove the plug-in box upwards.
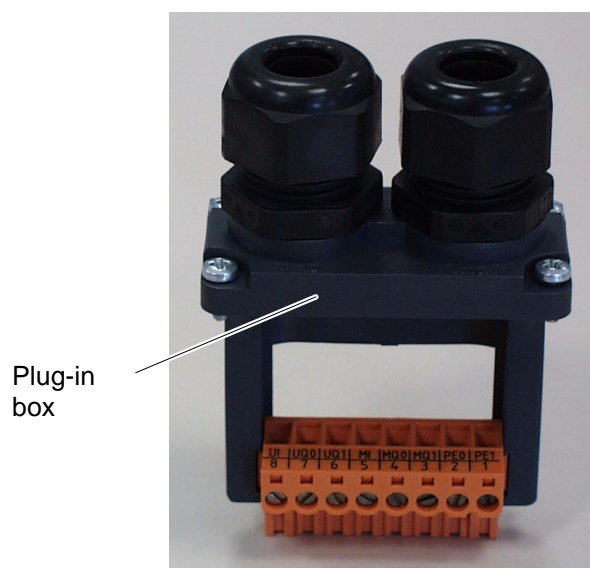


Plug-in box

☞   **Diameter of power supply cables: 6 to 12 mm.**

Part 3 is attached to the plug-in box. Tightening torque 3.75 Nm.



3                          2                          1

★   Strip the insulation off the cable.

☞   **Do not tin-coat the litz wires. The usage of wire end ferrules is not required.**



55 mm

7 mm
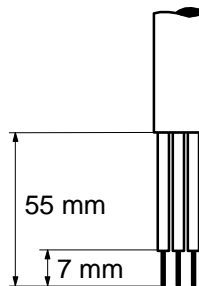
★   Push the cable through all three parts until the coating at part 3 laps over for about 3 mm.

★   Connect the lines with the terminal strip. In order to facilitate the connection, take the terminal strip out of the plug-in box from the side.

## Assignment of the Terminal Strip X10 / X10.1, in general

24 V for logic and inputs
24 V for outputs
0 V for logic, in- and outputs
Protective earth conductor
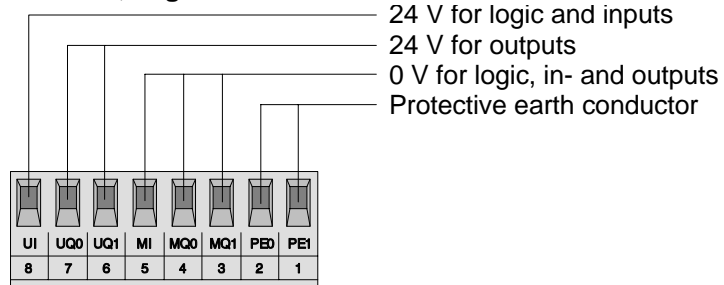
| UI | UQ0 | UQ1 | MI | MQ0 | MQ1 | PE0 | PE1 |
|----|-----|-----|----|-----|-----|-----|-----|
| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |

| Terminal | | Assignment |
|----------|---|------------|
| UI | 8 | 24 V for logic and inputs |
| UQ0 | 7 | 24 V for outputs |
| UQ1 | 6 | 24 V for outputs |
| MI | 5 | 0 V for logic, in- and outputs |
| MQ0 | 4 | 0 V for logic, in- and outputs |
| MQ1 | 3 | 0 V for logic, in- and outputs |
| PE0 | 2 | Protective earth conductor |
| PE1 | 1 | Protective earth conductor |

☞ **Currents of more than 8 A per terminal require jumpers.**

## Assignment for Separate Supply of Logic/Inputs and Outputs
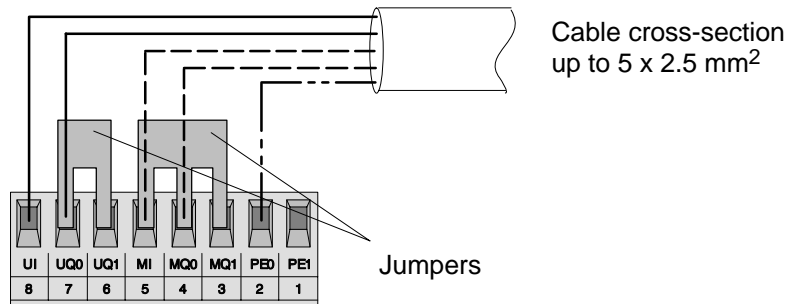
Cable cross-section
up to 5 x 2.5 mm$^2$

| UI | UQ0 | UQ1 | MI | MQ0 | MQ1 | PE0 | PE1 |
|----|-----|-----|----|-----|-----|-----|-----|
| 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |

Jumpers

**Assignment for Common Supply of Logic, In- and Outputs**



Cable cross-section up to $3 \times 2.5 \text{ mm}^2$

Jumpers

| UI | UQ0 | UQ1 | MI | MQ0 | MQ1 | PE0 | PE1 |
|----|-----|-----|----|-----|-----|-----|-----|
| 8  | 7   | 6   | 5  | 4   | 3   | 2   | 1   |
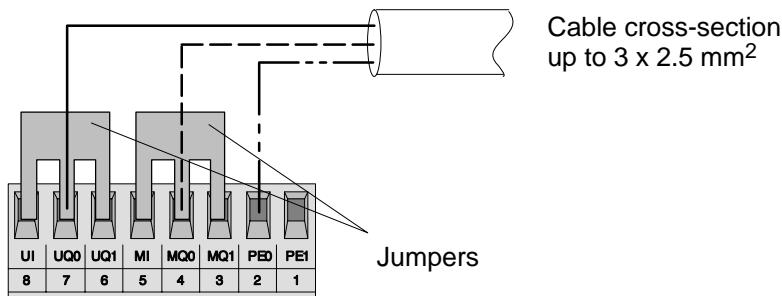
**Assignment for Common Supply of Logic, In- and Outputs and Routing**



Cable cross-section up to $3 \times 2.5 \text{ mm}^2$

Routing power supply, cable cross-section up to $3 \times 2.5 \text{ mm}^2$

Jumpers

| UI | UQ0 | UQ1 | MI | MQ0 | MQ1 | PE0 | PE1 |
|----|-----|-----|----|-----|-----|-----|-----|
| 8  | 7   | 6   | 5  | 4   | 3   | 2   | 1   |
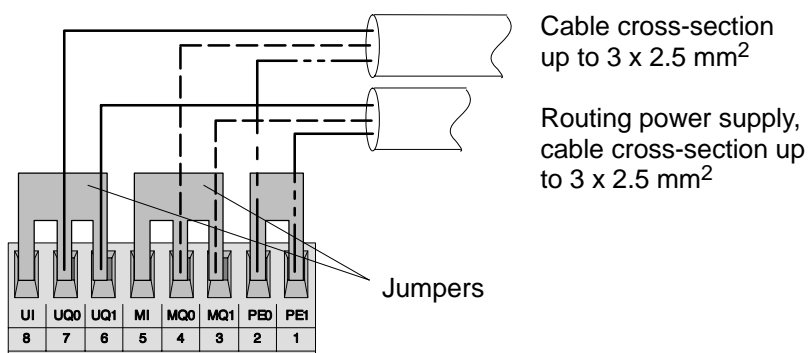
☞ **When routing the power supply, be aware of the voltage drop caused by the line resistance. When under load, the voltage must not drop below 19.2 V at any bus station.**

**CAUTION**
**Ensure degree of protection.**
**If the power supply is not routed and, thus, the second PG screw system is not required, please insert the sealing plug from the package into the screw system. This will guarantee the specified degree of protection.**

★ Tighten the PG screw system (part 1). Tightening torque 2.5 Nm.

★ Check the sealing at the housing of the electronic system and the mounting surface at the plug-in box. They must be clean and undamaged.

★ Now reinsert the plug-in box into the electronic system.

★ Screw in the four screws for the housing. Tightening torque 0.7 Nm.

## 5.2.2    Bus Connection

★    In order to connect the bus lines, you must untie the four screws on top of the housing.



Screws
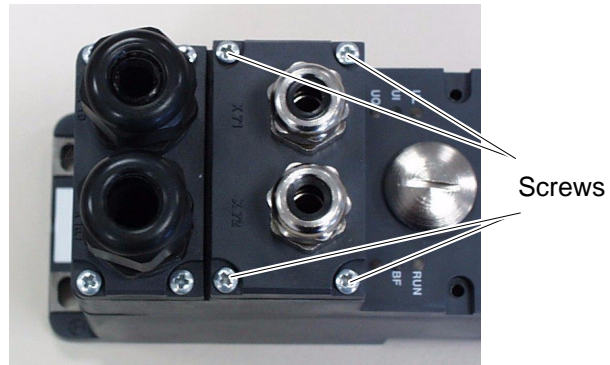
★    Remove the plug-in box upwards.
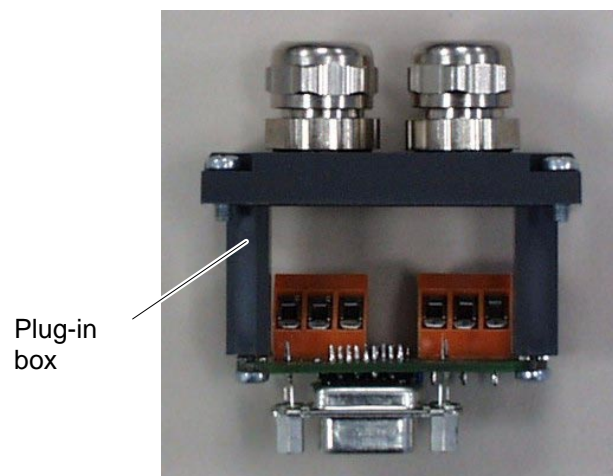


Plug-in box

☞ **Diameter for the bus lines: 5.5 to 9.0 mm.**

Part 4 is attached to the plug-in box. Tightening torque 3.75 Nm.
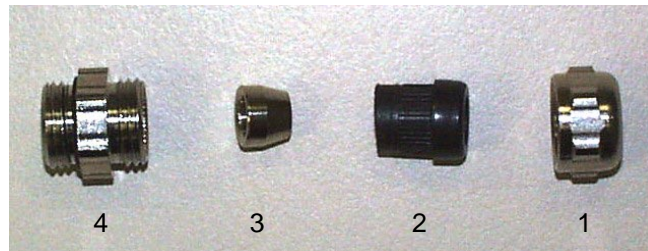


★    Strip the insulation off the cable.
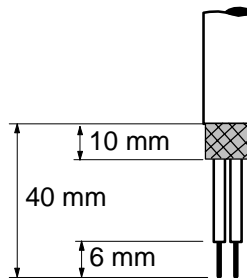


★    Push the cable through part 1 to 3. Part 3 separates conductors and shielding.

★    Now push the cable through part 4.

---

**CAUTION**
**Ensure degree of protection.**
**If the power supply is not routed and, thus, the second PG screw system is not required, please insert the sealing plug from the package into the screw system. This will guarantee the specified degree of protection.**

---

★    Tighten the PG screw system. Tightening torque 2.5 Nm.

★   Connect the conductors with the terminal strip.

## Assignment of the Terminal Strip for CANopen

CAN high
CAN low
GND

CAN high
CAN low
GND

Input
X71

Bus routing
X72
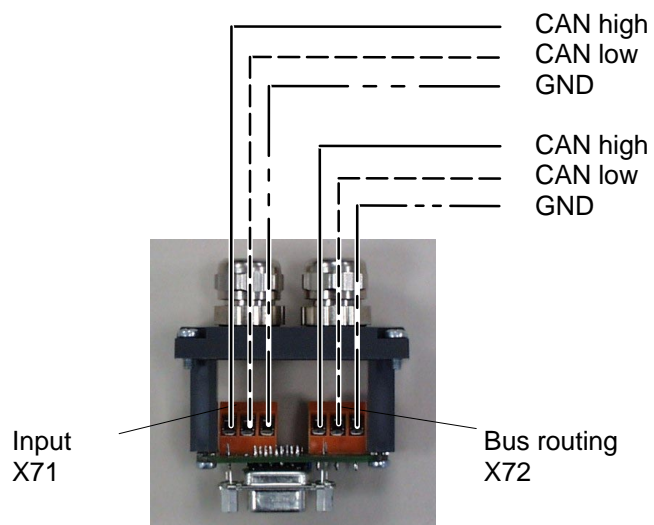
## Assignment of the Terminal Strip for PROFIBUS-DP

A-line, green
B-line, red

A-line, green
B-line, red

Input
X71

Bus routing
X72
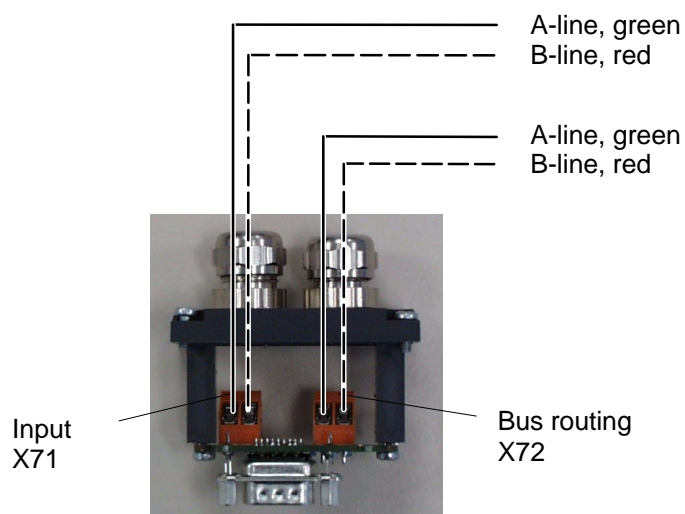
☞ **The shields of X71 and X72 are internally connected.**

★     Turn the switch for the terminating resistance of the bus line to the correct position.
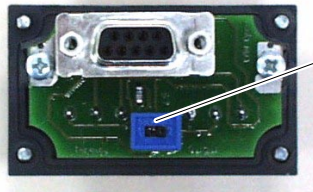


Switch for terminating resistance

| Position | | Function |
|---|---|---|
| **CAN** | **PROFIBUS-DP** | |
| TERMINATION | TERM | Bus line terminated, terminating resistance on |
| OUTPUT | LINE | Bus routing, terminating resistance off |

☞    **If the switch is turned to TERMINATION (TERM), the bus routing terminals are switched off.**

★     Check the sealing at the housing of the electronic system and the mounting surface at the plug-in box. They must be clean and undamaged.

★     Now reinsert the plug-in box into the electronic system.

★     Screw in the four screws for the housing. Tightening torque 0.7 Nm.

## 5.3 Rotary Switches for Bus Address and Baud Rate

The rotary switches for setting the bus address are located under the screw plug. The CANopen version has additionally been provided with a third rotary switch for setting the baud rate.



Screw plug

## 5.3.1 PROFIBUS-DP



Bus address ten's digit

S1

Bus address unit's digit

S2
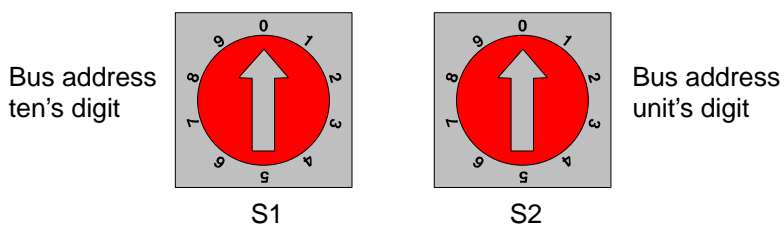
**Bus address:**
- Setting range: 2...99 (0 and 1 are not allowed)
- Status at delivery: 2 (S1 = 0, S2 = 2)

**Baud rate:**

Is automatically adjusted upon "Power on". Adjustments during operation are not possible.

★ Open the screw plug.

★ Set the bus address. To do so, turn the arrowlike indentation to the correct position with a small screwdriver. The rotary switch must snap into place.

★ Close the opening with the screw plug.
Tightening torque 3.75 Nm.

## 5.3.2    CANopen
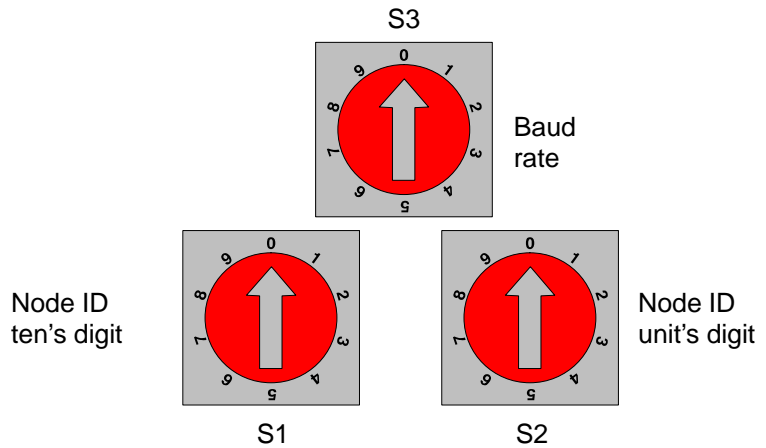


**Bus address (Node ID):**
- Setting range:      1...99 (0 is not allowed)
- Status at delivery:  2      (S1 = 0, S2 = 2)

**Baud rate:**
- Setting range:      refer to table
- Status at delivery:  500 kBaud   (S3 = 4)

★    Open the screw plug.

★    Set the node ID and the baud rate. To do so, turn the arrowlike indentation to the correct position with a small screwdriver. The rotary switch must snap into place.

| S3 Baud rate (kBaud) | | | |
|---|---|---|---|
| 0 | 10 | 6 | 125 (CANrho) |
| 1 | 20 | 7 | 250 (CANrho) |
| 2 | 125 | 8 | 500 (CANrho) |
| 3 | 250 | 9 | 1000 (CANrho) |
| 4 | 500 | | |
| 5 | 1000 | | |
| **Please note:**   **Switch positions 0 to 5 are CANopen-conform, Switch positions 6 to 9 are CANrho-conform.** | | | |

☞ **Upon runup (Power on), after 'NMT-Reset Node' and after 'NMT Reset Communication' of the B~IO67 CAN bus module, the set node ID will be read in again.**
**A modification of the baud rate during operation will only be accepted after another 'Power on'.**

★    Close the opening with the screw plug.
      Tightening torque 3.75 Nm.

## 5.4   Diagnosis and Operation Displays

### 5.4.1   Operating Voltages



| Light Emitting Diodes | | | | | | Significance |
|---|---|---|---|---|---|---|
| **UL** | | **UI** | | **UQ** | | |
| **green** | **red** | **green** | **red** | **green** | **red** | |
| ● | | | | | | Internal 5V logic voltage available |
| ○ | | | | | | Internal 5V logic voltage not available |
| | | ● | | | | 24V sensor voltage available |
| | | | ● | | | Maximum total current of the sensor supply has been exceeded |
| | | ○ | | | | 24V sensor voltage not available |
| | | | | ● | | 24V load voltage available |
| | | | | | ● | Overload of one or more outputs. Is lit as long as the overloaded output is being triggered. |
| | | | | ○ | | 24V load voltage not available |

Explanations:

○      LED is not lit.

●      LED is lit.

☞ **With the 8DO type, the LED of the UI is not lit because a sensor voltage is not required. With the 8DI and the 16DI type, the LED of the UQ is not lit because a load voltage is not required.**

☞ **If the internal 5V logic voltage is missing, the remaining statuses will not be indicated.**

☞ **The status 'Overload UI' and the status 'Overload UQ' will be sent to the master via the field bus.**

## 5.4.2    PROFIBUS-DP



| Light Emitting Diode BF | Significance |
|---|---|
| **red** | |
| ◯ | Bus works correctly, without errors. |
| ● | Bus error (incorrect baud rate or node address) or initializing phase on PROFIBUS. |

◯ = LED is not lit.
● = LED is lit.

**Extended Diagnosis**

By means of an extended PROFIBUS diagnosis, the PROFIBUS-DP master can call up diagnostic data from the B~IO67. In addition to the standard diagnosis of 6 bytes as per EN 50 170-2, another 7 bytes for extended diagnosis are transmitted.

| Byte | Contents | Designation (EN 50 170-2) |
|---|---|---|
| 1 | First part station status | Station_Status_1 |
| 2 | Second part station status | Station_Status_2 |
| 3 | Third part station status | Station_Status_3 |
| 4 | Address of the diagnosis master | Diag.Master_Add |
| 5 | High byte identification number | |
| 6 | Low byte identification number | |
| 7 | Extended diagnosis data:  Header | |
| 8 | Extended diagnostic data:  user data | |
| 9 to 13 | Extended diagnostic data:  not used | |

**Byte 7:**
The header of the extended diagnostic data has a value of $00000111_b$ (0x07).

**Byte 8:**
The following will be transmitted as user data:
- Overload sensor supply
- Overload output

| Bit7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 (LSB) |
|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | 0 | Overload output | Overload sensor supply |

**Byte 9 to 13:**
Not used, available only because of compatibility reasons (value $00_h$).

## 5.4.3     CANopen



| Light Emitting Diodes | | Significance |
|---|---|---|
| **RUN** | **BF** | |
| **green** | **red** | |
| ● | | Bus interface is in Operational Mode. |
| ●● | | Bus interface is in Preoperational Mode.<br>● Slave has not yet received an NMT_Start message.<br>● Guarding Failure<br>● Synchronization error (missing PDO in SYNC mode)<br>● Slave has been put in Preoperational Mode by CAN master through:<br>  ● NMT_RESET_NODE<br>  ● NMT_RESET_COM<br>  ● NMT_STOP<br>  ● NMT_DISCONNECT<br>  ● NMT_PREOPERATIONAL |
| ○ | | Bus interface is in Initialization Mode.<br>● Incorrect node ID (node ID = 0)<br>● Partner cannot be reached<br>  ● Remaining CAN bus stations are turned off<br>  ● Bus cable removed, defect or faulty<br>  ● Baud rate set incorrectly |
| | ● | Bus off |
| | ●● | Invalid node ID (node ID = 0) |
| | ●●●● | Bus Warning Level exceeded |
| | ○ | Bus without error |

Explanations:

○       LED is not lit.

●       LED is lit.

●●      Slow flashing of LED, 0.8 s on / 0.2 s off

●●●●    Fast flashing of LED, 0.125 s on / 0.125 s off

## 5.5       Operating Characteristics CANopen

The operating characteristics of the CAN bus interface are dependent on the CANopen properties and on the I/O configuration.

**PDO channels:**

CAN data messages have a maximum data capacity of 8 bytes which makes it possible to have have each CAN node provided with 2 channels for sending and 2 channels for receiving PDOs (Process Data Object).

B~IO67 connections occupy a maximum of 2 bytes for in- or outputs, so that only 1 sending and 1 receiving channel is realized respectively.

**SDO channel:**

For each CAN node, there is one SDO channel (Service Data Object) which is available for sending as well as for receiving.

## 5.5.1       Starting Characteristics

**'Power On':**

After establishing the 24V logic supply, the hardware components of the B~IO67 module will be tested:

- In case of an error, the module will be set to system HALT.
- After a successful start-up test, the CAN controller will be initialized according to the settings of the S1 to S3 rotary switches.

**Preoperational Mode:**

After a successful initialization, the module is in 'Preoperational Mode'. With an '**NMT START**' message, the CAN master can put the module into the 'Operational Status'.

**Operational Mode:**

In Operational Mode, the process data can be transmitted via PDO.

## 5.5.2       Diagnosis

Diagnosis is supported and can be switched on and off via parameter byte (2040).

Status at delivery: Diagnosis is active.

## 5.5.3        Object Dictionary

The object dictionary (OD) defines, among other things, which communication objects will be made available, and how they will be made available.

**Standard OD Objects**

For standard OD objects, the CiA DS-301 identifies the following types of entry:

| Entry | Utilization |
|---|---|
| Constants | Information about module statuses, version identification, etc. |
| Readable entries | |
| Writable entries | For module control and configuration different from the presettings; e.g. replace assignment of objects, change identifier, etc. |
| Writable and readable entries | |

☞ **In case of a voltage loss, all values in the OD that have been changed by either the user or during operation because the situation required such an action will be lost. After restart, all object are reset to the default value.**

All OD objects of the B~IO67-CAN are described in the device data base (EDS files) in ASCII format. You can download them from the Internet or order them on CD-ROM (refer to page 8–2).

**Manufacturer-Specific OD Objects**

Beyond the CiA-specified objects, there exists an area that is reserved for manufacturers, in which device-specific objects can be entered and thus made available to the user.

| Index (HEX) | Sub-Index (HEX) | Object Description | Refer to page |
|---|---|---|---|
| 1002 | 0 | **Manufacturer Status Register (MSR)** <br> The MSR is not included in the area reserved for manufacturers, but the coding of this object lies in the responsibility of the manufacturer. | 5–22 |
| 2000 | 0 | **Module Control Register (MCR)** <br> Influences the performance characteristics of B~IO67 CAN. | 5–22 |
| 2020 |  | **Diagnostic Information** | 5–24 |
|  | 0 | **Number of diagnosis entries** |  |
|  | 1 | **Diagnostic Status** <br> Primary information regarding the pending diagnosis. It is sent via the Emergency Object. Further details can be requested with SDO via sub-index 2. |  |
|  | 2 | **Diagnostic Data** <br> Detailed error information |  |
| 2030 |  | **Configuration Information** | 5–24 |
|  | 0 | **Number of recognized modules** <br> always = 1 |  |
|  | 1 | **Configuration Data** <br> Hardware identification of B~IO67-CAN. |  |
| 2040 |  | **Parameter Information** | 5–25 |
|  | 0 | **Number of parameter data** |  |
|  | 1 | **Parameter-Info** <br> Reading or reloading of parameterization. |  |
|  | 2 | **Device Parameter Data** <br> Diagnosis switch-on and -off. |  |

**Index      1002**   **Manufacturer Status Register (MSR)**
**Sub-Index    0**

The MSR contains status information of the B~IO67-CAN.

Size:  1 byte

| MSB | | | | | | | LSB | |
|---|---|---|---|---|---|---|---|---|
| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 | |
| | | | | | 0 | 0 | 0 | Initialization |
| | | | | | 0 | 0 | 1 | Not used |
| | | | | | 0 | 1 | 0 | Not used |
| | | | | | 0 | 1 | 1 | Not used |
| | | | | | 1 | 0 | 0 | Not used |
| | | | | | 1 | 0 | 1 | Preoperational |
| | | | | | 1 | 1 | 0 | Operational |
| | | | | | 1 | 1 | 1 | Undefined status |
| | | | | | | | | Reserved |
| x | | | | | | | | Error summary bit |

Error summary bit:
x = 0: no error
x = 1: at least one error is present

**Index      2000**   **Module Control Register (MCR)**
**Sub-Index    0**

The MCR can be used to modify the characteristics of the B~IO67-CAN:

● Bit 0 to bit 3 determine the characteristics in case of an error or after receipt of an NMT service.

● Bit 8 (high byte) controls the input sending characteristics (XMIT).

Size:  2 bytes

| high byte | | low byte | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Bit 9 bis 15 | Bit 8 | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |

Module status in case of error
Output in case of error
EMCY reaction in case of error
Reserved
Reserved
Reserved
Reserved
Input XMIT characteristics
Reserved

**Module status in case of error (Bit 0)**

$0 \Rightarrow$    preoperational (default)

$1 \Rightarrow$    operational

**Outputs in case of error (Bit 2,1)**

$00 \Rightarrow$   CLAB: Outputs will be switched off (default)

$01 \Rightarrow$   last state: Outputs maintain their latest status

$10 \Rightarrow$   reserved

$11 \Rightarrow$   reserved

**EMCY Reaction (Bit 3)**

$0 \Rightarrow$    In case of an error, the Emergency Object (EMCY) will be sent. (default)

$1 \Rightarrow$    In case of an error, the Emergency Object (EMCY) will not be sent.

**Input XMIT Characteristics** (no relation to error occurrence!)

$0 \Rightarrow$    An input change causes all active PDOs to send the entire input information. (default)

$1 \Rightarrow$    An input change solely causes the PDO to send the information to which the input has been assigned.

**Characteristics in case of error:**

| Error occurrence | Module Status | Outputs | EMCY Reaction |
|---|---|---|---|
| BUS OFF<br><br>The 'transmit error counter' of the CAN controller has exceeded the limit of 256. | as per MCR Bit 0 | as per MCR Bit 2,1 | as per MCR Bit 3 |
| Missing PDO (SYNC-Mode)<br><br>Missing receiving PDO (RCV) during synchronous cyclical operation | as per MCR Bit 0 | as per MCR Bit 2,1 | as per MCR Bit 3 |
| Guarding Failure<br><br>Node guard monitoring time has elapsed.<br>(Only with node guarding activated by CAN master). | as per MCR Bit 0 | as per MCR Bit 2,1 | as per MCR Bit 3 |

**Characteristics after receiving an NMT service:**

| NMT service | Module Status | Outputs | EMCY Reaction |
|---|---|---|---|
| NMT_RESET_NODE | preoperational | all outputs cleared | no EMCY |
| NMT_RESET_COM | preoperational | as per MCR Bit 2,1 | no EMCY |
| NMT_STOP | preoperational | as per MCR Bit 2,1 | no EMCY |
| NMT_DISCONNECT | preoperational | as per MCR Bit 2,1 | no EMCY |
| NMT_PREOPERATIONAL | preoperational | as per MCR Bit 2,1 | no EMCY |

**Index    2020**  **Diagnostic Information**

Diagnostic information can be read via this index. The B~IO67-CAN provides one byte for diagnosis.

**Index    2020**
**Sub-Index    0**  **Number of Diagnosis Entries**

Length of the current diagnostic data:

1:    Diagnosis is active.
0:    Diagnosis is not active.

**Index    2020**
**Sub-Index    1**  **Diagnostic Status**

The diagnostic status delivers the primary information about the pending diagnosis. After a modification in the diagnosis, the diagnostic status will be sent via the Emergency Object. Further details can be requested with SDO via sub-index 2.

00 hex:      No diagnosis available

01 hex:      Diagnosis message is available

**Index    2020**
**Sub-Index    2**  **Diagnostic Data**

Diagnosis byte of B~IO67-CAN.

| MSB | | | | | | | LSB | |
|---|---|---|---|---|---|---|---|---|
| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 | |
| 0 | 0 | 0 | 0 | 0 | 0 | | 0 | No diagnosis |
| | | | | | | | 1 | Overload sensor supply |
| | | | | | | 0 | | No diagnosis |
| | | | | | | 1 | | Overload output |

**Index    2030**  **Configuration Information**

**Index    2030**
**Sub-Index    0**  **Number of Recognized Modules**

Number of modules = 1

**Index    2030**
**Sub-Index    1**  **Configuration Data**

Contains the hardware identification of the addressed B~IO67 module:
0:    B~IO67 CAN 8DI

1:    B~IO67 CAN 16DI

4:    B~IO67 CAN 8DO

5:    B~IO67 CAN 8DI/4DO

45:    B~IO67 CAN 8DI/8DO

| **Index      2040** | **Parameter Information** |
|---|---|
| | This is the index with which B~IO67-CAN is parameterized. |

| **Index      2040**<br>**Sub-Index    0** | **Number of Parameter Data** |
|---|---|
| | Number of data = 1 |

| **Index      2040**<br>**Sub-Index    1** | **Parameter Info** |
|---|---|
| | The set parameterization can be read or new parameterization data can be loaded into B~IO67-CAN. |

| **Index      2040**<br>**Sub-Index    2** | **Device Parameter Data** |
|---|---|
| | The diagnosis can be switched on or off, further parameterization is not possible. |

| MSB | | | | | | | LSB | |
|---|---|---|---|---|---|---|---|---|
| Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 | Device Parameter |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Diagnosis disabled |
| | | | | | | | 1 | Diagnosis enabled (default) |

## 5.5.4      CAN Identifier

In the delivery status, the identifiers are set according to the requirements of the CIA DS-301 (master/slave connection set) after start-up of the B~IO67-CAN module:

- The complete B~IO67-CAN system works as a slave.
  With the help of the slave's node ID, an application, DBT, or NMT master can calculate its identifier.
- No communication among the slaves.

Via SDO, a DBT master can randomly modify the B~IO67-CAN's identifier so that a direct communication of processing data also becomes possible among slaves.

**Standard Identifier Assignment** (ID length 11 bits = area from 0 to 2047) according to requirements of 'predef. Master/Slave Connection Set'.

| Hex | Decimal | |
|:---:|:---:|---|
| 0 | 0 | NMT services |
| 1 to 0x7F | 1 to 127 | Reserved by CAL |
| 0x80 | 128 | SYNC message (CANrho mode: 0x64) |
| 0x81 to 0xFF | 129 to 255 | Emergency Messages |
| 0x100 | 256 | Time Stamp |
| 0x181 to 0x1FF | 385 to 511 | PDO1 (Transmit) |
| 0x200 | 512 | Reserved by CAL |
| 0x201 to 0x27F | 513 to 639 | PDO1 (Receive) |
| 0x280 | 640 | Reserved by CAL |
| 0x281 to 0x2FF | 641 to 767 | PDO2 (Transmit) |
| 0x300 | 768 | Reserved by CAL |
| 0x301 to 0x37F | 769 to 895 | PDO2 (Receive) |
| 0x400 to 0x580 | 896 to 1408 | Reserved by CAL |
| 0x581 to 0x5FF | 1409 to 1535 | SDO (Transmit) |
| 0x600 | 1536 | Reserved by CAL |
| 0x601 to 0x67F | 1537 to 1663 | SDO (Receive) |
| 0x680 to 0x6E0 | 1664 to 1760 | Reserved for SDO |
| 0x701 to 0x77F | 1793 to 1919 | Node guarding |
| 0x760 to 0x7EF | 1888 to 2031 | Reserved for NMT |
| 0x7F0 to 0x7FF | 2032 to 2047 | Reserved by CAL |

The identifier of the PDO channels as well as those for the SYNC object can be randomly redefined via the Object Dictionary.

**Node ID-independent Identifier Definitions**

| Object | Identifier | Direction |
|--------|-----------|-----------|
| NMT | 0 | Send/Receive |
| SYNC [1] | 128 (CANopen) 100 (CANrho) | Receive |

**Node ID-dependent Identifier Definitions**

| Object | Identifier | Direction |
|--------|-----------|-----------|
| Emergency | 128 + Node ID | Send |
| NMT Node Guarding | 1792 + Node ID | Send/Receive |
| SDO | 1408 + Node ID | Send |
| SDO | 1536 + Node ID | Receive |
| PDO1 | 384 + Node ID | Send |
| PDO2 | 640 + Node ID | Send |
| PDO1 | 512 + Node ID | Receive |
| PDO2 | 768 + Node ID | Receive |

Example: Set Node ID = 4

| Object | Identifier | Direction |
|--------|-----------|-----------|
| Emergency | 132 | Send |
| NMT Node Guarding | 1796 | Send/Receive |
| SDO | 1412 | Send |
| SDO | 1540 | Receive |
| PDO1 | 388 | Send |
| PDO2 | 644 | Send |
| PDO1 | 516 | Receive |
| PDO2 | 772 | Receive |

☞ **When the B~IO67-CAN is delivered, only the PDO1 is assigned for sending and receiving.**

**CANrho-Conform Setting**

With the S3 rotary switch, CANrho-conform communication characteristics can be set. The following properties are different from those of CANopen:

- By default, all PDOs are not set for acyclical but for cyclical synchronous data exchange.
- The SYNC message is not set to 128 but to 100.
- The SYNC message contains a data byte which is interpreted by the B~IO67-CAN as follows:
  - '0':    Initialization phase
  - '1':    Cyclical operation

- The B~IO67-CAN system's switchover from 'Preoperational' to 'Operational' happens automatically via the contents of the 1$^{st}$ data byte of the SYNC message.

## 5.5.5      Functional Scope

| Performance/Function protocol-independent | Features | Comments |
|---|---|---|
| Baud rates in kBaud | 10, 20, 125, 250, 500, 1000 | CANopen |
|  | 125, 250, 500, 1000 | CANrho |
| Max. input data | 32 bytes | Utilization: max. 2 bytes |
| Max. output data | 32 bytes | Utilization: max. 2 bytes |
| Diagnosis | 1 byte |  |
| Actual configuration information | No |  |

| CANopen |  |  |
|---|---|---|
| Asynchronous Mode | Yes | Individually configurable for each PDO |
| Synchronous Mode | Yes | Individually configurable for each PDO |
| Number of SDOs (Send) | 1 |  |
| Number of SDOs (Receive) | 1 |  |
| Number of PDOs (Send) | 4 (max.) | The PDOs can be configured as desired (asynchronous, synchronous, acyclically synchronous, etc.) |
| Number of PDOs (Receive) | 4 (max.) | The PDOs can be configured as desired (asynchronous, synchronous, acyclically synchronous, etc.) |
| Emergency Object | 1 |  |
| Time Stamp | No | Not supported |
| SYNC Object | 1 | Receiving (RCV) a SYNC object is supported; sending(XMIT) a SYNC object is not supported. |
| NMT Service Support | ● Stop<br>● Start<br>● Disconnect<br>● Enter Preoperational<br>● Reset Node<br>● Reset Communication |  |
| Default and Variable Mapping | Yes |  |
| Node Guarding | Yes |  |
| Simple Boot up | Yes |  |
| Extended Boot up | No |  |
| Device Profile | Yes | CiA Draft Standard Proposal 401 (NZ) Device Profile of I/O modules |

Notes:

# 6     Technical Data

## 6.1     B~IO67

| Technical Data | B~IO67 |
|---|---|
| corresponds to the following standards | • EN 61 131-2<br>corresponds to IEC 61 131-2<br>• EN 61 131-2/A11<br>• EN 50 178<br>corresponds to VDE 0160<br>• EN 60 204-1<br>corresponds to VDE 0113 part 1<br>• EN 50 081-2<br>corresponds<br>to VDE 0839 part 81-2<br>• EN 50 082-2<br>corresponds<br>to VDE 0839 part 82-2<br>• EN 60 529<br>corresponds to DIN VDE 0470-1<br>• EMC statute of 09-25-1998<br>and its amending statutes |
| Power supply<br>as per EN 61 131-2<br>• Nominal value<br>• Permissible range | <br><br>24 VDC<br>19.2 to 30.0 VDC |
| Current input<br>from 24 V power supply<br>• UI, logic<br>• UQ0, externally supplied power<br>for output byte 0<br>• UQ1, load current supply<br>for output byte 1 | <br><br>$\leq 1.2$ A<br>$\leq 8$ A<br><br>$\leq 8$ A |
| Reverse voltage protection | yes, without load |
| Insulation test voltage between bus<br>and power supply | • 350 VAC<br>• 500 VDC<br>• 500 V pulse 1.2/50 $\mu$s |
| Corrosion / chemical resistance<br>• $SO_2$<br><br>• $H_2S$ | <br>< 0.5 ppm, rel. humidity < 60%,<br>no condensation<br>< 0.1 ppm, rel. humidity < 60%,<br>no condensation |

| Technical Data | B~IO67 |
|---|---|
| Mechanical stress(shock and vibration resistance)<br><br>● Vibration, sinewave oscillations in all 3 axes as per EN 61 131-2 | 10 to 57 Hz<br>● 0.375 mm constant amplitude<br>● 0.75 mm occasional amplitude<br><br>57 to 150 Hz<br>● 5 g constant<br>● 10 g occasional |
| ● Shock, impact on all 3 axes as per EN 60 068-2-27 | 11 ms semi sine wave 30 g |
| Air and creepage distance<br><br>● Overvoltage category<br>● Pollution degree as per EN 61 131-2<br>  ● in operation<br>  ● open housing | <br><br>II<br><br><br>3<br>2 |
| Degree of protection as per EN 60 529 | IP 65 and IP 67 |
| Class of protection as per EN 50 178 | 1 |
| Humidity rating as per EN 61 131-2<br><br>● Operation as per EN 50 178<br><br>● Storage/Transportation as per EN 50 178 | RH-2; 5 to 95 %, no condensation<br><br>3K3 as per EN 60 721-3-1 to 4<br>5 to 85 %, no condensation<br>1K3 as per EN 60 721-3-1 to 4<br>5 to 95 % |
| Range of temperature as per EN 61 131-2<br><br>● operation<br><br><br>● storage | <br><br>5 to 55 °C, with a maximum average temperature of 50°C over a period of 24 hours<br>−25 to +70 °C |
| Range of atmospheric pressure as per EN 61 131-2 | Operation up to 2000 m above sea level |
| Mass<br><br>● PG version<br>● Plug-in version | <br><br>490 g<br>400 g |
| Dimensions<br><br>● Proportion<br>● Mounting depth | <br><br>Refer to page 3–16<br>Refer to page 4–3 |

| Technical Data | B~IO67 |
|---|---|
| Electrical isolation<br><br>● Bus to logic<br><br>● Logic to in- and outputs | <br><br>yes<br><br>no |
| Interference radiation<br><br>● Harmful radiation<br><br>● Radio interference suppression, enclosure, as per  EN 50 081-2 | <br><br>none<br><br>Class A as per EN 55 011<br>● Frequency 30 to 230 MHz<br>  Limit value 40 dB ($\mu$V/m) in 10 m<br>● Frequency 230 to 1000 MHz<br>  Limit value 47 dB ($\mu$V/m) in 10 m |
| EMI resistance<br><br>● High-frequency, electromagnetic fields as per EN 61 131-2, EN 50 082-2 measurement as per EN 61 000-4-3, criterion A<br><br>● Electrostatic discharge on expos-able enclosure components and indirect discharge on coupling board as per EN 61 131-2, EN 50 082-2 measurement as per EN 61 000-4-2, criterion A | <br><br>Test field strength: 10 V/m<br>Frequency band: 26 to 1000 MHz<br>AM 80 % with 1 kHz<br>sweep rate: 0.0015 dec./s<br><br>Test voltage<br>● Air discharge15 kV<br>● Contact discharge 4 kV |
| Conducted interferences as per EN 61 131-2, EN 50 082-2<br><br>● HF coupling, asymmetrical, as per EN 61 000-4-6 criterion A<br>  ● 24 V voltage supply<br>  ● digital in- and outputs and data transmission line<br><br>● Rapid burst pulses as per EN 61 000-4-4 criterion A<br>  ● 24 V voltage supply<br>  ● digital in- and outputs and data transmission line<br><br>● dampened sine wave as per EN 61 000-4-12 criterion A<br>  ● 24 V voltage supply<br>  ● digital in- and outputs and data transmission line | <br><br>Amplitude: 10 V<br>Frequency range: 0.15 to 80 MHz<br>Modulation: AM 80 %, 1 kHz<br><br>direct coupling<br>coupling clamp<br><br>2 kV<br>symmetrical/asymmetrical<br><br>direct coupling<br>capacitive coupling clamp<br><br>1 MHz<br>1 kV, symmetrical<br><br>direct coupling<br>direct coupling |

## 6.2    PROFIBUS-DP

| Technical Data | PROFIBUS-DP |
|---|---|
| corresponds to the following standard | EN 50 170 part 2 |
| Interface | RS485 |
| Electrical isolation | yes, voltage endurance 500 VDC |
| Bus address | 2 to 99 |
| Baud rate | 9.6 kBaud to 12 MBaud |
| Diagnosis | yes |

## 6.3    CANopen

| Technical Data | CANopen |
|---|---|
| corresponds to the specifications and directives of the following | CiA/DS 102 to CiA/DS 301 Version 3.0 implemented |
| Electrical isolation | yes, voltage endurance 500 VDC |
| Bus address (Node ID) | 1 to 99 |
| Baud rate | • 10, 20, 125, 250, 500 kBaud and 1 MBaud for CANopen<br>• 125, 250, 500 kBaud and 1 MBaud for CANrho |
| Diagnosis | yes |

## 6.4 Inputs

| Technical Data | Inputs |
|---|---|
| Inputs as per EN 61 131-2 | 8 or 16 digital inputs, type 1 |
| Electrical isolation | no |
| Potentials | common 0V potential |
| Reverse voltage protection | yes |
| Input voltage<br>● Rated voltage<br>● 0 signal<br>● 1 signal<br>● Operating level | <br>24 VDC<br>−3 to 5 VDC<br>11 to 30 VDC<br>9 VDC |
| Input current<br>● 0 signal<br>● 1 signal | <br>≤ 1.5 mA<br>> 2 mA |
| Sensor supply<br>● Output voltage<br>● Rated current of output (sum)<br>● Short circuit / excess current protection | <br>≥ UI − 0.5 VDC<br>1.0 A<br>typ. 2.8 A |
| Delay interval<br>● from 0 to 1<br>● from 1 to 0 | <br>3 ms<br>3 ms |
| Status display | Via the LED of the I/O terminal block |
| Length of line, unshielded | max. 100 m |
| 2-wire proximity switch<br>● Closed circuit current<br>● Voltage drop | <br>≤ 1.5 mA in logic state 0<br>≤ 6 V in logic state 1 |

## 6.5        Outputs

| Technical Data | Outputs |
|---|---|
| Outputs as per EN 61 131-2 | 4 or 8 semiconductor outputs, non-latching, shielded, with automatic restart, current sourcing |
| Electrical isolation | no |
| Potentials | common 0V potential |
| Reverse voltage protection | yes, without load |
| Output voltage | Nominal value 24 $V_{DC}$ |
| 0 V feedback | allowed via I/O terminal block only |
| Voltage drop with 1-signal | $\leq 0.5$ V |
| Output current<br>• Nominal value<br>• 1 signal<br>• 0 signal, leakage current | <br>2.0 A<br>2 mA to 2.4 A<br>$\leq 0.5$ mA |
| Total current | see Derating curve, chapter 6.6 |
| Idle current<br>• with 1 signal per output<br>• with 0 signal per output | <br>7 mA<br>1 mA |
| Overload protection<br>• Minimum current level that causes switch-off<br>• Automatic restart after | <br>2.8 A<br><br>approx. 10 ms |
| Switching frequency<br>• Ohmic load<br>• Lamp load<br>• Inductive load | <br>max. 100 Hz<br>max. 8 Hz<br>max. 1 Hz |
| Output delay | < 500 µs |
| Contactor size | SG8, 30 W<br>NG6, Bosch hydraulic valve |
| Lamp load | 15 W |
| Status display | via the LED of the I/O terminal block |
| Length of line, unshielded | max. 100 m |
| Voltage induced on circuit interruption | –30 V |
| Parallel connection of outputs | no |

## 6.6        Derating

The total currents are identical for different bus systems and PG or plug-in versions.

☞ **Each output can be loaded with a maximum of 2 A. If the I/O slots are provided with a double assignment (Pin 2 and Pin 4), the total current is limited to 3 A because of the common return conductor (Pin 3).**

The total current needs to be considered for the 8DO type only.
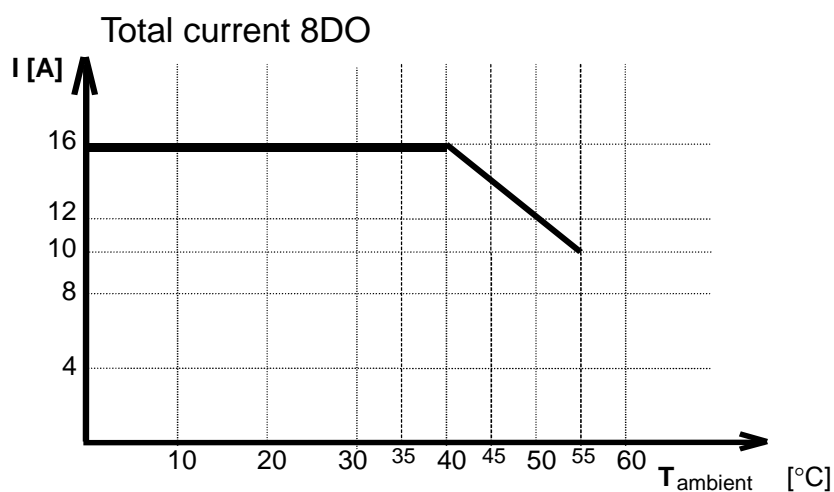


Total current 8DO

☞ **The total current of the 8DI/4DO and 8DI/8DO types for the entire temperature range adds up to 8 A.**

All specifications regarding the total current and the ambient temperature are dependent on a mounting surface that conducts heat well, e.g. metal. The installation on a surface that does not conduct heat well, e.g. wood, reduces the maximum ambient temperature by approximately 10 °C.

Notes:

# 7    Installation Guidelines

When installing a system that employs electrical equipment like e.g. control systems, the following standards must be observed:

● DIN VDE 0100
● EN 60 204-1
● EN 50 178

**DANGER**

**Danger for persons and equipment!**

● **Hazardous system conditions that could cause personal injury or property damage must be avoided!**

● **Strict adherence to the regulations governing the installation of EMERGENCY-STOP devices, as stipulated in EN 60 204-1, is required!**

● **Uncontrolled restart of machinery upon restoration of power, e.g., subsequent to an EMERGENCY-STOP occurrence, must be made impossible!**

● **The prescribed measures (connection to PE conductor, insulation, etc.) must ensure protection against damages and injuries that can result from direct or indirect contact!**

## 7.1    Power Supply Unit

The power supply must feature safety separation, as per EN 50 178, section 5.2.18.1. Transformers with safety separation must be constructed according to EN 60 742.

This provided, the 24V power supply net is then considered to be an extra low voltage with safety separation as per EN 50178 section 5.2.8.1. The power can be supplied either as Safety Extra Low Voltage (SELV) without earthing of the reference conductor or as Protective Extra Low Voltage (PELV) with earthing of the reference conductor.

A 3-phase power supply unit with single full-bridge rectification is sufficient. The offset AC voltage components must not exceed 5%.

All 24V voltage supply lines must be

● installed separately from lines with higher voltage or
● specially insulated, with the insulation being at least suitable for the highest voltage encountered, EN 60 204-1, 1997, section 14.1.3.

☞ **All peripherals, such as digital sensors/actuators or further bus connections, that are going to be connected to the interfaces of the B~IO67 modules must also comply with the safety separation requirements of electrical circuits.**
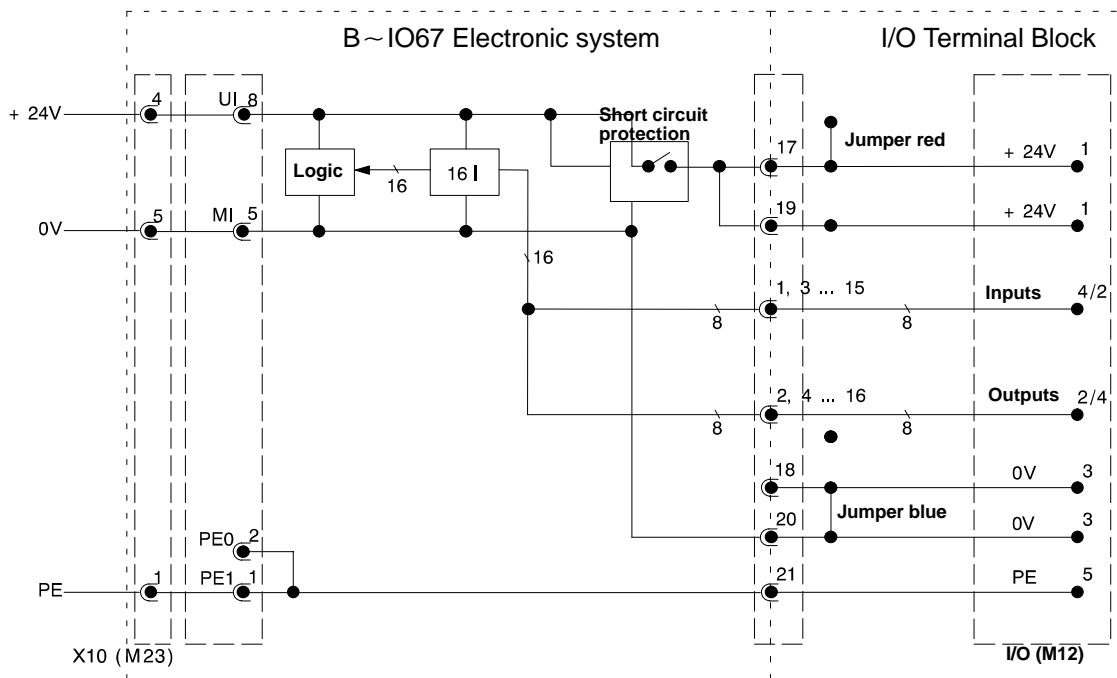
## 7.2        24 V Voltage Supply

The 24V power supply unit of the B~IO67 modules is provided with two connection options:

- Reference conductor is connected to PE conductor; refer to section 7.2.1.
- Reference conductor is not connected to PE conductor; refer to section 7.2.2.
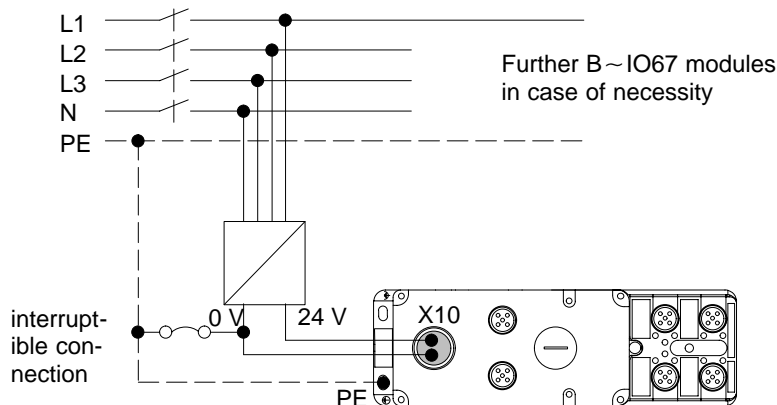
**Structure of 8DI/8DO**
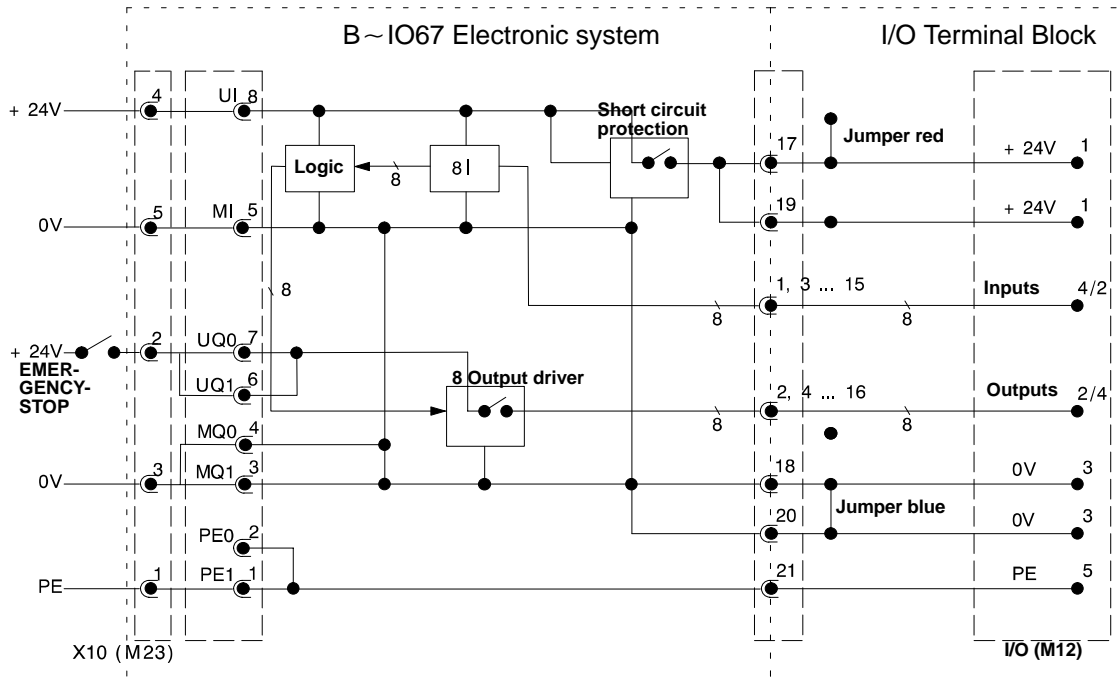


**Structure 16DI**

### 7.2.1    Reference Conductor Connected to PE Conductor

If the reference conductor (N, 0 V) is connected to the PE conductor system, this connection must be located centrally (e.g. at the load power supply unit or at the isolating transformer) and it must be interruptible in order to measure the earth leakage current. This type of connection is to be preferred. This provided, the supplying circuit is considered a PELV circuit, also refer to section 7.1.



### 7.2.2    Reference Conductor Not Connected to PE Conductor

If the reference conductor (N, 0 V) is not connected to the PE conductor system, an earth leakage monitor must be used for the recognition of earth faults in order to prevent unintentional switch-on in case of insulation faults. This provided, the supplying circuit is considered a SELV circuit, also refer to section 7.1. Please be aware that additionally connected equipment can make the earth-free installation void.
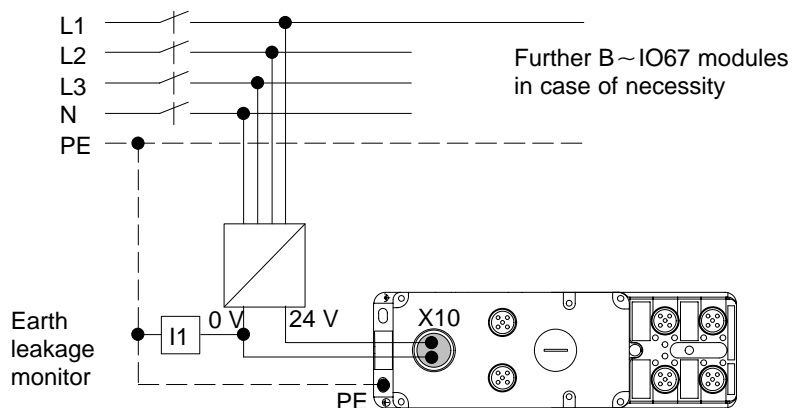
## 7.2.3     Capacitive Load of the Power Supply Network

In order to suppress interferences, the B~IO67 modules are provided with capacitances that are put between the power supply lines and the protective earth. This is to be considered when using an earth leakage monitor.

| B~IO67 Module | Capacity 24 V[1] $\rightarrow$ PE | Capacity 0 V $\rightarrow$ PE |
|---|---|---|
| B~IO67 ... 8DI | 5 nF | 5 nF |
| B~IO67 ... 16DI | 5 nF | 5 nF |
| B~IO67 ... 8DI/4DO | 10 nF | 5 nF |
| B~IO67 ... 8DI/8DO | 10 nF | 5 nF |
| B~IO67 ... 8DO | 10 nF | 5 nF |

1) Sum of UI, UQ0 and UQ1

## 7.2.4     Power Supply Rating

When rating the power supply the maximum currents must be considered, refer to VDE 0100-523. A voltage of 19.2 to 30.0 V must be applied directly to the device.

The voltage must also be observed in case of

- mains voltage fluctuations due to e.g. varying mains loads.
- varying load conditions such as short circuit, standard load, lamp load or idle status.

The maximum cross-section of the B~IO67 modules' power supply lines is 2.5 mm$^2$.

**Voltage dips**

To ensure uninterrupted operation, the logic circuit power supply of the B~IO67 is capable of bridging voltage dips of up to 10 ms.

## 7.2.5     Master Switch

B~IO67 modules, sensors, and actuators must be provided with a master switch as per VDE 0100.

## 7.2.6　　Fuses

Fuses and circuit breakers protect the lines in an electrical network. The power supply lines of B~IO67 modules must be protected. The supply of the sensors and the supply of the actuators should be protected separately. If the supply lines are shorter than 3 m and earth fault- and short circuit-proof, additional fuses in these lines are not necessary.

When selecting fuses, a number of aspects have to be considered. The most important parameter is the rated current of the electric circuit that needs to be protected (see also VDE 0100-430), which is also decisive for the cross section of the line (see VDE 0100-523).

Further criteria for the selection of protective devices is:

- Rated voltage
- Temperature
- Internal resistance of the fuse
- In-rush current
- Lengths of lines
- Source impedance of the network
- Possible location of error
- Vibrations

For further information, please refer to:

Handbuch Nr. 32 (manual no. 32)
VDE Schriftenreihe (VDE publication series)
"Bemessung und Schutz von Leitungen und Kabeln nach DIN 57 100, VDE 0100 Teil 430 und Teil 523"

In addition, relevant information is also available from many manufacturers of fuses and circuit breakers.

## 7.2.7     Earthing

The B~IO67 electronic system provides two earthing methods. The protective earth must always be linked to the PE protective earthing connection. The functional earthing connection can be linked either directly or capacitively with the earth. For this purpose, the B~IO67 electronic system has been provided with a capacitive coupling device (RC combination 1 MΩ and 4.7 nF). The screen of the bus line is internally linked with the connection of the functional earth.

Earthing conductors must be well connected with the corresponding earthing point. If metal components are used as earthing conductors, remove any possibly present chromating or similar prior to connection. Earthing conductors should be preferably braided, with their cross section as large and their length as short as possible.

**Connection of the Protective Earth – PE**

The PE is connected via the power supply or via the specified installation point.

☞ **The PE connection of the enclosure or the power supply must always be wired.**



Installation point with functional earth connection

Installation point with PE connection (protective earth)
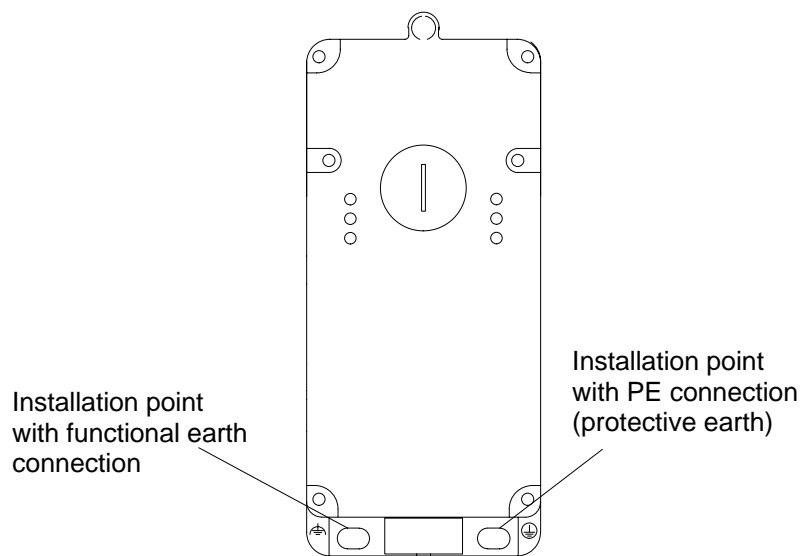
|  | Functional earth is connected with: | Protective earth (PE) is connected with: |
|---|---|---|
| **Power Supply** | – | Plug-in Version: X10, pin 1 |
|  | – | PG-Version: PE0, PE1 |
| **Bus connection X71/X72** | CAN bus plug; Dual in-line package, pin 1 | – |
|  | PROFIBUS plug: Dual in-line package, pin 5 | – |
| **I/O plug, M12** | – | Pin 5 |

**Connection of Functional Earth**

You have two possibilities at your disposal to connect the functional earth: It can be connected either with the specified installation point or via the capacitive coupling device. If there is no conductive surface available, the earthing is realized via a cable lug and a low-noise earthing point.

● Capacitive Connection of Functional Earth

The capacitive connection is used in systems with different potentials in order to avoid compensating currents via the screen.

To do so, you only have to connect the PE. The functional earth must be insulated from the PE. In case of a metal surface, please use the insulating sleeve included in the package, in order to fasten the B~IO67 electronic system to the installation point with functional earth connection and the metal sleeve to fasten it to the installation point with PE connection.

Metal sleeves
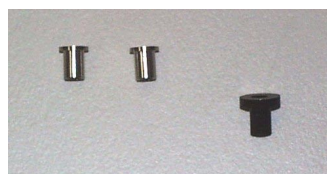


Insulating sleeve

● Direct Connection of Functional Earth

In case of a metal surface, please use the included metal sleeves for both installation points. With this type of connection, the capacitive coupling device will be jumpered.

**Equipotential Bonding**

Please create equipotential bonding between the system components and the power supply as per DIN VDE 0100 part 540.

## 7.3        I/O Terminal Blocks

## 7.3.1      Outputs

**Inductive Loads**

In principle, the B~IO67 outputs use built-in DC clamp diodes to keep inductive switching peaks at a safe level.

A cable break, removing a plug to the inductive load, e.g. the solenoid valves, contactors, etc., or the intentional switch-off via a mechanic contact though leads to very high interference levels which can be further spread by galvanic, inductive or capacitive coupling within the system which then may lead to malfunctions of this or other systems. To attenuate these interferences, an appropriate interference suppression device (freewheeling diodes, varistor, or RC elements) must be provided directly at the inductive load. Especially if a switch is connected in series to the inductive load, e.g. for safety interlocks, a suppressor circuit is an absolute requirement.

All commonly used interference suppressors can be used.

Because of their universal applicability, we recommend to use bidirectional suppressor diodes. They consist either of two oppositely polarized, series-connected suppressor diodes or of a single polarized suppressor diode with a bridge-connected rectifier. Ready-to-use modules of this type are commonly available in commerce.

Another suitable means of interference suppression are varistor modules. Manufacturers of contactors e.g., sell, in addition to their contactors, such matching varistors.

Additional information can be obtained from the German-language manual "Handbuch zur Entstörung von geschalteten Induktivitäten", available at:

Friedrich Lütze GmbH & Co
Abteilung Marketing
Bruckwiesenstraße 17 - 19
D - 71384 Weinstadt (Großheppach)

### 7.3.2      Inputs

All inputs have mutual 24V and 0V potentials.

The digital inputs of the B~IO67 modules can be connected with any main switching contact commonly available in commerce and any type of 3-wire proximity switch for an operating voltage of 24 V.

Any 2-wire proximity switch meeting the following requirements can be used:
● Closed circuit current, low status      < 1.5 mA
● Voltage drop, high status               < 8 V

The following 2-wire proximity switches can not be connected:
● 2-wire proximity switches that largely utilize the IEC 947-5-2 standard
● 2-wire proximity switches conforming to the NAMUR standard.

### 7.3.3      Coupling of In- and Outputs

Inputs and outputs can be connected with each other. This is necessary when the output states shall be read back as input values. Due to the tuned in- and output characteristics, the connection of an additional load is not necessary.

## 7.4    Electromagnetic Compatibility

Electromagnetic compatibility (EMC) describes the capability of an electric installation to function satisfactorily within its electromagnetic environment without influencing this environment – which also comprises other systems – not more than is permissible (EN 61 000-4-1).

### 7.4.1    General Information

An essential objective in automation technology is the achievement of the highest possible degree of system reliability. It is therefore of primary importance to prevent system downtimes caused by the effects of interferences.

### 7.4.2    Interferences

Possible sources of interferences for the user are:

● Self-generated interferences, e.g. caused by frequency inverters, inductive loads, etc.

● Externally generated interferences, e.g. caused by lightning discharges, mains fluctuations, etc.

These interference sources influence the potentially susceptible device in several ways. In general, the coupling paths of the interferences are the following:

● radiated interference injection

● conducted interference injection

● electrostatic discharges

Conducted interferences can develop into radiated interferences and vice versa. For example, a conducted interference generates a field on a cable; by radiation on a parallel-routed cable, this field then causes a conducted interference as well.

### 7.4.3    Signal-to-Noise Ratio

The signal-to-noise ratio describes the capability of a device or component to tolerate, without operational limitations, interferences up to a certain level. Electronic installation, like e.g. controllers, have an essentially lower signal-to-noise ratio than other operational equipment, like e.g. contactors.

## 7.4.4        EMC Statute and CE Mark of Conformity

With regard to its interference immunity, a system as a whole, must comply with specific minimum requirements. Compliance with these specifications lies in the responsibility of the plant engineer or the vendor of the entire machine. This fact is stipulated in the EMC Statute which is based on the EMC Directive of the Council of the European Communities.

The minimum requirements regarding the compliance with the EMC Statute are defined in standards for products or product lines. In the absence of such standards, basic specifications are utilized. Conformity with the respective regulations is proven by the application of the CE Mark of Conformity.

While the CE Mark of Conformity indicates conformity and compliance with all relevant directives of the Council of the European Communities, it neither represents a seal of quality nor an assurance of specific characteristics. It exclusively addresses the controlling authorities.

Depending on product and location, several directives may be relevant. In addition, the manufacturer is obliged to issue a corresponding Declaration of Conformity which, in the event of an official inspection, must be presented to the authorities.

Compliance with these requirements is usually verified by standardized tests that are described in the so-called "basic specifications", e.g., in EN 61 000-4-X = VDE 0847-4-X. To ensure interference immunity in the field as well, also the user is required to observe the conditions for installation provided by the manufacturer.

When installing the system, compliance is not only required with the EMC Directive (89/336/EEC) but also with the Low Voltage Directive (72/23/EEC), the Machinery Directive (89/392/EEC), and other directives and/or guidelines that refer to specific types of systems.

## 7.4.5     EMC Characteristics of B~IO67

The B~IO67 system itself fully complies with the EMC requirements resulting from the relevant standards.

Conformity with applicable standards was tested on specific system configurations. Nevertheless, this does not mean that electromagnetic compatibility of the system can be guaranteed for any configuration. The responsibility for the entire system lies solely with the plant engineer.

Sufficient electromagnetic compatibility can be achieved only by strict compliance with the installation guidelines. This is an indispensable prerequisite for the assumption that a system composed of individual CE-labelled units will also meet the protection objectives of the directive of the Council of the European Communities as one entity.

For a fairly comprehensive overview regarding the application of the directive please refer to the publication entitled "Guidelines on the application of Council Directive 89/336/EEC of May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility" which was issued in its version of 23 May 1997 by the European Commission.

**Testing for Surges**

The appendix of EN 50 082-2, which, at the moment, is not part of the standard, mentions a surge test for DC power supplies and interfaces for process controlling. This test is of significance in cases where cables exit buildings (e.g. hazards due to lightning), or where they are routed in close proximity to interference-prone power lines.

A system with B~IO67 modules can meet such requirements under the following conditions:

- All power supplies must either be connected to external varistor modules like e.g. Weidmüller DK4U or MCZ OVP Varistor 30V or to surge suppressor modules, like e.g. Weidmüller RSU 24V AC/DC.
- All digital in- and outputs that need protection must be connected with external varistor modules or surge suppressor modules.

**Radiant Emittances & Radio Interferences**

The B~IO67 complies with the EN 50 081-2 generic standard which defines the limit values for interference emissions. This standard applies exclusively to applications in an industrial environment. In contrast to residential areas, an industrial setting is characterized by the following specifications:

● No connection to the public low voltage network.

● Availability of a personal high or medium voltage transformer.

● Operation in an industrial setting, or in close proximity to industrial supply networks.

The limit values for industrial usage are higher than for usage in a residential setting. Therefore, the user will be required to provide additional measures if he intends to use the equipment in a residential setting:

● Installation of the device in an RF-shielded enclosure, like e.g. a cage made out of perforated plate or similar.

● An I/O system is normally characterized by a large number of peripheral interfaces. They represent a major pathway for decoupling radio interferences. In order to remain within reduced emission levels, filtering and screening measures must be applied to all lines that exit the screened area.

For systems with B~IO67 modules that are supposed to be used within a residential or commercial setting or in small plants, the operator is required to obtain an individual license from the competent authority or testing laboratory. In Germany, such licenses can be obtained from the Regulierungsbehörde für Telekommunikation und Post (RegTP) and its local branches.

**Protection against Electrostatic Discharges**

All modules of the B~IO67 system contain components that can be destroyed by electrostatic discharges (ESD). A defect of the module caused by such discharges is not necessarily noticeable immediately, but may also manifest itself in the form of occasional or delayed failures.

It is therefore absolutely necessary to comply with the relevant measures regarding the handling of electronic components and modules. In particular, hot insertion and unplugging of connectors are not permitted. Before touching a module directly, the person must be electrostatically discharged.

## 7.4.6    Installation Measures Ensuring Interference Immunity

Without exception, priority shall be given to the prevention and/or removal of interferences at their source. Please note the following aspects:

**Earthing**

To facilitate the dispersion of interference potentials acting between the device and the ground reference plane, the device's housing must be linked to the ground via a low-impedance connection. Especially in the case of pulse-shaped interferences with rise times in the nanosecond range, the inductive susceptibility of simple cables obstructs the dispersion of interferences significantly. Grounding strips provide significantly better high-frequency characteristics, and shall therefore be preferred.

**Screening**

A major source of interference has its origin in magnetic or electrical coupling. Coupling can be avoided by sufficient screening and spacial separation. This requires that potentially interference-prone components like power supply and motor cables, contactors, frequency inverters, etc. are installed either separately or screened from components having a lower signal-to-noise ratio, like signal cables, electronic controllers, etc.

The systematic spacial separation of potential interference sources and potentially susceptible devices as early as in the planning phase of a system represents the most cost-efficient measure to maximize its interference immunity.

Preference shall be given to the usage of transformers featuring shielding winding because they ensure a very effective attenuation of interferences at higher voltage levels.

**Twisted Pair Wiring**

Twisted-pair wiring is mainly used for data cables but also for power supply cables. The tightly twisted conductors prevent the occurrence of coupling-induced interference potentials.

It is essential that a twisted-pair cable consists of a forward and a return line so that the flowing currents add up to zero. This is the case for many data transmission methods, and in general also for power supplies. Standard bus lines are delivered with twisted pair wiring.

**Parallel Routing of Data Cables and Interference-Prone Power Cables**

Tight parallel installation of data transmission or input/output lines and interference-prone lines, such as motor lines or lines to poorly interference-suppressed contactors, must be avoided. The smaller the distance between the parallel-routed cables, the greater the interference.

In cable ducts and control cabinets, the power and data cables must be routed at the largest possible distance from each other, i.e., at a minimum distance of 10 cm and preferably in separate, screened compartments. Data cables shall cross power cables at an angle of $90°$.

**Interference Suppression of Inductive Loads**

In principle, most controlling outputs use built-in DC clamp diodes to keep inductive switching peaks at a safe level. This also applies to the outputs of the B~IO67 system.

A cable break, removing a plug to the inductive load, e.g. the solenoid valves, contactors, etc., or the intentional switch-off via a mechanic contact though leads to very high interference levels which can be further spread by galvanic, inductive or capacitive coupling within the system. To attenuate these interferences, an appropriate interference suppression device (free-wheeling diodes, varistor, or RC elements) must be provided directly at the inductive load.

Because of their universal applicability, we recommend to use bidirectional suppressor diodes. They consist either of two oppositely polarized, series-connected suppressor diodes or of a single polarized suppressor diode with a bridge-connected rectifier. Ready-to-use modules of this type are commonly available in commerce.

Another suitable means of interference suppression are varistor modules. Manufacturers of contactors e.g., sell, in addition to their contactors, such matching varistors.

**Filters**

Usually, the interference immunity of B~IO67 modules is sufficient in order to guarantee a function even in an environment that is relatively strongly contaminated by interferences. To attain a further improvement of EMC properties, it might be necessary to implement additional filtering measures. Such measures are to be verified for each individual case. Suitable filters can be selected from a wide range of available products on the market.

**Voltage Dips**

To ensure uninterrupted operation, the logic circuit power supply of the B~IO67 is capable of bridging voltage dips of up to 10 ms. This makes an interruption of the bus operation caused by brief voltage dips highly unlikely. No voltage bridging is available for the supply of outputs. Accordingly, brief voltage dips may cause contactors and other actuators to drop out.

In general, the falsification of input data due to voltage dips is already prevented by filters in the input circuits. Normal response times take up to 3 ms. In the event that interruptions of greater duration occur, the introduction of suitable measures will be required. For example, magnetic IR drop compensators can be employed on the AC side, and backup batteries and/or backup capacitors on the DC side.

# 7.5        Line Installation

**Cable Fixture**

When installing lines with cable fixtures, make sure that the line remains freely moveable within the fixtures and does not get squeezed or deformed. Lines that are too tightly fastened may be subject to premature damage.

correct                    incorrect
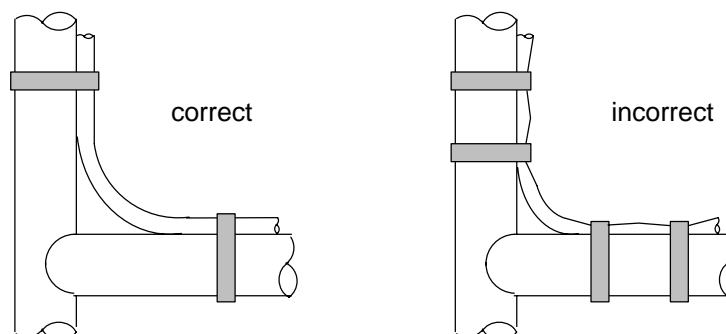
**Line Bundles**

If you assemble lines in bundles, please leave enough room. The lines must be able to move within the bundle, otherwise they will be subject to pressure-related and tensile stress.

**Bending Radius**

Make sure that the bending radius is sufficient. This way, the bending stress is distributed over a bigger section of the line whose life will be essentially prolonged. Minimum bending radius for fixed applications: 3 times the line diameter; minimum bending radius for moveable applications: 10 times the line diameter.

For relieving the terminals, make sure that the lines' slings are sufficient.

correct                    incorrect
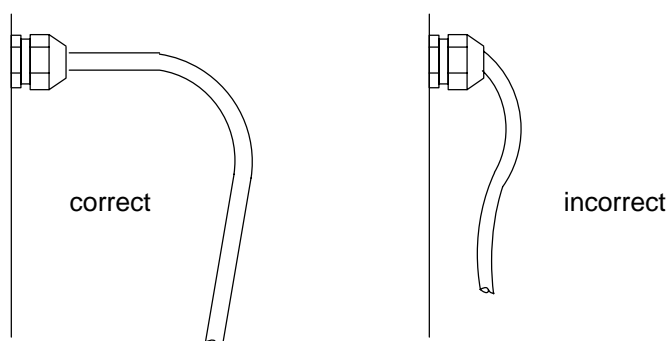
**Moveable Lines**

Moveable lines need the possibility to absorb the kinetic energy. Large cable slings or specific mechanisms for cable routing prolong the life of the lines essentially.

# 8      Ordering Data and Accessories

The devices of the B~IO67 product line are compact modules with separate bus- and I/O terminal block levels. Therefore, the electronic system and the I/O terminal blocks must be ordered separately.

**B~IO67 Electronic System**

| Designation | Order number |
|---|---|
| B~IO67 P-DP 8DO | 1070 920 678 |
| B~IO67 P-DP 8DI / 4DO | 1070 920 679 |
| B~IO67 P-DP 8DI / 8DO | 1070 920 708 |
| B~IO67 P-DP 8DI | 1070 920 676 |
| B~IO67 P-DP 16DI | 1070 920 677 |
|  |  |
| B~IO67 S-DP 8DO | 1070 920 682 |
| B~IO67 S-DP 8DI / 4DO | 1070 920 683 |
| B~IO67 S-DP 8DI / 8DO | 1070 920 711 |
| B~IO67 S-DP 8DI | 1070 920 680 |
| B~IO67 S-DP 16DI | 1070 920 681 |
|  |  |
| B~IO67 P-CAN 8DO | 1070 920 686 |
| B~IO67 P-CAN 8DI / 4DO | 1070 920 687 |
| B~IO67 P-CAN 8DI / 8DO | 1070 920 841 |
| B~IO67 P-CAN 8DI | 1070 920 684 |
| B~IO67 P-CAN 16DI | 1070 920 685 |
|  |  |
| B~IO67 S-CAN 8DO | 1070 920 690 |
| B~IO67 S-CAN 8DI / 4DO | 1070 920 691 |
| B~IO67 S-CAN 8DI / 8DO | 1070 920 844 |
| B~IO67 S-CAN 8DI | 1070 920 688 |
| B~IO67 S-CAN 16DI | 1070 920 689 |

**I/O Terminal Block**

| Designation | Order number |
|---|---|
| I/O-I-8-M 5P M12, octuple terminal block, 5-pin | 1070 920 709 |
| I/O-I-8-M 4P M12, octuple terminal block, 4-pin | 1070 920 837 |
| I/O-I-4-M 5P M12, quadruple terminal block, 5-pin | 1070 920 710 |
|  |  |
| I/O-I-8-M 4P IDC, IDC technique,<br>　　　　　　octuple terminal block, 4-pin | 1070 920 840 |
| I/O-I-8-M 3P IDC, IDC technique,<br>　　　　　　octuple terminal block, 3-pin | 1070 920 839 |
| I/O-I-4-M 4P IDC, IDC technique<br>　　　　　　quadruple terminal block, 4-pin | 1070 920 838 |

**Accessories**

| Designation | Order number |
|---|---|
| Power connector, M23 socket | 1 824 484 030 |
|  |  |
| Bus connector, M12 CAN socket | 1 824 484 029 |
| Bus connector, M12 CAN plug | 1 824 484 028 |
| Bus connector, M12 DP socket | 1 824 484 027 |
| Bus connector, M12 DP plug | 1 824 484 026 |
| Bus terminator, M12 CAN | 1070 921 001 |
| Bus terminator, M12 DP | 1070 921 000 |
|  |  |
| I/O connector, M12 plug, straight | 1 834 484 222 |
| I/O connector, M12 plug, right-angled | 1 834 484 223 |
| I/O quick-connect terminal element for IDC technique, 3-pin | 1070 920 902 |
| I/O quick-connect terminal element for IDC technique, 4-pin | 1070 920 903 |
| I/O protection cap, M12 | 1 823 312 001 |
|  |  |
| Device data base files (EDS/GSD files) on CD ROM | 1070 075 547 |

☞ **The EDS/GSD files can also be loaded down from the Internet: http://www.bosch.de/at.**

# A    Appendix

## A.1    Abbreviations

| Abbreviation | Significance |
|---|---|
| B~IO | Bus Input Output |
| BF | Bus error |
| BTN | Bus station (node address) |
| CAN | Controller Area Network |
| CANopen | (Open) transmission protocol on the bus of the controller area network |
| CANrho | CANrho-conform communication characteristics on the bus of the controller area network |
| DC | Direct current |
| DI | Digital inputs |
| DO | Digital outputs |
| DP | Fieldbus PROFIBUS-DP |
| EEM | Electrostatically endangered modules |
| EMC | Electromagnetic Compatibility |
| ESD | Electrostatic discharge, abbreviation for all terms that concern electrostatic discharges, e.g. ESD protection, ESD danger |
| P | PG screw system |
| PE | Protective earth |
| PLC | Programmable Logic Controller |
| RUN | Operational mode of the CAN bus |
| UI | 24V Voltage Supply |
| UL | 5V Logic Voltage |
| UQ | 24V Load Voltage |

## A.2  Index

**BOSCH**

Notes:

# Bosch Automation Technology

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We reserve the right to make technical alterations

Your concessionary

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