Your Global Automation Partner

TURCK

# TBIL-L. . .-16DXP-AUX
# I/O Hub with IO-Link

Instructions for Use

# Table of Contents

# 1 About these instructions

These instructions for use describe the structure, functions and the use of the product and will help you to operate the product as intended. Read these instructions carefully before using the product. This is to avoid possible damage to persons, property or the device. Retain the instructions for future use during the service life of the product. If the product is passed on, pass on these instructions as well.

## 1.1 Target groups

These instructions are aimed at qualified personal and must be carefully read by anyone mounting, commissioning, operating, maintaining, dismantling or disposing of the device.

## 1.2 Explanation of symbols used

The following symbols are used in these instructions:

| | |
|---|---|
|  | **DANGER**<br>DANGER indicates a dangerous situation with high risk of death or severe injury if not avoided. |
|  | **WARNING**<br>WARNING indicates a dangerous situation with medium risk of death or severe injury if not avoided. |
|  | **CAUTION**<br>CAUTION indicates a dangerous situation of medium risk which may result in minor or moderate injury if not avoided. |
|  | **NOTICE**<br>NOTICE indicates a situation which may lead to property damage if not avoided. |
|  | **NOTE**<br>NOTE indicates tips, recommendations and useful information on specific actions and facts. The notes simplify your work and help you to avoid additional work. |
| ▶ | **CALL TO ACTION**<br>This symbol denotes actions that the user must carry out. |
| ⇨ | **RESULTS OF ACTION**<br>This symbol denotes relevant results of actions. |

## 1.3 Additional documents

The following additional documents are available online at **www.turck.com**:

- Data sheet
- Commissioning manual IO-Link devices
- IO-Link parameter manuals for IO-Link devices
- EU Declaration of Conformity (current version)
- Approvals

## 1.4 Feedback about these instructions

We make every effort to ensure that these instructions are as informative and as clear as possible. If you have any suggestions for improving the design or if some information is missing in the document, please send your suggestions to **techdoc@turck.com**.

# 2 Notes on the product

## 2.1 Product identification

This instruction is valid for following devices:

- TBIL-L…-16DXP-AUX

## 2.2 Scope of delivery

The scope of delivery includes:

- I/O hub
- Dummy plugs for M12-connectors
- Label clips
- Quick Start Guide

## 2.3 Turck service

Turck supports you with your projects, from initial analysis to the commissioning of your application. The Turck product database under www.turck.com contains software tools for programming, configuration or commissioning, data sheets and CAD files in numerous export formats.

The contact details of Turck subsidiaries worldwide can be found on p. [▷ 33].

# 3 For your safety

The product is designed according to state-of-the-art technology. However, residual risks still exist. Observe the following warnings and safety notices to prevent damage to persons and property. Turck accepts no liability for damage caused by failure to observe these warning and safety notices.

## 3.1 Intended use

The block module TBIL-L…-16DXP-AUX is an IO-Link device (Class A) and serves as I/O hub between field devices (sensors and actuators) and the IO-Link master. The hub has 16 I/O channels. Each I/O channel can be used as either a digital input or output without additional configuration. The device is designed in IP65/IP67/IP69K and can be mounted directly in the field. The devices can also be used in safety applications up to Performance Level d (according to ISO 13849) and SIL 2 (according to IEC 61508) [▶ 14].

The devices may only be used as described in these instructions. Any other use is not in accordance with the intended use. Turck accepts no liability for any resulting damage.

## 3.2 Notes on the use in safety-related applications

- For the use in safety applications: Observe chapter “Using the device in safety applications”.
- The device is part of a safety-related overall system. The overall system must always be evaluated as a whole with regard to the requirements of EN IEC 61508 and EN ISO 13849-1.
- The devices are not specified for a certain application. Make sure that application-specific aspects are considered.
- Replace the devices before the expiration of the permissible duration of use (see ”Safety characteristic data for the galvanic isolation”).
- If there is a fault, e.g. a defective housing, do not use the device.
- During operation, surface temperatures may occur that could cause burns if touched.
- Perform a function test every 12 months.
- The devices must not be repaired. If problems occur with regard to functional safety, notify Turck immediately and return the devices immediately to:

  Hans Turck GmbH & Co. KG
  Witzlebenstraße 7
  45472 Mülheim an der Ruhr
  Germany

## 3.3 General safety notes

- The device may only be assembled, installed, operated, parameterized and maintained by professionally-trained personnel.
- The device may only be used in accordance with applicable national and international regulations, standards and laws.
- The device meets the EMC requirements for industrial areas. When used in residential areas, take measures to avoid radio interference.

# 4 Product description

The I/O hub TBIL-L…-16DXP-AUX connects up to 16 digital sensors or actuators with one IO-Link master port.

Eight M12 connectors are available for connecting the field devices. Each I/O channel of the TBIL-L…-16DXP-AUX can be used either as a digital input or output without additional configuration. The I/O hub is connected to the IO-Link master via an M12 socket. An additional 7/8" connector is available for connecting the auxiliary voltages V1 and V2 to supply connected field devices. The devices are designed in a fully encapsulated housing with degree of protection IP65/IP67/IP69K.

## 4.1 Device overview

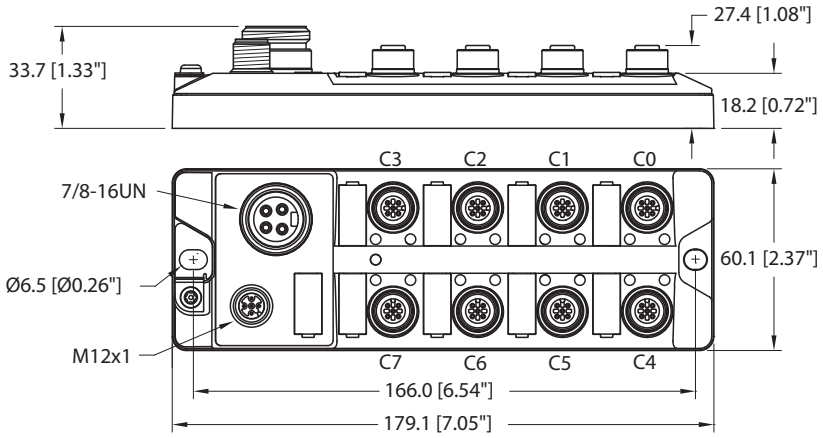



Fig. 1: Dimensions TBIL-L4-16DXP-AUX

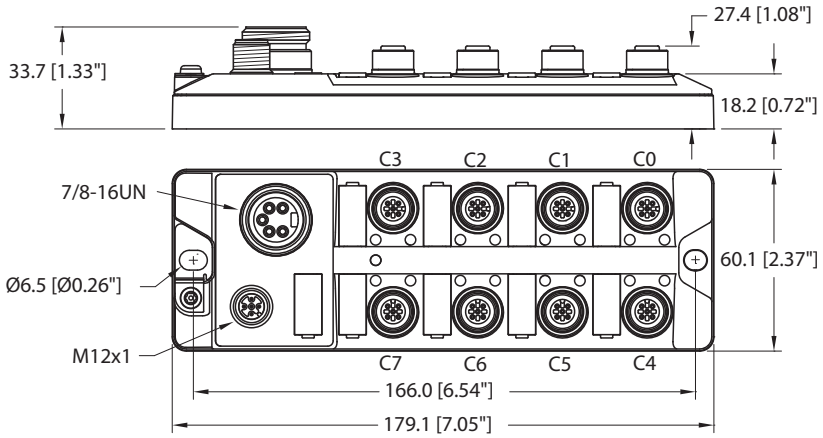



Fig. 2: Dimensions TBIL-L5-16DXP-AUX

### 4.1.1 Display elements

The device has the following LED indicators:

- IO-Link communication
- I/O status
- Supply voltage (V1, V2, $V_{IOL}$)

## 4.2 Properties and features

- Fibre-glass reinforced housing
- Shock and vibration tested
- Fully potted module electronics
- Protection class IP65/IP67/IP69K
- IO-Link Class A device with 3 galvanically isolated supply voltages (V1/V2/$V_{IOL}$)
- IO-Link diagnostics for short-circuit and supply over- and undervoltage
- 2 universal digital channels per connector
- Metal connectors

## 4.3 Functions and operating modes

The I/O hub TBIL-L…-16DXP-AUX is an IO-Link Class A device with three galvanically isolated supply voltages V1, V2 $V_{IOL}$. The connectors C0…C3 are supplied from V1, the connectors C4…C7 from V2. In addition, $V_{IOL}$ supplies the internal module electronics via the standard IO-Link connector. The galvanic isolation of V1, V2 and $V_{IOL}$ allows that V1 and V2 for the outputs at connectors C0…C3 or respectively C4…C7 can be safely switched off or not safely for the purpose of energy management.

The device provides diagnostics for power supply and overload or short circuit of the sensors and actuators via IO-Link.

# 5 Installing

The device is mounted via two M4 screws on a flat and pre-drilled mounting surface.

- ▶ Fasten the module to the mounting surface with two M4 screws. The maximum tightening torque for the screws is 0.5 Nm

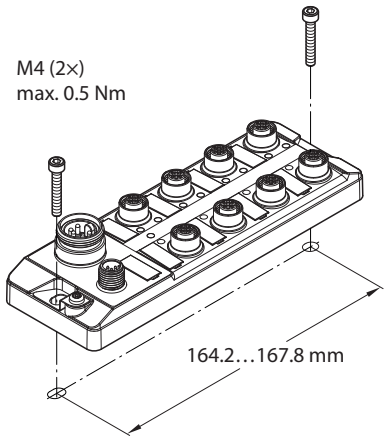



Fig. 3: Mounting the device on a mounting plate

# 6 Connecting

**NOTICE**
Intrusion of liquids or foreign bodies through leaking connections
**Loss of protection class IP65/IP67/IP69K, device damage possible**

- ▶ Tighten M12 connectors with a tightening torque of 0.6 Nm.
- ▶ Only use accessories that guarantee the protection class.
- ▶ Always seal unused connectors with suitable screw caps or blind caps. The tightening torque for the screw caps is 0.5 Nm.

## 6.1 Connecting the supply voltage

For the connection to the power supply, the device has a 7/8" connector. The connector is designed as 4-pin (TBIL-L4) or 5-pin (TBIL-L5) connector. V1 and V2 are galvanically isolated from each other. The maximum tightening torque is 0.8 Nm.

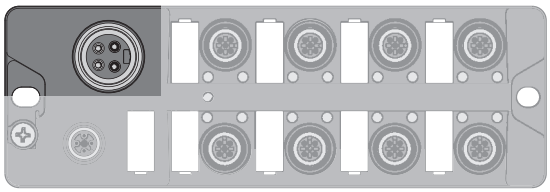


Fig. 4: TBIL-L4… – 7/8" connector (P2) for connecting the supply voltage

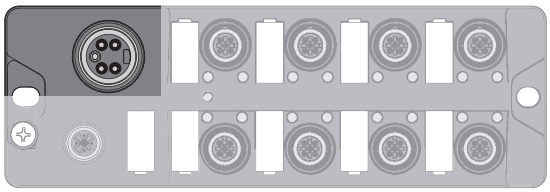
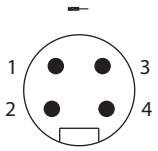


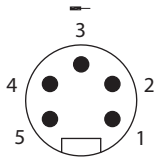
Fig. 5: TBIL-L5… – 7/8" connector (P2) for connecting the supply voltage

▶ Connect the device to the power supply according to the pin assignment.




1 = 24 VDC (V2)
2 = 24 VDC (V1)
3 = GND (V1)
4 = GND (V2)

Fig. 6: TBIL-L4– Pin assignment supply voltage (P2)




1 = GND (V2)
2 = GND (V1)
3 = FE
4 = 24 VDC (V1)
5 = 24 VDC (V2)

Fig. 7: TBIL-L5– Pin assignment supply voltage (P2)

### 6.1.1 Supply concept

The I/O hub TBIL-L…-16DXP-AUX is supplied with two galvanically isolated auxiliary voltages V1 and V2 via the 7/8" connector. This divides the IO-Link channels into two electrically isolated potential groups C0…C3 (supplied from V1) and C4…C7 (supplied from V2).

The galvanic isolation of the potential group allows a safety shutdown of parts of an installation via emergency-off circuits.

| | |
|---|---|
| V1 | Supply of connectors C0…C3 and the connected sensors and actuators |
| V2 | Supply of connectors C4…C7 and the connected sensors and actuators |
| $V_{IOL}$ | Power supply of the IO-Link electronic |

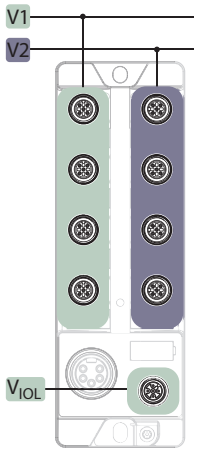



Fig. 8: Supply concept TBIL-L…-16DXP-AUX

## 6.2 Connecting IO-Link

The device provides a 5-pin M12 connector for the connection to IO-Link and the supply voltage.

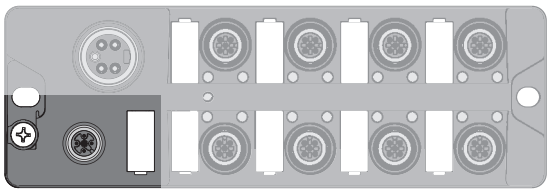


Fig. 9: M12 connector (P1) for the connection to IO-Link

- ▶ Connect the device to IO-Link and the supply voltage according to the pin assignment below.

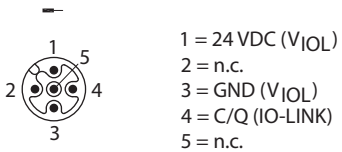



Fig. 10: Pin assignment IO-Link

## 6.3 Connecting digital sensors and actuators

For connecting digital sensors and actuators, 5-pin M12 connectors are available.

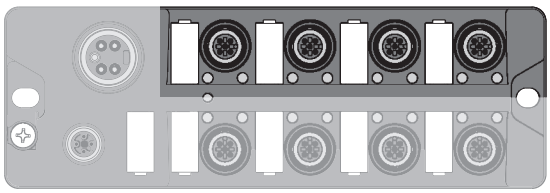
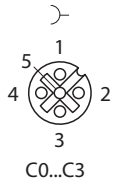


Fig. 11: M12 connector for connecting digital sensors and actuator (C0…C3)

- Connect the sensors and actuators to the device according to the pin assignment.




1 = VAUX1 (V1)
2 = In/Out (odd)
3 = GND (V1)
4 = In/Out (even)
5 = FE

Fig. 12: Pin assignment TBIL-L…-16DXP-AUX (C0…C3)

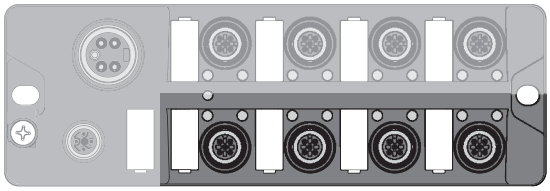
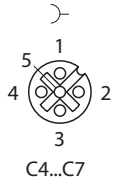


Fig. 13: M12 connector for connecting digital sensors and actuator (C4…C7)




1 = VAUX2 (V2)
2 = In/Out (odd)
3 = GND (V2 )
4 = In/Out (even)
5 = FE

Fig. 14: Pin assignment TBIL-L…-16DXP-AUX (C4…C7)

### External supply of sensors and actuators

Sensors and actuators, which are supplied via an external power supply, can also be connected to the TBIL I/O hub. If sensors or actuators are supplied via an external power supply, the following safety regulations have to be observed:

- Supply sensors and actuators from SELV or PELV power supplies.
- Decouple external circuits that are not designed as SELV or PELV systems by optocouplers, relays or other measures.

# 7 Using the device in safety applications

The device is designed in accordance with EN ISO 13849-1 “Safety of machinery - Safety-related parts of control systems”.

## 7.1 Safety function

The safety function is executed by the higher-level system.

The supply voltage V1 of the outputs at C0…C3 and the supply voltage V2 of the outputs at C4…C7 can be safely switched off by an external safety relay or a safe control.

### Safe state

In the safe state, the outputs are switched off (0 V). The disconnection is done externally in the higher-level system.

### Performance Level (PL)/SIL Level

Due to the galvanic isolation of load and operating voltage, the design of the devices allows the fault exclusion of voltage carry-over to safely disconnected equipment with a single fault safety of category 3 for safety functions up to performance level d (according to EN ISO 13849). The maximum achievable Safety Integrity Level is SIL CL2 (according to EN 62061:2016, section 6.7.7).

The device is part of a safety-related overall system. The overall system must always be evaluated as a whole with regard to the requirements of EN ISO 13849-1 and EN 62061.

### Safety characteristic data for the galvanic isolation

| Characteristic data | Value | |
|---|---|---|
| MTTF | See ”Technical data” | |
| Lifetime | 20 years | |
| Diagnostic coverage | 0…99 % | Determination via FMEA according to ISO 13849-2: 2013 |

**NOTE**
The calculation of $MTTF_D$ data of electronic components is done according to ISO 13849-1:201, Annex C.5: "$MTTF_D$ data of electrical components" and D.1: "Parts count method".

## 7.2 Safety planning

The operator is responsible for the safety planning.

### Prerequisites

- Perform a hazard and risk analysis.
- Develop a safety concept for the machine or plant.
- Calculate the safety integrity for the complete machine or plant.
- Validate the complete system.

## 7.3 Safe commissioning

### 7.3.1 Installing connecting cables safely

**NOTICE**
Incorrect connection of connecting cables
**Danger of cross connections**

- Install and connect the cables safely and separately in accordance with EN 60204-1.
- Install cables with cross-circuit protection if the safe installation of the cables is not possible.

### 7.3.2 Switch off supply voltage safely

**WARNING**
1-pole switch-off the supply voltage
**Safe separation not guaranteed**

- Always switch-off the supply voltage on both poles.

### 7.3.3 Connecting sensors and actuators

**WARNING**
External feed
**Deactivation of the galvanic isolation**

- If the galvanic isolation is used, ensure on the application side that no external feed can occur.
- DXP channels that operate with safe disconnectable potential must be supplied by the corresponding conenctor.

## 7.4 Function tests

- Have the function test carried out by qualified personnel only.
- Before commissioning the system, check and document the switch-off of the V1 and V2 voltage group by an upstream safety relay.
- Control the switching behavior of he output circuits.

## 7.5 Cited standards

| Standard | Title |
|---|---|
| DIN EN ISO 13849-1:2016-06 | Safety-related parts of control systems |
| EN 62061:2005 + Cor.:2010 + A1:2013 + A2:2015<br>IEC 62061:2005 + A1:2012 + A2:2015 | Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems |
| DIN EN 61508:2011<br>IEC 61508:2010 | Functional safety of electrical/electronic/ programmable electronic safety-related systems |
| DIN EN 61131-2:2008<br>IEC 61131-2:2007 | Programmable controllers |
| EN ISO 12100:2010<br>DIN EN ISO 12100:211-03 | Safety of machinery - General principles for design - Risk assessment and risk reduction |

# 8 Parameterizing and configuring

## 8.1 Parameters

IO-Link object directory — ISDU device parameters: Direct Parameter Page

| ISDU Index | Sub index | Object name | Access | Length in bytes | Meaning/default value |
|---|---|---|---|---|---|
| Hex. (dec.) | | | | | |
| 0x00 (0) | Direct Parameter Page 1 | | read only | 16 | |
| | 0x03 | Min. cycle time | read only | 1 | |
| | 0x05 | IO-Link version ID | read only | 1 | 17 |
| | 0x08 | Vendor ID | read only | 2 | ID for Turck: 0x013D |
| | 0x09 | | | | |
| | 0x0A | Device ID | read only | 3 | E. g.: TBIL-L…-16DXP-AUX: 0xE330… |
| | 0x0B | | | | |
| | 0x0C | | | | |

IO-Link object directory — ISDU device parameters: Identification

| ISDU Index | Object name | Access | Length in bytes | Meaning/ default value | Comment |
|---|---|---|---|---|---|
| Hex. (dec.) | | | | | |
| 0x10 (16) | Vendor name | read only | 16 | Turck | |
| 0x11 (17) | Vendor text | read only | 32 | www.turck.com | |
| 0x12 (18) | Product name | read only | 32 | TBIL-L…-16DXP-AUX | |
| 0x13 (19) | Product ID | read only | 16 | ID of the device | |
| 0x14 (20) | Product text | read only | 32 | I/O hub | |
| 0x15 (21) | Serial number | read only | 16 | Sequential serial number | |
| 0x16 (22) | Hardware ID | read only | 8 | Hardware revision of the device, e. g. V1.0 | |
| 0x17 (23) | Firmware revision | read only | 16 | Firmware revision of the device, e. g. V1.0.7.0 | |
| 0x18 (24) | Application Specific Tag | read/ write | 32 | Default "***" | Field for customer or application specific data |

| ISDU Index<br>Hex. (dec.) | Object name | Access | Length in bytes | Meaning/ default value | Comment |
|---|---|---|---|---|---|
| 0x19 (25) | Function Tag | read/ write | 32 | Default "***" | Field for the application specific device function |
| 0x1A (26) | Location Tag | read/ write | 32 | Default "***" | Field for the application-specific installation location of the device |

IO-Link object directory — ISDU device parameters: Preferred Index (parameters and diagnostics of the digital in- and outputs)

| ISDU Index<br>Hex. (dec.) | Object name | Access | Length in bytes | Meaning |
|---|---|---|---|---|
| 0x40 (64) | Parameter ID | read/ write | 4 | Customer-specific ID, for free use |
| 0x41 (65) | Inverting input | read/ write | 2 | Invert digital input |
| 0x42 (66) | Activate output | read/ write | 2 | Activate output |
| 0x43 (67) | Impulse stretching input | read/ write | 16 | Pulse stretching input |
| 0x44 (68) | Short circuit recovery | read/ write | 2 | Manual output reset after overcurrent |
| 0x45 (69) | Failsafe | read/ write | 4 | Output after error |
| 0x46 (70) | Under voltage diagnostics | read/ write | 2 | Enable V1 and V2 undervoltage diagnostics/ threshold values for undervoltage diagnostics V1, V2 and $V_{IOL}$ |
| **Diagnostics** | | | | |
| 0x50 (80) | Supply error | read only | 2 | ■ Undervoltage supply V1, V2 and $V_{IOL}$<br>■ Overcurrent VAUX connector C0…C7 |
| **Diagnostics** | | | | |
| 0x51 (81) | Output short circuit | read only | 2 | Overcurrent output 0…15 |

### Invert digital input — 0x41 (65), sub index 0

This parameter inverts the state of the digital input in the process image.

| Format | Length | |
|---|---|---|
| Byte | 2 byte | 1 bit per channel |

Default values are shown in **bold**.

| Value | Meaning | |
|---|---|---|
| **0** | **No** | |
| 1 | Yes | Input signal inverted |

| **Byte 0** | | | | | | | | **Byte 1** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Bit offset** | | | | | | | | **Bit offset** | | | | | | | |
| **7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** | **15** | **14** | **13** | **12** | **11** | **10** | **9** | **8** |
| **Sub index** | | | | | | | | **Sub index** | | | | | | | |
| **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| C7P2 (B) | C7P4 (A) | C6P2 (B) | C6P4 (A) | C5P2 (B) | C5P4 (A) | C4P2 (B) | C4P4 (A) | C3P2 (B) | C3P4 (A) | C2P2 (B) | C2P4 (A) | C1P2 (B) | C1P4 (A) | C0P2 (B) | C0P4 (A) |

### Activate output — 0x42 (66), sub index 0

This parameter activates or deactivates the output function of the digital channel.

| Format | Length | |
|---|---|---|
| Byte | 2 byte | 1 bit per channel |

Default values are shown in **bold**.

| Value | Meaning | |
|---|---|---|
| 0 | No | Output function deactivated, channel can only be used as input |
| **1** | **Yes** | Output function activated, channel can be used as in- or output |

| **Byte 0** | | | | | | | | **Byte 1** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Bit offset** | | | | | | | | **Bit offset** | | | | | | | |
| **7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** | **15** | **14** | **13** | **12** | **11** | **10** | **9** | **8** |
| **Sub index** | | | | | | | | **Sub index** | | | | | | | |
| **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| C7P2 (B) | C7P4 (A) | C6P2 (B) | C6P4 (A) | C5P2 (B) | C5P4 (A) | C4P2 (B) | C4P4 (A) | C3P2 (B) | C3P4 (A) | C2P2 (B) | C2P4 (A) | C1P2 (B) | C1P4 (A) | C0P2 (B) | C0P4 (A) |

**NOTE**
This parameter can also be set for all connectors of the module via the IODD.

### Pulse stretching input — 0x43 (67)

This parameter defines the duration of the pulse stretching for digital input edges in multiples of 10 ms. This allows that even short signals with longer PLC cycle times can be detected.

| Format | Length | |
|---|---|---|
| Array of byte | 16 byte | 1 byte per channel |

Default values are shown in **bold**.

| Value | Meaning | |
|---|---|---|
| **0** | **Disabled** | Pulse stretching deactivated |
| 1 | 1…255 | Pulse stretching (in steps of 10 ms) |

| **Bit offset** | | | | | | | | **Bit offset** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | **8** | **16** | **24** | **32** | **40** | **48** | **56** | **64** | **72** | **80** | **88** | **96** | **104** | **112** | **120** |
| **Sub index** | | | | | | | | **Sub index** | | | | | | | |
| **16** | **15** | **14** | **13** | **12** | **11** | **10** | **9** | **8** | **7** | **6** | **5** | **4** | **3** | **2** | **1** |
| C7P2 (B) | C7P4 (A) | C6P2 (B) | C6P4 (A) | C5P2 (B) | C5P4 (A) | C4P2 (B) | C4P4 (A) | C3P2 (B) | C3P4 (A) | C2P2 (B) | C2P4 (A) | C1P2 (B) | C1P4 (A) | C0P2 (B) | C0P4 (A) |

**NOTE**
This parameter can also be set for all connectors of the module via the IODD.

### Manual output reset after overcurrent — 0x44 (68), sub index 0

This parameter defines if a manual reset is necessary after an overcurrent occurred at the digital channel.

| Format | Length | |
|---|---|---|
| Byte | 2 byte | 1 bit per channel |

Default values are shown in **bold**.

| Value | Meaning | |
|---|---|---|
| **0** | **No** | Automatic recovery mode |
| 1 | Yes | Controlled recovery mode (output has to be reset manually) |

**NOTE**
This parameter can also be set for all connectors of the module via the IODD.

| **Byte 0** | | | | | | | | **Byte 1** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Bit offset** | | | | | | | | **Bit offset** | | | | | | | |
| **7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** | **15** | **14** | **13** | **12** | **11** | **10** | **9** | **8** |
| **Sub index** | | | | | | | | **Sub index** | | | | | | | |
| **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| C7P2 (B) | C7P4 (A) | C6P2 (B) | C6P4 (A) | C5P2 (B) | C5P4 (A) | C4P2 (B) | C4P4 (A) | C3P2 (B) | C3P4 (A) | C2P2 (B) | C2P4 (A) | C1P2 (B) | C1P4 (A) | C0P2 (B) | C0P4 (A) |

## Output after error — 0x45 (69), Sub Index 0

This parameter defines the behavior of the output in case of an interruption of the IO-Link communication.

| Format | Length | |
|---|---|---|
| Array of byte | 4 byte | 2 bit per channel |

Default values are shown in **bold**.

| Value | Meaning | |
|---|---|---|
| **00** | **0** | Set output to 0 |
| 01 | 1 | Set output to 1 |
| 10 | Current value | Hold current value |
| 11 | reserved | |

| **Byte 0** | | | | **Byte 1** | | | | **Byte 2** | | | | **Byte 3** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Bit offset** | | | | | | | | | | | | | | | |
| **6** | **4** | **2** | **0** | **14** | **12** | **10** | **8** | **22** | **20** | **18** | **16** | **30** | **28** | **26** | **24** |
| **Sub index** | | | | | | | | | | | | | | | |
| **13** | **14** | **15** | **16** | **9** | **10** | **11** | **12** | **5** | **6** | **7** | **8** | **1** | **2** | **3** | **4** |
| C7P2 (B) | C7P4 (A) | C6P2 (B) | C6P4 (A) | C5P2 (B) | C5P4 (A) | C4P2 (B) | C4P4 (A) | C3P2 (B) | C3P4 (A) | C2P2 (B) | C2P4 (A) | C1P2 (B) | C1P4 (A) | C0P2 (B) | C0P4 (A) |

**NOTE**
This parameter can also be set for all connectors of the module via the IODD.

## Enable undervoltage diagnostics V1, V2 and $V_{IOL}$/threshold values for undervoltage diagnostics — 0×46 (70), sub index 0

This parameter defines whether undervoltage diagnostic messages are sent in case of an V1, V2 or $V_{IOL}$ undervoltage. Additionally it defines the threshold values for undervoltage diagnostics for V1, V2 and $V_{IOL}$.

| Format | Length | |
|---|---|---|
| Array of byte | 2 byte | 3 bit per module |

Default values are shown in **bold**.

| Value | Meaning | |
|---|---|---|
| **Activate undervoltage diagnostics** | | |
| 0 | No | |
| **1** | **Yes** | Undervoltage diagnostics activated |
| **Threshold value for undervoltage diagnostics V1, V2 and $V_{IOL}$** | | |
| **0** | **Standard (IEC 61131-2)** | Lower threshold: 19.2 V<br>Upper threshold: 20.4 V |
| 1 | Extended | Lower threshold: 17.5 V |

| **Byte 0** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Bit offset** | | | | | | | |
| **7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| - | - | - | - | - | - | - | - |

| **Byte 1** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Bit offset** | | | | | | | |
| **15** | **14** | **13** | **12** | **11** | **10** | **9** | **8** |
| - | - | - | - | - | Activate V2 under-voltage diagnostics | Activate V1 under-voltage diagnostics | Threshold |

# 9 Operating

**CAUTION**
Operating the device outside the specification
**Slight injuries and equipment damage possible.**

- ▶ Operate the unit only within the operating temperature specified in the technical data.
- ▶ Use only thermally suitable connection cables.

## 9.1 Process input data

| Byte no. | Bit offset | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| **Inputs** | | | | | | | | |
| 0 | C3P2 (B) | C3P4 (A) | C2P2 (B) | C2P4 (A) | C1P2 (B) | C1P4 (A) | C0P2 (B) | C0P4 (A) |
| 1 | C7P2 (B) | C7P4 (A) | C6P2 (B) | C6P4 (A) | C5P2 (B) | C5P4 (A) | C4P2 (B) | C4P4 (A) |
| **Module diagnostics** | | | | | | | | |
| 2 | Group diagnostics | - | - | Undervoltage V2 | Undervoltage V1 | Undervoltage $V_{IOL}$ | - | - |
| **Connector diagnostics – overcurrent sensor supply** | | | | | | | | |
| 3 | Overcurrent C7 | Overcurrent C6 | Overcurrent C5 | Overcurrent C4 | Overcurrent C3 | Overcurrent C2 | Overcurrent C1 | Overcurrent C0 |
| **Channel diagnostics – overcurrent output** | | | | | | | | |
| 4 | Overcurrent C3P2 | Overcurrent C3P4 | Overcurrent C2P2 | Overcurrent C2P4 | Overcurrent C1P2 | Overcurrent C1P4 | Overcurrent C0P2 | Overcurrent C0P4 |
| 5 | Overcurrent C7P2 | Overcurrent C7P4 | Overcurrent C6P2 | Overcurrent C6P4 | Overcurrent C5P2 | Overcurrent C5P4 | Overcurrent C4P2 | Overcurrent C4P4 |

**NOTE**
The diagnostics can also be be accessed via IO-Link indices.

| Designation | Meaning | | |
|---|---|---|---|
| **Inputs** | | | |
| CxPy | 0 | Input inactive | |
| | 1 | Input active | |
| **Module diagnostics** | | | |
| Group diagnostics | 0 | No diagnostics | |
| | 1 | Module diagnostics active | ▶ Evaluate the bit to monitor the diagnostics cyclically.<br>⇨ Bit = 0: no diagnostics active<br>⇨ Bit = 1: Module diagnostics<br>▶ Bit = 1: Evaluate further diagnostic bits to determine the origin of the diagnosctic message. |

| Designation | Meaning | |
|---|---|---|
| Undervoltage Vx | 0 | No diagnostics |
| | 1 | Undervoltage of supply voltage V1, V2 or $V_{IOL}$ |
| **Connector diagnostics – overcurrent sensor supply** | | |
| Overcurrent Cx | 0 | No diagnostics |
| | 1 | Overload at the sensor/actuator supply at the connector. At modules with group diagnostics all connector-LEDs of the supply group flash simultaneously in case of an error. |
| **Channel diagnostics – overcurrent output** | | |
| Overcurrent Cx | 0 | No diagnostics |
| | 1 | Overcurrent at output or short-circuit |

## 9.2 Process output data

| Byte no. | Bit offset | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| **Outputs** | | | | | | | | |
| **0** | C3P2 (B) | C3P4 (A) | C2P2 (B) | C2P4 (A) | C1P2 (B) | C1P4 (A) | C0P2 (B) | C0P4 (A) |
| **1** | C7P2 (B) | C7P4 (A) | C6P2 (B) | C6P4 (A) | C5P2 (B) | C5P4 (A) | C4P2 (B) | C4P4 (A) |

| Designation | Meaning | |
|---|---|---|
| CxPy | 0 | Output inactive |
| | 1 | Output active |

## 9.3 LED displays

The device has the following LED indicators:

- IO-Link communication
- I/O status

### 9.3.1 IO-Link

| IO-Link LED | Meaning |
|---|---|
| Green flashing (1 Hz) | IO-Link communication OK, valid process data are sent |
| Red | IO-Link communication error or module error |
| Red flashing (1 Hz) | IO-Link communication OK, invalid process data or diagnostic message |
| Off | No voltage supply |

### 9.3.2 Channel LEDs

| LED 0…15 | Meaning (input) | Meaning (output) |
|---|---|---|
| Green | Input signal is present | Output active |
| Red flashing (0.5 Hz) | Overload of the sensor supply<br>In devices with group diagnostics, all connector-LEDs of the supply group flash simultaneously in case of an error. | |
| Red | – | Output active, overload/overcurrent at output |
| Off | No input signal | Output inactive |

## 9.4 Diagnostic data

### Group diagnostics: undervoltage V1/V2 and overcurrent sensor supply – 0x50 (80), sub index 0

The group diagnosis indicates errors in the module and sensor supply:

- Group diagnostics: Diagnostics pending at the module
- Undervoltage V1 (per module)
- Undervoltage V2 (per module)
- Undervoltage $V_{IOL}$ (per module)
- Overcurrent sensor supply (per connector)

| Format | Length |
|---|---|
| Array of bytes | 2 byte |

0 = no diagnostics

1 = diagnostic message available

| **Byte 0** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Bit offset** | | | | | | | |
| **15** | **14** | **13** | **12** | **11** | **10** | **9** | **8** |
| Group diagnostics | - | - | Undervoltage supply V2 | Undervoltage supply V1 | Undervoltage supply $V_{IOL}$ | - | - |

| **Byte 1** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Bit offset** | | | | | | | |
| **7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| Overcurrent VAUX C7 | Overcurrent VAUX C6 | Overcurrent VAUX C5 | Overcurrent VAUX C4 | Overcurrent VAUX C3 | Overcurrent VAUX C2 | Overcurrent VAUX C1 | Overcurrent VAUX C0 |

### Overcurrent output – 0x51 (81), sub index 0

The diagnostics indicates an overcurrent at the corresponding digital output.

| Format | Length | |
|---|---|---|
| Array of bytes | 2 byte | 1 bit per output |

0 = no diagnostics

1 = diagnostic message available

| Byte 0 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Bit offset | | | | | | | |
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Overcur-rent C3P2 | Overcur-rent C3P4 | Overcur-rent C2P2 | Overcur-rent C2P4 | Overcur-rent C1P2 | Overcur-rent C1P4 | Overcur-rent C0P2 | Overcur-rent C0P4 |

| Byte 1 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Bit offset | | | | | | | |
| 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Overcur-rent C7P2 | Overcur-rent C7P4 | Overcur-rent C6P2 | Overcur-rent C6P4 | Overcur-rent C5P2 | Overcur-rent C5P4 | Overcur-rent C4P2 | Overcur-rent C4P4 |

## 9.5 IO-Link error codes

| Error code | Description | |
|---|---|---|
| 0x8011 | Index not available | |
| 0x8012 | Sub index not available | |
| 0x8023 | Accesss denied | Index cannot be written |
| 0x8030 | Parameter value out of range | |
| 0x8033 | Parameter length overrun | Length of data to be written does not match the length defined for this parameter. |
| 0x8034 | Parameter length overrun | |
| 0x8035 | Function not available | Function not available in the device |
| 0x8041 | Inconsistent parameter set | |

# 10 Troubleshooting

If the device does not function as expected, first check whether ambient interference is present. If there is no ambient interference present, check the connections of the device for faults.

If there are no faults, there is a device malfunction. In this case, decommission the device and replace it with a new device of the same type.

# 11 Maintenance

Ensure that the plug connections and cables are always in good condition.

The devices are maintenance-free, clean dry if required.

# 12 Repair

The device must not be repaired by the user. The device must be decommissioned if it is faulty. Observe our return acceptance conditions when returning the device to Turck.

## 12.1 Returning devices

Returns to Turck can only be accepted if the device has been equipped with a Decontamination declaration enclosed. The decontamination declaration can be downloaded from
**https://www.turck.de/en/retoure-service-6079.php**
and must be completely filled in, and affixed securely and weather-proof to the outside of the packaging.

# 13 Disposal

The devices must be disposed of correctly and must not be included in general household garbage.

# 14 Technical data

| Technical data | |
|---|---|
| **Supply** | |
| Operating/load voltage | 24 VDC |
| Permissible range | 18…30 VDC |
| Total current | V1: max. 9 A,<br>V2: max. 9 A,<br>$V_{IOL}$ + V1 + V2: max. 11 A |
| Operating current | V1: max: 80 mA<br>V2: max: 80 mA<br>$V_{IOL}$: max: 20 mA |
| Sensor/actuator supply VAUX1 | Supply from V1, C0…C3, short-circuit-proof, max. 120 mA per connector |
| Sensor/actuator supply VAUX2 | Supply from V2, C4…C7, short-circuit-proof, max. 120 mA per connector |
| Power loss, typical | ≤ 3.5 W |
| Potential isolation | Possible isolation of voltage groups V1, V2 and $V_{IOL}$, voltage proof up to 500 VDC |
| **Digital inputs** | |
| Number of channels | 16 digital pnp inputs (EN 61131-2) |
| Type of input diagnostics | Channel diagnostics |
| Signal voltage low level | -3…5 VDC (EN 61131-2, type 1 and 3) |
| Signal voltage, high level | 11…30 VDC (EN 61131-2, type 1 and 3) |
| Input current | 7 mA |
| **Digital outputs** | |
| Number of channels | 16 digital pnp outputs |
| Type of output diagnostics | Channel diagnostics |
| Output voltage | 24 VDC from supply voltage |
| Output current | 2 A per channel, 4 A per connector |
| ■ According to UL approval | 2.5 A per connector |
| Load type | Ohmic, inductive lamp load |
| Short-circuit protection | Yes |
| Potential isolation | 500 VDC |
| **IO-Link** | |
| IO-Link specification | Specified according to version 1.1 |
| IO-Link port type | Class A |
| Parameterization | FDT/DTM, IODD |
| Frame type | 2.6 |
| Transmission rate | COM 2: 38.4 kbit/s |
| Transmission physics | 3-wire physics (PHY2) |
| Minimum cycle time | 4.2 ms |
| **Connectors** | |
| Power supply | TBIL-L4-…: 7/8″ male connector, 4-pin<br>TBIL-L5-…: 7/8″ male connector, 5-pin |

| Technical data | |
|---|---|
| IO-Link | M12 × 1, 5 pin |
| Input/output | M12 × 1, 5-pole |
| Permissible torques | |
| ■ IO-Link | 0.8 Nm |
| ■ I/O channels | 0.8 Nm |
| ■ Mounting (M6 screws) | 1.5 Nm |
| **Standard/directive conformity** | |
| Vibration test | According to EN 60068-2-6 |
| Shock test | According to EN 60068-2-27 |
| Drop and topple | According to IEC 60068-2-31/IEC 60068-2-32 |
| Electromagnetic compatibility | According to EN 61131-2/-6-4 |
| Approvals | CE, cULus |
| **General Information** | |
| Dimensions (B × L × H) | 60.1 × 179.1 × 29.5 mm |
| Operating temperature | -40…+70 °C |
| ■ According to UL approval | -40…+6w0 °C |
| Storage temperature | -40…+85 °C |
| Protection class | IP65<br>IP67<br>IP69K |
| MTTF | 164 years acc. to SN 29500 (Ed. 99) 20 °C |
| Housing material | PA6-GF30 |
| Housing color | Black |
| Halogen-free | Yes |
| Mounting | 2 mounting holes, Ø 6.5 mm |

# 15 Turck subsidiaries — contact information

| | |
|---|---|
| **Germany** | Hans Turck GmbH & Co. KG<br>Witzlebenstraße 7, 45472 Mülheim an der Ruhr<br>**www.turck.de** |
| **Australia** | Turck Australia Pty Ltd<br>Building 4, 19-25 Duerdin Street, Notting Hill, 3168 Victoria<br>**www.turck.com.au** |
| **Austria** | Turck GmbH<br>Graumanngasse 7/A5-1, A-1150 Wien<br>**www.turck.at** |
| **Belgium** | TURCK MULTIPROX<br>Lion d'Orweg 12, B-9300 Aalst<br>**www.multiprox.be** |
| **Brazil** | Turck do Brasil Automação Ltda.<br>Rua Anjo Custódio Nr. 42, Jardim Anália Franco, CEP 03358-040 São Paulo<br>**www.turck.com.br** |
| **Canada** | Turck Canada Inc.<br>140 Duffield Drive, CDN-Markham, Ontario L6G 1B5<br>**www.turck.ca** |
| **China** | Turck (Tianjin) Sensor Co. Ltd.<br>18,4th Xinghuazhi Road, Xiqing Economic Development Area, 300381 Tianjin<br>**www.turck.com.cn** |
| **Czech Republic** | TURCK s.r.o.<br>Na Brne 2065, CZ-500 06 Hradec Králové<br>**www.turck.cz** |
| **France** | TURCK BANNER S.A.S.<br>11 rue de Courtalin Bat C, Magny Le Hongre, F-77703 MARNE LA VALLEE Cedex 4<br>**www.turckbanner.fr** |
| **Great Britain** | TURCK BANNER LIMITED<br>Blenheim House, Hurricane Way, GB-SS11 8YT Wickford, Essex<br>**www.turckbanner.co.uk** |
| **Hungary** | TURCK Hungary kft.<br>Árpád fejedelem útja 26-28., Óbuda Gate, 2. em., H-1023 Budapest<br>**www.turck.hu** |
| **India** | TURCK India Automation Pvt. Ltd.<br>401-403 Aurum Avenue, Survey. No 109 /4, Near Cummins Complex, Baner-Balewadi Link Rd., 411045 Pune - Maharashtra<br>**www.turck.co.in** |
| **Italy** | TURCK BANNER S.R.L.<br>Via San Domenico 5, IT-20008 Bareggio (MI)<br>**www.turckbanner.it** |

| | |
|---|---|
| **Japan** | TURCK Japan Corporation<br>ISM Akihabara 1F, 1-24-2, Taito, Taito-ku, 110-0016 Tokyo<br>**www.turck.jp** |
| **Korea** | Turck Korea Co, Ltd.<br>B-509 Gwangmyeong Technopark, 60 Haan-ro, Gwangmyeong-si,<br>14322 Gyeonggi-Do<br>**www.turck.kr** |
| **Malaysia** | Turck Banner Malaysia Sdn Bhd<br>Unit A-23A-08, Tower A, Pinnacle Petaling Jaya, Jalan Utara C,<br>46200 Petaling Jaya Selangor<br>**www.turckbanner.my** |
| **Mexico** | Turck Comercial, S. de RL de CV<br>Blvd. Campestre No. 100, Parque Industrial SERVER, C.P. 25350 Arteaga,<br>Coahuila<br>**www.turck.com.mx** |
| **Netherlands** | Turck B. V.<br>Ruiterlaan 7, NL-8019 BN Zwolle<br>**www.turck.nl** |
| **Poland** | TURCK sp.z.o.o.<br>Wroclawska 115, PL-45-836 Opole<br>**www.turck.pl** |
| **Romania** | Turck Automation Romania SRL<br>Str. Siriului nr. 6-8, Sector 1, RO-014354 Bucuresti<br>**www.turck.ro** |
| **Russian Federation** | TURCK RUS OOO<br>2-nd Pryadilnaya Street, 1, 105037 Moscow<br>**www.turck.ru** |
| **Sweden** | Turck Sweden Office<br>Fabriksstråket 9, 433 76 Jonsered<br>**www.turck.se** |
| **Singapore** | TURCK BANNER Singapore Pte. Ltd.<br>25 International Business Park, #04-75/77 (West Wing) German Centre,<br>609916 Singapore<br>**www.turckbanner.sg** |
| **South Africa** | Turck Banner (Pty) Ltd<br>Boeing Road East, Bedfordview, ZA-2007 Johannesburg<br>**www.turckbanner.co.za** |
| **Turkey** | Turck Otomasyon Ticaret Limited Sirketi<br>Inönü mah. Kayisdagi c., Yesil Konak Evleri No: 178, A Blok D:4,<br>34755 Kadiköy/ Istanbul<br>**www.turck.com.tr** |
| **USA** | Turck Inc.<br>3000 Campus Drive, USA-MN 55441 Minneapolis<br>**www.turck.us** |

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