

Your Global Automation Partner



TBIL-M1-16DXP

I/O Hub with IO-Link

Instructions for Use

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1 About These Instructions

These operating instructions 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

DANGER indicates a dangerous situation with high risk of death or severe injury if not avoided.



WARNING

WARNING indicates a dangerous situation with medium risk of death or severe injury if not avoided.



CAUTION

CAUTION indicates a dangerous situation of medium risk which may result in minor or moderate injury if not avoided.



NOTICE

NOTICE indicates a situation which may lead to property damage if not avoided.



NOTE

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

This symbol denotes actions that the user must carry out.



RESULTS OF ACTION

This symbol denotes relevant results of actions.

1.3 Additional documents

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

- Data sheet
- EU Declaration of Conformity
- Commissioning manual IO-Link devices

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-M1-16DXP

2.2 Scope of delivery

The scope of delivery includes:

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

2.3 Legal requirements

The device falls under the following EU directives:

- 2014/30/EU (electromagnetic compatibility)
- 2011/65/EU (RoHS Directive)

2.4 Manufacturer and service

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

Turck supports you with your projects, from initial analysis to the commissioning of your application. The Turck product database contains software tools for programming, configuration or commissioning, data sheets and CAD files in numerous export formats. You can access the product database at the following address: www.turck.de/products

For further inquiries in Germany contact the Sales and Service Team on:

- Sales: +49 208 4952-380
- Technology: +49 208 4952-390

Outside Germany, please contact your local Turck representative.

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

These devices are designed solely for use in industrial areas.

The block module TBIL-M1-16DXP is an IO-Link device 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 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 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 only meets the EMC requirements for industrial areas and is not suitable for use in residential areas.

4 Product Description

The I/O hub TBIL-M1-16DXP connects up to 16 digital sensors or actuators with one IO-Link master port.

Eight M12 connectors are available for connecting the field devices. Depending on the connected field device, each I/O channel of the TBIL-M1-16DXP 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. The devices are designed in a fully encapsulated housing with degree of protection IP65/IP67/IP69K.

4.1 Device overview

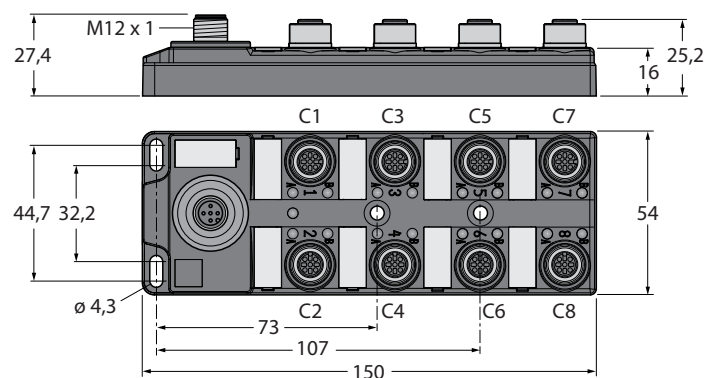


Fig. 1: Dimensions

4.1.1 Display elements

The device has the following LED indicators:

- IO-Link communication
- I/O status

4.2 Properties and features

- Fibre-glass reinforced housing
- Shock and vibration tested
- Fully potted module electronics
- Protection class IP65/IP67/IP69K
- 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-M1-16DXP connects up to 16 digital sensors or actuators with one IO-Link master port.

The device provides diagnostics for power supply and short circuit of the sensors and actuators on the IO-Link master.

5 Installing

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

- Fasten the module to the mounting surface with 4 M4 screws. The maximum tightening torque for the screws is 0.5 Nm

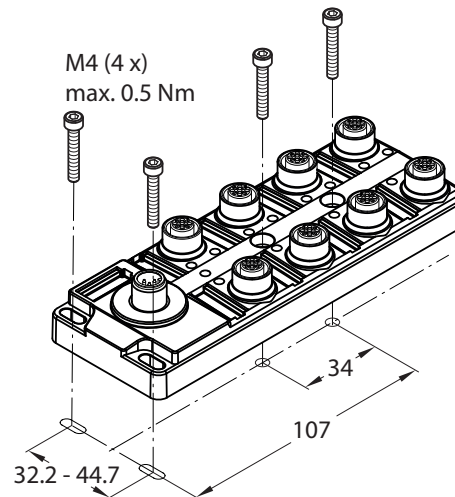


Fig. 2: Mounting the device to a mounting plate

6 Connecting

6.1 Connecting the supply voltage and IO-Link

The devices provide a 5-pin M12 connector for the connection to IO-Link.

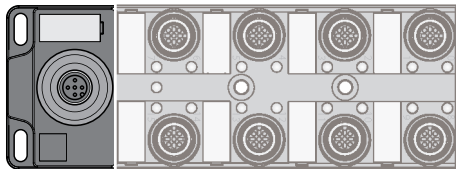


Fig. 3: M12 connector for the connection to IO-Link

- Connect the device to power supply IO-Link according to the pin assignment below.

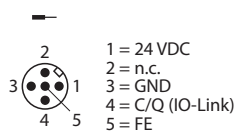


Fig. 4: Pin assignment IO-Link

6.2 Connecting digital sensors and actuators

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

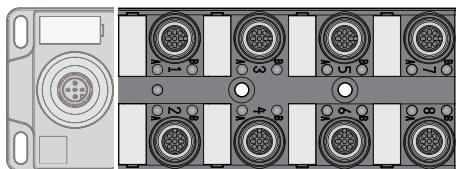


Fig. 5: M12 connector for connecting digital sensors and actuators (C1...C8)

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

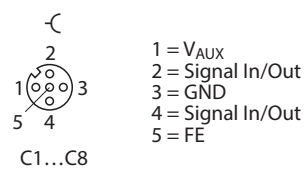


Fig. 6: Pin assignment TBIL-M1-16DXP (C1...C8)

Supply sensors and actuators externally

sensors and actuators which are supplied externally can also be connected to the TBIL I/O hubs. When sensors and actuators are supplied externally, 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 opto-couplers, relays or other measures.

7 Parameterizing and Configuring

7.1 Parameters

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

ISDU Index Hex. (dec.)	Sub index	Object name	Access	Length in byte	Meaning/default value
0x00 (0)		Direct Parameter Page 1	Read only	16	
	0x07	Vendor ID	Read only	2	ID for Turck: 0x013D
	0x08				
	0x09	Device ID	Read only	3	TBIL-M1-16DXP: 0x1E3303
	0x0A				
	0x0B				

IO-Link object directory – ISDU device parameters: Identification

ISDU Index Hex. (dec.)	Object name	Access	Length in byte	Meaning/default value	Comment
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-M1-16DXP	
0x13 (19)	Product ID	Read only	16	Ident-No. of the device 6814102	
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/write	8	Hardware version of the device, e.g. V1.0	
0x17 (23)	Firmware revision	Read only	16	Firmware version of the device, e.g.	
0x18 (24)	Application Specific Tag	Read/write	32	Default "****"	Customer-specific or application-specific data can be stored in this field.

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

ISDU Index Hex. (dec.)	Object name	Access	Length in byte	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
Diagnostics				
0x50 (80)	Supply error	Read only	2	<div> <div></div> Undervoltage/overvoltage supply <div></div> Overcurrent VAUX Connector C1...C8 </div>
0x51 (81)	Output short circuit	Read only	2	Overcurrent output C1...C8, A/B

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

The default values are written in **bold**.

Value	Meaning
0	No
1	Yes

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
C8P2 (B)	C8P4 (A)	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)

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

The default values are written 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
C8P2 (B)	C8P4 (A)	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)



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
C8P2 (B)	C8P4 (A)	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)



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

The default values are written 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
C8P2 (B)	C8P4 (A)	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)

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 Bytes	4 byte

2 bit per channel

The default values are written 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	16	24
Sub index															
13	14	15	16	9	10	11	12	5	6	7	8	1	2	3	4
C8P2 (B)	C8P4 (A)	C7P2 (B)	C7P4 (A)	C6P2 (B)	C6P4 (A)	C5P2 (B)	C5P4 (A)	C4P2 (B)	C4P4 (A)	C3P2 (B)	C3P4 (A)	C2P1 (A)	C2P4 (A)	C1P2 (B)	C1P4 (A)



NOTE

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

7.2 System commands

The device supports the following system commands (System Command).

General system commands (according to IO-Link specification)

Command	
128	Device reset, the device is restarted.
130	Reset to factory settings

Manufacturer specific system commands

Command	
Invert digital input	
170	All inputs not inverted
171	All inputs inverted
Pulse stretching input	
180	Deactivate pulse stretching for all channels (standard pulse = 2.5 ms)

Command	
Activate output	
190	Configure all channels as input
191	Configure all channels as output
Manual output reset after overcurrent	
200	Automatic output recovery after overcurrent for all channels
201	Manual output reset after overcurrent for all channels
Output After Error	
210	All outputs set LOW after error
211	All outputs set HIGH after error
212	All outputs hold their current value after error

8 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.

8.1 Process input data

Byte no.	Bit offset							
	7	6	5	4	3	2	1	0
Inputs								
0	DI8 C4P2 (B)	DI7 C4P4 (A)	DI6 C3P2 (B)	DI5 C3P4 (A)	DI4 C2P2 (B)	DI3 C2P4 (A)	DI2 C1P2 (B)	DI1 C1P4 (A)
1	DI16 C8P2 (B)	DI15 C8P4 (A)	DI14 C7P2 (B)	DI13 C7P4 (A)	DI12 C6P2 (B)	DI11 C6P4 (A)	DI10 C5P2 (B)	DI9 C5P4 (A)
Designation Meaning								
Inputs								
CxPy		0	Input inactive					
		1	Input active					



NOTE

The diagnostics can also be retrieved via IO-Link indices.

8.2 Process output data

Byte no.	Bit offset							
	7	6	5	4	3	2	1	0
Outputs								
0	DO8 C4P2 (B)	DO7 C4P4 (A)	DO6 C3P2 (B)	DO5 C3P4 (A)	DO4 C2P2 (B)	DO3 C2P4 (A)	DO2 C1P2 (B)	DO1 C1P4 (A)
1	DO16 C8P2 (B)	DO15 C8P4 (A)	DO14 C7P2 (B)	DO13 C7P4 (A)	DO12 C6P2 (B)	DO11 C6P4 (A)	DO10 C5P2 (B)	DO9 C5P4 (A)
Designation Meaning								
CxPy		0	Output inactive					
		1	Output active					

8.3 LED displays

The device has the following LED indicators:

- IO-Link communication
- I/O status

8.3.1 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

8.3.2 Channel LEDs

LED C1 A/B...C8 A/B	Meaning (input)	Meaning (output)
Green	Input active	Output active
Red flashing (0.5 Hz)	Overload of the connector supply Both connector LEDs are flashing.	
Red	–	Output active, overload/overcurrent at output
Off	Input inactive	Output inactive

8.4 Evaluating diagnostic data

Group diagnostics: Undervoltage power supply 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 supply (per module)
- Overvoltage supply (per module)
- Overcurrent sensor supply (per connector)

0 = no diagnostics

1 = diagnostic message pending

Byte 0							
Bit offset							
15	14	13	12	11	10	9	8
Sub index							
-	-	-	-	-	1	-	2
Group diagnostics	-	-	-		Undervoltage supply	-	Overvoltage supply

Byte 1							
Bit offset							
7	6	5	4	3	2	1	0
Sub index							
3	4	5	6	7	8	9	10
Over-current VAUX C8	Over-current VAUX C7	Over-current VAUX C6	Over-current VAUX C5	Over-current VAUX C4	Over-current VAUX C3	Over-current VAUX C2	Over-current VAUX C1

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

The diagnosis indicates an overcurrent at the corresponding digital output.

0 = no diagnostics

1 = overcurrent at the output

Bit offset															
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Sub index															
16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
C5P4 (A)	C5P2 (B)	C6P4 (A)	C6P2 (B)	C1P4 (A)	C7P2 (B)	C8P4 (A)	C8P2 (B)	C1P4 (A)	C1P2 (B)	C2P4 (A)	C2P2 (B)	C3P4 (A)	C3P2 (B)	C4P4 (A)	C4P2 (B)

8.5 IO-Link events

Event Code	Description	Event Mode	
0x5000	Hardware error	0xF4 (appears) 0xB4 (disappears)	
0x5110	Overvoltage	0xF4 (appears) 0xB4 (disappears)	Overvoltage at supply
0x5111	Undervoltage	0xF4 (appears) 0xB4 (disappears)	Undervoltage at supply
0x7710	Overcurrent VAUX connector x or overcurrent output x	0xF4 (appears) 0xB4 (disappears)	Group event for overcurrent: Overcurrent of the sensor supply at one of the connectors (C1...C8) or overcurrent at one of the outputs (DO1...DO16) The mapped diagnostics in the process image of the inputs show which slot or output detects an overcurrent.

8.6 IO-Link error codes

Error code	Description	
0x8011	Index not available	
0x8012	Sub index not available	
0x8023	Access 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	

9 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.

10 Maintenance

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

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

11 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.

11.1 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.

12 Disposal



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

13 Technical Data

Technical Data	
Power supply	
Operating/load voltage	24 VDC
Permissible range	20.4...30 VDC
Total current	Max. 4 A per module
Sensor/actuator supply VAUX	Connector C1...C8 from power supply, short-circuit proof, max. 120 mA per connector, with diagnostics
Power loss, typical	≤ 3.5 W
Inputs	
Number of channels	16 digital pnp inputs (EN 61131-2)
Type of input diagnostics	Group 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 delay	0.010 ms
Max. input current	15 mA
Potential isolation	Inputs to FE, 500 VDC
Outputs	
Number of channels	16 digital pnp outputs
Type of output diagnostics	Group diagnostics
Output voltage	24 VDC from supply voltage
Output current per channel	0.5 A, short-circuit-proof
Output delay	0.15 ms
Load type	Ohmic, inductive lamp load
Potential isolation	Outputs to FE, 500 VDC
IO-Link	
IO-Link specification	Specified according to version 1.1
Parameterization	FDT/DTM, IODD
Transmission rate	COM 2: 38.4 kbit/s
Transmission physics	3-wire physics (PHY2)
Minimum cycle time	3.2 ms
Connectors	
IO-Link	M12 × 1, 5-pole
Input/output	M12 × 1, 5-pole
Permissible torques	
■ IO-Link	0.8 Nm
■ I/O channels	0.8 Nm
■ Mounting (M4 screws)	0.5 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
Electro-magnetic compatibility	According to EN 61131-2/-6-4

Technical Data

Approvals	CE, cULus
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General Information

Dimensions (B × L × H)	54 × 150 × 27.4 mm
------------------------	--------------------

Operating temperature	-40...+70 °C (for total current up to 4 A)
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Storage temperature	-40...+85 °C
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Protection class	IP65 IP67 IP69K
------------------	-----------------------

MTTF	96 years
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Housing material	PA6-GF30
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Housing color	Black
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Halogen-free	Yes
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Mounting	4 mounting holes, Ø 4.3 mm
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Approvals	CE
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14 Appendix: EU Declaration of Conformity

EU-Konformitätserklärung Nr.: 5035-4M
 EU Declaration of Conformity No.:

TURCK

Wir/ We: **HANS TURCK GMBH & CO KG**
WITZLEBENSTR. 7, 45472 MÜLHEIM A.D. RUHR

erklären in alleiniger Verantwortung, dass die Produkte
 declare under our sole responsibility that the products

Kompakte I/O Module in IP20/IP67: FDN20-*, FNDL-*, FDNP-*, FDP20-*, FGDP,
 Compact I/O modules in FGEN-*, FLDP-*, FLIB-*, FXEN-*, TBDP-*,
 IP20/IP67: TBEN-*, TBIL-*, TBEC-*, FEN20-*

auf die sich die Erklärung bezieht, den Anforderungen der folgenden EU-Richtlinien durch Einhaltung der
 folgenden Normen genügen:
 to which this declaration relates are in conformity with the requirements of the following EU-directives by compliance with the following
 standards:

EMV - Richtlinie /EMC Directive EN 61131-2:2007 (Abschnitte / section 8, 9, 10)	2014 / 30 / EU	26.02.2014
RoHS – Richtlinie /RoHS Directive EN IEC 63000:2018	2011 / 65 / EU	08.06.2011

Weitere Normen, Bemerkungen:
 additional standards, remarks:

Zusätzliche Informationen:
 Supplementary information:

Mülheim a. d. Ruhr, den 29.09.2020

Ort und Datum der Ausstellung /
 Place and date of issue



i.V. Dr. M. Linde, Leiter Zulassungen /Manager Approvals
 Name, Funktion und Unterschrift des Befugten /
 Name, function and signature of authorized person

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