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TURCK

Inductive Sensors uprox with IO-Link Interface

Instructions for Use

Contents

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 Other documents

Besides this document the following material can be found on the Internet at www.turck.com:

- Data sheet of the respective device
- IODD file
- IO-Link parameters manual

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

B I 10 U – M18 – IOL 6 X2 – H1 1 4 1

B I 10 U Functional Principle – **M18 .** Design – **IOL 6 X2** Electrical Version –

Special functions
U uprox or uprox+ or uprox3 Faktor 1 sensors

[mm]
… Switching distance

Functional principle
I Inductive

Installation
B Flush
N Non-flush

additional information housing
WD for Wash-Down-Applications

Housing
CK40 Rectangular, variable orientation of active face in 5 directions
EM Threaded barrel, stainless steel, Ø in [mm]
M Threaded barrel, brass, Ø in [mm]
MT Threaded barrel, brass, PTFE coated, Ø in [mm]
QV40 Rectangular, variable orientation of active face in 5 directions

Indication
X2 Multicolor LED

Voltage range
6 10…30 VDC

Technology
IOL IO-Link

H1 1 4 1 Electrical Connection: Connector

Assignment
1 Standard assignment

Number of contacts
4 Number of contacts

Connector type
1 Straight

Connector type
H1 M12 × 1 connector

2.2 Scope of delivery

The scope of delivery includes:

- Sensor
- 2 fixing nuts (with threaded barrel devices)
- 2 lock washers (with M12 and BI…U-MT… design)
- Mounting bracket BS4-CK40 (with NI…U-CK40…)
- Mounting block and mounting bracket (with NI…U-QV40…)
- Quick Start Guide

2.3 Legal requirements

The device is subject to the following EC directives:

- 2014/35/EU (low voltage)
- 2014/30/EU (electromagnetic compatibility)

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 inductive sensors of the uprox series enable the contactless and wear-free detection of metallic objects. The factor 1 sensors have no reduction factor; the switching distance is the same for all metals. The sensors are not susceptible to interference from strong magnetic fields.

The devices can be operated and set with IO-Link masters compliant with specification 1.1 via an IO-Link interface. Process and diagnostics data can be exchanged during operation via IO-Link with the higher controller level.

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 Obvious misuse

- The devices are not safety components and must not be used for personal or property protection.
- The listed measuring ranges relate to a standard target in accordance with EN 60947-5-2:2012. Using other targets (in particular small targets) can result in different switching behavior.

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 only meets the EMC requirements for industrial areas and is not suitable for use in residential areas.

4 Product Description

The cylindrical devices are provided with a metal housing with an M12, M18 or M30 male thread with an LCP front cap. Variants with a PTFE-coated housing and PTFE-coated front cap are also available. The active face can be installed flush with the surrounding area.

The rectangular devices are provided with a plastic housing. The active face of the NI…U-QV40 and NI…U-CK40 devices can be set in five positions. The active face can be installed flush, partially flush or non-flush with the surrounding mounting area (see [▸ 17]).

All devices are provided with a metal-bodied M12 connector (plug) for connecting the sensor cable. The devices can be set and operated via an IO-Link interface. The devices are provided with two outputs that can be set independently of each other. Output 1 can be operated either as a switching output or in IO-Link mode, output 2 is designed as a switching output. The switching distance and other functions can be set for both outputs (see [▸ 10]).

4.1 Device overview

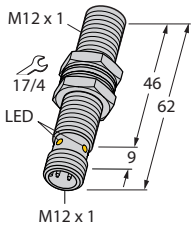


Fig. 1: Dimensions – M12... design

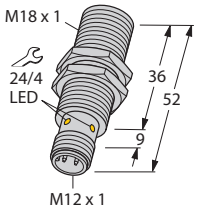


Fig. 2: Dimensions – M18... design

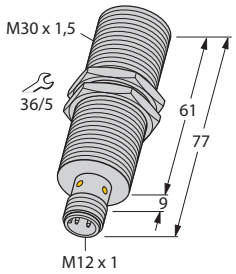


Fig. 3: Dimensions – M30... design

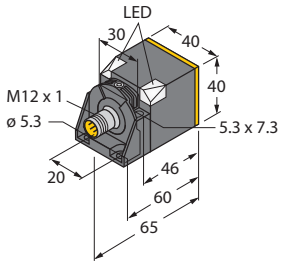


Fig. 4: Dimensions – CK40 design

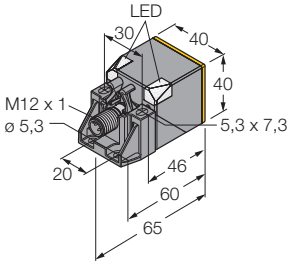


Fig. 5: Dimensions – QV40 design

4.1.1 Display elements

The cylindrical devices have one green and one yellow status LED. The rectangular devices each have two green and two yellow status corner LEDs.

4.2 Properties and features

- Cylindrical and rectangular designs
- Factor 1 for all metals
- Protection type IP68, ...WD... designs additionally IP69K
- Resistant to magnetic fields
- Large switching distance
- DC 4-wire, 15…30 VDC
- Male connector, M12 x 1
- Communication via IO-Link V1.1 or via standard I/O
- Switching distance and hysteresis can be set
- Identification via 32 byte memory
- Temperature monitoring with settable limits
- Various timer and diagnostic functions
- Counter for operating hours and switching cycles

4.2.1 Properties and features – Rectangular designs

- Corner LEDs
- Predamping protection based on self-compensation
- Partially embedded mounting
- Active face adjustable in five positions

4.3 Operating principle

Inductive sensors detect metal objects contactless and wear-free by creating an electromagnetic field that interacts with the detected object.

The sensors of the uprox series have no reduction factor; the switching distance is the same for all metals.

4.4 Functions and operating modes

The devices can be operated in IO-Link mode, in SIO mode or in analog mode. The devices must be connected to an IO-Link master for operation in IO-Link mode.

IO-Link mode provides bidirectional IO-Link communication between an IO-Link master and the sensors. For this the devices are integrated in the controller level via an IO-Link master. Measured values, switching information and diagnostics data are made available with the process data via the IO-Link interface. Identification messages and extended diagnostics information can be queried acyclically via IO-Link. Different sensor functions can be configured via the IO-Link interface.

4.4.1 Sensor functions

“One switch point”

The output configuration and the switching behavior can be set for one switch point. Switching distance (in 20 % increments) and hysteresis are adjustable. With the “One switch point” function, output 2 can be used as a temperature indicator.

“Two switch points”

Switching output 1 and switching output 2 can be used and set to separate switching distances in 20 % increments. A variable hysteresis cannot be set for the “Two switch points” function.

"Low resolution analog mode"

NOTE
The low resolution analog mode can only be used in operation on an IO-Link master.

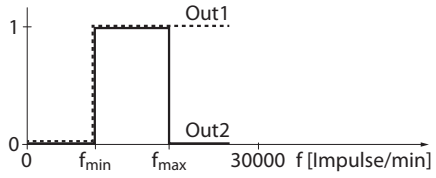
In low resolution analog mode the switch states are sampled sequentially in 20 % increments. This provides distance information which is output via Bit 2…Bit 4 of the process data in binary format.

Switching state indication (binary coded)	Not actuated	S_n 20 %	40 %	60 %	80 %	100 %
1st bit (Bit 4)	0	1	1	0	0	0
2nd bit (Bit 3)	0	0	0	1	1	0
3rd bit (Bit 2)	0	1	0	1	0	1

NOTE
Output 1 and 2 can be configured as required. Output 2 can be used as a temperature indicator or as an inspection alarm. The maximum switching frequency is reduced to 7 Hz in low resolution analog mode.

"Rotational speed monitor"

The "Rotational speed monitor" function enables the device to detect frequency values below and above a specified frequency window. Upper and lower limit values of the frequency window can be set between 0 and 30000 pulses per minute. The switching behavior of the outputs is described in the following figure:



Output	$f < f_{min}$	$f_{min} < f < f_{max}$	$f > f_{max}$
Output 1	0	1	1
Output 2	0	1	0

The actual speed can be queried via the acyclic IO-Link parameter data. The tolerance is 3 %. The switching distance is permanently set to S_n = 60 % in the "Rotational speed monitor" function. The output configuration can be selected as required.

"Pulse divider"

The "Pulse divider" function causes the device to output a signal pulse to the control level after a specified number of actuation pulses. The number of actuation pulses (dividers) can be set between 1 and 128.

The following values can be set for the minimum duration of the signal pulse:

- Target object (0 ms)
- 1 ms
- 10 ms
- 100 ms

NOTE
In the event of a voltage drop the number of actuation pulses is reset.

The output configuration can be selected as required.

4.4.2 Settable properties: Output configuration – Switching output

Output configuration – Output 1

The following output configurations can be set for output 1:

- PNP, NO contact (NO)
- PNP, NC contact (NC)
- NPN, NO contact (NO)
- NPN, NC contact (NC)
- Push-pull, non-inverted (NO)
- Push-pull, inverted (NC)

Output configuration – Output 2

- PNP, NO contact (NO)
- PNP, NC contact (NC)
- NPN, NO contact (NO)
- NPN, NC contact (NC)
- Push-pull, non-inverted (NO)
- Push-pull, inverted (NC)
- Temperature indicator (not available in SIO mode and for the "Two switch points" function)

Switching distance

NOTE
The feature is only available for "One switch point" and "Two switch points" functions as well as in low resolution analog mode.

The switching distance can be set for both outputs to 20 %, 40 %, 60 %, 80 % and 100 % of the maximum rated switching distance. Different switching distances can be set independently of each other for output 1 and output 2. The switching distance of output 1 must be greater than the switching distance of output 2; otherwise the switching distance for switching output 1 is set automatically to 20 % greater than the switching distance for switching output 2. If the device automatically changes the switching distance for switching output 1, this is indicated by a request for a new data update.

Switching hysteresis

NOTE
The switching hysteresis setting is only available for the “One switch point” function.

The switching distance hysteresis can be set to the 2 stages **standard** and **small**.

NOTICE
Small hysteresis selected
Uncontrolled changing between the switching states
- ▶ Set the switching distance and target in the application so that a setting to **small** hysteresis is possible.

Switch-on delay

NOTE
The switch-on delay can only be set for the “One switch point” function.

If the switch-on delay T_{on} is activated, the switch signal pulse is generated after the actual sensor actuation. The switch-on delay can be set between 0…60000 ms.

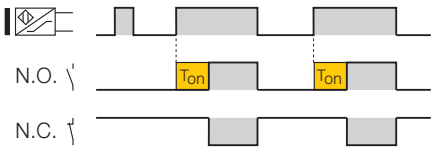


Fig. 6: Switch-on delay

The set output configuration is not changed. Switch pulses that are shorter than the set switch-on delay are not transferred to the controller.

Switch-off delay

NOTE
The switch-off delay can only be set for the “One switch point” function.

If the switch-off delay T_{off} is activated, the generation of the switch signal pulse is delayed by the set time after sensor actuation.

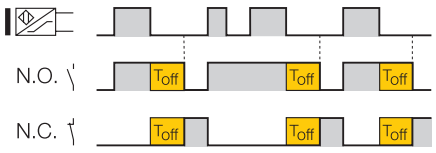


Fig. 7: Switch-off delay

The set output configuration is not changed. Interruptions in switch pulses that are shorter than the set switch-off delay are ignored at the output and are transferred with a switch signal to the controller.

Temperature indicator

NOTE
The temperature indicator does not provide a precise value and does not show the exact ambient temperature.

The device is provided with an integrated temperature indicator. The actual internal sensor temperature can be read via the acyclic IO-Link parameter data. The application specific limit values **Alarm undertemperature** and **Alarm overtemperature** can be set within the permissible temperature range. Values below and above the limit values are transferred to the controller via bit 1 and bit 2 of the process data. The acyclic parameter data enables the set limits to be read out.

The temperature unit can be set to °C, °F or °K. A temperature alarm can be set at output 2 for all functions apart from the "Two switch points" function in SIO mode. The device switches when the actual value is above or below the set limits.

Counter for operating hours and switching cycles

The device is provided with an integrated counter for operating hours and switching cycles. The actual, total operating hours or the switching cycles can be read via the acyclic IO-Link parameter data. Limit values for operating hours and switching cycles can be defined in the IO-Link parameters. Values above the limit values are transferred to the controller via bit 7 of the process data. The set limits can be read acyclically via the acyclic parameter data. An inspection alarm can be set at output 2 for all functions apart from the "Two switch points" function in SIO mode. The device switches when the actual value is above the set limits.

Application specific marking

The device is provided with a 32 byte memory for application specific marking. The first byte of the memory is transferred to the controller level via bits 8…bit 15 of the cyclic process data; up to 256 devices can be identified via the process data. The acyclic parameter data enables the memory to be completely read out.

Alternating oscillator frequency

NOTE
The "Alternating oscillator frequency" feature is only available for devices suitable for non-flush mounting.

An alternating oscillator frequency reduces the lateral installation constraints between two adjacently mounted devices. The alternating oscillator frequency is denoted as "F2" in the IODD.

LED mode

The LED settings can be adjusted as follows:

- Only operating voltage indication: U_B (green), output (yellow)
- Only switching state: Output (yellow)
- Off

LED temperature indication

The green LED can indicate values above or below the set temperature limits with a 1 Hz flash signal. Both LEDs on the rectangular devices flash green.

Start delay

NOTE
The “Start delay” function can only be set for the “Rotational speed monitor” function.

If the start delay is active, the switch signals are passed on to the controller once with a time delay after each interruption of the power supply. The start delay can be set between 0…60000 ms. Output 1 and output 2 are switched during the set start delay, bit 5 of the process data is set here to 1. The start delay bridges the start time of drives in order to prevent the output of unwanted fault messages of the higher-level controller due to low speeds.

4.4.3 SIO mode (standard I/O mode)

In standard I/O mode, devices can be operated via a fieldbus device or a controller with digital PNP or NPN inputs. An IO-Link master is not required.

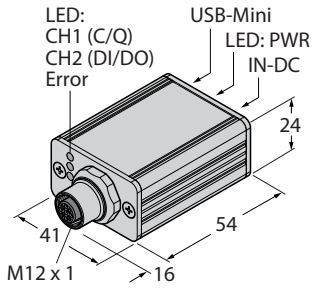
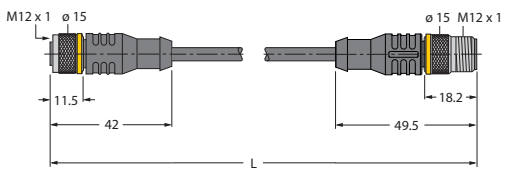
In SIO mode, the device has two switching outputs. The following IO-Link communication cannot be used:

- Binary coded analog values
- Application specific marking
- Reading of IO-Link parameter data

All other sensor functions and settable features can be used in SIO mode. The set functions can be evaluated via the switch signals of the particular output.

Parameter changes made via IO-Link are also retained in the device after saving and after the power supply is interrupted. Devices can be set via IO-Link and then operated at the digital inputs with the appropriate settings in SIO mode.

4.5 Technical accessories

Dimension drawing	Type	Description
	USB-2-IOL-0002	IO-Link adapter with integrated USB interface
	RKC4.4T-TXL1001	Connection cable, M12 female connector, straight, 4-pin, cable length: 2 m, sheathing material: PVC, black; cULus approval; other cable lengths and types available, see www.turck.com

5 Mounting

5.1 Mounting cylindrical devices

The sensors can be mounted in any position.

The following table shows the maximum tightening torque for fastening the sensor:

Design	Max. tightening torque
BI4U-EM12WD-…	10 Nm
BI6U-M12…	10 Nm
BI6U-MT12	7 Nm
BI8U-EM18WD-…	25 Nm
BI10U-MT18…	10 Nm
BI10U-M18…	25 Nm
BI20U-M30…/BI20U-MT30…	50 Nm
BI15U-EM30WD-…	75 Nm

- ▶ Clean the mounting surface and the surrounding area.
- ▶ Install the sensor in a fixture (mounting bracket or fixing clamp) if necessary.
- ▶ Install the sensor or the mounting fixture at the intended location. Observe the minimum mounting distances.

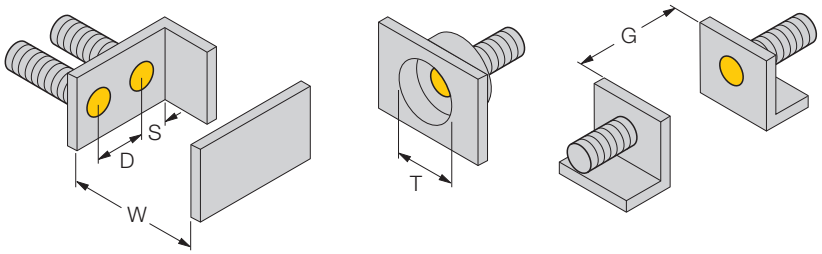


Fig. 8: Minimum mounting distances – Cylinder designs, flush mounting possible

Distance	BI6U-M12-…/ BI6U-MT12-…/ BI4U-EM12WD-…	BI10U-M18-…/ BI6U-MT18-…/ BI8U-EM18WD-…	BI20U-M30-…/ BI20U-MT30-…/ BI15U-EM30WD-…
T	3 × W	3 × W	3 × W
G	6 × S_n	6 × S_n	6 × S_n
W	3 × S_n	3 × S_n	3 × S_n
D	24 mm	36 mm	60 mm
S	1.5 × W	1.5 × W	1.5 × W

5.1.1 Mounting cylindrical devices with a half-shell clamp

NOTICE
Mounting with a half-shell clamp
Device damage due to faulty mounting

- ▶ Align the uprox marking on the front cap of the sensor horizontally in relation to the half-shell clamp.
- ▶ Observe maximum tightening torque of the half-shell clamp (see data sheet).

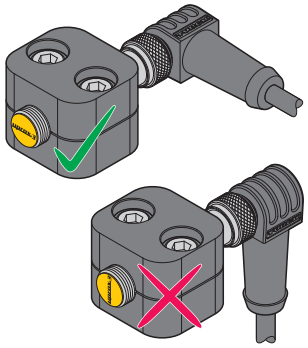
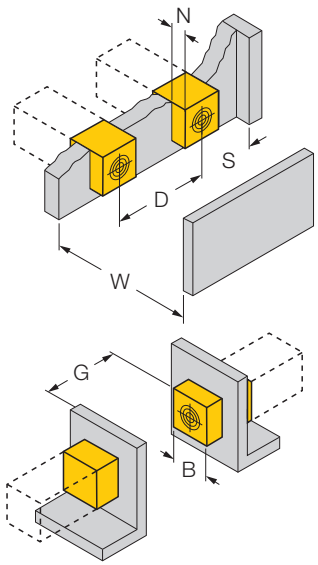


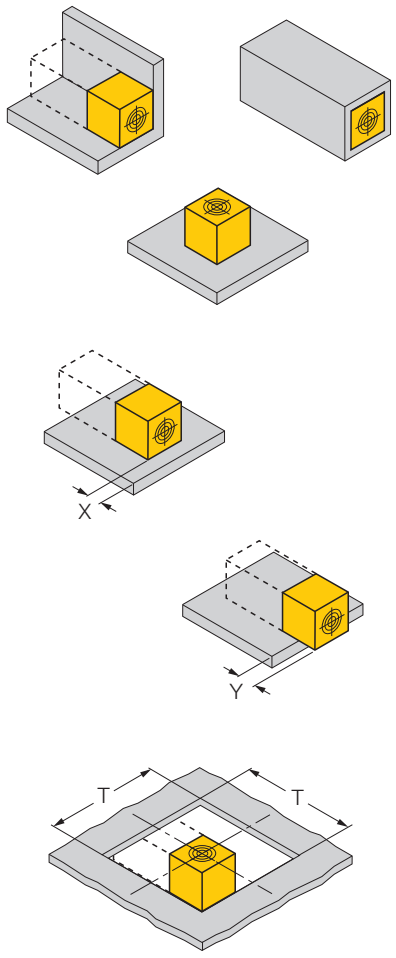
Fig. 9: Aligning the sensor in the mounting bracket

5.2 Mounting rectangular devices

The sensors can be mounted in any position. A 4-side flush mounting is possible. The switching distance is reduced if the device is mounted from the rear or with a protrusion.

- ▶ Clean the mounting surface and the surrounding area.
- ▶ Install the sensor in a fixture (mounting bracket or fixing clamp) if necessary.
- ▶ Install the sensor or the mounting fixture at the intended location. Observe the minimum mounting distances and mounting conditions.

Minimum mounting distances	Distance	NI50U-… in rectangular design
	D	240 mm
	W	105 mm
	S	60 mm
	G	300 mm
	N	30 mm
	B	40 mm



Mounting condition	Distance		Sr
1-side flush	D	240 mm	35 mm
2-side flush	D	240 mm	35 mm
3-side flush	D	80 mm	20 mm
4-side flush	D	60 mm	17 mm
Recessed mounting on metal	X	10 mm	20 mm
	X	20 mm	20 mm
	X	30 mm	20 mm
	X	40 mm	20 mm
Protruded on metal	Y	10 mm	40 mm
	Y	20 mm	50 mm
	Y	30 mm	50 mm
	Y	40 mm	50 mm
Mounting in aperture plate	T	150 mm	
Installation with twisted mounting position, on metal			50 mm
Installation with twisted mounting position, on metal, one side wall			25 mm
Installation with twisted mounting position, on metal, 2 side walls			15 mm
Installation with twisted mounting position, on metal, 3 side walls			

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5.2.1 Positioning the active face (NI50U-QV40…)

The active face can be set in five different directions:

- active face front (as supplied)
- active face left
- active face right
- active face up
- active face down

▶ Gently press together the fixing clamp on the mounting bracket to release the device from the mounting bracket.

▶ Twist the active face to the side.

▶ Insert the device into the mounting bracket until the fixing clamp snaps into position.

▶ Optional: twist the active face left, right, up or down.

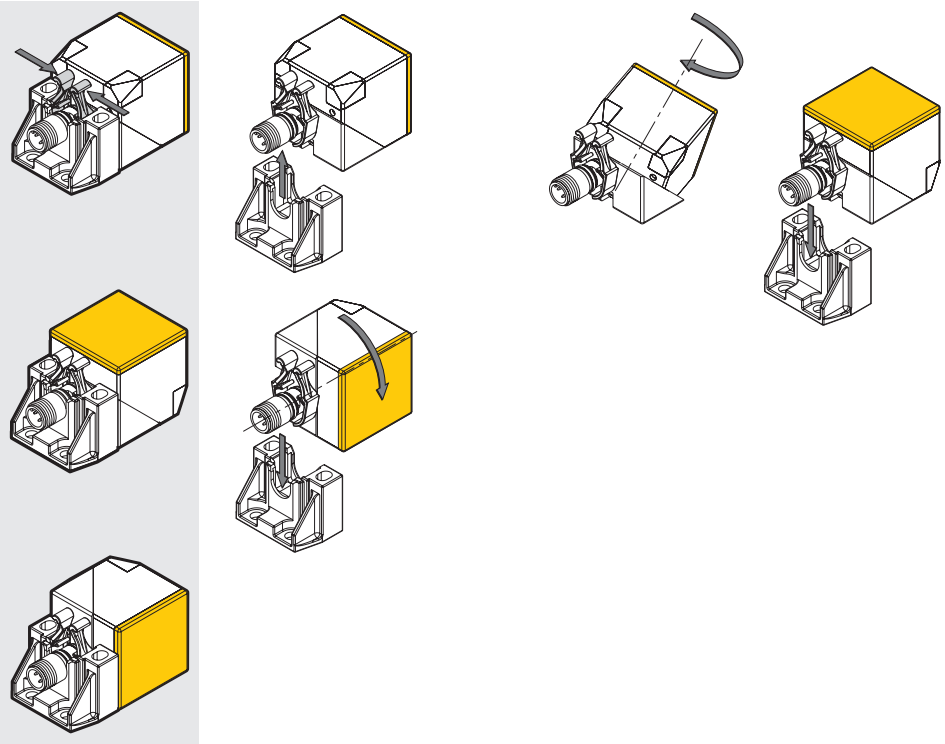

Fig. 10: Positioning the active face

5.2.2 Positioning the active face (NI50U-CK40…)

The active face can be set in five different directions:

- active face front (as supplied)
- active face left
- active face right
- active face up
- active face down

▶ Undo the locking screw.
▶ Pull the sensor from the mounting bracket.
▶ Undo the screws on the sensor.
▶ Remove the adapter bracket and rotate 180°.
▶ Re-tighten the screws on the sensor and align the male connector if necessary.
▶ Fit the sensor and the mounting bracket and tighten the locking screw.

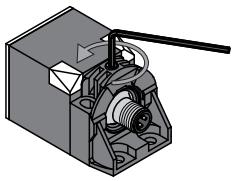

Fig. 11: Undo the locking screw

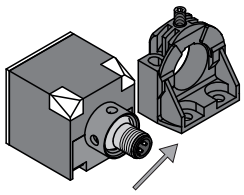

Fig. 12: Pull the sensor out of the mounting bracket

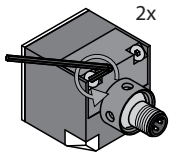

Fig. 13: Undo the screws on the sensor

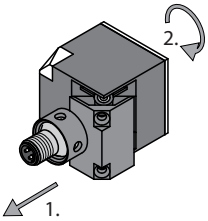

Fig. 14: Remove the adapter bracket and rotate 180°

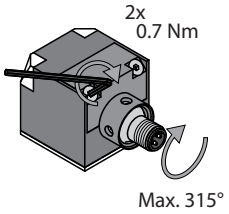

Fig. 15: Tighten the screws on the sensor and align the male connector

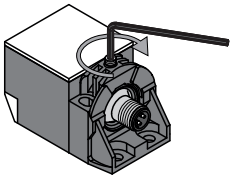

Fig. 16: Fit the sensor and the mounting bracket and tighten the locking screw

6 Connection

- Connect the open end of the connection cable as shown in the wiring diagram and the terminal layout of the particular connected device to the IO-Link master, fieldbus device or controller with the corresponding inputs.
- Connect the female connector of the connection cable to the male connector at the rear of the sensor.

6.1 Wiring diagram

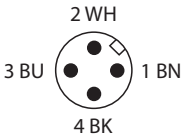

Fig. 17: Pin assignment

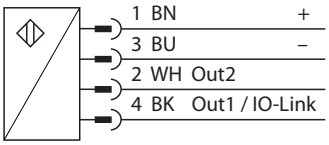

Fig. 18: Wiring diagram

7 Commissioning

The device is operational automatically 8 ms after the cables are connected and the power supply is switched on. If the device is connected to an IO-Link master, IO-Link communication starts automatically. For this the IO-Link master sends a wakeup request to the device.

7.1 Initiating IO-Link mode

- ▶ Set a cycle time of at least 8 ms on the IO-Link master.
- ⇨ The device is operational.

7.2 Initiating SIO mode

- ▶ Connect the device to a standard I/O port or an analog port.
- ⇨ The device is operational after a delay of 500 ms.

The delay is necessary in SIO mode for the operation of preactuated sensors so that the sensor can exclude being connected to an IO-Link master. The operation delay has no effect on any potential IO-Link communication.

8 Operation

8.1 LED display

The devices are provided with a green and a yellow status LED.

NOTE
The switching state of the device is only indicated via the LEDs in SIO mode.
In IO-Link mode the green LED flashes (1 s on, 0.1 s).

LED indication	Meaning
Green flashing (1 s on, 0.1 s off)	IO-Link communication
Green	Device is operational
Yellow	Switching output 1 actuated
Yellow flashing (approx. 1 Hz)	Switching output 2 actuated
Yellow flashing (approx. 4 Hz)	Temperature indicator
Green/yellow flashing	Fault in SIO mode

8.2 Operating devices in IO-Link mode

A range of sensor functions and adjustable properties are available in IO-Link mode. All parameters can be changed by the control system via bidirectional IO-Link communication, both during commissioning and during operation.

NOTE
Any changes to the output configuration are only updated after a power reset or after a switch to SIO mode.

8.3 Operating devices in SIO mode

In SIO mode the device operates according to the last setting made in IO-Link mode. Not all sensor functions and settable features of the device are available for use in SIO mode. The following functions can be set as standard:

- "One switch point" sensor function
- Output 1: PNP (NO contact), output 2: PNP (NC contact)
- Switching distance: 100 %
- Both LEDs on

9 Setting

The device has two outputs which can be set independently of each other. Output 1 can be operated either as a switching output or as an interface for IO-Link communication, output 2 is designed as an analog output.

9.1 Setting via IO-Link

The devices can be parameterized via the IO-Link communication interface within the limits of their technical specifications (see data sheet). For further information on IO-Link see the IO-Link commissioning manual (D900633).

9.1.1 IO-Link parameters

Different parameter settings for the particular application are made via the IO-Link interface. For further information on the functions and IO-Link parameters see [▶ 12]: [▶ 12] and in the IO-Link parameter manual of the device.

9.1.2 Parameter transfer using an IO-Link Call module

Since such a wide range of functions are performed by the devices, the parameter subindices described in the IO-Link parameters manual cannot be addressed when transferring parameters using an IO-Link Call module that corresponds to the IO-Link specification. In order to transfer values, the complete data string of the parameter index must be transferred from the control system to the device in binary. The subindex that refers to the entire string must be set to "0" in the IO-Link Call module. It is not possible to separate the subindices.

9.1.3 Process data

Bit	Function	Meaning/bit information
0	Output 1	0: Output 1 not actuated 1: Output 1 switches (depending on the sensor function and the output configuration).
1	Output 2	0: Output 2 not actuated 1: Output 2 switches (depending on the sensor function and the output configuration). 1: Output 2 is not set as a temperature indicator (“One switch point” sensor function)
2	Switch point 2^0	3-bit coding for the set switching distance (3rd bit)
3	Switch point 2^1	3-bit coding for the set switching distance (2nd bit)
4	Switch point 2^2	3-bit coding for the set switching distance (1st bit)
5	Start delay	1: Start delay switched on and activated after a voltage reset (for “Rotational speed monitor” sensor function)
6	Temperature alarm	1: The temperature indicator detects a value above or below the set temperature limits.
7	Inspection alarm	1: The operating hours counter or the switching cycles counter of the sensor is above the set value.
8…15	Application specific marking	A 32 byte memory is provided for application specific marking. The first byte of the memory is transferred cyclically to the controller.

If the sensor is actuated, bits 0…4 show the switching state according to the actual settings.

Example: “One switch point” sensor function, 100% switching distance, output 2 not set as a temperature indicator.

Bit	State	Meaning
0	1	Output 1 switches.
1	1	Output 2 is not set as a temperature indicator.
2	1	3-bit coding for the set switching distance (100%), see [▷ 10]
3	0	
4	0	

9.2 Setting in SIO mode

Various sensor functions and settable features (see [▷ 10]) can be used in SIO mode. The set functions can be evaluated via the switch signals or analog values of the particular output.

9.2.1 Configuring the device prior to initial commissioning

- ▶ Configure the sensor functions and properties via an IO-Link master or an IO-Link USB adaptor using a configuration tool.
- ⇨ The selected settings are saved and will be operational following the installation of the device in the plant.

9.2.2 Configuring the device following initial commissioning

- ▶ Disconnect the device from the control system.
- ▶ Configure the sensor functions and properties via an IO-Link master or an IO-Link USB adaptor using a configuration tool.
- ⇨ The selected settings are saved and will be operational following reinstallation in the plant.

10 Troubleshooting

- If possible, deploy the device in another location in the application.

If the malfunction persists, this indicates that there is a sensor error.

- Take the device out of operation and replace the malfunctioning device with another device of the same type.

If the device functions correctly elsewhere in the application, this indicates that there is an application-related error.

- Check the area around the device for metallic foreign bodies in the metal-free zones.
- Check the area around the device for sources of EMC interference.

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 Decommissioning

- Disconnect the connection cable from the power supply and/or processing units.
- Disconnect the connection cable from the device.
- Undo the connections of the device or if necessary the mounting aid for the mounting area.
- If present: Undo the connection between the device and the mounting aid.

14 Disposal

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

15 Technical Data

15.1 Technical data – Bi…U-M…

Type	BI6U-M12-…	BI10U-M18-…	Bi20U-M30…
Rated operating distance S_n	6 mm	10 mm	20 mm
Mounting condition		Flush	
Assured switching distance		≤ (0.81 × S_n) mm	
Repetition accuracy		≤ 2 % of full scale	
Temperature drift		≤ ± 10 %	
Hysteresis		3…15 %	
Ambient temperature		-25…+70 °C	
Operating voltage		15…30 VDC	
Ripple		≤10 % U_{ss}	
DC rated operational current		≤ 150 mA	
No-load current		≤ 20 mA	
Residual current		≤ 0.1 mA	
Insulation test voltage		≤ 0.5 kV	
Short-circuit protection		Yes/cyclic	
Voltage drop at I_e		≤ 1.8 V	
Wire breakage / reverse polarity protection		Yes/completely	
Output function		4-wire, NO contact/N/O contact, PNP/NPN/Push-pull/IO-Link	
Output 1		Switching output or IO-Link mode	
Output 2		Switching output	
Switching frequency		max. 0.5 kHz	
IO-Link specification		IO-Link specified according to version 1.1 and V1.0 (separate IODD)	
IO-Link port type		Class A	
Communication mode		COM 2/38.4 Kbit/s	
Process data width		16-bit	
Switching point information		1-bit	
Status bit information		2-bit	
Frame type		2.2	
Design	Threaded barrel, M12 × 1	Threaded barrel, M18 × 1	Threaded barrel, M30 × 1.5
Dimensions	52 mm	52 mm	62 mm
Housing material		Metal, CuZn, chrome-plated	
Material of active face		Plastic, LCP	
Max. tightening torque of housing nuts	10 Nm	10 Nm	10 Nm
Electrical connection		Male connector, M12 x 1	
Vibration resistance		55 Hz (1 mm)	
Shock resistance		30 g (11 ms)	
Type of protection		IP68	
MTTF		874 years acc. to SN 29500 (Ed. 99) 40 °C	

15.2 Technical data – BI…U-MT…

Type	BI6U-M12-…	BI10U-M18-…	Bi20U-M30…
Rated operating distance S_n	6 mm	10 mm	20 mm
Mounting condition		Flush	
Assured switching distance		≤ (0.81 × S_n) mm	
Repetition accuracy		≤ 2 % of full scale	
Temperature drift		≤ ± 10 %	
Hysteresis		3…15 %	
Ambient temperature		-25…+70 °C	
Operating voltage		15…30 VDC	
Ripple		≤10 % U_{ss}	
DC rated operational current		≤ 150 mA	
No-load current		≤ 20 mA	
Residual current		≤ 0.1 mA	
Insulation test voltage		≤ 0.5 kV	
Short-circuit protection		Yes/cyclic	
Voltage drop at I_e		≤ 1.8 V	
Wire breakage / reverse polarity protection		yes/completely	
Output function		4-wire, NO contact/N/O contact, PNP/NPN/Push-pull/IO-Link	
Output 1		Switching output or IO-Link mode	
Output 2		Switching output	
Switching frequency		Max. 0.5 kHz	
IO-Link specification		IO-Link specified according to version 1.1 and V1.0 (separate IODD)	
IO-Link port type		Class A	
Communication mode		COM 2/38.4 Kbit/s	
Process data width		16-bit	
Switching point information		1-bit	
Status bit information		2-bit	
Frame type		2.2	
Design	Threaded barrel, M12 × 1	Threaded barrel, M18 × 1	Threaded barrel, M30 × 1.5
Dimensions	52 mm	52 mm	62 mm
Housing material		Metal, CuZn, PTFE-coated	
Material of active face		Plastic, LCP, PTFE-coated	
Max. tightening torque of housing nuts	7 Nm	10 Nm	50 Nm
Electrical connection		Male connector, M12 x 1	
Vibration resistance		55 Hz (1 mm)	
Shock resistance		30 g (11 ms)	
Type of protection		IP68	
MTTF		874 years acc. to SN 29500 (Ed. 99) 40 °C	

15.3 Technical data – NI50U-…

Type	NI50U-CK40-…	NI50U-QV40
Rated operating distance S_n	50 mm	
Mounting condition	Non-flush, flush mounting possible	
Assured switching distance	≤ (0.81 × S_n) mm	
Repetition accuracy	≤ 2 % of full scale	
Temperature drift	≤ ± 10 % ≤ ± 20 % ≤ -25 °C v ≥ +70 °C	
Hysteresis	3…15 %	
Ambient temperature	-30…+85 °C	
Operating voltage	15…30 VDC	
Ripple	≤10 % U_{ss}	
DC rated operational current	≤ 150 mA	
No-load current	≤ 20 mA	
Residual current	≤ 0.1 mA	
Insulation test voltage	≤ 0.5 kV	
Short-circuit protection	Yes/cyclic	
Voltage drop at I_e	≤ 1.8 V	
Wire breakage / reverse polarity protection	Yes/completely	
Output function	4-wire, NO contact/N/O contact, PNP/NPN/Push-pull/IO-Link	
Output 1	Switching output or IO-Link mode	
Output 2	Switching output	
Switching frequency	Max. 0.5 kHz	0.25 kHz
IO-Link specification	IO-Link specified according to version 1.1	
IO-Link port type	Class A	
Communication mode	COM 2/38.4 Kbit/s	
Process data width	16-bit	
Switching point information	2-bit	
Frame type	2.2	
Design	Rectangular, CK40	Rectangular, QV40
Dimensions	65 × 40 × 40 mm	
Housing material	Plastic, PBT-GF20-V0	Plastic, PBT-GF30-V0
Electrical connection	Male connector, M12 x 1	
Vibration resistance	55 Hz (1 mm)	
Shock resistance	30 g (11 ms)	
Type of protection	IP68	
MTTF	874 years acc. to SN 29500 (Ed. 99) 40 °C	

15.4 Technical data – Bi…U-M…WD...

Type	BI4U-EM12WD-…	BI8U-EM18WD-…	BI15U-EM30WD-…
Rated operating distance S_n	4 mm	8 mm	15 mm
Mounting condition	Flush		
Assured switching distance	≤ (0.81 × S_n) mm		
Repetition accuracy	≤ 2 % of full scale		
Temperature drift	≤ ± 10 %		
	≤ ± 20 %, ≤ -25 °C , ≥ +70 °C		
Hysteresis	3…15 %		
Ambient temperature	-40…+100 °C		
Operating voltage	10…30 VDC		
Ripple	≤10 % U_{ss}		
DC rated operational current	≤ 150 mA		
No-load current	≤ 20 mA		
Residual current	≤ 0.1 mA		
Insulation test voltage	≤ 0.5 kV		
Short-circuit protection	Yes/cyclic		
Voltage drop at I_e	≤ 1.8 V		
Wire breakage / reverse polarity protection	Yes/completely		
Output function	4-wire, NO/NC contact, PNP/NPN		
Output 1	Switching output or IO-Link mode		
Output 2	Switching output		
Switching frequency	Max. 0.5 kHz		
IO-Link specification	IO-Link specified according to version 1.1 and V1.0 (separate IODD)		
IO-Link port type	Class A		
Communication mode	COM 2/38.4 Kbit/s		
Process data width	16-bit		
Switching point information	2-bit		
Status bit information	3-bit		
Frame type	2.2		
Design	Threaded barrel, M12 × 1	Threaded barrel, M18 × 1	Threaded barrel, M30 × 1.5
Dimensions	52 mm	52 mm	62 mm
Housing material	Stainless steel, V4A (1.4404)		
Material of active face	Plastic, LCP		
Max. tightening torque of housing nuts	10 Nm	25 Nm	75 Nm
Electrical connection	Male connector, M12 x 1		
Vibration resistance	55 Hz (1 mm)		
Shock resistance	30 g (11 ms)		
Type of protection	IP68 / IP69K		
MTTF	874 years acc. to SN 29500 (Ed. 99) 40 °C		

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