TURCK

Your Global Automation Partner

NIC…-EM30-IOL-…
Inductive Couplers

Instructions for Use

Contents

1 About these Instructions

These instructions describe the setup, functions and use of the product and help you to operate the product according to its intended purpose. Read these instructions carefully before using the product. This will prevent the risk of personal injury and damage to property. Keep these instructions safe 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

The following symbols are used in these instructions:

	**DANGER** DANGER indicates a hazardous situation with a high level of risk, which, if not avoided, will result in death or serious injury.
	**WARNING** WARNING indicates a hazardous situation with a medium level of risk, which, if not avoided, will result in death or serious injury.
	**CAUTION** CAUTION indicates a hazardous situation with a medium level of risk, which, if not avoided, will result in moderate or minor injury.
	**NOTICE** CAUTION indicates a situation which, if not avoided, may cause damage to property.
	**NOTE** NOTE indicates tips, recommendations and important information about special action steps and issues. The notes simplify your work and help you to avoid additional work.
▶	**MANDATORY ACTION** This symbol denotes actions that the user must carry out.
⇨	**RESULT OF ACTION** This symbol denotes the relevant results of an action.

1.3 Other documents

Besides this document, the following material can be found at **www.turck.com**:

- Data sheet
- Declarations of conformity (current version)
- Quick Start Guide
- Commissioning manual IO-Link devices
- Approvals
- IO-Link parameters

1.4 Feedback about these instructions

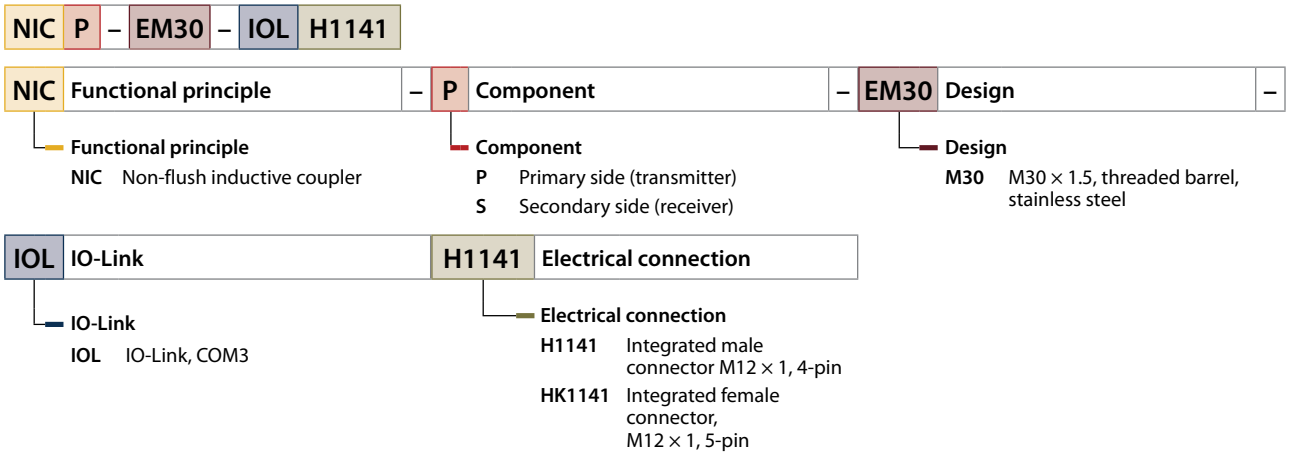
We make every effort to ensure that these instructions are as informative and as clear as possible. If you have any suggestions for improving the design or if some information is missing in the document, please send your suggestions to **techdoc@turck.com**.

2 Notes on the product

2.1 Product identification

These instructions apply to the following inductive couplers:

- NICP-EM30-IOL-H1141
- NICS-EM30-IOL-HK1141



2.2 Scope of delivery

The delivery consists of the following:

- Primary side or secondary side
- Two M30 nuts for mounting
- Quick Start Guide

2.3 Turck service

Turck supports you in your projects – from the initial analysis right through to the commissioning of your application. The Turck product database at www.turck.com offers you several software tools for programming, configuring or commissioning, as well as data sheets and CAD files in many export formats.

The contact data for Turck branches is provided at [▷ 23].

3 For your safety

The product is designed according to state of the art technology. Residual hazards, however, still exist. Observe the following safety instructions and warnings in order to prevent danger to persons and property. Turck accepts no liability for damage caused by failure to observe these safety instructions.

3.1 Intended use

Inductive couplers are used in industrial applications for the contactless transfer of energy (power up to 18 W) and for bidirectional data exchange across an air interface (max. 7 mm). The devices consist of a primary side and a secondary side. The primary side supplies power to the secondary side across an air interface. Both sides supply data from the connected sensors and actuators.

The device must 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 instructions

- The device must only be fitted, installed, operated, parameterized and maintained by trained and qualified personnel.
- The device meets the EMC requirements for the industrial areas. When used in residential areas, take measures to prevent radio frequency interference.
- Only use the device in compliance with the applicable national and international regulations, standards and laws.
- Do not place any metallic objects in the electrical field between the primary and secondary side.
- A stay in the electromagnetic field of the inductive couplers can be harmful to health. Observe a minimum distance of 30 cm from the actively radiating surface of the devices.
- The protective effect of the device can be impaired if the device is used in any way that is not specified by Turck.

3.3 Notes on the UL approval

- The device must be powered by a Class 2 power supply unit or a power supply with a limited voltage/current.

4 Product description

The devices have a cylindrical design with an M30 × 1.5 male thread. An M12 connector on the housing is provided to connect the NICP-EM30-IOL-H1141 primary side. The NICS-EM30-IOL-HK1141 secondary side is provided with an M12 female connector.

4.1 Device overview

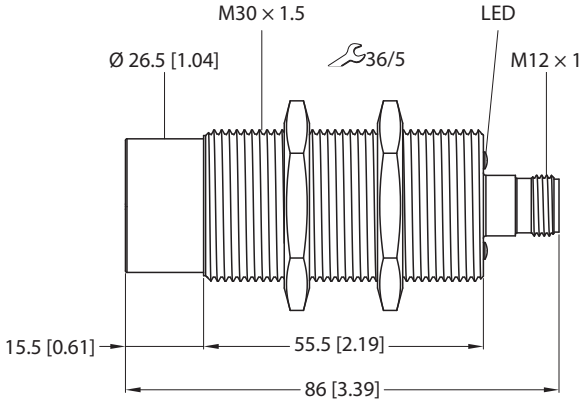


Fig. 1: NICP-EM30-IOL-H1141 primary side

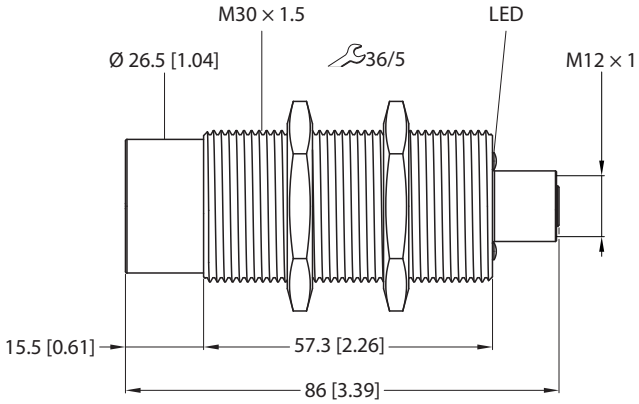


Fig. 2: NICS-EM30-IOL-HK1141 secondary side

4.2 Properties and features

- Threaded barrel, M30 × 1.5
- Stainless steel, 1.4404
- DC 4-wire, 24 VDC +20 %/-15 %

4.3 Operating principle

Inductive couplers transfer power according to the inductive coupling power transfer (ICPT) principle. The frequency of the alternating field is 100…148.5 kHz. Data is transferred on a carrier frequency of 2.4 GHz.

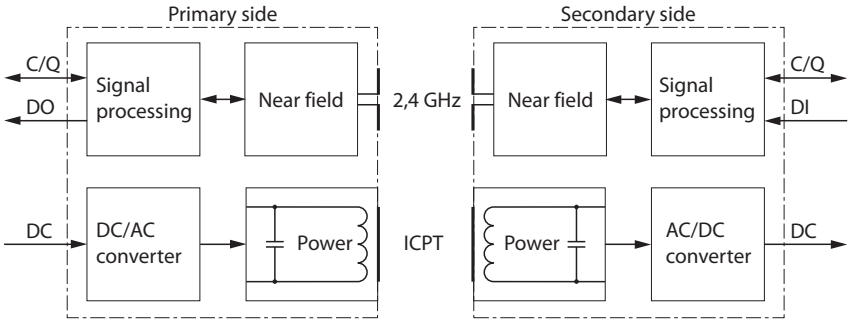


Fig. 3: Block diagram

Inductive couplers are used in industrial applications for the contactless transfer of power and for bidirectional data exchange across an air interface (max. 7 mm). The devices consist of a primary side and a secondary side. The primary side supplies power to the secondary side across an air interface. Both sides supply data from the connected sensors and actuators.

4.4 Functions and operating modes

The inductive couplers can be operated in IO-Link mode and in SIO mode. In IO-Link mode, the devices transfer power and IO-Link signals. Either signals from two PNP/NPN inputs or one PNP/NPN output can be transferred in SIO mode.

4.4.1 IO-Link mode

IO-Link mode enables bidirectional IO-Link communication between an IO-Link master and an IO-Link device via the air interface.

4.4.2 SIO mode

In standard I/O mode (SIO mode), signals can be transmitted from two PNP/NPN inputs or one PNP/NPN output. The switching of PNP and NPN or input and output is carried out in configuration mode. The secondary side with a connected junction box (e.g. VB2-FSM4.4-2FKM4) transfers two standard PNP/NPN signals to the primary side. The junction box is not required when using sensors with two outputs (power clamps). The second input or output is deactivated (pin 2) when using an actuator. The actuator must be connected to pin 4. For use with a digital output, the device must be configured via IO-Link.

4.4.3 Configuration mode

The following modifications can be carried out in configuration mode:

- setting the inductive coupler system
- reading diagnostic information from the inductive coupler system

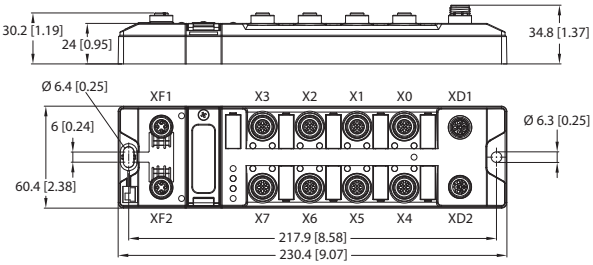
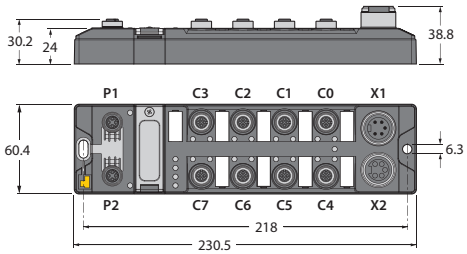
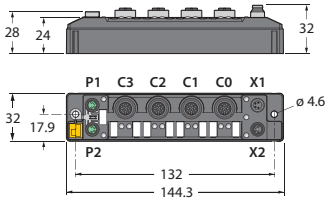
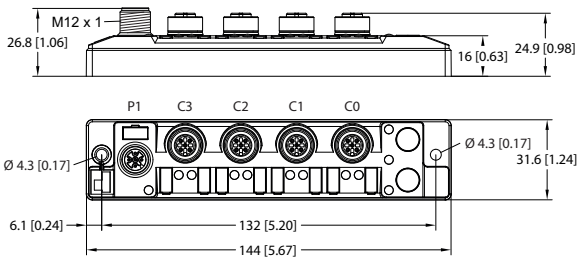
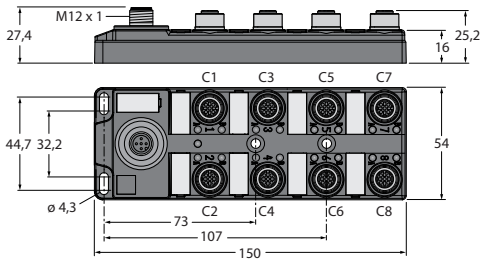
4.4.4 Foreign object detection (FOD)

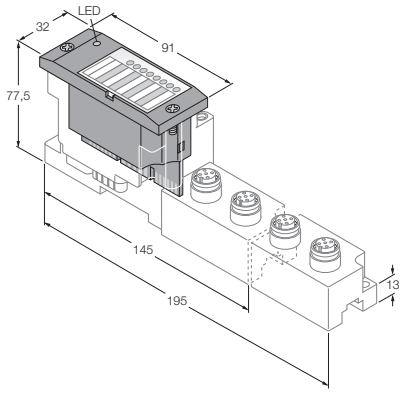
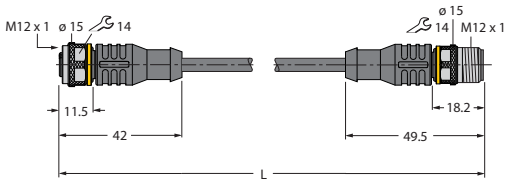
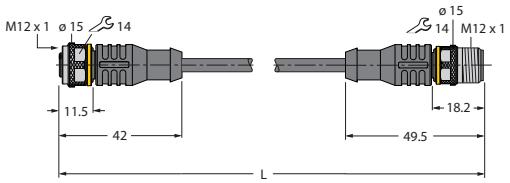
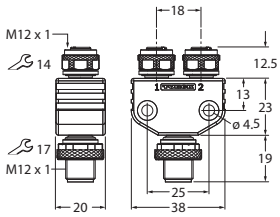
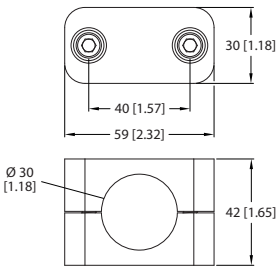
The foreign object detection (FOD) detects the presence of metal objects between the primary and secondary side during the power transfer. The power supply of the device is switched off if the FOD detects foreign objects. The operation of the system is automatically restored as soon as the primary side no longer detects any metal.

Operating principle of foreign object detection: Power is taken from the coupler system if a metal object is located in the electromagnetic field between the primary side and the secondary side when power is transferred. The coupler system detects the loss in power and interrupts the power transfer.

Limits of foreign object detection: No foreign object is identified if the loss of power between the primary side and secondary side is too little. Smaller metal foreign objects such as M2 screws only take a little power from the coupler system and are therefore not detected. The FOD also does not detect any metal foreign objects if the power transfer between the primary side and secondary side is negligible.

4.5 Technical accessories

Dimension drawing	ID	Type	Description
	100003910	TBEN-LL-8IOL	Compact multiprotocol I/O module for Ethernet, 8 IO-Link master channels, 4 universal digital PNP channels, 2 A, channel diagnostics
	6814017	TBEN-L5-8IOL	Compact multiprotocol I/O module for Ethernet, 8 IO-Link master channels, 4 universal digital PNP channels, 2 A, channel diagnostics
	6814024	TBEN-S2-4IOL	Compact multiprotocol I/O module for Ethernet, 4 IO-Link master channels, 4 universal digital PNP channels, 0.5 A, channel diagnostics
	100002596	TBIL-S4-8DIP	I/O hub to connect digital signals to IO-Link master, 8 digital inputs, 4 M12 ports
	6814102	TBIL-M1-16DXP	I/O hub for IO-Link, 16 universal digital PNP channels

Dimension drawing	ID	Type	Description
	6827386	BL67-4IOL	IO-Link 1.1 master for BL67 modular fieldbus system, 4 IO-Link ports and 4 programmable PNP ports
	6625608	RKC4.4T-2-RSC4.4T/TXL	Connection cable, M12 female connector, straight, 4-pin; M12 male connector, straight, 4-pin; cable material PUR, black, cable length: 2 m
	6626356	RKS4.4T-2-RSS4.4T/TXL	Connection cable, M12 female connector, straight, 4-pin, jacket material PUR, black, cable length 2 m
	6632239	VB2-FSM4.4-2FKM4.4	2-way splitter, Y-splitter without cable, M12 male connector, 4-pin, 2 × M12 female connector, 4-pin, parallel wiring, RoHS compliant, protection type IP67
	100047196	BSM-30	Mounting bracket, mounting accessories for M30 × 1.5 inductive sensors, in accordance with DIN 3015-1, consisting of two half shells, aluminum

5 Installing

NOTICE
Electromagnetic fields from other devices can impair the inductive couplers.
Damage to device
- Prevent overlapping with electromagnetic fields from other devices (e.g., other inductive couplers).

NOTE
Heat buildup
Loss of power due to high device temperature
- Install the device in heat conductive material (e.g. mounting clip BSM-30).
- Ensure sufficient ventilation and heat dissipation.

The maximum tightening torque of the housing nuts is 40 Nm.

- Install the device at the intended location. Observe the minimum mounting distances.
- Align the front faces of the primary and secondary sides to each other. The maximum distance between the primary and secondary side is 7 mm.
- Refer to tables “Angle offset” and “Lateral offset”.

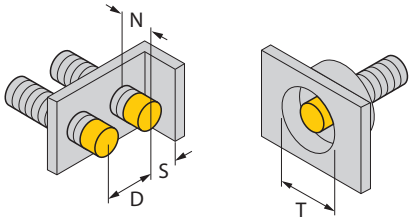


Fig. 4: Mounting distances

Distance	Minimum mounting distances
D	60 mm
N	26.5 mm
S	30 mm
T	60 mm

5.1 Angle offset

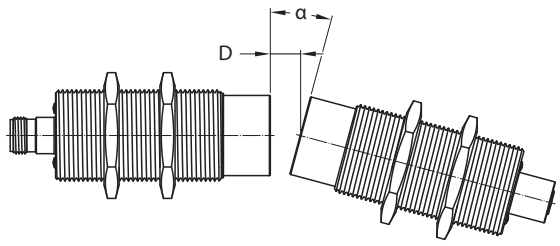


Fig. 5: Angle offset

Distance D	Angle α
2 mm	7.5°
4 mm	15°
5 mm	20°
7 mm	30°

5.2 Lateral offset

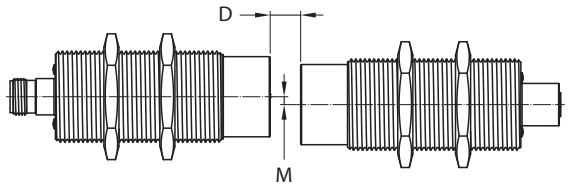


Fig. 6: Lateral offset between primary side (left) and secondary side (right)

Distance D	Offset M
0…4 mm	5 mm
5 mm	3 mm
7 mm	2 mm

6 Connection

- Use shielded cables in environments with severe electromagnetic interference.

6.1 Wiring diagrams

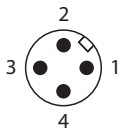


Fig. 7: Pin layout of primary side

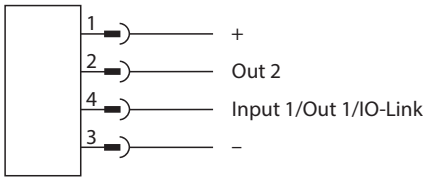


Fig. 8: Wiring diagram of primary side

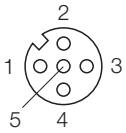


Fig. 9: Pin layout of secondary side

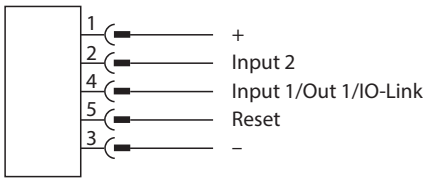


Fig. 10: Wiring diagram of secondary side

6.2 IO-Link mode

NOTE
In IO-Link mode, pin 2 cannot be used as a digital input or output.

- Connect the NICP… primary side to an IO-Link master via an M12 connection cable (e.g. RKC4.4T-2-RSC4.4T/TXL) as shown in the wiring diagrams.
- Connect the NICS… secondary side via an M12 connection cable to an IO-Link device as shown in the wiring diagrams.

6.3 SIO mode

6.3.1 Digital input

- One sensor: Connect the NICS… secondary side via an M12 connection cable to a sensor as shown in the wiring diagrams.
- Two sensors: Connect the NICS… secondary side via an M12 connection cable to a two-way splitter (e.g. VB2-FSM4.4-2FKM4) as shown in the wiring diagrams. The two-way splitter is not required when using sensors with two outputs (power clamps).
- Connect the NICP… primary side via an M12 connection cable to a controller or a fieldbus device as shown in the wiring diagrams.

6.3.2 Digital output

NOTE
When transferring from a digital output, pin 2 cannot be used as a digital input or output. For use with a digital output, the device must be configured via IO-Link.

- Connect the NICS… secondary side output 1 (pin 4) to an actuator via an M12 connection cable as shown in the wiring diagrams.
- Connect the NICP… primary side via an M12 connection cable to a controller or a fieldbus device as shown in the wiring diagrams.

7 Commissioning

After the connection is made and the power supply is switched on, the device is operational after a readiness delay. The readiness delay of the data transfer depends on:

- the connected devices on the secondary side
- the set cycle time in the IO-Link master
- the connection time and connected IO-Link devices, IO-Link master and their parameters

The connection time for the complete system is normally 1400 ms. The following measures can be taken to reduce the connection time:

- Use of a Turck IO-Link master with the Quick startup switched on: Connection time normally 1100 ms
- Primary side already switched on: Connection time normally 600 ms
- Optimize alignment: The connection time can be higher near the limits of the mounting distances, the angular displacement or the lateral displacement (see [▷ 12]).

7.1 IO-Link mode

▶ Set the cycle time of min. 10 ms on the IO-Link master.
⇨ The inductive coupler is operational.

8 Operation

CAUTION
The housing gets very hot during operation.
Risk of burning due to hot housing surfaces
- ▶ Protect the enclosure from contact with flammable material.
- ▶ Protect the enclosure from accidental contact.

Multiple components of the secondary side with the same configuration can be run on one primary side (dynamic pairing). Process data is delayed by one IO-Link cycle for each coupler system. Acyclic data is delayed depending on the size of the transmitted data. The time between the coupling operations must be at least 2 s to ensure a constant startup time.

8.1 LEDs

Primary side	Secondary side	Meaning
Green	Green	Operating voltage, SIO mode pin 4 (C/Q) inactive
Orange flashing 5 Hz	Green	Operating voltage, SIO mode pin 4 (C/Q) active or inactive – poor connection quality
Green flashing 0.5 Hz	Off	No secondary side coupled
Green flashing 1 s on, 0.1 s off	Green flashing 1 s on, 0.1 s off	IO-Link communication with connected device
Green	Red	IO-Link master connected, but no IO-Link communication with device on the secondary side
Orange	Orange	SIO mode pin 4 (C/Q) active
Orange flashing 1 Hz	Off	Foreign object detection (FOD) active
Orange/green alternately 1 Hz	Orange/green alternately 1 Hz	Configuration mode
Red flashing 5 Hz	Off	Primary side error
Secondary side red flashing (5 Hz), behavior of the primary side not relevant		Secondary side error

8.2 Temperature derating

Derating is required at temperatures above 45 °C.

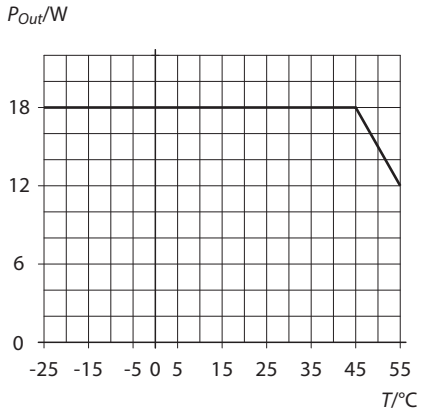


Fig. 11: Temperature derating

8.3 Resetting to factory settings

In configuration mode, the inductive coupler can be reset to the factory settings. Alternative manual reset:

- ▶ Switch on the primary side power supply.
- ▶ Connect pin 5 of the secondary side with pin 4.
- ▶ Align the secondary side with the primary side (see [▷ 12]).
- ⇨ The factory settings are restored.

Without dynamic paring:

- ▶ Switch on the primary side power supply.
- ▶ Connect pin 5 of the secondary side with GND of the secondary side.
- ▶ Align the secondary side with the primary side (see [▷ 12]).
- ⇨ The factory settings are restored.

9 Setting

The device can be parameterized via IO-Link. The following steps are required to switch the system to the configuration mode:

- ▶ An IO-Link device with a freely writable Application Specific Tag must be connected to the secondary side.
- ▶ The inductive couplers must be in the coupled state.
- ▶ Write **_EnterConfigMode** in the Application Specific Tag. Observe upper and lower case.
- ▶ Use the IODD of the inductive coupler for the port.
- ⇨ The connection to the IO-Link device is interrupted.
- ⇨ The inductive coupler system is operated as an IO-Link device.

Close configuration mode:

- ▶ Write **_LeaveConfigMode** in the Application Specific Tag. Observe upper and lower case.

or

- ▶ Carry out a voltage reset.

10 Troubleshooting

10.1 Foreign Object Detection (FOD)

The device detects metallic objects in the active area between the primary side and the secondary side via FOD. If an object is detected, the device switches off the power supply automatically. The LED of the primary side is orange if the FOD is active.

CAUTION
Heated metal parts in the active area
Risk of burning

- ▶ Wear safety gloves when removing foreign objects.

- ▶ Remove foreign objects from the active area.
- ⇨ The device returns automatically to operating mode.

10.2 Preventing disconnections

In environments with severe radio interference (e.g. a high number of 2.4 GHz signals), the coupler automatically searches for the ideal channel for radio transmission. While changing the channel, the connection is interrupted briefly.

- ▶ Reduce 2.4 GHz signals in the environment to prevent disconnections.

11 Maintenance

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

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

The active area between the primary and secondary side must occasionally be cleared of metal contamination (e.g. metal chippings) in order to maintain correct operation.

12 Repair

The device is not intended for repair 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

If a device has to be returned, bear in mind that only devices with a decontamination declaration will be accepted. This is available for download at
https://www.turck.de/en/return-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 properly and do not belong in the domestic waste.

14 Technical data

14.1 Technical data of the primary side

NICP-EM30-IOL-H1141	
ID	100018258
Operating voltage	24 VDC +20 % / -15 %
Operating current	max. 1700 mA
Nominal distance	0…7 mm
Ambient temperature	-25…+55 °C
Storage temperature	-40…+70 °C
Output function	IO-Link/2 digital channels
Protection type	IP67 (DIN EN 60529: dust proof, complete protection from contact, protection from occasional immersion) IP68 (DIN EN 60529: dust proof, complete protection from contact, protection from permanent immersion, 7 days at 1 m depth in water)
Electrical connection	M12 connector, 4-pin

14.2 Technical data of the secondary side

NICS-EM30-IOL-HK1141	
ID	100018259
Output voltage	24 VDC ±10 %
Output current	max. 750 mA
Nominal distance	0…7 mm
Ambient temperature	-25…+55 °C
Storage temperature	-40…+70 °C
Output peak current	2.5 A for 0.1 ms, 10 A for 0.02 ms
Output function	IO-Link/2 digital channels
Protection type	IP67 (DIN EN 60529: dust proof, complete protection from contact, protection from occasional immersion) IP68 (DIN EN 60529: dust proof, complete protection from contact, protection from permanent immersion, 7 days at 1 m depth in water)
Electrical connection	M12 female connector, 5-pin
Min. input voltage High Level Low Level	 8 V 5 V
Input current	< 4.5 mA

14.3 Technical data of inductive transfer system

Inductive transfer system	
Readiness time of secondary side	600 ms
Readiness time of system	1400 ms
Standby power coupled	6.6 W
Standby power uncoupled	1 W
Switch delay	Typically 10 ms, max. 30 ms
IO-Link communication	COM2/COM3, IO-Link 1.1, max. 230.4 kBaud
Min. cycle time	10 ms
Rotation	1250 rpm
Short-circuit protection	Yes
Reverse polarity protection	Yes

14.4 Ambient conditions

The inductive coupler is designed for use inside buildings.

Inductive transfer system	
Operating height	≤ 2000 m above sea level
Relative humidity	10…85 % RH Condensation water on active surfaces and change in air humidity can affect switching distances.
Pollution degree	3 (acc. to IEC 60947-1-2007)

14.5 Design

Technical data	
Housing material	Stainless steel, 1.4404
Material of active face	LCP

15 Turck branches — contact data

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