TURCK

Your Global Automation Partner

MR15-Q80-IOLCJ-H1141
Radar Scanner

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 on the Internet at www.turck.com:

- Data sheet
- Declarations of conformity
- Quick Start Guide
- 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

These instructions apply to the following radar scanners:

MR	15	–	Q80	–	IOLCJ	–	H1	1	4	1

MR 15 Series

- **Sensing range**
  … Max. range in m
- **Functional principle**
  MR Radar-scanner

Q80 Design

- **Housing**
  Q80 rectangular, 80 × 80 × 34.6 mm

IOLCJ Electrical version

- **Output function**
  IOLCJ IO-Link, 2 Switching outputs, SAE J1939

H1 1 4 1 Electrical connection: Connector

- **Assignment**
  1 Standard assignment
- **Number of contacts**
  4 4 contacts
- **Connector type**
  1 Straight
- **Connector type**
  H1 M12 × 1 connector

2.2 Scope of delivery

The delivery consists of the following:

- Radar scanner
- 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.

For the contact details of our branches worldwide, please see page [▸ 49].

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

The radar scanners in the MR… product series detect the presence of objects within a detection range without contact and measure the position of these objects within the space. If there are several objects within the detection range, it is possible to select whether the object closest to the sensor or the object with the strongest echo signal is evaluated. Detection range and object detection can be adjusted via filter settings and sensor configurations. The devices 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.

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 Obvious misuse

- The devices are not safety components and must not be used for personal or property protection.

3.3 General safety instructions

- The device meets the EMC requirements for the industrial areas. When used in residential areas, take measures to prevent radio frequency interference.
- The device must only be fitted, installed, operated, parameterized and maintained by trained and qualified personnel.
- Only use the device in compliance with the applicable national and international regulations, standards and laws.
- The maximum transmission output of the sensor is within the approved limit values specified in ETSI EN 305550 and FCC/CFR. 47 Part 15.
- Only operate the device within the limits stated in the technical specifications.
- Any extended stay within the area of radiation of the device may be harmful to health. Maintain a minimum distance of 20 cm from the actively radiating surface of the radar sensor.

4 Product description

Scanners in the MR… product series have a die-cast aluminum housing with protection class IP67/IP68/IP69K and have a shock resistance of 100 g. The active surface is made of plastic. The devices are equipped with a 4-pin M12 connector for connecting the sensor cable, which allows IO-Link communication and the transmission of freely adjustable switching information.
A 5-pin M12 connector is used to connect the SAE J1939 interface.

4.1 Device overview

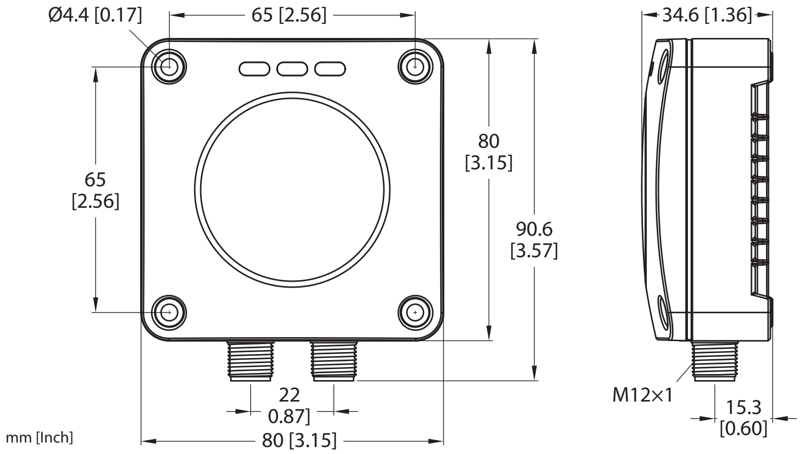


Fig. 1: Dimensions

4.1.1 Indication elements

The radar scanner has three LEDs to indicate operating voltage and device status [▸ 44].

4.2 Properties and features

- Range: 15 m
- Blind zone: 35 cm
- Resolution: 1 mm
- Cone angle: adjustable, max. 120°
- Approved in accordance with ETSI 305550-2
- Approved in accordance with FCC/CFR. 47 Part 15
- 2 × M12 × 1, 1 × 4-pin, 1 × 5-pin
- Operating voltage 9…33 VDC
- Switching output switchable between PNP/NPN
- IO-Link, SSP 4
- SAE J1939
- Rectangular, 80 × 80 mm

4.3 Operating principle

The FMCW radar (frequency modulated continuous wave) measures the distance to stationary objects.

The sensor outputs a radar signal that changes in frequency. The rate of change of the frequency is constant. Objects in the detection range reflect the transmitted signal. The change in the signal delay and frequency of the reflected signal are used to determine the distance to the object.

A MIMO (Multiple Input Multiple Output) radar system consists of multiple receiving and transmitting antennas. The lateral offset of the antennas also allows the exact position in the space to be determined.

4.4 Functions and operating modes

The device measures the distance between the detected object and the end of the sensor housing; it also measures the respective azimuth and elevation angles and the radial velocity. For the switching outputs, a single switching point, two switching points or a window function can be defined for the distance, angle or velocity channels. In addition, the measured values are sent to the higher-level control system via the IO-Link process data and via the SAE J1939 protocol. The distance value is transmitted in m, the angle in ° and the speed in m/s via the process data.

The device can be parameterized via IO-Link and via the SAE J1939 protocol.

4.4.1 Setting options

The devices have three setting options:

- Setting via IO-Link
- Setting via SAE J1939 Proprietary A PGN 0xEFxx
- Setting via the Turck Radar Monitor via TAS

4.4.2 Operating modes — switching outputs

The switching outputs can be set via IO-Link or TAS. The switching outputs can be configured and evaluated independently of each other. A value from the process data can be assigned to a switching output. Depending on the process value, the output provides a switching signal.

The switching outputs can be used either as pure switching outputs in accordance with the Smart Sensor Profile or for collision detection. It is also possible to combine a switching output in accordance with the Smart Sensor Profile and an output for collision detection.

For collision detection, the sensor switches if an object is located in a defined signal field or within a defined radius.

The switching points for the pure switching outputs can be defined via a set process value for the azimuth angle, elevation angle, distance or speed. The output behavior is described on page [▶ 9].

4.4.3 Output functions — switching output

The switching logic can via IO-Link be inverted. The following examples apply to the **HIGH** (0 → 1) switching logic.

Single point mode

In single point mode, the switching behavior is defined via a SP1 limit value and a hysteresis. The output changes its switching state at limit value SP1. The hysteresis can via IO-Link be set and must be within the detection range.

If an object is moved away from the sensor, the switching output is active as long as the object is located between the start of the detection range and the limit value SP1 plus the set hysteresis (SP1+Hyst). If the object passes the limit value (SP1+Hyst), the switching output becomes inactive.

If an object is moved toward the sensor, the switching output is inactive as long as the object is located between the end of the detection range and the limit value SP1. If the object passes the limit value SP1, the switching output becomes active.

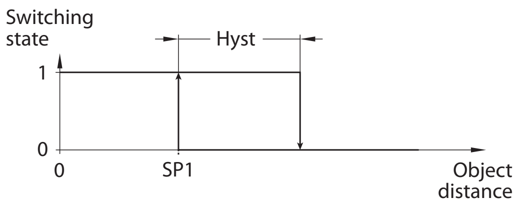


Fig. 2: Single point mode

Two point mode

In two point mode, the switching behavior is defined via a switch-off point SP1 and a switch-on point SP2. This mode can also be used as a freely adjustable hysteresis.

If an object is moved away from the sensor, the switching output is active for as long as the object is located between the start of the detection range and the switch-off point SP1. If the object passes the switch-off point SP1, the switching output becomes inactive.

If an object is moved toward the sensor, the switching output is inactive as long as the object is located between the end of the detection range and the switch-on point SP2. If the object passes the switch-on point SP2, the switching output becomes active.

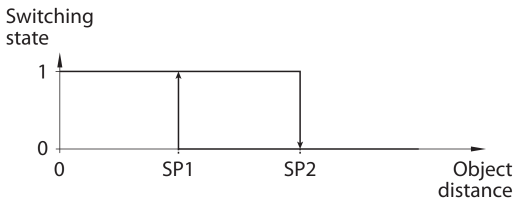


Fig. 3: Two point mode

Window mode

In window mode, an upper and a lower window limit are set for the switching output. A hysteresis can be set for the window limits SP1 and SP2. The switch window must be within the detection range. The hysteresis can via IO-Link be set and must be within the detection range.

If the process value increases, the switching output is inactive as long as the process value is between the start of the detection range and the window limit SP2. The switching output remains active until the process value increases above the window limit SP1 plus the hysteresis (SP1+Hyst). If the process value increases above (SP1+Hyst), the switching output becomes inactive again.

If the process value decreases, the switching output is inactive as long as the process value is between the end of the detection range and the window limit SP1. The switching output remains active until the process value decreases below the window limit SP2 minus the hysteresis (SP2-Hyst). If the process value decreases below (SP2- Hyst), the switching output becomes inactive again.

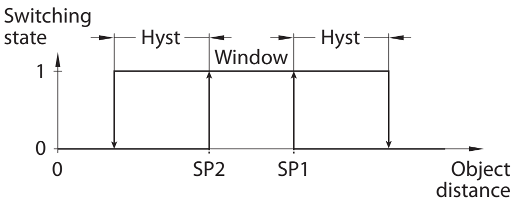


Fig. 4: Window mode

4.4.4 IO-Link mode

In order to operate in IO-Link mode, the device must be connected to an IO-Link master. When the port is configured in IO-Link mode, bidirectional IO-Link communication takes place between the IO-Link master and the device. To make this possible, the device is integrated via an IO-Link master at the control level. First the communication parameters are exchanged, and then the cyclic data exchange of process data (objects) starts.

4.4.5 SIO mode (standard I/O mode)

NOTE
SIO mode is only available at male connector 1 (switching output 1: Pin 4, switching output 2: Pin 2).

In standard I/O mode no IO-Link communication takes place between the device and the master. The device only transfers the switching state of its binary outputs and can also be run via a fieldbus device or controller with digital PNP or NPN inputs. An IO-Link master is not required for operation.

The device parameters can be set via IO-Link and then operated at the digital inputs with the appropriate settings in SIO mode. Not all functions and properties of the device can be used in SIO mode.

The outputs can each be assigned a switching signal in SIO mode. The following switching signals are possible:

- Switching signals from the object process data: a specific distance, angle or velocity value
- Switching signals from the collision process data: radius 1…6 or signal field 1…3

4.4.6 Object detection

The radar scanner detects objects as individual data points. The data points are defined by a distance value to the sensor, a value for the elevation angle and a value for the azimuth angle. The detected objects are calculated internally by the sensor using the data points. In addition, the sensor outputs a delta value for all variables. The delta values indicate the object outlines.

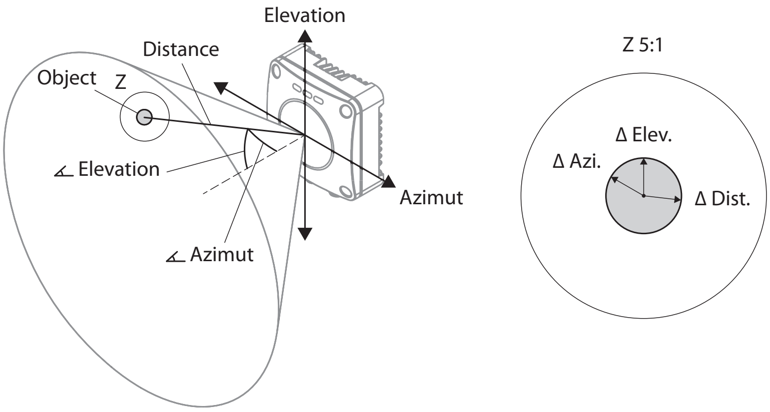


Fig. 5: Object detection

Object size

The expected size of the objects can be set via IO-Link or TAS.

To calculate the object size, a radius is drawn around each recorded data point. The size of the radius can be adjusted. If several radii intersect, the data points contained therein are combined into objects. The larger the radius selected, the more data points are combined into one object.

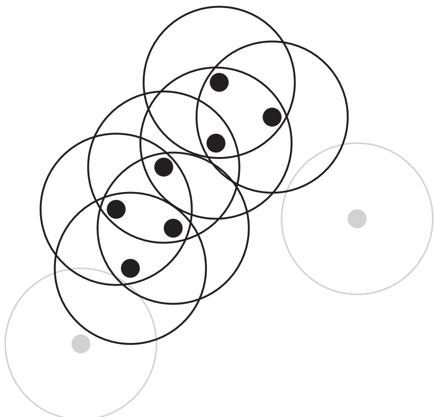


Fig. 6: Data points and radii (schematic representation)

Radar exposure time

During object detection, the sensor internally generates images that are superimposed onto each other. The more images that are superimposed onto each other, the more likely the sensor is to detect objects that are only weakly reflective. The number of images can be set via IO-Link or the radar monitor in TAS (see the radar exposure time parameter in the chapter Setting, [▸ 35]). The images are updated in the same way as in a ring memory: When using the default setting, the sensor superimposes three images onto each other during object detection.

If an object is detected in the first image that is no longer physically present in the detection range when the second image is captured, the object is no longer output by the sensor once the fourth image is captured.

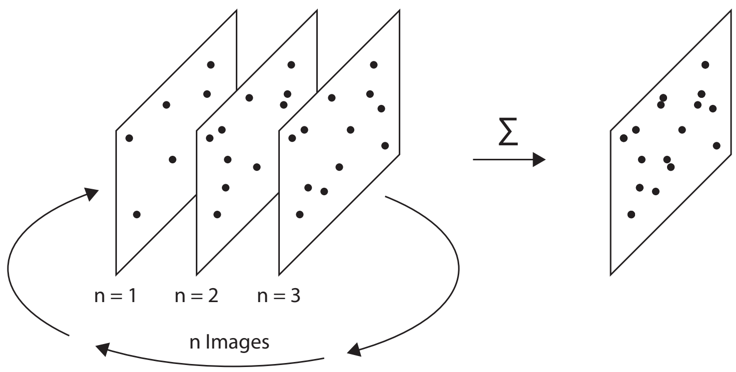


Fig. 7: Principle of radar exposure time

The higher the radar exposure time selected, the longer the update time:

Radar exposure time	Update time per image	Total update time
2	50 ms	100 ms
3	50 ms	150 ms
4	100 ms	400 ms
5	100 ms	500 ms

4.4.7 Collision radii

Up to six collision radii can be defined independently of each other via IO-Link and TAS. If an object is detected within a radius, the sensor outputs a signal. Depending on the parameterization, the signal can be output as a switching signal at one of the outputs or via the process data.

A collision radius must be defined using the distance to the sensor.

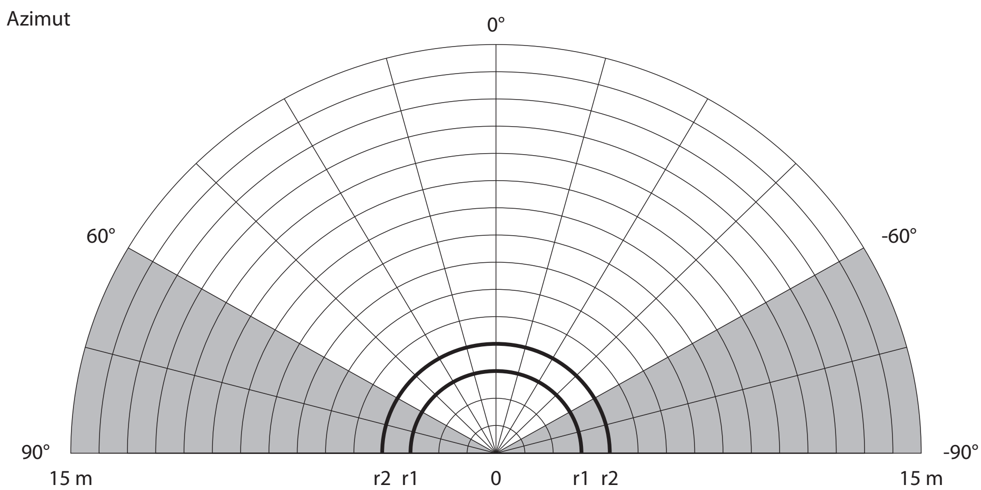


Fig. 8: Example of collision radii

4.4.8 Signal fields

Up to three application-specific signal fields can be set independently of each other via IO-Link and TAS. The signal fields can also overlap. If an object is detected within a signal field, the sensor outputs a signal. Depending on the parameterization, the signal can be output as a switching signal at one of the outputs or via the process data.

A signal field must be defined using the distance to the sensor, azimuth angle and elevation angle. If an object is located between the sensor and a signal field, shading of the signal field is signaled via the process data. As an option, a safety distance of up to 500 mm can be set around the detected objects using the object parameters.

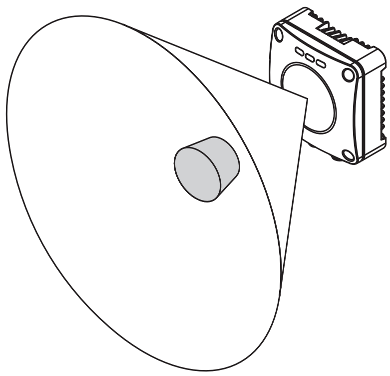


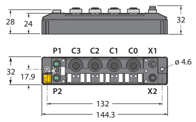
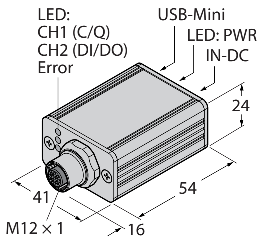
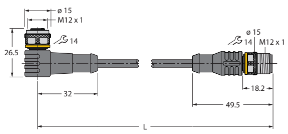
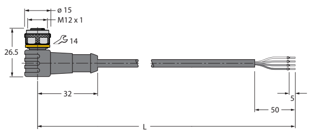
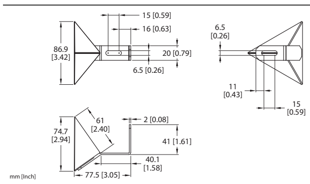
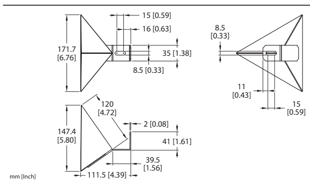
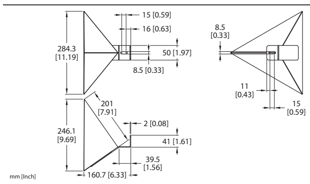
Fig. 9: Signal field (schematic diagram)

For collision detection, the sensor switches if an object is located in a defined signal field or within a defined radius.

4.4.9 Velocity detection

The device detects the radial velocity of an object in the detection range. The radial velocity is the proportion of a velocity vector with which an object moves toward or away from the sensor. The velocity at which an object moves to the right or left in the space cannot be detected.

4.5 Technical accessories

Figure	Type	Description
	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
	USB-2-IOL-0002	IO-Link adapter V1.1 with integrated USB interface
	WKC4.4T-2-RSC4.4T/TXL	Extension cable, M12 female connector, angled to M12 connector, straight, 4-pin, cable length: 2 m, jacket material: PUR, black; cULus approval
	WKC4.4T-2/TXL	Extension cable, M12 female connector, angled, 4-pin, cable length: 2 m, jacket material: PUR, black; cULus approval
	RR-6	Radar reflector made of stainless steel, cathetus length 60 mm, RadarCrossSection: 10 m^2 (cf. automobile)
	RR-12	Radar reflector made of stainless steel, cathetus length 120 mm, RadarCrossSection: 250 m^2 (cf. HGV)
	RR-20	Radar reflector made of stainless steel, cathetus length 200 mm, RadarCrossSection: 1115 m^2 (cf. ship)

In addition to the above connection cables, Turck also offers other cable types for specific applications with the correct terminals for the device. More information on this is available from the Turck product database at **www.turck.de/products** in the Connectivity area.

5 Installing

The lens curvature does not have to be taken into account for the installation. The "Turck" lettering indicates the sensor's azimuth axis.

The sensors can be installed in any alignment according to application requirements. The radar wave propagates perpendicular to the surface of the radar lens. The distance and angle of the detection range can be set to customer specifications. The maximum cone angle is limited to ±60° (azimuth) and ±50° (elevation).

The maximum tightening torque when mounting the sensor is 7 Nm.

- Install the sensor at the intended location. Be aware of the blind zone s_{min}, in which no object detection is possible (see [47]).
- Install the sensor in such a way that no foreign objects are located in the detection range.

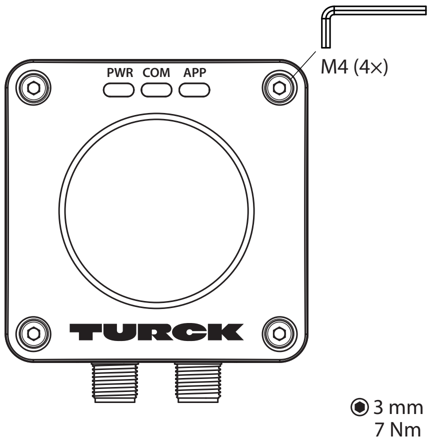


Fig. 10: Installing the radar scanner

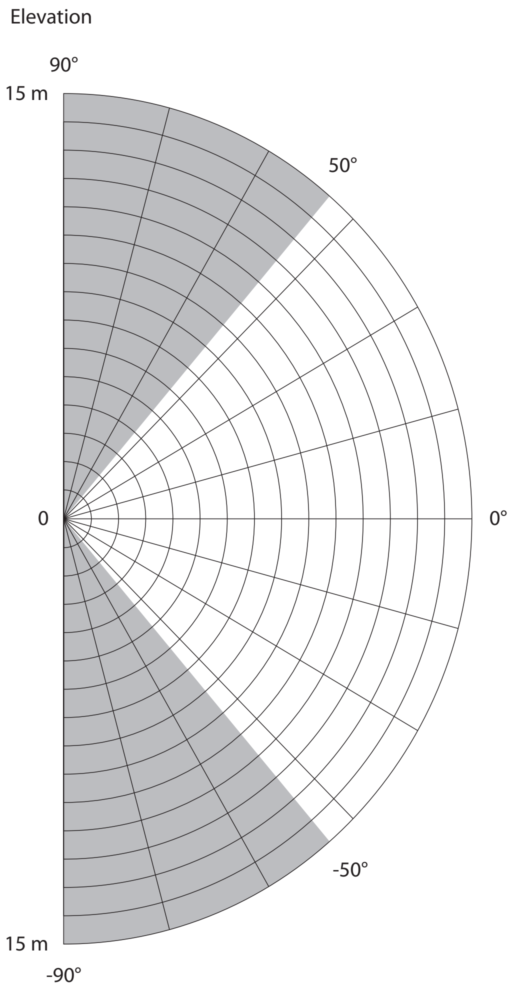


Fig. 11: Maximum cone angle (elevation)

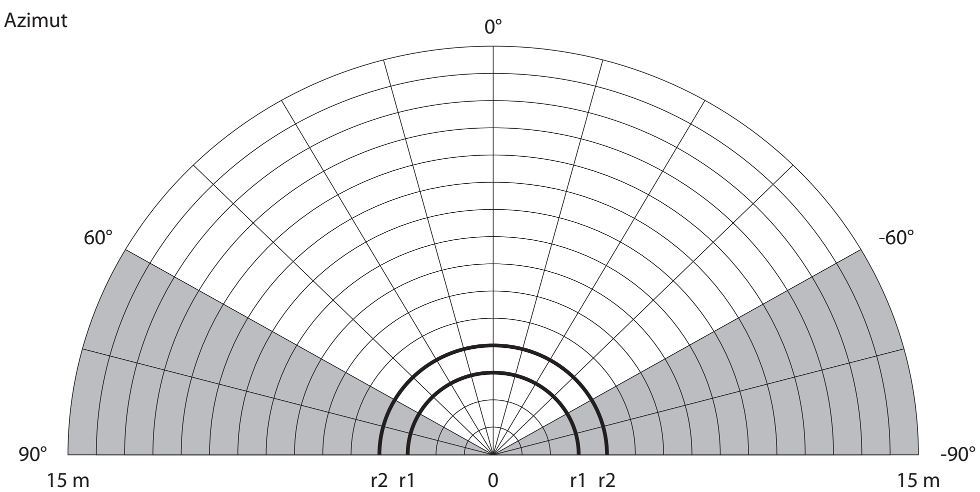


Fig. 12: Maximum cone angle (azimuth)

6 Connection

NOTE
The device must be provided with an SELV/PELV power supply compliant with a limited energy circuit in accordance with UL61010-1 3rd Edition (IEC/EN 61010-1).

- Connect the female connector of the connection cable to the male connector of the sensor.
- Connect the open end of the connection cable to the power supply and/or processing units.

6.1 Wiring diagrams

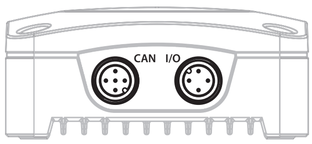


Fig. 13: Location of the connectors

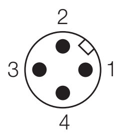


Fig. 14: Pin assignment for male connector 1 (IO-Link and switching outputs)

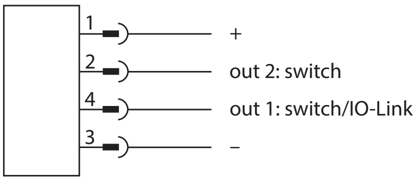


Fig. 15: Wiring diagram for male connector 1 (IO-Link and switching outputs)

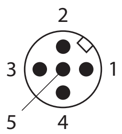


Fig. 16: Pin assignment for male connector 2 (SAE J1939)

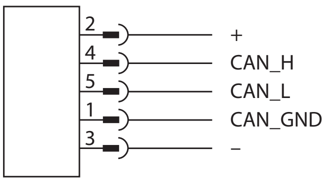


Fig. 17: Wiring diagram for male connector 2 (SAE J1939)

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7 Commissioning

After connecting and switching on the power supply, the device is automatically ready for operation.

7.1 Commissioning using IO-Link

NOTE
The voltage range in IO-Link mode is 18…30 VDC.

Turck recommends using the Turck Automation Suite (TAS) to facilitate commissioning using IO-Link. TAS can be used to display all parameters and process data. The Turck Radar Monitor can also be visualized in TAS.

7.1.1 Initiating IO-Link mode

▶ Set a cycle time of at least 2.3 ms on the IO-Link master.

➪ The device is operational. After a readiness delay of 450 ms, the process data can be sent to the IO-Link master.

7.1.2 IO-Link process data

Process input data

Byte no.	**Bit**							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0		No measurement data					Switching signal channel 4.2	Switching signal channel 4.1
1	Scaling velocity							
2	Velocity							
3								
4	Signal field 3 Bit 2	Signal field 3 Bit 1	Signal field 2 Bit 2	Signal field 2 Bit 1	Signal field 1 Bit 2	Signal field 1 Bit 1	Switching signal channel 3.2	Switching signal channel 3.1
5	Scaling of elevation angle							
6	Elevation angle							
7								
8	Radius 6	Radius 5	Radius 4	Radius 3	Radius 2	Radius 1	Switching signal channel 2.2	Switching signal channel 2.1
9	Scaling of azimuth angle							
10	Azimuth angle							
11								
12	Signal strength						Switching signal channel 1.2	Switching signal channel 1.1
13	Scaling of distance							
14	Distance							
15								

Designation	Scaling	Value range	Meaning
Distance	1 mm/bit	0…64255 mm	Distance between an object and the sensor.
Azimuth angle	0.5°/bit	-65…+60°	Process value for the azimuth angle at which an object is to the sensor.
Elevation angle	0.5°/bit	-65…+60°	Process value for the elevation angle at which an object is to the sensor.
Velocity	0.1 m/s/bit	-9…+9 m/s	Velocity of a detected object
Signal strength	2 %	0…126 %	The strength of the signal that reflects a detected object
No measurement data			0: object detected within the detection range, process data is output 1: no object detected within the detection range
Radius 1…6			0: no object detected within radius … 1: object detected within radius …
Internal error			Error, diagnostics available
Signal field 1…3 Bit 1			The status of a signal field is the result of combining two bits (see table "Status of a signal field": Possible bit combinations)
Signal field 1…3 Bit 2			

Status of a signal field: possible bit combinations

Bit 1	Bit 2	Meaning
0	0	No object in the signal field, signal field not shaded
1	0	Signal field shaded
0	1	Collision detected
1	1	Collision detected, signal field shaded

Process output data

Byte no.	Bit							
	7	6	5	4	3	2	1	0
0	Process output data							

7.2 Activating SIO mode

▶ Connect the device to a standard I/O port or an analog port.

➪ The device is operational after a readiness delay of 500 ms.

The readiness delay in SIO mode is required to operate preactivated sensors so that the sensor can exclude being connected to an IO-Link master. The readiness delay does not have an effect on any potential IO-Link communication.

7.3 Commissioning using SAE J1939

Upon power up, the device sends a J1939 Packet over CAN called a NAME. The NAME is a 64 bit (8 bytes) designation that provides a unique identity to each item.

The last byte in the identifier specifies the J1939 address. The default address of the sensor is 0x80 ($128_{dec.}$). The value range for the address is 0x80…0xF7 ($128_{dec.}$…$247_{dec.}$). The NAME is transferred in Little Endian format in the data field and is structured as follows:

Freely selectable address	Industry group	Vehicle system instance	Vehicle system	Reserved	Function	Function instance	ECU instance	Manufacturer code	Identity number
1 bit	3 bits	4 bits	7 bits	1 bit	8 bits	5 bits	3 bits	11 bits	21 bits

Byte no.	Bit							
	7	6	5	4	3	2	1	0
0	Identification number, LSB → MSB							
1								
2	Manufacturer code, LSB → MSB			Identity number				
3	Manufacturer code							
4	Function instance					ECU instance		
5	Function							
6	Vehicle system							Reserved
7	Freely selectable address	Industry group			Vehicle system instance			

7.3.1 SAE J1939 parameter data

PGN 0xEF… (Proprietary A) is used to transfer the data. The default address of the sensor is 0x80 ($128_{dec.}$). The value range for the address is 0x80…0xF7 ($128_{dec.}$…$247_{dec.}$).

The parameter data consists of 8 bytes with the following content:

Byte no.	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	Index (LSB…MSB)							
1								
2	Subindex (LSB…MSB)							
3	r/w (MSB)	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved (LSB)
4	Data (LSB…MSB)							
5								
6								
7								

In addition to the parameter data, the ID of the device must be included in the sent frame. The ID has the following structure:

Byte	Contents
0	0x18
1	PGN 0xEF (Proprietary A)
2	Sensor address
3	Address of SAE J1939 manager

SAE J1939: Parameter overview

Name	Index	Sub-index	Access	Value	Description
Standard command	0x2	0x0	Write	0x80	System command
				0x81	Reset application
				0x82	Restore factory settings
				0x83	Back-to-box
Number of defects	0x20	0x0	Read		
Operating hours	0x48	0x0	Read		
SSC 1.1 (distance)	0x49	0x1	Read		
SSC 1.2 (distance)	0x49	0x2	Read		
SSC 2.1 (azimuth)	0x49	0x3	Read		
SSC 2.2 (azimuth)	0x49	0x4	Read		
SSC 3.1 (elevation)	0x49	0x5	Read		
SSC 3.2 (elevation)	0x49	0x6	Read		
SSC 4.1 (velocity)	0x49	0x7	Read		
SSC 4.2 (velocity)	0x49	0x8	Read		
Operating hours limit	0x4A	0x0	Read/ write	0…71582788	
SSC 1.1 (distance)	0x4B	0x1	Read/ write		

Name	Index	Sub-index	Access	Value	Description
SSC 1.2 (distance)	0x4B	0x2	Read/write		
SSC 2.1 (azimuth)	0x4B	0x3	Read/write		
SSC 2.2 (azimuth)	0x4B	0x4	Read/write		
SSC 3.1 (elevation)	0x4B	0x5	Read/write		
SSC 3.2 (elevation)	0x4B	0x6	Read/write		
SSC 4.1 (velocity)	0x4B	0x7	Read/write		
SSC 4.2 (velocity)	0x4B	0x8	Read/write		
Polarity	0x53	0x0	Read/write	0	PNP (U_B switching)
				1	NPN (GND switching)
				2	Automatic detection
SSC 1.1: Distance	0x56	0x1	Read/write	0	Off
				1	On
SSC 1.2: Distance	0x56	0x2	Read/write	0	Off
				1	On
SSC 2.1: Azimuth	0x56	0x3	Read/write	0	Off
				1	On
SSC 2.2: Azimuth	0x56	0x4	Read/write	0	Off
				1	On
SSC 3.1: Elevation	0x56	0x5	Read/write	0	Off
				1	On
SSC 3.2: Elevation	0x56	0x6	Read/write	0	Off
				1	On
SSC 4.1: Velocity	0x56	0x7	Read/write	0	Off
				1	On
SSC 4.2: Velocity	0x56	0x8	Read/write	0	Off
				1	On
Polarity	0x5F	0x0	Read/write	0	PNP (UB switching)
				1	NPN (GND switching)
				2	Automatic detection
Distance	0x69	0x1	Read	300…15050	
Azimuth	0x69	0x2	Read	-650…650	
Elevation	0x69	0x3	Read	-650…650	
Velocity	0x69	0x4	Read	-90…90	
Distance	0x6A	0x1	Read	300…15050	
Azimuth	0x6A	0x2	Read	-650…650	
Elevation	0x6A	0x3	Read	-650…650	
Velocity	0x6A	0x4	Read	-90…90	

Name	Index	Sub-index	Access	Value	Description
Switching output damping	0x71	0x0	Read/ write	0…800	
SSC 1.1: Switch-on delay, distance	0x78	0x1	Read/ write	0…600	
SSC 1.2: Switch-on delay, distance	0x78	0x2	Read/ write	0…600	
SSC 2.1: Switch-on delay, azimuth	0x78	0x3	Read/ write	0…600	
SSC 2.2: Switch-on delay, azimuth	0x78	0x4	Read/ write	0…600	
SSC 3.1: Switch-on delay, elevation	0x78	0x5	Read/ write	0…600	
SSC 3.2: Switch-on delay, elevation	0x78	0x6	Read/ write	0…600	
SSC 4.1: Switch-on delay, velocity	0x78	0x7	Read/ write	0…600	
SSC 4.2: Switch-on delay, velocity	0x78	0x8	Read/ write	0…600	
SSC 1.1: switch-off delay, distance	0x79	0x1	Read/ write	0…600	
SSC 1.2: Switch-off delay, distance	0x79	0x2	Read/ write	0…600	
SSC 2.1: Switch-off delay, azimuth	0x79	0x3	Read/ write	0…600	
SSC 2.2: Switch-off delay, azimuth	0x79	0x4	Read/ write	0…600	
SSC 3.1: Switch-off delay, elevation	0x79	0x5	Read/ write	0…600	
SSC 3.2: Switch-off delay, elevation	0x79	0x6	Read/ write	0…600	
SSC 4.1: Switch-off delay, velocity	0x79	0x7	Read/ write	0…600	
SSC 4.2: Switch-off delay, velocity	0x79	0x8	Read/ write	0…600	
Signal strength display	0x7C	0x0	Read/ write	0	Off
				1	On
Azimuth angle suppression, right	0x80	0x0	Read/ write	-600…500	
Azimuth angle suppression, left	0x81	0x0	Read/ write	-500…600	
Elevation angle suppression, downward	0x82	0x0	Read/ write	-600…500	
Elevation angle suppression, upward	0x83	0x0	Read/ write	-500…600	

Name	Index	Sub-index	Access	Value	Description
Signal amplitude filter mode	0x90	0x0	Read/ write	0	Deactivated
				1	Max. amplitude activated
				2	Min. amplitude activated
				3	Max. and min. amplitude activated
Max. amplitude	0x91	0x0	Read/ write	40…10000	
Min. amplitude	0x92	0x0	Read/ write	10…9970	
Foreground suppression	0x94	0x0	Read/ write	300…14950	
Background suppression	0x95	0x0	Read/ write	400…15050	
Object size	0xA9	0x0	Read/ write	0	0.15 m
				1	0.5 m
				2	0.75 m
				3	1 m
Radar exposure time	0xAA	0x0	Read/ write	2	2
				3	3
				4	4
				5	5
Precision mode	0xAB	0x0	Read/ write	0	Off
				1	On
Safety distance around objects	0xAC	0x0	Read/ write	0…500	
Radius 1	0xB0	0x1	Read/ write	0…15000	
				0	Deactivated
Radius 2	0xB0	0x2	Read/ write	0…15000	
				0	Deactivated
Radius 3	0xB0	0x3	Read/ write	0…15000	
				0	Deactivated
Radius 4	0xB0	0x4	Read/ write	0…15000	
				0	Deactivated
Radius 5	0xB0	0x5	Read/ write	0…15000	
				0	Deactivated
Radius 6	0xB0	0x6	Read/ write	0…15000	
				0	Deactivated
Signal field 1: Distance, near	0xB1	0x1	Read/ write	0…15000	
				0	Deactivated
Signal field 1: Distance, far	0xB1	0x2	Read/ write	0…15000	
				0	Deactivated
Signal field 1: Azimuth, right	0xB1	0x3	Read/ write	-600…600	

Name	Index	Sub-index	Access	Value	Description
Signal field 1: Azimuth, left	0xB1	0x4	Read/ write	-600…600	
Signal field 1: Elevation, downward	0xB1	0x5	Read/ write	-600…600	
Signal field 1: Elevation, upward	0xB1	0x6	Read/ write	-600…600	
Signal field 2: Distance, near	0xB2	0x1	Read/ write	0…15000	
				0	Deactivated
Signal field 2: Distance, far	0xB2	0x2	Read/ write	0…15000	
				0	Deactivated
Signal field 2: Azimuth, right	0xB2	0x3	Read/ write	-600…600	
Signal field 2: Azimuth, left	0xB2	0x4	Read/ write	-600…600	
Signal field 2: Elevation, downward	0xB2	0x5	Read/ write	-600…600	
Signal field 2: Elevation, upward	0xB2	0x6	Read/ write	-600…600	
Signal field 3: Distance, near	0xB3	0x1	Read/ write	0…15000	
				0	Deactivated
Signal field 3: Distance, far	0xB3	0x2	Read/ write	0…15000	
				0	Deactivated
Signal field 3: Azimuth, right	0xB3	0x3	Read/ write	-600…600	
Signal field 3: Azimuth, left	0xB3	0x4	Read/ write	-600…600	
Signal field 3: Elevation, downward	0xB3	0x5	Read/ write	-600…600	
Signal field 3: Elevation, upward	0xB3	0x6	Read/ write	-600…600	
Switching outputs	0xB4	0x1	Read/ write	0	Switching at both outputs/collision detection off
				1	Switching at output 1/collision detection at output 2
				2	Switching at output 2/collision detection at output 1
				3	Collision detection at both outputs

Name	Index	Sub-index	Access	Value	Description
Collision detection switching output 1	0xB4	0x2	Read/ write	0	Off
				1	Radius 1
				2	Radius 2
				3	Radius 3
				4	Radius 4
				5	Radius 5
				6	Radius 6
				10	Signal field 1
				11	Signal field 2
				12	Signal field 3
Collision detection switching output 2	0xB4	0x3	Read/ write	0	Off
				1	Radius 1
				2	Radius 2
				3	Radius 3
				4	Radius 4
				5	Radius 5
				6	Radius 6
				10	Signal field 1
				11	Signal field 2
				12	Signal field 3
Logic output 1	0xB4	0x4	Read/ write	False	Normally open contact NOC
				True	Normally closed contact NCC
Polarity output 1	0xB4	0x5	Read/ write	0	PNP
				1	NPN
				2	Automatic detection
Logic output 2	0xB4	0x6	Read/ write	False	Normally open contact NOC
				True	Normally closed contact NCC
Polarity output 2	0xB4	0x7	Read/ write	0	PNP
				1	NPN
				2	Automatic detection
Suppressing stationary objects	0xB5	0x0	Read/ write	0	All objects
				1	Moving objects only
Sensor alignment	0xC8	0x0	Read/ write	0	0° M12 male connector, bottom (default)
				1	90°
				2	180°
				3	270°
Detection threshold	0xCE	0x0	Read/ write	50…350	
Object concentration in distance	0xCF	0x0	Read/ write	0	Widespread
				1	Concentrated

Name	Index	Sub-index	Access	Value	Description
Physical output 1	0xD1	0x0	Read/ write	0	Distance
				1	Azimuth
				2	Elevation
				3	Velocity
Physical output 2	0xD2	0x0	Read/ write	0	Distance
				1	Azimuth
				2	Elevation
				3	Velocity
SSC 1.1: SP1	0x3C	0x1	Read/ write	400…15000	
SSC 1.1: SP2	0x3C	0x2	Read/ write	350…14950	
SSC 1.1: Logic	0x3D	0x0	Read/ write	0	Normally open contact NOC
				1	Normally closed contact NCC
SSC 1.1: Switching mode	0x3D	0x1	Read/ write	0	Deactivated
				1	Single point mode
				2	Window mode
				3	Two point mode
SSC 1.1: Hysteresis	0x3D	0x2	Read/ write	50…14650	
SSC 1.2: SP1	0x3E	0x0	Read/ write	400…15000	
SSC 1.2: SP2	0x3E	0x1	Read/ write	350…14950	
SSC 1.2: Logic	0x3F	0x0	Read/ write	0	Normally open contact NOC
				1	Normally closed contact NCC
SSC 1.2: Switching mode	0x3F	0x1	Read/ write	0	Deactivated
				1	Single point mode
				2	Window mode
				3	Two point mode
SSC 1.2: Hysteresis	0x3F	0x2	Read/ write	50…14650	
SSC 2.1: SP2	0x400C	0x2	Read/ write	-600…500	
SSC 2.1: Logic	0x400D	0x1	Read/ write	0	Normally open contact NOC
				1	Normally closed contact NCC
SSC 2.1: Switching mode	0x400D	0x2	Read/ write	0	Deactivated
				1	Single point mode
				2	Window mode
				3	Two point mode
SSC 2.1: Hysteresis	0x400D	0x3	Read/ write	50…14650	
SSC 2.2: SP1	0x400E	0x1	Read/ write	400…15000	

Name	Index	Sub-index	Access	Value	Description
SSC 2.2: SP2	0x400E	0x2	Read/ write	350…14950	
SSC 2.2: Logic	0x400F	0x1	Read/ write	0	Normally open contact NOC
				1	Normally closed contact NCC
SSC 2.2: Switching mode	0x400F	0x2	Read/ write	0	Deactivated
				1	Single point mode
				2	Window mode
				3	Two point mode
SSC 2.2: Hysteresis	0x400F	0x3	Read/ write	50…14650	
SSC 3.1: SP1	0x401C	0x1	Read/ write	400…15000	
SSC 3.1: SP2	0x401C	0x2	Read/ write	350…14950	
SSC 3.1: Logic	0x401D	0x1	Read/ write	0	Normally open contact NOC
				1	Normally closed contact NCC
SSC 3.1: Switching mode	0x401D	0x2	Read/ write	0	Deactivated
				1	Single point mode
				2	Window mode
				3	Two point mode
SSC 3.1: Hysteresis	0x401D	0x3	Read/ write	50…14650	
SSC 3.2: SP1	0x401E	0x1	Read/ write	400…15000	
SSC 3.2: SP2	0x401E	0x2	Read/ write	350…14950	
SSC 3.2: Logic	0x401F	0x1	Read/ write	0	Normally open contact NOC
				1	Normally closed contact NCC
SSC 3.2: Switching mode	0x401F	0x2	Read/ write	0	Deactivated
				1	Single point mode
				2	Window mode
				3	Two point mode
SSC 3.2: Hysteresis	0x401F	0x3	Read/ write	50…14650	
SSC 4.1: SP1	0x402C	0x1	Read/ write	400…15000	
SSC 4.1: SP2	0x402C	0x2	Read/ write	350…14950	
SSC 4.1: Logic	0x402D	0x1	Read/ write	0	Normally open contact NOC
				1	Normally closed contact NCC
SSC 4.1: Switching mode	0x402D	0x2	Read/ write	0	Deactivated
				1	Single point mode
				2	Window mode
				3	Two point mode

Name	Index	Sub-index	Access	Value	Description
SSC 4.1: Hysteresis	0x402D	0x3	Read/ write	50…14650	
SSC 4.2: SP1	0x402E	0x1	Read/ write	400…15000	
SSC 4.2: SP2	0x402E	0x2	Read/ write	350…14950	
SSC 4.2: Logic	0x402F	0x1	Read/ write	0	Normally open contact NOC
				1	Normally closed contact NCC
SSC 4.2: Switching mode	0x402F	0x2	Read/ write	0	Deactivated
				1	Single point mode
				2	Window mode
				3	Two point mode
SSC 4.2: Hysteresis	0x402F	0x3	Read/ write	50…14650	

7.3.2 SAE J1939 process data

The device transmits 64-bit process data to the higher-level controller via the SAE J1939 interface. PG 0xFF20 ($65312_{dec.}$) is used to transfer the data. The process data is structured as follows:

Byte no.	Bit							
	7	**6**	**5**	**4**	**3**	**2**	**1**	**0**
0	Distance							
1								
2	Azimuth angle							
3	Elevation angle							
4	Velocity							
5	Signal strength							
6	Radius 6	Radius 5	Radius 4	Radius 3	Radius 2	Radius 1	Reserved	No measurement data
7	Signal field 3 Bit 2	Signal field 3 Bit 1	Signal field 2 Bit 2	Signal field 2 Bit 1	Signal field 1 Bit 2	Signal field 1 Bit 1	Reserved	Internal error

Meaning of the status bits

NOTE
Depending on the setting, the process values refer to the object that is closest to the sensor or that reflects most strongly.

Designation	Slot name	Slot identifier	Scaling	Value range	Meaning
Distance	SAEds12	231	1 mm/bit	0…64255 mm	Distance between an object and the sensor.
Azimuth angle	SAEad10	248	0.5°/bit	-65…+60°	Process value for the azimuth angle at which an object is to the sensor.
Elevation angle	SAEad10	248	0.5°/bit	-65…+60°	Process value for the elevation angle at which an object is to the sensor.
Velocity	Proprietary		0.1 m/s/bit	-9…+9 m/s	Velocity of a detected object
Signal strength	Proprietary		2 %	0…126 %	The strength of the signal that reflects a detected object
No measurement data					0: object detected within the detection range, process data is output 1: no object detected within the detection range
Radius 1…6					0: no object detected within radius … 1: object detected within radius …
Internal error					Error, diagnostics available

Designation	Slot name	Slot identifier	Scaling	Value range	Meaning
Signal field 1…3 Bit 1					The status of a signal field is the result of combining two bits (see table "Status of a signal field": Possible bit combinations)
Signal field 1…3 Bit 2					

Status of a signal field: possible bit combinations

Bit 1	Bit 2	Meaning
0	0	No object in the signal field, signal field not shaded
1	0	Signal field shaded
0	1	Collision detected
1	1	Collision detected, signal field shaded

8 Setting and parameterization

Parameterization via IO-Link is explained in the IO-Link commissioning manual. The behavior of the sensor can be adapted to the specific application via IO-Link and TAS. In addition to the output behavior in accordance with the Smart Sensor Profile and mapping the switching outputs in SIO mode, it is also possible to e.g. set the following measurement-specific parameters:

- Detection parameters that influence the detection performance of the sensor
- Object parameters that influence the evaluation of the raw data for object detection
- Filter parameters for adapting the detection range to the application
- Collision parameters for setting radii and signal fields

8.1 Setting and visualizing with the Turck Radar Monitor

The device can be parameterized and tested using TAS (Turck Automation Suite). The IODD can be read in via TAS such that all parameters of the IODD can be accessed.

An overview of the IO-Link parameters and descriptions can be found via the IODDfinder. The Turck Radar Monitor is also available for visualizing process data.

A Turck IO-Link master is required to access the sensor parameters and the Turck Radar Monitor.

Refer to the instructions for use of the relevant device for information on the Turck IO-Link masters.

- ▶ Connect the IO-Link master to the power supply.
- ▶ Connect the IO-Link master to a PC via the Ethernet interface.
- ▶ Connect the sensor to an IO-Link port of the IO-Link master.

8.1.1 Reading IODD into TAS

- ▶ Set the input port of the IO-Link master as an IO-Link port.
- ▶ Open the **IO-LINK** tab in TAS.
- ▶ Load the device-specific IODD into TAS via **Load IODD**.

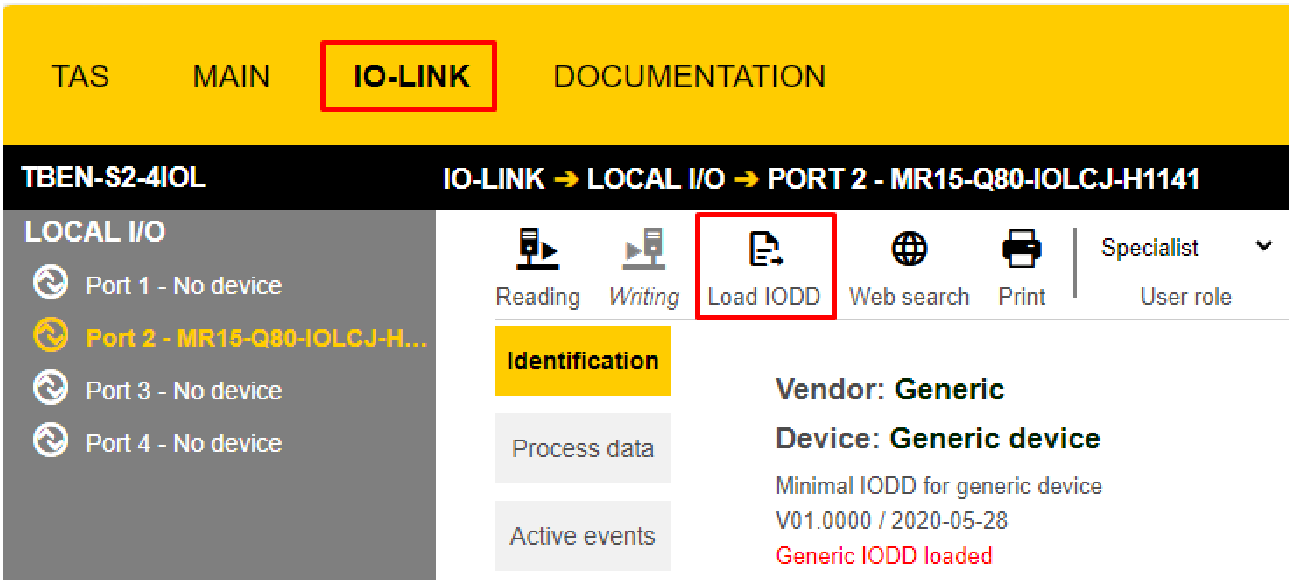

Fig. 18: Loading the IODD

8.1.2 Turck Radar Monitor: Overview

The Turck Radar Monitor makes it possible to visualize the process data and filter signals. The display consists of:

- FFT diagram
- Object detection

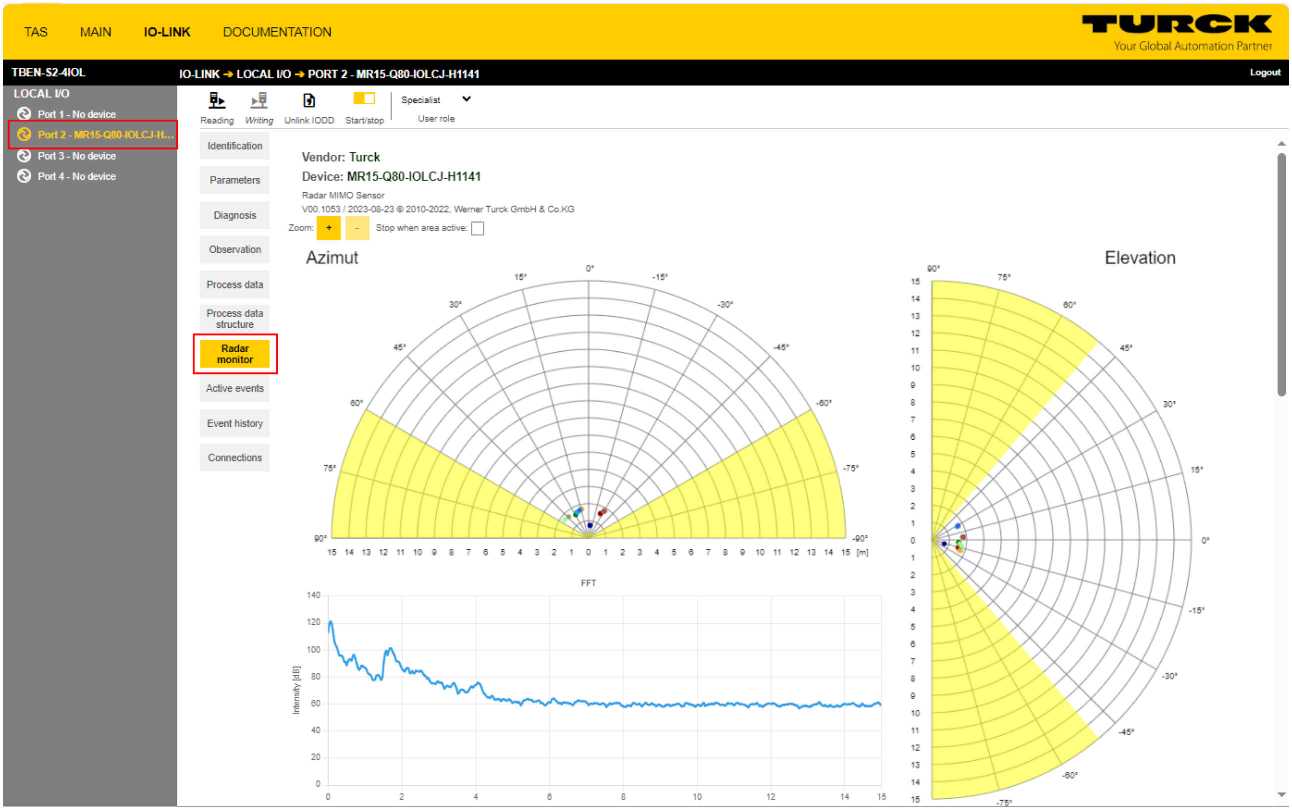

Fig. 19: Turck Radar Monitor visualization

In Turck Radar Monitor, three-dimensional object detection is represented by two planar axes:

- Azimuth: horizontal detection range
- Elevation: vertical detection range

The zoom function can be used to enlarge or reduce the size of the view. If **Stop when area active** is selected, the radar monitor update stops when an object is found in one of the specified areas. The **FFT** diagram shows the signal intensity curve.

The **Distance unit** parameter can be used to select between mm, m, in, ft and yd. Changing the unit of measurement also changes the scaling of the radar monitor.

The objects detected by the sensor are listed in a table in Turck Radar Monitor. The following object data is assigned to each object detected:

- Distance to the sensor
- Azimuth angle
- Elevation angle
- Velocity
- Signal intensity

Dist. [m]	Δ Dist. [mm]	Azi.[°]	Δ Azi.[°]	Elev.[°]	Δ Elev.[°]	Velo. [m/s]	Ampl.[dB]
2.221	135	-2.6	1.8	0.8	1.7	0.00	106.4
6.245	34	-34	0	18.2	0	0.00	92.7
6.261	67	-31.7	0	18.2	0	0.00	92.8
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

Fig. 20: Turck Radar Monitor table

The sensor also calculates a delta value from the distance values and the angle values. The delta becomes larger as more data points are combined to form an object or as the object size parameter expands further. The information regarding distance, elevation angle and azimuth angle in the radar monitor indicate the center of an object. The delta values indicate the object outlines.

8.1.3 Setting the sensor sensitivity

The sensor sensitivity can be set using the detection threshold of the sensor and the expected density of the object being detected.

- ▶ Adjust the sensor sensitivity for the specific application as specified in the table below.

Parameter	Options	Function	Explanation
Detection threshold		5…35 dB in increments of 1 dB **Default: 6.0 dB**	The smaller the value, the more sensitive the sensor.
Object density	Concentrated	Adaptation of the object detection algorithm depending on the situation	Setting to be used in environments in which many objects are expected to be detected
	Widespread		Setting to be used in environments in which few objects are expected to be detected
Precision mode	On		Optimizes the sensor for pure distance measurement. The sensor becomes more accurate.
	Off		

8.1.4 Setting object parameters

The sensor can be adjusted to the expected objects using the object parameters.

- Set the object parameters as specified in the table below:

Parameter	Options	Function	Explanation
Object size	**0.15 m**		The algorithm for object generation combines detected data points within the selected radius into an object. The larger the selected value, the more data points are combined into one object.
	0.5 m		
	0.75 m		
	1 m		
Safety distance around objects		0…500 mm in increments of 1 mm **Default: 0 mm**	Defines a distance to a detected object. A detected object is virtually enlarged by the distance.
Radar exposure time	2	Number of images superimposed by the sensor for object detection.	The longer the radar exposure time, the more effectively weakly reflective targets can be detected. [▷ 11].
	3		
	4		
	5		
Suppressing stationary objects	All objects		The sensor detects all recognized objects.
	Moving objects only		The sensor only detects moving objects.
Object selection	Next object		The sensor detects the next object within the detection range.
	Strongest object		The sensor detects the object with the strongest signal intensity.

8.1.5 Filtering signals

The device has filter options for suppressing interference signals. It is possible to suppress the foreground and background and adjust the azimuth and elevation angles.

Parameter	Options	Function	Explanation
Signal amplitude filter mode	Deactivated	Signal amplitude filter disabled	
	Max. amplitude activated	Opens the input window for max. signal amplitude, which will be used for filtering.	
	Min. amplitude activated	Opens the input window for min. signal amplitude, which will be used for filtering.	
	Max. and min. amplitude activated	Opens the input window for max. and min. signal amplitude, which will be used for filtering.	
Min. amplitude		1…997 dB in increments of 0.1 dB Default: off	Only visible if the **min. amplitude** option is activated or **max. and min. amplitude activated** is selected in the **signal amplitude filter mode** parameter. The value for **min. Amplitude** must be at least 3 dB lower than the value for **max. amplitude**.
Max. amplitude		4…1000 dB in increments of 0.1 dB Default: off	Only visible if the **max. amplitude** option is activated or **max. and min. amplitude activated** is selected in the **signal amplitude filter mode** parameter. The value for **max. amplitude** must be at least 4 dB lower than the value for **min. amplitude**.
Foreground suppression		300…14950 mm in increments of 1 mm Default: 300 mm	The minimum distance between foreground and background suppression is 100 mm. Example: If the foreground suppression is set to 1000 mm, the background suppression must be ≤ 900 mm or ≥ 1100 mm.
Background suppression		400…14950 mm in increments of 1 mm Default: 15050 mm	
Azimuth angle suppression, right		Default: -60°	Value for limiting the azimuth angle to the right. The value entered must be less than the value of the **Azimuth angle suppression, left** parameter.
Azimuth angle suppression, left		Default: +60°	Value for limiting the azimuth angle to the right. The value entered must be more than the value of the **Azimuth angle suppression, right** parameter.
Elevation angle suppression, upward		Default: +50°	Value for limiting the elevation angle upward. The value entered must be more than the value of the **Elevation angle suppression, downward** parameter.

Parameter	Options	Function	Explanation
Elevation angle suppression, downward		Default: -50°	Value for limiting the elevation angle downward. The value entered must be less than the value of the **Elevation angle suppression, upward** parameter.

8.1.6 Setting the collision radii

Up to six collision radii can be set independently of each other. If an object is detected within a radius, the sensor outputs a signal.

Parameter	Options	Function	Explanation
Radius 1…6	**Deactivated**		
	Enter value	350…15000 mm in increments of 1 mm	

8.1.7 Configuring signal fields

Up to three application-specific signal fields can be set independently of each other. The signal fields can also overlap. If an object is detected within a signal field, the sensor outputs a signal. Depending on the parameterization, the signal can be output as a switching signal at one of the outputs or via the process data. A signal field must be defined using the distance to the sensor, azimuth angle and elevation angle.

- ▶ Configure the signal fields as per the table below:

Parameter	Options	Function	Explanation
Signal field 1…3: Distance, near	**Deactivated**		
	Enter value	350…15000 mm in increments of 1 mm	Distance value for the start of the signal field (closer to the sensor). The value entered must be less than the value of the parameter **Signal field 1…3: Distance, far**
Signal field 1…3: Distance, far	**Deactivated**		
	Enter value	350…15000 mm in increments of 1 mm	Distance value for the end of the signal field (further away from the sensor). The value entered must be more than the value of the parameter **Signal field 1…3: Distance, near**
Signal field 1…3: Azimuth, right	**Deactivated**		
	Enter value	-60…+60° in increments of 1°	Value for propagating the azimuth angle to the right. The value entered must be less than the value of the parameter **Signal field 1…3: Azimuth, left**.
Signal field 1…3: Azimuth, left	**Deactivated**		
	Enter value	-60…+60° in increments of 1°	Value for propagating the azimuth angle to the left. The value entered must be more than the value of the parameter **Signal field 1…3: Azimuth, right**.
Signal field 1…3: Elevation, upward	**Deactivated**		

Parameter	Options	Function	Explanation
	Enter value	-50…+50° in increments of 1°	Value for propagating the elevation angle upward. The value entered must be more than the value of the parameter **Signal field 1…3: Elevation, downward**.
Signal field 1…3: Elevation, downward	**Deactivated**		
	Enter value	-50…+50° in increments of 1°	Value for propagating the elevation angle downward. The value entered must be less than the value of the parameter **Signal field 1…3: Elevation, upward**.

8.1.8 Setting the signal strength indicator

The signal strength indicator can be used to set whether the signal strength of a detected object is to be displayed via the LEDs. For LED behavior, see [▹ 44].

- ▶ Switch the signal strength indicator on or off under Parameter --> General settings.

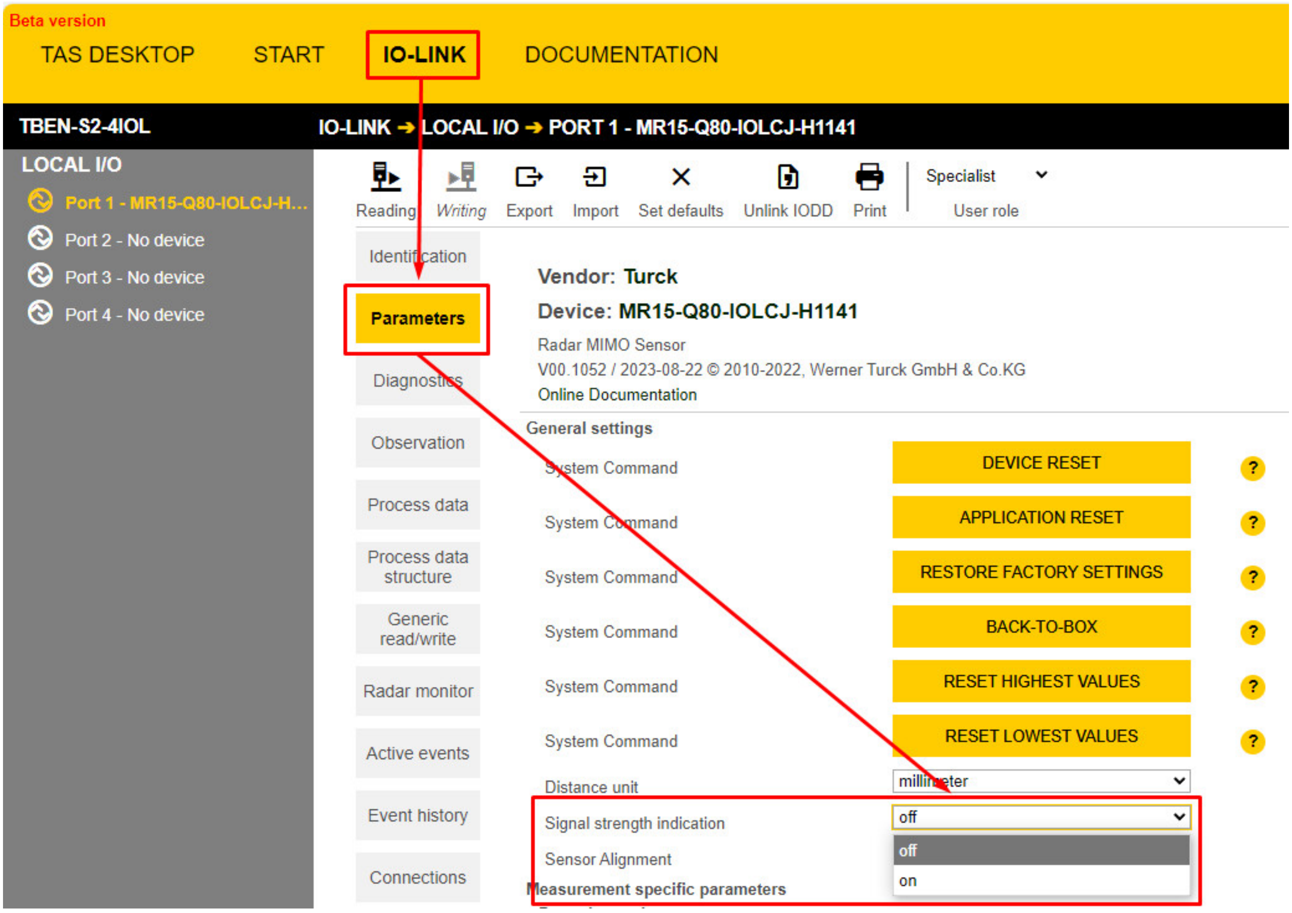

Fig. 21: Signal strength indicator in TAS

8.1.9 Setting the switching output

The following example shows the settings for the switching outputs in TAS. As an example, output 1 is set as a pure switching output in 2-point mode, and output 2 is set for collision detection for radius 1.

For pure switching outputs, the parameters for the corresponding channel must be set depending on the selected process value:

Process value	Output	Channel
Distance	1	1.1
	2	1.2
Azimuth angle	1	2.1
	2	2.2
Elevation angle	1	3.1
	2	3.2
Velocity	1	4.1
	2	4.2

The example shows settings for channel 2.1 (azimuth angle).

For collision detection, a radius or signal field must be set via the parameters or via the Turck Radar Monitor.

▶ In TAS, open the **Parameters** area.

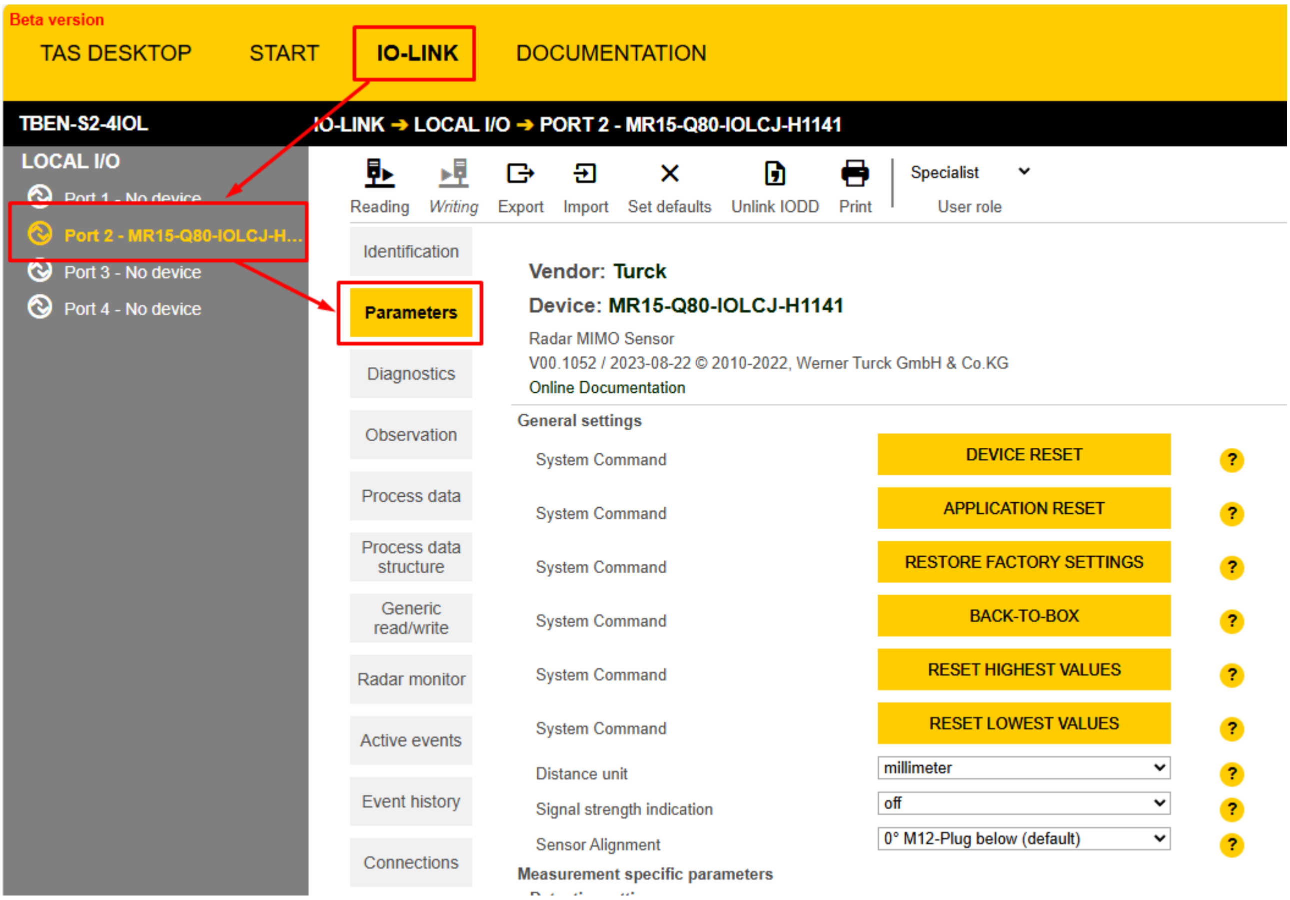

Fig. 22: Parameters in TAS

▶ Set the output behavior using the **Collision configuration** → **Configuration On/Off** parameter.

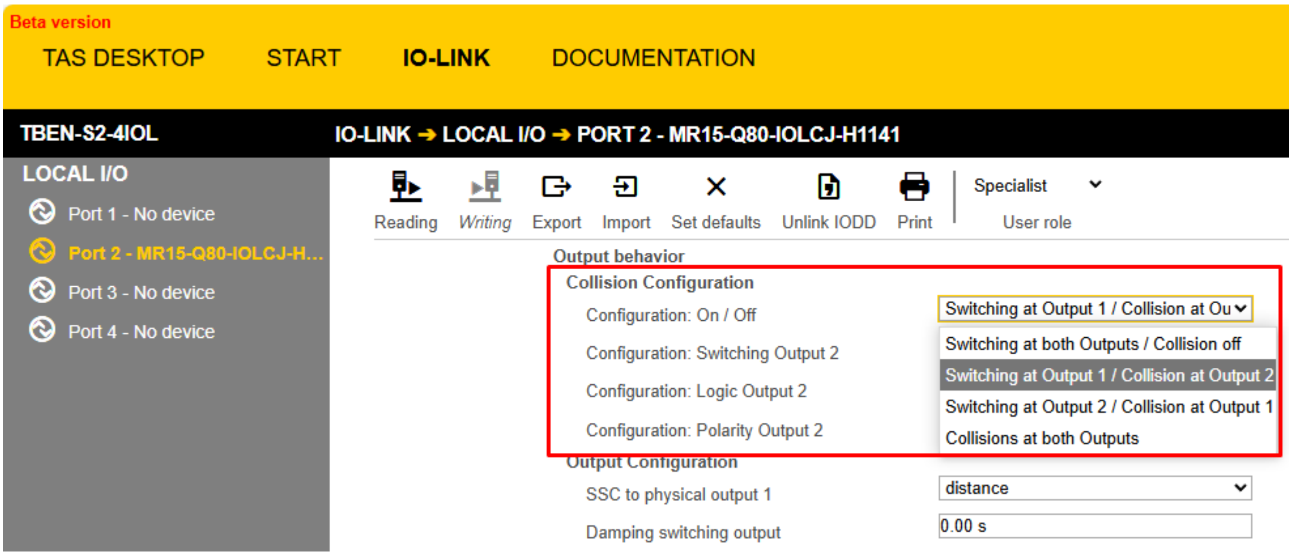

Fig. 23: Setting the output behavior

▶ Select the radius via the parameter **Collision configuration** → **Configuration: Switching output 2** (here: radius 1).

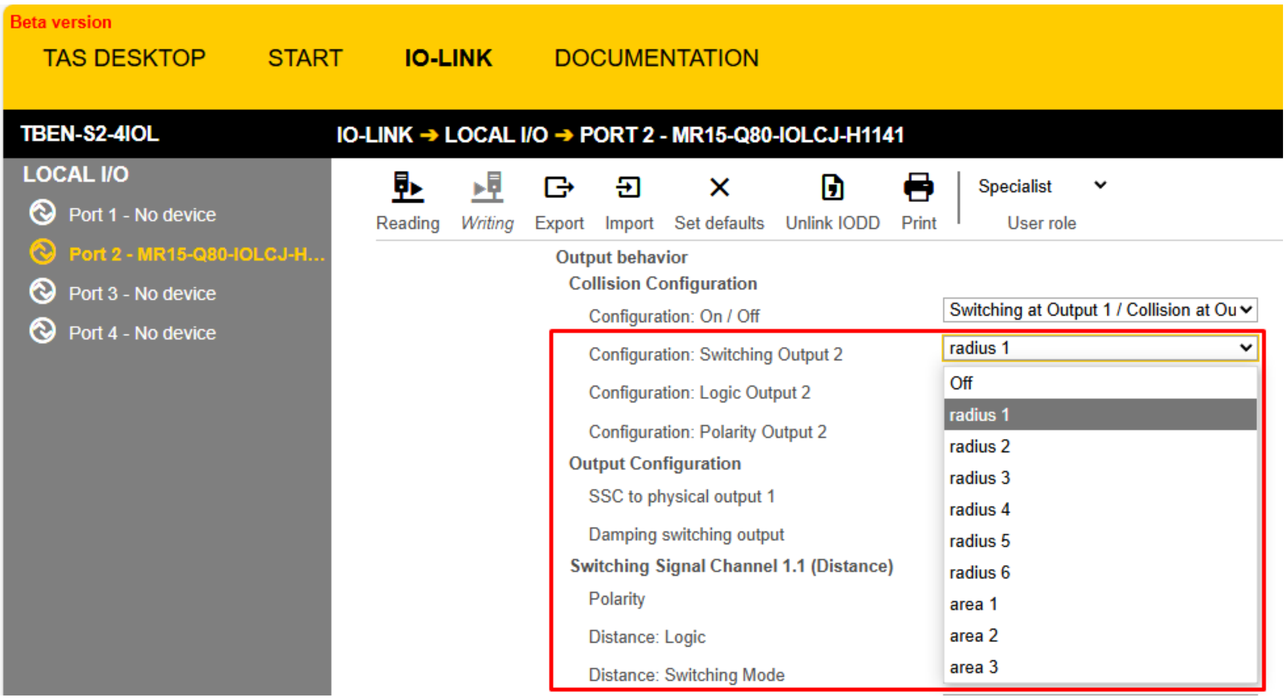

Fig. 24: Selecting a radius

- Define the radius (here: 600 mm).

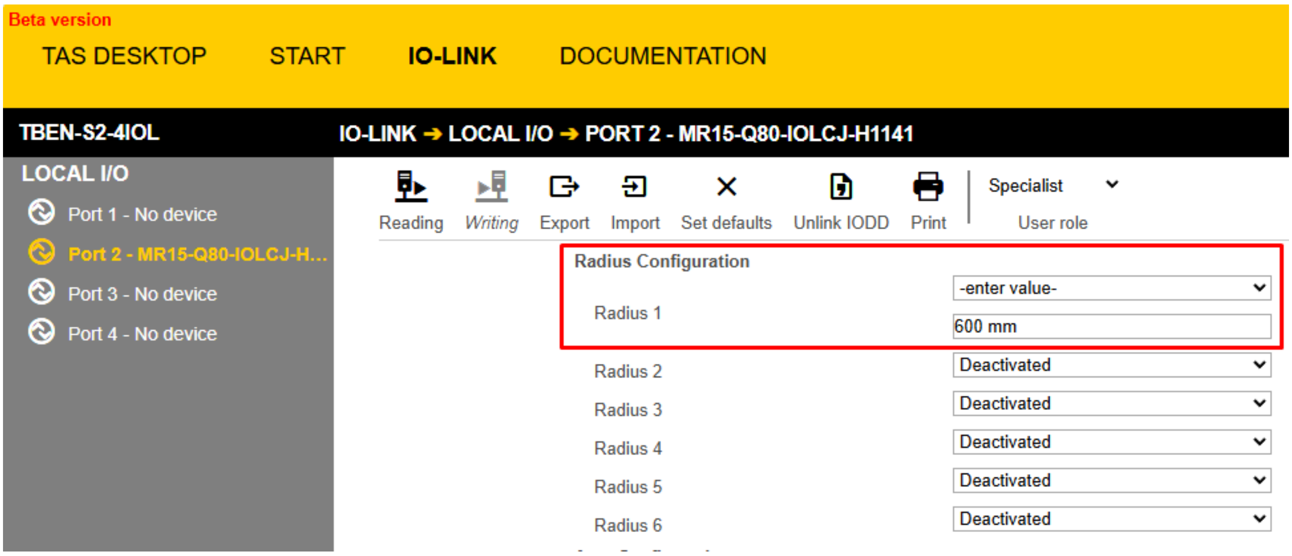

Fig. 25: Defining the radius

- Define the process value for switching output 1 (here: Azimuth angle).

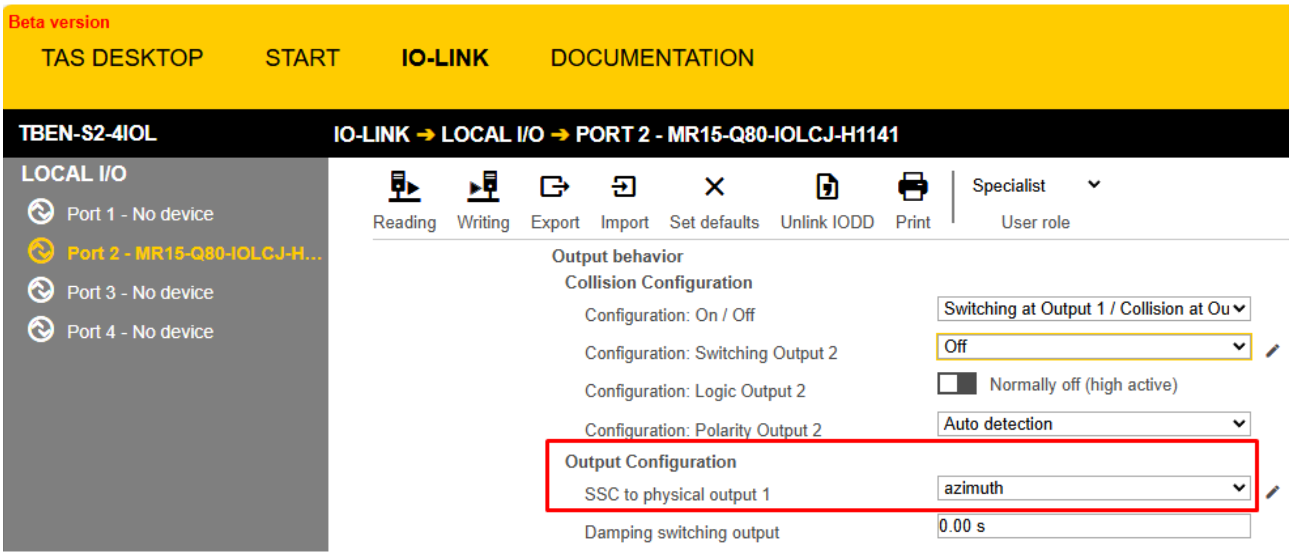

Fig. 26: Defining the azimuth angle as the process value

- Define the parameter for switching output 1 (here: Channel 2.1).

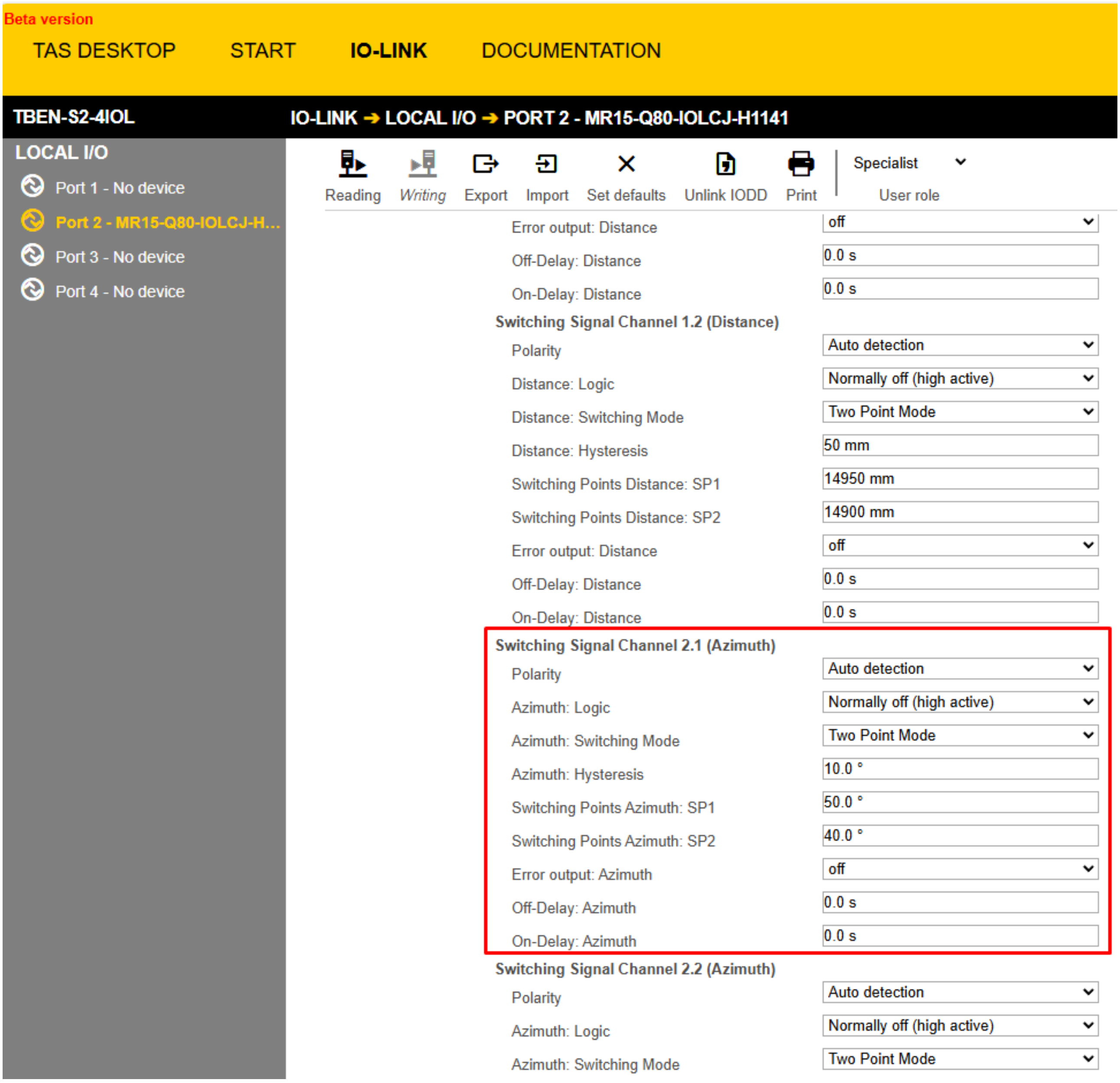

Fig. 27: Defining the parameter

- Click **Write** to save the settings to the device.

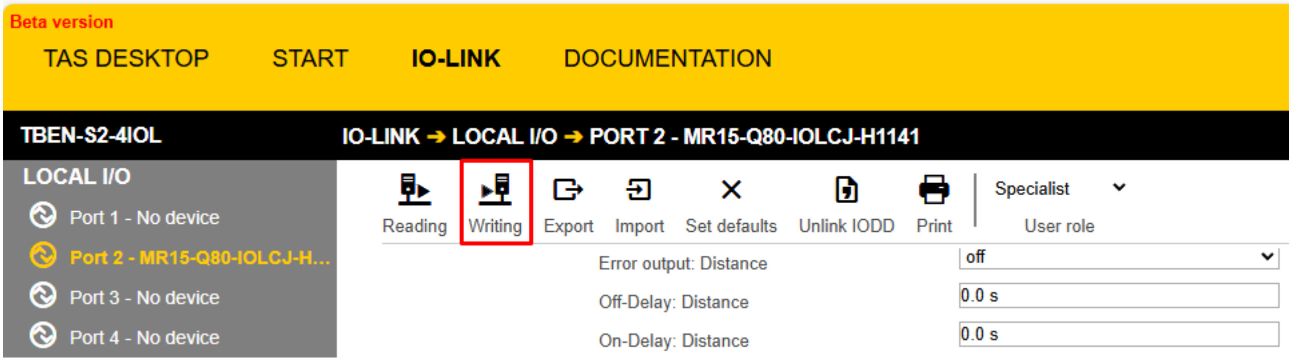

Fig. 28: Saving the settings

9 Operation

9.1 LEDs

PWR LED	Meaning
Green	Sensor ready for operation, signal strength > 108 dB
Green flashing (1 Hz)	Signal strength < 78 dB (when signal strength indicator is active)
Green flashing (4 Hz)	Signal strength < 108 dB (when signal strength indicator is active)
Yellow	Output 2 active
Yellow flashing	Short circuit at output 2

COM LED	Meaning
Green	SIO mode active
Green flashing (900 ms on/100 ms off)	IO-Link communication active
Green flashing (5 Hz)	CAN communication active
Yellow	Output 1 active
Red flashing	Bus connection interrupted
Red/green flashing	Address request: SAE J1939

APP LED	Meaning
Off	No object detected
Green	Object within detection range
Yellow	Object in range 1
Yellow flashing	Object in radius 1

9.2 Combined status displays

PWR	COM	APP	Meaning
Off	Off	Off	No voltage present
Red flashing (1 Hz)	Red flashing (1 Hz)	Red flashing (1 Hz)	Internal hardware fault
Green/yellow/red running light	Green/yellow/red running light	Green/yellow/red running light	Firmware update active
Green/yellow flashing	Green/yellow flashing	Green/yellow flashing	Wink command for device identification within the plant

10 Troubleshooting

If the device does not work as expected, proceed as follows:

- ▶ Exclude environmental disturbances.
- ▶ Check the connections of the device for errors.
- ▶ Check device for parameterization errors.

If the malfunction persists, the device is faulty. In this case, decommission the device and replace it with a new device of the same type.

11 Maintenance

The device is maintenance-free. Clean with a damp cloth if required.

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

Technical Data	MR15-Q80-IOLCJ-H1141
ID	100041054
Radar data	
Function	Radar button
Frequency range	60…64 GHz
Range	350…15000 mm
Resolution	1 mm
Minimum switching range	50 mm
Linearity error	≤ ± 0.3 %
Edge length of the norm target	100 mm
Output power ERP	10 dBm
Output power EIRP	20 dBm
Cone angle	120°
Repetition accuracy	4 mm
Electrical data	
Operating voltage	9…33 VDC
Residual ripple	< 10 % U_{ss}
DC rated operational current	≤ 250 mA
No-load current	≤ 400 mA
Short-circuit protection	Yes/cyclic
Reverse polarity protection	Yes
Communication protocol	IO-Link SAE J1939
Output function	NC/NO programmable, PNP/NPN
Output 2	Switching output
Voltage drop at I_e	≤ 2 V
Switching frequency	≤ 10 Hz
Startup delay	≤ 300 ms
Typical response time	< 70 ms
IO-Link	
IO-Link specification	V1.1
IO-Link port type	Class A
Communication mode	COM 3 (230.4 kBaud)
Process data width	128 bits
Measured value information	128 bits
Switching point information	17 bits
Frame type	2.2
Minimum cycle time	3 ms
Function pin 4	IO-Link

Technical Data	MR15-Q80-IOLCJ-H1141
Function pin 2	DI
Maximum cable length	20 m
Profile support	Smart Sensor Profile
Mechanical data	
Design	Rectangular, Q80
Dimensions	90.6 × 80 × 34.6 mm
Housing material	Plastic, PBT-GF20 die-cast aluminum alloy
Electrical connection	M12 × 1 connector
Ambient temperature	-40…+85 °C
Storage temperature	-40…+85 °C
Protection class	IP67 IP68 IP69K (not assessed by UL)
Operating voltage indicator	LED, green
Switching state indication	3-color LED, yellow
Vibration resistance	20 g (10…2000 Hz), EN 60068-2-6
Shock testing	EN 60068-2-27
Shock resistance	100 g (11 ms)
EMC	EN 61000-6-2:2019 ETSI EN 301489-3 v.1.6.1
Approvals	CE, ETSI, FCC, UL

15 Turck branches — contact data

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Austria	Turck GmbH Graumanngasse 7/A5-1, A-1150 Vienna **www.turck.at**
Belgium	TURCK MULTIPROX Lion d'Orweg 12, B-9300 Aalst **www.multiprox.be**
Brazil	Turck do Brasil Automação Ltda. Rua Anjo Custódio Nr. 42, Jardim Anália Franco, CEP 03358-040 São Paulo **www.turck.com.br**
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China	Turck (Tianjin) Sensor Co. Ltd. 18,4th Xinghuazhi Road, Xiqing Economic Development Area, 300381 Tianjin **www.turck.com.cn**
Czech Republic	TURCK s.r.o. Na Brne 2065, CZ-500 06 Hradec Králové **www.turck.cz**
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Turkey	Turck Otomasyon Ticaret Limited Sirketi Inönü mah. Kayisdagi c., Yesil Konak Evleri No: 178, A Blok D:4, 34755 Kadiköy/ Istanbul **www.turck.com.tr**
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USA	Turck Inc. 3000 Campus Drive, USA-MN 55441 Minneapolis **www.turck.us**

16 Appendix: Conformity and approvals

16.1 EU Declaration of Conformity

Hans Turck GmbH & Co. KG hereby declares that the radar sensors of the MR… product series conforms to Directive 2014/53/EU and the Radio Equipment Regulations 2017. The complete text of the EU/UK declaration of conformity can be found on the Internet at: **www.turck.com**

16.2 FCC digital device limitations

FCC ID: YQ7-MRXXX-Q80

This device complies with Part 15 of the FCC Rules standard(s). Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Radiofrequency radiation exposure Information:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

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