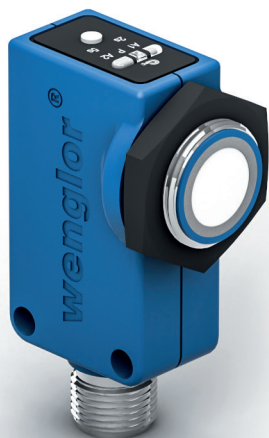


# U1RT002 U1RT003

Ultrasonic Distance Sensor



## Operating Instructions

# Table of Contents

- 1. General ..... 4**
  - 1.1 Information Concerning these Instructions ..... 4
  - 1.2 Explanations of Symbols ..... 4
  - 1.3 Limitation of Liability ..... 5
  - 1.4 Copyrights ..... 5
- 2. For Your Safety..... 6**
  - 2.1 Use for Intended Purpose ..... 6
  - 2.2 Use for Other than the Intended Purpose ..... 7
  - 2.3 Personnel Qualifications ..... 7
  - 2.4 Modification of Products ..... 7
  - 2.5 General Safety Precautions ..... 7
  - 2.6 Approvals and Protection Class ..... 8
- 3. Technical Data ..... 9**
  - 3.1 General Data ..... 9
  - 3.2 Warm-Up Phase ..... 10
  - 3.3 Mode-Dependent Data ..... 11
  - 3.4 Sonic Cone Diagrams ..... 12
  - 3.5 Housing Dimensions ..... 13
  - 3.6 Complementary Products ..... 14
  - 3.7 Layout ..... 14
  - 3.8 Control Panel ..... 15
  - 3.9 Scope of Delivery ..... 15
- 4. Transport and Storage..... 16**
  - 4.1 Transport ..... 16
  - 4.2 Storage ..... 16
- 5. Installation and Electrical Connection ..... 17**
  - 5.1 Installation ..... 17
  - 5.2 Electrical Connection ..... 18
  - 5.3 Diagnosis ..... 19
    - 5.3.1 LED Indicators ..... 19
    - 5.3.2 Troubleshooting ..... 19
- 6. Default Settings ..... 20**
- 7. Sensor Settings ..... 21**
- 8. Setup via IO-Link ..... 22**
  - 8.1 Settings via IO-Link/Parameters ..... 22
    - 8.1.1 Sensor Functions ..... 22
    - 8.1.2 Input/Output Functions (I/O) ..... 27
      - 8.1.2.1 Pin Function ..... 27
      - 8.1.2.2 Output Functions ..... 28
      - 8.1.2.3 Input Functions ..... 29
    - 8.1.3 Switching Point Functions (SSC1/SSC2) ..... 29
    - 8.1.4 Condition Monitoring Functions ..... 31
      - 8.1.4.1 Status Message Function ..... 31
      - 8.1.4.2 Warning/Error Output Function ..... 31
    - 8.1.5 Simulation Functions ..... 32

8.2 Condition Monitoring/Process Data ..... 33

    8.2.1 Process Data In ..... 33

    8.2.2 Process Data Out ..... 33

8.3 Events ..... 34

**9. wTeach2 Configuration Software ..... 34**

**10. NFC..... 34**

**11. Maintenance Instructions..... 35**

**12. Proper Disposal..... 35**

**13. Appendix ..... 35**

    13.1 Index of Changes for the Operating Instructions ..... 35

    13.2 EU Declaration of Conformity ..... 35

# 1. General

## 1.1 Information Concerning these Instructions

- These instructions apply to products U1RT002 and U1RT003.
- They make it possible to use the product safely and efficiently.
- These instructions are an integral part of the product and must be kept on hand for the entire duration of its service life.
- Local accident prevention regulations and national work safety regulations must be complied with as well.
- The product is subject to further technical development, and thus the information contained in these operating instructions may also be subject to change.



**NOTE!**  
The operating instructions must be read carefully before using the product and must be kept on hand for later reference.

## 1.2 Explanations of Symbols

- Safety precautions and warnings are emphasized by means of symbols and signal words.
- Safe use of the product is only possible if these safety precautions and warnings are adhered to.

The safety precautions and warnings are laid out in accordance with the following principle:



**SIGNAL WORD!**  
**Type and source of danger!**  
Possible consequences in the event that the hazard is disregarded.

- Measures for averting the hazard.

The meanings of the signal words, as well as the scope of the associated hazards, are listed below:



**DANGER!**  
This signal word indicates a hazard with a high degree of risk which, if not avoided, results in death or severe injury.



**WARNING!**  
This signal word indicates a hazard with a medium degree of risk which, if not avoided, may result in death or severe injury.



**CAUTION!**  
This signal word indicates a hazard with a low degree of risk which, if not avoided, may result in minor or moderate injury.



**ATTENTION!**  
This signal word draws attention to a potentially hazardous situation which, if not avoided, may result in property damage.



**NOTE!**  
A note draws attention to useful tips and suggestions, as well as information regarding efficient, error-free use.

### 1.3 Limitation of Liability

- The product has been developed in consideration of the current state-of-the-art technology, as well as applicable standards and guidelines. Subject to change without notice.
- wenglor sensoric elektronische Geräte GmbH (hereinafter referred to as "wenglor") excludes all liability in the event of:
  - Non-compliance with the instructions,
  - Use of the product for purposes other than those intended,
  - Use by untrained personnel,
  - Use of unapproved spare parts,
  - Unapproved modification of products
- These operating instructions do not include any guarantees from wenglor with regard to the described procedures or specific product characteristics.
- wenglor assumes no liability for printing errors or other inaccuracies contained in these operating instructions unless wenglor was verifiably aware of such errors at the point in time at which the operating instructions were prepared.

### 1.4 Copyrights

- The contents of these instructions are protected by copyright law.
- All rights are reserved by wenglor.
- Commercial reproduction or any other commercial use of the provided content and information, in particular graphics and images, is not permitted without previous written consent from wenglor.

## 2. For Your Safety

### 2.1 Use for Intended Purpose

This sensor is used for object detection and distance determination.

Ultrasonic sensors emit pulsed ultrasonic waves at a certain frequency using air as a transmitting medium. The sensors evaluate the transit time of the ultrasound reflected from the object. Parameters can be taught into the sensors using the teach-in key, via an input or via IO-Link. The output is switched when the preselected switching point is reached. Two independent switching outputs can be set up. Furthermore, the measured value can be read out via IO-Link 1.1. In addition to reflex mode, two sensors can also be used in through-beam mode.

The product may only be used in the specified ambient conditions ([see technical data on the product detail page at www.wenglor.com](https://www.wenglor.com)). The guidelines, safety data and approvals specified in the technical data must also be taken into account.

This product can be used for object detection or distance measurement in the following industries:

- Special machinery manufacturing
- Heavy machinery manufacturing
- Logistics
- Automotive industry
- Packaging industry
- Pharmaceuticals industry
- Clothing industry
- Plastics industry
- Woodworking industry
- Consumer goods industry
- Paper industry
- Electronics industry
- Glass industry
- Steel industry
- Printing industry
- Aviation industry
- Construction industry
- Chemicals industry
- Agriculture industry
- Alternative energies
- Raw materials extraction

## 2.2 Use for Other than the Intended Purpose

- No safety components in accordance with 2006/42/EC (Machinery Directive).
- The product is not suitable for use in potentially explosive atmospheres.
- The product may be used only with accessories supplied or approved by wenglor, or in combination with approved products. A list of approved accessories and combination products can be found at [www.wenglor.com](http://www.wenglor.com) on the product detail page.



### **DANGER!**

#### **Risk of personal injury or property damage in case of use for other than the intended purpose!**

Use for other than the intended purpose may lead to hazardous situations.

- Instructions regarding use for intended purpose must be observed.
- 

## 2.3 Personnel Qualifications

- Suitable technical training is a prerequisite.
- In-house electronics training is required.
- Trained personnel who use the product must have (uninterrupted) access to the operating instructions.



### **DANGER!**

#### **Risk of personal injury or property damage in case of incorrect initial start-up and maintenance!**

Personal injury and damage to equipment may occur.

- Adequate training and qualification of personnel.
- 

## 2.4 Modification of Products



### **DANGER!**

#### **Risk of personal injury or property damage if the product is modified.**

Personal injury and damage to equipment may occur. Non-observance may result in loss of the CE mark, and the guarantee may be rendered null and void.

- Modification of the product is impermissible.
- 

## 2.5 General Safety Precautions



### **NOTE!**

- These instructions are an integral part of the product and must be kept on hand for the entire duration of its service life.
  - Read the operating instructions carefully before using the product.
  - Protect the sensor against contamination and mechanical influences.
-

2.6 Approvals and Protection Class





## 3. Technical Data

### 3.1 General Data

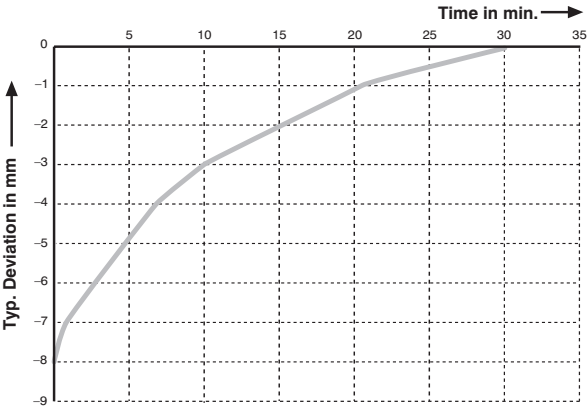
Technical Data	Order number	U1RT002	U1RT003
Ultrasound Data			
Working range, Reflex Sensor		100...1,200 mm	
Working range, Through-Beam Sensor		100...2,000 mm	
Setting range		100...1,200 mm	
Reproducibility		5 mm	
Linearity deviation		2 mm	
Resolution		1 mm	
Ultrasonic frequency		240 kHz	
Aperture angle		< 12°	
Service life (ambient temp. = +25° C)		100,000 h	
Switching hysteresis		1 % of the switching distance, at least 2 mm	
Electrical Data			
Supply voltage *		18...30 V DC	
Current consumption (operating voltage = 24 V)		≤ 30 mA	
Switching frequency, Reflex Sensor		7 Hz	
Switching frequency, Through-Beam Sensor		7 Hz	
Response time, Reflex Sensor		72 ms	
Response time, Through-Beam Sensor		72 ms	
Temperature range (during operation)		-30...60 °C	
Number of switching outputs		2	
Switching output voltage drop		< 2.5 V	
Switching output switching current		100 mA	
Short-circuit protection		Yes	
Reverse polarity and overload-proof		Yes	
Lockable		Yes	
Interface		IO-Link, NFC	
IO-Link version		1.1	
Smart Sensor Profile		Yes	
Data Storage		Yes	
Protection class		III	
Mechanical Data			
Setting method		Teach-in, IO-Link, NFC	
Housing material		Plastic, PBT, ABS	
Sleeve material		Nickel-plated brass	
Nut material		Plastic, PA	
Degree of protection		IP67, IP68	

\* Start-up time: 650 ms

Technical Data	Order number	U1RT002	U1RT003
Connection type		M12×1; 4/5-pin	
Technical Safety Data			
MTTFd (EN ISO 13849-1)		1.558, 40 a	
Functions			
PNP NO		Yes (default setting)	No
NPN NO		No	Yes (default setting)
Error output		Yes	
IO-Link		Yes	

### 3.2 Warm-Up Phase

The warm-up phase lasts roughly 30 minutes. At the beginning of the warm-up phase, linearity deviation and reproducibility may deviate from the specified values. During the course of the warm-up phase, values improve as an exponential function until the values in the technical data are reached. The switch-on drift during this time is shown in the following diagram.



### 3.3 Mode-Dependent Data

Some technical data depend on the filter set. Depending on the setting, the following data are obtained:

#### Reflex and Through-beam Mode

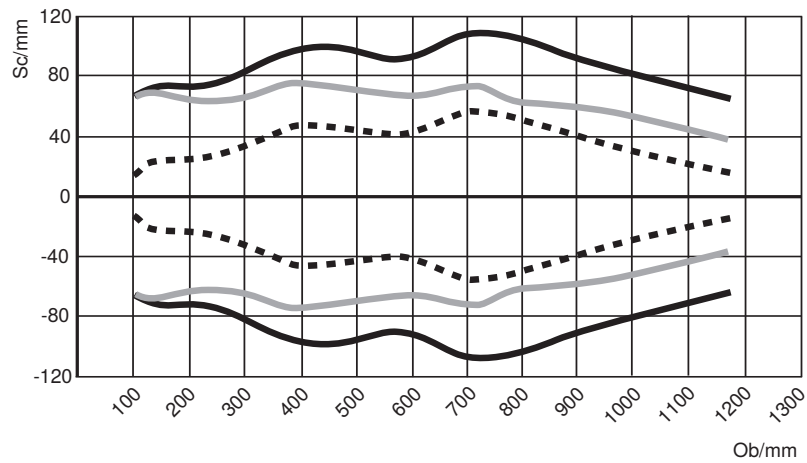
Filter value	Switching frequency in Hz	Response time in ms
0	7.0	72
1	5.0	100
2	4.0	125
3	3.5	142
4	3.0	167
5	2.5	200
6	2.3	218
7	2.1	238
8	1.9	263
9	1.7	295
10	1.6	310
11	1.5	333
12	1.4	357
13	1.3	381
14	1.2	417
15	1.1	429
16*	1.1	429
17*	1.0	500
18*	0.9	572
19*	0.8	650
20*	0.5	2,000

\* The specified switching frequency and response time correspond to the maximum duration including interference filter.  
A detailed description of the filter function can be found in section [“8.1.1 Sensor Functions” on page 22](#).

### 3.4 Sonic Cone Diagrams

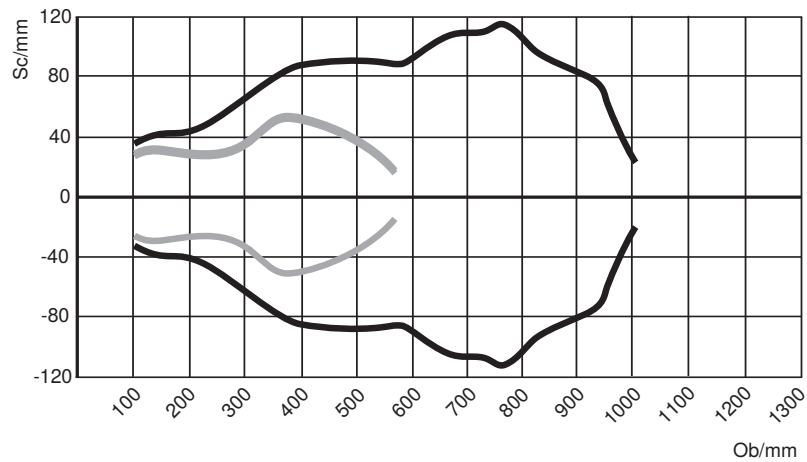
#### Measurement of sonic cone on plate 100×100 mm

Characteristic curves show the position of the center or the front edge of the measured object (100 × 100 mm plate) at the time of switching.



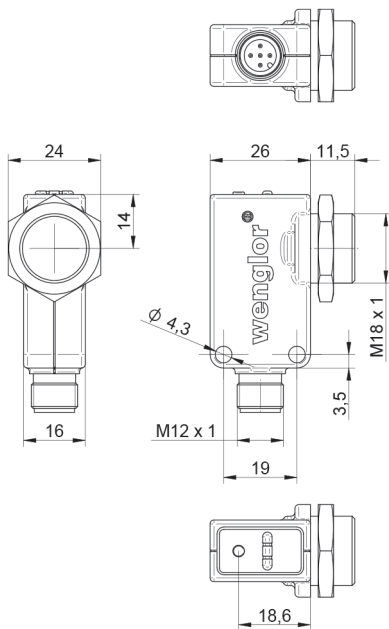
#### Measurement of the sonic cone on a rod with a diameter of 25 mm

Characteristic curves show the position of the center or the front edge of the measured object (Ø 25 mm rod) at the time of switching.



- Ob = Object      Sc = Sonic cone width
- Standard sonic cone (center of the measured object)
  - Narrow sonic cone (center of the measured object)
  - - - Standard sonic cone (front edge of the measured object)

### 3.5 Housing Dimensions



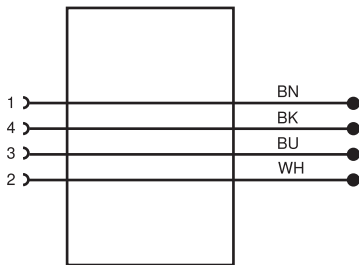
Dimensions in mm  
M3 screw = 0.5 Nm

### 3.6 Complementary Products

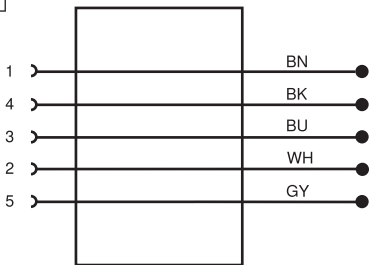
wenglor can provide you with suitable connection equipment for your product.

Suitable connection equipment no. **2** **35**

**S02**



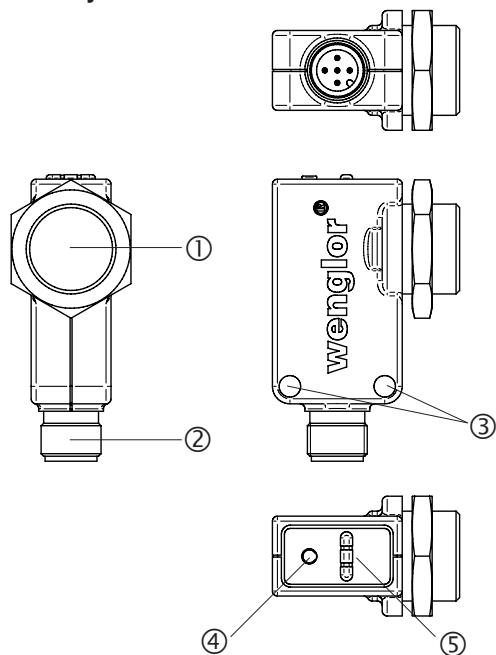
**S06**



IO-Link masters

Baffle plate

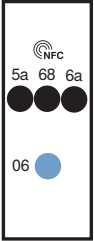
### 3.7 Layout



- 1 = sensing face
- 2 = connector plug
- 3 = mounting holes
- 4 = teach-in key
- 5 = indicator LEDs

## 3.8 Control Panel

A 49



06 = teach-in key

5a = switching status indicator O1

68 = supply voltage

6a = switching status display, O2

## 3.9 Scope of Delivery

- 1 ultrasonic distance sensor U1RTxxx
- 1 plastic nut (NUT-M18-E012)
- 1 quick start

## 4. Transport and Storage

### 4.1 Transport

Upon receipt of shipment, inspect the goods for damage in transit. In the case of damage, conditionally accept the package and notify the manufacturer of the damage. Then return the device, making reference to damage in transit.

### 4.2 Storage

**The following points must be taken into consideration with regard to storage:**

- Do not store the product outdoors.
- Store the product in a dry, dust-free place.
- Protect the product against mechanical impacts.
- Protect the product against exposure to direct sunlight.



#### **ATTENTION!**

#### **Risk of property damage in case of improper storage!**

The product may be damaged.

- Storage instructions must be complied with.
-



# 5. Installation and Electrical Connection

## 5.1 Installation

- Protect the product from contamination during installation.
- Observe all applicable electrical and mechanical regulations, standards, and safety rules.
- Protect the product against mechanical influences.
- Make sure that the sensor is mounted in a mechanically secure fashion.
- If the object has smooth surfaces, the angle between the axis of the sound waves and the surface of the object should be 90° ±3°. The angle can be considerably larger in the case of rough object surfaces.
- The sensor's sensing face must remain unobstructed.



**NOTE!**  
**Observe the blind spot.**

In the area between the sensor's active surface and the beginning of its working range, correct functioning of the sensor is not assured. No objects may be located in this area.

	Object position			Switching position / switching LED	Error output / error LED	Measured value, IO-Link
Working range		×		Defined	Defined	Defined
Blind spot	×			Undefined	Undefined	Undefined
Above the working range			×	Defined	Defined	Defined



**ATTENTION!**  
**Risk of property damage in case of improper installation!**  
The product may be damaged.

- Installation instructions must be complied with.



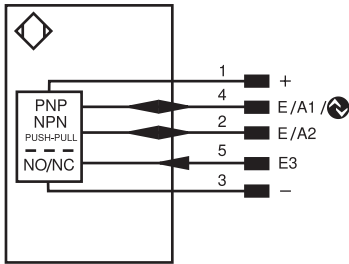
**CAUTION!**  
**Risk of personal injury or property damage during installation!**  
Personal injury and damage to the product may occur.

- A safe installation environment must be assured.

## 5.2 Electrical Connection

- Wire the sensor in accordance with the connection diagram.
- Switch on the supply voltage (see “3. Technical Data” on page 9).
- The blue supply voltage indicator lights up.

243



Wire colors:  
1 = brown  
2 = white  
3 = blue  
4 = black  
5 = gray

- + supply voltage "+"
- supply voltage "0 V"
- O1 switching output 1 normally open (NO)
- O2 switching output 2 normally open (NO)
- I input (analog or digital)
- ⚡ IO-Link












**DANGER!**  
**Risk of personal injury or property damage due to electric current.**

- Live parts may cause personal injury or damage to equipment.
- The electric device may be connected by appropriately qualified personnel only.

## 5.3 Diagnosis

### 5.3.1 LED Indicators

Indicator	Status	Meaning
Supply voltage indicator P		Sensor ready for operation
		No voltage supply
Switching status indicator O1, O2		Switching output active
	 2.5 Hz	Warning
	 5 Hz	Error
		Switching output inactive

-  Not lit up
-  Flashing
-  Permanently lit up

### 5.3.2 Troubleshooting

Error	Possible Cause	Elimination
Warning	Warning signal	<ul style="list-style-type: none"><li>• Reduce the distance between the sensor and the object</li><li>• Adjust the angle to the object</li></ul>
	Undervoltage	<ul style="list-style-type: none"><li>• Increase the voltage supply to at least 18 V DC</li></ul>
Error	No signal	<ul style="list-style-type: none"><li>• Adjust sensor object distance</li><li>• Minimize environmental influences (air circulation, ultrasonic sources)</li><li>• Check installation</li></ul>
	Object too close	<ul style="list-style-type: none"><li>• Increase sensor object distance</li></ul>
	Object too far	<ul style="list-style-type: none"><li>• Decrease sensor object distance</li></ul>
	Short circuit	<ul style="list-style-type: none"><li>• Check the electrical wiring and eliminate the short circuit</li></ul>
	Over-temperature	<ul style="list-style-type: none"><li>• Disconnect the sensor from the supply voltage and allow it to cool</li></ul>
	Device error	<ul style="list-style-type: none"><li>• Disconnect the sensor from the supply voltage and restart it</li><li>• Replace the sensor</li></ul>

Via IO-Link, it is possible to identify the respective causes precisely by means of condition monitoring. Further diagnosis functions and status messages are also possible. See section [“8.2 Condition Monitoring/Process Data” on page 33](#).

Required Action in Case of Fault:



- NOTE!**
- Shut down the machine.
  - Analyze and eliminate the cause of error with the aid of the diagnostics information.
  - If the error cannot be eliminated, please contact wenglor's support department.
  - Do not operate in case of indeterminate malfunctioning.
  - The machine must be shut down if the error cannot be definitively explained or properly eliminated.



- DANGER!**  
**Risk of personal injury or property damage in case of non-compliance!**  
The system's safety function is disabled. Personal injury and damage to equipment may occur.
- Required action as specified in case of fault.

6. Default Settings

Technical Data	U1RT002	U1RT003
Sensor operating mode	Normal	
Filter	0	
Sonic cone	Standard	
Process data	Outputs and measured value	
Temperature mode	Internal	
O1 pin function	Switching output	
O1 teach-in mode	Foreground	
O1 PNP/NPN	PNP	NPN
O1 NO/NC	NO	
O1 switching point	1200	
O1 additional hysteresis	0	
O2 pin function	Switching output	
O2 teach-in mode	Foreground	
O2 PNP/NPN	PNP	NPN
O2 NO/NC	NO	
O2 switching point	1200 mm	
O2 additional hysteresis	0 mm	
I3 function	Teach-in input	

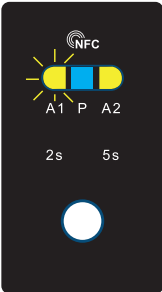
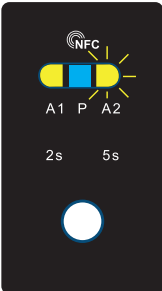
# 7. Sensor Settings


This section describes the settings that can be made directly on the sensor via the control panel.



## Teach-In

The three different teach-in modes foreground teach-in, background teach-in and window teach-in are available. These can be set via IO-Link (see section [“8.1 Settings via IO-Link/Parameters” on page 22](#)) or via the teach-in keys on the sensor. It should be noted here that the window teach-in must not take place via the keys, but exclusively via IO-Link. Foreground teach-in is used by default.

 <p>The diagram shows the sensor's control panel with an NFC symbol at the top. Below it is a horizontal bar with three segments: a yellow segment on the left labeled 'A1', a blue segment in the middle labeled 'P', and a yellow segment on the right labeled 'A2'. Below this bar are two time indicators: '2s' and '5s'. At the bottom is a circular button with a blue ring.</p>	<p><b>Teach-In for O1</b></p> <ol style="list-style-type: none"><li>1. Install the sensor in accordance with the installation instructions.</li><li>2. Position the object in front of the sensor.</li><li>3. Press and hold the teach-in key for 2 seconds until LED O1 starts to flash.</li><li>4. Release the teach-in key.</li><li>5. The distance is taught in, and LED O1 lights up in order to confirm successful teach-in.</li></ol>
 <p>The diagram shows the sensor's control panel with an NFC symbol at the top. Below it is a horizontal bar with three segments: a yellow segment on the left labeled 'A1', a blue segment in the middle labeled 'P', and a yellow segment on the right labeled 'A2'. Below this bar are two time indicators: '2s' and '5s'. At the bottom is a circular button with a blue ring.</p>	<p><b>Teach-In for O2</b></p> <ol style="list-style-type: none"><li>1. Install the sensor in accordance with the installation instructions.</li><li>2. Position the object in front of the sensor.</li><li>3. Press and hold the teach-in key for 5 seconds until LED O2 starts to flash.</li><li>4. Release the teach-in key.</li><li>5. The distance is taught in, and LED O2 lights up in order to confirm successful teach-in.</li></ol>



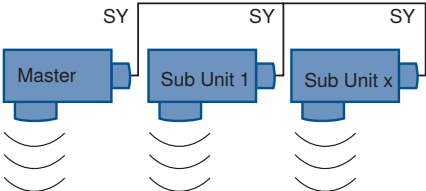

**NOTE!**  
If there is no object within the measuring range, the switching distance is set to the end of the setting range.



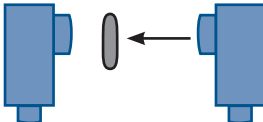

## 8. Setup via IO-Link

The sensors can exchange parameters and process data via IO-Link. The parameters can be used to make many additional settings on the device. The process data transmit cyclical data and condition monitoring. To this end, the sensor is connected to a suitable IO-Link master (see product detail page/complementary products).  
The interface protocol and the IODD can be found at [www.wenglor.com](http://www.wenglor.com) in the download area for the respective product.

### 8.1 Settings via IO-Link/Parameters


#### 8.1.1 Sensor Functions


Function	Possible Settings	Default
Localization	<p>The switching status indicators of the sensor can be switched to flashing. This allows the sensor to be easily located in a plant.</p> <p><b>On</b> LEDs and key illumination flash</p> <p><b>Off</b> LEDs and key illumination function normally</p>	Off
Sensor mode	<p><b>Normal</b> The sensor works as a reflex sensor.</p> <p><b>Synchronous Master Unit</b> <b>Synchronous Sub Unit</b> A maximum of 40 sensors can be used together in the synchronous mode in order to detect a large surface. The sensors emit ultrasonic pulses simultaneously (synchronously).</p> <ol style="list-style-type: none"><li>1. Connect I3/pin 5 of all sensors to each other.</li><li>2. Set up one sensor as the "Synchronous Master".</li><li>3. Set all other sensors as "Synchronous Sub Unit".</li></ol> <div></div> <p><b>NOTE!</b></p> <div><ul style="list-style-type: none"><li>• Synchronous mode is only possible with the PNP output function.</li><li>• In synchronous mode, both outputs O1, O2 can still be used, as the synchronization runs exclusively via I3.</li></ul></div>	Normal

Function	Possible Settings	Default						
	<div><div></div><div><p><b>NOTE!</b></p><ul style="list-style-type: none"><li>• Sensors in synchronous mode should have the same sonic cone settings for optimal measurement results.</li><li>• The response time of the sensors in synchronous mode increases to 1.43 × the response time in normal mode (e.g. filter 0: response time in normal mode = 72 ms; response time in synchronous mode = 103 ms).</li></ul></div></div> <div><div></div><div><p><b>NOTE!</b></p><p>Synchronous mode is designed for direct connection.</p></div></div> <div><p><b>Through-Beam Sensor Emitter</b></p><p><b>Through-Beam Sensor Receiver</b></p><p>In addition to the reflex mode, a through-beam mode is also available. Two sensors are required to this end.</p><ol style="list-style-type: none"><li>1. Set a sensor as a "through-beam sensor emitter".</li><li>2. Set up another sensor as a "through-beam sensor receiver".</li><li>3. If the receiver is operated as a normally closed contact, it is switched when an object is located between the emitter and the receiver.</li></ol><div></div><p>Technical Data in Through-Beam Mode:</p><table><tr><td>Range:</td><td>1...2000 mm</td></tr><tr><td>Switching frequency:</td><td>7 Hz</td></tr><tr><td>Response time:</td><td>72 ms</td></tr></table><p>Differentiation between one and two layers of thin material such as paper or foil is possible in the through-beam operating mode.</p><ol style="list-style-type: none"><li>1. Position the emitter and the receiver a short distance from each other.</li><li>2. Adjust the distance between the emitter and the receiver so that the receiver continues to switch for one layer but not for two.</li></ol><div><div></div><div><p><b>NOTE!</b></p><ul style="list-style-type: none"><li>• Teach-in via the teach-in key is not possible in the through-beam operating mode.</li><li>• Adjustments can be made by changing the distance between the emitter and the receiver and with the help of the sonic cone settings at the emitter.</li><li>• With distances of 1...100 mm, the sonic cone must be set to "extra narrow"</li><li>• The influence of reflections from the environment (e.g. when detecting gaps) can be minimized to "narrow" or "extra narrow" by the sonic cone setting.</li></ul></div></div></div>	Range:	1...2000 mm	Switching frequency:	7 Hz	Response time:	72 ms	
Range:	1...2000 mm							
Switching frequency:	7 Hz							
Response time:	72 ms							

Function	Possible Settings	Default																																										
Filter	The selected filter has an influence on the response time (see response time in section “3. Technical Data” on page 9) and the number of distance values to be evaluated.	0																																										
	<table><tr><th>Filter</th><th>Description</th></tr><tr><td>0-15</td><td>Median filter Median filter from the specified number of measured values. If the signal is missing or invalid, an error is issued. This filter can provide additional smoothing of the signal in applications with objects with a homogeneous surface in a stable environment.</td></tr><tr><td>0</td><td>Median filter of 2 measured values</td></tr><tr><td>1</td><td>Median filter of 3 measured values</td></tr><tr><td>2</td><td>Median filter of 4 measured values</td></tr><tr><td>3</td><td>Median filter of 5 measured values</td></tr><tr><td>4</td><td>Median filter of 6 measured values</td></tr><tr><td>5</td><td>Median filter of 7 measured values</td></tr><tr><td>6</td><td>Median filter of 8 measured values</td></tr><tr><td>7</td><td>Median filter of 9 measured values</td></tr><tr><td>8</td><td>Median filter of 10 measured values</td></tr><tr><td>9</td><td>Median filter of 11 measured values</td></tr><tr><td>10</td><td>Median filter of 12 measured values</td></tr><tr><td>11</td><td>Median filter of 13 measured values</td></tr><tr><td>12</td><td>Median filter of 14 measured values</td></tr><tr><td>13</td><td>Median filter of 15 measured values</td></tr><tr><td>14</td><td>Median filter of 16 measured values</td></tr><tr><td>15</td><td>Median filter of 17 measured values</td></tr><tr><td>16 – 20</td><td>Median filter and interference filter Median filter from the specified number of measured values. The additional interference filter can be used to increase measurement reliability in the case of brief interferences in the measured section. Disturbances such as waves, air vortices, sound-absorbing areas or bulk solids generate temporarily invalid signals that can lead to incorrect measurements. A higher filter level allows the interfering signals to be ignored for a defined period. If the distance changes continuously, the response time remains unchanged when the filter is activated.</td></tr><tr><td>16</td><td>Median filter of 18 measured values and bridging of 4 missing measured values (112 ms)</td></tr><tr><td>17</td><td>Median filter of 21 measured values and bridging of 7 missing measured values (196 ms)</td></tr></table>		Filter	Description	0-15	Median filter Median filter from the specified number of measured values. If the signal is missing or invalid, an error is issued. This filter can provide additional smoothing of the signal in applications with objects with a homogeneous surface in a stable environment.	0	Median filter of 2 measured values	1	Median filter of 3 measured values	2	Median filter of 4 measured values	3	Median filter of 5 measured values	4	Median filter of 6 measured values	5	Median filter of 7 measured values	6	Median filter of 8 measured values	7	Median filter of 9 measured values	8	Median filter of 10 measured values	9	Median filter of 11 measured values	10	Median filter of 12 measured values	11	Median filter of 13 measured values	12	Median filter of 14 measured values	13	Median filter of 15 measured values	14	Median filter of 16 measured values	15	Median filter of 17 measured values	16 – 20	Median filter and interference filter Median filter from the specified number of measured values. The additional interference filter can be used to increase measurement reliability in the case of brief interferences in the measured section. Disturbances such as waves, air vortices, sound-absorbing areas or bulk solids generate temporarily invalid signals that can lead to incorrect measurements. A higher filter level allows the interfering signals to be ignored for a defined period. If the distance changes continuously, the response time remains unchanged when the filter is activated.	16	Median filter of 18 measured values and bridging of 4 missing measured values (112 ms)	17	Median filter of 21 measured values and bridging of 7 missing measured values (196 ms)
	Filter		Description																																									
	0-15		Median filter Median filter from the specified number of measured values. If the signal is missing or invalid, an error is issued. This filter can provide additional smoothing of the signal in applications with objects with a homogeneous surface in a stable environment.																																									
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	2		Median filter of 4 measured values																																									
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	4		Median filter of 6 measured values																																									
	5		Median filter of 7 measured values																																									
	6		Median filter of 8 measured values																																									
	7		Median filter of 9 measured values																																									
	8		Median filter of 10 measured values																																									
	9		Median filter of 11 measured values																																									
	10		Median filter of 12 measured values																																									
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	16		Median filter of 18 measured values and bridging of 4 missing measured values (112 ms)																																									
	17		Median filter of 21 measured values and bridging of 7 missing measured values (196 ms)																																									



Function	Possible Settings	Default						
Filter	<table><tr><td>18</td><td>Median filter of 24 measured values and bridging from 15 missing measured values (420 ms)</td></tr><tr><td>19</td><td>Median filter of 27 measured values and bridging from 31 missing measured values (868 ms)</td></tr><tr><td>20</td><td>Median filter of 36 measured values and bridging from 62 missing measured values (1.7 s)</td></tr></table>	18	Median filter of 24 measured values and bridging from 15 missing measured values (420 ms)	19	Median filter of 27 measured values and bridging from 31 missing measured values (868 ms)	20	Median filter of 36 measured values and bridging from 62 missing measured values (1.7 s)	0
	18	Median filter of 24 measured values and bridging from 15 missing measured values (420 ms)						
	19	Median filter of 27 measured values and bridging from 31 missing measured values (868 ms)						
	20	Median filter of 36 measured values and bridging from 62 missing measured values (1.7 s)						
<div> <b>NOTE!</b> The technical data resulting from the various modes are specified in <a href="#">“3. Technical Data” on page 9.</a></div>								
Transmit signal	<p>The transmit signal of the sensor can be switched off. This allows the sensor to be deactivated when not in use and, if necessary, interference can be avoided.</p> <p><b>On</b> Transmit signal is on.</p> <p><b>Off</b> Transmit signal is off. No measurements are taken. The switching behavior is identical to when no signal is received in reflective operation or as a through-beam sensor.</p>	On						
Sonic cone	<p>This setting can be used to adjust the shape and range of the sonic cone. The diagrams for the individual sonic cones on standardized objects can be found in <a href="#">“3.4 Sonic Cone Diagrams” on page 12.</a> Narrow cones can be used to block out constant disturbances in the measuring section (e.g. tank walls).</p> <p><b>Standard</b> <b>Narrow</b> <b>Extra narrow</b></p>	Standard						
Measured value unit (process data type)	<p>The measured distance can be read out in millimeters or inches.</p> <p><b>Millimeter</b> Read-out of distance values in mm for internal temperature compensation or external temperature compensation via the parameters</p> <p><b>Inch</b> Read-out of distance values in 1/10 inch for internal temperature compensation or external temperature compensation via the parameters</p> <p><b>Millimeter (with external temperature)</b> Output of distance values in mm and input of external temperature via Process Data Out</p> <p><b>Inches (with external temperature)</b> Output of distance values in 1/10 inch and input of external temperature via Process Data Out</p>	Millimeter						

Function	Possible Settings	Default
Temperature mode	<p>The sensor has internal temperature compensation. Alternatively, the temperature can be measured externally and sent to the sensor as a process or parameter.</p> <p><b>Internal</b> Sensor operates with internal temperature compensation</p> <p><b>External</b> Sensor works with external temperature compensation and uses the transmitted process or parameters (see section “<a href="#">8.2 Condition Monitoring/Process Data</a>”). Whether process or parameter data is to be used is specified via the setting under "Measured value unit "Process data type".</p>	Internal
External temperature	<p>Temperature values can be transmitted to the sensor at a resolution of 1 °C for temperature compensation. Parameter is used if the external temperature compensation is to work via the parameters.</p> <p><b>–30...+60 °C</b></p> <div style="display: flex; align-items: center;">  <p><b>NOTE!</b> Regular updating of external temperature data is recommended, in order to prevent abrupt temperature changes and jumps in measurement results resulting therefrom. If no temperature value is transmitted when the sensor is started up in the external temperature mode, the standard value of 23 °C is used.</p> </div>	23 °C

8.1.2 Input/Output Functions (I/O)

8.1.2.1 Pin Function

The pin function is used to define the function of pins I/O1, I/O2, and I3, as these can be used for different functions.

Pin	Possible Settings	Default
I/O1	<b>Switching Output</b> Switching point SSC1 is assigned to the switching output. <b>Error Output</b> The error output switches if one of the assigned errors occurs; see table “Status Messages” on page 31. <b>Warning Output</b> The warning output switches if one of the assigned warnings occurs; see table “Status Messages” on page 31. <b>Transmit Signal Off Input</b> See I3 for an explanation <b>Teach-In Input</b> See I3 for an explanation <b>Deactivated</b> The pin is deactivated.	Switching output
I/O2	<b>Switching Output</b> Switching point SSC2 is assigned to the switching output. <b>Antivalent Switching Output</b> The switching output switches antivalently to switching output O1. <b>Error Output</b> The error output switches if one of the assigned errors occurs; see table “Status Messages” on page 31. <b>Warning Output</b> The warning output switches if one of the assigned warnings occurs; see table “Status Messages” on page 31. <b>Transmit Signal Off Input</b> See I3 for an explanation <b>Teach-In Input</b> See I3 for an explanation <b>Deactivated</b> The pin is deactivated.	Switching output

I3	<p><b>Transmit Signal Off Input</b> The sensor's transmit signal is deactivated as long as the input is activated. The sensor does not send a measured value and sets the status to "No signal".</p> <p><b>Teach-In Input</b> Teach-in The outputs (switching outputs) can be set using the same procedure as with the teach-in key (see section 6). An activated input corresponds to a depressed teach-in key.</p> <p><b>Locking</b> If 18...30 V DC is continuously applied to the teach-in input, the teach-in key is locked and protected against inadvertent changes, like the input signal.</p> <p><b>Synchronous Input/Output</b> The input is used for communication between the Synchronous Master Unit and the Synchronous Sub Unit.</p> <p><b>Deactivated</b> The pin is deactivated.</p>	Transmit signal off input
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### 8.1.2.2 Output Functions

The output functions are used to set the physical outputs.

Function	Possible Settings	Default
PNP/NPN/ Push-Pull	<b>PNP</b> <b>NPN</b> <b>Push-Pull</b>	PNP
NC/NO	<b>NO</b> Light switching (normally open) The output is high when the condition has been fulfilled depending on the setting (switching point, warning, error). <b>NC</b> Dark switching (normally closed) The output is low when the condition has been fulfilled depending on the setting (switching point, warning, error).	NO
On-delay	<b>0...10,000 ms</b>	0 ms
Off-delay	<b>0...10,000 ms</b>	0 ms

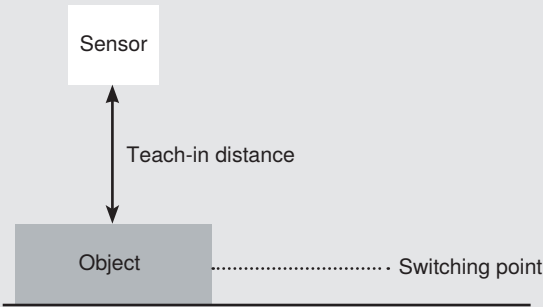
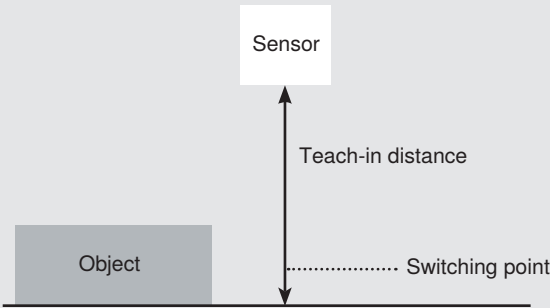
8.1.2.3 Input Functions

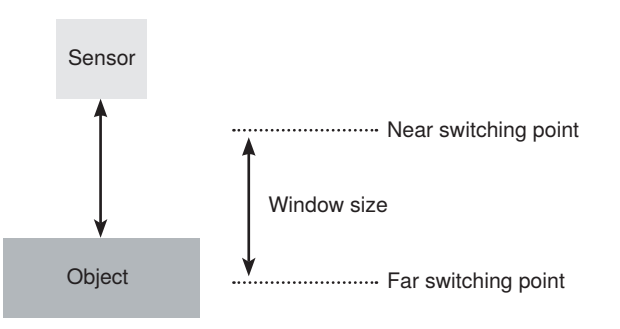

The input functions are used to set the physical inputs.

Function	Possible Settings	Default
Input mode	<b>Operating Voltage Active</b> The function is triggered as soon as operating voltage is applied to the input. <b>Operating Voltage Inactive</b> The function is triggered as soon as 0 V is applied to the input or the input is not occupied.	Operating voltage active

8.1.3 Switching Point Functions (SSC1/SSC2)

The switching point functions are used to set the two switching points, SSC1 and SSC2. SSC1 is assigned to output O1 and SSC2 is assigned to output O2.

Function	Possible Settings	Default
Teach-in	Starts the teach-in process	
Teach-in mode	<b>Foreground Teach-In</b>  <b>Background Teach-In</b> 	Foreground teach-in

Function	Possible Settings	Default
	<p><b>Window Teach-In</b></p>  <p> <b>NOTE!</b> The far switching point must be greater than the near switching point.</p>	
Switching point	<b>100...1200 mm</b>	1200 mm
Near switching point window	<b>100...1200 mm</b>	100 mm
Far switching point window	<b>100...1200 mm</b>	100 mm
Additional hysteresis	<p><b>0...500 mm</b></p> <p>The hysteresis is the difference between the switch-on and switch-off point.</p> <p>The sensor has a minimum hysteresis of 1% of the switching distance, but at least 2 mm. This cannot be changed. An additional hysteresis in mm can be set for each switching point.</p> <p>The total hysteresis is calculated from internal switching hysteresis (1%) + additional hysteresis.</p> <p>The sum of the switching point, hysteresis and additional hysteresis must not exceed the maximum measuring range of the sensor.</p>	0 mm

8.1.4 Condition Monitoring Functions

8.1.4.1 Status Message Function

The sensor provides various status messages. Due to the process data structure, four status messages can be transmitted as individual process data. These parameters can be used to set the status messages that are transmitted via the process data.

Function	Possible Settings	Default
Message 1	See table “Status Messages” on page 31	Warning signal
Message 2	See table “Status Messages” on page 31	Short circuit
Message 3	See table “Status Messages” on page 31	Undervoltage
Message 4	See table “Status Messages” on page 31	No signal

8.1.4.2 Warning/Error Output Function

The status messages used to trigger the collective message can be defined for the warning output and the error output respectively. The status messages are OR-linked so that the output is activated when one of the defined status messages is activated.

Function	Possible Settings	Default
Warning output	See table “Status Messages” on page 31	Signal warning, undervoltage
Error output	See table “Status Messages” on page 31	No signal, object too close, object too wide, short circuit, device error

Status Messages

Warnings	
Warning signal	The object reflects too little sound (weak signal).
Undervoltage	The supply voltage is too low.
Emitter off	The emitter of the sensor is switched off.

Error	
No signal	The sensor is not receiving a signal. The error can occur, for example, due to: <ul style="list-style-type: none"><li>• Strong air turbulence</li><li>• Ultrasonic sources too strong in the measuring range</li><li>• Very small or poorly reflective (sound-absorbing) objects are located within the working range.</li><li>• Incorrect installation</li></ul>
Object too close	The object is below the setting range or the set measuring range.
Object too far	The object is above the setting range or the set measuring range.

Error	
Short circuit	A short circuit has occurred on at least one pin.
Device error	A hardware error has occurred.

### 8.1.5 Simulation Functions

This function simulates the behavior of the sensor regardless of the current status and measured value. This can be used to check whether a plant in which the sensor is integrated reacts correctly to the data supplied by the sensor and processes them accordingly.

If a measured value is specified, the sensor behaves as if the specified measured value corresponds to the actual measured value. This means that the behavior of the outputs and status messages is simulated according to the specified measured value.

In addition, the individual outputs and status messages can be simulated separately from the measured value.

Function	Possible Settings	Default
Simulation Mode	On Off	Off
Simulation measured value	Current measured value min...max. measuring range	Current measured value
Simulation SSC1	According to the measured value On Off	According to the measured value
Simulation SSC2	According to the measured value On Off	According to the measured value
Simulation status messages	Tests the individual status messages According to the measured value On Off	According to the measured value



**NOTE!**

- Output O1 is used for IO-Link communication in this function and cannot be simulated.
- Simulation mode ends automatically as soon as the power supply is interrupted.




## 8.2 Condition Monitoring/Process Data

The data described in the following section can be read or written cyclically via IO-Link/process data.

### 8.2.1 Process Data In

Data	Meaning
Measured value	Measured distance in mm or 1/10 inch As the sensor cannot determine a measured value in the following error cases, substitute values are read out: No signal: 0x7FFC / 32764 mm Object too close: 0x8008 / – 32760 mm Object too far: 0x7FF8 / 32760 mm
Scale	Scaling of the measured value to the base length unit; –3 corresponds to mm.
SSC1	Switching point 1
SSC2	Switching point 2
Warning	Collective warning in the event of one of the warning status messages (see table “ <a href="#">Status Messages</a> ” on page 31)
Error	Collective warning in the event of one of the error status messages (see table “ <a href="#">Status Messages</a> ” on page 31)
Message 1	Status message 1 read out (see “ <a href="#">8.1.4.1 Status Message Function</a> ”)
Message 2	Status message 2 read out (see “ <a href="#">8.1.4.1 Status Message Function</a> ”)
Message 3	Status message 3 read out (see “ <a href="#">8.1.4.1 Status Message Function</a> ”)
Message 4	Status message 4 read out (see “ <a href="#">8.1.4.1 Status Message Function</a> ”)

### 8.2.2 Process Data Out

Data	Meaning
Transmit signal	Transmit signal on/off   <b>NOTE!</b> This parameter can be used to configure multiplex operation of the sensors. In the multiplex mode, ultrasonic sensors emit their pulses alternately. This operating mode prevents sensors located in direct proximity to each other from interfering with one another.
Localization	Sensor flashes for easy sensor location
Teach-In SSC1	Starts the teach-in process for SSC1
Teach-In SSC2	Starts the teach-in process for SSC2
External temperature value	Enter the external temperature in °C for temperature compensation

### 8.3 Events

Events are diagnostic information that is standardized by IO-Link and exchanged between the IO-Link master and the device. The following events are supported:

Name	Eventcode	Type	Specification
Device error – unknown error	0x1000	Error	IO-Link
Short circuit – check installation	0x7710	Error	IO-Link
Supply voltage too low – check tolerances	0x5111	Warning	IO-Link

## 9. wTeach2 Configuration Software

For information on installing and connecting the software and its structure, as well as information on the general functions, see the wTeach operating instructions. They can be found online in the download area under order number DNNF005.

## 10.NFC

The devices can be set up and their parameters can be configured via the NFC interface with the help of an smartphone and wenglor's "weCon" app. Process data cannot be read out via NFC but they're available via IO-Link.

The wenglor app can be downloaded free of charge from the Google Play Store or from App Store. Download the app and follow the installation instructions.

Scan the code below to access the wenglor app directly.



The settings are selected via the app and are then transmitted to the sensor.

With the "Read" or "Write" mode activated, hold the smartphone's antenna just above the sensor's active NFC sensing face.



**NOTE!**

- NFC antenna position varies from one smartphone to the next.
- Refer to the smartphone's operating instructions in order to determine the antenna's exact position

If a connection isn't established immediately, move the smartphone across the sensing face until connection is successful.

The sensor doesn't necessarily have to be connected to supply voltage for data transmission, i.e. transmission is also possible in the de-energized state. The only exception is the "Reset" function. This requires a connection to the supply voltage.

## 11. Maintenance Instructions



**NOTE!**

- This wenglor sensor is maintenance-free.
- Cleaning and inspection of the plug connections at regular intervals are advisable.
- Do not clean the sensor with solvents or cleaning agents that could damage the product.
- The product must be protected against contamination during initial start-up.

## 12. Proper Disposal

wenglor sensoric GmbH does not accept the return of unusable or irreparable products. Respectively valid national waste disposal regulations apply to product disposal.

## 13. Appendix

### 13.1 Index of Changes for the Operating Instructions

Version	Date	Description/Changes
1.0.0	09/16/2021	Initial version of the operating instructions
1.1.0	11/29/2021	Change in <a href="#">"3. Technical Data" on page 9</a>
1.2.0	01/17/2022	Change in <a href="#">"7. Sensor Settings" on page 21</a>
1.3.0	10/24/2022	Change in <a href="#">"10. NFC" on page 34</a>
1.4.0	11/14/2023	Change in <a href="#">"3.4 Sonic Cone Diagrams" on page 12</a>
1.5.0	01/31/2024	Change in <a href="#">"3.4 Sonic Cone Diagrams" on page 12</a>
1.6.0	04/22/2024	Change in <a href="#">"3. Technical Data" on page 9</a>

### 13.2 EU Declaration of Conformity

The EU declaration of conformity can be found on our website at [www.wenglor.com](http://www.wenglor.com) in the product's separate download area.