

# OPT2022

Color Sensor



 **IO-Link**<sup>®</sup>

**Operating Instructions**

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# 1. General

## 1.1. Information Concerning these Instructions

- These instructions apply to the product with ID code OPT2022.
- 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.



### 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 attention-getting 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:



### ATTENTION-GETTING 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 attention-getting words, as well as the scope of the associated hazards, are listed below:



### DANGER!

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



### WARNING!

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



### CAUTION!

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



### ATTENTION!

This 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 and applicable standards and guidelines. Subject to change without notice.
- 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 replacement parts
  - Unapproved modification of products

### 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

The spectral composition of the colors of objects can be measured and analyzed with the OPT2022 6-band Multi-Spectral Sensor. Innovative color chip technology divides the selected color spectrum into six spectral ranges (ROYGBV color space) with separately adjustable tolerance ranges. In combination with glass fiber-optic cables, the sensor adapts itself to the specific requirements of any given application and can be operated in the scanning as well as the through-beam mode. The Color Sensor is equipped with twelve switching outputs and integrated LED technology, which automatically ensures ideal adjustment of light intensity. Sensor settings can be selected directly at the OLED display or via the IO-Link interface.

This product can be used in the following industry sectors:

- Automotive industry
- Food industry
- Packaging industry
- Pharmaceuticals industry
- Clothing industry
- Plastics industry
- Consumer goods industry
- Paper industry
- Electronics industry
- Glass industry
- Printing industry

### 2.2. Use for Other than the Intended Purpose

- Not a safety component in accordance with the EC machinery directive.
- The product is not suitable for use in potentially explosive atmospheres.
- Only accessories supplied or approved by wenglor may be used with the product.



#### **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.

– Observe instructions regarding use for intended purpose.

---



#### **CAUTION!**

**Danger of burns!**


Some housing components heat up to 25 K above ambient temperature.

---

### 2.3. Personnel Qualifications


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

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 **WARNING!**  
**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.

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### 2.4. Modification of Products

 **NOTE!**  
Modification of the product is impermissible. Non-observance may result in loss of the CE marking and the guarantee may be rendered null and void.


### 2.5. General Safety Precautions

 **NOTES!**

- 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.
- Installation, initial start-up and maintenance of the product may only be carried out by qualified personnel.
- Not a safety component in accordance with the EU machinery directive

### 2.6. Laser/LED Warnings

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 **WARNING!**  
**Risk of personal injury in the event of direct contact with the eye!**  
Personal injury may occur.  
– Avoid direct eye contact with the sensor's light beam.

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### 2.7. Approvals and IP Protection



### 3. Technical Data

Order No.	OPT2022
<b>Technical Data</b>	
<b>Optical Characteristics</b>	
Spectral Sensitivity	450...700 nm
Light Source	White Light
<b>Electrical Characteristics</b>	
Supply Voltage	10...30 V DC
Supply Voltage with IO-Link	18...30 V DC
Current Consumption ( $U_b = 24\text{ V}$ )	~ 260 mA
Switching Frequency	2 kHz
Switching Outputs	12
Response Time	~ 500 $\mu\text{s}$ $\times$ filter
Switching Output Voltage Drop	1,5 V
PNP Switching Output/Switching Current	100 mA
Short Circuit Protection	yes
Reverse Polarity Protection	yes
Overload Protection	yes
Interface	IO-Link
IO-Link-Version	1.1
Protection Class	III
<b>Mechanical Characteristics</b>	
Temperature Range	-25...60 °C
Adjustment	Teach-in
Degree of Protection	IP67
Connection	M12 $\times$ 1, 4+8-pin
DIN-Rail mounting	35 mm
<b>Function</b>	
Selectable menu language	yes
<b>Output function</b>	
PNP-NO/NC switchable	yes
NO/NC switchable	yes
Error Output	yes
Contamination Output	yes

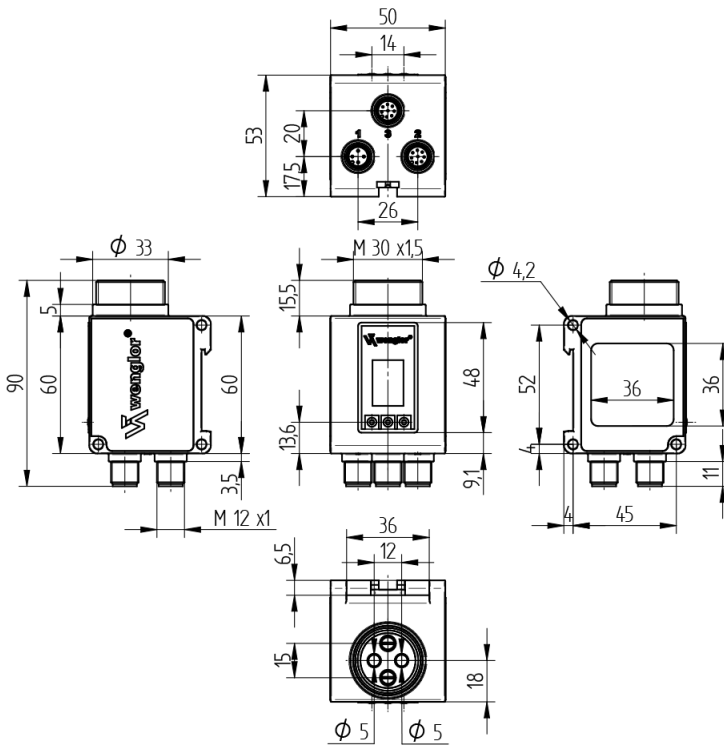


#### NOTES!

The warm-up phase takes approx. 30 minutes.



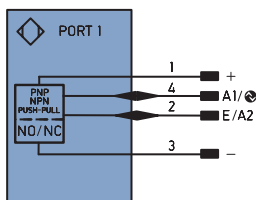
### 3.1. Housing dimensions



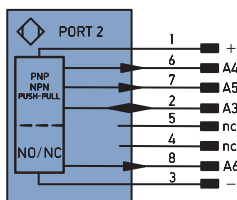
## 3.2. Connection Diagram

Even if more than one plug is connected, only one source of supply voltage may be used.

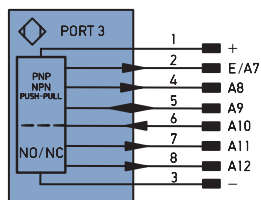
127



163



129



### Legend

+	Supply Voltage +
-	Supply Voltage 0 V
~	Supply Voltage (AC Voltage)
A	Switching Output (NO)
Ā	Switching Output (NC)
V	Contamination/Error Output (NO)
ṽ	Contamination/Error Output (NC)
E	Input (analog or digital)
T	Teach Input
Z	Time Delay (activation)
S	Shielding
RxD	Interface Receive Path
TxD	Interface Send Path
RDY	Ready
GND	Ground
CL	Clock
E/A	Output/Input programmable
	IO-Link
PoE	Power over Ethernet
IN	Safety Input
QSSD	Safety Output
Signal	Signal Output
Bl_D+/-	Ethernet Gigabit bidirect. data line (A-D)
EN0RS422	Encoder 0-pulse 0-0 (TTL)

PT	Platinum measuring resistor
nc	not connected
U	Test Input
Ū	Test Input inverted
W	Trigger Input
O	Analog Output
O-	Ground for the Analog Output
BZ	Block Discharge
AWV	Valve Output
a	Valve Control Output +
b	Valve Control Output 0 V
SY	Synchronization
E+	Receiver-Line
S+	Emitter-Line
⊕	Grounding
SnR	Switching Distance Reduction
Rx+/-	Ethernet Receive Path
Tx+/-	Ethernet Send Path
Bus	Interfaces-Bus A(+)/B(-)
La	Emitted Light disengageable
Mag	Magnet activation
RES	Input confirmation
EDM	Contactor Monitoring
ENARS422	Encoder A/Ā (TTL)
ENBRS422	Encoder B/B̄ (TTL)

ENa	Encoder A
ENb	Encoder B
AMIN	Digital output MIN
AMAX	Digital output MAX
AOK	Digital output OK
SY In	Synchronization In
SY OUT	Synchronization OUT
Q.Lt	Brightness output
M	Maintenance
rsv	reserved

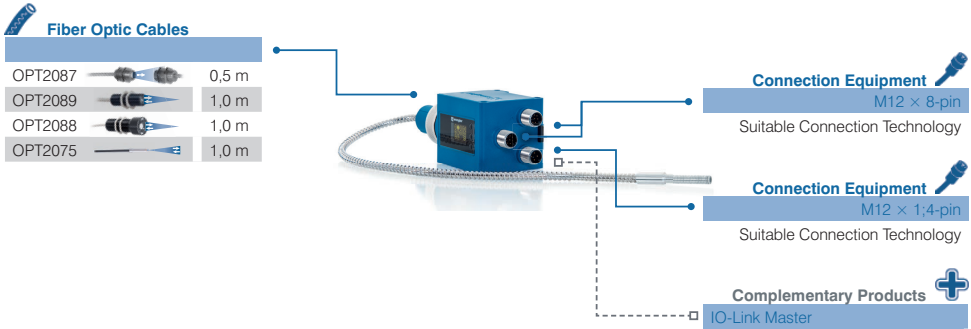
### Wire Colors according to DIN IEC 757

BK	Black
BN	Brown
RD	Red
OG	Orange
YE	Yellow
GN	Green
BU	Blue
VT	Violet
GY	Grey
WH	White
PK	Pink
GNYE	Green/Yellow

## 3.3. Complementary Products

Fiber Optic Cables

## System overview OPT2022



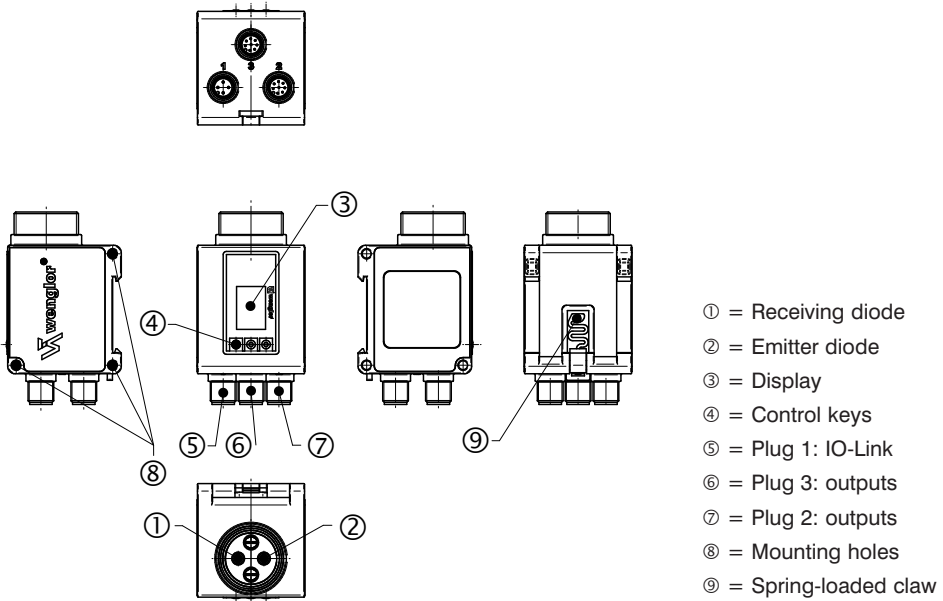
### Legend

**Required** accessories

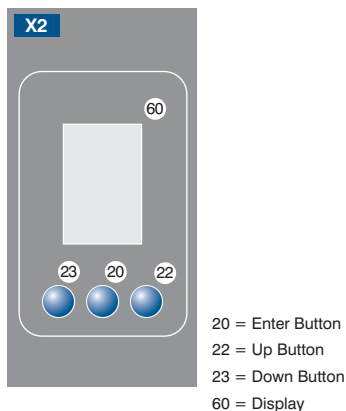
**Optional** accessories

**Included** in delivery \*

## 3.4. Layout



### 3.5. Control Panel



### 3.6. Scope of Delivery

- OPT2022
- Connecting nut
- Quickstart

## 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 condition 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.
- Comply with storage instructions.
-

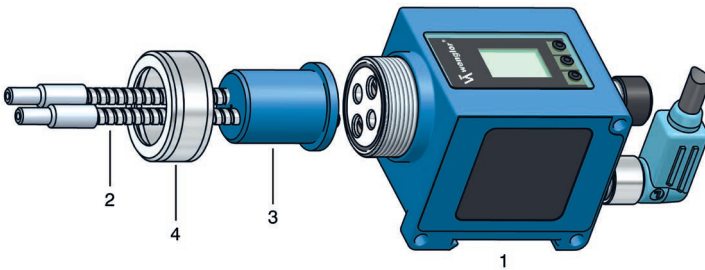
## 5. Installation and Electrical Connection

### 5.1. Installation

- Protect the product against contamination during installation (see section „2.5. General Safety Precautions“ on page 7)
- 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.
- The use of corresponding end brackets is recommended for mounting to DIN rails.
- In order to avoid damaging the LED lens, always connect a fiber-optic cable or attach the rubber protector.

#### Attaching Glass Fiber-Optic Cables

- Remove the protective cap from the sensor before attaching fiber-optic cables.
- Protect fiber-optic cables from mechanical influences!



1 Color Sensor  
2 wenglor® Fiber Optic

3 adapter No. 1  
4 Sleeve Nut



#### ATTENTION!

#### Risk of property damage in case of improper installation!

The product may be damaged.  
– Comply with installation instructions.

### 5.2. Electrical Connection

- Connect the sensor to 10 ... 30 V DC at plug no. 1 and/or 2 and/or 3, depending on which outputs are required (see „3.2. Connection Diagram“ on page 10)
- Even if more than one plug is connected, only one source of supply voltage may be used.

## 5.3. Diagnostics

Conduct in case of fault:



### NOTE!

- Shut down the machine.
- With the help of the diagnostics information, analyze and eliminate the cause of error.
- If the error cannot be eliminated, please contact Automation Direct's support department (techbox@automationdirect.com).
- Do not operate in case of indeterminate malfunctioning.
- The machine must be shut down if the error cannot be unequivocally clarified or reliably 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.

– Conduct in case of fault as specified.

## 6. Overview of Functions

### 6.1. Default Settings

		OPT2022
Pin function	A1	Switching Output
	A2	Switching Output
	A3	Switching Output
	A4	Switching Output
	A5	Switching Output
	A6	Switching Output
	A7	Switching Output
	A8	Switching Output
	A9	Switching Output
	A10	Switching Output
	A11	Switching Output
	A12	Switching Output
Outputs	Teach mode	Windows-Teach-in
	Tolerance	Small
	PNP/NPN/Push-pull	Push-pull
	NO/NC	NO
Display	Mode	Digital
	Intensity	Screen saver
Operating Mode		Detection

## 6.2. Function Definitions

Name	Function	Page
Run	Change to display mode	17
Pin-Function	Selection of pin function	18
Windows-Teach-in	Teach-in with window width (tolerance)	18
Sample-Teach-in	Automatic tolerance adjustment based on a good part or a bad part.	18
Tolerance	Window size for window teach-in	19
Output function	Selection of NO or NC	19
Switching Thresholds	Manual shifting of the thresholds	20
Error or Contamination Output	An output which is activated when the sensor is within an unreliable range	20
Display	Display settings	21

## 6.3. Menu structure

- Connect the sensor to the supply voltage. After initialization the sensor shows the indication screen and is ready for operation. During the first commissioning you can first of all select the menu language by simply pressing a button.
- Switch to the configuration menu by pressing any key.



### NOTE!

If no setting is made in the configuration setting for a duration of 30 s, the sensor automatically jumps back into the display view. By pressing the button once again, the sensor jumps back to the menu view used last. Settings made are adapted when quitting the configuration menu.

The keys are used for navigation, and for configuring settings. The functions of the navigation keys vary from menu to menu. The functions of the keys appear in the display as follows:

- ▲ : Navigate up.
- ▼ : Navigate down.
- ◀ | ▶ : Selection is acknowledged with the enter key.
- ◀ Back: One level up in the menu.
- ◀◀ Run: Change to the display mode



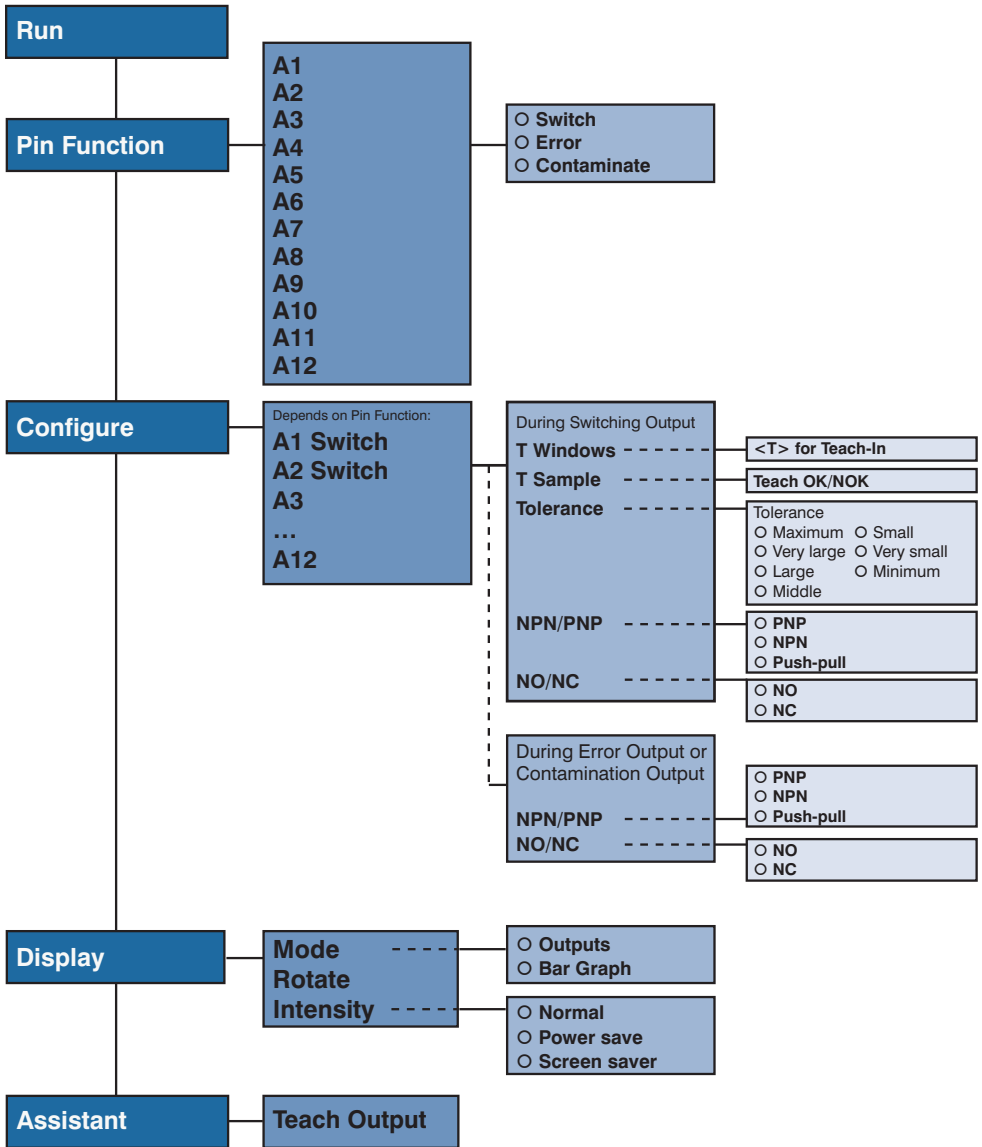
### ATTENTION!

**Risk of property damage if sharp objects are used!**

The keys may be damaged.

- Do not use sharp objects in order to enter settings.

The sensor configuration menu is set-up as follows:





## 7. Settings

### 7.1. Causes for Triggering of Error Indication (display)



- Not enough light is reflected.
- Very small objects, or objects which do not reflect well, are located within the working range.
- Incorrect installation
- Object is outside of the working range.

### 7.2. Run

Sensor switches to display mode.

Set pin function A with corresponding condition. If A is not displayed, it is deactivated in the pin function menu item.



Legend Status-LEDs:


Meaning	Condition 1	Condition 2	Condition 3	Condition 4
Switching Output	① Switched	⓪ Not switched	–	–
Error Output	✓ Ok	⚠ No signal	–	–
Contamination Output	✓ Ok	☀ Signal too low	–	–
Signal Strength	✓ Ok	☀ Signal too low	☀ Signal too high	⚠ No signal
temperature	✓ Ok	❄ temperature too low	🔥 temperature too high	–

### 7.3. Pin function

The Pin function is used to determine the function of pins A1, A2, A3, A4, A5, A6, A7, A8, A9, A10, A11 and/or A12 since the pins may be used for different functions.

Function	Description
<b>Ax</b>	Configuration of Pin A1,2, 3, 4, 5, 7, 6, 8, 9, 10, 11 and/or 12
<ul style="list-style-type: none"> <li>○ Deactivated</li> <li>○ Switch</li> <li>○ Error</li> <li>○ Contamination</li> <li>◀ Back</li> <li>◀◀ Run</li> </ul>	<p><b>Deactivated:</b> Deactivation of the output</p> <p><b>Switch:</b> Switching Output</p> <p><b>Error:</b> Error Output</p> <p><b>Contamination:</b> Contamination Output</p>

### 7.4. Windows-Teach-in

Function	Description
<b>T Windows</b>	Configuration of Pin A1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 or 12
<ul style="list-style-type: none"> <li>&lt;T&gt; for Teach-in</li> <li>T</li> <li>▶</li> </ul>	<p>Window teach-in procedure:</p> <ol style="list-style-type: none"> <li>1) Align the spot to the background (if there is one) or the object.</li> <li>2) Press the "T" key. → The switching points are taught in.</li> </ol> <p> <b>NOTE!</b></p> <ul style="list-style-type: none"> <li>• T sample: additional teach-in of an OK or an NOK sample part in order to adjust tolerances.</li> <li>• Window width can be reduced or enlarged in the tolerance menu.</li> </ul>
<b>T Sample</b>	Sample teach
<ul style="list-style-type: none"> <li>Teach OK/NOK</li> <li>OK</li> <li>▶</li> <li>NOK</li> </ul>	<p>Sample teach-in procedure:</p> <ol style="list-style-type: none"> <li>1) Teach in an OK sample. <ul style="list-style-type: none"> <li>• Align the spot to the object.</li> <li>• Press the "OK" key. → The tolerance is increased.</li> </ul> </li> <li>2) Teach in an NOK sample <ul style="list-style-type: none"> <li>• Align the spot to the object.</li> <li>• Press the "NOK" key. → The tolerance is decreased.</li> </ul> </li> </ol>

### 7.4.1. Tolerance

Function	Description
<b>Tolerance</b>	Changing tolerance
<ul style="list-style-type: none"> <li>○ Maximum</li> <li>○ Very large</li> <li>○ Large</li> <li>○ Middle</li> <li>○ Small</li> <li>○ Very small</li> <li>○ Minimum</li> <li>◀ Back</li> <li>◀◀ Run</li> </ul>	<p><b>Maximum:</b> Tolerance is set to a maximum value.</p> <p><b>Very large:</b> Tolerance is set to a very large value.</p> <p><b>Large:</b> Tolerance is set to a large value.</p> <p><b>Middle:</b> Tolerance is set to a medium value.</p> <p><b>Small:</b> Tolerance is set to a small value.</p> <p><b>Minimum:</b> Tolerance is set to a very small value.</p> <p><b>Minimal:</b> Tolerance is set to a minimum value.</p>

### 7.5. NO/NC Output Function

Function	Description
<b>NO/NC</b>	Output configuration
<ul style="list-style-type: none"> <li>○ NO</li> <li>○ NC</li> <li>◀ Back</li> <li>◀◀ Run</li> </ul>	<p><b>NO:</b> Normally open. The output closes as soon as an object reaches the switching point.</p> <p><b>NC:</b> Normally closed. The output opens as soon as an object reaches the switching point.</p>

### 7.6. NPN PNP

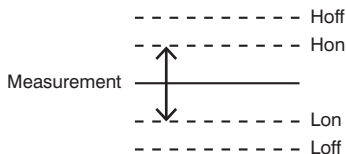
Function	Description
<b>NPN/PNP</b>	Output configuration
<ul style="list-style-type: none"> <li>○ PNP</li> <li>○ NPN</li> <li>○ Push-pull</li> <li>◀ Back</li> <li>◀◀ Run</li> </ul>	<p><b>PNP:</b> A load or the evaluation device is connected between the negative pole (supply) and the output. If switched, the output is connected with the positive pole via an electric switch.</p> <p><b>NPN:</b> A load or the evaluation device is connected between the positive pole (supply) and the output. If the sensor switches, the output is connected with the negative pole via an electric switch.</p> <p><b>Push-pull:</b> Push-pull output. Acts like an electronic switch which optionally switches the output to the positive pole or the negative pole.</p>

## 7.7. Switching Thresholds

The switching thresholds can be set manually via IO-Link.

### Switching points:

The following switching points are calculated on the basis of the measured value during Teach-In:



Hoff = Hon + Hysteresis

Hon = Hue value + window size

Lon = Hue value – window size (this result can easily become negative)

Loff = Lon – Hysteresis (this result can easily become negative)

Only the windows size values can be changed with interface. The other values are calculated on the basis of hysteresis, although hysteresis is not a fixed value itself but rather a calculated value as well.

## 7.8. Error or Contamination Output

When the pin is configured as an error or a contamination output, the following functions can be selected:

Function	Description
<b>A1 Error (example)</b>	Error output or contamination output
<b>NPN/PNP</b>	<b>NPN/PNP:</b> Output configuration
<b>NO/NC</b>	<b>NO/NC:</b> Output configuration
◀ Back	
◀◀ Run	

Explanations concerning “NPN/PNP” are included in section „7.6. NPN PNP“ on page 19. Explanations concerning “NO/NC” are included in section „7.5. NO/NC Output Function“ on page 19.

## 7.9. Display

Function	Description
<b>Display</b> <input type="radio"/> Rotate <input type="radio"/> Intensity <input type="radio"/> Mode ◀ Back ◀◀ Run	Adjusting the display device  <b>Rotate:</b> Rotate display by 180°. The display is rotated by 180° by pressing the key. The rotation is canceled by pressing this key again. <b>Intensity:</b> Set the display intensity <b>Mode:</b> Select display mode
<b>Intensity</b> <input type="radio"/> Normal <input type="radio"/> Power save <input type="radio"/> Screen saver ◀ Back ◀◀ Run	Set the display intensity  <b>Normal:</b> The intensity of the display is set to a normal value. <b>Power save:</b> The display switches off after one minute without a button being pressed and automatically switches back on when a button is pressed. <b>Screen saver:</b> The colors of the display are inverted every minute.
<b>Mode</b> <input type="radio"/> Digital <input type="radio"/> Bar Graph ◀ Back ◀◀ Run	Select display mode  <b>Digital:</b> The condition of each output is indicated on the display. <b>Bar Graph:</b> The ROYGBV color spaces / shares of the object are indicated in a bar graph.

## 8. Interfaces

### 8.1. IO-Link

Process and parameters data can be found in the interface protocol for IO-Link.

## 9. Maintenance Instructions



### NOTE!

- This wenglor Sensor is maintenance-free.
- It is advisable to clean the lens and the display, and to check the plug connections at regular intervals.
- Do not clean with solvents or cleansers which could damage the device.
- The product must be protected against contamination during initial start-up

## 10. Proper Disposal

Respectively valid national waste disposal regulations apply to product disposal.

## 11. Exclusion of Liability

wenglor sensoric GmbH, hereinafter referred to as wenglor, makes explicit reference to the fact that the information contained in these operating instructions may be subject to continuous further development and technical changes. These operating instructions do not imply any guarantee from wenglor with regard to the described procedures or specific product characteristics.

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## 12. Appendix

### 12.1. Index of Abbreviations

Abbreviation	Meaning
A	Output
DC	Direct current
kHz	Kilohertz
LED	Light Emitting Diode
mA	Milliamperes
mm	Millimeters
ms	Milliseconds
NC	Normally closed
NO	Normally Open
NPN	Negative-positive-negative
Nr.	Number
OLED	Organic light emitting display
PNP	Positive-negative-positive
U <sub>b</sub>	Operating voltage
V	Volts
°C	Degrees Celsius
K	Kelvin

### 12.2. Change Index, Operating Instructions

Version	Date	Description/Change	Associated Software
1.0.0	17.11.16	Initial version of the operating instructions	Firmware: 1.0.0

### 12.3. EU Declaration of Conformity

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