

Operating Instructions

P1PF001

Color Sensor



EN



Table of Contents

1 General	4
1.1 Information Concerning these Instructions.....	4
1.2 Explanation 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.....	6
2.3 Personnel Qualifications.....	6
2.4 Modification of Products.....	7
2.5 General Safety Precautions	7
2.6 Approvals and protection classes	7
3 Technical Data	8
3.1 General information.....	8
3.2 Housing Dimensions	9
3.3 Control panel	9
3.4 Complementary Products	9
4 Transport and Storage	10
4.1 Transport	10
4.2 Storage	10
5 Installation and Electrical Connection	11
5.1 Installation	11
5.2 Adjustment	11
5.3 Electrical Connection	11
5.4 Diagnosis	12
5.5 Troubleshooting	12
6 Display	14
7 Settings.....	16
7.1 Configuration with Push of Button / Teach-In	16
8 Function Description.....	18
8.1 Sensor Functions	18
8.2 Input/output functions (I/O).....	19
8.2.1 Pin Functions	19
8.2.2 Output Functions.....	20
8.2.3 Input Functions.....	20
8.3 Switching Point Functions.....	21
8.4 Condition Monitoring Functions	22
8.4.1 Status Message Function	22
8.4.2 Warning/Error Output Function	22
8.4.3 Simulation Functions	22
9 IO-Link	24
9.1 Parameters.....	24
10 wTeach2 Configuration Software.....	25

11 Maintenance Instructions 26

12 Proper Disposal 27

13 Declarations of Conformity..... 28

1 General

1.1 Information Concerning these Instructions

- These instructions 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. The current version can be found at www.wenglor.com in the product's separate download area.



INFORMATION

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

1.2 Explanation 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.



NOTICE

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



INFORMATION

Information draws attention to useful tips and suggestions, as well as information on 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.
- A valid declaration of conformity can be accessed at www.wenglor.com in the product's separate download area.
- 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

Color sensors

Color sensors analyze the finest color nuances in automated processes at high speeds and select colored objects based on predefined reference colors. Thanks to pulsed white light, the sensors are insensitive to ambient light.

This Product Can Be Used in the Following Industry Sectors:

- Special-purpose mechanical engineering
- Heavy mechanical engineering
- Logistics
- Automotive industry
- Food industry
- Packaging industry
- Pharmaceuticals industry
- Plastics industry
- Woodworking industry
- Consumer goods industry
- Paper industry
- Electronics industry
- Glass industry
- Steel industry
- Aviation industry
- Chemicals industry
- Alternative energies
- Raw materials extraction

2.2 Use for Other than the Intended Purpose

- Not a safety component 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 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.

→ Observe instructions regarding use for intended purpose.

2.3 Personnel Qualifications

- Suitable technical training is a prerequisite.
- In-house electronics training is required.
- Trained personnel who use the product must have (permanent) 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. Noncompliance may result in loss of the CE and/or UKCA mark and voiding of the warranty.

→ Modification of the product is not permitted

2.5 General Safety Precautions



INFORMATION

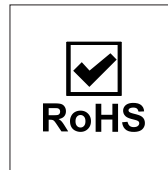
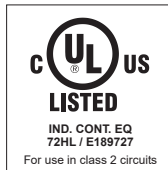
These instructions are an integral part of the product and must be kept on hand for the entire duration of its service life.

In the event of possible changes, the current version of the operating instructions can be found at www.wenglor.com in the product's separate download area.

Read the operating instructions carefully before using the product.

Protect the sensor against contamination and mechanical influences.

2.6 Approvals and protection classes

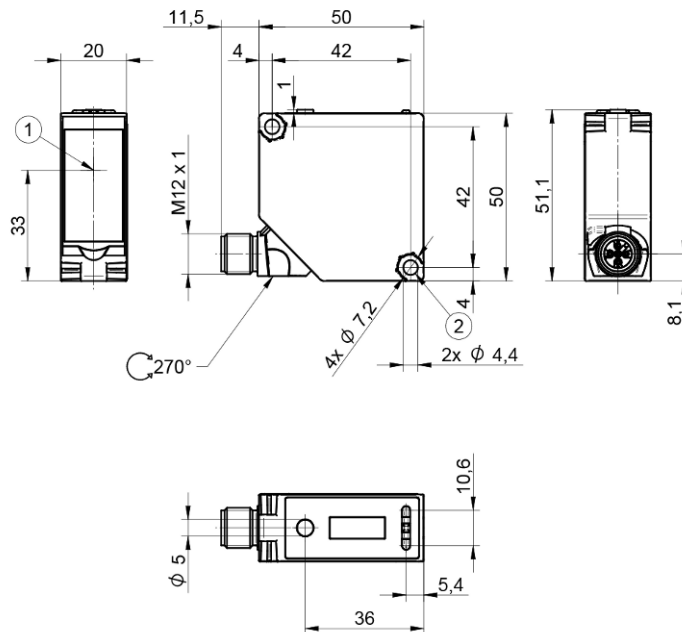


3 Technical Data

3.1 General information

	P1PF001
Optical data	
Working Range	30...40 mm
Working Distance	35 mm
Switching Hysteresis	< 1 %
Light Source	White Light
Service Life (T = +25 °C)	100000 h
Max. Ambient Light	10000 Lux
Light Spot Diameter	
Electrical data	
Supply Voltage	18...30 V DC
Supply Voltage with IO-Link	
Current Consumption (U _b = 24 V)	< 50 mA
Switching Frequency	8 kHz
Response Time	50 µs
Temperature Drift	< 10 %
Temperature Range	-25...60 °C
Switching Output Voltage Drop	1.5 V
Short Circuit Protection	yes
Reverse Polarity Protection	yes
Interface	IO-Link V1.1
Protection Class	III
Mechanical data	
Setting Method	Teach-In
Housing Material	Plastic, ABS
Optic Cover	Plastic, PMMA
Degree of Protection	IP67
Connection	M12 × 1; 5-pin
Safety technology data	
MTTFd (EN ISO 13849-1)	719.27 a
Output functions	
Output	PNP
Circuit	NO
Adjustable parameters	
Output	Push-pull NPN PNP
Circuit	NC NO
Other parameters	Off-delay On-delay
General data	
Scope of delivery	1 × Z1PE002 mounting set 1 × initial start-up instructions 1 × sensor

3.2 Housing Dimensions

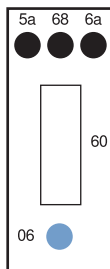


- ① Optical axis
- ② Wrench Size 7

Dimensions in mm (1 mm = 0.03937 inch)

3.3 Control panel

X13



- 06 = Teach Button
- 5a = Switching Status Indicator, O1
- 68 = Power LED
- 6a = Switching Status Indicator, O2
- 60 = display

3.4 Complementary Products

wenglor offers you the right connection and mounting technology as well as other accessories for your product. You can find this at www.wenglor.com on the product details page at the bottom.

4 Transport and Storage

4.1 Transport

Upon receipt of shipment, the goods must be inspected 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.



NOTICE

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.
- Relevant electrical and mechanical regulations, standards, and safety rules must be observed.
- Protect the product from mechanical impact.
- Ensure that the sensor is mechanically secure.
- Torque values must be observed (see section Technical Data [► 8]).



NOTICE

Risk of property damage in case of improper installation!

The product may be damaged!

→ Comply with installation instructions.



CAUTION

Risk of personal injury or property damage during installation!

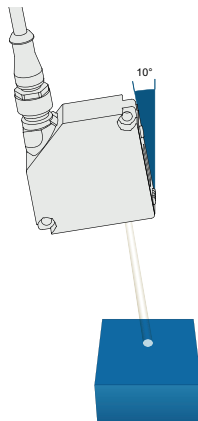
Personal injury and damage to the product may occur.

→ Ensure a safe installation environment.

5.2 Adjustment

The following information must be observed when adjusting the sensor to ensure the most stable object detection possible:

- Adjust the sensor at the working distance so that a sharp image of the light spot is produced.
- A slightly inclined mounting of the sensor with an angle of up to 10° is recommended.



5.3 Electrical Connection

- Wire the sensor according to the connection diagram.
- Switch on the supply voltage (see section Technical Data [► 8]).
- If using IO-Link, connect the sensor to 18...30 V DC.

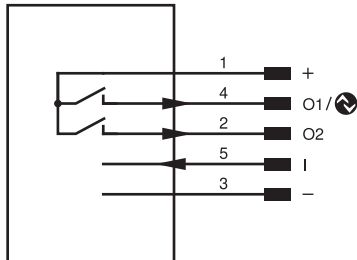


DANGER

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

Live parts may cause damage to persons and equipment.

→ The electrical device may only be connected by qualified personnel.



Pin	Pin function	Polarity	Circuit
1	Supply voltage +		
2	Switching output	PNP	NO
3	Supply voltage 0 V		
4	Switching output	PNP	NO
5	Input		High active

5.4 Diagnosis

Display	Status	Meaning
Power LED P		Sensor ready
		No voltage supply available
		Warning The LEDs for switching status indicator O1 and O2 remain in operation
		Error The LEDs for switching status indicator O1 and O2 are not functioning
Switching status indicators O1, O2		Switching outputs active
		Switching output not active
Localization		Localization function active

 = not lit

 = permanently lit

 = flashing

5.5 Troubleshooting

Warnings

Possible cause	Solution
Temperature too low	• Increase ambient temperature

Possible cause	Solution
Temperature too high	• Mount mounting bracket as cooling plate • Reduce load on outputs
Undervoltage	• Increase voltage supply to at least 18 V DC

Error

Possible cause	Remedy
Short circuit	• Check the wiring and eliminate the short circuit
Temperature error	• Disconnect the sensor from the supply voltage and allow it to cool down • Mount mounting bracket as cooling plate • Reduce load at the outputs
Device error	• Disconnect the sensor from the supply voltage and restart it • Replace sensor



INFORMATION

Action in case of error:

1. Take the machine out of service.
2. Analyze and rectify the cause of the error using the diagnostic information.
3. If the fault cannot be rectified, contact wenglor support.
4. Do not operate the machine if the error behavior is unclear.
5. The machine must be taken out of service if the error cannot be clearly identified or reliably rectified.



DANGER

Risk of personal injury or property damage if not observed!

The safety function of the system is disabled. Damage to personnel and equipment.

→ Behavior in case of error as specified.

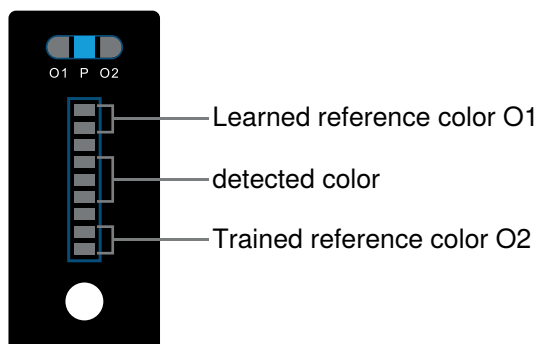
6 Display

The sensor has an integrated display in the form of a 9-segment LED bar display. This visualizes the currently detected color and the learned reference colors. Two different display views are available.

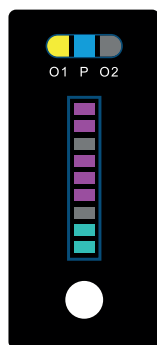
Physical output display

The physical output display is preset in the delivery state. The display is divided into three areas:

- The upper section shows the trained reference color for output O1 (segments 1 and 2).
- The middle section displays the currently recognized color (segments 4, 5, and 6).
- The lower section displays the programmed reference color for output O2 (segments 8 and 9).



Example: Output O1 switched:

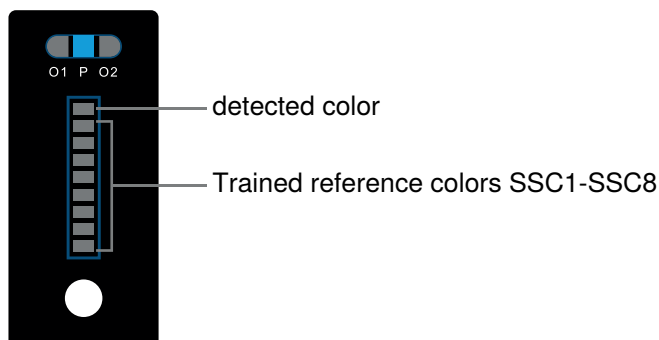


Virtual output display

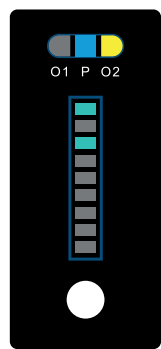
The display can be switched to the virtual output display via IO-Link.

In this view, the display serves as the switching status indicator for digital outputs SSC1 to SSC8.

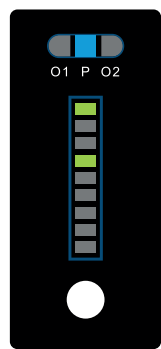
In addition to the currently recognized color (segment 1), the reference color of the active digital switching output is displayed (segments 2 to 9).



Example: Output SSC2 switched:



Example of output SSC3 switched:



7 Settings

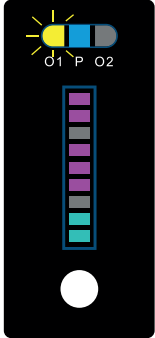
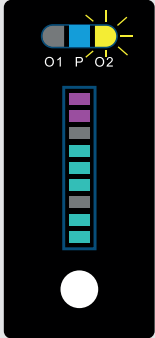
The sensor can be set via teach-in, IO-Link and wTeach2. The different setting options are outlined below.

7.1 Configuration with Push of Button / Teach-In

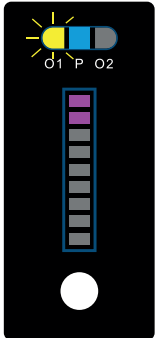
This section describes the settings that can be configured directly on the sensor using the button.

Two bar graph modes are available. These can be set via IO-Link (see section Settings via IO-Link/Parameters). The physical output display is used in the default setting.

Teach-in with physical output display

	Teach-in for O1 • Position the object so that the light spot hits the color to be taught in. • Press and hold the teach-in key for 2 seconds until LED O1 starts flashing. • Release the teach-in key. • LED O1 flashes twice briefly to confirm successful teach-in. • The display shows the learned color in the upper section.
	Teach-in for O2 • Position the object so that the light spot hits the color to be taught in. • Press and hold the teach-in key for 5 seconds until LED O2 starts flashing. • Release the teach-in key. • The O1 LED flashes twice briefly to confirm successful teach-in. • The display shows the taught-in color in the lower section.

Teach-in with visual output display

	Teach-in for O1 • Position the object so that the light spot hits the color to be taught in. • Press and hold the teach-in key for 2 seconds until LED O1 starts flashing. • Release the teach-in key. • LED O1 flashes twice briefly to confirm successful teach-in. • The display shows the taught-in color in the second segment from the top as long as the taught-in color is in the light spot of the sensor.
---	--



Teach-in for O2

- Position the object so that the light spot hits the color to be taught in.
- Press and hold the teach-in key for 5 seconds until LED O2 starts flashing.
- Release the teach-in key.
- The O2 LED flashes twice briefly to confirm successful teach-in.
- The display shows the taught-in color in the third segment from the top as long as the taught-in color is in the light spot of the sensor.

8 Function Description

The functions described in the following section can be set via wTeach or IODD via IO-Link.

8.1 Sensor Functions

Function	Possible settings	Default setting
Localization	The LEDs O1 and O2 on the sensor can be set to flash. This makes it easy to locate the sensor in a system. On The LEDs O1 and O2 flash. Off LEDs in normal operation.	Off
Key disabling	The teach-in key can be locked to protect the sensor against accidental adjustment. Unlocked Operation possible via the teach-in key Locked Operation via teach-in key not possible	Unlocked
mode of operation	There are two operating modes available for interpreting the color. RGB The signal values of the red, green, and blue color channels are output. HSL The color is defined by hue (H), saturation (S), and lightness (L).	RGB
Bar graph mode	The display has two different views. Physical output display The display is divided into three areas. • The middle section displays the currently recognized color. • The upper section shows the programmed reference color for output O1. • The lower section visualizes the taught-in reference color for output O2. Virtual output display The display is divided into nine segments. • Segment 1 displays the currently detected color. • Segments 2 to 9 display the learned color from SSC1 to SSC8 if the corresponding color has been detected by the sensor.	Physical output display
Emitted light	The transmit LED of the sensor can be switched on or off. On Transmit LED on Off Transmit LED off The sensor no longer supplies a measured value. Note!	On

Function	Possible settings	Default setting
	If the emitted light LED is switched off, the sensor behavior corresponds to the status "No signal."	
Filter	The interference filter can be used to increase measurement reliability in the event of temporary interference. A higher filter level allows the interfering signals to be ignored. If changes happen suddenly, the response time is extended. This extension of the response time depends on the filter level and the mode used. The maximum switching frequency can be reached only with minimum filter selection Minimum Medium Maximum	Minimum
Hysteresis	The hysteresis is the difference between the switch-on and switch-off point and can be set in 3 stages. Minimum Medium Maximum	Medium
Light intensity	The light intensity of the sensor can be adjusted to the color to be detected in order to achieve optimum signal strength. Maximum Optimal for very dark colors. medium Minimum Optimal for very light colors. Custom	medium

8.2 Input/output functions (I/O)

8.2.1 Pin Functions

The pin function is used to define the function of the pins, as they can be used for different functions.

Function	Possible settings	Default settings
O1	switching output The switching point SSC1 is assigned to the switching output. error output The error output switches when one of the assigned errors occurs, see table "Status messages." Warning output The warning output switches when one of the assigned warnings occurs, see table "Status messages".	switching output
O2	switching output The switching point O2 is assigned to the switching output. Antivalent switching output The switching output switches antivalent to switching output O1. error output The error output switches in the event of one of the assigned errors, see table "Status messages." Warning output	switching output

Function	Possible settings	Default settings
	The warning output switches when one of the assigned warnings occurs, see table "Status messages". Deactivated The pin is deactivated.	
I3	teach-in input The output can be set using the same procedure as with the teach-in key (see section Configuration with Push of Button / Teach-In [► 16]). An activated input corresponds to a pressed teach-in key. Trigger input In trigger mode, a switching operation is only triggered by an edge (change of an electrical signal from negative to positive or vice versa) at the trigger input. Deactivated The pin is deactivated.	teach-in input

8.2.2 Output Functions

The output functions are used to set the physical outputs.

Digital outputs

Function	Possible settings	Default
PNP/NPN/push-pull	PNP The load or analysis module is connected between the negative pole (reference) and the output. When the sensor switches, the output is connected to the positive pole via an electronic switch. The switching signal is maintained when a pull-down resistor is connected. NPN The load or the analysis module is connected between the positive pole (reference) and the output. When the sensor switches, the output is connected to the negative pole via an electronic switch. The switching signal is maintained when a pull-up resistor is connected. push-pull PNP and NPN are switched alternately.	PNPPNP
NC/normally open	NO Light switching (normally open) The output is closed when the condition has been met, depending on the setting (switching point, warning, error). NC Dark switching The output is open when the condition has been met, depending on the setting (switching point, warning, error).	NO NO
On-delay	0...10,000 ms	0 ms
Off-delay	0...10,000 ms	0 ms
Impulse	0...10.000 ms	0 ms

8.2.3 Input Functions

The input functions are used to set the physical inputs.

Function	Possible settings	Default
Input mode	Supply voltage active Function is triggered as soon as supply voltage is applied to the input. Supply voltage inactive Function is triggered as soon as 0 V is applied to the input or the input is opened.	Supply voltage active

8.3 Switching Point Functions

The switching point functions are used to set switching points SSC1 to SSC8. SSC1 is assigned to output O1 and SSC2 to output O2.

Function	Possible settings	Default
Teach-in	Starts the teach-in process.	
Switching point red/green/blue	Teach signal in the mode of operation for RGB The switching point corresponds to the switching threshold of the contrast value and is defined in digits. 0...1023	
Upper window size red/green/blue	Teach signal in mode of operation RGB The upper window size is set. The entered value is added to the switching point of the respective color.	50
Lower window size red/green/blue	Teach signal in the mode of operation for RGB The lower window size is set. The entered value is subtracted from the switching point of the respective color.	50
Switching point hue	Teach signal in the HSL mode of operation The switching point corresponds to the switching threshold of the hue and is specified as an angle in the color wheel. 0...359	
Switching point saturation	Teach signal in HSL mode of operation The switching point corresponds to the switching threshold of the saturation. 0...1023	
Switching point brightness	Teach signal in HSL mode of operation The switching point corresponds to the switching threshold for brightness. 0...1023	
Upper window size Hue	Teach signal in HSL mode of operation The upper window size for the hue is set. The entered value is added to the switching point of the hue.	20
Upper window size for saturation	Teach signal in the HSL mode of operation The upper window size for saturation is set. The entered value is added to the saturation switching point.	50
Upper window size Brightness	Teach signal in HSL mode of operation The upper window size for brightness is set. The entered value is added to the brightness switching point.	50
Lower window size Hue	Teach signal in HSL mode of operation The lower window size for the hue is set. The entered value is subtracted from the switching point for the hue.	20
Lower window size for saturation	Teach signal in the HSL mode of operation The lower window size for saturation is set. The entered value is subtracted from the saturation switching point.	50

Function	Possible settings	Default
Lower window size Brightness	Teach signal in the HSL mode of operation The lower window size for brightness is set. The entered value is subtracted from the brightness switching point.	50

8.4 Condition Monitoring Functions

8.4.1 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.

8.4.2 Warning/Error Output Function

For the warning output and the error output, you can define the status messages that are used to trigger the collective message. The status messages are linked with an OR function, 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	Temperature too high, temperature too low, undervoltage
error output	See table Status messages	Device error, overtemperature, short circuit

status messages

Warning	
Undervoltage	The supply voltage is too low.
Temperature too low	The sensor's internal temperature is low.
Temperature too high	The sensor's internal temperature is high.

Error	
Short circuit	A short circuit has occurred on at least one pin.
Over-temperature	The over-temperature has been exceeded. To protect the emitting unit, the laser is switched off.
Device error	A hardware error has occurred. For safety reasons, the emitted light is switched off.

8.4.3 Simulation Functions

This function simulates the behavior of the sensor regardless of its current status and measured value. This allows you to check whether a system in which the sensor is integrated responds correctly to the data supplied by the sensor and processes it 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.



INFORMATION

The O1 output is used for IO-Link communication in this function and cannot be simulated.
Simulation mode is automatically terminated as soon as the voltage supply is interrupted.

Function	Possible settings	Default
Simulation mode	On Off	Off
Test signal value (red/color tone)	Current signal value 0...1023 (red) 0...359 (color tone)	Current measured value
Test signal value (green/saturation)	Current signal value 0...1023	Current measured value
Test signal value (blue/brightness)	Current signal value 0...1023	Current measured value
Test SSC1-SSC8	According to measured value On Off Use process value	Off
Status messages test	Tests the individual status messages according to the measured value On Off	According to measured value

9 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 in the download area for the respective product.

9.1 Parameters

The parameters that can be configured via IO-Link are given in the functional description in the section Function description [► 18].

10 **wTeach2 Configuration Software**

For information on installing and connecting the wTeach2 software and its structure, as well as information on the general functions, see the wTeach2 operating instructions. They can be found online in the download area at www.wenglor.com under order number DNNF005.

11 Maintenance Instructions



NOTICE

This wenglor product is maintenance-free.

Cleaning and inspection of the plug connections at regular intervals are advisable.

Do not clean the product 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 **Declarations of Conformity**

Declarations of conformity can be found on our website at www.wenglor.com in the product's separate download area.