OPT2023
Color Sensor

Operating Instructions

Original operating instructions
Subject to change without notice
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www.wenglor.com
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1. Proper Use

wenglor color sensors detect pre-defined colors.

2. Safety Precautions

- This operating instruction is part of the product and must be kept during its entire service life.
- Read this operating instruction carefully before using the product.
- Installation, start-up and maintenance of this product has only to be carried out by trained personnel.
- Tampering with or modifying the product is not permissible.
- Protect the product against contamination during start-up.
- Not a safety component in accordance with the EU Machinery Directive.

3. EU Declaration of Conformity

The EU declaration of conformity can be found on our website at www.wenglor.com in download area.
4. Technical Data

<table>
<thead>
<tr>
<th>Order No.</th>
<th>OPT2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working Range</td>
<td>30...40 mm</td>
</tr>
<tr>
<td>Working Distance</td>
<td>35 mm</td>
</tr>
<tr>
<td>Light Source</td>
<td>White Light</td>
</tr>
<tr>
<td>Service Life (Tu = 25 °C)</td>
<td>100000 h</td>
</tr>
<tr>
<td>Max. Ambient Light</td>
<td>10000 Lux</td>
</tr>
<tr>
<td>Light Spot Diameter</td>
<td>3 mm</td>
</tr>
<tr>
<td>Supply Voltage</td>
<td>10...30 V</td>
</tr>
<tr>
<td>Current Consumption (Ub = 24 V)</td>
<td>&lt; 80 mA</td>
</tr>
<tr>
<td>Switching Frequency</td>
<td>1.8 kHz</td>
</tr>
<tr>
<td>Response Time</td>
<td>$\sim \frac{1000}{1.8} \mu s \times \text{filter}$</td>
</tr>
<tr>
<td>Temperature Range</td>
<td>–25...60 °C</td>
</tr>
<tr>
<td>Switching Outputs</td>
<td>3</td>
</tr>
<tr>
<td>Switching Output Voltage Drop</td>
<td>1.5 V</td>
</tr>
<tr>
<td>PNP Switching Output/Switching Current</td>
<td>100 mA</td>
</tr>
<tr>
<td>Short Circuit Protection</td>
<td>yes</td>
</tr>
<tr>
<td>Reverse Polarity Protection</td>
<td>yes</td>
</tr>
<tr>
<td>Overload Protection</td>
<td>yes</td>
</tr>
<tr>
<td>Digital Inputs</td>
<td>2</td>
</tr>
<tr>
<td>Protection Class</td>
<td>III</td>
</tr>
<tr>
<td>Adjustment</td>
<td>Teach-In</td>
</tr>
<tr>
<td>Housing</td>
<td>Plastic</td>
</tr>
<tr>
<td>Degree of Protection</td>
<td>IP68</td>
</tr>
<tr>
<td>Connection</td>
<td>M12 × 1; 8-pin</td>
</tr>
<tr>
<td>NO/NC switchable</td>
<td>✓</td>
</tr>
<tr>
<td>Configurable as PNP/NPN/Push-Pull</td>
<td>✓</td>
</tr>
<tr>
<td>Error Output</td>
<td>✓</td>
</tr>
<tr>
<td>Contamination Output</td>
<td>✓</td>
</tr>
</tbody>
</table>
4.1 Connection Diagram

OPT2023

Legend

+ Supply Voltage +
- Supply Voltage 0 V
= Supply Voltage (AC Voltage)
A Switching Output (NO)
Ä Switching Output (NC)
V Contamination/Error Output (NO)
V Contamination/Error Output (NC)
E Input (analog or digital)
T Teach Input
Z Time Delay (activation)
S Shielding
RD Interface Receive Path
TXO Interface Send Path
RDY Ready
GND Ground
CL Clock
E/A Output/Input programmable
🔗 IO-Link
PoE Power over Ethernet
IN Safety Input
OOD Safety Output
Signal Signal Output
RDL R Ethernet Gigabit bidirect. data line (A-D)
ENDET Encoder 0-pulse 0-5 (TTL)

PT Platinum measuring resistor
nc not connected
U Test Input
Ü Test Input inverted
W Trigger Input
O Analog Output
O= Ground for the Analog Output
BZ Block Discharge
A/W Valve Output
a Valve Control Output +
b Valve Control Output 0 V
SY Synchronization
F+ Receiver-Line
S+ Emitter-Line
@ Grounding
SR Switching Distance Reduction
Rx +/- Ethernet Receive Path
Tx +/- Ethernet Send Path
Üba Interfaces-Bus A(+) / B(-)
La Emitted Light disengageable
Ma Magnet activation
RES Input confirmation
EDM Contactor Monitoring
ENET Encoder A/A (TTL)
ENB Encoder B/B (TTL)

ENa Encoder A
ENa Encoder B
AWX Digital output MIN
AWX Digital output MAX
AOK Digital output OK
SY IN Synchronization In
SY OUT Synchronization OUT
DST Brightness output
M Maintenance

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
PF Pink
GNYE Green/Yellow

OPT2023
4.2 Housing dimensions

Screw M4 = 1 Nm

4.3 Control Panel

20 = Enter Button
22 = Up Button
23 = Down Button
60 = Display
5. Mounting instructions

During the operation of the Sensors, the corresponding electrical and mechanical regulations, as well as safety regulations must be observed. The Sensor must be protected from mechanical impact.

Mounting:
6. Initial Operation

6.1 Initial Operation

Connect the sensor to the supply voltage. After initialization the sensor shows the indication screen and is ready for operation. During the first commissioning and after a reset you can first of all select the menu language by simply pressing a button (see Fig. 1).

![Language selection](image)

Fig. 1: Set menu language

The functions of the keys appear in the display as follows:

- **▲**: Navigate up.
- **▼**: Navigate down.
- **↵**: Selection is acknowledged with the enter key.

**Meaning of the menu points:**

- Next: One level down in the menu.
- Back: One level up in the menu.
- Run/Terminate: Change to the display mode:

Change to the configuration menu by pressing any button.

**Notice:** 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.

**Important:** Do not use pointed objects for sensor setting. Otherwise you risk damaging the buttons.

**Assistant:** The sensor is equipped with an assistant for simplified adjustment to the respective application. After cancelling the configuration assistant, the complete menu appears at the display.
6.2 Default Settings

<table>
<thead>
<tr>
<th>Pin function</th>
<th>OPT2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>Switching Output</td>
</tr>
<tr>
<td>A2</td>
<td>Switching Output</td>
</tr>
<tr>
<td>A3</td>
<td>Switching Output</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outputs</th>
<th>OPT2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teach mode</td>
<td>T Window</td>
</tr>
<tr>
<td>Tolerance</td>
<td>Small</td>
</tr>
<tr>
<td>PNP/NPN/Push-pull</td>
<td>Push-pull</td>
</tr>
<tr>
<td>NO/NC</td>
<td>NO</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Display</th>
<th>OPT2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode</td>
<td>Outputs</td>
</tr>
<tr>
<td>Intensity</td>
<td>Screen saver</td>
</tr>
</tbody>
</table>
7. Functional description

Run

Pin Function
A1
A2
A3

Configure

Depends on Pin Function:
A1 Switch
A2 Switch
A3 Switch

During Switching Output
T Window
T Sample
Tolerance
NPN/PNP
NO/NC

During Error Output or Contamination Output
NPN/PNP
NO/NC

Display

Mode Rotate Intensity

Assistent

Teach Output

- Outputs
- Bar Graph
- Min
- Medium
- Max
- Power Save
- Screensaver

- <T> for Teach-In
- Teach OK/NOK
- Tolerance
  - Maximum
  - Very large
  - Large
  - Middle
  - Small
  - Very small
  - Minimum

- PNP
- NPN
- Push-Pull

- NO
- NC

- NO
- NC
Below is an explanation of the functions of each menu item.

7.1 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.

<table>
<thead>
<tr>
<th>Meaning</th>
<th>Condition 1</th>
<th>Condition 2</th>
<th>Condition 3</th>
<th>Condition 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switching Output</td>
<td>Switched</td>
<td>Not switched</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Error Output</td>
<td>OK</td>
<td>No signal</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Contamination Output</td>
<td>OK</td>
<td>Signal too low</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Signal Strength</td>
<td>OK</td>
<td>Signal too low</td>
<td>Signal too high</td>
<td>No signal</td>
</tr>
</tbody>
</table>

7.2 Pin function

The Pin function is used to determine the function of pins A1, A2, A3 since the pins may be used for different functions.

A1

Configuration of Pin A1

Deactivated: Deactivation of the output
Switch: Switching Output
Error: Error Output
Contamination: Contamination Output

A2

Configuration of pin A2

Deactivated: Deactivation of the output
Switch: Switching Output
Error: Error Output
Contamination: Contamination Output

A3

Configuration of pin A3

Deactivated: Deactivation of the output
Switch: Switching Output
Error: Error Output
Contamination: Contamination Output
7.3 A setting

Depending on the preset pin function, the name is displayed in this menu item, e.g. A1 Switch. Each menu item includes the following sub items:

**For Switching Output**

If the pin is preset as Switching Output, the following functions may be set:

<table>
<thead>
<tr>
<th>Detection RGB:</th>
<th>T Window:</th>
<th>Teach-In of a tolerance window in which the sensor is switched.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T Sample:</td>
<td>Additional Teach-In of an OK or NOK sample</td>
</tr>
<tr>
<td></td>
<td>Tolerance:</td>
<td>Specification of the color tolerance level</td>
</tr>
<tr>
<td></td>
<td>NPN/PNP:</td>
<td>Configuration of the output</td>
</tr>
<tr>
<td></td>
<td>NO/NC:</td>
<td>Configuration of the output</td>
</tr>
</tbody>
</table>

These menu items are described in more detail in chapter 7.3.1 to 7.3.5.

**For error and contamination output**

If the pin is set as error or contamination output, the following functions can be set:

<table>
<thead>
<tr>
<th>A1 Error (example)</th>
<th>A1 and/or A2 as error output or contamination output</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPN/PNP</td>
<td>NPN/PNP: Configuration of the output</td>
</tr>
<tr>
<td>NO/NC</td>
<td>NO/NC: Configuration of the output</td>
</tr>
</tbody>
</table>

Explanations for “NPN/PNP” are provided in chapter 7.3.4, page 13. Explanations for “NO/NC” are provided in chapter 7.3.5, page 13.

### 7.3.1. Switching Output Window Teach-In

There are two switching points for window Teach-In. The size of the window is referred to as tolerance. If a color is within the window, the sensor switches.

<table>
<thead>
<tr>
<th>T Window</th>
<th>Window Teach-In</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;T&gt; for Teach-In</td>
<td>Teach-In Window-Teaching process:</td>
</tr>
</tbody>
</table>

1) Align illuminated spot with the background (if available) or to the object.
2) Press “T” button. –> The switching points are taught in.

**Notice:**

- T Sample: Additional Teach-In of OK or NOK samples in order to adjust tolerance.
- In the “Tolerance” menu item (see chapter 7.3.3), the size of the window width can be reduced or increased.
### 7.3.2. Switching Output Sample Teach-In

<table>
<thead>
<tr>
<th>Sample Teach-In</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OK</strong></td>
</tr>
<tr>
<td><strong>NOK</strong></td>
</tr>
</tbody>
</table>

Teach-IN Sample Teaching process:
1) Teach-IN of OK sample
   - Align light spot with the object.
   - Press “OK” button. -> Tolerance is increased.
2) Teach-IN of NOK sample
   - Align light spot with the object.
   - Press “NOK” button. -> Tolerance is decreased.

### 7.3.3. Switching Output Tolerance

<table>
<thead>
<tr>
<th>Tolerance</th>
<th>Changing tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum</td>
<td>Tolerance is set to a maximum value.</td>
</tr>
<tr>
<td>Very large</td>
<td>Tolerance is set to a very large value.</td>
</tr>
<tr>
<td>Large</td>
<td>Tolerance is set to a large value.</td>
</tr>
<tr>
<td>Middle</td>
<td>Tolerance is set to a medium value.</td>
</tr>
<tr>
<td>Small</td>
<td>Tolerance is set to a small value.</td>
</tr>
<tr>
<td>Very small</td>
<td>Tolerance is set to a very small value.</td>
</tr>
<tr>
<td>Minimum</td>
<td>Tolerance is set to a minimum value.</td>
</tr>
</tbody>
</table>

### 7.3.4. Switching Output NPN/PNP

<table>
<thead>
<tr>
<th>NPN/PNP</th>
<th>Output configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PNP</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>NPN</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Push-pull</strong></td>
<td>Push-pull output. Acts like an electronic switch which optionally switches the output to the positive pole or the negative pole.</td>
</tr>
</tbody>
</table>

### 7.3.5. Switching Output NO/NC

<table>
<thead>
<tr>
<th>NO/NC</th>
<th>Output configuration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NO</strong></td>
<td>Normally open. The output closes as soon as an object reaches the switching point.</td>
</tr>
<tr>
<td><strong>NC</strong></td>
<td>Normally closed. The output opens as soon as an object reaches the switching point.</td>
</tr>
</tbody>
</table>
7.4 Display

Adjusting the display device

<table>
<thead>
<tr>
<th>Mode</th>
<th>Rotate</th>
<th>Intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mode: Select display mode (see chapter “7.4.1. Display Mode”, page 14)

Rotate: Rotate display by 180°.

The display is rotated by 180° by pressing the ← key. The rotation is canceled by pressing this key again.

Intensity: Set the display intensity (see chapter “7.4.2. Display Intensity”, page 14)

7.4.1. Display Mode

Select display mode

<table>
<thead>
<tr>
<th>Outputs</th>
<th>Bar Graph</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Outputs: The condition of each output is indicated on the display.

Bar Graph: The RGB color spaces / shares of the object are indicated in a bar graph.

7.4.2. Display Intensity

Set the display intensity

<table>
<thead>
<tr>
<th>Min</th>
<th>Normal</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Min: The intensity of the display is set to a minimum value.

Medium: The intensity of the display is set to a normal value.

Max: The intensity of the display is set to a maximum value.

Power save: The display switches off after one minute without a button being pressed and automatically switches back on when a button is pressed.

Screen saver: The colors of the display are inverted every minute.

7.5 Assistant

Starting/using the assistant

The sensor is equipped with an assistant for the simplified setting to each application. If you abort the configuration assistant, you will return to the comprehensive menu.

If you use the assistant, you will get the following support for teaching in object colors:

Select output

Here you can select the output for which a color should be taught in.

<table>
<thead>
<tr>
<th>A1</th>
<th>A2</th>
<th>A3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Acknowledge your selection always with ➔ Next in order to access the next window.
Aligning light spot with the color
O Teach-In (T)

Next
Back
Exit

Align your object with the working area and select Teach-In (T). You will get a message whether Teach-In was successful.

Does the sensor switch reliably?
<Ax Display>
O Yes
O T Sample OK
O T Sample NOK
O No

Next
Back
Exit

Select <Ax Display> in order to check in the OLED display whether each taught-in output reliably switches to the taught-in color. If the output does not switch reliably, you have the following options:

- T Sample OK: You may teach in another OK sample. This increases the tolerance.
- T Sample NOK: You may teach in a NOK sample. This decreases the tolerance.
- No: You may completely re-Teach-In the color.

Want to teach in another output?
O Yes
O No

Next
Back
Exit

Select “Yes” to teach in another color on another output. Select “No” to quit the assistant.
8. Maintenance Instructions

- 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.

9. 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.

10. Change Index, Operating Instructions

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Description/Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0.0</td>
<td>17.11.2016</td>
<td>Initial version of the operating instructions</td>
</tr>
<tr>
<td>1.1.0</td>
<td>04.05.2017</td>
<td>Connection Diagram changed</td>
</tr>
</tbody>
</table>