colorSENSOR OT Series

Product name:

colorSENSOR OT-3-MA-50-25
colorSENSOR OT-3-MA-50-12.5
(incl. software colorCONTROL-S)

Design

- By use of an aperture Ø 5 mm the detection range at the working distance of 30 mm will be reduced to 5 mm.

Mounting accessories:

(p. 8)
FL-34 (flange)
WFL-34 (flange)

Optics holding device
(aluminum, anodized)

Receiver optics and transmitter optics with 8x white light LED incl. 3-color filter detector (True Color)
scratch-resistant optics cover made of glass

4-pole fem. connector
Binder Series 707
RS232-interface

Connecting cable:
CAB-M5-4P-St-ge; xm-PUR; RB232 or CAB-M5-4P-St-ge; xm-PVC; USB

TEACH button
(external teaching via input IN0)

Connecting cable:
CAB-M5-4P-St-ge; xm-PUR; open

8-pole fem. connector
Binder Series 712
(connection to PLC)

Sturdy aluminum housing, anodized in blue

Mounting screws
(M34)

Connecting cable:
CAB-M9-8P-St-ge; xm-PUR; open

LED display:
Switching state indication by means of 5 yellow LED

colorSENSOR OT-3 Series • True Color Sensors

Instruction Manual colorSENSOR OT-3-MA-50
## Technical Data

<table>
<thead>
<tr>
<th>Type</th>
<th>OT-3-MA-50-12.5</th>
<th>OT-3-MA-50-25</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Light source</strong></td>
<td>8x white-light LED, AC-, DC-operation (adjustable or OFF in case of luminous objects adjustable via software)</td>
<td>8x white-light LED, AC-, DC-operation (adjustable or OFF in case of luminous objects adjustable via software)</td>
</tr>
<tr>
<td><strong>Illumination technique</strong></td>
<td>focused</td>
<td>focused</td>
</tr>
<tr>
<td><strong>Effect of illumination</strong></td>
<td>Big dynamic range for flat/dark surfaces</td>
<td>Big dynamic range for flat/dark surfaces</td>
</tr>
<tr>
<td><strong>Target distance</strong></td>
<td>typ. 20 mm up to 120 mm ideal distance 50 mm</td>
<td>typ. 20 mm up to 120 mm ideal distance 50 mm</td>
</tr>
<tr>
<td><strong>Light spot size</strong></td>
<td>Ø 12.5 (12.5 dia.) mm at 50 mm</td>
<td>Ø 25 (25 dia.) mm at 50 mm</td>
</tr>
<tr>
<td><strong>Reproducibility</strong></td>
<td>in the X, Y color range each 1 digit at 12-bit A/D conversion</td>
<td>in the X, Y color range each 1 digit at 12-bit A/D conversion</td>
</tr>
<tr>
<td><strong>Color distance</strong></td>
<td>ΔE ≥ 0.8</td>
<td>ΔE ≥ 0.8</td>
</tr>
<tr>
<td><strong>Receiver</strong></td>
<td>3-color filter detector (TRUE COLOR Detector, color filter bend according to CIE 1931)</td>
<td>3-color filter detector (TRUE COLOR Detector, color filter bend according to CIE 1931)</td>
</tr>
<tr>
<td><strong>Alternating light operation</strong></td>
<td>AC: typ. 10 kHz up to 40 kHz depends on the gain step (AMP1 up to AMP8) DC: adjustable via PC software</td>
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</tr>
<tr>
<td><strong>Ambient light</strong></td>
<td>up to 5000 Lux (in AC-operation)</td>
<td>up to 5000 Lux (in AC-operation)</td>
</tr>
<tr>
<td><strong>Protection class</strong></td>
<td>IP 67 (optics), IP 64 (controller)</td>
<td>IP 67 (optics), IP 64 (controller)</td>
</tr>
<tr>
<td><strong>Current consumption</strong></td>
<td>typ. 320 mA</td>
<td>typ. 320 mA</td>
</tr>
<tr>
<td><strong>Interface</strong></td>
<td>RS 232 (optional USB)</td>
<td>RS 232 (optional USB)</td>
</tr>
<tr>
<td><strong>Connector type</strong></td>
<td>to PLC: 8-pole female connector (Binder series 712) to PC: 4-pole female connector (Binder series 707)</td>
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</tr>
<tr>
<td><strong>Connection cable</strong></td>
<td>to PLC: CAB-M9-8P-St-ge; xm-PUR; open to PC: CAB-M5-4P-St-ge; xm-PUR; RS232; CAB-M5-4P-St-ge; xm-PVC; USB</td>
<td>to PLC: CAB-M9-8P-St-ge; xm-PUR; open to PC: CAB-M5-4P-St-ge; xm-PUR; RS232; CAB-M5-4P-St-ge; xm-PVC; USB</td>
</tr>
<tr>
<td><strong>Housing material</strong></td>
<td>Aluminum, anodized in black</td>
<td>Aluminum, anodized in black</td>
</tr>
<tr>
<td><strong>Operating temperature</strong></td>
<td>-20°C - + 55°C (-4°F up to +131°F)</td>
<td>-20°C - + 55°C (-4°F up to +131°F)</td>
</tr>
<tr>
<td><strong>Storage temperature</strong></td>
<td>-20°C - +85°C (-4°F up to +185°F)</td>
<td>-20°C - +85°C (-4°F up to +185°F)</td>
</tr>
<tr>
<td><strong>Pulse lengthening</strong></td>
<td>adjustable 0 ms up to 100 ms</td>
<td>adjustable 0 ms up to 100 ms</td>
</tr>
<tr>
<td><strong>Max. switching current</strong></td>
<td>100 mA, short-circuit-proof</td>
<td>100 mA, short-circuit-proof</td>
</tr>
<tr>
<td><strong>Switching frequency</strong></td>
<td>max. 30 kHz (depends on the number of teach-colors and averaging value)</td>
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</tr>
<tr>
<td><strong>Outputs</strong></td>
<td>OUT 0 - OUT 4, digital (0V/+Ub), short-circuit-proof 100 mA max. switching current n-pn-, n-pn-available (bright-, dark-switching can be switched over)</td>
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</tr>
<tr>
<td><strong>Averaging</strong></td>
<td>over 32768 values max.</td>
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</tr>
<tr>
<td><strong>Voltage supply</strong></td>
<td>+24 VDC (± 10 %), protected against polarity reversal, overload protected</td>
<td>+24 VDC (± 10 %), protected against polarity reversal, overload protected</td>
</tr>
<tr>
<td><strong>Switching state display</strong></td>
<td>Visualization by means of 5 yellow LED's</td>
<td>Visualization by means of 5 yellow LED's</td>
</tr>
<tr>
<td><strong>Color memory capacity</strong></td>
<td>non-volatile EEPROM with parameter sets for 31 colors max.</td>
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</tr>
<tr>
<td><strong>TEACH button</strong></td>
<td>for external teaching of color reference values via input IN0</td>
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</tr>
<tr>
<td><strong>Temperature drift X,Y</strong></td>
<td>&lt; 0.01% / K</td>
<td>&lt; 0.01% / K</td>
</tr>
<tr>
<td><strong>Signal gain</strong></td>
<td>8 steps (AMP1 - AMP8), adjustable</td>
<td>8 steps (AMP1 - AMP8), adjustable</td>
</tr>
<tr>
<td><strong>EMC test</strong></td>
<td>according to DIN EN 60947-5-2</td>
<td>according to DIN EN 60947-5-2</td>
</tr>
<tr>
<td><strong>Color spaces</strong></td>
<td>X/Y INT; s/i M (Lab)</td>
<td>X/Y INT; s/i M (Lab)</td>
</tr>
</tbody>
</table>
Dimensions

All dimensions in mm
**Connector Assignment**

### Connection to PLC:
8-pole fem. connector Binder Series 712

**Pin:**  | **Color:** | **Assignment:**
---|---|---
1 | white | GND (0V)
2 | brown | +24VDC (+10%)
3 | green | IN0
4 | yellow | OUT0
5 | grey | OUT1
6 | pink | OUT2
7 | blue | OUT3
8 | red | OUT4

**Connecting cable:**
- CAB-M9-8P-St-ge; 2m-PUR; open
- CAB-M9-8P-St-ge; 5m-PUR; open
(Standard length 2 m)

### Connection to PC:
4-pole fem. connector Binder Series 707

**Pin:**  | **Assignment:**
---|---
1 | +24VDC (+Ub, OUT) |
2 | GND (0V) |
3 | RxD |
4 | TxD |

**Connecting cable:**
- CAB-M5-4P-St-ge; 2m-PUR; RS232
- CAB-M5-4P-St-ge; 5m-PUR; RS232
(Standard length 2 m)

Alternatively:
**Connecting cable (incl. driver software):**
- CAB-M5-4P-St-ge; 2m-PVC; USB
- CAB-M5-4P-St-ge; 5m-PVC; USB
(Standard length 2 m)
Measuring Principle

Measuring principle of the color sensors of colorSENSOR OT-3 series:

The colorSENSOR OT-3 provides highly flexible signal acquisition. For example, the sensor can be operated in alternating-light mode (AC mode), which makes the sensor insensitive to extraneous light. It also can be set to constant-light mode (DC mode), which makes the sensor extremely fast and allows a scan-frequency of up to 35 kHz.

An OFF function turns off the integrated light source at the sensor and changes to DC operation. The sensor then can detect so-called "self-luminous objects". In PULSE operation extremely dark surfaces can be reliably detected. With the stepless adjustment of the integrated light source and the selectable gain of the receiver signal the sensor can be set to almost any surface or any "self-luminous object".

When the integrated light source of the colorSENSOR OT-3 color sensor is activated, the sensor detects the radiation that is diffusely reflected from the object. As a light source the colorSENSOR OT-3 color sensor uses a white-light LED with adjustable transmitter power. An integrated 3-fold receiver for the red, green, and blue content of the light that is reflected from the object, or the light that is emitted by a "self-luminous object", is used as a receiver. As mentioned above, a special feature here is that the gain of the receiver can be set in 8 steps. This makes it possible to optimally adjust the sensor to almost any surface and to different "self-luminous objects".

The colorSENSOR OT-3 color sensor can be "taught" up to 31 colors. For each of these taught colors it is possible to set tolerances. In X/Y INT or s/i M mode these tolerances form a color cylinder in space. In X/Y/INT or s/i/M mode the tolerances form a color sphere in space. Color evaluation according to s/i M is based on the lab calculation method. All modes can be used in combination with several operating modes such as "FIRST HIT" and "BEST HIT". Raw data are represented with 12 bit resolution.

Color detection either operates continuously or is started through an external PLC trigger signal. The respective detected color either is provided as a binary code at the 5 digital outputs or can be sent directly to the outputs, if only up to 5 colors are to be detected. At the same time the detected color code is visualised by means of 5 LEDs at the housing of the colorSENSOR OT-3.

Visualization

Visualization of the color code:

The color code is visualised by way of 5 yellow LEDs at the housing of the colorSENSOR OT-3 color sensor. At the same time in the binary mode (OUT BINARY) the color code indicated on the LED display is output as 5-bit binary information at the digital outputs OUT0 to OUT4 of the 8-pin colorSENSOR OT-3/PLC socket.

The colorSENSOR OT-3 color sensor is able to process a maximum of 31 colors (color code 0 ... 30) in accordance with the corresponding rows in the COLOR TEACH TABLE. An "error" respectively a "not detected color" is displayed by the lighting of all LED (OUT0 ... OUT4 digital outputs are set to HIGH-level).

In the DIRECT mode (OUT DIRECT HI or OUT DIRECT LO) the maximum numbers of colors to be taught is 5 (color no. 0, 1, 2, 3, 4). If DIRECT HI is activated, the specially digital output is set to HI, while the other 4 are set to LO. If the current color does not correspond with any of the teach-in colors, all digital outputs are set to LOW (no LED is lighting).

If DIRECT LO is activated, the specially digital output is set to LO, while the other 4 are set to HI. If the current color does not correspond with any of the teach-in colors, all digital outputs are set to HIGH (all LED are lighting).
LED display:

The color code is visualized by means of 5 yellow LEDs at the housing of the color sensor. At the same time the color code indicated at the LED display is output as 5-bit binary information at the digital outputs OUT0 ... OUT4 of the 8-pole PLC connector.

In the DIRECT mode the maximum number of color codes to be taught is 5. These 5 color codes can be directly output at the 5 digital outputs. The respective detected color code is displayed by means of the 5 yellow LEDs at the color sensor housing.

Error or „not detected“
colorSENSOR OT-3-MA-50-12.5

By use of an aperture Ø 5 mm the detection range at the working distance of 30 mm will be reduced to 5 mm.
Mounting Accessories

FL-34 (flange):

Example: FL-34 with colorSENSOR OT-3-GL-30 mounted

WFL-34 (flange, angle type 90°):

Example: WFL-34 with colorSENSOR OT-3-GL-30 mounted

(All dimensions in mm)
Application Example

Measurement of colored foils in the gray/beige range

Color inspection of colored foils in the gray/beige range. The test was performed with a colorSENSOR OT-3-MA-50 color sensor at a distance of approx. 50 mm from the object.