MICRO-EPSILON

Instruction Manual

colorSENSOR LT-3-LU

High-end color sensor

MICRO-EPSILON Eltrotec GmbH
Heinckelstraße 2

D-73066 Uhingen / Germany

Tel. +49/7161/98872-300
Fax +49/7161/98872-303
e-mail eltrotec@micro-epsilon.de
www.micro-epsilon.com

CE

Certified acc. to DIN EN ISO 9001: 2008

colorSENSOR LT Series

colorSENSOR LT-3-LU

- Big working range: typ. 1 mm ... 300 mm
  (depends on the fiber optics used and attachment optics)
- UV light conducting fiber optics available
- Up to 31 colors can be stored
- RS232 interface (USB adapter is available)
- UV-LED, 385 nm, modulated (AC-/DC-/PULSE-
  operation or OFF for luminous objects can be switched)
- Detection of different luminescent colors
- Insensitive to outside light in AC-operation and PULSE-operation
- Brightness correction can be activated
- Switching frequency up to 35 kHz
- Several TEACH functions (via PC, PLC, or push button)
- Various evaluation algorithms can be activated
- "BEST HIT" mode ("human color assessment")
- Switching state display by means of 5 yellow LEDs
- Temperature compensated in climatic cabinet
- Averaging' can be activated (from 1 up to over 32000 values)
- 3-color filter detector (true color detector: "human color perception")

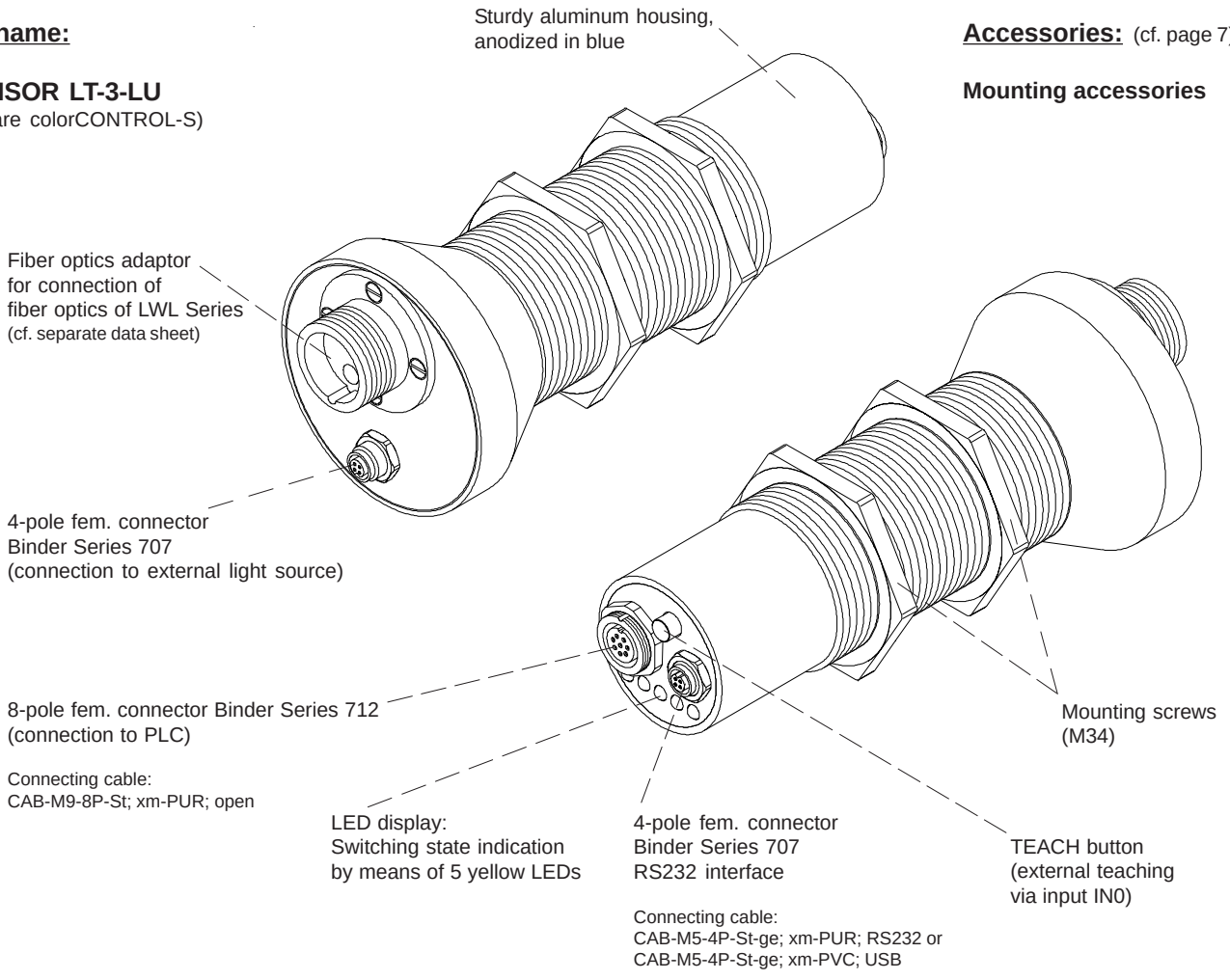
Design

Product name:

colorSENSOR LT-3-LU
(incl. software colorCONTROL-S)

Accessories: (cf. page 7)

Mounting accessories

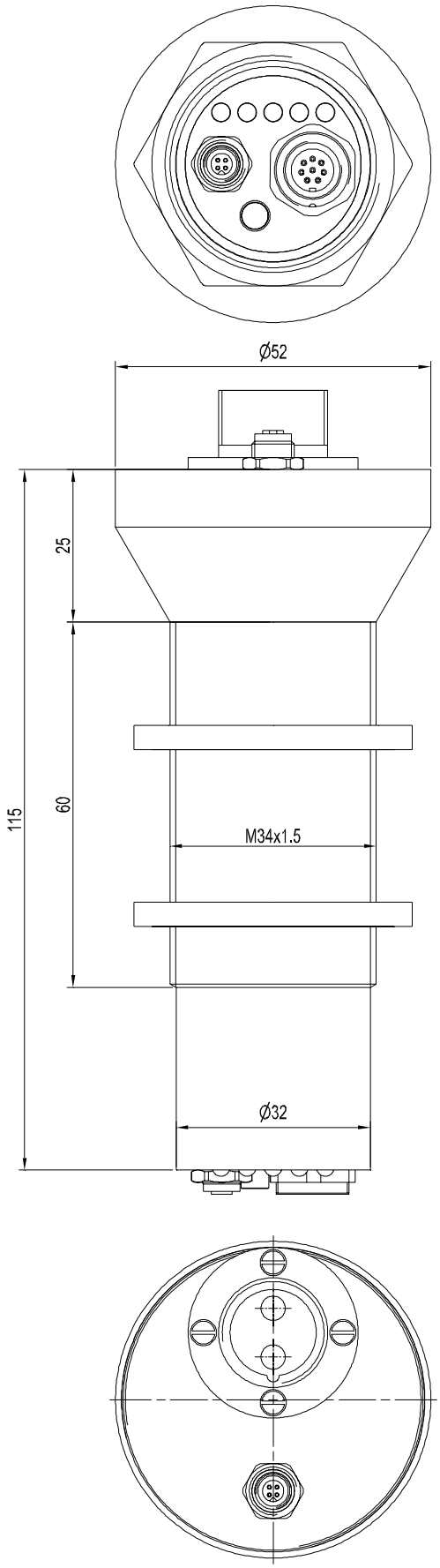


Technical Data

Type	LT-3-LU
Article number	10234066
Object distance	Dependent on the optical fibers used and the optical heads Reflex optical fiber typ. 2 mm - 25 mm with lens typ. 5 mm - 50 mm [1)]
Light spot diameter	Dependent on the optical fibers used and the optical heads [1)]
Color difference	$\Delta E \geq 0.5$
Color spaces	X/Y INT; s/i M (Lab)
Averaging	more than max. 32768 values
Size of the color memory	max. 31 colors in non-volatile EEPROM with parameter sets
Switching frequency	max. 30 kHz (depending on number of colors being taught and the setting for the averaging)
Reproducibility	In the x,y color range, 1 digit each with 12-Bit-A/D conversion
Temperature drift X,Y	< 0.01 % /K
Light source	Super-bright UV LED, 385 nm, AC-, DC mode, (adjustable or OFF for self-luminous objects, software-switchable)
Type of illumination	via optical fiber
Effect through illumination	Suitable for flexibly recognizing luminescent colors
Ambient light	to 5000 Lux (AC mode)
Intermittent light operation	AC: typ. 10 kHz to 40 kHz (depending on amplification level AMP1 to AMP8) DC: switchable by PC software
Power supply	+24 VDC (± 10 %), inverse polarity protected, overload-proof
Current consumption	typ. 320 mA
Max. switching current	100 mA, short-circuit protected
TEACH button/inputs	1 button and IN0 for external teaching of the color references
Outputs	OUT 0 - OUT 4, digital (0 V/+Ub), short-circuit protected, 100 mA max. switching current npn-, pnp-capable (bright or dark switching, switchable)
Switching state display	Visualisation by means of 5 yellow LEDs
Interface	RS232 (optional USB)
Type of connector	to PLC: 8-pole flange socket (Binder series 712) to PC: 4-pole flange socket (Binder series 707)
Connection cable	to power/PLC: art. no. 11234091 / to PC: art. no 11234095 (RS232); 11234096 (USB).
Receiver	3-color filter detector (TRUE COLOR detector, color filter curve as per CIE 1931)
Software	colorCONTROL S
Pulse extension	adjustable 0 ms - 100 ms
Signal amplification	8 stage (AMP1 - AMP8), adjustable
Housing material	Aluminium, black anodised
Operating temperature	-20 °C - +55 °C
Storage temperature	-20 °C - +85 °C
Protection class	IP 67 (lens), IP 64 (electronics)
EMC test according	DIN EN 60947-5-2
Optical fiber	See color sensor catalog, page 34 onwards

[1)] Type: FAR-T-A2.0-2,5-1200-67°-UV Reflex
FAD-T-A2.0-2,5-1200-67°-UV Transmitted light

Dimensions

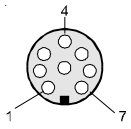


All dimensions in mm

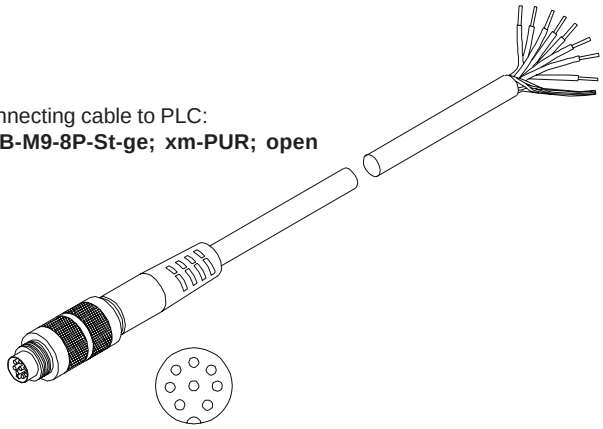
Connector Assignment

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)



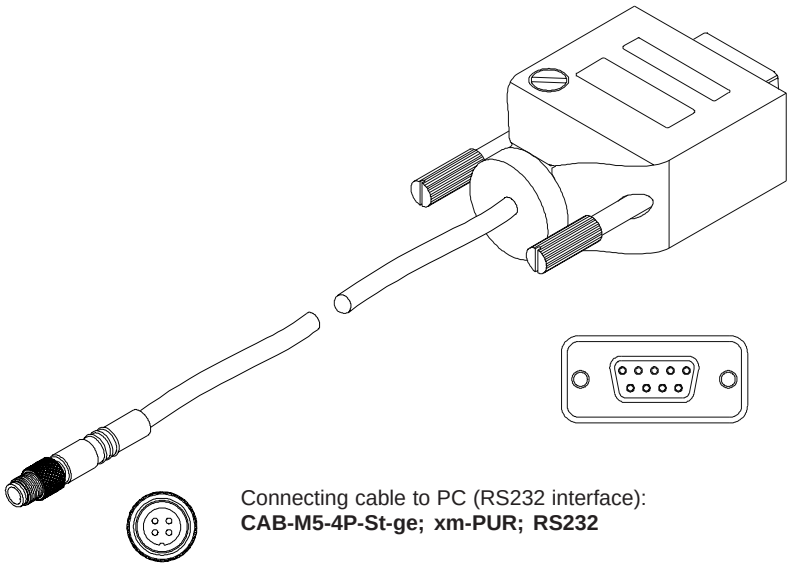
Connecting cable to PLC:
CAB-M9-8P-St-ge; xm-PUR; open

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

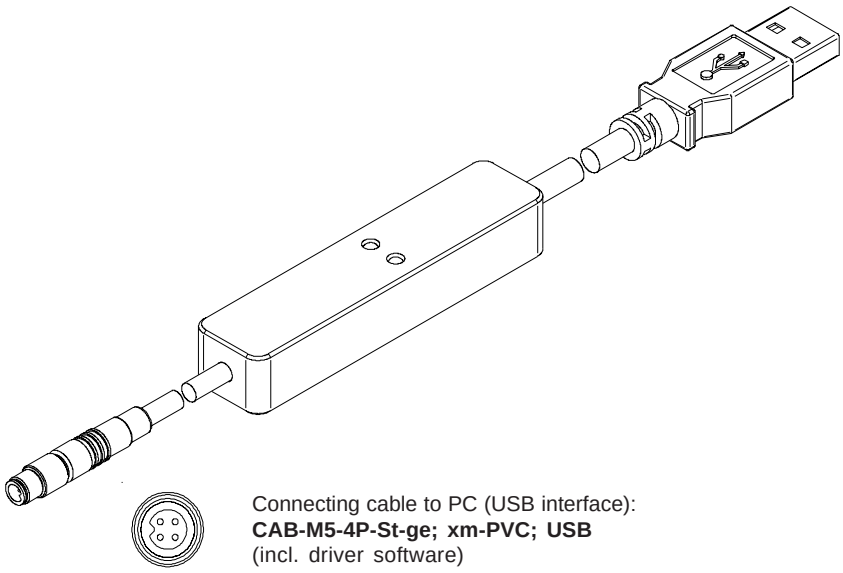
Pin:	Assignment:
1	+24VDC (+Ub, OUT)
2	GND (0V)
3	RxD
4	TxD

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)



Connecting cable to PC (RS232 interface):
CAB-M5-4P-St-ge; xm-PUR; RS232



Connecting cable to PC (USB interface):
CAB-M5-4P-St-ge; xm-PVC; USB
(incl. driver software)

Measuring Principle

Measuring principle of color sensor colorSENSOR LT-3-LU:

The colorSENSOR LT-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 more than 35 kHz.

When the integrated light source of the colorSENSOR LT-3-LU color sensor is activated, the sensor detects the radiation that is diffusely reflected from the object to be measured.

As a light source the colorSENSOR LT-3 color sensor uses one UV-LED (385nm) with adjustable transmitter power to excite the luminescent marking. An integrated 3-fold receiver for the red, green, and blue content of the visible light that is emitted by the luminescent marking 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 luminescent colorant that can be excited in the long-wave UV range (365nm or 385nm).

The colorSENSOR LT-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 LT-3. [Please note: Visualisation by means of LEDs not available with colorSENSOR LT-1-LC-20 types.]

With a TEACH button at the sensor housing the color sensor can be taught up to 31 colors. For this purpose the corresponding evaluation mode must be set with the software. The TEACH button is connected in parallel to the input IN0 (green wire at cable CAB-M9-8P-St-ge; xm-PUR; open). [Please note: TEACH button not available with colorSENSOR LT-1-LC-20 types.]

Parameters and measurement values can be exchanged between a PC and the colorSENSOR LT-3 color sensor through the serial RS232 interface. All the parameters for color detection also can be saved to the non-volatile EEPROM of the colorSENSOR LT-3 color sensor through this serial RS232 interface. When parameterisation is finished, the color sensor continues to operate with the current parameters in STAND-ALONE mode without a PC.

The sensors of the colorSENSOR LT-3-LU series also can be calibrated. Analogous to white-light balancing with color sensors, balancing of the colorSENSOR LT-3-LU could be performed to any luminescent color marking.

Visualization

Visualization of the color code:

The color code is visualised by way of 5 yellow LEDs at the housing of the colorSENSOR LT-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 LT-3/PLC socket.

The colorSENSOR LT-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).

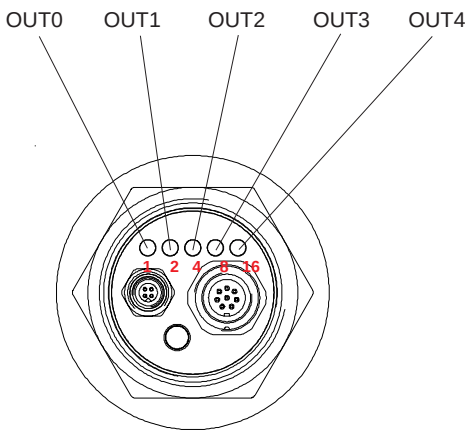
If DIRECT LO is activated, the specially digital output is set to LO, while the other 4 are set to HI. If the current color does not correspond with any of the teach-in colors, all digital outputs are set to HIGH (all LED are lighting).

LED Display

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.

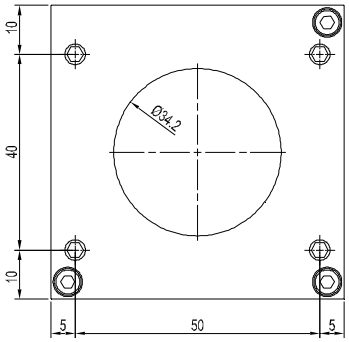
In the DIRECT mode the maximum number of color codes to be taught is 5. These 5 color codes can be directly output at the 5 digital outputs. The respective detected color code is displayed by means of the 5 yellow LEDs at the color sensor housing.

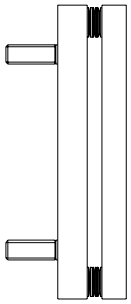


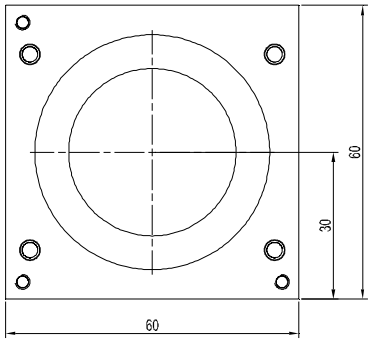
○○○○○ 0	●○○○○ 1	○●○○○ 2
●●○○○ 3	○○●○○ 4	●○●○○ 5
○●●○○ 6	●●●○○ 7	○○○●○ 8
●○○●○ 9	○●○●○ 10	●●○●○ 11
○○●●○ 12	●○●●○ 13	○●●●○ 14
●●●●○ 15	○○○○● 16	●○○○● 17
○●○○● 18	●●○○● 19	○○●○● 20
●○●○● 21	○●●○● 22	●●●○● 23
○○○●● 24	●○○●● 25	○●○●● 26
●●○●● 27	○○●●● 28	●○●●● 29
○●●●● 30	●●●●● Error or „not detected“	

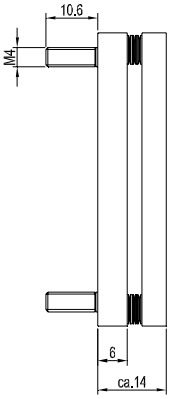
Mounting Accessories

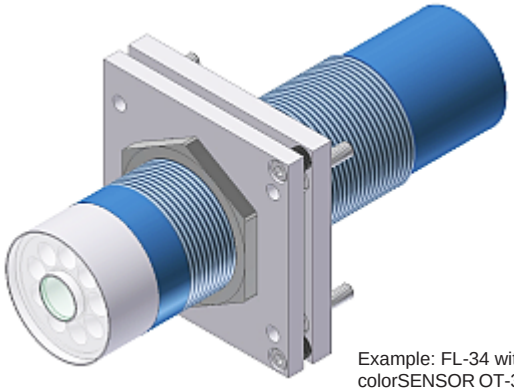
FL-34 (flange):





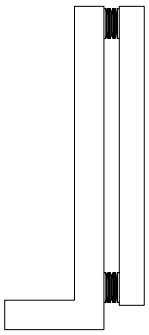


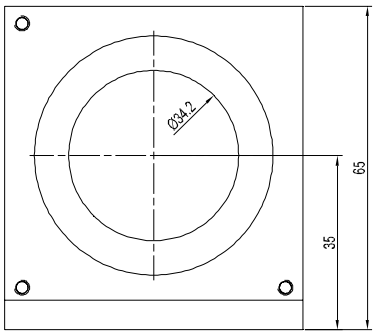


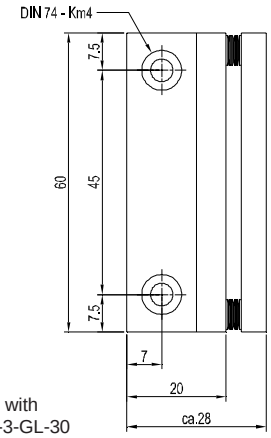


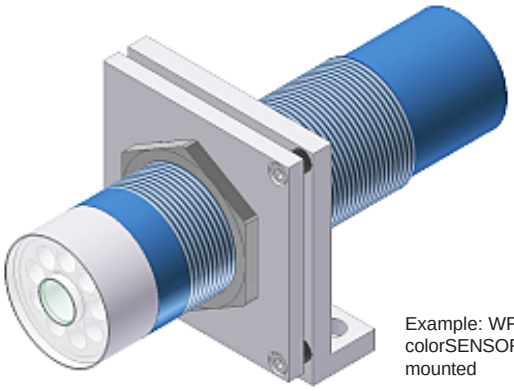
Example: FL-34 with colorSENSOR OT-3-GL-30 mounted

WFL-34 (flange, angle type 90°):









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

(All dimensions in mm)

MICRO-EPSILON Eltrotec GmbH
Heinkelstraße 2 · 73066 Uhingen / Germany
Tel. +49 (0) 7161 / 98872-300 · Fax +49 (0) 7161 / 98872-303
eltrotec@micro-epsilon.de · www.micro-epsilon.com

X9751270-A021042HDR