



More Precision

Color sensors colorSENSOR
LED Analyzers colorCONTROL



colorSENSOR LT-1-LC-20

Compact color sensor



- ▶ 31 Colors via software
- ▶ 5-fold tolerance adjustment
- ▶ Optical fiber with focus lenses

Features:

- Color memory: 31 (via software)
- RS232 interface
- White light LED
- Color spaces: X/Y INT; s/i M (Lab)
- True Color color chip
- Several TEACH possibilities (via PC or external)
- A variety of evaluation algorithms can be activated
- Color grouping
- Adaption of optical fiber and focus lens
- Robust aluminium housing
- Switching frequency up to 35kHz
- colorCONTROL S software

Application examples:

- Detection of color rings on metallic and plastic sleeves
- Reading out and statistically evaluating color values
- Recognizing color markings in the printing industry
- Color and grey-scale detection
- Inspection of packaging
- Sorting tasks on the basis of color (e.g. checking O-rings, closures, crown corks, and labels)
- Color recognition on interior components (e.g. head supports, ...)
- LED tests of function, color and intensity

With the aid of a modulated white light LED, a spot of white light is projected directly through an optical fiber to the surface being inspected. Part of the light back-scattered from the object being measured is now focused by optical fiber onto a perceptive True-Color detector element, sub-divided according to RGB color values and transformed into $L^*a^*b^*$.

With the LC-20, 31 colors can be taught using the colorCONTROL S software. If a color that has been taught is recognized by the sensor, a change in switching condition is made via the 5 encoded digital outputs.

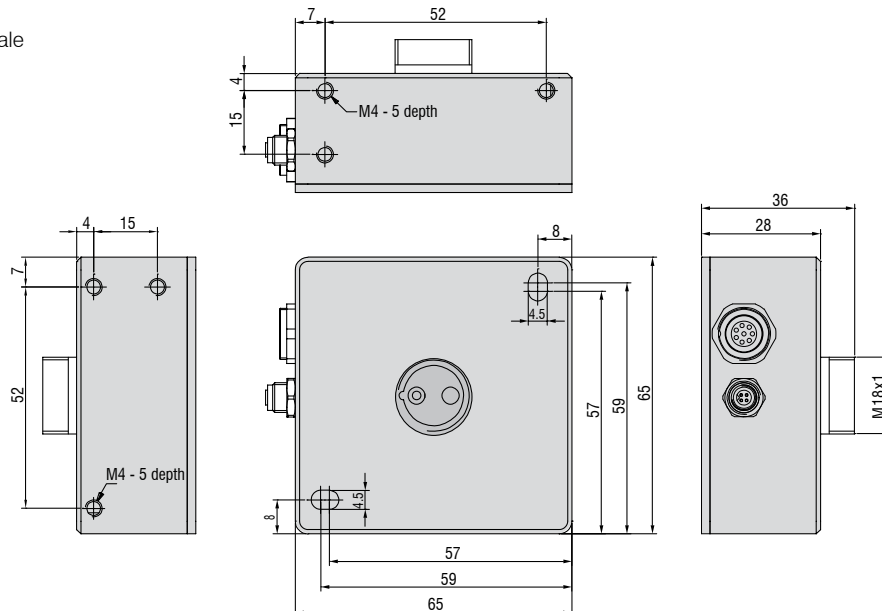
Type	LT-1-LC-20
Article number	10234060
Object distance	Dependent on the optical fibers used and the optical heads Reflex mode fiber optical cables typically 2mm-15mm with lens, typically 5mm-100mm ¹⁾
Light spot diameter	Dependent on the optical fibers used and the optical heads Reflex mode fiber optical cables, typically Ø 0.6mm-20mm ¹⁾
Color difference	$\Delta E \geq 1.5$
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. 35kHz (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 white light LED, AC or DC or PULSE mode (adjustable or OFF for self-luminous objects, software-switchable)
Type of illumination	Via optical fiber
Effect through illumination	Suitable for flexibility
Ambient light	Up to 5000Lux (in AC and PULSE mode)
Intermittent light operation	AC: typ. to 20kHz (depending on amplification level AMP1 to AMP8) DC: typ. to 35kHz PULSE mode: typ. to 5kHz
Power supply	+24VDC ($\pm 10\%$), inverse polarity protected, overload-proof
Current consumption	< 160mA
Max. switching current	100mA, short-circuit protected
TEACH button/inputs	No button for external teaching of the color references apart from IN0
Outputs	OUT 0 - OUT 4, digital (0V/+Ub), short-circuit protected, 100 mA max. switching current npn-, pnp-capable (bright or dark switching, switchable)
Switching state display	-
Interface	RS232
Type of connector	to PLC: 8-pole flange socket (Binder series 712) to PC: 8-pole flange socket (Binder series 712)
Connection cable	to power/PLC: Art. No. 11234091 / to PC: 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 0ms-100ms
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	IP54
EMC test according	DIN EN 60947-5-2
Optical fiber	Page 34 onwards

¹⁾ Typ: FAR-T-A2.0-2,5-1200-67° Reflex

Typ: FAD-T-A2.0-2,5-1200-67° Transmitted light (p. 34 onwards)

Dimensions:

Dimensions in mm, not to scale



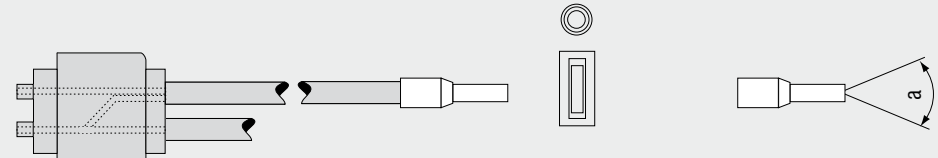
Glass fiber light guides

for colorSENSOR

Order code for optical fiber

You can see an overview of the Fasop optical fiber range on the following pages.

You can define your own individual fiber optic light guides from the various components using the order key.



Ordering code: **FA D T A 2.0 2.5 1200 67°**

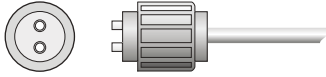
1 2 3 4 5 6

- 1** Adaption to devices e.g. to FA-Adapter for the CLS series, or color sensors of the colorSENSOR LT and WLCS-M series
- 2** Function of the optical fiber (D = transmitted light mode, R = reflex mode)
- 3** Sheathing e.g. silicone-metal sheath (T)
- 4** Sensor mechanism type, e.g. A2.0
Fiber bundle e.g. 2.5mm dia.
- 5** Overall length of e.g. 1200mm (standard length / bearing types)
- 6** Aperture angle of the fiber, e.g. 67°

Technical data for FASOP optical fibers

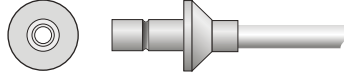
Single fiber diameter	20, 30, 50, 70µm standard fiber (depending on structure)	
Aperture angle	Standard fibers	67° (NA 0,56)
	Special fibers	22° (NA 0.21) 121° (NA 0.87 / wide angle) 22° UV (80/100µm) 22° IR (80/100/150µm)
Material	Optical glass (e.g. for UV / IR / in quartz glass)	
Dielectric strength	50kV/m with PVC protective sheath	
Permissible temperature range with sheathing that has appropriate fiber bonding	PVC	-20°C to +80°C (P) (Z)
	Metal	+40°C to +180°C (M)
	Metal with special bonding	-40°C to +400°C (E)
	Metal/silicone	-40°C to +180°C (T)
Fiber transmission	Usable for wavelengths from 190-2500nm of different types (We can provide the most suitable solution depending on the requirements) Transmission curves on request!	

1 Adapter version

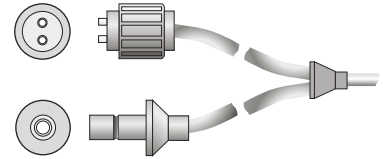


Adaption for:
Optical fiber light barriers:
 Series RLS, CLS, IFA, TLB
Color sensors:
 Series FES-M, WLCS

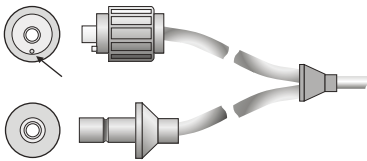
FA



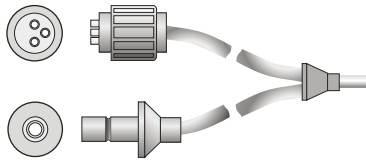
FOT **Adaption for light source:**
 Series FEL-M, FEL-I, FOT



FE **Adaption for color sensors with additional light source:**
 Series FES-M

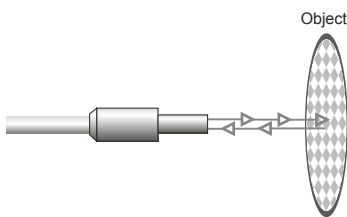


FW **Adaption for color recognition:**
 Series FAG-I-80, FEG-I-18/28



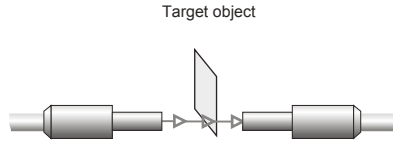
FF **Adaption for color recognition:**
 Series FAG-I-8, FEG-I-10/20

2 Functions



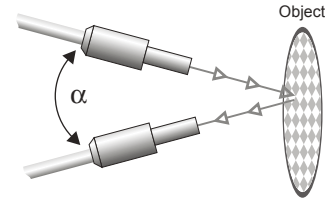
R

Reflected light operation (button)*



D

Transmitted light operation (barrier)*



D

Transmitted light operation (V arrangement) for reflective and shiny surfaces

* All functions can also be performed as multiple reflex and transmitted light functions

3 Sheathing

Silicone metal sheath

Metal wire-spiral-reinforced hose with glass fiber braiding and silicone rubber sheathing



Characteristics

Very flexible, highly resistant to bending, tension and torsion; temperature-stable to 180°C, liquid-tight

T

Stainless-steel sheath

Flexible stainless steel wire-spiral-reinforced hose ¹⁾



Characteristics

Flexible, protection against mechanical stress, temperature-stable to 400°C

E

Metal sheath

Flexible brass wire-spiral-reinforced hose ¹⁾



Characteristics

Flexible, protection against mechanical stress, temperature-stable to 180°C

M

¹⁾ Bending radius corresponds to three times the external diameter of the sheath.

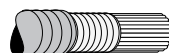
²⁾ Bending radius corresponds to twice the external diameter of the sheath.

Details of sheath diameters can be found in Section 4:

Please note: Every version can be supplied with increased vibration protection (VS). See the „Special versions“ section for more information

PVC-metal sheath

Flexible brass spiral-reinforced hose coated with PVC sheathing ¹⁾



Characteristics

Flexible, protection against mechanical stress, temperature-stable to 80°C

Z

PVC special sheath

Highly flexible plastic hose ²⁾

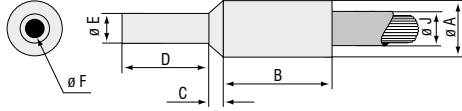


Characteristics

highly flexible, small sheath diameter, temperature-stable to 80°C

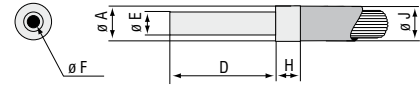
P

4 Sensor mechanism variants and fiber bundles



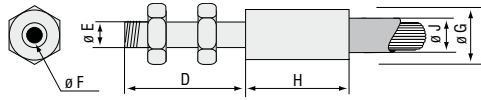
Type	A Ø	B	C	D	E Ø	F Ø	P	Ø J M	T
A 1.0	4.6	8	2	11	2.5	1.5	4	4	-
A 1.1	6.6	8	2	11	2.5	1.5	-	5	4.4
A 2.0	6.6	10	2	12	4.5	2.5	6	6	5.8
A 3.0	8.5	11	2	15	6	3	7	7	7.5

A Type A ferrule, stainless steel



Type	A Ø	D	E Ø	F Ø	H	Ø J P	Ferrule
B 1.1	2	30	1	0.6	2	2	stainless steel
B 1.2	2	10	1	0.6	2	2	stainless steel
B 2.0	3	10	2	1	2	3	alu
B 3.0	5	12	4	2.5	2	5	alu
B 4.0	8	12	6	3	2	8	alu

B Type B ferrule
(only suitable for PVC sheathing)

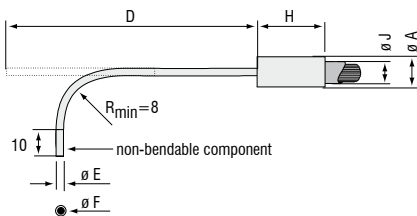


Type	D	E Ø	F Ø	G Ø	H	P	Ø J M	T
C 1.0	30	M4	1.0	6	13	5	5	4.4
C 2.0	30	M6	2.5	8	15	6	6	5.8
C 3.0	30	M10	3	11	12	7	7	7.5

C Type C ferrule, stainless steel

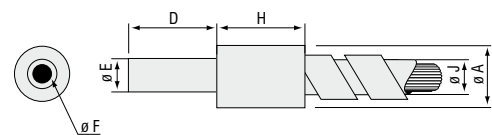
All details in mm
Tolerances: typ. +/- 0.1mm
Al ferrule, black anodised

**Different sizes are possible by arrangement,
please ask our product specialists.**
(see also the „Special versions“ section)



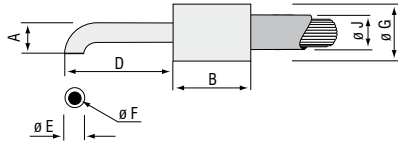
Type	A Ø	D	E Ø	F Ø	H	P	Ø J M	T
O 1.0	2	100	1	0.6	10	2	-	-
O 1.1	7	100	1	0.6	20	-	5	4.4
O 2.0	3	100	1.3	1	10	3	-	-
O 2.1	7	100	1.3	1	20	-	5	4.4

O Type O ferrule
Bendable, to an extent



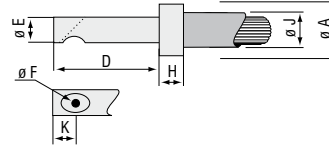
Type	A Ø	D	E Ø	F Ø	H	Ø J M	T	Ferrule
M 1.1	6	30	1	0.6	10	5	4.4	stainless steel
M 1.2	6	10	1	0.6	10	5	4.4	stainless steel
M 2.0	6	10	2	1	10	5	4.4	alu
M 3.0	7	12	4	2.5	12	6	5.8	alu
M 4.0	9	12	6	3.5	12	7	7.5	alu
M 5.0	12	16	7	5	16	9	9	alu
M 6.0	13	16	8	6	18	10	11.5	alu
M 8.0	16	20	10	8	20	13	13.5	alu
M10.0	18	20	12	10	20	15	-	alu

M Type M ferrule



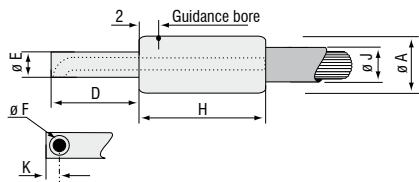
Type	A Ø	B	D	E Ø	F Ø	G Ø	r	P	Ø J M	T
D 1.0	2.5	10	20	1	0.6	3	1.5	2	-	-
D 1.1	2.5	13	20	1	0.6	6	1.5	-	-	4.4
D 2.0	6	13	20	2	1.5	6	4	5	5	4.4
D 3.0	15	17	20	5	2.5	9	10	7	7	6.5

D Type D ferrule, stainless steel
(* D1.0 only suitable for PVC sheathing)



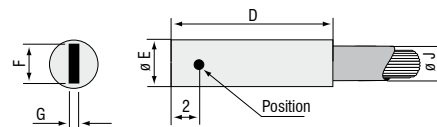
Type	A Ø	D	E Ø	F Ø	H	K	P	Ø J M	T
E 1.0	4	20	3	1.5	1.5	4	4	-	-
E 2.0	5	20	4	2.5	1.5	4	5	5	-
E 2.1	7	20	4	2.5	10	4	-	-	5.8
E 3.0	8	20	6	3	1.5	5	7	7	-

E Type E ferrule, stainless steel
(* E1.0 only suitable for PVC sheathing)



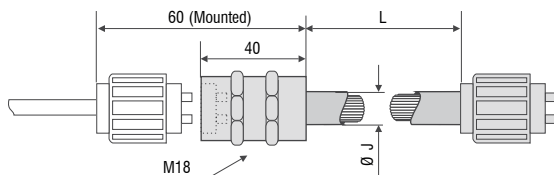
Type	A Ø	D	E Ø	F Ø	H	K	P	Ø J M	T
F 1.0	8	20	6	1.5	9	3	5	5	5.8
F 2.0	10	20	8	2.5	10	4	6	6	6.5
F 3.0	12	20	10	3	10	5	7	7	7.5

F Type F ferrule, stainless steel



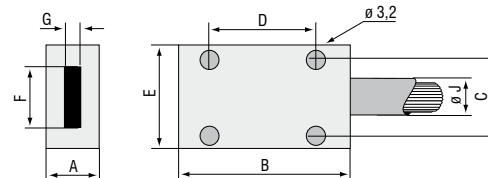
Type	D	E Ø	F	G max.	P	Ø J M	T
R 1.0	25	4	3	0.5	3	-	-
R 1.1	30	7	3	0.5	6	6	5.8
R 2.0	25	7	6	1	6	6	5.8**
R 2.1	30	10	6	1	-	7	7.5

R Type R ferrule, aluminium
* R1.0 only suitable for PVC sheathing
** at 6x1 mm², can be made to a length of 1200



Fiber bundle Ø (3mm)/ channel	P	Ø J M	T	L
	12	13	13.5	

LV Type LV ferrule
Optical fiber extension / feed-through



Typ	A	B	C	D	E	F	G	Ø J
Q1	12	25	9	15	15	5	0.5	dependent on fiber cross-section
Q2	12	30	14	20	20	10	0.3	
Q3	12	35	24	25	30	18	0.3	
Q4	12	55	34	40	40	28	0.2	
Q5	12	55	44	40	50	38	0.15	
Q6	12	55	54	40	60	48	0.15	
Q7	16	75	64	60	70	58	*	
Q8	16	75	74	60	80	68	*	
Q9	20	90	84	75	90	78	*	
Q10	20	90	94	75	100	88	*	

(F x G 3.5 mm² for CLS and IFA applications with FA adapter)

Q Type Q, aluminium
also available in stainless steel

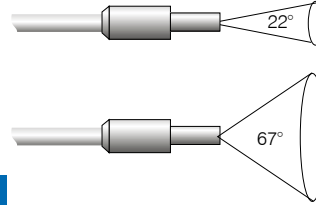
All details in mm
Attention: With angular sensor mechanism versions, a reduction in range can be expected compared to axially emerging versions.

5 + 6 Length and aperture angle



Standard lengths are: 600*, 1200*, 1800 and 2400mm.
 * Bearing types
 Length tolerance type: +/- 4%
 Cable lengths of up to 30m can be supplied on request!

5



Dependent on the glass fiber material used the following aperture angles are included in the standard range: 22°, 67°, 121°

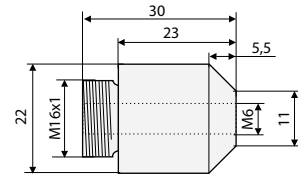
6

Adapter

Adapter Type	Ferrule Dim. E Ø	Fits ferrules	Art. no.
A	2.5	A1.0, A1.1	10820552
B	4	B3.0, M3.0, R1.0	10821562
C	6	A3.0, B4.0, M4.0	10821119
C	6	M1.1, M1.2, M2.0 *	10821119
H	4.5	A2.0	10821561
C2	M6	C2.0 (optional C3.0)	10822628

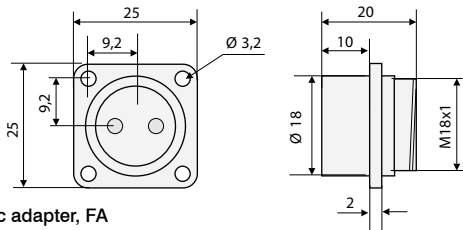
* These ferrules fit in the adapter, size A diameter (collar size)

Adapter pieces for focus lenses

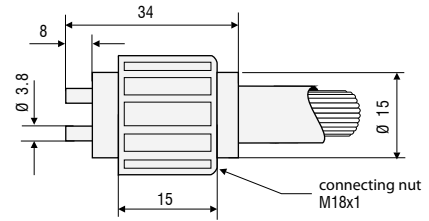


Adapter piece

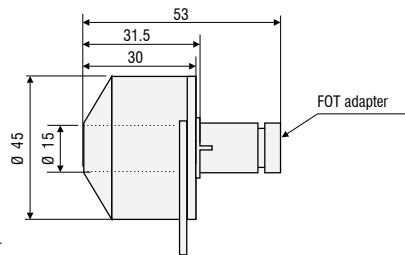
Suitable for FLF-B-35 focus lens



Fiber optic adapter, FA
Front panel mounting



Adapter, FA
System FASOP



Color filtered head
for FOT optical fiber

Special versions

■ Optical fibers with increased vibration protection

Glass fibers are very flexible due to their small diameter and they can be bent or guided almost at will. However, glass fibers can break due to hard shocks or jerky movements (strong positive or negative accelerations). Especially for fiber optic, which are subject to these conditions, our glass fiber series makes it possible to produce fiber-optic cables with increased vibration protection. Friction between the glass fibers is minimized by a special treatment and shocks are reduced by damping. (Additional designation VS) When ordering an optical fiber with increased vibration protection, please add the abbreviation „VS“ to the optical fiber code.

■ Optical fibers with special bonding for high temperatures (T250) (T400) (T600)

The glass fibers can be bonded for high temperature ranges. The standard bonding is suitable for temperatures up to 80°C. Temperatures of up to 250°C and even 400°C can be reached when special adhesives are used. For higher temperature ranges it is necessary to use Type E stainless steel sheathing.

When ordering an optical fiber for high temperatures, please add the abbreviations „T250“ or „T400“ to the optical fiber code. Temperatures of up to 600°C can be reached with metallic fibers and with sapphire optics installed.

■ Different types of fiber

Other types of fiber can be supplied on request. These include UV fibers, special infrared fibers, wide-angle fibers or plastic fibers.

■ Customer-specific glass fiber optical fibers

One of the strengths of the Micro-Epsilon Eltrotec optical fiber production is the manufacturing of very complex fibers, both large and small sensor mechanisms (with multiple segments and special adapters, among other things). Micro-Epsilon-Eltrotec can draw on many years of experience in the fields of sensor technology and cold light illumination, as well as in illumination for cameras, microscopes and medical applications, and in endoscopy.

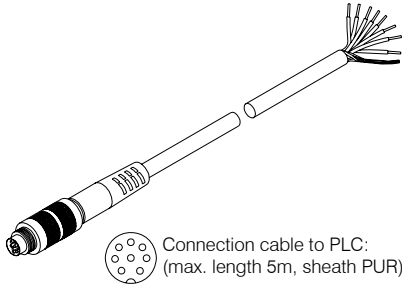
Cables and other accessories

colorSENSOR accessories		
Art. no.	Description	suitable for:
11234089	CAB-M23-19P-Bu-ge; 2m-PUR; open	colorSENSOR WLCS M-41 (power and PLC)
11234090	CAB-M9-3P-St-ge; 2m-PUR; RS232	colorSENSOR WLCS M-41 (RS232)
11234091	CAB-M9-8P-St-ge; 2m-PUR; open	colorSENSOR LT and OT series (power and PLC)
11234092	CAB-M9-5P-St-ge; 2m-PUR; RS232	colorSENSOR OT-3-XX-200 (RS232)
11234093	CAB-M9-4P-St-ge; 2m-PVC; RS232	colorSENSOR LT-1-ST; LT-2-XX (RS232)
11234094	CAB-M9-4P-St-ge; 2m-PVC; USB	colorSENSOR LT-1-ST; LT-2-XX (USB)
11234095	CAB-M5-4P-St-ge; 2m-PUR; RS232	colorSENSOR LT-1-LC-20; LT-3; OT-3 series (RS232)
11234096	CAB-M5-4P-St-ge; 2m-PVC; USB	inc. RS232 to USB adapter suitable for: colorSENSOR LT-1-LC-20; LT-3; OT-3 series (USB)
11234097	CAB-M23-19P-Bu-ge; 5m-PUR; open	colorSENSOR WLCS M-41 (power and PLC)
11234098	CAB-M9-3P-St-ge; 5m-PUR; RS232	colorSENSOR WLCS M-41 (RS232)
11234099	CAB-M9-8P-St-ge; 5m-PUR; open	colorSENSOR LT and OT series (power and PLC)
11234100	CAB-M9-5P-St-ge; 5m-PUR; RS232	colorSENSOR OT-3-XX-200 (RS232)
11234101	CAB-M9-4P-St-ge; 5m-PVC; RS232	colorSENSOR LT-1-ST; LT-2-XX (RS232)
11234102	CAB-M9-4P-St-ge; 5m-PVC; USB	colorSENSOR LT-1-ST; LT-2-XX (USB)
11234103	CAB-M5-4P-St-ge; 5m-PUR; RS232	colorSENSOR LT-1-LC-20; LT-3; OT-3 series (RS232)
11234104	CAB-M5-4P-St-ge; 5m-PVC; USB	inc. RS232 to USB adapter suitable for: colorSENSOR LT-1-LC-20; LT-3; OT-3 series (USB)

colorCONTROL accessories		
Art. no.	Description	suitable for:
10814105	POF-2.2mm optical fiber	colorCONTROL MFA
11251112	Threaded ferrule; LWL; M4	POF-2.2
11251113	Mounted lens 6mm	Threaded ferrule; LWL; M4
11253931	Threaded ferrule; 3mm lens; LWL; M4	POF-2.2
11254108	Threaded ferrule; 90° optics; LWL; M5	POF-2.2
11294106	CAB-M9-8P-Bu-ge; 2m-PUR; open	colorCONTROL MFA-55/100 (power and PLC)
11294107	CAB-M9-5P-Bu-ge; 2m-PUR; Ethernet	colorCONTROL MFA-55/100 (Ethernet)
11294109	CAB-M9-8P-Bu-ge; 5m-PUR; open	colorCONTROL MFA-55/100 (power and PLC)
11294110	CAB-M9-5P-Bu-ge; 5m-PUR; Ethernet	colorCONTROL MFA-55/100 (Ethernet)
11293227	Connection cable, Cross Ethernet Adapter; 0.5m	colorCONTROL MFA-55/100
11293624	colorCONTROL MFA 55 exchange adapter	colorCONTROL MFA-55
11293519	colorCONTROL MFA 100 exchange adapter	colorCONTROL MFA-100
11294205	CAB-M9-2P-Bu-ge; 2m-PUR; open	colorCONTROL MFA-5 (power)
11294206	CAB-M9-2P-Bu-ge; 5m-PUR; open	colorCONTROL MFA-5 (power)
11234094	CAB-M9-4P-St-ge; 2m-PVC; USB	colorCONTROL MFA-5 (USB)
11234102	CAB-M9-4P-St-ge; 5m-PVC; USB	colorCONTROL MFA-5 (USB)
11234095	CAB-M5-4P-St-ge; 2m-PUR; RS232	colorCONTROL MFA-5 (RS232)
11234103	CAB-M5-4P-St-ge; 5m-PUR; RS232	colorCONTROL MFA-5 (RS232)
11294203	CAB-female connector strip-6P-ge; 1m-PVC; 2P-open	colorCONTROL MFA-5-P (power)
11294054	CAB-female connector strip-6P-ge; 1m-PVC; USB	colorCONTROL MFA-5-P (USB and power)
11294204	CAB-female connector strip-6P-ge; 1m-PVC; RS232	colorCONTROL MFA-5-P (RS232)

Pin assignment

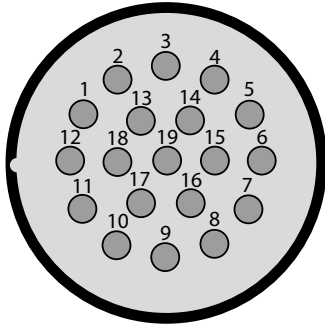
CAB-M9-8P-St-ge; Xm-PUR; open
(Anr.: 11234091; 11234098)



Connection cable to PLC:
(max. length 5m, sheath PUR)

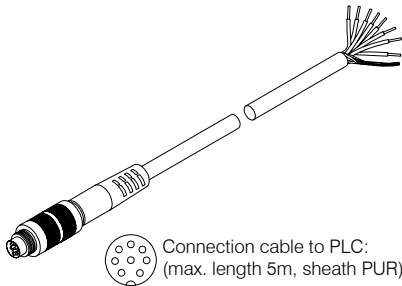
Pin	Color	LT-1- LC-10 / ST	SB1 LT-2- ST / DU	SB2 LT-2- ST / DU	LT-1-LC-20 LT-3-XX OT-3-XX
1	white	OUT 0	n.c. / OUT A 0	OUT 1	GND (0V)
2	brown	OUT 1	n.c. / OUT A 1	OUT 2	+24VDC ($\pm 10\%$)
3	green	IN 1	IN 1	OUT 3	IN 0
4	yellow	IN 0	IN 0	OUT 4	OUT 0
5	grey	n.c. / OUT 4	CLK (OUT K)	OUT 5	OUT 1
6	pink	OUT 3	n.c. / OUT A 2	OUT 6	OUT 2
7	blue	GND (0V)	GND (0V)	OUT 7	OUT 3
8	red	+24VDC ($\pm 10\%$)	+24VDC ($\pm 10\%$)	OUT 0	OUT 4

CAB-M23-19P-Bu-ge; Xm-PUR; open
(Anr.: 11234089; 11234097)



Pin	Color	WLCS-M-41
1	green	IN TF
2	grey	OUT Int. OK
3	pink	n.c.
4	red	OUT 4
5	white	OUT 2
6	blue	GND (0V)
7	violet	n.c.
8	grey/pink	n.c.
9	red/blue	IN HOLD
10	white/green	IN 1
11	brown/green	IN 2
12	yellow	PE
13	white/yellow	Common
14	-	-
15	black	OUT 1
16	yellow/brown	OUT 3
17	white/grey	IN 3
18	grey/brown	IN 4
19	brown	+24VDC ($\pm 10\%$)

CAB-M9-8P-Bu-ge; Xm-PUR; open
(Anr.: 11294106; 11294109)



Connection cable to PLC:
(max. length 5m, sheath PUR)

Pin	Color	MFA 55/100
1	white	IN 0
2	brown	+24VDC ($\pm 10\%$)
3	green	n.c.
4	yellow	OUT 0
5	grey	OUT 1
6	pink	OUT 2
7	blue	GND (0V)
8	red	OUT 3

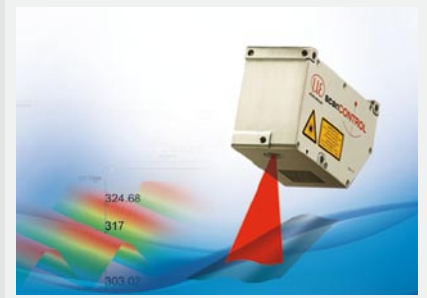
High performance sensors made by Micro-Epsilon



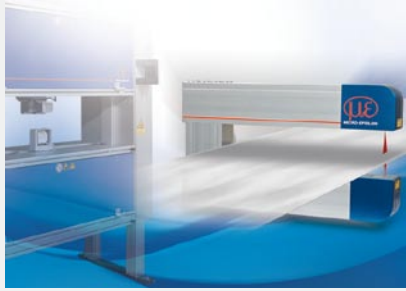
Sensors and systems for displacement and position



Sensors and measurement devices for non-contact temperature measurement



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