



# More Precision

Color sensors colorSENSOR  
LED Analyzers colorCONTROL



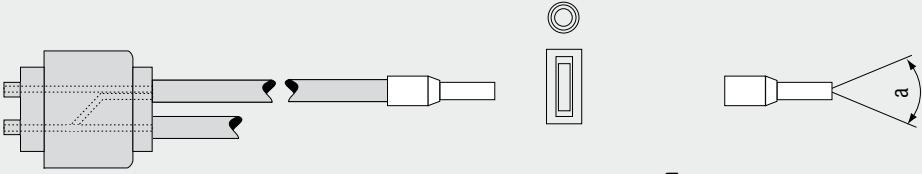
# Glass fiber light guides

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°**

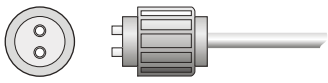
1 2 3 4 5 6

- 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

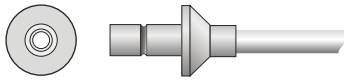
<b>Single fiber diameter</b>	20, 30, 50, 70µm standard fiber (depending on structure)	
<b>Aperture angle</b>	Standard fibers	67° (NA 0,56)
	Special fibers	22° (NA 0.21) 121° (NA 0.87 / wide angle) 22° UV (80/100µm) 22° IR (80/100/150µm)
<b>Material</b>	Optical glass (e.g. for UV / IR / in quartz glass)	
<b>Dielectric strength</b>	50kV/m with PVC protective sheath	
<b>Permissible temperature range with sheathing that has appropriate fiber bonding</b>	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)
<b>Fiber transmission</b>	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



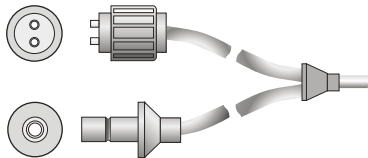
**Adaption for:**  
**Optical fiber light barriers:**  
 Series RLS, CLS, IFA, TLB  
**Color sensors:**  
 Series FES-M, WLCS

**FA**



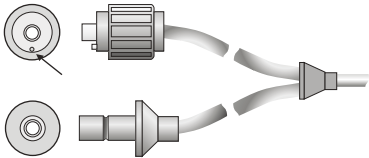
**Adaption for light source:**  
 Series FEL-M, FEL-I, FOT

**FOT**



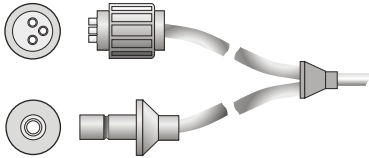
**Adaption for color sensors with additional light source:**  
 Series FES-M

**FE**



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

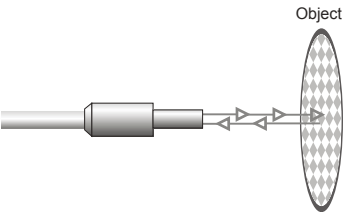
**FW**



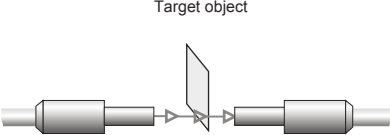
**Adaption for color recognition:**  
 Series FAG-I-8, FEG-I-10/20

**FF**

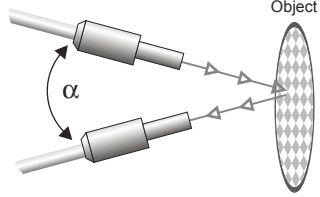
## 2 Functions



**R** **Reflected light operation (button)\***



**D** **Transmitted light operation (barrier)\***

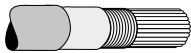


**D** **Transmitted light operation (V arrangement) for reflective and shiny surfaces**

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

## 3 Sheathing

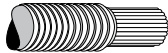
**Silicone metal sheath**  
 Metal wire-spiral-reinforced hose with glass fiber braiding and silicone rubber sheathing



**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 <sup>1)</sup>



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

**E**

**Metal sheath**  
 Flexible brass wire-spiral-reinforced hose <sup>1)</sup>



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

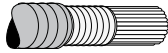
**M**

<sup>1)</sup> Bending radius corresponds to three times the external diameter of the sheath.  
<sup>2)</sup> 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 <sup>1)</sup>



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

**Z**

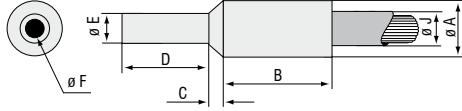
**PVC special sheath**  
 Highly flexible plastic hose <sup>2)</sup>



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

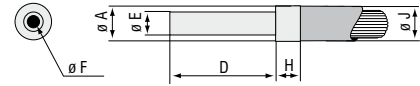
**P**

## 4 Sensor mechanism variants and fiber bundles



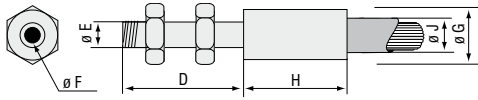
Type	A Ø	B	C	D	E Ø	F Ø	P	Ø J M	T
A 1.0	4.6	8	2	11	2.5	1.5	4	4	-
A 1.1	6.6	8	2	11	2.5	1.5	-	5	4.4
A 2.0	6.6	10	2	12	4.5	2.5	6	6	5.8
A 3.0	8.5	11	2	15	6	3	7	7	7.5

**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)

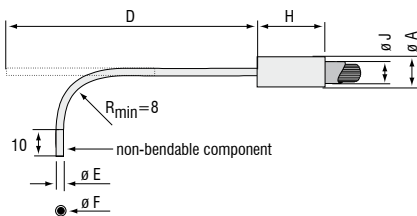


Type	D	E Ø	F Ø	G Ø	H	P	Ø J M	T
C 1.0	30	M4	1.0	6	13	5	5	4.4
C 2.0	30	M6	2.5	8	15	6	6	5.8
C 3.0	30	M10	3	11	12	7	7	7.5

**C** Type C ferrule, stainless steel

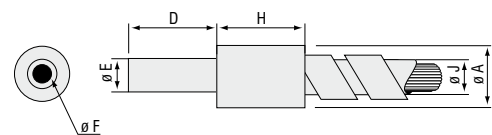
All details in mm  
Tolerances: typ. +/- 0.1mm  
Al ferrule, black anodised

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



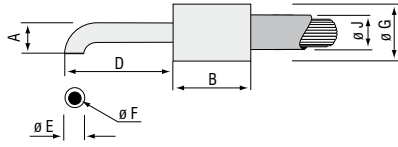
Type	A Ø	D	E Ø	F Ø	H	P	Ø J M	T
O 1.0	2	100	1	0.6	10	2	-	-
O 1.1	7	100	1	0.6	20	-	5	4.4
O 2.0	3	100	1.3	1	10	3	-	-
O 2.1	7	100	1.3	1	20	-	5	4.4

**O** Type O ferrule  
Bendable, to an extent



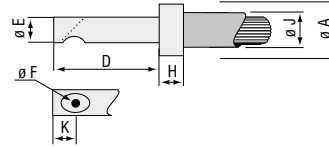
Type	A Ø	D	E Ø	F Ø	H	Ø J M	T	Ferrule
M 1.1	6	30	1	0.6	10	5	4.4	stainless steel
M 1.2	6	10	1	0.6	10	5	4.4	stainless steel
M 2.0	6	10	2	1	10	5	4.4	alu
M 3.0	7	12	4	2.5	12	6	5.8	alu
M 4.0	9	12	6	3.5	12	7	7.5	alu
M 5.0	12	16	7	5	16	9	9	alu
M 6.0	13	16	8	6	18	10	11.5	alu
M 8.0	16	20	10	8	20	13	13.5	alu
M10.0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

**M** Type M ferrule



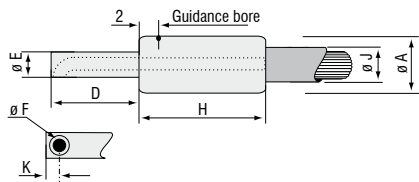
Type	A Ø	B	D	E Ø	F Ø	G Ø	r	P	Ø J M	T
D 1.0	2.5	10	20	1	0.6	3	1.5	2	-	-
D 1.1	2.5	13	20	1	0.6	6	1.5	-	-	4.4
D 2.0	6	13	20	2	1.5	6	4	5	5	4.4
D 3.0	15	17	20	5	2.5	9	10	7	7	6.5

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



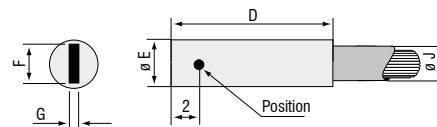
Type	A Ø	D	E Ø	F Ø	H	K	P	Ø J M	T
E 1.0	4	20	3	1.5	1.5	4	4	-	-
E 2.0	5	20	4	2.5	1.5	4	5	5	-
E 2.1	7	20	4	2.5	10	4	-	-	5.8
E 3.0	8	20	6	3	1.5	5	7	7	-

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



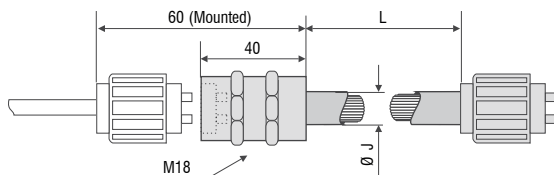
Type	A Ø	D	E Ø	F Ø	H	K	P	Ø J M	T
F 1.0	8	20	6	1.5	9	3	5	5	5.8
F 2.0	10	20	8	2.5	10	4	6	6	6.5
F 3.0	12	20	10	3	10	5	7	7	7.5

**F** Type F ferrule, stainless steel



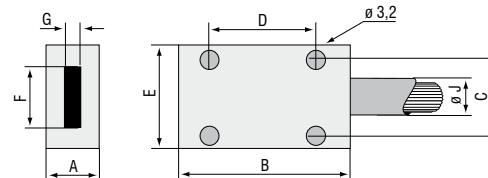
Type	D	E Ø	F	G max.	P	Ø J M	T
R 1.0	25	4	3	0.5	3	-	-
R 1.1	30	7	3	0.5	6	6	5.8
R 2.0	25	7	6	1	6	6	5.8**
R 2.1	30	10	6	1	-	7	7.5

**R** Type R ferrule, aluminium  
\* R1.0 only suitable for PVC sheathing  
\*\* at 6x1 mm<sup>2</sup>, 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 mm<sup>2</sup> for CLS and IFA applications with FA adapter)

**Q** Type Q, aluminium  
also available in stainless steel

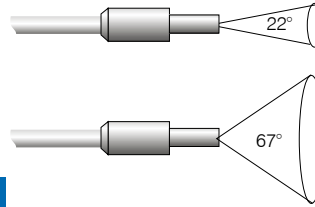
All details in mm  
Attention: With angular sensor mechanism versions, a reduction in range can be expected compared to axially emerging versions.

## 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°

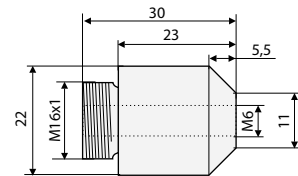
6

## 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

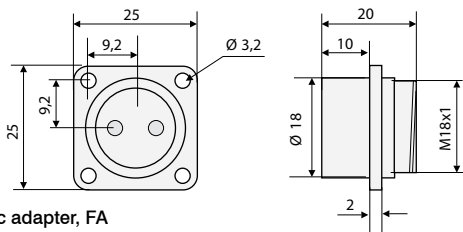
\* These ferrules fit in the adapter, size A diameter (collar size)

### Adapter pieces for focus lenses

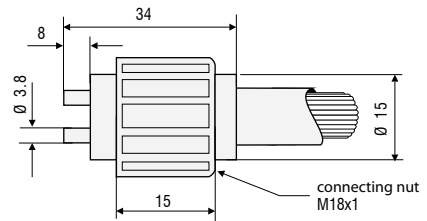


### Adapter piece

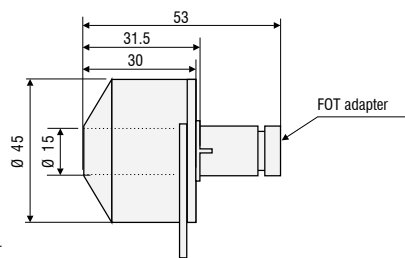
Suitable for FLF-B-35 focus lens



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.


## Series KL-xx/xx



- ▶ Focussing of color and optical fiber sensors
- ▶ Improving the efficiency of the application
- ▶ Many possible applications

### Features:

- Working distances from 8mm to 200mm
- Scratch-resistant glass lens
- Robust aluminium housing (black anodized)
- Bundling to a small light spot
- Increasing the range
- Minimum color change when the distance is altered
- High luminous efficiency
- Special designs possible, according to customer requirements
- Color measurement on small objects at a relatively large distance (KI-3, KL-4)
- Recognizing highly absorbent objects (KL-5, KL-14, KL-17)

	Type	Article number	Object distance (typ.)	Detection range (typ.)*	LWL FASOP
	KL-3	10823012	8mm - 20mm	1mm - 5mm	A 2.0 <sup>1)</sup>
	KL-M18-A2.0	10823020	15mm - 50mm	2mm - 10mm	A 2.0 <sup>1)</sup>
	KL-M34	10823278	80mm - 150 mm	10mm - 20mm	A 2.0 <sup>1)</sup>
	KL-M34/62	10824196	80mm - 150 mm	2mm - 5mm	A 2.0 <sup>1)</sup>
	KL-4	10823262	8mm - 20mm	0.6mm - 3mm	A 1.1 <sup>1)</sup>
	KL-M18-A1.1	10824140	10mm - 50mm	2mm - 7mm	A 1.1 <sup>1)</sup>
	KL-D-40	10824143	15mm - 25mm	3mm - 5mm	A 2.0 <sup>2)</sup>
	KL-D-28	10824197	20mm - 30mm	5mm - 8mm	A 2.0 <sup>2)</sup>
	KL-D-20	10823021	20mm - 40mm	4mm - 10mm	A 2.0 <sup>2)</sup>
	KI-D-17	10823220	30mm - 80mm	8mm - 25mm	A 2.0 <sup>2)</sup>
	KL-D-14	10823022	60mm - 120mm	10mm - 20mm	A 2.0 <sup>2)</sup>
	KL-D-6	10823409	100mm - 200mm	15mm - 30mm	A 2.0 <sup>2)</sup>
	KL-5	10824198	8mm - 20mm	2mm x 0.3mm to 15mm x 3mm	R 1.1 <sup>1)</sup>
	KL-8	10823920	8mm - 20mm	4mm x 0.7mm to 30mm x 5mm	R 2.1 <sup>1)</sup>

\*The smallest figure in the table relates to the smallest typical optical diameter that is generated. This corresponds to roughly the smallest detection area for color or optical fiber sensors.

<sup>1)</sup> Reflex optical fiber (FAR)

<sup>2)</sup> Transmitted light mode fiber optical cables (FAD)

## Cables and other accessories

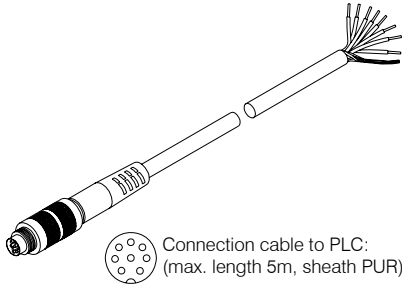
<b>colorSENSOR accessories</b>		
Art. no.	Description	suitable for:
11234089	CAB-M23-19P-Bu-ge; 2m-PUR; open	colorSENSOR WLCS M-41 (power and PLC)
11234090	CAB-M9-3P-St-ge; 2m-PUR; RS232	colorSENSOR WLCS M-41 (RS232)
11234091	CAB-M9-8P-St-ge; 2m-PUR; open	colorSENSOR LT and OT series (power and PLC)
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)

<b>colorCONTROL accessories</b>		
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

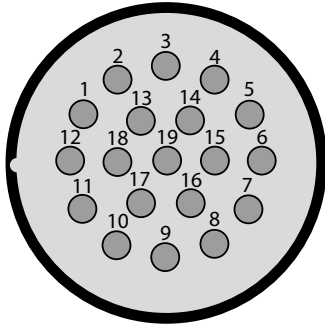
CAB-M9-8P-St-ge; Xm-PUR; open  
(Anr.: 11234091; 11234098)



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

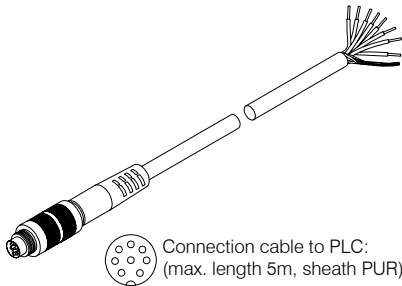
Pin	Color	LT-1- LC-10 / ST	SB1 LT-2- ST / DU	SB2 LT-2- ST / DU	LT-1-LC-20 LT-3-XX OT-3-XX
1	white	OUT 0	n.c. / OUT A 0	OUT 1	GND (0V)
2	brown	OUT 1	n.c. / OUT A 1	OUT 2	+24VDC ( $\pm 10\%$ )
3	green	IN 1	IN 1	OUT 3	IN 0
4	yellow	IN 0	IN 0	OUT 4	OUT 0
5	grey	n.c. / OUT 4	CLK (OUT K)	OUT 5	OUT 1
6	pink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

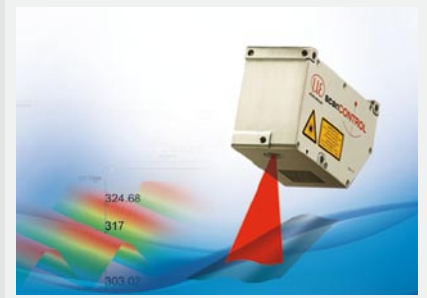
## High performance sensors made by Micro-Epsilon



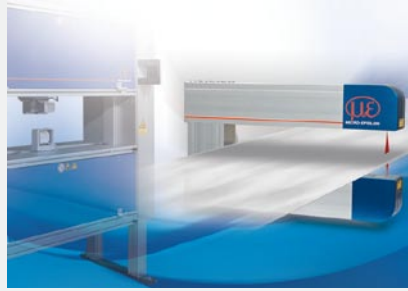
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