MICRO-EPSILON

More Precision

colorSENSOR // Color sensors, LED Analyzers

colorSENSOR CFO100

- *256 colors can be saved*
- *Repeatability ≤ 0.5*
- *Easy key operation*
- *Automatic LED control*
- *Fiber optics with focus lenses*
- *Multi-teach function*

Features:

- Color memory: 256 colors in 6 color groups can be saved using keys
- Max. 3 color channels (6 with binary coding)
- Ethernet interface
- White light LED
- Color inspection in the L*a*b* / L*u*v* color space
- Different evaluation algorithms can be activated
- 6 color groups
- Adaptable fiber optics and focus lenses
- Sturdy aluminum housing
- Measurement frequency up to 10 kHz

Application examples:

- Detection of color rings on metal and plastic sleeves
- Color values can be read and statistically evaluated
- Color mark recognition in printing industry
- Color and gray-scale detection
- Packaging control
- Color sorting tasks (e.g. O-ring control, closures, crown caps, labels)
- Color recognition on interior parts (e.g. head supports)

The colorSENSOR CFO100 is a new sensor for precise color recognition for industrial measurement tasks. The controller is distinguished by high color accuracy, state-of-the-art interfaces and intuitive operation. Fiber optics which can be adapted for various measuring tasks, are connected to the controller.

Using a modulated high-power white light LED, a white light spot is projected via the fiber optics onto the surface to be detected. Part of the light that is back scattered from the target is directed onto a perceptive True Color detector via the same fiber optics, separated into long-, medium- and short-wave light components (X=long, Y=medium, Z=short) and transformed into L*a*b* color values.

Intuitive key operation enables the user to easily teach-in up to 256 colors in 6 color groups. One function alone adapts the illumination, averaging and signal amplification to the current measurement situation. Furthermore, tolerance models and tolerance values can be adjusted individually.

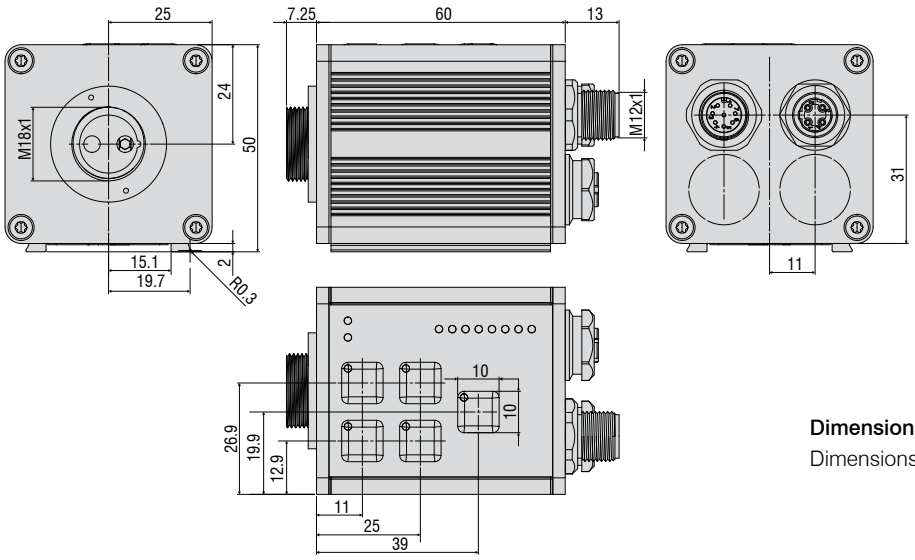
If the sensor recognizes one of the taught colors, the switching state changes via three digital outputs. Binary output switching provides cable breakage protection and enables output of up to 6 color groups.

Equipped with optical fibers, the sensor can also be used in restricted areas as the sensor head requires a minimum of space.

Model	CFO100
Article number	10234670
Object distance	depending on the fiber optics used as well as front lens attachment reflected-light optical fiber typ. 2 mm - 25 mm with lens typ. 5 mm - 100 mm [2]
Light spot diameter	depending on the fiber optics used as well as front lens attachment reflected-light optical fiber typ. dia. 0.6 mm - 20 mm [1]
Repeatability [1]	$\Delta E \leq 0.5$
Color distance	$\Delta E \leq 1.0$
Color spaces	XYZ, xyY, L*a*b*, L*u*v*, u'v'L*
Averaging	automatic adaption depending on the measurement frequency over max. 200 values
Size of color memory	max. 256 colors in non-volatile EEPROM with parameter sets
Measuring frequency	standard 1 kHz; max. 10 kHz (number of colors being taught and the setting for the averaging depend on this)
Temperature drift X, Y	0.1 % / K
Light source	white light LED, AC mode (adjustable or OFF for self-luminous objects, software-switchable)
Type of illumination	via fiber optics
Effect from illumination	automatically adjustable
Ambient light	up to 5000 lux
Alternating light operation	AC: typ. 1 kHz; max. 10 kHz
Power supply	+18 ... 28 VDC
Power consumption	typ. 500 mA
Max. switching current	100 mA
TEACH key/inputs	5 keys and IN0 for externally teaching color reference, tolerance stage and configuring sensor, triggering, key lock, clear memory
Outputs	OUT0 - OUT2, digital (0 V/+Ub), 100 mA max. switching current
Switching state display	visualization with 13 white LEDs
Interface	Ethernet and RS232 process interface
Type of connector	to power/PLC: 8-pole flange connector (M12A) to PC: 4-pole flange socket (M12D) (Ethernet DHCP-capable)
Connection cable	to power/PLC: art. no. 11234717 / to PC: art. no. 11234735 (Ethernet)
Receiver	3-color filter detector (XYZ TRUE COLOR detector, color curve according to CIE1931)
Pulse extension	off by default, typ. 10 ms, adjustable > 30 µs
Signal amplification	2 stages, automatic
Housing material	Aluminum, anodized black
Operating temperature	-10 ... +55 °C
Storage temperature	-10 ... +85 °C
Protection class	IP65

[1] maximum color distance ΔE of 1000 successive measurements of the color value of a red and a dark gray reference tile (R = 5%), measured with sensor FAR-T-A2.0-2,5-1200-67° at 1000 Hz and brightness adjustment with a white standard (R = 95%)

[2] Model: FAR-T-A2.0-2.5-1200-67° Reflex; Model: FAD-T-A2.0-2.5-1200-67° Transmitted light



Dimensions:
Dimensions in mm, not to scale

colorSENSOR CFO200

- *More than 320 colors can be saved*
- *Repeatability ≤ 0.3*
- *Easy key operation*
- *Automatic LED control*
- *Fiber optics with focus lenses*
- *Multi-teach function*

Features:

- Color memory: > 320 colors in 254 color groups can be saved using keys
- Max. 8 color channels (254 with binary coding)
- Ethernet interface
- White light LED
- Color inspection in the L*a*b* / L*u*v* color space
- Different evaluation algorithms can be activated
- 254 color groups
- Adaptable fiber optics and focus lenses
- Sturdy aluminum housing
- Measurement frequency up to 30 kHz

Application examples:

- Detection of color rings on metal and plastic sleeves
- Color values can be read and statistically evaluated
- Color mark recognition in printing industry
- Color and gray-scale detection
- Packaging control
- Color sorting tasks (e.g. O-ring control, closures, crown caps, labels)
- Color recognition on interior parts (e.g. head supports)
- Color recognition of exterior parts (e.g. parking sensors, exterior mirrors, etc.)
- Coloring of liquids (e.g. oil, apple juice, etc.)
- Gray shades of concrete blocks and paving stones
- Internal coating of cans
- Distinction of materials and coatings (stainless steel/tin or brass/gold)

The colorSENSOR CFO200 is a new sensor for precise color recognition in industrial measurement tasks. The controller is distinguished by high color accuracy, state-of-the-art interfaces and intuitive operation. Fiber optics which can be adapted for various measuring tasks, are connected to the controller.

Using a modulated high-power white light LED, a white light spot is projected via the fiber optics onto the surface to be detected. Part of the light that is back scattered from the target is directed onto a perceptive True Color detector via the same fiber optics, separated into long-, medium- and short-wave light components (X=long, Y=medium, Z=short) and transformed into L*a*b* color values.

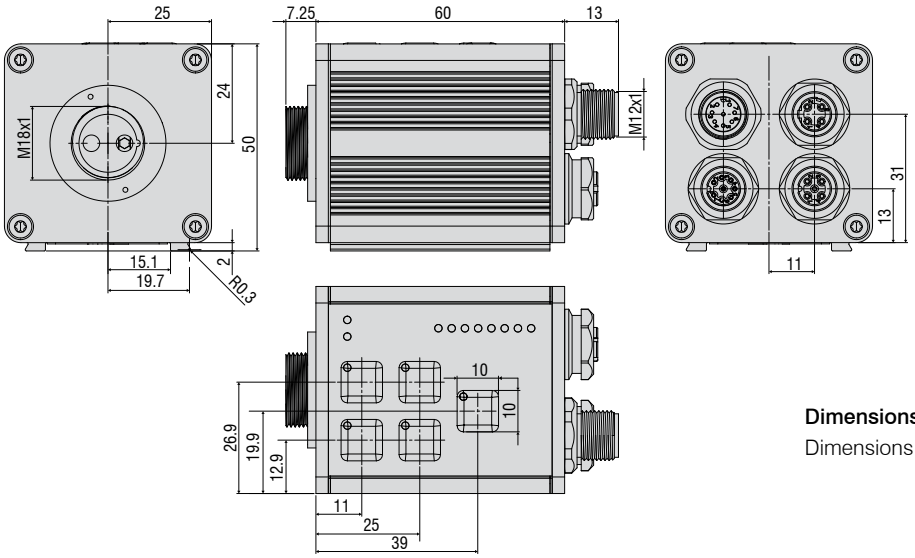
Intuitive key operation enables the user to easily teach-in more than 320 colors in 254 color groups. One function alone adapts the illumination, averaging and signal amplification to the current measurement situation. Furthermore, tolerance models and tolerance values can be adjusted individually.

If the sensor recognizes one of the taught colors, the switching state changes via 8 digital outputs. Binary output switching provides cable breakage protection and enables output of up to 254 color groups.

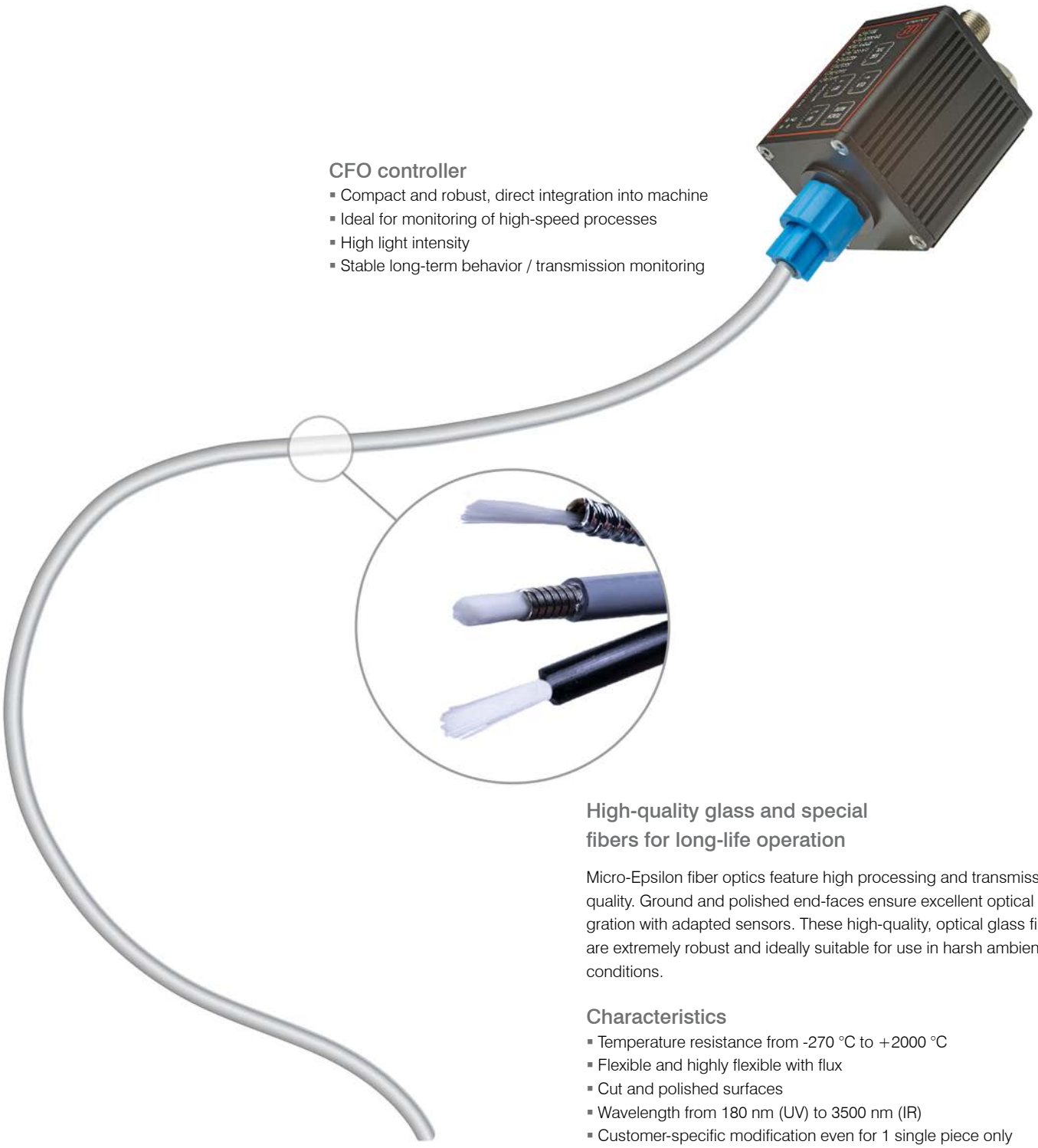
Equipped with optical fibers, the sensor can also be used in restricted areas as the sensor head requires a minimum of space.

Model	CFO200
Article number	10234671
Object distance	depends on the fiber optics and the ancillary lens used reflected-light optical fiber typ. 2 mm - 25 mm with lens typ. 5 mm - 200 mm [2]
Light spot diameter	depending on the fiber optics used as well as front lens attachment reflected-light optical fiber typ. dia. 0.6 mm - 20 mm [2]
Repeatability [1]	$\Delta E \leq 0.3$
Color distance	$\Delta E \leq 0.6$
Color spaces	XYZ, xyY, L*a*b*, L*u*v*, u'v'L*
Averaging	automatic adaption depending on the measurement frequency over max. 200 values
Size of color memory	> 320 colors in non-volatile EEPROM with parameter sets
Measuring frequency	standard 1 kHz; max. 30 kHz (number of colors being taught and the setting for the averaging depend on this)
Temperature drift X, Y	0.1 % / K
Light source	white light LED, AC mode (adjustable or OFF for self-luminous objects, software-switchable)
Type of illumination	via fiber optics
Effect from illumination	automatically adjustable
Ambient light	up to 5000 lux
Alternating light operation	AC: typ. 1 kHz; max. 30 kHz
Power supply	+18 ... 28 VDC
Power consumption	typ. 500 mA
Max. switching current	100 mA
TEACH key/inputs	5 keys and IN0 - IN3 for externally teaching color reference, tolerance stage and configuring sensor, triggering, key lock, clear memory
Outputs	OUT 0 - OUT 7, digital (0 V/+Ub), 100 mA max. switching current
Switching state display	visualization with 13 white LEDs
Interface	Ethernet, RS232 and USB process interfaces
Type of connector	to power/PLC: 8-pole flange connector; PLC: 8-pole flange socket (M12A) to PC: 4-pole flange socket (M12D) (Ethernet DHCP-capable)
Connection cable	to power/PLC: art. no. 11234717 / 11234722; to PC: art. no. 11234735 (Ethernet)
Receiver	3-color filter detector (XYZ TRUE COLOR detector, color curve according to CIE1931)
Pulse extension	off by default, typ. 10 ms, adjustable > 30 µs
Signal amplification	5 stages, automatic
Housing material	Aluminum, anodized black
Operating temperature	-10 ... +55 °C
Storage temperature	-10 ... +85 °C
Protection class	IP65

[1] maximum color distance ΔE of 1000 successive measurements of the color value of a red and a dark gray reference tile (R = 5%), measured with sensor FAR-T-A2.0-2,5-1200-67° at 1000 Hz and brightness adjustment with a white standard (R = 95%)
[2] Model: FAR-T-A2.0-2.5-1200-67° Reflex; Model: FAD-T-A2.0-2.5-1200-67° Transmitted light



Dimensions:
Dimensions in mm, not to scale



CFO controller

- Compact and robust, direct integration into machine
- Ideal for monitoring of high-speed processes
- High light intensity
- Stable long-term behavior / transmission monitoring

High-quality glass and special fibers for long-life operation

Micro-Epsilon fiber optics feature high processing and transmission quality. Ground and polished end-faces ensure excellent optical integration with adapted sensors. These high-quality, optical glass fibers are extremely robust and ideally suitable for use in harsh ambient conditions.

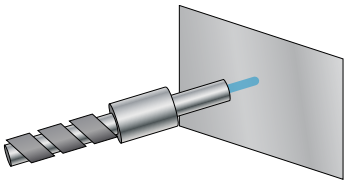
Characteristics

- Temperature resistance from -270 °C to +2000 °C
- Flexible and highly flexible with flux
- Cut and polished surfaces
- Wavelength from 180 nm (UV) to 3500 nm (IR)
- Customer-specific modification even for 1 single piece only

Heads for versatile applications

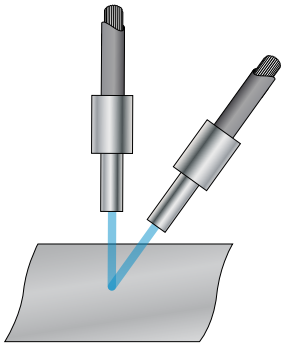
Functions of the fiber optics

Application instructions on selecting the appropriate function.



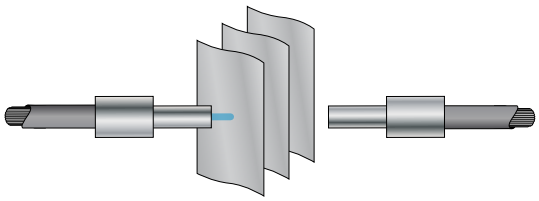
Reflex mode

- Max. measurement distance 200 mm
- Easy and fast installation
- Detection of smallest objects from 0.2 mm
- Color evaluation to determine color, gloss level, gray value, presence
- Ideal for part recognition, sorting tasks,
- presence monitoring, color tests



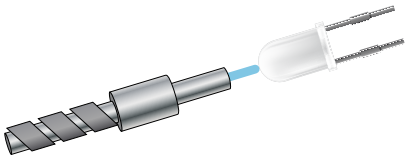
Reflex mode V arrangement

- Max. measurement distance 200 mm (with reflecting surfaces)
- Easy adjustment due to mounting accessories
- Very exact positioning of the detection point
- Immune to dust and particles in the beam path



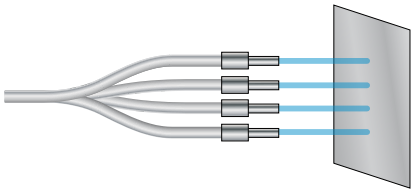
Transmitted light mode

- Distance between receiving and transmission unit up to 50 mm
- Color recognition of transparent objects
- Arbitrary point of light transmission
- Ideal for part recognition, color tests, sorting tasks, presence monitoring



Receive mode with self-luminous objects

- Max. measurement distance 30 mm
- Recognition of slightest variations in color and intensity
- For color sensor with external illumination
- Ideal for testing LED illumination and self-luminous objects



Available on request

Special types for multiple reflex mode

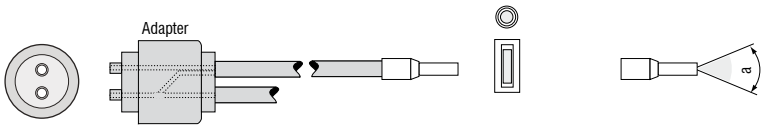
Transmission and receiving fibers are, statistically mixed, guided in two or more separated fiber optics. Therefore, several positions can be detected using only one sensor.

Available on request

Special types for multiple transmitted light mode

The light path of the axially opposing probe head ferrules is interrupted or damped by one or more objects.

Order code for fiber optics



	Function	Sheathing	Probe head	Fiber bundle øF	Total length	Aperture angle
Order code	FA	D	T	A 2.0	2,5	1200	67°

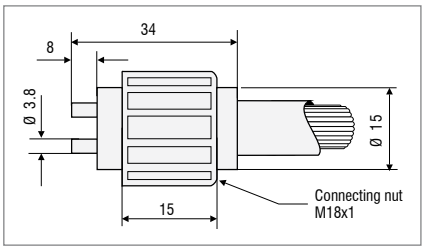
5 Aperture angle of the fiber, 67° (standard)

4 Total length, e.g. 1200 mm

3 Probe head type e.g. A2.0 with fiber bundle Ø 2.5 mm

2 Choose sheathing depending on the ambient conditions, e.g. silicone-metal sheath (T)

1 Function (D = transmitted light mode, R = reflex mode)

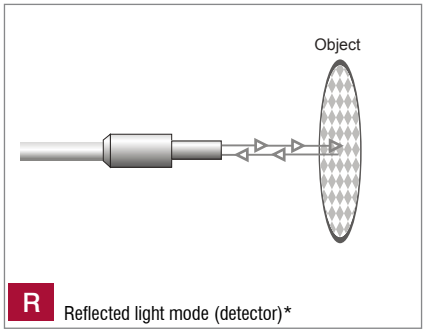


Adapter, FA System FASOP

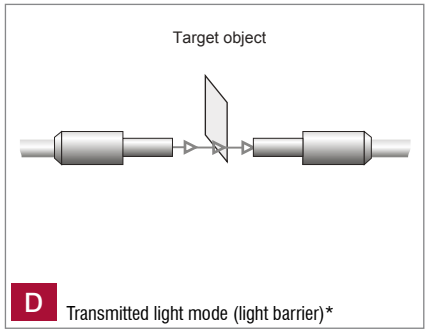
1 Function of the fiber optics

(D = transmitted light mode, R = reflex mode)

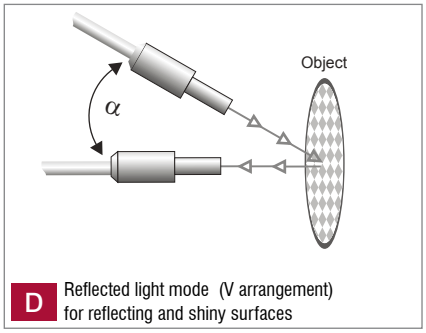
Please define the accessibility of the spot to be inspected and the size of the measurement object for the appropriate function of the fiber optics and the diameter of the glass fiber bundle.



R Reflected light mode (detector)*



D Transmitted light mode (light barrier)*



D Reflected light mode (V arrangement) for reflecting and shiny surfaces

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

2 Sheathing

Please determine the sheathing and the bonding of the fiber optics based on the prevailing environmental conditions and mechanical stress. Please contact us in case of high temperature applications or extreme, mechanical stress.

Silicone-metal sheath
Metal wire-spiral-reinforced hose with glass-fiber braiding and silicone rubber sheathing [1]

Characteristics:
- Very flexible, ideal for frequent bending
- Highly resistant to bending, tension and torsion
- Temperature-stable from -60 °C to +180 °C
- Liquid-tight

T 

VA stainless-steel sheath
Flexible stainless steel wire-spiral-reinforced hose [1]

Characteristics:
- Flexible
- Protection against mechanical stress
- Temperature-stable to 400 °C
- Stainless

E 

Metal sheath
Flexible brass wire-spiral-reinforced hose, chrome-plated [1]

Characteristics:
- Flexible
- Protection against mechanical stress
- Temperature-stable to 300 °C

M 

PVC-metal sheath
Flexible brass spiral-reinforced hose coated with PVC sheathing [1]

Characteristics:
- Flexible
- Protection against mechanical stress such as pressure and tension - Temperature-stable from -20 °C to +80 °C

Z 

PVC special sheath
Plastic hose [2]

Characteristics:
- For rigid installation
- Small sheath diameter
- Temperature-stable to 80 °C

P 

BOA special sheath
Corrugated tube with stainless steel braiding [2]

Characteristics:
- Protection against mechanical stress
- Ideal for drag-chain applications
- Temperature-stable from -270 °C to +600 °C

BOA 

Special models

Fiber optics with increased vibration protection - VS option

Fiber optics can be manufactured with increased vibration protection for use with mechanical loads such as shock, acceleration, and movement. This special treatment minimizes friction between fibers and reduces shocks. The fibers are embedded into a gel cushion.

Special models

Fiber optics with special bonding for high temperatures

Standard bonding is suitable for maximum temperatures up to 80 °C. Special adhesives allow for temperatures of up to 250 °C and even 400 °C. These higher temperature ranges require the use of Type E stainless steel sheathing. With quartz and sapphire fibers and appropriate adhesive, special fiber optics for use in environments up to 2000 °C can be produced.

[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 about sheath diameters can be found in section 3 (probe head types)

3 Probe heads and fiber bundles

Please choose a probe head type and ensure that the probe head is compatible with the fiber bundle diameter øF (see 1) and the sheath (see 2).

Standard probe head bonding for -10 °C to +80 °C
Please refer to the technical data for special models (T250, T400).

All details in mm; tolerances: typ. ± 0.1 mm
Alu ferrules, black anodized

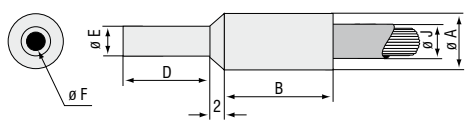
Please contact us if you require other dimensions.

Detection ranges of the probe heads

Fiber bundle ØF mm	Working distance mm	Light spot for 67° fiber approx. Ø mm	Light spot for 22° fiber approx. Ø mm
0.6	5	3	3
	10	5	4
	15	8[1)]	6
	20	12[1)]	8
1	5	3	3
	10	7	5
	15	11	8[1)]
	20	15[1)]	11[1)]
1.5	5	4	3
	10	7	5
	15	11	8
	20	19[1)]	11
2.5	5	5	4
	10	10	8
	15	13	10
	20	19[1)]	13
3	5	8	5
	10	12	7
	15	15	10
	20	18[1)]	13

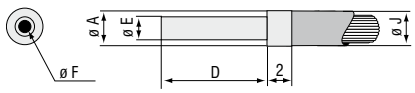
Typical values determined with colorSENSOR CFO200
[1)] only under certain circumstances

A Type A ferrule, stainless steel



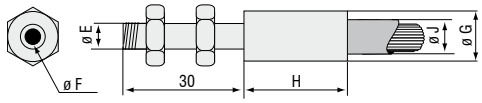
Ø F	Model	Ø A	B	D	Ø E	Ø J P	Ø J M	Ø J T
1.5	A 1.0	4.6	8	11	2.5	4	4	–
1.5	A 1.1	6.6	8	11	2.5	–	5	4.4
2.5	A 2.0	6.6	10	12	4.5	6	6	5.8
3	A 3.0	8.5	11	15	6	7	7	7.5

B Type B ferrule
(only suitable for PVC sheathing)



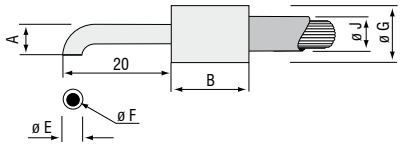
Ø F	Model	Ø A	D	Ø E	Ø J P	Ferrule
0.6	B 1.1	2	30	1	2	Stainless steel
0.6	B 1.2	2	10	1	2	Stainless steel
1	B 2.0	3	10	2	3	Alu
2.5	B 3.0	5	12	4	5	Alu
3	B 4.0	8	12	6	8	Alu

C Type C ferrule, stainless steel



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

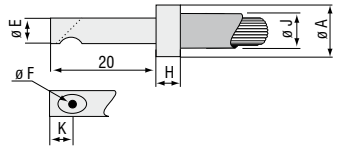
D Type D ferrule, stainless steel
With angular probe heads, a reduction in range can be expected compared to axially emerging versions.



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

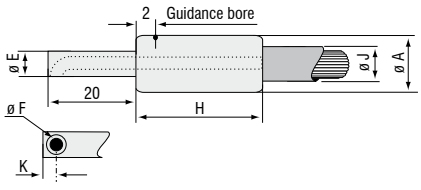
* D1.0 only suitable for PVC sheathing

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



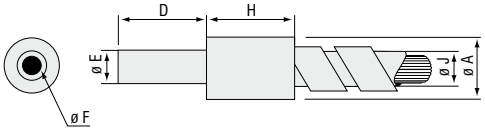
Ø F	Model	Ø A	Ø E	H	K	Ø J P	Ø J M	Ø J T
1.5	E 1.0	4	3	1.5	4	4	–	–
2.5	E 2.0	5	4	1.5	4	5	5	–
2.5	E 2.1	7	4	10	4	–	–	5.8
3	E 3.0	8	6	1.5	5	7	7	–

F Type F ferrule, stainless steel
With angular probe heads, a reduction in range can be expected compared to axially emerging versions.



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

M Type M ferrule, aluminum / stainless steel

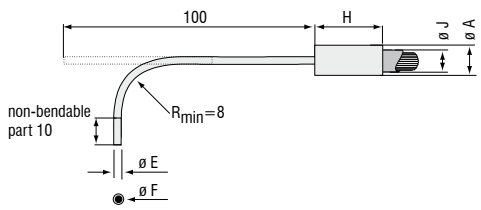


Ø F	Model	Ø A	D	Ø E	H	Ø J M	Ø J T	Ferrule
0.6	M 1.1	6	30	1	10	5	4.4	Stainless steel
0.6	M 1.2	6	10	1	10	5	4.4	Stainless steel
1	M 2.0	6	10	2	10	5	4.4	Alu
2.5	M 3.0	7	12	4	12	6	5.8	Alu
3.5	M 4.0	9	12	6	12	7	7.5	Alu

Larger fiber cross-sections are possible

O Type O ferrule, bendable to a certain extent

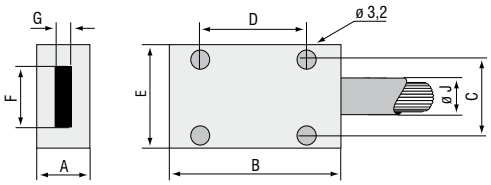
With angular probe heads, a reduction in range can be expected compared to axially emerging versions.



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

Q Type Q, aluminum

Also available in stainless steel

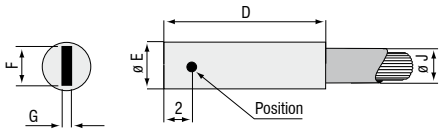


Model	A	B	C	D	E	F	G	Ø J
Q1	12	25	9	15	15	5	0.5	
Q2	12	30	14	20	20	10	0.3	
Q3	12	35	24	25	30	18	0.3	
Q4	12	55	34	40	40	28	0.2	
Q5	12	55	44	40	50	38	0.15	
Q6	12	55	54	40	60	48	0.15	
Q7	16	75	64	60	70	58	*	
Q8	16	75	74	60	80	68	*	
Q9	20	90	84	75	90	78	*	
Q10	20	90	94	75	100	88	*	

Ø J: depends on fiber cross-section

FxG max. 9.62 mm²
F=3.5 mm as special model
Q7 to Q10 only available as FAR special model

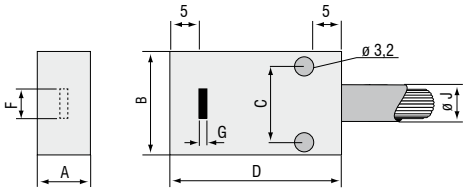
R Type R ferrule, aluminum



Model	D	Ø E	F	G max.	Ø J P	Ø J M	Ø J 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

* R1.0 and R2.0 only suitable for PVC sheathing
** at 6 x 1 mm², can be made to a length of 1200

P Type P ferrule, aluminum

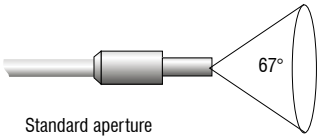


Model	A	B	C	D	F	G	Ø J P	Ø J M	Ø J T
P 1.0	8	15	9	25	3	0.1	4	5	4.4
P 2.1	8	17	11	30	6	0.3	4	6	6.5
P 3.1	12	17	11	30	10	0.5	6	6	6.5

4 Length

Standard lengths are: 600*, 1200*, 1800 and 2400 mm.
*Bearing types
Length tolerance typ.: ± 4 %
Cable lengths from 200 mm are available on request. The recommended max. cable length for color inspection tasks is 2,400 mm.

5 Aperture angle



Standard aperture angle 67°

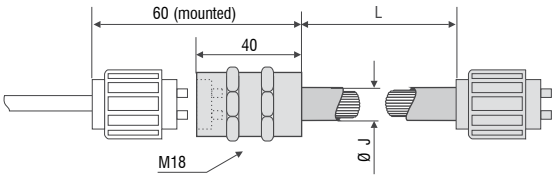
Technical data // Fiber optics		
Length	Standard lengths: 600, 1200, 1800 and 2400 mm, up to 30 m on request	
Aperture angle	Standard fiber	67° (NA 0.56)[1]
	Special fibers on request	22° (NA 0.21/ glass fibers) 80° (NA 0.64/glass fibers) 120° (NA 0.86/glass fibers) 25° (NA 0.22/UV-VIS and VIS-IR quartz fibers) 14° (NA 0.12/UV-VIS and VIS-IR quartz fibers)
Material	Optical glass; quartz glass or sapphire glass on request	
Dielectric strength	50 kV/m with PVC protective sheath	
Probe Head Temperature range Fiber bonding	Standard	-10 °C to +80 °C
	T250	-40 °C to +250 °C
	T400	-40 °C to +400 °C
	T600 special model	0 °C to +600 °C
	T2000 special model	0 °C to +2000 °C
Permissible temperature range with sheathing that has appropriate fiber bonding	PVC (Type P / Type Z)	-20 °C to +80 °C
	Metal (type M)	-40 °C to +300 °C
	Metal with special bonding (Type E)	-40 °C to +400 °C
	Metal/silicone (Type T)	-60 °C to +180 °C
	Corrugated tube with stainless steel braiding (type BOA)	-270 °C to +600 °C
Fiber transmission	Different types for wavelengths from UV 180 nm to IR 3500 nm. We can provide the most suitable solution depending on your requirements. Transmission curves on request.	
Vibration protection	Increased vibration protection (VS option)	

[1] Fiber transmission with standard fiber 390 - 1390 nm

Extensions / feed-through

For extension or feed-through of the fiber optics please use the Type LV ferrule.

LV **Type LV ferrule**
Fiber optic extension / feed-through



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

Available on request

Pressure-proof feed-through up to 10 bar [2] [3]
Housing feed-through
Adapter for optical fiber FA on FA
Suitable for use in vacuum
Suitable for use with drag cable
Vibration protection
Tomography
Single channel
Multi-channel
Adaption for C-mount lenses
Special fiber optics according to customer requirements/drawing

[2] in combination with FAD-X-FAD adapter for optical fiber
[3] also suitable for use in vacuum up to 10^{-5}

KL-xx/xx series

- Focusing of color and fiber optic sensors

- Improving the efficiency of the application

- Many possible applications

Features:

- Working distances from 8 mm to 200 mm
- Scratch-resistant glass lens
- Robust aluminum housing (black anodized)
- Bundling to a small light spot
- Increasing the range with C-mount objective > 300 mm distance
- Minimum color change when the distance is altered
- High luminous efficiency
- Special designs according to customer requirements
- Color measurement on small objects at a relatively large distance (KI-3, KL-4)
- Recognition of highly absorbent objects (KL-5, KL-14, KL-17)

	Probe head type	Article number	Object distance (typ.)	Detection range (typ.)*	Dimensions
	KL-3-A2.0 [3]	10823012	8 mm - 20 mm	Ø 1mm - 5 mm Ø 1 mm with 10 mm	L x Ø approx. 11 mm x 14 mm
	KL-M18-A2.0 [1]	10823020	20 mm - 50 mm	Ø 3 mm - 10 mm Ø 3 mm with 20 mm	L x Ø approx. 51 mm x M18 x 1
	KL-M18-XL-A2.0 [1]	10824358	Pos1 50 - 120 mm Pos2 10 - 180 mm Pos3 10 - 160 mm	Pos1 Ø 4 - 7 mm Ø 4 mm with 80 mm Pos2 Ø 7 - 11 mm Ø 7 mm with 110 mm Pos3 Ø 7 - 11 mm Ø 7 mm with 120 mm	L x Ø approx. 90 mm x M18x1 (L=50 mm)
	KL-M34-A2.0 [1]	10823278	100 mm - 180 mm	Ø 15 mm - 18 mm Ø 15 mm with 100 mm	L x Ø approx. 85 mm x M34 x 1.5
	KL-M34/62-A2.0 [1]	10824196	80 mm - 200 mm	Ø 3 mm - 5 mm Ø 3 mm with 120 mm	L x Ø approx. 170 mm x 62 mm
	KL-4-A1.1 [1]	10823262	8 mm - 20 mm	Ø 0.6 mm - 3 mm Ø 0.6 mm with 10 mm	L x Ø approx. 60 mm x 15 mm
	KL-M18-A1.1 [1]	10824140	10 mm - 50 mm	Ø 2 mm - 7 mm Ø 2 mm with 10 mm	L x Ø approx. 51 mm x M18 x 1
	KL-D-40-A2.0 [2]	10824143	15 mm - 25 mm	Ø 3 mm - 6 mm Ø 3 mm with 15 mm	L x W x H approx. 43.4 x 49.5 x 12 mm
	KL-D-28-A2.0 [2]	10824197	20 mm - 30 mm	Ø 5 mm - 8 mm Ø 5 mm with 20 mm	L x W x H approx. 31.7 x 40.5 x 15 mm
	KL-D-20-A2.0 [2]	10823021	10 mm - 50 mm	Ø 4 mm - 10 mm Ø 4 mm with 10 mm	L x W x H approx. 21.4 x 33 x 12 mm
	KL-D-17-A2.0 [2]	10823220	30 mm - 80 mm	Ø 8 mm - 25 mm Ø 8 mm with 30 mm	L x W x H approx. 36.5 x 25.5 x 15 mm
	KL-D-14-A2.0 [2]	10823022	60 mm - 120 mm	Ø 10 mm - 20 mm Ø 10 mm with 60 mm	L x W x H approx. 37 x 50 x 20 mm
	KL-D-6-A2.0 [2]	10823409	100 mm - 200 mm	Ø 15 mm - 30 mm Ø 15 mm with 100 mm	L x W x H approx. 31.1 x 45.1 x 20 mm
	KL-5-R1.1 [1]	10824198	8 mm - 20 mm	2 x 0.3 mm up to 15 x 3 mm 2 x 0.3 mm with 10 mm	L x Ø approx. 11 mm x 14 mm
	KL-8-R2.1 [1]	10823920	8 mm - 20 mm	4 x 0.7mm up to 30 x 5 mm 4 x 0.7 mm with 10 mm	L x Ø approx. 11 mm x 14 mm

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

[1] Reflected-light optical fiber (FAR)

[2] Transmitted-light optical fiber (FAD)

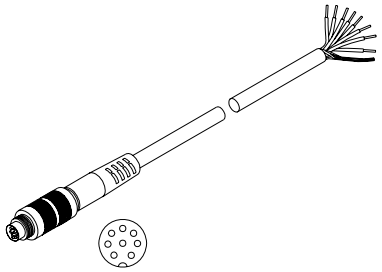
[3] possible with FAR-X-A2.0-0,6-XXXX-67° reflected-light optical fiber (spot size of approx. 0.2 mm)

colorSENSOR Accessory		
Art. No.	Description	suitable for:
11234717	CAB-M12-8P-co-fm-straight; 2m-PUR; open ends	colorSENSOR CFO (SYS; power and PLC)
11234718	CAB-M12-8P-co-fm-straight; 5m-PUR; open ends	colorSENSOR CFO (SYS; power and PLC)
11234722	CAB-M12-8P-co-straight; 2m-PUR; open ends	colorSENSOR CFO200 (digital I/O; PLC)
11234723	CAB-M12-8P-co-straight; 5m-PUR; open ends	colorSENSOR CFO200 (digital I/O; PLC)
11234735	CAB-M12-4P-co-straight; 2m-PUR-Cat5e; RJ45-Eth	colorSENSOR CFO (Ethernet)
11234736	CAB-M12-4P-co-straight; 5m-PUR-Cat5e; RJ45-Eth	colorSENSOR CFO (Ethernet)
11234713	CFO mounting adapter	colorSENSOR CFO
11234762	CFO DIN rail mounting kit	colorSENSOR CFO
11234763	CFO DIN rail mounting adapter	colorSENSOR CFO
11234091	CAB-M9-8P-co-straight; 2 m-PUR; open ends	colorSENSOR LT and OT series (power und PLC)
11234099	CAB-M9-8P-co-straight; 5 m-PUR; open ends	colorSENSOR LT and OT series (power und PLC)
11234093	CAB-M9-4P-co-straight; 2 m-PVC; RS232	colorSENSOR LT-2-DU (RS232)
11234101	CAB-M9-4P-co-straight; 5m-PVC; RS232	colorSENSOR LT-2-DU (RS232)
11234094	CAB-M9-4P-co-straight; 2m-PVC; USB	colorSENSOR LT-2-DU (USB)
11234102	CAB-M9-4P-co-straight; 5m-PVC; USB	colorSENSOR LT-2-DU (USB)
11234095	CAB-M5-4P-co-straight; 2m-PUR; RS232	colorSENSOR OT-3 Serie (RS232)
11234103	CAB-M5-4P-co-straight; 5m-PUR; RS232	colorSENSOR OT-3 series (RS232)
11234096	CAB-M5-4P-co-straight; 2m-PVC; USB	incl. RS232/USB converter suitable for: colorSENSOR OT-3 series (USB)
11234104	CAB-M5-4P-co-straight; 5m-PVC; USB	incl. RS232/USB converter suitable for: colorSENSOR OT-3 series (USB)
11234368	CAB-M5-4P-co-straight; 2m-PVC; RJ45-fm-Eth	incl. RS232/Ethernet converter suitable for: colorSENSOR OT-3 series (Ethernet)
11234694	White standard 30 mm zenith	colorSENSOR and colorCONTROL
11234695	White standard 30 mm zenith calibrated	colorSENSOR and colorCONTROL
11233482	White reference module	colorSENSOR LT-2-DU
2420065	PS2030 power supply 24 V / 24 W / 1 A; 2m-PVC; terminal-2P-co-fm-straight	Power supply of all sensors with 24 VDC

colorCONTROL MFA Accessory		
Art. No.	Description	suitable for:
10814105	POF-2.2mm fiber optics	colorCONTROL MFA
11251112	Fiber-optic thread fitting; M4	POF-2,2
11251113	Mountable lens 6 mm	Fiber-optic thread fitting; M4
11253931	Fiber-optic thread fitting; 3 mm lens; M4	POF-2,2
11254108	Fiber-optic thread fitting; 90° lens, M5	POF-2,2
11253959	Reducing adapter 2.2/1 mm POF; 2 pc.	colorCONTROL MFA for use of POF-1mm
10813842	POF-1mm fiber optics	colorCONTROL MFA in connection with the reducing adapter 2.2/1mm POF
11253906	End sleeve 1 mm	POF-1 mm
10824431	End sleeve 1 mm x 50 mm	POF-1 mm
11234305	CAB-M8-4P-co-fm-straight; 2m-PUR; open ends	colorCONTROL MFA-1 (power and PLC)
11234306	CAB-M8-4P-co-fm-straight; 5m-PUR; open ends	colorCONTROL MFA-1 (power and PLC)
11294205	CAB-M9-2P-co-fm-straight; 2m-PUR; open ends	colorCONTROL MFA-5 (power)
11294206	CAB-M9-2P-co-fm-straight; 5m-PUR; open ends	colorCONTROL MFA-5 (power)
11234094	CAB-M9-4P-co-straight; 2m-PVC; USB	colorCONTROL MFA-5 (USB)
11234102	CAB-M9-4P-co-straight; 5m-PVC; USB	colorCONTROL MFA-5 (USB)
11234095	CAB-M5-4P-co-straight; 2m-PUR; RS232	colorCONTROL MFA-5 (RS232)
11234103	CAB-M5-4P-co-straight; 5m-PUR; RS232	colorCONTROL MFA-5 (RS232)
11294243	Assembly kit MFA-10	colorCONTROL MFA-5 + MFA-5-M
11294244	Assembly kit MFA-15	colorCONTROL MFA-5 + 2 x MFA-5-M
11294245	Assembly kit MFA-20	colorCONTROL MFA-5 + 3 x MFA-5-M
11294203	CAB-socket board-6P-co-fm-straight; 2m-PVC; 2P-open ends	colorCONTROL MFA-5-P (power)
11294054	CAB-socket board-6P-co-fm-straight; 1m-PVC; USB	colorCONTROL MFA-5-P (USB and power)
11294204	CAB-socket board-4P-co-fm-straight; 2.5m-PVC; RS232	colorCONTROL MFA-5-P (RS232)

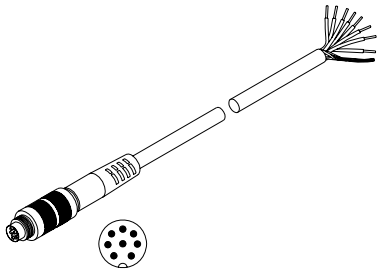
Pin assignment

CAB-M12-8P-co-fm-straight; Xm-PUR; open ends
(art.no.: 11234717; 11234718)
Connection cable SYS; Power and PLC
(max. length 10 m, PUR sheath)



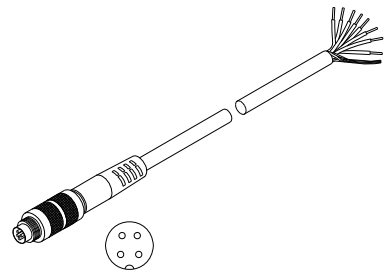
Pin	Color	CFO100/200
1	white	IN0
2	brown	+UB
3	green	TX
4	yellow	RX
5	gray	OUT0
6	pink	OUT1
7	blue	GND
8	red	OUT2

CAB-M9-8P-co-straight; Xm-PUR; open ends
(art.no.: 11234091; 11234098)
Connection cable to power/PLC or digital I/O
(max. length 10 m, PUR sheath)



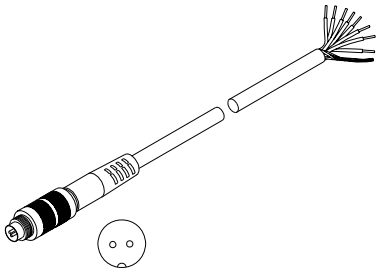
Pin	Color	LT-2-DU SB1	LT-2-DU SB2	OT-3-XX
1	white	OUT 0 / OUT A 0	OUT1	GND (0V)
2	brown	OUT 1 / OUT A 1	OUT2	+24 VDC (± 10%)
3	green	IN1	OUT3	IN0
4	yellow	IN0	OUT4	OUT0
5	gray	CLK (OUT K)	OUT5	OUT1
6	pink	OUT 2 / OUT A 2	OUT6	OUT2
7	blue	GND (0V)	OUT7	OUT3
8	red	+24 VDC (± 10%)	OUT0	OUT4

CAB-M8-4P-fm-co-straight; Xm-PUR; open ends
(art.no.: 11234305; 11234306)
Connection cable to Power/PLC
(max. length 5 m, PUR sheath)



Pin	Color	MFA-1
1	brown	+ 24 VDC
2	white	External Teach
3	blue	GND
4	black	NPN/PNP

CAB-M9-2P-co-fm-Straight; Xm-PUR; open ends
(Art.-No.: 11294205; 11294206)
Connection cable Power
(max. length 10 m, PUR sheath)



Pin	Color	MFA-5
1	white	+24 VDC
2	brown	GND

High performance sensors made by Micro-Epsilon

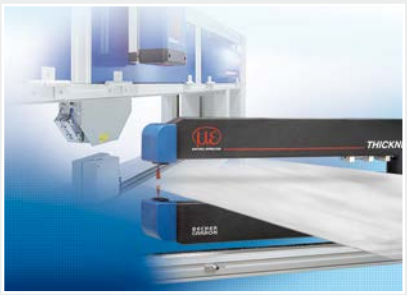
Sensors and systems for displacement and position

Sensors and measurement devices for non-contact temperature measurement

2D/3D profile sensors (laser scanner)

Optical micrometers, fiber optic sensors and fiber optics

Color recognition sensors, LED analyzers and color inline spectrometer



Measurement and inspection systems

MICRO-EPSILON

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**