



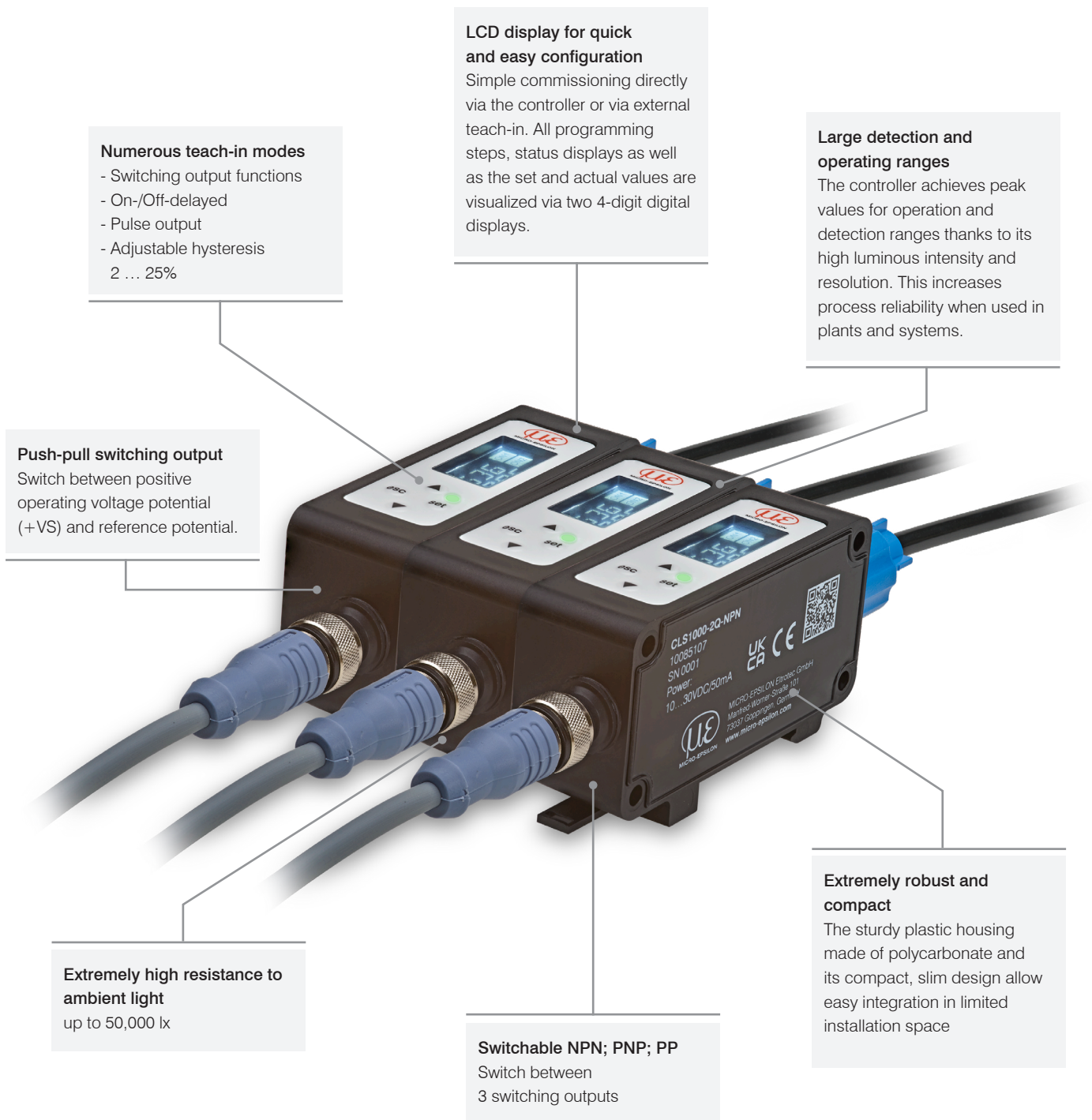
# More Precision

**optoCONTROL CLS1000** // Fiber optic sensor for industrial applications



# Fiber optic sensor for industrial applications

## optoCONTROL CLS1000

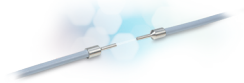







## High-performance fiber optic sensors for numerous monitoring tasks

Fiber optic sensors from Micro-Epsilon are an optoelectronic sensor solution consisting of a controller and a sensor (sensor head and fiber optic cable). The optoCONTROL CLS1000 controllers are composed of a compact transmitter and receiver unit with integrated signal evaluation. The infrared light is transmitted to the object and back via a high-quality fiber optic cable that works on the principle of total reflection.

The received light intensity is used for evaluation. Due to the large number of sheaths and sensor head variants, the sensors can be adapted to any application and are therefore very versatile in installation. The high-quality optical glass fibers are characterized by compact installation size and robust materials. This makes them particularly suitable for use in harsh ambient conditions such as high temperatures.

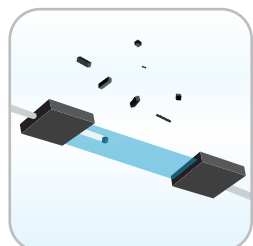
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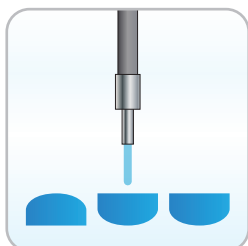
# Fiber optic sensor for industrial applications

## opto**CONTROL** CLS1000

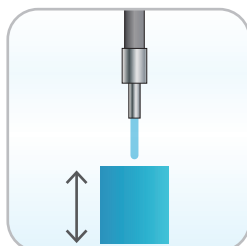
Large and flexible fields of use



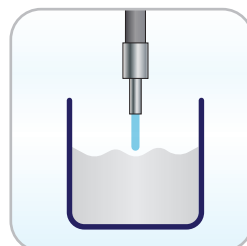
Area detection / counting tasks



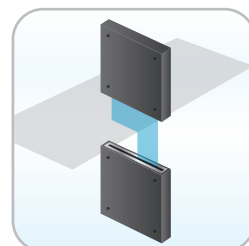
Position detection



Position determination



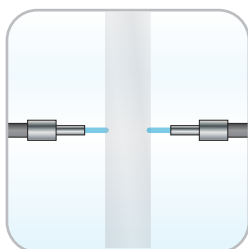
Filling level monitoring



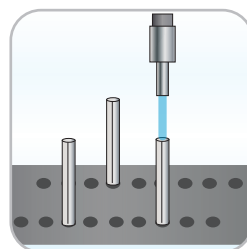
Intensity tests / turbidity / web edge



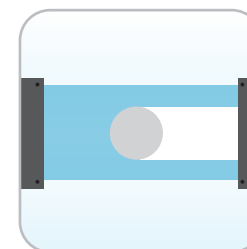
Presence detection  
(e.g. a groove)



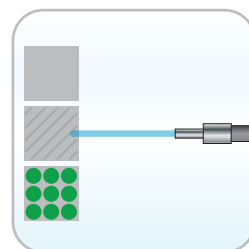
Light barrier



Use as detector  
(e.g. presence of a pin)



Distinction of size and diameter



Recognition and distinction of materials

For all types of surfaces and materials



Transparent objects, e.g., glasses, films and lubricating films, as well as water and other liquids



Metallic-structured objects, e.g. steel, aluminum or carbon



Dark objects, e.g. black rubber



Smooth, reflective objects, e.g. silicon wafers, mirrors, metals

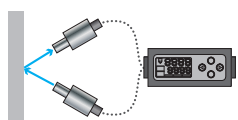


All common materials such as wood, ceramics, plastics and many more.

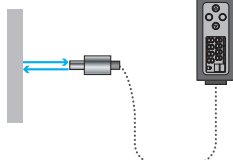
Different measurement arrangements and sensors

Reflex mode

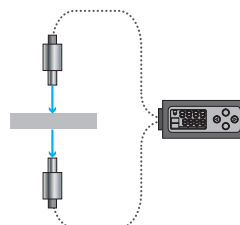
Two-way system



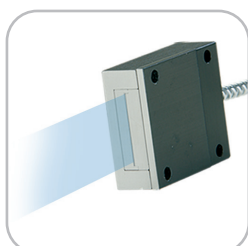
One-way system



Transmission mode



Compact, cylindrical sensors



Wide sensors with large light curtain



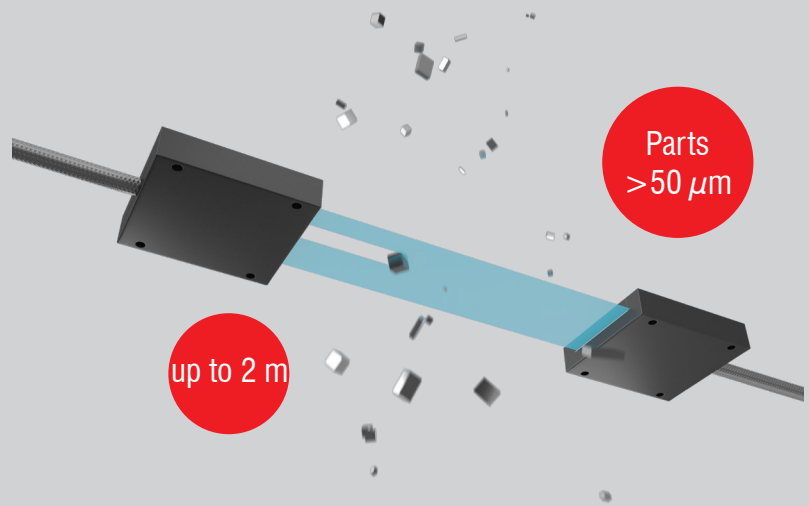
Special sensors & customer-specific sensors



## Advantages & characteristics of fiber optic sensors

### Easy of use meets strong performance

- Intense infrared LED (wavelength 870 nm)
- Highest detection accuracy: detection of the smallest parts from  $50\text{ }\mu\text{m}$  or edges down to  $50\text{ }\mu\text{m}$
- Large detection and operating ranges up to 2 m
- Easy button and display operation



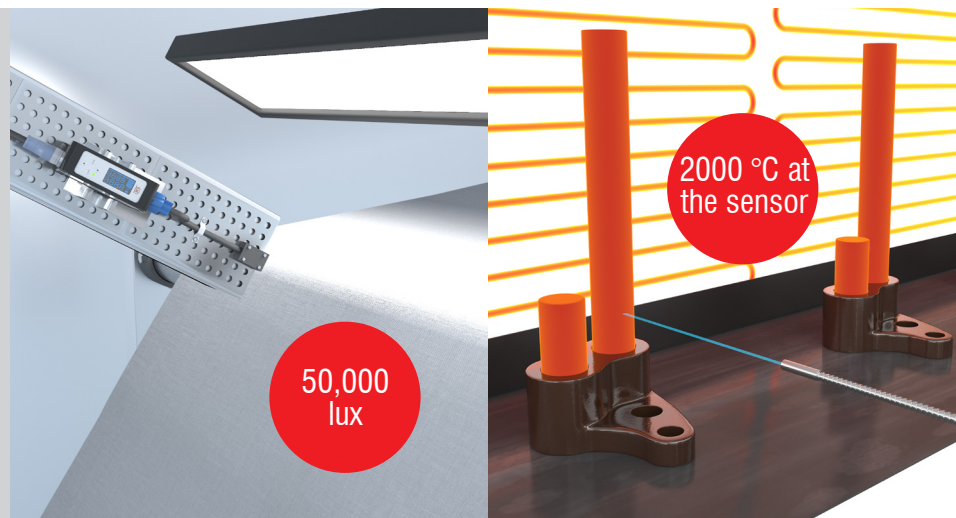
### Miniature design ideal for machine integration

- Can be installed in small spaces at the measuring point
- Flexible conductor with a diameter of only 2 mm
- Compact controller
- Length of optical fiber up to 2.4 m
- Lightweight



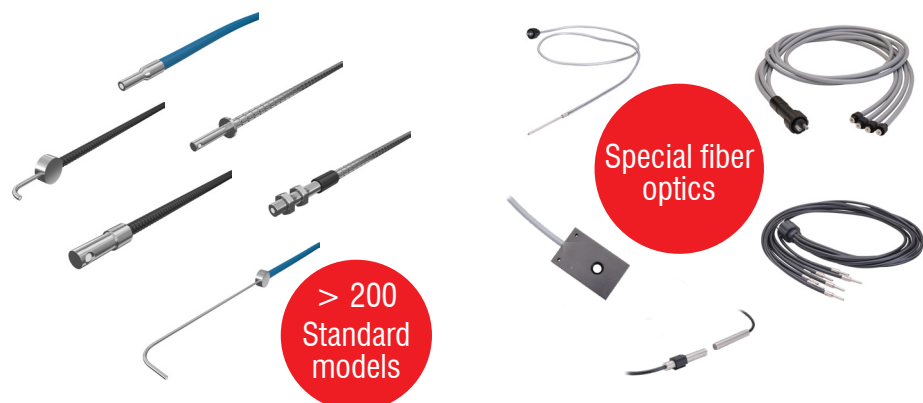
### Extremely robust optical glass fibers

- Resistant to oil and chemicals
- Heat resistant: sensor head up to  $2000\text{ }^{\circ}\text{C}$ , optical fiber up to  $600\text{ }^{\circ}\text{C}$
- Extremely high ambient light resistance up to 50,000 lux
- Suitable for use with robots
- Increased vibration protection
- Special alloys



### Versatile models from catalog to customer-specific

- Special types, e.g., for vacuum, extremely hot or particularly confined installation space, available from as little as 1 piece
- Custom presets for series production and OEM possible
- Optimized for use: Mechanically, in the software, right down to the output signal



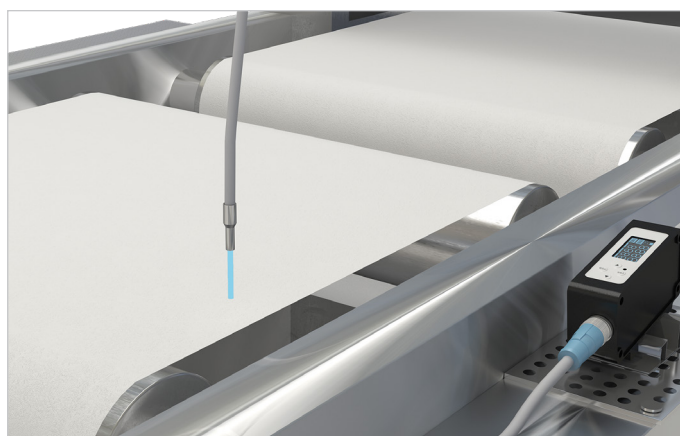
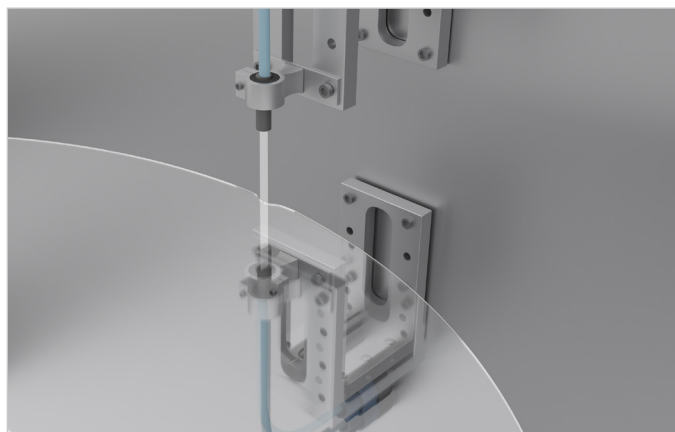
## Application examples

### optoCONTROL CLS1000

#### Wafer notch detection

In wafer production, the position of the wafer must be known or a specific position must be reached for further processing. This is determined using the wafer notch and transferred by optical sensors. Thanks to its material independence, the reflective wafer can be optimally detected and, thanks to its excellent recognition performance, the notch can be positioned reliably and with an accuracy of a few tenths of a millimeter.

*Recommended systems: CLS1000-AI-NPN + CFS4-C10-E-T400,  
CLS1000-AI-NPN + CFS4-R21*



#### Breakage inspection of belt material

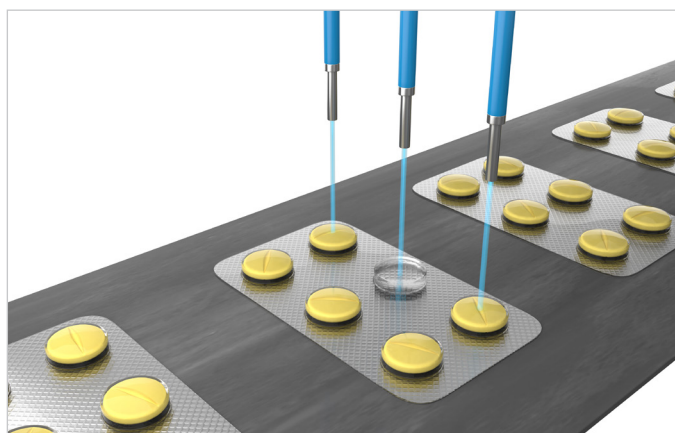
Due to the low response time of 100  $\mu$ s, the optoelectrical fiber optic sensors are able to quickly detect disturbances such as breakage of strip materials. Their high switching frequency of 2.5 kHz also enables fast signal output via the analog output. In addition, the high detection range of up to 430 mm and the cable length of up to 2400 mm allow the sensor to be safely mounted outside the hazardous zone.

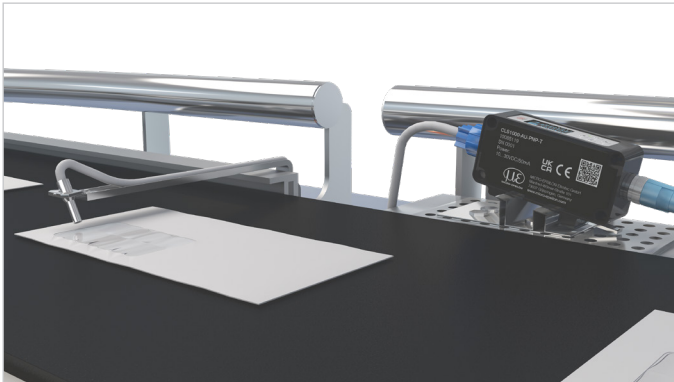
*Recommended system: CLS1000-AU-PP + CFS4-A30*

#### Packaging control of blisters

When packaging tablets in blisters, the presence detection of the medication is required. For this purpose, the fiber optic sensors detect the tablets through the transparent layer of the blister. The challenge here is to capture all pockets of the blister at the high speed at which the belt travels. The system can then filter out incorrectly or insufficiently filled blisters.

*Recommended system: CLS1000-QN + CFS4-A11*

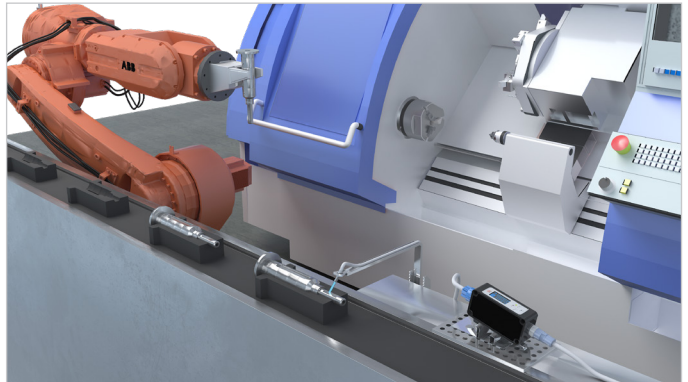




### Detection of envelope windows

During the production of envelopes, quality assurance must check whether the window has been inserted. The fiber optic sensors of the optoCONTROL CLS1000 series reliably detect the windows of the envelopes at a frequency of up to 2.5 kHz. The CFS4-A20 sensor is positioned at a distance of 30 mm and an angle of 60° above the window.

*Recommended system: CLS1000-2Q + CFS4-A20*



### Groove detection on the shaft

After the mechanical processing of shafts, fiber optic sensors from Micro-Epsilon automatically check the required depth and height of the milled groove. For testing, the CLS1000-AU controller is used in combination with the CFS4-A20 sensor. The sensor measures the required depth of 3 mm at a distance of 5 to 8 mm. The output analog signal between 4 ... 20 mA is passed on to the IF2030/ETH interface module.

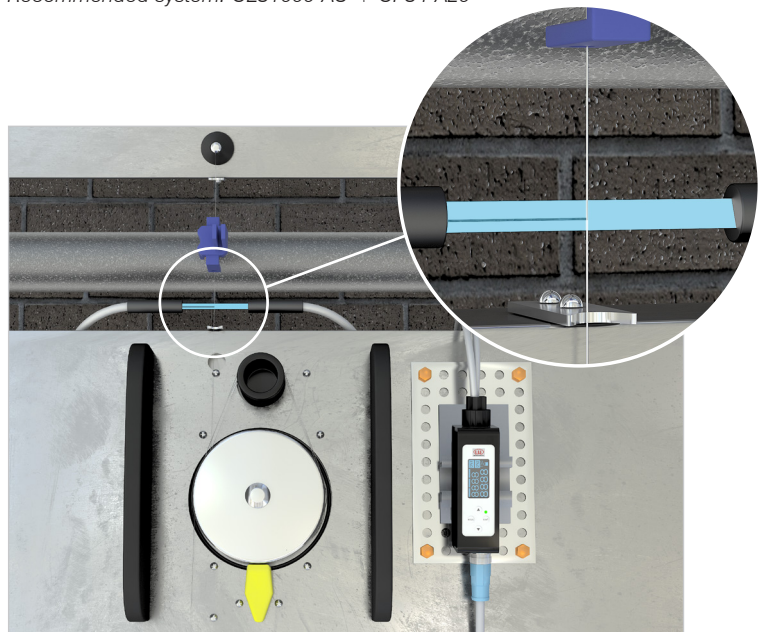
*Recommended system: CLS1000-AU + CFS4-A20*



### Positioning the film edge

During the winding process or for web inspection of films, film manufacturers rely on sensor technology from Micro-Epsilon. Fiber optic sensors of the type optoCONTROL CLS1000 are used to perform an edge detection of transparent films. Thanks to the wide CFS3-Q5 fiber optic cable, the position of the edge can be reliably detected based on the width.

*Recommended system: CLS1000-AU + CFS3-Q5*



### Presence detection of a thread

When texturing threads, the presence of the thread must be continuously checked, as the very thin threads of approx. 80 µm break easily. For presence monitoring, the optoCONTROL CLS1000-AI is used together with the CFS3-R11 sensor. The distance between sensor and receiver is approx. 65 mm. The IF1032 interface module is used to evaluate the output signal at the controller. This setup is also suitable for droplet measurement when detecting leaks.

*Recommended system: CLS1000-AI + CFS3-R11*

# Fiber optic sensors

## optoCONTROL CFS



All sensors can be customized.  
We would be pleased to manufacture your sensor according to your drawing.  
Please contact us directly for more information!

### Examples of customer-specific modifications

#### Function

- Special types for transmission sensor CFS3
- Special types for CFS4 reflex sensor

#### Optical fiber sheath

- Silicone-metal sheath
- VA stainless-steel sheath
- Metal sheath
- PVC metal sheath
- PVC special sheath
- BOA special sheath
- MA-radius-limiting special sheath

#### Fiber bundle diameter

- 0.6 / 1 / 1.5 / 2.5 / 3 mm

#### Optical fiber (length)

- Available from 300 mm
- Standard length 1,200 mm
- 600, 1,800 and 2,400 mm optionally available
- Individual length from 0.3 to 2.4 m possible

#### Aperture angle

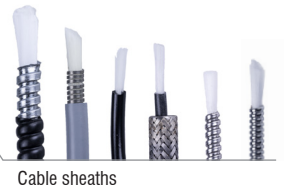
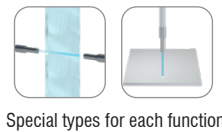
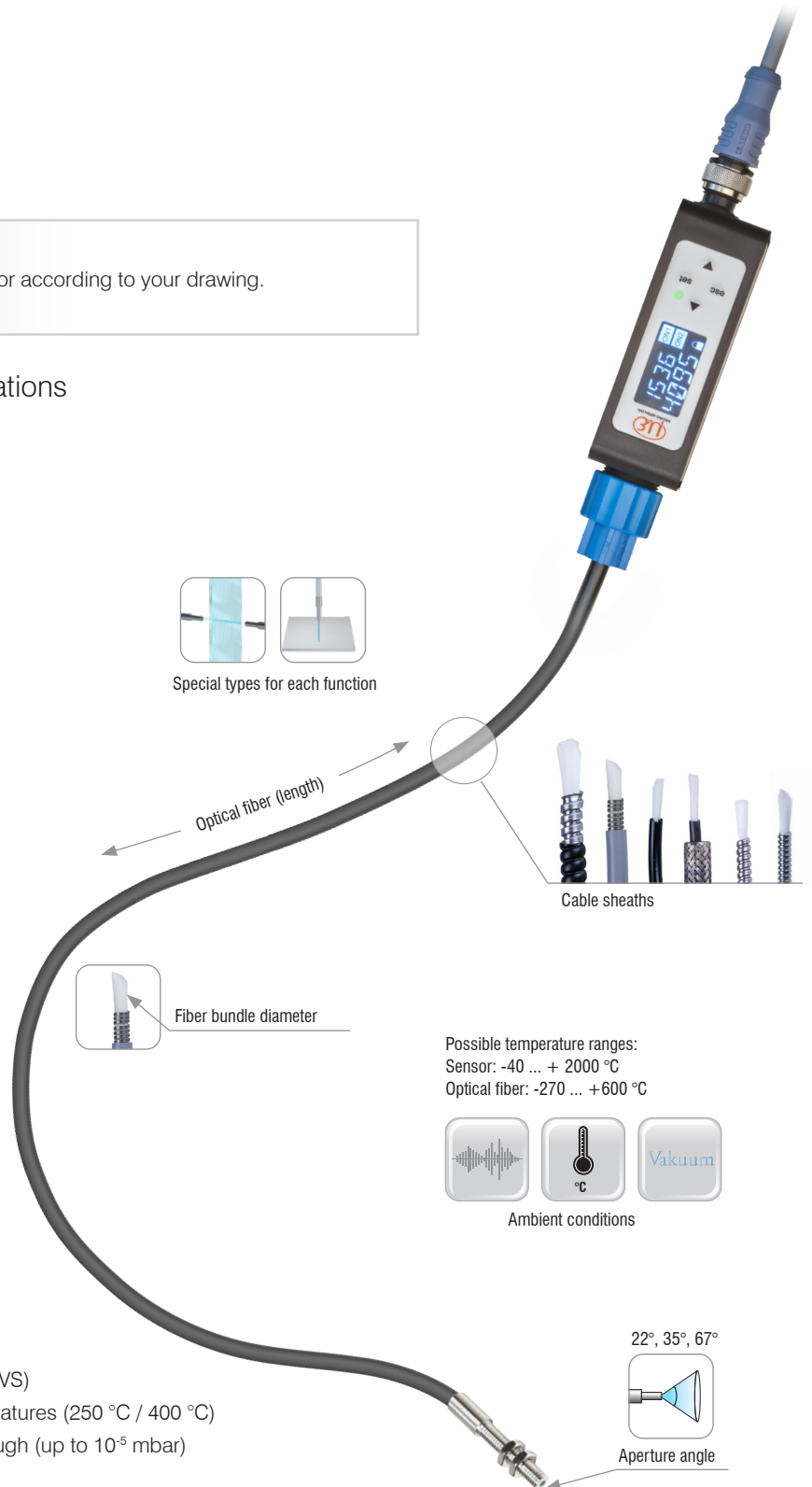
- Standard 67°
- Optional 22° / 35°

#### Ambient conditions

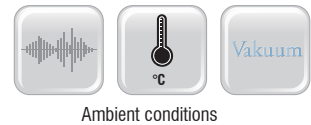
- Special versions with increased vibration resistance (VS)
- Special variants with special bonding for high temperatures (250 °C / 400 °C)
- Pressure-tight special variants with vacuum feedthrough (up to 10<sup>-5</sup> mbar)

#### Sensor heads

- Straight sensor heads with a viewing direction of 0 degree
- 90° output for confined installation spaces
- Sensor head with wide light band (possible width between 3 and 88 mm)
- Sensor heads with and without external thread
- Thin sensor heads with bendable head
- Sensor heads in angular arrangement (CFS1)



Possible temperature ranges:  
Sensor: -40 ... + 2000 °C  
Optical fiber: -270 ... + 600 °C



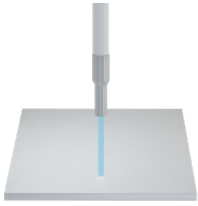
22°, 35°, 67°





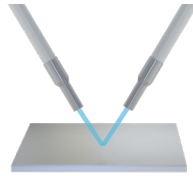
## Notes on the function of the CFS sensors

Application instructions on selecting the appropriate function.



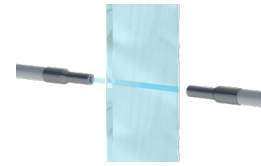
### Reflex sensor (one-way system)

- Detection range max. 1200 mm
- Quick and easy installation
- Detection of the finest structures
- Presence detection
- Ideal for level monitoring, position and location determination



### Reflex mode V-arrangement (two-way system)

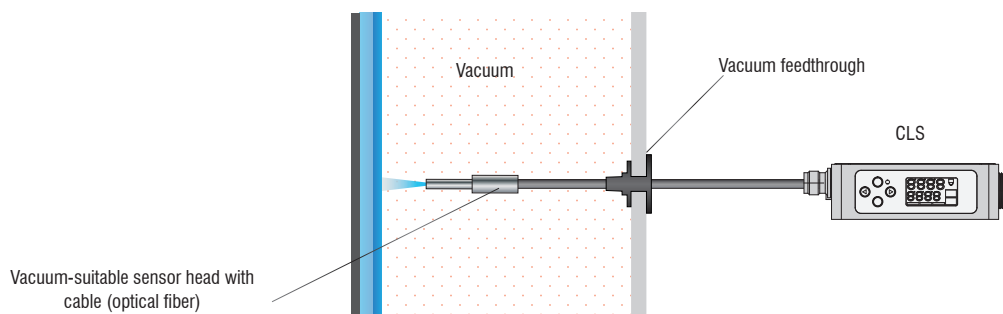
- Detection range max. 1200 mm
- Very exact positioning of the switching point
- Two objects generate highest intensity on the intersection
- Suitable for light dust and particles flying in the path of the beam
- Gloss detection



### Transmission mode (two-way system)

- Large distance between receiving and transmission unit up to 2000 mm
- Objects are detected by interruption of light beam
- Arbitrary point of light transmission
- Detection of transparent objects
- Ideal for part recognition, counting tasks, edge detection, presence monitoring

## Vacuum suitability







The fiber optic sensors and fiber optic cables are built with passive components and do not emit heat to the environment.

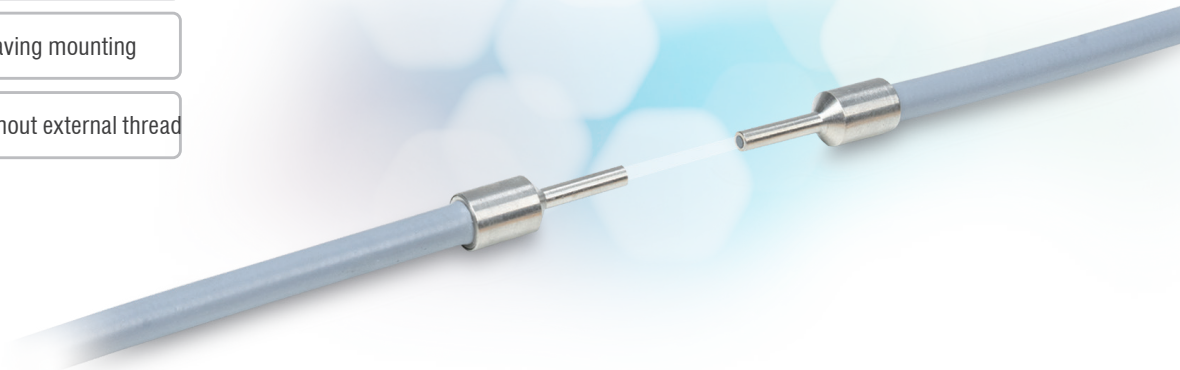
In vacuum, sensors (temperature bonding T250), optical fibers (stainless steel sheath), and the vacuum feedthrough up to  $10^{-5}$  mbar can be used.



# Transmission sensor for transparent/translucent objects

## optoCONTROL CFS3

-  Large operating range between receiver and transmitter unit with up to 2000 mm
-  No exact positioning of the measuring object necessary
-  Simple and space-saving mounting
-  Models with and without external thread



With the transmission sensor, the infrared light emitted by the controller is guided via the optical fiber to the transmitter and from there to the detecting object. There, the light beam is either interrupted or transmitted, depending on the target. The receiving unit of the sensor receives the remaining light and sends it back to the controller via the optical fiber. The remaining light component consists of either the unshielded light component or light transmitted from the object. By illuminating the transmitter through the object, it is possible to detect levels of liquids in jars as well as transparent objects. In addition to detecting transparent and semi-transparent objects, the sensor arrangement of the transmission sensor in transmitted light (180:0) is ideally suited for area detection, as a light barrier, for distinguishing sizes and diameters, for tolerance inspection and for web edge detection.

The CFS3 sensors, in combination with the performance of the CLS1000 series, provide reliable results. Here, the distance variation between the test specimen and receiver or illumination has no noticeable influence on the result. The transmission sensor can be universally used but is also suitable for special solutions (customer-specific adaptations).

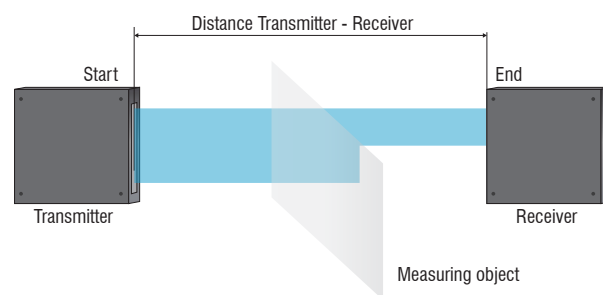
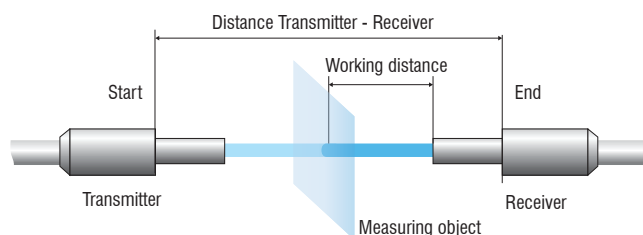
The sensors are available with different operating ranges, temperature ranges and lengths. This enables a wide range of applications. The fiber optic cable has a sensor head, which is available in different versions:

**With external thread:** For example, threaded sensors can be easily fixed on a mounting bracket.

**Without external thread:** Cylindrical sensor heads are suitable for space-saving mounting. This is achieved by simply setting a grub screw.

### Measurement geometry:

Transmission sensor 0°:180°



Transmission sensor with transmitter and receiver

**90° deflection:** If the installation depth and the mounting space are very limited, sensors with integrated 90° deflection are the optimal solution.





**Flat sensor head:** Thanks to the light band, flat sensor heads are ideal for distinguishing sizes and diameters, monitoring web edges, and area detection.

Model		CFS3-A11	CFS3-A20	CFS3-C30	CFS3-M12-600	CFS3-M20-M	
Article number		10810518	10810490	10811921	10810353	10810438	
Sensor type		Transmission sensor					
Operating range (transmitter-receiver distance)	Start	1 mm					
	End	500 mm	1700 mm	2000 mm	90 mm	200 mm	
Working distance (measuring object - receiver)		Measuring object can be freely positioned between transmitter and receiver					
Measurement geometry		0°:180°					
Min. target size <sup>1)</sup>		Ø0.1 µm	Ø0.2 µm	Ø0.3 µm	Ø0.05 µm	Ø0.1 µm	
Connection		Screwable fiber optic cable via FA socket (M18x1),					
		Standard length 1.2 m; max. bending radius 13.2 mm	Standard length 1.2 m; max. bending radius 17.4 mm	Standard length 1.2 m; max. bending radius 22.5 mm	Length 0.6 m; max. bending radius 13.2 mm	Standard length 1.2 m; max. bending radius 15 mm	
Mounting		FA (M18x1)					
Temperature range	Storage	Sensor head: -10 ... +80 °C; Optical fiber: -60 ... +180 °C				Sensor head: -10 ... +80 °C	
	Operation					Fiber optic cable: -40 ... +300 °C	
Humidity (non-condensing)		20 ... 80 % RH				20 ... 60 % RH	
Protection class (DIN EN 60529)		IP64				IP40	
Sensor head		Stainless steel					
Material	Optical fibers	integrated glass fiber (Ø1.5 mm) and metal- silicone (T) sheathing	integrated glass fiber (Ø2.5 mm) and metal- silicone (T) sheathing	integrated glass fiber (Ø3.0 mm) and metal- silicone (T) sheathing	integrated glass fiber (Ø0.6 mm) and metal- silicone (T) sheathing	integrated glass fiber (Ø1.0 mm) and brass spiral hose chrome- plated (M)	
Weight		90 g	160 g	280 g	48 g	100 g	
Compatibility		compatible with all CLS and CFO controllers					
Special features		All variants are also available with different sheath, length 0.3 ... 10 m, vibration protection, IP protection, suitable for drag chains and available for temperature ranges up to 2000 °C. In combination with a pressure-tight feedthrough, a stainless steel sheath and T250° bonding, vacuum applications down to 10 <sup>-6</sup> mbar are also possible.					

<sup>1)</sup> These values apply over the entire operating range. Except the middle of the distance between the transmitter and receiver

# Reflex sensor for the distinction of materials and parts

## optoCONTROL CFS4

-  Detection range up to 430 mm
-  Options with light band and 90° output
-  Simple and space-saving mounting
-  Models with and without external thread



In the case of the reflex sensor, the infrared light emitted by the controller is guided to the detecting object via the sensor's fiber-optic light guides and reflected there. Both diffuse and directly reflected components are present in the back-reflected infrared light. The reflected light components of the object to be detected are received by the same sensor and transmitted back to the controller via the optical fiber for evaluation.

The high-quality reflective sensor, in combination with the performance of the CLS1000 series, delivers even more precise detection of a wide variety of objects and structures. The sensors are available with a wide range of detection ranges, temperature ranges and lengths. This enables a wide range of applications. The fiber optic cable has a sensor head, which is available in different versions:

These sensor heads can be easily mounted in the machine on a bracket using M4, M6, and M10 threads.

With external thread: For example, threaded sensors can be easily fixed on a mounting bracket.

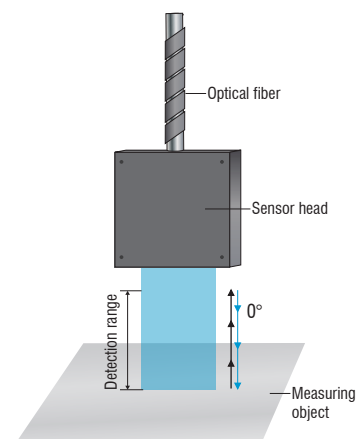
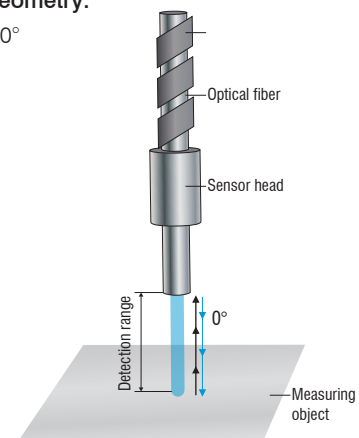
Without external thread: Cylindrical sensor heads are suitable for space-saving mounting. This is achieved by simply setting a grub screw.

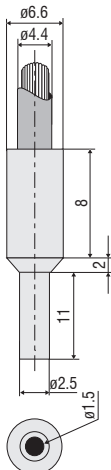
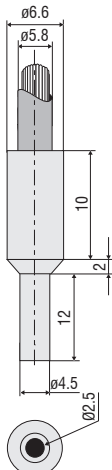
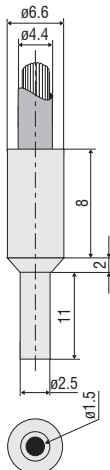
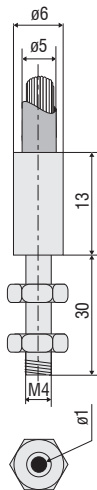

90° deflection: If the installation depth and the mounting space are very limited, sensors with integrated 90° deflection are the optimal solution.

Flat sensor head: Thanks to the light band, flat sensor heads are best suited for detecting larger objects. These can be located anywhere in the light band.

### Measurement geometry:

Reflex sensor 0°:0°

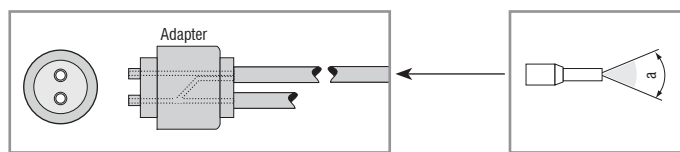


						
Model	CFS4-A11	CFS4-A20	CFS4-A30	CFS4-C10-M	CFS4-B11-P	
Article number	10810487	10810351	10810584	10810383	10810254	
Sensor type	Reflex sensor					
Detection range <sup>1)</sup>	Start	1 mm	1 mm	1 mm	1 mm	
	End	132 mm	394 mm	430 mm	50 mm	19 mm
Measurement geometry	0°:0°					
Connection	Screwable fiber optic cable via FA socket (M18x1), standard length 1.2 m					
	max. bending radius 13.2 mm	max. bending radius 17.4 mm	max. bending radius 22.5 mm	max. bending radius 13.2 mm	max. bending radius 6 mm	
Mounting	FA (M18x1)					
Temperature range	Storage	Sensor head: -10 ... +80 °C; Fiber optic cable: -60 ... +180 °C		Sensor head: -10 ... +80 °C	Sensor head: -10 ... +80 °C;	
	Operation			Fiber optic cable: -40 ... +300 °C	Fiber optic cable: -20 ... +80 °C	
Humidity (non-condensing)	20 ... 80 % RH			20 ... 60 % RH	20 ... 80 % RH	
Protection class (DIN EN 60529)	IP64			IP40	IP64	
Material	Sensor head	Stainless steel				
	Optical fibers	integrated glass fiber (Ø1.5 mm) and metal-silicone coating (T)	integrated glass fiber (Ø3.0 mm) and metal- silicone (T) sheathing	integrated glass fiber (Ø1.0 mm) and metal (M) sheathing	integrated glass fiber (Ø0.6 mm) and PVC plastic (P) sheathing	
Weight	50 g	90 g	114 g	60 g	15 g	
Compatibility	compatible with all CLS and CFO controllers					
Special features	All variants are also available with different sheath, length 0.3 ... 10 m, vibration protection, IP protection, suitable for drag chains and available for temperature ranges up to 2000 °C. In combination with a pressure-tight feedthrough, a stainless steel sheath and T250° bonding, vacuum applications down to 10 <sup>-5</sup> mbar are also possible.					

<sup>1)</sup> Detection range refers to polished stainless steel.

# Standard sensor types for individual configuration

## Optical glass fibers



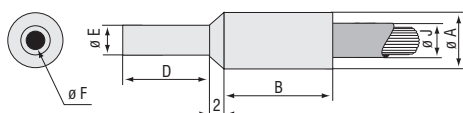
Fiber optics types CFS3 or CFS4

+

Ferrule

The end ferrule gives the fiber optic bundle its defined measurement geometry, e.g., as a point or line. This also enables 90° deflections or defines the mechanical fastening (screw connection, clamping, integrated thread).

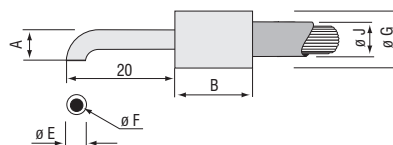
### A Type A ferrule, stainless steel



Ø F	Type	Ø A	B	D	Ø E	P	Ø J M	T
1.5	A10	4.6	8	11	2.5	4	4	–
1.5	A11	6.6	8	11	2.5	–	5	4.4
2.5	A20	6.6	10	12	4.5	6	6	5.8
3	A30	8.5	11	15	6	7	7	7.5

### D Type D ferrule, stainless steel

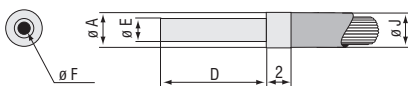
With angular probe heads, a reduction in range can be expected compared to axially emerging versions.



Ø F	Type	Ø A	B	Ø E	Ø G	r	P	Ø J M	T
0.6	D10/90	2.5	10	1	3	1.5	2	–	–
0.6	D11/90	2.5	13	1	6	1.5	–	–	4.4
1.5	D20/90	6	13	2	6	4	5	5	4.4
2.5	D30/90	15	17	5	9	10	7	7	6.5

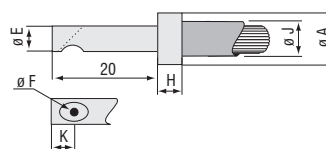
\* D10/90 only suitable for PVC sheath

### B Type B ferrule (only suitable for PVC sheath)



Ø F	Type	Ø A	D	Ø E	Ø J P	Ferrule
0.6	B11	2	30	1	2	Stainless steel
0.6	B12	2	10	1	2	Stainless steel
1	B20	3	10	2	3	Alu
2.5	B30	5	12	4	5	Alu
3	B40	8	12	6	8	Alu

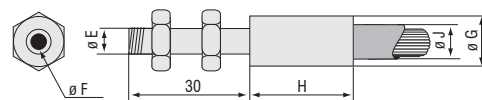
### E Type E ferrule, stainless steel



Ø F	Type	Ø A	Ø E	H	K	P	Ø J M	T
1.5	E10/90	4	3	1.5	4	4	–	–
2.5	E20/90	5	4	1.5	4	5	5	–
2.5	E21/90	7	4	10	4	–	–	5.8
3	E30/90	8	6	1.5	5	7	7	–

\* E10/90 only suitable for PVC sheathing

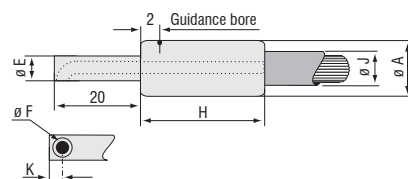
### C Type C ferrule, stainless steel



Ø F	Type	E	Ø G	H	P	Ø J M	T
1.0	C10	M4	6	13	5	5	4.4
2.5	C20	M6	8	15	6	6	5.8
3	C30	M10	11	12	7	7	7.5

### F Type F ferrule, stainless steel

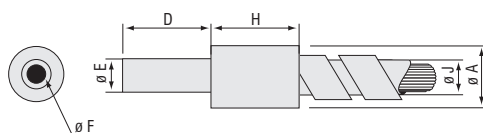
With angular probe heads, a reduction in range can be expected compared to axially emerging versions.



Ø F	Type	Ø A	Ø E	H	K	P	Ø J M	T
1.5	F10/90	8	6	9	3	5	5	5.8
2.5	F20/90	10	8	10	4	6	6	6.5
3	F30/90	12	10	10	5	7	7	7.5



## M Ferrule type M, aluminum / stainless steel

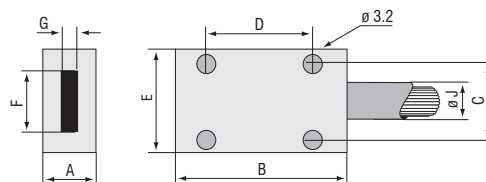


Ø F	Type	Ø A	D	Ø E	H	Ø J	M	T	Ferrule
0.6	M11	6	30	1	10	5	4.4		Stainless steel
0.6	M12	6	10	1	10	5	4.4		Stainless steel
1	M20	6	10	2	10	5	4.4		Alu
2.5	M30	7	12	4	12	6	5.8		Alu
3.5	M40	9	12	6	12	7	7.5		Alu
5	M50	12	16	7	16	9	9		Alu
6	M60	13	16	8	18	10	11.5		Alu
8	M80	16	20	10	20	13	13.5		Alu
10	M100	18	20	12	20	15	-		Alu

Larger fiber cross-sections possible

## Q Type Q, aluminum

Also available in stainless steel



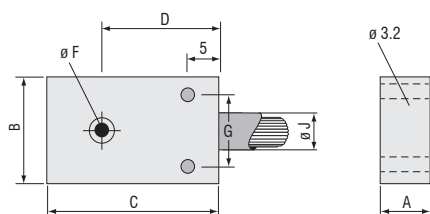
F	G	Type	A	B	C	D	E	Ø J
5	0.5	Q1	12	25	9	15	15	
10	0.3	Q2	12	30	14	20	20	
18	0.3	Q3	12	35	24	25	30	
28	0.2	Q4	12	55	34	40	40	
38	0.15	Q5	12	55	44	40	50	
48	0.15	Q6	12	55	54	40	60	
58	*	Q7	16	75	64	60	70	
68	*	Q8	16	75	74	60	80	
78	*	Q9	20	90	84	75	90	
88	*	Q10	20	90	94	75	100	

FxG max. 9.62 mm²; F=3.5 mm as special variant

Q7 to Q10 only available as FAR special model

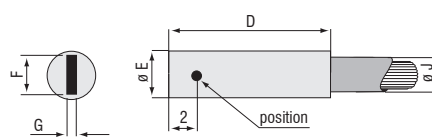
depends on  
fiber cross-section

## N End sleeve type N, aluminum



F	Type	A	B	C	D	G	P	Ø J	M	T
0.6	N10/90	6	15	25	20	9	4	5	4.4	
1.5	N21/90	8	18	25	20	11	5	5	5.8	
2.5	N31/90	12	20	25	20	13	6	6	6.5	

## R Type R ferrule, aluminum

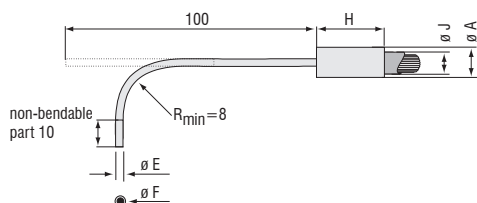


F	G max.	Type	D	Ø E	P	Ø J	M	T
3	0.5	R10*	25	4	3	-	-	-
3	0.5	R11	30	7	6	6	5.8	
6	1	R20	25	7	6	-	-	
6	1	R21	30	10	-	7	7.5	

\* R10 and R20 only suitable for PVC sheath

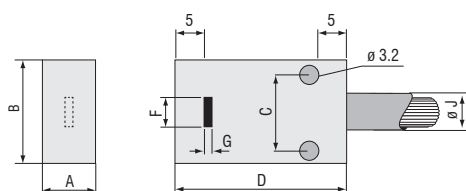
## O Type O ferrule, bendable to a certain extent

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



Ø F	Type	Ø A	Ø E	H	P	Ø J	M	T
0.6	O10	2	1	10	2	-	-	-
0.6	O11	7	1	20	-	5	4.4	
1	O20	3	1.3	10	3	-	-	
1	O21	7	1.3	20	-	5	4.4	

## P Type P ferrule, aluminum



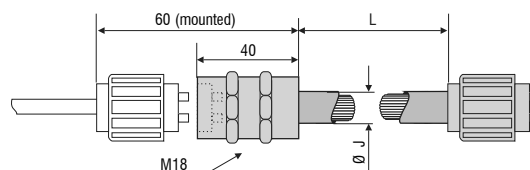
F	G	Type	A	B	C	D	P	Ø J	M	T
3	0.1	P10/90	8	15	9	25	4	5	4.4	
6	0.3	P21/90	8	17	11	30	4	6	6.5	
10	0.5	P31/90	12	17	11	30	6	6	6.5	

## Extensions / feedthrough

For extension or feedthrough of the optical fibers please use the Type LV ferrule.

## LV Type LV ferrule

Fiber optic extension / feedthrough



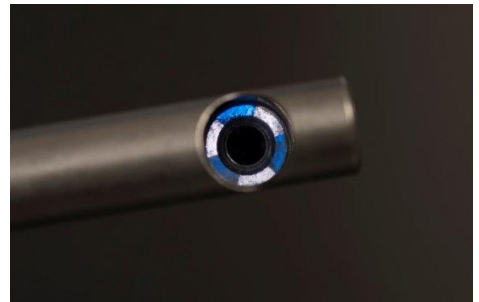
Fiber bundle Ø	P	Ø J	M	T	L
(3 mm) / channel	12	13	13.5	variable	

## Special sensors CFS-SL

A wide variety of applications and installation situations require a sensor that is perfectly matched to the application. On request, we can manufacture individual sensors with special fiber optics and probe heads according to your specifications and dimensions.

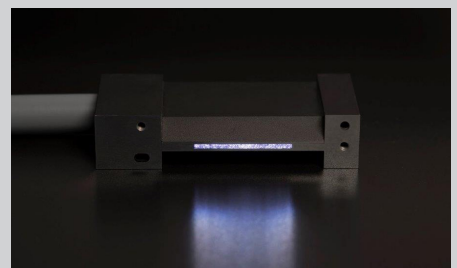
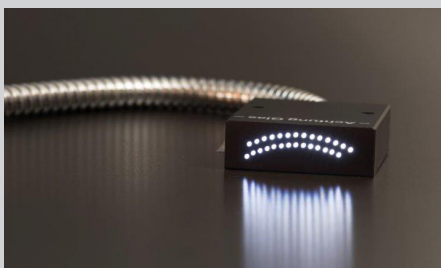
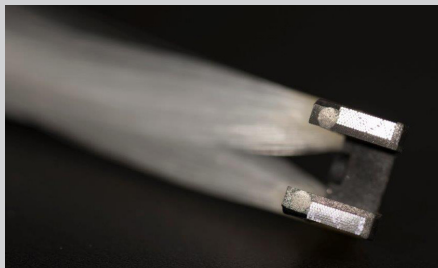
In addition to a wide range of standard sensors, we work directly with our customers to create complex fiber optic components for the respective application.

Whether in conjunction with evaluation electronics, for object illumination or special applications - the full spectrum of possibilities offered by fiber optic technology is demonstrated here.



### Special sensors from standardized applications

In cooperation with our customers, we have manufactured a large number of special sensors in recent years. The following images show examples of these sensors, which are used in special machines for complex measurement tasks. Special sensors can be manufactured in many different materials for any measurement task and for direct installation in your machine, starting from a single unit, as far as this is physically possible.



For marketing purposes and for better illustration, a white light source was used in the images shown here.

# Configuration

## Optical glass fibers

	Function	Ferrule	Sheath	Fiber bundle Ø	Total length	Aperture angle	max. temp. range	Vibration protection	Drag chain suitability
CFS	3	A20	T	2.5	1200	67°	T2000	VS	D

Standard types or customized configuration from pages 10 - 15

Individual configuration from pages 18/19. Information in the sensor designation only if the specification deviates from the specified standard.

Specification of suitability for drag chains  
D=suitable for drag chains

Specification of vibration protection  
VS = Vibration protection

Specification of temperature bonding  
with the maximum possible temperature

Specification of aperture angle  
Not applicable when standard aperture angle is 67°

Length of optical fiber.  
Not applicable for standard length of 1200 mm

Specification of fiber bundle diameter. Only if this deviates from the values listed in the tables.

Specification of sheath based on ambient conditions.  
Not applicable for T-sheath, as it is a standard sheath

Specification of the ferrule.  
Addition "/90" for 90° beam path

Specification of the function: 1 = angle sensor; 2= circular sensor;  
3= transmission sensor; 4= reflex sensor; 5= receiver sensor

## Sheath T

Please determine the sheath and the bonding of the optical fiber based on the prevailing environmental conditions and mechanical stress.  
Please contact us for high-temperature applications or use under extreme mechanical stress.

### Silicone-metal sheath

Metal spiral hose with glass-fiber braiding and silicone rubber sheath <sup>1)</sup>

#### Characteristics:

- Very flexible, ideal for frequent bends
- Highly resistant to folding, tension and torsion;
- Temperature-stable from -60 °C to +180 °C
- Liquid-tight

T



### VA stainless-steel sheath

Flexible stainless steel spiral hose <sup>1)</sup>

#### Characteristics:

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

E



### Metal sheath

Flexible brass spiral hose, chrome-plated <sup>1)</sup>

#### Characteristics:

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

M



### PVC metal sheath

Flexible brass spiral-reinforced hose coated with PVC sheath <sup>1)</sup>

#### 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 <sup>2)</sup>

#### Characteristics:

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

P



### BOA special sheath

Corrugated tube with stainless steel braiding <sup>3)</sup>

#### Characteristics:

- Protection against mechanical stress
- Ideal for drag-chain applications
- Temperature-stable from -50 °C to +600 °C

BOA



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

<sup>2)</sup> Bending radius corresponds to twice the outer diameter of the sheath.

<sup>3)</sup> Bending radius corresponds to at least 80 - 100 mm, depending on the outer diameter of the sheath.

Details about sheath diameters can be found in section 2.

## Fiber bundle 2.5

 Range Transmission mode (typ.)		90 mm	200 mm	500 mm	1700 mm	2000 mm
Min. object size (typ.)		0.05 mm	0.1 mm	0.1 mm	0.2 mm	0.3 mm
 Range Reflex mode (typ.) *	Copper	35 mm	76 mm	217 mm	820 mm	>1200 mm
	Raw aluminum	24 mm	61 mm	164 mm	514 mm	457 mm
	Stainless steel	21 mm	50 mm	135 mm	412 mm	415 mm
	White, rough plastics	13 mm	33 mm	84 mm	260 mm	260 mm
	Mat black cardboard	6 mm	16 mm	44 mm	130 mm	135 mm
Required fiber bundle øF		0.6 mm	1 mm	1.5 mm	2.5 mm	3 mm

\*Analog output 5 V and maximum amplification

Total length **1200**



Standard lengths are: 600\*, 1200\*, 1800 and 2400 mm.

\* Bearing types

For CLS1000-xx also > 2400 mm possible.

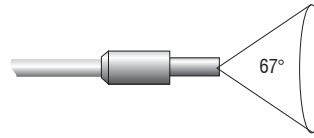
Length tolerance typ.:  $\pm 4\%$

Cable lengths from 200 mm are available on request.

Recommended maximum cable length:

CLS up to max. 10,000 mm

Aperture angle **67°**



The standard aperture angle is 67°.

Other opening angles are also available on request, when physical feasibility is provided.

Maximum temperature range **T2000**

The glass fibers can be bonded in several stages for high temperature ranges. Standard bonding is suitable for temperatures up to 80 °C.

With special adhesives, temperatures of up to 250 °C can be reached in the first stage and up to 400 °C in the second stage. Special versions with temperature ranges up to 2000 °C (temperature at the sensor) are also available.

Vibration protection **VS**

For mechanical stresses such as impacts, accelerations and movements, the fiber optics can be manufactured with increased vibration protection. This special treatment reduces the friction between the fibers and absorbs shocks. The fibers are embedded in a gel cushion.








Suitability for drag chains **D**

For use in machines with moving parts, the internal structure of the fiber optic cables has been modified so that even when the minimum permissible bending radius is reached, the individual fibers are not damaged and error-free operation is achieved.



# Controller

## optoCONTROL CLS1000

-  Large detection and operating ranges
-  Numerous teach-in modes for fast sensor adjustment
-  Detection of the finest structures
-  Extremely high resistance to ambient light up to 50,000 lx
-  LCD display for quick and easy configuration
-  Extremely robust and compact
-  Switchable NPN; PNP; PP



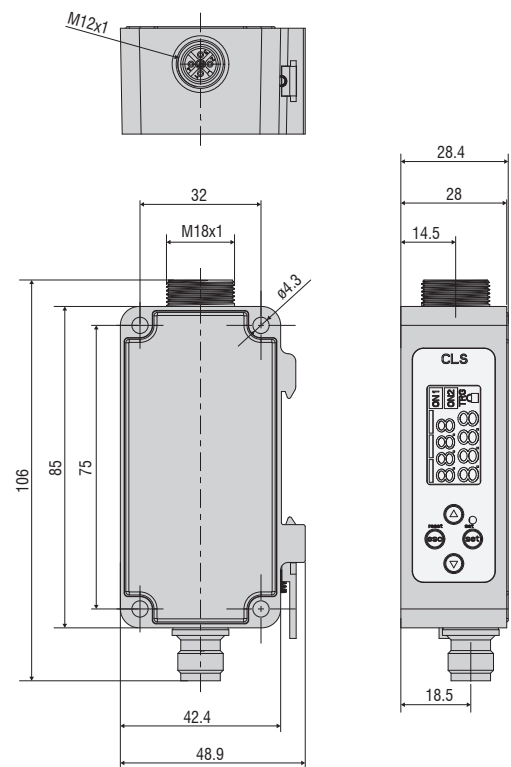
### Reliable presence detection and position control

The fiber optic sensor comprises a CFS sensor and a CLS1000 controller. The wide detection and operating ranges of up to 2000 mm make the fiber optic sensor ideal for the detection of components even at great distances.

The optoCONTROL CLS1000 optoelectronic fiber optic sensor is suitable for use in automation thanks to its variable switching outputs. The fiber optic sensor is used, for example, in position control and for position and presence detection.

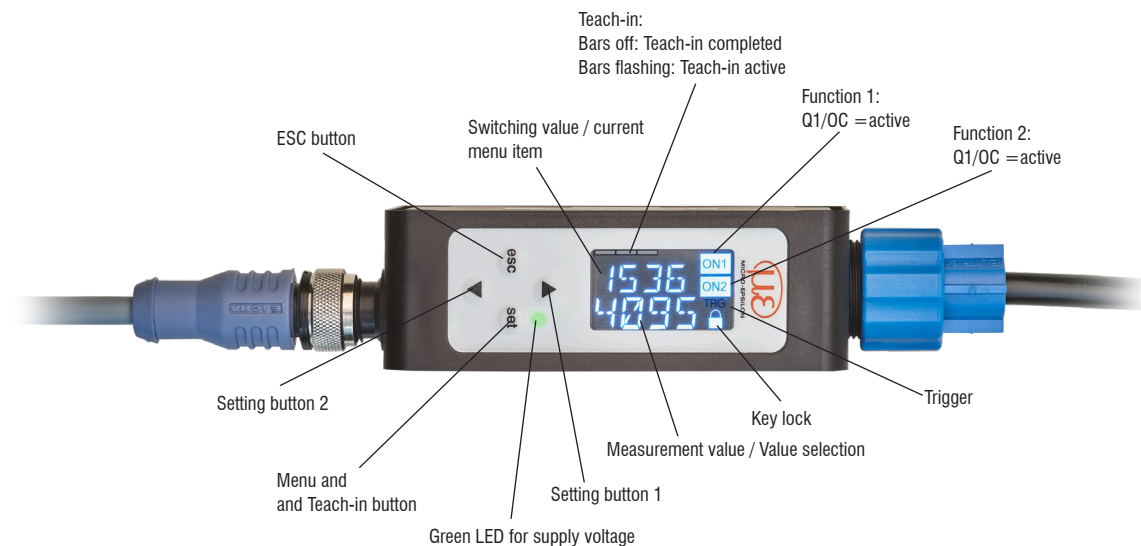
The CLS1000 controller is available in five different versions: CLS1000-QN with antivalence function (normally open/normally closed), CLS1000-2Q with two switching outputs, CLS1000-OC with optocoupler, CLS1000-AU with voltage output and CLS1000-AI with current output. Each model is available in NPN, PNP or push-pull versions, each with or without trigger.

Due to the high resistance to ambient light and the possibility to adapt the controller in OEM applications, the CLS1000 can be used in almost all environments, regardless of high temperatures or confined installation spaces.



(dimensions in mm, not to scale)

## LCD Display / Control Panel



## Controller variants

### Controller with two switching outputs **optoCONTROL CLS1000-2Q**

- Two independently adjustable switching outputs
- Two individual switching thresholds

### Controller with optocoupler **optoCONTROL CLS1000-OC**

- Optocoupler output for potential-free switching
- Galvanic isolation of the output circuitry

### Controller with voltage output **optoCONTROL CLS1000-AU**

- Freely scalable analog output  
Voltage from 0 ... 10 V
- Analog output as intensity output
- Analog output and switching output

### Controller with antivalence function **optoCONTROL CLS1000-QN**

- Two antivalent switching outputs: Q and QN
- Wire breakage protection thanks to antivalent switching output

### Controller with current output **optoCONTROL CLS1000-AI**

- Freely scalable analog output  
Current from 0 ... 20 mA or 4 ... 20 mA
- Analog output as intensity output
- Analog output and switching output



# Controller with antivalence function

## opto**CONTROL** CLS1000-QN

Two antivalent switching outputs  
Q and QN

Switchable NPN; PNP; PP

Safe operation in case of wire breakage  
due to antivalent switching output



Model		CLS1000-QN-NPN	CLS1000-QN-PNP	CLS1000-QN-PP	CLS1000-QN-NPN-T	CLS1000-QN-PNP-T	CLS1000-QN-PP-T
Article number		10085101	10085102	10085103	10085104	10085105	10085106
Operating range		max. 2000 mm (depending on transmission sensor)					
Detection range		max. 1200 mm (depending on reflex sensor)					
Response time		100 μs					
Switching frequency		2.5 kHz (depending on pulse/pause ratio)					
Temperature stability		≤ 0.1 % FSO / K					
Light source		infrared LED 870 nm					
Permissible ambient light		50,000 lx					
Supply voltage <sup>1)</sup>		12 ... 30 VDC					
Max. current consumption		50 mA					
Switching output	switchable NPN; PNP; PP	2x NPN normally open/ normally closed (Q/QN; NO/NC)	2x PNP normally open/ normally closed (Q/QN; NO/NC)	2x PP normally open/ normally closed (Q/QN; NO/NC)	2x NPN normally open/ normally closed (Q/QN; NO/NC)	2x PNP normally open/ normally closed (Q/QN; NO/NC)	2x PP normally open/ normally closed (Q/QN; NO/NC)
Switching type		light/dark switching (switchable)					
Signal input		-			Trigger In		
Connection	Optical	FA socket M18x1 for screwable optical fiber (length 0.3 m ... 15 m, min. bending radius 18 mm)					
	Electrical	4-pin M12 socket for power supply and signals (connection cable see accessories)			5-pin M12 socket for power supply and signals (connection cable see accessories)		
Mounting		DIN rail mounting, mounting adapter, (see accessories), mounting holes					
Temperature range	Storage	-10 ... +70 °C					
	Operation	-5 ... +55 °C					
Shock (DIN EN 60068-2-27)		20 g / 11 ms in 3 axes, two directions and 1000 shocks each					
Vibration (DIN EN 60068-2-6)		15 g / 10 ... 1000 Hz in 3 axes, 10 cycles each					
Protection class (DIN EN 60529)		IP67					
Material		Plastic housing (polycarbonate)					
Weight		200 g					
Compatibility		with all CFS sensors (FAR, FAD, FAZ and FAS)					
Control and indicator elements		Parameterization/operation via membrane keypad and LCD display on controller; LED for power on					
Special features		up to 7 teach-in modes; adjustable switching output functions on-delayed and off-delayed as well as pulse output; adjustable hysteresis 2 ... 25 %			up to 7 teach-in modes; adjustable switching output functions on-delay and off-delay as well as pulse output; adjustable hysteresis 2 ... 25%; variety of trigger types		

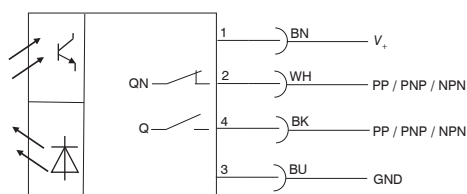
FSO = Full Scale Output

The specified data apply for a consistent room temperature of 22 °C, sensor is continuously in operation, open signal outputs.

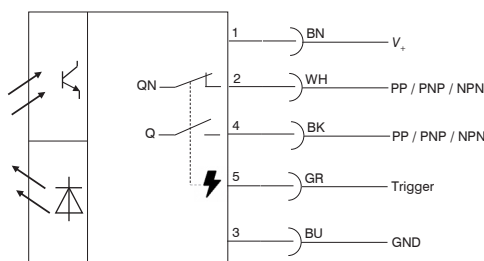
<sup>1)</sup> Residual ripple ≤ 10%

### Connection diagram

CLS1000-QN-xx



CLS1000-QN-xx-T



# Controller with two switching outputs opto**CONTROL** CLS1000-2Q

Two independently adjustable  
switching outputs

Two individual switching thresholds



Model		CLS1000-2Q-NPN	CLS1000-2Q-PNP	CLS1000-2Q-PP	CLS1000-2Q-NPN-T	CLS1000-2Q-PNP-T	CLS1000-2Q-PP-T
Article number		10085107	10085108	10085109	10085110	10085111	10085112
Operating range		max. 2000 mm (depending on transmission sensor)					
Detection range		max. 1200 mm (depending on reflex sensor)					
Response time		100 μs					
Switching frequency		2.5 kHz (depending on pulse/pause ratio)					
Temperature stability		≤ 0.1 % FSO / K					
Light source		infrared LED 870 nm					
Permissible ambient light		50,000 lx					
Supply voltage <sup>1)</sup>		12 ... 30 VDC					
Max. current consumption		50 mA					
Switching output	each switchable NPN; PNP; PP	2x NPN (Q1/Q2)	2x PNP (Q1/Q2)	2x PP (Q1/Q2)	2x NPN (Q1/Q2)	2x PNP (Q1/Q2)	2x PP (Q1/Q2)
Switching type		light/dark switching (switchable)					
Signal input		-			Trigger In		
Connection	Optical	FA socket M18x1 for screwable optical fiber (length 0.3 m ... 15 m, min. bending radius 18 mm)					
	Electrical	4-pin M12 socket for power supply and signals (connection cable see accessories)			5-pin M12 socket for power supply and signals (connection cable see accessories)		
Mounting		DIN rail, mounting rail (see accessories), mounting holes					
Temperature range	Storage	-10 ... +70 °C					
	Operation	-5 ... +55 °C					
Shock (DIN EN 60068-2-27)		20 g / 11 ms in 3 axes, two directions and 1000 shocks each					
Vibration (DIN EN 60068-2-6)		15 g / 10 ... 1000 Hz in 3 axes, 10 cycles each					
Protection class (DIN EN 60529)		IP67					
Material		Plastic housing (polycarbonate)					
Weight		200 g					
Compatibility		with all CFS sensors (FAR, FAD, FAZ and FAS)					
Control and indicator elements		Parameterization/operation via membrane keypad and LCD display on controller; LED for power on					
Special features		up to 7 teach-in modes; adjustable switching output functions on-delayed and off-delayed as well as pulse output; adjustable hysteresis 2 ... 25 %			up to 7 teach-in modes; adjustable switching output functions on-delay and off-delay as well as pulse output; adjustable hysteresis 2 ... 25%; variety of trigger types		

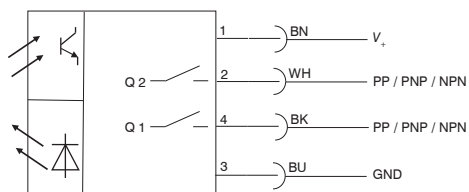
FSO = Full Scale Output

The specified data apply for a consistent room temperature of 22 °C, sensor is continuously in operation, open signal outputs.

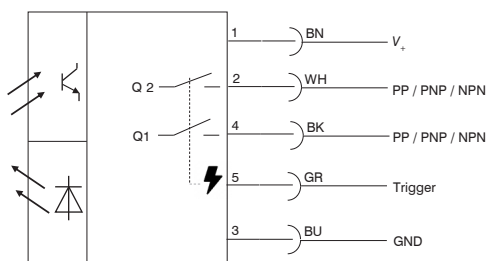
<sup>1)</sup> Residual ripple ≤ 10%

## Connection diagram

CLS1000-2Q-xx



CLS1000-2Q-xx-T



# Controller with optocoupler opto**CONTROL** CLS1000-OC

Optocoupler output for  
potential-free switching

Galvanic isolation of the  
output circuit



Model	CLS1000-OC	CLS1000-OC-T
Article number	10085113	10085114
Operating range	max. 2000 mm (depending on transmission sensor)	
Detection range	max. 1200 mm (depending on reflex sensor)	
Response time	100 µs	
Switching frequency	2.5 kHz (depending on pulse/pause ratio)	
Temperature stability	≤ 0.1 % FSO / K	
Light source	infrared LED 870 nm	
Permissible ambient light	50,000 lx	
Supply voltage <sup>1)</sup>	12 ... 30 VDC	
Max. current consumption	50 mA	
Switching output	Optocoupler (OC)	
Switching type	light/dark switching (switchable)	
Signal input	-	Trigger In
Connection	Optical FA socket M18x1 for screwable optical fiber (length 0.3 m ... 15 m, min. bending radius 18 mm)	Electrical 5-pin M12 socket for power supply and signals (connection cable see accessories)
Mounting	DIN rail, mounting rail (see accessories), mounting holes	
Temperature range	Storage -10 ... +70 °C	Operation -5 ... +55 °C
Shock (DIN EN 60068-2-27)	20 g / 11 ms in 3 axes, two directions and 1000 shocks each	
Vibration (DIN EN 60068-2-6)	15 g / 10 ... 1000 Hz in 3 axes, 10 cycles each	
Protection class (DIN EN 60529)	IP67	
Material	Plastic housing (polycarbonate)	
Weight	200 g	
Compatibility	with all CFS sensors (FAR, FAD, FAZ and FAS)	
Control and indicator elements	Parameterization/operation via membrane keypad and LCD display on controller; LED for power on	
Special features	up to 7 teach-in modes; adjustable switching output functions on-delayed and off-delayed as well as pulse output; adjustable hysteresis 2 ... 25 %	up to 7 teach-in modes; adjustable switching output functions on-delay and off-delay as well as pulse output; adjustable hysteresis 2 ... 25%; variety of trigger types

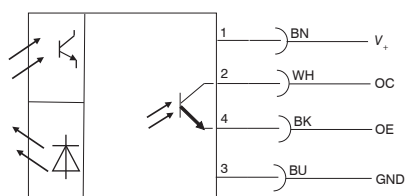
FSO = Full Scale Output

The specified data apply for a consistent room temperature of 22 °C, sensor is continuously in operation, open signal outputs.

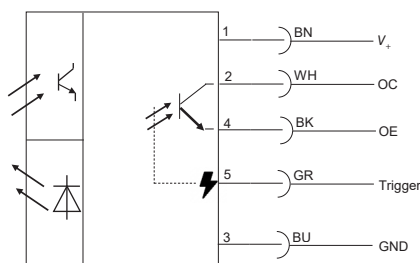
<sup>1)</sup> Residual ripple ≤ 10%

## Connection diagram

CLS1000-OC



CLS1000-OC-T





# Controller with voltage output opto**CONTROL** CLS1000-AU



Freely scalable analog output  
Voltage from 0 ... 10 V

Analog output as intensity output

Analog output and switching output

Model	CLS1000-AU-NPN	CLS1000-AU-PNP	CLS1000-AU-PP	CLS1000-AU-NPN-T	CLS1000-AU-PNP-T	CLS1000-AU-PP-T
Article number	10085115	10085116	10085117	10085118	10085119	10085120
Operating range	max. 2000 mm (depending on transmission sensor)					
Detection range	max. 1200 mm (depending on reflex sensor)					
Response time	100 μs					
Switching frequency	2.5 kHz (depending on pulse/pause ratio)					
Frequency response (-3dB)	10 kHz					
Temperature stability	≤ 0.1 % FSO / K					
Light source	infrared LED 870 nm					
Permissible ambient light	50,000 lx					
Supply voltage <sup>1)</sup>	12 ... 30 VDC					
Max. current consumption	50 mA					
Analog output	0 ... 10 V					
Switching output	NPN	PNP	PP	NPN	PNP	PP
Switching type	light/dark switching (switchable)					
Signal input	-			Trigger In		
Connection	Optical	FA socket M18x1 for screwable optical fiber (length 0.3 m ... 15 m, min. bending radius 18 mm)				
	Electrical	4-pin M12 socket for power supply and signals (connection cable see accessories)		5-pin M12 socket for power supply and signals (connection cable see accessories)		
Mounting	DIN rail, DIN rail mounting (see accessories), mounting holes					
Temperature range	Storage	-10 ... +70 °C				
	Operation	-5 ... +55 °C				
Shock (DIN EN 60068-2-27)	20 g / 11 ms in 3 axes, two directions and 1000 shocks each					
Vibration (DIN EN 60068-2-6)	15 g / 10 ... 1000 Hz in 3 axes, 10 cycles each					
Protection class (DIN EN 60529)	IP67					
Material	Plastic housing (polycarbonate)					
Weight	200 g					
Compatibility	with all CFS sensors (FAR, FAD, FAZ and FAS)					
Control and indicator elements	Parameterization/operation via membrane keypad and LCD display on controller; LED for power on					
Special features	up to 9 teach-in modes; adjustable switching output functions on-delay and off-delay as well as pulse output adjustable hysteresis 2 ... 25%			up to 9 teach-in modes; adjustable switching output functions on-delay and off-delay as well as pulse output adjustable hysteresis 2 ... 25%; variety of trigger types		

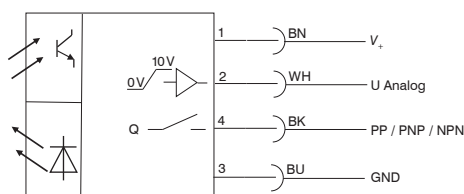
FSO = Full Scale Output

The specified data apply for a consistent room temperature of 22 °C, sensor is continuously in operation, open signal outputs.

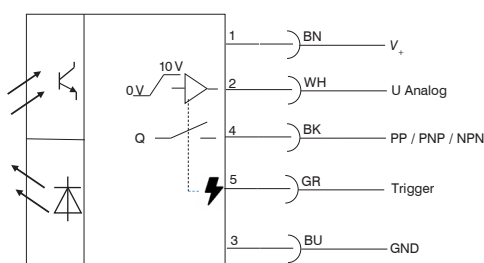
<sup>1)</sup> Residual ripple ≤ 10%

## Connection diagram

CLS1000-AU-xx



CLS1000-AU-xx-T



# Controller with current output opto**CONTROL** CLS1000-AI

Freely scalable analog output current  
from 0 ... 20 or 4 ... 20 mA

Analog output as intensity output

Analog output and switching output



Model	CLS1000-AI-NPN	CLS1000-AI-PNP	CLS1000-AI-PP	CLS1000-AI-NPN-T	CLS1000-AI-PNP-T	CLS1000-AI-PP-T
Article number	10085121	10085122	10085123	10085124	10085125	10085126
Operating range	max. 2000 mm (depending on transmission sensor)					
Detection range	max. 1200 mm (depending on reflex sensor)					
Response time	100 μs					
Switching frequency	2.5 kHz (depending on pulse/pause ratio)					
Frequency response (-3dB)	10 kHz					
Temperature stability	≤ 0.1 % FSO / K					
Light source	infrared LED 870 nm					
Permissible ambient light	50,000 lx					
Supply voltage <sup>1)</sup>	12 ... 30 VDC					
Max. current consumption	50 mA					
Analog output	switchable 0 ... 20 mA or 4 ... 20 mA					
Switching output	NPN	PNP	PP	NPN	PNP	PP
Switching type	light/dark switching (switchable)					
Signal input	-			Trigger In		
Connection	Optical	FA socket M18x1 for screwable optical fiber (length 0.3 m ... 15 m, min. bending radius 18 mm)				
	Electrical	4-pin M12 socket for power supply and signals (connection cable see accessories)			5-pin M12 socket for power supply and signals (connection cable see accessories)	
Mounting	DIN rail, DIN rail mounting (see accessories), mounting holes					
Temperature range	Storage	-10 ... +70 °C				
	Operation	-5 ... +55 °C				
Shock (DIN EN 60068-2-27)	20 g / 11 ms in 3 axes, two directions and 1000 shocks each					
Vibration (DIN EN 60068-2-6)	15 g / 10 ... 1000 Hz in 3 axes, 10 cycles each					
Protection class (DIN EN 60529)	IP67					
Material	Plastic housing (polycarbonate)					
Weight	200 g					
Compatibility	with all CFS sensors (FAR, FAD, FAZ and FAS)					
Control and indicator elements	Parameterization/operation via membrane keypad and LCD display on controller; LED for power on					
Special features	up to 9 teach-in modes; adjustable switching output functions on-delay and off-delay as well as pulse output adjustable hysteresis 2 ... 25%			up to 9 teach-in modes; adjustable switching output functions on-delay and off-delay as well as pulse output adjustable hysteresis 2 ... 25%; variety of trigger types		

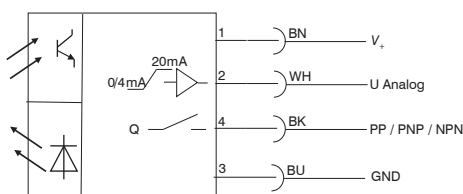
FSO = Full Scale Output

The specified data apply for a consistent room temperature of 22 °C, sensor is continuously in operation, open signal outputs.

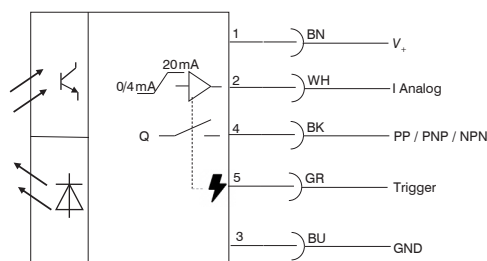
<sup>1)</sup> Residual ripple ≤ 10%

## Connection diagram

CLS1000-AI-xx



CLS1000-AI-xx-T



# Connection options & Accessories

## optoCONTROL CLS1000

CLS1000-AU / CLS1000-AI

CLS1000-OC / CLS1000-2Q / CLS1000-QN

Controller



Connection possibilities and accessories	
<b>Supply voltage connection</b> PS2020 / PS2031	
<b>Interface module for Ethernet connection</b> IF1032/ETH	
<b>Control / machine</b> Analog output (current/voltage) Switching output	

Connection possibilities and accessories	
<b>Supply voltage connection</b> PS2020 / PS2031	
<b>Interface module for Ethernet connection</b> IF1032/ETH	
<b>Control / machine</b> Switching output (antivalent, optocoupler, or two switching outputs)	

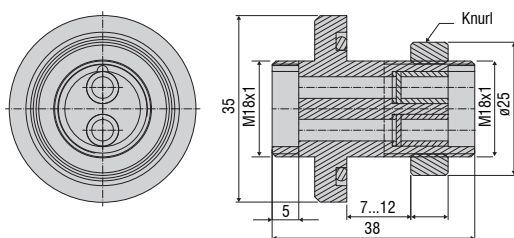
### Connection cables & Accessories

Art. no.	Model	Description
11245302	PC1000-2	Signal / supply cable, 2 m, 4-pin unshielded
11245303	PC1000-5	Signal / supply cable, 5 m, 4-pin unshielded
11245304	PC1000-10	Signal / supply cable, 10 m, 4-pin unshielded
11245551	PC1000-2-T	Signal / supply cable, 2 m, 5-pin unshielded
11245300	PC1000-5-T	Signal / supply cable, 5 m, 5-pin unshielded
11245301	PC1000-10-T	Signal / supply cable, 10 m, 5-pin unshielded
11245305	PC1000/90-2	Signal / supply cable, 2 m, 4-pin unshielded, 90° outlet
11245306	PC1000/90-5	Signal / supply cable, 5 m, 4-pin unshielded, 90° outlet
2420096	PS2031	Power supply unit universal 100 ... 240 V / 24 V / 1 A
2420062	PS2020	PS2020 Power supply 24 V
2420066	IF1032/ETH	Interface module for Ethernet connection

10811916 Pressure-tight feedthrough for vacuum 7-12 mm

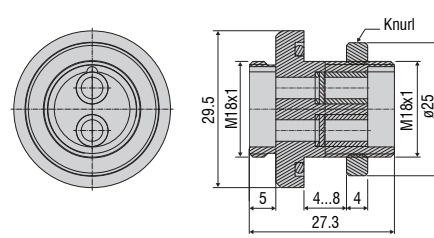
10812254

Pressure-tight feedthrough for vacuum 4-8 mm



Aluminum (anodized black)

Tested up to a pressure difference of 10 bar



Aluminum (anodized black)

Tested up to a pressure difference of 10 bar

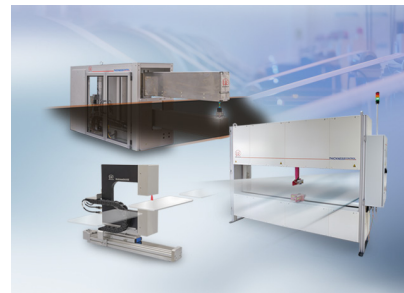
## Sensors and Systems from Micro-Epsilon



Sensors and systems for displacement, distance and position



Sensors and measurement devices for non-contact temperature measurement



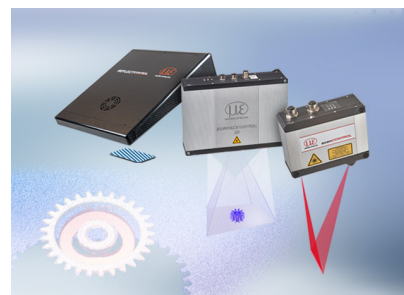
Measuring and inspection systems for metal strips, plastics and rubber



Optical micrometers and fiber optics, measuring and test amplifiers



Color recognition sensors, LED analyzers and inline color spectrometers



3D measurement technology for dimensional testing and surface inspection