MICRO-EPSILON

More Precision

optoCONTROL CLS-K // Fiber optic sensors

The optoCONTROL CLS-K series is an optoelectronic sensor solution where the electronics and the probe heads are coupled via optical fibers and therefore arranged separately. Due to numerous sheathings and probe heads, these optical fibers can be adapted to any application, therefore being flexible in use. Sophisticated, optical glass fibers stand out due to minimal installation dimensions and robust materials and are ideally suitable for harsh ambient conditions and high temperatures.

The optoCONTROL CLS-K series includes a compact transmitter and receiver unit for infrared light with integrated signal evaluation. The light transmission to the object and back is based on high-quality, optical glass fibers according to the principle of total reflection. The received light intensity is used for evaluation.
The optoCONTROL CLS-K electronics offers variable amplification possibilities; the output signal is available for downstream systems as a voltage or current signal. In addition to these, there are versions with electrically isolated optocoupler or relay outputs, displays, as well as a special version that provides temperature compensation and is protected to IP65.

These fiber optic sensors enable a wide variety of applications, from monitoring the presence of and recognizing the position of components in automatic assembly machines, feeding systems, test and inspection applications, through to gap and web-edge detection.

Detection and inspection of small objects

High-speed processes

Integration in industrial environments

CLS-K Controller

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

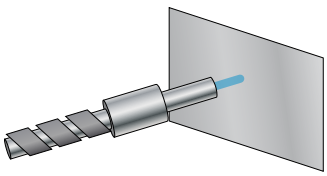
High-quality glass and special fibers for long-life operation

Micro-Epsilon optical fibers 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.

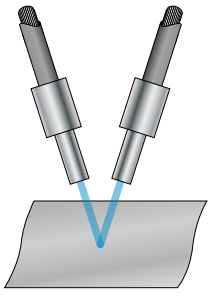
Characteristics

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

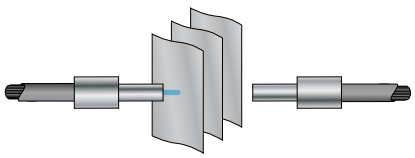
Probe heads for versatile applications



Reflex mode

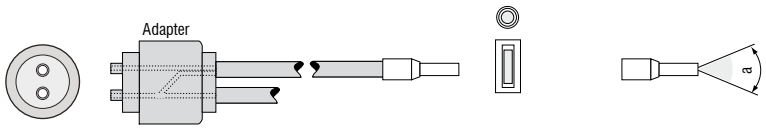


V arrangement in reflex mode



Transmitted light mode

Order code for optical fibers



	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. 1200mm

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

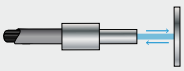
2 Choose sheathing depending on the ambient conditions, e.g. silicone-metal sheath (T)

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

1 Function

(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 optical fiber and the diameter of the glass fiber bundle.

 Range Transmitted light mode (typ.) *1		90mm	200mm	500mm	1700mm	2000mm
Min. object size (typ.)		≤ 0.05mm	≤ 0.1mm	≤ 0.1mm	≤ 0.2mm	≤ 0.3mm
 Range Reflex mode (typ.) *1 *2	polished stainless steel	≤ 11mm	≤ 24mm	≤ 44mm	≤ 150mm	≤ 188mm
	raw aluminum	≤ 8mm	≤ 21mm	≤ 40mm	≤ 139mm	≤ 170mm
	white, rough plastics	≤ 6mm	≤ 10mm	≤ 21mm	≤ 21mm	≤ 80mm
	mat black cardboard	≤ 3mm	≤ 3mm	≤ 6mm	≤ 6mm	≤ 21mm
Required fiber bundle øF		**0.6mm**	**1mm**	**1.5mm**	**2.5mm**	**3mm**

*1: reduced range with 90° angular probe heads
*2: influences during reflex mode: distance, fiber bundle, reflectivity of surface (color, structure, gloss and surface treatment)

! The probe heads to be used depend on the diameter of the fiber bundle.

2 Sheathing

Please determine the sheathing and the bonding of the optical fiber based on the prevailing environmental conditions and mechanical stress. Please contact use 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, ideal for the food industry

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 60°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

On request 

Special models

Optical fibers with increased vibration protection - VS option

Optical fibers 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

Optical fibers 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 optical fibers 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.

3 Probe heads and fiber bundles

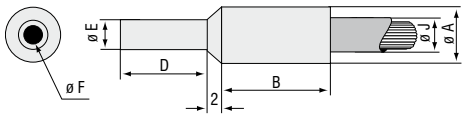
Please choose a probe head type and ensure that the probe head is compatible with the fiber bundle diameter øF (see 1) and the sheath (see 2).

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. ±0.1mm
Alu ferrules, black anodized

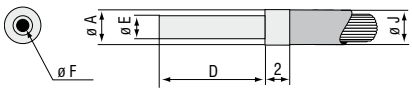
Please contact us if you require other dimensions.

A Type A ferrule, stainless steel



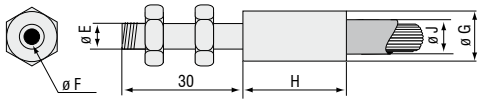
Ø F	Type	Ø A	B	D	Ø E	Ø J P	Ø J M	Ø J T
1.5	A 1.0	4.6	8	11	2.5	4	4	–
1.5	A 1.1	6.6	8	11	2.5	–	5	4.4
2.5	A 2.0	6.6	10	12	4.5	6	6	5.8
3	A 3.0	8.5	11	15	6	7	7	7.5

B Type B ferrule
(only suitable for PVC sheathing)



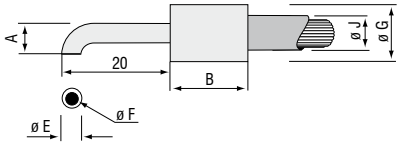
Ø F	Typ	Ø A	D	Ø E	Ø J P	Ferrule
0.6	B 1.1	2	30	1	2	Stainless steel
0.6	B 1.2	2	10	1	2	Stainless steel
1	B 2.0	3	10	2	3	Alu
2.5	B 3.0	5	12	4	5	Alu
3	B 4.0	8	12	6	8	Alu

C Type C ferrule, stainless steel



Ø F	Type	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

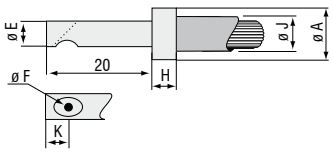
D Type D ferrule, stainless steel
With angular probe heads, a reduction in range can be expected compared to axially emerging versions.



Ø F	Type	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

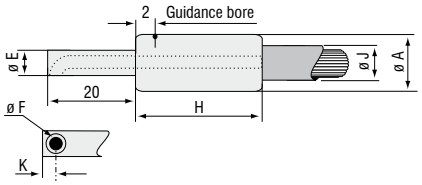
E Type E ferrule, stainless steel
(* E1.0 only suitable for PVC sheathing)



Ø F	Type	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	–

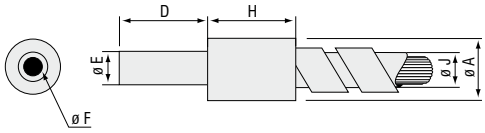
F Type F ferrule, stainless steel

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



Ø F	Type	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

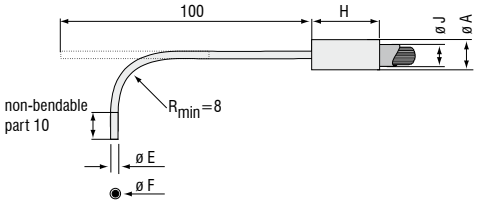


Ø F	Type	Ø A	D	Ø E	H	Ø J M	Ø J T	Ferrule
0.6	M 1.1	6	30	1	10	5	4.4	Stainless steel
0.6	M 1.2	6	10	1	10	5	4.4	Stainless steel
1	M 2.0	6	10	2	10	5	4.4	Alu
2.5	M 3.0	7	12	4	12	6	5.8	Alu
3.5	M 4.0	9	12	6	12	7	7.5	Alu

Larger fiber cross-sections are possible

O Type O ferrule, bendable to a certain extent

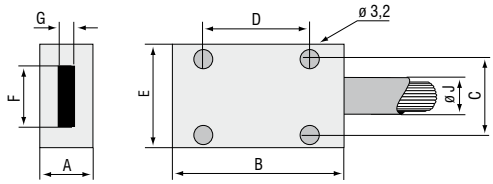
With angular probe heads, a reduction in range can be expected compared to axially emerging versions.



Ø F	Type	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

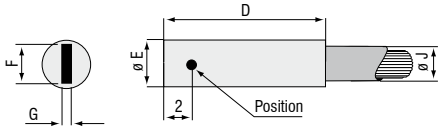


Type	A	B	C	D	E	F	G	Ø J
Q1	12	25	9	15	15	5	0.5	
Q2	12	30	14	20	20	10	0.3	
Q3	12	35	24	25	30	18	0.3	
Q4	12	55	34	40	40	28	0.2	
Q5	12	55	44	40	50	38	0.15	
Q6	12	55	54	40	60	48	0.15	
Q7	16	75	64	60	70	58	*	
Q8	16	75	74	60	80	68	*	
Q9	20	90	84	75	90	78	*	
Q10	20	90	94	75	100	88	*	

depends on fiber cross-section

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

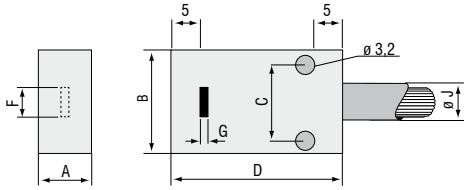
R Type R ferrule, aluminum



Type	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 6x1mm², can be made to a length of 1200

P Type P ferrule, aluminum

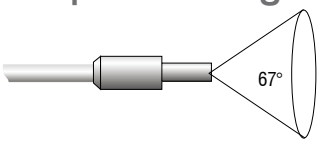


Type	A	B	C	D	F	G	Ø J P	Ø J M	Ø J T
P 1.0	8	15	9	25	3	0.1	4	5	4.4
P 2.1	8	17	11	30	6	0.3	4	6	6.5
P 3.1	12	17	11	30	10	0.5	6	6	6.5

4 Length:

Standard lengths are: 600*, 1200*, 1800 and 2400mm.
*Bearing types
Typ. length tolerance: ±4%
Cable lengths of up to 30m can be supplied on request.

5 Aperture angle



Standard aperture angle 67°

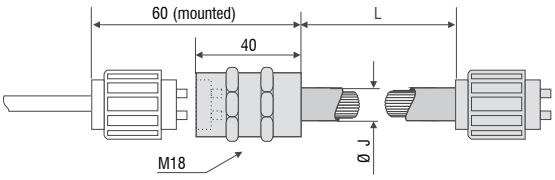
Technical data // Optical fibers		
Length	Standard lengths: 600, 1200, 1800 and 2400mm, up to 30m on request	
Aperture angle	Standard fiber	67° (NA 0.56)[1]
	Special fibers on request	22° (NA 0.21/glass fibers) 80° (NA 0.64/glass fibers) 120° (NA 0.86/glass fibers) 25° (NA 0.22/UV-VIS and VIS-IR quartz fibers) 14° (NA 0.12/UV-VIS and VIS-IR quartz fibers)
Material	Optical glass; quartz glass or sapphire glass on request	
Dielectric strength	50kV/m with PVC protective sheath	
Probe head Temperature range Fiber bonding	Standard	-10°C up to +80°C
	T250	-40°C up to +250°C
	T400	-40°C up to +400°C
	T600 special model	0°C up to +600°C
	T2000 special model	0°C up to +2000°C
Permissible temperature range with sheathing that has appropriate fiber bonding	PVC (Type P / Type Z)	-20°C up to +80°C
	Metal (type M)	-40°C up to +300°C
	Metal with special bonding (Type E)	-40°C up to +400°C
	Metal/silicone (Type T)	-40°C up to +180°C
Fiber transmission	Different types for wavelengths from UV 180nm to IR 3500nm. 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 standard fiber 390 - 1390nm

Extensions / feed-through

For extension or feed-through of the optical fibers please use the Type LV ferrule.

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



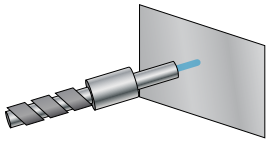
Fiber bundle Ø	P	Ø J M	T	L
(3mm)/ channel	12	13	13.5	variable

Available on request

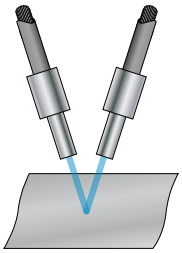
Pressure-proof feed-through
Housing feed-through
Adapter fiber-optic cable FA on FA

Optical fiber functions

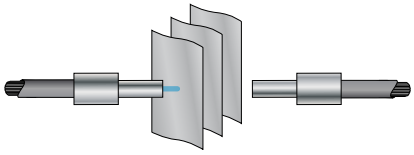
Application instructions on selecting the appropriate function.



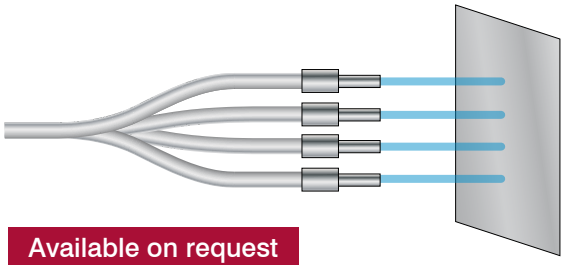
Reflex mode
- Max. measurement distance 180mm
- Easy and fast installation
- Detection of smallest objects from 0.2mm
- Intensity evaluation to determine position, gloss level, gray value, presence
- Ideal for part recognition, counting tasks, presence monitoring



Reflex mode V arrangement
- Max. measurement distance 1000mm (with reflecting surfaces)
- Easy adjustment due to mounting accessories
- Very exact positioning of the switching point
- Objects generate highest intensity on the intersection
- Immune to dust and particles in the beam path



Transmitted light mode
- Large distance between receiving and transmission unit up to 2000mm
- Objects are detected by interruption of light beam
- Arbitrary point of light transmission
- High reproducibility of the object transmission
- Intensity measurement with semi-transparent objects
- Ideal for part recognition, counting tasks, edge detection, presence monitoring



Available on request

Special types for multiple reflex mode
Transmission and receiving fibers are, statistically mixed, guided in two or more separated optical fibers. 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.

KL-xx/xx series

- Focusing of fiber optic sensors

- Improving the efficiency of the application

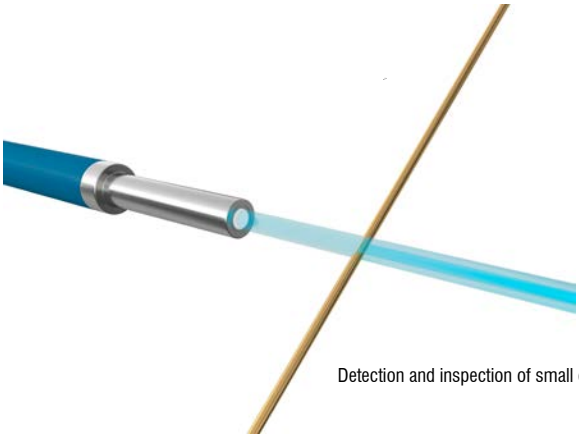
- Many possible applications

Features:

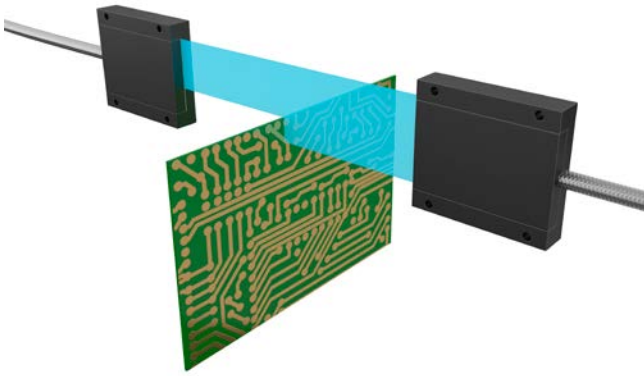
- Working distances from 8mm to 200mm
- Scratch-resistant glass lens
- Robust aluminum housing (black anodized)
- Bundling to a small light spot
- Increasing the range
- Minimum color change when the distance is altered
- High luminous efficiency
- Special designs according to customer requirements
- Recognition of highly absorbent objects

Available on request

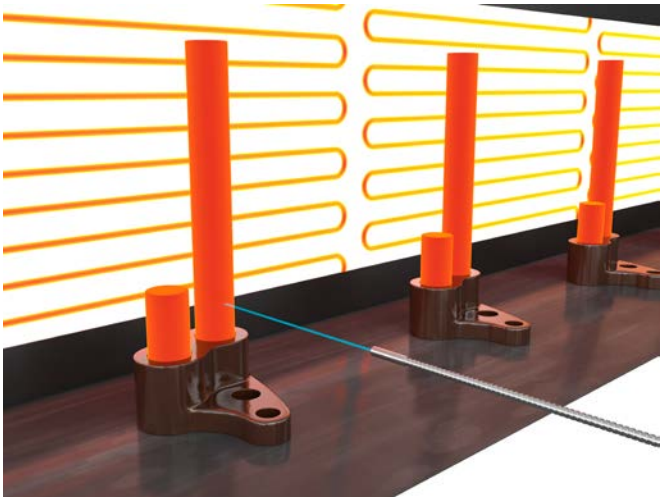
Focus lenses for special applications



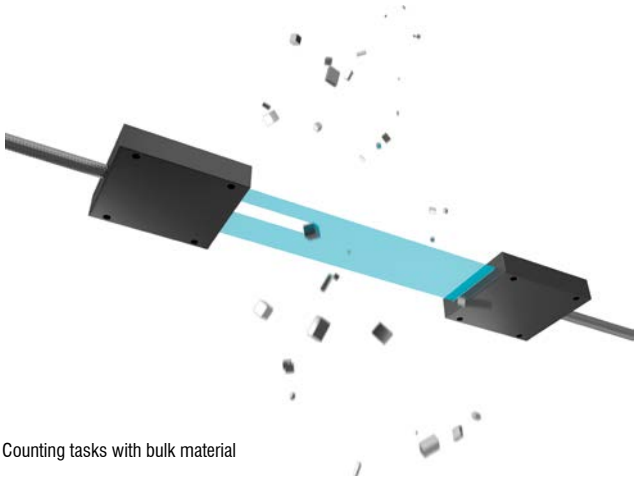
Detection and inspection of small objects



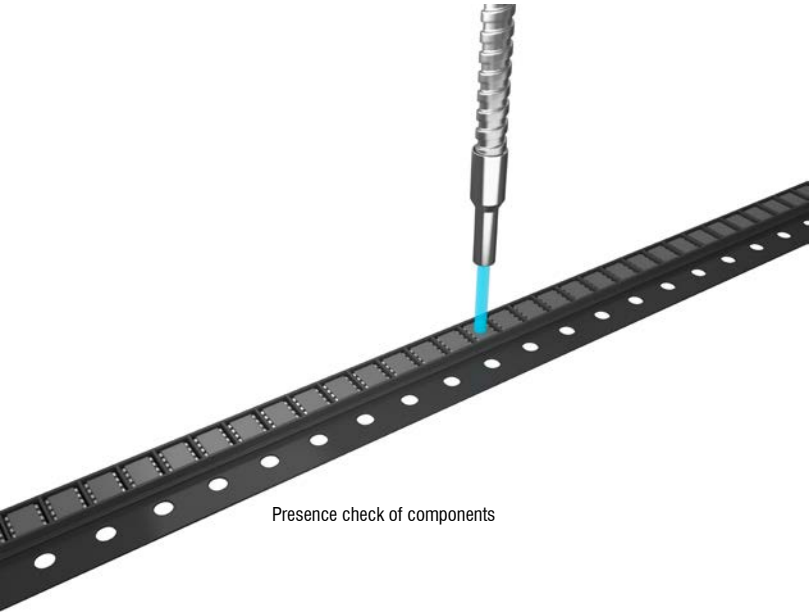
Edge detection of PCBs



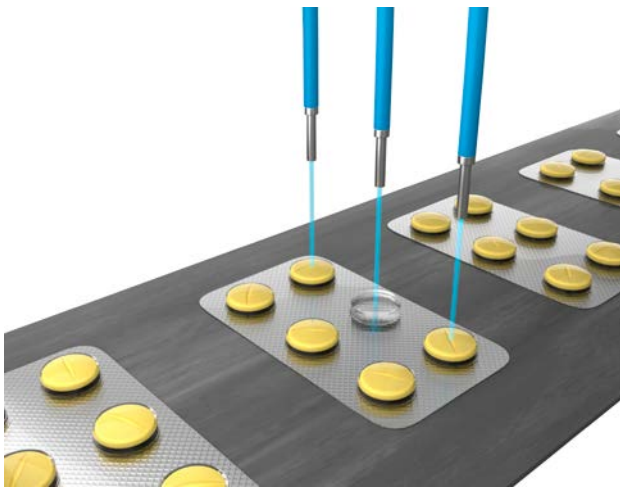
Inspection tasks with high ambient temperatures



Counting tasks with bulk material



Presence check of components



Packaging control of blisters

Features:

- Scanning distance up to 180mm*
- Range of up to 2m*

  * depending on the fiber bundle diameter
- Switching output: NPN, PNP, optocoupler, relay (depending on the version)
- Adjustable drop-out delay 5-100ms (optional)

Applications:

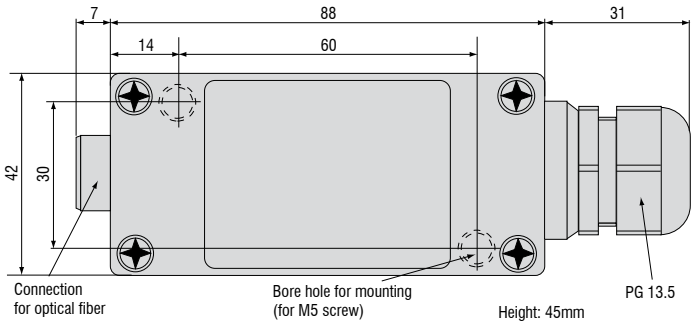
- Test & measurement tasks
- Position recognition of small parts
- Position and assembly monitoring on automatic assembly machines and feeding systems
- Presence monitoring
- Checking length and diameter

Advantages:

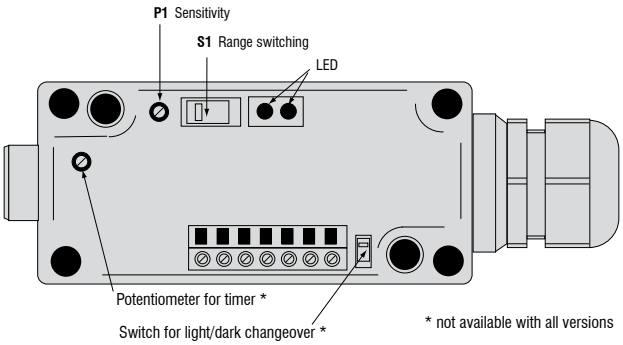
- Precise and reliable object detection
- Low drift due to transmission monitoring, making it particularly suitable for measuring tasks
- High switching frequency and short response time
- Sensor monitoring via analog signal
- Stable long-term behavior by monitoring and regulating the emission of the transmitter diode

Type CLS-K	10	11	20	30	31	40	50	51
Order No.	10010023	10010024	10040025	10040027	10020028	10040029	10040030	10040031
Operating voltage VDC	10-30	10-30	24	10-30	10-30	24	10-30	10-30
Residual ripple	≤10%							
Current consumption	~ 50mA							
Switching delay	≤ 500ms							
Response time	≤ 120µs							
Temperature drift	≤ (-)0.5% /K							
Reproducibility	≤ 1% with $\Delta\vartheta$ = 2K							
Switching state	LED display red and green							
Operating mode	light and dark switch output		switchable light/dark switching					
Sensitivity	adjustable via 10-level potentiometer P1							
Range switching	1:100 (Short range : Long range)							
Hysteresis	4 % of the measuring range							
Protection class	IP65 (with mounted optical fiber)							
Operating temperature	0°C to +50°C							
Storage temperature	-25°C to +70°C							
Housing material	Makrolon® 8035/UL94V1, transparent cover, black lower part							
Weight, Dimensions	approx. 215g/135g, 125x42x45mm							
Switching output (*short-circuit protected)	Transistor* 2x NPN O.C.		Relays 1x changeover contact	Optocoupler*	PNP*	Relays 1x changeover contact	Optocoupler*	PNP*
Switching voltage	30VDC		0.01-250VAC 0.01-220VDC	30VDC	30VDC	0.01-250VAC 0.01-220VDC	30VDC	30VDC
Switching current	5-100mA		50µA-2 A	5-100mA	5-100mA	50µA-2 A	5-100mA	5-100mA
Switching power			5 µW-60W 125VA			5 µW-60W 125VA		
Max. switching frequency	4kHz		60Hz	4kHz	4kHz	60Hz	4kHz	4kHz
Saturation voltage	≤ 2.0V			≤ 2.0V	≤ 2.0V		≤ 2.0V	≤ 2.0V
Pulse stretching 5-100ms	adjustable with potentiometer P2							
Analog output	0.1-5 VDC, output resistance 1kOhm							
Type of connection	2m cable	screw clamps 1.5mm²			connector	screw clamps 1.5mm²		

Dimensions in mm, not to scale

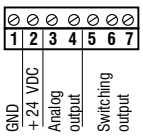


Control and display interface



Connections:

Terminal block



Output:
CLS-K-11: NPN O.C.
CLS-K-20/40: Relay
CLS-K-30/50: Optocoupler O.C./O.E
CLS-K-31/51: PNP
All light/dark switches versions

Connection cable

brown — GND
pink — +24 VDC
green — Analog output +
yellow — Analog GND output
grey — NPN-Switching output *1
white — NPN-Switching output *2

Output:
CLS-K-10: NPN O.C.

*1 dark switching
*2 light switching

Features:

- Scanning distance up to 180mm*
- Range up to 2m*

  * depending on the fiber bundle diameter
- Supply 12-30VDC
- NPN switching output
- Stable long-term behavior by monitoring and regulating the emission of the transmitter diode

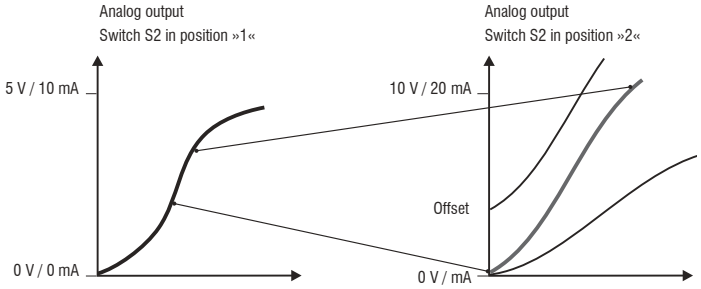
Applications:

- Test & measurement tasks
- Checking length and diameter
- Production monitoring via analog output and display
- Assembly control
- Indirect displacement measurement via optical fiber with cross-section converter

Advantages:

- Low drift by transmission monitoring
- Fast response time
- Sensor monitoring via analog signal

Scaling of analog output

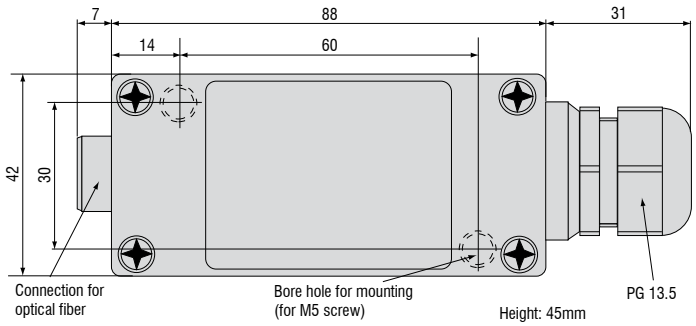


The CLS-K-61/63 amplifier offers the possibility to scale the important signal range over the entire analog range. This enables to increase the sensitivity in a certain range, e.g. for the detection of small objects.

Type CLS-K	60	61	63	65
Order No.	10030032	10030033	10040035	10040036
Supply	12-30VDC			
Residual ripple	≤10%			
Current consumption	~ 70mA			
Switching delay	≤ 500ms			
Switching frequency	≤ 4kHz			
Response time	≤ 120µs			
Temperature drift	≤ (-)0.5% /K			
Reproducibility	≤ 1% with Δϑ = 2K			
Hysteresis	4% of the measuring range value			
Analog Output	0-20mA	0-10VDC	0-20mA	4-20mA
Voltage output	load ≤ 600Ω			
Switching output	transistor 2x NPN O.C.			
Switching voltage	30VDC			
Switching current	5-100mA			
Sensitivity	adjustable via 10-level potentiometer P1			
Range switching	1:100 (Short range : Long range)			
Switching state	LED-display red/green			
Operating mode	light/dark switching output			
Protection class	IP65 (with optical fiber)			
Power supply and output	transient-protection polarity and short-circuit protection			
Operating temperature	0 to 50°C			
Storage temperature	-25°C to 70°C			
Type of connection	screw connectors	2m cable	screw connectors	screw connectors
Display	no	yes	no	no
Housing material	Makrolon® 8035 / UL94V1			
Weight	approx. 215g / 135g			

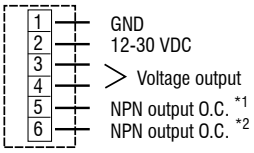
Dimensions:

Dimensions in mm, not to scale

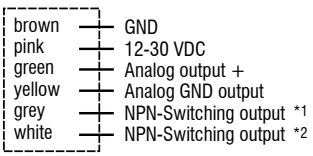


Connections:

CLS-K-60/63/65



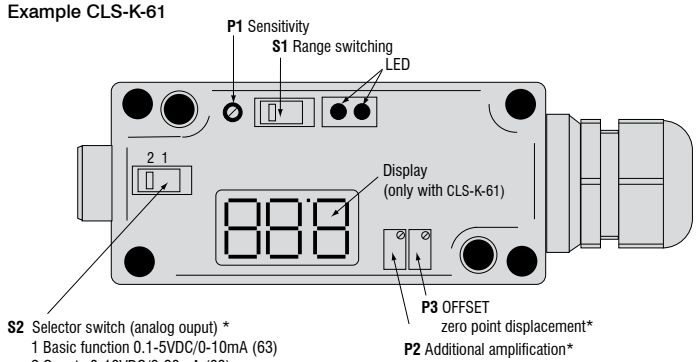
CLS-K-61



*1 dark switching
*2 light switching

Control and display interface:

Example CLS-K-61



* Not available with version CLS-K-60/65

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Sensors and systems for displacement and position

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Optical micrometers, fiber optic sensors and fiber optics

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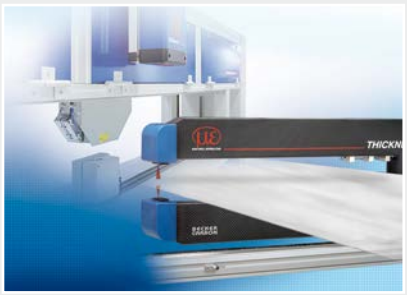

Measurement and inspection systems

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