

LWL Series

▶ Optical Fibers Attachment Optics

Optical fibers offer solutions for difficult tasks in optoelectronics. They can be used universally and allow flexible applications.

- Highest quality
- Selection from different fiber types
- Thermal stability
- Great variety of available standard sensor heads
- Special designs



Characteristics

Light-conducting glass fibers are optical components that allow the transmission of light through any curved path based on the principle of total reflection.

The individual fiber is composed of high-break core glass and low-break cladding glass. The light beams entering the core glass within the critical angle are guided through the fiber by way of reflection at the core/cladding contact surfaces (step index fiber).

The highly flexible optical fibers are made of bundled individual glass fibers. The ends are each glued into a sensor head and a connector. The faces are optically polished. For protection against mechanical, chemical, or thermal destruction the optical fibers are provided with a corresponding protective sheath.



Order Information

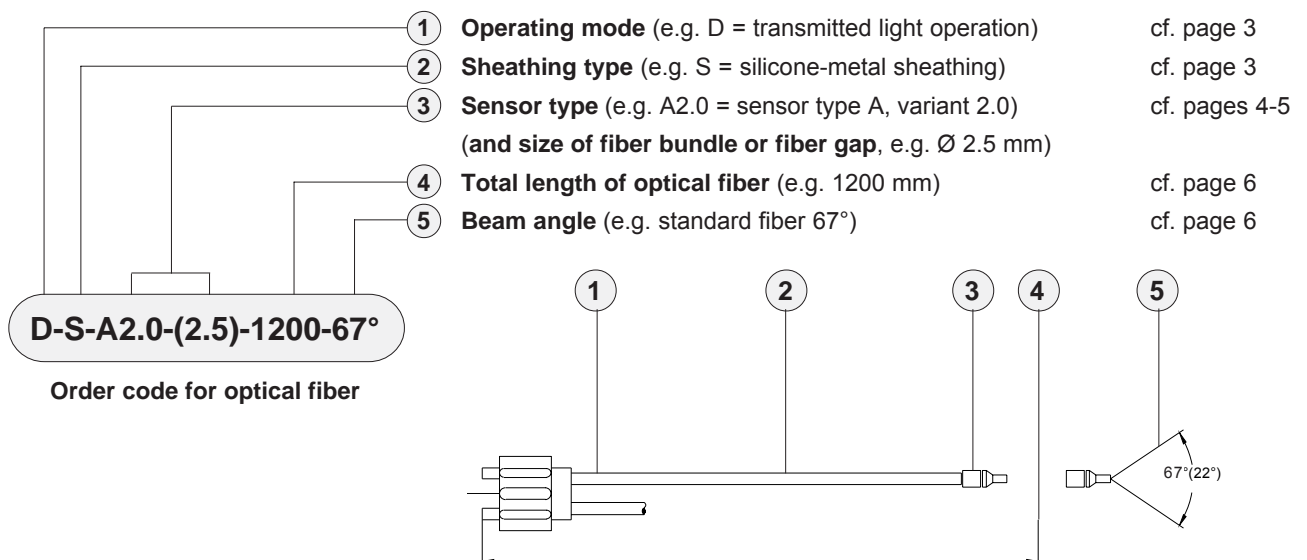
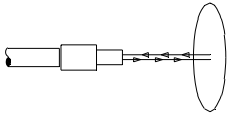

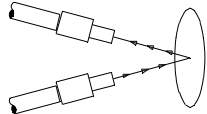








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Operating Mode

Reflected light operation (R)	Transmitted light operation (D)	
		
<p>Transmitter and receiver fibers are contained in one fiber optic cable. The light comes from the transmitter fibers, is reflected at the object to be measured, and reaches the evaluation amplifier through the receiver fibers.</p>	<p>Transmitter and receiver fibers are separated and arranged opposite each other. The received quantity of light, which is evaluated by the amplifier, changes in accordance with the degree of covering of the light beam.</p>	<p>Transmitter and receiver fibers are arranged at a certain angle. The light is reflected at the object to be measured and reaches the evaluation amplifier through the receiver fibers. <u>Advantage:</u> Gloss and reflection on surfaces can be suppressed.</p>

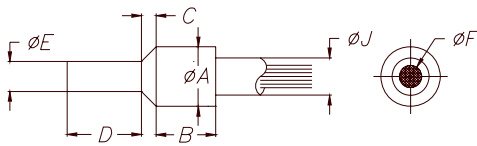
Sheathing

<p>PVC special sheathing (P)</p>	<p>Silicone-metal sheathing (S)</p>
	
<p>Highly-flexible plastic sheathing. The bending radius is equal to twice the outside diameter of the sheathing.</p> <p><u>Advantages:</u></p> <ul style="list-style-type: none"> - Highly flexible - Small diameter - Thermally stable from -20°C to +80°C - Low-priced 	<p>Metal spiral tube with glass-filament braiding and silicone-rubber sheathing. The bending radius is equal to three times the outside diameter of the sheathing.</p> <p><u>Advantages:</u></p> <ul style="list-style-type: none"> - Highly flexible - High resistance to kinking - High tensile and torsional strength - Thermally stable from -40°C to +180°C - Liquid-tight
<p>Metal sheathing (M)</p>	<p>Special steel sheathing (E)</p>
	
<p>Flexible brass spiral tube, chromium-plated. The bending radius is equal to three times the outside diameter of the sheathing.</p> <p><u>Advantages:</u></p> <ul style="list-style-type: none"> - Flexible - Mechanical protection - Thermally stable from +40°C to +180°C 	<p>Flexible special steel spiral tube. The bending radius is equal to three times the outside diameter of the sheathing.</p> <p><u>Advantages:</u></p> <ul style="list-style-type: none"> - Flexible - Mechanical protection - Thermally stable from -40°C to +400°C



Sensor Types

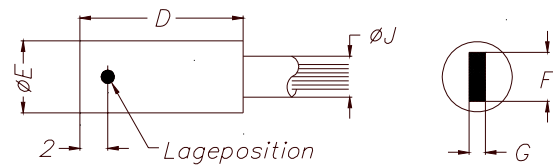
Sensor type A (end sleeve: special steel)



Type	A	B	C	D	E	F	ØJ		
	Ø				Ø	Ø	P	M	S
A1.0	4,6	8	2	11	2,5	1,5	4	-	-
A1.1	6,6	8	2	11	2,5	1,5	-	5	4,4
A2.0	6,6	10	2	12	4,5	2,5	6	6	5,8
A3.0	8,5	11	2	15	6,0	3,0	7	7	7,5

A1.0-end sleeve suitable for PVC sheath only

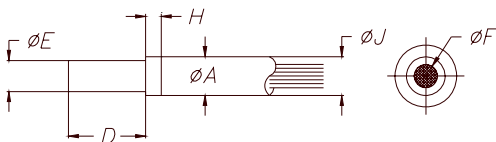
Sensor type R (end sleeve: aluminium)



Type	D	E	F	G	ØJ		
		Ø		max.	P	M	S
R1.0	25	4	3	0,5	3	-	-
R1.1	30	7	3	0,5	6	6	5,8
R2.0	25	7	6	1,0	6	-	-
R2.1	30	10	6	1,0	-	7	7,5

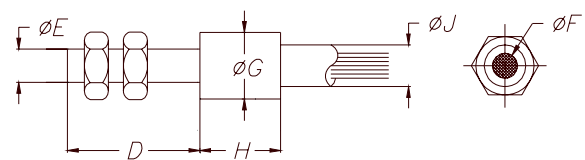
R1.0- and R2.0-end sleeve suitable for PVC sheath only

Sensor type B (suitable for PVC sheath only)



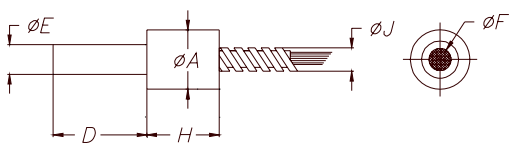
Type	A	D	E	F	H	ØJ	end sleeve
	Ø		Ø	Ø		P	
B1.1	2	30	1	0,6	2	2	special steel
B1.2	2	10	1	0,6	2	2	special steel
B2.0	3	10	2	1,0	2	3	aluminum
B3.0	5	12	4	2,5	2	5	aluminum
B4.0	8	12	6	3,0	2	8	aluminum

Sensor type C (end sleeve: special steel)



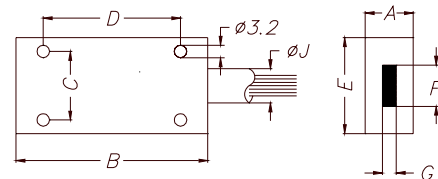
Type	D	E	F	G	H	ØJ		
			Ø	Ø		P	M	S
C1.0	30	M4	1,0	6	13	5	5	4,4
C2.0	30	M6	2,5	8	15	6	6	5,8
C3.0	30	M10	3,0	11	12	7	7	7,5

Sensor type M (end sleeve: special steel or alu)



Type	A	D	E	F	H	ØJ		end sleeve
	Ø		Ø	Ø		M	S	
M1.1	6	30	1	0,6	10	5	4,4	special steel
M1.2	6	10	1	0,6	10	5	4,4	special steel
M2.0	6	10	2	1,0	10	5	4,4	aluminum
M3.0	7	12	4	2,5	12	6	5,8	aluminum
M4.0	9	12	6	3,5	12	7	7,5	aluminum
M5.0	12	16	7	5,0	16	9	9,0	aluminum
M6.0	13	16	8	6,0	18	10	11,5	aluminum
M8.0	16	20	10	8,0	20	13	13,5	aluminum
M10.0	18	20	12	10,0	20	15	-	aluminum

Sensor type Q (end sleeve: aluminium)



Type	A	B	C	D	E	F	G	ØJ
	Q1	12	25	9	15	15	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	50	48	0,15	

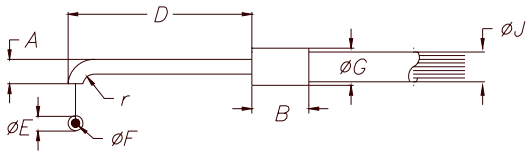
depends on fiber cross-section





Sensor Types

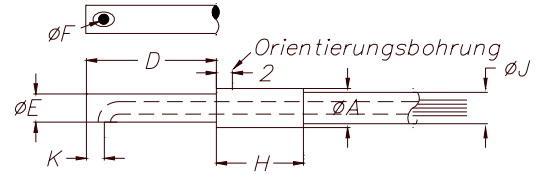
Sensor type D (end sleeve: special steel)



Typ	A	B	D	E	F	G	r	ØJ		
	Ø			Ø	Ø	Ø		P	M	S
D1.0	2,5	10	20	1	0,6	3	1,5	2	-	-
D1.1	2,5	13	20	1	0,6	6	1,5	-	-	4,4
D2.0	6	13	20	2	1,5	6	4	5	5	4,4
D3.0	15	17	20	5	2,5	9	10	7	7	6,5

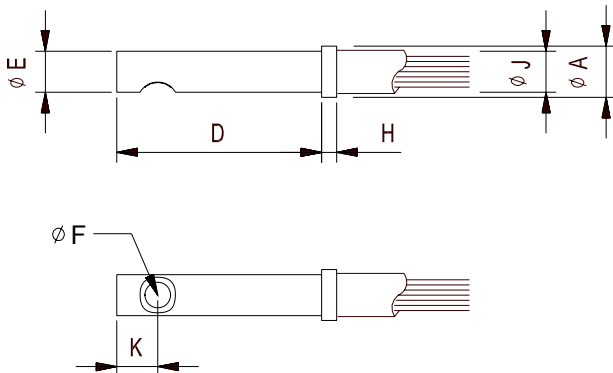
D1.0-end sleeve suitable for PVC sheath only

Sensor type F (end sleeve: special steel)



Type	A	D	E	F	H	K	ØJ		
	Ø		Ø	Ø			P	M	S
F1.0	8	20	6	1,5	9	3	5	5	5,8
F2.0	10	20	8	2,5	10	4	6	6	6,5
F3.0	12	20	10	3	10	5	7	7	7,5

Sensor type E (end sleeve: special steel)



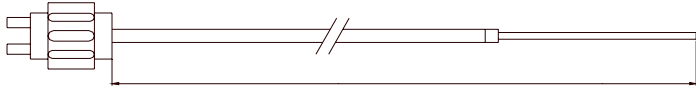
Typ	A	D	E	F	H	K	ØJ		
	Ø		Ø	Ø			P	M	S
E1.0	4	20	3	1,5	1,5	4	4	-	-
E2.0	5	20	4	2,5	1,5	4	5	5	-
E2.1	7	20	4	2,5	10	4	-	-	5,8
E3.0	8	20	6	3	1,5	5	7	7	-

E1.0-end sleeve suitable for PVC sheath only



Standard Lengths

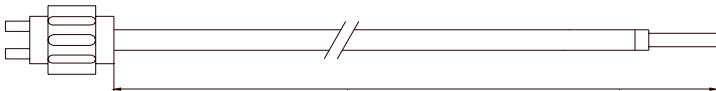
Available standard lengths are **600 mm or 1200 mm** ((special cable lengths are also available), length tolerance +2%)



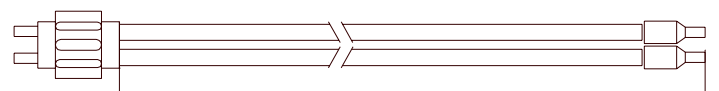
Total length l = 600 mm or 1200 mm



Total length l = 600 mm or 1200 mm



Total length l = 600 mm or 1200 mm

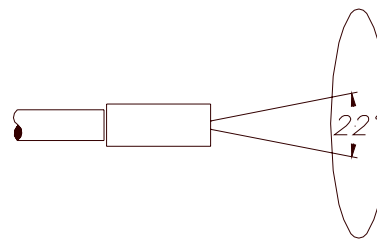
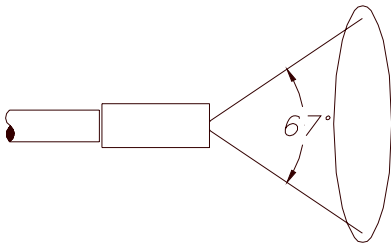


Total length l = 600 mm or 1200 mm

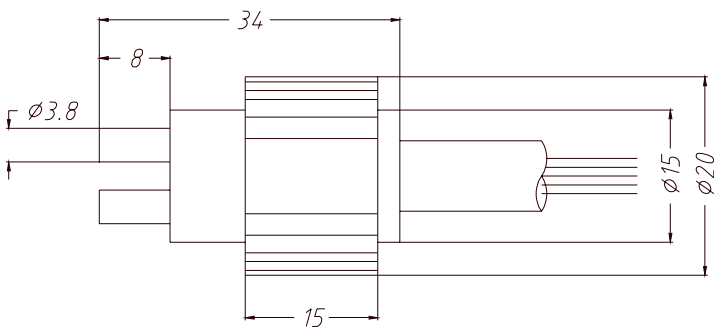


Beam Angle

Depending on the glass-fiber material used, the following beam angles are available in the standard product range: 67° or 22°



Dimensions of Adaptor



Dimensions are given in mm



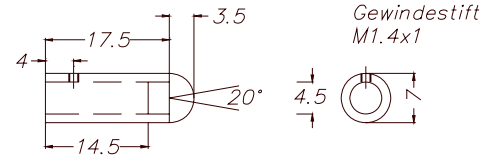
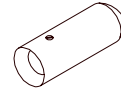
KL-1

Focus lens KL-1

Suitable for optical fibers with transmitted light operation:
D-S-A2.0-(2.5)-...-67° or D-S-A2.0-(2.5)-...-22°

Characteristics:

- Focusing onto a small light spot
- Enlargement of range
- Better illumination
- Scratch-resistant optics made of glass
- Sturdy aluminum housing, anodized in black



All dimensions in mm



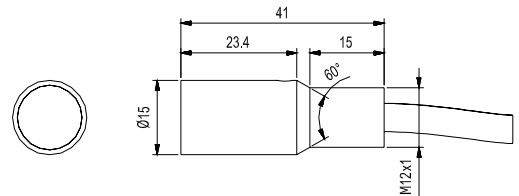
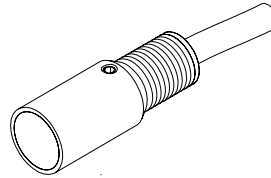
KL-2

Focus lens KL-2

Suitable for optical fibers with transmitted light operation:
D-S-A2.0-(2.5)-...-67° or D-S-A2.0-(2.5)-...-22°

Characteristics:

- Focusing onto a small light spot
- Increase of range
- Better illumination
- Scratch-resistant optics made of glass
- Sturdy aluminum housing, anodized in black



All dimensions in mm



KL-3

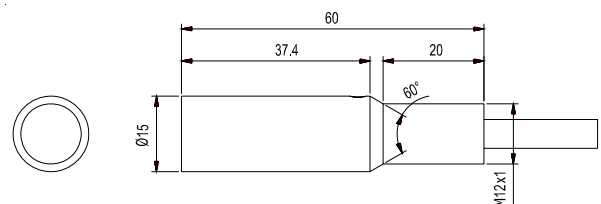
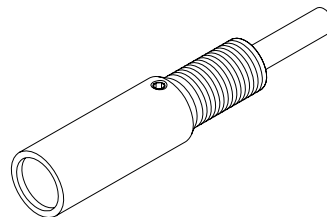
Focus lens KL-3

Suitable for optical fibers with reflected light operation:
R-S-A2.0-(2.5)-...-67° or R-S-A2.0-(2.5)-...-22°

Suitable for optical fibers with transmitted light operation:
D-S-A2.0-(2.5)-...-67° or D-S-A2.0-(2.5)-...-22°

Characteristics:

- Focusing onto a small light spot
(spot diameter at 10 mm distance: typ. 1 mm)
- Working range typ. 10 mm ... 20 mm
- Color measurement at small objects in relatively big distance
- Scratch-resistant optics made of glass
- Sturdy aluminum housing, anodized in black



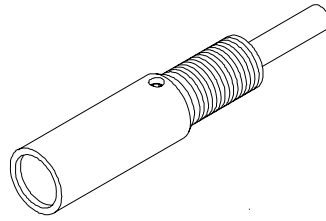
All dimensions in mm



KL-4

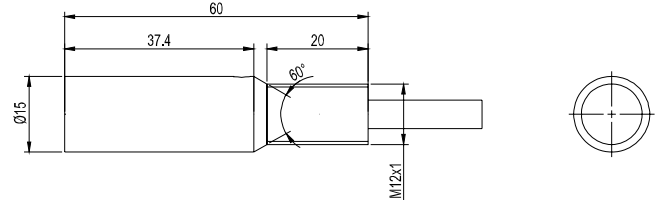
Focus lens KL-4

Suitable for optical fibers
with reflected light operation:
R-S-A1.1-(1.5)-...-67° or
R-S-A1.1-(1.5)-...-22°



Characteristics:

- Focusing onto a small light spot
(spot diameter at 10 mm distance: typ. 0.5 mm)
- Working range typ. 10 mm ... 15 mm
- Color measurement at small objects in relatively big distance
- Scratch-resistant optics made of glass
- Sturdy aluminum housing, anodized in black



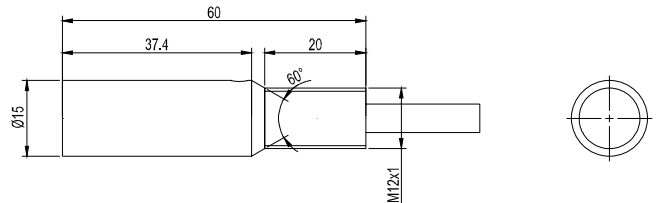
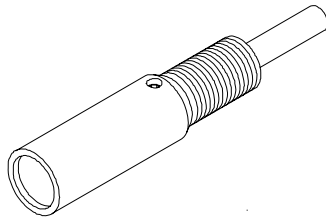
All dimensions in mm



KL-5

Focus lens KL-5

Suitable for optical fibers
with reflected light operation:
R-S-R1.1-(3x0.5)-1200-67° or
R-S-R1.1-(3x0.5)-1200-22°



All dimensions in mm



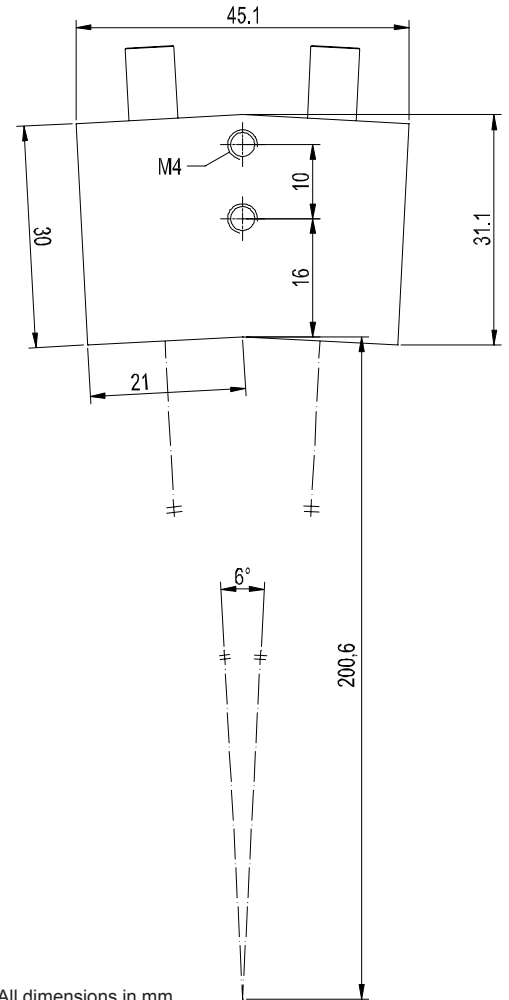
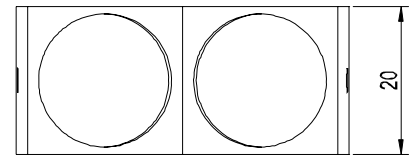
KL-6

Reflex optics KL-6

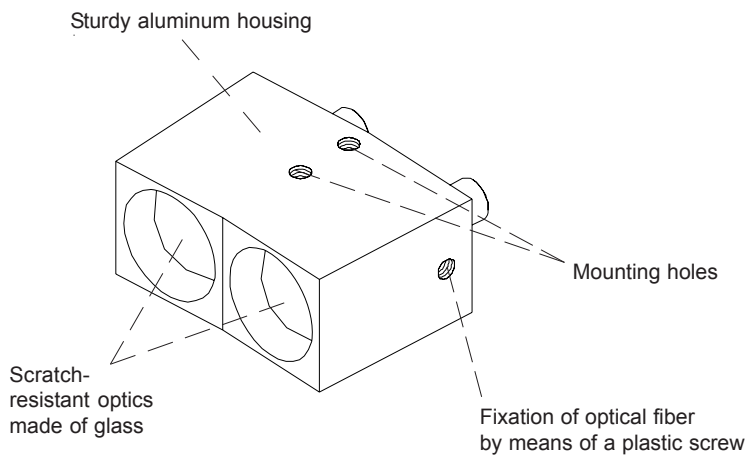
**Suitable for optical fibers with transmitted light operation:
D-S-A2.0-(2.5)-...-67°**

Characteristics:

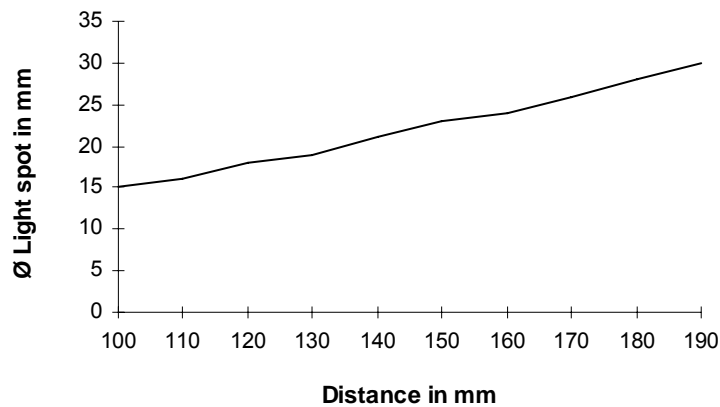
- Also suitable for detection of highly absorbing objects (e.g. black varnished parts) by using color sensor of type SI-COLO2-LWL-HAMP or SI-COLO3-LWL-SP-HAMP
- Big working distance (typ. 200 mm)
- Working range ty. 100 mm ... 250 mm
- Minimal color change when changing the distance
- Can be focused
- Scratch-resistant optics made of glass
- Sturdy aluminum housing



All dimensions in mm



KL-6 with D-S-A2.0-(2.5)-1600-67°



KL-6 with D-S-A2.0-(2.5)-1200-67°:

Distance (mm)	Ø Light spot (mm)
100	15
110	16
120	18
130	19
140	21
150	23
160	24
170	26
180	28
190	30
200	31
210	33
220	34
230	36



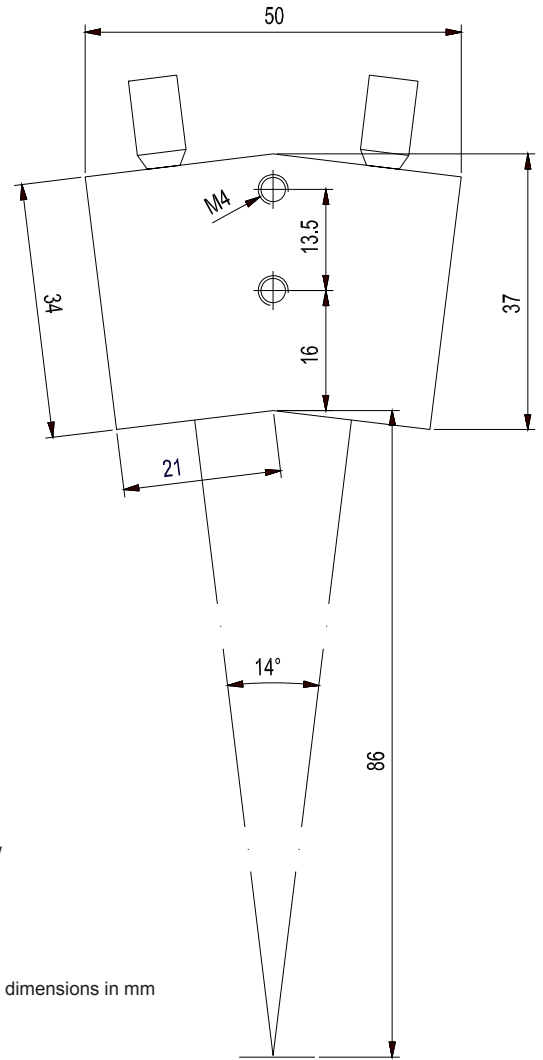
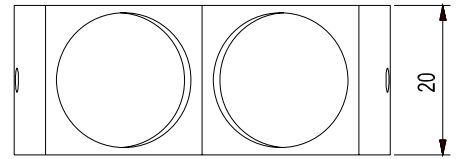
KL-14

Reflex optics KL-14

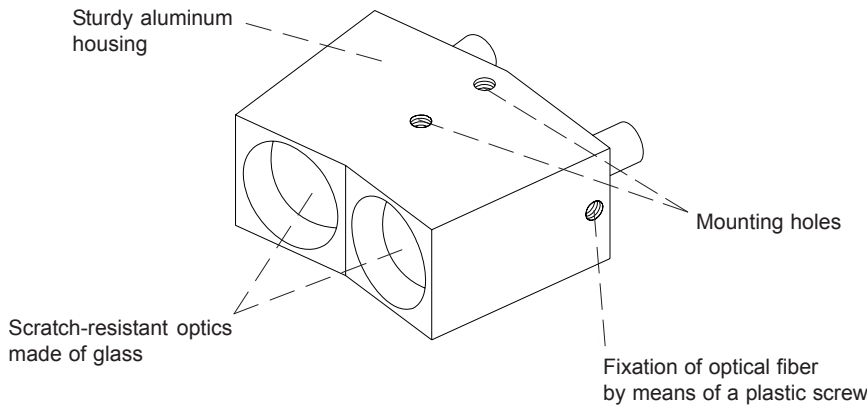
Suitable for optical fiber (transmitted light operation) of type D-S-A2.0-(2.5)-...-67°

Characteristics:

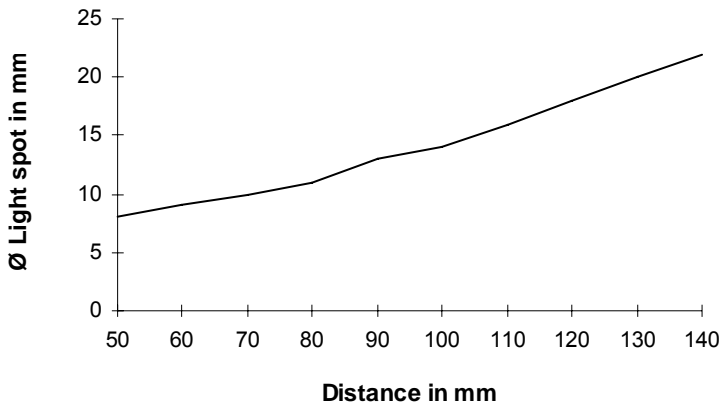
- Also suitable for detection of highly absorbing objects (e.g. black varnished parts) by using color sensor of type SI-COLO2-LWL-HAMP or SI-COLO3-LWL-SP-HAMP
- Big working distance (typ. 80 mm)
- Working range ty. 60 mm ... 120 mm
- Minimal color change when changing the distance
- Can be focused
- Scratch-resistant optics made of glass
- Sturdy aluminum housing



All dimensions in mm



KL-14 with D-S-A2.0-(2.5)-1600-67°



KL-14 mit D-S-A2.0-(2.5)-1200-67°:

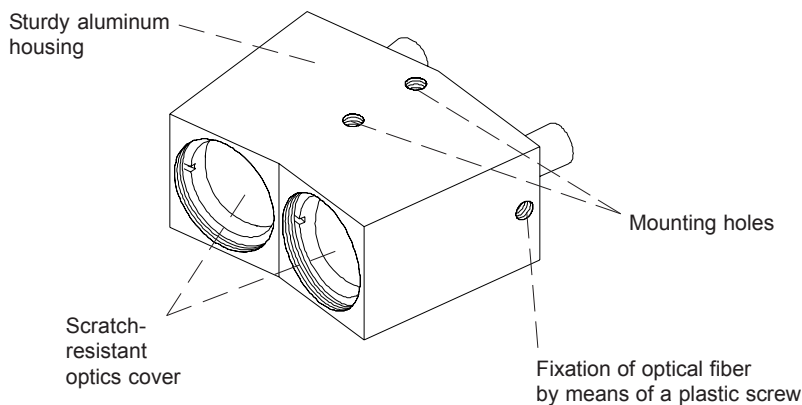
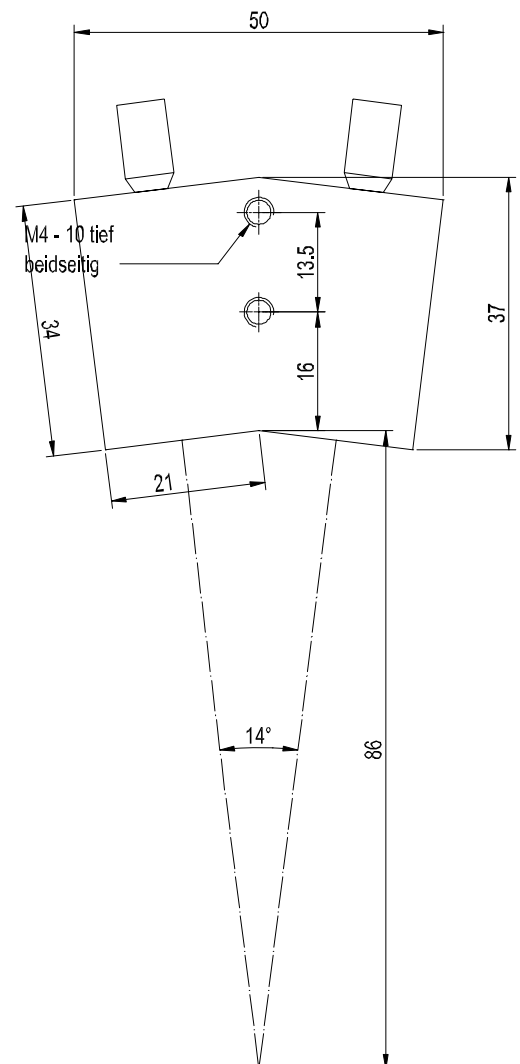
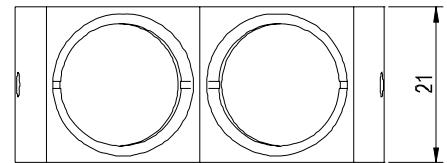
Distance (mm)	Ø Light spot (mm)	Intensity INT (digits)
50	8	62
60	9	99
70	10	171
80	11	200
90	13	190
100	14	146
110	16	115
120	18	90
130	20	72
140	22	60


KL-14-T400
Reflex optics KL-14-T400

High temperature stable
Suitable for optical fiber (transmitted light operation) of type
D-S-A2.0-(2.5)-1200-67°-T400

Characteristics:

- Also suitable for detection of highly absorbing objects (e.g. black varnished parts) by using color sensor of type SI-COLO2-LWL-HAMP or SI-COLO3-LWL-SP-HAMP
- Big working distance (typ. 80 mm)
- Working range ty. 60 mm ... 120 mm
- Minimal color change when changing the distance
- Can be focused
- Scratch-resistant optics made of glass
- Sturdy aluminum housing
- Temperature stable up to 400°C



All dimensions in mm



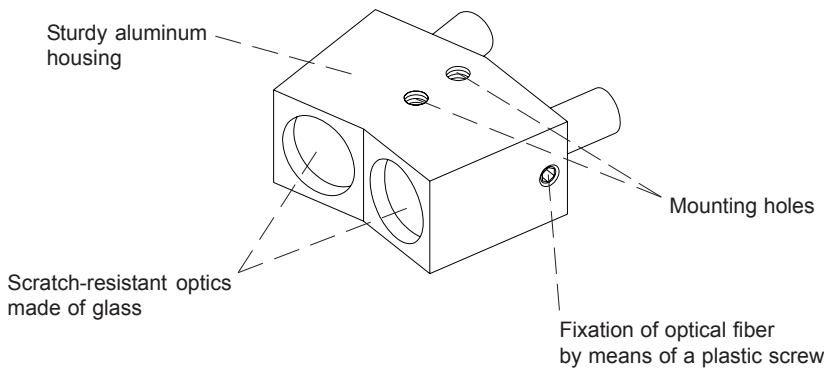
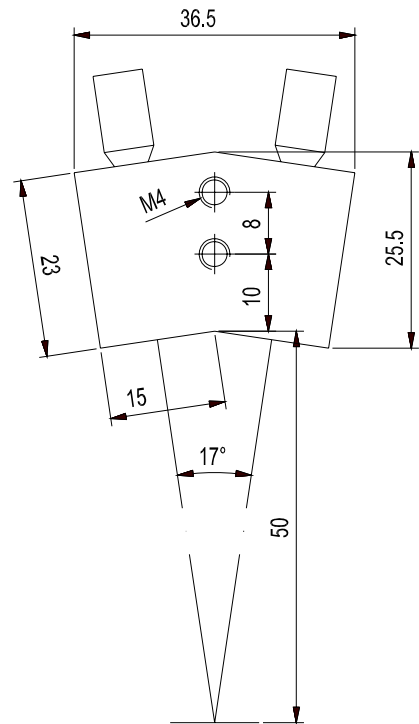
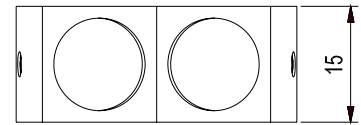
KL-17

Reflex optics KL-17

Suitable for optical fiber (transmitted light operation) of type D-S-A2.0-(2.5)-...-67°

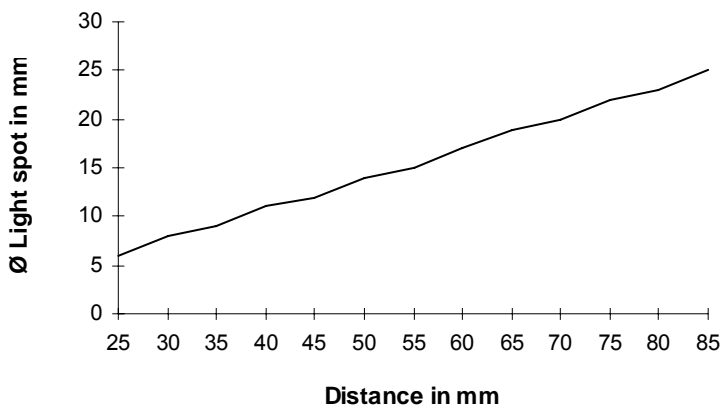
Characteristics:

- Also suitable for detection of highly absorbing objects (e.g. black varnished parts) by using color sensor of type SI-COLO2-LWL-HAMP or SI-COLO3-LWL-SP-HAMP
- Big working distance (typ. 50 mm)
- Working range typ. 30 mm ... 80 mm
- Minimal color change when changing the distance
- Can be focused
- Scratch-resistant optics made of glass
- Sturdy aluminum housing



All dimensions in mm

KL-17 with D-S-A2.0-(2.5)-1600-67°



KL-17 with D-S-A2.0-(2.5)-1200-67°:

Distance (mm)	Ø Light spot (mm)	Intensity INT (digits)
25	6	50
30	8	100
35	9	160
40	11	198
45	12	210
50	14	202
55	15	173
60	17	158
65	19	133
70	20	112
75	22	90
80	23	79
85	25	72



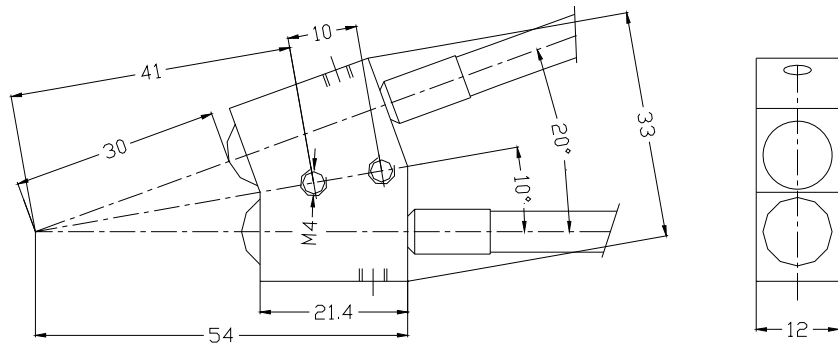
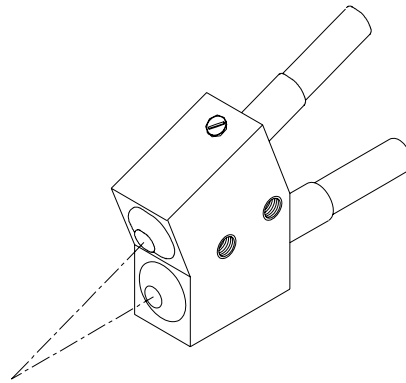
KL-20

Reflex optics KL-20

Suitable for optical fiber (transmitted light operation) of type D-S-A2.0-(2.5)-...-67°

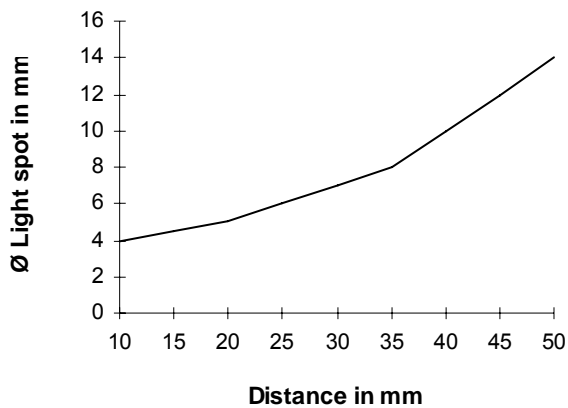
Characteristics:

- Big working distance
- Working range typ. 20 mm ... 40 mm
- Minimal color change when changing the distance
- Can be focused
- Scratch-resistant optics made of glass
- Sturdy aluminum housing



All dimensions in mm

KL-20 with D-S-A2.0-(2.5)-1600-67°



KL-20 with D-S-A2.0-(2.5)-1200-67°:

Distance (mm)	Ø Light spot (mm)	Intensity INT (digits)
10	4	8
20	5	74
25	6	140
30	7	133
35	8	92
40	10	53
45	12	32
50	14	18



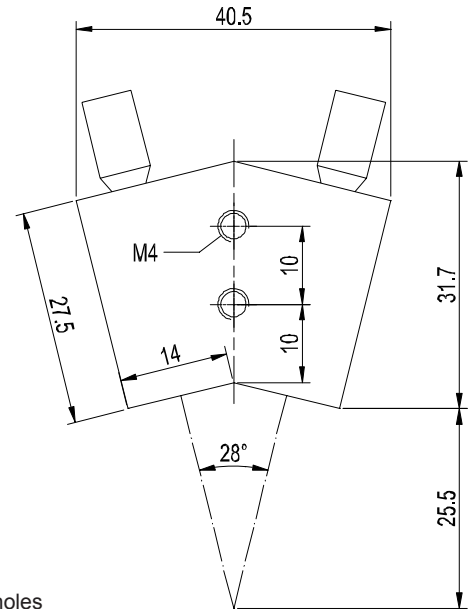
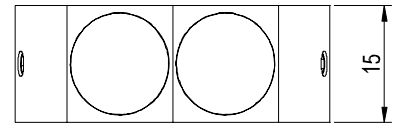
KL-28

Reflex optics KL-28

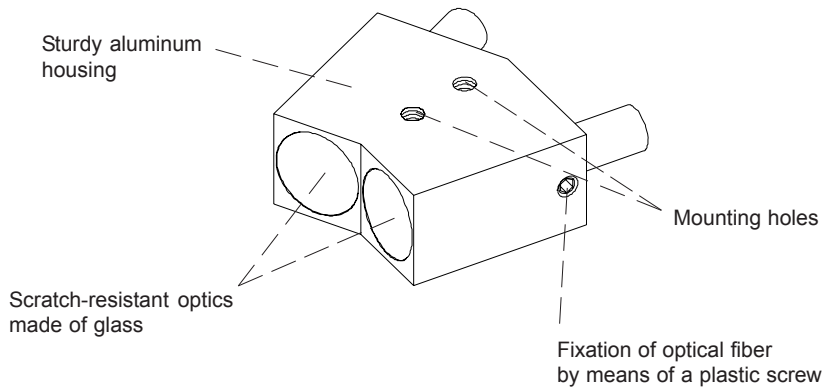
Suitable for optical fiber (transmitted light operation) of type D-S-A2.0-(2.5)-...-67°

Characteristics:

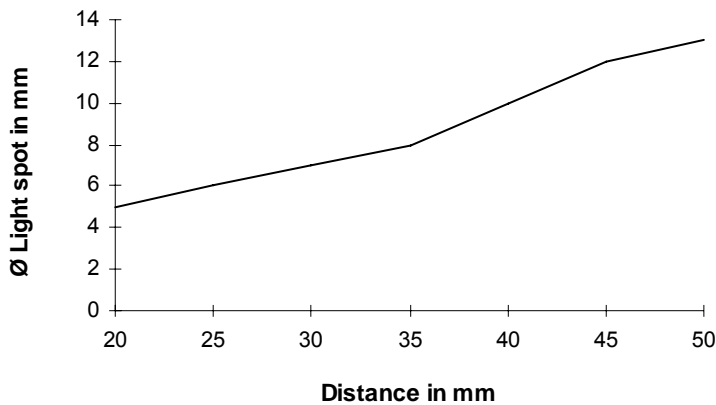
- Also suitable for detection of highly absorbing objects (e.g. black varnished parts) by using color sensor of type SI-COLO2-LWL-HAMP or SI-COLO3-LWL-SP-HAMP
- Working distance typ. 25 mm
- Working range typ. 20 mm ... 30 mm
- Minimal color change when changing the distance
- Can be focused
- Scratch-resistant optics made of glass
- Sturdy aluminum housing



All dimensions in mm



KL-28 with D-S-A2.0-(2.5)-1600-67°



KL-28 with D-S-A2.0-(2.5)-1200-67°:

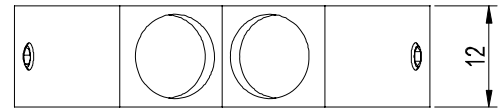
Distance (mm)	Ø Light spot (mm)
20	5
25	6
30	7
35	8
40	10
45	12
50	13



KL-40

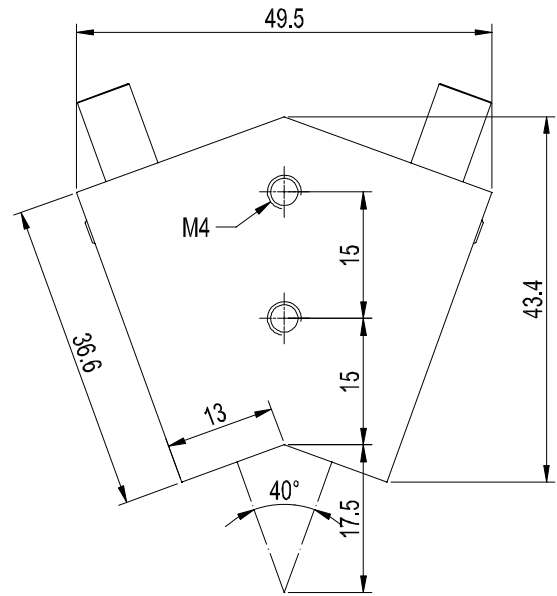
Reflex optics KL-40

Suitable for optical fiber (transmitted light operation) of type D-S-A2.0-(2.5)-...-67°

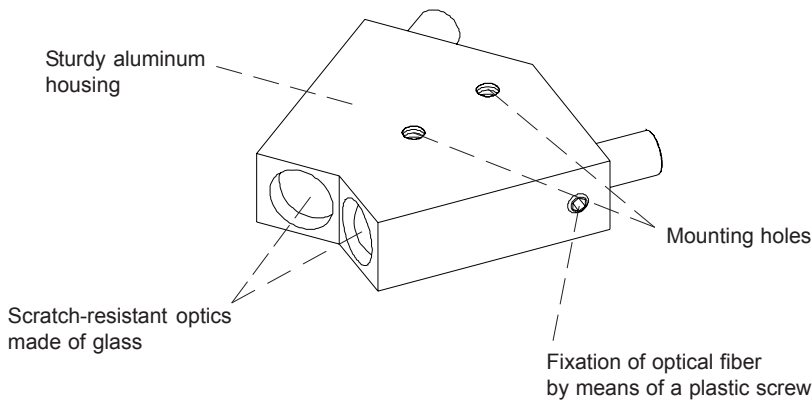


Characteristics:

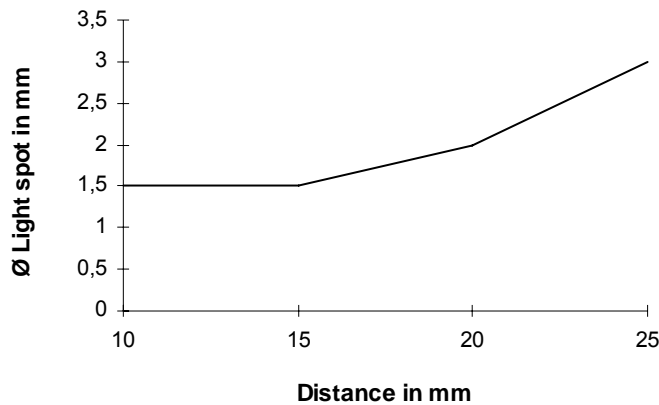
- Also suitable for detection of highly absorbing objects (e.g. black varnished parts) by using color sensor of type SI-COLO2-LWL-HAMP or SI-COLO3-LWL-SP-HAMP
- Working distance typ. 20 mm
- Working range typ. 15 mm ... 25 mm
- Minimal color change when changing the distance
- Can be focused
- Scratch-resistant optics made of glass
- Sturdy aluminum housing



All dimensions in mm



KL-40 with D-S-A2.0-(2.5)-1600-67°



KL-40 with D-S-A2.0-(2.5)-1200-67°:

Distance (mm)	Ø Light spot (mm)
10	1,5
15	1,5
20	3
25	5



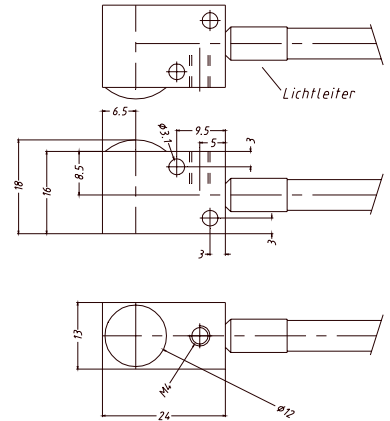
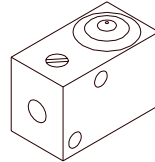
KL-90

Prism optics KL-90

Suitable for optical fibers (transmitted light operation) of type
D-S-A2.0-(2.5)-...-67° or
D-S-A2.0-(2.5)-...-22°

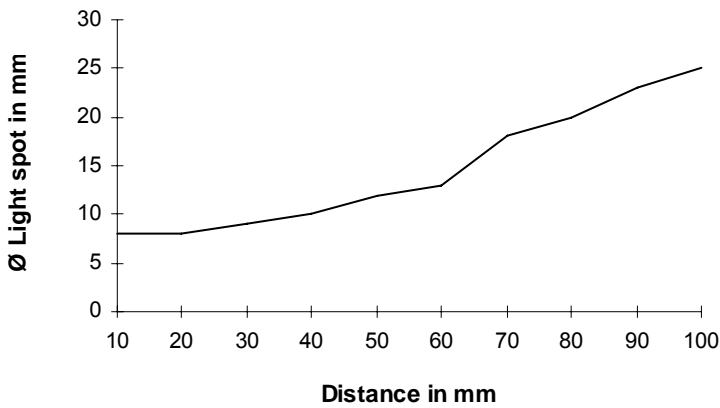
Characteristics:

- Low mounting depth
- High luminous efficacy
- Can be focused
- Scratch-resistant optics made of glass
- Sturdy aluminum housing



All dimensions in mm

KL-90 with D-S-A2.0-(2.5)-1600-67°

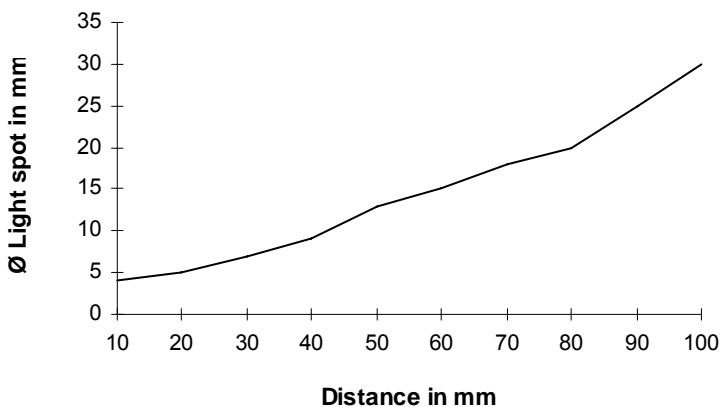


KL-90 mit D-S-A2.0-(2.5)-1200-67°:

Distance (mm)	Ø Light spot (mm)
10	8
20	8
30	9
40	10
50	12
60	13
70	18
80	20
90	23
100	25

max. distance transmitter/receiver = 400 mm
 when optical transparent (clear) objects are to be detected

KL-90 with D-S-A2.0-(2.5)-1600-22°



KL-90 with D-S-A2.0-(2.5)-1200-22°:

Distance (mm)	Ø Light spot (mm)
10	4
20	5
30	7
40	9
50	13
60	15
70	18
80	20
90	25
100	30

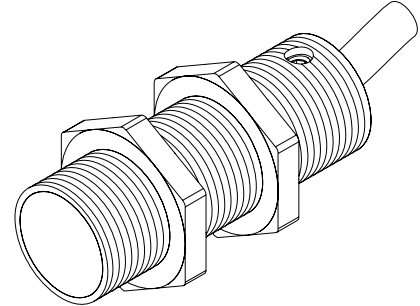
max. distance transmitter/receiver = 100 mm
 when optical transparent (clear) objects are to be detected


KL-M18
Reflex optics KL-M18

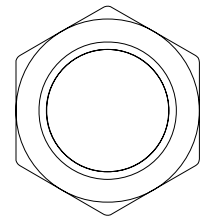
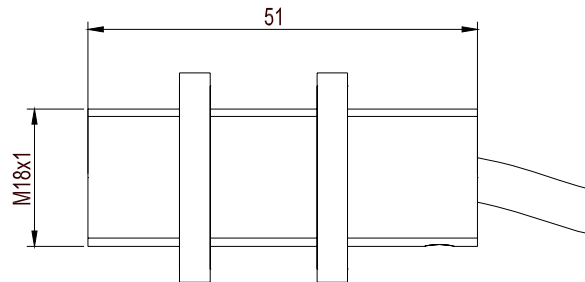
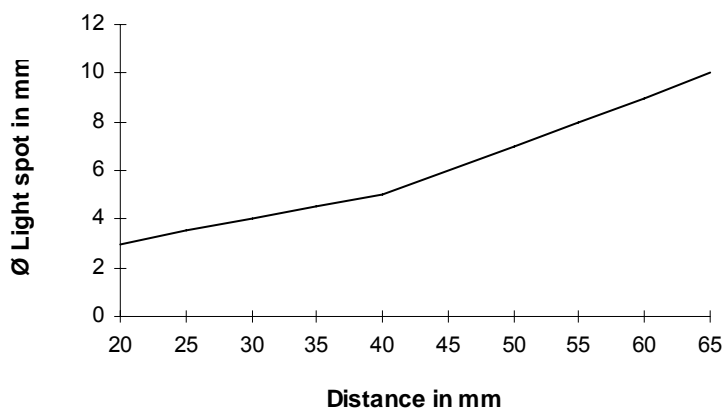
Suitable for optical fibers with reflected light operation
e.g. R-P-A2.0-(2.5)-...-67°

Characteristics:

- Also suitable for detection of highly absorbent object (e.g. black varnished parts) when color sensor of type SI-COLO2-LWL-HAMP or SI-COLO3-LWL-SP-HAMP is used
- Big working distance (typ. 60 mm)
- Working range typ. 20 mm ... 65 mm
- Minimum change of color when distance changes
- Can be focused
- Scratch-resistant optics made of glass
- Sturdy housing made of brass (nickel-plated)



All dimensions in mm


KL-M18 with R-P-A2.0-(2.5)-600-67°


Color sensor SI-COLO2-LWL-HAMP-15 and KL-M18 with R-P-A2.0-(2.5)-600-67°:

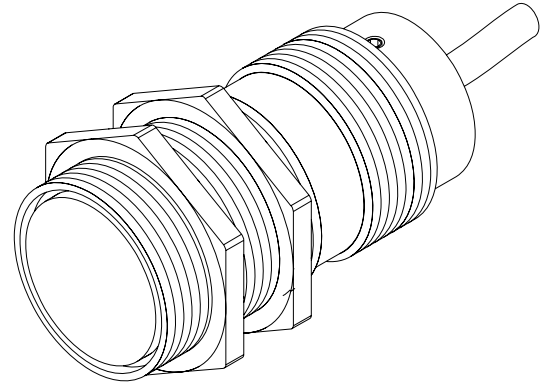
Distance (mm)	Ø Light spot (mm)	Intensity INT (digits)
14		
16		
18		
20	3	177
23		203 (max.)
25	3.5	187
30	4	116
35	4.5	70
40	5	48
45	6	36
50	7	31
55	8	26
60	9	24
65	10	21


KL-M34
Reflex optics KL-M34:

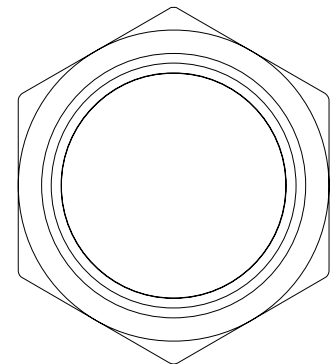
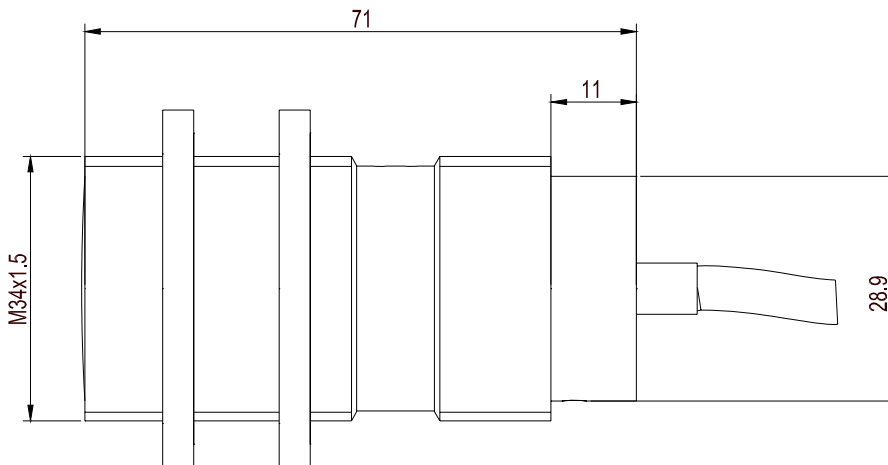
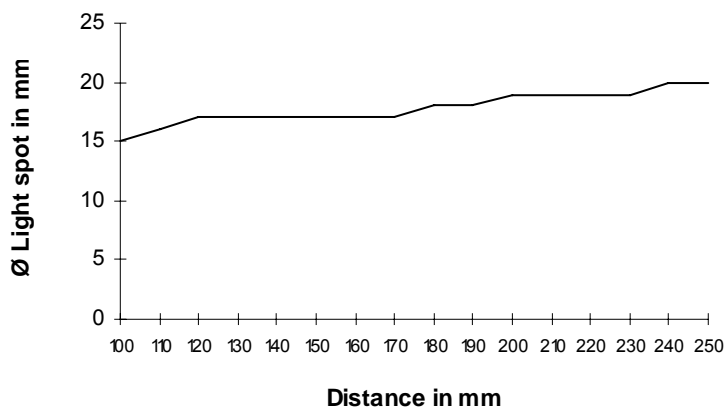
Suitable for optical fibers with reflected light operation
 e.g. R-S-A2.0-(2.5)-...-67°

Characteristics:

- Also suitable for detection of highly absorbent object (e.g. black varnished parts) when color sensor of type SI-COLO2-LWL-HAMP or SI-COLO3-LWL-SP-HAMP is used
- Big working distance (typ. 200 mm)
- Working range typ. 100 mm ... 250 mm
- Minimum change of color when distance changes
- Can be focused
- Scratch-resistant optics made of glass
- Sturdy housing made of brass (nickel-plated)



All dimensions in mm


KL-M34 with R-P-A2.0-(2.5)-600-67°


At a distance of 100 to 150 mm the intensity can be improved by readjusting the focus (fiber optics cable should be pulled out from KL-M34 a little).

Color sensor SI-COLO2-LWL-HAMP-15 and KL-M34 with R-P-A2.0-(2.5)-600-67°:

Distance (mm)	Ø Light spot (mm)	Intensity INT (digits)
100	15	156
110	16	164
120	17	171
130	17	176 (max.)
140	17	179
150	17	178
160	17	174
170	17	168
180	18	162
190	18	155
200	19	147
210	19	142
220	19	137
230	19	131
240	20	127
250	20	122



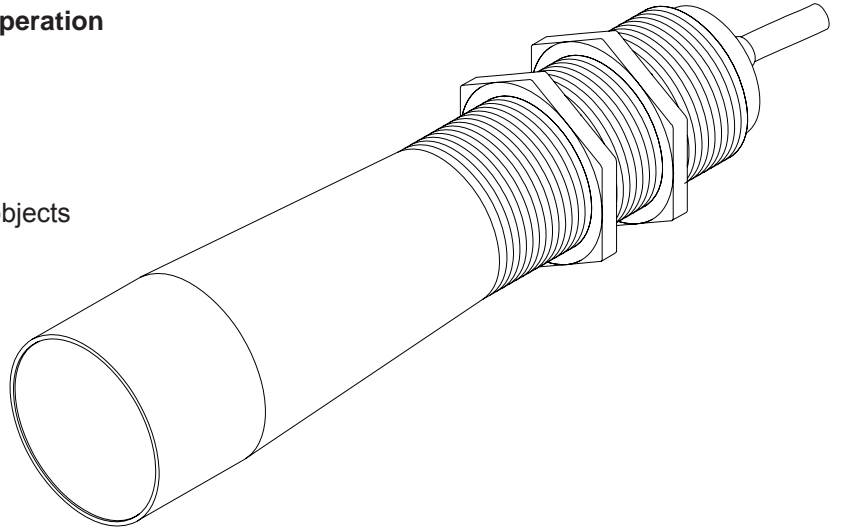
KL-M34/42

Reflex optics KL-M34/42:

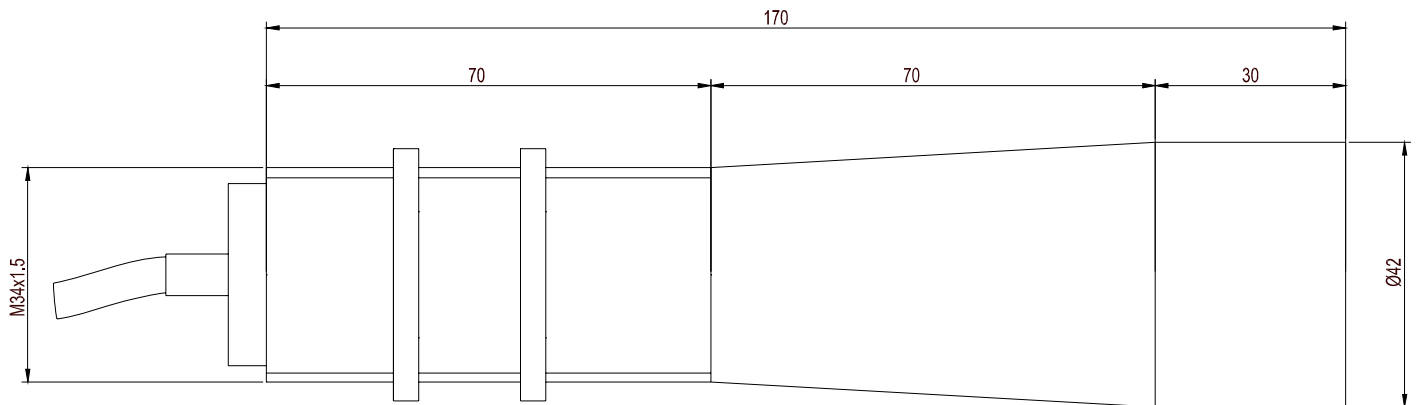
Suitable for optical fibers with reflected light operation
e.g. R-S-A2.0-(2.5)-...-67°

Characteristics:

- Also suitable for detection of highly absorbent objects (e.g. black varnished parts) when color sensor of type SI-COLO2-LWL-HAMP or SI-COLO3-LWL-SP-HAMP is used
- Big working distance (typ. 120 mm)
- Working range typ. 80 mm ... 160 mm
- Minimum change of color when distance changes
- Can be focused
- Scratch-resistant optics made of glass
- Sturdy housing made of brass (nickel-plated)
- Small spot (approx. 3 mm at distance 120 mm)



All dimensions in mm





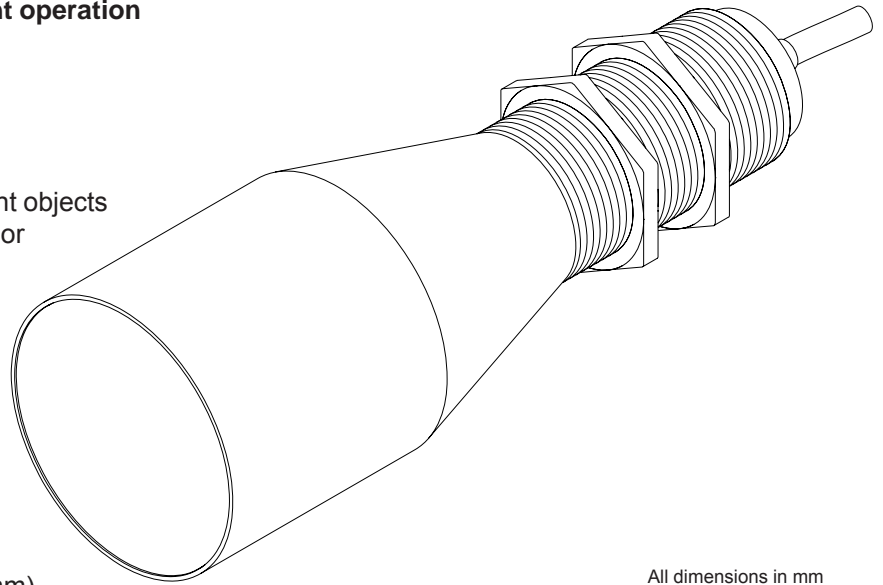
KL-M34/62

Reflex optics KL-M34/62:

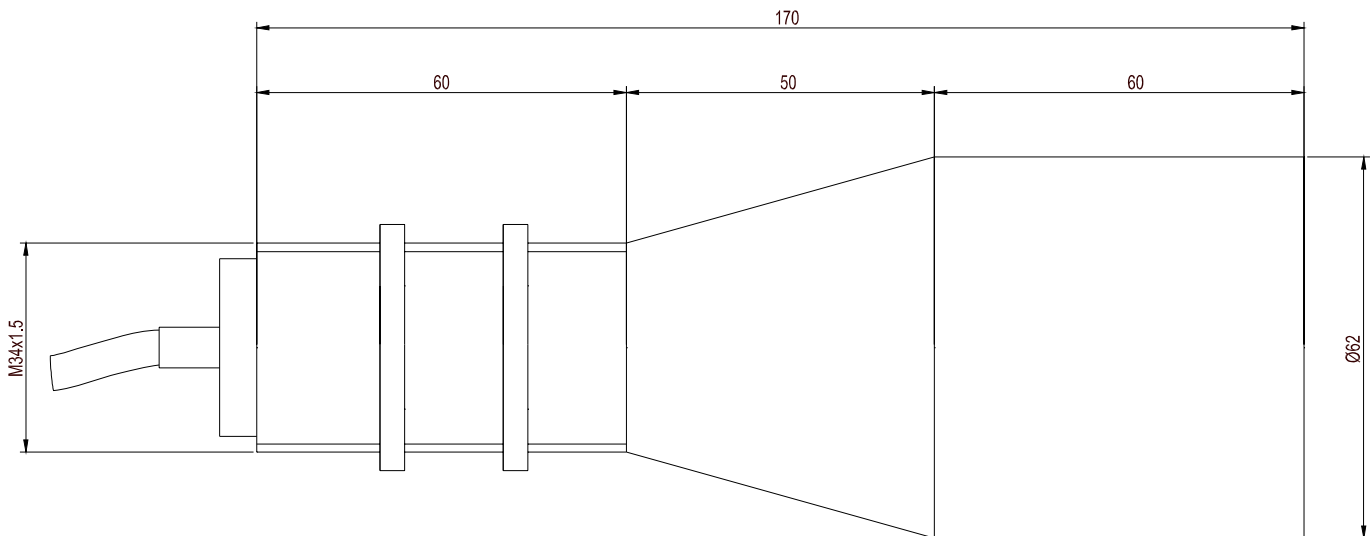
Suitable for optical fibers with reflected light operation
e.g. R-S-A2.0-(2.5)-...-67°

Characteristics:

- Also suitable for detection of highly absorbent objects (e.g. black varnished parts) when color sensor of type SI-COLO2-LWL-HAMP or SI-COLO3-LWL-SP-HAMP is used
- Big working distance (typ. 120 mm)
- Working range typ. 80 mm ... 150 mm
- Minimum change of color when distance changes
- Can be focused
- Scratch-resistant optics made of glass
- Sturdy housing made of brass (nickel-plated)
- Small spot (approx. 3 mm at distance 120 mm)



All dimensions in mm





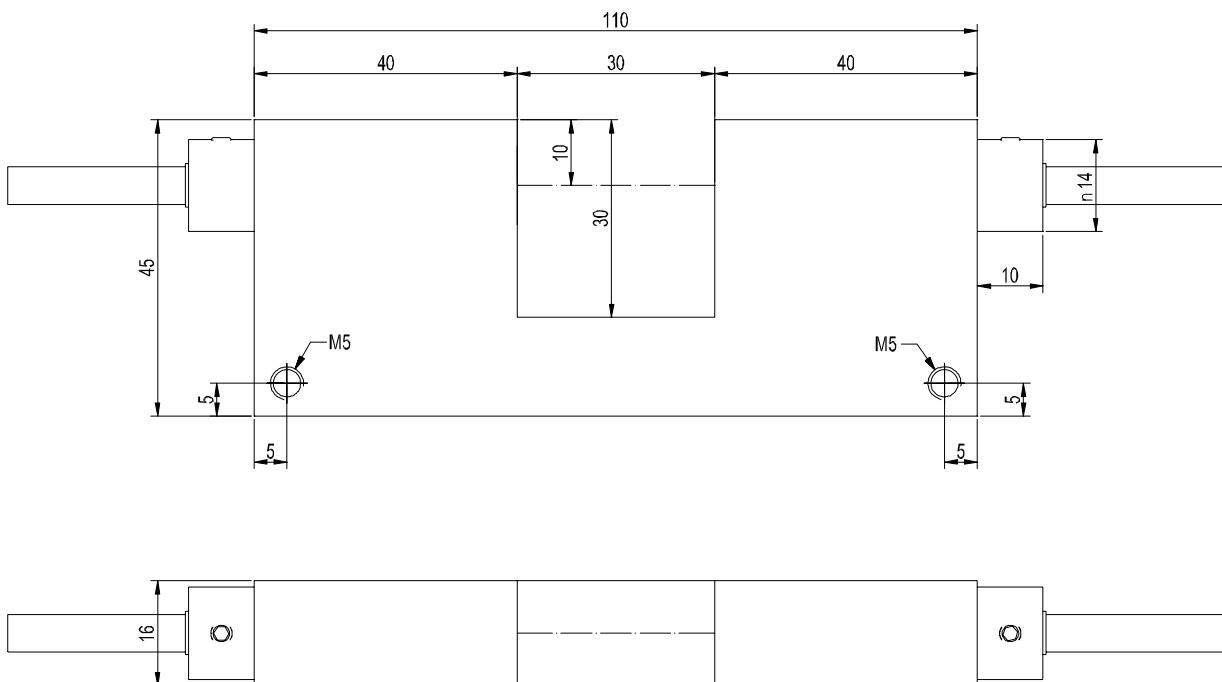
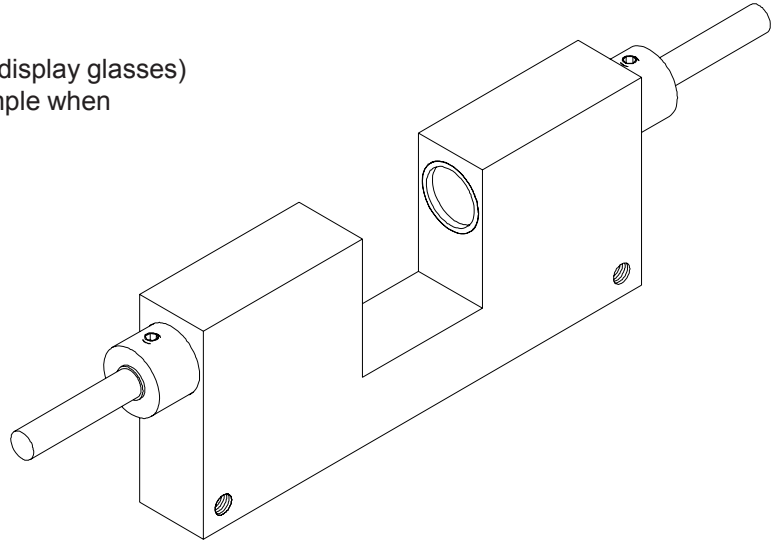
KL-3/30

Transmitted light optics KL-3/30:

Suitable for optical fibers with reflected/transmitted light operation
R/D-S-A2.0-(2.5/1.75)-1200-67°

Characteristics:

- Suitable for detection of fluids (transported e.g. in display glasses) in reflected or transmitted light operation, for example when spray liquid is led to spray facilities
- Minimum change of color when distance changes
- Working range typ. 30 mm
- Can be focused
- Scratch-resistant optics made of glass
- Sturdy aluminum housing



All dimensions in mm

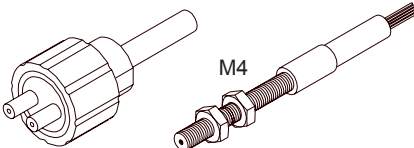
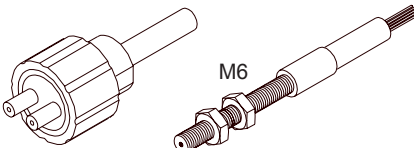
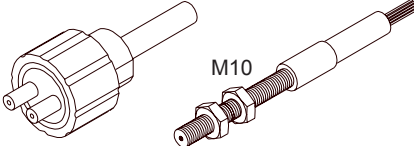
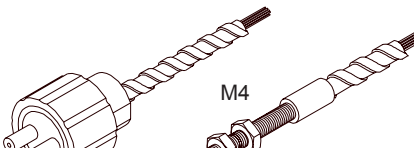
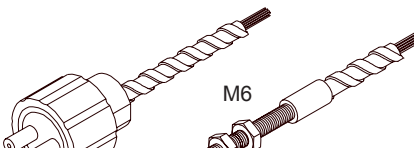
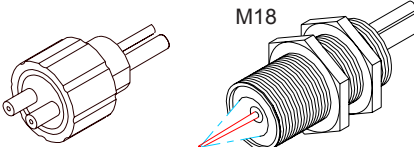
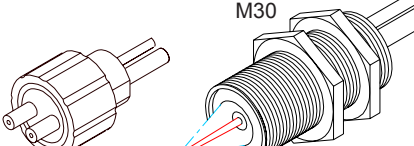


Reflected Light Operation

Product name	Shape (adaptor and sensor head)	Product description
R-P-A2.0-(2.5)-600-67° R-P-A2.0-(2.5)-600-22° R-P-A2.0-(2.5)-1200-67° R-P-A2.0-(2.5)-1200-22°		Reflected light operation (R) PVC special sheath (P) Sensor type A2.0 (fiber bundle Ø 2.5 mm) Total length 600 mm or 1200 mm Beam angle 67° or 22°
R-S-A2.0-(2.5)-600-67° R-S-A2.0-(2.5)-600-22° R-S-A2.0-(2.5)-1200-67° R-S-A2.0-(2.5)-1200-67°		Reflected light operation (R) Silicone-metall sheath (S) Sensor type A2.0 (fiber bundle Ø 2.5 mm) Total length 600 mm Beam angle 67° or 22°
R-E-A2.0-(2.5)-600-67° R-E-A2.0-(2.5)-1200-67°		Reflected light operation (R) Special steel sheath (E) Sensor type A2.0 (fiber bundle Ø 2.5 mm) Total length 600 mm or 1200 mm Beam angle 67°
R-P-B1.1-1200-67° R-P-B1.1-1200-22°		Reflected light operation (R) PVC special sheath (P) Sensor type B1.1 (fiber bundle Ø 0.6 mm) Total length 1200 mm Beam angle 67° or 22°
R-P-B2.0-(1.0)-1200-67°		Reflected light operation (R) PVC special sheath (P) Sensor type B2.0 (fiber bundle Ø 1.0 mm) Total length 1200 mm Beam angle 67°
R-S-R1.1-(3x0.5)-600-67° R-S-R1.1-(3x0.5)-600-22° R-S-R1.1-(3x0.5)-1200-67° R-S-R1.1-(3x0.5)-1200-22°		Reflected light operation (R) Silicone-metal sheath (S) Sensor type R1.1 (fiber gap 3 mm x 0.5 mm) Total length 1200 mm Beam angle 67° or 22°
R-S-R2.1-(6x1)-1200-67° R-S-R2.1-(6x1)-1200-22°		Reflected light operation (R) Silicone-metal sheath (S) Sensor type R2.1 (fiber gap 6 mm x 1 mm) Total length 1200 mm Beam angle 67° or 22°



Reflected Light Operation

Product name	Shape (adaptor and sensor head)	Product description
R-S-C1.0-(1.0)-1200-67° R-S-C1.0-(1.0)-1200-22°		Reflected light operation (R) Silicone-metal sheath (S) Sensor type C1.0 (fiber bundle Ø 1.0 mm) Total length 1200 mm Beam angle 67° or 22°
R-S-C2.0-(2.5)-1200-67° R-S-C2.0-(2.5)-1200-22°		Reflected light operation (R) Silicone-metal sheath (S) Sensor type C2.0 (fiber bundle Ø 2.5 mm) Total length 1200 mm Beam angle 67° or 22°
R-S-C3.0-(3.0)-1200-67° R-S-C3.0-(3.0)-1200-22°		Reflected light operation (R) Silicone-metal sheath (S) Sensor type C3.0 (fiber bundle Ø 3.0 mm) Total length 1200 mm Beam angle 67° or 22°
R-E-C1.0-(1.0)-1200-67° R-E-C1.0-(1.0)-1200-22°		Reflected light operation (R) Special steel sheath (E) Sensor type C1.0 (fiber bundle Ø 1.0 mm) Total length 1200 mm Beam angle 67° or 22°
R-E-C2.0-(2.5)-1200-67° R-E-C2.0-(2.5)-1200-22°		Reflected light operation (R) Special steel sheath (E) Sensor type C2.0 (fiber bundle Ø 2.5 mm) Total length 1200 mm Beam angle 67° or 22°
R-P-M18-(25)-1200-25		Reflected light operation (R) PVC special sheath (P) Sensor type M18 Total length 1200 mm Focused on 25 mm
R-P-M30-(30)-1200-30		Reflected light operation (R) PVC special sheath (P) Sensor type M30 Total length 1200 mm Focused on 30 mm



Reflected Light Operation

Product name	Shape (adaptor and sensor head)	Product description
R-S-Q2-(10x0.3)-1200-67° R-S-Q2-(10x0.3)-1200-22°		Reflected light operation (R) Silicone-metal sheath (S) Sensor type Q2 (fiber gap 10 mm x 0.3 mm) Total length 1200 mm Beam angle 67° or 22°
R-S-Q3-(18x0.3)-1200-67° R-S-Q3-(18x0.3)-1200-22°		Reflected light operation (R) Silicone-metal sheath (S) Sensor type Q3 (fiber gap 18 mm x 0.3 mm) Total length 1200 mm Beam angle 67° or 22°
R-S-Q4-(28x0.2)-1200-67° R-S-Q4-(28x0.2)-1200-22°		Reflected light operation (R) Silicone-metal sheath (S) Sensor type Q4 (fiber gap 28 mm x 0.2 mm) Total length 1200 mm Beam angle 67° or 22°
R-M-Q2-(10x0.3)-1200-67° R-M-Q2-(10x0.3)-1200-22°		Reflected light operation (R) Metal sheath (M) Sensor type Q2 (fiber gap 10 mm x 0.3 mm) Total length 1200 mm Beam angle 67° or 22°
R-M-Q3-(18x0.3)-1200-67° R-M-Q3-(18x0.3)-1200-22°		Reflected light operation (R) Metal sheath (M) Sensor type Q3 (fiber gap 18 mm x 0.3 mm) Total length 1200 mm Beam angle 67° or 22°
R-M-Q4-(28x0.2)-1200-67° R-M-Q4-(28x0.2)-1200-22°		Reflected light operation (R) Metal sheath (M) Sensor type Q4 (fiber gap 28 mm x 0.2 mm) Total length 1200 mm Beam angle 67° or 22°
R-E-Q2-(10x0.3)-1200-67° R-E-Q2-(10x0.3)-1200-22°		Reflected light operation (R) Special steel sheath (E) Sensor type Q2 (fiber gap 10 mm x 0.3 mm) Total length 1200 mm Beam angle 67° or 22°

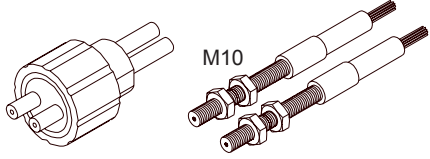
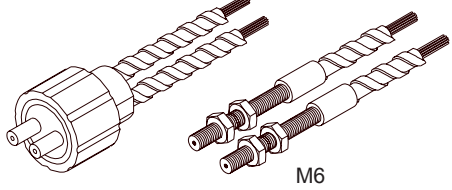
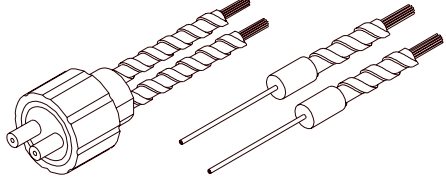
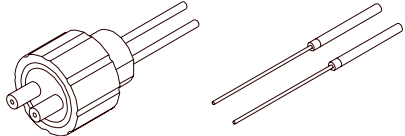
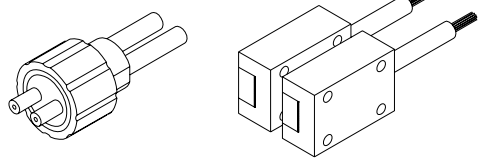
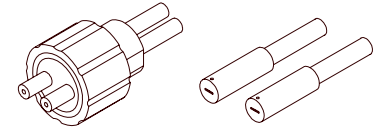
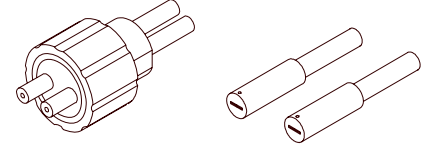


Reflected Light Operation

Product name	Shape (adaptor and sensor head)	Product description
R-E-Q3-(18x0.3)-1200-67° R-E-Q3-(18x0.3)-1200-22°		Reflected light operation (R) Special steel sheath (E) Sensor type Q3 (fiber gap 18 mm x 0.3 mm) Total length 1200 mm Beam angle 67° or 22°
R-E-Q4-(28x0.2)-1200-67° R-E-Q4-(28x0.2)-1200-22°		Reflected light operation (R) Special steel sheath (E) Sensor type Q4 (fiber gap 28 mm x 0.2 mm) Total length 1200 mm Beam angle 67° or 22°
R-S-D1.1-(0.6)-1200-67° R-S-D1.1-(0.6)-1200-22°		Reflected light operation (R) Silicone-metal sheath (S) Sensor type D1.1 (fiber bundle Ø 0.6 mm) Total length 1200 mm Beam angle 67° or 22°
R-S-F1.0-(1.5)-1200-67° R-S-F1.0-(1.5)-1200-22°		Reflected light operation (R) Silicone-metal sheath (S) Sensor type F1.0 (fiber bundle Ø 1.5 mm) Total length 1200 mm Beam angle 67° or 22°
R-P-E1.0-(1.5)-600-67° R-P-E1.0-(1.5)-1200-67°		Reflected light operation (R) PVC special sheath (P) Sensor type E1.0 (fiber bundle Ø 1.5 mm) Total length 600 mm or 1200 mm Beam angle 67°
R-P-E2.0-(2.5)-600-67° R-P-E2.0-(2.5)-1200-67°		Reflected light operation (R) PVC special sheath (P) Sensor type E2.0 (fiber bundle Ø 2.5 mm) Total length 600 mm or 1200 mm Beam angle 67°
R-M-E2.0-(2.5)-600-67° R-M-E2.0-(2.5)-1200-67°		Reflected light operation (R) Metal sheath (M) Sensor type E2.0 (fiber bundle Ø 2.5 mm) Total length 600 mm or 1200 mm Beam angle 67°

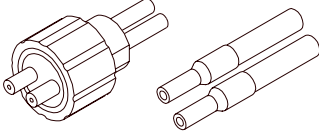
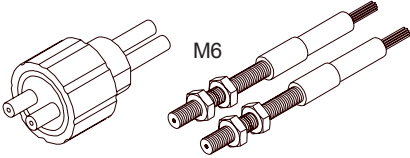


Transm. Light Operation

Product name	Shape (adaptor and sensor head)	Product description
D-S-C3.0-(3.0)-1200-67° D-S-C3.0-(3.0)-1200-22°		Transmitted light operation (D) Silicone-metal sheath (S) Sensor type C3.0 (fiber bundle Ø 3.0 mm) Total length 1200 mm Beam angle 67° or 22°
D-E-C2.0-(2.5)-1200-67° D-E-C2.0-(2.5)-1200-22°		Transmitted light operation (D) Special steel sheath (E) Sensor type C2.0 (fiber bundle Ø 2.5 mm) Total length 1200 mm Beam angle 67° or 22°
D-M-M1.1-(0.6)-1200-22°		Transmitted light operation (D) Metal sheath (E) Sensor type M1.1 (fiber bundle Ø 0.6 mm) Total length 1200 mm Beam angle 67° or 22°
D-P-B1.1-(0.6)-600-67°		Transmitted light operation (D) PVC special sheath (P) Sensor type B1.1 (fiber bundle Ø 0.6 mm) Total length 600 mm Beam angle 67°
D-S-Q4-(28x0.2)-1200-67° D-S-Q4-(28x0.2)-1200-22°		Transmitted light operation (D) Silicone-metal sheath (S) Sensor type Q4 (fiber gap 28 mm x 0.2 mm) Total length 1200 mm Beam angle 67° or 22°
D-S-R1.1-(3x0.75)-1200-67°		Transmitted light operation (D) Silicone-metal sheath (S) Sensor type R1.1 (fiber gap 3 mm x 0.75 mm) Total length 1200 mm Beam angle 67°
D-S-R2.1-(6x1)-1200-67°		Transmitted light operation (D) Silicone-metal sheath (S) Sensor type R2.1 (fiber gap 6 mm x 1 mm) Total length 1200 mm Beam angle 67°



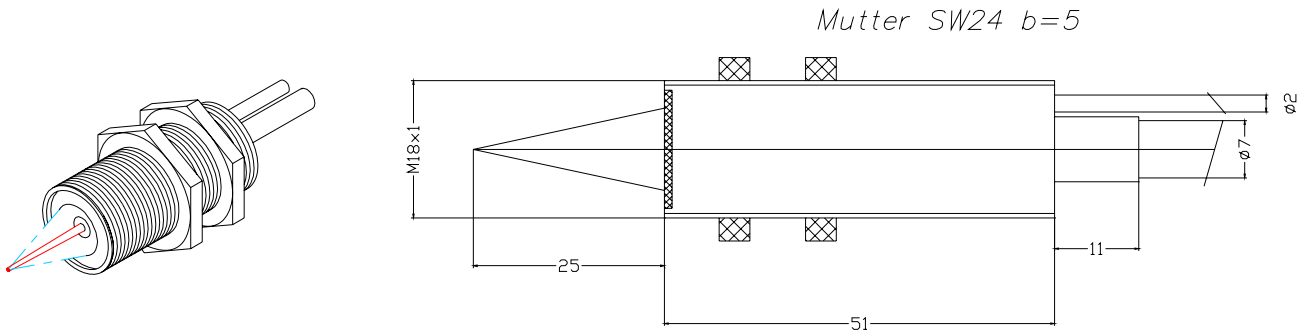
Transm. Light Operation

Product name	Shape (adaptor and sensor head)	Product description
D-S-A2.0-(2.5)-1200-67° D-S-A2.0-(2.5)-1200-22°		Transmitted light operation (D) Silicone-metal sheath (S) Sensor type A2.0 (fiber bundle Ø 2.5 mm) Total length 1200 mm Beam angle 67° or 22°
D-S-C2.0-(2.5)-1200-67° D-S-C2.0-(2.5)-1200-22°		Transmitted light operation (D) Silicone-metal sheath (S) Sensor type C2.0 (fiber bundle Ø 2.5 mm) Total length 1200 mm Beam angle 67° or 22°

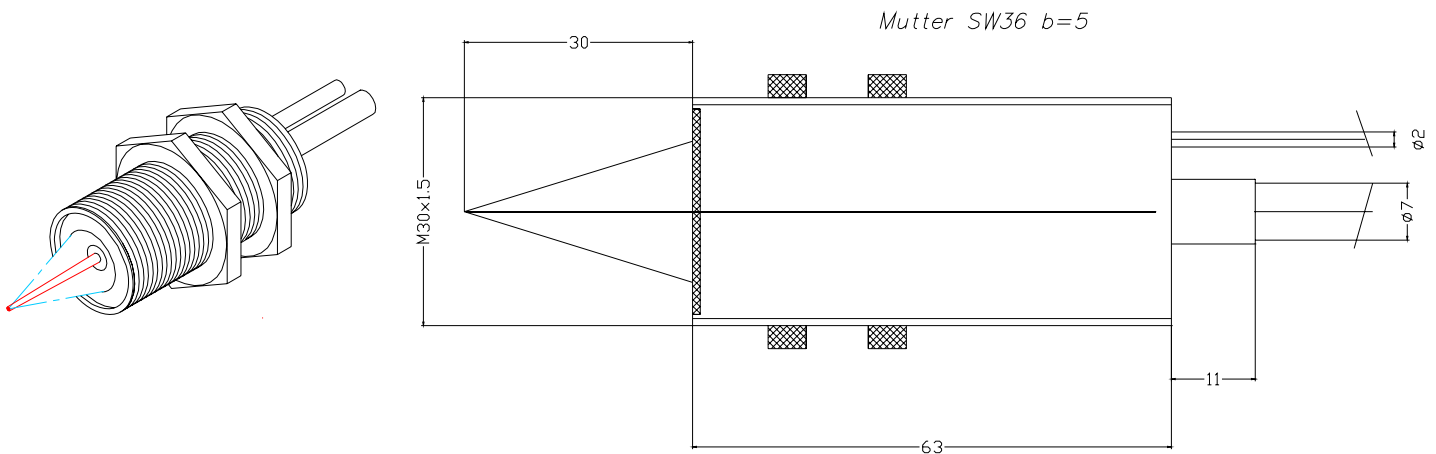


Special Optical Fibers

R-P-M18-(25)-1200-25 (Reflected light operation, type M18, focused onto 25 mm)



R-P-M30-(30)-1200-30 (Reflected light operation, type M30, focused onto 30 mm)



Mounting Hints

Please note the following information for the usage of optical fibers:

Optical fibers consist of a large number of single glass fibers with a diameter from 10 up to 70 μm . In spite of their high flexibility and resistance they have to be protected against tension, twist off, and bend.



Bending radius: At least 4 times the sheath's outside diameter
 Mounting: Without heavy pressure to the fiber
 Installment: Tension-free!

For applications with heavy mechanical strain we recommend to use optical fibers with silicone-metal sheath.