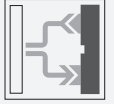




Fiber optic sensor SU18/35/40a/102/115/126a

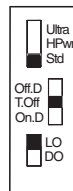
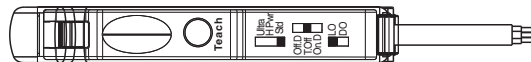
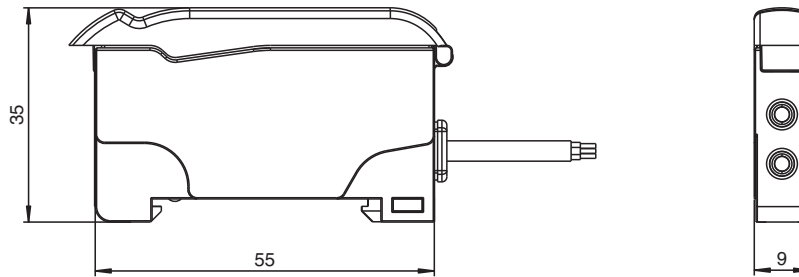


- Basic line for DIN rail installation
- High power version
- Sleek design
- 3 response times selectable
- Protected against mutual interference (no cross-talk)
- Self diagnosis function

Fiber optic sensor for glass fiber optics and plastic fiber optics



Dimensions



Ultra = Ultra
HPwr = High-Power
Std = Standard
Off.D = Off Delay
T.Off = Timer off
On.D = On Delay
LO = Light on
DO = Dark on

Technical Data

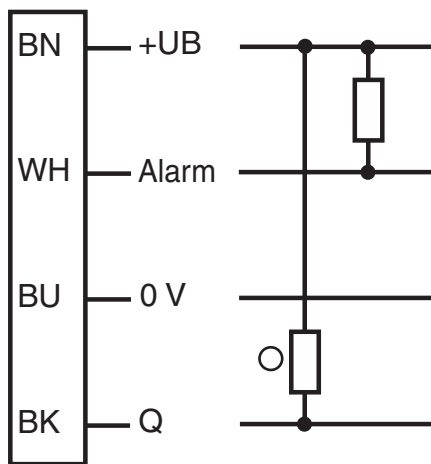
General specifications

Sensor range	up to 460 mm (KLR-C02-2,2-2,0-K146)
Detection range	up to 1500 mm (KLE-C01-2,2-2,0-K116)
Light source	LED
Light type	modulated visible red light , 640 nm

Technical Data

Ambient light limit	10000 Lux
Functional safety related parameters	
MTTF _d	690 a
Mission Time (T _M)	20 a
Diagnostic Coverage (DC)	0 %
Indicators/operating means	
Operation indicator	LED green, statically lit Power on , Undervoltage indicator: Green LED, pulsing (approx. 0.8 Hz) , short-circuit : LED green flashing (approx. 4 Hz)
Function indicator	LED yellow: static illumination switching state, flashes when falling short of the stability control
Control elements	Teach-In key slide switch 2 positions: light/dark switching slide switch 3 positions: timer function - timer off, on delay 40 ms, off-delay 40 ms slide switch 3 positions: operating mode - Standard, High Power, Ultra
Electrical specifications	
Operating voltage	U _B 10 ... 30 V DC
Ripple	10 %
No-load supply current	I ₀ ≤ 30 mA
Output	
Pre-fault indication output	1 NPN, short-circuit protected open collector
Switching type	light/dark on, switchable
Signal output	1 NPN, short-circuit protected open collector
Switching voltage	max. 30 V DC
Switching current	max. 100 mA , resistive load
Voltage drop	U _d ≤ 2 V DC at 100 mA ; ≤ 0.7 V at 10 mA
Switching frequency	f Standard mode: 3 kHz , High power mode: 1 kHz , Ultra mode: 100 Hz
Response time	Standard mode: 160 μs , High power mode: 500 μs , Ultra mode: 5 ms
Repeat accuracy	R ≤ 0.5 % of adjusted sensor range
Conformity	
Product standard	EN 60947-5-2
Approvals and certificates	
EAC conformity	TR CU 020/2011
UL approval	cULus Listed, Class 2 Power Source, Type 1 enclosure
CCC approval	CCC approval / marking not required for products rated ≤36 V
Ambient conditions	
Ambient temperature	-10 ... 55 °C (14 ... 131 °F)
Storage temperature	-20 ... 70 °C (-4 ... 158 °F)
Mechanical specifications	
Housing width	9 mm
Housing height	34.5 mm
Housing depth	62.3 mm
Degree of protection	IP50
Connection	2 m PVC cable, 4 x 0,14 mm ²
Material	
Housing	PC
Mass	45 g

Connection Assignment

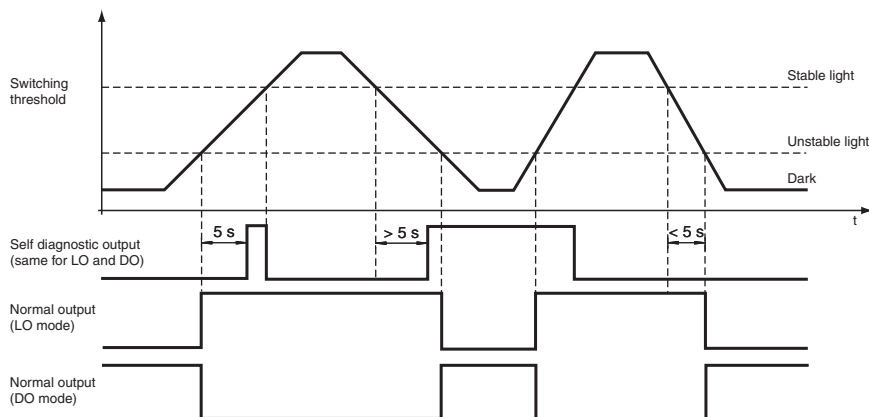


○ = Light on
● = Dark on

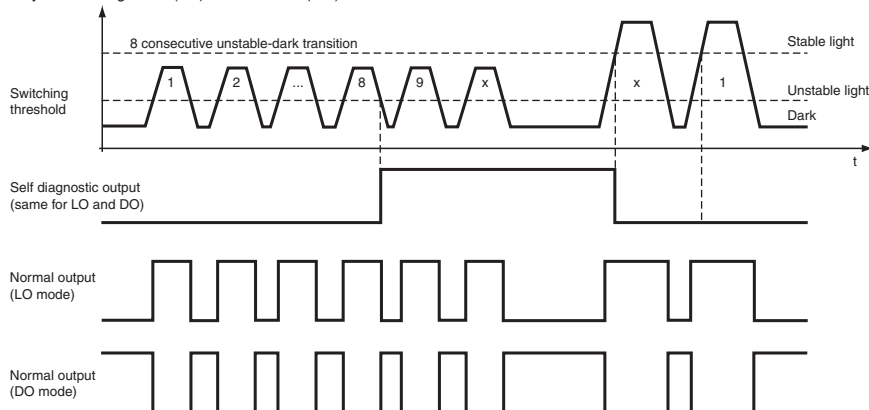
Characteristic Curve

Self-Diagnostic definition and operation:

5 sec. rule for light-ON (LO) and dark-ON (DO) mode

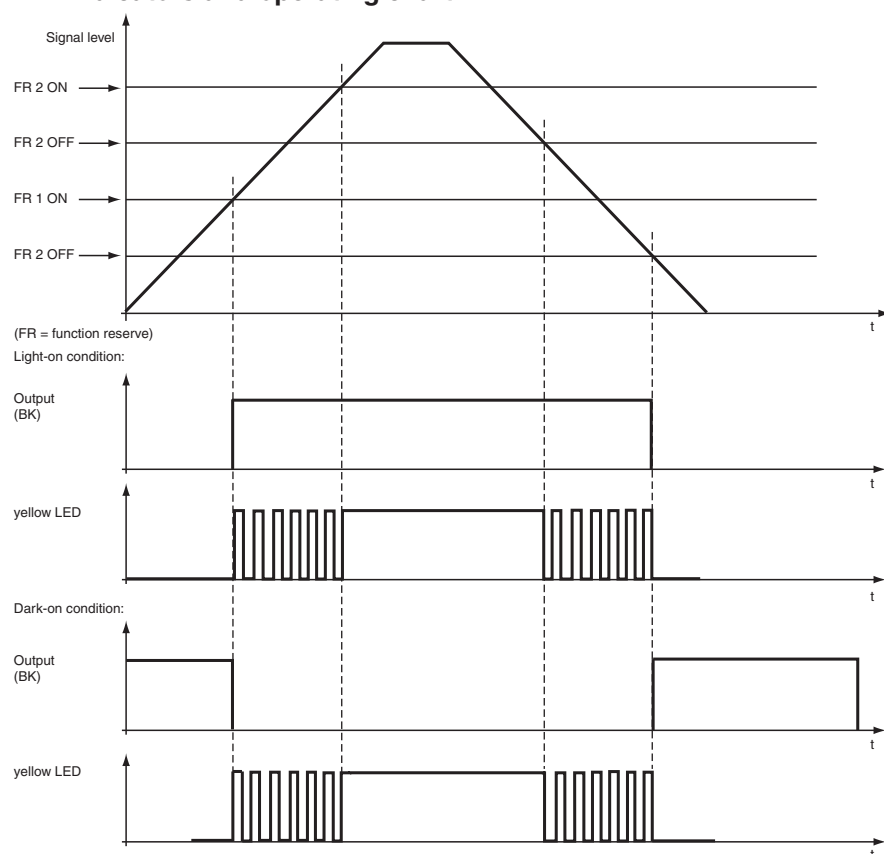


8 cyc. rule for light-ON (LO) and dark-ON (DO) mode



Characteristic Curve

LED indicators and operating chart:



Accessories

	KLR-C02-2,2-2,0-K146	Plastic fiber optic - diffuse
	KLR-C02-2,2-2,0-K70	Plastic fiber optic - diffuse
	KLR-C02-1,0-2,0-K75	Plastic fiber optic - diffuse
	KLR-C09-1,25-2,0-K76	Plastic fiber optic - diffuse
	KLR-C09-1,25-2,0-K74	Plastic fiber optic - diffuse
	KLR-C16-2,2-2,0-K71	Plastic fiber optic - diffuse
	KLR-A32-2,2-2,0-K83	Plastic fiber optic - diffuse
	KHR-C02-2,2-2,0-K131	Plastic fiber optic - diffuse
	KHTR-C02-2,2-2,0-K88	Plastic fiber optic - diffuse

Release date: 2022-08-08 Date of issue: 2022-08-08 Filename: 808451_eng.pdf

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Accessories

	KLE-C01-2,2-2,0-K116	Plastic fiber optic - thru-beam
	KLE-C01-2,2-2,0-K103	Plastic fiber optic - thru-beam
	KLE-C01-2,2-2,0-K102	Plastic fiber optic - thru-beam
	KLE-C01-2,2-2,0-K101	Plastic fiber optic - thru-beam
	KLE-C01-2,2-2,0-K113	Plastic fiber optic - thru-beam
	KLE-C01-1,0-2,0-K120	Plastic fiber optic - thru-beam
	KHE-C01-2,2-2,0-K122	Plastic fiber optic - thru-beam
	KHTE-C01-2,2-2,0-K118	Plastic fiber optic - thru-beam
	LHE 00-1,1-1,0-20M4	Glass fiber optic - thru-beam with silicon covering

Teach-In

Teach-in procedures

2-Point Teach*:

1. Place the first target to be learned.
2. Press and hold the Teach button for > 2 seconds to enter Teach mode.
3. Press for another 3 second, both LEDs switch off for 1 second to indicate that you are now in 2-point teach mode.
4. Remove the target (to teach the background) or move the target further away.
5. Press the Teach button for < 2 seconds to end Teach mode.

Both LEDs will indicate fast in-phase blinking and then alternate blinking to signal end of Teach mode. 2-Point Teach is completed.

* Remarks: The 2-point Teach-in can be used for thru-beam and diffuse mode applications.

The teach-in takes in this case in the reverse order.

1. Object absent (light path free).
2. Object present.

Dynamic Teach:

1. Press and hold the Teach button for > 2 seconds to enter Teach mode. Both LEDs will indicate fast in-phase blinking follow by slow in-phase blinking.
2. Pass a moving target.
3. Press and hold the Teach button for < 2 seconds to end Teach mode. Both LEDs will indicate alternate blinking to signal end of Teach mode.

Maximum Teach:

1. Remove target
2. Press and hold the Teach button for > 2 seconds to enter Teach mode. Both LEDs will indicate fast in-phase blinking follow by slow in-phase blinking.
3. Press and hold the Teach button for > 2 seconds to end Teach mode. Both LEDs will indicate fast in-phase blinking and then alternate blinking to signal end of Teach mode.

Position Teach:

1. Place a target.
2. Press and hold the Teach button for > 2 second to enter Teach mode. Both LEDs will indicate fast in-phase blinking follow by slow in-phase blinking. If the target is too near (strong signal), the fast blinking will last slightly longer follow by slow blinking.
3. Press and hold the Teach button for > 2 seconds to end Teach mode. Both LEDs will indicate fast in-phase blinking and then alternate blinking to signal end of Teach mode.

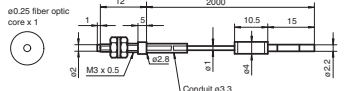
Indications for the Green and Yellow LEDs in detection mode (normal operation):

- Yellow LED is stable ON to indicate that signal received is > FR2.
- Yellow LED will flash at 4 Hz to indicate function reserve, FR1 < signal level < FR2.
- Green LED stable ON to indicate power supply is ON, sensor is ready.
- Green LED will flash once for each key actuation, e.g. actuation of the Teach button.
- Green LED will flash at 4 Hz to indicate a short-circuit fault at the output(s).
- Green LED will flash at 0.8 Hz dual flashing to indicate an under-voltage fault at the power supply.

Indications for the Green and Yellow LEDs in the Teach Mode:

- Yellow & Green LEDs in-phase blinking indicates that the sensor has entered the Teach Mode.
- Slow Yellow & Green LEDs in-phase blinking indicates that the sensor is ready or it is waiting to learn new information about the target and/or the background.
- Fast Yellow & Green LEDs in-phase blinking means that the sensor is in the progress of learning new target. When the learning is complete, slow in-phase blinking will be resumed as before.
- Green & Yellow LEDs flash alternately at 8 Hz indicates there has been a Teach fault or Teach error.
- Green & Yellow LEDs flash alternately at 2.5 Hz indicates the end of successful Teach.

Selection table - thru-beam fiber optic cable

Head shape	Mounting	Model number	Core	Detection distance *	Fiber cross section	minimum Object size	Fiber optic length	Bend radius	Dimensions	Special features
Highly precise										
Threaded	M3	KLE-C01-1.0-2.0-K120	PMMA	Ultra: 80 mm HiPwr: 45 mm Std: 20 mm	0.25 mm	0.05 mm	2 m	min. 10 mm		

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Head shape	Mounting	Model number	Core	Detection distance *	Fiber cross section	minimum Object size	Fiber optic length	Bend radius	Dimensions	Special features
Threaded	M4	KLE-00-2.2-2.0-K55	PMMA	Ultra: 872 mm HiPwr: 500 mm Std: 228 mm	1 mm		2 m	min. 25 mm		
High detection range										
Threaded	M3	KLE-C01-2.2-2.0-K116	PMMA	Ultra: 1500 mm HiPwr: 950 mm Std: 450 mm	1.5 mm	0.35 mm	2 m	min. 40 mm		
Threaded	M6	KLE-C01-2.2-2.0-K115	PMMA	Ultra: 1500 mm HiPwr: 950 mm Std: 450 mm	1.5 mm	0.35 mm	2 m	min. 40 mm		
Threaded	M8 x 1	FEF-PLT1	PMMA	Ultra: 25620 mm HiPwr: 15070 mm Std: 6000 mm calculated values related on 2 m Fiber optic length	1 mm		1 m	min. 25 mm		Narrow beam
Threaded	M8 x 1	FEF-PLT1-L2	PMMA	Ultra: 25620 mm HiPwr: 15070 mm Std: 6000 mm calculated values related on 2 m Fiber optic length	1 mm		2 m	min. 25 mm		Narrow beam
Threaded	M8 x 1	FEF-PLT1-L5	PMMA	Ultra: 25620 mm HiPwr: 15070 mm Std: 6000 mm calculated values related on 2 m Fiber optic length	1 mm		4 m	min. 25 mm		Narrow beam
Cylindrical	dia. 3 mm	KLE-C01-2.2-2.0-K117	PMMA	Ultra: 1360 mm HiPwr: 820 mm Std: 400 mm	1.5 mm	0.35 mm	2 m	min. 25 mm		
Side view / Periscope										
Cylindrical	dia. 4.75 mm	KHE-C01-2.2-2.0-K136	PMMA	Ultra: 200 mm HiPwr: 110 mm Std: 50 mm	0.5 mm	0.15 mm	2 m	min. 1 mm		only 1 mm Bend radius
Array										
Rectangular	3 x M2 x 0.5	KLE-A16-2.2-2.0-K109	PMMA	Ultra: 420 mm HiPwr: 240 mm Std: 100 mm	16 x 0.25 mm	0.05 mm	2 m	min. 25 mm		
Rectangular	3 x M3 x 0.5	KLE-A16-2.2-2.0-K110	PMMA	Ultra: 420 mm HiPwr: 240 mm Std: 100 mm	16 x 0.25 mm	0.05 mm	2 m	min. 25 mm		
Rectangular	3 x M3 x 0.5	KLE-A16-2.2-2.0-K111	PMMA	Ultra: 420 mm HiPwr: 240 mm Std: 100 mm	16 x 0.25 mm	0.05 mm	2 m	min. 25 mm		

Head shape	Mounting	Model number	Core	Detection distance *	Fiber cross section	minimum Object size	Fiber optic length	Bend radius	Dimensions	Special features
Rectangular	2 x 3.2 mm	KLE-A32-2.2-2.0-K142	PMMA	Ultra: 140 mm HiPwr: 80 mm Std: 35 mm	32 x 0.25 mm		2 m	min. 25 mm		
High temperature resistance										
Cylindrical	dia. 3 mm	KHTE-C01-2.2-2.0-K118	PMMA	Ultra: 475 mm HiPwr: 270 mm Std: 115 mm	1 mm	0.35 mm	2 m	min. 25 mm		- 55°C ... + 115 °C
Sturdy design										
Threaded	M3	LHE 00-1.1-1.0-14M3	glass	Ultra: 710 mm HiPwr: 420 mm Std: 195 mm	1.1 mm		1 m	4 mm static		- 40°C ... + 180 °C
Threaded	M4 x 0.7 / M2.6	LHE 00-1.1-1.0-20M4	glass	Ultra: 710 mm HiPwr: 420 mm Std: 195 mm	1.1 mm		1 m	4 mm static		4 x high Detection range with Auxiliary lens K-LA01/ 8 x high Detection range with Auxiliary lens K-LA06 Side view / Periscope with K-LA02/ - 40°C ... + 180 °C
Threaded	M6	LHE 00-1.1-1.0-G	glass	Ultra: 710 mm HiPwr: 420 mm Std: 195 mm	1.1 mm		1 m	4 mm static		- 40°C ... + 180 °C
Cylindrical	dia. 1.5 mm	LHE 00-1.1-1.0-10C1.5	glass	Ultra: 710 mm HiPwr: 420 mm Std: 195 mm	1.1 mm		1 m	4 mm static		- 40°C ... + 180 °C
Cylindrical	dia. 3 mm	LHE 00-1.1-1.0-15C3	glass	Ultra: 710 mm HiPwr: 420 mm Std: 195 mm	1.1 mm		1 m	4 mm static		- 40°C ... + 180 °C
Right angle	Bar 3 mm	LHE 00-1.1-1.0-WC3	glass	Ultra: 710 mm HiPwr: 420 mm Std: 195 mm	1.1 mm		1 m	4 mm static		- 40°C ... + 180 °C
Right angle	Bar 10 mm	LHE 00-1.1-1.0-K9	glass	Ultra: 710 mm HiPwr: 420 mm Std: 195 mm	1.1 mm		1 m	4 mm static		- 40°C ... + 180 °C
Special design										
Rectangular	2 x 2.2 mm	KHE-A01-1.0-2.0-K138	PMMA	Ultra: 100 mm HiPwr: 60 mm Std: 25 mm	0.5 mm	0.05 mm	2 m	min. 1 mm		only 1 mm Bend radius

Head shape	Mounting	Model number	Core	Detection distance *	Fiber cross section	minimum Object size	Fiber optic length	Bend radius	Dimensions	Special features
Slot	2 x 3.2 m m	KLE-C02-1.25-2.0-K134	PMMA	5 mm	2 x 0.25 m m		2 m	min. 10 mm		
Slot	2 x 3.2 m m	KLE-C02-1.25-2.0-K135	PMMA	10 mm	2 x 0.25 m m		2 m	min. 10 mm		



Std: Standard Mode, 160 μ s
HiPwr: HighPower Mode, 500 μ s
Ultra: Ultra Mode, 5 ms

Selection table - diffuse mode fiber optic cable

Head shape	Mounting	Model number	Core	Detection distance *	Fiber cross-section	Fiber optic length	Bend radius	Dimensions	Special features
Highly precise									
Threaded	M3 x 0.5	KLR-C02-1.0-2.0-K75	PMMA	Ultra: 12 mm HiPwr: 6 mm Std: 4 mm	2 x 0.25 m	2 m	min. 10 mm		
Threaded	M4 x 0.7	KLR-C02-1.0-2.0-K73	PMMA	Ultra: 12 mm HiPwr: 6 mm Std: 4 mm	2 x 0.25 m	2 m	min. 10 mm		
Threaded	M3 x 0.5	KLR-C04-1.25-2.0-K78	PMMA	Ultra: 25 mm HiPwr: 18 mm Std: 8 mm	4 x 0.25 m	2 m	min. 15 mm		
Cylindrical	dia. 2.0 mm	KLR-C02-1.0-2.0-K91	PMMA	Ultra: 12 mm HiPwr: 6 mm Std: 4 mm	2 x 0.25 m	2 m	min. 10 mm		
Cylindrical	dia. 3.0 mm	KLR-C02-1.0-2.0-K90	PMMA	Ultra: 12 mm HiPwr: 6 mm Std: 4 mm	2 x 0.25 m	2 m	min. 10 mm		
Cylindrical	dia. 1.5 mm	KLR-C04-1.25-2.0-K80	PMMA	Ultra: 25 mm HiPwr: 18 mm Std: 8 mm	4 x 0.25 m	2 m	min. 15 mm		
Cylindrical	dia. 1.5 mm	KLR-C04-1.0-2.0-K133	PMMA	Ultra: 25 mm HiPwr: 18 mm Std: 7 mm	4 x 0.25 m	2 m	min. 15 mm		

Head shape	Mounting	Model number	Core	Detection distance *	Fiber cross-section	Fiber length	Bend radius	Dimensions	Special features
Cylindrical	dia. 2.0 mm	KLR-C02-1.0-2.0-K87	PMMA	Ultra: 85 mm HiPwr: 52 mm Std: 25 mm	2 x 0.5 mm	2 m	min. 15 mm		
Cylindrical	dia. 3.0 mm	KLR-C04-1.25-2.0-K79	PMMA	Ultra: 25 mm HiPwr: 18 mm Std: 8 mm	4 x 0.25 mm	2 m	min. 15 mm		
Coaxial									
Threaded	M3 x 0.5	KLR-C09-1.25-2.0-K76	PMMA	Ultra: 100 mm HiPwr: 60 mm Std: 30 mm	1 x 0.5 mm Emitter 9 x 0.25 mm Receiver	2 m	min. 15 mm		only 0.5 mm light spot at 8 mm with auxiliary lens K-LA03
Threaded	M4 x 0.7 /M2.6	KLR-C09-1.25-2.0-K74	PMMA	Ultra: 100 mm HiPwr: 60 mm Std: 30 mm	1 x 0.5 mm Emitter 9 x 0.25 mm Receiver	2 m	min. 15 mm		only 0.7 mm light spot at 10 mm with auxiliary lens K-LA04/ 2 x high Detection range with Auxiliary lens K-LA01/ 3 x high Detection range with Auxiliary lens K-LA06
Threaded	M6 x 0.75	KLR-C16-2.2-2.0-K71	PMMA	Ultra: 300 mm HiPwr: 190 mm Std: 85 mm	1 x 1.0 mm Emitter 16 x 0.25 mm Receiver	2 m	min. 25 mm		
Cylindrical	dia. 1.0 mm	KLR-C06-1.25-2.0-K81	PMMA	Ultra: 70 mm HiPwr: 45 mm Std: 20 mm	1 x 0.25 mm Emitter 6 x 0.25 mm Receiver	2 m	min. 15 mm		
Cylindrical	dia. 3.0 mm	KLR-C09-1.25-2.0-K77	PMMA	Ultra: 110 mm HiPwr: 60 mm Std: 30 mm	1 x 0.5 mm Emitter 9 x 0.25 mm Receiver	2 m	min. 15 mm		
Cylindrical	dia. 5.0 mm	KLR-C16-2.2-2.0-K72	PMMA	Ultra: 300 mm HiPwr: 190 mm Std: 85 mm	1 x 1.0 mm Emitter 16x 0.25 mm Receiver	2 m	min. 25 mm		
Highly flexible									
Threaded	M3	KHR-C02-1.0-2.0-K96	PMMA	Ultra: 40 mm HiPwr: 25 mm Std: 12 mm	2 x 0.5 mm	2 m	min. 1 mm		
Threaded	M4	KHR-C02-1.0-2.0-K95	PMMA	Ultra: 40 mm HiPwr: 25 mm Std: 12 mm	2 x 0.5 mm	2 m	min. 1 mm		
Threaded	M4	KHR-C02-1.3-2.0-K92	PMMA	Ultra: 210 mm HiPwr: 130 mm Std: 60 mm	2 x 1.0 mm	2 m	min. 2 mm		

Head shape	Mounting	Model number	Core	Detection distance *	Fiber cross-section	Fiber optic length	Bend radius	Dimensions	Special features
Threaded	M6	KHR-C02-2.2-2.0-K94	PMMA	Ultra: 40 mm HiPwr: 25 mm Std: 12 mm	2 x 0.5 mm	2 m	min. 1 mm		
Cylindrical	dia. 3.0 mm	KHR-C02-1.3-2.0-K93	PMMA	Ultra: 200 mm HiPwr: 130 mm Std: 60 mm	2 x 1.0 mm	2 m	min. 2 mm		
Flexible									
Threaded	M6 x 0.75	KLR-C02-2.2-2.0-K70	PMMA	Ultra: 280 mm HiPwr: 180 mm Std: 80 mm	2 x 1.0 mm	2 m	min. 25 mm		
Cylindrical	dia. 3.0 mm	KLR-C02-1.3-2.0-K86	PMMA	Ultra: 280 mm HiPwr: 180 mm Std: 80 mm	2 x 1.0 mm	2 m	min. 25 mm		
Cylindrical	dia. 5.0 mm	KLR-C02-2.2-2.0-K85	PMMA	Ultra: 280 mm HiPwr: 180 mm Std: 80 mm	2 x 1.0 mm	2 m	min. 25 mm		
Bendable tip									
Threaded	M3 x 0.5	KLR 00-1.0-2.0-K58	PMMA	Ultra: 68 mm HiPwr: 40 mm Std: 20 mm		2 m	min. 15 mm		
Threaded	M6	KLR 00-2.2-2.0-K57	PMMA	Ultra: 210 mm HiPwr: 130 mm Std: 60 mm		2 m	min. 15 mm		
High detection range									
Threaded		KLR-C02-2.2-2.0-K146	PMMA	Ultra: 460 mm HiPwr: 270 mm Std: 150 mm		2 m	mind. 40 mm		
Threaded		KLR-C10-1,25-2,0-K144	PMMA	Ultra: 95 mm HiPwr: 60 mm Std: 30 mm		2 m	mind. 15 mm		
Side view / Periscope									
Threaded	M6	KHR-C02-2.2-2.0-K131	PMMA	Ultra: 210 mm HiPwr: 135 mm Std: 60 mm	2 x 1.0 mm	2 m	min. 2 mm		only 2 mm Bend radius

Head shape	Mounting	Model number	Core	Detection distance *	Fiber cross-section	Fiber optic length	Bend radius	Dimensions	Special features
Threaded	dia. 5.0 mm	KHR-C02-1.0-2.0-K132	PMMA	Ultra: 52 mm HiPwr: 33 mm Std: 15 mm	2 x 0.5 mm	2 m	min. 1 mm		only 1 mm Bend radius
Array									
Rectangular	3 x M2 x 0.5	KLR-A18-1.3-2.0-K82	PMMA	Ultra: 86 mm HiPwr: 55 mm Std: 25 mm	18 x 0.25 mm	2 m	min. 25 mm		
Rectangular	3 x M3 x 0.5	KLR-A32-2.2-2.0-K83	PMMA	Ultra: 120 mm HiPwr: 78 mm Std: 35 mm	10.85 mm	2 m	min. 25 mm		
Rectangular	2 x 3.2 mm	KLR-A32-2.2-2.0-K141	PMMA	Ultra: 120 mm HiPwr: 78 mm Std: 35 mm	16 x 0.25 mm	2 m	mind. 25 mm		
High temperature resistance									
Threaded	M6	KHTR-C02-2.2-2.0-K88	PMMA	Ultra: 280 mm HiPwr: 180 mm Std: 80 mm	2 x 1.0 mm	2 m	min. 25 mm		- 55°C ... + 115°C
Cylindrical	dia. 5.0 mm	KHTR-C02-2.2-2.0-K89	PMMA	Ultra: 280 mm HiPwr: 180 mm Std: 80 mm	2 x 1.0 mm	2 m	min. 25 mm		- 55°C ... + 115°C
Sturdy design									
Threaded	M3 x 0.5	LHR 00-0.8-1.0-14M3	glass	Ultra: 195 mm HiPwr: 100 mm Std: 40 mm	0.8 mm	1 m	4 mm static		- 40°C ... + 180°C
Threaded	M4 x 0.7	LHR 00-0.8-1.0-20M4	glass	Ultra: 195 mm HiPwr: 100 mm Std: 40 mm	0.8 mm	1 m	4 mm static		- 40°C ... + 180°C
Threaded	M6	LHR 00-1.1-1.0-G	glass	Ultra: 230 mm HiPwr: 156 mm Std: 70 mm	1.1 mm	1 m	4 mm static		- 40°C ... + 180°C
Cylindrical	dia. 3 mm	LHR 00-1.1-1.0-Z1	glass	Ultra: 230 mm HiPwr: 156 mm Std: 70 mm	1.1 mm	1 m	4 mm static		- 40°C ... + 180°C
Cylindrical	dia. 4.5 mm	LHR 00-1.1-1.0-K1	glass	Ultra: 230 mm HiPwr: 156 mm Std: 70 mm	1.1 mm	1 m	4 mm static		- 40°C ... + 180°C

	Std: Standard Mode, 160 μ s HiPwr: HighPower Mode, 500 μ s Ultra: Ultra Mode, 5 ms
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