F 10 – family of sub-miniature sensors

Small housings, great performance

TYPICAL F 10

- Sub-miniature sensor for installation in the smallest of spaces and in moving machine parts

- The world's smallest laser sensor with background suppression, adjustable via teach-in

- Sensors as LED or laser versions

- F 10 BlueLight: specially designed for scanning solar wafers and strongly light-absorbing objects

- User-friendly commissioning via electronic teach-in button or control wire

- Well thought-out mounting accessories for rapid and simple integration

Simple mounting:
Mounting using a dovetail that permits fine retro-adjustment of the sensor is particularly recommended when space is limited.

Special characteristics:
The glass-fibre-reinforced plastic housing with its integrated mounting sleeve, dovetail guide on the back, and laser-marked indelible type code are characteristic of the F 10.

Mini-sensor with maximum ease-of-use:
Simple commissioning with an electronic teach-in button and easily visible status LEDs is by no means typical for housings of this size.

The sensors of the F 10 series, available as LED and laser versions, form one of the most comprehensive series on the market in sub-miniature housings. Their precise background suppression, adjustable via teach-in, makes the sensors unique. The light spot of the F 10 laser sensors also remains so focused that small parts in the millimetre range can still be reliably detected even at long distances – for example, a wire with a diameter of 0.5 mm at a distance of 60 mm. One highlight of the new F 10 LED sensors is the F 10 BlueLight with its blue transmission LED, specially developed for detecting solar wafers and strongly light-absorbing objects using the scanning principle.

The F 10 sensors not only impress through their excellent performance data, but also through their unmistakeable design with special features – unique in this size of housing. The dovetail mounting system considerably simplifies fine adjustment, particularly in difficult installation locations, and the various connection variants allow rapid commissioning and replacement. The mounting holes of the sub-miniature sensors are reinforced with metal eyelets. A small sensor that will give users great pleasure!

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F 10 Product Overview					
	Type of light	Adjustment	Scanning distance/range	Special features	Page
Photoelectric diffuse sensors with background suppression					
FT 10-RLH	Laser	Teach-in	70 mm	The only scanner with scanning distance adjustment, IO-Link	368
FT 10-B-RLF	Laser	Fixed focus	15 mm / 30 mm		370
FT 10-RH	LED	Teach-in	70 mm	IO-Link	372
FT 10-RF	LED	Fixed focus	15 mm / 30 mm / 50 mm		374
FT 10-BF	LED, blue	Fixed focus	30 mm / 50 mm	BlueLight technology	376
Photoelectric retro-reflective sensors					
FR 10-RL	Laser	Teach-in	2 m	Long range, precise small-part detection	378
FR 10-R	LED	Teach-in	1.6 m	Long range	380
Photoelectric through-beam sensors					
FS/FE 10-RL	Laser	Teach-in	3 m	Sensor pair, very accurate object positioning	382
FS 10-RL/FE 10-RL	Laser	Teach-in	3 m	Transmitter/receiver, very accurate object positioning	384

FT 10-RLH

Diffuse laser sensor with background suppression

PRODUCT HIGHLIGHTS

- Sub-miniature sensor with laser light and adjustable background suppression

- Precise and reliable switching behaviour, even with varying object surfaces and colors

- Reliable operation even with highly reflective machine parts in the background, thanks to SensoPart ASIC technology

- Particularly suitable for detecting the smallest of parts and for installation in extremely confined spaces

- Setting of smart functions via IO-Link

Optical data	
Scanning distance	6 … 70 mm[1]
Adjustment range	10 … 70 mm[1]
Type of light	Laser, red, 655 nm
Light spot size (total detection area)	1 × 3 mm
Laser Class (IEC 60825-1)	1

Functions		
Indicator LED, green	Operating voltage indicator	
Indicator LED, yellow	Switching output indicator	
Scanning distance adjustment	Via Teach-in button, control input[6] and IO-Link	
Adjustment possibilities	N.O./N.C. and Auto-Detect / NPN / PNP via teach-in button, control input[6] and IO-Link Button lock via control input[6] and IO-Link Wide variety of adjustment possibilities via IO-Link	
Default settings	Max. scanning distance and N.O.	

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 20 mA
Output current, le	≤ 50 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Switching output, Q	1× Auto-Detect (PNP/NPN)[3]
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 800 Hz
Response time	500 µs
Control input, IN (only 4-pin design)	$+U_B$ = teach-in -U_B = button locked Open = normal operation

Mechanical data	
Dimensions	21.1 × 14.6 × 8 mm
Enclosure rating	IP 67[4]
Material, housing	PUR
Material, front screen	PMMA
Type of connection	See selection table
Ambient temperature: operation	-20 … +50 °C[5]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	Approx. 3 g
Weight (cable device)	Approx. 22 g
Weight (pigtail)	Approx. 10 g

IO-Link	
Communication mode	COM 2
Min. cycletime	2.3 ms
SIO mode	Compatible
Length process data	16 Bit
Specification	1.1

[1] Reference material white, 90 % reflectivity [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] Auto-Detect, automatic PNP/NPN selection by the sensor, PNP or NPN fixed
[4] With connected IP 67 plug [5] UL: -20 … +30 °C
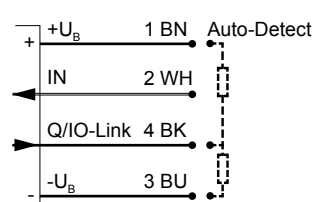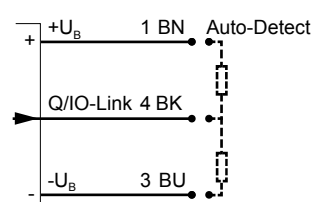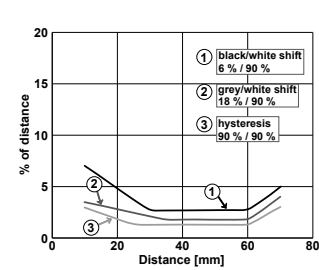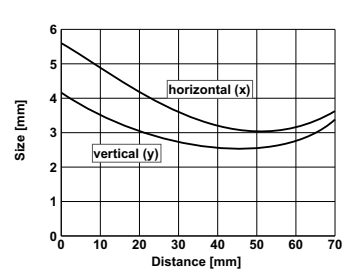
Version: 02/2019. Subject to changes; diagrams similar

Scanning distance	Switching output	Type of connection	Part number	Article number
6 … 70 mm	Auto-Detect	Plug, M5x0.5, 4-pin, IO-Link ❂	FT 10-RLH-PNSL-E4	600-11163
6 … 70 mm	Auto-Detect	Cable, 2 m, 4-wire, IO-Link ❂	FT 10-RLH-PNSL-K4	600-11164
6 … 70 mm	Auto-Detect	Pigtail, 200 mm with M8 plug, 4-pin, IO-Link ❂	FT 10-RLH-PNSL-KM4	600-11165
6 … 70 mm	Auto-Detect	Pigtail, 200 mm with M8 plug, 3-pin, IO-Link ❂	FT 10-RLH-PNSL-KM3	600-11166

Including dovetail clamp mounting MBD F 10 for all types

Plug connection

153-00894

Cable connection

153-00895

Connection, 4-pin, IO-Link

154-00566

Connection, 3-pin, IO-Link

154-00572

Scanning properties

① black/white shift 6 % / 90 %
② grey/white shift 18 % / 90 %
③ hysteresis 90 % / 90 %
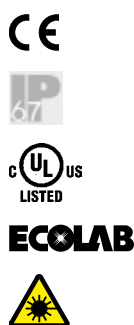
155-02719

Light spot size

155-01770

Reference material	Detection range	Accessories	
White (90 %)	6 … 70 mm	Connection cables	From Page A-46
Grey (18 %)	7 … 70 mm	Brackets	From Page A-4
Black (6 %)	7 … 70 mm	SensoIO (901-01000)	From Page A-56

FT 10-B-RLF

Diffuse laser sensor with background suppression, fixed focus

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IP 67
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PRODUCT HIGHLIGHTS

- Sub-miniature sensor with laser light and precise fixed background suppression
- Reliable switching behaviour even with varying object surfaces and colors
- Particularly suitable for detecting the smallest of parts and for installation in extremely confined spaces
- Tamper-proof sensor design – no misalignment possible
- Robust, glass-fibre-reinforced plastic housings

Optical data	
Scanning distance	6 … 15 mm[1]
	6 … 30 mm[1]
Type of light	Laser, red, 655 nm
Light spot size (total detection area)	1 × 3 mm
Laser Class (IEC 60825-1)	1

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Adjustment possibilities	N.O. / N.C. via control input

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 12 mA
Output current, le	≤ 50 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Switching output, Q	PNP/NPN (see selection table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Control input, IN (only 4-pin design)	$+U_B$ = N.C. $-U_B$ / Open = N.O.

Mechanical data	
Dimensions	21.1 × 14.6 × 8 mm
Enclosure rating	IP 67[3]
Material, housing	PUR
Material, front screen	PMMA
Type of connection	See selection table
Ambient temperature: operation	-20 … +50 °C[4]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	Approx. 3 g
Weight (cable device)	Approx. 22 g
Weight (pigtail)	Approx. 10 g

[1] Reference material white, 90 % reflectivity   [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz   [3] With connected IP 67 plug   [4] UL: -20 ... +30 °C
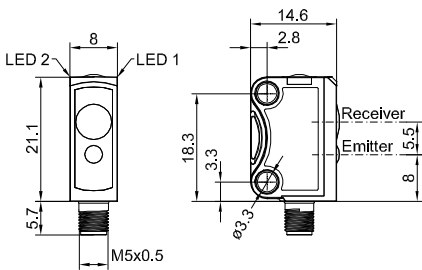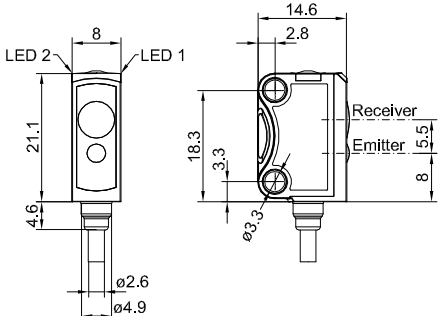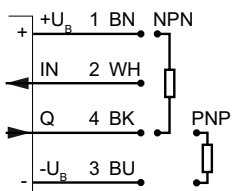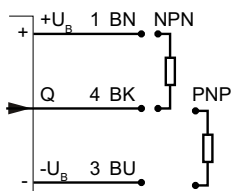
Operating range	Switching output	Type of connection	Part number	Article number
6 … 15 mm	PNP	Plug, M5x0.5, 4-pin	FT 10-B-RLF1-PS-E4	600-11100
6 … 15 mm	NPN	Plug, M5x0.5, 4-pin	FT 10-B-RLF1-NS-E4	600-11101
6 … 30 mm	PNP	Plug, M5x0.5, 4-pin	FT 10-B-RLF2-PS-E4	600-11106
6 … 30 mm	NPN	Plug, M5x0.5, 4-pin	FT 10-B-RLF2-NS-E4	600-11107
6 … 15 mm	PNP	Cable, 2 m, 4-wire	FT 10-B-RLF1-PS-K4	600-11102
6 … 15 mm	NPN	Cable, 2 m, 4-wire	FT 10-B-RLF1-NS-K4	600-11103
6 … 30 mm	PNP	Cable, 2 m, 4-wire	FT 10-B-RLF2-PS-K4	600-11108
6 … 30 mm	NPN	Cable, 2 m, 4-wire	FT 10-B-RLF2-NS-K4	600-11109
6 … 15 mm	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-B-RLF1-PS-KM4	600-11104
6 … 15 mm	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-B-RLF1-NS-KM4	600-11105
6 … 30 mm	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-B-RLF2-PS-KM4	600-11110
6 … 30 mm	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-B-RLF2-NS-KM4	600-11111

Version: 02/2019. Subject to changes; diagrams similar

Operating range	Switching output	Type of connection	Part number	Article number
6 … 15 mm	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-B-RLF1-PS-KM3	600-11142
6 … 15 mm	NPN	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-B-RLF1-NS-KM3	600-11143
6 … 30 mm	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-B-RLF2-PS-KM3	600-11144
6 … 30 mm	NPN	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-B-RLF2-NS-KM3	600-11145

Including dovetail clamp mounting MBD F 10 for all types

Plug connection	Cable connection

Connection, 4-pin	Connection, 3-pin

Reference material	Detection range
White (90 %)	6 … 15 mm / 30 mm
Grey (18 %)	7 … 15 mm / 30 mm
Black (6 %)	7 … 15 mm / 30 mm

Accessories	
Connection cables	From Page A-46
Brackets	From Page A-4

7

FT 10-RH

Photoelectric diffuse sensor with background suppression

PRODUCT HIGHLIGHTS

- Sub-miniature sensor with precise adjustable background suppression
- Precise and reliable switching behaviour even with varying object surfaces and colors
- Reliable operation even with highly reflective machine parts in the background, thanks to SensoPart ASIC technology
- Static and dynamic teach-in via electronic teach-in button or control line
- Setting of smart functions via IO-Link

Optical data

Scanning distance	5 … 70 mm[1]
Adjustment range	10 … 70 mm[1]
Used light	LED, red, 650 nm
Light spot size	See diagram
Repeatability	0,45 mm[2, 3]
Hysteresis	≤ 2 mm[2]
Grey/white shift (18 % / 90 %)	≤ 3 mm[2]
Black/white shift (6 % / 90 %)	≤ 4 mm[2]

Functions

Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Scanning distance adjustment	Via Teach-in button, control input[6] and IO-Link
Teach-in modes	Mode 1: during running process Mode 2: during standing process
Adjustment possibilities	N.O./N.C. and Auto-Detect / NPN / PNP via teach-in button, control input[6] and IO-Link Button lock via control input[6] and IO-Link Wide variety of adjustment possibilities via IO-Link
Default settings	Max. range and N.O.

Electrical data

Operating voltage, $+U_B$	10 … 30 V DC[4]
No-load current, I_0	≤ 20 mA
Output current, Ie	≤ 50 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection class	2
Power On Delay	< 300 ms
Switching output, Q	1× Auto-Detect (PNP/NPN)[5]
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 800 Hz
Response time	500 µs
Control input, IN[3]	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

Mechanical data

Dimensions	21,1 x 14,6 x 8 mm
Enclosure rating	IP 67[7]
Material, housing	PUR
Material, front screen	PMMA
Type of connection	See selection table
Ambient temperature: operation	-20 … +60 °C[8]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	Approx. 3 g
Weight (cable device)	Approx. 22 g
Weight (pigtail)	Approx. 10 g

IO-Link

Communication mode	COM 2
Min. cycletime	2.3 ms
SIO mode	Compatible
Length process data	16 Bit
Specification	1.1

[1] Reference material white, 90 % reflectivity   [2] At maximum scanning distance   [3] In constant environmental conditions   [4] Max. 10 % ripple within U_B, ~ 50 Hz / 100 Hz
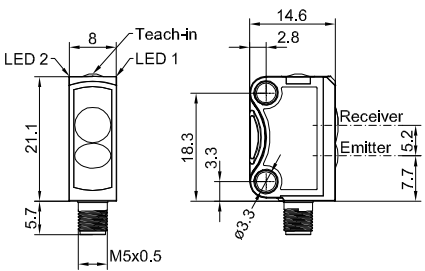[5] Auto-Detect, automatic PNP/NPN selection by the sensor, PNP or NPN fixed   [6] Only 4-pin design   [7] With connected IP 67 plug   [8] UL: -20 ... +30 °C
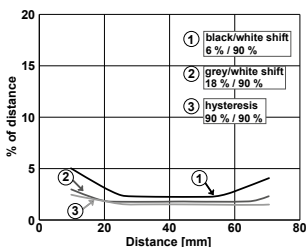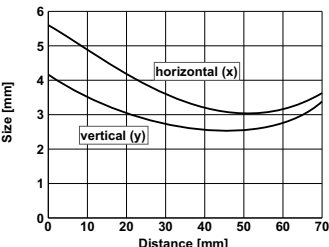
Version: 02/2019. Subject to changes; diagrams similar

Scanning distance	Switching output	Type of connection	Part number	Article number
5 … 70 mm[1]	Auto-Detect	Plug, M5x0.5, 4-pin, IO-Link ❧	FT 10-RH-PNSL-E4	600-11048
5 … 70 mm[1]	Auto-Detect	Cable, 2 m, 4-wire, IO-Link ❧	FT 10-RH-PNSL-K4	600-11049
5 … 70 mm[1]	Auto-Detect	Pigtail, 200 mm with M8 plug, 4-pin, IO-Link ❧	FT 10-RH-PNSL-KM4	600-11050
5 … 70 mm[1]	Auto-Detect	Pigtail, 200 mm with M8 plug, 3-pin, IO-Link ❧	FT 10-RH-PNSL-KM3	600-11051

Including dovetail clamp mounting MBD F 10 for all types

Plug connection

153-01109

Cable connection

153-01110

Connection, 4-pin, IO-Link

154-00566

Connection, 3-pin, IO-Link

154-00572

Scanning properties

155-02718

Light spot size

155-01770

Reference material		Detection range	Accessories	
White (90 %)		5 … 70 mm	Connection cables	From Page A-46
Grey (18 %)		8 … 70 mm	Brackets	From Page A-4
Black (6 %)		8 … 70 mm	SensoIO (901-01000)	From Page A-56

FT 10-RF

Photoelectric diffuse sensor with background suppression, fixed focus

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ECOLAB

PRODUCT HIGHLIGHTS

- Sub-miniature sensor with precise fixed background suppression
- Economical multi-purpose sensor
- Reliable switching behaviour even with varying object surfaces and colors
- Tamper-proof sensor design – no misalignment possible
- Simple mounting and adjustment through innovative dovetail clamp mounting

Optical data	
Scanning distance	2 … 15 mm[1]
	2 … 30 mm[1]
	2 … 50 mm[1]
Used light	LED, red, 650 nm
Light spot size	See diagram

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Adjustment possibilities	N.O. / N.C. via control input[3]

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 20 mA
Output current, Ie	≤ 50 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection class	2
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see selection table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Control input, IN[3]	$+U_B$ = N.C.
	$-U_B$ / Open = N.O.

Mechanical data	
Dimensions	21,1 x 14,6 x 8 mm
Enclosure rating	IP 67[4]
Material, housing	PUR
Material, front screen	PMMA
Type of connection	See selection table
Ambient temperature: operation	-20 … +60 °C[5]
Ambient temperature: storage	-20 … +80 °C
Weight (cable device)	Approx. 22 g
Weight (pigtail)	Approx. 10 g

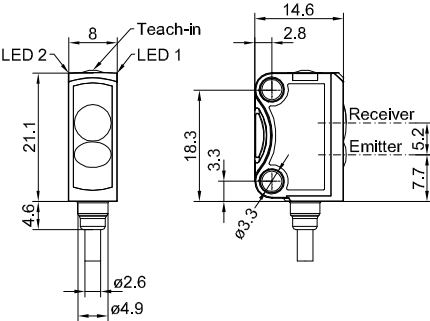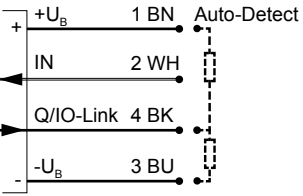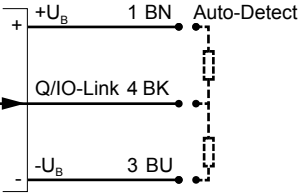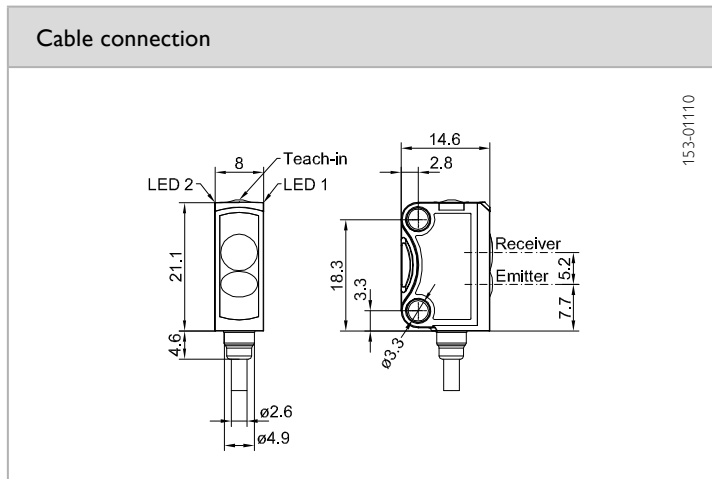[1] Reference material white, 90 % reflectivity   [2] Max. 10 % ripple within U_B, ~ 50 Hz / 100 Hz   [3] Only 4-pin design   [4] With connected IP 67 plug   [5] UL: -20 ... +30 °C

Scanning distance	Switching output	Type of connection	Part number	Article number
2 … 15 mm[1]	PNP	Cable, 2 m, 4-wire	FT 10-RF1-PS-K4	600-11008
2 … 15 mm[1]	NPN	Cable, 2 m, 4-wire	FT 10-RF1-NS-K4	600-11011
2 … 30 mm[1]	PNP	Cable, 2 m, 4-wire	FT 10-RF2-PS-K4	600-11014
2 … 30 mm[1]	NPN	Cable, 2 m, 4-wire	FT 10-RF2-NS-K4	600-11017
2 … 50 mm[1]	PNP	Cable, 2 m, 4-wire	FT 10-RF3-PS-K4	600-11020
2 … 50 mm[1]	NPN	Cable, 2 m, 4-wire	FT 10-RF3-NS-K4	600-11023
2 … 15 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-RF1-PS-KM4	600-11009
2 … 15 mm[1]	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-RF1-NS-KM4	600-11012
2 … 30 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-RF2-PS-KM4	600-11015
2 … 30 mm[1]	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-RF2-NS-KM4	600-11018
2 … 50 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-RF3-PS-KM4	600-11021
2 … 50 mm[1]	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-RF3-NS-KM4	600-11024
2 … 15 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-RF1-PS-KM3	600-11010
2 … 15 mm[1]	NPN	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-RF1-NS-KM3	600-11013

Version: 02/2019. Subject to changes; diagrams similar

Scanning distance	Switching output	Type of connection	Part number	Article number
2 … 30 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-RF2-PS-KM3	600-11016
2 … 30 mm[1]	NPN	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-RF2-NS-KM3	600-11019
2 … 50 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-RF3-PS-KM3	600-11022
2 … 50 mm[1]	NPN	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-RF3-NS-KM3	600-11025

Including dovetail clamp mounting MBD F 10 for all types

Cable connection

153-01110

Connection, 4-pin

154-00312

Connection, 3-pin

154-00311

Light spot size

155-01769
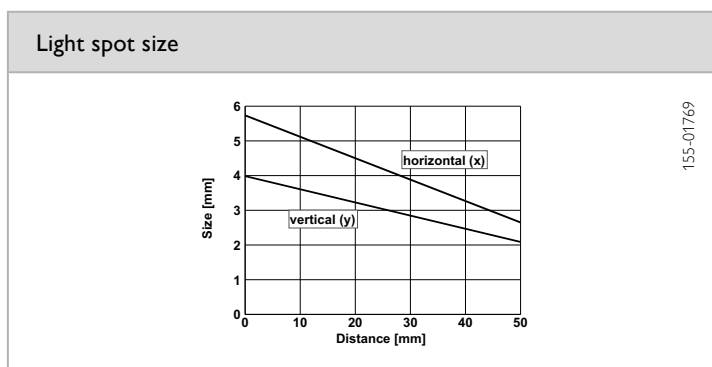
Reference material	Detection range			Accessories	
	FT 10-RF1	FT 10-RF2	FT 10-RF3	Connection cables	From Page A-46
white (90 %)	2 … 15 mm	2 … 30 mm	2 … 50 mm	Brackets	From Page A-4
grey (18 %)	3 … 15 mm	4 … 30 mm	5 … 50 mm		
black (6 %)	4 … 15 mm	5 … 30 mm	7 … 50 mm		

FT 10-BF

BlueLight-Photoelectric diffuse sensor with background suppression, fixed focus

PRODUCT HIGHLIGHTS

- Sub-miniature sensor with BlueLight technology and precise fixed background suppression

- Reliable switching behaviour with strongly light-absorbing and transparent objects, e.g. solar wafers in every process phase

- Reliable operation without reflector - even with critical surfaces

- Tamper-proof sensor design - no misalignment possible

- Simple mounting and adjustment through innovative dovetail clamp mounting

Optical data

Scanning distance	2 … 30 mm[1] / 2 … 50 mm[1]
Optimum scanning distance	15 … 20 mm
Used light	LED, blue, 450 nm
LED risk group (DIN 62471)	2
Light spot size	See diagram
Ambient light	EN 60947-5-2

Functions

Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Adjustment possibilities	N.O. / N.C. via control input[3]

Electrical data

Operating voltage $+U_B$	10 … 30 V DC[2]
No-load supply current I_0	≤ 20 mA
Output current Ie	≤ 50 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection class	2
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see selection table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	1000 Hz
Response time	500 µs
Control input, IN[3]	$+U_B$ = N.C. $-U_B$ / Open = N.O.

Mechanical data

Dimensions	21,1 x 14,6 x 8 mm
Enclosure rating	IP 67[4]
Material, housing	PUR
Material, front screen	PMMA
Type of connection	See selection table
Ambient temperature: operation	-20 … +50 °C[5]
Ambient temperature: storage	-20 … +80 °C
Weight (cable device)	Approx. 22 g
Weight (pigtail)	Approx. 10 g

[1] Reference material white, 90 % reflectivity   [2] Max. residual ripple 10 %, within U_B, approx. 50 Hz/100 Hz   [3] Only 4-pin design   [4] With connected IP 67 plug   [5] UL: -20 … +30 °C
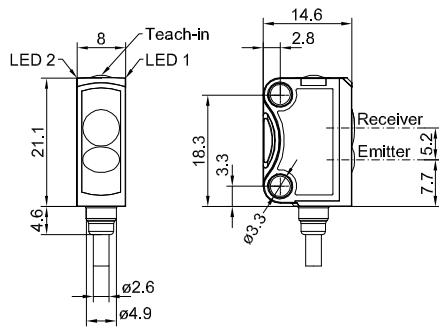
Scanning distance	Switching output	Type of connection	Part number	Article number
2 … 30 mm[1]	PNP	Cable, 2 m, 4-wire	FT 10-BF2-PS-K4	600-11026
2 … 30 mm[1]	NPN	Cable, 2 m, 4-wire	FT 10-BF2-NS-K4	600-11029
2 … 30 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-BF2-PS-KM4	600-11027
2 … 30 mm[1]	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-BF2-NS-KM4	600-11030
2 … 30 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-BF2-PS-KM3	600-11028
2 … 30 mm[1]	NPN	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-BF2-NS-KM3	600-11031
2 … 50 mm[1]	PNP	Cable, 2 m, 4-wire	FT 10-BF3-PS-K4	600-11036
2 … 50 mm[1]	NPN	Cable, 2 m, 4-wire	FT 10-BF3-NS-K4	600-11039
2 … 50 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-BF3-PS-KM4	600-11037
2 … 50 mm[1]	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-BF3-NS-KM4	600-11040
2 … 50 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-BF3-PS-KM3	600-11038
2 … 50 mm[1]	NPN	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-BF3-NS-KM3	600-11041

Including dovetail clamp mounting MBD F 10 for all types

Version: 02/2019. Subject to changes; diagrams similar

Cable connection

153-01110

LED 2 — Teach-in — LED 1

8

14.6
2.8

21.1

18.3
3.3

ø3.3

4.6

Receiver
Emitter

5.2
7.7

ø2.6
ø4.9

Connection, 4-pin

154-00312

+U_B 1 BN   NPN
+
IN   2 WH
Q   4 BK   PNP
-U_B 3 BU
-

Connection, 3-pin

154-00311

+U_B 1 BN   NPN
+
Q   4 BK   PNP
-U_B 3 BU
-

7

Light spot size

155-01769

horizontal (x)

vertical (y)

Size [mm]

6
5
4
3
2
1
0

0   10   20   30   40   50
Distance [mm]
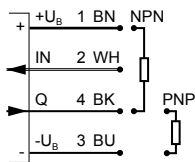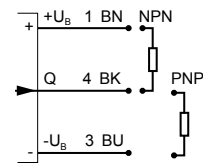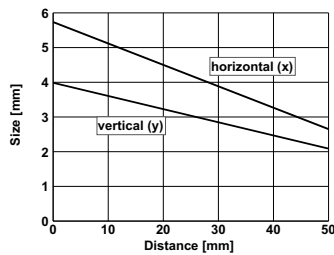
Accessories

Connection cables	From Page A-46
Brackets	From Page A-4

FR 10-RL

Retro-reflective laser sensor

CE
IP 67
c (UL) us LISTED
ECOLAB

PRODUCT HIGHLIGHTS

- Sub-miniature sensor for installation in the smallest of spaces
- Bright, precise laser light spot for optimum small-part detection and simple alignment
- Suitable for numerous different reflectors
- User-friendly operation via electronic Teach-in button or control line
- Robust, glass-fibre-reinforced plastic housings

Optical data	
Limit range	0.1 … 4 m[1]
Operating range	0.1 … 3 m[1]
Type of light	Laser, red, 655 nm
Light spot size	See diagram
Laser Class (IEC 60825-1)	1

Functions		
Indicator LED, green	Operating voltage indicator	
Indicator LED, yellow	Switching output indicator	
Sensitivity adjustment	Via Teach-in button and control input	
Teach-in modes	Mode 1: during running process Mode 2: during standing process	
Adjustment possibilities	N.O. / N.C. via Teach-in button and control input Button lock via control input	
Default settings	Max. range and N.O.	

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 12 mA
Output current, le	≤ 50 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Switching output, Q	PNP/NPN (see selection table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Control input, IN (only 4-pin design)	$+U_B$ = teach-in -U_B = button locked Open = normal operation

Mechanical data	
Dimensions	21.1 x 14.6 x 8 mm
Enclosure rating	IP 67[3]
Material, housing	PUR
Material, front screen	PMMA
Type of connection	See selection table
Ambient temperature: operation	-20 … +50 °C[4]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	Approx. 3 g
Weight (cable device)	Approx. 22 g
Weight (pigtail)	Approx. 10 g

[1] Reference material: R5/L reflector   [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz   [3] With connected IP 67 plug   [4] UL: -20 ... +30 °C

Operating range	Switching output	Type of connection	Part number	Article number
0.1 … 3 m	PNP	Plug, M5x0.5, 4-pin	FR 10-RL-PS-E4	603-31000
0.1 … 3 m	NPN	Plug, M5x0.5, 4-pin	FR 10-RL-NS-E4	603-31001
0.1 … 3 m	PNP	Cable, 2 m, 4-wire	FR 10-RL-PS-K4	603-31002
0.1 … 3 m	NPN	Cable, 2 m, 4-wire	FR 10-RL-NS-K4	603-31003
0.1 … 3 m	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FR 10-RL-PS-KM4	603-31004
0.1 … 3 m	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FR 10-RL-NS-KM4	603-31005
0.1 … 3 m	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FR 10-RL-PS-KM3	603-31006
0.1 … 3 m	NPN	Pigtail, 200 mm with M8 plug, 3-pin	FR 10-RL-NS-KM3	603-31007

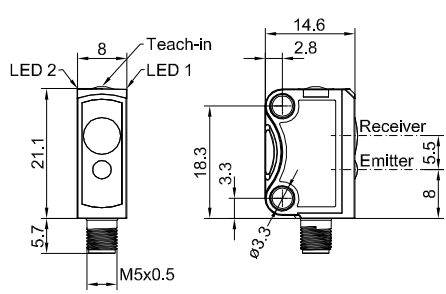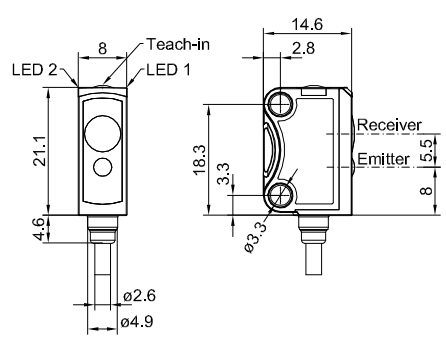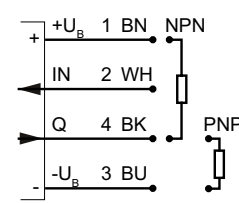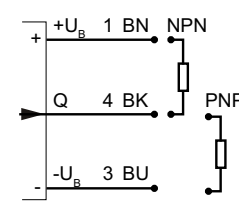Including dovetail clamp mounting MBD F 10 for all types

Version: 02/2019. Subject to changes; diagrams similar

Plug connection

153-00894

Teach-in
LED 2
LED 1
8
14.6
2.8
21.1
18.3
3.3
Receiver
Emitter
5.5
8
5.7
ø3.3
M5x0.5

Cable connection

153-00895

LED 2
LED 1
Teach-in
8
14.6
2.8
21.1
18.3
3.3
Receiver
Emitter
5.5
8
4.6
ø3.3
ø2.6
ø4.9

Connection, 4-pin

154-00508

+U$_B$ 1 BN   NPN
+
IN   2 WH
Q   4 BK   PNP
-U$_B$ 3 BU
-

Connection, 3-pin

154-00509

+U$_B$ 1 BN   NPN
+
Q   4 BK   PNP
-U$_B$ 3 BU
-

7

Light spot size

155-01289

horizontal (x)
vertical (y)
Size [mm]
Distance [m]

Reflector / Reflective foil*	Operating range	Accessories	
R5/L	0.1 … 3 m	Reflectors	From Page A-18
RF-100 KL*	0.1 … 3 m	Connection cables	From Page A-46
		Brackets	From Page A-4

FR 10-R

Photoelectric retro-reflective sensor

PRODUCT HIGHLIGHTS

- Sub-miniature sensor for installation in the smallest of spaces
- Despite very small sensor housing very long operating range of 1.6 m
- Fast response time: only 500 µs
- Static and dynamic teach-in via electronic teach-in button or control line
- Simple mounting and adjustment through innovative dovetail clamp mounting

Optical data	
Operating range	0.1 … 1.6 m[1]
Used light	LED, red, 650 nm
Light spot size	See diagram
Polarising filter	Yes

Functions	
Indicator LED green	Operating voltage indicator
Indicator LED yellow	Switching output indicator
Sensitivity adjustment	Via Teach-in button and control input[3]
Teach-in modes	Mode 1: during running process Mode 2: during standing process
Adjustment possibilities	N.O./N.C. via Teach-in button and control input[3] Button lock via control input[3]
Default settings	Max. range and N.O.

Electrical data	
Operating voltage, +U_B	10 … 30 V DC[2]
No-load current, I_0	≤ 20 mA
Output current, le	≤ 50 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection class	2
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see selection table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Control input, IN[3]	+U_B = teach-in -U_B = button locked Open = normal operation

Mechanical data	
Dimensions	21,1 x 14,6 x 8 mm
Enclosure rating	IP 67[4]
Material, housing	PUR
Material, front screen	PMMA
Type of connection	See selection table
Ambient temperature: operation	-20 … +60 °C[5]
Ambient temperature: storage	-20 … +80 °C
Weight (cable device)	Approx. 22 g
Weight (pigtail)	Approx. 10 g

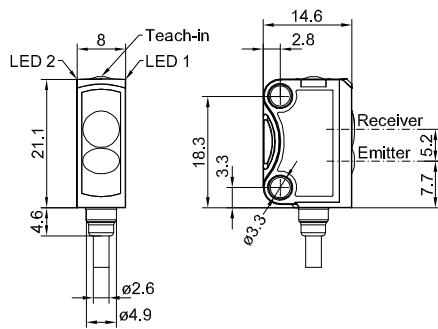[1] Reference material reflector R5   [2] Max. 10 % ripple within U_B, ~ 50 Hz / 100 Hz   [3] Only 4-pin design   [4] With connected IP 67 plug   [5] UL: -20 ... +30 °C

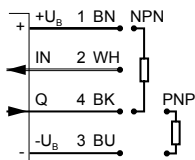| Operating range	Switching output	Type of connection	Part number	Article number-Nr.
0.1 … 1.6 m[1]	PNP	Cable, 2 m, 4-wire	FR 10-R-PS-K4	603-11001
0.1 … 1.6 m[1]	NPN	Cable, 2 m, 4-wire	FR 10-R-NS-K4	603-11004
0.1 … 1.6 m[1]	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FR 10-R-PS-KM4	603-11002
0.1 … 1.6 m[1]	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FR 10-R-NS-KM4	603-11005
0.1 … 1.6 m[1]	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FR 10-R-PS-KM3	603-11003
0.1 … 1.6 m[1]	NPN	Pigtail, 200 mm with M8 plug, 3-pin	FR 10-R-NS-KM3	603-11006

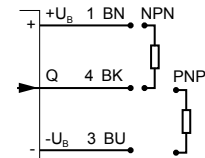Including dovetail clamp mounting MBD F 10 for all types

Version: 02/2019. Subject to changes; diagrams similar

Cable connection

153-01110

Teach-in	
LED 2	LED 1
8	14.6
2.8	
21.1	18.3
4.6	3.3
ø2.6	Receiver
ø4.9	Emitter 5.2
	7.7
	ø3.3

Connection, 4-pin

154-00312

```
+UB   1 BN    NPN
+
IN    2 WH
Q     4 BK         PNP
-UB   3 BU
```

Connection, 3-pin

154-00311

```
+UB   1 BN    NPN
+
Q     4 BK         PNP
-UB   3 BU
-
```

Light spot size

155-01767

horizontal (x)

vertical (y)

Size [mm]: 0, 20, 40, 60, 80, 100, 120, 140
Distance [m]: 0, 0.2, 0.4, 0.6, 0.8, 1, 1.2, 1.4, 1.6
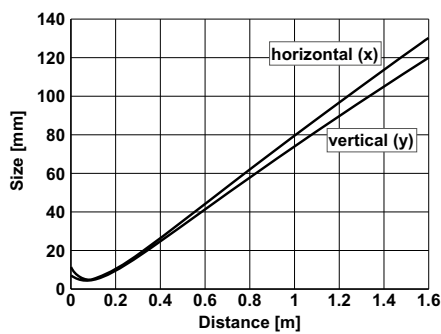
Reflector / Reflective foil*	Operating range (min./max. reflector distance)	Accessories	
R5	0.1 … 1.6 m	Reflectors	From Page A-18
R1	0.1 … 1 m	Connection cables	From Page A-46
R2-2LB1	0,15 … 0,5 m	Brackets	From Page A-4
R3-2LK1	0,15 … 0,5 m		
RF-100 KL*	0,15 … 1 m		

FS/FE 10-RL

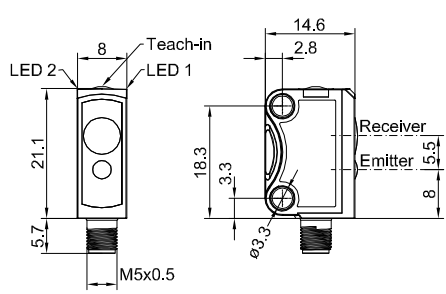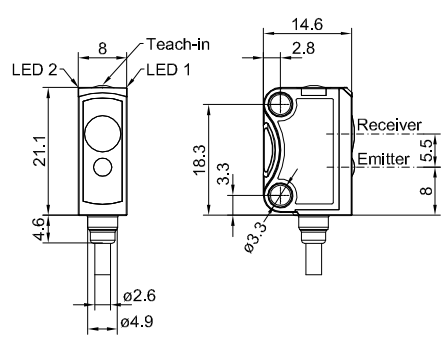## Through-beam laser sensor

PRODUCT HIGHLIGHTS

- Sub-miniature sensor for installation in the smallest of spaces
- Bright, precise laser light spot for optimum small-part detection and simple alignment
- High switching frequency for detection in even the fastest processes
- User-friendly operation via electronic Teach-in button or control line
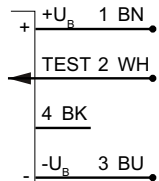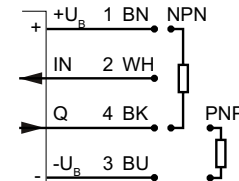- Robust, glass-fibre-reinforced plastic housings

Optical data	
Limit range	0 … 5 m
Operating range	0 … 4 m
Type of light	Laser, red, 655 nm
Light spot size	See diagram
Laser Class (IEC 60825-1)	1

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running process Mode 2: during standing process
Adjustment possibilities (receiver)	N.O. / N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. range and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
No-load current, I_0	≤ 12 mA
Output current, Ie	≤ 50 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Switching output, Q	PNP/NPN (see selection table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 4000 Hz
Response time	125 µs
Control input, IN (receiver) (only 4-pin design)	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation
Control input, Test (transmitter)	$+U_B$ = Test (transmitter off) $-U_B$ / Open = normal operation

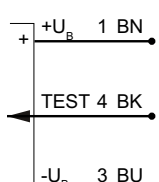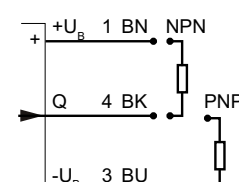| Mechanical data	
Dimensions	21.1 × 14.6 × 8 mm
Enclosure rating	IP 67[2]
Material, housing	PUR
Material, front screen	PMMA
Type of connection	See selection table
Ambient temperature: operation	-20 ... +50 °C[3]
Ambient temperature: storage	-20 ... +80 °C
Weight (plug device)	Approx. 6 g
Weight (cable device)	Approx. 44 g
Weight (pigtail)	Approx. 20 g

[1] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz   [2] With connected IP 67 plug   [3] UL: -20 ... +30 °C

Operating range	Switching output	Type of connection	Part number	Design	Article number
1 … 4 m	PNP	Plug, M5×0.5, 4-pin	FS/FE 10-RL-PS-E4	Sensor pair (transmitter & receiver)	611-51000
1 … 4 m	NPN	Plug, M5×0.5, 4-pin	FS/FE 10-RL-NS-E4	Sensor pair (transmitter & receiver)	611-51001
1 … 4 m	PNP	Cable, 2 m, 4-wire	FS/FE 10-RL-PS-K4	Sensor pair (transmitter & receiver)	611-51002
1 … 4 m	NPN	Cable, 2 m, 4-wire	FS/FE 10-RL-NS-K4	Sensor pair (transmitter & receiver)	611-51003
1 … 4 m	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FS/FE 10-RL-PS-KM4	Sensor pair (transmitter & receiver)	611-51004
1 … 4 m	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FS/FE 10-RL-NS-KM4	Sensor pair (transmitter & receiver)	611-51005
1 … 4 m	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FS/FE 10-RL-PS-KM3	Sensor pair (transmitter & receiver)	611-51006
1 … 4 m	NPN	Pigtail, 200 mm with M8 plug, 3-pin	FS/FE 10-RL-NS-KM3	Sensor pair (transmitter & receiver)	611-51007

Including dovetail clamp mounting MBD F 10 for all types

Version: 02/2019. Subject to changes; diagrams similar

Plug connection

153-00894

LED 2
LED 1
Teach-in
8
21.1
5.7
M5x0.5
14.6
2.8
18.3
3.3
ø3.3
Receiver
Emitter
5.5
8

Cable connection

153-00895

LED 2
LED 1
Teach-in
8
21.1
4.6
ø2.6
ø4.9
14.6
2.8
18.3
3.3
ø3.3
Receiver
Emitter
5.5
8

Connection, transmitter, 4-pin

154-00511

+U_B 1 BN
TEST 2 WH
4 BK
-U_B 3 BU

Connection, receiver, 4-pin

154-00508

+U_B 1 BN   NPN
IN   2 WH
Q   4 BK   PNP
-U_B 3 BU

Connection, transmitter, 3-pin

154-00514

+U_B 1 BN
TEST 4 BK
-U_B 3 BU

Connection, receiver, 3-pin

154-00509

+U_B 1 BN   NPN
Q   4 BK   PNP
-U_B 3 BU

Light spot size

155-01321

horizontal (x)
vertical (y)
Size [mm]
Distance [m]

Accessories

Connection cables	From Page A-46
Brackets	From Page A-4

7

FS 10-RL / FE 10-RL

Through-beam laser sensor

PRODUCT HIGHLIGHTS

- Sub-miniature sensor for installation in the smallest of spaces
- Bright, precise laser light spot for optimum small-part detection and simple alignment
- High switching frequency for detection in even the fastest processes
- User-friendly operation via electronic Teach-in button or control line
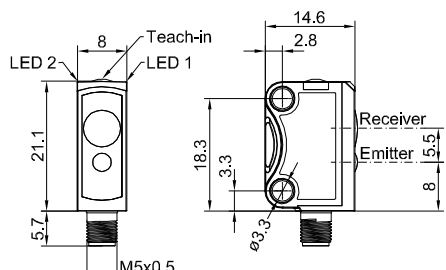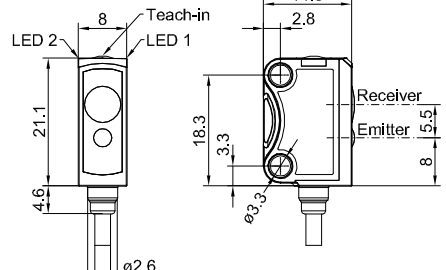- Robust, glass-fibre-reinforced plastic housings

Optical data

Limit range	0 … 5 m
Operating range	0 … 4 m
Type of light	Laser, red, 655 nm
Light spot size	See diagram
Laser Class (IEC 60825-1)	1

Functions

Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running process Mode 2: during standing process
Adjustment possibilities (receiver)	N.O. / N.C. via Teach-in button and control input; Button lock via control input
Default settings	Max. range and N.O.

Electrical data

Operating voltage, $+U_B$	10 … 30 V DC[1]
No-load current, I_0	≤ 12 mA
Output current, Ie	≤ 50 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Switching output, Q	PNP/NPN (see selection table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 4000Hz
Response time	125 µs
Control input, IN (receiver) (only 4-pin design)	$+U_B$ = Teach-in; $-U_B$ = button locked; Open = normal operation
Control input, Test (transmitter)	$+U_B$ = Test (transmitter off) $-U_B$ / Open = normal operation

Mechanical data

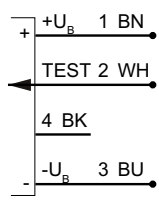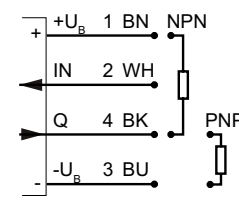|	
Dimensions	21.1 × 14.6 × 8 mm
Enclosure rating	IP 67[2]
Material, housing	PUR
Material, front screen	PMMA
Type of connection	See selection table
Ambient temperature: operation	-20 … +50 °C[3]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	Approx. 6 g
Weight (cable device)	Approx. 44 g
Weight (pigtail)	Approx. 20 g

[1] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz   [2] With connected IP 67 plug   [3] UL: -20 … +30 °C

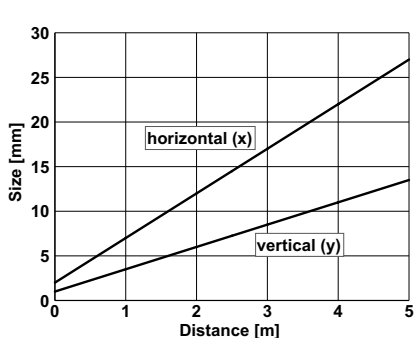| Operating range	Switching output	Type of connection	Part number	Design	Article number
1 … 4 m	PNP	Plug, M5x0.5, 4-pin	FE 10-RL-PS-E4	Receiver	602-71000
1 … 4 m	–	Plug, M5x0.5, 4-pin	FS 10-RL-E4	Transmitter	601-61000
1 … 4 m	NPN	Plug, M5x0.5, 4-pin	FE 10-RL-NS-E4	Receiver	602-71001
1 … 4 m	PNP	Cable, 2 m, 4-wire	FE 10-RL-PS-K4	Receiver	602-71002
1 … 4 m	–	Cable, 2 m, 4-wire	FS 10-RL-K4	Transmitter	601-61002
1 … 4 m	NPN	Cable, 2 m, 4-wire	FE 10-RL-NS-K4	Receiver	602-71003
1 … 4 m	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FE 10-RL-PS-KM4	Receiver	602-71004
1 … 4 m	–	Pigtail, 200 mm with M8 plug, 4-pin	FS 10-RL-KM4	Transmitter	601-61004
1 … 4 m	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FE 10-RL-NS-KM4	Receiver	602-71005
1 … 4 m	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FE 10-RL-PS-KM3	Receiver	602-71006
1 … 4 m	–	Pigtail, 200 mm with M8 plug, 3-pin	FS 10-RL-KM3	Transmitter	601-61005

Version: 02/2019. Subject to changes; diagrams similar

Operating range	Switching output	Type of connection	Part number	Design	Article number.
1 ... 4 m	NPN	Pigtail, 200 mm with M8 plug, 3-pin	FE 10-RL-NS-KM3	Receiver	602-71008

Including dovetail clamp mounting MBD F 10 for all types

Plug connection

153-00894

Teach-in
LED 2
LED 1
8
21.1
5.7
M5x0.5
14.6
2.8
18.3
3.3
Receiver
Emitter
5.5
8
ø3.3

Cable connection

153-00895

Teach-in
LED 2
LED 1
8
21.1
4.6
14.6
2.8
18.3
3.3
Receiver
Emitter
5.5
8
ø3.3
ø2.6
ø4.9

Connection, transmitter, 4-pin

154-00511

+ +U$_B$ 1   BN

TEST   2   WH

4   BK

- -U$_B$ 3   BU

Connection, receiver, 4-pin

154-00508

+ +U$_B$ 1   BN   NPN

IN   2   WH

Q   4   BK   PNP

- -U$_B$ 3   BU

Connection, transmitter, 3-pin

154-00514

+ +U$_B$ 1   BN

TEST   4   BK

- -U$_B$ 3   BU

Connection, receiver, 3-pin

154-00509

+ +U$_B$ 1   BN   NPN

Q   4   BK   PNP

- -U$_B$ 3   BU

Light spot size

155-01321

horizontal (x)

vertical (y)

Size [mm] vs Distance [m]

Accessories

Connection cables	From Page A-46
Brackets	From Page A-4