

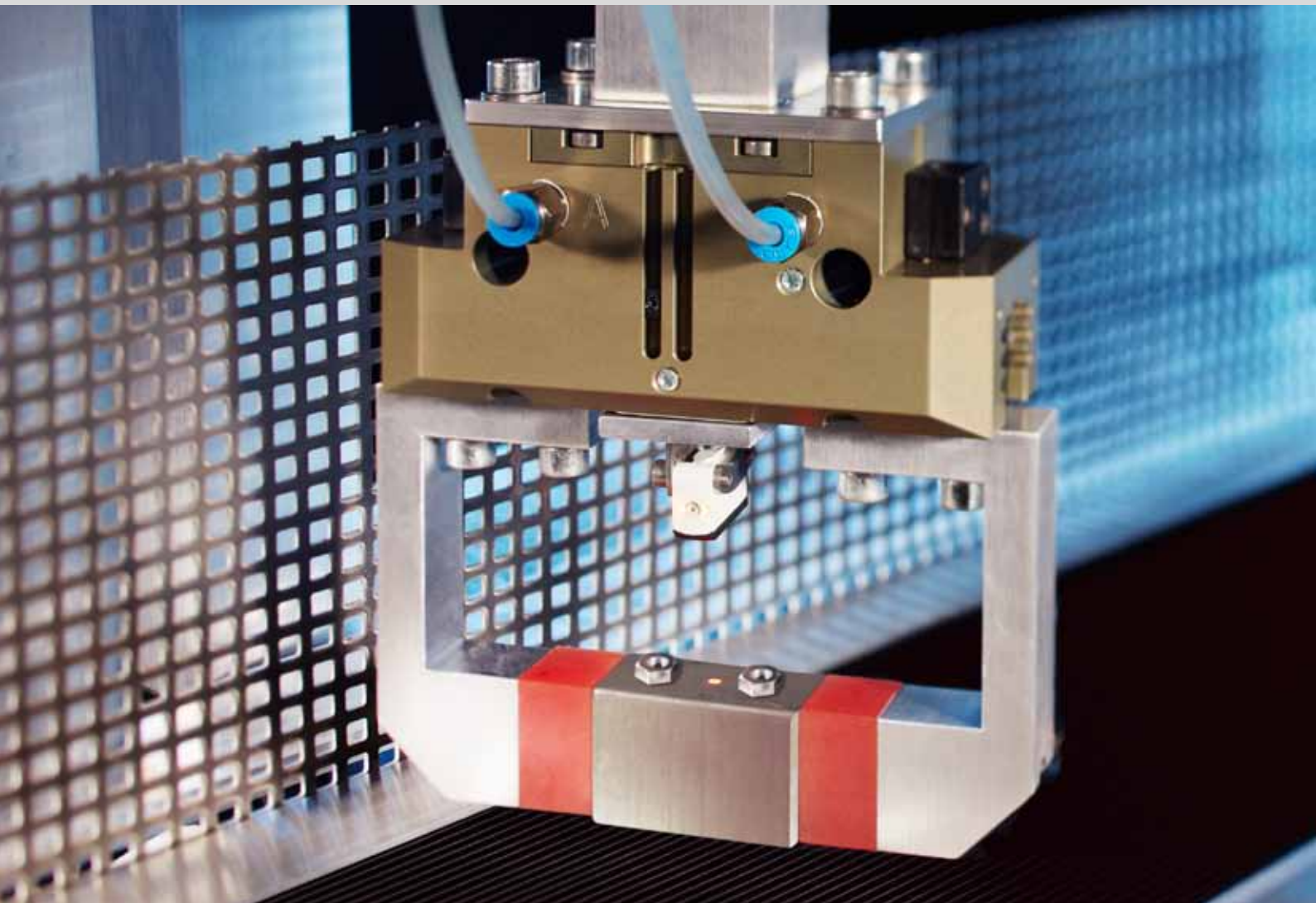
## Our smallest

F 10 – fits in every robot arm



## Small multi-talent

There's always space for a sensor from the F 10 family



*In the robot's arm:* Thanks to its miniaturised housing and low weight the sensors of the F 10 series are predestined for use where space is very limited – integrated in a robot arm, for example.

### Applications

- Where space is limited
- In handling and assembly systems
- In highly integrated machines
- As an alternative to fibre-optic systems

### Typical sectors

- Special machine construction
- Semiconductor and electronics production
- Laboratory automation
- Pharmaceutical industry and medical technology
- Solar industry
- Packaging machines
- Print and paper industry



**Blue light:**

*The new F 10 Bluelight radiates enhanced process stability, especially for monitoring the presence of solar wafers and strongly light-absorbing objects.*



**The smart alternative:**

*Instead of a transmitter and a receiver, as frequently required in a fibre-optic system, the proximity sensors of the F 10 family require no counterpart – and can therefore offer considerably easier and more space-saving mounting.*



**Installation made easy:**

*The sensors of the F 10 series can be sunk into a profile to save space. They are thus protected and perfectly integrated in the machine design.*

There is simply no space for conventional sensors in many applications. No problem for the F 10. It fits into almost any space. Whether in handling and positioning applications, during the production of solar cells, or for the placement of semiconductor components – an F 10 is capable of maximum performance even in the most difficult of installation situations. Thus the photo-electric proximity sensor with background suppression – just 21.1 × 14.6 × 8 mm<sup>3</sup> in size and weighing only 3 grams – even fits into a robot gripper without being a burden. Its precisely adjustable background suppression allows flexible teach-in for the most varied of applications, and nothing can distract it from the target object. Even bright or highly reflective machine parts in the background have no effect on switching behaviour. F 10 sensors have all the robustness of bigger sensors thanks to their glass-fibre-reinforced plastic housings and tension-resistant cables.

With their small dimensions and powerful features, as well as the great variety of functional principles, the laser and LED sensors of the F 10 series not only open up completely new application potentials, but also represent an alternative to considerably more expensive fibre-optic systems. They are at home wherever high demands must be met in the most restricted of spaces.

# Small housings – great performance

F 10 sensor with bluelight



**The F 10 Bluelight sensor originally developed for the solar industry is a true all-rounder.**

Thanks to its blue LED emitter, the F 10 Bluelight sensor series guarantees much greater detection reliability in special applications - whether with very dark or transparent objects - as application tests have proved. The F 10 Bluelight series comprises two fixed focus devices which can detect objects between 2 to 30 mm and 2 to 50 mm respectively, with expert precision. Backgrounds are ignored thanks to SensoPart's background suppression technology.

## TYPICAL F 10

**F 10 Bluelight with extra reliable detection with:**

- very dark objects
- transparent objects
- large scanning angles





**From production to further processing and final inspection**

Missing or non-moulded inserts can often cause costly tool damage.



**Optical presence detection of electronic trays**

Insufficiently or incorrectly filled trays frequently cause malfunctions and downtimes during production.



**Optical presence detection of black plastic tubes**

The F 10 series plays a decisive role in the plastics industry when it comes to simple applications involving very dark or transparent objects, or installation in small spaces.



**Automation with sensors**

SensoPart offers a wide variety of photoelectric and proximity sensors, including special versions such as the F 10 Bluelight with blue LED emitter for the detection of poorly reflective objects, e.g. black injection-moulded parts.

# Mastering challenges

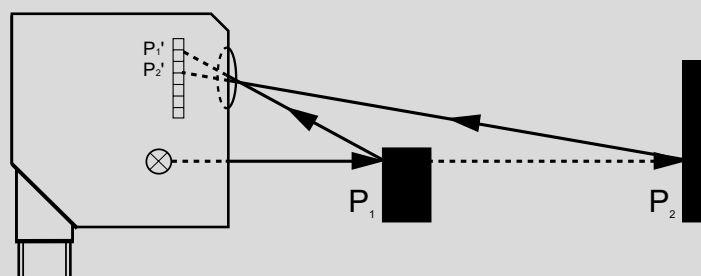
The F 10 family cannot be distracted from what matters – thanks to optimum adjustable background suppression

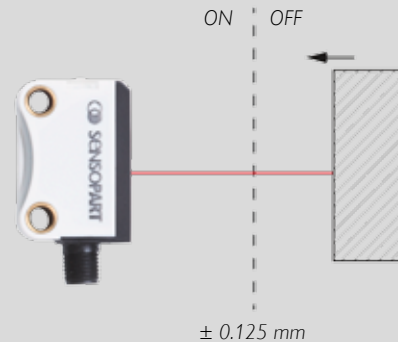


Polished panelling sheets on machines, blinking warning lamps on passing vehicles, moving machine parts, sunbeams through a window: all these are background effects that can make detecting the actual target object considerably more difficult and represent a challenge for any sensor. Even under these conditions, however, one can rely on the proximity sensors of the F 10 sub-miniature family with background suppression and the ASIC technology developed by SensoPart. Because the sensors only see what they are supposed to see: the object, regardless of its material, shape and colour – and nothing else!

## Object detection by means of distance measurement

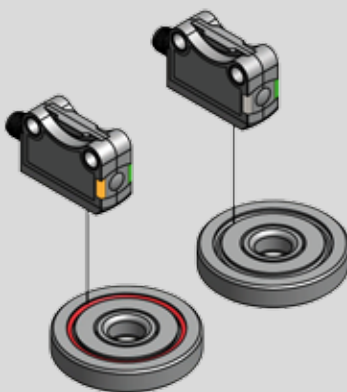
SensoPart proximity sensors with background suppression can always differentiate between the object and the background, even in strongly reflective environments. The sensor measures the distance to object  $P_1$  and to any background  $P_2$  using the triangulation process and not the object's reflectivity. The signal  $P_2'$  coming from the background is then suppressed.





### Maximum switching accuracy

The F 10 sensors with background suppression can resolve a change in distance (object shift) of 0.25 mm in the switching point – a standard for maximum positioning accuracy regardless of the object's colour or surface.



**Millimetre accuracy:**  
The FT 10-RLH even detects height differences of just 1 mm, found for example when monitoring the presence of a sealing washer, without difficulty.

### Precise detection

Our laser sensors – with their precise, clearly contoured light spots – even detect minute parts reliably. Thus the F 10 series' sub-miniature photoelectric proximity sensor with background suppression easily detects a wire with a diameter of 0.5 mm from a distance of 60 mm.



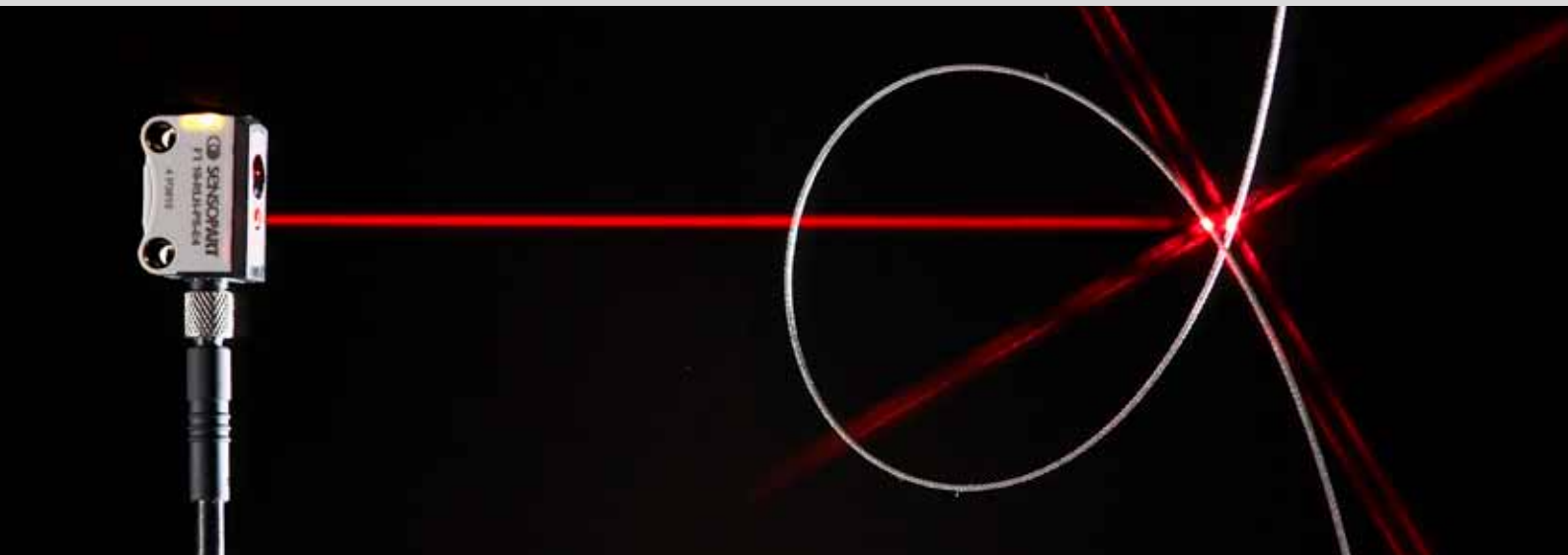
**Mini-sensor with maximum user-friendliness:**  
Simple commissioning with an electronic teach-in button and easily visible status LEDs is far from normal at this size.


### Teach-in – greater stability, greater reliability

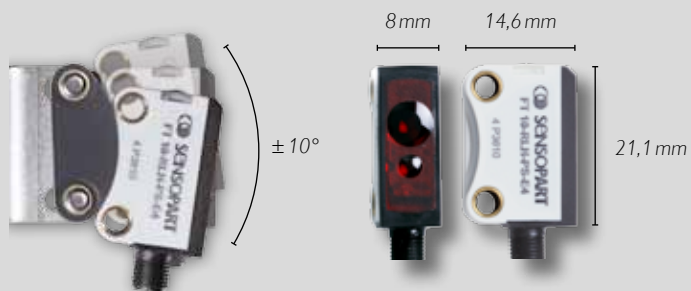
Despite the small, compact housing of the F 10 family it still offers the user-friendliness of its larger brothers: the entire F 10 series of sensors can be uniformly commissioned via teach-in. In addition, electronic data storage ensures that the switching point does not shift as a result of vibrations or impacts, as can occur when using devices adjusted by potentiometer. Moreover, the sensor can be adjusted and locked from a central control unit – and is therefore absolutely tamperproof.

# F 10 – family of sub-miniature sensors

Small housings, great performance



 made in Germany



#### 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.















#### 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



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 unmistakable 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!

| F 10 – Product Overview  |   |  |                         |  |      |
|--|---|--|-------------------------|--|------|
|  | Type of light   | Adjustment   | Scanning distance/range | Special features   | Page |
| <b>Photoelectric proximity sensors with background suppression</b> |   |  |                         |  |      |
| FT 10-RLH  | Laser      | Teach-in  | 60 mm                   | The only scanner with scanning distance adjustment         | 10   |
| FT 10-RLHR   | Laser      | Teach-in  | 60 mm                   | Broad-beam light spot                                      | 12   |
| FT 10-B-RLF  | Laser      | Fixed focus  | 15 mm/30 mm             |  | 14   |
| FT 10-RH   | LED   | Teach-in  | 70 mm                   |  | 16   |
| FT 10-RF   | LED   | Fixed focus  | 15 mm/30 mm/50 mm       |  | 18   |
| FT 10-BF Bluelight   | LED, blue  | Fixed focus  | 30 mm                   | Blue transmission LED for strongly light-absorbing objects | 20   |
| <b>Retroreflective photoelectric sensors</b>                       |   |  |                         |  |      |
| FR 10-RL   | Laser      | Teach-in  | 2 m                     | Long range, precise small-part detection                   | 22   |
| FR 10-R  | LED   | Teach-in  | 1,6 m                   | Long range   | 24   |
| <b>Through-beam photoelectric sensors</b>                          |   |  |                         |  |      |
| FS/FE 10-RL  | Laser      | Teach-in  | 3 m                     | Sensor pair; very accurate object positioning              | 26   |
| FS 10-RL/FE 10-RL  | Laser      | Teach-in  | 3 m                     | Transmitter/receiver; very accurate object positioning     | 28   |

# FT 10-RLH

## Laser photoelectric proximity sensor with background suppression



### PRODUCT HIGHLIGHTS

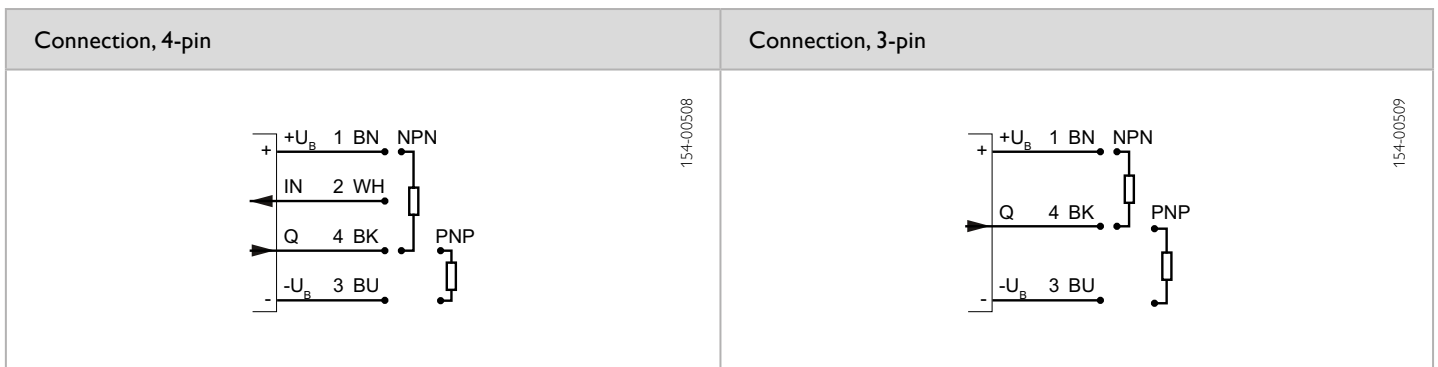
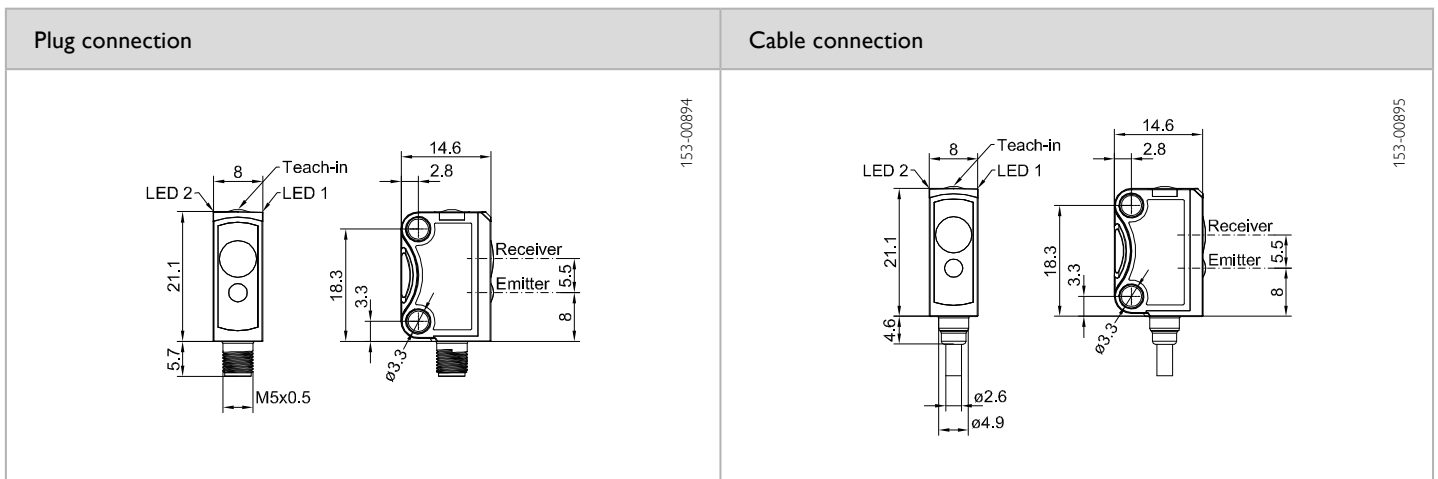
- Sub-miniature sensor with laser light and adjustable background suppression
- Precise and reliable switching behaviour, even with varying object surfaces and colours
- Reliable operation even with highly reflective machine parts in the background, thanks to SensoPart ASIC technology
- Particularly suitable for detecting the smallest of parts and for installation in extremely confined spaces

| Optical data                                      |  | Functions                      |                                       |
|---|--|--------------------------------|---------------------------------------|
| Scanning distance                                 | 6 ... 60 mm <sup>1</sup>   | Indicator LED, green           | Operating voltage indicator           |
| Adjustment range                                  | 10 ... 60 mm <sup>1</sup>  | Indicator LED, yellow          | Switching output indicator            |
| Type of light                                     | Laser, red, 655 nm   | Scanning distance adjustment   | Via Teach-in button and control input |
| Light spot size (total detection area)            | 1 x 3 mm <sup>2</sup>  | Adjustment possibilities       | Button lock via control input         |
| Laser Class (DIN EN 60825-1:2008-5)               | 1  | Default settings               | Max. scanning distance and N.O.       |
| Electrical data                                   |  | Mechanical data                |                                       |
| Operating voltage, +U <sub>B</sub>                | 10 ... 30V DC <sup>2</sup>   | Dimensions                     | 21.1 x 14.6 x 8 mm                    |
| No-load current, I <sub>0</sub>                   | ≤ 12 mA  | Enclosure rating               | IP 67 <sup>3</sup>                    |
| Output current, I <sub>e</sub>                    | ≤ 50 mA  | Material, housing              | PUR                                   |
| Protective circuits                               | Reverse-polarity protection, U <sub>B</sub> / short-circuit protection (Q)               | Material, front screen         | PMMA                                  |
| Protection Class                                  | 2  | Type of connection             | See Selection Table                   |
| Switching output, Q                               | PNP/NPN (see Selection Table)  | Ambient temperature: operation | -20 ... +50 °C                        |
| Output function                                   | N.O.   | Ambient temperature: storage   | -20 ... +80 °C                        |
| Switching frequency, f (ti/tp 1:1)                | ≤ 1000 Hz  | Weight (plug device)           | Ca. 3 g                               |
| Response time                                     | 500 μs   | Weight (cable device)          | Ca. 22 g                              |
| Control input, I <sub>N</sub> (only 4-pin design) | +U <sub>B</sub> = teach-in<br>-U <sub>B</sub> = button locked<br>Open = normal operation | Weight (pigtail)               | Ca. 10 g                              |

<sup>1</sup> Reference material white, 90 % reflectivity    <sup>2</sup> Max. 10 % ripple, within U<sub>B</sub>, ~ 50 Hz / 100 Hz    <sup>3</sup> With connected IP 67 plug

| Scanning distance | Switching output | Type of connection                  | Part number          | Article number |
|-------------------|------------------|-------------------------------------|----------------------|----------------|
| 6 ... 60 mm       | PNP              | Plug, M5x0.5, 4-pin                 | FT 10-RLH-PS-E4      | 600-11130      |
| 6 ... 60 mm       | NPN              | Plug, M5x0.5, 4-pin                 | FT 10-RLH-NS-E4      | 600-11131      |
| 6 ... 60 mm       | PNP              | Cable, 2 m, 4-wire                  | FT 10-RLH-PS-K4      | 600-11132      |
| 6 ... 60 mm       | NPN              | Cable, 2 m, 4-wire                  | FT 10-RLH-NS-K4      | 600-11133      |
| 6 ... 60 mm       | PNP              | Pigtail, 200 mm with M8 plug, 4-pin | FT 10-RLH-PS-KM4     | 600-11134      |
| 6 ... 60 mm       | NPN              | Pigtail, 200 mm with M8 plug, 4-pin | FT 10-RLH-NS-KM4     | 600-11135      |
| 6 ... 60 mm       | PNP              | Pigtail, 200 mm with M8 plug, 3-pin | FT 10-RLH-PS-KM3     | 600-11146      |
| 6 ... 60 mm       | NPN              | Pigtail, 200 mm with M8 plug, 3-pin | FT 10-RLH-NS-KM3     | 600-11147      |
| 6 ... 60 mm       | PNP              | Pigtail, 500 mm with M8 plug, 3-pin | FT 10-RLH-PS-KM3-X07 | 600-11158      |

Including dovetail clamp mounting MBD F 10 for all types



| Reference material | Detection range |
|--------------------|-----------------|
| White (90 %)       | 6 ... 60 mm     |
| Grey (18 %)        | 7 ... 60 mm     |
| Black (6 %)        | 7 ... 60 mm     |

| Accessories       |              |
|-------------------|--------------|
| Connection cables | From page 30 |
| Brackets          |              |

# FT 10-RLHR

Laser photoelectric proximity sensor with background suppression



## PRODUCT HIGHLIGHTS

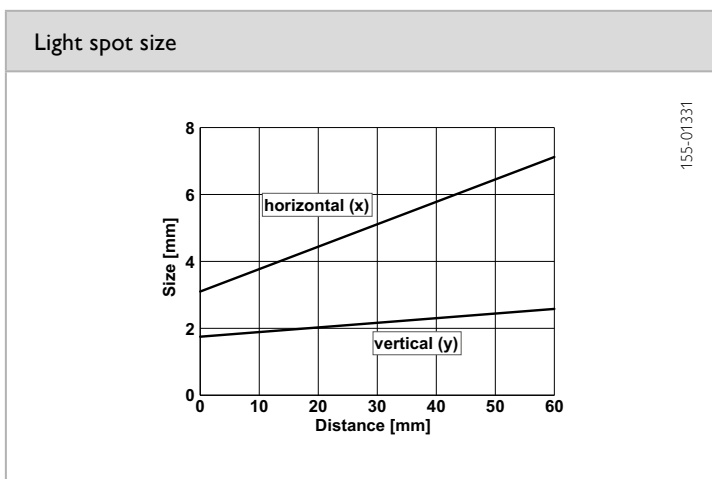
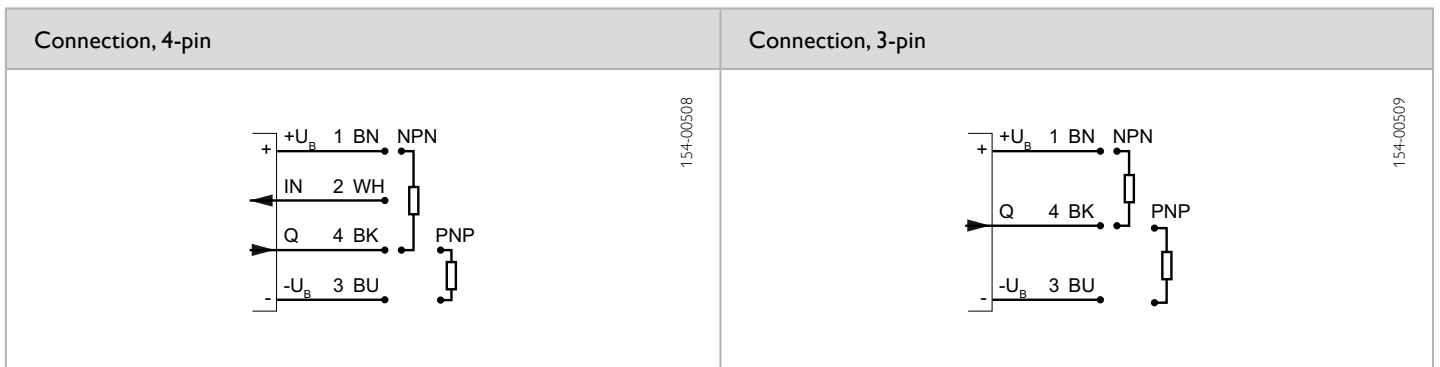
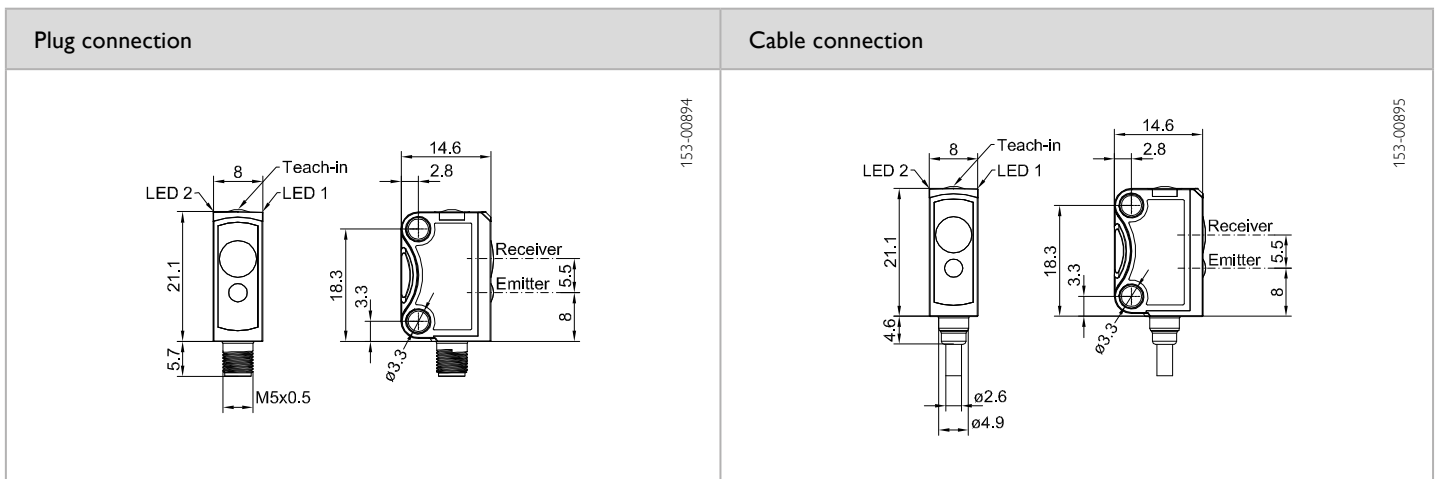
- Sub-miniature sensor with wide laser light spot and adjustable background suppression
- Precise and reliable switching behaviour, even with varying object surfaces and colours
- Reliable operation even with highly reflective machine parts in the background, thanks to SensoPart ASIC technology
- Particularly suitable for installation in the smallest of spaces
- Simple operation via electronic Teach-in button or control line

| Optical data                             |  | Functions                      |                                       |
|--|--|--------------------------------|---------------------------------------|
| Scanning distance                        | 6 ... 60 mm <sup>1</sup>   | Indicator LED, green           | Operating voltage indicator           |
| Adjustment range                         | 10 ... 60 mm <sup>1</sup>  | Indicator LED, yellow          | Switching output indicator            |
| Type of light                            | Laser, red, 655 nm   | Scanning distance adjustment   | Via Teach-in button and control input |
| Light spot size                          | See diagram  | Adjustment possibilities       | Button lock via control input         |
| Laser Class<br>(DIN EN 60825-1:2008-5)   | 1  | Default settings               | Max. scanning distance and N.O.       |
| Electrical data                          |  | Mechanical data                |                                       |
| Operating voltage, +U <sub>B</sub>       | 10 ... 30V DC <sup>2</sup>   | Dimensions                     | 21.1 x 14.6 x 8 mm                    |
| No-load current, I <sub>0</sub>          | ≤ 12 mA  | Enclosure rating               | IP 67 <sup>3</sup>                    |
| Output current, I <sub>e</sub>           | ≤ 50 mA  | Material, housing              | PUR                                   |
| Protective circuits                      | Reverse-polarity protection, U <sub>B</sub> / short-circuit protection (Q)               | Material, front screen         | PMMA                                  |
| Protection Class                         | 2  | Type of connection             | See Selection Table                   |
| Switching output, Q                      | PNP/NPN (see Selection Table)  | Ambient temperature: operation | -20 ... +50 °C                        |
| Output function                          | N.O.   | Ambient temperature: storage   | -20 ... +80 °C                        |
| Switching frequency, f (ti/tp 1:1)       | ≤ 1000 Hz  | Weight (plug device)           | Ca. 3 g                               |
| Response time                            | 500 μs   | Weight (cable device)          | Ca. 22 g                              |
| Control input, IN<br>(only 4-pin design) | +U <sub>B</sub> = teach-in<br>-U <sub>B</sub> = button locked<br>Open = normal operation | Weight (pigtail)               | Ca. 10 g                              |

<sup>1</sup> Reference material white, 90 % reflectivity    <sup>2</sup> Max. 10 % ripple, within U<sub>B</sub>, ~ 50 Hz / 100 Hz    <sup>3</sup> With connected IP 67 plug

| Scanning distance | Switching output | Type of connection                  | Part number       | Article number |
|-------------------|------------------|-------------------------------------|-------------------|----------------|
| 6 ... 60 mm       | PNP              | Plug, M5x0.5, 4-pin                 | FT 10-RLHR-PS-E4  | 600-11136      |
| 6 ... 60 mm       | NPN              | Plug, M5x0.5, 4-pin                 | FT 10-RLHR-NS-E4  | 600-11137      |
| 6 ... 60 mm       | PNP              | Cable, 2 m, 4-wire                  | FT 10-RLHR-PS-K4  | 600-11138      |
| 6 ... 60 mm       | NPN              | Cable, 2 m, 4-wire                  | FT 10-RLHR-NS-K4  | 600-11139      |
| 6 ... 60 mm       | PNP              | Pigtail, 200 mm with M8 plug, 4-pin | FT 10-RLHR-PS-KM4 | 600-11140      |
| 6 ... 60 mm       | NPN              | Pigtail, 200 mm with M8 plug, 4-pin | FT 10-RLHR-NS-KM4 | 600-11141      |
| 6 ... 60 mm       | PNP              | Pigtail, 200 mm with M8 plug, 3-pin | FT 10-RLHR-PS-KM3 | 600-11148      |
| 6 ... 60 mm       | NPN              | Pigtail, 200 mm with M8 plug, 3-pin | FT 10-RLHR-NS-KM3 | 600-11149      |

Including dovetail clamp mounting MBD F 10 for all types



| Reference material | Detection range |
|--------------------|-----------------|
| White (90 %)       | 6 ... 60 mm     |
| Grey (18 %)        | 7 ... 60 mm     |
| Black (6 %)        | 7 ... 60 mm     |

| Accessories       |              |
|-------------------|--------------|
| Connection cables | From page 30 |
| Brackets          |              |

# FT 10-B-RLF

Laser photoelectric proximity sensor with background suppression, fixed focus



## PRODUCT HIGHLIGHTS

- Sub-miniature sensor with laser light and precise fixed background suppression
- Reliable switching behaviour even with varying object surfaces and colours
- 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

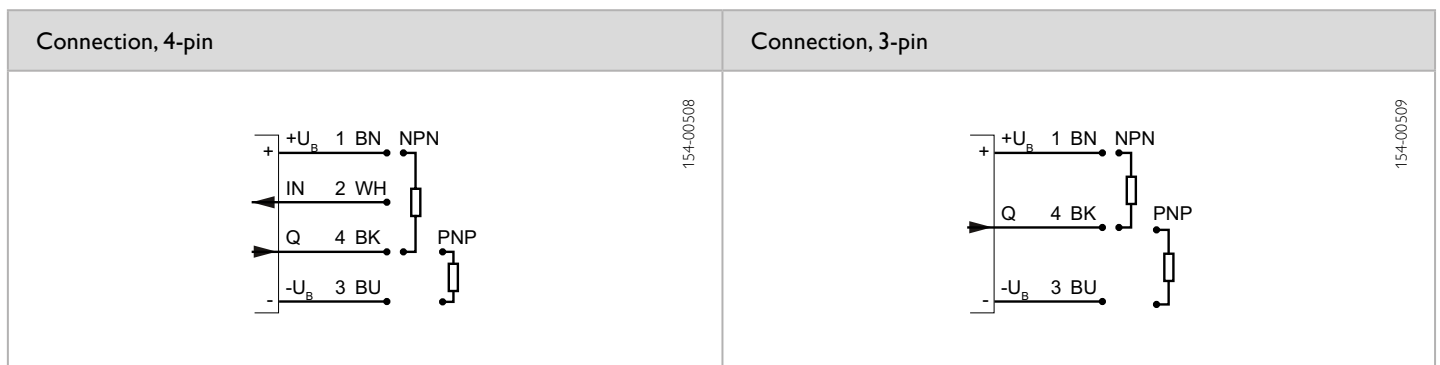
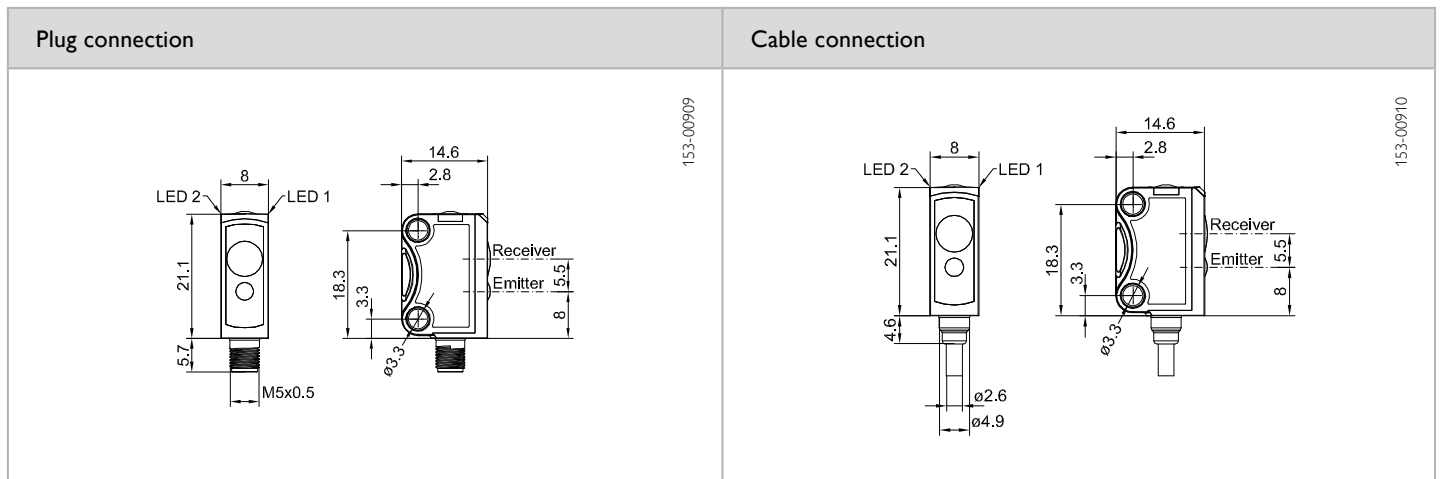
| Optical data                                      |  | Functions                      |                               |
|---|--|--------------------------------|-------------------------------|
| Scanning distance                                 | 6 ... 15 mm <sup>1</sup><br>6 ... 30 mm <sup>1</sup>                       | Indicator LED, green           | Operating voltage indicator   |
| Type of light                                     | Laser, red, 655 nm   | Indicator LED, yellow          | Switching output indicator    |
| Light spot size (total detection area)            | 1 x 3 mm <sup>2</sup>  | Adjustment possibilities       | N.O. / N.C. via control input |
| Laser Class (DIN EN 60825-1:2008-5)               | 1  |                                |                               |
| Electrical data                                   |  | Mechanical data                |                               |
| Operating voltage, +U <sub>B</sub>                | 10 ... 30V DC <sup>2</sup>   | Dimensions                     | 21.1 x 14.6 x 8 mm            |
| No-load current, I <sub>0</sub>                   | ≤ 12 mA  | Enclosure rating               | IP 67 <sup>3</sup>            |
| Output current, I <sub>e</sub>                    | ≤ 50 mA  | Material, housing              | PUR                           |
| Protective circuits                               | Reverse-polarity protection, U <sub>B</sub> / short-circuit protection (Q) | Material, front screen         | PMMA                          |
| Protection Class                                  | 2  | Type of connection             | See Selection Table           |
| Switching output, Q                               | PNP/NPN (see Selection Table)  | Ambient temperature: operation | -20 ... +50 °C                |
| Output function                                   | N.O. / N.C.  | Ambient temperature: storage   | -20 ... +80 °C                |
| Switching frequency, f (ti/tp 1:1)                | ≤ 1000 Hz  | Weight (plug device)           | Ca. 3 g                       |
| Response time                                     | 500 μs   | Weight (cable device)          | Ca. 22 g                      |
| Control input, I <sub>N</sub> (only 4-pin design) | +U <sub>B</sub> = N.C.<br>-U <sub>B</sub> / Open = N.O.                    | Weight (pigtail)               | Ca. 10 g                      |

<sup>1</sup> Reference material white, 90 % reflectivity    <sup>2</sup> Max. 10 % ripple, within U<sub>B</sub> ~ 50 Hz / 100 Hz    <sup>3</sup> With connected IP 67 plug

| 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      |

| 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



| 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 30 |
| Brackets          |              |

# FT 10-RH

## Photoelectric proximity 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 colours
- 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

| Optical data                       |  | Functions                      |  |
|------------------------------------|--|--------------------------------|--|
| Scanning distance                  | 5 ... 70 mm <sup>1</sup>   | Indicator LED, green           | Operating voltage indicator  |
| Adjustment range                   | 10 ... 70 mm <sup>1</sup>  | Indicator LED, yellow          | Switching output indicator   |
| Used light                         | LED, red, 650 nm   | Scanning distance adjustment   | Via Teach-in button and control input <sup>5</sup>   |
| Light spot size                    | See diagram  | Teach-in modes                 | Mode 1: during running process<br>Mode 2: during standing process  |
| Repeatability                      | 0,45 mm <sup>2,3</sup>   | Adjustment possibilities       | N.O./N.C. via Teach-in button and control input <sup>5</sup><br>Button lock via control input <sup>5</sup> |
| Hysteresis                         | ≤ 2 mm <sup>2</sup>  | Default settings               | Max. range and N.O.  |
| Grey/white shift (18%/90%)         | ≤ 3 mm <sup>2</sup>  |                                |  |
| Black/white shift (6%/90%)         | ≤ 4 mm <sup>2</sup>  |                                |  |
| Electrical data                    |  | Mechanical data                |  |
| Operating voltage, +U <sub>B</sub> | 10 ... 30V DC <sup>4</sup>   | Dimensions                     | 21,1 x 14,6 x 8 mm   |
| No-load current, I <sub>0</sub>    | ≤ 20 mA  | Enclosure rating               | IP 67 <sup>6</sup>   |
| Output current, I <sub>e</sub>     | ≤ 50 mA  | Material, housing              | PUR  |
| Protective circuits                | Reverse-polarity protection, U <sub>B</sub> / short-circuit protection (Q)               | Material, front screen         | PMMA   |
| Protection class                   | 2  | Type of connection             | See Selection Table  |
| Power On Delay                     | < 300 ms   | Ambient temperature: operation | -20 ... +60 °C   |
| Switching output, Q                | PNP/NPN  | Ambient temperature: storage   | -20 ... +80 °C   |
| Output function                    | N.O./N.C.  | Weight (plug device)           | approx. 3 g  |
| Switching frequency, f (ti/tp 1:1) | ≤ 1000 Hz  | Weight (cable device)          | approx. 22 g   |
| Response time                      | 500 μs   | Weight (pigtail)               | approx. 10 g   |
| Control input, IN <sup>3</sup>     | +U <sub>B</sub> = teach-in<br>-U <sub>B</sub> = button locked<br>Open = normal operation |                                |  |

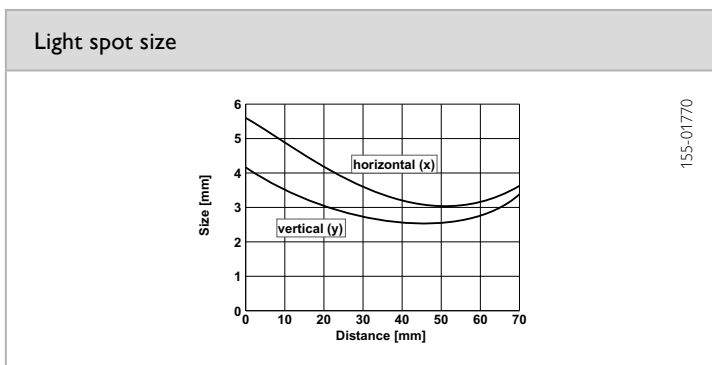
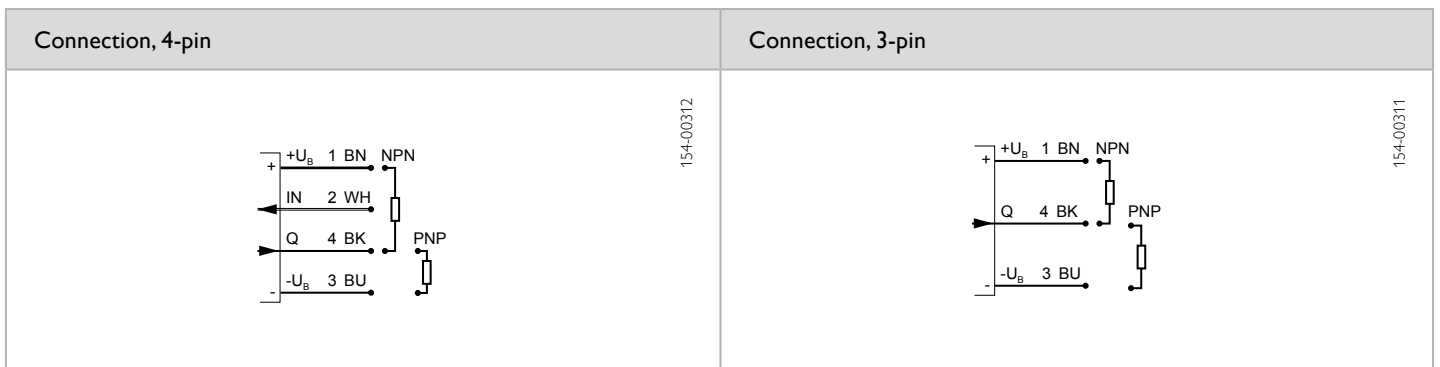
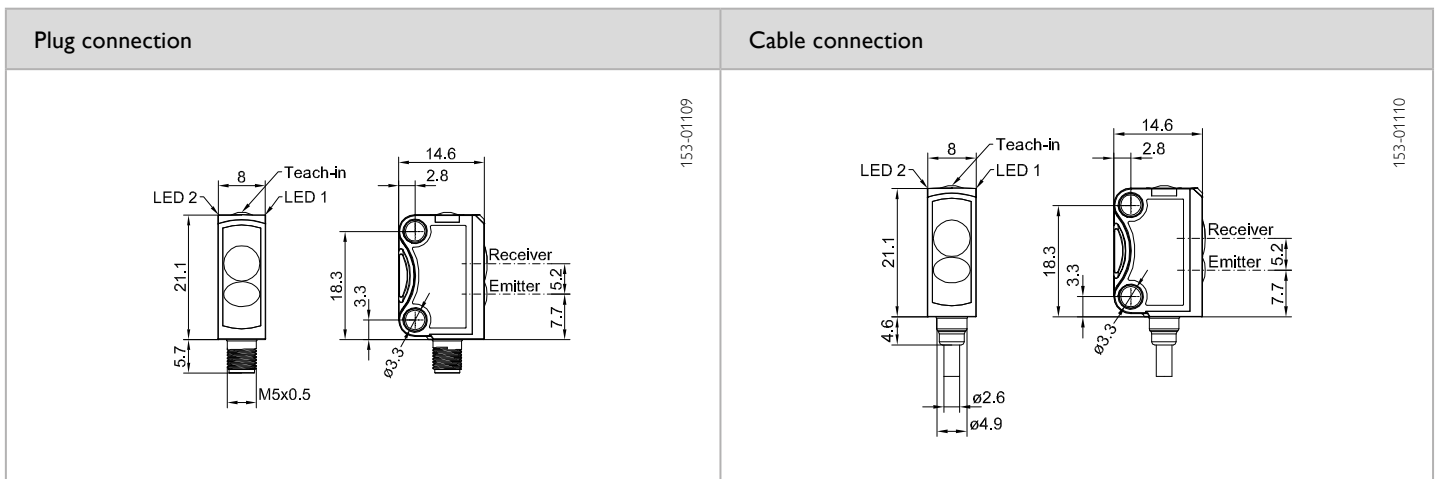
<sup>1</sup> Reference material white, 90 % reflectivity    <sup>2</sup> At maximum scanning distance    <sup>3</sup> In constant environmental conditions    <sup>4</sup> Max. 10 % ripple within U<sub>B</sub>, ~ 50 Hz / 100 Hz

<sup>5</sup> Only 4-pin design    <sup>6</sup> With connected IP 67 plug

| Scanning distance        | Switching output | Type of connection                  | Part number     | Article number |
|--------------------------|------------------|-------------------------------------|-----------------|----------------|
| 5 ... 70 mm <sup>1</sup> | PNP              | Plug, M5x0.5, 4-pin                 | FT 10-RH-PS-E4  | 600-11000      |
| 5 ... 70 mm <sup>1</sup> | NPN              | Plug, M5x0.5, 4-pin                 | FT 10-RH-NS-E4  | 600-11004      |
| 5 ... 70 mm <sup>1</sup> | PNP              | Cable, 2 m, 4-wire                  | FT 10-RH-PS-K4  | 600-11001      |
| 5 ... 70 mm <sup>1</sup> | NPN              | Cable, 2 m, 4-wire                  | FT 10-RH-NS-K4  | 600-11005      |
| 5 ... 70 mm <sup>1</sup> | PNP              | Pigtail, 200 mm with M8 plug, 4-pin | FT 10-RH-PS-KM4 | 600-11002      |
| 5 ... 70 mm <sup>1</sup> | NPN              | Pigtail, 200 mm with M8 plug, 4-pin | FT 10-RH-NS-KM4 | 600-11006      |
| 5 ... 70 mm <sup>1</sup> | PNP              | Pigtail, 200 mm with M8 plug, 3-pin | FT 10-RH-PS-KM3 | 600-11003      |
| 5 ... 70 mm <sup>1</sup> | NPN              | Pigtail, 200 mm with M8 plug, 3-pin | FT 10-RH-NS-KM3 | 600-11007      |

Including dovetail clamp mounting MBD F 10 for all types





| Reference material | Detection range |
|--------------------|-----------------|
| White (90 %)       | 5 ... 70 mm     |
| Grey (18 %)        | 8 ... 70 mm     |
| Black (6 %)        | 8 ... 70 mm     |

| Accessories       |              |
|-------------------|--------------|
| Connection cables | From page 30 |
| Brackets          |              |

# FT 10-RF

Photoelectric proximity sensor with background suppression, fixed focus



## PRODUCT HIGHLIGHTS

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

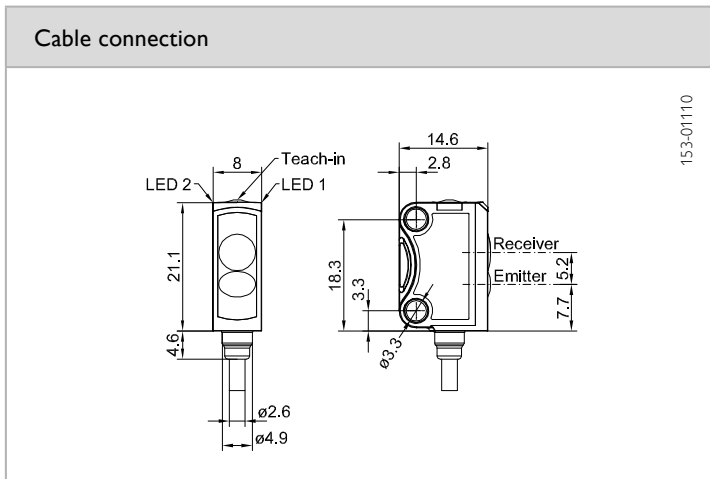
| Optical data                               |  | Functions                      |  |
|--|--|--------------------------------|--|
| Scanning distance                          | 2 ... 15 mm <sup>1</sup><br>2 ... 30 mm <sup>1</sup><br>2 ... 50 mm <sup>1</sup> | Indicator LED, green           | Operating voltage indicator                |
| Used light                                 | LED, red, 650 nm   | Indicator LED, yellow          | Switching output indicator                 |
| Light spot size                            | See diagram  | Adjustment possibilities       | N.O. / N.C. via control input <sup>3</sup> |
| Electrical data                            |  | Mechanical data                |  |
| Operating voltage, +U <sub>B</sub>         | 10 ... 30V DC <sup>2</sup>   | Dimensions                     | 21,1 x 14,6 x 8 mm                         |
| No-load current, I <sub>0</sub>            | ≤ 20 mA  | Enclosure rating               | IP 67 <sup>4</sup>                         |
| Output current, I <sub>e</sub>             | ≤ 50 mA  | Material, housing              | PUR  |
| Protective circuits                        | Reverse-polarity protection, U <sub>B</sub> / short-circuit protection (Q)       | Material, front screen         | PMMA                                       |
| Protection class                           | 2  | Type of connection             | See Selection Table                        |
| Power On Delay                             | < 300 ms   | Ambient temperature: operation | -20 ... +60 °C                             |
| Switching output, Q                        | PNP/NPN (see Selection Table)  | Ambient temperature: storage   | -20 ... +80 °C                             |
| Output function                            | N.O./N.C.  | Weight (cable device)          | approx. 22 g                               |
| Switching frequency, f (ti/tp 1:1)         | ≤ 1000 Hz  | Weight (pigtail)               | approx. 10 g                               |
| Response time                              | 500 μs   |                                |  |
| Control input, I <sub>N</sub> <sup>3</sup> | +U <sub>B</sub> = N.C.<br>-U <sub>B</sub> / Open = N.O.                          |                                |  |

<sup>1</sup> Reference material white, 90 % reflectivity    <sup>2</sup> Max. 10 % ripple within U<sub>B</sub>, ~ 50 Hz / 100 Hz    <sup>3</sup> Only 4-pin design    <sup>4</sup> With connected IP 67 plug

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

| Scanning distance        | Switching output | Type of connection                  | Part number      | Article number |
|--------------------------|------------------|-------------------------------------|------------------|----------------|
| 2 ... 30 mm <sup>1</sup> | PNP              | Pigtail, 200 mm with M8 plug, 3-pin | FT 10-RF2-PS-KM3 | 600-11016      |
| 2 ... 30 mm <sup>1</sup> | NPN              | Pigtail, 200 mm with M8 plug, 3-pin | FT 10-RF2-NS-KM3 | 600-11019      |
| 2 ... 50 mm <sup>1</sup> | PNP              | Pigtail, 200 mm with M8 plug, 3-pin | FT 10-RF3-PS-KM3 | 600-11022      |
| 2 ... 50 mm <sup>1</sup> | 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



| Connection, 4-pin | Connection, 3-pin |
|-------------------|-------------------|
|                   |                   |

| Light spot size |
|-----------------|
|                 |

| Reference material | Detection range          |                          |                          | Accessories       | From page 30 |
|--------------------|--------------------------|--------------------------|--------------------------|-------------------|--------------|
| white (90 %)       | FT 10-RF1<br>2 ... 15 mm | FT 10-RF2<br>2 ... 30 mm | FT 10-RF3<br>2 ... 50 mm | Connection cables |              |
| grey (18 %)        | 3 ... 15 mm              | 4 ... 30 mm              | 5 ... 50 mm              | Brackets          |              |
| black (6 %)        | 4 ... 15 mm              | 5 ... 30 mm              | 7 ... 50 mm              |                   |              |

# FT 10-BF

Bluelight photoelectric proximity sensor with background suppression, fixed focus



## PRODUCT HIGHLIGHTS

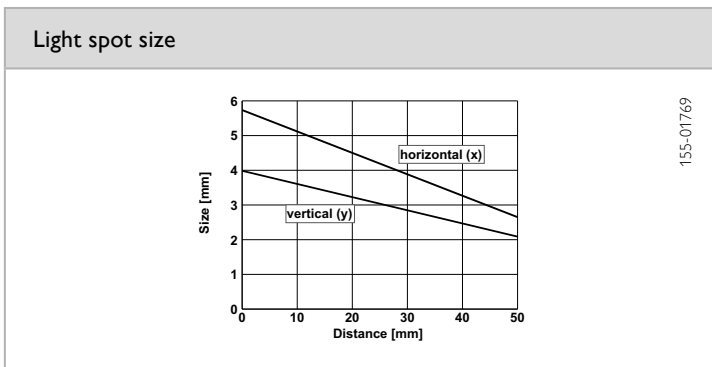
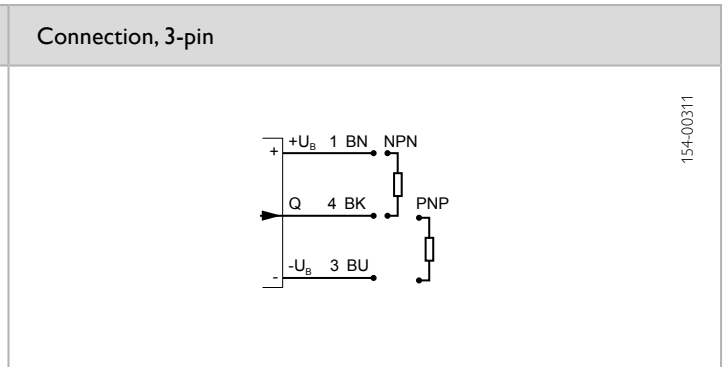
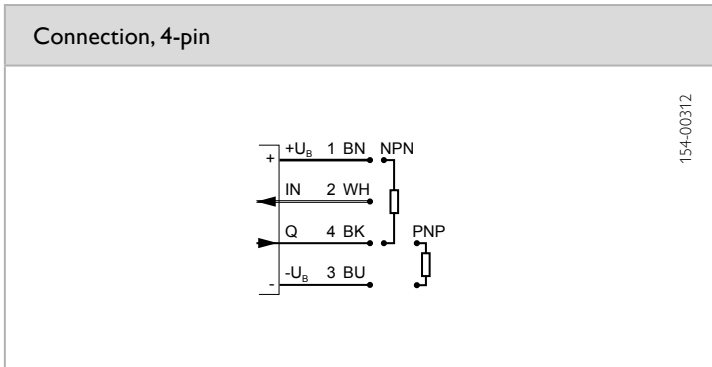
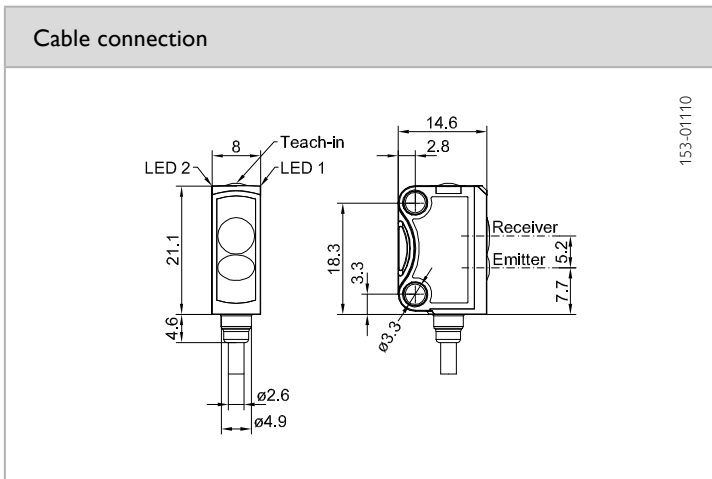
- Sub-miniature sensor with blue transmission LED and precise fixed background suppression
- Reliable switching behaviour with strongly light-absorbing objects, e.g. solar wafers
- Reliable operation without reflector - even with critical surfaces
- Tamper-proof sensor design - no misalignment possible
- Simple mounting and adjustment through innovative dovetail clamp mounting

| Optical data                          |  | Functions                      |  |
|---------------------------------------|--|--------------------------------|--|
| Scanning distance                     | 2 ... 30 mm <sup>1</sup> / 2 ... 50 mm <sup>1</sup>                        | Indicator LED, green           | Operating voltage indicator                |
| Optimum scanning distance             | 15 ... 20 mm   | Indicator LED, yellow          | Switching output indicator                 |
| Used light                            | LED, blue, 450 nm  | Adjustment possibilities       | N.O. / N.C. via control input <sup>3</sup> |
| LED risk group (DIN 62471)            | 2  |                                |  |
| Light spot size                       | See diagram  |                                |  |
| Electrical data                       |  | Mechanical data                |  |
| Operating voltage +U <sub>B</sub>     | 10 ... 30V DC <sup>2</sup>   | Dimensions                     | 21,1 x 14,6 x 8 mm                         |
| No-load supply current I <sub>0</sub> | ≤ 20 mA  | Enclosure rating               | IP 67 <sup>4</sup>                         |
| Output current I <sub>e</sub>         | ≤ 50 mA  | Material, housing              | PUR  |
| Protective circuits                   | Reverse-polarity protection, U <sub>B</sub> / short-circuit protection (Q) | Material, front screen         | PMMA                                       |
| Protection class                      | 2  | Type of connection             | See Selection Table                        |
| Power On Delay                        | < 300 ms   | Ambient temperature: operation | -20 ... +50 °C                             |
| Switching output, Q                   | PNP/NPN (see Selection Table)  | Ambient temperature: storage   | -20 ... +80 °C                             |
| Output function                       | N.O./N.C.  | Weight (cable device)          | approx. 22 g                               |
| Switching frequency, f (ti/tp 1:1)    | 800 Hz   | Weight (pigtail)               | approx. 10 g                               |
| Response time                         | 625 μs   |                                |  |
| Control input, IN <sup>3</sup>        | +U <sub>B</sub> = N.C.<br>-U <sub>B</sub> / Open = N.O.                    |                                |  |

<sup>1</sup> Reference material white, 90 % reflectivity    <sup>2</sup> Max. residual ripple 10 %, within U<sub>B</sub>, approx. 50 Hz/100 Hz    <sup>3</sup> Only 4-pin design    <sup>4</sup>With connected IP 67 plug

| Scanning distance        | Switching output | Type of connection                  | Part number      | Article number |
|--------------------------|------------------|-------------------------------------|------------------|----------------|
| 2 ... 30 mm <sup>1</sup> | PNP              | Cable, 2 m, 4-wire                  | FT 10-BF2-PS-K4  | 600-11026      |
| 2 ... 30 mm <sup>1</sup> | NPN              | Cable, 2 m, 4-wire                  | FT 10-BF2-NS-K4  | 600-11029      |
| 2 ... 30 mm <sup>1</sup> | PNP              | Pigtail, 200 mm with M8 plug, 4-pin | FT 10-BF2-PS-KM4 | 600-11027      |
| 2 ... 30 mm <sup>1</sup> | NPN              | Pigtail, 200 mm with M8 plug, 4-pin | FT 10-BF2-NS-KM4 | 600-11030      |
| 2 ... 30 mm <sup>1</sup> | PNP              | Pigtail, 200 mm with M8 plug, 3-pin | FT 10-BF2-PS-KM3 | 600-11028      |
| 2 ... 30 mm <sup>1</sup> | NPN              | Pigtail, 200 mm with M8 plug, 3-pin | FT 10-BF2-NS-KM3 | 600-11031      |
| 2 ... 50 mm <sup>1</sup> | PNP              | Cable, 2 m, 4-wire                  | FT 10-BF3-PS-K4  | 600-11036      |
| 2 ... 50 mm <sup>1</sup> | NPN              | Cable, 2 m, 4-wire                  | FT 10-BF3-NS-K4  | 600-11039      |
| 2 ... 50 mm <sup>1</sup> | PNP              | Pigtail, 200 mm with M8 plug, 4-pin | FT 10-BF3-PS-KM4 | 600-11037      |
| 2 ... 50 mm <sup>1</sup> | NPN              | Pigtail, 200 mm with M8 plug, 4-pin | FT 10-BF3-NS-KM4 | 600-11040      |
| 2 ... 50 mm <sup>1</sup> | PNP              | Pigtail, 200 mm with M8 plug, 3-pin | FT 10-BF3-PS-KM3 | 600-11038      |
| 2 ... 50 mm <sup>1</sup> | 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



**Accessories**

|                   |              |
|-------------------|--------------|
| Connection cables | From page 30 |
| Brackets          |              |

# FR 10-RL

## Laser retroreflective photoelectric sensor



### PRODUCT HIGHLIGHTS

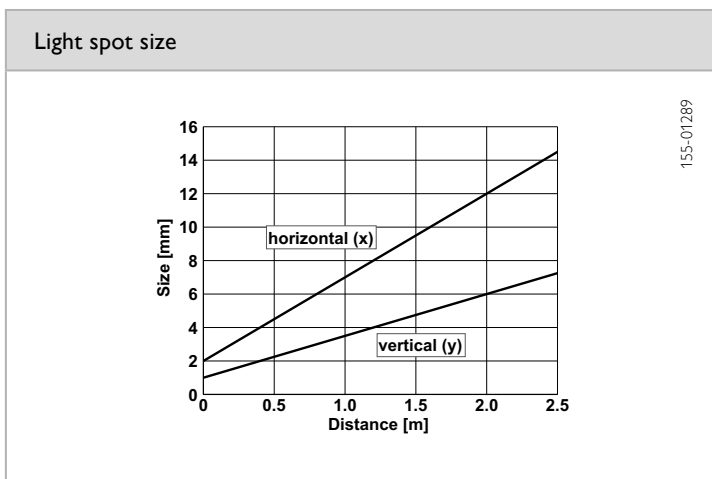
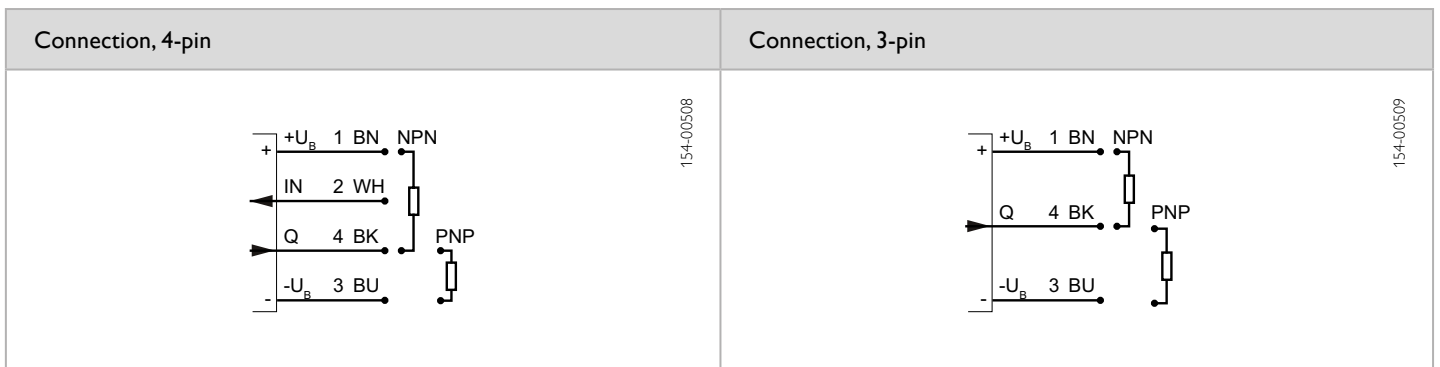
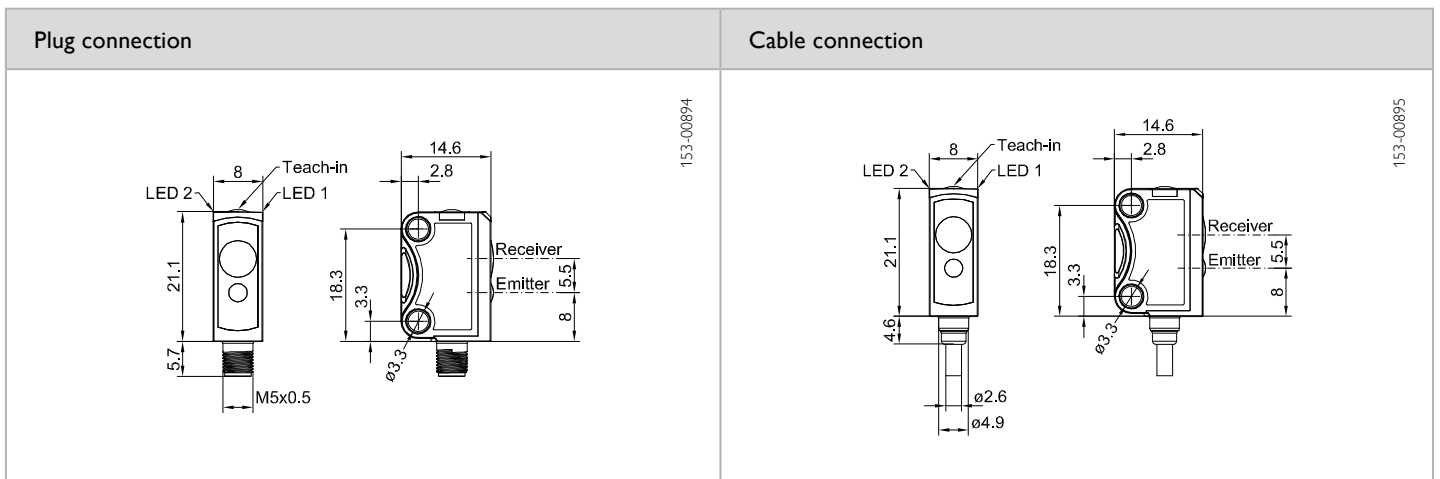
- Sub-miniature sensor for installation in the smallest of spaces
- Bright, precise laser light spot for optimum small-part detection and simple alignment
- Suitable for numerous different reflectors
- User-friendly operation via electronic Teach-in button or control line
- Robust, glass-fibre-reinforced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

| Optical data                             |  | Functions                      |   |
|--|--|--------------------------------|---|
| Limit range                              | 0.1 ... 2.5 m <sup>1</sup>   | Indicator LED, green           | Operating voltage indicator   |
| Operating range                          | 0.1 ... 2 m <sup>1</sup>   | Indicator LED, yellow          | Switching output indicator  |
| Type of light                            | Laser, red, 655 nm   | Sensitivity adjustment         | Via Teach-in button and control input   |
| Light spot size                          | See diagram  | Teach-in modes                 | Mode 1: during running process<br>Mode 2: during standing process                     |
| Laser Class<br>(DIN EN 60825-1:2008-5)   | 1  | Adjustment possibilities       | N.O. / N.C. via Teach-in button<br>and control input<br>Button lock via control input |
|  |  | Default settings               | Max. range and N.O.   |
| Electrical data                          |  | Mechanical data                |   |
| Operating voltage, +U <sub>B</sub>       | 10 ... 30V DC <sup>2</sup>   | Dimensions                     | 21.1 × 14.6 × 8 mm  |
| No-load current, I <sub>0</sub>          | ≤ 12 mA  | Enclosure rating               | IP 67 <sup>3</sup>  |
| Output current, I <sub>e</sub>           | ≤ 50 mA  | Material, housing              | PUR   |
| Protective circuits                      | Reverse-polarity protection, U <sub>B</sub> /<br>short-circuit protection (Q)            | Material, front screen         | PMMA  |
| Protection Class                         | 2  | Type of connection             | See Selection Table   |
| Switching output, Q                      | PNP/NPN (see Selection Table)  | Ambient temperature: operation | -20 ... +50 °C  |
| Output function                          | N.O./N.C.  | Ambient temperature: storage   | -20 ... +80 °C  |
| Switching frequency, f (ti/tp 1:1)       | ≤ 1000 Hz  | Weight (plug device)           | Ca. 3 g   |
| Response time                            | 500 μs   | Weight (cable device)          | Ca. 22 g  |
| Control input, IN<br>(only 4-pin design) | +U <sub>B</sub> = teach-in<br>-U <sub>B</sub> = button locked<br>Open = normal operation | Weight (pigtail)               | Ca. 10 g  |

<sup>1</sup> Reference material: R5/L reflector    <sup>2</sup> Max. 10 % ripple, within U<sub>B</sub>, ~ 50 Hz / 100 Hz    <sup>3</sup> With connected IP 67 plug

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



| Reflector / Reflective foil* | Operating range | Accessories                                 |
|------------------------------|-----------------|---|
| R5/L                         | 0.1 ... 2 m     | Reflectors<br>Connection cables<br>Brackets |
| R2-2LB                       | 0.1 ... 2 m     |   |
| R3-2LK                       | 0.1 ... 2 m     |   |
| RF-50 KL*                    | 0.06 ... 0.75 m |   |
| RF-100 KL*                   | 0.1 ... 2 m     |   |
|                              |                 | From page 30                                |

# FR 10-R

## Retroreflective photoelectric 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  $\mu$ s
- Static and dynamic teach-in via electronic teach-in button or control line
- Simple mounting and adjustment through innovative dovetail clamp mounting

| Optical data                               |  | Functions                      |  |
|--|--|--------------------------------|--|
| Operating range                            | 0.1 ... 1.6 m <sup>1</sup>   | Indicator LED green            | Operating voltage indicator  |
| Used light                                 | LED, red, 650 nm   | Indicator LED yellow           | Switching output indicator   |
| Light spot size                            | See diagram  | Sensitivity adjustment         | Via Teach-in button and control input <sup>3</sup>   |
| Polarising filter                          | Yes  | Teach-in modes                 | Mode 1: during running process<br>Mode 2: during standing process  |
|  |  | Adjustment possibilities       | N.O./N.C. via Teach-in button and control input <sup>3</sup><br>Button lock via control input <sup>3</sup> |
|  |  | Default settings               | Max. range and N.O.  |
| Electrical data                            |  | Mechanical data                |  |
| Operating voltage, +U <sub>B</sub>         | 10 ... 30V DC <sup>2</sup>   | Dimensions                     | 21,1 × 14,6 × 8 mm   |
| No-load current, I <sub>0</sub>            | ≤ 20 mA  | Enclosure rating               | IP 67 <sup>4</sup>   |
| Output current, I <sub>e</sub>             | ≤ 50 mA  | Material, housing              | PUR  |
| Protective circuits                        | Reverse-polarity protection, U <sub>B</sub> / short-circuit protection (Q)               | Material, front screen         | PMMA   |
| Protection class                           | 2  | Type of connection             | See Selection Table  |
| Power On Delay                             | < 300 ms   | Ambient temperature: operation | -20 ... +60 °C   |
| Switching output, Q                        | PNP/NPN (see Selection Table)  | Ambient temperature: storage   | -20 ... +80 °C   |
| Output function                            | N.O./N.C.  | Weight (cable device)          | approx. 22 g   |
| Switching frequency, f (ti/tp 1:1)         | ≤ 1000 Hz  | Weight (pigtail)               | approx. 10 g   |
| Response time                              | 500 $\mu$ s  |                                |  |
| Control input, I <sub>N</sub> <sup>3</sup> | +U <sub>B</sub> = teach-in<br>-U <sub>B</sub> = button locked<br>Open = normal operation |                                |  |

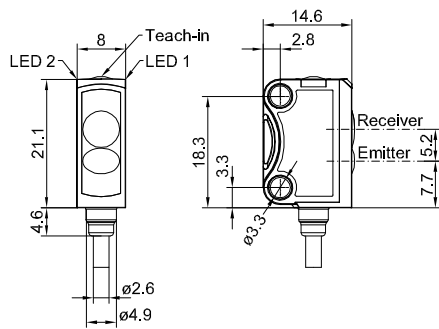
<sup>1</sup> Reference material reflector R5    <sup>2</sup> Max. 10 % ripple within U<sub>B</sub>, ~ 50 Hz / 100 Hz    <sup>3</sup> Only 4-pin design    <sup>4</sup> With connected IP 67 plug

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

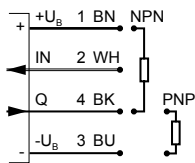


### Cable connection



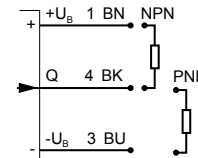
153-01110

### Connection, 4-pin



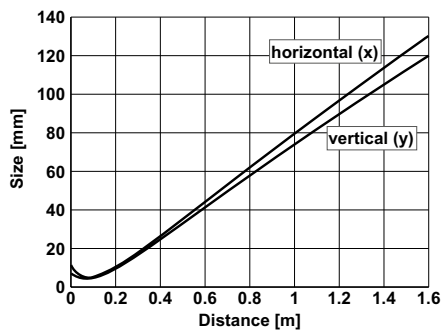
154-00312

### Connection, 3-pin



154-00311

### Light spot size



155-01767

| Reflector / Reflective foil* | Operating range (min./max. reflector distance) | Accessories |              |
|------------------------------|--|-------------|--------------|
| R5                           | 0.1 ... 1.6 m                                  | Reflectors  | From page 30 |
| R1                           | 0.1 ... 1 m                                    | Brackets    |              |
| R2-2LB1                      | 0,15 ... 0,5 m                                 |             |              |
| R3-2LK1                      | 0,15 ... 0,5 m                                 |             |              |
| RF-100 KL*                   | 0,15 ... 1 m                                   |             |              |

# FS/FE 10-RL

## Laser through-beam photoelectric sensor



### PRODUCT HIGHLIGHTS

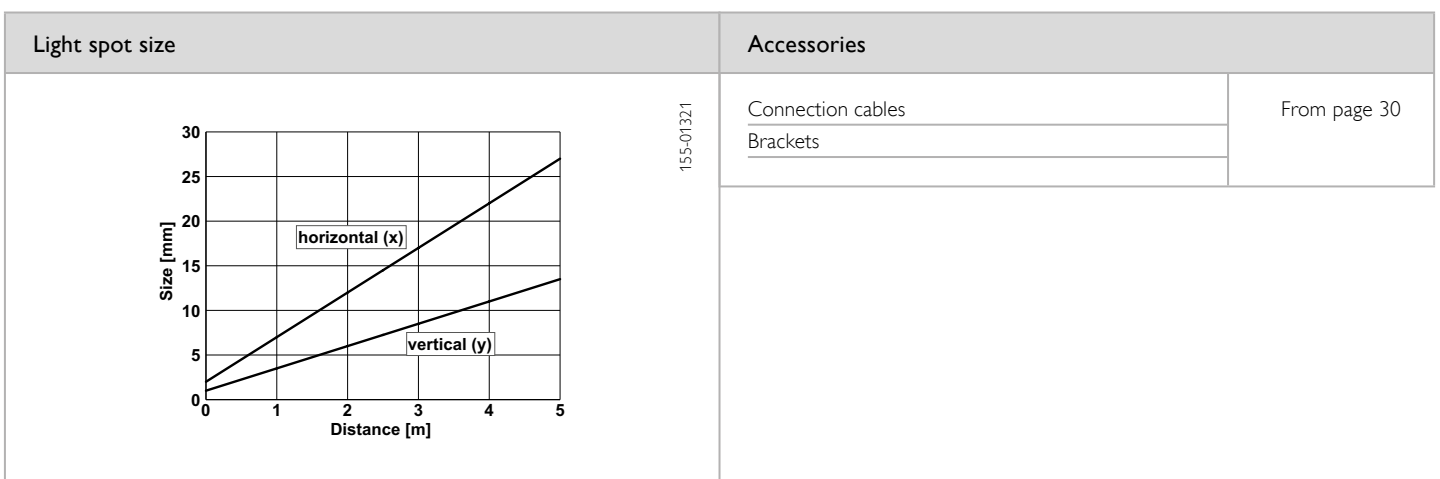
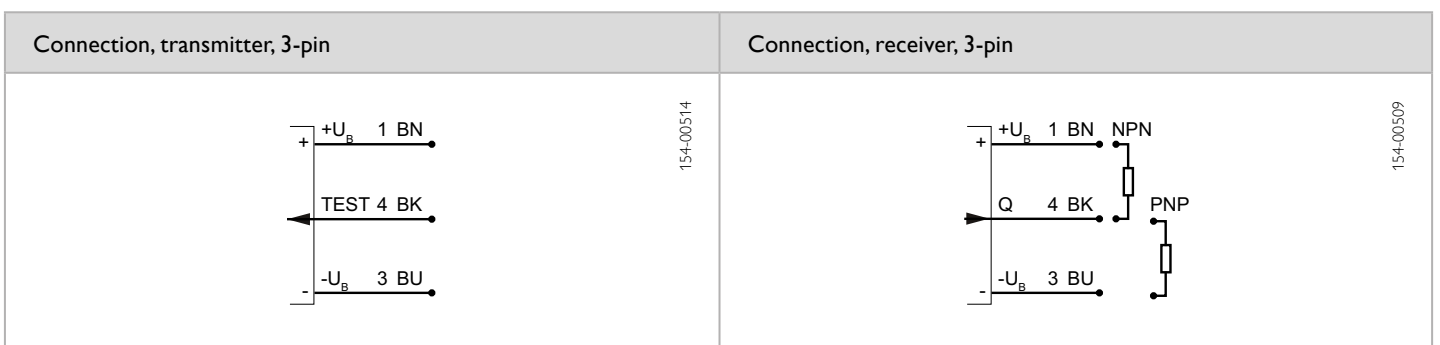
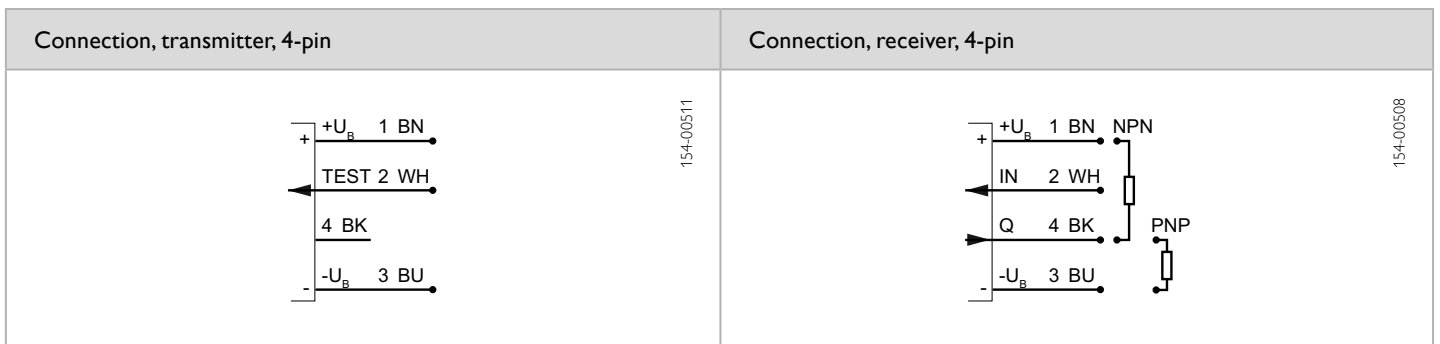
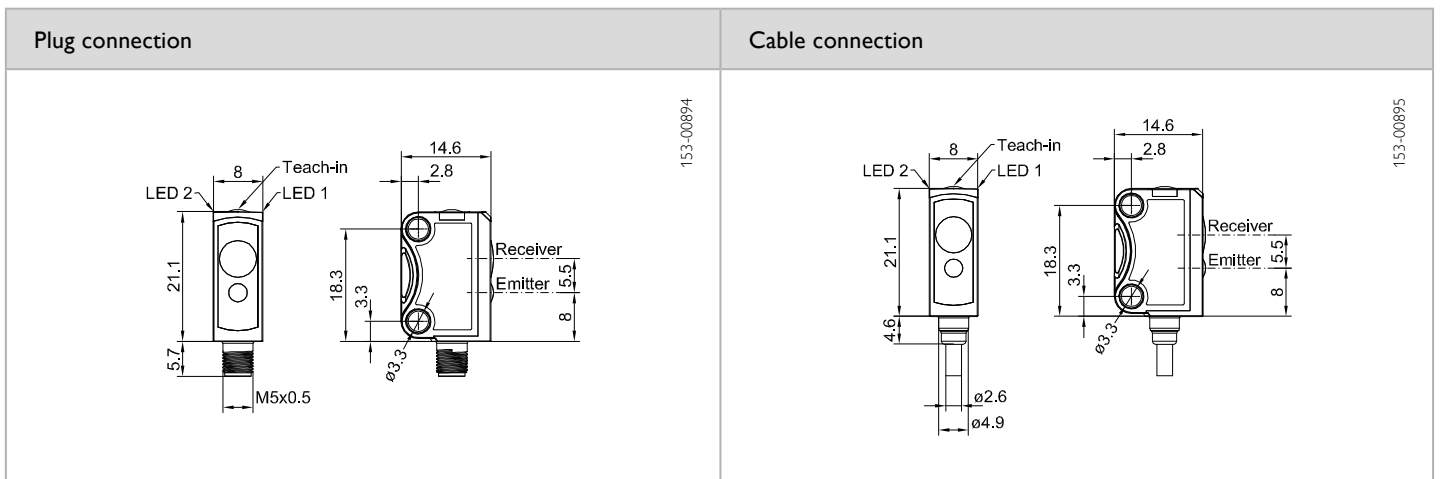
- Sub-miniature sensor for installation in the smallest of spaces
- Bright, precise laser light spot for optimum small-part detection and simple alignment
- High switching frequency for detection in even the fastest processes
- User-friendly operation via electronic Teach-in button or control line
-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

| Optical data  |  | Functions                              |   |
|---|--|--|---|
| Limit range   | 0 ... 5 m  | Indicator LED, green                   | Operating voltage indicator   |
| Operating range                                     | 0 ... 3 m  | Indicator LED, yellow                  | Switching output indicator  |
| Type of light                                       | Laser, red, 655 nm   | Sensitivity adjustment                 | Via Teach-in button and control input   |
| Light spot size                                     | See diagram  | Teach-in modes                         | Mode 1: during running process<br>Mode 2: during standing process                     |
| Laser Class<br>(DIN EN 60825-1:2008-5)              | 1  | Adjustment possibilities<br>(receiver) | N.O. / N.C. via Teach-in button<br>and control input<br>Button lock via control input |
|   |  | Default settings                       | Max. range and N.O.   |
| Electrical data                                     |  | Mechanical data                        |   |
| Operating voltage, +U <sub>b</sub>                  | 10 ... 30V DC <sup>1</sup>   | Dimensions                             | 21.1 × 14.6 × 8 mm  |
| No-load current, I <sub>o</sub>                     | ≤ 12 mA  | Enclosure rating                       | IP 67 <sup>2</sup>  |
| Output current, I <sub>e</sub>                      | ≤ 50 mA  | Material, housing                      | PUR   |
| Protective circuits                                 | Reverse-polarity protection, U <sub>b</sub> /<br>short-circuit protection (Q)            | Material, front screen                 | PMMA  |
| Protection Class                                    | 2  | Type of connection                     | See Selection Table   |
| Switching output, Q                                 | PNP/NPN (see Selection Table)  | Ambient temperature: operation         | -20 ... +50 °C  |
| Output function                                     | N.O. / N.C.  | Ambient temperature: storage           | -20 ... +80 °C  |
| Switching frequency, f (ti/tp 1:1)                  | ≤ 4000Hz   | Weight (plug device)                   | Ca. 6 g   |
| Response time                                       | 125 μs   | Weight (cable device)                  | Ca. 44 g  |
| Control input, IN (receiver)<br>(only 4-pin design) | +U <sub>b</sub> = teach-in<br>-U <sub>b</sub> = button locked<br>Open = normal operation | Weight (pigtail)                       | Ca. 20 g  |
| Control input, Test (transmitter)                   | +U <sub>b</sub> = Test (transmitter off)<br>-U <sub>b</sub> / Open = normal operation    |  |   |

<sup>1</sup> Max. 10 % ripple, within U<sub>b</sub>, ~ 50 Hz / 100 Hz    <sup>2</sup> With connected IP 67 plug

| Operating range | Switching output | Type of connection                  | Part number        | Design                               | Article number |
|-----------------|------------------|-------------------------------------|--------------------|--------------------------------------|----------------|
| 1 ... 3 m       | PNP              | Plug, M5x0.5, 4-pin                 | FS/FE 10-RL-PS-E4  | Sensor pair (transmitter & receiver) | 611-51000      |
| 1 ... 3 m       | NPN              | Plug, M5x0.5, 4-pin                 | FS/FE 10-RL-NS-E4  | Sensor pair (transmitter & receiver) | 611-51001      |
| 1 ... 3 m       | PNP              | Cable, 2 m, 4-wire                  | FS/FE 10-RL-PS-K4  | Sensor pair (transmitter & receiver) | 611-51002      |
| 1 ... 3 m       | NPN              | Cable, 2 m, 4-wire                  | FS/FE 10-RL-NS-K4  | Sensor pair (transmitter & receiver) | 611-51003      |
| 1 ... 3 m       | PNP              | Pigtail, 200 mm with M8 plug, 4-pin | FS/FE 10-RL-PS-KM4 | Sensor pair (transmitter & receiver) | 611-51004      |
| 1 ... 3 m       | NPN              | Pigtail, 200 mm with M8 plug, 4-pin | FS/FE 10-RL-NS-KM4 | Sensor pair (transmitter & receiver) | 611-51005      |
| 1 ... 3 m       | PNP              | Pigtail, 200 mm with M8 plug, 3-pin | FS/FE 10-RL-PS-KM3 | Sensor pair (transmitter & receiver) | 611-51006      |
| 1 ... 3 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



# FS 10-RL / FE 10-RL

Laser through-beam photoelectric 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  |   | Functions                              |  |
|---|---|--|--|
| Limit range   | 0 ... 5 m   | Indicator LED, green                   | Operating voltage indicator  |
| Operating range                                     | 0 ... 3 m   | Indicator LED, yellow                  | Switching output indicator   |
| Type of light                                       | Laser, red, 655 nm  | Sensitivity adjustment                 | Via Teach-in button and control input  |
| Light spot size                                     | See diagram   | Teach-in modes                         | Mode 1: during running process<br>Mode 2: during standing process                |
| Laser Class<br>(DIN EN 60825-1:2008-5)              | 1   | Adjustment possibilities<br>(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                                     |   | Mechanical data                        |  |
| Operating voltage, +U <sub>B</sub>                  | 10 ... 30V DC <sup>1</sup>  | Dimensions                             | 21.1 × 14.6 × 8 mm   |
| No-load current, I <sub>0</sub>                     | ≤ 12 mA   | Enclosure rating                       | IP 67 <sup>2</sup>   |
| Output current, I <sub>e</sub>                      | ≤ 50 mA   | Material, housing                      | PUR  |
| Protective circuits                                 | Reverse-polarity protection, U <sub>B</sub> / short-circuit protection (Q)              | Material, front screen                 | PMMA   |
| Protection Class                                    | 2   | Type of connection                     | See Selection Table  |
| Switching output, Q                                 | PNP/NPN (see Selection Table)   | Ambient temperature: operation         | -20 ... +50 °C   |
| Output function                                     | N.O./N.C.   | Ambient temperature: storage           | -20 ... +80 °C   |
| Switching frequency, f (ti/tp 1:1)                  | ≤ 4000Hz  | Weight (plug device)                   | Ca. 6 g  |
| Response time                                       | 125 µs  | Weight (cable device)                  | Ca. 44 g   |
| Control input, IN (receiver)<br>(only 4-pin design) | +U <sub>B</sub> = Teach-in; -U <sub>B</sub> = button locked;<br>Open = normal operation | Weight (pigtail)                       | Ca. 20 g   |
| Control input, Test (transmitter)                   | +U <sub>B</sub> = Test (transmitter off)<br>-U <sub>B</sub> / Open = normal operation   |  |  |

<sup>1</sup> Max. 10 % ripple, within U<sub>B</sub>, ~ 50 Hz / 100 Hz    <sup>2</sup> With connected IP 67 plug

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

| Operating range | Switching output | Type of connection                  | Part number     | Design   | Article number. |
|-----------------|------------------|-------------------------------------|-----------------|----------|-----------------|
| 1 ... 3 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                             | Cable connection                            |
|---|---|
| <p style="text-align: right;">153-00894</p> | <p style="text-align: right;">153-00895</p> |


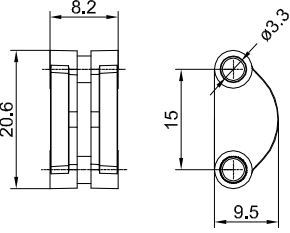

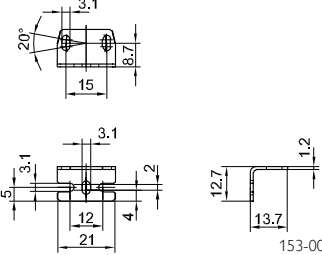
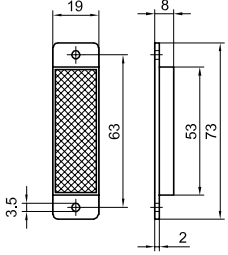
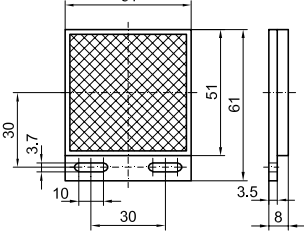
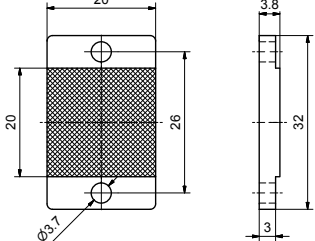
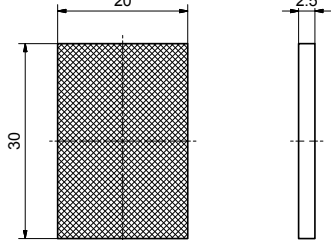
| Connection, transmitter, 4-pin              | Connection, receiver, 4-pin                 |
|---|---|
| <p style="text-align: right;">154-00511</p> | <p style="text-align: right;">154-00508</p> |

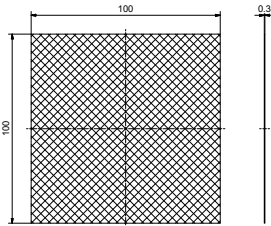
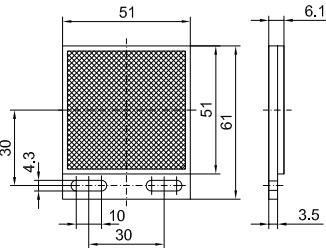
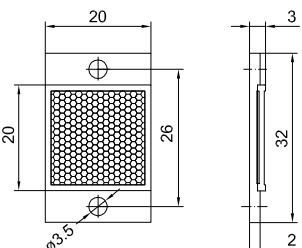
| Connection, transmitter, 3-pin              | Connection, receiver, 3-pin                 |
|---|---|
| <p style="text-align: right;">154-00514</p> | <p style="text-align: right;">154-00509</p> |

| Light spot size                             | Accessories  |                   |              |          |
|---|--|-------------------|--------------|----------|
| <p style="text-align: right;">155-01321</p> | <table border="1"> <tr> <td>Connection cables</td> <td rowspan="2">From page 30</td> </tr> <tr> <td>Brackets</td> </tr> </table> | Connection cables | From page 30 | Brackets |
| Connection cables                           | From page 30   |                   |              |          |
| Brackets                                    |  |                   |              |          |

# Accessories

## Brackets

| Brackets  |   |  |  |
|---|---|--|--|
|                      |  <p>153-00899</p>                                    | <p>Part number / Article number</p> <p>Description</p> <p>Suitable for</p>   | <p>MBD F10 / 660-01001</p> <p>Dovetail clamp mounting, adjustable <math>\pm 10^\circ</math>, with screws</p> <p>Material: PBT</p> <p>F 10</p>  |
|                      |  <p>153-00907</p>                                    | <p>Part number / Article number</p> <p>Description</p> <p>Suitable for</p>   | <p>MS F 10 / 660-01000</p> <p>Mounting bracket with screws</p> <p>1x mounting plate M3</p> <p>1x mounting plate <math>\varnothing 3.1</math> mm</p> <p>Material: stainless steel V2A</p> <p>F 10</p> |
| Reflectors for retroreflective photoelectric sensor   |   |  |  |
|  <p>153-00068</p>  | <p>Part number / Article number</p> <p>Description</p> <p>Dimensions</p> <p>Mounting</p> <p>Temperature range</p> <p>Suitable for</p> | <p>R1 / 904-51532</p> <p>Reflector in housing</p> <p>19 x 73 x 8 mm<sup>3</sup></p> <p>2 mounting holes M3</p> <p>-20 ... +60 °C</p> <p>Retroreflective photoelectric sensor (LED)</p>                               |  |
|  <p>153-00069</p>  | <p>Part number / Article number</p> <p>Description</p> <p>Dimensions</p> <p>Mounting</p> <p>Temperature range</p> <p>Suitable for</p> | <p>R5 / 904-51533</p> <p>Reflector in housing</p> <p>51 x 61 x 8 mm<sup>3</sup></p> <p>2 mounting holes</p> <p>-20 ... +60 °C</p> <p>Retroreflective photoelectric sensor (LED)</p>                                  |  |
|  <p>153-001046</p> | <p>Part number / Article number</p> <p>Description</p> <p>Dimensions</p> <p>Mounting</p> <p>Temperature range</p> <p>Suitable for</p> | <p>R2-2LB1 / 904-51595</p> <p>Reflector in housing, with very fine structure</p> <p>20 x 32 x 3.8 mm<sup>3</sup></p> <p>2 mounting holes</p> <p>-20 ... +60 °C</p> <p>Retroreflective photoelectric sensor (LED)</p> |  |
|  <p>153-01047</p>  | <p>Part number / Article number</p> <p>Description</p> <p>Dimensions</p> <p>Mounting</p> <p>Temperature range</p> <p>Suitable for</p> | <p>R3-2LK1 / 904-51596</p> <p>Reflector in housing with very fine structure</p> <p>20 x 30 x 2.5 mm<sup>3</sup></p> <p>Self-adhesive</p> <p>-20 ... +60 °C</p> <p>Retroreflective photoelectric sensor (LED)</p>     |  |

| Reflectors for retroreflective photoelectric sensor   |   |   |                       |             |  |            |                               |          |                          |                   |                |              |  |  |
|---|---|---|-----------------------|-------------|--|------------|-------------------------------|----------|--------------------------|-------------------|----------------|--------------|--|--|
|  <p style="text-align: right;">153-01125</p>                       | <table border="1"> <tr><td>Part number / Article number</td><td>RF-100 KL / 904-51644</td></tr> <tr><td>Description</td><td>Reflective tape 100 x 100 mm, to cut to size</td></tr> <tr><td>Dimensions</td><td>100 x 100 mm<sup>2</sup></td></tr> <tr><td>Mounting</td><td>Self-adhesive</td></tr> <tr><td>Temperature range</td><td>-40 ... +70 °C</td></tr> <tr><td>Suitable for</td><td>Retroreflective photoelectric sensor (LED &amp; laser)</td></tr> </table> | Part number / Article number  | RF-100 KL / 904-51644 | Description | Reflective tape 100 x 100 mm, to cut to size | Dimensions | 100 x 100 mm <sup>2</sup>     | Mounting | Self-adhesive            | Temperature range | -40 ... +70 °C | Suitable for | Retroreflective photoelectric sensor (LED & laser) |  |
| Part number / Article number  | RF-100 KL / 904-51644   |   |                       |             |  |            |                               |          |                          |                   |                |              |  |  |
| Description   | Reflective tape 100 x 100 mm, to cut to size  |   |                       |             |  |            |                               |          |                          |                   |                |              |  |  |
| Dimensions  | 100 x 100 mm <sup>2</sup>   |   |                       |             |  |            |                               |          |                          |                   |                |              |  |  |
| Mounting  | Self-adhesive   |   |                       |             |  |            |                               |          |                          |                   |                |              |  |  |
| Temperature range   | -40 ... +70 °C  |   |                       |             |  |            |                               |          |                          |                   |                |              |  |  |
| Suitable for  | Retroreflective photoelectric sensor (LED & laser)  |   |                       |             |  |            |                               |          |                          |                   |                |              |  |  |
|  <p style="text-align: right;">153-00242</p>                       | <table border="1"> <tr><td>Part number / Article number</td><td>R5/L / 904-51543</td></tr> <tr><td>Description</td><td>Reflector in housing</td></tr> <tr><td>Dimensions</td><td>51 x 51 x 6.1 mm<sup>3</sup></td></tr> <tr><td>Mounting</td><td>2 mounting holes (slots)</td></tr> <tr><td>Temperature range</td><td>-20 ... +60 °C</td></tr> <tr><td>Suitable for</td><td>Retroreflective photoelectric sensor (laser)</td></tr> </table>                         | Part number / Article number  | R5/L / 904-51543      | Description | Reflector in housing                         | Dimensions | 51 x 51 x 6.1 mm <sup>3</sup> | Mounting | 2 mounting holes (slots) | Temperature range | -20 ... +60 °C | Suitable for | Retroreflective photoelectric sensor (laser)       |  |
| Part number / Article number  | R5/L / 904-51543  |   |                       |             |  |            |                               |          |                          |                   |                |              |  |  |
| Description   | Reflector in housing  |   |                       |             |  |            |                               |          |                          |                   |                |              |  |  |
| Dimensions  | 51 x 51 x 6.1 mm <sup>3</sup>   |   |                       |             |  |            |                               |          |                          |                   |                |              |  |  |
| Mounting  | 2 mounting holes (slots)  |   |                       |             |  |            |                               |          |                          |                   |                |              |  |  |
| Temperature range   | -20 ... +60 °C  |   |                       |             |  |            |                               |          |                          |                   |                |              |  |  |
| Suitable for  | Retroreflective photoelectric sensor (laser)  |   |                       |             |  |            |                               |          |                          |                   |                |              |  |  |
|  <p style="text-align: right;">153-00773</p>                      | <table border="1"> <tr><td>Part number / Article number</td><td>R2-2LB / 904-51586</td></tr> <tr><td>Description</td><td>Reflector in housing</td></tr> <tr><td>Dimensions</td><td>20 x 32 x 3 mm<sup>3</sup></td></tr> <tr><td>Mounting</td><td>2 mounting holes</td></tr> <tr><td>Temperature range</td><td>-20 ... +60 °C</td></tr> <tr><td>Suitable for</td><td>Retroreflective photoelectric sensor (laser)</td></tr> </table>                                 | Part number / Article number  | R2-2LB / 904-51586    | Description | Reflector in housing                         | Dimensions | 20 x 32 x 3 mm <sup>3</sup>   | Mounting | 2 mounting holes         | Temperature range | -20 ... +60 °C | Suitable for | Retroreflective photoelectric sensor (laser)       |  |
| Part number / Article number  | R2-2LB / 904-51586  |   |                       |             |  |            |                               |          |                          |                   |                |              |  |  |
| Description   | Reflector in housing  |   |                       |             |  |            |                               |          |                          |                   |                |              |  |  |
| Dimensions  | 20 x 32 x 3 mm <sup>3</sup>   |   |                       |             |  |            |                               |          |                          |                   |                |              |  |  |
| Mounting  | 2 mounting holes  |   |                       |             |  |            |                               |          |                          |                   |                |              |  |  |
| Temperature range   | -20 ... +60 °C  |   |                       |             |  |            |                               |          |                          |                   |                |              |  |  |
| Suitable for  | Retroreflective photoelectric sensor (laser)  |   |                       |             |  |            |                               |          |                          |                   |                |              |  |  |
| Connection cables   |   |   |                       |             |  |            |                               |          |                          |                   |                |              |  |  |
| Part number   | Article number  | Description   |                       |             |  |            |                               |          |                          |                   |                |              |  |  |
| <b>M5, 4-pin</b><br>CN4 FG-2m-PUR<br>CN4 FG-5m-PUR<br>CN4 FW-2m-PUR<br>CN4 FW-5m-PUR  | 902-51793<br>902-51791<br>902-51794<br>902-51792  | 2 m, straight, PUR<br>5 m, straight, PUR<br>2 m, 90°, PUR<br>5 m, 90°, PUR  |                       |             |  |            |                               |          |                          |                   |                |              |  |  |
| <b>M8, 3-pin</b><br>K3-2m-G-PUR<br>K3-5m-G-PUR<br>K3-10m-G-PUR<br>K3-2m-W-PUR<br>K3-5m-W-PUR<br>K3-2m-W-PL-PUR<br>K3-5m-W-PL-PUR<br>K3-10m-W-PL-PUR | 902-50679<br>902-51614<br>902-50694<br>902-50681<br>902-51615<br>902-50683<br>902-51616<br>902-50693  | 2 m, straight, PUR<br>5 m, straight, PUR, suitable for drag chains<br>10 m, straight, PUR, suitable for drag chains<br>2 m, 90°, PUR, suitable for drag chains<br>5 m, 90°, PUR, suitable for drag chains<br>2 m, 90°, PUR, with indicator LED<br>5 m, 90°, PUR, with indicator LED, suitable for drag chains<br>10 m, 90°, PUR, with indicator LED, suitable for drag chains |                       |             |  |            |                               |          |                          |                   |                |              |  |  |
| <b>M8, 4-pin</b><br>K4-2m-G-PUR<br>K4-5m-G-PUR<br>K4-10m-G-PUR<br>K4-2m-W-PUR<br>K4-5m-W-PUR<br>K4-10m-W-PUR<br>K4-2m-W-PL-PUR<br>K4-5m-W-PL-PUR    | 902-50801<br>902-51617<br>902-51610<br>902-50803<br>902-51618<br>902-51629<br>902-51642<br>902-51643  | 2 m, straight, PUR, suitable for drag chains<br>5 m, straight, PUR, suitable for drag chains<br>10 m, straight, PUR, suitable for drag chains<br>2 m, 90°, PUR, suitable for drag chains<br>5 m, 90°, PUR, suitable for drag chains<br>10 m, 90°, PUR, suitable for drag chains<br>2 m, 90°, PUR, with indicator LED<br>5 m, 90°, PUR, with indicator LED                     |                       |             |  |            |                               |          |                          |                   |                |              |  |  |

# We look ahead

Yesterday, today and in the future



“We gauge ourselves not by what is possible today, but by our vision of what can be achieved” – this has been our motto since the foundation of SensoPart in 1994. Our goal is to always be a step ahead and to be able to offer our customers the most innovative sensor for industrial automation.

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