Photoelectric sensors and proximity sensors

Performance and quality made in Germany

F 10 – sub-miniature sensor family

from Page 236

FT 10-RLH-PS-KM4
- *The world's smallest adjustable laser photoelectric proximity sensor with background suppression*

>> Page 238

FS/FE 10-RL-…
- *Very precise front edge detection thanks to high scanning rate and fine laser beam*

>> Page 254

F 25 – the new generation miniature sensor family

from Page 258

FT 25-RLH-PS-M4M
- *Extremely accurate small-part detection thanks to tiny laser light spot*
- *Precise background suppression through SensoPart ASIC technology*

>> Page 260

FT 25-RHD-PNS-M4M
- *Photoelectric proximity sensor with adjustable background suppression*
- *Long scanning distance of 400 mm with miniature housing*

>> Page 264

F 55 – photoelectric sensors and proximity sensors with high-quality housings

from Page 292

FT 55-RHM-PS-L4
- *Photoelectric proximity sensor with background suppression*
- *Stainless steel housings for use in the food industry*

>> Page 304

FT 55-RL2-PS-L4
- *Laser photoelectric proximity sensor*
- *Detection of the slightest contrast differences at a scanning distance of up to 1.2 m*

>> Page 306

F 20 – photoelectric sensors and proximity sensors in miniature housings

from Page 326

FR 20 RLO-PSM4
- *Autocollimation laser retro-reflective photoelectric sensor*
- *Extremely accurate small-part detection from range of 0 mm*
- *High scanning accuracy due to high switching frequency of 4 kHz and precise light spot*

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Photoelectric sensors and proximity sensors are the standard sensors in automation technology. At SensoPart you will find the right sensor for almost every conceivable application. Our product portfolio offers a comprehensive selection of differing sizes, ranges and switching variants. Regardless of whether you choose a sub-miniature sensor for restricted machine conditions or a large housing with a particularly long range or scanning distance – all our sensors share excellent performance data, high reliability and solid workmanship "made in Germany".

Our photoelectric sensors and proximity sensors offer, for example, precise background suppression, extremely accurate small-part detection or reliable detection of transparent objects. And they operate extremely reliably in harsh industrial conditions: our current sensor series have tightly sealed (IP 69K / IP 67) plastic housings and are immune to cleaning according to the Ecolab standard.

Mounting and alignment are easy and rapid with products from SensoPart: well thought-out, user-friendly accessories such as the dovetail mounting offered by some of our series, the adjustment possibilities via Teach-in button and control input, or the Autodetect function (only available from SensoPart), with which sensors can automatically determine whether PNP or NPN wiring is present – so that only one sensor variant is required.

The SensoPart portfolio not only contains powerful, reliable and solid products for standard applications, but also real highlights. Our new FT 25-RHD proximity sensor, for example: its highly precise background suppression, the lowest black/white-shift currently available on the market, and the long scanning distance ensure absolutely reliable switching behaviour – without impairment by varying object surfaces and colours, or critical backgrounds. Or our FT 10-RLH sub-miniature laser scanner – the only one of its size with adjustable background suppression. Or … see for yourself on the following pages!

F 50 – photoelectric sensors and proximity sensors in compact housings

from Page 362

FT 50 RLHD-PAL4

- *Laser photoelectric proximity sensor with background suppression*
- *Long scanning distance of 300 mm with compact housing and extremely accurate small-part detection*

>> Page 366

F 88 – the photoelectric sensor and proximity sensor family for harsh operating conditions

from Page 378

FT 88-IH-RAT-PM

- *Infrared photoelectric proximity sensor with background suppression*
- *Relay output with toggle switch*
- *Very high scanning distance of 2 m*
- *Simple adjustment of time functions*

>> Page 386

FT 92 – proximity sensors with long ranges

from Page 398

FT 92 IL-PSL4

- *Infrared laser photoelectric proximity sensor with background suppression*
- *Very long range of 6 m thanks to time-of-flight technology*
- *Simple sensor alignment by means of integrated red-light pilot laser*

>> Page 400

Photoelectric sensors and proximity sensors in cylindrical housings

from Page 402

FMH 18

- *Best sensor in cylindrical housing with background suppression*

>> Page 406

FR 18-2 RM-PS-L4

- *Retroreflective photoelectric sensor*
- *Standard M18 sleeve in robust full-metal housing*

>> Page 426

made in Germany

TYPICAL SENSOPART

- SensoPart develops, produces and sells photoelectric proximity sensors with the best background suppression on the market – thanks to SensoPart ASIC technology
- Highly developed laser technology – precise and small laser light spots for extremely accurate small-part detection
- Sensors with the best black/white-shift for reliable switching behaviour regardless of object colour and surface
- Patented sensor designs and mounting systems
- Differing transmission light sources for the most varied of requirements: laser, LED, or infrared light transmitters
- Wide variety of adjustment possibilities: potentiometer, teach-in, external control line or fixed pre-setting
- Cuboid or cylindrical housing options
- Robust workmanship: glass-fibre-reinforced plastic housings (IP 69K / IP 67) or metal housings, stable plug connections made of plastic and metal, as well as metal-reinforced drilled holes for mounting
- Internationally recognised UL-certification
- Ecolab-certification
- Safe operation thanks to Laser Class 1
- Intelligent mounting solutions for easy mounting and adjustment
- IO-Link

By far the best object detection

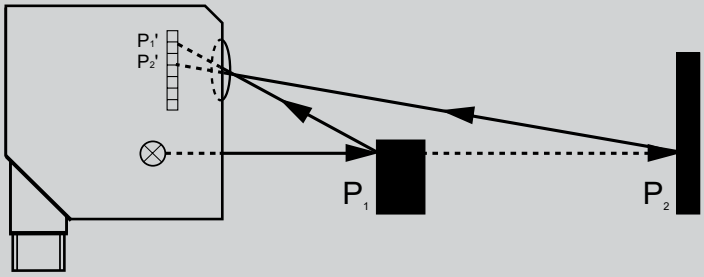
Our sensors detect almost any object in any surroundings thanks to the distance principle

A challenge for every sensor

Polished covering panels on machinery, blinking warning lamps on passing vehicles, moving machine parts, sunlight coming through a window – all these are background effects that can make detection of the actual target object considerably more difficult. So it is a major advantage if one uses sensors that one can rely on: proximity sensors with background suppression from SensoPart. They only see what they are supposed to see: the object itself – regardless of the material, shape and colour – and nothing else!

Object detection by means of distance measurement

SensoPart proximity sensors with background suppression can always differentiate between object and background even in strongly reflective environments. The sensor measures the distance to the object, P_1, and to the possible background, P_2, according to the triangulation process and not the reflectivity of the object. The signal, $P_{2'}$, coming from the background is then cut out. SensoPart has implemented the detection principle of distance measurement with incomparable precision. This high quality could be achieved because we have developed an optoelectronic, integrated circuit (an ASIC), in which the optical receiver cell and the evaluation electronics are integrated in the smallest of spaces



Your advantages

- Reliable object detection
- High process stability
- An economical solution

Technology provides the technical edge

Thanks to its tiny dimensions, the ASIC microchip even fits into the sub-miniature sensors of the F 10 series. Thus SensoPart offers the world's smallest laser sensor with adjustable background suppression.

With the latest generation F 10, F 25, and F 55 series, SensoPart offers photoelectric proximity sensors with the best background suppression currently available.

Your advantage is our priority

Reliable object detection

- Regardless of size, shape, colour, material and surface properties of the target object
- Detection using the distance measurement principle: precise and reliable

High process stability

- Reliable suppression of undesirable reflections and ambient light
- Suppression of moving parts in the background (e.g. conveyor belts, machine parts, persons)
- Reliable detection of the target object even when close to the background

The economical solution

- Usable in all task areas
- Rapid commissioning thanks to simple teach-in
- High machine run-times through quality sensors from SensoPart, made in Germany

1 *Reliable detection of the thinnest tubes in front of metallic backgrounds thanks to focused laser light spot and precise background suppression.*

2 *Detection of black foam rubber pads against reflective backgrounds.*

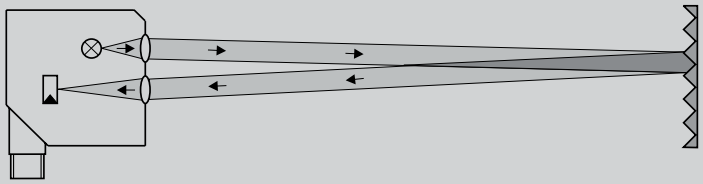
3 *Strongly reflective CDs are reliably detected against metallic backgrounds and with ambient light effects.*

4 *Solar wafers with shimmering blue surfaces against polished metal surfaces with ambient light reflections are reliably detected.*

Photoelectric sensors and proximity sensors

System description

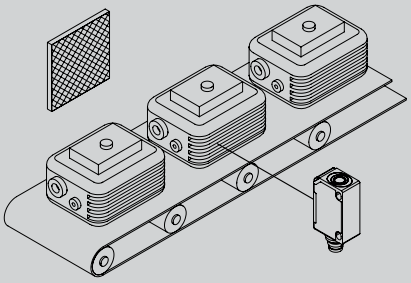
Retroreflective photoelectric sensors



The transmitter and receiver are accommodated in a single housing in retroreflective photoelectric sensors. The light emitted by the transmitter hits a reflector and is reflected. The receiver evaluates the reflected light. The advantage lies in the small size of the reflector. It is also easy to install because it is a passive element and thus requires no connections.

Like through-beam photoelectric sensors, retroreflective photoelectric sensors are often selected according to the desired range. Because the light has to travel the path from the sensor to the reflector twice one also talks of the two-way photoelectric sensor. The light from the transmitter is, explained simply, emitted in a cone shape. This means that the cross-section of the light cone increases with rising range. This is also why a larger reflector is needed at longer ranges than at shorter distances. The range is therefore quoted in the data sheet in relation to the type of reflector.

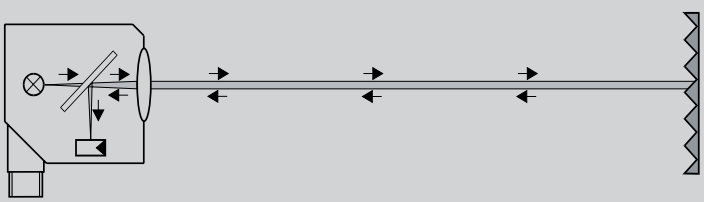
Laser sensors provide an almost parallel light beam. Whereby the light beam is extremely fine and parallel over the entire operating range. This advantage is, above all, used when the smallest of objects have to be detected along the entire operating range. Regardless of the physical principle, all retroreflective photoelectric sensors from SensoPart have a so-called polarisation filter. Polarisation filters are optical filters that let the light beams through only in one direction. Use of a polarisation filter in combination with pyramidical reflectors can also allow the reliable detection of reflective objects by retroreflective photoelectric sensors.



Checking completeness

The presence of the inserted components must be checked before further production steps.

The autocollimation principle

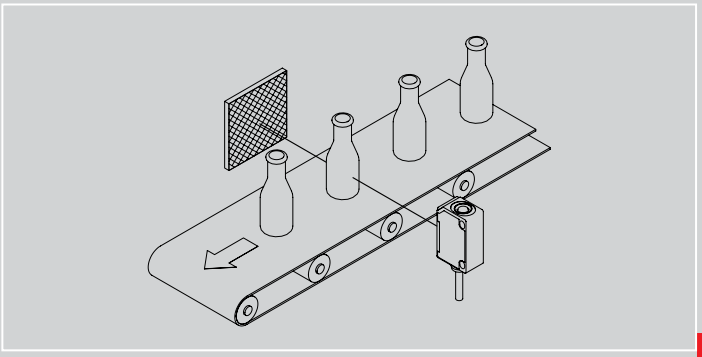


With retroreflective photoelectric sensors one speaks of the autocollimation principle when the light reflected from the reflector travels parallel to itself (i.e. within itself). The light emitted by the sensor hits a reflector and is reflected. The reflected light is then deflected to a receiver by a semi-transparent mirror and evaluated.

The autocollimation principle

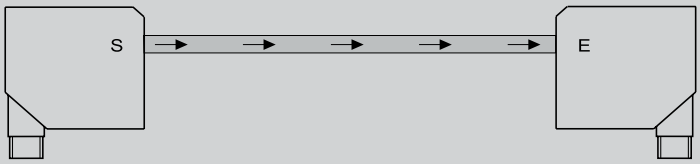
Unlike the double-lens system, a retroreflective photoelectric sensor using the autocollimation principle has a very homogeneous and narrow optical path. Its switching point is largely independent of the entry direction of the target object.

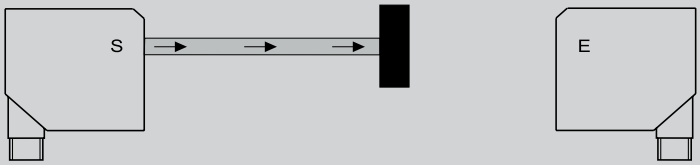
A major advantage of sensors with the autocollimation principle is detection from a range of 0 mm. There is thus, unlike the double-lens system, no blind zone.



Monitoring bottles
The retroreflective photoelectric sensor specially developed for this purpose achieves reliable detection of transparent objects.

Through-beam photoelectric sensors

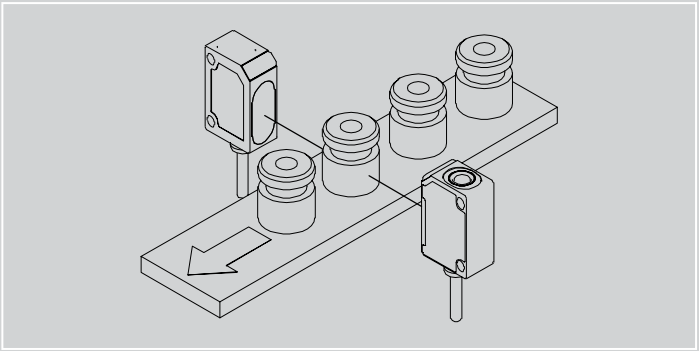




A through-beam photoelectric sensor has a separate transmitter and receiver. This means that light only travels the path between the transmitter and the receiver once. For this reason one speaks of through-beam photoelectric sensors.

The range is of decisive importance when using through-beam photoelectric sensors. Photoelectric sensors are principally selected according to their range. In the case of very critical operating conditions, such as high dust levels or intense steam generation, care must be taken to ensure that the photoelectric sensor is not operated at its limit range. Any clouds of steam would reduce the available range. The range quoted in the data sheet should not be exceeded – in order to ensure functionality in poor operating conditions.

When using deflector mirrors, the total path to be monitored should be less than the range quoted in the data sheet.

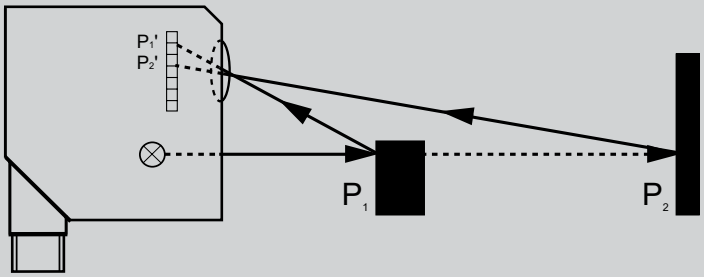


Detecting workpieces in harsh environments
Through-beam photoelectric sensors can also provide dependable detection even under poor conditions – thanks to their high level of reliability.

Photoelectric sensors and proximity sensors

System description

Proximity sensors with background suppression



Advantages

- Independent of object colour and surface
- Reflections in the background are reliably suppressed
- Robust in sunshine
- Scanning distance adjustable according to applications

Differing object colours and surfaces can seriously affect the detection behaviour of a diffuse scanner. As a result of the purely energetic evaluation it is not possible, for example, to detect a black object against a white background. The white background reflects more light than the object itself.

The background suppression process was developed in order to be able to reliably master such tasks. Whereby both the light returning from the background as well as that reflected by the object are evaluated. The light hits two different positions (P_1' & P_2') on the receiver element.

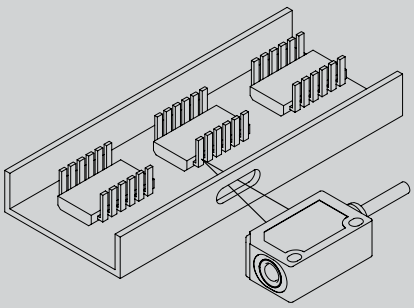
So it is not the returning energy, but the geometrical position of the target object that is evaluated (triangulation). With this process one can, for example, reliably detect a dark object on a light conveyor belt.

There are various ways to physically achieve background suppression. Generally one differentiates between a fixed and an adjustable background suppression.

In the case of fixed background suppression, the transmitter and receiver elements are fixed-mounted. The operating range is defined by the overlapping of the transmitter and receiver angles. Objects outside this operating range cannot be detected.

In the case of adjustable background suppression, the parameters for object detection can be set mechanically via a rotary switch or electronically via teach-in. This provides much more flexible use.

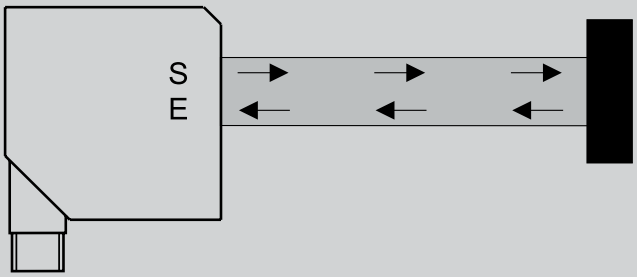
Laser devices are particularly suitable for detecting the smallest of objects. A red-light sensor should be employed for larger objects.



Monitoring pins

The fine light beam of the laser sensor permits the precise detection of even such small objects without any impairment by the background.

Proximity sensors



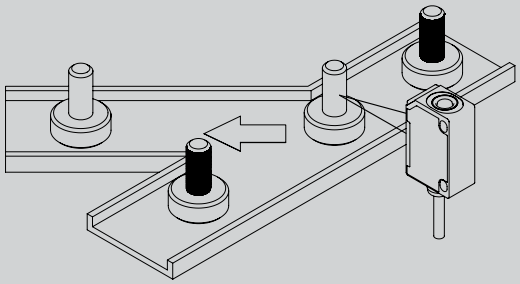
The transmitter and receiver of a proximity sensor are accommodated in a single housing. The light emitted by the transmitter hits the target object, which reflects the light. This returning light is evaluated by the receiver. The advantage of this method is that no reflector is required.

Because the scanner evaluates the reflected light and its energy, the range of conventional scanners (also called energetic or diffuse scanners) is largely dependent on the object's colour and its surface properties. Because black objects strongly absorb light, diffuse scanners can only achieve a very short range here. The surface structure is responsible for the type of reflection. Very rough, heterogeneous surfaces reflect diffusely, i.e. in all directions. Only a small percentage of the reflected light returns to the receiver. The scanning distance in this case is also low.

Proximity sensors based on energetic evaluation are therefore particularly suitable for the detection of larger objects or of objects whose material colour and surface properties remain constant.

One must also ensure that the quantity of light reflected back from the background is not greater than that reflected by the object itself. This effect occurs, for example, when a black object is in front of a white background. In this case detection with an energetic scanner is impossible. The use of a scanner with background suppression is recommended here.

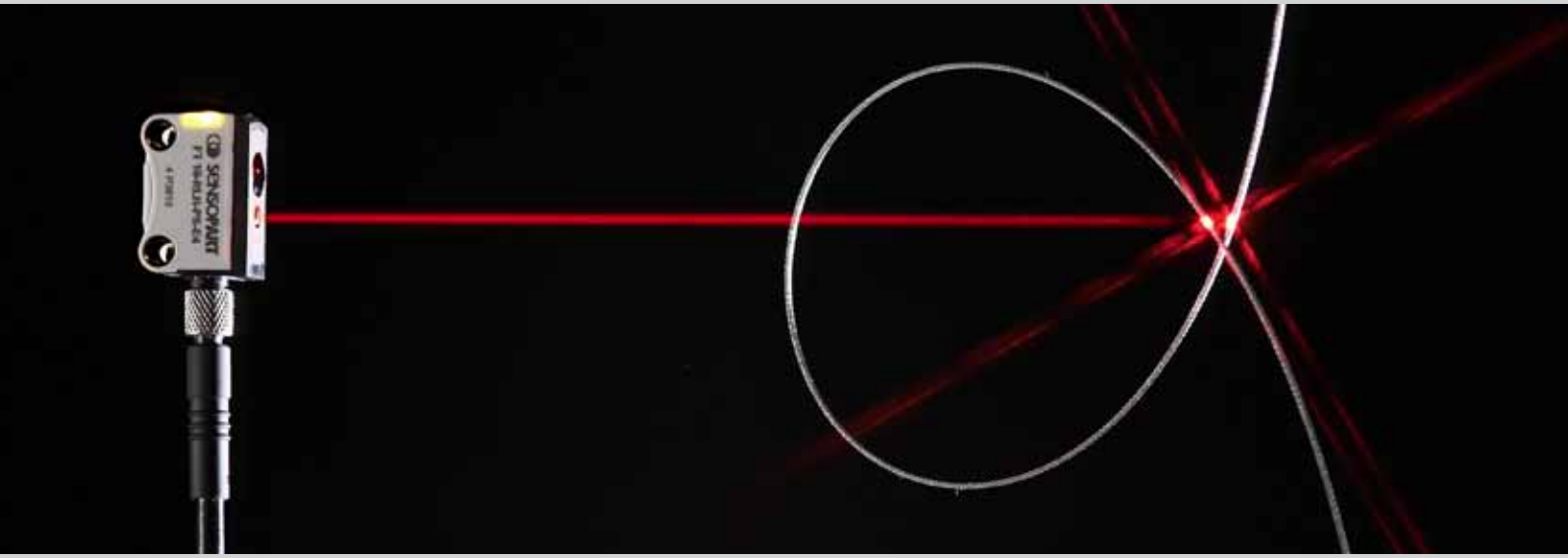
The reliable detection of objects is possible if the background of the object is free, for example when an energetic scanner is mounted transversely over a conveyor belt. The setting of the sensor on the varying object surfaces and backgrounds takes place by means of a mechanical rotary switch on the sensor or via teach-in. The sensor can be set to a maximum scanning distance for a detection task without a background. A precise setting is necessary for applications with a background.



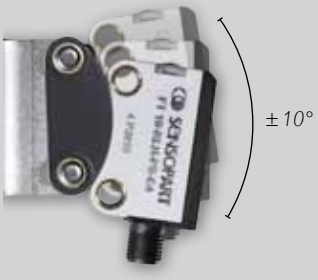
Rejection of uncoated parts
Brightness differences can be reliably detected by a diffuse scanner.

F 10 – family of sub-miniature sensors

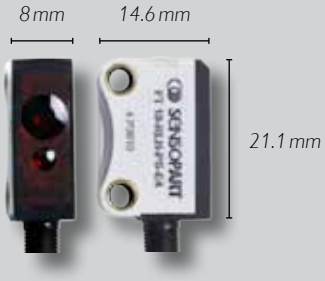
Small housings, great performance



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.

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.

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 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!

F 10 Product Overview					
	Type of light	Adjustment	Scanning distance/range	Special features	Page
Photoelectric proximity sensors with background suppression					
FT 10-RLH	Laser	Teach-in	60 mm	The only scanner with scanning distance adjustment	238
FT 10-RLHR	Laser	Teach-in	60 mm	Broad-beam light spot	240
FT 10-B-RLF	Laser	Fixed focus	15 mm / 30 mm		242
FT 10-RH	LED	Teach-in	70 mm		244
FT 10-RF	LED	Fixed focus	15 mm / 30 mm / 50 mm		246
FT 10-BF Bluelight	LED, blue	Fixed focus	30 mm / 50 mm	Blue transmission LED for strongly light-absorbing objects	248
Retroreflective photoelectric sensors					
FR 10-RL	Laser	Teach-in	2 m	Long range, precise small-part detection	250
FR 10-R	LED	Teach-in	1.6 m	Long range	252
Through-beam photoelectric sensors					
FS/FE 10-RL	Laser	Teach-in	3 m	Sensor pair, very accurate object positioning	254
FS 10-RL/FE 10-RL	Laser	Teach-in	3 m	Transmitter/receiver, very accurate object positioning	256

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

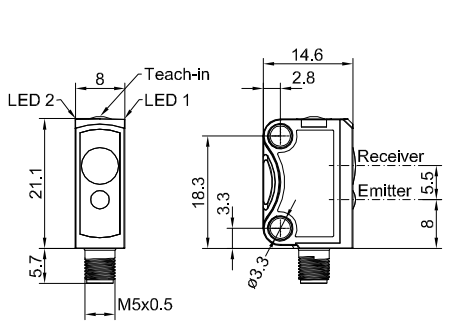
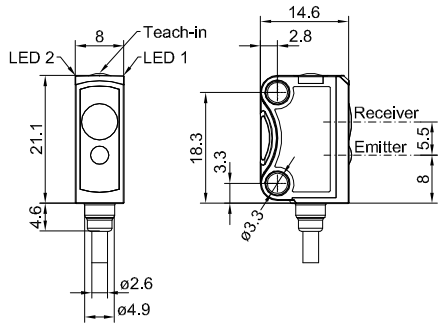
Optical data		Functions	
Scanning distance	6 … 60 mm[1]	Indicator LED, green	Operating voltage indicator
Adjustment range	10 … 60 mm[1]	Indicator LED, yellow	Switching output indicator
Type of light	Laser, red, 655 nm	Scanning distance adjustment	Via Teach-in button and control input
Light spot size (total detection area)	1 x 3 mm[2]	Adjustment possibilities	Button lock via control input
Laser Class (DIN EN 60825-1:2008-5)	1	Default settings	Max. scanning distance and N.O.

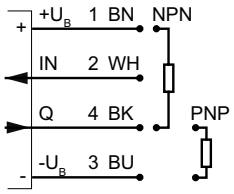
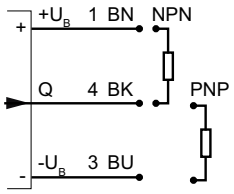
Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]	Dimensions	21.1 x 14.6 x 8 mm[3]
No-load current, I_0	≤ 12 mA	Enclosure rating	IP 67[3]
Output current, Ie	≤ 50 mA	Material, housing	PUR
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-20 … +50 °C
Switching output, Q	PNP/NPN (see Selection Table)	Ambient temperature: storage	-20 … +80 °C
Output function	N.O.	Weight (plug device)	Ca. 3 g
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Weight (cable device)	Ca. 22 g
Response time	500 µs	Weight (pigtail)	Ca. 10 g
Control input, IN (only 4-pin design)	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation		

[1] Reference material white, 90 % reflectivity [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] 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

Plug connection	Cable connection
	

Connection, 4-pin	Connection, 3-pin
	

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

Accessories	
Connection cables	From Page A-34
Brackets	From Page A-4

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

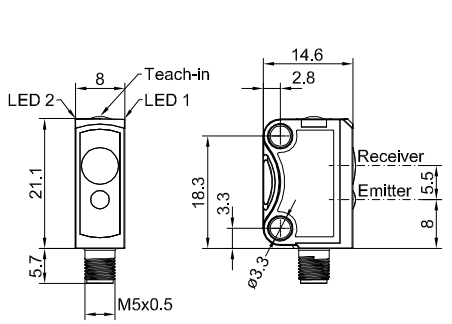
Optical data		Functions	
Scanning distance	6 … 60 mm[1]	Indicator LED, green	Operating voltage indicator
Adjustment range	10 … 60 mm[1]	Indicator LED, yellow	Switching output indicator
Type of light	Laser, red, 655 nm	Scanning distance adjustment	Via Teach-in button and control input
Light spot size	See diagram	Adjustment possibilities	Button lock via control input
Laser Class (DIN EN 60825-1:2008-5)	1	Default settings	Max. scanning distance and N.O.
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC[2]	Dimensions	21.1 x 14.6 x 8 mm[3]
No-load current, I_0	≤ 12 mA	Enclosure rating	IP 67[3]
Output current, Ie	≤ 50 mA	Material, housing	PUR
Protective circuits	Reverse-polarity protection, U_B / 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 (only 4-pin design)	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation	Weight (pigtail)	Ca. 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

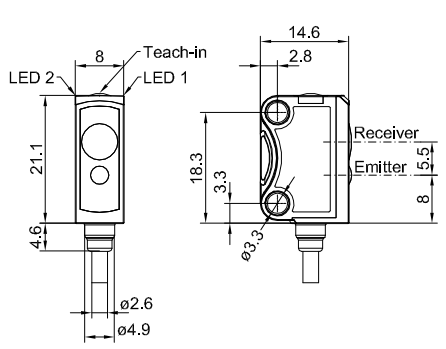
Scanning distance	Switching output	Type of connection	Part number	Article number
6 … 60 mm	PNP	Plug, M5x0.5, 4-pin	FT 10-RLHR-PS-E4	600-11136
6 … 60 mm	NPN	Plug, M5x0.5, 4-pin	FT 10-RLHR-NS-E4	600-11137
6 … 60 mm	PNP	Cable, 2 m, 4-wire	FT 10-RLHR-PS-K4	600-11138
6 … 60 mm	NPN	Cable, 2 m, 4-wire	FT 10-RLHR-NS-K4	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

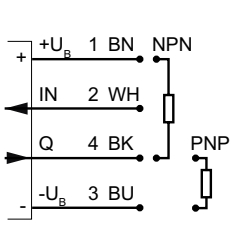
Plug connection



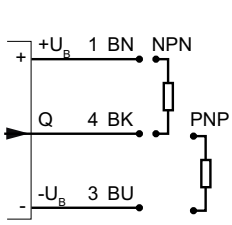
Cable connection



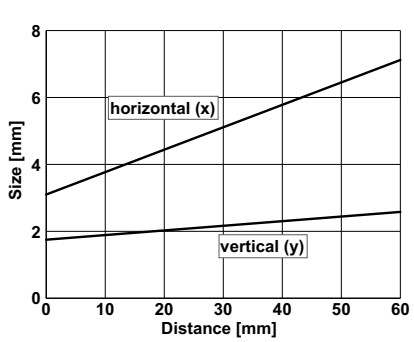
Connection, 4-pin



Connection, 3-pin



Light spot size



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

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

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[1] 6 … 30 mm[1]	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[2]	Adjustment possibilities	N.O. / N.C. via control input
Laser Class (DIN EN 60825-1:2008-5)	1		

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]	Dimensions	21.1 x 14.6 x 8 mm[3]
No-load current, I_0	≤ 12 mA	Enclosure rating	IP 67[3]
Output current, Ie	≤ 50 mA	Material, housing	PUR
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	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 (plug device)	Ca. 3 g
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Weight (cable device)	Ca. 22 g
Response time	500 µs	Weight (pigtail)	Ca. 10 g
Control input, IN (only 4-pin design)	$+U_B$ = N.C. $-U_B$ / Open = N.O.		

[1] Reference material white, 90 % reflectivity [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] 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

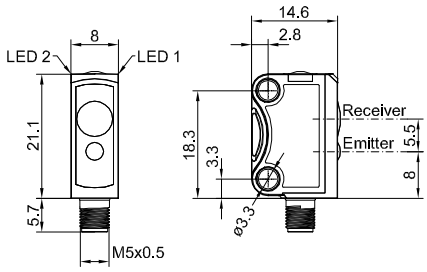
Version: 02/2015. Subject to changes; diagrams similar

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

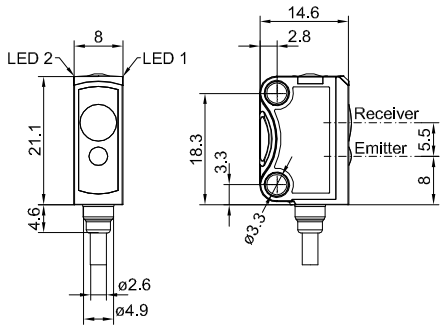
Plug connection

153-00909



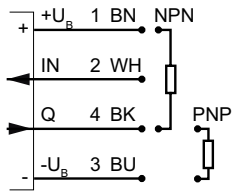
Cable connection

153-00910



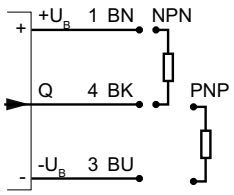
Connection, 4-pin

154-00508



Connection, 3-pin

154-00509



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-34
Brackets	From Page A-4

FT 10-RH

Photoelectric proxmity 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	
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 and control input[5]
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[5] Button lock via control input[5]
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	PNP/NPN
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[3]
Enclosure rating	IP 67[6]
Material, housing	PUR
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	approx. 3 g
Weight (cable device)	approx. 22 g
Weight (pigtail)	approx. 10 g

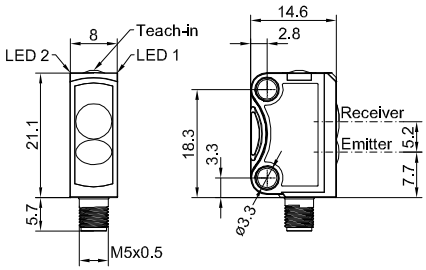
[1] Reference material white, 90 % reflectivity [2] at maximum scanning distance [3] in constant environmental conditions [4] max. 10 % ripple within U_B, ~ 50 Hz / 100 Hz
[5] only 4-pin design [6] with connected IP 67 plug

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

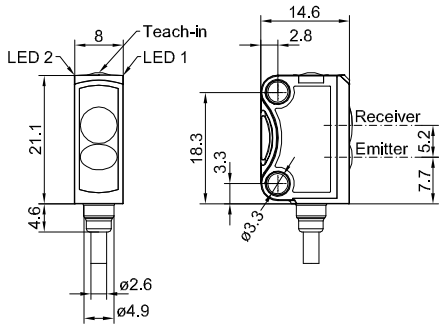
Including dovetail clamp mounting MBD F 10 for all types

Version: 02/2015. Subject to changes; diagrams similar

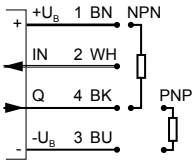
Plug connection



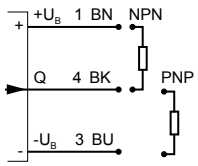
Cable connection



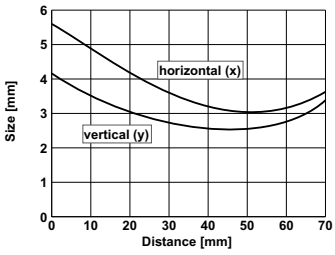
Connection, 4-pin



Connection, 3-pin



Light spot size



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

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

FT 10-RF

Photoelectric proxmity 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[1] 2 … 30 mm[1] 2 … 50 mm[1]	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[3]
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC[2]	Dimensions	21,1 x 14,6 x 8 mm[3]
No-load current, I_0	≤ 20 mA	Enclosure rating	IP 67[4]
Output current, Ie	≤ 50 mA	Material, housing	PUR
Protective circuits	Reverse-polarity protection, U_B / 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, IN[3]	$+U_B$ = N.C. $-U_B$ / Open = N.O.		

[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

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

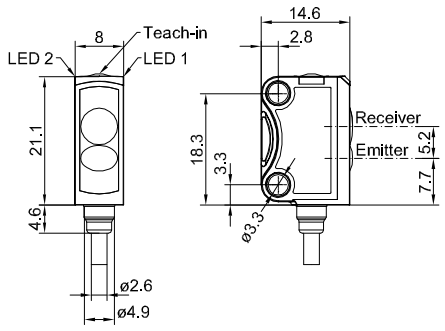
Version: 02/2015. Subject to changes; diagrams similar

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

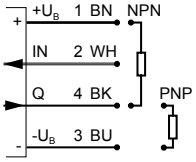
Cable connection

153-01110



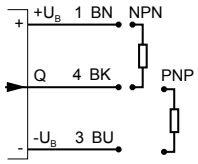
Connection, 4-pin

154-00312



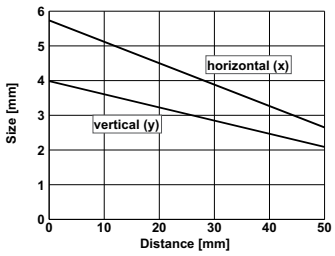
Connection, 3-pin

154-00311



Light spot size

155-01769



Reference material

	FT 10-RF1	FT 10-RF2	FT 10-RF3
white (90 %)	2 … 15 mm	2 … 30 mm	2 … 50 mm
grey (18 %)	3 … 15 mm	4 … 30 mm	5 … 50 mm
black (6 %)	4 … 15 mm	5 … 30 mm	7 … 50 mm

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

FT 10-BF

Bluelight photoelectric proxmity 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[1] / 2 … 50 mm[1]	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[3]
LED risk group (DIN 62471)	2		
Light spot size	See diagram		

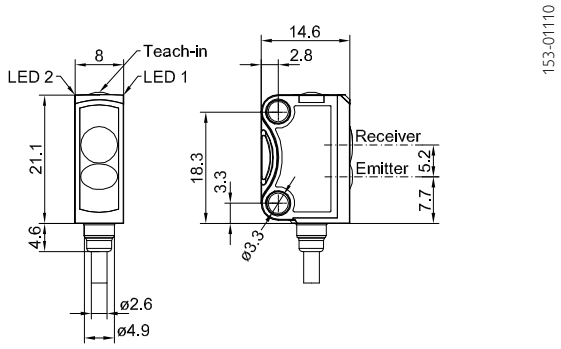
Electrical data		Mechanical data	
Operating voltage $+U_B$	10 … 30 V DC[2]	Dimensions	21,1 x 14,6 x 8 mm[3]
No-load supply current I_0	≤ 20 mA	Enclosure rating	IP 67[4]
Output current Ie	≤ 50 mA	Material, housing	PUR
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection class	2	Ambient temperature: operation	-20 … +50 °C
Power On Delay	< 300 ms	Ambient temperature: storage	-20 … +80 °C
Switching output, Q	PNP/NPN (see Selection Table)	Weight (cable device)	approx. 22 g
Output function	N.O. /N.C.	Weight (pigtail)	approx. 10 g
Switching frequency, f (ti/tp 1:1)	800 Hz		
Response time	625 µs		
Control input, IN[3]	$+U_B$ = N.C. $-U_B$ / Open = N.O.		

[1] Reference material white, 90 % reflectivity [2] max. residual ripple 10 %, within U_B, approx. 50 Hz/100 Hz [3] only 4-pin designg [4] with connected IP 67 plug

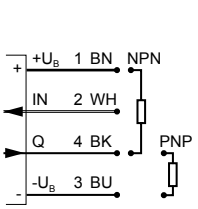
Scanning distance	Switching output	Type of connection	Part number	Article number
2 … 30 mm[1]	PNP	Cable, 2 m, 4-wire	FT 10-BF2-PS-K4	600-11026
2 … 30 mm[1]	NPN	Cable, 2 m, 4-wire	FT 10-BF2-NS-K4	600-11029
2 … 30 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-BF2-PS-KM4	600-11027
2 … 30 mm[1]	NPN	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

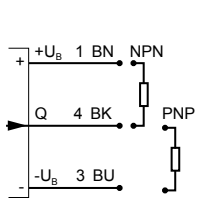
Cable connection



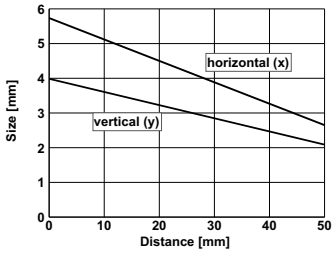
Connection, 4-pin



Connection, 3-pin



Light spot size



Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

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	
Limit range	0.1 … 2.5 m[1]
Operating range	0.1 … 2 m[1]
Type of light	Laser, red, 655 nm
Light spot size	See diagram
Laser Class (DIN EN 60825-1:2008-5)	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, 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)	≤ 1000 Hz
Response time	500 µs
Control input, IN (only 4-pin design)	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

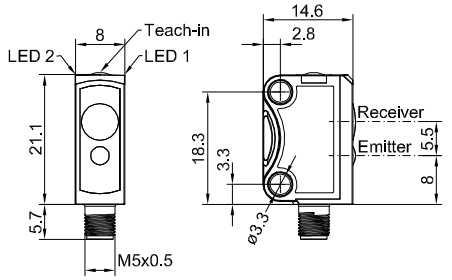
Mechanical data	
Dimensions	21.1 x 14.6 x 8 mm[3]
Enclosure rating	IP 67[3]
Material, housing	PUR
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +50 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	Ca. 3 g
Weight (cable device)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

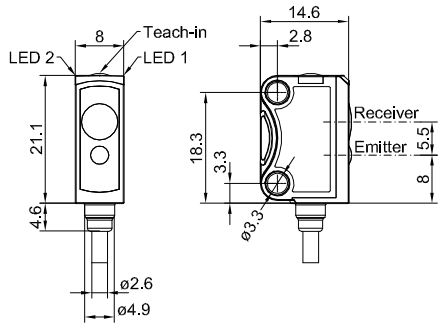
Operating range	Switching output	Type of connection	Part number	Article number
0.1 … 2 m	PNP	Plug, M5x0.5, 4-pin	FR 10-RL-PS-E4	603-31000
0.1 … 2 m	NPN	Plug, M5x0.5, 4-pin	FR 10-RL-NS-E4	603-31001
0.1 … 2 m	PNP	Cable, 2 m, 4-wire	FR 10-RL-PS-K4	603-31002
0.1 … 2 m	NPN	Cable, 2 m, 4-wire	FR 10-RL-NS-K4	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

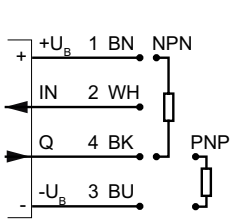
Plug connection



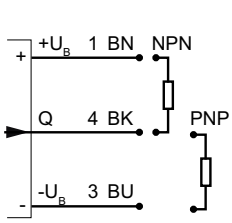
Cable connection



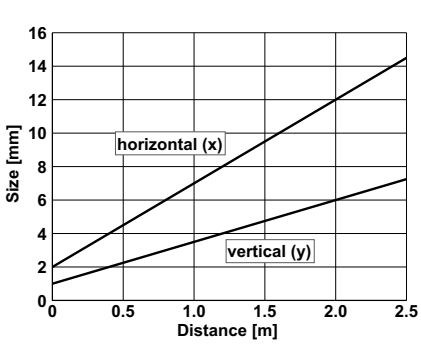
Connection, 4-pin



Connection, 3-pin



Light spot size



Reflector / Reflective foil*	Operating range
R5/L	0.1 … 2 m
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

Accessories	
Reflectors	From Page A-18
Connection cables	From Page A-34
Brackets	From Page A-4

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 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, 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]	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

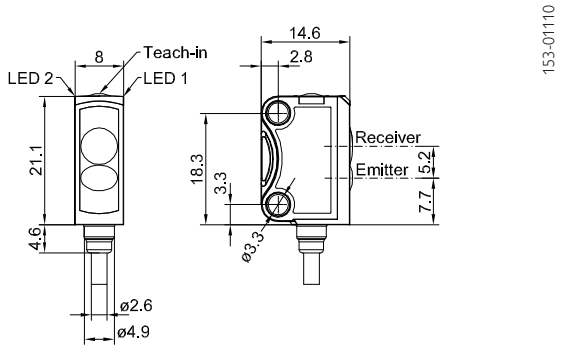
Mechanical data	
Dimensions	21,1 x 14,6 x 8 mm[3]
Enclosure rating	IP 67[4]
Material, housing	PUR
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (cable device)	approx. 22 g
Weight (pigtail)	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

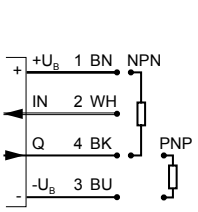
Operating range	Switching output	Type of connection	Part number	Article number-Nr.
0.1 … 1.6 m[1]	PNP	Cable, 2 m, 4-wire	FR 10-R-PS-K4	603-11001
0.1 … 1.6 m[1]	NPN	Cable, 2 m, 4-wire	FR 10-R-NS-K4	603-11004
0.1 … 1.6 m[1]	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FR 10-R-PS-KM4	603-11002
0.1 … 1.6 m[1]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

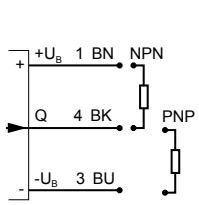
Cable connection



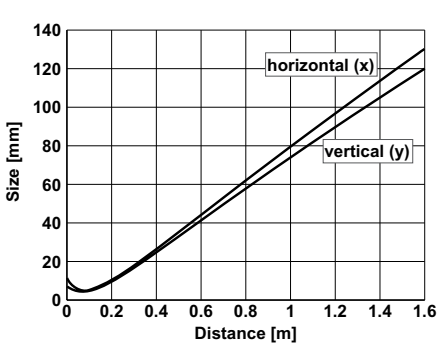
Connection, 4-pin



Connection, 3-pin



Light spot size



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

Accessories	
Reflectors	From Page A-34
Brackets	From Page A-4

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	
Limit range	0 … 5 m
Operating range	0 … 3 m
Type of light	Laser, red, 655 nm
Light spot size	See diagram
Laser Class (DIN EN 60825-1:2008-5)	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 x 14.6 x 8 mm[3]
Enclosure rating	IP 67[2]
Material, housing	PUR
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 ... +50 °C
Ambient temperature: storage	-20 ... +80 °C
Weight (plug device)	Ca. 6 g
Weight (cable device)	Ca. 44 g
Weight (pigtail)	Ca. 20 g

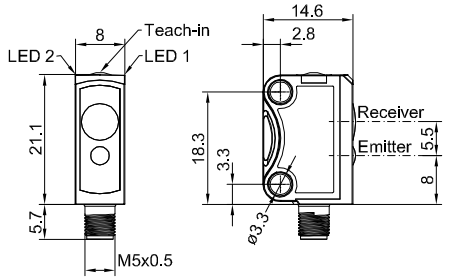
[1] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [2] With connected IP 67 plug

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

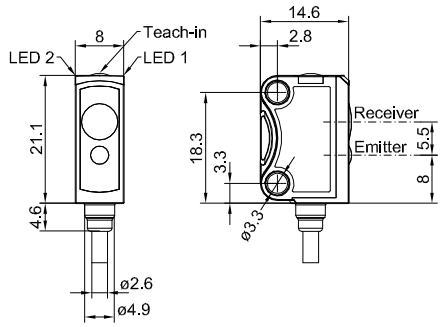
Including dovetail clamp mounting MBD F 10 for all types

Version: 02/2015. Subject to changes; diagrams similar

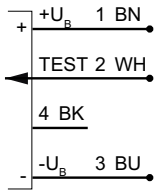
Plug connection



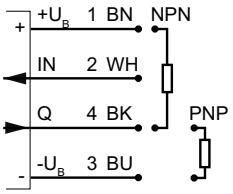
Cable connection



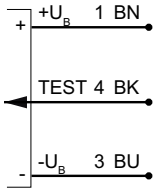
Connection, transmitter, 4-pin



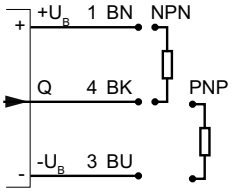
Connection, receiver, 4-pin



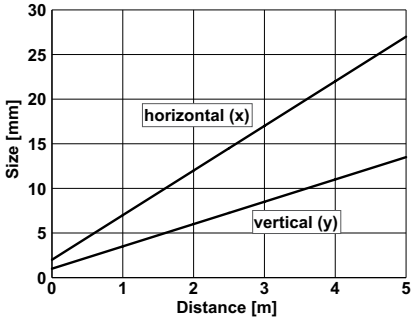
Connection, transmitter, 3-pin



Connection, receiver, 3-pin



Light spot size



Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

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	
Limit range	0 … 5 m
Operating range	0 … 3 m
Type of light	Laser, red, 655 nm
Light spot size	See diagram
Laser Class (DIN EN 60825-1:2008-5)	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 x 14.6 x 8 mm[3]
Enclosure rating	IP 67[2]
Material, housing	PUR
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +50 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	Ca. 6 g
Weight (cable device)	Ca. 44 g
Weight (pigtail)	Ca. 20 g

[1] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [2] With connected IP 67 plug

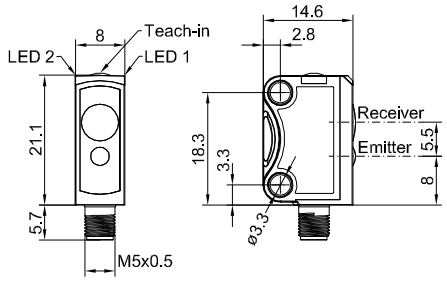
Operating range	Switching output	Type of connection	Part number	Design	Article number
1 ... 3 m	PNP	Plug, M5x0.5, 4-pin	FE 10-RL-PS-E4	Receiver	602-71000
1 ... 3 m	–	Plug, M5x0.5, 4-pin	FS 10-RL-E4	Transmitter	601-61000
1 ... 3 m	NPN	Plug, M5x0.5, 4-pin	FE 10-RL-NS-E4	Receiver	602-71001
1 ... 3 m	PNP	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

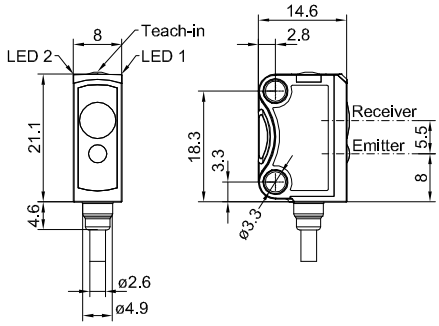
Plug connection

153-00894



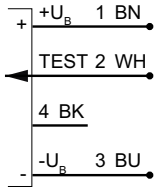
Cable connection

153-00895



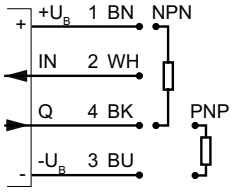
Connection, transmitter, 4-pin

154-00511



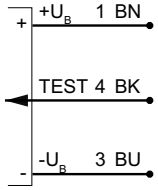
Connection, receiver, 4-pin

154-00508



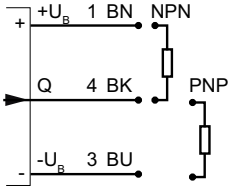
Connection, transmitter, 3-pin

154-00514



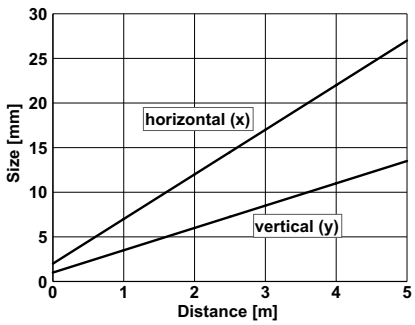
Connection, receiver, 3-pin

154-00509



Light spot size

155-01321



Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

F 25 – the miniature sensor family of the new generation

The best of its type

made in Germany

The specialist for glass detection:
The FR 25-RGO retroreflective photoelectric sensor has been specially designed for detecting transparent objects. It offers absolutely precise and reproducible switching behaviour thanks to its autocollimation principle and automatic adaptation of the switching threshold (the DELTA function).

(Left) ***Simple mounting, precise adjustment:*** *The robust aluminium dovetail mounting is particularly suitable when installation space is limited. It allows easy and accurate fine adjustment of the sensor after installation.*

Precise background suppression:
Thanks to extremely precise background suppression, the sensors of the F 25 series are completely immune to reflective and glossy machine parts and background effects. Together with switching that is independent of colour and object properties, F 25 sensors are the best on the market.

TYPICAL F 25

- The best black/white-shift on the market in this sensor class
- Precise background suppression thanks to the ASIC microchip
- Auto-detect: automatic adjustment of the switching output (PNP/NPN), unique on the market
- Precise detection of transparent objects of any shape (FR-25-RGO with DELTA function)
- Long ranges with compact miniature housing
- All sensors available in laser and LED designs
- Robust glass-fibre-reinforced plastic housings (IP 69K & IP 67, Ecolab)
- Robust sensor design with metal plug and mounting holes reinforced with metal inserts
- Simplest mounting thanks to dovetail, patented rod mounting and clamping jaws
- Safe operation thanks to Laser Class 1

The right sensor for every application: the new F 25 sensor family from SensoPart offers a very large range of variants – from the LED through-beam photoelectric sensor to the laser photoelectric proximity sensor with adjustable background suppression. Everything that the user could want is in the programme, including special applications: the FR 25-RGO autocollimation sensor detects transparent objects of any shape whilst automatically adapting its switching threshold to the operating conditions (the DELTA function).

Whether small-part detection or checking presence on a conveyor belt, the excellent performance of the F 25 series is always impressive. Thus the FT 25-RHD scanner not only offers very precise background suppression, but also the best black/white-shift in its class.

The robust design with tightly sealed housings (IP 69K & IP 67), the tough metal plugs and mounting holes with metal inserts, the simple dovetail mounting, the easy setup via teach-in or control input, and the many other clever details ensure uncomplicated and efficient operating processes. Not to mention the Auto-detect function that is exclusive to SensoPart: sensors equipped with it autonomously detect whether there is PNP or NPN wiring.

F 25 – Product Overview

	Type of light	Adjustment	Scanning distance / range	Special features	Page
Photoelectric proximity sensors with background suppression					
FT 25-RLH	Laser	Teach-in	120 mm	Most accurate small-part detection	260
FT 25-RH	LED	Teach-in	200 mm		262
FT 25-RHD	LED	Teach-in	400 mm	Long scanning distance	264
FT 25-RF1/2	LED	Fixed focus	60 mm / 80 mm		266
Photoelectric proximity sensors with foreground suppression					
FT 25-RV	LED	Teach-in	200 mm	window function (switching window)	268
Photoelectric proximity sensors					
FT 25-RL	Laser	Teach-in	250 mm	Detection of minimal grey value differences	270
FT 25-R	LED	Teach-in	800 mm		272
Retroreflective photoelectric sensors					
FR 25-RGO	LED	Teach-in	2 m	Autocollimation, detection of transparent objects	274
FR 25-RGO2	LED	Teach-in	2 m	Autocollimation	276
FR 25-RLO	Laser	Teach-in	4 m	Autocollimation, most accurate small-part detection	278
FR 25-RL	Laser	Teach-in	15 m	Most accurate small-part detection	280
FR 25-R	LED	Teach-in	7 m		282
FR 25-RF	LED	Fixed setting	5 m		284
Through-beam photoelectric sensors					
FS/FE 25-RL	Laser	Teach-in	20 m	Most accurate small-part detection	286
FS/FE 25-R	LED	Teach-in	15 m		288
FS/FE 25-RF	LED	Fixed setting	6 m		290

FT 25-RLH

Laser photoelectric proximity sensor with background suppression

PRODUCT HIGHLIGHTS

- Precisely adjustable background suppression
- Reliable switching despite varying object colours and surfaces
- Reliable operation even with highly reflective backgrounds, thanks to SensoPart ASIC technology
- Particularly suitable for the detection of the smallest of objects
- Simple alignment thanks to easily visible light spot
- Robust glass-fibre-reinforced plastic housings

Optical data	
Scanning distance	4 … 120 mm[1]
Adjustment range	10 … 120 mm[1]
Type of light	Laser, red, 650 nm
Light spot size	See diagram
Laser Class (DIN EN 60825-1:2008-5)	1

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Scanning distance 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. scanning distance and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 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	34 x 20 x 12 mm[3]
Enclosure rating	IP 69K & IP 67[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C[5]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (metal plug device[6])	10 g
Weight (cable device)	40 g
Weight (pigtail)	20 g
Vibration and impact resistance	EN 60947-5-2

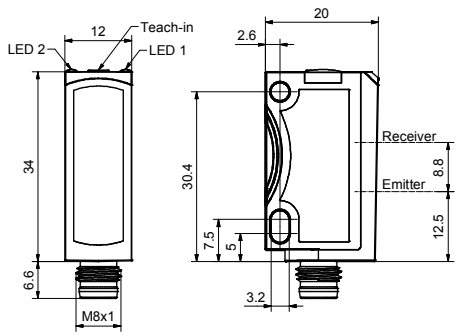
[1] Reference material: white, 90 % reflectivity [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] Only 4-pin design [4] With connected IP 67 / IP 69K plug [5] UL: -20 °C... + 50 °C
[6] no Ecolab

Scanning distance	Switching output	Type of connection	Part number	Article number
4 … 120 mm	PNP	Plug, M8x1, 3-pin	FT 25-RLH-PS-M3	609-11011
4 … 120 mm	PNP	Plug, M8x1, 4-pin	FT 25-RLH-PS-M4	609-11005
4 … 120 mm	NPN	Plug, M8x1, 4-pin	FT 25-RLH-NS-M4	609-11002
4 … 120 mm	PNP	Metal plug, M8x1, 3-pin	FT 25-RLH-PS-M3M	609-11007
4 … 120 mm	NPN	Metal plug, M8x1, 3-pin	FT 25-RLH-NS-M3M	609-11008
4 … 120 mm	PNP	Metal plug, M8x1, 4-pin	FT 25-RLH-PS-M4M	609-11009
4 … 120 mm	NPN	Metal plug, M8x1, 4-pin	FT 25-RLH-NS-M4M	609-11010
4 … 120 mm	PNP	Cable, 2 m, 4-wire	FT 25-RLH-PS-K4	609-11004
4 … 120 mm	NPN	Cable, 2 m, 4-wire	FT 25-RLH-NS-K4	609-11001
4 … 120 mm	PNP	Pigtail, 150 mm with plug, M8 4-pin	FT 25-RLH-PS-KM4	609-11012
4 … 120 mm	NPN	Pigtail, 150 mm with plug, M8, 4-pin	FT 25-RLH-NS-KM4	609-11013

Version: 02/2015. Subject to changes; diagrams similar

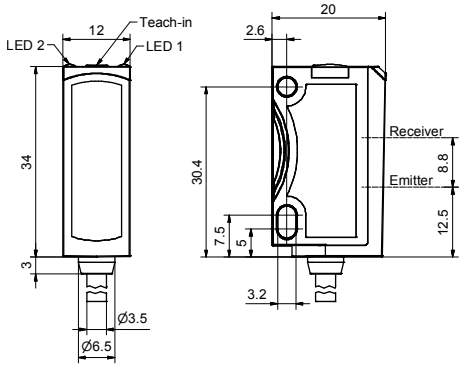
Scanning distance	Switching output	Type of connection	Part number	Article number
4 … 120 mm	PNP	Pigtail, 150 mm with plug, M12, 4-pin	FT 25-RLH-PS-KL4	609-11006
4 … 120 mm	NPN	Pigtail, 150 mm with plug, M12, 4-pin	FT 25-RLH-NS-KL4	609-11003

Plug connection



153-00934

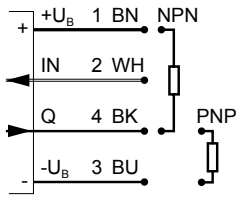
Cable connection



153-00933

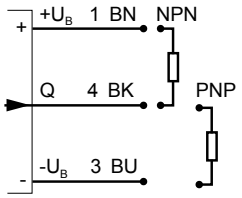
8

Connection, 4-pin



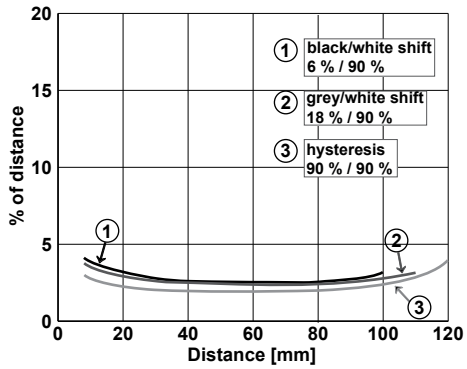
154-00312

Connection, 3-pin



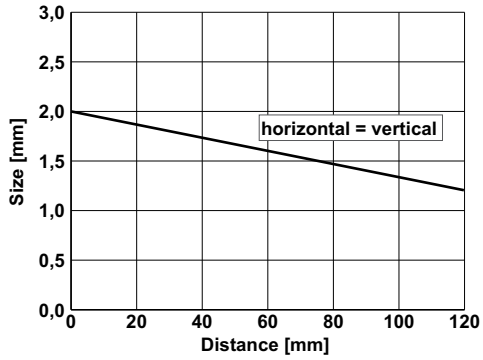
154-00311

Scanning properties



155-01393

Light spot size



155-01394

Reference material	Detection range	Accessories	
White (90 %)	4 … 120 mm	Connection cables	From Page A-34
Grey (18 %)	5 … 110 mm	Brackets	From Page A-4
Black (6 %)	8 … 100 mm		

FT 25-RH

Photoelectric proximity sensor with background suppression

PRODUCT HIGHLIGHTS

- Precisely adjustable background suppression
- Reliable switching despite varying object colours and surfaces
- Reliable operation even with highly reflective backgrounds, thanks to SensoPart ASIC technology
- Simple alignment thanks to easily visible light spot
- Sensor setting via teach-in and control input
- Robust glass-fibre-reinforced plastic housings

Optical data		Functions	
Scanning distance	1 … 200 mm[1]	Indicator LED, green	Operating voltage indicator
Adjustment range	10 … 200 mm[1]	Indicator LED, yellow	Switching output indicator
Type of light	LED, red, 632 nm	Scanning distance adjustment	Via Teach-in button and control input
Light spot size	See diagram	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. scanning distance and N.O.

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]	Dimensions	34 x 20 x 12 mm[3]
No-load current, I_0	≤ 30 mA	Enclosure rating	IP 69K & IP 67[4]
Output current, Ie	≤ 100 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-20 … +60 °C[5]
Power On Delay	< 300 ms	Ambient temperature: storage	-20 … +80 °C
Switching output, Q	PNP/NPN (see Selection Table)	Weight (plug device)	10 g
Output function	N.O./N.C.	Weight (metal plug device[6])	10 g
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Weight (cable device)	40 g
Response time	500 µs	Weight (pigtail)	20 g
Control input, IN[3]	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation	Vibration and impact resistance	EN 60947-5-2

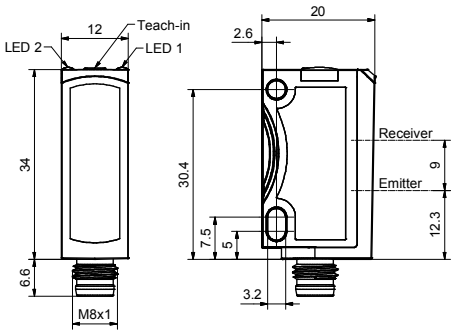
[1] Reference material: white, 90 % reflectivity [2] Max. 10 % ripple, within UB, ~ 50 Hz / 100 Hz [3] Only 4-pin design [4] With connected IP 67 / IP 69K plug [5] UL: -20 °C... + 50 °C
[6] no Ecolab

Scanning distance	Switching output	Type of connection	Part number	Article number
1 … 200 mm	PNP	Plug, M8x1, 4-pin	FT 25-RH-PS-M4	608-11004
1 … 200 mm	NPN	Plug, M8x1, 4-pin	FT 25-RH-NS-M4	608-11006
1 … 200 mm	PNP	Metal plug, M8x1, 3-pin	FT 25-RH-PS-M3M	608-11012
1 … 200 mm	NPN	Metal plug, M8x1, 3-pin	FT 25-RH-NS-M3M	608-11013
1 … 200 mm	PNP	Metal plug, M8x1, 4-pin	FT 25-RH-PS-M4M	608-11014
1 … 200 mm	NPN	Metal plug, M8x1, 4-pin	FT 25-RH-NS-M4M	608-11015
1 … 200 mm	PNP	Cable, 2 m, 4-wire	FT 25-RH-PS-K4	608-11005
1 … 200 mm	NPN	Cable, 2 m, 4-wire	FT 25-RH-NS-K4	608-11007
1 … 200 mm	PNP	Pigtail, 150 mm with plug, M8, 4-pin	FT 25-RH-PS-KM4	608-11031
1 … 200 mm	NPN	Pigtail, 150 mm with plug, M8, 4-pin	FT 25-RH-NS-KM4	608-11032

Version: 02/2015. Subject to changes; diagrams similar

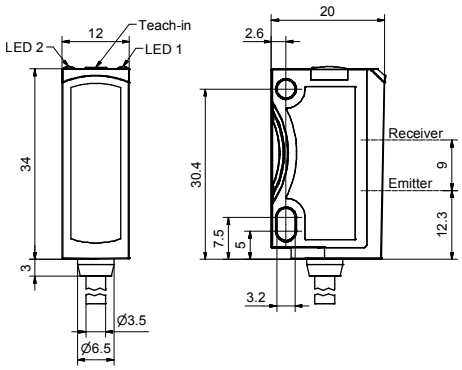
Scanning distance	Switching output	Type of connection	Part number	Article number
1 … 200 mm	PNP	Pigtail, 150 mm with plug, M12, 4-pin	FT 25-RH-PS-KL4	608-11008
1 … 200 mm	NPN	Pigtail, 150 mm with plug, M12, 4-pin	FT 25-RH-NS-KL4	608-11009

Plug connection



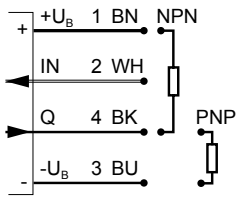
153-00839

Cable connection



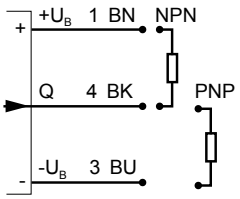
153-00838

Connection, 4-pin



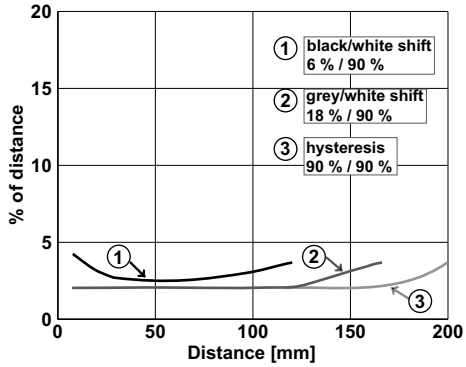
154-00312

Connection, 3-pin



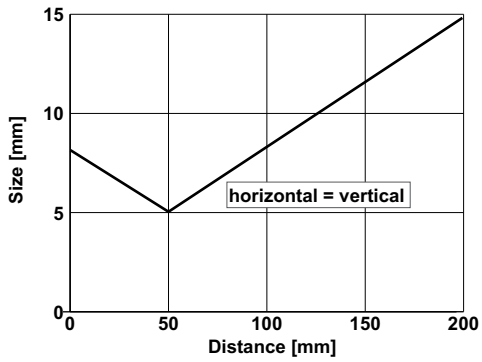
154-00311

Scanning properties



155-01380

Light spot size



155-01379

Reference material	Detection range	Accessories	
White (90 %)	1 … 200 mm	Connection cables	From Page A-34
Grey (18 %)	2 … 160 mm	Brackets	From Page A-4
Black (6 %)	4 … 120 mm		

FT 25-RHD

Photoelectric proximity sensor with background suppression

PRODUCT HIGHLIGHTS

- Auto-detect photoelectric proximity sensor with real PNP and real NPN functions
- Precisely adjustable background suppression
- Long scanning distance of 400 mm with small and compact housings
- Reliable operation even with highly reflective backgrounds, thanks to SensoPart ASIC technology
- Simple alignment thanks to easily visible light spot
- Robust glass-fibre-reinforced plastic housings

Optical data	
Scanning distance	3 … 400 mm[1]
Adjustment range	30 … 400 mm[1]
Type of light	LED, red, 632 nm
Light spot size	See diagram

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Scanning distance 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 Auto-detect / NPN/PNP via Teach-in button and control input (only Auto-detect variants)
Default settings	Max. scanning distance and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 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 / Auto-Detect (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	$+U_B$ = teach-in, $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions	34 x 20 x 12 mm[3]
Enclosure rating	IP 69K & IP 67[3]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C[4]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (metal plug device[5])	10 g
Weight (cable device)	40 g
Weight (pigtail)	20 g
Vibration and impact resistance	EN 60947-5-2

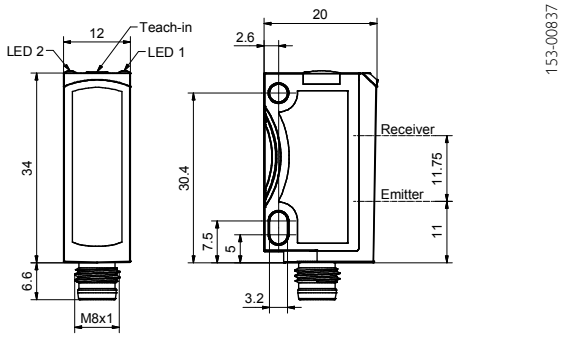
[1] Reference material: white, 90 % reflectivity [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 / IP 69K plug [4] UL: -20 °C... + 50 °C [5] no Ecolab

Scanning distance	Switching output	Type of connection	Part number	Article number
3 … 400 mm	PNP	Plug, M8x1, 4-pin	FT 25-RHD-PS-M4	608-11000
3 … 400 mm	NPN	Plug, M8x1, 4-pin	FT 25-RHD-NS-M4	608-11002
3 … 400 mm	PNP	Plug, M8x1, 3-pin	FT 25-RHD-PS-M3M	608-11029
3 … 400 mm	PNP	Metal plug, M8x1, 4-pin	FT 25-RHD-PS-M4M	608-11016
3 … 400 mm	NPN	Metal plug, M8x1, 4-pin	FT 25-RHD-NS-M4M	608-11017
3 … 400 mm	PNP	Cable, 2 m, 4-wire	FT 25-RHD-PS-K4	608-11001
3 … 400 mm	NPN	Cable, 2 m, 4-wire	FT 25-RHD-NS-K4	608-11003
3 … 400 mm	PNP	Pigtail, 150 mm with plug, M8, 4-pin	FT 25-RHD-PS-KM4	608-11030

Version: 02/2015. Subject to changes; diagrams similar

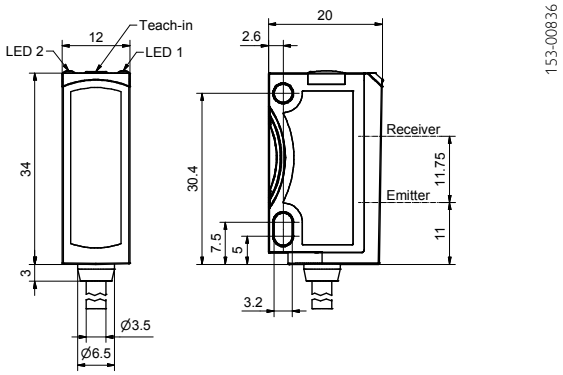
Scanning distance	Switching output	Type of connection	Part number	Article number
3 … 400 mm	NPN	Pigtail, 150 mm with plug, M8, 4-pin	FT 25-RHD-NS-KM4	608-11033
3 … 400 mm	PNP	Pigtail, 150 mm with plug, M12, 4-pin	FT 25-RHD-PS-KL4	608-11010
3 … 400 mm	NPN	Pigtail, 150 mm with plug, M12, 4-pin	FT 25-RHD-NS-KL4	608-11011
3 … 400 mm	Auto-detect	Metal plug, M8x1, 4-pin	FT 25-RHD-PNS-M4M	608-11019

Plug connection



153-00837

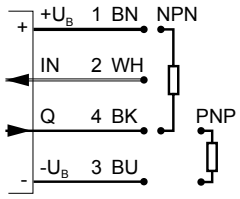
Cable connection



153-00836

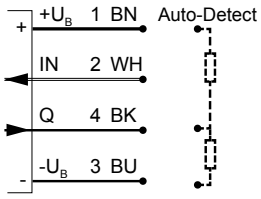
8

Connection, 4-pin



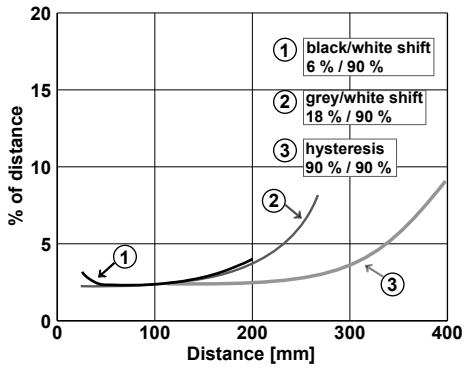
154-00312

Connection, 4-pin, Auto-detect



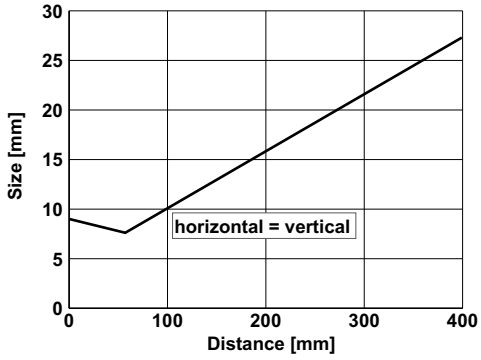
154-00313

Scanning properties



155-01382

Light spot size



155-01381

Reference material	Detection range
White (90 %)	3 … 400 mm
Grey (18 %)	6 … 260 mm
Black (6 %)	12 … 200 mm

Accessories	
Connection cables	From Page A-34
Brackets	From Page A-4

FT 25-RF

Photoelectric proximity sensor with background suppression, fixed focus

PRODUCT HIGHLIGHTS

- Precise fixed background suppression
- Economical solution for numerous applications
- Tamper-proof sensor design – no misalignment possible
- Simple alignment thanks to easily visible light spot
- Robust glass-fibre-reinforced plastic housings

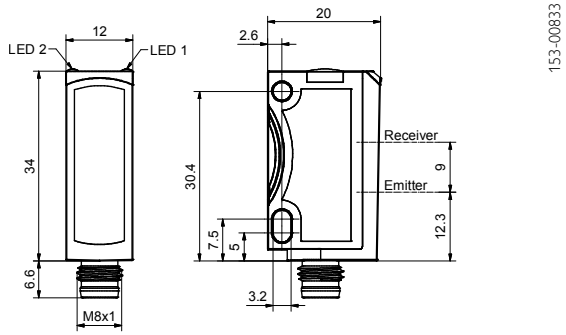
Optical data		Functions	
Scanning distance	1 … 60 mm[1] / 1 … 80 mm[1]	Indicator LED, green	Operating voltage indicator
Type of light	LED, red, 632 nm	Indicator LED, yellow	Switching output indicator
Light spot size	See diagram	Adjustment possibilities	N.O./N.C. via control input
Hysteresis	~ 5%[2]		

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[3]	Dimensions	34 x 20 x 12 mm[3]
No-load current, I_0	≤ 30 mA	Enclosure rating	IP 69K & IP 67[4]
Output current, Ie	≤ 100 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-20 … +60 °C[5]
Power On Delay	< 300ms	Ambient temperature: storage	-20 … +80 °C
Switching output, Q	PNP/NPN (see Selection Table)	Weight (plug device)	10 g
Output function	N.O./N.C.	Weight (cable device)	40 g
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Vibration and impact resistance	EN 60947-5-2
Response time	500 µs		
Control input, IN	$+U_B$ = N.C. $-U_B$ / Open = N.O.		

[1] Reference material: white, 90 % reflectivity [2] Based on scanning distance [3] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [4] With connected IP 67 / IP 69K plug
[5] UL: -20 °C... + 50 °C

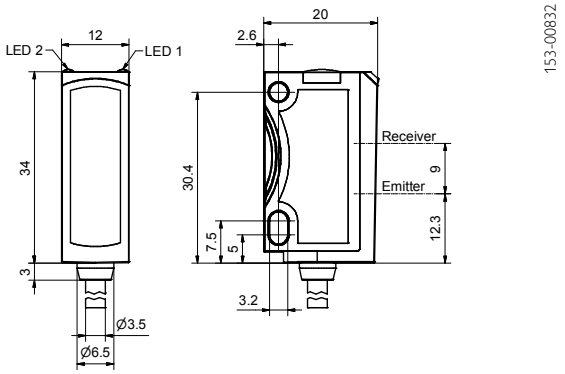
Scanning distance	Switching output	Type of connection	Part number	Article number
1 … 60 mm	PNP	Plug, M8x1, 4-pin	FT 25-RF1-PS-M4	608-11020
1 … 60 mm	PNP	Cable, 2 m, 4-wire	FT 25-RF1-PS-K4	608-11021
1 … 80 mm	PNP	Plug, M8x1, 4-pin	FT 25-RF2-PS-M4	608-11022
1 … 80 mm	PNP	Cable, 2 m, 4-wire	FT 25-RF2-PS-K4	608-11023
1 … 80 mm	NPN	Cable, 2 m, 4-wire	FT 25-RF2-NS-K4	608-11024

Plug connection



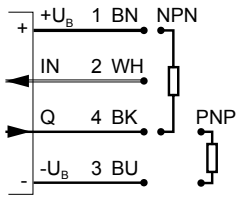
153-00833

Cable connection



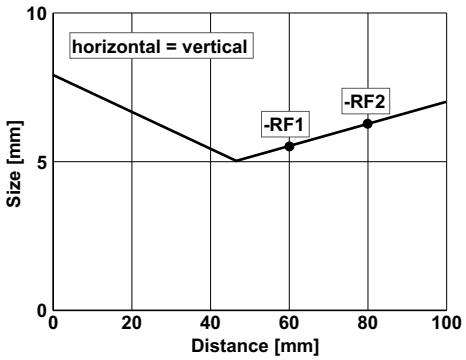
153-00832

Connection, 4-pin



154-00312

Light spot size



155-01395

Reference material	Detection range
White (90 %)	1 … 60 mm / 80 mm
Grey (18 %)	2 … 60 mm / 80 mm
Black (6 %)	4 … 60 mm / 80 mm

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

FT 25-RV

Photoelectric proximity sensor with foreground suppression

PRODUCT HIGHLIGHTS

- Auto-detect photoelectric proximity sensor with real PNP and real NPN functions
- Precisely adjustable foreground suppression
- Long scanning distance of 200 mm with small and compact housings
- Additional adjustable window function (switching window)
- 2-point teach-in or dynamic teach-in also possible via external control line

Optical data	
Scanning distance	30 … 200 mm[1]
Type of light	LED, red, 632 nm
Light spot size	See diagram

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Scanning distance adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running process Mode 2: during standing process Mode 3: switching window
Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input Auto-detect / NPN/PNP via Teach-in button and control input (only Auto-detect-variants)
Default settings	Max. scanning distance and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 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 / Auto-Detect (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	$+U_B$ = teach-in, $-U_B$ = button locked Open = normal operation

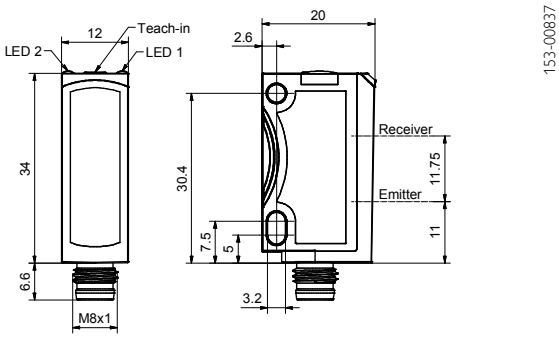
Mechanical data	
Dimensions	34 x 20 x 12 mm[3]
Enclosure rating	IP 69K & IP 67[3]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C[4]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (metal plug device[5])	10 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: white, 90 % reflectivity [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 / IP 69K plug [4] UL: -20 °C... + 50 °C [5] no Ecolab

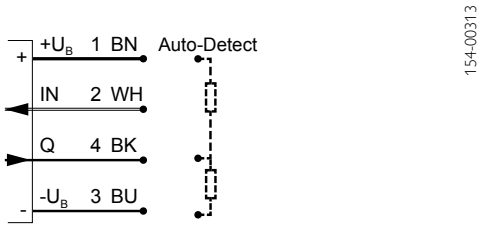
Scanning distance	Switching output	Type of connection	Part number	Article number
30 … 200 mm	PNP	Plug, M8x1, 4-pin	FT 25-RV-PS-M4	604-41006
30 … 200 mm	NPN	Plug, M8x1, 4-pin	FT 25-RV-NS-M4	604-41007
30 … 200 mm	Auto-Detect	Plug, M8x1, 4-pin	FT 25-RV-PNS-M4	604-41005
30 … 200 mm	Auto-Detect	Metal plug, M8x1, 4-pin	FT 25-RV-PNS-M4M	604-41004

Version: 02/2015. Subject to changes; diagrams similar

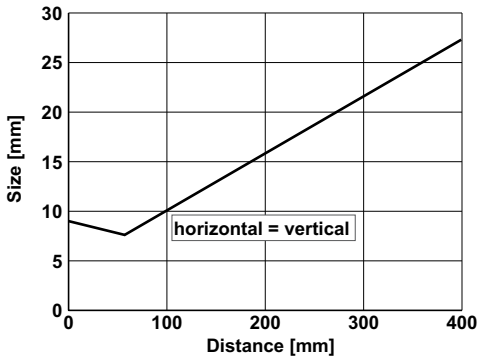
Plug connection



Connection, 4-pin, Auto-Detect



Light spot size



Reference material	Detection range
White (90 %)	30 … 200 mm
Grey (18 %)	30 … 200 mm
Black (6 %)	30 … 200 mm

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

FT 25-RL

Diffuse laser photoelectric proximity switch

PRODUCT HIGHLIGHTS

- Differentiates between even the slightest of grey value differences
- Sensor settings via teach-in and control input
- Durable laser printing
- Very small, easily visible laser light spot
- Wide range of variants

Optical data	
Scanning distance	1 … 250 mm[1]
Adjustment range	25 … 250 mm[1]
Type of light	Laser, red, 650 nm
Light spot size	See diagram
Laser Class (DIN EN 60825-1:2008-5)	1
Hysteresis	≤ 10%[2]

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. scanning distance and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[3]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 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)	≤ 1500 Hz
Response time	333 µs
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

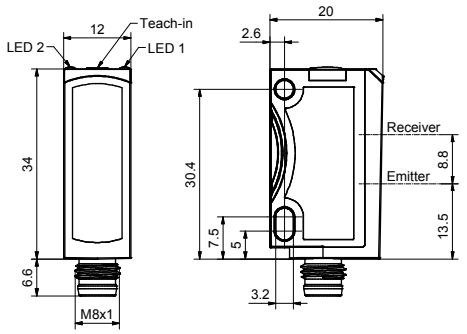
Mechanical data	
Dimensions	34 x 20 x 12 mm[3]
Enclosure rating	IP 69K & IP 67[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C[5]
Ambient temperature: storage	-20 … +80 °C
Weight (metal plug device[6])	10 g
Weight (cable device)	40 g
Weight (pigtail)	20 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: white, 90 % reflectivity [2] Up to scanning distance of 150 mm [3] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [4] With connected IP 67 / IP 69K plug
[5] UL: -20 °C... + 50 °C [6] no Ecolab

Scanning distance	Switching output	Type of connection	Part number	Article number
1 … 250 mm	PNP	Metal plug, M8x1, 4-pin	FT 25-RL-PS-M4M	609-21013
1 … 250 mm	NPN	Metal plug, M8x1, 4-pin	FT 25-RL-NS-M4M	609-21014
1 … 250 mm	PNP	Cable, 2 m, 4-wire	FT 25-RL-PS-K4	609-21010
1 … 250 mm	NPN	Cable, 2 m, 4-wire	FT 25-RL-NS-K4	609-21008
1 … 250 mm	PNP	Pigtail, 152 mm with plug, M8, 4-pin	FT 25-RL-PS-KM4	609-21002
1 … 250 mm	NPN	Pigtail, 152 mm with plug, M8, 4-pin	FT 25-RL-NS-KM4	609-21007
1 … 250 mm	PNP	Pigtail, 150 mm with plug, M12, 4-pin	FT 25-RL-PS-KL4	609-21012
1 … 250 mm	NPN	Pigtail, 150 mm with plug, M12, 4-pin	FT 25-RL-NS-KL4	609-21009

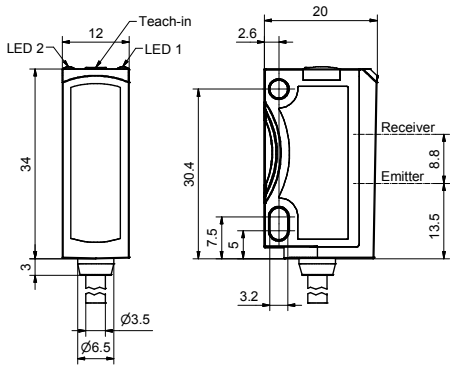
Version: 02/2015. Subject to changes; diagrams similar

Plug connection



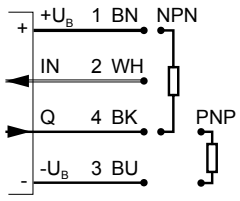
153-00937

Cable connection



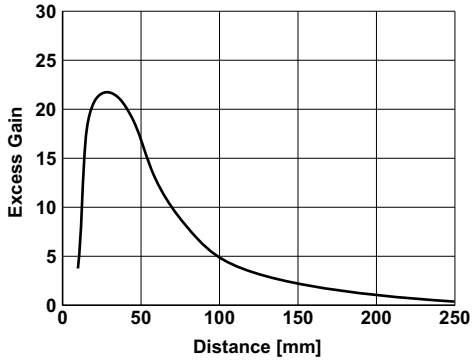
153-00936

Connection, 4-pin



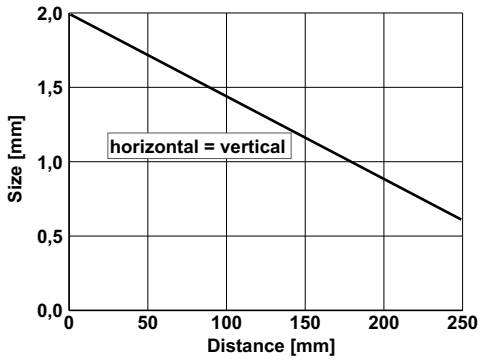
154-00312

Functional reserves



155-01384

Light spot size



155-01383

Reference material	Detection range
White (90 %)	1 … 250 mm
Grey (18 %)	6 … 100 mm
Black (6 %)	20 … 60 mm

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

FT 25-R

Diffuse photoelectric proximity sensor

PRODUCT HIGHLIGHTS

- Differentiates between even the slightest of grey value differences
- Sensor settings via teach-in and control input
- Simple alignment thanks to easily visible light spot
- Robust glass-fibre-reinforced plastic housings
- Durable laser printing

Optical data		Functions	
Scanning distance	0 … 800 mm[1]	Indicator LED, green	Operating voltage indicator
Adjustment range	20 … 800 mm[1]	Indicator LED, yellow	Switching output indicator
Type of light	LED, red, 632 nm	Sensitivity adjustment	Via Teach-in button and control input
Light spot size	See diagram	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. scanning distance and N.O.

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]	Dimensions	34 x 20 x 12 mm[3]
No-load current, I_0	≤ 30 mA	Enclosure rating	IP 69K & IP 67[3]
Output current, Ie	≤ 100 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-20 … +60 °C[4]
Power On Delay	< 300 ms	Ambient temperature: storage	-20 … +80 °C
Switching output, Q	PNP/NPN (see Selection Table)	Weight (plug device)	10 g
Output function	N.O./N.C.	Weight (metal plug device[5])	10 g
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Weight (cable device)	40 g
Response time	500 µs	Weight (pigtail)	20 g
Control input, IN	+ U_B = teach-in - U_B = button locked Open = normal operation	Vibration and impact resistance	EN 60947-5-2

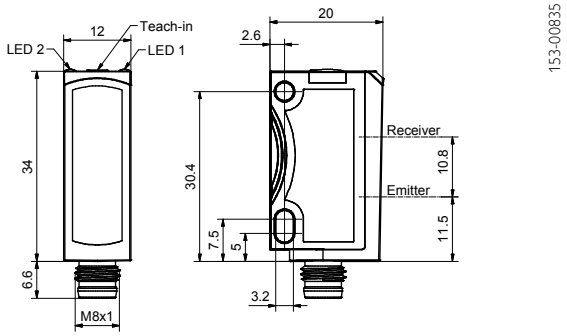
[1] Reference material: white, 90 % reflectivity [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 / IP 69K plug [4] UL: -20 °C... + 50 °C [5] no Ecolab

Scanning distance	Switching output	Type of connection	Part number	Article number
0 … 800 mm	PNP	Plug, M8x1, 4-pin	FT 25-R-PS-M4	607-21000
0 … 800 mm	NPN	Plug, M8x1, 4-pin	FT 25-R-NS-M4	607-21002
0 … 800 mm	PNP	Metal plug, M8x1, 4-pin	FT 25-R-PS-M4M	607-21006
0 … 800 mm	NPN	Metal plug, M8x1, 4-pin	FT 25-R-NS-M4M	607-21007
0 … 800 mm	PNP	Cable, 2 m, 4-wire	FT 25-R-PS-K4	607-21001
0 … 800 mm	NPN	Cable, 2 m, 4-wire	FT 25-R-NS-K4	607-21003
0 … 800 mm	PNP	Pigtail, 150 mm with plug, M8, 4-pin	FT 25-R-PS-KM4	607-21022
0 … 800 mm	NPN	Pigtail, 150 mm with plug, M8, 4-pin	FT 25-R-NS-KM4	607-21023

Version: 02/2015. Subject to changes; diagrams similar

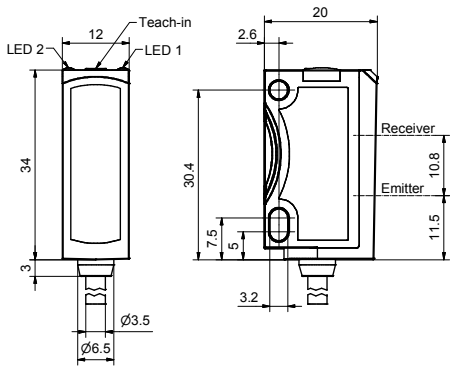
Scanning distance	Switching output	Type of connection	Part number	Article number
0 … 800 mm	PNP	Pigtail, 150 mm with plug, M12, 4-pin	FT 25-R-PS-KL4	607-21004
0 … 800 mm	NPN	Pigtail, 150 mm with plug, M12, 4-pin	FT 25-R-NS-KL4	607-21005

Plug connection



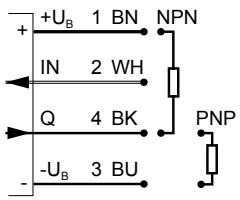
153-00835

Cable connection



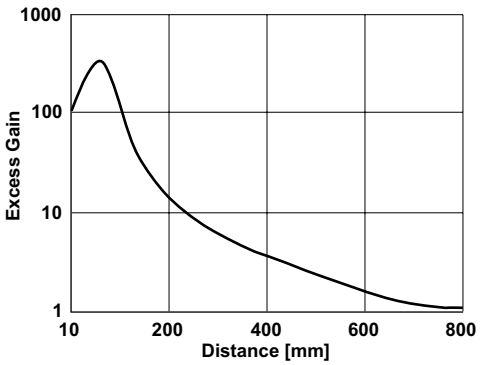
153-00834

Connection, 4-pin



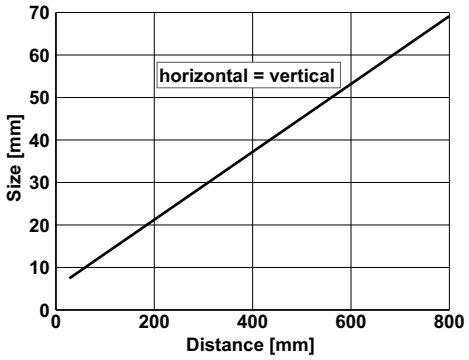
154-00312

Functional reserves



155-01367

Light spot size



155-01368

Reference material	Detection range	Accessories	
White (90 %)	0 … 800 mm	Connection cables	From Page A-34
Grey (18 %)	1 … 450 mm	Brackets	From Page A-4
Black (6 %)	3 … 250 mm		

FR 25-RGO

Retroreflective photoelectric sensor for detection of transparent objects

PRODUCT HIGHLIGHTS

- Reliable detection of transparent objects regardless of shape
- Autocollimation principle: reliable and precise detection from a range of 0 mm
- DELTA function (Dynamic Evaluation of Light for Threshold Adaption): dynamic sensor adaptation to changing environmental conditions – dust and dirt have no effect
- Precise and easily visible light spot with sharp contour for easy alignment of the sensor

Optical data	
Operating range	0.5 … 2 m[1]
Type of light	LED, red, 632 nm
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
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	≤ 30 mA
Output current, Ie	≤ 100 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	+ U_B = teach-in - U_B = button locked Open = normal operation

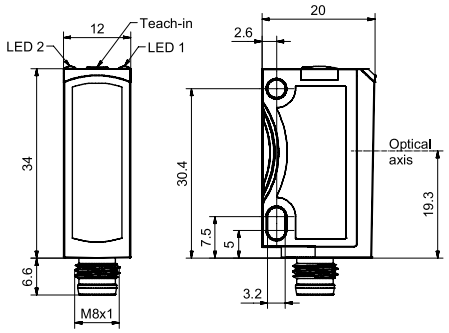
Mechanical data	
Dimensions	34 x 20 x 12 mm[3]
Enclosure rating	IP 69K & IP 67[3]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C[4]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (metal plug device[5])	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: R5/L reflector [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 / IP 69K plug [4] UL: -20 °C... + 50 °C [5] no Ecolab

Operating range	Switching output	Type of connection	Part number	Article number
0 … 2 m	PNP	Plug, M8x1, 4-pin	FR 25-RGO-PS-M4	606-11020
0 … 2 m	NPN	Plug, M8x1, 4-pin	FR 25-RGO-NS-M4	606-11021
0 … 2 m	PNP	Metal plug, M8x1, 4-pin	FR 25-RGO-PS-M4M	606-11016
0 … 2 m	NPN	Metal plug, M8x1, 4-pin	FR 25-RGO-NS-M4M	606-11017
0 … 2 m	PNP	Cable, 2 m, 4-wire	FR 25-RGO-PS-K4	606-11018
0 … 2 m	NPN	Cable, 2 m, 4-wire	FR 25-RGO-NS-K4	606-11019
0 … 2 m	PNP	Pigtail, 150 mm with plug, M8, 4-pin	FR 25-RGO-PS-KM4	606-11030
0 … 2 m	NPN	Pigtail, 150 mm with plug, M8, 4-pin	FR 25-RGO-NS-KM4	606-11031
0 … 2 m	PNP	Pigtail, 500 mm with plug, M8, 4-pin	FR 25-RGO-PS-KM4-X04	606-11032

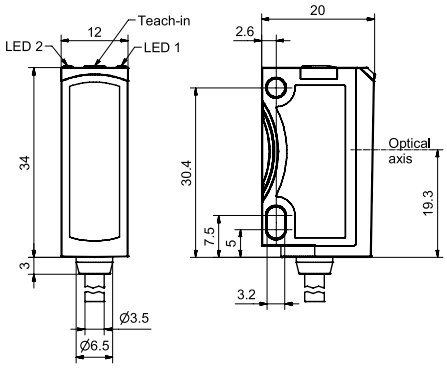
Version: 02/2015. Subject to changes; diagrams similar

Plug connection



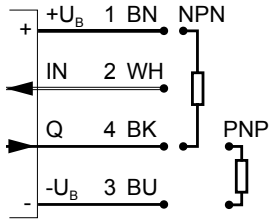
153-00964

Cable connection



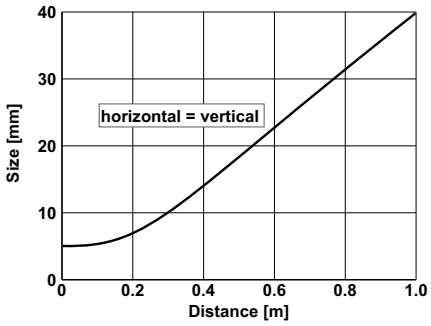
153-00963

Connection, 4-pin



154-00312

Light spot size



155-01531

Reflector / Reflective foil*	Operating range (min./max. reflector distance)
R5/L	0.5… 2 m
RF-100 KL*	0 … 2 m
R2-2LB1	0 … 500 mm
R3-2LK1	0 … 500 mm

Accessories

Reflectors	From Page A-18
Connection cables	From Page A-34
Brackets	From Page A-4

8

FR 25-RGO2

Autocollimation retroreflective photoelectric sensor

PRODUCT HIGHLIGHTS

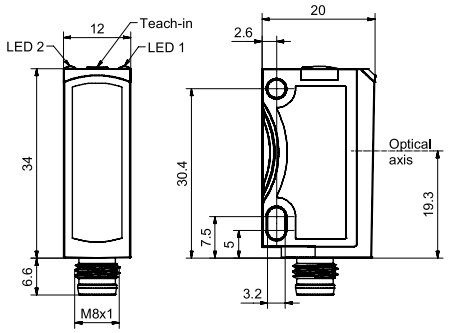
- Autocollimation principle: reliable and precise detection from a range of 0 mm
- Precise detection, even through narrow openings and drilled holes
- Compact miniature housings for installation in the smallest of spaces
- Simple operation via electronic Teach-in button or control input
- Robust glass-fibre-reinforced plastic housings

Optical data		Functions	
Operating range	0.5 … 2 m[1]	Indicator LED, green	Operating voltage indicator
Type of light	LED, red, 632 nm	Indicator LED, yellow	Switching output indicator
Polarising filter	Yes	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		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC[2]	Dimensions	34 x 20 x 12 mm[3]
No-load current, I_0	≤ 30 mA	Enclosure rating	IP 69K & IP 67[3]
Output current, Ie	≤ 100 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-20 … +60 °C[4]
Power On Delay	< 300 ms	Ambient temperature: storage	-20 … +80 °C
Switching output, Q	PNP/NPN (see Selection Table)	Weight	10 g
Output function	N.O./N.C.	Vibration and impact resistance	EN 60947-5-2
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz		
Response time	500 µs		
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation		

[1] Reference material: R5/L reflector [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 / IP 69K plug [4] UL: -20 °C... + 50 °C

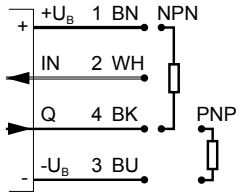
Operating range	Switching output	Type of connection	Part number	Article number
0 … 2 m	PNP	Plug, M8x1, 4-pin	FR 25-RGO2-PS-M4	606-11022
0 … 2 m	NPN	Plug, M8x1, 4-pin	FR 25-RGO2-NS-M4	606-11023

Plug connection



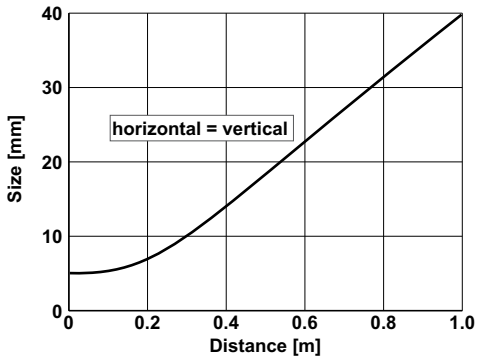
153-00964

Connection, 4-pin



154-00312

Light spot size



155-01531

Reflector / Reflective foil*	Operating range (min./max. reflector distance)
R5/L	0.5 … 2 m
RF-100 KL*	0 … 2 m
R2-2LB1	0 … 500 mm
R3-2LK1	0 … 500 mm

Accessories

Reflectors	From Page A-18
Connection cables	From Page A-34
Brackets	From Page A-4

8

FR 25-RLO

Autocollimation laser retroreflective photoelectric sensor

PRODUCT HIGHLIGHTS

- Reliable small-part detection over the entire operating range from a size of 0.2 mm
- Precise front-edge detection even in fastest automation processes thanks to a high switching frequency of 10 kHz
- Constant detection position with lateral object approach over the entire operating range for maximum switching point and positioning accuracy

Optical data	
Limit range	0 … 5 m[1]
Operating range	0 … 4 m[1]
Type of light	Laser, red, 650 nm
Light spot size	See diagram
Laser Class (DIN EN 60825-1:2008-5)	1
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
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	≤ 30 mA
Output current, Ie	≤ 100 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)	See Selection Table
Response time	See Selection Table
Control input, IN[3]	+ U_B = teach-in - U_B = button locked Open = normal operation

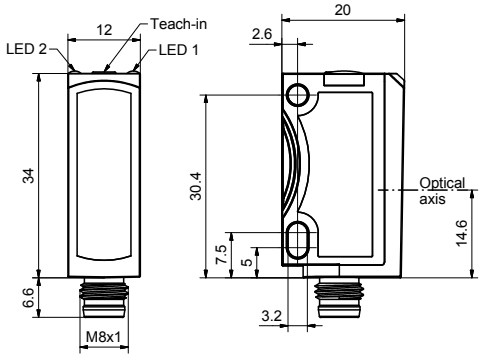
Mechanical data	
Dimensions	34 x 20 x 12 mm[3]
Enclosure rating	IP 69K & IP 67[3]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C[5]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (metal plug device[5])	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: R5/L reflector [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 / IP 69K plug [4] UL: -20 °C... + 50 °C [5] no Ecolab

Switching frequency, f (ti/tp 1:1)[2]	Response time	Switching output	Type of connection	Part number	Article number
≤ 10 kHz	50 µs	PNP	Metal plug, M8x1, 4-pin	FR 25-RLO1-PS-M4M	609-31003
≤ 10 kHz	50 µs	NPN	Metal plug, M8x1, 4-pin	FR 25-RLO1-NS-M4M	609-31004
≤ 10 kHz	50 µs	PNP	Cable, 2 m, 4-wire	FR 25-RLO1-PS-K4	609-31005
≤ 10 kHz	50 µs	NPN	Cable, 2 m, 4-wire	FR 25-RLO1-NS-K4	609-31006
≤ 4 kHz	125 µs	PNP	Plug, M8x1, 4-pin	FR 25-RLO2-PS-M4	609-31007
≤ 4 kHz	125 µs	NPN	Plug, M8x1, 4-pin	FR 25-RLO2-NS-M4	609-31008
≤ 4 kHz	125 µs	PNP	Cable, 2 m, 4-wire	FR 25-RLO2-PS-K4	609-31009
≤ 4 kHz	125 µs	NPN	Cable, 2 m, 4-wire	FR 25-RLO2-NS-K4	609-31010
≤ 4 kHz	125 µs	PNP	Pigtail, 150 mm with plug, M8, 4-pin	FR 25-RLO2-PS-KM4	609-31011

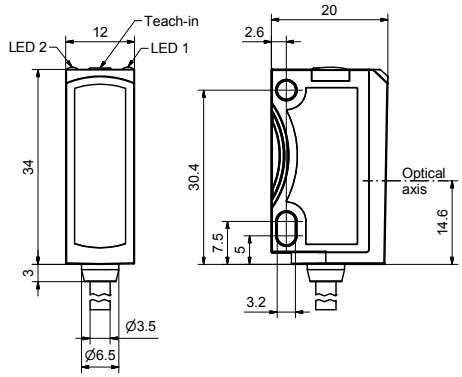
Switching frequency, f (ti/tp 1:1)[2]	Response time	Switching output	Type of connection	Part number	Article number
≤ 4 kHz	125 µs	NPN	Pigtail, 150 mm with plug, M8, 4-pin	FR 25-RLO2-NS-KM4	609-31012
≤ 4 kHz	125 µs	PNP	Pigtail, 500 mm with plug, M8, 4-pin	FR 25-RLO2-PS-KM4-X05	609-31013

Plug connection



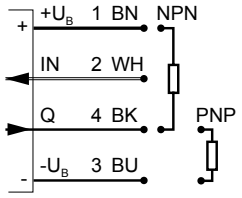
153-01088

Cable connection



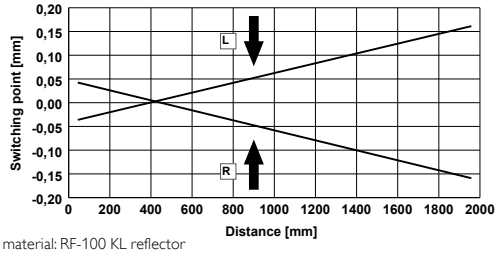
153-01089

Connection, 4-pin



154-00312

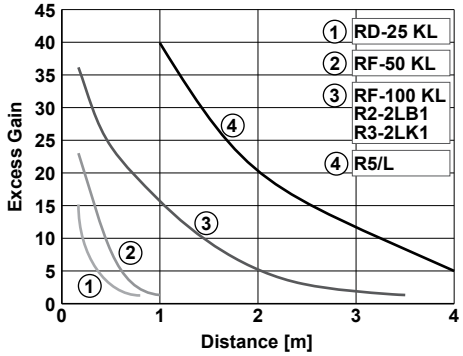
Lateral object approach



Reference material: RF-100 KL reflector

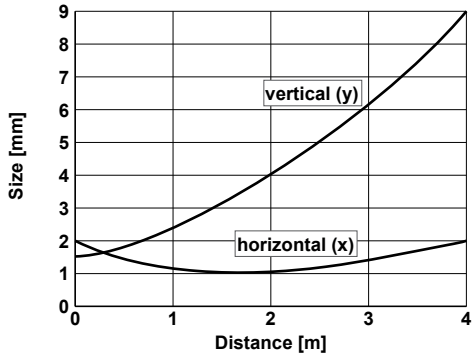
155-01720

Functional reserves



155-01715

Light spot size



155-01716

Small part detection

Reflector / Reflective foil*	Reflector distance	Scanning distance	Smallest detectable part
R5L	1000 ... 4000 mm	0 ... 4000 mm	≥ 1 mm
RD-25 KL	50 ... 500 mm	50 ... 500 mm	≥ 0.2 mm
RF-100 KL*	500 ... 2500 mm	0 ... 500 mm	≥ 0.2 mm
R2-2LB1	500 ... 2500 mm	0 ... 500 mm	≥ 0.2 mm
R3-2LK1	500 ... 2500 mm	0 ... 500 mm	≥ 0.2 mm
RF-50 KL*	100 ... 500 mm	100 ... 500 mm	≥ 0.2 mm

Reflector / Reflective foil*	Operating range (min./max. reflector distance)
R5L	0 ... 4000 mm
RD-25 KL	50 ... 600 mm
RF-100 KL*	0 ... 2500 mm
R2-2LB1	0 ... 2500 mm
R3-2LK1	0 ... 2500 mm
RF-50 KL*	0 ... 800 mm

FR 25-RL

Laser retroreflective photoelectric sensor

PRODUCT HIGHLIGHTS

- Particularly suitable for short-range applications
- Suitable for a wide variety of different reflectors
- Very small, easily visible laser light spot
- Sensor settings via teach-in and control input
- Robust glass-fibre-reinforced plastic housings

Optical data	
Limit range	0.1 … 15 m[1]
Operating range	0.1 … 13 m[1]
Type of light	Laser, red, 650 nm
Light spot size	See diagram
Laser Class (DIN EN 60825-1:2008-5)	1
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
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	≤ 30 mA
Output current, Ie	≤ 100 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)	≤ 2000 Hz
Response time	250 µs
Control input, IN[3]	+ U_B = teach-in - U_B = button locked Open = normal operation

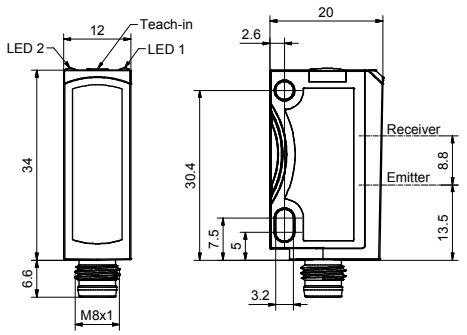
Mechanical data	
Dimensions	34 x 20 x 12 mm[3]
Enclosure rating	IP 69K & IP 67[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C[5]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (metal plug device[6])	10 g
Weight (cable device)	40 g
Weight (pigtail)	20 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: R5/L reflector [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] Only 4-pin design [4] With connected IP 67 / IP 69K plug [5] UL: -20 °C... + 50 °C [6] no Ecolab

Operating range	Switching output	Type of connection	Part number	Article number
1 … 13 m	PNP	Metal plug, M8x1, 3-pin	FR 25-RL-PS-M3M	609-31000
1 … 13 m	PNP	Metal plug, M8x1, 4-pin	FR 25-RL-PS-M4M	609-31001
1 … 13 m	NPN	Metal plug, M8x1, 4-pin	FR 25-RL-NS-M4M	609-31002
1 … 13 m	PNP	Cable, 2 m, 4-wire	FR 25-RL-PS-K4	609-21004
1 … 13 m	NPN	Cable, 2 m, 4-wire	FR 25-RL-NS-K4	609-21001
1 … 13 m	PNP	Pigtail, 150 mm with plug, M8, 4-pin	FR 25-RL-PS-KM4	609-21016
1 … 13 m	NPN	Pigtail, 150 mm with plug, M8, 4-pin	FR 25-RL-NS-KM4	609-21017
1 … 13 m	PNP	Pigtail, 150 mm with plug, M12, 4-pin	FR 25-RL-PS-KL4	609-21006
1 … 13 m	NPN	Pigtail, 150 mm with plug, M12, 4-pin	FR 25-RL-NS-KL4	609-21003

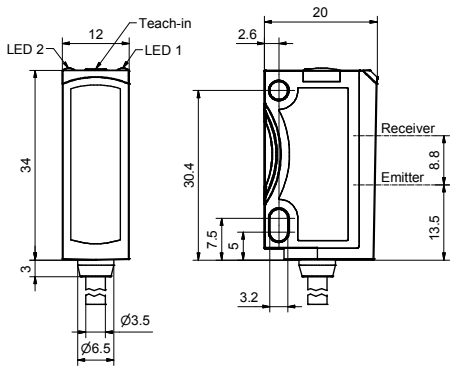
Version: 02/2015. Subject to changes; diagrams similar

Plug connection



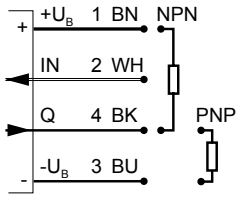
153-00937

Cable connection



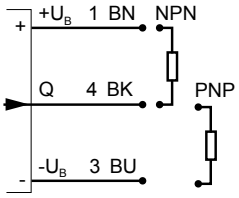
153-00936

Connection, 4-pin



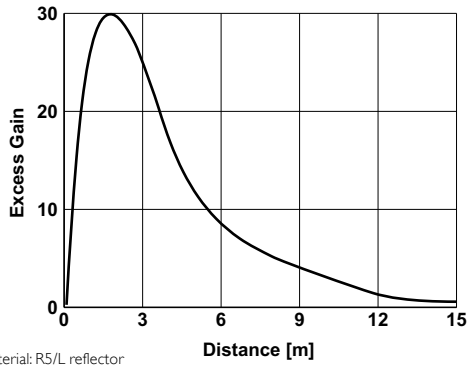
154-00312

Connection, 3-pin



154-00311

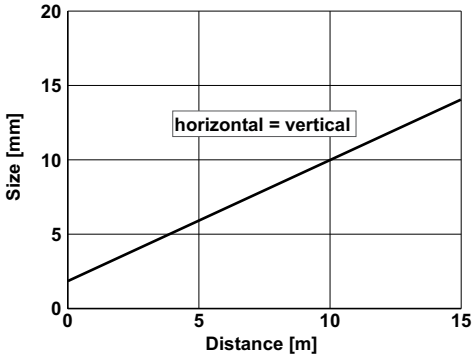
Functional reserves



155-01390

Reference material: R5/L reflector

Light spot size



155-01391

Reflector (especially for short range)	Operating range
RD-25 KL	0.15 … 1 m

Accessories

Reflectors	From Page A-18
Connection cables	From Page A-34
Brackets	From Page A-4

FR 25-R

Retroreflective photoelectric sensor

PRODUCT HIGHLIGHTS

- Auto-detect retroreflective photoelectric sensor with real PNP and real NPN functions
- Particularly suitable for short-range applications
- Simple alignment thanks to easily visible light spot
- Robust glass-fibre-reinforced plastic housings
- Durable laser printing
- Wide range of variants

Optical data	
Limit range	0.1 … 7 m[1]
Operating range	0.1 … 6 m[1]
Type of light	LED, red, 632 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
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 Auto-detect / NPN / PNP via Teach-in button and control input (only Auto-detect variants)
Default settings	Max. range and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 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/Auto-detect (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

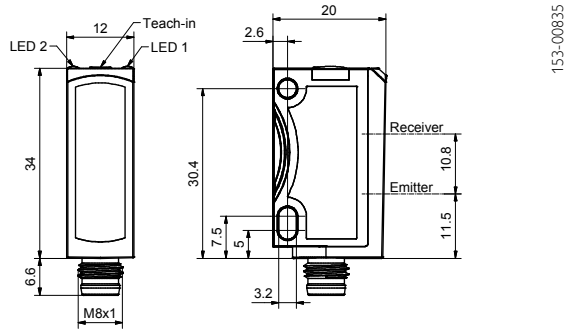
Mechanical data	
Dimensions	34 x 20 x 12 mm[3]
Enclosure rating	IP 69K & IP 67[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C[5]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (metal plug device[6])	10 g
Weight (cable device)	40 g
Weight (pigtail)	20 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: R10 reflector [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] Only 4-pin design [4] With connected IP 67 / IP 69K plug [5] UL: -20 °C... + 50 °C [6] no Ecolab

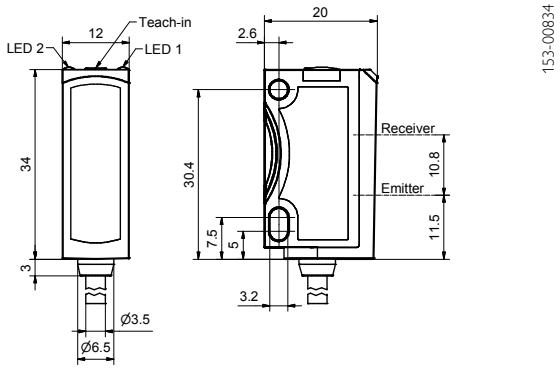
Operating range	Switching output	Type of connection	Part number	Article number
0.1 … 6 m	PNP	Plug, M8x1, 4-pin	FR 25-R-PS-M4	606-11000
0.1 … 6 m	NPN	Plug, M8x1, 4-pin	FR 25-R-NS-M4	606-11002
0.1 … 6 m	PNP	Metal plug, M8x1, 3-pin	FR 25-R-PS-M3M	606-11006
0.1 … 6 m	NPN	Metal plug, M8x1, 3-pin	FR 25-R-NS-M3M	606-11007
0.1 … 6 m	PNP	Metal plug, M8x1, 4-pin	FR 25-R-PS-M4M	606-11008
0.1 … 6 m	NPN	Metal plug, M8x1, 4-pin	FR 25-R-NS-M4M	606-11009
0.1 … 6 m	PNP	Cable, 2 m, 4-wire	FR 25-R-PS-K4	606-11001
0.1 … 6 m	NPN	Cable, 2 m, 4-wire	FR 25-R-NS-K4	606-11003

Operating range	Switching output	Type of connection	Part number	Article number
0.1 … 6 m	PNP	Pigtail, 150 mm with plug, M8, 4-pin	FR 25-R-PS-KM4	606-11028
0.1 … 6 m	NPN	Pigtail, 150 mm with plug, M8, 4-pin	FR 25-R-NS-KM4	606-11029
0.1 … 6 m	PNP	Pigtail, 150 mm with plug, M12, 4-pin	FR 25-R-PS-KL4	606-11004
0.1 … 6 m	NPN	Pigtail, 150 mm with plug, M12, 4-pin	FR 25-R-NS-KL4	606-11005
0.1 … 6 m	Auto-detect	Metal plug, M8x1, 4-pin	FR 25-R-PNS-M4M	606-11011

Plug connection

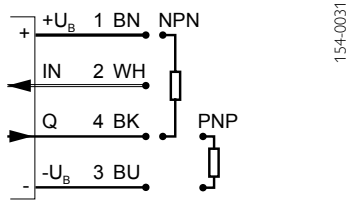


Cable connection

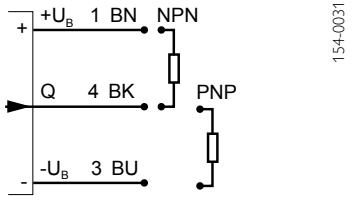


8

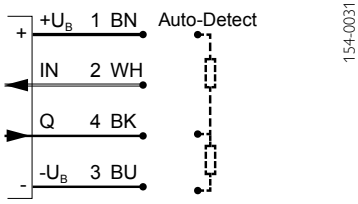
Connection, 4-pin



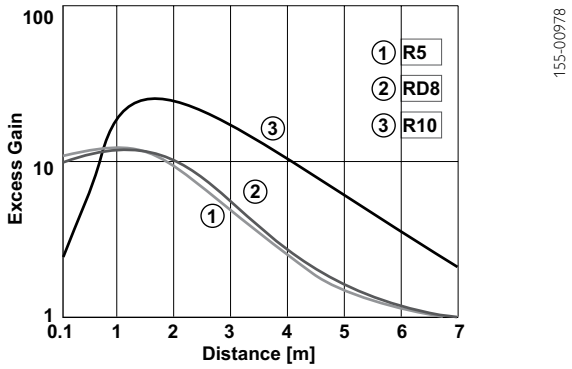
Connection, 3-pin



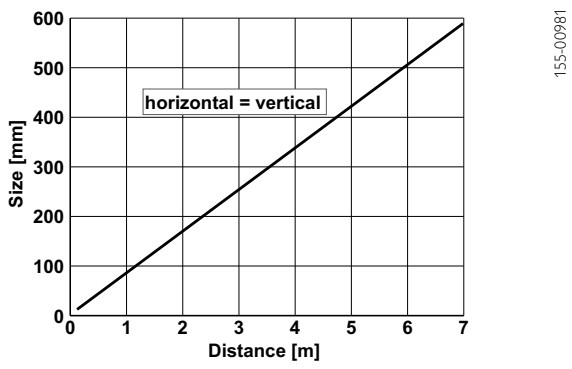
Connection, 4-pin, Auto-Detect



Functional reserves



Light spot size



Reflector	Operating range
R10	0.1 … 6 m
RD8	0,05 … 4 m
R5	0.1 … 4 m

Accessories

Reflectors	From Page A-18
Connection cables	From Page A-34
Brackets	From Page A-4

FR 25-RF

Retroreflective photoelectric sensor, fixed setting

PRODUCT HIGHLIGHTS

- Economical solution for numerous applications
- Tamper-proof sensor design – no misalignment possible
- Suitable for a wide variety of different reflectors
- Simple alignment thanks to easily visible light spot
- Robust glass-fibre-reinforced plastic housings

Optical data	
Limit range	0.1 … 5 m[1]
Operating range	0.1 … 3 m[1]
Type of light	LED, red, 632 nm
Light spot size	See diagram
Polarising filter	Yes

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

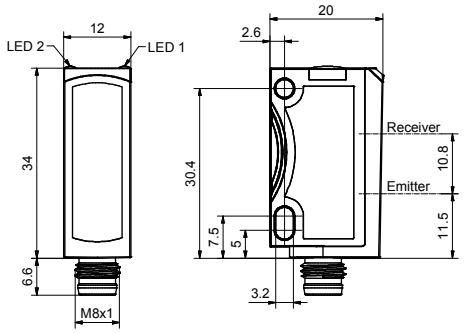
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Control input, IN	$+U_B$ = N.C. $-U_B$ / Open = N.O.

Mechanical data	
Dimensions	34 x 20 x 12 mm[3]
Enclosure rating	IP 69K & IP 67[3]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C[4]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: R10 reflector [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 / IP 69K plug [4] UL: -20 °C... + 50 °C

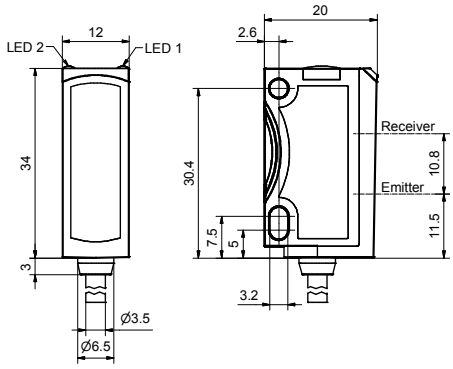
Operating range	Switching output	Type of connection	Part number	Article number
0.1 … 3 m	PNP	Plug, M8x1, 3-pin	FR 25-RF-PS-M3	606-11038
0.1 … 3 m	PNP	Plug, M8x1, 4-pin	FR 25-RF-PS-M4	606-11012
0.1 … 3 m	NPN	Plug, M8x1, 4-pin	FR 25-RF-NS-M4	606-11013
0.1 … 3 m	PNP	Cable, 2 m, 4-wire	FR 25-RF-PS-K4	606-11014
0.1 … 3 m	NPN	Cable, 2 m, 4-wire	FR 25-RF-NS-K4	606-11015

Plug connection



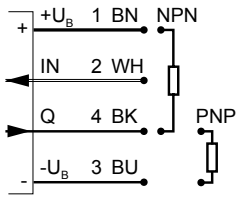
153-00942

Cable connection



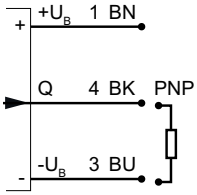
153-00943

Connection, 4-pin



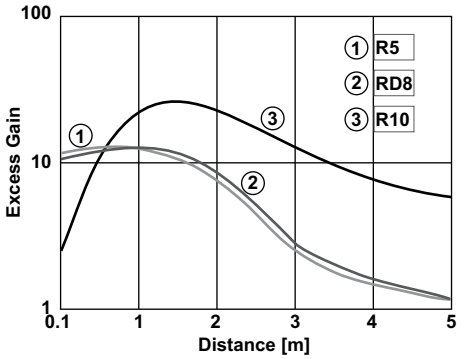
154-00312

Connection, 3-pin



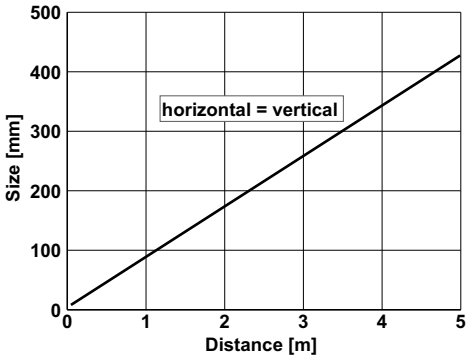
154-00531

Functional reserves



155-01399

Light spot size



155-01396

Reflector	Operating range
R10	0.1 … 3 m
RD8	0.1 … 3 m
R5	0.1 … 3 m

Accessories

Reflectors	From Page A-18
Connection cables	From Page A-34
Brackets	From Page A-4

FS/FE 25-RL

Laser through-beam photoelectric sensor

PRODUCT HIGHLIGHTS

- Long range with small and compact housings
- Test input for checking sensor pair function
- Very small, easily visible laser light spot
- Sensor settings via teach-in and control input
- Robust glass-fibre-reinforced plastic housings

Optical data	
Limit range	0 … 20 m
Operating range	0 … 18 m
Type of light	Laser, red, 650 nm
Light spot size	See diagram
Laser Class (DIN EN 60825-1:2008-5)	1

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment (receiver)	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.

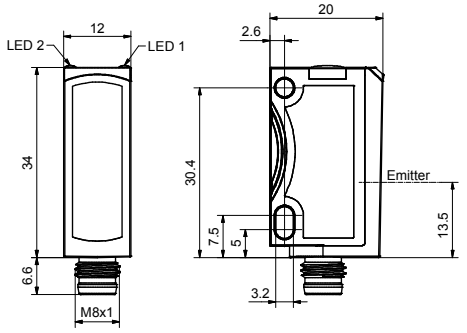
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 2000 Hz
Response time	250 µs
Control input, IN (receiver)	$+U_B$ = 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	34 x 20 x 12 mm[3]
Enclosure rating	IP 69K & IP 67[2]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C[3]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (metal plug device[4])	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [2] With connected IP 67 / IP 69K plug [3] UL: -20 °C... + 50 °C [4] no Ecolab

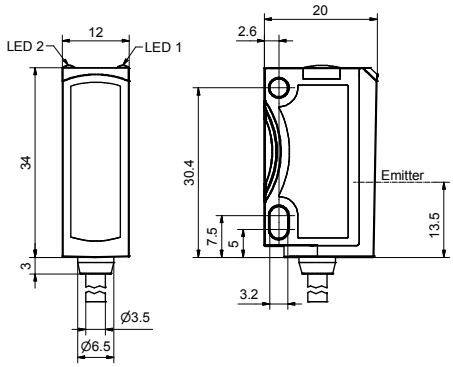
Operating range	Switching output	Type of connection	Part number	Article number
0 … 18 m	PNP	Metal plug, M8x1, 4-pin	FE 25-RL-PS-M4M	605-21014
0 … 18 m	NPN	Metal plug, M8x1, 4-pin	FE 25-RL-NS-M4M	605-21015
0 … 18 m	–	Metal plug, M8x1, 4-pin	FS 25-RL-M4M	605-11007
0 … 18 m	PNP	Cable, 2 m, 4-wire	FE 25-RL-PS-K4	605-21004
0 … 18 m	NPN	Cable, 2 m, 4-wire	FE 25-RL-NS-K4	605-21007
0 … 18 m	–	Cable, 2 m, 4-wire	FS 25-RL-K4	605-11002

Plug connection (transmitter)



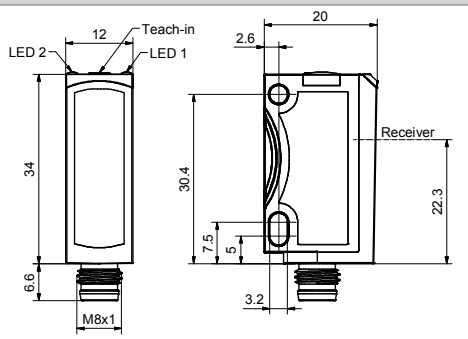
153-00940

Cable connection (transmitter)



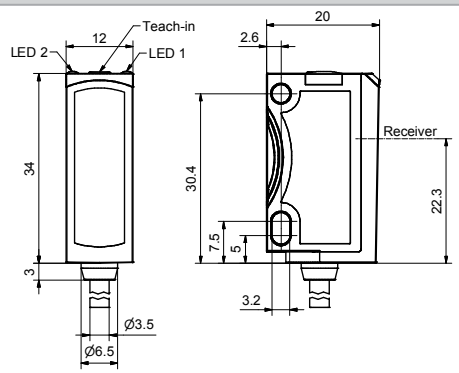
153-00939

Plug connection (receiver)



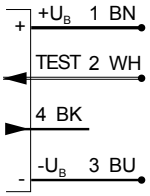
153-00854

Cable connection (receiver)



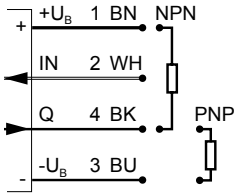
153-00853

Connection, transmitter, 4-pin



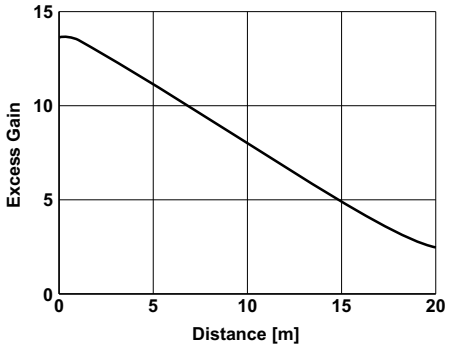
154-00315

Connection, receiver, 4-pin



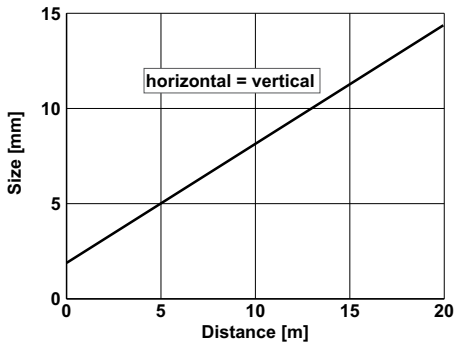
154-00312

Functional reserves



155-01388

Light spot size



155-01389

Accessories

Connection cables	From Page A-34	Brackets	From Page A-4

8

FS/FE 25-R

Through-beam photoelectric sensor

PRODUCT HIGHLIGHTS

- Test input for checking sensor pair function
- Sensor settings via teach-in and control input
- Simple alignment thanks to easily visible light spot
- Robust glass-fibre-reinforced plastic housings
- Durable laser printing

Optical data	
Limit range	0 … 15 m
Operating range	0 … 13 m
Type of light	LED, red, 632 nm
Light spot size	See diagram

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment (receiver)	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.

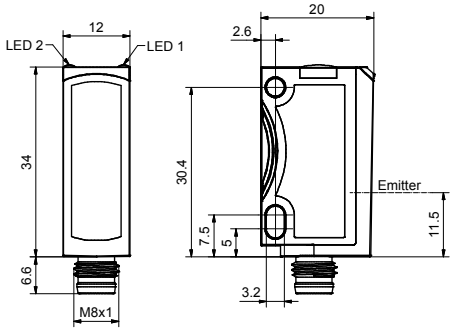
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Control input, IN (receiver)	$+U_B$ = 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	34 x 20 x 12 mm[3]
Enclosure rating	IP 69K & IP 67[2]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C[3]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (metal plug device[4])	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Max 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [2] With connected IP 67 / IP 69K plug [3] UL: -20 °C... + 50 °C [4] no Ecolab

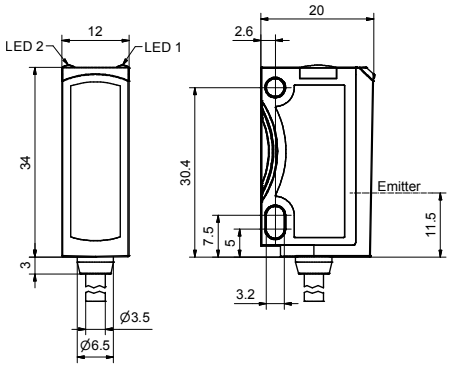
Operating range	Switching output	Type of connection	Part number	Article number
0 … 13 m	PNP	Metal plug, M8x1, 4-pin	FE 25-R-PS-M4M	605-21012
0 … 13 m	NPN	Metal plug, M8x1, 4-pin	FE 25-R-NS-M4M	605-21013
0 … 13 m	–	Metal plug, M8x1, 4-pin	FS 25-R-M4M	605-11006
0 … 13 m	PNP	Cable, 2 m, 4-wire	FE 25-R-PS-K4	605-21001
0 … 13 m	NPN	Cable, 2 m, 4-wire	FE 25-R-NS-K4	605-21003
0 … 13 m	–	Cable, 2 m, 4-wire	FS 25-R-K4	605-11001

Plug connection (transmitter)



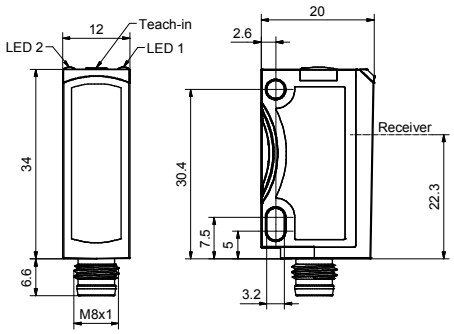
153-00852

Cable connection (transmitter)



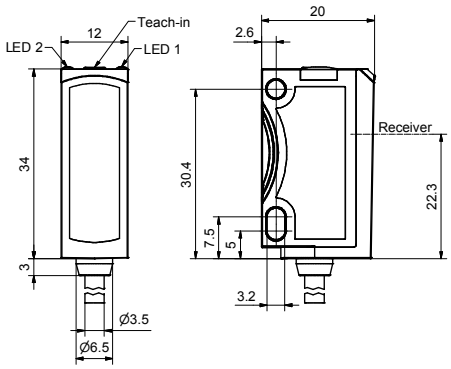
153-00851

Plug connection (receiver)



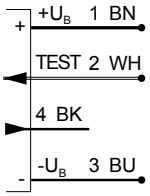
153-00854

Cable connection (receiver)



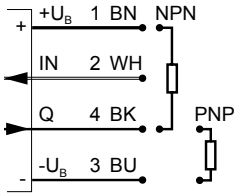
153-00853

Connection, transmitter, 4-pin



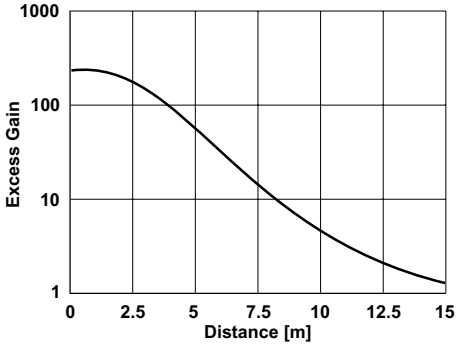
154-00315

Connection, receiver, 4-pin



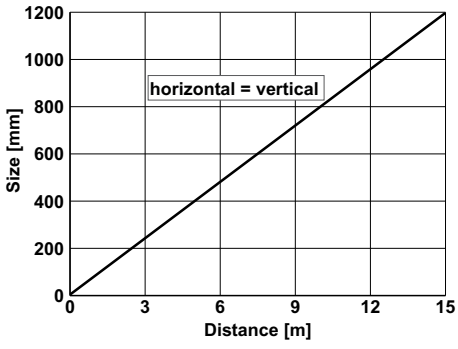
154-00312

Functional reserves



155-01370

Light spot size



155-01371

Accessories

Connection cables	From Page A-34	Brackets	From Page A-4

FS/FE 25-RF

Through-beam photoelectric sensor, fixed setting

PRODUCT HIGHLIGHTS

- Economical solution for numerous applications
- Tamper-proof sensor design – no misalignment possible
- Simple alignment thanks to easily visible light spot
- Robust glass-fibre-reinforced plastic housings
- Durable laser printing

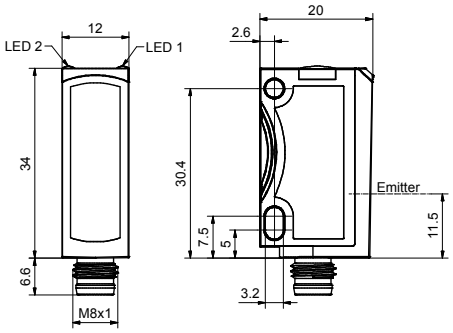
Optical data		Functions	
Limit range	0 … 6 m	Indicator LED, green	Operating voltage indicator
Operating range	0 … 4 m	Indicator LED, yellow	Switching output indicator
Type of light	LED, red, 632 nm	Adjustment possibilities (receiver)	N.O./N.C. via control input
Light spot size	See diagram		

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]	Dimensions	34 x 20 x 12 mm[3]
No-load current, I_0	≤ 30 mA	Enclosure rating	IP 69K & IP 67[2]
Output current, Ie	≤ 100 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-20 … +60 °C[3]
Power On Delay	< 300 ms	Ambient temperature: storage	-20 … +80 °C
Switching output, Q	PNP/NPN (see Selection Table)	Weight (plug device)	10 g
Output function	N.O./N.C.	Vibration and impact resistance	EN 60947-5-2
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz		
Response time	500 µs		
Control input, IN (receiver)	$+U_B$ = N.C. $-U_B$ / Open = N.O.		
Control input, Test (transmitter)	$+U_B$ = Test (transmitter off) $-U_B$ / Open = normal operation		

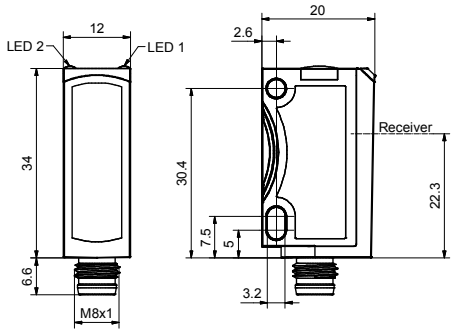
[1] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [2] With connected IP 67 / IP 69K plug [3] UL: -20 °C... + 50 °C

Operating range	Switching output	Type of connection	Part number	Article number
0 … 4 m	PNP	Plug, M8x1, 4-pin	FE 25-RF-PS-M4	605-21016
0 … 4 m	NPN	Plug, M8x1, 4-pin	FE 25-RF-NS-M4	605-21017
0 … 4 m	–	Plug, M8x1, 4-pin	FS 25-RF-M4	605-11008

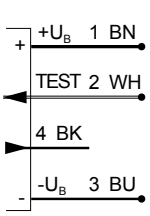
Plug connection (transmitter)



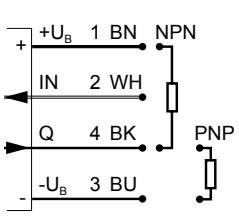
Plug connection (receiver)



Connection, transmitter, 4-pin

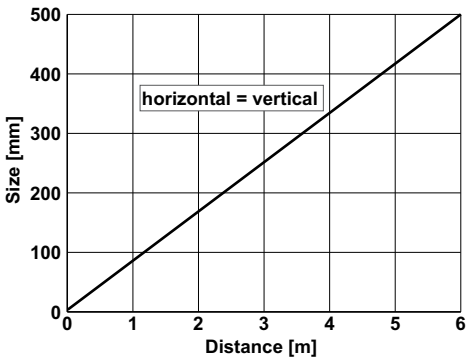


Connection, receiver, 4-pin



Functional reserves

Light spot size



Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

F 55 – family of photoelectric sensors with high-quality housings

The compact class with long ranges

Always sparkling clean

Neither bubble baths with aggressive chemicals nor high-pressure rinsing processes with jets of water or steam can damage the tightly sealed stainless steel housings of the F 55 series. No deposits can adhere during the cleaning process due to the completely smooth housing surface with flush inset operating elements.

TYPICAL F 55

- Glass-fibre-reinforced plastic or stainless steel housings (IP 69K & IP 67, Ecolab)
- Bright, easily visible, light spot with sharp contour even in daylight
- Precise background suppression and minimal black/white-shift
- User-friendly operation of all diffuse variants via electronic Teach-in button or control line
- Laser or LED options
- Two dovetail guides for simple sensor alignment
- Well thought-out mounting accessories

SensoPart sets new standards in the compact class with its F 55 family of photoelectric sensors. The products in this series combine excellent performance data with a robust housing design and many user-friendly details. They guarantee reliable detection by means of focused laser light or red-light LED with precise background suppression.

The sensors of the F 55 series have a very high light intensity: the photoelectric proximity sensor with background suppression, for example, reaches a scanning distance of up to 5000 mm. The bright, sharply contoured light spot is still easily visible even at long distances and in intense daylight, considerably simplifying commissioning.

The F 55 series covers all standard applications in industrial automation: whether for part detection in the automotive industry or for sorting tasks in machine construction – the sensors excel everywhere with their excellent performance. The food industry-enabled tightly sealed stainless steel variants (IP 69K) with Ecolab certification – rounding out the comprehensive sensor programme – shine in all regards.

F 55 – Product Overview					
	Type of light	Adjustment	Scanning distance / range	Special features	Page
Photoelectric proximity sensors with background suppression					
FT 55- RLH	Laser	Potentiometer	800 mm		294
FT 55-RL2H	Laser	Potentiometer	1000 mm	Precise small-part detection at long scanning distances	296
FT 55-RLHP2	Laser	Teach-in	5000 mm	Very long scanning distances	298
FT 55B-RH	LED	Potentiometer	800 mm		300
FT 55-RH	LED	Potentiometer	1200 mm		302
FT 55-RHM	LED	Teach-in	550 mm	Stainless steel housing	304
Photoelectric proximity sensors					
FT 55-RL2	Laser	Teach-in	1200 mm	Detection of slightest grey value differences	306
FT 55-R	LED	Teach-in	2000 mm		308
FT 55-RM	LED	Teach-in	1750 mm	Stainless steel housing	310
Retroreflective photoelectric sensors					
FR 55-RLO	Laser	Teach-in	20 m	Autocollimation, most accurate small-part detection	312
FR 55-RL	Laser	Teach-in	14 m		314
FR 55-R	LED	Teach-in	14 m		316
FR 55-RM	LED	Teach-in	13 m	Stainless steel housing	318
Through-beam photoelectric sensors					
FS/FE 55-RL	Laser	Teach-in	30 m		320
FS/FE 55-R	LED	Teach-in	25 m		322
FS/FE 55-RM	LED	Teach-in	20 m	Stainless steel housing	324

FT 55-RLH

Laser photoelectric proximity sensor with background suppression

PRODUCT HIGHLIGHTS

- Precisely adjustable background suppression – reliable operation even with highly reflective and glossy backgrounds
- Particularly suitable for the detection of the smallest of objects
- Very small, easily visible laser light spot
- Precise scanning distance adjustment by means of potentiometer
- Plug and cable connection rotatable

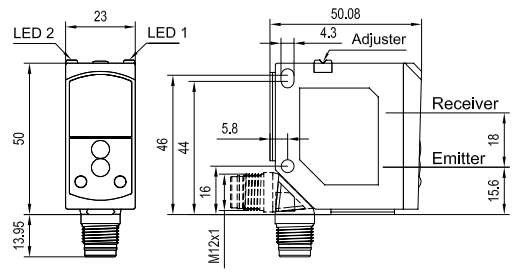
Optical data		Functions	
Scanning distance	5 … 800 mm[1]	Indicator LED, green	Operating voltage indicator
Type of light	Laser, red, 655 nm	Indicator LED, yellow	Switching output indicator / contamination indicator
Light spot size	See diagram	Scanning distance adjustment	Via potentiometer
Laser Class (DIN EN 60825-1: 2008-05)	1	Adjustment possibilities	N.O./N.C. via control input
		Default settings	Max. scanning distance (6 %)

Electrical data		Mechanical data	
Operating voltage, $+U_B$	12 … 30 V DC[2]	Dimensions	50 x 50.08 x 23 mm[3]
No-load current, I_0	≤ 30 mA	Enclosure rating	IP 69K & IP 67[3]
Output current, Ie	≤ 100 mA	Material, housing	PC-ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-20 … +60 °C
Power On Delay	< 300 ms	Ambient temperature: storage	-20 … +80 °C
Switching output, Q	PNP/NPN (see Selection Table)	Weight (plug device)	35 g
Output function	N.O./N.C.	Weight (cable device)	125 g
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Vibration and impact resistance	EN 60947-5-2
Response time	500 µs		
Control input, IN	$+U_B$ = N.C. $-U_B$ / Open = N.O.		

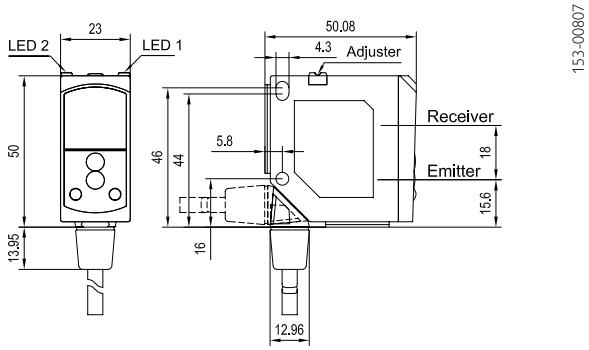
[1] Reference material: white, 90 % reflectivity [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 / IP 69K plug

Scanning distance	Switching output	Type of connection	Part number	Article number
5 … 800 mm	PNP	Plug, M12x1, 4-pin	FT 55-RLH-PS-L4	623-11018
5 … 800 mm	NPN	Plug, M12x1, 4-pin	FT 55-RLH-NS-L4	623-11019
5 … 800 mm	PNP	Cable, 3 m, 4-wire	FT 55-RLH-PS-K4	623-11021
5 … 800 mm	NPN	Cable, 3 m, 4-wire	FT 55-RLH-NS-K4	623-11022

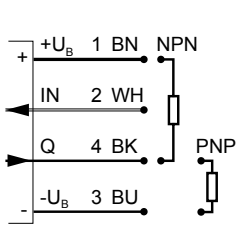
Plug connection



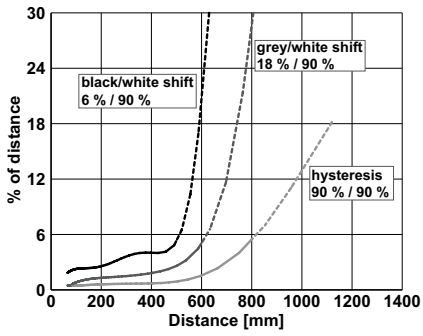
Cable connection



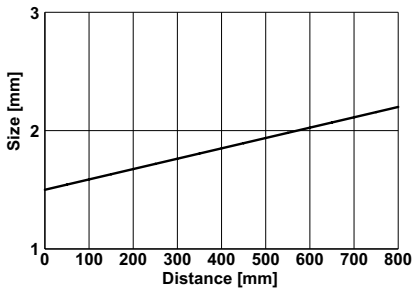
Connection, 4-pin



Scanning properties



Light spot size



Reference material	Detection range
White (90 %)	5 … 800 mm
Grey (18 %)	10 …600 mm
Black (6 %)	30 … 500 mm

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

FT 55-RL2H

Laser photoelectric proximity sensor with background suppression

PRODUCT HIGHLIGHTS

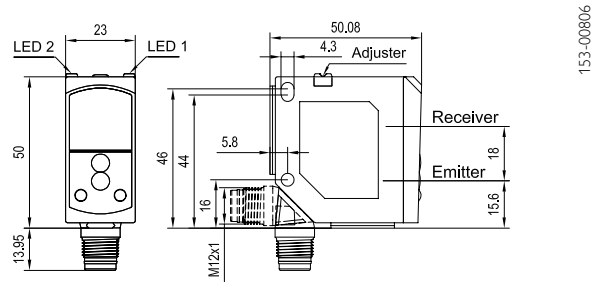
- Long scanning distance of 1 m combined with extremely accurate small-part detection
- Precisely adjustable background suppression – reliable operation even with highly reflective and glossy backgrounds
- Very small, easily visible laser light spot
- Precise scanning distance adjustment by means of potentiometer
- Integrated display window for scanning distance adjustment

Optical data		Functions	
Scanning distance	5 … 1000 mm[1]	Indicator LED, green	Operating voltage indicator
Type of light	Laser, red, 655 nm	Indicator LED, yellow	Switching output indicator / contamination indicator
Light spot size	See diagram	Scanning distance adjustment	Via potentiometer
Laser Class (DIN EN 60825-1:2008-5)	2	Adjustment possibilities	N.O./N.C. via control input
		Default settings	S_n = 500 mm (6 %)
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	12 … 30 V DC[2]	Dimensions	50 x 50.08 x 23 mm[3]
No-load current, I_0	≤ 30 mA	Enclosure rating	IP 69K & IP 67[3]
Output current, Ie	≤ 100 mA	Material, housing	PC-ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-20 … +60 °C
Power On Delay	< 300 ms	Ambient temperature: storage	-20 … +80 °C
Switching output, Q	PNP/NPN (see Selection Table)	Weight (plug device)	35 g
Output function	N.O./N.C.	Weight (cable device)	125 g
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Vibration and impact resistance	EN 60947-5-2
Response time	500 µs		
Control input, IN	$+U_B$ = N.C. $-U_B$ / Open = N.O.		

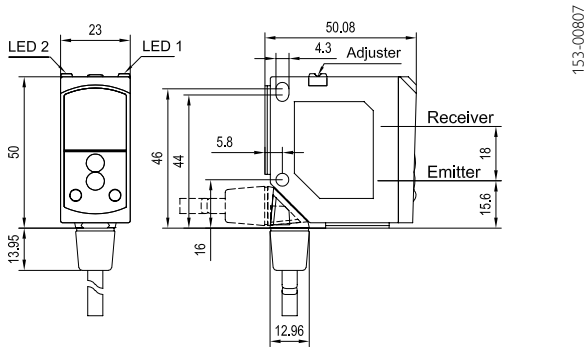
[1] Reference material: white, 90 % reflectivity [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 / IP 69K plug

Scanning distance	Switching output	Type of connection	Part number	Article number
5 … 1000 mm	PNP	Plug, M12x1, 4-pin	FT 55-RL2H-PS-L4	623-11006
5 … 1000 mm	NPN	Plug, M12x1, 4-pin	FT 55-RL2H-NS-L4	623-11007
5 … 1000 mm	PNP	Cable, 3 m, 4-wire	FT 55-RL2H-PS-K4	623-11009
5 … 1000 mm	NPN	Cable, 3 m, 4-wire	FT 55-RL2H-NS-K4	623-11010

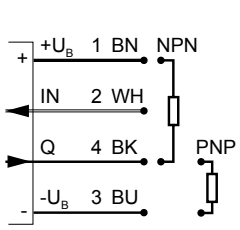
Plug connection



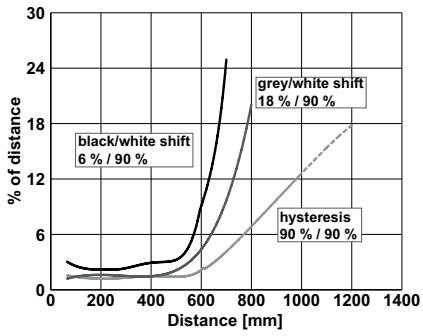
Cable connection



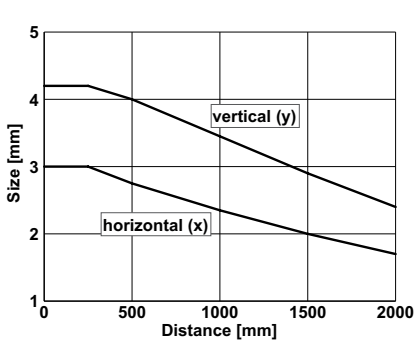
Connection, 4-pin



Scanning properties



Light spot size



Reference material	Detection range
White (90 %)	5 … 1000 mm
Grey (18 %)	10 … 800 mm
Black (6 %)	15 … 700 mm

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

FT 55-RLHP2

Laser photoelectric proximity sensor with background suppression – Time-of-flight technology

PRODUCT HIGHLIGHTS

- For detection tasks with all object surfaces at high scanning distances
- Reliable object detection even with tilted objects and with bright, highly reflective or shiny backgrounds
- Compact housing for an easy integration
- Simple teach-in (also external)
- Clearly visible laser light spot (laser class 1) for an easy alignment and full eye safety

Optical data	
Scanning distance	0 … 5 m (see Selection Table)[1]
Hysteresis	40 mm
Black/white shift (6%/90%)	≤ ± 40 mm
Grey value shift (18%/90%)	≤ ± 40 mm
Type of light	Laser, red 655 nm
Laser class (DIN EN 60825-1:2008-5)	1

Functions	
Indicator LED 2 green	Operating voltage indicator
Indicator LED 2 yellow[2]	Switching output indicator Q2
Indicator LED 1 yellow	Switching output indicator Q resp. Q1
Scanning distance adjustment	Via Teach-in Button and control input
Adjustment possibilities	N.O. / N.C. via Teach-in Button and control input Key lock via control input
Default settings	3 m, N.O.

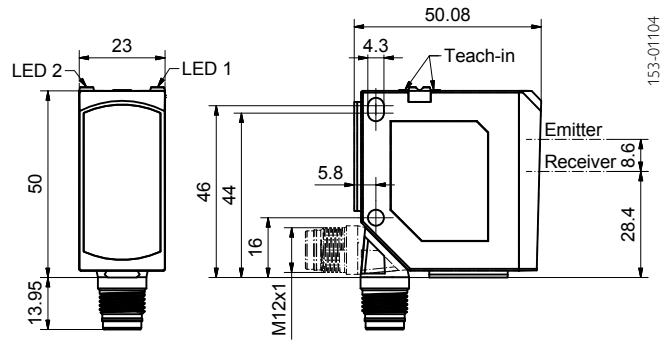
Electrical data	
Operating voltage $+U_B$	18 … 30 V DC
No-load current I_0	≤ 60 mA
Output current Ie Q	≤ 100 mA
Protection circuits	Reverse polarity protection U_B / short-circuit protection (Q)
Protection class	2
Power On Delay	< 5 s
Switching output Q	1 x PNP/NPN/Auto-Detect 2 x PNP/NPN/Auto-Detect
Output function	N.O. / N.C.
Switching frequency f (ti/tp 1:1) Q	≤ 500 Hz
Response time Q	1 ms
Temperature drift	< 0.1 %/K
Warm-up time	20 min.
Control input IN	$+U_B$ = Teach-in $-U_B$ = Button locked Open = normal operation

Mechanical data	
Dimensions	50 x 50,08 x 23 mm³
Enclosure rating	IP 67 & IP 69K[3]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection table
Ambient temperature: operation	-40 … +60 °C
Ambient temperature: storage	-40 … +80 °C
Weight (plug device)	42 g
Resistance to vibration and impacts	EN 60947-5-2

[1] Reference material 90 % reflectivity [2] For variant FT 55-RLHP2-2PNS-L5 [3] With connected IP 67 / IP 69K plug

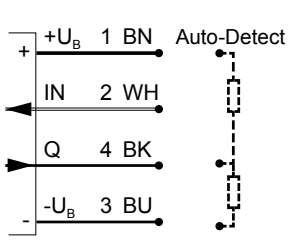
Scanning distance	Switching output	Type of connection	Part Number	Article number
0 … 5 m	1 x Auto-Detect	Plug, M12x1, 4-pin	FT 55-RLHP2-PNS-L4	623-11031
0 … 5 m	2 x Auto-Detect	Plug, M12x1, 5-pin	FT 55-RLHP2-2PNS-L5	623-11034

Plug connection[4]

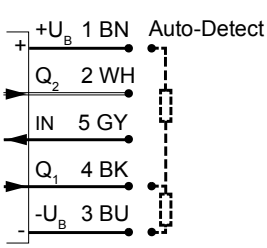


[4] FT 55-RLHP2-PNS-L4 with a teach-in button

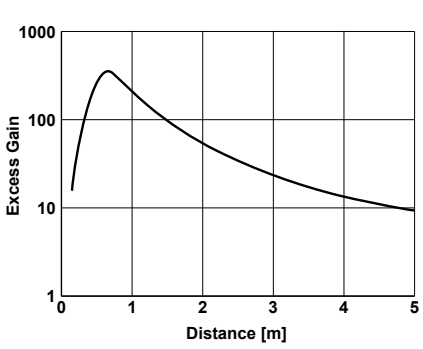
Connection, 4-pin, Auto-Detect



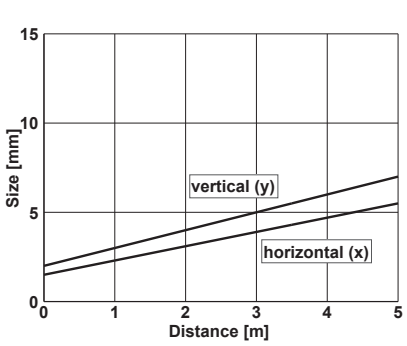
Connection, 5-pin, Auto-Detect



Scanning properties



Light spot size



Reference material	Scanning distance
White (90 %)	0 … 5 m
Grey (18 %)	0 … 5 m
Black (6 %)	0.05… 3 m

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

FT 55B-RH

Photoelectric proximity sensor with background suppression

PRODUCT HIGHLIGHTS

- Precisely adjustable background suppression
- Reliable switching despite differing object colours and surfaces
- Simple alignment thanks to easily visible light spot
- Plug and cable connection rotatable

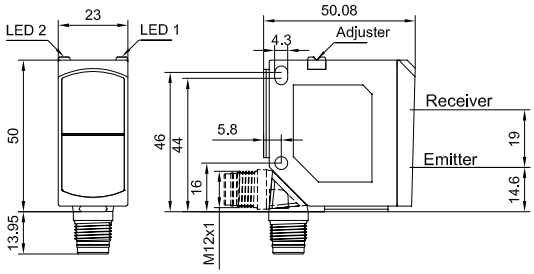
Optical data		Functions	
Scanning distance	3 … 800 mm[1]	Indicator LED, green	Operating voltage indicator
Type of light	LED, red, 640 nm	Indicator LED, yellow	Switching output indicator / contamination indicator
Light spot size	See diagram	Scanning distance adjustment	Via potentiometer
		Adjustment possibilities	N.O./N.C. via control input
		Default settings	Max. scanning distance (6 %)

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]	Dimensions	50 x 50.08 x 23 mm[3]
No-load current, I_0	≤ 30 mA	Enclosure rating	IP 69K & IP 67[3]
Output current, Ie	≤ 100 mA	Material, housing	PC-ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-20 … +60 °C
Power On Delay	< 300 ms	Ambient temperature: storage	-20 … +80 °C
Switching output, Q	PNP/NPN (see Selection Table)	Weight (plug device)	35 g
Output function	N.O./N.C.	Weight (cable)	125 g
Switching frequency, f (ti/tp 1:1)	≤ 600 Hz	Vibration and impact resistance	EN 60947-5-2
Response time	830 µs		
Control input, IN	$+U_B$ = N.C. $-U_B$ / Open = N.O.		

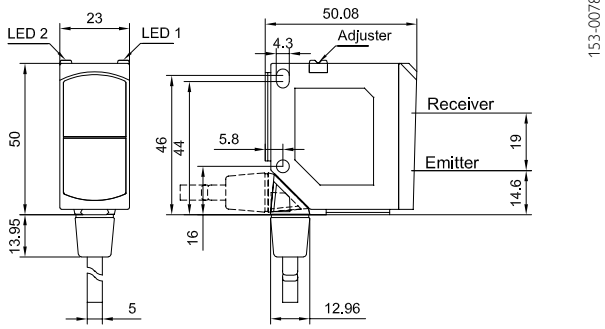
[1] Reference material: white, 90 % reflectivity [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 / IP 69K plug

Scanning distance	Switching output	Type of connection	Part number	Article number
3 … 800 mm	PNP	Plug, M12x1, 4-pin	FT 55B-RH-PS-L4	623-11012
3 … 800 mm	NPN	Plug, M12x1, 4-pin	FT 55B-RH-NS-L4	623-11013
3 … 800 mm	PNP	Cable 3 m, 4-wire	FT 55B-RH-PS-K4	623-11014
3 … 800 mm	NPN	Cable 3 m, 4-wire	FT 55B-RH-NS-K4	623-11015

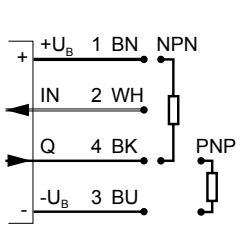
Plug connection



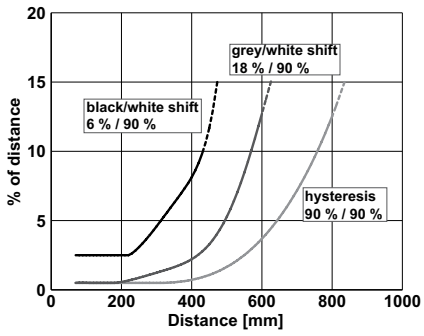
Cable connection



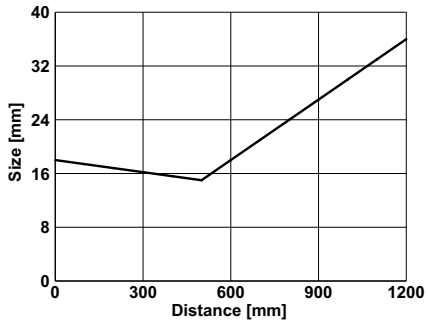
Connection, 4-pin



Scanning properties



Light spot size



Reference material	Detection range
White (90 %)	3 … 800 mm
Grey (18 %)	5 … 600 mm
Black (6 %)	15 … 450 mm

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

FT 55-RH

Photoelectric proximity sensor with background suppression

PRODUCT HIGHLIGHTS

- Long scanning distance of 1.20 m
- Precisely adjustable background suppression – reliable operation even with highly reflective and glossy backgrounds
- Reliable suppression of ambient light, such as sunlight and halogen lamps
- Precise scanning distance adjustment by means of potentiometer

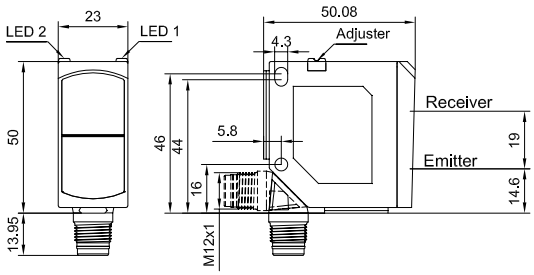
Optical data		Functions	
Scanning distance	3 … 1200 mm[1]	Indicator LED, green	Operating voltage indicator
Type of light	LED, red, 640 nm	Indicator LED, yellow	Switching output indicator / contamination indicator
Light spot size	See diagram	Scanning distance adjustment	Via potentiometer
		Adjustment possibilities	N.O./N.C. via control input
		Default settings	S_n = 500 mm (6 %)

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]	Dimensions	50 x 50.08 x 23 mm[3]
No-load current, I_0	≤ 30 mA	Enclosure rating	IP 69K & IP 67[3]
Output current, Ie	≤ 100 mA	Material, housing	PC-ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-20 … +60 °C
Power On Delay	< 300 ms	Ambient temperature: storage	-20 … +80 °C
Switching output, Q	PNP/NPN (see Selection Table)	Weight (plug device)	35 g
Output function	N.O./N.C.	Weight (cable device)	125 g
Switching frequency, f (ti/tp 1:1)	≤ 600 Hz	Vibration and impact resistance	EN 60947-5-2
Response time	830 µs		
Control input, IN	$+U_B$ = N.C. $-U_B$ / Open = N.O.		

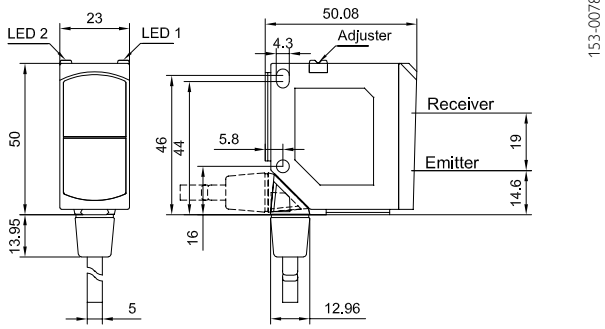
[1] Reference material: white, 90 % reflectivity [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 / IP 69K plug

Scanning distance	Switching output	Type of connection	Part number	Article number
3 … 1200 mm	PNP	Plug, M12x1, 4-pin	FT 55-RH-PS-L4	623-11000
3 … 1200 mm	NPN	Plug, M12x1, 4-pin	FT 55-RH-NS-L4	623-11001
3 … 1200 mm	PNP	Cable, 3 m, 4-wire	FT 55-RH-PS-K4	623-11003
3 … 1200 mm	NPN	Cable, 3 m, 4-wire	FT 55-RH-NS-K4	623-11004

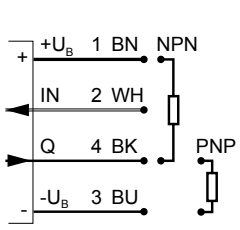
Plug connection



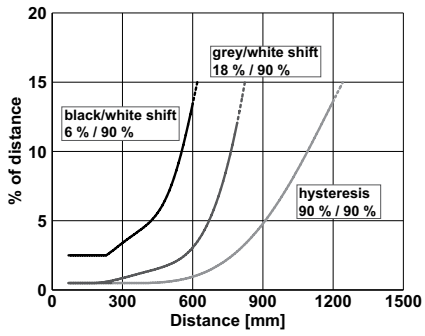
Cable connection



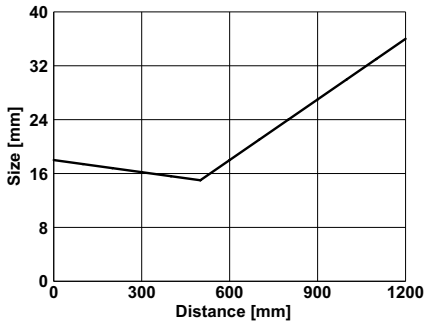
Connection, 4-pin



Scanning properties



Light spot size



Reference material	Detection range
White (90 %)	3 … 1200 mm
Grey (18 %)	5 … 800 mm
Black (6 %)	10 … 600 mm

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

FT 55-RHM

Photoelectric proximity sensor with background suppression – stainless steel housing

PRODUCT HIGHLIGHTS

- Minimum black / white-shift for reliable switching regardless of object colour and surface
- Stable stainless steel housing – ideal for use in hygiene zones
- Housing concept designed for intensive cleaning processes in the food industry
- Sensor adjustment via teach-in and control input

Optical data	
Scanning distance	3 … 550 mm[1]
Adjustment range	100 … 550 mm[1]
Type of light	LED, red, 640 nm
Light spot size	See diagram

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator / functional reserve indicator
Scanning distance 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. scanning distance and N.O.

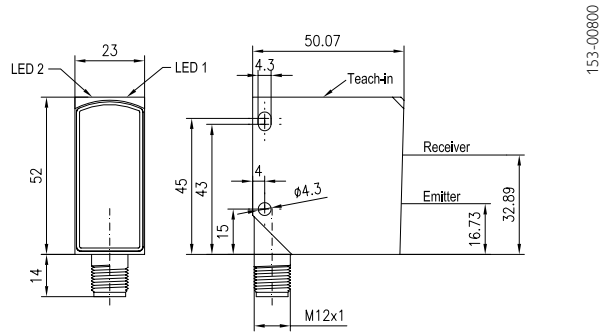
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 400 Hz
Response time	1.25 ms
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions	52 x 50.07 x 23 mm[3]
Enclosure rating	IP 69K & IP 67[3]
Material, housing	Stainless steel, 316L
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	145 g
Vibration and impact resistance	EN 60947-5-2

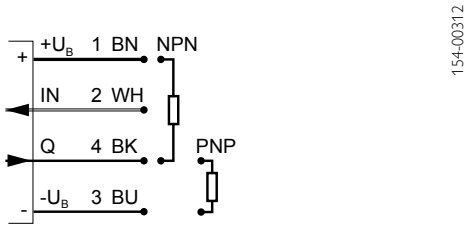
[1] Reference material: white, 90 % reflectivity [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 / IP 69K plug

Scanning distance	Switching output	Type of connection	Part number	Article number
3 … 550 mm	PNP	Plug, M12x1, 4-pin	FT 55-RHM-PS-L4	623-11025
3 … 550 mm	NPN	Plug, M12x1, 4-pin	FT 55-RHM-NS-L4	623-11026

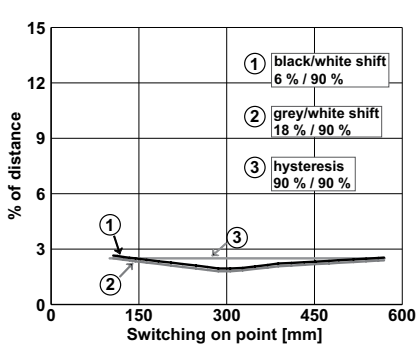
Plug connection



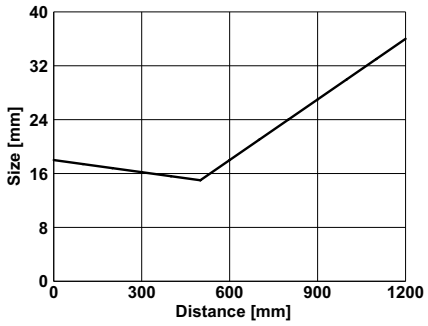
Connection, 4-pin



Scanning properties



Light spot size



Reference material	Detection range
White (90 %)	3 … 550 mm
Grey (18 %)	12 … 550 mm
Black (6 %)	20 … 550 mm

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

FT 55-RL2

Diffuse laser photoelectric proximity sensor

PRODUCT HIGHLIGHTS

- Differentiation of even the slightest of grey value differences
- Sensor adjustment via teach-in and control input
- Very small, easily visible laser light spot
- Plug and cable connection rotatable

Optical data	
Scanning distance	5 … 1200 mm[1]
Type of light	Laser, red, 655 nm
Light spot size	See diagram
Laser Class (DIN EN 60825-1:2008-5)	2
Hysteresis	≤ 15 %

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator / contamination 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. scanning distance and N.O.

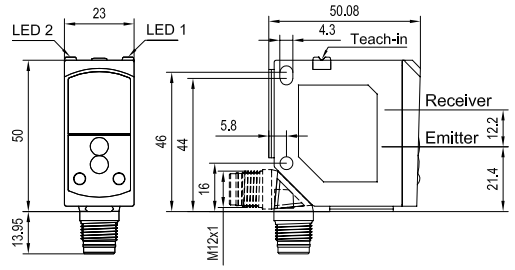
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 600 Hz
Response time	830 µs
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions	50 x 50.08 x 23 mm[3]
Enclosure rating	IP 69K & IP 67[3]
Material, housing	PC-ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	35 g
Weight (cable device)	125 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: white, 90 % reflectivity [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 / IP 69K plug

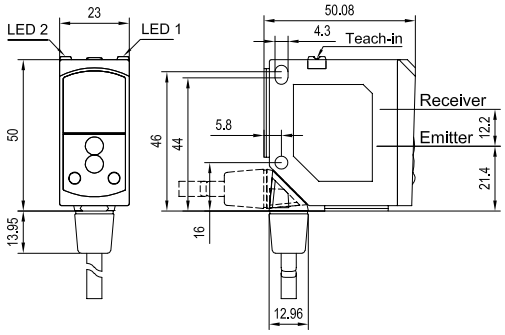
Scanning distance	Switching output	Type of connection	Part number	Article number
5 … 1200 mm	PNP	Plug, M12x1, 4-pin	FT 55-RL2-PS-L4	622-21006
5 … 1200 mm	NPN	Plug, M12x1, 4-pin	FT 55-RL2-NS-L4	622-21007
5 … 1200 mm	PNP	Cable, 3 m, 4-wire	FT 55-RL2-PS-K4	622-21009
5 … 1200 mm	NPN	Cable, 3 m, 4-wire	FT 55-RL2-NS-K4	622-21010

Plug connection



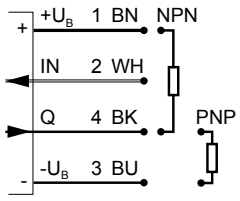
153-00848

Cable connection



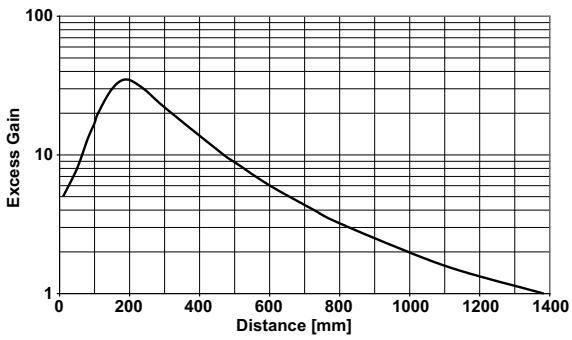
153-00849

Connection, 4-pin



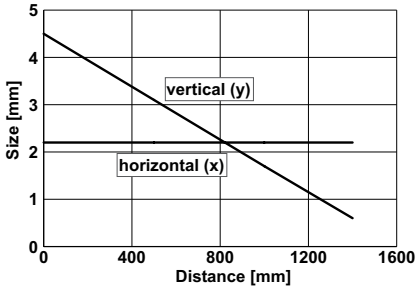
154-00312

Functional reserves



155-01238

Light spot size



155-01239

Reference material	Detection range
White (90 %)	5 … 1200 mm
Grey (18 %)	10 … 700 mm
Black (6 %)	100 … 400 mm

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

FT 55-R

Diffuse photoelectric proximity sensor

PRODUCT HIGHLIGHTS

- Differentiation of even the slightest of grey value differences
- Sensor adjustment via teach-in and control input
- Simple alignment thanks to easily visible light spot
- Plug and cable connection rotatable

Optical data	
Scanning distance	5 … 2000 mm[1]
Type of light	LED, red, 640 nm
Light spot size	See diagram

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator / contamination 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. scanning distance and N.O.

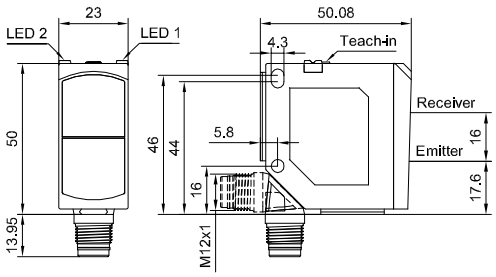
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 600 Hz
Response time	830 µs
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions	50 x 50.08 x 23 mm[3]
Enclosure rating	IP 69K & IP 67[3]
Material, housing	PC-ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	35 g
Weight (cable device)	125 g
Vibration and impact resistance	EN 60947-5-2

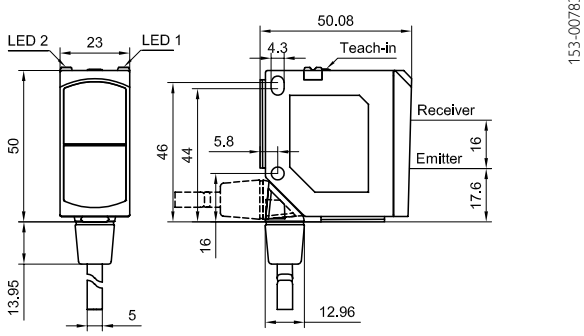
[1] Reference material: white, 90 % reflectivity [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 / IP 69K plug

Scanning distance	Switching output	Type of connection	Part number	Article number
5 … 2000 mm	PNP	Plug, M12x1, 4-pin	FT 55-R-PS-L4	622-21000
5 … 2000 mm	NPN	Plug, M12x1, 4-pin	FT 55-R-NS-L4	622-21001
5 … 2000 mm	PNP	Cable, 3 m, 4-wire	FT 55-R-PS-K4	622-21003
5 … 2000 mm	NPN	Cable, 3 m, 4-wire	FT 55-R-NS-K4	622-21004

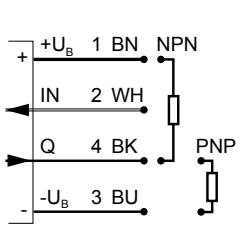
Plug connection



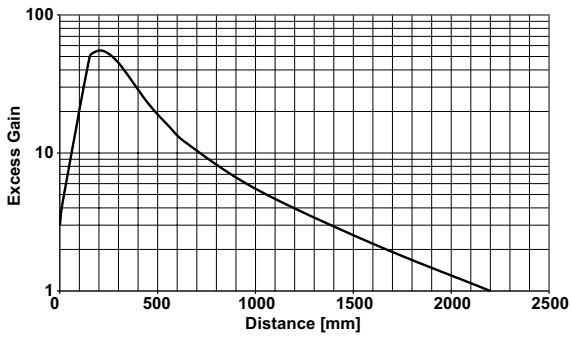
Cable connection



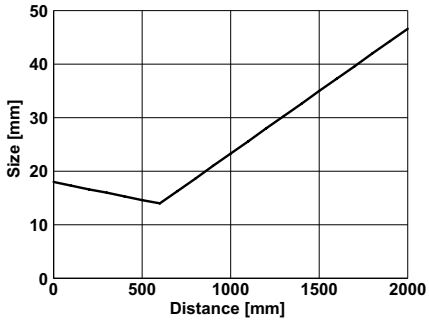
Connection, 4-pin



Functional reserves



Light spot size



Reference material	Detection range
White (90 %)	5 … 2000 mm
Grey (18 %)	10 … 1200 mm
Black (6 %)	90 … 600 mm

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

FT 55-RM

Diffuse photoelectric proximity sensor – stainless steel housing

PRODUCT HIGHLIGHTS

- Stable stainless steel housing – ideal for use in hygiene zones, e.g. in the food and beverages industries
- Housing concept designed for intensive cleaning processes
- Sensor adjustment via teach-in and control input
- Simple alignment thanks to easily visible light spot

Optical data	
Scanning distance	0 … 1750 mm[1]
Type of light	LED, red, 640 nm
Light spot size	See diagram

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator / contamination 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. scanning distance and N.O.

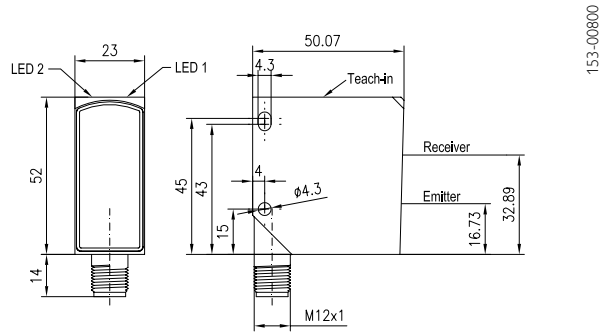
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 600 Hz
Response time	830 µs
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions	52 x 50.07 x 23 mm[3]
Enclosure rating	IP 69K & IP 67[3]
Material, housing	Stainless steel, 316L
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	138 g
Vibration and impact resistance	EN 60947-5-2

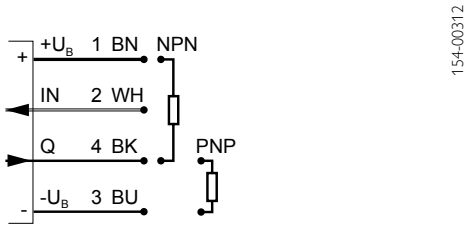
[1] Reference material: white, 90 % reflectivity [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 / IP 69K plug

Scanning distance	Switching output	Type of connection	Part number	Article number
0 … 1750 mm	PNP	Plug, M12x1, 4-pin	FT 55-RM-PS-L4	622-21012
0 … 1750 mm	NPN	Plug, M12x1, 4-pin	FT 55-RM-NS-L4	622-21013

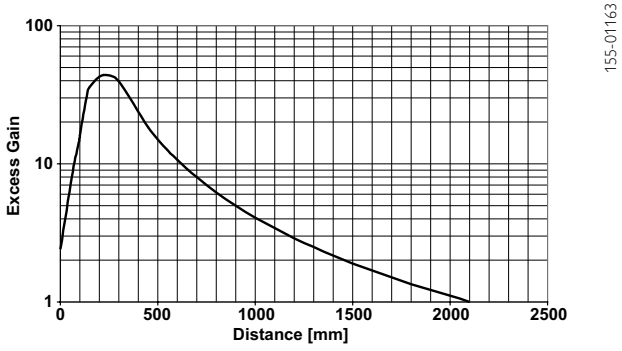
Plug connection



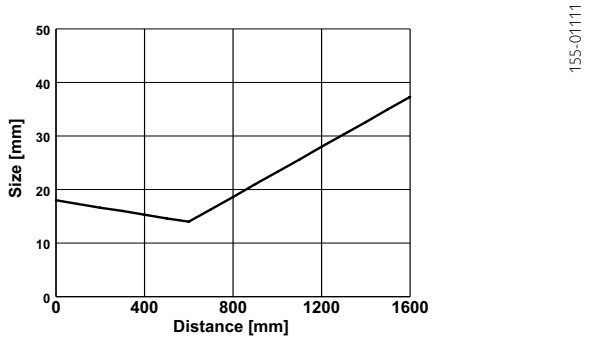
Connection, 4-pin



Functional reserves



Light spot size



Reference material	Detection range
White (90 %)	0 … 1750 mm
Grey (18 %)	15 … 1100 mm
Black (6 %)	90 … 550 mm

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

FR 55-RLO

Autocollimation laser retroreflective photoelectric sensor

PRODUCT HIGHLIGHTS

- Reliable small-part detection from a size of 0.2 mm at a scanning distance of 0–5 m
- Precise front-edge detection even in fastest automation processes thanks to a high switching frequency of 5 kHz
- Reliable detection of objects through the smallest of openings thanks to autocollimation; therefore sensor can be placed outside any danger zone
- No blind zone - detection from a range of 0 mm

Optical data	
Limit range	0 … 25 m[1]
Operating range	0 … 20 m[1]
Type of light	Laser, red, 655 mm
Light spot size	See diagram
Laser Class (DIN EN 60825-1:2008-5)	1
Polarising filter	Yes

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator / contamination 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	≤ 30 mA
Output current, Ie	≤ 100 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)	See Selection Table
Response time	See Selection Table
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

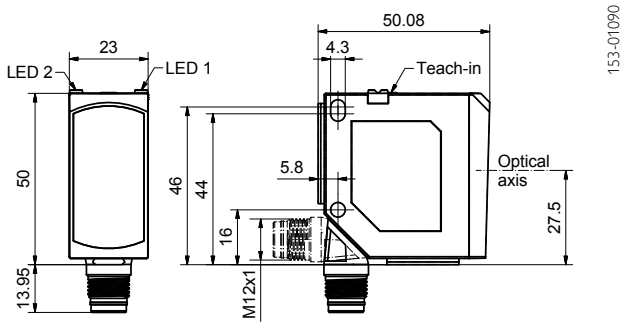
Mechanical data	
Dimensions	50 x 50.08 x 23 mm[3]
Enclosure rating	IP 69K & IP 67[3]
Material, housing	PC-ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	35 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: R5/L reflector [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 / IP 69K plug

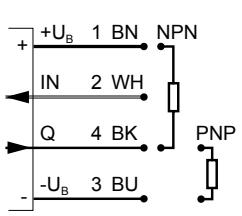
Switching frequency f (ti/tp 1:1)[2]	Response time	Switching output	Type of connection	Part number	Article number
≤ 5 kHz	100 µs	PNP	Plug M12x1, 4-pin	FR 55-RLO1-PS-L4	621-11021
≤ 5 kHz	100 µs	NPN	Plug M12x1, 4-pin	FR 55-RLO1-NS-L4	621-11022
≤ 2,5 kHz	200 µs	PNP	Plug M12x1, 4-pin	FR 55-RLO2-PS-L4	621-11023
≤ 2,5 kHz	200 µs	NPN	Plug M12x1, 4-pin	FR 55-RLO2-NS-L4	621-11024

Version: 02/2015. Subject to changes; diagrams similar

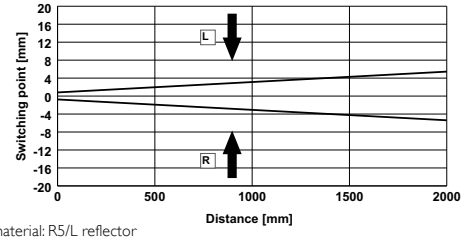
Plug connection



Connection, 4-pin

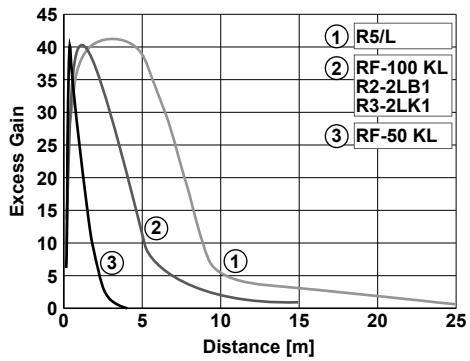


Lateral object approach

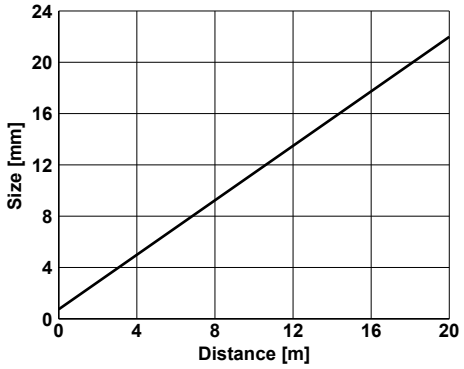


Reference material: R5/L reflector

Functional reserves



Light spot size



Reflector / Reflective foil*	Operating range (min./max. reflector distance)
R5/L	0 … 20 m
RF-100 KL*	0 … 15 m
R2-2LB1	0 … 15 m
R3-2LK1	0 … 15 m
RF-50 KL*	0 … 3 m

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

FR 55-RL

Laser retroreflective photoelectric sensor

PRODUCT HIGHLIGHTS

- Particularly suitable for the detection of the smallest of objects – smallest detectable part < 2 mm
- Bright, precise laser light spot in Laser Class 1
- Suitable for a wide variety of different reflectors
- Sensor adjustment via teach-in and control input

Optical data	
Limit range	0.3 … 14 m[1]
Operating range	0.3 … 12 m[1]
Type of light	Laser, red, 655 nm
Light spot size	See diagram
Laser Class (DIN EN 60825-1:2008-5)	1
Polarising filter	Yes

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator / contamination 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	≤ 30 mA
Output current, Ie	≤ 100 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)	≤ 2000 Hz
Response time	250 µs
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

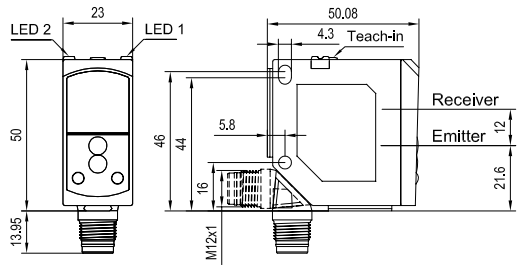
Mechanical data	
Dimensions	50 x 50.08 x 23 mm[3]
Enclosure rating	IP 69K & IP 67[3]
Material, housing	PC-ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	35 g
Weight (cable device)	125 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: R5/L reflector [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 / IP 69K plug

Operating range	Switching output	Type of connection	Part number	Article number
0.3 … 12 m	PNP	Plug, M12x1, 4-pin	FR 55-RL-PS-L4	621-11006
0.3 … 12 m	NPN	Plug, M12x1, 4-pin	FR 55-RL-NS-L4	621-11007
0.3 … 12 m	PNP	Cable, 3 m, 4-wire	FR 55-RL-PS-K4	621-11009
0.3 … 12 m	NPN	Cable, 3 m, 4-wire	FR 55-RL-NS-K4	621-11010

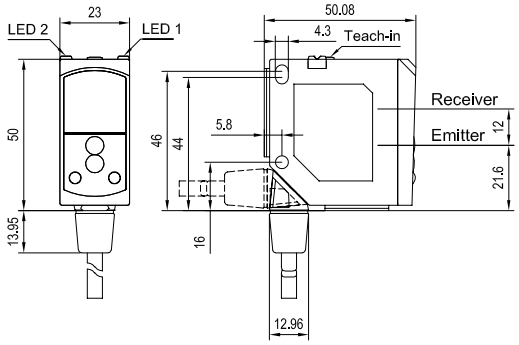
Version: 02/2015. Subject to changes; diagrams similar

Plug connection



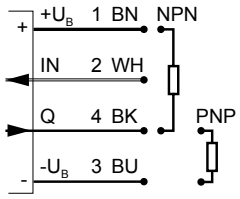
153-00804

Cable connection



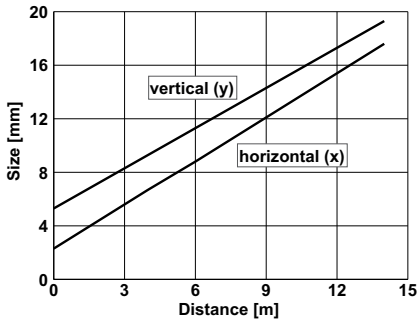
153-00805

Connection, 4-pin



154-00312

Light spot size



155-01114

Reflector / Reflective foil*	Operating range
R5/L	0.3 … 12 m
RF-100 KL*	0.2 … 6 m

Accessories

Reflectors	From Page A-18
Connection cables	From Page A-34
Brackets	From Page A-4

8

FR 55-R

Retroreflective photoelectric sensor

PRODUCT HIGHLIGHTS

- Simple alignment thanks to easily visible light spot
- Suitable for a wide variety of different reflectors
- Sensor adjustment via teach-in and control input
- Plug and cable connection rotatable

Optical data	
Limit range	0.3 … 14 m[1]
Operating range	0.3 … 12 m[1]
Type of light	LED, red, 640 nm
Light spot size	See diagram
Polarising filter	Yes

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator / contamination 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	S_n = 8 m and N.O.

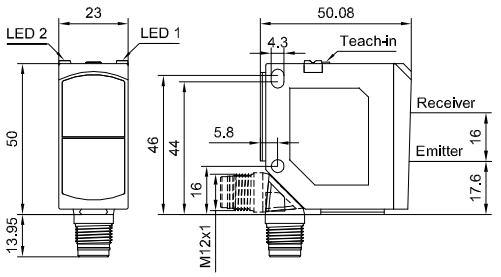
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 600 Hz
Response time	830 µs
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions	50 x 50.08 x 23 mm[3]
Enclosure rating	IP 69K & IP 67[3]
Material, housing	PC-ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	35 g
Weight (cable device)	125 g
Vibration and impact resistance	EN 60947-5-2

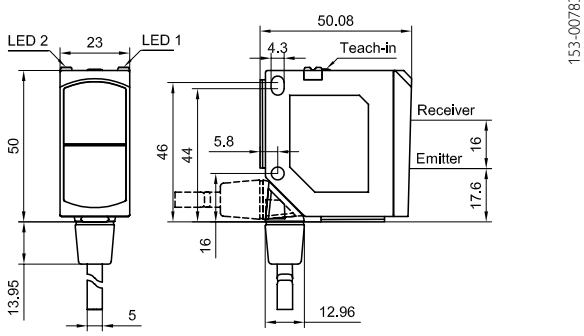
[1] Reference material: R10 reflector [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 / IP 69K plug

Operating range	Switching output	Type of connection	Part number	Article number
0.3 … 12 m	PNP	Plug, M12x1, 4-pin	FR 55-R-PS-L4	621-11000
0.3 … 12 m	NPN	Plug, M12x1, 4-pin	FR 55-R-NS-L4	621-11001
0.3 … 12 m	PNP	Cable, 3 m, 4-wire	FR 55-R-PS-K4	621-11003
0.3 … 12 m	NPN	Cable, 3 m, 4-wire	FR 55-R-NS-K4	621-11004

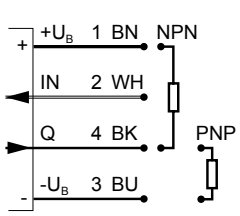
Plug connection



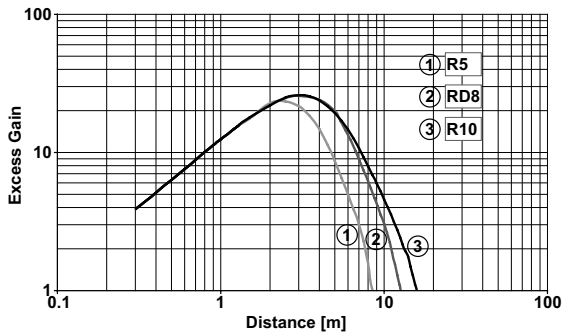
Cable connection



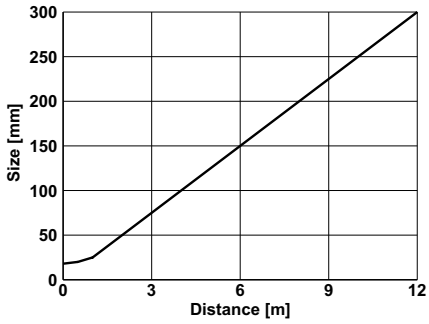
Connection, 4-pin



Functional reserves



Light spot size



Reflector / Reflective foil*	Operating range
R10	0.3 … 12 m
RD8	0.3 … 10 m
R5	0.3 … 6 m
RF-100 KL*	0.25 … 6 m

Accessories	
Reflectors	From Page A-18
Connection cables	From Page A-34
Brackets	From Page A-4

FR 55-RM

Retroreflective photoelectric sensor – stainless steel housing

PRODUCT HIGHLIGHTS

- Stable stainless steel housing – ideal for use in hygiene zones, e.g. in the food and beverages industries
- Housing concept designed for intensive cleaning processes
- Sensor adjustment via teach-in and control input
- Simple alignment thanks to easily visible light spot

Optical data	
Limit range	0.4 … 13 m[1]
Operating range	0.4 … 11 m[1]
Type of light	LED, red, 640 nm
Light spot size	See diagram
Polarising filter	Yes

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator / contamination 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	S_n = 8 m and N.O.

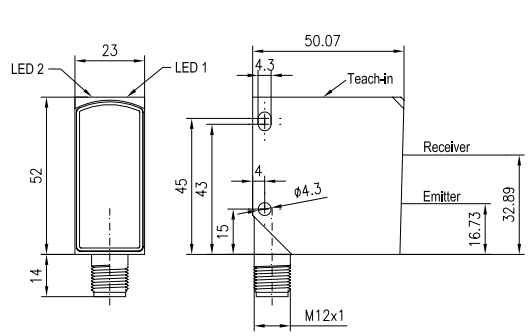
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 600 Hz
Response time	830 µs
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions	52 x 50.07 x 23 mm[3]
Enclosure rating	IP 69K & IP 67[3]
Material, housing	Stainless steel, 316L
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	138 g
Vibration and impact resistance	EN 60947-5-2

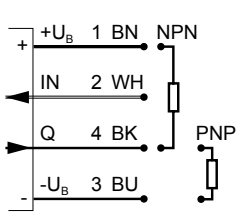
[1] Reference material: R10 reflector [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 / IP 69K plug

Operating range	Switching output	Type of connection	Part number	Article number
0.4 … 11 m	PNP	Plug, M12x1, 4-pin	FR 55-RM-PS-L4	621-11012
0.4 … 11 m	NPN	Plug, M12x1, 4-pin	FR 55-RM-NS-L4	621-11013

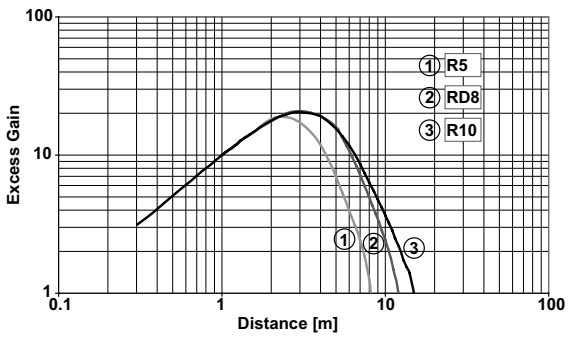
Plug connection



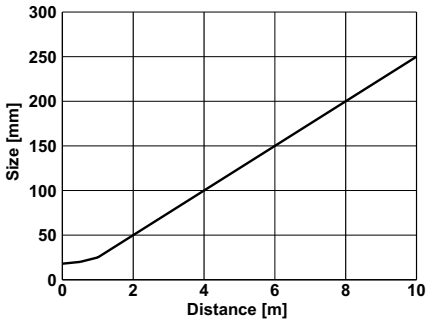
Connection, 4-pin



Functional reserves



Light spot size



Reflector	Operating range
R10	0.4 … 11 m
RD8	0.4 … 9 m
R5	0.4 … 6 m

Accessories	
Reflectors	From Page A-18
Connection cables	From Page A-34
Brackets	From Page A-4

FS/FE 55-RL

Laser through-beam photoelectric sensor

PRODUCT HIGHLIGHTS

- Long range combined with precise laser light spot for extremely accurate small-part detection
- High switching frequency for the reliable detection of even the most rapid processes
- Sensor adjustment via teach-in and control input
- Plug and cable connection rotatable

Optical data	
Limit range	0 … 30 m
Operating range	0 … 25 m
Type of light	Laser, red, 655 nm
Light spot size	See diagram
Laser Class (DIN EN 60825-1:2008-5)	1

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Indicator LED, red (receiver)	Alignment indicator
Sensitivity adjustment (receiver)	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	≤ 30mA
Output current, Ie	≤ 100 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)	≤ 3500 Hz
Response time	140 µs
Control input, IN (receiver)	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation
Control input, TEST (transmitter)	$+U_B$ = Test (transmitter off) $-U_B$ / Open = normal operation

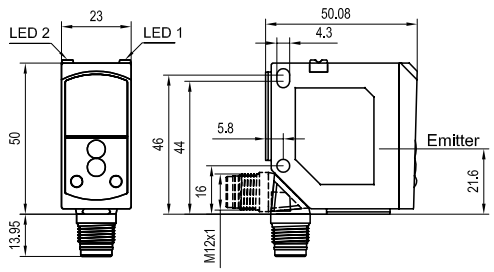
Mechanical data	
Dimensions	50 x 50.08 x 23 mm[3]
Enclosure rating	IP 69K & IP 67[2]
Material, housing	PC-ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	35 g
Weight (cable device)	125 g
Vibration and impact resistance	EN 60947-5-2

[1] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [2] With connected IP 67 / IP 69K plug

Operating range	Switching output	Type of connection	Part number	Article number
0 … 25 m	PNP	Plug, M12x1, 4-pin	FE 55-RL-PS-L4	620-21006
0 … 25 m	NPN	Plug, M12x1, 4-pin	FE 55-RL-NS-L4	620-21007
0 … 25 m	–	Plug, M12x1, 4-pin	FS 55-RL-L4	620-11002
0 … 25 m	PNP	Cable, 3 m, 4-wire	FE 55-RL-PS-K4	620-21009
0 … 25 m	NPN	Cable, 3 m, 4-wire	FE 55-RL-NS-K4	620-21010
0 … 25 m	–	Cable, 3 m, 4-wire	FS 55-RL-K4	620-11003

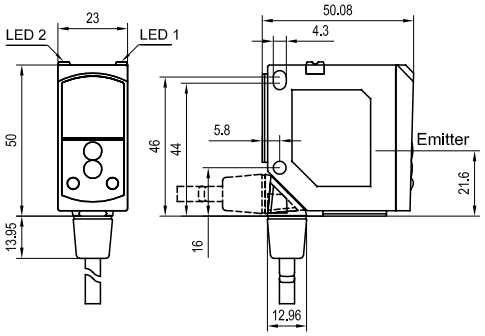
Version: 02/2015. Subject to changes; diagrams similar

Plug connection (transmitter)



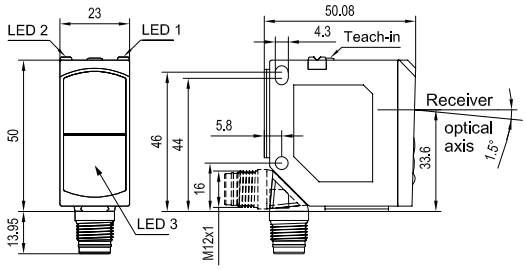
153-00808

Cable connection (transmitter)



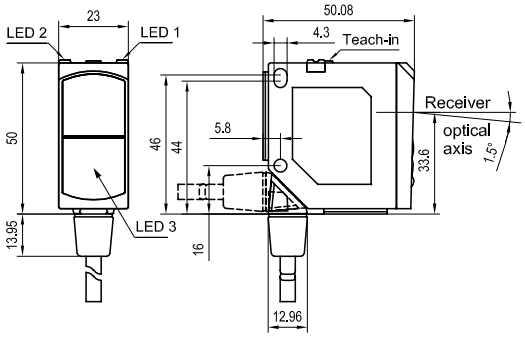
153-00809

Plug connection (receiver)



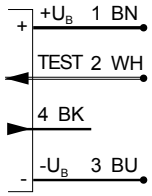
153-00812

Cable connection (receiver)



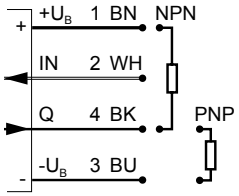
153-00813

Connection, transmitter, 4-pin



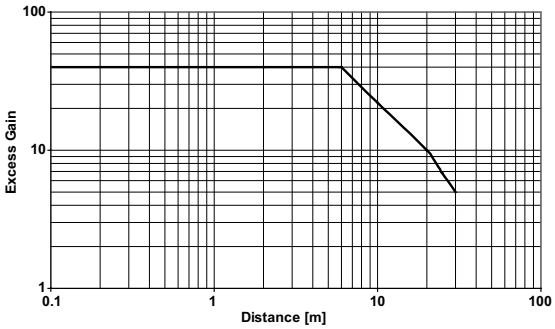
154-00315

Connection, receiver, 4-pin



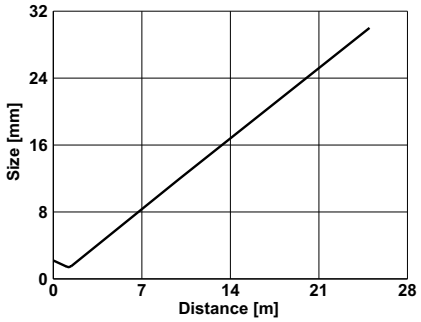
154-00312

Functional reserves



155-01138

Light spot size



155-01139

Accessories

Connection cables	From Page A-34	Brackets	From Page A-4

FS/FE 55-R

Through-beam photoelectric sensor

PRODUCT HIGHLIGHTS

- Alignment indicator and easily visible light spot for simple alignment of the through-beam system
- Test input to check sensor pair function
- Sensor adjustment via teach-in and control input
- Plug and cable connection rotatable

Optical data	
Limit range	0 … 25 m
Operating range	0 … 20 m
Type of light	LED, red, 640 nm
Light spot size	See diagram

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Indicator LED, red (receiver)	Alignment indicator
Sensitivity adjustment (receiver)	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.

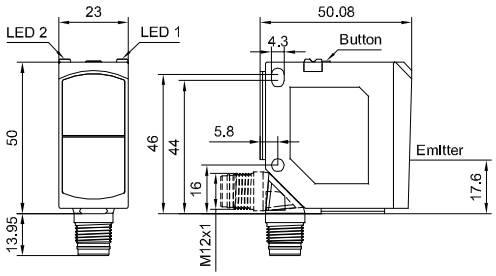
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 500 Hz
Response time	1 ms
Control input, IN (receiver)	$+U_B$ = 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	50 x 50.08 x 23 mm[3]
Enclosure rating	IP 69K & IP 67[2]
Material, housing	PC-ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	35 g
Weight (cable device)	125 g
Vibration and impact resistance	EN 60947-5-2

[1] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [2] With connected IP 67 / IP 69K plug

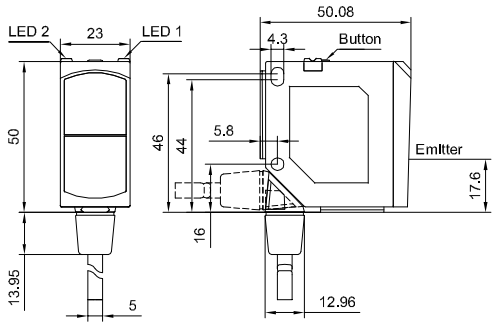
Operating range	Switching output	Type of connection	Part number	Article number
0 … 20 m	PNP	Plug, M12x1, 4-pin	FE 55-R-PS-L4	620-21000
0 … 20 m	NPN	Plug, M12x1, 4-pin	FE 55-R-NS-L4	620-21001
0 … 20 m	–	Plug, M12x1, 4-pin	FS 55-R-L4	620-11000
0 … 20 m	PNP	Cable, 3 m, 4-wire	FE 55-R-PS-K4	620-21003
0 … 20 m	NPN	Cable, 3 m, 4-wire	FE 55-R-NS-K4	620-21004
0 … 20 m	–	Cable, 3 m, 4-wire	FS 55-R-K4	620-11001

Plug connection (transmitter)



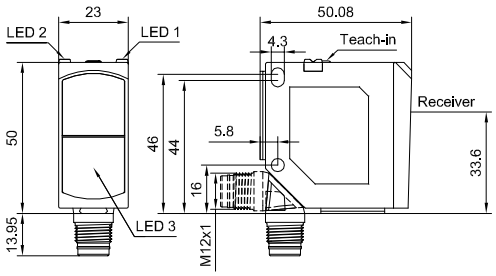
153-00787

Cable connection (transmitter)



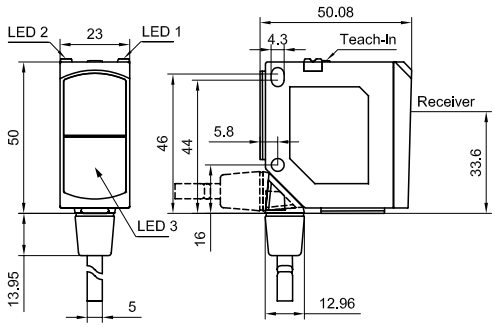
153-00786

Plug connection (receiver)



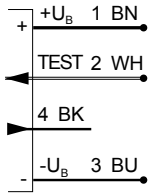
153-00790

Cable connection (receiver)



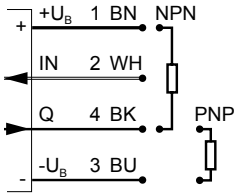
153-00791

Connection, transmitter, 4-pin



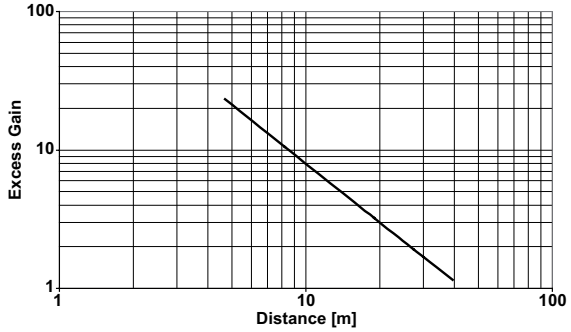
154-00315

Connection, receiver, 4-pin



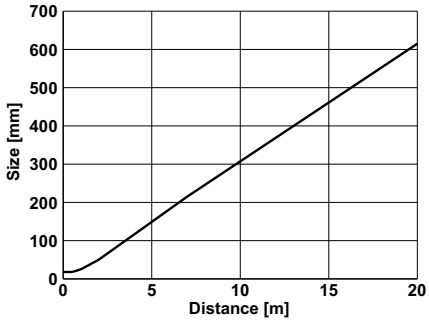
154-00312

Functional reserves



155-00986

Light spot size



155-00994

Accessories

Connection cables	From Page A-34	Brackets	From Page A-4

FS/FE 55-RM

Through-beam photoelectric sensor – stainless steel housing

PRODUCT HIGHLIGHTS

- Stable stainless steel housing – ideal for use in hygiene zones, e.g. in the food and beverages industries
- Housing concept designed for intensive cleaning processes
- Sensor adjustment via teach-in and control input
- Simple alignment thanks to easily visible light spot and alignment indicator

Optical data	
Limit range	0 … 20 m
Operating range	0 … 15 m
Type of light	LED, red, 640 nm
Light spot size	See diagram

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Indicator LED, red (receiver)	Alignment indicator
Sensitivity adjustment (receiver)	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.

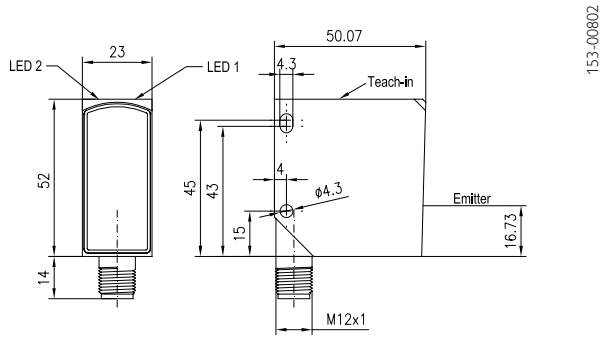
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 500Hz
Response time	1 ms
Control input, IN (receiver)	$+U_B$ = 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	52 x 50.07 x 23 mm[3]
Enclosure rating	IP 69K & IP 67[2]
Material, housing	Stainless steel, 316L
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	138 g
Vibration and impact resistance	EN 60947-5-2

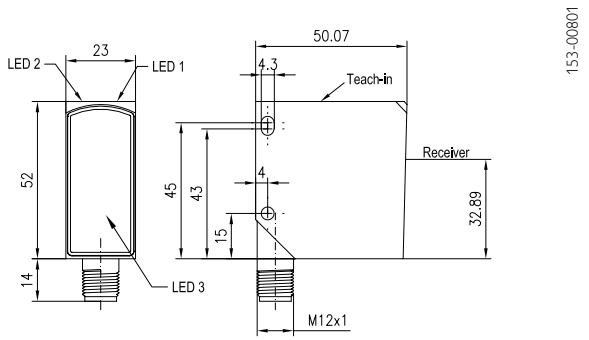
[1] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [2] With connected IP 67 / IP 69K plug

Operating range	Switching output	Type of connection	Part number	Article number
0 … 15 m	PNP	Plug, M12x1, 4-pin	FE 55-RM-PS-L4	620-21012
0 … 15 m	NPN	Plug, M12x1, 4-pin	FE 55-RM-NS-L4	620-21013
0 … 15 m	–	Plug, M12x1, 4-pin	FS 55-RM-L4	620-11004

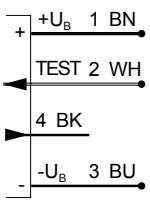
Plug connection (transmitter)



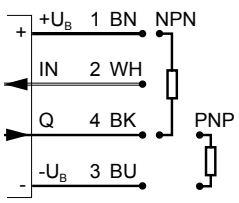
Plug connection (receiver)



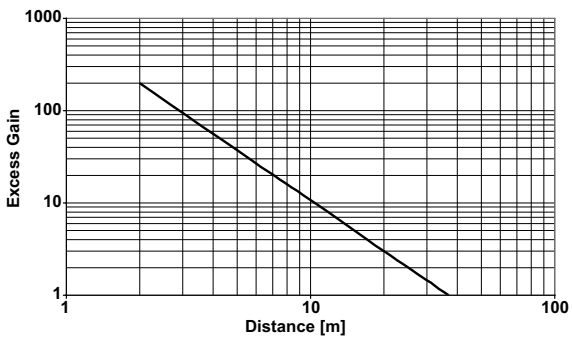
Connection, transmitter, 4-pin



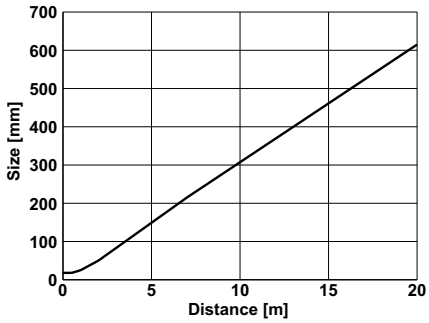
Connection, receiver, 4-pin



Functional reserves



Light spot size



Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

F 20 – photoelectric sensors and proximity sensors in miniature housings

The well-proven sensor series

Of all SensoPart's sensor series, the F 20 is the one with the largest range of variants – so that it contains the right sensor for almost every application. F 20 sensors are therefore found in numerous sectors, for example in the automotive industry, in mechanical engineering, in the electronics and beverages industries, as well as in packaging machines and in the print and paper industries.

The applications of the F 20 series range from positioning tasks to the detection of transparent objects and the smallest of parts: the FR 20-RLO photoelectric proximity sensor reliably detects parts from a size of 0.2 mm. Thanks to its autocollimation principle, it covers the entire range without a blind zone and even "sees" through the smallest drilled holes or apertures.

Compact and robust:
With its miniature housing, the F 20 is suitable for almost all applications. All sensors in this series are equipped with metal plugs so they are very tough and long-lived.

Not only is the variety offered by the F 20 series impressive, but also its uncompromising industrial suitability. Every sensor is serially equipped with a robust metal plug, well thought-out mounting accessories, and simple adjustment via teach-in or via the control input – because it is often these details that decide on the suitability of a sensor in everyday operation.

TYPICAL F 20

- Largest choice of variants for numerous requirements
- Compact miniature housings for extremely limited mounting conditions
- Detection of transparent objects of any shape
- Most accurate small-part detection throughout the entire range from 0 mm
- Reliable suppression of highly reflective machine parts
- Laser, LED or infrared transmitter options, with teach-in or fixed settings
- User-friendly commissioning via electronic Teach-in button or control line
- Well thought-out mounting accessories for rapid and simple integration
- UL-certification

F 20 – Product Overview					
	Type of light	Adjustment	Scanning distance / range	Special features	Page
Photoelectric proximity sensors with background suppression					
FT 20 RLH	Laser	Teach-in	60 mm		328
FT 20 RLHD	Laser	Teach-in	110 mm	Long scanning distance	330
FT 20 RH	LED	Teach-in	100 mm		332
FT 20 IH	Infrared	Teach-in	150 mm		334
FT 23 RF	LED	Fixed focus	60 / 80 mm		336
Photoelectric proximity sensors					
FT 20 RL	Laser	Teach-in	150 mm		338
FT 20 R	LED	Teach-in	300 mm		340
FT 23 R	LED	Fixed setting	300 mm		342
Retroreflective photoelectric sensors					
FR 20 RG1	LED	Teach-in	0.5 m	For transparent objects, using autocollimation principle	344
FR 20 RG	LED	Teach-in	0.5 m	For transparent objects	346
FR 20 RLO	Laser	Teach-in	4 m	Very accurate object positioning, no blind zone	348
FR 20 RL	Laser	Teach-in	3 m	Very accurate object positioning	350
FR 20 R	LED	Teach-in	2.5 m		352
FR 20 RD	LED	Teach-in	3.5 m		354
FR 23 R	LED	Fixed setting	2.5 m		356
Through-beam photoelectric sensors					
FS/FE 20 R	LED	Teach-in	8 m		358
FS/FE 23 R	LED	Fixed setting	4 m		360

FT 20 RLH

Laser photoelectric proximity sensor with background suppression

PRODUCT HIGHLIGHTS

- Detection of the smallest parts
- Precise background suppression
- Laser Protection Class 1
- Sensor adjustment via teach-in and control input
- Compact miniature housing

Optical data	
Scanning distance	20 … 60 mm[1]
Type of light	Laser, red, 650 nm
Light spot size	See table
Laser Class (DIN EN 60825-1:2008-5)	1

Functions	
Indicator LED, green	Operating voltage indicator / contamination indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Scanning distance adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running operation 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. scanning distance and N.O.

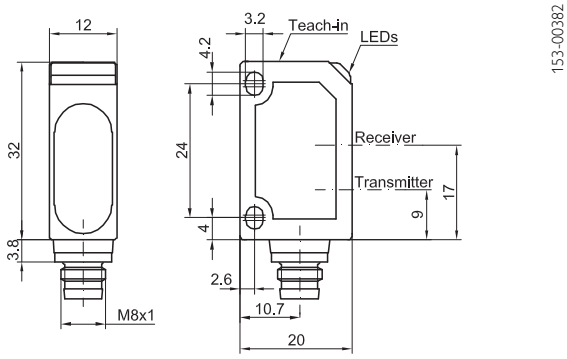
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Control input, IN[2]	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions	32 x 20 x 12 mm[3]
Enclosure rating	IP 67[3]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (metal plug device)	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: grey, 18 % reflectivity [2] Only 4-pin design [3] With connected IP 67 plug

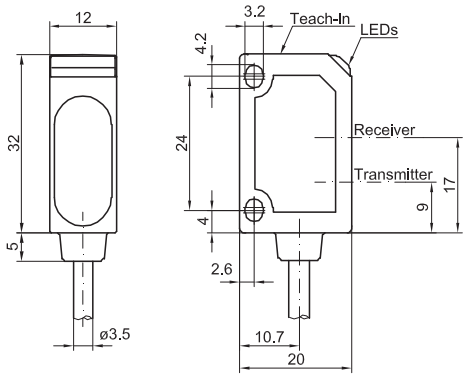
Scanning distance	Switching output	Type of connection	Part number	Article number
20 … 60 mm	PNP	Metal plug, M8x1, 3-pin	FT 20 RLH-PSM3	551-11019
20 … 60 mm	NPN	Metal plug, M8x1, 3-pin	FT 20 RLH-NSM3	551-11020
20 … 60 mm	PNP	Metal plug, M8x1, 4-pin	FT 20 RLH-PSM4	551-11014
20 … 60 mm	NPN	Metal plug, M8x1, 4-pin	FT 20 RLH-NSM4	551-11016
20 … 60 mm	PNP	Cable, 2 m, 4-wire	FT 20 RLH-PSK4	551-11015
20 … 60 mm	NPN	Cable, 2 m, 4-wire	FT 20 RLH-NSK4	551-11017

Plug connection



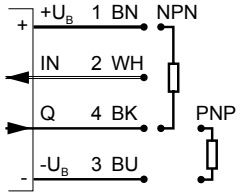
153-00382

Cable connection



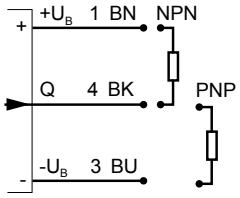
153-00381

Connection, 4-pin



154-00312

Connection, 3-pin



154-00311

8

Light spot size

Scanning distance (mm)	20	35	40	60
Light spot diameter (mm)	1.5	0.1	0.5	2.5

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

FT 20 RLHD

Laser photoelectric proximity sensor with background suppression

PRODUCT HIGHLIGHTS

- Detection of the smallest parts
- Precise background suppression
- Very small, easily visible laser light spot
- Sensor adjustment via teach-in and control input
- Compact miniature housing

Optical data	
Scanning distance	30 … 110 mm[1]
Type of light	Laser, red, 650 nm
Light spot size[2]	Ø < 0.7 mm
Laser Class (DIN EN 60825-1:2008-5)	2

Functions	
Indicator LED, green	Operating voltage indicator / contamination indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Scanning distance adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running operation 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. scanning distance and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 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

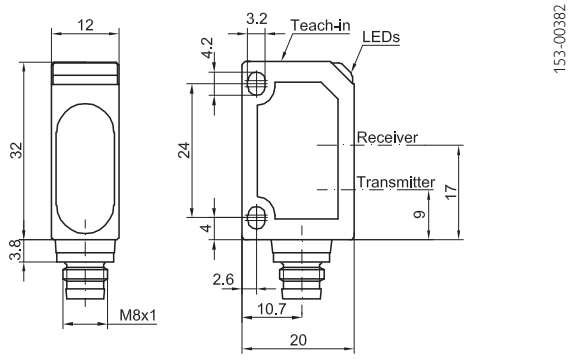
Mechanical data	
Dimensions	32 x 20 x 12 mm[3]
Enclosure rating	IP 67[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (metal plug device)	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: grey, 18 % reflectivity [2] In focus [3] Only 4-pin design [4] With connected IP 67 plug

Scanning distance	Switching output	Type of connection	Part number	Article number
30 … 110 mm	PNP	Metal plug, M8x1, 3-pin	FT 20 RLHD-PSM3	551-11026
30 … 110 mm	PNP	Metal plug, M8x1, 4-pin	FT 20 RLHD-PSM4	551-11022
30 … 110 mm	NPN	Metal plug, M8x1, 4-pin	FT 20 RLHD-NSM4	551-11023
30 … 110 mm	PNP	Cable, 2 m, 4-wire	FT 20 RLHD-PSK4	551-11024
30 … 110 mm	NPN	Cable, 2 m, 4-wire	FT 20 RLHD-NSK4	551-11025

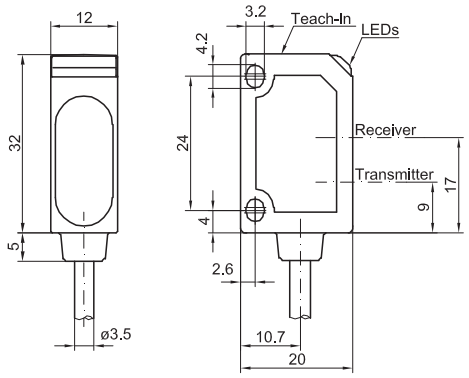
Version: 02/2015. Subject to changes; diagrams similar

Plug connection



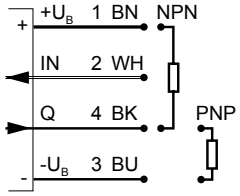
153-00382

Cable connection



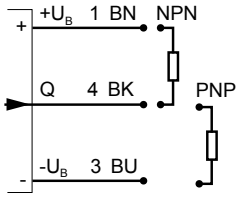
153-00381

Connection, 4-pin



154-00312

Connection, 3-pin



154-00311

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

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FT 20 RH

Photoelectric proximity sensor with background suppression

PRODUCT HIGHLIGHTS

- Precise background suppression
- Simple alignment thanks to easily visible light spot
- Compact miniature housing
- Large range of variants

Optical data	
Scanning distance	25 … 100 mm[1]
Type of light	LED, red, 640 nm
Light spot size[2]	< 5 x 5 mm[2]

Functions	
Indicator LED, green	Operating voltage indicator / contamination indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Scanning distance adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running operation 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. scanning distance and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 100 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

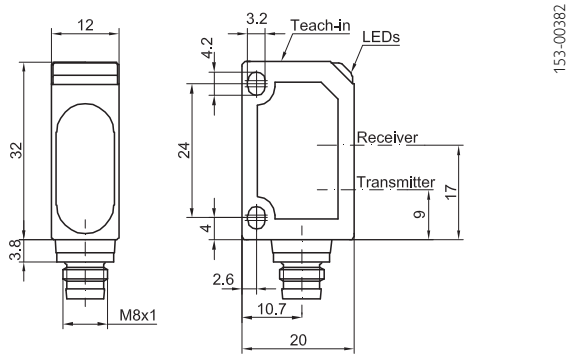
Mechanical data	
Dimensions	32 x 20 x 12 mm[3]
Enclosure rating	IP 67[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (metal plug device)	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: grey, 18 % reflectivity [2] At scanning distance of 60 mm [3] Only 4-pin design [4] With connected IP 67 plug

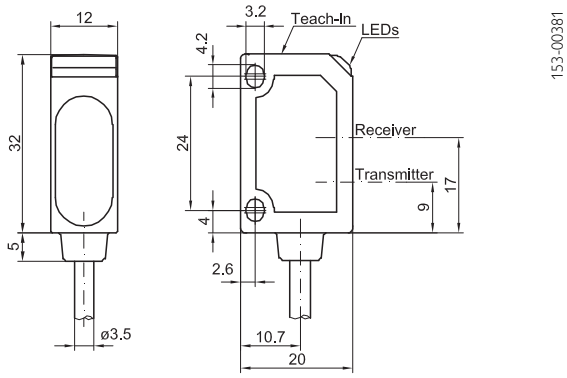
Scanning distance	Switching output	Type of connection	Part number	Article number
25 … 100 mm	PNP	Metal plug, M8x1, 3-pin	FT 20 RH-PSM3	551-11004
25 … 100 mm	NPN	Metal plug, M8x1, 3-pin	FT 20 RH-NSM3	551-11005
25 … 100 mm	PNP	Metal plug, M8x1, 4-pin	FT 20 RH-PSM4	551-11000
25 … 100 mm	NPN	Metal plug, M8x1, 4-pin	FT 20 RH-NSM4	551-11002
25 … 100 mm	PNP	Cable, 2 m, 4-wire	FT 20 RH-PSK4	551-11001
25 … 100 mm	NPN	Cable, 2 m, 4-wire	FT 20 RH-NSK4	551-11003
25 … 100 mm	PNP	Pigtail, 200 mm with plug, M8, 4-pin	FT 20 RH-PS-KM4	551-11006

Version: 02/2015. Subject to changes; diagrams similar

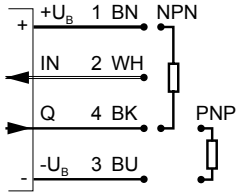
Plug connection



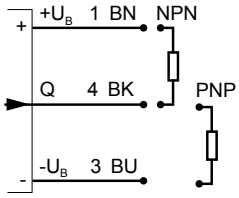
Cable connection



Connection, 4-pin



Connection, 3-pin



Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

FT 20 IH

Infrared photoelectric proximity sensor with background suppression

PRODUCT HIGHLIGHTS

- Precise background suppression
- Sensor adjustment via teach-in and control input
- Stable metal plug connection
- Compact miniature housing

Optical data	
Scanning distance	30 … 150 mm[1]
Type of light	LED, infrared, 880 nm

Functions	
Indicator LED, green	Operating voltage indicator / contamination indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Scanning distance adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running operation 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. scanning distance and N.O.

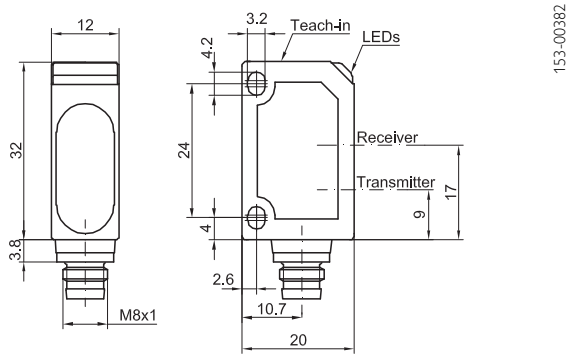
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Control input, IN[2]	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions	32 x 20 x 12 mm[3]
Enclosure rating	IP 67[3]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (metal plug device)	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: grey, 18 % reflectivity [2] Only 4-pin design [3] With connected IP 67 plug

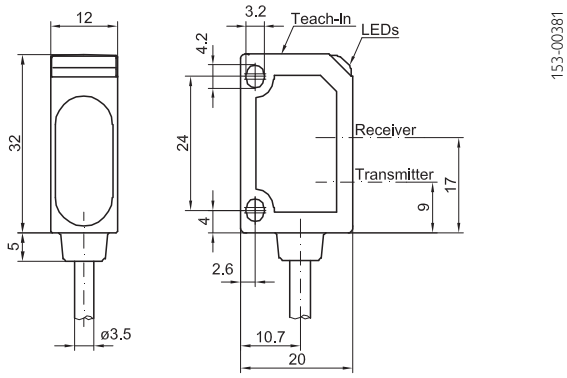
Scanning distance	Switching output	Type of connection	Part number	Article number
30 … 150 mm	PNP	Metal plug, M8x1, 3-pin	FT 20 IH-PSM3	551-11021
30 … 150 mm	PNP	Metal plug, M8x1, 4-pin	FT 20 IH-PSM4	551-11010
30 … 150 mm	NPN	Metal plug, M8x1, 4-pin	FT 20 IH-NSM4	551-11012
30 … 150 mm	PNP	Cable, 2 m, 4-wire	FT 20 IH-PSK4	551-11011
30 … 150 mm	NPN	Cable, 2 m, 4-wire	FT 20 IH-NSK4	551-11013

Plug connection



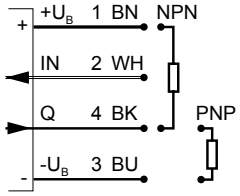
153-00382

Cable connection



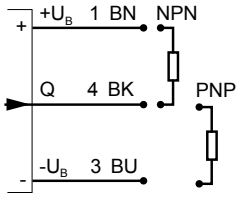
153-00381

Connection, 4-pin



154-00312

Connection, 3-pin



154-00311

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

FT 23 RF

Photoelectric proximity sensor with background suppression, fixed focus

PRODUCT HIGHLIGHTS

- Economical solution for numerous applications
- Tamper-proof sensor design
- Simple alignment thanks to easily visible light spot
- Large range of variants

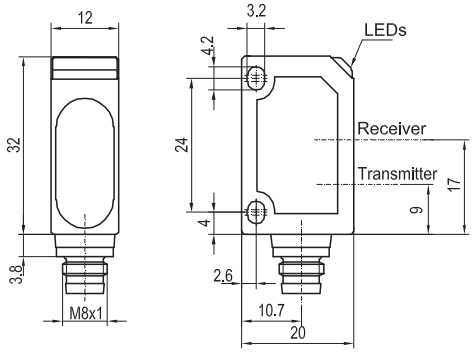
Optical data		Functions	
Scanning distance	60 mm[1] / 80 mm[1]	Indicator LED, green	Operating voltage indicator / contamination indicator
Type of light	LED, red, 660 nm	Indicator LED, yellow	Switching output indicator / contamination indicator
Light spot size[2]	5 x 5 mm[2]	Adjustment possibilities	N.O./N.C. via control input

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC	Dimensions	32 x 20 x 12 mm[3]
No-load current, I_0	≤ 25 mA	Enclosure rating	IP 67[3]
Output current, Ie	≤ 100 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U_B / 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 (metal plug device)	10 g
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Weight (cable device)	40 g
Response time	500 µs	Vibration and impact resistance	EN 60947-5-2
Control input, IN	$+U_B$ = N.C. $-U_B$ / Open = N.O.		

[1] Reference material: white, 90 % reflectivity [2] At scanning distance of 60 mm [3] With connected IP 67 plug

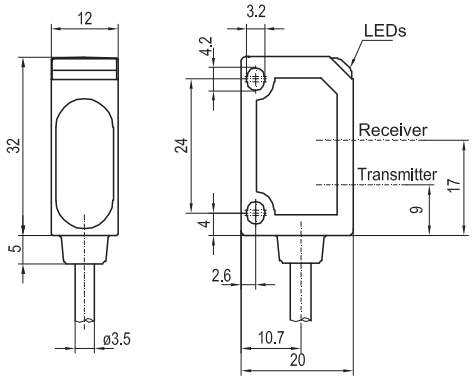
Scanning distance	Switching output	Type of connection	Part number	Article number
60 mm	PNP	Metal plug, M8x1, 4-pin	FT 23 RF-PSM4	551-21012
60 mm	NPN	Metal plug, M8x1, 4-pin	FT 23 RF-NSM4	551-21018
60 mm	PNP	Cable, 2 m, 4-wire	FT 23 RF-PSK4	551-21017
60 mm	NPN	Cable, 2 m, 4-wire	FT 23 RF-NSK4	551-21019
80 mm	PNP	Metal plug, M8x1, 4-pin	FT 23 RF-PSM4-X03	551-21024

Plug connection



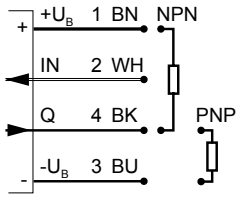
153-00380

Cable connection



153-00379

Connection, 4-pin



154-00312

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

FT 20 RL

Diffuse laser photoelectric proximity sensor

PRODUCT HIGHLIGHTS

- High switching frequency of 4000 Hz
- Very small, easily visible laser light spot
- Sensor adjustment via teach-in and control input
- Compact miniature housing

Optical data	
Scanning distance	40 … 150 mm[1]
Type of light	Laser, red, 650 nm
Light spot size	See table
Laser Class (DIN EN 60825-1:2008-5)	2

Functions	
Indicator LED, green	Operating voltage indicator / contamination indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running operation 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. scanning distance and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 100 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)	≤ 4000 Hz
Response time	125 µs
Control input, IN[2]	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

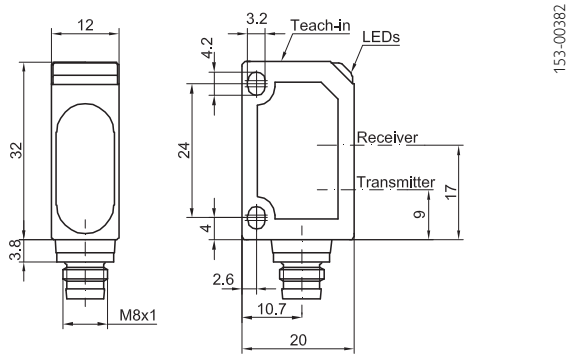
Mechanical data	
Dimensions	32 x 20 x 12 mm[3]
Enclosure rating	IP 67[3]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (metal plug device)	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: white, 90 % reflectivity [2] Only 4-pin design [3] With connected IP 67 plug

Scanning distance	Switching output	Type of connection	Part number	Article number
40 … 150 mm	PNP	Metal plug, M8x1, 3-pin	FT 20 RL-PSM3	551-21022
40 … 150 mm	PNP	Metal plug, M8x1, 4-pin	FT 20 RL-PSM4	551-21007
40 … 150 mm	NPN	Metal plug, M8x1, 4-pin	FT 20 RL-NSM4	551-21009
40 … 150 mm	PNP	Cable, 2 m, 4-wire	FT 20 RL-PSK4	551-21008
40 … 150 mm	NPN	Cable, 2 m, 4-wire	FT 20 RL-NSK4	551-21010

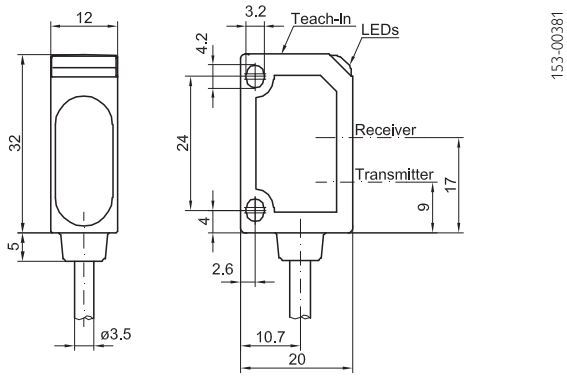
Version: 02/2015. Subject to changes; diagrams similar

Plug connection



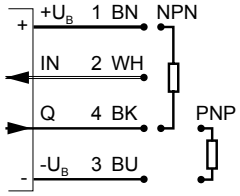
153-00382

Cable connection



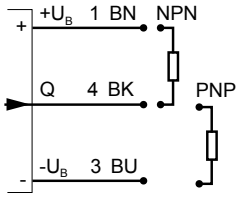
153-00381

Connection, 4-pin



154-00312

Connection, 3-pin



154-00311

8

Light spot size

Scanning distance (mm)	40	80	120	150
Light spot diameter (mm)	2	0.4	1.5	3

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

FT 20 R

Diffuse photoelectric proximity sensor

PRODUCT HIGHLIGHTS

- Sensor adjustment via teach-in and control input
- Simple alignment thanks to easily visible light spot
- Compact miniature housing
- Large range of variants

Optical data	
Scanning distance	20 … 300 mm[1]
Type of light	LED, red, 660 nm
Light spot size[2]	12 x 12 mm[2]

Functions	
Indicator LED, green	Operating voltage indicator / contamination indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running operation 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. scanning distance and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 100 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

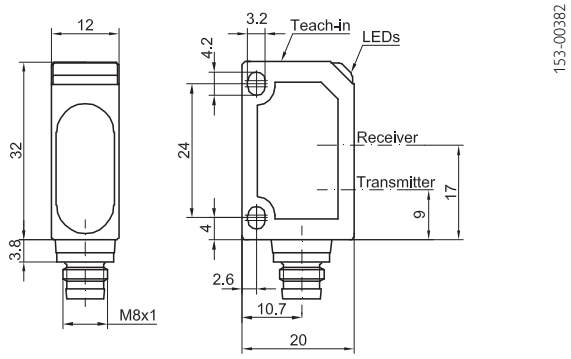
Mechanical data	
Dimensions	32 x 20 x 12 mm[3]
Enclosure rating	IP 67[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (metal plug device)	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: white, 90 % reflectivity [2] At scanning distance of 160 mm [3] Only 4-pin design [4] With connected IP 67 plug

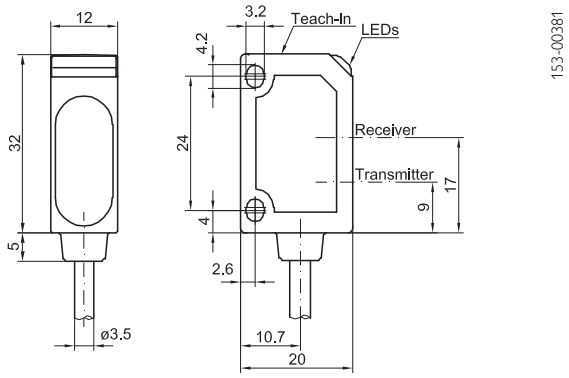
Scanning distance	Switching output	Type of connection	Part number	Article number
20 … 300 mm	PNP	Metal plug, M8x1, 3-pin	FT 20 R-PSM3	551-21004
20 … 300 mm	NPN	Metal plug, M8x1, 3-pin	FT 20 R-NSM3	551-21005
20 … 300 mm	PNP	Metal plug, M8x1, 4-pin	FT 20 R-PSM4	551-21000
20 … 300 mm	NPN	Metal plug, M8x1, 4-pin	FT 20 R-NSM4	551-21002
20 … 300 mm	PNP	Cable, 2 m, 4-wire	FT 20 R-PSK4	551-21001
20 … 300 mm	NPN	Cable, 2 m, 4-wire	FT 20 R-NSK4	551-21003

Version: 02/2015. Subject to changes; diagrams similar

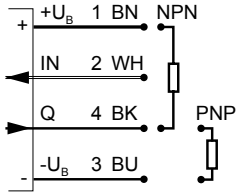
Plug connection



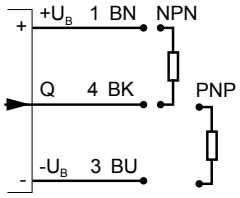
Cable connection



Connection, 4-pin



Connection, 3-pin



Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

FT 23 R

Diffuse photoelectric proximity sensor, fixed setting

PRODUCT HIGHLIGHTS

- Economical solution for numerous applications
- Tamper-proof sensor design
- Simple alignment thanks to easily visible light spot
- Compact miniature housing

Optical data	
Scanning distance	20 … 300 mm[1]
Type of light	LED, red, 660 nm
Light spot size[2]	12 x 12 mm[2]

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

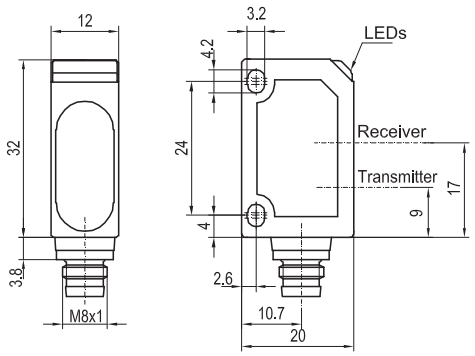
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Control input, IN	$+U_B$ = N.C. $-U_B$ / Open = N.O.

Mechanical data	
Dimensions	32 x 20 x 12 mm[3]
Enclosure rating	IP 67[3]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (metal plug device)	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: white, 90 % reflectivity [2] At scanning distance of 160 mm [3] With connected IP 67 plug

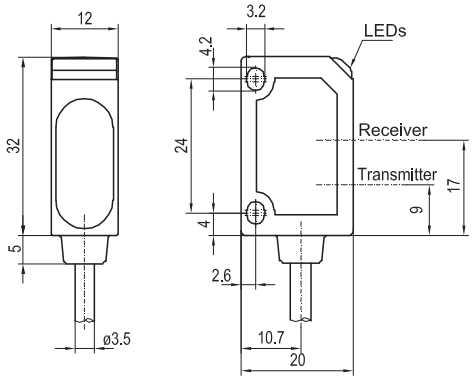
Scanning distance	Switching output	Type of connection	Part number	Article number
20 … 300 mm	PNP	Metal plug, M8x1, 4-pin	FT 23 R-PSM4	551-21011
20 … 300 mm	NPN	Metal plug, M8x1, 4-pin	FT 23 R-NSM4	551-21015
20 … 300 mm	PNP	Cable, 2 m, 4-wire	FT 23 R-PSK4	551-21014
20 … 300 mm	NPN	Cable, 2 m, 4-wire	FT 23 R-NSK4	551-21016

Plug connection



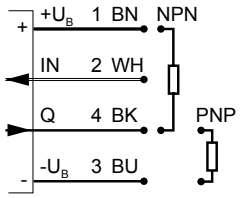
153-00380

Cable connection



153-00379

Connection, 4-pin



154-00312

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

FR 20 RG1

Retroreflective photoelectric sensor for detecting transparent objects, autocollimation

PRODUCT HIGHLIGHTS

- Autocollimation principle for reliable detection of transparent objects of any shape
- Particularly suitable for detecting bottles, ampoules, blisters and transparent foils
- Minimal blind zone thanks to autocollimation
- Temperature compensation for reliable switching over the entire temperature range

Optical data	
Operating range	5 … 500 mm[1]
Type of light	LED, red, 660 nm
Light spot size[2]	20 x 20 mm[2]

Functions	
Indicator LED, green	Operating voltage indicator / contamination indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running operation 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
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 100 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	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

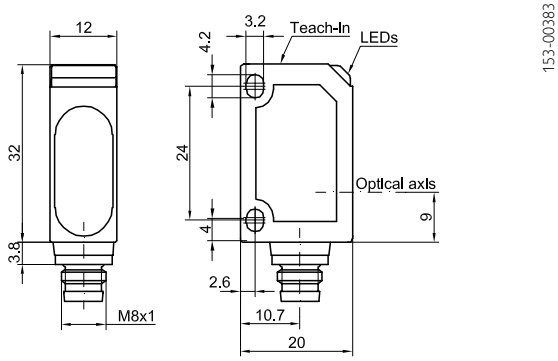
Mechanical data	
Dimensions	32 x 20 x 12 mm[3]
Enclosure rating	IP 67[3]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (metal plug device)	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: R5/L reflector [2] At range of 500 mm [3] With connected IP 67 plug

Operating range	Switching output	Type of connection	Part number	Article number
5 … 500 mm	PNP	Metal plug, M8x1, 4-pin	FR 20 RG1-PSM4	553-51006
5 … 500 mm	NPN	Metal plug, M8x1, 4-pin	FR 20 RG1-NSM4	553-51008
5 … 500 mm	PNP	Cable, 2 m, 4-wire	FR 20 RG1-PSK4	553-51007
5 … 500 mm	NPN	Cable, 2 m, 4-wire	FR 20 RG1-NSK4	553-51009

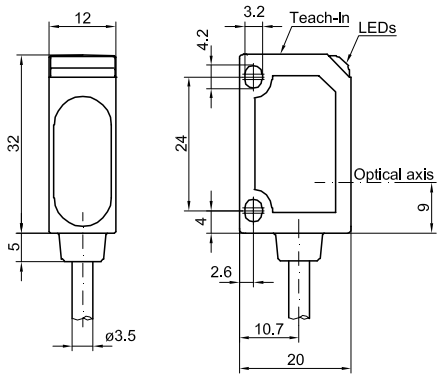
Version: 02/2015. Subject to changes; diagrams similar

Plug connection



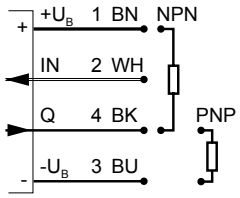
153-00383

Cable connection



153-00384

Connection, 4-pin



154-00312

Accessories

Reflectors	From Page A-18
Connection cables	From Page A-34
Brackets	From Page A-4

8

FR 20 RG

Retroreflective photoelectric sensor for detecting transparent objects

PRODUCT HIGHLIGHTS

- Particularly suitable for bottle detection
- Low switching hysteresis for the detection of transparent objects
- Sensor adjustment via teach-in and control input
- Stable metal plug connection
- Large range of variants

Optical data	
Limit range	700 mm[1]
Operating range	50 … 500 mm[1]
Type of light	LED, red, 660 nm
Light spot size[2]	20 x 20 mm[2]

Functions	
Indicator LED, green	Operating voltage indicator / contamination indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running operation 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
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 100 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

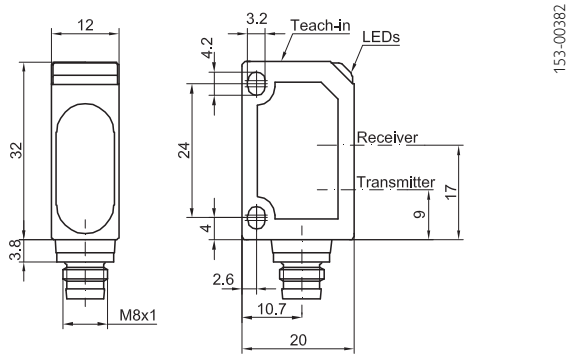
Mechanical data	
Dimensions	32 x 20 x 12 mm[3]
Enclosure rating	IP 67[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (metal plug device)	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: R5 reflector [2] At range of 500 mm [3] Only 4-pin design [4] With connected IP 67 plug

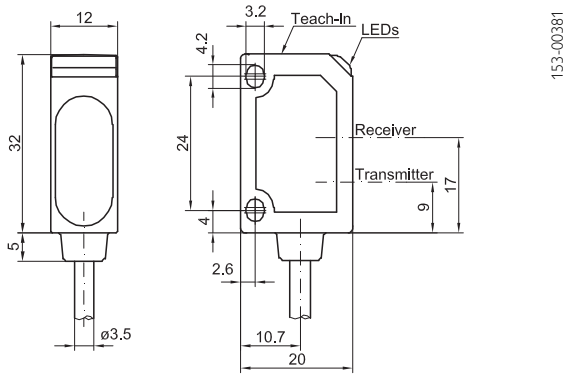
Operating range	Switching output	Type of connection	Part number	Article number
50 … 500 mm	PNP	Metal plug, M8x1, 3-pin	FR 20 RG-PSM3	553-51004
50 … 500 mm	NPN	Metal plug, M8x1, 3-pin	FR 20 RG-NSM3	553-51005
50 … 500 mm	PNP	Metal plug, M8x1, 4-pin	FR 20 RG-PSM4	553-51000
50 … 500 mm	NPN	Metal plug, M8x1, 4-pin	FR 20 RG-NSM4	553-51002
50 … 500 mm	PNP	Cable, 2 m, 4-wire	FR 20 RG-PSK4	553-51001
50 … 500 mm	NPN	Cable, 2 m, 4-wire	FR 20 RG-NSK4	553-51003

Version: 02/2015. Subject to changes; diagrams similar

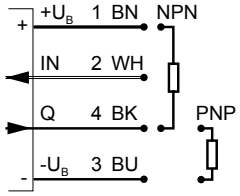
Plug connection



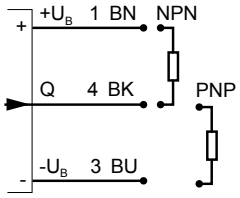
Cable connection



Connection, 4-pin



Connection, 3-pin



Accessories

Reflectors	From Page A-18
Connection cables	From Page A-34
Brackets	From Page A-4

8

FR 20 RLO

Laser retroreflective photoelectric sensor, autocollimation

PRODUCT HIGHLIGHTS

- Most accurate small-part detection of tenphs of a mm
- Autocollimation – transmitter and receiver on a single axis
- Suitable for numerous, highly varied, reflectors and reflective tapes
- Highly accurate even at long ranges of up to 4 m

Optical data	
Operating range	0 … 4 m[1]
Type of light	Laser, red, 650 nm
Laser Class (DIN EN 60825-1:2008-5)	1
Light spot size[2]	Ø 2 mm

Functions	
Indicator LED, green	Operating voltage indicator / contamination indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running operation 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.

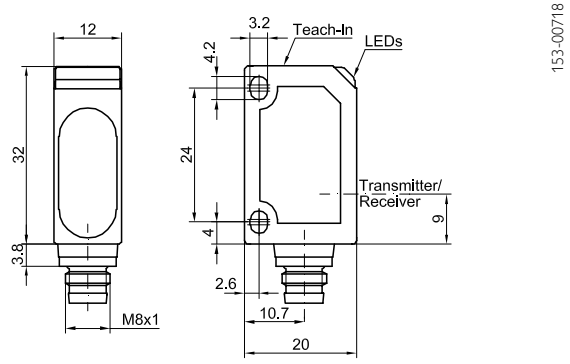
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 4000 Hz
Response time	125 µs
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions	32 x 20 x 12 mm[3]
Enclosure rating	IP 67[3]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (metal plug device)	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

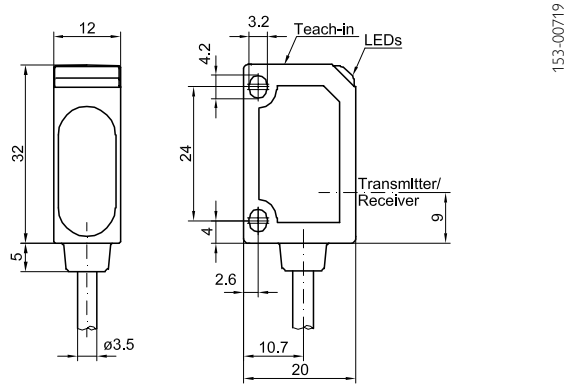
[1] Reference material: R5/L reflector [2] At range of 2.5 m [3] With connected IP 67 plug

Operating range	Switching output	Type of connection	Part number	Article number
0 … 4 m	PNP	Metal plug, M8x1, 4-pin	FR 20 RLO-PSM4	555-31005
0 … 4 m	NPN	Metal plug, M8x1, 4-pin	FR 20 RLO-NSM4	555-31006
0 … 4 m	PNP	Cable, 2 m, 4-wire	FR 20 RLO-PSK4	555-31007
0 … 4 m	NPN	Cable, 2 m, 4-wire	FR 20 RLO-NSK4	555-31008

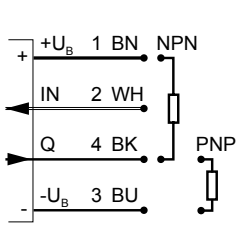
Plug connection



Cable connection



Connection, 4-pin



Small part detection

Smallest detectable part[5]	≥ 1 mm	≥ 0.2 mm	≥ 0.2 mm	≥ 1 mm
Within operating range	0 … 4000 mm	50 … 500 mm	0 … 500 mm	50 … 2500 mm
Reference material	R5/L reflector (51 x 61 mm)	RD-25 KL reflector (Ø 25.2 mm)	RF-50 KL reflective tape (51 x 51 mm)	RF-100 KL reflective tape (230 x 230 mm)
Reflector distance	1000 … 4000 mm	50 … 500 mm	100 … 500 mm	500 … 2500 mm

[5] Switching accuracy ≤ 2 mm at operating distance < 50 mm and objects < 0.5 mm

Accessories

Reflectors	From Page A-18
Connection cables	From Page A-34
Brackets	From Page A-4

FR 20 RL

Laser retroreflective photoelectric sensor

PRODUCT HIGHLIGHTS

- Detection of the smallest of parts
- Suitable for numerous, highly varied, reflectors and reflective tapes
- Very small, easily visible laser light spot
- Laser Protection Class 1

Optical data	
Operating range	0.07 … 3 m[1]
Type of light	Laser, red, 650 nm
Laser Class (DIN EN 60825-1:2008-5)	1
Light spot size[2]	< 1 mm

Functions	
Indicator LED, green	Operating voltage indicator / contamination indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running operation 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
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 100 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)	≤ 4000 Hz
Response time	125 µs
Control input, IN[3]	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

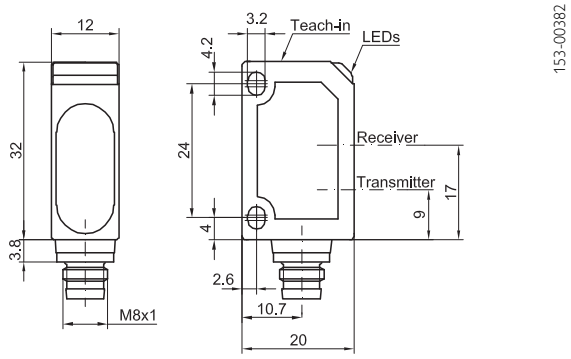
Mechanical data	
Dimensions	32 x 20 x 12 mm[3]
Enclosure rating	IP 67[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (metal plug device)	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: R5/L reflector [2] At range of 300 mm [3] Only 4-pin design [4] With connected IP 67 plug

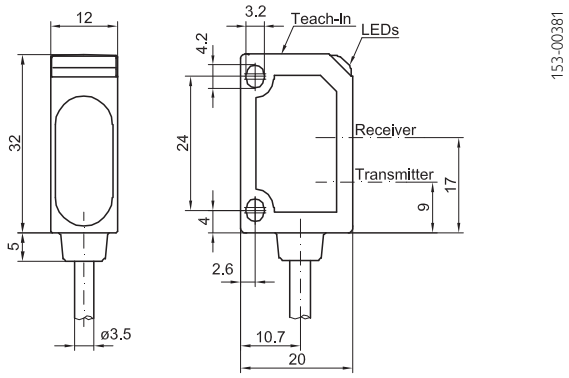
Operating range	Switching output	Type of connection	Part number	Article number
0.07 … 3 m	PNP	Metal plug, M8x1, 3-pin	FR 20 RL-PSM3	555-31004
0.07 … 3 m	PNP	Metal plug, M8x1, 4-pin	FR 20 RL-PSM4	555-31000
0.07 … 3 m	NPN	Metal plug, M8x1, 4-pin	FR 20 RL-NSM4	555-31002
0.07 … 3 m	PNP	Cable, 2 m, 4-wire	FR 20 RL-PSK4	555-31001
0.07 … 3 m	NPN	Cable, 2 m, 4-wire	FR 20 RL-NSK4	555-31003

Version: 02/2015. Subject to changes; diagrams similar

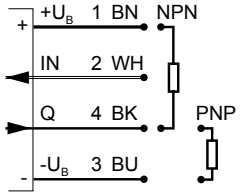
Plug connection



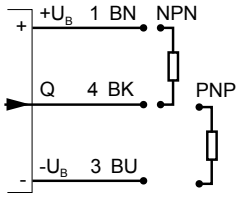
Cable connection



Connection, 4-pin



Connection, 3-pin



Accessories

Reflectors	From Page A-18
Connection cables	From Page A-34
Brackets	From Page A-4

8

FR 20 R

Retroreflective photoelectric sensor

PRODUCT HIGHLIGHTS

- Simple alignment thanks to easily visible light spot
- Sensor adjustment via teach-in and control input
- Suitable for numerous, highly varied, reflectors and reflective tapes
- Compact miniature housing

Optical data	
Limit range	3 m[1]
Operating range	0.05 … 2.5 m[1]
Type of light	LED, red, 660 nm
Light spot size[2]	75 x 75 mm[2]

Functions	
Indicator LED, green	Operating voltage indicator / contamination indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running operation 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
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 100 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

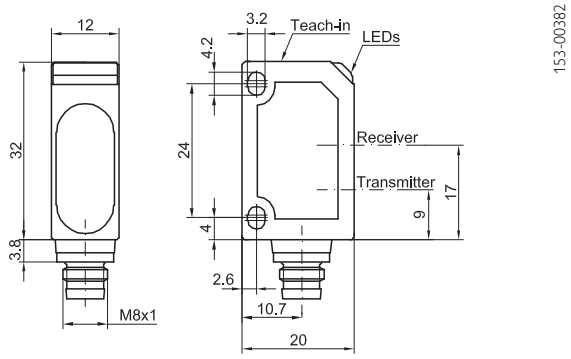
Mechanical data	
Dimensions	32 x 20 x 12 mm[3]
Enclosure rating	IP 67[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (metal plug device)	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: R5 reflector [2] At range of 1.5 m [3] Only 4-pin design [4] With connected IP 67 plug

Operating range	Switching output	Type of connection	Part number	Article number
0.05 … 2.5 m	PNP	Metal plug, M8x1, 3-pin	FR 20 R-PSM3	553-11009
0.05 … 2.5 m	NPN	Metal plug, M8x1, 3-pin	FR 20 R-NSM3	553-11010
0.05 … 2.5 m	PNP	Metal plug, M8x1, 4-pin	FR 20 R-PSM4	553-11000
0.05 … 2.5 m	NPN	Metal plug, M8x1, 4-pin	FR 20 R-NSM4	553-11002
0.05 … 2.5 m	PNP	Cable, 2 m, 4-wire	FR 20 R-PSK4	553-11001
0.05 … 2.5 m	NPN	Cable, 2 m, 4-wire	FR 20 R-NSK4	553-11003

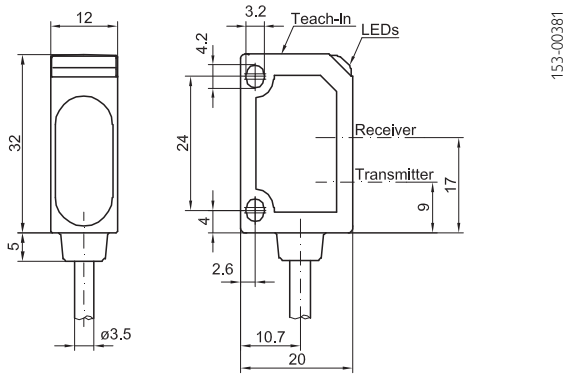
Version: 02/2015. Subject to changes; diagrams similar

Plug connection



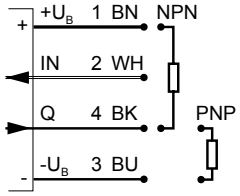
153-00382

Cable connection



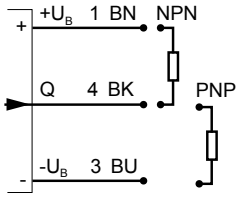
153-00381

Connection, 4-pin



154-00312

Connection, 3-pin



154-00311

8

Accessories

Reflectors	From Page A-18
Connection cables	From Page A-34
Brackets	From Page A-4

FR 20 RD

Retroreflective photoelectric sensor

PRODUCT HIGHLIGHTS

- Simple alignment thanks to easily visible light spot
- Sensor adjustment via teach-in and control input
- Suitable for numerous, highly varied, reflectors and reflective tapes
- Compact miniature housing

Optical data	
Limit range	4 m[1]
Operating range	0.05 … 3.5 m[1]
Type of light	LED, red, 660 nm
Light spot size[2]	75 x 75 mm[2]

Functions	
Indicator LED, green	Operating voltage indicator / contamination indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running operation 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.

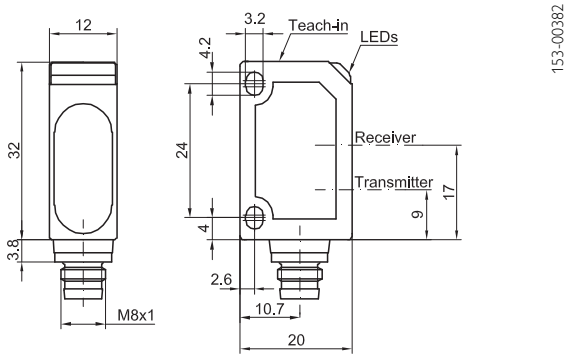
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions	32 x 20 x 12 mm[3]
Enclosure rating	IP 67[3]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (metal plug device)	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: RD8 reflector [2] At range of 1.5 m [3] With connected IP 67 plug

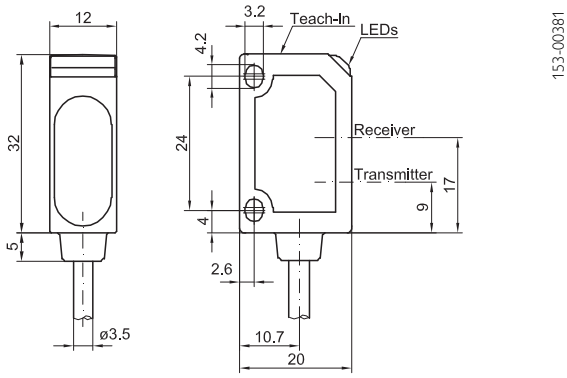
Operating range	Switching output	Type of connection	Part number	Article number
0.05 … 3.5 m	PNP	Metal plug, M8x1, 4-pin	FR 20 RD-PSM4	553-11004
0.05 … 3.5 m	NPN	Metal plug, M8x1, 4-pin	FR 20 RD-NSM4	553-11006
0.05 … 3.5 m	PNP	Cable, 2 m, 4-wire	FR 20 RD-PSK4	553-11005
0.05 … 3.5 m	NPN	Cable, 2 m, 4-wire	FR 20 RD-NSK4	553-11007

Plug connection



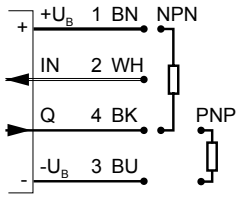
153-00382

Cable connection



153-00381

Connection, 4-pin



154-00312

Accessories

Reflectors	From Page A-18
Connection cables	From Page A-34
Brackets	From Page A-4

8

FR 23 R

Retroreflective photoelectric sensor, fixed setting

PRODUCT HIGHLIGHTS

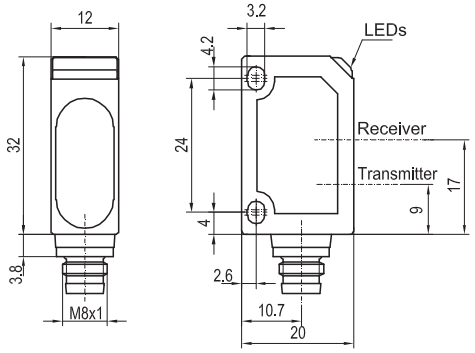
- Economical solution for numerous applications
- Tamper-proof sensor design
- Simple alignment thanks to easily visible light spot
- Compact miniature housing

Optical data		Functions	
Limit range	3 m[1]	Indicator LED, green	Operating voltage indicator / contamination indicator
Operating range	0.05 … 2.5 m[1]	Indicator LED, yellow	Switching output indicator / contamination indicator
Type of light	LED, red, 660 nm	Adjustment possibilities	N.O./N.C. via control input
Light spot size[2]	75 x 75 mm[2]		
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC	Dimensions	32 x 20 x 12 mm[3]
No-load current, I_0	≤ 25 mA	Enclosure rating	IP 67[3]
Output current, Ie	≤ 100 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U_B / 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 (metal plug device)	10 g
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Weight (cable device)	40 g
Response time	500 µs	Vibration and impact resistance	EN 60947-5-2
Control input, IN	$+U_B$ = N.C. $-U_B$ / Open = N.O.		

[1] Reference material: R5 reflector [2] At range of 1.5 m [3] With connected IP 67 plug

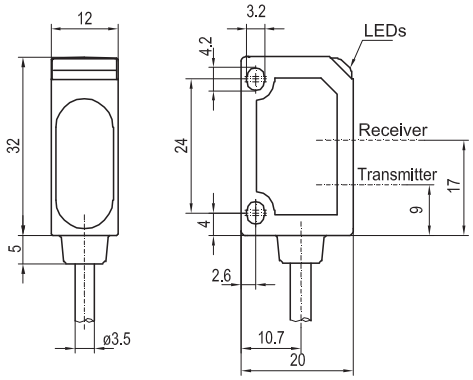
Operating range	Switching output	Type of connection	Part number	Article number
0.05 … 2.5 m	PNP	Metal plug, M8x1, 4-pin	FR 23 R-PSM4	553-11012
0.05 … 2.5 m	NPN	Metal plug, M8x1, 4-pin	FR 23 R-NSM4	553-11014
0.05 … 2.5 m	PNP	Cable, 2 m, 4-wire	FR 23 R-PSK4	553-11013
0.05 … 2.5 m	NPN	Cable, 2 m, 4-wire	FR 23 R-NSK4	553-11015

Plug connection



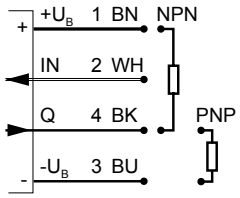
153-00380

Cable connection



153-00379

Connection, 4-pin



154-00312

Accessories

Reflectors	From Page A-18
Connection cables	From Page A-34
Brackets	From Page A-4

8

FS/FE 20 R

Through-beam photoelectric sensor

PRODUCT HIGHLIGHTS

- Sensor adjustment via teach-in and control input
- Simple alignment thanks to easily visible light spot
- Compact miniature housing
- Large range of variants

Optical data	
Limit range	0 … 8.5 m
Operating range	0 … 8 m
Type of light	LED, red, 660 nm

Functions	
Indicator LED, green	Operating voltage indicator / contamination indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Sensitivity adjustment (receiver)	Via Teach-in button and control input
Teach-in modes	Mode 1: during running operation 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.

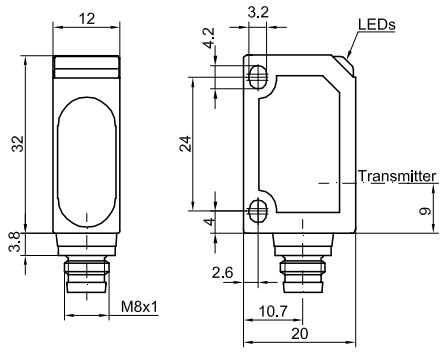
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 500 Hz
Response time	1 ms
Control input, IN (receiver)	+ U_B = teach-in function - U_B = Teach-in button locked Open = normal operation

Mechanical data	
Dimensions	32 x 20 x 12 mm³
Enclosure rating	IP 67[1]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (metal plug device)	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

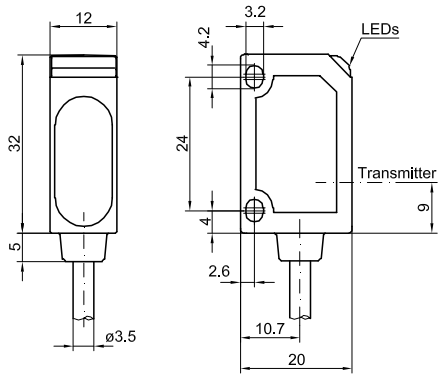
[1] With connected IP 67 plug

Operating range	Switching output	Type of connection	Part number	Article number
0 … 8 m	PNP	Metal plug, M8x1, 4-pin	FE 20 R-PSM4	552-21000
0 … 8 m	NPN	Metal plug, M8x1, 4-pin	FE 20 R-NSM4	552-21002
0 … 8 m	–	Metal plug, M8x1, 4-polig	FS 20 R-M4	552-11000
0 … 8 m	PNP	Cable, 2 m, 4-wire	FE 20 R-PSK4	552-21001
0 … 8 m	NPN	Cable, 2 m, 4-wire	FE 20 R-NSK4	552-21003
0 … 8 m	–	Cable, 2 m, 4-wire	FS 20 R-K4	552-11001

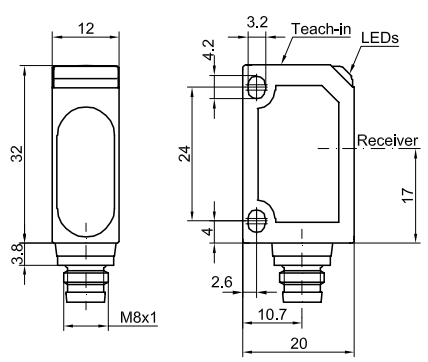
Plug connection (transmitter)



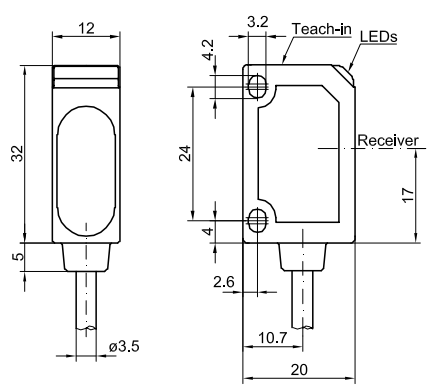
Cable connection (transmitter)



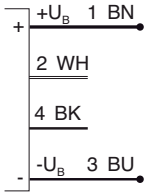
Plug connection (receiver)



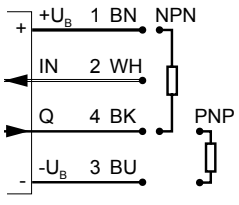
Cable connection (receiver)



Connection, transmitter, 4-pin



Connection, receiver, 4-pin



Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

FS/FE 23 R

Through-beam photoelectric sensor, fixed setting

PRODUCT HIGHLIGHTS

- Economical solution for numerous applications
- Tamper-proof sensor design
- Simple alignment thanks to easily visible light spot
- Compact miniature housing

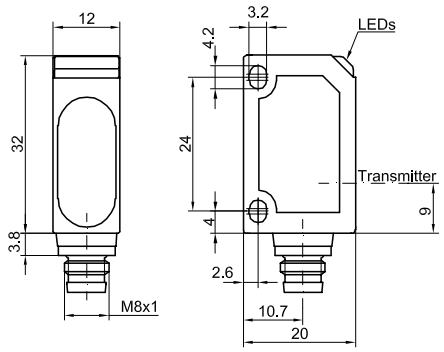
Optical data		Functions	
Limit range	0 … 4.5 m	Indicator LED, green	Operating voltage indicator / contamination indicator
Operating range	0 … 4 m	Indicator LED, yellow	Switching output indicator / contamination indicator
Type of light	LED, red, 660 nm	Adjustment possibilities (receiver)	N.O./N.C. via control input
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC	Dimensions	32 x 20 x 12 mm³
No-load current, I_0	≤ 25 mA	Enclosure rating	IP 67[1]
Output current, Ie	≤ 100 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U_B / 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 (metal plug device)	10 g
Switching frequency, f (ti/tp 1:1)	≤ 500 Hz	Weight (cable device)	40 g
Response time	1 ms	Vibration and impact resistance	EN 60947-5-2
Control input, IN (receiver)	$+U_B$ = N.C. $-U_B$ / Open = N.O.		

[1] With connected IP 67 plug

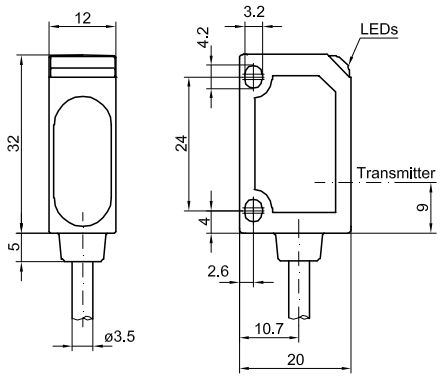
Operating range	Switching output	Type of connection	Part number	Article number
0 … 4 m	PNP	Metal plug, M8x1, 4-pin	FE 23 R-PSM4	552-11007
0 … 4 m	NPN	Metal plug, M8x1, 4-pin	FE 23 R-NSM4	552-11009
0 … 4 m	–	Metal plug, M8x1, 4-pin	FS 23 R-M4	552-11004
0 … 4 m	PNP	Cable, 2 m, 4-wire	FE 23 R-PSK4	552-11008
0 … 4 m	NPN	Cable, 2 m, 4-wire	FE 23 R-NSK4	552-11010
0 … 4 m	–	Cable, 2 m, 4-wire	FS 23 R-K4	552-11005

Version: 02/2015. Subject to changes; diagrams similar

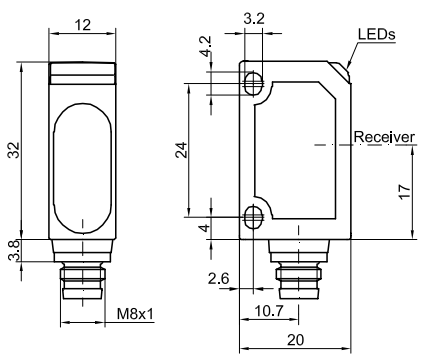
Plug connection (transmitter)



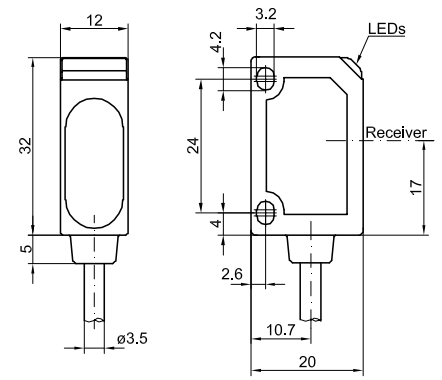
Cable connection (transmitter)



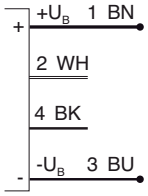
Plug connection (receiver)



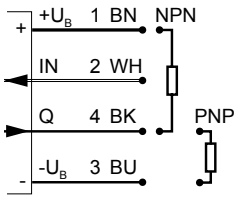
Cable connection (receiver)



Connection, transmitter, 4-pin



Connection, receiver, 4-pin

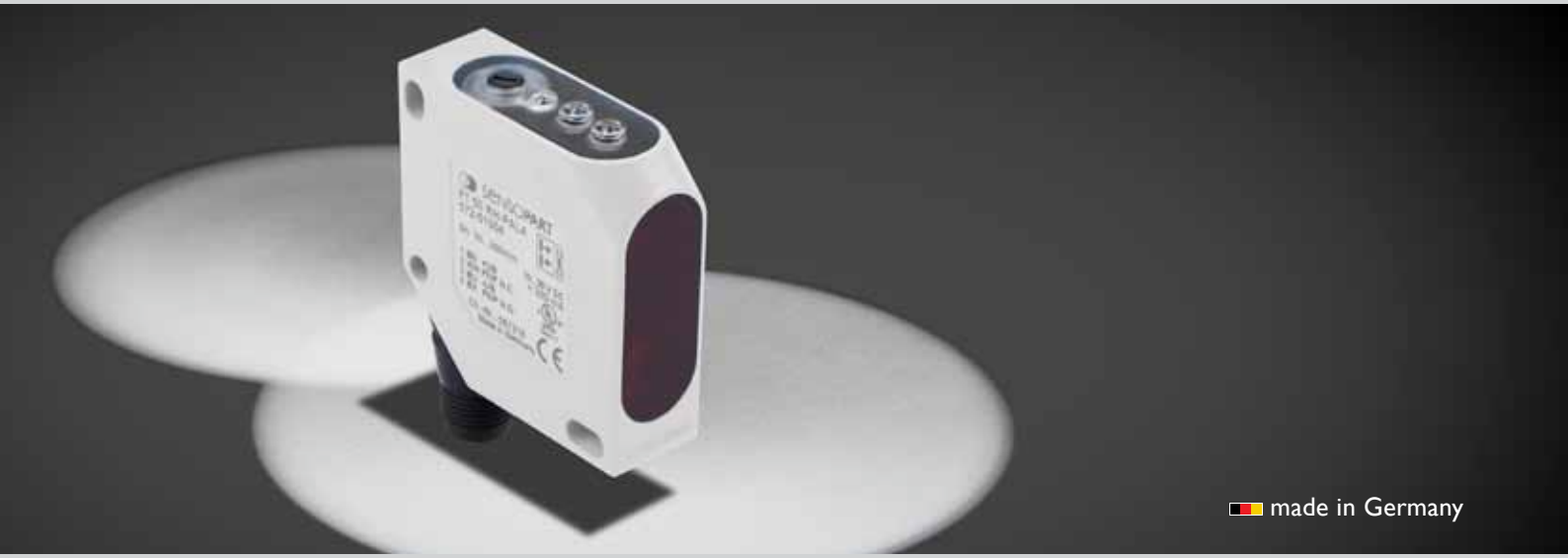


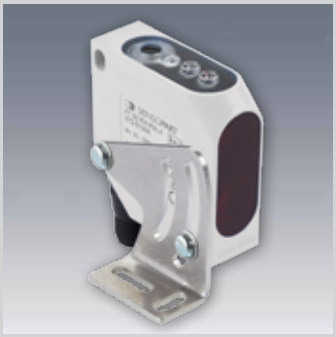
Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

F 50 – photoelectric sensors and proximity sensors in compact housings

The reliable standard series





Well thought-out mounting accessories: *SensoPart offers the right mounting aid for almost every mounting situation. This considerably simplifies sensor installation and adjustment. Designs with a supplementary protective function are also available.*

TYPICAL F 50

- Universal use in numerous automation applications
- Autocollimation variants with high precision and no blind zone
- Precise background suppression
- Laser, LED or infrared light transmitter options
- Simple adjustment via potentiometer, with numeric display
- Rotatable plug (270°)
- Well thought-out mounting accessories
- UL-certification

The photoelectric sensors and photoelectric proximity sensors of the F 50 series are virtually synonymous with versatile use and particularly reliable products. They have guaranteed user-satisfaction in a wide variety of sectors from the automotive industry, through mechanical engineering and wood processing, to the packaging and print industries.

The F 50 sensors' reliable detection (with laser-light, red-light or infrared LED options) and precise background suppression are impressive. Automation tasks such as (small) part detection, checking presence and positioning are their usual areas of use. SensoPart also offers product variants for special applications: for example, the FR 50-R / RL autocollimation photoelectric sensor that can detect objects from a range of 0 mm.

The sensors of the F 50 series, however, not only offer very reliable operation, but also make users' lives easy. Thus mounting is considerably simplified by the connection plug that can be rotated through 270° and the well thought-out mounting accessories, while adjustment and commissioning are also easy and user-friendly thanks to the direct numeric display. You simply cannot go wrong with an F 50 device!

F 50 – Product Overview					
	Type of light	Adjustment	Scanning distance / range	Special features	Page
Photoelectric proximity sensors with background suppression					
FT 50 RLH	Laser	Potentiometer	150 mm	Most accurate small-part detection	364
FT 50 RLHD	Laser	Potentiometer	300 mm	Most accurate small-part detection	366
FT 50 RH	LED	Potentiometer	300 mm		368
FT 50 IH	Infrared	Potentiometer	600 mm		370
Photoelectric proximity sensors					
FR 50 RL	Laser	Potentiometer	25 m	Autocollimation	372
FR 50 R	LED	Potentiometer	6 m	Autocollimation	374
Through-beam photoelectric sensor					
FS/FE 50 I	Infrared	Potentiometer	18 m		376

FT 50 RLH

Laser photoelectric proximity sensor with background suppression

PRODUCT HIGHLIGHTS

- Particularly suitable for detecting the smallest of objects
- Precisely adjustable background suppression
- Simple scanning distance adjustment thanks to indicator scale
- High switching frequency of 2500 Hz

Optical data	
Scanning distance	30 … 150 mm[1]
Type of light	Laser, red, 650 nm
Light spot size	See table
Laser Class (DIN EN 60825-1:2008-5)	2
Hysteresis[2]	< 5 %

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Indicator LED, red	Contamination indicator
Scanning distance adjustment	Via potentiometer

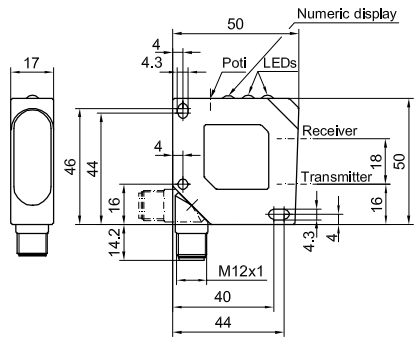
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[3]
No-load current, I_0	≤ 50 mA[4]
Output current, Ie	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN, antivalent (see Selection Table)
Output function	N.O./N.C. (see Selection Table)
Switching frequency, f (ti/tp 1:1)	≤ 2500 Hz
Response time	200 µs
Connection, BK	N.O.
Connection, WH[5]	N.C.
Contamination output, WH (optional)	N.O. (see Selection Table)

Mechanical data	
Dimensions	50 x 50 x 17 mm[3]
Enclosure rating	IP 67[6]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +45 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	40 g
Weight (cable device)	130 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: grey, 18 % reflectivity [2] 18 % / 18 % [3] Max. 10 % ripple, within U_B [4] At 24 V DC [5] Without contamination output [6] With connected IP 67 plug

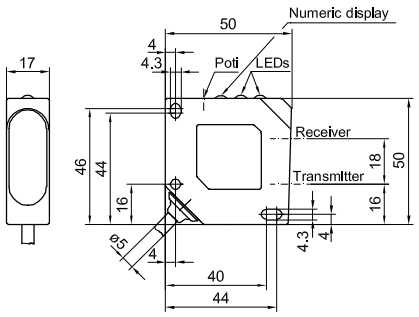
Scanning distance	Switching output	Type of connection	Contamination output	Part number	Article number
30 … 150 mm	PNP, antivalent	Plug, M12x1, 4-pin	No	FT 50 RLH-PAL4	572-51008
30 … 150 mm	NPN, antivalent	Plug, M12x1, 4-pin	No	FT 50 RLH-NAL4	572-51011
30 … 150 mm	PNP (N.O.)	Plug, M12x1, 4-pin	Yes	FT 50 RLH-PSVL4	572-51010
30 … 150 mm	NPN (N.O.)	Plug, M12x1, 4-pin	Yes	FT 50 RLH-NSVL4	572-51012
30 … 150 mm	PNP, antivalent	Cable, 3 m, 4-wire	No	FT 50 RLH-PAK4	572-51013
30 … 150 mm	NPN, antivalent	Cable, 3 m, 4-wire	No	FT 50 RLH-NAK4	572-51015
30 … 150 mm	PNP (N.O.)	Cable, 3 m, 4-wire	Yes	FT 50 RLH-PSVK4	572-51014
30 … 150 mm	NPN (N.O.)	Cable, 3 m, 4-wire	Yes	FT 50 RLH-NSVK4	572-51016

Plug connection



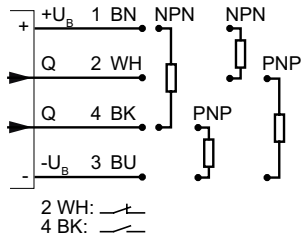
153-00061

Cable connection



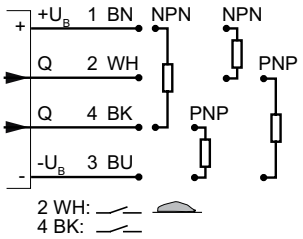
153-00060

Connection, 4-pin



154-00517

Connection, 4-pin with contamination output



154-00525

Light spot size

Scanning distance (mm)	30	60	80	100	150
Light spot diameter (mm)	1.8	0.7	0.1	1.1	2.5

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

FT 50 RLHD

Laser photoelectric proximity sensor with background suppression

PRODUCT HIGHLIGHTS

- Precise small part detection even at long scanning distances of up to 300 mm
- Very small, easily visible laser light spot
- Precisely adjustable background suppression
- High switching frequency of 2500 Hz

Optical data	
Scanning distance	50 … 300 mm[1]
Type of light	Laser, red, 650 nm
Light spot size	See table
Laser Class (DIN EN 60825-1:2008-5)	2
Hysteresis[2]	< 5 %

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Indicator LED, red	Contamination indicator
Scanning distance adjustment	Via potentiometer

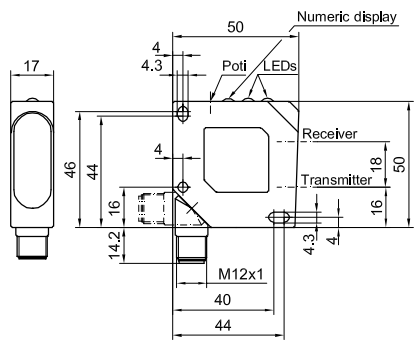
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[3]
No-load current, I_0	≤ 50 mA[4]
Output current, Ie	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN, antivalent (see Selection Table)
Output function	N.O./N.C. (see Selection Table)
Switching frequency, f (ti/tp 1:1)	≤ 2500 Hz
Response time	200 µs
Connection, BK	N.O.
Connection, WH[5]	N.C.
Contamination output, WH (optional)	N.O. (see Selection Table)

Mechanical data	
Dimensions	50 x 50 x 17 mm[3]
Enclosure rating	IP 67[6]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +45 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	40 g
Weight (cable device)	130 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: grey, 18 % reflectivity [2] 18 % / 18 % [3] Max. 10 % ripple, within U_B [4] At 24 V DC [5] Without contamination output [6] With connected IP 67 plug

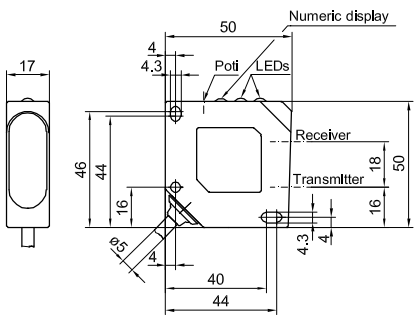
Scanning distance	Switching output	Type of connection	Contamination output	Part number	Article number
50 … 300 mm	PNP, antivalent	Plug, M12x1, 4-pin	No	FT 50 RLHD-PAL4	572-51062
50 … 300 mm	NPN, antivalent	Plug, M12x1, 4-pin	No	FT 50 RLHD-NAL4	572-51063
50 … 300 mm	PNP (N.O.)	Plug, M12x1, 4-pin	Yes	FT 50 RLHD-PSVL4	572-51051
50 … 300 mm	PNP, antivalent	Cable, 3 m, 4-wire	No	FT 50 RLHD-PAK4	572-51064
50 … 300 mm	NPN, antivalent	Cable, 3 m, 4-wire	No	FT 50 RLHD-NAK4	572-51065

Plug connection



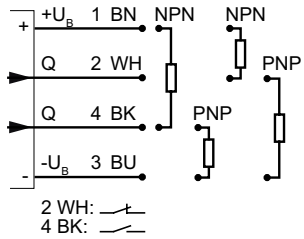
153-00061

Cable connection



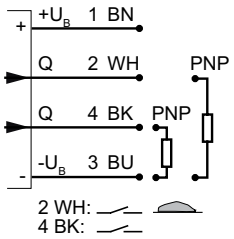
153-00060

Connection, 4-pin



154-00517

Connection, 4-pin with contamination output



154-00526

Light spot size

Scanning distance (mm)	50	80	100	150	180	200	250	300
Light spot diameter (mm)	5 x 1.75	4.8 x 1.75	4.5 x 1.5	4 x 1.5	3.8 x 1.5	3.8 x 1.2	3.2 x 1	3 x 1

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

FT 50 RH

Photoelectric proximity sensor with background suppression

PRODUCT HIGHLIGHTS

- Precisely adjustable background suppression
- Simple scanning distance adjustment thanks to indicator scale
- Optional contamination output
- Plug connector rotatable

Optical data	
Scanning distance	30 … 300 mm[1]
Type of light	LED, red, 660 nm
Light spot size[2]	8 x 8 mm[2]

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Indicator LED, red	Contamination indicator
Scanning distance adjustment	Via potentiometer

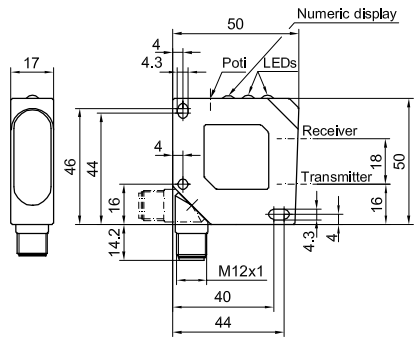
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[3]
No-load current, I_0	≤ 35 mA[4]
Output current, Ie	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN, antivalent (see Selection Table)
Output function	N.O./N.C. (see Selection Table)
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Connection, BK	N.O.
Connection, WH[5]	N.C.
Contamination output, WH (optional)	N.O. (see Selection Table)

Mechanical data	
Dimensions	50 x 50 x 17 mm[3]
Enclosure rating	IP 67[6]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	40 g
Weight (cable device)	130 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: grey, 18 % reflectivity [2] At scanning distance of 200 mm [3] Max. 10 % ripple, within U_B [4] At 24 V DC [5] Without contamination output
[6] With connected IP 67 plug

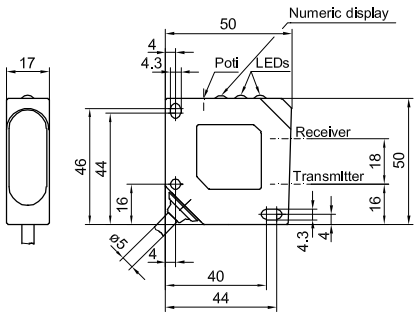
Scanning distance	Switching output	Type of connection	Contamination output	Part number	Article number
30 … 300 mm	PNP, antivalent	Plug, M12x1, 4-pin	No	FT 50 RH-PAL4	572-51004
30 … 300 mm	NPN, antivalent	Plug, M12x1, 4-pin	No	FT 50 RH-NAL4	572-51005
30 … 300 mm	PNP (N.O.)	Plug, M12x1, 4-pin	Yes	FT 50 RH-PSVL4	572-51006
30 … 300 mm	NPN (N.O.)	Plug, M12x1, 4-pin	Yes	FT 50 RH-NSVL4	572-51007
30 … 300 mm	PNP, antivalent	Cable, 3 m, 4-wire	No	FT 50 RH-PAK4	572-51000
30 … 300 mm	NPN, antivalent	Cable, 3 m, 4-wire	No	FT 50 RH-NAK4	572-51001
30 … 300 mm	PNP (N.O.)	Cable, 3 m, 4-wire	Yes	FT 50 RH-PSVK4	572-51002
30 … 300 mm	NPN (N.O.)	Cable, 3 m, 4-wire	Yes	FT 50 RH-NSVK4	572-51003

Plug connection



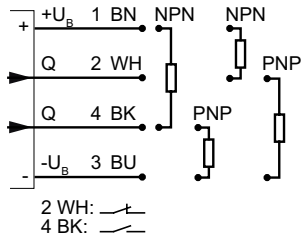
153-00061

Cable connection



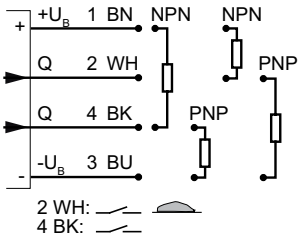
153-00060

Connection, 4-pin



154-00517

Connection, 4-pin with contamination output



154-00525

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

FT 50 IH

Infrared photoelectric proximity sensor with background suppression

PRODUCT HIGHLIGHTS

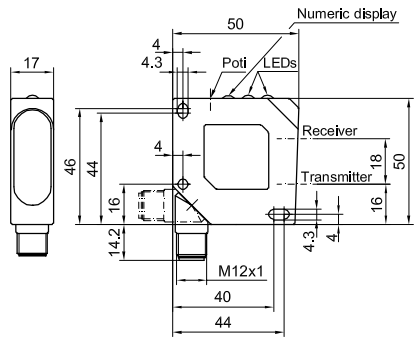
- Long scanning distance of 600 mm
- Precisely adjustable background suppression
- Simple scanning distance adjustment thanks to indicator scale
- Optional contamination output

Optical data		Functions	
Scanning distance	150 … 600 mm[1]	Indicator LED, green	Operating voltage indicator
Type of light	LED, infrared, 880 nm	Indicator LED, yellow	Switching output indicator
Light spot size[2]	20 x 20 mm[2]	Indicator LED, red	Contamination indicator
Hysteresis[3]	< 5 %	Scanning distance adjustment	Via potentiometer
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC[4]	Dimensions	50 x 50 x 17 mm[3]
No-load current, I_0	≤ 70 mA[5]	Enclosure rating	IP 67[7]
Output current, Ie	≤ 200 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-20 … +60 °C
Power On Delay	≤ 300 ms	Ambient temperature: storage	-20 … +80 °C
Switching output, Q	PNP/NPN, antivalent (see Selection Table)	Weight (plug device)	40 g
		Weight (cable device)	130 g
Output function	N.O./N.C. (see Selection Table)	Vibration and impact resistance	EN 60947-5-2
Switching frequency, f (ti/tp 1:1)	≤ 800 Hz		
Response time	625 µs		
Connection, BK	N.O.		
Connection, WH[6]	N.C.		
Contamination output, WH (optional)	N.O. (see Selection Table)		

[1] Reference material: grey, 18 % reflectivity [2] At scanning distance of 400 mm [3] 18 % / 18 % [4] Max. 10 % ripple, within U_B [5] At 24 V DC [6] Without contamination output
[7] With connected IP 67 plug

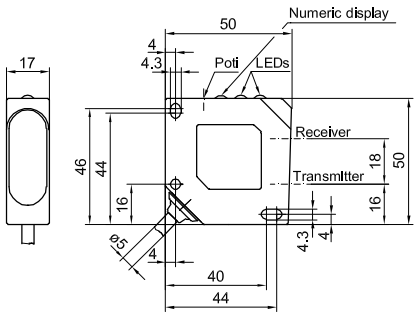
Scanning distance	Switching output	Type of connection	Contamination output	Part number	Article number
150 … 600 mm	PNP, antivalent	Plug, M12x1, 4-pin	No	FT 50 IH-PAL4	572-51029
150 … 600 mm	NPN, antivalent	Plug, M12x1, 4-pin	No	FT 50 IH-NAL4	572-51038
150 … 600 mm	PNP (N.O.)	Plug, M12x1, 4-pin	Yes	FT 50 IH-PSVL4	572-51031
150 … 600 mm	NPN (N.O.)	Plug, M12x1, 4-pin	Yes	FT 50 IH-NSVL4	572-51058
150 … 600 mm	PNP, antivalent	Cable, 3 m, 4-wire	No	FT 50 IH-PAK4	572-51032
150 … 600 mm	NPN, antivalent	Cable, 3 m, 4-wire	No	FT 50 IH-NAK4	572-51037
150 … 600 mm	PNP (N.O.)	Cable, 3 m, 4-wire	Yes	FT 50 IH-PSVK4	572-51033
150 … 600 mm	NPN (N.O.)	Cable, 3 m, 4-wire	Yes	FT 50 IH-NSVK4	572-51057

Plug connection



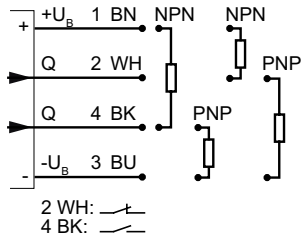
153-00061

Cable connection



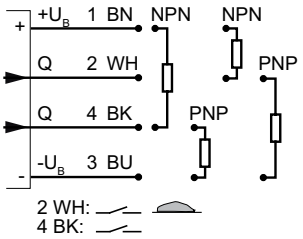
153-00060

Connection, 4-pin



154-00517

Connection, 4-pin with contamination output



154-00525

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

FR 50 RL

Laser retroreflective photoelectric sensor

PRODUCT HIGHLIGHTS

- Autocollimation principle for maximum precision even at long ranges
- No blind zone – detection from range of 0 mm
- Particularly suitable for detecting the smallest of objects
- High switching frequency of 2500 Hz
- Very small, easily visible laser light spot

Optical data	
Limit operating range	0 … 25 m[1]
Operating range	0 … 20 m[1]
Type of light	Laser, red, 650 nm
Light spot size	See table
Laser Class (DIN EN 60825-1:2008-5)	1

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Indicator LED, red	Contamination indicator
Sensitivity adjustment	Via potentiometer

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 40 mA[3]
Output current, Ie	≤ 200 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, antivalent (see Selection Table)
Output function	N.O./N.C. (see Selection Table)
Switching frequency, f (ti/tp 1:1)	≤ 2500 Hz
Response time	200 µs
Connection, BK	N.O.
Connection, WH[4]	N.C.
Contamination output, WH (optional)	N.O. (see Selection Table)

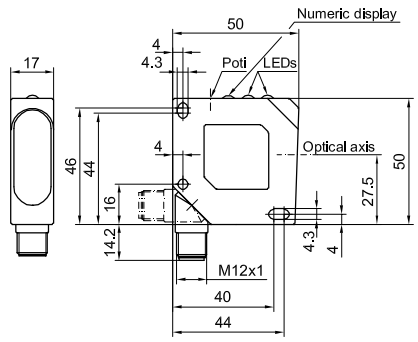
Mechanical data	
Dimensions	50 x 50 x 17 mm[3]
Enclosure rating	IP 67[5]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +45 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	40 g
Weight (cable device)	130 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: R5/L reflector [2] Max. 10 % ripple, within U_B [3] At 24 V DC [4] Without contamination output [5] With connected IP 67 plug

Operating range	Switching output	Type of connection	Contamination output	Part number	Article number
0 … 20 m	PNP, antivalent	Plug, M12x1, 4-pin	No	FR 50 RL-PAL4	571-50009
0 … 20 m	NPN, antivalent	Plug, M12x1, 4-pin	No	FR 50 RL-NAL4	571-50011
0 … 20 m	PNP (N.O.)	Plug, M12x1, 4-pin	Yes	FR 50 RL-PSVL4	571-50010
0 … 20 m	NPN (N.O.)	Plug, M12x1, 4-pin	Yes	FR 50 RL-NSVL4	571-50012
0 … 20 m	PNP, antivalent	Cable, 3 m, 4-wire	No	FR 50 RL-PAK4	571-50013
0 … 20 m	NPN, antivalent	Cable, 3 m, 4-wire	No	FR 50 RL-NAK4	571-50015
0 … 20 m	PNP (N.O.)	Cable, 3 m, 4-wire	Yes	FR 50 RL-PSVK4	571-50014
0 … 20 m	NPN (N.O.)	Cable, 3 m, 4-wire	Yes	FR 50 RL-NSVK4	571-50016

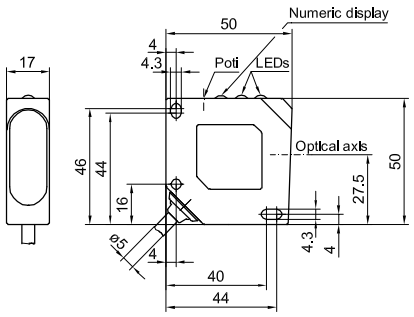
Version: 02/2015. Subject to changes; diagrams similar

Plug connection



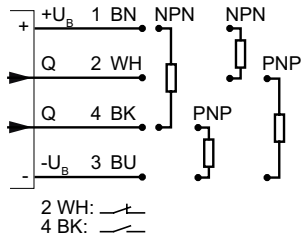
153-00062

Cable connection



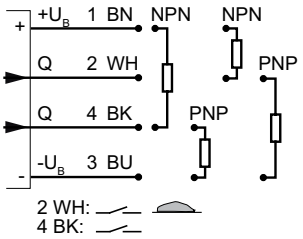
153-00063

Connection, 4-pin



154-00517

Connection, 4-pin with contamination output



154-00525

Light spot size

Operating range (m)	4	12	20
Light spot diameter (mm)	5	15	24

Accessories

Reflectors	From Page A-18
Connection cables	From Page A-34
Brackets	From Page A-4

FR 50 R

Retroreflective photoelectric sensor

PRODUCT HIGHLIGHTS

- Autocollimation principle for maximum precision even at long ranges
- No blind zone – detection from range of 0 mm
- Simple alignment thanks to easily visible light spot
- Plug connector rotatable

Optical data	
Limit operating range	0 … 6 m[1]
Operating range	0 … 5.5 mm[1]
Type of light	LED, red, 660 nm
Light spot size	See table

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Indicator LED, red	Contamination indicator
Sensitivity adjustment	Via potentiometer

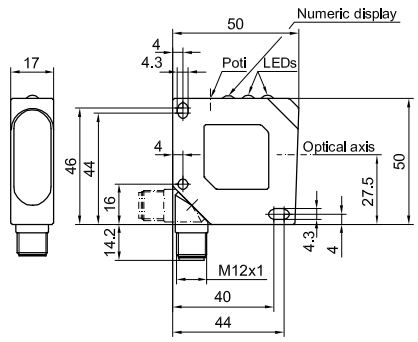
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA[3]
Output current, Ie	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN, antivalent (see Selection Table)
Output function	N.O./N.C. (see Selection Table)
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Connection, BK	N.O.
Connection, WH[4]	N.C.
Contamination output, WH (optional)	N.O. (see Selection Table)

Mechanical data	
Dimensions	50 x 50 x 17 mm[3]
Enclosure rating	IP 67[5]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	40 g
Weight (cable device)	130 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: RD8 reflector [2] Max. 10 % ripple, within U_B [3] At 24 V DC [4] Without contamination output [5] With connected IP 67 plug

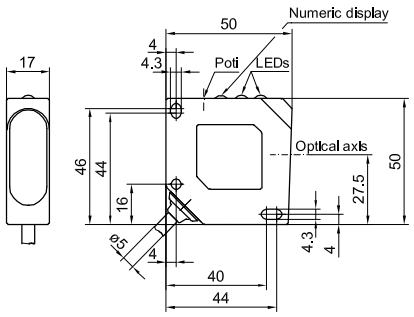
Operating range	Switching output	Type of connection	Contamination output	Part number	Article number
0 … 5.5 m	PNP, antivalent	Plug, M12x1, 4-pin	No	FR 50 R-PAL4	571-50004
0 … 5.5 m	NPN, antivalent	Plug, M12x1, 4-pin	No	FR 50 R-NAL4	571-50005
0 … 5.5 m	PNP (N.O.)	Plug, M12x1, 4-pin	Yes	FR 50 R-PSVL4	571-50006
0 … 5.5 m	NPN (N.O.)	Plug, M12x1, 4-pin	Yes	FR 50 R-NSVL4	571-50007
0 … 5.5 m	PNP (N.C.)	Plug, M12x1, 4-pin	Yes	FR 50 R-POVL4	571-50033
0 … 5.5 m	PNP, antivalent	Cable, 3 m, 4-wire	No	FR 50 R-PAK4	571-50000
0 … 5.5 m	NPN, antivalent	Cable, 3 m, 4-wire	No	FR 50 R-NAK4	571-50001
0 … 5.5 m	PNP (N.O.)	Cable, 3 m, 4-wire	Yes	FR 50 R-PSVK4	571-50002
0 … 5.5 m	NPN (N.O.)	Cable, 3 m, 4-wire	Yes	FR 50 R-NSVK4	571-50003

Plug connection



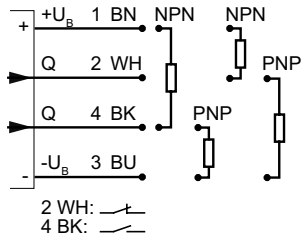
153-00062

Cable connection



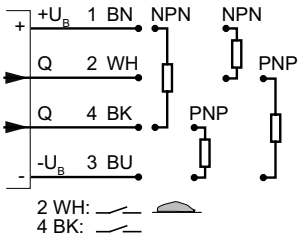
153-00063

Connection, 4-pin



154-00517

Connection, 4-pin with contamination output



154-00525

8

Light spot size

Operating range (m)	0.1	0.5
Light spot size (mm)	15 x 10	Ø 15

Accessories

Reflectors	From Page A-18
Connection cables	From Page A-34
Brackets	From Page A-4

FS/FE 50 I

Infrared through-beam photoelectric sensor

PRODUCT HIGHLIGHTS

- Simple range adjustment thanks to indicator scale
- Test input for controlling function of the sensor pair
- Optional contamination output
- Plug connector rotatable

Optical data	
Limit operating range	0 … 18 m
Operating range	0 … 15 m
Type of light	LED, infrared, 880 nm

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Indicator LED, red (transmitter)	Operating voltage indicator (transmitter off)
Indicator LED, red (receiver)	Contamination indicator
Sensitivity adjustment (receiver)	Via potentiometer

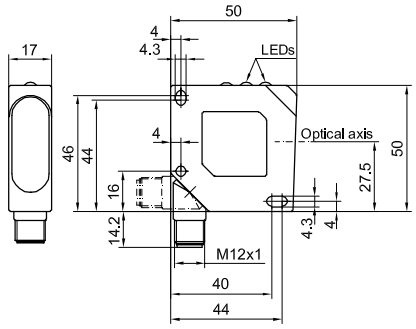
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN, antivalent (see Selection Table)
Output function	N.O./N.C. (see Selection Table)
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Connection, BK (receiver)	N.O.
Connection, WH[2] (receiver)	N.C.
Contamination output, WH (receiver, optional)	N.O. (see Selection Table)
Control input, (transmitter)	$+U_B$ = Test (transmitter off) $-U_B$ / Open = normal operation

Mechanical data	
Dimensions	50 x 50 x 17 mm[3]
Enclosure rating	IP 67[3]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	40 g
Weight (cable device)	130 g
Vibration and impact resistance	EN 60947-5-2

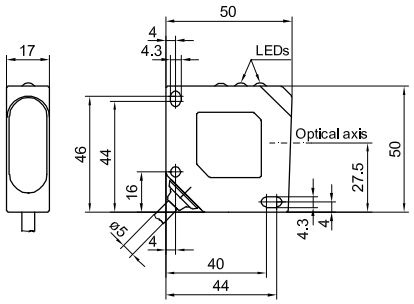
[1] Max. 10 % ripple, within U_B [2] Without contamination output [3] With connected IP 67 plug

Operating range	Switching output	Type of connection	Contamination output	Part number	Article number
0 … 15 m	PNP, antivalent	Plug, M12x1, 4-pin	No	FE 50 I-PAL4	573-52007
0 … 15 m	PNP (N.O.)	Plug, M12x1, 4-pin	Yes	FE 50 I-PSVL4	573-52004
0 … 15 m	–	Plug, M12x1, 4-pin	No	FS 50 I-L4	573-52006
0 … 15 m	PNP, antivalent	Cable, 3 m, 4-wire	No	FE 50 I-PAK4	573-52003
0 … 15 m	PNP (N.O.)	Cable, 3 m, 4-wire	Yes	FE 50 I-PSVK4	573-52005
0 … 15 m	–	Cable, 3 m, 4-wire	No	FS 50 I-K4	573-52002

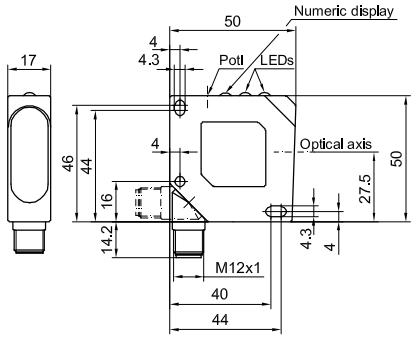
Plug connection (transmitter)



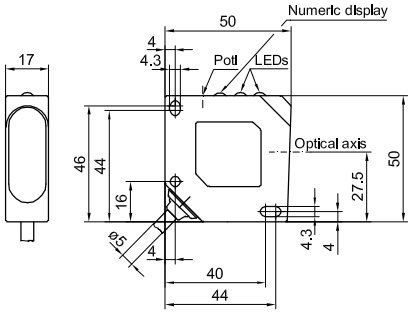
Cable connection (transmitter)



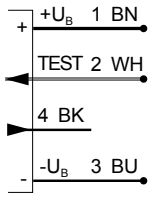
Plug connection (receiver)



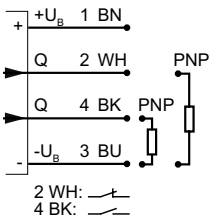
Cable connection (receiver)



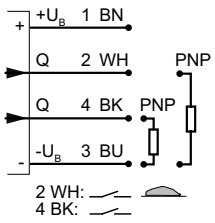
Connection, transmitter, 4-pin



Connection, receiver, 4-pin



Connection, receiver, 4-pin with contamination output



Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

F 88 – family of photoelectric sensors for harsh environmental conditions

The strong and solid series

TYPICAL F 88

- Very long ranges and scanning distances
- PNP or NPN variants with 2 switching outputs or relay with time function
- AC/DC devices with clamping space
- Simple adjustment via potentiometer
- Robust plastic housings
- Additional dovetail slot for simple mounting
- Well thought-out mounting accessories
- UL-certification

Above all else, the sensors of the F 88 series are robust and dependable! Their high system reserves guarantee reliable detection even in critical industrial environments. An F 88 fears neither dust and dirt nor vibrations, and the stable housing/plug unit is designed for these conditions.

The high-level light performance can be seen in the generously proportioned detection ranges: the FT 88 scanner with background suppression even "sees" objects at a distance of 700 mm, while the FS/FE 88 through-beam photoelectric sensor manages a range of 65 m. With these performance data, the F 88 series can be used in many demanding applications in sectors such as the automotive industry, wood processing or in mechanical engineering.

The robust sensors are also ideally suited for heavy industry as well as for protecting gates and doors.

The sensors of the F 88 series are also generously proportioned when it comes to signal outputs: they have two switching outputs (PNP or NPN), and a variant with relay output and time function is also available. The right output is therefore available for every supply voltage and the sensor offers flexible adaptation to operating conditions. User-friendly sensor mounting – with dovetail slot and well thought-out mounting accessories – is also typical SensoPart. There is thus something for almost every user requirement!

F 88 – Product Overview					
	Type of light	Adjustment	Scanning distance / range	Special features	Page
Photoelectric proximity sensors with background suppression					
FT 88-RH	LED	Potentiometer	700 mm	PNP, NPN	380
FT 88-RH	LED	Potentiometer	700 mm	Relay output	382
FT 88-IH	Infrared	Potentiometer	2 m	PNP, NPN	384
FT 88-IH	Infrared	Potentiometer	2 m	Relay output	386
Photoelectric proximity sensor					
FT 88-R	LED	Potentiometer	2 m	PNP, NPN	388
Retroreflective photoelectric sensors					
FR 88-R	LED	Potentiometer	12 m	PNP, NPN	390
FR 88-R	LED	Potentiometer	12 m	Relay output	392
Through-beam photoelectric sensors					
FS/FE 88-R	LED	Potentiometer	30 m / 65 m	PNP, NPN	394
FS/FE 88-R	LED	Potentiometer	30 m / 65 m	Relay output	396

FT 88-RH

Photoelectric proximity sensor with background suppression

PRODUCT HIGHLIGHTS

- Long scanning distance of 700 mm
- Precise background suppression
- Antivalent switching output

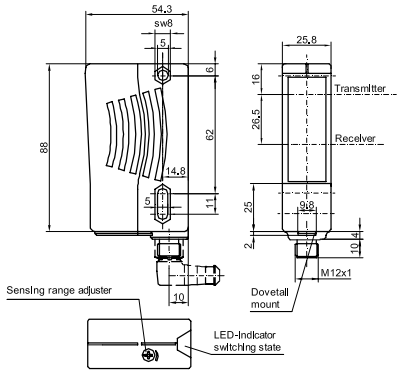
Optical data		Functions	
Scanning distance	20 … 700 mm[1]	Indicator LED, yellow	Switching output indicator
Type of light	LED, red, 660 nm	Scanning distance adjustment	Via potentiometer
Light spot size[2]	Ø 15 mm	Default setting	Max. scanning distance
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC[3]	Dimensions	88 x 54.3 x 25.8 mm[3]
No-load current, I_0	≤ 40 mA	Enclosure rating	IP 67[4]
Output current, Ie	≤ 200 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-40 … +60 °C
Power On Delay	≤ 300 ms	Ambient temperature: storage	-40 … +75 °C
Switching output, Q	PNP/NPN antivalent (see Selection Table)	Weight (plug device)	70 g
		Vibration and impact resistance	EN 60947-5-2
Output function	N.O./N.C.		
Switching frequency, f (ti/tp 1:1)	≤ 250 Hz		
Response time	2 ms		
Connection, BK	N.O.		
Connection, WH	N.C.		

[1] Reference material: grey, 18 % reflectivity [2] At scanning distance of 700 mm [3] Max. 10 % ripple, within U_B [4] With connected IP 67 plug

Scanning distance	Switching output	Type of connection	Part number	Article number
20 … 700 mm	PNP	Plug, M12x1, 5-pin	FT 88-RH-PA-L5	821-11010
20 … 700 mm	NPN	Plug, M12x1, 5-pin	FT 88-RH-NA-L5	821-11011

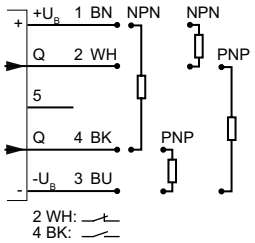
Version: 02/2015. Subject to changes; diagrams similar

Plug connection



153-00548

Connection, 5-pin



154-00518

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

FT 88-RH

Photoelectric proximity sensor with background suppression, relay output

PRODUCT HIGHLIGHTS

- Long scanning distance of 700 mm
- Precise background suppression
- Relay output
- Adjustable time function
- N.O. / N.C. switchable

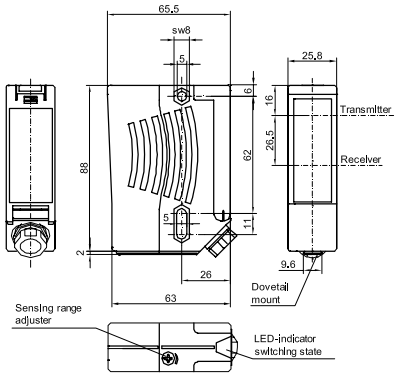
Optical data		Functions	
Scanning distance	20 … 700 mm[1]	Indicator LED, yellow	Switching output indicator
Type of light	LED, red, 660 nm	Scanning distance adjustment	Via potentiometer
Light spot size[2]	Ø 15 mm	Adjustment possibilities	Time and output function (N.O./N.C.) via operating elements in clamping space
		Default setting	Max. scanning distance

Electrical data		Mechanical data	
Operating voltage, ~U_B	12 … 240 V AC / DC	Dimensions	88 x 65.5 x 25.8 mm[3]
Power consumption	≤ 3.5 VA	Enclosure rating	IP 67[4]
Output current, Ie	≤ 2 A (≤ 250 V AC/DC)	Material, housing	ABS
Protection Class	2[3]	Material, front screen	PMMA
Power On Delay	≤ 300 ms	Type of connection	See Selection Table
Switching output, Q	Relay	Ambient temperature: operation	-25 … +60 °C
Output function	Change-over contact (N.O./N.C.)	Ambient temperature: storage	-40 … +75 °C
Switching frequency, f (ti/tp 1:1)	≤ 25 Hz	Weight (clamping space device)	120 g
		Vibration and impact resistance	EN 60947-5-2

[1] Reference material: grey, 18 % reflectivity [2] At scanning distance of 700 mm [3] With closed clamping space [4] With connected IP 67 plug

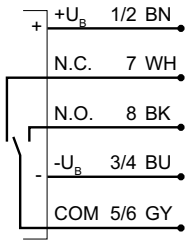
Scanning distance	Switching output	Type of connection	Part number	Article number
20 … 700 mm	Relay	Clamping space, 8 spring clamp terminals, cable gland, M16x1.5	FT 88-RH-RAT-PM	821-11009

Plug connection



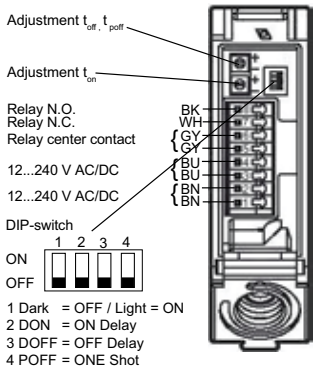
153-00549

Connection, 8-pin



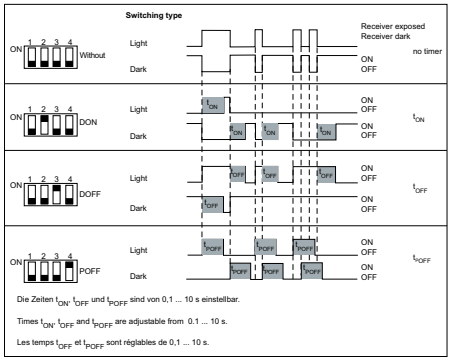
154-00523

Connection, relay



155-00640

Time functions



155-00641

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

FT 88-IH

Infrared photoelectric proximity sensor with background suppression

PRODUCT HIGHLIGHTS

- Long scanning distance of 2000 mm
- Precise background suppression
- Antivalent switching output

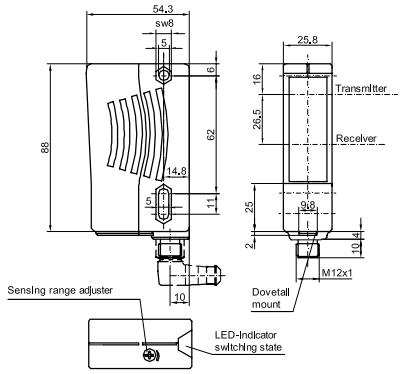
Optical data		Functions	
Scanning distance	20 … 2000 mm[1]	Indicator LED, yellow	Switching output indicator
Type of light	LED, infrared, 880 nm	Scanning distance adjustment	Via potentiometer
Light spot size[2]	Ø 70 mm	Default setting	Max. scanning distance
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC[3]	Dimensions	88 x 54.3 x 25.8 mm[3]
No-load current, I_0	≤ 40 mA	Enclosure rating	IP 67[4]
Output current, Ie	≤ 200 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U_B / 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	-40 … +60 °C
Switching output, Q	PNP/NPN antivalent (see Selection Table)	Ambient temperature: storage	-40 … +75 °C
Output function	N.O./N.C.	Weight (plug device)	70 g
Switching frequency, f (ti/tp 1:1)	≤ 250 Hz	Vibration and impact resistance	EN 60947-5-2
Response time	2 ms		
Connection, BK	N.O.		
Connection, WH	N.C.		

[1] Reference material: grey, 18 % reflectivity [2] At scanning distance of 2000 mm [3] Max. 10 % ripple, within U_B [4] With connected IP 67 plug

Scanning distance	Switching output	Type of connection	Part number	Article number
20 … 2000 mm	PNP	Plug, M12x1, 5-pin	FT 88-IH-PA-L5	821-11013
20 … 2000 mm	NPN	Plug, M12x1, 5-pin	FT 88-IH-NA-L5	821-11014

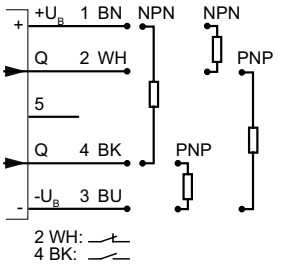
Version: 02/2015. Subject to changes; diagrams similar

Plug connection



153-00548

Connection, 5-pin



154-00518

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

FT 88-IH

Infrared photoelectric proximity sensor with background suppression, relay output

PRODUCT HIGHLIGHTS

- Long scanning distance of 2000 mm
- Precise background suppression
- Relay output
- Adjustable time function
- N.O./N.C. switchable

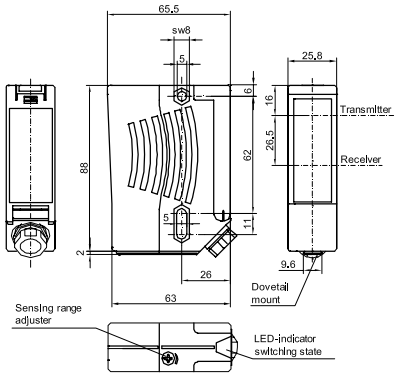
Optical data		Functions	
Scanning distance	20 … 2000 mm[1]	Indicator LED, yellow	Switching output indicator
Type of light	LED, infrared, 880 nm	Scanning distance adjustment	Via potentiometer
Light spot size[2]	Ø 70 mm	Adjustment possibilities	Time and output function (N.O./N.C.) via operating elements in clamping space
		Default setting	Max. scanning distance

Electrical data		Mechanical data	
Operating voltage, ~U_B	12 … 240 V AC / DC	Dimensions	88 x 65.5 x 25.8 mm[3]
Power consumption	≤ 3.5 VA	Enclosure rating	IP 67[4]
Output current, Ie	≤ 2 A (≤ 250 V AC / DC)	Material, housing	ABS
Protection Class	2[3]	Material, front screen	PMMA
Power On Delay	≤ 300 ms	Type of connection	See Selection Table
Switching output, Q	Relay	Ambient temperature: operation	-40 … +60 °C
Output function	Change-over contact (N.O./N.C.)	Ambient temperature: storage	-40 … +75 °C
Switching frequency, f (ti/tp 1:1)	≤ 25 Hz	Weight (clamping space device)	120 g
		Vibration and impact resistance	EN 60947-5-2

[1] Reference material: grey, 18 % reflectivity [2] At scanning distance of 2000 mm [3] With closed clamping space [4] With connected IP 67 plug

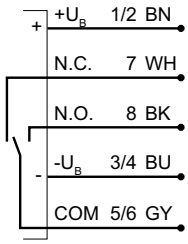
Scanning distance	Switching output	Type of connection	Part number	Article number
20 … 2000 mm	Relay	Clamping space, 8 spring clamp terminals, cable gland, M16x1.5	FT 88-IH-RAT-PM	821-11012

Plug connection



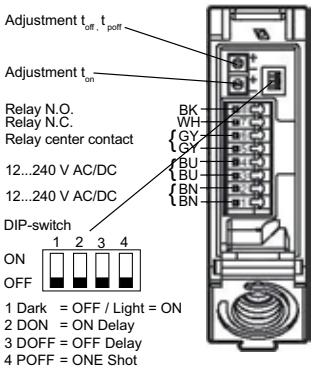
153-00549

Connection, 8-pin



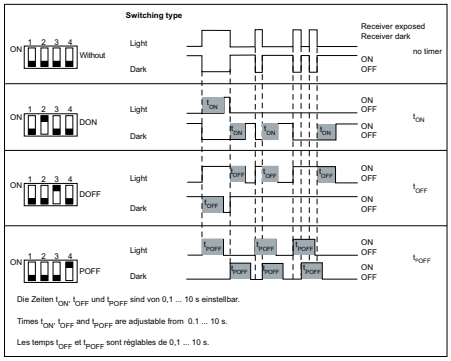
154-00523

Connection, relay



155-00640

Time functions



155-00641

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

FT 88-R

Diffuse photoelectric proximity sensor

PRODUCT HIGHLIGHTS

- Push-pull output, antivalent
- Simple alignment thanks to easily visible light spot
- Precise sensitivity adjustment by means of potentiometer

Optical data	
Scanning distance	50 … 2000 mm[1]
Type of light	LED, red, 660 nm
Light spot size[2]	Ø 50 mm
Hysteresis	< 12 %

Functions	
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via potentiometer
Default setting	Max. scanning distance

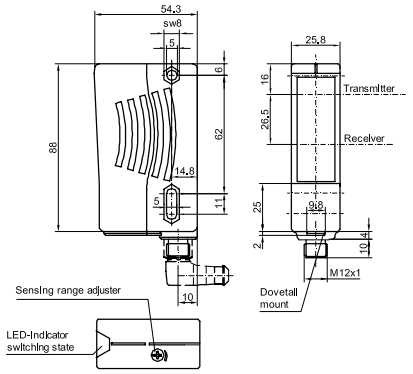
Electrical data	
Operating voltage, $+U_B$	10 ... 30 V DC[3]
No-load current, I_0	≤ 40 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	300 ms
Switching output, Q	PNP/NPN, push-pull, antivalent
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 125 Hz
Response time	4 ms
Connection, BK	N.O.
Connection, WH	N.C.

Mechanical data	
Dimensions	88 x 54.3 x 25.8 mm[3]
Enclosure rating	IP 65[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-25 … +60 °C
Ambient temperature: storage	-40 … +75 °C
Weight (plug device)	70 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material, white, 90 % reflectivity [2] At scanning distance of 2000 mm [3] Max. 10 % ripple, within U_B [4] With connected IP 65 plug

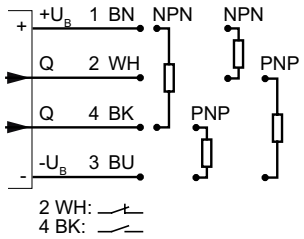
Scanning distance	Switching output	Type of connection	Part number	Article number
50 … 2000 mm	PNP/NPN, push-pull, antivalent	Plug, M12x1, 4-pin	FT 88-R-GA-L4	821-21009

Plug connection



153-00597

Connection, 4-pin



154-00517

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

FR 88-R

Retroreflective photoelectric sensor

PRODUCT HIGHLIGHTS

- Antivalent switching output
- Simple alignment thanks to easily visible light spot
- Precise sensitivity adjustment by means of potentiometer

Optical data	
Operating range	0.05 … 12 m[1]
Type of light	LED, red, 660 nm
Light spot size[2]	Ø 200 mm

Functions	
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via potentiometer
Default setting	Max. range

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[3]
No-load current, I_0	≤ 40 mA
Output current, Ie	≤ 200 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 antivalent (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500µs
Connection, BK	N.O.
Connection, WH	N.C.
Contamination output, Gy (optional)	N.C.

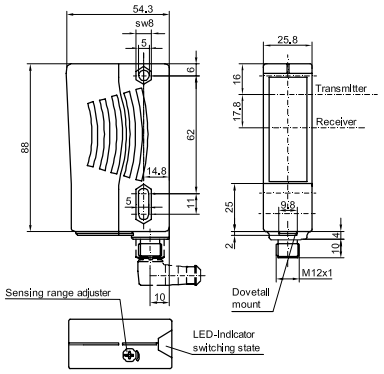
Mechanical data	
Dimensions	88 x 54.3 x 25.8 mm[3]
Enclosure rating	IP 67[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-40 … +60 °C
Ambient temperature: storage	-40 … +75 °C
Weight (plug device)	70 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: R10 reflector [2] At range of 12 m [3] Max. 10 % ripple, within U_B [4] With connected IP 67 plug

Operating range	Switching output	Type of connection	Part number	Article number
0.05 … 12 m	PNP	Plug, M12x1, 5-pin	FR 88-R-PAV-L5	823-11010
0.05 … 12 m	NPN	Plug, M12x1, 5-pin	FR 88-R-NAV-L5	823-11011

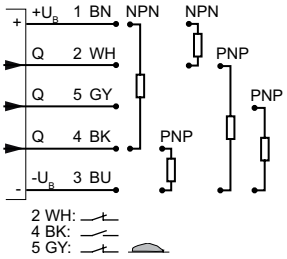
Version: 02/2015. Subject to changes; diagrams similar

Plug connection



153-00551

Connection, 5-pin



154-00522

Accessories

Reflectors	From Page A-18
Connection cables	From Page A-34
Brackets	From Page A-4

FR 88-R

Retroreflective photoelectric sensor with relay output

PRODUCT HIGHLIGHTS

- Relay output
- Simple alignment thanks to easily visible light spot
- Precise sensitivity adjustment by means of potentiometer
- Adjustable time function
- N.O./N.C. switchable

Optical data	
Operating range	0.05 … 12 m[1]
Type of light	LED, red, 660 nm
Light spot size[2]	Ø 200 mm

Functions	
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via potentiometer
Adjustment possibilities	Time and output function (N.O./N.C.) via operating elements in clamping space
Default setting	Max. range

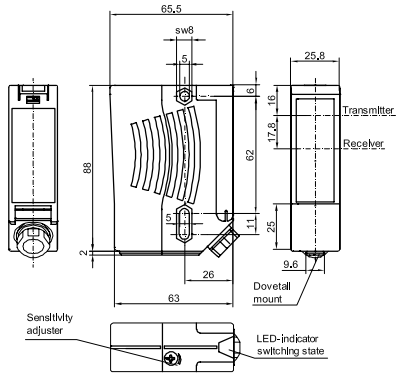
Electrical data	
Operating voltage, ~U_B	12 … 240 V AC / DC
Power consumption	≤ 3.5 VA
Output current, Ie	≤ 2 A (≤ 250 V AC / DC)
Protection Class	2[3]
Power On Delay	≤ 300 ms
Switching output, Q	Relay
Output function	Change-over contact (N.O./N.C.)
Switching frequency, f (ti/tp 1:1)	≤ 25 Hz

Mechanical data	
Dimensions	88 x 65.5 x 25.8 mm[3]
Enclosure rating	IP 67[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-40 … +60 °C
Ambient temperature: storage	-40 … +75 °C
Weight (clamping space device)	120 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: R10 reflector [2] At range of 12 m [3] With closed clamping space [4] With connected IP 67 plug

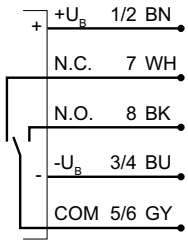
Operating range	Switching output	Type of connection	Part number	Article number
0.05 … 12 m	Relay	Clamping space, 8 spring clamp terminals, cable gland, M16x1.5	FR 88-R-RAT-PM	823-11009

Plug connection



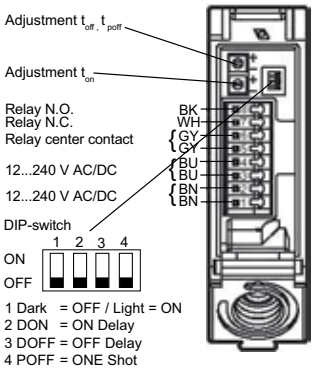
153-00550

Connection, 5-pin



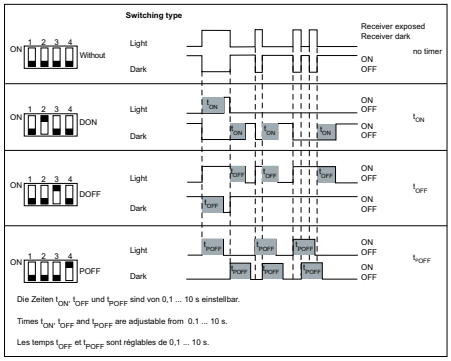
154-00523

Connection, relay



155-00640

Time functions



155-00641

Accessories

Reflectors	From Page A-18
Connection cables	From Page A-34
Brackets	From Page A-4

FS/FE 88-R

Through-beam photoelectric sensor

PRODUCT HIGHLIGHTS

- Antivalent switching output
- Simple alignment thanks to easily visible light spot
- Precise sensitivity adjustment by means of potentiometer
- Contamination output

Optical data	
Operating range	0 ... 30 m
Type of light	LED, red, 660 nm
Light spot size[1]	Ø 600 mm

Functions	
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment (receiver)	Via potentiometer
Default setting	Max. range

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0 (transmitter)	≤ 50 mA
No-load current, I_0 (receiver)	≤ 35 mA
Output current, Ie	≤ 200 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 antivalent (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Connection, BK	N.O.
Connection, WH	N.C.
Contamination output, Gy (receiver / optional)	N.C.
Control input, Test (transmitter)	$+U_B$ = Test (transmitter off)[3] $-U_B$ / Open = normal operation

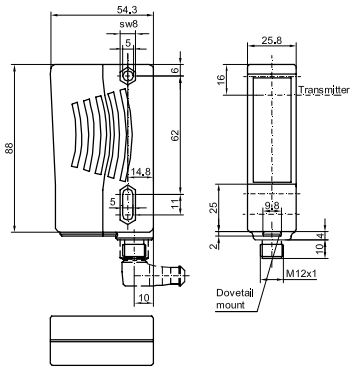
Mechanical data	
Dimensions	88 x 54.3 x 25.8 mm[3]
Enclosure rating	IP 67[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-40 … +60 °C
Ambient temperature: storage	-40 … +75 °C
Weight (plug device)[5]	140 g
Vibration and impact resistance	EN 60947-5-2

[1] At range of 30 m [2] Max. 10 % ripple, within U_B [3] I_{max} < 3 mA at 30 V DC [4] With connected IP 67 plug [5] Sensor pair

Operating range	Switching output	Type of connection	Part number	Article number
0 ... 30 m	PNP	Plug, M12x1, 5-pin	FE 88-R-PAV-L5	822-21010
0 ... 30 m	NPN	Plug, M12x1, 5-pin	FE 88-R-NAV-L5	822-21011
0 ... 30 m	–	Plug, M12x1, 5-pin	FS 88-R-L5	822-11004

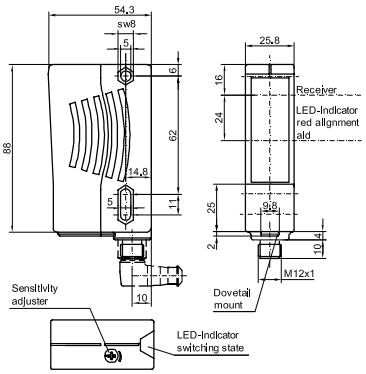
Version: 02/2015. Subject to changes; diagrams similar

Plug connection (transmitter)



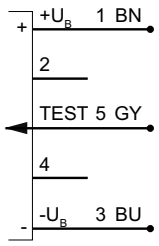
153-00555

Plug connection (receiver)



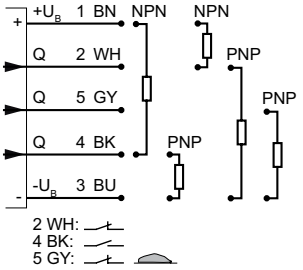
153-00554

Connection, transmitter, 5-pin



154-00521

Connection, receiver, 5-pin



154-00522

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

FS/FE 88-R

Through-beam photoelectric sensor with relay output

PRODUCT HIGHLIGHTS

- Long operating range of 65 m
- Simple alignment thanks to easily visible light spot
- Adjustable time function
- N.O./N.C. switchable

Optical data	
Operating range	0 ... 65 m
Type of light	LED, red, 660 nm
Light spot size[1]	Ø 1.3 m

Functions	
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment (receiver)	Via potentiometer
Adjustment possibilities	Time and output function (N.O./N.C.) via operating elements in clamping space
Default setting	Max. range

Electrical data	
Operating voltage, ~U_B	12 … 240 V AC / DC[2]
Power consumption	≤ 3.5 VA
Protection Class	2[3]
Power On Delay	≤ 300 ms
Switching output, Q	Relay
Output function	Change-over contact (N.O./N.C.)
Switching frequency, f (ti/tp 1:1)	≤ 25 Hz

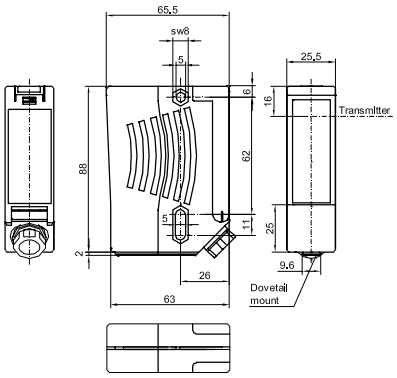
Mechanical data	
Dimensions	88 x 65.5 x 25.8 mm[3]
Enclosure rating	IP 67[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-40 … +60 °C
Ambient temperature: storage	-40 … +75 °C
Weight (clamping space device)[5]	200 g
Vibration and impact resistance	EN 60947-5-2

[1] At range of 65 m [2] Max. 10 % ripple, within U_B [3] With closed clamping space [4] With connected IP 67 plug [5] Sensor pair

Operating range	Switching output	Type of connection	Part number	Article number
0 ... 65 m	Relay	Clamping space, 8 spring clamp terminals, cable gland, M16x1.5	FE 88-R-RAT-PM	822-21009
0 ... 65 m	–	Clamping space, 8 spring clamp terminals, cable gland, M16x1.5	FS 88-R-PM	822-11003

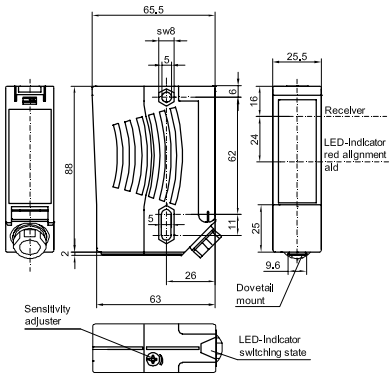
Version: 02/2015. Subject to changes; diagrams similar

Plug connection (transmitter)



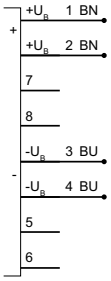
153-00553

Plug connection (receiver)



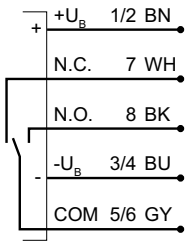
153-00552

Connection, transmitter, 8-pin



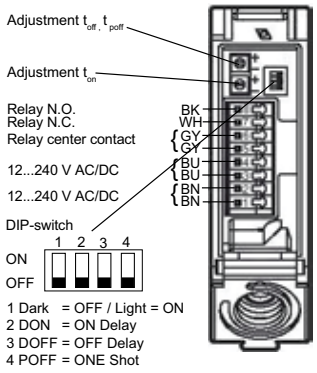
154-00520

Connection, receiver, 5-pin



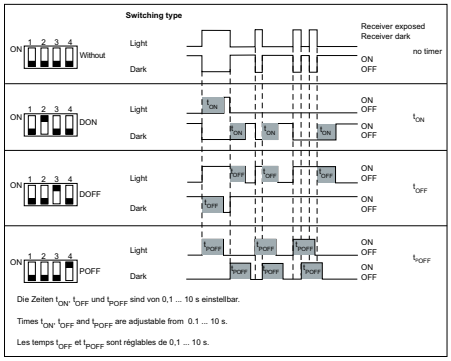
154-00523

Connection (relay)



155-00640

Time functions (relay)



155-00641

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

FT 92 – proximity switch with long scanning distance

The far-sighted sensor with pulse time-of-flight measurement

TYPICAL FT 92

- Very long range
- Precise background suppression with time-of-flight technology
- User-friendly fine adjustment of sensor with pilot laser
- Rapid and easy adjustment via teach-in
- Safe operation thanks to Laser Class 1
- Robust housing/plug unit
- Well thought-out mounting accessories
- UL-certification

The FT 92 proximity switch has been specially designed for detection tasks with long distances to the process: the sensor, equipped with an infrared laser (Laser Class 1) reaches ranges of up to 6 m. Whereby its measurement principle of infrared pulse time-of-flight technology guarantees particularly precise background suppression, and thus reliable detection even against highly reflective or glossy backgrounds – as well as absolute immunity to ambient light.

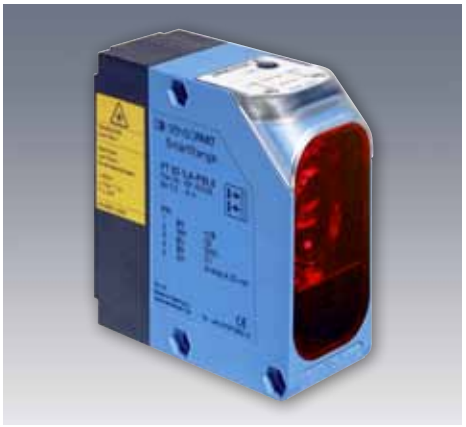
Long distances not only require excellent optical performance, but also helpful functions for installation and commissioning. Thus a pilot laser that can be switched off simplifies fine adjustment of the sensor, and the wide variety of mounting options provides users with rapid and user-friendly installation.

The FT 92 is suitable for numerous applications in industrial automation, e.g. for small-part detection, for checking presence or for positioning tasks. The far-sighted sensor can therefore be found in many sectors: in the automotive industry and in mechanical engineering, in the wood-processing industry, in packaging machines or in the control of gates and doors. Its stable and robust design ensures smooth, trouble-free operation everywhere – as well as satisfied users!

F 92 – Product Overview					
	Type of light	Adjustment	Scanning distance / range	Special features	Page
Photoelectric proximity sensor with background suppression					
FT 92 IL	Infrared	Teach-in	6 m	Long range	400

FT 92 IL

Infrared photoelectric proximity sensor with background suppression



PRODUCT HIGHLIGHTS

- Long range of 6 m
- Precise background suppression through time-of-flight technology
- Reliable operation even with highly reflective and glossy backgrounds
- Simple alignment via integrated pilot laser

Optical data	
Scanning distance	0.2 … 6 m[1]
Type of light, measurement laser	Infrared, 905 nm
Laser Class, measurement laser (DIN EN 60825-1:2008-5)	1
Type of light, pilot laser	Laser, red, 650 nm
Laser Class, pilot laser (DIN EN 60825-1:2008-5)	2
Repeatability, Fast / Slow	≤ ± 15 mm / 10 mm

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Indicator LED, orange	Operating mode indicator (Fast / Slow)
Scanning distance adjustment	Via Teach-in button
Adjustment possibilities	Switching point set via Teach-in button Switching window set via Teach-in button Slow / Fast mode via Teach-in button N.O./N.C. via Teach-in button Pilot laser via Teach-in button
Default settings	Sn = 5.8 m and N.O.

Electrical data	
Operating voltage, $+U_B$	18 … 30 V DC[2]
No-load current, I_0	≤ 125 mA
Output current, Ie	100 mA
Voltage drop, U_D	≤ 2.4 V
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.
Response time, Fast / Slow	13 / 80 ms

Mechanical data	
Dimensions	95 x 93 x 42 mm[3]
Enclosure rating	IP 67[3]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +50 °C
Ambient temperature: storage	-40 … +80 °C
Weight (plug device)	200 g
Weight (cable device)	270 g
Vibration and impact resistance	EN 60947-5-2

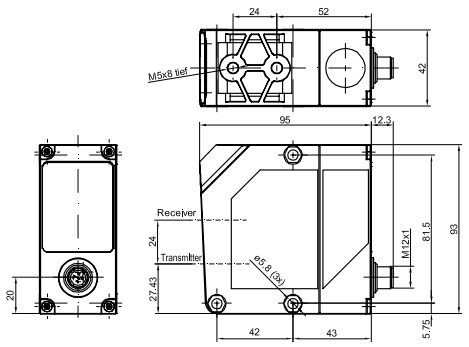
[1] Reference material, white, 90 % reflectivity [2] Max. 10 % ripple, within U_B [3] With connected IP 67 plug

Scanning distance	Switching output	Type of connection	Part number	Article number
0.2 … 6 m	PNP	Plug, M12x1, 4-pin	FT 92 IL-PSL4	591-91007
0.2 … 6 m	NPN	Plug, M12x1, 4-pin	FT 92 IL-NSL4	591-91009
0.2 … 6 m	PNP	Cable, 3 m, 3-wire	FT 92 IL-PSK3	591-91011
0.2 … 6 m	NPN	Cable, 3 m, 3-wire	FT 92 IL-NSK3	591-91010
0.2 … 6 m	PNP	Pigtail, 300 mm, with M12x1 plug, 4-pin	FT 92 IL-PS-KL4	591-91012

Accessories	
Connection cables	From Page A-34
Brackets	From Page A-4

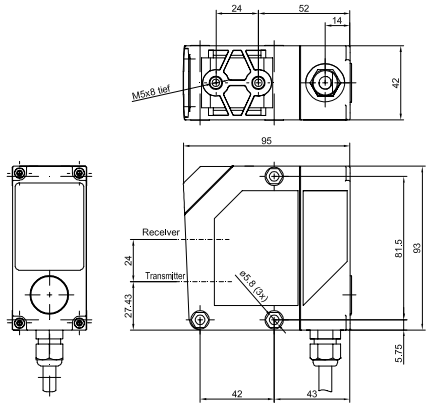
Version: 05/2015. Subject to changes; diagrams similar

Plug connection



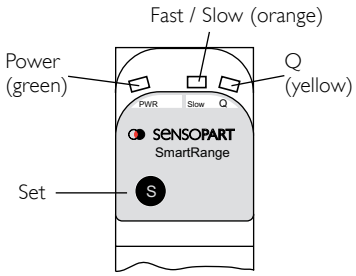
153-00346

Cable connection



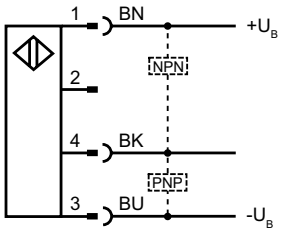
153-00700

Operating / display elements



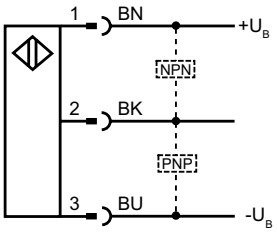
155-01378

Connection, 4-pin



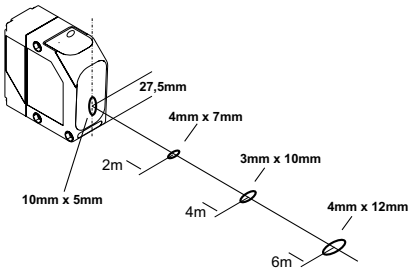
154-00460

Connection, 3-pin



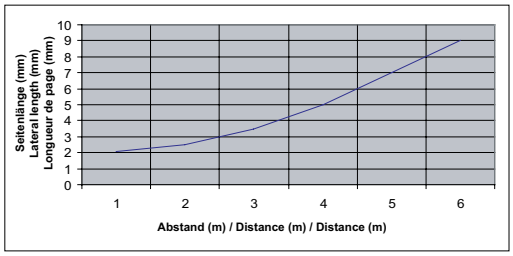
154-00459

Light spot size



155-00454

Smallest detectable part



155-00207

Reference material	Detection range
White (90 %)	0.2 … 6 m
Grey (18 %)	0.2 … 6 m
Black (6 %)	0.2 … 2.5 m

8

F 04/05/12/18/30 – photoelectric sensors and proximity sensors in cylindrical housings

All-round performance

Sensors in cylindrical housings have several special aspects compared to those with cubic housings. They are not only particularly robust but also, thanks to their integrated thread, offer easy and space-saving installation. Special designs that can "see around corners" are also available: they are equipped with a special optical system that deflects the transmission and reception beams around the sensor axis by 90°, expanding the mounting options available.

The sensors of the F 04/05/12/18/30 series differ in the diameter of the integrated metal threaded sleeve (4, 5, 12, 18 or 30 mm). Each series offers the usual functional variants: through-beam and retroreflective photoelectric sensors, energetic scanners, and scanners with background suppression. The sensors are optionally available with red-light or infrared LED or with pulsed red-light laser. Variants with potentiometer or teach-in operation are also available.

TYPICAL F 04/05/12/18/30

- Robust housings
- Very easy installation
- Straight or angled optics options
- Metric threads in 5 sizes: 4, 5, 12, 18 or 30 mm
- Red-light / infrared LED or laser light options
- FMF 18 for detection of liquid limit levels

F 04/05/12/18/30 – Product Overview					
	Type of light	Adjustment	Scanning distance / range	Special features	Page
Photoelectric proximity sensors with background suppression					
FT 12 RH	Red	Teach-in	10 … 60 mm	M12 housing, dynamic teach-in	404
FMH 18	Red	Potentiometer	40 … 120 mm	M18 housing, very precise detection	406
FT 12 RF	Red	None	24 mm	M12 housing	408
Photoelectric proximity sensors					
FM 04	Infrared	None	0 … 50 mm	Very small housing, M4	410
FM 05	Infrared	None	0 … 50 mm	Very small housing, M5	412
FT 12 R	Red	Potentiometer	1 … 300 mm		414
FT 18-2	Red / infrared	Potentiometer	0 … 800 mm	M18 metal housing	416
FT 18-2	Red / infrared	Potentiometer	0 … 800 mm	M18 plastic housing	418
FMS 18-34 B	Infrared	Potentiometer	5 … 400 mm	M18 housing	420
FMS 30-34 B	Infrared	Potentiometer	5 … 1000 mm	M30 housing, long operating range	422
Retroreflective photoelectric sensors					
FR 12 R	Red	Potentiometer	60 … 1500 mm	M12 housing	424
FR 18-2	Red	Potentiometer	3.0 m	M18 metal housing	426
FR 18-2	Infrared	Potentiometer	3.6 m	M18 plastic housing	428
Through-beam photoelectric sensors					
FS/FE 12 RL	Laser	Control line	0 … 5 m	M12 housing	430
FSE 18-2	Infrared		10 m	M18 housing	432
FS/FE 18 RL	Laser	Control line	0 … 50 m	M18 housing	434
FL 18 W	Laser	Potentiometer	0 … 50 m	M18 housing, adjustable transmission beam size	436
FL 18 WM	Laser	Potentiometer	0 … 5 m	air tube prevents malfunction	438
FL 18	Laser	Potentiometer	0 … 50 m	M18 housing, adjustable transmission beam size	440
Filling level sensor					
FMF 18-34	Infrared	Fixed		M18 housing, detection of liquids	442

FT 12 RH

Photoelectric proximity sensor with background suppression

PRODUCT HIGHLIGHTS

- Adjustable background suppression
- Dynamic teach-in via button / control line without machine stoppage
- Lockable Teach-in button

Optical data	
Scanning distance	10 … 60 mm[1]
Type of light	Red, 660 nm
Light spot size	5 x 5 mm[2]
Grey value shift (90 % white / 18 % grey)	< 6 %

Functions	
Indicator LED, green	Stability indicator
Indicator LED, yellow	Switching state indicator
Scanning distance adjustment	Via Teach-in button and control input
Adjustment possibilities	Control line for setting or locking N.O./N.C. selectable
Default settings	Max. scanning distance, PNP and N.O.

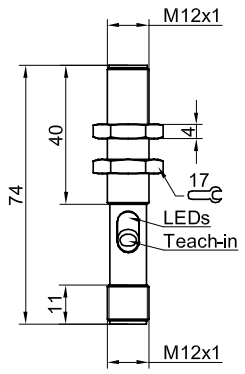
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection
Protection Class	2
Switching output, Q	PNP
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	1000 Hz
Response time	≤ 500 µs
Control input, ET	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions (cable devices)	M12 x 74 mm
Enclosure rating	IP 67[3]
Material, housing	Brass, nickel-plated
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	30 g

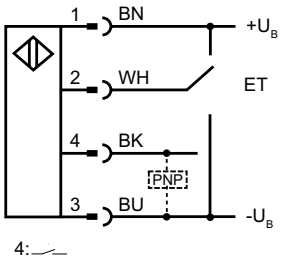
[1] Reference material: Kodak white, 90 % reflectivity [2] At scanning distance of 50 mm [3] With connected IP 67 plug

Type of connection	Part number	Article number
Plug, M12x1, 4-pin	FT 12 RH-PSL4	506-11000

Plug connection



Connection, 4-pin



Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

FMH 18

Photoelectric proximity sensor with background suppression

PRODUCT HIGHLIGHTS

- Scanning distance: 40 … 120 mm
- Red light, 660 nm
- Background suppression
- Robust metal housing
- Metal M18 threaded sleeve
- Antivalent switching outputs

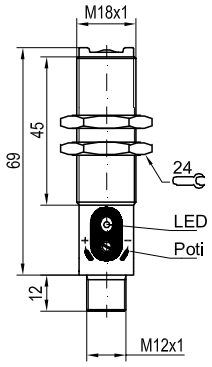
Optical data		Functions	
Scanning distance	40 … 120 mm[1]	Indicator LED, yellow	Switching state indicator
Type of light	Red, 660 nm	Scanning distance adjustment	Via 18-step potentiometer
Light spot size	8 x 10 mm[2]		
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC[3]	Dimensions	See dimensional drawings
No-load current, I_0	≤ 30 mA	Dimensions (angled)	See dimensional drawings
Output current, Ie	200 mA	Enclosure rating	IP 67[4]
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection	Material, housing	Brass, nickel-plated
		Material, front screen	Glass
Protection Class	2	Type of connection	See Selection Table
Power On Delay	≤ 300 ms	Ambient temperature: operation	-20 … +60 °C
Switching output, Q	PNP	Ambient temperature: storage	-20 … +80 °C
Output function	N.O./N.C.	Weight (plug device)	60 g
Switching frequency, f (ti/tp 1:1)	600 Hz	Weight (cable device)	160 g
Connection, BK	N.O.		
Connection, WH	N.C.		

[1] Reference material: Kodak grey, 18 % reflectivity [2] At scanning distance of 100 mm [3] 10 % ripple, within U_B [4] With connected IP 67 plug

Scanning distance	Light exit	Switching output	Type of connection	Part number	Article number
40 … 120 mm	Straight	PNP, antivalent	Plug, M12, 4-pin	FMH 18-L4	518-51505
40 … 120 mm	90° angle	PNP, antivalent	Plug, M12, 4-pin	FMH 18W-L4	518-51507
40 … 120 mm	Straight	PNP, antivalent	Cable, 3 m, 4-wire	FMH 18	518-51504
40 … 120 mm	90° angle	PNP, antivalent	Cable, 3 m, 4-wire	FMH 18W	518-51506

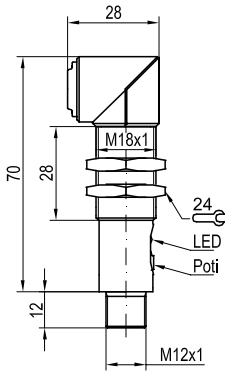
Accessories	
Connection cables	From Page A-34
Brackets	From Page A-4

Plug connection, FMH 18-L4



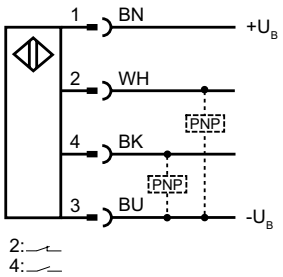
153-00029

Plug connection, FMH 18W-L4



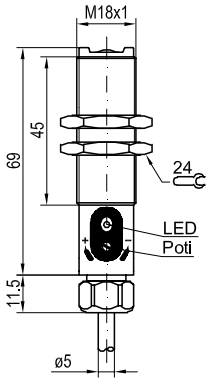
153-00030

Connection, 4-pin



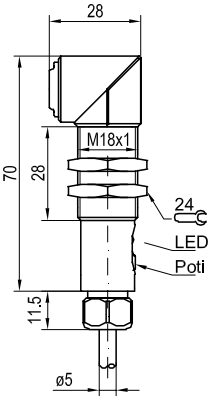
154-00193

Cable connection, FMH 18



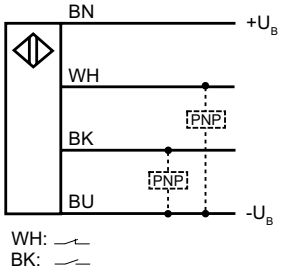
153-00027

Cable connection, FMH 18W



153-00028

Connection, 4-wire



154-00193

8

FT 12 RF

Fixed focus photoelectric proximity sensor with background suppression

PRODUCT HIGHLIGHTS

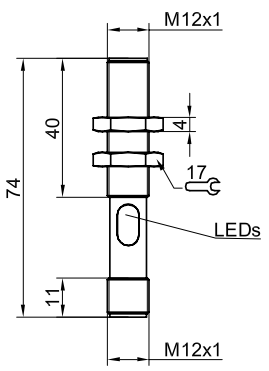
- Simple installation thanks to standard M12 metal thread
- High immunity to dirt due to high signal reserves
- Indicator for detection stability

Optical data		Functions	
Scanning distance	24 mm[1]	Indicator LED, green	Operating voltage indicator
Type of light	Red, 660 nm	Indicator LED, yellow	Switching state indicator
Hysteresis (18 %)	< 5 %	Scanning distance adjustment	Fixed setting
Grey value shift (90 % white / 18 % grey)	< 5 %	Default settings	PNP N.O.
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC	Dimensions	M12 x 74 mm
No-load current, I_0	≤ 25 mA	Enclosure rating	IP 67[2]
Output current, Ie	≤ 100 mA	Material, housing	Brass, nickel-plated
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-20 … +60 °C
Switching output, Q	PNP	Ambient temperature: storage	-20 … +80 °C
Output function	N.O.	Weight (plug device)	30 g
Switching frequency, f (ti/tp 1:1)	1000 Hz		
Response time	≤ 500 µs		

[1] Reference material: Kodak white, 90 % reflectivity [2] With connected IP 67 plug

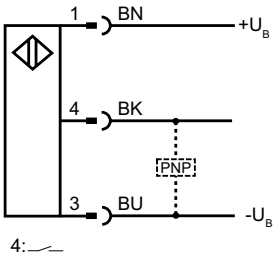
Type of connection	Part number	Article number
Plug, M12x1, 4-pin	FT 12 RF-PSL4	506-11004

Plug connection



153-00289

Connection, 3-pin



154-00160

Preferred direction of approach

155-00240

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

FM 04

Photoelectric proximity sensor

PRODUCT HIGHLIGHTS

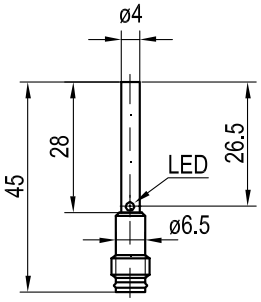
- Very small housing diameter: 4 mm
- Long switching distance of 50 mm
- Glass optics for easy cleaning
- Fully sealed under vacuum, enclosure rating of IP 67

Optical data		Functions	
Scanning distance	0 … 50 mm[1]	Indicator LED, yellow	Switching state indicator
Type of light	Infrared, 880 nm		
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC	Dimensions (plug device)	Ø 4 x 45 mm
No-load current, I_0	≤ 15 mA	Dimensions (cable device)	Ø 4 x 35 mm
Output current, Ie	≤ 100 mA	Enclosure rating	IP 67[2]
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection	Material, housing	Stainless steel, V2A
		Material, front screen	Glass
Power On Delay	120 msec	Type of connection	See Selection Table
Switching output, Q	PNP/NPN / max. 100 mA	Ambient temperature: operation	0 … +55 °C
Output function	N.O.	Vibration and impact resistance	IEC 60947-5-2
Switching frequency, f (ti/tp 1:1)	≤ 250 Hz		
Response time	≤ 2.5 ms		

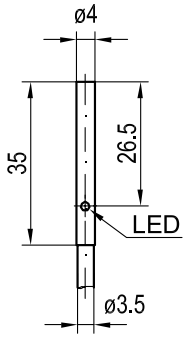
[1] Reference material: Kodak white, 90 % reflectivity [2] With connected IP 67 plug

Switching output	Type of connection	Part number	Article number
PNP	Plug, M8, 3-pin	FM 04-163	718-51400
NPN	Plug, M8, 3-pin	FM 04-153	718-51401
PNP	Cable, PVC, 3 x 0.14 mm², 2 m	FM 04-161	718-51398
NPN	Cable, PVC, 3 x 0.14 mm², 2 m	FM 04-151	718-51399

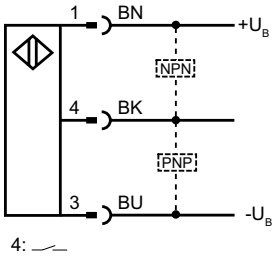
Plug connection



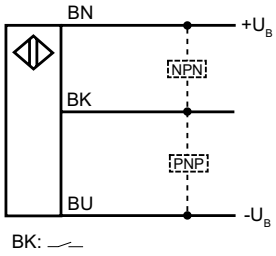
Cable connection



Connection plug, 3-pin



Connection cable, 3-wire



Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

FM 05

Photoelectric proximity sensor

PRODUCT HIGHLIGHTS

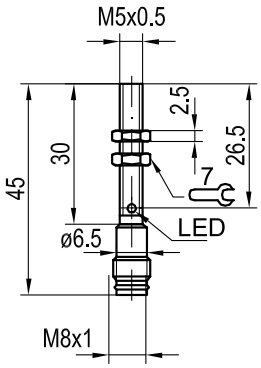
- Very small housing: cylindrical, M5
- Simple installation due to standard thread
- Glass optics for easy cleaning
- Fully sealed under vacuum, enclosure rating of IP 67

Optical data		Functions	
Scanning distance	0 … 50 mm[1]	Indicator LED, yellow	Switching state indicator
Type of light	Infrared, 880 nm		
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC	Dimensions (cable device)	M5 x 45 mm
No-load current, I_0	≤ 15 mA	Dimensions (plug device)	M5 x 35 mm
Output current, Ie	≤ 100 mA	Enclosure rating	IP 67[2]
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection	Material, housing	Stainless steel, V2A
		Material, front screen	Glass
Power On Delay	120 ms	Type of connection	See Selection Table
Switching output, Q	PNP/NPN / max. 100 mA	Ambient temperature: operation	0 … +55 °C
Output function	N.O.	Vibration and impact resistance	IEC 60947-5-2
Switching frequency, f (ti/tp 1:1)	≤ 250 Hz		
Response time	≤ 2.5 ms		

[1] Reference material: Kodak white, 90 % reflectivity [2] With connected IP 67 plug

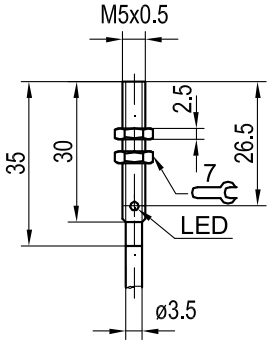
Switching output	Type of connection	Part number	Article number
PNP	Plug, M8, 3-pin	FM 05-163	718-51404
NPN	Plug, M8, 3-pin	FM 05-153	718-51405
PNP	Cable, PVC, 3 x 0.14 mm², 2 m	FM 05-161	718-51402
NPN	Cable, PVC, 3 x 0.14 mm², 2 m	FM 05-151	718-51403

Plug connection



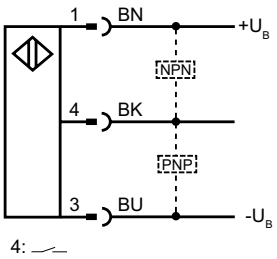
153-00043

Cable connection



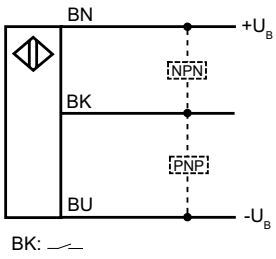
153-00042

Connection plug, 3-pin



154-00163

Connection cable, 3-wire



154-00163

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

FT 12 R

Photoelectric proximity sensor

PRODUCT HIGHLIGHTS

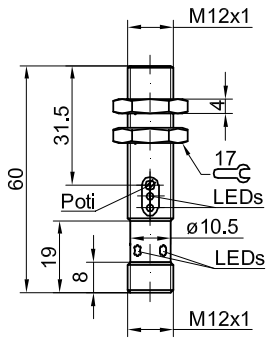
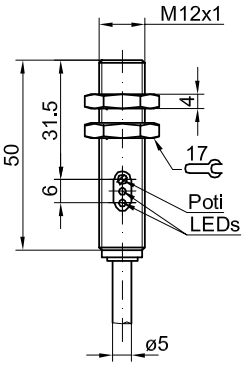
- Scanning distance: 1 … 300 mm, adjustable
- Red light, 660 nm
- Easy installation thanks to standard M12 metal thread
- Functional reserve indicator
- N.O./N.C. switchable

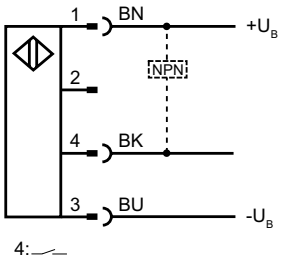
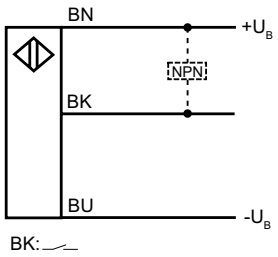
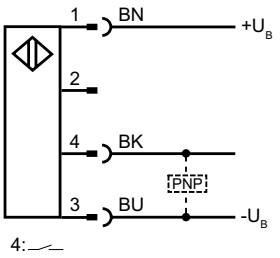
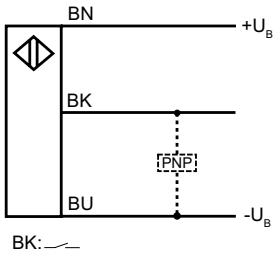
Optical data		Functions	
Scanning distance	1 … 300 mm[1]	Indicator LED, green	Functional reserve indicator
Type of light	Red, 660 nm	Indicator LED, yellow	Switching state indicator
Light spot size	Ø 5 mm[2]	Scanning distance adjustment	Via potentiometer
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 36 V DC	Dimensions (plug device)	M12 x 60 mm
No-load current, I_0	≤ 15 mA	Dimensions (cable device)	M12 x 50 mm
Output current, Ie	≤ 200 mA	Enclosure rating	IP 67[3]
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection	Material, housing	Brass, chromium-plated
		Material, front screen	Glass
Protection Class	2	Type of connection	See Selection Table
Power On Delay	60 msec	Ambient temperature: operation	-25 … +55 °C
Switching output, Q	PNP/NPN / max. 200 mA	Weight (plug device)	20 g
Output function	N.O.	Weight (cable device)	100 g
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Vibration and impact resistance	IEC 60947-5-2
Response time	≤ 500 µs		

[1] Reference material: Kodak white, 90 % reflectivity [2] At scanning distance of 10 mm [3] With connected IP 67 plug

Switching output	Type of connection	Part number	Article number
PNP	Plug, M12, 4-pin	FT 12 R-PSL4	701-21000
NPN	Plug, M12, 4-pin	FT 12 R-NSL4	701-21001
PNP	Cable, PVC, 3 x 0.34 mm², 2 m	FT 12 R-PSK3	701-21002
NPN	Cable, PVC, 3 x 0.34 mm², 2 m	FT 12 R-NSK3	701-21003

Version: 02/2015. Subject to changes; diagrams similar

Plug connection	Cable connection
 153-00208	 153-00207

Connection, 4-pin	Connection, 3-pin
 154-00489	 154-00488
 154-00224	 154-00160

Accessories	
Connection cables	From Page A-34
Brackets	From Page A-4

FT 18-2

Diffuse photoelectric proximity sensor

PRODUCT HIGHLIGHTS

- Economical solution for numerous applications
- Scanning distance of up to 800 mm, adjustable via potentiometer
- Red light or infrared
- Variants with angled light exit
- Robust metal housings (IP 67)
- Simple adjustment via potentiometer
- 2 through holes as additional mounting possibility

Optical data	
Scanning distance	See Selection Table
Type of light	See Selection Table
Light spot size	See Selection Table

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via potentiometer
Adjustment possibilities	N.O./N.C. via control input (IN)
Default settings	Max. scanning distance and N.O.

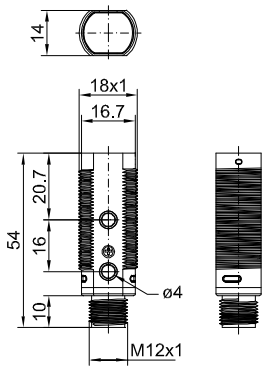
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	≤ 1 ms
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked open = normal operation

Mechanical data	
Dimensions	See dimensional drawings
Enclosure rating	IP 67[1]
Material, housing	Brass, nickel-plated
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-25 … +55 °C
Weight (plug device)	23 g[2] / 25 g[3]
Weight (cable device)	63 g[2] / 65 g[3]

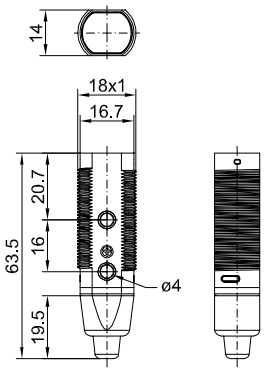
[1] With connected IP 67 plug [2] Straight light exit variant [3] Angled light exit variant

Scanning distance	Type of light	Light exit	Switching output	Type of connection	Part number	Article number
0 … 400 mm	Red light	Straight	PNP	Metal plug, M12, 4-pin	FT 18-2 RM-PS-L4	740-21021
0 … 400 mm	Red light	Straight	NPN	Metal plug, M12, 4-pin	FT 18-2 RM-NS-L4	740-21022
0 … 400 mm	Red light	Straight	PNP	Cable, 2 m, 4-wire	FT 18-2 RM-PS-K4	740-21023
0 … 400 mm	Red light	Straight	NPN	Cable, 2 m, 4-wire	FT 18-2 RM-NS-K4	740-21024
0 … 320 mm	Red light	90° angle	PNP	Metal plug, M12, 4-pin	FT 18-2 RWM-PS-L4	740-21025
0 … 320 mm	Red light	90° angle	NPN	Metal plug, M12, 4-pin	FT 18-2 RWM-NS-L4	740-21026
0 … 320 mm	Red light	90° angle	PNP	Cable, 2 m, 4-wire	FT 18-2 RWM-PS-K4	740-21027
0 … 320 mm	Red light	90° angle	NPN	Cable, 2 m, 4-wire	FT 18-2 RWM-NS-K4	740-21028
0 … 800 mm	Infrared	Straight	PNP	Metal plug, M12, 4-pin	FT 18-2 IDM-PS-L4	740-21029
0 … 800 mm	Infrared	Straight	NPN	Metal plug, M12, 4-pin	FT 18-2 IDM-NS-L4	740-21030
0 … 800 mm	Infrared	Straight	PNP	Cable, 2 m, 4-wire	FT 18-2 IDM-PS-K4	740-21031
0 … 800 mm	Infrared	Straight	NPN	Cable, 2 m, 4-wire	FT 18-2 IDM-NS-K4	740-21032

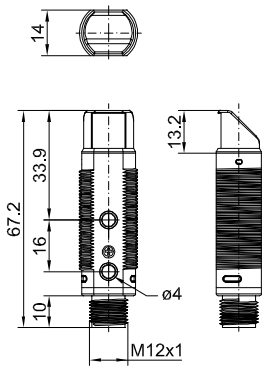
Plug connection (straight)



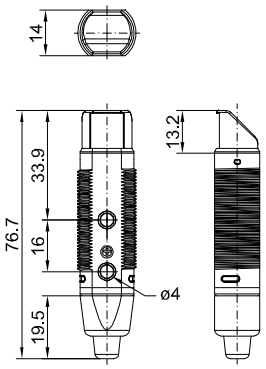
Cable connection (straight)



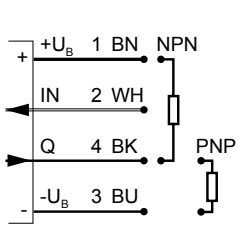
Plug connection (angled)



Cable connection (angled)



Connection, 4-pin



Light spot size	Straight		90° angle	
Scanning distance (mm)	200	400	150	300
Light spot diameter (mm)	Ø 14	Ø 27	Ø 14	Ø 25

Scope of delivery

- Sensor
- 2 x securing nuts

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

FT 18-2

Diffuse photoelectric proximity sensor

PRODUCT HIGHLIGHTS

- Economical solution for numerous applications
- Scanning distance of up to 800 mm, adjustable via potentiometer
- Red light or infrared
- Variants with angled light exit
- Robust plastic housings (IP 67)
- Simple adjustment via potentiometer
- 2 through holes as additional mounting possibility

Optical data	
Scanning distance	See Selection Table
Type of light	See Selection Table
Light spot size	See Selection Table

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via potentiometer
Adjustment possibilities	N.O./N.C. via control input (IN)
Default settings	Max. scanning distance and N.O.

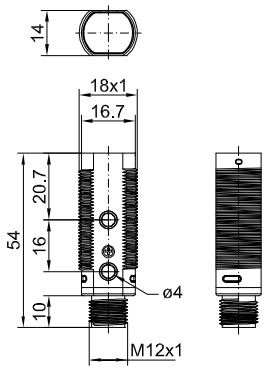
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	≤ 1 ms
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked open = normal operation

Mechanical data	
Dimensions	See dimensional drawings
Enclosure rating	IP 67[1]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-25 … +55 °C
Weight (plug device)	11 g[2] / 13 g[3]
Weight (cable device)	55 g[2] / 57g[3]

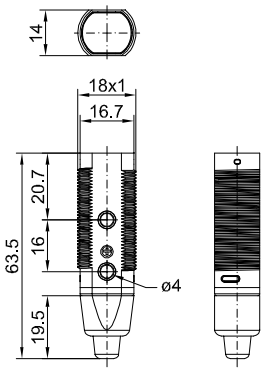
[1] With connected IP 67 plug [2] Straight light exit variant [3] Angled light exit variant

Scanning distance	Type of light	Light exit	Switching output	Type of connection	Part number	Article number
0 … 400 mm	Red light	Straight	PNP	Plug, M12, 4-pin	FT 18-2 R-PS-L4	740-21033
0 … 400 mm	Red light	Straight	NPN	Plug, M12, 4-pin	FT 18-2 R-NS-L4	740-21034
0 … 400 mm	Red light	Straight	PNP	Cable, 2 m, 4-wire	FT 18-2 R-PS-K4	740-21020
0 … 400 mm	Red light	Straight	NPN	Cable, 2 m, 4-wire	FT 18-2 R-NS-K4	740-21035
0 … 320 mm	Red light	90° angle	PNP	Plug, M12, 4-pin	FT 18-2 RW-PS-L4	740-21036
0 … 320 mm	Red light	90° angle	NPN	Plug, M12, 4-pin	FT 18-2 RW-NS-L4	740-21037
0 … 320 mm	Red light	90° angle	PNP	Cable, 2 m, 4-wire	FT 18-2 RW-PS-K4	740-21038
0 … 320 mm	Red light	90° angle	NPN	Cable, 2 m, 4-wire	FT 18-2 RW-NS-K4	740-21039
0 … 800 mm	Infrared	Straight	PNP	Plug, M12, 4-pin	FT 18-2 ID-PS-L4	740-21040
0 … 800 mm	Infrared	Straight	NPN	Plug, M12, 4-pin	FT 18-2 ID-NS-L4	740-21041
0 … 800 mm	Infrared	Straight	PNP	Cable, 2 m, 4-wire	FT 18-2 ID-PS-K4	740-21042
0 … 800 mm	Infrared	Straight	NPN	Cable, 2 m, 4-wire	FT 18-2 ID-NS-K4	740-21043

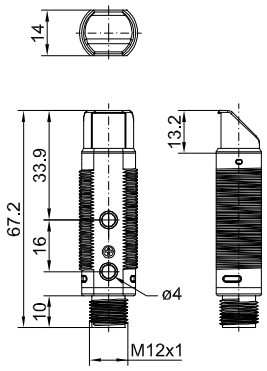
Plug connection (straight)



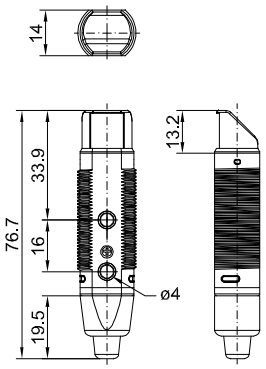
Cable connection (straight)



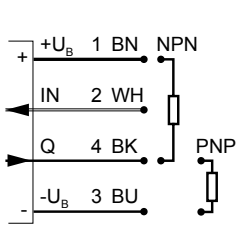
Plug connection (angled)



Cable connection (angled)



Connection, 4-pin



Light spot size	Straight		90° angle	
Scanning distance (mm)	200	400	150	300
Light spot diameter (mm)	Ø 14	Ø 27	Ø 14	Ø 25

Scope of delivery

Sensor
2 x securing nuts

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

FMS 18-34 B

Photoelectric proximity sensor

PRODUCT HIGHLIGHTS

- Scanning distance: 5 … 400 mm, adjustable
- Wide beam (large aperture angle)
- Separating seam
- Metal M18 threaded sleeve
- Contamination indicator

Optical data	
Scanning distance	5 … 400 mm[1]
Type of light	Infrared, 880 nm
Distance hysteresis	≤ 10 % of set scanning distance
Aperture angle	25°

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Indicator LED, red	Contamination indicator
Sensitivity adjustment	Via 18-step potentiometer
Default setting	Max. scanning distance

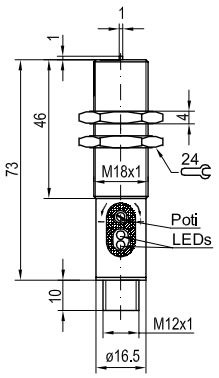
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 200 mA
Pull-up resistance	22 kΩ
Pull-down resistance	22 kΩ
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	See Selection Table
Output function	See Selection Table
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs

Mechanical data	
Dimensions	See dimensional drawings
Enclosure rating	IP 65[3]
Material, housing	Brass, nickel-plated
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-40 … +80 °C
Weight (plug device)	65 g
Weight (cable device)	165 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: Kodak white, 90 % reflectivity [2] 10 % ripple, within U_B [3] With connected IP 65 plug

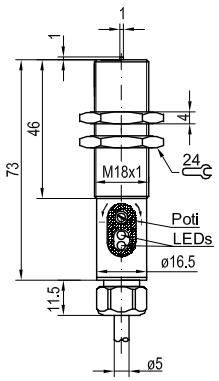
Scanning distance	Switching output	Type of connection	Part number	Article number
5 … 400 mm	PNP (N.O.) / NPN (N.O.)	Plug, M12x1, 4-pin	FMS 18-34 B-L4	516-50781
5 … 400 mm	PNP (N.O.) / NPN (N.O.)	Cable, 3 m, 4-wire	FMS 18-34 B	516-50782
5 … 400 mm	PNP (N.O.) / NPN (N.C.)	Cable, 3 m, 4-wire	FMS 18-34 B ONSP	516-50783

Plug connection



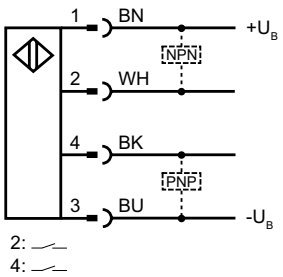
153-00032

Cable connection



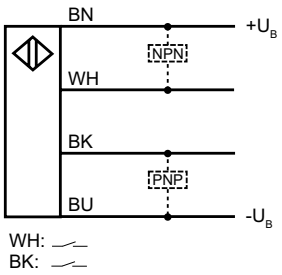
153-00031

Connection, 4-pin



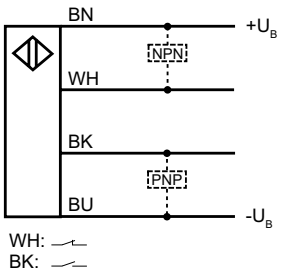
154-00211

Connection, 4-wire: FMS 18-34 B



154-00211

Connection, 4-wire: FMS 18-34 B ONSP



154-00213

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

FMS 30-34 B

Photoelectric proximity sensor

PRODUCT HIGHLIGHTS

- Scanning distance: 5 … 1000 mm, adjustable
- Wide beam (large aperture angle)
- Separating seam
- Metal M30 threaded sleeve
- Contamination indicator

Optical data	
Scanning distance	5 … 1000 mm[1]
Type of light	Infrared, 880 nm
Distance hysteresis	≤ 10 % of set scanning distance
Aperture angle	50°

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Indicator LED, red	Contamination indicator
Sensitivity adjustment	Via 18-step potentiometer

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 40 mA
Output current, Ie	≤ 200 mA
Pull-up resistance	22 kΩ
Pull-down resistance	22 kΩ
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	50 Hz

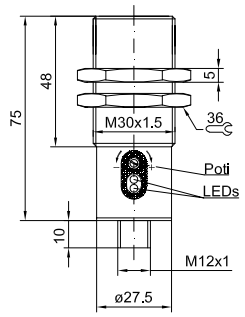
Mechanical data	
Dimensions	See dimensional drawings
Enclosure rating	IP 65[3]
Material, housing	Brass, nickel-plated
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-40 … +80 °C
Weight (plug device)	170 g
Weight (cable device)	280 g
Vibration and impact resistance	60947-5-2

[1] Reference material: white, 90 % reflectivity [2] 10 % ripple, within U_B [3] With connected IP 65 plug

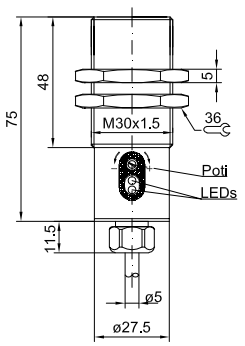
Scanning distance	Type of connection	Part number	Article number
5 … 1000 mm	Plug, M12x1, 4-pin	FMS 30-34 B-L4	550-51596
5 … 1000 mm	Cable, 3 m, 4-wire	FMS 30-34 B	550-51595

Version: 02/2015. Subject to changes; diagrams similar

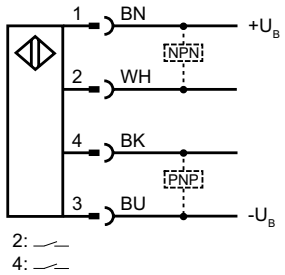
Plug connection



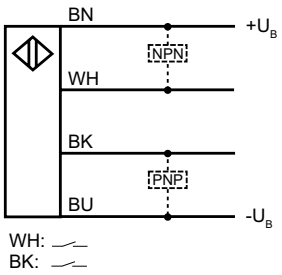
Cable connection



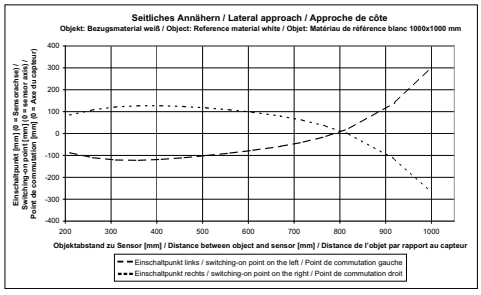
Connection, 4-pin



Connection, 4-wire



Switching characteristics, FMS 30-34 B



Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

FR 12 R

Retroreflective photoelectric sensor

PRODUCT HIGHLIGHTS

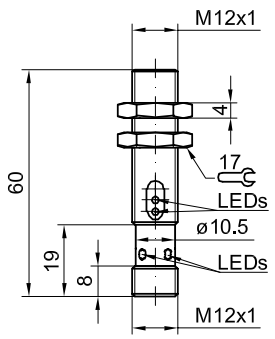
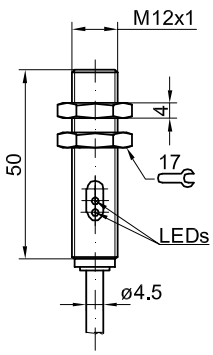
- Robust M12 metal housings with short mounting lengths
- Operating range: 60 … 1500 mm
- Red light, 660 nm
- Switching state and functional reserve indicators

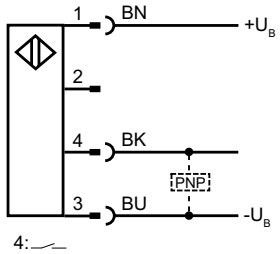
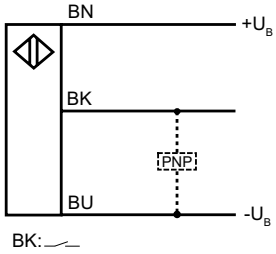
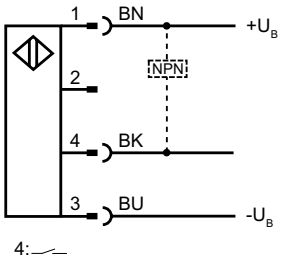
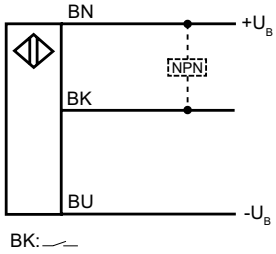
Optical data		Functions	
Scanning distance	60 … 1500 mm[1]	Indicator LED, green	Functional reserve indicator
Type of light	Red, 660 nm	Indicator LED, yellow	Switching state indicator
Light spot size	Ø 10 mm[2]	Scanning distance adjustment	Fixed setting
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 36 V DC	Dimensions (plug device)	M12 x 60 mm
No-load current, I_0	≤ 15 mA	Dimensions (cable device)	M12 x 50 mm
Output current, Ie	≤ 200 mA	Enclosure rating	IP 67[3]
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection	Material, housing	Brass, chromium-plated
		Material, front screen	Glass
Protection Class	2	Type of connection	See Selection Table
Power On Delay	20 msec	Ambient temperature: operation	-25 … +55 °C
Switching output, Q	PNP/NPN / max 200 mA	Weight (plug device)	20 g
Output function	N.O.	Weight (cable device)	100 g
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Vibration and impact resistance	IEC 60947-5-2
Response time	≤ 500 µs		

[1] Reference material: RD8 reflector, Ø 84 mm [2] At scanning distance of 50 mm [3] With connected IP 67 plug

Switching output	Type of connection	Part number	Article number
PNP	Plug, M12, 4-pin	FR 12 R-PSL4	703-11000
NPN	Plug, M12, 4-pin	FR 12 R-NSL4	703-11001
PNP	Cable, PVC, 3 x 0.34 mm², 2 m	FR 12 R-PSK3	703-11002
NPN	Cable, PVC, 3 x 0.34 mm², 2 m	FR 12 R-NSK3	703-11003

Version: 02/2015. Subject to changes; diagrams similar

Plug connection	Cable connection
 153-00250	 153-00249

Connection, 4-pin	Connection, 3-pin
 154-00224	 154-00160
 154-00489	 154-00488

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

FR 18-2

Retroreflective photoelectric sensor

PRODUCT HIGHLIGHTS

- Economical solution for numerous applications
- Range of up to 3.0 m
- Variants with angled light exit
- Robust metal housings (IP 67)
- Polarisation filter for reliable detection of highly reflective surfaces
- Simple adjustment via potentiometer
- 2 through holes as additional mounting possibility

Optical data	
Operating range	See Selection Table[1]
Type of light	See Selection Table
Polarising filter	Yes

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via potentiometer
Adjustment possibilities	N.O./N.C. via control input (IN)
Default settings	Max. scanning distance and N.O.

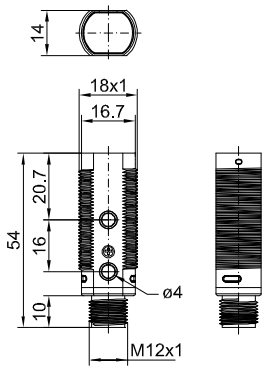
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	≤ 1 ms
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked open = normal operation

Mechanical data	
Dimensions	See dimensional drawings
Enclosure rating	IP 67[2]
Material, housing	Brass, nickel-plated
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-25 … +55 °C
Weight (plug device)	34 g[3] / 36 g[4]
Weight (cable device)	74 g[3] / 76 g[4]

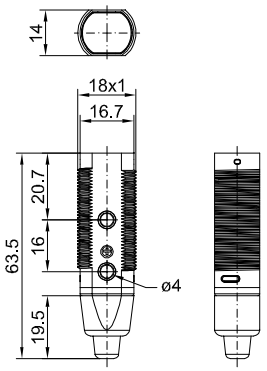
[1] Reference material: R5 reflector [2] With connected IP 67 plug [3] Straight light exit variant [4] Angled light exit variant

Operating range	Type of light	Light exit	Switching output	Type of connection	Part number	Article number
3.0 m	Red light	Straight	PNP	Metal plug, M12, 4-pin	FR 18-2 RM-PS-L4	741-11014
3.0 m	Red light	Straight	NPN	Metal plug, M12, 4-pin	FR 18-2 RM-NS-L4	741-11015
3.0 m	Red light	Straight	PNP	Cable, 2 m, 4-wire	FR 18-2 RM-PS-K4	741-11016
3.0 m	Red light	Straight	NPN	Cable, 2 m, 4-wire	FR 18-2 RM-NS-K4	741-11017
2.4 m	Red light	90° angle	PNP	Metal plug, M12, 4-pin	FR 18-2 RWM-PS-L4	741-11018
2.4 m	Red light	90° angle	NPN	Metal plug, M12, 4-pin	FR 18-2 RWM-NS-L4	741-11019
2.4 m	Red light	90° angle	PNP	Cable, 2 m, 4-wire	FR 18-2 RWM-PS-K4	741-11020
2.4 m	Red light	90° angle	NPN	Cable, 2 m, 4-wire	FR 18-2 RWM-NS-K4	741-11021

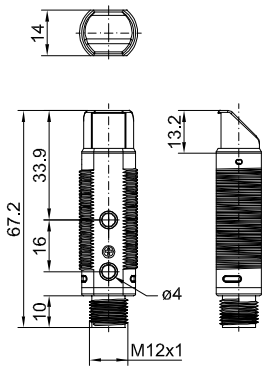
Plug connection (straight)



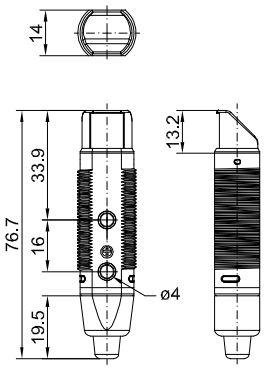
Cable connection (straight)



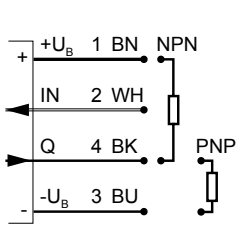
Plug connection (angled)



Cable connection (angled)



Connection, 4-pin



Scope of delivery

- Sensor
- Reflector: 53.4 x 53.4 mm²
- 2 x securing nuts

Accessories

Reflectors	From Page A-18
Connection cables	From Page A-34
Brackets	From Page A-4

FR 18-2

Retroreflective photoelectric sensor

PRODUCT HIGHLIGHTS

- Economical solution for numerous applications
- Range of up to 3.60 m
- Variants with angled light exit
- Robust plastic housings (IP 67)
- Simple adjustment via potentiometer
- 2 through holes as additional mounting possibility

Optical data	
Operating range	See Selection Table[1]
Type of light	See Selection Table
Polarising filter	No

Functions	
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via potentiometer
Adjustment possibilities	N.O./N.C. via control input (IN)
Default settings	Max. scanning distance and N.O.

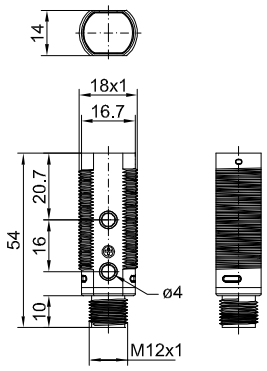
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	≤ 1 ms
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked open = normal operation

Mechanical data	
Dimensions	See dimensional drawings
Enclosure rating	IP 67[2]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-25 … +55 °C
Weight (plug device)	11 g[3] / 13 g[4]
Weight (cable device)	55 g[3] / 57 g[4]

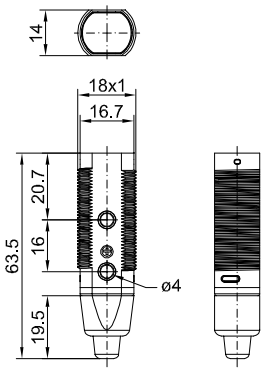
[1] Reference material: R5 reflector [2] With connected IP 67 plug [3] Straight light exit variant [4] Angled light exit variant

Operating range	Type of light	Light exit	Switching output	Type of connection	Part number	Article number
3.6 m	Infrared	Straight	PNP	Plug, M12, 4-pin	FR 18-2 I-PS-L4	741-11022
3.6 m	Infrared	Straight	NPN	Plug, M12, 4-pin	FR 18-2 I-NS-L4	741-11023
3.6 m	Infrared	Straight	PNP	Cable, 2 m, 4-wire	FR 18-2 I-PS-K4	741-11024
3.6 m	Infrared	Straight	NPN	Cable, 2 m, 4-wire	FR 18-2 I-NS-K4	741-11025
2.5 m	Infrared	90° angle	PNP	Plug, M12, 4-pin	FR 18-2 IW-PS-L4	741-11026
2.5 m	Infrared	90° angle	NPN	Plug, M12, 4-pin	FR 18-2 IW-NS-L4	741-11027
2.5 m	Infrared	90° angle	PNP	Cable, 2 m, 4-wire	FR 18-2 IW-PS-K4	741-11028
2.5 m	Infrared	90° angle	NPN	Cable, 2 m, 4-wire	FR 18-2 IW-NS-K4	741-11029

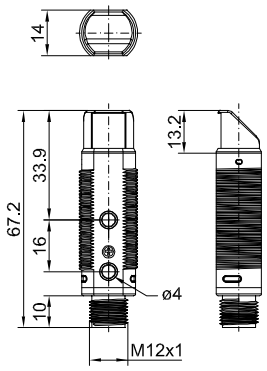
Plug connection (straight)



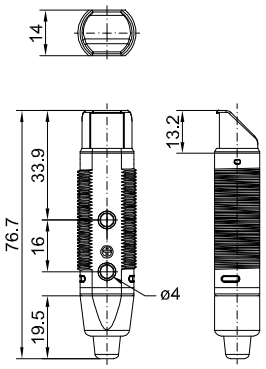
Cable connection (straight)



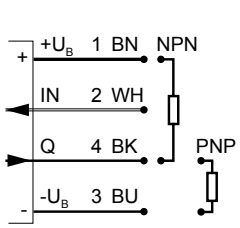
Plug connection (angled)



Cable connection (angled)



Connection, 4-pin



Scope of delivery

- Sensor
- Reflector: 53.4 x 53.4 mm²
- 2 x securing nuts

Accessories

Reflectors	From Page A-18
Connection cables	From Page A-34
Brackets	From Page A-4

FS/FE 12 RL

Laser through-beam photoelectric sensor

PRODUCT HIGHLIGHTS

- Fine, parallel light beam
- Small part detection to 0.2 mm at a max. distance of 1 m
- Simple installation thanks to standard M12 metal thread
- Control line for setting of 3 sensitivity levels
- Test input

Optical data	
Range	0 … 5 m
Type of light	Laser, red, 650 nm
Laser Class (DIN EN 60825-1:2008-5)	2

Functions	
Indicator LED, yellow	Switching state indicator
Sensitivity adjustment	Via control line

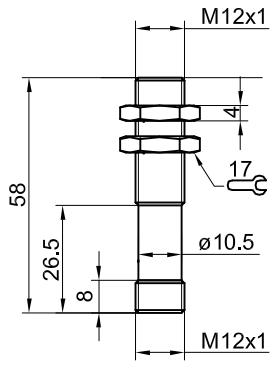
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	10 kHz
Control input, Test, transmitter	$-U_B$: transmitter = off $+U_B$ or Open: transmitter = on
Control input, Gain, receiver[1]	1 Open= medium sensitivity 2 $-U_B$ = high sensitivity 3 $+U_B$ = low sensitivity

Mechanical data	
Dimensions	M12 x 58 mm
Enclosure rating	IP 67[2]
Material, housing	Brass, nickel-plated
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (transmitter / receiver)	30 g

[1] Change in Gain setting is only effective after renewed switch on / switch off [2] With connected IP 67 plug

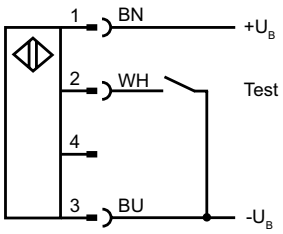
Transmitter / receiver	Switching output	Type of connection	Part number	Article number
Receiver	PNP N.O.	Plug, M12, 4-pin	FE 12 RL-PS-L4	580-51402
Receiver	PNP N.C.	Plug, M12, 4-pin	FE 12 RL-PO-L4	580-51403
Receiver	NPN N.C.	Plug, M12, 4-pin	FE 12 RL-NS-L4	580-51405
Transmitter	–	Plug, M12, 4-pin	FS 12 RL-L4	580-51401

Plug connection (transmitter / receiver)



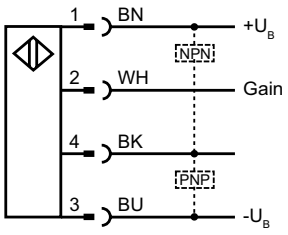
153-00345

Connection, transmitter, 4-pin



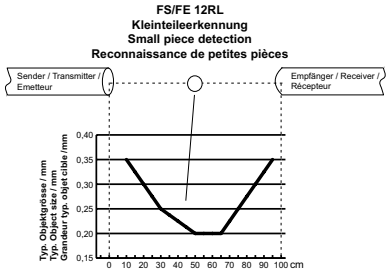
154-00171

Connection, receiver, 4-pin: PNP/NPN



154-00265

Small part detection



155-00215

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

FSE 18-2

Through-beam photoelectric sensor

PRODUCT HIGHLIGHTS

- Economical solution for numerous applications
- Long range of up to 10 m
- Robust metal housings (IP 67)
- Simple adjustment via potentiometer
- 2 through holes as additional mounting possibility

Optical data	
Operating range	10 m
Type of light	See Selection Table

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via potentiometer
Adjustment possibilities	N.O./N.C. via control input (IN)
Default settings	Max. scanning distance and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 400 Hz
Response time	≤ 2.5 ms
Control input, IN	$+U_B$ = Test (transmitter off) $-U_B$ / open = normal operation

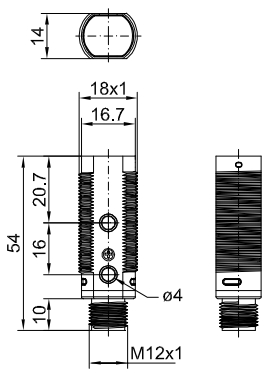
Mechanical data	
Dimensions	See dimensional drawings
Enclosure rating	IP 67[1]
Material, housing	Brass, nickel-plated
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-25 … +55 °C
Weight (plug device)	46 g
Weight (cable device)	130 g

[1] With connected IP 67 plug

Transmitter / receiver	Type of light	Light exit	Switching output	Type of connection	Part number	Article number
Transmitter / receiver	Infrared	Straight	PNP	Metal plug, M12, 4-pin	FSE 18-2 IM-PS-L4	742-51004
Transmitter / receiver	Infrared	Straight	NPN	Metal plug, M12, 4-pin	FSE 18-2 IM-NS-L4	742-51005
Transmitter / receiver	Infrared	Straight	PNP	Cable, 2 m, 4-wire	FSE 18-2 IM-PS-K4	742-51006
Transmitter / receiver	Infrared	Straight	NPN	Cable, 2 m, 4-wire	FSE 18-2 IM-NS-K4	742-51007

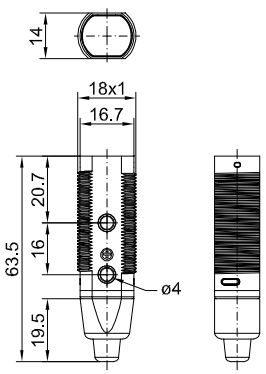
Scope of delivery
Transmitter & receiver
2 x securing nuts

Plug connection



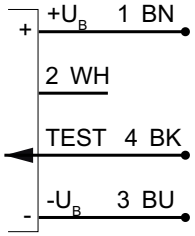
153-00985

Cable connection



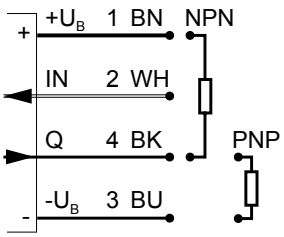
153-00984

Connection, 4-pin (transmitter)



154-00516

Connection, 4-pin (receiver)



154-00312

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

FS/FE 18 RL

Laser through-beam photoelectric sensor

PRODUCT HIGHLIGHTS

- Operating range: 50 m
- Small housings
- Red light laser, 650 nm
- Control line for setting of 3 sensitivity levels
- Test input

Optical data	
Operating range	0 … 50 m
Type of light	Laser, pulsed, red, 650 nm
Laser Class (DIN EN 60825-1:2008-5)	2

Functions	
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via control line

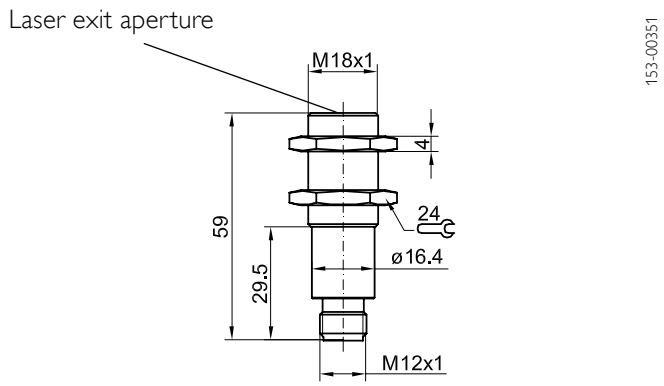
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	≤ 10000 Hz
Response time	50 µs
Control input, Test	Test input (transmitter) $-U_B$: transmitter = off $+U_B$ or Open: transmitter = on
Control input, Gain	Open: medium sensitivity – medium distance[1] $-U_B$: high sensitivity – high distance[1] $+U_B$: low sensitivity – low distance

Mechanical data	
Dimensions (plug device)	M18x1 x 59 mm
Enclosure rating	IP 67[2]
Material, housing	Brass, nickel-plated
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (transmitter / receiver)	70 g

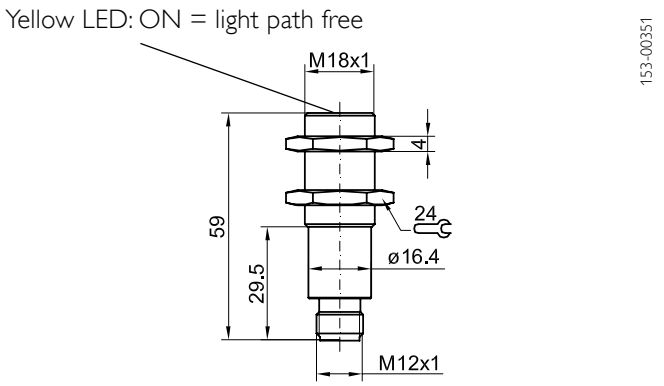
[1] Change in Gain setting is only effective after renewed switch on / switch off [2] With connected IP 67 plug

Transmitter / receiver	Switching output	Type of connection	Part number	Article number
Receiver	PNP	Plug, M12x1, 4-pin	FE 18 RL-PS-L4	580-51400
Receiver	NPN	Plug, M12x1, 4-pin	FE 18 RL-NS-L4	580-51399
Transmitter	–	Plug, M12x1, 4-pin	FS 18 RL-L4	580-51398

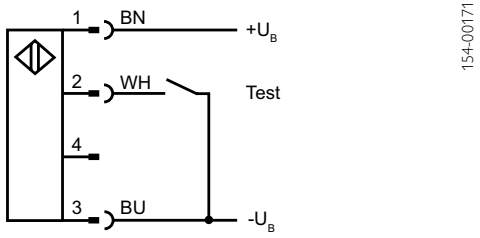
Plug connection (transmitter)



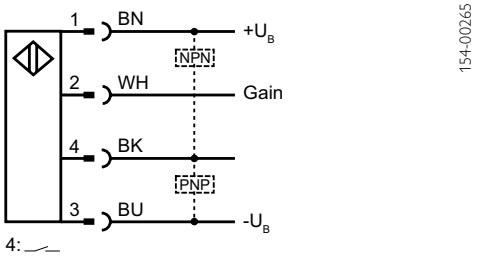
Plug connection (receiver)



Connection, 4-pin (transmitter)



Connection, 4-pin (receiver)



Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

8

FLS 18W / FLE 18W

Laser through-beam photoelectric sensor

PRODUCT HIGHLIGHTS

- Operating range: 50 m
- Red light laser, 650 nm
- Transmitter beam can be focused according to application
- Accuracy adjustable via beam spot size
- Smallest detectable part: 0.03 mm
- Switching frequency, 6000 Hz
- Metal M18 threaded sleeve

Optical data	
Operating range	0 … 50 m
Type of light	Laser, red, 650 nm
Laser Class (DIN EN 60825-1:2008-5)	2

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Indicator LED, red	Contamination indicator
Sensitivity adjustment	Via 18-step potentiometer
Default settings	Max. operating range

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP
Output function	N.O./N.C. (see Selection Table)
Switching frequency, f (ti/tp 1:1)	≤ 6000 Hz
Response time	83 µs
Control input, Test	< 2 V: transmitter off > 10 V or Open: transmitter on

Mechanical data	
Dimensions	See dimensional drawings
Enclosure rating	IP 65[2]
Material, housing	Brass, nickel-plated
Type of connection	See Selection Table
Ambient temperature: operation	-10 … +50 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	85 g
Weight (cable device)	190 g

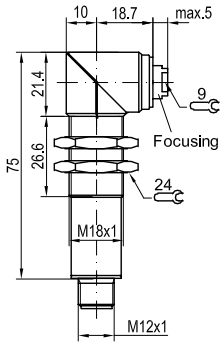
[1] 10 % ripple, within U_B [2] With connected IP 65 plug

Transmitter / receiver	Switching output	Type of connection	Part number	Article number
Transmitter	–	Plug, M12x1, 4-pin	FLS 18W-L4	580-51408
Receiver	PNP (N.O./N.C.)	Plug, M12x1, 4-pin	FLE 18W-L4	580-51414
Receiver	PNP (N.C.)	Plug, M12x1, 4-pin	FLE 18W-L4-15	580-51415
Transmitter	–	Cable, 3 m, 4-wire	FLS 18W	580-51409
Receiver	PNP (N.O./N.C.)	Cable, 3 m, 4-wire	FLE 18W	580-51416
Receiver	PNP (N.C.)	Cable, 3 m, 4-wire	FLE 18W-15	580-51417

Accessories	
Connection cables	From Page A-34
Brackets	From Page A-4

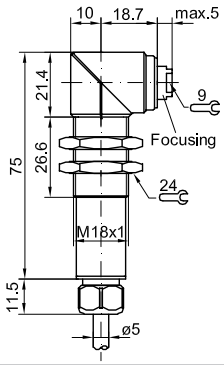
Version: 02/2015. Subject to changes; diagrams similar

Plug connection (transmitter): FLS 18W-L4



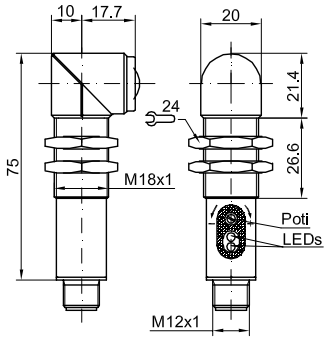
153-00052

Cable connection, (transmitter): FLS 18W



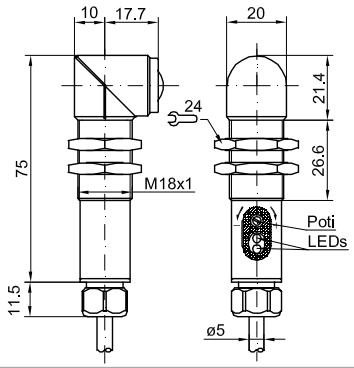
153-00050

Plug connection (receiver): FLE 18W-L4 / FLE 18W-L4-15



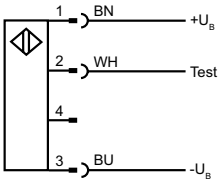
153-00053

Cable connection, (receiver): FLE 18W / FLE 18W-15



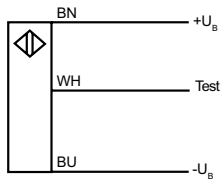
153-00051

Connection, 4-pin (transmitter)



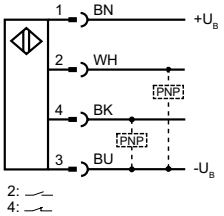
154-00231

Connection, 4-wire (transmitter)



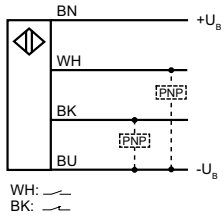
154-00231

Connection, 4-pin (receiver): FLE 18W



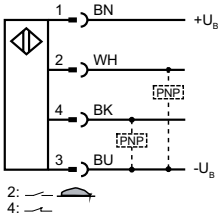
154-00230

Connection, 4-wire (receiver): FLE 18W



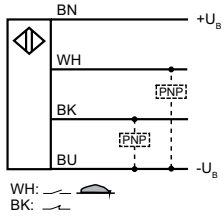
154-00230

Connection, 4-pin (receiver): FLE 18W-L4-15



154-00464

Connection, 4-wire (receiver): FLE 18W-15



154-00464

FLS 18WM / FLE 18WM

Laser through-beam photoelectric sensor with air tube

PRODUCT HIGHLIGHTS

- Ideal for drill breakage control
- Air tube prevents malfunction
- Easily visible and focusable laser light spot
- Minimum detectable drill 1 mm
- High switching frequency, 6000 Hz

Optical data	
Operating range	< 5 m
Type of light	Laser, red, 650 nm
Laser Class (DIN EN 60825-1:2008-5)	2
Max. resolution	0.3 mm

Functions	
Indicator LED, green (receiver FLE)	Operating voltage indicator
Indicator LED, yellow (receiver FLE)	Switching output indicator
Indicator LED, red (receiver FLE)	Contamination indicator
Sensitivity adjustment	Via 18-step potentiometer
Default settings	Max. operating range

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
No-load current, I_0 (transmitter FLS)	≤ 10 mA
No-load current, I_0 (receiver FLE)	≤ 15 mA
Output power (transmitter FLS)	< 1 mW
Output current, Ie (receiver FLE)	≤ 200 mA
Voltage drop at signal output (receiver)	≤ 2,4 V
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2[2]
Power On Delay	≤ 300 ms
Switching output, Q	PNP, antivalent
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 6000 Hz
Response time/drop-out delay (transmitter)	83 µs
Connection BK	N.C.
Connection WH	Contamination output: N. O.

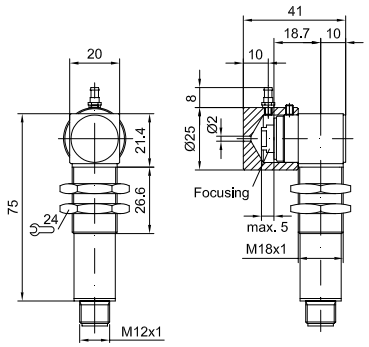
Mechanical data	
Dimensions	See dimensional drawings
Enclosure rating	IP 65[3]
Material, housing	Brass, nickel-plated
Material air tube	Aluminium, black anodized
Type of connection	Plug, M12x1, 4-pin
Connection air tube	Tube, inside Ø-3 mm
Ambient temperature: operation (transmitter FLS)	-10 … +50 °C
Ambient temperature: operation (receiver FLE)	-10 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight	approx. 85 g

[1] Max. 10 % ripple, within U_B [2] U_{imp} = 500 V [3] With connected IP 65 plug

Transmitter / receiver	Switching output	Type of connection	Part number	Article number
Receiver	PNP, antivalent	Plug, M12x1, 4-pin	FLE 18WM-L4-X01	580-51440
Transmitter	–	Plug, M12x1, 4-pin	FLS 18WM-L4-X01	580-51439
Receiver	PNP, antivalent	Plug, M12x1, 4-pin	FLE 18WM-L4-X02	580-51447
Transmitter	–	Plug, M12x1, 4-pin	FLS 18WM-L4-X02	580-51446

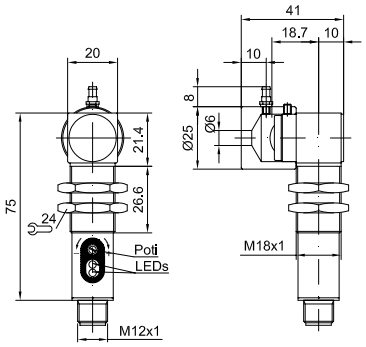
Version: 02/2015. Subject to changes; diagrams similar

Plug connection (transmitter): FLS 18WM-L4-X01



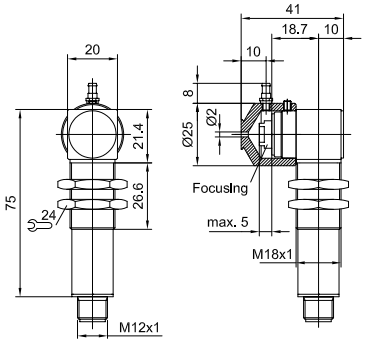
153-00769

Plug connection, (receiver): FLE 18WM-L4-X01



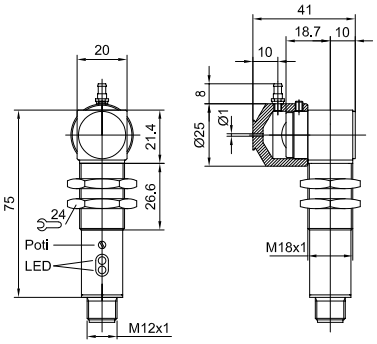
153-00770

Plug connection (transmitter): FLS 18WM-L4-X02



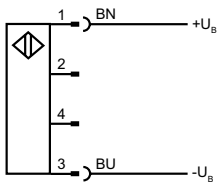
153-00767

Plug connection, (receiver): FLE 18WM-L4-X02



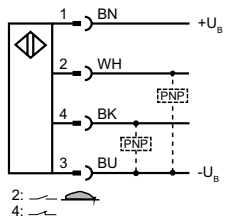
153-00768

Connection, 4-pin (transmitter)



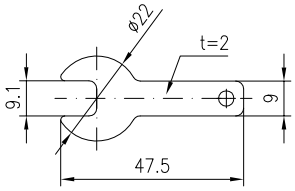
154-00455

Connection, 4-pin (receiver)



154-00464

Focus key



154-01124

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

FLS 18 / FLE 18

Laser through-beam photoelectric sensor

PRODUCT HIGHLIGHTS

- Operating range: 50 m
- Red light laser, 650 nm
- Transmitter beam can be focused according to application
- Accuracy adjustable via beam spot size
- Smallest detectable part: 0.03 mm
- Switching frequency, 6000 Hz
- Metal M18 threaded sleeve

Optical data	
Operating range	0 … 50 m
Type of light	Laser, red, 650 nm
Laser Class (DIN EN 60825-1:2008-5)	2

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Indicator LED, red	Contamination indicator
Sensitivity adjustment	Via 18-step potentiometer
Default settings	Max. operating range

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP
Output function	N.O./N.C. (see Selection Table)
Switching frequency, f (ti/tp 1:1)	≤ 6000 Hz
Response time	83 µs
Control input, Test	< 2 V: transmitter off > 10 V or Open: transmitter on

Mechanical data	
Dimensions	See dimensional drawings
Enclosure rating	IP 65[2]
Material, housing	Brass, nickel-plated
Type of connection	See Selection Table
Ambient temperature: operation	-10 … +50 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	85 g
Weight (cable device)	190 g

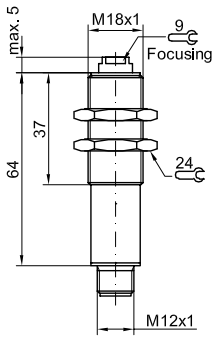
[1] 10 % ripple, within U_B [2] With connected IP 65 plug

Transmitter / receiver	Switching output	Type of connection	Part number	Article number
Transmitter	–	Plug, M12x1, 4-pin	FLS 18-L4	580-51406
Receiver	PNP (N.O./N.C.)	Plug, M12x1, 4-pin	FLE 18-L4	580-51410
Receiver	PNP (N.C.)	Plug, M12x1, 4-pin	FLE 18-L4-15	580-51411
Transmitter	–	Cable, 3 m, 4-wire	FLS 18	580-51407
Receiver	PNP (N.O./N.C.)	Cable, 3 m, 4-wire	FLE 18	580-51412
Receiver	PNP (N.C.)	Cable, 3 m, 4-wire	FLE 18-15	580-51413

Accessories	
Connection cables	From Page A-34
Brackets	From Page A-4

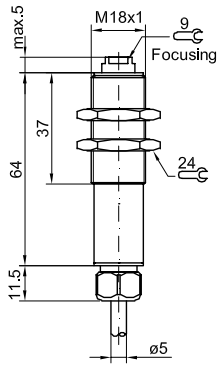
Version: 02/2015. Subject to changes; diagrams similar

Plug connection (transmitter): FLS 18-L4



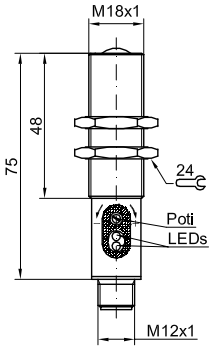
153-00057

Cable connection, (transmitter): FLS 18



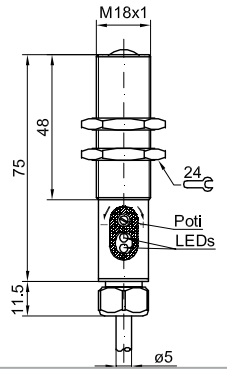
153-00055

Plug connection (receiver): FLE 18-L4 / FLE 18-L4-15



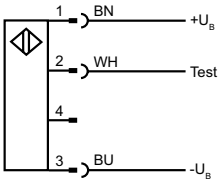
153-00058

Cable connection, (receiver): FLE 18 / FLE 18-15



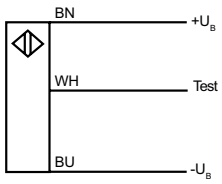
153-00056

Connection, 4-pin (transmitter)



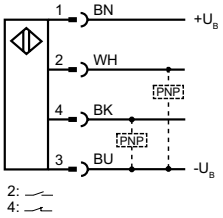
154-00231

Connection, 4-wire (transmitter)



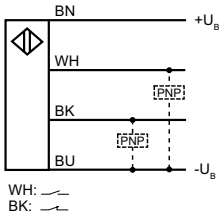
154-00231

Connection, 4-pin (receiver): FLE 18-L4



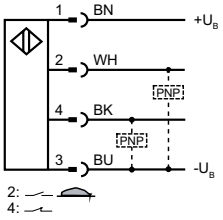
154-00230

Connection, 4-wire (receiver): FLE 18



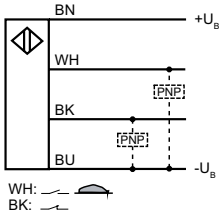
154-00230

Connection, 4-pin (receiver): FLE 18-L4-15



154-00464

Connection, 4-wire (receiver): FLE 18-15



154-00464

8

FMF 18-34

Filling level sensor

CE

PRODUCT HIGHLIGHTS

- Sensor with glass rod prism for detecting liquids
- M16 x 1.5 thread for screwing into containers and pipes
- Reliable differentiation between liquids and foam
- Stainless steel

Optical data	
Scanning distance	(See Functional Principle)
Type of light	Infrared, pulsed, 880 nm
Ambient light limit	1200 Lux

Functions	
Default settings	Switching process on submersion in a medium
Condition	The refractive index of a liquid must be at least 1.20 Examples: reference air = 880 nm air = ca. 1.00 water= ca. 1.33 benzene = ca. 1.50 alcohol = ca. 1.32

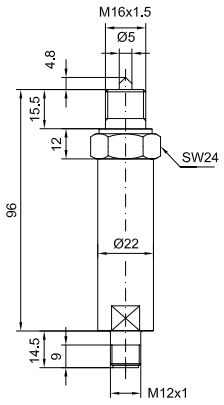
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 200 mA
Pull-up resistance	22 kΩ
Pull-down resistance	22 kΩ
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection
Protection Class	2
Switching output, Q	PNP/NPN, antivalent
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs

Mechanical data	
Dimensions	See dimensional drawings
Enclosure rating	IP 65[2]
Material, housing	Stainless steel, V2A
Material, front screen	Glass
Type of connection	See Selection Table
Pressure resistance	10 bar
Impact resistance	EN 60947-5-2
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-40 … +80 °C
Weight (plug device)	140 g

[1] 10 % ripple, within U_B [2] With connected IP 65 plug

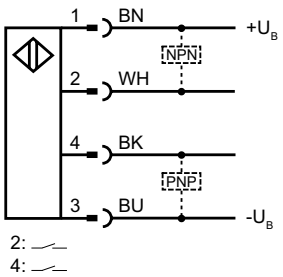
Scanning distance	Type of connection	Part number	Article number
(See Functional Principle)	Plug, M12x1, 4-pin	FMF 18-34 L4-SP	504-50929

Plug connection



153-00765

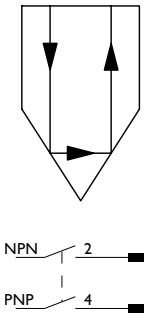
Connection, 4-pin



154-00211

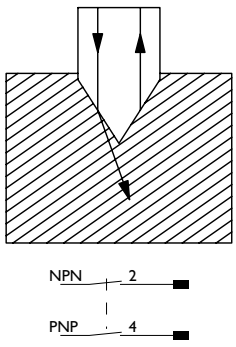
Functional Principle

Total reflection at glass/air boundary layer.



155-00928

Refraction at glass/liquid boundary layer.



155-00929

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4

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