

# Distance sensors

Measurement from 20 mm to 250 m

## Optical distance sensors

from Page 188

### FT 25

- Operating range (scanning distance) from 20 mm to 200 mm
- LED short-range distance sensors using the triangulation principle
- Miniature housing for simple integration
- Analogue output 0 ... 10 V

from Page 194

### FT 50

- Operating range (scanning distance) from 30 to 300 mm
- High absolute accuracy
- High measurement frequency
- Laser distance sensors using the triangulation principle
- High precision thanks to resolution of up to 7  $\mu\text{m}$
- RS485 and analogue interfaces

from Page 194

### FT 80

- Operating range (scanning distance) from 250 mm to 750 mm
- High repeatability
- Laser distance sensors using the triangulation principle
- RS485 and analogue interfaces

from Page 206

### F 55 / F 90 / F 91 / F 92

- Laser distance sensors using the time-of-flight principle
- Scanner versions up to measurement distance of 10 m
- Reflector versions up to 250 m range
- Wide choice of interfaces (serial and analogue)



Rapid and precise measurement, accurate positioning, and detection of the most varied of materials – distance measurement is a central requirement in many areas of automation technology. Whether for checking the winding of coils with millimetre accuracy, the detection of double sheets, or the accurate positioning of storage and retrieval machines – distance sensors from SensoPart are reliable tools for many purposes in the following sectors:

- The automotive and supplier industries
- Mechanical engineering and special machine construction
- Assembly and handling
- The packaging industry
- Handling and warehousing systems
- The steel industry
- The textile and paper industries
- The wood industry

**The technologies used are as varied as the applications.**

Our optical sensors use the triangulation process for operating ranges below 1 m, and time-of-flight measurement for longer operating distances. Apart from optical sensors, ultrasonic sensors are also used for transparent or strongly reflective materials, in particular, and inductive sensors are employed for metal objects at close-range and in harsh operating conditions.



Monorail system with car bodies in the automotive industry



Car production  
Positioning the body using distance sensors

from Page 226

**FR 85 Rail Pilot**

- Distance sensors using the time-of-flight principle
- Specialised solution for anti-collision applications on monorails
- Cornering also possible
- Large aperture angle, thus long detection range



Ultrasonic distance sensors  
from Page 594

- Distance sensors using the ultrasonic time-of-flight principle
- Cubic and cylindrical housings
- Large portfolio for differing measurement ranges
- Reliable operation with all surfaces and colours – and especially with transparent objects



Inductive distance sensors  
from Page 644

- Long switching distances up to 10 mm with accurate linear measurement range
- Distance measurement on metals according to the inductive principle
- Various housings
- High accuracy and long linear measurement range



Eyesight vision systems  
from Page 142

- 2D camera technology for measuring e.g. moulded and turned parts
- Versatile measurement tool for all dimensional accuracy tasks
- Image and result visualisation in inspection mode



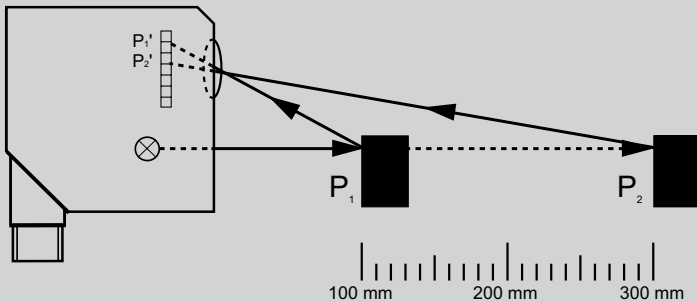
# Distance sensors

## System description

### Distance measurement using triangulation

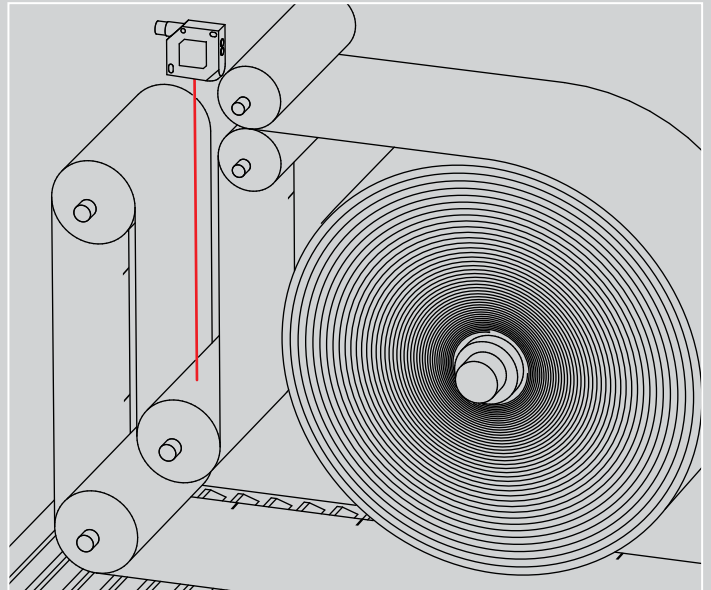
The measurement principle of optical triangulation is suitable for the precise determination of distances at close range. With the help of special receiver optics and a position-sensitive detector (e.g. a photodiode line), the sensor can determine the object distance regardless of its reflectivity (see illustration below). The colour and surface properties (e.g. highly reflective) thus have practically no effect on measurement accuracy.

The FT 50 RLA laser distance sensor provides a signal proportional to the distance, transmitted via the analogue output (e.g. 4 ... 20 mA) or a serial RS485 interface. The switching range of the digital outputs can be set to any zone within the operating range using teach-in.



**The triangulation process:** with the help of a line-shaped position-sensitive detector, the distance sensor measures the distance to the object regardless of the amount of light reflected.

The light reflected back from the object ( $P_1$ ) hits the line at point  $P_1'$ . The sensor determines the distance signal from this. The light correspondingly hits the detector at a different point ( $P_2'$ ) at object distance  $P_2$ .



Dancer roll control using the FT 50 RLA-220 laser distance sensor

### Collision prevention sensors for monorails

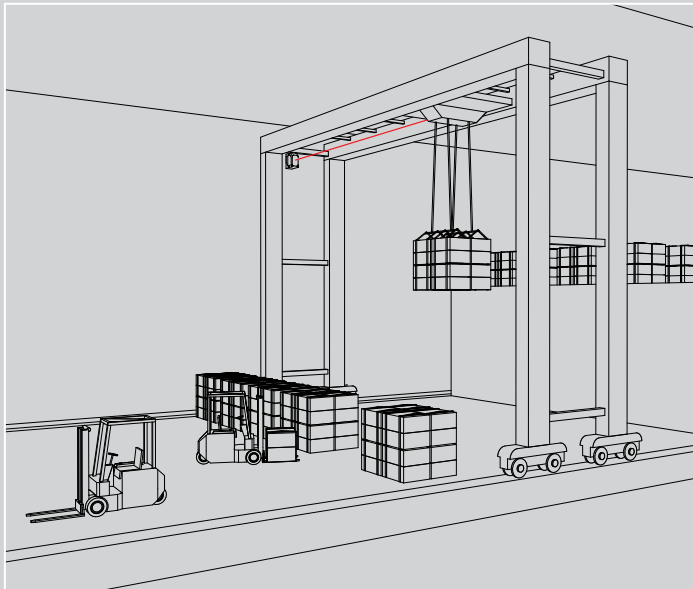
Collision prevention on monorail systems in car production is a special distance measurement task. The FR 85 series was specially developed for this application. These sensors provide excellent measurement results regardless of the reflectivity of the target object, and their comprehensive range of functions is impressive.

The FR 85 offers high measurement accuracy and immunity to ambient light because it is based on time-of-flight technology. A long measurement range (up to 6 m) and flexibly adjustable protection field geometries allow adaptation to the situation on site, even when cornering.

### Distance measurement using time-of-flight

SensoPart uses time-of-flight technology to measure longer distances (up to 250 m). The sensor emits pulsed laser light that is reflected by the target object. The distance to the object is determined by the time taken between emission and reception of the light.

The use of pulsed light provides reliable background suppression and very high immunity to ambient light. The distance sensors of the F 90 series, using time-of-flight technology, measure distances of up to 250 m with a high level of accuracy. The sensors are particularly suitable for use on production lines and in handling and warehousing systems due to their reliable detection and long ranges or scanning distances.



Crane positioning with FR 92 distance sensor

### Inductive analogue sensors

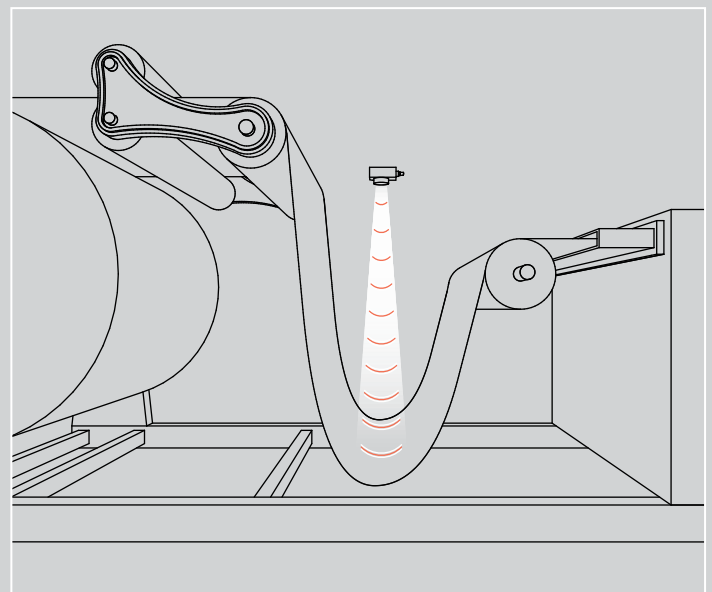
The reasonably priced solution for metallic objects. Compared to optical or ultrasonic sensors, inductive distance sensors have only limited ranges. They are still used under harsh conditions, in particular, as a result of their great robustness.

- Inductive distance sensors with analogue output of 4 ... 20 mA
- Operating range of 0 ... 6 mm to 4.5 ... 12 mm
- Falling characteristic line on approach
- Robust metal housings

### Ultrasonic sensors

Ultrasonic sensors are the right choice for materials with which optical systems cannot be reliably operated. Ultrasonic sensors work using the time-of-flight of sound. The sensor emits ultrasonic pulses. The target object reflects the sound. The sensor measures the time-of-flight of the pulse and calculates the distance value. This value is transmitted to the controller as a current or voltage signal.

- Operating ranges from 20 ... 6000 mm
- Operating range and analogue output adjustable via teach-in
- Analogue output 0 ... 10 V / 4 ... 20 mA




Monitoring throughput with the UT 20 ultrasonic sensor

# FT 25-RA – optical short-range distance sensors

The compact class for measurement and regulatory tasks



 made in Germany



## FT 25-RA for dancer roll regulation

The precise control of the FT 25-RA ensures a constant tension of the paper roll during unwinding.

## TYPICAL FT 25-RA

- Operating range: 20 ... 80 mm / 30 ... 200 mm
- Distance sensor with 1 ... 10V analogue output
- Easily integratable ultra-compact ABS housing: 34 x 12 x 20 mm
- High precision and high repeatability – especially for control tasks
- Resolution: from 0.12 mm
- Two adjustable switching points as window mode for 2-point control
- Teach-in operation



## In a miniature housing

The FT 25-RA is also suitable for limited installation spaces thanks to its compact dimensions of 34 x 12 x 20 mm<sup>3</sup>.

In addition to its analogue voltage output the small distance sensors also have a switching output and offer the possibility of defining a switching window by means of two switching points. Thanks to their simple operation, these sensors are suitable for straightforward measurement and control tasks at distances of up to 200 mm.

**Key applications:**

- Dancer roll regulation, sag monitoring
- Determining the roll diameter of an unwinding machine
- Stacking height measurement, double layer detection and height measurements in the wood processing, packaging- and handling industry
- Distance measurement and positioning on robot grippers in „pick & place“ applications

FT 25-RA / FT 20 RA – Product Overview			
	Operating range	Special features	Page
FT 25-RA	20 ... 80 mm / 30 ... 200 mm	Small housing with long range	190
FT 20 RA	20 ... 80 mm	Small housing	192

# FT 25-RA

## Miniature distance sensor



### PRODUCT HIGHLIGHTS

- Miniature housing with measurement ranges up to 200 mm for an easy integration and high flexibility
- High linearity and high repeatability for precise control tasks
- Almost surface independent detection on homogeneous object surfaces
- Invertible analogue characteristic
- Window mode e.g. for two-step controls separately adjustable

Optical data		Functions	
Measurement range	20 ... 80 mm <sup>1</sup>	30 ... 200 mm <sup>1</sup>	Indicator LED, green
Resolution	0.12 mm (12-bit)	0.68 mm (12-bit)	Indicator LED, yellow
Linearity	± 0.4 mm <sup>2</sup>	± 2 mm <sup>2</sup>	Measurement range adjustment
Repeatability	< 0.4 mm <sup>2,3</sup>	< 1 mm <sup>2,3</sup>	Adjustment possibilities
Type of light	LED, red, 632 nm	LED, red, 632 nm	Default settings
			Operating voltage indicator
			Switching output indicator
			Via Teach-in button
			Analogue measurement range Q <sub>A</sub>
			Invertible analogue characteristic
			Switching output Q (window mode)
			N.O./N.C. via teach-in button
			See Table
Electrical data		Mechanical data	
Operating voltage, +U <sub>B</sub>	13 ... 30V DC	Dimensions	34 × 20 × 12 mm
No-load current, I <sub>0</sub>	≤ 30 mA	Enclosure rating	IP 67 / IP 69K <sup>4</sup>
Output current, I <sub>e</sub> Q	≤ 100 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U <sub>B</sub> / short-circuit protection (Q)	Material, front screen	PMMA
Protection Class	2	Type of connection	See Selection Table
Power On Delay	< 300 ms	Ambient temperature: operation	-20 ... +60 °C <sup>5</sup>
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
Max. capacitive load Q	10 nF	Resistance to vibrations and impacts	EN 60947-5-2
Switching frequency, f (ti/tp 1:1) Q	≤ 1000 Hz		
Response time Q	500 μs		
Analogue output Q <sub>A</sub>	1 ... 10V / max. 3 mA		
Response time Q <sub>A</sub>	400 μs (FT 25-RA-60)		
	3.4 ms (FT 25-RA-170)		
Warm-up time	10 min.		
Temperature drift	< 0.1 mm/K (FT 25-RA-60)		
	< 0.2 mm/K (FT 25-RA-170)		

<sup>1</sup> Reference material: 6...90 % reflectivity    <sup>2</sup> Reference material grey, 18 % reflectivity    <sup>3</sup> At constant ambient conditions    <sup>4</sup> With connected IP 67 / IP 69K plug    <sup>5</sup> UL: -20°C...+50 °C

Measurement range	Analogue output	Switching output	Type of connection	Part number	Article number
20 ... 80 mm	1 ... 10V	PNP	Metal plug, M8x1, 4-pin	FT 25-RA-60-PSU-M4M	604-41000
20 ... 80 mm	1 ... 10V	NPN	Metal plug, M8x1, 4-pin	FT 25-RA-60-NSU-M4M	604-41001
30 ... 200 mm	1 ... 10V	PNP	Metal plug, M8x1, 4-pin	FT 25-RA-170-PSU-M4M	604-41002
30 ... 200 mm	1 ... 10V	NPN	Metal plug, M8x1, 4-pin	FT 25-RA-170-NSU-M4M	604-41003

Plug connection (20 ... 80 mm)	Plug connection (30 ... 200 mm)
<p style="text-align: right;">153-00839</p>	<p style="text-align: right;">153-00837</p>

Connection, 4-pin	Light spot size
<p style="text-align: right;">154-00543</p>	<p style="text-align: right;">155-01663</p>

Scanning properties FT 25-RA-60	Scanning properties FT 25-RA-170
<p style="text-align: right;">155-01666</p>	<p style="text-align: right;">155-01667</p>

Characteristic output and analogue curves	Default settings										
<p style="text-align: right;">155-01661</p>	<table border="1"> <thead> <tr> <th></th> <th>FT 25-RA-60</th> <th>FT 25-RA-170</th> </tr> </thead> <tbody> <tr> <td>Analogue output <math>Q_A</math> (1 ... 10V)</td> <td>20 ... 80 mm</td> <td>30 ... 200 mm</td> </tr> <tr> <td>Switching output Q (A1 ... A2), N.O.</td> <td>20 ... 80 mm</td> <td>30 ... 200 mm</td> </tr> </tbody> </table>		FT 25-RA-60	FT 25-RA-170	Analogue output $Q_A$ (1 ... 10V)	20 ... 80 mm	30 ... 200 mm	Switching output Q (A1 ... A2), N.O.	20 ... 80 mm	30 ... 200 mm	
	FT 25-RA-60	FT 25-RA-170									
Analogue output $Q_A$ (1 ... 10V)	20 ... 80 mm	30 ... 200 mm									
Switching output Q (A1 ... A2), N.O.	20 ... 80 mm	30 ... 200 mm									
<p style="text-align: right;">155-01681</p>	<table border="1"> <thead> <tr> <th colspan="3">Accessories</th> </tr> </thead> <tbody> <tr> <td>Connection cables</td> <td colspan="2">From Page A-34</td> </tr> <tr> <td>Brackets</td> <td colspan="2">From Page A-4</td> </tr> </tbody> </table>		Accessories			Connection cables	From Page A-34		Brackets	From Page A-4	
Accessories											
Connection cables	From Page A-34										
Brackets	From Page A-4										



# FT 20 RA

## Distance sensor



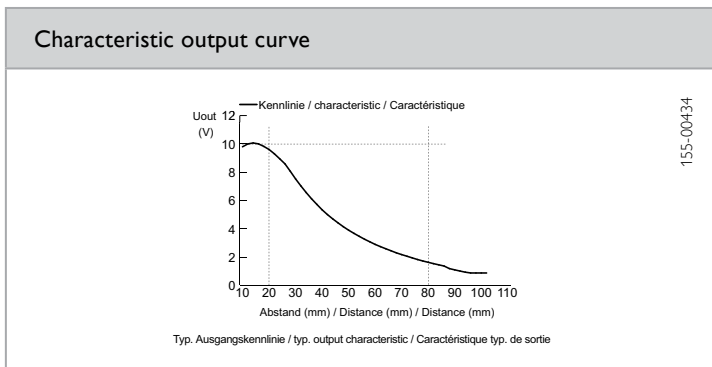
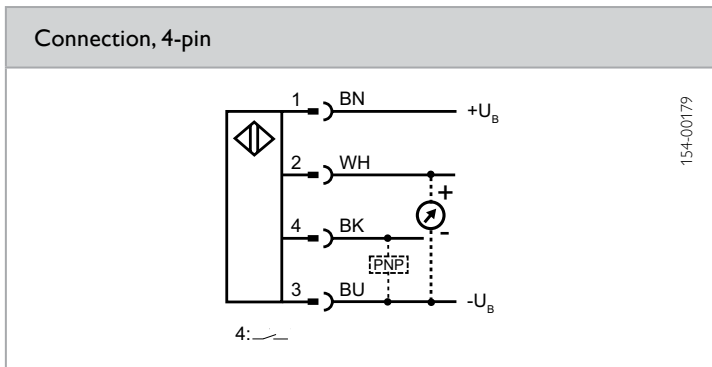
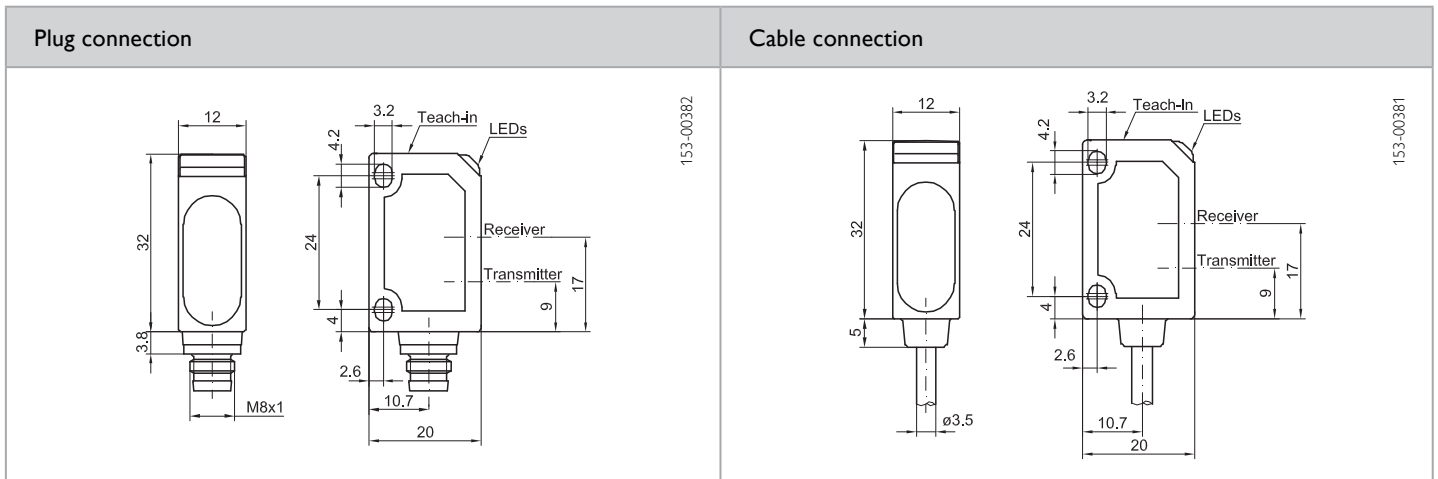
### PRODUCT HIGHLIGHTS

- Operating range 20 ... 80 mm
- Analogue output 0 ... 10V
- Simple teach-in
- Adjustable switching window (switch on/off points) for e.g. two-point control
- Red light (660 nm)

Optical data		Functions	
Operating range	20 ... 80 mm <sup>1</sup>	Indicator LED, green	Operating voltage indicator
Measurement range	60 mm	Indicator LED, yellow	Switching output indicator
Type of light	LED, red, 660 nm	Scanning distance adjustment	Via Teach-in button
Resolution	≈ 2 % distance (measurement value)		
Linearity	< 1 %		
Electrical data		Mechanical data	
Operating voltage, +U <sub>B</sub>	15 ... 30V DC	Dimensions	32 x 20 x 12 mm
No-load current, I <sub>0</sub>	≤ 30 mA	Enclosure rating	IP 67 <sup>2</sup>
Output current, I <sub>e</sub>	≤ 100 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U <sub>B</sub> / short-circuit protection (Q)	Material, front screen	PMMA
Protection Class	2	Type of connection	See Selection Table
Switching output, Q	PNP	Ambient temperature: operation	-20 ... +60 °C
Output function	N.O./N.C.	Ambient temperature: storage	-20 ... +80 °C
Analogue output	0 ... 10V / max. 3 mA	Weight (metal plug device)	10 g
Limit frequency, analogue output	≤ 200 Hz	Weight (cable device)	40 g
Load	≥ 10 kΩ		
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz		
Response time	500 μs		

<sup>1</sup> Reference material: Kodak white, 90 %    <sup>2</sup>With connected IP 67 plug

Type of connection	Part number	Article number
Plug, M8, 4-pin	FT 20 RA-60-F-M4	554-11000
Cable, 2 m, 4-wire	FT 20 RA-60-F-K4	554-11001



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

# FT 50/FT 80 – laser distance sensors

Precise and rapid measurement with many extras



made in Germany



### **Independent of reflectivity**

*These highly precise triangulation sensors are predestined for the detection of differing materials thanks to their high contrast-independence.*

### TYPICAL FT 50 / FT 80

- Laser distance sensors with a variety of measurement ranges
- Shape and colour of the target object is largely irrelevant
- High accuracy and resolutions up to 7  $\mu\text{m}$
- Rapid response time up to 1 kHz
- Intelligent teach-in user concept
- 2 switching outputs
- Analogue output: 4 ... 20 mA / 0 ... 10V
- Variants with serial interface for measuring differences and thicknesses in master/slave mode
- ABS housing with rotatable plug

These distance sensors are particularly easy to commission thanks to their fixed operating distances. Voltage rises linearly with increasing distance.

Regardless of the reflectivity of the target object, these sensors provide excellent measurement results and their comprehensive range of functions is impressive.

The optional serial interface allows user-friendly configuration via PC, providing visualisation of measurement values.

FT 50 / FT 80 – Product Overview				
	Housing dimensions	Operating range	Special features	Page
FT 50 RLA-20	50 x 17 x 50 mm	40 ... 60 mm	Analogue output	196
FT 50 RLA-40	50 x 17 x 50 mm	45 ... 85 mm	Analogue output	198
FT 50 RLA-70 -100 -220	50 x 17 x 50 mm	30 ... 100 mm 70 ... 170 mm 80 ... 300 mm	Analogue output, switching outputs, simple teach-in of measurement ranges; RS485 interface	200
FT 80 RLA-500	83 x 25 x 65 mm	250 ... 750 mm	Analogue output, switching outputs, RS485 interface; M12 8-pin	204

# FT 50 RLA 20

Distance sensor



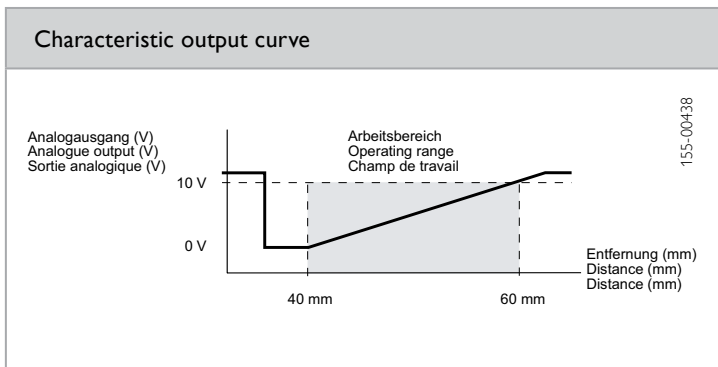
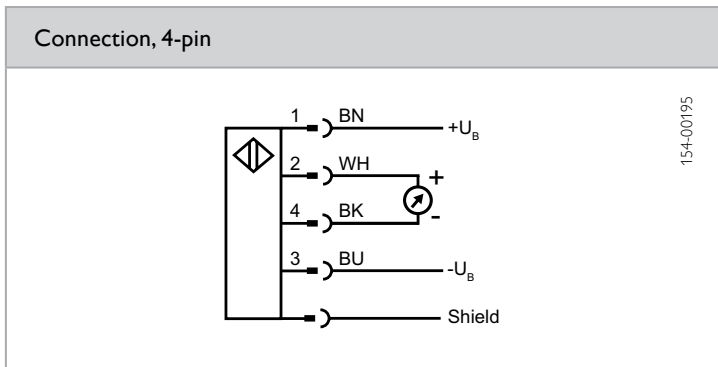
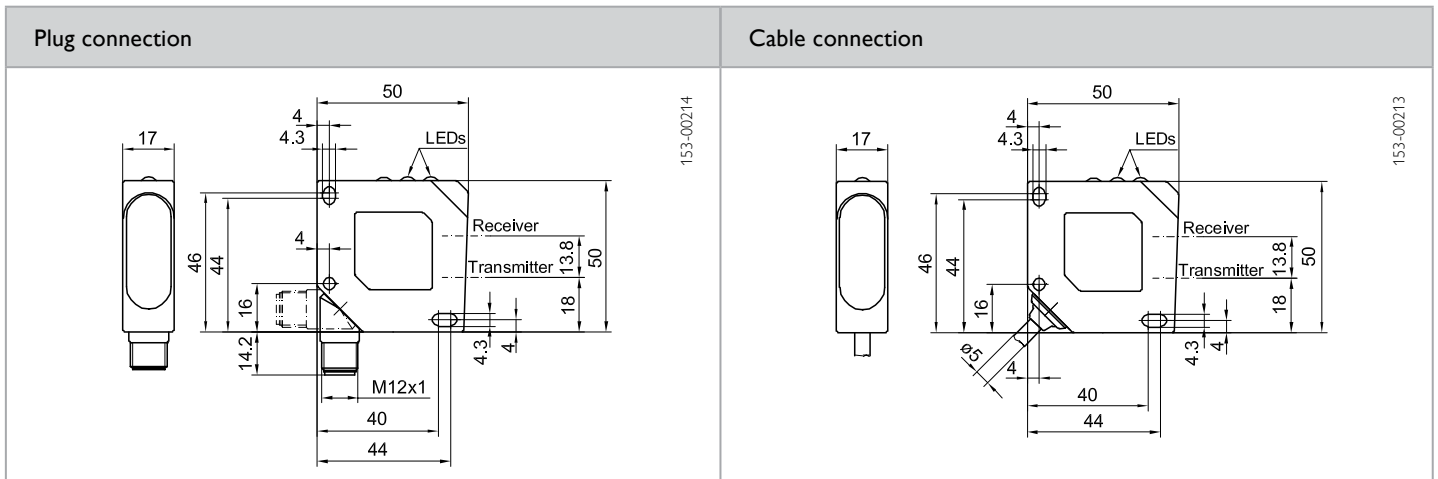
## PRODUCT HIGHLIGHTS

- High resolution and small laser light spot
- Operating range: 40 ... 60 mm
- Small, easily visible laser light spot
- No adjustments necessary
- Resolution: 7  $\mu\text{m}$  / 40  $\mu\text{m}$
- Analogue output: 0 ... 10 V
- Device plug rotatable through 270°

Optical data		Functions	
Operating range	40 ... 60 mm <sup>1</sup>	Indicator LED, green	Operating voltage indicator
Measurement range	20 mm	Indicator LED, red	Contamination indicator
Type of light	Laser, red, 670 nm	Scanning distance adjustment	Fixed setting
Laser Class (DIN EN 60825-1:2008-5)	2		
Resolution	40 $\mu\text{m}$ / 7 $\mu\text{m}$ (see Selection Table)		
Linearity	< 1 %		
Light spot size	< 1 mm bei 50 mm		
Repeatability	< 0.1 mm / 0.05 mm (see Selection Table)		
Electrical data		Mechanical data	
Operating voltage, +U <sub>B</sub>	18 ... 28 V DC	Dimensions	50 x 50 x 17 mm
No-load current, I <sub>0</sub>	≤ 35 mA	Enclosure rating	IP 67 <sup>2</sup>
Protective circuits	Reverse-polarity protection, U <sub>B</sub> / short-circuit protection, Q	Material, housing	ABS, impact-resistant
Protection Class	2	Material, front screen	PMMA
Analogue output	0 ... 10 V / max. 3 mA	Type of connection	See Selection Table
Limit frequency	400 Hz / 40 Hz (see Selection Table)	Ambient temperature: operation	0 ... +45 °C
Temperature drift	10 $\mu\text{m}$ / K	Ambient temperature: storage	-20 ... +60 °C
Rise time (10 to 90 %)	3 ms / 30 ms (see Selection Table)	Weight (plug device)	40 g
Fall time (90 to 10 %)	2 ms / 20 ms (see Selection Table)	Weight (cable device)	260 g
		Vibration and impact resistance	EN 60947-2

<sup>1</sup> Reference material: Kodak grey, 18 %    <sup>2</sup>With connected IP 67 plug

Resolution	Repeatability	Rise time	Fall time	Limit frequency	Type of connection	Part number	Article number
40 $\mu\text{m}$	< 0.1 mm	3 ms	2 ms	400 Hz	Plug, M12x1, 4-pin	FT 50 RLA-20-F-L4S	574-41005
7 $\mu\text{m}$	< 0.05 mm	30 ms	20 ms	40 Hz	Plug, M12x1, 4-pin	FT 50 RLA-20-S-L4S	574-41007
40 $\mu\text{m}$	< 0.1 mm	3 ms	2 ms	400 Hz	Cable, 6 m, 4-wire	FT 50 RLA-20-F-K5	574-41004
7 $\mu\text{m}$	< 0.05 mm	30 ms	20 ms	40 Hz	Cable, 6 m, 4-wire	FT 50 RLA-20-S-K5	574-41006



**Accessories**

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

# FT 50 RLA 40

Distance sensor



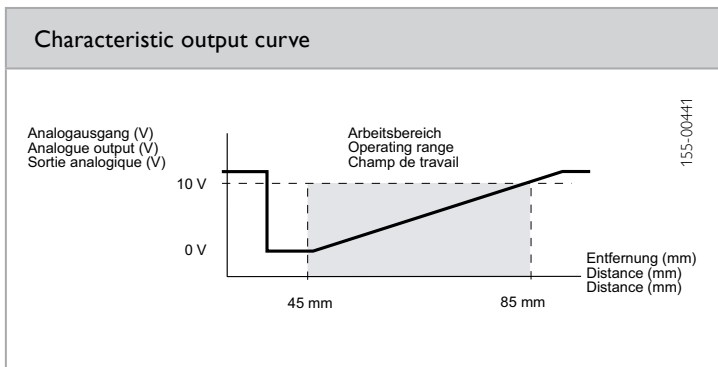
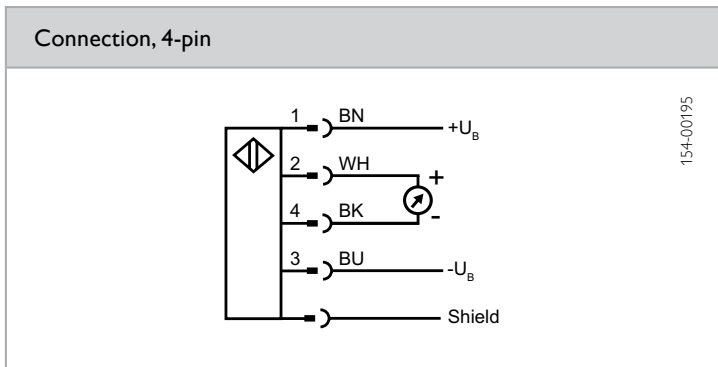
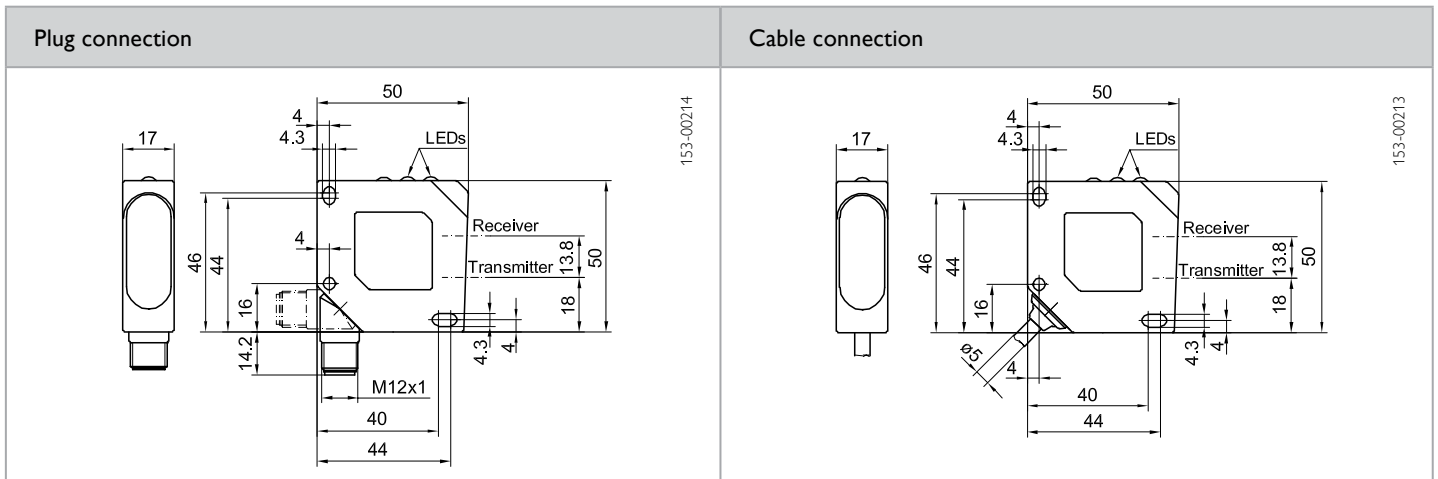
## PRODUCT HIGHLIGHTS

- High resolution and small light spot
- Operating range: 45 ... 85 mm
- Laser red light (670 nm)
- Small, easily visible light spot
- No adjustments necessary
- Resolution: 0.02 mm / 0.08 mm
- Analogue output: 0 ... 10V
- Device plug rotatable through 270°

Optical data		Functions	
Operating range	45 ... 85 mm <sup>1</sup>	Indicator LED, green	Operating voltage indicator
Measurement range	40 mm	Indicator LED, red	Contamination indicator
Type of light	Laser, red, 670 nm	Scanning distance adjustment	Fixed setting
Laser Class (DIN EN 60825-1:2008-5)	2		
Resolution	80 µm / 20 µm (see Selection Table)		
Linearity	< 1 %		
Light spot size	< 0.8 mm at 65 mm		
Repeatability	< 0.2 mm / 0.1 mm (see Selection Table)		
Electrical data		Mechanical data	
Operating voltage, +U <sub>B</sub>	18 ... 28V DC	Dimensions	50 x 50 x 17 mm
No-load current, I <sub>0</sub>	≤ 35 mA	Enclosure rating	IP 67 <sup>2</sup>
Protective circuits	Reverse-polarity protection, U <sub>B</sub> / short-circuit protection, Q	Material, housing	ABS, impact-resistant
Protection Class	2	Material, front screen	PMMA
Analogue output	0 ... 10V (max. 3 mA)	Type of connection	See Selection Table
Limit frequency	400 Hz / 40 Hz (See Selection Table)	Ambient temperature: operation	0 ... +45 °C
Temperature drift	18 µm / K	Ambient temperature: storage	-20 ... +60 °C
Rise time (10 to 90 %)	3 ms / 30 ms (See Selection Table)	Weight (plug device)	40 g
Fall time (90 to 10 %)	2 ms / 20 ms (See Selection Table)	Weight (cable device)	260 g
		Vibration and impact resistance	EN 60947-2

<sup>1</sup> Reference material: Kodak grey, 18 %    <sup>2</sup> With connected IP 67 plug

Resolution	Repeatability	Rise time	Fall time	Limit frequency	Type of connection	Part number	Article number
80 µm	< 0.2 mm	3 ms	2 ms	400 Hz	Plug, M12x1, 4-pin	FT 50 RLA-40-F-L4S	574-41001
20 µm	< 0.1 mm	30 ms	20 ms	40 Hz	Plug, M12x1, 4-pin	FT 50 RLA-40-S-L4S	574-41003
80 µm	< 0.2 mm	3 ms	2 ms	400 Hz	Cable, 6 m, 4-wire	FT 50 RLA-40-F-K5	574-41000
20 µm	< 0.1 mm	30 ms	20 ms	40 Hz	Cable, 6 m, 4-wire	FT 50 RLA-40-S-K5	574-41002



**Accessories**

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



# FT 50 RLA 70 / 100 / 220

Distance sensor



## PRODUCT HIGHLIGHTS

- Precise distance measurement
- Largely independent of target object reflectivity (highly reflective and glossy objects)
- High long-term stability and low temperature effects
- High resolution
- Very high update rate of analogue output (response time)
- One switching output, one analogue output 4 ... 20 mA
- Simple adjustment via teach-in button

Optical data		Functions	
Operating range	30 ... 100 mm / 70 ... 170 mm / 80 ... 300 mm <sup>1</sup>	Indicator LED, green	Operating voltage indicator
Measurement range	70 mm, 100 mm, 220 mm	Indicator LED, yellow	Switching output indicator
Type of light	Laser, red, 650 nm	Scanning distance adjustment	Via Teach-in button and control input
Laser Class (DIN EN 60825-1:2008-5)	2	Adjustment possibilities	N.O. / N.C. via Teach-in button and control input
Resolution	< 0.1 % of operating range end-value <sup>2</sup> (see Selection Table)		Button lock via control input
Linearity	< 0.25 % of operating range end-value (see Selection Table)		
Repeatability	< 0.25 % of measurement value		
Electrical data		Mechanical data	
Operating voltage, +U <sub>b</sub>	18 ... 30V DC	Dimensions	50 x 50 x 17 mm
No-load current, I <sub>0</sub>	≤ 40 mA	Enclosure rating	IP 67 <sup>3</sup>
Output current, I <sub>e</sub>	≤ 100 mA	Material, housing	ABS, impact-resistant
Protective circuits	Reverse-polarity protection, U <sub>b</sub> / short-circuit protection, Q	Material, front screen	PMMA
Protection Class	2	Type of connection	See Selection Table
Power On Delay	< 300 ms	Ambient temperature: operation	-10 ... +60 °C
Switching output, Q	PNP	Ambient temperature: storage	-20 ... +80 °C
Output function	N.O. / N.C.	Weight	43 g
Max. capacitive load, Q	< 100 nF	Vibration and impact resistance	EN 60947-2
Analogue output	4 ... 20 mA		
Temperature drift	< 0.02 % of operating range end-value / K		
Load	≤ 500 Ω (recommended)		
Switching frequency, f (ti/tp 1:1)	≤ 1 kHz (speed mode) ≤ 10 Hz (averaging mode)		
Response time	0.4 ms (speed mode) 40 ms (averaging mode)		
Control input, IN	When High (+U <sub>b</sub> ) = laser disable When Low (-U <sub>b</sub> ) = button lock When open = free-running		

<sup>1</sup> Reference material: Kodak grey, 18 %    <sup>2</sup> Smallest measurable change    <sup>3</sup> With connected IP 67 plug

Operating range	Measurement range	Resolution	Linearity	Type of connection	Part number	Article number
30 ... 100 mm	70 mm	0.1 mm	0.25 mm	Plug, M12x1, 5-pin	FT 50 RLA-70-PL5	574-41027
70 ... 170 mm	100 mm	0.17 mm	0.42 mm	Plug, M12x1, 5-pin	FT 50 RLA-100-PL5	574-41032
80 ... 300 mm	220 mm	0.3 mm	0.75 mm	Plug, M12x1, 5-pin	FT 50 RLA-220-PL5	574-41029

Plug connection	Type	X (distance, receiver)
	153-00716	FT 50 RLA 70 FT 50 RLA 100 FT 50 RLA 220
		29.4 mm
		32.5 mm
		32.5 mm

Connection, 5-pin	Installation
154-00176	155-00270
	155-00274

Characteristic analogue curve	Light spot geometry																																	
<p>Operating range (default setting)</p> <p>OK LED (green) (Good Target)</p> <p>Analogue output (invertible)</p> <table border="1"> <tr> <td>FT 50 RLA 70</td> <td>30 mm</td> <td>100 mm</td> </tr> <tr> <td>FT 50 RLA 100</td> <td>70 mm</td> <td>170 mm</td> </tr> <tr> <td>FT 50 RLA 220</td> <td>80 mm</td> <td>300 mm</td> </tr> </table>	FT 50 RLA 70	30 mm	100 mm	FT 50 RLA 100	70 mm	170 mm	FT 50 RLA 220	80 mm	300 mm	<table border="1"> <thead> <tr> <th>FT 50 RLA</th> <th>70 ...</th> <th>100 ...</th> <th>220 ...</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>30</td> <td>70</td> <td>80</td> </tr> <tr> <td>B</td> <td>100</td> <td>170</td> <td>300</td> </tr> <tr> <td>C</td> <td>1.5 × 3</td> <td>1.5 × 3.5</td> <td>1.5 × 3.5</td> </tr> <tr> <td>D</td> <td>1.5 × 3.25</td> <td>1.7 × 3.9</td> <td>2 × 4.5</td> </tr> <tr> <td>X</td> <td>29.4</td> <td>32.5</td> <td>32.5</td> </tr> </tbody> </table>	FT 50 RLA	70 ...	100 ...	220 ...	A	30	70	80	B	100	170	300	C	1.5 × 3	1.5 × 3.5	1.5 × 3.5	D	1.5 × 3.25	1.7 × 3.9	2 × 4.5	X	29.4	32.5	32.5
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155-00271	155-00269																																	

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

# FT 50 RLA 70 / 100 / 220

Distance sensor with RS485 interface



## PRODUCT HIGHLIGHTS

- Largely independent of target object reflectivity (highly reflective and glossy objects)
- RS485 interface for parameterisation and measurement value output
- High resolution
- Rapid response time
- 2 switching outputs, 1 analogue output 4 ... 20 mA
- High long-term stability and low temperature effects

Optical data		Functions	
Operating range	30 ... 100 mm / 70 ... 170 mm / 80 ... 300 mm <sup>1</sup>	Indicator LED, green	Operating voltage indicator
Measurement range	70 mm, 100 mm, 120 mm	Indicator LED, yellow	Switching output indicator
Type of light	Laser, red, 650 nm	Scanning distance adjustment	Via Teach-in button and control input
Laser Class (DIN EN 60825-1:2008-5)	2	Adjustment possibilities	N.O. / N.C. via Teach-in button and control input
Resolution	< 0.1 % of operating range end-value (0.1 mm / 0.17 mm / 0.3 mm) <sup>2</sup>	Default settings	Button lock via control input
Linearity	< 0.25 % of operating range end-value (0.25 mm / 0.42 mm / 0.75 mm)		Max. scanning distance and N.O.
Repeatability	< 0.25 % of measurement value		
Electrical data		Mechanical data	
Operating voltage, +U <sub>b</sub>	18 ... 30V DC	Dimensions	50 x 50 x 17 mm
No-load current, I <sub>0</sub>	≤ 40 mA	Enclosure rating	IP 67 <sup>3</sup>
Output current, I <sub>e</sub>	≤ 100 mA	Material, housing	ABS, impact-resistant
Protective circuits	Reverse-polarity protection, U <sub>b</sub> / short-circuit protection, Q (not Type S1)	Material, front screen	PMMA
Protection Class	2	Type of connection	See Selection Table
Power On Delay	≤ 300 ms	Ambient temperature: operation	-10 ... +60 °C
Switching output, Q <sub>1</sub> / Q <sub>2</sub>	PNP	Ambient temperature: storage	-20 ... +80 °C
Output function	N.O. / N.C.	Weight	43 g
Analogue output	4 ... 20 mA	Vibration and impact resistance	EN 60947-2
Temperature drift	< 0.02 % of operating range end-value / K		
Load	≤ 500 Ω		
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz		
Response time	≥ 0.4 ms (when mean value formation = off) / 4 ms / 40 ms to end-value		
Serial interface	See Selection Table		

<sup>1</sup> Reference material: Kodak grey, 18 %    <sup>2</sup> Smallest measurable change    <sup>3</sup> With connected IP 67 plug

Scanning distance	Measurement range	Resolution	Linearity	Serial interface	Type of connection	Part number	Article number
30 ... 100 mm	70 mm	0,1 mm	0,25 mm	–	Plug, M12x1, 8-pin	FT 50 RLA-70-L8	574-41018
30 ... 100 mm	70 mm	0,1 mm	0,25 mm	RS485	Plug, M12x1, 8-pin	FT 50 RLA-70-S1L8	574-41019
70 ... 170 mm	100 mm	0,17 mm	0,42 mm	RS485	Plug, M12x1, 8-pin	FT 50 RLA-100-S1L8	574-41033
80 ... 300 mm	220 mm	0,3 mm	0,75 mm	–	Plug, M12x1, 8-pin	FT 50 RLA-220-L8	574-41014
80 ... 300 mm	220 mm	0,3 mm	0,75 mm	RS485	Plug, M12x1, 8-pin	FT 50 RLA-220-S1L8	574-41015

Plug connection	Type	X (distance, receiver)
	153-00716	FT 50 RLA 70 FT 50 RLA 100 FT 50 RLA 220
		29,4 mm
		32,5 mm
		32,5 mm

Connection, 8-pin	Type	Pin 1	Pin 5
	154-00127	FT 50 RLA -S1L8. FT 50 RLA -L8.	RS485 Y/A - RS485 Z/B -

Characteristic analogue curve	Light spot geometry																																	
<p>Operating range (default setting)</p> <p>OK LED (green) (Good Target)</p> <p>Analogue output (invertible)</p> <table border="1"> <tr> <td>FT 50 RLA 70</td> <td>30 mm</td> <td>100 mm</td> </tr> <tr> <td>FT 50 RLA 100</td> <td>70 mm</td> <td>170 mm</td> </tr> <tr> <td>FT 50 RLA 220</td> <td>80 mm</td> <td>300 mm</td> </tr> </table>	FT 50 RLA 70	30 mm	100 mm	FT 50 RLA 100	70 mm	170 mm	FT 50 RLA 220	80 mm	300 mm	<p>155-00271</p> <table border="1"> <thead> <tr> <th>FT 50 RLA</th> <th>70 ...</th> <th>100 ...</th> <th>220 ...</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>30</td> <td>70</td> <td>80</td> </tr> <tr> <td>B</td> <td>100</td> <td>170</td> <td>300</td> </tr> <tr> <td>C</td> <td>1.5 × 3</td> <td>1.5 × 3.5</td> <td>1.5 × 3.5</td> </tr> <tr> <td>D</td> <td>1.5 × 3.25</td> <td>1.7 × 3.9</td> <td>2 × 4.5</td> </tr> <tr> <td>X</td> <td>29,4</td> <td>32,5</td> <td>32,5</td> </tr> </tbody> </table> <p>155-00269</p>	FT 50 RLA	70 ...	100 ...	220 ...	A	30	70	80	B	100	170	300	C	1.5 × 3	1.5 × 3.5	1.5 × 3.5	D	1.5 × 3.25	1.7 × 3.9	2 × 4.5	X	29,4	32,5	32,5
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Installation	Accessories				
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Connection cables	From Page A-34				
Brackets	From Page A-4				

# FT 80 RLA

Distance sensor with RS485 interface



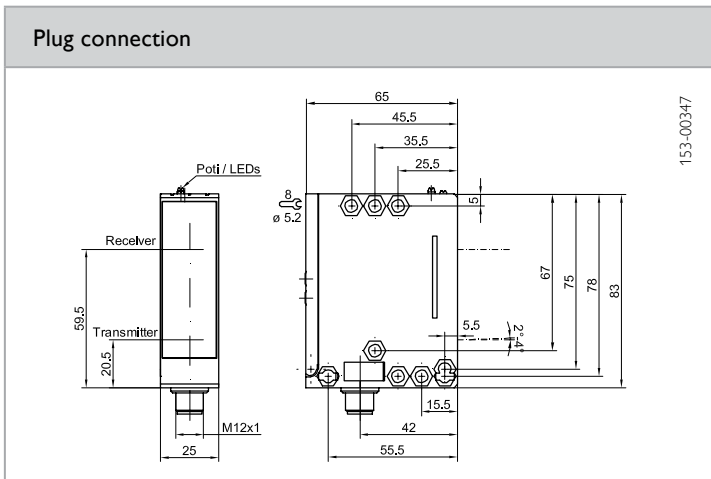
## PRODUCT HIGHLIGHTS

- Long operating distance
- 2 switching outputs + analogue output: 4 ... 20 mA
- High resolution (0.1% of measurement range)
- Type S1 with serial Bus interface (RS485 half-duplex)
- Adjustable via Teach-in; Type S1 also via software
- Wide range of functions

Optical data		Functions	
Operating range	250 ... 750 mm <sup>1</sup>	Indicator LED, green	Operating voltage indicator
Measurement range	500 mm	Indicator LED, yellow	Switching output indicator
Type of light	Laser, red, 650 nm	Indicator LED, red	State indicator
Laser Class (DIN EN 60825-1:2008-5)	2	Scanning distance adjustment	Via Teach-in button and control input
Resolution	< 0.1 % of measurement range end-value	Adjustment possibilities	Button lock via control input
Linearity	< 0.25 % of measurement range end-value	Default settings	Max. scanning distance and N.O.
Electrical data		Mechanical data	
Operating voltage, +U <sub>B</sub>	18 ... 30V DC	Dimensions	83 x 65 x 25 mm
No-load current, I <sub>0</sub>	≤ 40 mA	Enclosure rating	IP 67 <sup>2</sup>
Output current, I <sub>e</sub>	≤ 100 mA	Material, housing	PBT
Protective circuits	Reverse-polarity protection, U <sub>B</sub> / short-circuit protection, Q (not Type S1)	Material, front screen	PMMA
Temperature drift		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-10 ... +60 °C
Power On Delay	≤ 300 ms	Ambient temperature: storage	-20 ... +80 °C
Switching output, Q <sub>1</sub> / Q <sub>2</sub>	PNP	Weight	107 g
Output function	N.O. / N.C.		
Analogue output	4 ... 20 mA		
Temperature drift	< 0.02 % of operating range end-value / K		
Load	≤ 500 Ω (recommended)		
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz		
Response time	≥ 0.4 ms (when mean value formation = off) / 4 ms / 40 ms to end-value		
Serial interface	See Selection Table		

<sup>1</sup> Reference material: Kodak grey, 18 %    <sup>2</sup>With connected IP 67 plug

Scanning distance	Measurement range	Resolution	Linearity	Serial interface	Type of connection	Part number	Article number
250 ... 750 mm	500 mm	0,1 mm	0,25 mm	–	Plug, M12x1, 8-pin	FT 80 RLA-500-L8	574-41020
250 ... 750 mm	500 mm	0,1 mm	0,25 mm	RS485	Plug, M12x1, 8-pin	FT 80 RLA-500-S1L8	574-41024



Connection, 8-pin	Type	Pin 1	Pin 5
	FT 80 RLA 500 -S1L8. FT 80 RLA 500 -L8.	RS485 Y/A not connected	RS485 Z/B not connected

154-00127

Characteristic analogue curve	Light spot geometry										
<p>Operating range (default settings)</p> <p>FT 80 RLA 500 ...</p>	<table border="1"> <thead> <tr> <th></th> <th>FT 80 RLA 500 ...</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>250 mm</td> </tr> <tr> <td>B</td> <td>750 mm</td> </tr> <tr> <td>C</td> <td>1.9 mm x 1.2 mm</td> </tr> <tr> <td>D</td> <td>2.7 mm x 1.9 mm</td> </tr> </tbody> </table>		FT 80 RLA 500 ...	A	250 mm	B	750 mm	C	1.9 mm x 1.2 mm	D	2.7 mm x 1.9 mm
	FT 80 RLA 500 ...										
A	250 mm										
B	750 mm										
C	1.9 mm x 1.2 mm										
D	2.7 mm x 1.9 mm										

155-00143

155-00157

### Accessories

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

# F 55 / F 90 / F 91 / F 92 –

## Laser distance sensors for long distances

Far-sighted with time-of-flight technology



 made in Germany



### Indicator

The distance is directly indicated in mm by the F 90 and F 91 devices, and can even be directly read off from the device in the dark – thanks to the Indicator's background illumination.



### Coil diameter

The FT 55-RLA measures the distance to the coil surface in order to activate roll changes.

### TYPICAL F 55 / F 90 / F 91 / F 92

- Laser distance sensor using time-of-flight technology
- Largely independent of target object's colour and properties
- Operating range: scanner up to 10 m, with reflector up to 250 m
- Variants with analogue output and switching output
- Interfaces for maximum compatibility, SSI-compatible, RS422 (PROFIBUS and DeviceNet via gateway)
- High repeatability and high measurement rates
- Compact housings from 50 x 50 x 23 mm

With a reflector these devices can achieve ranges of up to 250 m (FR 90 ILA).

Ranges of up to 10 m can be achieved with the scanner versions (FT 90 ILA).

### Pilot laser

Correct adjustment of the F 90 at long distances is considerably simplified by using the pilot laser. This can be switched off so that no-one is irritated by it during running operation.

Long ranges of up to 250 m are no problem with time-of-flight technology – and ideal in handling and warehousing systems.

F 55 / F 90 / F 91 / F 92 – Product Overview				
	Operating distance	Functional principle	Special features	Page
FT 55-RLAP	0,1 ... 5 m	Scanning on object	Compact design, high flexibility	208
FT 90 ILA	0.5 ... 10 m	Scanning on object	2 switching outputs, RS422 interface, SSI-compatible, switchable red-light pilot laser	210
FT 91 ILA	0.5 ... 6 m	Scanning on object	2 switching outputs, RS422 interface, SSI-compatible, switchable red-light pilot laser	212
FT 92 ILA/RLA	0.2 ... 6 m	Scanning on object	2 switching outputs, 1 analogue output, switchable red-light pilot laser	214
FR 55-RLAP	0,3 ... 70 m	Reflector	1 analogue output 4 ... 20 mA, 2 switching outputs, compact design, high flexibility	216
FR 55-RLP	0,3 ... 70 m	Reflector	2 switching outputs, compact design, high flexibility	218
FR 90 ILA	0.5 ... 250 m	Reflector	2 switching outputs, RS422 interface, SSI-compatible, switchable red-light pilot laser	220
FR 91 ILA	0.5 ... 50 m	Reflector	2 switching outputs, RS422 interface, SSI-compatible, switchable red-light pilot laser	222
FR 92 ILA	0.2 ... 30 m	Reflector	2 switching outputs, 1 analogue output, switchable red-light pilot laser	224



# FT 55-RLAP

Distance sensor for large distances – Time-of-flight technology



## PRODUCT HIGHLIGHTS

- For measurement and control tasks with all object surfaces at long scanning distances
- Stable and precise distance measurement even with tilted objects and with bright, highly reflective or shiny backgrounds
- Compact design for an easy integration
- High flexibility thanks to invertible analogue characteristic ( $Q_A$ ) and window mode (Q)
- Easy installation and operation via external teach-in
- Clearly visible laser light spot (laser class 1) for an easy alignment and full eye safety

Optical data		Functions	
Measurement range	0.1 ... 5 m (see Selection Table) <sup>1</sup>	Indicator LED 2, green	Operating voltage indicator
Resolution	< 5 mm (12-bit)	Indicator LED 2, yellow	Status indicator analogue output
Linearity	$\pm 30 \text{ mm}^{1,2}$	Indicator LED 1 yellow	Switching output indicator
Repeatability	$1.2 \text{ mm}^{1,2,3}$	Measurement range adjustment	Via Teach-in button or control input
Hysteresis	20 mm	Adjustment possibilities	Analogue measurement range $Q_A$
Type of light	Laser, red 655 nm		Invertible analogue characteristic
Laser class (DIN EN 60825-1:2008-5)	1		Switching output Q (window mode)
			N.O. / N.C. and Auto-Detect / NPN / PNP via teach-in and control line
			Button lock via control input
		Default settings	See Selection Table
Electrical data			
Operating voltage $+U_B$	18 ... 30V DC	Response time Q	2 ms
No-load current I	$\leq 60 \text{ mA}$	Load	$\leq 500 \text{ Ohm}$ (4 ... 20 mA) $\geq 4 \text{ k Ohm}$ (0 ... 10 V)
Output current I <sub>e</sub> Q	$\leq 100 \text{ mA}$	Analogue output $Q_A$	4 ... 20 mA / 0 ... 10 V
Protection circuits	Reverse polarity protection $U_B$ / short-circuit protection (Q)	Update rate $Q_A$	2 ms
Protection class	2	Temperature drift	< 2 mm / K
Power On Delay	< 5 s	Warm-up time	20 min.
Switching output Q	Auto-Detect (PNP/NPN) <sup>4</sup>	Control input IN	$+U_B$ = Teach-in $-U_B$ = Button locked Open = normal operation
Output function	N.O. / N.C.		
Switching frequency f (ti/tp 1:1)	$\leq 250 \text{ Hz}$		
Mechanical data			
Dimensions	50 x 50.1 x 23 mm	Ambient temperature: operation	-40 ... +60 °C <sup>6</sup>
Enclosure rating	IP 67 & IP 69K <sup>5</sup>	Ambient temperature: storage	-40 ... +80 °C
Material, housing	ABS	Weight (plug device)	42 g
Material, front screen	PMMA	Resistance to vibration and impacts	EN 60947-5-2
Type of connection	See Selection Table		

<sup>1</sup> Reference material 90 % reflectivity

<sup>2</sup> At 50 Hz

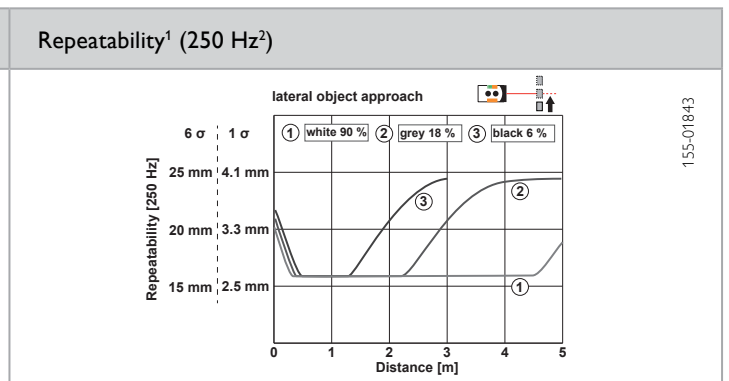
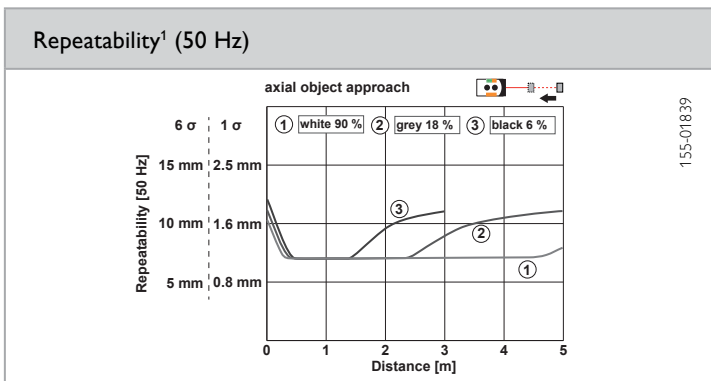
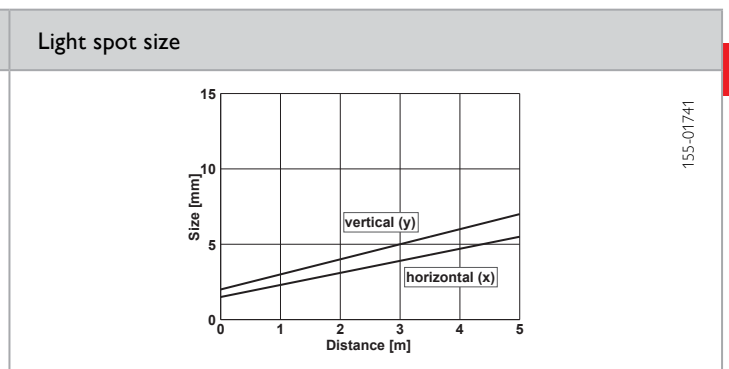
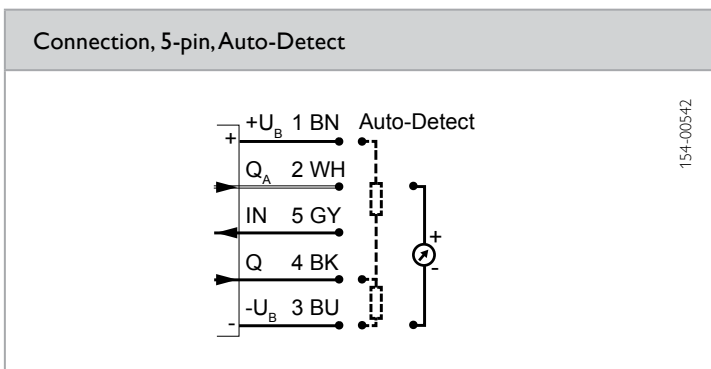
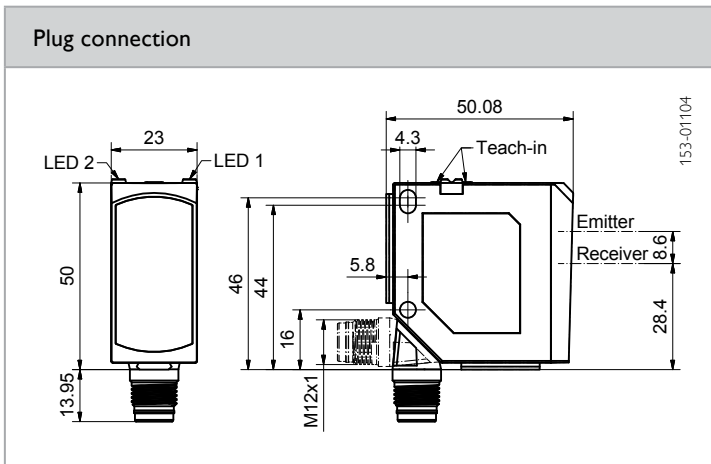
<sup>3</sup> For 1  $\sigma$ , see diagram for further values

<sup>4</sup> Auto-Detect: Automatic selection of PNP or NPN by the sensor, PNP or NPN can be fixed

<sup>5</sup> With connected IP 67 / IP 69K plug

<sup>6</sup> Up to +50 °C with current output 4 ... 20 mA

Measurement range <sup>1</sup>	Analogue output	Switching output	Type of connection	Part Number	Article number
0.1 ... 5 m	4 ... 20 mA	Auto-Detect	Plug, M12x1, 5-pin	FT 55-RLAP-5-PNSI-L5	622-21018
0.1 ... 5 m	0 ... 10V	Auto-Detect	Plug, M12x1, 5-pin	FT 55-RLAP-5-PNSU-L5	622-21021



<sup>1</sup> At constant ambient conditions    <sup>2</sup> Automatic adjustment to 50 Hz at constant distance

Characteristic analogue curve	Reference material	Measurement range
<p>21.1 mA / 11 V 20 mA / 10 V</p> <p>4 mA / 0.09 V 3.6 mA / 0.06 V</p> <p>Q<sub>A</sub></p> <p>Q</p> <p>High</p> <p>Low</p> <p>A<sub>1</sub>    A<sub>2</sub></p> <p>Distance [mm]</p>	White (90 %) Grey (18 %) Black (6 %)	0.1 ... 5 m 0.1 ... 5 m 0.1 ... 3 m
	<b>Default setting<sup>3</sup></b>	
	Analogue output Q <sub>A</sub> (4...20 mA / 0,09 ... 10V)	0.3 ... 3 m
	Switching output Q (A <sub>1</sub> ...A <sub>2</sub> ), N.O., Auto-Detect	0.3 ... 3 m
	<b>Accessories</b>	
	Connection cables	From Page A-34
	Brackets	From Page A-4

<sup>3</sup>The specified precision is achieved by teaching the distances

# FT 90 ILA

## Distance sensor



### PRODUCT HIGHLIGHTS

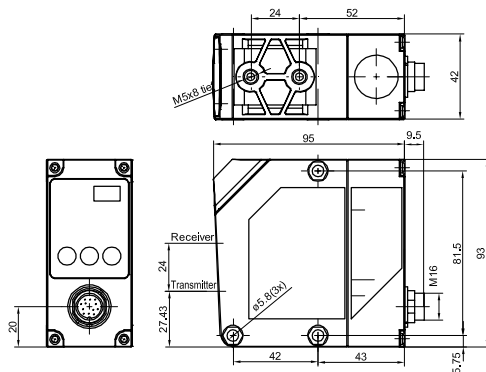
- Long scanning distance (up to 10 m on white objects)
- High repeatability
- High measurement rates
- Open interfaces ensure maximum compatibility (SSI-compatible, RS422)
- Profibus and DeviceNet via gateway
- Switchable red-light pilot laser
- 2 switching outputs

Optical data		Functions	
Operating range	0.5 ... 10 m <sup>1</sup>	Indicator LED, green	Operating voltage indicator
Measurement range	9.5 m	Indicator LED, yellow	Switching output indicator
Type of light	Infrared, 905 nm (measurement laser) Laser, red, 650 nm (pilot laser)	Scanning distance adjustment	Via Teach-in button and control input
Laser Class (DIN EN 60825-1:2008-5)	1 (measurement laser) 2 (pilot laser)		
Resolution	0.1 mm or 0.125 mm		
Linearity	± 8 mm		
Repeatability	± 4 mm		
Electrical data		Mechanical data	
Operating voltage, +U <sub>b</sub>	18 ... 30V DC <sup>2</sup>	Dimensions	93 × 93 × 42 mm
Output current, I <sub>e</sub>	≤ 100 mA	Enclosure rating	IP 67 <sup>3</sup>
Plausibility output, Q <sub>p</sub>	50 mA	Material, housing	ABS, impact-resistant
Service output, Q <sub>s</sub>	50 mA	Material, front screen	PMMA
Protective circuits	Reverse-polarity protection, U <sub>b</sub> / short-circuit protection, Q	Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-10 ... +50 °C (-20 ... +50 °C in continuous operation)
Power On Delay	≤ 12 ms	Ambient temperature: storage	-30 ... +75 °C
Switching output, Q <sub>1</sub> / Q <sub>2</sub>	PNP	Weight	230 g
Output function	N.O.	Vibration and impact resistance	EN 60947-5-2
Analogue output	4 ... 20 mA		
Temperature drift	< ± 5 mm absolute		
Serial interface	RS422 or SSI-compatible (GREY / BINARY) adjustable		
Bus interface	Profibus or DeviceNet, each via gateway (accessory)		
Cable length / m	< 25 / < 50 / < 100 / < 200 / < 400		
Cycle rate	< 500 kHz / < 400 kHz / < 300 kHz / < 200 kHz / < 100 kHz		

<sup>1</sup> Reference material: Kodak white, 90 %    <sup>2</sup> 10 % ripple, within U<sub>b</sub>    <sup>3</sup> With connected IP 67 plug

Type of connection	Part number	Article number
Plug, M16x1, 12-pin	FT 90 ILA-S2-Q12	591-91000

### Plug connection



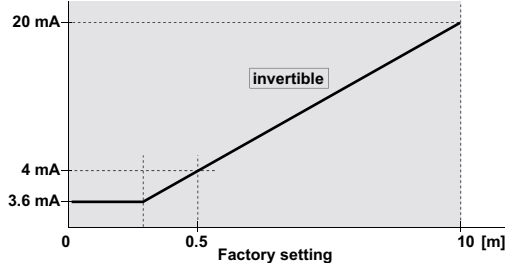
153-00457

### Connection, 12-pin

Pin	Name	Cable Type 1 (12-pin) colour	Cable Type 2 (5-pin) colour	Description
A	TX+	White		RS422: transmission data / SSI: Data+
B	Q1	Brown	Black	Switching output, Q1
C	RX+	Green		RS422: receiver data / SSI: clock+
D	analog	Yellow		Analogue output 4 ... 20 mA (only FT9X)
E	Qs	Grey	Orange	Service output, Qs
F	Qp	Pink		Plausibility output, Qp
G	U <sub>b</sub>	Red	Brown	U <sub>b</sub> + 18 ... 30V
H	RX-	Black		RS422: receiver data / SSI: clock
J	NC	Violet		
K	TX-	Grey/pink		RS422: transmitter data / SSI: Data-
L	Q2	Red/blue	White	Switching output, Q2
M	CND	Blue	Blue	0V (GND)

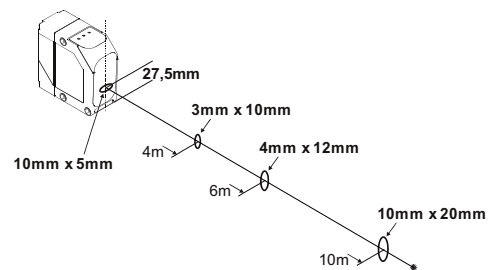
6

### Characteristic analogue curve



155-01406

### Light spot geometry



155-01808

### Scanning distance

White 90 %	0.5 ... 10 m
Grey 10 %	0.5 ... 7 m
Black 6 %	0.5 ... 3 m

### Accessories

Connection cables	From Page A-34
Brackets	From Page A-4
AS F 90 Aligning aid	From Page A-4
MSP F 90 A Fine adjustment	From Page A-4
Converters and adapter cables	From Page A-38

# FT 91 ILA

## Distance sensor



### PRODUCT HIGHLIGHTS

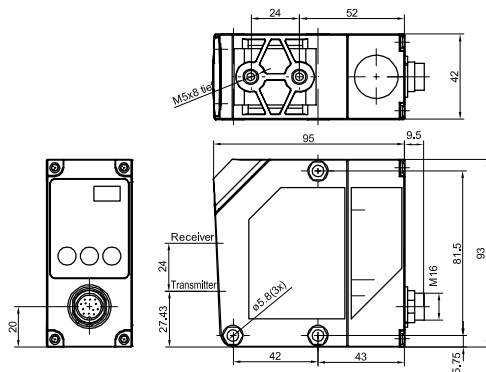
- Long scanning distance (up to 10 m on white objects)
- High repeatability
- High measurement rates
- Open interfaces ensure maximum compatibility (SSI-compatible, RS422)
- Profibus and DeviceNet via gateway
- Switchable red-light pilot laser
- 2 switching outputs

Optical data		Functions	
Operating range	0.5 ... 6 m <sup>1</sup>	Indicator LED, green	Operating voltage indicator
Type of light	Infrared, 905 nm (measurement laser) Laser, red, 650 nm (pilot laser)	Indicator LED, yellow	Switching output indicator
Laser Class (DIN EN 60825-1:2008-5)	1 (measurement laser) 2 (pilot laser)	Scanning distance adjustment	Via Teach-in button and control input
Resolution	0.1 mm or 0.125 mm		
Linearity	± 10 mm		
Repeatability	± 5 mm		
Electrical data		Mechanical data	
Operating voltage, +U <sub>B</sub>	18 ... 30V DC <sup>2</sup>	Dimensions	93 × 93 × 42 mm
Output current, I <sub>e</sub>	≤ 100 mA	Enclosure rating	IP 67 <sup>3</sup>
Plausibility output, Q <sub>p</sub>	50 mA	Material, housing	ABS, impact-resistant
Service output, Q <sub>s</sub>	50 mA	Material, front screen	PMMA
Protective circuits	Reverse-polarity protection, U <sub>B</sub> / short-circuit protection, Q	Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-10 ... +50 °C (-20 ... +50 °C in continuous operation)
Power On Delay	≤ 12 ms	Ambient temperature: storage	-30 ... +75 °C
Switching output, Q <sub>1</sub> / Q <sub>2</sub>	PNP	Weight	230 g
Output function	N.O.	Vibration and impact resistance	EN 60947-5-2
Analogue output	4 ... 20 mA		
Temperature drift	< 0.5 mm / K		
Serial interface	RS422 or SSI-compatible (GREY / BINARY) adjustable		
Bus interface	Profibus or DeviceNet, each via gateway (accessory)		
Cable length / m	< 25 / < 50 / < 100 / < 200 / < 400		
Cycle rate	< 500 kHz / < 400 kHz / < 300 kHz / < 200 kHz / < 100 kHz		

<sup>1</sup> Reference material: Kodak white, 90 %    <sup>2</sup> 10 % ripple, within U<sub>B</sub>    <sup>3</sup> With connected IP 67 plug

Type of connection	Part number	Article number
Plug, M16, 12-pin	FT 91 ILA-S2-Q12	591-91003

### Plug connection



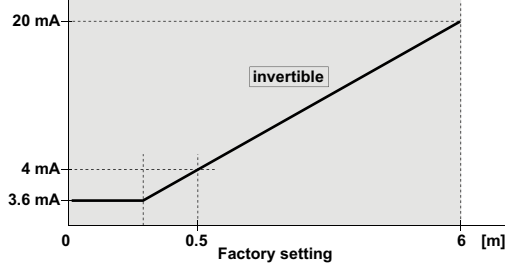
153-00457

### Connection, 12-pin

Pin	Name	Cable Type 1 (12-pin) colour	Cable Type 2 (5-pin) colour	Description
A	TX+	White		RS422: transmission data / SSI: Data+
B	Q1	Brown	Black	Switching output, Q1
C	RX+	Green		RS422: receiver data / SSI: clock+
D	analog	Yellow		Analogue output 4 ... 20 mA (only FT9X)
E	Qs	Grey	Orange	Service output, Qs
F	Qp	Pink		Plausibility output, Qp
G	U <sub>b</sub>	Red	Brown	U <sub>b</sub> + 18 ... 30V
H	RX-	Black		RS422: receiver data / SSI: clock
J	NC	Violet		
K	TX-	Grey/pink		RS422: transmitter data / SSI: Data-
L	Q2	Red/blue	White	Switching output, Q2
M	CND	Blue	Blue	0V (GND)

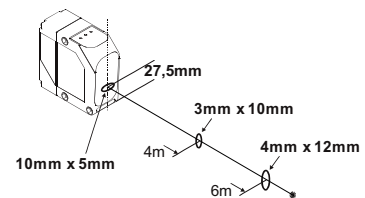
6

### Characteristic analogue curve



155-01809

### Light spot geometry



155-01810

### Scanning distance

White 90 %	0.5 ... 6 m
Grey 10 %	0.5 ... 4 m
Black 6 %	0.5 ... 2 m

### Accessories

Connection cables	From Page A-34
Brackets	From Page A-4
AS F 90 Aligning aid	From Page A-4
MSP F 90 A Fine adjustment	From Page A-4
Converters and adapter cables	From Page A-38

# FT 92 ILA / IRLA

Distance sensor



## PRODUCT HIGHLIGHTS

- Long scanning distance and range
- High repeatability
- High measurement rates
- Very good price/performance ratio
- Switchable red-light pilot laser
- 2 PNP switching outputs
- 1 analogue output: 4 ... 20 mA
- All outputs in measurement range freely adjustable
- Standard M12 plug

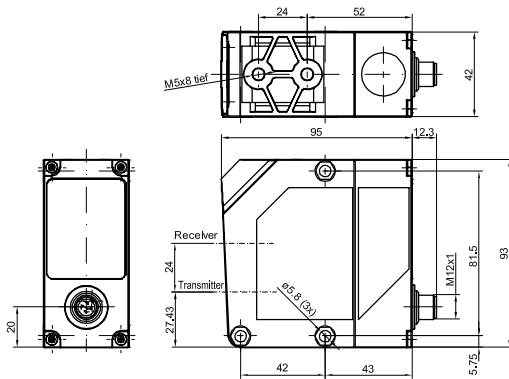
Optical data		Functions	
Scanning distance	0.2 ... 6 m <sup>1</sup>	Indicator LED, green	Operating voltage indicator
Type of light	Infrared, 905 nm (measurement laser) Laser, red, 650 nm (pilot laser)	Indicator LED, yellow	2 x switching output indicator
Laser Class (DIN EN 60825-1:2008-5)	1 (measurement laser) 2 (pilot laser)	Indicator LED, orange	Operating mode
Repeatability Fast/Slow	< ± 15 / 10 mm <sup>2</sup>	Indicator LED, red	Menu Indicator
Linearity	≤ ± 40 mm <sup>2</sup>	Scanning distance adjustment	Via Teach-in button
		Default settings	Max. scanning distance and N.O.
Electrical data		Mechanical data	
Operating voltage, +U <sub>b</sub>	18 ... 30V DC <sup>3</sup>	Dimensions	95 x 93 x 42 mm
No-load current, I <sub>0</sub>	≤ 125 mA	Enclosure rating	IP 67 <sup>4</sup>
Output current, I <sub>e</sub>	≤ 100 mA	Material, housing	ABS, impact-resistant
Protective circuits	Reverse-polarity protection, U <sub>b</sub> / short-circuit protection (Q)	Material, front screen	PMMA
Protection Class	2	Type of connection	See Selection Table
Power On Delay	< 300 ms	Ambient temperature: operation	-20 ... +50 °C
Switching output, Q <sub>1</sub> / Q <sub>2</sub>	PNP / NPN 100 mA (see Selection Table)	Ambient temperature: storage	-40 ... +80 °C
Analogue output	4 ... 20 mA	Weight	200 g
Temperature drift	≤ 1.2 mm / K	Vibration and impact resistance	EN 60947-5-2
Load	≤ 500 Ω		

<sup>1</sup> With RL250 reflector    <sup>2</sup> Data apply after a minimum switch-on time of 30 min    <sup>3</sup> 10 % ripple, within U<sub>b</sub>    <sup>4</sup> With connected IP 67 plug

Switching output	Type of connection	Part number	Article number
PNP	Plug, M12, 5-pin	FT 92 ILA-PSL5	591-91005
NPN	Plug, M12, 5-pin	FT 92 ILA-NSL5	591-91008
PNP	Plug, M12, 5-pin	FT 92 IRLA-PSL5 <sup>5</sup>	591-91013

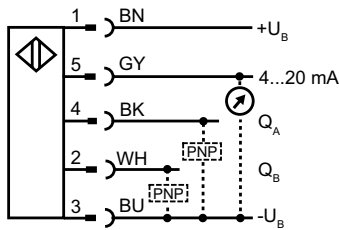
<sup>5</sup> Pilot laser (red) on permanently

Plug connection



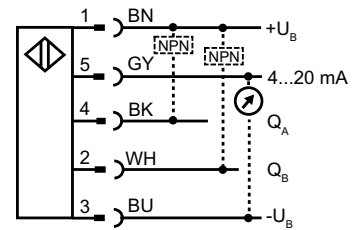
153-00346

Connection, 5-pin (PNP)



154-00125

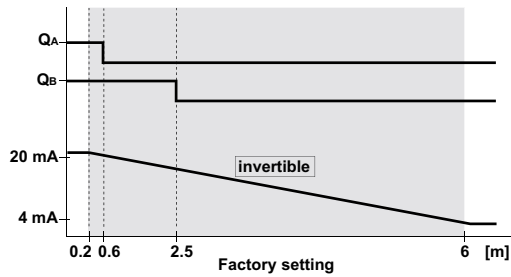
Connection, 5-pin (NPN)



154-00472

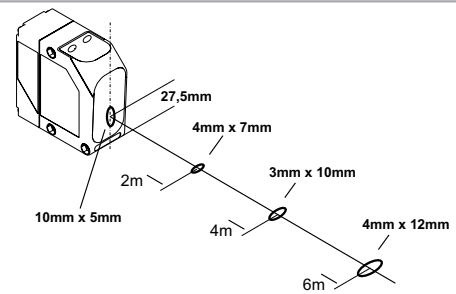
6

Characteristic analogue curve



155-01373

Light spot geometry



155-00141

Scanning distance

White 90 %	0.2 ... 6 m
Grey 18 %	0.2 ... 6 m
Black 6 %	0.2 ... 2.5 m

Accessories

Connection cables	From Page A-34
Brackets	From Page A-4
AS F 90 Aligning aid	From Page A-4
MSP F 90 A Fine adjustment	From Page A-4
Converters and adapter cables	From Page A-38



# FR 55-RLAP

Distance sensor with a reflector for large distances – Time-of-flight technology



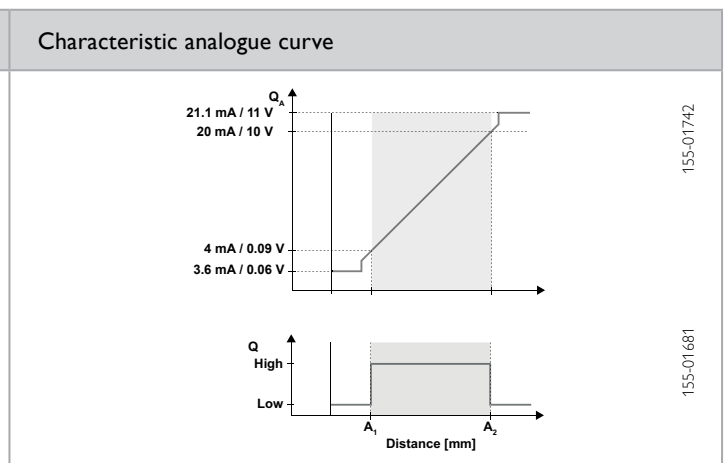
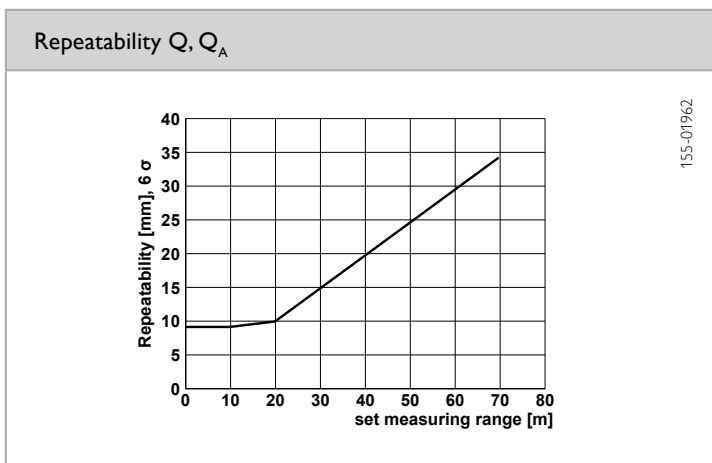
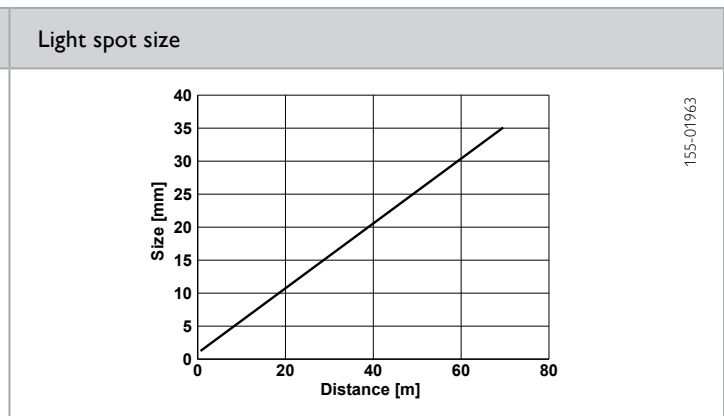
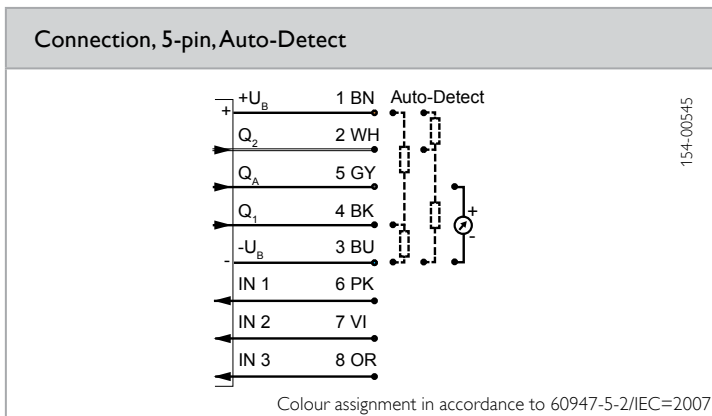
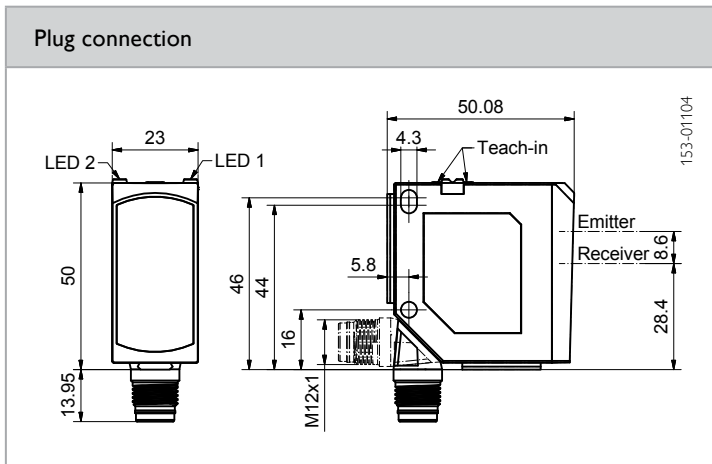
## PRODUCT HIGHLIGHTS

- Sensor with large range for anticollision and positioning applications
- High flexibility thanks to adjustable analogue characteristic ( $Q_A$ )
- 4 distance positions with 2 switching outputs, adjustable via window function
- $Q_1/Q_2$  switchable to  $Q_1/\bar{Q}_1$  as antivalent outputs
- Compact design for an easy integration
- Easy installation and operation via external teach-in
- Clearly visible laser light spot (laser class 1) for a precise alignment and full eye safety
- Laser can be switched off via control line

Optical data		Functions	
Measurement range	0.3 ... 70 <sup>1</sup>	Indicator LED 1, green	Operating voltage indicator
Resolution	8 $\mu$ A	Indicator LED 1, yellow	Switching output indicator
Linearity	$\pm 0.5\%$ <sup>1,2</sup>	Indicator LED 2 yellow	Switching output indicator
Repeatability Q	1.5 mm <sup>3</sup>	Measurement range adjustment	Via Teach-in button or control input
Hysteresis	60 mm	Adjustment possibilities	Analogue measurement range $Q_A$ Invertible analogue characteristic Switching output Q (window mode) N.O. / N.C. / antivalent $Q_1/\bar{Q}_1$ and Auto-Detect / NPN / PNP via teach-in and control line Button lock via control input
Type of light	Laser, red 655 nm		Button lock via control input
Laser class (DIN EN 60825-1:2008-5)	1		See Selection Table
		Default settings	
Electrical data			
Operating voltage $+U_B$	18 ... 30V DC	Response time Q	10 ms
No-load current $I_0$	$\leq 60$ mA	Load	$\leq 500$ Ohm (4 ... 20 mA)
Output current $I_e$ Q	$\leq 100$ mA	Analogue output $Q_A$	4 ... 20 mA
Protection circuits	Reverse polarity protection $U_B$ / short-circuit protection (Q)	Update rate $Q_A$	10 ms
Protection class	2	Temperature drift	< 1 mm / K
Power On Delay	< 5 s	Warm-up time	20 min.
Switching output Q	Auto-Detect (PNP/NPN) <sup>4</sup>	Control input IN 1 und IN 2	$+U_B$ = Teach-in $-U_B$ = Button locked Open = normal operation
Output function	N.O. / N.C. / antivalent $Q_1/\bar{Q}_1$	Control input IN 3	$+U_B$ = Laser off $-U_B$ = Laser on offen = Laser on
Switching frequency f (ti/tp 1:1)	$\leq 50$ Hz		
Mechanical data			
Dimensions	50 x 50.1 x 23 mm	Ambient temperature: operation	-30 ... +60 °C
Enclosure rating	IP 67 & IP 69K <sup>5</sup>	Ambient temperature: storage	-40 ... +80 °C
Material, housing	ABS	Weight (plug device)	42 g
Material, front screen	PMMA	Resistance to vibration and impacts	EN 60947-5-2
Type of connection	See Selection Table		

<sup>1</sup> Reference material: RF250 reflector    <sup>2</sup> Of set measuring range    <sup>3</sup> For 1  $\sigma$ , the set measuring range is < 20 m, for further values see diagram    <sup>4</sup> Auto-Detect: Automatic selection of PNP or NPN by the sensor; PNP or NPN can be fixed    <sup>5</sup> With connected IP 67 / IP 69K plug

Measurement range <sup>1</sup>	Analogue output	Switching output	Type of connection	Part Number	Article number
0.3 ... 70 m	4 ... 20 mA	2 x Auto-Detect	Plug, M12x1, 8-pin	FR 55-RLAP-70-2PNSI-L8	621-11026



<sup>1</sup> At constant ambient conditions

Default setting	Measurement range	Accessories	
Analogue output $Q_A$ (4...20 mA)	2 ... 6 m	Mounting angle MA F 55 (579-50007)	From Page A-4
Switching output $Q$ ( $A_1$ ... $A_2$ ), N.O., Auto-Detect	2 ... 6 m	Further brackets	From Page A-4
Switching output $Q_2$ ( $A_1$ ... $A_2$ ), N.O., Auto-Detect	2 ... 6 m	Connection cables (C L8FG-S-2m-PUR / 902-51830)	From Page A-34
		Further connection cables	From Page A-34
		Reflective foil RF 250 (599-91009)	From Page A-18
		Further reflectors	From Page A-18

# FR 55-RLP

Distance sensor with a reflector for large distances – Time-of-flight technology



## PRODUCT HIGHLIGHTS

- Sensor with large range for anticollision and positioning applications
- 4 distance positions with 2 switching outputs, adjustable via window function
- Q<sub>2</sub> can be switched to Q<sub>1</sub> as antivalent output, e.g. for wire breakage monitoring
- Compact design for an easy integration
- Easy installation and operation via external teach-in
- Clearly visible laser light spot (laser class 1) for a precise alignment and full eye safety

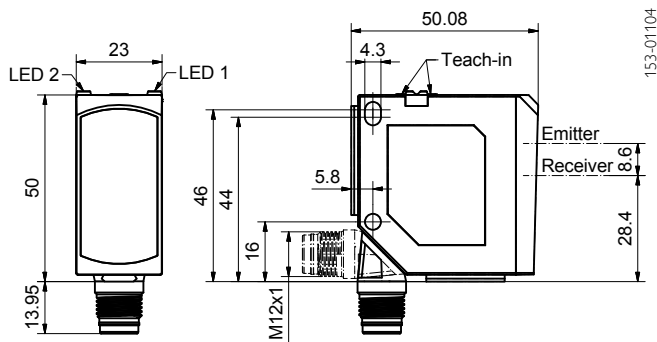
Optical data		Functions	
Measurement range	0.3 ... 70 <sup>1</sup>	Indicator LED 1, green	Operating voltage indicator
Repeatability Q	1.5 mm <sup>2</sup>	Indicator LED 1, yellow	Switching output indicator
Hysteresis	60 mm	Indicator LED 2 yellow	Switching output indicator
Type of light	Laser, red 655 nm	Measurement range adjustment	Via Teach-in button or control input
Laser class (DIN EN 60825-1:2008-5)	1	Adjustment possibilities	Switching output Q (window mode) N.O. / N.C. / antivalent Q <sub>1</sub> /Q <sub>1</sub> and Auto-Detect / NPN / PNP via teach-in and control line
		Default settings	Button lock via control input See Selection Table
Electrical data			
Operating voltage +U <sub>B</sub>	18 ... 30V DC	Response time Q	10 ms
No-load current I <sub>0</sub>	≤ 60 mA	Temperature drift	< 1 mm / K
Output current I <sub>e</sub> Q	≤ 100 mA	Warm-up time	20 min.
Protection circuits	Reverse polarity protection U <sub>B</sub> / short-circuit protection (Q)	Control input IN	+U <sub>B</sub> = Teach-in -U <sub>B</sub> = Button locked Open = normal operation
Protection class	2		
Power On Delay	< 5 s		
Switching output Q	Auto-Detect (NPN / PNP) <sup>3</sup>		
Output function	N.O. / N.C. / antivalent Q <sub>1</sub> /Q <sub>1</sub>		
Switching frequency f (ti/tp 1:1)	≤ 50 Hz		
Mechanical data			
Dimensions	50 x 50.1 x 23 mm	Ambient temperature: operation	-30 ... +60 °C
Enclosure rating	IP 67 & IP 69K <sup>4</sup>	Ambient temperature: storage	-40 ... +80 °C
Material, housing	ABS	Weight (plug device)	42 g
Material, front screen	PMMA	Resistance to vibration and impacts	EN 60947-5-2
Type of connection	See Selection Table		

<sup>1</sup> RF250 reflector    <sup>2</sup> For 1 σ, the set measuring range is < 20 m, for further values see diagram    <sup>3</sup> Auto-Detect: Automatic selection of PNP or NPN by the sensor; PNP or NPN can be fixed

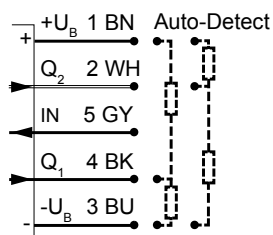
<sup>4</sup> With connected IP 67 / IP 69K plug

Measurement range <sup>1</sup>	Switching output	Type of connection	Part Number	Article number
0.3... 70 m	2 x Auto-Detect	Plug, M12x1, 5-pin	FR 55-RLP-70-2PNS-L5	621-11027

### Plug connection

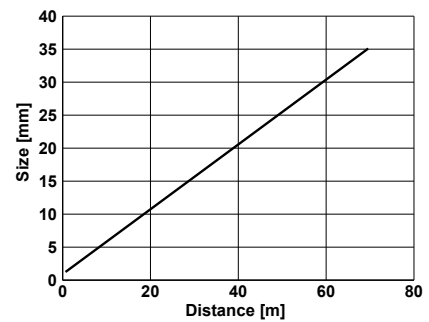


### Connection, 5-pin, Auto-Detect



154-00546

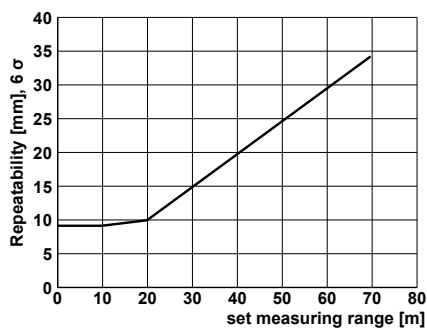
### Light spot size



155-01963

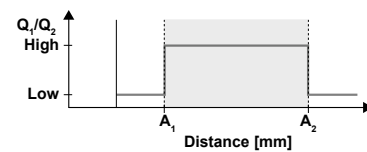
6

### Repeatability<sup>1</sup> Q<sub>1</sub> / Q<sub>2</sub>



154-01962

### Switching output Q<sub>1</sub> / Q<sub>2</sub>



155-01965

<sup>1</sup> At constant ambient conditions

Default setting	Measurement range	Accessories	
Switching output Q <sub>1</sub> (A <sub>1</sub> ...A <sub>2</sub> ), N.O., Auto-Detect	2 ... 6 m	Mounting angle MA F 55 (579-50007)	From Page A-4
Switching output Q <sub>2</sub> (A <sub>1</sub> ...A <sub>2</sub> ), N.O., Auto-Detect	2 ... 6 m	Further brackets	From Page A-4
		Connection cables	From Page A-34
		Reflective foil RF 250 (599-91009)	From Page A-18
		Further reflectors	From Page A-18

# FR 90 ILA

## Reflector distance sensor



### PRODUCT HIGHLIGHTS

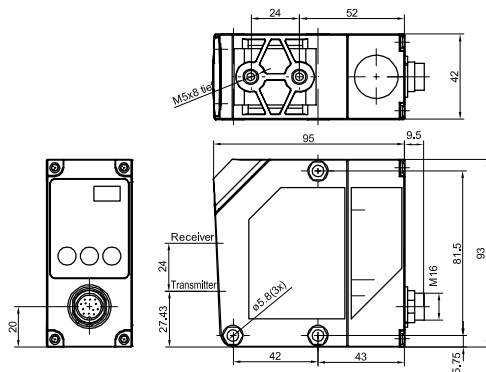
- Long range of up to 250 m on specified reflector
- High repeatability
- High measurement rates
- Ideal for precise positioning tasks
- Open interfaces ensure maximum compatibility (SSI-compatible, RS422)
- Profibus and DeviceNet via gateway
- Switchable red-light pilot laser
- 2 switching outputs

Optical data		Functions	
Scanning distance	0.5 ... 250 m	Indicator LED, green	Operating voltage indicator
Type of light	Infrared, 905 nm (measurement laser) Laser, red, 650 nm (pilot laser)	Indicator LED, yellow	Switching output indicator
Laser Class (DIN EN 60825-1:2008-5)	1 (measurement laser) 2 (pilot laser)	Scanning distance adjustment	Via Teach-in button and control input
Resolution	0.1 mm or 0.125 mm		
Linearity	± 3 mm (from 2 m)		
Repeatability	< ± 2 mm		
Light spot	20 × 20 mm <sup>1</sup>		
Electrical data		Mechanical data	
Operating voltage, +U <sub>B</sub>	18 ... 30V DC <sup>2</sup>	Dimensions	93 × 93 × 42 mm
Output current, I <sub>e</sub>	≤ 100 mA	Enclosure rating	IP 67 <sup>3</sup>
Plausibility output, Q <sub>p</sub>	50 mA	Material, housing	ABS, impact-resistant
Service output, Q <sub>s</sub>	50 mA	Material, front screen	PMMA
Protective circuits	Reverse-polarity protection, U <sub>B</sub> / short-circuit protection, Q	Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-10 ... +50 °C (-20 ... +50 °C in continuous operation)
Power On Delay	≤ 12 ms	Ambient temperature: storage	-30 ... +75 °C
Switching output, Q <sub>1</sub> / Q <sub>2</sub>	PNP	Weight	230 g
Output function	N.O.	Vibration and impact resistance	EN 60947-5-2
Temperature drift	< ± 5 mm absolute		
Serial interface	RS422 or SSI-compatible (GREY / BINARY) adjustable		
Bus interface	Profibus or DeviceNet each via gateway (accessories)		
Cable length / m	< 25 / < 50 / < 100 / < 200 / < 400		
Cycle rate	< 500 kHz / < 400 kHz / < 300 kHz / < 200 kHz / < 100 kHz		

<sup>1</sup>At scanning distance of 10 m    <sup>2</sup>10 % ripple, within U<sub>B</sub>    <sup>3</sup>With connected IP 67 plug

Type of connection	Part number	Article number
Plug, M16x1, 12-pin	FR 90 ILA-S2-Q12	591-91001

### Plug connection



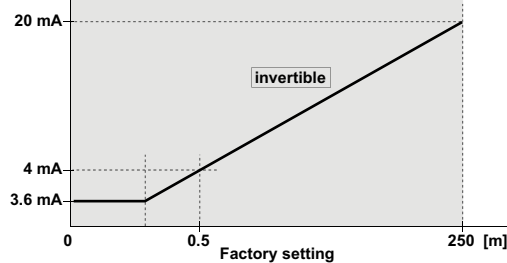
153-00457

### Connection, 12-pin

Pin	Name	Cable Type 1 (12-pin) colour	Cable Type 2 (5-pin) colour	Description
A	TX+	White		RS422: transmission data / SSi: Data+
B	Q1	Brown	Black	Switching output, Q1
C	RX+	Green		RS422: receiver data / SSi: clock+
D	analog	Yellow		Analogue output 4 ... 20 mA (only FT9X)
E	Qs	Grey	Orange	Service output, Qs
F	Qp	Pink		Plausibility output, Qp
G	U <sub>b</sub>	Red	Brown	U <sub>b</sub> + 18 ... 30V
H	RX-	Black		RS422: receiver data / SSi: clock
J	NC	Violet		
K	TX-	Grey/pink		RS422: transmitter data / SSi: Data-
L	Q2	Red/blue	White	Switching output, Q2
M	CND	Blue	Blue	0V (GND)

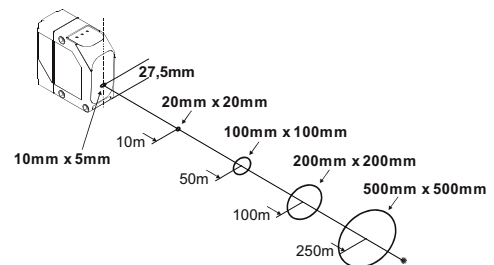
6

### Characteristic analogue curve



155-01811

### Light spot geometry



155-01807

### Accessories

Reflectors	From Page A-18
Connection cables	From Page A-34
Brackets	From Page A-4
AS F 90 Aligning aid	From Page A-4
MSP F 90 A Fine adjustment	From Page A-4
Converters and adapter cables	From Page A-38

# FR 91 ILA

## Reflector distance sensor



### PRODUCT HIGHLIGHTS

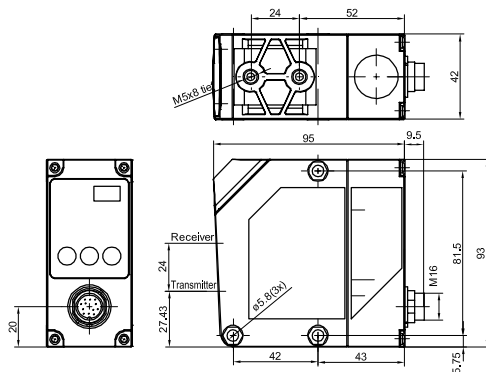
- Long range of up to 50 m on specified reflector
- High repeatability
- High measurement rates
- Very good price/performance ratio
- Open interfaces ensure maximum compatibility (SSI-compatible, RS422)
- Profibus and DeviceNet via gateway
- Switchable red-light pilot laser
- 2 switching outputs

Optical data		Functions	
Scanning distance	0.5 ... 50 m	Indicator LED, green	Operating voltage indicator
Type of light	Infrared, 905 nm (measurement laser) Laser, red, 650 nm (pilot laser)	Indicator LED, yellow	Switching output indicator
Laser Class (DIN EN 60825-1:2008-5)	1 (measurement laser) 2 (pilot laser)	Scanning distance adjustment	Via Teach-in button and control input
Resolution	0.1 mm or 0.125 mm		
Linearity	± 5 mm (from 2 m)		
Repeatability	< ± 4 mm		
Light spot	20 × 20 mm <sup>1</sup>		
Electrical data		Mechanical data	
Operating voltage, +U <sub>B</sub>	18 ... 30V DC <sup>2</sup>	Dimensions	95 × 93 × 42 mm
Output current, I <sub>e</sub>	≤ 100 mA	Enclosure rating	IP 67 <sup>3</sup>
Plausibility output, Q <sub>p</sub>	50 mA	Material, housing	ABS, impact-resistant
Service output, Q <sub>s</sub>	50 mA	Material, front screen	PMMA
Protective circuits	Reverse-polarity protection, U <sub>B</sub> / short-circuit protection, Q	Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-10 ... +50 °C
Power On Delay	≤ 12 ms	Ambient temperature: storage	-30 ... +75 °C
Switching output, Q <sub>1</sub> / Q <sub>2</sub>	PNP	Weight	230 g
Output function	N.O.	Vibration and impact resistance	EN 60947-5-2
Temperature drift	< 0.5 mm / K		
Serial interface	RS422 or SSI-compatible (GREY / BINARY) adjustable		
Bus interface	Profibus or DeviceNet, each via gateway (accessories)		
Cable length / m	< 25 / < 50 / < 100 / < 200 / < 400		
Cycle rate	< 500 kHz / < 400 kHz / < 300 kHz / < 200 kHz / < 100 kHz		

<sup>1</sup> At scanning distance of 10 m    <sup>2</sup> 10 % ripple, within U<sub>B</sub>    <sup>3</sup> With connected IP 67 plug

Type of connection	Part number	Article number
Plug, M16, 12-pin	FR 91 ILA-S2-Q12	591-91002

### Plug connection



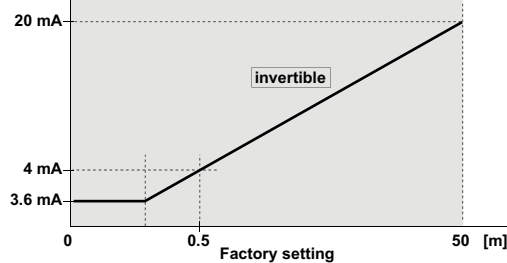
153-00457

### Connection, 12-pin

Pin	Name	Cable Type 1 (12-pin) colour	Cable Type 2 (5-pin) colour	Description
A	TX+	White		RS422: transmission data / SSi: Data+
B	Q1	Brown	Black	Switching output, Q1
C	RX+	Green		RS422: receiver data / SSi: clock+
D	analog	Yellow		Analogue output 4 ... 20 mA (only FT9X)
E	Qs	Grey	Orange	Service output, Qs
F	Qp	Pink		Plausibility output, Qp
G	U <sub>b</sub>	Red	Brown	U <sub>b</sub> + 18 ... 30V
H	RX-	Black		RS422: receiver data / SSi: clock
J	NC	Violet		
K	TX-	Grey/pink		RS422: transmitter data / SSi: Data-
L	Q2	Red/blue	White	Switching output, Q2
M	CND	Blue	Blue	0V (GND)

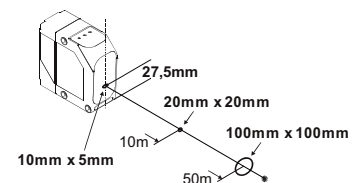
6

### Characteristic analogue curve



155-01812

### Light spot geometry



155-01813

### Accessories

Reflectors	From Page A-18
Connection cables	From Page A-34
Brackets	From Page A-4
AS F 90 Aligning aid	From Page A-4
MSP F 90 A Fine adjustment	From Page A-4
Converters and adapter cables	From Page A-38



# FR 92 ILA

## Reflector distance sensor



### PRODUCT HIGHLIGHTS

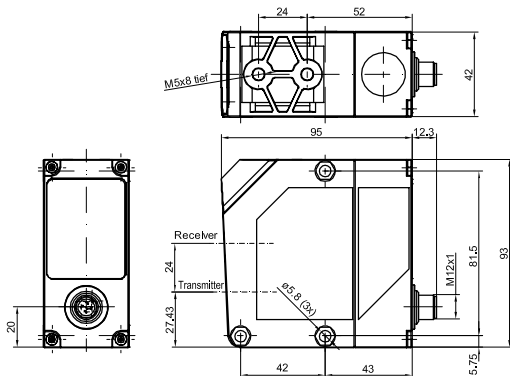
- Long scanning distance and range (scanning up to 6 m on white objects, with reflector up to 30 m)
- High repeatability
- High measurement rates
- Switchable red-light pilot laser
- Simple teach-in

Optical data		Functions	
Scanning distance	0.2 ... 30 m <sup>1</sup>	Indicator LED, green	Operating voltage indicator
Type of light	Infrared, 905 nm (measurement laser) Laser; red, 650 nm (pilot laser)	Indicator LED, yellow	Switching output indicator
Laser Class (DIN EN 60825-1:2008-5)	1 (measurement laser) 2 (pilot laser)	Indicator LED, orange	Operating mode
Repeatability Fast/Slow	≤ ± 10 / 5 mm <sup>2</sup>	Indicator LED, red	Menu Indicator
Linearity	≤ ± 60 mm <sup>2</sup>	Scanning distance adjustment	Via Teach-in button
		Default settings	Max. scanning distance and N.O.
Electrical data		Mechanical data	
Operating voltage, +U <sub>B</sub>	18 ... 30V DC <sup>3</sup>	Dimensions	95 × 93 × 42 mm
No-load current, I <sub>0</sub>	≤ 125 mA	Enclosure rating	IP 67 <sup>4</sup>
Output current, I <sub>e</sub>	100 mA	Material, housing	ABS
Max. voltage drop at switching output	≤ 2.4V	Material, front screen	PMMA
Protective circuits	Reverse-polarity protection, U <sub>B</sub> / short-circuit protection (Q)	Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-20 ... +50 °C
Power On Delay	< 300 ms	Ambient temperature: storage	-40 ... +80 °C
Response time fast / slow	30 ms / 65 ms	Weight	200 g
Switching output, Q <sub>1</sub> / Q <sub>2</sub>	PNP	Vibration and impact resistance	EN 60947-5-2
Output function	N.O.		
Analogue output	4 ... 20 mA		
Temperature drift analogue	3 mm / K		
Temperature drift switching output	1.5 mm / K		

<sup>1</sup>With RL250 reflector    <sup>2</sup>Data apply after a minimum switch-on time of 30 min    <sup>3</sup>10 % ripple, within U<sub>B</sub>    <sup>4</sup>With connected IP 67 plug

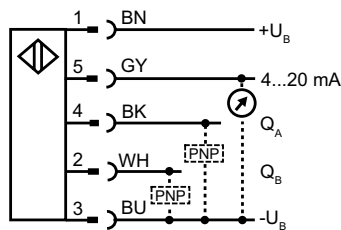
Type of connection	Part number	Article number
Plug, M12, 5-pin	FR 92 ILA-PSL5	591-91006

Plug connection



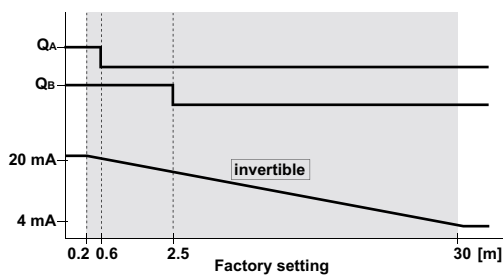
153-00346

Connection, 5-pin



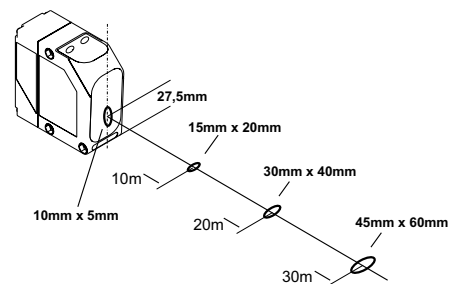
154-00125

Characteristic output and analogue curves



155-01359

Light spot geometry



155-00210


Accessories

Reflectors	From Page A-18
Connection cables	From Page A-34
Brackets	From Page A-4
AS F 90 Aligning aid	From Page A-4
MSP F 90 A Fine adjustment	From Page A-4
Converters and adapter cables	From Page A-38

# FR 85 Rail Pilot – optical collision protection sensors

Safe movement on monorail systems



 made in Germany



*Monorail system with car bodies in the automotive industry*

## TYPICAL FR 85 RAIL PILOT

- Laser photoelectric reflex switches for preventing collisions on monorail systems
- Operating range: 0 ... 6 m
- Typical measurement accuracy:  $\pm 10$  cm
- Large optics aperture angle and thus long detection range
- 1 input and 2 PNP outputs
- RS485 interface
- Detection range adjustable externally
- Reliable suppression of foreign objects (girders, pillars)
- ABS housing: 145 x 85 x 80 mm

The sensor's task is to prevent collisions between vehicles on monorail systems. The Rail Pilot achieves this reliably. The distances to be maintained, and the braking distances of the monorail vehicles, depend on the load transported and on the speed – this is taken into account by means of flexibly adjustable switching distances.

Even constantly changing objects in the vicinity of the vehicles and sensors have no effect on the reliable functioning of collision prevention.

FR 85 Rail Pilot – Product Overview			
	Operating range	Special features	Page
FR 85 Rail Pilot	0 ... 6 m	RS485 interface or PNP switching outputs	228

# FR 85 Rail Pilot

Distance sensor for collision prevention



## PRODUCT HIGHLIGHTS

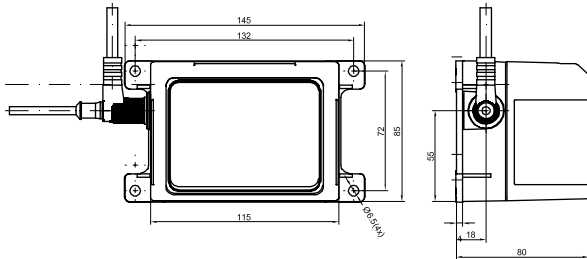
- Measurement range: 0 ... 6 m
- Wide detection cone
- Switching point accuracy  $\pm 10$  cm
- 2x2 detection zones
- 1 input
- 2 PNP outputs
- RS485 interface
- Detection zone adjustable externally
- Reliable suppression of foreign objects (girders, pillars)

Optical data		Functions	
Scanning distance	0 ... 6 m <sup>1</sup>	Indicator LED, green	Operating voltage indicator
Type of light	Infrared, 905 nm	Indicator LED, red	Switching output indicator
Laser Class (DIN EN 60825-1:2008-5)	1	Scanning distance adjustment	Via control wire
Repeatability	$\pm 100$ mm		
Electrical data		Mechanical data	
Operating voltage, +U <sub>B</sub>	18 ... 30V DC <sup>2</sup>	Dimensions	145 x 85 x 80 mm
No-load current, I <sub>0</sub>	$\leq 200$ mA	Enclosure rating	IP 54 <sup>4</sup>
Output current, I <sub>e</sub>	$\leq 200$ mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U <sub>B</sub> / short-circuit protection (Q)	Material, front screen	PMMA
Protection Class	2	Type of connection	See Selection Table
Power On Delay	< 300 ms	Ambient temperature: operation	0 ... +50 °C
Switching output, Q	See Selection Table	Ambient temperature: storage	-20 ... +70 °C
Output function	See Selection Table	Weight	340 g
Serial interface	RS485 / R = 1 k $\Omega$ <sup>3</sup>		
Control input E1 / banking	Close and remote switching -U <sub>B</sub> (low) Q1 = switching point 1; Q2 = switching point 2 +U <sub>B</sub> (high) Q1 = switching point 3; Q2 = switching point 4		

<sup>1</sup> Reference material: R10/2 reflector    <sup>2</sup> 10 % ripple, within U<sub>B</sub>    <sup>3</sup>Type FR85 ... S1L5    <sup>4</sup>With connected IP 54 plug

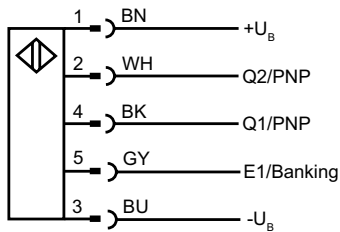
Interface	Baud rate	Suitable for control	Type of connection	Part number	Article number
RS485	57,6 kB	Lenze / DETO	Plug, M12x1, 5-pin	FR 85-2 ILLG-S1L5	529-11008
RS485	62,5 kB	LJU	Plug, M12x1, 5-pin	FR 85-2 ILLG-S1L5-62,5 kB	529-11014
2 switching points Q (PNP) N.C.	-	-	Plug, M12x1, 5-pin	FR 85-2 ILLG-POL5	529-11010

Plug connection



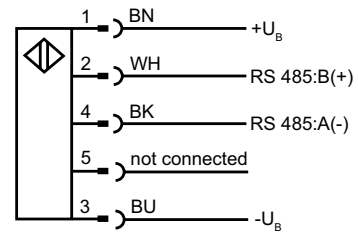
153-00349

Connection, 5-pin: FR 85-2 ILLG-POL5



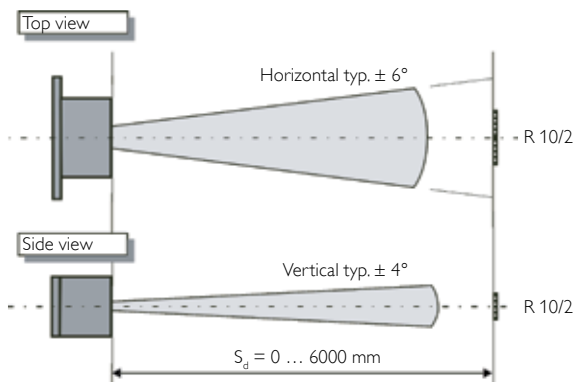
154-00325

Connection, 5-pin: FR 85-2 ILLG-S1L5



154-00478

Detection cone



155-00202

Reflector	Article number	Accessories	
R10 / 2 (2xR10)	904-51636	Reflectors	From Page A-18
Reflective foil	904-51548	Connection cables	From Page A-34
		Setup Box FR 85-2 ILLX 533-11016	From Page A-38