

# Distance sensors

Measurement from 10 mm to 250 m

## Optical distance sensors

### from Page 270

#### FT 10 IO-Link

- Operating range (scanning distance) from 10 mm to 70 mm
- Laser short-range distance sensors using the triangulation principle
- Minimal dimensions
- Measurement value output via IO-Link

### from Page 274

#### FT 25 IO-Link

- Operating range (scanning distance) from 20 mm to 200 mm
- Laser- and LED short-range distance sensors using the triangulation principle
- Miniature housing for simple integration
- Analogue output 1 ... 10 V and measurement value output via IO-Link

### from Page 280

#### FT 55-RLAM IO-Link

- Operating range up to 1 m
- Excellent sensor qualities at long ranges
- Laser distance sensor using the triangulation principle
- Analogue output and digital output of measurement values via IO-Link

### from Page 286

#### FT 50

- Operating range from 30 to 300 mm
- Proven laser distance sensor using the triangulation principle
- High absolute accuracy
- Analogue output and digital output of measurement values via RS485



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.



Determining the exact position of parts on an assembly line



Detection of double layers on printed-circuit boards

## from Page 296

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

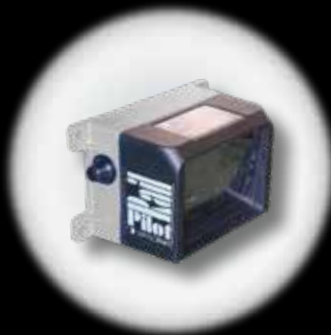
- Laser distance sensors using the time-of-flight principle
- Scanner versions up to measurement distance of 10 m
- Reflector versions up to 250 m range
- Wide choice of interfaces (serial and analogue),  
IO-Link



## from Page 318

### 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 646

- 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 colors – and especially with transparent objects



## Inductive distance sensors from Page 696

- 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



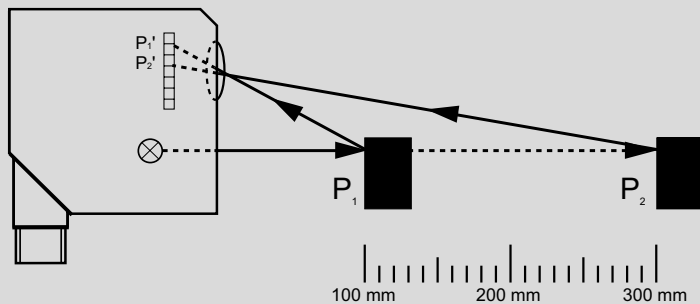
# Distance sensors

## System description

### Distance measurement using triangulation

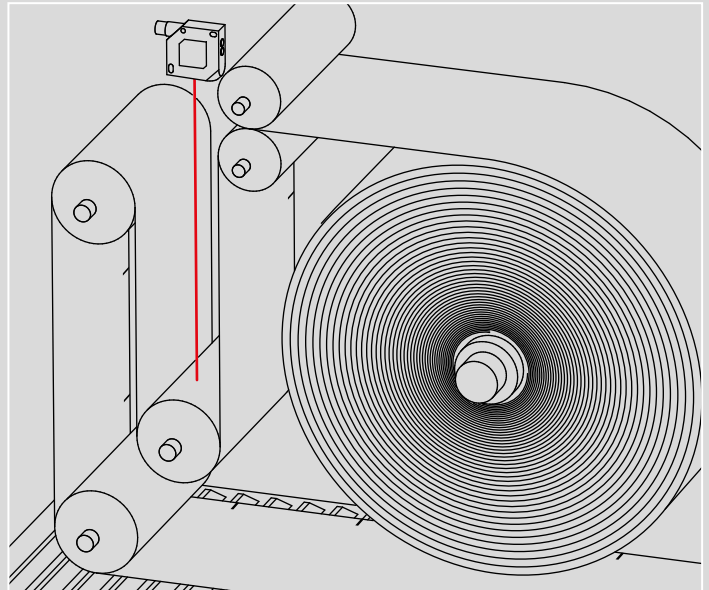
The measurement principle of optical triangulation is suitable for the precise determination of distances at close range. With the help of special receiver optics and a position-sensitive detector (e.g. a photodiode line), the sensor can determine the object distance regardless of its reflectivity (see illustration below). The color 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 quantity 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

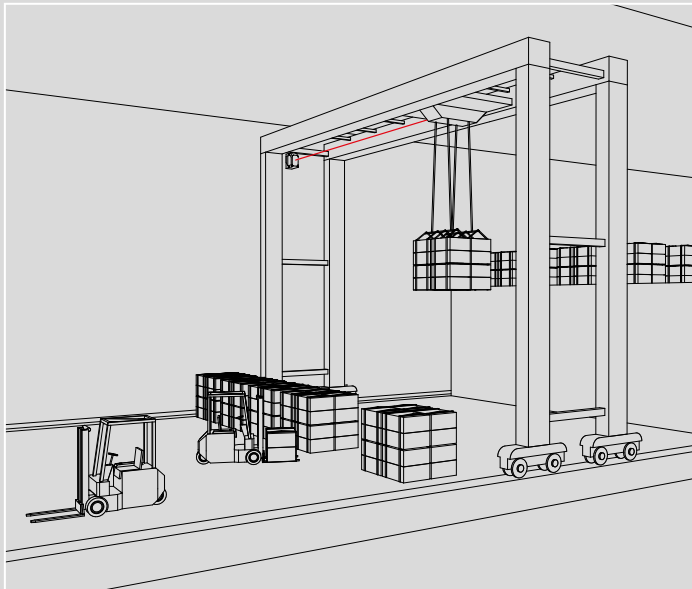
Collision prevention on monorail systems in car production is a special distance measurement task. The FR 85 series was specially developed for this application. These sensors provide excellent measurement results regardless of the reflectivity of the target object, and their comprehensive range of functions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

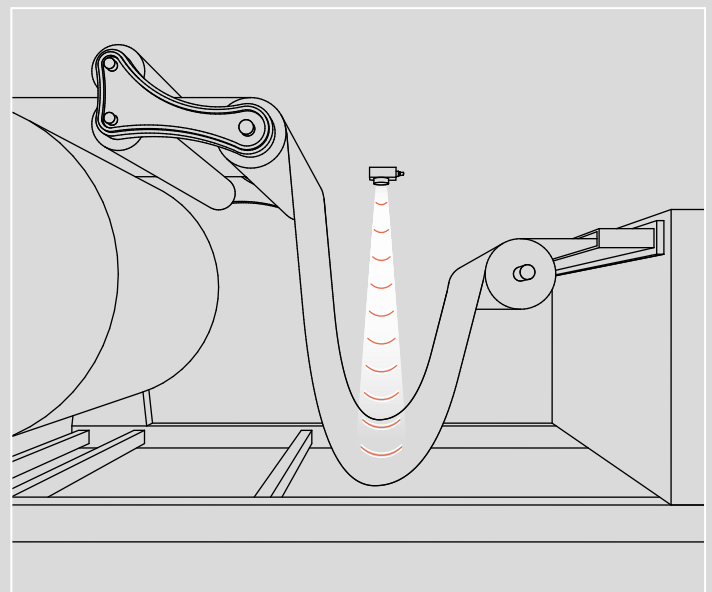
The reasonably priced solution for metallic objects. Compared to optical or ultrasonic sensors, inductive distance sensors have only limited ranges. They are still used under harsh conditions, in particular, as a result of their great robustness.

- 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 10-RLA – The smallest optical distance sensor in the world

Subminiature distance sensor for precision measurement tasks in confined spaces



## When things get too cramped:

The **FT 10-RLA** demonstrates outstanding ability, even in extremely cramped installation conditions. As the smallest optical distance sensor on the market, it is ideally suited to challenging measurement tasks, e.g. during assembly of semi-conductor devices or in robotics applications.



### *Small but powerful*

*Measuring just 21.1 x 14.6 x 8 mm in size and only 10 grammes in weight, it is scarcely larger than the tip of your finger – and therefore ideal for cramped conditions.*

## TYPICAL FT 10-RLA

Minimum weight, ideal for robotics applications


- Also suited to smallest installation space thanks to minimal dimensions
- Measurement value output via IO-Link
- Excellent sensor characteristics with repeat accuracy and linearity
- Measuring range 10 to 70 mm
- Laser class 1 for optimum eye safety

Reduced to the smallest possible size and weight: Measuring just 21.1 x 14.6 x 8 mm and only approximately 10 g, SensoPart's new laser distance sensor is the smallest of its kind. Despite a subminiature design, it has excellent sensor capacities with particularly exceptional linearity and repeatability. The measuring range is 10 to 70 mm with only a tiny blind zone of 10 mm. The sharp rectangular light spot (1 x 3 mm), which is characteristic of laser sensors, guarantees reliable small part detection.

#### Examples of sectors and applications:

- Robotics, e.g. distance measurement on gripper
- Electronics production, e.g. double layer control on printed circuit boards or height check of components
- Assembly and handling technology, e.g. for checking accuracy of installation

5

FT 10-RLA – Product Overview			
	Operating range	Special features	Page
FT 10-RLA	10 ... 70 mm	Laser, small housing, Measurement value output via IO-Link 	272

# FT 10-RLA

## Sub-miniature laser distance sensor



### PRODUCT HIGHLIGHTS

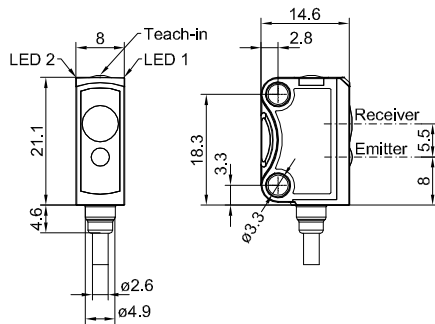
- Measurement value output **only** via IO-Link
- Minimum weight
- Also suited to smallest installation spaces thanks to minimal dimensions
- Adjustable averaging times
- Laser class 1 for optimum eye safety

Optical data		Functions	
Measurement range	10 ... 70 mm <sup>1</sup>	Indicator LED, green	Operating voltage indicator
Resolution	13 bit via IO-Link	Indicator LED, yellow	Switching output indicator
Linearity	± 0.4 mm (at 40 mm, see characteristics) <sup>2</sup>	Measurement range adjustment	Via IO-Link
Repeatability	< 0.1 mm (at 40 mm, see characteristics) <sup>2,3</sup>	Adjustment possibilities	Button lock via control input N.O./N.C. and Auto-Detect / NPN / PNP via Teach-in button or IO-Link Smart functions and averaging times via IO-Link
Type of light	Laser, red, 655 nm		
Light spot size	1 x 3 mm		
Laser class (IEC 60825-1)	1		
Resistance to ambient light	≤ 5000 Lux	Default settings	See Table
Electrical data		Mechanical data	
Operating voltage, +U <sub>B</sub>	13 ... 30V DC	Dimensions	21.1 x 14.6 x 8 mm
No-load current, I <sub>0</sub>	≤ 20 mA	Enclosure rating	IP 67 <sup>5</sup>
Output current, I <sub>e Q</sub>	≤ 50 mA	Material, housing	PUR
Protective circuits	Reverse-polarity protection, U <sub>B</sub> / short-circuit protection (Q)	Material, front screen	PMMA
Protection Class	2	Type of connection	See selection table
Switching output, Q	1x Auto-Detect (PNP/NPN) <sup>4</sup>	Ambient temperature: operation	-20 ... +50 °C <sup>6</sup>
Output function Q	N.O./N.C.	Ambient temperature: storage	-20 ... +60 °C
Switching frequency, f (ti/tp 1:1) Q	≤ 1000 Hz	Weight (cable device)	22 g
Response time Q	500 µs	Weight (pigtail)	10 g
Warm-up time	10 min.	Resistance to vibrations and impacts	EN 60947-5-2
Measurement frequency	4 kHz		
Averaging times	Default setting min. cycle time, adjustable factor 1 ... 10 on "min. cycle time"		
		IO-Link	
		Communication mode	COM 2
		Min. cycletime	2.7 ms
		SIO mode	Compatible
		Length process data	24 Bit
		Specification	1.1

<sup>1</sup> Reference material 5...90 % reflectivity    <sup>2</sup> Reference material 90 % reflectivity    <sup>3</sup> Stationary object, averaging default setting    <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 plug    <sup>6</sup> UL : max. +30 °C

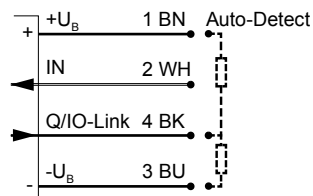
Measurement range	Measurement value output	Switching output	Type of connection	Part number	Article number
10 ... 70 mm	IO-Link	Auto-Detect	Pigtail, 200 mm with plug, M8 4-pin, IO-Link	FT 10-RLA-60-PNSL-KM4	600-11175
10 ... 70 mm	IO-Link	Auto-Detect	Cable, 2 m, 4-wire, IO-Link	FT 10-RLA-60-PNSL-K4	600-11176

## Cable connection



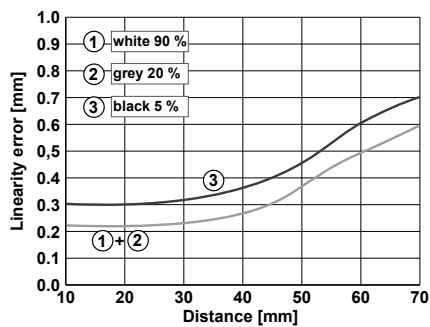
153-00895

## Connection, 4-pin, IO-Link



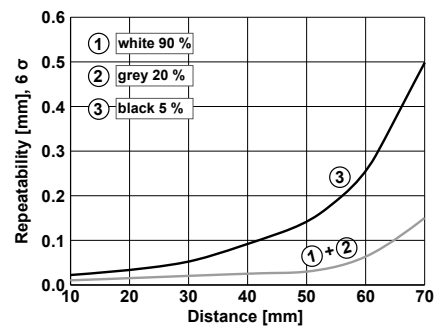
154-00566

## Linearity error (typ.)



155-03282

## Repeatability<sup>1</sup> (typ.)



155-03281

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

## Accessories

Connection cables	From Page A-46
Brackets	From Page A-4
Sensolo (901-01000)	From Page A-56



# FT 25 – optical short-range distance sensors

The compact class for measurement and regulatory tasks



made in Germany



## FT 25-R(L)A for dancer roll regulation

The precise control of the FT 25-R(L)A ensures a constant tension of the paper roll during unwinding.

## TYPICAL FT 25-R(L)A

- Operating range: 20 ... 80 mm / 20 ... 100 mm / 30 ... 200 mm
- Distance sensor with 1 ... 10 V 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-R(L)A is also suitable for limited installation spaces thanks to its compact dimensions of 34 x 12 x 20 mm.

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 easy operation, these sensors are particularly suitable for simple measurement and regulatory tasks at distances of up to 200 mm. Our laser and LED variants cover a very broad range of applications.

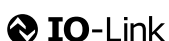
#### Key applications:

- Dancer roll regulation, sag monitoring (LED / laser)
- Determining the roll diameter of an unwinding machine (LED / laser)
- Stacking height measurement, double layer detection and height measurements in the wood processing, packaging- and handling industry (LED / laser)
- Distance measurement and positioning on robot grippers in „pick & place“ applications (LED / laser)
- Small part measurement, e.g. O-rings and electronic components (laser)
- Measurement on multicolored and high-contrast objects, e.g. packages (laser)

FT 25-R(L)A – Product Overview			
	Operating range	Special features	Page
FT 25-RLA	20 ... 100 mm	Laser, small housing, IO-Link 	276
FT 25-RA	20 ... 80 mm / 30 ... 200 mm	Small housing with long range, IO-Link 	278

# FT 25-RLA

## Miniature laser distance sensor



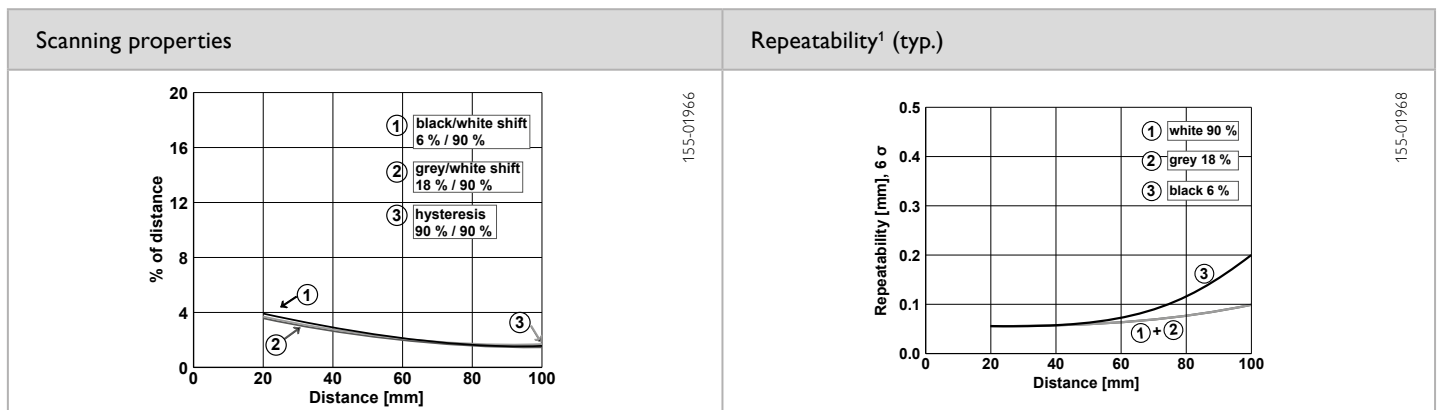
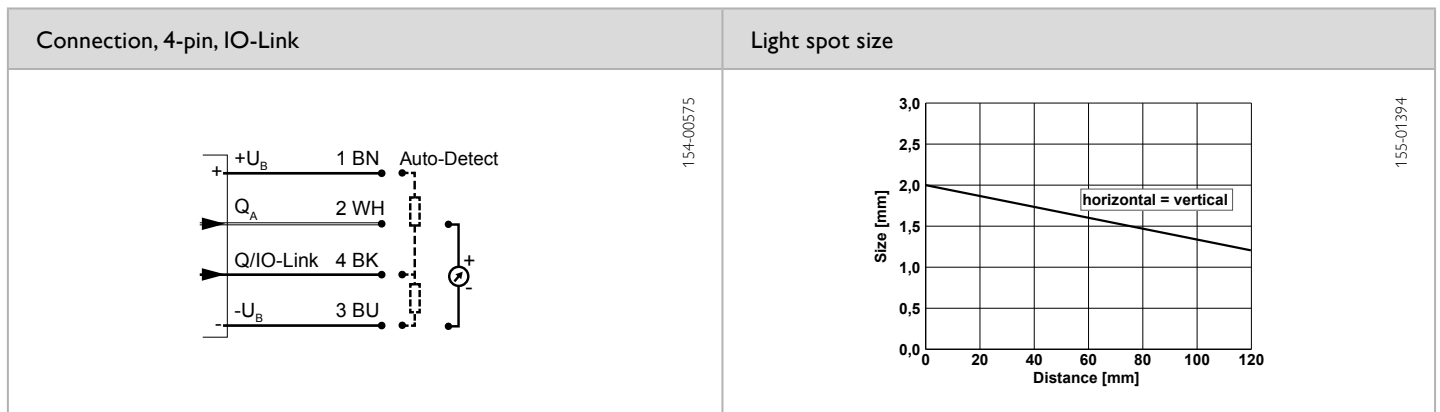
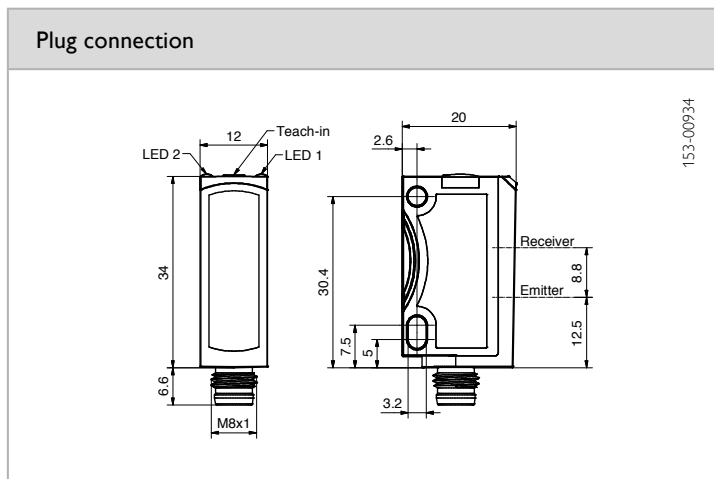
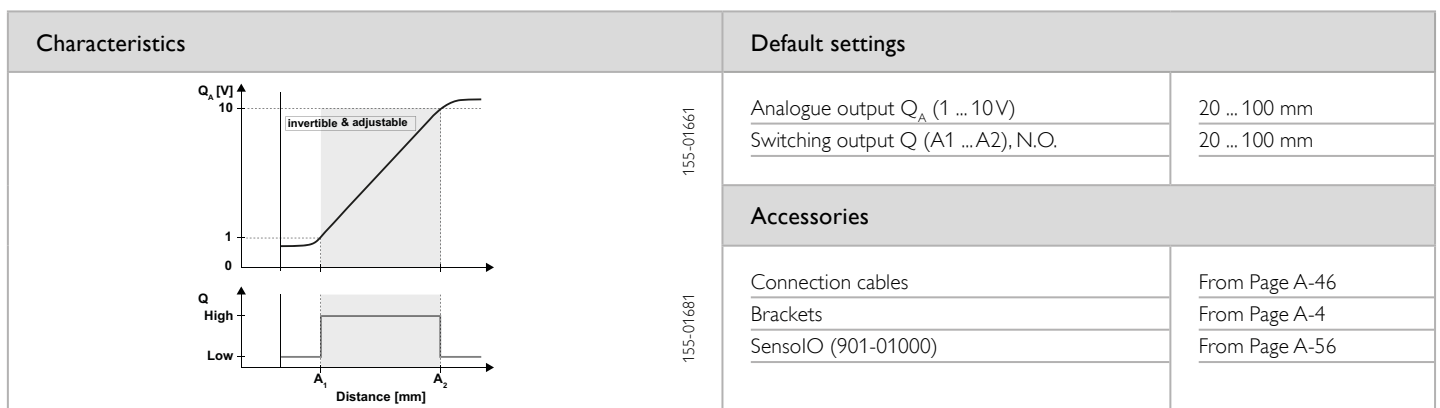
### PRODUCT HIGHLIGHTS

- Small laser light spot for reliable distance measurement of small objects part detection
- Miniature housing and low weight - suitable for robotic applications
- High linearity and high repeatability for precise control tasks
- Invertible analogue characteristic
- Window mode e.g. for two-step controls separately adjustable
- Measurement value output via IO-Link

Optical data		Functions	
Measurement range	20 ... 100 mm <sup>1</sup>	Indicator LED, green	Operating voltage indicator
Resolution	0.12 mm (12-bit)	Indicator LED, yellow	Switching output indicator
Linearity	± 0.25 mm <sup>2</sup>	Measurement range adjustment	Via Teach-in button
Repeatability	< 0.25 mm <sup>2,3</sup>	Adjustment possibilities	Analogue measurement range Q <sub>A</sub>
Type of light	Laser, red, 650 nm		Invertible analogue characteristic
Light spot size	See diagram		Switching output Q (window mode)
Laser class (IEC 60825-1)	1		N.O. / N.C. via teach-in button
			Wide variety of adjustment possibilities of service and process data via IO-Link
		Default settings	See Table
Electrical data		Mechanical data	
Operating voltage, +U <sub>B</sub>	13 ... 30V DC	Dimensions	34 x 20 x 12 mm
No-load current, I <sub>0</sub>	≤ 30 mA	Enclosure rating	IP 67 / IP 69 <sup>5</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>6</sup>
Switching output, Q	1x Auto-Detect (PNP/NPN) <sup>4</sup>	Ambient temperature: storage	-20 ... +80 °C
Output function	N.O./N.C.	Weight (metal plug device)	10 g
Max. capacitive load	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	IO-Link	
Analogue output Q <sub>A</sub>	1 ... 10V / max. 3 mA		
Response time Q <sub>A</sub>	3.4 ms		
Warm-up time	10 min.		
Temperature drift	< 0.1 mm/K		
		Communication mode	COM 2
		Min. cycletime	2.7 ms
		SIO mode	Compatible
		Length process data	24 Bit
		Specification	1.1

<sup>1</sup> Reference material: 6 ... 90 % reflectivity    <sup>2</sup> Reference material, 18 % reflectivity    <sup>3</sup> At 6 σ, at constant ambient conditions, typ. 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 69 plug    <sup>6</sup> UL: -20 ... +50 °C

Measurement range	Analogue output	Switching output	Type of connection	Part number	Article number
20 ... 100 mm	1 ... 10V	Auto-Detect	Metal plug, M8x1, 4-pin, IO-Link	FT 25-RLA-80-PNSUL-M4M	604-41013


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


# FT 25-RA

## Miniature distance sensor



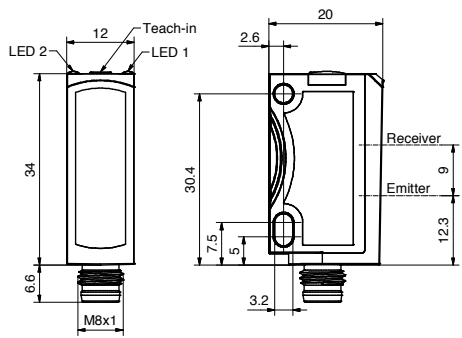
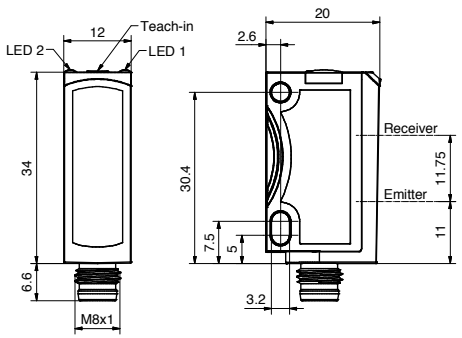
### PRODUCT HIGHLIGHTS

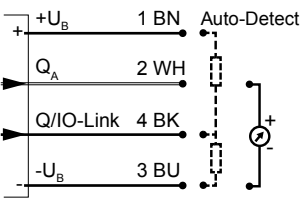
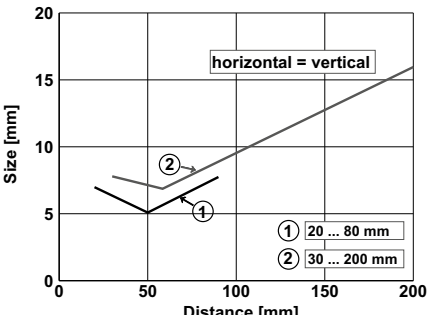
- Miniature housing with measurement ranges up to 200 mm for an easy integration and high flexibility
- High linearity and high repeatability for precise control tasks
- Almost surface independent detection on homogeneous object surfaces
- Invertible analogue characteristic
- Window mode e.g. for two-step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

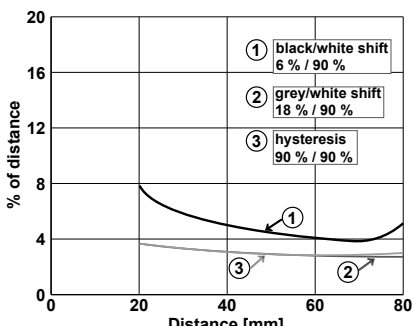
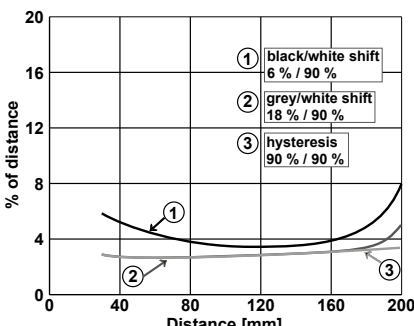
Optical data			Functions	
Measurement range	20 ... 80 mm <sup>1</sup>	30 ... 200 mm <sup>1</sup>	Indicator LED, green	Operating voltage indicator
Resolution	0.12 mm (12-bit)	0.68 mm (12-bit)	Indicator LED, yellow	Switching output indicator
Linearity	± 0.4 mm <sup>2</sup>	± 2 mm <sup>2</sup>	Measurement range adjustment	Via Teach-in button and IO-Link
Repeatability	< 0.4 mm <sup>2,3</sup>	< 1 mm <sup>2,3</sup>	Adjustment possibilities	Analogue measurement range Q <sub>A</sub>
Type of light	LED, red, 632 nm	LED, red, 632 nm		Invertible analogue characteristic
Light spot size	See diagram	See diagram		Switching output Q (window mode)
				N.O./N.C. via teach-in button
				Wide variety of adjustment possibilities of service and process data via IO-Link
			Default settings	See Table
Electrical data			Mechanical data	
Operating voltage, +U <sub>B</sub>	13 ... 30V DC		Dimensions	34 x 20 x 12 mm
No-load current, I <sub>0</sub>	≤ 30 mA		Enclosure rating	IP 67 / IP 69 <sup>5</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>6</sup>
Switching output, Q	1x Auto-Detect (PNP/NPN) <sup>4</sup>		Ambient temperature: storage	-20 ... +80 °C
Output function	N.O./N.C.		Weight (metal plug device <sup>7</sup> )	10 g
Max. capacitive load, Q	10 nF		Weight (pigtail)	20 g
Switching frequency, f (ti/tp 1:1), Q	≤ 1000 Hz		Resistance to vibrations and impacts	EN 60947-5-2
Response time, Q	500 µs			
Analogue output, Q <sub>A</sub>	1 ... 10V / max. 3 mA		IO-Link	
Response time, Q <sub>A</sub>	400 µs (FT 25-RA-60) 3.4 ms (FT 25-RA-170)		Communication mode	COM 2
Warm-up time	10 min.		Min. cycletime	2.7 ms
Temperature drift	< 0.1 mm/K (FT 25-RA-60) < 0.2 mm/K (FT 25-RA-170)		SIO mode	Compatible
			Length process data	24 Bit
			Specification	1.1

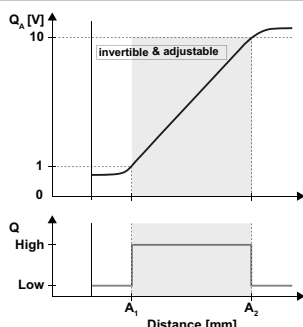
<sup>1</sup> Reference material: 6 ... 90 % reflectivity    <sup>2</sup> Reference material grey, 18 % reflectivity    <sup>3</sup> At constant ambient conditions    <sup>4</sup> Auto-Detect, automatic PNP/NPN selection by the sensor, PNP or NPN fixed    <sup>5</sup> With connected IP 67 / IP 69 plug    <sup>6</sup> UL: -20 ... +50 °C    <sup>7</sup> No Ecolab

Measurement range	Analogue output	Switching output	Type of connection	Part number	Article number
20 ... 80 mm	1 ... 10V	Auto-Detect	Metal plug, M8x1, 4-pin, IO-Link	FT 25-RA-60-PNSUL-M4M	604-41008
30 ... 200 mm	1 ... 10V	Auto-Detect	Metal plug, M8x1, 4-pin, IO-Link	FT 25-RA-170-PNSUL-M4M	604-41009
20 ... 80 mm	1 ... 10V	Auto-Detect	Pigtail, 500 mm with plug, M8 4-pin, IO-Link	FT 25-RA-60-PNSUL-KM4-X15	604-41014

Plug connection (20 ... 80 mm)	Plug connection (30 ... 200 mm)
	

Connection, 4-pin, IO-Link	Light spot size
	

Scanning properties FT 25-RA-60	Scanning properties FT 25-RA-170
	


Characteristic output and analogue curves		Default settings		
	155-01661		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
Accessories				
	155-01681	Connection cables		From Page A-46
		Brackets		From Page A-4
		Sensolo (901-01000)		From Page A-56

# FT 55 RLAM

## Precise laser triangulation sensor for a wide range of applications

Precise measurements easily adjustable



 made in Germany

The new FT 55-RLAM compact distance sensor from SensoPart is a true allrounder, reliably detecting surfaces from black to shiny. Offering extensive connectivity, the triangulation sensor is equipped with an analogue output, two switching outputs, an IO-Link interface and optional RS485 interface. The laser class 1 sensor comes with an innovative and user-friendly operating concept including a large LCD display, unusual in this performance category.



*Determining the position of a package so that it can be gripped by a robotic arm*



### TYPICAL FT 55-RLAM

- Stable processes thanks to excellent sensor qualities across the entire operating range
  - Operating range up to 600 mm / 1000 mm
  - Repeatability  $\leq 60 \mu\text{m}$  /  $\leq 100 \mu\text{m}$
  - Linearity  $\leq 0.6 \text{ mm}$  /  $1.5 \text{ mm}$
  - Resolution  $30 \mu\text{m}$  /  $50 \mu\text{m}$  at  $Q_A$
- IO-Link – a future-proof interface that meets the demands of Industry 4.0
- Laser class 1 – for optimum security
- Simple and fast setup using the intuitive LCD display
- Robust metal housing – sensor durability even in challenging processes
- Thickness or parallel differential measurement in master-slave mode

## Well-equipped with FT 55-RLAM

This unique combination of characteristics makes the FT 55-RLAM sensor ideally suited for diverse sectors and applications, for example precise positioning in robotics tasks, measuring coil diameters or monitoring the tension of web materials. Thanks to the master-slave function, the sensor can also be used for width or thickness measurements. One sensor – countless applications!

5

FT 55-RLAM – Product Overview				
	Operating distance			Page
FT 55-RLAM-480	120 ... 600 mm	Scanning on object	Analogue measurement value output or IO-Link  , display, laser class 1	282
FT 55-RLAM-800	200 ... 1000 mm	Scanning on object	Analogue measurement value output or IO-Link  , display, laser class 1	284



# FT 55-RLAM-480

Distance sensor for a wide range of applications



## PRODUCT HIGHLIGHTS

- Operating range up to 600 mm enables versatile applications in which precision at large distances is required
- Precise measurements thanks to repeatability up to 0.06 mm
- Switching hysteresis of 1.2 enables smart part detection even at large distances up to 600 mm

Optical data		Functions	
Operating range <sup>1</sup>	120 ... 600 mm	Indicator LED 1, green	Operating voltage indicator
Resolution (14 Bit)	30 µm	Indicator LED 2, yellow	Status indicator Q <sub>1</sub> / Q <sub>2</sub>
Linearity (typ.) <sup>1</sup>	± 0.6 mm	Measurement range adjustment	Via display or IO-Link
Repeatability <sup>1</sup>	up to 0.06 mm, see selection table	Adjustment possibilities	Teach-in Q <sub>1</sub> , Q <sub>2</sub> , Q <sub>A</sub> , Q as switching window or switching point; Setting of mean value at Q <sub>A</sub>
Hysteresis <sup>1</sup>	≤ 1.2 mm		Auto-Detect / NPN / PNP / Push-Pull
Type of light	Laser, red 655 nm		Smart Functions (On-delay and drop-out delay, counter, impulse, frequency)
Immunity to ambient light	≤ 20.000 lux		
Light spot size (w x h)	4 x 1 mm		
Measurement frequency	5 kHz		
Laser class (IEC 60825-1)	1		
Electrical data			
Operating voltage +U <sub>B</sub>	15 ... 30V DC	Load	≤ 1 kOhm (4 ... 20 mA)
Power consumption	≤ 1.5 W		≤ 500 Ohm (2 ... 10 mA)
Output current I <sub>Q</sub>	< 50 mA		≥ 2 kOhm (0 ... 10V, 2 ... 10V)
Protection circuits	Reverse polarity protection U <sub>B</sub> / short-circuit protection (Q)	Switching frequency f (ti/tp 1:1) Q	≤ 1000 Hz
Protection class	2	Response time Q	600 µs
Power On Delay	< 300 ms	Response time Q <sub>A</sub>	400 µs
Switching output Q	Auto-Detect <sup>2</sup> / PNP / NPN / Push-Pull	Analogue output Q <sub>A</sub>	2 ... 10 mA / 4 ... 20 mA
Output function	N.O./N.C.		0 ... 10V / 2 ... 10V
Averaging time Q <sub>A</sub> <sup>3</sup>	1 ms, 10 ms, 100 ms, 1000 ms	Temperature drift Q <sub>A</sub> / digital	< 0.02 %/K / 0.01 %/K
		Warm-up time	20 min.
Mechanical data			
Dimensions	50 x 50.5 x 25 mm	Ambient temperature: operation	-20 ... +50 °C <sup>5</sup>
Enclosure rating	IP 67 & IP 69 <sup>4</sup>	Ambient temperature: storage	-20 ... +60 °C
Material, housing	Zinc die-cast, matt chrome	Weight (plug device)	185 g
Material, front screen / Display	PMMA	Resistance to vibration and impacts	EN 60947-5-2
Type of connection	See selection table	Display	LCD, with background illumination


<sup>1</sup> 6 ... 90 %; homogenous object, not moving

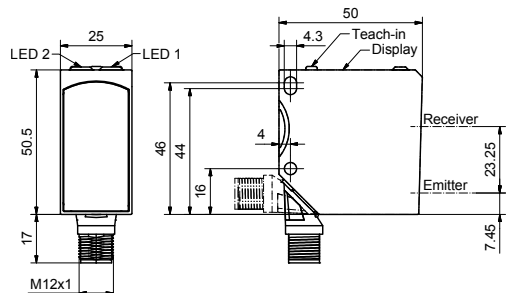
<sup>2</sup> Auto-Detect: Automatic selection of PNP or NPN by the sensor; PNP or NPN can be fixed

<sup>3</sup> Scalable

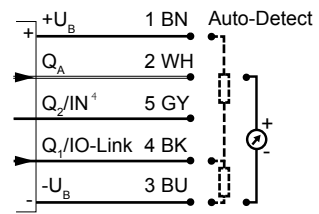
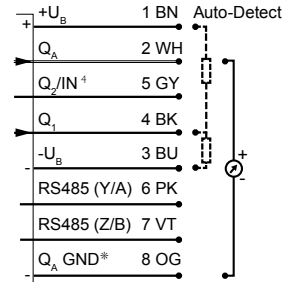
<sup>4</sup> With connected IP 67 / IP 69 plug <sup>5</sup> UL: max. +45 °C

IO-Link			
Communication mode	COM 2	Length process data	32 Bit
Min. cycletime	3 ms	Data Storage	compatible
SIO mode	Compatible	Specification	1.1

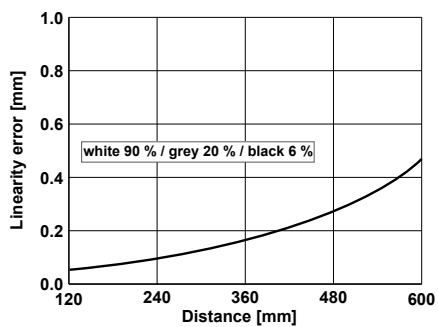
Interface	Type of connection	Part Number	Article number
IO-Link	Plug, M12x1, 5-pin, IO-Link 	FT 55-RLAM-480-PNSUIDL-L5M	624-41004
RS485	Plug, M12x1, 8-pin	FT 55-RLAM-480-PNSUID-S1L8M	624-41005

Plug connection and optical axis	Response time $Q_A$	Repeatability $6 \sigma^1$
	1 ms	1.2 mm
	10 ms	0.38 mm
	100 ms	0.12 mm
	1000 ms	0.06 mm
<sup>1</sup> Repeatability $6 \sigma$ , $6 \dots 90 \%$ , homogenous object, not moving		

5

Connection, 5-pin, Auto-Detect <sup>2,3</sup>	Connection, 8-pin, Auto-Detect <sup>2,3</sup>
	
*8 PIN fonctionnant avec un cable de norme DIN EN 60947-5-5 / IEC = 2007	

<sup>2</sup> In IO-Link mode, a 4-pin cable must be used    <sup>3</sup> The sensor must be used with shielded cables    <sup>4</sup> Can be used as output or input

Linearity error (typ.)


Default setting	Accessories														
<table border="1"> <tr> <td>Analogue output <math>Q_A</math></td> <td>4 ... 20 mA, Measurement range limits</td> </tr> <tr> <td>Switching output <math>Q_1</math></td> <td>280 mm, N.O.</td> </tr> <tr> <td>Switching output <math>Q_2</math></td> <td>440 mm, N.O.</td> </tr> </table>	Analogue output $Q_A$	4 ... 20 mA, Measurement range limits	Switching output $Q_1$	280 mm, N.O.	Switching output $Q_2$	440 mm, N.O.	<table border="1"> <tr> <td>Connection cable 8-pin to 4-pin for SensIO (L8/L4-2m-PUR / 902-51857)<sup>4</sup></td> <td>From Page A-46</td> </tr> <tr> <td>Further connection cables</td> <td>From Page A-46</td> </tr> <tr> <td>Bracket SensoClip MBD F 55ST2 (579-50012)</td> <td>From Page A-4</td> </tr> <tr> <td>SensIO (901-01000)</td> <td>From Page A-56</td> </tr> </table>	Connection cable 8-pin to 4-pin for SensIO (L8/L4-2m-PUR / 902-51857) <sup>4</sup>	From Page A-46	Further connection cables	From Page A-46	Bracket SensoClip MBD F 55ST2 (579-50012)	From Page A-4	SensIO (901-01000)	From Page A-56
Analogue output $Q_A$	4 ... 20 mA, Measurement range limits														
Switching output $Q_1$	280 mm, N.O.														
Switching output $Q_2$	440 mm, N.O.														
Connection cable 8-pin to 4-pin for SensIO (L8/L4-2m-PUR / 902-51857) <sup>4</sup>	From Page A-46														
Further connection cables	From Page A-46														
Bracket SensoClip MBD F 55ST2 (579-50012)	From Page A-4														
SensIO (901-01000)	From Page A-56														

<sup>4</sup> Utiliser pour les variantes en 8 pôles câbles selon norme DIN EN 60947-5-5 / IEC = 2007, From Page A-46

# FT 55-RLAM-800

Distance sensor for a wide range of applications



## PRODUCT HIGHLIGHTS

- Operating range up to 1 m enables versatile applications in which precision at large distances is required
- Precise measurements thanks to repeatability up to 0.1 mm
- Switching hysteresis of 2 mm enables smart part detection even at large distances up to 1000 mm

Optical data		Functions	
Operating range <sup>1</sup>	200 ... 1000 mm	Indicator LED 1, green	Operating voltage indicator
Resolution (14 Bit) <sup>1</sup>	50 µm	Indicator LED 2, yellow	Status indicator Q <sub>1</sub> / Q <sub>2</sub>
Linearity (typ.) <sup>1</sup>	± 1.5 mm	Measurement range adjustment	Via display or IO-Link
Repeatability <sup>1</sup>	up to 0.1 mm, see selection table	Adjustment possibilities	Teach-in Q <sub>1</sub> , Q <sub>2</sub> , Q <sub>A</sub> , Q as switching window or switching point
Hysteresis <sup>1</sup>	≤ 2 mm		Setting of mean value at Q <sub>A</sub>
Type of light	Laser, red 655 nm		Auto-Detect / NPN / PNP / Push-Pull
Immunity to ambient light	≤ 20.000 lux		Smart Functions (On-delay and drop-out delay, counter, impulse, frequency)
Light spot size (w x h)	4 x 1 mm		
Measurement frequency	5 kHz		
Laser class (IEC 60825-1)	1		
Electrical data			
Operating voltage +U <sub>B</sub>	15 ... 30V DC	Load	≤ 1 kOhm (4 ... 20 mA)
Power consumption	≤ 1.5 W		≤ 500 Ohm (2 ... 10 mA)
Output current I <sub>Q</sub>	< 50 mA		≥ 2 kOhm (0 ... 10V, 2 ... 10V)
Protection circuits	Reverse polarity protection U <sub>B</sub> / short-circuit protection (Q)	Switching frequency f (ti/tp 1:1) Q	≤ 1000 Hz
Protection class	2	Response time Q	600 µs
Power On Delay	< 300 ms	Response time Q <sub>A</sub>	400 µs
Switching output Q	Auto-Detect <sup>2</sup> / PNP / NPN / Push-Pull	Analogue output Q <sub>A</sub>	2 ... 10 mA / 4 ... 20 mA
Output function	N.O./N.C.		0 ... 10V / 2 ... 10V
Averaging time Q <sub>A</sub> <sup>3</sup>	1 ms, 10 ms, 100 ms, 1000 ms	Temperature drift Q <sub>A</sub> / digital	< 0.02 %/K / 0.01 %/K
		Warm-up time	20 min.
Mechanical data			
Dimensions	50 x 50.5 x 25 mm	Ambient temperature: operation	-20 ... +50 °C <sup>5</sup>
Enclosure rating	IP 67 & IP 69 <sup>4</sup>	Ambient temperature: storage	-20 ... +60 °C
Material, housing	Zinc die-cast, matt chrome	Weight (plug device)	185 g
Material, front screen / Display	PMMA	Resistance to vibration and impacts	EN 60947-5-2
Type of connection	See selection table	Display	LCD, with background illumination


<sup>1</sup> 6 ... 90 %; homogenous object, not moving

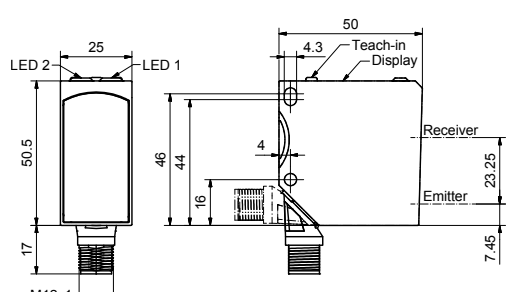
<sup>2</sup> Auto-Detect: Automatic selection of PNP or NPN by the sensor; PNP or NPN can be fixed

<sup>3</sup> Scalable

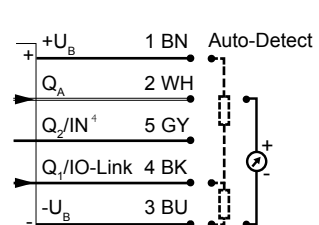
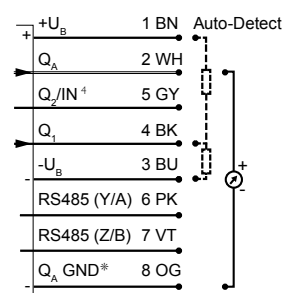
<sup>4</sup> With connected IP 67 / IP 69 plug <sup>5</sup> UL: max. +45 °C

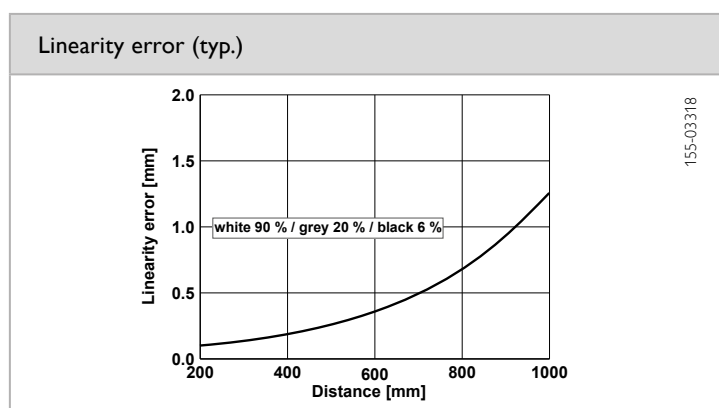
IO-Link			
Communication modus	COM 2	Length process data	32 Bit
Min. cycletime	3 ms	Data Storage	compatible
SIO mode	Compatible	Specification	1.1

Interface	Type of connection	Part Number	Article number
IO-Link	Plug, M12x1, 5-pin, IO-Link 	FT 55-RLAM-800-PNSUIDL-L5M	624-41006
RS485	Plug, M12x1, 8-pin	FT 55-RLAM-800-PNSUID-S1L8M	624-41007

Plug connection and optical axis	Response time $Q_A$	Repeatability $6 \sigma^1$
	1 ms	3 mm
	10 ms	1 mm
	100 ms	0.3 mm
	1000 ms	0.1 mm
<sup>1</sup> Repeatability $6 \sigma$ , 6 ... 90 %, homogenous object, not moving		

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Connection, 5-pin, Auto-Detect <sup>2/3</sup>	Connection, 8-pin, Auto-Detect <sup>2/3</sup>
	
*8 PIN fonctionnant avec un cable de norme DIN EN 60947-5-5 / IEC = 2007	

<sup>2</sup> In IO-Link mode, a 4-pin cable must be used    <sup>3</sup> The sensor must be used with shielded cables    <sup>4</sup> Can be used as output or input


Default setting	Accessories
Analogue output $Q_A$	4 ... 20 mA, Measurement range limits
Switching output $Q_1$	450 mm, N.O.
Switching output $Q_2$	750 mm, N.O.
	Connection cable 8-pin to 4-pin for SensolO (L8/L4-2m-PUR / 902-51857) <sup>4</sup>
	Further connection cables
	Bracket SensoClip MDB F55ST2 (579-50012)
	SensolO (901-01000)
	From Page A-46
	From Page A-46
	From Page A-4
	From Page A-4
	From Page A-56

<sup>4</sup> Utiliser pour les variantes en 8 pôles câbles selon norme DIN EN 60947-5-5 / IEC = 2007, voir page A-39

# FT 50 – 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

- Laser distance sensors with a variety of measurement ranges
- Shape and color 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 ... 10 V
- 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	288
FT 50 RLA-40	50 x 17 x 50 mm	45 ... 85 mm	Analogue output	290
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	292

# FT 50 RLA 20

Distance sensor



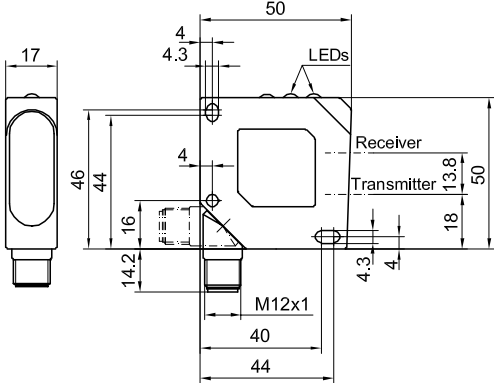
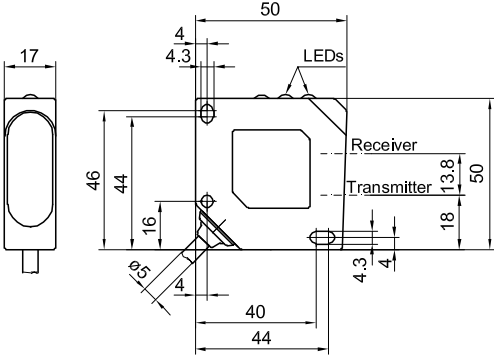
## PRODUCT HIGHLIGHTS

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

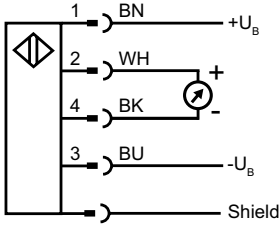
Optical data		Functions	
Operating range	40 ... 60 mm <sup>1</sup>	Indicator LED, green	Operating voltage indicator
Measurement range	20 mm	Indicator LED, red	Contamination indicator
Type of light	Laser, red, 670 nm	Scanning distance adjustment	Fixed setting
Laser Class (IEC 60825-1)	1		
Resolution	40 µm / 7 µm (see selection table)		
Linearity	< 1 %		
Light spot size	< 1 mm at 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 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

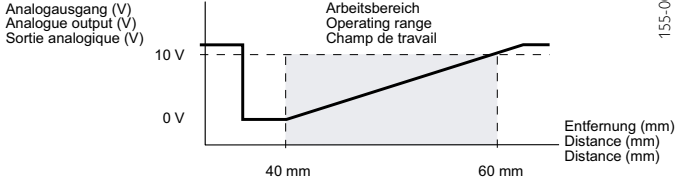
<sup>1</sup> Reference material: Kodak grey, 18 %    <sup>2</sup> With connected IP 67 plug

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

Plug connection	Cable connection
 <p>153-00214</p>	 <p>153-00213</p>

5

Connection, 4-pin
 <p>154-00195</p>

Characteristic output curve
 <p>155-00438</p>

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



# FT 50 RLA 40

Distance sensor



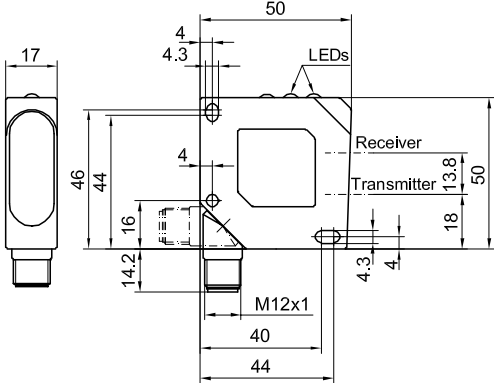
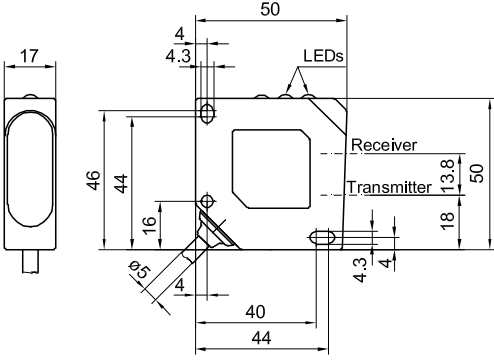
## PRODUCT HIGHLIGHTS

- 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 ... 10 V
- Device plug rotatable through 270°

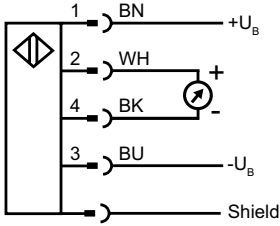
Optical data		Functions	
Operating range	45 ... 85 mm <sup>1</sup>	Indicator LED, green	Operating voltage indicator
Measurement range	40 mm	Indicator LED, red	Contamination indicator
Type of light	Laser, red, 670 nm	Scanning distance adjustment	Fixed setting
Laser Class (IEC 60825-1)	1		
Resolution	80 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 ... 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	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

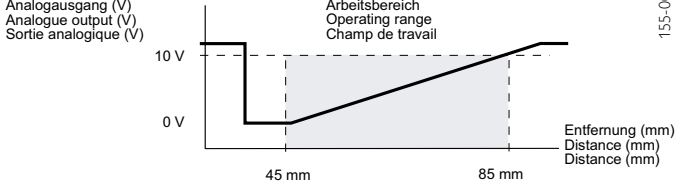
<sup>1</sup> Reference material: Kodak grey, 18 %    <sup>2</sup> With connected IP 67 plug

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

Plug connection	Cable connection
 <p>153-00214</p>	 <p>153-00213</p>

5

Connection, 4-pin
 <p>154-00195</p>

Characteristic output curve
 <p>155-00441</p>

Accessories	
Connection cables	From Page A-46
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 (IEC 60825-1)	1	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)
	FT 50 RLA 70	29.4 mm
	FT 50 RLA 100	32.5 mm
	FT 50 RLA 220	32.5 mm

5

Connection, 5-pin	Installation

Characteristic analogue curve		Light spot geometry																									
<div>Operating range (default setting)</div> <div><p>OK LED (green) (Good Target)</p><p>On Off</p><p>20 mA 4 mA</p><p>30 mm 100 mm</p><p>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></div>		<div>Light spot geometry</div> <div><p>Receiver Transmitter</p><p>A B C D X</p><p>3.5</p></div> <table><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 x 3</td><td>1.5 x 3.5</td><td>1.5 x 3.5</td></tr><tr><td>D</td><td>1.5 x 3.25</td><td>1.7 x 3.9</td><td>2 x 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 x 3	1.5 x 3.5	1.5 x 3.5	D	1.5 x 3.25	1.7 x 3.9	2 x 4.5	X	29.4	32.5	32.5
FT 50 RLA	70 ...	100 ...	220 ...																								
A	30	70	80																								
B	100	170	300																								
C	1.5 x 3	1.5 x 3.5	1.5 x 3.5																								
D	1.5 x 3.25	1.7 x 3.9	2 x 4.5																								
X	29.4	32.5	32.5																								

Accessories	
Connection cables	From Page A-46
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 (IEC 60825-1)	1	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


5555

# 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 color 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
- Versions with IO-Link


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, IO-Link 	298
FT 55-RLAP2	0,06 ... 5 m	Scanning on object	Compact design, IO-Link 	300
FT 90 ILA	0,5 ... 10 m	Scanning on object	2 switching outputs, RS422 interface, SSI-compatible, switchable red-light pilot laser	302
FT 91 ILA	0,5 ... 6 m	Scanning on object	2 switching outputs, RS422 interface, SSI-compatible, switchable red-light pilot laser	304
FT 92 ILA/RLA	0,2 ... 6 m	Scanning on object	2 switching outputs, 1 analogue output, switchable red-light pilot laser	306
FR 55-RLAP	0,3 ... 70 m	Reflector	1 analogue output 4 ... 20 mA, 2 switching outputs, compact design, high flexibility	308
FR 55-RLP	0,3 ... 70 m	Reflector	2 switching outputs, compact design, high flexibility	310
FR 90 ILA	0,5 ... 250 m	Reflector	2 switching outputs, RS422 interface, SSI-compatible, switchable red-light pilot laser	312
FR 91 ILA	0,5 ... 50 m	Reflector	2 switching outputs, RS422 interface, SSI-compatible, switchable red-light pilot laser	314
FR 92 ILA	0,2 ... 30 m	Reflector	2 switching outputs, 1 analogue output, switchable red-light pilot laser	316



# 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	± 30 mm <sup>1,2</sup>	Indicator LED 1 yellow	Switching output indicator
Repeatability	1.2 mm <sup>1,2,3</sup>	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	Default settings	Invertible analogue characteristic
Laser class (IEC 60825-1)	1		Switching output $Q$ (window mode)
			N.O. / N.C. and Auto-Detect / NPN / PNP via teach-in and control line
			See selection Table
Electrical data			
Operating voltage $+U_B$	18 ... 30V DC	Response time $Q$	2 ms
No-load current $I_0$	≤ 60 mA	Load	≤ 500 Ohm (4 ... 20 mA)
Output current $I_Q$	≤ 100 mA		≥ 4 k Ohm (0 ... 10 V)
Protection circuits	Reverse polarity protection $U_B$ / short-circuit protection ( $Q$ )	Analogue output $Q_A$	4 ... 20 mA / 0 ... 10 V
Protection class	2	Update rate $Q_A$	2 ms
Power On Delay	< 5 s	Temperature drift	< 2 mm / K
Switching output $Q$	Auto-Detect (PNP/NPN) <sup>4</sup>	Warm-up time	20 min.
Output function	N.O. / N.C.	Control input IN	$+U_B$ = Teach-in / $-U_B$ = button locked
Switching frequency $f$ (ti/tp 1:1) $Q$	≤ 250 Hz		Open = normal operation
Mechanical data		IO-Link	
Dimensions	50 x 50.1 x 23 mm	Communication mode	COM 2
Enclosure rating	IP 67 & IP 69K <sup>5</sup>	Min. cycle time	2.7 ms
Material, housing	ABS	SIO mode	Compatible
Material, front screen	PMMA	Process bit length	24 Bit
Type of connection	See selection table	Specification	1.1
Ambient temperature: operation	-40 ... +60 °C <sup>6,7</sup>		
Ambient temperature: storage	-40 ... +80 °C		
Weight (plug device)	42 g		
Resistance to vibration and impacts	EN 60947-5-2		

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

<sup>2</sup> At 50 Hz

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

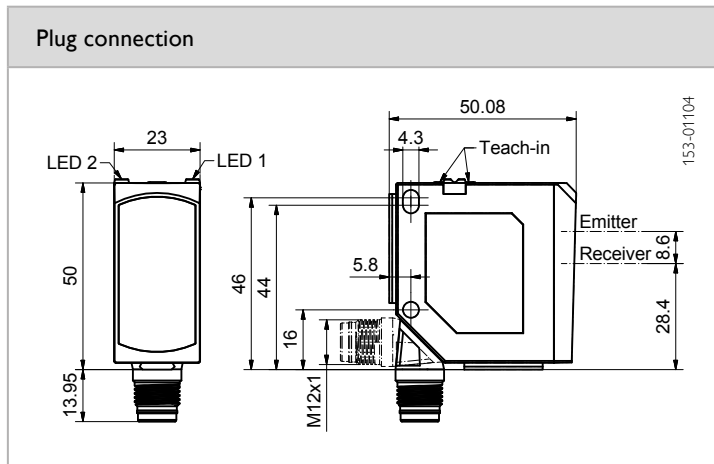
<sup>4</sup> Auto-Detect: Automatic selection of PNP or NPN by the sensor; PNP or NPN can be fixed

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

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

<sup>7</sup> UL: max. +45 °C

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, IO-Link	FT 55-RLAP-5-PNSIL-L5	622-21023
0.1 ... 5 m	0 ... 10V	Auto-Detect	Plug, M12x1, 5-pin, IO-Link	FT 55-RLAP-5-PNSUL-L5	622-21024



Connection, 5-pin, Auto-Detect	Light spot size

Repeatability <sup>1</sup> (50 Hz)	Repeatability <sup>1</sup> (250 Hz <sup>2</sup> )

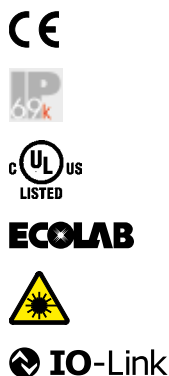
<sup>1</sup> At constant ambient conditions    <sup>2</sup> Automatic adjustment to 50 Hz at constant distance

Characteristic analogue curve	Reference material	Measurement range
	White (90 %)	0.1 ... 5 m
	Grey (18 %)	0.1 ... 5 m
	Black (6 %)	0.1 ... 3 m
	<b>Default setting<sup>3</sup></b>	
	Analogue output $Q_A$ (4...20 mA / 0,09 ... 10V)	0.3 ... 3 m
	Switching output $Q$ ( $A_1$ ... $A_2$ ), N.O., Auto-Detect	0.3 ... 3 m
	<b>Accessories</b>	
	Connection cables	From Page A-46
	Brackets	From Page A-4

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

# FT 55-RLAP2

Distance sensor with IO-Link measurement value output



## PRODUCT HIGHLIGHTS

- Measurement value output via IO-Link
- 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
- Clearly visible laser light spot (laser class 1) for an easy alignment and full eye safety

Optical data		Functions	
Scanning distance	0 ... 5 m (see selection table) <sup>1</sup>	Indicator LED 2 green	Operating voltage indicator
Hysteresis	20 mm	Indicator LED 1 yellow	Switching output indicator Q
Black/white shift (6 % / 90 %)	≤ ± 40 mm	Scanning distance adjustment	Via Teach-in Button and IO-Link
Grey value shift (18 % / 90 %)	≤ ± 40 mm	Adjustment possibilities	N.O. / N.C. via Teach-in Button and IO-Link, wide variety of adjustment possibilities for service and process data via IO-Link
Type of light	Laser, red 655 nm		
Laser class (IEC 60825-1)	1		
Resolution	< 5 mm	Default settings	3 m, N.O.
Linearity	± 30 mm		
Repeatability	1.2 mm		
Electrical data		Mechanical data	
Operating voltage +U <sub>B</sub>	18 ... 30V DC	Dimensions	50 x 50.1 x 23 mm
No-load current I <sub>0</sub>	≤ 60 mA	Enclosure rating	IP 67 & IP 69K <sup>3</sup>
Output current I <sub>e</sub> Q	≤ 100 mA	Material, housing	ABS
Protection 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	< 5 s	Ambient temperature: operation	-40 ... +60 °C <sup>4</sup>
Switching output Q	1 x Auto-Detect (PNP/NPN) <sup>2</sup>	Ambient temperature: storage	-40 ... +80 °C
Output function	N.O./N.C.	Weight (plug device)	42 g
Switching frequency f (ti/tp 1:1) Q	≤ 250 Hz	Resistance to vibration and impacts	EN 60947-5-2
Response time Q	1 ms	<b>IO-Link</b>	
Temperature drift	< 2 mm / K		
Warm-up time	20 min.	Communication mode	COM 2
Control input IN	+U <sub>B</sub> = Teach-in -U <sub>B</sub> = button locked Open = normal operation	Min. cycle time	2.7 ms
		SIO mode	Compatible
		Process bit length	24 Bit
		Specification	1.1

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

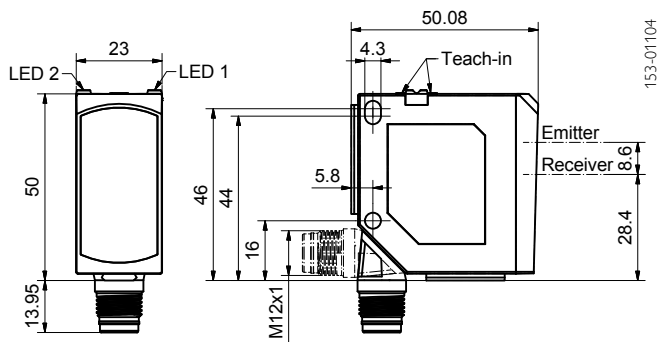
<sup>2</sup> Auto-Detect: Automatic selection of PNP or NPN by the sensor; PNP or NPN can be fixed

<sup>3</sup> With connected IP 67 / IP 69K plug

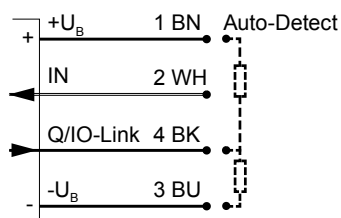
<sup>4</sup> UL: max. +45 °C

Scanning distance	Switching output	Type of connection	Part Number	Article number
0.06 ... 5 m	1 x Auto-Detect	Plug, M12x1, 4-pin, IO-Link	FT 55-RLAP2-PNSL-L4	623-11035
0.06 ... 5 m	2 x Auto-Detect	Plug, M12x1, 5-pin, IO-Link	FT 55-RLAP2-2PNSL-L5	622-21022

# Plug connection

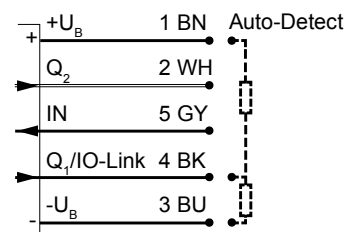


## Connection, 4-pin, IO-Link



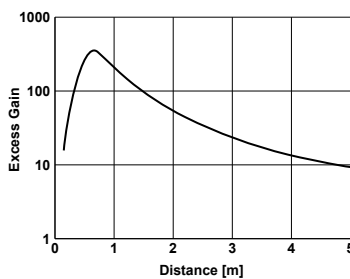
154-00566

## Connection, 5-pin, IO-Link



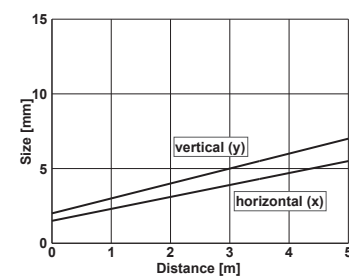
154-00565

## Scanning properties



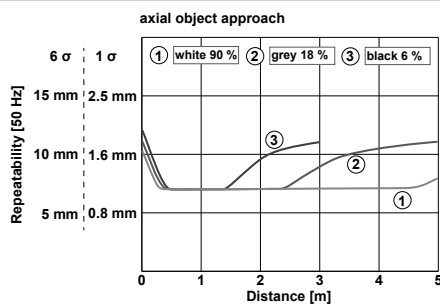
155-01838

## Light spot size



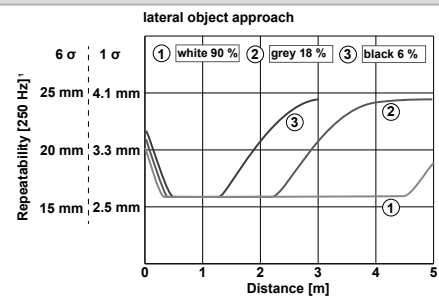
155-01741

## Repeatability<sup>1</sup> (50 Hz)



155-02029

## Repeatability<sup>1</sup> (250 Hz<sup>2</sup>)



155-02030

<sup>1</sup>automatic adjustment to 50 Hz at constant distance

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

Reference material	Scanning distance	Accessories	
White (90 %)	0.06 ... 5 m	Connection cables	From Page A-46
Grey (18 %)	0.06 ... 5 m	Brackets	From Page A-4
Black (6 %)	0.06 ... 3 m		

# FT 90 ILA

## Distance sensor



### PRODUCT HIGHLIGHTS

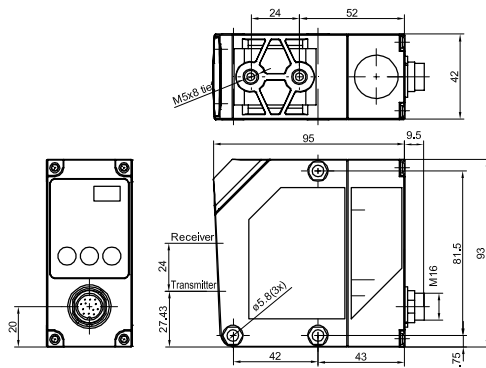
- Long scanning distance (up to 10 m on white objects)
- High repeatability
- High measurement rates
- Open interfaces ensure maximum compatibility (SSI-compatible, RS422)
- Profibus and DeviceNet via gateway
- Switchable red-light pilot laser
- 2 switching outputs

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 (IEC 60825-1)	1 (measurement laser) 1 (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
Switching frequency f (ti/tp 1:1) Q	≤ 300 Hz		
Analogue output	4 ... 20 mA		
Response time Q <sub>A</sub>	10 ms		
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

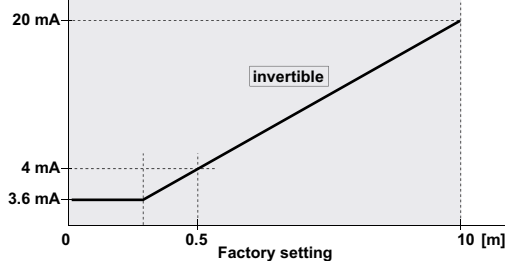


153-00457

## Connection, 12-pin

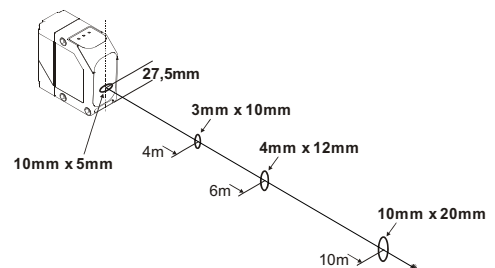
Pin	Name	Cable Type 1 (12-pin) color	Cable Type 2 (5-pin) color	Description
A	TX+	White		RS422: transmission data / SSi: Data+
B	Q1	Brown	Black	Switching output, Q1
C	RX+	Green		RS422: receiver data / SSi: clock+
D	analog	Yellow		Analogue output 4 ... 20 mA (only FT9X)
E	Qs	Grey	Orange	Service output, Qs
F	Qp	Pink		Plausibility output, Qp
G	$U_B$	Red	Brown	$U_B + 18 \dots 30V$
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)

## 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-46
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-53

# 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 (IEC 60825-1)	1 (measurement laser) 1 (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
Switching frequency f (ti/tp 1:1) Q	≤ 300 Hz		
Analogue output	4 ... 20 mA		
Response time Q <sub>A</sub>	10 ms		
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

Technical drawing of a rectangular box. The box has a height of 20 units. It features a large rectangular panel on the front face, a small rectangular label in the top right corner of the panel, and three circular elements arranged horizontally below the panel. The bottom face of the box has a circular feature with a cross-hatch pattern. The box is secured with four screws, one in each corner.

Pin	Name	Cable Type 1 (12-pin) color	Cable Type 2 (5-pin) color	Description
A	TX+	White	Black	RS422: transmission data / SSI: Data+
B	Q1	Brown		Switching output, Q1
C	RX+	Green		RS422: receiver data / SSI: clock+
D	analog	Yellow		Analogue output 4 ... 20 mA (only FT9X)
E	Qs	Grey		Service output, Qs
F	Qp	Pink	Brown	Plausibility output, Qp
G	U <sub>B</sub>	Red		U <sub>B</sub> + 18 ... 30 V
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)

The graph shows the invertible region of the parameter space. The y-axis represents current  $I$  in mA, with marked values at 3.6, 4, and 20. The x-axis represents the Factory setting, with marked values at 0, 0.5, and 6. A horizontal line at  $I = 3.6$  mA is labeled 'invertible'. The region below this line is shaded gray, indicating the invertible region.

Technical drawing showing a 3D perspective view of a mechanical component. The component is a rectangular block with a cylindrical feature on top. Dimensions are indicated: 10mm x 5mm (base dimensions), 27.5mm (height of the block), 3mm x 10mm (cylindrical feature dimensions), 4mm (distance from the base to the center of the cylindrical feature), 4mm x 12mm (another cylindrical feature dimensions), and 6mm (distance from the base to the center of the second cylindrical feature).

155-01810

White 90 %	0.5 ... 6 m	Connection cables	From Page A-46
Grey 10 %	0.5 ... 4 m	Brackets	From Page A-4
Black 6 %	0.5 ... 2 m	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-53



# 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

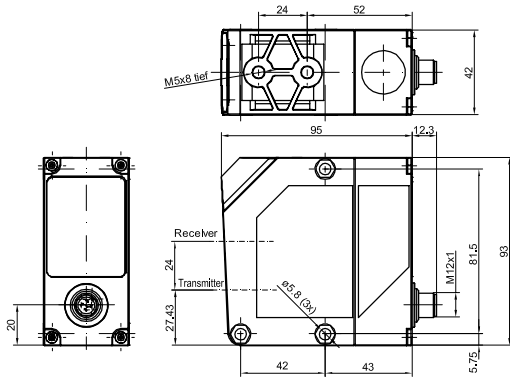
Optical data		Functions	
Scanning distance	0.2 ... 6 m <sup>1</sup>	Indicator LED, green	Operating voltage indicator
Type of light	Infrared, 905 nm (measurement laser) Laser, red, 650 nm (pilot laser)	Indicator LED, yellow	2 x switching output indicator
Laser Class (IEC 60825-1)	1 (measurement laser) 1 (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 frequency f (ti/tp 1:1) Q	≤ 300 Hz	Ambient temperature: storage	-40 ... +80 °C
Switching output, Q <sub>1</sub> / Q <sub>2</sub>	PNP/NPN 100 mA (see selection table)	Weight	200 g
Analogue output	4 ... 20 mA	Vibration and impact resistance	EN 60947-5-2
Response time Q <sub>A</sub>	10 ms		
Temperature drift	≤ 1.2 mm / K		
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

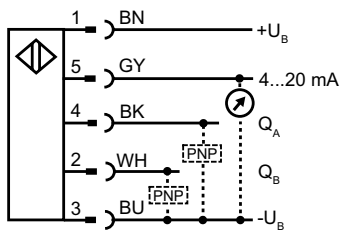
<sup>5</sup> Pilot laser (red) on permanently

## Plug connection



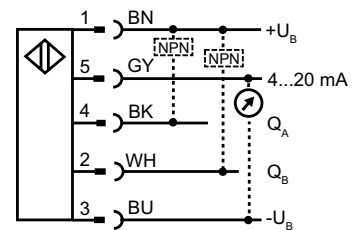
153-00346

## Connection, 5-pin (PNP)



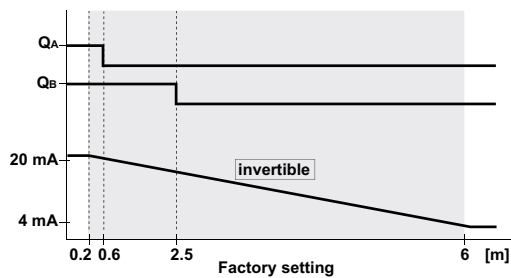
154-00125

## Connection, 5-pin (NPN)



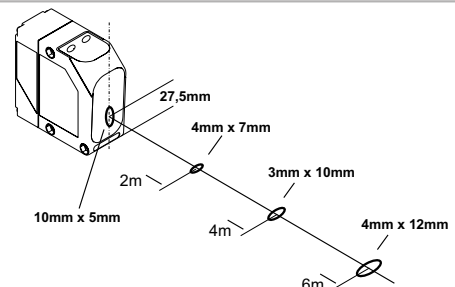
154-00472

## Characteristic analogue curve



155-01373

## Light spot geometry



155-00141

## Scanning distance

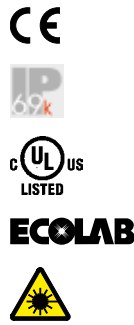
White 90 %	0.2 ... 6 m
Grey 18 %	0.2 ... 6 m
Black 6 %	0.2 ... 2.5 m

## Accessories

Connection cables	From Page A-46
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-53

# FR 55-RLAP

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



## PRODUCT HIGHLIGHTS

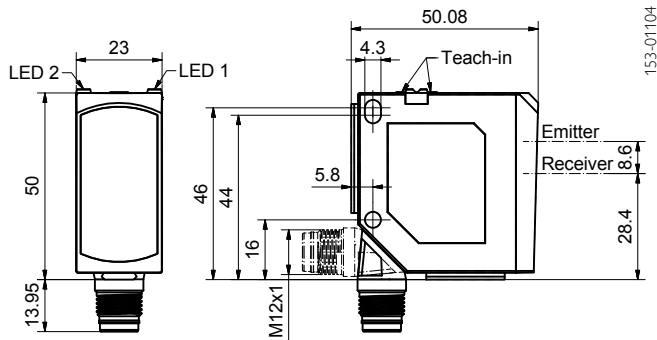
- Sensor with large range for anticollision and positioning applications
- High flexibility thanks to adjustable analogue characteristic ( $Q_A$ )
- 4 distance positions with 2 switching outputs, adjustable via window function
- $Q_1/Q_2$  switchable to  $Q_1/\overline{Q}_1$  as antivalent outputs
- 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 m <sup>1</sup>	Indicator LED 1, green	Operating voltage indicator
Resolution	8 µA	Indicator LED 1, yellow	Switching output indicator
Linearity	± 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 $Q_1/\overline{Q}_1$ and Auto-Detect / NPN / PNP via teach-in and control line Button lock via control input
Type of light	Laser, red 655 nm		See selection table
Laser class (IEC 60825-1)	1	Default settings	
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	Load	≤ 500 Ohm (4 ... 20 mA)
Output current I <sub>e</sub> Q	≤ 100 mA	Analogue output $Q_A$	4 ... 20 mA
Protection circuits	Reverse polarity protection U <sub>B</sub> / 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 <sub>B</sub> = Teach-in -U <sub>B</sub> = Button locked Open = normal operation
Output function	N.O./N.C./antivalent $Q_1/\overline{Q}_1$	Control input IN 3	+U <sub>B</sub> = Laser off -U <sub>B</sub> = Laser on offen = Laser on
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 <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: RF250 reflector    <sup>2</sup> Of set measuring range    <sup>3</sup> For 1 σ, 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    <sup>6</sup> UL: max. +45 °C

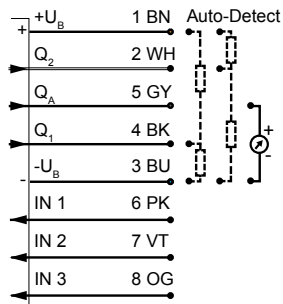
Measurement range <sup>1</sup>	Analogue output	Switching output	Type of connection	Part Number	Article number
0.3 ... 70 m	4 ... 20 mA	2 x Auto-Detect	Plug, M12x1, 8-pin	FR 55-RLAP-70-2PNSI-L8	621-11026

# Plug connection



153-01104

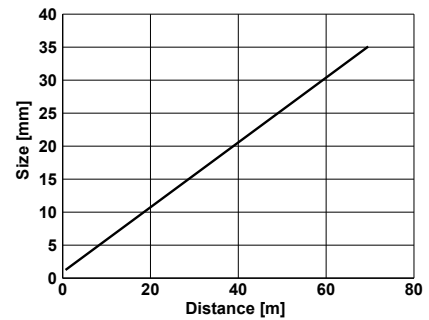
# Connection, 8-pin, Auto-Detect



154-00545

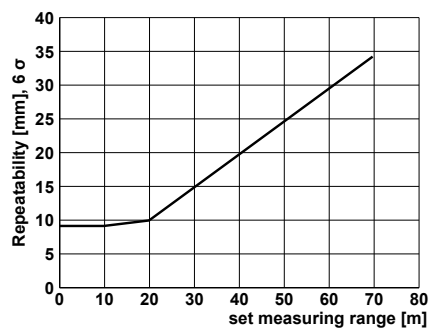
Color assignment in accordance to 60947-5-2/IEC=2007

# Light spot size



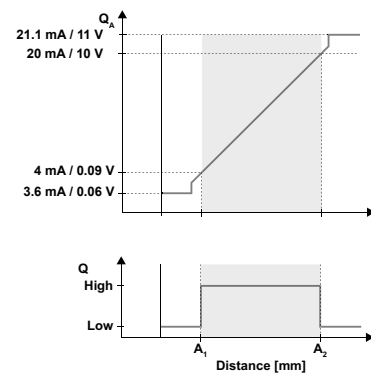
155-01963

# Repeatability<sup>1</sup> Q, Q<sub>A</sub>



155-01962

# Characteristic analogue curve



155-01742

155-01681

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

Default setting	Measurement range	Accessories	
Analogue output Q <sub>A</sub> (4...20 mA)	2 ... 6 m	Mounting angle MA F 55 (579-50007)	From Page A-4
Switching output Q <sub>1</sub> (A <sub>1</sub> ...A <sub>2</sub> ), N.O., Auto-Detect	2 ... 6 m	Further brackets	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	Connection cables (C L8FG-S-2m-PUR / 902-51830)	From Page A-46
		Further connection cables	From Page A-46
		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
- $Q_2$  can be switched to  $Q_1$  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

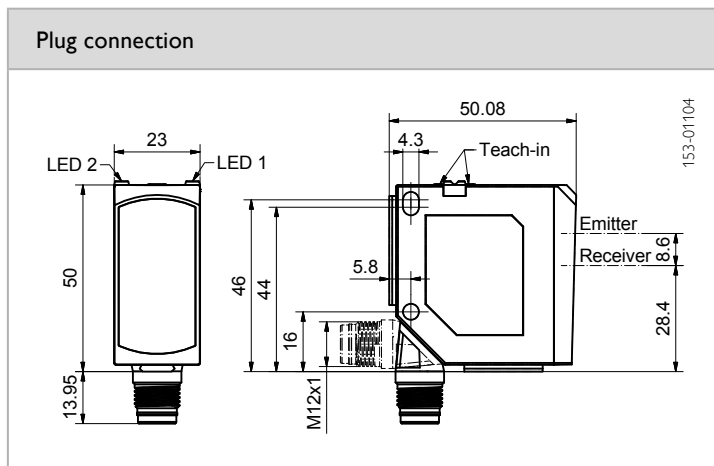
Optical data		Functions	
Measurement range	0.3 ... 70 m <sup>1</sup>	Indicator LED 1, green	Operating voltage indicator
Repeatability Q	1.5 mm <sup>2</sup>	Indicator LED 1, yellow	Switching output indicator
Hysteresis	60 mm	Indicator LED 2 yellow	Switching output indicator
Type of light	Laser, red 655 nm	Measurement range adjustment	Via Teach-in button or control input
Laser class (IEC 60825-1)	1	Adjustment possibilities	Switching output Q (window mode) N.O. / N.C. / antivalent $Q_1/Q_1$ 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 <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 $Q_1/\overline{Q_1}$		
Switching frequency f (ti/tp 1:1) Q	≤ 50 Hz		
Mechanical data			
Dimensions	50 x 50.1 x 23 mm	Ambient temperature: operation	-30 ... +60 °C <sup>5</sup>
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    <sup>5</sup> UL: max. +45 °C

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



Connection, 5-pin, Auto-Detect	Light spot size

Repeatability <sup>1</sup> $Q_1 / Q_2$	Switching output $Q_1 / Q_2$

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

Default setting	Measurement range	Accessories
Switching output $Q_1$ ( $A_1 \dots A_2$ ), N.O., Auto-Detect	2 ... 6 m	Mounting angle MA F 55 (579-50007)
Switching output $Q_2$ ( $A_1 \dots A_2$ ), N.O., Auto-Detect	2 ... 6 m	Further brackets
		Connection cables
		Reflective foil RF 250 (599-91009)
		Further reflectors
		From Page A-4
		From Page A-4
		From Page A-46
		From Page A-18
		From Page A-18

# FR 90 ILA

## Reflector distance sensor



### PRODUCT HIGHLIGHTS

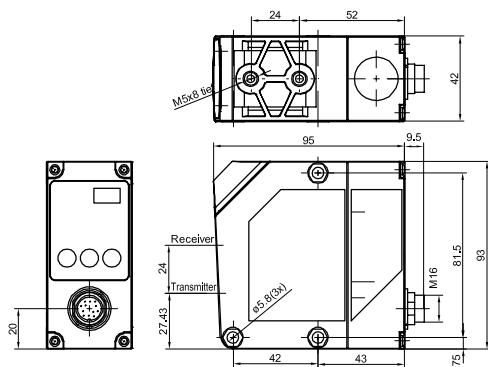
- Long range of up to 250 m on specified reflector
- High repeatability
- High measurement rates
- Ideal for precise positioning tasks
- Open interfaces ensure maximum compatibility (SSI-compatible, RS422)
- Profibus and DeviceNet via gateway
- Switchable red-light pilot laser
- 2 switching outputs

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 (IEC 60825-1)	1 (measurement laser) 1 (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 frequency f (ti/tp 1:1) Q	≤ 300 Hz	Weight	230 g
Switching output, Q <sub>1</sub> / Q <sub>2</sub>	PNP	Vibration and impact resistance	EN 60947-5-2
Output function	N.O.		
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



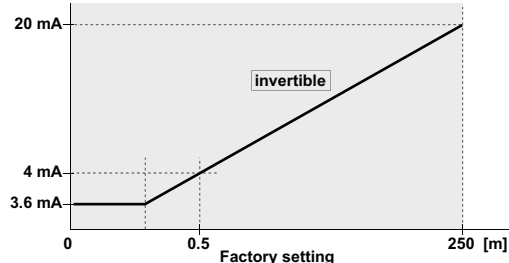
153-00457

5

## Connection, 12-pin

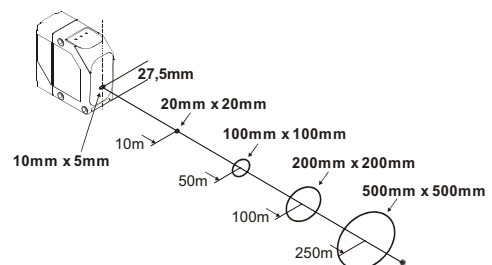
Pin	Name	Cable Type 1 (12-pin) color	Cable Type 2 (5-pin) color	Description
A	TX+	White		RS422: transmission data / SSi: Data+
B	Q1	Brown	Black	Switching output, Q1
C	RX+	Green		RS422: receiver data / SSi: clock+
D	analog	Yellow		Analogue output 4 ... 20 mA (only FT9X)
E	Qs	Grey	Orange	Service output, Qs
F	Qp	Pink		Plausibility output, Qp
G	$U_B$	Red	Brown	$U_B + 18 \dots 30V$
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)

## Characteristic analogue curve



155-01811

## Light spot geometry



155-01807

## Accessories

Reflectors	From Page A-18
Connection cables	From Page A-46
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-53



# FR 91 ILA

## Reflector distance sensor



### PRODUCT HIGHLIGHTS

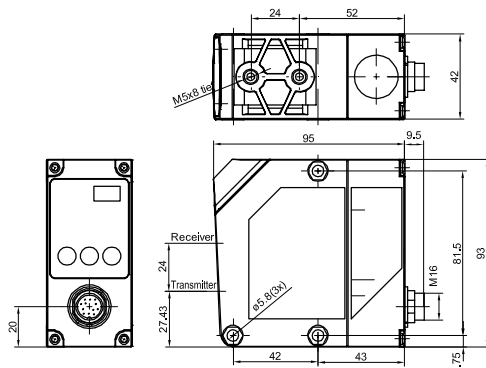
- Long range of up to 50 m on specified reflector
- High repeatability
- High measurement rates
- Very good price/performance ratio
- Open interfaces ensure maximum compatibility (SSI-compatible, RS422)
- Profibus and DeviceNet via gateway
- Switchable red-light pilot laser
- 2 switching outputs

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 (IEC 60825-1)	1 (measurement laser) 1 (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 frequency f (ti/tp 1:1) Q	≤ 300 Hz	Weight	230 g
Switching output, Q <sub>1</sub> / Q <sub>2</sub>	PNP	Vibration and impact resistance	EN 60947-5-2
Output function	N.O.		
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

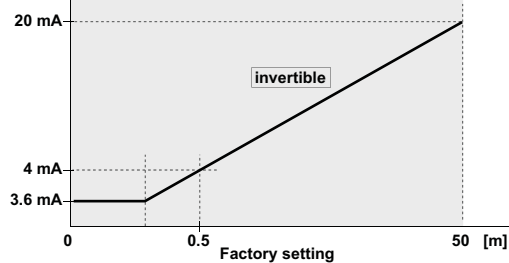


153-00457

## Connection, 12-pin

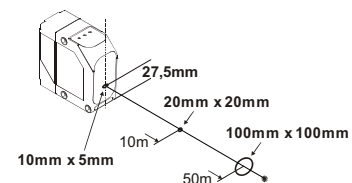
Pin	Name	Cable Type 1 (12-pin) color	Cable Type 2 (5-pin) color	Description
A	TX+	White		RS422: transmission data / SSi: Data+
B	Q1	Brown	Black	Switching output, Q1
C	RX+	Green		RS422: receiver data / SSi: clock+
D	analog	Yellow		Analogue output 4 ... 20 mA (only FT9X)
E	Qs	Grey	Orange	Service output, Qs
F	Qp	Pink		Plausibility output, Qp
G	$U_B$	Red	Brown	$U_B + 18 \dots 30V$
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)

## Characteristic analogue curve



155-01812

## Light spot geometry



155-01813

## Accessories

Reflectors	From Page A-18
Connection cables	From Page A-46
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-53

# FR 92 ILA

## Reflector distance sensor



### PRODUCT HIGHLIGHTS

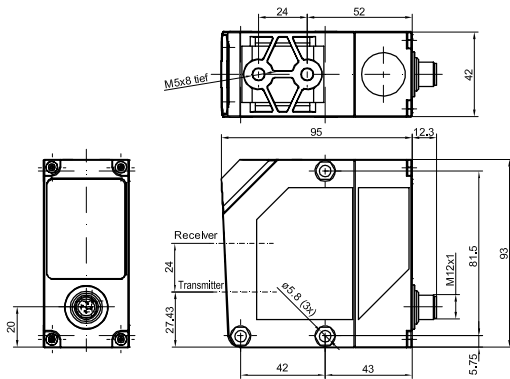
- Long scanning distance and range (scanning up to 6 m on white objects, with reflector up to 30 m)
- High repeatability
- High measurement rates
- Switchable red-light pilot laser
- Simple teach-in

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 (IEC 60825-1)	1 (measurement laser) 1 (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
Switching frequency f (ti/tp 1:1) Q	≤ 300 Hz	Weight	200 g
Response time fast / slow	30 ms / 65 ms	Vibration and impact resistance	EN 60947-5-2
Switching output, Q <sub>1</sub> / Q <sub>2</sub>	PNP		
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

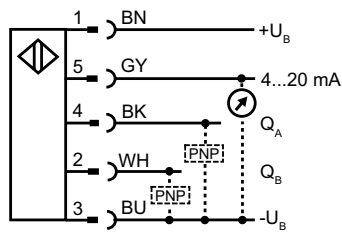
Type of connection	Part number	Article number
Plug, M12, 5-pin	FR 92 ILA-PSL5	591-91006

## Plug connection



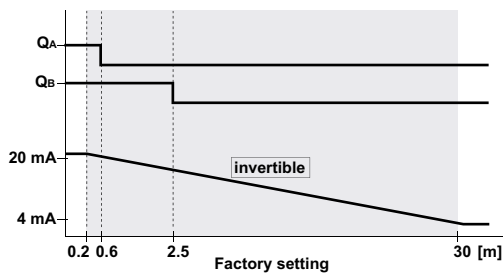
153-00346

## Connection, 5-pin



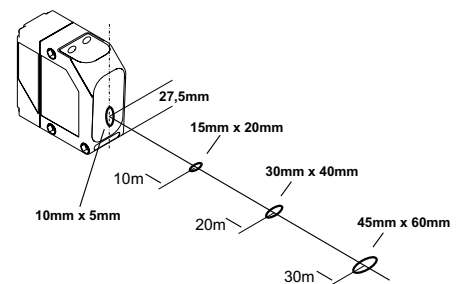
154-00125

## Characteristic output and analogue curves



155-01359

## Light spot geometry



155-00210

## Accessories

Reflectors	From Page A-18
Connection cables	From Page A-46
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-53

# 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

- Retro-reflective laser sensor 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

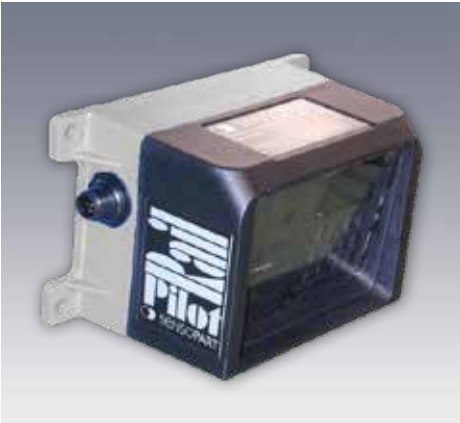
The sensor's task is to prevent collisions between vehicles on monorail systems. The Rail Pilot achieves this reliably. The distances to be maintained, and the braking distances of the monorail vehicles, depend on the load transported and on the speed – this is taken into account by means of flexibly 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	320

# FR 85 Rail Pilot

Distance sensor for collision prevention



## PRODUCT HIGHLIGHTS

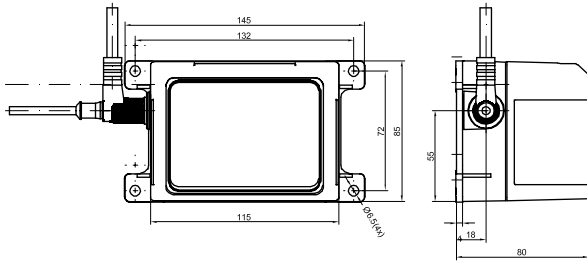
- Measurement range: 0 ... 6 m
- Wide detection cone
- Switching point accuracy  $\pm 10$  cm
- 2x2 detection zones
- 1 input
- 2 PNP outputs
- RS485 interface
- Detection zone adjustable externally
- Reliable suppression of foreign objects (girders, pillars)

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 (IEC 60825-1)	1	Scanning distance adjustment	Via control wire
Resolution	~ 16 mm		
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

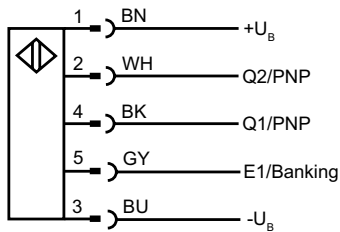
Interface	Baud rate	Suitable for control	Type of connection	Part number	Article number
RS485	57,6 kB	Lenze / DETO	Plug, M12x1, 5-pin	FR 85-2 ILLG-S1L5	529-11008
RS485	62,5 kB	LJU	Plug, M12x1, 5-pin	FR 85-2 ILLG-S1L5-62,5 kB	529-11014
2 switching points Q (PNP) N.C.	-	-	Plug, M12x1, 5-pin	FR 85-2 ILLG-POL5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

# Plug connection



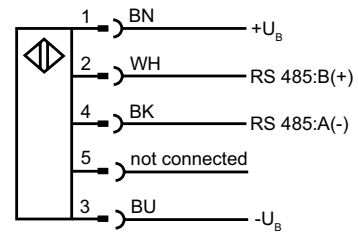
153-00349

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



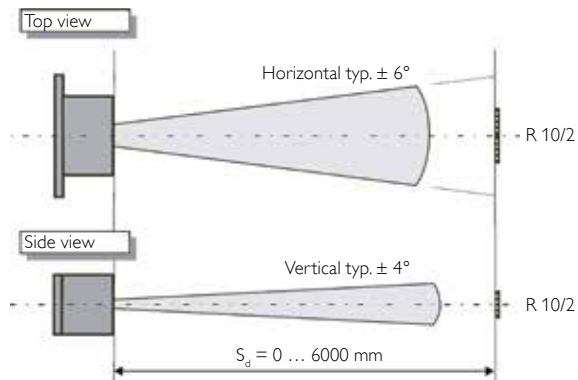
154-00325

## 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
		Connection cables	From Page A-46
		Setup Box FR 85-2 ILLX 533-11016	From Page A-53