

Distance sensors

Measurement from 10 mm to 250 m

Optical distance sensors

from Page 287

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 291

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 297

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 303

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 313

F 55 / F 90 / F 91 / F 92

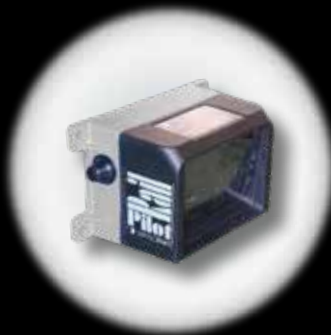
- Laser distance sensors using the time-of-flight principle
- Scanner versions up to measurement distance of 10 m
- Reflector versions up to 250 m range
- Wide choice of interfaces (serial and analogue),
 IO-Link



from Page 333

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 658

- 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 707

- 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



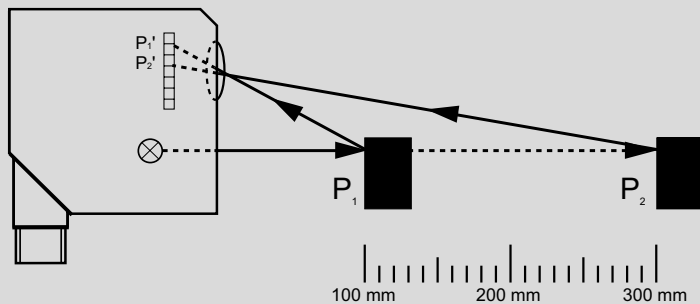
Distance sensors

System description

Distance measurement using triangulation

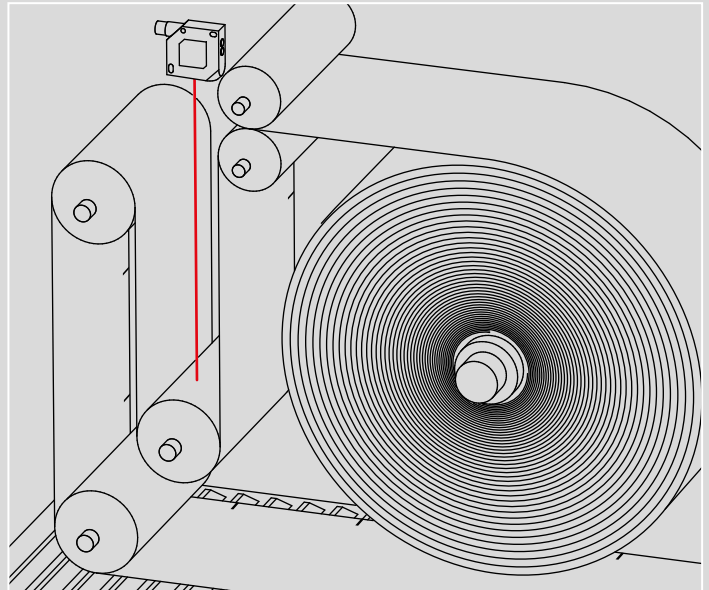
The measurement principle of optical triangulation is suitable for the precise determination of distances at close range. With the help of special receiver optics and a position-sensitive detector (e.g. a photodiode line), the sensor can determine the object distance regardless of its reflectivity (see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

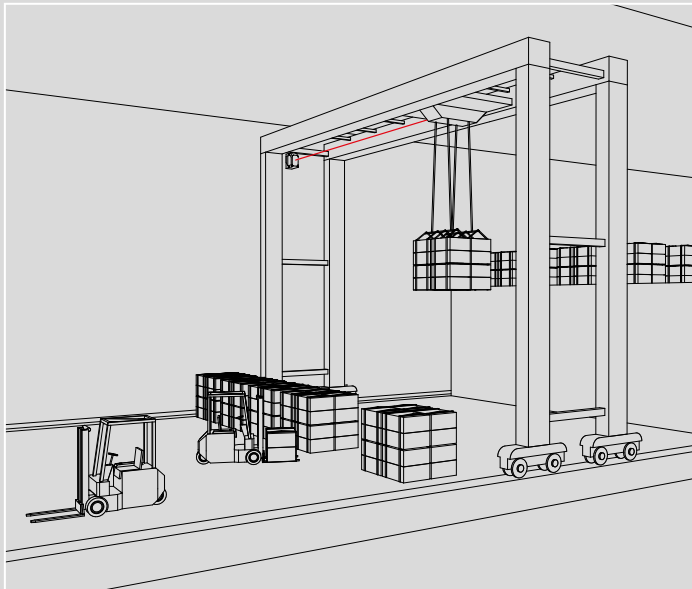
Collision prevention on monorail systems in car production is a special distance measurement task. The FR 85 series was specially developed for this application. These sensors provide excellent measurement results regardless of the reflectivity of the target object, and their comprehensive range of functions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

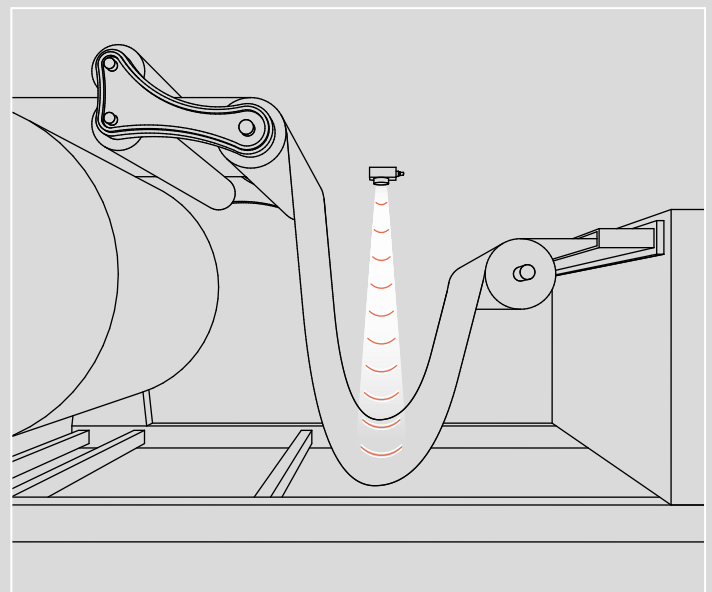
The reasonably priced solution for metallic objects. Compared to optical or ultrasonic sensors, inductive distance sensors have only limited ranges. They are still used under harsh conditions, in particular, as a result of their great robustness.

- 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.

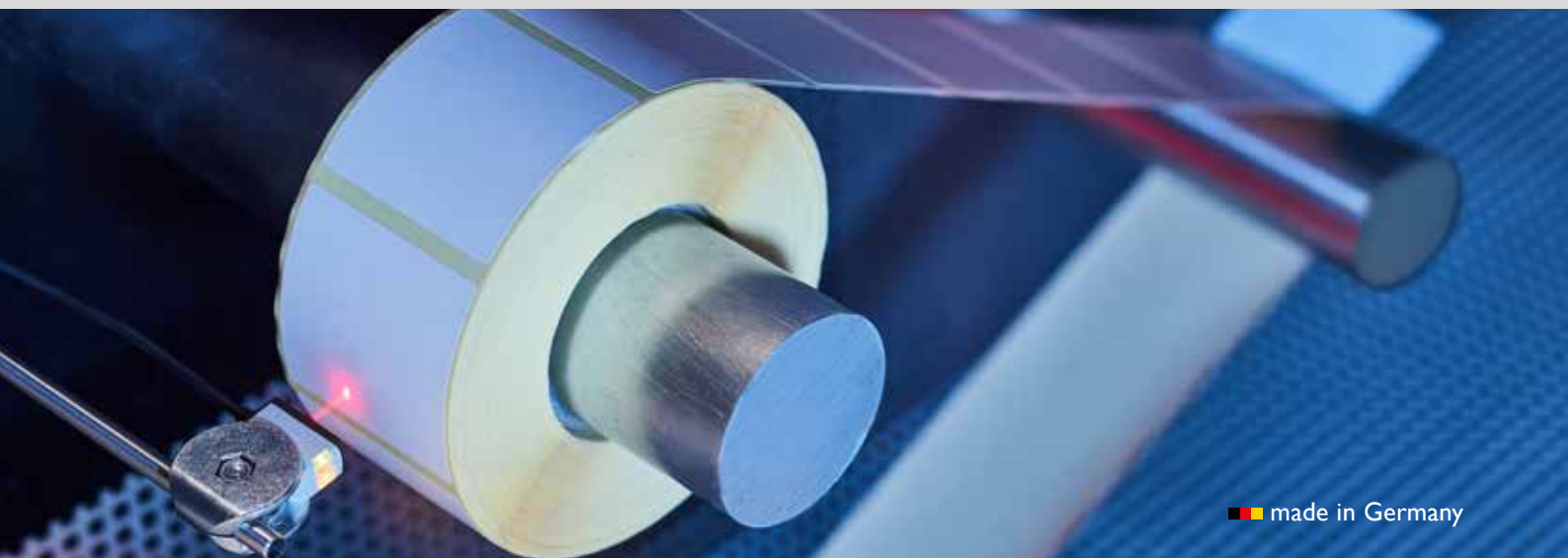
- Operating ranges from 20 ... 6000 mm
- Operating range and analogue output adjustable via teach-in
- Analogue output 0 ... 10 V / 4 ... 20 mA



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 	289

FT 10-RLA

Sub-miniature laser distance sensor



PRODUCT HIGHLIGHTS

- Measurement value output 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 ¹	Indicator LED, green	Operating voltage indicator
Resolution	0.01 mm	Indicator LED, yellow	Switching output indicator
Linearity	± 0.2 ... 0.8 mm (see characteristics) ²	Measurement range adjustment	Via IO-Link
Repeatability	0.01 ... 0.2 mm (6 σ, see characteristics) ^{2,3}	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 selection table
Electrical data		Mechanical data	
Operating voltage, +U _B	10 ... 30V DC	Dimensions	21.1 x 14.6 x 8 mm
No-load current, I ₀	≤ 12 mA	Enclosure rating	IP 67 ⁵
Output current, I _{e Q}	≤ 50 mA	Material, housing	PUR
Protective circuits	Reverse-polarity protection, U _B / short-circuit protection (Q)	Material, front screen	PMMA
Protection Class	2	Type of connection	See selection table
Switching output, Q	1x Auto-Detect (PNP/NPN) ⁴	Ambient temperature: operation	-20 ... +50 °C ⁶
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
Response time measurement value	4 ms		
Averaging times	4 / 40 / 80 / 120 / 160 / 200 / 240 / 280 / 320 / 360 / 400 ms (Default setting 4 ms)		
Temperature-specific measurement deviation	0.01 mm/K (typ.)		
IO-Link			
Communication mode	COM 2		
Min. cycletime	2.7 ms		
SIO mode	Compatible		
Data storage	Compatible		
Length process data	24 Bit		
Specification	1.1		

¹ Reference material 5...90 % reflectivity be fixed
⁵ With connected IP 67 plug

² Reference material 90 % reflectivity
⁶ UL: max. +30 °C

³ Stationary object,

⁴ Auto-Detect: Automatic selection of PNP or NPN by the sensor; PNP or NPN can

Cable connection

Repeatability¹ (typ.)

Accessories	
Connection cables	From Page A-38
Brackets	From Page A-4
SensoIO (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:

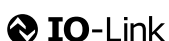
- Dancer roll regulation, sag monitoring (LED / laser)
- Determining the roll diameter of an unwinding machine (LED / laser)
- Stacking height measurement, double layer detection and height measurements in the wood processing, packaging- and handling industry (LED / laser)
- Distance measurement and 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)

5

FT 25-R(L)A – Product Overview			
	Operating range	Special features	Page
FT 25-RLA	20 ... 100 mm	Laser, small housing, IO-Link 	293
FT 25-RA	20 ... 80 mm / 30 ... 200 mm	Small housing with long range, IO-Link 	295

FT 25-RLA

Miniature laser distance sensor



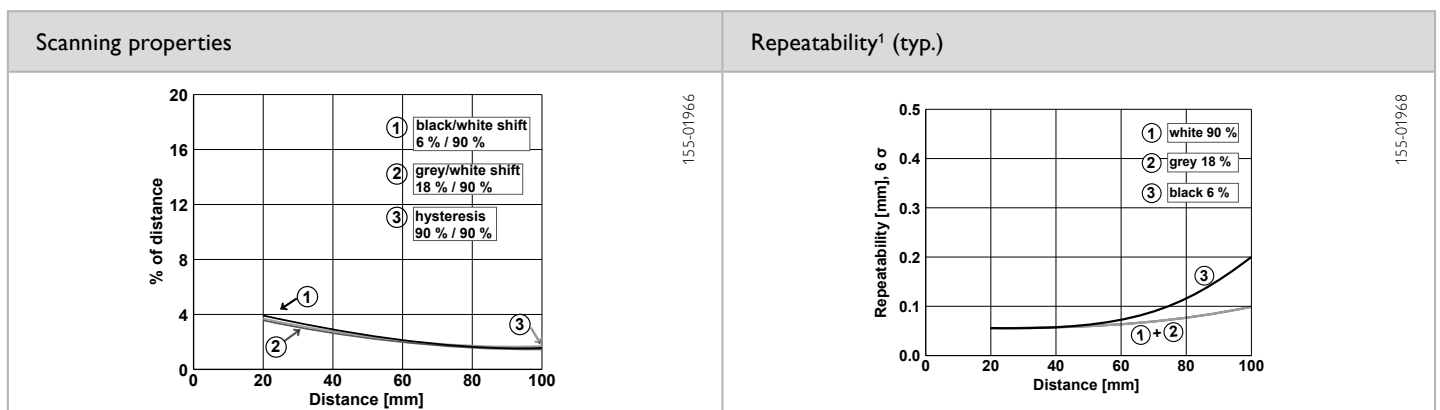
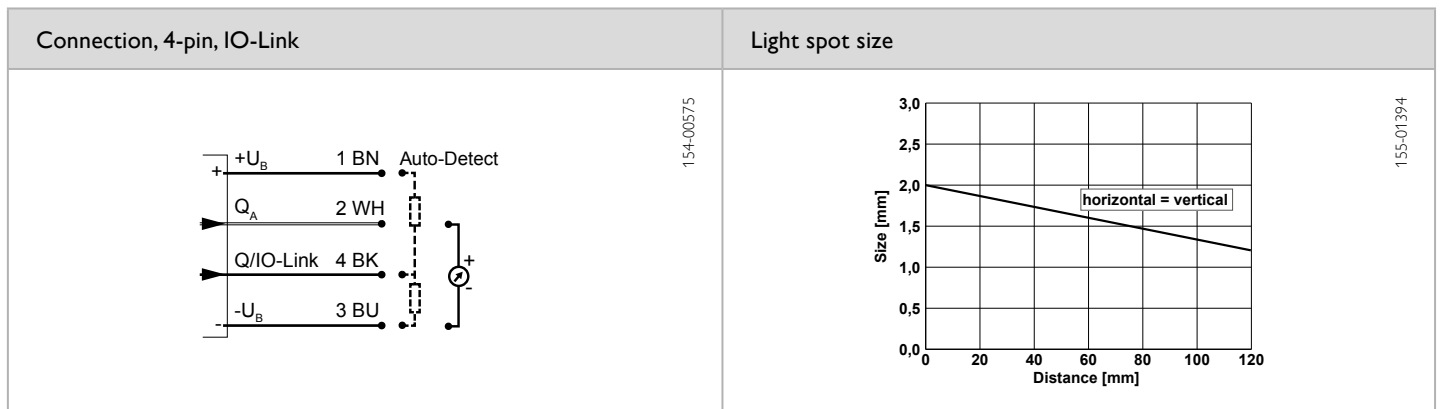
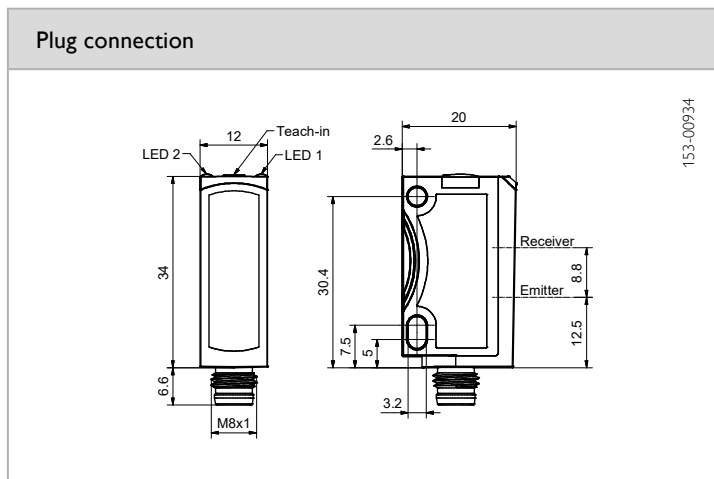
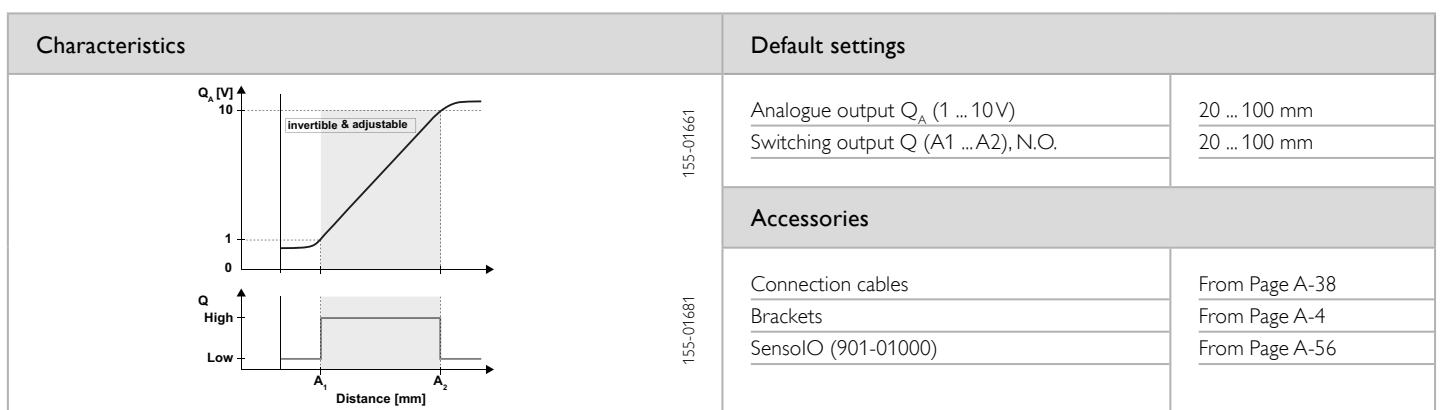
PRODUCT HIGHLIGHTS

- 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 ¹	Indicator LED, green	Operating voltage indicator
Resolution	0.12 mm (12-bit)	Indicator LED, yellow	Switching output indicator
Linearity	± 0.25 mm ²	Measurement range adjustment	Via Teach-in button
Repeatability	< 0.25 mm ^{2,3}	Adjustment possibilities	Analogue measurement range Q _A
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 _B	13 ... 30V DC	Dimensions	34 x 20 x 12 mm
No-load current, I ₀	≤ 30 mA	Enclosure rating	IP 67 / IP 69 ⁵
Output current, I _e Q	≤ 100 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U _B / short-circuit protection (Q)	Material, front screen	PMMA
Protection Class	2	Type of connection	See selection table
Power On Delay	< 300 ms	Ambient temperature: operation	-20 ... +60 °C ⁶
Switching output, Q	1x Auto-Detect (PNP/NPN) ⁴	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 _A	1 ... 10V / max. 3 mA		
Response time Q _A	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

¹ Reference material: 6 ... 90 % reflectivity ² Reference material, 18 % reflectivity ³ At 6 σ, at constant ambient conditions, typ. values see diagram ⁴ Auto-Detect: Automatic selection of PNP or NPN by the sensor; PNP or NPN can be fixed ⁵ With connected IP 67 / IP 69 plug ⁶ 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


¹ At constant ambient conditions


FT 25-RA

Miniature distance sensor



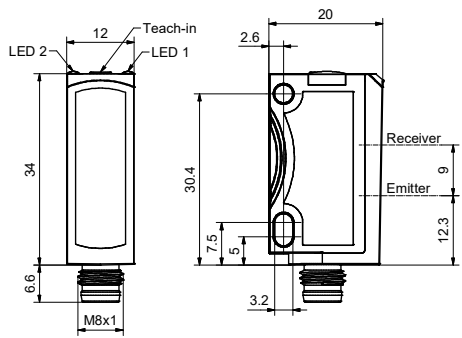
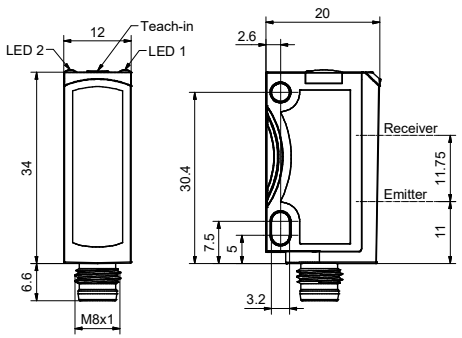
PRODUCT HIGHLIGHTS

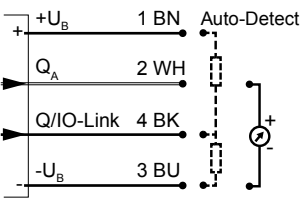
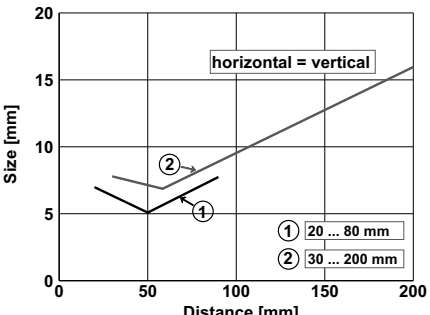
- Miniature housing with measurement ranges up to 200 mm for an easy integration and high flexibility
- High linearity and high repeatability for precise control tasks
- Almost surface independent detection on homogeneous object surfaces
- Invertible analogue characteristic
- Window mode e.g. for two-step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

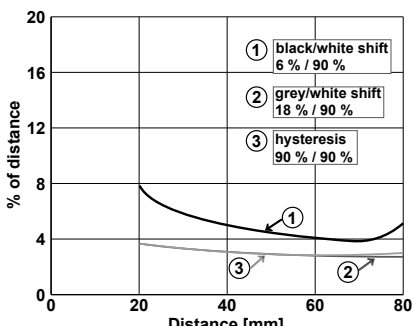
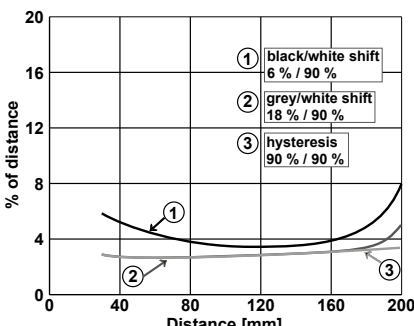
Optical data			Functions	
Measurement range	20 ... 80 mm ¹	30 ... 200 mm ¹	Indicator LED, green	Operating voltage indicator
Resolution	0.12 mm (12-bit)	0.68 mm (12-bit)	Indicator LED, yellow	Switching output indicator
Linearity	± 0.4 mm ²	± 2 mm ²	Measurement range adjustment	Via Teach-in button and IO-Link
Repeatability	< 0.4 mm ^{2,3}	< 1 mm ^{2,3}	Adjustment possibilities	Analogue measurement range Q _A
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 _B	13 ... 30V DC		Dimensions	34 x 20 x 12 mm
No-load current, I ₀	≤ 30 mA		Enclosure rating	IP 67 / IP 69 ⁵
Output current, I _e Q	≤ 100 mA		Material, housing	ABS
Protective circuits	Reverse-polarity protection, U _B / short-circuit protection (Q)		Material, front screen	PMMA
Protection Class	2		Type of connection	See selection table
Power On Delay	< 300 ms		Ambient temperature: operation	-20 ... +60 °C ⁶
Switching output, Q	1x Auto-Detect (PNP/NPN) ⁴		Ambient temperature: storage	-20 ... +80 °C
Output function	N.O./N.C.		Weight (metal plug device ⁷)	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 _A	1 ... 10V / max. 3 mA		IO-Link	
Response time, Q _A	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

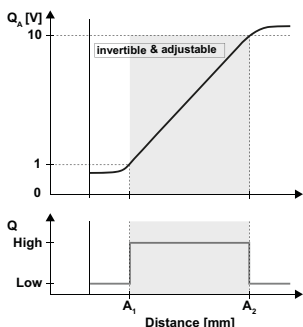
¹ Reference material: 6 ... 90 % reflectivity ² Reference material grey, 18 % reflectivity ³ At constant ambient conditions ⁴ Auto-Detect, automatic PNP/NPN selection by the sensor, PNP or NPN fixed ⁵ With connected IP 67 / IP 69 plug ⁶ UL: -20 ... +50 °C ⁷ No Ecolab

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 155-01681	FT 25-RA-60 Analogue output Q_A (1 ... 10V) Switching output Q (A1 ... A2), N.O. Accessories Connection cables Brackets SensoIO (901-01000)	FT 25-RA-170 30 ... 200 mm 30 ... 200 mm From Page A-38 From Page A-4 From Page A-56

FT 55 RLAM

Precise laser triangulation sensor for a wide range of applications

Precise measurements easily adjustable



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 $\leq 20 \mu\text{m}$ / $\leq 40 \mu\text{m}$
 - Linearity $\leq 0.6 \text{ mm}$ / 1.5 mm
 - Resolution $\leq 30 \mu\text{m}$ / $\leq 50 \mu\text{m}$ at Q_A or $1 \mu\text{m}$ via IO-Link
- IO-Link – a future-proof interface that meets the demands of Industry 4.0
- Laser class 1 – for optimum security (Variant with laser class 2 for measurements on very dark objects optional)
- 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

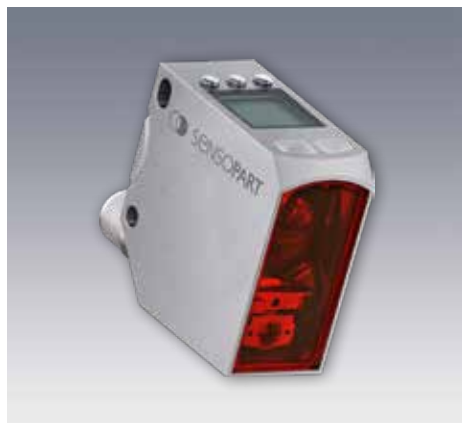
This unique combination of characteristics makes the FT 55-RLAM sensor ideally suited for diverse sectors and applications, for example precise positioning in robotics tasks, measuring coil diameters or monitoring the tension of web materials. Thanks to the master-slave function, the sensor can also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

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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; Variants with laser class 1 or laser class 2	299
FT 55-RLAM-800	200 ... 1000 mm	Scanning on object	Analogue measurement value output or IO-Link  , display; Variants with laser class 1 or laser class 2	301

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 $\leq 20 \mu\text{m}$
- Switching hysteresis of 1.2 enables smart part detection even at large distances up to 600 mm
- Variant with laser class 2 for measurements on very dark objects

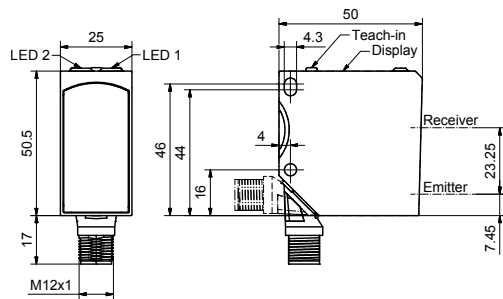
Optical data		Functions	
Operating range ¹	120 ... 600 mm	Indicator LED 1, green	Operating voltage indicator
Resolution (14 Bit)	30 μm	Indicator LED 2, yellow	Status indicator Q_1 / Q_2
Linearity (typ.) ¹	$\pm 0.6 \text{ mm}$	Measurement range adjustment	Via display or IO-Link
Repeatability ¹	20 ... 200 μm , see illustration repeatability	Adjustment possibilities	Teach-in Q_1 , Q_2 , Q_A , Q as switching window or switching point
Hysteresis ¹	$\leq 1.2 \text{ mm}$		Setting of mean value at Q_A
Type of light	Laser, red 655 nm		Auto-Detect / NPN / PNP / Push-Pull
Immunity to ambient light	$\leq 20,000 \text{ lux}^2$		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 ³		
Laser class (IEC 60825-1)	1 / 2, see selection table		
Electrical data			
Operating voltage + U_B	15 ... 30V DC	Load	$\leq 1 \text{ k}\Omega$ (2 ... 10 mA)
Power consumption	$\leq 1.5 \text{ W}$		$\leq 500 \text{ }\Omega$ (4 ... 20 mA)
Output current Ie Q	< 50 mA		$\geq 2 \text{ k}\Omega$ (0 ... 10V, 2 ... 10V)
Protection circuits	Reverse polarity protection U_B / short-circuit protection (Q)	Switching frequency f (ti/tp 1:1) Q	$\leq 1000 \text{ Hz}^5$
Protection class	2	Response time Q	600 μs^6
Power On Delay	< 300 ms	Update time Q_A	400 μs^7
Switching output Q	Auto-Detect ⁴ / PNP / NPN / Push-Pull	Averaging time Q_A ⁸	1 ms, 10 ms, 100 ms, 1000 ms
Output function Q	N.O./N.C.	Response time Q_A	Update time Q_A + averaging time Q_A
Temperature drift Q_A / digital	< 0.02 %/K / 0.01 %/K	Analogue output Q_A	2 ... 10 mA / 4 ... 20 mA
Warm-up time	20 min.		0 ... 10V / 2 ... 10V
Mechanical data			
Dimensions	50 x 50.5 x 25 mm	Ambient temperature: operation	-20 ... +50 °C ¹⁰
Enclosure rating	IP 67 & IP 69 ⁹	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

¹ 5 ... 90 %; homogenous object, not moving ² Laser class 2: 3000 Lux ³ Laser class 2: 2.5 kHz ⁴ Auto-Detect: Automatic selection of PNP or NPN by the sensor; PNP or NPN can be fixed ⁵ Laser class 2: 500 Hz ⁶ Laser class 2: 1 ms ⁷ Laser class 2: 800 μs ⁸ Scalable ⁹ With connected IP 67 / IP 69 plug ¹⁰ 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	Laser class	Part Number	Article number
IO-Link	Plug, M12x1, 5-pin, IO-Link	1	FT 55-RLAM-480-PNSUIDL-L5M	624-41004
RS485	Plug, M12x1, 8-pin	1	FT 55-RLAM-480-PNSUID-S1L8M	624-41005
IO-Link	Plug, M12x1, 5-pin, IO-Link	2	FT 55-RL2AM-480-PNSUIDL-L5M	624-41008

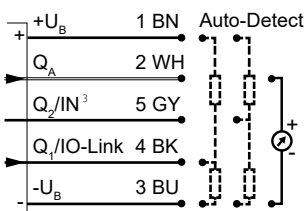
Plug connection and optical axis



153-01270

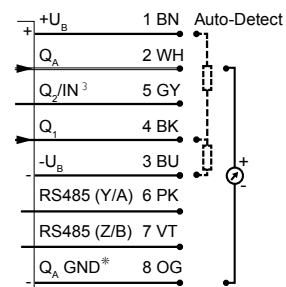
5

Connection, 5-pin, Auto-Detect^{1,2}



154-00590

Connection, 8-pin, Auto-Detect^{1,2}

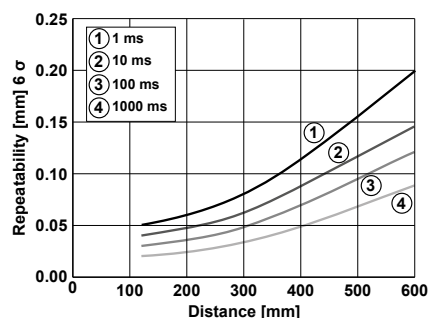


154-00553

*8 PIN fonctionnant avec un cable de norme DIN EN 60947-5-5 / IEC = 2007

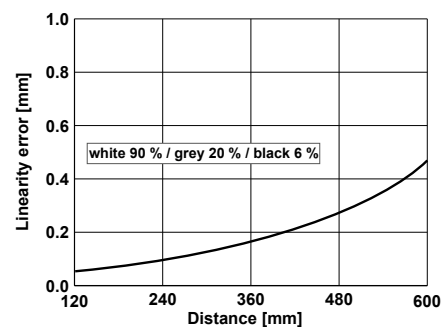
¹ In IO-Link mode, a 4-pin cable must be used ² For analogue transmission of measured values we recommend shielded cables ³ Can be used as output or input

Repeatability (typ.)⁴



155-03461

Linearity error (typ.)



155-03317

⁴ Repeatability 6 sigma, 5 ... 90 %, homogenous object, not moving

Default setting

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.

Accessories

Connection cable 8-pin to 4-pin for SensIO (L8/L4-2m-PUR / 902-51857) ⁵	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

⁵ For 8-pin versions, use DIN EN 60947-5-2 / IEC = 2007 compliant cables, see 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 $\leq 40 \mu\text{m}$
- Switching hysteresis of 2 mm enables smart part detection even at large distances up to 1000 mm
- Variant with laser class 2 for measurements on very dark objects

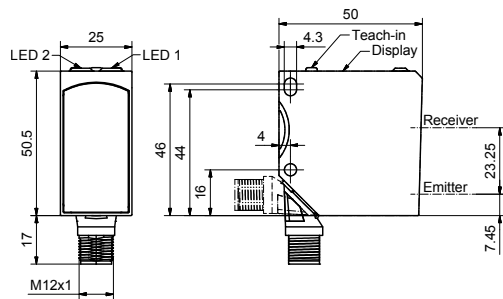
Optical data		Functions	
Operating range ¹	200 ... 1000 mm	Indicator LED 1, green	Operating voltage indicator
Resolution (14 Bit)	50 μm	Indicator LED 2, yellow	Status indicator Q_1 / Q_2
Linearity (typ.) ¹	$\pm 1.5 \text{ mm}$	Measurement range adjustment	Via display or IO-Link
Repeatability ¹	40 ... 820 μm , see illustration repeatability	Adjustment possibilities	Teach-in Q_1 , Q_2 , Q_A , Q as switching window or switching point
Hysteresis ¹	$\leq 2 \text{ mm}$		Setting of mean value at Q_A
Type of light	Laser, red 655 nm		Auto-Detect / NPN / PNP / Push-Pull
Immunity to ambient light	$\leq 20,000 \text{ lux}^2$		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 ³		
Laser class (IEC 60825-1)	1 / 2, see selection table		
Electrical data			
Operating voltage + U_B	15 ... 30V DC	Load	$\leq 1 \text{ kOhm}$ (2 ... 10 mA)
Power consumption	$\leq 1.5 \text{ W}$		$\leq 500 \text{ Ohm}$ (4 ... 20 mA)
Output current Ie Q	$< 50 \text{ mA}$		$\geq 2 \text{ kOhm}$ (0 ... 10V, 2 ... 10V)
Protection circuits	Reverse polarity protection U_B / short-circuit protection (Q)	Switching frequency f (ti/tp 1:1) Q	$\leq 1000 \text{ Hz}^5$
Protection class	2	Response time Q	600 μs^6
Power On Delay	$< 300 \text{ ms}$	Update time Q_A	400 μs^7
Switching output Q	Auto-Detect ⁴ / PNP / NPN / Push-Pull	Averaging time Q_A ⁸	1 ms, 10 ms, 100 ms, 1000 ms
Output function Q	N.O./N.C.	Response time Q_A	Update time Q_A + averaging time Q_A
Temperature drift Q_A / digital	$< 0.02 \text{ \%}/\text{K}$ / $0.01 \text{ \%}/\text{K}$	Analogue output Q_A	2 ... 10 mA / 4 ... 20 mA
Warm-up time	20 min.		0 ... 10V / 2 ... 10V
Mechanical data			
Dimensions	50 x 50.5 x 25 mm	Ambient temperature: operation	-20 ... +50 $^{\circ}\text{C}^{10}$
Enclosure rating	IP 67 & IP 69 ⁹	Ambient temperature: storage	-20 ... +60 $^{\circ}\text{C}$
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

¹ 5 ... 90 %; homogenous object, not moving ² Laser class 2: 3000 Lux ³ Laser class 2: 2.5 kHz ⁴ Auto-Detect: Automatic selection of PNP or NPN by the sensor; PNP or NPN can be fixed ⁵ Laser class 2: 500 Hz ⁶ Laser class 2: 1 ms ⁷ Laser class 2: 800 μs ⁸ Scalable ⁹ With connected IP 67 / IP 69 plug ¹⁰ UL: max. +45 $^{\circ}\text{C}$

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
IO-Link	Plug, M12x1, 5-pin, IO-Link	FT 55-RL2AM-800-PNSUIDL-L5M	624-41009

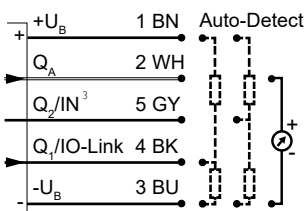
Plug connection and optical axis



153-01270

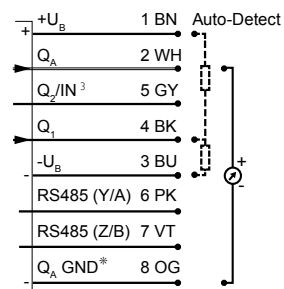
5

Connection, 5-pin, Auto-Detect^{1,2}



154-00590

Connection, 8-pin, Auto-Detect^{1,2}

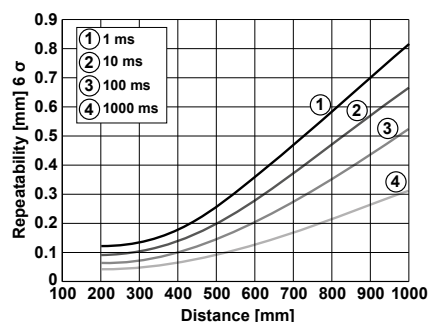


154-00553

*8 PIN fonctionnant avec un cable de norme DIN EN 60947-5-5 / IEC = 2007

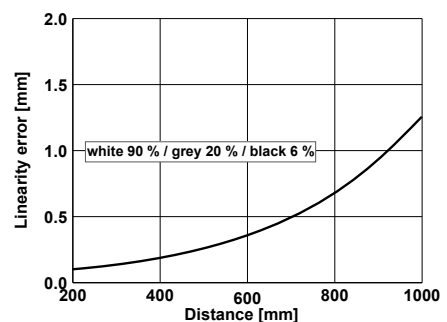
¹ In IO-Link mode, a 4-pin cable must be used ² For analogue transmission of measured values we recommend shielded cables ³ Can be used as output or input

Repeatability (typ.)⁴



155-03460

Linearity error (typ.)



155-03318

⁴ Repeatability 6 σ , 5 ... 90 %, homogenous object, not moving

Default setting		Accessories	
Analogue output Q_A	4 ... 20 mA, Measurement range limits	Connection cable 8-pin to 4-pin for SensIO (L8/L4-2m-PUR / 902-51857) ⁵	From Page A-46
Switching output Q_1	450 mm, N.O.	Further connection cables	From Page A-46
Switching output Q_2	750 mm, N.O.	Bracket SensoClip MBD F 55ST2 (579-50012)	From Page A-4
		SensIO (901-01000)	From Page A-4
			From Page A-56

⁵ For 8-pin versions, use DIN EN 60947-5-2 / IEC = 2007 compliant cables, see From Page A-46

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 μm
- 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	305
FT 50 RLA-40	50 x 17 x 50 mm	45 ... 85 mm	Analogue output	307
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	309

FT 50 RLA 20

Distance sensor



PRODUCT HIGHLIGHTS

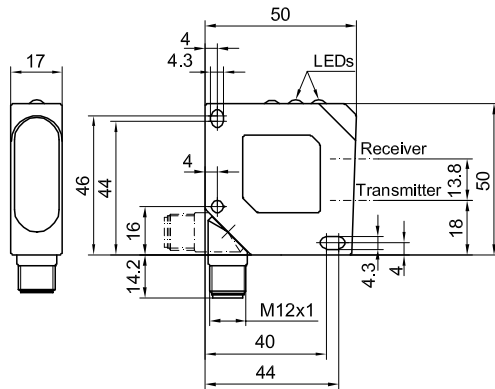
- High resolution and small laser light spot
- Operating range: 40 ... 60 mm
- Small, easily visible laser light spot
- No adjustments necessary
- Resolution: 7 µm / 40 µm
- Analogue output: 0 ... 10 V
- Device plug rotatable through 270°

Optical data		Functions	
Operating range	40 ... 60 mm ¹	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 _B	18 ... 28 V DC	Dimensions	50 x 50 x 17 mm
No-load current, I ₀	≤ 35 mA	Enclosure rating	IP 67 ²
Protective circuits	Reverse-polarity protection, U _B / 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

¹ Reference material: Kodak grey, 18 % ²With connected IP 67 plug

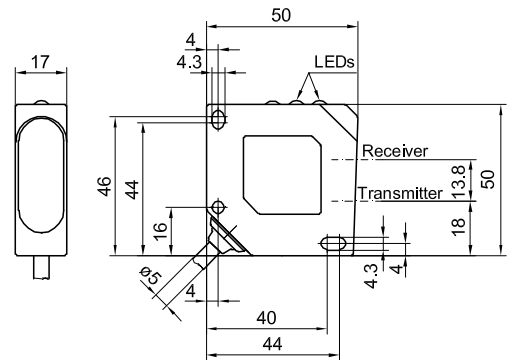
Resolution	Repeatability	Rise time	Fall time	Limit frequency	Type of connection	Part number	Article number
40 µm	< 0.1 mm	3 ms	2 ms	400 Hz	Plug, M12x1, 4-pin	FT 50 RLA-20-F-L4S	574-41005
7 µm	< 0.05 mm	30 ms	20 ms	40 Hz	Plug, M12x1, 4-pin	FT 50 RLA-20-S-L4S	574-41007
40 µm	< 0.1 mm	3 ms	2 ms	400 Hz	Cable,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



153-00214

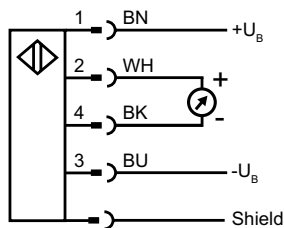
Cable connection



153-00213

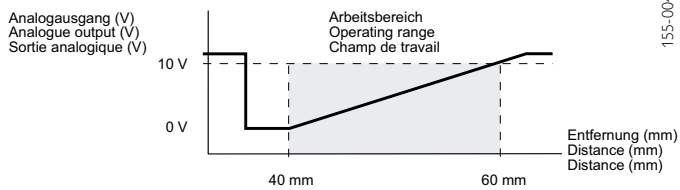
5

Connection, 4-pin



154-00195

Characteristic output curve



155-00438

Accessories

Connection cables	From Page A-38
Brackets	From Page A-4

FT 50 RLA 40

Distance sensor



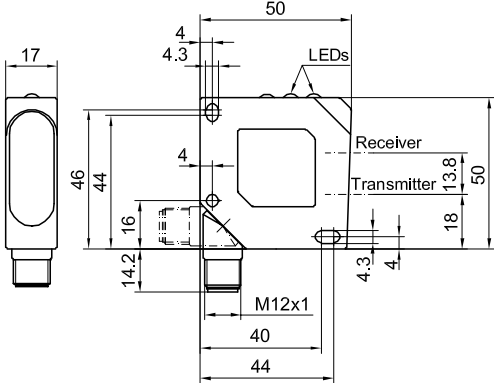
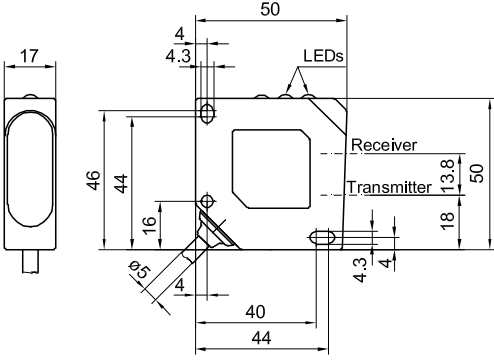
PRODUCT HIGHLIGHTS

- 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°

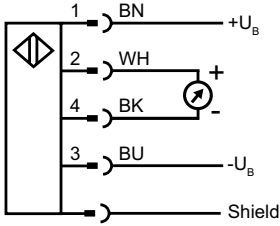
Optical data		Functions	
Operating range	45 ... 85 mm ¹	Indicator LED, green	Operating voltage indicator
Measurement range	40 mm	Indicator LED, red	Contamination indicator
Type of light	Laser, red, 670 nm	Scanning distance adjustment	Fixed setting
Laser Class (IEC 60825-1)	1		
Resolution	80 µm / 20 µm (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 _B	18 ... 28 V DC	Dimensions	50 x 50 x 17 mm
No-load current, I ₀	≤ 35 mA	Enclosure rating	IP 67 ²
Protective circuits	Reverse-polarity protection, U _B / 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

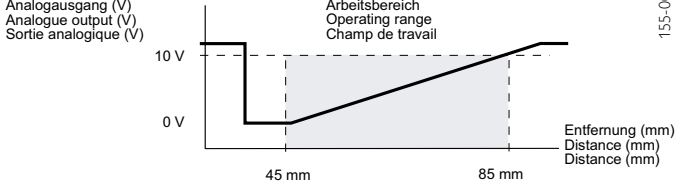
¹ Reference material: Kodak grey, 18 % ² With connected IP 67 plug

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-38
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 ¹	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 ² (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 _B	18 ... 30V DC	Dimensions	50 x 50 x 17 mm
No-load current, I ₀	≤ 40 mA	Enclosure rating	IP 67 ³
Output current, I _e	≤ 100 mA	Material, housing	ABS, impact-resistant
Protective circuits	Reverse-polarity protection, U _B / short-circuit protection, Q	Material, front screen	PMMA
Protection Class	2	Type of connection	See selection table
Power On Delay	< 300 ms	Ambient temperature: operation	-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 _B) = laser disable When Low (-U _B) = button lock When open = free-running		

¹ Reference material: Kodak grey, 18 % ² Smallest measurable change ³ 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>FT 50 RLA 70 30 mm 100 mm</p><p>FT 50 RLA 100 70 mm 170 mm</p><p>FT 50 RLA 220 80 mm 300 mm</p></div>	<div>155-00271</div> <div><p>Receiver Transmitter</p><p>A B C D X</p><p>8.5</p></div> <table><tr><th>FT 50 RLA</th><th>70 ...</th><th>100 ...</th><th>220 ...</th></tr><tr><td>A</td><td>30</td><td>70</td><td>80</td></tr><tr><td>B</td><td>100</td><td>170</td><td>300</td></tr><tr><td>C</td><td>1.5 × 3</td><td>1.5 × 3.5</td><td>1.5 × 3.5</td></tr><tr><td>D</td><td>1.5 × 3.25</td><td>1.7 × 3.9</td><td>2 × 4.5</td></tr><tr><td>X</td><td>29.4</td><td>32.5</td><td>32.5</td></tr></table> <div>155-00269</div>	FT 50 RLA	70 ...	100 ...	220 ...	A	30	70	80	B	100	170	300	C	1.5 × 3	1.5 × 3.5	1.5 × 3.5	D	1.5 × 3.25	1.7 × 3.9	2 × 4.5	X	29.4	32.5	32.5
FT 50 RLA	70 ...	100 ...	220 ...																						
A	30	70	80																						
B	100	170	300																						
C	1.5 × 3	1.5 × 3.5	1.5 × 3.5																						
D	1.5 × 3.25	1.7 × 3.9	2 × 4.5																						
X	29.4	32.5	32.5																						

Accessories	
Connection cables	From Page A-38
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 ¹	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 (0.1 mm / 0.17 mm / 0.3 mm) ²	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 _B	18 ... 30V DC	Dimensions	50 x 50 x 17 mm
No-load current, I ₀	≤ 40 mA	Enclosure rating	IP 67 ³
Output current, I _e	≤ 100 mA	Material, housing	ABS, impact-resistant
Protective circuits	Reverse-polarity protection, U _B / 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 ₁ / Q ₂	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		

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

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

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

5

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

Characteristic analogue curve		Light spot geometry																									
<div>Operating range (default setting)</div> <div><p>OK LED (green) (Good Target)</p><p>Analogue output (invertible)</p><p>20 mA</p><p>4 mA</p><p>On</p><p>Off</p><p>FT 50 RLA 70 30 mm 100 mm</p><p>FT 50 RLA 100 70 mm 170 mm</p><p>FT 50 RLA 220 80 mm 300 mm</p></div>		<div><p>155-00271</p><p>Receiver</p><p>Transmitter</p><p>A</p><p>B</p><p>C</p><p>D</p><p>X</p><p>0.5</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 × 3</td><td>1.5 × 3.5</td><td>1.5 × 3.5</td></tr><tr><td>D</td><td>1.5 × 3.25</td><td>1.7 × 3.9</td><td>2 × 4.5</td></tr><tr><td>X</td><td>29.4</td><td>32.5</td><td>32.5</td></tr></tbody></table> <p>155-00269</p>		FT 50 RLA	70 ...	100 ...	220 ...	A	30	70	80	B	100	170	300	C	1.5 × 3	1.5 × 3.5	1.5 × 3.5	D	1.5 × 3.25	1.7 × 3.9	2 × 4.5	X	29.4	32.5	32.5
FT 50 RLA	70 ...	100 ...	220 ...																								
A	30	70	80																								
B	100	170	300																								
C	1.5 × 3	1.5 × 3.5	1.5 × 3.5																								
D	1.5 × 3.25	1.7 × 3.9	2 × 4.5																								
X	29.4	32.5	32.5																								

Installation	Accessories
	<p>Connection cables</p> <p>Brackets</p>
	<p>From Page A-38</p> <p>From Page A-4</p>

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 	315
FT 55-RLAP2	0.06 ... 5 m	Scanning on object	Compact design, IO-Link 	317
FT 90 ILA	0.5 ... 10 m	Scanning on object	2 switching outputs, RS422 interface, SSI-compatible, switchable red-light pilot laser	319
FT 91 ILA	0.5 ... 6 m	Scanning on object	2 switching outputs, RS422 interface, SSI-compatible, switchable red-light pilot laser	321
FT 92 ILA/RLA	0.2 ... 6 m	Scanning on object	2 switching outputs, 1 analogue output, switchable red-light pilot laser	323
FR 55-RLAP	0.3 ... 70 m	Reflector	1 analogue output 4 ... 20 mA, 1 switching output, external teach input, compact design, high flexibility, IO-Link 	325
FR 90 ILA	0.5 ... 250 m	Reflector	2 switching outputs, RS422 interface, SSI-compatible, switchable red-light pilot laser	327
FR 91 ILA	0.5 ... 50 m	Reflector	2 switching outputs, RS422 interface, SSI-compatible, switchable red-light pilot laser	329
FR 92 ILA	0.2 ... 30 m	Reflector	2 switching outputs, 1 analogue output, switchable red-light pilot laser	331

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) ¹	Indicator LED 2, green	Operating voltage indicator
Resolution	< 5 mm (12-bit)	Indicator LED 2, yellow	Status indicator analogue output
Linearity	± 30 mm ^{1,2}	Indicator LED 1 yellow	Switching output indicator
Repeatability	1.2 mm ^{1,2,3}	Measurement range adjustment	Via Teach-in button or control input
Hysteresis	20 mm	Adjustment possibilities	Analogue measurement range Q_A
Type of light	Laser, red 655 nm	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) ⁴	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 ⁵	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 ^{6,7}		
Ambient temperature: storage	-40 ... +80 °C		
Weight (plug device)	42 g		
Resistance to vibration and impacts	EN 60947-5-2		

¹ Reference material 90 % reflectivity

² At 50 Hz

³ For 1 σ , see diagram for further values

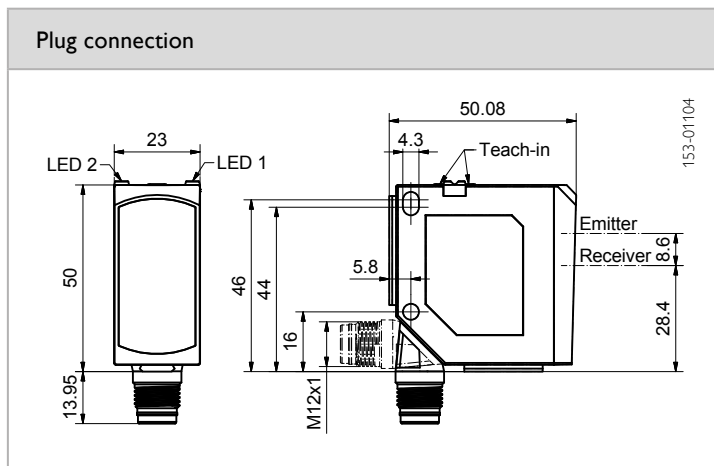
⁴ Auto-Detect: Automatic selection of PNP or NPN by the sensor; PNP or NPN can be fixed

⁵ With connected IP 67 / IP 69K plug

⁶ Up to +50 °C with current output 4 ... 20 mA

⁷ UL: max. +45 °C

Measurement range ¹	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 ¹ (50 Hz)	Repeatability ¹ (250 Hz ²)

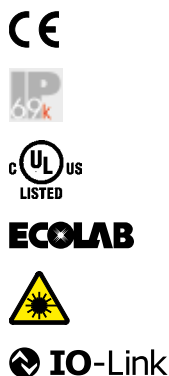
¹ At constant ambient conditions ² Automatic adjustment to 50 Hz at constant distance

Characteristic analogue curve	Reference material	Measurement range
	White (90 %) Grey (18 %) Black (6 %)	0.1 ... 5 m 0.1 ... 5 m 0.1 ... 3 m
	Default setting³	
	Analogue output Q_A (4...20 mA / 0,09 ... 10V) Switching output Q (A_1 ... A_2), N.O., Auto-Detect	0.3 ... 3 m 0.3 ... 3 m
	Accessories	
	Connection cables Brackets	From Page A-38 From Page A-4

³ 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) ¹	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 _B	18 ... 30V DC	Dimensions	50 x 50.1 x 23 mm
No-load current I ₀	≤ 60 mA	Enclosure rating	IP 67 & IP 69K ³
Output current I _e Q	≤ 100 mA	Material, housing	ABS
Protection circuits	Reverse polarity protection U _B / short-circuit protection (Q)	Material, front screen	PMMA
Protection class	2	Type of connection	See selection table
Power On Delay	< 5 s	Ambient temperature: operation	-40 ... +60 °C ⁴
Switching output Q	1 x Auto-Detect (PNP/NPN) ²	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	IO-Link	
Temperature drift	< 2 mm / K		
Warm-up time	20 min.	Communication mode	COM 2
Control input IN	+U _B = Teach-in -U _B = button locked Open = normal operation	Min. cycle time	2.7 ms
		SIO mode	Compatible
		Process bit length	24 Bit
		Specification	1.1

¹ Reference material 90 % reflectivity

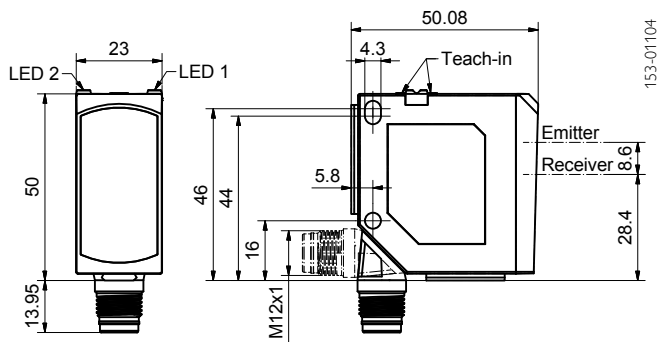
² Auto-Detect: Automatic selection of PNP or NPN by the sensor; PNP or NPN can be fixed

³ With connected IP 67 / IP 69K plug

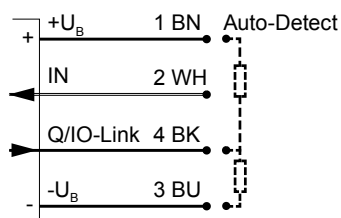
⁴ UL: max. +45 °C

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

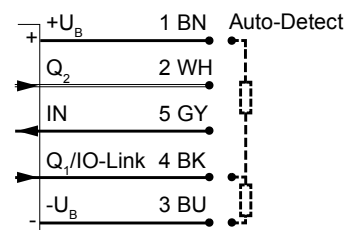
Plug connection



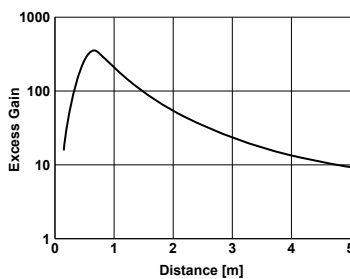
Connection, 4-pin, IO-Link



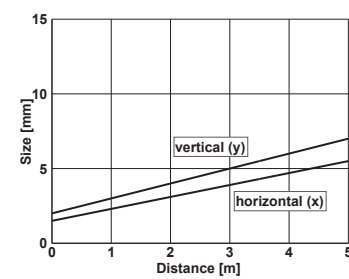
Connection, 5-pin, IO-Link



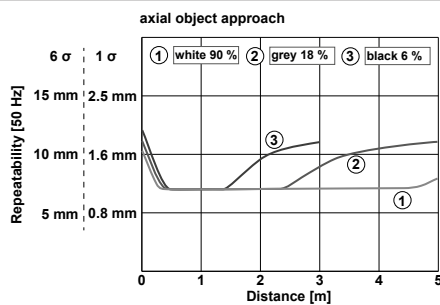
Scanning properties



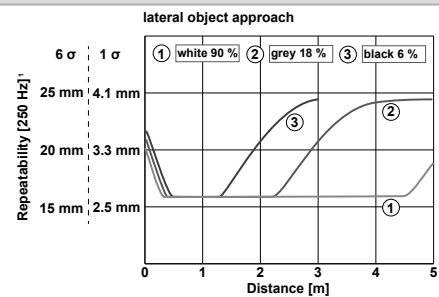
Light spot size



Repeatability¹ (50 Hz)



Repeatability¹ (250 Hz²)


¹automatic adjustment to 50 Hz at constant distance

¹ At constant ambient conditions ² Automatic adjustment to 50 Hz at constant distance

Reference material	Scanning distance	Accessories	
White (90 %)	0.06 ... 5 m	Connection cables	From Page A-38
Grey (18 %)	0.06 ... 5 m	Brackets	From Page A-4
Black (6 %)	0.06 ... 3 m		

FT 90 ILA

Distance sensor



PRODUCT HIGHLIGHTS

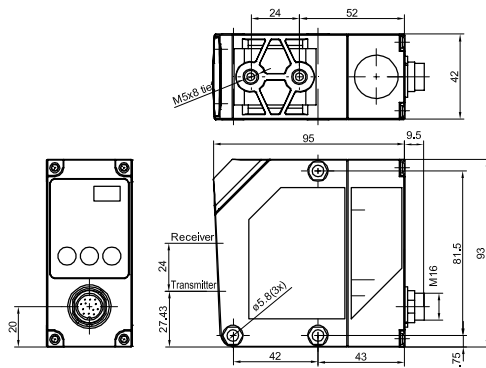
- Long scanning distance (up to 10 m on white objects)
- High repeatability
- High measurement rates
- Open interfaces ensure maximum compatibility (SSI-compatible, RS422)
- Profibus and DeviceNet via gateway
- Switchable red-light pilot laser
- 2 switching outputs

Optical data		Functions	
Operating range	0.5 ... 10 m ¹	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 _B	18 ... 30V DC ²	Dimensions	93 × 93 × 42 mm
Output current, I _e	≤ 100 mA	Enclosure rating	IP 67 ³
Plausibility output, Q _p	50 mA	Material, housing	ABS, impact-resistant
Service output, Q _s	50 mA	Material, front screen	PMMA
Protective circuits	Reverse-polarity protection, U _B / 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 ₁ / Q ₂	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 _A	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		

¹ Reference material: Kodak white, 90 % ² 10 % ripple, within U_B ³ 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

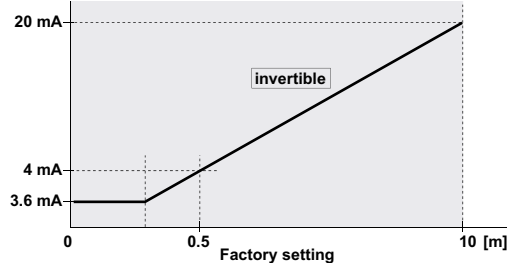


153-00457

Connection, 12-pin

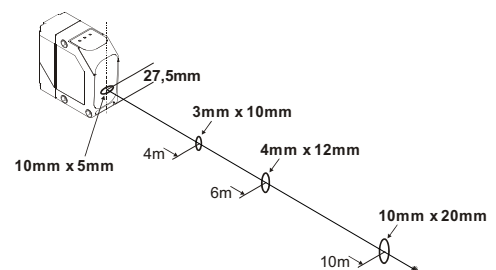
Pin	Name	Cable Type 1 (12-pin) color	Cable Type 2 (5-pin) color	Description
A	TX+	White		RS422: transmission data / SSi: Data+
B	Q1	Brown	Black	Switching output, Q1
C	RX+	Green		RS422: receiver data / SSi: clock+
D	analog	Yellow		Analogue output 4 ... 20 mA (only FT9X)
E	Qs	Grey	Orange	Service output, 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-38
Brackets	From Page A-4
AS F 90 Aligning aid	From Page A-4
MSP F 90 A Fine adjustment	From Page A-4
Converters and adapter cables	From Page A-38

FT 91 ILA

Distance sensor



PRODUCT HIGHLIGHTS

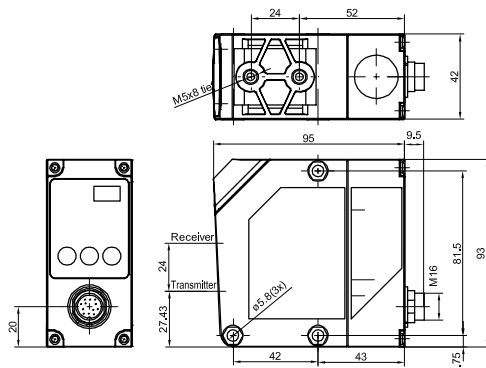
- Long scanning distance (up to 10 m on white objects)
- High repeatability
- High measurement rates
- Open interfaces ensure maximum compatibility (SSI-compatible, RS422)
- Profibus and DeviceNet via gateway
- Switchable red-light pilot laser
- 2 switching outputs

Optical data		Functions	
Operating range	0.5 ... 6 m ¹	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 _B	18 ... 30V DC ²	Dimensions	93 × 93 × 42 mm
Output current, I _e	≤ 100 mA	Enclosure rating	IP 67 ³
Plausibility output, Q _p	50 mA	Material, housing	ABS, impact-resistant
Service output, Q _s	50 mA	Material, front screen	PMMA
Protective circuits	Reverse-polarity protection, U _B / 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 ₁ / Q ₂	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 _A	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		

¹ Reference material: Kodak white, 90 % ² 10 % ripple, within U_B ³ With connected IP 67 plug

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

Plug connection

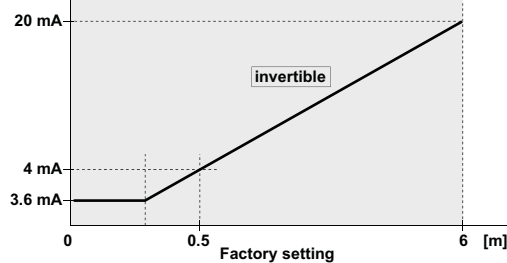


153-00457

Connection, 12-pin

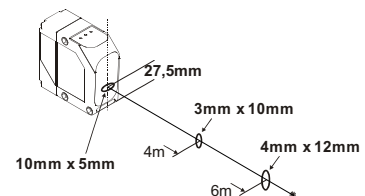
Pin	Name	Cable Type 1 (12-pin) color	Cable Type 2 (5-pin) color	Description
A	TX+	White		RS422: transmission data / SSi: Data+
B	Q1	Brown	Black	Switching output, Q1
C	RX+	Green		RS422: receiver data / SSi: clock+
D	analog	Yellow		Analogue output 4 ... 20 mA (only FT9X)
E	Qs	Grey	Orange	Service output,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



155-01809

Light spot geometry



155-01810

Scanning distance

White 90 %
Grey 10 %
Black 6 %

0.5 ... 6 m
0.5 ... 4 m
0.5 ... 2 m

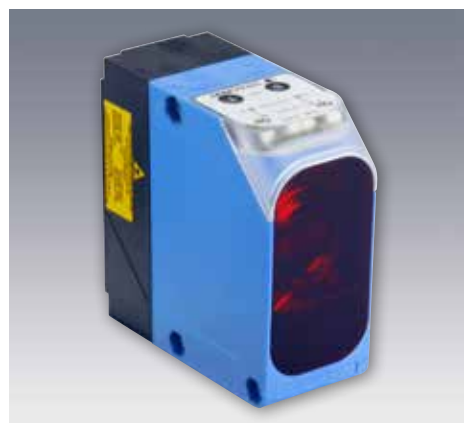
Accessories

Connection cables
Brackets
AS F 90 Aligning aid
MSP F 90 A Fine adjustment
Converters and adapter cables

From Page A-38
From Page A-4
From Page A-4
From Page A-4
From Page A-38

FT 92 ILA / IRLA

Distance sensor



PRODUCT HIGHLIGHTS

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

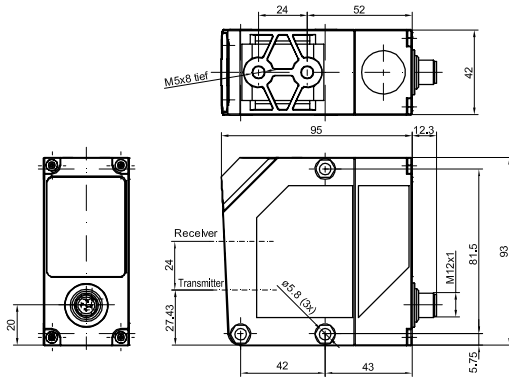
Optical data		Functions	
Scanning distance	0.2 ... 6 m ¹	Indicator LED, green	Operating voltage indicator
Type of light	Infrared, 905 nm (measurement laser) Laser, red, 650 nm (pilot laser)	Indicator LED, yellow	2 x switching output indicator
Laser Class (IEC 60825-1)	1 (measurement laser) 1 (pilot laser)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

¹ With RL250 reflector ² Data apply after a minimum switch-on time of 30 min ³ 10 % ripple, within U_B ⁴ 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 ⁵	591-91013

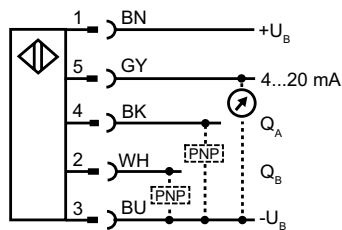
⁵ Pilot laser (red) on permanently

Plug connection



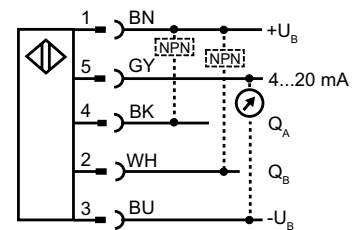
153-00346

Connection, 5-pin (PNP)



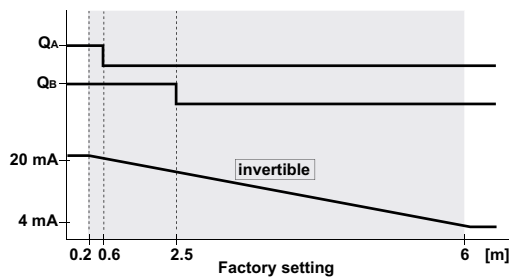
154-00125

Connection, 5-pin (NPN)



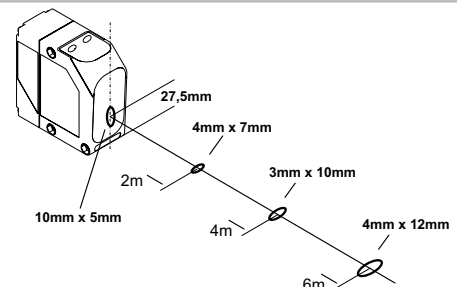
154-00472

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

FR 55-RLAP

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



PRODUCT HIGHLIGHTS

- Sensor with large range for anticollision and positioning applications
- IO-Link with many functions for an individual application customisation
- 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 ¹	Indicator LED 1, green	Operating voltage indicator
Resolution Q _A	35 mm = 8 µA (11 Bit) ²	Indicator LED 2 yellow	Switching output indicator
Resolution IO-Link	1 mm	Measurement range adjustment	Via Teach-in button, control input or IO-Link
Linearity Q _A	± 0.5 % ^{1,3,4}	Adjustment possibilities	Adjustable analogue measurement range Q _A , invertible analogue characteristic, adjustable switching output Q
Linearity IO-Link	50 ... 350 mm		Adjustable analogue measurement range Q _A , invertible analogue characteristic, adjustable switching output Q
Repeatability	≤ 6 mm ⁵ (see selection table)		Adjustable analogue measurement range Q _A , invertible analogue characteristic, adjustable switching output Q
Hysteresis	60 mm	Software functions adjustable via IO-Link (e.g. via SensIO)	Window mode, hysteresis mode or switching point, adjustable mean value filter; delay functions (on/off/pulse), counter; signal quality output in percent via IO-Link
Type of light	Laser, red 655 nm		Window mode, hysteresis mode or switching point, adjustable mean value filter; delay functions (on/off/pulse), counter; signal quality output in percent via IO-Link
Laser class (IEC 60825-1)	1	Default settings	See selection table
			See selection table
Electrical data			
Operating voltage +U _B	18 ... 30V DC	Temperature drift	< 1 mm/K
No-load current I ₀	≤ 60 mA	Warm-up time	20 min.
Output current I _e Q	≤ 100 mA	Control input IN	+U _B = Teach-in / -U _B = button locked Open = normal operation
Protection circuits	Reverse polarity protection U _B / short-circuit protection (Q)	IO-Link	
Protection class	2		
Power On Delay	≤ 100 ms	Communication mode	COM 2
Switching output Q	1× Auto-Detect (PNP/NPN) ⁶	Min. cycle time	3 ms
Output function	N.O./N.C.	IO-Link profile	Smart SensorV1.0
Switching frequency f (ti/tp 1:1) Q	≤ 50 Hz	Resolution distance value	1 mm
Response time Q	10 ms	SIO mode	Compatible
Load	≤ 500 Ohm (4 ... 20 mA) ≥ 4 k Ohm (0 ... 10V)	Data storage	Compatible
Analogue output Q _A	4 ... 20 mA / 0 ... 10V ⁷	Specification	V1.1
Response time measured value	See table repeatability		
Update rate Q _A	10 ms ⁶		
Mechanical data			
Dimensions	50 × 50.1 × 23 mm	Ambient temperature: operation	-30 ... +60 °C ⁹
Enclosure rating	IP 67 & IP 69K ⁸	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		

¹ Reference material: RF250 reflector ² For a max. measurement range of 70 m ³ 0.5 % of the set measurement range, for load 500 Ω ⁴ Min. linearity error 50 mm

⁵ The set measuring range is < 10 m, for further values see diagram ⁶ Auto-Detect: Automatic selection of PNP or NPN by the sensor; PNP or NPN can be fixed

⁷ adjustable via IO-Link, e.g. with SensIO ⁸ With connected IP 67 / IP 69K plug ⁹ UL: max. +45 °C

Measurement range ¹	Analogue output	Switching output	Type of connection	Part Number	Article number
0.3 ... 70 m	4 ... 20 mA	1 x Auto-Detect	Plug, M12x1, 5-pin, IO-Link	FR 55-RLAP-70-PNSIL-L5	621-11028

¹ Reference material: RF250 reflector

Plug connection	Connection, 5-pin, Auto-Detect

5

Linearity Q_A / digital (typ.) ¹⁰	Light spot size

¹⁰ Linearity deviations can be positive or negative

Repeatability Q_A (typ.) ¹¹	Characteristic analogue curve										
<div> <p>Averaging time Repeatability⁴ [mm], typ.</p> <table> <tr> <td>10 ms</td> <td>≤ 13</td> </tr> <tr> <td>100 ms</td> <td>≤ 12</td> </tr> <tr> <td>200 ms</td> <td>≤ 11</td> </tr> <tr> <td>900 ms</td> <td>≤ 7</td> </tr> <tr> <td>1000 ms</td> <td>≤ 6</td> </tr> </table> </div>	10 ms	≤ 13	100 ms	≤ 12	200 ms	≤ 11	900 ms	≤ 7	1000 ms	≤ 6	
10 ms	≤ 13										
100 ms	≤ 12										
200 ms	≤ 11										
900 ms	≤ 7										
1000 ms	≤ 6										

¹¹ Constant ambient conditions, 6 σ static object, reflector RF 250 (599-91009)

Default setting	Measurement range	Accessories
Analogue output Q_A	2 ... 6 m	Mounting angle MA F 55 (579-50007)
Switching output Q , N.O.	Switching window 2 ... 6 m	Connection cables (C L8FG-S-2m-PUR / 902-51830)
Response time measured value (e. g. Q_A)	2 ... 6 m	Reflective foil RF 250 (599-91009)
		Sensolo (901-01000)

FR 90 ILA

Reflector distance sensor



PRODUCT HIGHLIGHTS

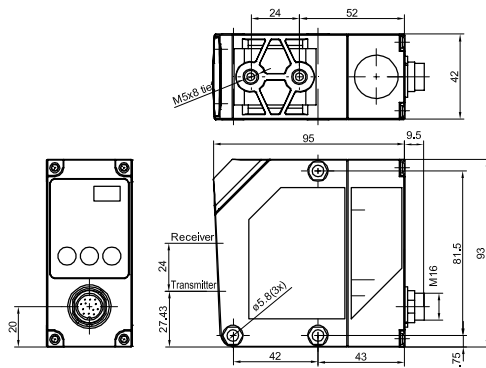
- Long range of up to 250 m on specified reflector
- High repeatability
- High measurement rates
- Ideal for precise positioning tasks
- Open interfaces ensure maximum compatibility (SSI-compatible, RS422)
- Profibus and DeviceNet via gateway
- Switchable red-light pilot laser
- 2 switching outputs

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 ¹		
Electrical data		Mechanical data	
Operating voltage, +U _B	18 ... 30V DC ²	Dimensions	93 × 93 × 42 mm
Output current, I _e	≤ 100 mA	Enclosure rating	IP 67 ³
Plausibility output, Q _p	50 mA	Material, housing	ABS, impact-resistant
Service output, Q _s	50 mA	Material, front screen	PMMA
Protective circuits	Reverse-polarity protection, U _B / 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 ₁ / Q ₂	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		

¹ At scanning distance of 10 m ² 10 % ripple, within U_B ³ With connected IP 67 plug

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

Plug connection

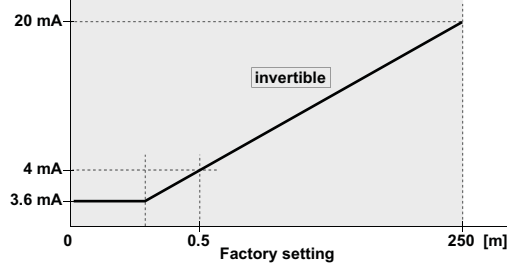


153-00457

Connection, 12-pin

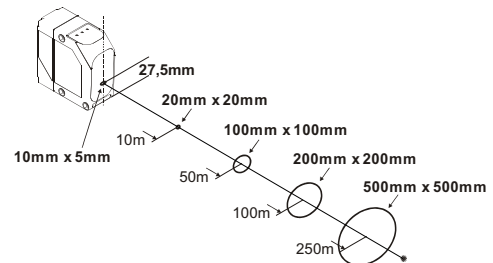
Pin	Name	Cable Type 1 (12-pin) color	Cable Type 2 (5-pin) color	Description
A	TX+	White		RS422: transmission data / SSi: Data+
B	Q1	Brown	Black	Switching output, Q1
C	RX+	Green		RS422: receiver data / SSi: clock+
D	analog	Yellow		Analogue output 4 ... 20 mA (only FT9X)
E	Qs	Grey	Orange	Service output, 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-38
Brackets	From Page A-4
AS F 90 Aligning aid	From Page A-4
MSP F 90 A Fine adjustment	From Page A-4
Converters and adapter cables	From Page A-38

FR 91 ILA

Reflector distance sensor



PRODUCT HIGHLIGHTS

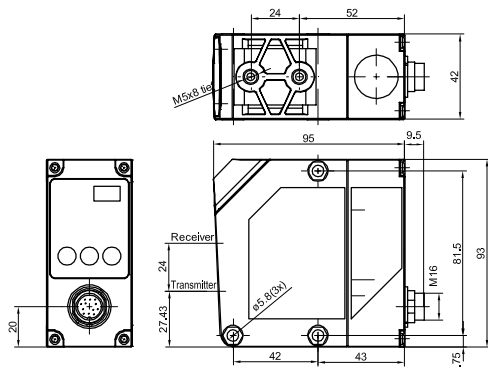
- Long range of up to 50 m on specified reflector
- High repeatability
- High measurement rates
- Very good price/performance ratio
- Open interfaces ensure maximum compatibility (SSI-compatible, RS422)
- Profibus and DeviceNet via gateway
- Switchable red-light pilot laser
- 2 switching outputs

Optical data		Functions	
Scanning distance	0.5 ... 50 m	Indicator LED, green	Operating voltage indicator
Type of light	Infrared, 905 nm (measurement laser) Laser, red, 650 nm (pilot laser)	Indicator LED, yellow	Switching output indicator
Laser Class (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 ¹		
Electrical data		Mechanical data	
Operating voltage, +U _B	18 ... 30V DC ²	Dimensions	95 × 93 × 42 mm
Output current, I _e	≤ 100 mA	Enclosure rating	IP 67 ³
Plausibility output, Q _p	50 mA	Material, housing	ABS, impact-resistant
Service output, Q _s	50 mA	Material, front screen	PMMA
Protective circuits	Reverse-polarity protection, U _B / 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 ₁ / Q ₂	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		

¹ At scanning distance of 10 m ² 10 % ripple, within U_B ³ 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

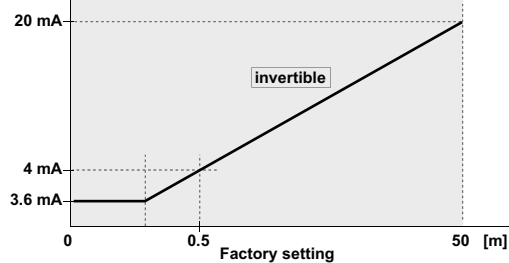


153-00457

Connection, 12-pin

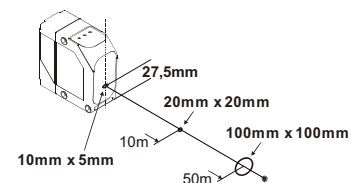
Pin	Name	Cable Type 1 (12-pin) color	Cable Type 2 (5-pin) color	Description
A	TX+	White		RS422: transmission data / SSi: Data+
B	Q1	Brown	Black	Switching output, Q1
C	RX+	Green		RS422: receiver data / SSi: clock+
D	analog	Yellow		Analogue output 4 ... 20 mA (only FT9X)
E	Qs	Grey	Orange	Service output, 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-38
Brackets	From Page A-4
AS F 90 Aligning aid	From Page A-4
MSP F 90 A Fine adjustment	From Page A-4
Converters and adapter cables	From Page A-38

FR 92 ILA

Reflector distance sensor



PRODUCT HIGHLIGHTS

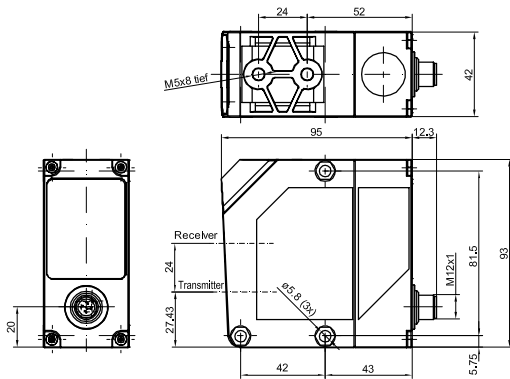
- Long scanning distance and range (scanning up to 6 m on white objects, with reflector up to 30 m)
- High repeatability
- High measurement rates
- Switchable red-light pilot laser
- Simple teach-in

Optical data		Functions	
Scanning distance	0.2 ... 30 m ¹	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 ²	Indicator LED, red	Menu Indicator
Linearity	≤ ± 60 mm ²	Scanning distance adjustment	Via Teach-in button
		Default settings	Max. scanning distance and N.O.
Electrical data		Mechanical data	
Operating voltage, +U _B	18 ... 30V DC ³	Dimensions	95 × 93 × 42 mm
No-load current, I ₀	≤ 125 mA	Enclosure rating	IP 67 ⁴
Output current, I _e	100 mA	Material, housing	ABS
Max. voltage drop at switching output	≤ 2.4V	Material, front screen	PMMA
Protective circuits	Reverse-polarity protection, U _B / 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 ₁ / Q ₂	PNP		
Output function	N.O.		
Analogue output	4 ... 20 mA		
Temperature drift analogue	3 mm / K		
Temperature drift switching output	1.5 mm / K		

¹ With RL250 reflector ² Data apply after a minimum switch-on time of 30 min ³ 10 % ripple, within U_B ⁴ With connected IP 67 plug

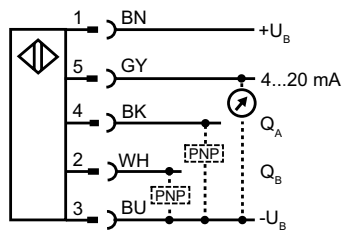
Type of connection	Part number	Article number
Plug, M12, 5-pin	FR 92 ILA-PSL5	591-91006

Plug connection



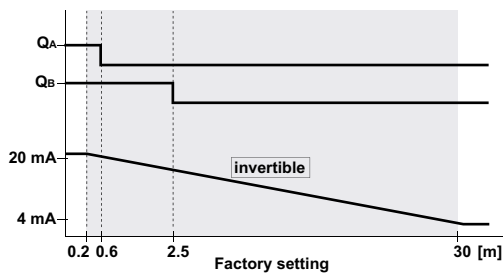
153-00346

Connection, 5-pin



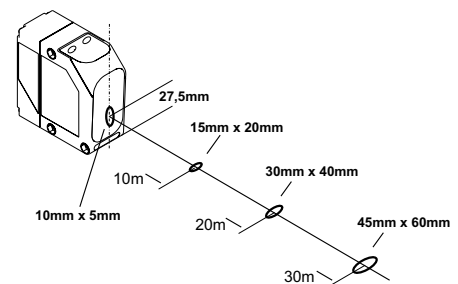
154-00125

Characteristic output and analogue curves



155-01359

Light spot geometry



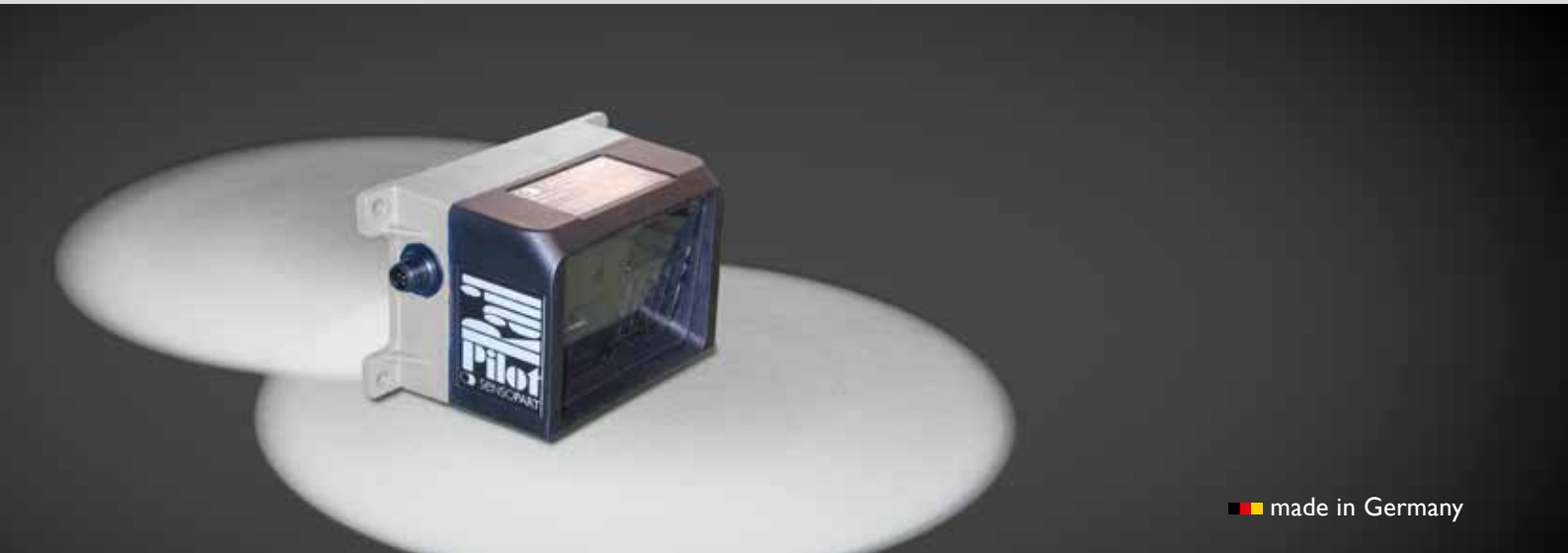
155-00210

Accessories

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

FR 85 RailPilot – optical collision protection sensors

Safe movement on monorail systems



made in Germany



Monorail system with car bodies in the automotive industry

TYPICAL FR 85 RAILPILOT

- Retro-reflective laser sensor for preventing collisions on monorail systems
- Operating range: 0 ... 6 m
- 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

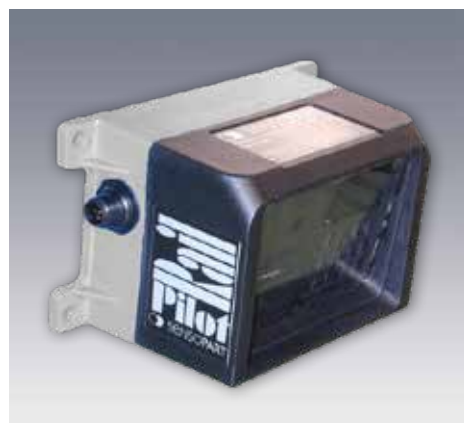
The sensor's task is to prevent collisions between vehicles on monorail systems. The Rail Pilot achieves this reliably. The distances to be maintained, and the braking distances of the monorail vehicles, depend on the load transported and on the speed – this is taken into account by means of flexibly 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 RailPilot – Product Overview			
	Operating range	Special features	Page
FR 85 RailPilot	0 ... 6 m	RS485 interface or PNP switching outputs	335

FR 85 RailPilot

Distance sensor for collision prevention



PRODUCT HIGHLIGHTS

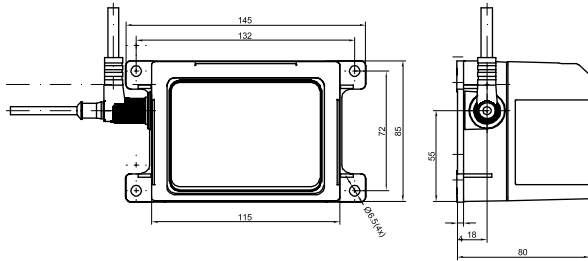
- Measurement range: 0 ... 6 m
- Wide detection cone
- 2x2 detection zones
- 1 input
- 2 PNP outputs
- RS485 interface
- Detection zone adjustable externally
- Reliable suppression of foreign objects (girders, pillars)

Optical data		Functions	
Scanning distance	0 ... 6 m ¹	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	~ 1 mm		
Repeatability	≤ 10 mm		
Linearity	± 70 mm		
Electrical data		Mechanical data	
Operating voltage, +U _B	18 ... 30V DC ²	Dimensions	145 x 85 x 80 mm
No-load current, I ₀	≤ 100 mA	Enclosure rating	IP 54 ⁴
Output current, I _e	≤ 200 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U _B / short-circuit protection (Q)	Material, front screen	PMMA
Protection Class	2	Type of connection	See selection table
Power On Delay	< 300 ms	Ambient temperature: operation	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 KΩ ³		
Control input E1 / banking	Close and remote switching -U _B (low) Q1 = switching point 1; Q2 = switching point 2 +U _B (high) Q1 = switching point 3; Q2 = switching point 4		

¹ Reference material: R10/2 reflector ² 10 % ripple, within U_B ³ Type FR85 ... S1L5 ⁴ 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

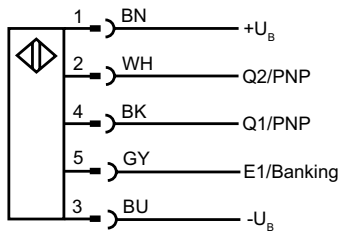
Plug connection



153-00349

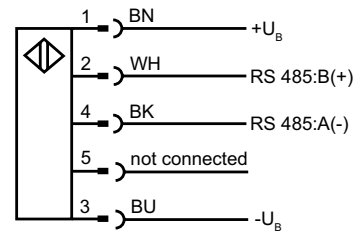
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Connection, 5-pin: FR 85-2 ILLG-POL5



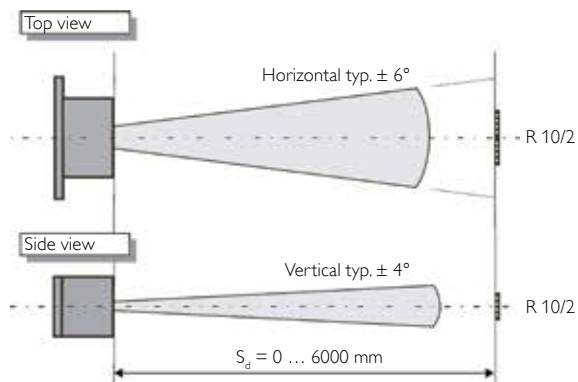
154-00325

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-38
		Setup Box FR 85-2 ILLX 533-11016	From Page A-38