

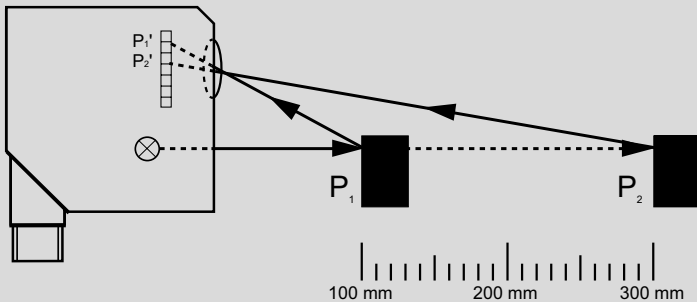
Distance sensors

System description

Distance measurement using triangulation

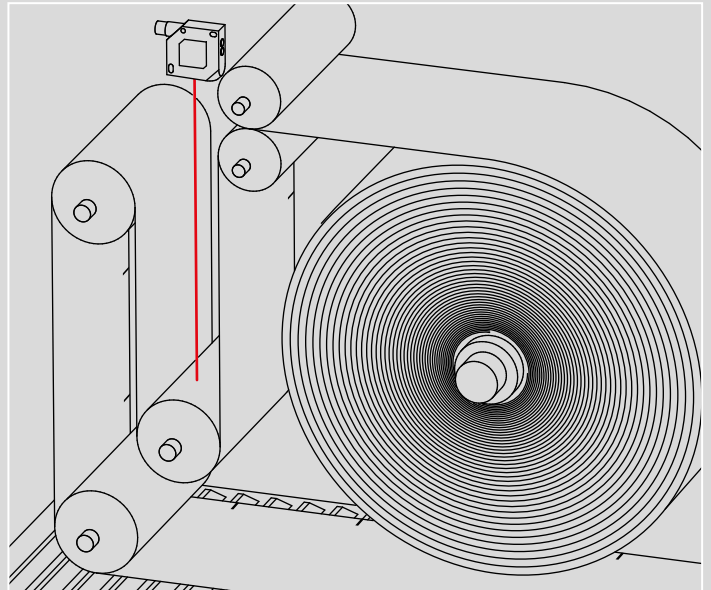
The measurement principle of optical triangulation is suitable for the precise determination of distances at close range. With the help of special receiver optics and a position-sensitive detector (e.g. a photodiode line), the sensor can determine the object distance regardless of its reflectivity (see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

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



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

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



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

Collision prevention sensors for monorails

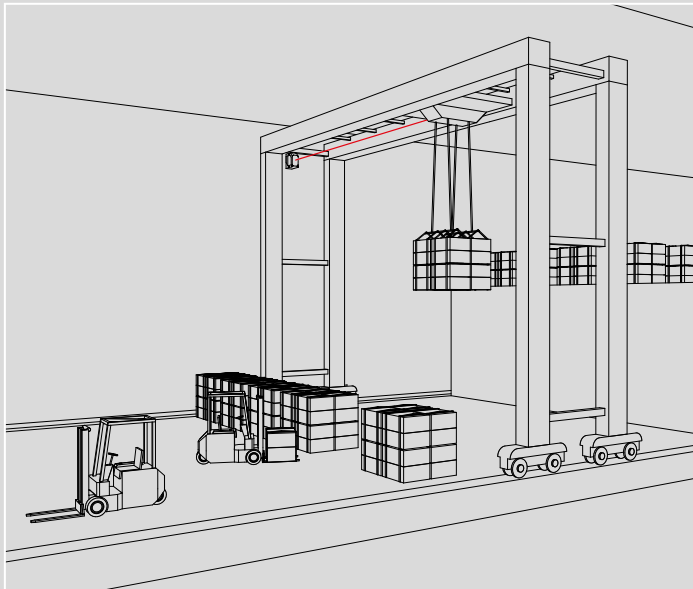
Collision prevention on monorail systems in car production is a special distance measurement task. The FR 85 series was specially developed for this application. These sensors provide excellent measurement results regardless of the reflectivity of the target object, and their comprehensive range of functions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

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

Distance measurement using time-of-flight

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

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



Crane positioning with FR 92 distance sensor

Inductive analogue sensors

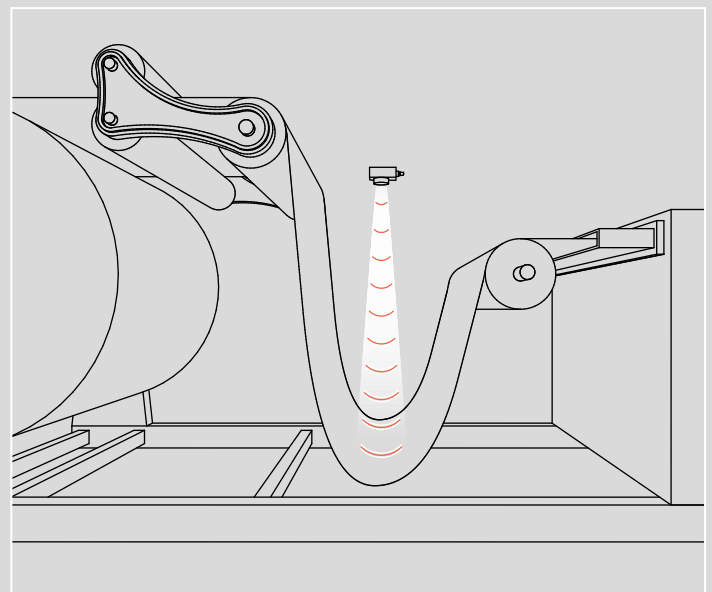
The reasonably priced solution for metallic objects. Compared to optical or ultrasonic sensors, inductive distance sensors have only limited ranges. They are still used under harsh conditions, in particular, as a result of their great robustness.

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

Ultrasonic sensors

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

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



Monitoring throughput with the UT 20 ultrasonic sensor

FT 25 – 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 ... 10V analogue output
- Easily integratable ultra-compact ABS housing: 34 x 12 x 20 mm
- High precision and high repeatability – especially for control tasks
- Resolution: from 0.12 mm
- Two adjustable switching points as window mode for 2-point control
- Teach-in operation



In a miniature housing

The FT 25-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 multicoloured and high-contrast objects, e.g. packages (laser)

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FT 25-R(L)A – Product Overview			
	Operating range	Special features	Page
FT 25-RLA	20 ... 100 mm	Laser, small housing	194
FT 25-RA	20 ... 80 mm / 30 ... 200 mm	Small housing with long range	196

FT 25-RLA

Miniature laser distance sensor



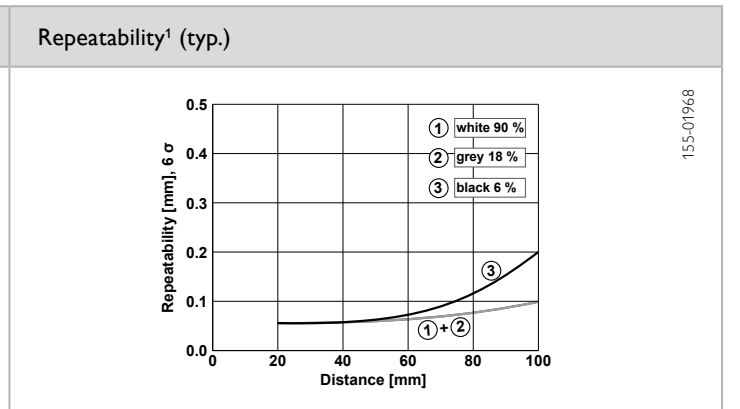
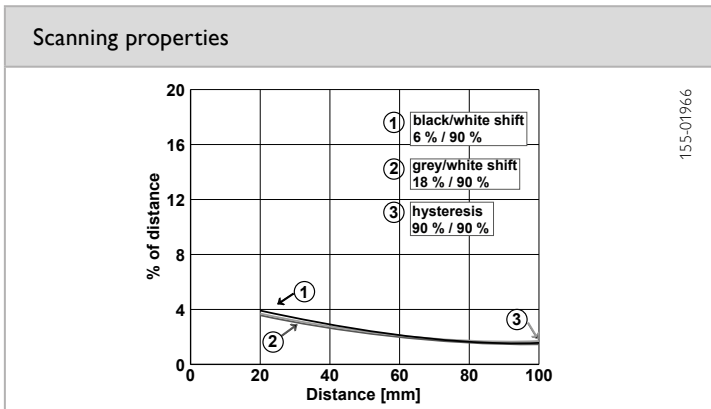
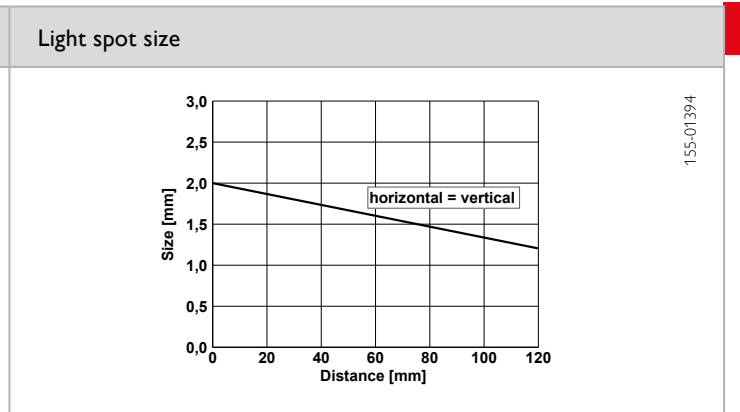
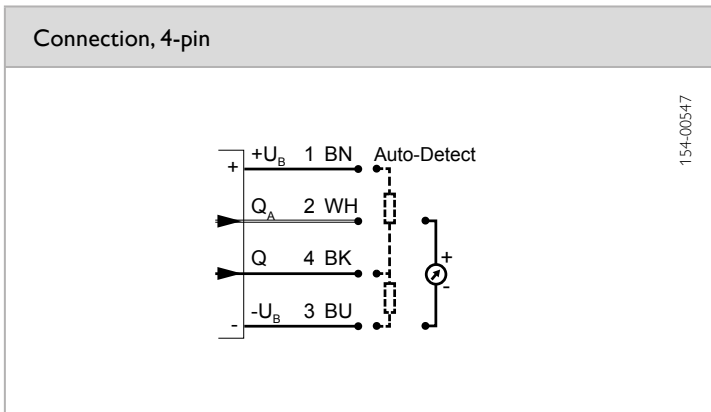
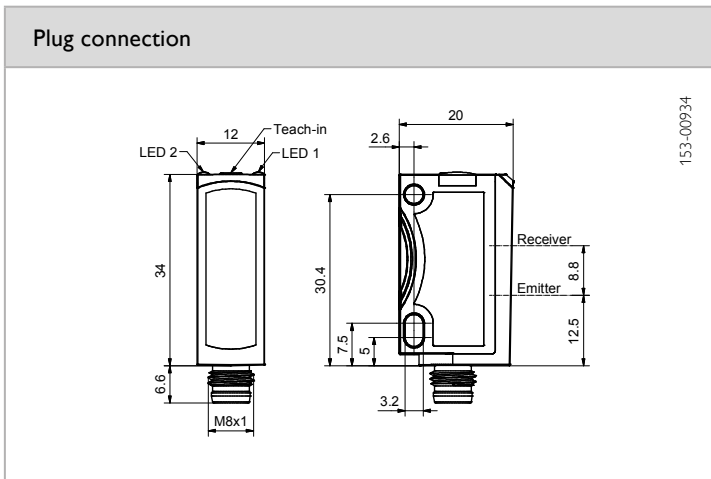
PRODUCT HIGHLIGHTS

- 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

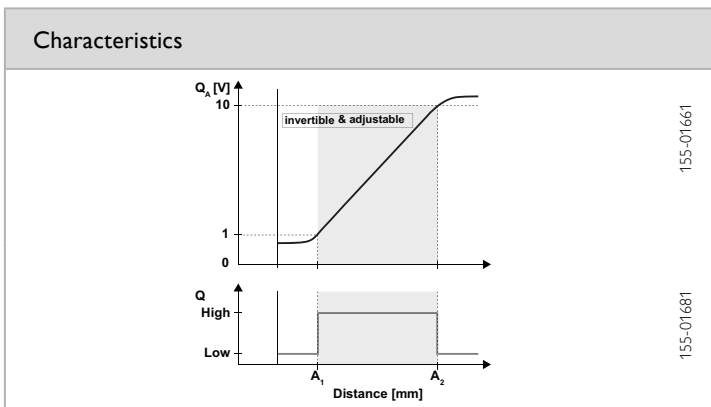
Optical data		Functions	
Measurement range	20 ... 100 mm ¹	Indicator LED, green	Operating voltage indicator
Resolution	0.12 mm (12-bit)	Indicator LED, yellow	Switching output indicator
Linearity	± 0.25 mm ²	Measurement range adjustment	Via Teach-in button
Repeatability	< 0.25 mm ^{2,3}	Adjustment possibilities	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. and Auto-Detect / NPN / PNP via teach-in button
		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 69K 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	Auto-Detect (NPN / PNP) 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		
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		

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 69K 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	FT 25-RLA-80-PNSU-M4M	604-41010



¹ At constant ambient conditions



Default settings

Analogue output Q_A (1 ... 10V)	20 ... 100 mm
Switching output Q (A1 ... A2), N.O.	20 ... 100 mm

Accessories

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

FT 25-RA

Miniature distance sensor



PRODUCT HIGHLIGHTS

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

Optical data			Functions	
Measurement range	20 ... 80 mm 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
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
			Default settings	See Table
Electrical data			Mechanical data	
Operating voltage, +U _B	13 ... 30V DC		Dimensions	34 × 20 × 12 mm
No-load current, I ₀	≤ 30 mA		Enclosure rating	IP 67 / IP 69K ⁴
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 ⁵
Switching output, Q	PNP/NPN (See Selection Table)		Ambient temperature: storage	-20 ... +80 °C
Output function	N.O./N.C.		Weight (metal plug device)	10 g
Max. capacitive load Q	10 nF		Resistance to vibrations and impacts	EN 60947-5-2
Switching frequency, f (ti/tp 1:1) Q	≤ 1000 Hz			
Response time Q	500 μs			
Analogue output Q _A	1 ... 10V / max. 3 mA			
Response time Q _A	400 μs (FT 25-RA-60)			
	3.4 ms (FT 25-RA-170)			
Warm-up time	10 min.			
Temperature drift	< 0.1 mm/K (FT 25-RA-60)			
	< 0.2 mm/K (FT 25-RA-170)			

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

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

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

Connection, 4-pin	Light spot size

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

Characteristic output and analogue curves	Default settings										
	<table border="1"> <tr> <th></th> <th>FT 25-RA-60</th> <th>FT 25-RA-170</th> </tr> <tr> <td>Analogue output Q_A (1 ... 10V)</td> <td>20 ... 80 mm</td> <td>30 ... 200 mm</td> </tr> <tr> <td>Switching output Q (A1 ... A2), N.O.</td> <td>20 ... 80 mm</td> <td>30 ... 200 mm</td> </tr> </table>		FT 25-RA-60	FT 25-RA-170	Analogue output Q_A (1 ... 10V)	20 ... 80 mm	30 ... 200 mm	Switching output Q (A1 ... A2), N.O.	20 ... 80 mm	30 ... 200 mm	
	FT 25-RA-60	FT 25-RA-170									
Analogue output Q_A (1 ... 10V)	20 ... 80 mm	30 ... 200 mm									
Switching output Q (A1 ... A2), N.O.	20 ... 80 mm	30 ... 200 mm									
Accessories											
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