

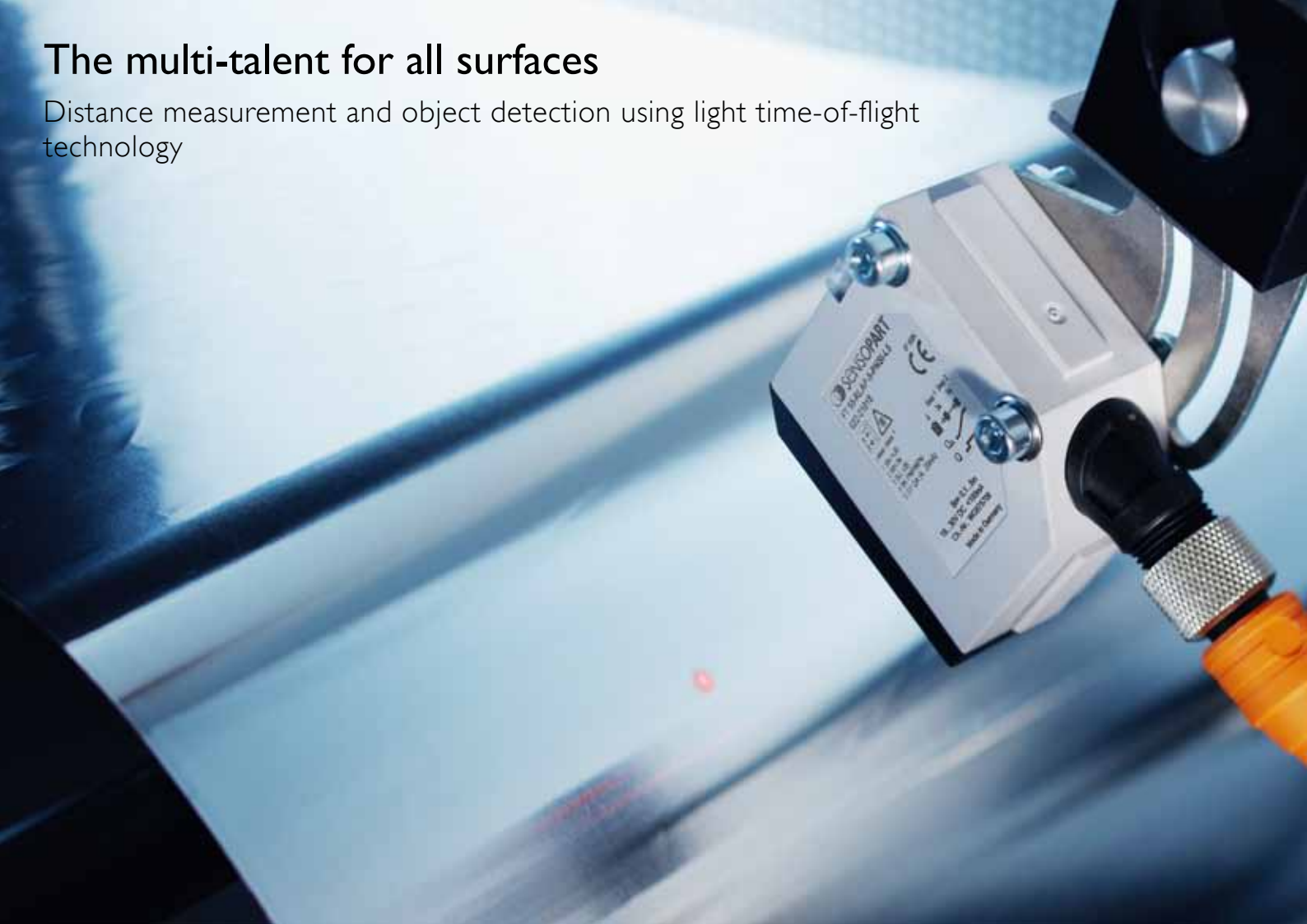
A finger on the pulse of time

F 55 – long-range compact time-of-flight sensors



The multi-talent for all surfaces

Distance measurement and object detection using light time-of-flight technology



Precise measurement and reliable detection of any objects at longer distances, with ambient light or against highly reflective backgrounds – these are typical requirements in factory automation. Conventional proximity sensors rapidly come up against their limits under these conditions, particularly when distances of well over a metre are involved.

Light time-of-flight measurement is the solution for such demanding automation tasks. SensoPart was one of the pioneers of this sensor principle, now improved in sensors of the FT55 series. In a very compact housing (50 x 50 x 23 mm³) these light time-of-flight sensors offer excellent performance data that has previously only been available in considerably larger sizes: long ranges and scanning distances of up to 5 m on light objects or 3 m on very dark objects, measurement accuracy in the millimetre range, and cycle frequencies of up to 500 Hz for rapid processes.

High switching reliability under all light conditions

At the same time, the light time-of-flight measurement principle offers perfect background suppression. Any materials and surfaces, from deepest black to highly reflective can thus be reliably detected with light time-of-flight sensors, even with interfering backgrounds such as reflector jackets, signalling lamps, reflective metal beams or shiny wet floors.

Users stay on the safe side with the compact light time-of-flight sensors of the FT 55 series. Whether for inspecting the diameter of coils, positioning robot arms, checking the occupancy of shelves in high-bay warehouses, positioning logs, or measuring stack heights and filling levels – the sensors' reliable and repeatable results never fail to impress.

Time-of-flight sensors – offering universal use in numerous sectors and applications

For the most varied of materials and surfaces:

- Metal (reflective, structured)
- Plastics and rubber (black, coloured)
- Wood (rough sawn, grainy)
- Liquids (non-transparent)



Typical applications:

- Checking the presence of parts and assemblies
- Positioning robots in car production
- Checking the diameter of coils
- Measuring stack heights and the filling levels of non-transparent media
- Positioning tasks in palletising plants
- Collision prevention and monitoring the surroundings on AGVs



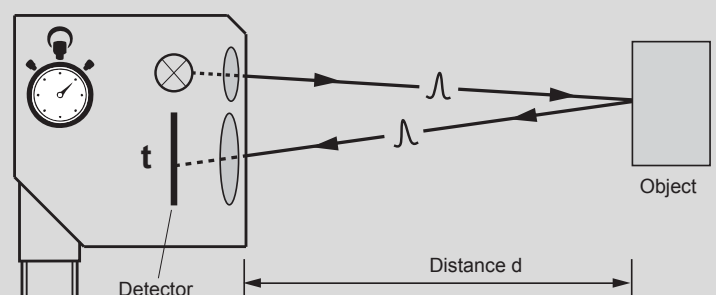
In front of problematic backgrounds:

- Ambient light (signalling lamps)
- Reflective objects (shelving beams, wet floors)
- Reflections (hi-vis clothing)



Time-of-flight principle:

SensoPart uses the measurement principle of time-of-flight technology for determining longer distances. Whereby a pulsed laser beam is emitted by the sensor and reflected by the target object. The distance to the object is measured using the time difference between emission of the light and reception of the reflection. This detection principle offers reliable background suppression and very high immunity to ambient light.



FT 55 – Time-of-flight sensors with ranges of up to 5 metres

Compact sensors for precise measurement tasks and reliable object detection



 made in Germany



Reliable object detection:

Even objects with highly reflective metal surfaces and at critical measurement angles are reliably detected.



Precise fine adjustment:

The clever mounting and adjustment concept has been specially developed for FT 55 distance sensors. Small changes in angle allow precise alignment of the light spot, even at long distances.

TYPICAL FT 55

- Long ranges and scanning distances (up to 5 m on light objects and 3 m on dark ones) in compact easy-to-install housings (50 x 50 x 23 mm³)
- Reliable object detection against any backgrounds thanks to light time-of-flight process
- High switching frequency (500/250 Hz) for rapid processes
- High repeatability in the mm range
- Laser Class 1, no danger to the human eye
- Glass-fibre-reinforced, high-density plastic housings (IP67/IP69K)
- Simple mounting and operation (dovetail, teach-in)







Measuring or switching – the right variant for every application

Measuring distances: laser distance sensors with analogue output

The distance sensors of type FT 55-RLAP, operating on the principle of light time-of-flight, measure distances of up to 5 m with great precision. They provide a signal that is proportional to the distance via the integrated analogue output (4...20 mA/0...10 V, invertible characteristics) and also have a switching output with switching window function that is adjustable independently of the analogue measurement range. The measuring distance sensor with analogue output is used, for example, for inspecting the diameter of coils, positioning robots or measuring filling levels and stack heights.

Object detection: laser proximity sensor with background suppression

The proximity sensor variants of type FT 55-RLHP2 are available with one or two digital switching outputs and offer reliable object detection at long distances (up to 5 m on white objects and 3 m on black objects). Dependable detection of the target object is also guaranteed in front of interfering backgrounds regardless of the colour, shape, structure and alignment of the object. The light time-of-flight scanners are used, for example, for inspecting the mounting of rubber and plastic components during car production, for checking the occupancy of shelves in high-bay warehouses, or for inspecting the position of logs.

FT 55 – Product Overview						
	Type of light	Adjustment	Scanning distance/range ¹	Special features	Page	
Laser distance sensor (scanner)						
FT 55-RLAP	Laser 	Teach-in 	0.1 ... 5 m	<ul style="list-style-type: none"> • Measurement over long distances • 4...20 mA or 0...10 V analogue output • Separate switching output with window function • Simple operation • Laser Class 1 	6	
Photoelectric proximity sensors with background suppression						
FT 55-RLHP2	Laser 	Teach-in 	0 ... 5 m	<ul style="list-style-type: none"> • Precise object detection over long distances • 1 or 2 switching outputs • Laser Class 1 	8	
FT 55-RLH	Laser 	Potentiometer	0.05 ... 0.8 m	<ul style="list-style-type: none"> • Precise background suppression and small-part detection • Laser Class 1 	10	
FT 55-RL2H	Laser 	Potentiometer	0.05 ... 1 m	<ul style="list-style-type: none"> • Precise background suppression and small-part detection • Laser Class 2 	12	

¹ Reference material white, 90% reflectivity

FT 55-RLAP

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



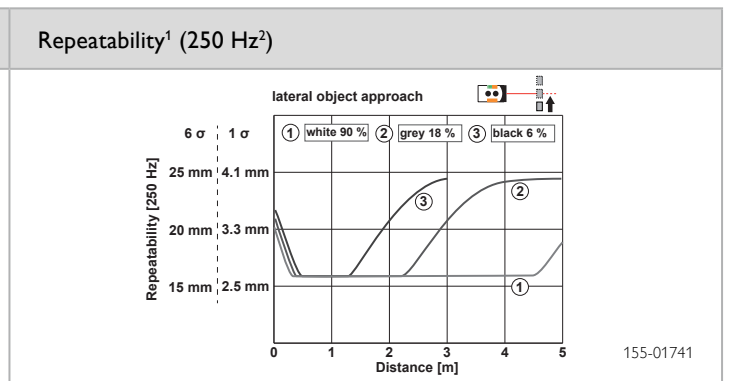
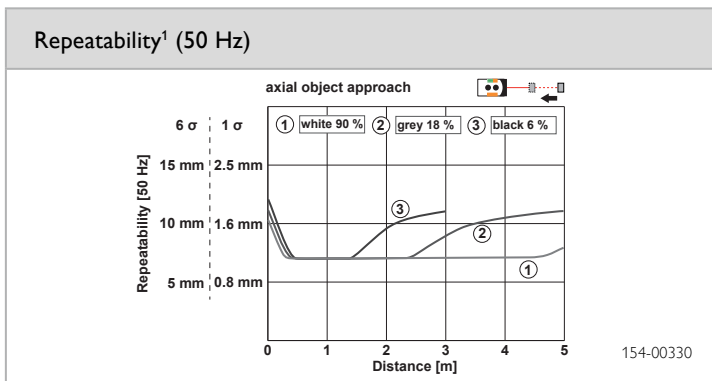
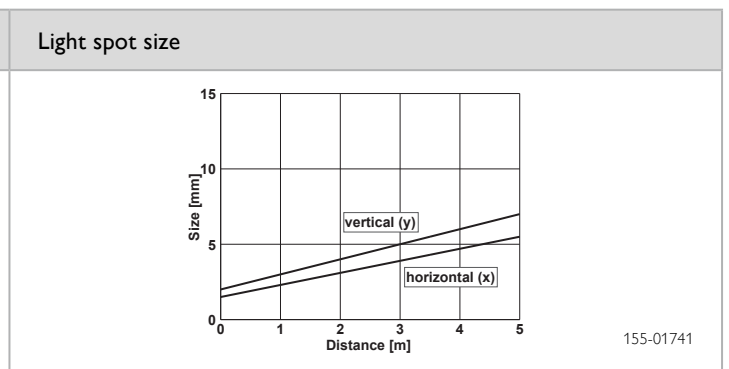
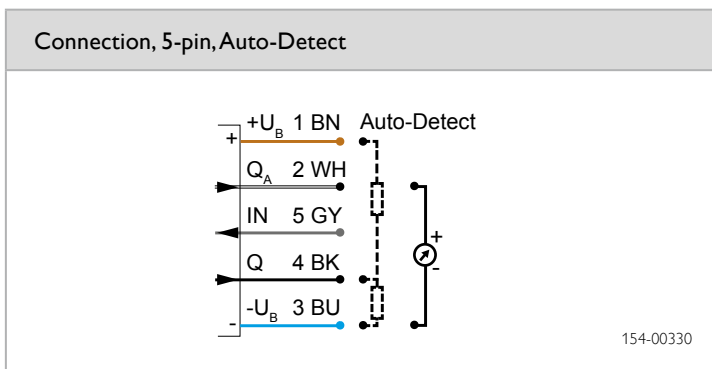
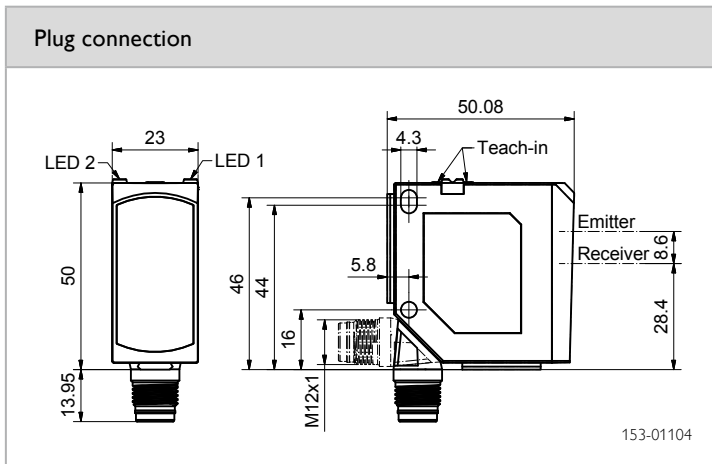
PRODUCT HIGHLIGHTS

- 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	$\pm 30 \text{ mm}^{1,2}$	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	40 mm	Adjustment possibilities	Analogue measurement range Q_A
Type of light	Laser, red 655 nm		Invertible analogue characteristic
Laser class (DIN EN 60825-1:2008-5)	1		Switching output Q (window mode)
			N.O. / N.C. and Auto-Detect / NPN / PNP via teach-in and control line
			Button lock via control input
		Default settings	See Selection Table
Electrical data			
Operating voltage $+U_B$	18 ... 30V DC	Response time Q	2 ms
No-load current I	$\leq 60 \text{ mA}$	Load	$\leq 500 \text{ Ohm}$ (4 ... 20 mA) $\geq 4 \text{ k Ohm}$ (0 ... 10 V)
Output current I_e Q	100 mA	Analogue output Q_A	4 ... 20 mA / 0 ... 10 V
Protection circuits	Reverse polarity protection U_B / short-circuit protection (Q)	Update rate Q_A	2 ms
Protection class	2	Temperature drift	< 0.1 %/K
Power On Delay	< 5 s	Warm-up time	20 min.
Switching output Q	Auto-Detect / PNP / NPN	Control input IN	$+U_B$ = Teach-in $-U_B$ = Button locked Open = normal operation
Output function	N.O. / N.C.		
Switching frequency f (ti/tp 1:1) Q	$\leq 250 \text{ Hz}$		
Mechanical data			
Dimensions	50 x 50,08 x 23 mm ³	Ambient temperature: operation	-40 ... +60 °C ⁵
Enclosure rating	IP 67 & IP 69K ⁴	Ambient temperature: storage	-40 ... +80 °C
Material, housing	ABS	Weight (plug device)	125 g
Material, front screen	PMMA	Resistance to vibration and impacts	EN 60947-5-2
Type of connection	See Selection Table		

¹ Reference material 90 % reflectivity ² At 50 Hz ³ For 1 σ , see diagram for further values ⁴ With connected IP 67 / IP 69K plug ⁵ Up to +50 °C with current output 4 ... 20 mA

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	FT 55-RLAP-5-PNSI-L5	622-21018
0.1 ... 5 m	0 ... 10V	Auto-Detect	Plug, M12x1, 5-pin	FT 55-RLAP-5-PNSU-L5	622-21021



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

Characteristic analogue curve	Reference material	Measurement range
<p>21.1 mA / 11 V 20 mA / 10 V</p> <p>4 mA / 0.09 V 3.6 mA / 0.06 V</p> <p>Q_A</p> <p>Q High Low</p> <p>A₁ A₂</p> <p>Distance [mm]</p>	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 (A1...A2), N.O., Auto-Detect	0.3 ... 3 m 0.3 ... 3 m
	Accessories	
	Connection cables Brackets	From page 14

155-01742

155-01681

³The specified precision is achieved by teaching the distances

FT 55-RLHP2

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



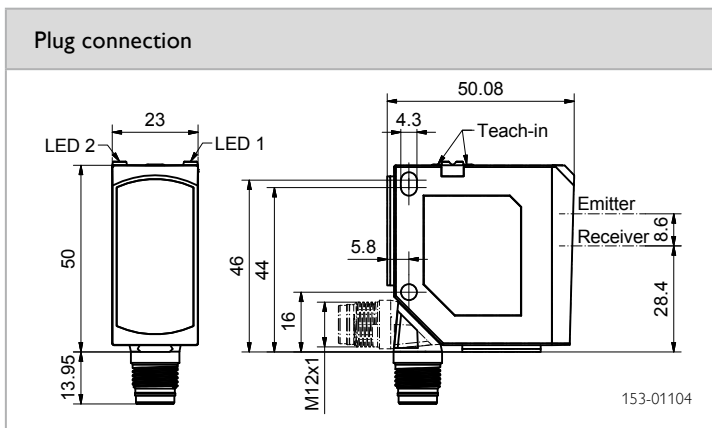
PRODUCT HIGHLIGHTS

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

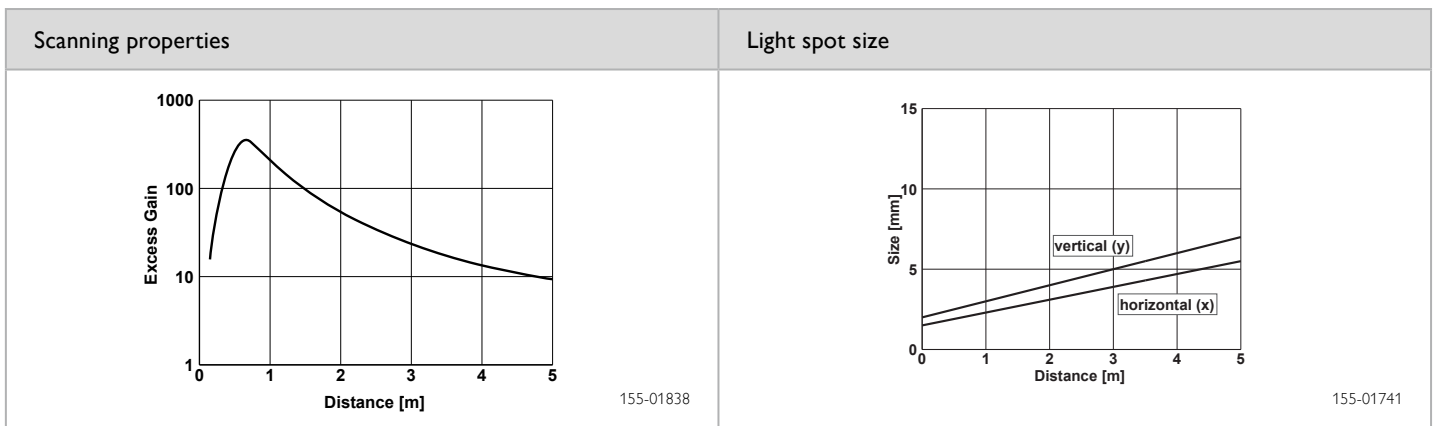
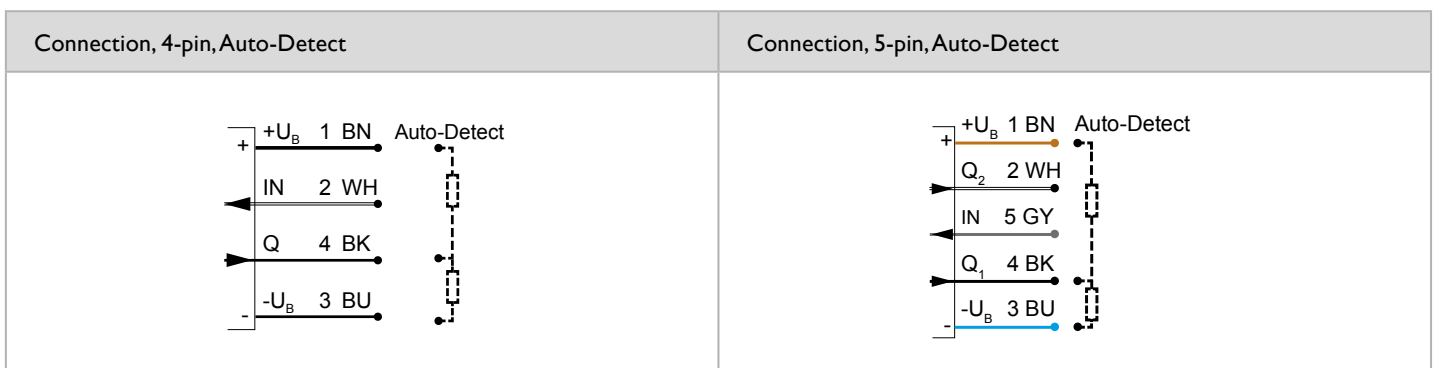
Optical data		Functions	
Scanning distance	0 ... 5 m (see Selection Table) ¹	Indicator LED 2 green	Operating voltage indicator
Hysteresis	40 mm	Indicator LED 2 yellow ²	Switching output indicator Q2
Black/white shift (6%/90%)	≤ ± 40 mm	Indicator LED 1 yellow	Switching output indicator Q resp. Q1
Grey value shift (18%/90%)	≤ ± 40 mm	Scanning distance adjustment	Via Teach-in Button and control input
Type of light	Laser; red 655 nm	Adjustment possibilities	N.O. / N.C. via Teach-in Button and control input
Laser class (DIN EN 60825-1:2008-5)	1	Default settings	Key lock via control input
			3 m, N.O.
Electrical data		Mechanical data	
Operating voltage +U _b	18 ... 30V DC	Dimensions	50 x 50,08 x 23 mm ³
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
Switching output Q	1 x PNP/NPN/Auto-Detect 2 x PNP/NPN/Auto-Detect	Ambient temperature: storage	-40 ... +80 °C
Output function	N.O. / N.C.	Weight (plug device)	125 g
Switching frequency f (ti/tp 1:1) Q	≤ 500 Hz	Resistance to vibration and impacts	EN 60947-5-2
Response time Q	1 ms		
Temperature drift	< 0.1 %/K		
Warm-up time	20 min.		
Control input IN	+U _b = Teach-in -U _b = Button locked Open = normal operation		

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

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



¹ FT 55-RLHP2-PNS-L4 with a teach-in button



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

Accessories	
Connection cables	From page 14
Brackets	

FT 55-RLH

Laser photoelectric proximity sensor with background suppression



PRODUCT HIGHLIGHTS

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

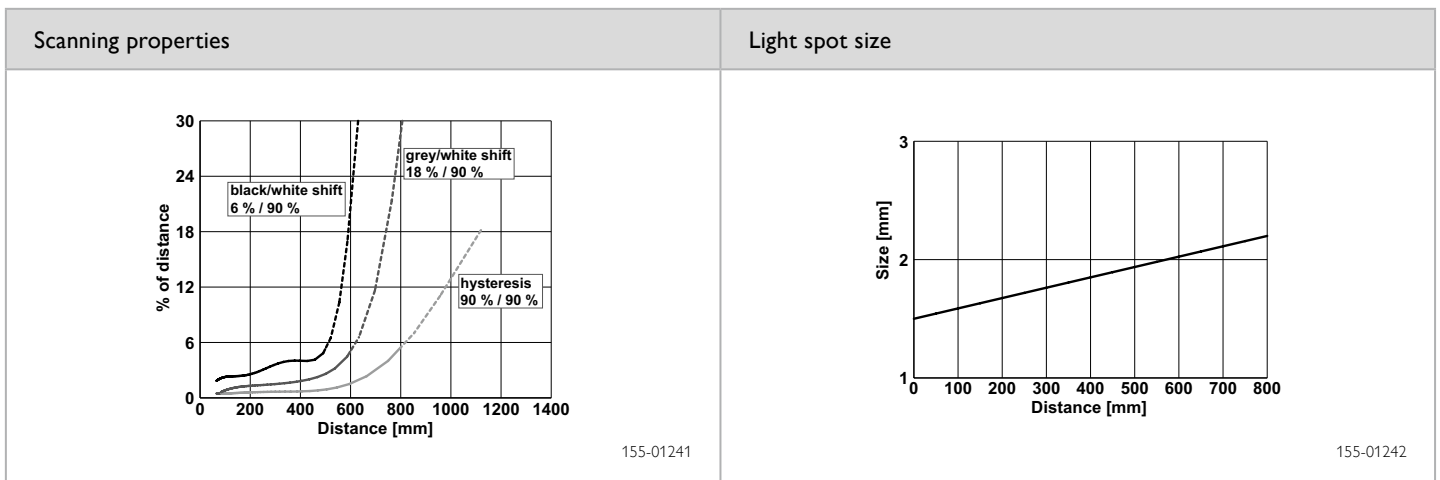
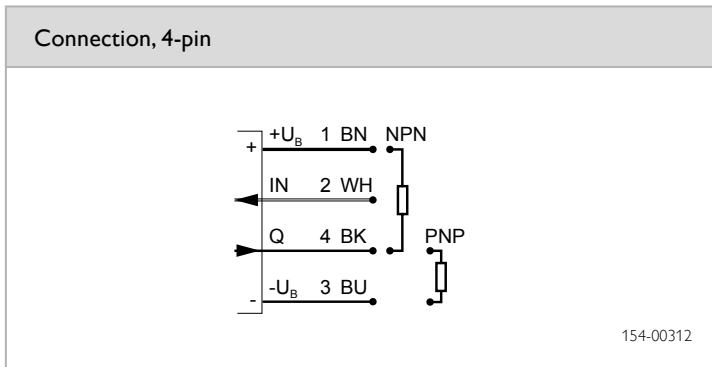
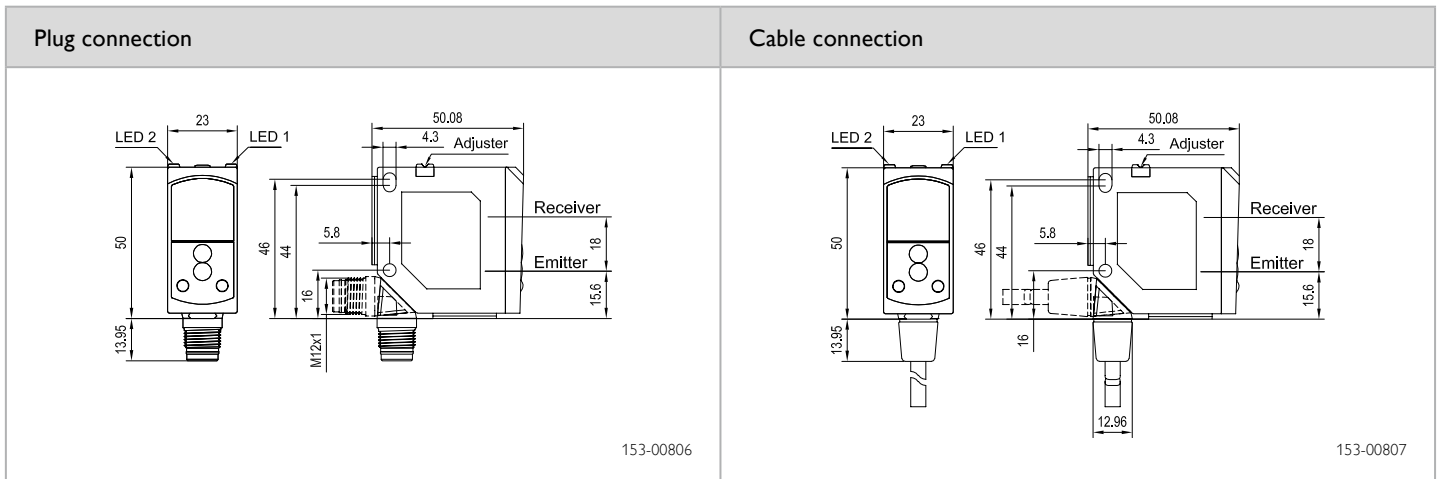
Optical data		Functions	
Scanning distance	5 ... 800 mm ¹	Indicator LED, green	Operating voltage indicator
Type of light	Laser, red, 655 nm	Indicator LED, yellow	Switching output indicator / contamination indicator
Light spot size	See diagram	Scanning distance adjustment	Via potentiometer
Laser Class (DIN EN 60825-1: 2008-05)	1	Adjustment possibilities	N.O./N.C. via control input
		Default settings	Max. scanning distance (6 %)
Electrical data		Mechanical data	
Operating voltage, +U _B	12 ... 30V DC ²	Dimensions	50 × 50.08 × 23 mm ³
No-load current, I ₀	≤ 30 mA	Enclosure rating	IP 69K & IP 67 ³
Output current, I _e	≤ 100 mA	Material, housing	PC-ABS
Protective circuits	Reverse-polarity protection, U _B / short-circuit protection (Q)	Material, front screen	PMMA
Protection Class	2	Type of connection	See Selection Table
Power On Delay	< 300 ms	Ambient temperature: operation	-20 ... +60 °C
Switching output, Q	PNP/NPN (see Selection Table)	Ambient temperature: storage	-20 ... +80 °C
Output function	N.O./N.C.	Weight (plug device)	35 g
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Weight (cable device)	125 g
Response time	500 μs	Vibration and impact resistance	EN 60947-5-2
Control input, IN	+U _B = N.C. -U _B / Open = N.O.		

¹ Reference material: white, 90 % reflectivity

² Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz

³ With connected IP 67 / IP 69K plug

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



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

Accessories	
Connection cables	From page 14
Brackets	

FT 55-RL2H

Laser photoelectric proximity sensor with background suppression



PRODUCT HIGHLIGHTS

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

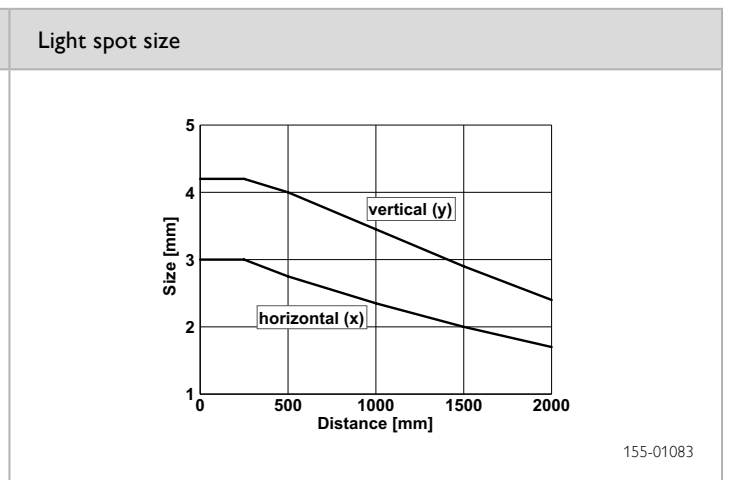
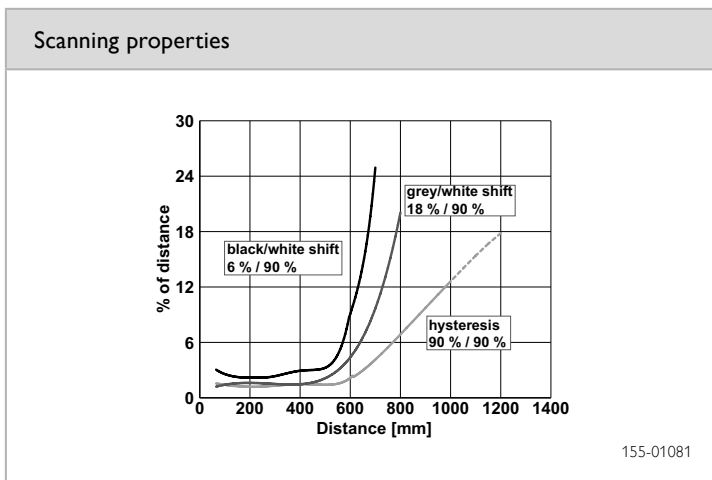
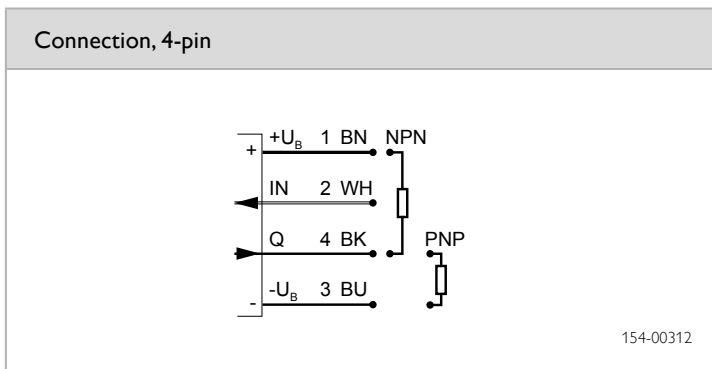
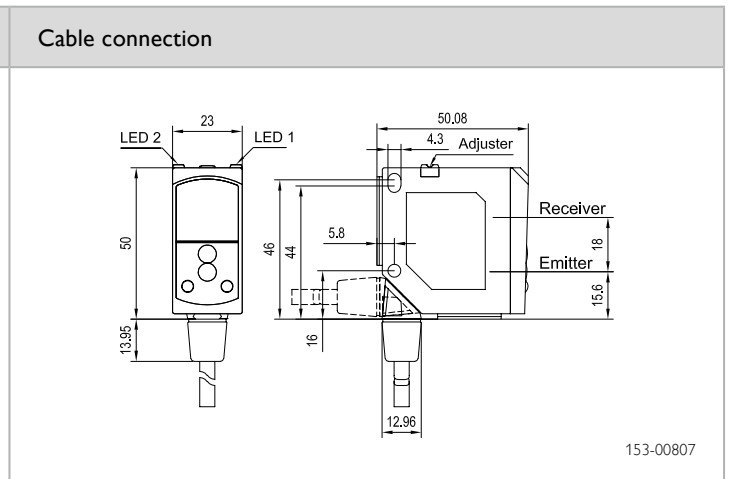
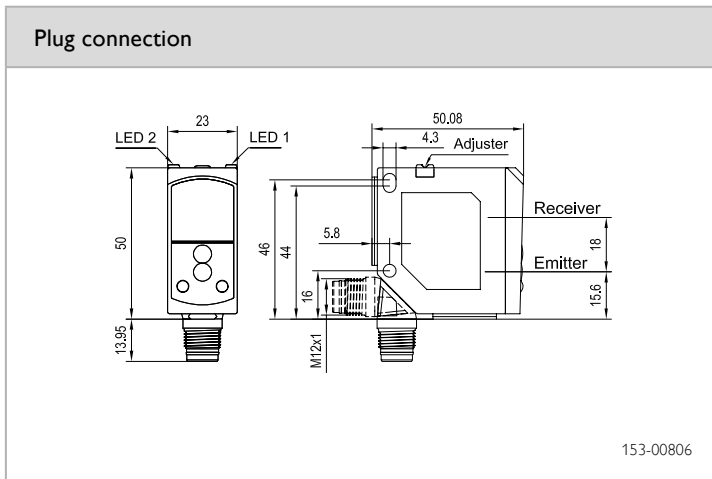
Optical data		Functions	
Scanning distance	5 ... 1000 mm ¹	Indicator LED, green	Operating voltage indicator
Type of light	Laser, red, 655 nm	Indicator LED, yellow	Switching output indicator / contamination indicator
Light spot size	See diagram	Scanning distance adjustment	Via potentiometer
Laser Class (DIN EN 60825-1:2008-5)	2	Adjustment possibilities	N.O./N.C. via control input
		Default settings	$S_n = 500 \text{ mm (6 \%)}$
Electrical data		Mechanical data	
Operating voltage, +U _b	12 ... 30V DC ²	Dimensions	50 × 50.08 × 23 mm ³
No-load current, I ₀	≤ 30 mA	Enclosure rating	IP 69K & IP 67 ³
Output current, I _e	≤ 100 mA	Material, housing	PC-ABS
Protective circuits	Reverse-polarity protection, U _b / short-circuit protection (Q)	Material, front screen	PMMA
Protection Class	2	Type of connection	See Selection Table
Power On Delay	< 300 ms	Ambient temperature: operation	-20 ... +60 °C
Switching output, Q	PNP/NPN (see Selection Table)	Ambient temperature: storage	-20 ... +80 °C
Output function	N.O./N.C.	Weight (plug device)	35 g
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Weight (cable device)	125 g
Response time	500 μs	Vibration and impact resistance	EN 60947-5-2
Control input, IN	+U _b = N.C. -U _b / Open = N.O.		

¹ Reference material: white, 90 % reflectivity

² Max. 10 % ripple, within U_b, ~ 50 Hz / 100 Hz

³ With connected IP 67 / IP 69K plug

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



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

Accessories

Connection cables	From page 14
Brackets	

Cables

Part number	Article number	Description
M12, 4-pin		
L4-2m-G-PUR	902-50805	2 m, straight, PUR
L4-5m-G-PUR	902-51612	5 m, straight, PUR
L4-10m-G-PUR	902-51628	10 m, straight, PUR
L4-2m-W-PUR	902-50807	2 m, 90°, PUR
L4-5m-W-PUR	902-51602	5 m, 90°, PUR
L4-2m-W-PL-PUR	902-50808	2 m, 90°, PUR, with indicator LED
L4-5m-W-PL-PUR	902-51603	5 m, 90°, PUR, with indicator LED
L4-10m-W-PL-PUR	902-51604	10 m, 90°, PUR, with indicator LED
L4S-2m-G-PVC	902-51632	2 m, straight, PVC, shielded
L4S-5m-G-PVC	902-51634	5 m, straight, PVC, shielded
L4S-2m-W-PVC	902-51633	2 m, 90°, PVC, shielded
L4S-5m-W-PVC	902-51635	5 m, 90°, PVC, shielded
CL4 FG-E-5m-PVC	902-50219	5 m, straight, PVC, with hex nut SW 14 stainless steel
CL4 FW-E-5m-PVC	902-50220	5 m, 90°, PVC, with hex nut SW 14 stainless steel
L4 KDG	022-50812	Coupling socket, straight
L4 KDW	022-50813	Coupling socket, 90°
LS4-60-G-K	022-10773	Plug connection
L4F/L4M-0,48 PUR	902-51670	Extension cable, M12 (90°) to M12 (straight), 0.48 m, PUR
M12, 5-pin		
L5-2m-G-PUR	902-51652	2 m, straight, PUR
L5-5m-G-PUR	902-51624	5 m, straight, PUR
L5-10m-G-PUR	902-51609	10 m, straight, PUR
L5-2m-W-PUR	902-51613	2 m, 90°, PUR
L5-5m-W-PUR	902-51641	5 m, 90°, PUR

We look ahead

Yesterday, today and in the future



“We gauge ourselves not by what is possible today, but by our vision of what can be achieved” – this has been our motto since the foundation of Sensopart in 1994. Our goal is to always be a step ahead and to be able to offer our customers the most innovative sensor for industrial automation.

With our easy to integrate VISOR® Vision sensors and our compact laser sensors with an amazing background suppression made in Germany, we stick up to this motto.

Get ready – we still have a lot of ideas for the future.

SENSOR TECHNOLOGY

- Light barriers
- Proximity switches
- Laser sensors
- Miniature sensors
- Distance sensors
- Colour sensors
- Contrast sensors
- Anti-collision sensors
- Slot sensors
- Fibre-optic amplifiers
- Inductive sensors
- Capacitive sensors
- Ultrasonic sensors

VISION

- Vision sensors
- Smart cameras
- Vision systems
- Object detection
- Object measurement
- Colour detection
- Code reading
- Lighting
- Lenses

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