SENSOPART

The Complete Catalogue

VISOR® and sensors for factory automation



VISOR® and sensors

Practical and effective automation solutions

>> To the digital catalogue
You can very easily call up this catalogue with your smart phone – using the code opposite.



SensoPart sets new standards for industrial sensors with the optoelectronic sensors of the **F 10, F 25** *and* **F 55** *series: all three housing sizes share excellent optical performance data, very precisely adjustable background suppression, intuitive and comfortable operation, and excellent quality – made in Germany. And our application-specific pre-configured – and thus immediately usable – all-in-one solutions in the* **VISOR®** *series show what is now possible in the vision segment.*

Contents

SENSOPART

1. Product News, Product Overviews Page 4 1

2. SensoPart: innovative, flexible and practical Page 12 2

3. Overview: sectors and applications Page 32 3

4. VISOR® vision sensors and the Eyesight vision systems Page 48 4

5. VISOR® Code Readers Page 118 5

6. Distance sensors Page 142 6

7. Colour, contrast and luminescence sensors Page 184 7

8. Photoelectric sensors and proximity sensors Page 218 8

9. Fibre-optic sensors and fibre-optic cables Page 430 9

10. Fork sensors and optical windows Page 530 10

11. Ultrasonic sensors Page 544 11

12. Inductive sensors Page 594 12

13. Capacitive sensors Page 648 13

14. SmartPlug Page 664 14

A. Accessories Page A-2 A

B. Glossary Page B-2 B

C. Index Page C-2 C

D. Type Key, Contact, General terms of trade Page D-2 D

Product news

VISOR® object sensor V20 Advanced

from Page 64

Vision sensors for object detection and classification

- *Highly accurate evaluation via 1.3 megapixel chip*
- *255 inspection tasks available, 255 evaluations can be used for each inspection task*



VISOR® Color

from Page 80

Improved object detection through additional colour information

- *Highly accurate evaluation via 1.3 megapixel colour chip*
- *Powerful colour detection, even with the smallest of colour nuances or self-illuminating components*
- *255 inspection tasks available, 255 evaluations can be used for each inspection task*



Eyesight vision system V20 Advanced

from Page 108

Complete image-processing package with robust and flexible smart camera

- *Highly accurate evaluation via 1.3 megapixel (colour) chip*
- *No limitation of inspection tasks (40 MB)*



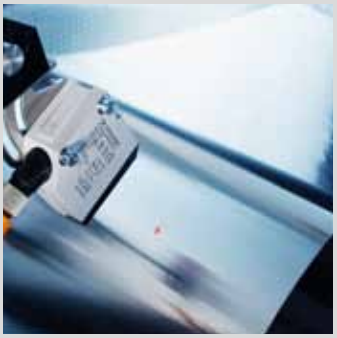
F 10 – sub-miniature sensors as LED variant

from Page 226

For installation in the smallest of spaces and in moving machine parts

- *High performance – small dimensions*
- *Special variant for detection of dark blue objects*

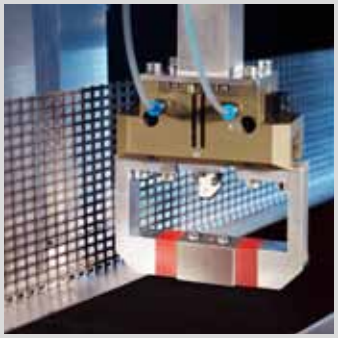




Determing coil thickness – FT 55 Time-of-flight sensors



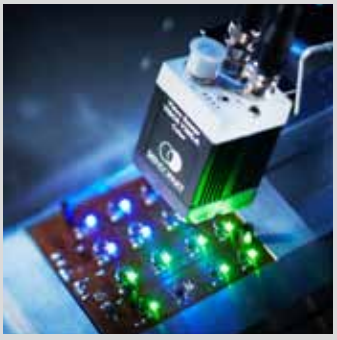
Correctly positioned? – VISOR® vision sensors



Fits into a robot arm – F 10 sub-miniature sensors



Reliable colour detection in a miniature housing– FT 25-C



All LEDs in the right place? – VISOR® Color



Dancer roll regulation – FT 25-RA

FT 25-RA – sub-mininiature distance sensor

from Page 148

For control tasks such as dancer roll regulation on automatic winding machines thanks to high repeatability

- *Operating range (scanning distance) from 20 mm to 200 mm*
- *Simple integration thanks to small housings*
- *Analogue output 0 … 10 V*



FT 25 C – miniature RGB colour sensor

from Page 190

Smallest RGB colour sensor with a high switching frequency of ≤10 kHz for rapid applications

- *Reliable detection of "non-colours", e. g. black, white and grey*
- *Very small and precise light spot for the detection of the smallest of marks*

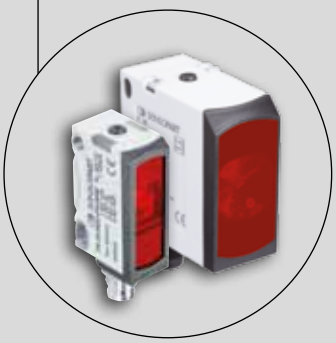


FR 25/55-RLO – autocollimation photoelectric sensors

from Page 266/300

The specialists for small-part and front-edge detection

- *Detection possible from range zero*
- *High switching accuracy and positioning accuracy on lateral object approach*



F 55 – time-of-flight sensors

from Page 166

Compact sensors for distance measurement and object detection

- *For measurement, regulatory and detection tasks on all object surfaces at large distances*
- *Reliable object detection even with bright, highly reflective or shiny backgrounds*

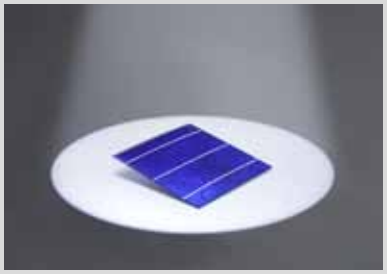


made in Germany

Product news		
	Special features	Page
VISOR® Object sensor V20 Advanced	Vision sensor for object detection and classification with 1.3 mega pixel resolution	64
VISOR® Color	Improved object detection through additional colour information	80
Eyesight Vision-System V20 Advanced	Complete image-processing package with robust and flexible Smart Camera	108
F 10 – sub-mininiature distance sensors with LED	For installation in the smallest of places and in moving machine parts	226
FT 25-RA – miniature distance sensor	For control tasks such as dancer roll regulation on automatic winding machines thanks to high repeatability	148
FT 25 C – miniature RGB colour sensor	Smallest RGB colour sensor with a high switching frequency of ≤10 kHz for rapid applications	190
FR 25/55-RLO – autocollimation photoelectric sensors	The specialists for small-part and front-edge detection	266/300
F 55 – time-of-flight sensors	Compact sensors for distance measurement and object detection at long distances	166

Product overview – vision sensors and systems



Features/sensors	VISOR® Object Sensor		VISOR® Color		VISOR® Solar Sensor	
	V10 Standard	V10/V20 Advanced	V10C Standard	V10C/V20C Advanced	V10 Standard	V10 Advanced
Highlights	Object detection and classification		Improved object detection through additional colour information		Positioning and inspecting solar cells	
			Colour area	Colour area	Wafer position and breakouts	Wafer position and breakouts
			–	Colour list	–	Busbar position and number
			–	Colour value		
Functions						
Resolution in pixels V10	736 x 480 Mono	736 x 480 Mono	736 x 480 Colour	736 x 480 Colour	736 x 480 Mono	736 x 480 Mono
Resolution in pixels V20	–	1280 x 1024 Mono	–	1280 x 1024 Colour	–	–
Image rate per second V10 | V20	50 | –	50 | 40	40 | –	40 | 20	50 | –	50 | –
Number of jobs | detectors	2 | 32	max. 255 | max. 255	8 | 32	max. 255 | max. 255	2 | 32	max. 255 | max. 255
Position tracking	–	✓	✓	✓	–	✓
Contour matching (X-, Y-translation, rotation)	✓	✓	✓	✓	–	–
Pattern comparison (X-, Y-translation)	✓	✓	–	✓	–	✓
Grey threshold	✓	✓	–	✓	✓	✓
Contrast	✓	✓	✓	✓	✓	✓
Brightness	✓	✓	–	✓	✓	✓
Freeform tool	Contour only	✓	–	✓	–	✓
Interfaces						
Inputs | outputs	2 | 4	2 | 4	2 | 4	2 | 4	2 | 4	2 | 4
Freely definable switching outputs/inputs, PNP or NPN	2	4	2	4	2	4
Encoder input	–	✓	–	✓	–	✓
I/O expansion	–	✓	–	✓	–	✓
RS 422 | RS 232	– | –	✓ | ✓	– | –	✓ | ✓	– | –	✓ | ✓
Ethernet	✓	✓	✓	✓	✓	✓
EtherNet/IP	✓	✓	✓	✓	✓	✓
Lens						
V10 integrated, 6 mm | 12 mm | 25 mm	✓ | ✓ | –	✓ | ✓ | ✓	✓ | ✓ | –	✓ | ✓ | ✓	✓ | – | –	✓ | ✓ | –
V20 integrated, 12 mm	–	✓	–	✓	–	–
C-mount	–	✓	–	✓	–	✓
More Information from page	**62**		**80**		**98**	





VISOR® Code Reader		
V10 Standard	**V10/V20 Advanced**	**V20 Professional (OCR)**
Code reading		
Data code	Data code	Data code
Bar code	Bar code	Bar code
–	–	Optical character recognition (OCR)
736 x 480 Mono	736 x 480 Mono	–
–	1280 x 1024 Mono	1280 x 1024 Mono
50 | –	50 | 40	– | 40
8 | 1	max. 255 | max. 255	max. 255 | max. 255
–	✓	✓
–	–	–
–	✓	✓
–	✓	✓
–	✓	✓
–	✓	✓
–	✓ (not with data codes and bar codes)	✓ (not with data codes, bar codes and OCR)
2 | 4	2 | 4	2 | 4
2	4	4
–	✓	✓
✓	✓	✓
✓ | ✓	✓ | ✓	✓ | ✓
✓	✓	✓
✓	✓	✓
✓ | ✓ | –	✓ | ✓ | ✓	–
–	✓	✓
–	✓	✓

Features/system	Eyesight Vision System	
	V10/V20	**V10C/V20C (Colour)**
Functions		
Resolution in pixels V10	736 x 480 Mono	736 x 480 Colour
Resolution in pixels V20	1280 x 1024 Mono	1280 x 1024 Colour
Image rate per second V10 | V20	50 | 40	40 | 20
Number of inspection programs	max. 40 Mbyte	max. 40 Mbyte
Commands		
Image/camera	Image capture, camera settings	
Colours	Select colour channel, colour inspection, colour filter (V10C/V20C)	
Pre-processing	Calibration and position tracking, correct brightness, remove background, filter functions	
Inputs/outputs	Test input, set output, access INI file, text, data transfer – serial, data transfer – LAN	
Visualisation	Image transfer	
Measurement	Image information, area test, list of points, determine points, determine lines, calculate circle, calculate distance, line distance, calculate cross-section, measure gap width, calipers, calculate angle, determine warpage point	
Program control	Stop watch, control of sequence and loop options, subprogram, access variable, evaluation	
Pattern/contour comparison	Count objects, inspect contour, track contour, correlation	
Scanning	Scan points, circular scanner, edge counter, find edges (projected), search ring for counting	
Access to libraries	Script interpreter	
Interfaces		
Inputs | outputs	2 | 4	2 | 4
Freely definable switching outputs/inputs	4	4
I/O expansion	✓	✓
RS422 | RS232	✓ | ✓	✓ | ✓
Ethernet	✓	✓
Lens		
V10 integrated, 6 mm | 12 mm	✓	✓
V20 integrated, 12 mm	✓ | ✓	✓ | ✓
C-mount	✓	✓

118

More information from page 106

Product overview – optical sensors

Product family Dimensions (H x W x D)		Distance sensors (Analogue sensors)	Colour (C), contrast (K) and luminescence sensors (UV)	Proximity switches
F 10 21,1 x 14,6 x 8 mm³				
F 25 34 x 20 x 12 mm³		FT 25-RA | **20 – 80 mm** FT 25-RA | **30 – 200 mm**	FT 25-RL | **250 mm** | K FT 25-W | **12 mm** | K FT 25-RGB | **12 mm** | K FT 25-C | **12 mm** | C	FT 25-RL | **250 mm** FT 25-R | **800 mm**
F 55 50 x 50 x 23 mm³		FT 55-RLAP | **5 m**		FT 55-RL2 | **1.200 mm** FT 55-R | **2.000 mm**
	Stainless steel			FT 55-RM | **1.750 mm**
F 20 32 x 20 x 12 mm³		FT 20-RA | **20 – 80 mm**		FT 20-RL | **150 mm** FT 20-R | **300 mm** FT 23-R | **300 mm**
F 50 50 x 50 x 17 mm³		FT 50-RLA-20 | **40 – 60 mm** FT 50-RLA-40 | **45 – 85 mm** FT 50-RLA-70 | **30 – 100 mm** FT 50-RLA-100 | **70 – 170 mm** FT 50-RLA-220 | **80 – 300 mm**	FT 50-C | **32 mm** | C FT 50-CUV | **50 mm** | UV	
Cylindrical sensors Ø 4/5 mm Ø 12 mm Ø 18 mm Ø 30 mm				FM 04/05 | **50 mm** FT 12-R | **300 mm** FT 18-2-R | **400 mm** FMS 18-B | **400 mm** FT 18-2-IR | **800 mm** FMS 30-B | **1.000 mm**
FL 70 84 x 35 x 10 mm³				
F 80 83 x 65 x 25 mm³ **F 90** 95 x 93 x 42 mm³		FT 80-RLA-500 | **250 – 750 mm** FT 91/92-ILA | **6 m** FT 90-ILA | **10 m** FR 91/92-ILA | **50 m** FR 90-ILA | **250 m**		
FG | FGL				
More information from page		142	184	218

Proximity switches with background suppression	Photoelectric reflex switches	Through-beam photoelectric switches	Fibre-optic sensors	Page
FT 10-RLH | **60 mm**	FR 10-RL | **2 m**	FS/FE 10-RL | **3 m**		226
FT 10-B-RLF | **15/30 mm**	FR 10-R | **1,6 m**			
FT 10-RH | **70 mm**				
FT 10-RF | **15/30/50 mm**				
FT 10-BF | **30 mm (Bluelight)**				
FT 25-RLH | **120 mm**	FR 25-RL | **13 m**	FS/FE 25-RL | **18 m**		148 206 250
FT 25-RH | **200 mm**	FR 25-R | **6 m**	FS/FE 25-R | **13 m**		
FT 25-RHD | **400 mm**	FR 25-RF | **3 m**	FS/FE 25-RF | **4 m**		
FT 25-RF | **60/80 mm**	FR 25-RGO | **2 m**			
	FR 25-RLO | **4 m**			
FT 55-RLH | **800 mm**	FR 55-RL | **12 m**	FS/FE 55-RL | **25 m**		166 250
FT 55-RL2H | **1.000 mm**	FR 55-R | **12 m**	FS/FE 55-R | **20 m**		
FT 55-B-RH | **800 mm**	FR 55-RLO | **20 m**			
FT 55-RH | **1.200 mm**				
FT 55-RLHP | **5 m**				
FT 55-RHM | **550 mm**	FR 55-RM | **11 m**	FS/FE 55-RM | **15 m**		
FT 20-RLH | **60 mm**	FR 20-RL | **3 m**	FS/FE 20-R | **8 m**	FL 20-R | Proximity switch **100 mm** P/E switch **1.000 mm**	150 316 436
FT 20-RLHD | **110 mm**	FR 20-R | **2,5 m**	FS/FE 23-R | **4 m**		
FT 20-RH | **100 mm**	FR 20-RD | **3,5 m**			
FT 23-RF | **60 mm**	FR 23-R | **2,5 m**			
FT 20-IH | **150 mm**	FR 20-RG/RG 1 | **0,5 m**			
	FR 20-RLO | **4 m**			
FT 50-RLH | **150 mm**	FR 50-RL | **20 m**	FS/FE 50-I | **15 m**		154 196 352
FT 50-RLHD | **300 mm**	FR 50 R | **5,5 m**			
FT 50-RH | **300 mm**				
FT 50-IH | **600 mm**				
FT 12-RH | **60 mm**	FR 12-R | **1,5 m**	FS/FE 12-RL | **5 m**		392
FT 12-RF | **24 mm**		FS/FE 12-R | **4 m**		
FMH 18 | **120 mm**		FS/FE 18-RL | **50 m**	FMS 18-U | Proximity switch **160 mm** P/E switch **700 mm**	
	FR 18-2-R | **3 m**	FS/FE 18-R | **20 m**		
	FR 18-2-IR | **3,6 m**	FLS/FLE 18-W | **50 m**	FMS 30-U | Proximity switch **800 mm** P/E switch **4.800 mm**	
		FSE 18-2-I | **10 m**	FAV 30 | **500 mm**	
			FL 70-R | Proximity switch **310 mm** P/E switch **810 mm**	440
			FL 70-R-XD | Proximity switch **310 mm** P/E switch **810 mm**	
FT 92-IL				162 168 170
		FGL-RK | **30 – 120 mm**		534
		FGL-IK | **30 – 120 mm**		
		FGL | **5 – 220 mm**		
		FG | **40 – 120 x 80 mm²**		
218	**218**	**218**	**430**	

Product overview – ultrasonic, inductive and capacitive sensors, Smart

Ultrasonic Sensors

Products		Adjustment	Scanning distances	Special features	Page
UT 20		Teach-in	140 mm / 150 mm / 240 mm / 700 mm	Ultrasonic sensors with soundpipe, PNP, NPN, analogue output	**548**
UT 12		Via control input	400 mm	PNP, NPN, analogue output	**564**
UT/UM 18		Via control input	250 mm / 300 mm / 800 mm	Variants with stainless steel housings, PNP, NPN, analogue output	**568**
UMT 30		Teach-in or display	350 mm / 1300 mm / 3400 mm / 6000 mm	Display, PNP, 2 x PNP or analogue output	**578**

Inductive Sensors

Products		Design	Switching distance	Special features	Page
IT 8 / 10 / 12 / 40 **IS 455 / 588**		Cubic	0.8 mm / 1.5 mm / 3mm / 4 mm / 8 mm / 15 mm / 20 mm / 35 mm	Miniature housing, AC/DC variants	**600**
IS 33		Cylindrical Ø 3 mm	0.6 mm	PNP, NPN	**608**
ISN 44-20 **IS 34** **IT 4**		Cylindrical Ø 4 mm	0.8 mm	PNP, NPN, NAMUR, stainless steel housing	**609**
IMT 5		Cylindrical Ø 5 mm	0.8 mm	PNP, NPN, stainless steel housing	**612**
ISZ 46 **IS 46 / 56** **IDT 6**		Cylindrical Ø 6,5 mm	1.5 mm / 2 mm / 3 mm	PNP, NPN	**613**
IS 48 / 58 **IMT 8**		Cylindrical Ø 8 mm	1.5 mm / 2 mm / 3 mm / 6 mm	PNP, NPN	**617**
IMT 12 **IT 12** **IS 512**		Cylindrical Ø 12 mm	2 mm / 4 mm / 6 mm / 10 mm	PNP, NPN	**624**
IS 514		Cylindrical Ø 14 mm	3 mm	PNP, stainless steel housing	**631**
IMT 18 **IS 518** **IT 18**		Cylindrical Ø 18 mm	5 mm / 8 mm / 10 mm / 12 mm / 20 mm	PNP, NPN, stainless steel housing	**632**
IMT 30 **IS 530** **IT 30**		Cylindrical Ø 30 mm	10 mm / 15 mm / 20 mm / 22 mm / 40 mm	PNP, NPN, stainless steel housing	**639**
IS 512 / 518		Cylindrical Ø 12 mm / 18 mm analogue	6 mm / 10 mm	Analogue output	**629**

Capacitive Sensors

Products		Installation	Adjustment	Switching distance	Page
KD / KL 06		Flush / non-flush	Potentiometer	0.1 … 1.5 / 0.1 … 3 mm	654
KD / KL 08		Flush / non-flush	Potentiometer	0.1 … 1.5 / 0.1 … 3 mm	656
KD / KL 12		Flush / non-flush	Potentiometer	1 … 4 / 1 … 8 mm	658
KD / KL 18		Flush / non-flush	Potentiometer	2 … 8 / 2 … 15 mm	660
KD / KL 30		Flush / non-flush	Potentiometer	1 … 20 / 1 … 30 mm	662

SmartPlug

Products		Special features	Page
MFI (Inverter)		Inverts NPN to PNP or PNP to NPN devices, N.C./N.O. also adjustable	668
MFC (Counter)		Adjustable counter (pulses or intervals) between 1 … 65535 ms	670
MFT (Timer)		Adjustable on-delay or drop-out delay between 1 … 65535 ms	672
MFF (Frequency)		Adjustable frequency monitoring between 15 … 1000 Hz	674
MFW (Wipe Function)		Adjustable wipe function for falling or rising edges; time range 1 … 65535 ms	676
MFU (Universal)		All-in multifunctional switching device programmable via USB	678

Accessories

Products		Description	Page
Mechanical accessories		Brackets for sensors	A-4
		Mountings for VISOR® and illumination	A-12
Optical accessories		Reflectors and reflective tape	A-16
		Lenses and protective casings	A-23
		Illumination	A-25
Electrical accessories		Cables	A-32
		Converters	A-36
		Power supply units and switching devices	A-37

Vision with foresight

At SensoPart we already anticipate the future of automation



"Our standard is not what is possible today, but the vision of what will be achievable in future" – this has been our credo since the founding of SensoPart in 1994. Our aim is to remain one step ahead and be able to offer our customers the most innovative products on the market.

When we have identified a path as correct we follow it consistently. As a family-run German company we can act independently and as we see fit – a major prerequisite for the extremely successful development that SensoPart has achieved since its start.

Successful products, now considered indispensable for modern factory automation, have been created from the many future-oriented ideas of earlier days. But we do not simply rest on our laurels – because we still have many ideas for the future.

Milestones in the company's history

1994 Founding of SensoPart Industriesensorik GmbH in Wieden, in the Black Forest

1997 Founding of SensoPart UK Ltd

1999 Founding of SensoPart France SARL

2001 Opening of second site in Gottenheim near Freiburg-im-Breisgau

2001 Baden-Württemberg Innovation Prize

2002 Special prize for young companies, awarded by state of Baden-Württemberg

2003 2nd place: German Sensor Application Prize



"Dependability, responsibility and trust"

SensoPart is a family-run German company and this also influences our attitude towards work: we believe that dependability is important, we take responsibility for our activities, and we value close and trusting relations within the company as well as with our customers and business partners.

Dr. Theodor Wanner,
Founder and Managing Director of SensoPart

2004 1st place: German Sensor Application Prize

2004 Founding of SensoPart Inc., USA

2005 Expansion of new building in Gottenheim

2006 Baden-Württemberg Innovation Prize

2008 "Top 100" Innovation Prize

2009 Freiburg Innovation Prize

2012 Founding of SensoPart China

20 years of SensoPart **2014**

Innovations made in Germany

Future-oriented solutions are created at SensoPart – and developed and produced at our Gottenheim and Wieden sites



Those entering the new SensoPart buildings in Gottenheim near Freiburg immediately notice that this is an innovative, open company. This first impression of order and transparency is confirmed by a glance at our production facilities: everything is in the right place here and everyone knows what they are doing. The result is the famous quality "made in Germany", of which we at SensoPart are particularly proud.

Less obvious, but nevertheless decisive for the whole, is our development department. We do everything to give new ideas and innovations space here. Regardless of whether the optimisation of a product's functional detail is involved or whether it is necessary to come up with a completely new product family, our development engineers are committed with a lot of energy and great expertise. Numerous Innovation Prizes in recent years document this: with success!

Milestones of product development



1994
FMH 18: the first proximity sensor in a cylindrical housing with very precisely adjustable background suppression, achieved via a 12-step potentiometer



1995
FT 50: scanner with adjustable background suppression and analogue switching point indicator, with rotatable plug



1996/1997
FT 20: smallest photoelectric proximity sensor with LED or laser light, adjustable background suppression and teach-in



1998
FT 50 C: the world's smallest colour sensor with white light LED and spectral colour separation with innovative tube prism system



1999
F 90: laser distance sensor with long range, light time-of-flight measurement and an adjustment laser that can be switched off



2003
FT 50 RLA: laser distance sensor (triangulation process) with excellent measurement properties and many supplementary functions



At SensoPart we follow the principle of lean production – characterised by maximum flexibility and efficiency, as well as the economical use of resources.



2006 / 2008
FA 45/46: vision sensors in compact industry-oriented housings (IP 67) with built-in lens and integrated illumination



2009
FT 55: family with laser photoelectric proximity sensors with highly precise, adjustable background suppression, in plastic or stainless steel housings (IP 69K)



2010
FT 10: the world's smallest laser proximity sensor with highly precise, adjustable background suppression, and suppression of interference



2011
F 25: variant-rich series of powerful and robust miniature sensors with highly precise, adjustable background suppression



2011
VISOR®: user-friendly vision sensor with particularly powerful image processing and expanded functionality

From practical experience, for practical use

We are near our customers – all over the world



Innovative, flexible and practical – this is SensoPart. We have already brought many innovative solutions to fruition in collaboration with our customers in Germany and abroad. Our sensor specialists know exactly what industry needs and maintain close personal exchanges with users. This allows the creation of consistently practical products and solutions that compete successfully on the market.

It is indeed true that selection of the right sensor, the optimum illumination and the appropriate configuration can sometimes be a science in itself. So it is all the more important that our customers can rely on our expertise and active support. Because only practical use shows the value of a good and partnership-based collaboration.

Sectors and applications

- Automotive and supplier industries
- Machine and plant construction
- Food and beverages industries
- Pharmaceutical and cosmetics industries
- Wood industry
- Print industry

- Monitoring presence and position
- Inspecting completeness
- Small part detection and sorting
- Front-edge detection
- Pick & place



What our customers say about us …

"Products from SensoPart are very easy to integrate and configure."

"SensoPart is always a good contact when tasks are tricky."

"SensoPart has practical people."

"We always get rapid and competent support from SensoPart."

"SensoPart understands us and knows what we need."

Electronic production

Packaging industry and logistics

Robotics

Solar industry

Product labelling and identification

Picking

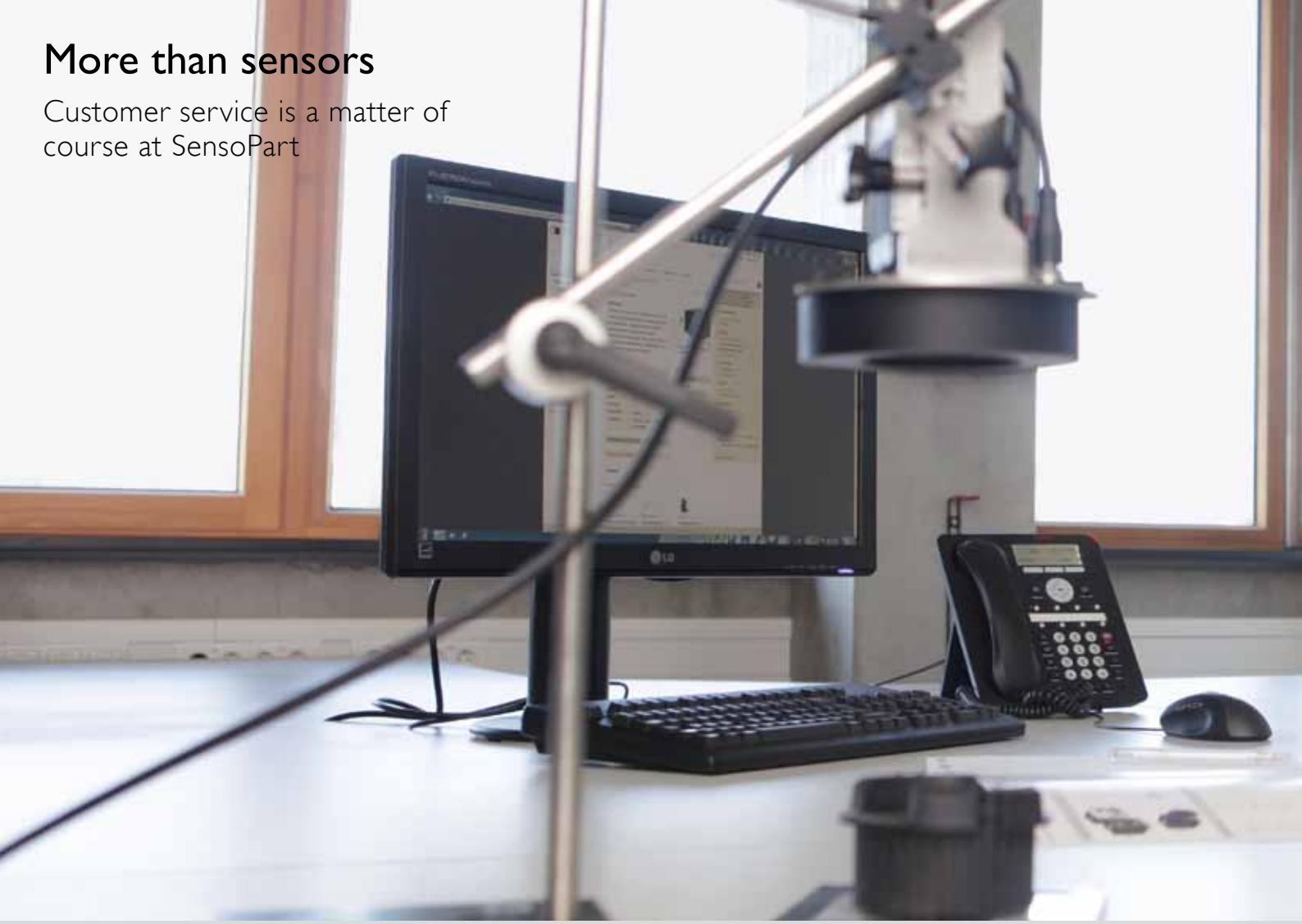
Automated product tracking

Inspecting cable occupancy

Inspecting LEDs, LC displays and monitors

More than sensors

Customer service is a matter of course at SensoPart



SensoPart not only sells sensors, but is also available for its customers before and after delivery of the product. We listen and are pleased to offer our comprehensive specialist knowledge and experience in industrial automation. For every customer requirement, however specialised, we find an effective and practical solution together.

Another advantage for our customers is that, at SensoPart, one hand knows what the other is doing. As a medium-sized company, we are sufficiently large to be able to achieve a lot but also flexible enough to react quickly. Thus our customers can always find a contact who knows exactly what is going on and can deal with their enquiry – as a matter of course.

Range of services for our customers

Technical feasibility analyses

Product and application consulting

Application support

Development support

After-sales support



Technology is important, but people are what matter for creating a successful business partnership. This is why we place great value on a personal, trusting relationship with our customers. Our personnel always have a sympathetic ear for questions and problems, and are delighted to be able to help with words and deeds.

Working out customer-specific solutions

Application support (telephone, online, on site)

Product training on site or at SensoPart

Rapid replacement and repair

www.sensopart.com/service

We are the future

Sustainable corporate development is a top priority at SensoPart



Forward-looking thinking and action are self-evident at SensoPart because they are the prerequisites for success – not just today, but also in the future. On the one hand, this involves environmentally friendly manufacturing techniques in line with the principle of lean production: all our processes are characterised by maximum efficiency, the responsible use of resources, and the consistent recycling of production waste.

Sustainability, on the other hand, means that we do everything possible to maintain our innovative capability. This is why we invest double the sector average on research and development. And we ensure that we will also have good personnel in future: about one-tenth of our workforce are trainees and students from the Baden-Württemberg Cooperative State University (DHBW). Some of them will, we are certain, make a lasting impression on the future of industrial sensors.



We take environmental protection seriously: solar collectors on the roof of our buildings in Gottenheim generate, on average, more electricity than is required by our production plants.

It's set up!

VISOR®. The vision sensor for fast implementation.



Unpack, set up and run – never before have vision sensors been so powerful and so easily and intuitively operated. The VISOR® is ready for operation in just ten minutes with a few mouse clicks. With VISOR® technology from SensoPart there is now a simple and effective solution for even the most difficult of automation tasks. Whether objects with complex shapes, colour detection, data matrix codes, self-illuminating display elements, or edge breakouts on solar cells – our application-specific vision sensors reliably detect all relevant object features.

Housings
Integrated evaluation unit with powerful signal processor, IP 67 enclosure rating, vibration-proof

Mounting
Simple and flexible mounting thanks to dovetail



Illumination
Integrated LED illumination (white, red, infrared, UV)

Interfaces
Integrated communication interfaces (Ethernet, serial interfaces, digital I/O)

Lens
Integrated lens or C-mount variants for long distances



Unmasked!

Regardless of if black, white or brightly coloured – our sensors miss nothing.

Who can see the tiger? Distinguishing object from background can sometimes be a real art. Photoelectric proximity sensors from SensoPart master this art with ultimate perfection. Thanks to their excellent background suppression they see precisely what matters: the object itself – and nothing else!

Reliable object detection
- Independent of the target object's size, shape, colour, material and surface properties
- Detection according to the principle of distance measurement: precise and reliable



High process stability
- Reliable suppression of unwanted reflections and ambient light
- Suppression of moving parts in the background (e.g. the transport belt, machine parts, persons)
- Reliable detection of target objects even at low distances to the background

The economical solution
- Applicable for all task areas
- Rapid commissioning via simple teach-in
- Long machine running times thanks to quality sensors from SensoPart, made in Germany

Tough

Our sensors are industry-oriented down to the last detail





ECOLAB

Ecolab is an established industry standard in the disinfection and detergent industry, providing a standardised test process.

Robust in any location
Thanks to their well thought-out designs and excellent workmanship, products from SensoPart are ideally equipped for harsh industrial conditions. Stable, tightly sealed housings and tough metal plugs make our sensors particularly reliable and long-lived. They withstand vibrations and daily cleaning with steam or water jets.

Well thought-out down to the last detail
The mounting holes of our sub-miniature sensors in the F 10 series are reinforced with metal eyelets. This prevents the housing from being damaged during installation through the use of screws that are too large or too great a torque.





An intelligent solution
The stainless steel sensors of the F 55 series are operated via a flush piezo-metal button which, in contrast to conventional moving operating buttons, is integrated in the sensor housing with a perfect seal – an intelligent solution for hygienically sensitive areas.

Industrial environments are not exactly gentle: dust and dirt, vibrations and tightly gripping hands belong to the harsh everyday experiences undergone by every sensor. All components, from the housing with its plug connections, through the mounting technology, to the optical and electronic assemblies must therefore be designed in such a way that damage is largely ruled out even under poor ambient conditions.

At SensoPart we place the highest value on the robustness and long service-lives of our products: the sensor housings are made of resistant materials (glass-fibre reinforced plastic, die-cast aluminium, or stainless steel) and tightly sealed (IP 67 or IP 69K) so that even cleaning with a jet of steam cannot harm them. Indestructible metal plugs do not give in even when faced with strong tensile loading, and a special injection process protects the sensors' electronic inner life from impacts and vibrations. Special mounting brackets offer additional protection when things get really hard.

Reliable function under all conditions

The industrial appropriateness of a sensor is not only a result of mechanical strength but also sensoric robustness. Thanks to their excellent background suppression our proximity sensors, for example, are immune to interfering effects such as incidental sunlight or reflections from bright metal parts. Varying target object colours also have no effect on their reliable function. Our sensors do exactly what one expects of them even under adverse conditions.



The IP 69K enclosure rating permits high-pressure cleaning at high temperatures. A jet of steam or water at a pressure of 100 bar and a temperature of 80°C, hitting the sensor from any direction, must not cause damage.

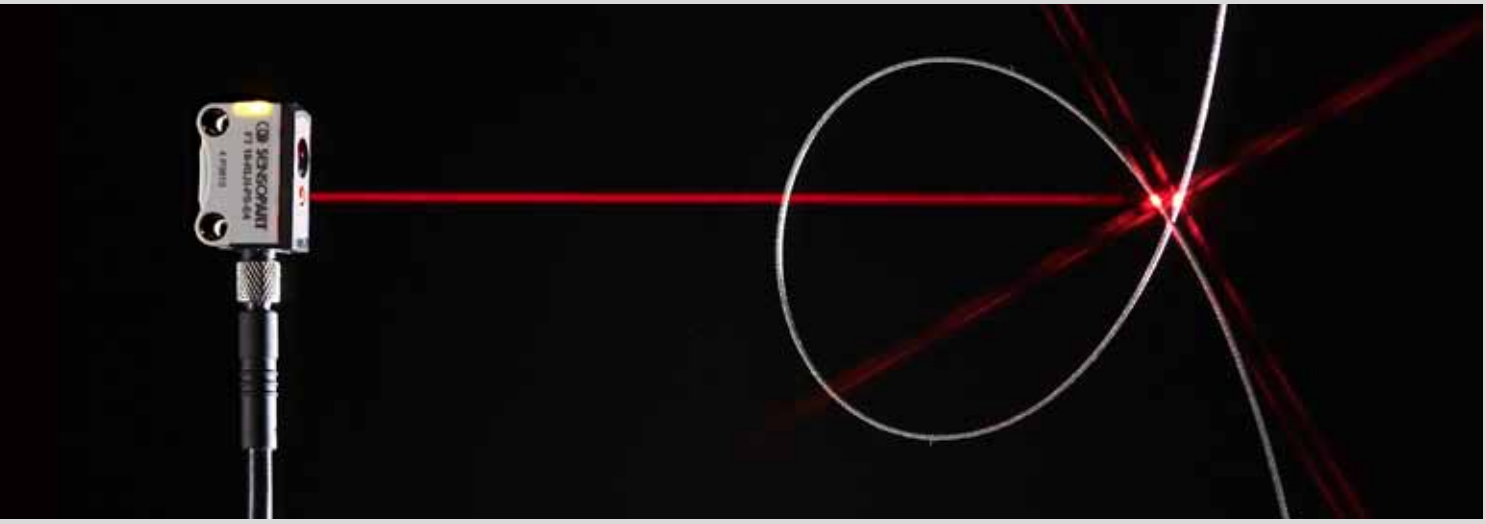


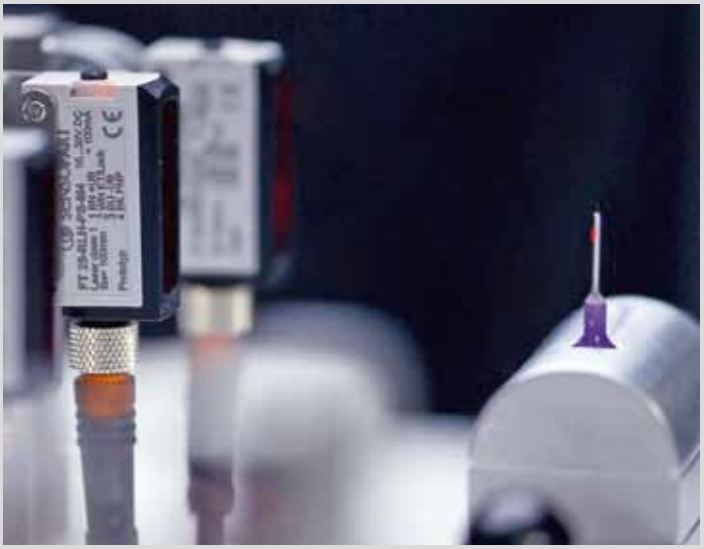
Firmly anchored

SensoPart offers suitable mounting solutions for the most varied of installation situations. Our retaining and fixing brackets are extremely stable and unshakeably hold the sensor in its place. Special designs with additional sensor protection are also available.

The greater the accuracy, the better

Our sensors are the best in their class regarding precision and reliability





To the point. Precisely

The sensors of the F 10 and F 25 series are experts in small-part detection. Even objects of only a few tenths of a millimetre are reliably detected. The precise background suppression is adjustable via potentiometer or teach-in, and ensures trouble-free operation.



With a reliable view

Sensors from SensoPart are the first choice for all applications in which precision, reliability and reproducibility matter. They detect objects of differing shapes, colours and sizes – even against bright backgrounds and with highly reflective machine parts.

The performance of average sensors is quite sufficient for many standard tasks in factory automation. But the wheat is separated from the chaff as soon as demands for accuracy and reliable function increase: in such cases one is well advised to choose a sensor from SensoPart. Because our sensors are always among the best in their class and thus offer, when it matters, the decisive advantage regarding performance or accuracy.

Process reliability. Background suppression from SensoPart
Above all our laser sensors: they reliably detect even tiny parts thanks to their precise, clearly contoured light spots. Sub-miniature photoelectric proximity sensors with background suppression in our F 10 series can thus easily detect a wire with a diameter of just 0.5 mm at a distance of 60 mm. And the quality of our sensors' background suppression is absolutely top class.

VISOR® – in a class of its own
Our vision sensors are also very popular among users: our new VISOR® series – with their rapid image processing, bright integrated LED illumination, and sophisticated evaluation algorithms – are absolutely first class. Whether for object detection in pick & place applications, the evaluation of 1D and 2D codes, or the detection of damaged edges on solar cells – in every specific application the sensors of the VISOR® platform show just how much technological expertise they contain.





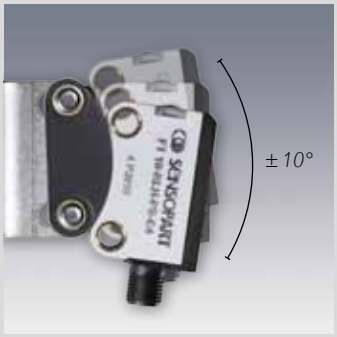
Rapid but nevertheless accurate
High throughput rates are important in solar cell production. But this must not be achieved at the cost of accuracy. A case for the VISOR® Solar sensor from SensoPart!

Simply clever!

Our sensors make life easy for users



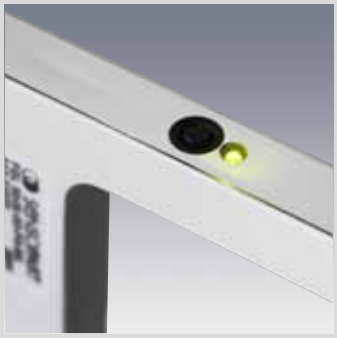
Simple mounting
The bracket, rotatable around two axes, considerably simplifies the alignment of vision sensors. Whereby it is extremely robust and does not become misaligned even with impacts and vibrations.



Comfortable fine alignment
Sensors can be precisely aligned after mounting thanks to the integrated dovetail guide (left). Mounting on a bar bracket is similarly easy (right).







Uniform operation
SensoPart uses a uniform teach-in operating concept for all its photoelectric sensors and proximity sensors, simplifying the operation of new products for users. The Teach-in button can be locked after setup to prevent any unintentional readjustment. Logically arranged LEDs show the switching state.





Flexible cabling
The rotatable cable attachment or plug simplifies cabling, particularly when installation space is limited.

IO-Link

EtherNet/IP

PROFIBUS

Interfaces as required
Our sensors have all the common interfaces and thus permit simple integration in higher-ranking control systems. Switching sensors are optionally available with the IO-Link interface, while vision sensors can be equipped with the fieldbus interfaces EtherNet/IP or PROFIBUS via an adapter.

Automation tasks can be very complex. But this by no means requires a complicated solution for users. At SensoPart we place great worth on developing technically convincing but nevertheless user-friendly solutions.

This already starts during installation: a large choice of well thought-out mounting elements permits installation in every conceivable location. Dovetail mounting, possible with many of our sensors, is particularly flexible, considerably simplifying retroactive fine alignment. We have also ensured that cabling is flexible – by means of rotatable cable and plug connections.

The setup of our sensors optionally takes place via potentiometer, teach-in, control line or – particularly user-friendly – via IO Link. The Auto-detect function for automatic PNP/NPN switchover of the switching output is also a clever idea.

VISOR® – image processing for everyman

The vision sensors of the VISOR® series are good examples of SensoPart's user-friendly philosophy: we have made quite complex image processing so easy that handling and operation are not much more complicated than that of switching sensors – so that machine operators also have no problem.



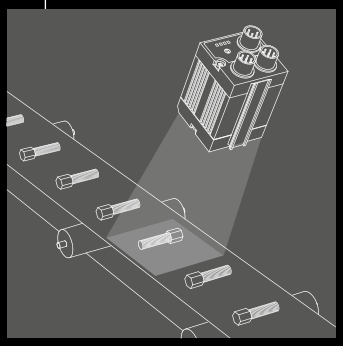
Setup in just a few steps
The user interface of the VISOR® configuration program offers a simple and comprehensible design. One need not be an image-processing expert!

Sectors and applications

The best solution for you

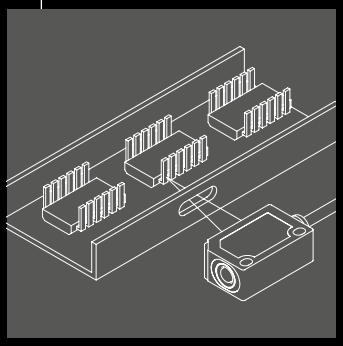
Object detection
from Page 34

- *Correct feed positions*
- *Inspection of completeness and presence*
- *Counting of parts*
- *Inspecting assembly processes*
- *Part detection and differentiation*



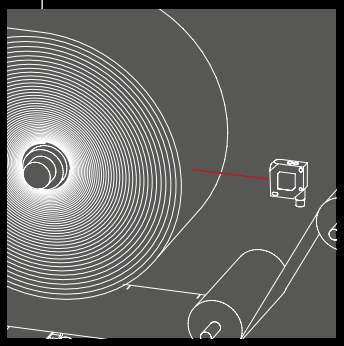
Position/ orientation detection
from Page 38

- *Highly precise front-edge detection, e.g. on transport belts*
- *Pick & place (2D position)*
- *Localisation of parts*
- *Assembly inspections*



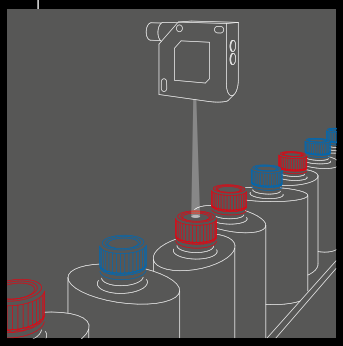
Measurement
from Page 40

- *Measurement of components*
- *Distance measurement in the µm range*
- *Monitoring sag & dancer rolls*
- *Technologies: triangulation, time-of-flight, ultrasonic, 2D camera*



Colour, contrast & luminescence
from Page 42

- *Detection and differentiation of coloured parts*
- *Detection of colour marks*
- *Inspection of self-lighting components such as LEDs or displays*
- *Printed mark detection*



There is nobody in sight, everything is moving as if by magic: transport belts rattle; robot arms whirl; workpieces are individualised, picked up and set down again, further transported on belts, put together to create assemblies. Sensors from SensoPart ensure that all these processes run smoothly and without human intervention – we offer the appropriate sensor type for every task in the process.

In the area of optoelectronics alone there is an enormous and comprehensive variety of sensors: whether through-beam photoelectric sensors, proximity sensors with background suppression, colour sensors, code readers, fibre-optic sensors, fork sensors, sub-miniature sensors, glass photoelectric sensors or ultraviolet sensors, with laser light or LED, in cuboid or metric housings – every housing and every technology has its specific strengths and areas of application.

Our switching sensors cover numerous standard industrial applications such as monitoring presence and completeness, distance and position determination, colour and mark detection, as well as customer-specific requirements in a great variety of sectors. Our vision sensors and systems detect complex objects or fluorescent colours, decipher data matrix codes, and detect crooked bottle tops or the broken edges of solar cells.

On the following pages we present a small selection of what our sensors can do for you. Contact us if your application is not included: we are certain that we will find the right solution for your process, too!

Identification
from Page 44

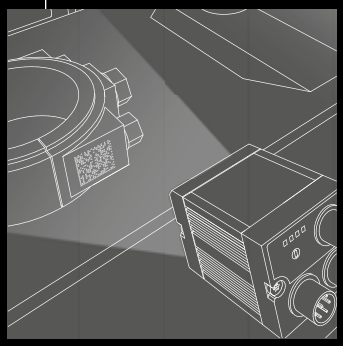
- *Product labelling*
- *Product identification*
- *Automated product tracking*
- *Product picking*
- *Quality assurance, determination of quality parameters*

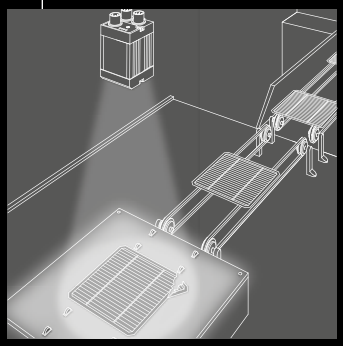
Applications for the solar sector
from Page 45

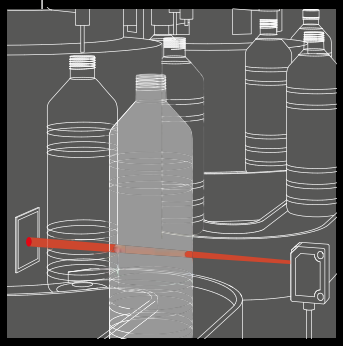
- *Position and edge damage inspection*
- *Wafer dimensions*
- *Code reading on solar cells*
- *Checking projections on wafer boxes*

Transparent objects
from Page 46

- *Detection of transparent objects of all types: glass, foils, PET*
- *Detection of objects of all shapes: flat glass, bottles*
- *Presence of objects*
- *Precise front-edge detection*







From practical experience, for practical use.
As versatile and varied as our sensors are, they have this in common: they are all extremely reliable. Because during development of our products we not only aim for the maximum that is feasibly possible, but also for innovative and solid solutions that can cope with the demands of daily practice.



VISOR® Solar sensor for position and edge-break detection.

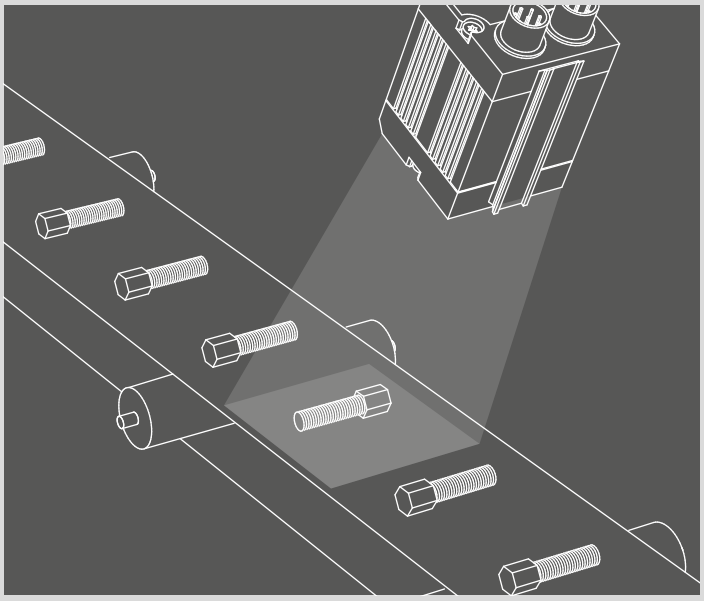


Small-part detection with the world's smallest laser scanner: FT 10.

Object detection

Checking presence, inspecting completeness, counting and sorting

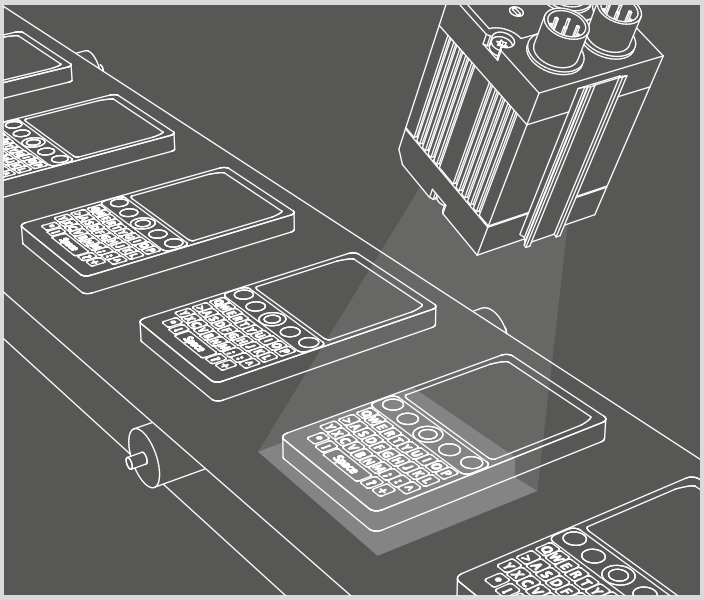
Is the object present? How is it lying on the belt? Is a detail missing or is it wrongly mounted? These and other applications can be reliably automated with sensors from SensoPart. For object detection tasks we recommend, for example, the use of photoelectric sensors or proximity sensors of the **F 10**, **F 25** or **F 55** series, or one of the fibre-optic cable sensors from the **FL 70** series. And our vision sensors in the **VISOR®** series are a good choice for checking the completeness of complex objects.



Feeding of small parts in correct alignment
Page 62

On the basis of a pattern comparison, a **VISOR® object sensor** detects whether the parts have been supplied in the correct orientation.

- Highly precise determination of orientation (X-/Y-position and orientation)
- Comprehensible configuration software with user guidance and context help
- Viewer software with hierarchical user rights
- Image recorder for simulation of the application without a sensor



Inspecting completeness of a mobile phone keyboard
Page 62

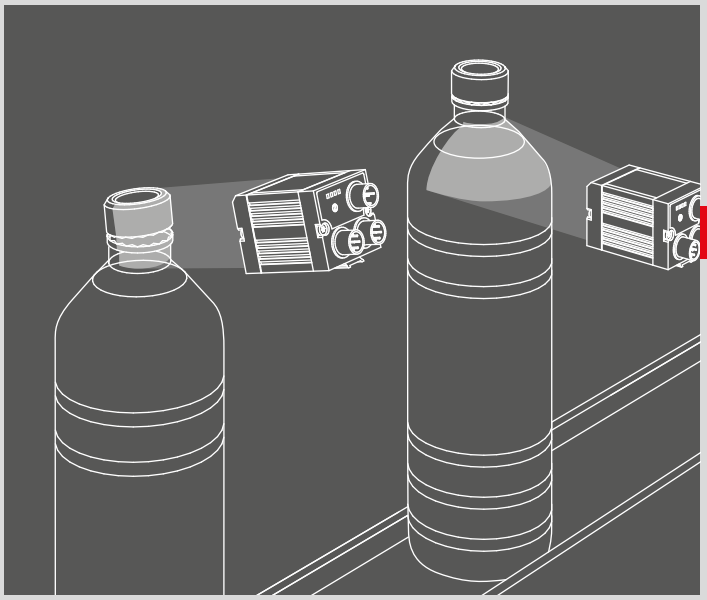
A **VISOR® object sensor** inspects whether all the keys are present on a mobile phone and mounted in the correct positions.

- Powerful part finding and tracking (five detectors plus position tracking)
- Simultaneous inspection of several object features
- Comprehensive logic functions
- 6 configurable result outputs
- Comprehensible, multi-lingual configuration software with user guidance and context help

Checking filling levels and the correct sit of bottle tops
Page 106

In a single pass, the **Eyesight vision system** checks whether the bottles have been filled to the correct level and whether the caps are sitting straight

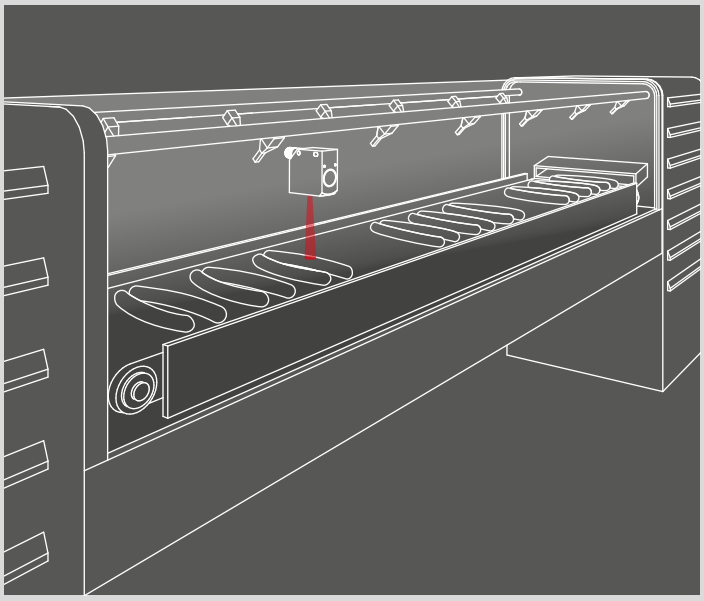
- Universally applicable stand-alone image processing system
- Rapid graphic parameterisation via drag & drop
- Comprehensive functions library with numerous image-processing tools
- Complex, iterative linkage of individual inspections
- Free definition of output data
- Easy and rapid commissioning



Detection of food before packaging
Page 292

With its tightly sealed stainless steel housing, the **FT 55-RHM laser scanner with background suppression** is suitable for applications in hygienically sensitive areas.

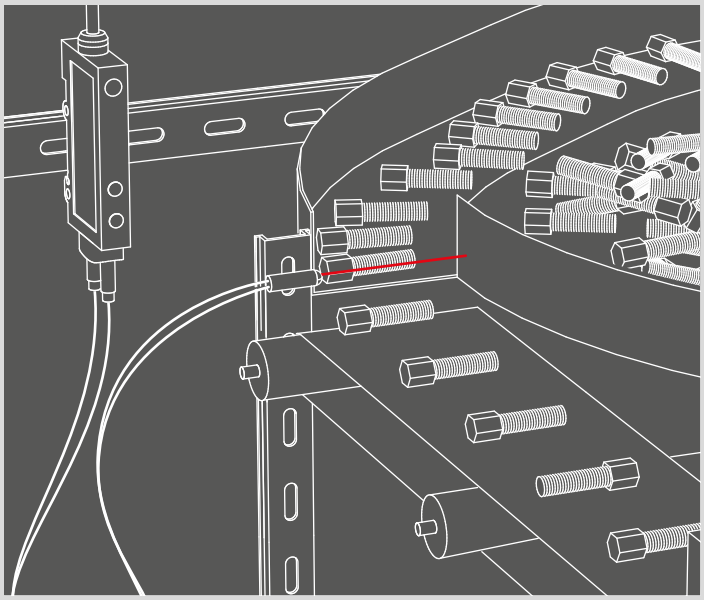
- Object detection almost completely colour-independent due to distance principle
- Reliable detection with differing backgrounds
- Bright light spot, also visible in daylight
- Robust, tightly sealed housing (IP 69K) with Ecolab approval
- Resistant towards chemicals and high temperatures
- Smooth housing surface for easy cleaning



Checking the presence of small parts on a vibrating feeder
Page 438

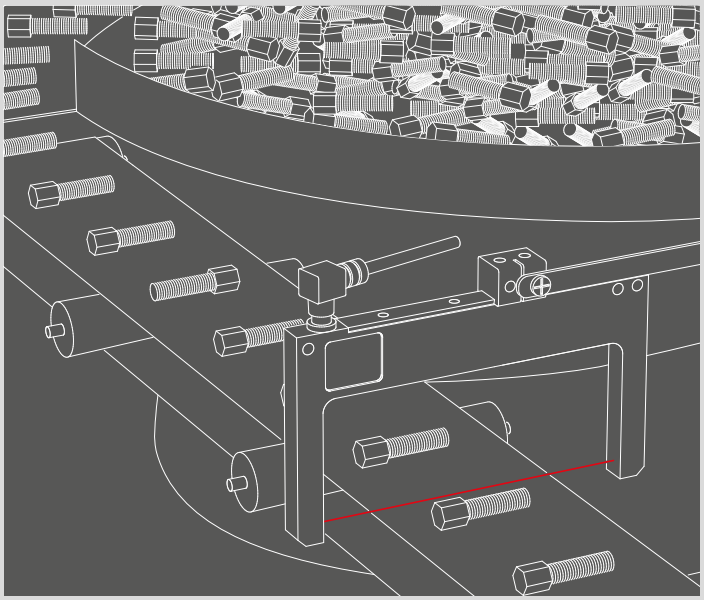
An **FL 70 fibre-optic sensor** registers the presence of workpieces at the end of the feed section.

- Extremely precise switching behaviour
- Simple teach-in with support from display
- Very good small-part detection through the use of focused fibre-optic cable
- Wide, individual range of fibre-optic cables for differing tasks
- Flexible fibre-optic cable arrangement



Object detection

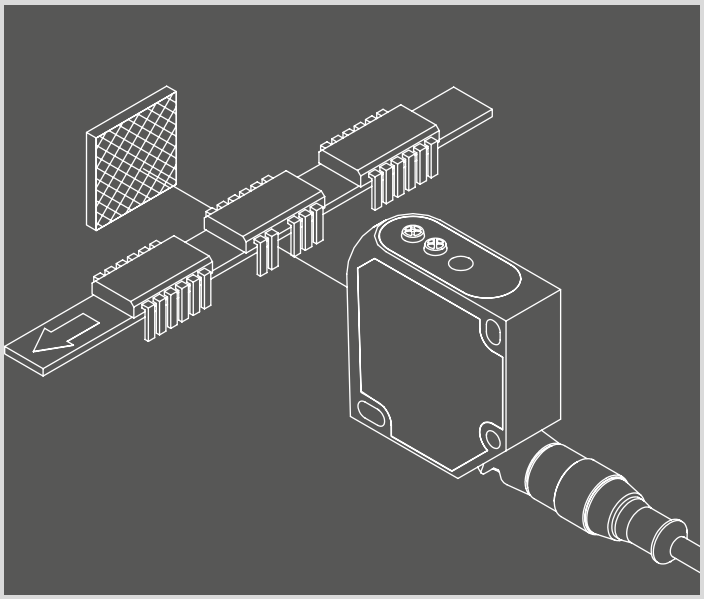
Checking presence, inspecting completeness, counting and sorting



Counting parts on a vibrating feeder
Page 530

An **FGL fork sensor** monitors whether the feed section is completely occupied with workpieces and, if necessary, stops the transport belt.

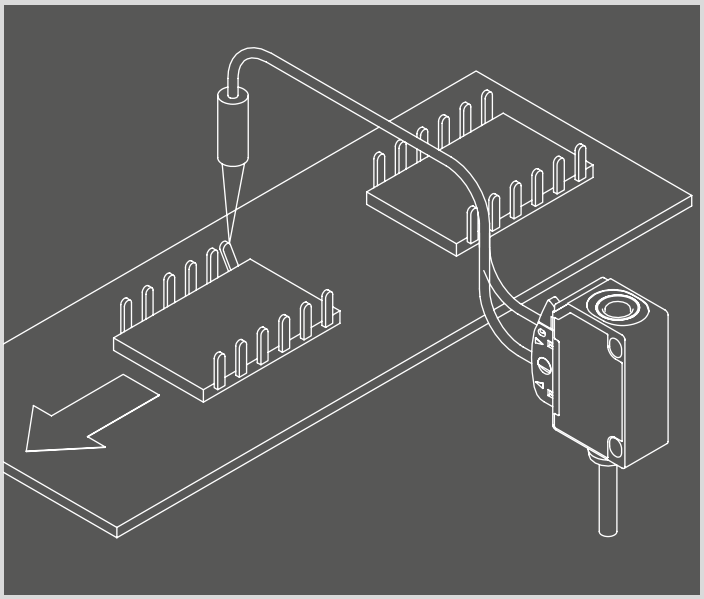
- Small-part detection down to 0.2 mm
- High switching frequency for rapid conveyor processes
- Vibration-proof plastic housings
- Wide variety of mounting possibilities for economical, easy mounting
- Status LEDs with all-round visibility on fork ends
- Sensitivity adjustment via teach-in



Counting plug pins
Page 302

The precise **FR 55-RL laser retroreflective photoelectric sensor** detects pins even with very small diameters.

- Reliable small-part detection thanks to fine laser beam
- Laser Class 1, no risk for the human eye
- Sensitivity adjustment via teach-in or control line
- Dovetail designs and rotatable plug/cable connection for simple and flexible mounting



Detection of IC pins
Page 436

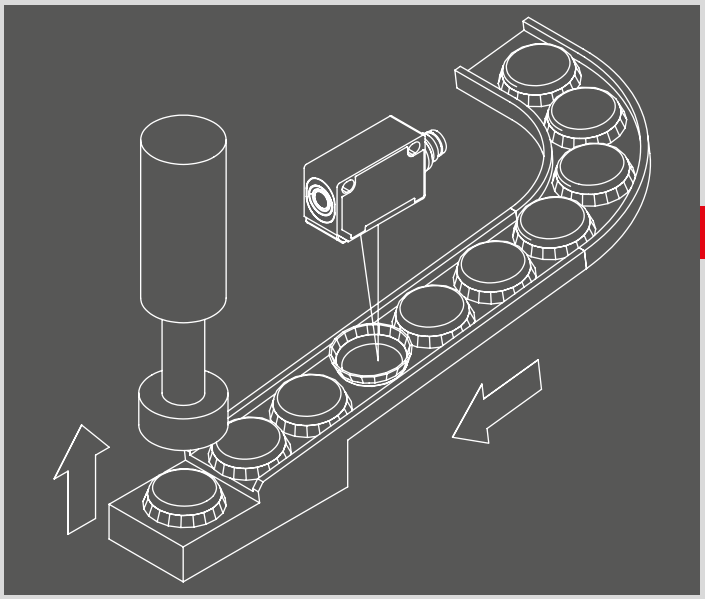
Even the smallest of objects, such as IC pins, can be reliably detected with the **FL 20 R fibre-optic sensor** as a result of its small light spot diameter.

- Amplifier easily integrated due to small housing
- Wide range of fibre-optic cables, covering numerous applications

Checking lids
Page 250

Lids lying the wrong way round are reliably detected with the **FT 25-RLH laser photoelectric proximity sensor** thanks to background suppression that works on the distance principle.

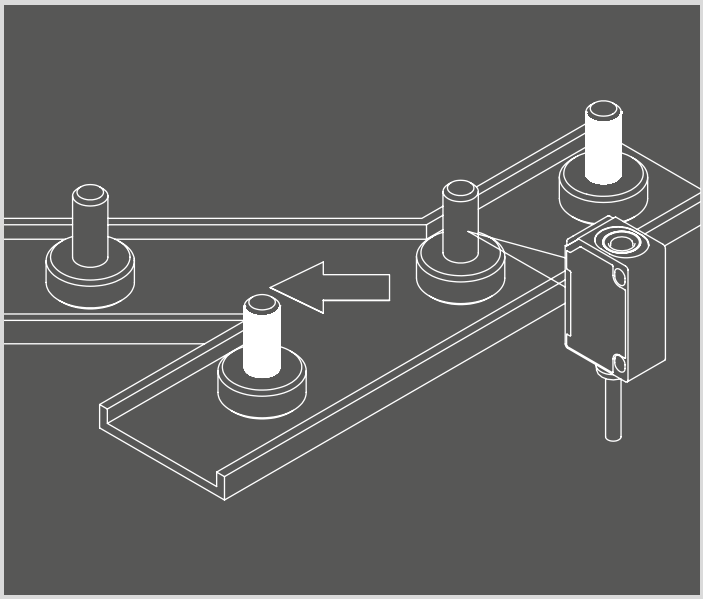
- Minimum height differences are detected
- Largely independent of object surfaces and colours
- Easy teach-in
- No impairment from highly reflective or moving backgrounds
- Most accurate small-part detection thanks to innovative laser technology (Laser Class 1)
- Versatile mounting possibilities



Diverting out uncoated parts
Page 260

Brightness differences can be reliably detected with the **FT 25-R diffuse photoelectric proximity sensor**.

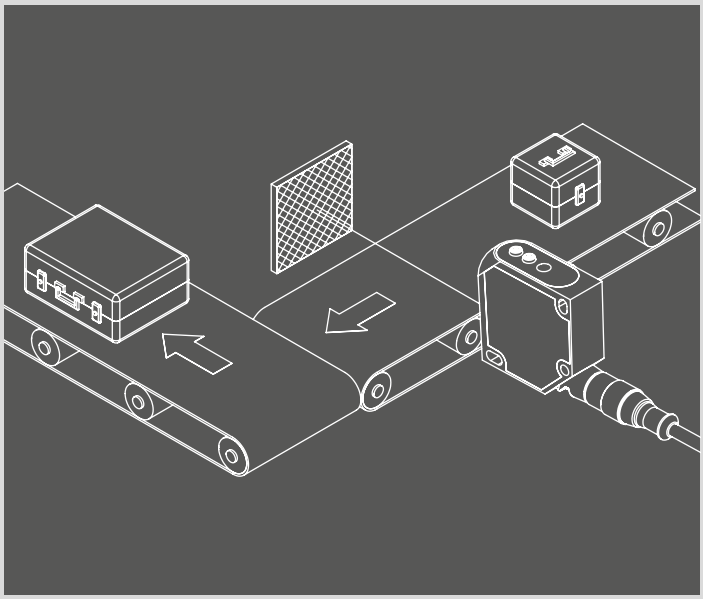
- Detection of even the slightest of grey differences
- Long operating distances possible
- Simple teach-in



Baggage distribution
Page 362

The **FR 50 R retroreflective photoelectric sensor** detects the arrival of a piece of luggage at the end of the belt.

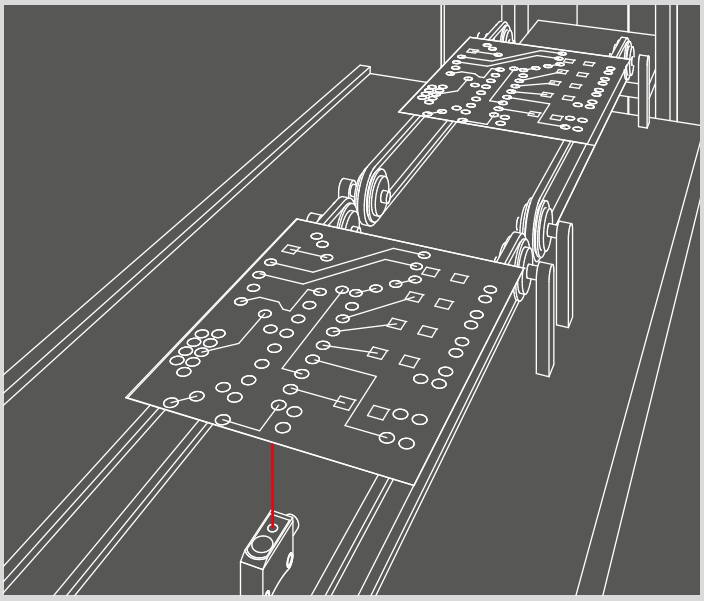
- Reliable detection of objects regardless of their surfaces
- Long ranges and operating distances possible



Detection of orientation/position

Front-edge detection, pick & place, quality inspections

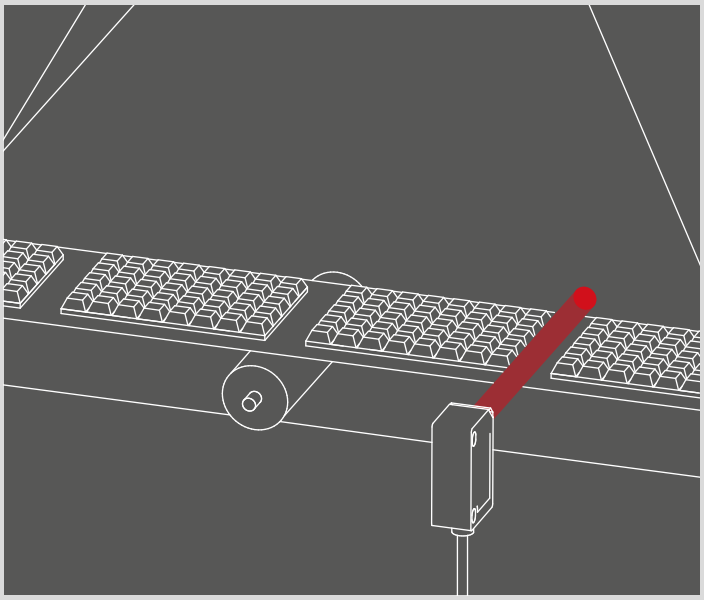
In order to be able to pick up a workpiece or component from a belt with a targeted robot gripper one has to know the exact position in advance. Our photoelectric proximity sensors with background suppression in the **FT 10** and **FT 25** series are ideally suited for such tasks. If, in a pick & place application, the X-/Y-position and orientation are also required, or if complex assemblies must be inspected for correct and complete assembly, we recommend our vision sensors in the **VISOR®** series, which can detect several features in a single pass.



Precise circuit board front-edge detection
Page 228

The front edges of circuit boards are registered with the **FT 10-RLH sub-miniature sensor** with background suppression.

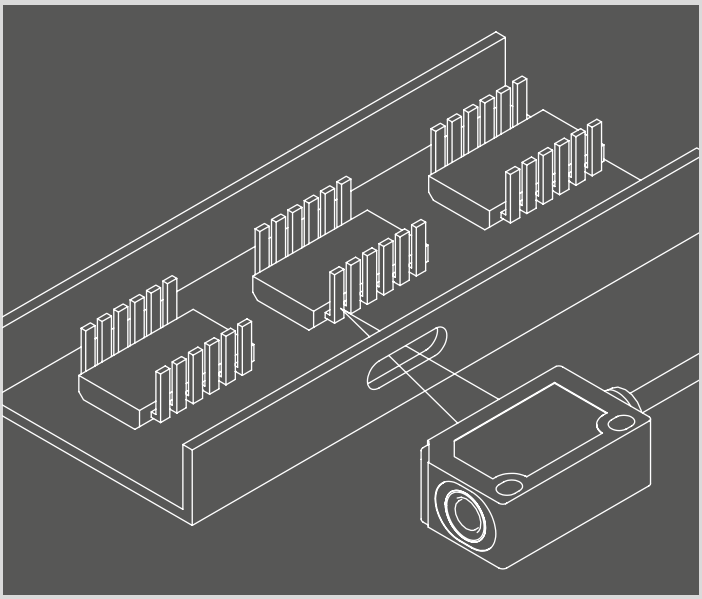
- Flexible mounting thanks to adjustable background suppression
- Reliable detection even with reflective metallic parts in the background
- Very low space requirement (dimensions only 21 x 14 x 8 mm^3)
- Precise switching behaviour due to small laser light spot (Laser Class 1)



Object front-edge detection
Page 254

One **FT 25-RHD photoelectric proximity sensor** with background suppression detects the front edges of individualised chocolate bars.

- No impairment by highly reflective or moving backgrounds and transport belts
- High scanning distance with all common materials and surfaces
- Adjustable, precise background suppression (distance measurement principle)
- Simple scanning distance adjustment via teach-in
- Very easily visible light spot for simple alignment
- Wide range of different types and designs
- Also available as a laser version for highly precise detection tasks



Monitoring IC pins
Page 250

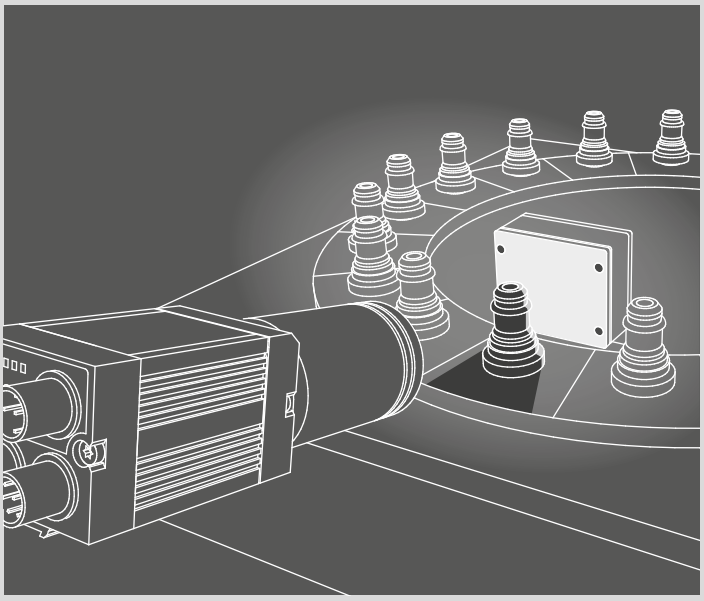
The fine light beam of the **FT 25-RLH laser sensor** permits precise detection of even small objects

- Reliable even with highly reflective metal parts
- High scanning rate possible with high switching frequency
- Independent of object colour and surface
- Backgrounds located very close to the object are reliably suppressed

Measurement

Measuring parts, monitoring sag, measuring thickness and distance

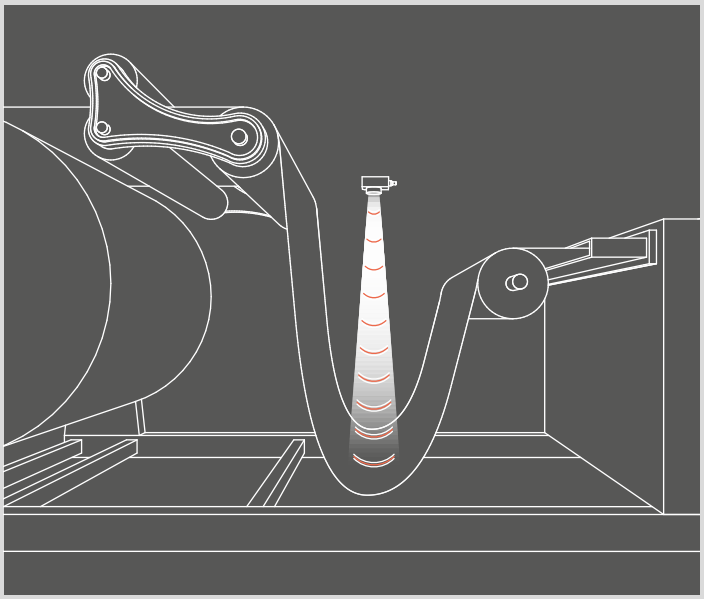
In many processes, similar values such as the distance or thickness of an object must be determined. In such applications, the laser distance sensors of the **FT 50 RLA** series (which operate using the triangulation principle), and the particularly far-sighted **FR 92** retroreflective photoelectric sensor (which measures distances of up to 250 m with an accuracy in the µm range by means of light time-of-flight technology), have proved useful. And our **Eyesight vision system**, with a function library of over 100 functions, is available for detailed inspections of dimensional accuracy.



Measurement of turned parts on a rotary table
Page 106

Turned parts can be inspected for dimensional accuracy with the **Eyesight vision system**.

- Compact smart camera with C-mount lens and dirt protection tube
- Appropriate illumination (surface light) for a reliable solution
- Intuitive graphic user interface
- Comprehensive functions library with numerous image-processing tools
- Images and results visualised for users via Ethernet



Monitoring the sag of carpets
Page 548

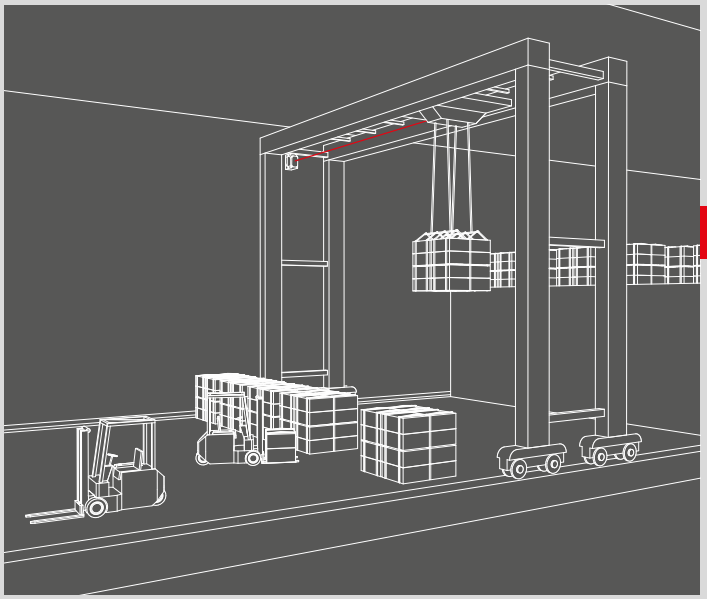
The **UT 20 ultrasonic sensor** checks the sag of textile floor coverings in order to ensure even winding.

- Highly accurate distance measurement
- Reliable operation on all surfaces: textiles, paper, foils (also transparent)
- Product range with analogue and switching outputs
- Very small housing for simple installation even when space is limited

Crane positioning with light time-of-flight distance sensors
Page 178

The **FR 92 distance sensor** measures the horizontal position of the jib on a gantry crane and thus improves collision prevention.

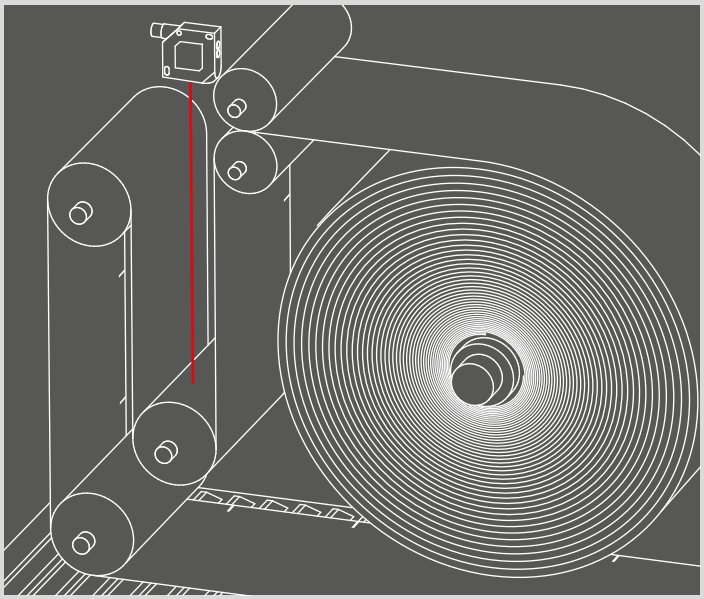
- Non-contact and robust light time-of-flight measurement instead of wear-prone mechanical distance determination
- Operating range of up to 250 m
- Various interfaces including SSI and RS 422
- High repeatability accuracy and high measurement rates



Dancer roll regulation and sag monitoring
Page 154

An **FT 50 RLA laser distance sensor** determines the position of the dancer roll and thus ensures even winding of the coil.

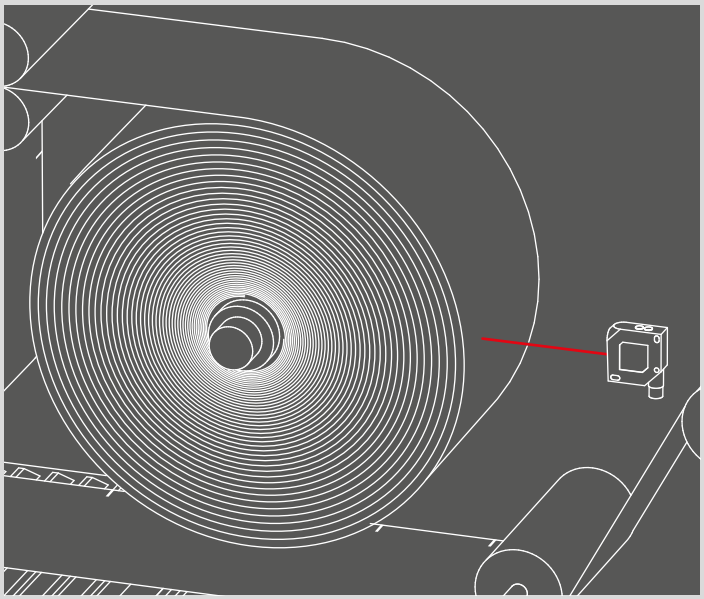
- Precise determination of dancer roll position for active traction force regulation of the web being wound
- Reliable detection regardless of the target object's surface properties
- Short response time for rapid processes
- Variety of measurement ranges for numerous tasks
- RS-485 interface and analogue output



Determining coil thickness on a packaging machine
Page 154

An **FT 50 RLA laser distance sensor** measures the distance to the coil surface in order to activate roll changes.

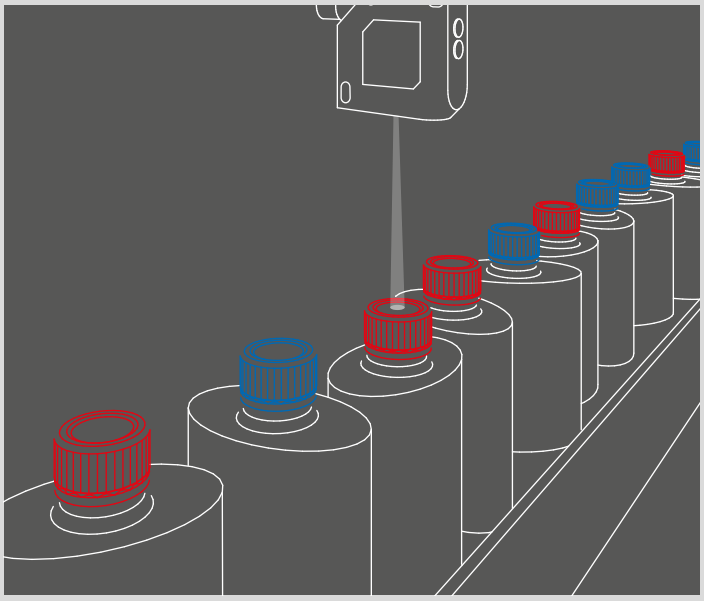
- Small housing for easy integration
- High accuracy regardless of target object's surface properties
- Short response time
- Programmable switching outputs



Colour, contrast and luminescence

Checking presence of coloured objects, printed mark detection, inspecting LEDs

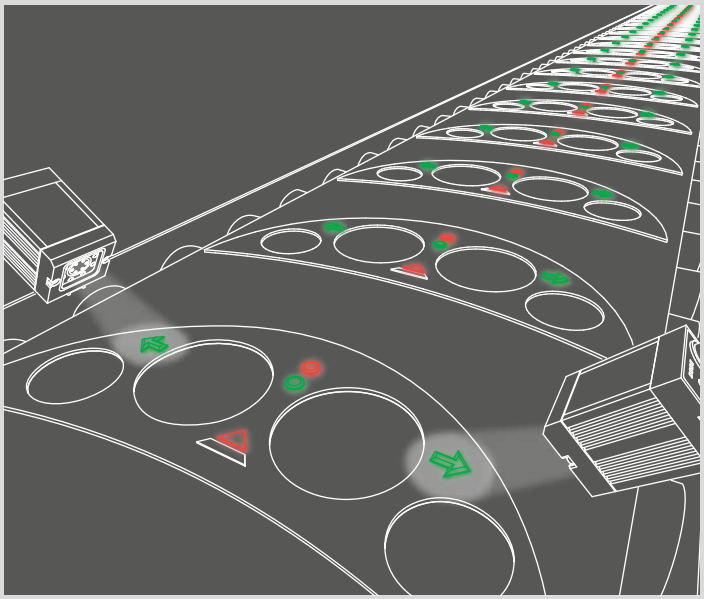
Most sensors are colour-blind, but not all: with the **FT 25**, **FT 50 C** and **FT 50 UV** series, SensoPart offers special sensors for detecting colours, grey values and even invisible luminescent marks. Whereby either the colour or grey values of the target object or attached colour marks or labels can be evaluated. The **VISOR® Color**, which can even detect self-lighting objects such as LEDs, is particularly versatile.



Detection of coloured bottle tops in a filling plant
Page 194

An **FT 50 C white-light colour sensor** checks whether the bottle tops are correct on the basis of their colour.

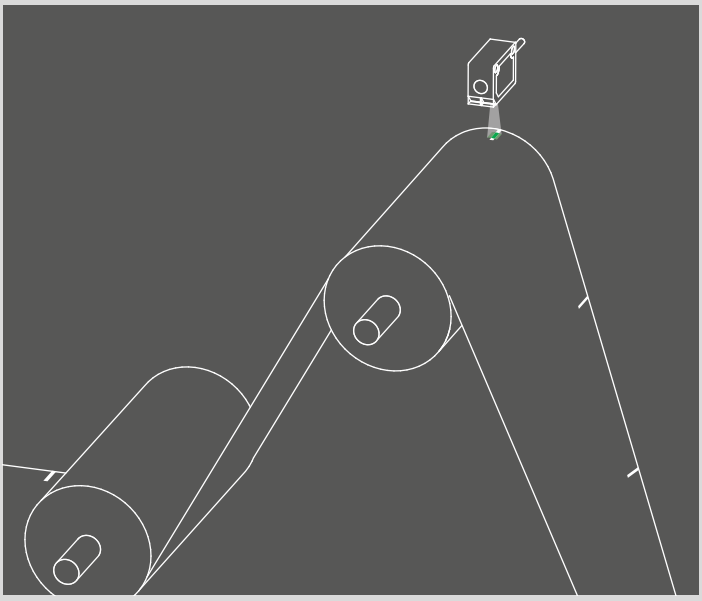
- High colour selectivity, independent of scanning distance fluctuations
- Reliable colour detection with tops made of metal or plastic
- Very reliable, even with wobbling or vibrating bottles and objects
- Teach-in of individual colours or scanning-in of colour ranges
- Available with three different light-spot geometries



Inspecting LEDs in car production
Page 80

A **VISOR® Color** inspects the correct colour of LEDs installed in dashboards.

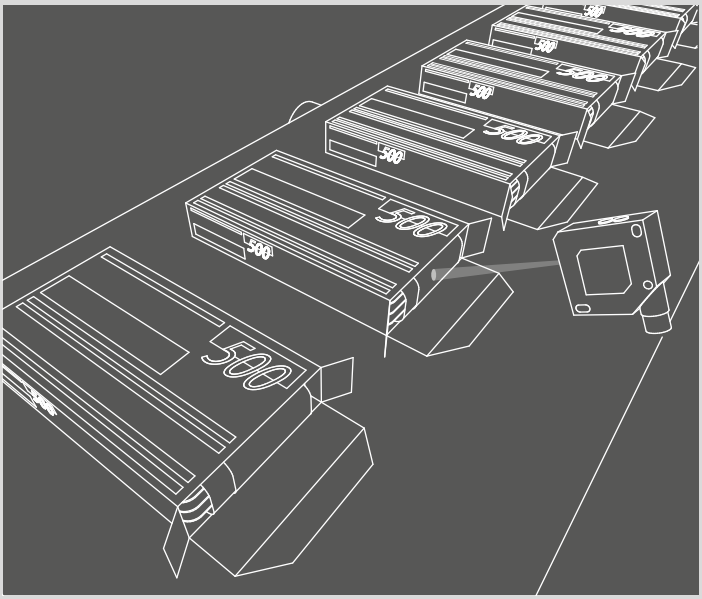
- Application-specific pre-configured vision sensor
- Detection of active (i.e. self-lighting) colours as well as "non-colours" (white, grey, black)
- High detection accuracy, even with very slight colour nuances
- Simple alignment with user-friendly configuration software
- Image recorder for offline simulation without sensor



Printed mark detection on endless packaging
Page 208

The cutting position is determined on the basis of printed marks detected using an **FT 25-RGB contrast scanner**.

- Resolution of 30 contrast levels
- Reflective foils are also reliably detected
- Unaffected by vibrations or flapping material
- High switching frequency for maximum positioning accuracy
- Comfortable teach-in operation, with feedback of signal/ contrast quality
- Very small housing
- Automatic selection of the ideal transmission colour for the taught-in contrast



Checking the presence of package inserts
Page 216

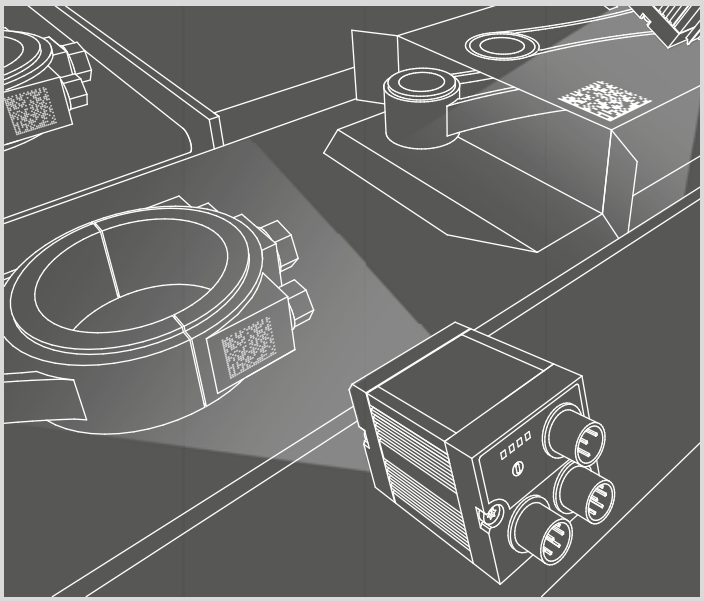
An **FT 50 C-UV luminescence sensor** detects the package inserts in the medical package. Whereby it uses the luminescent properties of the paper for reliable detection.

- Extremely reliable detection at varying distances between sensor and target object using a patented sensor concept
- Also suitable for narrow packages thanks to small light spot
- Small, compact housing (dimensions just 50 x 50 x 17 mm^3)
- Reliable suppression of luminescence in the background of the target object

Identification

Reading of bar codes and data matrix codes, OCR, tracking of components

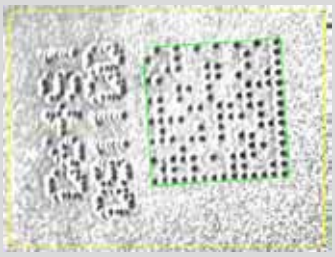
The unbroken tracking of parts and products plays an increasingly important role in industrial processes. This is why parts are provided with one- or two-dimensional codes that are either attached using labels or directly placed on the part by means of dot peening or laser (direct marking). Our code readers in the VISOR® series read bar codes and data matrix codes of numerous types. Even extremely small printing or marked codes on difficult substrates (wrinkled, reflective, rough) can be reliably detected using a variety of optical and illumination variants.



Evaluation of printed and directly marked codes
Page 118

A **VISOR® Code Reader** checks both the dot-peened data matrix code on a die-cast part and the code printed on the corresponding packaging.

- For all conventional 2D data matrix codes and 1D bar codes
- Optimum cost-effectiveness due to the combination of code reading and object detection in a single device
- High operational reliability thanks to reliable detection of even poorly legible codes
- Flexible and simple integration in PC and PLC environments
- Very high flexibility, e.g. reading of several similar or differing codes types in a single read process
- Reading of optical characters with OCR



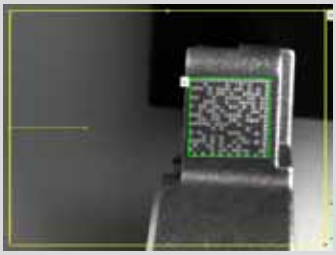
Dot-peened code on rough substrate
This is made readable by means of powerful algorithms. The dot-peened imprint in optical characters can be checked for presence using object detection.



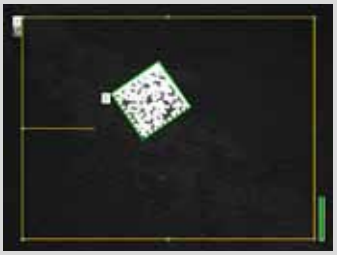
Code with low contrast
This is made readable by the high tolerance to weakly contrasting codes.



Reading optical characters
Dotted fonts can also be read with OCR.



Code with small "quiet zone"
Even codes with a small quiet zone or damaged finder pattern can be read.



Code reading on solar cells
Even extremely small codes, such as those on silicon solar cells, or highly reflective codes, e.g. on thin-layer solar cells, can be read.

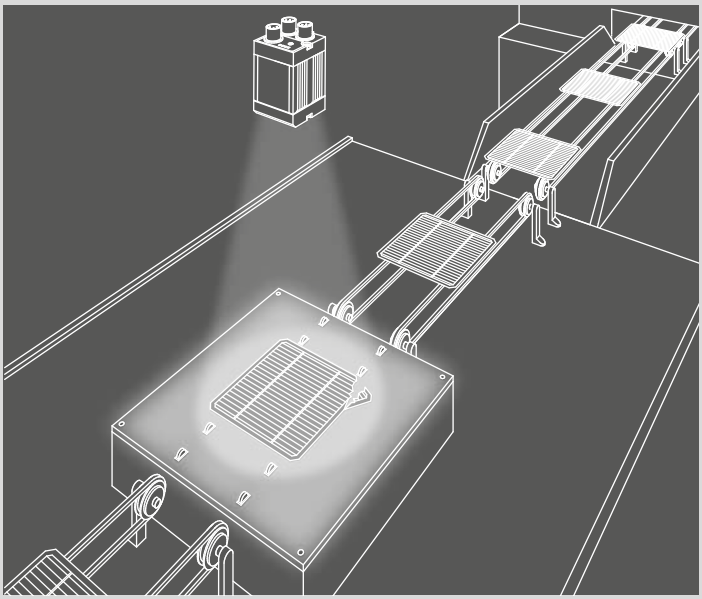


Printed codes on pharmaceutical packaging
It is possible to search for both ECC200 or bar codes (e.g. EAN 13) simultaneously. In addition to code reading, the presence of optical characters can be inspected using object detection.

Applications in the solar sector

Positioning, detecting edge breaks, front-edge detection and checking for projections, double layers detection

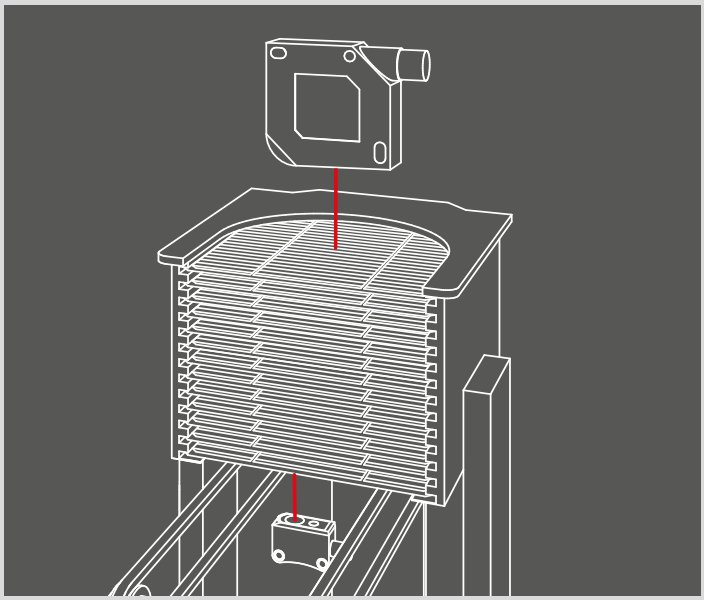
SensoPart has developed customised automation solutions for the photovoltaic industry. These include, for example, monitoring the positions and broken edges of solar wafers and cells in handling areas, as well as the unbroken tracking of crystalline and thin-layer solar cells via directly marked data matrix codes. In addition to switching sensors, application-specific solar sensors from the VISOR® series are used for these applications.



Monitoring the positions and broken edges of solar wafers
Page 98

VISOR® Solar sensors check the correct position of the wafer and detect any broken edges during various phases of solar cell production.

- Precise detection of position and orientation of wafers and cells
- Breakage detection regardless of type of wafer or cell
- Edges monitored with sub-pixel accuracy
- Simple integration in just a few steps
- No background suppression necessary
- Measurement of wafers
- Position and orientation of busbars



Checking presence of wafers
Page 228 / Page 154

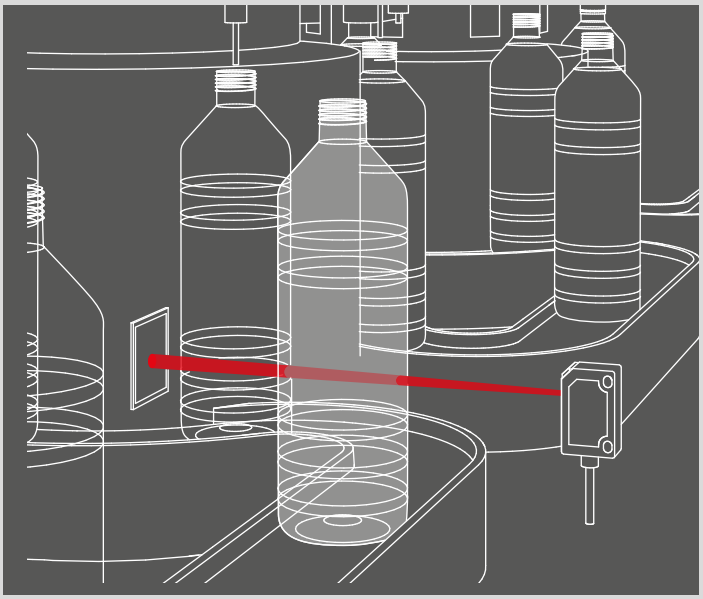
An **FT 10-RLH** sub-miniature scanner with background suppression detects the lowest wafer in the cassette. At the same time, an **FT 50-RLA** analogue laser distance sensor checks slot occupation from above.

- Bright, precise light spot for accurate switching behaviour and easy alignment
- Sub-miniature housing for installation in the smallest of spaces (dimensions only 21 x 14 x 8 mm^3)
- Reliable and precise height detection and determination with the **FT 50-RLA distance sensor**

Transparent objects

Checking presence of bottles, foils and small transparent parts

Transparent objects pose special challenges for sensors because their low absorption rates require very high switching sensitivity and accuracy. SensoPart offers special retroreflective photoelectric sensors **(FR 25-RGO)** as well as ultrasonic sensors (**UT 20, UT 20 Soundpipe, UMT 30** and cylindrical housings) for the reliable detection of such objects. This permits the reliable detection of transparent objects of any shape, and made of any material.



Checking the presence of bottles in a filling plant
Page 262

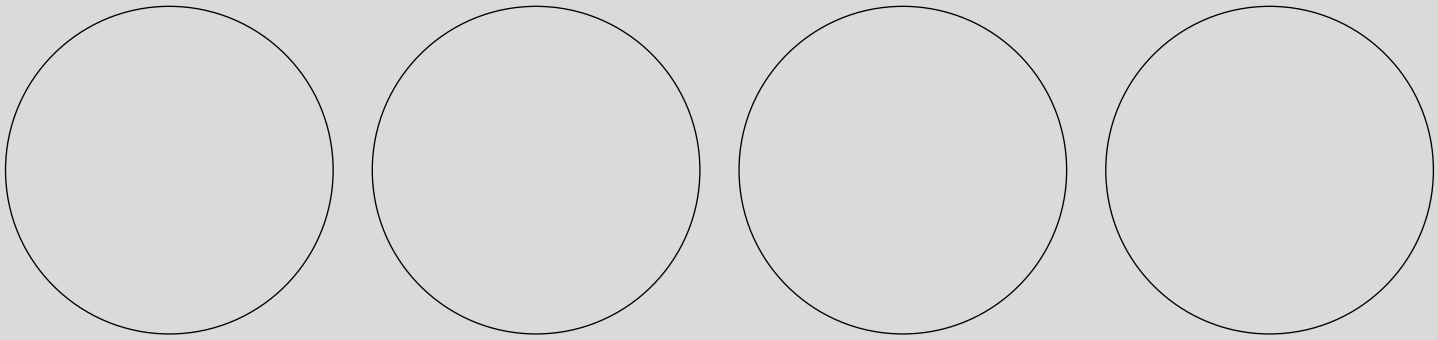
The **FR 25-RGO retroreflective photoelectric sensor** detects transparent bottles in a filling plant.

- Reliable detection of glass and transparent plastic using the autocollimation principle
- Reliable detection of any bottle diameters and objects, e.g. small ampoules in the pharmaceutical industry
- Trouble-free flat glass and foil detection
- Operating range of up to 2 m, reliable detection from range of 0 mm
- DELTA function: automatic adaptation of the sensor to changing ambient conditions

More applications:
Page 544

UT 20 Soundpipe ultrasonic sensors in cuboid housings and the **UMT 30 ultrasonic sensor** reliably detect transparent objects in various industrial sectors.

- Reliable detection of ampoules in the pharmaceutical industry
- Dependable monitoring of blister packages for tablets
- Reliable detection of transparent foils in the print industry
- Control of pallet packaging plants with transparent stretch foil



VISOR® vision sensors and the Eyesight vision systems

Image processing made simple!

VISOR® Object Sensor
from Page 62

V10-OB-S1-W12
- *Standard version configurable for two inspection tasks, up to 32 evaluations can be used for each inspection task*

>> Page 70

V20-OB-A2-W12
- *Advanced version configurable for 255 inspection tasks as required, with 255 evaluations per inspection task as desired*
- *Megapixel resolution*

>> Page 64



VISOR® Color
from Page 80

V10C-CO-S2-W12
- *Standard version for colour detection with up to 8 inspection tasks and up to 32 evaluations*

>> Page 88

V20C-CO-A2-W12
- *Advanced version for colour detection and object detection with up to 255 inspection tasks and up to 255 evaluations*

>> Page 82



VISOR® Solar Sensor
from Page 98

V10-SO-S1-W6
- *Standard version for detecting position and breakouts of wafers and cells*
- *Easy operation without previous knowledge of image processing*

>> Page 100

V10-SO-A1-W6
- *Advanced version for the comprehensive measurement of wafers and cells*
- *With busbar detection*

>> Page 102



Eyesight Vision System
from Page 106

V20-EYE-A2-C
- *Megapixel resolution (1280 x 1024 pixels) for higher precision*

>> Page 110

V10-EYE-A1-C
- *Complete image-processing package with robust and flexible hardware*
- *Standard resolution (736 x 480 pixels)*

>> Page 116



SensoPart covers the entire range of industrial image processing with its portfolio of vision solutions – from VISOR® plug & play solutions for standard applications to the freely configurable Eyesight vision system for particularly complex automation tasks.

Camera + Software = Vision!

A powerful smart camera in compact tightly sealed sensor housings with uniform dovetail mounting forms the basis of our VISOR® vision sensor and Eyesight vision systems. Among other features, it has integrated signal processing, LED illumination (white, red, infrared, UV), data interfaces and digital I/Os, integrated optics or C-mount, as well as user-friendly configuration software.

Most of the inspection tasks that are required in practice can be solved with one of our VISOR® vision sensors that are ready for use in just a few steps. With up to 50 evaluations per second, our VISOR® vision sensors are also the right choice for rapid processes.

And for particularly complex cases we offer the Eyesight, a flexible vision system with which you can also implement your most sophisticated automation requirements.



C-mount variants:
- *C-mount for many variants; can be combined with C-mount protective casings*
- *VISOR® V20 variants with megapixel resolution for high precision*

VISOR® Code Reader

from Page 118

V20-CR-P2-R12

- *Professional version with optical character reading (OCR)*
- *Megapixel resolution*

>> Page 126

V10-CR-A1-R12

- *Advanced version for detection of 1D/2D codes and objects*
- *Reads several different code types in a single reading pass*

>> Page 136



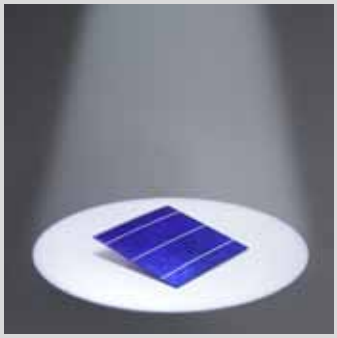
made in Germany



Object detection and classification:
The VISOR® object sensor monitors the sorting of parts and regulates ejection.



Detection of coloured objects:
The VISOR® Color sensor detects not only colours and colour intensities, but also "non-colours", i.e. white, black and grey.



Positioning and inspecting solar cells:
The VISOR® Solar sensor detects the position and orientation of wafers and cells, as well as any damage.



Code reading:
The VISOR® Code Reader detects all common printed and directly marked data matrix and bar codes.

Ready, steady, go!

VISOR® vision sensors – complexities made easy



Unpack, adjust and off you go – vision sensors have never before been so powerful and so easily and intuitively operated. The VISOR® is ready for operation in only ten minutes with just a few mouse clicks. Thanks to VISOR® technology from SensoPart, there is now also a simple and effective solution for the most difficult automation tasks. Whether objects with complex shapes, colour detection, data matrix codes, self-illuminating display elements, or edge breakouts on solar cells, our application-specific vision sensors reliably detect all relevant object features.

It's all there.

Housing:
Integrated evaluation unit with powerful signal processor
Vibration-proof with an enclosure rating of IP 67

Mounting:
Simple and flexible mounting thanks to dovetail design



Illumination:
Integrated LED illumination (white, red, infrared, UV)

Interfaces:
Integrated communication interfaces (Ethernet, serial interfaces, digital I/O)

Figure 1:1

Lens:
Integrated lens or C-mount variants for long operating distances



C-mount variants for long operating distances

VISOR® object sensor

System description

The VISOR® object sensor from SensoPart not only impresses with its excellent performance data, but also with its sophisticated operating concept: even the definition of complex inspection tasks is achieved rapidly and without complication thanks to its comfortable and easily understood user interface – even without detailed image-processing knowledge. You define and test your inspection tasks (jobs) and desired evaluations (detectors) in a few intuitive setup steps.

The effect of every setting is immediately visible in the image. Comprehensive logic functions allow the direct assignment of more complex inspection results to one of six digital result outputs (or even to 32 switching outputs via the I/O expansion module available as an accessory). Time-based control of signal output is also possible via the integrated encoder function. The integrated image recorder, with which you can carry out fault analyses and simulations, is also very helpful.

Everything in view with the Viewer: after completing configuration, the vision sensor works in your production plant autonomously, i.e. without a PC connection. Of course, data can be called up at any time during running operation: our own Viewer software with heriarchical user rights (reliably preventing unintentional changes to the configuration) is available for this. Professional image processing can be so simple and comfortable!w

Step-by-step to your goal

1. Job: select an inspection task or create a new one.

2. Position tracking: define a position detector (optional).

3. Detectors: define the desired evaluations.

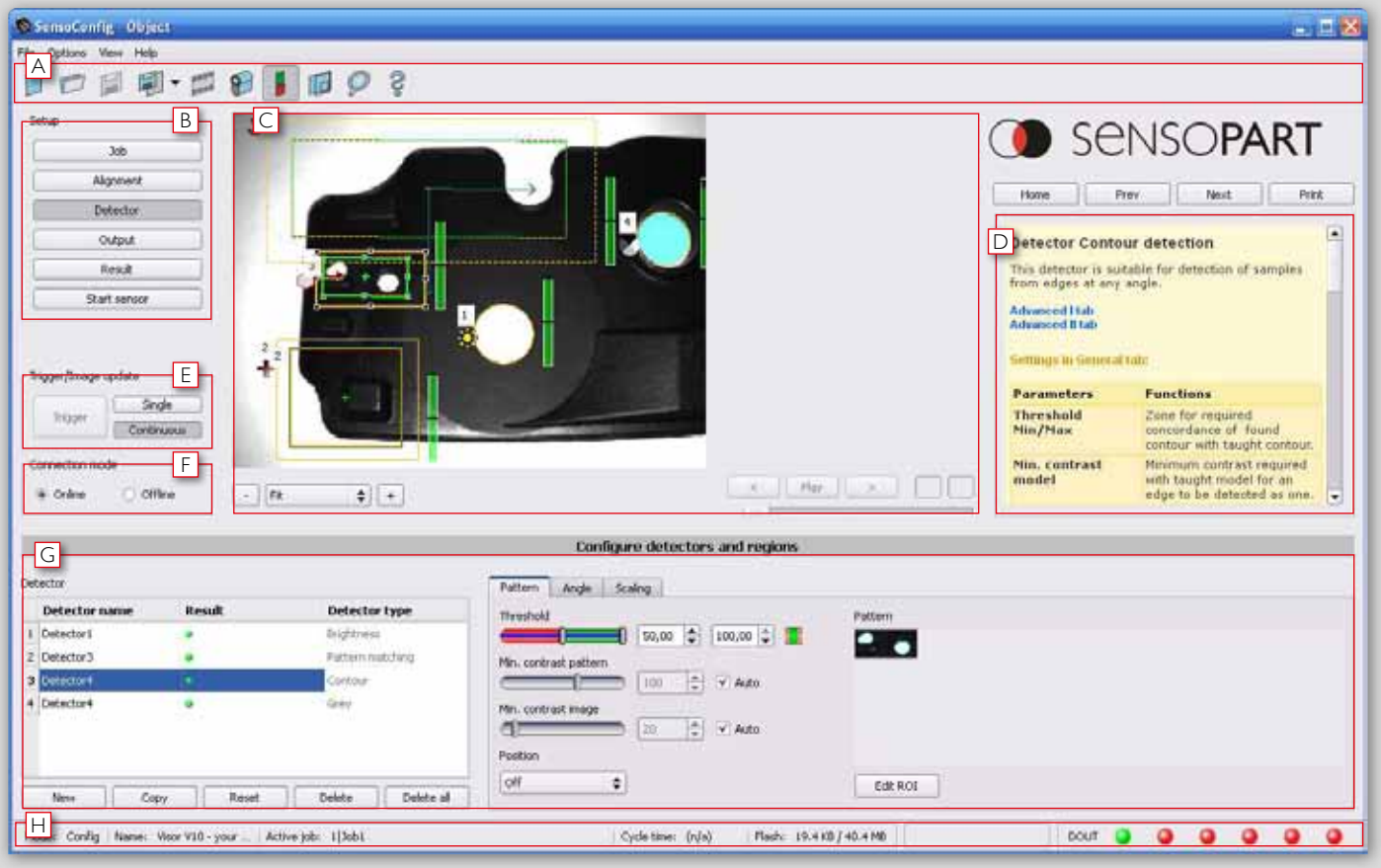
4. Output: assign the inspection results to the switching outputs.

5. Results: test your configuration.

6. Start the sensor: run your job on the sensor.

Product variants: the VISOR® object sensor

Features/sensors	Standard	Advanced
Functions		
Resolution V10 in pixels	736 × 480	736 × 480
Resolution V20 in pixels	–	1280 × 1024
Image rate per second V10 | V20	50 | –	40 | 50
Number of jobs | detectors	2 | 32	max. 255 | max. 255
Position tracking	–	✓
Contour (X-, Y-translation, rotation)	✓	✓
Pattern comparison (X-, Y-translation)	✓	✓
Grey threshold	✓	✓
Contrast	✓	✓
Brightness	✓	✓
Freeform Tool	Contour only	✓
Interfaces		
Inputs | outputs	2 | 4	2 | 4
Freely definable switching outputs/ inputs, PNP or NPN	2	4
Encoder input	–	✓
I/O expansion	–	✓
RS232 | RS422	– | –	✓ | ✓
Ethernet/data transmission	✓	✓
EtherNet/IP	✓	✓
PROFIBUS/interface connection	–	✓
Lens		
V10 integrated, 6 mm | 12 mm | 25 mm	✓ | ✓ | –	✓ | ✓ | ✓
V20 integrated, 12 mm	–	✓
C-mount	–	✓
Operation/visualisation		
Viewer software with user guidance	✓	✓
Hierarchical user rights	✓	✓



Overview of the user interface

A **Menu bar:** rapid access to the most important functions

B **Setup navigation:** dependable user guidance through the configuration process

C **Image window:** live picture of the object with graphic display of inspection area and results

D **Context help:** precise information on every work step

E **Trigger function:** triggered operation or free-running, single picture or serial switching

F **Online/offline operation:** operating with sensor connected or simulation with stored pictures

G **Configuration window:** input of parameters for every navigation step

H **Status line:** current information on active job and on state of outputs

VISOR® Color

System description

The vision colour sensors of the VISOR® Color series offer comprehensive functions for detecting coloured objects. Instead of the usual monochrome imaging chip they are equipped with a colour chip with a resolution of up to 1.3 megapixels (V20).

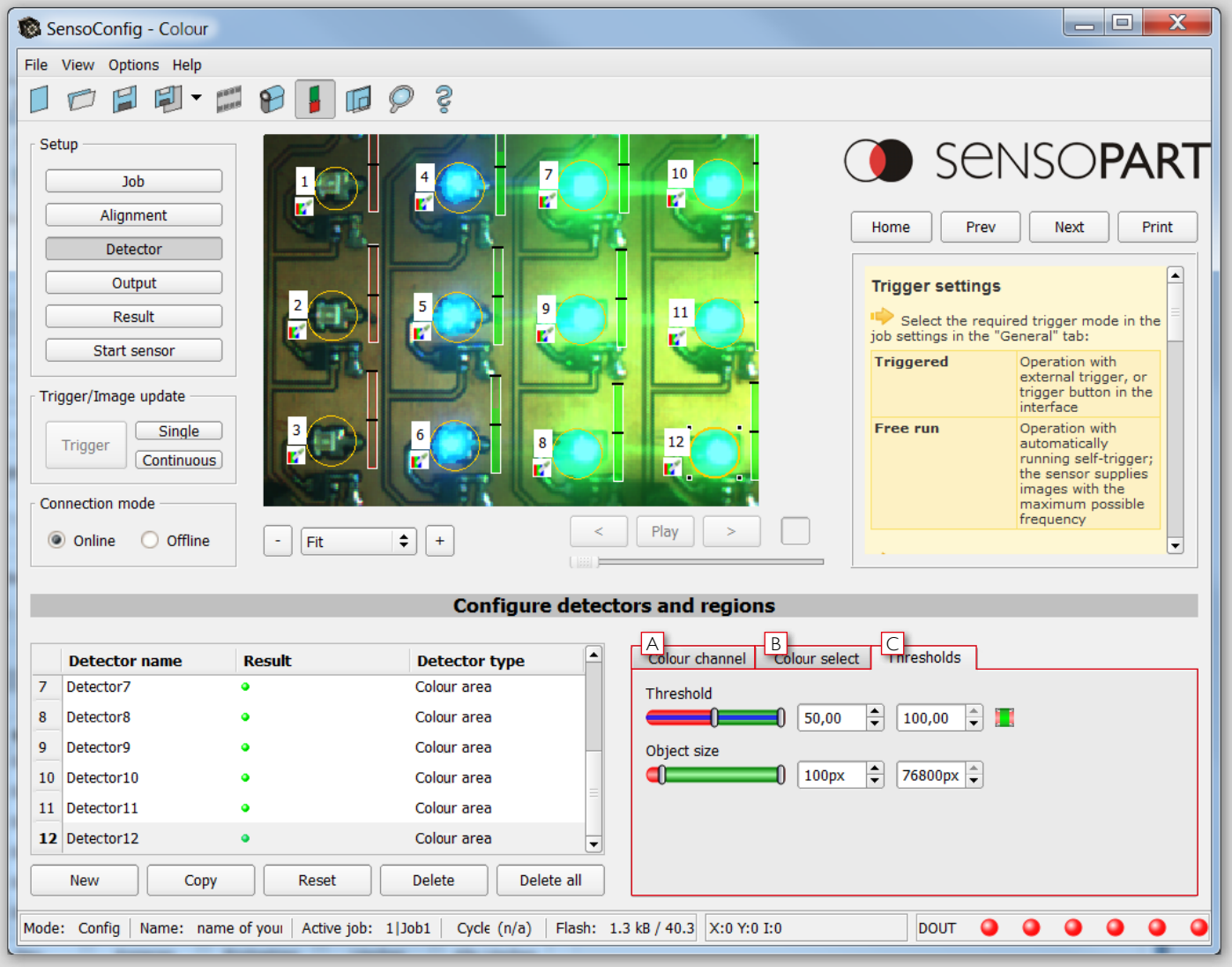
The comprehensive selection of detectors for object detection corresponds to the functional range of VISOR® object sensors. In addition to the detectors for sample comparison, contour, contrast, grey level, brightness and position tracking (selectable via sample comparison, contour or edge scanning), the VISOR® Color is also equipped with three detectors for colour detection. Three colour spaces (RGB, HSV, Lab) and several colour channels are available.

With the new colour detectors, the VISOR® Color is capable of differentiating between the finest of colour nuances. Any desired number of colours, colour gradients or colour patterns can be stored in the sensor memory and called up on demand. Moreover, objects with similar colours can be searched for.

Uniform operation for all VISOR® sensors
Setup of the VISOR® Color takes place via the proven intuitive user interface of the VISOR® series, with which even complex inspection tasks can be configured without detailed knowledge of image processing. Inspection tasks (jobs), position tracking (alignment) and the desired evaluations (detector) can be configured and tested in a few intuitively understandable setup steps. The effect of every setting is immediately visible in the image. Comprehensive logic functions allow the direct assignment of complex inspection results to one of six digital results outputs. With the help of the I/O expansion, available as an accessory, it is even possible to trigger up to 32 supplementary switching outputs.

Product variants: VISOR® Color

Features/sensors	Standard	Advanced
Functions		
Resolution, V10	736 x 480 Color	736 x 480 Color
Resolution, V20	–	1280 x 1024 Color
Image rate per second V10 | V20	40 | –	40 | 20
Number of jobs | detectors	8 | 32	max. 255 | max. 255
Position tracking	✓	✓
Contour (X-, Y-translation, rotation)	✓	✓
Sample comparison (X-, Y-translation)	–	✓
Grey level	–	✓
Contrast	✓	✓
Brightness	–	✓
Colour value	–	✓
Colour area	✓	✓
Colour list	–	✓
Free-form tool	–	✓
Interfaces		
Inputs | outputs	2 | 4	2 | 4
Freely definable switching inputs / outputs, PNP or NPN	2	4
Encoder input	–	✓
Interface for IO box	–	✓
RS232 | RS422	– | –	✓
Ethernet / Data transfer	✓	✓ | ✓
EtherNet / IP	✓	✓
PROFIBUS interface	–	✓
Lens		
V10 integrated, 6 mm | 12 mm | 25 mm	✓ | ✓ | –	✓ | ✓ | ✓
V20 integrated, 12 mm	–	✓
C-mount	–	✓
Operation / visualization		
Viewer software with user guidance	✓	✓
Graded user rights	✓	✓



Overview of the user interface

A **Colour channel:** selection of the colour space and the colour channels in which the detector is to operate.

B **Colour selection:** setting of the colour to be searched for.
A good/bad result is generated depending on the proportion of the area.

C **Thresholds:** setting of the threshold for the good/bad signal.

VISOR® Solar sensor

System description

The tailor-made solution for wafer handling.
The VISOR® Solar sensor can be configured for image processing with a few clicks and without previous knowledge. The user defines the inspection criteria and selects the relevant information, e.g. wafer position and orientation, wafer dimensions, breakout depth, position and orientation of the busbar, or wafer quality.

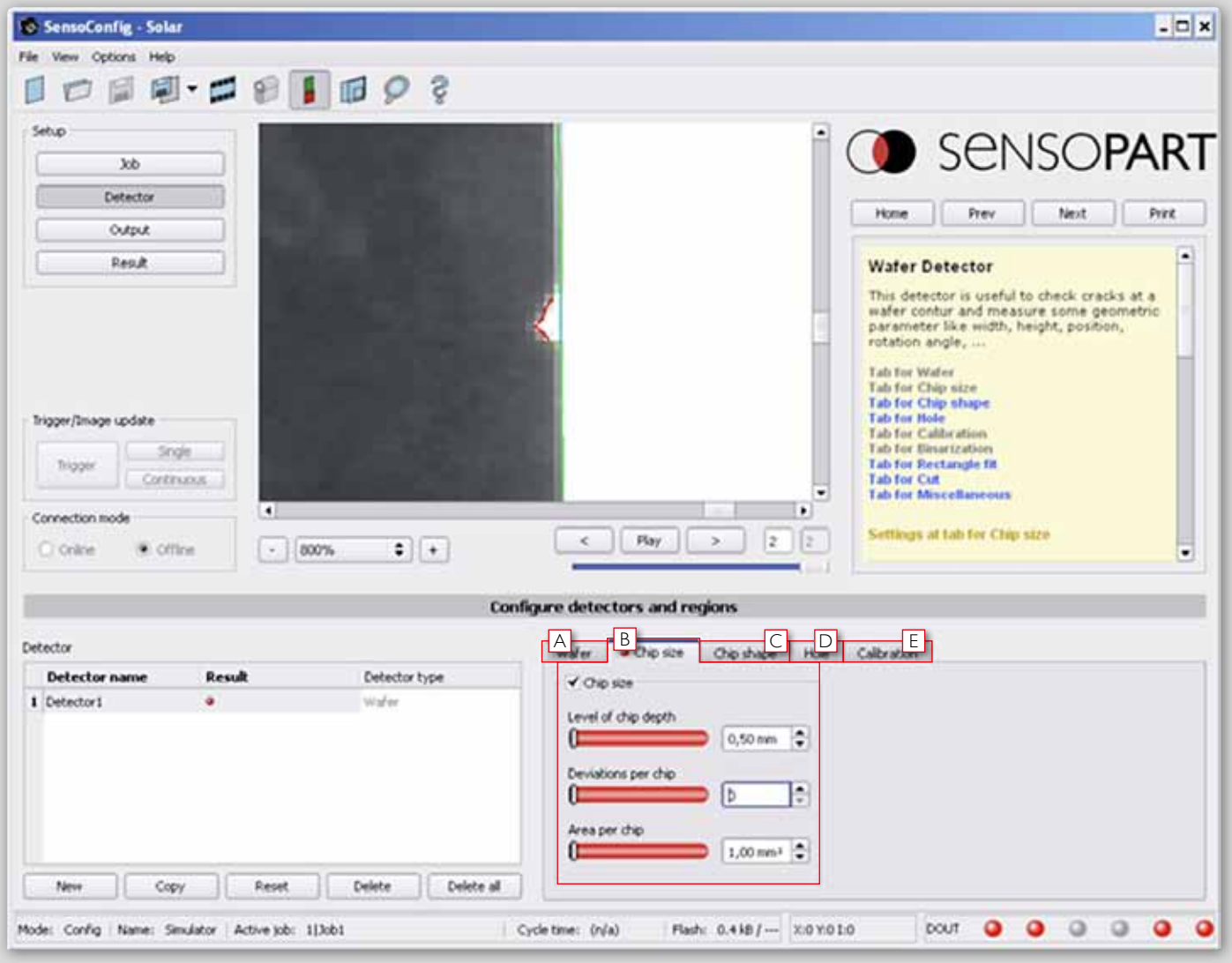
Plug & play: using the VISOR® Solar sensor is much easier than a classic image-processing solution. Because the functions relevant for wafer and cell inspections, e.g. the detection of wafer geometry and any defects, are already pre-configured so that the sensor is ready for operation after just a few mouse clicks. This is quick, doesn't cost much and functions wonderfully. Sunny times await you!

HIGHLIGHTS OF THE VISOR® SOLAR SENSOR

- Simple integration
- Precise position detection to ± 50 µm
- Finds breakouts from depth of 0.50 mm
- Detection of holes
- Conveyor systems can be cut out
- Short cycle times from 60 ms
- Reliable operation, even in daylight
- No backlight necessary
- Little space required: operating distance from 360 mm

Product variants: the VISOR® Solar sensor

Features/sensors	Standard	Advanced
Functions		
Resolution in pixels	736 x 480	736 x 480
Image rate per second	50	50
Number of jobs | detectors	2 | 32	255 | 255
Position tracking	–	✓
Pattern comparison (X-,Y-translation)	–	✓
Grey threshold	✓	✓
Contrast	✓	✓
Brightness	✓	✓
Wafer position and breakouts	✓	✓
Busbar position and number	–	✓
Interfaces		
Inputs | outputs	2 | 4	2 | 4
Freely definable switching outputs/ inputs, PNP or NPN	2	4
Encoder input	–	✓
I/O expansion	–	✓
RS232 | RS422	– | –	✓ | ✓
Ethernet/data transmission	✓	✓
EtherNet/IP	✓	✓
PROFIBUS/interface connection	–	✓
Lens		
Integrated 6 mm | 12 mm	✓ | –	✓ | ✓
C-mount	–	✓
Operation/visualisation		
Viewer software with user guidance	✓	✓
Hierarchical user rights	✓	✓



Overview of the user interface

A **Wafer:** select wafer size.

B **Breakout dimensions:** define good / bad criteria according to the size of the breakout.

C **Breakout shape:** detection of differentiate shaped breakouts.

D **Holes:** reject wafers with holes.

E **Calibration:** the camera is calibrated with one click.

Eyesight vision system

System description

Most image-processing applications can be rapidly and easily solved with pre-configured VISOR® vision sensors. However, their range of functions is not always sufficient for particularly demanding or specific tasks – but here, too, SensoPart has the right solution: the freely programmable Eyesight vision system offers comprehensive configuration possibilities so that you can also implement very complex automation applications with the smart camera. Whereby complex is not synonymous with complicated: the graphic programming by means of drag & drop makes it easy for you to "construct" your own applications.

EYESIGHT HIGHLIGHTS

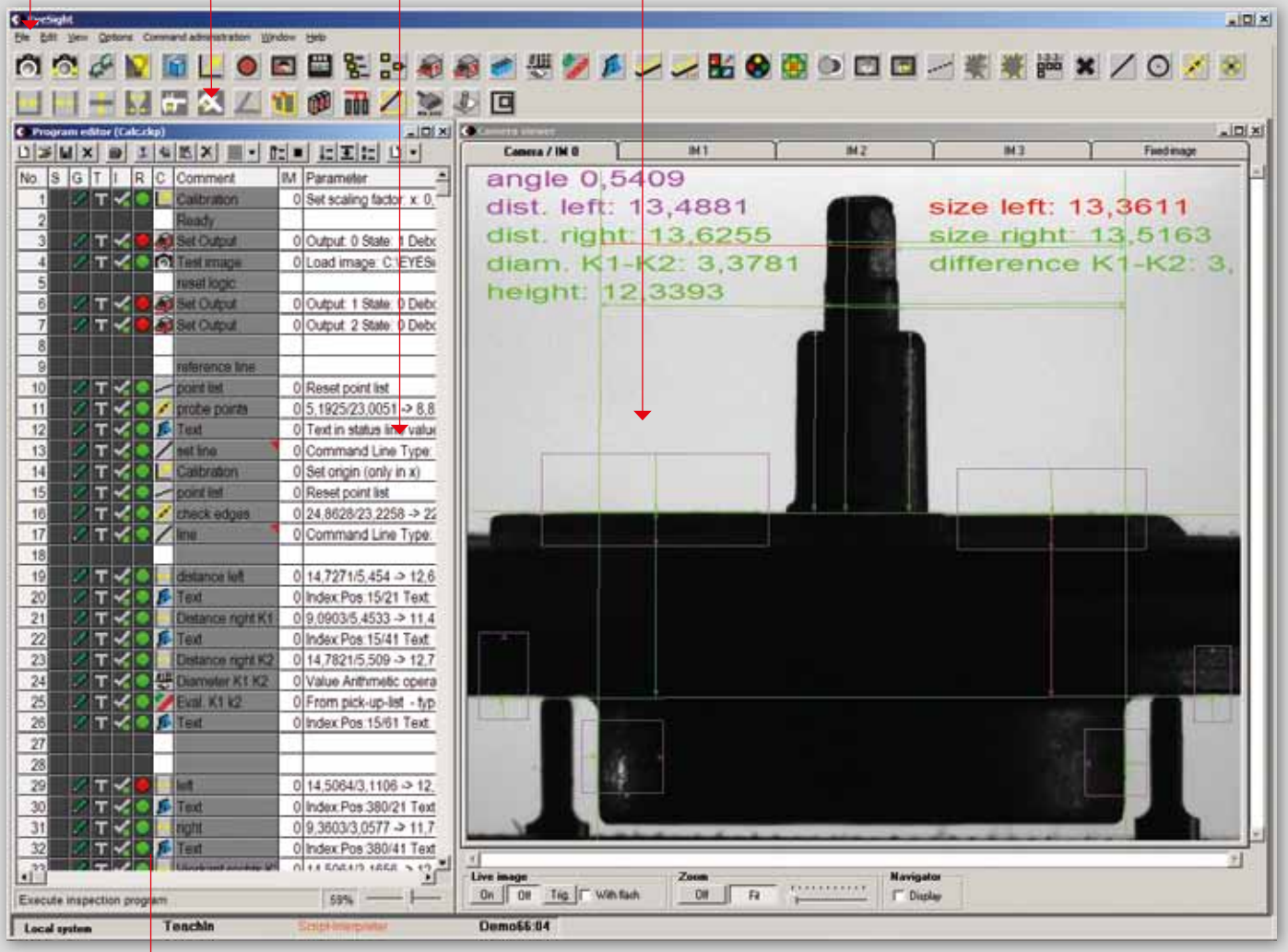
- Complete image-processing package with robust and flexible smart camera
- Programming via drag & drop of function blocks
- Complex iterative linkage of individual inspections
- Image and result visualisation in inspection mode
- Interpreter for programming your own functions
- Image processing can be simulated on the PC without the camera
- Freely programmable data protocol for Ethernet and serial interface

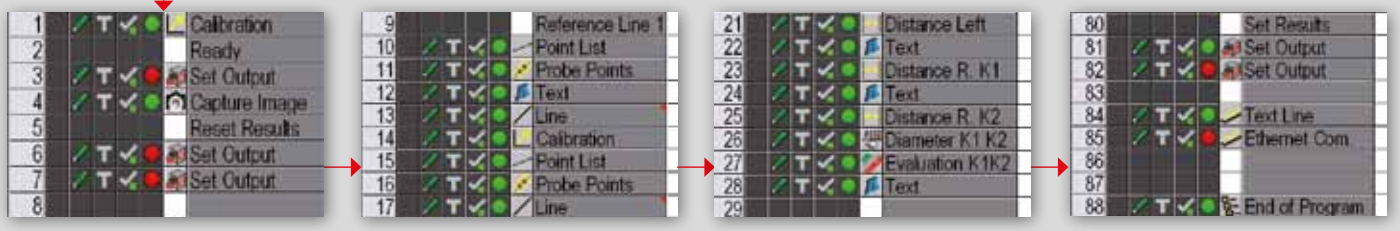
Product variants: the Eyesight vision system

Features/sensors	V20 Advanced	V10 Advanced	V20C Advanced	V10C Advanced
Functions				
Resolution in pixels	1280 x1024, monochrome	736 x 480, monochrome	1280 x1024, color	736 x 480, color
Image rate per second	40	50	20	40
Number of inspection programs	No limitation (max. 40 Mb)	No limitation (max. 40 Mb)	No limitation (max. 40 Mb)	No limitation (max. 40 Mb)
Function blocks	See overview of commands >> Page 60	See overview of commands >> Page 60	See overview of commands >> Page 60	See overview of commands >> Page 60
Interfaces				
Inputs | outputs	2 | 4	2 | 4	2 | 4	2 | 4
Freely definable switching outputs/inputs	4	4	4	4
I/O expansion	✓	✓	✓	✓
RS422 | RS232	✓ | ✓	✓ | ✓	✓ | ✓	✓ | ✓
Ethernet/data transmission	✓	✓	✓	✓
Lens				
Integrated 6 mm | 12 mm	– | ✓	✓ | ✓	– | ✓	✓ | ✓
C-mount	✓	✓	✓	✓
Operation/visualisation				
Viewer software eye view	✓	✓	✓	✓

Overview of the user interface

Menu bar | Command bar | Programme Editor | Camera viewer





Step-by-step to your goal

Step 1

Image capture

- *Calibration*
- *Reset outputs*
- *Enter triggered image*

Step 2

Referencing

- *Object position determination*
- *Define object reference lines*
- *Graphic provision of position*

Step 3

Inspection of parts

- *Measure distances/diameter*
- *Calculate difference values*
- *Define target/actual values*
- *Graphic provision of measurement values*

Step 4

Output of results

- *Set outputs according to results logic*
- *Transmit data to the master computer via Ethernet*
- *End programme*

Eyesight vision system

System description

Overview of commands: Eyesight vision system

Image/camera

- Image capture
- Camera settings

Colours *

- Select colour channel
- Colour inspection
- Colour filter

Pre-processing

- Calibration and position tracking
- Correct brightness
- Remove background
- Filter functions

Inputs/outputs

- Test input
- Set output
- Access INI file

Inputs/outputs

- Text
- Data transfer, serial
- Data transfer, LAN (text line)

Visualisation

- Image transfer

Measurement

- Image information
- Area test
- List of points
- Determine points
- Determine lines
- Calculate circle
- Calculate distance
- Line distance
- Calculate cross-section

Measurement

- Measure gap width
- Caliper (hor./vert.)
- Caliper (free)
- Calculate angle
- Determine warpage point

Programme control

- Stop watch
- Control of sequence and loop options
- Run subprogramme
- Access variable
- Evaluation

Sample/contour comparison

- Count objects
- Inspect contour
- Track contour

Pattern/contour comparison

- Correlation

Scanning

- Scan points
- Circular scanner
- Edge counter (straight)
- Find edges (projected)
- Search ring for counting

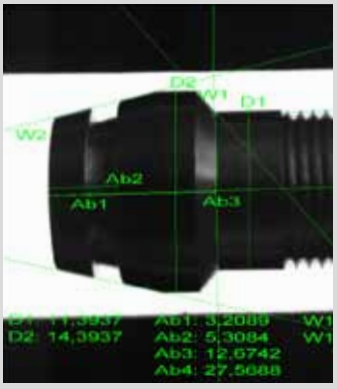
Access to libraries

- Script Interpreter

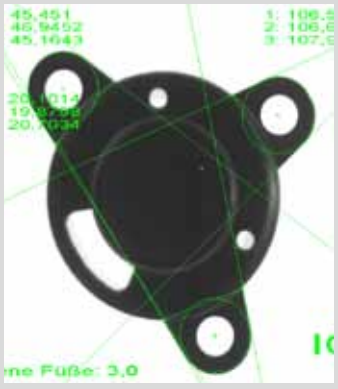
* with colour version



Circle calculator:
Round objects or segments of circles can be measured with this tool for easy detection of deformations. An example of this would be checking for underfilling or overfilling during the plastic process.



Angle calculation:
Components can be tested for dimensional accuracy with the measurement tool. Angles on components, for example, can be determined and evaluated with the angle tool. The thread is also checked for completeness and the dimensions are checked with the help of the distance tool.



Distance calculation:
Any distances in the component can be measured and evaluated with the distance tool. In addition, radii, angles, and drilled holes can also be checked in an inspection programme.

Accessories for VISOR® vision sensors and the Eyesight vision system

System description

Good lighting is all-important for image-processing applications – because the best evaluation system cannot compensate for anything that has already been lost during image capture. This is why all our vision systems have powerful integrated illumination that is more than bright enough for most applications. Supplementary illumination may be helpful, however, in critical lighting situations, e.g. with strong ambient light incidence, or highly reflective or strongly contoured objects. SensoPart offers a comprehensive selection of surface, ring and diffuse lighting with which all applications can be properly illuminated.

Integrated lens or C-mount? In most cases you will also have no problem with the integrated lens of your vision sensor. If necessary for the application, however, with very long measurement distances for example, a C-mount version with a separate lens is available.

The SensoPart range also covers all eventualities with other accessories, from mounting brackets, through interface cables, to I/O expansion. Because we want to be sure that you are missing nothing!

A few basics regarding good illumination

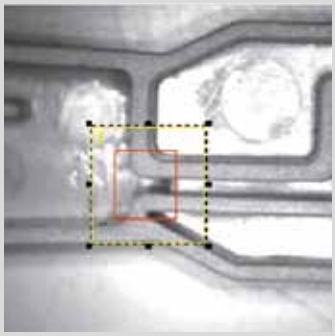


White, red or infrared light?
White light can be used everywhere because it includes the whole spectrum of light, so it achieves good contrast with objects of differing surface properties and colours. Red or infrared light is recommended, on the other hand, for the targeted highlighting or suppression of coloured object features or for eliminating ambient light effects.

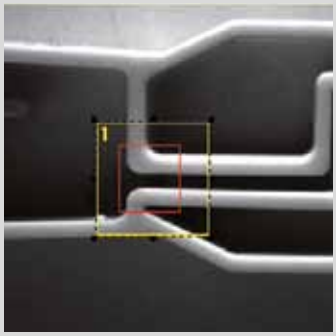


Surface or ring lighting?
Every structure has its specific virtues. Surface lighting, for example, is often used for backlit applications in which the target object is lit from behind – so that the external contours are strongly highlighted. Very symmetrical incidental illumination can be implemented with ring lighting, and diffuse illumination is recommended for, among other things, strongly reflective surfaces.

With a bright field
Edges and background are difficult to differentiate.



With a dark field
Edges are clearly highlighted using dark field illumination.



Light or dark field?
Targeted features can be amplified, and interfering effects suppressed, by using the right illumination. Light or reflective features are well differentiated when an object is illuminated from the direction of the sensor (light field); if the light is directed towards the sensor at a slight angle (dark field), the structures of the target object are more strongly differentiated.

VISOR® object sensor for part detection

Detects the right part in the wrong place and vice versa





Glue dot present?
Early detection by monitoring presence – in this case caps for the beverages packaging industry – long before quality assurance. Preventing expensive rejections.



Position and position tolerance measurement:
The sensor "learns" the contours and their direction from a picture, and reacts reliably to deviations. The sensor responds correctly even if a nut is the wrong way round.



Spout present or not?
Too much shrinking – or too little? The Vision object sensor's contour detector keeps an eye on all the relevant details during the production of blood bags.

HIGHLIGHTS OF VISOR® OBJECT SENSOR

- User-friendly configuration and viewer software with hierarchical user rights and online help
- Powerful part-finding and tracking
- Precise position determination: x/y-position and orientation
- Comprehensive logic functions for the digital switching outputs
- Flexible definition of output data (header, trailer, net data)
- Support of EtherNet/IP and DHCP
- Comprehensive possibilities for archiving pictures and data

Objects that sometimes appear in unexpected positions and have complex shapes and details – classic switching sensors would be completely overwhelmed by such detection tasks. Not the VISOR® object sensor from SensoPart: it always maintains its overview, detecting defective parts, parts in the wrong position, wrong orientation, wrong sequence or a combination of them all – in an instant. With its highly precise position and orientation detection, our VISOR® object sensor is one of the best in its class.

Five detectors plus position detection

A total of five detectors are available for inspection tasks and evaluations: pattern comparison, contour detection, brightness, grey threshold and contrast detection. The Advanced version of the VISOR® object sensor also offers position tracking, among other things: this permits reliable detection of those features that are not always present in precisely the taught-in position. All evaluations take place relative to the current part position and orientation, without them having to be defined for every possible position of an individual feature. This powerful tool allows you to solve even demanding applications confidently!

VISOR® Object Sensors – Product Overview

	Firmware Option	Resolution	Focal Length	Integrated illumination	Page
V20-OB-A2-xxx	Advanced	1280 x 1024 pixels	12 mm	White, red or infrared LEDs	64
V20-OB-A2-xxx	Advanced	1280 x 1024 pixels	C-mount	None	66
V10-OB-S1-xxx	Standard	736 x 480 pixels	6 mm	White, red or infrared LEDs	68
V10-OB-S1-xxx	Standard	736 x 480 pixels	12 mm	White, red or infrared LEDs	70
V10-OB-A1-xxx	Advanced	736 x 480 pixels	6 mm	White, red or infrared LEDs	72
V10-OB-A1-xxx	Advanced	736 x 480 pixels	12 mm	White, red or infrared LEDs	74
V10-OB-A1-xxx	Advanced	736 x 480 pixels	25 mm	White, red or infrared LEDs	76
V10-OB-A1-xxx	Advanced	736 x 480 pixels	C-mount	None	78

VISOR® V20 object sensor

Advanced vision sensor for object detection, 12 mm



PRODUCT HIGHLIGHTS

- User-friendly configuration and viewer software with hierarchical user rights
- Object detection with 1.3 mega pixel
- Powerful part-finding and tracking
- Precise position determination: X/Y-position and orientation
- Comprehensive logic functions for digital switching outputs
- Encoder input

Optical data	
Resolution	1280 x 1024 pixels
CMOS	1/1.8", monochrome
Integrated lens, focal length	12 mm, adjustable focal position
Adjustment range	30 mm to infinity
Integrated illumination	White, red, infrared LEDs
Minimum field of view, X x Y	16 x 13 mm[2]

Functions	
Number of jobs / detectors	max. 255 / max. 255
Detectors	Contour, pattern comparison, contrast, brightness, grey level
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast
Typical cycle times[2]	Typ. 20 ms pattern comparison Typ. 30 ms contour Typ. 2 ms brightness Typ. 2 ms contrast Typ. 2 ms grey threshold

Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Ca. 13 s after Power on
Outputs	PNP / NPN (switchable)
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP/NPN High > U_B-1 V, Low < 3 V
Input resistance	> 20 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

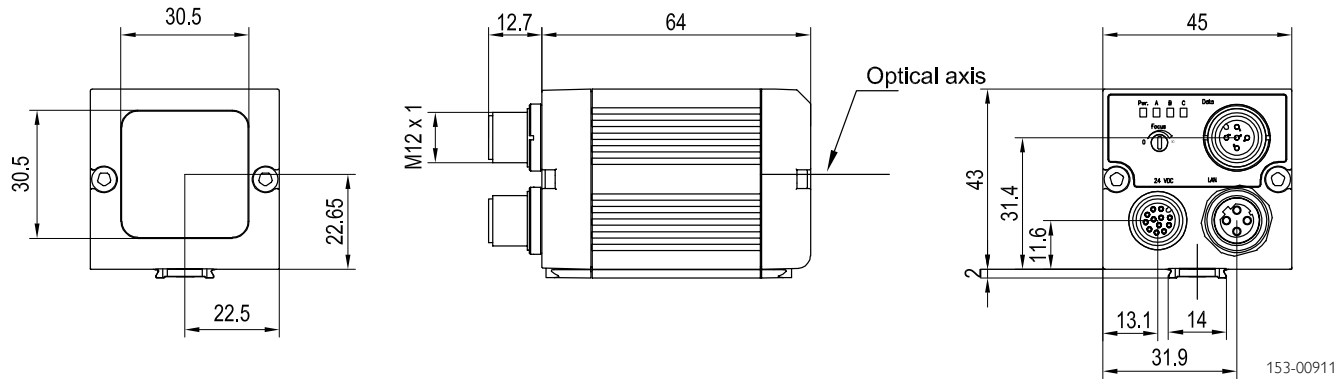
Mechanical data	
Dimensions	65 x 45 x 45 mm[3] (without plug)
Enclosure rating	IP 67
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50° C[3]
Ambient temperature: storage	-20 … +60° C[3]
Weight	Ca. 160 g
Plug connections	Supply and I/O M12, 12-pin Ethernet M12, 4-pin Data M12, 5-pin
Vibration and impact resistance	EN 60947-5-2

[1] Max. ripple < 5 V_{SS} [2] with VGA-resolution (640 x 480 pixels) [3] 80 % air humidity, non-condensing

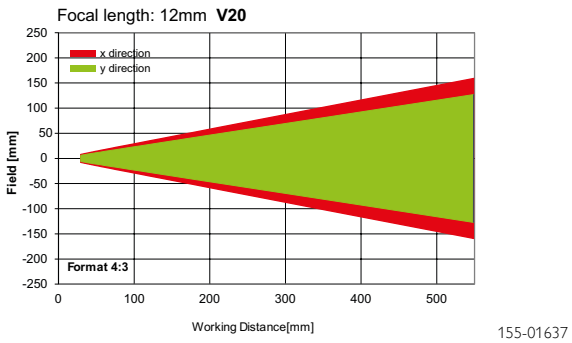
Illumination	Part number	Article number
White	V20-OB-A2-W12	536-91011
Red	V20-OB-A2-R12	536-91012
Infrared	V20-OB-A2-I12	536-91013

Version: 10/2013. Subject to changes; diagrams similar

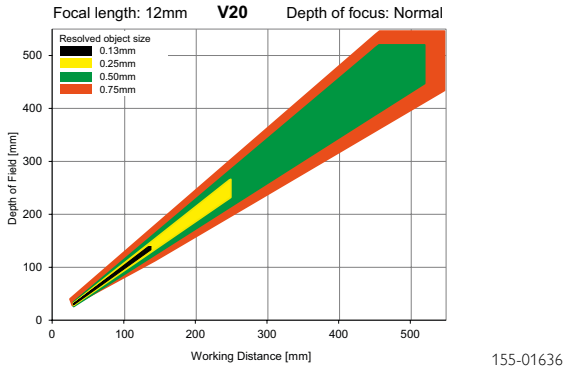
VISOR® vision sensor



Field of view



Depth of field: normal



Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Brackets	From Page A-4
Interface accessories	From Page A-36

VISOR® V20 object sensor

Advanced vision sensor for object detection, C-mount



PRODUCT HIGHLIGHTS

- User-friendly configuration and viewer software with hierarchical user rights
- Object detection with 1.3 mega pixel
- Powerful part-finding and tracking
- Precise position determination: X/Y-position and orientation
- Comprehensive logic functions for digital switching outputs
- Encoder input

Optical data	
Resolution	1280 x 1024 pixels
CMOS	1/1.8", monochrome
Integrated lens, focal length	C-Mount
Adjustment range	Dependent on lens
Integrated illumination	None
Minimum field of view, X x Y	Dependent on lens

Functions	
Number of jobs / detectors	max. 255 / max. 255
Detectors	Contour, pattern comparison, contrast, brightness, grey level
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast
Typical cycle times[2]	Typ. 20 ms pattern comparison Typ. 30 ms contour Typ. 2 ms brightness Typ. 2 ms contrast Typ. 2 ms grey threshold

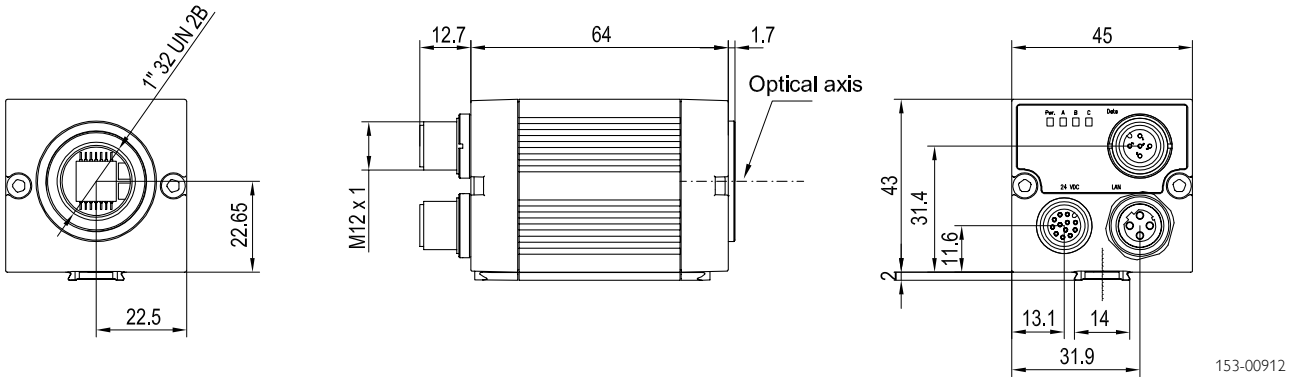
Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Ca. 13 s after Power on
Outputs	PNP / NPN (switchable)
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP/NPN High > U_B-1 V, Low < 3 V
Input resistance	> 20 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm[3] (without plug)
Enclosure rating	IP 65[3]
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50 °C[4]
Ambient temperature: storage	-20 … +60 °C[4]
Weight	Ca. 160 g
Plug connections	Supply and I/O M12, 12-pin Ethernet M12, 4-pin Data M12, 5-pin
Vibration and impact resistance	EN 60947-5-2

[1] Max. ripple < 5 V_{SS} [2] With VGA-resolution (640 x 480 Pixel) [3] With LPT45 C-mount protective casing [4] 80 % air humidity, non-condensing

Part number	Article number
V20-OB-A2-C	536-91010

VISOR® vision sensor



Lens



	LO C 8	LO C 12	LO C 16	LO C 25	LO C 50
Focal length	8 mm	12 mm	16 mm	25 mm	50 mm
Article number	526-51513	526-51514	526-51515	526-51516	526-51113

Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Lenses	From Page A-23
Brackets	From Page A-4
Interface accessories	From Page A-36

VISOR® V10 object sensor

Standard vision sensor for object detection, 6 mm



PRODUCT HIGHLIGHTS

- User-friendly configuration and viewer software with hierarchical user rights
- Detectors for object detection
- Powerful part-finding
- Precise position determination: X/Y-position and orientation
- Comprehensive logic functions for digital switching outputs

Optical data	
Resolution	736 x 480 pixels
CMOS	1/3", monochrome
Integrated lens, focal length	6 mm, adjustable focal position
Adjustment range	6 mm to infinity
Integrated illumination	White, red, infrared LEDs
Minimum field of view, X x Y	5 x 4 mm²

Functions	
Number of jobs / detectors	2 / 32
Detectors	Contour, pattern comparison, contrast, brightness, grey level
Properties	Pattern comparison / contour: teach-in and detection of patterns and contours; grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast
Typical cycle times	Typ. 20 ms pattern comparison Typ. 30 ms contour Typ. 2 ms brightness Typ. 2 ms contrast Typ. 2 ms grey threshold

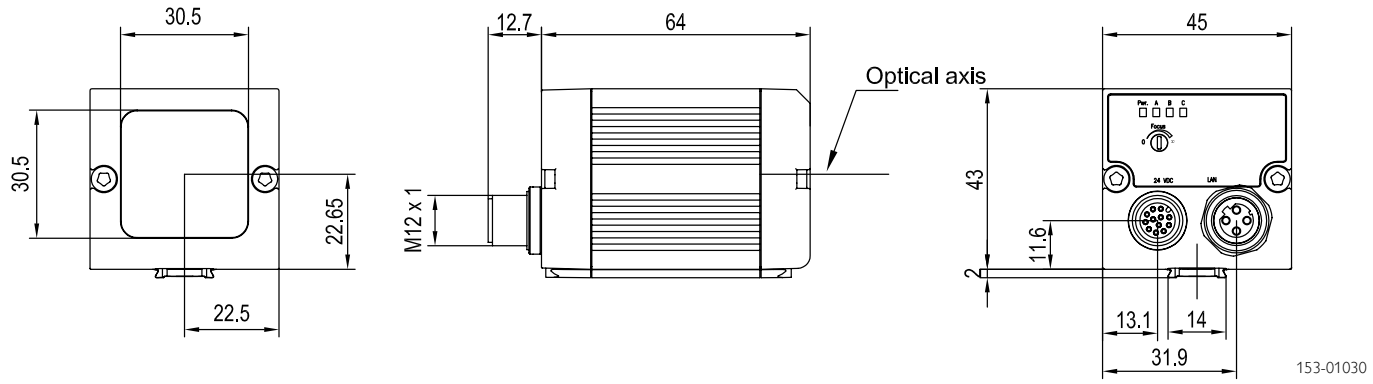
Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Ca. 13 s after Power on
Outputs	PNP / NPN (switchable)
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP/NPN High > U_B-1 V, Low < 3 V
Input resistance	> 20 kOhm
Interfaces	Ethernet (LAN), EtherNet/IP
Inputs/outputs	2 inputs, 4 outputs, 2 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm³ (without plug)
Enclosure rating	IP 67
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50 °C[2]
Ambient temperature: storage	-20 … +60 °C[2]
Weight	Ca. 160 g
Plug connections	Supply and I/O M12, 12-pin Ethernet M12, 4-pin
Vibration and impact resistance	EN 60947-5-2

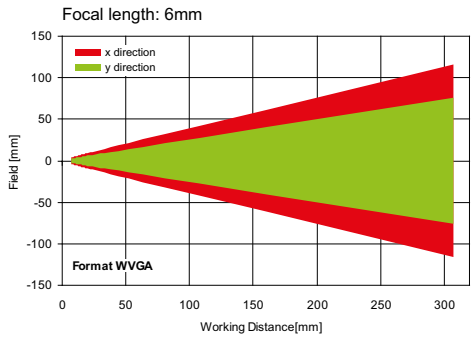
[1] Max. ripple < 5 V_{SS} [2] 80 % air humidity, non-condensing

Illumination	Depth of field	Part number	Article number
White	Normal	V10-OB-S1-W6	535-91008
Red	Normal	V10-OB-S1-R6	535-91010
Infrared	Normal	V10-OB-S1-I6	535-91046

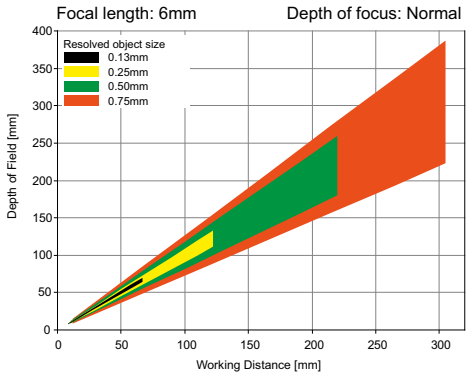
VISOR® vision sensor



Field of view



Depth of field: normal



Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Brackets	From Page A-4
Interface accessories	From Page A-36

VISOR® V10 object sensor

Standard vision sensor for object detection, 12 mm



PRODUCT HIGHLIGHTS

- User-friendly configuration and viewer software with hierarchical user rights
- Detectors for object detection
- Powerful part-finding
- Precise position determination: X/Y-position and orientation
- Comprehensive logic functions for digital switching outputs

Optical data	
Resolution	736 x 480 pixels
CMOS	1/3", monochrome
Integrated lens, focal length	12 mm, adjustable focal position
Adjustment range	30 mm to infinity
Integrated illumination	White, red, infrared LEDs
Minimum field of view, X x Y	8 x 6 mm²

Functions	
Number of jobs / detectors	2 / 32
Detectors	Contour, pattern comparison, contrast, brightness, grey level
Properties	Pattern comparison / contour: teach-in and detection of patterns and contours; grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast
Typical cycle times	Typ. 20 ms pattern comparison Typ. 30 ms contour Typ. 2 ms brightness Typ. 2 ms contrast Typ. 2 ms grey threshold

Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Ca. 13 s after Power on
Outputs	PNP / NPN (switchable)
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP/NPN High > U_B-1 V, Low < 3 V
Input resistance	> 20 kOhm
Interfaces	Ethernet (LAN), EtherNet/IP
Inputs/outputs	2 inputs, 4 outputs, 2 selectable inputs/outputs

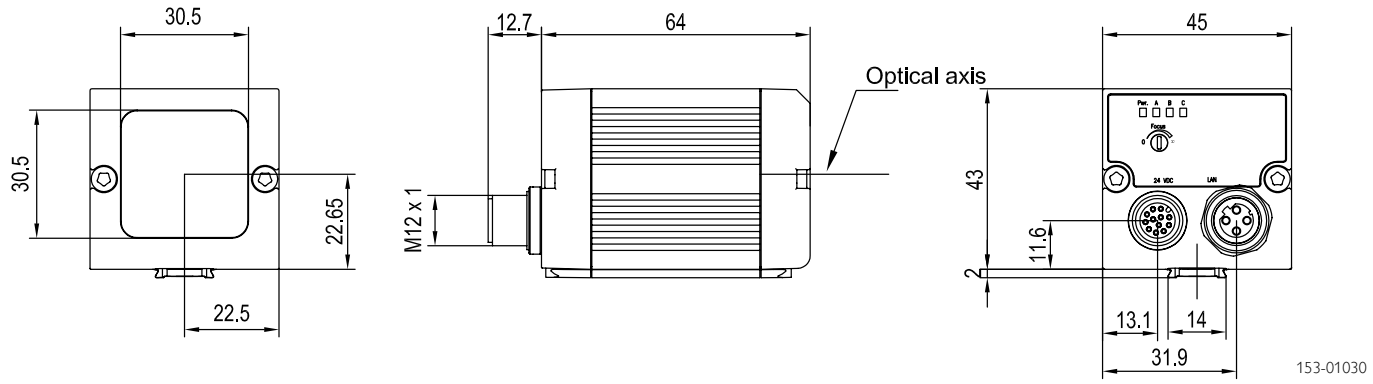
Mechanical data	
Dimensions	65 x 45 x 45 mm³ (without plug)
Enclosure rating	IP 67
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50 °C[2]
Ambient temperature: storage	-20 … +60 °C[2]
Weight	Ca. 160 g
Plug connections	Supply and I/O M12, 12-pin Ethernet M12, 4-pin
Vibration and impact resistance	EN 60947-5-2

[1] Max. ripple < 5 V_{SS} [2] 80 % air humidity, non-condensing

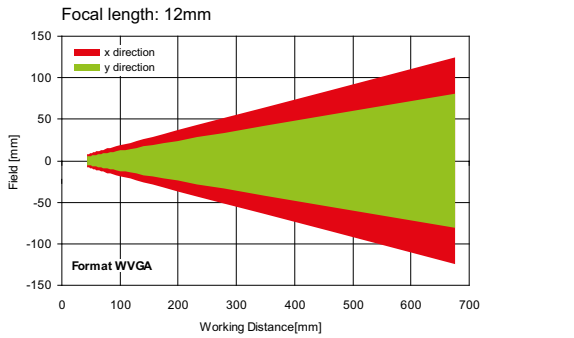
Illumination	Depth of field	Part number	Article number
White	Normal	V10-OB-S1-W12	535-91009
Red	Normal	V10-OB-S1-R12	535-91011
Infrared	Normal	V10-OB-S1-I12	535-91047

Version: 10/2013. Subject to changes; diagrams similar

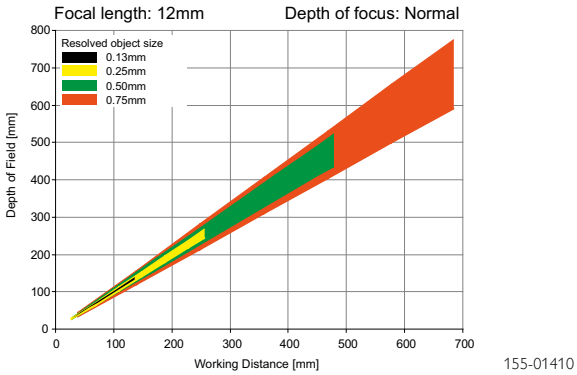
VISOR® vision sensor



Field of view



Depth of field: normal



Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Brackets	From Page A-4
Interface accessories	From Page A-36

VISOR® V10 object sensor

Advanced vision sensor for object detection, 6 mm



PRODUCT HIGHLIGHTS

- User-friendly configuration and viewer software with hierarchical user rights
- Detectors for object detection
- Powerful part-finding and tracking
- Precise position determination: X/Y-position and orientation
- Comprehensive logic functions for digital switching outputs
- Encoder input

Optical data	
Resolution	736 x 480 pixels
CMOS	1/3", monochrome
Integrated lens, focal length	6 mm, adjustable focal position
Adjustment range	6 mm to infinity
Integrated illumination	White, red, infrared LEDs
Minimum field of view, X x Y	5 x 4 mm²

Functions	
Number of jobs / detectors	max. 255 / max. 255
Detectors	Contour, pattern comparison, contrast, brightness, grey level
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast
Typical cycle times	Typ. 20 ms pattern comparison Typ. 30 ms contour Typ. 2 ms brightness Typ. 2 ms contrast Typ. 2 ms grey threshold

Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Ca. 13 s after Power on
Outputs	PNP / NPN (switchable)
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP/NPN High > U_B-1 V, Low < 3 V
Input resistance	> 20 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

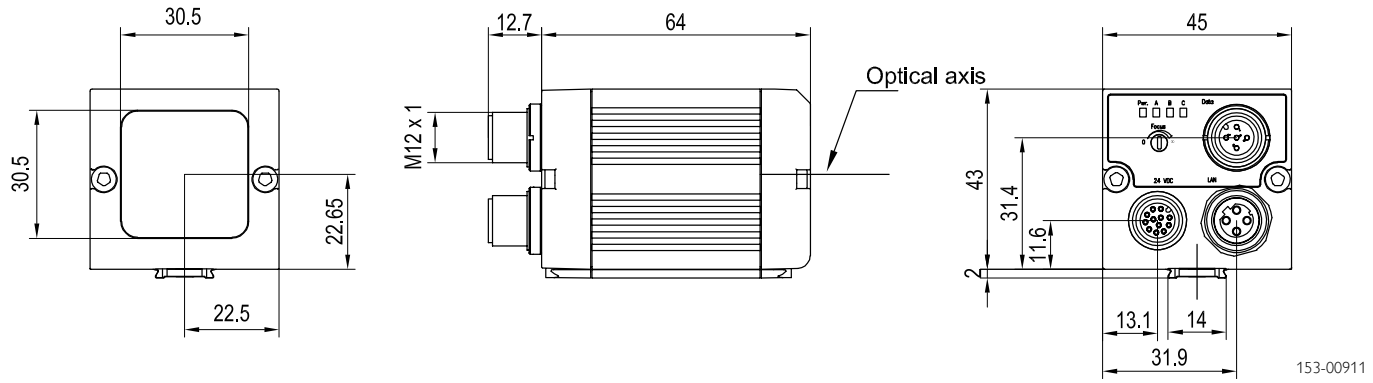
Mechanical data	
Dimensions	65 x 45 x 45 mm³ (without plug)
Enclosure rating	IP 67
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50 °C[2]
Ambient temperature: storage	-20 … +60 °C[2]
Weight	Ca. 160 g
Plug connections	Supply and I/O M12, 12-pin Ethernet M12, 4-pin Data M12, 5-pin
Vibration and impact resistance	EN 60947-5-2

[1] Max. ripple < 5 V_{SS} [2] 80 % air humidity, non-condensing

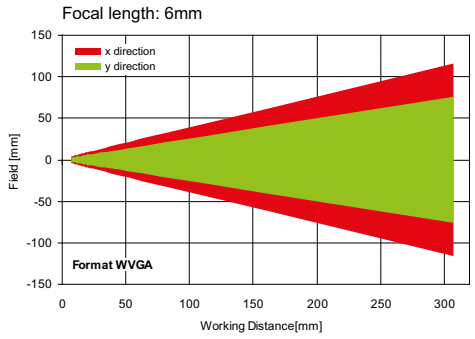
Illumination	Depth of field	Part number	Article number
White	Normal	V10-OB-A1-W6	535-91001
White	Enhanced	V10-OB-A1-W6D	535-91013
Red	Normal	V10-OB-A1-R6	535-91003
Red	Enhanced	V10-OB-A1-R6D	535-91016
Infrared	Normal	V10-OB-A1-I6	535-91006
Infrared	Enhanced	V10-OB-A1-I6D	535-91019

Version: 10/2013. Subject to changes; diagrams similar

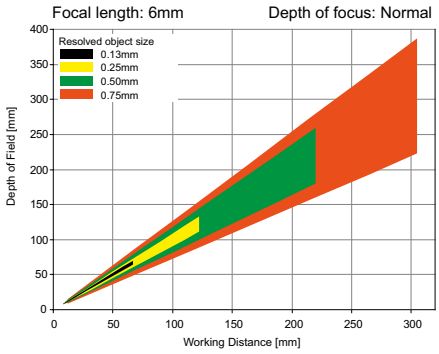
VISOR® vision sensor



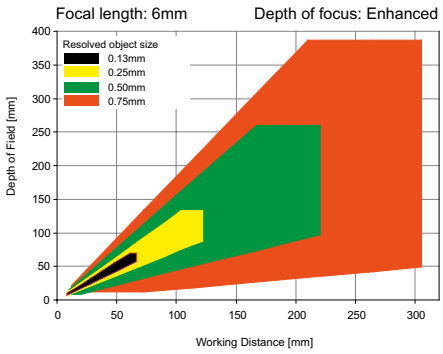
Field of view



Depth of field: normal



Depth of field: enhanced



Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Brackets	From Page A-4
Interface accessories	From Page A-36

VISOR® V10 object sensor

Advanced vision sensor for object detection, 12 mm



PRODUCT HIGHLIGHTS

- User-friendly configuration and viewer software with hierarchical user rights
- Detectors for object detection
- Powerful part-finding and tracking
- Precise position determination: X/Y-position and orientation
- Comprehensive logic functions for digital switching outputs
- Encoder input

Optical data	
Resolution	736 x 480 pixels
CMOS	1/3", monochrome
Integrated lens, focal length	12 mm, adjustable focal position
Adjustment range	30 mm to infinity
Integrated illumination	White, red, infrared LEDs
Minimum field of view, X x Y	8 x 6 mm[2]

Functions	
Number of jobs / detectors	max. 255 / max. 255
Detectors	Contour, pattern comparison, contrast, brightness, grey level
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast
Typical cycle times	Typ. 20 ms pattern comparison Typ. 30 ms contour Typ. 2 ms brightness Typ. 2 ms contrast Typ. 2 ms grey threshold

Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Ca. 13 s after Power on
Outputs	PNP / NPN (switchable)
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP/NPN High > U_B-1 V, Low < 3 V
Input resistance	> 20 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

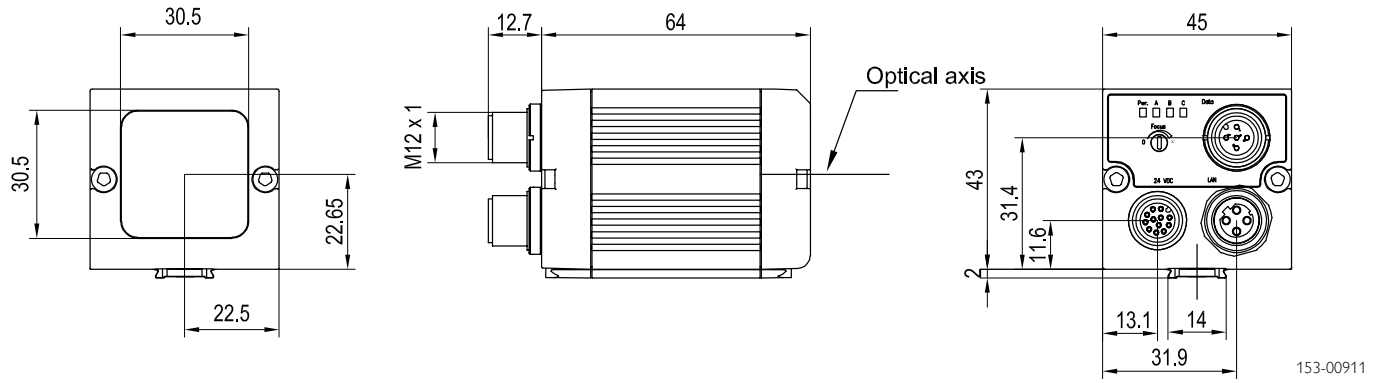
Mechanical data	
Dimensions	65 x 45 x 45 mm[3] (without plug)
Enclosure rating	IP 67
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50° C[2]
Ambient temperature: storage	-20 … +60° C[2]
Weight	Ca. 160 g
Plug connections	Supply and I/O M12, 12-pin Ethernet M12, 4-pin Data M12, 5-pin
Vibration and impact resistance	EN 60947-5-2

[1] Max. ripple < 5 V_{SS} [2] 80 % air humidity, non-condensing

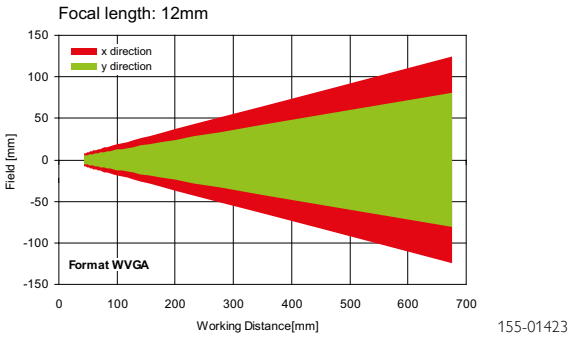
Illumination	Depth of field	Part number	Article number
White	Normal	V10-OB-A1-W12	535-91002
White	Enhanced	V10-OB-A1-W12D	535-91014
Red	Normal	V10-OB-A1-R12	535-91004
Red	Enhanced	V10-OB-A1-R12D	535-91017
Infrared	Normal	V10-OB-A1-I12	535-91007
Infrared	Enhanced	V10-OB-A1-I12D	535-91020

Version: 10/2013. Subject to changes; diagrams similar

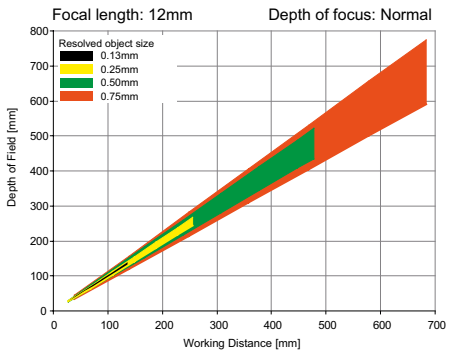
VISOR® vision sensor



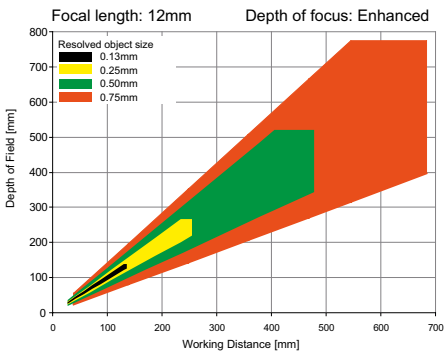
Field of view



Depth of field: normal



Depth of field: enhanced



Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Brackets	From Page A-4
Interface accessories	From Page A-36

VISOR® V10 object sensor

Advanced vision sensor for object detection, 25 mm



PRODUCT HIGHLIGHTS

- User-friendly configuration and viewer software with hierarchical user rights
- Detectors for object detection
- Powerful part-finding and tracking
- Precise position determination: X/Y-position and orientation
- Comprehensive logic functions for digital switching outputs
- Encoder input

Optical data	
Resolution	736 x 480 pixels
CMOS	1/3", monochrome
Integrated lens, focal length	25 mm, adjustable focal position
Adjustment range	140 mm to infinity
Integrated illumination	White, red, infrared LEDs
Minimum field of view, X x Y	18 x 14 mm[2]

Functions	
Number of jobs / detectors	max. 255 / max. 255
Detectors	Contour, pattern comparison, contrast, brightness, grey level
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast
Typical cycle times	Typ. 20 ms pattern comparison Typ. 30 ms contour Typ. 2 ms brightness Typ. 2 ms contrast Typ. 2 ms grey threshold

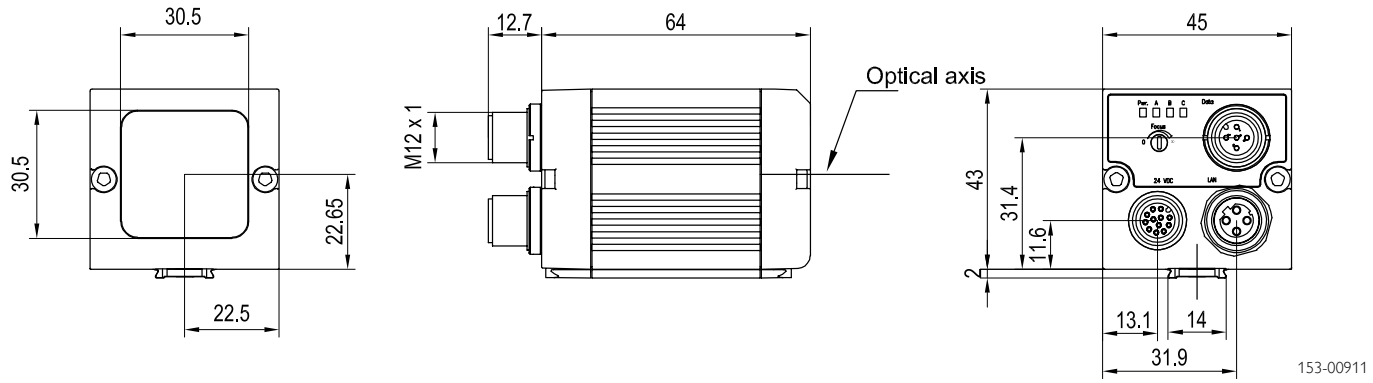
Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Ca. 13 s after Power on
Outputs	PNP / NPN (switchable)
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP/NPN High > U_B-1 V, Low < 3 V
Input resistance	> 20 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm[3] (without plug)
Enclosure rating	IP 67
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50 °C[2]
Ambient temperature: storage	-20 … +60 °C[2]
Weight	Ca. 160 g
Plug connections	Supply and I/O M12, 12-pin Ethernet M12, 4-pin Data M12, 5-pin
Vibration and impact resistance	EN 60947-5-2

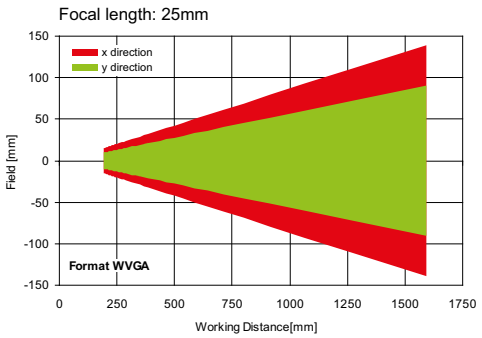
[1] Max. ripple < 5 V_{SS} [2] 80 % air humidity, non-condensing

Illumination	Depth of field	Part number	Article number
White	Normal	V10-OB-A1-W25	535-91012
Red	Normal	V10-OB-A1-R25	535-91015
Infrared	Normal	V10-OB-A1-I25	535-91018

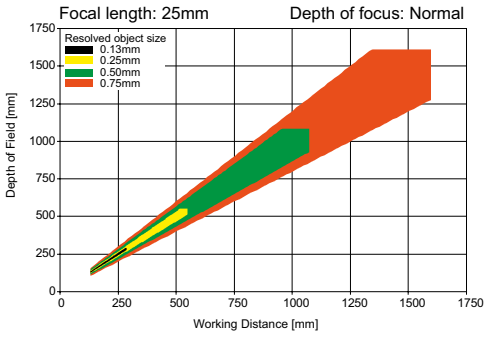
VISOR® vision sensor



Field of view



Depth of field: normal



Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Brackets	From Page A-4
Interface accessories	From Page A-36

VISOR® V10 object sensor

Advanced vision sensor for object detection, C-mount



PRODUCT HIGHLIGHTS

- User-friendly configuration and viewer software with hierarchical user rights
- Detectors for object detection
- Powerful part-finding and tracking
- Precise position determination: X/Y-position and orientation
- Comprehensive logic functions for digital switching outputs
- Encoder input

Optical data	
Resolution	736 x 480 pixels
CMOS	1/3", monochrome
Integrated lens, focal length	C-Mount
Adjustment range	Dependent on lens
Integrated illumination	None
Minimum field of view, X x Y	Dependent on lens

Functions	
Number of jobs / detectors	max. 255 / max. 255
Detectors	Contour, pattern comparison, contrast, brightness, grey level
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast
Typical cycle times	Typ. 20 ms pattern comparison Typ. 30 ms contour Typ. 2 ms brightness Typ. 2 ms contrast Typ. 2 ms grey threshold

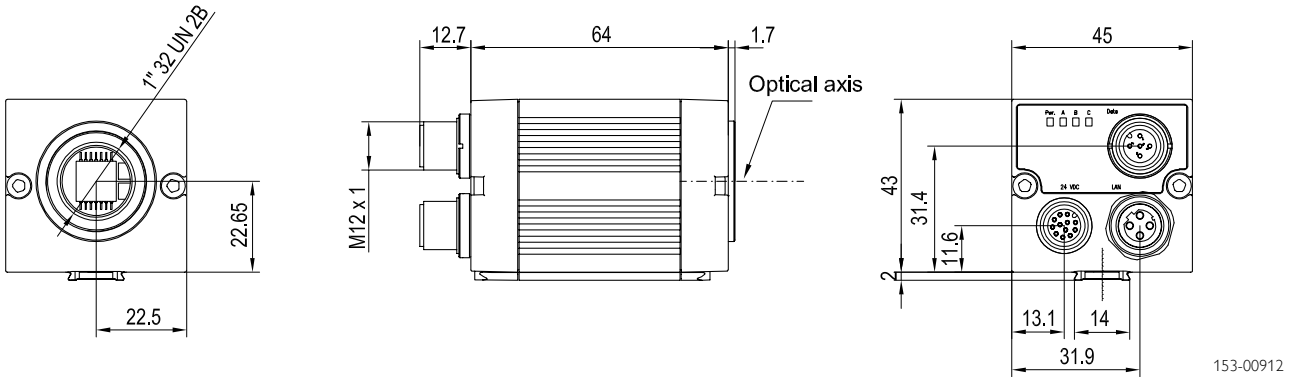
Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Ca. 13 s after Power on
Outputs	PNP / NPN (switchable)
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP/NPN High > U_B-1 V, Low < 3 V
Input resistance	> 20 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm³ (without plug)
Enclosure rating	IP 65[2]
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50 °C[3]
Ambient temperature: storage	-20 … +60 °C[3]
Weight	Ca. 160 g
Plug connections	Supply and I/O M12, 12-pin Ethernet M12, 4-pin Data M12, 5-pin
Vibration and impact resistance	EN 60947-5-2

[1] Max. ripple < 5 V_{SS} [2] With LPT45 C-mount protective casing [3] 80 % air humidity, non-condensing

Part number	Article number
V10-OB-A1-C	535-91005

VISOR® vision sensor



Lens



	LO C 8	LO C 12	LO C 16	LO C 25	LO C 50
Focal length	8 mm	12 mm	16 mm	25 mm	50 mm
Article number	526-51513	526-51514	526-51515	526-51516	526-51113

Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Lenses	From Page A-23
Brackets	From Page A-4
Interface accessories	From Page A-36

VISOR® Color

Vision sensor for the most precise object detection





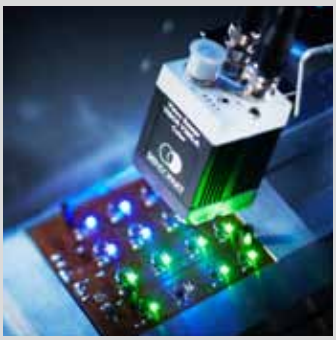
The same or not the same?
The VISOR® Color detects even the smallest of colour nuances more reliably than the human eye. This allows, for example, the detection of colour deviations or the sorting of parts by colour.



Incorrect occupancy ruled out:
The VISOR® Color combines colour and object detection in a single device and can therefore simultaneously inspect occupancy of the blister for completeness and for occupancy with the correct colour.

HIGHLIGHTS OF THE VISOR® COLOR

- Improved object detection through additional colour information
- Powerful colour detection, even with the smallest of colour nuances or self-illuminating components
- Powerful part finding and tracking
- Highly accurate evaluation via 1.3 megapixel colour chip
- Up to 6 digital switching outputs (another 32 with IO box)
- User-friendly configuration and viewer software with graded user rights and online help



All LEDs in the right place?
A unique performance feature of vision colour sensors is the detection of active (self-illuminating) colours. For example, displays in the automotive industry or electronic components can be inspected for correct placement with the VISOR® Color.

Colour is an important feature for detecting and differentiating between objects during the production process. Whether coloured marks in quality assurance, coloured printing or labels, LEDs or display elements, the occupancy of cable harnesses, or the browning level of baked goods – industry is much more colourful than is generally assumed.

Classic colour sensors are limited to the detection of passive colours, i. e. of object colours or coloured marks – they have to give up when confronted with self-illuminating objects. The VISOR® Color vision colour sensor from SensoPart knows no such restrictions – it not only "sees" objects of any shape and colour, but also provides additional information on colour intensity and the position of the particular object. It can also represent an alternative to conventional contrast sensors for determining grey values and contrast differences when other object features are to be evaluated simultaneously.

The upgrade to colour is easy

The new generation of VISOR® Color vision colour sensors not only supports colour detection but also all the performance features of the VISOR® object sensor. The operating concept of the two vision sensors is identical – there are just three additional detectors for colour detection with corresponding configuration possibilities. The introductory effort for those switching from the VISOR® object sensor is thus minimal – when will you put more colours into your applications?

VISOR® Color – product overview

	Product variant	Resolution	Focal length	Integrated illumination	Page
V20C-CO-A2-xx	Advanced	1280 x 1024 pixels	12 mm	White	82
V20C-CO-A2-xx	Advanced	1280 x 1024 pixels	C-mount	None	84
V10C-CO-S2-xx	Standard	736 x 480 pixels	6 mm	White	86
V10C-CO-S2-xx	Standard	736 x 480 pixels	12 mm	White	88
V10C-CO-A2-xx	Advanced	736 x 480 pixels	6 mm	White	90
V10C-CO-A2-xx	Advanced	736 x 480 pixels	12 mm	White	92
V10C-CO-A2-xx	Advanced	736 x 480 pixels	25 mm	White	94
V10C-CO-A2-xx	Advanced	736 x 480 pixels	C-mount	None	96

VISOR® V20 Color

Advanced vision sensor for object detection, colour, 12 mm



PRODUCT HIGHLIGHTS

- Object detection in colour with 1.3 mega pixel resolution
- Reliable detection of very slight colour nuances or self-illuminating components
- Powerful part finding and tracking
- User-friendly configuration and viewer software with hierarchical user rights
- Unlimited number of jobs and detectors
- Encoder input

Optical data	
Resolution	1280 x 1024 pixels
CMOS	1/1.8", colour
Integrated lens, focal length	12 mm, adjustable focal position
Adjustment range	30 mm to infinity
Integrated illumination	White LEDs
Minimum field of view, X x Y	16 x 13 mm[2]

Functions	
Number of jobs / detectors	max. 255 / max. 255
Detectors	Contour, pattern comparison, contrast, brightness, grey level, colour value, colour area, colour list
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast; colour area: two-dimensional colour inspection with adustable tolerance; colour list: finding the most similar colours
Typical cycle times[2]	Typ. 30 ms pattern comparison; typ. 60 ms contour; typ. 2 ms brightness; typ. 2 ms contrast; typ. 2 ms grey threshold; typ. 2 ms colour value; typ. 30 ms colour area; typ. 2 ms colour list

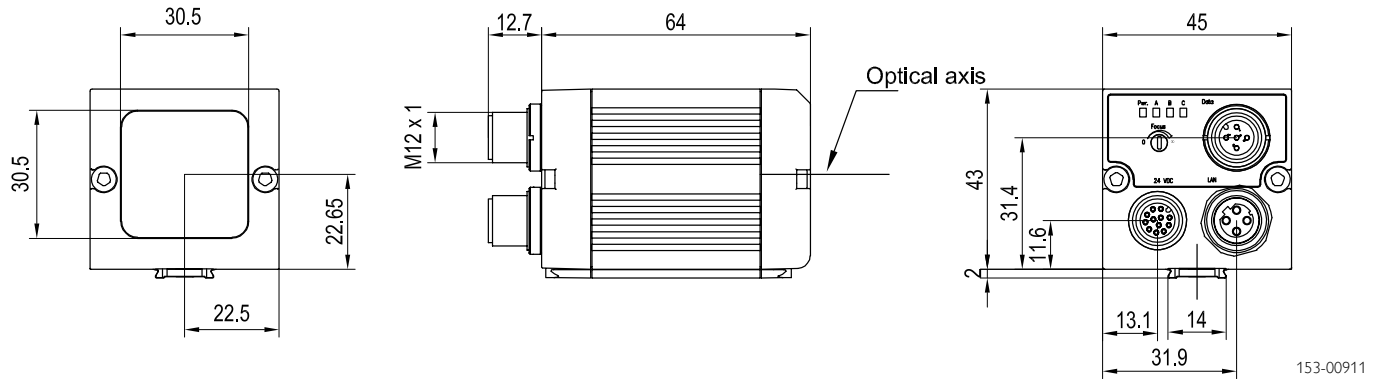
Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Approx. 13 s after Power on
Outputs	PNP / NPN (switchable)
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP/NPN High > U_B-1 V, Low < 3 V
Input resistance	> 20 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm[3] (without plug)
Enclosure rating	IP 67
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50° C[3]
Ambient temperature: storage	-20 … +60° C[3]
Weight	Approx. 160 g
Plug connections	Supply and I/O M12, 12-pin Ethernet M12, 4-pin Data M12, 5-pin
Vibration and impact resistance	EN 60947-5-2

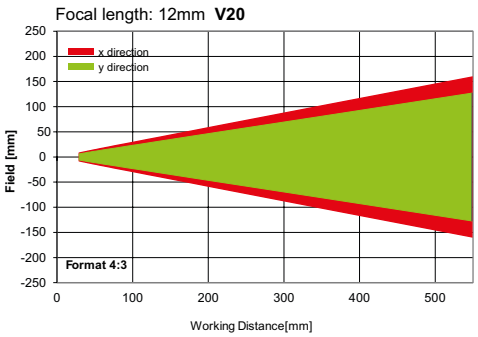
[1] Max. ripple < 5 V_{SS} [2] with VGA-resolution (640 x 480 pixels) [3] 80 % air humidity, non-condensing

Illumination	Part number	Article number
White	V20C-CO-A2-W12	536-91020

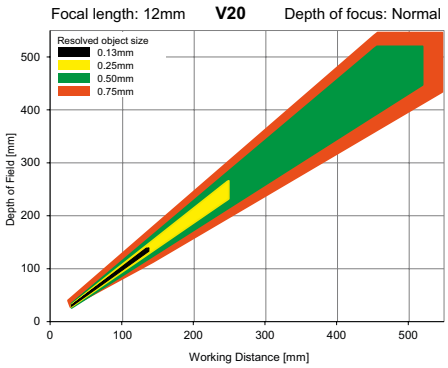
VISOR® vision sensor



Field of view



Depth of field: normal



Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Brackets	From Page A-4
Interface accessories	From Page A-36

VISOR® V20 Color

Advanced vision sensor for object detection, colour, C-mount



PRODUCT HIGHLIGHTS

- Object detection in colour with 1.3 megapixel resolution
- Reliable detection of very slight colour nuances or self-illuminating components
- Powerful part finding and tracking
- User-friendly configuration and viewer software with hierarchical user rights
- Unlimited number of jobs and detectors
- Encoder input

Optical data	
Resolution	1280 x 1024 pixels
CMOS	1/1.8", colour
Integrated lens, focal length	C-Mount
Adjustment range	Dependent on lens
Integrated illumination	None
Minimum field of view, X x Y	Dependent on lens

Functions	
Number of jobs / detectors	max. 255 / max. 255
Detectors	Contour, pattern comparison, contrast, brightness, grey level, colour value, colour area, colour list
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast; colour area: two-dimensional colour inspection with adustable tolerance; colour list: finding the most similar colours
Typical cycle times[2]	Typ. 30 ms pattern comparison; typ. 60 ms contour; typ. 2 ms brightness; typ. 2 ms contrast; typ. 2 ms grey threshold; typ. 2 ms colour value; typ. 30 ms colour area; typ. 2 ms colour list

Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Approx. 13 s after Power on
Outputs	PNP / NPN (switchable)
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP/NPN High > U_B-1 V, Low < 3 V
Input resistance	> 20 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

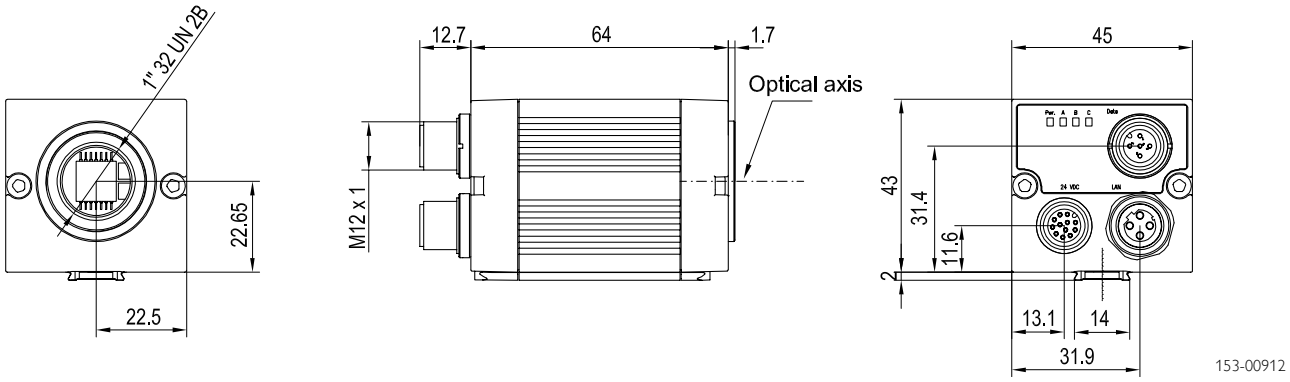
Mechanical data	
Dimensions	65 x 45 x 45 mm[3] (without plug)
Enclosure rating	IP 65[3]
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50 °C[4]
Ambient temperature: storage	-20 … +60 °C[4]
Weight	Approx. 160 g
Plug connections	Supply and I/O M12, 12-pin Ethernet M12, 4-pin Data M12, 5-pin
Vibration and impact resistance	EN 60947-5-2

[1] Max. ripple < 5 V_{SS} [2] With VGA-resolution (640 x 480 Pixel) [3] With LPT45 C-mount protective casing [4] 80 % air humidity, non-condensing

Part number	Article number
V20C-CO-A2-C	536-91021

Version: 10/2013. Subject to changes; diagrams similar

VISOR® vision sensor



Lens



	LO C 8	LO C 12	LO C 16	LO C 25	LO C 50
Focal length	8 mm	12 mm	16 mm	25 mm	50 mm
Article number	526-51513	526-51514	526-51515	526-51516	526-51113

Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Lenses	From Page A-23
Brackets	From Page A-4
Interface accessories	From Page A-36

VISOR® V10 Color

Standard vision sensor for object detection, colour, 6 mm



PRODUCT HIGHLIGHTS

- Object detection in colour
- Reliable detection of very slight colour nuances or self-illuminating components
- Powerful part finding and tracking
- User-friendly configuration and viewer software with hierarchical user rights

Optical data	
Resolution	736 x 480 pixels
CMOS	1/3", colour
Integrated lens, focal length	6 mm, adjustable focal position
Adjustment range	6 mm to infinity
Integrated illumination	White LEDs
Minimum field of view, X x Y	5 x 4 mm²

Functions	
Number of jobs / detectors	8 / 32
Detectors	Position tracking X/Y and orientation via contour inspection; colour area
Properties	Position tracking X/Y and orientation; contour: teach-in and detection of contours; colour area: two-dimensional colour inspection with adustable tolerance
Typical cycle times	Typ. 60 ms position tracking Typ. 30 ms colour area

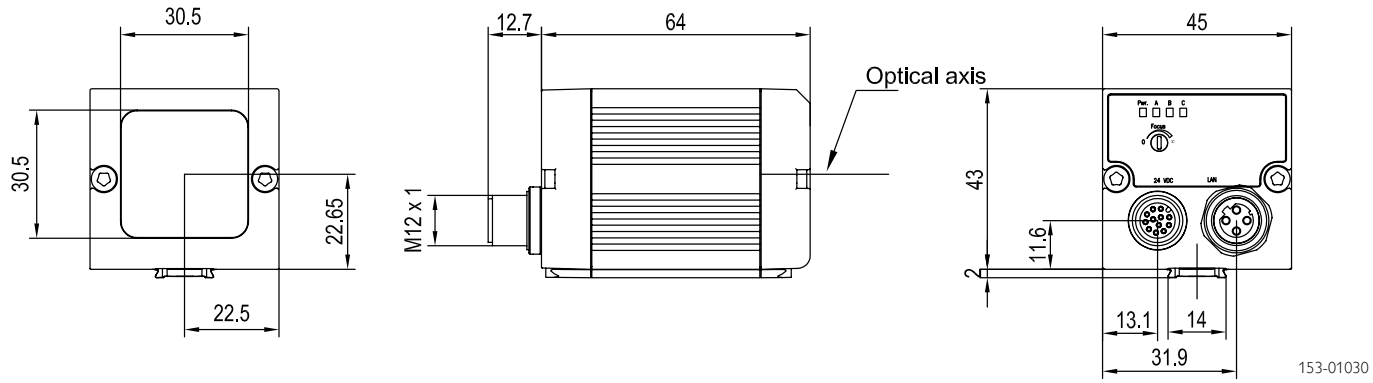
Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Approx. 13 s after Power on
Outputs	PNP / NPN (switchable)
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP/NPN High > U_B-1 V, Low < 3 V
Input resistance	> 20 kOhm
Interfaces	Ethernet (LAN), EtherNet/IP
Inputs/outputs	2 inputs, 4 outputs, 2 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm³ (without plug)
Enclosure rating	IP 67
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50 °C[2]
Ambient temperature: storage	-20 … +60 °C[2]
Weight	Approx. 160 g
Plug connections	Supply and I/O M12, 12-pin Ethernet M12, 4-pin
Vibration and impact resistance	EN 60947-5-2

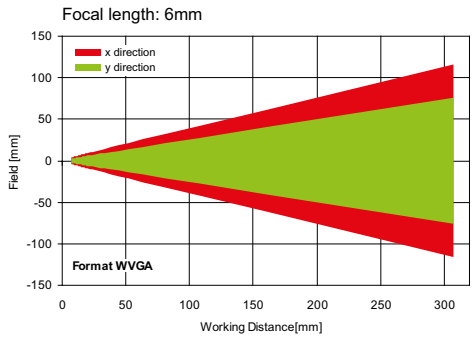
[1] Max. ripple < 5 V_{SS} [2] 80 % air humidity, non-condensing

Illumination	Depth of field	Part number	Article number
White	Normal	V10C-CO-S2-W6	535-91071

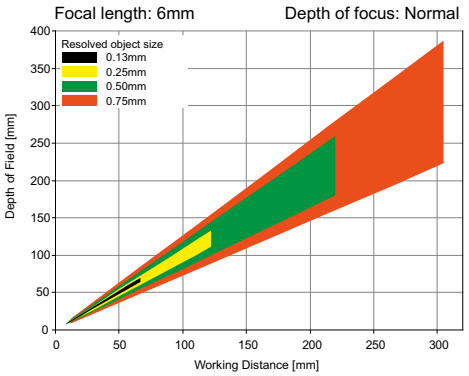
VISOR® vision sensor



Field of view



Depth of field: normal



Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Brackets	From Page A-4
Interface accessories	From Page A-36

VISOR® V10 Color

Standard vision sensor for object detection, colour, 12 mm



PRODUCT HIGHLIGHTS

- Object detection in colour
- Reliable detection of very slight colour nuances or self-illuminating components
- Powerful part finding and tracking
- User-friendly configuration and viewer software with hierarchical user rights

Optical data	
Resolution	736 x 480 pixels
CMOS	1/3", colour
Integrated lens, focal length	12 mm, adjustable focal position
Adjustment range	30 mm to infinity
Integrated illumination	White LEDs
Minimum field of view, X x Y	8 x 6 mm²

Functions	
Number of jobs / detectors	8 / 32
Detectors	Position tracking X/Y and orientation via contour inspection; colour area
Properties	Position tracking X/Y and orientation; contour: teach-in and detection of contours; colour area: two-dimensional colour inspection with adustable tolerance
Typical cycle times	Typ. 60 ms position tracking Typ. 30 ms colour area

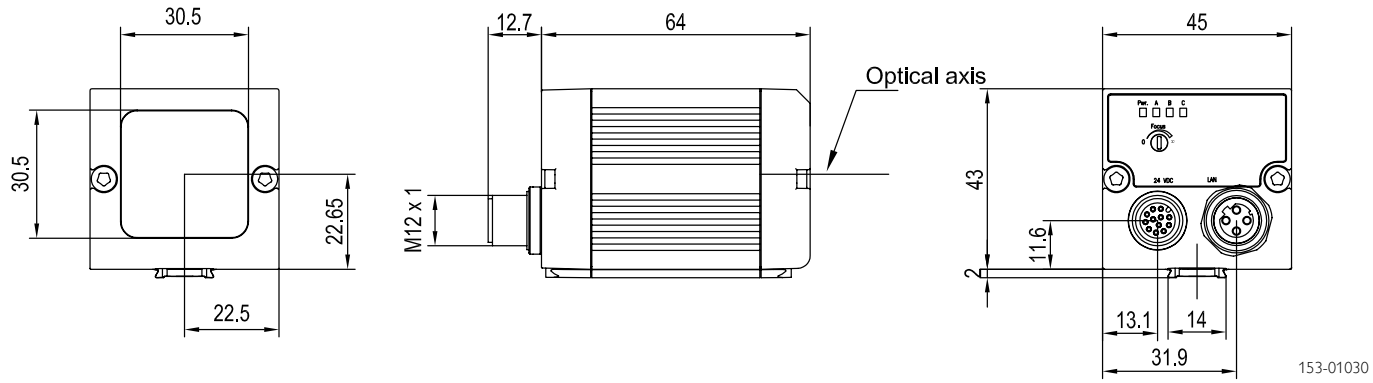
Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Approx. 13 s after Power on
Outputs	PNP / NPN (switchable)
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP/NPN High > U_B-1 V, Low < 3 V
Input resistance	> 20 kOhm
Interfaces	Ethernet (LAN), EtherNet/IP
Inputs/outputs	2 inputs, 4 outputs, 2 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm³ (without plug)
Enclosure rating	IP 67
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50 °C[2]
Ambient temperature: storage	-20 … +60 °C[2]
Weight	Approx. 160 g
Plug connections	Supply and I/O M12, 12-pin Ethernet M12, 4-pin
Vibration and impact resistance	EN 60947-5-2

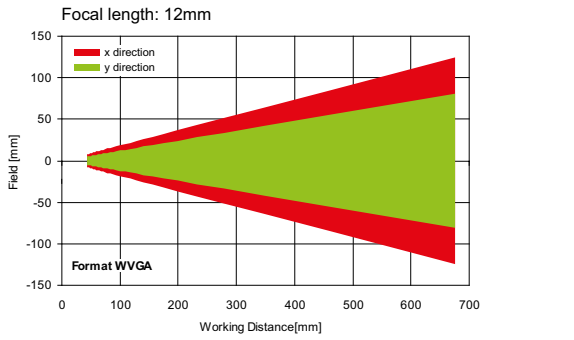
[1] Max. ripple < 5 V_{SS} [2] 80 % air humidity, non-condensing

Illumination	Depth of field	Part number	Article number
White	Normal	V10C-CO-S2-W12	535-91072

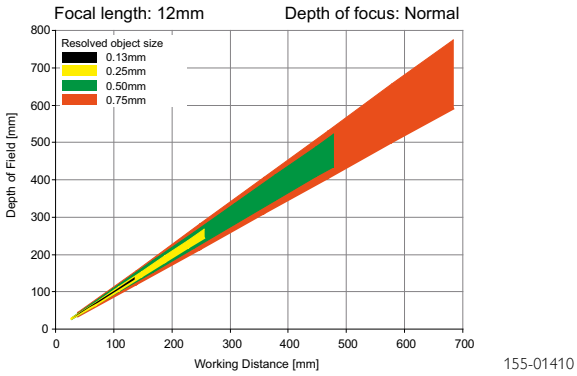
VISOR® vision sensor



Field of view



Depth of field: normal



Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Brackets	From Page A-4
Interface accessories	From Page A-36

VISOR® V10 Color

Advanced vision sensor for object detection, colour, 6 mm



PRODUCT HIGHLIGHTS

- Object detection in colour
- Reliable detection of very slight colour nuances or self-illuminating components
- Powerful part finding and tracking
- User-friendly configuration and viewer software with hierarchical user rights
- Unlimited number of jobs and detectors
- Encoder input

Optical data	
Resolution	736 x 480 pixels
CMOS	1/3", colour
Integrated lens, focal length	6 mm, adjustable focal position
Adjustment range	6 mm to infinity
Integrated illumination	White LEDs
Minimum field of view, X x Y	5 x 4 mm²

Functions	
Number of jobs / detectors	max. 255 / max. 255
Detectors	Contour, pattern comparison, contrast, brightness, grey level, colour value, colour area, colour list
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast; colour area: two-dimensional colour inspection with adustable tolerance; colour list: finding the most similar colours
Typical cycle times	Typ. 30 ms pattern comparison; typ. 60 ms contour; typ. 2 ms brightness; typ. 2 ms contrast; typ. 2 ms grey threshold; typ. 2 ms colour value; typ. 30 ms colour area; typ. 2 ms colour list

Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Approx. 13 s after Power on
Outputs	PNP / NPN (switchable)
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP/NPN High > U_B-1 V, Low < 3 V
Input resistance	> 20 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

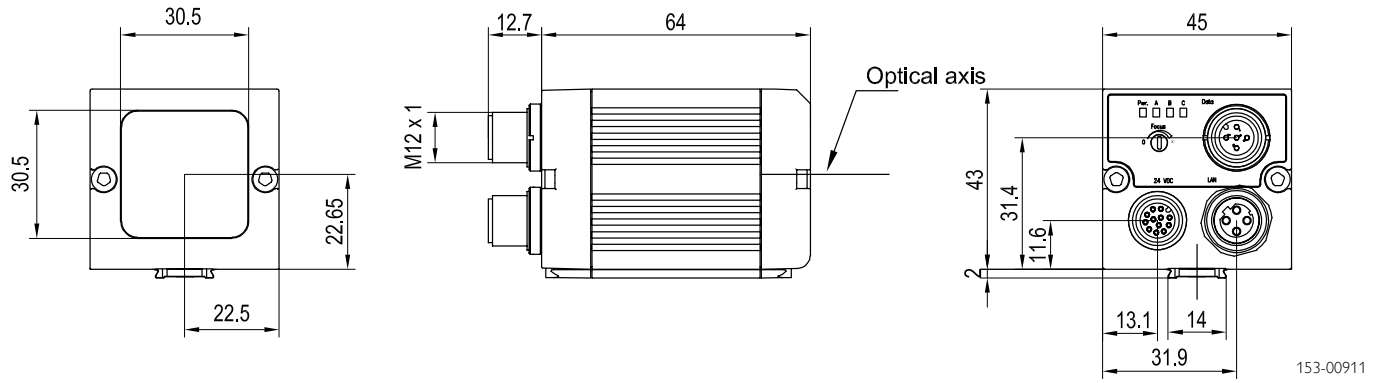
Mechanical data	
Dimensions	65 x 45 x 45 mm³ (without plug)
Enclosure rating	IP 67
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50 °C[2]
Ambient temperature: storage	-20 … +60 °C[2]
Weight	Approx. 160 g
Plug connections	Supply and I/O M12, 12-pin Ethernet M12, 4-pin Data M12, 5-pin
Vibration and impact resistance	EN 60947-5-2

[1] Max. ripple < 5 V_{SS} [2] 80 % air humidity, non-condensing

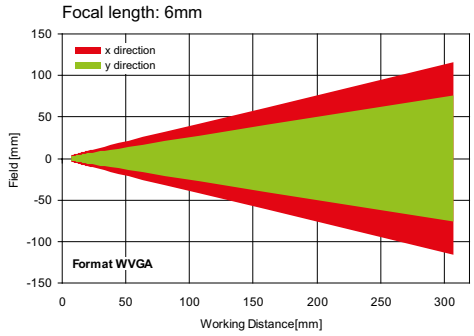
Illumination	Depth of field	Part number	Article number
White	Normal	V10C-CO-A2-W6	535-91073

Version: 10/2013. Subject to changes; diagrams similar

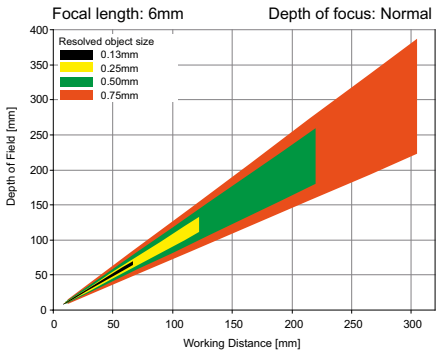
VISOR® vision sensor



Field of view



Depth of field: normal



Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Brackets	From Page A-4
Interface accessories	From Page A-36

VISOR® V10 Color

Advanced vision sensor for object detection, colour, 12 mm



PRODUCT HIGHLIGHTS

- Object detection in colour
- Reliable detection of very slight colour nuances or self-illuminating components
- Powerful part finding and tracking
- User-friendly configuration and viewer software with hierarchical user rights
- Unlimited number of jobs and detectors
- Encoder input

Optical data	
Resolution	736 x 480 pixels
CMOS	1/3", colour
Integrated lens, focal length	12 mm, adjustable focal position
Adjustment range	30 mm to infinity
Integrated illumination	White LEDs
Minimum field of view, X x Y	8 x 6 mm²

Functions	
Number of jobs / detectors	max. 255 / max. 255
Detectors	Contour, pattern comparison, contrast, brightness, grey level, colour value, colour area, colour list
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast; colour area: two-dimensional colour inspection with adustable tolerance; colour list: finding the most similar colours
Typical cycle times	Typ. 30 ms pattern comparison; typ. 60 ms contour; typ. 2 ms brightness; typ. 2 ms contrast; typ. 2 ms grey threshold; typ. 2 ms colour value; typ. 30 ms colour area; typ. 2 ms colour list

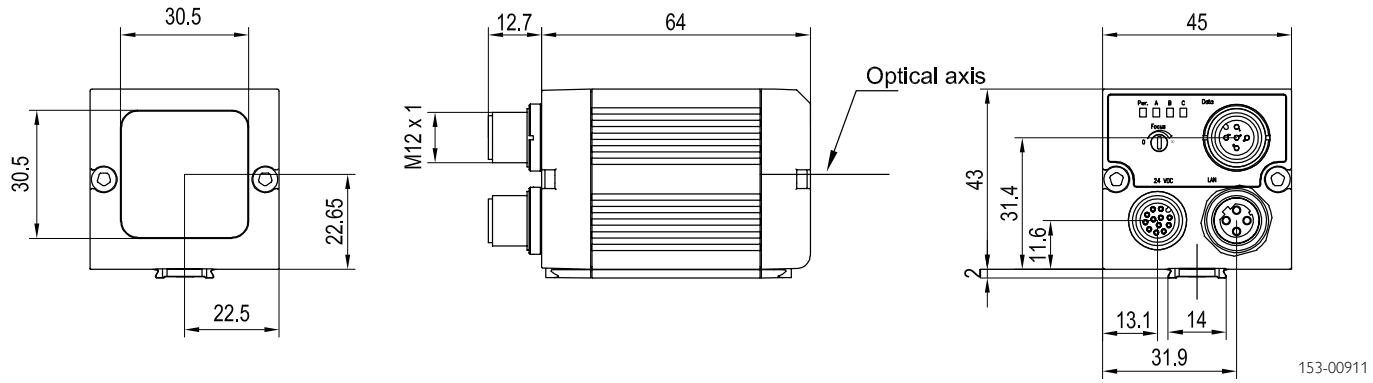
Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Approx. 13 s after Power on
Outputs	PNP / NPN (switchable)
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP/NPN High > U_B-1 V, Low < 3 V
Input resistance	> 20 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm³ (without plug)
Enclosure rating	IP 67
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50° C[2]
Ambient temperature: storage	-20 … +60° C[2]
Weight	Approx. 160 g
Plug connections	Supply and I/O M12, 12-pin Ethernet M12, 4-pin Data M12, 5-pin
Vibration and impact resistance	EN 60947-5-2

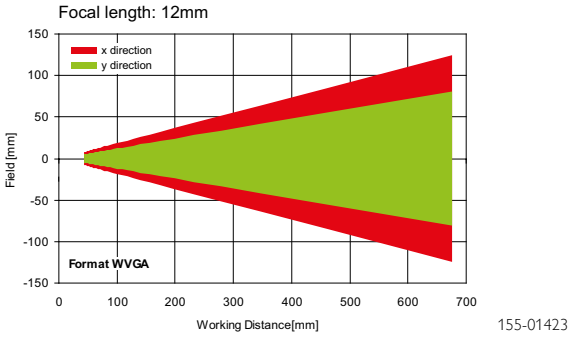
[1] Max. ripple < 5 V_{SS} [2] 80 % air humidity, non-condensing

Illumination	Depth of field	Part number	Article number
White	Normal	V10C-CO-A2-W12	535-91074

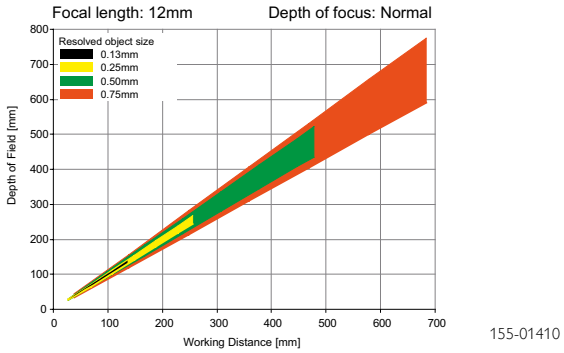
VISOR® vision sensor



Field of view



Depth of field: normal



Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Brackets	From Page A-4
Interface accessories	From Page A-36

VISOR® V10 Color

Advanced vision sensor for object detection, colour, 25 mm



PRODUCT HIGHLIGHTS

- Object detection in colour
- Reliable detection of very slight colour nuances or self-illuminating components
- Powerful part finding and tracking
- User-friendly configuration and viewer software with hierarchical user rights
- Unlimited number of jobs and detectors
- Encoder input

Optical data	
Resolution	736 x 480 pixels
CMOS	1/3", colour
Integrated lens, focal length	25 mm, adjustable focal position
Adjustment range	140 mm to infinity
Integrated illumination	White LEDs
Minimum field of view, X x Y	18 x 14 mm[2]

Functions	
Number of jobs / detectors	max. 255 / max. 255
Detectors	Contour, pattern comparison, contrast, brightness, grey level, colour value, colour area, colour list
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast; colour area: two-dimensional colour inspection with adustable tolerance; colour list: finding the most similar colours
Typical cycle times	Typ. 30 ms pattern comparison; typ. 60 ms contour; typ. 2 ms brightness; typ. 2 ms contrast; typ. 2 ms grey threshold; typ. 2 ms colour value; typ. 30 ms colour area; typ. 2 ms colour list

Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Approx. 13 s after Power on
Outputs	PNP / NPN (switchable)
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP/NPN High > U_B-1 V, Low < 3 V
Input resistance	> 20 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

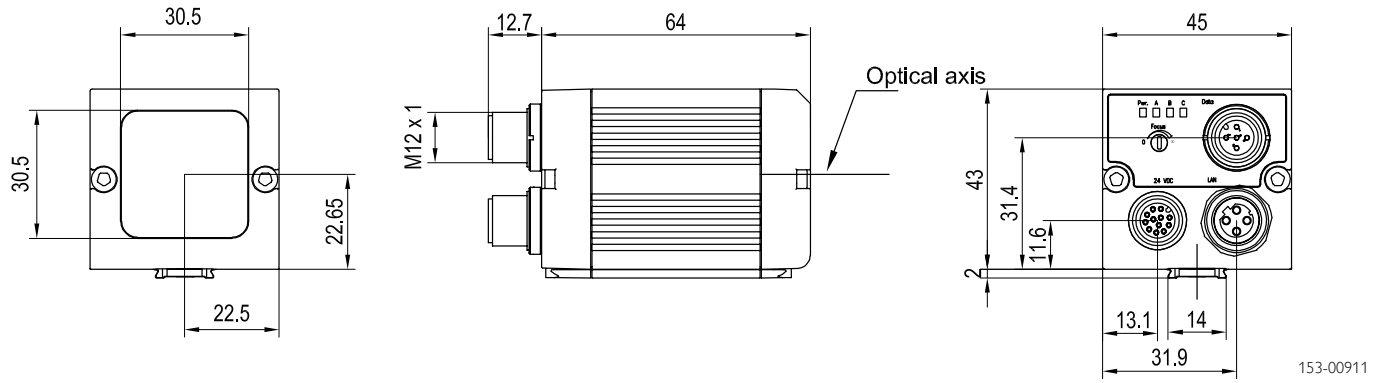
Mechanical data	
Dimensions	65 x 45 x 45 mm[3] (without plug)
Enclosure rating	IP 67
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50 °C[2]
Ambient temperature: storage	-20 … +60 °C[2]
Weight	Approx. 160 g
Plug connections	Supply and I/O M12, 12-pin Ethernet M12, 4-pin Data M12, 5-pin
Vibration and impact resistance	EN 60947-5-2

[1] Max. ripple < 5 V_{SS} [2] 80 % air humidity, non-condensing

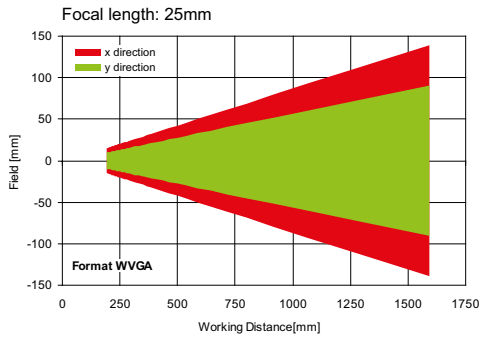
Illumination	Depth of field	Part number	Article number
White	Normal	V10C-CO-A2-W25	535-91075

Version: 10/2013. Subject to changes; diagrams similar

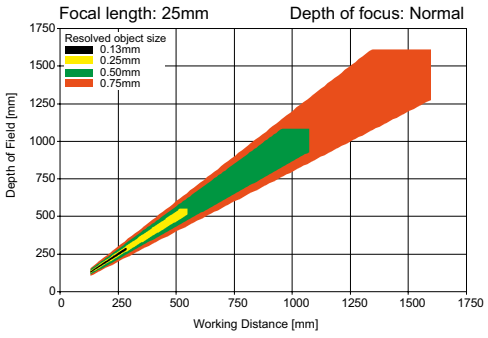
VISOR® vision sensor



Field of view



Depth of field: normal



Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Brackets	From Page A-4
Interface accessories	From Page A-36

VISOR® V10 Color

Advanced vision sensor for object detection, colour, C-mount



PRODUCT HIGHLIGHTS

- Object detection in colour
- Reliable detection of very slight colour nuances or self-illuminating components
- Powerful part finding and tracking
- User-friendly configuration and viewer software with hierarchical user rights
- Unlimited number of jobs and detectors
- Encoder input

Optical data	
Resolution	736 x 480 pixels
CMOS	1/3", colour
Integrated lens, focal length	C-Mount
Adjustment range	Dependent on lens
Integrated illumination	None
Minimum field of view, X x Y	Dependent on lens

Functions	
Number of jobs / detectors	max. 255 / max. 255
Detectors	Contour, pattern comparison, contrast, brightness, grey level, colour value, colour area, colour list
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast; colour area: two-dimensional colour inspection with adustable tolerance; colour list: finding the most similar colours
Typical cycle times	Typ. 30 ms pattern comparison; typ. 60 ms contour; typ. 2 ms brightness; typ. 2 ms contrast; typ. 2 ms grey threshold; typ. 2 ms colour value; typ. 30 ms colour area; typ. 2 ms colour list

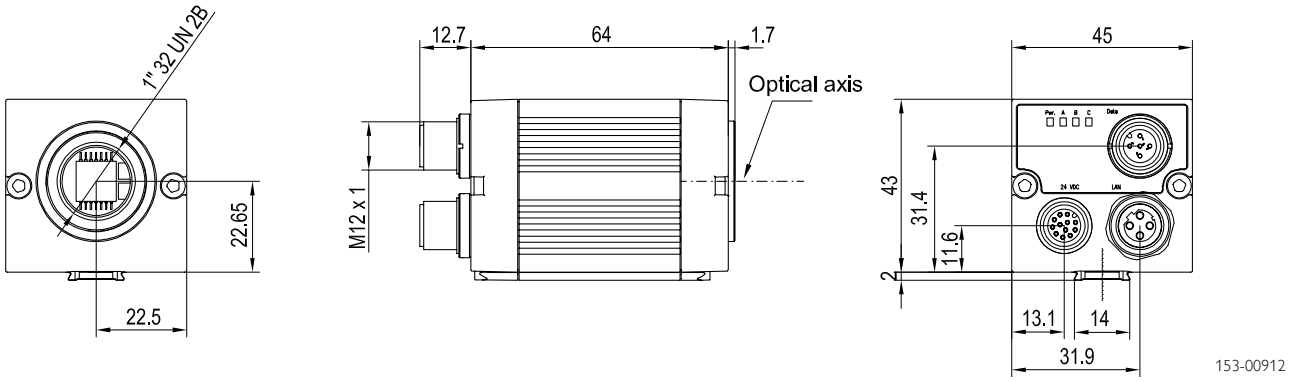
Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Approx. 13 s after Power on
Outputs	PNP / NPN (switchable)
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP/NPN High > U_B-1 V, Low < 3 V
Input resistance	> 20 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm[3] (without plug)
Enclosure rating	IP 65[2]
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50 °C[3]
Ambient temperature: storage	-20 … +60 °C[3]
Weight	Approx. 160 g
Plug connections	Supply and I/O M12, 12-pin Ethernet M12, 4-pin Data M12, 5-pin
Vibration and impact resistance	EN 60947-5-2

[1] Max. ripple < 5 V_{SS} [2] With LPT45 C-mount protective casing [3] 80 % air humidity, non-condensing

Part number	Article number
V10C-CO-A2-C	535-91076

VISOR® vision sensor



Lens



	LO C 8	LO C 12	LO C 16	LO C 25	LO C 50
Focal length	8 mm	12 mm	16 mm	25 mm	50 mm
Article number	526-51513	526-51514	526-51515	526-51516	526-51113

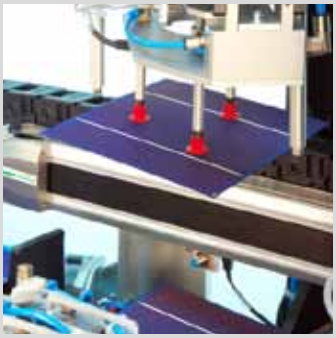
Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Lenses	From Page A-23
Brackets	From Page A-4
Interface accessories	From Page A-36

VISOR® Solar sensor for inspecting solar cells

Focusing on what matters





The VISOR® Solar sensor operates accurately and reliably even in fast-cycle processes.



The VISOR® Solar sensor measures every wafer or cell and thus detects even minimal edge breakouts.

HIGHLIGHTS OF VISOR® SOLAR SENSOR

- Simple integration
- Precise position detection down to ± 50 µm
- Edge defects can be detected up to a depth of 0.50 mm
- Detection of holes
- Transport belts can be masked via software
- Short cycle time from 60 ms
- Reliable operation, even in daylight
- No backlight necessary
- Low space requirement: operating distance from 360 mm

SensoPart has expanded its range of vision sensors with the VISOR® Solar in order to combat rising cost pressure in the production of solar cells. The compact sensor detects the position and any damage to wafers and cells. It allows robots to pick up and lay down wafers accurately. Wafers and solar cells with fine breakouts can be directly rejected during this step, before they can completely break up and damage other material.

These sensors can also be integrated in existing lines – as easily as a light barrier. Before a cell is printed, the sensor checks it for damage that could lead to breakage during the print process, preventing costly machine breakdowns.

VISOR® Solar sensor – Product Overview					
	Firmware Option	Resolution	Focal length	Integrated illumination	Page
V10-SO-S1-xxx	Standard	736 x 480 pixels	6 mm	White LEDs	100
V10-SO-A1-xxx	Advanced	736 x 480 pixels	6 mm	White or infrared LEDs	102
V10-SO-A1-xxx	Advanced	736 x 480 pixels	12 mm	White or infrared LEDs	104

VISOR® V10 Solar sensor

Standard vision sensor for wafer and cell inpection, 6 mm



PRODUCT HIGHLIGHTS

- Automatic detection of wafer and cell geometry
- Suitable for frontlit and backlit applications
- Simple sensor optimisation regarding evaluation speed and test precision (sub-pixel process)
- Detection of holes/cracks and breakouts
- Distortion correction

Optical data	
Resolution	736 x 480 pixels
CMOS	1/3", monochrome
Integrated lens, focal length	6 mm, adjustable focal position
Adjustment range	6 mm to infinity
Integrated illumination	White LEDs
Minimum field of view, X x Y	5 x 4 mm²

Functions	
Number of jobs / detectors	2 / 32
Detectors	Wafers, contrast, brightness, grey level
Properties	Wafers: localisation and examination of wafers Grey threshold, brightness: evaluation of brightness Contrast: evaluation of contrast
Typical cycle times	Typ. 100 ms wafer Typ. 2 ms brightness Typ. 2 ms contrast Typ. 2 ms grey threshold

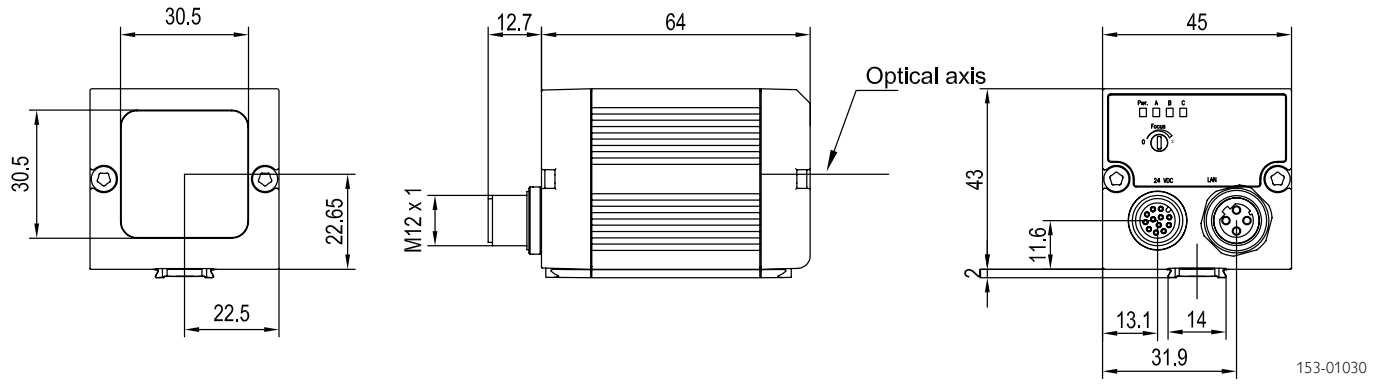
Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Ca. 13 s after Power on
Outputs	PNP / NPN (switchable)
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP/NPN High > U_B-1 V, Low < 3 V
Input resistance	> 20 kOhm
Interfaces	Ethernet (LAN), EtherNet/IP
Inputs/outputs	2 inputs, 4 outputs, 2 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm³ (without plug)
Enclosure rating	IP 67
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50 °C[2]
Ambient temperature: storage	-20 … +60 °C[2]
Weight	Ca. 160 g
Plug connections	Supply and I/O M12, 12-pin Ethernet M12, 4-pin
Vibration and impact resistance	EN 60947-5-2

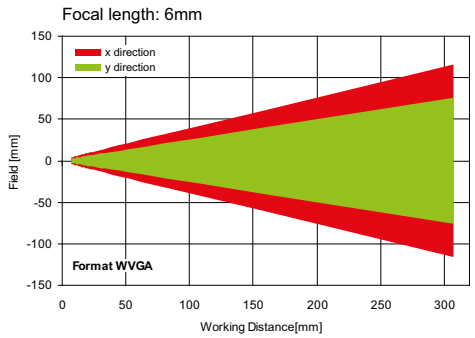
[1] Max. ripple < 5 V_{SS} [2] 80 % air humidity, non-condensing

Illumination	Depth of field	Part number	Article number
White	Normal	V10-SO-S1-W6	535-91049

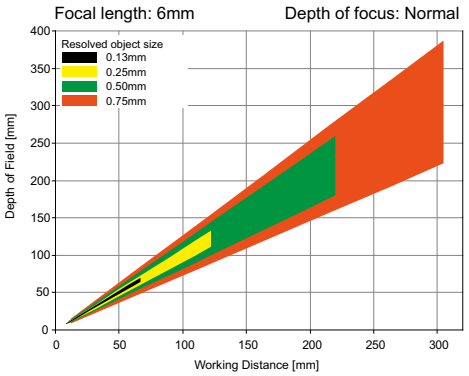
VISOR® vision sensor



Field of view



Depth of field: normal



Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Brackets	From Page A-4
Interface accessories	From Page A-36

VISOR® V10 Solar sensor

Advanced vision sensor for wafer and cell inspection, 6 mm



PRODUCT HIGHLIGHTS

- Automatic detection of wafer and cell geometry
- Suitable for frontlit and backlit applications
- Simple sensor optimisation regarding evaluation speed and test precision (sub-pixel process)
- Detection of holes/cracks and breakouts
- Distortion correction
- Examination and position detection of busbars

Optical data	
Resolution	736 x 480 pixels
CMOS	1/3", monochrome
Integrated lens, focal length	6 mm, adjustable focal position
Adjustment range	6 mm to infinity
Integrated illumination	White, infrared LEDs
Minimum field of view, X x Y	5 x 4 mm²

Functions	
Number of jobs / detectors	n / n
Detectors	Wafers, busbars, pattern comparison, contrast, brightness, grey level
Properties	Position tracking Wafers incl. busbars: localisation of wafers or busbars and examination of wafers Pattern comparison: teach-in and detection of patterns Grey threshold, brightness: evaluation of brightness Contrast: evaluation of contrast
Typical cycle times	Typ. 100 ms wafers Typ. 20 ms pattern comparison Typ. 2 ms brightness Typ. 2 ms contrast Typ. 2 ms grey threshold

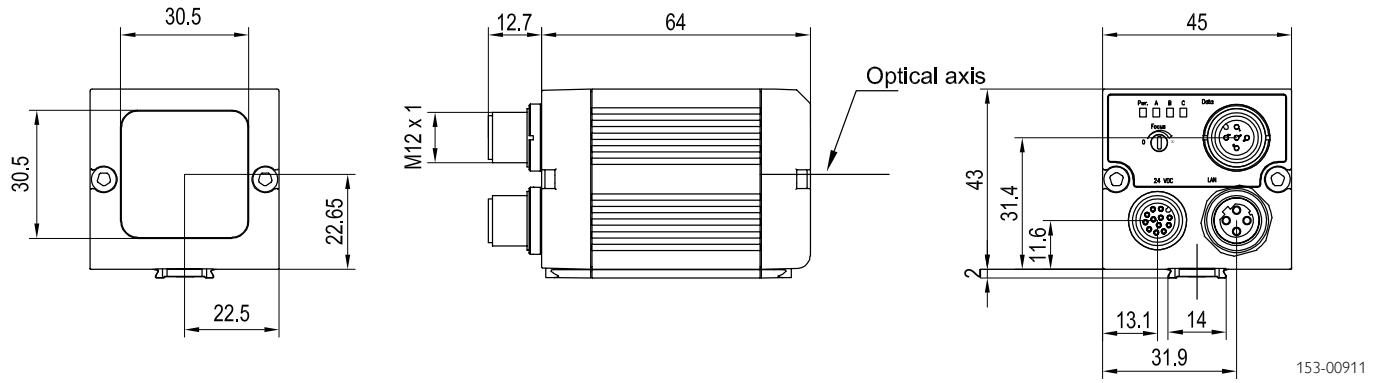
Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Ca. 13 s after Power on
Outputs	PNP / NPN (switchable)
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP/NPN High > U_B-1 V, Low < 3 V
Input resistance	> 20 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, EtherNet/IP
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm³ (without plug)
Enclosure rating	IP 67
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50 °C[2]
Ambient temperature: storage	-20 … +60 °C[2]
Weight	Ca. 160 g
Plug connections	Supply and I/O M12, 12-pin Ethernet M12, 4-pin Data M12, 5-pin
Vibration and impact resistance	EN 60947-5-2

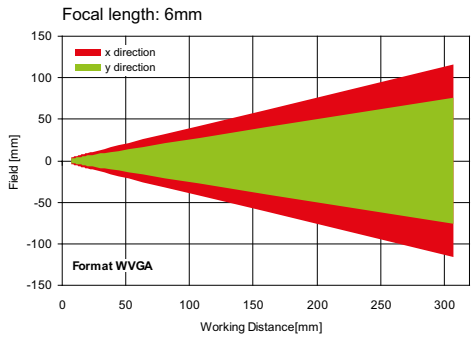
[1] Max. ripple < 5 V_{SS} [2] 80 % air humidity, non-condensing

Illumination	Depth of field	Part number	Article number
White	Normal	V10-SO-A1-W6	535-91051
Infrared	Normal	V10-SO-A1-I6	535-91053

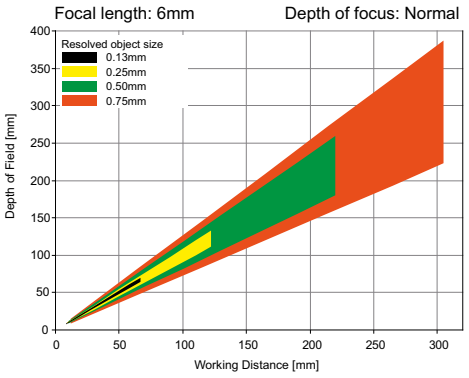
VISOR® vision sensor



Field of view



Depth of field: normal



Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Brackets	From Page A-4
Interface accessories	From Page A-36

VISOR® V10 Solar sensor

Advanced vision sensor for wafer and cell inspection, 12 mm



PRODUCT HIGHLIGHTS

- Automatic detection of wafer and cell geometry
- Suitable for frontlit and backlit applications
- Simple sensor optimisation regarding evaluation speed and test precision (sub-pixel process)
- Detection of holes/cracks and breakouts
- Distortion correction
- Examination and position detection of busbars

Optical data	
Resolution	736 x 480 pixels
CMOS	1/3", monochrome
Integrated lens, focal length	12 mm, adjustable focal position
Adjustment range	30 mm to infinity
Integrated illumination	White, infrared LEDs
Minimum field of view, X x Y	8 x 6 mm²

Functions	
Number of jobs / detectors	max. 255 / max. 255
Detectors	Wafers, busbars, pattern comparison, contrast, brightness, grey level
Properties	Position tracking Wafers incl. busbars: localisation of wafers or busbars and examination of wafers Pattern comparison: teach-in and detection of patterns Grey threshold, brightness: evaluation of brightness Contrast: evaluation of contrast
Typical cycle times	Typ. 100 ms wafer Typ. 20 ms pattern comparison Typ. 2 ms brightness Typ. 2 ms contrast Typ. 2 ms grey threshold

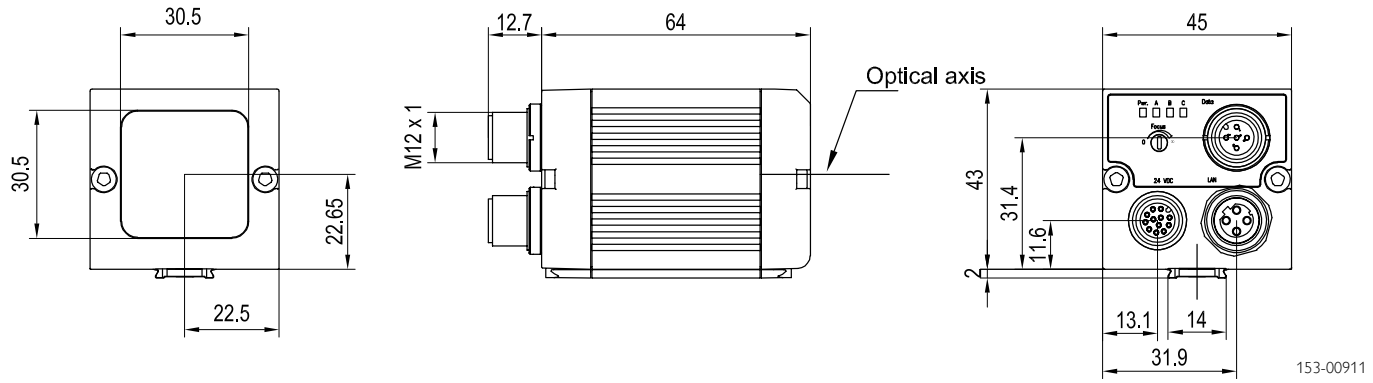
Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Ca. 13 s after Power on
Outputs	PNP / NPN (switchable)
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP/NPN High > U_B-1 V, Low < 3 V
Input resistance	> 20 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm³ (without plug)
Enclosure rating	IP 67
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50 °C[2]
Ambient temperature: storage	-20 … +60 °C[2]
Weight	Ca. 160 g
Plug connections	Supply and I/O M12, 12-pin Ethernet M12, 4-pin Data M12, 5-pin
Vibration and impact resistance	EN 60947-5-2

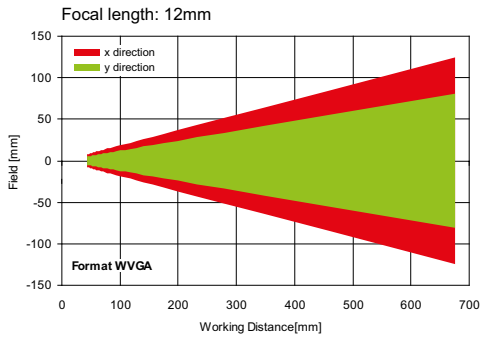
[1] Max. ripple < 5 V_{SS} [2] 80 % air humidity, non-condensing

Illumination	Depth of field	Part number	Article number
White	Normal	V10-SO-A1-W12	535-91052
Infrared	Normal	V10-SO-A1-I12	535-91054

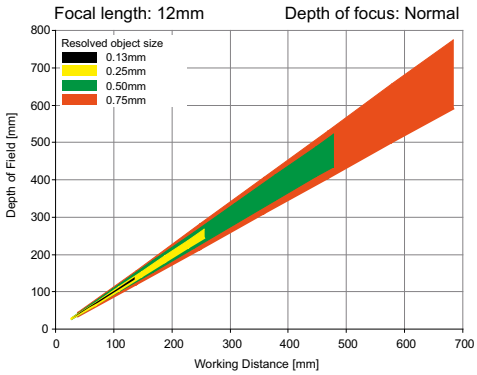
VISOR® vision sensor



Field of view



Depth of field: normal



Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Brackets	From Page A-4
Interface accessories	From Page A-36

Eyesight vision system – everything is possible

At last. You can do what you want!





Taking measures:
The dimensional accuracy of an object (e.g. a turned or pressed part) is an important quality feature, and can indirectly provide information on its consistency, stresses or wear, preventing rejects in downstream processes.



Providing direction:
The correct alignment of an object is an important prerequisite for downstream processes, e.g. for positioning and tracking a gripper. Colours, shapes and contours are suitable for monitoring correct orientation



Preventing faults:
Very different features can be checked at a glance with the Eyesight – here, for example, the position and colour of the cap, filling level and presence of the use-by date. This pays, because each unnoticed fault may be expensive later.

EYESIGHT HIGHLIGHTS

- Complete image-processing package with robust and flexible smart camera
- Programming via drag & drop of function blocks
- Complex iterative linkage of individual inspections
- Image and result visualisation in inspection mode
- Interpreter for programming one's own functions
- Image processing simulated on PC without camera
- Freely programmable data protocol for Ethernet and serial interface

Most image-processing applications can be rapidly and easily solved with pre-configured VISOR® vision sensors. However, their range of functions is not always sufficient for particularly demanding or specific tasks – but here, too, SensoPart has the right solution: the freely programmable Eyesight vision system offers comprehensive configuration possibilities so that you can also implement very complex automation applications with the smart camera. Whereby complex is not synonymous with complicated: graphic programming by means of drag & drop makes it easy for you to "construct" your own applications.

Eyesight has numerous of routines for object measurement, position determination and tracking, data communication, warpage point determination, contour inspection/tracking, colour selection/monitoring, brightness correction as well as a variety of filter functions. What can otherwise only be achieved by fully-fledged image-processing systems, you can implement with Eyesight with considerably less effort – and at a relatively reasonable price.

Eyesight Vision Systems – Product Overview					
	Firmware Option	Resolution	Focal length	Integrated illumination	Page
V20-EYE-A2-xxx	Monochrome, colour	1280 x 1024 pixels	12	White, red or infrared LEDs	108
V20-EYE-A2-xxx	Monochrome, colour	1280 x 1024 pixels	C-Mount	None	110
V10-EYE-A1-xxx	Monochrome, colour	736 x 480 pixels	6	White, red or infrared LEDs	112
V10-EYE-A1-xxx	Monochrome, colour	736 x 480 pixels	12	White, red or infrared LEDs	114
V10-EYE-A1-xxx	Monochrome, colour	736 x 480 pixels	C-Mount	None	116

V20 Eyesight

Vision system for complex image-processing applications, 12 mm



PRODUCT HIGHLIGHTS

- Complete image-processing package with robust and flexible hardware, 1.3 mega pixel
- Programming via drag & drop of function blocks
- Complex, iterative linkage of individual inspections
- Image processing can be simulated on the PC without camera
- Image and result visualisation in inspection mode
- Script interpreter for advanced user functions

Optical data	
Resolution	1280 x 1024 pixels
CMOS	1/1.8", monochrome or colour
Integrated lens, focal length	12 mm, adjustable focal position
Adjustment range	30 mm to infinity
Integrated illumination	White, red, infrared LEDs
Minimum field of view, X x Y	16 x 13 mm²

Functions	
Number of inspection programs	No limitation (max. ca. 40 MB)
Functions	All function blocks for object measurement, position determination/ tracking, sequence control, data and image transfer, contour inspection, sub-programs, script interpreter.
Properties	See overview of commands
Typical cycle times	Dependent on inspection program

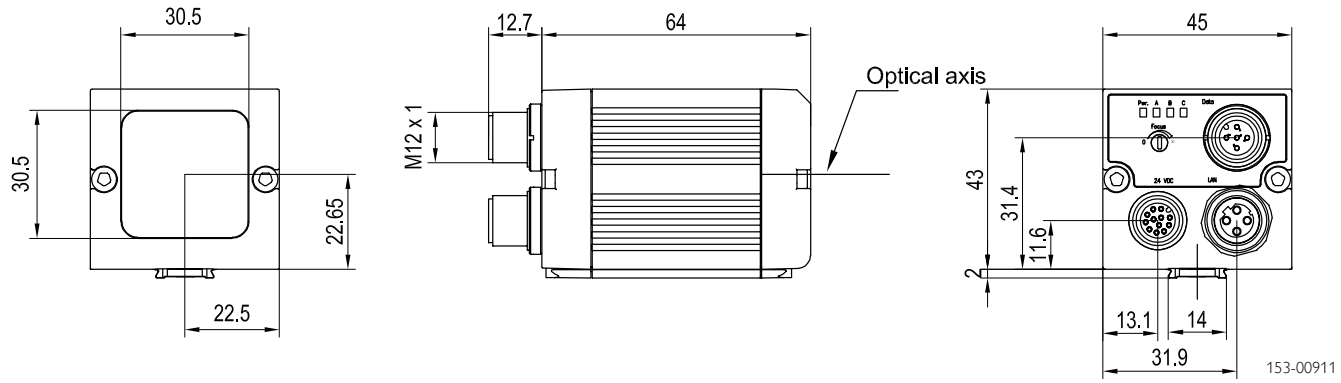
Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Ca. 13 s after Power on
Outputs	PNP
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP High > U_B-1 V, Low < 3 V
Input resistance	> 20 kΩ
Interfaces	Ethernet (LAN), RS422, RS232
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm³ (without plug)
Enclosure rating	IP 67
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50 °C[2]
Ambient temperature: storage	-20 … +60 °C[2]
Weight	Ca. 160 g
Plug connections	Supply and I/O M12, 12-pin Ethernet M12, 4-pin Data M12, 5-pin
Vibration and impact resistance	EN 60947-5-2

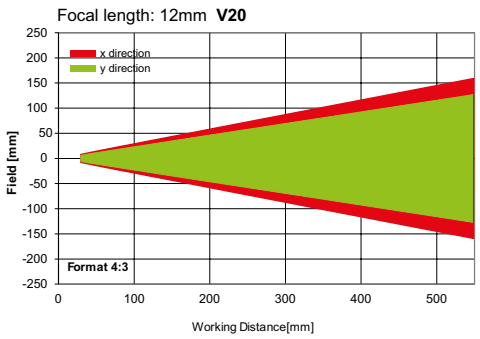
[1] Max. ripple < 5 V_{SS} [2] 80 % air humidity, non-condensing

Illumination	Product variant	Part number	Article number
White	Monochrome	V20-EYE-A2-W12	537-91008
Red	Monochrome	V20-EYE-A2-R12	537-91009
Infrared	Monochrome	V20-EYE-A2-I12	537-91010
White	Colour	V20C-EYE-A2-W12	537-91014

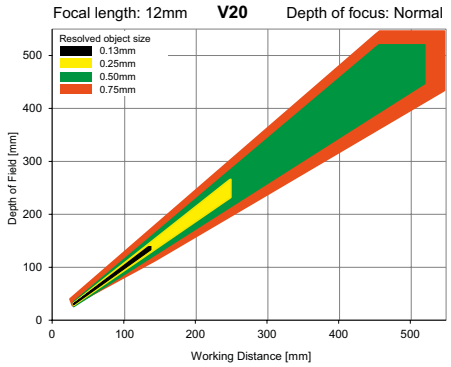
V20 vision system



Field of view



Depth of field: normal



Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Brackets	From Page A-4
Interface accessories	From Page A-36

V20 Eyesight

Vision system for complex image-processing applications, C-mount



PRODUCT HIGHLIGHTS

- Complete image-processing package with robust and flexible hardware, 1.3 mega pixel
- Programming via drag & drop of function blocks
- Complex, iterative linkage of individual inspections
- Image processing can be simulated on the PC without camera
- Image and result visualisation in inspection mode
- Script interpreter for advanced user functions

Optical data	
Resolution	1280 x 1024 pixels
CMOS	1/1.8", monochrome or colour
Integrated lens, focal length	C-mount
Adjustment range	Dependent on lens
Integrated illumination	None
Minimum field of view, X x Y	Dependent on lens

Functions	
Number of inspection programs	No limitation (max. ca. 40 MB)
Functions	All function blocks for object measurement, position determination/ tracking, sequence control, data and image transfer, contour inspection, sub-programs, script interpreter.
Properties	See overview of commands
Typical cycle times	Dependent on inspection program

Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Ca. 13 s after Power on
Outputs	PNP
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP High > U_B-1 V, Low < 3 V
Input resistance	> 20 kΩ
Interfaces	Ethernet (LAN), RS422, RS232
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

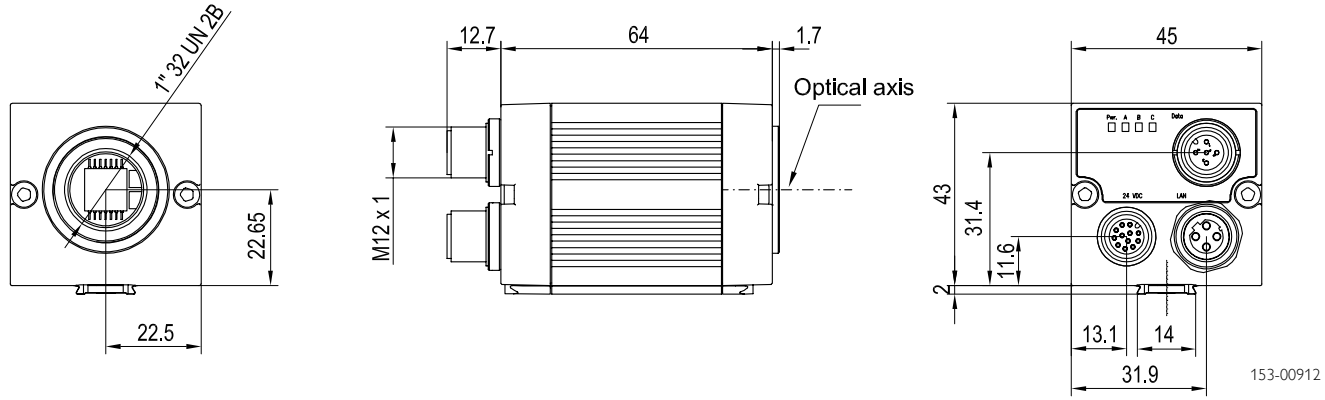
Mechanical data	
Dimensions	65 x 45 x 45 mm³ (without plug)
Enclosure rating	IP 65[2]
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50 °C[3]
Ambient temperature: storage	-20 … +60 °C[3]
Weight	Ca. 160 g
Plug connections	Supply and I/O M12, 12-pin Ethernet M12, 4-pin Data M12, 5-pin
Vibration and impact resistance	EN 60947-5-2

[1] Max. ripple < 5 V_{SS} [2] With LPT45 C-mount protective casing [3] 80 % air humidity, non-condensing

Product variant	Part number	Article number
Monochrome	V20-EYE-A2-C	537-91007
Colour	V20C-EYE-A2-C	537-91015

Version: 10/2013. Subject to changes; diagrams similar

V20 vision system



Lens



	LO C 8	LO C 12	LO C 16	LO C 25	LO C 50
Focal length	8 mm	12 mm	16 mm	25 mm	50 mm
Article number	526-51513	526-51514	526-51515	526-51516	526-51113

Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Lenses	From Page A-23
Brackets	From Page A-4
Interface accessories	From Page A-36

V10 Eyesight

Vision system for complex image-processing applications, 6 mm



PRODUCT HIGHLIGHTS

- Complete image-processing package with robust and flexible hardware
- Programming via drag & drop of function blocks
- Complex, iterative linkage of individual inspections
- Image processing can be simulated on the PC without camera
- Image and result visualisation in inspection mode
- Script interpreter for advanced user functions

Optical data	
Resolution	736 x 480 pixels
CMOS	1/3", monochrome or colour
Integrated lens, focal length	6 mm, adjustable focal position
Adjustment range	6 mm to infinity
Integrated illumination	White, red, infrared LEDs
Minimum field of view, X x Y	5 x 4 mm²

Functions	
Number of inspection programs	No limitation (max. ca. 40 MB)
Functions	All function blocks for object measurement, position determination / tracking, sequence control, data and image transfer, contour inspection, sub-programs, script interpreter.
Properties	See overview of commands
Typical cycle times	Dependent on inspection program

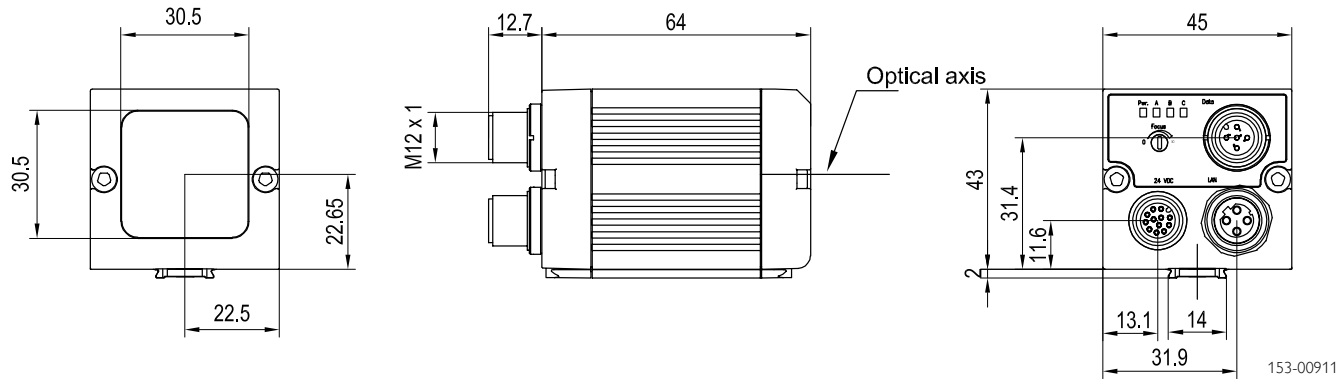
Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Ca. 13 s after Power on
Outputs	PNP
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP High > U_B-1 V, Low < 3 V
Input resistance	> 20 kΩ
Interfaces	Ethernet (LAN), RS422, RS232
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm³ (without plug)
Enclosure rating	IP 67
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50 °C[2]
Ambient temperature: storage	-20 … +60 °C[2]
Weight	Ca. 160 g
Plug connections	Supply and I/O M12, 12-pin Ethernet M12, 4-pin Data M12, 5-pin
Vibration and impact resistance	EN 60947-5-2

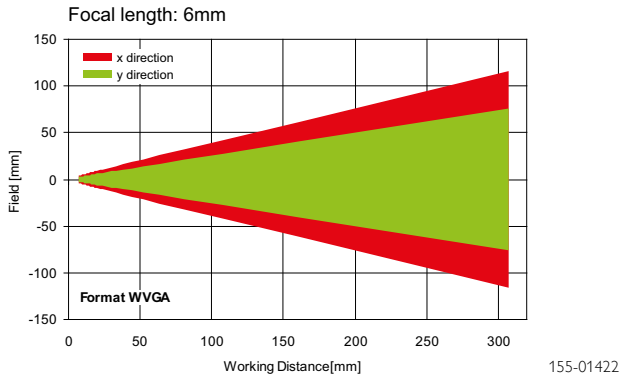
[1] Max. ripple < 5 V_{SS} [3] 80 % air humidity, non-condensing

Illumination	Product variant	Part number	Article number
White	Monochrome	V10-EYE-A1-W6	537-91000
Red	Monochrome	V10-EYE-A1-R6	537-91002
Infrared	Monochrome	V10-EYE-A1-I6	537-91005
White	Colour	V10C-EYE-A2-W6	537-91011

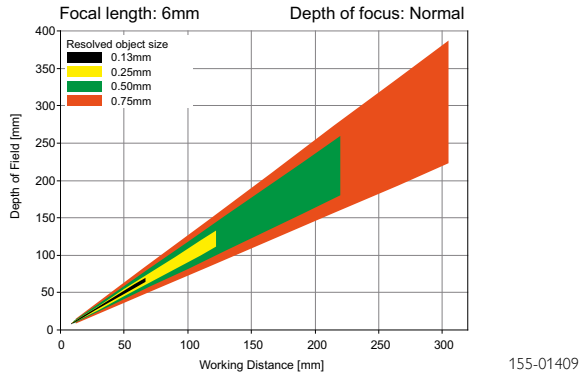
V10 vision system



Field of view



Depth of field: normal



Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Brackets	From Page A-4
Interface accessories	From Page A-36

V10 Eyesight

Vision system for complex image-processing applications, 12 mm



PRODUCT HIGHLIGHTS

- Complete image-processing package with robust and flexible hardware
- Programming via drag & drop of function blocks
- Complex, iterative linkage of individual inspections
- Image processing can be simulated on the PC without camera
- Image and result visualisation in inspection mode
- Script interpreter for advanced user functions

Optical data	
Resolution	736 x 480 pixels
CMOS	1/3", monochrome or colour
Integrated lens, focal length	12 mm, adjustable focal position
Adjustment range	30 mm to infinity
Integrated illumination	White, red, infrared LEDs
Minimum field of view, X x Y	8 x 6 mm²

Functions	
Number of inspection programs	No limitation (max. ca. 40 MB)
Functions	All function blocks for object measurement, position determination/ tracking, sequence control, data and image transfer, contour inspection, sub-programs, script interpreter.
Properties	See overview of commands
Typical cycle times	Dependent on inspection program

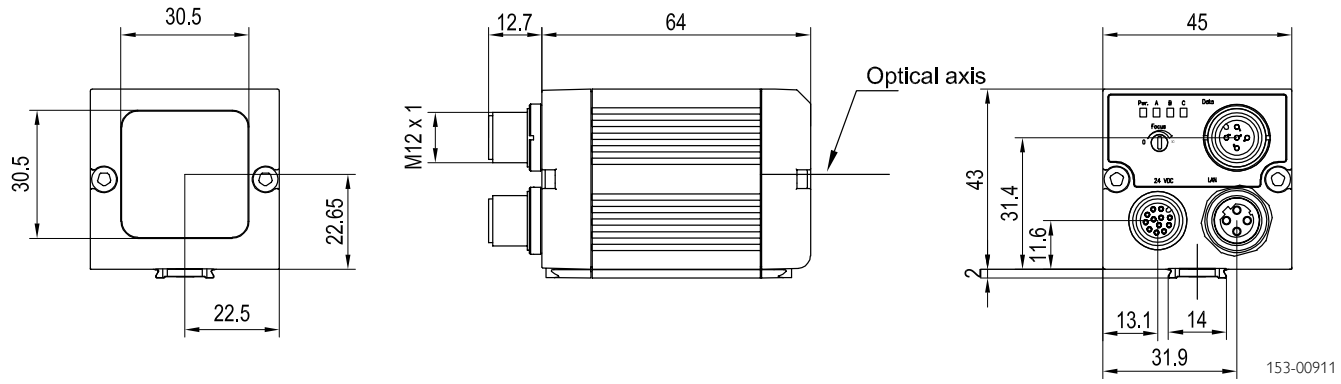
Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Ca. 13 s after Power on
Outputs	PNP
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP High > U_B-1 V, Low < 3 V
Input resistance	> 20 kΩ
Interfaces	Ethernet (LAN), RS422, RS232
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm³ (without plug)
Enclosure rating	IP 67
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50 °C[2]
Ambient temperature: storage	-20 … +60 °C[2]
Weight	Ca. 160 g
Plug connections	Supply and I/O M12, 12-pin Ethernet M12, 4-pin Data M12, 5-pin
Vibration and impact resistance	EN 60947-5-2

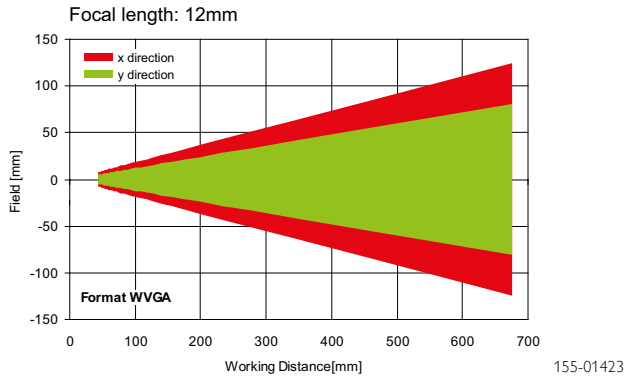
[1] Max. ripple < 5 V_{SS} [2] 80 % air humidity, non-condensing

Illumination	Product variant	Part number	Article number
White	Monochrome	V10-EYE-A1-W12	537-91001
Red	Monochrome	V10-EYE-A1-R12	537-91003
Infrared	Monochrome	V10-EYE-A1-I12	537-91006
White	Colour	V10C-EYE-A2-W12	537-91012

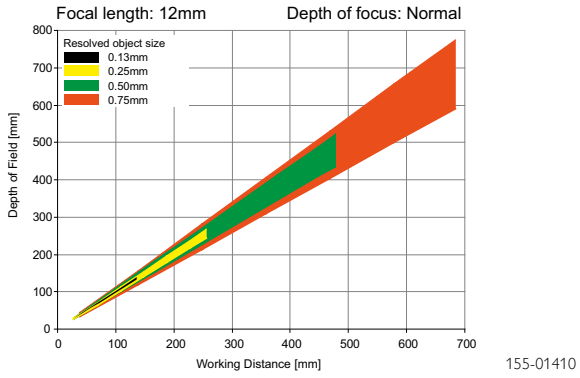
V10 vision system



Field of view



Depth of field: normal



Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Brackets	From Page A-4
Interface accessories	From Page A-36

V10 Eyesight

Vision system for complex image-processing applications, C-mount



PRODUCT HIGHLIGHTS

- Complete image-processing package with robust and flexible hardware
- Programming via drag & drop of function blocks
- Complex, iterative linkage of individual inspections
- Image processing can be simulated on the PC without camera
- Image and result visualisation in inspection mode
- Script interpreter for advanced user functions

Optical data	
Resolution	736 x 480 pixels
CMOS	1/3", monochrome or colour
Integrated lens, focal length	C-mount
Adjustment range	Dependent on lens
Integrated illumination	None
Minimum field of view, X x Y	Dependent on lens

Functions	
Number of inspection programs	No limitation (max. ca. 40 MB)
Functions	All function blocks for object measurement, position determination/ tracking, sequence control, data and image transfer, contour inspection, sub-programs, script interpreter.
Properties	See overview of commands
Typical cycle times	Dependent on inspection program

Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Ca. 13 s after Power on
Outputs	PNP
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP High > U_B-1 V, Low < 3 V
Input resistance	> 20 kΩ
Interfaces	Ethernet (LAN), RS422, RS232
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

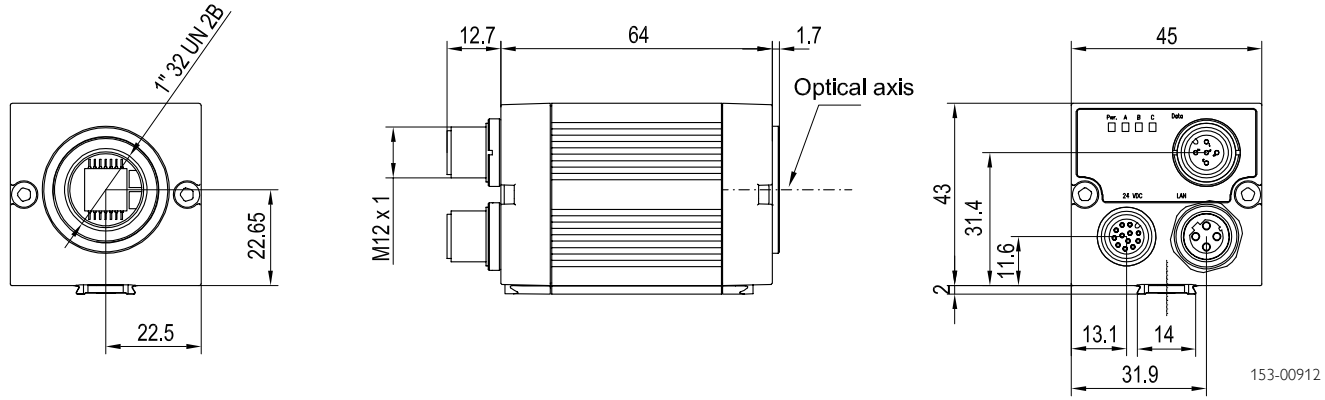
Mechanical data	
Dimensions	65 x 45 x 45 mm³ (without plug)
Enclosure rating	IP 65[2]
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50 °C[3]
Ambient temperature: storage	-20 … +60 °C[3]
Weight	Ca. 160 g
Plug connections	Supply and I/O M12, 12-pin Ethernet M12, 4-pin Data M12, 5-pin
Vibration and impact resistance	EN 60947-5-2

[1] Max. ripple < 5 V_{SS} [2] With LPT45 C-mount protective casing [3] 80 % air humidity, non-condensing

Product variant	Part number	Article number
Monochrome	V10-EYE-A1-C	537-91004
Colour	V10C-EYE-A2-C	537-91013

Version: 10/2013. Subject to changes; diagrams similar

V10 vision system



Lens



	LO C 8	LO C 12	LO C 16	LO C 25	LO C 50
Focal length	8 mm	12 mm	16 mm	25 mm	50 mm
Article number	526-51513	526-51514	526-51515	526-51516	526-51113

Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Lenses	From Page A-23
Brackets	From Page A-4
Interface accessories	From Page A-36

VISOR® Code Reader

In a class of its own.



VISOR® Code Reader

V20-CR-P2-R12

- *Professional version for detecting 1D/2D codes, objects and for optical character reading with OCR*
- *Megapixel resolution*
- *Rapidly detects as many jobs and detectors as desired*
- *Has position tracking*
- *Reads several different types of codes in one reading pass*

>> Page 126

V10-CR-S1-R12

- *Standard version for detecting 1D/2D codes*
- *Maximum of 8 inspection tasks with one evaluation each (maximum of 5 identical types of code per reading)*

>> Page 132

The VISOR® Code Reader from SensoPart easily reads bar codes of numerous types as well as printed and directly marked data matrix codes according to the ECC200 standard, regardless of the carrier materials (metal, plastic, paper, glass). The sensor even easily deciphers skewed or distorted codes, or those attached to convex, reflective or transparent surfaces.

Built-in early warning system: the VISOR® Code Reader evaluates the quality of your printed and directly marked data matrix codes on the basis of standardised quality parameters according to ISO and AIM standards.

HIGHLIGHTS OF VISOR® CODE READER

- Reliably reads bar codes as well as printed and directly marked data matrix codes, and even several codes simultaneously and mixed 1D/2D codes
- Supplementary object detection for features other than codes
- Evaluation of quality parameters according to ISO/IEC 15415 and AIM DPM 2006
- Flexible definition of output data (header, trailer, net data)
- String comparision with message via the digital switching output
- Support of EtherNet/IP and DHCP
- Comprehensive possibilities for archiving pictures and data
- Reading of optical characters with OCR

Applications

- Product labelling and identification
- Automated product tracking
- Product picking, quality assurance

Sectors

- Automotive and supplier industries
- Food and beverages industries
- Pharmaceutical and cosmetics industries
- Packaging industry and logistics
- Laboratory automation
- Solar industry

made in Germany



Printed bar codes



Laser-printed codes on plastic



Codes on glass

A lot of information in a small space: *up to 2,334 ASCII symbols (7 bit) or 3,116 digits can be coded with an ECC-200 data matrix code.*

VISOR® Code Reader – Product Overview					
	Product variants	Resolution	Focal length	Integrated illumination	Page
V20-CR-A2-xxx	Advanced	1280 x 1024 pixels	12 mm	White, red or infrared LEDs	122
V20-CR-A2-xxx	Advanced	1280 x 1024 pixels	C-mount	None	124
V20-CR-P2-xxx	Professional	1280 x 1024 pixels	12 mm	White, red or infrared LEDs	126
V20-CR-P2-xxx	Professional	1280 x 1024 pixels	C-mount	None	128
V10-CR-S1-xxx	Standard	736 x 480 pixels	6 mm	White, red or infrared LEDs	130
V10-CR-S1-xxx	Standard	736 x 480 pixels	12 mm	White, red or infrared LEDs	132
V10-CR-A1-xxx	Advanced	736 x 480 pixels	6 mm	White, red or infrared LEDs	134
V10-CR-A1-xxx	Advanced	736 x 480 pixels	12 mm	White, red or infrared LEDs	136
V10-CR-A1-xxx	Advanced	736 x 480 pixels	25 mm	White, red or infrared LEDs	138
V10-CR-A1-xxx	Advanced	736 x 480 pixels	C-mount	None	140

The VISOR® Code Reader reads whatever's printed, dot peened and lasered.

System description

With its integrated object detection, the VISOR® Code Reader is unique in its price segment. The compact sensor reads conventional 1D bar codes, 2D data matrix codes and now also optical characters (OCR). It also has four detectors for object detection (pattern comparison, brightness, grey level and contrast), with which other object features – for example, stamps or logos – can be evaluated in a single reading pass. Codes and object features are even reliably detected with deviations from the taught-in position – using position tracking (optionally activated).

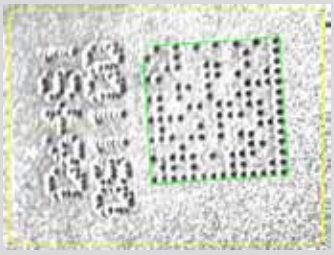
A special image filter with expanded setting options guarantees excellent reading performance even under difficult reading conditions. The test results can largely be evaluated within the sensor itself – with the option of string comparison or regular printouts – so that there is no need for a PLC or PC connection in many cases. If, however, this proves necessary, it can be easily and flexibly connected using freely available PLC function blocks for Siemens S7, Codesys and Allen Bradley.

With integrated quality parameters complying with ISO and AIM standards, the VISOR® Code Reader also permits the informative evaluation of printed and directly marked 1D and 2D codes. Integrated red, infrared or white light variants provide maximum functional reliability through optimum code illumination.

In addition, the robust, compact and industry-oriented housings guarantee reliability even where space is restricted. Integrated 6 mm or 12 mm optics or C-mount devices also save effort and costs through their optimum adaptation to the most varied of code sizes and operating distances. The new V20 variants also offer a resolution of 1.3 megapixels for particularly small codes or large search areas.

VISOR® Code Reader product variants

Features/sensors	Standard	Advanced	Professional
Functions			
V10 resolution in pixels	736 x 480	736 x 480	–
V20 resolution in pixels	–	1280 x 1024	1280 x 1024
Image rate per second V10 | V20	50 | –	50 | 40	– | 40
Number of jobs | detectors	8 | 1	max. 255 | max. 255	max. 255 | max. 255
Position tracking	–	✓	✓
Pattern comparison (X-,Y-translation)	–	✓	✓
Grey threshold	–	✓	✓
Contrast	–	✓	✓
Brightness	–	✓	✓
Data code	✓	✓	✓
Bar code	✓	✓	✓
OCR	–	–	✓
Freeform Tool	–	✓	✓
		(not with data codes and bar codes	*(not with data codes, bar codes and OCR)*
Interfaces			
Inputs | outputs	2 | 4	2 | 4	2 | 4
Freely definable switching outputs/inputs, PNP or NPN	2	4	4
Encoder input	–	✓	✓
I/O expansion	✓	✓	✓
RS422 | RS232	✓ | ✓	✓ | ✓	✓ | ✓
Ethernet / data transmission	✓	✓	✓
EtherNet / IP	✓	✓	✓
PROFIBUS interface connection	✓	✓	✓
Lens			
V10: integrated 6 mm | 12 mm | 25 mm	✓ | ✓ | –	✓ | ✓ | ✓	–
V20: integrated 12 mm	–	✓	✓
C-mount	–	✓	✓
Operation / visualisation			
Viewer software with user guidance	✓	✓	✓
Hierarchised user rights	✓	✓	✓



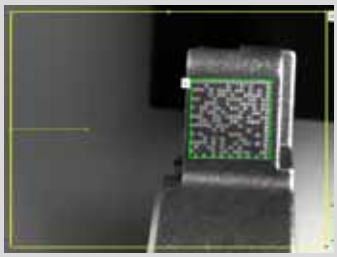
Dot peened code on rough substrate
Code is made legible by powerful reading algorithm. Presence of the nailed imprint in plain text can be checked using object detection.



Low-contrast code
Code is made legible through high tolerance – also towards weakly contrasting codes.



Optical character reading
Dot matrix printing can also be read with OCR



Code with small "quiet zone"
Even codes with a small quiet zone or damaged finder pattern can be read.



Code reading on solar cells
Even extremely small codes (e.g. on silicon solar cells) or highly reflective codes (e.g. on thin-layer solar cells) can be read.



Printed codes on pharmaceutical packaging
ECC200 or bar codes (e.g. EAN 13) can be searched for simultaneously. In addition to code reading, the presence of optical characters can also be checked using object detection.

Special features of the VISOR® Code Reader

- Can be used for all common 2D codes (e.g. ECC 200 data matrix) and common 1D bar codes
- Optimum cost-effectiveness through combination of two functions in one device: code reading and object detection
- High operating dependability through reliable detection of even poorly readable codes under difficult ambient conditions
- Flexible and simple connection to PC and PLC environments due to comprehensive possibilities for archiving pictures and read results, as well as freely available PLC function blocks for Siemens S7, Codesys and Allen Bradley
- Very high flexibility, e.g. also due to reading several similar or different codes in one reading pass
- Reading of optical characters with OCR based on neuronal networks, particularly suitable for point printing

VISOR® V20 Code Reader

Advanced vision sensor for code reading with object detection, 12 mm



PRODUCT HIGHLIGHTS

- Can be used for all common 2D codes (ECC 200 data matrix) and common 1D bar codes
- Combination of two functions in one device: code reading and object detection
- Reliable detection of even poorly readable codes under difficult ambient conditions
- Comprehensive tools for flexible and easy connection to PC and PLC environments
- Reading of several similar or differing types of codes in one reading pass

Optical data	
Resolution	1280 x 1024 pixels
CMOS	1/1.8", monochrome
Integrated lens, focal length	12 mm, adjustable focal position
Adjustment range	30 mm to infinity
Integrated illumination	White, red, infrared, UV LEDs
Minimum field of view, X x Y	16 x 13 mm[2]

Functions	
Number of jobs / detectors	max. 255 / max. 255
Detectors	Pattern comparison, contrast, brightness, grey level, bar code, data code
Properties	X/Y position tracking; pattern comparison: teach-in and pattern detection; grey level, brightness: evaluation of brightness; contrast: evaluation of contrast; bar code: reading of 1D bar codes, EAN, UPC, RSS, 2/5 Interleaved, 2/5 Industrial, Code 39, Code 93, Code 128, GS1, Pharmacode, Codabar; data code: reading of 2D codes: ECC200, QR code, PDF 417
Typical cycle time[2]	Typ. 20 ms pattern comparison; typ. 2 ms brightness; typ. 2 ms contrast; typ. 2 ms grey level; typ. 30 ms bar code; typ. 40 ms data code

Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Ca. 13 s after Power on
Outputs	PNP / NPN (switchable)
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP/NPN High > U_B-1 V, Low < 3 V
Input resistance	> 20 kΩ
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

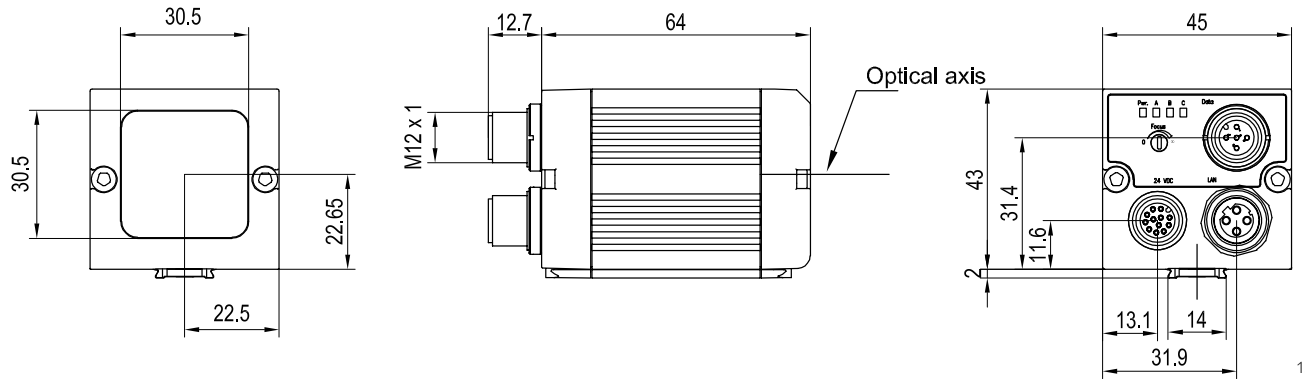
Mechanical data	
Dimensions	65 x 45 x 45 mm[3] (without plug)
Enclosure rating	IP 67
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 ... +50 °C[3]
Ambient temperature: storage	-20 ... +60 °C[3]
Weight	Ca. 160 g
Plug connection	Power and I/O M12 12-pin Ethernet M12 4-pin Data M12 5-pin
Vibration and impact resistance	EN 60947-5-2

[1] Max. ripple < 5 V_{SS} [2] with VGA-resolution (640 x 480 pixels) [3] 80 % air humidity, non-condensing

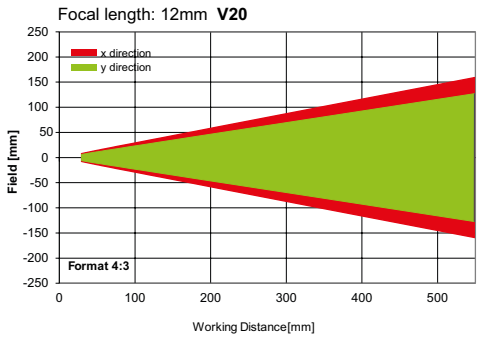
Illumination	Part number	Article number
White	V20-CR-A2-W12	536-91001
Red	V20-CR-A2-R12	536-91002
Infrared	V20-CR-A2-I12	536-91003
UV	V20-CR-A2-U12	536-91019

Version: 10/2013. Subject to changes; diagrams similar

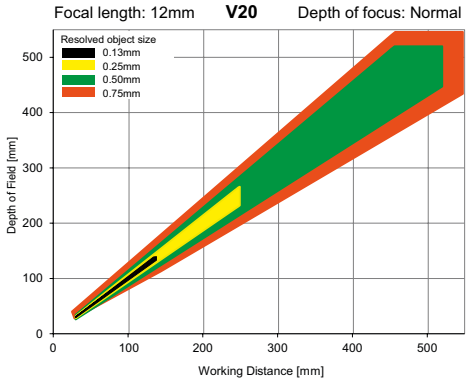
VISOR® vision sensor



Field of view



Depth of field: normal



Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Brackets	From Page A-4
Interface accessories	From Page A-36

VISOR® V20 Code Reader

Advanced vision sensor for code reading with object detection, C-mount



PRODUCT HIGHLIGHTS

- Can be used for all common 2D codes (ECC 200 data matrix) and common 1D bar codes
- Combination of two functions in one device: code reading and object detection
- Reliable detection of even poorly readable codes under difficult ambient conditions
- Comprehensive tools for flexible and easy connection to PC and PLC environments
- Reading of several similar or differing types of codes in one reading pass

Optical data	
Resolution	1280 x 1024 pixels
CMOS	1/1.8", monochrome
Integrated lens, focal length	C-mount
Adjustment range	Dependent on lens
Integrated illumination	None
Minimum field of view, X x Y	Dependent on lens

Functions	
Number of jobs / detectors	max. 255 / max. 255
Detectors	Pattern comparison, contrast, brightness, grey level, bar code, data code
Properties	X/Y position tracking; pattern comparison: teach-in and pattern detection; grey level, brightness: evaluation of brightness; contrast: evaluation of contrast; bar code: reading of 1D bar codes, EAN, UPC, RSS, 2/5 Interleaved, 2/5 Industrial, Code 39, Code 93, Code 128, GS1, Pharmacode, Codabar; data code: reading of 2D codes: ECC200, QR code, PDF 417
Typical cycle time[2]	Typ. 20 ms pattern comparison; typ. 2 ms brightness; typ. 2 ms contrast; typ. 2 ms grey level; typ. 30 ms bar code; typ. 40 ms data code

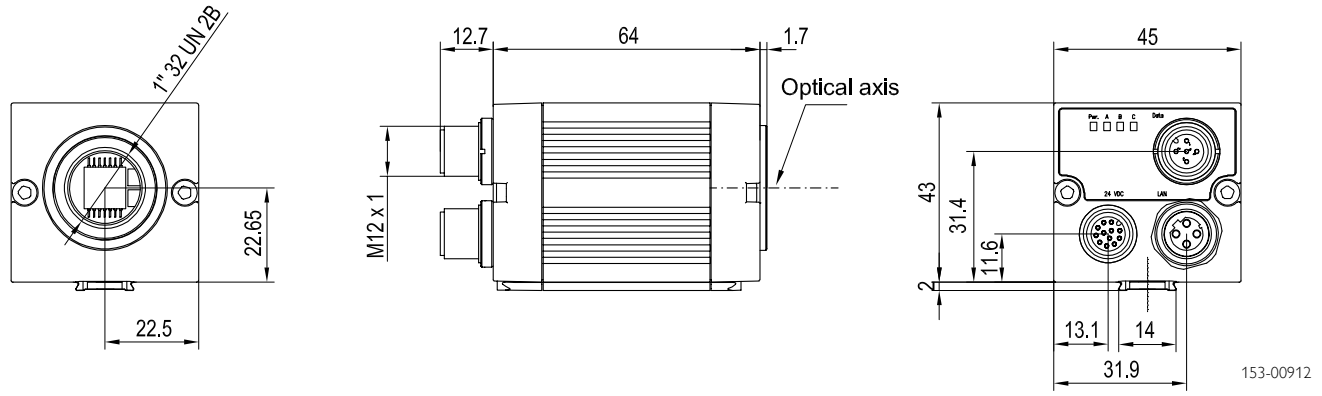
Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Ca. 13 s after Power on
Outputs	PNP / NPN (switchable)
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP/NPN High > U_B-1 V, Low < 3 V
Input resistance	> 20 kΩ
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm[3] (without plug)
Enclosure rating	IP 65[3]
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50 °C[4]
Ambient temperature: storage	-20 … +60 °C[4]
Weight	Ca. 160 g
Plug connection	Power and I/O M12 12-pin Ethernet M12 4-pin Data M12 5-pin
Vibration and impact resistance	EN 60947-5-2

[1] Max. ripple < 5 V_{SS} [2] With VGA-resolution (640 x 480 Pixel) [3] With LPT45 C-mount protective casing [4] 80 % air humidity, non-condensing

Part number	Article number
V20-CR-A2-C	536-91000

VISOR® vision sensor



Lens



	LO C 8	LO C 12	LO C 16	LO C 25	LO C 50
Focal length	8 mm	12 mm	16 mm	25 mm	50 mm
Article number	526-51513	526-51514	526-51515	526-51516	526-51113

Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Lenses	From Page A-23
Brackets	From Page A-4
Interface accessories	From Page A-36

VISOR® V20 Code Reader

Professional vision sensor for code reading, object detection and OCR, 12 mm



PRODUCT HIGHLIGHTS

- Can be used for all common 2D codes (ECC 200 data matrix) and common 1D bar codes
- Combination of two functions in one device: code reading and object detection
- Reliable detection of even poorly readable codes under difficult ambient conditions
- Comprehensive tools for flexible and easy connection to PC and PLC environments
- Reading of several similar or differing types of codes in one reading pass
- Reading of optical characters with OCR

Optical data	
Resolution	1280 x 1024 pixels
CMOS	1/1.8", monochrome
Integrated lens, focal length	12 mm, adjustable focal position
Adjustment range	30 mm to infinity
Integrated illumination	White, red, infrared LEDs
Minimum field of view, X x Y	16 x 13 mm[2]

Functions	
Number of jobs / detectors	max. 255 / max. 255
Detectors	Pattern comparison, contrast, brightness, grey level, bar code, data code, OCR
Properties	X/Y position tracking; pattern comparison: teach-in and pattern detection; grey level, brightness: evaluation of brightness; contrast: evaluation of contrast; bar code: reading of 1D bar codes, EAN, UPC, RSS, 2/5 Interleaved, 2/5 Industrial, Code 39, Code 93, Code 128, GS1, Pharmacode, Codabar; data code: reading of 2D codes: ECC200, QR code, PDF 417; OCR: optical character reading
Typical cycle time[2]	Typ. 20 ms pattern comparison; typ. 2 ms brightness; typ. 2 ms contrast; typ. 2 ms grey level; typ. 30 ms bar code; typ. 40 ms data code; typ. 15 ms per character OCR

Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Ca. 13 s after Power on
Outputs	PNP / NPN (switchable)
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP/NPN High > U_B-1 V, Low < 3 V
Input resistance	> 20 kΩ
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

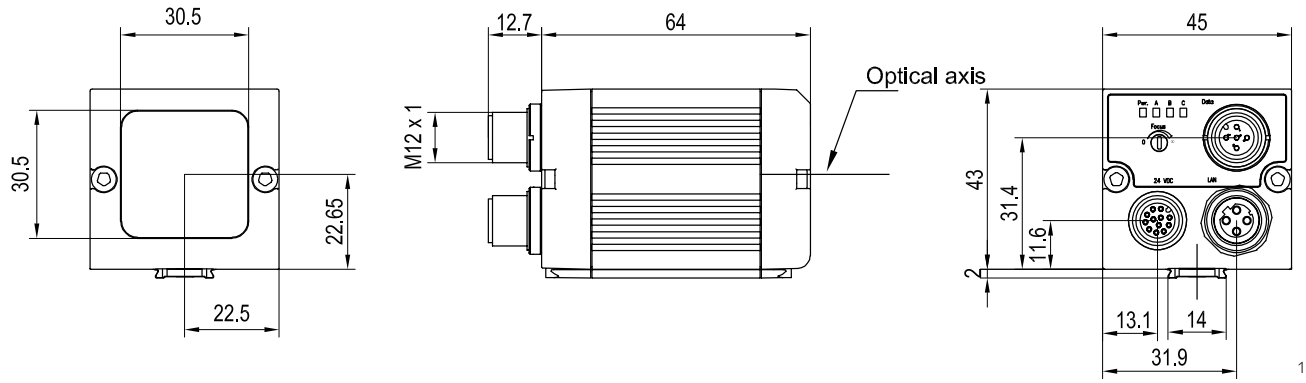
Mechanical data	
Dimensions	65 x 45 x 45 mm[3] (without plug)
Enclosure rating	IP 67
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 ... +50 °C[3]
Ambient temperature: storage	-20 ... +60 °C[3]
Weight	Ca. 160 g
Plug connection	Power and I/O M12 12-pin Ethernet M12 4-pin Data M12 5-pin
Vibration and impact resistance	EN 60947-5-2

[1] Max. ripple < 5 V_{SS} [2] With VGA-resolution (640 x 480 Pixel) [3] 80 % air humidity, non-condensing

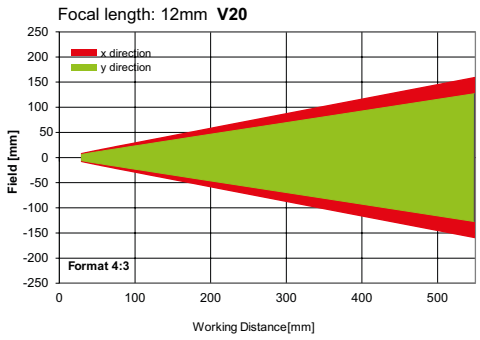
Illumination	Part number	Article number
White	V20-CR-P2-W12	536-91005
Red	V20-CR-P2-R12	536-91006
Infrared	V20-CR-P2-I12	536-91007

Version: 10/2013. Subject to changes; diagrams similar

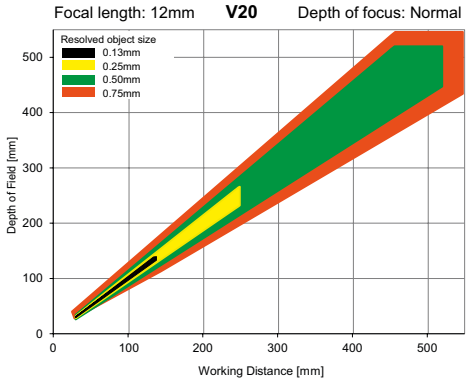
VISOR® vision sensor



Field of view



Depth of field: normal



Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Brackets	From Page A-4
Interface accessories	From Page A-36

VISOR® V20 Code Reader

Professional vision sensor for code reading, object detection and OCR, C-mount



PRODUCT HIGHLIGHTS

- Can be used for all common 2D codes (ECC 200 data matrix) and common 1D bar codes
- Combination of two functions in one device: code reading and object detection
- Reliable detection of even poorly readable codes under difficult ambient conditions
- Comprehensive tools for flexible and easy connection to PC and PLC environments
- Reading of several similar or differing types of codes in one reading pass
- Reading of optical characters with OCR

Optical data	
Resolution	1280 x 1024 pixels
CMOS	1/1.8", monochrome
Integrated lens, focal length	C-mount
Adjustment range	Dependent on lens
Integrated illumination	None
Minimum field of view, X x Y	Dependent on lens

Functions	
Number of jobs / detectors	max. 255 / max. 255
Detectors	Pattern comparison, contrast, brightness, grey level, bar code, data code, OCR
Properties	X/Y position tracking; pattern comparison: teach-in and pattern detection; grey level, brightness: evaluation of brightness; contrast: evaluation of contrast; bar code: reading of 1D bar codes, EAN, UPC, RSS, 2/5 Interleaved, 2/5 Industrial, Code 39, Code 93, Code 128, GS1, Pharmacode, Codabar; data code: reading of 2D codes: ECC200, QR code, PDF 417; OCR: optical character reading
Typical cycle time[2]	Typ. 20 ms pattern comparison; typ. 2 ms brightness; typ. 2 ms contrast; typ. 2 ms grey level; typ. 30 ms bar code; typ. 40 ms data code; typ. 15 ms per character OCR

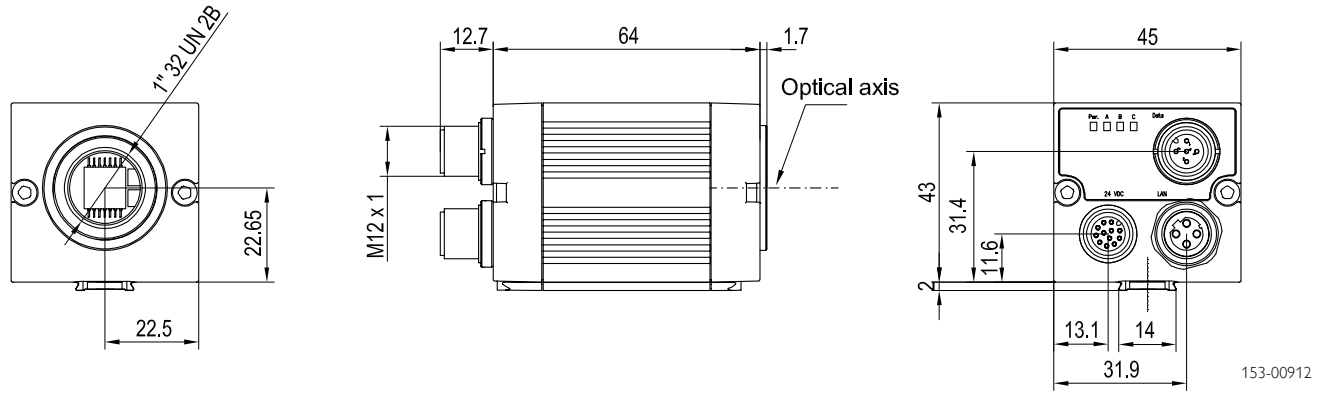
Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Ca. 13 s after Power on
Outputs	PNP / NPN (switchable)
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP/NPN High > U_B-1 V, Low < 3 V
Input resistance	> 20 kΩ
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm[3] (without plug)
Enclosure rating	IP 65[3]
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50 °C[4]
Ambient temperature: storage	-20 … +60 °C[4]
Weight	Ca. 160 g
Plug connection	Power and I/O M12 12-pin Ethernet M12 4-pin Data M12 5-pin
Vibration and impact resistance	EN 60947-5-2

[1] Max. ripple < 5 V_{SS} [2] With VGA-resolution (640 x 480 Pixel) [3] With LPT45 C-mount protective casing [4] 80 % air humidity, non-condensing

Part number	Article number
V20-CR-P2-C	536-91004

VISOR® vision sensor



Lens



	LO C 8	LO C 12	LO C 16	LO C 25	LO C 50
Focal length	8 mm	12 mm	16 mm	25 mm	50 mm
Article number	526-51513	526-51514	526-51515	526-51516	526-51113

Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Lenses	From Page A-23
Brackets	From Page A-4
Interface accessories	From Page A-36

VISOR® V10 Code Reader

Standard vision sensor for code reading, 6 mm



PRODUCT HIGHLIGHTS

- Can be used for all common 2D codes (ECC 200 data matrix) and common 1D bar codes
- Reliable detection of even poorly readable codes under difficult ambient conditions
- Comprehensive tools for flexible and easy connection to PC and PLC environments

Optical data	
Resolution	736 x 480 pixels
CMOS	1/3", monochrome
Integrated lens, focal length	6 mm, adjustable focal position
Adjustment range	6 mm to infinity
Integrated illumination	White, red, infrared LEDs
Minimum field of view, X x Y	5 x 4 mm²

Functions	
Number of jobs / detectors	8 / 1
Detectors	Bar code / data code
Properties	UPC, RSS, 2/5 Interleaved, 2/5 Industrial, Code 39, Code 93, Code 128, GS1, Pharmacode, Codabar; data code: reading of 2D codes, ECC200, QR code, PDF 417
Typical cycle time	Typ. 30 ms bar code Typ. 40 ms data code

Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Ca. 13 s after Power on
Outputs	PNP / NPN (switchable)
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP/NPN High > U_B-1V, Low < 3V
Input resistance	> 20 kOhm
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP
Inputs/outputs	2 inputs, 4 outputs, 2 selectable inputs/outputs

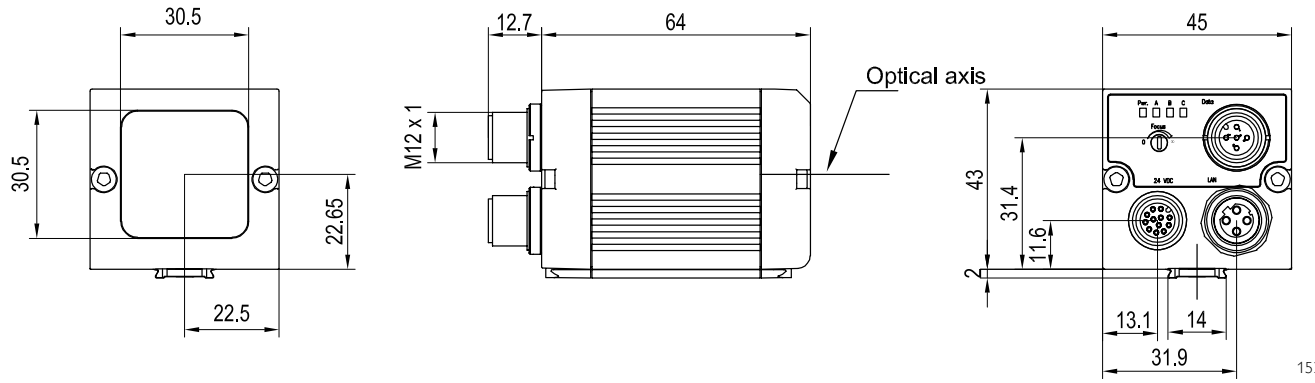
Mechanical data	
Dimensions	65 x 45 x 45 mm³ (without plug)
Enclosure rating	IP 67
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50 °C[2]
Ambient temperature: storage	-20 … +60 °C[2]
Weight	Ca. 160 g
Plug connection	Power and I/O M12, 12pin Ethernet M12, 4pin Data M12, 5-pin
Vibration and impact resistance	EN 60947-5-2

[1] Max. ripple < 5 V_{SS} [2] 80 % air humidity, non-condensing

Illumination	Depth of field	Part number	Article number
White	Normal	V10-CR-S1-W6	535-91034
White	Enhanced	V10-CR-S1-W6D	535-91036
Red	Normal	V10-CR-S1-R6	535-91038
Red	Enhanced	V10-CR-S1-R6D	535-91040
Infrared	Normal	V10-CR-S1-I6	535-91042
Infrared	Enhanced	V10-CR-S1-I6D	535-91044

Version: 10/2013. Subject to changes; diagrams similar

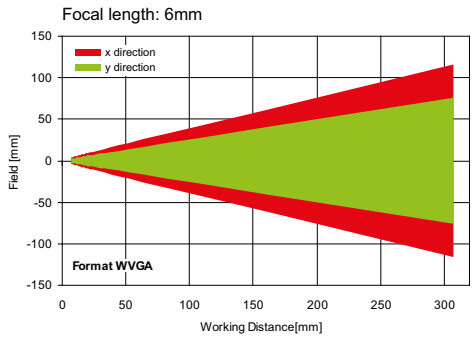
VISOR® vision sensor



153-00911

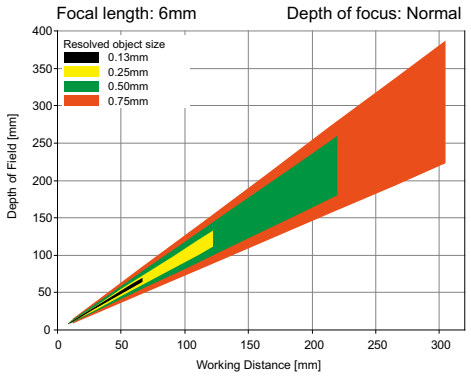
5

Field of view



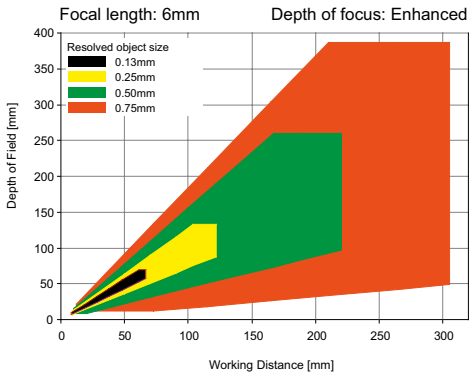
155-01422

Depth of field: normal



155-01409

Depth of field: enhanced



155-01421

Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Brackets	From Page A-4
Interface accessories	From Page A-36

VISOR® V10 Code Reader

Standard vision sensor for code reading, 12 mm



PRODUCT HIGHLIGHTS

- Can be used for all common 2D codes (ECC 200 data matrix) and common 1D bar codes
- Reliable detection of even poorly readable codes under difficult ambient conditions
- Comprehensive tools for flexible and easy connection to PC and PLC environments

Optical data	
Resolution	736 x 480 pixels
CMOS	1/3", monochrome
Integrated lens, focal length	12 mm, adjustable focal position
Adjustment range	30 mm to infinity
Integrated illumination	White, red, infrared LEDs
Minimum field of view, X x Y	8 x 6 mm²

Functions	
Number of jobs / detectors	8 / 1
Detectors	Bar code / data code
Properties	Bar code: reading of 1D bar codes, EAN, UPC, RSS, 2/5 Interleaved, 2/5 Industrial, Code 39, Code 93, Code 128, GS1, Pharmacode, Codabar; data code: reading of 2D codes, ECC200, QR code, PDF 417
Typical cycle time	Typ. 30 ms bar code Typ. 40 ms data code

Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Ca. 13 s after Power on
Outputs	PNP / NPN (switchable)
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP/NPN High > U_B-1 V, Low < 3 V
Input resistance	> 20 kOhm
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP
Inputs/outputs	2 inputs, 4 outputs, 2 selectable inputs/outputs

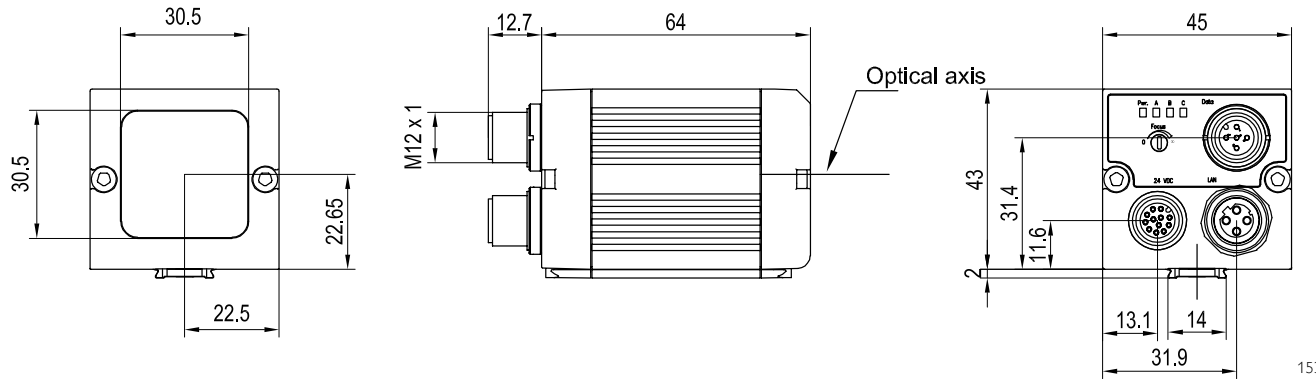
Mechanical data	
Dimensions	65 x 45 x 45 mm³ (without plug)
Enclosure rating	IP 67
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50 °C[2]
Ambient temperature: storage	-20 … +60 °C[2]
Weight	Ca. 160 g
Plug connection	Supply and I/O M12, 12-pin Ethernet M12, 4-pin Data M12, 5-pin
Vibration and impact resistance	EN 60947-5-2

[1] Max. ripple < 5 V_{SS} [2] 80 % air humidity, non-condensing

Illumination	Depth of field	Part number	Article number
White	Normal	V10-CR-S1-W12	535-91035
White	Enhanced	V10-CR-S1-W12D	535-91037
Red	Normal	V10-CR-S1-R12	535-91039
Red	Enhanced	V10-CR-S1-R12D	535-91041
Infrared	Normal	V10-CR-S1-I12	535-91043
Infrared	Enhanced	V10-CR-S1-I12D	535-91045

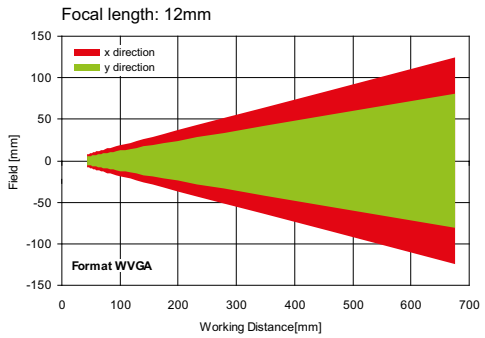
Version: 10/2013. Subject to changes; diagrams similar

VISOR® vision sensor



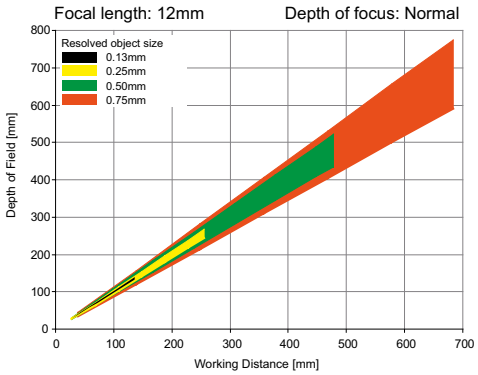
153-00911

Field of view



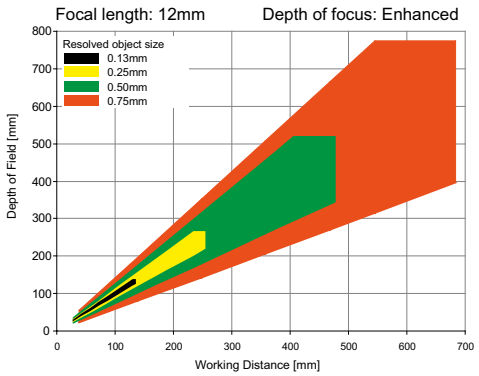
155-01423

Depth of field: normal



155-01410

Depth of field: enhanced



155-01411

Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Brackets	From Page A-4
Interface accessories	From Page A-36

VISOR® V10 Code Reader

Advanced vision sensor for code reading with object detection, 6 mm



PRODUCT HIGHLIGHTS

- Can be used for all common 2D codes (ECC 200 data matrix) and common 1D bar codes
- Combination of two functions in one device: code reading and object detection
- Reliable detection of even poorly readable codes under difficult ambient conditions
- Comprehensive tools for flexible and easy connection to PC and PLC environments
- Reading of several similar or differing types of codes in one reading pass

Optical data	
Resolution	736 x 480 pixels
CMOS	1/3", monochrome
Integrated lens, focal length	6 mm, adjustable focal position
Adjustment range	6 mm to infinity
Integrated illumination	White, red, infrared LEDs
Minimum field of view, X x Y	5 x 4 mm²

Functions	
Number of jobs / detectors	max. 255 / max. 255
Detectors	Pattern comparison, contrast, brightness, grey level, bar code, data code
Properties	X/Y position tracking; pattern comparison: teach-in and pattern detection; grey level, brightness: evaluation of brightness; contrast: evaluation of contrasts; bar code: reading of 1D bar codes, EAN, UPC, RSS, 2/5 Interleaved, 2/5 Industrial, Code 39, Code 93, Code 128, GS1, Pharmacode, Codabar; data code: reading of 2D codes, ECC200, QR code, PDF 417
Typical cycle time	Typ. 20 ms pattern comparison; typ. 2 ms brightness; typ. 2 ms contrast; typ. 2 ms grey level; typ. 30 ms bar code; typ. 40 ms data code

Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Ca. 13 s after Power on
Outputs	PNP / NPN (switchable)
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP/NPN High > U_B-1 V, Low < 3 V
Input resistance	> 20 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm³ (without plug)
Enclosure rating	IP 67
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50 °C[2]
Ambient temperature: storage	-20 … +60 °C[2]
Weight	Ca. 160 g
Plug connection	Supply and I/O M12, 12-pin Ethernet M12, 4-pin Data M12, 5-pin
Vibration and impact resistance	EN 60947-5-2

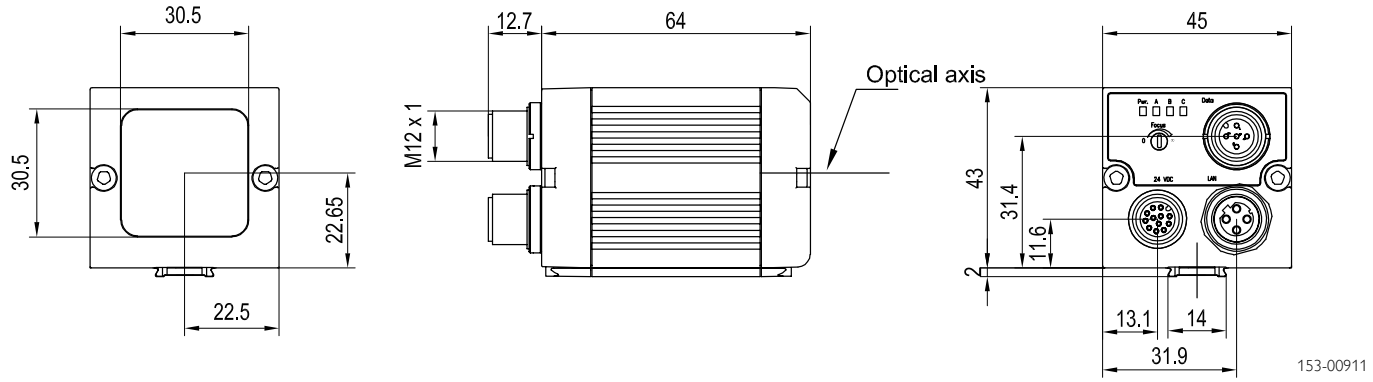
[1] Max. ripple < 5 V_{SS} [2] 80 % air humidity, non-condensing

Illumination	Depth of field	Part number	Article number
White	Normal	V10-CR-A1-W6	535-91021
White	Enhanced	V10-CR-A1-W6D	535-91023
Red	Normal	V10-CR-A1-R6	535-91025
Red	Enhanced	V10-CR-A1-R6D	535-91027

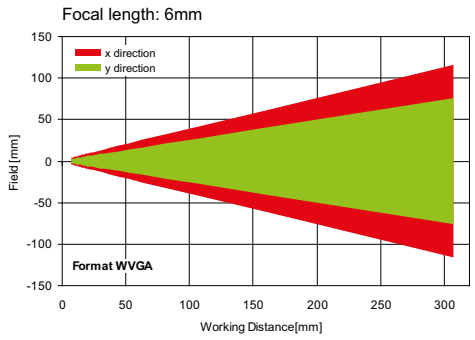
Version: 10/2013. Subject to changes; diagrams similar

Illumination	Depth of field	Part number	Article number
Infrared	Normal	V10-CR-A1-I6	535-91029
Infrared	Enhanced	V10-CR-A1-I6D	535-91031

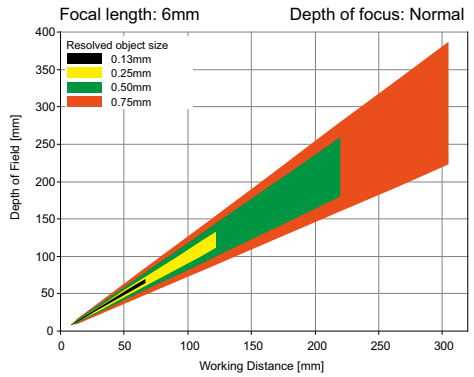
VISOR® vision sensor



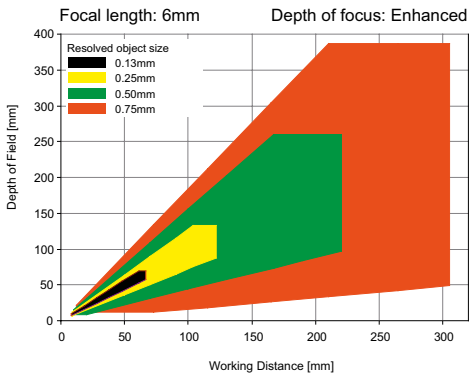
Field of view



Depth of field: normal



Depth of field: enhanced



Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Brackets	From Page A-4
Interface accessories	From Page A-36

VISOR® V10 Code Reader

Advanced vision sensor for code reading with object detection, 12 mm



PRODUCT HIGHLIGHTS

- Can be used for all common 2D codes (ECC 200 data matrix) and common 1D bar codes
- Combination of two functions in one device: code reading and object detection
- Reliable detection of even poorly readable codes under difficult ambient conditions
- Comprehensive tools for flexible and easy connection to PC and PLC environments
- Reading of several similar or differing types of codes in one reading pass

Optical data	
Resolution	736 x 480 pixels
CMOS	1/3", monochrome
Integrated lens, focal length	12 mm, adjustable focal position
Adjustment range	30 mm to infinity
Integrated illumination	White, red, infrared LEDs
Minimum field of view, X x Y	8 x 6 mm²

Functions	
Number of jobs / detectors	max. 255 / max. 255
Detectors	Pattern comparison, contrast, brightness, grey level, bar code, data code
Properties	X/Y position tracking; pattern comparison: teach-in and pattern detection; grey level, brightness: evaluation of brightness; contrast: evaluation of contrast; bar code: reading of 1D bar codes, EAN, UPC, RSS, 2/5 Interleaved, 2/5 Industrial, Code 39, Code 93, Code 128, GS1, Pharmacode, Codabar; data code: reading of 2D codes: ECC200, QR code, PDF 417
Typical cycle time	Typ. 20 ms pattern comparison; typ. 2 ms brightness; typ. 2 ms contrast; typ. 2 ms grey level; typ. 30 ms bar code; typ. 40 ms data code

Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Ca. 13 s after Power on
Outputs	PNP / NPN (switchable)
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP/NPN High > U_B-1 V, Low < 3 V
Input resistance	> 20 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232 EtherNet/IP
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm³ (without plug)
Enclosure rating	IP 67
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50 °C[2]
Ambient temperature: storage	-20 … +60 °C[2]
Weight	Ca. 160 g
Plug connection	Supply and I/O M12, 12-pin Ethernet M12, 4-pin Data M12, 5-pin
Vibration and impact resistance	EN 60947-5-2

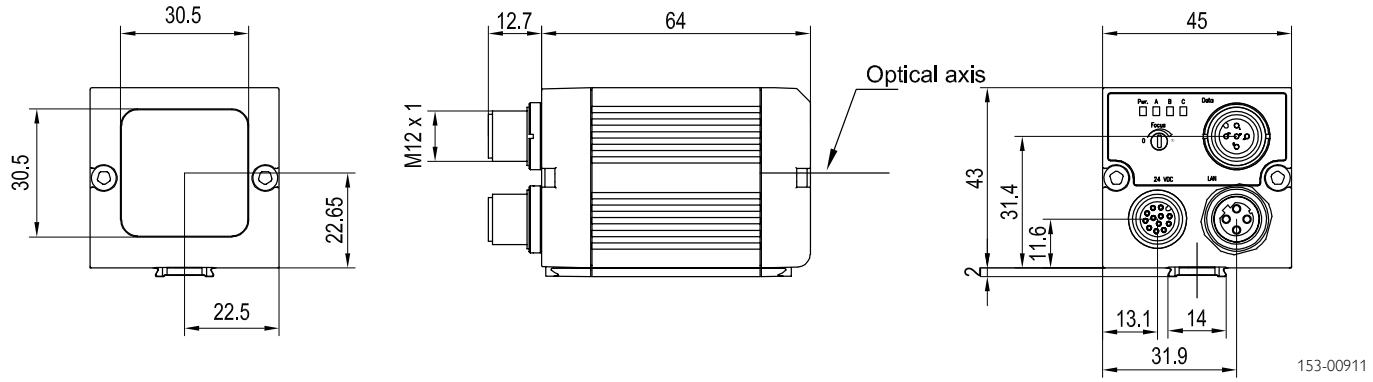
[1] Max. ripple < 5 V_{SS} [2] 80 % air humidity, non-condensing

Illumination	Depth of field	Part number	Article number
White	Normal	V10-CR-A1-W12	535-91022
White	Enhanced	V10-CR-A1-W12D	535-91024
Red	Normal	V10-CR-A1-R12	535-91026
Red	Enhanced	V10-CR-A1-R12D	535-91028

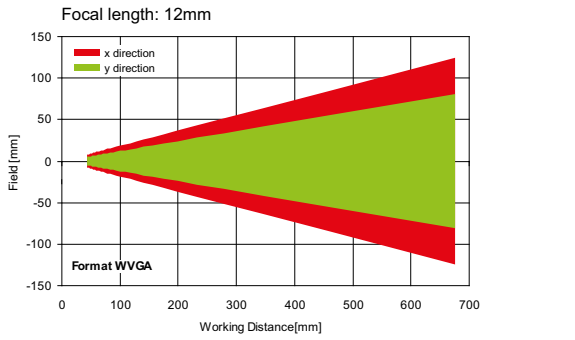
Version: 10/2013. Subject to changes; diagrams similar

Illumination	Depth of field	Part number	Article number
Infrared	Normal	V10-CR-A1-I12	535-91030
Infrared	Enhanced	V10-CR-A1-I12D	535-91032

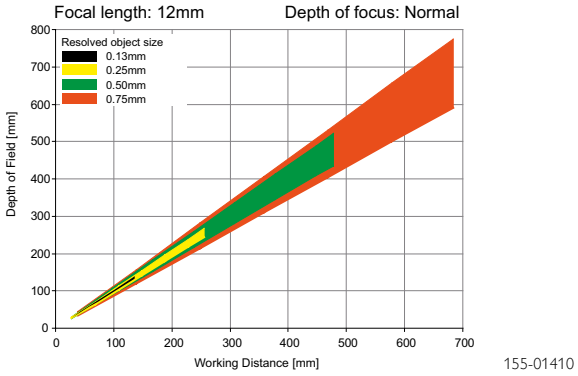
VISOR® vision sensor



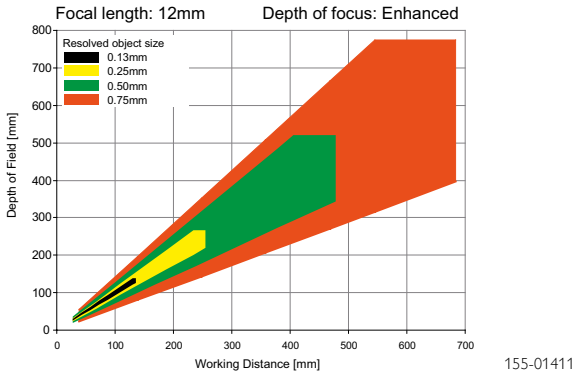
Field of view



Depth of field: normal



Depth of field: enhanced



Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Brackets	From Page A-4
Interface accessories	From Page A-36

VISOR® V10 Code Reader

Advanced vision sensor code reading with object detection, 25 mm



PRODUCT HIGHLIGHTS

- Can be used for all common 2D codes (ECC 200 data matrix) and common 1D bar codes
- Combination of two functions in one device: code reading and object detection
- Reliable detection of even poorly readable codes under difficult ambient conditions
- Comprehensive tools for flexible and easy connection to PC and PLC environments
- Reading of several similar or differing types of codes in one reading pass

Optical data	
Resolution	736 x 480 pixels
CMOS	1/3", monochrome
Integrated lens, focal length	25 mm, adjustable focal position
Adjustment range	140 mm to infinity
Integrated illumination	White, red, infrared LEDs
Minimum field of view, X x Y	18 x 14 mm[2]

Functions	
Number of jobs / detectors	max. 255 / max. 255
Detectors	Pattern comparison, contrast, brightness, grey level, bar code, data code
Properties	X/Y position tracking; pattern comparison: teach-in and pattern detection; grey level, brightness: evaluation of brightness; contrast: evaluation of contrast; bar code: reading of 1D bar codes, EAN, UPC, RSS, 2/5 Interleaved, 2/5 Industrial, Code 39, Code 93, Code 128, GS1, Pharmacode, Codabar; data code: reading of 2D codes: ECC200, QR code, PDF 417
Typical cycle times	Typ. 20 ms pattern comparison; typ. 2 ms brightness; typ. 2 ms contrast; typ. 2 ms grey level; typ. 30 ms bar code; typ. 40 ms data code

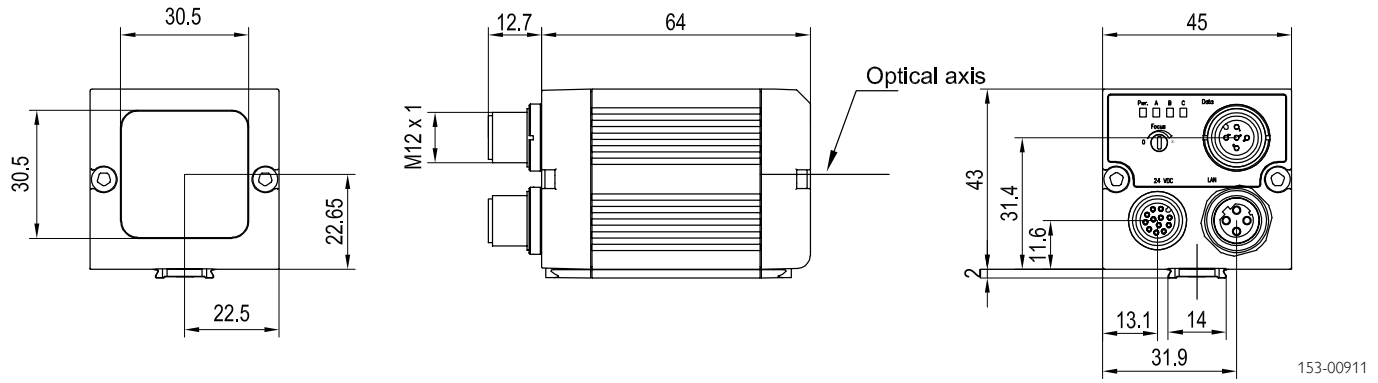
Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Ca. 13 s after Power on
Outputs	PNP / NPN (switchable)
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP/NPN High > U_B-1 V, Low < 3 V
Input resistance	> 20 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm[3] (without plug)
Enclosure rating	IP 67
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50 °C[2]
Ambient temperature: storage	-20 … +60 °C[2]
Weight	Ca. 160 g
Plug connections	Supply and I/O M12, 12-pin Ethernet M12, 4-pin Data M12, 5-pin
Vibration and impact resistance	EN 60947-5-2

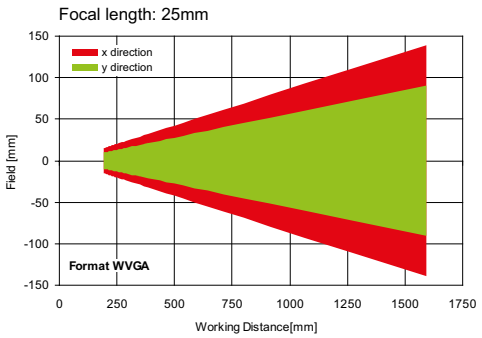
[1] Max. ripple < 5 V_{SS} [2] 80 % air humidity, non-condensing

Illumination	Depth of field	Part number	Article number
White	Normal	V10-CR-A1-W25	535-91084
Red	Normal	V10-CR-A1-R25	535-91085
Infrared	Normal	V10-CR-A1-I25	535-91086

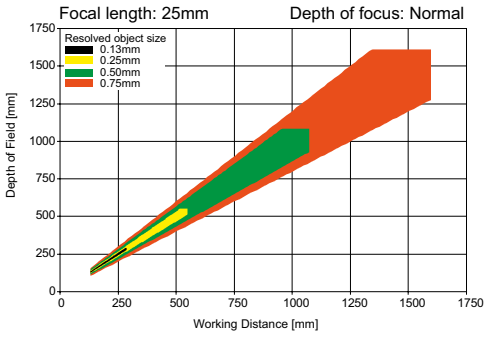
VISOR® vision sensor



Field of view



Depth of field: normal



Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Brackets	From Page A-4
Interface accessories	From Page A-36

VISOR® V10 Code Reader

Advanced vision sensor for code reading with object detection, C-mount



PRODUCT HIGHLIGHTS

- Can be used for all common 2D codes (ECC 200 data matrix) and common 1D bar codes
- Combination of two functions in one device: code reading and object detection
- Reliable detection of even poorly readable codes under difficult ambient conditions
- Comprehensive tools for flexible and easy connection to PC and PLC environments
- Reading of several similar or differing types of codes in one reading pass

Optical data	
Resolution	736 x 480 pixels
CMOS	1/3", monochrome
Integrated lens, focal length	C-mount
Adjustment range	Dependent on lens
Integrated illumination	None
Minimum field of view, X x Y	Dependent on lens

Functions	
Number of jobs / detectors	max. 255 / max. 255
Detectors	Pattern comparison, contrast, brightness, grey level, bar code, data code
Properties	X/Y position tracking; pattern comparison: teach-in and pattern detection; grey level, brightness: evaluation of brightness; contrast: evaluation of contrast; bar code: reading of 1D bar codes, EAN, UPC, RSS, 2/5 Interleaved, 2/5 Industrial, Code 39, Code 93, Code 128, GS1, Pharmacode, Codabar; data code: reading of 2D codes: ECC200, QR code, PDF 417
Typical cycle time	Typ. 20 ms pattern comparison; typ. 2 ms brightness; typ. 2 ms contrast; typ. 2 ms grey level; typ. 30 ms bar code; typ. 40 ms data code

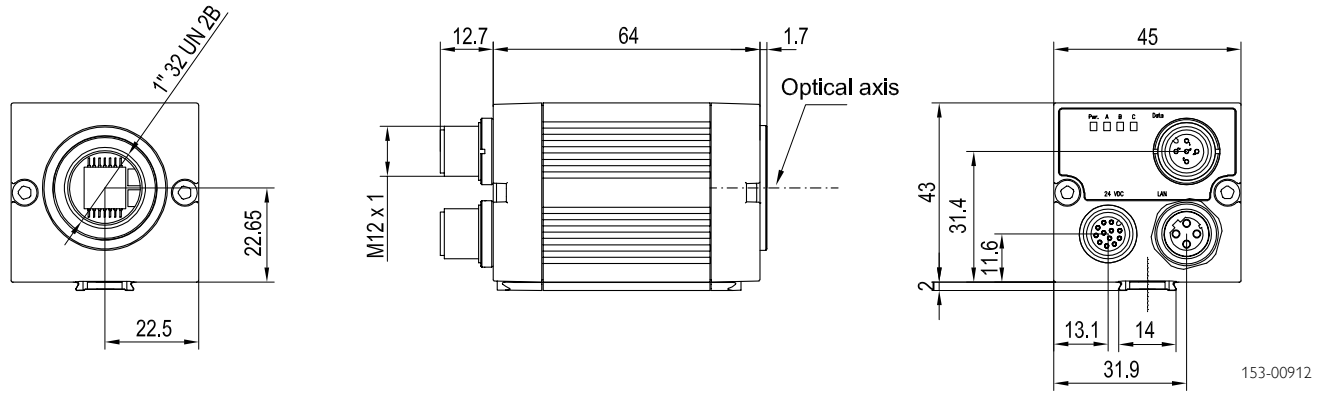
Electrical data	
Operating voltage, $+U_B$	18 … 26.4 V DC[1]
Current consumption (without illumination and I/O)	≤ 120 mA
Current consumption (without I/O)	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection of all outputs
Power On Delay	Ca. 13 s after Power on
Outputs	PNP / NPN (switchable)
Max. output current (per output)	50 mA, 100 mA (pin 12)
Inputs	PNP/NPN High > U_B-1 V, Low < 3 V
Input resistance	> 20 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232 EtherNet/IP
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm[3] (without plug)
Enclosure rating	IP 65[2]
Material, housing	Aluminium, plastic
Material, front screen	Plastic
Ambient temperature: operation	0 … +50 °C[3]
Ambient temperature: storage	-20 … +60 °C[3]
Weight	Ca. 160 g
Plug connection	Supply and I/O M12, 12-pin Ethernet M12, 4-pin Data M12, 5-pin
Vibration and impact resistance	EN 60947-5-2

[1] Max. ripple < 5 V_{SS} [2] With LPT45 C-mount protective casing [3] 80 % air humidity, non-condensing

Part number	Article number
V10-CR-A1-C	535-91033

VISOR® vision sensor



Lens



	LO C 8	LO C 12	LO C 16	LO C 25	LO C 50
Focal length	8 mm	12 mm	16 mm	25 mm	50 mm
Article number	526-51513	526-51514	526-51515	526-51516	526-51113

Accessories

Connection cables	From Page A-32
Illumination	From Page A-25
Lenses	From Page A-23
Brackets	From Page A-4
Interface accessories	From Page A-36

Distance sensors

Measurement from 20 mm to 250 m

Optical distance sensors

from Page 146

FT 25

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

from Page 152

FT 50

- *Operating range (scanning distance) from 30 to 300 mm*
- *High absolute accuracy*
- *High measurement frequency*
- *Laser distance sensors using the triangulation principle*
- *High precision thanks to resolution of up to 7 µm*
- *RS485 and analogue interfaces*

from Page 152

FT 80

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

from Page 164

F 55 / F 90 / F 91 / F 92

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









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

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

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



Monorail system with car bodies in the automotive industry



Car production
Positioning the body using distance sensors

from Page 180

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 544

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



Inductive distance sensors from Page 594

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



Eyesight vision systems from Page 106

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



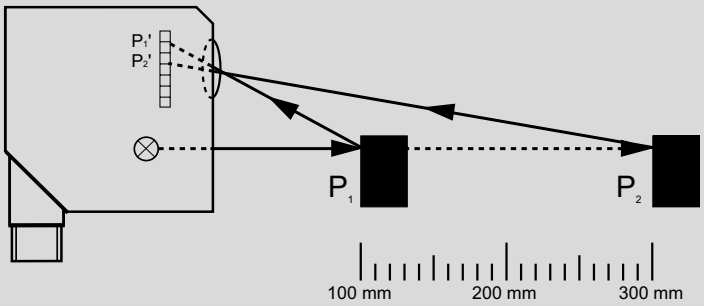
Distance sensors

System description

Distance measurement using triangulation

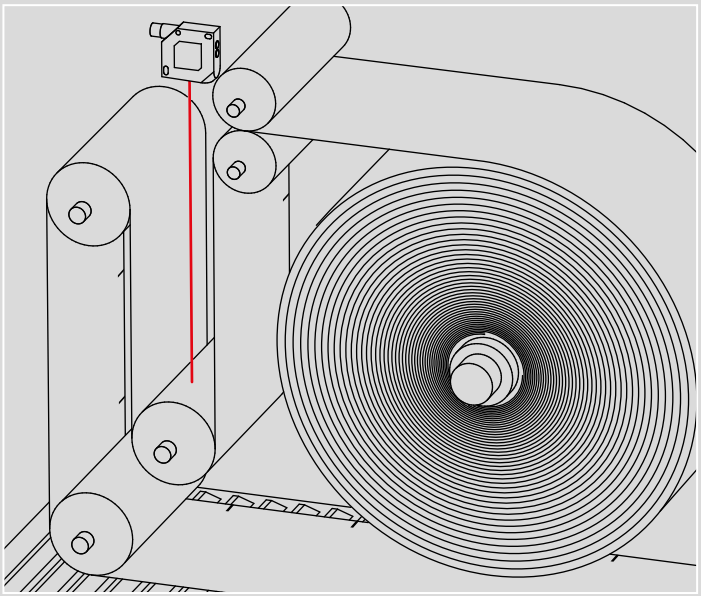
The measurement principle of optical triangulation is suitable for the precise determination of distances at close range. With the help of special receiver optics and a position-sensitive detector (e.g. a photodiode line), the sensor can determine the object distance regardless of its reflectivity (see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

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



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

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



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

Collision prevention sensors for monorails

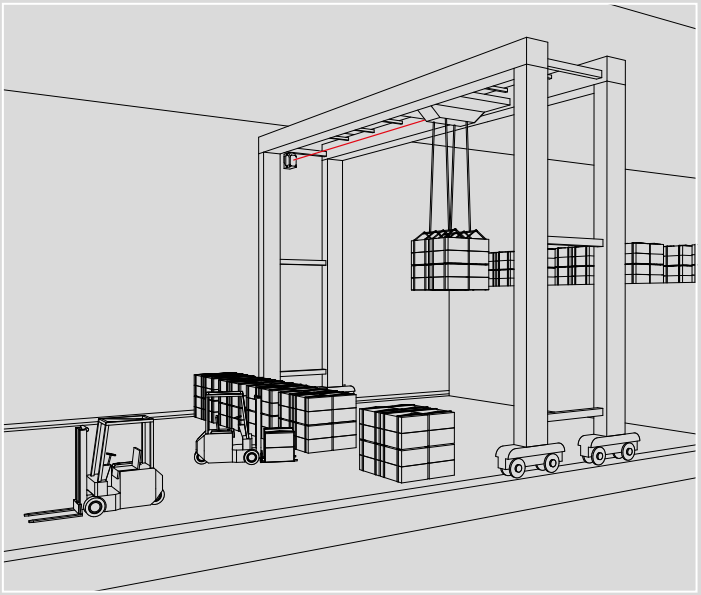
Collision prevention on monorail systems in car production is a special distance measurement task. The FR 85 series was specially developed for this application. These sensors provide excellent measurement results regardless of the reflectivity of the target object, and their comprehensive range of functions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

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

Distance measurement using time-of-flight

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

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



Crane positioning with FR 92 distance sensor

Inductive analogue sensors

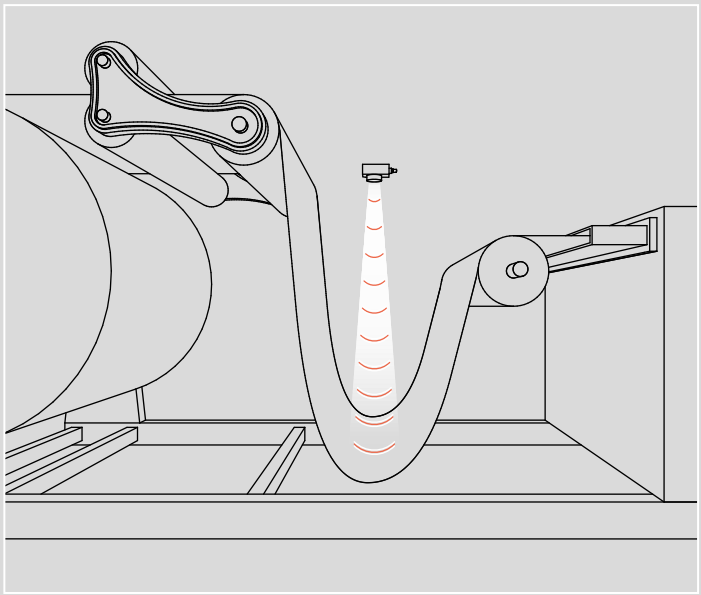
The reasonably priced solution for metallic objects. Compared to optical or ultrasonic sensors, inductive distance sensors have only limited ranges. They are still used under harsh conditions, in particular, as a result of their great robustness.

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

Ultrasonic sensors

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

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



Monitoring throughput with the UT 20 ultrasonic sensor

FT 25-RA – optical short-range distance sensors

The compact class for measurement and regulatory tasks





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

TYPICAL FT 25-RA

- Operating range: 20 ... 80 mm / 30 ... 200 mm
- Distance sensor with 1 … 10 V analogue output
- Easily integratable ultra-compact ABS housing: 34 x 12 x 20 mm³
- High precision and high repeatability – especially for control tasks
- Resolution: from 0.12 mm
- Two adjustable switching points as window mode for 2-point control
- Teach-in operation



In a miniature housing
The FT 25-RA is also suitable for limited installation spaces thanks to its compact dimensions of 34 x 12 x 20 mm³.

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

Key applications:

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

FT 25 RA – Product Overview			
	Operating range	Special features	Page
FT 25-RA	20 … 80 mm / 30 ... 200 mm	Small housing with long range	148
FT 20 RA	20 … 80 mm	Small housing	150

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 independant detection on homogeneous object surfaces
- Invertible analogue characteristic
- Window mode e.g. for two-step controls separately adjustable

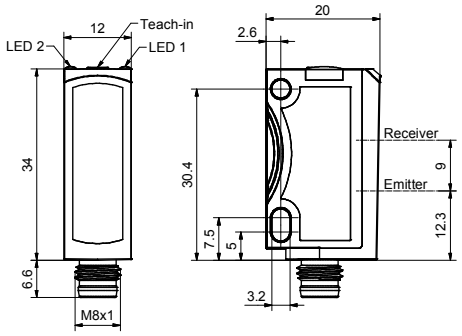
Optical data			Functions	
Measurement range	20 … 80 mm[1]	30 … 200 mm[1]	Indicator LED, green	Operating voltage indicator
Resolution	0.12 mm (12-bit)	0.68 mm (12-bit)	Indicator LED, yellow	Switching output indicator
Linearity	± 0.4 mm[2]	± 2 mm[2]	Measurement range adjustment	Via Teach-in button
Repeatability	< 0.4 mm[2, 3]	< 1 mm[2, 3]	Adjustment possibilities	Analogue measurement range Q_A Invertible analogue characteristic Switching output Q (window mode) N.O./N.C. via teach-in button
Type of light	LED, red, 632 nm	LED, red, 632 nm	Default settings	See Table

Electrical data		Mechanical data	
Operating voltage, $+U_B$	13 … 30 V DC	Dimensions	34 x 20 x 12 mm
No-load current, I_0	≤ 30 mA	Enclosure rating	IP 67 / IP 69K[4]
Output current, le 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 (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 … 10 V / 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°C...+50 °C

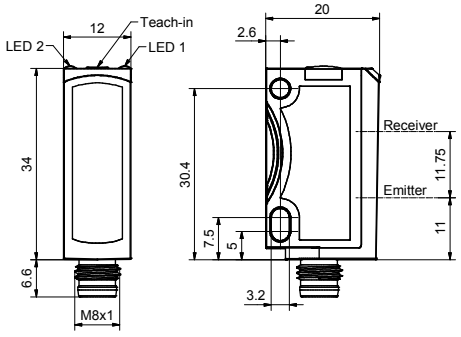
Measurement range	Analogue output	Switching output	Type of connection	Part number	Article number
20 ... 80 mm	1 ... 10 V	PNP	Metal plug, M8x1, 4-pin	FT-25-RA-60-PSU-M4M	604-41000
20 ... 80 mm	1 ... 10 V	NPN	Metal plug, M8x1, 4-pin	FT-25-RA-60-NSU-M4M	604-41001
30 ... 200 mm	1 ... 10 V	PNP	Metal plug,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

Plug connection (20 ... 80 mm)



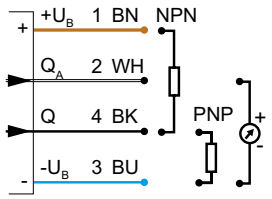
153-00839

Plug connection (30 ... 200 mm)



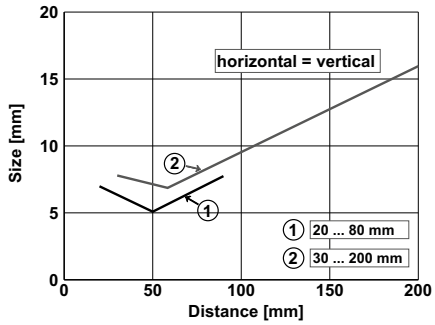
153-00837

Connection, 4-pin



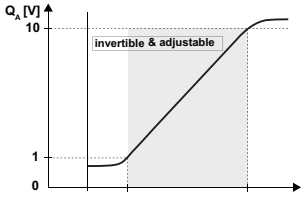
154-00329

Light spot size

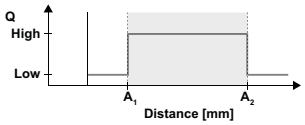


155-01663

Characteristic output and analogue curves



155-01661



155-01681

Default settings

	FT 25-RA-60	FT 25-RA-170
Analogue output Q_A (1 ... 10 V)	20 ... 80 mm	30 ... 200 mm
Switching output Q (A1 ... A2), N.O.	20 ... 80 mm	30 ... 200 mm

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

FT 20 RA

Distance sensor



PRODUCT HIGHLIGHTS

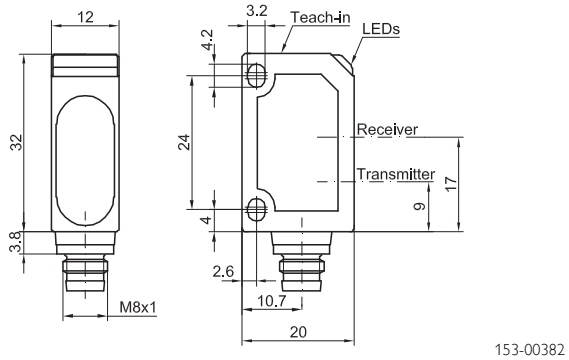
- Operating range 20 … 80 mm
- Analogue output 0 … 10 V
- Simple teach-in
- Adjustable switching window (switch on/off points) for e.g. two-point control
- Red light (660 nm)

Optical data		Functions	
Operating range	20 … 80 mm[1]	Indicator LED, green	Operating voltage indicator
Measurement range	60 mm	Indicator LED, yellow	Switching output indicator
Type of light	LED, red, 660 nm	Scanning distance adjustment	Via Teach-in button
Resolution	≈ 2 % distance (measurement value)		
Linearity	< 1 %		
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	15 … 30 V DC	Dimensions	32 x 20 x 12 mm
No-load current, I_0	≤ 30 mA	Enclosure rating	IP 67[2]
Output current, Ie	≤ 100 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-20 … +60 °C
Switching output, Q	PNP	Ambient temperature: storage	-20 … +80 °C
Output function	N.O./N.C.	Weight (plug device)	10 g
Analogue output	0 … 10 V / max. 3 mA	Weight (cable device)	40 g
Limit frequency, analogue output	≤ 200 Hz		
Load	≥ 10 kΩ		
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz		
Response time	500 µs		

[1] Reference material: Kodak white, 90 % [2] With connected IP 67 plug

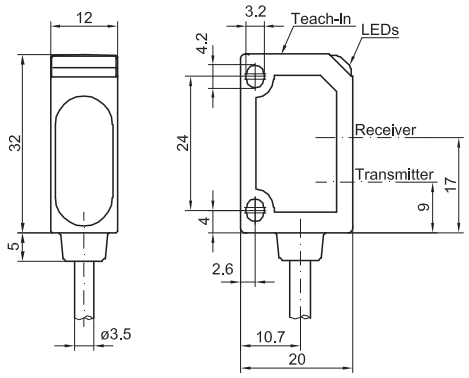
Type of connection	Part number	Article number
Plug, M8, 4-pin	FT 20 RA-60-F-M4	554-11000
Cable, 2 m, 4-wire	FT 20 RA-60-F-K4	554-11001

Plug connection



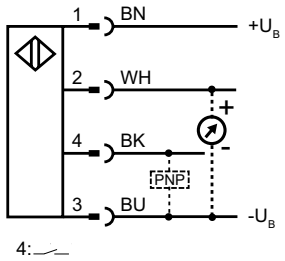
153-00382

Cable connection



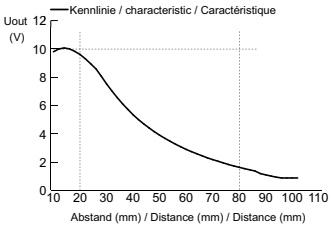
153-00381

Connection, 4-pin



154-00179

Characteristic output curve



Typ. Ausgangskennlinie / typ. output characteristic / Caractéristique typ. de sortie

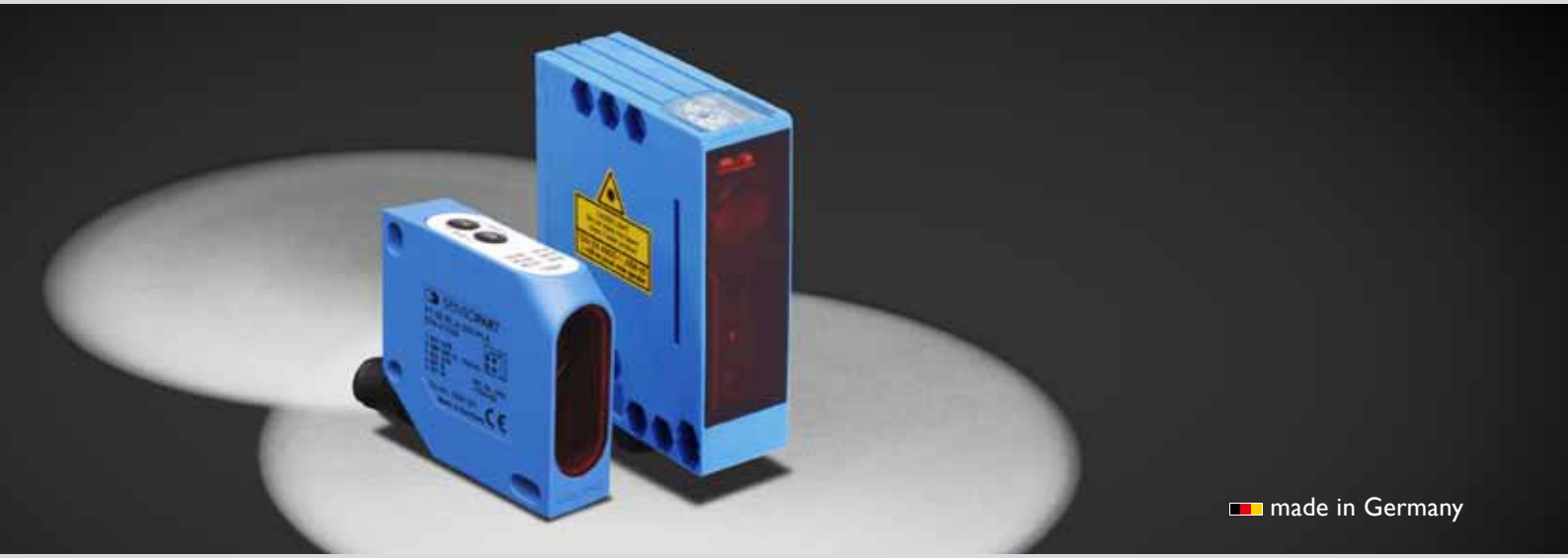
155-00434

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

FT 50 / FT 80 – laser distance sensors

Precise and rapid measurement with many extras









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

TYPICAL FT 50 / FT 80

- Laser distance sensors with a variety of measurement ranges
- Shape and colour of the target object is largely irrelevant
- High accuracy and resolutions up to 7 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 mm³	40 … 60 mm	Analogue output	154
FT 50 RLA-40	50 x 17 x 50 mm³	45 … 85 mm	Analogue output	156
FT 50 RLA-70 … L5 -100 … L5 -220 … L5	50 x 17 x 50 mm³	30 … 100 mm 70 … 170 mm 80 … 300 mm	Analogue output, switching output, simple teach-in of measurement ranges; M12, 5-pin	158
FT 50 RLA-70 … L8 -100 … L8 -220 … L8	50 x 17 x 50 mm³	30 … 100 mm 70 … 170 mm 80 … 300 mm	Analogue output, switching outputs, RS485 interface; M12, 8-pin	160
FT 80 RLA-500	83 x 25 x 65 mm³	250 … 750 mm	Analogue output, switching outputs, RS485 interface; M12 8-pin	162

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 (DIN EN 60825-1:2008-5)	2		
Resolution	40 µm / 7µm (see Selection Table)		
Linearity	< 1 %		
Light spot size	< 1 mm bei 50 mm		

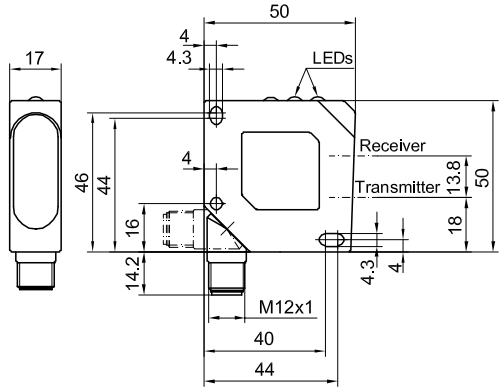
Electrical data		Mechanical data	
Operating voltage, $+U_B$	18 … 28 V DC	Dimensions	50 x 50 x 17 mm
No-load current, I_0	≤ 35 mA	Enclosure rating	IP 67[2]
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection, Q	Material, housing	ABS, impact-resistant
		Material, front screen	PMMA
Protection Class	2	Type of connection	See Selection Table
Analogue output	0 … 10 V / max. 3 mA	Ambient temperature: operation	0 … +45 °C
Limit frequency	400 Hz / 40 Hz (see Selection Table)	Ambient temperature: storage	-20 … +60 °C
Temperature drift	10 µm / K	Weight (plug device)	40 g
Rise time (10 to 90 %)	3 ms / 30 ms (see Selection Table)	Weight (cable device)	260 g
Fall time (90 to 10 %)	2 ms / 20 ms (see Selection Table)	Vibration and impact resistance	EN 60947-2

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

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

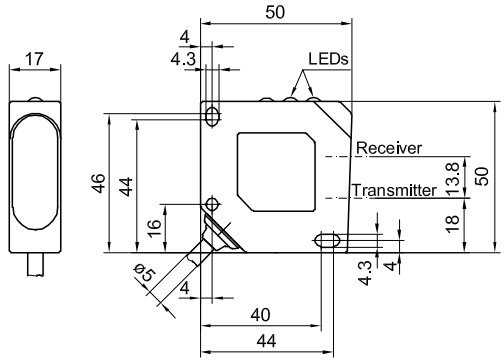
Version: 10/2013. Subject to changes; diagrams similar

Plug connection



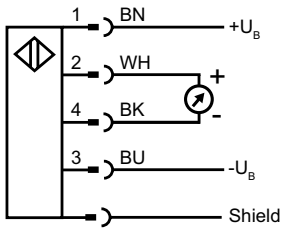
153-00214

Cable connection



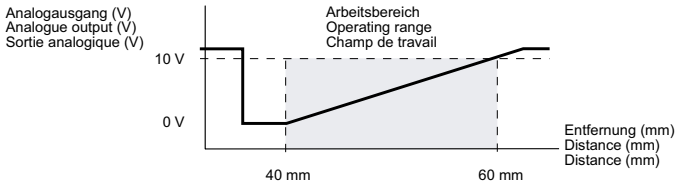
153-00213

Connection, 4-pin



154-00195

Characteristic output curve



155-00438

Accessories

Connection cables	From Page A-32
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 (DIN EN 60825-1:2008-5)	2		
Resolution	80 µm / 20 µm (see Selection Table)		
Linearity	< 1 %		
Light spot size	< 0.8 mm at 65 mm		

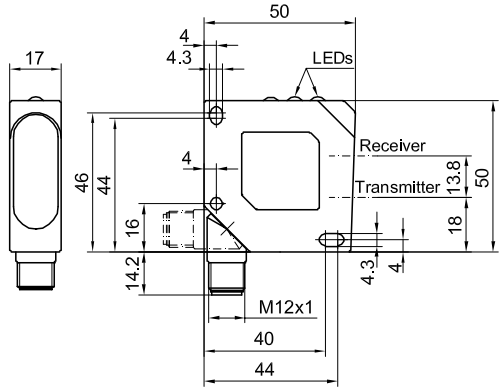
Electrical data		Mechanical data	
Operating voltage, $+U_B$	18 … 28 V DC	Dimensions	50 x 50 x 17 mm
No-load current, I_0	≤ 35 mA	Enclosure rating	IP 67[2]
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection, Q	Material, housing	ABS, impact-resistant
		Material, front screen	PMMA
Protection Class	2	Type of connection	See Selection Table
Analogue output	0 … 10 V (max. 3 mA)	Ambient temperature: operation	0 … +45 °C
Limit frequency	400 Hz / 40 Hz (See Selection Table)	Ambient temperature: storage	-20 … +60 °C
Temperature drift	18 µm / K	Weight (plug device)	40 g
Rise time (10 to 90 %)	3 ms / 30 ms (See Selection Table)	Weight (cable device)	260 g
Fall time (90 to 10 %)	2 ms / 20 ms (See Selection Table)	Vibration and impact resistance	EN 60947-2

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

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

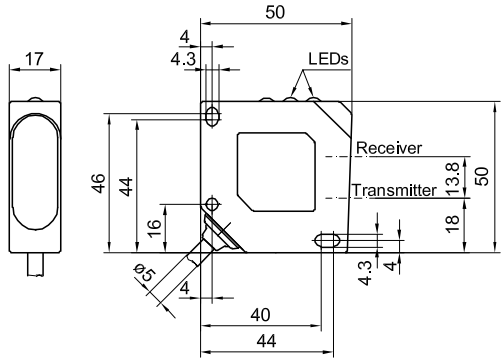
Version: 10/2013. Subject to changes; diagrams similar

Plug connection



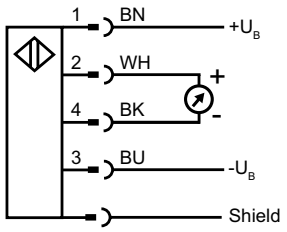
153-00214

Cable connection



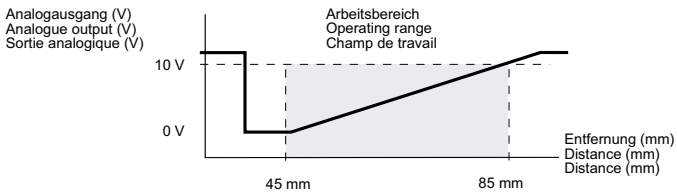
153-00213

Connection, 4-pin



154-00195

Characteristic output curve



155-00441

Accessories

Connection cables	From Page A-32
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	
Operating range	30 … 100 mm / 70 … 170 mm / 80 … 300 mm[1]
Measurement range	70 mm, 100 mm, 220 mm
Type of light	Laser, red, 650 nm
Laser Class (DIN EN 60825-1:2008-5)	2
Resolution	< 0.1 % of operating range end-value[2] (see Selection Table)
Linearity	< 0.25 % of operating range end-value (see Selection Table)
Repeatability	< 0.25 % of measurement value

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Scanning distance adjustment	Via Teach-in button and control input
Adjustment possibilities	N.O. / N.C. via Teach-in button and control input Button lock via control input

Electrical data	
Operating voltage, $+U_B$	18 … 30 V DC
No-load current, I_0	≤ 40 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection, Q
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP
Output function	N.O. / N.C.
Max. capacitive load, Q	< 100 nF
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

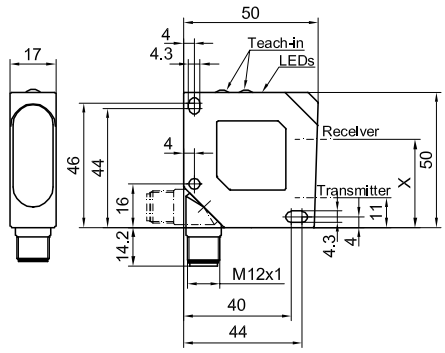
Mechanical data	
Dimensions	50 x 50 x 17 mm
Enclosure rating	IP 67[3]
Material, housing	ABS, impact-resistant
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-10 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight	43 g
Vibration and impact resistance	EN 60947-2

[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

Version: 10/2013. Subject to changes; diagrams similar

Plug connection



153-00716

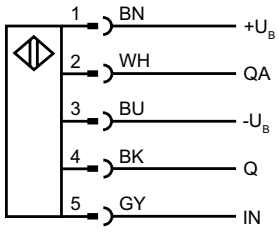
Type

FT 50 RLA 70
FT 50 RLA 100
FT 50 RLA 220

X (distance, receiver)

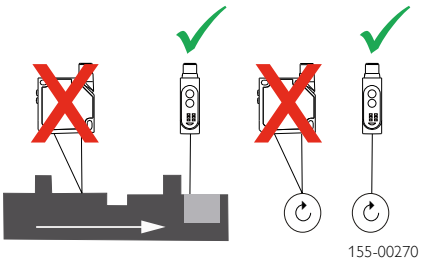
29.4 mm
32.5 mm
32.5 mm

Connection, 5-pin

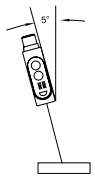


154-00176

Installation



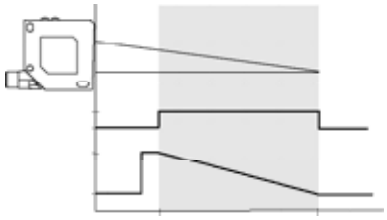
155-00270



155-00274

Characteristic analogue curve

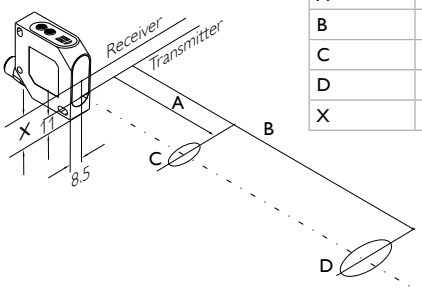
Operating range (default setting)



FT 50 RLA 70	30 mm	100 mm
FT 50 RLA 100	70 mm	170 mm
FT 50 RLA 220	80 mm	300 mm

155-00271

Light spot geometry



FT 50 RLA	70 …	100 …	220 …
A	30	70	80
B	100	170	300
C	1.5 x 3	1.5 x 3.5	1.5 x 3.5
D	1.5 x 3.25	1.7 x 3.9	2 x 4.5
X	29.4	32.5	32.5

155-00269

Accessories

Connection cables	From Page A-32
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	
Operating range	30 … 100 mm / 70 … 170 mm / 80 … 300 mm[1]
Measurement range	70 mm, 100 mm, 120 mm
Type of light	Laser, red, 650 nm
Laser Class (DIN EN 60825-1:2008-5)	2
Resolution	< 0.1 % of operating range end-value (0.1 mm / 0.17 mm/ 0.3 mm)[2]
Linearity	< 0.25 % of operating range end-value (0.25 mm / 0.42 mm / 0.75 mm)
Repeatability	< 0.25 % of measurement value

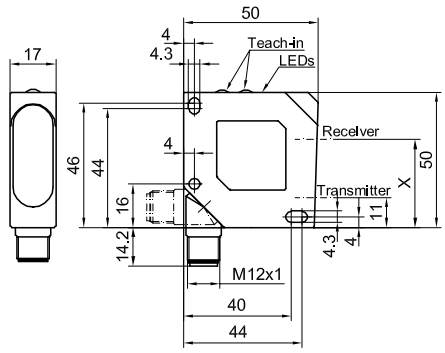
Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Scanning distance adjustment	Via Teach-in button and control input
Adjustment possibilities	N.O. / N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. scanning distance and N.O.

Electrical data	
Operating voltage, $+U_B$	18 … 30 V DC
No-load current, I_0	≤ 40 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection, Q (not Type S1)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q_1 / Q_2	PNP
Output function	N.O. / N.C.
Analogue output	4 … 20 mA
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

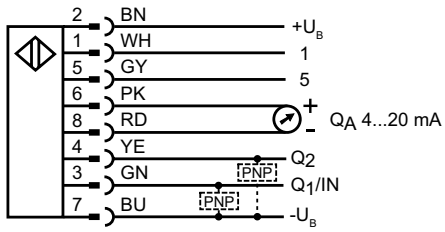
Mechanical data	
Dimensions	50 x 50 x 17 mm[3]
Enclosure rating	IP 67[3]
Material, housing	ABS, impact-resistant
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-10 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight	43 g
Vibration and impact resistance	EN 60947-2

[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

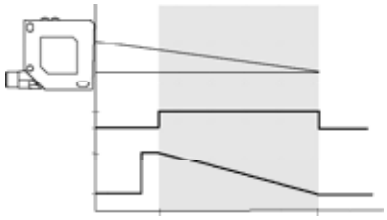
Plug connection	Type	X (distance, receiver)
 153-00716	FT 50 RLA 70 FT 50 RLA 100 FT 50 RLA 220	29,4 mm 32,5 mm 32,5 mm

6

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

Characteristic analogue curve	Light spot geometry

Operating range (default setting)

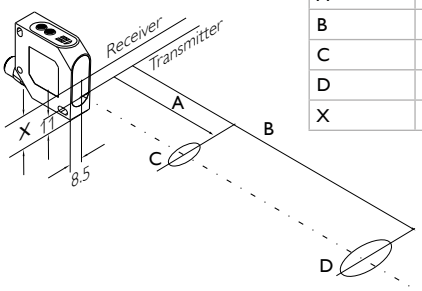


OK LED (green)
(Good Target)

Analogue output
(invertible)

FT 50 RLA 70	30 mm	100 mm
FT 50 RLA 100	70 mm	170 mm
FT 50 RLA 220	80 mm	300 mm

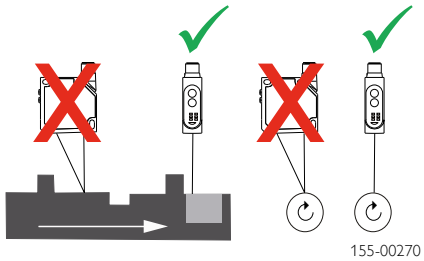
155-00271



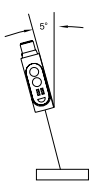
FT 50 RLA	70 …	100 …	220 …
A	30	70	80
B	100	170	300
C	1.5 x 3	1.5 x 3.5	1.5 x 3.5
D	1.5 x 3.25	1.7 x 3.9	2 x 4.5
X	29.4	32.5	32.5

155-00269

Installation	Accessories



155-00270



155-00274

Accessories	
Connection cables	From Page A-32
Brackets	From Page A-4

FT 80 RLA

Distance sensor with RS485 interface



PRODUCT HIGHLIGHTS

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

Optical data	
Operating range	250 … 750 mm[1]
Measurement range	500 mm
Type of light	Laser, red, 650 nm
Laser Class (DIN EN 60825-1:2008-5)	2
Resolution	< 0.1 % of measurement range end-value
Linearity	< 0.25 % of measurement range end-value

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Indicator LED, red	State indicator
Scanning distance adjustment	Via Teach-in button and control input
Adjustment possibilities	Button lock via control input
Default settings	Max. scanning distance and N.O.

Electrical data	
Operating voltage, $+U_B$	18 … 30 V DC
No-load current, I_0	≤ 40 mA
Output current, Ie	≤ 100 mA
Protective circuits Temperature drift	Reverse-polarity protection, U_B / short-circuit protection, Q (not Type S1)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q_1 / Q_2	PNP
Output function	N.O. / N.C.
Analogue output	4 … 20 mA
Temperature drift	< 0.02 % of operating range end-value / K
Load	≤ 500 Ω (recommended)
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	≥ 0.4 ms (when mean value formation = off) / 4 ms / 40 ms to end-value
Serial interface	See Selection Table

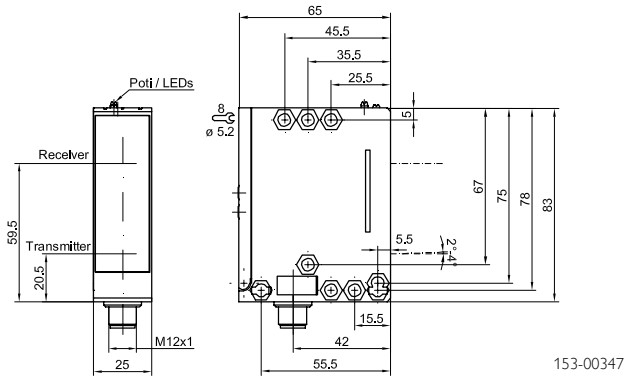
Mechanical data	
Dimensions	83 x 65 x 25 mm
Enclosure rating	IP 67[2]
Material, housing	PBT
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-10 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight	107 g

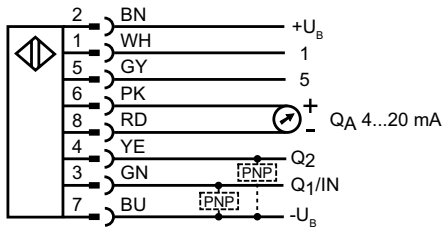
[1] Reference material: Kodak grey, 18 % [2] With connected IP 67 plug

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

Version: 10/2013. Subject to changes; diagrams similar

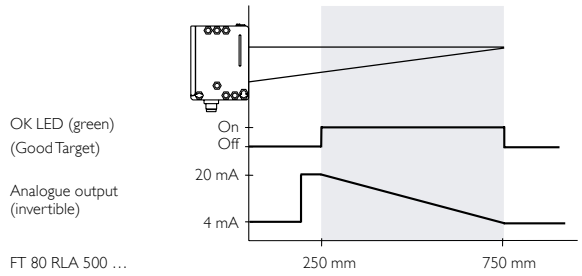
Plug connection



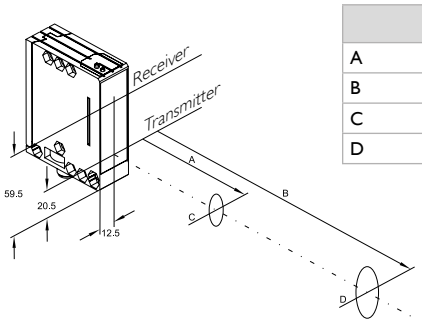
Connection, 8-pin	Type	Pin 1	Pin 5
	FT 80 RLA 500 -S1L8. FT 80 RLA 500 -L8.	RS485 Y/A not connected	RS485 Z/B not connected

Characteristic analogue curve

Operating range (default settings)



Light spot geometry



	FT 80 RLA 500 …
A	250 mm
B	750 mm
C	1.9 mm x 1.2 mm
D	2.7 mm x 1.9 mm

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

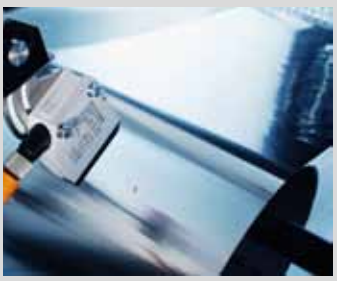
F 55 / F 90 / F 91 / F 92 –
Laser distance sensors for long distances

Far-sighted with time-of-flight technology





Indicator
The distance is directly Indicatored 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 diametre
The FT 55-RLA measures the distance to the coil surface in order to activate roll changes.

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

- Laser distance sensor using time-of-flight technology
- Largely independent of target object's colour and properties
- Operating range: scanner up to 10 m, with reflector up to 250 m
- Variants with analogue output and switching output
- Interfaces for maximum compatibility, SSI-compatible, RS422 (PROFIBUS and DeviceNet via gateway)
- High repeatability and high measurement rates
- Compact housings from 50 x 50 x 23 mm³

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	0,5 … 5 m	Scanning on object	Compact design, high flexibility	166
FT 90 ILA	0.5 … 10 m	Scanning on object	2 switching outputs, RS422 interface, SSI-compatible, switchable red-light pilot laser	168
FT 91 ILA	0.5 … 6 m	Scanning on object	2 switching outputs, RS422 interface, SSI-compatible, switchable red-light pilot laser	170
FT 92 ILA/RLA	0.2 … 6 m	Scanning on object	2 switching outputs, 1 analogue output, switchable red-light pilot laser	172
FR 90 ILA	0.5 … 250 m	Reflector	2 switching outputs, RS422 interface, SSI-compatible, switchable red-light pilot laser	174
FR 91 ILA	0.5 … 50 m	Reflector	2 switching outputs, RS422 interface, SSI-compatible, switchable red-light pilot laser	176
FR 92 ILA	0.2 … 30 m	Reflector	2 switching outputs, 1 analogue output, switchable red-light pilot laser	178

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	
Operating range	0.5 … 10 m[1]
Measurement range	9.5 m
Type of light	Infrared, 905 nm (measurement laser) Laser, red, 650 nm (pilot laser)
Laser Class (DIN EN 60825-1:2008-5)	1 (measurement laser) 2 (pilot laser)
Resolution	0.1 mm or 0.125 mm
Linearity	± 8 mm
Repeatability	± 4 mm

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Scanning distance adjustment	Via Teach-in button and control input

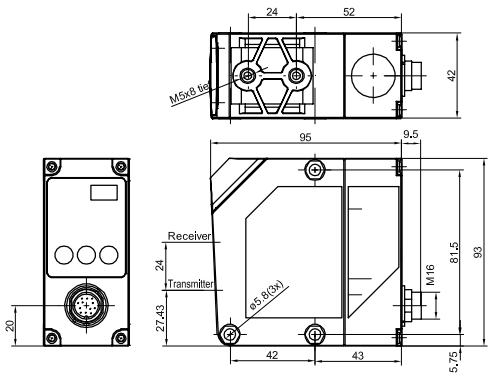
Electrical data	
Operating voltage, $+U_B$	18 … 30 V DC[2]
Output current, Ie	≤ 100 mA
Plausibility output, Qp	50 mA
Service output, Qs	50 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection, Q
Protection Class	2
Power On Delay	≤ 12 ms
Switching output, Q_1 / Q_2	PNP
Output function	N.O.
Analogue output	4 … 20 mA
Temperature drift	< ± 5 mm absolute
Serial interface	RS422 or SSI-compatible (GREY / BINARY) adjustable
Bus interface	Profibus or DeviceNet, each via gateway (accessory)
Cable length / m	< 25 / < 50 / < 100 / < 200 / < 400
Cycle rate	< 500 kHz / < 400 kHz / < 300 kHz / < 200 kHz / < 100 kHz

Mechanical data	
Dimensions	93 x 93 x 42 mm
Enclosure rating	IP 67[3]
Material, housing	ABS, impact-resistant
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-10 … +50 °C (-20 … +50 °C in continuous operation)
Ambient temperature: storage	-30 … +75 °C
Weight	230 g
Vibration and impact resistance	EN 60947-5-2

[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

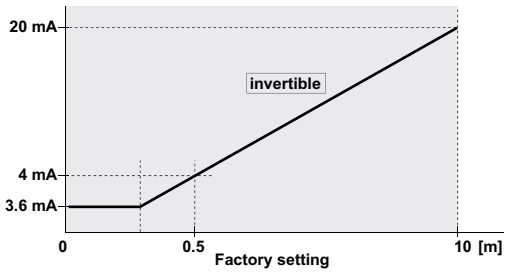


153-00457

Connection, 12-pin

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

Characteristic analogue curve



155-01406

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-32
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-36

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	
Operating range	0.5 … 6 m[1]
Type of light	Infrared, 905 nm (measurement laser) Laser, red, 650 nm (pilot laser)
Laser Class (DIN EN 60825-1:2008-5)	1 (measurement laser) 2 (pilot laser)
Resolution	0.1 mm or 0.125 mm
Linearity	± 10 mm
Repeatability	± 5 mm

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Scanning distance adjustment	Via Teach-in button and control input

Electrical data	
Operating voltage, $+U_B$	18 … 30 V DC[2]
Output current, Ie	≤ 100 mA
Plausibility output, Qp	50 mA
Service output, Qs	50 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection, Q
Protection Class	2
Power On Delay	≤ 12 ms
Switching output, Q_1 / Q_2	PNP
Output function	N.O.
Analogue output	4 … 20 mA
Temperature drift	< 0.5 mm / K
Serial interface	RS422 or SSI-compatible (GREY / BINARY) adjustable
Bus interface	Profibus or DeviceNet, each via gateway (accessory)
Cable length / m	< 25 / < 50 / < 100 / < 200 / < 400
Cycle rate	< 500 kHz / < 400 kHz / < 300 kHz / < 200 kHz / < 100 kHz

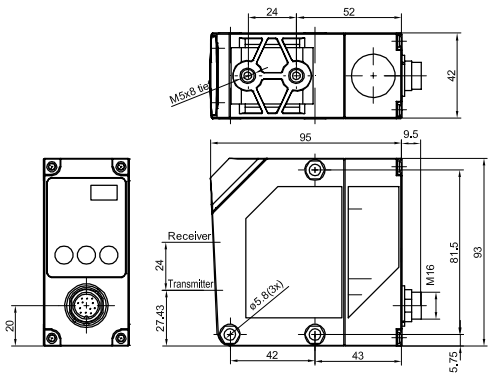
Mechanical data	
Dimensions	93 x 93 x 42 mm
Enclosure rating	IP 67[3]
Material, housing	ABS, impact-resistant
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-10 … +50 °C (-20 … +50 °C in continuous operation)
Ambient temperature: storage	-30 … +75 °C
Weight	230 g
Vibration and impact resistance	EN 60947-5-2

[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

Version: 10/2013. Subject to changes; diagrams similar

Plug connection

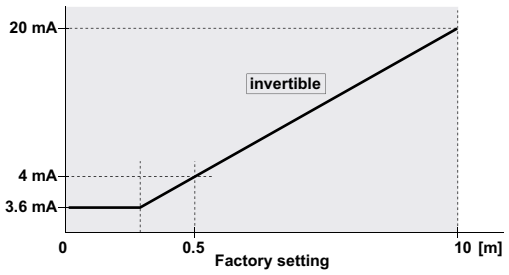


153-00457

Connection, 12-pin

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

Characteristic analogue curve



155-01406

Scanning distance

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

Accessories

Connection cables	From Page A-32
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-36

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	
Scanning distance	0.2 … 6 m[1]
Type of light	Infrared, 905 nm (measurement laser) Laser, red, 650 nm (pilot laser)
Laser Class (DIN EN 60825-1:2008-5)	1 (measurement laser) 2 (pilot laser)
Repeatability Fast/Slow	< ± 15 / 10 mm[2]
Linearity	≤ ± 40 mm[2]

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	2 x switching output indicator
Indicator LED, orange	Operating mode
Indicator LED, red	Menu Indicator
Scanning distance adjustment	Via Teach-in button
Default settings	Max. scanning distance and N.O.

Electrical data	
Operating voltage, $+U_B$	18 … 30 V DC[3]
No-load current, I_0	≤ 125 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q_1 / Q_2	PNP / NPN 100 mA (see Selection Table)
Analogue output	4 … 20 mA
Temperature drift	≤ 1.2 mm / K
Load	≤ 500 Ω

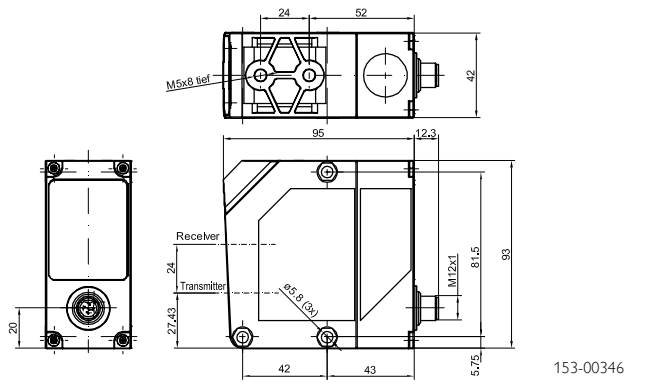
Mechanical data	
Dimensions	95 x 93 x 42 mm
Enclosure rating	IP 67[4]
Material, housing	ABS, impact-resistant
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +50 °C
Ambient temperature: storage	-40 … +80 °C
Weight	200 g
Vibration and impact resistance	EN 60947-5-2

[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

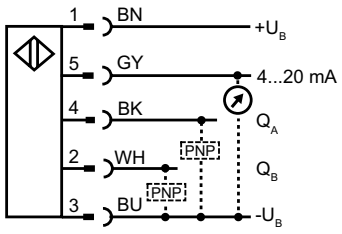
[5] Pilot laser (red) on permanently

Plug connection



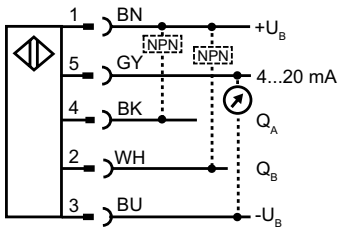
153-00346

Connection, 5-pin (PNP)



154-00125

Connection, 5-pin (NPN)



154-00472

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-32
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-36

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	
Scanning distance	0.5 … 250 m
Type of light	Infrared, 905 nm (measurement laser) Laser, red, 650 nm (pilot laser)
Laser Class (DIN EN 60825-1:2008-5)	1 (measurement laser) 2 (pilot laser)
Resolution	0.1 mm or 0.125 mm
Linearity	± 3 mm (from 2 m)
Repeatability	< ± 2 mm
Light spot	20 x 20 mm[1]

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Scanning distance adjustment	Via Teach-in button and control input

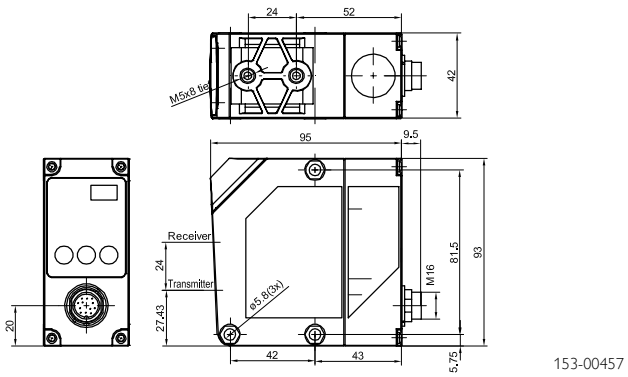
Electrical data	
Operating voltage, $+U_B$	18 … 30 V DC[2]
Output current, Ie	≤ 100 mA
Plausibility output, Qp	50 mA
Service output, Qs	50 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection, Q
Protection Class	2
Power On Delay	≤ 12 ms
Switching output, Q_1 / Q_2	PNP
Output 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

Mechanical data	
Dimensions	93 x 93 x 42 mm
Enclosure rating	IP 67[3]
Material, housing	ABS, impact-resistant
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-10 … +50 °C (-20 … +50 °C in continuous operation)
Ambient temperature: storage	-30 … +75 °C
Weight	230 g
Vibration and impact resistance	EN 60947-5-2

[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



Connection, 12-pin

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

Accessories

Reflectors	From Page A-16
Connection cables	From Page A-32
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-36

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	
Scanning distance	0.5 … 50 m
Type of light	Infrared, 905 nm (measurement laser) Laser, red, 650 nm (pilot laser)
Laser Class (DIN EN 60825-1:2008-5)	1 (measurement laser) 2 (pilot laser)
Resolution	0.1 mm or 0.125 mm
Linearity	± 5 mm (from 2 m)
Repeatability	< ± 4 mm
Light spot	20 x 20 mm[1]

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Scanning distance adjustment	Via Teach-in button and control input

Electrical data	
Operating voltage, $+U_B$	18 … 30 V DC[2]
Output current, Ie	≤ 100 mA
Plausibility output, Qp	50 mA
Service output, Qs	50 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection, Q
Protection Class	2
Power On Delay	≤ 12 ms
Switching output, Q_1 / Q_2	PNP
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

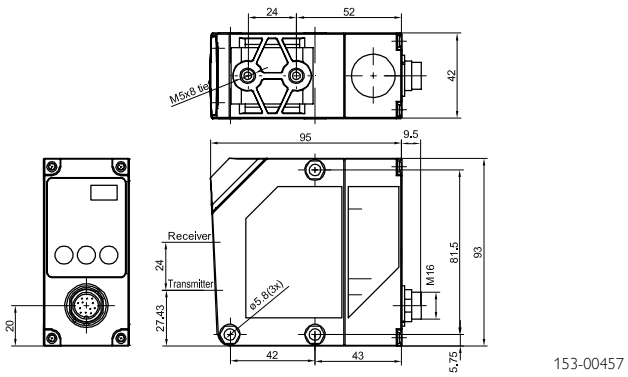
Mechanical data	
Dimensions	95 x 93 x 42 mm
Enclosure rating	IP 67[3]
Material, housing	ABS, impact-resistant
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-10 … +50 °C
Ambient temperature: storage	-30 … +75 °C
Weight	230 g
Vibration and impact resistance	EN 60947-5-2

[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

Version: 10/2013. Subject to changes; diagrams similar

Plug connection



Connection, 12-pin

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

Accessories

Reflectors	From Page A-16
Connection cables	From Page A-32
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-36

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	
Scanning distance	0.2 … 30 m[1]
Type of light	Infrared, 905 nm (measurement laser) Laser, red, 650 nm (pilot laser)
Laser Class (DIN EN 60825-1:2008-5)	1 (measurement laser) 2 (pilot laser)
Repeatability Fast/Slow	≤ ± 10 / 5 mm[2]
Linearity	≤ ± 60 mm[2]

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Indivator LED, orange	Operating mode
Indicator LED, red	Menu Indicator
Scanning distance adjustment	Via Teach-in button
Default settings	Max. scanning distance and N.O.

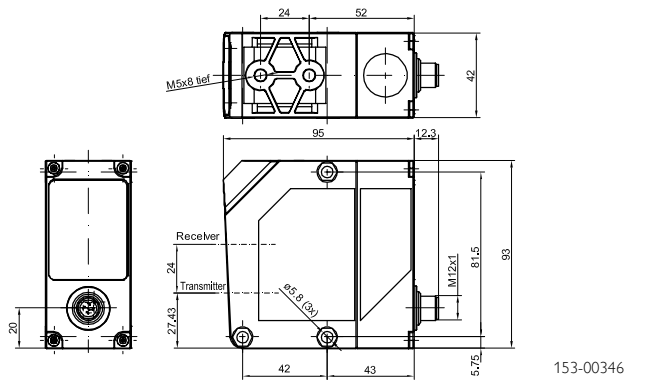
Electrical data	
Operating voltage, $+U_B$	18 … 30 V DC[3]
No-load current, I_0	≤ 125 mA
Output current, Ie	100 mA
Max. voltage drop at switching output	≤ 2.4 V
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Response time fast / slow	30 ms / 65 ms
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

Mechanical data	
Dimensions	95 x 93 x 42 mm
Enclosure rating	IP 67[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +50 °C
Ambient temperature: storage	-40 … +80 °C
Weight	200 g
Vibration and impact resistance	EN 60947-5-2

[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

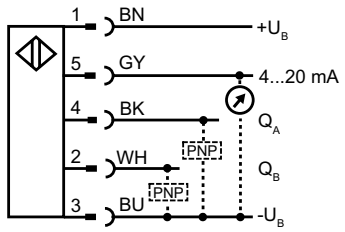
Type of connection	Part number	Article number
Plug, M12, 5-pin	FR 92 ILA-PSL5	591-91006

Plug connection



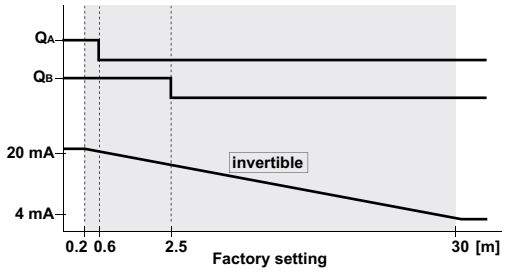
153-00346

Connection, 5-pin



154-00125

Characteristic output and analogue curves



155-01359

Accessories

Reflectors	From Page A-16
Connection cables	From Page A-32
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-36

FR 85 Rail Pilot – optical collision protection sensors

Safe movement on monorail systems





Monorail system with car bodies in the automotive industry

TYPICAL FR 85 RAIL PILOT

- Laser photoelectric reflex switches for preventing collisions on monorail systems
- Operating range: 0 … 6 m
- Typical measurement accuracy: ± 10 cm
- Large optics aperture angle and thus long detection range
- Cornering also possible
- 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^3

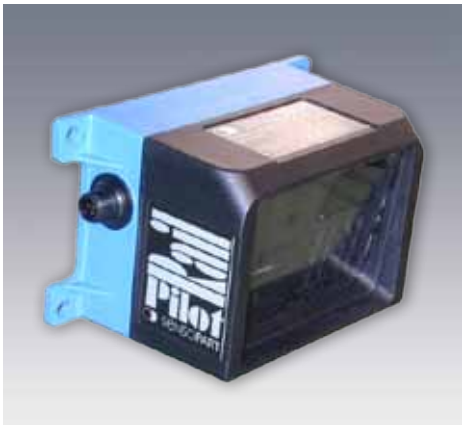
The sensor's task is to prevent collisions between vehicles on monorail systems. The Rail Pilot achieves this reliably. The distances to be maintained, and the braking distances of the monorail vehicles, depend on the load transported and on the speed – this is taken into account by means of flexibly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

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

FR 85 Rail Pilot – Product Overview			
	Operating range	Special features	Page
FR 85 Rail Pilot	0 … 6 m	RS485 interface or PNP switching outputs	182

FR 85 Rail Pilot

Distance sensor for collision prevention



PRODUCT HIGHLIGHTS

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

Optical data	
Scanning distance	0 … 6 m[1]
Type of light	Infrared, 905 nm
Laser Class (DIN EN 60825-1:2008-5)	1
Repeatability	± 100 mm

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, red	Switching output indicator
Scanning distance adjustment	Via control wire

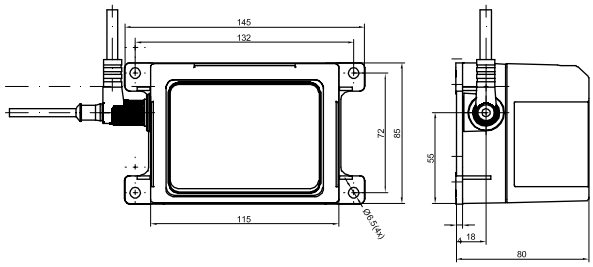
Electrical data	
Operating voltage, $+U_B$	18 … 30 V DC[2]
No-load current, I_0	≤ 200 mA
Output current, Ie	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	See Selection Table
Output function	See Selection Table
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

Mechanical data	
Dimensions	145 x 85 x 80 mm
Enclosure rating	IP 54[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	0 … +50 °C
Ambient temperature: storage	-20 … +70 °C
Weight	340 g

[1] Reference material: R10/2 reflector [2] 10 % ripple, within U_B [3] Type FR85 … S1L5 [4] With connected IP 54 plug

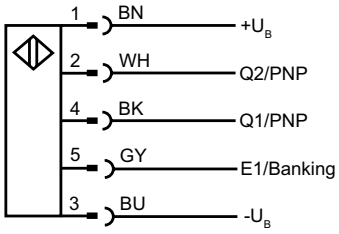
Interface	Type of connection	Part number	Article number
RS485	Plug, M12x1, 5-pin	FR 85-2 ILLG-S1L5	529-11008
2 switching points Q (PNP) N.C.	Plug, M12x1, 5-pin	FR 85-2 ILLG-POL5	529-11010

Plug connection



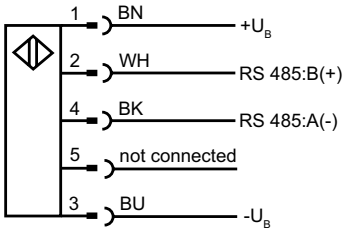
153-00349

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



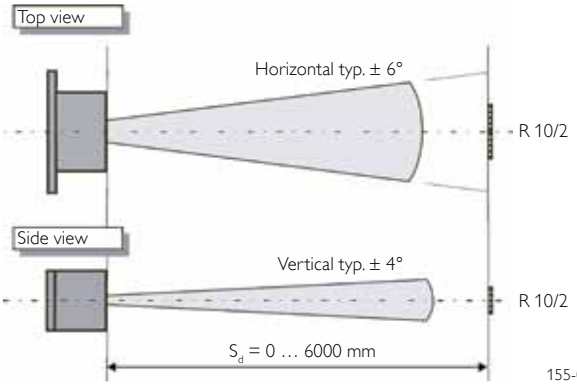
154-00325

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



154-00478

Detection cone



155-00202

Reflector	Article number
R10 / 2 (2xR10)	904-51636
Reflective foil	904-51548

Accessories	
Reflectors	From Page A-16
Connection cables	From Page A-32
Setup Box FR 85-2 ILLX 533-11016	From Page A-36

Colour, contrast and luminescence sensors

A broad spectrum

FT 25-C
RGB colour sensor
from Page 190

- *Smallest RGB colour sensor with high switching frequency of ≤ 10 kHz*
- Precise *detection of "non-colours", e.g. black, white and grey*
- *Small, precise light spot for the detection of smallest marks*



FT 50 C –
white-light colour sensor
from Page 194

- *Colour detection with simplest teach-in*
- *Patented optical technology ensures reliable detection with fluctuating scanning distances*
- *Parameterisation and online colour information via RS485*



FT 25-W/-RGB
contrast sensor
from Page 204

- *Miniature contrast sensor – 15-times smaller than standard housing*
- *Detection of minimum contrast differences through multi-colour RGB evaluation or white-light illumination*
- *Automatic selection of ideal transmission colour after teach-in*
- *High positioning accuracy thanks to minimum response time (≤ 20 µs) and very precise light spot*



FT 50 C-UV –
luminescence sensor
from Page 214

- *High flexibility through large scanning range*
- *Small, precise light spot for maximum positioning accuracy*
- *Robust reflection-resistant operation*



5 operation principles for colour detection

The attachment of colour marks that are then evaluated with a colour or contrast sensor is a proven method for identifying objects in industrial production. Even objects with differing shapes and surface properties can be very reliably detected in this way. SensoPart offers sensors with five different functional principles for colour and contrast detection.

VISOR® Color

With the VISOR® Color you can exploit the colour feature economically and thus open up numerous new application potentials. It is now just as possible to automate inspections previously carried out visually as it is to add the evaluation of the colour feature to an existing process – because the VISOR® Color is not just a colour sensor, but also offers a wide range of additional functions for object detection.

FT 25/50 C

SensoPart offers the FT 25/50 C colour sensors for the "classic" colour detection of objects and printed marks. The FT 25-RGB is well suited for the detection of one colour in fast processes.

The FT 50 C can not only differentiate between individual colours, but also user-defined colour ranges. Thanks to its high level of colour selectivity, this sensor is suitable for almost all industrial colour detection tasks.

FT 25-W/-RGB

The F 25 series also includes contrast sensors which, with their small and precise light spot, can differentiate between the slightest of contrast differences on objects or printed marks at high process speeds. The FT 25-RGB, with its multi-colour RGB evaluation, can even automatically select the ideal transmission colour (red, green or blue) for the contrast that is present.

FT 50 C-UV

Finally, the FT 50 C-UV luminescence sensor is a special product: this innovative sensor detects features that are invisible to the human eye by irradiating the target object with ultraviolet light. This sensor has a highly varied range of applications because luminophores are not only attached to labels, but can also be mixed with different materials (e.g. paint, chalk, glue and lubricants).

VISOR® Color
from Page 80

V10C-CO-S2-W12
- *Standard version for colour detection with up to 8 inspection tasks and up to 32 evaluations*

>> Page 88

V20C-CO-A2-W12
- *Advanced version for colour detection and object detection with up to 255 inspection tasks and up to 255 evaluations*

>> Page 82



made in Germany

SENSOPART IN COLOURS

- Five different sensor principles for a wide range of uses
- Precise detection of the finest colour or grey value differences and non-colours
- Detection of self-illuminating colours and luminophores
- Numerous outputs and interfaces for simple integration in machine control systems
- Comfortable operation by means of teach-in or configuration software
- Maximum positioning accuracy, even at high process speeds
- Automatic transmission LED colour selection; communication via light spot – simple, comprehensible, clearly defined

Colour sensors

System description

Functional description

Colour sensors operate according to the energetic reflection principle, whereby the partial spectra of red, green and blue are evaluated separately. Either the three colours are emitted sequentially and the quantity of light reflected from the target object is individually registered (FT 25-C), or the sensor emits white light that is first split into the RGB partial spectra in the receiver (FT 50 C). The RGB intensity values thus determined are compared with previously taught-in reference values. The switching output is activated if the colour values are within the defined tolerance range.

A special feature of the FT 25-C colour sensor is teach-in with a "communicating" light spot: the quality of the colour detection is signalled to users by the blinking of the light spots in the various colours.

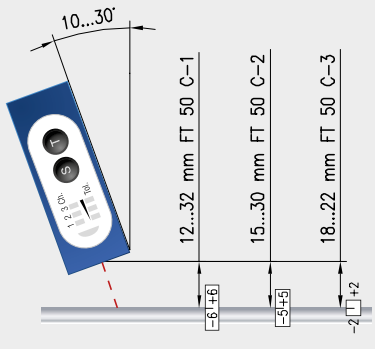
The FT 50 C colour sensor operates according to the passive three-range process with white-light LED and an optical "funnel" that we developed. This patented sensor concept allows very fine colour selection – so that even minimal colour differences can be detected – and an above-average depth of field that ensures the reliable function of the colour sensor, even with fluctuating scanning distances.

High process speed



The FT 25-C miniature colour sensor reliably switches with 10 kHz with the taught-in colour (including black and white) and is particulary suitable for use in rapid processes, e.g. in labeling machines.

Depth of field



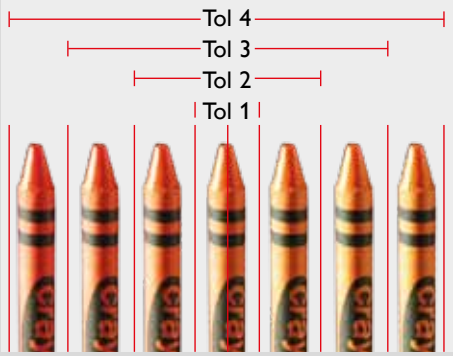
The depth of field of the FT 50 C also varies depending on the light spot geometry:
+/– 6 mm (with default setting)
+/– 5 mm (with default setting)
+/– 2 mm (with default setting)

Scan function



In the case of heterogeneously coloured surfaces, the Scan function of the FT 50 C allows the scanning-in and storage of colour gradients. The colours within the scanned colour range are then detected.

Tolerance ranges

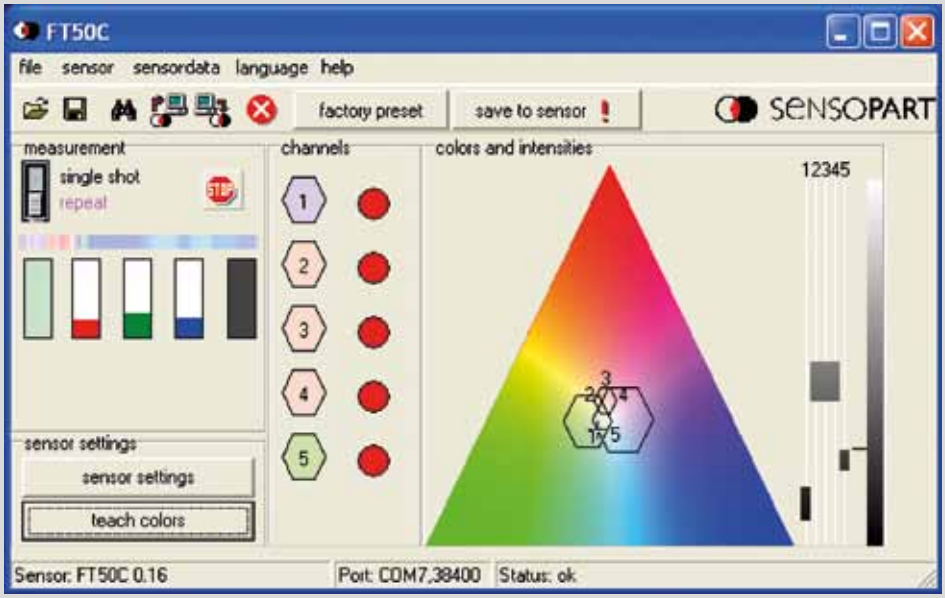


The detection window can be adapted by adjusting colour selectivity.

Versatile colour settings

The FT 50 C colour sensor offers very comprehensive opportunities for teaching-in and administrating colours. Additional reference colours can be taught-in, or the colour range expanded, in up to four steps. In practice, this function proves helpful when, for example, labels with fluctuating print quality require reliable detection. Larger colour ranges, as well as heterogeneously coloured surfaces or colour gradients, can be detected using the "ColourScan" function (see Figs. 1 and 2 below). In this case, high colour selectivity can be achieved with the "Scanplus" function so that the sensor reliably detects incorrect or missing colours.

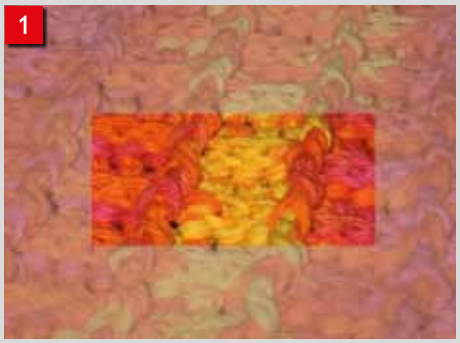
As many colours as desired can be taught-in via the interface and stored in the machine controller – and called up again in the form of colour vectors (data string with a target value incl. tolerance).

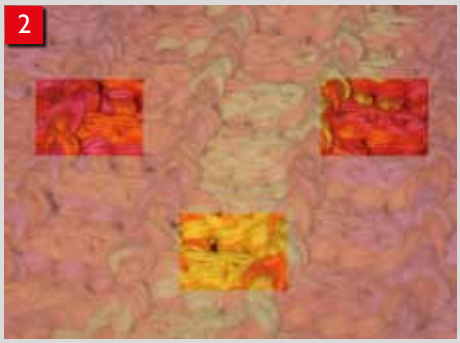


PC-based software (FT 50 C)

The serial interface and PC software also allow the entire bandwidth of the sensor's functions to be controlled from the PC. Thus settings can be made interactively and the sensors easily adapted to the particular application. Colour patterns can also be stored after teach-in and, when necessary, reloaded. No renewed teach-in is necessary.

The current version of the software can be obtained at **www.sensopart.com**





ColourScan (FT 50 C)

Heterogeneously coloured surfaces can be taught-in (scanned in) with the help of the integrated Scan or Scanplus functions. If a larger colour range is scanned-in and assigned to a single channel, the sensor switches with all colours that lie within this colour spectrum (Fig. 1). An improved selectivity is achieved with the Scanplus function, with which this range can be split into several parts (Fig. 2).

Contrast sensors

System description

Functional description

Contrast sensors operate on the energetic reflection principle and detect grey value differences on matt, glossy or transparent objects and surfaces.

Switching frequency

As a result of the high switching frequency (25 kHz) of the FT 25-W and FT 25-RGB contrast sensors, the front edges of printed marks are very precisely detected, achieving maximum position accuracy. This also ensures reliable sensor switching behaviour even at very high process speeds.

White-light contrast sensors

The FT 25-W contrast sensor uses white light and has a very small and precise rectangular light spot (1 × 4 mm^2). This also allows the detection of very small printed marks and coloured objects with weak contrast differences. The sensor can be parameterised during running operation and, during the teach-in process, automatically adapts the switching threshold to the object colour and background.

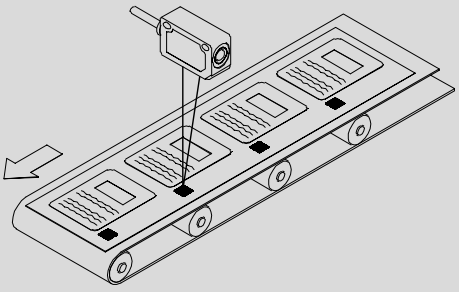
Laser contrast sensors

These sensors operate with red laser light (Laser Class 1) and also have a very small light spot (Ø 0.7 mm in focus). This permits even very small printed marks of differing colours to be read at longer distances. During the teach-in process, the sensor automatically adapts the switching threshold to the mark colour and background.

RGB contrast sensors

The FT 25-RGB contrast sensor has three different transmission LEDs (red, green and blue). During teach-in, the sensor evaluates the taught-in contrast and then automatically selects the ideal transmission colour (red, green or blue) for the contrast present. As a result, even extremely low contrast differences can be reliable detected.

Application example



Detection of printed marks
The contrast difference between the printed marks and the unprinted paper is evaluated here.

Functional description

The detection process is based on the luminescence of certain materials, called luminophores. The sensor transmits invisible UV light at a wavelength of 375 nm. This excites the luminophores contained in the object so that they emit light in the visible range of the electromagnetic spectrum. The sensor energetically evaluates these precisely taught-in, material-specific frequencies and compares them with the taught-in value.

Luminophores can be attached to labels or mixed with a variety of materials (e.g. paints, chalk, glue and lubricants) for detection purposes. Thus, for example, paper contains optical brighteners that are excited by the UV light and reflect light (mostly blue) to the sensor.

Applications

Examples of applications include the detection of labels on glass bottles, invisible printed marks for object alignment, and the presence of oils to which luminescent materials have been added. Fluorescent chalks, paints and dyes; text markers; glues; sealants; lubricants; and optical brighteners in paper, textiles and plastics are examples of luminescent materials.

Universal
- One variant for all types of luminescence (red, blue, etc.)
- Competitors require several variants for this, because they need supplementary filters!

RGB-3 range reception system
- Reliable detection even with low amounts of luminophores in the object
- Extremely reliable detection thanks to high signal reserves
- Immune to reflections (e.g. on glass or glossy metals)
- Differentiation between different luminophores

Very good depth of field
- Detection at varying object distances, even with fluttering objects such as paper
- No fine adjustment necessary, e.g. with batch changes

Small, precise light spot
- Accurate detection of the smallest of invisible printed marks

Easy teach-in
(on device or comfortably via external connection)
- Single channel: ready-to-run

FT 25-C

RGB colour sensor in miniature housing with high switching frequency





Reliable colour detection:
The main task of the FT 25-C RGB colour sensor is the detection of a defined colour. It is also suitable for very rapid applications thanks to its high switching frequency. Mounting by means of a dovetail and the MBD F25ST mounting rod, available as an accessory, allows easy and precise fine alignment.

TYPICAL FT 25-C

- Smallest cubic colour sensor on the market (34 x 20 x 12 mm³)
- High switching frequency of 10 kHz for rapid applications
- Detection of a taught-in colour
- Detection of "non-colours", e. g. black, white and grey
- Bright light spot with sharp contour for easy alignment and precise front-edge detection
- Static or external teach-in
- "Communicating" light spot for simplest setup
- Hermetically sealed housings (IP 69K & IP 67)

The FT 25-C RGB colour sensor is not only the smallest cubic colour sensor currently available on the market, but is also one of the quickest: with a switching frequency of up to 10 kHz it is as fast as a contrast sensor and thus also suitable for the most rapid printed mark applications. The FT 25-C can identify any colour in the visible spectrum including all the "non-colours" and also very reliably detects the smallest of colour differences. It keeps even the narrowest print marks and smallest markings in view thanks to its bright light spot with a sharp elongated contour (1 x 5 mm²).

Fits into every space

Thanks to its miniature design, SensoPart's smallest colour sensor is also easily accommodated in very restricted installation spaces, whereby the patented dovetail mounting allows user-friendly fine alignment. The operating concept is also clever: the FT 25-C is rapidly and easily configured via teach-in or control line. The quality of the colour detection is signalled via a "communicating" light spot: the blinking of the red, blue or green transmission LED provides you with a clear statement on the stability of your process.

As a result of its space-saving design and rapidity, the FT 25-C is suitable for use in numerous sectors and applications, for example, packaging and labeling machines as well as bottling lines.

FT 25-C – Product Overview				
	Type of light	Scanning distance	Special features	Page
FT 25-C	Red LED, green LED, blue LED	12 ± 3 mm	The world's smallest RGB colour sensor with a switching frequency of ≤ 10 kHz	192

FT 25-C

RGB colour sensor



PRODUCT HIGHLIGHTS

- Smallest RGB colour sensor with high switching frequency ≤ 10 kHz
- Precise detection of the slightest of contrast differences
- Very robust operation despite fluttering and glossy objects
- Feedback via „responding light spot“ about quality of taught-in colour value

Optical data	
Scanning distance	12 mm
Depth of field	± 3 mm
Type of light	Red LED, 633 nm Green LED, 525 nm Blue LED, 460 nm
Light spot size	1 x 5 mm²

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via Teach-in button and control input
Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	N.O.

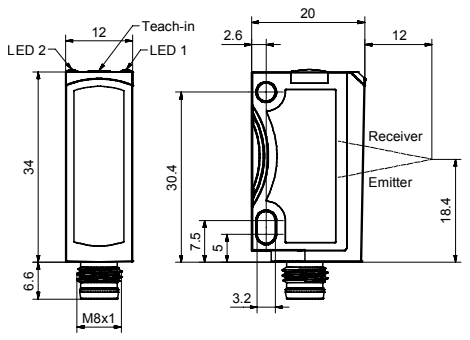
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection class	2
Power On Delay	< 300 ms
Switching output, Q	Push-Pull
Output function	N.O. / N.C.
Switching frequency, f (ti/tp 1:1)[2]	See Selection Table
Response time	See Selection Table

Mechanical data	
Dimensions	34 x 20 x 12 mm³
Enclosure rating	IP 67 / IP 69K[3]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +55 °C[4]
Ambient temperature: storage	-20 … +80 °C
Weight (metal plug device)	10 g
Vibration and impact resistance	EN 60947-5-2

[1] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [2] f = 1 / (T x Nyq x 2) [3] With connected IP 67 / IP 69K plug [4] UL: -20 … +50 °C

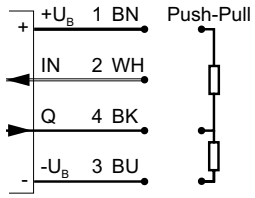
Switching frequency, f (ti/tp 1:1)[2]	Response time	Scanning distance	Type of connection	Part number	Article number
≤ 10000 Hz	≤ 50 µs	12 ± 3 mm	Metal plug, M8x1, 4-pin	FT 25-C1-GS-M4M	607-21020
≤ 2500 Hz	≤ 200 µs	12 ± 3 mm	Metal plug, M8x1, 4-pin	FT 25-C2-GS-M4M	607-21021

Plug connection



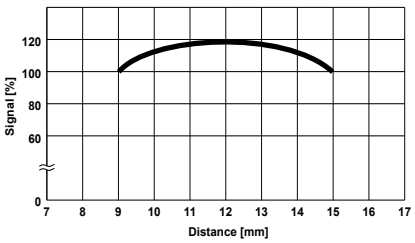
153-00995

Connection, 4-pin



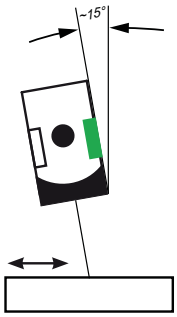
154-00320

Signal process



155-01648

Installation



155-01726

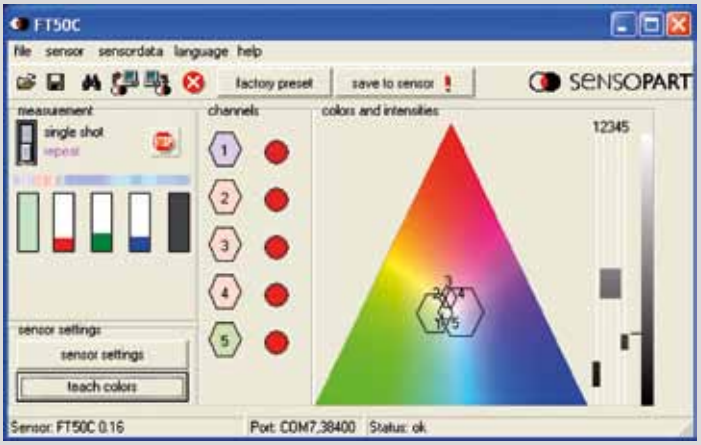
Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

FT 50 C white-light colour sensor

Reliability despite varying object distances





PC-based software

The entire range of sensor functions can also be controlled from a PC, thanks to the serial interface and PC software.

TYPICAL FT 50 C

- High depth of field for reliable detection despite vibrations
- Up to 5 colours or colour ranges internally, or unlimited colours via RS485 serial interface
- Three different light spot geometries available
- High colour selectivity for reliable detection despite scanning distance fluctuations
- Simple teach-in or scan-in of colours
- Up to 3 result outputs
- IO Link on request

The FT 50 C white-light colour sensor is one of the most important innovations that SensoPart has placed on the sensor market in recent years. The scanner, awarded a prestigious innovation prize, offers a considerably expanded range of functions and particularly user-friendly operation compared to conventional colour sensors.

The compact sensor can administrate up to 5 reference colours or colour ranges internally. These can either be taught-in or, particularly easily, scanned-in. Separate tolerance values for colour and intensity can be defined for each taught-in reference colour. In practice, this function proves helpful when, for example, labels with fluctuating print quality must be reliably detected. The tolerances are automatically determined when the colours are scanned in. As a result of its special patented optical system – the optical "funnel" – the FT 50 C also achieves an above-average depth of field. It can thus easily detect even inexactly transported, moving or vibrating target objects, e.g. workpieces on a conveyor belt. Rapidly moving objects are also reliably detected thanks to the high switching frequency of up to 500 Hz.

The range of interfaces on the FT 50 C is also particularly varied: depending on the variant, it has up to three switching outputs, a serial RS485 interface or an IO-Link interface. The serial interface variant is not internally restricted to a maximum of five colours: as many reference colours as desired can be taught-in and transferred to the machine controller, where they can be stored – in the form of colour vectors (target values and tolerances) – for later retrieval. This range of functions, together with the high detection reliability and very user-friendly operation, is unique in this class of sensors!

FT 50 C – Product Overview

	Type of light	Scanning distance	Special features	Page
FT 50 C	LED, white	… 32 mm	1 switching output	196
FT 50 C	LED, white	… 32 mm	3 switching outputs	198
FT 50 C	LED, white	… 32 mm	Serial interface	200
IO Box for FT 50 C				202

FT 50 C

Colour sensor with a switching output



PRODUCT HIGHLIGHTS

- Colours are reliably detected despite fluctuating scanning distances thanks to patented optical technology
- Very good depth of field
- Very simple setup (via button and control line)
- Even the smallest of colour differences are reliably detected due to pulsed white light
- Varying light spot sizes depending on task

Optical data	
Scanning distance	See Selection Table
Scanning distance tolerance	See Selection Table
Type of light	LED, white
Light spot size	See Selection Table

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Colour setting	Via teach-in button and control line
Default setting	N.O.

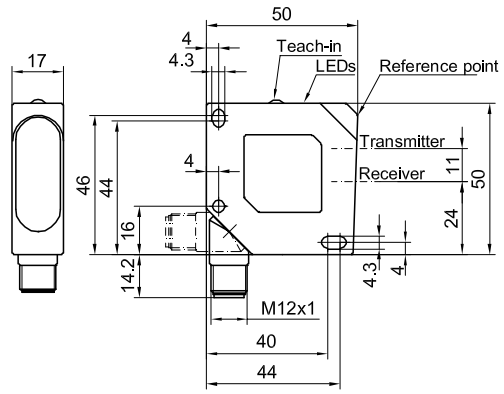
Electrical data	
Operating voltage, $+U_B$	12 … 28 V DC[1]
No-load current, I_0	≤ 40 mA
Output current, Ie	≤ 100 mA
Voltage drop, U_D	≤ 2.4 V
Max. capacitive load	< 100 nF
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Input IN ET (external teach-in)	> 12 V … 28 V: button locked < 3 V or open: normal operation Min. response time: 100 ms
Input lock (button lock)	> 12 V … 28 V: button locked < 3 V or open: button free
Switching output, Q	PNP
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	≤ 500 Hz

Mechanical data	
Dimensions	50 x 50 x 17 mm[3]
Enclosure rating	IP 67[2]
Material, housing	ABS, impact-resistant
Material, front screen	PMMA
Type of connection	Plug, M12, 5-pin, rotatable
Ambient temperature: operation	-10 … +55 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Max. 10 % ripple, within U_B [2] With connected IP 67 plug [3] At scanning distance of 22 mm

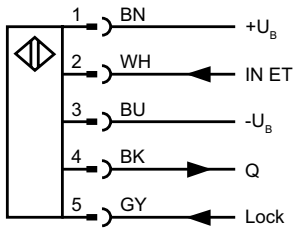
Scanning distance/Scanning distance tolerance/Light spot size	Switching output	Type of connection	Part number	Article number
12 … 32 mm / ± 6 mm / Ø 4 mm[3]	PNP	Plug, M12, 5-pin	FT 50 C-1-PSL5	575-11016
15 … 30 mm / ± 5 mm / 2 x 2 mm[3]	PNP	Plug, M12, 5-pin	FT 50 C-2-PSL5	575-11017
18 … 22 mm / ± 2 mm / 5 x 1 mm[3]	PNP	Plug, M12, 5-pin	FT 50 C-3-PSL5	575-11018

Plug connection



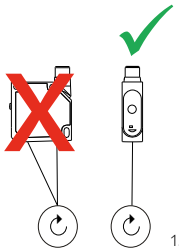
153-00826

Connection, 5-pin

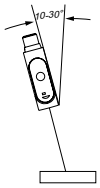


154-00262

Installation



155-01167



155-01228

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

7

FT 50 C

Colour sensor with 3 switching outputs



PRODUCT HIGHLIGHTS

- Colours are reliably detected despite fluctuating scanning distances thanks to patented optical technology
- 3 colours distinguishable via 3 switching outputs
- Even the smallest of colour differences are reliably detected
- Easy teach-in of colours via Teach-in button or control line

Optical data	
Scanning distance	See Selection Table
Scanning distance tolerance	See Selection Table
Type of light	LED, white
Light spot size	See Selection Table

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	3 x switching output indicators
Indicator LED, red	3 x tolerance level indicators
Colour and tolerance settings	Via teach-in button and control line
Adjustment possibilities	Colours taught-in via Teach-in button and control line Pulse stretching via Teach-in button Button lock via control input
Default setting	Normal operation, Tol. 3 for X01, typ. = Tol. 5

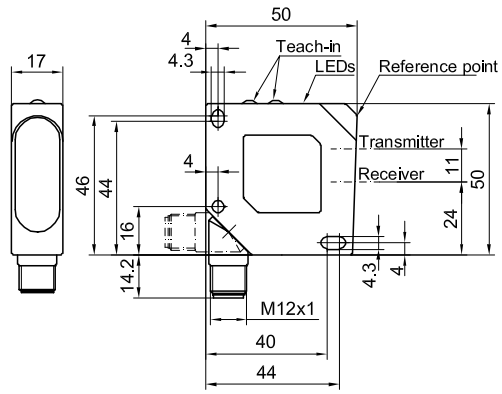
Electrical data	
Operating voltage, $+U_B$	12 … 28 V DC[2]
No-load current, I_0	≤ 40 mA
Output current, Ie	≤ 100 mA
Voltage drop, Ud	≤ 2.4 V
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	3 x PNP
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	500 Hz
Response time	10 ms
Control input, AT	> 12 V … 28 V = triggered < 3 V / open = free-running Response time: 10 ms
Control input, KeyLock	> 12 V … 28 V = button locked < 3 V / open = normal operation Pulse stretching / release delay: 50 ms
Control input, Ext. Teach-in (normal operation Q3)	> 12 V … 28 V = Teach-in < 3 V / open = normal operation Min. response time: 2 ms

Mechanical data	
Dimensions	50 x 50 x 17 mm[3]
Enclosure rating	IP 67[3]
Material, housing	ABS, impact-resistant
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-10 … +55 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] At scanning distance of 22 mm [2] Max. 10 % ripple, within U_B [3] With connected IP 67 plug

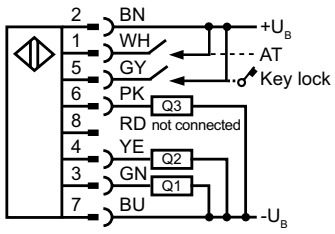
Scanning distance/Scanning distance tolerance/Light spot size	Switching output	Type of connection	Part number	Article number
12 … 32 mm / ± 6 mm / Ø 4 mm[1]	3 x PNP	Plug, M12, 8-pin	FT 50 C-1-PSL8	575-11000
15 … 30 mm / ± 5 mm / 2 x 2 mm[1]	3 x PNP	Plug, M12, 8-pin	FT 50 C-2-PSL8	575-11003
18 … 22 mm / ± 2 mm / 5 x 1 mm[1]	3 x PNP	Plug, M12, 8-pin	FT 50 C-3-PSL8	575-11004

Plug connection



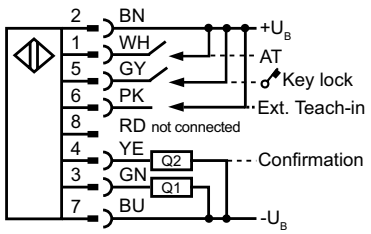
153-00350

Connection, 8-pin (normal operation)



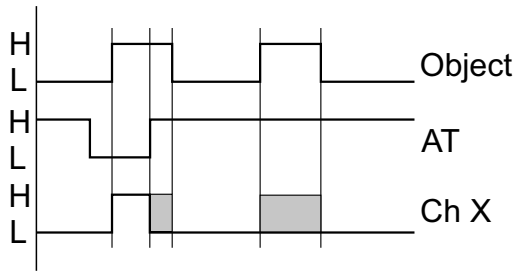
154-00197

Connection, 8-pin (external teach-in)



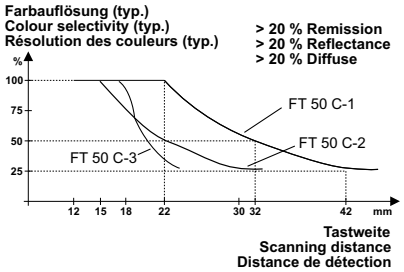
154-00198

Control input (AT)



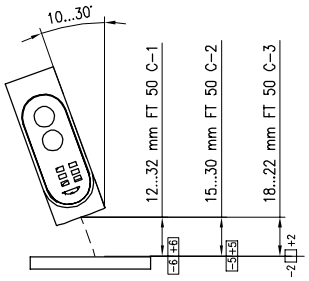
155-00085

Colour selectivity

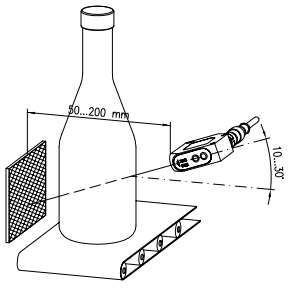


155-00926

Installation



155-00698



155-00925

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

FT 50 C

Colour sensor with serial switching interface



PRODUCT HIGHLIGHTS

- Colours are reliably detected despite fluctuating scanning distances thanks to patented optical technology
- Transfer of colour channel or colour value, as well as reading, modification and storage of sensor parameters, via RS485 interface
- Even the smallest of colour differences are reliably detected
- ColourScan function for detection of colour ranges
- Reliable detection of even the smallest of coloured objects

Optical data	
Scanning distance	See Selection Table
Scanning distance tolerance	See Selection Table
Type of light	LED, white
Light spot size	See Selection Table

Functions	
Indicator LED, green	Operating voltage indicator
3 x indicator LEDs, yellow	Switching output indicators
3 x indicator LEDs, red	Tolerance level indicators
Colour & tolerance setting	Via teach-in button and control line
Default setting	White, 90 %, taught-in, sensor address = 1 (RS485)
Supplementary functions	ColourScan, triggering, teach-in, button lock

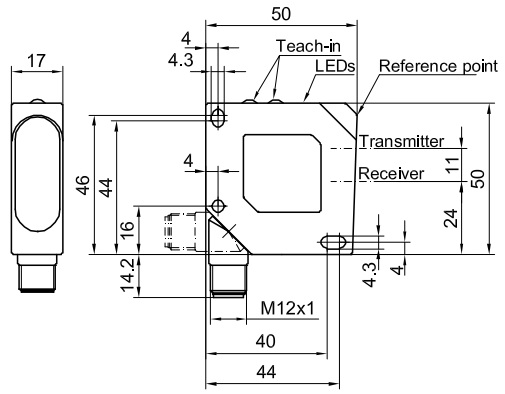
Electrical data	
Operating voltage, $+U_B$	12 … 28 V DC[1]
No-load current, I_0	≤ 40 mA
Output current, Ie	≤ 100 mA
Voltage drop, U_D	≤ 2.4 V
Max. capacitive load	< 100 nF
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q) (not RS485)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	See Selection Table
Output function	N.O. / N.C.
Switching frequency, f (ti/tp 1:1)	Max. 500 Hz
Time stage for Q	50 ms release delay, adjustable
Control input, KL / TR	Button lock input (KL) or triggering (TR), adjustable
Control input, IN ET	PNP / NPN, input for external teach-in
Min. response time	2 ms
Control input, IN ES	PNP / NPN, input for external scanning
Serial interface	RS485 (half-duplex)

Mechanical data	
Dimensions	50 x 50 x 17 mm[3]
Enclosure rating	IP 67[3]
Material, housing	ABS, impact-resistant
Material, front screen	PMMA
Type of connection	Plug, M12x1, 8-pin, rotatable
Ambient temperature: operation	-10 … +55 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] At scanning distance of 22 mm [2] Max. 10 % ripple, within U_B [3] With connected IP 67 plug

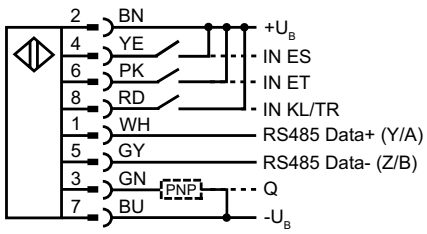
Scanning distance/Scanning distance tolerance/Light spot size	Switching output	Type of connection	Part number	Article number
12 … 32 mm / ± 6 mm / Ø 4 mm[1]	PNP	Plug, M12, 8-pin	FT 50 C-1-PS1-L8	575-11007
12 … 32 mm / ± 6 mm / Ø 4 mm[1]	NPN	Plug, M12, 8-pin	FT 50 C-1-NS1-L8	575-11010
15 … 30 mm / ± 5 mm / 2 x 2 mm[1]	PNP	Plug, M12, 8-pin	FT 50 C-2-PS1-L8	575-11008
15 … 30 mm / ± 5 mm / 2 x 2 mm[1]	NPN	Plug, M12, 8-pin	FT 50 C-2-NS1-L8	575-11011
18 … 22 mm / ± 2 mm / 5 x 1 mm[1]	PNP	Plug, M12, 8-pin	FT 50 C-3-PS1-L8	575-11009
18 … 22 mm / ± 2 mm / 5 x 1 mm[1]	NPN	Plug, M12, 8-pin	FT 50 C-3-NS1-L8	575-11012

Plug connection



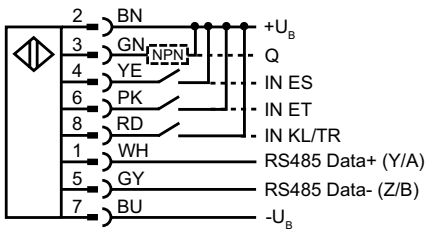
153-00350

Connection, 8-pin



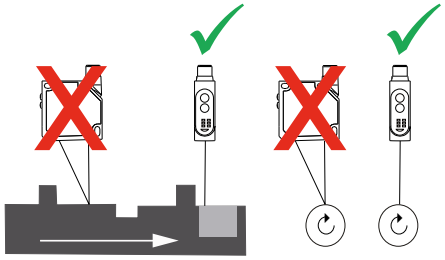
154-00473

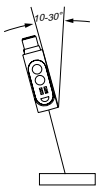
Connection, 8-pin



154-00474

Installation


155-00270



155-00697

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4
Progsensor software	www.sensopart.com

IO Box

Expansion box for FT 50 C



PRODUCT HIGHLIGHTS

- Input/output expansion for FT50C…-S1L8 colour sensors
- Up to 32 colours can be stored
- 32 PNP output channels
- Definition of colour sequences and colour groups
- ColourScan function
- Display for simple visualisation and operator guidance
- Time function selectable
- DIN rail mounting

Functions	
Off-delay	5 ms to 2000 ms in increments
On-delay	5 ms to 2000 ms in increments
Wipe function (shot)	5 ms to 2000 ms in increments
Output function	Conversion between N.C. and N.O. for each individual switching output

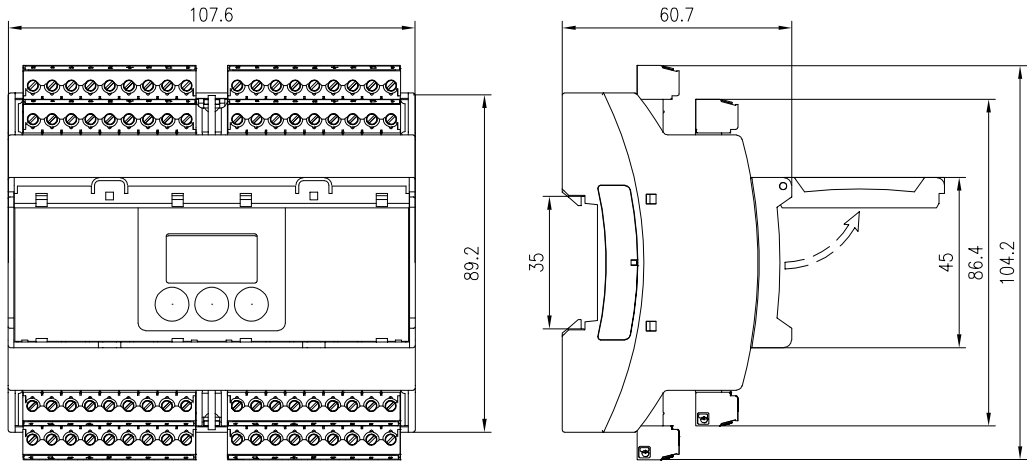
Electrical data	
Operating voltage, $+U_B$	24 V DC ± 10 %
No-load current, I_0	≤ 250 mA
Switching output, Q	32 x PNP
Switching frequency, f (ti/tp 1:1)	166 Hz in combination with colour sensor FT 50 C … S1L8
On-delay t_{On} switching output	≤ 2 ms
Off-delay t_{Off} switching output	≤ 2 ms
Maximal permissible cable length	Power supply 3 m, otherwise 30 m
Serial interface	RS485 Z/B / RS485 Y/A

Mechanical data	
Dimensions	107.6 x 104.2 x 60.7 mm^3 (lid closed)
Enclosure rating	IP 20
Material, housing	Plastic
Connection system	Screw clamp contacts
Ambient temperature: operation	0 … +50 °C
Ambient temperature: storage	0 … +50 °C
Vibration and impact resistance	EN 60947-5-2

Part number	Article number
T-CS1T-12T34PRD	533-01007

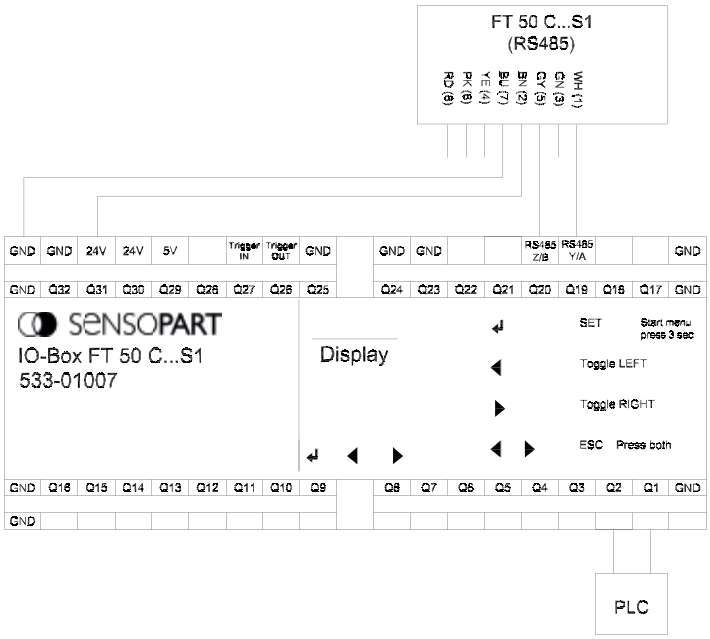
Accessories (not included in scope of delivery of colour terminal)	
Part number	**Article number**
FT 50 C-1-PS1-L8	575-11007
FT 50 C-2-PS1-L8	575-11008
FT 50 C-3-PS1-L8	575-11009
FT 50 C-1-NS1-L8	575-11010
FT 50 C-2-NS1-L8	575-11011
FT 50 C-3-NS1-L8	575-11012

Dimensional drawing, IO Box



153-00795

Connection IO Box



155-01763

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

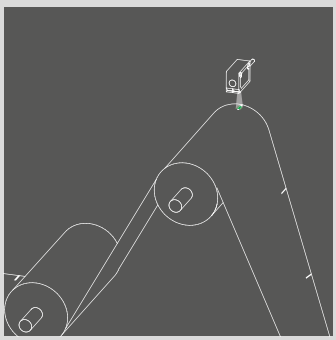
FT 25 – Contrast sensor

Miniature housing, maximum performance





Rod mounting MBD F 25ST *allows user-friendly and precise sensor alignment (see accessories).*

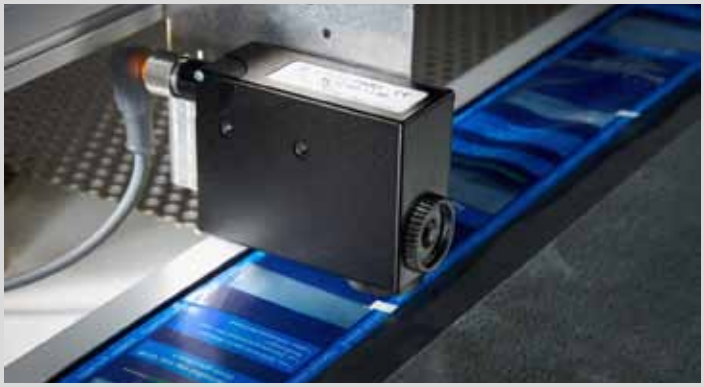


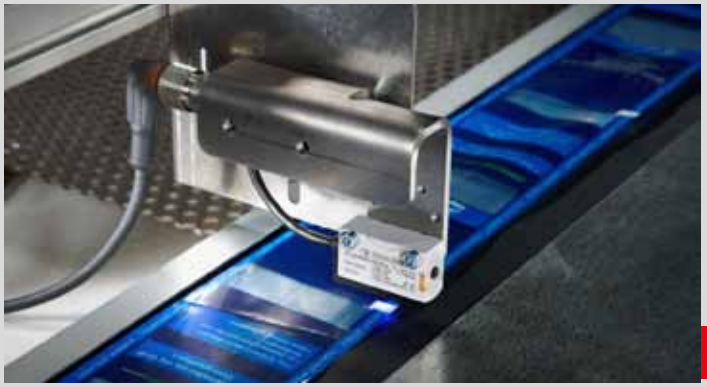
Areas of application:

- Printing machines
- Labelling machines
- Horizontal packaging machines
- Vertical packaging machines
- Bottling plants

TYPICAL FT 25-W/-RGB

- Precise detection of any printed marks
- High positioning accuracy thanks to minimum response time
- High switching frequency of 25 kHz with compact miniature housing
- Small, precise light spot with sharp contour for easy sensor alignment and detection of even the smallest of printed marks
- Feedback via light spot (simple, comprehensible, clearly defined)
- Dynamic, static or external teach-in
- High depth of field
- White-light LED or RGB diode options available





Out with the old, in with the new: *The contrast sensors from the F 25 series are assembly and connection compatible with the conventional standard housing (image on the left). The fastening bores are aligned in the same distance from each other. The integrated cable with a M12-connector fits to the corresponding mating connector.*

Contrast sensors are mainly used for printed mark detection in very rapid processes in the print and packaging industries. SensoPart offers high quality products – with white-light LED (FT 25-W, FT 20WT series), red-light laser (FT 25-RL) or RGB diode (FT 25-RGB) options.

While the white-light and RGB scanners can detect even the smallest of contrast differences, the red-light laser offers the advantage of a particularly small light spot (Ø 0.7 mm in focus) in combination with a long scanning distance.

The sensors can be configured during running operation via teach-in, whereby the switching threshold is automatically adapted to object and mark colours and the background. After teach-in, the quality of the taught-in contrast is communicated via the light spot. Users thus receive unambiguous feedback on how reliable their process is.

FT 25 / FT 20 – Product Overview

	Type of light	Scanning distance	Special features	Page
FT 25-W	White LED	12 ± 2,5 mm	Minimal response time	206
FT 25-RGB	Red LED, green LED, blue LED	12 ± 3 mm	Automatic selection of ideal transmission colour, minimal response time	208
FT 25-RL	Laser	250 mm	Long scanning distance	210
FT 20 WT	White LED	17 ± 2 mm		212

FT 25-W

White-light contrast sensor



PRODUCT HIGHLIGHTS

- Precise detection of the slightest contrast differences
- Very robust operation despite fluttering and glossy objects
- Simple alignment through very precise and easily visible light spot
- Housings that are many times smaller than standard housings – and offer better performance
- Very high positioning accuracy with 10 µs scanning

Optical data	
Scanning distance	12 mm
Depth of field	± 2.5 mm
Type of light	White LED, 400 … 780 nm
Light spot size	1 x 4 mm²

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via teach-in button and control line
Teach-in modes	Mode 1: with running process Mode 2: with standing process
Adjustment possibilities	LO / DO DO via Teach-in button and control line Button lock via control input

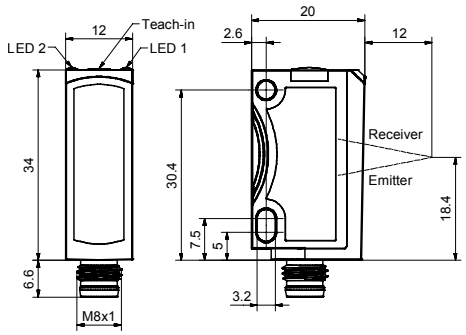
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP / NPN, push-pull
Output function	LO / DO
Switching frequency, f (ti/tp 1:1)[2]	See Selection Table
Response time	See Selection Table
Jitter (electrical)	See Selection Table

Mechanical data	
Dimensions	34 x 20 x 12 mm[3]
Enclosure rating	IP 69K & IP 67[3]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +55 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (integrated cable)	20 g
Vibration and impact resistance	EN 60947-5-2

[1] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [2] f = 1 / (T x Nyq x 2) [3] With connected IP 67 / IP 69K plug

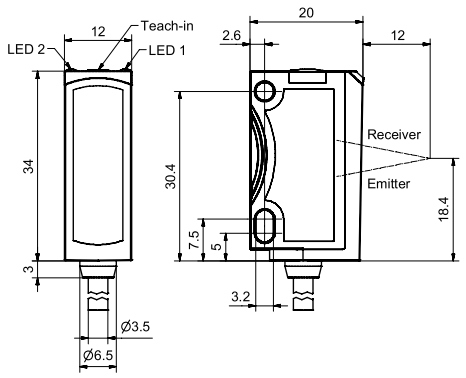
Switching frequency, f (ti/tp 1:1)[2]	Response time	Jitter (electrical)	Type of connection	Part number	Article number
≤ 25000 Hz	≤ 20 µs	10 µs	Metal plug, M8x1, 4-pin	FT 25-W1-GS-M4M	607-21013
≤ 25000 Hz	≤ 20 µs	10 µs	Integrated cable: 150 mm with plug M12x1, 4-pin	FT 25-W1-GS-KL4	607-21012
≤ 10000 Hz	≤ 50 µs	25 µs	Plug, M8x1, 4-pin	FT 25-W2-GS-M4	607-21014
≤ 10000 Hz	≤ 50 µs	25 µs	Integrated cable: 150 mm with plug M12x1, 4-pin	FT 25-W2-GS-KL4	607-21015

Plug connection



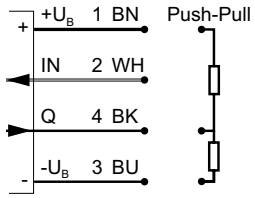
153-00995

Integrated cable



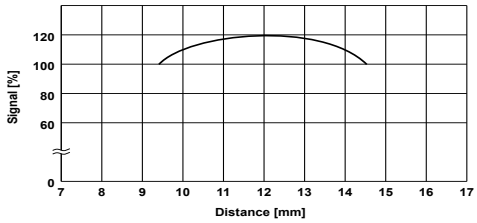
153-00996

Connection, 4-pin



154-00320

Signal process



155-01647

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

FT 25-RGB

Multi-colour contrast sensor



PRODUCT HIGHLIGHTS

- Precise detection of the slightest of contrast differences through multi-colour RGB evaluation
- Very robust operation despite fluttering and glossy objects
- Simple alignment thanks to very precise and easily visible light spot
- Communication via 3-colour light spot (simple, comprehensible, clearly defined)
- Very accurate positioning due to rapid scanning rate of 10 µs

Optical data	
Scanning distance	12 mm
Depth of field	± 3 mm
Type of light	Red LED Green LED Blue LED
Light spot size	1 x 4 mm[2]

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via teach-in button and control line
Teach-in modes	Mode 1: with running process Mode 2: with standing process
Adjustment possibilities	LO / DO via Teach-in button and control line Button lock via control input

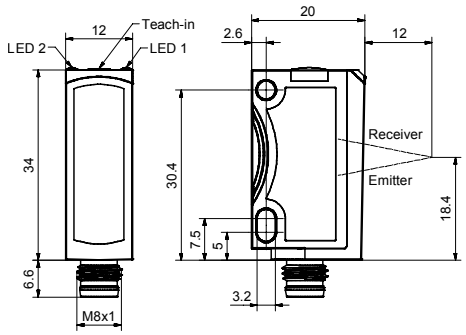
Electrical data	
Operating voltage, +U_B	10 … 30 V DC[1]
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP / NPN, push-pull
Output function	LO / DO
Switching frequency, f (ti/tp 1:1)[2]	See Selection Table
Response time	See Selection Table
Jitter (electrical)	See Selection Table

Mechanical data	
Dimensions	34 x 20 x 12 mm[3]
Enclosure rating	IP 69K & IP 67[3]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +55 °C[4]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (integrated cable)	20 g
Vibration and impact resistance	EN 60947-5-2

[1] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [2] f = 1 / (T x Nyq x 2) [3] With connected IP 67 / IP 69K plug [4] UL: -20 … +50 °C

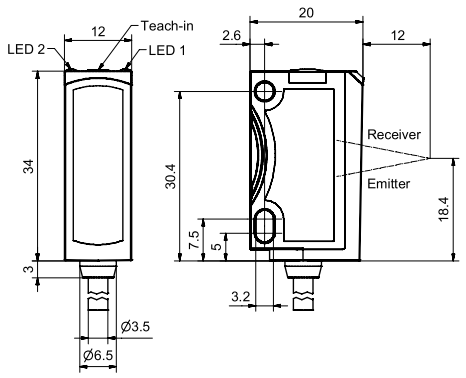
Switching frequency, f (ti/tp 1:1)[2]	Response time	Jitter (electrical)	Type of connection	Part number	Article number
≤ 25000 Hz	≤ 20 µs	< 10 µs	Metal plug, M8x1, 4-pin	FT 25-RGB1-GS-M4M	607-21011
≤ 25000 Hz	≤ 20 µs	< 10 µs	Integrated cable: 150 mm with plug M12x1, 4-pin	FT 25-RGB1-GS-KL4	607-21010
≤ 10000 Hz	≤ 50 µs	< 25 µs	Plug, M8x1, 4-pin	FT 25-RGB2-GS-M4	607-21017
≤ 10000 Hz	≤ 50 µs	< 25 µs	Integrated cable: 150 mm with plug M12x1, 4-pin	FT 25-RGB2-GS-KL4	607-21018

Plug connection



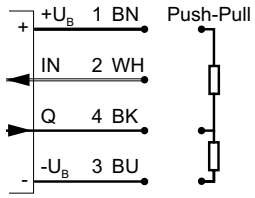
153-00995

Integrated cable



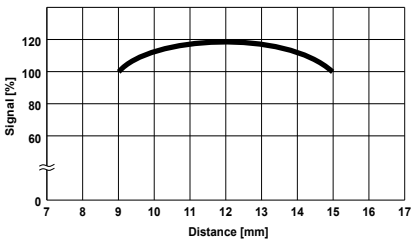
153-00996

Connection, 4-pin



154-00320

Signal process



155-01648

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

FT 25-RL

Laser contrast sensor



PRODUCT HIGHLIGHTS

- Differentiation even with low grey value differences at long scanning distances
- Sensor setup via teach-in and control input
- Resilient laser printing
- Very small, easily visible laser light spot
- Large range of variants

Optical data	
Scanning distance	1 … 250 mm[1]
Adjustment range	25 … 250 mm[1]
Type of light	Laser, red, 650 nm
Light spot size	See diagram
Laser Class (DIN EN 60825-1:2008-5)	1
Hysteresis	≤ 10%[2]

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via teach-in button and control line
Teach-in modes	Mode 1: with running process Mode 2: with standing process
Adjustment possibilities	LO / DO via Teach-in button and control line Button lock via control input
Default setting	Max. scanning distance and N.O.

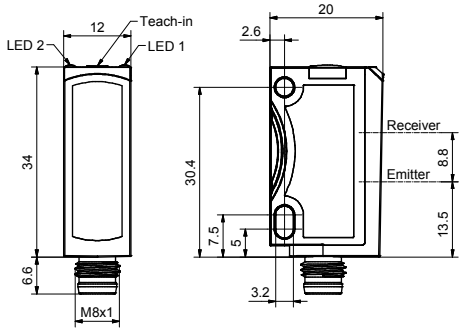
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[3]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP / NPN (See Selection Table)
Output function	LO / DO
Switching frequency, f (ti/tp 1:1)	≤ 1500 Hz
Response time	333 µs
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked open = normal operation

Mechanical data	
Dimensions	34 x 20 x 12 mm[3]
Enclosure rating	IP 69K & IP 67[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (cable device)	40 g
Weight (integrated cable)	20 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: white, 90 % reflectivity [2] Up to scanning distance of 150 mm [3] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [4] With connected IP 67 / IP 69K plug

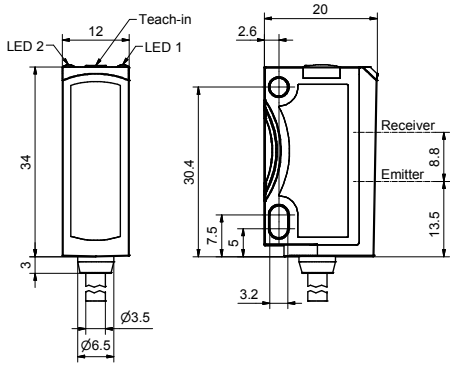
Scanning distance	Switching output	Type of connection	Part number	Article number
1 … 250 mm	PNP	Metal plug, M8x1, 4-pin	FT 25-RL-PS-M4M	609-21013
1 … 250 mm	NPN	Metal plug, M8x1, 4-pin	FT 25-RL-NS-M4M	609-21014
1 … 250 mm	PNP	Cable, 2 m, 4-wire	FT 25-RL-PS-K4	609-21010
1 … 250 mm	NPN	Cable, 2 m, 4-wire	FT 25-RL-NS-K4	609-21008
1 … 250 mm	PNP	Integrated cable: 150 mm with plug M12, 4-pin	FT 25-RL-PS-KL4	609-21012
1 … 250 mm	NPN	Integrated cable: 150 mm with plug M12, 4-pin	FT 25-RL-NS-KL4	609-21009

Plug connection



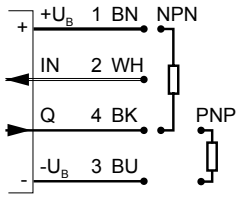
153-00937

Integrated cable



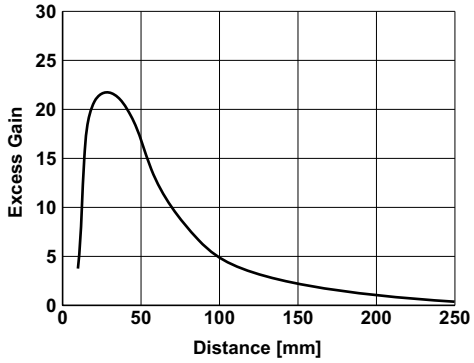
153-00936

Connection, 4-pin



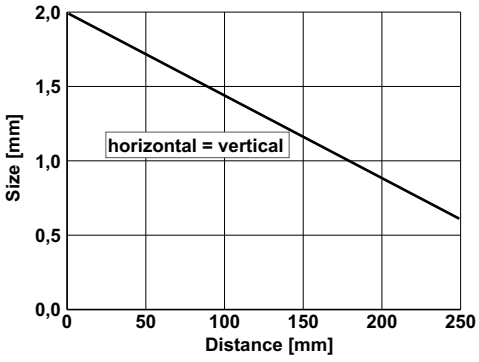
154-00312

Functional reserves



155-01384

Light spot size



155-01383

Reference material	Detection range
White (90 %)	1 … 250 mm
Grey (18 %)	6 … 100 mm
Black (6 %)	20 … 60 mm

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

FT 50 C-UV – luminescence sensor

An eye for the invisible





Simple sensor adjustment via Teach-in button or external control line.

The FT 50 C-UV is very robust and dazzle-proof due to its reliable optical concept.

TYPICAL FT 50 C-UV

- Very reliable detection regardless of object surface
- Teach-in for setup of differing objects by means of button or external control line
- Reliable detection even with minimum amounts of luminophores
- Wide scanning range provides reliable detection with varying object distances
- Small precise light spot for maximum positioning & small part accuracy
- Robust and dazzle-proof operation, e.g. on glass and highly reflective metals
- Rotatable plug (270°)
- UL certification

Low contrast or colour differences between printed marks and objects, or uneven object surfaces (e.g. rough, mottled or printed surfaces), frequently prove problematic for conventional colour and contrast sensors. The evaluation of luminescent features offers a simple and reliable alternative in these cases, or when marks are intended to be invisible on a product. Thus printed labels or the package inserts for medicines can be checked, chalk marks on wooden surfaces can be detected, and bottles can be positioned in the filling plant with the help of invisible printed marks. Other applications include checking the presence of oils with added luminescent materials, or monitoring glue application on paper.

With its three-range reception system, the FT 50 C-UV can evaluate luminescences over the entire spectral range of visible light – users can easily choose the desired RGB partial spectrum via teach-in. This differentiates the SensoPart solution from most of the UV sensors available on the market, which require appropriate filters to achieve this. The FT 50 C-UV can also distinguish between differing luminophores on the basis of the frequency of the emitted light.

The powerful sensor detects even minimal amounts of luminophores, and thus operates very reliably. Highly reflective surfaces or varying object distances, e.g. with fluttering objects such as paper or when there is a batch change, have no effect at all on proper function. An absolutely reliable automation solution made by SensoPart!

FT 50 C-UV – Product Overview			
	Type of light	Scanning distance	Page
FT 50 C-UV	UV diode	5 … 50 mm	216

FT 50 C-UV

Luminescence sensor



PRODUCT HIGHLIGHTS

- Detection of luminescent materials, e.g. in paper, oil and glues
- Precise, small light spot for maximum positioning accuracy
- Flexibility through large scanning range
- Robust, dazzle-proof operation
- Plug rotatable for simple integration in the machine

Optical data	
Scanning distance	5 … 50 mm
Optimum scanning distance	18 mm
Type of light	UV diode, 375 nm[1]
Light spot size	See diagram

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via teach-in button and control line
Teach-in	During standing process
Adjustment possibilities	Button lock via control input
Default setting	Max. sensitivity and N.O.

Electrical data	
Operating voltage, $+U_B$	12 … 28 V DC[2]
No-load current, I_0	≤ 40 mA
Output current, Ie	≤ 100 mA
Voltage drop, U_D	≤ 2.4 V
Max. capacitive load	< 100 nF
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	≤ 500 Hz
Response time	1 ms
Control input, ET[3]	12 V … 28 V = teach-in < 3V / open = normal operation
Control input, Lock	12 V … 28 V = button locked < 3V / open = normal operation (button free)

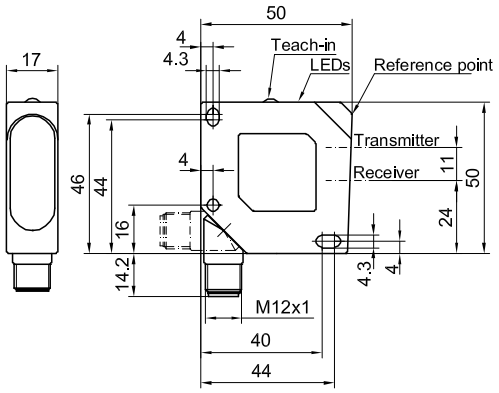
Mechanical data	
Dimensions	50 x 50 x 17 mm[3]
Enclosure rating	IP 67[4]
Material, housing	ABS
Material, front screen	Glass
Type of connection	(See Selection Table)
Ambient temperature: operation	-10 … +55 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Risk-free at observation distances of > 60 mm acc. to DIN EN 62471:2008. Do not look into beam at observation distances of < 60 mm.
[2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] Min. response time 100 ms [4] With connected IP 67 / IP 69K plug

Scanning distance	Switching output	Type of connection	Part number	Article number
5 … 50 mm	PNP	Plug, M12x1, 5-pin	FT 50 C-UV-1-PSL5	575-11020

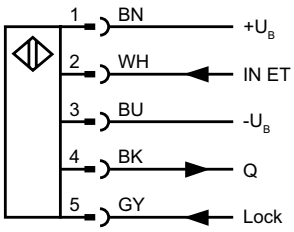
Version: 10/2013. Subject to changes; diagrams similar

Plug connection



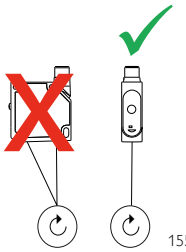
153-00826

Connection, 5-pin

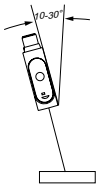


154-00262

Installation

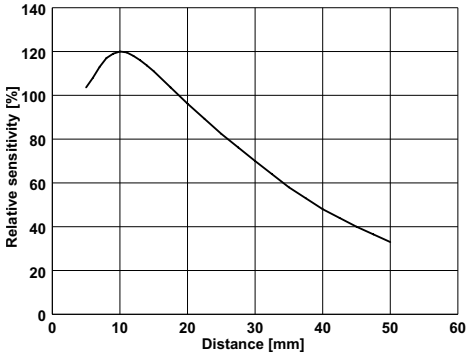


155-01167



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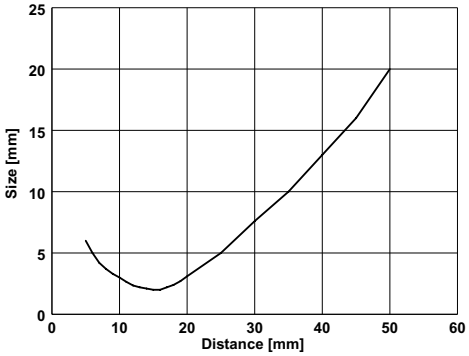
Relative sensitivity*



155-01320

* Reference material: white, 90 % reflectivity

Light spot size



155-01319

Accessories

Connection cables	From Page 670
Brackets	From Page 642

Photoelectric sensors and proximity sensors

Performance and quality made in Germany

F 10 – sub-miniature sensor family

from Page 226

FT 10-RLH-PS-KM4
- *The world's smallest adjustable laser photoelectric proximity sensor with background suppression*

>> Page 228

FS/FE 10-RL-…
- *Very precise front edge detection thanks to high scanning rate and fine laser beam*

>> Page 244



F 25 – the new generation miniature sensor family

from Page 248

FT 25-RLH-PS-M4M
- *Extremely accurate small-part detection thanks to tiny laser light spot*
- *Precise background suppression through SensoPart ASIC technology*

>> Page 250

FT 25-RHD-PNS-M4M
- *Photoelectric proximity sensor with adjustable background suppression*
- *Long scanning distance of 400 mm with miniature housing*

>> Page 254



F 55 – photoelectric sensors and proximity sensors with high-quality housings

from Page 280

FT 55-RHM-PS-L4
- *Photoelectric proximity sensor with background suppression*
- *Stainless steel housings for use in the food industry*

>> Page 292

FT 55-RL2-PS-L4
- *Laser photoelectric proximity sensor*
- *Detection of the slightest contrast differences at a scanning distance of up to 1.2 m*

>> Page 294



F 20 – photoelectric sensors and proximity sensors in miniature housings

from Page 314

FR 20 RLO-PSM4
- *Autocollimation laser retro-reflective photoelectric sensor*
- *Extremely accurate small-part detection from range of 0 mm*
- *High scanning accuracy due to high switching frequency of 4 kHz and precise light spot*

>> Page 336



Photoelectric sensors and proximity sensors are the standard sensors in automation technology. At SensoPart you will find the right sensor for almost every conceivable application. Our product portfolio offers a comprehensive selection of differing sizes, ranges and switching variants. Regardless of whether you choose a sub-miniature sensor for restricted machine conditions or a large housing with a particularly long range or scanning distance – all our sensors share excellent performance data, high reliability and solid workmanship "made in Germany".

Our photoelectric sensors and proximity sensors offer, for example, precise background suppression, extremely accurate small-part detection or reliable detection of transparent objects. And they operate extremely reliably in harsh industrial conditions: our current sensor series have tightly sealed (IP 69K / IP 67) plastic housings and are immune to cleaning according to the Ecolab standard.

Mounting and alignment are easy and rapid with products from SensoPart: well thought-out, user-friendly accessories such as the dovetail mounting offered by some of our series, the adjustment possibilities via Teach-in button and control input, or the Autodetect function (only available from SensoPart), with which sensors can automatically determine whether PNP or NPN wiring is present – so that only one sensor variant is required.

The SensoPart portfolio not only contains powerful, reliable and solid products for standard applications, but also real highlights. Our new FT 25-RHD proximity sensor, for example: its highly precise background suppression, the lowest black/white-shift currently available on the market, and the long scanning distance ensure absolutely reliable switching behaviour – without impairment by varying object surfaces and colours, or critical backgrounds. Or our FT 10-RLH sub-miniature laser scanner – the only one of its size with adjustable background suppression. Or … see for yourself on the following pages!

F 50 – photoelectric sensors and proximity sensors in compact housings

from Page 350

FT 50 RLHD-PAL4

- *Laser photoelectric proximity sensor with background suppression*
- *Long scanning distance of 300 mm with compact housing and extremely accurate small-part detection*

>> Page 354



F 88 – the photoelectric sensor and proximity sensor family for harsh operating conditions

from Page 366

FT 88-IH-RAT-PM

- *Infrared photoelectric proximity sensor with background suppression*
- *Relay output with toggle switch*
- *Very high scanning distance of 2 m*
- *Simple adjustment of time functions*

>> Page 374



FT 92 – proximity sensors with long ranges

from Page 386

FT 92 IL-PSL4

- *Infrared laser photoelectric proximity sensor with background suppression*
- *Very long range of 6 m thanks to time-of-flight technology*
- *Simple sensor alignment by means of integrated red-light pilot laser*

>> Page 388



Photoelectric sensors and proximity sensors in cylindrical housings

from Page 390

FMH 18

- *Best sensor in cylindrical housing with background suppression*

>> Page 394

FR 18-2 RM-PS-L4

- *Retroreflective photoelectric sensor*
- *Standard M18 sleeve in robust full-metal housing*

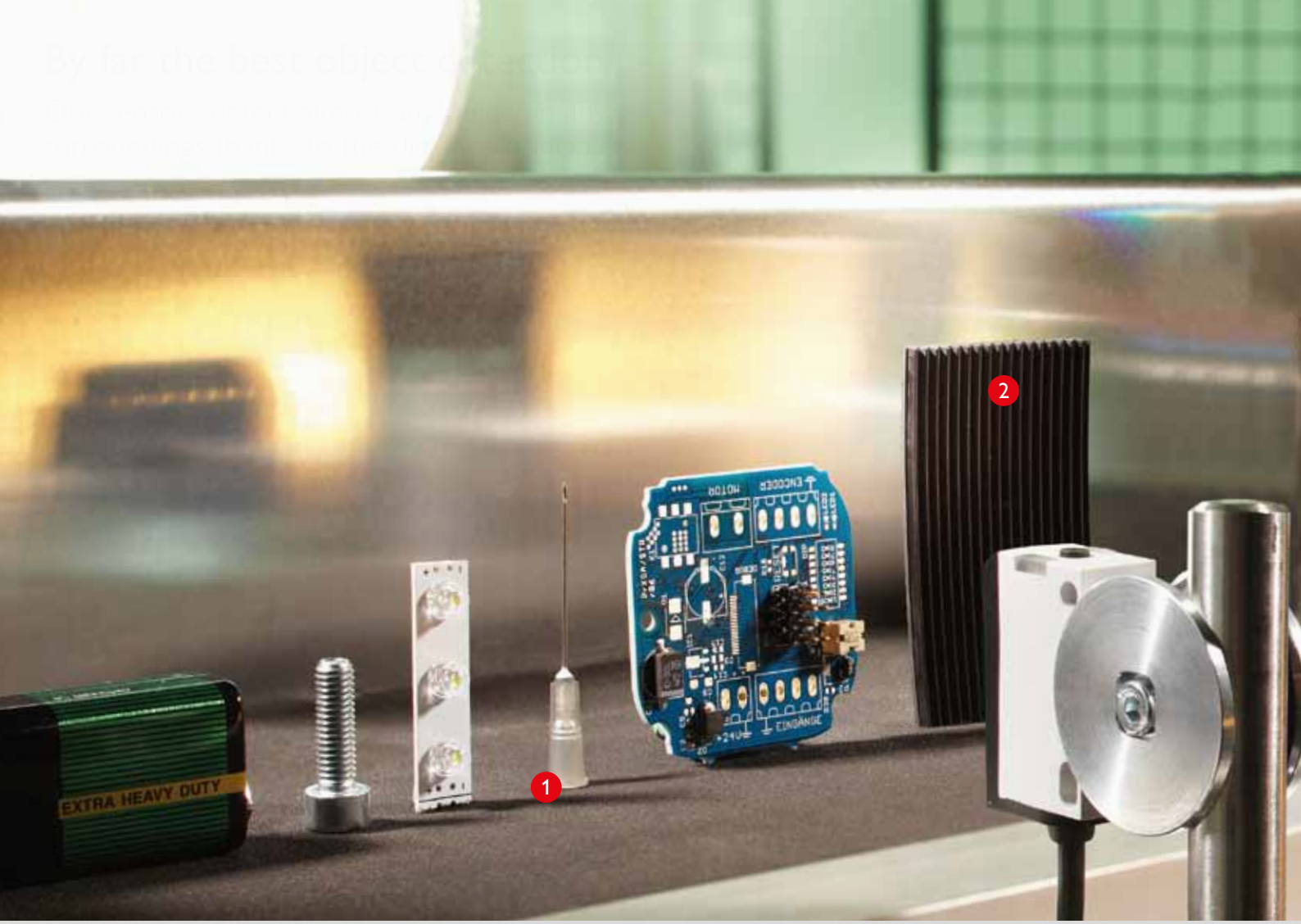
>> Page 414



made in Germany

TYPICAL SENSOPART

- SensoPart develops, produces and sells retroreflective photoelectric sensors with the best background suppression on the market – thanks to SensoPart ASIC technology
- Highly developed laser technology – precise and small laser light spots for extremely accurate small-part detection
- Sensors with the best black/white-shift for reliable switching behaviour regardless of object colour and surface
- Patented sensor designs and mounting systems
- Differing transmission light sources for the most varied of requirements: laser, LED, or infrared light transmitters
- Wide variety of adjustment possibilities: potentiometer, teach-in, external control line or fixed pre-setting
- Cuboid or cylindrical housing options
- Robust workmanship: glass-fibre-reinforced plastic housings (IP 69K / IP 67) or metal housings, stable plug connections made of plastic and metal, as well as metal-reinforced drilled holes for mounting
- Internationally recognised UL-certification
- Ecolab-certification
- Safe operation thanks to Laser Class 1
- Intelligent mounting solutions for easy mounting and adjustment
- IO-Link

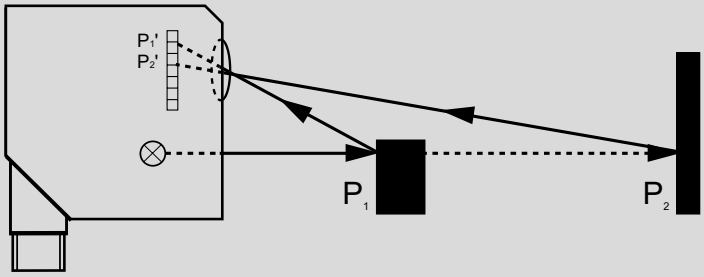


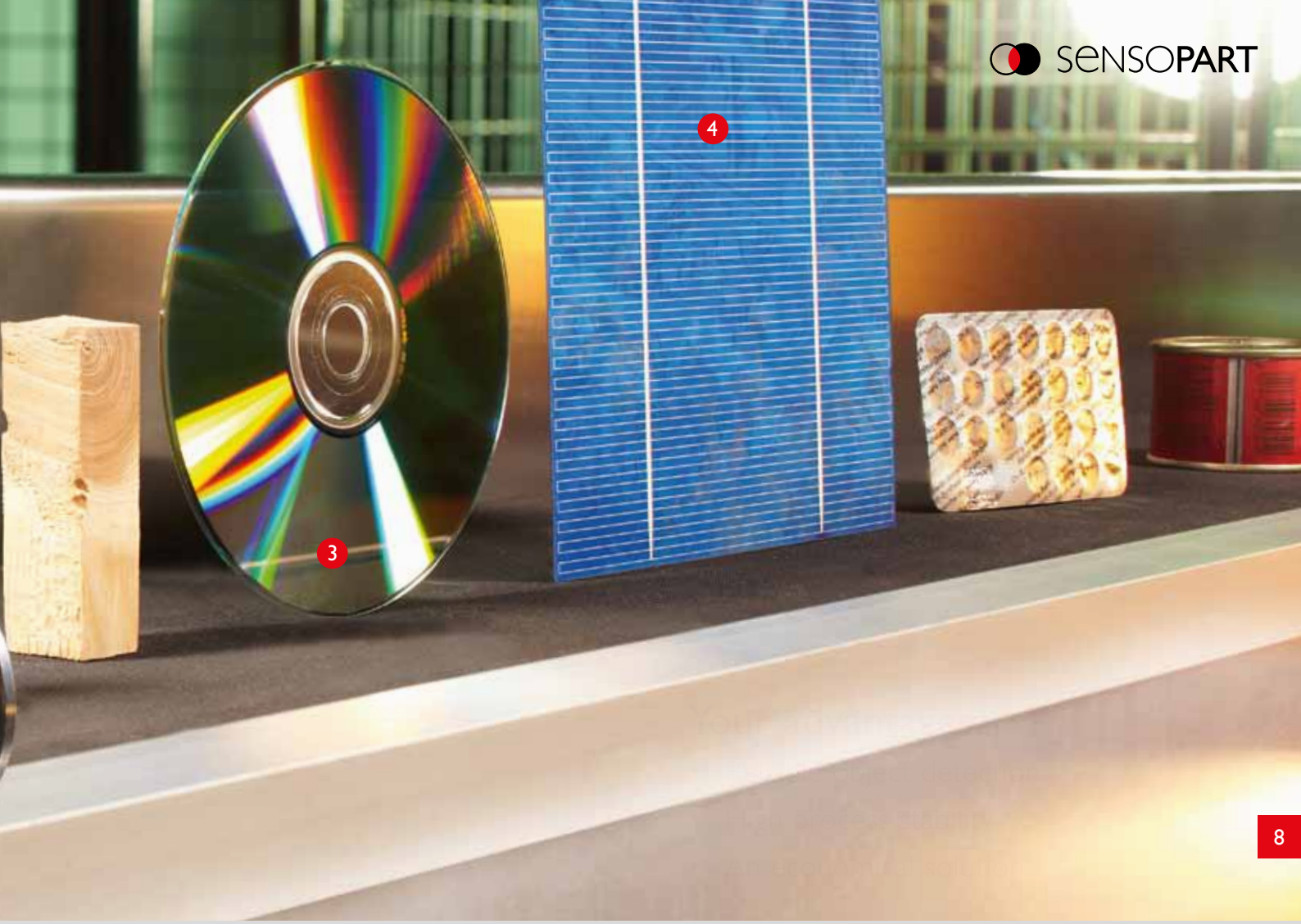
A challenge for every sensor

Polished covering panels on machinery, blinking warning lamps on passing vehicles, moving machine parts, sunlight coming through a window – all these are background effects that can make detection of the actual target object considerably more difficult. So it is a major advantage if one uses sensors that one can rely on: proximity sensors with background suppression from SensoPart. They only see what they are supposed to see: the object itself – regardless of the material, shape and colour – and nothing else!

Object detection by means of distance measurement

SensoPart proximity sensors with background suppression can always differentiate between object and background even in strongly reflective environments. The sensor measures the distance to the object, P_1, and to the possible background, P_2, according to the triangulation process and not the reflectivity of the object. The signal, P_2, coming from the background is then cut out. SensoPart has implemented the detection principle of distance measurement with incomparable precision. This high quality could be achieved because we have developed an optoelectronic, integrated circuit (an ASIC), in which the optical receiver cell and the evaluation electronics are integrated in the smallest of spaces





Technology provides the technical edge

Thanks to its tiny dimensions, the ASIC microchip even fits into the sub-miniature sensors of the F 10 series. Thus SensoPart offers the world's smallest laser sensor with adjustable background suppression.

With the latest generation F 10, F 25, and F 55 series, SensoPart offers photoelectric proximity sensors with the best background suppression currently available.

Your advantage is our priority

Reliable object detection

- Regardless of size, shape, colour, material and surface properties of the target object
- Detection using the distance measurement principle: precise and reliable

High process stability

- Reliable suppression of undesirable reflections and ambient light
- Suppression of moving parts in the background (e.g. conveyor belts, machine parts, persons)
- Reliable detection of the target object even when close to the background

The economical solution

- Usable in all task areas
- Rapid commissioning thanks to simple teach-in
- High machine run-times through quality sensors from SensoPart, made in Germany

1 *Reliable detection of the thinnest tubes in front of metallic backgrounds thanks to focused laser light spot and precise background suppression.*

2 *Detection of black foam rubber pads against reflective backgrounds.*

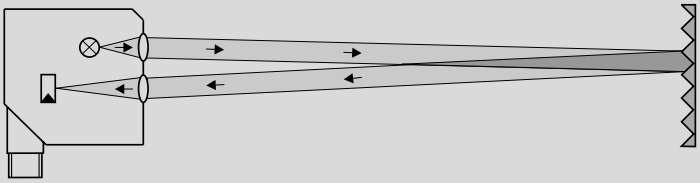
3 *Strongly reflective CDs are reliably detected against metallic backgrounds and with ambient light effects.*

4 *Solar wafers with shimmering blue surfaces against polished metal surfaces with ambient light reflections are reliably detected.*

Photoelectric sensors and proximity sensors

System description

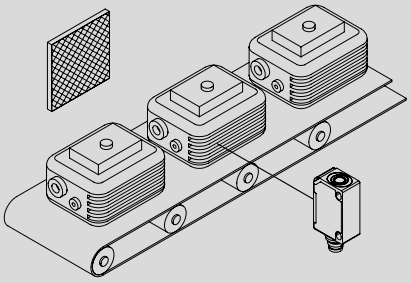
Retroreflective photoelectric sensors



The transmitter and receiver are accommodated in a single housing in retroreflective photoelectric sensors. The light emitted by the transmitter hits a reflector and is reflected. The receiver evaluates the reflected light. The advantage lies in the small size of the reflector. It is also easy to install because it is a passive element and thus requires no connections.

Like through-beam photoelectric sensors, retroreflective photoelectric sensors are often selected according to the desired range. Because the light has to travel the path from the sensor to the reflector twice one also talks of the two-way photoelectric sensor. The light from the transmitter is, explained simply, emitted in a cone shape. This means that the cross-section of the light cone increases with rising range. This is also why a larger reflector is needed at longer ranges than at shorter distances. The range is therefore quoted in the data sheet in relation to the type of reflector.

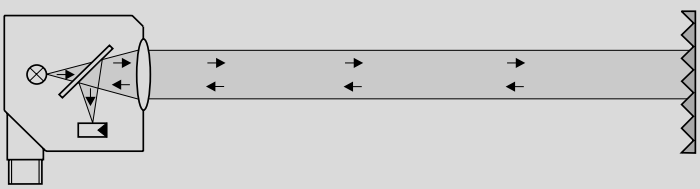
Laser sensors provide an almost parallel light beam. Whereby the light beam is extremely fine and parallel over the entire operating range. This advantage is, above all, used when the smallest of objects have to be detected along the entire operating range. Regardless of the physical principle, all retroreflective photoelectric sensors from SensoPart have a so-called polarisation filter. Polarisation filters are optical filters that let the light beams through only in one direction. Use of a polarisation filter in combination with pyramidical reflectors can also allow the reliable detection of reflective objects by retroreflective photoelectric sensors.



Checking completeness

The presence of the inserted components must be checked before further production steps.

The autocollimation principle

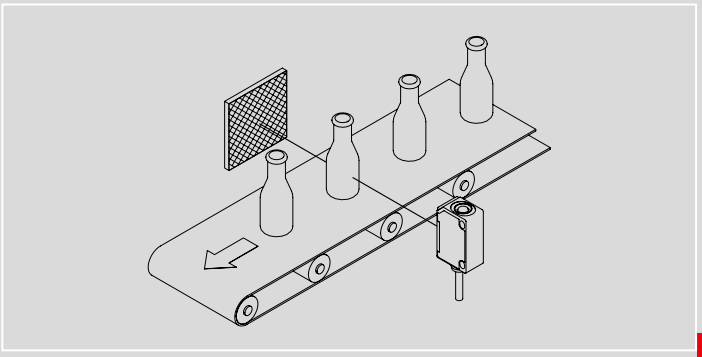


With retroreflective photoelectric sensors one speaks of the autocollimation principle when the light reflected from the reflector travels parallel to itself (i.e. within itself). The light emitted by the sensor hits a reflector and is reflected. The reflected light is then deflected to a receiver by a semi-transparent mirror and evaluated.

The autocollimation principle

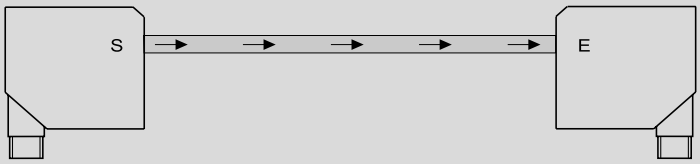
Unlike the double-lens system, a retroreflective photoelectric sensor using the autocollimation principle has a very homogeneous and narrow optical path. Its switching point is largely independent of the entry direction of the target object.

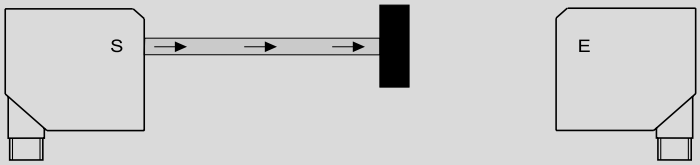
A major advantage of sensors with the autocollimation principle is detection from a range of 0 mm. There is thus, unlike the double-lens system, no blind zone.



Monitoring bottles
The retroreflective photoelectric sensor specially developed for this purpose achieves reliable detection of transparent objects.

Through-beam photoelectric sensors

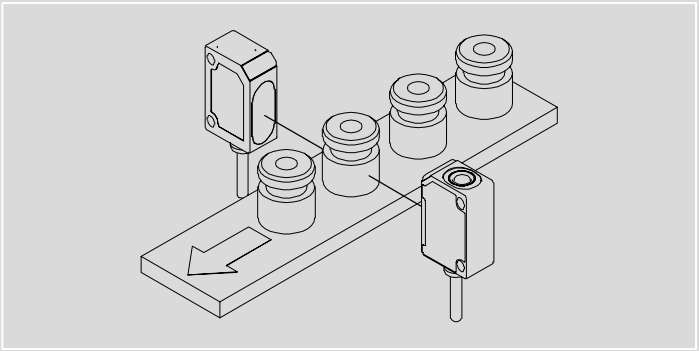




A through-beam photoelectric sensor has a separate transmitter and receiver. This means that light only travels the path between the transmitter and the receiver once. For this reason one speaks of through-beam photoelectric sensors.

The range is of decisive importance when using through-beam photoelectric sensors. Photoelectric sensors are principally selected according to their range. In the case of very critical operating conditions, such as high dust levels or intense steam generation, care must be taken to ensure that the photoelectric sensor is not operated at its limit range. Any clouds of steam would reduce the available range. The range quoted in the data sheet should not be exceeded – in order to ensure functionality in poor operating conditions.

When using deflector mirrors, the total path to be monitored should be less than the range quoted in the data sheet.

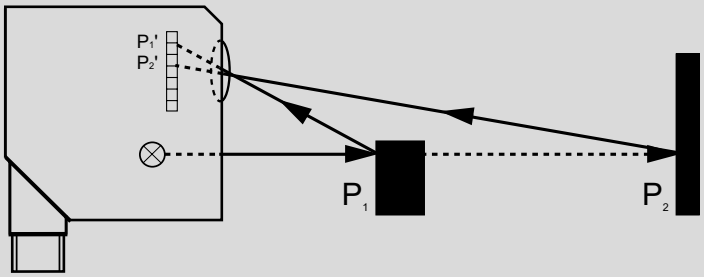


Detecting workpieces in harsh environments
Through-beam photoelectric sensors can also provide dependable detection even under poor conditions – thanks to their high level of reliability.

Photoelectric sensors and proximity sensors

System description

Proximity sensors with background suppression



Advantages

- Independent of object colour and surface
- Reflections in the background are reliably suppressed
- Robust in sunshine
- Scanning distance adjustable according to applications

Differing object colours and surfaces can seriously affect the detection behaviour of a diffuse scanner. As a result of the purely energetic evaluation it is not possible, for example, to detect a black object against a white background. The white background reflects more light than the object itself.

The background suppression process was developed in order to be able to reliably master such tasks. Whereby both the light returning from the background as well as that reflected by the object are evaluated. The light hits two different positions (P_1' & P_2') on the receiver element.

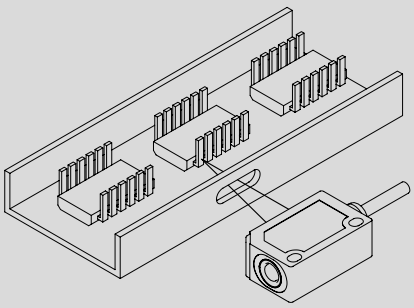
So it is not the returning energy, but the geometrical position of the target object that is evaluated (triangulation). With this process one can, for example, reliably detect a dark object on a light conveyor belt.

There are various ways to physically achieve background suppression. Generally one differentiates between a fixed and an adjustable background suppression.

In the case of fixed background suppression, the transmitter and receiver elements are fixed-mounted. The operating range is defined by the overlapping of the transmitter and receiver angles. Objects outside this operating range cannot be detected.

In the case of adjustable background suppression, the parameters for object detection can be set mechanically via a rotary switch or electronically via teach-in. This provides much more flexible use.

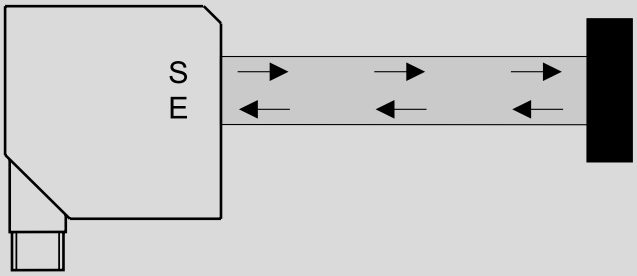
Laser devices are particularly suitable for detecting the smallest of objects. A red-light sensor should be employed for larger objects.



Monitoring pins

The fine light beam of the laser sensor permits the precise detection of even such small objects without any impairment by the background.

Proximity sensors



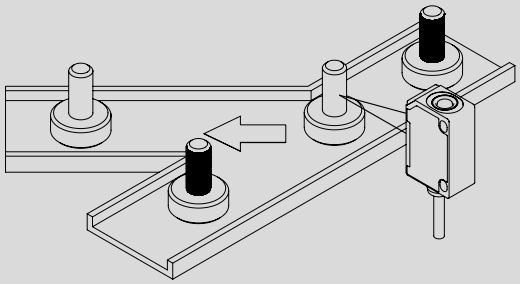
The transmitter and receiver of a proximity sensor are accommodated in a single housing. The light emitted by the transmitter hits the target object, which reflects the light. This returning light is evaluated by the receiver. The advantage of this method is that no reflector is required.

Because the scanner evaluates the reflected light and its energy, the range of conventional scanners (also called energetic or diffuse scanners) is largely dependent on the object's colour and its surface properties. Because black objects strongly absorb light, diffuse scanners can only achieve a very short range here. The surface structure is responsible for the type of reflection. Very rough, heterogeneous surfaces reflect diffusely, i.e. in all directions. Only a small percentage of the reflected light returns to the receiver. The scanning distance in this case is also low.

Proximity sensors based on energetic evaluation are therefore particularly suitable for the detection of larger objects or of objects whose material colour and surface properties remain constant.

One must also ensure that the quantity of light reflected back from the background is not greater than that reflected by the object itself. This effect occurs, for example, when a black object is in front of a white background. In this case detection with an energetic scanner is impossible. The use of a scanner with background suppression is recommended here.

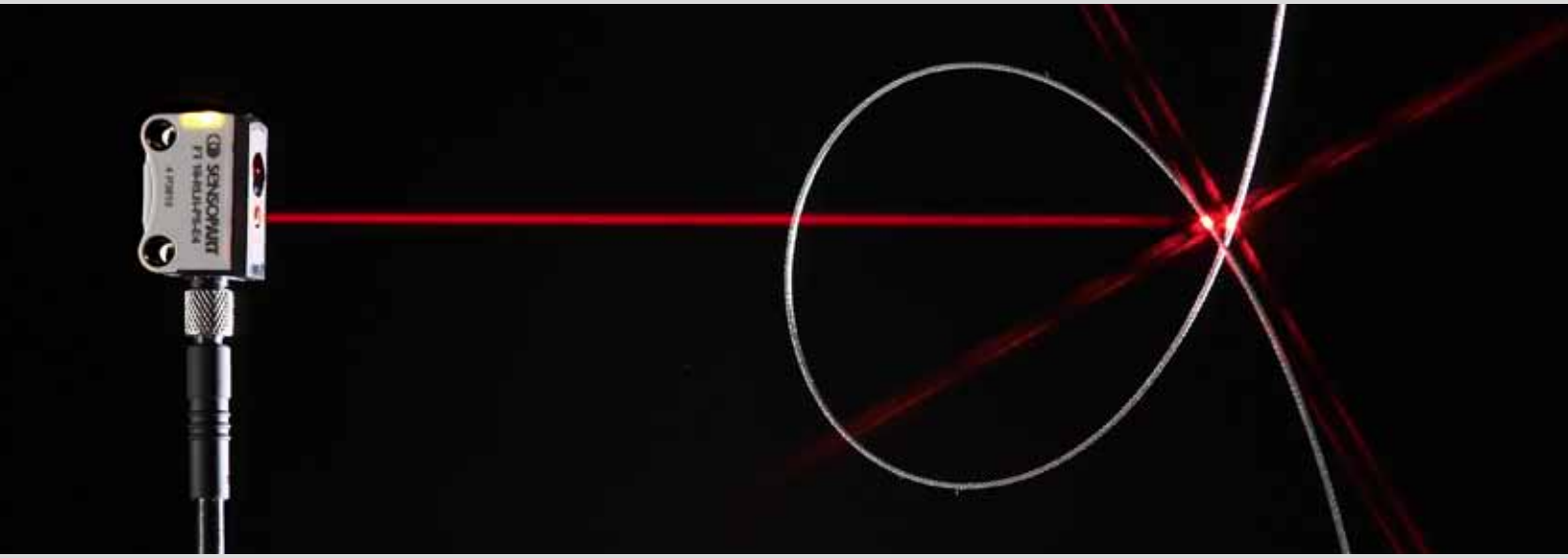
The reliable detection of objects is possible if the background of the object is free, for example when an energetic scanner is mounted transversely over a conveyor belt. The setting of the sensor on the varying object surfaces and backgrounds takes place by means of a mechanical rotary switch on the sensor or via teach-in. The sensor can be set to a maximum scanning distance for a detection task without a background. A precise setting is necessary for applications with a background.



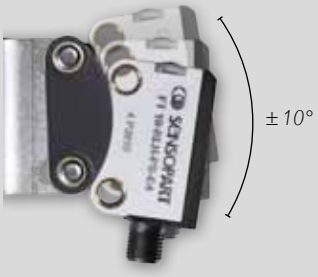
Rejection of uncoated parts
Brightness differences can be reliably detected by a diffuse scanner.

F 10 – family of sub-miniature sensors

Small housings, great performance



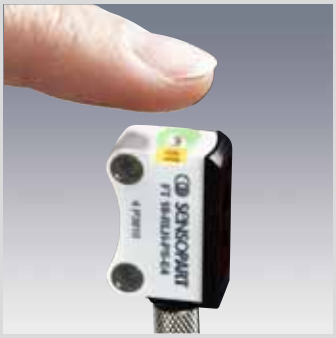
made in Germany



Simple mounting:
Mounting using a dovetail that permits fine retro-adjustment of the sensor is particularly recommended when space is limited.



Special characteristics:
The glass-fibre-reinforced plastic housing with its integrated mounting sleeve, dovetail guide on the back, and laser-marked indelible type code are characteristic of the F 10.



Mini-sensor with maximum ease-of-use:
Simple commissioning with an electronic teach-in button and easily visible status LEDs is by no means typical for housings of this size.

TYPICAL F 10

- Sub-miniature sensor for installation in the smallest of spaces and in moving machine parts
- The world's smallest laser sensor with background suppression, adjustable via teach-in
- Sensors as LED or laser versions
- F 10 Bluelight: specially designed for scanning solar wafers and strongly light-absorbing objects
- User-friendly commissioning via electronic teach-in button or control wire
- Well thought-out mounting accessories for rapid and simple integration

The sensors of the F 10 series, available as LED and laser versions, form one of the most comprehensive series on the market in sub-miniature housings. Their precise background suppression, adjustable via teach-in, makes the sensors unique. The light spot of the F 10 laser sensors also remains so focused that small parts in the millimetre range can still be reliably detected even at long distances – for example, a wire with a diameter of 0.5 mm at a distance of 60 mm. One highlight of the new F 10 LED sensors is the F 10 Bluelight with its blue transmission LED, specially developed for detecting solar wafers and strongly light-absorbing objects using the scanning principle.

The F 10 sensors not only impress through their excellent performance data, but also through their unmistakeable design with special features – unique in this size of housing. The dovetail mounting system considerably simplifies fine adjustment, particularly in difficult installation locations, and the various connection variants allow rapid commissioning and replacement. The mounting holes of the sub-miniature sensors are reinforced with metal eyelets. A small sensor that will give users great pleasure!

F 10 Product Overview					
	Type of light	Adjustment	Scanning distance/range	Special features	Page
Photoelectric proximity sensors with background suppression					
FT 10-RLH	Laser	Teach-in	60 mm	The only scanner with scanning distance adjustment	228
FT 10-RLHR	Laser	Teach-in	60 mm	Broad-beam light spot	230
FT 10-B-RLF	Laser	Fixed focus	15 mm / 30 mm		232
FT 10-RH	LED	Teach-in	70 mm		234
FT 10-RF	LED	Fixed focus	15 mm / 30 mm / 50 mm		236
FT 10-BF Bluelight	LED, blue	Fixed focus	30 mm	Blue transmission LED for strongly light-absorbing objects	238
Retroreflective photoelectric sensors					
FR 10-RL	Laser	Teach-in	2 m	Long range, precise small-part detection	240
FR 10-R	LED	Teach-in	1.6 m	Long range	242
Through-beam photoelectric sensors					
FS/FE 10-RL	Laser	Teach-in	3 m	Sensor pair, very accurate object positioning	244
FS 10-RL/FE 10-RL	Laser	Teach-in	3 m	Transmitter/receiver, very accurate object positioning	246

FT 10-RLH

Laser photoelectric proximity sensor with background suppression



PRODUCT HIGHLIGHTS

- Sub-miniature sensor with laser light and adjustable background suppression
- Precise and reliable switching behaviour, even with varying object surfaces and colours
- Reliable operation even with highly reflective machine parts in the background, thanks to SensoPart ASIC technology
- Particularly suitable for detecting the smallest of parts and for installation in extremely confined spaces

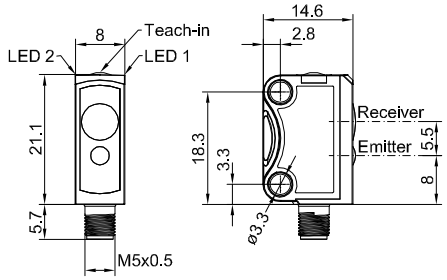
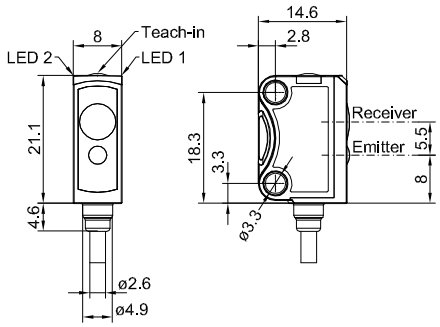
Optical data		Functions	
Scanning distance	6 … 60 mm[1]	Indicator LED, green	Operating voltage indicator
Adjustment range	10 … 60 mm[1]	Indicator LED, yellow	Switching output indicator
Type of light	Laser, red, 655 nm	Scanning distance adjustment	Via Teach-in button and control input
Light spot size (total detection area)	1 x 3 mm[2]	Adjustment possibilities	Button lock via control input
Laser Class (DIN EN 60825-1:2008-5)	1	Default settings	Max. scanning distance and N.O.

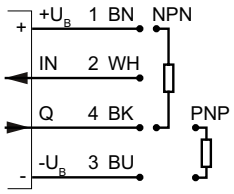
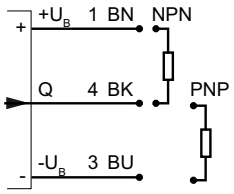
Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]	Dimensions	21.1 x 14.6 x 8 mm[3]
No-load current, I_0	≤ 12 mA	Enclosure rating	IP 67[3]
Output current, Ie	≤ 50 mA	Material, housing	PUR
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
Protection Class	2	Type of connection	See Selection Table
Switching output, Q	PNP / NPN (see Selection Table)	Ambient temperature: operation	-20 … +50 °C
Output function	N.O.	Ambient temperature: storage	-20 … +80 °C
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Weight (plug device)	Ca. 3 g
Response time	500 µs	Weight (cable device)	Ca. 22 g
Control input, IN (only 4-pin design)	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation	Weight (pigtail)	Ca. 10 g

[1] Reference material white, 90 % reflectivity [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 plug

Scanning distance	Switching output	Type of connection	Part number	Article number
6 … 60 mm	PNP	Plug, M5x0.5, 4-pin	FT 10-RLH-PS-E4	600-11130
6 … 60 mm	NPN	Plug, M5x0.5, 4-pin	FT 10-RLH-NS-E4	600-11131
6 … 60 mm	PNP	Cable, 2 m, 4-wire	FT 10-RLH-PS-K4	600-11132
6 … 60 mm	NPN	Cable, 2 m, 4-wire	FT 10-RLH-NS-K4	600-11133
6 … 60 mm	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-RLH-PS-KM4	600-11134
6 … 60 mm	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-RLH-NS-KM4	600-11135
6 … 60 mm	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-RLH-PS-KM3	600-11146
6 … 60 mm	NPN	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-RLH-NS-KM3	600-11147
6 … 60 mm	PNP	Pigtail, 500 mm with M8 plug, 3-pin	FT 10-RLH-PS-KM3-X07	600-11158

Including dovetail clamp mounting MBD F 10 for all types

Plug connection	Cable connection
 153-00894	 153-00895

Connection, 4-pin	Connection, 3-pin
 154-00508	 154-00509

Reference material	Detection range
White (90 %)	6 … 60 mm
Grey (18 %)	7 … 60 mm
Black (6 %)	7 … 60 mm

Accessories	
Connection cables	From Page A-32
Brackets	From Page A-4

FT 10-RLHR

Laser photoelectric proximity sensor with background suppression



PRODUCT HIGHLIGHTS

- Sub-miniature sensor with wide laser light spot and adjustable background suppression
- Precise and reliable switching behaviour, even with varying object surfaces and colours
- Reliable operation even with highly reflective machine parts in the background, thanks to SensoPart ASIC technology
- Particularly suitable for installation in the smallest of spaces
- Simple operation via electronic Teach-in button or control line

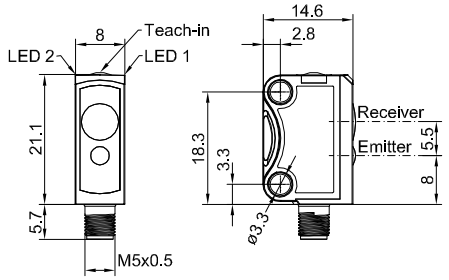
Optical data		Functions	
Scanning distance	6 … 60 mm[1]	Indicator LED, green	Operating voltage indicator
Adjustment range	10 … 60 mm[1]	Indicator LED, yellow	Switching output indicator
Type of light	Laser, red, 655 nm	Scanning distance adjustment	Via Teach-in button and control input
Light spot size	See diagram	Adjustment possibilities	Button lock via control input
Laser Class (DIN EN 60825-1:2008-5)	1	Default settings	Max. scanning distance and N.O.
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC[2]	Dimensions	21.1 x 14.6 x 8 mm[3]
No-load current, I_0	≤ 12 mA	Enclosure rating	IP 67[3]
Output current, Ie	≤ 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	PNP / NPN (see Selection Table)	Ambient temperature: operation	-20 … +50 °C
Output function	N.O.	Ambient temperature: storage	-20 … +80 °C
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Weight (plug device)	Ca. 3 g
Response time	500 µs	Weight (cable device)	Ca. 22 g
Control input, IN (only 4-pin design)	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation	Weight (pigtail)	Ca. 10 g

[1] Reference material white, 90 % reflectivity [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 plug

Scanning distance	Switching output	Type of connection	Part number	Article number
6 … 60 mm	PNP	Plug, M5x0.5, 4-pin	FT 10-RLHR-PS-E4	600-11136
6 … 60 mm	NPN	Plug, M5x0.5, 4-pin	FT 10-RLHR-NS-E4	600-11137
6 … 60 mm	PNP	Cable, 2 m, 4-wire	FT 10-RLHR-PS-K4	600-11138
6 … 60 mm	NPN	Cable, 2 m, 4-wire	FT 10-RLHR-NS-K4	600-11139
6 … 60 mm	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-RLHR-PS-KM4	600-11140
6 … 60 mm	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-RLHR-NS-KM4	600-11141
6 … 60 mm	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-RLHR-PS-KM3	600-11148
6 … 60 mm	NPN	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-RLHR-PS-KM3	600-11149

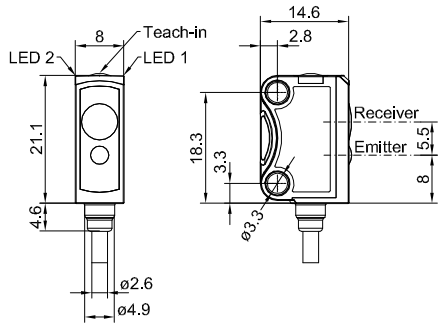
Including dovetail clamp mounting MBD F 10 for all types

Plug connection



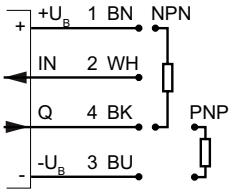
153-00894

Cable connection



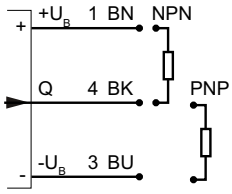
153-00895

Connection, 4-pin



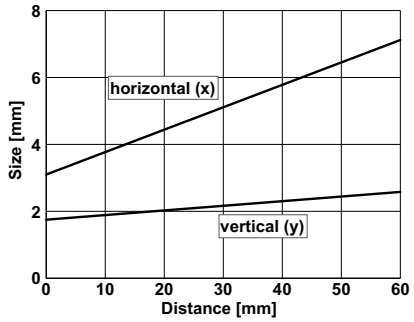
154-00508

Connection, 3-pin



154-00509

Light spot size



155-01331

Reference material	Detection range
White (90 %)	6 … 60 mm
Grey (18 %)	7 … 60 mm
Black (6 %)	7 … 60 mm

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

FT 10-B-RLF

Laser photoelectric proximity sensor with background suppression, fixed focus



PRODUCT HIGHLIGHTS

- Sub-miniature sensor with laser light and precise fixed background suppression
- Reliable switching behaviour even with varying object surfaces and colours
- Particularly suitable for detecting the smallest of parts and for installation in extremely confined spaces
- Tamper-proof sensor design – no misalignment possible
- Robust, glass-fibre-reinforced plastic housings

Optical data		Functions	
Scanning distance	6 … 15 mm[1] 6 … 30 mm[1]	Indicator LED, green	Operating voltage indicator
Type of light	Laser, red, 655 nm	Indicator LED, yellow	Switching output indicator
Light spot size (total detection area)	1 x 3 mm[2]	Adjustment possibilities	N.O. / N.C. via control input
Laser Class (DIN EN 60825-1:2008-5)	1		

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]	Dimensions	21.1 x 14.6 x 8 mm[3]
No-load current, I_0	≤ 12 mA	Enclosure rating	IP 67[3]
Output current, Ie	≤ 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	PNP / NPN (see Selection Table)	Ambient temperature: operation	-20 … +50 °C
Output function	N.O. / N.C.	Ambient temperature: storage	-20 … +80 °C
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Weight (plug device)	Ca. 3 g
Response time	500 µs	Weight (cable device)	Ca. 22 g
Control input, IN (only 4-pin design)	$+U_B$ = N.C. $-U_B$ / Open = N.O.	Weight (pigtail)	Ca. 10 g

[1] Reference material white, 90 % reflectivity [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 plug

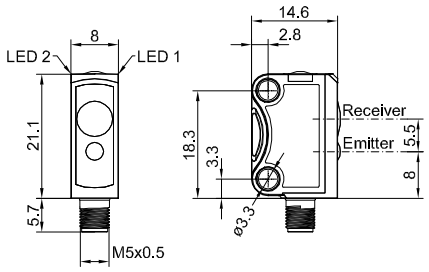
Operating range	Switching output	Type of connection	Part number	Article number
6 … 15 mm	PNP	Plug, M5x0.5, 4-pin	FT 10-B-RLF1-PS-E4	600-11100
6 … 15 mm	NPN	Plug, M5x0.5, 4-pin	FT 10-B-RLF1-NS-E4	600-11101
6 … 30 mm	PNP	Plug, M5x0.5, 4-pin	FT 10-B-RLF2-PS-E4	600-11106
6 … 30 mm	NPN	Plug, M5x0.5, 4-pin	FT 10-B-RLF2-NS-E4	600-11107
6 … 15 mm	PNP	Cable, 2 m, 4-wire	FT 10-B-RLF1-PS-K4	600-11102
6 … 15 mm	NPN	Cable, 2 m, 4-wire	FT 10-B-RLF1-NS-K4	600-11103
6 … 30 mm	PNP	Cable, 2 m, 4-wire	FT 10-B-RLF2-PS-K4	600-11108
6 … 30 mm	NPN	Cable, 2 m, 4-wire	FT 10-B-RLF2-NS-K4	600-11109
6 … 15 mm	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-B-RLF1-PS-KM4	600-11104
6 … 15 mm	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-B-RLF1-NS-KM4	600-11105
6 … 30 mm	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-B-RLF2-PS-KM4	600-11110
6 … 30 mm	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-B-RLF2-NS-KM4	600-11111

Version: 10/2013. Subject to changes; diagrams similar

Operating range	Switching output	Type of connection	Part number	Article number
6 … 15 mm	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-B-RLF1-PS-KM3	600-11142
6 … 15 mm	NPN	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-B-RLF1-NS-KM3	600-11143
6 … 30 mm	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-B-RLF2-PS-KM3	600-11144
6 … 30 mm	NPN	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-B-RLF2-NS-KM3	600-11145

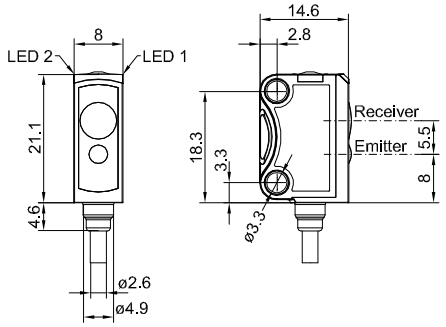
All types include MBD F 10 dovetail clamp mounting.

Plug connection



153-00909

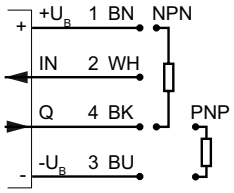
Cable connection



153-00910

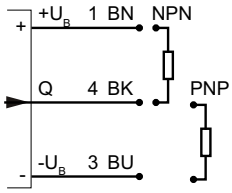
8

Connection, 4-pin



154-00508

Connection, 3-pin



154-00509

Reference material	Detection range
White (90 %)	6 … 15 mm / 30 mm
Grey (18 %)	7 … 15 mm / 30 mm
Black (6 %)	7 … 15 mm / 30 mm

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

FT 10-RH

Photoelectric proxmity sensor with background suppression (available from Q4/2013)



PRODUCT HIGHLIGHTS

- Sub-miniature sensor with precise adjustable background suppression
- Precise and reliable switching behaviour even with varying object surfaces and colours
- Reliable operation even with highly reflective machine parts in the background, thanks to SensoPart ASIC technology
- Static and dynamic teach-in via electronic teach-in button or control line
- IO-Link interface for easy parameterisation and central data logging

Optical data		Functions	
Scanning distance	5 … 70 mm[1]	Indicator LED, green	Operating voltage indicator
Adjustment range	10 … 70 mm[1]	Indicator LED, yellow	Switching output indicator
Used light	LED, red	Scanning distance adjustment	Via Teach-in button and control input[3]
Light spot size	See diagram	Teach-in modes	Mode 1: during running process Mode 2: during standing process
		Adjustment possibilities	N.O./N.C. via Teach-in button and control input[3] Button lock via control input[3]
		Default settings	Max. range and N.O.

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]	Dimensions	21,1 x 14,6 x 8 mm[3]
No-load current, I_0	≤ 30 mA	Enclosure rating	IP 67[4]
Output current, Ie	≤ 50 mA	Material, housing	PUR
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection class	2	Ambient temperature: operation	-20 … +50 °C
Power On Delay	< 300 ms	Ambient temperature: storage	-20 … +80 °C
Switching output, Q	PNP / NPN	Weight (plug device)	approx. 3 g
Output function	N.O. / N.C.	Weight (cable device)	approx. 22 g
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Weight (pigtail)	approx. 10 g
Response time	500 µs		
Control input, IN[3]	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation		

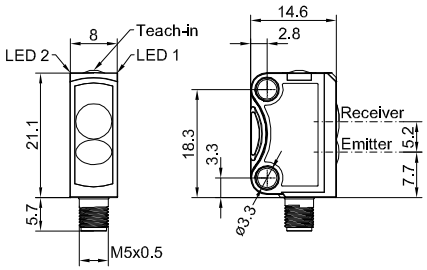
[1] Reference material white, 90 % reflectivity [2] max. 10 % ripple within U_B, ~ 50 Hz / 100 Hz [3] only 4-pin design [4] with connected IP 67 plug

Scanning distance	Switching output	Type of connection	Part number	Article number
5 … 70 mm[1]	PNP	Plug, M5x0.5, 4-pin	FT 10-RH-PS-E4	600-11000
5 … 70 mm[1]	NPN	Plug, M5x0.5, 4-pin	FT 10-RH-NS-E4	600-11004
5 … 70 mm[1]	PNP	Cable, 2 m, 4-wire	FT 10-RH-PS-K4	600-11001
5 … 70 mm[1]	NPN	Cable, 2 m, 4-wire	FT 10-RH-NS-K4	600-11005
5 … 70 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-RH-PS-KM4	600-11002
5 … 70 mm[1]	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-RH-NS-KM4	600-11006
5 … 70 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-RH-PS-KM3	600-11003
5 … 70 mm[1]	NPN	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-RH-NS-KM3	600-11007

Including dovetail clamp mounting MBD F 10 for all types

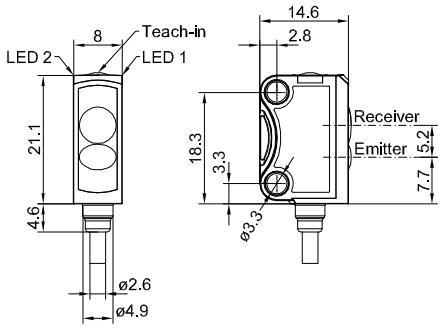
Version: 10/2013. Subject to changes; diagrams similar

Plug connection



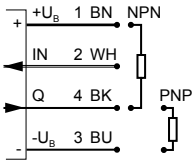
153-01109

Cable connection



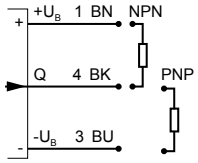
153-01110

Connection, 4-pin



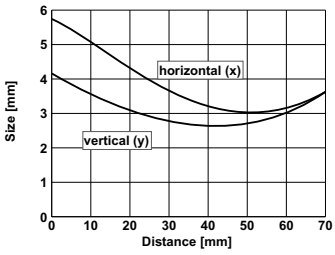
154-00312

Connection, 3-pin



154-00311

Light spot size



155-01770

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FT 10-RF

Photoelectric proxmity sensor with background suppression, fixed focus (available from Q4/2013)



PRODUCT HIGHLIGHTS

- Sub-miniature sensor with precise fixed background suppression
- Economical multi-purpose sensor
- Reliable switching behaviour even with varying object surfaces and colours
- Tamper-proof sensor design – no misalignment possible
- Simple mounting and adjustment through innovative dovetail clamp mounting

Optical data	
Scanning distance	1 … 15 mm[1] 1 … 30 mm[1] 1 … 50 mm[1]
Used light	LED, red
Light spot size	See diagram

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Adjustment possibilities	N.O. / N.C. via control input[3]

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 50 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection class	2
Power On Delay	< 300 ms
Switching output, Q	PNP / NPN (see Selection Table)
Output function	N.O. / N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Control input, IN[3]	$+U_B$ = N.C. $-U_B$ / Open = N.O.

Mechanical data	
Dimensions	21,1 x 14,6 x 8 mm[3]
Enclosure rating	IP 67[4]
Material, housing	PUR
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +50 °C
Ambient temperature: storage	-20 … +80 °C
Weight (cable device)	approx. 22 g
Weight (pigtail)	approx. 10 g

[1] Reference material white, 90 % reflectivity [2] max. 10 % ripple within U_B, ~ 50 Hz / 100 Hz [3] only 4-pin design [4] with connected IP 67 plug

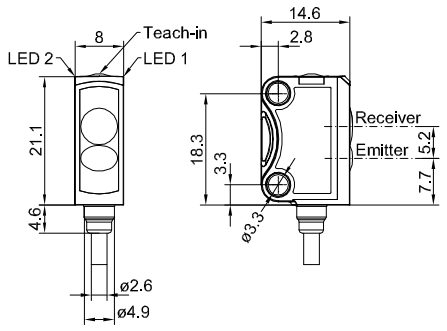
Scanning distance	Switching output	Type of connection	Part number	Article number
1 … 15 mm[1]	PNP	Cable, 2 m, 4-wire	FT 10-RF1-PS-K4	600-11008
1 … 15 mm[1]	NPN	Cable, 2 m, 4-wire	FT 10-RF1-NS-K4	600-11011
1 … 30 mm[1]	PNP	Cable, 2 m, 4-wire	FT 10-RF2-PS-K4	600-11014
1 … 30 mm[1]	NPN	Cable, 2 m, 4-wire	FT 10-RF2-NS-K4	600-11017
1 … 50 mm[1]	PNP	Cable, 2 m, 4-wire	FT 10-RF3-PS-K4	600-11020
1 … 50 mm[1]	NPN	Cable, 2 m, 4-wire	FT 10-RF3-NS-K4	600-11023
1 … 15 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-RF1-PS-KM4	600-11009
1 … 15 mm[1]	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-RF1-NS-KM4	600-11012
1 … 30 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-RF2-PS-KM4	600-11015
1 … 30 mm[1]	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-RF2-NS-KM4	600-11018
1 … 50 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-RF3-PS-KM4	600-11021
1 … 50 mm[1]	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-RF3-NS-KM4	600-11024
1 … 15 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-RF1-PS-KM3	600-11010
1 … 15 mm[1]	NPN	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-RF1-NS-KM3	600-11013

Version: 10/2013. Subject to changes; diagrams similar

Scanning distance	Switching output	Type of connection	Part number	Article number
1 … 30 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-RF2-PS-KM3	600-11016
1 … 30 mm[1]	NPN	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-RF2-NS-KM3	600-11019
1 … 50 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-RF3-PS-KM3	600-11022
1 … 50 mm[1]	NPN	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-RF3-NS-KM3	600-11025

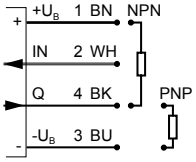
Including dovetail clamp mounting MBD F 10 for all types

Cable connection



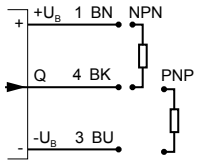
153-01110

Connection, 4-pin



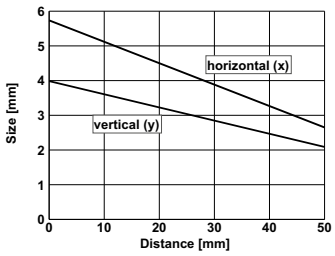
154-00312

Connection, 3-pin



154-00311

Light spot size



155-01769

Reference material

	Detection range		
	FT 10-RF1	FT 10-RF2	FT 10-RF3
white (90 %)	1 … 15 mm	1 … 30 mm	1 … 50 mm
grey (18 %)	3 … 15 mm	4 … 30 mm	1 … 50 mm
black (6 %)	4 … 15 mm	4 … 30 mm	1 … 50 mm

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

FT 10-BF Bluelight

Bluelight photoelectric proxmity sensor with background suppression, fixed focus (available from Q4/2013)



PRODUCT HIGHLIGHTS

- Sub-miniature sensor with blue transmission LED and precise fixed background suppression
- Reliable switching behaviour with strongly light-absorbing objects, e.g. solar wafers
- Reliable operation without reflector - even with critical surfaces
- Tamper-proof sensor design - no misalignment possible
- Simple mounting and adjustment through innovative dovetail clamp mounting

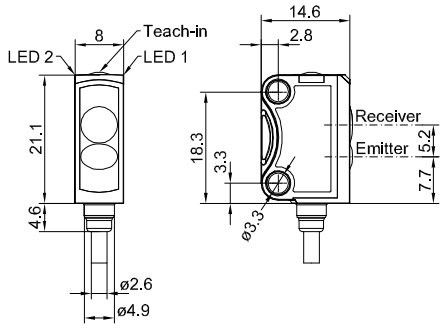
Optical data		Functions	
Scanning distance	1 … 30 mm[1]	Indicator LED, green	Operating voltage indicator
Optimum scanning distance	15 … 20 mm	Indicator LED, yellow	Switching output indicator
Used light	LED, blue	Adjustment possibilities	N.O. / N.C. via control input[3]
Light spot size	See diagram		
Electrical data		**Mechanical data**	
Operating voltage $+U_B$	10 … 30 V DC[2]	Dimensions	21,1 x 14,6 x 8 mm[3]
No-load supply current I_0	≤ 30 mA	Enclosure rating	IP 67[4]
Output current Ie	≤ 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
Power On Delay	< 300 ms	Ambient temperature: operation	-20 … +40 °C
Switching output, Q	PNP / NPN (see Selection Table)	Ambient temperature: storage	-20 … +80 °C
Output function	N.O. / N.C.	Weight (cable device)	approx. 22 g
Switching frequency, f (ti/tp 1:1)	800 Hz	Weight (pigtail)	approx. 10 g
Response time	625 µs		
Control input, IN[3]	$+U_B$ = N.C. $-U_B$ / Open = N.O.		

[1] Reference material white, 90 % reflectivity [2] max. residual ripple 10 %, within U_B, approx. 50 Hz/100 Hz [3] only 4-pin designg [4] with connected IP 67 plug

Scanning distance	Switching output	Type of connection	Part number	Article number
1 … 30 mm[1]	PNP	Cable, 2 m, 4-wire	FT 10-BF2-PS-K4	600-11026
1 … 30 mm[1]	NPN	Cable, 2 m, 4-wire	FT 10-BF2-NS-K4	600-11029
1 … 30 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-BF2-PS-KM4	600-11027
1 … 30 mm[1]	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-BF2-NS-KM4	600-11030
1 … 30 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-BF2-PS-KM3	600-11028
1 … 30 mm[1]	NPN	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-BF2-NS-KM3	600-11031

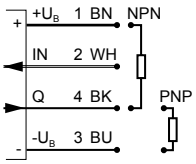
Including dovetail clamp mounting MBD F 10 for all types

Cable connection



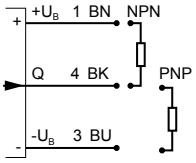
153-01110

Connection, 4-pin



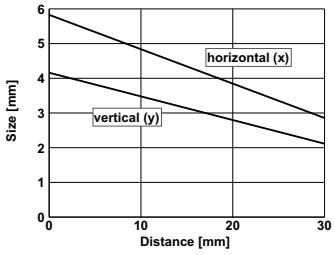
154-00312

Connection, 3-pin



154-00311

Light spot size



155-01768

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FR 10-RL

Laser retroreflective photoelectric sensor



PRODUCT HIGHLIGHTS

- Sub-miniature sensor for installation in the smallest of spaces
- Bright, precise laser light spot for optimum small-part detection and simple alignment
- Suitable for numerous different reflectors
- User-friendly operation via electronic Teach-in button or control line
- Robust, glass-fibre-reinforced plastic housings

Optical data		Functions	
Limit range	0.1 … 2.5 m[1]	Indicator LED, green	Operating voltage indicator
Operating range	0.1 … 2 m[1]	Indicator LED, yellow	Switching output indicator
Type of light	Laser, red, 655 nm	Sensitivity adjustment	Via Teach-in button and control input
Light spot size	See diagram	Teach-in modes	Mode 1: during running process Mode 2: during standing process
Laser Class (DIN EN 60825-1:2008-5)	1	Adjustment possibilities	N.O. / N.C. via Teach-in button and control input Button lock via control input
		Default settings	Max. range and N.O.

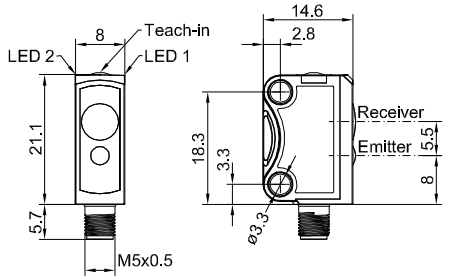
Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]	Dimensions	21.1 x 14.6 x 8 mm[3]
No-load current, I_0	≤ 12 mA	Enclosure rating	IP 67[3]
Output current, Ie	≤ 50 mA	Material, housing	PUR
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-20 … +50 °C
Switching output, Q	PNP / NPN (see Selection Table)	Ambient temperature: storage	-20 … +80 °C
Output function	N.O. / N.C.	Weight (plug device)	Ca. 3 g
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Weight (cable device)	Ca. 22 g
Response time	500 µs	Weight (pigtail)	Ca. 10 g
Control input, IN (only 4-pin design)	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation		

[1] Reference material: R5/L reflector [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 plug

Operating range	Switching output	Type of connection	Part number	Article number
0.1 … 2 m	PNP	Plug, M5x0.5, 4-pin	FR 10-RL-PS-E4	603-31000
0.1 … 2 m	NPN	Plug, M5x0.5, 4-pin	FR 10-RL-NS-E4	603-31001
0.1 … 2 m	PNP	Cable, 2 m, 4-wire	FR 10-RL-PS-K4	603-31002
0.1 … 2 m	NPN	Cable, 2 m, 4-wire	FR 10-RL-NS-K4	603-31003
0.1 … 2 m	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FR 10-RL-PS-KM4	603-31004
0.1 … 2 m	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FR 10-RL-NS-KM4	603-31005
0.1 … 2 m	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FR 10-RL-PS-KM3	603-31006
0.1 … 2 m	NPN	Pigtail, 200 mm with M8 plug, 3-pin	FR 10-RL-NS-KM3	603-31007

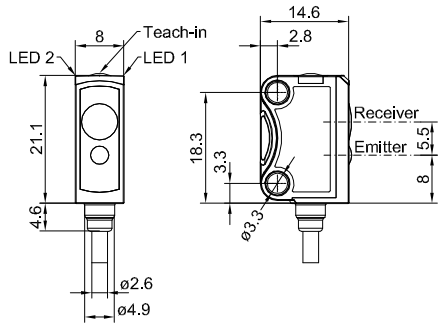
Including dovetail clamp mounting MBD F 10 for all types

Plug connection



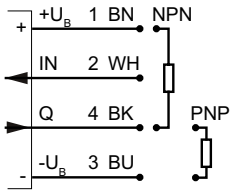
153-00894

Cable connection



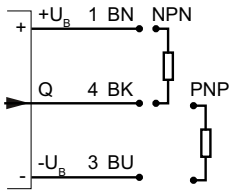
153-00895

Connection, 4-pin



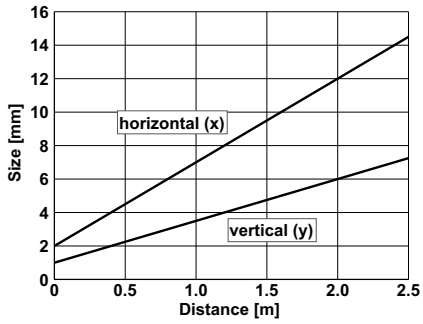
154-00508

Connection, 3-pin



154-00509

Light spot size



155-01289

Reflector / reflective foil *	Operating range
R5/L	0.1 … 2 m
R2-2LB	0.1 … 2 m
RF-50 KL*	0.06 … 0.75 m
RF-100-KL*	0.1 … 2 m

Accessories	
Reflectors	From Page A-16
Connection cables	From Page A-32
Brackets	From Page A-4

FR 10-R

Retroreflective photoelectric sensor (available from Q4/2013)



PRODUCT HIGHLIGHTS

- Sub-miniature sensor for installation in the smallest of spaces
- Despite very small sensor housing very long operating range of 1.6 m
- Fast response time: only 500 µs
- Static and dynamic teach-in via electronic teach-in button or control line
- Simple mounting and adjustment through innovative dovetail clamp mounting

Optical data	
Scanning distance	0.1 … 1.6 m[1]
Used light	LED, red
Light spot size	See diagram

Functions	
Indicator LED green	Operating voltage indicator
Indicator LED yellow	Switching output indicator
Sensitivity adjustment	Via Teach-in button and control input[3]
Teach-in modes	Mode 1: during running process Mode 2: during standing process
Adjustment possibilities	N.O./N.C. via Teach-in button and control input[3] Button lock via control input[3]
Default settings	Max. range and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 50 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection class	2
Power On Delay	< 300 ms
Switching output, Q	PNP / NPN (see Selection Table)
Output function	N.O. / N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Control input, IN[3]	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

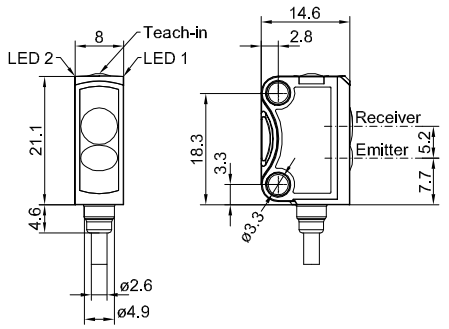
Mechanical data	
Dimensions	21,1 x 14,6 x 8 mm[3]
Enclosure rating	IP 67[4]
Material, housing	PUR
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +50 °C
Ambient temperature: storage	-20 … +80 °C
Weight (cable device)	approx. 22 g
Weight (pigtail)	approx. 10 g

[1] Reference material reflector R5 [2] max. 10 % ripple within U_B, ~ 50 Hz / 100 Hz [3] only 4-pin design [4] with connected IP 67 plug

Operating range	Switching output	Type of connection	Part number	Article number-Nr.
0.1 … 1.6 m[1]	PNP	Cable, 2 m, 4-wire	FR 10-R-PS-K4	603-11001
0.1 … 1.6 m[1]	NPN	Cable, 2 m, 4-wire	FR 10-R-NS-K4	603-11004
0.1 … 1.6 m[1]	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FR 10-R-PS-KM4	603-11002
0.1 … 1.6 m[1]	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FR 10-R-NS-KM4	603-11005
0.1 … 1.6 m[1]	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FR 10-R-PS-KM3	603-11003
0.1 … 1.6 m[1]	NPN	Pigtail, 200 mm with M8 plug, 3-pin	FR 10-R-NS-KM3	603-11006

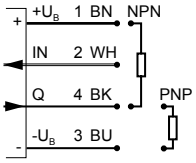
Including dovetail clamp mounting MBD F 10 for all types

Cable connection



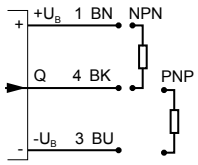
153-01110

Connection, 4-pin



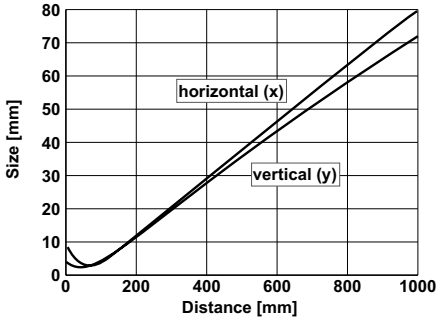
154-00312

Connection, 3-pin



154-00311

Light spot size



155-01767

Reflector / reflective foil *	Operating range
R5	0.1 … 1.6 m
R1	0.1 … 1 m

Accessories	
Connection cables	From Page A-32
Brackets	From Page A-4

FS/FE 10-RL

Laser through-beam photoelectric sensor



PRODUCT HIGHLIGHTS

- Sub-miniature sensor for installation in the smallest of spaces
- Bright, precise laser light spot for optimum small-part detection and simple alignment
- High switching frequency for detection in even the fastest processes
- User-friendly operation via electronic Teach-in button or control line
- Robust, glass-fibre-reinforced plastic housings

Optical data	
Limit range	0 … 5 m
Operating range	0 … 3 m
Type of light	Laser, red, 655 nm
Light spot size	See diagram
Laser Class (DIN EN 60825-1:2008-5)	1

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running process Mode 2: during standing process
Adjustment possibilities (receiver)	N.O. / N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. range and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
No-load current, I_0	≤ 12 mA
Output current, Ie	≤ 50 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Switching output, Q	PNP / NPN (see Selection Table)
Output function	N.O. / N.C.
Switching frequency, f (ti/tp 1:1)	≤ 4000Hz
Response time	125 µs
Control input, IN (receiver) (only 4-pin design)	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation
Control input, Test (transmitter)	$+U_B$ = Test (transmitter off) $-U_B$ / Open = normal operation

Mechanical data	
Dimensions	21.1 x 14.6 x 8 mm[3]
Enclosure rating	IP 67[2]
Material, housing	PUR
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 : +50 °C
Ambient temperature: storage	-20 : +80 °C
Weight (plug device)	Ca. 6 g
Weight (cable device)	Ca. 44 g
Weight (pigtail)	Ca. 20 g

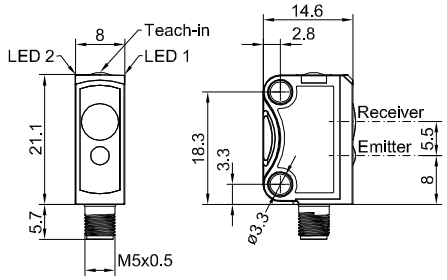
[1] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [2] With connected IP 67 plug

Operating range	Switching output	Type of connection	Part number	Design	Article number
1 … 3 m	PNP	Plug, M5x0.5, 4-pin	FS/FE 10-RL-PS-E4	Sensor pair (transmitter & receiver)	611-51000
1 … 3 m	NPN	Plug, M5x0.5, 4-pin	FS/FE 10-RL-NS-E4	Sensor pair (transmitter & receiver)	611-51001
1 … 3 m	PNP	Cable, 2 m, 4-wire	FS/FE 10-RL-PS-K4	Sensor pair (transmitter & receiver)	611-51002
1 … 3 m	NPN	Cable, 2 m, 4-wire	FS/FE 10-RL-NS-K4	Sensor pair (transmitter & receiver)	611-51003
1 … 3 m	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FS/FE 10-RL-PS-KM4	Sensor pair (transmitter & receiver)	611-51004
1 … 3 m	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FS/FE 10-RL-NS-KM4	Sensor pair (transmitter & receiver)	611-51005
1 … 3 m	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FS/FE 10-RL-PS-KM3	Sensor pair (transmitter & receiver)	611-51006
1 … 3 m	NPN	Pigtail, 200 mm with M8 plug, 3-pin	FS/FE 10-RL-NS-KM3	Sensor pair (transmitter & receiver)	611-51007

Including dovetail clamp mounting MBD F 10 for all types

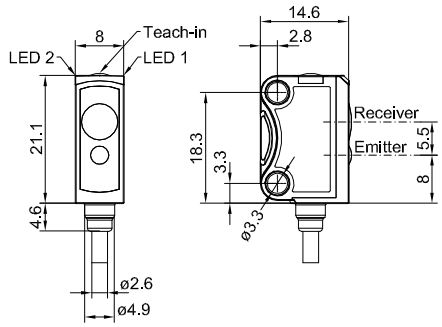
Version: 10/2013. Subject to changes; diagrams similar

Plug connection



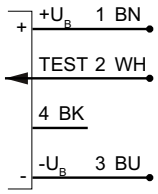
153-00894

Cable connection



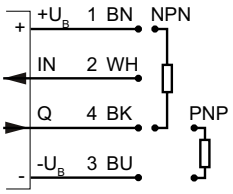
153-00895

Connection, transmitter, 4-pin



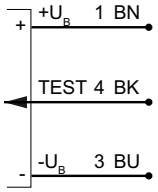
154-00511

Connection, receiver, 4-pin



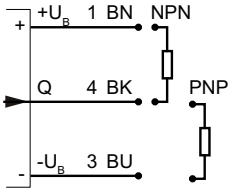
154-00508

Connection, transmitter, 3-pin



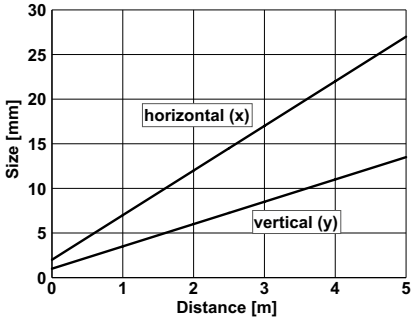
154-00514

Connection, receiver, 3-pin



154-00509

Light spot size



155-01321

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FS 10-RL / FE 10-RL

Laser through-beam photoelectric sensor



PRODUCT HIGHLIGHTS

- Sub-miniature sensor for installation in the smallest of spaces
- Bright, precise laser light spot for optimum small-part detection and simple alignment
- High switching frequency for detection in even the fastest processes
- User-friendly operation via electronic Teach-in button or control line
- Robust, glass-fibre-reinforced plastic housings

Optical data	
Limit range	0 … 5 m
Operating range	0 … 3 m
Type of light	Laser, red, 655 nm
Light spot size	See diagram
Laser Class (DIN EN 60825-1:2008-5)	1

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running process Mode 2: during standing process
Adjustment possibilities (receiver)	N.O. / N.C. via Teach-in button and control input; Button lock via control input
Default settings	Max. range and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
No-load current, I_0	≤ 12 mA
Output current, Ie	≤ 50 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Switching output, Q	PNP / NPN (see Selection Table)
Output function	N.O. / N.C.
Switching frequency, f (ti/tp 1:1)	≤ 4000Hz
Response time	125 µs
Control input, IN (receiver) (only 4-pin design)	$+U_B$ = Teach-in; $-U_B$ = button locked; Open = normal operation
Control input, Test (transmitter)	$+U_B$ = Test (transmitter off) $-U_B$ / Open = normal operation

Mechanical data	
Dimensions	21.1 x 14.6 x 8 mm[3]
Enclosure rating	IP 67[2]
Material, housing	PUR
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +50 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	Ca. 6 g
Weight (cable device)	Ca. 44 g
Weight (pigtail)	Ca. 20 g

[1] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [2] With connected IP 67 plug

Operating range	Switching output	Type of connection	Part number	Design	Article number
1 ... 3 m	PNP	Plug, M5x0.5, 4-pin	FE 10-RL-PS-E4	Receiver	602-71000
1 ... 3 m	–	Plug, M5x0.5, 4-pin	FS 10-RL-E4	Transmitter	601-61000
1 ... 3 m	NPN	Plug, M5x0.5, 4-pin	FE 10-RL-NS-E4	Receiver	602-71001
1 ... 3 m	PNP	Cable, 2 m, 4-wire	FE 10-RL-PS-K4	Receiver	602-71002
1 ... 3 m	–	Cable, 2 m, 4-wire	FS 10-RL-K4	Transmitter	601-61002
1 ... 3 m	NPN	Cable, 2 m, 4-wire	FE 10-RL-NS-K4	Receiver	602-71003
1 ... 3 m	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FE 10-RL-PS-KM4	Receiver	602-71004
1 ... 3 m	–	Pigtail, 200 mm with M8 plug, 4-pin	FS 10-RL-KM4	Transmitter	601-61004
1 ... 3 m	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FE 10-RL-NS-KM4	Receiver	602-71005
1 ... 3 m	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FE 10-RL-PS-KM3	Receiver	602-71006
1 ... 3 m	–	Pigtail, 200 mm with M8 plug, 3-pin	FS 10-RL-KM3	Transmitter	601-61005

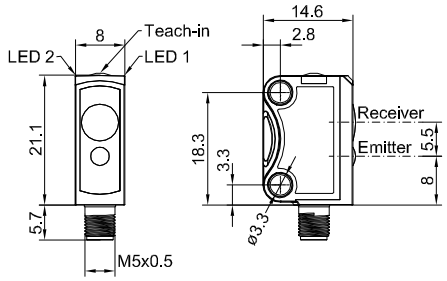
Including dovetail clamp mounting MBD F 10 for all types

Version: 10/2013. Subject to changes; diagrams similar

Operating range	Switching output	Type of connection	Part number	Design	Article number.
1 ... 3 m	NPN	Pigtail, 200 mm with M8 plug, 3-pin	FE 10-RL-NS-KM3	Receiver	602-71008

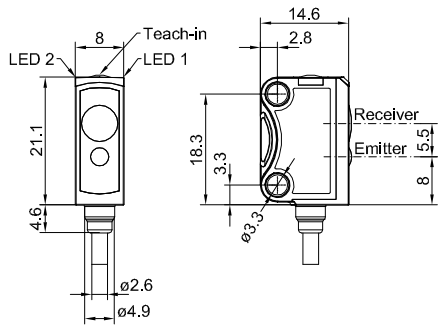
Including dovetail clamp mounting MBD F 10 for all types

Plug connection



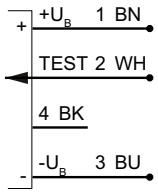
153-00894

Cable connection



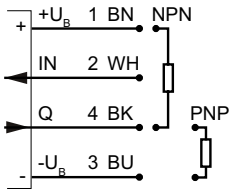
153-00895

Connection, transmitter, 4-pin



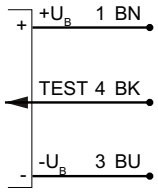
154-00511

Connection, receiver, 4-pin



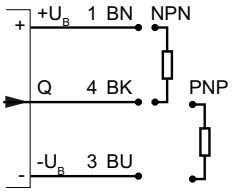
154-00508

Connection, transmitter, 3-pin



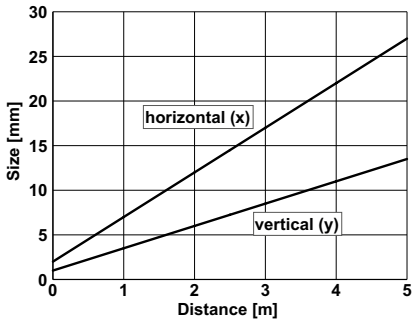
154-00514

Connection, receiver, 3-pin



154-00509

Light spot size



155-01321

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

F 25 – the miniature sensor family of the new generation

The best of its type

made in Germany



The specialist for glass detection:
The FR 25-RGO retroreflective photoelectric sensor has been specially designed for detecting transparent objects. It offers absolutely precise and reproducible switching behaviour thanks to its autocollimation principle and automatic adaptation of the switching threshold (the DELTA function).



(Left) ***Simple mounting, precise adjustment:*** *The robust aluminium dovetail mounting is particularly suitable when installation space is limited. It allows easy and accurate fine adjustment of the sensor after installation.*

Precise background suppression:
Thanks to extremely precise background suppression, the sensors of the F 25 series are completely immune to reflective and glossy machine parts and background effects. Together with switching that is independent of colour and object properties, F 25 sensors are the best on the market.

TYPICAL F 25

- The best black/white-shift on the market in this sensor class
- Precise background suppression thanks to the ASIC microchip
- Auto-detect: automatic adjustment of the switching output (PNP/NPN), unique on the market
- Precise detection of transparent objects of any shape (FR-25-RGO with DELTA function)
- Long ranges with compact miniature housing
- All sensors available in laser and LED designs
- Robust glass-fibre-reinforced plastic housings (IP 69K & IP 67, Ecolab)
- Robust sensor design with metal plug and mounting holes reinforced with metal inserts
- Simplest mounting thanks to dovetail, patented rod mounting and clamping jaws
- Safe operation thanks to Laser Class 1

The right sensor for every application: the new F 25 sensor family from SensoPart offers a very large range of variants – from the LED through-beam photoelectric sensor to the laser photoelectric proximity sensor with adjustable background suppression. Everything that the user could want is in the programme, including special applications: the FR 25-RGO autocollimation sensor detects transparent objects of any shape whilst automatically adapting its switching threshold to the operating conditions (the DELTA function).

Whether small-part detection or checking presence on a conveyor belt, the excellent performance of the F 25 series is always impressive. Thus the FT 25-RHD scanner not only offers very precise background suppression, but also the best black/white-shift in its class.

The robust design with tightly sealed housings (IP 69K & IP 67), the tough metal plugs and mounting holes with metal inserts, the simple dovetail mounting, the easy setup via teach-in or control input, and the many other clever details ensure uncomplicated and efficient operating processes. Not to mention the Auto-detect function that is exclusive to SensoPart: sensors equipped with it autonomously detect whether there is PNP or NPN wiring.

F 25 – Product Overview					
	Type of light	Adjustment	Scanning distance / range	Special features	Page
Photoelectric proximity sensors with background suppression					
FT 25-RLH	Laser	Teach-in	120 mm	Most accurate small-part detection	250
FT 25-RH	LED	Teach-in	200 mm		252
FT 25-RHD	LED	Teach-in	400 mm		254
FT 25-RF1/2	LED	Fixed focus	60 mm / 80 mm		256
Photoelectric proximity sensors					
FT 25-RL	Laser	Teach-in	250 mm	Detection of minimal grey value differences	258
FT 25-R	LED	Teach-in	800 mm		260
Retroreflective photoelectric sensors					
FR 25-RGO	LED	Teach-in	2 m	Autocollimation, detection of transparent objects	262
FR 25-RGO2	LED	Teach-in	2 m	Autocollimation	264
FR 25-RLO	Laser	Teach-in	4 m	Autocollimation, most accurate small-part detection	266
FR 25-RL	Laser	Teach-in	15 m	Most accurate small-part detection	268
FR 25-R	LED	Teach-in	7 m		270
FR 25-RF	LED	Fixed setting	5 m		272
Through-beam photoelectric sensors					
FS/FE 25-RL	Laser	Teach-in	20 m	Most accurate small-part detection	274
FS/FE 25-R	LED	Teach-in	15 m		276
FS/FE 25-RF	LED	Fixed setting	6 m		278

FT 25-RLH

Laser photoelectric proximity sensor with background suppression



PRODUCT HIGHLIGHTS

- Precisely adjustable background suppression
- Reliable switching despite varying object colours and surfaces
- Reliable operation even with highly reflective backgrounds, thanks to SensoPart ASIC technology
- Particularly suitable for the detection of the smallest of objects
- Simple alignment thanks to easily visible light spot
- Robust glass-fibre-reinforced plastic housings

Optical data	
Scanning distance	4 … 120 mm[1]
Adjustment range	10 … 120 mm[1]
Type of light	Laser, red, 650 nm
Light spot size	See diagram
Laser Class (DIN EN 60825-1:2008-5)	1

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Scanning distance adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running process Mode 2: during standing process
Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. scanning distance and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Control input, IN[3]	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

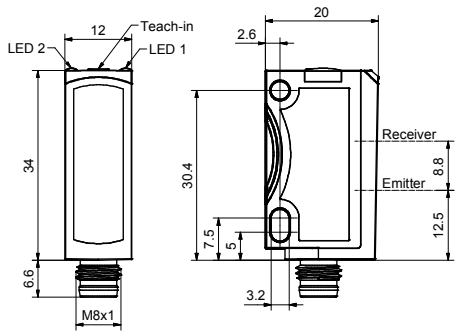
Mechanical data	
Dimensions	34 x 20 x 12 mm[3]
Enclosure rating	IP 69K & IP 67[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C[5]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (metal plug device[6])	10 g
Weight (cable device)	40 g
Weight (pigtail)	20 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: white, 90 % reflectivity [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] Only 4-pin design [4] With connected IP 67 / IP 69K plug [5] UL: -20 °C... + 50 °C
[6] no Ecolab

Scanning distance	Switching output	Type of connection	Part number	Article number
4 … 120 mm	PNP	Plug, M8x1, 3-pin	FT 25-RLH-PS-M3	609-11011
4 … 120 mm	PNP	Plug, M8x1, 4-pin	FT 25-RLH-PS-M4	609-11005
4 … 120 mm	NPN	Plug, M8x1, 4-pin	FT 25-RLH-NS-M4	609-11002
4 … 120 mm	PNP	Metal plug, M8x1, 3-pin	FT 25-RLH-PS-M3M	609-11007
4 … 120 mm	NPN	Metal plug, M8x1, 3-pin	FT 25-RLH-NS-M3M	609-11008
4 … 120 mm	PNP	Metal plug, M8x1, 4-pin	FT 25-RLH-PS-M4M	609-11009
4 … 120 mm	NPN	Metal plug, M8x1, 4-pin	FT 25-RLH-NS-M4M	609-11010
4 … 120 mm	PNP	Cable, 2 m, 4-wire	FT 25-RLH-PS-K4	609-11004
4 … 120 mm	NPN	Cable, 2 m, 4-wire	FT 25-RLH-NS-K4	609-11001
4 … 120 mm	PNP	Pigtail, 150 mm with plug, M12, 4-pin	FT 25-RLH-PS-KL4	609-11006
4 … 120 mm	NPN	Pigtail, 150 mm with plug, M12, 4-pin	FT 25-RLH-NS-KL4	609-11003

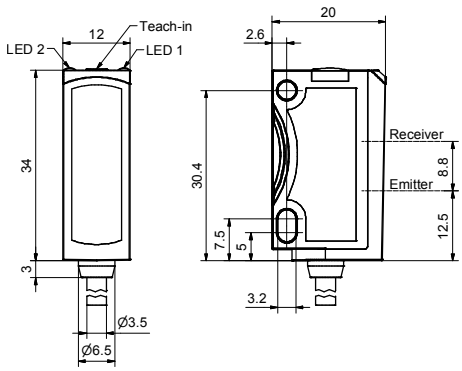
Version: 10/2013. Subject to changes; diagrams similar

Plug connection



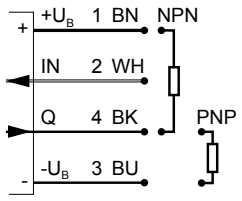
153-00934

Cable connection



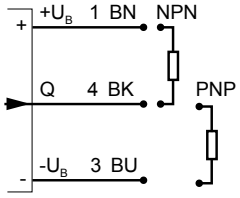
153-00933

Connection, 4-pin



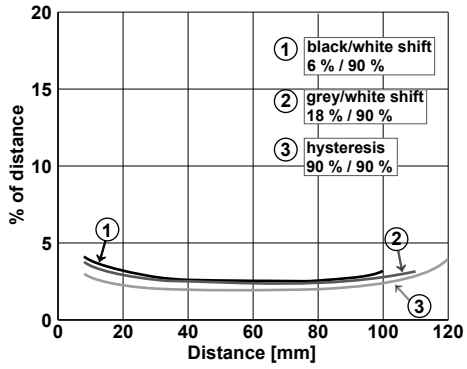
154-00312

Connection, 3-pin



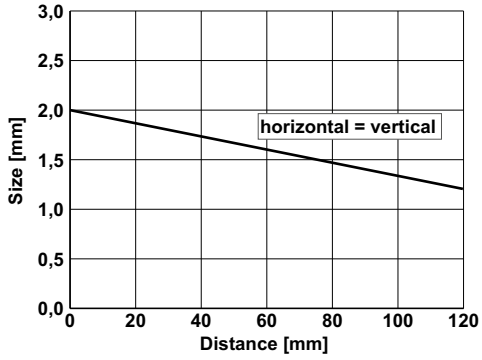
154-00311

Scanning properties



155-01393

Light spot size



155-01394

Reference material	Detection range
White (90 %)	4 … 120 mm
Grey (18 %)	5 … 110 mm
Black (6 %)	8 … 100 mm

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

FT 25-RH

Photoelectric proximity sensor with background suppression



PRODUCT HIGHLIGHTS

- Precisely adjustable background suppression
- Reliable switching despite varying object colours and surfaces
- Reliable operation even with highly reflective backgrounds, thanks to SensoPart ASIC technology
- Simple alignment thanks to easily visible light spot
- Sensor setting via teach-in and control input
- Robust glass-fibre-reinforced plastic housings

Optical data	
Scanning distance	1 … 200 mm[1]
Adjustment range	10 … 200 mm[1]
Type of light	LED, red, 632 nm
Light spot size	See diagram

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Scanning distance adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running process Mode 2: during standing process
Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. scanning distance and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Control input, IN[3]	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

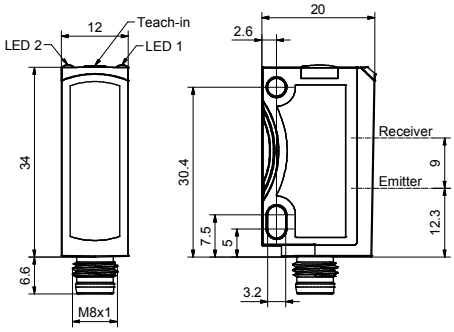
Mechanical data	
Dimensions	34 x 20 x 12 mm[3]
Enclosure rating	IP 69K & IP 67[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C[5]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (metal plug device[6])	10 g
Weight (cable device)	40 g
Weight (pigtail)	20 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: white, 90 % reflectivity [2] Max. 10 % ripple, within UB, ~ 50 Hz / 100 Hz [3] Only 4-pin design [4] With connected IP 67 / IP 69K plug [5] UL: -20 °C... + 50 °C
[6] no Ecolab

Scanning distance	Switching output	Type of connection	Part number	Article number
1 … 200 mm	PNP	Plug, M8x1, 4-pin	FT 25-RH-PS-M4	608-11004
1 … 200 mm	NPN	Plug, M8x1, 4-pin	FT 25-RH-NS-M4	608-11006
1 … 200 mm	PNP	Metal plug, M8x1, 3-pin	FT 25-RH-PS-M3M	608-11012
1 … 200 mm	NPN	Metal plug, M8x1, 3-pin	FT 25-RH-NS-M3M	608-11013
1 … 200 mm	PNP	Metal plug, M8x1, 4-pin	FT 25-RH-PS-M4M	608-11014
1 … 200 mm	NPN	Metal plug, M8x1, 4-pin	FT 25-RH-NS-M4M	608-11015
1 … 200 mm	PNP	Cable, 2 m, 4-wire	FT 25-RH-PS-K4	608-11005
1 … 200 mm	NPN	Cable, 2 m, 4-wire	FT 25-RH-NS-K4	608-11007
1 … 200 mm	PNP	Pigtail, 150 mm with plug, M12, 4-pin	FT 25-RH-PS-KL4	608-11008
1 … 200 mm	NPN	Pigtail, 150 mm with plug, M12, 4-pin	FT 25-RH-NS-KL4	608-11009

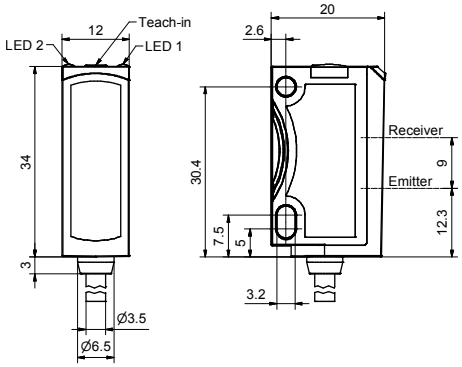
Version: 10/2013. Subject to changes; diagrams similar

Plug connection



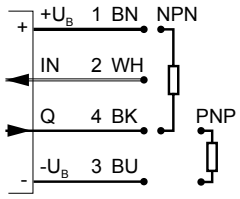
153-00839

Cable connection



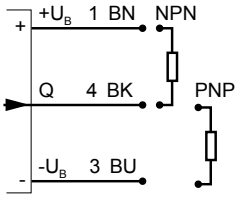
153-00838

Connection, 4-pin



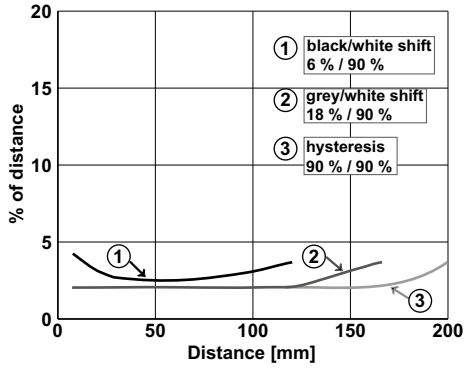
154-00312

Connection, 3-pin



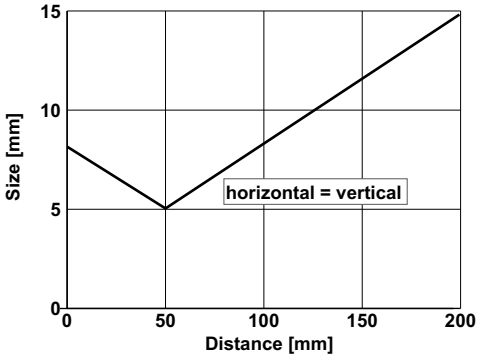
154-00311

Scanning properties



155-01380

Light spot size



155-01379

Reference material	Detection range
White (90 %)	1 … 200 mm
Grey (18 %)	2 … 160 mm
Black (6 %)	4 … 120 mm

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

FT 25-RHD

Photoelectric proximity sensor with background suppression



PRODUCT HIGHLIGHTS

- Auto-detect photoelectric proximity sensor with real PNP and real NPN functions
- Precisely adjustable background suppression
- Long scanning distance of 400 mm with small and compact housings
- Reliable operation even with highly reflective backgrounds, thanks to SensoPart ASIC technology
- Simple alignment thanks to easily visible light spot
- Robust glass-fibre-reinforced plastic housings

Optical data	
Scanning distance	3 … 400 mm[1]
Adjustment range	30 … 400 mm[1]
Type of light	LED, red, 632 nm
Light spot size	See diagram

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Scanning distance adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running process Mode 2: during standing process
Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input Auto-detect / NPN/PNP via Teach-in button and control input (only Auto-detect variants)
Default settings	Max. scanning distance and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN / Auto-detect (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Control input, IN	$+U_B$ = teach-in, $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions	34 x 20 x 12 mm[3]
Enclosure rating	IP 69K & IP 67[3]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C[4]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (metal plug device[5])	10 g
Weight (cable device)	40 g
Weight (pigtail)	20 g
Vibration and impact resistance	EN 60947-5-2

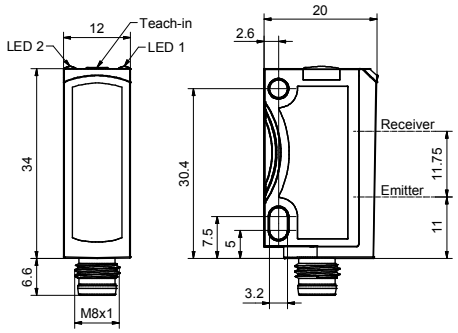
[1] Reference material: white, 90 % reflectivity [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 / IP 69K plug [4] UL: -20 °C... + 50 °C [5] no Ecolab

Scanning distance	Switching output	Type of connection	Part number	Article number
3 … 400 mm	PNP	Plug, M8x1, 4-pin	FT 25-RHD-PS-M4	608-11000
3 … 400 mm	NPN	Plug, M8x1, 4-pin	FT 25-RHD-NS-M4	608-11002
3 … 400 mm	PNP	Metal plug, M8x1, 4-pin	FT 25-RHD-PS-M4M	608-11016
3 … 400 mm	NPN	Metal plug, M8x1, 4-pin	FT 25-RHD-NS-M4M	608-11017
3 … 400 mm	PNP	Cable, 2 m, 4-wire	FT 25-RHD-PS-K4	608-11001
3 … 400 mm	NPN	Cable, 2 m, 4-wire	FT 25-RHD-NS-K4	608-11003
3 … 400 mm	PNP	Pigtail, 150 mm with plug, M12, 4-pin	FT 25-RHD-PS-KL4	608-11010

Version: 10/2013. Subject to changes; diagrams similar

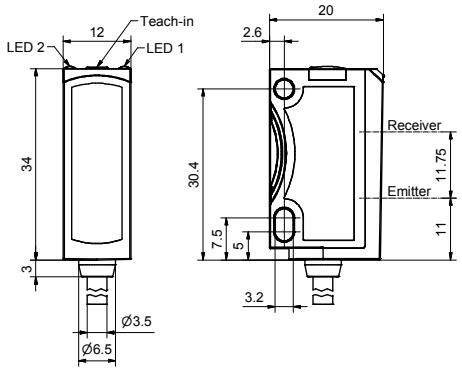
Scanning distance	Switching output	Type of connection	Part number	Article number
3 … 400 mm	NPN	Pigtail, 150 mm with plug, M12, 4-pin	FT 25-RHD-NS-KL4	608-11011
3 … 400 mm	Auto-detect	Metal plug, M8x1, 4-pin	FT 25-RHD-PNS-M4M	608-11019

Plug connection



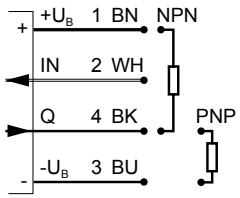
153-00837

Cable connection



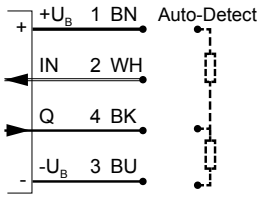
153-00836

Connection, 4-pin



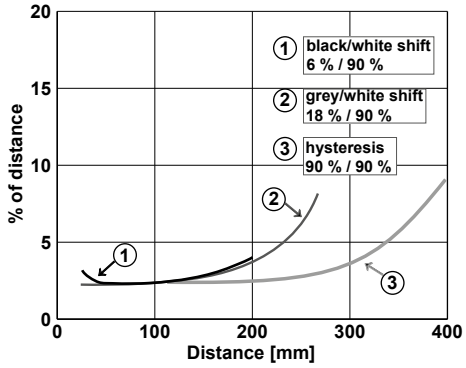
154-00312

Connection, Auto-detect



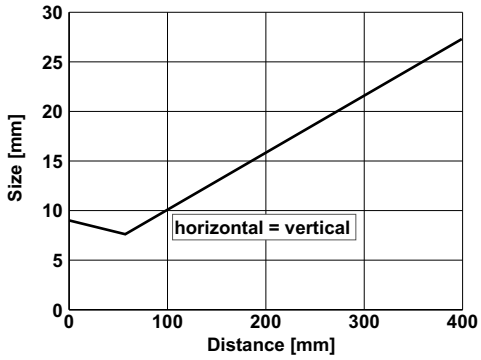
154-00313

Scanning properties



155-01382

Light spot size



155-01381

Reference material	Detection range	Accessories	
White (90 %)	3 … 400 mm	Connection cables	From Page A-32
Grey (18 %)	6 … 260 mm	Brackets	From Page A-4
Black (6 %)	12 … 200 mm		

FT 25-RF

Photoelectric proximity sensor with background suppression, fixed focus



PRODUCT HIGHLIGHTS

- Precise fixed background suppression
- Economical solution for numerous applications
- Tamper-proof sensor design – no misalignment possible
- Simple alignment thanks to easily visible light spot
- Robust glass-fibre-reinforced plastic housings

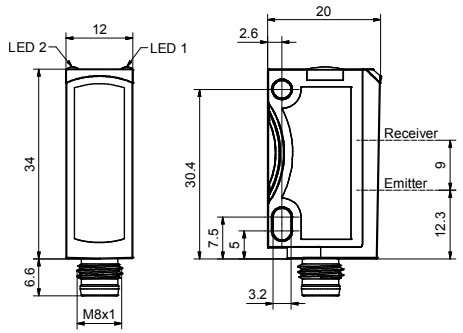
Optical data		Functions	
Scanning distance	1 … 60 mm[1] / 1 … 80 mm[1]	Indicator LED, green	Operating voltage indicator
Type of light	LED, red, 632 nm	Indicator LED, yellow	Switching output indicator
Light spot size	See diagram	Adjustment possibilities	N.O./N.C. via control input
Hysteresis	~ 5%[2]		

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[3]	Dimensions	34 x 20 x 12 mm[3]
No-load current, I_0	≤ 30 mA	Enclosure rating	IP 69K & IP 67[4]
Output current, Ie	≤ 100 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-20 … +60 °C[5]
Power On Delay	< 300ms	Ambient temperature: storage	-20 … +80 °C
Switching output, Q	PNP/NPN (see Selection Table)	Weight (plug device)	10 g
Output function	N.O./N.C.	Weight (cable device)	40 g
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Vibration and impact resistance	EN 60947-5-2
Response time	500 µs		
Control input, IN	$+U_B$ = N.C. $-U_B$ / Open = N.O.		

[1] Reference material: white, 90 % reflectivity [2] Based on scanning distance [3] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [4] With connected IP 67 / IP 69K plug
[5] UL: -20 °C... + 50 °C

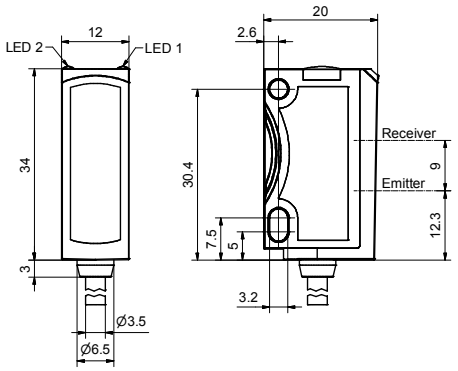
Scanning distance	Switching output	Type of connection	Part number	Article number
1 … 60 mm	PNP	Plug, M8x1, 4-pin	FT 25-RF1-PS-M4	608-11020
1 … 60 mm	PNP	Cable, 2 m, 4-wire	FT 25-RF1-PS-K4	608-11021
1 … 80 mm	PNP	Plug, M8x1, 4-pin	FT 25-RF2-PS-M4	608-11022
1 … 80 mm	PNP	Cable, 2 m, 4-wire	FT 25-RF2-PS-K4	608-11023
1 … 80 mm	NPN	Cable, 2 m, 4-wire	FT 25-RF2-NS-K4	608-11024

Plug connection



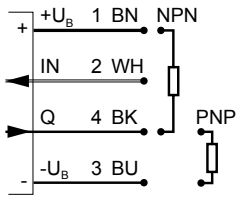
153-00833

Cable connection



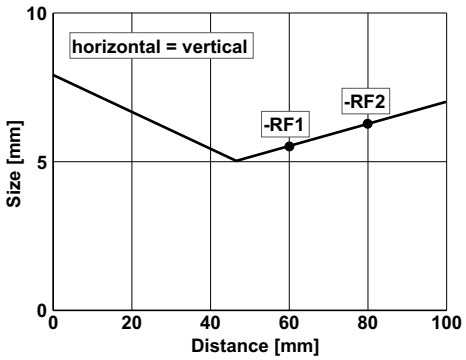
153-00832

Connection, 4-pin



154-00312

Light spot size



155-01395

Reference material	Detection range
White (90 %)	1 … 60 mm / 80 mm
Grey (18 %)	2 … 60 mm / 80 mm
Black (6 %)	4 … 60 mm / 80 mm

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FT 25-RL

Diffuse laser photoelectric proximity switch



PRODUCT HIGHLIGHTS

- Differentiates between even the slightest of grey value differences
- Sensor settings via teach-in and control input
- Durable laser printing
- Very small, easily visible laser light spot
- Wide range of variants

Optical data	
Scanning distance	1 … 250 mm[1]
Adjustment range	25 … 250 mm[1]
Type of light	Laser, red, 650 nm
Light spot size	See diagram
Laser Class (DIN EN 60825-1:2008-5)	1
Hysteresis	≤ 10%[2]

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running process Mode 2: during standing process
Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. scanning distance and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[3]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1500 Hz
Response time	333 µs
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

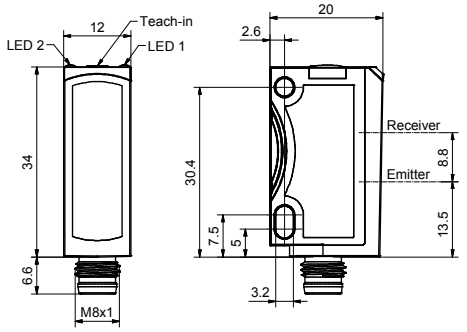
Mechanical data	
Dimensions	34 x 20 x 12 mm[3]
Enclosure rating	IP 69K & IP 67[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C[5]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (metal plug device[6])	10 g
Weight (cable device)	40 g
Weight (pigtail)	20 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: white, 90 % reflectivity [2] Up to scanning distance of 150 mm [3] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [4] With connected IP 67 / IP 69K plug
[5] UL: -20 °C... + 50 °C [6] no Ecolab

Scanning distance	Switching output	Type of connection	Part number	Article number
1 … 250 mm	PNP	Metal plug, M8x1, 4-pin	FT 25-RL-PS-M4M	609-21013
1 … 250 mm	NPN	Metal plug, M8x1, 4-pin	FT 25-RL-NS-M4M	609-21014
1 … 250 mm	PNP	Cable, 2 m, 4-wire	FT 25-RL-PS-K4	609-21010
1 … 250 mm	NPN	Cable, 2 m, 4-wire	FT 25-RL-NS-K4	609-21008
1 … 250 mm	PNP	Pigtail, 150 mm with plug, M12, 4-pin	FT 25-RL-PS-KL4	609-21012
1 … 250 mm	NPN	Pigtail, 150 mm with plug, M12, 4-pin	FT 25-RL-NS-KL4	609-21009

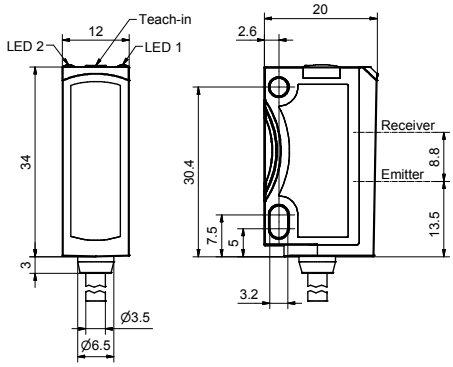
Version: 10/2013. Subject to changes; diagrams similar

Plug connection



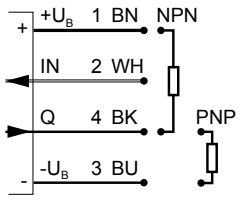
153-00937

Cable connection



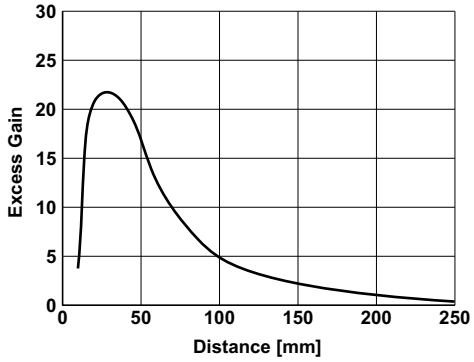
153-00936

Connection, 4-pin



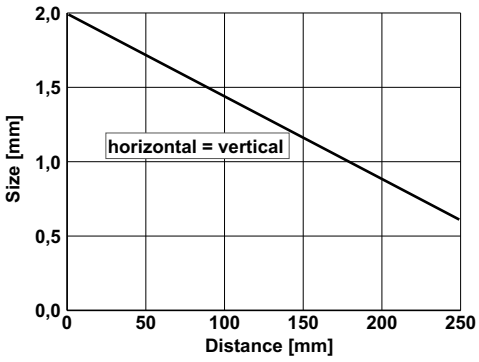
154-00312

Functional reserves



155-01384

Light spot size



155-01383

Reference material	Detection range
White (90 %)	1 … 250 mm
Grey (18 %)	6 … 100 mm
Black (6 %)	20 … 60 mm

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

FT 25-R

Diffuse photoelectric proximity sensor



PRODUCT HIGHLIGHTS

- Differentiates between even the slightest of grey value differences
- Sensor settings via teach-in and control input
- Simple alignment thanks to easily visible light spot
- Robust glass-fibre-reinforced plastic housings
- Durable laser printing

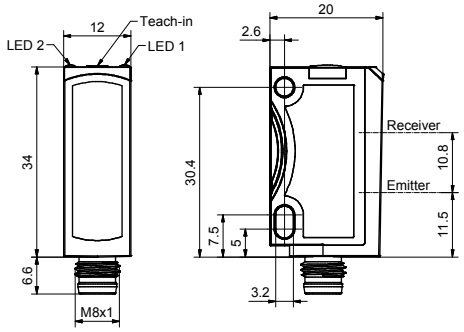
Optical data		Functions	
Scanning distance	0 … 800 mm[1]	Indicator LED, green	Operating voltage indicator
Adjustment range	20 … 800 mm[1]	Indicator LED, yellow	Switching output indicator
Type of light	LED, red, 632 nm	Sensitivity adjustment	Via Teach-in button and control input
Light spot size	See diagram	Teach-in modes	Mode 1: during running process Mode 2: during standing process
		Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input
		Default settings	Max. scanning distance and N.O.
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC[2]	Dimensions	34 x 20 x 12 mm[3]
No-load current, I_0	≤ 30 mA	Enclosure rating	IP 69K & IP 67[3]
Output current, Ie	≤ 100 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-20 … +60 °C[4]
Power On Delay	< 300 ms	Ambient temperature: storage	-20 … +80 °C
Switching output, Q	PNP/NPN (see Selection Table)	Weight (plug device)	10 g
Output function	N.O./N.C.	Weight (metal plug device[5])	10 g
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Weight (cable device)	40 g
Response time	500 µs	Weight (pigtail)	20 g
Control input, IN	+ U_B = teach-in - U_B = button locked Open = normal operation	Vibration and impact resistance	EN 60947-5-2

[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 [4] UL: -20 °C... + 50 °C [5] no Ecolab

Scanning distance	Switching output	Type of connection	Part number	Article number
0 … 800 mm	PNP	Plug, M8x1, 4-pin	FT 25-R-PS-M4	607-21000
0 … 800 mm	NPN	Plug, M8x1, 4-pin	FT 25-R-NS-M4	607-21002
0 … 800 mm	PNP	Metal plug, M8x1, 4-pin	FT 25-R-PS-M4M	607-21006
0 … 800 mm	NPN	Metal plug, M8x1, 4-pin	FT 25-R-NS-M4M	607-21007
0 … 800 mm	PNP	Cable, 2 m, 4-wire	FT 25-R-PS-K4	607-21001
0 … 800 mm	NPN	Cable, 2 m, 4-wire	FT 25-R-NS-K4	607-21003
0 … 800 mm	PNP	Pigtail, 150 mm with plug, M12, 4-pin	FT 25-R-PS-KL4	607-21004
0 … 800 mm	NPN	Pigtail, 150 mm with plug, M12, 4-pin	FT 25-R-NS-KL4	607-21005

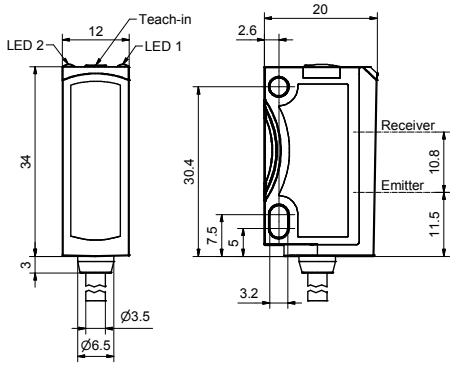
Version: 10/2013. Subject to changes; diagrams similar

Plug connection



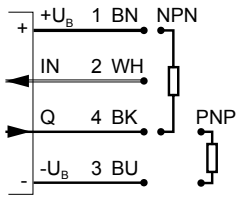
153-00835

Cable connection



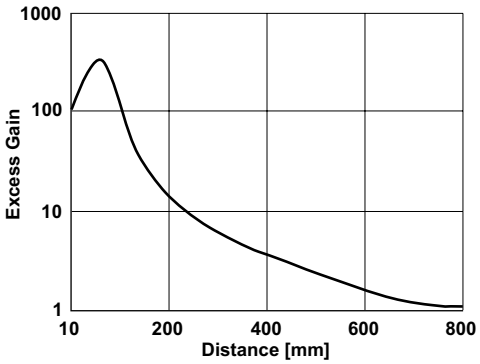
153-00834

Connection, 4-pin



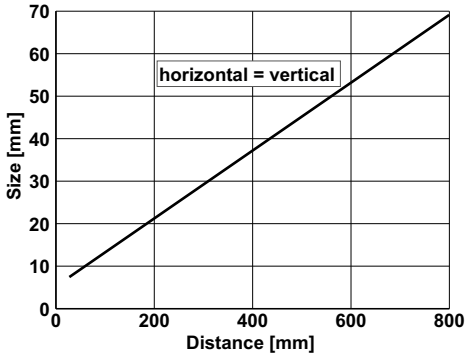
154-00312

Functional reserves



155-01367

Light spot size



155-01368

Reference material	Detection range
White (90 %)	0 … 800 mm
Grey (18 %)	1 … 450 mm
Black (6 %)	3 … 250 mm

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

FR 25-RGO

Retroreflective photoelectric sensor for detection of transparent objects



PRODUCT HIGHLIGHTS

- Reliable detection of transparent objects regardless of shape
- Autocollimation principle: reliable and precise detection from a range of 0 mm
- DELTA function (Dynamic Evaluation of Light for Threshold Adaption): dynamic sensor adaptation to changing environmental conditions – dust and dirt have no effect
- Precise and easily visible light spot with sharp contour for easy alignment of the sensor

Optical data	
Operating range	0 … 2 m[1]
Type of light	LED, red, 632 nm
Polarising filter	Yes

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running process Mode 2: during standing process
Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. range and N.O.

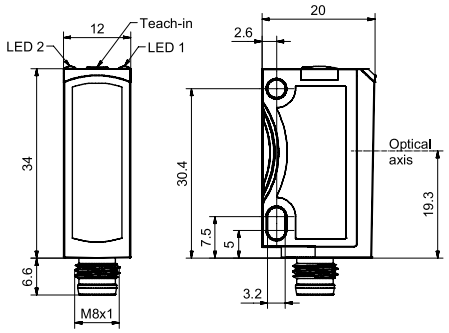
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Control input, IN	+ U_B = teach-in - U_B = button locked Open = normal operation

Mechanical data	
Dimensions	34 x 20 x 12 mm[3]
Enclosure rating	IP 69K & IP 67[3]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C[4]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (metal plug device[5])	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: R5/L reflector [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 / IP 69K plug [4] UL: -20 °C... + 50 °C [5] no Ecolab

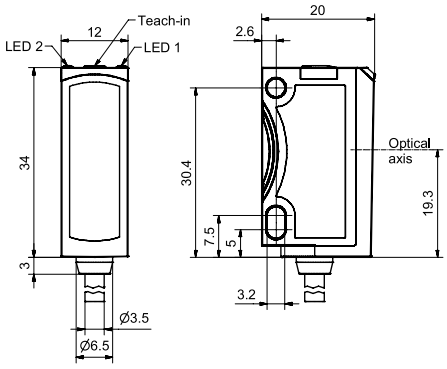
Operating range	Switching output	Type of connection	Part number	Article number
0 … 2 m	PNP	Plug, M8x1, 4-pin	FR 25-RGO-PS-M4	606-11020
0 … 2 m	NPN	Plug, M8x1, 4-pin	FR 25-RGO-NS-M4	606-11021
0 … 2 m	PNP	Metal plug, M8x1, 4-pin	FR 25-RGO-PS-M4M	606-11016
0 … 2 m	NPN	Metal plug, M8x1, 4-pin	FR 25-RGO-NS-M4M	606-11017
0 … 2 m	PNP	Cable, 2 m, 4-wire	FR 25-RGO-PS-K4	606-11018
0 … 2 m	NPN	Cable, 2 m, 4-wire	FR 25-RGO-NS-K4	606-11019

Plug connection



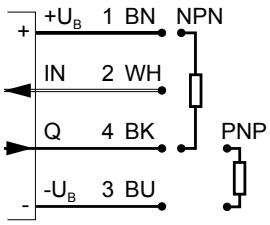
153-00964

Cable connection



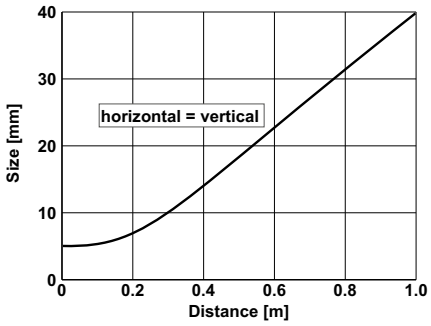
153-00963

Connection, 4-pin



154-00312

Light spot size



155-01531

Reflector / reflective tape	Operating range (min./max. reflector distance)
R5/L (904-51543)	0 … 2 m
RF-100 KL (904-51644)	0 … 2 m
R2-2LB1 (904-51595)	0 … 500 mm
R3-2LK1 (904-51596)	0 … 500 mm

Accessories

Reflectors	From Page A-16
Connection cables	From Page A-32
Brackets	From Page A-4

8

FR 25-RGO2

Autocollimation retroreflective photoelectric sensor



PRODUCT HIGHLIGHTS

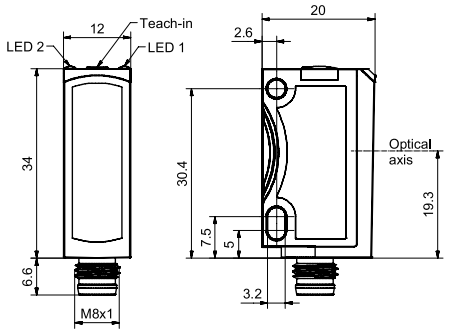
- Autocollimation principle: reliable and precise detection from a range of 0 mm
- Precise detection, even through narrow openings and drilled holes
- Compact miniature housings for installation in the smallest of spaces
- Simple operation via electronic Teach-in button or control input
- Robust glass-fibre-reinforced plastic housings

Optical data		Functions	
Operating range	0 … 2 m[1]	Indicator LED, green	Operating voltage indicator
Type of light	LED, red, 632 nm	Indicator LED, yellow	Switching output indicator
Polarising filter	Yes	Sensitivity adjustment	Via Teach-in button and control input
		Teach-in modes	Mode 1: during running process Mode 2: during standing process
		Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input
		Default settings	Max. range and N.O.
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC[2]	Dimensions	34 x 20 x 12 mm[3]
No-load current, I_0	≤ 30 mA	Enclosure rating	IP 69K & IP 67[3]
Output current, Ie	≤ 100 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-20 … +60 °C[4]
Power On Delay	< 300 ms	Ambient temperature: storage	-20 … +80 °C
Switching output, Q	PNP/NPN (see Selection Table)	Weight	10 g
Output function	N.O./N.C.	Vibration and impact resistance	EN 60947-5-2
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz		
Response time	500 µs		
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation		

[1] Reference material: R5/L reflector [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 / IP 69K plug [4] UL: -20 °C... + 50 °C

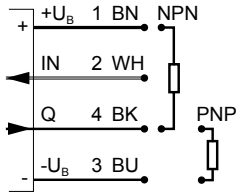
Operating range	Switching output	Type of connection	Part number	Article number
0 … 2 m	PNP	Plug, M8x1, 4-pin	FR 25-RGO2-PS-M4	606-11022
0 … 2 m	NPN	Plug, M8x1, 4-pin	FR 25-RGO2-NS-M4	606-11023

Plug connection



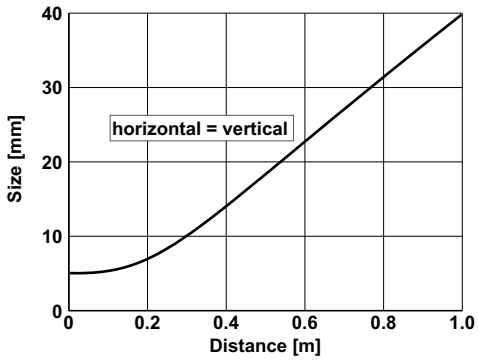
153-00964

Connection, 4-pin



154-00312

Light spot size



155-01531

Reflector / reflective tape	Operating range (min./max. reflector distance)
R5/L (904-51543)	0 … 2 m
RF-100 KL (904-51644)	0 … 2 m
R2-2LB1 (904-51595)	0 … 500 mm
R3-2LK1 (904-51596)	0 … 500 mm

Accessories

Reflectors	From Page A-16
Connection cables	From Page A-32
Brackets	From Page A-4

FR 25-RLO

Autocollimation laser retroreflective photoelectric sensor



PRODUCT HIGHLIGHTS

- Reliable small-part detection over the entire operating range from a size of 0.2 mm
- Precise front-edge detection even in fastest automation processes thanks to a high switching frequency of 10 kHz
- Constant detection position with lateral object approach over the entire operating range for maximum switching point and positioning accuracy

Optical data	
Limit range	0 … 5 m[1]
Operating range	0 … 4 m[1]
Type of light	Laser, red, 650 nm
Light spot size	See diagram
Laser Class (DIN EN 60825-1:2008-5)	1
Polarising filter	Yes

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running process Mode 2: during standing process
Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. range and N.O.

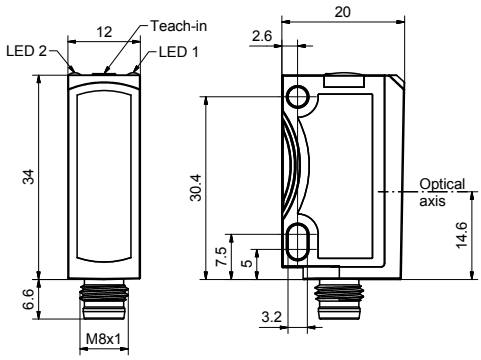
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	See Selection Table
Response time	See Selection Table
Control input, IN[3]	+ U_B = teach-in - U_B = button locked Open = normal operation

Mechanical data	
Dimensions	34 x 20 x 12 mm[3]
Enclosure rating	IP 69K & IP 67[3]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C[5]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (metal plug device[5])	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: R5/L reflector [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 / IP 69K plug [4] UL: -20 °C... + 50 °C [5] no Ecolab

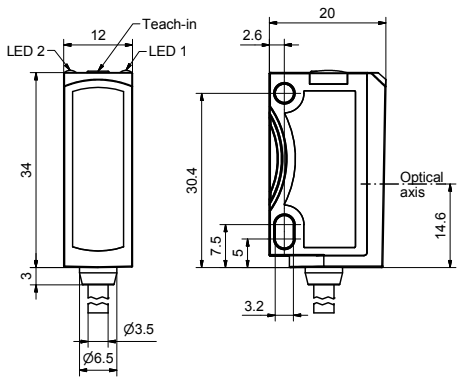
Switching frequency, f (ti/tp 1:1)[2]	Response time	Switching output	Type of connection	Part number	Article number
≤ 10 kHz	50 µs	PNP	Metal plug, M8x1, 4-pin	FR 25-RLO1-PS-M4M	609-31003
≤ 10 kHz	50 µs	NPN	Metal plug, M8x1, 4-pin	FR 25-RLO1-NS-M4M	609-31004
≤ 10 kHz	50 µs	PNP	Cable, 2 m, 4-wire	FR 25-RLO1-PS-K4	609-31005
≤ 10 kHz	50 µs	NPN	Cable, 2 m, 4-wire	FR 25-RLO1-NS-K4	609-31006
≤ 4 kHz	125 µs	PNP	Plug, M8x1, 4-pin	FR 25-RLO2-PS-M4	609-31007
≤ 4 kHz	125 µs	NPN	Plug, M8x1, 4-pin	FR 25-RLO2-NS-M4	609-31008
≤ 4 kHz	125 µs	PNP	Cable, 2 m, 4-wire	FR 25-RLO2-PS-K4	609-31009
≤ 4 kHz	125 µs	NPN	Cable, 2 m, 4-wire	FR 25-RLO2-NS-K4	609-31010

Plug connection



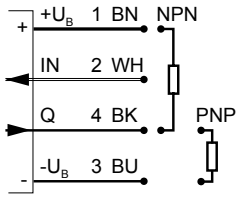
153-01088

Cable connection



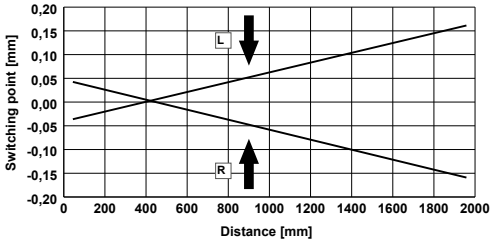
153-01089

Connection, 4-pin



154-00312

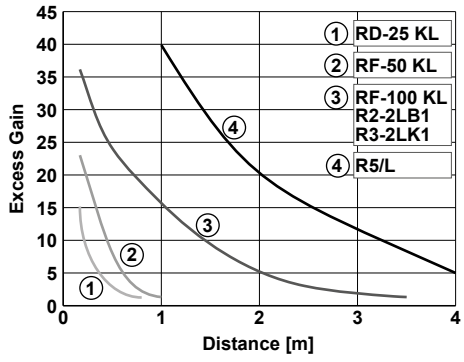
Lateral object approach



Reference material: RF-100 KL reflector

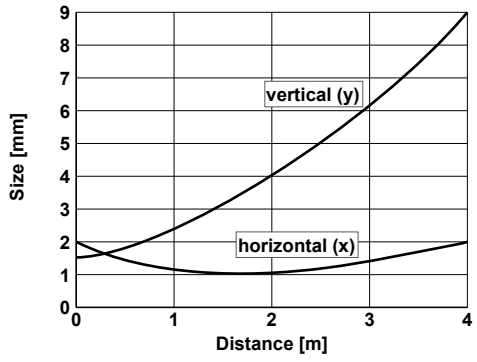
155-01720

Functional reserves



155-01715

Light spot size



155-01716

Small part detection

Reflector	Reflector distance	Scanning distance	Smallest detectable part
R5L	1000 ... 4000 mm	0 ... 4000 mm	≥ 1 mm
RD-25 KL	50 ... 500 mm	50 ... 500 mm	≥ 0.2 mm
RF-100 KL	500 ... 2500 mm	0 ... 500 mm	≥ 0.2 mm
R2-2LB1	500 ... 2500 mm	0 ... 500 mm	≥ 0.2 mm
R3-2LK1	500 ... 2500 mm	0 ... 500 mm	≥ 0.2 mm
RF-50 KL	100 ... 500 mm	100 ... 500 mm	≥ 0.2 mm

Reflector	Operating range (min./max. reflector distance)
R5L	0 ... 4000 mm
RD-25 KL	50 ... 600 mm
RF-100 KL	0 ... 2500 mm
R2-2LB1	0 ... 2500 mm
R3-2LK1	0 ... 2500 mm
RF-50 KL	0 ... 800 mm

FR 25-RL

Laser retroreflective photoelectric sensor



PRODUCT HIGHLIGHTS

- Particularly suitable for short-range applications
- Suitable for a wide variety of different reflectors
- Very small, easily visible laser light spot
- Sensor settings via teach-in and control input
- Robust glass-fibre-reinforced plastic housings

Optical data	
Limit range	1 … 15 m[1]
Operating range	1 … 13 m[1]
Type of light	Laser, red, 650 nm
Light spot size	See diagram
Laser Class (DIN EN 60825-1:2008-5)	1
Polarising filter	Yes

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running process Mode 2: during standing process
Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. range and N.O.

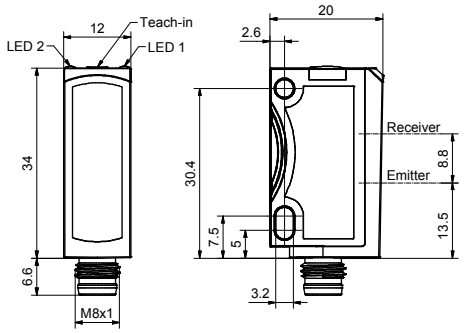
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 2000 Hz
Response time	250 µs
Control input, IN[3]	+ U_B = teach-in - U_B = button locked Open = normal operation

Mechanical data	
Dimensions	34 x 20 x 12 mm[3]
Enclosure rating	IP 69K & IP 67[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C[5]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (metal plug device[6])	10 g
Weight (cable device)	40 g
Weight (pigtail)	20 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: R5/L reflector [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] Only 4-pin design [4] With connected IP 67 / IP 69K plug [5] UL: -20 °C... + 50 °C [6] no Ecolab

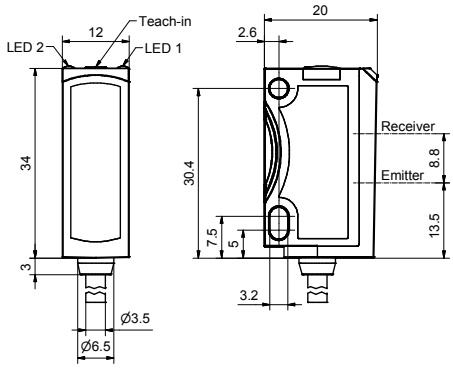
Operating range	Switching output	Type of connection	Part number	Article number
1 … 13 m	PNP	Metal plug, M8x1, 3-pin	FR 25-RL-PS-M3M	609-31000
1 … 13 m	PNP	Metal plug, M8x1, 4-pin	FR 25-RL-PS-M4M	609-31001
1 … 13 m	NPN	Metal plug, M8x1, 4-pin	FR 25-RL-NS-M4M	609-31002
1 … 13 m	PNP	Cable, 2 m, 4-wire	FR 25-RL-PS-K4	609-21004
1 … 13 m	NPN	Cable, 2 m, 4-wire	FR 25-RL-NS-K4	609-21001
1 … 13 m	PNP	Pigtail, 150 mm with plug, M12, 4-pin	FR 25-RL-PS-KL4	609-21006
1 … 13 m	NPN	Pigtail, 150 mm with plug, M12, 4-pin	FR 25-RL-NS-KL4	609-21003

Plug connection



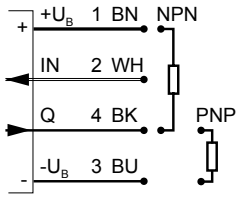
153-00937

Cable connection



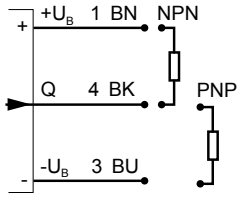
153-00936

Connection, 4-pin



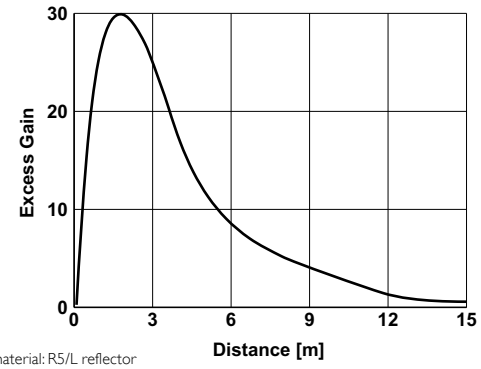
154-00312

Connection, 3-pin



154-00311

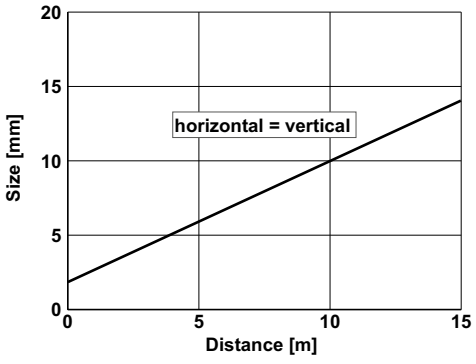
Functional reserves



Reference material: R5/L reflector

155-01390

Light spot size



155-01391

Reflector (especially for short range)	Operating range
RD-25 KL	0.15 … 1 m

Accessories

Reflectors	From Page A-16
Connection cables	From Page A-32
Brackets	From Page A-4

FR 25-R

Retroreflective photoelectric sensor



PRODUCT HIGHLIGHTS

- Auto-detect retroreflective photoelectric sensor with real PNP and real NPN functions
- Particularly suitable for short-range applications
- Simple alignment thanks to easily visible light spot
- Robust glass-fibre-reinforced plastic housings
- Durable laser printing
- Wide range of variants

Optical data	
Limit range	0.01 … 7 m[1]
Operating range	0.01 … 6 m[1]
Type of light	LED, red, 632 nm
Light spot size	See diagram
Polarising filter	Yes

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running process Mode 2: during standing process
Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input Auto-detect / NPN / PNP via Teach-in button and control input (only Auto-detect variants)
Default settings	Max. range and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN/Auto-detect (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Control input, IN[3]	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions	34 x 20 x 12 mm[3]
Enclosure rating	IP 69K & IP 67[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C[5]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (metal plug device[6])	10 g
Weight (cable device)	40 g
Weight (pigtail)	20 g
Vibration and impact resistance	EN 60947-5-2

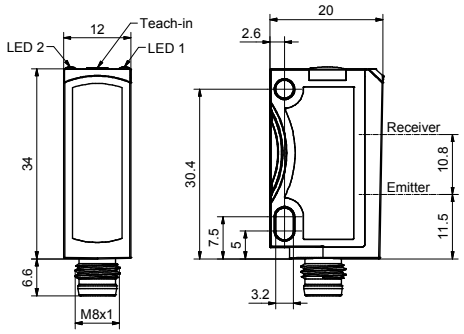
[1] Reference material: R10 reflector [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] Only 4-pin design [4] With connected IP 67 / IP 69K plug [5] UL: -20 °C... + 50 °C [6] no Ecolab

Operating range	Switching output	Type of connection	Part number	Article number
0.01 … 6 m	PNP	Plug, M8x1, 4-pin	FR 25-R-PS-M4	606-11000
0.01 … 6 m	NPN	Plug, M8x1, 4-pin	FR 25-R-NS-M4	606-11002
0.01 … 6 m	PNP	Metal plug, M8x1, 3-pin	FR 25-R-PS-M3M	606-11006
0.01 … 6 m	NPN	Metal plug, M8x1, 3-pin	FR 25-R-NS-M3M	606-11007
0.01 … 6 m	PNP	Metal plug, M8x1, 4-pin	FR 25-R-PS-M4M	606-11008
0.01 … 6 m	NPN	Metal plug, M8x1, 4-pin	FR 25-R-NS-M4M	606-11009
0.01 … 6 m	PNP	Cable, 2 m, 4-wire	FR 25-R-PS-K4	606-11001
0.01 … 6 m	NPN	Cable, 2 m, 4-wire	FR 25-R-NS-K4	606-11003

Version: 10/2013. Subject to changes; diagrams similar

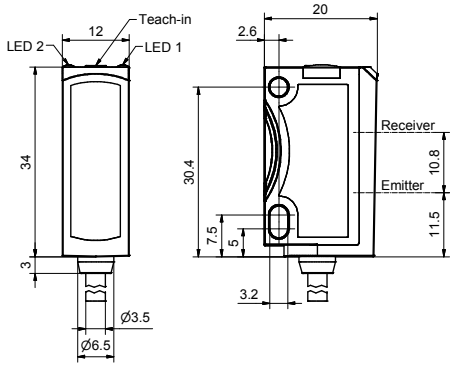
Operating range	Switching output	Type of connection	Part number	Article number
0.01 … 6 m	PNP	Pigtail, 150 mm with plug, M12, 4-pin	FR 25-R-PS-KL4	606-11004
0.01 … 6 m	NPN	Pigtail, 150 mm with plug, M12, 4-pin	FR 25-R-NS-KL4	606-11005
0.01 … 6 m	Auto-detect	Metal plug, M8x1, 4-pin	FR 25-R-PNS-M4M	606-11011

Plug connection



153-00835

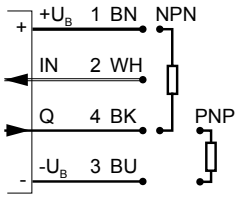
Cable connection



153-00834

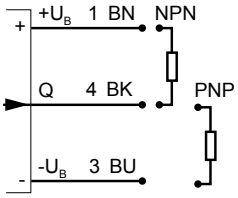
8

Connection, 4-pin



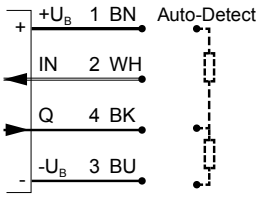
154-00312

Connection, 3-pin



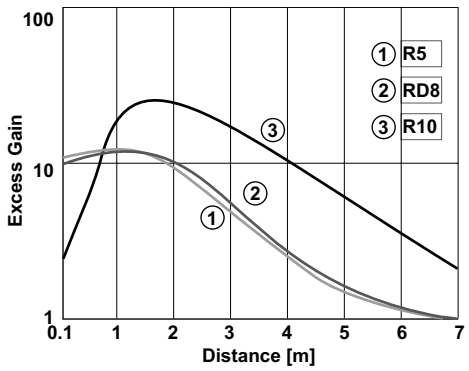
154-00311

Connection, Auto-detect



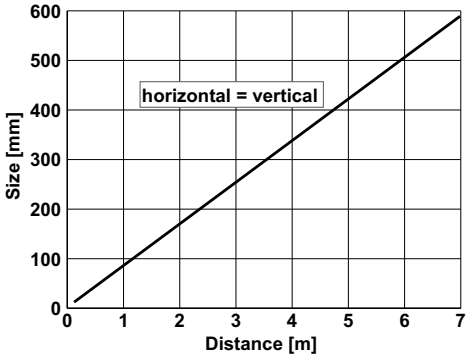
154-00313

Functional reserves



155-00978

Light spot size



155-00981

Reflector	Operating range
R10	0.1 … 6 m
RD8	0,05 … 4 m
R5	0.1 … 4 m

Accessories	
Reflectors	From Page A-16
Connection cables	From Page A-32
Brackets	From Page A-4

FR 25-RF

Retroreflective photoelectric sensor, fixed setting



PRODUCT HIGHLIGHTS

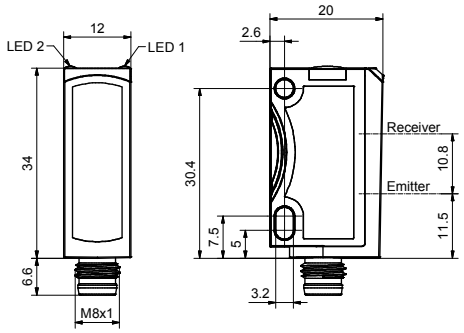
- Economical solution for numerous applications
- Tamper-proof sensor design – no misalignment possible
- Suitable for a wide variety of different reflectors
- Simple alignment thanks to easily visible light spot
- Robust glass-fibre-reinforced plastic housings

Optical data		Functions	
Limit range	0.1 … 5 m[1]	Indicator LED, green	Operating voltage indicator
Operating range	0.1 … 3 m[1]	Indicator LED, yellow	Switching output indicator
Type of light	LED, red, 632 nm	Adjustment possibilities	N.O./N.C. via control input
Light spot size	See diagram		
Polarising filter	Yes		
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC[2]	Dimensions	34 x 20 x 12 mm[3]
No-load current, I_0	≤ 30 mA	Enclosure rating	IP 69K & IP 67[3]
Output current, Ie	≤ 100 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-20 … +60 °C[4]
Power On Delay	< 300 ms	Ambient temperature: storage	-20 … +80 °C
Switching output, Q	PNP/NPN (see Selection Table)	Weight (plug device)	10 g
Output function	N.O./N.C.	Weight (cable device)	40 g
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Vibration and impact resistance	EN 60947-5-2
Response time	500 µs		
Control input, IN	$+U_B$ = N.C. $-U_B$ / Open = N.O.		

[1] Reference material: R10 reflector [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 / IP 69K plug [4] UL: -20 °C... + 50 °C

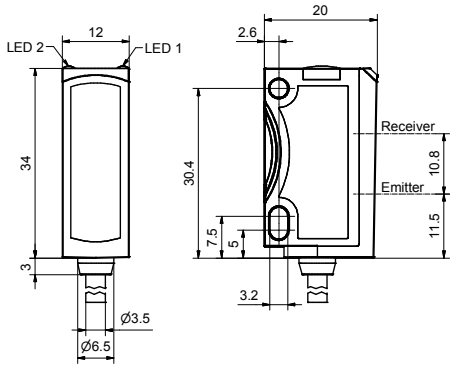
Operating range	Switching output	Type of connection	Part number	Article number
0.1 … 3 m	PNP	Plug, M8x1, 4-pin	FR 25-RF-PS-M4	606-11012
0.1 … 3 m	NPN	Plug, M8x1, 4-pin	FR 25-RF-NS-M4	606-11013
0.1 … 3 m	PNP	Cable, 2 m, 4-wire	FR 25-RF-PS-K4	606-11014
0.1 … 3 m	NPN	Cable, 2 m, 4-wire	FR 25-RF-NS-K4	606-11015

Plug connection



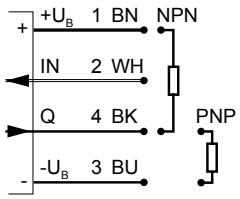
153-00942

Cable connection



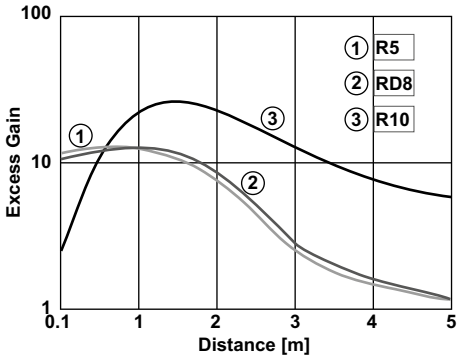
153-00943

Connection, 4-pin



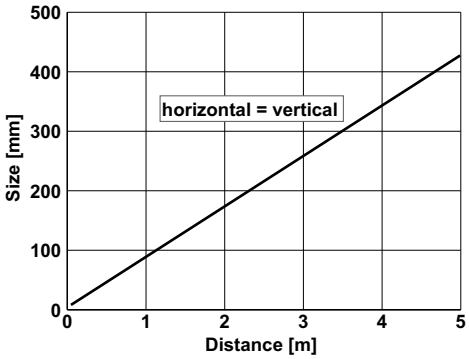
154-00312

Functional reserves



155-01399

Light spot size



155-01396

Reflector	Operating range
R10	0.1 … 3 m
RD8	0.1 … 3 m
R5	0.1 … 3 m

Accessories

Reflectors	From Page A-16
Connection cables	From Page A-32
Brackets	From Page A-4

FS/FE 25-RL

Laser through-beam photoelectric sensor



PRODUCT HIGHLIGHTS

- Long range with small and compact housings
- Test input for checking sensor pair function
- Very small, easily visible laser light spot
- Sensor settings via teach-in and control input
- Robust glass-fibre-reinforced plastic housings

Optical data	
Limit range	0 … 20 m
Operating range	0 … 18 m
Type of light	Laser, red, 650 nm
Light spot size	See diagram
Laser Class (DIN EN 60825-1:2008-5)	1

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment (receiver)	Via Teach-in button and control input
Teach-in modes	Mode 1: during running process Mode 2: during standing process
Adjustment possibilities (receiver)	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. range and N.O.

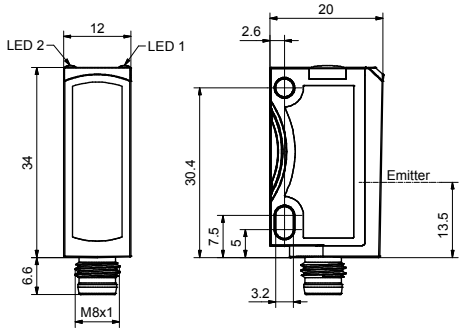
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 2000 Hz
Response time	250 µs
Control input, IN (receiver)	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation
Control input, Test (transmitter)	$+U_B$ = Test (transmitter off) $-U_B$ / Open = normal operation

Mechanical data	
Dimensions	34 x 20 x 12 mm[3]
Enclosure rating	IP 69K & IP 67[2]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C[3]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (metal plug device[4])	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [2] With connected IP 67 / IP 69K plug [3] UL: -20 °C... + 50 °C [4] no Ecolab

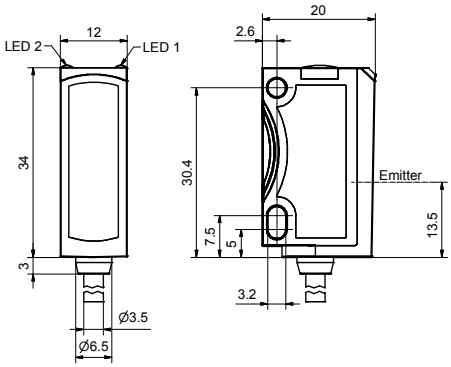
Operating range	Switching output	Type of connection	Part number	Article number
0 … 18 m	PNP	Metal plug, M8x1, 4-pin	FE 25-RL-PS-M4M	605-21014
0 … 18 m	NPN	Metal plug, M8x1, 4-pin	FE 25-RL-NS-M4M	605-21015
0 … 18 m	–	Metal plug, M8x1, 4-pin	FS 25-RL-M4M	605-11007
0 … 18 m	PNP	Cable, 2 m, 4-wire	FE 25-RL-PS-K4	605-21004
0 … 18 m	NPN	Cable, 2 m, 4-wire	FE 25-RL-NS-K4	605-21007
0 … 18 m	–	Cable, 2 m, 4-wire	FS 25-RL-K4	605-11002

Plug connection (transmitter)



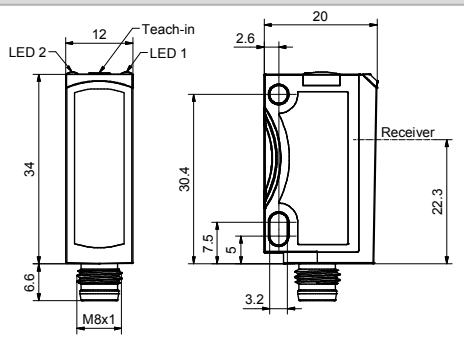
153-00940

Cable connection (transmitter)



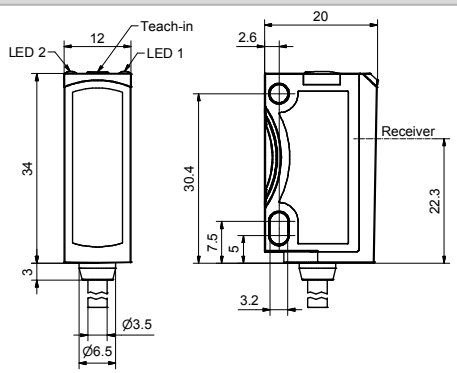
153-00939

Plug connection (receiver)



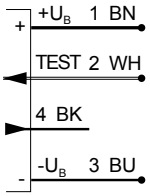
153-00854

Cable connection (receiver)



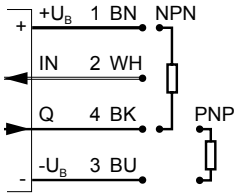
153-00853

Connection, transmitter, 4-pin



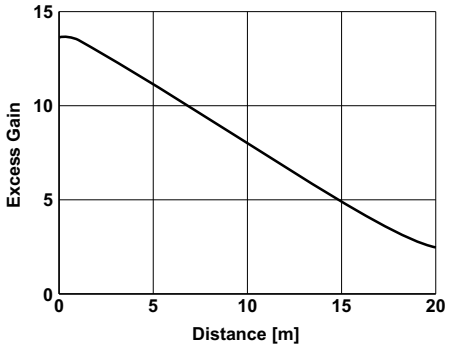
154-00315

Connection, receiver, 4-pin



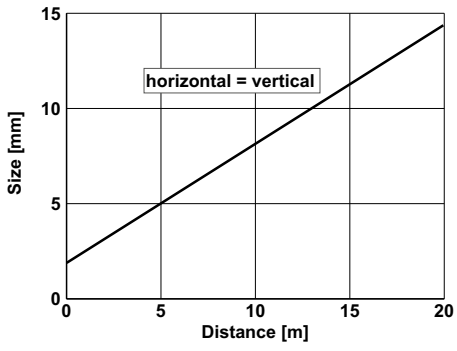
154-00312

Functional reserves



155-01388

Light spot size



155-01389

Accessories

Connection cables	From Page A-32	Brackets	From Page A-4

8

FS/FE 25-R

Through-beam photoelectric sensor



PRODUCT HIGHLIGHTS

- Test input for checking sensor pair function
- Sensor settings via teach-in and control input
- Simple alignment thanks to easily visible light spot
- Robust glass-fibre-reinforced plastic housings
- Durable laser printing

Optical data	
Limit range	0 … 15 m
Operating range	0 … 13 m
Type of light	LED, red, 632 nm
Light spot size	See diagram

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment (receiver)	Via Teach-in button and control input
Teach-in modes	Mode 1: during running process Mode 2: during standing process
Adjustment possibilities (receiver)	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. range and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Control input, IN (receiver)	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation
Control input, Test (transmitter)	$+U_B$ = Test (transmitter off) $-U_B$ / Open = normal operation

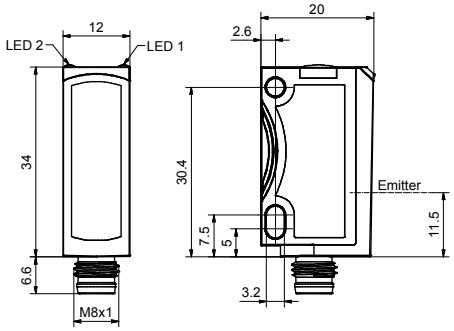
Mechanical data	
Dimensions	34 x 20 x 12 mm[3]
Enclosure rating	IP 69K & IP 67[2]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C[3]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (metal plug device[4])	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Max 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [2] With connected IP 67 / IP 69K plug [3] UL: -20 °C... + 50 °C [4] no Ecolab

Operating range	Switching output	Type of connection	Part number	Article number
0 … 13 m	PNP	Metal plug, M8x1, 4-pin	FE 25-R-PS-M4M	605-21012
0 … 13 m	NPN	Metal plug, M8x1, 4-pin	FE 25-R-NS-M4M	605-21013
0 … 13 m	–	Metal plug, M8x1, 4-pin	FS 25-R-M4M	605-11006
0 … 13 m	PNP	Cable, 2 m, 4-wire	FE 25-R-PS-K4	605-21001
0 … 13 m	NPN	Cable, 2 m, 4-wire	FE 25-R-NS-K4	605-21003
0 … 13 m	–	Cable, 2 m, 4-wire	FS 25-R-K4	605-11001

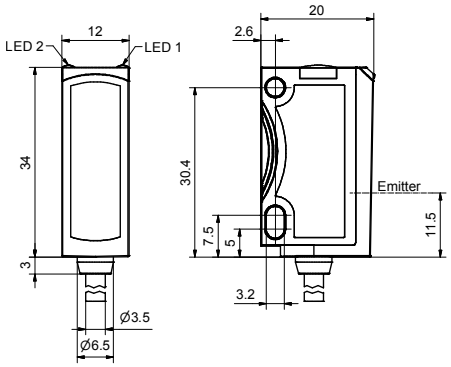
Version: 10/2013. Subject to changes; diagrams similar

Plug connection (transmitter)



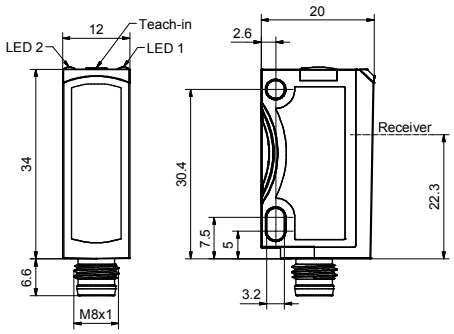
153-00852

Cable connection (transmitter)



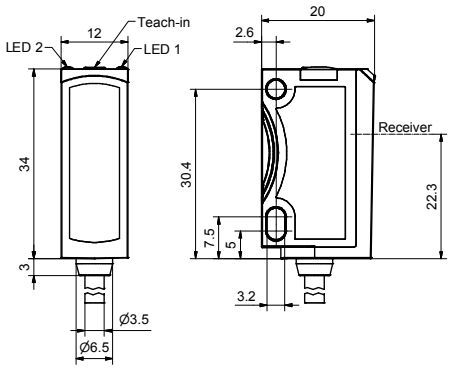
153-00851

Plug connection (receiver)



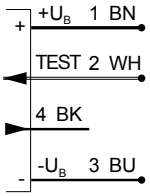
153-00854

Cable connection (receiver)



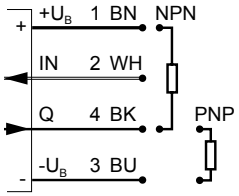
153-00853

Connection, transmitter, 4-pin



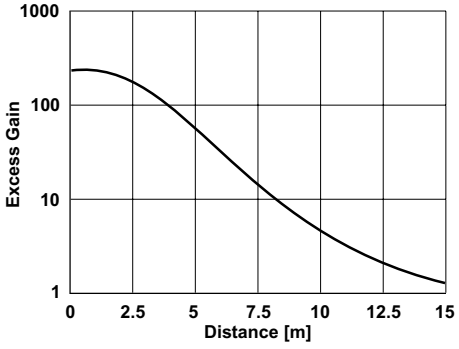
154-00315

Connection, receiver, 4-pin



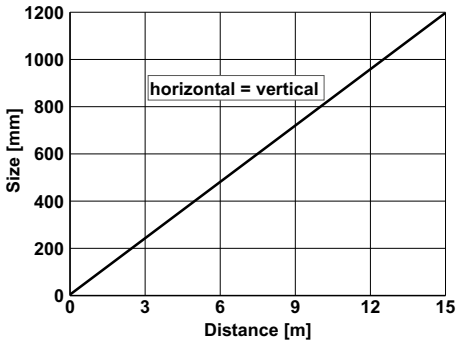
154-00312

Functional reserves



155-01370

Light spot size



155-01371

Accessories

Connection cables	From Page A-32	Brackets	From Page A-4

FS/FE 25-RF

Through-beam photoelectric sensor, fixed setting



PRODUCT HIGHLIGHTS

- Economical solution for numerous applications
- Tamper-proof sensor design – no misalignment possible
- Simple alignment thanks to easily visible light spot
- Robust glass-fibre-reinforced plastic housings
- Durable laser printing

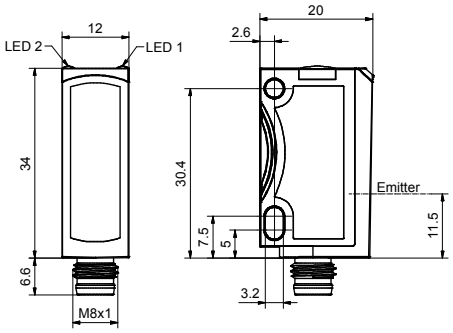
Optical data		Functions	
Limit range	0 … 6 m	Indicator LED, green	Operating voltage indicator
Operating range	0 … 4 m	Indicator LED, yellow	Switching output indicator
Type of light	LED, red, 632 nm	Adjustment possibilities (receiver)	N.O./N.C. via control input
Light spot size	See diagram		

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]	Dimensions	34 x 20 x 12 mm[3]
No-load current, I_0	≤ 30 mA	Enclosure rating	IP 69K & IP 67[2]
Output current, Ie	≤ 100 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-20 … +60 °C[3]
Power On Delay	< 300 ms	Ambient temperature: storage	-20 … +80 °C
Switching output, Q	PNP/NPN (see Selection Table)	Weight (plug device)	10 g
Output function	N.O./N.C.	Vibration and impact resistance	EN 60947-5-2
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz		
Response time	500 µs		
Control input, IN (receiver)	$+U_B$ = N.C. $-U_B$ / Open = N.O.		
Control input, Test (transmitter)	$+U_B$ = Test (transmitter off) $-U_B$ / Open = normal operation		

[1] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [2] With connected IP 67 / IP 69K plug [3] UL: -20 °C... + 50 °C

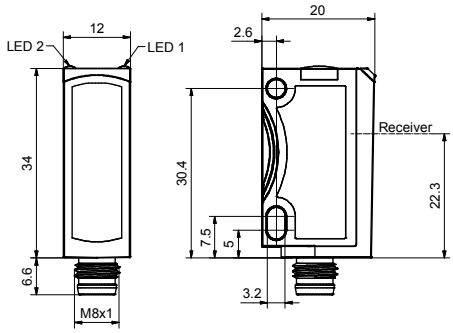
Operating range	Switching output	Type of connection	Part number	Article number
0 … 4 m	PNP	Plug, M8x1, 4-pin	FE 25-RF-PS-M4	605-21016
0 … 4 m	NPN	Plug, M8x1, 4-pin	FE 25-RF-NS-M4	605-21017
0 … 4 m	–	Plug, M8x1, 4-pin	FS 25-RF-M4	605-11008

Plug connection (transmitter)



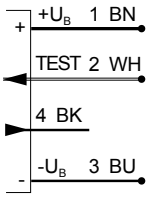
153-00852

Plug connection (receiver)



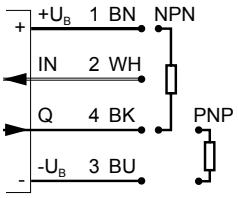
153-00944

Connection, transmitter, 4-pin



154-00315

Connection, receiver, 4-pin



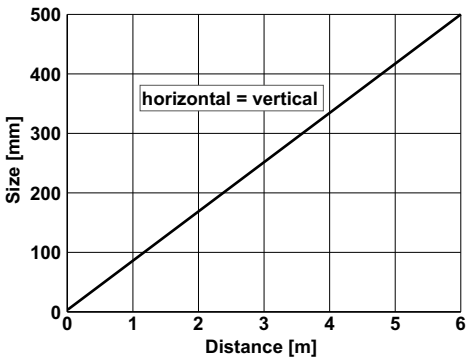
154-00312

Functional reserves



155-01398

Light spot size



155-01397

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

F 55 – family of photoelectric sensors with high-quality housings

The compact class with long ranges







Always sparkling clean

Neither bubble baths with aggressive chemicals nor high-pressure rinsing processes with jets of water or steam can damage the tightly sealed stainless steel housings of the F 55 series. No deposits can adhere during the cleaning process due to the completely smooth housing surface with flush inset operating elements.



TYPICAL F 55

- Glass-fibre-reinforced plastic or stainless steel housings (IP 69K & IP 67, Ecolab)
- Bright, easily visible, light spot with sharp contour even in daylight
- Precise background suppression and minimal black/white-shift
- User-friendly operation of all diffuse variants via electronic Teach-in button or control line
- Laser or LED options
- Two dovetail guides for simple sensor alignment
- Well thought-out mounting accessories

SensoPart sets new standards in the compact class with its F 55 family of photoelectric sensors. The products in this series combine excellent performance data with a robust housing design and many user-friendly details. They guarantee reliable detection by means of focused laser light or red-light LED with precise background suppression.

The sensors of the F 55 series have a very high light intensity: the photoelectric proximity sensor with background suppression, for example, reaches a scanning distance of up to 5000 mm. The bright, sharply contoured light spot is still easily visible even at long distances and in intense daylight, considerably simplifying commissioning.

The F 55 series covers all standard applications in industrial automation: whether for part detection in the automotive industry or for sorting tasks in machine construction – the sensors excel everywhere with their excellent performance. The food industry-enabled tightly sealed stainless steel variants (IP 69K) with Ecolab certification – rounding out the comprehensive sensor programme – shine in all regards.

F 55 – Product Overview					
	Type of light	Adjustment	Scanning distance / range	Special features	Page
Photoelectric proximity sensors with background suppression					
FT 55- RLH	Laser	Potentiometer	800 mm		282
FT 55-RL2H	Laser	Potentiometer	1000 mm	Precise small-part detection at long scanning distances	284
FT 55-RLHP	Laser	Teach-in	5000 mm	Very long scanning distances	286
FT 55B-RH	LED	Potentiometer	800 mm		288
FT 55-RH	LED	Potentiometer	1200 mm		290
FT 55-RHM	LED	Teach-in	550 mm	Stainless steel housing	292
Photoelectric proximity sensors					
FT 55-RL2	Laser	Teach-in	1200 mm	Detection of slightest grey value differences	294
FT 55-R	LED	Teach-in	2000 mm		296
FT 55-RM	LED	Teach-in	1750 mm	Stainless steel housing	298
Retroreflective photoelectric sensors					
FR 55-RLO	Laser	Teach-in	20 m	Autocollimation, most accurate small-part detection	300
FR 55-RL	Laser	Teach-in	14 m		302
FR 55-R	LED	Teach-in	14 m		304
FR 55-RM	LED	Teach-in	13 m	Stainless steel housing	306
Through-beam photoelectric sensors					
FS/FE 55-RL	Laser	Teach-in	30 m		308
FS/FE 55-R	LED	Teach-in	25 m		310
FS/FE 55-RM	LED	Teach-in	20 m	Stainless steel housing	312

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

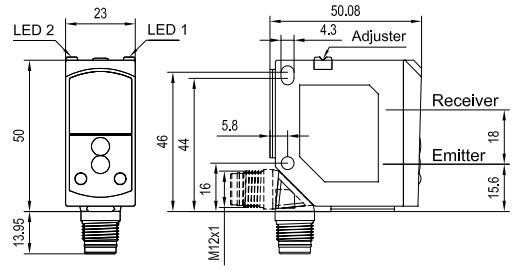
Optical data		Functions	
Scanning distance	5 … 800 mm[1]	Indicator LED, green	Operating voltage indicator
Type of light	Laser, red, 655 nm	Indicator LED, yellow	Switching output indicator / contamination indicator
Light spot size	See diagram	Scanning distance adjustment	Via potentiometer
Laser Class (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 … 30 V DC[2]	Dimensions	50 x 50.08 x 23 mm[3]
No-load current, I_0	≤ 30 mA	Enclosure rating	IP 69K & IP 67[3]
Output current, Ie	≤ 100 mA	Material, housing	PC-ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-20 … +60 °C
Power On Delay	< 300 ms	Ambient temperature: storage	-20 … +80 °C
Switching output, Q	PNP/NPN (see Selection Table)	Weight (plug device)	35 g
Output function	N.O./N.C.	Weight (cable device)	125 g
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Vibration and impact resistance	EN 60947-5-2
Response time	500 µs		
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

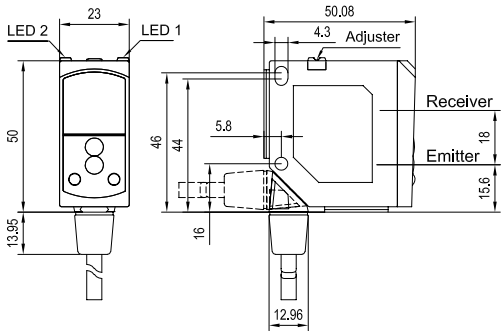
Scanning distance	Switching output	Type of connection	Part number	Article number
5 … 800 mm	PNP	Plug, M12x1, 4-pin	FT 55-RLH-PS-L4	623-11018
5 … 800 mm	NPN	Plug, M12x1, 4-pin	FT 55-RLH-NS-L4	623-11019
5 … 800 mm	PNP	Cable, 3 m, 4-wire	FT 55-RLH-PS-K4	623-11021
5 … 800 mm	NPN	Cable, 3 m, 4-wire	FT 55-RLH-NS-K4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

Plug connection



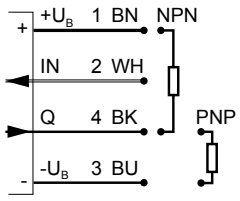
153-00806

Cable connection



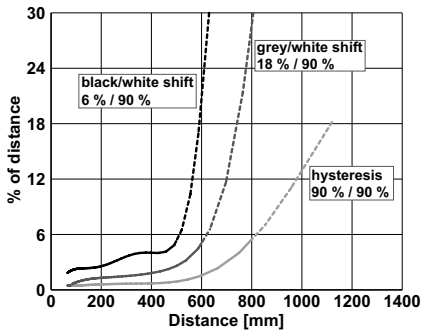
153-00807

Connection, 4-pin



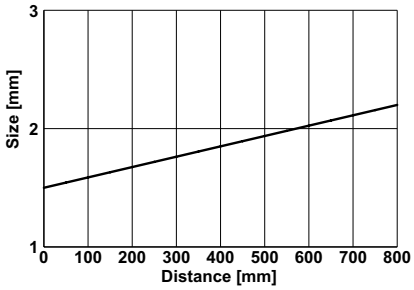
154-00312

Scanning properties



155-01241

Light spot size



155-01242

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

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

FT 55-RL2H

Laser photoelectric proximity sensor with background suppression



PRODUCT HIGHLIGHTS

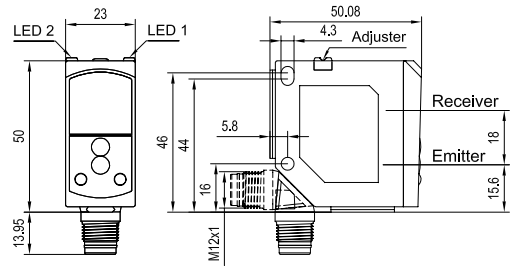
- Long scanning distance of 1 m combined with extremely accurate small-part detection
- Precisely adjustable background suppression – reliable operation even with highly reflective and glossy backgrounds
- Very small, easily visible laser light spot
- Precise scanning distance adjustment by means of 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 mm (6 %)
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	12 … 30 V DC[2]	Dimensions	50 x 50.08 x 23 mm[3]
No-load current, I_0	≤ 30 mA	Enclosure rating	IP 69K & IP 67[3]
Output current, Ie	≤ 100 mA	Material, housing	PC-ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-20 … +60 °C
Power On Delay	< 300 ms	Ambient temperature: storage	-20 … +80 °C
Switching output, Q	PNP/NPN (see Selection Table)	Weight (plug device)	35 g
Output function	N.O./N.C.	Weight (cable device)	125 g
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Vibration and impact resistance	EN 60947-5-2
Response time	500 µs		
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

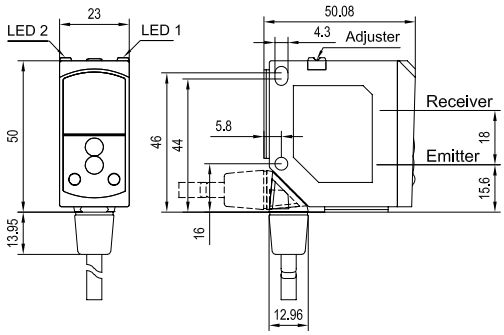
Scanning distance	Switching output	Type of connection	Part number	Article number
5 … 1000 mm	PNP	Plug, M12x1, 4-pin	FT 55-RL2H-PS-L4	623-11006
5 … 1000 mm	NPN	Plug, M12x1, 4-pin	FT 55-RL2H-NS-L4	623-11007
5 … 1000 mm	PNP	Cable, 3 m, 4-wire	FT 55-RL2H-PS-K4	623-11009
5 … 1000 mm	NPN	Cable, 3 m, 4-wire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

Plug connection



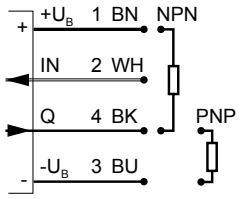
153-00806

Cable connection



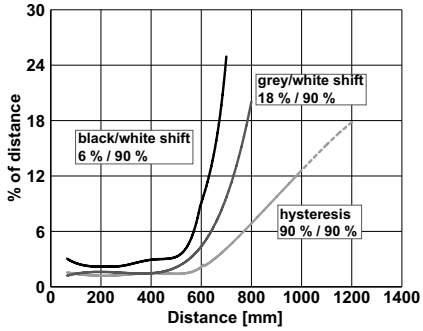
153-00807

Connection, 4-pin



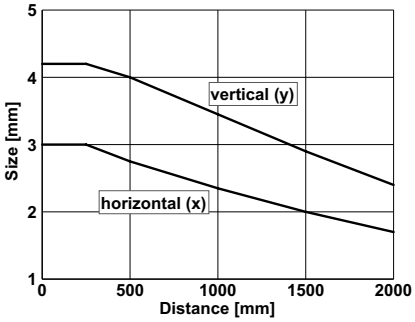
154-00312

Scanning properties



155-01081

Light spot size



155-01083

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

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

FT 55B-RH

Photoelectric proximity sensor with background suppression



PRODUCT HIGHLIGHTS

- Precisely adjustable background suppression
- Reliable switching despite differing object colours and surfaces
- Simple alignment thanks to easily visible light spot
- Plug and cable connection rotatable

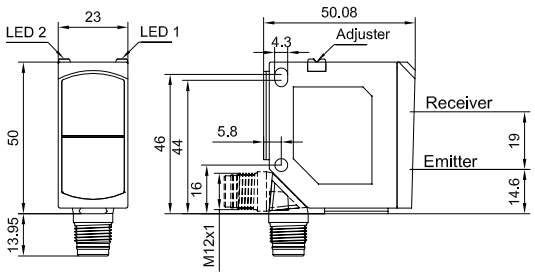
Optical data		Functions	
Scanning distance	3 … 800 mm[1]	Indicator LED, green	Operating voltage indicator
Type of light	LED, red, 640 nm	Indicator LED, yellow	Switching output indicator / contamination indicator
Light spot size	See diagram	Scanning distance adjustment	Via potentiometer
		Adjustment possibilities	N.O./N.C. via control input
		Default settings	Max. scanning distance (6 %)

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]	Dimensions	50 x 50.08 x 23 mm[3]
No-load current, I_0	≤ 30 mA	Enclosure rating	IP 69K & IP 67[3]
Output current, Ie	≤ 100 mA	Material, housing	PC-ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-20 … +60 °C
Power On Delay	< 300 ms	Ambient temperature: storage	-20 … +80 °C
Switching output, Q	PNP/NPN (see Selection Table)	Weight (plug device)	35 g
Output function	N.O./N.C.	Weight (cable)	125 g
Switching frequency, f (ti/tp 1:1)	≤ 600 Hz	Vibration and impact resistance	EN 60947-5-2
Response time	830 µs		
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

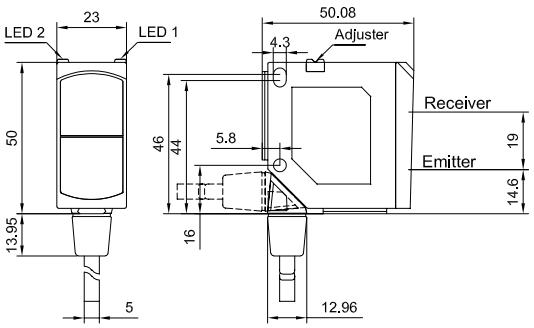
Scanning distance	Switching output	Type of connection	Part number	Article number
3 … 800 mm	PNP	Plug, M12x1, 4-pin	FT 55B-RH-PS-L4	623-11012
3 … 800 mm	NPN	Plug, M12x1, 4-pin	FT 55B-RH-NS-L4	623-11013
3 … 800 mm	PNP	Cable 3 m, 4-wire	FT 55B-RH-PS-K4	623-11014
3 … 800 mm	NPN	Cable 3 m, 4-wire	FT 55B-RH-NS-K4	623-11015

Plug connection



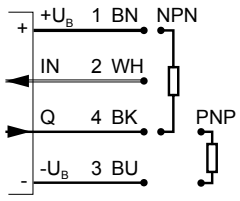
153-00785

Cable connection



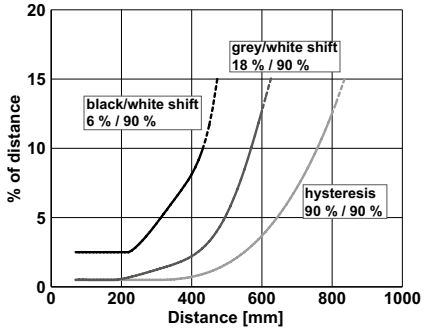
153-00784

Connection, 4-pin



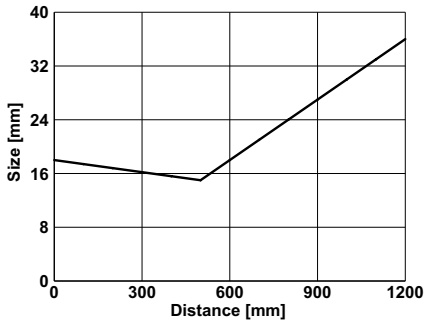
154-00312

Scanning properties



155-01080

Light spot size



155-01082

Reference material	Detection range
White (90 %)	3 … 800 mm
Grey (18 %)	5 … 600 mm
Black (6 %)	15 … 450 mm

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FT 55-RH

Photoelectric proximity sensor with background suppression



PRODUCT HIGHLIGHTS

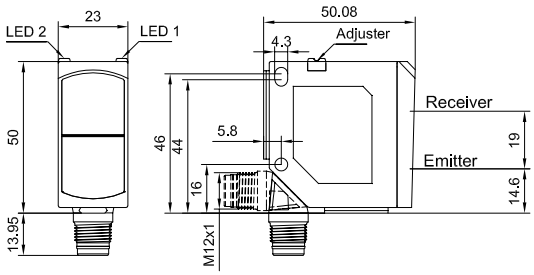
- Long scanning distance of 1.20 m
- Precisely adjustable background suppression – reliable operation even with highly reflective and glossy backgrounds
- Reliable suppression of ambient light, such as sunlight and halogen lamps
- Precise scanning distance adjustment by means of potentiometer

Optical data		Functions	
Scanning distance	3 … 1200 mm[1]	Indicator LED, green	Operating voltage indicator
Type of light	LED, red, 640 nm	Indicator LED, yellow	Switching output indicator / contamination indicator
Light spot size	See diagram	Scanning distance adjustment	Via potentiometer
		Adjustment possibilities	N.O./N.C. via control input
		Default settings	S_n = 500 mm (6 %)
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC[2]	Dimensions	50 x 50.08 x 23 mm[3]
No-load current, I_0	≤ 30 mA	Enclosure rating	IP 69K & IP 67[3]
Output current, Ie	≤ 100 mA	Material, housing	PC-ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-20 … +60 °C
Power On Delay	< 300 ms	Ambient temperature: storage	-20 … +80 °C
Switching output, Q	PNP/NPN (see Selection Table)	Weight (plug device)	35 g
Output function	N.O./N.C.	Weight (cable device)	125 g
Switching frequency, f (ti/tp 1:1)	≤ 600 Hz	Vibration and impact resistance	EN 60947-5-2
Response time	830 µs		
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

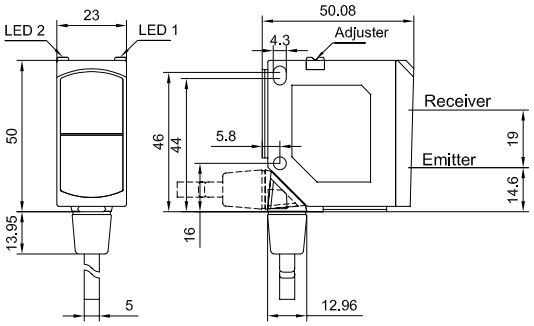
Scanning distance	Switching output	Type of connection	Part number	Article number
3 … 1200 mm	PNP	Plug, M12x1, 4-pin	FT 55-RH-PS-L4	623-11000
3 … 1200 mm	NPN	Plug, M12x1, 4-pin	FT 55-RH-NS-L4	623-11001
3 … 1200 mm	PNP	Cable, 3 m, 4-wire	FT 55-RH-PS-K4	623-11003
3 … 1200 mm	NPN	Cable, 3 m, 4-wire	FT 55-RH-NS-K4	623-11004

Plug connection



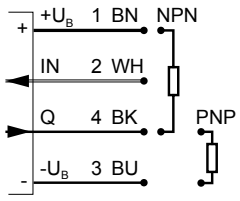
153-00785

Cable connection



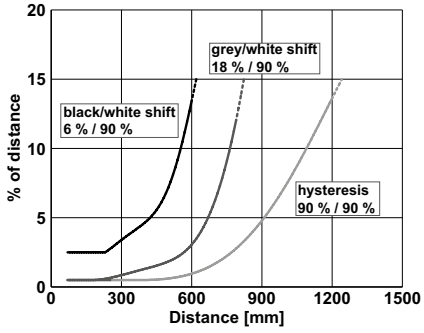
153-00784

Connection, 4-pin



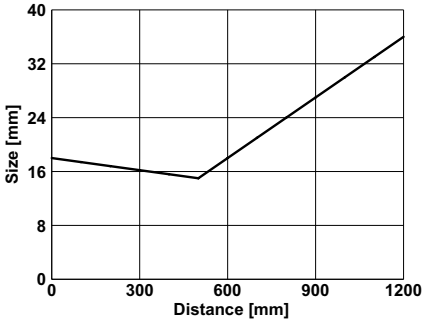
154-00312

Scanning properties



155-00979

Light spot size



155-00980

Reference material	Detection range
White (90 %)	3 … 1200 mm
Grey (18 %)	5 … 800 mm
Black (6 %)	10 … 600 mm

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FT 55-RHM

Photoelectric proximity sensor with background suppression – stainless steel housing



PRODUCT HIGHLIGHTS

- Minimum black / white-shift for reliable switching regardless of object colour and surface
- Stable stainless steel housing – ideal for use in hygiene zones
- Housing concept designed for intensive cleaning processes in the food industry
- Sensor adjustment via teach-in and control input

Optical data	
Scanning distance	3 … 550 mm[1]
Adjustment range	100 … 550 mm[1]
Type of light	LED, red, 640 nm
Light spot size	See diagram

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator / functional reserve indicator
Scanning distance adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running process Mode 2: during standing process
Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. scanning distance and N.O.

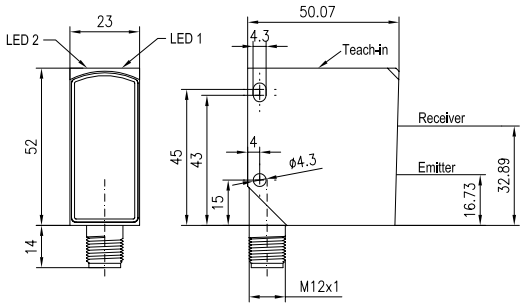
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 400 Hz
Response time	1.25 ms
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions	52 x 50.07 x 23 mm[3]
Enclosure rating	IP 69K & IP 67[3]
Material, housing	Stainless steel, 316L
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	145 g
Vibration and impact resistance	EN 60947-5-2

[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

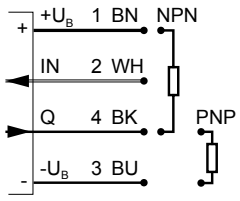
Scanning distance	Switching output	Type of connection	Part number	Article number
3 … 550 mm	PNP	Plug, M12x1, 4-pin	FT 55-RHM-PS-L4	623-11025
3 … 550 mm	NPN	Plug, M12x1, 4-pin	FT 55-RHM-NS-L4	623-11026

Plug connection



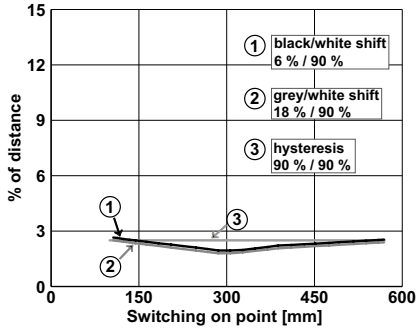
153-00800

Connection, 4-pin



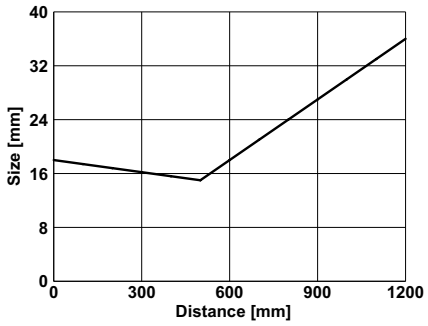
154-00312

Scanning properties



155-01286

Light spot size



155-00980

Reference material	Detection range
White (90 %)	3 … 550 mm
Grey (18 %)	12 … 550 mm
Black (6 %)	20 … 550 mm

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

FT 55-RL2

Diffuse laser photoelectric proximity sensor



PRODUCT HIGHLIGHTS

- Differentiation of even the slightest of grey value differences
- Sensor adjustment via teach-in and control input
- Very small, easily visible laser light spot
- Plug and cable connection rotatable

Optical data	
Scanning distance	5 … 1200 mm[1]
Type of light	Laser, red, 655 nm
Light spot size	See diagram
Laser Class (DIN EN 60825-1:2008-5)	2
Hysteresis	≤ 15 %

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running process Mode 2: during standing process
Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. scanning distance and N.O.

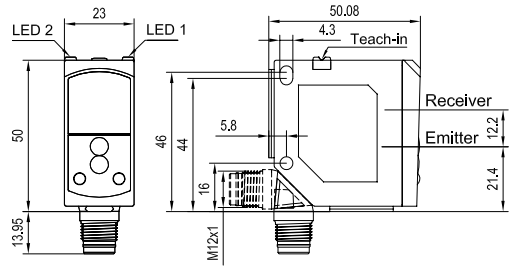
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 600 Hz
Response time	830 µs
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions	50 x 50.08 x 23 mm[3]
Enclosure rating	IP 69K & IP 67[3]
Material, housing	PC-ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	35 g
Weight (cable device)	125 g
Vibration and impact resistance	EN 60947-5-2

[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

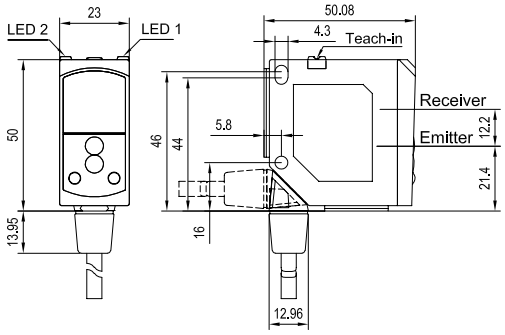
Scanning distance	Switching output	Type of connection	Part number	Article number
5 … 1200 mm	PNP	Plug, M12x1, 4-pin	FT 55-RL2-PS-L4	622-21006
5 … 1200 mm	NPN	Plug, M12x1, 4-pin	FT 55-RL2-NS-L4	622-21007
5 … 1200 mm	PNP	Cable, 3 m, 4-wire	FT 55-RL2-PS-K4	622-21009
5 … 1200 mm	NPN	Cable, 3 m, 4-wire	FT 55-RL2-NS-K4	622-21010

Plug connection



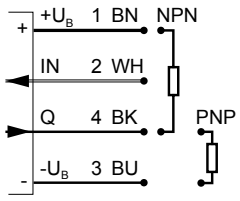
153-00848

Cable connection



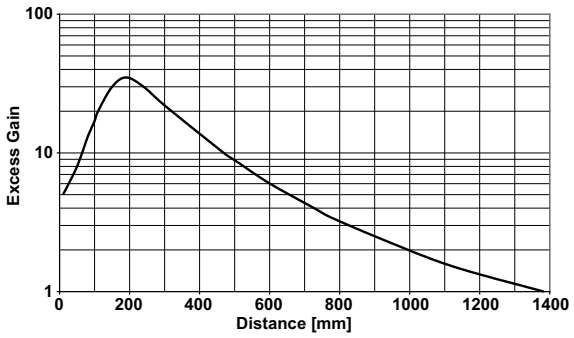
153-00849

Connection, 4-pin



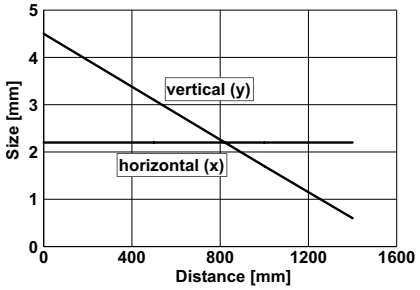
154-00312

Functional reserves



155-01238

Light spot size



155-01239

Reference material	Detection range
White (90 %)	5 … 1200 mm
Grey (18 %)	10 … 700 mm
Black (6 %)	100 … 400 mm

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FT 55-R

Diffuse photoelectric proximity sensor



PRODUCT HIGHLIGHTS

- Differentiation of even the slightest of grey value differences
- Sensor adjustment via teach-in and control input
- Simple alignment thanks to easily visible light spot
- Plug and cable connection rotatable

Optical data	
Scanning distance	5 … 2000 mm[1]
Type of light	LED, red, 640 nm
Light spot size	See diagram

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running process Mode 2: during standing process
Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. scanning distance and N.O.

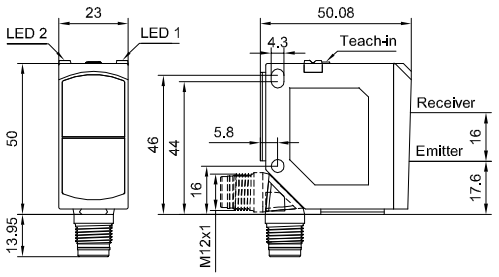
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 600 Hz
Response time	830 µs
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions	50 x 50.08 x 23 mm[3]
Enclosure rating	IP 69K & IP 67[3]
Material, housing	PC-ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	35 g
Weight (cable device)	125 g
Vibration and impact resistance	EN 60947-5-2

[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

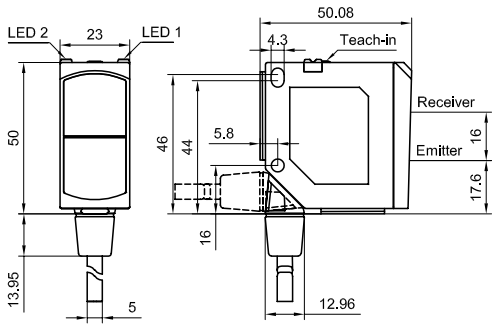
Scanning distance	Switching output	Type of connection	Part number	Article number
5 … 2000 mm	PNP	Plug, M12x1, 4-pin	FT 55-R-PS-L4	622-21000
5 … 2000 mm	NPN	Plug, M12x1, 4-pin	FT 55-R-NS-L4	622-21001
5 … 2000 mm	PNP	Cable, 3 m, 4-wire	FT 55-R-PS-K4	622-21003
5 … 2000 mm	NPN	Cable, 3 m, 4-wire	FT 55-R-NS-K4	622-21004

Plug connection



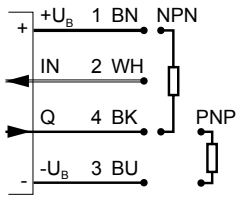
153-00782

Cable connection



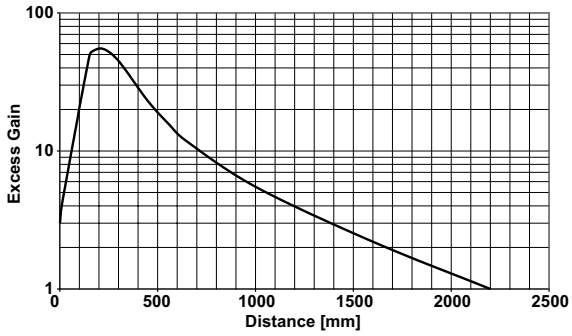
153-00783

Connection, 4-pin



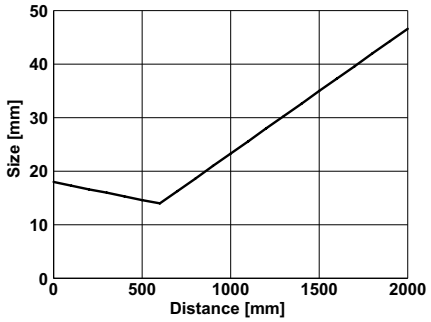
154-00312

Functional reserves



155-00982

Light spot size



155-00983

Reference material	Detection range
White (90 %)	5 … 2000 mm
Grey (18 %)	10 … 1200 mm
Black (6 %)	90 … 600 mm

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

FT 55-RM

Diffuse photoelectric proximity sensor – stainless steel housing



PRODUCT HIGHLIGHTS

- Stable stainless steel housing – ideal for use in hygiene zones, e.g. in the food and beverages industries
- Housing concept designed for intensive cleaning processes
- Sensor adjustment via teach-in and control input
- Simple alignment thanks to easily visible light spot

Optical data	
Scanning distance	0 … 1750 mm[1]
Type of light	LED, red, 640 nm
Light spot size	See diagram

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running process Mode 2: during standing process
Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. scanning distance and N.O.

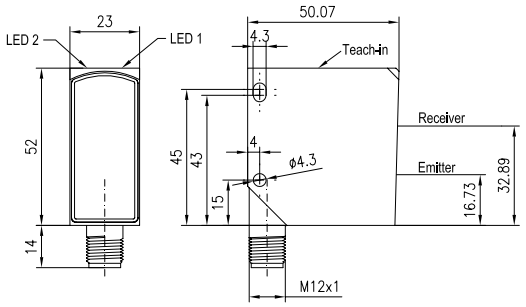
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 600 Hz
Response time	830 µs
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions	52 x 50.07 x 23 mm[3]
Enclosure rating	IP 69K & IP 67[3]
Material, housing	Stainless steel, 316L
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	138 g
Vibration and impact resistance	EN 60947-5-2

[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

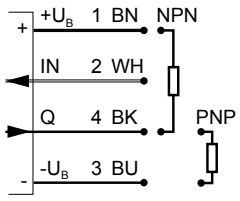
Scanning distance	Switching output	Type of connection	Part number	Article number
0 … 1750 mm	PNP	Plug, M12x1, 4-pin	FT 55-RM-PS-L4	622-21012
0 … 1750 mm	NPN	Plug, M12x1, 4-pin	FT 55-RM-NS-L4	622-21013

Plug connection



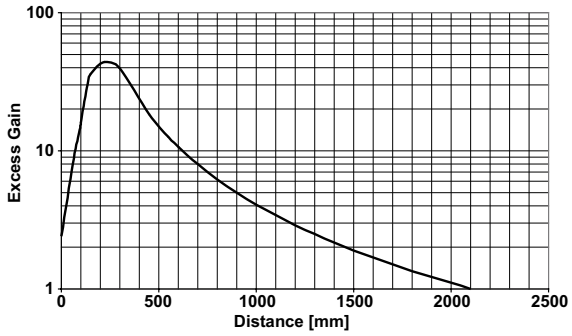
153-00800

Connection, 4-pin



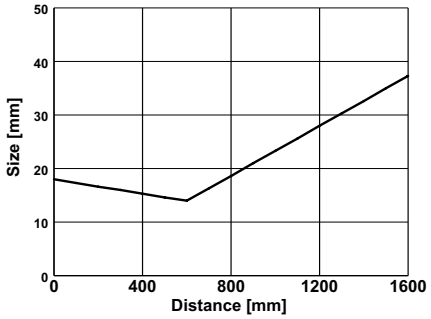
154-00312

Functional reserves



155-01163

Light spot size



155-01111

Reference material	Detection range
White (90 %)	0 … 1750 mm
Grey (18 %)	15 … 1100 mm
Black (6 %)	90 … 550 mm

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

FR 55-RLO

Autocollimation laser retroreflective photoelectric sensor



PRODUCT HIGHLIGHTS

- Reliable small-part detection from a size of 0.2 mm at a scanning distance of 0–5 m
- Precise front-edge detection even in fastest automation processes thanks to a high switching frequency of 5 kHz
- Reliable detection of objects through the smallest of openings thanks to autocollimation; therefore sensor can be placed outside any danger zone
- No blind zone - detection from a range of 0 mm

Optical data	
Limit range	0 … 25 m[1]
Operating range	0 … 20 m[1]
Type of light	Laser, red, 655 mm
Light spot size	See diagram
Laser Class (DIN EN 60825-1:2008-5)	1
Polarising filter	Yes

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running process Mode 2: during standing process
Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. range and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	See Selection Table
Response time	See Selection Table
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

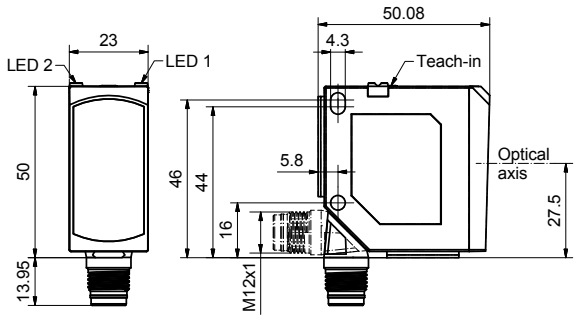
Mechanical data	
Dimensions	50 x 50.08 x 23 mm[3]
Enclosure rating	IP 69K & IP 67[3]
Material, housing	PC-ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	35 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: R5/L reflector [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 / IP 69K plug

Switching frequency f (ti/tp 1:1)[2]	Response time	Switching output	Type of connection	Part number	Article number
≤ 5 kHz	100 µs	PNP	Plug M12x1, 4-pin	FR 55-RLO1-PS-L4	621-11021
≤ 5 kHz	100 µs	NPN	Plug M12x1, 4-pin	FR 55-RLO1-NS-L4	621-11022
≤ 2,5 kHz	200 µs	PNP	Plug M12x1, 4-pin	FR 55-RLO2-PS-L4	621-11023
≤ 2,5 kHz	200 µs	NPN	Plug M12x1, 4-pin	FR 55-RLO2-NS-L4	621-11024

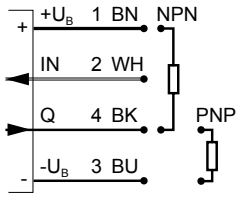
Version: 10/2013. Subject to changes; diagrams similar

Plug connection



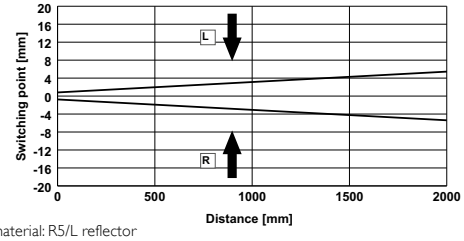
153-01090

Connection, 4-pin



154-00312

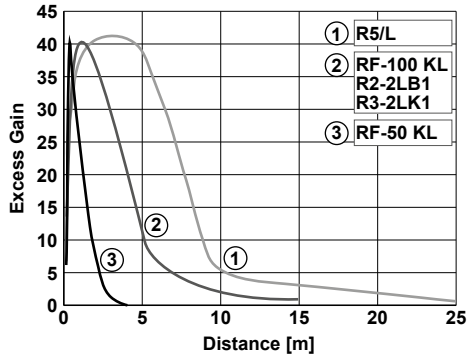
Lateral object approach



Reference material: R5/L reflector

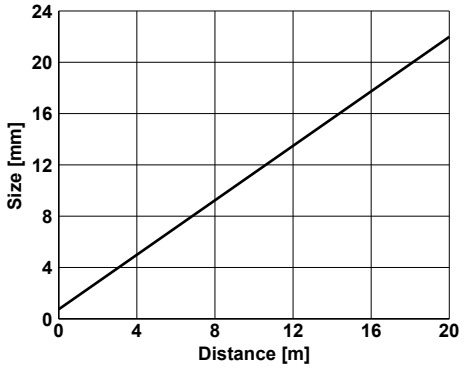
155-01724

Functional reserves



155-01723

Light spot size



155-01722

Reflector	Operating range (min./max. reflector distance)
R5/L	0 … 20 m
RF-100 KL	0 … 15 m
R2-2LB1	0 … 15 m
R3-2LK1	0 … 15 m
RF-50 KL	0 … 3 m

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

FR 55-RL

Laser retroreflective photoelectric sensor



PRODUCT HIGHLIGHTS

- Particularly suitable for the detection of the smallest of objects – smallest detectable part < 2 mm
- Bright, precise laser light spot in Laser Class 1
- Suitable for a wide variety of different reflectors
- Sensor adjustment via teach-in and control input

Optical data	
Limit range	0.3 … 14 m[1]
Operating range	0.3 … 12 m[1]
Type of light	Laser, red, 655 nm
Light spot size	See diagram
Laser Class (DIN EN 60825-1:2008-5)	1
Polarising filter	Yes

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running process Mode 2: during standing process
Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. range and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 2000 Hz
Response time	250 µs
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

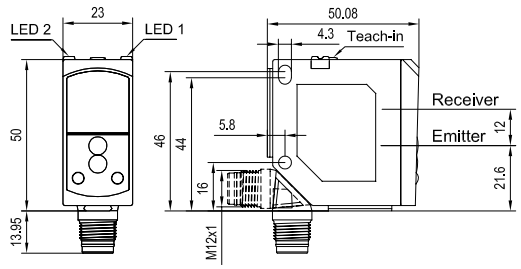
Mechanical data	
Dimensions	50 x 50.08 x 23 mm[3]
Enclosure rating	IP 69K & IP 67[3]
Material, housing	PC-ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	35 g
Weight (cable device)	125 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: R5/L reflector [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 / IP 69K plug

Operating range	Switching output	Type of connection	Part number	Article number
0.3 … 12 m	PNP	Plug, M12x1, 4-pin	FR 55-RL-PS-L4	621-11006
0.3 … 12 m	NPN	Plug, M12x1, 4-pin	FR 55-RL-NS-L4	621-11007
0.3 … 12 m	PNP	Cable, 3 m, 4-wire	FR 55-RL-PS-K4	621-11009
0.3 … 12 m	NPN	Cable, 3 m, 4-wire	FR 55-RL-NS-K4	621-11010

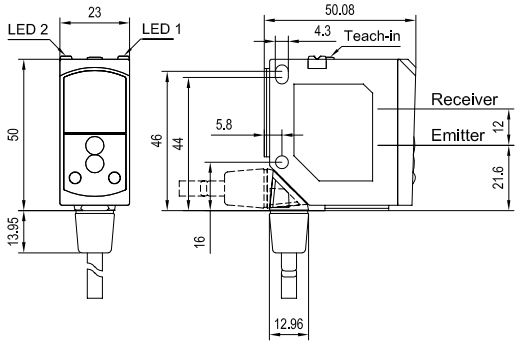
Version: 10/2013. Subject to changes; diagrams similar

Plug connection



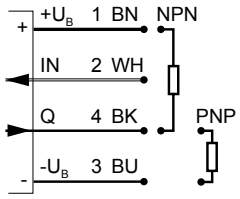
153-00804

Cable connection



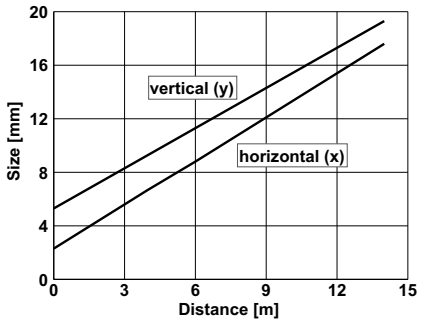
153-00805

Connection, 4-pin



154-00312

Light spot size



155-01114

Reflector / reflective foil*	Operating range
R5/L	0.3 … 12 m
RF-100 KL*	0.2 … 6 m

Accessories

Reflectors	From Page A-16
Connection cables	From Page A-32
Brackets	From Page A-4

8

FR 55-R

Retroreflective photoelectric sensor



PRODUCT HIGHLIGHTS

- Simple alignment thanks to easily visible light spot
- Suitable for a wide variety of different reflectors
- Sensor adjustment via teach-in and control input
- Plug and cable connection rotatable

Optical data	
Limit range	0.3 … 14 m[1]
Operating range	0.3 … 12 m[1]
Type of light	LED, red, 640 nm
Light spot size	See diagram
Polarising filter	Yes

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running process Mode 2: during standing process
Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	S_n = 8 m and N.O.

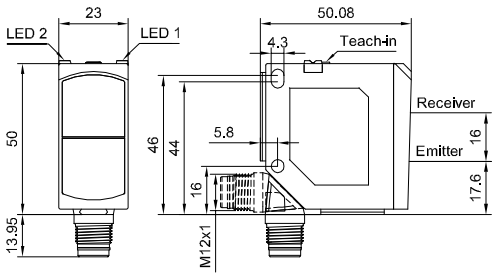
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 600 Hz
Response time	830 µs
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions	50 x 50.08 x 23 mm[3]
Enclosure rating	IP 69K & IP 67[3]
Material, housing	PC-ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	35 g
Weight (cable device)	125 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: R10 reflector [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 / IP 69K plug

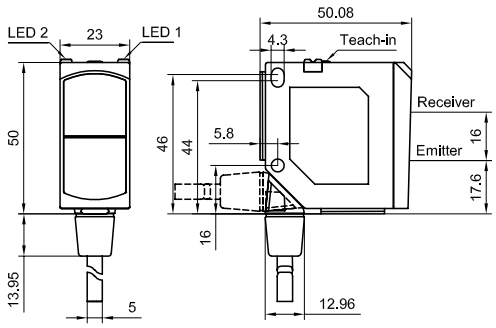
Operating range	Switching output	Type of connection	Part number	Article number
0.3 … 12 m	PNP	Plug, M12x1, 4-pin	FR 55-R-PS-L4	621-11000
0.3 … 12 m	NPN	Plug, M12x1, 4-pin	FR 55-R-NS-L4	621-11001
0.3 … 12 m	PNP	Cable, 3 m, 4-wire	FR 55-R-PS-K4	621-11003
0.3 … 12 m	NPN	Cable, 3 m, 4-wire	FR 55-R-NS-K4	621-11004

Plug connection



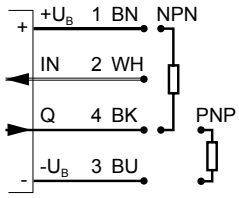
153-00782

Cable connection



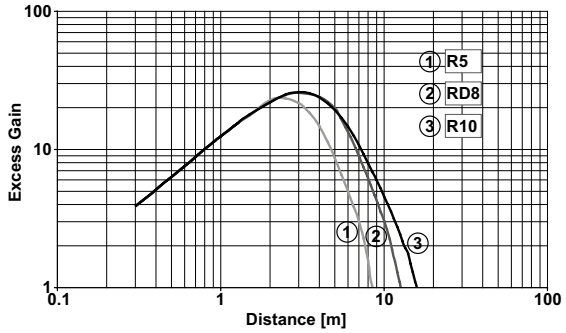
153-00783

Connection, 4-pin



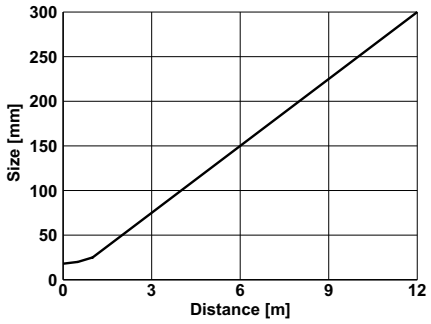
154-00312

Functional reserves



155-00985

Light spot size



155-00984

Reflector / reflective tape*	Operating range
R10	0.3 … 12 m
RD8	0.3 … 10 m
R5	0.3 … 6 m
RF-100 KL*	0.25 … 6 m

Accessories	
Reflectors	From Page A-16
Connection cables	From Page A-32
Brackets	From Page A-4

FR 55-RM

Retroreflective photoelectric sensor – stainless steel housing



PRODUCT HIGHLIGHTS

- Stable stainless steel housing – ideal for use in hygiene zones, e.g. in the food and beverages industries
- Housing concept designed for intensive cleaning processes
- Sensor adjustment via teach-in and control input
- Simple alignment thanks to easily visible light spot

Optical data	
Limit range	0.4 … 13 m[1]
Operating range	0.4 … 11 m[1]
Type of light	LED, red, 640 nm
Light spot size	See diagram
Polarising filter	Yes

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running process Mode 2: during standing process
Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	S_n = 8 m and N.O.

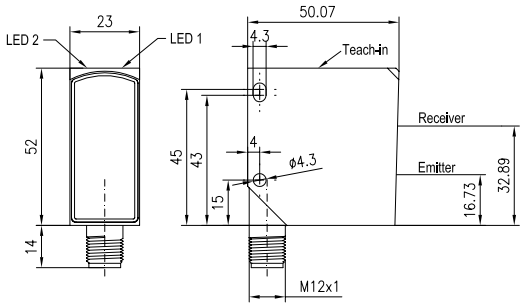
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 600 Hz
Response time	830 µs
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions	52 x 50.07 x 23 mm[3]
Enclosure rating	IP 69K & IP 67[3]
Material, housing	Stainless steel, 316L
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	138 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: R10 reflector [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 / IP 69K plug

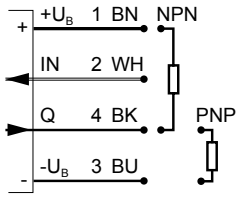
Operating range	Switching output	Type of connection	Part number	Article number
0.4 … 11 m	PNP	Plug, M12x1, 4-pin	FR 55-RM-PS-L4	621-11012
0.4 … 11 m	NPN	Plug, M12x1, 4-pin	FR 55-RM-NS-L4	621-11013

Plug connection



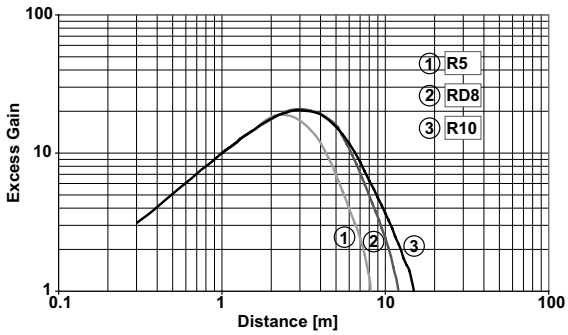
153-00800

Connection, 4-pin



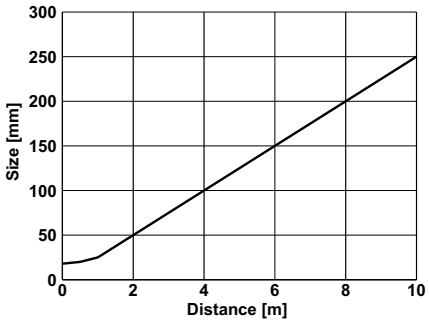
154-00312

Functional reserves



155-01162

Light spot size



155-01112

Reflector	Operating range
R10	0.4 … 11 m
RD8	0.4 … 9 m
R5	0.4 … 6 m

Accessories	
Reflectors	From Page A-16
Connection cables	From Page A-32
Brackets	From Page A-4

FS/FE 55-RL

Laser through-beam photoelectric sensor



PRODUCT HIGHLIGHTS

- Long range combined with precise laser light spot for extremely accurate small-part detection
- High switching frequency for the reliable detection of even the most rapid processes
- Sensor adjustment via teach-in and control input
- Plug and cable connection rotatable

Optical data	
Limit range	0 … 30 m
Operating range	0 … 25 m
Type of light	Laser, red, 655 nm
Light spot size	See diagram
Laser Class (DIN EN 60825-1:2008-5)	1

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Indicator LED, red (receiver)	Alignment indicator
Sensitivity adjustment (receiver)	Via Teach-in button and control input
Teach-in modes	Mode 1: during running process Mode 2: during standing process
Adjustment possibilities (receiver)	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. range and N.O.

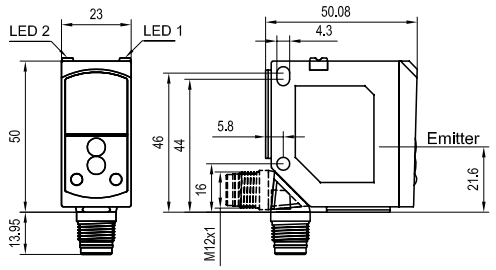
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
No-load current, I_0	≤ 30mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 3500 Hz
Response time	140 µs
Control input, IN (receiver)	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation
Control input, TEST (transmitter)	$+U_B$ = Test (transmitter off) $-U_B$ / Open = normal operation

Mechanical data	
Dimensions	50 x 50.08 x 23 mm[3]
Enclosure rating	IP 69K & IP 67[2]
Material, housing	PC-ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	35 g
Weight (cable device)	125 g
Vibration and impact resistance	EN 60947-5-2

[1] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [2] With connected IP 67 / IP 69K plug

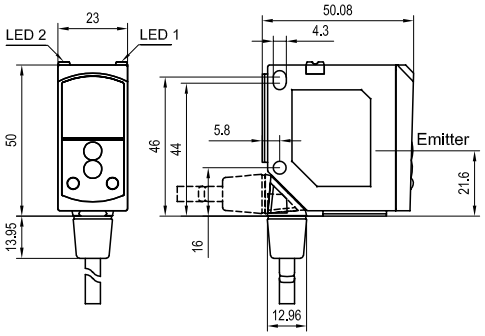
Operating range	Switching output	Type of connection	Part number	Article number
0 … 25 m	PNP	Plug, M12x1, 4-pin	FE 55-RL-PS-L4	620-21006
0 … 25 m	NPN	Plug, M12x1, 4-pin	FE 55-RL-NS-L4	620-21007
0 … 25 m	–	Plug, M12x1, 4-pin	FS 55-RL-L4	620-11002
0 … 25 m	PNP	Cable, 3 m, 4-wire	FE 55-RL-PS-K4	620-21009
0 … 25 m	NPN	Cable, 3 m, 4-wire	FE 55-RL-NS-K4	620-21010
0 … 25 m	–	Cable, 3 m, 4-wire	FS 55-RL-K4	620-11003

Plug connection (transmitter)



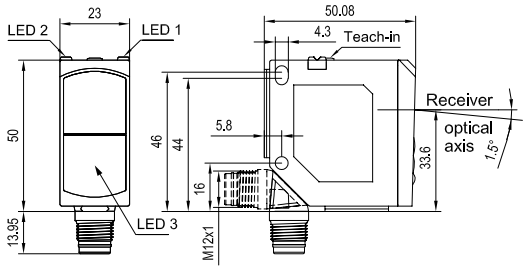
153-00808

Cable connection (transmitter)



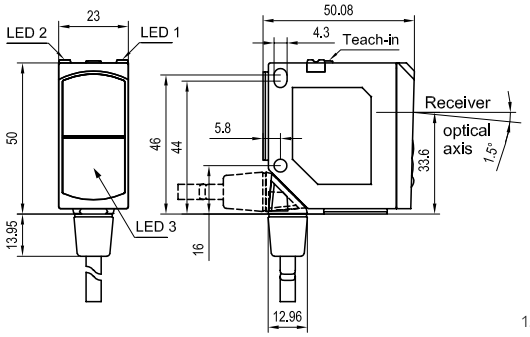
153-00809

Plug connection (receiver)



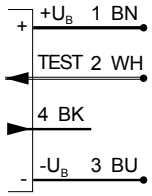
153-00812

Cable connection (receiver)



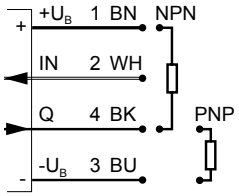
153-00813

Connection, transmitter, 4-pin



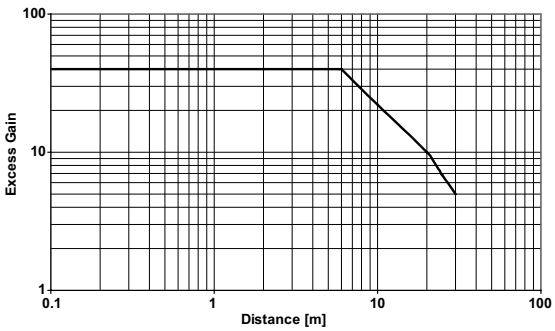
154-00315

Connection, receiver, 4-pin



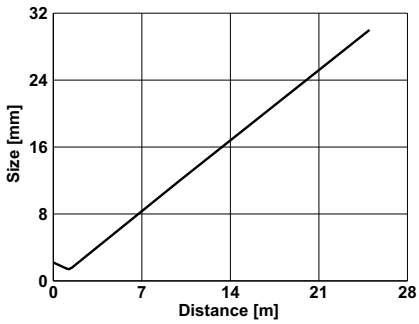
154-00312

Functional reserves



155-01138

Light spot size



155-01139

Accessories

Connection cables	From Page A-32	Brackets	From Page A-4

FS/FE 55-R

Through-beam photoelectric sensor



PRODUCT HIGHLIGHTS

- Alignment indicator and easily visible light spot for simple alignment of the through-beam system
- Test input to check sensor pair function
- Sensor adjustment via teach-in and control input
- Plug and cable connection rotatable

Optical data	
Limit range	0 … 25 m
Operating range	0 … 20 m
Type of light	LED, red, 640 nm
Light spot size	See diagram

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Indicator LED, red (receiver)	Alignment indicator
Sensitivity adjustment (receiver)	Via Teach-in button and control input
Teach-in modes	Mode 1: during running process Mode 2: during standing process
Adjustment possibilities (receiver)	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. range and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 500 Hz
Response time	1 ms
Control input, IN (receiver)	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation
Control input, TEST (transmitter)	$+U_B$ = Test (transmitter off) $-U_B$ / Open = normal operation

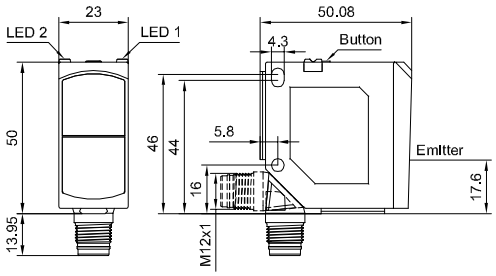
Mechanical data	
Dimensions	50 x 50.08 x 23 mm[3]
Enclosure rating	IP 69K & IP 67[2]
Material, housing	PC-ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	35 g
Weight (cable device)	125 g
Vibration and impact resistance	EN 60947-5-2

[1] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [2] With connected IP 67 / IP 69K plug

Operating range	Switching output	Type of connection	Part number	Article number
0 … 20 m	PNP	Plug, M12x1, 4-pin	FE 55-R-PS-L4	620-21000
0 … 20 m	NPN	Plug, M12x1, 4-pin	FE 55-R-NS-L4	620-21001
0 … 20 m	–	Plug, M12x1, 4-pin	FS 55-R-L4	620-11000
0 … 20 m	PNP	Cable, 3 m, 4-wire	FE 55-R-PS-K4	620-21003
0 … 20 m	NPN	Cable, 3 m, 4-wire	FE 55-R-NS-K4	620-21004
0 … 20 m	–	Cable, 3 m, 4-wire	FS 55-R-K4	620-11001

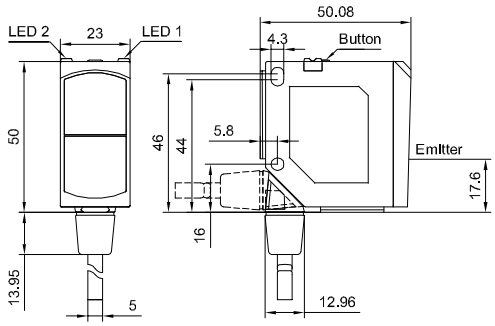
Version: 10/2013. Subject to changes; diagrams similar

Plug connection (transmitter)



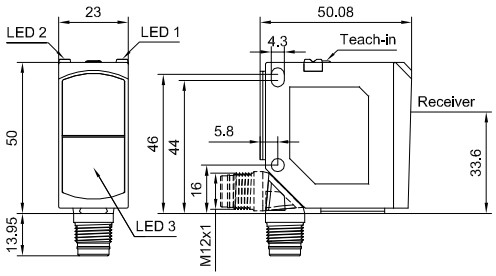
153-00787

Cable connection (transmitter)



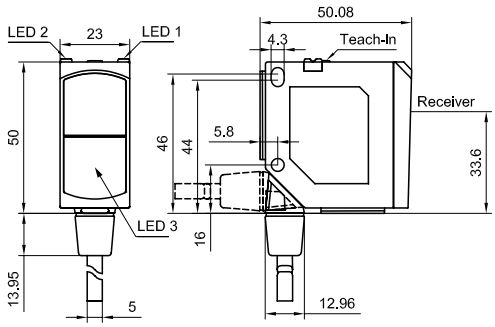
153-00786

Plug connection (receiver)



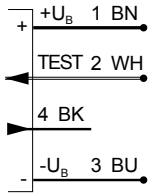
153-00790

Cable connection (receiver)



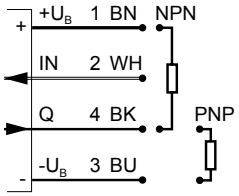
153-00791

Connection, transmitter, 4-pin



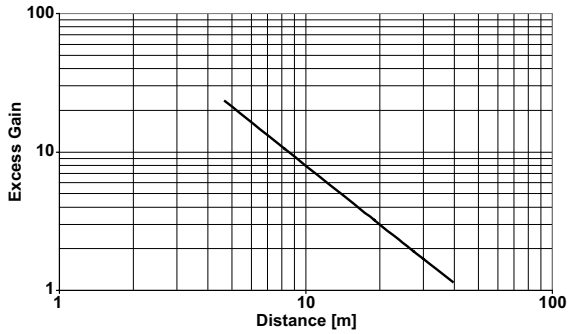
154-00315

Connection, receiver, 4-pin



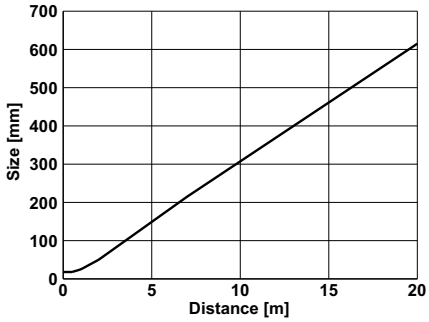
154-00312

Functional reserves



155-00986

Light spot size



155-00994

Accessories

Connection cables	From Page A-32	Brackets	From Page A-4

FS/FE 55-RM

Through-beam photoelectric sensor – stainless steel housing



PRODUCT HIGHLIGHTS

- Stable stainless steel housing – ideal for use in hygiene zones, e.g. in the food and beverages industries
- Housing concept designed for intensive cleaning processes
- Sensor adjustment via teach-in and control input
- Simple alignment thanks to easily visible light spot and alignment indicator

Optical data	
Limit range	0 … 20 m
Operating range	0 … 15 m
Type of light	LED, red, 640 nm
Light spot size	See diagram

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Indicator LED, red (receiver)	Alignment indicator
Sensitivity adjustment (receiver)	Via Teach-in button and control input
Teach-in modes	Mode 1: during running process Mode 2: during standing process
Adjustment possibilities (receiver)	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. range and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 500Hz
Response time	1 ms
Control input, IN (receiver)	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation
Control input, TEST (transmitter)	$+U_B$ = Test (transmitter off) $-U_B$ / Open = normal operation

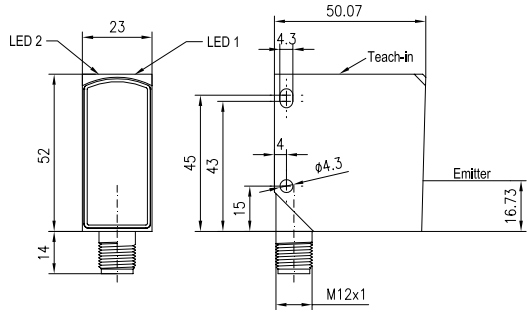
Mechanical data	
Dimensions	52 x 50.07 x 23 mm[3]
Enclosure rating	IP 69K & IP 67[2]
Material, housing	Stainless steel, 316L
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	138 g
Vibration and impact resistance	EN 60947-5-2

[1] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [2] With connected IP 67 / IP 69K plug

Operating range	Switching output	Type of connection	Part number	Article number
0 … 15 m	PNP	Plug, M12x1, 4-pin	FE 55-RM-PS-L4	620-21012
0 … 15 m	NPN	Plug, M12x1, 4-pin	FE 55-RM-NS-L4	620-21013
0 … 15 m	–	Plug, M12x1, 4-pin	FS 55-RM-L4	620-11004

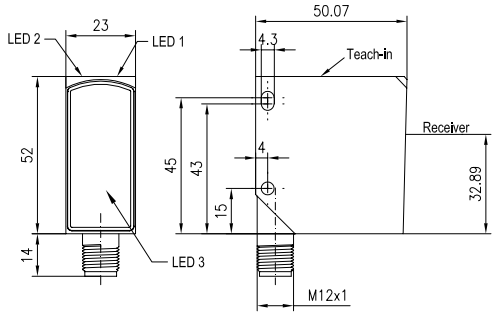
Version: 10/2013. Subject to changes; diagrams similar

Plug connection (transmitter)



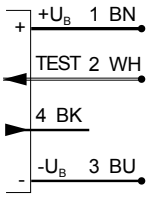
153-00802

Plug connection (receiver)



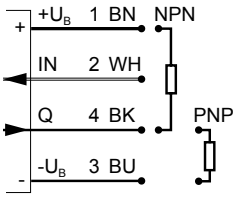
153-00801

Connection, transmitter, 4-pin



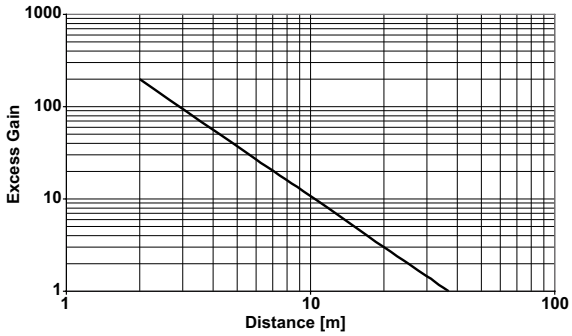
154-00315

Connection, receiver, 4-pin



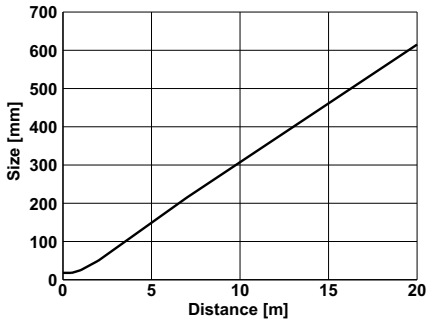
154-00312

Functional reserves



155-01165

Light spot size



155-01166

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

F 20 – photoelectric sensors and proximity sensors in miniature housings

The well-proven sensor series



Of all SensoPart's sensor series, the F 20 is the one with the largest range of variants – so that it contains the right sensor for almost every application. F 20 sensors are therefore found in numerous sectors, for example in the automotive industry, in mechanical engineering, in the electronics and beverages industries, as well as in packaging machines and in the print and paper industries.

The applications of the F 20 series range from positioning tasks to the detection of transparent objects and the smallest of parts: the FR 20-RLO photoelectric proximity sensor reliably detects parts from a size of 0.2 mm. Thanks to its autocollimation principle, it covers the entire range without a blind zone and even "sees" through the smallest drilled holes or apertures.



Compact and robust:
With its miniature housing, the F 20 is suitable for almost all applications. All sensors in this series are equipped with metal plugs so they are very tough and long-lived.

Not only is the variety offered by the F 20 series impressive, but also its uncompromising industrial suitability. Every sensor is serially equipped with a robust metal plug, well thought-out mounting accessories, and simple adjustment via teach-in or via the control input – because it is often these details that decide on the suitability of a sensor in everyday operation.

TYPICAL F 20

- Largest choice of variants for numerous requirements
- Compact miniature housings for extremely limited mounting conditions
- Detection of transparent objects of any shape
- Most accurate small-part detection throughout the entire range from 0 mm
- Reliable suppression of highly reflective machine parts
- Laser, LED or infrared transmitter options, with teach-in or fixed settings
- User-friendly commissioning via electronic Teach-in button or control line
- Well thought-out mounting accessories for rapid and simple integration
- UL-certification

F 20 – Product Overview					
	Type of light	Adjustment	Scanning distance / range	Special features	Page
Photoelectric proximity sensors with background suppression					
FT 20 RLH	Laser	Teach-in	60 mm		316
FT 20 RLHD	Laser	Teach-in	110 mm	Long scanning distance	318
FT 20 RH	LED	Teach-in	100 mm		320
FT 20 IH	Infrared	Teach-in	150 mm		322
FT 23 RF	LED	Fixed focus	60 / 80 mm		324
Photoelectric proximity sensors					
FT 20 RL	Laser	Teach-in	150 mm		326
FT 20 R	LED	Teach-in	300 mm		328
FT 23 R	LED	Fixed setting	300 mm		330
Retroreflective photoelectric sensors					
FR 20 RG1	LED	Teach-in	0.5 m	For transparent objects, using autocollimation principle	332
FR 20 RG	LED	Teach-in	0.5 m	For transparent objects	334
FR 20 RLO	Laser	Teach-in	4 m	Very accurate object positioning, no blind zone	336
FR 20 RL	Laser	Teach-in	3 m	Very accurate object positioning	338
FR 20 R	LED	Teach-in	2.5 m		340
FR 20 RD	LED	Teach-in	3.5 m		342
FR 23 R	LED	Fixed setting	2.5 m		344
Through-beam photoelectric sensors					
FS/FE 20 R	LED	Teach-in	8 m		346
FS/FE 23 R	LED	Fixed setting	4 m		348

FT 20 RLH

Laser photoelectric proximity sensor with background suppression



PRODUCT HIGHLIGHTS

- Detection of the smallest parts
- Precise background suppression
- Laser Protection Class 1
- Sensor adjustment via teach-in and control input
- Compact miniature housing

Optical data	
Scanning distance	20 … 60 mm[1]
Type of light	Laser, red, 650 nm
Light spot size	See table
Laser Class (DIN EN 60825-1:2008-5)	1

Functions	
Indicator LED, green	Operating voltage indicator / contamination indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Scanning distance adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running operation Mode 2: during standing process
Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. scanning distance and N.O.

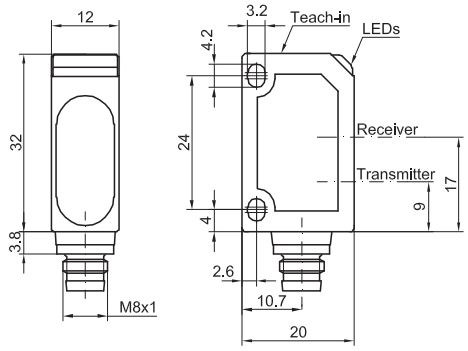
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Control input, IN[2]	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions	32 x 20 x 12 mm[3]
Enclosure rating	IP 67[3]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: grey, 18 % reflectivity [2] Only 4-pin design [3] With connected IP 67 plug

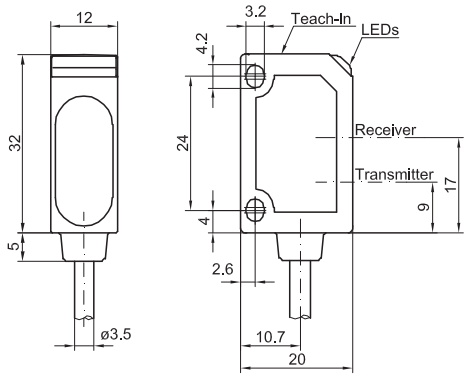
Scanning distance	Switching output	Type of connection	Part number	Article number
20 … 60 mm	PNP	Metal plug, M8x1, 3-pin	FT 20 RLH-PSM3	551-11019
20 … 60 mm	NPN	Metal plug, M8x1, 3-pin	FT 20 RLH-NSM3	551-11020
20 … 60 mm	PNP	Metal plug, M8x1, 4-pin	FT 20 RLH-PSM4	551-11014
20 … 60 mm	NPN	Metal plug, M8x1, 4-pin	FT 20 RLH-NSM4	551-11016
20 … 60 mm	PNP	Cable, 2 m, 4-wire	FT 20 RLH-PSK4	551-11015
20 … 60 mm	NPN	Cable, 2 m, 4-wire	FT 20 RLH-NSK4	551-11017

Plug connection



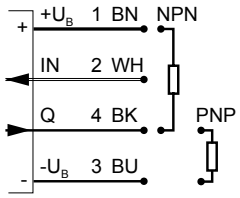
153-00382

Cable connection



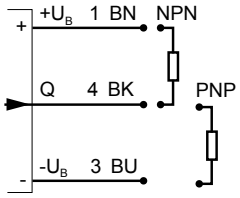
153-00381

Connection, 4-pin



154-00312

Connection, 3-pin



154-00311

Light spot size

Scanning distance (mm)	20	35	40	60
Light spot diameter (mm)	1.5	0.1	0.5	2.5

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FT 20 RLHD

Laser photoelectric proximity sensor with background suppression



PRODUCT HIGHLIGHTS

- Detection of the smallest parts
- Precise background suppression
- Very small, easily visible laser light spot
- Sensor adjustment via teach-in and control input
- Compact miniature housing

Optical data	
Scanning distance	30 … 110 mm[1]
Type of light	Laser, red, 650 nm
Light spot size[2]	Ø < 0.7 mm
Laser Class (DIN EN 60825-1:2008-5)	2

Functions	
Indicator LED, green	Operating voltage indicator / contamination indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Scanning distance adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running operation Mode 2: during standing process
Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. scanning distance and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Control input, IN[3]	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

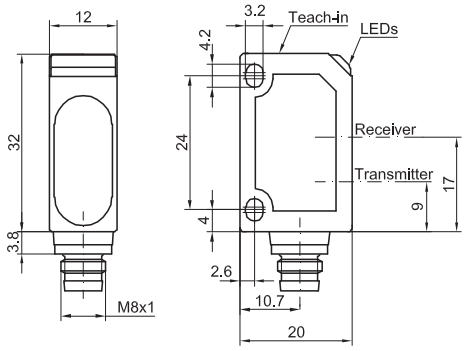
Mechanical data	
Dimensions	32 x 20 x 12 mm[3]
Enclosure rating	IP 67[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: grey, 18 % reflectivity [2] In focus [3] Only 4-pin design [4] With connected IP 67 plug

Scanning distance	Switching output	Type of connection	Part number	Article number
30 … 110 mm	PNP	Metal plug, M8x1, 3-pin	FT 20 RLHD-PSM3	551-11026
30 … 110 mm	PNP	Metal plug, M8x1, 4-pin	FT 20 RLHD-PSM4	551-11022
30 … 110 mm	NPN	Metal plug, M8x1, 4-pin	FT 20 RLHD-NSM4	551-11023
30 … 110 mm	PNP	Cable, 2 m, 4-wire	FT 20 RLHD-PSK4	551-11024
30 … 110 mm	NPN	Cable, 2 m, 4-wire	FT 20 RLHD-NSK4	551-11025

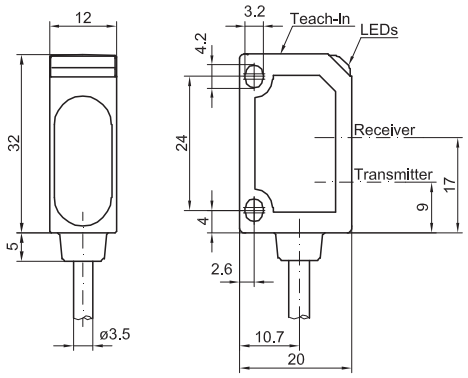
Version: 10/2013. Subject to changes; diagrams similar

Plug connection



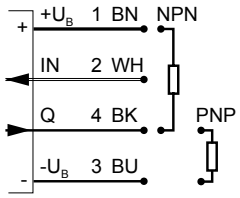
153-00382

Cable connection



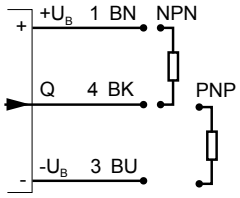
153-00381

Connection, 4-pin



154-00312

Connection, 3-pin



154-00311

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FT 20 RH

Photoelectric proximity sensor with background suppression



PRODUCT HIGHLIGHTS

- Precise background suppression
- Simple alignment thanks to easily visible light spot
- Compact miniature housing
- Large range of variants

Optical data	
Scanning distance	25 … 100 mm[1]
Type of light	LED, red, 640 nm
Light spot size[2]	< 5 x 5 mm[2]

Functions	
Indicator LED, green	Operating voltage indicator / contamination indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Scanning distance adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running operation Mode 2: during standing process
Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. scanning distance and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Control input, IN[3]	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

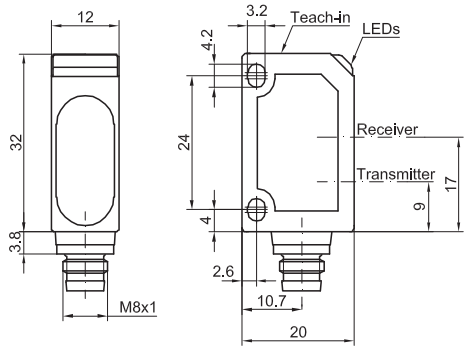
Mechanical data	
Dimensions	32 x 20 x 12 mm[3]
Enclosure rating	IP 67[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: grey, 18 % reflectivity [2] At scanning distance of 60 mm [3] Only 4-pin design [4] With connected IP 67 plug

Scanning distance	Switching output	Type of connection	Part number	Article number
25 … 100 mm	PNP	Metal plug, M8x1, 3-pin	FT 20 RH-PSM3	551-11004
25 … 100 mm	NPN	Metal plug, M8x1, 3-pin	FT 20 RH-NSM3	551-11005
25 … 100 mm	PNP	Metal plug, M8x1, 4-pin	FT 20 RH-PSM4	551-11000
25 … 100 mm	NPN	Metal plug, M8x1, 4-pin	FT 20 RH-NSM4	551-11002
25 … 100 mm	PNP	Cable, 2 m, 4-wire	FT 20 RH-PSK4	551-11001
25 … 100 mm	NPN	Cable, 2 m, 4-wire	FT 20 RH-NSK4	551-11003

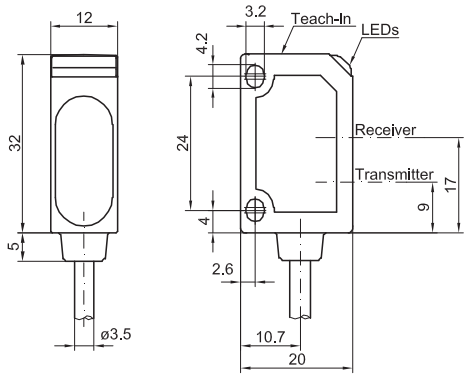
Version: 10/2013. Subject to changes; diagrams similar

Plug connection



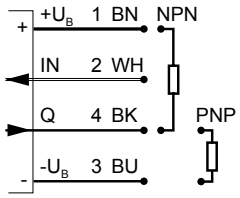
153-00382

Cable connection



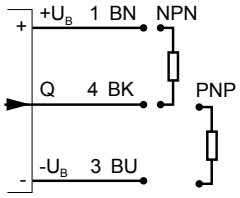
153-00381

Connection, 4-pin



154-00312

Connection, 3-pin



154-00311

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FT 20 IH

Infrared photoelectric proximity sensor with background suppression



PRODUCT HIGHLIGHTS

- Precise background suppression
- Sensor adjustment via teach-in and control input
- Stable metal plug connection
- Compact miniature housing

Optical data	
Scanning distance	30 … 150 mm[1]
Type of light	LED, infrared, 880 nm

Functions	
Indicator LED, green	Operating voltage indicator / contamination indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Scanning distance adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running operation Mode 2: during standing process
Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. scanning distance and N.O.

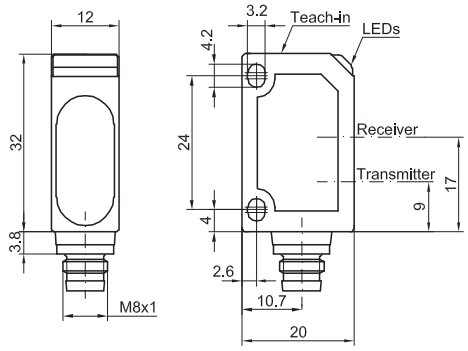
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Control input, IN[2]	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions	32 x 20 x 12 mm[3]
Enclosure rating	IP 67[3]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: grey, 18 % reflectivity [2] Only 4-pin design [3] With connected IP 67 plug

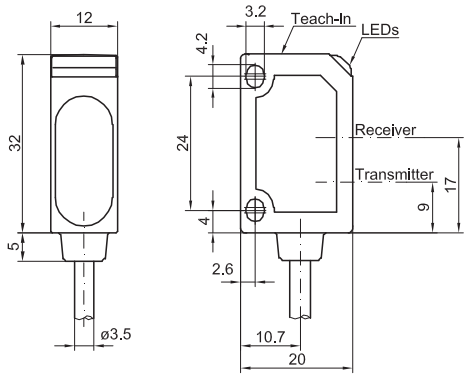
Scanning distance	Switching output	Type of connection	Part number	Article number
30 … 150 mm	PNP	Metal plug, M8x1, 3-pin	FT 20 IH-PSM3	551-11021
30 … 150 mm	PNP	Metal plug, M8x1, 4-pin	FT 20 IH-PSM4	551-11010
30 … 150 mm	NPN	Metal plug, M8x1, 4-pin	FT 20 IH-NSM4	551-11012
30 … 150 mm	PNP	Cable, 2 m, 4-wire	FT 20 IH-PSK4	551-11011
30 … 150 mm	NPN	Cable, 2 m, 4-wire	FT 20 IH-NSK4	551-11013

Plug connection



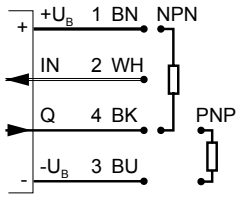
153-00382

Cable connection



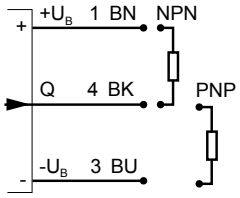
153-00381

Connection, 4-pin



154-00312

Connection, 3-pin



154-00311

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FT 23 RF

Photoelectric proximity sensor with background suppression, fixed focus



PRODUCT HIGHLIGHTS

- Economical solution for numerous applications
- Tamper-proof sensor design
- Simple alignment thanks to easily visible light spot
- Large range of variants

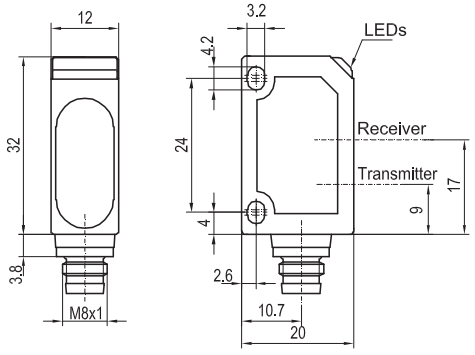
Optical data		Functions	
Scanning distance	60 mm[1] / 80 mm[1]	Indicator LED, green	Operating voltage indicator / contamination indicator
Type of light	LED, red, 660 nm	Indicator LED, yellow	Switching output indicator / contamination indicator
Light spot size[2]	5 x 5 mm[2]	Adjustment possibilities	N.O./N.C. via control input

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC	Dimensions	32 x 20 x 12 mm[3]
No-load current, I_0	≤ 25 mA	Enclosure rating	IP 67[3]
Output current, Ie	≤ 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
Switching output, Q	PNP/NPN (see Selection Table)	Ambient temperature: storage	-20 … +80 °C
Output function	N.O./N.C.	Weight (plug device)	10 g
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Weight (cable device)	40 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] At scanning distance of 60 mm [3] With connected IP 67 plug

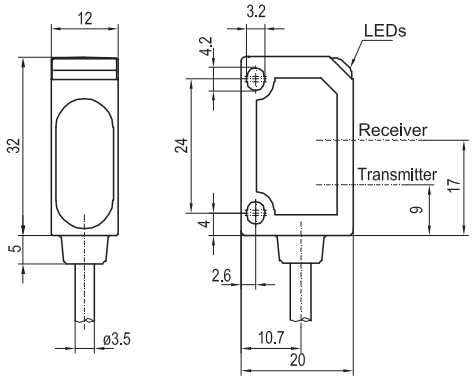
Scanning distance	Switching output	Type of connection	Part number	Article number
60 mm	PNP	Metal plug, M8x1, 4-pin	FT 23 RF-PSM4	551-21012
60 mm	NPN	Metal plug, M8x1, 4-pin	FT 23 RF-NSM4	551-21018
60 mm	PNP	Cable, 2 m, 4-wire	FT 23 RF-PSK4	551-21017
60 mm	NPN	Cable, 2 m, 4-wire	FT 23 RF-NSK4	551-21019
80 mm	NPN	Metal plug, M8x1, 4-pin	FT 23 RF-PSM4-X03	551-21024

Plug connection



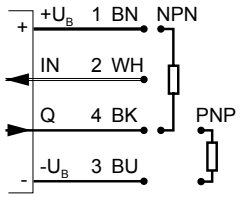
153-00380

Cable connection



153-00379

Connection, 4-pin



154-00312

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FT 20 RL

Diffuse laser photoelectric proximity sensor



PRODUCT HIGHLIGHTS

- High switching frequency of 4000 Hz
- Very small, easily visible laser light spot
- Sensor adjustment via teach-in and control input
- Compact miniature housing

Optical data	
Scanning distance	40 … 150 mm[1]
Type of light	Laser, red, 650 nm
Light spot size	See table
Laser Class (DIN EN 60825-1:2008-5)	2

Functions	
Indicator LED, green	Operating voltage indicator / contamination indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running operation Mode 2: during standing process
Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. scanning distance and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 4000 Hz
Response time	125 µs
Control input, IN[2]	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

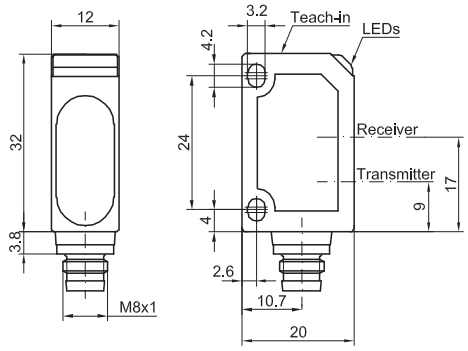
Mechanical data	
Dimensions	32 x 20 x 12 mm[3]
Enclosure rating	IP 67[3]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: white, 90 % reflectivity [2] Only 4-pin design [3] With connected IP 67 plug

Scanning distance	Switching output	Type of connection	Part number	Article number
40 … 150 mm	PNP	Metal plug, M8x1, 3-pin	FT 20 RL-PSM3	551-21022
40 … 150 mm	PNP	Metal plug, M8x1, 4-pin	FT 20 RL-PSM4	551-21007
40 … 150 mm	NPN	Metal plug, M8x1, 4-pin	FT 20 RL-NSM4	551-21009
40 … 150 mm	PNP	Cable, 2 m, 4-wire	FT 20 RL-PSK4	551-21008
40 … 150 mm	NPN	Cable, 2 m, 4-wire	FT 20 RL-NSK4	551-21010

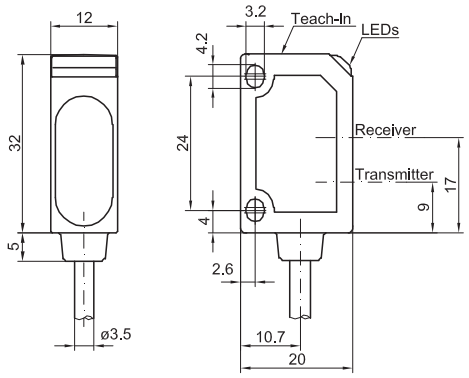
Version: 10/2013. Subject to changes; diagrams similar

Plug connection



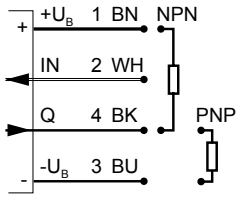
153-00382

Cable connection



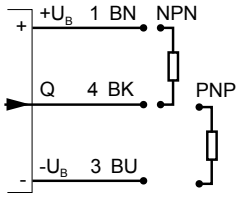
153-00381

Connection, 4-pin



154-00312

Connection, 3-pin



154-00311

Light spot size

Scanning distance (mm)	40	80	120	150
Light spot diameter (mm)	2	0.4	1.5	3

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FT 20 R

Diffuse photoelectric proximity sensor



PRODUCT HIGHLIGHTS

- Sensor adjustment via teach-in and control input
- Simple alignment thanks to easily visible light spot
- Compact miniature housing
- Large range of variants

Optical data	
Scanning distance	20 … 300 mm[1]
Type of light	LED, red, 660 nm
Light spot size[2]	12 x 12 mm[2]

Functions	
Indicator LED, green	Operating voltage indicator / contamination indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running operation Mode 2: during standing process
Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. scanning distance and N.O.

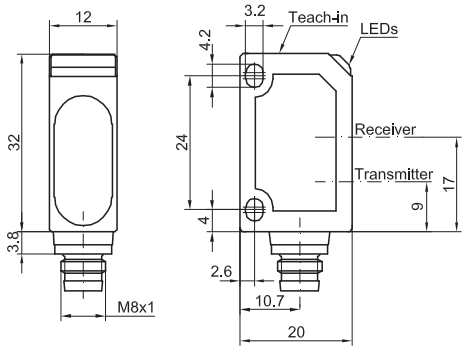
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Control input, IN[3]	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions	32 x 20 x 12 mm[3]
Enclosure rating	IP 67[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: white, 90 % reflectivity [2] At scanning distance of 160 mm [3] Only 4-pin design [4] With connected IP 67 plug

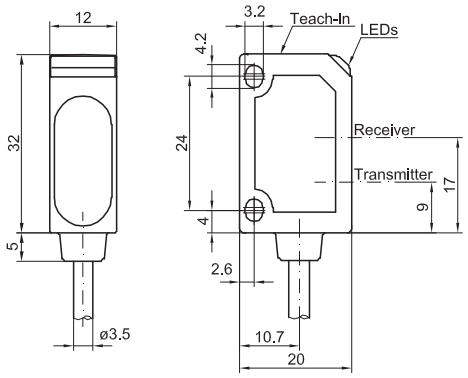
Scanning distance	Switching output	Type of connection	Part number	Article number
20 … 300 mm	PNP	Metal plug, M8x1, 3-pin	FT 20 R-PSM3	551-21004
20 … 300 mm	NPN	Metal plug, M8x1, 3-pin	FT 20 R-NSM3	551-21005
20 … 300 mm	PNP	Metal plug, M8x1, 4-pin	FT 20 R-PSM4	551-21000
20 … 300 mm	NPN	Metal plug, M8x1, 4-pin	FT 20 R-NSM4	551-21002
20 … 300 mm	PNP	Cable, 2 m, 4-wire	FT 20 R-PSK4	551-21001
20 … 300 mm	NPN	Cable, 2 m, 4-wire	FT 20 R-NSK4	551-21003

Plug connection



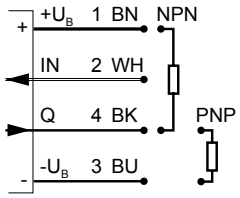
153-00382

Cable connection



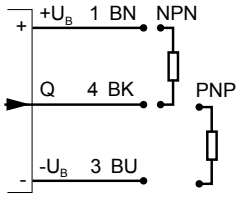
153-00381

Connection, 4-pin



154-00312

Connection, 3-pin



154-00311

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FT 23 R

Diffuse photoelectric proximity sensor, fixed setting



PRODUCT HIGHLIGHTS

- Economical solution for numerous applications
- Tamper-proof sensor design
- Simple alignment thanks to easily visible light spot
- Compact miniature housing

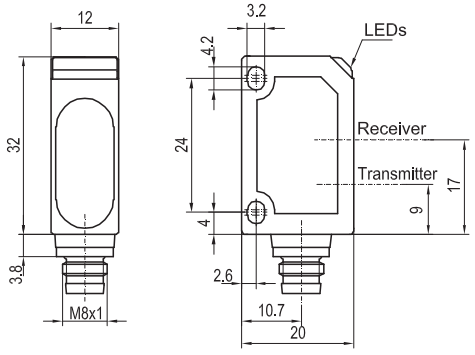
Optical data		Functions	
Scanning distance	20 … 300 mm[1]	Indicator LED, green	Operating voltage indicator / contamination indicator
Type of light	LED, red, 660 nm	Indicator LED, yellow	Switching output indicator / contamination indicator
Light spot size[2]	12 x 12 mm[2]	Adjustment possibilities	N.O./N.C. via control input

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC	Dimensions	32 x 20 x 12 mm[3]
No-load current, I_0	≤ 25 mA	Enclosure rating	IP 67[3]
Output current, Ie	≤ 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
Switching output, Q	PNP/NPN (see Selection Table)	Ambient temperature: storage	-20 … +80 °C
Output function	N.O./N.C.	Weight (plug device)	10 g
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Weight (cable device)	40 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] At scanning distance of 160 mm [3] With connected IP 67 plug

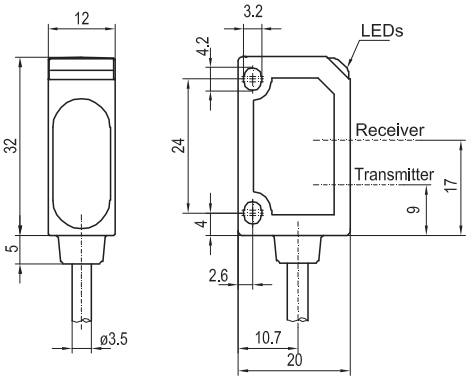
Scanning distance	Switching output	Type of connection	Part number	Article number
20 … 300 mm	PNP	Metal plug, M8x1, 4-pin	FT 23 R-PSM4	551-21011
20 … 300 mm	NPN	Metal plug, M8x1, 4-pin	FT 23 R-NSM4	551-21015
20 … 300 mm	PNP	Cable, 2 m, 4-wire	FT 23 R-PSK4	551-21014
20 … 300 mm	NPN	Cable, 2 m, 4-wire	FT 23 R-NSK4	551-21016

Plug connection



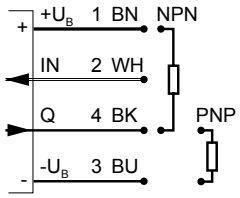
153-00380

Cable connection



153-00379

Connection, 4-pin



154-00312

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FR 20 RG1

Retroreflective photoelectric sensor for detecting transparent objects, autocollimation



PRODUCT HIGHLIGHTS

- Autocollimation principle for reliable detection of transparent objects of any shape
- Particularly suitable for detecting bottles, ampoules, blisters and transparent foils
- Minimal blind zone thanks to autocollimation
- Temperature compensation for reliable switching over the entire temperature range

Optical data	
Operating range	5 … 500 mm[1]
Type of light	LED, red, 660 nm
Light spot size[2]	20 x 20 mm[2]

Functions	
Indicator LED, green	Operating voltage indicator / contamination indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running operation Mode 2: during standing process
Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. range and N.O.

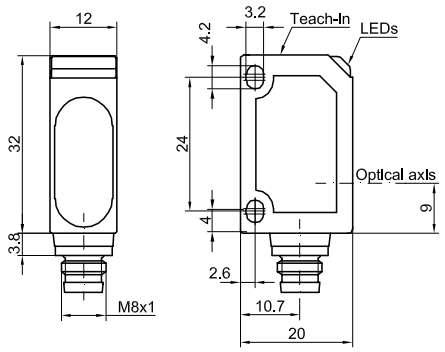
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions	32 x 20 x 12 mm[3]
Enclosure rating	IP 67[3]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: R5/L reflector [2] At range of 500 mm [3] With connected IP 67 plug

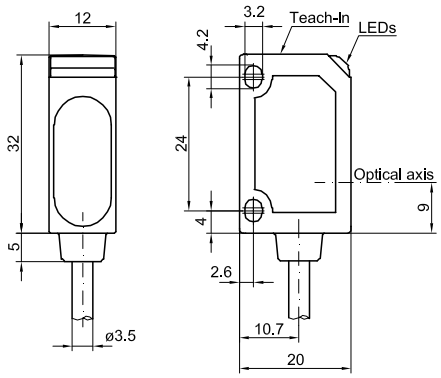
Operating range	Switching output	Type of connection	Part number	Article number
5 … 500 mm	PNP	Metal plug, M8x1, 4-pin	FR 20 RG1-PSM4	553-51006
5 … 500 mm	NPN	Metal plug, M8x1, 4-pin	FR 20 RG1-NSM4	553-51008
5 … 500 mm	PNP	Cable, 2 m, 4-wire	FR 20 RG1-PSK4	553-51007
5 … 500 mm	NPN	Cable, 2 m, 4-wire	FR 20 RG1-NSK4	553-51009

Plug connection



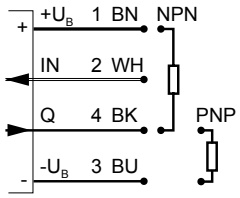
153-00383

Cable connection



153-00384

Connection, 4-pin



154-00312

Accessories

Reflectors	From Page A-16
Connection cables	From Page A-32
Brackets	From Page A-4

8

FR 20 RG

Retroreflective photoelectric sensor for detecting transparent objects



PRODUCT HIGHLIGHTS

- Particularly suitable for bottle detection
- Low switching hysteresis for the detection of transparent objects
- Sensor adjustment via teach-in and control input
- Stable metal plug connection
- Large range of variants

Optical data		Functions	
Limit range	700 mm[1]	Indicator LED, green	Operating voltage indicator / contamination indicator
Operating range	50 … 500 mm[1]	Indicator LED, yellow	Switching output indicator / contamination indicator
Type of light	LED, red, 660 nm	Sensitivity adjustment	Via Teach-in button and control input
Light spot size[2]	20 x 20 mm[2]	Teach-in modes	Mode 1: during running operation Mode 2: during standing process
		Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input
		Default settings	Max. range and N.O.

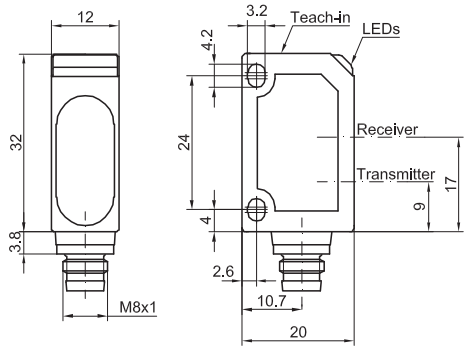
Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC	Dimensions	32 x 20 x 12 mm[3]
No-load current, I_0	≤ 25 mA	Enclosure rating	IP 67[4]
Output current, Ie	≤ 100 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-20 … +60 °C
Power On Delay	≤ 300 ms	Ambient temperature: storage	-20 … +80 °C
Switching output, Q	PNP/NPN (see Selection Table)	Weight (plug device)	10 g
Output function	N.O./N.C.	Weight (cable device)	40 g
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Vibration and impact resistance	EN 60947-5-2
Response time	500 µs		
Control input, IN[3]	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation		

[1] Reference material: R5 reflector [2] At range of 500 mm [3] Only 4-pin design [4] With connected IP 67 plug

Operating range	Switching output	Type of connection	Part number	Article number
50 … 500 mm	PNP	Metal plug, M8x1, 3-pin	FR 20 RG-PSM3	553-51004
50 … 500 mm	NPN	Metal plug, M8x1, 3-pin	FR 20 RG-NSM3	553-51005
50 … 500 mm	PNP	Metal plug, M8x1, 4-pin	FR 20 RG-PSM4	553-51000
50 … 500 mm	NPN	Metal plug, M8x1, 4-pin	FR 20 RG-NSM4	553-51002
50 … 500 mm	PNP	Cable, 2 m, 4-wire	FR 20 RG-PSK4	553-51001
50 … 500 mm	NPN	Cable, 2 m, 4-wire	FR 20 RG-NSK4	553-51003

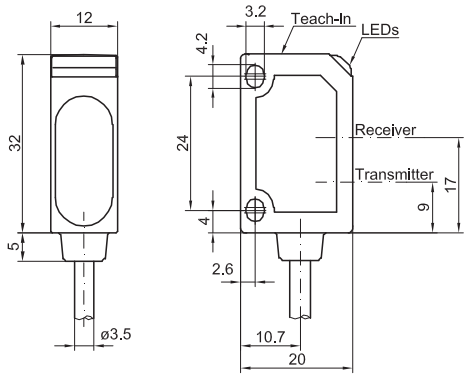
Version: 10/2013. Subject to changes; diagrams similar

Plug connection



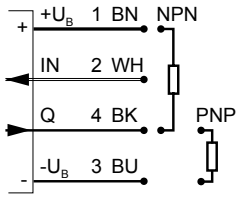
153-00382

Cable connection



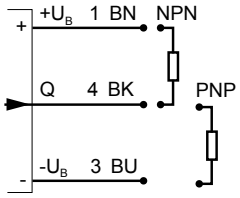
153-00381

Connection, 4-pin



154-00312

Connection, 3-pin



154-00311

Accessories

Reflectors	From Page A-16
Connection cables	From Page A-32
Brackets	From Page A-4

8

FR 20 RLO

Laser retroreflective photoelectric sensor, autocollimation



PRODUCT HIGHLIGHTS

- Most accurate small-part detection of tenphs of a mm
- Autocollimation – transmitter and receiver on a single axis
- Suitable for numerous, highly varied, reflectors and reflective tapes
- Highly accurate even at long ranges of up to 4 m

Optical data	
Operating range	0 … 4 m[1]
Type of light	Laser, red, 650 nm
Laser Class (DIN EN 60825-1:2008-5)	1
Light spot size[2]	Ø 2 mm

Functions	
Indicator LED, green	Operating voltage indicator / contamination indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running operation Mode 2: during standing process
Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. range and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 4000 Hz
Response time	125 µs
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

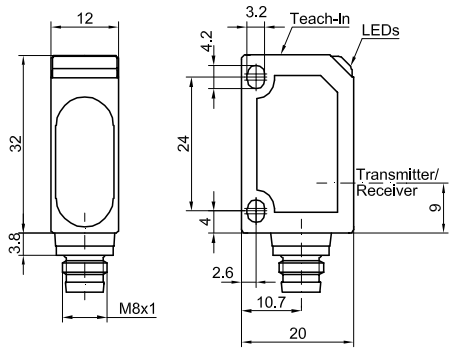
Mechanical data	
Dimensions	32 x 20 x 12 mm[3]
Enclosure rating	IP 67[3]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: R5/L reflector [2] At range of 2.5 m [3] With connected IP 67 plug

Operating range	Switching output	Type of connection	Part number	Article number
0 … 4 m	PNP	Metal plug, M8x1, 4-pin	FR 20 RLO-PSM4	555-31005
0 … 4 m	NPN	Metal plug, M8x1, 4-pin	FR 20 RLO-NSM4	555-31006
0 … 4 m	PNP	Cable, 2 m, 4-wire	FR 20 RLO-PSK4	555-31007
0 … 4 m	NPN	Cable, 2 m, 4-wire	FR 20 RLO-NSK4	555-31008

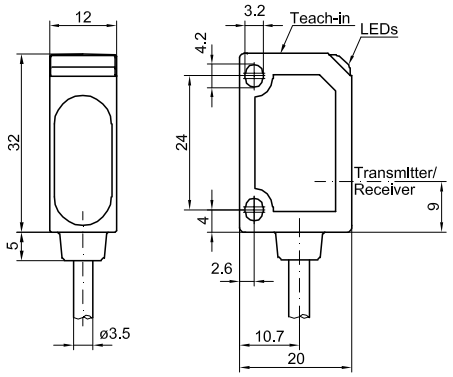
Version: 10/2013. Subject to changes; diagrams similar

Plug connection



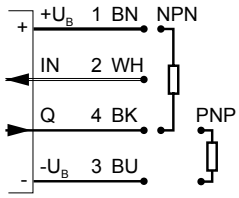
153-00718

Cable connection



153-00719

Connection, 4-pin



154-00312

Small part detection

Smallest detectable part[5]	≥ 1 mm	≥ 0.2 mm	≥ 0.2 mm	≥ 1 mm
Within operating range	0 … 4000 mm	50 … 500 mm	0 … 500 mm	50 … 2500 mm
Reference material	R5/L reflector (51 x 61 mm)	RD-25 KL reflector (Ø 25.2 mm)	RF-50 KL reflective tape (51 x 51 mm)	RF-100 KL reflective tape (230 x 230 mm)
Reflector distance	1000 … 4000 mm	50 … 500 mm	100 … 500 mm	500 … 2500 mm

[5] Switching accuracy ≤ 2 mm at operating distance < 50 mm and objects < 0.5 mm

Accessories

Reflectors	From Page A-16
Connection cables	From Page A-32
Brackets	From Page A-4

FR 20 RL

Laser retroreflective photoelectric sensor



PRODUCT HIGHLIGHTS

- Detection of the smallest of parts
- Suitable for numerous, highly varied, reflectors and reflective tapes
- Very small, easily visible laser light spot
- Laser Protection Class 1

Optical data	
Operating range	0.07 … 3 m[1]
Type of light	Laser, red, 650 nm
Laser Class (DIN EN 60825-1:2008-5)	1
Light spot size[2]	< 1 mm

Functions	
Indicator LED, green	Operating voltage indicator / contamination indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running operation Mode 2: during standing process
Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. range and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 4000 Hz
Response time	125 µs
Control input, IN[3]	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

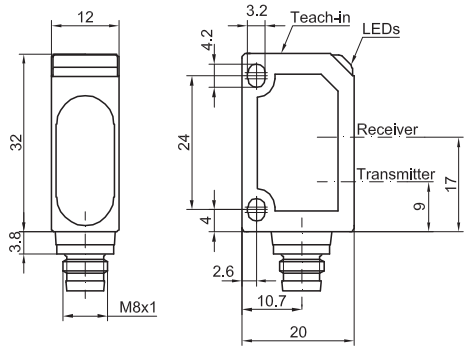
Mechanical data	
Dimensions	32 x 20 x 12 mm[3]
Enclosure rating	IP 67[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: R5/L reflector [2] At range of 300 mm [3] Only 4-pin design [4] With connected IP 67 plug

Operating range	Switching output	Type of connection	Part number	Article number
0.07 … 3 m	PNP	Metal plug, M8x1, 3-pin	FR 20 RL-PSM3	555-31004
0.07 … 3 m	PNP	Metal plug, M8x1, 4-pin	FR 20 RL-PSM4	555-31000
0.07 … 3 m	NPN	Metal plug, M8x1, 4-pin	FR 20 RL-NSM4	555-31002
0.07 … 3 m	PNP	Cable, 2 m, 4-wire	FR 20 RL-PSK4	555-31001
0.07 … 3 m	NPN	Cable, 2 m, 4-wire	FR 20 RL-NSK4	555-31003

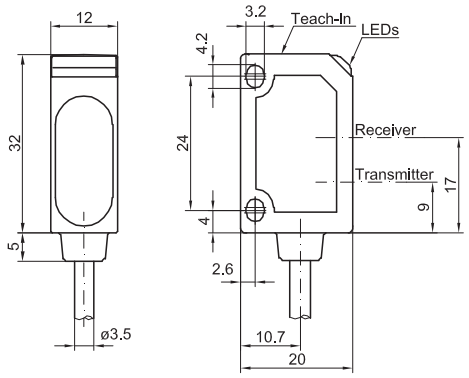
Version: 10/2013. Subject to changes; diagrams similar

Plug connection



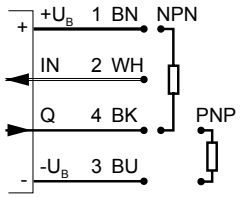
153-00382

Cable connection



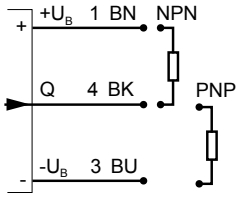
153-00381

Connection, 4-pin



154-00312

Connection, 3-pin



154-00311

Accessories

Reflectors	From Page A-16
Connection cables	From Page A-32
Brackets	From Page A-4

8

FR 20 R

Retroreflective photoelectric sensor



PRODUCT HIGHLIGHTS

- Simple alignment thanks to easily visible light spot
- Sensor adjustment via teach-in and control input
- Suitable for numerous, highly varied, reflectors and reflective tapes
- Compact miniature housing

Optical data	
Limit range	3 m[1]
Operating range	0.05 … 2.5 m[1]
Type of light	LED, red, 660 nm
Light spot size[2]	75 x 75 mm[2]

Functions	
Indicator LED, green	Operating voltage indicator / contamination indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running operation Mode 2: during standing process
Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. range and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Control input, IN[3]	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

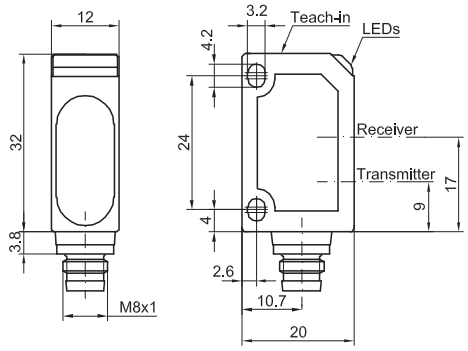
Mechanical data	
Dimensions	32 x 20 x 12 mm[3]
Enclosure rating	IP 67[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: R5 reflector [2] At range of 1.5 m [3] Only 4-pin design [4] With connected IP 67 plug

Operating range	Switching output	Type of connection	Part number	Article number
0.05 … 2.5 m	PNP	Metal plug, M8x1, 3-pin	FR 20 R-PSM3	553-11009
0.05 … 2.5 m	NPN	Metal plug, M8x1, 3-pin	FR 20 R-NSM3	553-11010
0.05 … 2.5 m	PNP	Metal plug, M8x1, 4-pin	FR 20 R-PSM4	553-11000
0.05 … 2.5 m	NPN	Metal plug, M8x1, 4-pin	FR 20 R-NSM4	553-11002
0.05 … 2.5 m	PNP	Cable, 2 m, 4-wire	FR 20 R-PSK4	553-11001
0.05 … 2.5 m	NPN	Cable, 2 m, 4-wire	FR 20 R-NSK4	553-11003

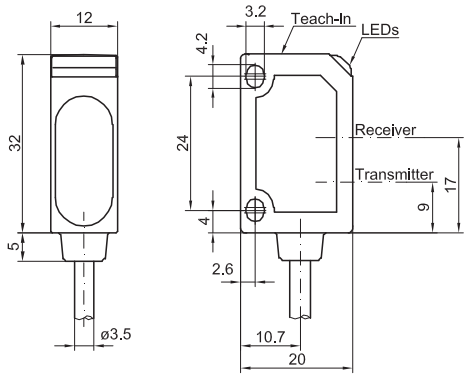
Version: 10/2013. Subject to changes; diagrams similar

Plug connection



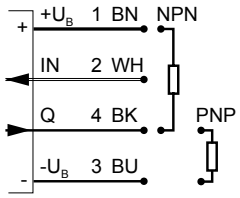
153-00382

Cable connection



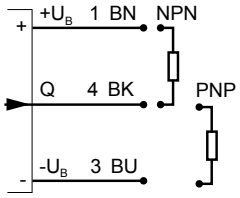
153-00381

Connection, 4-pin



154-00312

Connection, 3-pin



154-00311

Accessories

Reflectors	From Page A-16
Connection cables	From Page A-32
Brackets	From Page A-4

FR 20 RD

Retroreflective photoelectric sensor



PRODUCT HIGHLIGHTS

- Simple alignment thanks to easily visible light spot
- Sensor adjustment via teach-in and control input
- Suitable for numerous, highly varied, reflectors and reflective tapes
- Compact miniature housing

Optical data	
Limit range	4 m[1]
Operating range	0.05 … 3.5 m[1]
Type of light	LED, red, 660 nm
Light spot size[2]	75 x 75 mm[2]

Functions	
Indicator LED, green	Operating voltage indicator / contamination indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running operation Mode 2: during standing process
Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. range and N.O.

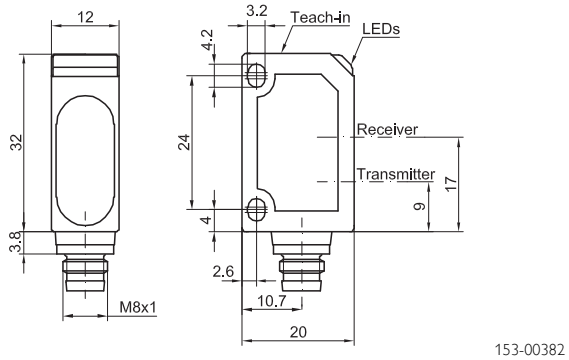
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions	32 x 20 x 12 mm[3]
Enclosure rating	IP 67[3]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: RD8 reflector [2] At range of 1.5 m [3] With connected IP 67 plug

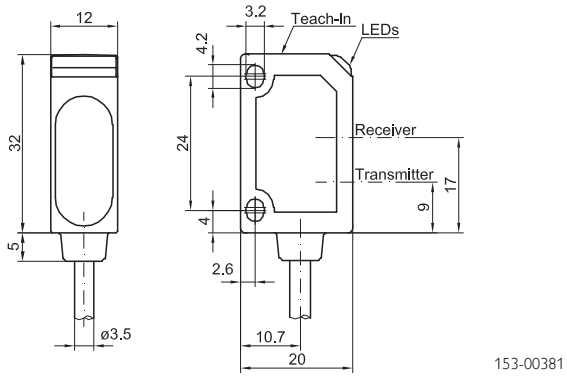
Operating range	Switching output	Type of connection	Part number	Article number
0.05 … 3.5 m	PNP	Metal plug, M8x1, 4-pin	FR 20 RD-PSM4	553-11004
0.05 … 3.5 m	NPN	Metal plug, M8x1, 4-pin	FR 20 RD-NSM4	553-11006
0.05 … 3.5 m	PNP	Cable, 2 m, 4-wire	FR 20 RD-PSK4	553-11005
0.05 … 3.5 m	NPN	Cable, 2 m, 4-wire	FR 20 RD-NSK4	553-11007

Plug connection



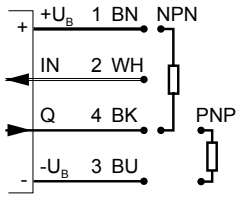
153-00382

Cable connection



153-00381

Connection, 4-pin



154-00312

Accessories

Reflectors	From Page A-16
Connection cables	From Page A-32
Brackets	From Page A-4

8

FR 23 R

Retroreflective photoelectric sensor, fixed setting



PRODUCT HIGHLIGHTS

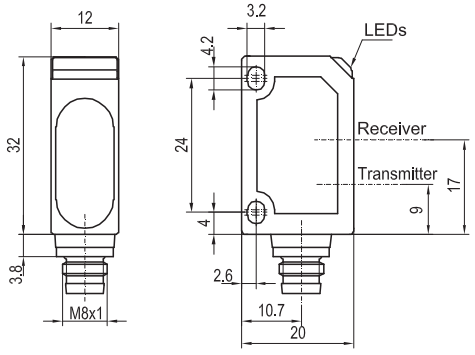
- Economical solution for numerous applications
- Tamper-proof sensor design
- Simple alignment thanks to easily visible light spot
- Compact miniature housing

Optical data		Functions	
Limit range	3 m[1]	Indicator LED, green	Operating voltage indicator / contamination indicator
Operating range	0.05 … 2.5 m[1]	Indicator LED, yellow	Switching output indicator / contamination indicator
Type of light	LED, red, 660 nm	Adjustment possibilities	N.O./N.C. via control input
Light spot size[2]	75 x 75 mm[2]		
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC	Dimensions	32 x 20 x 12 mm[3]
No-load current, I_0	≤ 25 mA	Enclosure rating	IP 67[3]
Output current, Ie	≤ 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
Switching output, Q	PNP/NPN (see Selection Table)	Ambient temperature: storage	-20 … +80 °C
Output function	N.O./N.C.	Weight (plug device)	10 g
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Weight (cable device)	40 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: R5 reflector [2] At range of 1.5 m [3] With connected IP 67 plug

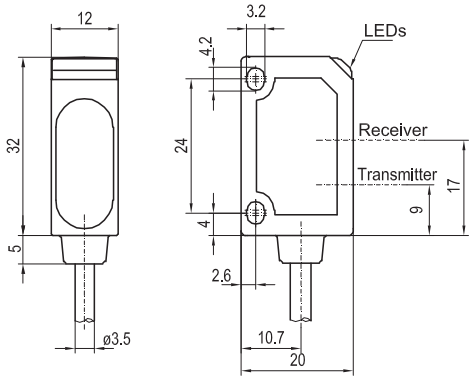
Operating range	Switching output	Type of connection	Part number	Article number
0.05 … 2.5 m	PNP	Metal plug, M8x1, 4-pin	FR 23 R-PSM4	553-11012
0.05 … 2.5 m	NPN	Metal plug, M8x1, 4-pin	FR 23 R-NSM4	553-11014
0.05 … 2.5 m	PNP	Cable, 2 m, 4-wire	FR 23 R-PSK4	553-11013
0.05 … 2.5 m	NPN	Cable, 2 m, 4-wire	FR 23 R-NSK4	553-11015

Plug connection



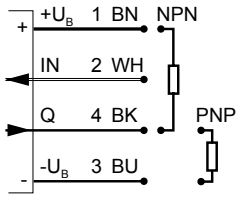
153-00380

Cable connection



153-00379

Connection, 4-pin



154-00312

Accessories

Reflectors	From Page A-16
Connection cables	From Page A-32
Brackets	From Page A-4

8

FS/FE 20 R

Through-beam photoelectric sensor



PRODUCT HIGHLIGHTS

- Sensor adjustment via teach-in and control input
- Simple alignment thanks to easily visible light spot
- Compact miniature housing
- Large range of variants

Optical data	
Limit range	0 … 8.5 m
Operating range	0 … 8 m
Type of light	LED, red, 660 nm

Functions	
Indicator LED, green	Operating voltage indicator / contamination indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Sensitivity adjustment (receiver)	Via Teach-in button and control input
Teach-in modes	Mode 1: during running operation Mode 2: during standing process
Adjustment possibilities (receiver)	N.O./N.C. via Teach-in button and control input Button lock via control input
Default settings	Max. range and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 500 Hz
Response time	1 ms
Control input, IN (receiver)	+ U_B = teach-in function - U_B = Teach-in button locked Open = normal operation

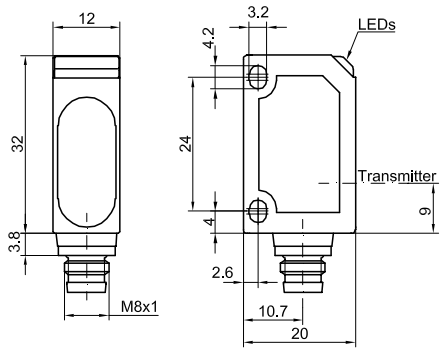
Mechanical data	
Dimensions	32 x 20 x 12 mm³
Enclosure rating	IP 67[1]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (cable device)	40 g
Vibration and impact resistance	EN 60947-5-2

[1] With connected IP 67 plug

Operating range	Switching output	Type of connection	Part number	Article number
0 … 8 m	PNP	Metal plug, M8x1, 4-pin	FE 20 R-PSM4	552-21000
0 … 8 m	NPN	Metal plug, M8x1, 4-pin	FE 20 R-NSM4	552-21002
0 … 8 m	–	Metal plug, M8x1, 4-polig	FS 20 R-M4	552-11000
0 … 8 m	PNP	Cable, 2 m, 4-wire	FE 20 R-PSK4	552-21001
0 … 8 m	NPN	Cable, 2 m, 4-wire	FE 20 R-NSK4	552-21003
0 … 8 m	–	Cable, 2 m, 4-wire	FS 20 R-K4	552-11001

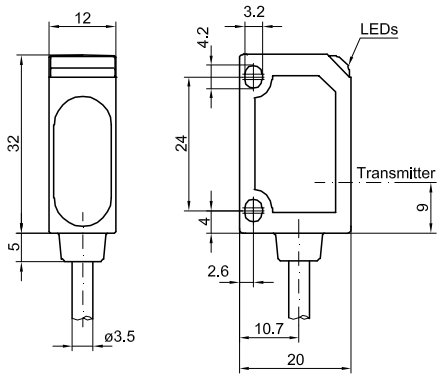
Version: 10/2013. Subject to changes; diagrams similar

Plug connection (transmitter)



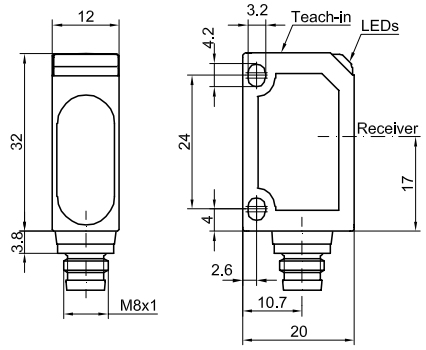
153-00212

Cable connection (transmitter)



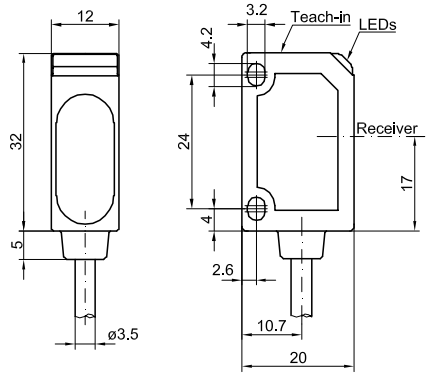
153-00211

Plug connection (receiver)



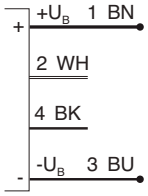
153-00342

Cable connection (receiver)



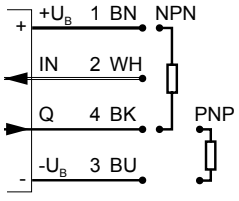
153-00341

Connection, transmitter, 4-pin



154-00318

Connection, receiver, 4-pin



154-00312

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FS/FE 23 R

Through-beam photoelectric sensor, fixed setting



PRODUCT HIGHLIGHTS

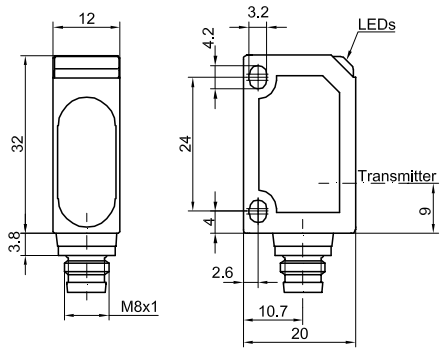
- Economical solution for numerous applications
- Tamper-proof sensor design
- Simple alignment thanks to easily visible light spot
- Compact miniature housing

Optical data		Functions	
Limit range	0 … 4.5 m	Indicator LED, green	Operating voltage indicator / contamination indicator
Operating range	0 … 4 m	Indicator LED, yellow	Switching output indicator / contamination indicator
Type of light	LED, red, 660 nm	Adjustment possibilities (receiver)	N.O./N.C. via control input
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC	Dimensions	32 x 20 x 12 mm³
No-load current, I_0	≤ 25 mA	Enclosure rating	IP 67[1]
Output current, Ie	≤ 100 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-20 … +60 °C
Power On Delay	≤ 300 ms	Ambient temperature: storage	-20 … +80 °C
Switching output, Q	PNP/NPN (see Selection Table)	Weight (plug device)	10 g
Output function	N.O./N.C.	Weight (cable device)	40 g
Switching frequency, f (ti/tp 1:1)	≤ 500 Hz	Vibration and impact resistance	EN 60947-5-2
Response time	1 ms		
Control input, IN (receiver)	$+U_B$ = N.C. $-U_B$ / Open = N.O.		

[1] With connected IP 67 plug

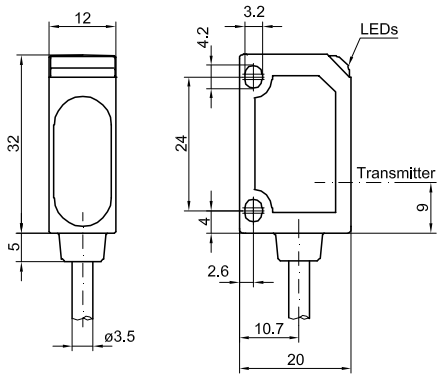
Operating range	Switching output	Type of connection	Part number	Article number
0 … 4 m	PNP	Metal plug, M8x1, 4-pin	FE 23 R-PSM4	552-11007
0 … 4 m	NPN	Metal plug, M8x1, 4-pin	FE 23 R-NSM4	552-11009
0 … 4 m	–	Metal plug, M8x1, 4-pin	FS 23 R-M4	552-11004
0 … 4 m	PNP	Cable, 2 m, 4-wire	FE 23 R-PSK4	552-11008
0 … 4 m	NPN	Cable, 2 m, 4-wire	FE 23 R-NSK4	552-11010
0 … 4 m	–	Cable, 2 m, 4-wire	FS 23 R-K4	552-11005

Plug connection (transmitter)



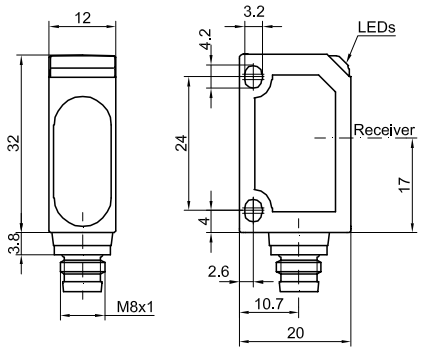
153-00212

Cable connection (transmitter)



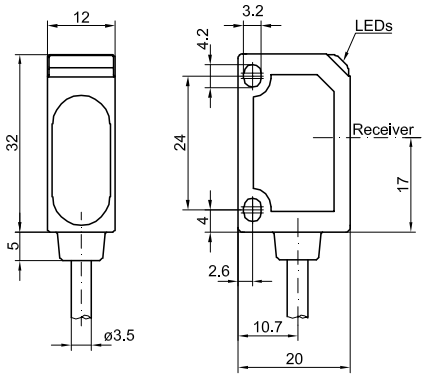
153-00211

Plug connection (receiver)



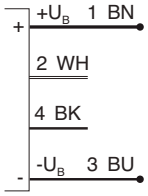
153-00418

Cable connection (receiver)



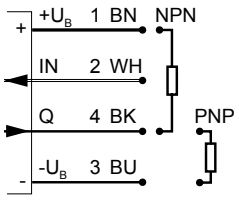
153-00423

Connection, transmitter, 4-pin



154-00318

Connection, receiver, 4-pin



154-00312

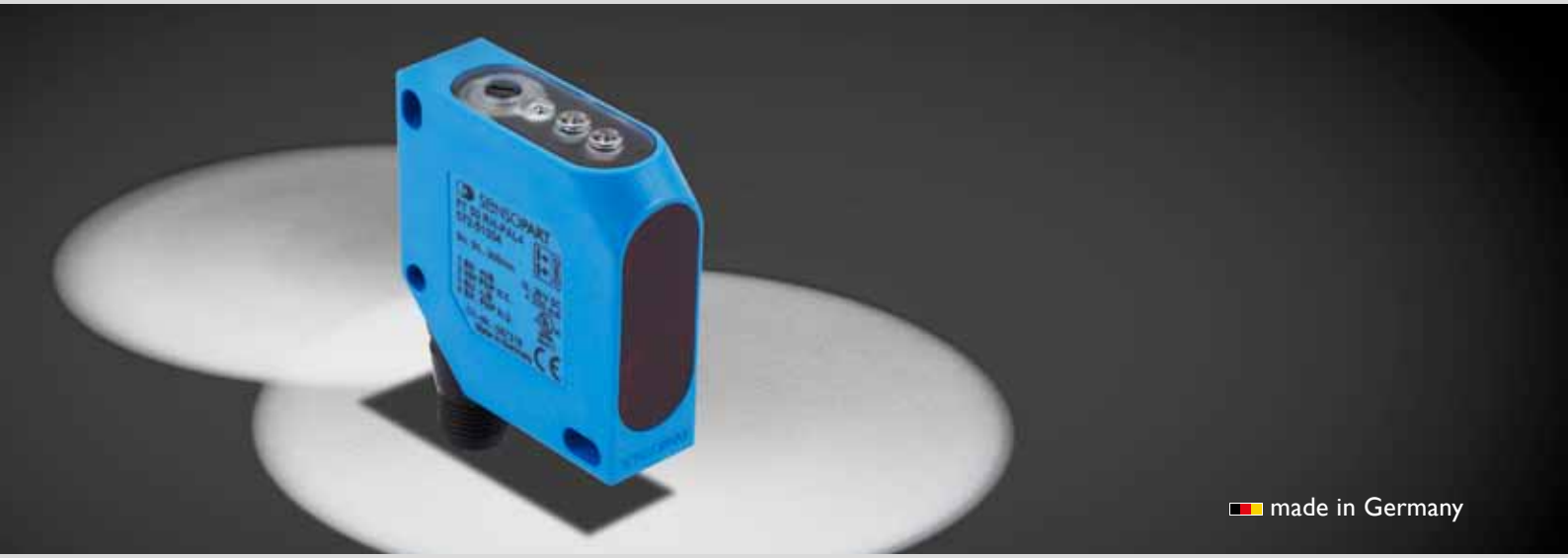
Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

F 50 – photoelectric sensors and proximity sensors in compact housings

The reliable standard series





Well thought-out mounting accessories: *SensoPart offers the right mounting aid for almost every mounting situation. This considerably simplifies sensor installation and adjustment. Designs with a supplementary protective function are also available.*

TYPICAL F 50

- Universal use in numerous automation applications
- Autocollimation variants with high precision and no blind zone
- Precise background suppression
- Laser, LED or infrared light transmitter options
- Simple adjustment via potentiometer, with numeric display
- Rotatable plug (270°)
- Well thought-out mounting accessories
- UL-certification

The photoelectric sensors and photoelectric proximity sensors of the F 50 series are virtually synonymous with versatile use and particularly reliable products. They have guaranteed user-satisfaction in a wide variety of sectors from the automotive industry, through mechanical engineering and wood processing, to the packaging and print industries.

The F 50 sensors' reliable detection (with laser-light, red-light or infrared LED options) and precise background suppression are impressive. Automation tasks such as (small) part detection, checking presence and positioning are their usual areas of use. SensoPart also offers product variants for special applications: for example, the FR 50-R / RL autocollimation photoelectric sensor that can detect objects from a range of 0 mm.

The sensors of the F 50 series, however, not only offer very reliable operation, but also make users' lives easy. Thus mounting is considerably simplified by the connection plug that can be rotated through 270° and the well thought-out mounting accessories, while adjustment and commissioning are also easy and user-friendly thanks to the direct numeric display. You simply cannot go wrong with an F 50 device!

F 50 – Product Overview					
	Type of light	Adjustment	Scanning distance / range	Special features	Page
Photoelectric proximity sensors with background suppression					
FT 50 RLH	Laser	Potentiometer	150 mm	Most accurate small-part detection	352
FT 50 RLHD	Laser	Potentiometer	300 mm	Most accurate small-part detection	354
FT 50 RH	LED	Potentiometer	300 mm		356
FT 50 IH	Infrared	Potentiometer	600 mm		358
Photoelectric proximity sensors					
FR 50 RL	Laser	Potentiometer	25 m	Autocollimation	360
FR 50 R	LED	Potentiometer	6 m	Autocollimation	362
Through-beam photoelectric sensor					
FS/FE 50 I	Infrared	Potentiometer	18 m		364

FT 50 RLH

Laser photoelectric proximity sensor with background suppression



PRODUCT HIGHLIGHTS

- Particularly suitable for detecting the smallest of objects
- Precisely adjustable background suppression
- Simple scanning distance adjustment thanks to indicator scale
- High switching frequency of 2500 Hz

Optical data	
Scanning distance	30 … 150 mm[1]
Type of light	Laser, red, 650 nm
Light spot size	See table
Laser Class (DIN EN 60825-1:2008-5)	2
Hysteresis[2]	< 5 %

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Indicator LED, red	Contamination indicator
Scanning distance adjustment	Via potentiometer

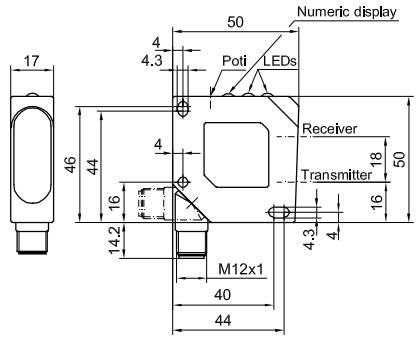
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[3]
No-load current, I_0	≤ 50 mA[4]
Output current, Ie	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN, antivalent (see Selection Table)
Output function	N.O./N.C. (see Selection Table)
Switching frequency, f (ti/tp 1:1)	≤ 2500 Hz
Response time	200 µs
Connection, BK	N.O.
Connection, WH[5]	N.C.
Contamination output, WH (optional)	N.O. (see Selection Table)

Mechanical data	
Dimensions	50 x 50 x 17 mm[3]
Enclosure rating	IP 67[6]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +45 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	40 g
Weight (cable device)	130 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: grey, 18 % reflectivity [2] 18 % / 18 % [3] Max. 10 % ripple, within U_B [4] At 24 V DC [5] Without contamination output [6] With connected IP 67 plug

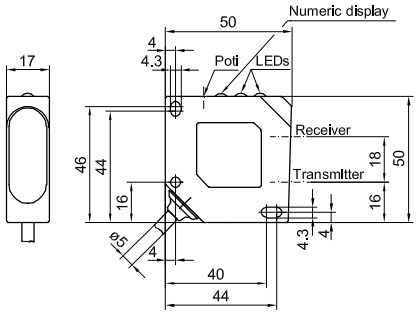
Scanning distance	Switching output	Type of connection	Contamination output	Part number	Article number
30 … 150 mm	PNP, antivalent	Plug, M12x1, 4-pin	No	FT 50 RLH-PAL4	572-51008
30 … 150 mm	NPN, antivalent	Plug, M12x1, 4-pin	No	FT 50 RLH-NAL4	572-51011
30 … 150 mm	PNP (N.O.)	Plug, M12x1, 4-pin	Yes	FT 50 RLH-PSVL4	572-51010
30 … 150 mm	NPN (N.O.)	Plug, M12x1, 4-pin	Yes	FT 50 RLH-NSVL4	572-51012
30 … 150 mm	PNP, antivalent	Cable, 3 m, 4-wire	No	FT 50 RLH-PAK4	572-51013
30 … 150 mm	NPN, antivalent	Cable, 3 m, 4-wire	No	FT 50 RLH-NAK4	572-51015
30 … 150 mm	PNP (N.O.)	Cable, 3 m, 4-wire	Yes	FT 50 RLH-PSVK4	572-51014
30 … 150 mm	NPN (N.O.)	Cable, 3 m, 4-wire	Yes	FT 50 RLH-NSVK4	572-51016

Plug connection



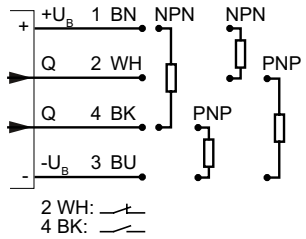
153-00061

Cable connection



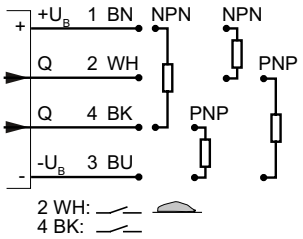
153-00060

Connection, 4-pin



154-00517

Connection, 4-pin with contamination output



154-00525

Light spot size

Scanning distance (mm)	30	60	80	100	150
Light spot diameter (mm)	1.8	0.7	0.1	1.1	2.5

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

FT 50 RLHD

Laser photoelectric proximity sensor with background suppression



PRODUCT HIGHLIGHTS

- Precise small part detection even at long scanning distances of up to 300 mm
- Very small, easily visible laser light spot
- Precisely adjustable background suppression
- High switching frequency of 2500 Hz

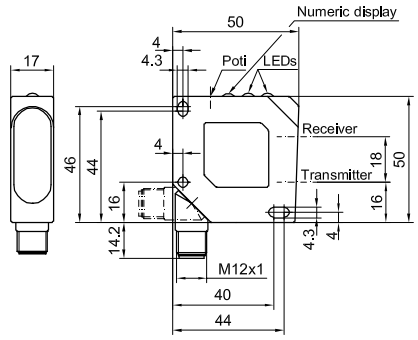
Optical data		Functions	
Scanning distance	50 … 300 mm[1]	Indicator LED, green	Operating voltage indicator
Type of light	Laser, red, 650 nm	Indicator LED, yellow	Switching output indicator
Light spot size	See table	Indicator LED, red	Contamination indicator
Laser Class (DIN EN 60825-1:2008-5)	2	Scanning distance adjustment	Via potentiometer
Hysteresis[2]	< 5 %		

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[3]	Dimensions	50 x 50 x 17 mm[3]
No-load current, I_0	≤ 50 mA[4]	Enclosure rating	IP 67[6]
Output current, Ie	≤ 200 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-20 … +45 °C
Power On Delay	≤ 300 ms	Ambient temperature: storage	-20 … +80 °C
Switching output, Q	PNP/NPN , antivalent (see Selection Table)	Weight (plug device)	40 g
		Weight (cable device)	130 g
Output function	N.O./N.C. (see Selection Table)	Vibration and impact resistance	EN 60947-5-2
Switching frequency, f (ti/tp 1:1)	≤ 2500 Hz		
Response time	200 µs		
Connection, BK	N.O.		
Connection, WH[5]	N.C.		
Contamination output, WH (optional)	N.O. (see Selection Table)		

[1] Reference material: grey, 18 % reflectivity [2] 18 % / 18 % [3] Max. 10 % ripple, within U_B [4] At 24 V DC [5] Without contamination output [6] With connected IP 67 plug

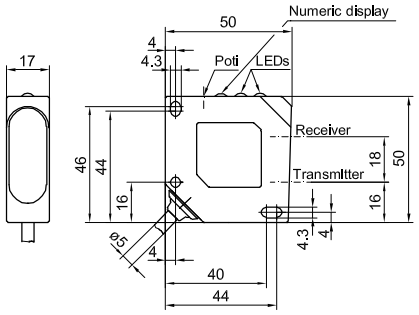
Scanning distance	Switching output	Type of connection	Contamination output	Part number	Article number
50 … 300 mm	PNP, antivalent	Plug, M12x1, 4-pin	No	FT 50 RLHD-PAL4	572-51062
50 … 300 mm	NPN, antivalent	Plug, M12x1, 4-pin	No	FT 50 RLHD-NAL4	572-51063
50 … 300 mm	PNP (N.O.)	Plug, M12x1, 4-pin	Yes	FT 50 RLHD-PSVL4	572-51051
50 … 300 mm	PNP, antivalent	Cable, 3 m, 4-wire	No	FT 50 RLHD-PAK4	572-51064
50 … 300 mm	NPN, antivalent	Cable, 3 m, 4-wire	No	FT 50 RLHD-NAK4	572-51065

Plug connection



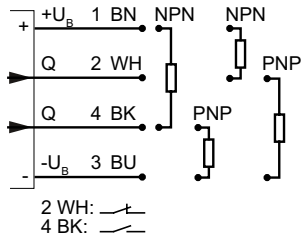
153-00061

Cable connection



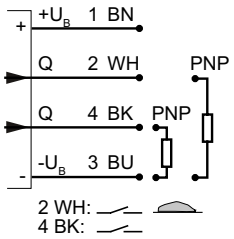
153-00060

Connection, 4-pin



154-00517

Connection, 4-pin with contamination output



154-00526

Light spot size

Scanning distance (mm)	50	80	100	150	180	200	250	300
Light spot diameter (mm)	5 x 1.75	4.8 x 1.75	4.5 x 1.5	4 x 1.5	3.8 x 1.5	3.8 x 1.2	3.2 x 1	3 x 1

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FT 50 RH

Photoelectric proximity sensor with background suppression



PRODUCT HIGHLIGHTS

- Precisely adjustable background suppression
- Simple scanning distance adjustment thanks to indicator scale
- Optional contamination output
- Plug connector rotatable

Optical data	
Scanning distance	30 … 300 mm[1]
Type of light	LED, red, 660 nm
Light spot size[2]	8 x 8 mm[2]

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Indicator LED, red	Contamination indicator
Scanning distance adjustment	Via potentiometer

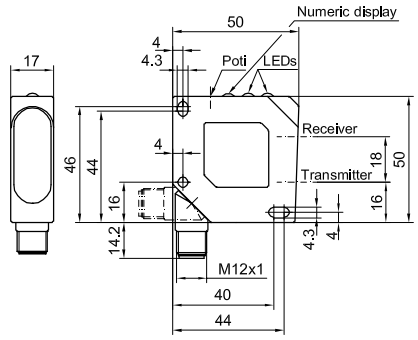
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[3]
No-load current, I_0	≤ 35 mA[4]
Output current, Ie	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN, antivalent (see Selection Table)
Output function	N.O./N.C. (see Selection Table)
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Connection, BK	N.O.
Connection, WH[5]	N.C.
Contamination output, WH (optional)	N.O. (see Selection Table)

Mechanical data	
Dimensions	50 x 50 x 17 mm[3]
Enclosure rating	IP 67[6]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	40 g
Weight (cable device)	130 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: grey, 18 % reflectivity [2] At scanning distance of 200 mm [3] Max. 10 % ripple, within U_B [4] At 24 V DC [5] Without contamination output
[6] With connected IP 67 plug

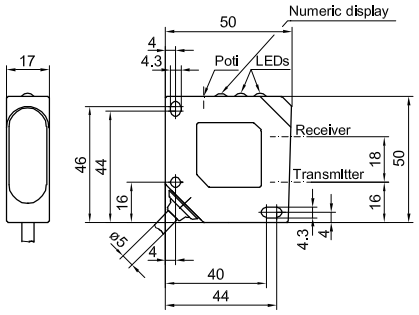
Scanning distance	Switching output	Type of connection	Contamination output	Part number	Article number
30 … 300 mm	PNP, antivalent	Plug, M12x1, 4-pin	No	FT 50 RH-PAL4	572-51004
30 … 300 mm	NPN, antivalent	Plug, M12x1, 4-pin	No	FT 50 RH-NAL4	572-51005
30 … 300 mm	PNP (N.O.)	Plug, M12x1, 4-pin	Yes	FT 50 RH-PSVL4	572-51006
30 … 300 mm	NPN (N.O.)	Plug, M12x1, 4-pin	Yes	FT 50 RH-NSVL4	572-51007
30 … 300 mm	PNP, antivalent	Cable, 3 m, 4-wire	No	FT 50 RH-PAK4	572-51000
30 … 300 mm	NPN, antivalent	Cable, 3 m, 4-wire	No	FT 50 RH-NAK4	572-51001
30 … 300 mm	PNP (N.O.)	Cable, 3 m, 4-wire	Yes	FT 50 RH-PSVK4	572-51002
30 … 300 mm	NPN (N.O.)	Cable, 3 m, 4-wire	Yes	FT 50 RH-NSVK4	572-51003

Plug connection



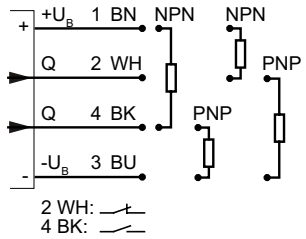
153-00061

Cable connection



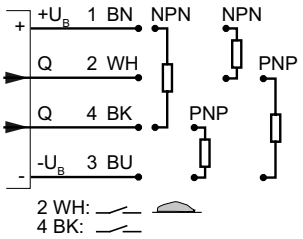
153-00060

Connection, 4-pin



154-00517

Connection, 4-pin with contamination output



154-00525

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FT 50 IH

Infrared photoelectric proximity sensor with background suppression



PRODUCT HIGHLIGHTS

- Long scanning distance of 600 mm
- Precisely adjustable background suppression
- Simple scanning distance adjustment thanks to indicator scale
- Optional contamination output

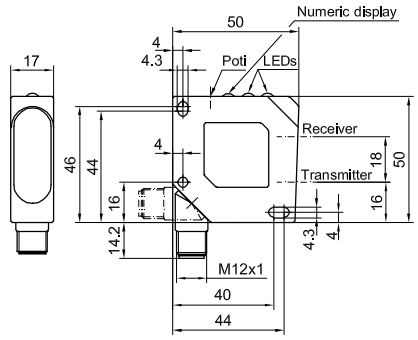
Optical data		Functions	
Scanning distance	150 … 600 mm[1]	Indicator LED, green	Operating voltage indicator
Type of light	LED, infrared, 880 nm	Indicator LED, yellow	Switching output indicator
Light spot size[2]	20 x 20 mm[2]	Indicator LED, red	Contamination indicator
Hysteresis[3]	< 5 %	Scanning distance adjustment	Via potentiometer
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC[4]	Dimensions	50 x 50 x 17 mm[3]
No-load current, I_0	≤ 70 mA[5]	Enclosure rating	IP 67[7]
Output current, Ie	≤ 200 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-20 … +60 °C
Power On Delay	≤ 300 ms	Ambient temperature: storage	-20 … +80 °C
Switching output, Q	PNP/NPN, antivalent (see Selection Table)	Weight (plug device)	40 g
		Weight (cable device)	130 g
Output function	N.O./N.C. (see Selection Table)	Vibration and impact resistance	EN 60947-5-2
Switching frequency, f (ti/tp 1:1)	≤ 800 Hz		
Response time	625 µs		
Connection, BK	N.O.		
Connection, WH[6]	N.C.		
Contamination output, WH (optional)	N.O. (see Selection Table)		

[1] Reference material: grey, 18 % reflectivity [2] At scanning distance of 400 mm [3] 18 % / 18 % [4] Max. 10 % ripple, within U_B [5] At 24 V DC [6] Without contamination output
[7] With connected IP 67 plug

Scanning distance	Switching output	Type of connection	Contamination output	Part number	Article number
150 … 600 mm	PNP, antivalent	Plug, M12x1, 4-pin	No	FT 50 IH-PAL4	572-51029
150 … 600 mm	NPN, antivalent	Plug, M12x1, 4-pin	No	FT 50 IH-NAL4	572-51038
150 … 600 mm	PNP (N.O.)	Plug, M12x1, 4-pin	Yes	FT 50 IH-PSVL4	572-51031
150 … 600 mm	NPN (N.O.)	Plug, M12x1, 4-pin	Yes	FT 50 IH-NSVL4	572-51058
150 … 600 mm	PNP, antivalent	Cable, 3 m, 4-wire	No	FT 50 IH-PAK4	572-51032
150 … 600 mm	NPN, antivalent	Cable, 3 m, 4-wire	No	FT 50 IH-NAK4	572-51037
150 … 600 mm	PNP (N.O.)	Cable, 3 m, 4-wire	Yes	FT 50 IH-PSVK4	572-51033
150 … 600 mm	NPN (N.O.)	Cable, 3 m, 4-wire	Yes	FT 50 IH-NSVK4	572-51057

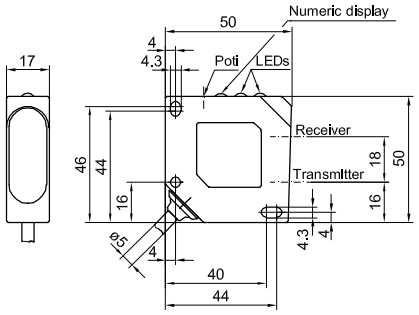
Version: 10/2013. Subject to changes; diagrams similar

Plug connection



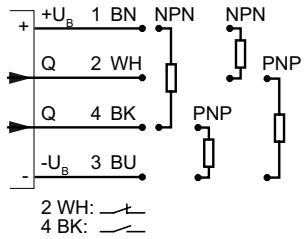
153-00061

Cable connection



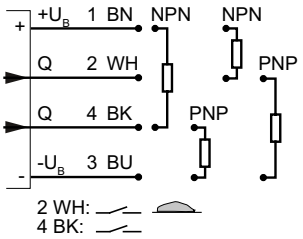
153-00060

Connection, 4-pin



154-00517

Connection, 4-pin with contamination output



154-00525

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FR 50 RL

Laser retroreflective photoelectric sensor



PRODUCT HIGHLIGHTS

- Autocollimation principle for maximum precision even at long ranges
- No blind zone – detection from range of 0 mm
- Particularly suitable for detecting the smallest of objects
- High switching frequency of 2500 Hz
- Very small, easily visible laser light spot

Optical data	
Limit operating range	0 … 25 m[1]
Operating range	0 … 20 m[1]
Type of light	Laser, red, 650 nm
Light spot size	See table
Laser Class (DIN EN 60825-1:2008-5)	1

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Indicator LED, red	Contamination indicator
Sensitivity adjustment	Via potentiometer

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 40 mA[3]
Output current, Ie	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN, antivalent (see Selection Table)
Output function	N.O./N.C. (see Selection Table)
Switching frequency, f (ti/tp 1:1)	≤ 2500 Hz
Response time	200 µs
Connection, BK	N.O.
Connection, WH[4]	N.C.
Contamination output, WH (optional)	N.O. (see Selection Table)

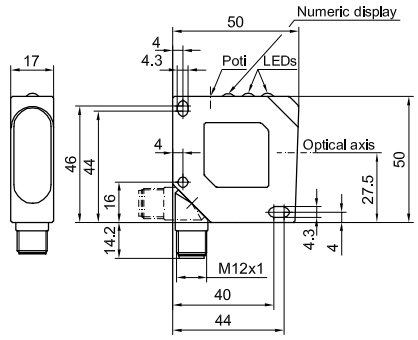
Mechanical data	
Dimensions	50 x 50 x 17 mm[3]
Enclosure rating	IP 67[5]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +45 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	40 g
Weight (cable device)	130 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: R5/L reflector [2] Max. 10 % ripple, within U_B [3] At 24 V DC [4] Without contamination output [5] With connected IP 67 plug

Operating range	Switching output	Type of connection	Contamination output	Part number	Article number
0 … 20 m	PNP, antivalent	Plug, M12x1, 4-pin	No	FR 50 RL-PAL4	571-50009
0 … 20 m	NPN, antivalent	Plug, M12x1, 4-pin	No	FR 50 RL-NAL4	571-50011
0 … 20 m	PNP (N.O.)	Plug, M12x1, 4-pin	Yes	FR 50 RL-PSVL4	571-50010
0 … 20 m	NPN (N.O.)	Plug, M12x1, 4-pin	Yes	FR 50 RL-NSVL4	571-50012
0 … 20 m	PNP, antivalent	Cable, 3 m, 4-wire	No	FR 50 RL-PAK4	571-50013
0 … 20 m	NPN, antivalent	Cable, 3 m, 4-wire	No	FR 50 RL-NAK4	571-50015
0 … 20 m	PNP (N.O.)	Cable, 3 m, 4-wire	Yes	FR 50 RL-PSVK4	571-50014
0 … 20 m	NPN (N.O.)	Cable, 3 m, 4-wire	Yes	FR 50 RL-NSVK4	571-50016

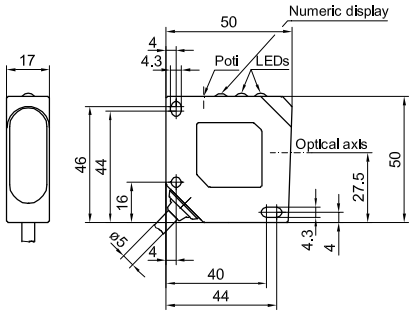
Version: 10/2013. Subject to changes; diagrams similar

Plug connection



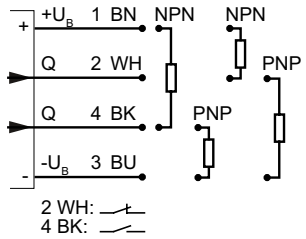
153-00062

Cable connection



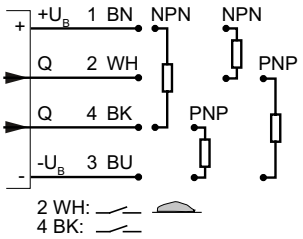
153-00063

Connection, 4-pin



154-00517

Connection, 4-pin with contamination output



154-00525

Light spot size

Operating range (m)	4	12	20
Light spot diameter (mm)	5	15	24

Accessories

Reflectors	From Page A-16
Connection cables	From Page A-32
Brackets	From Page A-4

FR 50 R

Retroreflective photoelectric sensor



PRODUCT HIGHLIGHTS

- Autocollimation principle for maximum precision even at long ranges
- No blind zone – detection from range of 0 mm
- Simple alignment thanks to easily visible light spot
- Plug connector rotatable

Optical data	
Limit operating range	0 … 6 m[1]
Operating range	0 … 5.5 mm[1]
Type of light	LED, red, 660 nm
Light spot size	See table

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Indicator LED, red	Contamination indicator
Sensitivity adjustment	Via potentiometer

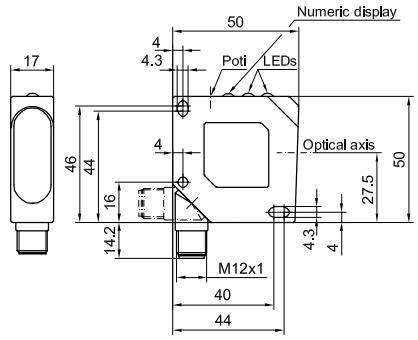
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA[3]
Output current, Ie	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN, antivalent (see Selection Table)
Output function	N.O./N.C. (see Selection Table)
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Connection, BK	N.O.
Connection, WH[4]	N.C.
Contamination output, WH (optional)	N.O. (see Selection Table)

Mechanical data	
Dimensions	50 x 50 x 17 mm[3]
Enclosure rating	IP 67[5]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	40 g
Weight (cable device)	130 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: RD8 reflector [2] Max. 10 % ripple, within U_B [3] At 24 V DC [4] Without contamination output [5] With connected IP 67 plug

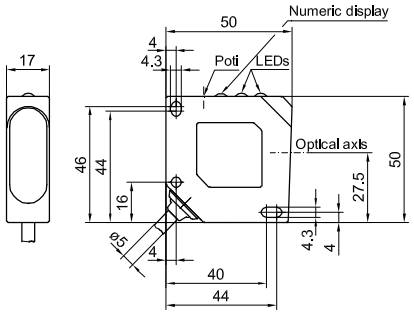
Operating range	Switching output	Type of connection	Contamination output	Part number	Article number
0 … 5.5 m	PNP, antivalent	Plug, M12x1, 4-pin	No	FR 50 R-PAL4	571-50004
0 … 5.5 m	NPN, antivalent	Plug, M12x1, 4-pin	No	FR 50 R-NAL4	571-50005
0 … 5.5 m	PNP (N.O.)	Plug, M12x1, 4-pin	Yes	FR 50 R-PSVL4	571-50006
0 … 5.5 m	NPN (N.O.)	Plug, M12x1, 4-pin	Yes	FR 50 R-NSVL4	571-50007
0 … 5.5 m	PNP (N.C.)	Plug, M12x1, 4-pin	Yes	FR 50 R-POVL4	571-50033
0 … 5.5 m	PNP, antivalent	Cable, 3 m, 4-wire	No	FR 50 R-PAK4	571-50000
0 … 5.5 m	NPN, antivalent	Cable, 3 m, 4-wire	No	FR 50 R-NAK4	571-50001
0 … 5.5 m	PNP (N.O.)	Cable, 3 m, 4-wire	Yes	FR 50 R-PSVK4	571-50002
0 … 5.5 m	NPN (N.O.)	Cable, 3 m, 4-wire	Yes	FR 50 R-NSVK4	571-50003

Plug connection



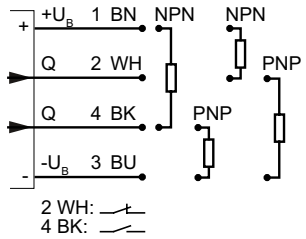
153-00062

Cable connection



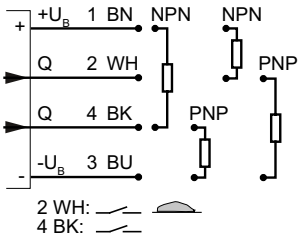
153-00063

Connection, 4-pin



154-00517

Connection, 4-pin with contamination output



154-00525

Light spot size

Operating range (m)	0.1	0.5
Light spot size (mm)	15 x 10	Ø 15

Accessories

Reflectors	From Page A-16
Connection cables	From Page A-32
Brackets	From Page A-4

FS/FE 50 I

Infrared through-beam photoelectric sensor



PRODUCT HIGHLIGHTS

- Simple range adjustment thanks to indicator scale
- Test input for controlling function of the sensor pair
- Optional contamination output
- Plug connector rotatable

Optical data	
Limit operating range	0 … 18 m
Operating range	0 … 15 m
Type of light	LED, infrared, 880 nm

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Indicator LED, red (transmitter)	Operating voltage indicator (transmitter off)
Indicator LED, red (receiver)	Contamination indicator
Sensitivity adjustment (receiver)	Via potentiometer

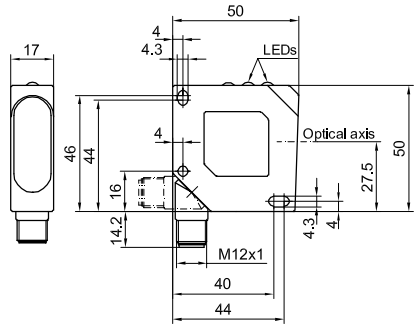
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN, antivalent (see Selection Table)
Output function	N.O./N.C. (see Selection Table)
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Connection, BK (receiver)	N.O.
Connection, WH[2] (receiver)	N.C.
Contamination output, WH (receiver, optional)	N.O. (see Selection Table)
Control input, (transmitter)	$+U_B$ = Test (transmitter off) $-U_B$ / Open = normal operation

Mechanical data	
Dimensions	50 x 50 x 17 mm[3]
Enclosure rating	IP 67[3]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	40 g
Weight (cable device)	130 g
Vibration and impact resistance	EN 60947-5-2

[1] Max. 10 % ripple, within U_B [2] Without contamination output [3] With connected IP 67 plug

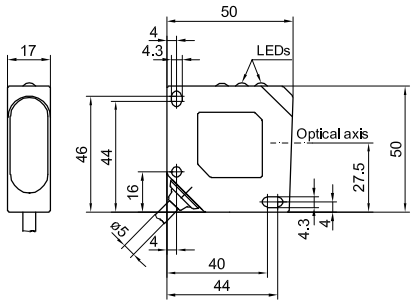
Operating range	Switching output	Type of connection	Contamination output	Part number	Article number
0 … 15 m	PNP, antivalent	Plug, M12x1, 4-pin	No	FE 50 I-PAL4	573-52007
0 … 15 m	PNP (N.O.)	Plug, M12x1, 4-pin	Yes	FE 50 I-PSVL4	573-52004
0 … 15 m	–	Plug, M12x1, 4-pin	No	FS 50 I-L4	573-52006
0 … 15 m	PNP, antivalent	Cable, 3 m, 4-wire	No	FE 50 I-PAK4	573-52003
0 … 15 m	PNP (N.O.)	Cable, 3 m, 4-wire	Yes	FE 50 I-PSVK4	573-52005
0 … 15 m	–	Cable, 3 m, 4-wire	No	FS 50 I-K4	573-52002

Plug connection (transmitter)



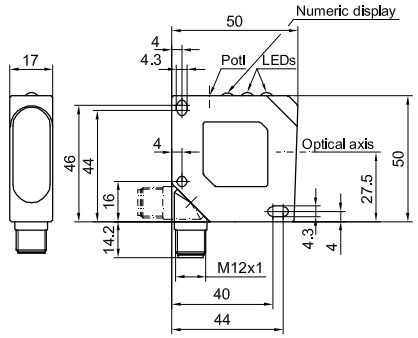
153-00206

Cable connection (transmitter)



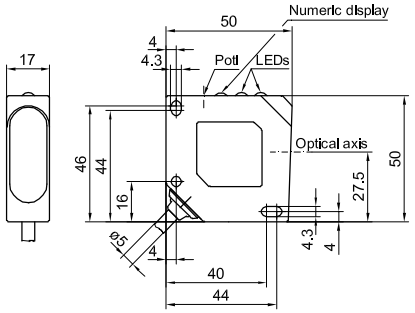
153-00064

Plug connection (receiver)



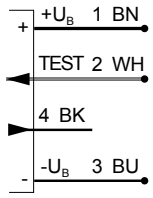
153-00062

Cable connection (receiver)



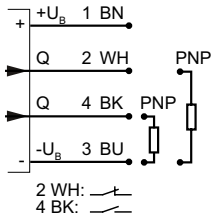
153-00063

Connection, transmitter, 4-pin



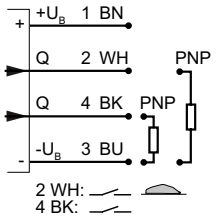
154-00315

Connection, receiver, 4-pin



154-00519

Connection, receiver, 4-pin with contamination output



154-00526

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

F 88 – family of photoelectric sensors for harsh environmental conditions

The strong and solid series



TYPICAL F 88

- Very long ranges and scanning distances
- PNP or NPN variants with 2 switching outputs or relay with time function
- AC/DC devices with clamping space
- Simple adjustment via potentiometer
- Robust plastic housings
- Additional dovetail slot for simple mounting
- Well thought-out mounting accessories
- UL-certification

Above all else, the sensors of the F 88 series are robust and dependable! Their high system reserves guarantee reliable detection even in critical industrial environments. An F 88 fears neither dust and dirt nor vibrations, and the stable housing/plug unit is designed for these conditions.

The high-level light performance can be seen in the generously proportioned detection ranges: the FT 88 scanner with background suppression even "sees" objects at a distance of 700 mm, while the FS/FE 88 through-beam photoelectric sensor manages a range of 65 m. With these performance data, the F 88 series can be used in many demanding applications in sectors such as the automotive industry, wood processing or in mechanical engineering.

The robust sensors are also ideally suited for heavy industry as well as for protecting gates and doors.

The sensors of the F 88 series are also generously proportioned when it comes to signal outputs: they have two switching outputs (PNP or NPN), and a variant with relay output and time function is also available. The right output is therefore available for every supply voltage and the sensor offers flexible adaptation to operating conditions. User-friendly sensor mounting – with dovetail slot and well thought-out mounting accessories – is also typical SensoPart. There is thus something for almost every user requirement!

F 88 – Product Overview					
	Type of light	Adjustment	Scanning distance / range	Special features	Page
Photoelectric proximity sensors with background suppression					
FT 88-RH	LED	Potentiometer	700 mm	PNP, NPN	368
FT 88-RH	LED	Potentiometer	700 mm	Relay output	370
FT 88-IH	Infrared	Potentiometer	2 m	PNP, NPN	372
FT 88-IH	Infrared	Potentiometer	2 m	Relay output	374
Photoelectric proximity sensor					
FT 88-R	LED	Potentiometer	2 m	PNP, NPN	376
Retroreflective photoelectric sensors					
FR 88-R	LED	Potentiometer	12 m	PNP, NPN	378
FR 88-R	LED	Potentiometer	12 m	Relay output	380
Through-beam photoelectric sensors					
FS/FE 88-R	LED	Potentiometer	30 m / 65 m	PNP, NPN	382
FS/FE 88-R	LED	Potentiometer	30 m / 65 m	Relay output	384

FT 88-RH

Photoelectric proximity sensor with background suppression



PRODUCT HIGHLIGHTS

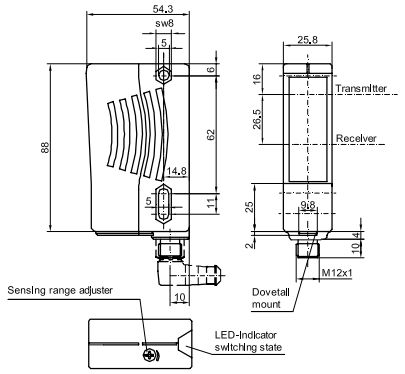
- Long scanning distance of 700 mm
- Precise background suppression
- Antivalent switching output

Optical data		Functions	
Scanning distance	20 … 700 mm[1]	Indicator LED, yellow	Switching output indicator
Type of light	LED, red, 660 nm	Scanning distance adjustment	Via potentiometer
Light spot size[2]	Ø 15 mm	Default setting	Max. scanning distance
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC[3]	Dimensions	88 x 54.3 x 25.8 mm[3]
No-load current, I_0	≤ 40 mA	Enclosure rating	IP 67[4]
Output current, Ie	≤ 200 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-40 … +60 °C
Power On Delay	≤ 300 ms	Ambient temperature: storage	-40 … +75 °C
Switching output, Q	PNP/NPN antivalent (see Selection Table)	Weight (plug device)	70 g
		Vibration and impact resistance	EN 60947-5-2
Output function	N.O./N.C.		
Switching frequency, f (ti/tp 1:1)	≤ 250 Hz		
Response time	2 ms		
Connection, BK	N.O.		
Connection, WH	N.C.		

[1] Reference material: grey, 18 % reflectivity [2] At scanning distance of 700 mm [3] Max. 10 % ripple, within U_B [4] With connected IP 67 plug

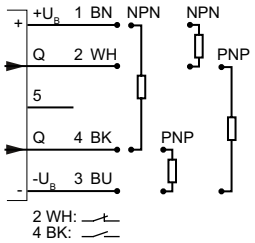
Scanning distance	Switching output	Type of connection	Part number	Article number
20 … 700 mm	PNP	Plug, M12x1, 5-pin	FT 88-RH-PA-L5	821-11010
20 … 700 mm	NPN	Plug, M12x1, 5-pin	FT 88-RH-NA-L5	821-11011

Plug connection



153-00548

Connection, 5-pin



154-00518

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FT 88-RH

Photoelectric proximity sensor with background suppression, relay output



PRODUCT HIGHLIGHTS

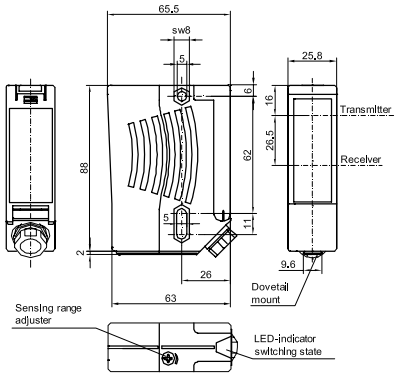
- Long scanning distance of 700 mm
- Precise background suppression
- Relay output
- Adjustable time function
- N.O. / N.C. switchable

Optical data		Functions	
Scanning distance	20 … 700 mm[1]	Indicator LED, yellow	Switching output indicator
Type of light	LED, red, 660 nm	Sensitivity adjustment	Via potentiometer
Light spot size[2]	Ø 15 mm	Adjustment possibilities	Time and output function (N.O./N.C.) via operating elements in clamping space
		Default setting	Max. scanning distance
Electrical data		**Mechanical data**	
Operating voltage, ~U_B	12 … 240 V AC / DC	Dimensions	88 x 65.5 x 25.8 mm[3]
Power consumption	≤ 3.5 VA	Enclosure rating	IP 67[4]
Output current, Ie	≤ 2 A (≤ 250 V AC/DC)	Material, housing	ABS
Protection Class	2[3]	Material, front screen	PMMA
Power On Delay	≤ 300 ms	Type of connection	See Selection Table
Switching output, Q	Relay	Ambient temperature: operation	-25 … +60 °C
Output function	Change-over contact (N.O./N.C.)	Ambient temperature: storage	-40 … +75 °C
Switching frequency, f (ti/tp 1:1)	≤ 25 Hz	Weight (clamping space device)	120 g
		Vibration and impact resistance	EN 60947-5-2

[1] Reference material: grey, 18 % reflectivity [2] At scanning distance of 700 mm [3] With closed clamping space [4] With connected IP 67 plug

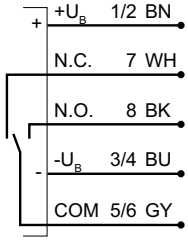
Scanning distance	Switching output	Type of connection	Part number	Article number
20 … 700 mm	Relay	Clamping space, 8 spring clamp terminals, cable gland, M16x1.5	FT 88-RH-RAT-PM	821-11009

Plug connection



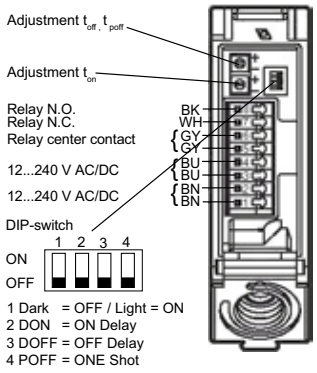
153-00549

Connection, 8-pin



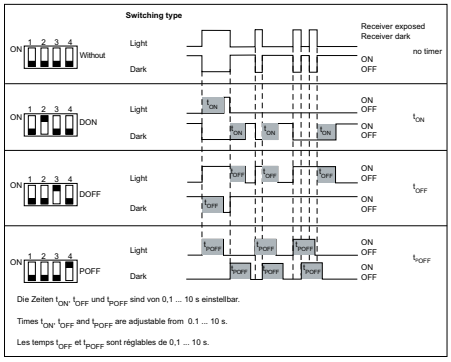
154-00523

Connection, relay



155-00640

Time functions



155-00641

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FT 88-IH

Infrared photoelectric proximity sensor with background suppression



PRODUCT HIGHLIGHTS

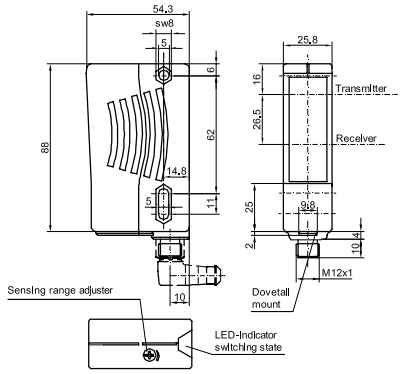
- Long scanning distance of 2000 mm
- Precise background suppression
- Antivalent switching output

Optical data		Functions	
Scanning distance	20 … 2000 mm[1]	Indicator LED, yellow	Switching output indicator
Type of light	LED, infrared, 880 nm	Scanning distance adjustment	Via potentiometer
Light spot size[2]	Ø 70 mm	Default setting	Max. scanning distance
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC[3]	Dimensions	88 x 54.3 x 25.8 mm[3]
No-load current, I_0	≤ 40 mA	Enclosure rating	IP 67[4]
Output current, Ie	≤ 200 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-40 … +60 °C
Power On Delay	≤ 300 ms	Ambient temperature: storage	-40 … +75 °C
Switching output, Q	PNP/NPN antivalent (see Selection Table)	Weight (plug device)	70 g
		Vibration and impact resistance	EN 60947-5-2
Output function	N.O./N.C.		
Switching frequency, f (ti/tp 1:1)	≤ 250 Hz		
Response time	2 ms		
Connection, BK	N.O.		
Connection, WH	N.C.		

[1] Reference material: grey, 18 % reflectivity [2] At scanning distance of 2000 mm [3] Max. 10 % ripple, within U_B [4] With connected IP 67 plug

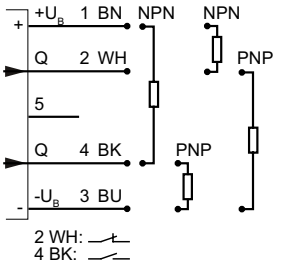
Scanning distance	Switching output	Type of connection	Part number	Article number
20 … 2000 mm	PNP	Plug, M12x1, 5-pin	FT 88-IH-PA-L5	821-11013
20 … 2000 mm	NPN	Plug, M12x1, 5-pin	FT 88-IH-NA-L5	821-11014

Plug connection



153-00548

Connection, 5-pin



154-00518

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FT 88-IH

Infrared photoelectric proximity sensor with background suppression, relay output



PRODUCT HIGHLIGHTS

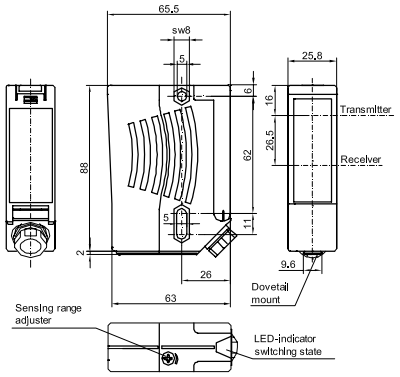
- Long scanning distance of 2000 mm
- Precise background suppression
- Relay output
- Adjustable time function
- N.O./N.C. switchable

Optical data		Functions	
Scanning distance	20 … 2000 mm[1]	Indicator LED, yellow	Switching output indicator
Type of light	LED, infrared, 880 nm	Scanning distance adjustment	Via potentiometer
Light spot size[2]	Ø 70 mm	Adjustment possibilities	Time and output function (N.O./N.C.) via operating elements in clamping space
		Default setting	Max. scanning distance
Electrical data		**Mechanical data**	
Operating voltage, ~U_B	12 … 240 V AC / DC	Dimensions	88 x 65.5 x 25.8 mm[3]
Power consumption	≤ 3.5 VA	Enclosure rating	IP 67[4]
Output current, Ie	≤ 2 A (≤ 250 V AC / DC)	Material, housing	ABS
Protection Class	2[3]	Material, front screen	PMMA
Power On Delay	≤ 300 ms	Type of connection	See Selection Table
Switching output, Q	Relay	Ambient temperature: operation	-40 … +60 °C
Output function	Change-over contact (N.O./N.C.)	Ambient temperature: storage	-40 … +75 °C
Switching frequency, f (ti/tp 1:1)	≤ 25 Hz	Weight (clamping space device)	120 g
		Vibration and impact resistance	EN 60947-5-2

[1] Reference material: grey, 18 % reflectivity [2] At scanning distance of 2000 mm [3] With closed clamping space [4] With connected IP 67 plug

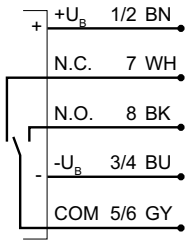
Scanning distance	Switching output	Type of connection	Part number	Article number
20 … 2000 mm	Relay	Clamping space, 8 spring clamp terminals, cable gland, M16x1.5	FT 88-IH-RAT-PM	821-11012

Plug connection



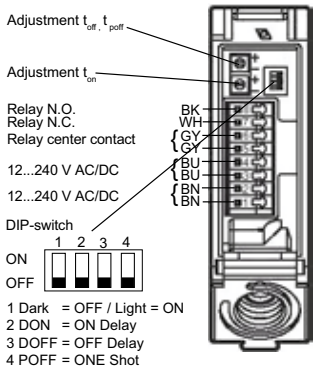
153-00549

Connection, 8-pin



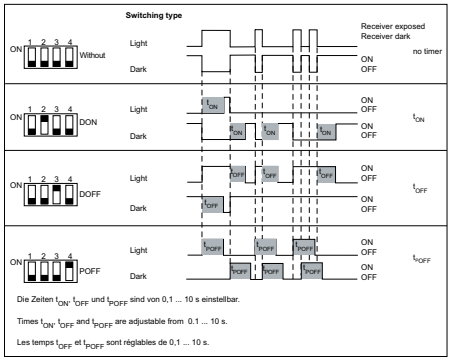
154-00523

Connection, relay



155-00640

Time functions



155-00641

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FT 88-R

Diffuse photoelectric proximity sensor



PRODUCT HIGHLIGHTS

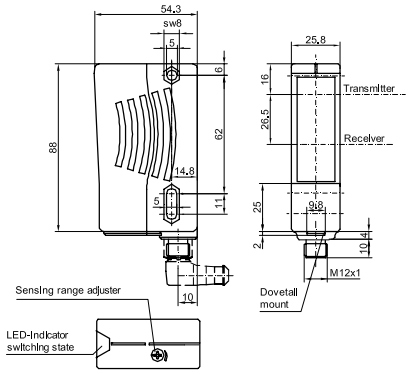
- Push-pull output, antivalent
- Simple alignment thanks to easily visible light spot
- Precise sensitivity adjustment by means of potentiometer

Optical data		Functions	
Scanning distance	50 … 2000 mm[1]	Indicator LED, yellow	Switching output indicator
Type of light	LED, red, 660 nm	Sensitivity adjustment	Via potentiometer
Light spot size[2]	Ø 50 mm	Default setting	Max. scanning distance
Hysteresis	< 12 %		
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 ... 30 V DC[3]	Dimensions	88 x 54.3 x 25.8 mm[3]
No-load current, I_0	≤ 40 mA	Enclosure rating	IP 65[4]
Output current, Ie	≤ 100 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-25 … +60 °C
Power On Delay	300 ms	Ambient temperature: storage	-40 … +75 °C
Switching output, Q	PNP/NPN, push-pull, antivalent	Weight (plug device)	70 g
Output function	N.O./N.C.	Vibration and impact resistance	EN 60947-5-2
Switching frequency, f (ti/tp 1:1)	≤ 125 Hz		
Response time	4 ms		
Connection, BK	N.O.		
Connection, WH	N.C.		

[1] Reference material, white, 90 % reflectivity [2] At scanning distance of 2000 mm [3] Max. 10 % ripple, within U_B [4] With connected IP 65 plug

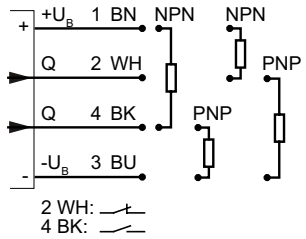
Scanning distance	Switching output	Type of connection	Part number	Article number
50 … 2000 mm	PNP/NPN, push-pull, antivalent	Plug, M12x1, 4-pin	FT 88-R-GA-L4	821-21009

Plug connection



153-00597

Connection, 4-pin



154-00517

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FR 88-R

Retroreflective photoelectric sensor



PRODUCT HIGHLIGHTS

- Antivalent switching output
- Simple alignment thanks to easily visible light spot
- Precise sensitivity adjustment by means of potentiometer

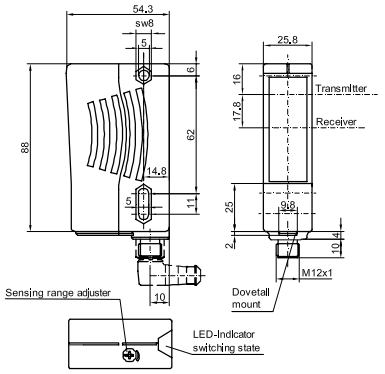
Optical data		Functions	
Operating range	0.05 … 12 m[1]	Indicator LED, yellow	Switching output indicator
Type of light	LED, red, 660 nm	Sensitivity adjustment	Via potentiometer
Light spot size[2]	Ø 200 mm	Default setting	Max. range

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[3]	Dimensions	88 x 54.3 x 25.8 mm[3]
No-load current, I_0	≤ 40 mA	Enclosure rating	IP 67[4]
Output current, Ie	≤ 200 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-40 … +60 °C
Power On Delay	≤ 300 ms	Ambient temperature: storage	-40 … +75 °C
Switching output, Q	PNP/NPN antivalent (see Selection Table)	Weight (plug device)	70 g
Output function	N.O./N.C.	Vibration and impact resistance	EN 60947-5-2
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz		
Response time	500µs		
Connection, BK	N.O.		
Connection, WH	N.C.		
Contamination output, Gy (optional)	N.C.		

[1] Reference material: R10 reflector [2] At range of 12 m [3] Max. 10 % ripple, within U_B [4] With connected IP 67 plug

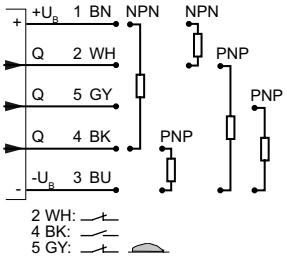
Operating range	Switching output	Type of connection	Part number	Article number
0.05 … 12 m	PNP	Plug, M12x1, 5-pin	FR 88-R-PAV-L5	823-11010
0.05 … 12 m	NPN	Plug, M12x1, 5-pin	FR 88-R-NAV-L5	823-11011

Plug connection



153-00551

Connection, 5-pin



154-00522

Accessories

Reflectors	From Page A-16
Connection cables	From Page A-32
Brackets	From Page A-4

FR 88-R

Retroreflective photoelectric sensor with relay output



PRODUCT HIGHLIGHTS

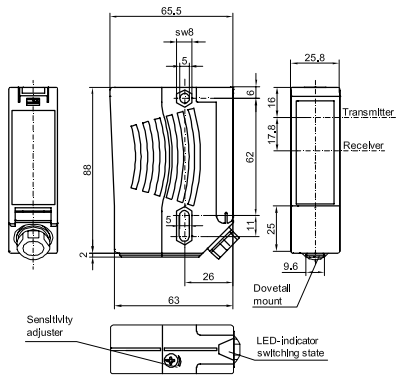
- Relay output
- Simple alignment thanks to easily visible light spot
- Precise sensitivity adjustment by means of potentiometer
- Adjustable time function
- N.O./N.C. switchable

Optical data		Functions	
Operating range	0.05 … 12 m[1]	Indicator LED, yellow	Switching output indicator
Type of light	LED, red, 660 nm	Sensitivity adjustment	Via potentiometer
Light spot size[2]	Ø 200 mm	Adjustment possibilities	Time and output function (N.O./N.C.) via operating elements in clamping space
		Default setting	Max. range
Electrical data		**Mechanical data**	
Operating voltage, ~U_B	12 … 240 V AC / DC	Dimensions	88 x 65.5 x 25.8 mm[3]
Power consumption	≤ 3.5 VA	Enclosure rating	IP 67[4]
Output current, Ie	≤ 2 A (≤ 250 V AC / DC)	Material, housing	ABS
Protection Class	2[3]	Material, front screen	PMMA
Power On Delay	≤ 300 ms	Type of connection	See Selection Table
Switching output, Q	Relay	Ambient temperature: operation	-40 … +60 °C
Output function	Change-over contact (N.O./N.C.)	Ambient temperature: storage	-40 … +75 °C
Switching frequency, f (ti/tp 1:1)	≤ 25 Hz	Weight (clamping space device)	120 g
		Vibration and impact resistance	EN 60947-5-2

[1] Reference material: R10 reflector [2] At range of 12 m [3] With closed clamping space [4] With connected IP 67 plug

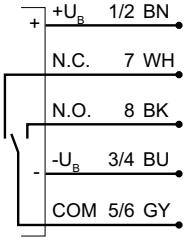
Operating range	Switching output	Type of connection	Part number	Article number
0.05 … 12 m	Relay	Clamping space, 8 spring clamp terminals, cable gland, M16x1.5	FR 88-R-RAT-PM	823-11009

Plug connection



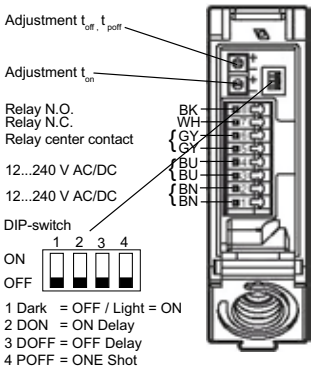
153-00550

Connection, 5-pin



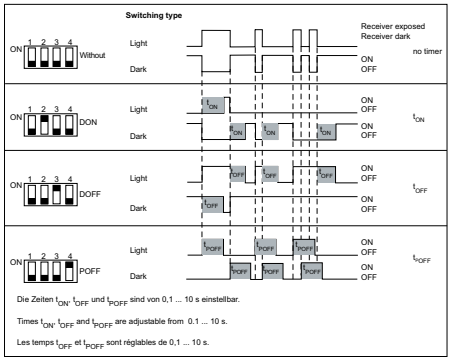
154-00523

Connection, relay



155-00640

Time functions



155-00641

Accessories

Reflectors	From Page A-16
Connection cables	From Page A-32
Brackets	From Page A-4

FS/FE 88-R

Through-beam photoelectric sensor



PRODUCT HIGHLIGHTS

- Antivalent switching output
- Simple alignment thanks to easily visible light spot
- Precise sensitivity adjustment by means of potentiometer
- Contamination output

Optical data	
Operating range	0 ... 30 m
Type of light	LED, red, 660 nm
Light spot size[1]	Ø 600 mm

Functions	
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment (receiver)	Via potentiometer
Default setting	Max. range

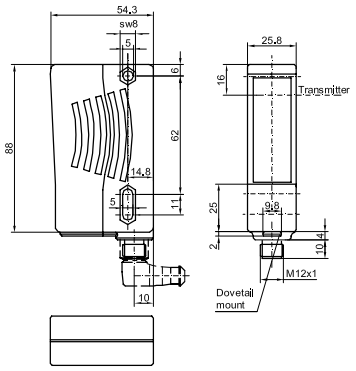
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0 (transmitter)	≤ 50 mA
No-load current, I_0 (receiver)	≤ 35 mA
Output current, Ie	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN antivalent (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Connection, BK	N.O.
Connection, WH	N.C.
Contamination output, Gy (receiver / optional)	N.C.
Control input, Test (transmitter)	$+U_B$ = Test (transmitter off)[3] $-U_B$ / Open = normal operation

Mechanical data	
Dimensions	88 x 54.3 x 25.8 mm[3]
Enclosure rating	IP 67[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-40 … +60 °C
Ambient temperature: storage	-40 … +75 °C
Weight (plug device)[5]	140 g
Vibration and impact resistance	EN 60947-5-2

[1] At range of 30 m [2] Max. 10 % ripple, within U_B [3] I_{max} < 3 mA at 30 V DC [4] With connected IP 67 plug [5] Sensor pair

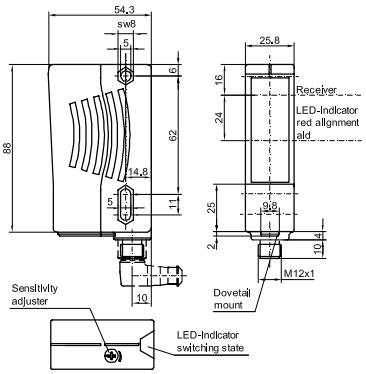
Operating range	Switching output	Type of connection	Part number	Article number
0 ... 30 m	PNP	Plug, M12x1, 5-pin	FE 88-R-PAV-L5	822-21010
0 ... 30 m	NPN	Plug, M12x1, 5-pin	FE 88-R-NAV-L5	822-21011
0 ... 30 m	–	Plug, M12x1, 5-pin	FS 88-R-L5	822-11004

Plug connection (transmitter)



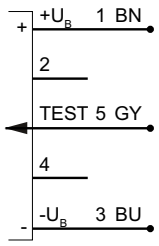
153-00555

Plug connection (receiver)



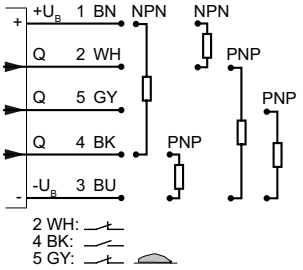
153-00554

Connection, transmitter, 5-pin



154-00521

Connection, receiver, 5-pin



154-00522

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FS/FE 88-R

Through-beam photoelectric sensor with relay output



PRODUCT HIGHLIGHTS

- Long operating range of 65 m
- Simple alignment thanks to easily visible light spot
- Adjustable time function
- N.O./N.C. switchable

Optical data	
Operating range	0 ... 65 m
Type of light	LED, red, 660 nm
Light spot size[1]	Ø 1.3 m

Functions	
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment (receiver)	Via potentiometer
Adjustment possibilities	Time and output function (N.O./N.C.) via operating elements in clamping space
Default setting	Max. range

Electrical data	
Operating voltage, ~U_B	12 … 240 V AC / DC[2]
Power consumption	≤ 3.5 VA
Protection Class	2[3]
Power On Delay	≤ 300 ms
Switching output, Q	Relay
Output function	Change-over contact (N.O./N.C.)
Switching frequency, f (ti/tp 1:1)	≤ 25 Hz

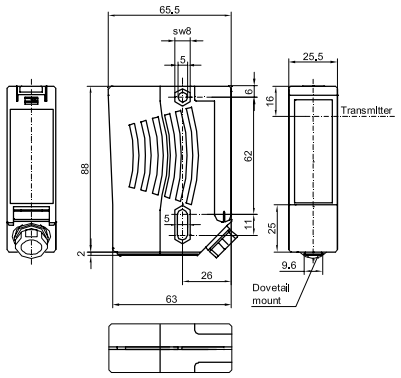
Mechanical data	
Dimensions	88 x 65.5 x 25.8 mm[3]
Enclosure rating	IP 67[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-40 … +60 °C
Ambient temperature: storage	-40 … +75 °C
Weight (clamping space device)[5]	200 g
Vibration and impact resistance	EN 60947-5-2

[1] At range of 65 m [2] Max. 10 % ripple, within U_B [3] With closed clamping space [4] With connected IP 67 plug [5] Sensor pair

Operating range	Switching output	Type of connection	Part number	Article number
0 ... 65 m	Relay	Clamping space, 8 spring clamp terminals, cable gland, M16x1.5	FE 88-R-RAT-PM	822-21009
0 ... 65 m	–	Clamping space, 8 spring clamp terminals, cable gland, M16x1.5	FS 88-R-PM	822-11003

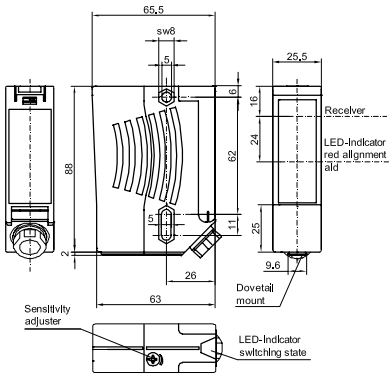
Version: 10/2013. Subject to changes; diagrams similar

Plug connection (transmitter)



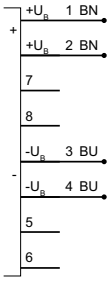
153-00553

Plug connection (receiver)



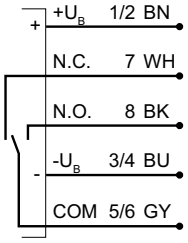
153-00552

Connection, transmitter, 8-pin



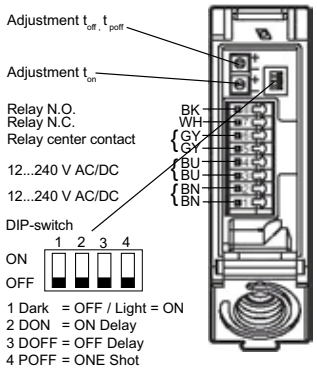
154-00520

Connection, receiver, 5-pin



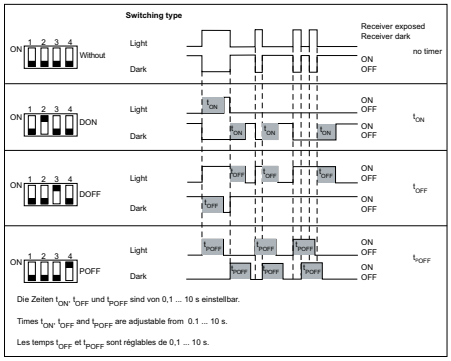
154-00523

Connection (relay)



155-00640

Time functions (relay)



155-00641

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FT 92 – proximity switch with long scanning distance

The far-sighted sensor with pulse time-of-flight measurement



TYPICAL FT 92

- Very long range
- Precise background suppression with time-of-flight technology
- User-friendly fine adjustment of sensor with pilot laser
- Rapid and easy adjustment via teach-in
- Safe operation thanks to Laser Class 1
- Robust housing/plug unit
- Well thought-out mounting accessories
- UL-certification

The FT 92 proximity switch has been specially designed for detection tasks with long distances to the process: the sensor, equipped with an infrared laser (Laser Class 1) reaches ranges of up to 6 m. Whereby its measurement principle of infrared pulse time-of-flight technology guarantees particularly precise background suppression, and thus reliable detection even against highly reflective or glossy backgrounds – as well as absolute immunity to ambient light.

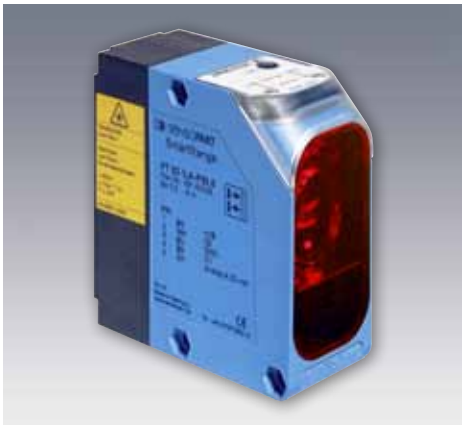
Long distances not only require excellent optical performance, but also helpful functions for installation and commissioning. Thus a pilot laser that can be switched off simplifies fine adjustment of the sensor, and the wide variety of mounting options provides users with rapid and user-friendly installation.

The FT 92 is suitable for numerous applications in industrial automation, e.g. for small-part detection, for checking presence or for positioning tasks. The far-sighted sensor can therefore be found in many sectors: in the automotive industry and in mechanical engineering, in the wood-processing industry, in packaging machines or in the control of gates and doors. Its stable and robust design ensures smooth, trouble-free operation everywhere – as well as satisfied users!

F 92 – Product Overview					
	Type of light	Adjustment	Scanning distance / range	Special features	Page
Photoelectric proximity sensor with background suppression					
FT 92 IL	Infrared	Teach-in	6 m	Long range	388

FT 92 IL

Infrared photoelectric proximity sensor with background suppression



PRODUCT HIGHLIGHTS

- Long range of 6 m
- Precise background suppression through time-of-flight technology
- Reliable operation even with highly reflective and glossy backgrounds
- Simple alignment via integrated pilot laser

Optical data	
Scanning distance	0.2 … 6 m[1]
Type of light, measurement laser	Infrared, 905 nm
Laser Class, measurement laser (DIN EN 60825-1:2008-5)	1
Type of light, pilot laser	Laser, red, 650 nm
Laser Class, pilot laser (DIN EN 60825-1:2008-5)	2
Repeatability, Fast / Slow	≤ ± 15 mm / 10 mm

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Indicator LED, orange	Operating mode indicator (Fast / Slow)
Scanning distance adjustment	Via Teach-in button
Adjustment possibilities	Switching point set via Teach-in button Switching window set via Teach-in button Slow / Fast mode via Teach-in button N.O./N.C. via Teach-in button Pilot laser via Teach-in button
Default settings	Sn = 5.8 m and N.O.

Electrical data	
Operating voltage, $+U_B$	18 … 30 V DC[2]
No-load current, I_0	≤ 125 mA
Output current, Ie	100 mA
Voltage drop, U_D	≤ 2.4 V
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Response time, Fast / Slow	13 / 80 ms

Mechanical data	
Dimensions	95 x 93 x 42 mm[3]
Enclosure rating	IP 67[3]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +50 °C
Ambient temperature: storage	-40 … +80 °C
Weight (plug device)	200 g
Weight (cable device)	270 g
Vibration and impact resistance	EN 60947-5-2

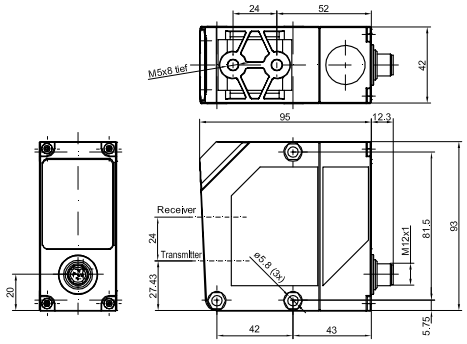
[1] Reference material, white, 90 % reflectivity [2] Max. 10 % ripple, within U_B [3] With connected IP 67 plug

Scanning distance	Switching output	Type of connection	Part number	Article number
0.2 … 6 m	PNP	Plug, M12x1, 4-pin	FT 92 IL-PSL4	591-91007
0.2 … 6 m	NPN	Plug, M12x1, 4-pin	FT 92 IL-NSL4	591-91009
0.2 … 6 m	PNP	Cable, 3 m, 3-wire	FT 92 IL-PSK3	591-91011
0.2 … 6 m	NPN	Cable, 3 m, 3-wire	FT 92 IL-NSK3	591-91010
0.2 … 6 m	PNP	Pigtail, 300 mm, with M12x1 plug, 4-pin	FT 92 IL-PS-KL4	591-91012

Accessories	
Connection cables	From Page A-32
Brackets	From Page A-4

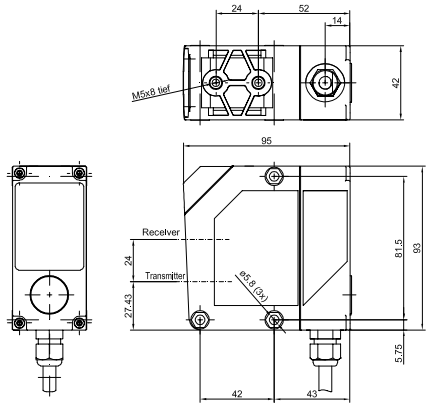
Version: 10/2013. Subject to changes; diagrams similar

Plug connection



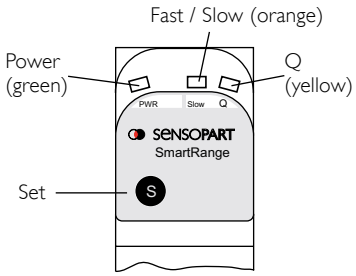
153-00346

Cable connection



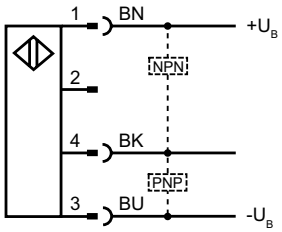
153-00700

Operating / display elements



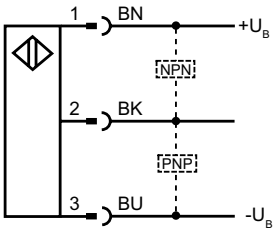
155-01378

Connection, 4-pin



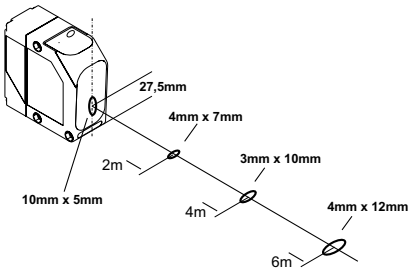
154-00460

Connection, 3-pin



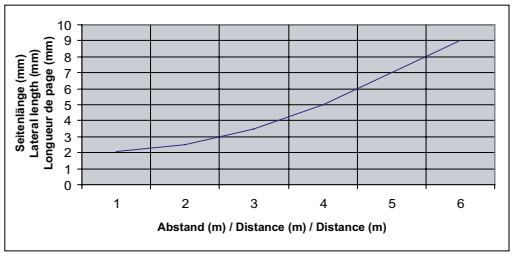
154-00459

Light spot size



155-00454

Smallest detectable part



155-00207

Reference material

White (90 %)
Grey (18 %)
Black (6 %)

Detection range

0.2 … 6 m
0.2 … 6 m
0.2 … 2.5 m

F 04/05/12/18/30 – photoelectric sensors and proximity sensors in cylindrical housings

All-round performance



Sensors in cylindrical housings have several special aspects compared to those with cubic housings. They are not only particularly robust but also, thanks to their integrated thread, offer easy and space-saving installation. Special designs that can "see around corners" are also available: they are equipped with a special optical system that deflects the transmission and reception beams around the sensor axis by 90°, expanding the mounting options available.

The sensors of the F 04/05/12/18/30 series differ in the diameter of the integrated metal threaded sleeve (4, 5, 12, 18 or 30 mm). Each series offers the usual functional variants: through-beam and retroreflective photoelectric sensors, energetic scanners, and scanners with background suppression. The sensors are optionally available with red-light or infrared LED or with pulsed red-light laser. Variants with potentiometer or teach-in operation are also available.

TYPICAL F 04/05/12/18/30

- Robust housings
- Very easy installation
- Straight or angled optics options
- Metric threads in 5 sizes: 4, 5, 12, 18 or 30 mm
- Red-light / infrared LED or laser light options
- FMF 18 for detection of liquid limit levels

F 04/05/12/18/30 – Product Overview					
	Type of light	Adjustment	Scanning distance / range	Special features	Page
Photoelectric proximity sensors with background suppression					
FT 12 RH	Red	Teach-in	10 … 60 mm	M12 housing, dynamic teach-in	392
FMH 18	Red	Potentiometer	40 … 120 mm	M18 housing, very precise detection	394
FT 12 RF	Red	None	24 mm	M12 housing	396
Photoelectric proximity sensors					
FM 04	Infrared	None	0 … 50 mm	Very small housing, M4	398
FM 05	Infrared	None	0 … 50 mm	Very small housing, M5	400
FT 12 R	Red	Potentiometer	1 … 300 mm		402
FT 18-2	Red / infrared	Potentiometer	0 … 800 mm	M18 metal housing	404
FT 18-2	Red / infrared	Potentiometer	0 … 800 mm	M18 plastic housing	406
FMS 18-34 B	Infrared	Potentiometer	5 … 400 mm	M18 housing	408
FMS 30-34 B	Infrared	Potentiometer	5 … 1000 mm	M30 housing, long operating range	410
Retroreflective photoelectric sensors					
FR 12 R	Red	Potentiometer	60 … 1500 mm	M12 housing	412
FR 18-2	Red	Potentiometer	3.0 m	M18 metal housing	414
FR 18-2	Infrared	Potentiometer	3.6 m	M18 plastic housing	416
Through-beam photoelectric sensors					
FS/FE 12 RL	Laser	Control line	0 … 5 m	M12 housing	418
FSE 18-2	Infrared		10 m	M18 housing	420
FS/FE 18 RL	Laser	Control line	0 … 50 m	M18 housing	422
FL 18 W	Laser	Potentiometer	0 … 50 m	M18 housing, adjustable transmission beam size	424
FL 18	Laser	Potentiometer	0 … 50 m	M18 housing, adjustable transmission beam size	426
Filling level sensor					
FMF 18-34	Infrared	Fixed		M18 housing, detection of liquids	428

FT 12 RH

Photoelectric proximity sensor with background suppression



PRODUCT HIGHLIGHTS

- Adjustable background suppression
- Dynamic teach-in via button / control line without machine stoppage
- Lockable Teach-in button

Optical data	
Scanning distance	10 … 60 mm[1]
Type of light	Red, 660 nm
Light spot size	5 x 5 mm[2]
Grey value shift (90 % white / 18 % grey)	< 6 %

Functions	
Indicator LED, green	Stability indicator
Indicator LED, yellow	Switching state indicator
Scanning distance adjustment	Via Teach-in button and control input
Adjustment possibilities	Control line for setting or locking N.O./N.C. selectable
Default settings	Max. scanning distance, PNP and N.O.

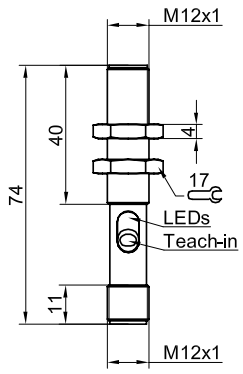
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection
Protection Class	2
Switching output, Q	PNP
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	1000 Hz
Response time	≤ 500 µs
Control input, ET	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions (cable devices)	M12 x 74 mm
Enclosure rating	IP 67[3]
Material, housing	Brass, nickel-plated
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	30 g

[1] Reference material: Kodak white, 90 % reflectivity [2] At scanning distance of 50 mm [3] With connected IP 67 plug

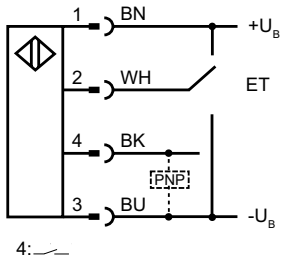
Type of connection	Part number	Article number
Plug, M12x1, 4-pin	FT 12 RH-PSL4	506-11000

Plug connection



153-00257

Connection, 4-pin



154-00164

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FMH 18

Photoelectric proximity sensor with background suppression



PRODUCT HIGHLIGHTS

- Scanning distance: 40 … 120 mm
- Red light, 660 nm
- Background suppression
- Robust metal housing
- Metal M18 threaded sleeve
- Antivalent switching outputs

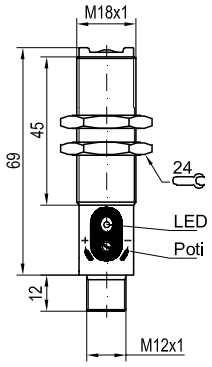
Optical data		Functions	
Scanning distance	40 … 120 mm[1]	Indicator LED, yellow	Switching state indicator
Type of light	Red, 660 nm	Scanning distance adjustment	Via 18-step potentiometer
Light spot size	8 x 10 mm[2]		
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC[3]	Dimensions	M18 x 69 mm
No-load current, I_0	≤ 30 mA	Dimensions (angled)	M18 x 70 mm
Output current, Ie	200 mA	Enclosure rating	IP 67[4]
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection	Material, housing	Brass, nickel-plated
		Material, front screen	Glass
Protection Class	2	Type of connection	See Selection Table
Power On Delay	≤ 300 ms	Ambient temperature: operation	-20 … +60 °C
Switching output, Q	PNP	Ambient temperature: storage	-20 … +80 °C
Output function	N.O./N.C.	Weight (plug device)	60 g
Switching frequency, f (ti/tp 1:1)	600 Hz	Weight (cable device)	160 g
Connection, BK	N.O.		
Connection, WH	N.C.		

[1] Reference material: Kodak grey, 18 % reflectivity [2] At scanning distance of 100 mm [3] 10 % ripple, within U_B [4] With connected IP 67 plug

Scanning distance	Light exit	Switching output	Type of connection	Part number	Article number
40 … 120 mm	Straight	PNP, antivalent	Plug, M12, 4-pin	FMH 18-L4	518-51505
40 … 120 mm	90° angle	PNP, antivalent	Plug, M12, 4-pin	FMH 18W-L4	518-51507
40 … 120 mm	Straight	PNP, antivalent	Cable, 3 m, 4-wire	FMH 18	518-51504
40 … 120 mm	90° angle	PNP, antivalent	Cable, 3 m, 4-wire	FMH 18W	518-51506

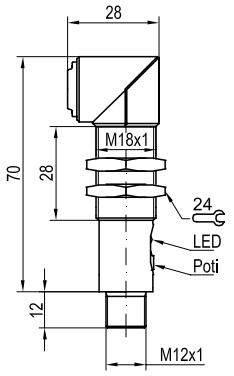
Accessories	
Connection cables	From Page A-32
Brackets	From Page A-4

Plug connection, FMH 18-L4



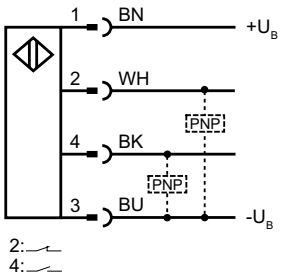
153-00029

Plug connection, FMH 18W-L4



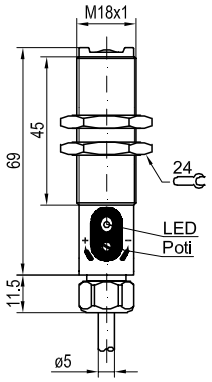
153-00030

Connection, 4-pin



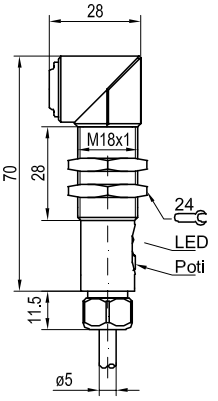
154-00193

Cable connection, FMH 18



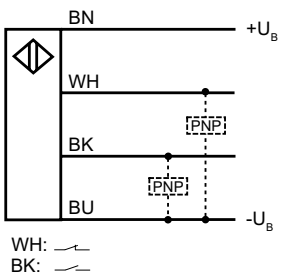
153-00027

Cable connection, FMH 18W



153-00028

Connection, 4-wire



154-00193

8

FT 12 RF

Fixed focus photoelectric proximity sensor with background suppression



PRODUCT HIGHLIGHTS

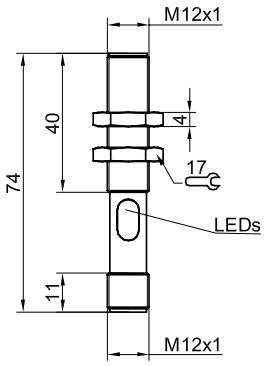
- Simple installation thanks to standard M12 metal thread
- High immunity to dirt due to high signal reserves
- Indicator for detection stability

Optical data		Functions	
Scanning distance	24 mm[1]	Indicator LED, green	Operating voltage indicator
Type of light	Red, 660 nm	Indicator LED, yellow	Switching state indicator
Hysteresis (18 %)	< 5 %	Scanning distance adjustment	Fixed setting
Grey value shift (90 % white / 18 % grey)	< 5 %	Default settings	PNP N.O.
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC	Dimensions	M12 x 74 mm
No-load current, I_0	≤ 25 mA	Enclosure rating	IP 67[2]
Output current, Ie	≤ 100 mA	Material, housing	Brass, nickel-plated
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection	Material, front screen	PMMA
		Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-20 … +60 °C
Switching output, Q	PNP	Ambient temperature: storage	-20 … +80 °C
Output function	N.O.	Weight (plug device)	30 g
Switching frequency, f (ti/tp 1:1)	1000 Hz		
Response time	≤ 500 µs		

[1] Reference material: Kodak white, 90 % reflectivity [2] With connected IP 67 plug

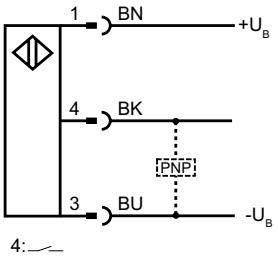
Type of connection	Part number	Article number
Plug, M12x1, 4-pin	FT 12 RF-PSL4	506-11004

Plug connection



153-00289

Connection, 3-pin



154-00160

Preferred direction of approach



155-00240

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

FM 04

Photoelectric proximity sensor



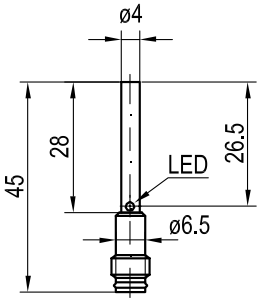
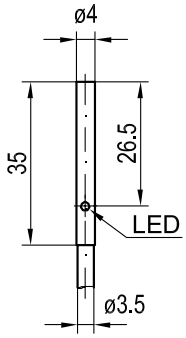
PRODUCT HIGHLIGHTS

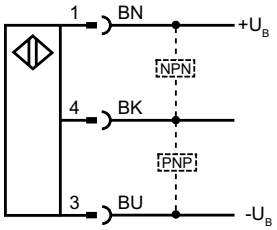
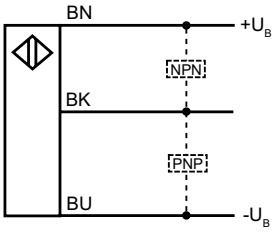
- Very small housing diameter: 4 mm
- Long switching distance of 50 mm
- Glass optics for easy cleaning
- Fully sealed under vacuum, enclosure rating of IP 67

Optical data		Functions	
Scanning distance	0 … 50 mm[1]	Indicator LED, yellow	Switching state indicator
Type of light	Infrared, 880 nm		
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC	Dimensions (plug device)	Ø 4 x 45 mm
No-load current, I_0	≤ 15 mA	Dimensions (cable device)	Ø 4 x 35 mm
Output current, Ie	≤ 100 mA	Enclosure rating	IP 67[2]
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection	Material, housing	Stainless steel, V2A
		Material, front screen	Glass
Power On Delay	120 msec	Type of connection	See Selection Table
Switching output, Q	PNP/NPN / max. 100 mA	Ambient temperature: operation	0 … +55 °C
Output function	N.O.	Vibration and impact resistance	IEC 60947-5-2
Switching frequency, f (ti/tp 1:1)	≤ 250 Hz		
Response time	≤ 2.5 ms		

[1] Reference material: Kodak white, 90 % reflectivity [2] With connected IP 67 plug

Switching output	Type of connection	Part number	Article number
PNP	Plug, M8, 3-pin	FM 04-163	718-51400
NPN	Plug, M8, 3-pin	FM 04-153	718-51401
PNP	Cable, PVC, 3 x 0.14 mm², 2 m	FM 04-161	718-51398
NPN	Cable, PVC, 3 x 0.14 mm², 2 m	FM 04-151	718-51399

Plug connection	Cable connection
 153-00041	 153-00040

Connection plug, 3-pin	Connection cable, 3-wire
 4: 154-00163	 BK: 15400163

Accessories	
Connection cables	From Page A-32
Brackets	From Page A-4

FM 05

Photoelectric proximity sensor



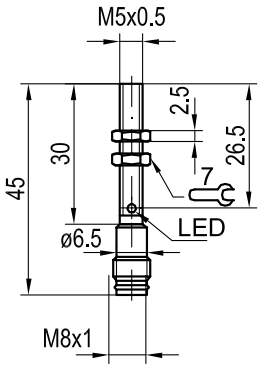
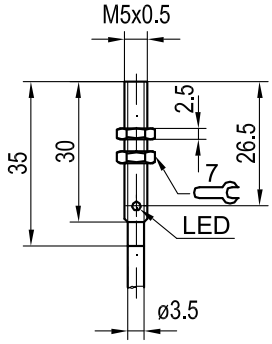
PRODUCT HIGHLIGHTS

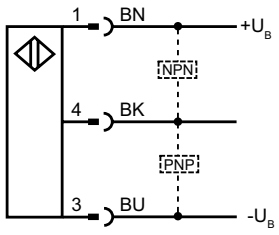
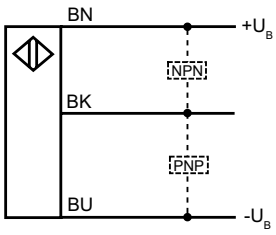
- Very small housing: cylindrical, M5
- Simple installation due to standard thread
- Glass optics for easy cleaning
- Fully sealed under vacuum, enclosure rating of IP 67

Optical data		Functions	
Scanning distance	0 … 50 mm[1]	Indicator LED, yellow	Switching state indicator
Type of light	Infrared, 880 nm		
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC	Dimensions (cable device)	M5 x 45 mm
No-load current, I_0	≤ 15 mA	Dimensions (plug device)	M5 x 35 mm
Output current, Ie	≤ 100 mA	Enclosure rating	IP 67[2]
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection	Material, housing	Stainless steel, V2A
		Material, front screen	Glass
Power On Delay	120 ms	Type of connection	See Selection Table
Switching output, Q	PNP/NPN / max. 100 mA	Ambient temperature: operation	0 … +55 °C
Output function	N.O.	Vibration and impact resistance	IEC 60947-5-2
Switching frequency, f (ti/tp 1:1)	≤ 250 Hz		
Response time	≤ 2.5 ms		

[1] Reference material: Kodak white, 90 % reflectivity [2] With connected IP 67 plug

Switching output	Type of connection	Part number	Article number
PNP	Plug, M8, 3-pin	FM 05-163	718-51404
NPN	Plug, M8, 3-pin	FM 05-153	718-51405
PNP	Cable, PVC, 3 x 0.14 mm², 2 m	FM 05-161	718-51402
NPN	Cable, PVC, 3 x 0.14 mm², 2 m	FM 05-151	718-51403

Plug connection	Cable connection
 153-00043	 153-00042

Connection plug, 3-pin	Connection cable, 3-wire
 4: 154-00163	 BK: 154-00163

Accessories	
Connection cables	From Page A-32
Brackets	From Page A-4

FT 12 R

Photoelectric proximity sensor



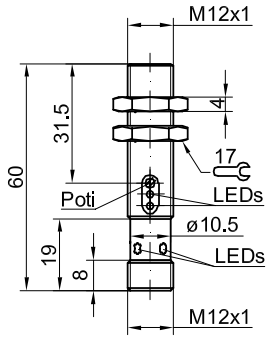
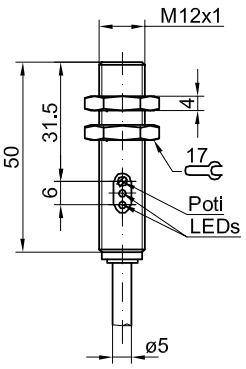
PRODUCT HIGHLIGHTS

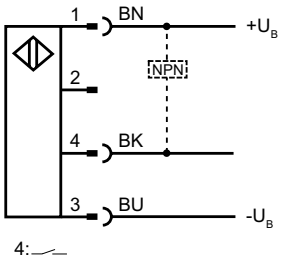
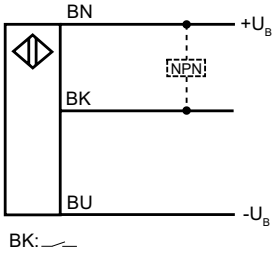
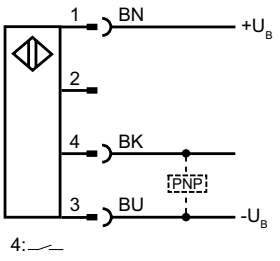
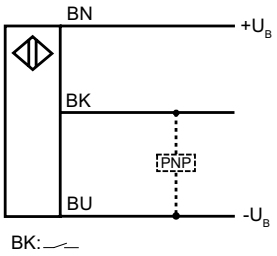
- Scanning distance: 1 … 300 mm, adjustable
- Red light, 660 nm
- Easy installation thanks to standard M12 metal thread
- Functional reserve indicator
- N.O./N.C. switchable

Optical data		Functions	
Scanning distance	1 … 300 mm[1]	Indicator LED, green	Functional reserve indicator
Type of light	Red, 660 nm	Indicator LED, yellow	Switching state indicator
Light spot size	Ø 5 mm[2]	Scanning distance adjustment	Via potentiometer
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 36 V DC	Dimensions (plug device)	M12 x 60 mm
No-load current, I_0	≤ 15 mA	Dimensions (cable device)	M12 x 50 mm
Output current, Ie	≤ 200 mA	Enclosure rating	IP 67[3]
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection	Material, housing	Brass, chromium-plated
		Material, front screen	Glass
Protection Class	2	Type of connection	See Selection Table
Power On Delay	60 msec	Ambient temperature: operation	-25 … +55 °C
Switching output, Q	PNP/NPN / max. 200 mA	Weight (plug device)	20 g
Output function	N.O.	Weight (cable device)	100 g
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Vibration and impact resistance	IEC 60947-5-2
Response time	≤ 500 µs		

[1] Reference material: Kodak white, 90 % reflectivity [2] At scanning distance of 10 mm [3] With connected IP 67 plug

Switching output	Type of connection	Part number	Article number
PNP	Plug, M12, 4-pin	FT 12 R-PSL4	701-21000
NPN	Plug, M12, 4-pin	FT 12 R-NSL4	701-21001
PNP	Cable, PVC, 3 x 0.34 mm², 2 m	FT 12 R-PSK3	701-21002
NPN	Cable, PVC, 3 x 0.34 mm², 2 m	FT 12 R-NSK3	701-21003

Plug connection	Cable connection
 153-00208	 153-00207

Connection, 4-pin	Connection, 3-pin
 154-00489	 154-00488
 154-00224	 154-00160

Accessories	
Connection cables	From Page A-32
Brackets	From Page A-4

FT 18-2

Diffuse photoelectric proximity sensor



PRODUCT HIGHLIGHTS

- Economical solution for numerous applications
- Scanning distance of up to 800 mm, adjustable via potentiometer
- Red light or infrared
- Variants with angled light exit
- Robust metal housings (IP 67)
- Simple adjustment via potentiometer
- 2 through holes as additional mounting possibility

Optical data	
Scanning distance	See Selection Table
Type of light	See Selection Table

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via potentiometer
Adjustment possibilities	N.O./N.C. via control input (IN)
Default settings	Max. scanning distance and N.O.

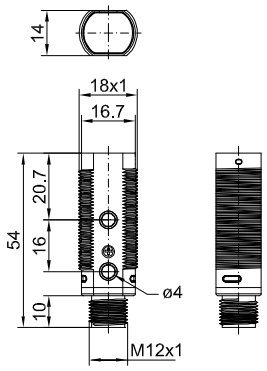
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection
Switching output, Q	PNP/NPN (see Selection Table)
Output function	$-U_B$ = N.O. / $+U_B$ = N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	≤ 1 ms

Mechanical data	
Dimensions	M18 x 44 mm
Enclosure rating	IP 67[1]
Material, housing	Metal
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-25 … +55 °C
Weight (plug device)	23 g[2] / 25 g[3]
Weight (cable device)	63 g[2] / 65 g[3]

[1] With connected IP 67 plug [2] Straight light exit variant [3] Angled light exit variant

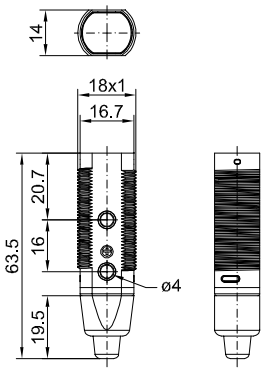
Scanning distance	Type of light	Light exit	Switching output	Type of connection	Part number	Article number
0 … 400 mm	Red light	Straight	PNP	Metal plug, M12, 4-pin	FT 18-2 RM-PS-L4	740-21021
0 … 400 mm	Red light	Straight	NPN	Metal plug, M12, 4-pin	FT 18-2 RM-NS-L4	740-21022
0 … 400 mm	Red light	Straight	PNP	Cable, 2 m, 4-wire	FT 18-2 RM-PS-K4	740-21023
0 … 400 mm	Red light	Straight	NPN	Cable, 2 m, 4-wire	FT 18-2 RM-NS-K4	740-21024
0 … 320 mm	Red light	90° angle	PNP	Metal plug, M12, 4-pin	FT 18-2 RWM-PS-L4	740-21025
0 … 320 mm	Red light	90° angle	NPN	Metal plug, M12, 4-pin	FT 18-2 RWM-NS-L4	740-21026
0 … 320 mm	Red light	90° angle	PNP	Cable, 2 m, 4-wire	FT 18-2 RWM-PS-K4	740-21027
0 … 320 mm	Red light	90° angle	NPN	Cable, 2 m, 4-wire	FT 18-2 RWM-NS-K4	740-21028
0 … 800 mm	Infrared	Straight	PNP	Metal plug, M12, 4-pin	FT 18-2 IDM-PS-L4	740-21029
0 … 800 mm	Infrared	Straight	NPN	Metal plug, M12, 4-pin	FT 18-2 IDM-NS-L4	740-21030
0 … 800 mm	Infrared	Straight	PNP	Cable, 2 m, 4-wire	FT 18-2 IDM-PS-K4	740-21031
0 … 800 mm	Infrared	Straight	NPN	Cable, 2 m, 4-wire	FT 18-2 IDM-NS-K4	740-21032

Plug connection (straight)



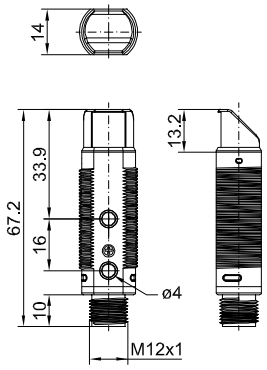
153-00985

Cable connection (straight)



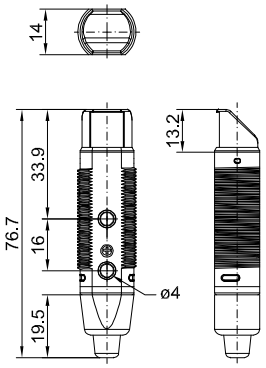
153-00984

Plug connection (angled)



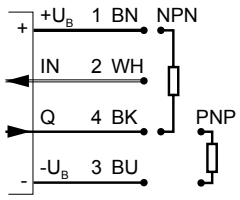
153-00987

Cable connection (angled)



153-00986

Connection, 4-pin



154-00312

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

FT 18-2

Diffuse photoelectric proximity sensor



PRODUCT HIGHLIGHTS

- Economical solution for numerous applications
- Scanning distance of up to 800 mm, adjustable via potentiometer
- Red light or infrared
- Variants with angled light exit
- Robust plastic housings (IP 67)
- Simple adjustment via potentiometer
- 2 through holes as additional mounting possibility

Optical data	
Scanning distance	See Selection Table
Type of light	See Selection Table

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via potentiometer
Adjustment possibilities	N.O./N.C. via control input (IN)
Default settings	Max. scanning distance and N.O.

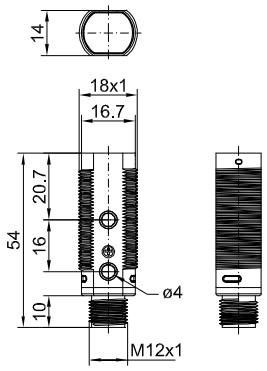
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C. / $-U_B$ = N.O. / $+U_B$ = N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	≤ 1 ms

Mechanical data	
Dimensions	M18 x 44 mm
Enclosure rating	IP 67[1]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-25 … +55 °C
Weight (plug device)	11 g[2] / 13 g[3]
Weight (cable device)	55 g[2] / 57g[3]

[1] With connected IP 67 plug [2] Straight light exit variant [3] Angled light exit variant

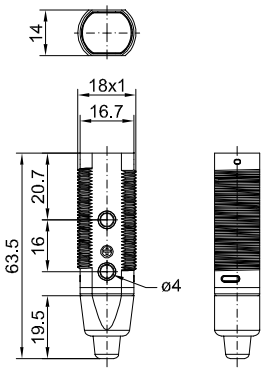
Scanning distance	Type of light	Light exit	Switching output	Type of connection	Part number	Article number
0 … 400 mm	Red light	Straight	PNP	Plug, M12, 4-pin	FT 18-2 R-PS-L4	740-21033
0 … 400 mm	Red light	Straight	NPN	Plug, M12, 4-pin	FT 18-2 R-NS-L4	740-21034
0 … 400 mm	Red light	Straight	PNP	Cable, 2 m, 4-wire	FT 18-2 R-PS-K4	740-21020
0 … 400 mm	Red light	Straight	NPN	Cable, 2 m, 4-wire	FT 18-2 R-NS-K4	740-21035
0 … 320 mm	Red light	90° angle	PNP	Plug, M12, 4-pin	FT 18-2 RW-PS-L4	740-21036
0 … 320 mm	Red light	90° angle	NPN	Plug, M12, 4-pin	FT 18-2 RW-NS-L4	740-21037
0 … 320 mm	Red light	90° angle	PNP	Cable, 2 m, 4-wire	FT 18-2 RW-PS-K4	740-21038
0 … 320 mm	Red light	90° angle	NPN	Cable, 2 m, 4-wire	FT 18-2 RW-NS-K4	740-21039
0 … 800 mm	Infrared	Straight	PNP	Plug, M12, 4-pin	FT 18-2 ID-PS-L4	740-21040
0 … 800 mm	Infrared	Straight	NPN	Plug, M12, 4-pin	FT 18-2 ID-NS-L4	740-21041
0 … 800 mm	Infrared	Straight	PNP	Cable, 2 m, 4-wire	FT 18-2 ID-PS-K4	740-21042
0 … 800 mm	Infrared	Straight	NPN	Cable, 2 m, 4-wire	FT 18-2 ID-NS-K4	740-21043

Plug connection (straight)



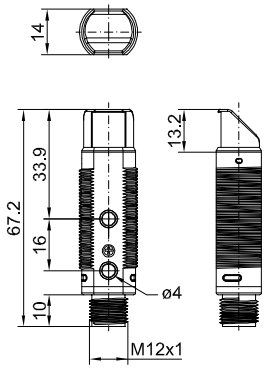
153-00985

Cable connection (straight)



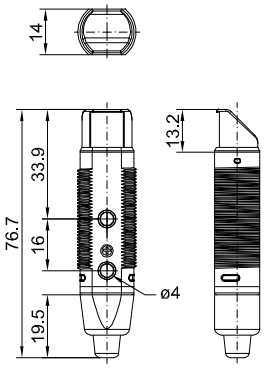
153-00984

Plug connection (angled)



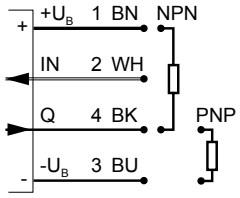
153-00987

Cable connection (angled)



153-00986

Connection, 4-pin



154-00312

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

FMS 18-34 B

Photoelectric proximity sensor



PRODUCT HIGHLIGHTS

- Scanning distance: 5 … 400 mm, adjustable
- Wide beam (large aperture angle)
- Separating seam
- Metal M18 threaded sleeve
- Contamination indicator

Optical data	
Scanning distance	5 … 400 mm[1]
Type of light	Infrared, 880 nm
Distance hysteresis	≤ 10 % of set scanning distance
Aperture angle	25°

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Indicator LED, red	Contamination indicator
Sensitivity adjustment	Via 18-step potentiometer
Default setting	Max. scanning distance

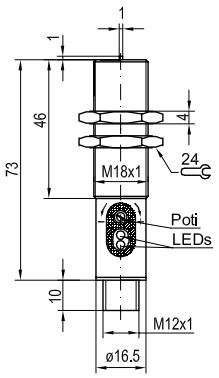
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 200 mA
Pull-up resistance	22 kΩ
Pull-down resistance	22 kΩ
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	See Selection Table
Output function	See Selection Table
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs

Mechanical data	
Dimensions	M18 x 73 mm
Enclosure rating	IP 65[3]
Material, housing	Brass, nickel-plated
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-40 … +80 °C
Weight (plug device)	65 g
Weight (receiver device)	165 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: Kodak white, 90 % reflectivity [2] 10 % ripple, within U_B [3] With connected IP 65 plug

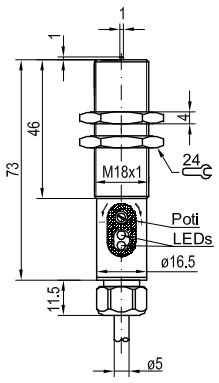
Scanning distance	Switching output	Type of connection	Part number	Article number
5 … 400 mm	PNP (N.O.) / NPN (N.O.)	Plug, M12x1, 4-pin	FMS 18-34 B-L4	516-50781
5 … 400 mm	PNP (N.O.) / NPN (N.O.)	Cable, 3 m, 4-wire	FMS 18-34 B	516-50782
5 … 400 mm	PNP (N.O.) / NPN (N.C.)	Cable, 3 m, 4-wire	FMS 18-34 B ONSP	516-50783

Plug connection



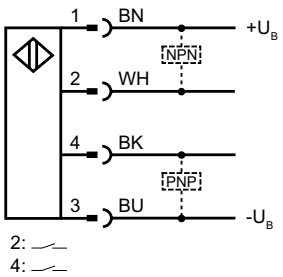
153-00032

Cable connection



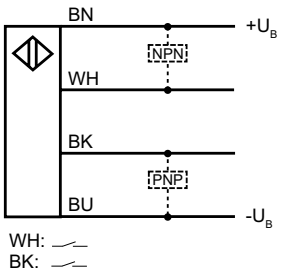
153-00031

Connection, 4-pin



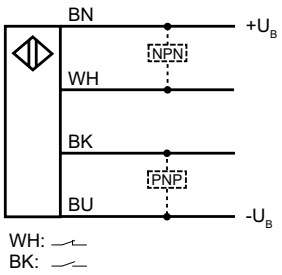
154-00211

Connection, 4-wire: FMS 18-34 B



154-00211

Connection, 4-wire: FMS 18-34 B ONSP



154-00213

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FMS 30-34 B

Photoelectric proximity sensor



PRODUCT HIGHLIGHTS

- Scanning distance: 5 … 1000 mm, adjustable
- Wide beam (large aperture angle)
- Separating seam
- Metal M30 threaded sleeve
- Contamination indicator

Optical data	
Scanning distance	5 … 1000 mm[1]
Type of light	Infrared, 880 nm
Distance hysteresis	≤ 10 % of set scanning distance
Aperture angle	50°

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Indicator LED, red	Contamination indicator
Sensitivity adjustment	Via 18-step potentiometer

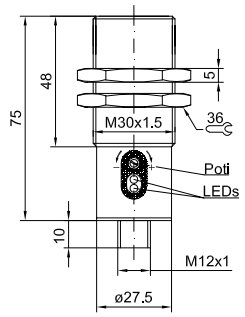
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 40 mA
Output current, Ie	≤ 200 mA
Pull-up resistance	22 kΩ
Pull-down resistance	22 kΩ
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	50 Hz

Mechanical data	
Dimensions	M12 x 75 mm
Enclosure rating	IP 65[3]
Material, housing	Brass, nickel-plated
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-40 … +80 °C
Weight (plug device)	170 g
Weight (cable device)	280 g
Vibration and impact resistance	60947-5-2

[1] Reference material: white, 90 % reflectivity [2] 10 % ripple, within U_B [3] With connected IP 65 plug

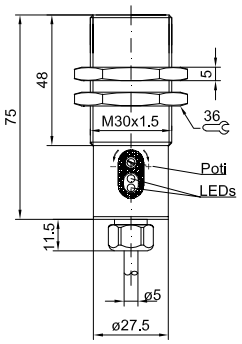
Scanning distance	Type of connection	Part number	Article number
5 … 1000 mm	Plug, M12x1, 4-pin	FMS 30-34 B-L4	550-51596
5 … 1000 mm	Cable, 3 m, 4-wire	FMS 30-34 B	550-51595

Plug connection



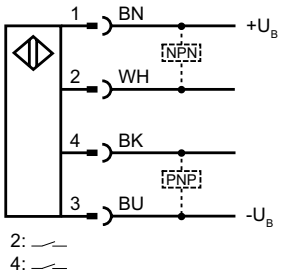
153-00034

Cable connection



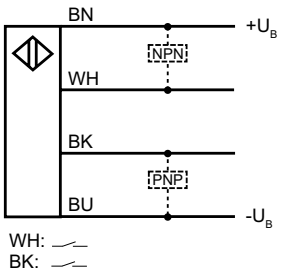
153-00033

Connection, 4-pin



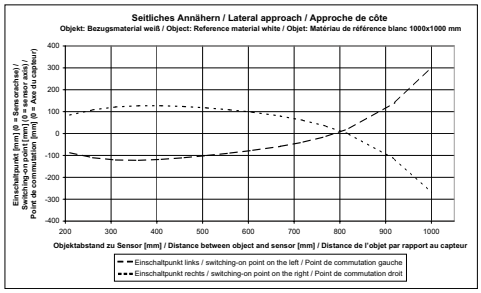
154-00211

Connection, 4-wire



154-00211

Switching characteristics, FMS 30-34 B



155-00658

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FR 12 R

Retroreflective photoelectric sensor



PRODUCT HIGHLIGHTS

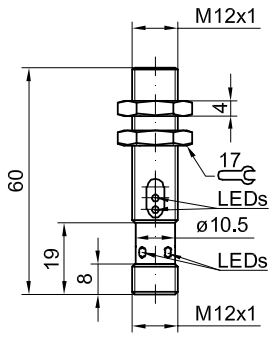
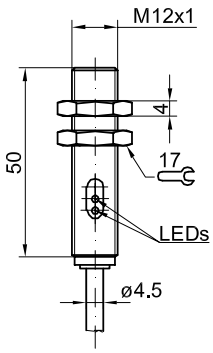
- Robust M12 metal housings with short mounting lengths
- Operating range: 60 … 1500 mm
- Red light, 660 nm
- Switching state and functional reserve indicators

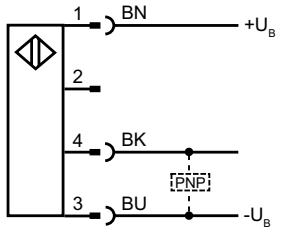
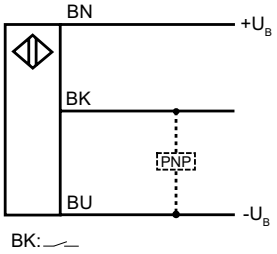
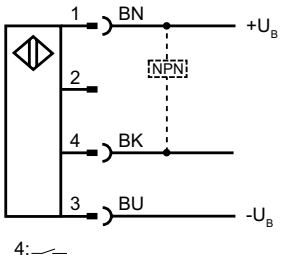
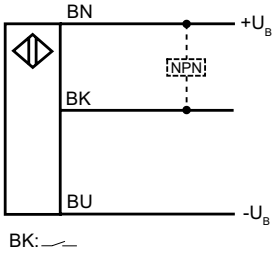
Optical data		Functions	
Scanning distance	60 … 1500 mm[1]	Indicator LED, green	Functional reserve indicator
Type of light	Red, 660 nm	Indicator LED, yellow	Switching state indicator
Light spot size	Ø 10 mm[2]	Scanning distance adjustment	Fixed setting
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 36 V DC	Dimensions (plug device)	M12 x 60 mm
No-load current, I_0	≤ 15 mA	Dimensions (cable device)	M12 x 50 mm
Output current, Ie	≤ 200 mA	Enclosure rating	IP 67[3]
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection	Material, housing	Brass, chromium-plated
		Material, front screen	Glass
Protection Class	2	Type of connection	See Selection Table
Power On Delay	20 msec	Ambient temperature: operation	-25 … +55 °C
Switching output, Q	PNP/NPN / max 200 mA	Weight (plug device)	20 g
Output function	N.O.	Weight (cable device)	100 g
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Vibration and impact resistance	IEC 60947-5-2
Response time	≤ 500 µs		

[1] Reference material: RD8 reflector, Ø 84 mm [2] At scanning distance of 50 mm [3] With connected IP 67 plug

Switching output	Type of connection	Part number	Article number
PNP	Plug, M12, 4-pin	FR 12 R-PSL4	703-11000
NPN	Plug, M12, 4-pin	FR 12 R-NSL4	703-11001
PNP	Cable, PVC, 3 x 0.34 mm², 2 m	FR 12 R-PSK3	703-11002
NPN	Cable, PVC, 3 x 0.34 mm², 2 m	FR 12 R-NSK3	703-11003

Version: 10/2013. Subject to changes; diagrams similar

Plug connection	Cable connection
 153-00250	 153-00249

Connection, 4-pin	Connection, 3-pin
 154-00224	 154-00160
 154-00489	 154-00488

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

FR 18-2

Retroreflective photoelectric sensor



PRODUCT HIGHLIGHTS

- Economical solution for numerous applications
- Range of up to 3.0 m
- Variants with angled light exit
- Robust metal housings (IP 67)
- Polarisation filter for reliable detection of highly reflective surfaces
- Simple adjustment via potentiometer
- 2 through holes as additional mounting possibility

Optical data	
Operating range	See Selection Table[1]
Type of light	See Selection Table
Polarising filter	Yes

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via potentiometer
Adjustment possibilities	N.O./N.C. via control input (IN)
Default settings	Max. scanning distance and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	≤ 1 ms

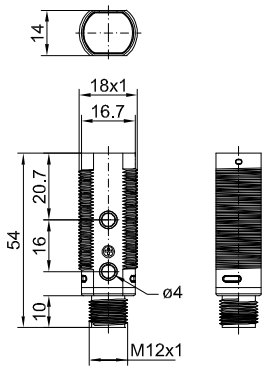
Mechanical data	
Dimensions	M18 x 44 mm
Enclosure rating	IP 67[2]
Material, housing	Metal
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-25 … +55 °C
Weight (plug device)	34 g[3] / 36 g[4]
Weight (cable device)	74 g[3] / 76 g[4]

[1] Reference material: R5 reflector [2] With connected IP 67 plug [3] Straight light exit variant [4] Angled light exit variant

Operating range	Type of light	Light exit	Switching output	Type of connection	Part number	Article number
3.0 m	Red light	Straight	PNP	Metal plug, M12, 4-pin	FR 18-2 RM-PS-L4	741-11014
3.0 m	Red light	Straight	NPN	Metal plug, M12, 4-pin	FR 18-2 RM-NS-L4	741-11015
3.0 m	Red light	Straight	PNP	Cable, 2 m, 4-wire	FR 18-2 RM-PS-K4	741-11016
3.0 m	Red light	Straight	NPN	Cable, 2 m, 4-wire	FR 18-2 RM-NS-K4	741-11017
2.4 m	Red light	90° angle	PNP	Metal plug, M12, 4-pin	FR 18-2 RWM-PS-L4	741-11018
2.4 m	Red light	90° angle	NPN	Metal plug, M12, 4-pin	FR 18-2 RWM-NS-L4	741-11019
2.4 m	Red light	90° angle	PNP	Cable, 2 m, 4-wire	FR 18-2 RWM-PS-K4	741-11020
2.4 m	Red light	90° angle	NPN	Cable, 2 m, 4-wire	FR 18-2 RWM-NS-K4	741-11021

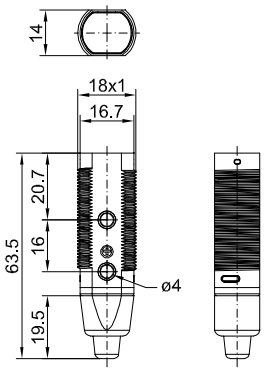
Scope of delivery
Reflector: 53.4 x 53.4 mm²
2 x securing nuts

Plug connection (straight)



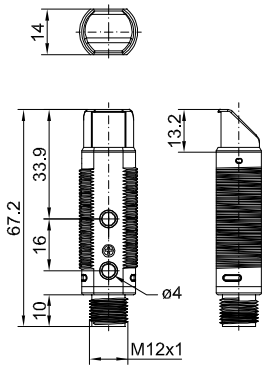
153-00985

Cable connection (straight)



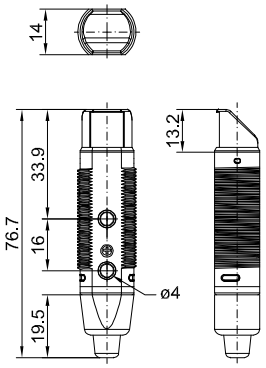
153-00984

Plug connection (angled)



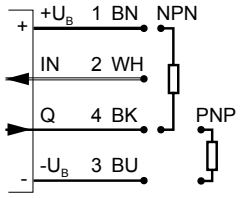
153-00987

Cable connection (angled)



153-00986

Connection, 4-pin



154-00312

Accessories

Reflectors	From Page A-16
Connection cables	From Page A-32
Brackets	From Page A-4

8

FR 18-2

Retroreflective photoelectric sensor



PRODUCT HIGHLIGHTS

- Economical solution for numerous applications
- Range of up to 3.60 m
- Variants with angled light exit
- Robust plastic housings (IP 67)
- Simple adjustment via potentiometer
- 2 through holes as additional mounting possibility

Optical data	
Operating range	See Selection Table[1]
Type of light	See Selection Table
Polarising filter	No

Functions	
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via potentiometer
Adjustment possibilities	N.O./N.C. via control input (IN)
Default settings	Max. scanning distance and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	≤ 1 ms

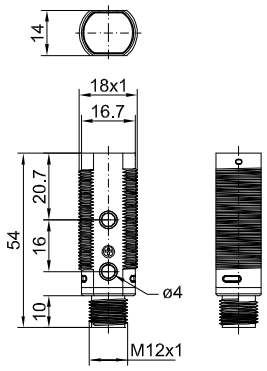
Mechanical data	
Dimensions	M18 x 44 mm
Enclosure rating	IP 67[2]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-25 … +55 °C
Weight (plug device)	11 g[3] / 13 g[4]
Weight (cable device)	55 g[3] / 57 g[4]

[1] Reference material: R5 reflector [2] With connected IP 67 plug [3] Straight light exit variant [4] Angled light exit variant

Operating range	Type of light	Light exit	Switching output	Type of connection	Part number	Article number
3.6 m	Infrared	Straight	PNP	Plug, M12, 4-pin	FR 18-2 I-PS-L4	741-11022
3.6 m	Infrared	Straight	NPN	Plug, M12, 4-pin	FR 18-2 I-NS-L4	741-11023
3.6 m	Infrared	Straight	PNP	Cable, 2 m, 4-wire	FR 18-2 I-PS-K4	741-11024
3.6 m	Infrared	Straight	NPN	Cable, 2 m, 4-wire	FR 18-2 I-NS-K4	741-11025
2.5 m	Infrared	90° angle	PNP	Plug, M12, 4-pin	FR 18-2 IW-PS-L4	741-11026
2.5 m	Infrared	90° angle	NPN	Plug, M12, 4-pin	FR 18-2 IW-NS-L4	741-11027
2.5 m	Infrared	90° angle	PNP	Cable, 2 m, 4-wire	FR 18-2 IW-PS-K4	741-11028
2.5 m	Infrared	90° angle	NPN	Cable, 2 m, 4-wire	FR 18-2 IW-NS-K4	741-11029

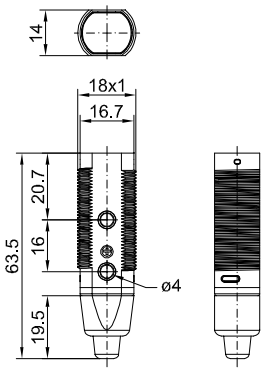
Scope of delivery
Reflector: 53.4 x 53.4 mm²
2 x securing nuts

Plug connection (straight)



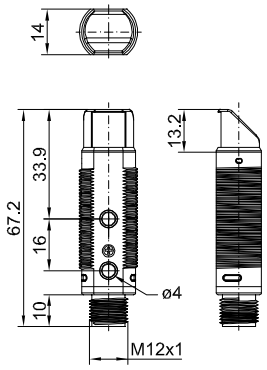
153-00985

Cable connection (straight)



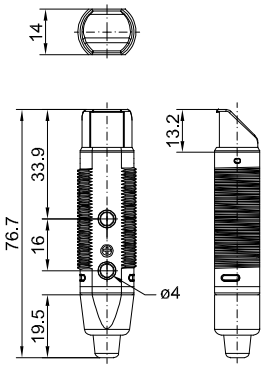
153-00984

Plug connection (angled)



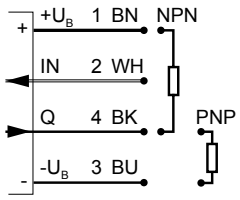
153-00987

Cable connection (angled)



153-00986

Connection, 4-pin



154-00312

Accessories

Reflectors	From Page A-16
Connection cables	From Page A-32
Brackets	From Page A-4

8

FS/FE 12 RL

Laser through-beam photoelectric sensor



PRODUCT HIGHLIGHTS

- Fine, parallel light beam
- Small part detection to 0.2 mm at a max. distance of 1 m
- Simple installation thanks to standard M12 metal thread
- Control line for setting of 3 sensitivity levels
- Test input

Optical data	
Range	0 … 5 m
Type of light	Laser, red, 650 nm
Laser Class (DIN EN 60825-1:2008-5)	2

Functions	
Indicator LED, yellow	Switching state indicator
Sensitivity adjustment	Via control line

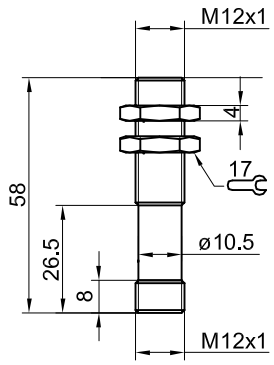
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	10 kHz
Control input, Test, transmitter	$-U_B$: transmitter = off $+U_B$ or Open: transmitter = on
Control input, Gain, receiver[1]	1 Open= medium sensitivity 2 $-U_B$ = high sensitivity 3 $+U_B$ = low sensitivity

Mechanical data	
Dimensions	M12 x 58 mm
Enclosure rating	IP 67[2]
Material, housing	Brass, nickel-plated
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (transmitter / receiver)	30 g

[1] Change in Gain setting is only effective after renewed switch on / switch off [2] With connected IP 67 plug

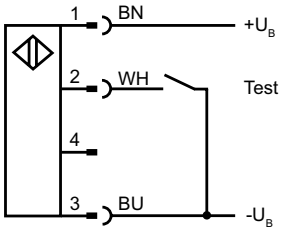
Transmitter / receiver	Switching output	Type of connection	Part number	Article number
Receiver	PNP N.O.	Plug, M12, 4-pin	FE 12 RL-PS-L4	580-51402
Receiver	PNP N.C.	Plug, M12, 4-pin	FE 12 RL-PO-L4	580-51403
Receiver	NPN N.C.	Plug, M12, 4-pin	FE 12 RL-NS-L4	580-51405
Transmitter	–	Plug, M12, 4-pin	FS 12 RL-L4	580-51401

Plug connection (transmitter / receiver)



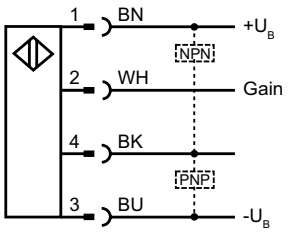
153-00345

Connection, transmitter, 4-pin



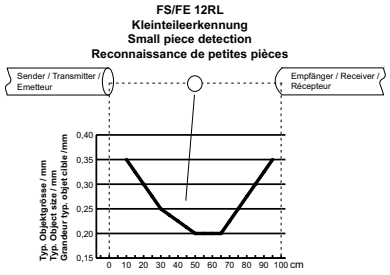
154-00171

Connection, receiver, 4-pin: PNP/NPN



154-00265

Small part detection



155-00215

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FSE 18-2

Through-beam photoelectric sensor



PRODUCT HIGHLIGHTS

- Economical solution for numerous applications
- Long range of up to 10 m
- Robust metal housings (IP 67)
- Simple adjustment via potentiometer
- 2 through holes as additional mounting possibility

Optical data	
Operating range	10 m
Type of light	See Selection Table

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via potentiometer
Adjustment possibilities	N.O./N.C. via control input (IN)
Default settings	Max. scanning distance and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 400 Hz
Response time	≤ 2.5 ms

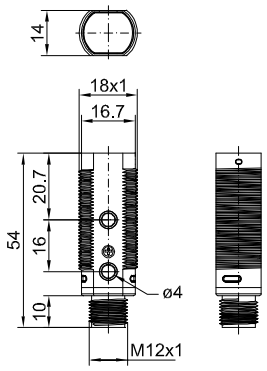
Mechanical data	
Dimensions	M18 x 44 mm
Enclosure rating	IP 67[1]
Material, housing	Metal
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-25 … +55 °C
Weight (plug device)	46 g
Weight (cable device)	130 g

[1] With connected IP 67 plug

Transmitter / receiver	Type of light	Light exit	Switching output	Type of connection	Part number	Article number
Transmitter / receiver	Infrared	Straight	PNP	Metal plug, M12, 4-pin	FSE 18-2 IM-PS-L4	742-51004
Transmitter / receiver	Infrared	Straight	NPN	Metal plug, M12, 4-pin	FSE 18-2 IM-NS-L4	742-51005
Transmitter / receiver	Infrared	Straight	PNP	Cable, 2 m, 4-wire	FSE 18-2 IM-PS-K4	742-51006
Transmitter / receiver	Infrared	Straight	NPN	Cable, 2 m, 4-wire	FSE 18-2 IM-NS-K4	742-51007

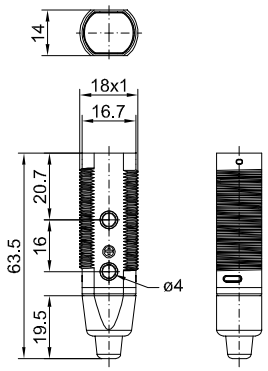
Scope of delivery
Transmitter & receiver
2 x securing nuts

Plug connection



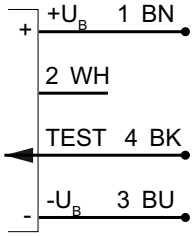
153-00985

Cable connection



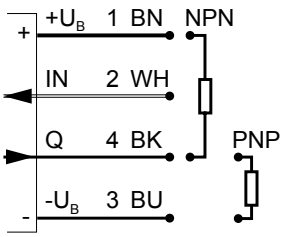
153-00984

Connection, 4-pin (transmitter)



154-00516

Connection, 4-pin (receiver)



154-00312

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FS/FE 18 RL

Laser through-beam photoelectric sensor



PRODUCT HIGHLIGHTS

- Operating range: 50 m
- Small housings
- Red light laser, 650 nm
- Control line for setting of 3 sensitivity levels
- Test input

Optical data	
Operating range	0 … 50 m
Type of light	Laser, pulsed, red, 650 nm
Laser Class (DIN EN 60825-1:2008-5)	2

Functions	
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via control line

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	≤ 10000 Hz
Response time	50 µs
Control input, Test	Test input (transmitter) $-U_B$: transmitter = off $+U_B$ or Open: transmitter = on
Control input, Gain	Open: medium sensitivity – medium distance[1] $-U_B$: high sensitivity – high distance[1] $+U_B$: low sensitivity – low distance

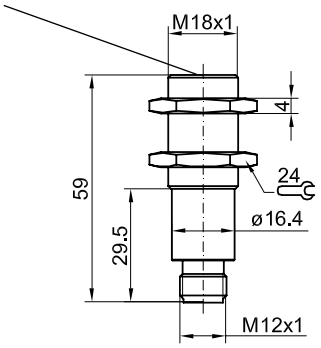
Mechanical data	
Dimensions (plug device)	M18x1 x 59 mm
Enclosure rating	IP 67[2]
Material, housing	Brass, nickel-plated
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (transmitter / receiver)	70 g

[1] Change in Gain setting is only effective after renewed switch on / switch off [2] With connected IP 67 plug

Transmitter / receiver	Switching output	Type of connection	Part number	Article number
Receiver	PNP	Plug, M12x1, 4-pin	FE 18 RL-PS-L4	580-51400
Receiver	NPN	Plug, M12x1, 4-pin	FE 18 RL-NS-L4	580-51399
Transmitter	–	Plug, M12x1, 4-pin	FS 18 RL-L4	580-51398

Plug connection (transmitter)

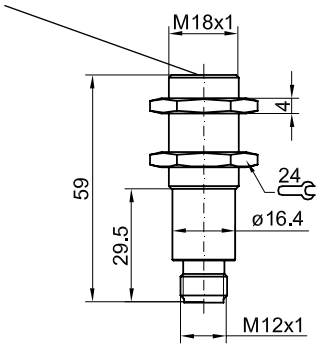
Laser exit aperture



153-00351

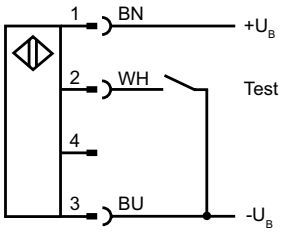
Plug connection (receiver)

Yellow LED: ON = light path free



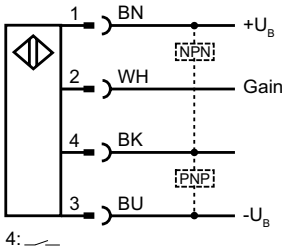
153-00351

Connection, 4-pin (transmitter)



154-00171

Connection, 4-pin (receiver)



154-00265

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

FL 18 W

Laser through-beam photoelectric sensor



PRODUCT HIGHLIGHTS

- Operating range: 50 m
- Red light laser, 650 nm
- Transmitter beam can be focused according to application
- Accuracy adjustable via beam spot size
- Smallest detectable part: 0.03 mm
- Switching frequency, 6000 Hz
- Metal M18 threaded sleeve

Optical data	
Operating range	0 … 50 m
Type of light	Laser, red, 650 nm
Laser Class (DIN EN 60825-1:2008-5)	2

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Indicator LED, red	Contamination indicator
Sensitivity adjustment	Via 18-step potentiometer
Default settings	Max. operating range

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP
Output function	N.O./N.C. (see Selection Table)
Switching frequency, f (ti/tp 1:1)	≤ 6000 Hz
Response time	83 µs
Control input, Test	< 2 V: transmitter off > 10 V or Open: transmitter on

Mechanical data	
Dimensions	(See dimensional drawings)
Enclosure rating	IP 65[2]
Material, housing	Brass, nickel-plated
Type of connection	See Selection Table
Ambient temperature: operation	-10 … +50 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	85 g
Weight (receiver device)	190 g

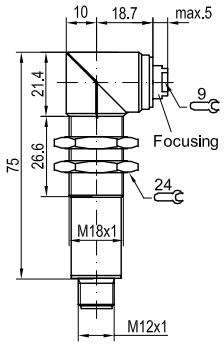
[1] 10 % ripple, within U_B [2] With connected IP 65 plug

Transmitter / receiver	Switching output	Type of connection	Part number	Article number
Transmitter	–	Plug, M12x1, 4-pin	FLS 18W-L4	580-51408
Receiver	PNP (N.O./N.C.)	Plug, M12x1, 4-pin	FLE 18W-L4	580-51414
Receiver	PNP (N.C.)	Plug, M12x1, 4-pin	FLE 18W-L4-15	580-51415
Transmitter	–	Cable, 3 m, 4-wire	FLS 18W	580-51409
Receiver	PNP (N.O./N.C.)	Cable, 3 m, 4-wire	FLE 18W	580-51416
Receiver	PNP (N.C.)	Cable, 3 m, 4-wire	FLE 18W-15	580-51417

Accessories	
Connection cables	From Page A-32
Brackets	From Page A-4

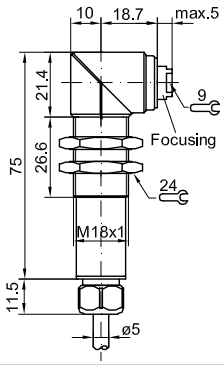
Version: 10/2013. Subject to changes; diagrams similar

Plug connection (transmitter): FLS 18W-L4



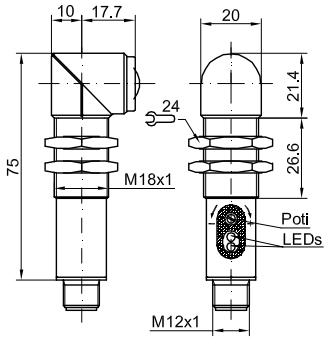
153-00052

Cable connection, (transmitter): FLS 18W



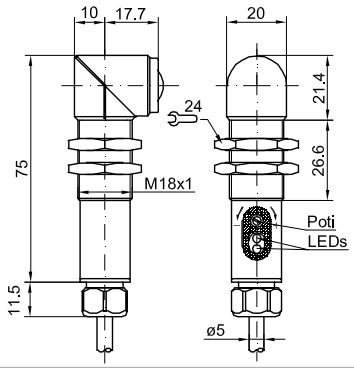
153-00050

Plug connection (receiver): FLE 18W-L4 / FLE 18W-L4-15



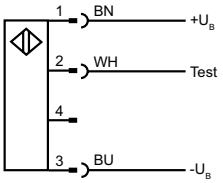
153-00053

Cable connection, (receiver): FLE 18W / FLE 18W-15



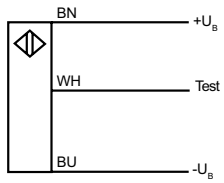
153-00051

Connection, 4-pin (transmitter)



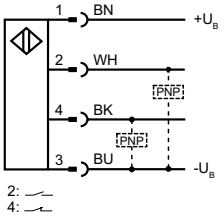
154-00231

Connection, 4-wire (transmitter)



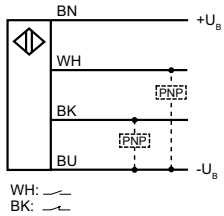
154-00231

Connection, 4-pin (receiver): FLE 18W



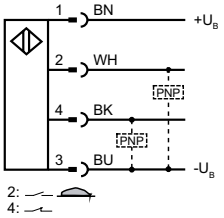
154-00230

Connection, 4-wire (receiver): FLE 18W



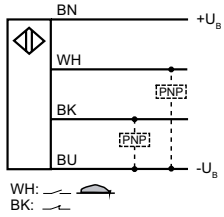
154-00230

Connection, 4-pin (receiver): FLE 18W-L4-15



154-00464

Connection, 4-wire (receiver): FLE 18W-15



154-00464

FL 18

Laser through-beam photoelectric sensor



PRODUCT HIGHLIGHTS

- Operating range: 50 m
- Red light laser, 650 nm
- Transmitter beam can be focused according to application
- Accuracy adjustable via beam spot size
- Smallest detectable part: 0.03 mm
- Switching frequency, 6000 Hz
- Metal M18 threaded sleeve

Optical data	
Operating range	0 … 50 m
Type of light	Laser, red, 650 nm
Laser Class (DIN EN 60825-1:2008-5)	2

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Indicator LED, red	Contamination indicator
Sensitivity adjustment	Via 18-step potentiometer
Default settings	Max. operating range

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP
Output function	N.O./N.C. (see Selection Table)
Switching frequency, f (ti/tp 1:1)	≤ 6000 Hz
Response time	83 µs
Control input, Test	< 2 V: transmitter off > 10 V or Open: transmitter on

Mechanical data	
Dimensions	(See dimensional drawings)
Enclosure rating	IP 65[2]
Material, housing	Brass, nickel-plated
Type of connection	See Selection Table
Ambient temperature: operation	-10 … +50 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	85 g
Weight (receiver device)	190 g

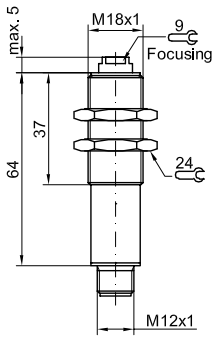
[1] 10 % ripple, within U_B [2] With connected IP 65 plug

Transmitter / receiver	Switching output	Type of connection	Part number	Article number
Transmitter	–	Plug, M12x1, 4-pin	FLS 18-L4	580-51406
Receiver	PNP (N.O./N.C.)	Plug, M12x1, 4-pin	FLE 18-L4	580-51410
Receiver	PNP (N.C.)	Plug, M12x1, 4-pin	FLE 18-L4-15	580-51411
Transmitter	–	Cable, 3 m, 4-wire	FLS 18	580-51407
Receiver	PNP (N.O./N.C.)	Cable, 3 m, 4-wire	FLE 18	580-51412
Receiver	PNP (N.C.)	Cable, 3 m, 4-wire	FLE 18-15	580-51413

Accessories	
Connection cables	From Page A-32
Brackets	From Page A-4

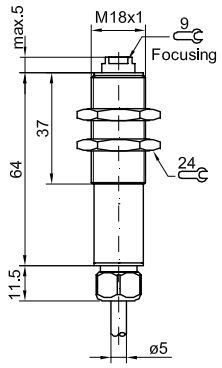
Version: 10/2013. Subject to changes; diagrams similar

Plug connection (transmitter): FLS 18-L4



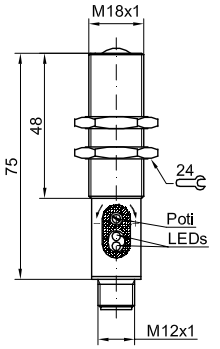
153-00057

Cable connection, (transmitter): FLS 18



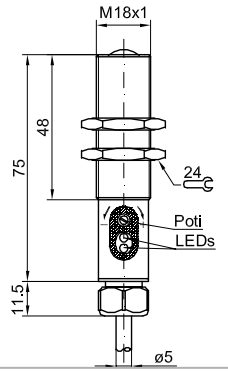
153-00055

Plug connection (receiver): FLE 18-L4 / FLE 18-L4-15



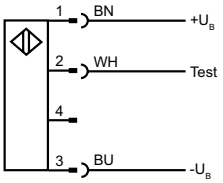
153-00058

Cable connection, (receiver): FLE 18 / FLE 18-15



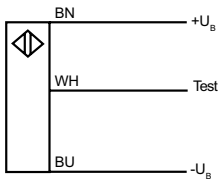
153-00056

Connection, 4-pin (transmitter)



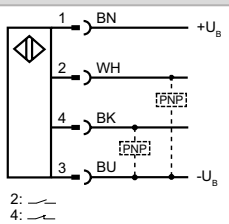
154-00231

Connection, 4-wire (transmitter)



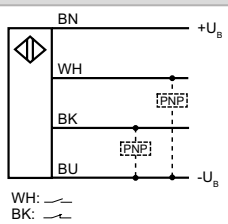
154-00231

Connection, 4-pin (receiver): FLE 18-L4



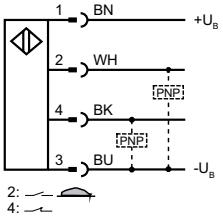
154-00230

Connection, 4-wire (receiver): FLE 18



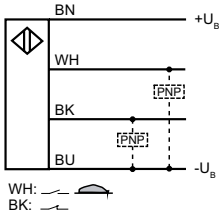
154-00230

Connection, 4-pin (receiver): FLE 18-L4-15



154-00464

Connection, 4-wire (receiver): FLE 18-15



154-00464

FMF 18-34

Filling level sensor



CE

PRODUCT HIGHLIGHTS

- Sensor with glass rod prism for detecting liquids
- M16 x 1.5 thread for screwing into containers and pipes
- Reliable differentiation between liquids and foam
- Stainless steel

Optical data	
Scanning distance	(See Functional Principle)
Type of light	Infrared, pulsed, 880 nm
Ambient light limit	1200 Lux

Functions	
Default settings	Switching process on submersion in a medium
Condition	The refractive index of a liquid must be at least 1.20 Examples: reference air = 880 nm air = ca. 1.00 water= ca. 1.33 benzene = ca. 1.50 alcohol = ca. 1.32

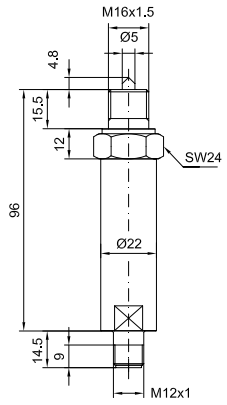
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 200 mA
Pull-up resistance	22 kΩ
Pull-down resistance	22 kΩ
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection
Protection Class	2
Switching output, Q	PNP/NPN, antivalent
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs

Mechanical data	
Dimensions	M16 x 96 mm
Enclosure rating	IP 65[2]
Material, housing	Stainless steel, V2A
Material, front screen	Glass
Type of connection	See Selection Table
Pressure resistance	10 bar
Impact resistance	EN 60947-5-2
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-40 … +80 °C
Weight (plug device)	140 g

[1] 10 % ripple, within U_B [2] With connected IP 65 plug

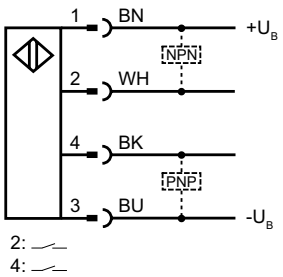
Scanning distance	Type of connection	Part number	Article number
(See Functional Principle)	Plug, M12x1, 4-pin	FMF 18-34 L4-SP	504-50929

Plug connection



153-00765

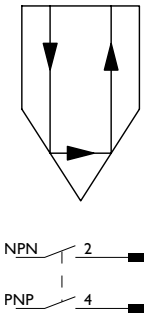
Connection, 4-pin



154-00211

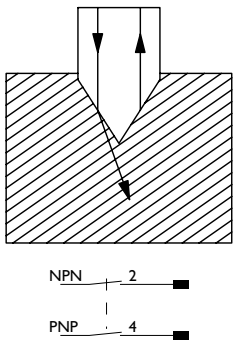
Functional Principle

Total reflection at glass/air boundary layer.



155-00928

Refraction at glass/liquid boundary layer.



155-00929

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

8

Fibre-optic sensors and cables

Fibre-optic sensors and fibre-optic cables for a wide range of applications

FL 20
from Page 434

- *Fibre-optic sensor in miniature housing for installation in restricted spaces*
- *Simple and reliable mounting of fibre-optic cables via clamping bracket*



FL 70
from Page 438

- *High-end fibre-optic sensor with 4-digit display*
- *Cuboid housing for DIN-rail mounting*
- *PNP, NPN or analogue output options*
- *Communication prevents mutual interference*



FMS 18 / FMS 30 / FSG 30
from Page 444

- *Fibre-optic sensors in robust full-metal housings for harsh operating conditions*
- *Large selection of robust fibre-optic cables*
- *PNP, NPN or analogue output options*



Fibre-optic cables – standard
from Page 454

- *Wide range of photoelectric sensor and proximity sensor variants*
- *Fibre-optic cables with lateral light exit for restricted spaces*
- *Proximity sensors and through-beam photoelectric sensors with long ranges*
- *Robust fibre and sheath materials for harsh operating conditions*



Fibre-optic cable systems from SensoPart are the solution when installation space is restricted or operating conditions are hot or dirty. Robust sheath and fibre materials in the fibre-optic cable also offer excellent protection against aggressive chemicals. The sensors are protected in a switching cabinet or at a safe distance, while the fibre-optic cable heads are mounted in the immediate vicinity of the target objects. The large selection of different cable heads opens up numerous application possibilities for our customers as well as providing a high level of flexibility regarding mounting.

Some fibre-optic cable systems from SensoPart cover the same applications as conventional optical sensors. Depending on the customer's application, they are available as photoelectric sensors or proximity sensors. Whereby the powerful fibre-optic sensors ensure high levels of functionality and reliability.

High flexibility and low weight on the gripper of a robot, aggressive detergents in the pharmaceutical or food industries, red-hot objects, minimal light spot dimensions for the detection of small parts, strip edge control, or the detection of liquids and levels in pipes and vessels – high-quality fibre-optic cable systems from SensoPart are predestined for use in all these applications.

Applications in which differing detection tasks have to be carried out in the smallest of spaces often pose the risk of mutual interference. This can lead to unwanted spurious switching. No problem for the FL 70 series: it has a communication interface that ensures that several FL 70 sensors can be synchronised and always switch correctly. The communication takes place fully automatically after battery installation, without any additional adjustment effort for customers. In other words, extremely simple installation and precise detection in the smallest of spaces.

Fibre-optic cables – focused optics

from Page 498

- *Precise, small light spot for small-part detection*
- *Adjustable scanning distance and light spot size*



Fibre-optic cables – light strips

from Page 504

- *Photoelectric sensor and proximity sensor variants*
- *Variety of light strip widths and ranges*



Fibre-optic cables – special

from Page 512

- *Bendable fibre-optic cable tips for particularly restricted installation conditions*
- *Prism scanner for filling level measurement*
- *V-scanner for small objects or liquid and level measurements*
- *Fork sensors in small housings*



Fibre-optic cables – accessories

from Page 524

- *Fibre-optic cable by the metre*
- *Ancillary lenses for extending ranges*
- *Cutting tool for shortening and bending fibre-optic cables*



TYPICAL SENSOPART

- Sub-miniature FL 20 housing for simple integration in machines
- Powerful & variable FL 70 fibre-optic cable sensors
- FMS/FSG series: powerful sensors for extreme demands
- Wide range of fibre-optic cables for standard applications or individual customer requirements
- Numerous adjustment possibilities: stable or dynamic teach-in, external control line, accuracy and speed adjustment, timing functions
- Intelligent fibre-optic sensor and cable mounting solutions for easy installation and adjustment
- Reliable operation without mutual interference thanks to communication between FL 70 devices

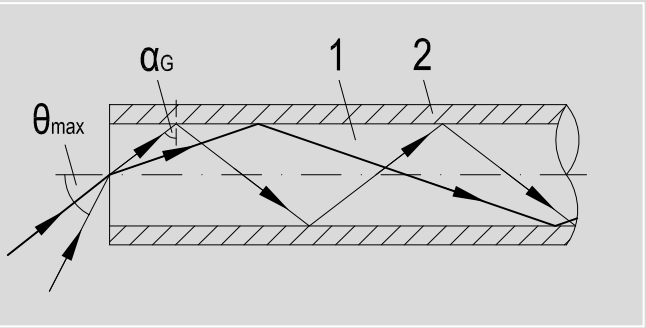
Fibre-optic cable sensors

System description

How fibre-optic cables function

Light guidance is based on the physical effect of total reflection, whereby light coupled into a glass fibre is repeatedly reflected back into the glass fibre from the boundary surface. The major advantage of this technology is that the light can be transported over long distances with almost no loss.

Fibre-optic sensors use this principle to bring the transmitted light to an inaccessible location and take up the reflected light again to return it to the sensor, mounted where more space is available. This technology, which can also be used for the detection of very small objects, is characterised by precision and reliability.



Light guidance in fibre-optic cable
The light is transported in the fibre-optic cable in an axial direction as a result of total reflection at the boundary surface between the sheath (2) and the core (1). The size of the limit angle of the total reflection (α_G) defines the acceptance angle of the fibre-optic cable (θ_{max}). Light hitting the face of the fibre at this or a smaller angle is transported in the fibre-optic cable.

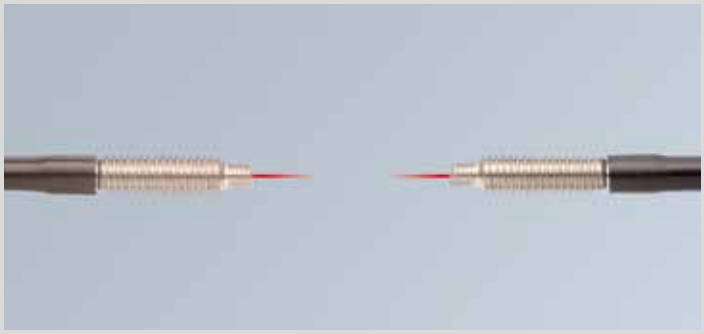
Fibre-optic cable materials



Fibre-optic cables differ in the transmission material used – glass or plastic. SensoPart offers the so-called fibre material in both variants. Glass fibres are highly resistant to chemicals and high temperatures. Suitable metal or silicone sheath materials allow the use of glass fibres in harsh environmental and process conditions. Larger glass-fibre cross-sections offer high functional reserves and reliability, even in dusty and dirty environments.

Fibre-optic cables as through-beam photoelectric sensors

The transmission and receiver fibre-optic cables of through-beam photoelectric sensors run in two separate fibre-optic cables. Both fibre-optic cables are optically connected to the sensor via a coupling. Whereby one fibre-optic cable transports the transmission light from the sensor to the detection location while the other, opposite, fibre-optic cable transports the light back to the receiver. The sensor switches if the light path between the two facing fibre-optic cable heads is interrupted by an object. Relatively long ranges are achieved with through-beam photoelectric sensors.



The photoelectric sensor type
Transmitter cables and receiver cables are laid in two separate sheaths and are connected to the appropriate optical component of the sensor via a coupling.

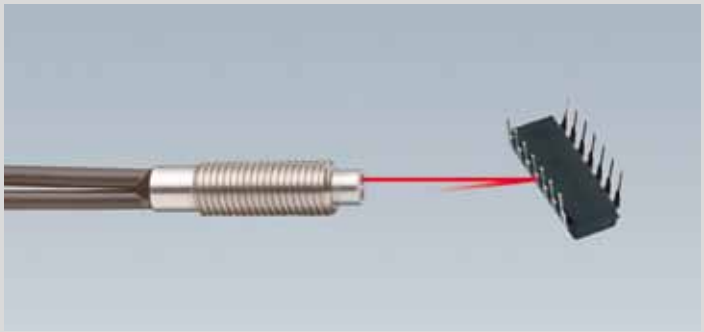
The fibre-optic cable as photoelectric proximity sensor

In the photoelectric proximity sensor variant, the transmitter and receiver cables are combined in one light exit sheath. While one of the fibre-optic cable strands is connected with the transmitter, the other strand transports the light reflected from the target object back to the sensor's receiver. The sensor switches.

The advantages of this cable arrangement lie in the very low space requirement and reduced mounting effort. The fibre-optic cable heads must be brought close to the target object because of the detection principle used. Expanded ranges can be achieved by using larger glass-fibre cross-sections.

Parallel vs. coaxial fibres

In the case of scanner fibre-optic cables, one also differentiates between two different fibre arrangements. In the standard design, the transmitter and receiver fibres run parallel, in coaxial fibre-optic cables the receiver fibres are arranged concentrically around the transmission fibres. When using supplementary optics for focusing (c.f. P. 498) the coaxial design offers application advantages, namely a smaller light spot, in particular, and thus improved small-part detection.



The photoelectric proximity sensor type
In photoelectric proximity sensor versions the transmission and receiver fibres are combined in a single cable and disgorge in a light exit sleeve.

The fibre-optic cable head – numerous different tips

Compact designs of machines and plant with extremely restricted spaces – access to the target objects is often difficult. But the heads of the fibre-optic cables are as varied as the tasks. Particularly fine or bendable fibre-optic cable heads and highly flexible fibre-optic cables provide access in these situations. Fibre-optic cable heads with a lateral light exit that deflect the light by 90° in the smallest of spaces provide assistance in restricted or blocked spaces, in particular. The use of fibre-optic cables together with appropriate cable heads provides flexibility with moving machine parts, low weight, and high impact and vibration resistance – ensuring trouble-free and reliable function.



FL 20 – sensor for plastic fibre-optic cable adaptation

Small, compact amplifier









Fibre assembly / mounting

- *Simple exchange of the fibre-optic cables even in mounted state*
- *No tool necessary*
- *Secure clamping:*
  1. Open clamping bracket
  2. Feed fibre-optic cables into the holder until you reach the stop (get past the resistance from the O-ring)
  3. Close clamping bracket

TYPICAL FL 20

- Miniature housing 32 x 20 x 12 mm³ for simple integration in machines
- Teach-in with button or control input
- Dynamic adjustment possible
- High switching frequency
- Red light, 660 nm
- N.O./N.C. switchable
- For fibre-optic cables with diameter of 2.2 mm
- Wide range of adaptable fibre-optic cables

The FL 20 fibre-optic sensor impresses with its small dimensions and convincing performance data. It covers all the requirements of opto-sensors under restricted space conditions and offers highly precise detection with simple handling.

Simple adjustment via teach-in or the control input and its robust metal plug design confirm the uncompromising industrial suitability of the FL 20 fibre-optic sensor.

A broad portfolio of fibre-optic cables with differing heads and a variety of sheath materials solves all tasks precisely and reliably.

FL 20 – Product Overview			
	Type of light	Special features	Page
FL 20	LED, red	Small housing, simple adjustment	436

FL 20 R

Fibre-optic sensor



PRODUCT HIGHLIGHTS

- Simple teach-in via button
- Control line for teach-in and button lock
- Contamination indicator
- N.O./N.C. switchable
- For fibre-optic cables with diameter of 2.2 mm

Optical data	
Scanning distance	Dependant on fibre-optic cable (scanner)[1]
Operating range	Dependant on fibre-optic cable (cabinet)
Type of light	LED, red, 660 nm
Distance hysteresis	< 10 % of set scanning distance

Functions	
Indicator LED, green	Stability indicator
Indicator LED, yellow	Light reception indicator
Sensor adjustment[2]	Via Teach-in button and control input
Adjustment possibilities	Button lock via control input
Default setting	N.O.

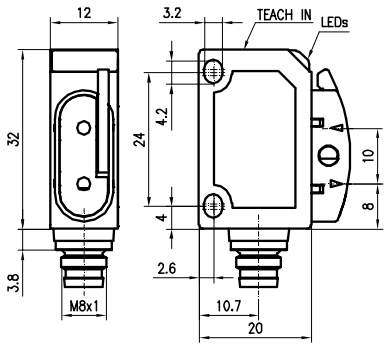
Functions	
Operating voltage, $+U_B$	10 … 30 V DC
Current consumption without load	≤ 25 mA
Output current, Ie	100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	1000 Hz
Control input, IN: (only 4-pin version)	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions	32 x 20 x 12 mm[3]
Enclosure rating	IP 67[3]
Material, housing	ABS
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	10 g
Weight (cable device)	40 g

[1] Reference material: white, 90 % reflectivity [2] Only 4-pin version [3] With suitable fibre-optic cable

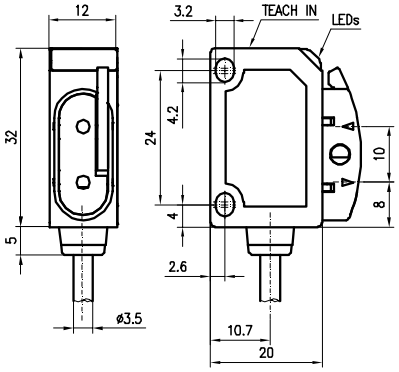
Switching output	Type of connection	Part number	Article number
PNP	Plug, M8x1, 4-pin	FL 20 R-PSM4	551-71000
PNP	Cable, 2 m, 4-wire	FL 20 R-PSK4	551-71001
NPN	Plug, M8x1, 4-pin	FL 20 R-NSM4	551-71002
NPN	Cable, 2 m, 4-wire	FL 20 R-NSK4	551-71003
PNP	Plug, M8x1, 3-pin	FL 20 R-PSM3	551-71004

Plug connection



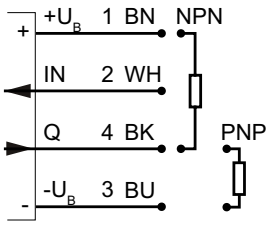
153-00415

Cable connection



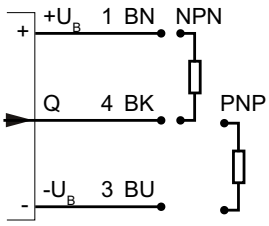
153-00416

Connection, 4-pin



154-00508

Connection, 3-pin



154-00509

9

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4
Fibre-optic cables	From Page 452

FL 70 – sensors for plastic fibre-optic cable adaptation

Functional DIN-rail devices







LOC = lock function – reliably secures against deliberate or accidental tampering



ADJ = adjustment – the sensor is in setup mode



SP1 = switching window 1 – window 1 has been taught-in



Monitoring accumulations with fibre-optic cables

Small plastic plugs are fed in on a vibration conveyor and individualised on a conveyor section. The monitoring of accumulations is carried out with an FL 70 R-PSD fibre-optic sensor in combination with SensoPart's K2L-34 plastic fibre-optic cable. The FL 70 R-PSD sensor is installed in a switching cabinet here. This is not strictly necessary because mounting directly on the machine would have been possible thanks to the robust housing and high enclosure rating of IP 64.

TYPICAL FL 70

- Very user-friendly teach-in
- High level of accuracy
- High switching frequency
- No mutual interference thanks to automatic optical communication during battery installation
- DIN-rail mounting
- Robust enclosure rating of IP 64
- Wide range of fibre-optic cables

FL 70 R

The FL 70 R variant manages without a display and is the more economical alternative for standard applications. All variants offer simple operation via teach-in, which is achieved by button or via the teach-in line. The buttons can be locked via the external teach-in line.

FL 70 R-…D

The FL 70 R-…D is the high-end fibre-optic device with a 4-character display. It is characterised by simple setting and many supplementary functions, e.g. fine adjustment of the switching point, inversion of the switching output, accuracy and speed adaptation, window programming, timer functions and reliable tamper-proofing. The display is always easy to read because it can be rotated through 180°.

FL 70 RA-…D

The FL 70 RA-…D has a supplementary analogue output which is a major advantage for complex applications, in particular, such as connecting a so-called cross-section converter. This allows, for example, edge control and inspections on the basis of object size.

FL 70 – Product Overview

	Type of light	Special features	Page
FL 70 R	LED, red	Teach-in	440
FL 70 R-…D	LED, red	Teach-in, display	442
FL 70 RA-…D	LED, red	Teach-in, display, analogue output	442

FL 70 R

Fibre-optic sensor



PRODUCT HIGHLIGHTS

- Fibre-optic sensor for the adaptation of a wide variety of fibre-optic cables
- DIN-rail mounting
- No mutual interference thanks to automatic communication
- Simple operation via electronic Teach-in button or control line
- Robust plastic housing (IP 64)

Optical data	
Scanning distance	Dependant on fibre-optic cable (scanner)[1]
Operating range	Dependant on fibre-optic cable (cabinet)
Type of light	LED, red, 630 nm
Distance hysteresis	< 10 % of set scanning distance

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Scanning distance adjustment	Via Teach-in button and control input
Adjustment possibilities	Button lock via control input; N.O./N.C.
Default setting	N.O.

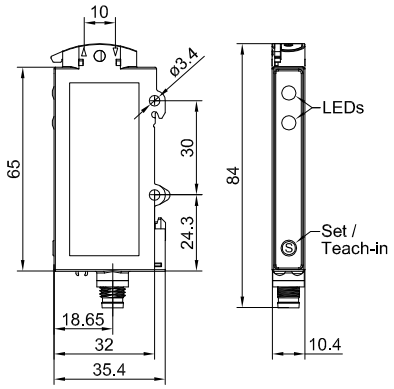
Functions	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 20 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 1500 Hz
Control input, IN (only 4-pin version)	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions	84 x 35 x 10 mm[3]
Enclosure rating	IP 64[3]
Material, housing	ABS
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	20 g
Weight (cable device)	50 g

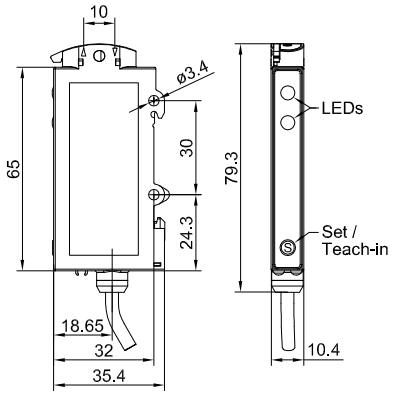
[1] Reference material: white, 90 % reflectivity [2] Max. 10 % ripple, within U_B [3] With connected IP 64 plug

Switching output	Type of connection	Part number	Article number
PNP	Plug, M8x1, 4-pin	FL 70 R-PS-M4	567-71000
NPN	Plug, M8x1, 4-pin	FL 70 R-NS-M4	567-71001
PNP	Cable, 2 m, 4-wire	FL 70 R-PS-K4	567-71002
NPN	Cable, 2 m, 4-wire	FL 70 R-NS-K4	567-71003

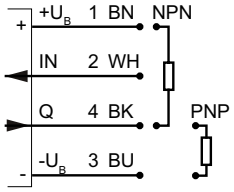
Plug connection



Cable connection



Connection, 4-pin



Accessories

Connection cables	From Page 670
Brackets	From Page 642
Fibre-optic cables	From Page 416

9

FL 70 R-...D / FL 70 RA-...D

Fibre-optic sensor with display



PRODUCT HIGHLIGHTS

- Fibre-optic sensor for the adaptation of a wide variety of fibre-optic cables
- Very user-friendly thanks to combination of display and teach-in
- Several operating modes for individual adaptation to the application
- DIN-rail mounting
- No mutual interference thanks to automatic communication
- Variants with supplementary analogue output

Optical data	
Scanning distance	Dependant on fibre-optic cable (scanner)[1]
Operating range	Dependant on fibre-optic cable (cabinet)
Type of light	LED, red, 630 nm
Distance hysteresis	< 10 % of set scanning distance

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Indicator LEDs, red (x6)	Feedback on selected functions
Teach-in modes	Switching point / switching window Fine adjustment of the switching point
Scanning distance adjustment	Via teach-in and control input
Adjustment possibilities	Invert switching output Switching frequency / accuracy Timer function (e.g. switch-on delay) Button lock, default settings
Default settings	N.O. / no special functions active

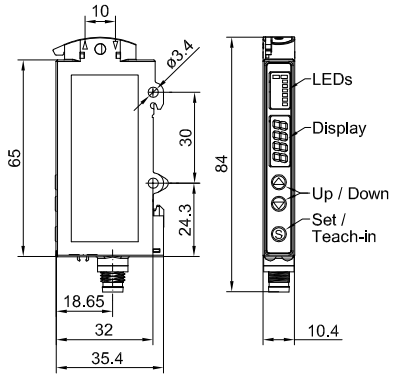
Functions	
Operating voltage, +U_B	10 … 30 V DC[2]
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Switching output, Q	PNP/NPN (see Selection Table)
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	Dependent on the setting / operating mode Standard Mode 1000 Hz / Fast Mode 8000 Hz Fine Mode 125 Hz / High Distance Mode 125 Hz
Control input, IN (only 4-pin version)	+ U_B = teach-in - U_B = button locked Open = normal operation
Analogue output (non-scalable)	See Selection Table
Display value 0000	0 V
Display value 4095	10 V

Mechanical data	
Dimensions	84 x 35 x 10 mm[3]
Enclosure rating	IP 64[3]
Material, housing	ABS
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	20 g
Weight (cable device)	50 g

[1] Reference material: white, 90 % reflectivity [2] Max. 10 % ripple, within U_B [3] With connected IP 64 plug

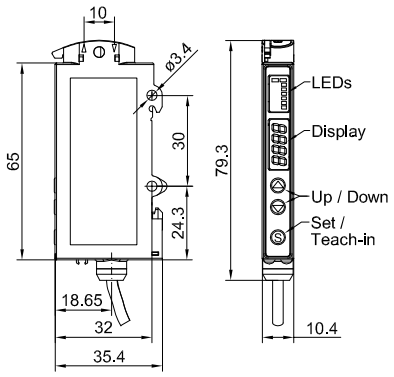
Switching output	Analogue output	Type of connection	Part number	Article number
PNP	No	Plug, M8x1, 4-pin	FL 70 R-PSD-M4	567-71004
NPN	No	Plug, M8x1, 4-pin	FL 70 R-NSD-M4	567-71005
PNP	0…10 V / 2 mA	Cable, 2 m, 5-wire	FL 70 RA-PSD-K5	567-71006
NPN	0…10 V / 2 mA	Cable, 2 m, 5-wire	FL 70 RA-NSD-K5	567-71007

Plug connection



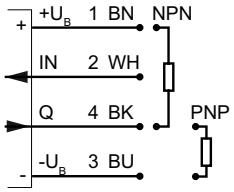
153-01083

Cable connection



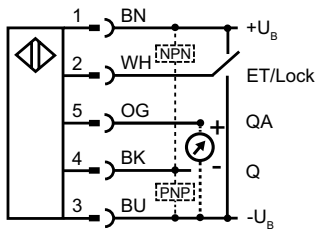
153-01082

Connection, 4-pin



154-00508

Connection, 5-pin



154-00191

Accessories

Connection cables	From Page 670
Brackets	From Page 642
Fibre-optic cables	From Page 416

FMS 18 / FMS 30 / FSG 30 – sensors for glass fibre adaptation

Robust, strong, reliable





Switching of output function and scanning distance
The N.C./N.O. function is set via the sliding switch on the front. The switching position "Sn/2" reduces the scanning distance by 50 % and thus permits improved small-part detection



Uncomplicated adaptation of fibre-optic cable and amplifier
The glass fibres can be adapted by simply screwing them to the FMS sensors (here the FMS 30).

TYPICAL FMS 18 / FMS 30 / FSG 30

- Operating range: scanner max. 800 mm (depending on the fibre-optic cable used)
- Operating range: photoelectric sensor max. 4800 mm (depending on the fibre-optic cable used)
- Robust metal housings
- Antivalent switching output
- N.O./N.C. switchable
- Various sheaths for glass fibres
- Fibre-optic cables for temperatures up to 160°C
- Resolution/scanning distance switchable
- Cross-section converter adaptable

FMS 18

The FMS 18-4 U fibre-optic sensor operates at minimum to medium switching distances and ranges. The device is particularly suitable for reliable non-contact detection in rapid processes as a result of its high switching frequency of 1 kHz. Despite the device's small size, its output signal can be inverted by using a plug-in bridge on the front. The sensor also has two separate outputs: P- and N-switching.

FMS 30

The FMS 30-4 U fibre-optic sensor operates throughout the entire range from low to very long switching distances and ranges. The switching distance can be halved by using the switch on the front of the device. This simplifies accurate adjustment of the switching point at close range and improves small-part detection. A second switch on the front inverts the output signal. The sensor can thus provide the logically correct signal, i.e. N.O. or N.C. depending on the particular application. Every device also has two separate outputs: P- and N-switching.

FSG 30

The FSG 30-UA fibre-optic sensor is characterised by an extremely high switching frequency of up to 20 kHz. This has been made possible by its reliable and highly precise source of constant light.

FMS 18 / FMS 30 / FSG 30 – Product Overview

	Type of light	Special features	Page
FMS 18	LED infrared, red	Extremely robust	446
FMS 30	LED infrared, red	Extremely robust, powerful	448

FMS 18-34 U

Photoelectric proximity sensor for adaptation of fibre-optic cables



PRODUCT HIGHLIGHTS

- Scanning distance dependant on fibre-optic cable
- Fibre-optic cable adaptable
- Universal PNP/NPN output
- N.O./N.C. selectable
- M18 metal threaded sleeve

Optical data	
Scanning distance	See Selection Table[1]
Type of light	See Selection Table
Distance hysteresis[1]	< 10 % of the set scanning distance

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Indicator LED, red	Contamination indicator
Sensitivity adjustment	Via 18-step potentiometer

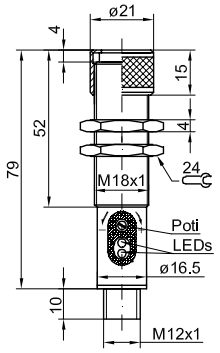
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2] / 15 … 30 V DC[3]
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 200 mA
Pull-up resistance	22 kΩ
Pull-down resistance	22 kΩ
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	See Selection Table[4]

Mechanical data	
Dimensions	M12 x 79 mm
Enclosure rating	IP 65[5]
Material, housing	Brass, nickel-plated
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-40 … +80 °C
Weight (plug device)	85 g
Weight (cable device)	185 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: white, 90 % reflectivity [2] Type of light: infrared 880 nm [3] 10 % ripple, within U_B [4] Type of light: infrared 880 nm with scanning distance of 1 m
[5] With connected IP 65 plug

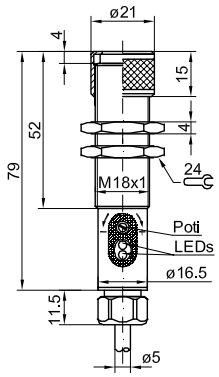
Scanning distance	Type of light	Switching frequency, f (ti/tp 1:1)	Type of connection	Part number	Article number
500 mm	Infrared, 880 nm	5000 Hz	Plug, M12, 4-pin	FMS 18-34 UL4-60	510-51590
1000 mm	Infrared, 880 nm	1000 Hz	Plug, M12, 4-pin	FMS 18-34 UL4	510-51589
500 mm	Infrared, 880 nm	5000 Hz	Cable, 3 m, 4-wire	FMS 18-34 U-60	510-51588
1000 mm	Infrared, 880 nm	1000 Hz	Cable, 3 m, 4-wire	FMS 18-34 U	510-51587
250 mm	Red, 645 nm	1000 Hz	Plug, M12, 4-pin	FMS 18-34 UL4-52	510-51602
500 mm	Infrared, 950 nm	1000 Hz	Plug, M12, 4-pin	FMS 18-34 UL4-54	510-51605
250 mm	Red, 645nm	1000 Hz	Cable, 3 m, 4-wire	FMS 18-34 U-52	510-51603
500 mm	Infrared, 950 nm	1000 Hz	Cable, 3 m, 4-wire	FMS 18-34 U-54	510-51604

Plug connection



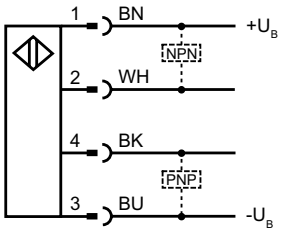
153-00002

Cable connection



153-00001

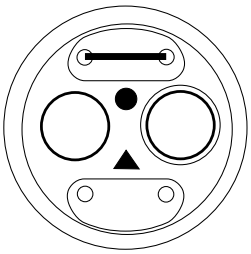
Connection, 4-pin



154-00282

9

N.O./N.C. function

Selectable via plug-in bridge on the front	Plug-in bridge	Scanner operation	Through-beam operation
	●	N.C.	N.O.
	Without plug-in bridge	N.O.	N.C.
	▲	Parking position	Parking position

155-00921

FMS 30-44 U

Photoelectric proximity sensor for adaptation of fibre-optic cables



PRODUCT HIGHLIGHTS

- Scanning distance dependant on fibre-optic cable
- High switching frequency, 1 kHz, 5 kHz
- Fibre-optic cable adaptable
- Universal PNP/NPN output
- N.O./N.C. selectable
- M30 metal threaded sleeve

Optical data	
Scanning distance	0.5 m / 1m[1]
Type of light	Infrared, 880 nm
Distance hysteresis[1]	< 10 % of the set scanning distance

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Indicator LED, red	Contamination indicator
Sensitivity adjustment	Via 18-step potentiometer

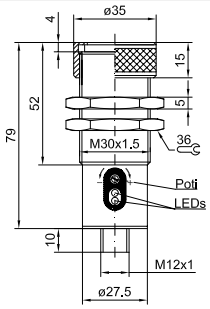
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 25 mA
Output current, Ie	≤ 200 mA
Pull-up resistance	22 kΩ
Pull-down resistance	22 kΩ
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	See Selection Table

Mechanical data	
Dimensions	(See connection diagram)
Enclosure rating	IP 65[3]
Material, housing	Brass, nickel-plated
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-40 … +80 °C
Weight	See Selection Table
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: white, 90 % reflectivity [2] 10 % ripple, within U_B [3] With connected IP 65 plug

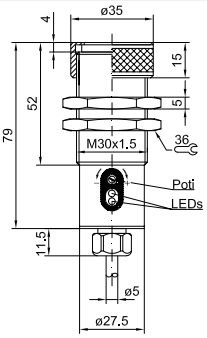
Scanning distance	Switching frequency, f (ti/tp 1:1)	Type of connection	Weight	Part number	Article number	No.
1 m	1000 Hz	Plug, M12, 4-pin	210 g	FMS 30-44 UL4-56	530-51591	1
0.5 m	5000 Hz	Plug, M12, 4-pin	210 g	FMS 30-44 UL4-60	530-51592	1
1 m	1000 Hz	Cable, 3 m, 4-wire	320 g	FMS 30-44 U-56	530-51587	2
0.5 m	5000 Hz	Cable, 3 m, 4-wire	310 g	FMS 30-44 U-60	530-51588	2
0.5 m	5000 Hz	Plug, M12, 5-pin	240 g	FMS 30-44 UT-60	530-51596	3
1 m	1000 Hz	Plug, M12, 5-pin	240 g	FMS 30-44 UG-56	530-51590	4
0.5 m	5000 Hz	Plug, M12, 4-pin	240 g	FMS 30-44 UG-60	530-51589	4

Plug connection, No. 1



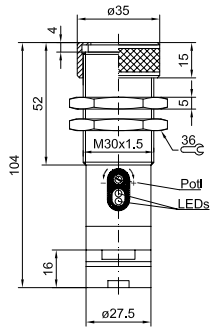
153-00005

Cable connection, No. 2



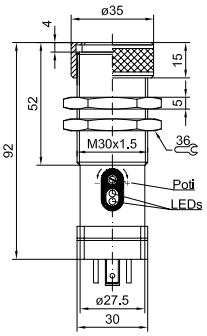
153-00004

Plug connection, No. 3



153-00006

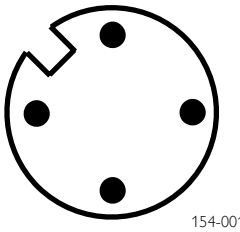
Plug connection. 4



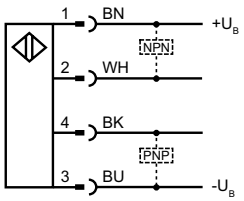
153-00007

9

Connection, 4-pin, No. 1

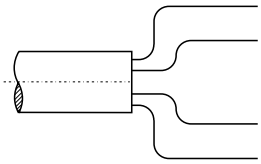


154-00136

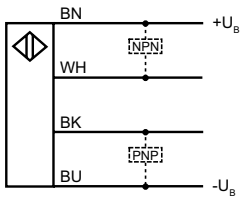


154-00282

Connection, 4-pin, No. 2

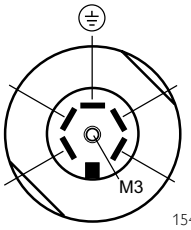


154-00132

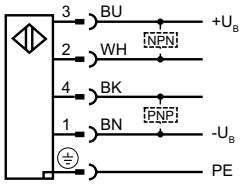


154-00282

Connection, 5-pin, No. 3

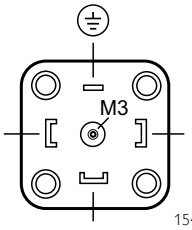


154-00145

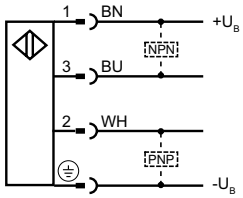


154-00260

Connection, 4-pin, No. 4

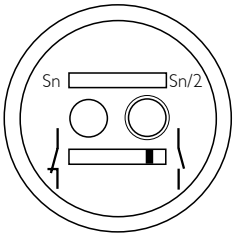


154-00146



154-00261

N.O./N.C. function



155-00927

N.O./N.C. function is set via the sliding switch on the front. Switch position "Sn/2" halves scanning distance but permits better resolution.

FMS 30-35 U

Photoelectric proximity sensor for adaptation of fibre-optic cables



PRODUCT HIGHLIGHTS

- Scanning distance dependant on fibre-optic cable
- Fibre-optic cable adaptable
- Universal PNP/NPN output
- N.O./N.C. selectable
- Contamination indicator / output
- M30 metal threaded sleeve

Optical data	
Scanning distance	2 m[1]
Type of light	Infrared, 880 nm
Distance hysteresis[1]	≤ 10 % of the set scanning distance
Aperture angle	< 18 %

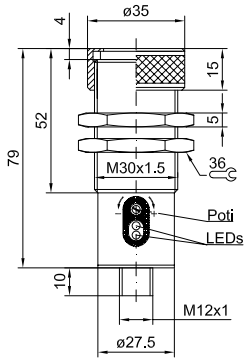
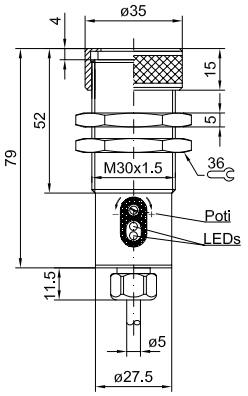
Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Indicator LED, red	Contamination indicator
Sensitivity adjustment	Via 18-step potentiometer

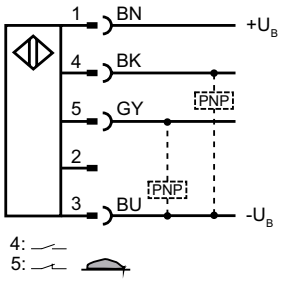
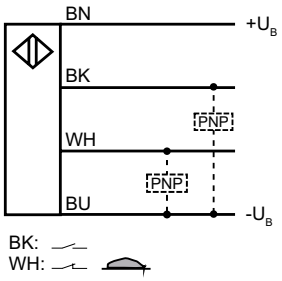
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 40 mA
Output current, Ie	≤ 200 mA
Pull-up resistance	22 kΩ
Pull-down resistance	22 kΩ
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 100 Hz

Mechanical data	
Dimensions	M12 x 79 mm
Enclosure rating	IP 65[3]
Material, housing	Brass, nickel-plated
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-40 … +80 °C
Weight (plug device)	215 g
Weight (cable device)	315 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: white, 90 % reflectivity [2] 10 % ripple, within U_B [3] With connected IP 65 plug

Type of connection	Part number	Article number
Cable, 3 m, 4-wire	FMS 30-35 U	544-51323
Plug, M12, 5-pin	FMS 30-35 UL5	544-51324

Plug connection	Cable connection
 153-00005	 153-00004

Connection, 5-pin	Connection, 4-pin
 154-00259	 154-00259

FMS 30-34 U

Photoelectric proximity sensor for adaptation of fibre-optic cables



PRODUCT HIGHLIGHTS

- **Our bestseller: ideal for the most diverse applications**
- Red light, infrared
- Scanning distance dependant on fibre-optic cable
- Fibre-optic cable adaptable
- N.O./N.C. selectable
- Contamination indicator / output
- M30 metal threaded sleeve

Optical data	
Scanning distance	1.5 m / 2 m[1]
Type of light	Red, 645 nm / infrared, 950 nm
Distance hysteresis[1]	< 10 % of the set scanning distance

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Indicator LED, red	Contamination indicator
Sensitivity adjustment	Via 18-step potentiometer

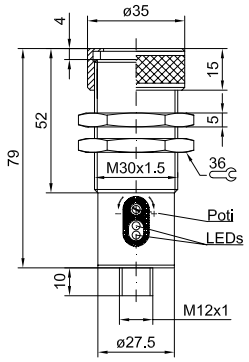
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 40 mA
Output current, Ie	≤ 200 mA
Pull-up resistance	22 kΩ
Pull-down resistance	22 kΩ
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	≤ 300 ms
Switching output, Q	PNP/NPN
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 100 Hz

Mechanical data	
Dimensions	M12 x 79 mm
Enclosure rating	IP 65[3]
Material, housing	Brass, nickel-plated
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-40 … +80 °C
Weight (plug device)	210 g
Weight (cable device)	315 g
Vibration and impact resistance	EN 60947-5-2

[1] Reference material: white, 90 % reflectivity [2] 10 % ripple, within U_B [3] With connected IP 65 plug

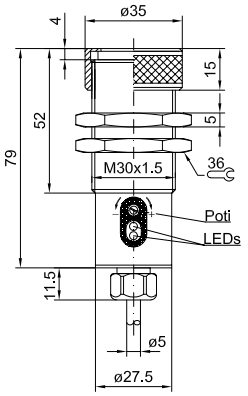
Scanning distance	Type of light	Type of connection	Part number	Article number
2 m	Red, 645 nm	Plug, M12, 4-pin	FMS 30-34 UL4-52	540-51607
2 m	Red, 645 nm	Cable, 3 m, 4-wire	FMS 30-34 U-52	540-51604
1.5 m	Infrared, 950 nm	Cable, 3 m, 4-wire	FMS 30-34 U-54	540-51605
2 m	Infrared, 950 nm	Plug, M12, 4-pin	FMS 30-34 UA4	540-51606

Plug connection: FMS 30-34 UL4-52



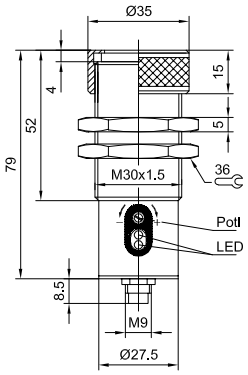
153-00005

Cable connection



153-00004

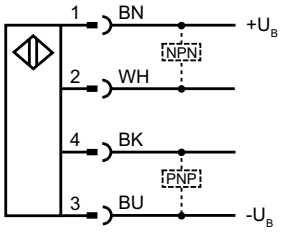
Plug connection: FMS 30-34 UA4



153-00008

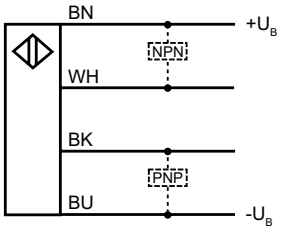
9

Connection, 4-pin: FMS 30-34 UL4-52



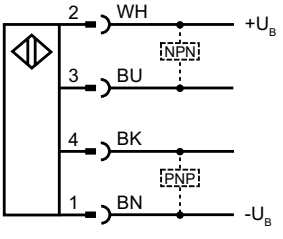
154-00282

Connection, 4-pin



154-00282

Connection, 4-pin: FMS 30-34 UA4



154-00263

Fibre-optic cables – standard

The right variant for every task





Look round the corner
When space is restricted it can be advantageous to use fibre-optic cables with lateral (radial) light exits – available with differing side lengths, depending on the model.



The protective sheath
Variants with a helical metal sheath (MSC devices) usually meet normal demands. For more difficult operating conditions – for example constant mechanical movements and loads or exposure to water spray, oil, coolants or high temperatures – SensoPart offers fibre-optic cables with silicone sheaths (Si devices).

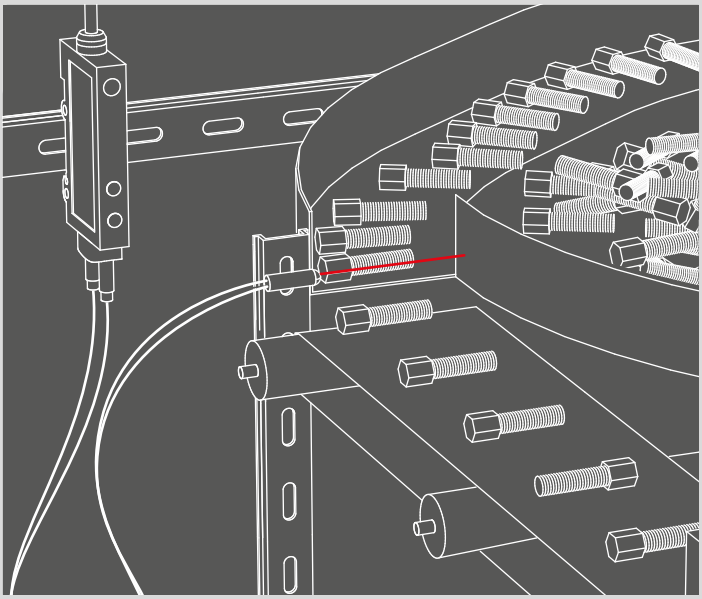
TYPICAL SENSOPART FIBRE-OPTIC CABLES

- Long ranges in combination with appropriate photoelectric sensors and proximity sensors
- Variety of sheath materials, also for harsh operating conditions
- Radial or axial light exit for simple installation, even when space is restricted
- Particularly high light output with glass fibres
- High temperature resistance with glass fibres (up to 160°C)
- Coaxial fibres for precise small-part detection
- Flexible plastic fibre-optic cables with very fine mounting heads
- Variety of mounting possibilities (adapters or heads)

Every task is unique and requires an individual sensor solution. Selection of the correct fibre-optic cable is of decisive importance, particularly with difficult and restricted space conditions. We place particular importance on the careful machining of the fibre material, fibre-optic cable ends and sheaths. This special treatment allows long ranges to be achieved, i.e. a sufficiently high light output reaches the target object, is guided back, and reliably evaluated.

Our fibre-optic cables can be adapted to almost every task thanks to the wide range of cables with differing heads and mounting possibilities – from the sheaths, through threaded sleeves or flexible and bendable needle sleeves, to cables that can see around corners.

Special materials, such as PVC, silicone or metal tubes, protect the fibre-optic cables against chemical and mechanical effects and make them temperature-resistant up to 160°C. Whether glass fibres for high light outputs or flexible plastic fibre-optic cables with the smallest of bending angles and very high resistance to vibrations and impacts, our standard fibre-optic cables prove their precision and reliability in everyday harsh industrial use.

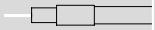
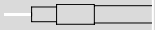
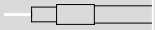
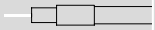
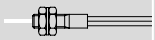
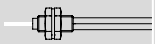
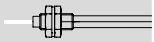
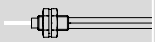
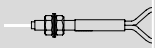
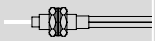
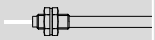
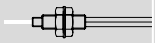
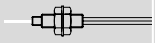
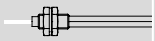
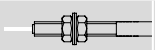
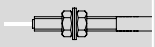
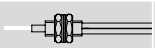
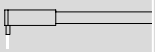
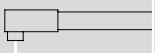
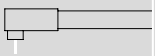
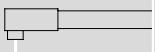
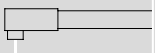
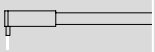
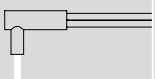


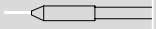
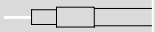
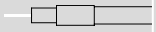
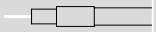
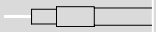
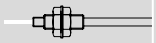
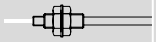
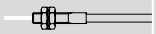
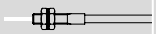
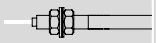
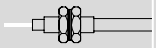
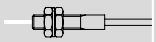
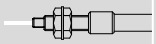
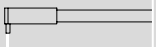
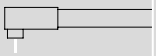
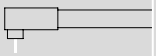
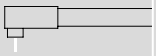
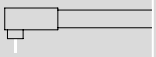
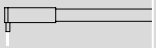
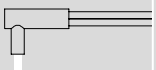
Checking the presence of small parts on a vibration conveyor system
Page 398

An **FL 70 fibre-optic sensor** registers the presence of work-pieces at the end of the feed section.

- Extremely precise switching behaviour
- Simple teach-in with the help of a display
- Very good small-part detection through the use of focused fibre-optic cables
- Broad and individual range of fibre-optic cables for differing tasks
- Flexible arrangement of the fibre-optic cable

Fibre-optic cables – standard

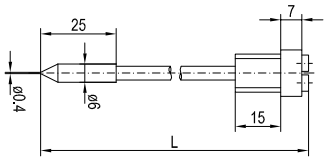
Fibre-optic cable	Proximity sensor (T) Photoelectric sensor (L)	Typical scanning distance / range	Light exit	Special features	For fibre-optic sensors
18/30 R 0,4/xxxx-Si	T	Up to 3 mm	Axial	• Small mounting dimensions • Robust design	FMS 18 / FMS 30 / FAV 30
18/30 R 1/xxxx-Si/MSC/PVC	T	Up to 15 mm	Axial	• Small mounting dimensions • Robust design	FMS 18 / FMS 30 / FAV 30
18/30 R 2/xxxx-Si/MSC/PVC 	T	Up to 60 mm	Axial	• Robust design	FMS 18 / FMS 30 / FAV 30
18/30 R 3/xxxx-Si/MSC/PVC 	T	Up to 200 mm	Axial	• Robust design	FMS 18 / FMS 30 / FAV 30
18/30 R 4/xxxx-Si/MSC 	T	Up to 400 mm	Axial	• Long range • Robust design	FMS 18 / FMS 30 / FAV 30
18/30 R 12/xxxx-Si/MSC 	T	Up to 800 mm	Axial	• Long range • Immune to contamination • Robust design	FMS 18 / FMS 30 / FAV 30
K1R-101 	T	Up to 95 mm	Axial	• Small mounting dimensions • Suitable for ancillary lens	FL 70 / FL 20
K2R-102 	T	Up to 295 mm	Axial	• Short fastening sleeve	FL 70 / FL 20
K2R-6 	T	Up to 265 mm	Axial	• Short fastening sleeve	FL 70 / FL 20
K2R-67 	T	Up to 295 mm	Axial	• Oil-resistant • Expanded temperature range	FL 70 / FL 20
LLK1RM3-PE-1m 	T	Up to 55 mm	Axial	• Stainless steel head with low head diameter	FL 70 / FL 20
LLK2RM6-PE-1m 	T	Up to 280 mm	Axial	• Stainless steel head	FL 70 / FL 20
33R1/xxx-MSC/Si 	T	Up to 210 mm	Axial	• Robust design • Low damping	FL 70 / FL 20
K1R-68 	T	Up to 200 mm	Axial	• Very small bending radius • Suitable for ancillary lens	FL 70 / FL 20
K1R-35 	T	Up to 80 mm	Axial	• Precise switching behaviour on lateral approach • Fibre length individually cutable • Suitable for ancillary lens	FL 70 / FL 20
K2R-25 	T	Up to 240 mm	Axial	• Precise switching behaviour on lateral approach • Short fastening sleeve	FL 70 / FL 20
LLK1RKM3-PE-1m 	T	Up to 150 mm	Axial	• Precise switching behaviour on lateral approach • Suitable for ancillary lens	FL 70 / FL 20
LLK1RKM3-18-PE-2m 	T	Up to 150 mm	Axial	• Precise switching behaviour on lateral approach • Short fastening sleeve • Suitable for ancillary lens	FL 70 / FL 20
LLK2RKM6-PE-1m 	T	Up to 310 mm	Axial	• Precise switching behaviour on lateral approach	FL 70 / FL 20
18/30 RZ 1/xxxx-Si/MSC 	T	Up to 15 mm	Radial	• For restricted spaces • Robust design • Low damping	FMS 18 / FMS 30 / FAV 30
18/30 RZ 2/xxxx-Si/MSC/PVC 	T	Up to 60 mm	Radial	• For restricted spaces • Robust design • Low damping	FMS 18 / FMS 30 / FAV 30
18/30 RZ 3/xxxx-Si/MSC/PVC 	T	Up to 200 mm	Radial	• For restricted spaces • Robust design • Low damping	FMS 18 / FMS 30 / FAV 30
18/30 RZ 4/xxxx-Si/MSC 	T	Up to 400 mm	Radial	• For restricted spaces • Long range • Robust design	FMS 18 / FMS 30 / FAV 30
18/30 RZ 12/xxxx-Si/MSC 	T	Up to 800 mm	Radial	• For restricted spaces • Long range • Robust design • Immune to contamination	FMS 18 / FMS 30 / FAV 30
33 RZ 1/xxx-MSC 	T	Up to 210 mm	Radial	• For restricted spaces • Robust design • Low damping	FL 70 / FL 20
LLK2RZ (LS=10) 	T	Up to 200 mm	Radial	• For restricted spaces • Precise switching behaviour on lateral approach	FL 70 / FL 20

Fibre-optic cable	Proximity sensor (T) Photoelectric sensor (L)	Typical scanning distance / range	Light exit	Special features	For fibre-optic sensors
K1RZ-31	T	Up to 30 mm	Radial	• For restricted spaces • Very fine stainless steel tip	FL 70 / FL 20
18/30 L 0,4/xxxx-Si 	L	Up to 20 mm	Axial	• Small mounting dimensions • Robust design	FMS 18 / FMS 30 / FAV 30
18/30 L 1/xxxx-Si/MSC/PVC 	L	Up to 100 mm	Axial	• Small mounting dimensions • Robust design	FMS 18 / FMS 30 / FAV 30
18/30 L 2/xxxx-Si/MSC/PVC 	L	Up to 400 mm	Axial	• Robust design	FMS 18 / FMS 30 / FAV 30
18/30 L 3/xxxx-Si/MSC/PVC 	L	Up to 1000 mm	Axial	• Long range • Robust design	FMS 18 / FMS 30 / FAV 30
18/30 L 4/xxxx-Si/MSC 	L	Up to 3000 mm	Axial	• Long range • Robust design	FMS 18 / FMS 30 / FAV 30
18/30 L 12/xxxx-Si/MSC 	L	Up to 4800 mm	Axial	• Long range • Robust design • Immune to contamination	FMS 18 / FMS 30 / FAV 30
K2L-201 	L	Up to 200 mm	Axial	• Small mounting dimensions • Suitable for ancillary lens	FL 70 / FL 20
K2L-202 	L	Up to 800 mm	Axial	• Short fastening sleeve • Suitable for ancillary lens	FL 70 / FL 20
K2L-7 	L	Up to 810 mm	Axial	• Small mounting dimensions • Suitable for ancillary lens	FL 70 / FL 20
K2L-77 	L	Up to 550 mm	Axial	• Oil-resistant • Expanded temperature range • Suitable for ancillary lens	FL 70 / FL 20
LLK2LM3-PE-1m 	L	Up to 240 mm	Axial	• Stainless steel head • Suitable for ancillary lens • Small mounting dimensions	FL 70 / FL 20
LLK2LM4-PE-1m 	L	Up to 780 mm	Axial	• Stainless steel head • Suitable for ancillary lens	FL 70 / FL 20
K1L-78 	L	Up to 405 mm	Axial	• Very small bending radius • Small mounting dimensions • Suitable for ancillary lens	FL 70 / FL 20
33L1/500-MSC 	L	Up to 550 mm	Axial	• Robust design • Low damping • Suitable for ancillary lens	FL 70 / FL 20
18/30 LZ 1/xxxx-Si/MSC 	L	Up to 100 mm	Radial	• For restricted spaces • Robust design • Low damping	FMS 18 / FMS 30 / FAV 30
18/30 LZ 2/xxxx-Si/MSC/PVC 	L	Up to 400 mm	Radial	• For restricted spaces • Robust design • Various sheaths • Low damping	FMS 18 / FMS 30 / FAV 30
18/30 LZ 3/xxxx-Si/MSC/PVC 	L	Up to 1000 mm	Radial	• For restricted spaces • Robust design • Low damping • Expanded range	FMS 18 / FMS 30 / FAV 30
18/30 LZ 4/xxxx-Si/MSC 	L	Up to 3000 mm	Radial	• For restricted spaces • Robust design • Low damping • Long range	FMS 18 / FMS 30 / FAV 30
18/30 LZ 12/xxxx-Si/MSC 	L	Up to 4800 mm	Radial	• For restricted spaces • Robust design • Low damping • Long range • Immune to contamination	FMS 18 / FMS 30 / FAV 30
33 LZ 1/xxx-Si/MSC 	L	Up to 550 mm	Radial	• For restricted spaces • Robust design • Low damping	FL 70 / FL 20
LLK2LZ 	L	Up to 600 mm	Radial	• For restricted spaces • Precise switching behaviour on lateral approach • Fibre length individually cutable	FL 70 / FL 20
K2L-34	L	Up to 150 mm	Radial	• For restricted spaces • Very fine tip	FL 70 / FL 20

Fibre-optic cables – standard

18/30 R 0,4/…-Si fibre-optic cable	Highlights





153-00141

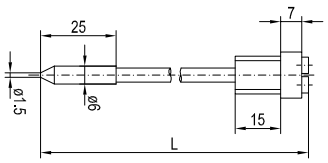
- Photoelectric proximity sensor
- Silicone sheath
- Small axial light exit
- Robust design
- -20 … 160 °C
- Fixing via mounting block MB 6 (Article number 903-05139)
- For FMS/FAV devices

Fibre arrangement Light exit	FMS 18 typ. scanning distance/range (mm)	FMS 30 typ. scanning distance/range (mm)	Core fibre Ø (mm) material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing Ø (mm)	LS (mm)
Axial	1	3	1 x 0.4 Glass	Silicone (Si)	-20 … 160 °C	15	See Selection Table	6	–

Length (m)	Part number	Article number
0.25	18/30 R 0,4/250-Si	979-50551
0.5	18/30 R 0,4/500-Si	979-50552
1	18/30 R 0,4/1000-Si	979-50544
2	18/30 R 0,4/2000-Si	979-50553

18/30 R 1/…-Si fibre-optic cable

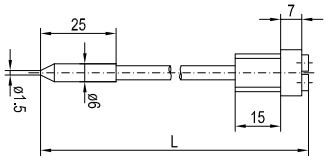




153-00145

18/30 R 1/…-MSC fibre-optic cable

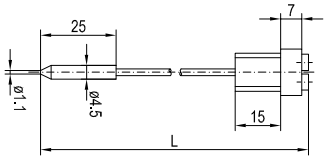




153-00145

18/30 R 1/…-PVC fibre-optic cable





153-00129

Highlights

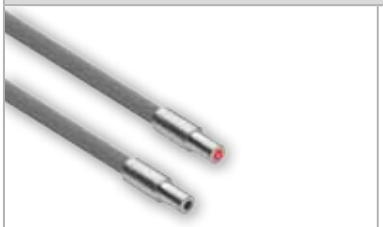
- Photoelectric proximity sensor
- Silicone, metal or PVC sheath
- Small axial light exit
- Robust design
- -20 … +80°C / +160 °C
- Fixing via mounting block MB 6 (MSC/Si) (Article number 903-05139)
- Fixing via mounting block MB 4.5 (PVC) (Article number 903-50314)
- For FMS/FAV devices

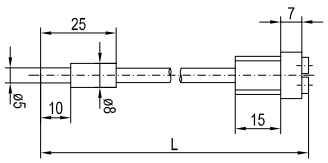
Fibre arrangement Light exit	FMS 18 typ. scanning distance/range (mm)	FMS 30 typ. scanning distance/range (mm)	Core fibre Ø (mm) material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing Ø (mm)	LS (mm)
Axial	5	15	1 x 0.8 (Si/MSC) 1 x 1.0 (PVC) Glass	See Selection Table	-20 … +160 °C (Si/MSC) -20 … +80 °C (PVC)	15 = (Si/MSC) 10 = (PVC)	See Selection Table	6 = (Si/MSC) 4.5 = (PVC)	–

Length (m)	Sheath material	Part number	Article number
0.25	Silicone (Si)	18/30 R 1/250-Si	979-08081
0.5	Silicone (Si)	18/30 R 1/500-Si	979-08082
0.75	Silicone (Si)	18/30 R 1/750-Si	979-08407
1	Silicone (Si)	18/30 R 1/1000-Si	979-08083
1.5	Silicone (Si)	18/30 R 1/1500-Si	979-08408
2	Silicone (Si)	18/30 R 1/2000-Si	979-08084
0.25	Brass, chrome-plated (MSC)	18/30 R 1/250-MSC	979-08057
0.5	Brass, chrome-plated (MSC)	18/30 R 1/500-MSC	979-08058
0.75	Brass, chrome-plated (MSC)	18/30 R 1/750-MSC	979-08387
1	Brass, chrome-plated (MSC)	18/30 R 1/1000-MSC	979-08059
1.5	Brass, chrome-plated (MSC)	18/30 R 1/1500-MSC	979-08388
2	Brass, chrome-plated (MSC)	18/30 R 1/2000-MSC	979-08060
0.25	PVC	18/30 R 1/250 PVC	979-08044
0.5	PVC	18/30 R 1/500 PVC	979-08045
0.75	PVC	18/30 R 1/750-PVC	979-08381
1	PVC	18/30 R 1/1000 PVC	979-08046
1.5	PVC	18/30 R 1/1500 PVC	979-08382
2	PVC	18/30 R 1/2000 PVC	979-08047

Fibre-optic cables – standard

18/30 R 2/…-Si fibre-optic cable

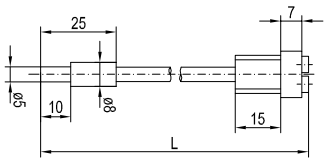




153-00151

18/30 R 2/…-MSC fibre-optic cable

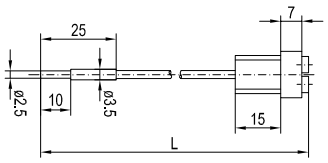




153-00151

18/30 R 2/…-PVC fibre-optic cable





153-00131

Highlights

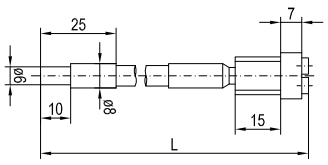
- Photoelectric proximity sensor
- Silicone, metal or PVC sheath
- Axial light exit
- Robust design
- -20 … +80 °C / +160 °C
- Fixing via mounting block MB 8 (MSC/Si) (Article number 903-05141)
- Fixing via mounting block MB 3.5 (PVC) (Article number 903-50313)
- For FMS/FAV devices

Fibre arrangement Light exit	FMS 18 typ. scanning distance/range (mm)	FMS 30 typ. scanning distance/range (mm)	Core fibre Ø (mm) material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing Ø (mm)	LS (mm)
Axial	50	60	1 x 1.6 (Si/MSC) 1 x 1.5 (PVC) Glass	See Selection Table	-20 … +160 °C (Si/MSC) -20…+80 °C (PVC)	20 = (Si/MSC) 15 = (PVC)	See Selection Table	8 = (Si/MSC) 3.5 = (PVC)	–

Length (m)	Sheath material	Part number	Article number
0.25	Silicone (Si)	18/30 R 2/250-Si	979-08089
0.5	Silicone (Si)	18/30 R 2/500-Si	979-08090
0.75	Silicone (Si)	18/30 R 2/750-Si	979-08411
1	Silicone (Si)	18/30 R 2/1000-Si	979-08091
1.5	Silicone (Si)	18/30 R 2/1500-Si	979-08412
2	Silicone (Si)	18/30 R 2/2000-Si	979-08092
0.25	Brass, chrome-plated (MSC)	18/30 R 2/250-MSC	979-08061
0.5	Brass, chrome-plated (MSC)	18/30 R 2/500-MSC	979-08062
0.75	Brass, chrome-plated (MSC)	18/30 R 2/750-MSC	979-08389
1	Brass, chrome-plated (MSC)	18/30 R 2/1000-MSC	979-08063
1.5	Brass, chrome-plated (MSC)	18/30 R 2/1500-MSC	979-08390
2	Brass, chrome-plated (MSC)	18/30 R 2/2000-MSC	979-08064
0.25	PVC	18/30 R 2/250 PVC	979-08048
0.5	PVC	18/30 R 2/500 PVC	979-08049
0.75	PVC	18/30 R 2/750 PVC	979-08383
1	PVC	18/30 R 2/1000 PVC	979-08050
1.5	PVC	18/30 R 2/1500 PVC	979-08384
2	PVC	18/30 R 2/2000 PVC	979-08051

18/30 R 3/…-Si fibre-optic cable

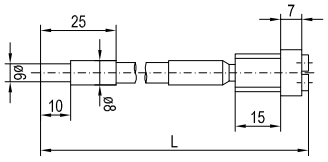




153-00153

18/30 R 3/…-MSC fibre-optic cable

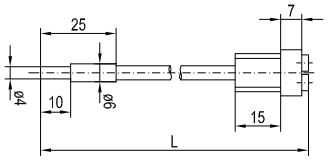




153-00153

18/30 R 3/…-PVC fibre-optic cable





153-00137

Highlights

- Photoelectric proximity sensor
- Silicone, metal or PVC sheath
- Axial light exit
- Robust design
- -20 … +80 °C / +160 °C
- Fixing via mounting block MB 8 (MSC/Si) (Article number 903-05141)
- Fixing via mounting block MB 6 (PVC) (Article number 903-05139)
- For FMS/FAV devices

9

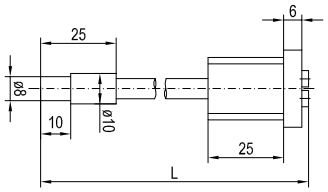
Fibre arrangement Light exit	FMS 18 typ. scanning distance/range (mm)	FMS 30 typ. scanning distance/range (mm)	Core fibre Ø (mm) material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing Ø (mm)	LS (mm)
Axial	160	200	2 x 2.0 (Si/MSC) 1 x 2.8 (PVC) Glass	See Selection Table	-20 … +160 °C (Si/MSC) -20 … +80 °C (PVC)	25 = (Si/MSC) 30 = (PVC)	See Selection Table	8 = (Si/MSC) 6 = (PVC)	–

Length (m)	Sheath material	Part number	Article number
0.25	Silicone (Si)	18/30 R 3/250-Si	979-08093
0.5	Silicone (Si)	18/30 R 3/500/Si	979-08094
0.75	Silicone (Si)	18/30 R 3/750-Si	979-08413
1	Silicone (Si)	18/30 R 3/1000-Si	979-08095
1.5	Silicone (Si)	18/30 R 3/1500-Si	979-08414
2	Silicone (Si)	18/30 R 3/2000-Si	979-08096
0.25	Brass, chrome-plated (MSC)	18/30 R 3/250-MSC	979-08065
0.5	Brass, chrome-plated (MSC)	18/30 R 3/500-MSC	979-08066
0.75	Brass, chrome-plated (MSC)	18/30 R 3/750-MSC	979-08391
1	Brass, chrome-plated (MSC)	18/30 R 3/1000-MSC	979-08067
1.5	Brass, chrome-plated (MSC)	18/30 R 3/1500-MSC	979-08392
2	Brass, chrome-plated (MSC)	18/30 R 3/2000-MSC	979-08068
0.25	PVC	18/30 R 3/250 PVC	979-08052
0.5	PVC	18/30 R 3/500 PVC	979-08053
0.75	PVC	18/30 R 3/750 PVC	979-08385
1	PVC	18/30 R 3/1000 PVC	979-08054
1.5	PVC	18/30 R 3/1500 PVC	979-08386
2	PVC	18/30 R 3/2000 PVC	979-08055

Fibre-optic cables – standard

30 R 4/…-Si fibre-optic cable

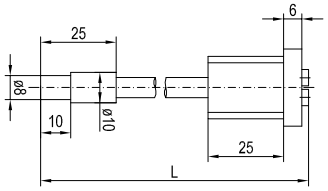




153-00159

30 R 4/…-MSC fibre-optic cable





153-00159

Highlights

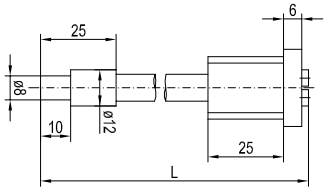
- Photoelectric proximity sensor
- Silicone, metal or PVC sheath
- Axial light exit
- Long scanning distance/range
- Robust design
- -20 … +160 °C
- Fixing via mounting block MB 10 (Article number 903-05142)
- For FMS/FAV devices

Fibre arrangement Light exit	FMS 18 typ. scanning distance/range (mm)	FMS 30 typ. scanning distance/range (mm)	Core fibre Ø (mm) material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing Ø (mm)	LS (mm)
Axial	–	400	2 x 2.3 Glass	See Selection Table	-20 … +160 °C	25	See Selection Table	10	–

Length (m)	Sheath material	Part number	Article number
0.25	Silicone (Si)	30 R 4/250-Si	979-06924
0.5	Silicone (Si)	30 R 4/500-Si	979-06925
0.75	Silicone (Si)	30 R 4/750-Si	979-08415
1	Silicone (Si)	30 R 4/1000-Si	979-06926
1.5	Silicone (Si)	30 R 4/1500-Si	979-08416
2	Silicone (Si)	30 R 4/2000-Si	979-06927
0.25	Brass. chrome-plated (MSC)	30 R 4/250-MSC	979-06654
0.5	Brass. chrome-plated (MSC)	30 R 4/500-MSC	979-06655
0.75	Brass. chrome-plated (MSC)	30 R 4/750-MSC	979-08393
1	Brass. chrome-plated (MSC)	30 R 4/1000-MSC	979-06656
1.5	Brass. chrome-plated (MSC)	30 R 4/1500-MSC	979-08394
2	Brass. chrome-plated (MSC)	30 R 4/2000-MSC	979-06657

30 R 12/…-Si fibre-optic cable

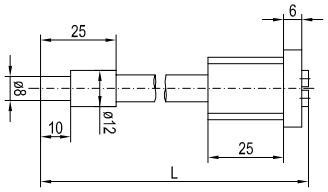




153-00161

30 R 12/…-MSC fibre-optic cable





153-00161

Highlights

- Photoelectric proximity sensor
- Silicone, metal or PVC sheath
- Axial light exit
- Extremely insensitive to contamination
- Long scanning distance/range
- Robust design
- -20 … +160 °C
- Fixing via mounting block MB 10 (Article number 903-05142)
- For FMS/FAV devices

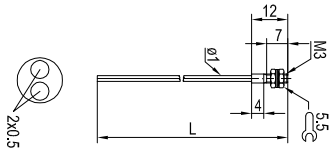
Fibre arrangement Light exit	FMS 18 typ. scanning distance/range (mm)	FMS 30 typ. scanning distance/range (mm)	Core fibre Ø (mm) material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing Ø (mm)	LS (mm)
Axial	–	800	2 x 3.5 Glass	See Selection Table	-20 … +160 °C	45	See Selection Table	12	–

Length (m)	Sheath material	Part number	Article number
0.25	Silicone (Si)	30 R 12/250-Si	979-06940
0.5	Silicone (Si)	30 R 12/500-Si	979-06941
0.75	Silicone (Si)	30 R 12/750-Si	979-08417
1	Silicone (Si)	30 R 12/1000-Si	979-06942
1.5	Silicone (Si)	30 R 12/1500-Si	979-08418
2	Silicone (Si)	30 R 12/2000-Si	979-06943
0.25	Brass. chrome-plated (MSC)	30 R 12/250-MSC	979-06646
0.5	Brass. chrome-plated (MSC)	30 R 12/500-MSC	979-06647
0.75	Brass. chrome-plated (MSC)	30 R 12/750-MSC	979-08395
1	Brass. chrome-plated (MSC)	30 R 12/1000-MSC	979-06648
1.5	Brass. chrome-plated (MSC)	30 R 12/1500-MSC	979-08396
2	Brass. chrome-plated (MSC)	30 R 12/2000-MSC	979-06643

Fibre-optic cables – standard

K1R-101 fibre-optic cable





153-00079

Highlights

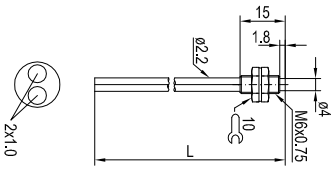
- Photoelectric proximity sensor
- Small installation dimensions
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Mono/axial	60 / 25 / 95	–	See drawing	LVLF6-M3	2 x 0.5 (T/R) PMMA	Polyethylene (PE)	-40 … +70 °C	25	2 m Cutable	M3 Stainless steel	–

Part number	Article number
K1R-101	720-50766

K2R-102 fibre-optic cable





153-00083

Highlights

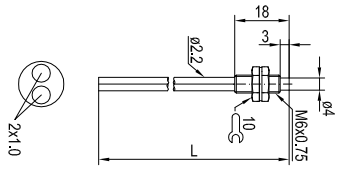
- Photoelectric proximity sensor
- Short mounting sleeve
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Mono/axial	150 / 85 / 295	80	See drawing	–	2 x 1.0 (T/R) PMMA	Polyethylene (PE)	-40 … +70 °C	25	2 m Cutable	M6x0.75 Stainless steel	–

Part number	Article number
K2R-102	720-50767

K2R-6 fibre-optic cable





153-00269

Highlights

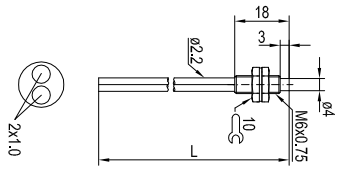
- Photoelectric proximity sensor
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Mono/axial	100 / 55 / 265	50	See drawing	–	2 x 1.0 (T/R) PMMA	Polyethylene (PE)	-40 … +70 °C	25	2 m Cutable	M6x0.75 Brass, nickel-plated	–

Part number	Article number
K2R-6	841-21000

K2R-67 fibre-optic cable





153-00270

Highlights

- Photoelectric proximity sensor
- Oil-resistant
- Expanded temperature range
- Fibre length individually cutable
- For FL 70/FL 20 devices

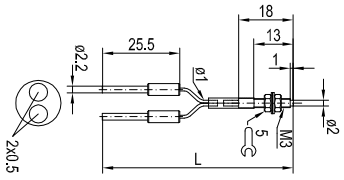
Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Mono/axial	120 / 70 / 295	60	See drawing	–	2 x 1.0 (T/R) PMMA	Polycarbonate (PC)	-40 … +85 °C	25	2 m Cutable	M6x0.75 Brass, nickel-plated	–

Part number	Article number
K2R-67	841-21001

Fibre-optic cables – standard

LLK1RM3-PE-1m fibre-optic cable





153-00450

Highlights

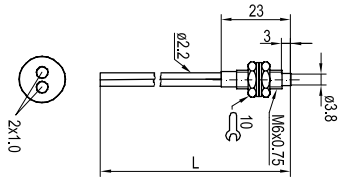
- Photoelectric proximity sensor
- Very small head diameter
- Stainless steel head
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Mono/axial	50 / 20 / 55	–	See drawing	LVLF6-M3	2 x 0.5 (T/R) PMMA	Polyethylene (PE)	-40 … +60 °C	15	1 m Cutable	M3 Stainless steel	–

Part number	Article number
LLK1RM3-PE-1m	750-21000

LLK2RM6-PE-1m fibre-optic cable





153-00452

Highlights

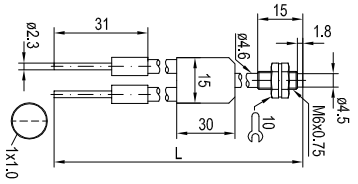
- Photoelectric proximity sensor
- Robust design
- Stainless steel head
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Mono/axial	150 / 90 /280	80	See drawing	–	2 x 1.0 (T/R) PMMA	Polyethylene (PE)	-40 … +60 °C	25	1 m Cutable	M6x0.75 Stainless steel	–

Part number	Article number
LLK2RM6-PE-1m	750-21001

33 R 1/…-Si fibre-optic cable

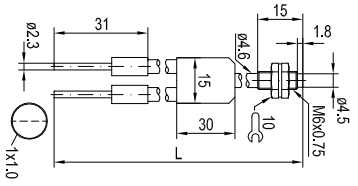




153-00088

33 R 1/…-MSC fibre-optic cable





153-00088

Highlights

- Photoelectric proximity sensor
- Silicone or metal sheath
- Robust design
- -20 … +160 °C
- Low damping
- For FL 70/FL 20 devices

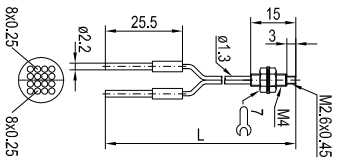
Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Axial	100 / 55 / 210	50	See drawing	–	1 x 1.0 (T/R) Glass	See Selection Table	-20 … +160 °C	15	See Selection Table	M6x0,75 Brass, nickel-plated	–

Length (m)	Sheath material	Part number	Article number
0.5	Silicone (Si)	33 R 1/500-Si	979-51445
0.5	Brass. chrome-plated (MSC)	33 R 1/500 MSC	979-51443
1	Brass. chrome-plated (MSC)	33 R 1/1000 MSC	979-51448
1.5	Brass. chrome-plated (MSC)	33 R 1/1500 MSC	979-51444
2	Brass. chrome-plated (MSC)	33 R 1/2000 MSC	979-51456

Fibre-optic cables – standard

K1R-68 fibre-optic cable





153-00271

Highlights

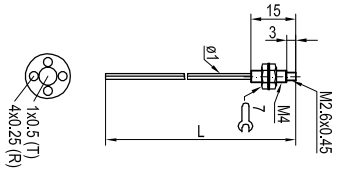
- Photoelectric proximity sensor
- Very small bending radius
- Head with mounting thread for attachments
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Axial	100 / 40 / 200	50	See drawing	LVLF6-M4	8 x 0.25 (T) 8 x 0.25 (R) PMMA	Polyethylene (PE)	-40 … +70 °C	3	2 m Cutable	M4 Brass, nickel-plated	–

Part number	Article number
K1R-68	951-50001

K1R-35 fibre-optic cable





153-00274

Highlights

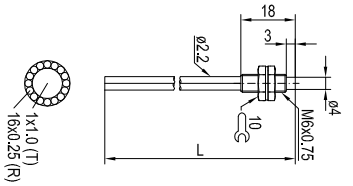
- Photoelectric proximity sensor
- Precise switching behaviour on lateral approach
- Head with mounting thread for attachments
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Coaxial	50 / 20 / 80	–	See drawing	LVLF6-M4	4 x 0.25 (R) 1 x 0.5 (T) PMMA	Polyethylene (PE)	-40 … +70 °C	15	2 m Cutable	M4 Brass, nickel-plated	–

Part number	Article number
K1R-35	841-21005

K2R-25 fibre-optic cable





153-00273

Highlights

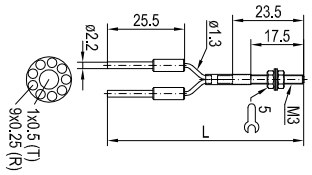
- Photoelectric proximity sensor
- Precise switching behaviour on lateral approach
- Short mounting sleeve
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Coaxial	130 / 60 / 240	70	See drawing	–	16 x 0.25 (R) 1 x 1.0 (T) PMMA	Polyethylene (PE)	-40 … +70 °C	25	2 m Cutable	M6x0.75 Brass, nickel-plated	–

Part number	Article number
K2R-25	841-21004

LLK1RKM3 PE-1m fibre-optic cable





153-00451

Highlights

- Photoelectric proximity sensor
- Precise switching behaviour on lateral approach
- Very small head diameter
- Stainless steel head
- Fibre length individually cutable
- For FL 70/FL 20 devices

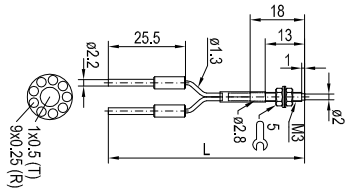
Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Coaxial	70 / 35 /150	–	See drawing	LVLF6-M3	9 x 0.25 (R) 1 x 0.5 (T) PMMA	Polyethylene (PE)	-40 … +60 °C	15	1 m Cutable	M3 Stainless steel	–

Part number	Article number
LLK1RKM3 PE-1m	750-21002

Fibre-optic cables – standard

LLK1RKM3-18 PE-2m fibre-optic cable





153-00692

Highlights

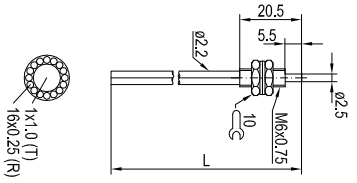
- Photoelectric proximity sensor
- Precise switching behaviour on lateral approach
- Short mounting sleeve
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Axial	70 / 35 / 150	–	See drawing	LVLF6-M3	9 x 0.25 (R) 1 x 0.5 (T) PMMA	Polyethylene (PE)	-40 … +70 °C	15	2 m Cutable	M3 Stainless steel	–

Part number	Article number
LLK1RKM3-18 PE-2m	750-21005

LLK2RKM6 PE-1m fibre-optic cable





153-00453

Highlights

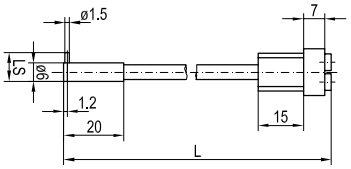
- Photoelectric proximity sensor
- Precise switching behaviour on lateral approach
- Robust design
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Coaxial	150 / 80 / 310	80	See drawing	–	16 x 0.25 (R) 1 x 1.0 (T) PMMA	Polyethylene (PE)	-40 … +60 °C	25	1 m Cutable	M6x0.75 Stainless steel	–

Part number	Article number
LLK2RKM6 PE-1m	750-21003

18/30 RZ 1/…-Si fibre-optic cable

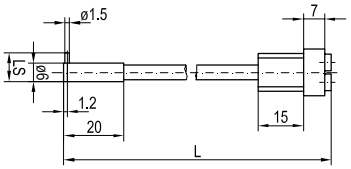




153-00146

18/30 RZ 1/…-MSC fibre-optic cable





153-00146

Highlights

- Photoelectric proximity sensor
- Silicone or metal sheath
- Radial light exit
- Robust design
- -20 … +160 °C
- Fixing via mounting block MB 6 (Article number 903-05139)
- For FMS/FAV devices

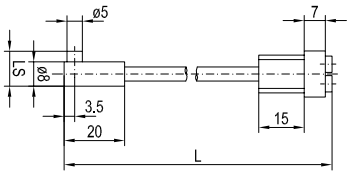
Fibre arrangement Light exit	FMS 18 typ. scanning distance/range (mm)	FMS 30 typ. scanning distance/range (mm)	Core fibre Ø (mm) material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing Ø (mm)	LS (mm)
Radial	5	15	1 x 1.0 Glass	See Selection Table	-20 … +160 °C	15	See Selection Table	6	See Selection Table

LS (mm)	Length (m)	Sheath material	Part number	Article number
10	0.25	Silicone (Si)	18/30 RZ 1/250-Si	979-06146
14	0.25	Silicone (Si)	18/30 RZ 1/250-Si	979-06147
10	0.5	Silicone (Si)	18/30 RZ 1/500-Si	979-06152
14	0.5	Silicone (Si)	18/30 RZ 1/500-Si	979-06153
10	0.75	Silicone (Si)	18/30 RZ 1/750 Si	979-06158
14	0.75	Silicone (Si)	18/30 RZ 1/750 Si	979-06159
10	1	Silicone (Si)	18/30 RZ 1/1000-Si	979-06164
14	1	Silicone (Si)	18/30 RZ 1/1000-Si	979-06165
10	1.5	Silicone (Si)	18/30 RZ 1/1500-Si	979-06170
14	1.5	Silicone (Si)	18/30 RZ 1/1500-Si	979-06171
10	2	Silicone (Si)	18/30 RZ 1/2000-Si	979-06176
14	2	Silicone (Si)	18/30 RZ 1/2000-Si	979-06177
10	0.25	Brass. chrome-plated (MSC)	18/30 RZ 1/250-MSC	979-06144
14	0.25	Brass. chrome-plated (MSC)	18/30 RZ 1/250-MSC	979-06145
10	0.5	Brass. chrome-plated (MSC)	18/30 RZ 1/500-MSC	979-06150
14	0.5	Brass. chrome-plated (MSC)	18/30 RZ 1/500-MSC	979-06151
10	0.75	Brass. chrome-plated (MSC)	18/30 RZ 1/750-MSC	979-06156
14	0.75	Brass. chrome-plated (MSC)	18/30 RZ 1/750-MSC	978-06157
10	1	Brass. chrome-plated (MSC)	18/30 RZ 1/1000-MSC	979-06162
14	1	Brass. chrome-plated (MSC)	18/30 RZ 1/1000-MSC	979-06163
10	1.5	Brass. chrome-plated (MSC)	18/30 RZ 1/1500-MSC	979-06168
14	1.5	Brass. chrome-plated (MSC)	18/30 RZ 1/1500-MSC	979-06169
10	2	Brass. chrome-plated (MSC)	18/30 RZ 1/2000-MSC	979-06174
14	2	Brass. chrome-plated (MSC)	18/30 RZ 1/2000-MSC	979-06175

Fibre-optic cables – standard

18/30 RZ 2/…-Si fibre-optic cable

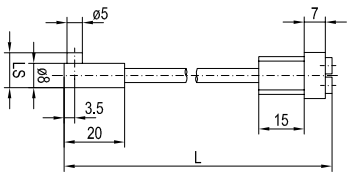




153-00152

18/30 RZ 2/…-MSC fibre-optic cable

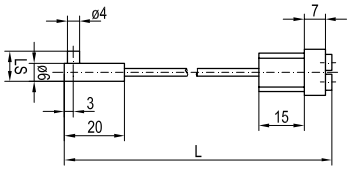




153-00152

18/30 RZ 2/…-PVC fibre-optic cable





153-00132

Highlights

- Photoelectric proximity sensor
- Silicone, metal or PVC sheath
- Radial light exit
- Robust design
- -20 … +80°C / +160 °C
- Fixing via mounting block MB 8 (MSC/Si) (Article number 903-05141)
- Fixing via mounting block MB 6 (PVC) (Article number 903-05139)
- For FMS/FAV devices

Fibre arrangement Light exit	FMS 18 typ. scanning distance/range (mm)	FMS 30 typ. scanning distance/range (mm)	Core fibre Ø (mm) material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing Ø (mm)	LS (mm)
Radial	50	60	2 x 1.0 (Si/MSC) 1 x 1.5 (PVC) Glass	See Selection Table	-20 … +160 °C (Si/MSC) -20 … +80 °C (PVC)	8	See Selection Table	8 = (Si/MSC) 6 = (PVC)	See Selection Table

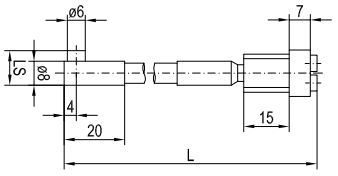
LS (mm)	Length (m)	Sheath material	Part number	Article number
10	0.25	Silicone (Si)	18/30 RZ 2/250-Si	979-06182
14	0.25	Silicone (Si)	18/30 RZ 2/250-Si	979-06183
10	0.5	Silicone (Si)	18/30 RZ 2/500-Si	979-06188
14	0.5	Silicone (Si)	18/30 RZ 2/500-Si	979-06189
10	0.75	Silicone (Si)	18/30 RZ 2/750-Si	979-06194
14	0.75	Silicone (Si)	18/30 RZ 2/750-Si	979-06195
10	1	Silicone (Si)	18/30 RZ 2/1000-Si	979-06200
14	1	Silicone (Si)	18/30 RZ 2/1000-Si	979-06201
10	1.5	Silicone (Si)	18/30 RZ 2/1500-Si	979-06206
14	1.5	Silicone (Si)	18/30 RZ 2/1500-Si	979-06207
10	2	Silicone (Si)	18/30 RZ 2/2000-Si	979-06212
14	2	Silicone (Si)	18/30 RZ 2/2000-Si	979-06213

LS (mm)	Length (m)	Sheath material	Part number	Article number
10	0.25	Brass, chrome-plated (MSC)	18/30 RZ 2/250-MSC	979-06180
14	0.25	Brass, chrome-plated (MSC)	18/30 RZ 2/250-MSC	979-06181
10	0.5	Brass, chrome-plated (MSC)	18/30 RZ 2/500-MSC	979-06186
14	0.5	Brass, chrome-plated (MSC)	18/30 RZ 2/500-MSC	979-06187
10	0.75	Brass, chrome-plated (MSC)	18/30 RZ 2/750-MSC	979-06192
14	0.75	Brass, chrome-plated (MSC)	18/30 RZ 2/750-MSC	979-06193
10	1	Brass, chrome-plated (MSC)	18/30 RZ 2/1000-MSC	979-06198
14	1	Brass, chrome-plated (MSC)	18/30 RZ 2/1000-MSC	979-06199
10	1.5	Brass, chrome-plated (MSC)	18/30 RZ 2/1500-MSC	979-06204
14	1.5	Brass, chrome-plated (MSC)	18/30 RZ 2/1500-MSC	979-06205
10	2	Brass, chrome-plated (MSC)	18/30 RZ 2/2000-MSC	979-06210
14	2	Brass, chrome-plated (MSC)	18/30 RZ 2/2000-MSC	979-06211
10	0.25	PVC	18/30 RZ 2/250-PVC	979-06178
14	0.25	PVC	18/30 RZ 2/250-PVC	979-06179
10	0.5	PVC	18/30 RZ 2/500-PVC	979-06184
14	0.5	PVC	18/30 RZ 2/500-PVC	979-06185
10	0.75	PVC	18/30 RZ 2/750-PVC	979-06190
14	0.75	PVC	18/30 RZ 2/750-PVC	979-06191
10	1	PVC	18/30 RZ 2/1000-PVC	979-06196
14	1	PVC	18/30 RZ 2/1000-PVC	979-06197
10	1.5	PVC	18/30 RZ 2/1500-PVC	979-06202
14	1.5	PVC	18/30 RZ 2/1500-PVC	979-06203
10	2	PVC	18/30 RZ 2/2000-PVC	979-06208
14	2	PVC	18/30 RZ 2/2000-PVC	979-06209

Fibre-optic cables – standard

18/30 RZ 3/…-Si fibre-optic cable

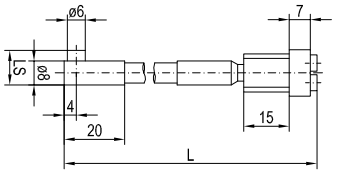




153-00154

18/30 RZ 3/…-MSC fibre-optic cable

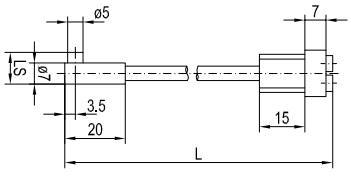




153-00154

18/30 RZ 3/…-PVC fibre-optic cable





153-00138

Highlights

- Photoelectric proximity sensor
- Silicone, metal or PVC sheath
- Radial light exit
- Robust design
- -20 … +80°C / +160 °C
- Fixing via mounting block MB 8 (Si/MSC) (Article number 903-05141)
- Fixing via mounting block MB 7 (PVC) (Article number 903-05140)
- For FMS/FAV devices

Fibre arrangement Light exit	FMS 18 typ. scanning distance/range (mm)	FMS 30 typ. scanning distance/range (mm)	Core fibre Ø (mm) material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing Ø (mm)	LS (mm)
Radial	160	200	2 x 2.0 (Si/MSC) 1 x 2.8 (PVC) Glass	See Selection Table	-20 … +160 °C (Si/MSC) -20 … +80 °C (PVC)	25 = (Si/MSC) 35 = (PVC)	See Selection Table	8 = (Si/MSC) 7 = (PVC)	See Selection Table

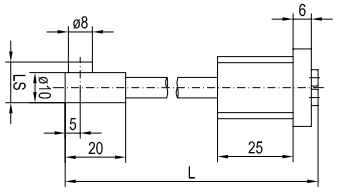
LS (mm)	Length (m)	Sheath material	Part number	Article number
10	0.25	Silicone (Si)	18/30 RZ 3/250 Si	979-06218
14	0.25	Silicone (Si)	18/30 RZ 3/250 Si	979-06219
10	0.5	Silicone (Si)	18/30 RZ 3/500 Si	979-06224
14	0.5	Silicone (Si)	18/30 RZ 3/500 Si	979-06225
10	0.75	Silicone (Si)	18/30 RZ 3/750-Si	979-06230
14	0.75	Silicone (Si)	18/30 RZ 3/750-Si	979-06231
10	1	Silicone (Si)	18/30 RZ 3/1000 Si	979-06236
14	1	Silicone (Si)	18/30 RZ 3/1000 Si	979-06237
10	1.5	Silicone (Si)	18/30 RZ 3/1500-Si	979-06242
14	1.5	Silicone (Si)	18/30 RZ 3/1500-Si	979-06243
10	2	Silicone (Si)	18/30 RZ 3/2000-Si	979-06248
14	2	Silicone (Si)	18/30 RZ 3/2000-Si	979-06249

LS (mm)	Length (m)	Sheath material	Part number	Article number
10	0.25	Brass, chrome-plated (MSC)	18/30 RZ 3/250-MSC	979-06216
14	0.25	Brass, chrome-plated (MSC)	18/30 RZ 3/250-MSC	979-06217
10	0.5	Brass, chrome-plated (MSC)	18/30 RZ 3/500-MSC	979-06222
14	0.5	Brass, chrome-plated (MSC)	18/30 RZ 3/500-MSC	979-06223
10	0.75	Brass, chrome-plated (MSC)	18/30 RZ 3/750-MSC	979-06228
14	0.75	Brass, chrome-plated (MSC)	18/30 RZ 3/750-MSC	979-06229
10	1	Brass, chrome-plated (MSC)	18/30 RZ 3/1000-MSC	979-06234
14	1	Brass, chrome-plated (MSC)	18/30 RZ 3/1000-MSC	979-06235
10	1.5	Brass, chrome-plated (MSC)	18/30 RZ 3/1500-MSC	979-06240
14	1.5	Brass, chrome-plated (MSC)	18/30 RZ 3/1500-MSC	979-06241
10	2	Brass, chrome-plated (MSC)	18/30 RZ 3/2000-MSC	979-06246
14	2	Brass, chrome-plated (MSC)	18/30 RZ 3/2000-MSC	979-06247
10	0.25	PVC	18/30 RZ 3/250-PVC	979-06214
14	0.25	PVC	18/30 RZ 3/250-PVC	979-06215
10	0.5	PVC	18/30 RZ 3/500-PVC	979-06220
14	0.5	PVC	18/30 RZ 3/500-PVC	979-06221
10	0.75	PVC	18/30 RZ 3/750-PVC	979-06226
14	0.75	PVC	18/30 RZ 3/750-PVC	979-06227
10	1	PVC	18/30 RZ 3/1000-PVC	979-06232
14	1	PVC	18/30 RZ 3/1000-PVC	979-06233
10	1.5	PVC	18/30 RZ 3/1500-PVC	979-06238
14	1.5	PVC	18/30 RZ 3/1500-PVC	979-06239
10	2	PVC	18/30 RZ 3/2000-PVC	979-06244
14	2	PVC	18/30 RZ 3/2000-PVC	979-06245

Fibre-optic cables – standard

30 RZ 4/…-Si fibre-optic cable

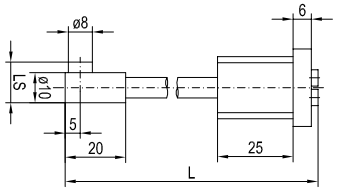




153-00160

30 RZ 4/…-MSC fibre-optic cable





153-00160

Highlights

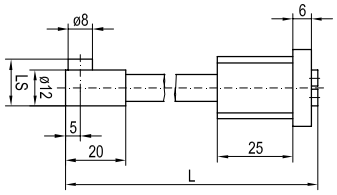
- Photoelectric proximity sensor
- Silicone or metal sheath
- Radial light exit
- Robust design
- -20 … +160 °C
- Fixing via mounting block MB 10 (Article number 903-05142)
- For FMS/FAV devices

Fibre arrangement Light exit	FMS 18 typ. scanning distance/range (mm)	FMS 30 typ. scanning distance/range (mm)	Core fibre Ø (mm) material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing Ø (mm)	LS (mm)
Radial	–	400	2 × 2.3 Glass	See Selection Table	-20 … +160 °C	25	See Selection Table	10	See Selection Table

LS (mm)	Length (m)	Sheath material	Part number	Article number
16	0.25	Silicone (Si)	30 RZ 4/250-Si	979-06252
20	0.25	Silicone (Si)	30 RZ 4/250-Si	979-06253
16	0.5	Silicone (Si)	30 RZ 4/500-Si	979-06256
20	0.5	Silicone (Si)	30 RZ 4/500-Si	979-06257
16	0.75	Silicone (Si)	30 RZ 4/750-Si	979-06260
20	0.75	Silicone (Si)	30 RZ 4/750-Si	979-06261
16	1	Silicone (Si)	30 RZ 4/1000-Si	979-06264
20	1	Silicone (Si)	30 RZ 4/1000-Si	979-06265
16	1.5	Silicone (Si)	30 RZ 4/1500-Si	979-06268
20	1.5	Silicone (Si)	30 RZ 4/1500-Si	979-06269
16	2	Silicone (Si)	30 RZ 4/2000-Si	979-06272
20	2	Silicone (Si)	30 RZ 4/2000-Si	979-06273
16	0.25	Brass. chrome-plated (MSC)	30 RZ 4/250-MSC	979-06250
20	0.25	Brass. chrome-plated (MSC)	30 RZ 4/250-MSC	979-06251
16	0.5	Brass. chrome-plated (MSC)	30 RZ 4/500-MSC	979-06254
20	0.5	Brass. chrome-plated (MSC)	30 RZ 4/500-MSC	979-06255
16	0.75	Brass. chrome-plated (MSC)	30 RZ 4/750-MSC	979-06258
20	0.75	Brass. chrome-plated (MSC)	30 RZ 4/750-MSC	979-06259
16	1	Brass. chrome-plated (MSC)	30 RZ 4/1000-MSC	979-06262
20	1	Brass. chrome-plated (MSC)	30 RZ 4/1000-MSC	979-06263
16	1.5	Brass. chrome-plated (MSC)	30 RZ 4/1500-MSC	979-06266
20	1.5	Brass. chrome-plated (MSC)	30 RZ 4/1500-MSC	979-06267
16	2	Brass. chrome-plated (MSC)	30 RZ 4/2000-MSC	979-06270
20	2	Brass. chrome-plated (MSC)	30 RZ 4/2000-MSC	979-06271

30 RZ 12/…-Si fibre-optic cable

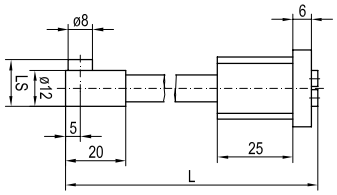




153-00162

30 RZ 12/…-MSC fibre-optic cable





153-00162

Highlights

- Photoelectric proximity sensor
- Silicone or metal sheath
- Radial light exit
- Robust design
- -20 … +160 °C
- Fixing via mounting block MB 10 (Article number 903-05142)
- For FMS/FAV devices

Fibre arrangement Light exit	FMS 18 typ. scanning distance/range (mm)	FMS 30 typ. scanning distance/range (mm)	Core fibre Ø (mm) material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing Ø (mm)	LS (mm)
Radial	–	800	2 x 3.5 Glass	See Selection Table	-20 … +160 °C	45	See Selection Table	12	See Selection Table

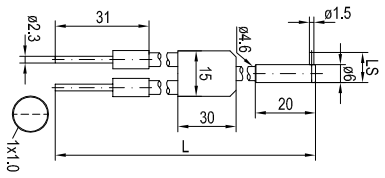
9

LS (mm)	Length (m)	Sheath material	Part number	Article number
16	0.25	Silicone (Si)	30 RZ 12/250-Si	979-06308
20	0.25	Silicone (Si)	30 RZ 12/250-Si	979-06309
16	0.5	Silicone (Si)	30 RZ 12/500-Si	979-06312
20	0.5	Silicone (Si)	30 RZ 12/500-Si	979-06313
16	0.75	Silicone (Si)	30 RZ 12/750-Si	979-06316
20	0.75	Silicone (Si)	30 RZ 12/750-Si	979-06317
16	1	Silicone (Si)	30 RZ 12/1000-Si	979-06320
20	1	Silicone (Si)	30 RZ 12/1000-Si	979-06321
16	1.5	Silicone (Si)	30 RZ 12/1500-Si	979-06324
20	1.5	Silicone (Si)	30 RZ 12/1500-Si	979-06325
16	2	Silicone (Si)	30 RZ 12/2000-Si	979-06328
20	2	Silicone (Si)	30 RZ 12/2000-Si	979-06329
16	0.25	Brass. chrome-plated (MSC)	30 RZ 12/250-MSC	979-06306
20	0.25	Brass. chrome-plated (MSC)	30 RZ 12/250-MSC	979-06307
16	0.5	Brass. chrome-plated (MSC)	30 RZ 12/500-MSC	979-06310
20	0.5	Brass. chrome-plated (MSC)	30 RZ 12/500-MSC	979-06311
16	0.75	Brass. chrome-plated (MSC)	30 RZ 12/750-MSC	979-06314
20	0.75	Brass. chrome-plated (MSC)	30 RZ 12/750-MSC	979-06315
16	1	Brass. chrome-plated (MSC)	30 RZ 12/1000-MSC	979-06318
20	1	Brass. chrome-plated (MSC)	30 RZ 12/1000-MSC	979-06319
16	1.5	Brass. chrome-plated (MSC)	30 RZ 12/1500-MSC	979-06322
20	1.5	Brass. chrome-plated (MSC)	30 RZ 12/1500-MSC	979-06323
16	2	Brass. chrome-plated (MSC)	30 RZ 12/2000-MSC	979-06326
20	2	Brass. chrome-plated (MSC)	30 RZ 12/2000-MSC	979-06327

Fibre-optic cables – standard

33 RZ 1/…-MSC fibre-optic cable





153-01032

Highlights

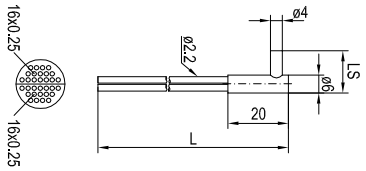
- Photoelectric proximity sensor
- Metal sheath
- Robust design
- -20 … +160 °C
- Fixing via mounting block MB 6 (Article number 903-05139)
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Axial	100 / 55 / 210	50	See drawing	–	1 x 1.0 (T/R) Glass	Brass, chrome-plated (MSC)	-20 … +160 °C	15	See Selection Table	Ø 6 mm Aluminium	10

Length (m)	Part number	Article number
0.5	33 RZ 1/500 MSC	979-51457
1.5	33 RZ 1/1500 MSC	979-51459
2	33 RZ 1/2000 MSC	979-51458

LLK2RZ LS=10 fibre-optic cable





153-00605

Highlights

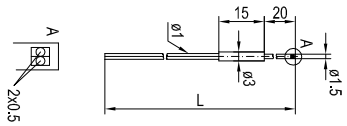
- Photoelectric proximity sensor
- Precise switching behaviour on lateral approach
- Lateral light exit
- Fixing via mounting block MB 6 (Article number 903-05139)
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Radial	100 / 50 / 200	50	See drawing	–	16 x 0.25 (T) 16 x 0.25 (R) PMMA	Polyethylene (PE)	-40 … +70 °C	15	2 m Cutable	Ø 6 mm Aluminium	10

Part number	Article number
LLK2RZ	951-50012

K1RZ-31 fibre-optic cable





153-00272

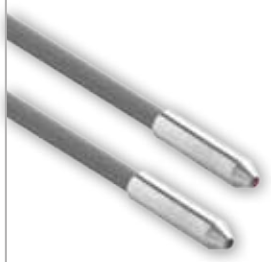
Highlights

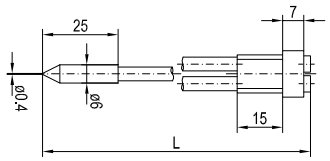
- Photoelectric proximity sensor
- Precise switching behaviour on lateral approach
- Lateral light exit
- Particularly suitable for restricted spaces
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Mono/axial	20 / 10 / 30	–	See drawing	–	2 x 0.5 (T/R) PMMA	Polyethylene (PE)	-40 … +70 °C	15	2 m Cutable	Ø 1.5 mm Stainless steel	–

Part number	Article number
K1RZ-31	841-21003

18/30 L 0,4/...-Si fibre-optic cable





153-00143

Highlights

- Through-beam photoelectric sensor
- Silicone sheath
- Small axial light exit
- Robust design
- -20 … +160 °C
- Fixing via mounting block MB 6 (Article number 903-05139)
- For FMS/FAV devices

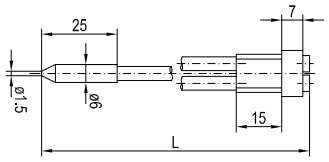
Fibre arrangement Light exit	FMS 18 typ. scanning distance/range (mm)	FMS 30 typ. scanning distance/range (mm)	Core fibre Ø (mm) (T=Transmitter; R=Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing Ø (mm)	LS (mm)
Axial	10	20	1 x 0.4 (T) / 1 x 0.4 (R) Glass	Silicone (Si)	-20 … +160 °C	15	See Selection Table	6	–

Length (m)	Part number	Article number
0.25	18/30 L 0,4/250-Si	978-50548
0.5	18/30 L 0,4/500-Si	978-50549
1	18/30 L 0,4/1000-Si	978-50545
2	18/30 L 0,4/2000-Si	978-50550

Fibre-optic cables – standard

18/30 L 1/…-Si fibre-optic cable

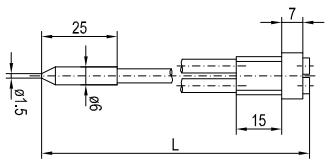




153-00148

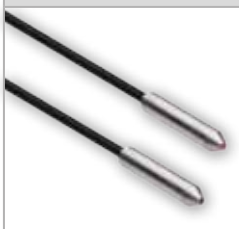
18/30 L 1/…-MSC fibre-optic cable

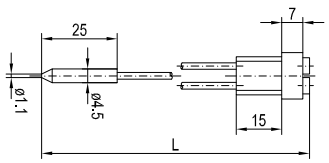




153-00148

18/30 L 1/…-PVC fibre-optic cable





153-00133

Highlights

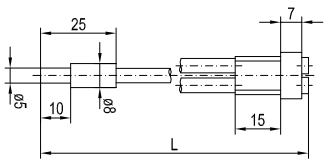
- Through-beam photoelectric sensor
- Silicone, metal or PVC sheath
- Small axial light exit
- Robust design
- -20 … +80 °C / +160 °C (PVC)/(Si/MSC)
- Fixing via mounting block MB 6 (MSC/Si) (Article number 903-05139)
- Fixing via mounting block MB 4.5 (PVC) (Article number 903-50314)
- For FMS/FAV devices

Fibre arrangement Light exit	FMS 18 typ. scanning distance/range (mm)	FMS 30 typ. scanning distance/range (mm)	Core fibre Ø (mm) (T=Transmitter; R=Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing Ø (mm)	LS (mm)
Axial	80	100	1 x 0.8 (T) / 1 x 0.8 (R) (Si/MSC) 1 x 1.0 (T) / 1 x 1.0 (R) (PVC) Glass	See Selection Table	-20 … +160 °C	15	See Selection Table	6	–

Length (m)	Sheath material	Part number	Article number
0.25	Silicone (Si)	18/30 L 1/250-Si	978-08230
0.5	Silicone (Si)	18/30 L 1/500-Si	978-08231
0.75	Silicone (Si)	18/30 L 1/750-Si	978-08567
1	Silicone (Si)	18/30 L 1/1000-Si	978-08232
1.5	Silicone (Si)	18/30 L 1/1500-Si	978-08568
2	Silicone (Si)	18/30 L 1/2000-Si	978-08233
0.25	Brass, chrome-plated (MSC)	18/30 L 1/250-MSC	978-08206
0.5	Brass, chrome-plated (MSC)	18/30 L 1/500-MSC	978-08207
0.75	Brass, chrome-plated (MSC)	18/30 L 1/750-MSC	978-08547
1	Brass, chrome-plated (MSC)	18/30 L 1/1000-MSC	978-08208
1.5	Brass, chrome-plated (MSC)	18/30 L 1/1500-MSC	978-08548
2	Brass, chrome-plated (MSC)	18/30 L 1/2000-MSC	978-08209
0.25	PVC	18/30 L 1/250-PVC	978-08193
0.5	PVC	18/30 L 1/500-PVC	978-08194
0.75	PVC	18/30 L 1/750-PVC	978-08541
1	PVC	18/30 L 1/1000-PVC	978-08195
1.5	PVC	18/30 L 1/1500-PVC	978-08542
2	PVC	18/30 L 1/2000-PVC	978-08196

18/30 L 2/…-Si fibre-optic cable

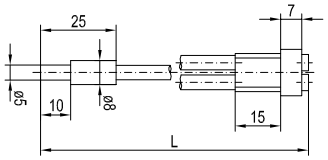




153-00155

18/30 L 2/…-MSC fibre-optic cable

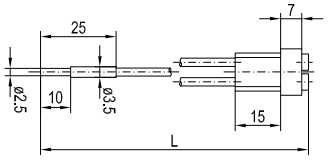




153-00155

18/30 L 2/…-PVC fibre-optic cable





153-00135

Highlights

- Through-beam photoelectric sensor
- Silicone, metal or PVC sheath
- Axial light exit
- Robust design
- -20 … +80 °C / +160 °C (PVC)/(Si/MSC)
- Fixing via mounting block MB 8 (MSC/Si) (Article number 903-05141)
- Fixing via mounting block MB 3.5 (PVC) (Article number 903-50313)
- For FMS/FAV devices

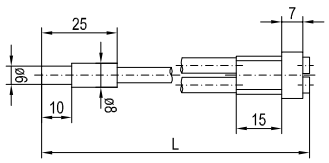
Fibre arrangement Light exit	FMS 18 typ. scanning distance/range (mm)	FMS 30 typ. scanning distance/range (mm)	Core fibre Ø (mm) (T=Transmitter; R=Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing Ø (mm)	LS (mm)
Axial	360	400	1 x 1.6 (T) / 1 x 1.6 (R) (Si/MSC) 1 x 1.5 (T) / 1 x 1.5 (R) (PVC) Glass	See Selection Table	-20 … +160 °C (Si/MSC) -20 … +80 °C (PVC)	20 = (Si/MSC) 15 = (PVC)	See Selection Table	8 = (Si/MSC) 3.5 = (PVC)	–

Length (m)	Sheath material	Part number	Article number
0.25	Silicone (Si)	18/30 L 2/250-Si	978-08238
0.5	Silicone (Si)	18/30 L 2/500-Si	978-08239
0.75	Silicone (Si)	18/30 L 2/750-Si	978-08571
1	Silicone (Si)	18/30 L 2/1000-Si	978-08240
1.5	Silicone (Si)	18/30 L 2/1500-Si	978-08572
2	Silicone (Si)	18/30 L 2/2000-Si	978-08241
0.25	Brass, chrome-plated (MSC)	18/30 L 2/250-MSC	978-08210
0.5	Brass, chrome-plated (MSC)	18/30 L 2/500-MSC	978-08211
0.75	Brass, chrome-plated (MSC)	18/30 L 2/750-MSC	978-08549
1	Brass, chrome-plated (MSC)	18/30 L 2/1000-MSC	978-08212
1.5	Brass, chrome-plated (MSC)	18/30 L 2/1500-MSC	978-08550
2	Brass, chrome-plated (MSC)	18/30 L 2/2000-MSC	978-08213
0.25	PVC	18/30 L 2/250-PVC	978-08197
0.5	PVC	18/30 L 2/500-PVC	978-08198
0.75	PVC	18/30 L 2/750-PVC	978-08543
1	PVC	18/30 L 2/1000-PVC	978-08199
1.5	PVC	18/30 L 2/1500-PVC	978-08544
2	PVC	18/30 L 2/2000-PVC	978-08200

Fibre-optic cables – standard

18/30 L 3/…-Si fibre-optic cable

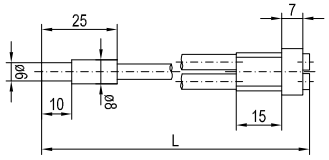




153-00157

18/30 L 3/…-MSC fibre-optic cable

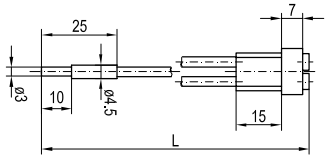




153-00157

18/30 L 3/…-PVC fibre-optic cable





153-00139

Highlights

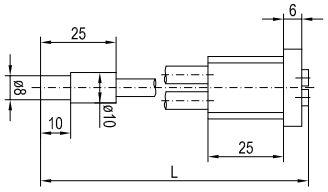
- Through-beam photoelectric sensor
- Silicone, metal or PVC sheath
- Axial light exit
- Robust design
- -20 … +80°C / +160 °C
- Fixing via mounting block MB 8 (MSC/Si) (Article number 903-05141)
- Fixing via mounting block MB 4.5 (PVC) (Article number 903-50314)
- For FMS/FAV devices

Fibre arrangement Light exit	FMS 18 typ. scanning distance/range (mm)	FMS 30 typ. scanning distance/range (mm)	Core fibre Ø (mm) (T=Transmitter; R=Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing Ø (mm)	LS (mm)
Axial	700	1000	1 x 2.0 (T) / 1 x 2.0 (R) Glass	See Selection Table	-20 … +160 °C (Si/MSC) -20 … +80 °C (PVC)	20	See Selection Table	8 = (Si/MSC) 4.5 = (PVC)	–

Length (m)	Sheath material	Part number	Article number
0.25	Silicone (Si)	18/30 L 3/250-Si	978-08242
0.5	Silicone (Si)	18/30 L 3/500-Si	978-08243
0.75	Silicone (Si)	18/30 L 3/750-Si	978-08573
1	Silicone (Si)	18/30 L 3/1000-Si	978-08244
1.5	Silicone (Si)	18/30 L 3/1500-Si	978-08574
2	Silicone (Si)	18/30 L 3/2000-Si	978-08245
0.25	Brass, chrome-plated (MSC)	18/30 L 3/250-MSC	978-08214
0.5	Brass, chrome-plated (MSC)	18/30 L 3/500-MSC	978-08215
0.75	Brass, chrome-plated (MSC)	18/30 L 3/750-MSC	978-08551
1	Brass, chrome-plated (MSC)	18/30 L 3/1000-MSC	978-08216
1.5	Brass, chrome-plated (MSC)	18/30 L 3/1500-MSC	978-08552
2	Brass, chrome-plated (MSC)	18/30 L 3/2000-MSC	978-08217
0.25	PVC	18/30 L 3/250-PVC	978-08201
0.5	PVC	18/30 L 3/500-PVC	978-08202
0.75	PVC	18/30 L 3/750-PVC	978-08545
1	PVC	18/30 L 3/1000-PVC	978-08203
1.5	PVC	18/30 L 3/1500-PVC	978-08546
2	PVC	18/30 L 3/2000-PVC	978-08204

30 L 4/…-Si fibre-optic cable

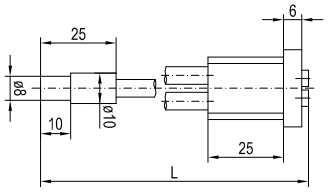




153-00163

30 L 4/...-MSC fibre-optic cable





153-00163

Highlights

- Through-beam photoelectric sensor
- Silicone or metal sheath
- Axial light exit
- Long range
- Robust design
- -20 … +160 °C
- Fixing via mounting block MB 10 (Article number 903-05142)
- For FMS/FAV devices

Fibre arrangement Light exit	FMS 18 typ. scanning distance/range (mm)	FMS 30 typ. scanning distance/range (mm)	Core fibre Ø (mm) (T=Transmitter; R=Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing Ø (mm)	LS (mm)
Axial	–	3000	1 x 2.3 (T) / 1 x 2.3 (R) Glass	See Selection Table	-20 … +160 °C	25	See Selection Table	10	–

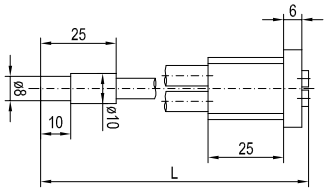
9

Length (m)	Sheath material	Part number	Article number
0.25	Silicone (Si)	30 L 4/250-Si	978-06932
0.5	Silicone (Si)	30 L 4/500-Si	978-06933
0.75	Silicone (Si)	30 L 4/750-Si	978-08575
1	Silicone (Si)	30 L 4/1000-Si	978-06934
1.5	Silicone (Si)	30 L 4/1500-Si	978-08576
2	Silicone (Si)	30 L 4/2000-Si	978-06935
0.25	Brass. chrome-plated (MSC)	30 L 4/250-MSC	978-06650
0.5	Brass. chrome-plated (MSC)	30 L 4/500-MSC	978-06651
0.75	Brass. chrome-plated (MSC)	30 L 4/750-MSC	978-08553
1	Brass. chrome-plated (MSC)	30 L 4/1000-MSC	978-06652
1.5	Brass. chrome-plated (MSC)	30 L 4/1500-MSC	978-08554
2	Brass. chrome-plated (MSC)	30 L 4/2000-MSC	978-06653

Fibre-optic cables – standard

30 L 12/…-Si fibre-optic cable

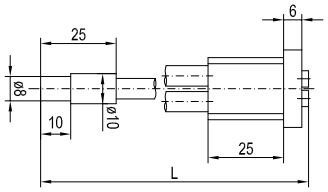




153-00165

30 L 12/...-MSC fibre-optic cable





153-00165

Highlights

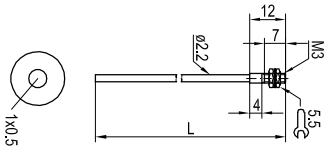
- Through-beam photoelectric sensor
- Silicone or metal sheath
- Axial light exit
- Extremely insensitive to contamination
- Long scanning distance/range
- Robust design
- -20 … +160 °C
- Fixing via mounting block MB 10 (Article number 903-05142)
- For FMS/FAV devices

Fibre arrangement Light exit	FMS 18 typ. scanning distance/range (mm)	FMS 30 typ. scanning distance/range (mm)	Core fibre Ø (mm) (T=Transmitter; R=Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing Ø (mm)	LS (mm)
Axial	–	4800	1 x 3.5 (T) / 1 x 3.5 (R) Glass	See Selection Table	-20 … +160 °C	25	See Selection Table	12	–

Length (m)	Sheath material	Part number	Article number
0.25	Silicone (Si)	30 L 12/250-Si	978-06948
0.5	Silicone (Si)	30 L 12/500-Si	978-06949
0.75	Silicone (Si)	30 L 12/750-Si	978-08577
1	Silicone (Si)	30 L 12/1000-Si	978-06950
1.5	Silicone (Si)	30 L 12/1500-Si	978-08578
2	Silicone (Si)	30 L 12/2000-Si	978-06951
0.25	Brass. chrome-plated (MSC)	30 L 12/250-MSC	978-06797
0.5	Brass. chrome-plated (MSC)	30 L 12/500-MSC	978-06798
0.75	Brass. chrome-plated (MSC)	30 L 12/750-MSC	978-08555
1	Brass. chrome-plated (MSC)	30 L 12/1000-MSC	978-06799
1.5	Brass. chrome-plated (MSC)	30 L 12/1500-MSC	978-08556
2	Brass. chrome-plated (MSC)	30 L 12/2000-MSC	978-06800

K2L-201 fibre-optic cable





153-00084

Highlights

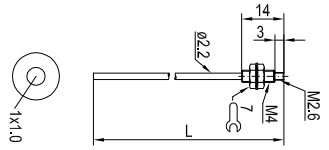
- Through-beam photoelectric sensor
- Small installation dimensions
- Suitable for ancillary optics for range expansion
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Mono/axial	120 / 60 / 200	–	See drawing	LVLF6-M3	1 x 0.5 (T) 1 x 0.5 (R) PMMA	Polyethylene (PE)	-40 … +70 °C	25	2 m Cutable	M3 Stainless steel	–

Part number	Article number
K2L-201	721-50771

K2L-202 fibre-optic cable





153-00087

Highlights

- Through-beam photoelectric sensor
- Short mounting sleeve
- Suitable for ancillary optics for range expansion
- Fibre length individually cutable
- For FL 70/FL 20 devices

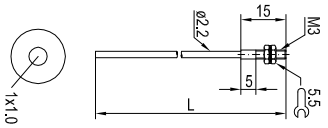
Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Mono/axial	350 / 200 / 800	180	See drawing	LVLF6-M4	1 x 1.0 (T) 1 x 1.0 (R) PMMA	Polyethylene (PE)	-40 … +70 °C	25	2 m Cutable	M4 Stainless steel	–

Part number	Article number
K2L-202	721-50772

Fibre-optic cables – standard

K2L-7 fibre-optic cable





153-00276

Highlights

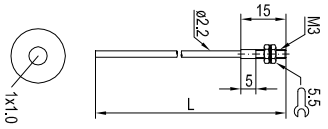
- Through-beam photoelectric sensor
- Small installation dimensions
- Suitable for ancillary optics for range expansion
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Mono/axial	350 / 220 / 810	180	See drawing	LVLF6-M3	1 x 1.0 (T) 1 x 1.0 (R) PMMA	Polyethylene (PE)	-40 … +70 °C	25	2 m Cutable	M3 Brass, nickel-plated	–

Part number	Article number
K2L-7	840-11000

K2L-77 fibre-optic cable





153-00277

Highlights

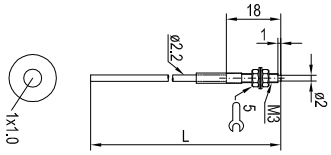
- Through-beam photoelectric sensor
- Oil-resistant
- Expanded temperature range
- Suitable for ancillary optics for range expansion
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Mono/axial	270 / 145 / 550	140	See drawing	LVLF6-M3	1 x 1.0 (T) 1 x 1.0 (R) PC	Polyamid (PA)	-40 … +85 °C	25	2 m Cutable	M3 Brass, nickel-plated	–

Part number	Article number
K2L-77	840-11001

LLK2LM3-PE-1m fibre-optic cable





153-00454

Highlights

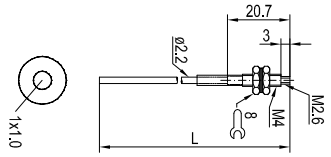
- Through-beam photoelectric sensor
- Stainless steel head with very small head diameter
- Suitable for ancillary optics for range expansion
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Mono/axial	150 / 60 / 240	80	See drawing	LVLF6-M3	1 x 1.0 (T) 1 x 1.0 (R) PMMA	Polyethylene (PE)	-40 … +60 °C	25	1 m Cutable	M3 Stainless steel	–

Part number	Article number
LLK2LM3-PE-1m	750-11000

LLK2LM4-PE-1m fibre-optic cable





153-00455

Highlights

- Through-beam photoelectric sensor
- Suitable for ancillary optics for range expansion
- Fibre length individually cutable
- For FL 70/FL 20 devices

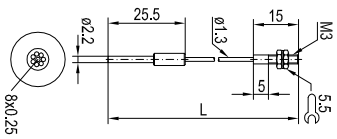
Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Mono/axial	400 / 240 / 780	200	See drawing	LVLF6-M4	1 x 1.0 (T) 1 x 1.0 (R) PMMA	Polyethylene (PE)	-40 … +60 °C	25	1 m Cutable	M4 Stainless steel	–

Part number	Article number
LLK2LM4-PE-1m	750-11001

Fibre-optic cables – standard

K1L-78 fibre-optic cable





153-00278

Highlights

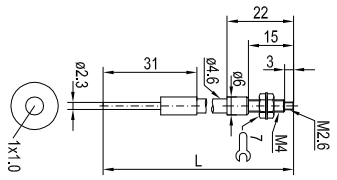
- Through-beam photoelectric sensor
- Very small bending radius
- Suitable for ancillary optics for range expansion
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Axial	200 / 120 / 405	100	See drawing	LVLF6-M3	8 x 0.25 (T) 8 x 0.25 (R) PMMA	Polyethylene (PE)	-40 … +70 °C	3	2 m Cutable	M3 Brass, nickel-plated	–

Part number	Article number
K1L-78	840-11002

33 L 1/…-MSC fibre-optic cable





153-00089

Highlights

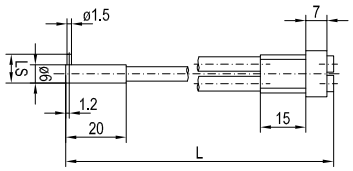
- Through-beam photoelectric sensor
- Metal sheath
- Robust design
- -20 … +160 °C
- Suitable for ancillary optics for range expansion
- Fixing via mounting block MB 6 (Article number 903-05139)
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Mono/axial	270 / 165 / 550	140	See drawing	LVLF6-M4	1 x 1.0 (T) 1 x 1.0 (R) Glass	Brass, chrome-plated (MSC)	-20 … +160 °C	15	See Selection Table	M4 Brass, nickel-plated	–

Length (m)	Part number	Article number
0.25	33 L1/250-MSC	978-51650
0.5	33 L1/500-MSC	978-51444
1	33 L1/1000-MSC	978-51657
2	33 L1/2000-MSC	978-51682

18/30 LZ 1/…-Si fibre-optic cable

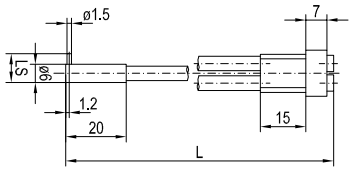




153-00149

18/30 LZ 1/…-MSC fibre-optic cable





153-00149

Highlights

- Through-beam photoelectric sensor
- Silicone or metal sheath
- Radial light exit
- Robust design
- -20 … +160 °C
- Fixing via mounting block MB 6 (Article number 903-05139)
- For FMS/FAV devices

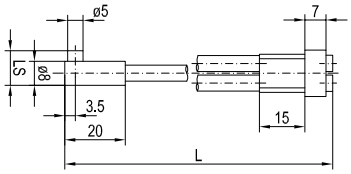
Fibre arrangement Light exit	FMS 18 typ. scanning distance/range (mm)	FMS 30 typ. scanning distance/range (mm)	Core fibre Ø (mm) (T=Transmitter; R=Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing Ø (mm)	LS (mm)
Radial	80	100	1 x 1.0 (T) / 1 x 1.0 (R) Glass	See Selection Table	-20 … +160 °C	15	See Selection Table	6	See Selection Table

LS (mm)	Length (m)	Sheath material	Part number	Article number
10	0.25	Silicone (Si)	18/30 LZ 1/250-Si	978-06366
14	0.25	Silicone (Si)	18/30 LZ 1/250-Si	978-06367
10	0.5	Silicone (Si)	18/30 LZ 1/500-Si	978-06372
14	0.5	Silicone (Si)	18/30 LZ 1/500-Si	978-06373
10	0.75	Silicone (Si)	18/30 LZ 1/750-Si	978-06378
14	0.75	Silicone (Si)	18/30 LZ 1/750-Si	978-06379
10	1	Silicone (Si)	18/30 LZ 1/1000-Si	978-06384
14	1	Silicone (Si)	18/30 LZ 1/1000-Si	978-06385
10	1.5	Silicone (Si)	18/30 LZ 1/1500-Si	978-06390
14	1.5	Silicone (Si)	18/30 LZ 1/1500-Si	978-06391
10	2	Silicone (Si)	18/30 LZ 1/2000-Si	978-06396
14	2	Silicone (Si)	18/30 LZ 1/2000-Si	978-06397
10	0.25	Brass. chrome-plated (MSC)	18/30 LZ 1/250-MSC	978-06364
14	0.25	Brass. chrome-plated (MSC)	18/30 LZ 1/250-MSC	978-06365
10	0.5	Brass. chrome-plated (MSC)	18/30 LZ 1/500-MSC	978-06370
14	0.5	Brass. chrome-plated (MSC)	18/30 LZ 1/500-MSC	978-06371
10	0.75	Brass. chrome-plated (MSC)	18/30 LZ 1/750-MSC	978-06376
14	0.75	Brass. chrome-plated (MSC)	18/30 LZ 1/750-MSC	978-06377
10	1	Brass. chrome-plated (MSC)	18/30 LZ 1/1000-MSC	978-06382
14	1	Brass. chrome-plated (MSC)	18/30 LZ 1/1000-MSC	978-06383
10	1.5	Brass. chrome-plated (MSC)	18/30 LZ 1/1500-MSC	978-06388
14	1.5	Brass. chrome-plated (MSC)	18/30 LZ 1/1500-MSC	978-06389
10	2	Brass. chrome-plated (MSC)	18/30 LZ 1/2000-MSC	978-06394
14	2	Brass. chrome-plated (MSC)	18/30 LZ 1/2000-MSC	978-06395

Fibre-optic cables – standard

18/30 LZ 2/…-Si fibre-optic cable

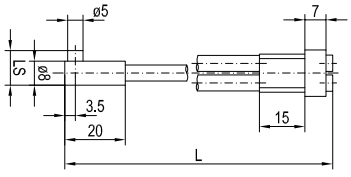




153-00156

18/30 LZ 2/…-MSC fibre-optic cable

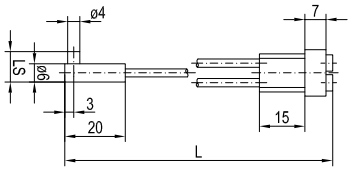




153-00156

18/30 LZ 2/…-PVC fibre-optic cable





153-00136

Highlights

- Through-beam photoelectric sensor
- Silicone, metal or PVC sheath
- Radial light exit
- Robust design
- -20 … +80°C / +160 °C
- Fixing via mounting block MB 8 (MSC/Si) (Article number 903-05141)
- Fixing via mounting block MB 6 (PVC) (Article number 903-05139)
- For FMS/FAV devices

Fibre arrangement Light exit	FMS 18 typ. scanning distance/range (mm)	FMS 30 typ. scanning distance/range (mm)	Core fibre Ø (mm) (T=Transmitter; R=Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing Ø (mm)	LS (mm)
Radial	360	400	1 x 1.6 (T) / 1 x 1.6 (R) (Si/MSC) 1 x 1.5 (T) / 1 x 1.5 (R) (PVC) Glass	See Selection Table	-20 … +160 °C (Si/MSC) -20 … +80 °C (PVC)	20 = (Si/MSC) 15 = (PVC)	See Selection Table	8 = (Si/MSC) 6 = (PVC)	See Selection Table

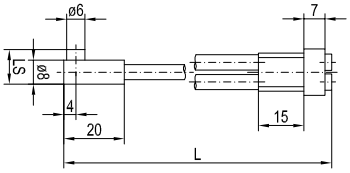
LS (mm)	Length (m)	Sheath material	Part number	Article number
10	0.25	Silicone (Si)	18/30 LZ 2/250-Si	978-06402
14	0.25	Silicone (Si)	18/30 LZ 2/250-Si	978-06403
10	0.5	Silicone (Si)	18/30 LZ 2/500-Si	978-06408
14	0.5	Silicone (Si)	18/30 LZ 2/500-Si	978-06409
10	0.75	Silicone (Si)	18/30 LZ 2/750-Si	978-06414
14	0.75	Silicone (Si)	18/30 LZ 2/750-Si	978-06415
10	1	Silicone (Si)	18/30 LZ 2/1000-Si	978-06420
14	1	Silicone (Si)	18/30 LZ 2/1000-Si	978-06421
10	1.5	Silicone (Si)	18/30 LZ 2/1500-Si	978-06426
14	1.5	Silicone (Si)	18/30 LZ 2/1500-Si	978-06427
10	2	Silicone (Si)	18/30 LZ 2/2000-Si	978-06432
14	2	Silicone (Si)	18/30 LZ 2/2000-Si	978-06433

LS (mm)	Length (m)	Sheath material	Part number	Article number
10	0.25	Brass, chrome-plated (MSC)	18/30 LZ 2/250-MSC	978-06400
14	0.25	Brass, chrome-plated (MSC)	18/30 LZ 2/250-MSC	978-06401
10	0.5	Brass, chrome-plated (MSC)	18/30 LZ 2/500-MSC	978-06406
14	0.5	Brass, chrome-plated (MSC)	18/30 LZ 2/500-MSC	978-06407
10	0.75	Brass, chrome-plated (MSC)	18/30 LZ 2/750-MSC	978-06412
14	0.75	Brass, chrome-plated (MSC)	18/30 LZ 2/750-MSC	978-06413
10	1	Brass, chrome-plated (MSC)	18/30 LZ 2/1000-MSC	978-06418
14	1	Brass, chrome-plated (MSC)	18/30 LZ 2/1000-MSC	978-06419
10	1.5	Brass, chrome-plated (MSC)	18/30 LZ 2/1500-MSC	978-06424
14	1.5	Brass, chrome-plated (MSC)	18/30 LZ 2/1500-MSC	978-06425
10	2	Brass, chrome-plated (MSC)	18/30 LZ 2/2000-MSC	978-06430
14	2	Brass, chrome-plated (MSC)	18/30 LZ 2/2000-MSC	978-06431
10	0.25	PVC	18/30 LZ 2/250-PVC	978-06398
14	0.25	PVC	18/30 LZ 2/250-PVC	978-06399
10	0.5	PVC	18/30 LZ 2/500-PVC	978-06404
14	0.5	PVC	18/30 LZ 2/500-PVC	978-06405
10	0.75	PVC	18/30 LZ 2/750-PVC	978-06410
14	0.75	PVC	18/30 LZ 2/750-PVC	978-06411
10	1	PVC	18/30 LZ 2/1000-PVC	978-06416
14	1	PVC	18/30 LZ 2/1000-PVC	978-06417
10	1.5	PVC	18/30 LZ 2/1500-PVC	978-06422
14	1.5	PVC	18/30 LZ 2/1500-PVC	978-06423
10	2	PVC	18/30 LZ 2/2000-PVC	978-06428
14	2	PVC	18/30 LZ 2/2000-PVC	978-06429

Fibre-optic cables – standard

18/30 LZ 3/…-Si fibre-optic cable

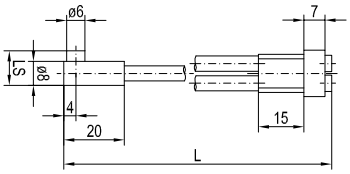




153-00158

18/30 LZ 3/…-MSC fibre-optic cable

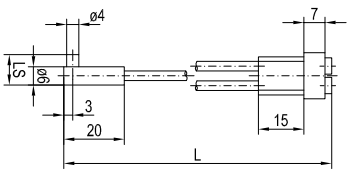




153-00158

18/30 LZ 3/…-PVC fibre-optic cable





153-00140

Highlights

- Through-beam photoelectric sensor
- Silicone, metal or PVC sheath
- Radial light exit
- Robust design
- -20 … +80°C / +160 °C
- Fixing via mounting block MB 8 (Si/MSC) (Article number 903-05141)
- Fixing via mounting block MB 6 (PVC) (Article number 903-05139)
- For FMS/FAV devices

Fibre arrangement Light exit	FMS 18 typ. scanning distance/range (mm)	FMS 30 typ. scanning distance/range (mm)	Core fibre Ø (mm) (T=Transmitter; R=Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing Ø (mm)	LS (mm)
Radial	700	1000	1 x 2.0 (T) / 1 x 2.0 (R) Glass	See Selection Table	-20 … +160 °C (Si/MSC) -20 … +80 °C (PVC)	20	See Selection Table	8 = (Si/MSC) 6 = (PVC)	See Selection Table

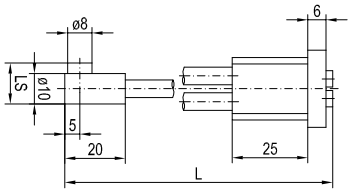
LS (mm)	Length (m)	Sheath material	Part number	Article number
10	0.25	Silicone (Si)	18/30 LZ 3/250-Si	978-06438
14	0.25	Silicone (Si)	18/30 LZ 3/250-Si	978-06439
10	0.5	Silicone (Si)	18/30 LZ 3/500-Si	978-06444
14	0.5	Silicone (Si)	18/30 LZ 3/500-Si	978-06445
10	0.75	Silicone (Si)	18/30 LZ 3/750-Si	978-06450
14	0.75	Silicone (Si)	18/30 LZ 3/750-Si	978-06451
10	1	Silicone (Si)	18/30 LZ 3/1000-Si	978-06456
14	1	Silicone (Si)	18/30 LZ 3/1000-Si	978-06457
10	1.5	Silicone (Si)	18/30 LZ 3/1500-Si	978-06462
14	1.5	Silicone (Si)	18/30 LZ 3/1500-Si	978-06463
10	2	Silicone (Si)	18/30 LZ 3/2000-Si	978-06468
14	2	Silicone (Si)	18/30 LZ 3/2000-Si	978-06469

LS (mm)	Length (m)	Sheath material	Part number	Article number
10	0.25	Brass, chrome-plated (MSC)	18/30 LZ 3/250-MSC	978-06436
14	0.25	Brass, chrome-plated (MSC)	18/30 LZ 3/250-MSC	978-06437
10	0.5	Brass, chrome-plated (MSC)	18/30 LZ 3/500-MSC	978-06442
14	0.5	Brass, chrome-plated (MSC)	18/30 LZ 3/500-MSC	978-06443
10	0.75	Brass, chrome-plated (MSC)	18/30 LZ 3/750-MSC	978-06448
14	0.75	Brass, chrome-plated (MSC)	18/30 LZ 3/750-MSC	978-06449
10	1	Brass, chrome-plated (MSC)	18/30 LZ 3/1000-MSC	978-06454
14	1	Brass, chrome-plated (MSC)	18/30 LZ 3/1000-MSC	978-06455
10	1.5	Brass, chrome-plated (MSC)	18/30 LZ 3/1500-MSC	978-06460
14	1.5	Brass, chrome-plated (MSC)	18/30 LZ 3/1500-MSC	978-06461
10	2	Brass, chrome-plated (MSC)	18/30 LZ 3/2000-MSC	978-06466
14	2	Brass, chrome-plated (MSC)	18/30 LZ 3/2000-MSC	978-06467
10	0.25	PVC	18/30 LZ 3/250-PVC	978-06434
14	0.25	PVC	18/30 LZ 3/250-PVC	978-06435
10	0.5	PVC	18/30 LZ 3/500-PVC	978-06440
14	0.5	PVC	18/30 LZ 3/500-PVC	978-06441
10	0.75	PVC	18/30 LZ 3/750-PVC	978-06446
14	0.75	PVC	18/30 LZ 3/750-PVC	978-06447
10	1	PVC	18/30 LZ 3/1000-PVC	978-06452
14	1	PVC	18/30 LZ 3/1000-PVC	978-06453
10	1.5	PVC	18/30 LZ 3/1500-PVC	978-06458
14	1.5	PVC	18/30 LZ 3/1500-PVC	978-06459
10	2	PVC	18/30 LZ 3/2000-PVC	978-06464
14	2	PVC	18/30 LZ 3/2000-PVC	978-06465

Fibre-optic cables – standard

30 LZ 4/…-Si fibre-optic cable

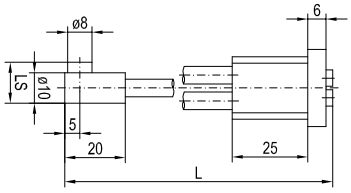




153-00164

30 LZ 4/…-MSC fibre-optic cable





153-00164

Highlights

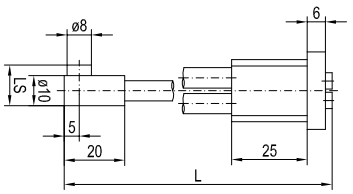
- Through-beam photoelectric sensor
- Silicone or metal sheath
- Radial light exit
- Long range
- Robust design
- -20 … +160 °C
- Fixing via mounting block MB 10 (Article number 903-05142)
- For FMS/FAV devices

Fibre arrangement Light exit	FMS 18 typ. scanning distance/range (mm)	FMS 30 typ. scanning distance/range (mm)	Core fibre Ø (mm) (T=Transmitter; R=Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing Ø (mm)	LS (mm)
Radial	–	3000	1 x 2.3 (T) / 1 x 2.3 (R) Glass	See Selection Table	-20 … +160 °C	25	See Selection Table	10	See Selection Table

LS (mm)	Length (m)	Sheath material	Part number	Article number
16	0.25	Silicone (Si)	30 LZ 4/250-Si	978-06472
20	0.25	Silicone (Si)	30 LZ 4/250-Si	978-06473
16	0.5	Silicone (Si)	30 LZ 4/500-Si	978-06476
20	0.5	Silicone (Si)	30 LZ 4/500-Si	978-06477
16	0.75	Silicone (Si)	30 LZ 4/750-Si	978-06481
20	0.75	Silicone (Si)	30 LZ 4/750-Si	978-06482
16	1	Silicone (Si)	30 LZ 4/1000-Si	978-06485
20	1	Silicone (Si)	30 LZ 4/1000-Si	978-06486
16	1.5	Silicone (Si)	30 LZ 4/1500-Si	978-06489
20	1.5	Silicone (Si)	30 LZ 4/1500-Si	978-06490
16	2	Silicone (Si)	30 LZ 4/2000-Si	978-06493
20	2	Silicone (Si)	30 LZ 4/2000-Si	978-06494
16	0.25	Brass. chrome-plated (MSC)	30 LZ 4/250-MSC	978-06470
20	0.25	Brass. chrome-plated (MSC)	30 LZ 4/250-MSC	978-06471
16	0.5	Brass. chrome-plated (MSC)	30 LZ 4/500-MSC	978-06474
20	0.5	Brass. chrome-plated (MSC)	30 LZ 4/500-MSC	978-06475
16	0.75	Brass. chrome-plated (MSC)	30 LZ 4/750-MSC	978-06478
20	0.75	Brass. chrome-plated (MSC)	30 LZ 4/750-MSC	978-06480
16	1	Brass. chrome-plated (MSC)	30 LZ 4/1000-MSC	978-06483
20	1	Brass. chrome-plated (MSC)	30 LZ 4/1000-MSC	978-06484
16	1.5	Brass. chrome-plated (MSC)	30 LZ 4/1500-MSC	978-06487
20	1.5	Brass. chrome-plated (MSC)	30 LZ 4/1500-MSC	978-06488
16	2	Brass. chrome-plated (MSC)	30 LZ 4/2000-MSC	978-06491
20	2	Brass. chrome-plated (MSC)	30 LZ 4/2000-MSC	978-06492

30 LZ 12/…-Si fibre-optic cable

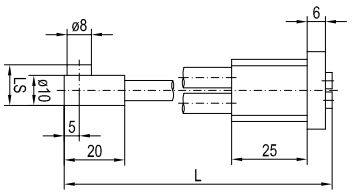




153-00166

30 LZ 12/…-MSC fibre-optic cable





153-00166

Highlights

- Through-beam photoelectric sensor
- Silicone or metal sheath
- Radial light exit
- Extremely insensitive to contamination
- Robust design
- -20 … +160 °C
- Fixing via mounting block MB 10 (Article number 903-05142)
- For FMS/FAV devices

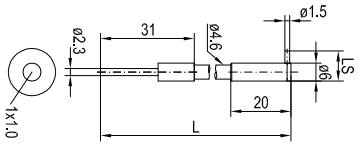
Fibre arrangement Light exit	FMS 18 typ. scanning distance/range (mm)	FMS 30 typ. scanning distance/range (mm)	Core fibre Ø (mm) (T=Transmitter; R=Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing Ø (mm)	LS (mm)
Radial	–	4800	1 x 3.5 (T) / 1 x 3.5 (R) Glass	See Selection Table	-20 … +160 °C	25	See Selection Table	10	See Selection Table

LS (mm)	Length (m)	Sheath material	Part number	Article number
16	0.25	Silicone (Si)	30 LZ 12/250-Si	978-06529
20	0.25	Silicone (Si)	30 LZ 12/250-Si	978-06530
16	0.5	Silicone (Si)	30 LZ 12/500-Si	978-06533
20	0.5	Silicone (Si)	30 LZ 12/500-Si	978-06534
16	0.75	Silicone (Si)	30 LZ 12/750-Si	978-06537
20	0.75	Silicone (Si)	30 LZ 12/750-Si	978-06538
16	1	Silicone (Si)	30 LZ 12/1000-Si	978-06541
20	1	Silicone (Si)	30 LZ 12/1000-Si	978-06542
16	1.5	Silicone (Si)	30 LZ 12/1500-Si	978-06545
20	1.5	Silicone (Si)	30 LZ 12/1500-Si	978-06546
16	2	Silicone (Si)	30 LZ 12/2000-Si	978-06549
20	2	Silicone (Si)	30 LZ 12/2000-Si	978-06550
16	0.25	Brass. chrome-plated (MSC)	30 LZ 12/250-MSC	978-06527
20	0.25	Brass. chrome-plated (MSC)	30 LZ 12/250-MSC	978-06528
16	0.5	Brass. chrome-plated (MSC)	30 LZ 12/500-MSC	978-06531
20	0.5	Brass. chrome-plated (MSC)	30 LZ 12/500-MSC	978-06532
16	0.75	Brass. chrome-plated (MSC)	30 LZ 12/750-MSC	978-06535
20	0.75	Brass. chrome-plated (MSC)	30 LZ 12/750-MSC	978-06536
16	1	Brass. chrome-plated (MSC)	30 LZ 12/1000-MSC	978-06539
20	1	Brass. chrome-plated (MSC)	30 LZ 12/1000-MSC	978-06540
16	1.5	Brass. chrome-plated (MSC)	30 LZ 12/1500-MSC	978-06543
20	1.5	Brass. chrome-plated (MSC)	30 LZ 12/1500-MSC	978-06544
16	2	Brass. chrome-plated (MSC)	30 LZ 12/2000-MSC	978-06547
20	2	Brass. chrome-plated (MSC)	30 LZ 12/2000-MSC	978-06548

Fibre-optic cables – standard

33 LZ 1/…-Si fibre-optic cable

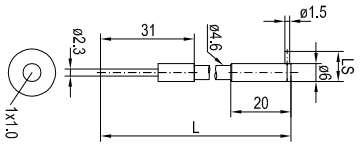




153-01033

33 LZ 1/…-MSC fibre-optic cable





153-01033

Highlights

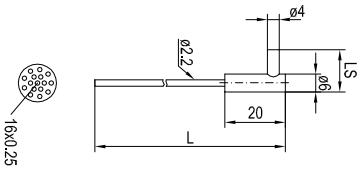
- Through-beam photoelectric sensor
- Silicone or metal sheath
- Robust design
- -20 … +160 °C
- Fixing via mounting block MB 6 (Article number 903-05139)
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing Ø (mm)	LS (mm)
Axial	270 / 165 / 550	140	See drawing	LVLF6-M4	1 × 1.0 (T) 1 × 1.0 (R) Glass	See Selection Table	-20 … +160 °C	15	See Selection Table	6	10

Cable length	Sheath material	Part number	Article number
Up to 2 m	Silicone (Si)	33 LZ 1/...-Si	978-51581
Up to 2 m	Brass, chrome-plated (MSC)	33 LZ 1/...-MSC	978-51580

LLK2LZ fibre-optic cable





153-00604

Highlights

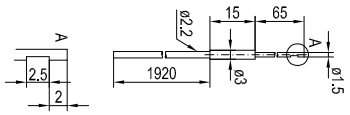
- Through-beam photoelectric sensor
- Lateral light exit
- Robust design
- Fixing via mounting block MB 6 (Article number 903-05139)
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing Ø (mm)	LS (mm)
Radial	300 / 150 / 600	150	See drawing	–	16 x 0.25 (T) 16 x 0.25 (R) PMMA	Polyethylene (PE)	-40 … +70 °C	15	2 m Cutable	8 Aluminium	10

Part number	Article number
LLK2LZ	950-50007

K2L-34 fibre-optic cable





153-00279

Highlights

- Through-beam photoelectric sensor
- Lateral light exit
- Bendable stainless steel tip
- Particularly suitable for restricted spaces
- Fibre length individually cutable
- For FL 70/FL 20 devices

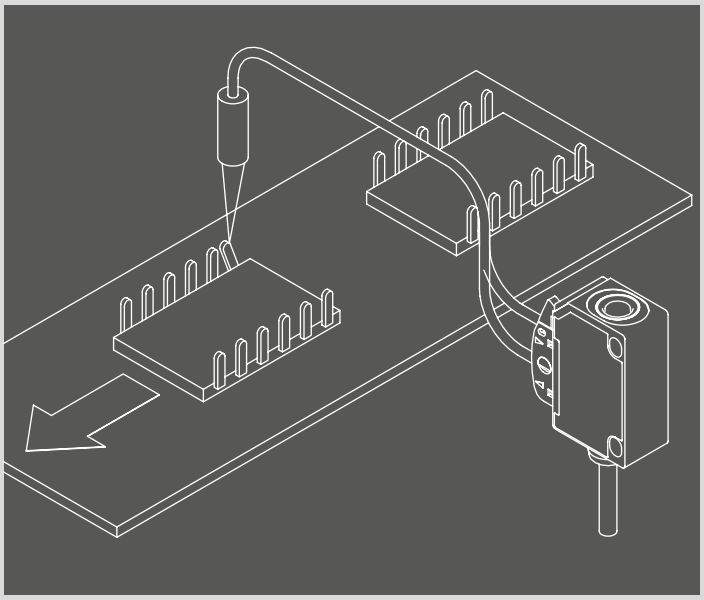
Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Bendable mono / radial tip	100 / 35 / 150	150	–	–	1 x 1.0 (T) 1 x 1.0 (R) PMMA	Polyethylene (PE)	-40 … +70 °C	15	2 m Cutable	Ø 1.5 mm Stainless steel	–

Part number	Article number
K2L-34	950-50002

Fibre-optic cables – focused optics

The ideal solution for small-part detection



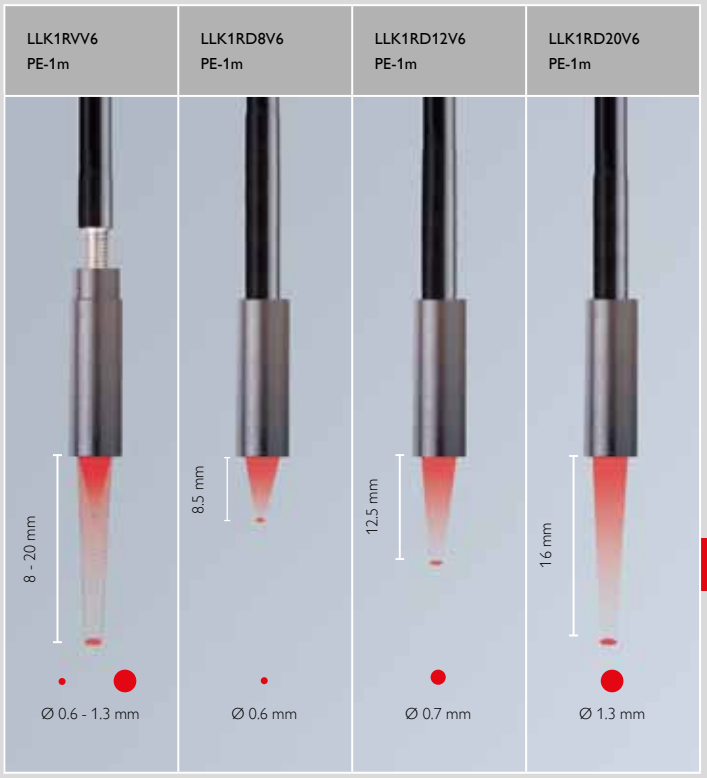


Detection of IC pins
Even the smallest of objects, such as IC pins in electronics production, are reliably detected thanks to focused optics and a small light spot diameter.

TYPICAL SENSOPART FIBRE-OPTIC CABLES

- Flexible plastic fibre-optic cables
- Coaxial fibres for precise object detection
- Adjustable scanning distances and light spot sizes

Coaxial fibre-optic cables are available with special ancillary optics for differing fixed or variable focus distances, especially for the detection of small objects. Light spot sizes of from 1.3 mm to 0.65 mm can be achieved with focusable coaxial fibre-optic cables. Special cable variants are also available for hole detection.



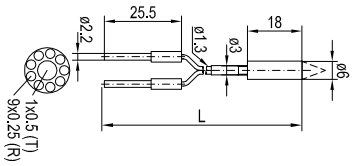
Focused light spot:
The three LLK1RDxV6 fixed focus variants with fixed focal distances (8/12/20 mm) offer maximum precision for small-part detection. The focus of the Varifocus LLK1RVV6 fibre-optic cable can be manually adjusted within a range of from 8 to 20 mm.

Fibre-optic cables – with focused optics

Fibre-optic cable	Proximity sensor (T) Photoelectric sensor (L)	Typical scanning distance/range	Light exit	Special features	For fibre-optic sensors
LLK1RD8V6-PE-1m	T	8 mm	Axial	• 8 mm operating distance • Very good small-part detection • Small light spot	FL 70 / FL 20
LLK1RD12V6-PE-1m	T	12 mm	Axial	• 12 mm operating distance • Very good small-part detection • Small light spot	FL 70 / FL 20
LLK1RD20V6-PE-1m	T	16 mm	Axial	• 16 mm operating distance • Very good small-part detection • Small light spot	FL 70 / FL 20
LLK1RVV6-PE-1m	T	8 … 20 mm	Axial	• Very good small-part detection • Scanning distance and light spot size , adjustable from 8 to 20 mm	FL 70 / FL 20
LLK2LV6-PE-1m	L	> 2000 mm	Axial	• Very long range	FL 70 / FL 20

LLK1RD8V6 PE-1m fibre-optic cable





153-00362

Highlights

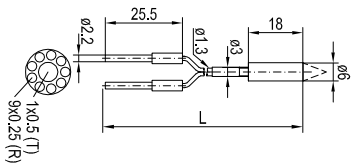
- Photoelectric proximity sensor
- Focused light spot at distance of 8.5 mm
- For small-part detection
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing / ancillary optics	LS (mm)
Coaxial, focused 8 mm, spot Ø 0.6 mm	8 / 8 / 8	–	See drawing	–	9 × 0.25 (R) 1 × 0.5 (T) PMMA	Polyethylene (PE)	-40 … +60 °C	15	1 m Cutable	Ø 6 mm Aluminium	–

Part number	Article number
LLK1RD8V6 PE-1m	951-50009

LLK1RD12V6 PE-1m fibre-optic cable





153-00362

Highlights

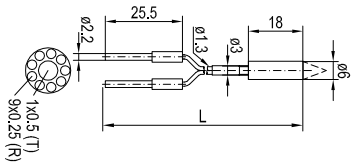
- Photoelectric proximity sensor
- Focused light spot at distance of 12.5 mm
- For small-part detection
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing / ancillary optics	LS (mm)
Coaxial, focused 12 mm, spot Ø 0.7 mm	12 / 12 / 12	–	See drawing	–	9 x 0.25 (R) 1 x 0.5 (T) PMMA	Polyethylene (PE)	-40 … +60 °C	15	1 m Cutable	Ø 6 mm Aluminium	–

Part number	Article number
LLK1RD12V6 PE-1m	951-50010

LLK1RD20V6 PE-1m fibre-optic cable





153-00362

Highlights

- Photoelectric proximity sensor
- Focused light spot at distance of 16 mm
- For small-part detection
- Fibre length individually cutable
- For FL 70/FL 20 devices

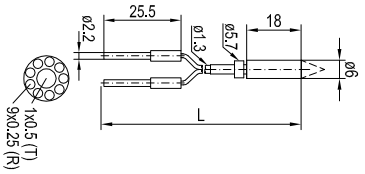
Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing / ancillary optics	LS (mm)
Coaxial, focused 16 mm, spot Ø 1.3 mm	16 / 16 / 16	–	See drawing	–	9 x 0.25 (R) 1 x 0.5 (T) PMMA	Polyethylene (PE)	-40 … +60 °C	15	1 m Cutable	Ø 6 mm Aluminium	–

Part number	Article number
LLK1RD20V6 PE-1m	951-50011

Fibre-optic cables – with focused optics

LLK1RVV6-PE-1m fibre-optic cable





153-00361

Highlights

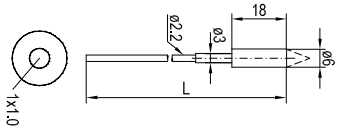
- Photoelectric proximity sensor
- Focal distance of light spot adjustable between 8 – 20 mm
- For small-part detection
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing / ancillary optics	LS (mm)
Coaxial, variable focus 8-20 mm, spot Ø 0.6-1.3 mm	8-20 / 8-20 / 8-20	–	See drawing	–	9 x 0.25 (T) 1 x 0.5 (R) PMMA	Polyethylene (PE)	-40 … +60 °C	15	1 m Cutable	Ø 6 mm Aluminium	–

Part number	Article number
LLK1RVV6-PE-1m	951-50008

LLK2LV6-PE-1m fibre-optic cable





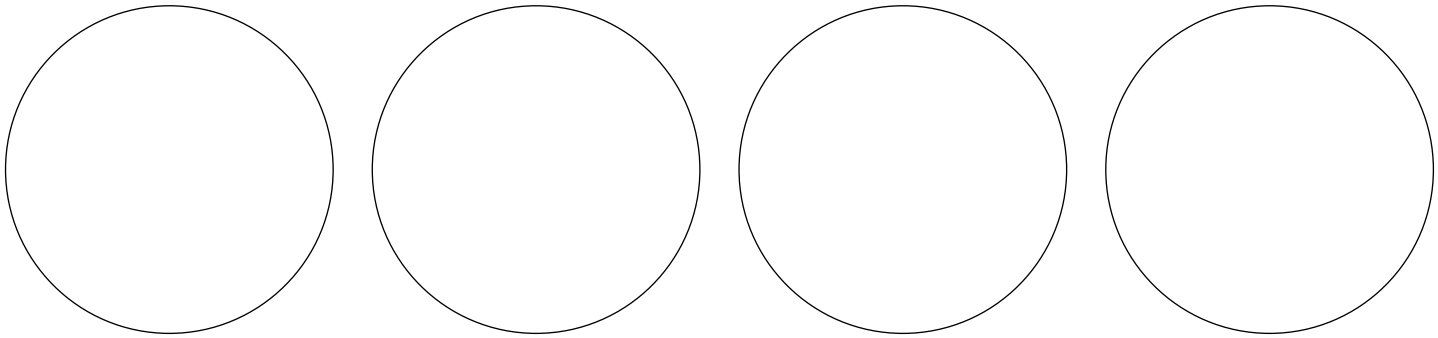
153-00456

Highlights

- Through-beam photoelectric sensor
- Expanded range due to ancillary lens
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing / ancillary optics	LS (mm)
Axial, collimation optics	> 2000 / > 2000 / > 2000	1000	See drawing	–	1 x 1.0 (T) 1 x 1.0 (R) PMMA	Polyethylene (PE)	-40 … +60 °C	25	1 m Cutable	Ø 6 mm Aluminium	–

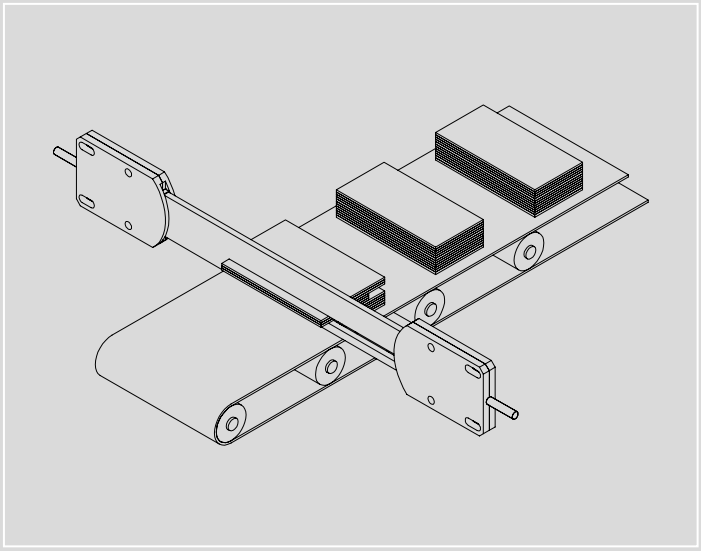
Part number	Article number
LLK2LV6-PE-1m	950-50006



Fibre-optic cables – light strips

For edge control and area detection





Monitoring stack height
When an object enters the detection area of the LLK2SLR fibre-optic cable, the connected FL 70 RA sensor receives a weakened light signal. The transmitted analogue value is proportional to the light signal and thus allows monitoring of the stack height.

TYPICAL SENSOPART FIBRE-OPTIC CABLES

- Long ranges
- Several light strip widths available
- Special designs for harsh operating conditions



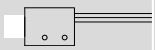
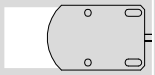
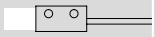
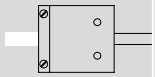
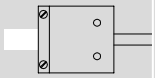
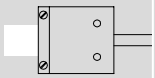
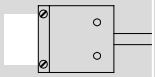
Cross-section converter
While the light exit of standard glass fibres is round, cross-section converters have a light exit that is designed as a rectangle or a thin line, for example.

A light strip can be of advantage for particular applications, e.g. for edge control during the production of foils, paper, sheet metals or textiles, or for measuring thickness and position. For such cases, fibre-optic cables are used with a special light exit sleeve – a so-called cross-section converter that generates a wide rectangular light strip. SensoPart offers light strips in a variety of designs and materials.

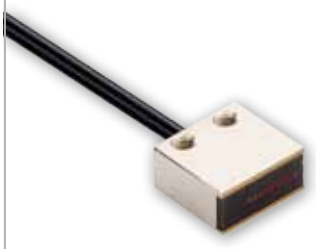
LLK2SLR fibre-optic cables combined with the FL 70 RA fibre-optic sensor are of particular importance. This system allows determination of the size of objects in the optical path.

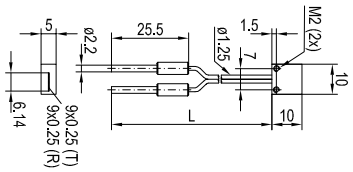
LLK2SLR fibre-optic cables spread a light strip in through-beam photoelectric sensor operation. When an object enters the optical path, the information is passed on to the FL 70 RA fibre-optic sensor which provides an absolute value via its analogue output. This allows, for example, the monitoring of stack heights, the sorting of small parts, the measurement of thicknesses and much more besides.

Fibre-optic cables – light strips

Fibre-optic cable	Proximity sensor (T) Photoelectric sensor (L)	Typical range	Light exit	Special features	For fibre-optic sensors
LLK1QRR10x10-PE-2m 	T	Up to 15 mm	Axial	• Small design for restricted spaces • Precise switching behaviour on lateral approach	FL 70 / FL 20
LLK2QRR19x25-PE-2m 	T	Up to 15 mm	Axial	• Precise switching behaviour on lateral approach	FL 70 / FL 20
LLK2SLR10-PE-2m 	L	Up to 2000 mm	Axial	• Small-part detection to 0.5 mm • Wide detection area • Long range	FL 70 / FL 20
K2Q-12 	L	Up to 550 mm	Axial	• Small design for restricted spaces	FL 70 / FL 20
30 QL 0,2x10/…-Si 	L	Up to 500 mm	Axial	• 10 mm light strip width • Robust design	FMS 18 / FMS 30 / FAV 30
30 QL 0,2x20/…-Si 	L	Up to 500 mm	Axial	• 20 mm light strip width • Robust design	FMS 18 / FMS 30 / FAV 30
30 QL 0,2x30/…-Si 	L	Up to 500 mm	Axial	• 30 mm light strip width • Robust design	FMS 18 / FMS 30 / FAV 30
30 QL 0,2x40/…-Si 	L	Up to 500 mm	Axial	• 40 mm light strip width • Long range • Robust design	FMS 18 / FMS 30 / FAV 30

LLK1QRR10x10-PE-2m fibre-optic cable





153-00609

Highlights

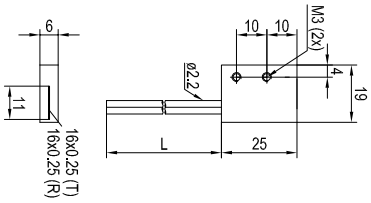
- Photoelectric proximity sensor
- For area monitoring or position detection
- Precise switching behaviour on lateral approach
- Elongated light exit (0.25 x 6.14 mm²)
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing / head	LS (mm)
Cross-section converter line	1-15 / 1-15 / 1-15	1-15	See drawing	–	9 x 0.25 (T) 9 x 0.25 (R) PMMA	Polyethylene (PE)	-40 … +70 °C	25	2 m Cutable	10 x 10 x 5 mm M2 Brass, nickel-plated	–

Part number	Article number
LLK1QRR10x10-PE-2m	750-11003

LLK2QRR19x25-PE-2m fibre-optic cable





153-00610

Highlights

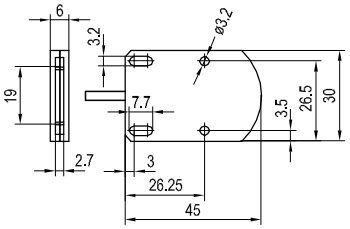
- Photoelectric proximity sensor
- For area monitoring or position detection
- Precise switching behaviour on lateral approach
- Elongated light exit (0.25 x 11 mm²)
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing / head	LS (mm)
Cross-section converter line	1-15 / 1-15 / 1-15	1-15	See drawing	–	16 x 0.25 (T) 16 x 0.25 (R) PMMA	Polyethylene (PE)	-40 … +70 °C	25	2 m Cutable	19 x 25 x 6 mm M3 Brass, nickel-plated	–

Part number	Article number
LLK2QRR19x25-PE-2m	750-11004

LLK2SLR10-PE-2m fibre-optic cable





153-00755

Highlights

- Through-beam photoelectric sensor
- Wide detection range (15 mm)
- Small-part detection to 0.5 mm
- Flexible mounting possibilities
- For measuring thickness and position
- Long range
- High-quality glass optics
- Parallel beam guidance
- Robust metal housing
- For FL 70/FL 20 devices

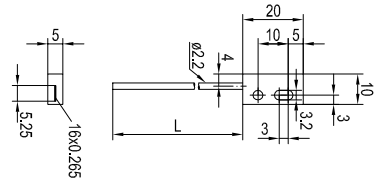
Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing / head	LS (mm)
Axial	600-1500 / 0-600 / 1300-2000	1-15	–	–	1 x 0.25 PMMA Glass optics	Polyethylene (PE)	-20 … +60 °C	25	2 m Cutable	See drawing	–

Part number	Article number
LLK2SLR10-PE-2m	952-50001

Fibre-optic cables – light strips

K2Q-12 fibre-optic cable





153-00275

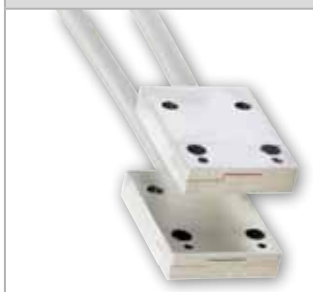
Highlights

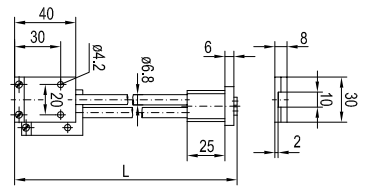
- Through-beam photoelectric sensor
- Light strip for position detection or area monitoring
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing / head	LS (mm)
Cross-section converter	250 / 155 / 550	130	See drawing	–	16 x 0.265 (T) 16 x 0.265 (R) PMMA	Polyethylene (PE)	-40 … +70 °C	15	2 m Cutable	20 x 10 mm Brass, nickel-plated	–

Part number	Article number
K2Q-12	952-50000

30 QL 0,2x10/…-Si fibre-optic cable





153-00176

Highlights

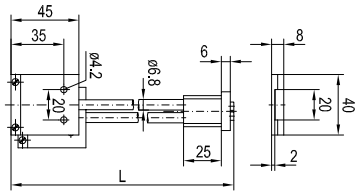
- Through-beam photoelectric sensor
- Cross-section converter
- 10 mm light exit
- Robust design with silicone sheath
- -20 … +160 °C
- For FMS/FAV devices

Fibre arrangement Light exit	FAV 30 Distance: transmit-ter – receiver (mm)	Operating range (mm)	Core fibre Ø (mm) (T=Transmitter; R=Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing / head	LS (mm)
Cross-section converter	50 - 80	6	0.2 x 10 (T) / 0.2 x 10 (R) Glass	Silicone (Si)	-20 … +160 °C	25	See Selection Table	See drawing	–

Length (m)	Part number	Article number
0.5	30 QL 0,2x10/500-Si	974-09621
1	30 QL 0,2x10/1000-Si	974-09617

30 QL 0,2x20/…-Si fibre-optic cable





153-00177

Highlights

- Through-beam photoelectric sensor
- Cross-section converter
- 20 mm light exit
- Robust design with silicone sheath
- -20 … +160 °C
- For FMS/FAV devices

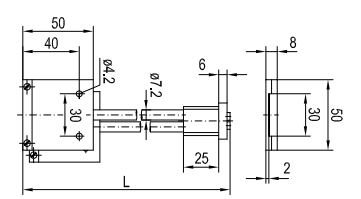
Fibre arrangement Light exit	FAV 30 Distance: transmitter – receiver (mm)	Operating range (mm)	Core fibre Ø (mm) (T=Transmitter; R=Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing / head	LS (mm)
Cross-section converter	50 - 200	12	0.2 x 20 (T) / 0.2 x 20 (R) Glass	Silicone (Si)	-20 … +160 °C	25	See Selection Table	See drawing	–

Length (m)	Part number	Article number
0.5	30 QL 0,2x20/500-Si	974-09622
1	30 QL 0,2x20/1000-Si	974-09618

9

30 QL 0,2x30/…-Si fibre-optic cable





153-00178

Highlights

- Through-beam photoelectric sensor
- Cross-section converter
- 30 mm light exit
- Robust design with silicone sheath
- -20 … +160 °C
- For FMS/FAV devices

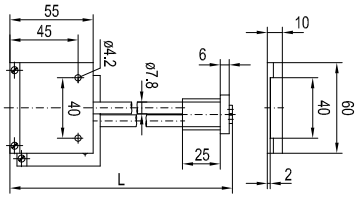
Fibre arrangement Light exit	FAV 30 Distance: transmitter – receiver (mm)	Operating range (mm)	Core fibre Ø (mm) (T=Transmitter; R=Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing / head	LS (mm)
Cross-section converter	100 - 300	18	0.2 x 30 (T) / 0.2 x 30 (R) Glass	Silicone (Si)	-20 … +160 °C	25	See Selection Table	See drawing	–

Length (m)	Part number	Article number
0.5	30 QL 0,2x30/500-Si	974-09623
1	30 QL 0,2x30/1000-Si	974-09619

Fibre-optic cables – light strips

30 QL 0,2x40/…-Si fibre-optic cable





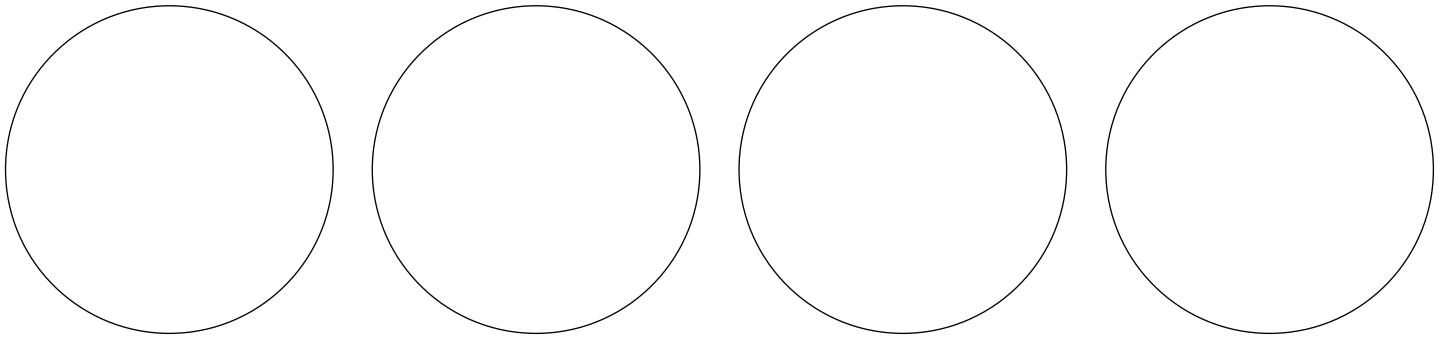
153-00179

Highlights

- Through-beam photoelectric sensor
- Cross-section converter
- 40 mm light exit
- Robust design with silicone sheath
- -20 … 160 °C
- For FMS/FAV devices

Fibre arrangement Light exit	FAV 30 Distance: transmitter – receiver (mm)	Operating range (mm)	Core fibre Ø (mm) (T=Transmitter; R=Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing / head	LS (mm)
Cross-section converter	220 - 500	24	0.2 x 40 (T) / 0.2 x 40 (R) Glass	Silicone (Si)	-20 … +160 °C	25	See Selection Table	See drawing	–

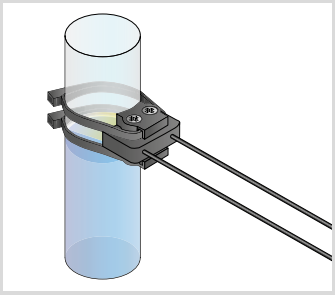
Length (m)	Part number	Article number
0.5	30 QL 0,2x40/500-Si	974-09624
1	30 QL 0,2x40/1000-Si	974-09620



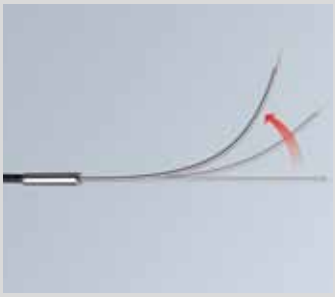
Fibre-optic cables – special designs

Fibre-optic cables for special requirements





Level measurement with fibre-optic cables: *This photoelectric proximity sensor can be mounted on transparent vessels, pipes and tubes with diameters of 6 to 26 mm. Reliable detection of liquids and levels is guaranteed – even with non-transparent liquids.*



Flexible scanning heads
The bundle of glass-fibres in a fibre-optic cable ends with a flexible scanning head in a small, thin, bendable stainless steel tube. This tube can be bent into the necessary shape for mounting in hard-to-reach locations.

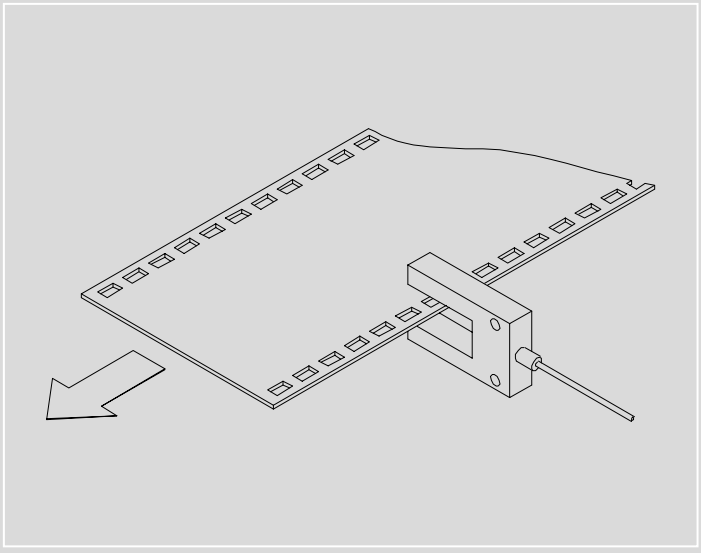
TYPICAL SENSOPART FIBRE-OPTIC CABLES

- Fine, flexible stainless steel tips for highly restricted and hard-to-reach installation locations
- V-scanners with small, flexible mounting heads for detecting small objects
- Prismatic scanners and V-scanners for monitoring liquids and filling levels
- Fork sensors in particularly small housings
- Compact installation dimensions
- Reliable detection

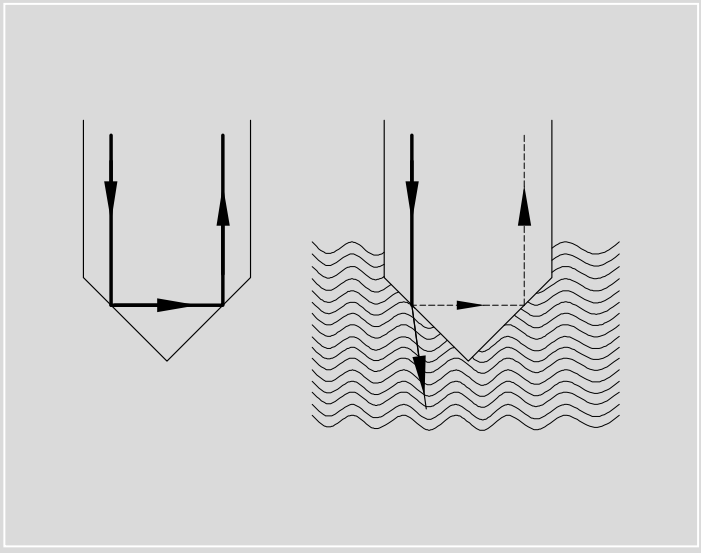
SensoPart offers a variety of special fibre-optic cable designs for particular applications and installation situations. Fork sensors, for example: in the fork design, the transmitter and receiver are precisely adjusted towards one another so that no alignment is necessary. Typical applications are the reliable detection of marks on continuous strips and small-part detection from a diameter of 0.2 mm.

Fibre-optic cables with very fine, flexible stainless steel tips are another highlight. The extraordinarily thin tube diameter allows access to extremely restricted spaces. The stainless steel tip can be individually reshaped with small bending radii and remains stable in this position. This ensures smooth process operation.

Particularly precise filling level monitoring is achieved by level sensors with glass tips. The sensor operates according to the principle of total reflection. The transmitted light is totally reflected in air in the prismatic tip and reaches the receiver without any appreciable loss. If the tip is now immersed in liquid, the refractive index changes and some of the light is refracted in the liquid. The light now arriving at the receiver is dampened and the sensor switches.

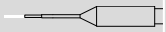
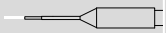
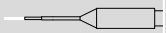
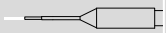
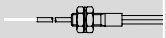
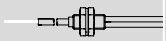
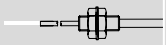
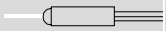
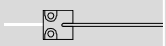
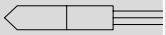
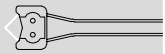
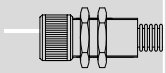
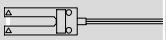
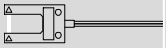


Perforation detection with a fork sensor
The fork sensor reliably detects the pattern of holes on the strip. Simple alignment and mounting, as well as its reliable detection principle, ensures trouble-free production processes.



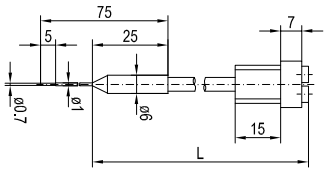
Method of function of the prismatic scanner
If the glass prism of the prismatic scanner is in air (left), total reflection results in almost all the light energy being reflected back to the receiver element of the fibre-optic sensor. If the refractive index of the surrounding liquid medium is large enough (n > 1.20), most of the light energy is coupled on the interface of the prismatic tip. The fibre-optic sensor switches.

Fibre-optic cables – special designs

Fibre-optic cable		Proximity sensor (T) Photoelectric sensor (L)	Typical range	Light exit	Special features	For fibre-optic sensors
18/30 R 0,5/xxxx-Si		T	Up to 3 mm	Axial	• Very fine bendable stainless steel tip • For restricted spaces	FMS 18 / FMS 30 / FAV 30
18/30 R 1,5/xxxx-Si		T	Up to 15 mm	Axial	• Bendable stainless steel tip • For restricted spaces	FMS 18 / FMS 30 / FAV 30
18/30 L 0,5/xxxx-Si		L	Up to 20 mm	Axial	• Very fine bendable stainless steel tip • For restricted spaces	FMS 18 / FMS 30 / FAV 30
18/30 L 1,5/xxxx-Si		L	Up to 100 mm	Axial	• Bendable stainless steel tip • For restricted spaces	FMS 18 / FMS 30 / FAV 30
K1R-103		T	Up to 105 mm	Axial	• Very fine bendable stainless steel tip • For restricted spaces	FL 70 / FL 20
K2R-100		T	Up to 290 mm	Axial	• Bendable stainless steel tip • For restricted spaces	FL 70 / FL 20
K2L-203		L	Up to 190 mm	Axial	• Very fine bendable stainless steel tip • For restricted spaces	FL 70 / FL 20
K2L-204		L	Up to 720 mm	Axial	• Bendable stainless steel tip • For restricted spaces	FL 70 / FL 20
K1R-104		T	Up to 205 mm	Axial	• Small-part and hole detection	FL 70 / FL 20
LLK1L10x10-PE-2m		L	Up to 220 mm	Axial	• Particularly flat and flexible mounting head • Fibre length individually cutable	FL 70 / FL 20
18/30 RP 2/xxxx-Si		T	–	–	• Prismatic scanner for level detection • Stainless steel head with glass prism	FMS 18 / FMS 30 / FAV 30
LLK2PR2-PE-2m		T	–	–	• Prismatic scanner for level detection • Stainless steel head with glass prism	FL 70 / FL 20
LLK1VRR22x15-PE-2m		T	–	V-scanner	• V-scanner for liquid or level detection • Small housing	FL 70 / FL 20
18/30 R 12/xxxx-N-02		T	Up to 800 mm	Axial	• Long range • Immune to contamination • Up to 250 °C	FMS 18 / FMS 30 / FAV 30
LLK1VRF5-PE-2m		T	4 mm	V-scanner	• V-scanner with lateral light exit • Small housing	FL 70 / FL 20
LLK1VRF17x18-PE-2m		T	7 mm	V-scanner	• V-scanner with lateral light exit • Small housing	FL 70 / FL 20
LLK1GL5-PE-2m		L	5 mm	Fork sensor	• Very compact housing	FL 70 / FL 20
LLK1GL10-PE-2m		L	10 mm	Fork sensor	• Very compact housing	FL 70 / FL 20

18/30 R 0,5/…-Si fibre-optic cable





153-00142

Highlights

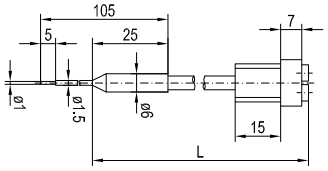
- Photoelectric proximity sensor
- Very fine bendable stainless steel tip
- Small axial light exit
- Robust design with silicone sheath
- -20 … 160 °C
- Fixing via mounting block MB 6 (Article number 903-05139)
- For FMS/FAV devices

Fibre arrangement Light exit	FMS 18 typ. scanning distance/ range (mm)	FMS 30 typ. scanning distance/ range (mm)	Core fibre Ø (mm) material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing Ø (mm)	LS (mm)
Axial	1	3	1 x 0.4 Glass	Silicone (Si)	-20 … 160 °C	15 (Si sheath) 5 (tip)	See Selection Table	6	–

Length (m)	Part number	Article number
0.25	18/30 R 0,5/250-Si	979-08069
0.5	18/30 R 0,5/500-Si	979-08097
1	18/30 R 0,5/750-Si	979-08070
2	18/30 R 0,5/1000-Si	979-08098

18/30 R 1,5/…-Si fibre-optic cable





153-00147

Highlights

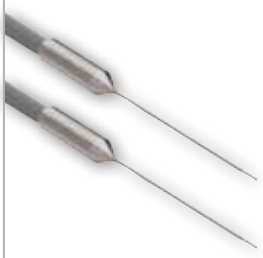
- Photoelectric proximity sensor
- Bendable stainless steel tip
- Small axial light exit
- Robust design with silicone sheath
- -20 … +160 °C
- Fixing via mounting block MB 6 (Article number 903-05139)
- For FMS/FAV devices

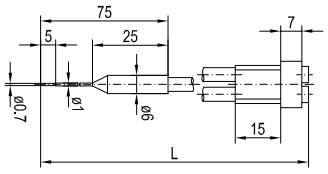
Fibre arrangement Light exit	FMS 18 typ. scanning distance/ range (mm)	FMS 30 typ. scanning distance/ range (mm)	Core fibre Ø (mm) material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing Ø (mm)	LS (mm)
Axial	5	15	1 x 0.8 Glass	Silicone (Si)	-20 … 160 °C	15 (Si sheath) 5 (tip)	See Selection Table	6	–

Length (m)	Part number	Article number
0.25	18/30 R 1,5/250-Si	979-08085
0.5	18/30 R 1,5/500-Si	979-08086
0.75	18/30 R 1,5/750-Si	979-08409
1	18/30 R 1,5/1000-Si	979-08087
1.5	18/30 R 1,5/1500-Si	979-08410
2	18/30 R 1,5/2000-Si	979-08088

Fibre-optic cables – special designs

18/30 L 0,5/...-Si fibre-optic cable





153-00144

Highlights

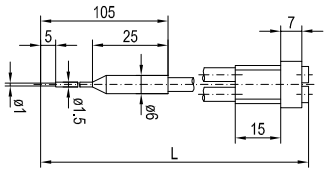
- Through-beam photoelectric sensor
- Flexible, bendable stainless steel tip
- Small axial light exit
- Robust design with silicone sheath
- -20 … +160 °C
- Fixing via mounting block MB 6 (Article number 903-05139)
- For FMS/FAV devices

Fibre arrangement Light exit	FMS 18 typ. scanning distance/ range (mm)	FMS 30 typ. scanning distance/ range (mm)	Core fibre Ø (mm) (T=Transmitter; R=Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing Ø (mm)	LS (mm)
Axial	10	20	1 x 0.4 (T) / 1 x 0.4 (R) Glass	Silicone (Si)	-20 … +160 °C	15 (Si sheath) 5 (tip)	See Selection Table	6	–

Length (m)	Part number	Article number
0.25	18/30 L 0,5/250-Si	978-08218
0.5	18/30 L 0,5/500-Si	978-08246
0.75	18/30 L 0,5/750-Si	978-08219
1	18/30 L 0,5/1000-Si	978-08247

18/30 L 1,5/…-Si fibre-optic cable





153-00150

Highlights

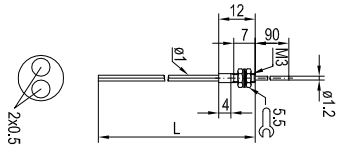
- Through-beam photoelectric sensor
- Flexible, bendable stainless steel tip
- Small axial light exit
- Robust design with silicone sheath
- -20 … +160 °C
- Fixing via mounting block MB 6 (Article number 903-05139)
- For FMS/FAV devices

Fibre arrangement Light exit	FMS 18 typ. scanning distance/ range (mm)	FMS 30 typ. scanning distance/ range (mm)	Core fibre Ø (mm) (T=Transmitter; R=Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing Ø (mm)	LS (mm)
Axial	80	100	1 x 0.8 (T) / 1 x 0.8 (R) Glass	Silicone (Si)	-20 … +160 °C	15 (Si sheath) 5 (tip)	See Selection Table	6	–

Length (m)	Part number	Article number
0.25	18/30 L 1,5/250-Si	978-08234
0.5	18/30 L 1,5/500-Si	978-08235
0.75	18/30 L 1,5/750-Si	978-08569
1	18/30 L 1,5/1000-Si	978-08236
1.5	18/30 L 1,5/1500-Si	978-08570
2	18/30 L 1,5/2000-Si	978-08237

K1R-103 fibre-optic cable





153-00080

Highlights

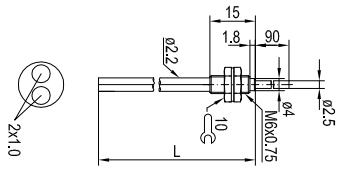
- Photoelectric proximity sensor
- Very fine bendable stainless steel tip
- Particularly suitable for restricted spaces
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Mono / axial Bendable tip	60 / 20 / 105	–	See drawing	–	2 x 0.5 (T/R) PMMA	Polyethylene (PE)	-40 … +70 °C	25	2 m Cutable	M3 Stainless steel	–

Part number	Article number
K1R-103	720-50769

K2R-100 fibre-optic cable





153-00081

Highlights

- Photoelectric proximity sensor
- Bendable stainless steel tip
- Particularly suitable for restricted spaces
- Robust design
- Fibre length individually cutable
- For FL 70/FL 20 devices

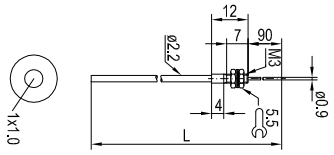
Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Mono/axial	140 / 70 / 290	70	See drawing	–	2 x 1.0 (T/R) PMMA	Polyethylene (PE)	-40 … +70 °C	25	2 m Cutable	M6x0.75 Stainless steel	–

Part number	Article number
K2R-100	720-50770

Fibre-optic cables – special designs

K2L-203 fibre-optic cable





153-00085

Highlights

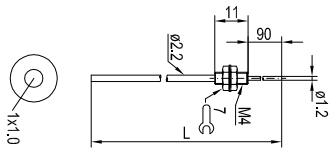
- Through-beam photoelectric sensor
- Very fine bendable stainless steel tip
- Particularly suitable for restricted spaces
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Mono / axial Bendable tip	120 / 60 / 190	–	See drawing	–	1 x 0.5 (T) 1 x 0.5 (R) PMMA	Polyethylene (PE)	-40 … +70 °C	15	2 m Cutable	M3 Stainless steel	–

Part number	Article number
K2L-203	721-50773

K2L-204 fibre-optic cable





153-00086

Highlights

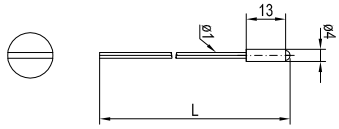
- Through-beam photoelectric sensor
- Very fine bendable stainless steel tip
- Particularly suitable for restricted spaces
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Mono / axial Bendable tip	350 / 195 / 720	180	See drawing	–	1 x 1.0 (T) 1 x 1.0 (R) PMMA	Polyethylene (PE)	-40 … +70 °C	25	2 m Cutable	M4 Stainless steel	–

Part number	Article number
K2L-204	721-50774

K1R-104 fibre-optic cable





153-00305

Highlights

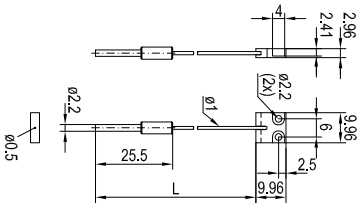
- Photoelectric proximity sensor
- For detecting small parts and holes
- Spherical optics for cylindrical light beam
- Precise switching behaviour on lateral approach
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Spherical optics	80 / 45 / 205	–	See drawing	–	2 x 0.5 (T/R) PMMA	Polyethylene (PE)	-40 … +70 °C	15	2 m Cutable	Ø 4 mm Stainless steel	–

Part number	Article number
K1R-104	841-21006

LLK1L10x10-PE-2m fibre-optic cable





153-00620

Highlights

- Through-beam photoelectric sensor
- Very small bending radius
- Particularly flat and flexible mounting head
- Fibre length individually cutable
- For FL 70/FL 20 devices

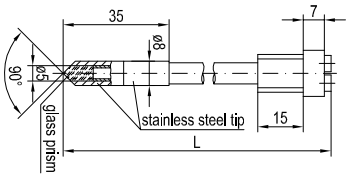
Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Flat measurement head	120 / 50 / 220	–	See drawing	–	1 x 0.5 (T) 1 x 0.5 (R) PMMA	Polyethylene (PE)	-40 … +70 °C	1	2 m Cutable	10 x 10 mm² M2 Brass, nickel-plated	–

Part number	Article number
LLK1L10x10-PE-2m	750-11010

Fibre-optic cables – special designs

18/30 RP 2 /-Si fibre-optic cable





153-00184

Highlights

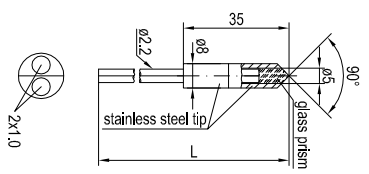
- Prismatic scanner for liquid and level detection
- Radial light exit
- Robust design with silicone sheath
- -20 … +120 °C
- Fixing via mounting block MB 8 (Article number 903-05141)
- For FMS/FAV devices

Fibre arrangement Light exit	FMS 18 typ. scanning distance/ range (mm)	FMS 30 typ. scanning distance/ range (mm)	Core fibre Ø (mm) material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing Ø (mm)	LS (mm)
Axial	–	–	2 x 1.6 Glass	Silicone (Si)	-25 … +120 °C	20	See Selection Table	8 Stainless steel	See Selection Table

Length (m)	Part number	Article number
0.25	18/30 RP 2/250-Si	975-06584
0.5	18/30 RP 2/500-Si	975-06585
1	18/30 RP 2/1000-Si	975-06586
2	18/30 RP 2/2000-Si	975-06587

LLK2PR2-PE-2m fibre-optic cable





153-00625

Highlights

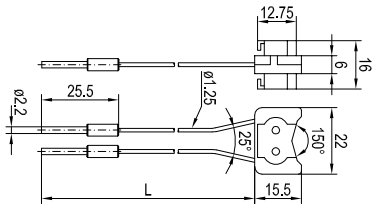
- Prismatic scanner for liquid and level detection
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Prismatic scanner	–	–	See drawing	–	2 x 1.0 (T/R) PMMA	Polyethylene (PE)	-40 … +70 °C	25	2 m Cutable	Ø 8 mm Stainless steel	–

Part number	Article number
LLK2PR2-PE-2m	951-50013

LLK1VRR22x15-PE-2m fibre-optic cable





153-00606

Highlights

- V-scanner for liquid and level detection in transparent vessels or tubes
- Small housing
- Fibre length individually cutable
- For FL 70/FL 20 devices

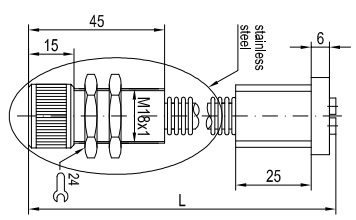
Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
V-scanner	Ø 6-26 / Ø 6-26 / Ø 6-26	Ø 6-26	–	–	2 x 0.5 (T/R) PMMA	Polyethylene (PE)	-40 … +70 °C	15	2 m Cutable	15.5 x 22 x 11 mm³ Polycarbonate (PC)	–

Part number	Article number
LLK1VRR22x15-PE-2m	750-11006

9

30 R 12/…-N-02 fibre-optic cable





153-00171

Highlights

- Photoelectric proximity sensor
- Axial light exit
- High scanning distance/range
- Extremely robust design with stainless steel sheath
- -25 … +250 °C
- For FMS/FAV devices

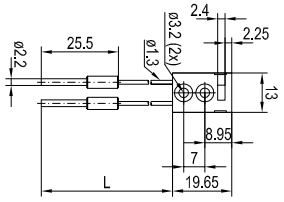
Fibre arrangement Light exit	FMS 18 typ. scanning distance/ range (mm)	FMS 30 typ. scanning distance/ range (mm)	Core fibre Ø (mm) material	Sheath material	Ambient temperature (rigid installation)	Bending radius (mm)	Cable length (m)	Collar bushing Ø (mm)	LS (mm)
Axial	–	800	2 x 3.5 Glass	Stainless steel, helical sleeve	-25 … +250 °C	45 (once) 100 (more than once)	See Selection Table	M18 x 1	–

Length (m)	Part number	Article number
0.5	30 R 12/500-N-02	979-05281
0.75	30 R 12/750-N-02	979-50546
1	30 R 12/1000-N-02	979-05280
1.5	30 R 12/1500-N-02	979-05279
2	30 R 12/2000-N-02	979-05278

Fibre-optic cables – special designs

LLK1VRF5-PE-2m fibre-optic cable





153-00611

Highlights

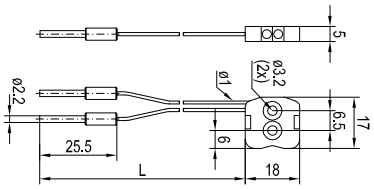
- V-scanner with lateral light exit
- Small housing
- Precise switching behaviour within operating range
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
V-scanner Transp. Media Radial	4 / 4 / 4	4	–	–	2 x 1.0 (T/R) PMMA	Polyethylene (PE)	-40 … +70 °C	25	2 m Cutable	19,6 x 13 x 5 mm³ M3 ABS plastic	–

Part number	Article number
LLK1VRF5-PE-2m	750-11005

LLK1VRF17x18-PE-2m fibre-optic cable





153-00619

Highlights

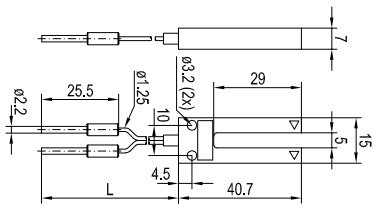
- V-scanner with lateral light exit
- Small housing
- Precise switching behaviour within operating range
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
V-scanner	7 / 7 / 7	–	–	–	2 x 0.5 (T/R) PMMA	Polyethylene (PE)	-40 … +70 °C	15	2 m Cutable	17 x 18 x 5 mm³ M3 Polycarbonate (PC)	–

Part number	Article number
LLK1VRF17x18-PE-2m	750-11009

LLK1GL5-PE-2m fibre-optic cable





153-00607

Highlights

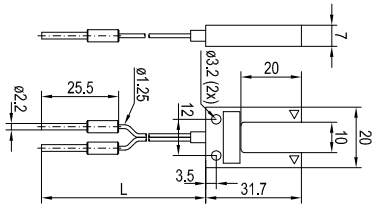
- Fork sensor with very compact housing
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Fork sensor 5 mm	5 / 5 / 5	5	–	–	1 x 0.25 (T) 1 x 0.25 (R) PMMA	Polyethylene (PE)	-40 … +70 °C	10	2 m Cutable	31,7 x 20 x 7 mm³ M3 ABS plastic	–

Part number	Article number
LLK1GL5-PE-2m	750-11008

LLK1GL10-PE-2m fibre-optic cable





153-00608

Highlights

- Fork sensor with very compact housing
- Fibre length individually cutable
- For FL 70/FL 20 devices

Design Light exit	FL 70 typ. scanning distance (mm) Standard / Fine / High	FL 20 typ. scanning distance (mm) Default setting	Fibre arrange-ment	Suitable for ancillary lens	Core fibre Ø (mm) (T = Transmitter; R = Receiver) Material	Sheath material	Ambient temperature (rigid installation)	Fibre bending radius (mm)	Cable length	Collar bushing	LS (mm)
Fork sensor 10 mm	10 / 10 / 10	10	–	–	1 x 0.25 (T) / 1 x 0.25 (R) PMMA	Polyethylene (PE)	-40 … +70 °C	10	2 m Cutable	40,7 x 15 x 7 mm³ M3 ABS plastic	–

Part number	Article number
LLK1GL10-PE-2m	750-11007

Fibre-optic cables – accessories

Everything needed for using fibre-optic cable systems



From products "by the metre" to ancillary lenses – SensoPart offers all the accessories necessary for the use of fibre-optic sensors. The comprehensive range also includes a special combination tool with which the sensitive fibre-optic cables can be shortened and bent with almost no performance loss.

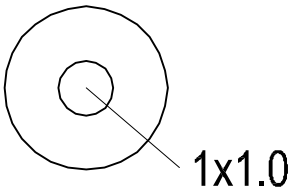
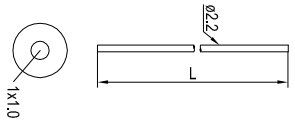
TYPICAL SENSOPART FIBRE-OPTIC CABLES

- Ancillary lenses for expanding the range of standard fibre-optic cables
- Deflection head for restricted spaces
- Connection adapter for all conventional fibre-optic sensors
- Precise shortening and bending of fibre-optic cables with almost no performance loss

Lichtleiter – Zubehör – Produktübersicht	
	Page
Metre goods	526
Adapters	527
Ancillary lenses	528
Cutting tool	529

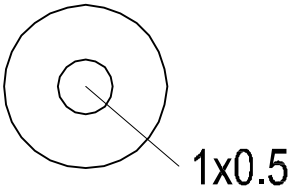
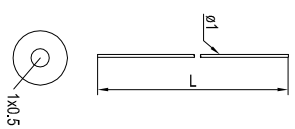
Fibre-optic cables – accessories

Metre goods

K2L 1,0 POF simplex fibre-optic cable	Highlights
  153-01034	• Simplex plastic fibre-optic cable • Fibre length individually cutable

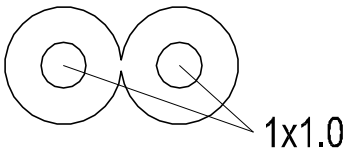
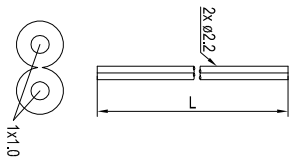
Core fibre Ø (mm)	Fibre material	External diameter (mm)	Sheath material	Numerical aperture	Damping at 650 nm (dB/km)	Fibre bending radius (mm)
1 x 1.0	PMMA	2.2	Polyethylene (PE)	0.5	≤ 150	25

Part number	Article number
K2L 1,0 POF simplex	978-51680

K2L 0,5 POF simplex fibre-optic cable	Highlights
  153-01035	• Simplex plastic fibre-optic cable • Fibre length individually cutable

Core fibre Ø (mm)	Fibre material	External diameter (mm)	Sheath material	Numerical aperture	Damping at 650 nm (dB/km)	Fibre bending radius (mm)
1 x 0.5	PMMA	1.0	Polyethylene (PE)	0.5	≤ 180	15

Part number	Article number
K2L 0.5 simplex	978-51688

K2R 1,0 POF duplex fibre-optic cable		Highlights
	 153-01021	• Duplex plastic fibre-optic cable • Fibre length individually cutable

Core fibre Ø (mm)	Fibre material	External diameter (mm)	Sheath material	Numerical aperture	Damping at 650 nm (dB/km)	Fibre bending radius (mm)
2 x 1.0	PMMA	2 x 2.0	Polyethylene (PE)	0.46	≤ 150	25

Part number	Article number
K2R 1.0 POF duplex	979-51694

LMS 1,0-S2,2	Highlights
	• Connection adapter (1.0 / 2.2 mm) for connecting fibres with external diameter of 1.0 mm to FL 20/FL 70 sensors

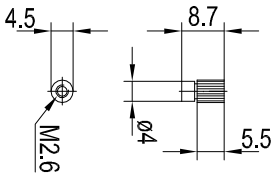
Part number	Article number
LMS1,0-S2,2	724-01000

LMS 1,3-S2,2	Highlights
	• Connection adapter (1.3 / 2.2 mm) for connecting fibres with external diameter of 1.3 mm to FL 20/FL 70 sensors

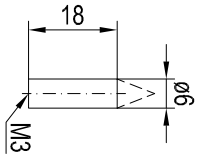
Part number	Article number
LMS1,3-S2,2	724-01001

Fibre-optic cables – accessories

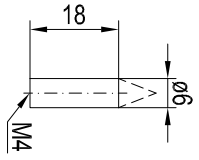
Ancillary lenses

33 LVL 2,2		Highlights
	 153-00077	• Ancillary lens for plastic fibres • For increasing the range of photoelectric sensors and reducing the aperture angle • Suitable for fibres with an external diameter of 2.2 mm or M2.6 sleeve • Axial light exit

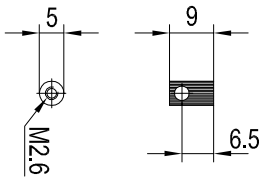
Part number	Article number
33 LVL 2,2	722-50775

LVLF6-M3		Highlights
	 153-00617	• Ancillary lens for fibre-optic cables • For increasing the range of photoelectric sensors, reducing the aperture angle, or focusing the operating distance • Can be used with collar bushings with an M3 external thread

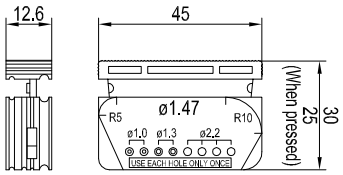
Part number	Article number
LVLF6-M3	722-01003

LVLF6-M4		Highlights
	 153-00618	• Ancillary lens for fibre-optic cables • For increasing the range of photoelectric sensors, reducing the aperture angle, or focusing the operating distance • Can be used with collar bushings with an M4 external thread

Part number	Article number
LVLF6-M4	722-01004

33 LVL 2,2-90°		Highlights
	 153-00078	• Deflection prism: 90° for plastic fibres • Suitable for fibres with an external diameter of 2.2 mm or M2.6 sleeve • Radial light exit

Part number	Article number
33 LVL 2,2-90 Grad	722-50776

Cutting/bending tool		Highlights
	 153-00624	• Combination tool for cutting and bending fibre-optic cables and fibre-optic cables with bendable tips

Part number	Article number
Cutting tool	724-50799

Fork sensors and optical windows

Experts in small part detection and counting tasks

FGL-RK – LED red light fork sensors

from Page 534

- *Precise small part detection from 0.2 mm*
- *Indicator LEDs with all-round visibility over entire fork edge*
- *Simple sensor mounting via dovetail guides*
- *Sensitivity adjustment via teach-in button or control line*



FGL-IK – infrared fork sensors

from Page 536

- *Precise small part detection from 0.2 mm*
- *Indicator LEDs with all-round visibility over entire fork edge*
- *Simple sensor mounting via dovetail guides*
- *Sensitivity adjustment via teach-in button or control line*



FGL – LED red light fork sensors with metal housings

from Page 538

- *Resistant zinc die-cast housings*
- *High switching frequency up to 3 kHz*
- *Sensitivity adjustment via potentiometer*



Fork sensors and optical windows display characteristic properties as a result of their special housing design: thanks to their precise beam guidance they are particularly suitable for small part detection. The sensors are also easy to mount because no time-consuming adjustment is required.

The fork sensors of the FGL-IK and FGL-RK series detect parts from a diameter of 0.2 mm. They are used, for example, for small part detection on conveyor sections and chutes or for counting bulk goods on vibration conveyors. Rotational speed measurement is another typical application. The optical windows of the FG series are employed, for example, for detecting thread breaks in the textile industry, for part detection in transparent tubes in pneumatic conveyors, or for ejection detection. Fork sensors and optical windows are frequently the first choice for use in plants subject to strong vibrations, in particular, thanks to their robust housings and the design-related fixed light beam.

Precise detection and user-friendly details: plastic fork sensors

Fork sensors with plastic housings (FGL-RK and –IK series) are, in all respects, perfectly thought-through products. On the one hand, they are particularly shatterproof thanks to the elastic housing material, on the other hand, their numerous user-friendly detail solutions are highly impressive. Thus, in addition to the usual mounting holes, threaded sleeves and dovetail designs are also integrated. In combination with the MBD-S94 bracket, the latter permits flexible mounting in almost any desired position in the process. Operation by means of dynamic teach-in also very easy: the measurement sensitivity can be directly adjusted on moving objects. In addition, the switching distance can be checked anytime thanks to the all-round visibility of the Indicator LEDs. Even a product that, at first glance, appears simple can be quite refined!



FGL with mounted MBD-S94 bracket and easily visible Indicator LEDs on the fork edge.

FG – Infrared optical windows

from Page 542

- *Robust metal housings*
- *Sensitivity adjustment per potentiometer*
- *Adjustable output signal duration of 10 … 300 ms*
- *Dynamic signal evaluation*



made in Germany

TYPICAL SENSOPART

- Simple and robust housing
- Metal or plastic housing options (FGL) or robust metal housings (FG)
- High resolution for precise small part detection (fork sensors from 0.2 mm, optical windows from 0.8 mm)
- Various fork and window widths available
- Easy, rapid mounting without complicated adjustment
- Red light or infrared LED options
- High switching frequency of up to 3 kHz
- Dynamic signal evaluation (FG)
- 3- or 4-pin connector depending on variant
- Reliable function even in harsh conditions
- Indicator LEDs easy to see from all sides

Fork Sensors and Optical Windows – Product Overview

	Type of light	Adjustment	Fork width / window size	Special features	Page
Fork sensors					
FGL-RK	Red light	Teach-in	30 / 50 / 80 / 120 mm	Teach-in, dovetail mounting	534
FGL-IK	Infrared	Teach-in	30 / 50 / 80 / 120 mm	Teach-in, dovetail mounting	536
FGL	Red light	Potentiometer	5 / 10 / 20 / 30 mm	Metal housings	538
FGL	Red light	Potentiometer	50 / 80 / 120 / 180 / 220 mm	Metal housings	540
Optical windows					
FG	Infrared	Potentiometer	40 x 80 mm² / 80 x 80 mm² / 120 x 80 mm²	Metal housings	542

Fork sensors

System description

Method of function

Fork sensors function according to the through-beam principle. The transmitter is located in one arm of the fork and transmits its light to the receiver directly opposite in the other fork arm. Thus a great advantage of fork sensors is that the transmitter and the receiver no longer need to be aligned. Reduced cabling work and flexible mounting possibilities further accelerate commissioning of the sensors. The shared housing design is available in differing fork widths (5 … 220 mm) and fork depths. The particular advantage of fork sensors lies in their simple commissioning.

An important feature of SensoPart fork sensors is their particularly reliable function with maximum precision. The smallest objects, with a diameter of 0.2 mm, are reliably detected. High switching frequencies also allow detection with rapid conveyor processes. Sensitivity adjustment of the sensors takes place via a teach-in button and can be carried out during running processes (dynamic teach-in). Fork sensors are available with metal or plastic housings, red light or invisible infrared light.

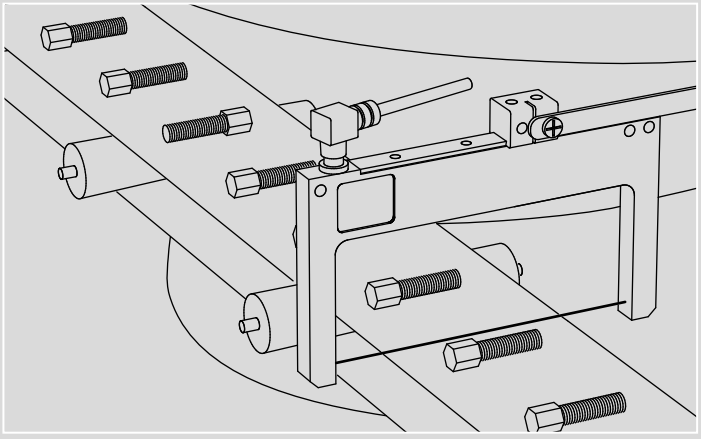
Precise small part detection on feed belts, rotational speed measurement or the precise positioning of objects are typical applications for fork sensors.

Metal version

- Simple and robust design
- N.O./N.C. function switchable
- 3-pin connection plug

Plastic version

- NPN or PNP output options
- 3- or 4-pin connection plug
- Dynamic teach-in
- Adjustment also possible on moving objects
- Switching state LEDs visible all-round
- Numerous mounting possibilities (including dovetail)



Counting parts on a vibration conveyor
An **FGL fork sensor** checks whether the feed section is completely occupied with work-pieces and, if necessary, stops the conveyor.

Optical windows

System description

Method of function

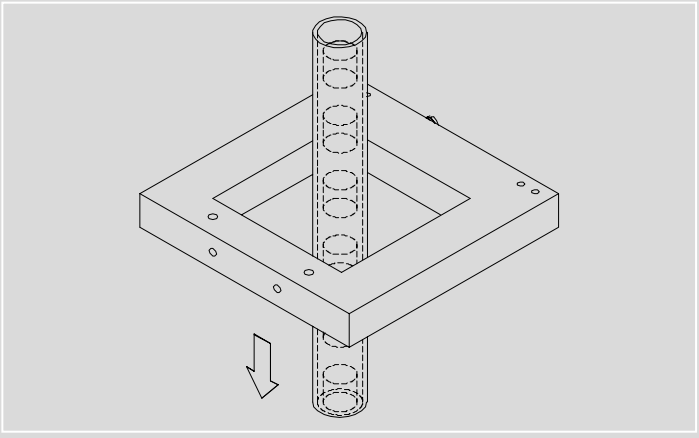
Strictly speaking, optical windows are through-beam light grids. In effect, several through-beam photoelectric switches are mounted and aligned on two opposite sides. Modulation of the transmitted light and the special geometrical arrangement ensure that the differing "through-beam photoelectric switches" do not interfere with one another. The number of "photoelectric switches" in the housing is an indication of the optical window's resolution and thus determines the minimum object size of the detection quality. The shared housings are available in differing frame widths (40, 80, 120 mm).

The simple cabling due to a single shared plug, the pre-aligned transmitter and receiver – and thus simplified commissioning – are particular advantages of the optical windows. Simply connect and align. Finished.

Checking the ejection of small parts, e.g. on presses and stamping machines, is a typical application for optical windows. Whereby the resolution of the light grid and its response time is decisive for the reliable detection of small objects. The resolution of SensoPart optical windows ensures the reliable detection of small parts from as little as 0.8 mm. It is even possible, thanks to dynamic signal evaluation, to detect objects through transparent tubes. The adjustable output signal duration (signal length: 10 … 300 ms) ensures maximum compatibility with the PLC.

Features

- High resolution
- Dynamic signal evaluation
- Infrared light
- Robust metal housings
- Simple sensitivity adjustment via potentiometer



FG detection of objects through a tube

Optical windows also detect objects transported through a partially transparent tube thanks to dynamic evaluation.

FGL… -RK

Fork sensors



PRODUCT HIGHLIGHTS

- Fork widths: 30 … 120 mm
- Small part detection from 0.2 mm
- Sensor adjustment via teach-in and control input
- Versatile mounting possibilities
- N.O./N.C. switchable

Optical data	
Fork width	30 … 120 mm (see Selection Table)
Type of light	LED, red, 640 nm
Smallest detectable part	(See table)

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running process Mode 2: process at standstill
Adjustment possibilities	N.O./N.C. via Teach-in button and control input Button lock via control input Default: via Teach-in button and control input
Default setting	Maximum stability (max. immunity to contamination)

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
No-load current, I_0	≤ 30 mA
Output current, Ie	≤ 100 mA
Voltage drop, U_D	≤ 2.4 V
Protective circuits	Reverse polarity protection, U_B / Short-circuit protection (Q)
Protection Class	2
Switching output, Q	PNP / NPN (see Selection Table)
Output function	N.O. / N.C.
Switching frequency, f (ti/tp 1:1)	≤ 2000 Hz
Response time	250 µs
Control input, ET[2]	$+U_B$ = Teach-in, $-U_B$ = button locked Open = normal operation

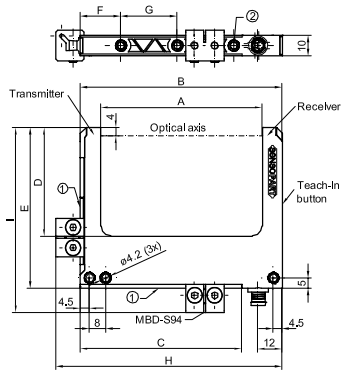
Mechanical data	
Dimensions	(See plug connection)
Enclosure rating	IP 67[3]
Material, housing	Polycarbonate
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight	See Selection Table
Vibration and impact resistance	EN 60947-5-2

[1] Max. 10 % ripple, within U_B [2] Only 4-pin design [3] With connected IP 67 plug

Fork width	Switching output	Type of connection	Weight	Part number	Article number
30 mm	PNP	Plug, M8x1, 3-pin	20 g	FGL 30-RK-30-PS-M3	832-11000
30 mm	NPN	Plug, M8x1, 3-pin	20 g	FGL 30-RK-30-NS-M3	832-11001
30 mm	PNP	Plug, M8x1, 4-pin	20 g	FGL 30-RK-30-PS-M4	832-11002
30 mm	NPN	Plug, M8x1, 4-pin	20 g	FGL 30-RK-30-NS-M4	832-11003
50 mm	PNP	Plug, M8x1, 3-pin	30 g	FGL 50-RK-50-PS-M3	832-11004
50 mm	NPN	Plug, M8x1, 3-pin	30 g	FGL 50-RK-50-NS-M3	832-11005
50 mm	PNP	Plug, M8x1, 4-pin	30 g	FGL 50-RK-50-PS-M4	832-11006
50 mm	NPN	Plug, M8x1, 4-pin	30 g	FGL 50-RK-50-NS-M4	832-11007

Fork width	Switching output	Type of connection	Weight	Part number	Article number
80 mm	PNP	Plug, M8x1, 3-pin	35 g	FGL 80-RK-50-PS-M3	832-11008
80 mm	NPN	Plug, M8x1, 3-pin	35 g	FGL 80-RK-50-NS-M3	832-11009
80 mm	PNP	Plug, M8x1, 4-pin	35 g	FGL 80-RK-50-PS-M4	832-11010
80 mm	NPN	Plug, M8x1, 4-pin	35 g	FGL 80-RK-50-NS-M4	832-11011
120 mm	PNP	Plug, M8x1, 3-pin	40 g	FGL 120-RK-50-PS-M3	832-11012
120 mm	NPN	Plug, M8x1, 3-pin	40 g	FGL 120-RK-50-NS-M3	832-11013
120 mm	PNP	Plug, M8x1, 4-pin	40 g	FGL 120-RK-50-PS-M4	832-11014
120 mm	NPN	Plug, M8x1, 4-pin	40 g	FGL 120-RK-50-NS-M4	832-11015

Plug connection



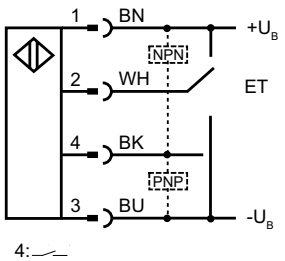
Typ / Type	A	B	C	D	E	F	G	H	I	②
FGL 30-RK-30-xx-xx	30	50	30	34	59,5	20	-	62,2	71,7	1x
FGL 50-RK-50-xx-xx	50	70	50	54	79,5	20	28	82,2	91,7	2x
FGL 80-RK-50-xx-xx	80	100	80	54	79,5	20	2x28	112,2	91,7	3x
FGL 120-RK-50-xx-xx	120	140	120	54	79,5	20	3x28	152,2	91,7	4x

Angaben in mm / Specifications are in mm / Données en mm

① Schwalbenschwanz / Dovetail / Pince à queue d'aronde
② Gewindeeinsatz M4, Einschraubtiefe max. 6 mm
Threaded insert M4, max. screw-in depth 6 mm
Insert filetage M4, profondeur vis max 6 mm

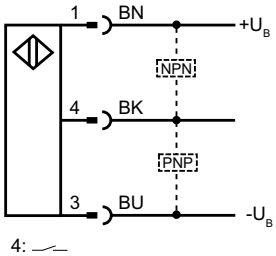
153-00543

Connection, 4-pin



154-00148

Connection, 3-pin



154-00163

Smallest detectable part

Type	FGL 30	FGL 50	FGL 80	FGL 120
Part size	0.2 mm	0.2 mm	0.2 mm	0.4 mm

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

FGL… -IK

Infrared fork sensors



PRODUCT HIGHLIGHTS

- Fork widths 30 … 120 mm
- Small part detection from 0.2 mm
- Sensor adjustment via teach-in and control input
- Versatile mounting possibilities
- N.O./N.C. switchable

Optical data	
Fork width	30 … 120 mm (see Selection Table)
Type of light	Infrared, 880 nm
Smallest detectable part	(See table)

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via Teach-in button and control input
Teach-in modes	Mode 1: during running process Mode 2: process at standstill
Adjustment possibilities	N.O. / N.C. via Teach-in button and control input Button lock via control input Default: via Teach-in button and control input
Default setting	Maximum stability (max. immunity to contamination)

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
No-load current, I_0	≤ 32 mA
Output current, Ie	100 mA
Voltage drop, U_D	≤ 2.4 V
Protective circuits	Reverse polarity protection, U_B / Short-circuit protection (Q)
Protection Class	2
Switching output, Q	PNP / NPN (see Selection Table)
Output function	N.O. / N.C.
Switching frequency, f (ti/tp 1:1)	2000 Hz
Response time	250 µs
Control input, ET[2]	$+U_B$ = Teach-in, $-U_B$ = button locked Open = normal operation

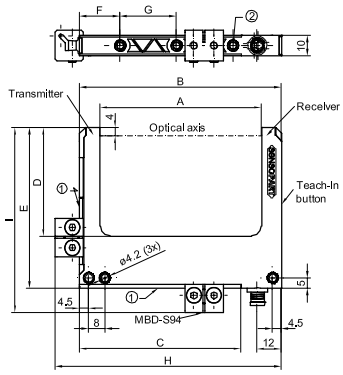
Mechanical data	
Dimensions	(See plug connection)
Enclosure rating	IP 67[3]
Material, housing	Polycarbonate
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight	See Selection Table
Vibration and impact resistance	EN 60947-5-2

[1] Max. 10 % ripple, within U_B [2] Only 4-pin design [3] With connected IP 67 plug

Fork width	Switching output	Type of connection	Weight	Part number	Article number
30 mm	PNP	Plug, M8x1, 3-pin	20 g	FGL 30-IK-30-PS-M3	832-11016
30 mm	NPN	Plug, M8x1, 3-pin	20 g	FGL 30-IK-30-NS-M3	832-11017
30 mm	PNP	Plug, M8x1, 4-pin	20 g	FGL 30-IK-30-PS-M4	832-11018
30 mm	NPN	Plug, M8x1, 4-pin	20 g	FGL 30-IK-30-NS-M4	832-11019
50 mm	PNP	Plug, M8x1, 3-pin	30 g	FGL 50-IK-50-PS-M3	832-11020
50 mm	NPN	Plug, M8x1, 3-pin	30 g	FGL 50-IK-50-NS-M3	832-11021
50 mm	PNP	Plug, M8x1, 4-pin	30 g	FGL 50-IK-50-PS-M4	832-11022
50 mm	NPN	Plug, M8x1, 4-pin	30 g	FGL 50-IK-50-NS-M4	832-11023

Fork width	Switching output	Type of connection	Weight	Part number	Article number
80 mm	PNP	Plug, M8x1, 3-pin	35 g	FGL 80-IK-50-PS-M3	832-11024
80 mm	NPN	Plug, M8x1, 3-pin	35 g	FGL 80-IK-50-NS-M3	832-11025
80 mm	PNP	Plug, M8x1, 4-pin	35 g	FGL 80-IK-50-PS-M4	832-11026
80 mm	NPN	Plug, M8x1, 4-pin	35 g	FGL 80-IK-50-NS-M4	832-11027
120 mm	PNP	Plug, M8x1, 3-pin	40 g	FGL 120-IK-50-PS-M3	832-11028
120 mm	NPN	Plug, M8x1, 3-pin	40 g	FGL 120-IK-50-NS-M3	832-11029
120 mm	PNP	Plug, M8x1, 4-pin	40 g	FGL 120-IK-50-PS-M4	832-11030
120 mm	NPN	Plug, M8x1, 4-pin	40 g	FGL 120-IK-50-NS-M4	832-11031

Plug connection



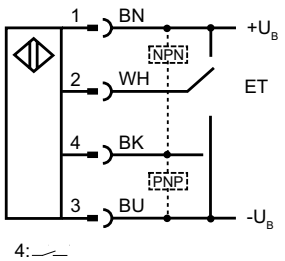
Typ / Type	A	B	C	D	E	F	G	H	I	②
FGL 30-IK-30-xx-xx	30	50	30	34	59,5	20	-	62,2	71,7	1x
FGL 50-IK-50-xx-xx	50	70	50	54	79,5	20	28	82,2	91,7	2x
FGL 80-IK-50-xx-xx	80	100	80	54	79,5	20	2x28	112,2	91,7	3x
FGL 120-IK-50-xx-xx	120	140	120	54	79,5	20	3x28	152,2	91,7	4x

Angaben in mm / Specifications are in mm / Données en mm

① Schwalbenschwanz / Dovetail / Pince à queue d'aronde
② Gewindeeinsatz M4, Einschraubtiefe max. 6 mm
Threaded insert M4, max. screw-in depth 6 mm
Insert filetage M4, profondeur vis max 6 mm

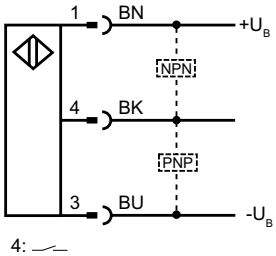
153-00697

Connection, 4-pin



154-00148

Connection, 3-pin



154-00163

Smallest detectable part

Type	FGL 30	FGL 50	FGL 80	FGL 120
Part size	0.2 mm	0.2 mm	0.2 mm	0.4 mm

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

FGL

Fork sensors with metal housings



PRODUCT HIGHLIGHTS

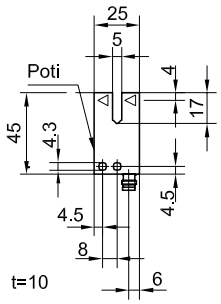
- Robust metal housings
- Small part detection from 0.3 mm
- High switching frequency up to 3000 Hz
- Precise sensitivity adjustment via potentiometer
- N.O. / N.C. switchable

Optical data		Functions	
Fork width	5 … 30 mm (see Selection Table)	Indicator LED, yellow	Switching output indicator
Type of light	LED, red, 640 nm	Sensitivity adjustment	Via potentiometer
Smallest detectable part	(See table)	Adjustment possibilities	N.O. / N.C. via potentiometer
Repeatability	0.02 mm		
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC[1]	Dimensions	(See plug connection)
No-load current, I_0	≤ 35 mA	Enclosure rating	IP 67[4]
Output current, Ie	≤ 200 mA	Material, housing	Die-cast zinc (GD Zn)
Voltage drop, U_D	< 3 V	Material, active areas	Glass
Protective circuits	Reverse polarity protection, U_B / Short-circuit protection (Q)	Type of connection	See Selection Table
Protection Class	2	Ambient temperature: operation	-10 … +60 °C
Switching output, Q	PNP	Ambient temperature: storage	-20 … +80 °C
Output function	N.O. / N.C.	Weight	See Selection Table
Switching frequency, f (ti/tp 1:1)	3000 Hz[2] / 1500 Hz[3]	Vibration and impact resistance	EN 60947-5-2

[1] Max. 10 % ripple, within U_B [2] FGL 5 / FGL 10 [3] FGL 20 / FGL 30 [4] With connected IP 67 plug

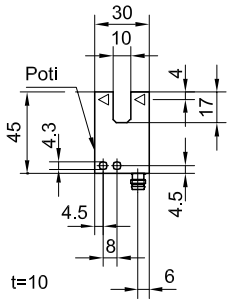
Fork width	Type of connection	Weight	Part number	Article number
5 mm	Metal plug, M8x1, 3-pin	32 g	FGL 5-R-PSM3	830-11000
10 mm	Metal plug, M8x1, 3-pin	36 g	FGL 10-R-PSM3	830-11001
20 mm	Metal plug, M8x1, 3-pin	50 g	FGL 20-R-PSM3	830-11002
30 mm	Metal plug, M8x1, 3-pin	66 g	FGL 30-R-PSM3	830-11003

Plug connection (5 mm fork width)



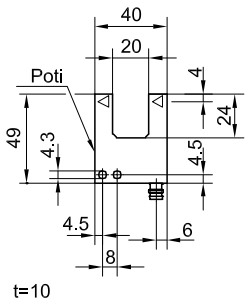
153-00262

Plug connection (10 mm fork width)



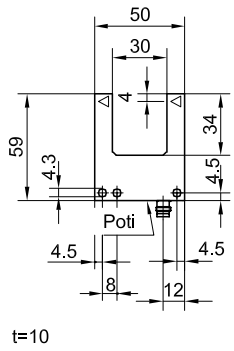
153-00263

Plug connection (20 mm fork width)



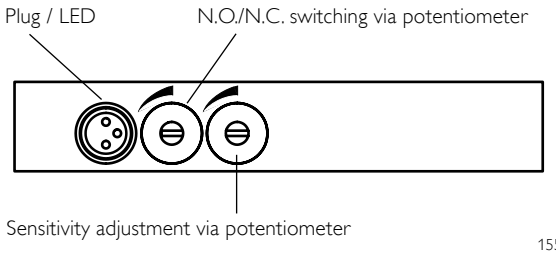
153-00264

Plug connection (30 mm fork width)



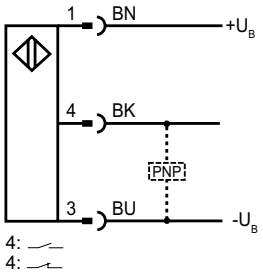
153-00265

Operating / display elements



155-00237

Connection, 3-pin



154-00456

10

Smallest detectable part

Type	FGL 5	FGL 10	FGL 20	FGL 30
Part size	0.3 mm	0.3 mm	0.3 mm	0.3 mm

Accessories

Connection cables	From Page A-32

FGL

Fork sensors with metal housings



PRODUCT HIGHLIGHTS

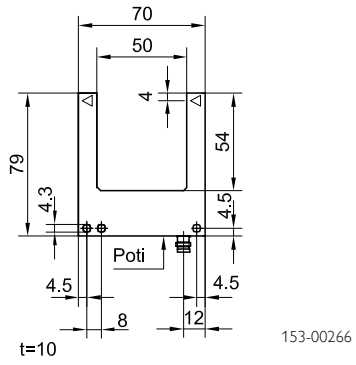
- Robust metal housings
- Small part detection from 0.4 mm
- High switching frequency of 1500 Hz
- Precise sensitivity adjustment via potentiometer
- N.O./N.C. switchable

Optical data		Functions	
Fork width	50 … 220 mm (see Selection Table)	Indicator LED, yellow	Switching output indicator
Type of light	LED, red, 640 nm	Sensitivity adjustment	Via potentiometer
Smallest detectable part	(See table)	Adjustment possibilities	N.O. / N.C. via potentiometer
Repeatability	0.04 mm[1] / 0.06 mm[2] / 0.08 mm[3]		
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC[4]	Dimensions	(See plug connection)
No-load current, I_0	≤ 35 mA	Enclosure rating	IP 67[5]
Output current, Ie	≤ 200 mA	Material, housing	Die-cast zinc (GD Zn)
Voltage drop, U_D	< 3 V	Material, active areas	Glass
Protective circuits	Reverse polarity protection, U_B / Short-circuit protection (Q)	Type of connection	See Selection Table
		Ambient temperature: operation	-10 … +60 °C
Protection Class	2	Ambient temperature: storage	-20 … +80 °C
Switching output, Q	PNP	Weight	See Selection Table
Output function	N.O. / N.C.	Vibration and impact resistance	EN 60947-5-2
Switching frequency, f (ti/tp 1:1)	1500 Hz		

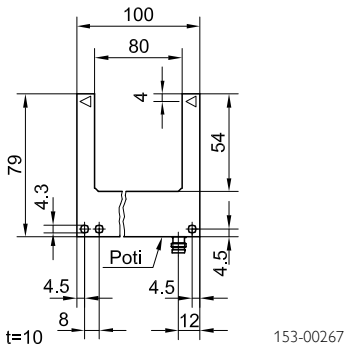
[1] FGL 50 [2] FGL 80 [3] FGL 120 / FGL 180 / FGL 220 [4] Max. 10 % ripple, within U_B [5] With connected IP 67 plug

Fork width	Type of connection	Weight	Part number	Article number
50 mm	Metal plug, M8x1, 3-pin	110 g	FGL 50-R-PSM3	830-11004
80 mm	Metal plug, M8x1, 3-pin	135 g	FGL 80-R-PSM3	830-11005
120 mm	Metal plug, M8x1, 3-pin	210 g	FGL 120-R-PSM3	830-11006
180 mm	Metal plug, M8x1, 3-pin	315 g	FGL 180-R-PSM3	830-11007
220 mm	Metal plug, M8x1, 3-pin	365 g	FGL 220-R-PSM3	830-11008

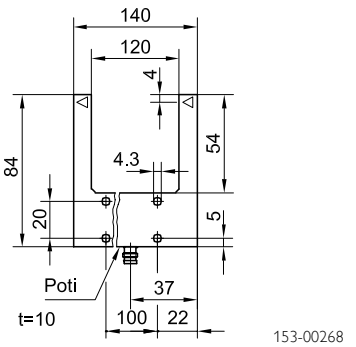
Plug connection (50 mm fork width)



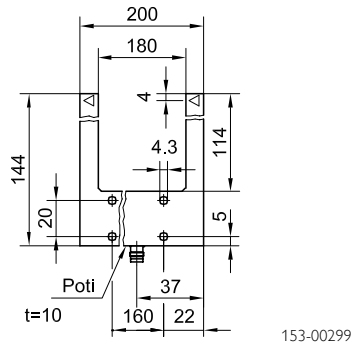
Plug connection (80 mm fork width)



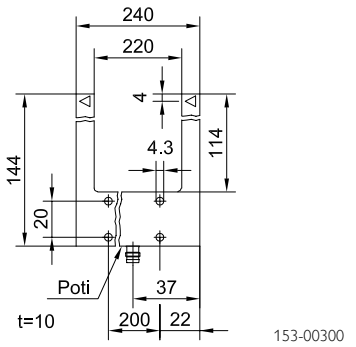
Plug connection (120 mm fork width)



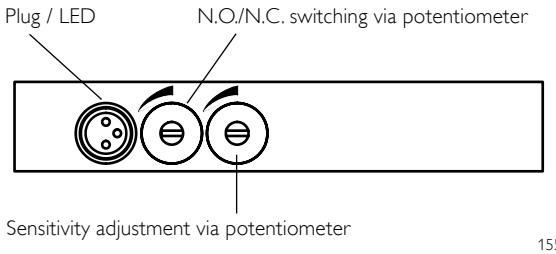
Plug connection (180 mm fork width)



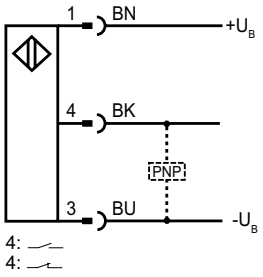
Plug connection (220 mm fork width)



Operating / display elements



Connection, 3-pin



10

Smallest detectable part

Type	FGL 50	FGL 80	FGL 120	FGL 180	FGL 220
Part size	0.4 mm	0.4 mm	0.8 mm	0.8 mm	0.8 mm

Accessories

Connection cables	From Page A-32

FG 40 / 80 / 120

Optical windows



PRODUCT HIGHLIGHTS

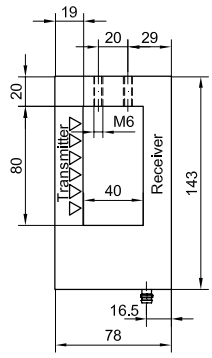
- Ideally suited for monitoring ejection
- Active zone 40, 80 or 120 mm
- Dynamic evaluation
- Adjustable output signal duration 10 … 300 ms

Optical data		Functions	
Window size	40 x 80 mm² / 80 x 80 mm² / 120 x 80 mm² (see Selection Table)	Display LED, green	Operating voltage indicator
Type of light	Infrared, 880 nm	Display LED, yellow	Switching output indicator
Resolution	0.8 mm[1] / 1.0 mm[2] / 1.5 mm[3]	Sensitivity adjustment	Via potentiometer
		Adjustment possibilities	Output signal duration via potentiometer
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC	Dimensions	(See plug connection)
No-load current, I_0	≤ 85 mA[1] / ≤ 125 mA[2] / ≤ 150 mA[3]	Enclosure rating	IP 65[4]
Output current, Ie	≤ 200 mA	Material, housing	Aluminium, anodised
Voltage drop,	≤ 3.5 V	Material, active areas	PMMA
Protective circuits	Reverse polarity protection, U_B / Short-circuit protection (Q)	Type of connection	See Selection Table
		Ambient temperature: operation	-10 … +55 °C
Protection Class	2	Weight	See Selection Table
Power On Delay	< 100 ms		
Switching output, Q	PNP		
Output function	N.O.		
Switching frequency, f (ti/tp 1:1)	3 … 100 Hz		

[1] FG 40 [2] FG 80 [3] FG 120 [4] With connected IP 65 plug

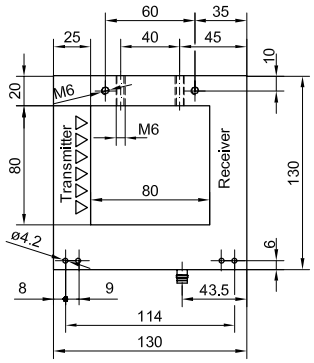
Window size	Switching output	Type of connection	Weight	Part number	Article number
40 x 80 mm²	PNP	Plug, M8x1, 3-pin	280 g	FG 40 I-PSM3	831-81000
80 x 80 mm²	PNP	Plug, M8x1, 3-pin	400 g	FG 80 I-PSM3	831-81001
120 x 80 mm²	PNP	Plug, M8x1, 3-pin	480 g	FG 120 I-PSM3	831-81002

Plug connection, FG 40



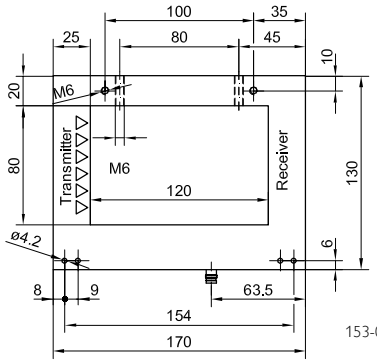
153-00293

Plug connection, FG 80



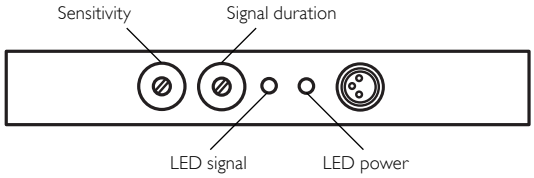
153-00294

Plug connection, FG 120



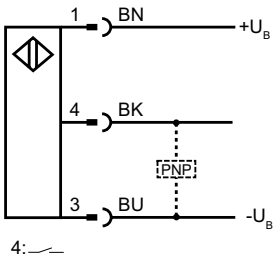
153-00295

Operating / display elements



155-01588

Connection, 3-pin



154-00160

Accessories

Connection cables	From Page A-32

10

Ultrasonic sensors

Reliable on almost all surfaces

UT 20
from Page 548

UT 20-S – miniature ultrasonic sensors with soundpipe
- *Reliable detection through the smallest of openings and drilled holes*
- *Ideal for measuring filling levels of microplates and for scanning circuit boards*
- *Small housings for installation in smallest of spaces*
- *PNP, NPN or analogue output options*

>> Page 548

UT 20 – miniature ultrasonic sensors
- *Small housing for installation in smallest of spaces*
- *High scanning distances of up to 700 mm with with compact miniature housing*
- *PNP, NPN or analogue output options*

>> Page 552

UT 12
from Page 564

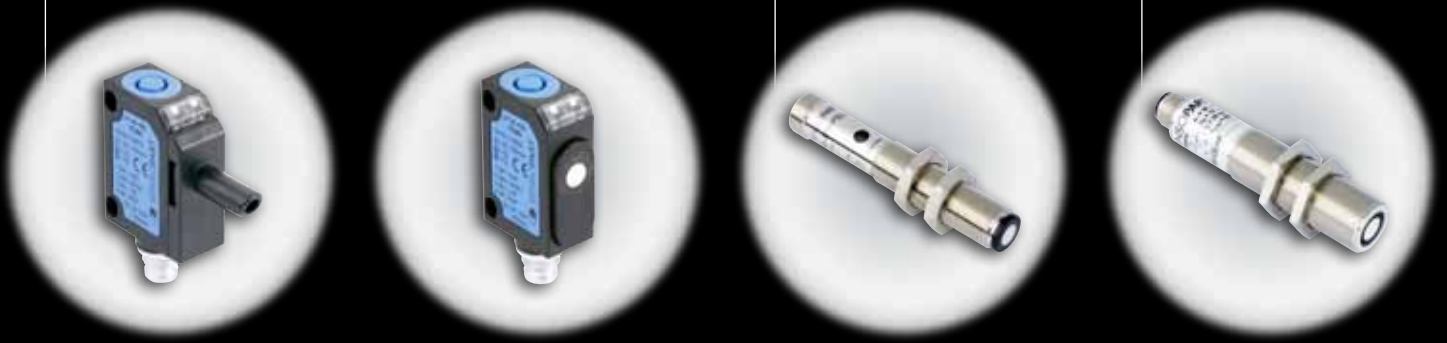
UT 12 – M12 ultrasonic sensors
- *Robust metal housings for harsh operating conditions*
- *Simple installation with universal M12 standard thread*
- *Simple sensor setting via control input*

>> Page 564

UT/UM 18
from Page 568

UT/UM 18 – M18 ultrasonic sensors
- *Robust brass or stainless steel housings for harsh operating conditions*
- *Simple installation with universal M18 standard thread*
- *Simple sensor setting via control input*

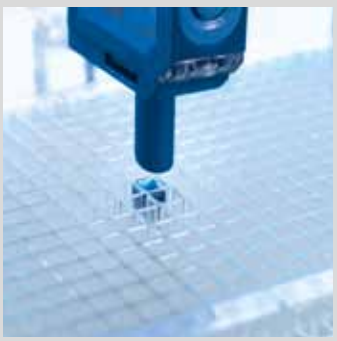
>> Page 568



Ultrasonic sensors may be a useful alternative where optical sensors come up against their physical limits. This applies, for example, for objects with uneven surfaces or under difficult ambient conditions, or with highly transparent media as well as moving, highly reflective liquid surfaces. Typical uses of ultrasonic sensors are therefore checking the presence of highly transparent foils and measuring the filling levels in liquid containers. A major advantage of ultrasonic sensors is the absolutely reliable background suppression resulting from their sound time-of-flight measurement principle.

The new ultrasonic sensor with soundpipe (UT 20S), in its very compact cubic housing, is a special product variant. As a result of its narrow sound cone, it allows the detection of objects even through the smallest of openings and drilled holes with a diameter of less than 5 mm. This makes it ideal for special applications, such as level measurement in the wells of microplates in medical analysis systems or for scanning circuit boards in the electronics industry.

The ultrasonic sensors of the UMT 30 series are real multifunctional artists. A three-digit display makes all sensor settings easy for users. The add-on menu with numerous supplementary functions, e.g. the synchronisation of several sensors or multiplex operation, in which several sensors measure after one another in ascending order, allows the UMT 30 to offer extremely flexible use for a wide range of applications.



The UT 20-S measuring levels in microplate wells.



Deflection mirrors are available for deflecting the sound beam when machine space is limited.

UMT 30

from Page 578

UMT 30 – M30 ultrasonic sensors with display

- *Long scanning distances up to 6 m*
- *Simple adjustment and direct measurement value output via display*
- *Automatic synchronisation and multiplex operation for the simultaneous operation of up to 10 sensors*
- *Numerous supplementary functions (add-on menu)*

>> Page 578



made in Germany

TYPICAL SENSOPART

- Reliable detection of objects with critical surfaces and highly transparent objects
- Available in cubic (32 x 20 x 12 mm³) or cylindrical (M12/M18/M30) housing options
- Simple adjustment via teach-in, control input or display
- PNP, NPN or analogue output options
- Tight metal or plastic housings (IP 67 & IP 65)
- Wide range of mounting accessories

Ultrasonic Sensors – Product Overview

	Adjustment	Scanning distances	Special features	Page
UT 20	Teach-in	140 mm / 150 mm / 240 mm / 700 mm	Ultrasonic sensors with soundpipe, PNP, NPN, analogue output	548
UT 12	Via control input	400 mm	PNP, NPN, analogue output	564
UT/UM 18	Via control input	250 mm / 300 mm / 800 mm	Variants with stainless steel housings, PNP, NPN, analogue output	568
UMT 30	Teach-in or display	350 mm / 1300 mm / 3400 mm / 6000 mm	Display, PNP, 2 x PNP or analogue output	578

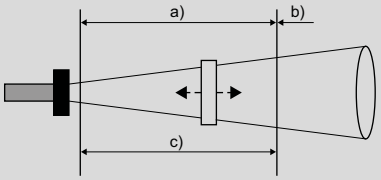
Ultrasonic sensors

System description

Method of function

Ultrasonic proximity switches operate on the basis of echo time-of-flight measurement. An ultrasonic pulse emitted by the sensor is reflected when it hits an object. The sensor calculates the distance from the time elapsed between emission of the ultrasonic pulse and receipt of the echo. Depending on the power amplifier, the measured distance is converted to a current or voltage signal (analogue sensor) proportional to the distance or the switching output is activated, depending on the set switching point.

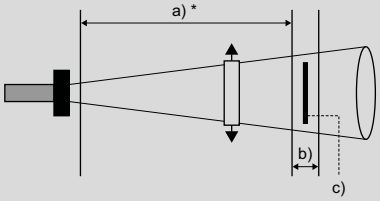
Applications



a) Output on
b) Output off
c) Adjusted switching distance

As a reflex scanner (proximity switch)

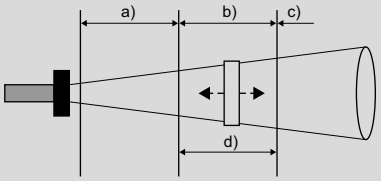
The classic operating mode uses background suppression, superior to other sensor principles. The switching output is activated when the object is located within the set switching distance. The switching point is subject to a hysteresis. This operating mode is suitable, for example, for detecting objects on a conveyor belt or for checking presence.



a)* Output on
b) Configured window
c) Reflector
* No object = output off

As a barrier or reflex switch

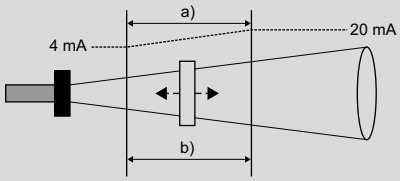
An ultrasonic sensor is used like a light barrier here, though no special reflector is employed (a piece of sheet metal is entirely sufficient here). For this purpose, the sensor in window mode is set in such a way that the reflector is located within the window. The ultrasonic reflex switch provides a signal as soon as an object is completely covered by the reflector. Whereby it is irrelevant whether the object absorbs the sound or even deflects it away. This operating mode is used for poorly detected material with irregular surfaces, e. g. foam.



a) Output off
b) Output on
c) Output off
d) Configured window

In window mode

The switching output is only activated when the object is located within a window that has been defined by setting two window limits. This can be used to monitor, for example, the correct bottle size in a crate of drinks. Bottles that are too tall or too short are diverted out.

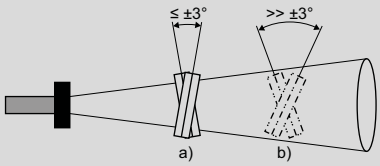


a) Linear output
b) Configured analogue window

Ultrasonic sensors with analogue output

In these models a voltage (0…10 V) or current (4…20 mA) is transmitted in proportion to the object distance. The window limits can be defined and selected between falling and rising characteristic curves.

Installation



a) Smooth
b) Rough

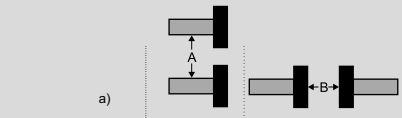
Ultrasonic sensors can be installed and operated in any orientation. Though installation locations that could lead to contamination of the sensor surface should be avoided because water droplets and encrustation can impair functional performance. Thin layers of dust and paint droplets generally have no effect.

If smooth surfaces are to be detected, sensors should be mounted as vertically as possible, i. e. at an angle of from 87° to 93° to the surface.

Rough surfaces, on the other hand, permit considerably greater angular deviations. A surface whose valley-to-peak depth is greater than or equal to the wavelength of the ultrasonic frequency is considered rough. The sound, however, is then reflected diffusely, which can lead to a reduction of the operating scanning distance. In this case the maximum permissible angular deviation and maximum scanning distance should be determined in trials.

Sound-absorbing materials (such as cotton wool or foam) can further reduce the scanning distance. In contrast, liquids and solid materials are good reflectors.

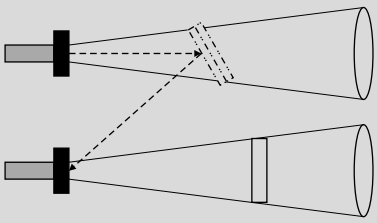
Mounting distances



a) Switching distance

0.25 m	≥ 0.35 m	≥ 2.50 m
0.35 m	≥ 0.40 m	≥ 2.50 m
1.30 m	≥ 1.10 m	≥ 8.00 m
3.40 m	≥ 2.00 m	≥ 18.00 m
6.00 m	≥ 4.00 m	≥ 30.00 m

The table provides the minimum distances between non-synchronised ultrasonic sensors. Sensors may mutually influence one another if these distances are not observed.



The above-mentioned mounting distances are only intended as a guide. In the case of tilting, the sound can be reflected towards the neighbouring sensor. The minimum distance should then be determined by means of trials. Some sensors permit synchronisation with one another and thus allow considerably lower scanning distances.

UT 20-S150

Ultrasonic sensor with soundpipe and switching output



PRODUCT HIGHLIGHTS

- Ideal for level control, particularly in narrow containers
- Narrow sound beam for precise detection even through small openings and drilled holes
- Reliable detection of highly transparent objects
- Detection independent of object colour and surface
- Compact miniature housings for use when space in machine is limited

Sensor data	
Limiting scanning distance	250 mm
Operating scanning distance	20 … 140 mm
Ultrasonic frequency	~ 380 kHz
Resolution	0.20 mm
Repeatability	± 0.15 %[1]
Hysteresis	2 mm
Temperature drift	0.17 % / °C

Functions	
LED indicator, green	Operating voltage indicator
LED indicator, yellow	Switching output indicator
Scanning distance adjustment	Via Teach-in button
Teach-in modes	Mode 1: set switching point Mode 2: set Window Mode Mode 3: set two-way / reflex switch
Adjustment possibilities	N.O. / N.C. via Teach-in button Button lock via Teach-in button Synchronisation via control input Default settings via Teach-in button
Default settings	Max. sensitivity and N.O.

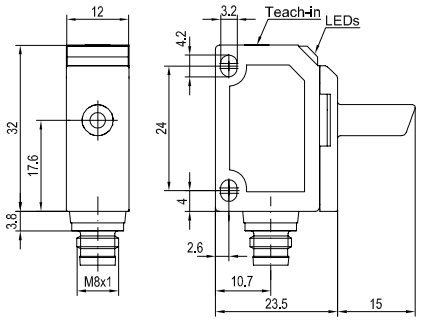
Electrical data	
Operating voltage, $+U_B$	20 … 30 V DC[2]
No-load current, I_0	≤ 25 mA
Output current, Ie	200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP / NPN (see Selection Table)
Output function	N.O. / N.C.
Switching frequency, f (ti/tp 1:1)	25 Hz
Response time	24 ms
Connection, WH	Sync.

Mechanical data	
Dimensions	32 x 38.5 x 12 mm
Enclosure rating	IP 67[3]
Material, housing	ABS
Material, ultrasonic converter	Polyurethane foam, epoxy resin with glass content
Type of connection	(See Selection Table)
Ambient temperature, operation	-25 … +70 °C
Ambient temperature, storage	-40 … +85 °C
Weight	10 g
Vibration and impact resistance	EN 60947-5-2

[1] From final value of limit scanning distance [2] Max. 10 % ripple, within U_B [3] With connected IP 67 plug

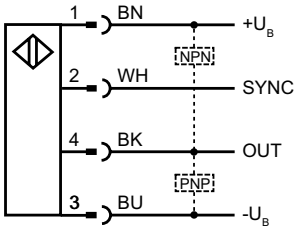
Operating scanning distance	Switching output	Type of connection	Part number	Article number
20 … 140 mm	PNP	Metal plug, M8x1, 4-pin	UT 20-S150-PSM4	693-11012
20 … 140 mm	NPN	Metal plug, M8x1, 4-pin	UT 20-S150-NSM4	693-11013

Plug connection



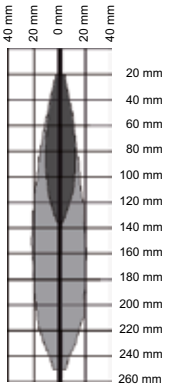
153-00982

Connection, 4-pin



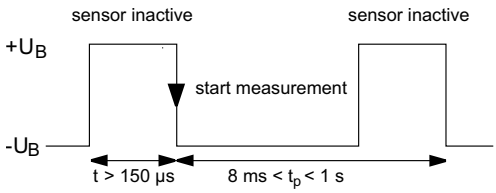
154-00116

Sound cone



155-01528

Synchronisation / triggering



Lay down a square-wave signal at the Sync input.
Pulse width t > 150 µs, repeat rate, t_p = 8 ms … 1 s.
A high level, $+U_B$ at Sync input deactivates the sensor.

155-00131

11

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

UT 20-S150-A

Ultrasonic sensor with soundpipe and analogue output



PRODUCT HIGHLIGHTS

- Ideal for level control, particularly in narrow containers
- Narrow sound beam for precise detection even through small openings and drilled holes
- Reliable detection of highly transparent objects
- Compact miniature housings for use when space in machine is limited
- Analogue output 0 … 10 V or 4 … 20 mA

Sensor data[1]		Functions	
Limiting scanning distance	250 mm	LED indicator, green	Operating voltage indicator
Operating scanning distance	20 … 140 mm	LED indicator, yellow	Switching output indicator
Ultrasonic frequency	~ 380 kHz	Set analogue characteristic	Via Teach-in button
Resolution	0.20 mm	Adjustment possibilities	Rising / falling edge via Teach-in button Button lock via Teach-in button Synchronisation via control input Default settings via Teach-in button
Repeatability	± 0.15 %[2]		
Temperature drift	≤ 2 %		

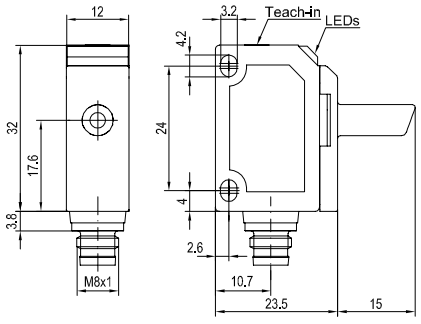
Electrical data		Mechanical data	
Operating voltage, $+U_B$	20 … 30 V DC[3]	Dimensions	32 x 38.5 x 12 mm
No-load current, I_0	≤ 25 mA	Enclosure rating	IP 67[4]
Current output	R_a < 500 Ω	Material, housing	ABS
Voltage output	R_a > 500 Ω	Material, ultrasonic converter	Polyurethane foam, epoxy resin with glass content
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Type of connection	(See Selection Table)
Protection Class	2	Ambient temperature, operation	-25 … +70 °C
Power On Delay	< 300 ms	Ambient temperature, storage	-40 … +85 °C
Analogue output	0 … 10 V / 4 … 20 mA (see Selection Table)	Weight	10 g
Response time	30 ms	Vibration and impact resistance	EN 60947-5-2
Connection, WH	Sync.		

[1] After 30 min. settling time [2] From final value of limit scanning distance [3] Max. 10 % ripple, within U_B [4] With connected IP 67 plug

Operating scanning distance	Analogue output	Type of connection	Part number	Article number
20 … 140 mm	0 … 10 V	Metal plug, M8x1, 4-pin	UT 20-S150-AUM4	693-11014
20 … 140 mm	4 … 20 mA	Metal plug, M8x1, 4-pin	UT 20-S150-AIM4	693-11015

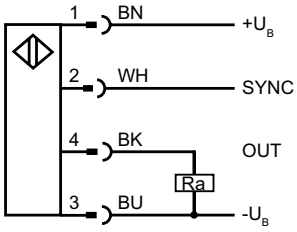
Version: 10/2013. Subject to changes; diagrams similar

Plug connection



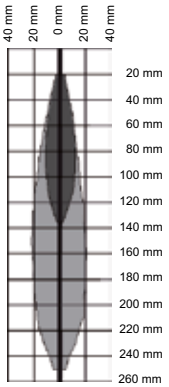
153-00982

Connection, 4-pin



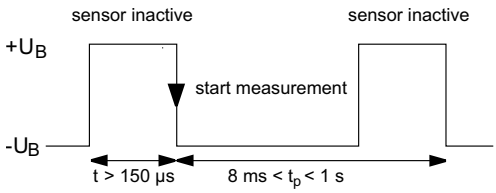
154-00115

Sound cone



155-01528

Synchronisation / triggering



Lay down a square-wave signal at the Sync input.
Pulse width t > 150 µs, repeat rate, t_p = 8 ms … 1 s.
A high level, $+U_B$ at Sync input deactivates the sensor.

155-00131

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

11

UT 20-150

Ultrasonic sensor with switching output



PRODUCT HIGHLIGHTS

- Detection regardless of object colour and surface
- Compact miniature housing for use when machine space is limited
- Robust ambient conditions have no effect on sensor
- Reliable detection of highly transparent objects

Sensor data	
Limit scanning distance	250 mm
Operating scanning distance	20 … 150 mm
Ultrasonic frequency	~ 380 kHz
Resolution	0.20 mm
Repeatability	± 0.15 %[1]
Hysteresis	2 mm
Temperature drift	0.17 % / °C

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Scanning distance adjustment	Via Teach-in button
Teach-in modes	Mode 1: set switching point Mode 2: set window operation Mode 3: set two-way / retroflective sensor
Adjustment possibilities	N.O. / N.C. via Teach-in button Button lock via Teach-in button Synchronisation via control input Default settings via Teach-in button
Default settings	Max. sensitivity and N.O.

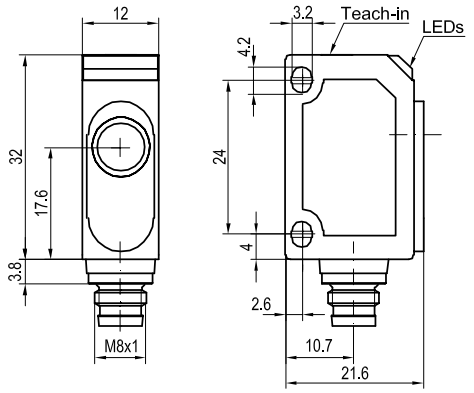
Electrical data	
Operating voltage, $+U_B$	20 … 30 V DC[2]
No-load current, I_0	≤ 25 mA
Output current, Ie	200 mA
Protective circuits	Reverse polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP / NPN (see Selection Table)
Output function	N.O. / N.C.
Switching frequency, f (ti/tp 1:1)	25 Hz
Response time	24 ms
Connection, WH	Sync.

Mechanical data	
Dimensions	32 x 21.6 x 12 mm
Enclosure rating	IP 67[3]
Material, housing	ABS
Material, ultrasonic converter	Polyurethane foam, epoxy resin with glass content
Type of connection	(See Selection Table)
Ambient temperature: operation	-25 … +70 °C
Ambient temperature: storage	-40 … +85 °C
Weight	10 g
Vibration and impact resistance	EN 60947-5-2

[1] From end-value of limit scanning distance [2] Max. 10 % ripple, within U_B [3] With connected IP 67 plug

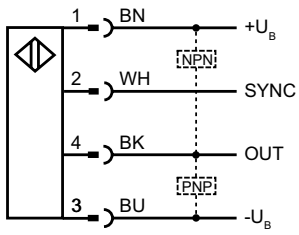
Operating scanning distance	Switching output	Type of connection	Part number	Article number
20 … 150 mm	PNP	Metal plug, M8x1, 4-pin	UT 20-150-PSM4	693-11000
20 … 150 mm	NPN	Metal plug, M8x1, 4-pin	UT 20-150-NSM4	693-11001

Plug connection



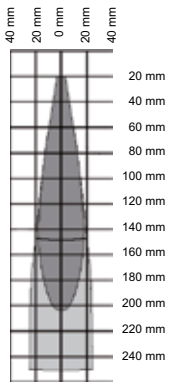
153-00391

Connection, 4-pin



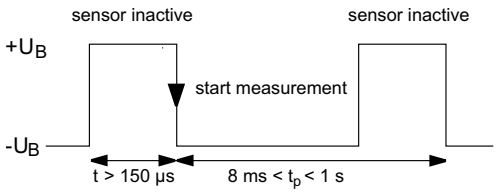
154-00116

Sound cone



155-00132

Synchronisation / triggering



Lay down a square-wave signal at the Sync input.
Pulse width t > 150 µs, repeat rate, t_p = 8 ms … 1 s.
A high level, $+U_B$ at Sync input deactivates the sensor.

155-00131

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

UT 20-150-A

Ultrasonic sensor with analogue output



PRODUCT HIGHLIGHTS

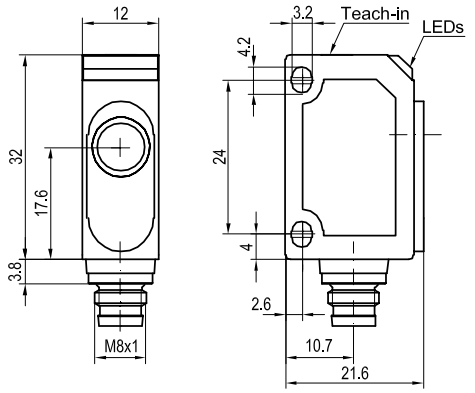
- Detection regardless of object colour and surface
- Compact miniature housing for use when machine space is limited
- Synchronisation input – simultaneous operation of several sensors in highly limited spaces
- Analogue output: 0 … 10 V or 4 … 20 mA

Sensor data[1]		Functions	
Limit scanning distance	250 mm	Indicator LED, green	Operating voltage indicator
Operating scanning distance	20 … 150 mm	Indicator LED, yellow	Switching output indicator
Ultrasonic frequency	~ 380 kHz	Set characteristic analogue curve	Via Teach-in button
Resolution	0.20 mm	Adjustment possibilities	Rising / falling slope via Teach-in button Button lock via Teach-in button Synchronisation via control input Default settings via Teach-in button
Repeatability	± 0.15 %[2]		
Temperature drift	≤ 2 %		
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	20 … 30 V DC[3]	Dimensions	32 x 21.6 x 12 mm
No-load current, I_0	≤ 25 mA	Enclosure rating	IP 67[4]
Current output	R_a < 500 Ω	Material, housing	ABS
Voltage output	R_a > 500 Ω	Material, ultrasonic converter	Polyurethane foam, epoxy resin with glass content
Protective circuits	Reverse polarity protection, U_B / short-circuit protection (Q)	Type of connection	(See Selection Table)
Protection Class	2	Ambient temperature: operation	-25 … +70 °C
Power On Delay	< 300 ms	Ambient temperature: storage	-40 … +85 °C
Analogue output	0 … 10 V / 4 … 20 mA (see Selection Table)	Weight	10 g
Response time	30 ms	Vibration and impact resistance	EN 60947-5-2
Connection, WH	Sync.		

[1] After 30 minutes settling time [2] From end-value of limit scanning distance [3] Max. 10 % ripple, within U_B [4] With connected IP 67 plug

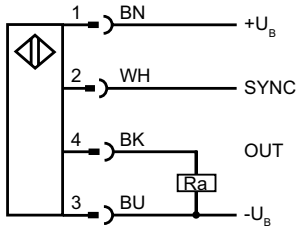
Operating scanning distance	Analogue output	Type of connection	Part number	Article number
20 … 150 mm	0 … 10 V	Metal plug, M8x1, 4-pin	UT 20-150-AUM4	693-11004
20 … 150 mm	4 … 20 mA	Metal plug, M8x1, 4-pin	UT 20-150-AIM4	693-11005

Plug connection



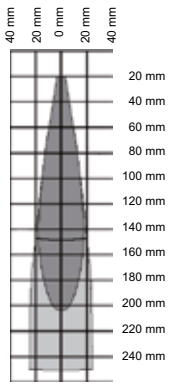
153-00391

Connection, 4-pin



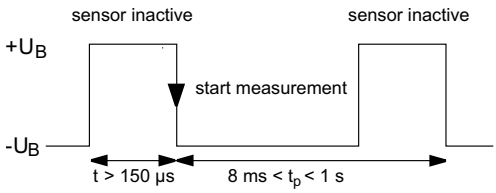
154-00115

Sound cone



155-00132

Synchronisation / triggering



Lay down a square-wave signal at the Sync input.
Pulse width t > 150 µs, repeat rate, t_p = 8 ms … 1 s.
A high level, $+U_B$ at Sync input deactivates the sensor.

155-00131

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

11

UT 20-240

Ultrasonic sensor with switching output



PRODUCT HIGHLIGHTS

- Ideal for monitoring filling levels, e.g. of liquids
- Reliable detection of highly transparent objects
- Detection regardless of object colour and surface
- Compact miniature housings for use when machine space is limited

Sensor data	
Limit scanning distance	350 mm
Operating scanning distance	50 … 240 mm
Ultrasonic frequency	~500 kHz
Resolution	0.20 mm
Repeatability	± 0.15 %[1]
Hysteresis	2 mm
Temperature drift	0.17 % / °C

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Scanning distance adjustment	Via Teach-in button
Teach-in modes	Mode 1: set switching point Mode 2: set window operation Mode 3: set two-way / retroflective sensor
Adjustment possibilities	N.O. / N.C. via Teach-in button Button lock via Teach-in button Synchronisation via control input Default settings via Teach-in button
Default settings	Max. sensitivity and N.O.

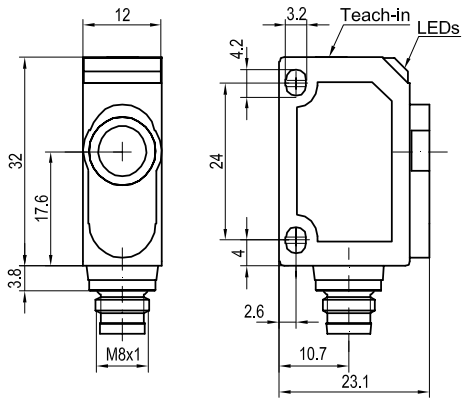
Electrical data	
Operating voltage, $+U_B$	20 … 30 V DC[2]
No-load current, I_0	≤ 25 mA
Output current, Ie	200 mA
Protective circuits	Reverse polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP / NPN (see Selection Table)
Output function	N.O. / N.C.
Switching frequency, f (ti/tp 1:1)	25 Hz
Response time	24 ms
Connection, WH	Sync.

Mechanical data	
Dimensions	32 x 23.1 x 12 mm
Enclosure rating	IP 67[3]
Material, housing	ABS
Material, ultrasonic converter	Polyurethane foam, epoxy resin with glass content
Type of connection	(See Selection Table)
Ambient temperature: operation	-25 … +70 °C
Ambient temperature: storage	-40 … +85 °C
Weight	10 g
Vibration and impact resistance	EN 60947-5-2

[1] From end-value of limit scanning distance [2] Max. 10 % ripple, within U_B [3] With connected IP 67 plug

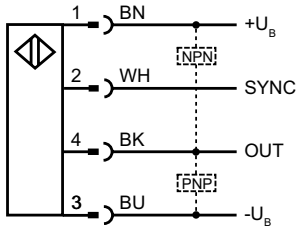
Operating scanning distance	Switching output	Type of connection	Part number	Article number
50 … 240 mm	PNP	Metal plug, M8x1, 4-pin	UT 20-240-PSM4	693-11002
50 … 240 mm	NPN	Metal plug, M8x1, 4-pin	UT 20-240-NSM4	693-11003

Plug connection



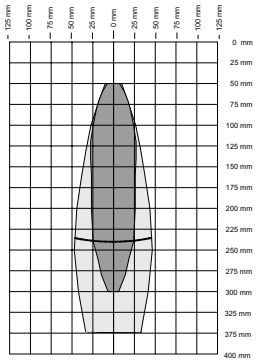
153-00469

Connection, 4-pin



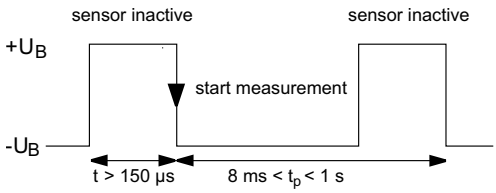
154-00116

Sound cone



155-00286

Synchronisation / triggering



Lay down a square-wave signal at the Sync input.
Pulse width t > 150 µs, repeat rate, t_p = 8 ms … 1 s.
A high level, $+U_B$ at Sync input deactivates the sensor.

155-00131

11

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

UT 20-240-A

Ultrasonic sensor with analogue output



PRODUCT HIGHLIGHTS

- Detection regardless of object colour and surface
- Compact miniature housing for use when machine space is limited
- Analogue output: 0 … 10 V or 4 … 20 mA
- Synchronisation input – simultaneous operation of several sensors in highly limited spaces

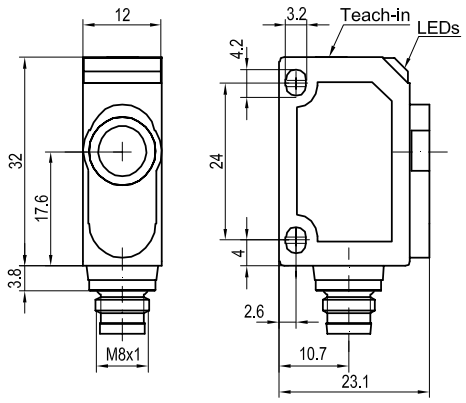
Sensor data[1]		Functions	
Limit scanning distance	350 mm	Indicator LED, green	Operating voltage indicator
Operating scanning distance	50 … 240 mm	Indicator LED, yellow	Switching output indicator
Ultrasonic frequency	~ 500 kHz	Set characteristic analogue curve	Via Teach-in button
Resolution	0.20 mm	Adjustment possibilities	Rising / falling slope via Teach-in button Button lock via Teach-in button Synchronisation via control input Default settings via Teach-in button
Repeatability	± 0.15 %[2]		
Temperature drift	≤ 2 %		
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	20 … 30 V DC[3]	Dimensions	32 x 23.1 x 12 mm
No-load current, I_0	≤ 25 mA	Enclosure rating	IP 67[4]
Current output	R_a < 500 Ω	Material, housing	ABS
Voltage output	R_a > 500 Ω	Material, ultrasonic converter	Polyurethane foam, epoxy resin with glass content
Protective circuits	Reverse polarity protection, U_B / short-circuit protection (Q)	Type of connection	(See Selection Table)
Protection Class	2	Ambient temperature: operation	-25 … +70 °C
Power On Delay	< 300 ms	Ambient temperature: storage	-40 … +85 °C
Analogue output	0 … 10 V / 4 … 20 mA (see Selection Table)	Weight	10 g
Response time	30 ms	Vibration and impact resistance	EN 60947-5-2
Connection, WH	Sync.		

[1] After 30 minutes settling time [2] From end-value of limit scanning distance [3] Max. 10 % ripple, within U_B [4] With connected IP 67 plug

Operating scanning distance	Analogue output	Type of connection	Part number	Article number
50 … 240 mm	0 … 10 V	Metal plug, M8x1, 4-pin	UT 20-240-AUM4	693-11006
50 … 240 mm	4 … 20 mA	Metal plug, M8x1, 4-pin	UT 20-240-AIM4	693-11007

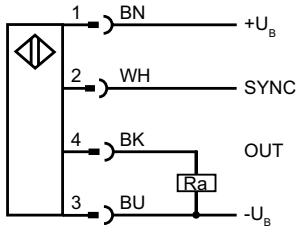
Version: 10/2013. Subject to changes; diagrams similar

Plug connection



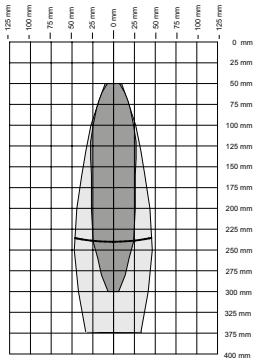
153-00469

Connection, 4-pin



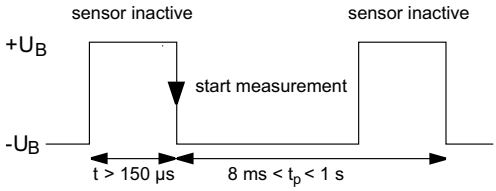
154-00115

Sound cone



155-00286

Synchronisation / triggering



Lay down a square-wave signal at the Sync input.
Pulse width t > 150 µs, repeat rate, t_p = 8 ms … 1 s.
A high level, $+U_B$ at Sync input deactivates the sensor.

155-00131

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

UT 20-700

Ultrasonic sensor with switching output



PRODUCT HIGHLIGHTS

- Long scanning distance of 700 mm with small and compact housing
- Ideal for monitoring filling levels, e.g. of liquids
- Detection regardless of object colour and surface
- Synchronisation input – simultaneous operation of several sensors in highly limited spaces

Sensor data	
Limit scanning distance	1000 mm
Operating scanning distance	120 … 700 mm
Ultrasonic frequency	~ 300 kHz
Resolution	0.20 mm
Repeatability	± 0.15 %[1]
Hysteresis	2 mm
Temperature drift	0.17 % / °C

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Scanning distance adjustment	Via Teach-in button
Teach-in modes	Mode 1: set switching point Mode 2: set window operation Mode 3: set two-way / retroflective sensor
Adjustment possibilities	N.O. / N.C. via Teach-in button Button lock via Teach-in button Synchronisation via control input Default settings via Teach-in button
Default settings	Max. sensitivity and N.O.

Electrical data	
Operating voltage, $+U_B$	20 … 30 V DC[2]
No-load current, I_0	≤ 35 mA
Output current, Ie	200 mA
Protective circuits	Reverse polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	PNP / NPN (see Selection Table)
Output function	N.O. / N.C.
Switching frequency, f (ti/tp 1:1)	14 Hz
Response time	42 ms
Connection, WH	Sync.

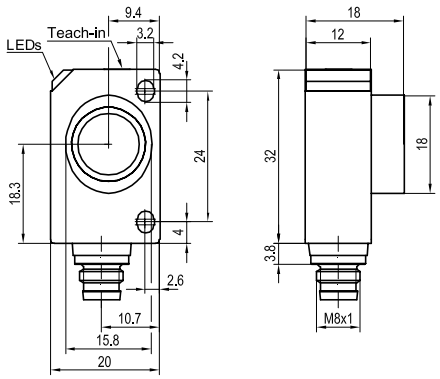
Mechanical data	
Dimensions	32 x 20 x 18 mm
Enclosure rating	IP 67[3]
Material, housing	ABS
Material, ultrasonic converter	Polyurethane foam, epoxy resin with glass content
Type of connection	(See Selection Table)
Ambient temperature: operation	-25 … +70 °C
Ambient temperature: storage	-40 … +85 °C
Weight	10 g
Vibration and impact resistance	EN 60947-5-2

[1] From end-value of limit scanning distance [2] Max. 10 % ripple, within U_B [3] With connected IP 67 plug

Operating scanning distance	Switching output	Type of connection	Part number	Article number
120 … 700 mm	PNP	Metal plug, M8x1, 4-pin	UT 20-700-PSM4	693-11008
120 … 700 mm	NPN	Metal plug, M8x1, 4-pin	UT 20-700-NSM4	693-11009

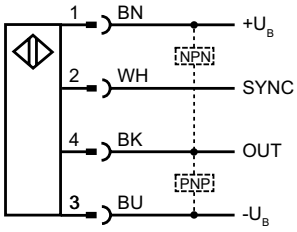
Version: 10/2013. Subject to changes; diagrams similar

Plug connection



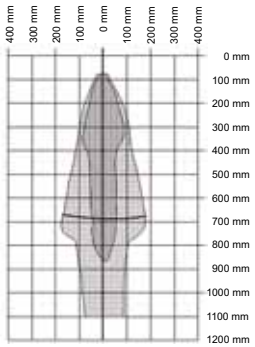
153-00444

Connection, 4-pin



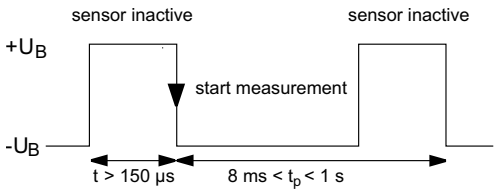
154-00116

Sound cone



155-00440

Synchronisation / triggering



Lay down a square-wave signal at the Sync input.
Pulse width t > 150 µs, repeat rate, t_p = 8 ms … 1 s.
A high level, $+U_B$ at Sync input deactivates the sensor.

155-00131

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

UT 20-700-A

Ultrasonic sensor with analogue output



PRODUCT HIGHLIGHTS

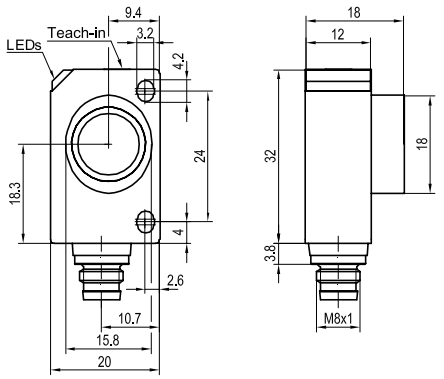
- Long scanning distance of 700 mm with small and compact housings
- Analogue output: 0 … 10 V or 4 … 20 mA
- Ideal for monitoring filling levels, e.g. of liquids
- Detection regardless of object colour and surface

Sensor data[1]		Functions	
Limit scanning distance	1000 mm	Indicator LED, green	Operating voltage indicator
Operating scanning distance	120 … 700 mm	Indicator LED, yellow	Switching output indicator
Ultrasonic frequency	~ 300 kHz	Set characteristic analogue curve	Via Teach-in button
Resolution	0.20 mm	Adjustment possibilities	Rising/falling edge via Teach-in button Button lock via Teach-in button Synchronisation via control input Default settings via Teach-in button
Repeatability	± 0.15 %[2]		
Temperature drift	≤ 2 %		
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	20 … 30 V DC[2]	Dimensions	32 x 20 x 18 mm
No-load current, I_0	≤ 35 mA	Enclosure rating	IP 67[3]
Current output	R_a < 500 Ω	Material, housing	ABS
Voltage output	R_a > 500 Ω	Material, ultrasonic converter	Polyurethane foam, epoxy resin with glass content
Protective circuits	Reverse polarity protection, U_B / short-circuit protection (Q)	Type of connection	(See Selection Table)
Protection Class	2	Ambient temperature: operation	-25 … +70 °C
Power On Delay	< 300 ms	Ambient temperature: storage	-40 … +85 °C
Analogue output	0 … 10 V / 4 … 20 mA (see Selection Table)	Weight	10 g
Response time	30 ms	Vibration and impact resistance	EN 60947-5-2
Connection, WH	Sync.		

[1] After 30 minutes settling time [2] Max. 10 % ripple, within U_B [3] With connected IP 67 plug

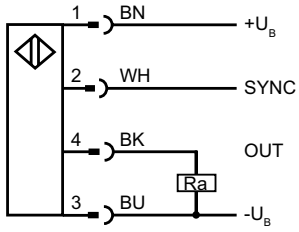
Operating scanning distance	Analogue output	Type of connection	Part number	Article number
120 … 700 mm	0 … 10 V	Metal plug, M8x1, 4-pin	UT 20-700-AUM4	693-11010
120 … 700 mm	4 … 20 mA	Metal plug, M8x1, 4-pin	UT 20-700-AIM4	693-11011

Plug connection



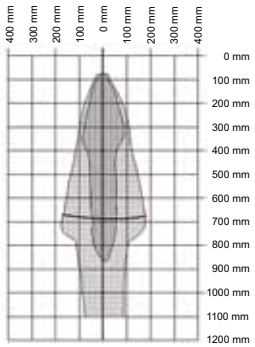
153-00444

Connection, 4-pin



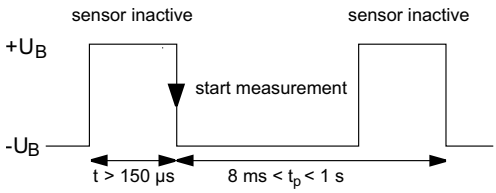
154-00115

Sound cone



155-00440

Synchronisation / triggering



Lay down a square-wave signal at the Sync input.
Pulse width t > 150 µs, repeat rate, t_p = 8 ms … 1 s.
A high level, $+U_B$ at Sync input deactivates the sensor.

155-00131

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

UT 12-370-P

Ultrasonic sensor with switching output



CE

PRODUCT HIGHLIGHTS

- Robust M12 metal housing for harsh operating conditions
- Detection regardless of object colour and surface
- Simple sensor adjustment via control input

Sensor data	
Operating scanning distance	30 … 400 mm
Adjustment range	50 … 400 mm
Ultrasonic frequency	~ 310 kHz
Hysteresis	1 %[1]
Temperature drift	± 1.5 %[2]
Repeatability	≤ 1 %

Functions	
Indicator LED, yellow	Switching output indicator
Indicator LED, red	Fault indicator
Scanning distance adjustment	Via control input
Teach-in modes	Mode 1: set switching point (N.O. / N.C.) Mode 2: set window operation (N.O. / N.C.)
Default settings	Switching point 1 = 50 mm, Switching point 2 = 400 mm

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[3]
No-load current, I_0	≤ 30 mA
Output current, Ie	100 mA
Voltage drop, U_D	≤ 3 V
Protective circuits	Short-circuit protection (Q) / overload protection
Switching output, Q	PNP
Output function	N.O. / N.C.
Switching frequency, f (ti/tp 1:1)	≤ 8 Hz
Response time	≤ 50 ms
Control input, WH	- U_B = switching point 1 + U_B = switching point 2

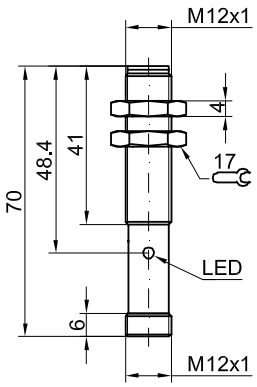
Mechanical data	
Dimensions	M12 x 70 mm
Enclosure rating	IP 65[4]
Material, housing	Nickel-plated brass
Material, ultrasonic converter	Polyurethane foam, epoxy resin with glass content, PBT (lid)
Type of connection	(See Selection Table)
Ambient temperature: operation	-25 … +70 °C
Ambient temperature: storage	-40 … +85 °C
Weight	25 g

[1] Relating to set switching distance [2] From end-value [3] Max. 10 % ripple, within U_B [4] With connected IP 65 plug

Operating scanning distance	Switching output	Type of connection	Part number	Article number
30 … 400 mm	PNP	Plug, M12x1, 4-pin	UT 12-370-PSL4	690-10100

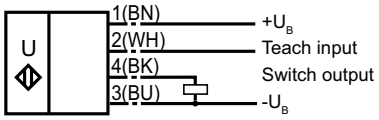
Version: 10/2013. Subject to changes; diagrams similar

Plug connection



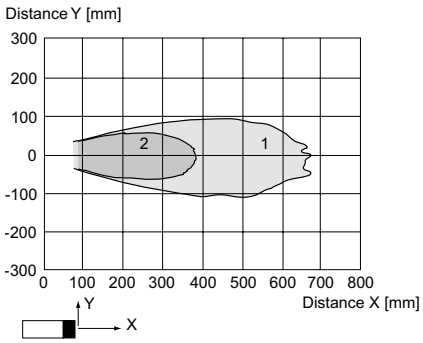
153-00583

Connection, 4-pin



154-00470

Sound cone



Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

155-00663

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

11

UT 12-370-A

Ultrasonic sensor with analogue output



CE

PRODUCT HIGHLIGHTS

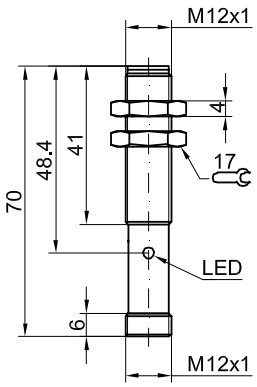
- Robust M12 metal housing for harsh operating conditions
- Analogue output: 4 … 20 mA
- Simple sensor adjustment via control input

Sensor data		Functions	
Operating scanning distance	30 … 400 mm	Indicator LED, yellow	Switching output indicator
Adjustment range	50 … 400 mm	Indicator LED, red	Fault indicator
Ultrasonic frequency	~ 310 kHz	Set characteristic analogue curve	Via control input
Resolution	0.40 mm[1]	Adjustment possibilities	Rising / falling slope via control input
Temperature drift	± 1.5 %[2]	Default settings	Evaluation limit 1 = 50 mm Evaluation limit 2 = 400 mm
Repeatability	± 0.5 %[2]		
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC[3]	Dimensions	M12 x 70 mm
No-load current, I_0	≤ 30 mA	Enclosure rating	IP 65[4]
Current output	R_a < 300 Ω	Material, housing	Nickel-plated brass
Protective circuits	Short-circuit protection (Q) / overload protection	Material, ultrasonic converter	Polyurethane foam, epoxy resin with glass content, PBT (lid)
Analogue output	4 … 20 mA	Type of connection	(See Selection Table)
Response time	≤ 50 ms	Ambient temperature: operation	-25 … +70 °C
Control input, WH	- U_B = lower evaluation limit + U_B = upper evaluation limit	Ambient temperature: storage	-40 … +85 °C
		Weight	25 g

[1] With max. detection range [2] From end-value [3] Max. 10 % ripple, within U_B [4] With connected IP 65 plug

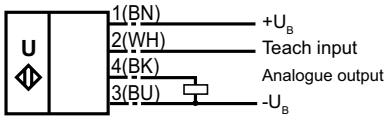
Operating scanning distance	Analogue output	Type of connection	Part number	Article number
30 … 400 mm	4 … 20 mA	Plug, M12x1, 4-pin	UT 12-370-A-IL4	690-10101

Plug connection



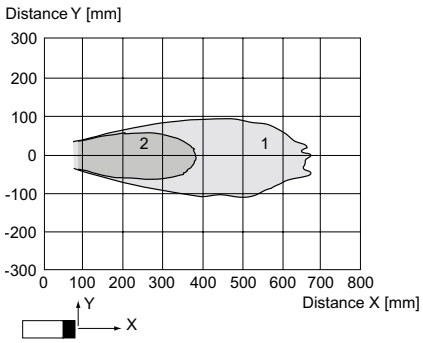
153-00583

Connection, 4-pin



154-00469

Sound cone



Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

155-00663

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

UT 18-270-P

Ultrasonic sensor with switching output



CE

PRODUCT HIGHLIGHTS

- Robust M18 metal housing for harsh operating conditions
- Detection regardless of object colour and surface
- Adjustable window mode
- Selectable N.O. / N.C.

Sensor data	
Operating scanning distance	30 … 300 mm
Adjustment range	50 … 300 mm
Ultrasonic frequency	~ 390 kHz
Hysteresis	1 %[1]
Temperature drift	± 1.5 %[2]
Repeatability	≤ 1 %

Functions	
Indicator LED, yellow	Switching output indicator
Indicator LED, red	Fault indicator
Scanning distance adjustment	Via control input
Teach-in modes	Mode 1: set switching point (N.O. / N.C.) Mode 2: set window operation (N.O. / N.C.)
Default settings	Switching point 1 = 50 mm Switching point 2 = 300 mm

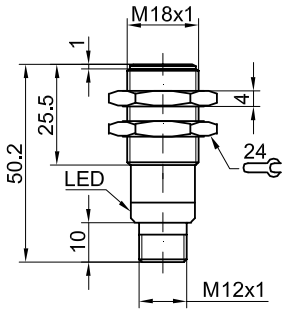
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[3]
No-load current, I_0	≤ 20 mA
Output current, Ie	200 mA
Voltage drop, U_D	≤ 3 V
Protective circuits	Short-circuit protection (Q) / overload protection
Switching output, Q	PNP
Output function	N.O. / N.C.
Switching frequency, f (ti/tp 1:1)	≤ 13 Hz
Response time	≤ 30 ms
Control input, WH	- U_B = switching point 1 + U_B = switching point 2

Mechanical data	
Dimensions	M18 x 50.2 mm
Enclosure rating	IP 65[4]
Material, housing	Nickel-plated brass
Material, ultrasonic converter	Polyurethane foam, epoxy resin with glass content, PBT (lid)
Type of connection	(See Selection Table)
Ambient temperature: operation	-25 … +70 °C
Ambient temperature: storage	-40 … +85 °C
Weight	25 g

[1] Relating to set switching distance [2] From end-value [3] Max. 10 % ripple, within U_B [4] With connected IP 65 plug

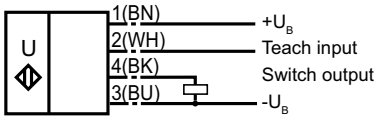
Operating scanning distance	Switching output	Type of connection	Part number	Article number
30 … 300 mm	PNP	Plug, M12x1, 4-pin	UT 18-270-PSL4	690-10102

Plug connection



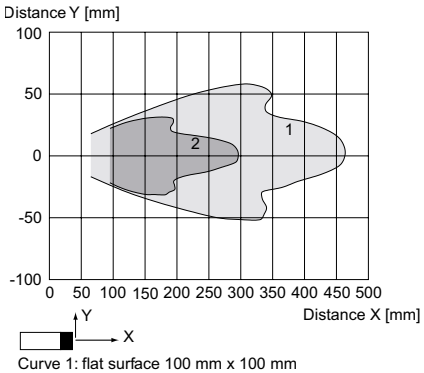
153-00582

Connection, 4-pin



154-00470

Sound cone



Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

155-00661

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

11

UT 18-270-A

Ultrasonic sensor with analogue output



CE

PRODUCT HIGHLIGHTS

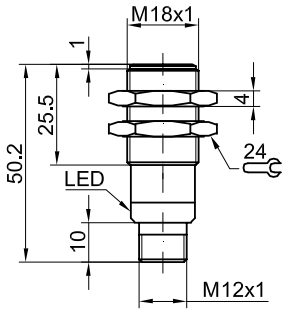
- Robust M18 metal housing for harsh operating conditions
- Detection regardless of object colour and surface
- Analogue output: 4 … 20 mA
- Rising/falling output characteristic adjustable

Sensor data		Functions	
Operating scanning distance	30 … 300 mm	Indicator LED, yellow	Switching output indicator
Adjustment range	50 … 300 mm	Indicator LED, red	Fault indicator
Ultrasonic frequency	~ 390 kHz	Set characteristic analogue curve	Via control input
Resolution	0.40 mm[1]	Adjustment possibilities	Rising / falling slope via control input
Temperature drift	± 1.5 %[2]	Default settings	Evaluation limit 1 = 50 mm Evaluation limit 2 = 300 mm
Repeatability	± 0.5 %[2]		
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC[3]	Dimensions	M18 x 50.2 mm
No-load current, I_0	≤ 20 mA	Enclosure rating	IP 65[4]
Current output	R_a < 300 Ω	Material, housing	Nickel-plated brass
Protective circuits	Short-circuit protection (Q) / overload protection	Material, ultrasonic converter	Polyurethane foam, epoxy resin with glass content, PBT (lid)
Analogue output	4 … 20 mA	Type of connection	(See Selection Table)
Response time	≤ 30 ms	Ambient temperature: operation	-25 … +70 °C
Control input, WH	- U_B = lower evaluation limit + U_B = upper evaluation limit	Ambient temperature: storage	-40 … +85 °C
		Weight	25 g

[1] With max. detection range [2] From end-value [3] Max. 10 % ripple, within U_B [4] With connected IP 65 plug

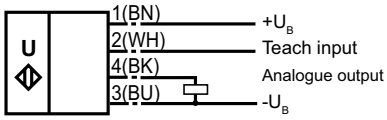
Operating scanning distance	Analogue output	Type of connection	Part number	Article number
30 … 300 mm	4 … 20 mA	Plug, M12x1, 4-pin	UT 18-270-A-IL4	690-10103

Plug connection



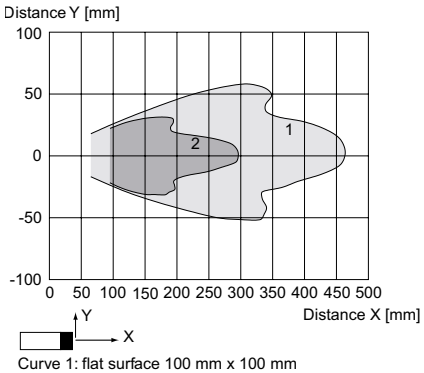
153-00582

Connection, 4-pin



154-00469

Sound cone



Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

155-00661

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

11

UT 18-750-P

Ultrasonic sensor with switching output



CE

PRODUCT HIGHLIGHTS

- Long operating scanning distance of 800 mm
- Robust M18 metal housing for harsh operating conditions
- Simple sensor adjustment via control input
- Window mode adjustable
- N.O. / N.C. selectable

Sensor data	
Operating scanning distance	50 … 800 mm
Adjustment range	70 … 800 mm
Ultrasonic frequency	~ 205 kHz
Hysteresis	1 %[1]
Temperature drift	± 1.5 %[2]
Repeatability	≤ 1 %

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Indicator LED, red	Fault indicator
Scanning distance adjustment	Via control input
Teach-in modes	Mode 1: set switching point (N.O. / N.C.) Mode 2: set window operation (N.O. / N.C.)
Default settings	Switching point 1 = 70 mm Switching point 2 = 800 mm

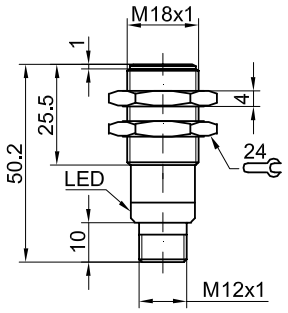
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[3]
No-load current, I_0	≤ 20 mA
Output current, Ie	200 mA
Voltage drop, U_D	≤ 3 V
Protective circuits	Short-circuit protection (Q) / overload protection
Switching output, Q	PNP
Output function	N.O. / N.C.
Switching frequency, f (ti/tp 1:1)	≤ 4 Hz
Response time	≤ 100 ms
Control input, WH	- U_B = switching point 1 + U_B = switching point 2

Mechanical data	
Dimensions	M18 x 50.2 mm
Enclosure rating	IP 65[4]
Material, housing	Nickel-plated brass
Material, ultrasonic converter	Polyurethane foam, epoxy resin with glass content, PBT (lid)
Type of connection	(See Selection Table)
Ambient temperature: operation	-25 … +70 °C
Ambient temperature: storage	-40 … +85 °C
Weight	25 g

[1] Relating to set switching distance [2] From end-value [3] Max. 10 % ripple, within U_B [4] With connected IP 65 plug

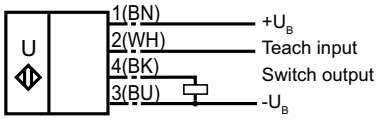
Operating scanning distance	Switching output	Type of connection	Part number	Article number
50 … 800 mm	PNP	Plug, M12x1, 4-pin	UT 18-750-PSL4	690-10104

Plug connection



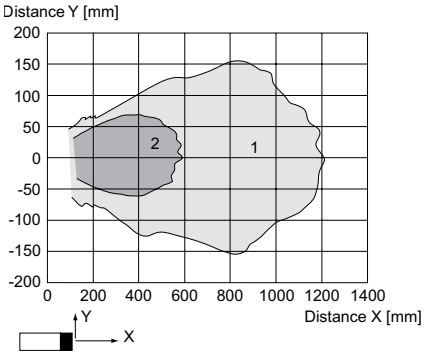
153-00582

Connection, 4-pin



154-00470

Sound cone



Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

155-00662

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

11

UT 18-750-A

Ultrasonic sensor with analogue output



CE

PRODUCT HIGHLIGHTS

- Long operating scanning distance of 800 mm
- Robust M18 metal housing for harsh operating conditions
- Analogue output: 4 … 20 mA
- Rising / falling output characteristic adjustable

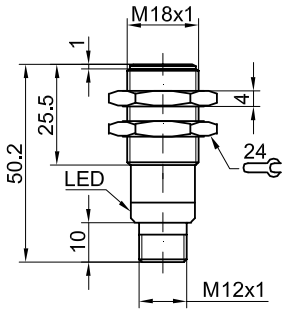
Sensor data		Functions	
Operating scanning distance	50 … 800 mm	Indicator LED, green	Operating voltage indicator
Adjustment range	70 … 800 mm	Indicator LED, yellow	Switching output indicator
Ultrasonic frequency	~ 205 kHz	Indicator LED, red	Fault indicator
Resolution	0.40 mm[1]	Set characteristic analogue curve	Via control input
Temperature drift	± 1.5 %[2]	Adjustment possibilities	Rising / falling slope via control input
Repeatability	± 0.5 %[2]	Default settings	Evaluation limit 1 = 70 mm Evaluation limit 2 = 800 mm
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	10 … 30 V DC[3]	Dimensions	M18 x 50.2 mm
No-load current, I_0	≤ 20 mA	Enclosure rating	IP 65[4]
Current output	R_a < 300 Ω	Material, housing	Nickel-plated brass
Protective circuits	Short-circuit protection (Q) / overload protection	Material, ultrasonic converter	Polyurethane foam, epoxy resin with glass content, PBT (lid)
Analogue output	4 … 20 mA	Type of connection	(See Selection Table)
Response time	≤ 100 ms	Ambient temperature: operation	-25 … +70 °C
Control input, WH	- U_B = lower evaluation limit + U_B = upper evaluation limit	Ambient temperature: storage	-40 … +85 °C
		Weight	25 g

[1] With max. detection range [2] From end-value [3] Max. 10 % ripple, within U_B [4] With connected IP 65 plug

Operating scanning distance	Analogue output	Type of connection	Part number	Article number
50 … 800 mm	4 … 20 mA	Plug, M12x1, 4-pin	UT 18-750-A-IL4	690-10105

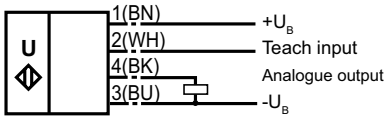
Version: 10/2013. Subject to changes; diagrams similar

Plug connection



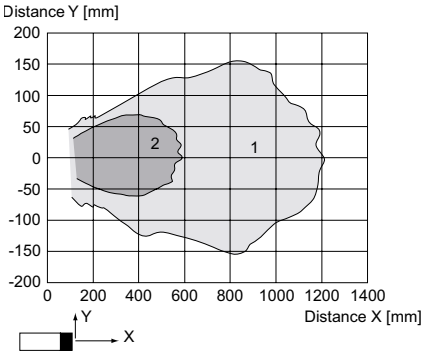
153-00582

Connection, 4-pin



154-00469

Sound cone



Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

155-00662

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

11

UM 18-60/250

Ultrasonic sensor with switching output



PRODUCT HIGHLIGHTS

- Robust M18 metal housings for harsh operating conditions
- Optional brass or stainless steel housings
- Operating scanning distance either 60 mm or 250 mm
- Simple sensor settings via control input

Sensor data	
Limit scanning distance	350 mm
Operating scanning distance	30 … 250 mm
Ultrasonic frequency	~ 320 kHz
Resolution	0.36 mm
Repeatability[1]	< 1 mm
Hysteresis	2 mm
Temperature drift	0.17 % / K

Functions	
Adjustment possibilities	Operating scanning distance 60 mm / 250 mm via control input

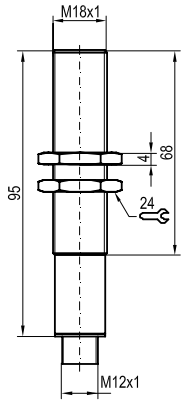
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
No-load current, I_0	≤ 30 mA
Output current, Ie	500 mA
Voltage drop, Ud	< 2.4 V DC
Protective circuits	Reverse polarity protection, U_B / short-circuit protection (Q)
Switching output, Q	PNP
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	25 Hz
Control input, WH	+ U_B = operating scanning distance 250 mm - U_B / open = operating scanning distance 60 mm

Mechanical data	
Dimensions	M18 x 95 mm
Enclosure rating	IP 65[3]
Material, housing	(See Selection Table)
Type of connection	(See Selection Table)
Ambient temperature: operation	-20 … +70 °C
Ambient temperature: storage	-40 … +85 °C
Weight	80 g

[1] With constant ambient conditions [2] Max. 10 % ripple, within U_B [3] With connected IP 65 plug

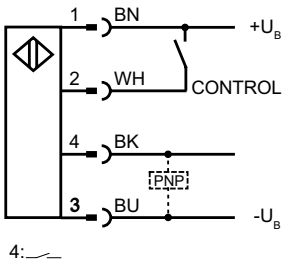
Operating scanning distance	Switching output	Housing material	Type of connection	Part number	Article number
30 … 250 mm	PNP	Nickel-plated brass	Plug, M12x1, 4-pin	UM 18-60/250-CD-HP	690-51541
30 … 250 mm	PNP	Stainless steel	Plug, M12x1, 4-pin	UM 18-60/250-CD-HP-E	690-51542

Plug connection



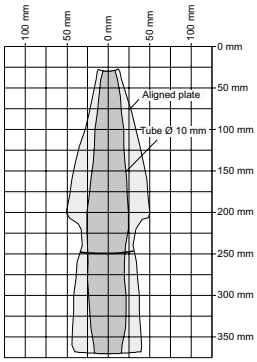
153-00572

Connection, 4-pin



154-00226

Sound cone



155-00650

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

11

UMT 30-350

Ultrasonic sensor with switching output



PRODUCT HIGHLIGHTS

- Ideal for monitoring the filling levels of liquids such as fats and oils
- With one or two switching outputs as option
- Easy pre-setting of sensor via digital display – sensor immediately ready for operation
- Synchronisation of up to 10 devices in restricted spaces
- Additional features with numerous supplementary functions

Sensor data	
Limiting scanning distance	600 mm
Operating scanning distance	65 … 350 mm
Ultrasonic frequency	~ 400 kHz
Resolution	0.025 mm
Repeatability	± 0.15 %[1]
Hysteresis[2]	5 mm
Temperature drift[2]	± 1 % (Temperature drift internal compensated, may be deactivated, 0.17 % / K without compensation)

Functions	
Display	Parameterisation
LED indicator 1	Switching output indicator
LED indicator 2	Switching output indicator
Scanning distance adjustment	Via Teach-in buttons and numerically via 7-segment display
Teach-in modes	Mode 1: set switching point Mode 2: set Window Mode Mode 3: set two-way reflex switch
Adjustment possibilities	N.O. / N.C. via Teach-in button Button lock via Teach-in button Default settings via Teach-in button
Supplementary functions	– Energy-saving Mode – Hysteresis – Measurement value filter – Filter strength – Response delay – Foreground suppression – Multiplex Mode, device address – Multiplex Mode, highest address – Measurement range – Calibration display – Detection range, sensitivity
Default settings[3]	Measurement range: limit scanning distance Switching distances: scanning distance Switching output: N.O.
Default settings[4]	Measurement range: limit scanning distance Switching distances: scanning distance and half scanning distance Switching output: N.O.

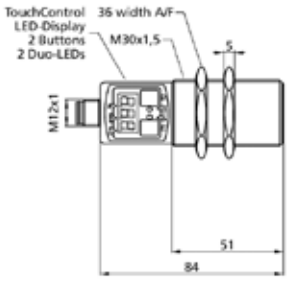
Electrical data	
Operating voltage, $+U_B$	9 … 30 V DC[5]
No-load current, I_0	≤ 80 mA
Output current, Ie	200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Power On Delay	< 300 ms
Switching output, Q	1 x PNP / 2 x PNP (see Selection Table)
Output function	N.O. / N.C.
Switching frequency, f (ti/tp 1:1)[2]	8 Hz[3] / 12 Hz[4]
Response time[2]	70 ms[3] / 64 ms[4]
Connection, GY	Sync. / Com.

Mechanical data	
Dimensions	M30 x 84 mm
Enclosure rating	IP 67[6]
Material, housing	Brass, nickel-plated, plastic content: PBT,TPU
Material, ultrasonic converter	Polyurethane foam, epoxy resin with glass content
Type of connection	(See Selection Table)
Ambient temperature, operation	-25 … +70 °C
Ambient temperature, storage	-40 … +85 °C
Weight (plug device)	150 g
Vibration and impact resistance	EN 60947-5-2

[1] Related to current measurement value [2] Parameterisable via control panel [3] 1 x PNP [4] 2 x PNP [5] Max. 10 % ripple, within U_B [6] With connected IP 67 plug

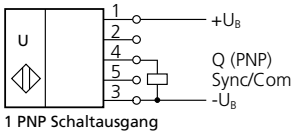
Operating scanning distance	Switching output	Type of connection	Part number	Article number
65 … 350 mm	1 x PNP	Plug, M12x1, 5-pin	UMT 30-350-PSD-L5	690-51560
65 … 350 mm	2 x PNP	Plug, M12x1, 5-pin	UMT 30-350-2PSD-L5	690-51561

Plug connection



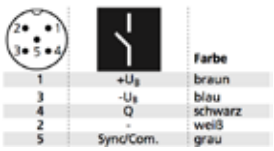
153-00955

Connection, 5-pin (1 x PNP)



1 PNP Schaltausgang

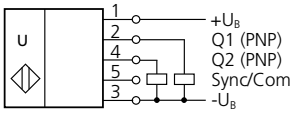
154-00322



		Farbe
1	+UB	braun
3	-UB	blau
4	Q	schwarz
2	-	weiß
5	Sync/Com.	grau

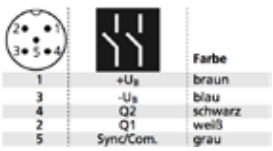
154-00306

Connection, 5-pin (2 x PNP)



2 PNP Schaltausgänge

154-00323

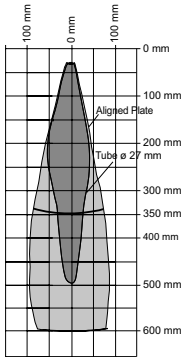


		Farbe
1	+UB	braun
3	-UB	blau
4	Q2	schwarz
2	Q1	weiß
5	Sync/Com.	grau

154-00307

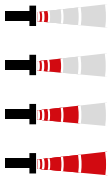
11

Sound cone



155-01561

Synchronisation / multiplex



A	B
≤ 0.40 m	≤ 2.50 m
≤ 1.10 m	≤ 8.00 m
≤ 2.00 m	≤ 18.00 m
≤ 4.00 m	≤ 30.00 m

Mounting distances below which synchronisation / multiplex should be used.

155-01580

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

UMT 30-350-A

Ultrasonic sensor with analogue output



PRODUCT HIGHLIGHTS

- Automatic selection to current or voltage output
- Easy pre-setting of sensor via digital display – sensor immediately ready for operation
- Synchronisation of up to 10 devices in restricted spaces
- Additional features with numerous supplementary functions

Sensor data	
Limiting scanning distance	600 mm
Operating scanning distance	65 … 350 mm
Ultrasonic frequency	~ 400 kHz
Resolution [1]	0.025 ... 0.17 mm
Repeatability	± 0.15 %[2]
Temperature drift[3]	± 1 % (Temperature drift internal compensated, may be deactivated, 0.17 % / K without compensation)

Functions	
Display	Parameterisation
LED indicator 1	Switching output indicator
LED indicator 2	Switching output indicator
Set analogue characteristic	Via Teach-in button and numerically via 7-segment display
Teach-in modes	Mode 1: set window limits Mode 2: rising / falling output characteristics
Adjustment possibilities	Button lock via Teach-in button Default settings via Teach-in button
Supplementary functions	– Energy-saving Mode – Indicator Mode – Current or voltage output selection – Measurement value filter – Filter strength – Response delay – Foreground suppression – Multiplex Mode, device address – Multiplex Mode, highest address – Measurement range – Calibration display – Detection range, sensitivity
Default settings	Measurement range: limit scanning distance Window limits, analogue signal: blind zone and scanning distance Switching output: rising analogue characteristic

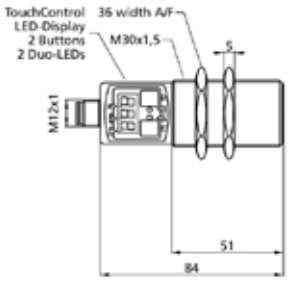
Electrical data	
Operating voltage, $+U_B$	9 … 30 V DC[4]
No-load current, I_0	≤ 80 mA
Current output	$R_L \leq 100\ \Omega$ with $9\,V \leq U_B \leq 20\,V$ $R_L \leq 500\ \Omega$ with $U_B \geq 20\,V$
Voltage output	$R_L \geq 100\ k\Omega$ with $U_B \geq 15\,V$
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Power On Delay	< 300 ms
Analogue output	0 … 10 V / 4 … 20 mA
Response time[3]	64 ms
Connection, GY	Sync. / Com.

Mechanical data	
Dimensions	M30 x 84 mm
Enclosure rating	IP 67[5]
Material, housing	Brass, nickel-plated, plastic content: PBT,TPU
Material, ultrasonic converter	Polyurethane foam, epoxy resin with glass content
Type of connection	(See Selection Table)
Ambient temperature, operation	-25 … +70 °C
Ambient temperature, storage	-40 … +85 °C
Weight	150 g
Vibration and impact resistance	EN 60947-5-2

[1] depending on the set analogue window [2] Related to current measurement value [3] Parameterisable via control panel [4] Max. 10 % ripple, within U_B [5] With connected IP 67 plug

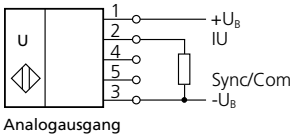
Operating scanning distance	Analogue output	Type of connection	Part number	Article number
65 … 350 mm	0 … 10 V / 4 … 20 mA	Plug, M12x1, 5-pin	UMT 30-350-A-IUD-L5	690-51572

Plug connection

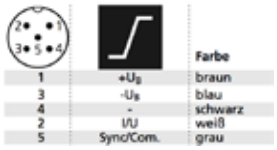


153-00955

Connection, 5-pin

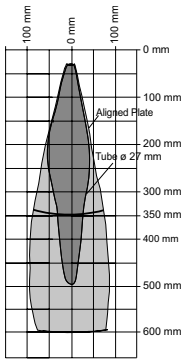


154-00324



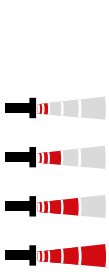
154-00308

Sound cone



155-01561

Synchronisation / multiplex





A	B
≤ 0.40 m	≤ 2.50 m
≤ 1.10 m	≤ 8.00 m
≤ 2.00 m	≤ 18.00 m
≤ 4.00 m	≤ 30.00 m

Mounting distances below which synchronisation / multiplex should be used.

155-01580

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

UMT 30-1300

Ultrasonic sensor with switching output



PRODUCT HIGHLIGHTS

- Ideal for monitoring the filling levels of liquids such as fats and oils
- With one or two switching outputs as option
- Sensor adjustment via teach-in or numerically via 7-segment display
- Synchronisation of up to 10 devices in restricted spaces
- Additional features with numerous supplementary functions

Sensor data	
Limiting scanning distance	2000 mm
Operating scanning distance	200 … 1300 mm
Ultrasonic frequency	~ 200 kHz
Resolution	0.18 mm
Repeatability	± 0.15 %[1]
Hysteresis[2]	20 mm
Temperature drift[2]	± 1 % (Temperature drift internal compensated, may be deactivated, 0.17 % / K without compensation)

Functions	
Display	Parameterisation
LED indicator 1	Switching output indicator
LED indicator 2	Switching output indicator
Scanning distance adjustment	Via Teach-in buttons and numerically via 7-segment display
Teach-in modes	Mode 1: set switching point Mode 2: set Window Mode Mode 3: set two-way reflex switch
Adjustment possibilities	N.O. / N.C. via teach-in button Button lock via teach-in button Default settings via teach-in button
Supplementary functions	– Energy-saving Mode – Hysteresis – Measurement value filter – Filter strength – Response delay – Foreground suppression – Multiplex Mode, device address – Multiplex Mode, highest address – Measurement range – Calibration display – Detection range, sensitivity
Default settings[3]	Measurement range: limit scanning distance Switching distances: scanning distance Switching output: N.O.
Default settings[4]	Measurement range: limit scanning distance Switching distances: scanning distance and half scanning distance Switching output: N.O.

Electrical data	
Operating voltage, $+U_B$	9 … 30 V DC[5]
No-load current, I_0	≤ 80 mA
Output current, Ie	200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Power On Delay	< 300 ms
Switching output, Q	1 x PNP / 2 x PNP (see Selection Table)
Output function	N.O. / N.C.
Switching frequency, f (ti/tp 1:1)[2]	6 Hz[3] / 8 Hz[4]
Response time[2]	110 ms[3] / 92 ms[4]
Connection, GY	Sync. / Com.

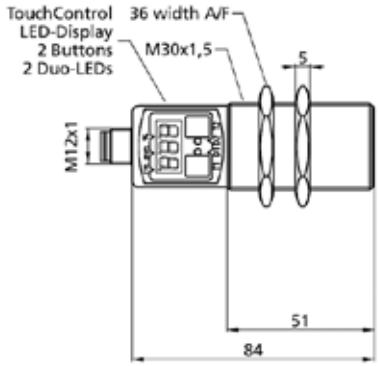
Mechanical data	
Dimensions	M30 x 84 mm
Enclosure rating	IP 67[6]
Material, housing	Brass, nickel-plated, plastic content: PBT,TPU
Material, ultrasonic converter	Polyurethane foam, epoxy resin with glass content
Type of connection	(See Selection Table)
Ambient temperature, operation	-25 … +70 °C
Ambient temperature, storage	-40 … +85 °C
Weight	150 g
Vibration and impact resistance	EN 60947-5-2

[1] Related to current measurement value [2] Parameterisable via control panel [3] 1 x PNP [4] 2 x PNP [5] Max. 10 % ripple, within U_B [6] With connected IP 67 plug

Version: 10/2013. Subject to changes; diagrams similar

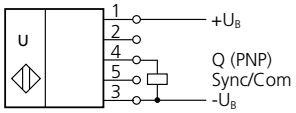
Operating scanning distance	Switching output	Type of connection	Part number	Article number
200 … 1300 mm	1 x PNP	Plug, M12x1, 5-pin	UMT 30-1300-PSD-L5	690-51563
200 … 1300 mm	2 x PNP	Plug, M12x1, 5-pin	UMT 30-1300-2PSD-L5	690-51564

Plug connection



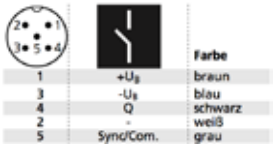
153-00952

Connection, 5-pin (1 x PNP)



1 PNP Schaltausgang

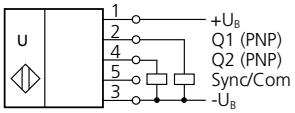
154-00322



		Farbe
1	+UB	braun
3	-UB	blau
4	Q	schwarz
2	-	weiß
5	Sync/Com.	grau

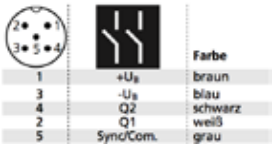
154-00306

Connection, 5-pin (2 x PNP)



2 PNP Schaltausgänge

154-00323

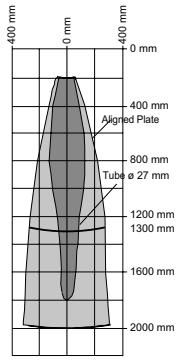


		Farbe
1	+UB	braun
3	-UB	blau
4	Q2	schwarz
2	Q1	weiß
5	Sync/Com.	grau

154-00307

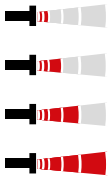
11

Sound cone



155-01562

Synchronisation / multiplex



	A	B
	≤ 0.40 m	≤ 2.50 m
	≤ 1.10 m	≤ 8.00 m
	≤ 2.00 m	≤ 18.00 m
	≤ 4.00 m	≤ 30.00 m

Mounting distances below which synchronisation / multiplex should be used.

155-01580

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

UMT 30-1300-A

Ultrasonic sensor with analogue output



PRODUCT HIGHLIGHTS

- Ideal for monitoring the filling levels of liquids such as fats and oils
- Automatic selection to current or voltage output
- Easy pre-setting of sensor via digital display – sensor immediately ready for operation
- Synchronisation of up to 10 devices in restricted spaces
- Additional features with numerous supplementary functions

Sensor data	
Limiting scanning distance	2000 mm
Operating scanning distance	200 … 1300 mm
Ultrasonic frequency	~ 200 kHz
Resolution [1]	0.18 ... 0.57 mm
Repeatability	± 0.15 %[2]
Temperature drift[3]	± 1 % (Temperature drift internal compensated, may be deactivated, 0.17 % / K without compensation)

Functions	
Display	Parameterisation
LED indicator 1	Switching output indicator
LED indicator 2	Switching output indicator
Set analogue characteristic	Via Teach-in buttons and numerically via 7-segment display
Teach-in modes	Mode 1: set window limits Mode 2: rising / falling output characteristics
Adjustment possibilities	Button lock via Teach-in button Default settings via Teach-in button
Supplementary functions	– Energy-saving Mode – Indicator Mode – Current or voltage output selection – Measurement value filter – Filter strength – Response delay – Foreground suppression – Multiplex Mode, device address – Multiplex Mode, highest address – Measurement range – Calibration display – Detection range, sensitivity
Default settings	Measurement range: limit scanning distance Window limits, analogue signal: blind zone and scanning distance Switching output: rising analogue characteristic

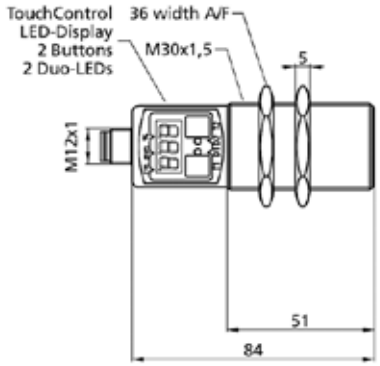
Electrical data	
Operating voltage, $+U_B$	9 … 30 V DC[4]
No-load current, I_0	≤ 80 mA
Current output	R_L ≤ 100 Ω with 9 V ≤ U_B ≤ 20 V; R_L ≤ 500 Ω with U_B ≥ 20 V
Voltage output	R_L ≥ 100 kΩ with U_B ≥ 15V
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Power On Delay	< 300 ms
Analogue output	0 … 10 V / 4 … 20 mA
Response time[3]	92 ms
Connection, GY	Sync. / Com.

Mechanical data	
Dimensions	M30 x 84 mm
Enclosure rating	IP 67[5]
Material, housing	Brass, nickel-plated, plastic content: PBT,TPU
Material, ultrasonic converter	Polyurethane foam, epoxy resin with glass content
Type of connection	(See Selection Table)
Ambient temperature, operation	-25 … +70 °C
Ambient temperature, storage	-40 … +85 °C
Weight	150 g
Vibration and impact resistance	EN 60947-5-2

[1] depending on the set analogue window [2] Related to current measurement value [3] Parameterisable via control panel [4] Max. 10 % ripple, within U_B [5] With connected IP 67 plug

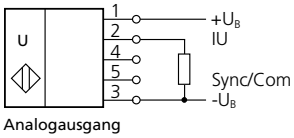
Operating scanning distance	Analogue output	Type of connection	Part number	Article number
200 … 1300 mm	0 … 10 V / 4 … 20 mA	Plug, M12x1, 5-pin	UMT 30-1300-A-IUD-L5	690-51562

Plug connection

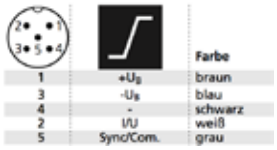


153-00952

Connection, 5-pin

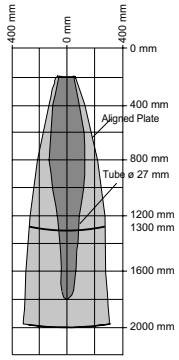


154-00324



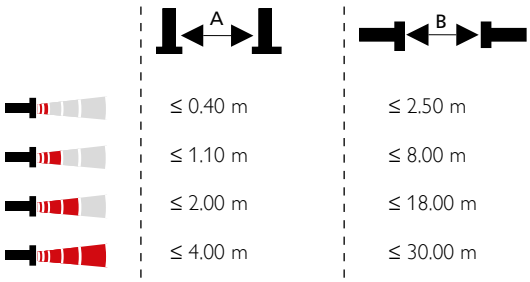
154-00308

Sound cone



155-01562

Synchronisation / multiplex



Mounting distances below which synchronisation / multiplex should be used.

155-01580

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

11

UMT 30-3400

Ultrasonic sensor with switching output



PRODUCT HIGHLIGHTS

- With one or two switching outputs as option
- Sensor adjustment via teach-in or numerically via 7-segment display
- Synchronisation of up to 10 devices in restricted spaces
- Additional features with numerous supplementary functions

Sensor data	
Limiting scanning distance	5000 mm
Operating scanning distance	350 … 3400 mm
Ultrasonic frequency	~ 120 kHz
Resolution	0.18 mm
Repeatability	± 0.15 %[1]
Hysteresis[2]	50 mm
Temperature drift[2]	± 1 % (Temperature drift internal compensated, may be deactivated, 0.17 % / K without compensation)

Functions	
Display	Parameterisation
LED indicator 1	Switching output indicator
LED indicator 2	Switching output indicator
Scanning distance adjustment	Via Teach-in buttons and numerically via 7-segment display
Teach-in modes	Mode 1: set switching point Mode 2: set Window Mode Mode 3: set two-way reflex switch
Adjustment possibilities	N.O. / N.C. via Teach-in button Button lock via Teach-in button Default settings via Teach-in button
Supplementary functions	– Energy-saving Mode – Hysteresis – Measurement value filter – Filter strength – Response delay – Foreground suppression – Multiplex Mode, device address – Multiplex Mode, highest address – Measurement range – Calibration display – Detection range, sensitivity
Default settings[3]	Measurement range: limit scanning distance Switching distances: scanning distance Switching output: N.O.
Default settings[4]	Measurement range: limit scanning distance Switching distances: scanning distance and half scanning distance Switching output: N.O.

Electrical data	
Operating voltage, $+U_B$	9 … 30 V DC[5]
No-load current, I_0	≤ 80 mA
Output current, Ie	200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Power On Delay	< 300 ms
Switching output, Q	1 x PNP / 2 x PNP (see Selection Table)
Output function	N.O. / N.C.
Switching frequency, f (ti/tp 1:1)[2]	3 Hz[3] / 4 Hz[4]
Response time[2]	180 ms[3] / 172 ms[4]
Connection, GY	Sync. / Com.

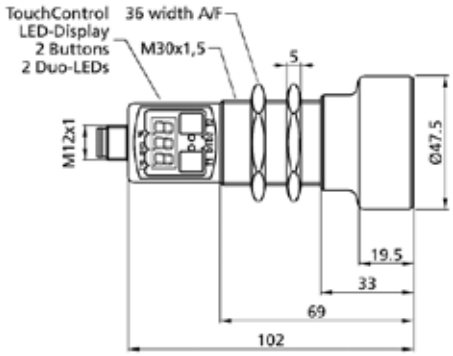
Mechanical data	
Dimensions	M30 x 102 mm
Enclosure rating	IP 67[6]
Material, housing	Brass, nickel-plated, plastic content: PBT,TPU
Material, ultrasonic converter	Polyurethane foam, epoxy resin with glass content
Type of connection	(See Selection Table)
Ambient temperature, operation	-25 … +70 °C
Ambient temperature, storage	-40 … +85 °C
Weight	210 g
Vibration and impact resistance	EN 60947-5-2

[1] Related to current measurement value [2] Parameterisable via control panel [3] 1 x PNP [4] 2 x PNP [5] Max. 10 % ripple, within U_B [6] With connected IP 67 plug

Version: 10/2013. Subject to changes; diagrams similar

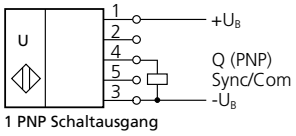
Operating scanning distance	Switching output	Type of connection	Part number	Article number
350 … 3400 mm	1 x PNP	Plug, M12x1, 5-pin	UMT 30-3400-PSD-L5	690-51567
350 … 3400 mm	2 x PNP	Plug, M12x1, 5-pin	UMT 30-3400-2PSD-L5	690-51568

Plug connection



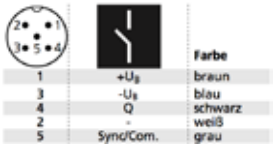
153-00953

Connection, 5-pin (1 x PNP)



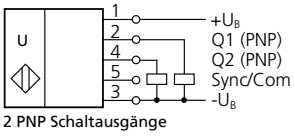
1 PNP Schaltausgang

154-00322



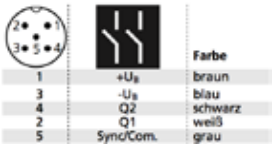
154-00306

Connection, 5-pin (2 x PNP)



2 PNP Schaltausgänge

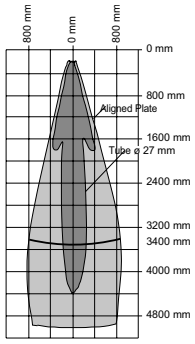
154-00323



154-00307

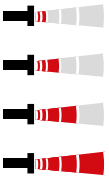
11

Sound cone



155-01563

Synchronisation / multiplex



A	B
≤ 0.40 m	≤ 2.50 m
≤ 1.10 m	≤ 8.00 m
≤ 2.00 m	≤ 18.00 m
≤ 4.00 m	≤ 30.00 m

Mounting distances below which synchronisation / multiplex should be used.

155-01580

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

UMT 30-3400-A

Ultrasonic sensor with analogue output



PRODUCT HIGHLIGHTS

- Automatic selection to current or voltage output
- Easy pre-setting of sensor via digital display – sensor immediately ready for operation
- Synchronisation of up to 10 devices in restricted spaces
- Additional features with numerous supplementary functions
- Choice of brass or stainless steel housings

Sensor data	
Limiting scanning distance	5000 mm
Operating scanning distance	350 … 3400 mm
Ultrasonic frequency	~ 120 kHz
Resolution[1]	0.18 ... 1.5 mm
Repeatability	± 0.15 %[2]
Temperature drift[3]	± 1 % (Temperature drift internal compensated, may be deactivated, 0.17 % / K without compensation)

Functions	
Display	Parameterisation
LED indicator 1	Switching output indicator
LED indicator 2	Switching output indicator
Set analogue characteristic	Via Teach-in buttons and numerically via 7-segment display
Teach-in modes	Mode 1: set window limits Mode 2: rising / falling output characteristics
Adjustment possibilities	Button lock via Teach-in button Default settings via Teach-in button
Supplementary functions	– Energy-saving Mode – Indicator Mode – Current or voltage output selection – Measurement value filter – Filter strength – Response delay – Foreground suppression – Multiplex Mode, device address – Multiplex Mode, highest address – Measurement range – Calibration display – Detection range, sensitivity
Default settings	Measurement range: limit scanning distance Window limits, analogue signal: blind zone and scanning distance Switching output: rising analogue characteristic

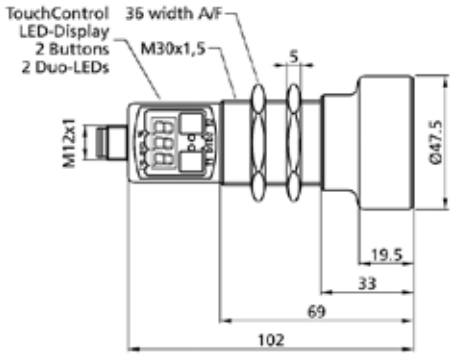
Electrical data	
Operating voltage, $+U_B$	9 … 30 V DC[4]
No-load current, I_0	≤ 80 mA
Current output	R_L ≤ 100 Ω with 9 V ≤ U_B ≤ 20 V; R_L ≤ 500 Ω with U_B ≥ 20 V
Voltage output	R_L ≥ 100 kΩ with U_B ≥ 15V
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Power On Delay	< 300 ms
Analogue output	0 … 10 V / 4 … 20 mA
Response time[3]	172 ms
Connection, GY	Sync. / Com.

Mechanical data	
Dimensions	M30 x 102 mm
Enclosure rating	IP 67[5]
Material, housing	(See Selection Table) Plastic content: PBT, TPU
Material, ultrasonic converter	Polyurethane foam, epoxy resin with glass content
Type of connection	(See Selection Table)
Ambient temperature, operation	-25 … +70 °C
Ambient temperature, storage	-40 … +85 °C
Weight	210 g
Vibration and impact resistance	EN 60947-5-2

[1] depending on the set analogue window [2] Related to current measurement value [3] Parameterisable via control panel [4] Max. 10 % ripple, within U_B [5] With connected IP 67 plug

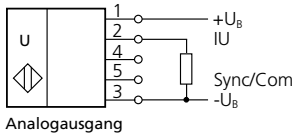
Operating scanning distance	Analogue output	Material, housing	Type of connection	Part number	Article number
350 … 3400 mm	0 … 10 V / 4 … 20 mA	Brass, nickel-plated	Plug, M12x1, 5-pin	UMT 30-3400-A-IUD-L5	690-51565
350 … 3400 mm	0 … 10 V / 4 … 20 mA	Stainless steel, 1.4571	Plug, M12x1, 5-pin	UMT 30-3400-AE-IUD-L5	690-51566

Plug connection



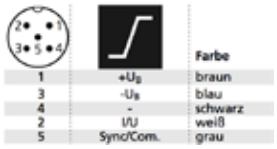
153-00953

Connection, 5-pin



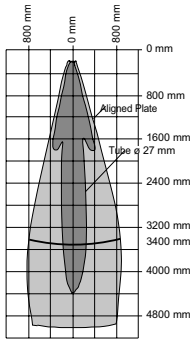
Analogausgang

154-00324



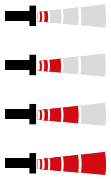
154-00308

Sound cone



155-01563

Synchronisation / multiplex



	A	B
	≤ 0.40 m	≤ 2.50 m
	≤ 1.10 m	≤ 8.00 m
	≤ 2.00 m	≤ 18.00 m
	≤ 4.00 m	≤ 30.00 m

Mounting distances below which synchronisation / multiplex should be used.

155-01580

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

UMT 30-6000

Ultrasonic sensor with switching output



PRODUCT HIGHLIGHTS

- Long scanning range of 6 m
- With one or two switching outputs as option
- Sensor adjustment via teach-in or numerically via 7-segment display
- Additional features with numerous supplementary functions

Sensor data	
Limiting scanning distance	8000 mm
Operating scanning distance	600 … 6000 mm
Ultrasonic frequency	~ 80 kHz
Resolution	0.18 mm
Repeatability	± 0.15 %[1]
Hysteresis[2]	100 mm
Temperature drift[2]	± 1 % (Temperature drift internal compensated, may be deactivated, 0.17 % / K without compensation)

Functions	
Display	Parameterisation
LED indicator 1	Switching output indicator
LED indicator 2	Switching output indicator
Scanning distance adjustment	Via Teach-in buttons and numerically via 7-segment display
Teach-in modes	Mode 1: set switching point Mode 2: set Window Mode Mode 3: set two-way reflex switch
Adjustment possibilities	N.O. / N.C. via Teach-in button Button lock via Teach-in button Default settings via Teach-in button
Supplementary functions	– Energy-saving Mode – Hysteresis – Measurement value filter – Filter strength – Response delay – Foreground suppression – Multiplex Mode, device address – Multiplex Mode, highest address – Measurement range – Calibration display – Detection range, sensitivity
Default settings[3]	Measurement range: limit scanning distance Switching distances: scanning distance Switching output: N.O.
Default settings[4]	Measurement range: limit scanning distance Switching distances: scanning distance and half scanning distance Switching output: N.O.

Electrical data	
Operating voltage, $+U_B$	9 … 30 V DC[5]
No-load current, I_0	≤ 80 mA
Output current, Ie	200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Power On Delay	< 300 ms
Switching output, Q	1 x PNP / 2 x PNP (see Selection Table)
Output function	N.O. / N.C.
Switching frequency, f (ti/tp 1:1)[2]	2 Hz[3] / 3 Hz[4]
Response time[2]	240 ms
Connection, GY	Sync. / Com.

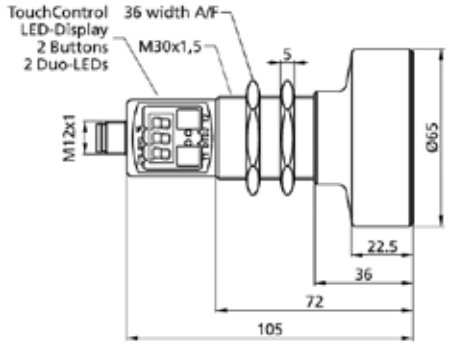
Mechanical data	
Dimensions	M30 x 105 mm
Enclosure rating	IP 67[6]
Material, housing	Brass, nickel-plated, plastic content: PBT,TPU
Material, ultrasonic converter	Polyurethane foam, epoxy resin with glass content
Type of connection	(See Selection Table)
Ambient temperature, operation	-25 … +70 °C
Ambient temperature, storage	-40 … +85 °C
Weight	270 g
Vibration and impact resistance	EN 60947-5-2

[1] Related to current measurement value [2] Parameterisable via control panel [3] 1 x PNP [4] 2 x PNP [5] Max. 10 % ripple, within U_B [6] With connected IP 67 plug

Version: 10/2013. Subject to changes; diagrams similar

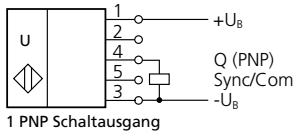
Operating scanning distance	Switching output	Type of connection	Part number	Article number
600 … 6000 mm	1 x PNP	Plug, M12x1, 5-pin	UMT 30-6000-PSD-L5	690-51570
600 … 6000 mm	2 x PNP	Plug, M12x1, 5-pin	UMT 30-6000-2PSD-L5	690-51571

Plug connection



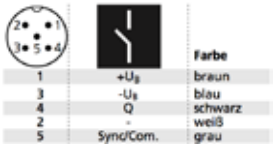
153-00954

Connection, 5-pin (1 x PNP)



1 PNP Schaltausgang

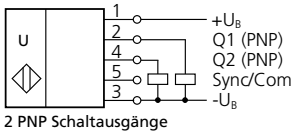
154-00322



		Farbe
1	+UB	braun
3	-UB	blau
4	Q	schwarz
2	-	weiß
5	Sync/Com.	grau

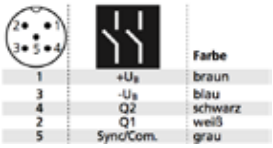
154-00306

Connection, 5-pin (2 x PNP)



2 PNP Schaltausgänge

154-00323

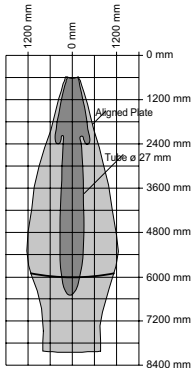


		Farbe
1	+UB	braun
3	-UB	blau
4	Q2	schwarz
2	Q1	weiß
5	Sync/Com.	grau

154-00307

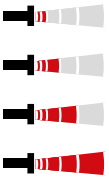
11

Sound cone



155-01564

Synchronisation / multiplex



A	B
≤ 0.40 m	≤ 2.50 m
≤ 1.10 m	≤ 8.00 m
≤ 2.00 m	≤ 18.00 m
≤ 4.00 m	≤ 30.00 m

Mounting distances below which synchronisation / multiplex should be used.

155-01580

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

UMT 30-6000-A

Ultrasonic sensor with analogue output



PRODUCT HIGHLIGHTS

- Long scanning range of 6 m
- Automatic selection to current or voltage output
- Easy pre-setting of sensor via digital display – sensor immediately ready for operation
- Synchronisation of up to 10 devices in restricted spaces
- Additional features with numerous supplementary functions

Sensor data	
Limiting scanning distance	8000 mm
Operating scanning distance	600 … 6000 mm
Ultrasonic frequency	~ 80 kHz
Resolution[1]	0.18 ... 2.4 mm
Repeatability	± 0.15 %[2]
Temperature drift[3]	± 1 % (Temperature drift internal compensated, may be deactivated, 0.17 % / K without compensation)

Functions	
Display	Parameterisation
LED indicator 1	Switching output indicator
LED indicator 2	Switching output indicator
Set analogue characteristic	Via Teach-in button and numerically via 7-segment display
Teach-in modes	Mode 1: set window limits Mode 2: rising / falling output characteristics
Adjustment possibilities	Button lock via Teach-in button Default settings via Teach-in button
Supplementary functions	– Energy-saving Mode – Indicator Mode – Current or voltage output selection – Measurement value filter – Filter strength – Response delay – Foreground suppression – Multiplex Mode, device address – Multiplex Mode, highest address – Measurement range – Calibration display – Detection range, sensitivity
Default settings	Measurement range: limit scanning distance Window limits, analogue signal: blind zone and scanning distance Switching output: rising analogue characteristic

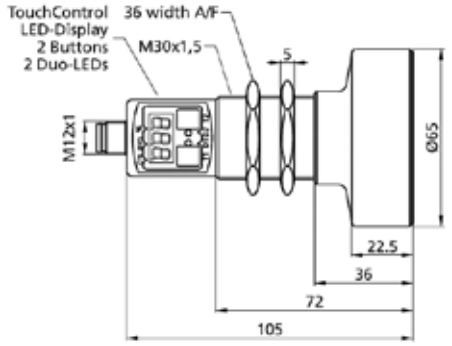
Electrical data	
Operating voltage, $+U_B$	9 … 30 V DC[4]
No-load current, I_0	≤ 80 mA
Current output	$R_L \leq 100\ \Omega$ with 9 V ≤ U_B ≤ 20 V; $R_L \leq 500\ \Omega$ with $U_B \geq 20$ V
Voltage output	$R_L \geq 100\ k\Omega$ with $U_B \geq 15$ V
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Power On Delay	< 300 ms
Analogue output	0 … 10 V / 4 … 20 mA
Response time[3]	240 ms
Connection, GY	Sync. / Com.

Mechanical data	
Dimensions	M30 x 105 mm
Enclosure rating	IP 67[5]
Material, housing	Brass, nickel-plated, plastic content: PBT, TPU
Material, ultrasonic converter	Polyurethane foam, epoxy resin with glass content
Type of connection	(See Selection Table)
Ambient temperature, operation	-25 … +70 °C
Ambient temperature, storage	-40 … +85 °C
Weight	270 g
Vibration and impact resistance	EN 60947-5-2

[1] depending on the set analogue window [2] Related to current measurement value [3] Parameterisable via control panel [4] Max. 10 % ripple, within U_B [5] With connected IP 67 plug

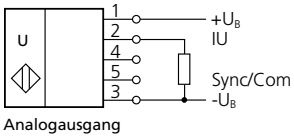
Operating scanning distance	Analogue output	Type of connection	Part number	Article number
600 … 6000 mm	0 … 10 V / 4 … 20 mA	Plug, M12x1, 5-pin	UMT 30-6000-A-IUD-L5	690-51569

Plug connection

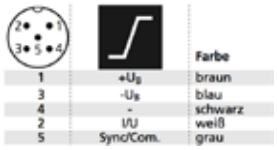


153-00954

Connection, 5-pin

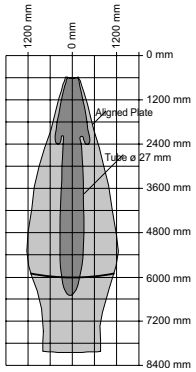


154-00324



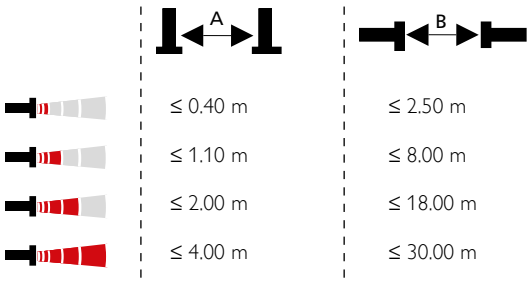
154-00308

Sound cone



155-01564

Synchronisation / multiplex



Mounting distances below which synchronisation / multiplex should be used.

155-01580

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

11

Inductive sensors

The metal detectors

Cubic housings from
from Page 600

- *Variety of housing sizes for numerous applications*
- *Plastic or metal housing options*
- *Switching distances from 1.5 mm to 35 mm*
- *Numerous connection possibilities*
- *Flush, quasi-flush and non-flush mounting possibilities*



Because of their functional principle, inductive sensors are only suitable for detecting metal objects. But they do this extremely reliably and are also very robust and resistant (e.g. regarding environmental factors), which makes them interesting for numerous industrial applications. They are mainly used wherever the detection of uniform movements is involved – for example as proximity switches for determining the position of transported machine parts such as saddles or hydraulic cylinders, for measuring rotary speeds on vehicle crankshafts, or as pulse generators for motor ignition.

Inductive sensors are extremely precise due to their high repeatability levels. Their simple design and uncomplicated commissioning ensure minimal downtimes. Whether in robotics, in assembly and handling, in factory automation or mechanical engineering: inductive sensors from SensoPart are reliable, require no maintenance, and offer versatile use thanks to the numerous housings and sizes available.

TYPICAL SENSOPART

- Reliable detection of metallic objects
- Product variants for standard or three-fold switching distances
- Robust cylindrical or cuboid metal housing options
- Simple installation thanks to integrated metric threads
- Different designs for flush, quasi-flush and non-flush mounting
- Switching or analogue output options available
- NAMUR-compliant design on request

Cylindrical housings
from Page 608

- *Variety of housing sizes for numerous applications*
- *High switching frequency of up to 5 kHz*
- *Robust stainless steel designs*
- *With switching or analogue output options*
- *Highly pressure-resistant sensors for up to 800 bar*
- *Flush, quasi-flush and non-flush mounting possibilities*
- *Full-metal "see-through" sensors (metal face)*
- *Three-fold switching distance*
- *K-factor 1, switching distance independent of type of metal*



Inductive sensors with standard switching distance

Housing size	Part no.	Type code	Installation	Switching distance	Swichting output	Connection type	Page
ø 3 mm	996-09390	IS 33-52	Flush	0.6 mm	PNP / NO	Cable, 3-wire	608
	996-09391	IS 33-51	Flush	0.6 mm	NPN / NO	Cable, 3-wire	608
	996-09444	ISN 44-20	Flush	0.8 mm	NAMUR	Cable, 2 m, 2-wire	609
ø 6.5 mm	996-09488	ISZ 46-02	Flush	1.5 mm	PNP / NO	Cable 2 m, 3-wire	613
	996-09487	ISZ 46-01	Flush	1.5 mm	NPN / NO	Cable, 2 m, 3-wire	613
	996-50590	IS 46-12	Flush	1.5 mm	PNP / NO	Plug, M8x1, 3-wire	614
	996-50613	IS 46-11 T	Flush	1.5 mm	NPN / NO	Plug, M8x1, 3-wire	614
	996-09401	IS 46-02	Flush	1.5 mm	PNP / NO	Cable, 2 m, 3-wire	614
	996-50586	IS 56-12	Quasi-flush	3 mm	PNP / NO	Plug, M8x1, 3-pin	616
	996-50632	IS 56-11 T	Quasi-flush	3 mm	NPN / NO	Plug, M8x1, 3-pin	616
	996-09963	IS 56-42	Quasi-flush	3 mm	PNP / NO	Plug, M12x1, 4-pin	616
	996-50390	IS 56-41	Quasi-flush	3 mm	NPN / NO	Plug, M12x1, 4-pin	616
	996-09409	IS 56-02	Quasi-flush	3 mm	PNP / NO	Cable, 2 m, 3-wire	616
	996-09408	IS 56-01	Quasi-flush	3 mm	NPN / NO	Cable, 2 m, 3-wire	616
M4	996-09397	IS 34-52	Flush	0.6 mm	PNP / NO	Cable, 2 m, 3-wire	610
	996-09395	IS 34-51	Flush	0.6 mm	NPN / NO	Cable, 2 m, 3-wire	610
	996-51486	IT 4 BD-PSK3	Flush	1 mm	PNP / NO	Cable, 3-wire	611
M5	697-01004	IMT 5-0B8-NS-K3	Flush	0.8 mm	NPN / NO	Cable 2 m	612
	697-01005	IMT 5-0B8-PS-K3	Flush	0.8 mm	PNP / NO	Cablel 2 m	612
	697-01006	IMT 5-0B8-NS-M3	Flush	0.8 mm	NPN / NO	M8 3-pin	612
	697-01007	IMT 5-0B8-PS-M3	Flush	0.8 mm	PNP / NO	M8 3-pin	612
M8	697-01008	IMT 8-1B5-NS-K3	Flush	1.5 mm	NPN / NO	Cable 2 m	618
	697-01009	IMT 8-1B5-PS-K3	Flush	1.5 mm	PNP / NO	Cable 2 m	618
	697-01010	IMT 8-1B5-NS-L4	Flush	1.5 mm	NPN / NO	M12 4-pin	618
	697-01011	IMT 8-1B5-PS-L4	Flush	1.5 mm	PNP / NO	M12 4-pin	618
	697-01012	IMT 8-2N-NS-K3	Non-flush	2 mm	NPN / NO	Cable 2 m	620
	697-01013	IMT 8-2N-PS-K3	Non-flush	2 mm	PNP / NO	Cable 2 m	620
	697-01014	IMT 8-2N-NS-L4	Non-flush	2 mm	NPN / NO	M12 4-pin	620

Selection Table Inductive Sensors

Inductive sensors with standard switching distance							
Housing size	Part no.	Type code	Installation	Switching distance	Swichting output	Connection type	Page
M8	996-50624	IS 48-12T	Flush	1.5 mm	PNP / NO	Plug, M8x1, 3-pin	617
	996-50623	IS 48-11T	Flush	1.5 mm	NPN / NO	Plug, M8x1, 3-pin	617
	996-09405	IS 48-02	Flush	1.5 mm	PNP / NO	Cable, 2 m, 3-wire	617
	996-09404	IS 48-01	Flush	1.5 mm	NPN / NO	Cable, 2 m, 3-wire	617
	996-50587	IS 58-12T	Flush	3 mm	PNP / NO	Plug, M8x1, 3-pin	622
	996-50640	IS 58-11T	Flush	3 mm	NPN / NO	Plug, M8x1, 3-pin	622
	996-09965	IS 58-42	Flush	3 mm	PNP / NO	Plug, M8x1, 4-pin	622
	996-09964	IS 58-41	Flush	3 mm	NPN / NO	Plug, M8x1, 4-pin	622
	996-09413	IS 58-02	Flush	3 mm	PNP / NO	Cable, 2 m, 3-wire	622
	996-09412	IS 58-01	Flush	3 mm	NPN / NO	Cable, 2 m, 3-wire	622
	697-01015	IMT 8-2N-PS-L4	Non-flush	2 mm	PNP / NO	M12 4-pin	620
M12	697-01016	IMT 12-2B-NS-K3	Flush	2 mm	NPN / NO	Cable 2 m	624
	697-01017	IMT 12-2B-PS-K3	Flush	2 mm	PNP / NO	Cable 2 m	624
	697-01018	IMT 12-2B-NS-L4	Flush	2 mm	NPN / NO	M12 4-pin	624
	697-01019	IMT 12-2B-PS-L4	Flush	2 mm	PNP / NO	M12 4-pin	624
	697-01020	IMT 12-4N-NS-K3	Non-flush	4 mm	NPN / NO	Cable 2 m	626
	697-01021	IMT 12-4N-PS-K3	Non-flush	4 mm	PNP / NO	Cable 2 m	626
	697-01022	IMT 12-4N-NS-L4	Non-flush	4 mm	NPN / NO	M12 4-pin	626
	697-01023	IMT 12-4N-PS-L4	Non-flush	4 mm	PNP / NO	M12 4-pin	626
	996-51479	IS 512-02 AI	Quasi-flush	6 mm	Analogue output 0 … 10 V / 4 … 20 mA	Cable, 4-wire	645
M14	996-51193	IS 514-42	Flush	3 mm	PNP / NO	Plug, M12x1, 4-pin	631
M18	697-01024	IMT 18-5B-NS-K3	Flush	5 mm	NPN / NO	Cable 2 m	632
	697-01025	IMT 18-5B-PS-K3	Flush	5 mm	PNP / NO	Cable 2 m	632
	697-01026	IMT 18-5B-NS-L4	Flush	5 mm	NPN / NO	M12 4-pin	632
	697-01027	IMT 18-5B-PS-L4	Flush	5 mm	PNP / NO	M12 4-pin	632
	697-01028	IMT 18-8N-NS-K3	Non-flush	8 mm	NPN / NO	Cable 2 m	634
	697-01029	IMT 18-8N-PS-K3	Non-flush	8 mm	PNP / NO	Cable 2 m	634
	697-01030	IMT 18-8N-NS-L4	Non-flush	8 mm	NPN / NO	M12 4-pin	634
	697-01031	IMT 18-8N-PS-L4	Non-flush	8 mm	PNP / NO	M12 4-pin	634
M18	996-09435	IS 518-02 A	Quasi-flush	10 mm	Analogue output 0 … 10 V / 4 … 20 mA	Cable, 4-wire	646
M30	697-01032	IMT 30-10B-NS-K3	Flush	10 mm	NPN / NO	Cable 2 m	639
	697-01033	IMT 30-10B-PS-K3	Flush	10 mm	PNP / NO	Cable 2 m	639
	697-01034	IMT 30-10B-NS-L4	Flush	10 mm	NPN / NO	M12 4-pin	639
	697-01035	IMT 30-10B-PS-L4	Flush	10 mm	PNP / NO	M12 4-pin	639
	697-01036	IMT 30-15N-NS-K3	Non-flush	15 mm	NPN / NO	Cable 2 m	640
	697-01037	IMT 30-15N-PS-K3	Non-flush	15 mm	PNP / NO	Cable 2 m	640
	697-01038	IMT 30-15N-NS-L4	Non-flush	15 mm	NPN / NO	M12 4-pin	640
	697-01039	IMT 30-15N-PS-L4	Non-flush	15 mm	PNP / NO	M12 4-pin	640

Inductive sensors with increased switching distance							
Housing size	Part no.	Type code	Installation	Switching distance	Swichting output	Connection type	Page
ø 6.5 mm	697-01040	IDT 6-2B-PS-K3	Flush	2 mm	PNP / NO	Cable 2 m	615
	697-01041	IDT 6-2B-NS-K3	Flush	2 mm	NPN / NO	Cable 2 m	615
	697-01042	IDT 6-2B-PS-M3	Flush	2 mm	PNP / NO	M8 3-pin	615
	697-01043	IDT 6-2B-NS-M3	Flush	2 mm	NPN / NO	M8 3-pin	615
M8	697-01044	IMT 8-2B-PS-K3	Flush	2 mm	PNP / NO	Cable 2 m	620
	996-51456	IS 58-14-S	Non-flush	6 mm	PNP / NO	Plug, M8x1, 3-pin	623
	996-51470	IS 58-13-S	Non-flush	6 mm	NPN / NO	Plug, M8x1, 3-pin	623
	996-51460	IS 58-44-S	Non-flush	6 mm	PNP / NO	Plug, M8x1, 4-pin	623
	996-51463	IS 58-43-S	Non-flush	6 mm	NPN / NO	Plug, M8x1, 4-pin	623
	996-51461	IS 58-04-S	Non-flush	6 mm	PNP / NO	Cable, 3-wire	623
	996-51465	IS 58-03-S	Non-flush	6 mm	NPN / NO	Cabel, 3-wire	623
	697-01045	IMT 8-2B-NS-K3	Flush	2 mm	NPN / NO	Cable 2 m	620
	697-01046	IMT 8-2B-PS-M3	Flush	2 mm	PNP / NO	M8 3-pin	620
	697-01047	IMT 8-2B-NS-M3	Flush	2 mm	NPN / NO	M8 3-pin	620
M12	996-51480	IT 12 BM-PSL4	Flush	6 mm	PNP / NO	Plug, M12x1, 4-pin	628
	996-51481	IT 12 NBM-PSL4	Non-flush	10 mm	PNP / NO	Plug, M12x1, 4-pin	628
	996-09969	IS 512-42	Quasi-flush	6 mm	PNP / NO	Plug, M12x1, 4-pin	629
	996-09968	IS 512-41	Quasi-flush	6 mm	NPN / NO	Plug, M12x1, 4-pin	629
	996-09421	IS 512-02	Quasi-flush	6 mm	PNP / NO	Cable, 2 m, 3-wire	629

Inductive sensors with increased switching distance

Housing size	Part no.	Type code	Installation	Switching distance	Swichting output	Connection type	Page
M12	996-09420	IS 512-01	Quasi-flush	6 mm	NPN / NO	Cable, 2 m, 3-wire	629
	996-51449	IS 512-44-S	Non-flush	10 mm	PNP / NO	Plug, M12x1, 4-pin	630
	996-09970	IS 512-43	Non-flush	10 mm	NPN / NO	Plug, M12x1, 4-pin	630
	996-51458	IS 512-04-S	Non-flush	10 mm	PNP / NO	Cable, 2 m, 3-wire	630
	996-51472	IS 512-03-S	Non-flush	10 mm	NPN / NO	Cable, 2 m, 3-wire	630
	697-01048	IMT 12-4B-PS-K3	Flush	4 mm	PNP / NO	Cable 2 m	626
	697-01049	IMT 12-4B-NS-K3	Flush	4 mm	NPN / NO	Cable 2 m	626
	697-01050	IMT 12-4B-PS-L4	Flush	4 mm	PNP / NO	M12 4-pin	626
	697-01051	IMT 12-4B-NS-L4	Flush	4 mm	NPN / NO	M12 4-pin	626
M18	697-01052	IMT 18-8B-PS-K3	Flush	8 mm	PNP / NO	Cable 2 m	634
	697-01053	IMT 18-8B-NS-K3	Flush	8 mm	NPN / NO	Cable 2 m	634
	697-01054	IMT 18-8B-PS-L4	Flush	8 mm	PNP / NO	M12 4-pin	634
	697-01055	IMT 18-8B-NS-L4	Flush	8 mm	NPN / NO	M12 4-pin	634
	996-09973	IS 518-42	Quasi-flush	12 mm	PNP / NO	Plug, M12x1, 4-pin	636
	996-09972	IS 518-41	Quasi-flush	12 mm	NPN / NO	Plug, M12x1, 4-pin	636
	996-09429	IS 518-02	Quasi-flush	12 mm	PNP / NO	Cable, 2 m, 3-wire	636
	996-09428	IS 518-01	Quasi-flush	12 mm	NPN / NO	Cable, 2 m, 3-wire	636
	996-51453	IS 518-44-S	Non-flush	20 mm	PNP / NO	Plug, M12x1, 4-pin	637
	996-50327	IS 518-43-S	Non-flush	20 mm	NPN / NO	Plug, M12x1, 4-pin	637
	996-51450	IS 518-04-S	Non-flush	20 mm	PNP / NO	Cable, 3-wire	637
	996-51482	IT 18 BM-PSL4	Flush	10 mm	PNP / NO	Plug, M12x1, 4-pin	638
	996-51483	IT 18 NBM-PSL4	Non-flush	20 mm	PNP / NO	Plug, M12x1, 4-pin	638
M30	697-01056	IMT 30-15B-PS-K3	Flush	15 mm	PNP / NO	Cable 2 m	640
	697-01057	IMT 30-15B-NS-K3	Flush	15 mm	NPN / NO	Cable 2 m	640
	697-01058	IMT 30-15B-PS-L4	Flush	15 mm	PNP / NO	M12 4-pin	640
	697-01059	IMT 30-15B-NS-L4	Flush	15 mm	NPN / NO	M12 4-pin	640
	996-09905	IS 530-42	Quasi-flush	22 mm	PNP / NO	Plug, M12x1, 4-pin	642
	996-50673	IS 530-41	Quasi-flush	22 mm	NPN / NO	Plug, M12x1, 4-pin	642
	996-09437	IS 530-02	Quasi-flush	22 mm	PNP / NO	Cable, 2 m, 3-wire	642
	996-09436	IS 530-01	Quasi-flush	22 mm	NPN / NO	Cable, 2 m, 3-wire	642
	996-51454	IS 530-44-S	Quasi-flush	22 mm	PNP / NO	Plug, M12x1, 4-pin	643
	996-51452	IS 530-04-S	Quasi-flush	22 mm	PNP / NO	Cable, 2 m, 3-wire	643
	996-09438	IS 530-03	Quasi-flush	22 mm	NPN / NO	Cable, 2 m, 3-wire	643
	996-51484	IT 30 BM-PSL4	Flush	20 mm	PNP / NO	Plug, M12x1, 4-pin	644
	996-51485	IT 30 NBM-PSL4	Non-flush	40 mm	PNP / NO	Plug, M12x1, 4-pin	644

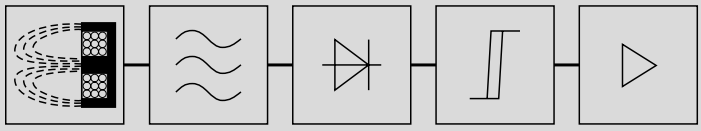
Cubic inductive sensors

Housing size	Part no.	Type code	Installation	Switching distance	Swichting output	Connection type	Page
40 x 26 x 12 mm³	697-01060	IT 12-4B-NS-K3	Flush	4 mm	NPN / NO	Cable 2 m	604
	697-01061	IT 12-4B-PS-K3	Flush	4 mm	PNP / NO	Cable 2 m	604
	697-01062	IT 12-4B-NS-M3	Flush	4 mm	NPN / NO	M8 3-pin	604
	697-01063	IT 12-4B-PS-M3	Flush	4 mm	PNP / NO	M8 3-pin	604
	697-01064	IT 12-8N-NS-K3	Non-flush	8 mm	NPN / NO	Cable 2 m	604
	697-01065	IT 12-8N-PS-K3	Non-flush	8 mm	PNP / NO	Cable 2 m	604
	697-01066	IT 12-8N-NS-M3	Non-flush	8 mm	NPN / NO	M8 3-pin	604
	697-01067	IT 12-8N-PS-M3	Non-flush	8 mm	PNP / NO	M8 3-pin	604
16 x 8 x 5 mm³	697-01068	IT 8-1B5K-PS-K3	Flush	1.5 mm	PNP / NO	Strand, 0.5 m, 3-wire	600
	697-01069	IT 8-1B5K-NS-K3	Flush	1.5 mm	NPN / NO	Strand, 0.5 m, 3-wire	600
27 x 10 x 7 mm³	697-01070	IT10-4N-PS-K3	Non-flush	4 mm	PNP / NO	Cable 2 m	601
	697-01071	IT10-4N-NS-K3	Non-flush	4 mm	NPN / NO	Cable 2 m	601
25 x 5 x 5 mm³	996-50585	IS 455-02	Flush	0.8 mm	PNP / NO	Cable, 2 m, 3-wire	602
	996-50607	IS 455-01	Flush	0.8 mm	NPN / NO	Cable, 2 m, 3-wire	602
50 x 8 x 8 mm³	996-51280	IS 588-02-X	Quasi-flush	3 mm	PNP / NO	Plug, M8x1, 3-pin	603
40 x 8 x 8 mm³	996-50589	IS 588-02	Quasi-flush	3 mm	PNP / NO	Cable, 2 m, 3-wire	603
	996-50589	IS 588-01	Quasi-flush	3 mm	NPN / NO	Cable, 2 m, 3-wire	603
40 x 40 x 55 mm³	810-50001	IT 40 BD-PAL 4	Flush	20 mm	PNP, antivalent (N.O/N.C.)	Plug, M12x1, 4-pin	606
	810-50006	IT 40 NB-PAL4	Non-flush	35 mm	PNP, antivalent (N.O/N.C.)	Plug, M12x1, 4-pin	606
	810-50007	IT 40 NB-NAL4	Non-flush	35 mm	PNP, antivalent (N.O/N.C.)	Plug, M12x1, 4-pin	606
	810-50004	IT 40 B-ACSL 4	Flush	15 mm	AC / DC / NO	Plug, M12x1, 4-pin	607
	810-50005	IT 40 BD-ACSL 4	Flush	20 mm	AC / DC / NO	Plug, M12x1, 4-pin	607
	810-50008	IT 40 NB-ACSL 4	Non-flush	35 mm	AC / DC / NO	Plug, M12x1, 4-pin	607

Inductive Sensors

System description

Method of function

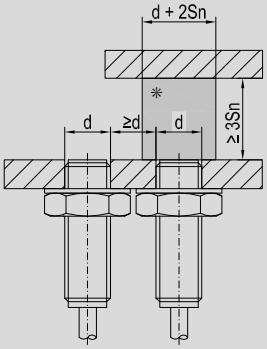


Inductive sensors exploit the interaction of metallic conductors with their alternating electromagnetic fields. Eddy currents are induced in the conductor. They draw energy from the field, reducing the oscillation amplitude. Inductive sensors evaluate this change. The area through which the high-frequency sensor field enters space is described as the active area. It roughly corresponds to the area of the pot core cap.

Applications

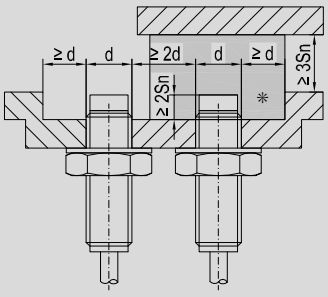
Inductive sensors are suitable for controlling and monitoring machine processes, and for providing signals in counting tasks where metals are involved. In particular, they are characterised by their immunity to vibrations, impacts, dust and dampness, and operate with extreme precision.

Flush-mountable proximity switches



Flush-mountable proximity switches can be embedded in metal up to the active area. The distance to any metal surfaces opposite must be ≥ 3 Sn and the distance between two proximity switches (mounted in series) must be ≥ d.

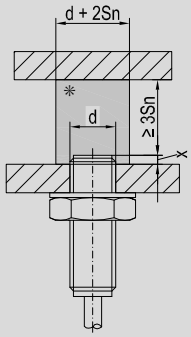
Non-flush mountable proximity switches



Non-flush mountable proximity switches have no metal housing near the active area. They have a free zone. For this reason they experience no pre-damping of the sensor field and can – unlike flush-mountable sensors – be used at longer switching distances. A metal-free zone, however, must always be maintained around the active area. The distance to any metal surfaces opposite must be ≥ 3 Sn and the distance between two proximity switches (mounted in series) must be ≥ 2 d.

* Metal-free zone

Quasi-flush-mountable proximity switches

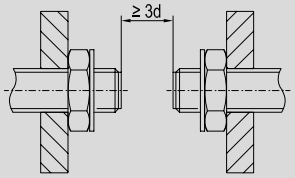


Quasi-flush-mountable proximity switches require a space behind the active area that is kept free of conductive materials. As a result, the nominal switching distance is available without restriction. Whereby the value "x" is the shortest distance between the active area and the conductive material located behind it.

Mounting in steel or non-ferrous metals	
Housing	x in mm
ø 6.5	1
M 8	1
8 x 8	1
M 12	2
M 18	4
M 30	6

Mounting in stainless steel	
Housing	x in mm
ø 6.5	0
M 8	0
8 x 8	0
M 12	1
M 18	1,5
M 30	2

Opposite mounting



All inductive proximity sensors mounted facing one another require a minimum distance of ≥ 3 d between their active areas.

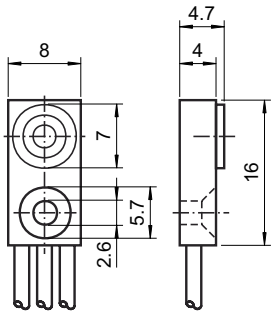
* Metal-free zone

IT 8

Inductive sensor in cubic housing



Strand



153-00892

Sensor data

Switching distance	1.5 mm
Ensured switching distance	0 … 1.215 mm
Hysteresis	~ 5 %
Reduction factor, Al	0.3
Reduction factor, Cu	0.2
Reduction factor, V2A	0.7

Electrical data

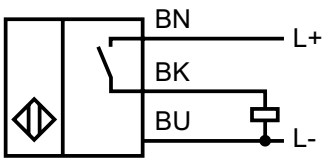
Operating voltage, $+U_B$	5 … 30 V DC
No-load current, I_0	≤ 15 mA
Output current, Ie	≤ 100 mA
Voltage drop, U_D	≤ 1.5 V
Residual current, Ir	≤ 10 µA
Protective circuits	Short-circuit protection (Q)
Switching output, Q	PNP / NPN (see Selection Table)
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	≤ 1200 Hz

Mechanical data

Dimensions	16 x 4.7 x 8 mm³
Enclosure rating	IP 67[1]
Material, housing	PA
Material, front surface	PA
Type of connection	See Selection Table
Ambient temperature: operation	-25 … +70 °C
Vibration and impact resistance	EN 60947-5-2

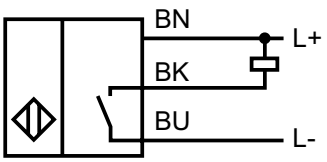
[1] With connected IP 67 plug

Connection, 3-wire (PNP)



154-00294

Connection, 3-wire (NPN)



154-00293

Switching distance	Mounting	Switching output	Type of connection	Part number	Article number
1.5 mm	Flush	PNP	Strand, 0.5 m, 3-wire	IT 8-1B5K-PS-K3	697-01068
1.5 mm	Flush	NPN	Strand, 0.5 m, 3-wire	IT 8-1B5K-NS-K3	697-01069

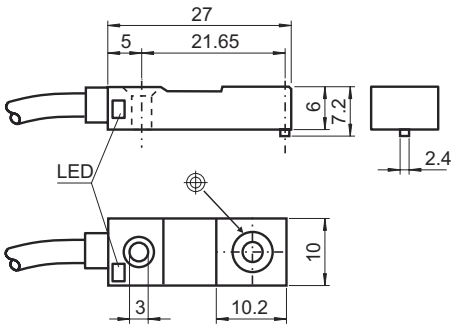
Version: 10/2013. Subject to changes; diagrams similar

IT 10

Inductive sensor in cubic housing



Cable connection



153-00893

Sensor data	
Switching distance	4 mm
Ensured switching distance	0 … 3.24 mm
Hysteresis	~ 5 %
Reduction factor, Al	0,4
Reduction factor, Cu	0,3
Reduction factor, V2A	0,7

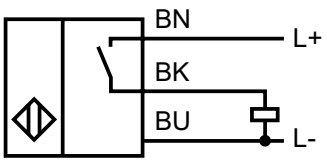
Functions	
Indicator LED, yellow	Switching output indicator

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 10 mA
Output current, Ie	≤ 100 mA
Voltage drop, U_D	≤ 3 V
Residual current, Ir	≤ 0.5 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)[2]
Switching output, Q	PNP / NPN (see Selection Table)
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz

Mechanical data	
Dimensions	27 x 7.2 x 10 mm[3]
Enclosure rating	IP 67[1]
Material, housing	PPS
Material, front surface	PPS
Type of connection	See Selection Table
Ambient temperature: operation	-25 … +70 °C
Vibration and impact resistance	EN 60947-5-2

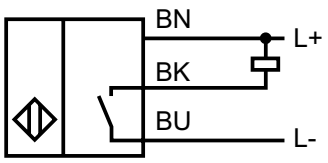
[1] With connected IP 67 plug [2] PNP variants only

Connection, 3-wire (PNP)



154-00294

Connection, 3-wire (NPN)



154-00293

Switching distance	Mounting	Switching output	Type of connection	Part number	Article number
4 mm	Non-flush	PNP	Cable, 2 m, 3-wire	IT 10-4N-PS-K3	697-01070
4 mm	Non-flush	NPN	Cable, 2 m, 3-wire	IT 10-4N-NS-K3	697-01071

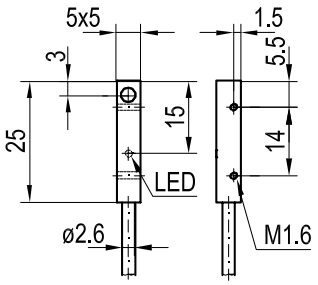
IS 455

Inductive sensor in cubic housing



CE

Cable connection



153-00586

Sensor data

Switching distance	0.8 mm
Repeatability	0.01 mm[1]
Hysteresis	≤ 10 %[2]
Reduction factor, Al	0.60
Reduction factor, Cu	0.60
Reduction factor, V2A	0.85
Reduction factor, steel FE 360	1.00
Reduction factor, brass	0.70

Functions

Indicator LED, yellow	Switching output indicator

Electrical data

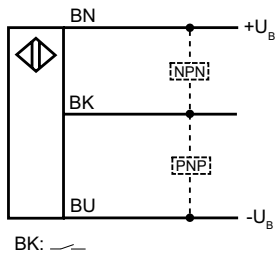
Operating voltage, $+U_B$	10 … 30 V DC[3]
No-load current, I_0	≤ 10 mA
Output current, Ie	≤ 200 mA
Voltage drop, U_D	≤ 2 V at 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q) / induction protection
Switching output, Q	PNP / NPN (see Selection Table)
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	≤ 5000 Hz

Mechanical data

Dimensions	5 x 5 x 25 mm[3]
Mounting	Flush
Enclosure rating	IP 67[4]
Material, housing	Brass, chrome-plated
Material, front surface	Polyester
Type of connection	See Selection Table
Ambient temperature: operation	-25 … +70 °C
Vibration and impact resistance	IEC 60947-5-2 / 7.4

[1] U_B = 20 … 30 V DC, T_A = 23 °C ± 5 °C [2] Refers to switching distance [3] Max. 20 % ripple, within U_B [4] With connected IP 67 plug

Connection, 3-wire



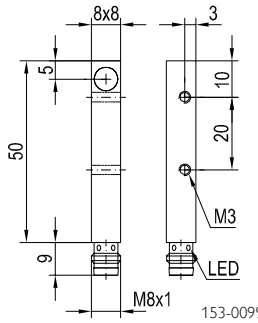
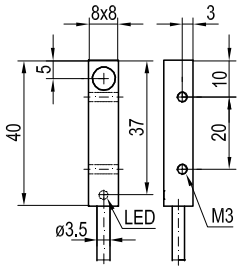
154-00163

Switching distance	Switching output	Type of connection	Part number	Article number
0.8 mm	PNP	Cable, 2m, 3-wire	IS 455-02	996-50585
0.8 mm	NPN	Cable, 2m, 3-wire	IS 455-01	996-50607

IS 588

Inductive sensor in cubic housing

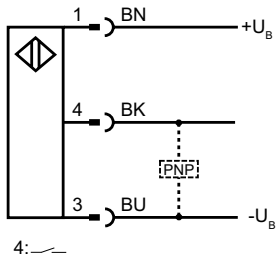
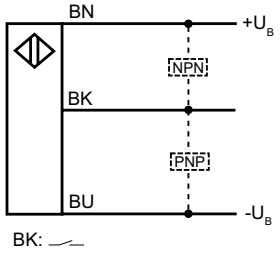


Plug connection	Cable connection
	
153-00997	153-00587

Sensor data		Functions	
Switching distance	3 mm	Indicator LED, yellow	Switching output indicator
Repeatability	0.15 mm[1]		
Hysteresis	≤ 10 %[2]		
Reduction factor, Al	0.36		
Reduction factor, Cu	0.27		
Reduction factor, V2A	0.77		
Reduction factor, steel FE 360	1.00		
Reduction factor, brass	0.45		

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[3]	Dimensions (plug device)	8 x 8 x 59 mm³
No-load current, I_0	≤ 10 mA	Dimensions (cable device)	8 x 8 x 40 mm³
Output current, Ie	≤ 200 mA	Mounting	Quasi-flush
Voltage drop, U_D	≤ 2 V at 200 mA	Enclosure rating	IP 67[4]
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q) / induction protection	Material, housing	Zamac, chrome-plated
		Material, front surface	PBTP
Switching output, Q	PNP	Type of connection	See Selection Table
Output function	N.O.	Ambient temperature: operation	-25 … 70 °C
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Vibration and impact resistance	IEC 60947-5-2 / 7.4

[1] U_B = 20 … 30 V DC, T_A = 23 °C ± 5 °C [2] Refers to switching distance [3] Max. 20 % ripple, within U_B [4] With connected IP 67 plug

Connection plug, 3-pin	Connection cable, 3-wire
	
154-00160	154-00163

Switching distance	Switching output	Type of connection	Part number	Article number
3 mm	PNP	Plug, M8x1, 3-pin	IS 588-02-X	996-51280
3 mm	PNP	Cable, 2 m, 3-wire	IS 588-02	996-50589
3 mm	NPN	Cable, 2 m, 3-wire	IS 588-01	996-50650

IT 12

Inductive sensor in cubic housing



Sensor data	
Switching distance (Flush)	4 mm
Ensured switching distance (Flush)	0 … 3.24 mm
Switching distance (Non-flush)	8 mm
Ensured switching distance (Non-flush)	0 … 6.48 mm
Hysteresis	~ 5 %
Reduction factor, Al	0.3
Reduction factor, Cu	0.2
Reduction factor, V2A	0.7

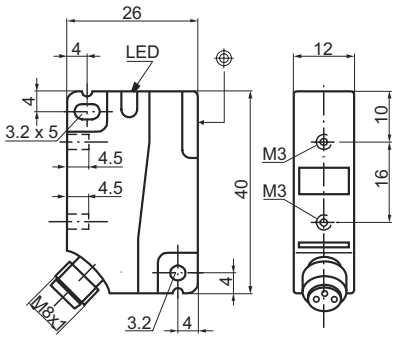
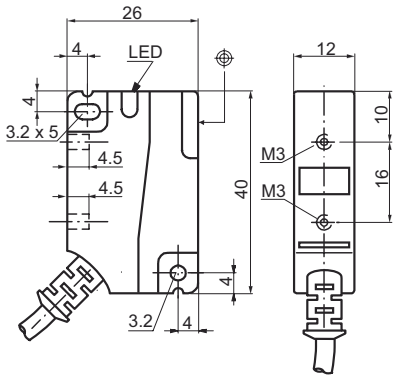
Functions	
Indicator LED, yellow	Switching output indicator

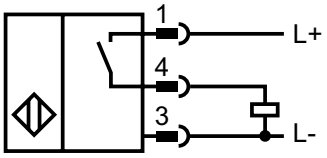
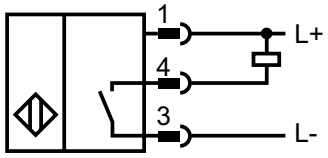
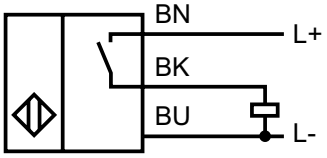
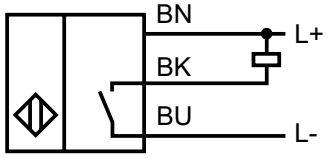
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 15 mA
Output current, Ie	≤ 250 mA
Voltage drop, U_D	≤ 2.5 V
Residual current, Ir	≤ 0.01 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Switching output, Q	PNP / NPN (see Selection Table)
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	≤ 1400 Hz

Mechanical data	
Dimensions	40 x 26 x 12 mm³
Enclosure rating	IP 67[1]
Material, housing	PA
Material, front surface	PA
Type of connection	See Selection Table
Ambient temperature: operation	-25 … +70 °C
Vibration and impact resistance	EN 60947-5-2

[1] With connected IP 67 plug

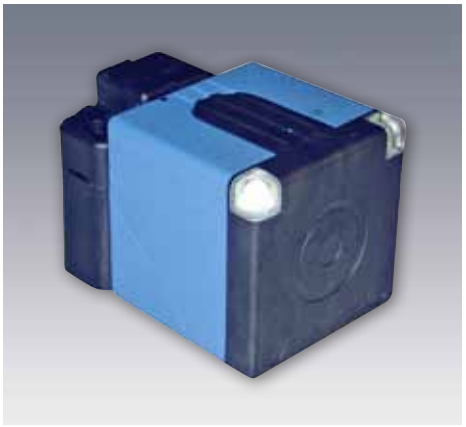
Switching distance	Mounting	Switching output	Type of connection	Part number	Article number
4 mm	Flush	PNP	Plug, M8x1, 3-pin	IT 12-4B-PS-M3	697-01063
4 mm	Flush	NPN	Plug, M8x1, 3-pin	IT 12-4B-NS-M3	697-01062
4 mm	Flush	PNP	Cable, 2 m, 3-wire	IT 12-4B-PS-K3	697-01061
4 mm	Flush	NPN	Cable, 2 m, 3-wire	IT 12-4B-NS-K3	697-01060
8 mm	Non-flush	PNP	Plug, M8x1, 3-pin	IT 12-8N-PS-M3	697-01067
8 mm	Non-flush	NPN	Plug, M8x1, 3-pin	IT 12-8N-NS-M3	697-01066
8 mm	Non-flush	PNP	Cable, 2 m, 3-wire	IT 12-8N-PS-K3	697-01065
8 mm	Non-flush	NPN	Cable, 2 m, 3-wire	IT 12-8N-NS-K3	697-01064

Plug connection	Cable connection
 153-00889	 153-00888

Connection plug, 3-pin (PNP)	Connection plug, 3-pin (NPN)
 154-00294	 154-00293
Connection cable, 3-wire (PNP)	**Connection cable, 3-wire (NPN)**
 154-00294	 154-00293

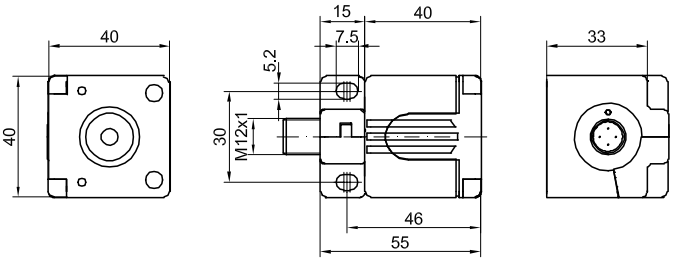
IT 40

Inductive sensor in cubic housing



CE

Plug connection



153-00571

Sensor data	
Switching distance	15 mm / 20 mm / 35 mm (see Selection Table)
Reduction factors	See Selection Table

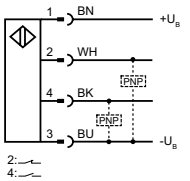
Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Default setting	Max. switching distance

Electrical data	
Operating voltage, $+U_B$	15 … 34 V DC
No-load current, I_0	≤ 30 mA[1]
Output current, Ie	≤ 200 mA
Protective circuits	Short-circuit protection (Q) / overload protection / induction protection
Power On Delay	100 ms
Switching output, Q	PNP / NPN, antivalent (see Selection Table)
Output function	N.O. / N.C. (see Selection Table)
Switching frequency, f (ti/tp 1:1)	See Selection Table
Connection, BK	N.O.
Connection, WH	N.C.

Mechanical data	
Dimensions	40 x 55 x 40 mm[3]
Mounting	Flush / non-flush See Selection Table
Enclosure rating	IP 67[2]
Material, housing	PBT
Type of connection	Plug, M12x1, 4-pin
Ambient temperature: operation	-25 … +85 °C[3]
Ambient temperature: storage	-40 … +85 °C
Weight	130 g
Vibration and impact resistance	EN 60947-5-2

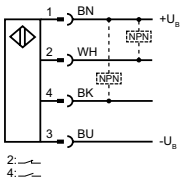
[1] At 24 V DC [2] With connected IP 67 plug [3] Except IT 40 NB-NAL4 (-25 … +70 °C)

Connection, 4-pin (PNP)



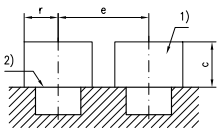
154-00193

Connection, 4-pin (NPN)



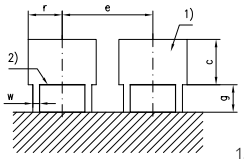
154-00494

Flush mounting



155-00087

Non-flush mounting



155-00086

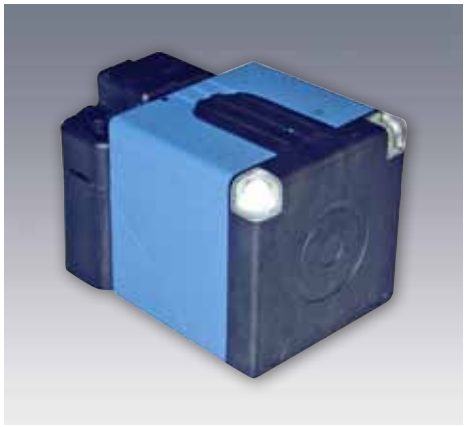
Switching distance	Mounting	Switching output	Switching frequency, f (ti/tp 1:1)	Reduction factors	Part number	Article number
15 mm	Flush[4]	PNP, antivalent (N.O./N.C.)	100 Hz	Al: 0.20 / Cu: 0.10 / V2A: 0.85	IT 40 B-PAL4	810-50000
15 mm	Flush[4]	NPN, antivalent (N.O./N.C.)	100 Hz	Al: 0.20 / Cu: 0.10 / V2A: 0.85	IT 40 B-NAL4	810-50002
20 mm	Flush[5]	PNP, antivalent (N.O./N.C.)	30 Hz	Al: 0.30 / Cu: 0.30 / V2A: 0.70	IT 40 BD-PAL4	810-50001
20 mm	Flush[5]	NPN, antivalent (N.O./N.C.)	30 Hz	Al: 0.30 / Cu: 0.30 / V2A: 0.70	IT 40 BD-NAL4	810-50003
35 mm	Non-flush[6]	PNP, antivalent (N.O./N.C.)	30 Hz	Al: 0.45 / Cu: 0.40 / V2A: 0.70	IT 40 NB-PAL4	810-50006
35 mm	Non-flush[6]	NPN, antivalent (N.O./N.C.)	30 Hz	Al: 0.45 / Cu: 0.40 / V2A: 0.70	IT 40 NB-NAL4	810-50007

[4] e > 75 mm, r > 25 mm, c > 30 mm [5] e > 80 mm, r > 30 mm, c > 40 mm [6] e > 160 mm, r > 80 mm, g > 40 mm, w > 15 mm, c > 90 mm

Version: 10/2013. Subject to changes; diagrams similar

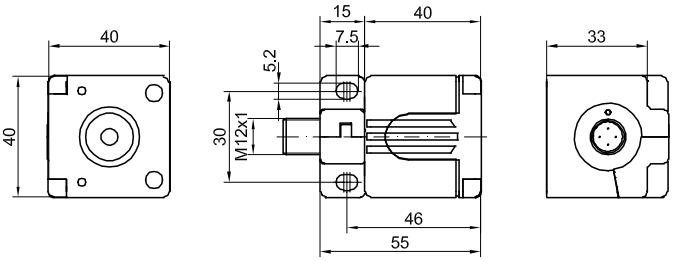
IT 40

Inductive sensor in cubic housing, AC/DC



CE

Plug connection



153-00571

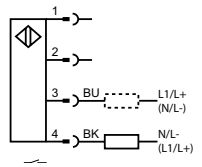
Sensor data		Functions	
Switching distance	15 mm / 20 mm / 35 mm (see Selection Table)	Indicator LED, green	Operating voltage indicator
Reduction factors	See Selection Table	Indicator LED, yellow	Switching output indicator
		Default setting	Max. switching distance

Electrical data		Mechanical data	
Operating voltage, $+U_B$	20 … 320 V DC / 20 … 265 V AC	Dimensions	40 x 55 x 40 mm[3]
No-load current, I_0	1.5 mA[1]	Mounting	Flush / non-flush (see Selection Table)
Output current, Ie	≤ 300 mA	Enclosure rating	IP 67[2]
Protective circuits	Induction protection	Material, housing	PBT
Power On Delay	100 ms	Type of connection	Plug, M12x1, 4-pin
Switching output, Q	AC / DC (see Selection Table)	Ambient temperature: operation	-25 … +85 °C[3]
Output function	N.O.	Ambient temperature: storage	-40 … +85 °C
Switching frequency, f (ti/tp 1:1)	See Selection Table	Weight	130 g
		Vibration and impact resistance	EN 60947-5-2

[1] at 24 V [2] With connected IP 67 plug [3] Except IT 40 NB-ACSL4 (-25 … +70 °C)

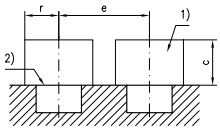
12

Connection, 4-pin



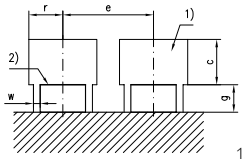
154-00503

Flush mounting



155-00087

Non-flush mounting



155-00086

Switching distance	Mounting	Switching output	Switching frequency, f (ti/tp 1:1)	Reduction factors	Part number	Article number
15 mm	Flush[4]	AC/DC	25 Hz (AC) / 50 Hz (DC)	Al: 0.20 / Cu: 0.10 / V2A: 0.85	IT 40 B-ACSL4	810-50004
20 mm	Flush[5]	AC/DC	25 Hz (AC) / 30 Hz (DC)	Al: 0.20 / Cu: 0.30 / V2A: 0.70	IT 40 BD-ACSL4	810-50005
35 mm	Non-flush[6]	AC/DC	25 Hz (AC) / 30 Hz (DC)	Al: 0.45 / Cu: 0.40 / V2A: 0.70	IT 40 NB-ACSL4	810-50008

[4] e > 75 mm, r > 25 mm, c > 30 mm [5] e > 80 mm, r > 30 mm, c > 40 mm [6] e > 160 mm, r > 80 mm, g > 40 mm, w > 15 mm, c > 90 mm

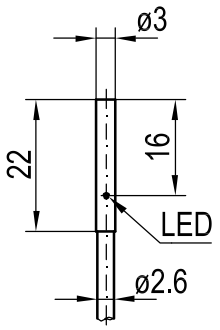
IS 33

Inductive sensor with stainless steel housing



CE

Cable connection



153-00512

Sensor data	
Switching distance	0.6 mm
Reduction factor, Al	0.55
Reduction factor, Cu	0.50
Reduction factor, V2A	0.80

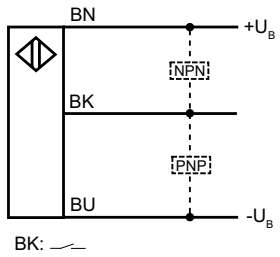
Functions	
Indicator LED, yellow	Switching output indicator

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
No-load current, I_0	≤ 10 mA
Output current, Ie	≤ 100 mA
Switching frequency, f (ti/tp 1:1)	≤ 5000 Hz
Switching output, Q	PNP / NPN (see Selection Table)
Output function	N.O.

Mechanical data	
Dimensions	Ø 3 x 22 mm
Mounting	Flush
Enclosure rating	IP 67[2]
Material, housing	Stainless steel
Type of connection	See Selection Table
Ambient temperature: operation	-25 … 70 °C

[1] Max. 20 % ripple, within U_B [2] With connected IP 67 plug

Connection, 3-wire



154-00163

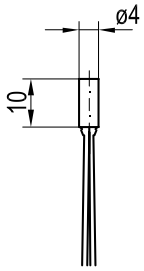
Switching distance	Switching output	Type of connection	Part number	Article number
0.6 mm	PNP	Cable, 3-wire	IS 33-52	996-09390
0.6 mm	NPN	Cable, 3-wire	IS 33-51	996-09391

ISN 44-20

Inductive sensor, NAMUR design



Cable connection



153-00315

Sensor data

Switching distance	0.8 mm
Repeatability	0.01 mm[1]
Reduction factor, Al	0.50
Reduction factor, Cu	0.45
Reduction factor, V2A	0.80
Reduction factor, steel FE 360	1.00
Reduction factor, brass	0.55

Electrical data

Operating voltage, $+U_B$ (NAMUR* conditions)	7.7 … 9 V DC[2]
Operating voltage, $+U_B$ (not NAMUR*)	5 … 30 V DC[2]
Operating resistance, NAMUR	1 kΩ
Recommended operating resistance	1 kΩ (5 … 10 V) / 2.2 kΩ (10 … 20 V) / 4.7 kΩ (20 … 30 V)
Output current, Ie (dampened / undampened)	≤ 1 mA / ≥ 2.2 mA
Protective circuits	Short-circuit protection (Q)
Switching frequency, f (ti/tp 1:1)	≤ 10000 Hz

Mechanical data

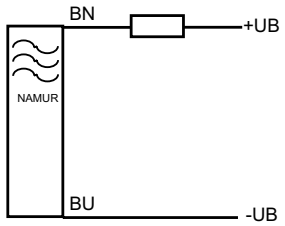
Dimensions	Ø 4 x 10 mm
Mounting	Flush
Enclosure rating	IP 67[3]
Material, housing	Stainless steel, V2A
Material, front surface	PA 66
Type of connection	See Selection Table
Ambient temperature: operation	-25 … 70 °C
Vibration and impact resistance	IEC 60947-5-2 / 7.4

12

[1] U_B = 7.7 … 9 V DC, T_A = 23 °C ± 5 °C [2] Max. 20 % ripple, within U_B [3] With connected IP 67 plug

* Standardization Association for Measurement and Control in the Chemical and Pharmaceutical Industries

Cable connection



154-00223

Switching distance	Switching output	Type of connection	Part number	Article number
0.8 mm	NAMUR*	Cable, 2 m, 2-wire	ISN 44-20	996-09444

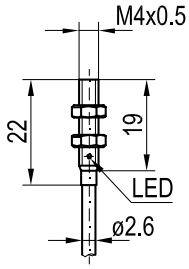
IS 34

Inductive sensor with stainless steel housing



CE

Cable connection



153-00513

Sensor data

Switching distance	0.6 mm
Repeatability	0.01 mm[1]
Hysteresis	~ 10 %[2]
Reduction factor, Al	0.55
Reduction factor, Cu	0.50
Reduction factor, V2A	0.80
Reduction factor, steel FE 360	1.00
Reduction factor, brass	0.65

Functions

Indicator LED, yellow	Switching output indicator

Electrical data

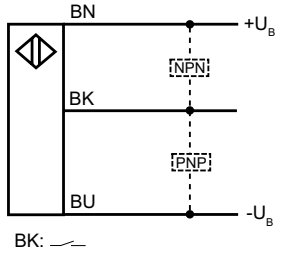
Operating voltage, $+U_B$	10 … 30 V DC[3]
No-load current, I_0	≤ 10 mA
Output current, Ie	≤ 100 mA
Voltage drop, U_D	≤ 2.0 V at 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q) / induction protection
Switching output, Q	PNP / NPN (see Selection Table)
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	≤ 5000 Hz

Mechanical data

Dimensions	M4 x 22 mm
Mounting	Flush
Enclosure rating	IP 67[4]
Material, housing	Stainless steel, V2A
Material, front surface	Polyester
Type of connection	See Selection Table
Ambient temperature: operation	-25 … +70 °C
Vibration and impact resistance	IEC 60947-5-2 / 7.4

[1] U_B = 20 … 30 V DC, T_A = 23 °C ± 5 °C [2] Refers to switching distance [3] Max. 20 % ripple, within U_B [4] With connected IP 67 plug

Connection, 3-wire



154-00163

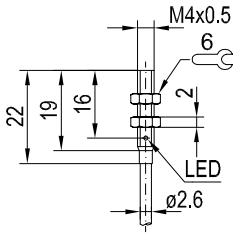
Switching distance	Switching output	Type of connection	Part number	Article number
0.6 mm	PNP	Cable, 2 m, 3-wire	IS 34-52	996-09397
0.6 mm	NPN	Cable, 2 m, 3-wire	IS 34-51	996-09395

IT 4

Inductive sensor with stainless steel housing



Cable connection



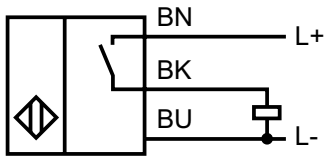
153-00998

Sensor data		Functions	
Switching distance	1 mm	Indicator LED, yellow	Switching output indicator
Hysteresis	1 … 15 %		

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC	Dimensions	M4 x 22 mm
Output current, Ie	≤ 100 mA	Mounting	Flush
Protective circuits	Reverse-polarity protection, U_B	Enclosure rating	IP 67[1]
Switching frequency, f (ti/tp 1:1)	≤ 3000 Hz	Material, housing	Stainless steel, V2A
Switching output, Q	PNP	Type of connection	See Selection Table
Output function	N.O.	Ambient temperature: operation	-25 … 70 °C

[1] With connected IP 67 plug

Connection, 3-wire



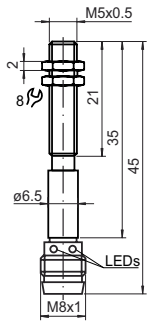
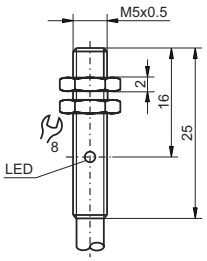
154-00294

Switching distance	Switching output	Type of connection	Part number	Article number
1 mm	PNP	Cable, 3-wire	IT 4 BD-PSK3	996-51486

IMT 5

Inductive sensor with stainless steel housing

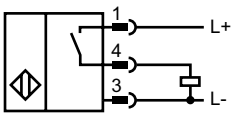
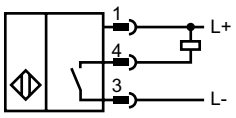
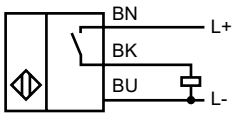
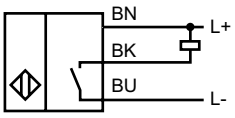


Plug connection	Cable connection
 153-00861	 153-00860

Sensor data		Functions	
Switching distance	0.8 mm	Indicator LED, yellow	Switching output indicator
Ensured switching distance	0 … 0.648 mm		
Reduction factor, Al	0.45		
Reduction factor, Cu	0.40		
Reduction factor, V2A	0.85 / 0.77[1]		

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC	Dimensions (plug device)	M5 x 45 mm
No-load current, I_0	See Selection Table	Dimensions (cable device)	M5 x 25 mm
Output current, Ie	See Selection Table	Mounting	Flush
Voltage drop, U_D	≤ 3 V	Enclosure rating	IP 67[2]
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, housing	Stainless steel
		Material, front surface	PBT / PC[1]
Switching output, Q	PNP / NPN (see Selection Table)	Type of connection	See Selection Table
Output function	N.O.	Ambient temperature: operation	-25 … +70 °C
Switching frequency, f (ti/tp 1:1)	≤ 3000 Hz		

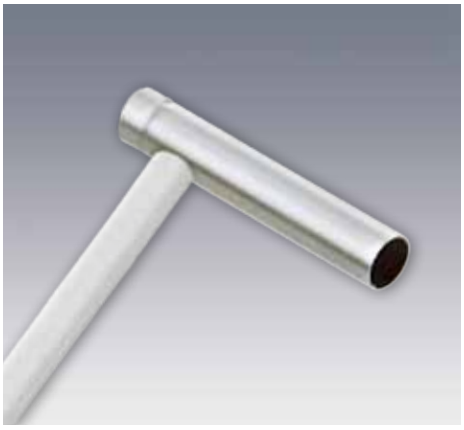
[1] IMT 5-0B8-PS-K3 [2] With connected IP 67 plug

Connection plug, 3-pin (PNP)	Connection plug, 3-pin (NPN)	Connection cable, 3-wire (PNP)	Connection cable, 3-wire (NPN)
 154-00294	 154-00293	 154-00294	 154-00293

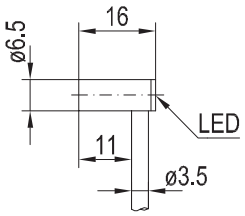
Switching distance	Switching output	Type of connection	No-load current, I_0	Output current, Ie	Part number	Article number
0.8 mm	PNP	Plug, M8x1, 3-pin	≤ 15 mA	0,1…100 mA	IMT 5-0B8-PS-M3	697-01007
0.8 mm	NPN	Plug, M8x1, 3-pin	≤ 12 mA	0,1…100 mA	IMT 5-0B8-NS-M3	697-01006
0.8 mm	PNP	Cable, 2 m, 3-wire	≤ 10 mA	0 … 200 mA	IMT 5-0B8-PS-K3	697-01005
0.8 mm	NPN	Cable, 2 m, 3-wire	≤ 12 mA	0 … 100 mA	IMT 5-0B8-NS-K3	697-01004

ISZ 46

Inductive sensor with stainless steel housing



Cable connection



153-00316

Sensor data

Switching distance	1.5 mm
Repeatability	0.02 mm[1]
Hysteresis	≤ 10 %[2]
Reduction factor, Al	0.45
Reduction factor, Cu	0.40
Reduction factor, V2A	0.80
Reduction factor, steel FE 360	1.00
Reduction factor, brass	0.50

Functions

Indicator LED, yellow	Switching output indicator

Electrical data

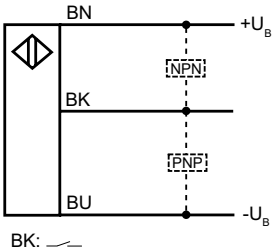
Operating voltage, $+U_B$	10 … 30 V DC[3]
No-load current, I_0	≤ 10 mA
Output current, Ie	≤ 200 mA
Voltage drop, U_D	≤ 2 V at 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q) / induction protection
Switching output, Q	PNP / NPN (see Selection Table)
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	≤ 5000 Hz

Mechanical data

Dimensions	Ø 6,5 x 16 mm
Mounting	Flush
Enclosure rating	IP 67[4]
Material, housing	Stainless steel, V2A
Material, front surface	PA 66
Type of connection	See Selection Table
Ambient temperature: operation	-25 … 70 °C
Vibration and impact resistance	IEC 60947-5-2 / 7.4

[1] U_B = 20 … 30 V DC, T_A = 23 °C ± 5 °C [2] Refers to switching distance [3] Max. 20 % ripple, within U_B [4] With connected IP 67 plug

Connection, 3-wire

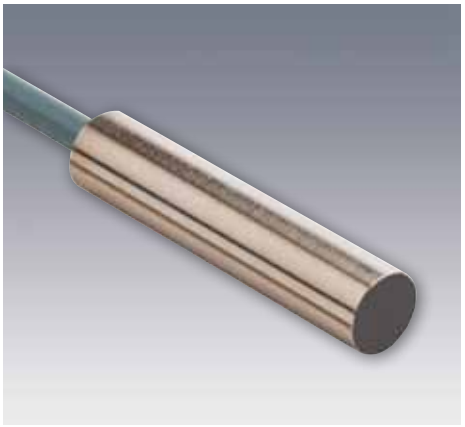


154-00163

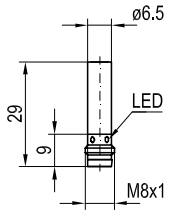
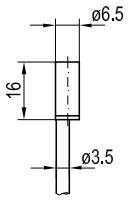
Switching distance	Switching output	Type of connection	Part number	Article number
1.5 mm	PNP	Cable, 2m, 3-wire	ISZ 46-02	996-09488
1.5 mm	NPN	Cable, 2m, 3-wire	ISZ 46-01	996-09487

IS 46

Inductive sensor with stainless steel housing



CE

Plug connection	Cable connection
 153-00311	 153-00310

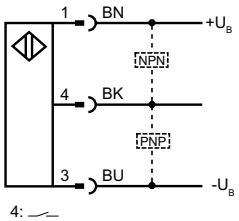
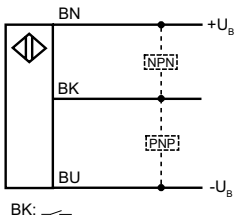
Sensor data	
Switching distance	1.5 mm
Repeatability	0.02 mm[1]
Hysteresis	≤ 10 %[2]
Reduction factor, Al	0.45
Reduction factor, Cu	0.40
Reduction factor, V2A	0.80
Reduction factor, steel FE 360	1.00
Reduction factor, brass	0.50

Functions	
Indicator LED, yellow	Switching output indicator

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[3]
No-load current, I_0	≤ 10 mA
Output current, Ie	≤ 200 mA
Voltage drop, U_D	≤ 2 V at 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q) / induction protection
Switching output, Q	PNP / NPN (see Selection Table)
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	≤ 5000 Hz

Mechanical data	
Dimensions (plug device)	Ø 6.5 x 29 mm
Dimensions (cable device)	Ø 6.5 x 16 mm
Mounting	Flush
Enclosure rating	IP 67[4]
Material, housing	Stainless steel, V2A
Material, front surface	PA 66
Type of connection	See Selection Table
Ambient temperature: operation	-25 … +70 °C
Vibration and impact resistance	IEC 60947-5-2 / 7.4

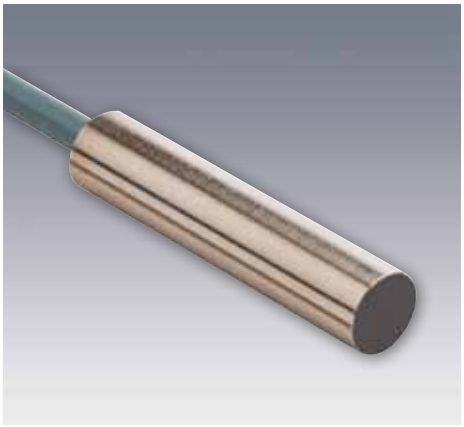
[1] U_B = 20 … 30 V DC, T_A = 23 °C ± 5 °C [2] Refers to switching distance [3] Max. 20 % ripple, within U_B [4] With connected IP 67 plug

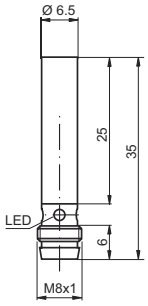
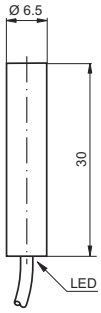
Connection plug, 3-pin	Connection cable, 3-wire
 154-00163	 154-00163

Switching distance	Switching output	Type of connection	Part number	Article number
1.5 mm	PNP	Plug, M8x1, 3-pin	IS 46-12	996-50590
1.5 mm	NPN	Plug, M8x1, 3-pin	IS 46-11 T	996-50613
1.5 mm	PNP	Cable, 2 m, 3-wire	IS 46-02	996-09401

IDT 6

Inductive sensor



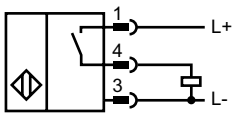
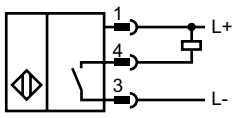
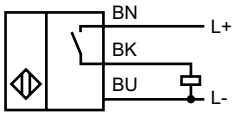
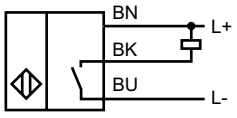
Plug connection	Cable connection
 153-00879	 153-00878

Sensor data		Functions	
Switching distance	2 mm	Indicator LED, yellow	Switching output indicator
Ensured switching distance	0 … 1.62 mm		
Reduction factor, Al	0.45		
Reduction factor, Cu	0.40 / 0.35[1]		
Reduction factor, V2A	0.75 / 0.70[1]		

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC / 5 … 30 V DC[1]	Dimensions (plug device)	Ø 6.5 x 35 mm
No-load current, I_0	≤ 15 mA	Dimensions (cable device)	Ø 6.5 x 30 mm
Operating current, I_L	≤ 100 mA	Mounting	Flush
Voltage drop, U_D	≤ 3 V / ≤ 2.5 V[1]	Enclosure rating	IP 67[3]
Protective circuits	Reverse-polarity protection, U_B[2] / short-circuit protection (Q)	Material, housing	Brass, nickel-plated
		Material, front surface	LCP
Switching output, Q	PNP / NPN (see Selection Table)	Type of connection	See Selection Table
Output function	N.O.	Ambient temperature: operation	-25 … +70 °C
Switching frequency, f (ti/tp 1:1)	≤ 3000 Hz		

[1] IDT 6 2B-NS-M3 [2] Except IDT 6 2B-NS-M3 [3] With connected IP 67 plug

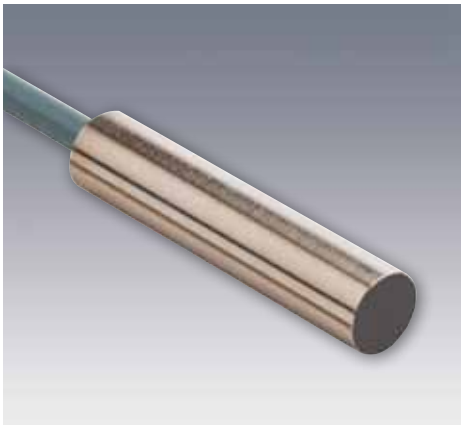
12

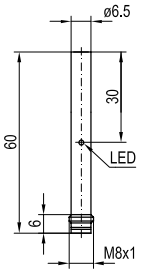
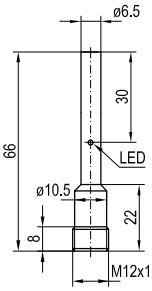
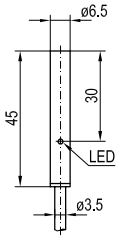
Connection plug, 3-pin (PNP)	Connection plug, 3-pin (NPN)	Connection cable, 3-wire (PNP)	Connection cable, 3-wire (NPN)
 154-00294	 154-00293	 154-00294	 154-00293

Switching distance	Switching output	Type of connection	Part number	Article number
2 mm	PNP	Plug, M8x1, 3-pin	IDT 6-2B-PS-M3	697-01042
2 mm	NPN	Plug, M8x1, 3-pin	IDT 6-2B-NS-M3	697-01043
2 mm	PNP	Cable, 2 m, 3-wire	IDT 6-2B-PS-K3	697-01040
2 mm	NPN	Cable, 2 m, 3-wire	IDT 6-2B-NS-K3	697-01041

IS 56

Inductive sensor

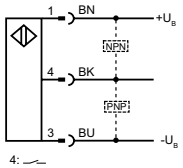
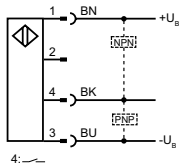
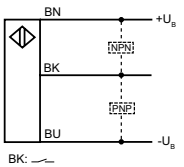


Plug connection (M8x1)	Plug connection (M12x1)	Cable connection
		
153-00313	153-00314	153-00312

Sensor data		Functions	
Switching distance	3 mm	Indicator LED, yellow	Switching output indicator
Repeatability	0.15 mm[1]		
Hysteresis	≤ 10 %[2]		
Reduction factor, Al	0.26		
Reduction factor, Cu	0.18		
Reduction factor, V2A	0.67		
Reduction factor, steel FE 360	1.00		
Reduction factor, brass	0.35		

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[3]	Dimensions	See Selection Table
No-load current, I_0	≤ 10 mA	Mounting	Quasi-flush
Output current, Ie	≤ 200 mA	Enclosure rating	IP 67[4]
Voltage drop, U_D	≤ 2 V at 200 mA	Material, housing	Brass, chrome-plated
Protective circuits	Reverse-polarity protection, U_B / Short-circuit protection (Q) / induction protection	Material, front surface	PBTP
		Type of connection	See Selection Table
Switching output, Q	PNP / NPN (see Selection Table)	Ambient temperature: operation	-25 … +70 °C
Output function	N.O.	Vibration and impact resistance	IEC 60947-5-2 / 7.4
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz		

[1] U_B = 20 … 30 V DC, T_A = 23 °C ± 5 °C [2] Refers to switching distance [3] Max. 20 % ripple, within U_B [4] With connected IP 67 plug

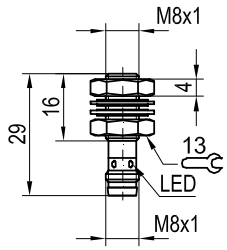
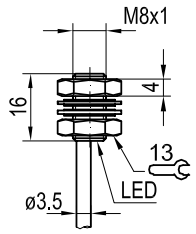
Connection plug, 3-pin	Connection plug, 4-pin	Connection cable, 3-wire
		
154-00163	154-00177	154-00163

Switching distance	Switching output	Dimensions	Type of connection	Part number	Article number
3 mm	PNP	Ø 6.5 x 60 mm	Plug, M8x1, 3-pin	IS 56-12	996-50586
3 mm	NPN	Ø 6.5 x 60 mm	Plug, M8x1, 3-pin	IS 56-11 T	996-50632
3 mm	PNP	Ø 6.5 x 66 mm	Plug, M12x1, 4-pin	IS 56-42	996-09963
3 mm	NPN	Ø 6.5 x 66 mm	Plug, M12x1, 4-pin	IS 56-41	996-50390
3 mm	PNP	Ø 6.5 x 45 mm	Cable, 2 m, 3-wire	IS 56-02	996-09409
3 mm	NPN	Ø 6.5 x 45 mm	Cable, 2 m, 3-wire	IS 56-01	996-09408

IS 48

Inductive sensor with stainless steel housing

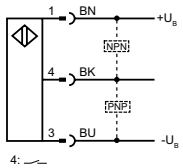
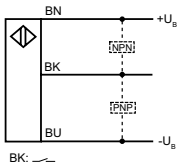


Plug connection	Cable connection
 153-00318	 153-00317

Sensor data		Functions	
Switching distance	1.5 mm	Indicator LED, yellow	Switching output indicator
Repeatability	0.02 mm[1]		
Hysteresis	≤ 10 %[2]		
Reduction factor, Al	0.45		
Reduction factor, Cu	0.40		
Reduction factor, V2A	0.80		
Reduction factor, steel FE 360	1.00		
Reduction factor, brass	0.50		

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[3]	Dimensions (plug device)	M8 x 29 mm
No-load current, I_0	≤ 10 mA	Dimensions (cable device)	M8 x 16 mm
Output current, Ie	≤ 200 mA	Mounting	Flush
Voltage drop, U_D	≤ 2 V at 200 mA	Enclosure rating	IP 67[4]
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q) / induction protection	Material, housing	Stainless steel, V2A
		Material, front surface	PA 66
Switching output, Q	PNP / NPN (see Selection Table)	Type of connection	See Selection Table
Output function	N.O.	Ambient temperature: operation	-25 … +70 °C
Switching frequency, f (ti/tp 1:1)	≤ 5000 Hz	Vibration and impact resistance	IEC 60947-5-2 / 7.4

[1] U_B = 20 … 30 V DC, T_A = 23 °C ± 5 °C [2] Refers to switching distance [3] Max. 20 % ripple, within U_B [4] With connected IP 67 plug

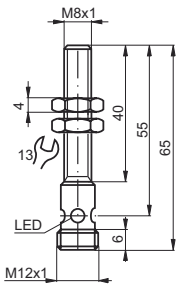
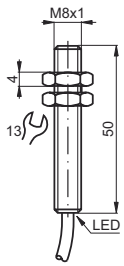
Connection plug, 3-pin	Connection cable, 3-wire
 154-00163	 154-00163

Switching distance	Switching output	Type of connection	Part number	Article number
1.5 mm	PNP	Plug, M8x1, 3-pin	IS 48-12T	996-50624
1.5 mm	NPN	Plug, M8x1, 3-pin	IS 48-11T	996-50623
1.5 mm	PNP	Cable, 2 m, 3-wire	IS 48-02	996-09405
1.5 mm	NPN	Cable, 2 m, 3-wire	IS 48-01	996-09404

IMT 8-1

Inductive sensor

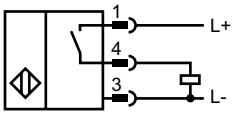
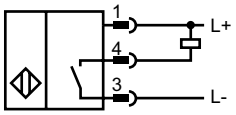
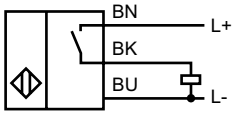
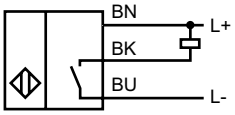


Plug connection	Cable connection
 153-00863	 153-00862

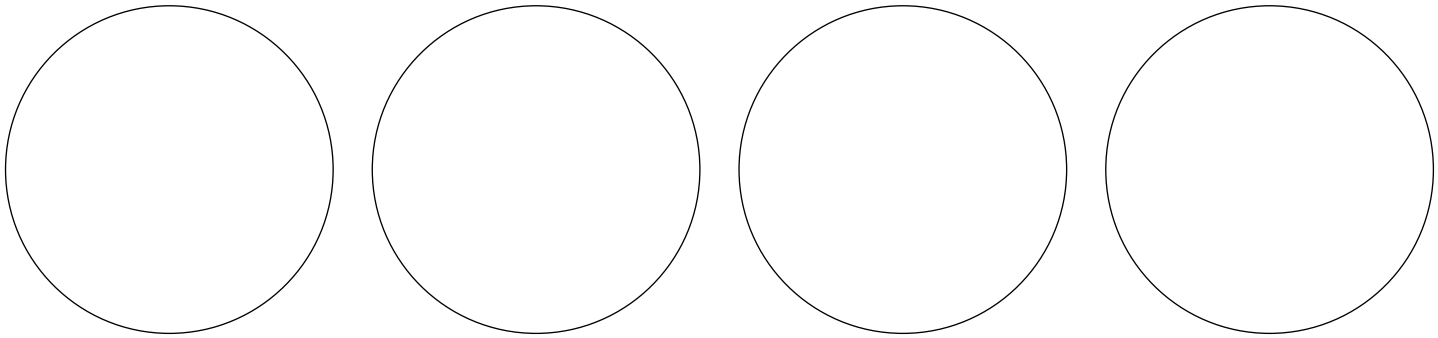
Sensor data		Functions	
Switching distance	1.5 mm	Indicator LED, yellow	Switching output indicator
Ensured switching distance	0 … 1.215 mm		
Reduction factor, Al	0.45		
Reduction factor, Cu	0.35		
Reduction factor, V2A	0.75		

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC	Dimensions (plug device)	M8 x 65 mm
No-load current, I_0	≤ 15 mA	Dimensions (cable device)	M8 x 50 mm
Operating current, I_L	≤ 100 mA	Mounting	Flush
Voltage drop, U_D	≤ 3 V	Enclosure rating	IP 67[1]
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, housing (plug device)	Brass, nickel-plated
Switching output, Q	PNP / NPN (see Selection Table)	Material, housing (cable device)	Brass
Output function	N.O.	Material, front surface	LCP
Switching frequency, f (ti/tp 1:1)	≤ 1500 Hz	Type of connection	See Selection Table
		Ambient temperature: operation	-25 … +70 °C

[1] With connected IP 67 plug

Connection plug, 3-pin (PNP)	Connection plug, 3-pin (NPN)	Connection cable, 3-wire (PNP)	Connection cable, 3-wire (NPN)
 154-00294	 154-00293	 154-00294	 154-00293

Switching distance	Switching output	Type of connection	Part number	Article number
1.5 mm	PNP	Plug, M12x1, 3-pin	IMT 8-1B5-PS-L4	697-01011
1.5 mm	NPN	Plug, M12x1, 3-pin	IMT 8-1B5-NS-L4	697-01010
1.5 mm	PNP	Cable, 2 m, 3-wire	IMT 8-1B5-PS-K3	697-01009
1.5 mm	NPN	Cable, 2 m, 3-wire	IMT 8-1B5-NS-K3	697-01008



IMT 8-2

Inductive sensor



Sensor data	
Switching distance	2 mm
Ensured switching distance	0 … 1.62 mm
Reduction factor, Al	0.45
Reduction factor, Cu	0.35[1] / 0.40[2]
Reduction factor, V2A	0.75 / 0.7[3]

Functions	
Indicator LED, yellow	Switching output indicator

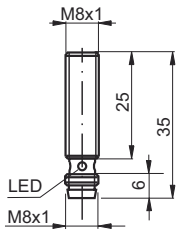
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC / 5 … 30 V DC[3]
No-load current, I_0	≤ 15 mA
Operating current, I_L	≤ 100 mA
Voltage drop, U_D	≤ 3 V / ≤ 2.5 V[3]
Protective circuits	Reverse-polarity protection, U_B[4] / short-circuit protection (Q)
Switching output, Q	PNP / NPN (see Selection Table)
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	See Selection Table

Mechanical data	
Dimensions (plug device, flush)	M8 x 35 mm
Dimensions (plug device, non-flush)	M8 x 65 mm
Dimensions (cable device, flush)	M8 x 30 mm
Dimensions (cable device non-flush)	M8 x 50 mm
Mounting	Flush / non-flush (see Selection Table)
Enclosure rating	IP 67[5]
Material, housing	Brass, nickel-plated
Material, front surface (flush)	LCP
Material, front surface (non-flush)	PBT
Type of connection	See Selection Table
Ambient temperature: operation	-25 … +70 °C

[1] Non-flush devices [2] Flush devices, except IMT 8-2B-NS-M3 (0.35) [3] IMT 8-2B-NS-M3 [4] Except IMT 8-2B-NS-M3 [5] With connected IP 67 plug

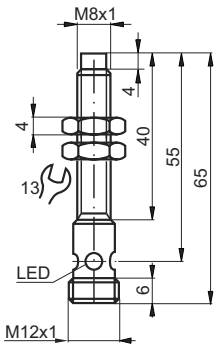
Switching distance	Mounting	Switching output	Switching frequency, f (ti/tp 1:1)	Type of connection	Part number	Article number
2 mm	Flush	PNP	≤ 3000 Hz	Plug, M8x1, 3-pin	IMT 8-2B-PS-M3	697-01046
2 mm	Flush	NPN	≤ 3000 Hz	Plug, M8x1, 3-pin	IMT 8-2B-NS-M3	697-01047
2 mm	Flush	PNP	≤ 3000 Hz	Cable, 2 m, 3-wire	IMT 8-2B-PS-K3	697-01044
2 mm	Flush	NPN	≤ 3000 Hz	Cable, 2 m, 3-wire	IMT 8-2B-NS-K3	697-01045
2 mm	Non-flush	PNP	≤ 1500 Hz	Plug, M12x1, 3-pin	IMT 8-2N-PS-L4	697-01015
2 mm	Non-flush	NPN	≤ 1500 Hz	Plug, M12x1, 3-pin	IMT 8-2N-NS-L4	697-01014
2 mm	Non-flush	PNP	≤ 1500 Hz	Cable, 2 m, 3-wire	IMT 8-2N-PS-K3	697-01013
2 mm	Non-flush	NPN	≤ 1500 Hz	Cable, 2 m, 3-wire	IMT 8-2N-NS-K3	697-01012

Plug connection (flush)



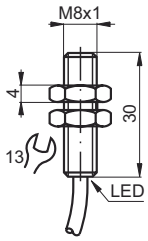
153-00881

Plug connection (non-flush)



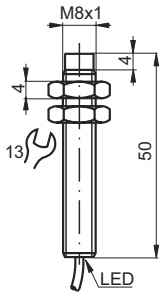
153-00865

Cable connection (flush)



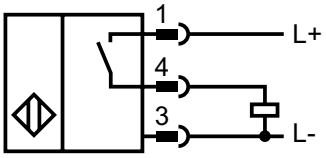
153-00880

Cable connection (non-flush)



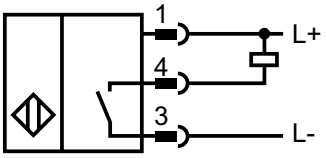
153-00864

Connection plug, 3-pin (PNP)



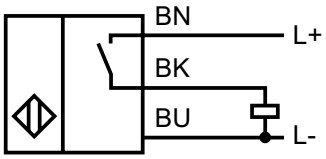
154-00294

Connection plug, 3-pin (NPN)



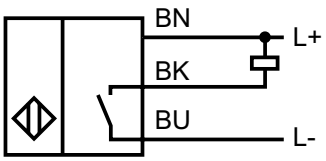
154-00293

Connection cable, 3-wire (PNP)



154-00294

Connection cable, 3-wire (NPN)



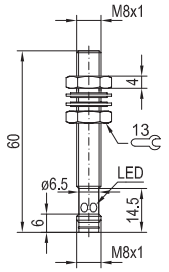
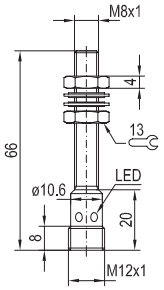
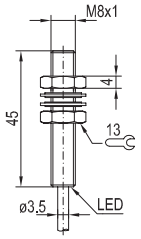
154-00293

IS 58

Inductive sensor



CE

Plug connection (M8x1)	Plug connection (M12x1)	Cable connection
 153-00321	 153-00323	 153-00319

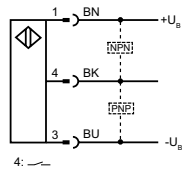
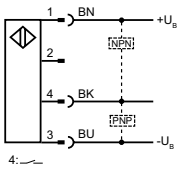
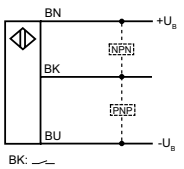
Sensor data	
Switching distance	3 mm
Repeatability	0.15 mm[1]
Hysteresis	≤ 15 %[2]
Reduction factor, Al	0.33
Reduction factor, Cu	0.27
Reduction factor, V2A	0.72
Reduction factor, steel FE 360	1.00
Reduction factor, brass	0.41

Functions	
Indicator LED, yellow	Switching output indicator

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[3]
No-load current, I_0	≤ 10 mA
Output current, Ie	≤ 200 mA
Voltage drop, U_D	≤ 2 V at 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q) / induction protection
Switching output, Q	PNP / NPN (see Selection Table)
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz

Mechanical data	
Dimensions	See Selection Table
Enclosure rating	IP 67[4]
Mounting	Flush
Material, housing	Nickel silver, chrome-plated
Material, front surface	PBTP (PPS)
Type of connection	See Selection Table
Ambient temperature: operation	-25 … +70 °C
Vibration and impact resistance	IEC 60947-5-2 / 7.4

[1] U_B = 20 … 30 V DC, T_A = 23 °C ± 5 °C [2] Refers to switching distance [3] Max. 20 % ripple, within U_B [4] With connected IP 67 plug

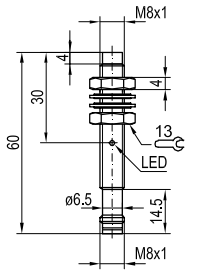
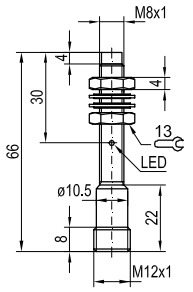
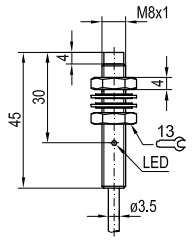
Connection plug, 3-pin	Connection plug, 4-pin	Connection cable, 3-wire
 154-00163	 154-00177	 154-00163

Switching distance	Switching output	Dimensions	Type of connection	Part number	Article number
3 mm	PNP	M8 x 60 mm	Plug, M8x1, 3-pin	IS 58-12 T	996-50587
3 mm	NPN	M8 x 60 mm	Plug, M8x1, 3-pin	IS 58-11 T	996-50640
3 mm	PNP	M8 x 66 mm	Plug, M12x1, 4-pin	IS 58-42	996-09965
3 mm	NPN	M8 x 66 mm	Plug, M12x1, 4-pin	IS 58-41	996-09964
3 mm	PNP	M8 x 45 mm	Cable, 2 m, 3-wire	IS 58-02	996-09413
3 mm	NPN	M8 x 45 mm	Cable, 2 m, 3-wire	IS 58-01	996-09412

IS 58

Inductive sensor with expanded switching distance

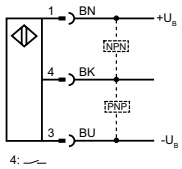
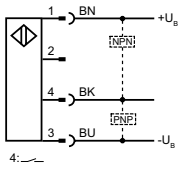
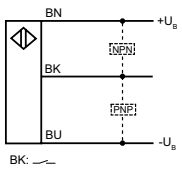


Plug connection (M8x1)	Plug connection (M12x1)	Cable connection
		
153-00322	153-00324	153-00320

Sensor data		Functions	
Switching distance	6 mm	Indicator LED, yellow	Switching output indicator
Repeatability	≤ 0.3 mm		
Reduction factor, Al	0.47		
Reduction factor, Cu	0.44		
Reduction factor, V2A	0.77		

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]	Dimensions	See Selection Table
No-load current, I_0	≤ 10 mA	Enclosure rating	IP 67[2]
Output current, Ie	≤ 200 mA	Mounting	Non-flush
Voltage drop, U_D	≤ 2 V at 200 mA	Material, housing	Brass, chrome-plated
Protective circuits	Short-circuit protection (Q) / overload protection	Material, front surface	PBTP
Power On Delay	50 ms	Type of connection	See Selection Table
Switching output, Q	PNP / NPN (see Selection Table)	Ambient temperature: operation	-25 … +70 °C
Output function	N.O.		
Switching frequency, f (ti/tp 1:1)	≤ 500 Hz		

[1] Max. 20 % ripple, within U_B [2] With connected IP 67 plug

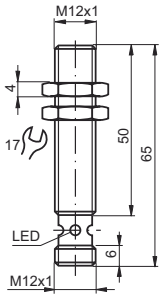
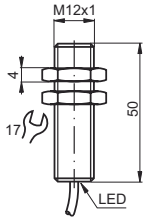
Connection plug, 3-pin	Connection plug, 4-pin	Connection cable, 3-wire
		
154-00163	154-00177	154-00163

Switching distance	Switching output	Dimensions	Type of connection	Part number	Article number
6 mm	PNP	M8 x 60 mm	Plug, M8x1, 3-pin	IS 58-14-S	996-51456
6 mm	NPN	M8 x 60 mm	Plug, M8x1, 3-pin	IS 58-13-S	996-51470
6 mm	PNP	M8 x 66 mm	Plug, M12x1, 4-pin	IS 58-44-S	996-51460
6 mm	NPN	M8 x 66 mm	Plug, M12x1, 4-pin	IS 58-43-S	996-51463
6 mm	PNP	M8 x 45 mm	Cable, 3-wire	IS 58-04-S	996-51461
6 mm	NPN	M8 x 45 mm	Cable, 3-wire	IS 58-03-S	996-51465

IMT 12-2

Inductive sensor

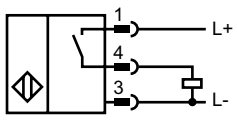
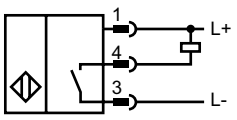
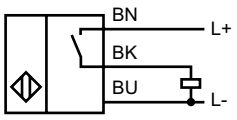
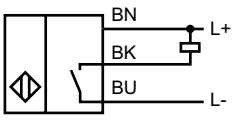


Plug connection	Cable connection
 153-00867	 153-00866

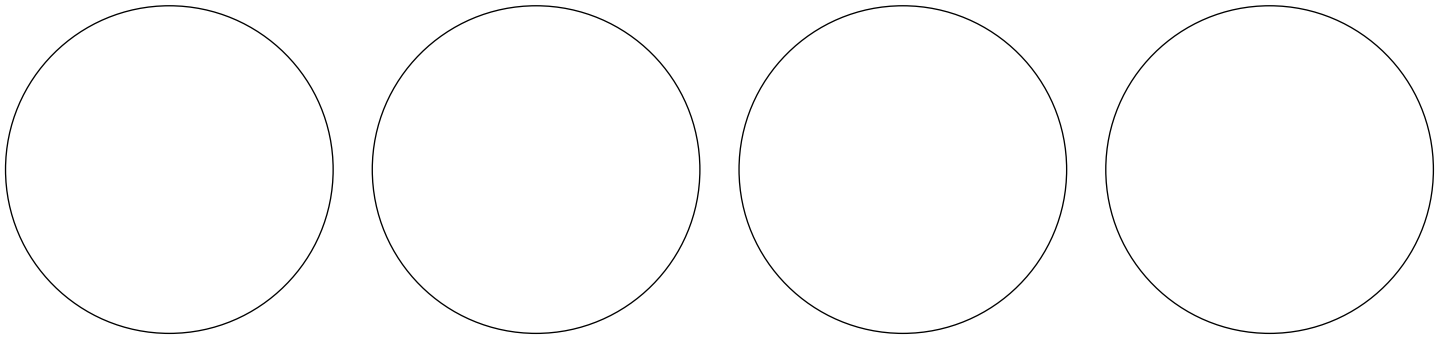
Sensor data		Functions	
Switching distance	2 mm	Indicator LED, yellow	Switching output indicator
Ensured switching distance	0 … 1.62 mm		
Reduction factor, Al	0.30		
Reduction factor, Cu	0.20		
Reduction factor, V2A	0.70		

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC	Dimensions (plug device)	M12 x 65 mm
No-load current, I_0	≤ 17 mA	Dimensions (cable device)	M12 x 50 mm
Operating current, I_L	≤ 200 mA	Mounting	Flush
Voltage drop, U_D	≤ 3 V	Enclosure rating	IP 67[1]
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, housing	Brass, nickel-plated
		Material, front surface	PBT
Switching output, Q	PNP / NPN (see Selection Table)	Type of connection	See Selection Table
Output function	N.O.	Ambient temperature: operation	-25 … +70 °C
Switching frequency, f (ti/tp 1:1)	≤ 1500 Hz		

[1] With connected IP 67 plug

Connection plug, 3-pin (PNP)	Connection plug, 3-pin (NPN)	Connection cable, 3-wire (PNP)	Connection cable, 3-wire (NPN)
 154-00294	 154-00293	 154-00294	 154-00293

Switching distance	Switching output	Type of connection	Part number	Article number
2 mm	PNP	Plug, M12x1, 3-pin	IMT 12-2B-PS-L4	697-01019
2 mm	NPN	Plug, M12x1, 3-pin	IMT 12-2B-NS-L4	697-01018
2 mm	PNP	Cable, 2 m, 3-wire	IMT 12-2B-PS-K3	697-01017
2 mm	NPN	Cable, 2 m, 3-wire	IMT 12-2B-NS-K3	697-01016



IMT 12-4

Inductive sensor



Sensor data	
Switching distance	4 mm
Ensured switching distance	0 … 3.24 mm
Reduction factor, Al (flush)	0.45[1] / 0.39[2]
Reduction factor, Cu (flush)	0.35
Reduction factor, V2A (flush)	0.7[1] / 0.75[2]
Reduction factor, Al (non-flush)	0.50
Reduction factor, Cu (non-flush)	0.40
Reduction factor, V2A (non-flush)	0.80

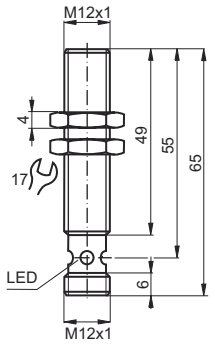
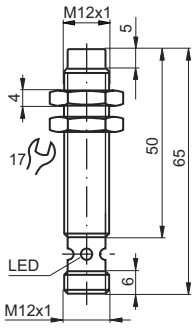
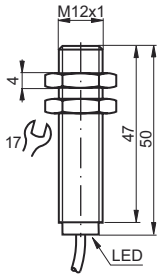
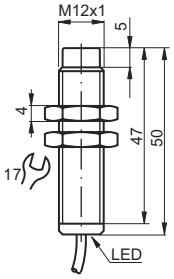
Functions	
Indicator LED, yellow	Switching output indicator

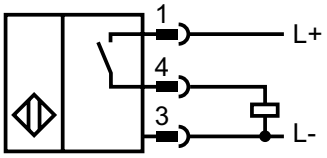
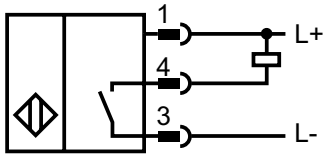
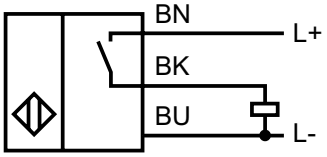
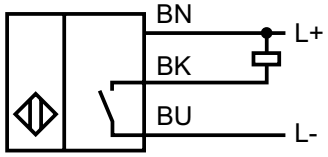
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 15 mA[3] / ≤ 17 mA[4]
Operating current, I_L	≤ 200 mA
Voltage drop, U_D	≤ 3 V
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Switching output, Q	PNP / NPN (see Selection Table)
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	See Selection Table

Mechanical data	
Dimensions (plug device)	M12 x 65 mm
Dimensions (cable device)	M12 x 50 mm
Mounting	Flush / non-flush (see Selection Table)
Enclosure rating	IP 67[5]
Material, housing	Brass, nickel-plated
Material, front surface	PBT
Type of connection	See Selection Table
Ambient temperature: operation	-25 … +70 °C

[1] PNP variants [2] NPN variants [3] Flush devices [4] Non-flush devices [5] With connected IP 67 plug

Switching distance	Mounting	Switching output	Switching frequency, f (ti/tp 1:1)	Type of connection	Part number	Article number
4 mm	Flush	PNP	≤ 1000 Hz	Plug, M12x1, 3-pin	IMT 12-4B-PS-L4	697-01050
4 mm	Flush	NPN	≤ 800 Hz	Plug, M12x1, 3-pin	IMT 12-4B-NS-L4	697-01051
4 mm	Flush	PNP	≤ 1000 Hz	Cable, 2 m, 3-wire	IMT 12-4B-PS-K3	697-01048
4 mm	Flush	NPN	≤ 800 Hz	Cable, 2 m, 3-wire	IMT 12-4B-NS-K3	697-01049
4 mm	Non-flush	PNP	≤ 1200 Hz	Plug, M12x1, 3-pin	IMT 12-4N-PS-L4	697-01023
4 mm	Non-flush	NPN	≤ 1200 Hz	Plug, M12x1, 3-pin	IMT 12-4N-NS-L4	697-01022
4 mm	Non-flush	PNP	≤ 1200 Hz	Cable, 2 m, 3-wire	IMT 12-4N-PS-K3	697-01021
4 mm	Non-flush	NPN	≤ 1200 Hz	Cable, 2 m, 3-wire	IMT 12-4N-NS-K3	697-01020

Plug connection (flush)	Plug connection (non-flush)
 153-00883	 153-00869
Cable connection (flush)	**Cable connection (non-flush)**
 153-00882	 153-00868

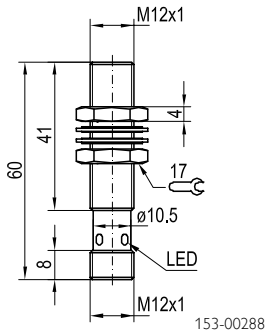
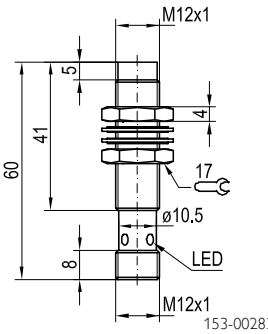
Connection plug, 3-pin (PNP)	Connection plug, 3-pin (NPN)
 154-00294	 154-00293
Connection cable, 3-wire (PNP)	**Connection cable, 3-wire (NPN)**
 154-00294	 154-00293

IT 12

Inductive sensor with expanded switching distance



CE

Plug connection (flush)	Plug connection (non-flush)
	

Sensor data	
Switching distance[1]	6 mm
Switching distance[2]	10 mm
Repeatability[1]	0.3 mm[4]
Repeatability[2]	0.5 mm[4]
Hysteresis	≤ 15 %[5]
Reduction factor, Al[3]	1.00 / 1.00
Reduction factor, Cu[3]	0.85 / 0.80
Reduction factor, V2A 1 mm thick[3]	0.50 / no detection
Reduction factor, V2A 2 mm thick[3]	0.90 / 0.65
Reduction factor, steel FE 360[3]	1.00 / 1.00
Reduction factor, brass[3]	1.30 / 1.40

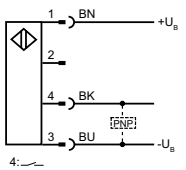
Functions	
Indicator LED, yellow	Switching output indicator

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[6]
No-load current, I_0	≤ 10 mA
Operating current, I_L	≤ 200 mA
Voltage drop, U_D	≤ 2 V at 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q) / induction protection
Switching output, Q	PNP
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	See Selection Table

Mechanical data	
Dimensions	M12 x 60 mm
Mounting	Flush / non-flush (see Selection Table)
Enclosure rating	IP 69K & IP 68[7]
Material, housing	Stainless steel, V2A
Material, front surface	Stainless steel, V2A
Type of connection	See Selection Table
Ambient temperature: operation	-25 … +70 °C
Vibration and impact resistance	IEC 60947-5-2 / 7.4

[1] Flush devices [2] Non-flush devices [3] Flush / non-flush devices [4] U_B = 20 … 30 V DC, T_A = 23 °C ± 5 °C [5] Refers to switching distance
[6] Max. 20 % ripple, within U_B [7] With connected IP 68 / IP 69K plug

Connection, 4-pin

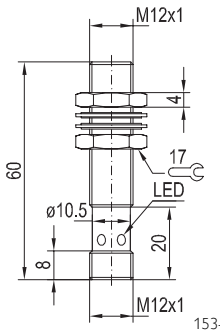
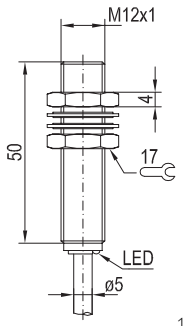


Switching distance	Mounting	Switching output	Switching frequency, f (ti/tp 1:1)	Type of connection	Part number	Article number
6 mm	Flush	PNP	≤ 600 Hz	Plug, M12x1, 4-pin	IT 12 BM-PSL4	996-51480
10 mm	Non-flush	PNP	≤ 400 Hz	Plug, M12x1, 4-pin	IT 12 NBM-PSL4	996-51481

IS 512

Inductive sensor with expanded switching distance

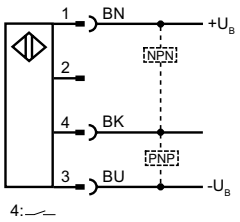
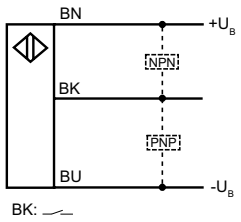


Plug connection	Cable connection
	

Sensor data		Functions	
Switching distance	6 mm	Indicator LED, yellow	Switching output indicator
Repeatability	0.3 mm[1]		
Hysteresis	≤ 10 %[2]		
Reduction factor, Al	0.30		
Reduction factor, Cu	0.25		
Reduction factor, V2A	0.70		
Reduction factor, steel FE 360	1.00		
Reduction factor, brass	0.40		

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[3]	Dimensions	See Selection Table
No-load current, I_0	≤ 10 mA	Enclosure rating	IP 67[4]
Output current, Ie	≤ 200 mA	Mounting	Quasi-flush
Voltage drop, U_D	≤ 2 V at 200 mA	Material, housing	Brass, chrome-plated
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q) / induction protection	Material, front surface	PBTP (PPS)
Switching output, Q	PNP / NPN (see Selection Table)	Type of connection	See Selection Table
Output function	N.O.	Ambient temperature: operation	-25 … +70 °C
Switching frequency, f (ti/tp 1:1)	≤ 800 Hz	Vibration and impact resistance	IEC 60947-5-2 / 7.4

[1] U_B = 20 … 30 V DC, T_A = 23 °C ± 5 °C [2] Refers to switching distance [3] Max. 20 % ripple, within U_B [4] With connected IP 67 plug

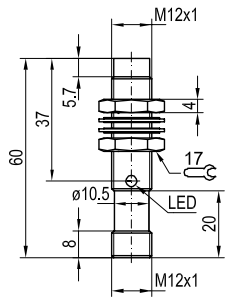
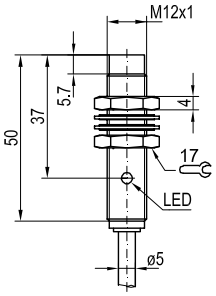
Connection plug, 4-pin	Connection cable, 3-wire
	

Switching distance	Switching output	Dimensions	Type of connection	Part number	Article number
6 mm	PNP	M12 x 60 mm	Plug, M12x1, 4-pin	IS 512-42	996-09969
6 mm	NPN	M12 x 60 mm	Plug, M12x1, 4-pin	IS 512-41	996-09968
6 mm	PNP	M12 x 50 mm	Cable, 2 m, 3-wire	IS 512-02	996-09421
6 mm	NPN	M12 x 50 mm	Cable, 2 m, 3-wire	IS 512-01	996-09420

IS 512

Inductive sensor with expanded switching distance

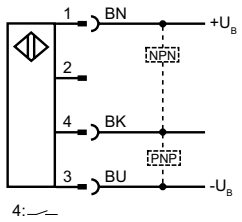
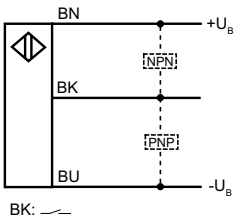


Plug connection	Cable connection
	
153-00327	153-00328

Sensor data		Functions	
Switching distance	10 mm	Indicator LED, yellow	Switching output indicator
Repeatability	≤ 0.3 mm[1]		
Hysteresis	≤ 10 %[2]		
Reduction factor, Al	0.49		
Reduction factor, Cu	0.45		
Reduction factor, V2A	0.77		
Reduction factor, steel FE 360	1.00		
Reduction factor, brass	0.56		

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[3]	Dimensions	See Selection Table
No-load current, I_0	≤ 10 mA	Enclosure rating	IP 67[4]
Output current, Ie	≤ 200 mA	Mounting	Non-flush
Voltage drop, U_D	≤ 2 V at 200 mA	Material, housing	Brass, chrome-plated
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q) / induction protection	Material, front surface	PBTP (PPS)
Switching output, Q	PNP / NPN (see Selection Table)	Type of connection	See Selection Table
Output function	N.O.	Ambient temperature: operation	-25 … +70 °C
Switching frequency, f (ti/tp 1:1)	≤ 400 Hz	Vibration and impact resistance	IEC 60947-5-2 / 7.4

[1] U_B = 20 … 30 V DC, T_A = 23 °C ± 5 °C [2] Refers to switching distance [3] Max. 20 % ripple, within U_B [4] With connected IP 67 plug

Connection plug, 4-pin	Connection cable, 3-wire
	
154-00177	154-00163

Switching distance	Switching output	Dimensions	Type of connection	Part number	Article number
10 mm	PNP	M12 x 60 mm	Plug, M12x1, 4-pin	IS 512-44-S	996-51449
10 mm	NPN	M12 x 60 mm	Plug, M12x1, 4-pin	IS 512-43	996-09970
10 mm	PNP	M12 x 50 mm	Cable, 2 m, 3-wire	IS 512-04-S	996-51458
10 mm	NPN	M12 x 50 mm	Cable, 2 m, 3-wire	IS 512-03-S	996-51472

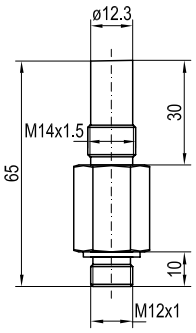
IS 514

Inductive sensor, high-pressure immunity with stainless steel housing



CE

Plug connection



153-00510

Sensor data

Switching distance	3 mm
Hysteresis	~ 10 %
High-pressure immunity: maximum	1000 bar
High-pressure immunity: operation	500 bar
Temperature drift	≤ 15 %
Reduction factor, Al	0.40
Reduction factor, Cu	0.35
Reduction factor, V2A	0.66

Electrical data

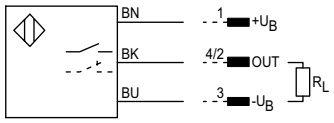
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 15 mA
Output current, Ie	≤ 250 mA
Voltage drop, U_D	≤ 2 V at 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Power On Delay	10 ms
Switching output, Q	PNP
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	≤ 500 Hz

Mechanical data

Dimensions	M14 x 65 mm
Mounting	Flush
Enclosure rating	IP 68[1]
Material, housing	Stainless steel, V2A
Material, front surface	Al_2O_3
Type of connection	See Selection Table
Ambient temperature: operation	-25 … +85 °C
Weight (plug device)	125 g

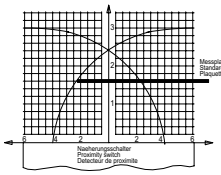
[1] With connected IP 68 plug

Connection, 4-pin



092-13196

Response curve



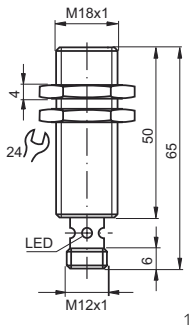
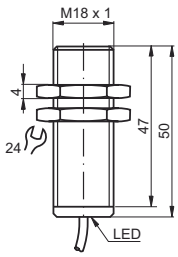
155-01475

Switching distance	Switching output	Type of connection	Part number	Article number
3 mm	PNP	Plug, M12x1, 4-pin	IS 514-42	996-51193

IMT 18-5

Inductive sensor



Plug connection	Cable connection
 153-00871	 153-00870

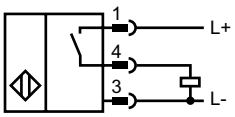
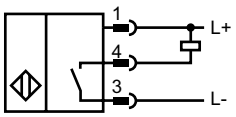
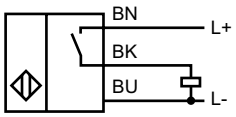
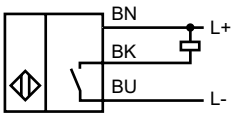
Sensor data	
Switching distance	5 mm
Ensured switching distance	0 … 4.05 mm
Reduction factor, Al	0.30
Reduction factor, Cu	0.30
Reduction factor, V2A	0.70

Functions	
Indicator LED, yellow	Switching output indicator

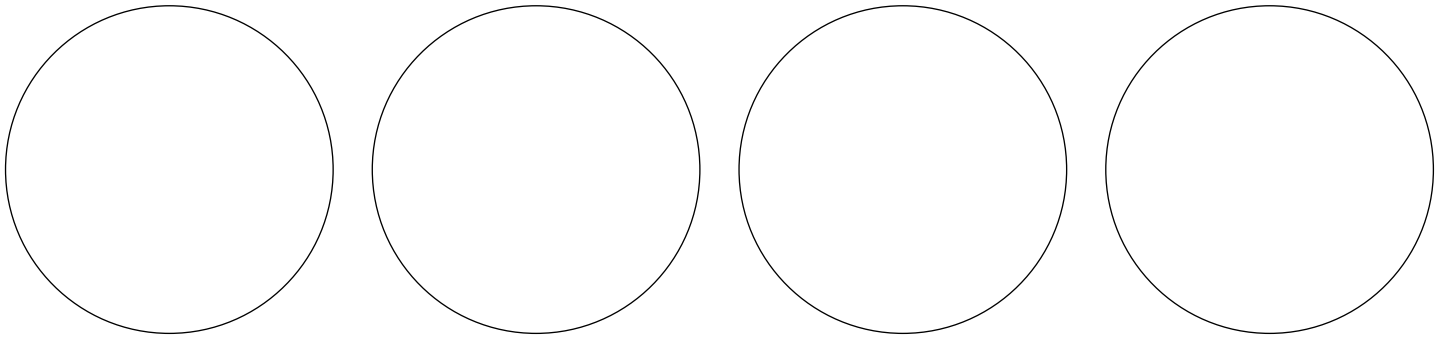
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 20 mA
Operating current, I_L	≤ 200 mA
Voltage drop, U_D	≤ 3 V
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Switching output, Q	PNP / NPN (see Selection Table)
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	≤ 800 Hz

Mechanical data	
Dimensions (plug device)	M18 x 65 mm
Dimensions (cable device)	M18 x 50 mm
Mounting	Flush
Enclosure rating	IP 67[1]
Material, housing	Brass, nickel-plated
Material, front surface	PBT
Type of connection	See Selection Table
Ambient temperature: operation	-25 … +70 °C

[1] With connected IP 67 plug

Connection plug, 3-pin (PNP)	Connection plug, 3-pin (NPN)	Connection cable, 3-wire (PNP)	Connection cable, 3-wire (NPN)
 154-00294	 154-00293	 154-00294	 154-00293

Switching distance	Switching output	Type of connection	Part number	Article number
5 mm	PNP	Plug, M12x1, 3-pin	IMT 18-5B-PS-L4	697-01027
5 mm	NPN	Plug, M12x1, 3-pin	IMT 18-5B-NS-L4	697-01026
5 mm	PNP	Cable, 2 m, 3-wire	IMT 18-5B-PS-K3	697-01025
5 mm	NPN	Cable, 2 m, 3-wire	IMT 18-5B-NS-K3	697-01024



IMT 18-8

Inductive sensor



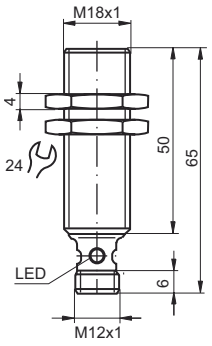
Sensor data		Functions	
Switching distance	8 mm	Indicator LED, yellow	Switching output indicator
Ensured switching distance	0 … 6.48 mm		
Reduction factor, Al	0.45[1] / 0.50[2]		
Reduction factor, Cu	0.40		
Reduction factor, V2A	0.70		

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC	Dimensions (plug device)	M18 x 65 mm
No-load current, I_0	≤ 15 mA[1] / ≤ 18 mA[2]	Dimensions (cable device)	M18 x 50 mm
Operating current, I_L	≤ 200 mA	Mounting	Flush / non-flush (see Selection Table)
Voltage drop, U_D	≤ 3 V	Enclosure rating	IP 67[3]
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, housing	Brass, nickel-plated
Switching output, Q	PNP / NPN (see Selection Table)	Material, front surface	PBT
Output function	N.O.	Type of connection	See Selection Table
Switching frequency, f (ti/tp 1:1)	≤ 500 Hz	Ambient temperature: operation	-25 … +70 °C

[1] Flush devices [2] Non-flush devices [3] With connected IP 67 plug

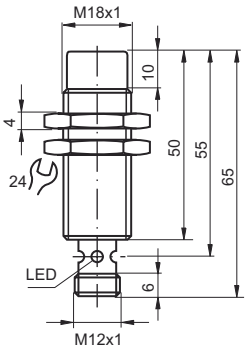
Switching distance	Mounting	Switching output	Type of connection	Part number	Article number
8 mm	Flush	PNP	Plug, M12x1, 3-pin	IMT 18-8B-PS-L4	697-01054
8 mm	Flush	NPN	Plug, M12x1, 3-pin	IMT 18-8B-NS-L4	697-01055
8 mm	Flush	PNP	Cable, 2 m, 3-wire	IMT 18-8B-PS-K3	697-01052
8 mm	Flush	NPN	Cable, 2 m, 3-wire	IMT 18-8B-NS-K3	697-01053
8 mm	Non-flush	PNP	Plug, M12x1, 3-pin	IMT 18-8N-PS-L4	697-01031
8 mm	Non-flush	NPN	Plug, M12x1, 3-pin	IMT 18-8N-NS-L4	697-01030
8 mm	Non-flush	PNP	Cable, 2 m, 3-wire	IMT 18-8N-PS-K3	697-01029
8 mm	Non-flush	NPN	Cable, 2 m, 3-wire	IMT 18-8N-NS-K3	697-01028

Plug connection (flush)



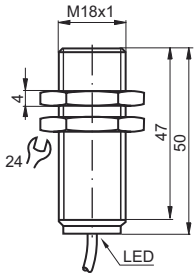
153-00885

Plug connection (non-flush)



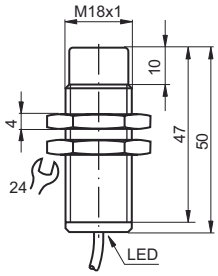
153-00873

Cable connection (flush)



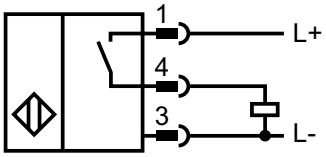
153-00884

Cable connection (non-flush)



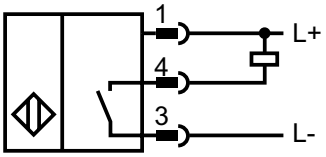
153-00872

Connection plug, 3-pin (PNP)



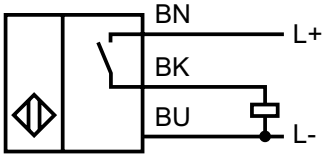
154-00294

Connection plug, 3-pin (NPN)



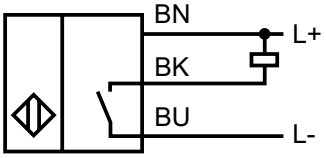
154-00293

Connection cable, 3-wire (PNP)



154-00294

Connection cable, 3-wire (NPN)

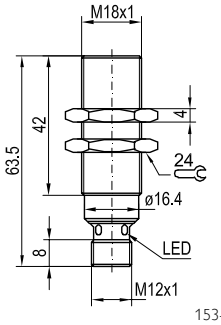
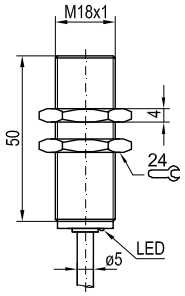


154-00293

IS 518

Inductive sensor with expanded switching distance

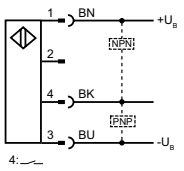
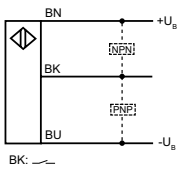


Plug connection	Cable connection
	
153-00330	153-00329

Sensor data		Functions	
Switching distance	12 mm	Indicator LED, yellow	Switching output indicator
Repeatability	0.6 mm[1]		
Hysteresis	≤ 10 %[2]		
Reduction factor, Al	0.26		
Reduction factor, Cu	0.20		
Reduction factor, V2A	0.63		
Reduction factor, steel FE 360	1.00		
Reduction factor, brass	0.33		

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[3]	Dimensions	See Selection Table
No-load current, I_0	≤ 10 mA	Mounting	Quasi-flush
Output current, Ie	≤ 200 mA	Enclosure rating	IP 67[4]
Voltage drop, U_D	≤ 2 V at 200 mA	Material, housing	Brass, chrome-plated
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q) / induction protection	Material, front surface	PBTP
		Type of connection	See Selection Table
Switching output, Q	PNP / NPN (see Selection Table)	Ambient temperature: operation	-25 … +70 °C
Output function	N.O.	Vibration and impact resistance	IEC 60947-5-2 / 7.4
Switching frequency, f (ti/tp 1:1)	≤ 500 Hz		

[1] U_B = 20 … 30 V DC, T_A = 23 °C ± 5 °C [2] Refers to switching distance [3] Max. 20 % ripple, within U_B [4] With connected IP 67 plug

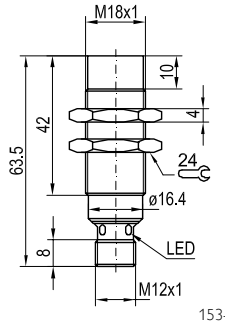
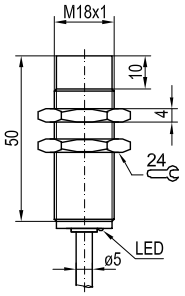
Connection plug, 4-pin	Connection cable, 3-wire
	
154-00177	154-00163

Switching distance	Switching output	Dimensions	Type of connection	Part number	Article number
12 mm	PNP	M18 x 63.5 mm	Plug, M12x1, 4-pin	IS 518-42	996-09973
12 mm	NPN	M18 x 63.5 mm	Plug, M12x1, 4-pin	IS 518-41	996-09972
12 mm	PNP	M18 x 50 mm	Cable, 2 m, 3-wire	IS 518-02	996-09429
12 mm	NPN	M18 x 50 mm	Cable, 2 m, 3-wire	IS 518-01	996-09428

IS 518

Inductive sensor with expanded switching distance

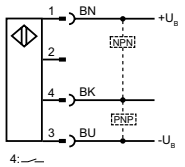
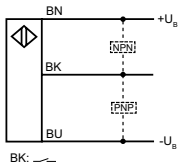


Plug connection	Cable connection
	
153-00331	153-00332

Sensor data		Functions	
Switching distance	20 mm	Indicator LED, yellow	Switching output indicator
Reduction factor, Al	0.40		
Reduction factor, Cu	0.35		
Reduction factor,V2A	0.66		

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]	Dimensions	See Selection Table
No-load current, I_0	≤ 10 mA	Mounting	Non-flush
Output current, Ie	≤ 200 mA	Enclosure rating	IP 67[2]
Voltage drop, U_D	≤ 2 V at 200 mA	Material, housing	Brass, nickel-plated
Protective circuits	Short-circuit protection (Q) / overload protection	Type of connection	See Selection Table
Power On Delay	100 ms	Ambient temperature: operation	-25 … +70 °C
Switching output, Q	PNP / NPN (see Selection Table)		
Output function	N.O.		
Switching frequency, f (ti/tp 1:1)	≤ 200 Hz		

[1] Max. 20 % ripple, within U_B [2] With connected IP 67 plug

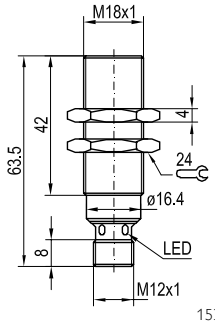
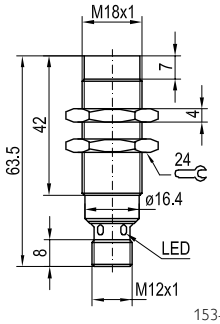
Connection plug, 4-pin	Connection cable, 3-wire
	
154-00177	154-00163

Switching distance	Switching output	Dimensions	Type of connection	Part number	Article number
20 mm	PNP	M18 x 63.5 mm	Plug, M12x1, 4-pin	IS 518-44-S	996-51453
20 mm	NPN	M18 x 63.5 mm	Plug, M12x1, 4-pin	IS 518-43-S	996-50327
20 mm	PNP	M18 x 50 mm	Cable, 3-wire	IS 518-04-S	996-51450

IT 18

Inductive sensor with expanded switching distance



Plug connection (flush)	Plug connection (non-flush)
	

Sensor data	
Switching distance[1]	10 mm
Switching distance[2]	20 mm
Repeatability[1]	0.5 mm[4]
Repeatability[2]	1 mm[4]
Hysteresis	≤ 15 %[5]
Reduction factor, Al[3]	1.00 / 1.00
Reduction factor, Cu[3]	0.80 / 0.90
Reduction factor, V2A 1 mm thick[3]	0.50 / 0.30
Reduction factor, V2A 2 mm thick[3]	0.90 / 0.60
Reduction factor, steel FE 360[3]	1.00 / 1.00
Reduction factor, brass[3]	1.20 / 1.35

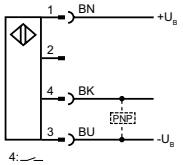
Functions	
Indicator LED, yellow	Switching output indicator

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[6]
No-load current, I_0	≤ 10 mA
Operating current, I_L	≤ 200 mA
Voltage drop, U_D	≤ 2 V at 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q) / induction protection
Switching output, Q	PNP
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	≤ 200 Hz

Mechanical data	
Dimensions	M18 x 63,5 mm
Mounting	Flush / non-flush (see Selection Table)
Enclosure rating	IP 69K & IP 68[7]
Material, housing	Stainless steel, V2A
Material, front surface	Stainless steel, V2A
Type of connection	See Selection Table
Ambient temperature: operation	-25 … +70 °C
Vibration and impact resistance	IEC 60947-5-2 / 7.4

[1] Flush devices [2] Non-flush devices [3] Flush / non-flush devices [4] U_B = 20 … 30 V DC, T_A = 23 °C ± 5 °C [5] Refers to switching distance
[6] Max. 20 % ripple, within U_B [7] With connected IP 68 / IP 69K plug

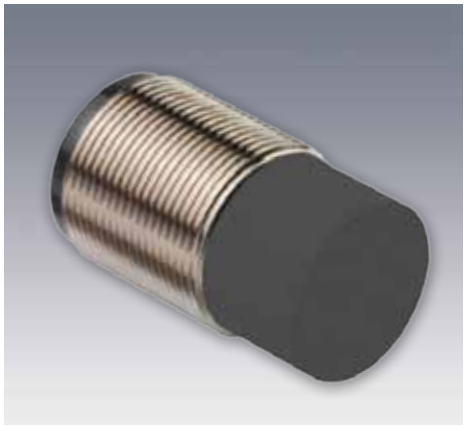
Connection, 4-pin

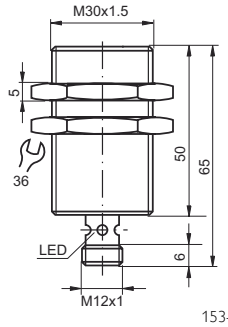
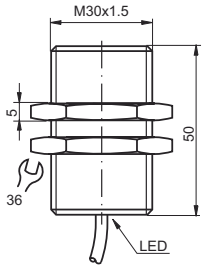


Switching distance	Mounting	Switching output	Type of connection	Part number	Article number
10 mm	Flush	PNP	Plug, M12x1, 4-pin	IT 18 BM-PSL4	996-51482
20 mm	Non-flush	PNP	Plug, M12x1, 4-pin	IT 18 NBM-PSL4	996-51483

IMT 30-10

Inductive sensor

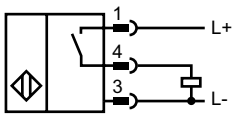
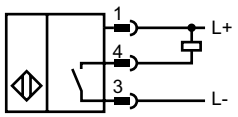
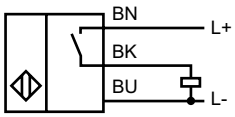
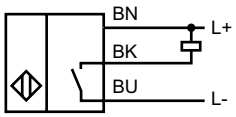


Plug connection	Cable connection
 153-00875	 153-00874

Sensor data		Functions	
Switching distance	10 mm	Indicator LED, yellow	Switching output indicator
Ensured switching distance	0 … 8.1 mm		
Reduction factor, Al	0.30		
Reduction factor, Cu	0.30		
Reduction factor, V2A	0.80		

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC	Dimensions (plug device)	M30 x 65 mm
No-load current, I_0	≤ 20 mA	Dimensions (cable device)	M30 x 50 mm
Operating current, I_L	≤ 200 mA	Mounting	Flush
Voltage drop, U_D	≤ 3 V	Enclosure rating	IP 67[1]
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, housing	Brass, nickel-plated
		Material, front surface	PBT
Switching output, Q	PNP / NPN (see Selection Table)	Type of connection	See Selection Table
Output function	N.O.	Ambient temperature: operation	-25 … +70 °C
Switching frequency, f (ti/tp 1:1)	≤ 200 Hz		

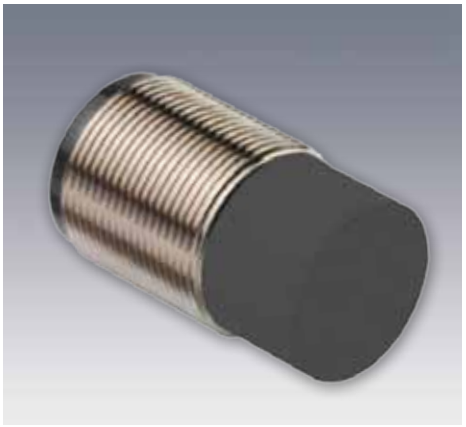
[1] With connected IP 67 plug

Connection plug, 3-pin (PNP)	Connection plug, 3-pin (NPN)	Connection cable, 3-wire (PNP)	Connection cable, 3-wire (NPN)
 154-00294	 154-00293	 154-00294	 154-00293

Switching distance	Switching output	Type of connection	Part number	Article number
10 mm	PNP	Plug, M12x1, 3-pin	IMT 30-10B-PS-L4	697-01035
10 mm	NPN	Plug, M12x1, 3-pin	IMT 30-10B-NS-L4	697-01034
10 mm	PNP	Cable, 2 m, 3-wire	IMT 30-10B-PS-K3	697-01033
10 mm	NPN	Cable, 2 m, 3-wire	IMT 30-10B-NS-K3	697-01032

IMT 30-15

Inductive sensor



Sensor data	
Switching distance	15 mm
Ensured switching distance	0 … 12.15mm
Reduction factor, Al	0.30[1] / 0.50[2]
Reduction factor, Cu	0.30[1] / 0.40[2]
Reduction factor, V2A	0.75[1] / 0.80[2]

Functions	
Indicator LED, yellow	Switching output indicator

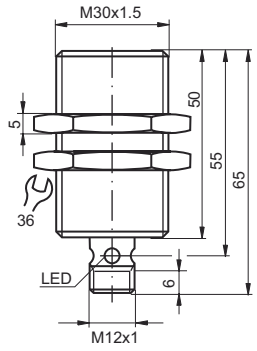
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 15 mA / ≤ 20 mA[3]
Operating current, I_L	≤ 200 mA
Voltage drop, U_D	≤ 3 V
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Switching output, Q	PNP / NPN (see Selection Table)
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	≤ 200 Hz

Mechanical data	
Dimensions (plug device)	M30 x 65 mm
Dimensions (cable device)	M30 x 50 mm
Mounting	Flush / non-flush (see Selection Table)
Enclosure rating	IP 67[4]
Material, housing	Brass, nickel-plated
Material, front surface	PBT
Type of connection	See Selection Table
Ambient temperature: operation	-25 … +70 °C

[1] Flush devices [2] Non-flush devices [3] IMT 30-15N-PS-L4 and IMT 30-15N-NS-L4 [4] With connected IP 67 plug

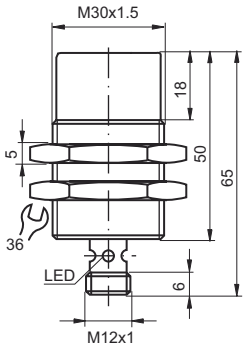
Switching distance	Mounting	Switching output	Type of connection	Part number	Article number
15 mm	Flush	PNP	Plug, M12x1, 3-pin	IMT 30-15B-PS-L4	697-01058
15 mm	Flush	NPN	Plug, M12x1, 3-pin	IMT 30-15B-NS-L4	697-01059
15 mm	Flush	PNP	Cable, 2 m, 3-wire	IMT 30-15B-PS-K3	697-01056
15 mm	Flush	NPN	Cable, 2 m, 3-wire	IMT 30-15B-NS-K3	697-01057
15 mm	Non-flush	PNP	Plug, M12x1, 3-pin	IMT 30-15N-PS-L4	697-01039
15 mm	Non-flush	NPN	Plug, M12x1, 3-pin	IMT 30-15N-NS-L4	697-01038
15 mm	Non-flush	PNP	Cable, 2 m, 3-wire	IMT 30-15N-PS-K3	697-01037
15 mm	Non-flush	NPN	Cable, 2 m, 3-wire	IMT 30-15N-NS-K3	697-01036

Plug connection (flush)



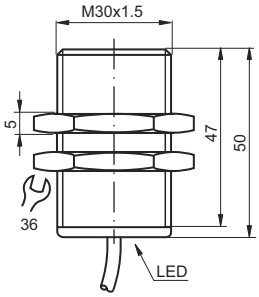
153-00887

Plug connection (non-flush)



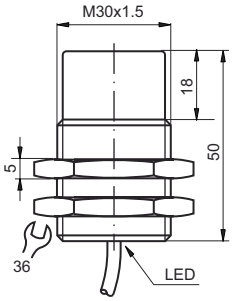
153-00877

Cable connection (flush)



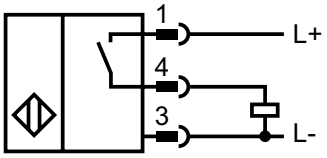
153-00886

Cable connection (non-flush)



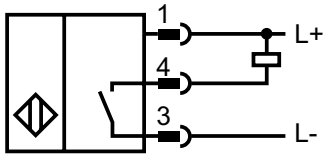
153-00876

Connection plug, 3-pin (PNP)



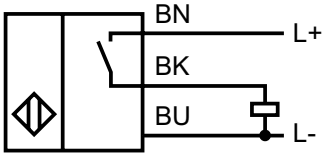
154-00294

Connection plug, 3-pin (NPN)



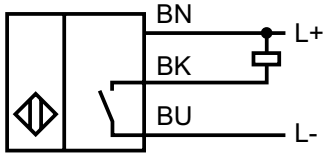
154-00293

Connection cable, 3-wire (PNP)



154-00294

Connection cable, 3-wire (NPN)



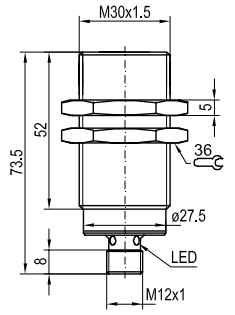
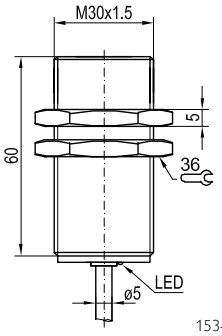
154-00293

IS 530

Inductive sensor with expanded switching distance



CE

Plug connection	Cable connection
	
153-00334	153-00333

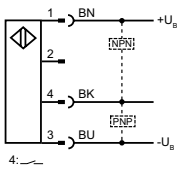
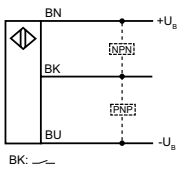
Sensor data	
Switching distance	22 mm
Repeatability	1.1 mm[1]
Hysteresis	≤ 10 %[2]
Reduction factor, Al	0.40
Reduction factor, Cu	0.35
Reduction factor, V2A	0.66
Reduction factor, steel FE 360	1.00
Reduction factor, brass	0.35

Functions	
Indicator LED, yellow	Operating voltage indicator

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[3]
No-load current, I_0	≤ 10 mA
Output current, Ie	≤ 200 mA
Voltage drop, U_D	≤ 2 V at 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q) / induction protection
Switching output, Q	PNP / NPN (see Selection Table)
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	≤ 200 Hz

Mechanical data	
Dimensions	See Selection Table
Mounting	Quasi-flush
Enclosure rating	IP 67[4]
Material, housing	Brass, chrome-plated
Material, front surface	PBTP
Type of connection	See Selection Table
Ambient temperature: operation	-25 … +70 °C
Vibration and impact resistance	IEC 60947-5-2 / 7.4

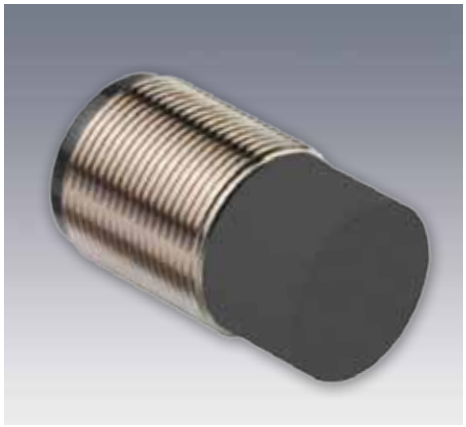
[1] U_B = 20 … 30 V DC, T_A = 23 °C ± 5 °C [2] Refers to switching distance [3] Max. 20 % ripple, within U_B [4] With connected IP 67 plug

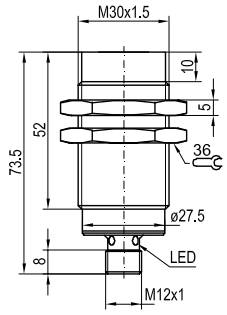
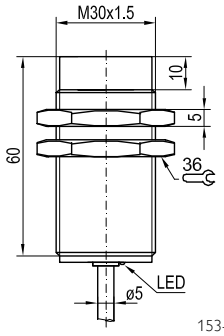
Connection plug, 4-pin	Connection cable, 3-wire
	
154-00177	154-00163

Switching distance	Switching output	Dimensions	Type of connection	Part number	Article number
22 mm	PNP	M30 x 73.5 mm	Plug, M12x1, 4-pin	IS 530-42	996-09905
22 mm	NPN	M30 x 73.5 mm	Plug, M12x1, 4-pin	IS 530-41	996-50673
22 mm	PNP	M30 x 60 mm	Cable, 2 m, 3-wire	IS 530-02	996-09437
22 mm	NPN	M30 x 60 mm	Cable, 2 m, 3-wire	IS 530-01	996-09436

IS 530

Inductive sensor with expanded switching distance

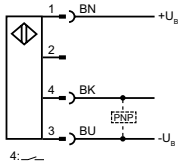
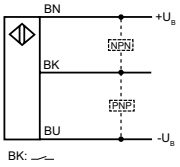


Plug connection	Cable connection
	
153-00335	153-00336

Sensor data		Functions	
Switching distance	40 mm	Indicator LED, yellow	Operating voltage indicator
Repeatability	2 mm[1]		
Hysteresis	≤ 10 %[2]		
Reduction factor, Al	0.42		
Reduction factor, Cu	0.37		
Reduction factor, V2A	0.78		
Reduction factor, steel FE 360	1.00		
Reduction factor, brass	0.47		

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[3]	Dimensions	See Selection Table
No-load current, I_0	≤ 10 mA	Mounting	Non-flush
Output current, Ie	≤ 200 mA	Enclosure rating	IP 67[4]
Voltage drop, U_D	≤ 2 V at 200 mA	Material, housing	Brass, chrome-plated
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q) / induction protection	Material, front surface	PBTP
		Type of connection	See Selection Table
Switching output, Q	PNP / NPN (see Selection Table)	Ambient temperature: operation	-25 … +70 °C
Output function	N.O.	Vibration and impact resistance	IEC 60947-5-2 / 7.4
Switching frequency, f (ti/tp 1:1)	≤ 100 Hz		

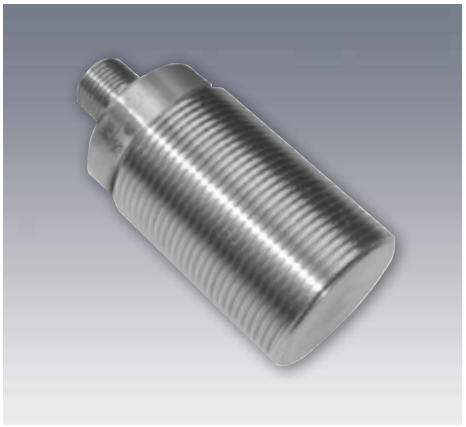
[1] U_B = 20 … 30 V DC, T_A = 23 °C ± 5 °C [2] Refers to switching distance [3] Max. 20 % ripple, within U_B [4] With connected IP 67 plug

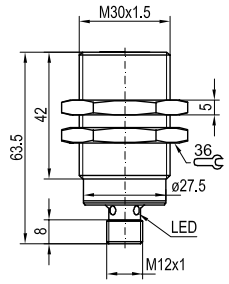
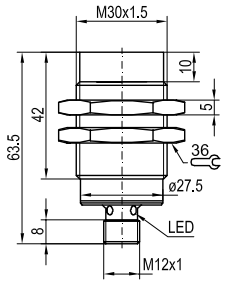
Connection plug, 4-pin	Connection cable, 3-wire
	
154-00224	154-00163

Switching distance	Switching output	Dimensions	Type of connection	Part number	Article number
40 mm	PNP	M30 x 73.5 mm	Plug, M12x1, 4-pin	IS 530-44-S	996-51454
40 mm	PNP	M30 x 60 mm	Cable, 2 m, 3-wire	IS 530-04-S	996-51452
40 mm	NPN	M30 x 60 mm	Cable, 2 m, 3-wire	IS 530-03	996-09438

IT 30

Inductive sensor with expanded switching distance



Plug connection (flush)	Plug connection (non-flush)
 153-00286	 153-00287

Sensor data	
Switching distance[1]	20 mm
Switching distance[2]	40 mm
Repeatability[1]	1 mm[4]
Repeatability[2]	2 mm[4]
Hysteresis	≤ 15 %[5]
Reduction factor, Al[3]	1.00 / 1.00
Reduction factor, Cu[3]	0.90 / 0.90
Reduction factor, V2A 1 mm thick[3]	0.35 / no detection
Reduction factor, V2A 2 mm thick[3]	0.70 / 0.25
Reduction factor, steel FE 360[3]	1.00 / 1.00
Reduction factor, brass[3]	1.30 / 1.20

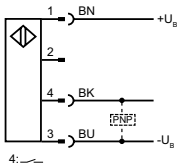
Functions	
Indicator LED, yellow	Switching output indicator

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[6]
No-load current, I_0	≤ 10 mA
Operating current, I_L	≤ 200 mA
Voltage drop, U_D	≤ 2 V at 200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q) / induction protection
Switching output, Q	PNP
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	See Selection Table

Mechanical data	
Dimensions	M30 x 63.5 mm
Mounting	Flush / non-flush (see Selection Table)
Enclosure rating	IP 69K & IP 68[7]
Material, housing	Stainless steel, V2A
Material, front surface	Stainless steel, V2A
Type of connection	See Selection Table
Ambient temperature: operation	-25 … +70 °C
Vibration and impact resistance	IEC 60947-5-2 / 7.4

[1] Flush devices [2] Non-flush devices [3] Flush / non-flush devices [4] U_B = 20 … 30 V DC, T_A = 23 °C ± 5 °C [5] Refers to switching distance
[6] Max. 20 % ripple, within U_B [7] With connected IP 68 / IP 69K plug

Connection, 4-pin



154-00224

Switching distance	Mounting	Switching output	Switching frequency, f (ti/tp 1:1)	Type of connection	Part number	Article number
20 mm	Flush	PNP	≤ 100 Hz	Plug, M12x1, 4-pin	IT 30 BM-PSL4	996-51484
40 mm	Non-flush	PNP	≤ 90 Hz	Plug, M12x1, 4-pin	IT 30 NBM-PSL4	996-51485

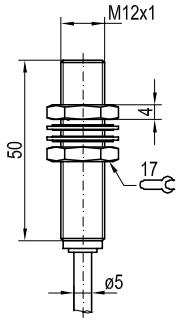
IS 512-02 AI

Inductive sensor with analogue output



CE

Cable connection



153-00337

Sensor data

Switching distance	0 … 6 mm
Repeatability	≤ 0.3 mm

Electrical data

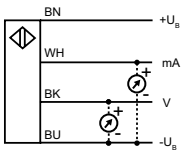
Operating voltage, $+U_B$	15 … 30 V DC[1]
No-load current, I_0	≤ 10 mA
Min. load resistance	0 Ω
Max. load resistance	200 Ω
Protective circuits	Short-circuit protection (Q) / overload protection
Analogue output	0 … 10 V / 4 … 20 mA

Mechanical data

Dimensions	M12 x 50 mm
Enclosure rating	IP 67[2]
Mounting	Quasi-flush
Material, housing	Brass, chrome-plated
Type of connection	See Selection Table
Ambient temperature: operation	-10 … +60 °C

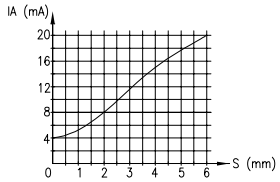
[1] Max. 10 % ripple, within U_B [2] With connected IP 67 plug

Connection, 4-wire



154-00215

Characteristic output curve



091-13282

Switching distance	Analogue output	Type of connection	Part number	Article number
6 mm	0 … 10 V / 4 … 20 mA	Cable, 4-wire	IS 512-02 AI	996-51479

12

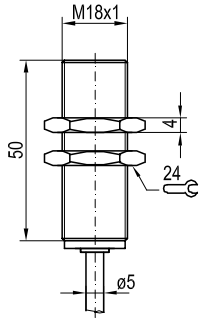
IS 518-02 A

Inductive sensor with analogue output



CE

Cable connection



153-00338

Sensor data

Switching distance	0 … 10 mm
Repeatability	≤ 0.3 mm

Electrical data

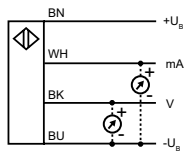
Operating voltage, $+U_B$	15 … 30 V DC[1]
No-load current, I_0	≤ 10 mA
Min. load resistance	0 Ω
Max. load resistance	200 Ω
Protective circuits	Short-circuit protection (Q) / overload protection
Analogue output	0 … 10 V / 4 … 20 mA

Mechanical data

Dimensions	M18 x 50 mm
Mounting	Quasi-flush
Enclosure rating	IP 67[2]
Material, housing	Brass, chrome-plated
Type of connection	See Selection Table
Ambient temperature: operation	-10 … +60 °C

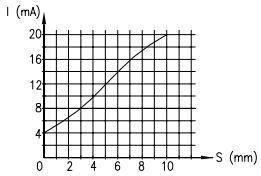
[1] Max. 10 % ripple, within U_B [2] With connected IP 67 plug

Connection, 4-wire



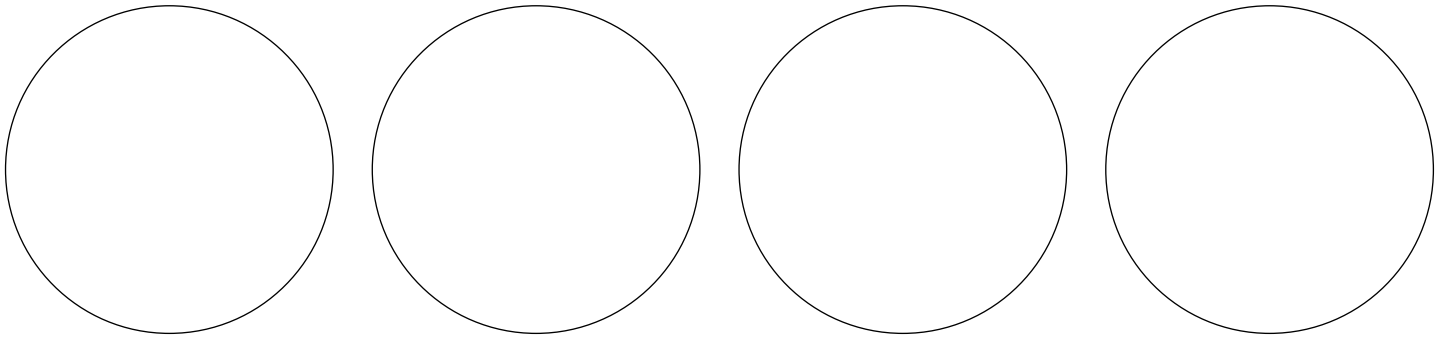
154-00215

Characteristic output curve



091-13294

Switching distance	Analogue output	Type of connection	Part number	Article number
10 mm	0 … 10 V / 4 … 20 mA	Cable, 4-wire	IS 518-02 A	996-09435



Capacitive sensors

Electrosensitive bloodhounds

KD/KL 06

from Page 654

- *Smallest design (ø 6.5 mm) with robust stainless steel housings*
- *Switching distance 0.1 … 1.5 mm (flush) or 0.1 … 3 mm (non-flush)*
- *Suitable for object detection and filling level measurement when mounting space limited*



KD/KL 08

from Page 656

- *Compact design in stainless steel housings*
- *Simple mounting thanks to universal M8 threads*
- *Switching distance 0.1 … 1.5 mm (flush) or 0.1 … 3 mm (non-flush)*



KD/KL 12

from Page 658

- *Robust stainless steel housings with universal M12 threads*
- *Switching distance 1 … 4 mm (flush) or 1 … 8 mm (non-flush)*
- *Sensitivity adjustment via potentiometer*



Capacitive sensors are suitable for the detection of metallic and non-metallic objects of all types. Even highly transparent glasses or liquids are easy to detect with a capacitive sensor. Only the dielectric conductivity of the target material is relevant: the greater the dielectric constant of a material, the higher the possible switching distances or the more reliable the detection.

The measurement of filling levels is among the classic applications of capacitive sensors because many liquids have comparatively high dielectric constants. Under certain circumstances it is also possible to measure from outside the container because capacitive sensors can, so to speak, see through walls. They are also used for detecting solids such as wood, paper and plastics. They are found in the most varied of industrial sectors due to their great immunity to interfering factors of all types. SensoPart offers a wide range of capacitive sensors in cylindrical housings for all areas of use.

TYPICAL SENSOPART

- Switching distances from 0.1 to 30 mm
- Robust cylindrical stainless steel housings (6.5 to 30 mm)
- Easy mounting thanks to conventional cylinder construction
- Simple sensitivity adjustment via potentiometer
- Various designs for flush and non-flush mounting
- Switching output: PNP or NPN
- Output function: N.O. or N.C.

KD/KL 18
from Page 660

- *Increased switching distance 2 … 8 mm (flush) or 2 … 15 mm (non-flush)*
- *Suitable for measurements through walls and measuring filling levels*
- *Sensitivity adjustment via potentiometer*



KD/KL 30
from Page 662

- *Long switching distance 1 … 20 mm (flush) or 1 … 30 mm (non-flush)*
- *Suitable for measurements through walls and for measuring at required distance from target object*



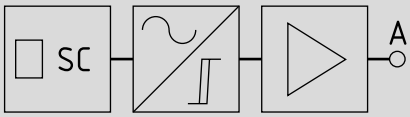
Capacitive Sensors – Product Overview

	Installation	Adjustment	Switching distance	Special features	Page
KD / KL 06	Flush / non-flush	Potentiometer	0.1 … 1.5 / 0.1 … 3 mm		654
KD / KL 08	Flush / non-flush	Potentiometer	0.1 … 1.5 / 0.1 … 3 mm		656
KD / KL 12	Flush / non-flush	Potentiometer	1 … 4 / 1 … 8 mm		658
KD / KL 18	Flush / non-flush	Potentiometer	2 … 8 / 2 … 15 mm	Longer switching distance	660
KD / KL 30	Flush / non-flush	Potentiometer	1 … 20 / 1 … 30 mm	Longer switching distance	662

Capacitive sensors

System description

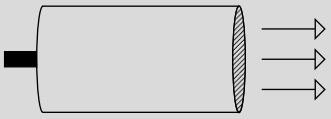
Method of function



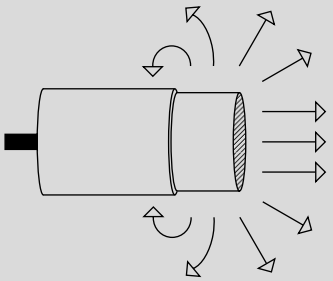
The non-contact capacitive sensor converts a value of interest for production purposes (distance or filling level) to a signal that can be further evaluated. Function is based on the change in the electrical field in the area of its active face. The basic structure of the device consists of an RC oscillator as a sensor, a demodulator and an output level.

The approach of metals or non-metals to the active face of the capacitive sensor results in a change in capacity, whereby the RC oscillator begins to oscillate. This causes the trigger level downstream from the oscillator to tip, and the switching amplifier changes its output state. The switching function at the output is N.O., N.C. or change-over contact depending on the device type.

Installation



Flush version
Sensors with a linear electrical field. These devices scan solid bodies (e.g. wafers, components, circuit boards, hybrids, cartons, stacks of paper, bottles, plastic blocks and sheets) for distance, or liquids through a partition made of glass or plastic (max. thickness 4 mm).



Non-flush version
Sensors with a spherical electrical field. The active face of these devices should be in contact with the target product to be actively scanned (e.g. granulate, sand, oil or water).

Size correction factor
With objects that are not flat and are smaller compared to the active face one obtains the following switching distances depending on the standardised surface F/F0 with F0 = sensor face surface (active face) and F = face surface of the target object. The data relate to flush sensors and objects in the form of long thin rods.

Standardised object area	Switching distance, S in %	ø – object in mm	F in mm²	S in mm
1.50	100	22	380	8
1.24	100	20	314	8
0.8	100	16	201	8
0.61	100	14	154	8
0.31	94	10	79	7.5
0.20	85	8	50	6.8
0.15	82.5	7	38	6.6
0.05	67.5	4	13	5.4
0.03	57.5	3	7	4.6

Table 1

Applications

Capacitive proximity switches are suitable for controlling and monitoring machine processes and for providing signals for counting tasks where metals and non-metals are available, as well as for signalling levels in containers and through container walls where liquid, pulverised or grainy materials require detection.

Types of interaction

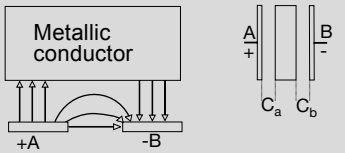


Fig. 1

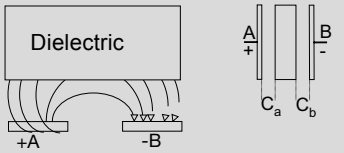


Fig. 2

Capacitive sensors are actuated by both conductive and non-conductive objects. Objects made of conductive materials form a counter-electrode to the sensor's active face. This forms two capacities, C_A and C_B connected in series, with the electrode surfaces A and B (Fig. 1). The capacity of this serial connection is always greater than the capacity of the uncovered electrodes A and B.

Metals achieve the highest switching distances due to their very high conductivity. Reduction factors for differing metals – like those of inductive sensors – must be taken into account.

Actuation by objects made of non-conductive materials (insulators): when one places an insulator between the electrodes of a condenser the capacity increases with the dielectric constant ε (Fig. 2) of the insulator.

The dielectric constant of all solids and liquids is greater than air ($\varepsilon_{air} = 1$; see Table 2). Similarly, objects made of non-conductive materials have an effect on the active face of a capacitive sensor by increasing the coupling capacity. Materials with greater dielectric constants achieve longer switching distances. When scanning organic materials (wood, grain, etc.) it should be noted that the achievable switching distance is very strongly influenced by the water content ($\varepsilon_{water} = 80$!)

Capacitive sensors

System description

The effect of differing materials

Switching distance and dielectric constants

The switching distance (S_r) is dependent on the dielectric constant (ε_r) of the target object. The maximum switching distance (100 %) is achieved with metallic objects while it is reduced with other materials in proportion to the dielectric constant of the target object.

Table 2 (below) shows the dielectric constants of some important materials. As a result of the high dielectric constant value of water, wood exhibits relatively large fluctuations. Damp wood is therefore considerably better detected by capacitive sensors than dry wood.

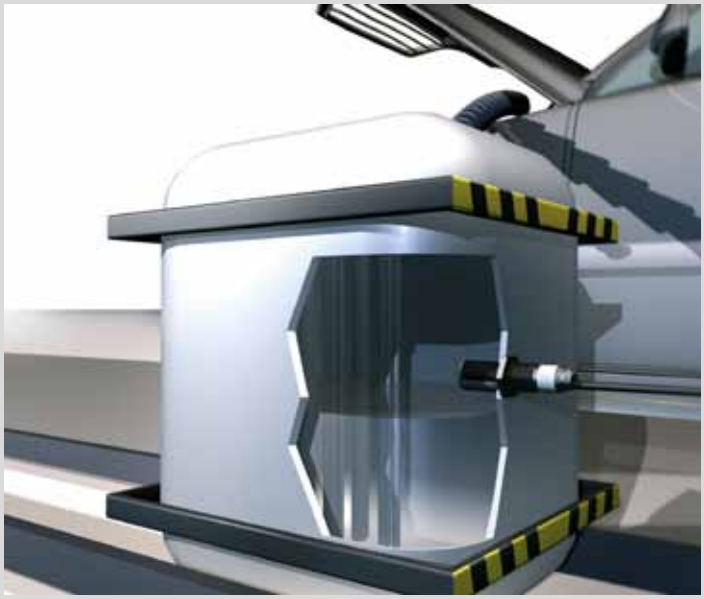
Dielectric constants (ε_r) of various materials			
Air. vacuum	1	Perspex	3.2
Teflon	2	Araldite	3.6
Wood	2 … 7	Bakelite	3.6
Paraffin	2.2	Quartz glass	3.7
Petroleum	2.2	Hard rubber	4
Terpentine oil	2.2	Oiled paper	4
Transformer oil	2.2	Pressboard	4
Paper	2.3	Porcelain	4.4
Polyethylene	2.3	Laminated paper	4.5
Polypropylene	2.3	Quartz sand	4.5
Cable compound	2.5	Glass	5
Soft rubber	2.5	Polyamide	5
Silicone rubber	2.8	Mica	6
PVC	2.9	Marble	8
Polystyrene	3	Alcohol	25.8
Celluloid	3	Water	80

Table 2



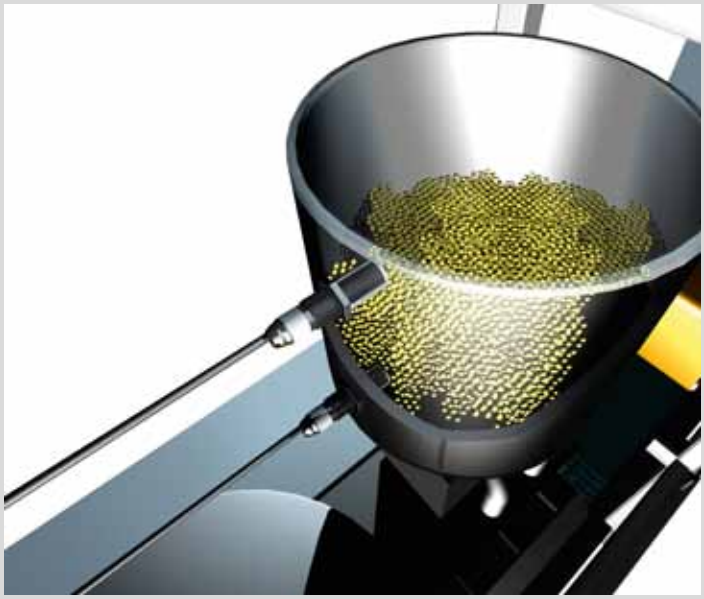
Object detection
Page 660

Capacitive sensors (e.g. KL 18) detect the quantity of the isolated bulk material through container walls with a thickness of up to 4 mm.



Level measuring
Page 656

The capacitive sensor (e.g. KL 08) detects the level of a reservoir for liquid refrigerant.

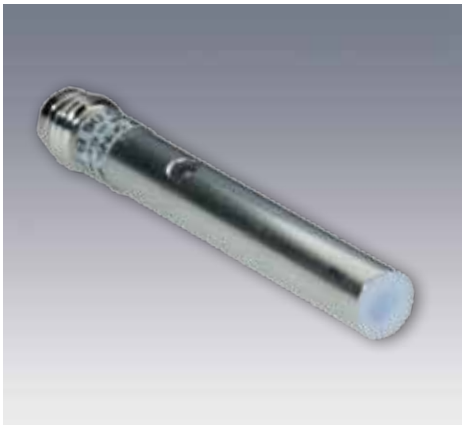


Level measuring
Page 658

For level control in a transparent container filled with pills, a capacitive sensor (e.g. KD 12) is used.

KD/KL 06

Capacitive sensor



CE

PRODUCT HIGHLIGHTS

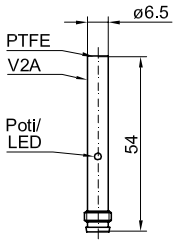
- Robust stainless steel housings
- Small housings
- Optional N.O. or N.C. variants
- Flush or non-flush design options

Sensor data		Functions	
Switching distance (flush)	0.1 … 1.5 mm	Indicator LED, yellow	Switching output indication
Switching distance (non-flush)	0.1 … 3 mm	Sensitivity adjustment	Via potentiometer
Hysteresis	15 %[1]	Default settings	Max. switching distance
Repeatability	2 %[1]		
Temperature drift	15 % / °C[1] [-5 … 55 °C]		
Electrical data		**Mechanical data**	
Operating voltage, $+U_B$	11 … 30 V DC	Dimensions	Ø 6.5 x 54 mm
No-load current, I_0	≤ 10 mA	Enclosure rating	IP 65
Output current, Ie	≤ 50 mA	Material, housing	Stainless steel V2A
Protective circuits	Reverse polarity protection. U_B / short-circuit protection (Q) / overload protection	Material, front surface	PTFE
		Type of connection	See Selection Table
Power On Delay	< 300 ms	Ambient temperature: operation	-10 … +70 °C
Switching output, Q	PNP / NPN (see Selection Table)	Vibration and impact resistance	EN 60947-5-2
Output function	N.O. / N.C. (see Selection Table)		
Switching frequency f (ti/tp 1:1)	100 Hz		

[1] Relating to switching distance

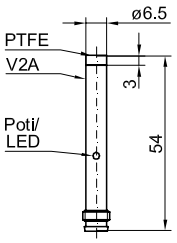
Switching distance	Installation	Switching output	Type of connection	Part number	Article number
0.1 … 1.5 mm	Flush	PNP (N.O.)	Plug, M8x1, 3-pin	KD 06 B-PSM3	681-50878
0.1 … 1.5 mm	Flush	PNP (N.C.)	Plug, M8x1, 3-pin	KD 06 B-POM3	681-50879
0.1 … 1.5 mm	Flush	NPN (N.O.)	Plug, M8x1, 3-pin	KD 06 B-NSM3	681-50880
0.1 … 1.5 mm	Flush	NPN (N.C.)	Plug, M8x1, 3-pin	KD 06 B-NOM3	681-50881
0.1 … 3 mm	Non-flush	PNP (N.O.)	Plug, M8x1, 3-pin	KL 06 NB-PSM3	681-50886
0.1 … 3 mm	Non-flush	PNP (N.C.)	Plug, M8x1, 3-pin	KL 06 NB-POM3	681-50887
0.1 … 3 mm	Non-flush	NPN (N.O.)	Plug, M8x1, 3-pin	KL 06 NB-NSM3	681-50888
0.1 … 3 mm	Non-flush	NPN (N.C.)	Plug, M8x1, 3-pin	KL 06 NB-NOM3	681-50889

Plug connection (flush)



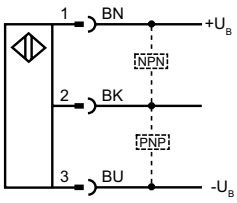
153-00516

Plug connection (non-flush)



153-00517

Connection, 3-pin



154-00459

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

13

KD/KL 08

Capacitive sensor



CE

PRODUCT HIGHLIGHTS

- Ideal for filling level measurements
- Robust stainless steel housings
- Optional N.O. or N.C. variants
- Flush or non-flush design options

Sensor data	
Switching distance (flush)	0.1 … 1.5 mm
Switching distance (non-flush)	0.1 … 3 mm
Hysteresis	15 %[1]
Repeatability	2 %[1]
Temperature drift	15 % / °C[1] [-5 … 55 °C]

Functions	
Indicator LED, yellow	Switching output indication
Sensitivity adjustment	Via potentiometer
Default settings	Max. switching distance

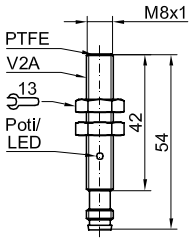
Electrical data	
Operating voltage, $+U_B$	11 … 30 V DC
No-load current, I_0	≤ 10 mA
Output current, Ie	≤ 50 mA
Protective circuits	Reverse polarity protection. U_B / short-circuit protection (Q) / overload protection
Power On Delay	< 300 ms
Switching output, Q	PNP / NPN (see Selection Table)
Output function	N.O. / N.C. (see Selection Table)
Switching frequency f (ti/tp 1:1)	100 Hz

Mechanical data	
Dimensions	M8 x 54 mm
Enclosure rating	IP 65
Material, housing	Stainless steel V2A
Material, front surface	PTFE
Type of connection	See Selection Table
Ambient temperature: operation	-10 … +70 °C
Vibration and impact resistance	EN 60947-5-2

[1] Relating to switching distance

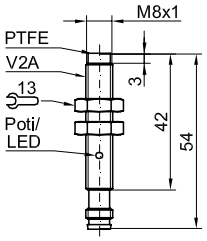
Switching distance	Installation	Switching output	Type of connection	Part number	Article number
0.1 … 1.5 mm	Flush	PNP (N.O.)	Plug, M8x1, 3-pin	KD 08 B-PSM3	681-50894
0.1 … 1.5 mm	Flush	PNP (N.C.)	Plug, M8x1, 3-pin	KD 08 B-POM3	681-50895
0.1 … 1.5 mm	Flush	NPN (N.O.)	Plug, M8x1, 3-pin	KD 08 B-NSM3	681-50896
0.1 … 3 mm	Non-flush	PNP (N.O.)	Plug, M8x1, 3-pin	KL 08 NB-PSM3	681-50902
0.1 … 3 mm	Non-flush	PNP (N.C.)	Plug, M8x1, 3-pin	KL 08 NB-POM3	681-50903
0.1 … 3 mm	Non-flush	NPN (N.O.)	Plug, M8x1, 3-pin	KL 08 NB-NSM3	681-50904
0.1 … 3 mm	Non-flush	NPN (N.C.)	Plug, M8x1, 3-pin	KL 08 NB-NOM3	681-50905

Plug connection (flush)



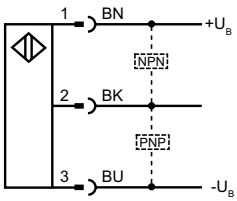
153-00518

Plug connection (non-flush)



153-00519

Connection, 3-pin



154-00459

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

13

KD/KL 12

Capacitive sensor



CE

PRODUCT HIGHLIGHTS

- Ideal for filling level measurements
- Robust stainless steel housings
- Optional N.O. or N.C. variants
- Flush or non-flush design options

Sensor data	
Switching distance (flush)	1 … 4 mm
Switching distance (non-flush)	1 … 8 mm
Hysteresis	15 %[1]
Repeatability	2 %[1]
Temperature drift (flush)	20 % / °C[1] [-5 … 55°C]
Temperature drift (non-flush)	15 % / °C[1] [-5 … 55°C]

Functions	
Indicator LED, yellow	Switching output indication
Sensitivity adjustment	Via potentiometer
Default settings	Max. switching distance

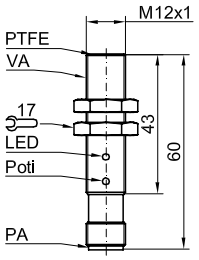
Electrical data	
Operating voltage, $+U_B$	12 … 35 V DC
No-load current, I_0	≤ 10 mA
Output current, Ie	≤ 200 mA
Protective circuits	Reverse polarity protection. U_B / short-circuit protection (Q) / overload protection
Power On Delay	< 300 ms
Switching output, Q	PNP / NPN (see Selection Table)
Output function	N.O. / N.C. (see Selection Table)
Switching frequency f (ti/tp 1:1)	100 Hz

Mechanical data	
Dimensions	M12 x 60 mm
Enclosure rating	IP 65
Material, housing	Stainless steel VA
Material, front surface	PTFE
Type of connection	See Selection Table
Ambient temperature: operation	-30 … +70 °C
Vibration and impact resistance	EN 60947-5-2

[1] Relating to switching distance

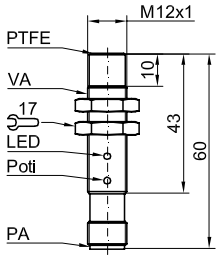
Switching distance	Installation	Switching output	Type of connection	Part number	Article number
1 … 4 mm	Flush	PNP (N.O.)	Plug, M12x1, 4-pin	KD 12 B-PSL4	681-50914
1 … 4 mm	Flush	PNP (N.C.)	Plug, M12x1, 4-pin	KD 12 B-POL4	681-50915
1 … 4 mm	Flush	NPN (N.O.)	Plug, M12x1, 4-pin	KD 12 B-NSL4	681-50916
1 … 4 mm	Flush	NPN (N.C.)	Plug, M12x1, 4-pin	KD 12 B-NOL4	681-50917
1 … 8 mm	Non-flush	PNP (N.O.)	Plug, M12x1, 4-pin	KL 12 NB-PSL4	682-50994
1 … 8 mm	Non-flush	PNP (N.C.)	Plug, M12x1, 4-pin	KL 12 NB-POL4	682-50995
1 … 8 mm	Non-flush	NPN (N.O.)	Plug, M12x1, 4-pin	KL 12 NB-NSL4	682-50996
1 … 8 mm	Non-flush	NPN (N.C.)	Plug, M12x1, 4-pin	KL 12 NB-NOL4	682-50997

Plug connection (flush)



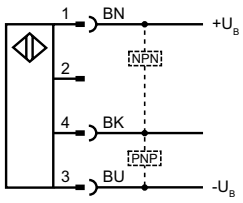
153-00520

Plug connection (non-flush)



153-00521

Connection, 4-pin



154-00460

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

13

KD/KL 18

Capacitive sensor



CE

PRODUCT HIGHLIGHTS

- Ideal for filling level measurements
- Robust stainless steel housings
- Optional N.O. or N.C. variants
- Flush or non-flush design options

Sensor data	
Switching distance (flush)	2 … 8 mm
Switching distance (non-flush)	2 … 15 mm
Hysteresis	15 %[1]
Repeatability	2 %[1]
Temperature drift	15 % / °C[1] [-5 … 55 °C]

Functions	
Indicator LED, yellow	Switching output indication
Sensitivity adjustment	Via potentiometer
Default settings	Max. switching distance

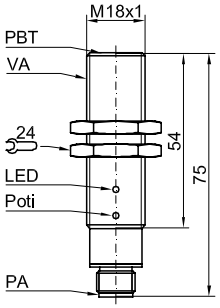
Electrical data	
Operating voltage, $+U_B$	10 … 35 V DC
No-load current, I_0	≤ 10 mA
Output current, Ie	≤ 300 mA
Protective circuits	Reverse polarity protection. U_B / short-circuit protection (Q) / overload protection
Power On Delay	< 300 ms
Switching output, Q	PNP / NPN (see Selection Table)
Output function	N.O. / N.C. (see Selection Table)
Switching frequency f (ti/tp 1:1)	100 Hz

Mechanical data	
Dimensions	M18 x 75 mm
Enclosure rating	IP 67
Material, housing	Stainless steel VA
Material, front surface (flush)	PBT
Material, front surface (non-flush)	PTFE
Type of connection	See Selection Table
Ambient temperature: operation	-30 … +70 °C
Vibration and impact resistance	EN 60947-5-2

[1] Relating to switching distance

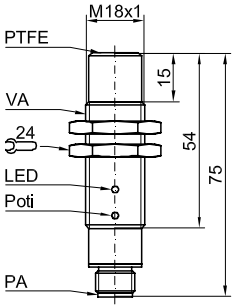
Switching distance	Installation	Switching output	Type of connection	Part number	Article number
2 … 8 mm	Flush	PNP (N.O.)	Plug, M12x1, 4-pin	KD 18 B-PSL4	681-50926
2 … 8 mm	Flush	PNP (N.C.)	Plug, M12x1, 4-pin	KD 18 B-POL4	681-50927
2 … 8 mm	Flush	NPN (N.O.)	Plug, M12x1, 4-pin	KD 18 B-NSL4	681-50928
2 … 8 mm	Flush	NPN (N.C.)	Plug, M12x1, 4-pin	KD 18 B-NOL4	681-50929
2 … 15 mm	Non-flush	PNP (N.O.)	Plug, M12x1, 4-pin	KL 18 NB-PSL4	682-51014
2 … 15 mm	Non-flush	PNP (N.C.)	Plug, M12x1, 4-pin	KL 18 NB-POL4	682-51015
2 … 15 mm	Non-flush	NPN (N.O.)	Plug, M12x1, 4-pin	KL 18 NB-NSL4	682-51016
2 … 15 mm	Non-flush	NPN (N.C.)	Plug, M12x1, 4-pin	KL 18 NB-NOL4	682-51017

Plug connection (flush)



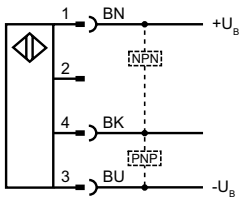
153-00522

Plug connection (non-flush)



153-00523

Connection, 4-pin



154-00460

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

13

KD/KL 30

Capacitive sensor



CE

PRODUCT HIGHLIGHTS

- Robust stainless steel housings
- N.O. / N.C. switchable
- Switching distance adjustment via potentiometer
- Long switching distance

Sensor data	
Switching distance (flush)	1 … 20 mm
Switching distance (non-flush)	1 … 30 mm
Hysteresis	15 %[1]
Repeatability	5 %[1]
Temperature drift (flush)	10 % / °C[1] [-5 … 55 °C]
Temperature drift (non-flush)	15 % / °C[1] [-5 … 55 °C]

Functions	
Display LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indication
Sensitivity adjustment	Via potentiometer
Adjustment possibilities	N.O. / N.C. via potentiometer
Default settings	Max. switching distance and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 35 V DC
No-load current, I_0	≤ 15 mA
Output current, Ie	≤ 300 mA
Protective circuits	Reverse polarity protection. U_B / short-circuit protection (Q) / overload protection
Power On Delay	< 300 ms
Switching output, Q	PNP / NPN (see Selection Table)
Output function	N.O. / N.C.
Switching frequency f (ti/tp 1:1)	100 Hz

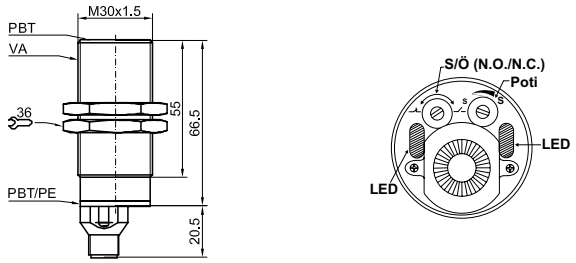
Mechanical data	
Dimensions	M30 x 87 mm
Enclosure rating	IP 64
Material, housing	Stainless steel VA
Material, front surface (flush)	PBT
Material, front surface (non-flush)	PTFE
Type of connection	See Selection Table
Ambient temperature: operation	-30 … +70 °C
Vibration and impact resistance	EN 60947-5-2

[1] Relating to switching distance

Switching distance	Installation	Switching output	Type of connection	Part number	Article number
1 … 20 mm	Flush	PNP	Plug, M12x1, 4-pin	KD 30 B-PSOL4	681-50942
1 … 20 mm	Flush	NPN	Plug, M12x1, 4-pin	KD 30 B-NSOL4	681-50944
1 … 30 mm	Non-flush	PNP	Plug, M12x1, 4-pin	KL 30 NB-PSOL4	682-51034
1 … 30 mm	Non-flush	NPN	Plug, M12x1, 4-pin	KL 30 NB-NSOL4	682-51036

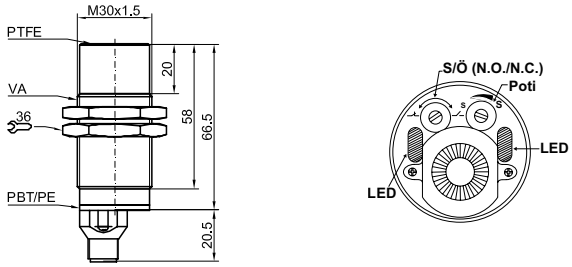
Version: 10/2013. Subject to changes; diagrams similar

Plug connection (flush)



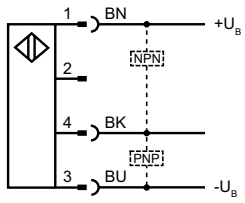
153-00524 / 155-00483

Plug connection (non-flush)



153-00525 / 155-00483

Connection, 4-pin



154-00460

Accessories

Connection cables	From Page A-32
Brackets	From Page A-4

13

SmartPlug

Plug-in intelligence

MFI Inverter
from Page 668

- *Inverts NPN to PNP or PNP to NPN devices, and N.C./N.O. also adjustable*

MFC Counter
from Page 670

- *Adjustable counter (pulses or intervals) between 1 … 65535 ms*
- *Count parts*
- *Parts from results*
- *Flip-flop*

MFT Timer
from Page 672

- *Adjustable on-delay or drop-out delay between 1 … 65535 ms*

MFF Frequency
from Page 674

- *Adjustable frequency monitoring between 15 … 1000 Hz*
- *Monitoring standstills*
- *Monitoring rotary speeds*
- *Detection of accumulations*



SmartPlug saves you from using expensive timing elements or supplementary control elements because SmartPlug makes the sensor smarter. Connected with SmartPlug, your sensor takes over additional control functions. As a timer, counter or inverter, for monitoring frequency, or for on-delay or drop-out delay. Adjustment of the classic MFC, MFI, MFT and MFF takes place using teach-in via a control line. The new universal genius MFU is programmable with a PDA (palm) or notebook via an infrared interface. Every variant of SmartPlug can be cascaded so that counters and timers, for example, can be combined.

SmartPlug is suitable for sensors from all producers with standardised M12 plugs; a special adapter cable is available for connection to an M8 plug. SmartPlug accommodates its refined electronics in a small, easy-to-handle 60 x 20 mm^2 plug housing. With its maximum output current of 400 mA, the SmartPlug can also be used as a switching amplifier. SmartPlug: plug-in intelligence!

SmartPlug is also compatible with sensors from other producers.

TYPICAL SENSOPART

- Very easy handling
- No installation costs, due to direct connection between sensor and cable
- Reasonably priced compared to conventional function modules
- Assists PLC programs in time-critical functions
- Can be used as a switching amplifier up to 400 mA
- User-friendly due to simple teach-in
- MFU model offers comfortable programming via infrared interface and/or notebook (USB)

MFW Wipe Function
from Page 676

- *Adjustable wipe function for falling or rising edges; time calculation 1 … 65535 ms*
- *Signal expansion*
- *Filter*



MFU Universal
from Page 678

- *All-in multifunctional switching device programmable via USB*
- *Freely programmable counter, inverter and timer*
- *Accessories for parameterisation available*



made in Germany

SmartPlug – Product Overview		
	Special features	Page
MFI (Inverter)	Inverts NPN to PNP or PNP to NPN devices, N.C./N.O. also adjustable	668
MFC (Counter)	Adjustable counter (pulses or intervals) between 1 … 65535 ms	670
MFT (Timer)	Adjustable on-delay or drop-out delay between 1 … 65535 ms	672
MFF (Frequency)	Adjustable frequency monitoring between 15 … 1000 Hz	674
MFW (Wipe Function)	Adjustable wipe function for falling or rising edges; time range 1 … 65535 ms	676
MFU (Universal)	All-in multifunctional switching device programmable via USB	678

SmartPlug

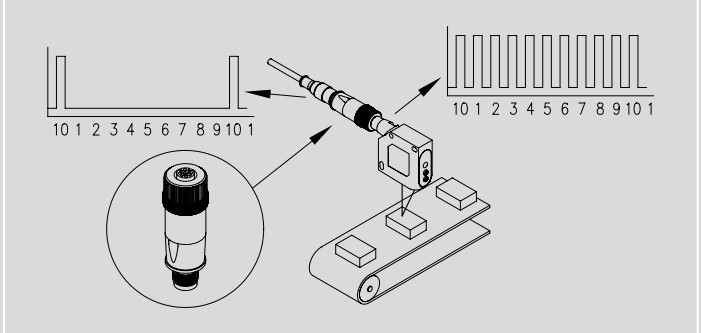
System description



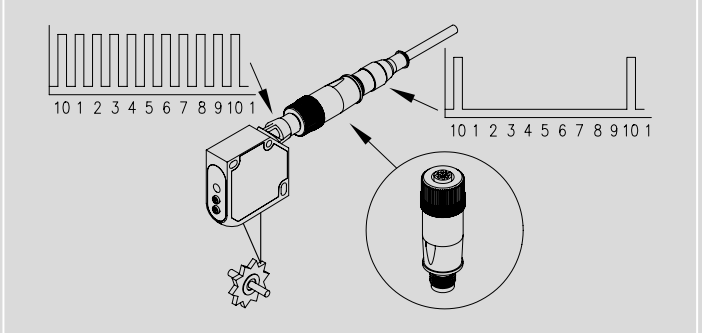
TYPICAL SENSOPART

- The smart solution for simple tasks
- Switching amplifier up to 400 mA
- Simple setting via external teach-in wire
- Compatible with all sensor producers
- Compatible with all methods of function: optic, ultrasonic, inductive, capazitive
- No supplementary installation required
- A product that evolved from practical use for practical use

SmartPlug MFC application:
counting parts in a container with the F 50
Switching takes place after every tenth object – a typical task in packaging.



SmartPlug MFC application:
counting gear teeth with the F 50
The rotations of a gearwheel can also be counted.



SmartPlug MFI 12 Inverter

Depending on the SmartPlug Type, the SmartPlug MFI 12 Inverter converts the signal of the connected sensor from PNP to NPN (MFI 12 PN4) or vice versa (MFI 12 NP4). The output function can also be switched via the control line (NO/NC).

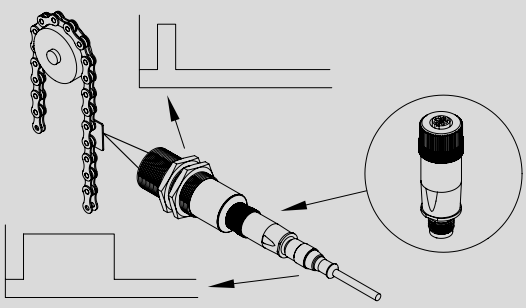
SmartPlug MFC 12 Counter

The SmartPlug MFC 12 Counter counts the output pulses of the connected sensor. The sensor's output pulse is switched through on reaching the preselected number. The preselected number can be set via teach-in.

SmartPlug MFT 12 Timer

The SmartPlug MFT 12 Timer supplements the connected sensor with the time function on-delay or drop-out delay. Both functions can be set via teach-in. The default setting is a drop-out delay of 100 ms. With this setting, the SmartPlug can be used directly for lengthening very short switching signals so they are suitable for PLCs.

SmartPlug MFT application:
chain detection with the FMS 30
The SmartPlug causes an on-delay or drop-out delay so that the PLC can evaluate the rapid movement of the chain.



SmartPlug MFF 12 Frequency Monitor

The SmartPlug MFF 12 monitors the frequency of the incoming signals. The SmartPlug's output is activated if the actual frequency falls below about 5% of the programmed level, and the sensor's signal is put through. Counting the input frequency on the SmartPlug; monitoring standstills; monitoring rotary speed; detecting accumulations.

SmartPlug MFW 12 Wipe Function

The SmartPlug MFW 12 Wipe Function reacts to the rising or falling edge (adjustable via external signal) of the input signal from the sensor and generates a switching pulse. The duration of the switching pulse, during which the SmartPlug holds the switching output of the signal, can be adjusted between 1 … 65535 ms.

SmartPlug MFU Universal

The all-rounder! Whether as a counter, inverter or timer, for monitoring frequency or for on-delay and drop-out delay – the SmartPlug MFU offers universal use compatible with all sensors from familiar producers, and communicates with a PC or notebook via an infrared interface. A USB adapter is available for simple programming via the notebook. All functions can be combined with one another. In addition to configuration, the user-friendly software allows reading out of the set values and the storage (and thus re-use) of settings already made.

SmartPlug MFI

NPN/PNP converter / inverter; adjustable N.O./N.C.



CE

PRODUCT HIGHLIGHTS

- Direct adaptation between sensor and connection cable
- Adjustable N.C. / N.O. function
- Simple settings via control line
- No additional installations necessary
- Switching frequency of up to 10 kHz
- Switching amplifier up to 400 mA

Functions	
Indicator	LED, red
Adjustment possibilities	PNP / NPN conversion and N.C. / N.O. inversion or NPN / PNP conversion and N.C. / N.O. inversion
Default setting	N.O.

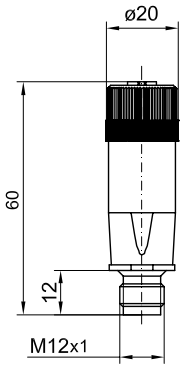
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
Power consumption	≤ 10 mA
Input resistance	> 10 kOhm
Input frequency	≤ 10 kHz
Input pulse width	50 µs
Output current, Ie	≤ 400 mA
Protective circuits	Short-circuit protection
Protection Class	2[2]
Switching output	See Selection Table
Standard connection	1 Bn $+U_B$ 3 BU $-U_B$ 4 BK output

Mechanical data	
Dimensions	Ø 20 x 60 mm
Enclosure rating	IP 67[3]
Material, housing	Plastic PBTP / PA
Type of connection: input	M12 x1 socket, 4-pin
Type of connection: output	M12 x1 plug, 4-pin
Ambient temperature: operation	0 … +60 °C
Ambient temperature: storage	-20 … +60 °C
Weight	15 g

[1] 10 % ripple, within U_B [2] Only when connected on both sides [3] With connected IP 67 plug

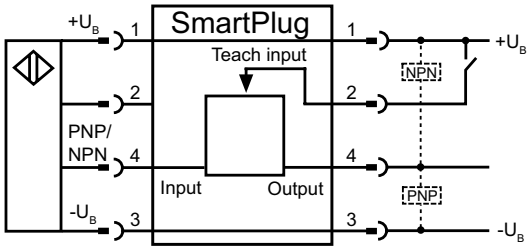
Switching output	Input	Description	Part number	Article number
NPN	PNP	Conversion of PNP sensor to NPN output	MFI 12 PN4	968-21002
PNP	NPN	Conversion of NPN sensor to PNP output	MFI 12 NP4	968-21003

Plug connection



153-00255

Connection, 4-pin



154-00239

Setting N.C./N.O. signal inversion

Setting of signal inversion is achieved via the "Teach Input" and "Input SmartPlug" signals.

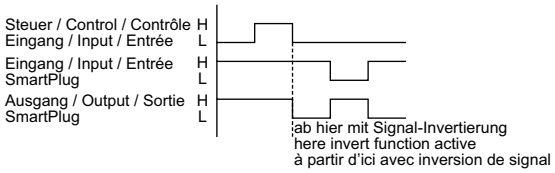
Example:

1. The SmartPlug should invert the sensor signal
   a. Activate sensor (output is active)
   b. Connect and separate Teach input and $+U_B$ (provide $+U_B$ pulse at "Teach Input").
   ➞ FINISHED

   The setting remains even in switched-off state.

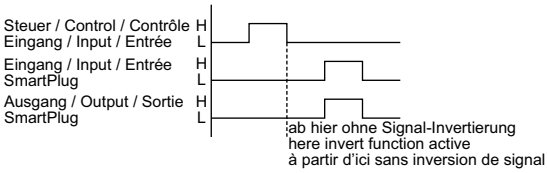
2. The SmartPlug should not invert the sensor signal (default setting)
   a. Do not activate sensor (output is inactive)
   b. Connect and separate Teach input and $+U_B$ (provide $+U_B$ pulse at "Teach Input").
   ➞ FINISHED

Teaching with signal inversion



155-00073

Teaching without signal inversion



155-00074

H = input or output active; L = input or output inactive

SmartPlug MFC

Programmable pulse or interval counter



CE

PRODUCT HIGHLIGHTS

- Direct adaptation between sensor and connection cable
- Counting of pulses or intervals
- Simple settings via external teach-in
- No additional installations necessary
- Switch inverter (N.C./N.O. function)
- Flip-flop (on/off switching)
- Distributor (1 pulse per rotation)
- Number range: 1 … 65535
- Switching amplifier up to 400 mA

Functions	
Indicator	LED, red
Adjustment possibilities	Monitoring standstills, monitoring rotary speeds, detecting accumulations

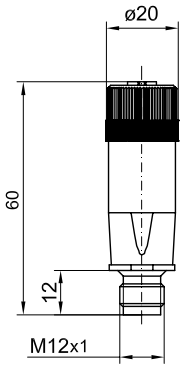
Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]	Dimensions	Ø 20 x 60 mm
Power consumption	≤ 10 mA	Enclosure rating	IP 67[3]
Input resistance	> 10 kOhm	Material, housing	Plastic PBTP / PA
Input frequency	≤ 1 kHz	Type of connection: input	M12 x1 socket, 4-pin
Input pulse width	50 µs	Type of connection: output	M12 x1 plug, 4-pin
Output current, Ie	≤ 400 mA	Ambient temperature: operation	0 … +60 °C
Protective circuits	Short-circuit protection	Ambient temperature: storage	-20 … +60 °C
Protection Class	2[2]	Weight	15 g
Switching output	See Selection Table		
Standard connection	1 Bn $+U_B$ 3 BU $-U_B$ 4 BK output		

[1] 10 % ripple, within U_B [2] Only when connected on both sides [3] With connected IP 67 plug

Switching output	Part number	Article number
PNP	MFC 12 PP4	968-21000
NPN	MFC 12 NN4	968-21001

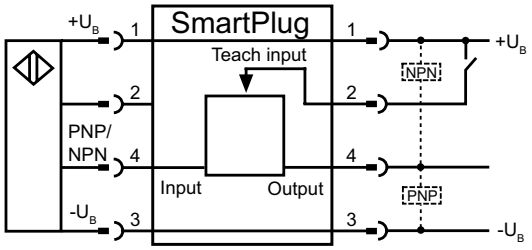
Version: 10/2013. Subject to changes; diagrams similar

Plug connection



153-00255

Connection, 4-pin



154-00239

Settings

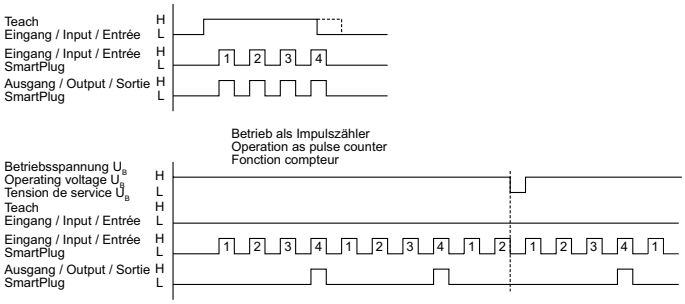
Setting of the preselected number is achieved via the "Teach Input" and "Input SmartPlug" signals.

If, for example, 4 pulses are to be counted, the setting can be carried out as follows (operating voltage is on):

1. Connect Teach Input with $+U_B$
2. Activate sensor 4 times (= 4 events) (the SmartPlug automatically detects 4 pulses at Input SmartPlug)
3. Separate Teach Input from $+U_B$ ➜ FINISHED

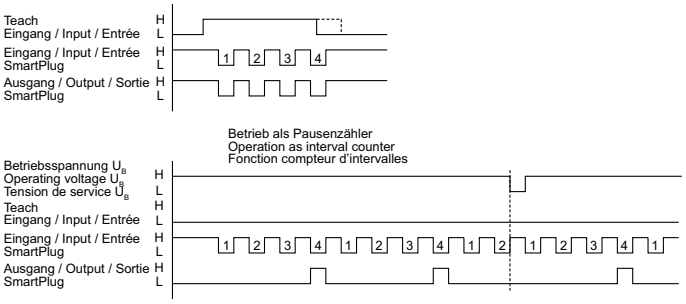
After making this setting, the output of the SmartPlug is active during every fourth sensor signal. The setting is also retained when turned off. The counting process is reset when the operating voltage is switched on again. The default preselected time is 1 (pulse counter).

Teach-in, pulse delay



155-00065

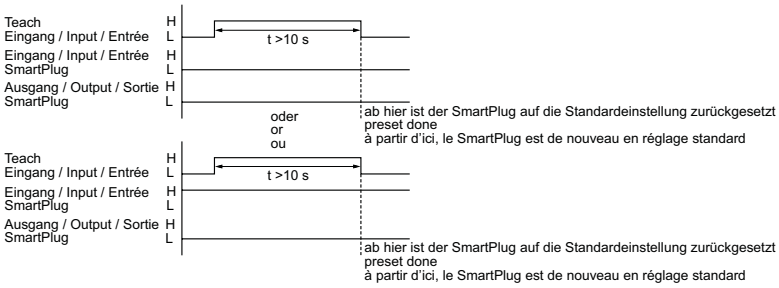
Teach-in, interval counter



155-00066

H = input or output active; L = input or output inactive

Reset to standard setting of 1 pulse counter



155-00075

SmartPlug MFT

Programmable timer for on-delay or drop-out delay



CE

PRODUCT HIGHLIGHTS

- Direct adaptation between sensor and connection cable
- On-delay or drop-out delay teachable
- Simple settings via external teach-in
- No additional installations necessary
- Time range: 1 … 65535 ms
- Switching amplifier up to 400 mA

Functions	
Indicator	LED, red
Adjustment possibilities	On-delay / drop-out delay
Default setting	100 ms drop-out delay

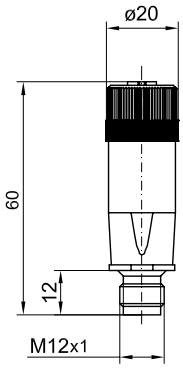
Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
Power consumption	≤ 10 mA
Input resistance	> 10 kOhm
Input frequency	≤ 10 kHz
Input pulse width	50 µs
Output current, Ie	≤ 400 mA
Protective circuits	Short-circuit protection
Protection Class	2[2]
Switching output	See Selection Table
Standard connection	1 Bn $+U_B$ 3 BU $-U_B$ 4 BK output

Mechanical data	
Dimensions	Ø 20 x 60 mm
Enclosure rating	IP 67[3]
Material, housing	Plastic PBTP / PA
Type of connection: input	M12 x1 socket, 4-pin
Type of connection: output	M12 x1 plug, 4-pin
Ambient temperature: operation	0 … +60 °C
Ambient temperature: storage	-20 … +60 °C
Weight	15 g

[1] 10 % ripple, within U_B [2] Only when connected on both sides [3] With connected IP 67 plug [4] Please define option with your order
[5] Presetting anywhere between 1 … 65535 ms

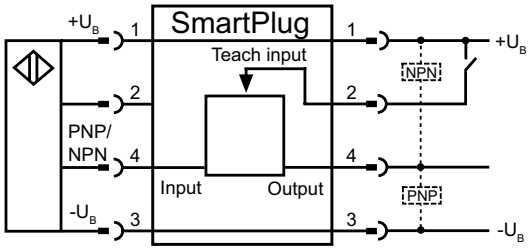
Switching output	Drop-out delay	Part number	Article number
PNP	100 ms	MFT 12 PP4	968-11000
NPN	100 ms	MFT 12 NN4	968-11001
PNP	1 … 65535 ms[4,5]	MFT 12 PP4 t:..	968-11002
NPN	1 … 65535 ms[4,5]	MFT 12 NN4 t:..	968-11003

Plug connection



153-00255

Connection, 4-pin



154-00239

Settings

Setting of the delay period is achieved via the "Teach Input" and "Input SmartPlug" signals.

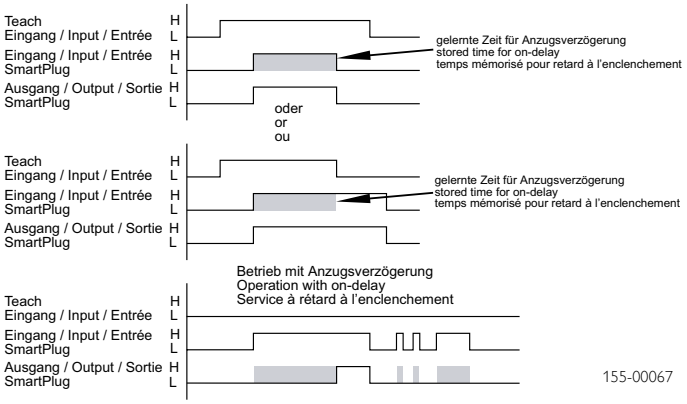
If, for example, a delay of four seconds should occur, the setting can be carried out as follows (operating voltage is switched on):

1. Connect Teach Input with $+U_B$
2. Actuate sensor for a duration of 4 seconds
3. Separate Teach Input from $+U_B$ ➜ FINISHED

After this adjustment, the SmartPlug has an on-delay of 4 s. The setting remains even when switched off.

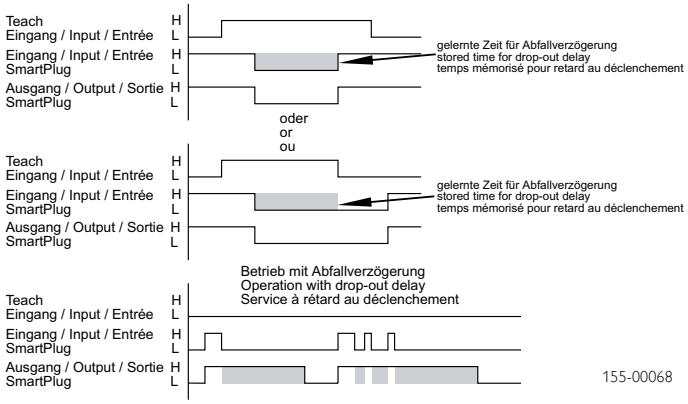
The timer is reset when the operating voltage is switched on. In the default state the preselected time is set to 100 ms drop-out delay.

Teaching-in an on-delay



155-00067

Teaching-in a drop-out delay

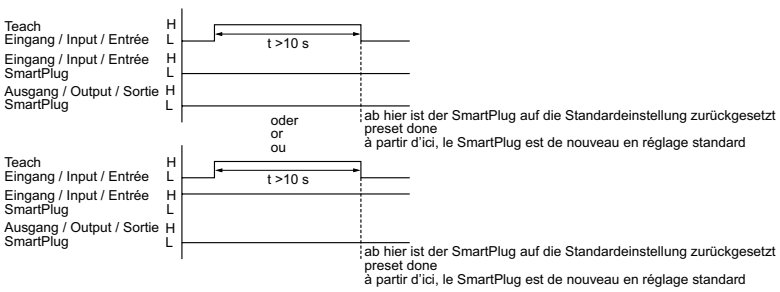


155-00068

H = input or output active; L = input or output inactive

14

Resetting to standard setting of 100 ms drop-out delay



155-00075

SmartPlug MFF

Programmable monitoring of frequency



CE

PRODUCT HIGHLIGHTS

- Direct adaptation between sensor and connection cable
- Monitoring of frequency of signals at "Input SmartPlug", e.g. for monitoring standstills, monitoring rotary speed and detecting accumulations
- Adjustable rotary speed or frequency limit via external teach-in
- No additional installations necessary
- Frequency range: 0.015 Hz … 1 kHz
- Switching amplifier up to 400 mA

Functions	
Indicator	LED, red
Adjustment possibilities	Monitoring standstills Monitoring rotary speed Detecting accumulations

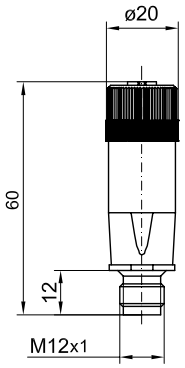
Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]	Dimensions	Ø 20 x 60 mm
Power consumption	≤ 10 mA	Enclosure rating	IP 67[3]
Input resistance	> 10 kOhm	Material, housing	Plastic PBTP / PA
Input frequency	≤ 1 kHz	Type of connection: input	M12 x1 socket, 4-pin
Input pulse width	50 µs	Type of connection: output	M12 x1 plug, 4-pin
Output current, Ie	≤ 400 mA	Ambient temperature: operation	0 … +60 °C
Protective circuits	Short-circuit protection	Ambient temperature: storage	-20 … +60 °C
Protection Class	2[2]	Weight	15 g
Switching output	See Selection Table		
Standard connection	1 Bn $+U_B$ 3 BU $-U_B$ 4 BK output		

[1] 10 % ripple, within U_B [2] Only when connected on both sides [3] With connected IP 67 plug

Switching output	Part number	Article number
PNP	MFF 12 PP4	968-51000
NPN	MFF 12 NN4	968-51001

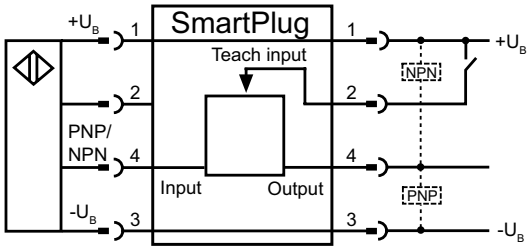
Accessories		
Description	**Part number**	**Article number**
Interface converter for configuration via PC	CUSB-IR-2m	901-05098
Connection adapter M8 (socket) to M12 (plug)	L4F/K4M - 0,6 PVC	902-51645

Plug connection



153-00255

Connection, 4-pin

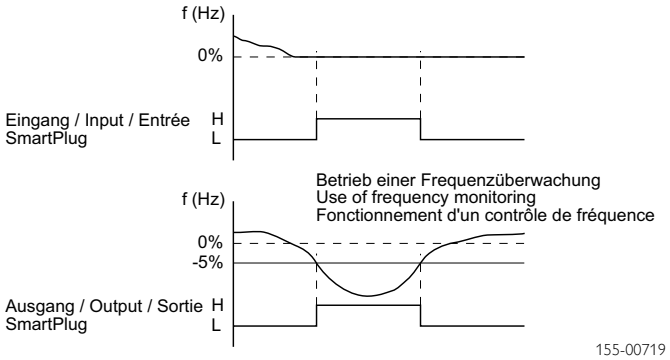


154-00239

Settings

1. Adjust the sensor with its SmartPlug MFF12 on the target object so that the sensor reliably switches.
2. Set the object in the motion to be monitored (e.g. motor set to nominal speed).
3. Connect Teach Input with +UB and separate again.
   (Lay down U_B pulse at Teach Input. Pulse must be at least as long as a complete movement cycle of the object.)
4. Finished: the SmartPlug output will be activated when the input frequency falls by more than 5%.

Teaching-in frequency monitoring



155-00719

SmartPlug MFW

Programmable timer for wipe function



CE

PRODUCT HIGHLIGHTS

- Direct adaptation between sensor and connection cable
- Teachable as switch-on or switch-off wipe function
- Simple setting via external teach-in
- No additional installations necessary
- Time range: 1 … 65535 ms
- Switching amplifier up to 400 mA

Functions	
Indicator	LED, red
Adjustment possibilities	Positive rise / negative drop-out
Default setting	100 ms drop-out delay

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]
Power consumption	≤ 10 mA
Input resistance	> 10 kOhm
Input frequency	≤ 10 kHz
Input pulse width	50 µs
Output current, Ie	≤ 400 mA
Protective circuits	Short-circuit protection
Protection Class	2[2]
Switching output	See Selection Table
Standard connection	1 Bn $+U_B$ 3 BU $-U_B$ 4 BK output

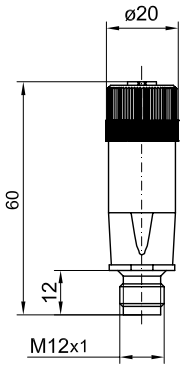
Mechanical data	
Dimensions	Ø 20 x 60 mm
Enclosure rating	IP 67[3]
Material, housing	Plastic PBTP / PA
Type of connection: input	M12 x1 socket, 4-pin
Type of connection: output	M12 x1 plug, 4-pin
Ambient temperature: operation	0 … +60 °C
Ambient temperature: storage	-20 … +60 °C
Weight	15 g

[1] 10 % ripple, within U_B [2] Only when connected on both sides [3] With connected IP 67 plug [4] Please define option with your order
[5] Presetting freely selectable between 1 … 65535 ms

Switching output	Drop-out delay	Part number	Article number
PNP	100 ms	MFW 12 PP4	968-11008
NPN	100 ms	MFW 12 NN4	968-11009
PNP	1 … 65535 ms[4,5]	MFW 12 PP4 t:..	968-11010
NPN	1 … 65535 ms[4,5]	MFW 12 NN4 t:..	968-11011

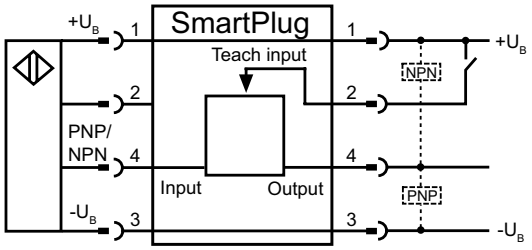
Version: 10/2013. Subject to changes; diagrams similar

Plug connection



153-00255

Connection, 4-pin



154-00239

Settings

Setting of the delay time is achieved via the "Teach Input" and "Input SmartPlug" signals.

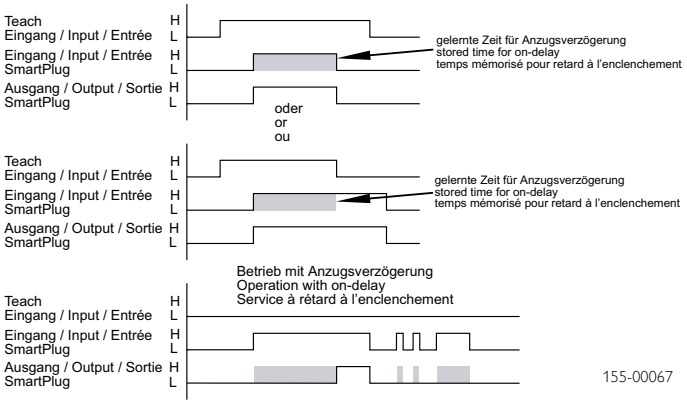
If, for example, there should be a delay of 4 seconds, the setting can be carried out as follows (operating voltage is switched on):

1. Connect Teach Input with $+U_B$
2. Actuate sensor for 4 seconds
3. Separate Teach Input from $+U_B$ ➜ FINISHED

After this setting, the SmartPlug has an on-delay of 4 seconds. The setting remains even when switched off.

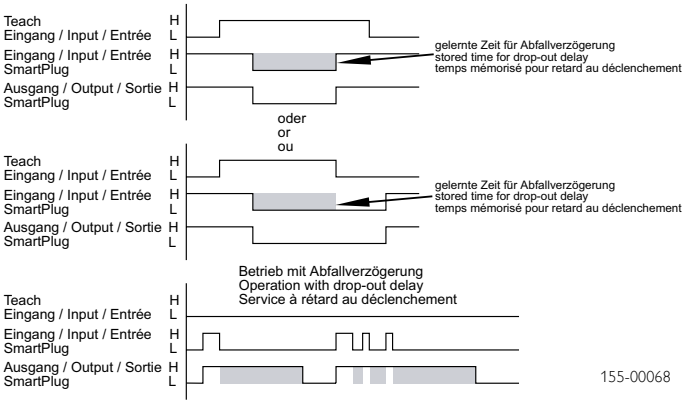
The timer is reset when operating voltage switched on. The default preselected time is set to 100 ms drop-out delay.

Teaching-in an on-delay



155-00067

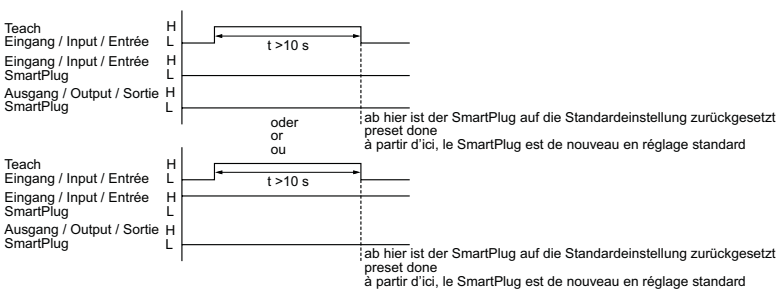
Teaching-in a drop-out delay



155-00068

H = input or output active; L = input or output inactive

Resetting to standard setting of 100 ms drop-out delay



155-00075

SmartPlug MFU

Multifunctional switching device



CE

PRODUCT HIGHLIGHTS

- Direct adaptation between sensor and connection cable
- Configurable via PC with USB interface
- No additional installations necessary
- PNP / NPN converter
- Counter for pulses and intervals
- Frequency monitoring
- Timer
- Switching amplifier up to 400 mA

Functions	
Indicator	LED, red
Adjustment possibilities	Time: 1 … 65535 ms Pre-set time: 1 … 65535 pulses Fequency: 15 Hz … 1 kHz

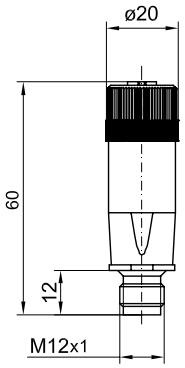
Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[1]	Dimensions	Ø 20 x 60 mm
Power consumption	≤ 10 mA	Enclosure rating	IP 67[3]
Input resistance	> 10 kOhm	Material, housing	Plastic PBTP / PA
Input frequency	≤ 8 kHz	Type of connection: input	M12 x1 socket, 4-pin
Input pulse width	50 µs	Type of connection: output	M12 x1 plug, 4-pin
Output current, Ie	≤ 400 mA	Ambient temperature: operation	0 … +60 °C
Protective circuits	Short-circuit protection	Ambient temperature: storage	-20 … +60 °C
Protection Class	2[2]	Weight	15 g
Switching output	See Selection Table		
Standard connection	1 Bn $+U_B$ 3 BU $-U_B$ 4 BK output		

[1] 10 % ripple, within U_B [2] Only when connected on both sides [3] With connected IP 67 plug

Switching output	Part number	Article number
PNP	MFU 12 P4	968-61000
NPN	MFU 12 N4	968-61001

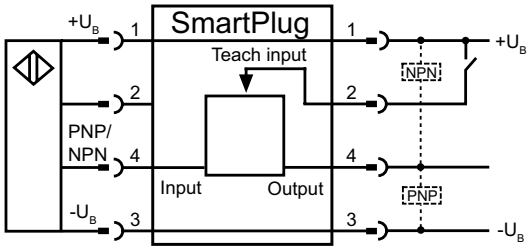
Accessories		
Description	**Part number**	**Article number**
Interface converter for configuration via PC (USB to IR)	CUSB-IR-2m	901-05098
Programmer adapter (RS232 to IR)	IR-RS232	901-05096
Connection adapter: M8 (socket) to M12 (plug)	L4F/K4M - 0,6 PVC	902-51645

Plug connection



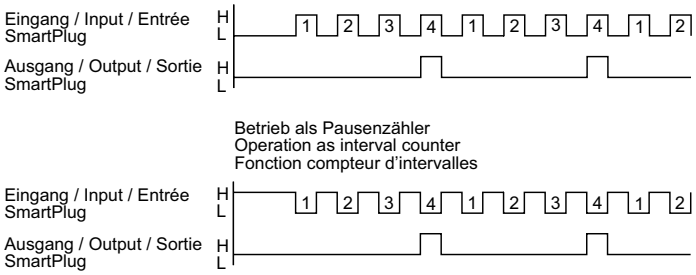
153-00255

Connection, 4-pin



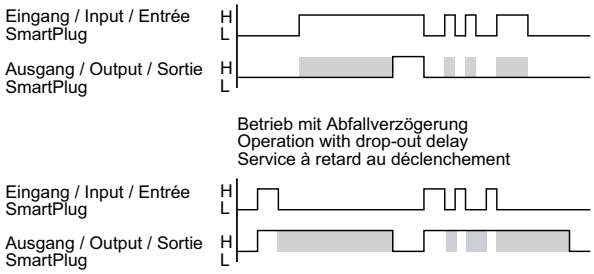
154-00239

Operation as pulse counter



155-00128

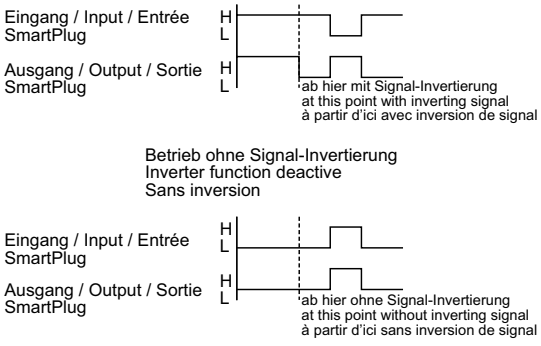
Operation as drop-out delay



155-00129

H = input or output active; L = input or output inactive

Operation with signal inversion



155-00130

Parameterisation via IR interface and "ProgSensor" configuration software



155-00762

Accessories

Connection cables	From Page A-32

Accessories

Meeting all needs

Mechanical accessories
from Page A-4

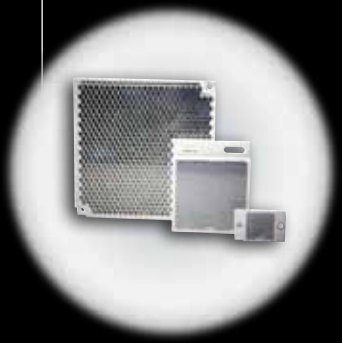
- *Brackets for sensors*
- *Mountings for VISOR® and illumination*

Optical accessories
from Page A-16

- *Reflectors and reflective tape*
- *Lenses and protective casings*
- *Illumination*









A sensor rarely comes unaccompanied: accessories supporting their mounting, commissioning and use are of considerable importance for the reliable functioning of an automation solution. The characteristic practical orientation of SensoPart products is thus also evident in a particularly versatile and user-friendly range of accessories. In this section they are divided into categories: mechanical, optical and electrical accessories.

The mechanical accessories include everything that is involved in mounting and protecting the sensor: mounting brackets, blocks, rods and rails, brackets with protective hoops, stainless steel casings for hygienic areas and many others. All accessories are extremely robust and designed to meet practical demands. We thus offer clever, sometimes patented, detailed solutions that greatly simplify the mounting and fine adjustment of sensors, particularly in difficult locations, such as dovetail mountings or rotatable brackets.

Optical accessories include lenses as well as protective casings, external illumination such as ring and surface lights, and reflectors of differing designs, shapes and sizes. All SensoPart lenses offer high optical quality. We offer C-mount lenses as an alternative to integrated lenses especially for vision sensors when, for example, very high measurement distances are required.

Our electrical accessories include a great variety of cables and adapters, power supply units and switching devices, as well as interface components for the integration of supplementary functions. One example of the latter category is the SmartPlug – very popular amongst users – which expands switching sensors with logic and control functions such as counters, timing elements, inverters or frequency converters. The SmartPlug is simply plugged in between the sensor and the cable – a brilliant little product that is only available from SensoPart!

Electrical accessories
from Page A-32

- *Cables*
- *Converters*
- *Power supply units and switching devices*








Flexible: *the bracket rotates around two axes, simplifying the fine adjustment of vision sensors.*



Practical: *sensors can be comfortably and precisely aligned after mounting with the help of rod brackets.*



Versatile: *SensoPart offers a comprehensive selection of reflectors and reflective tape: rectangular, square or round.*



Robust: *all mounting and bracket elements are extremely stable and offer additional protection for sensors when necessary.*

Accessories – Product Overview	
	Page
Mechanical accessories	A-4
Brackets for sensors	A-4
Mountings for VISOR® and illumination	A-12
Optical accessories	A-16
Reflectors and reflective tape	A-16
Lenses and protective casings	A-23
Illumination	A-25
Electrical accessories	A-32
Cables	A-32
Converters	A-36
Power supply units and switching devices	A-37

A

Accessories

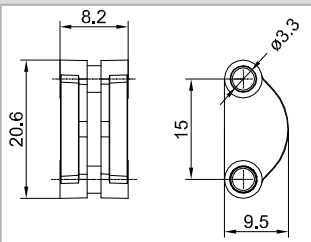
Brackets



- Brackets
- Mountings

Brackets for F 10 series

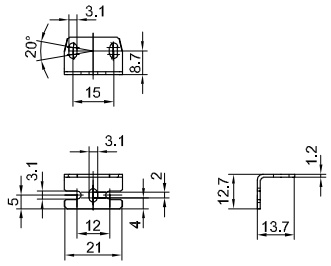




153-00899

Part number / Article number	MBD F10 / 660-01001
Description	Dovetail clamp mounting, adjustable ± 10°, with screws Material: PBT
Suitable for	F 10



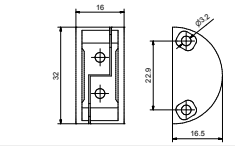


153-00907

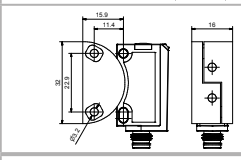
Part number / Article number	MS F 10 / 660-01000
Description	Mounting bracket with screws 1x mounting plate M3 1x mounting plate ø 3.1 mm Material: stainless steel V2A
Suitable for	F 10

Brackets for F 25, F 20, UT 20, FL 20 series





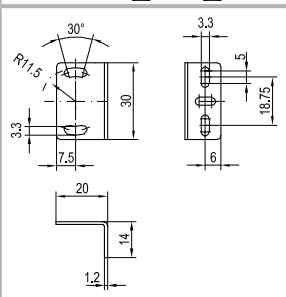
153-00945



153-00946

Part number / Article number	MBD F 25 / 661-01000
Description	Dovetail clamp mounting, adjustable ± 15°, with screws Material: anodised aluminium
Suitable for	F 25

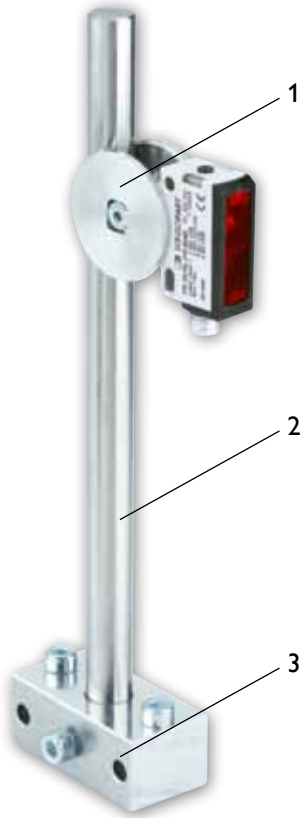




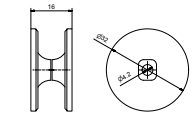
153-00241

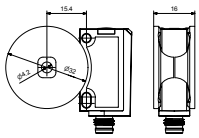
Part number / Article number	MS F 20 / 558-41000
Description	Mounting bracket with screws 1x retaining strip Material: nickel-plated steel
Suitable for	F 20 F 25 UT 20 FL 20

Brackets for F 25, F 20, UT 20, FL 20 series



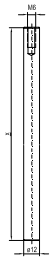
1





Part number / Article number	MBD F 25ST / 661-01001
Description	Bracket for dovetail on mounting rod, with clamping screw Material: aluminium
Suitable for	F 25

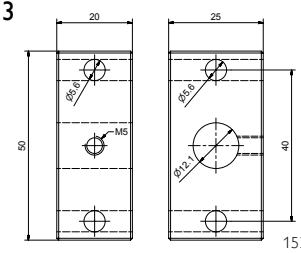
2



x = 200	MST 45-20
x = 300	MST 45-30
x = 400	MST 45-40

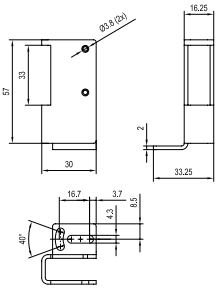
Part number / Article number	MST 45-20 / 543-11005 MST 45-30 / 543-11006 MST 45-40 / 543-11007
Description	Mounting rod with M6 internal thread Material: stainless steel
Suitable for	MB ST1 MP 45 MBD F 25ST MZ 45 MS F88-2 MG 45 MS F88-3

3



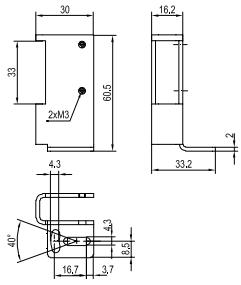
Part number / Article number	MB ST1 / 661-01002
Description	Bracket for mounting rods, with clamping screw Material: aluminium
Suitable for	MST 45-20 MST 45-30 MST 45-40





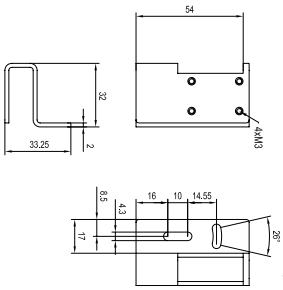
Part number / Article number	MSP F 20-11 / 558-41006
Description	Protective sensor angle bracket with screws, very robust Material: stainless steel V2A
Suitable for	F 20 UT 20-150 F 25 UT 20-S150 FL 20 UT 20-240





Part number / Article number	MSP F 20-1 / 558-41004
Description	Protective sensor angle bracket with screws, very robust Material: stainless steel V2A
Suitable for	F 20 F 25 UT 20 FL 20



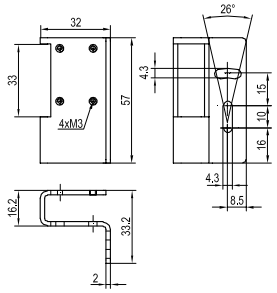
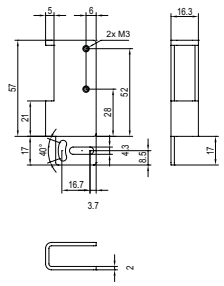
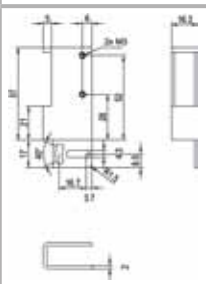
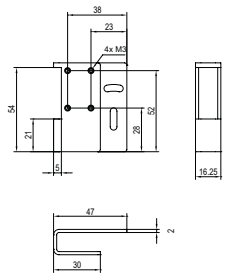
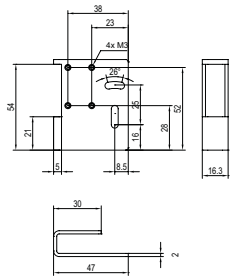
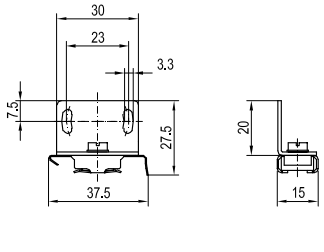


Part number / Article number	MSP F 20-23 / 558-41011
Description	Protective sensor angle bracket with screws, very robust Material: stainless steel V2A
Suitable for	F 20 F 25 UT 20 FL 20

A

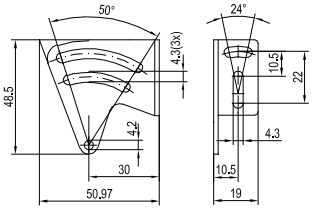
Accessories

Brackets

Brackets for F 20, F 25, UT 20, FL 20 series (Cont.)			
	 153-00297	Part number / Article number Description Suitable for	MSP F 20-2 / 558-41005 Protective sensor angle bracket with screws, very robust Material: stainless steel V2A F 20 UT 20-150 F 25 UT 20-S150 FL 20 UT 20-240
	 153-00973	Part number / Article number Description Suitable for	MSP F 20-13 / 558-41008 Protective sensor angle bracket with screws, very robust Material: stainless steel V2A F 20 UT 20-150 F 25 UT 20-S150 FL 20 UT 20-240
	 153-00972	Part number / Article number Description Suitable for	MSP F 20-12 / 558-41007 Protective sensor angle bracket with screws, very robust Material: stainless steel V2A F 20 UT 20-150 F 25 UT 20-S150 FL 20 UT 20-240
	 153-00974	Part number / Article number Description Suitable for	MSP F 20-21 / 558-41009 Protective sensor angle bracket with screws, very robust Material: stainless steel V2A F 20 UT 20-150 F 25 UT 20-S150 FL 20 UT 20-240
	 153-00975	Part number / Article number Description Suitable for	MSP F 20-22 / 558-41010 Protective sensor angle bracket with screws, very robust Material: stainless steel V2A F 20 UT 20-150 F 25 UT 20-S150 FL 20 UT 20-240
	 153-00291	Part number / Article number Description Suitable for	MS F 20-DIN / 558-41001 DIN rail mounting with screws Material: nickel-plated steel FL 20

Brackets for F 50, F 55, F 80, F 88, FGL series

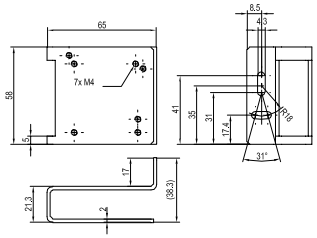




153-00065

Part number / Article number	MS F 50 / 579-50000
Description	Angle bracket with screws Material: stainless steel VA
Suitable for	F 50 F 55

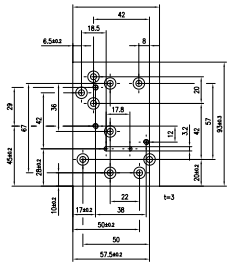




153-00298

Part number / Article number	MSP F 50 / 579-50005
Description	Protective sensor angle bracket with screws, very robust, light exit possible on three sides Material: stainless steel VA
Suitable for	F 50

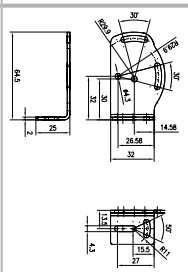




153-01018

Part number / Article number	MP F 50 / 579-50003
Description	Adapter plate Material: galvanised steel plate
Suitable for	F 50 F 55

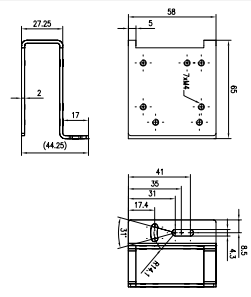




153-00818

Part number / Article number	MS F 55 / 579-50010
Description	Angle bracket with screws Material: stainless steel V2A
Suitable for	F 50 F 55

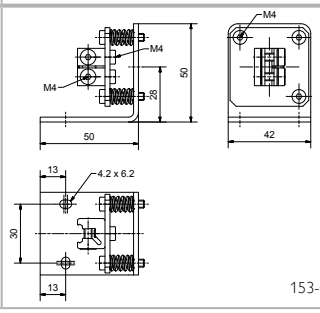




153-00819

Part number / Article number	MSP F 55 / 579-50011
Description	Protective sensor angle bracket with screws, very robust Material: stainless steel V2A
Suitable for	F 55





153-01126

Part number / Article number	MA F 55 / 579-50007
Description	Mounting angle, fine-adjustable with adjusting screws. Material: galvanised steel
Suitable for	F 55

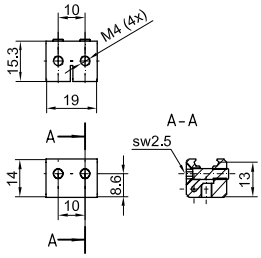
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Accessories

Brackets

Brackets for F 50, F 55, F 80, F 88, FGL series (Cont.)

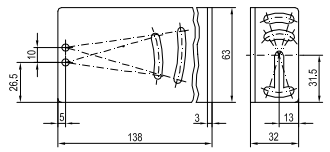




153-00542

Part number / Article number	MBD-S94 / 533-21000
Description	Dovetail double clamp mounting Material: metal
Suitable for	F 55 FGL F 88

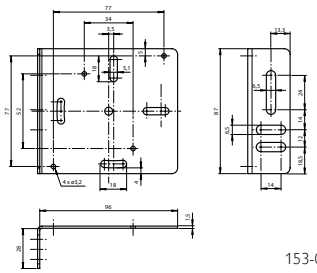




153-00239

Part number / Article number	MS F 80 / 820-41000
Description	Angle bracket with screws Material: nickel-plated steel
Suitable for	F 80

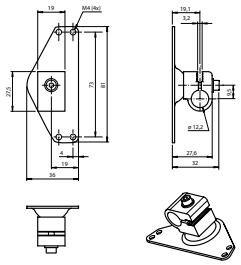




153-00561

Part number / Article number	MS F 88-1 / 820-41001
Description	Angle bracket Material: stainless steel
Suitable for	F 88

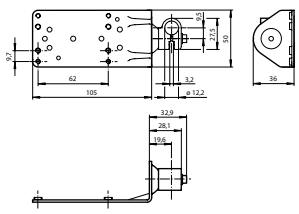




153-00562

Part number / Article number	MS F 88-2 / 820-41002
Description	Bracket for mounting rod with joint for fine adjustment, with screws Material: metal
Suitable for	F 88



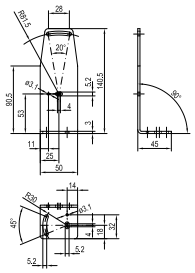


153-00563

Part number / Article number	MS F 88-3 / 820-41003
Description	Bracket for mounting rod with joint for fine adjustment, with screws Material: metal
Suitable for	F 88

Brackets for F 90, F 91, F 92 series



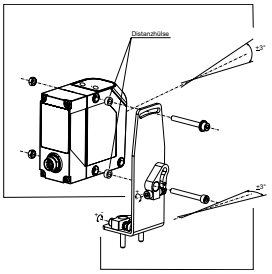


153-00470

Part number / Article number	MSP F 90 / 599-91002
Description	Angle bracket with screws Material: stainless steel V2A
Suitable for	F 90 F 91 F 92

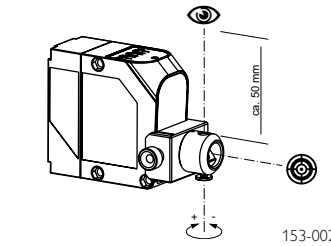
Brackets for F 90, F 91, F 92 series (Cont.)





Part number / Article number	MSP F 90 A / 599-91003
Description	Fine adjustment for angle bracket MSP F 90, set of two Material: metal
Suitable for	MSP F90

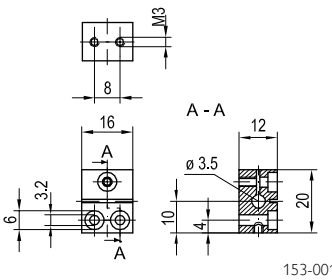




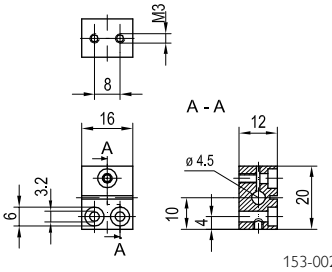
Part number / Article number	AS F 90 / 599-91004
Description	Aligning aid for pilot laser, for fine adjustment at long distances
Suitable for	F 90 F 91 F 92

Brackets for fibre-optic cables and round housings

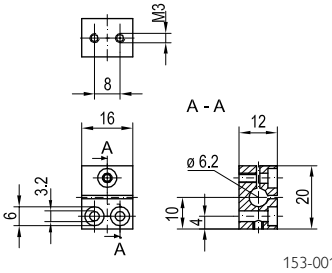




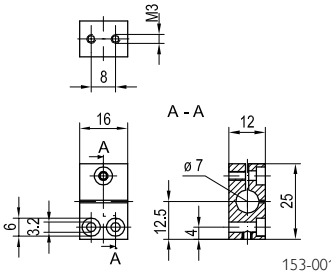
Part number / Article number	MB 3,5 / 903-50313
Description	Mounting block / fibre mount, closed curve Material: nickel-plated brass
Suitable for	Fibre-optic cables



Part number / Article number	MB 4,5 / 903-50314
Description	Mounting block / fibre mount, open curve Material: nickel-plated brass
Suitable for	Fibre-optic cables



Part number / Article number	MB 6 / 903-05139
Description	Mounting block / fibre mount, open curve Material: nickel-plated brass
Suitable for	Fibre-optic cables



Part number / Article number	MB 7 / 903-05140
Description	Mounting block / fibre mount, open curve Material: nickel-plated brass
Suitable for	Fibre-optic cables

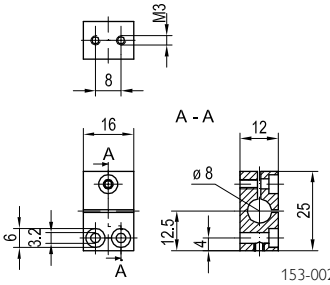
A

Accessories

Brackets

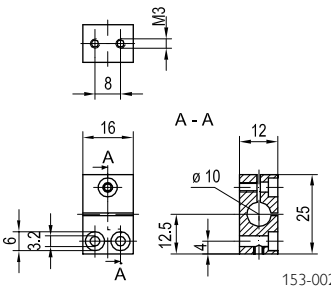
Brackets for fibre-optic cables and round housings (Cont.)





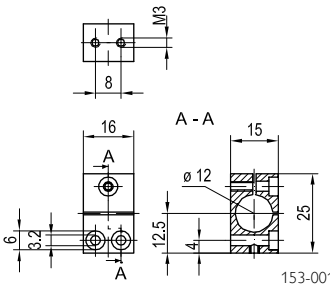
153-00235

Part number / Article number	MB 8 / 903-05141
Description	Mounting block / fibre mount, open curve Material: nickel-plated brass
Suitable for	Fibre-optic cables, round M8 housings



153-00236

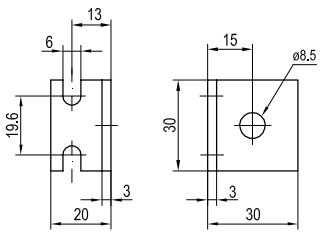
Part number / Article number	MB 10 / 903-05142
Description	Mounting block / fibre mount, open curve Material: nickel-plated brass
Suitable for	Fibre-optic cables, round M10 housings



153-00196

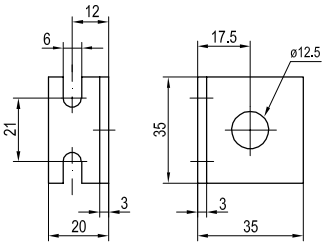
Part number / Article number	MB 12 / 903-05143
Description	Mounting block / fibre mount, closed curve Material: nickel-plated brass
Suitable for	Fibre-optic cables, round M12 housings





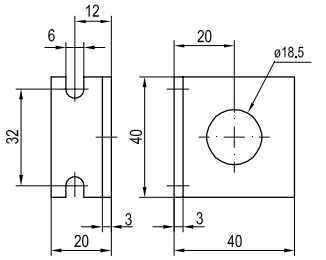
153-00559

Part number / Article number	MC 08 / 041-01306
Description	Mounting angle for round housings Material: aluminium
Suitable for	Round M8 housings



153-00558

Part number / Article number	MA 12 / 041-01305
Description	Mounting angle for round housings Material: aluminium
Suitable for	Round M12 housings

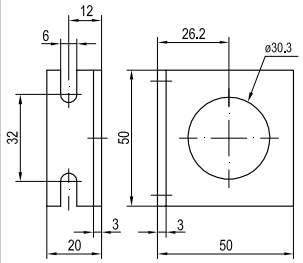


153-00015

Part number / Article number	MA 18 / 041-01304
Description	Mounting angle for round housings Material: aluminium
Suitable for	Round M18 housings

Brackets for fibre-optic cables and round housings (Cont.)

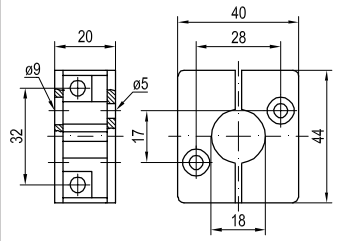




153-00017

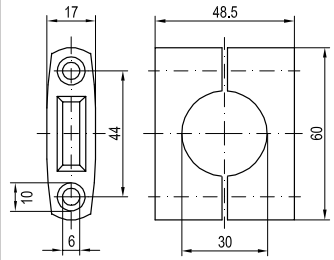
Part number / Article number	MA 30 / 041-01303
Description	Mounting angle for round housings Material: aluminium
Suitable for	Round M30 housings





153-00016

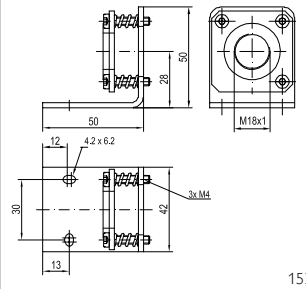
Part number / Article number	MC 18 / 042-01528
Description	Retaining clip for round housings Material: plastic
Suitable for	Round M18 housings



153-00018

Part number / Article number	MC 30 / 042-01527
Description	Retaining clip for round housings Material: plastic
Suitable for	Round M30 housings

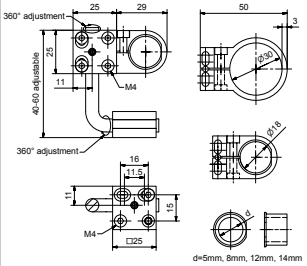




153-00059

Part number / Article number	MA 18 A / 042-12825
Description	Universal mounting angle for round housings, fine-adjustable with adjusting screws Material: galvanised steel
Suitable for	Round M12 and M18 housings

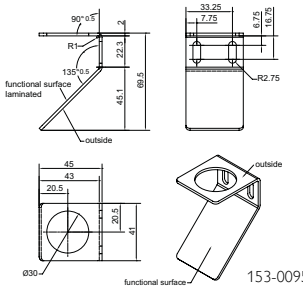




153-01016

Part number / Article number	MS M5-30 / 558-41012
Description	Universal bracket for round housings Material: connecting rod, metal / mounting elements, plastic
Suitable for	Round M5, M8, M12, M14, M18 and M30 housings





153-00959

Part number / Article number	Deflection mirror / 691-51535
Description	Deflection mirror for ultrasonic sensors Material: stainless steel
Suitable for	UMT 30-350 UMT 30-1300

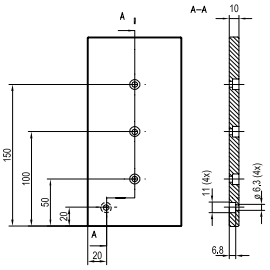
A

Accessories

Mountings

Mountings for V10, V20

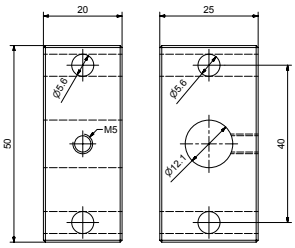




153-00547

Part number / Article number	MP 45 / 543-11003
Description	Mounting plate for mounting rod Material: anodised aluminium
Suitable for	MST 45-xx

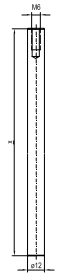




153-01000

Part number / Article number	MB ST1 / 661-01002
Description	Mounting for mounting rod with clamping screw Material: aluminium
Suitable for	MST 45-20 MST 45-30 MST 45-40



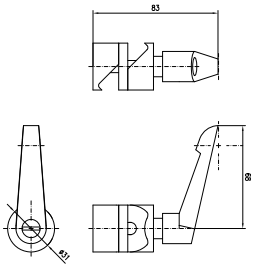


x = 200	MST 45-20
x = 300	MST 45-30
x = 400	MST 45-40

153-00545

Part number / Article number	MST 45-20 / 543-11005 MST 45-30 / 543-11006 MST 45-40 / 543-11007
Description	Mounting rod with M6 internal thread Material: stainless steel
Suitable for	MP 45, MB ST 1, MG 45, MB 45, MZ 45

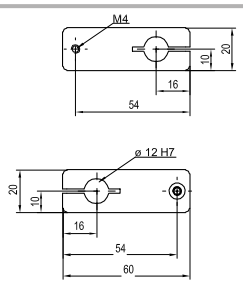




153-00776

Part number / Article number	MG 45 / 543-11008
Description	Mounting clamp for mounting rod Material: anodised aluminium, steel screw with plastic handle
Suitable for	MST 45-xx

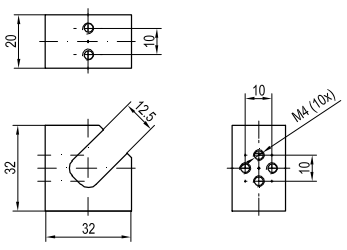




153-00546

Part number / Article number	MZ 45 / 543-11004
Description	Intermediate mounting piece for mounting rod Material: anodised aluminium
Suitable for	MST 45-xx



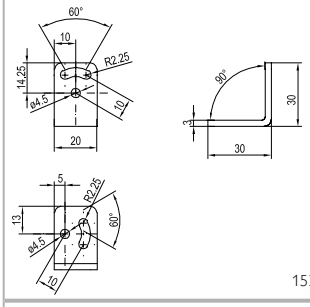


153-00481

Part number / Article number	MB 45 / 543-11002
Description	Mounting block for mounting rod Material: anodised aluminium
Suitable for	MST 45-xx MA 45 MA 45 L

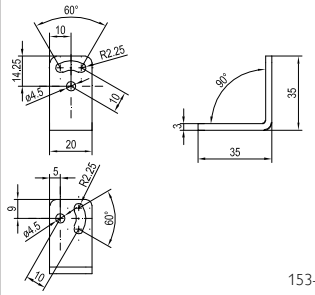
Mountings for V10,V20 (Cont.)





153-00482

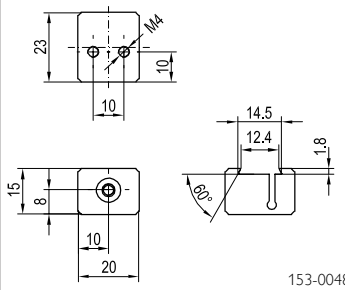
Part number / Article number	MA 45 / 543-11001
Description	Mounting angle Material: stainless steel V2A
Suitable for	MK 45 MK 45 L MB 45



153-00600

Part number / Article number	MA 45 L / 543-11013
Description	Mounting angle, long Material: stainless steel V2A
Suitable for	MK 45 MK 45 L MB 45

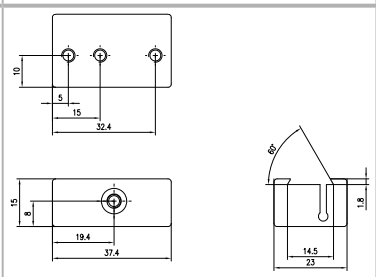




153-00480

Part number / Article number	MK 45 / 543-11000
Description	Mounting clamp, dovetail Material: anodised aluminium Screw: steel
Suitable for	V10 / V20

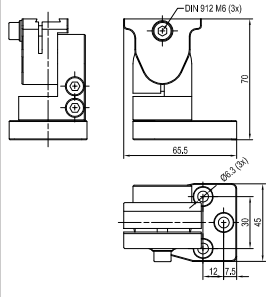




153-00901

Part number / Article number	MK 45 L / 543-11021
Description	Mounting clamp, dovetail, long Material: anodised aluminium, Screw: steel
Suitable for	V10 / V20





153-00913

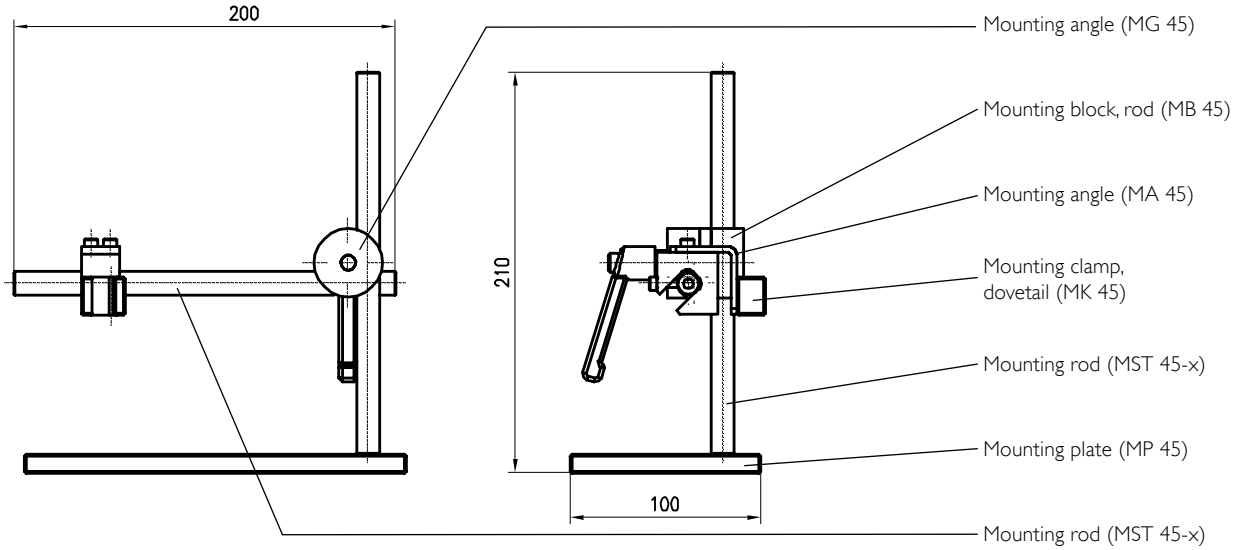
Part number / Article number	MG 2A / 543-11023
Description	Mounting angle with 2 axes Material: anodised aluminium
Suitable for	V10 / V20

A

Accessories

Mountings

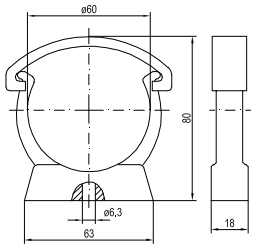
Mountings for V10, V20 (Cont.)



153-00435

Mountings for illumination

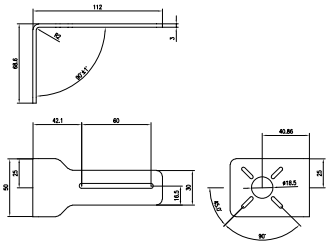




153-00228

Part number / Article number	MC 60 / 042-12820
Description	Retaining clip for mounting fluorescent tube Material: plastic
Suitable for	LZS neon tubes

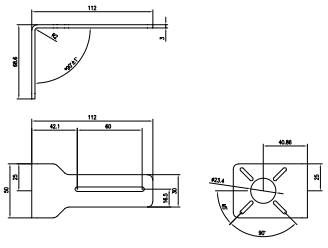




153-00707

Part number / Article number	MA LR-18/112 / 543-11016
Description	Angle bracket for lighting, Ø 18 mm Length: 112 mm Material: nickel-plated steel
Suitable for	LR 32 x-24-KFL5 LD 50 xD-24-KFL5

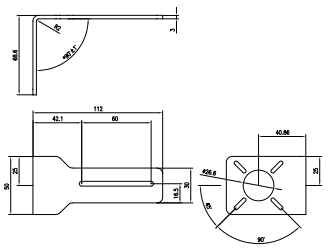




153-00721

Part number / Article number	MA LR-23/112 / 543-11019
Description	Angle bracket for lighting, Ø 23 mm Length: 112 mm Material: nickel-plated steel
Suitable for	LR 56 x-24-KFL5 LR 70 xD-24-KFL5 LR 70 xID-24-KFL5



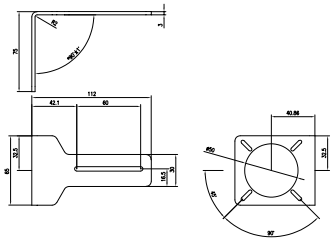


153-00722

Part number / Article number	MA LR-26/112 / 543-11017
Description	Angle bracket for lighting, Ø 26 mm Length: 112 mm Material: nickel-plated steel
Suitable for	LR 50 xW-24-KFL5 LR 70 x-24-KFL5

Mountings for illumination (Cont.)

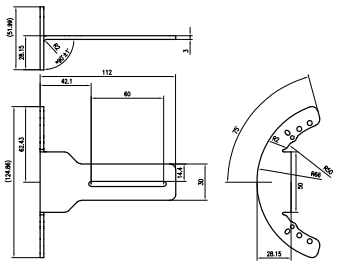




153-00723

Part number / Article number	MA LR-50/112 / 543-11018
Description	Angle bracket for lighting, Ø 50 mm Length: 112 mm Material: nickel-plated steel
Suitable for	LR 74 xW-24-KFL5 LR 75 xI-24-KFL5 LR 90 xW-24-KFL5 LR 100 xID-24-KFL5

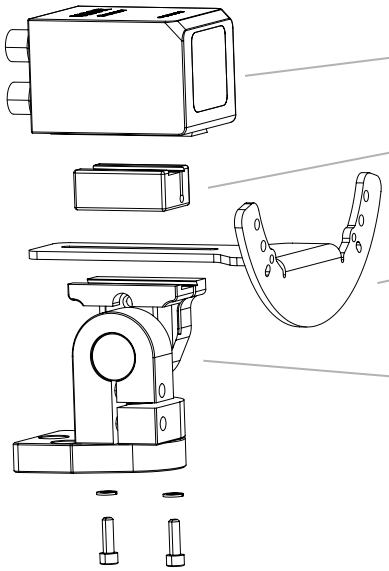




153-00724

Part number / Article number	MA LR-100/112 / 543-11015
Description	Angle bracket for lighting, Ø 100 mm Length: 112 mm Material: nickel-plated steel
Suitable for	LR 100 xD-24-KFL5 LR 130 xI-24-KFL5 LR 132 xW-24-KFL LFR 115 xD-24-2L12 LFR 45 xD





V10,V20

Mounting clamp, dovetail, long
MK 45 L/ 543-11021

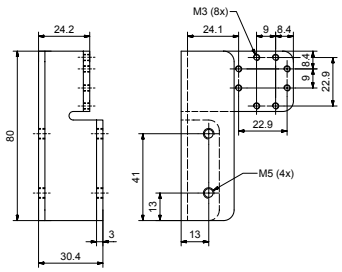
Angle bracket for lighting:
MA LR-100/112 / 543-11015
MA LR-18/112 / 543-11016
MA LR-26/112 / 543-11017
MA LR-50/112 / 543-11018
MA LR-23/112 / 543-11019

Mounting angle with 2 axes
MG 2A / 543-11023

153-01108

Special bracket for F 25





153-01040

Part number / Article number	MZ F 25 / 661-01003
Description	Mounting adapter for FT 25 contrast sensors with horizontal or vertical light exit options, with screws Material: stainless steel V2A
Suitable for	FT 25-W...-KL4 FT 25-RGB...-KL4

A

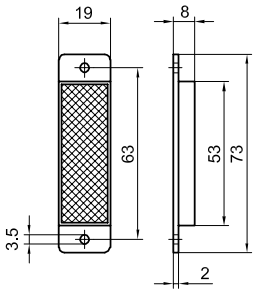
Accessories

Reflectors



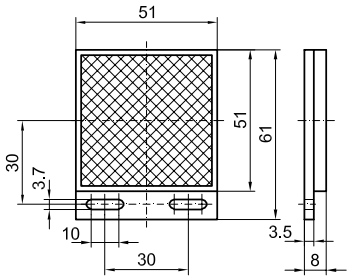
- Reflectors
- Lenses / Protective casings
- Illumination

Reflectors for LED Retroreflective photoelectric sensor



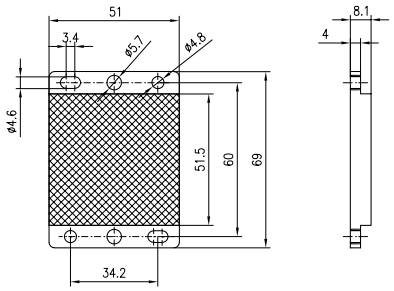
153-00068

Part number / Article number	R1 / 904-51532
Description	Reflector in housing
Dimensions	19 x 73 x 8 mm³
Mounting	2 mounting holes M3
Temperature range	-20 … +60 °C
Suitable for	Retroreflective photoelectric sensor (LED)



153-00069

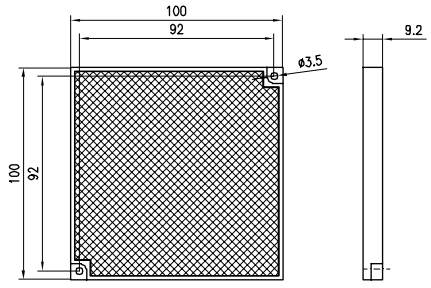
Part number / Article number	R5 / 904-51533
Description	Reflector in housing
Dimensions	51 x 61 x 8 mm³
Mounting	2 mounting holes
Temperature range	-20 … +60 °C
Suitable for	Retroreflective photoelectric sensor (LED)



153-00816

Part number / Article number	R50 BC / 904-51641
Description	Reflector, chemically resistant for critical cleaning processes
Dimensions	51 x 69 x 8.1 mm³
Mounting	6 mounting holes
Temperature range	-20 … +140 °C
Suitable for	Retroreflective photoelectric sensor (LED)

ECOLAB

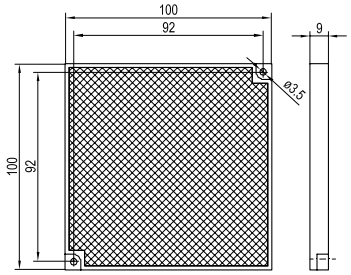


153-00817

Part number / Article number	R100 BC / 904-51642
Description	Reflector, chemically resistant for critical cleaning processes
Dimensions	100 x 100 x 9.2 mm³
Mounting	2 mounting holes
Temperature range	-20 … +140 °C
Suitable for	Retroreflective photoelectric sensor (LED)

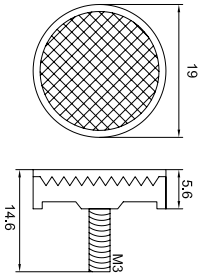
ECOLAB

Reflectors for LED Retroreflective photoelectric sensor



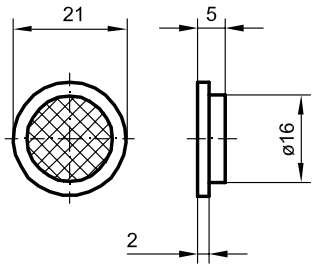
153-00557

Part number / Article number	R10 / 904-51637 R10 / 2 (2 x R10) / 904-51636
Description	Reflector in housing
Dimensions	100 x 100 x 9 mm³
Mounting	2 mounting holes
Temperature range	-40 … +70 °C
Suitable for	Retroreflective photoelectric sensor (LED) FR 85



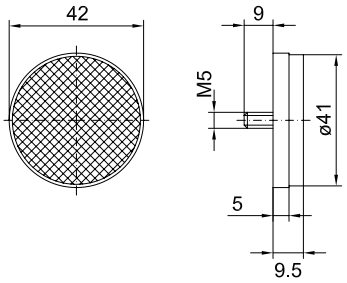
153-01014

Part number / Article number	RD2-G / 904-51567
Description	Reflector in housing
Dimensions	Ø 19 x 5.6 mm³
Mounting	Grub screw M3, centred
Temperature range	-20 … +60 °C
Suitable for	Retroreflective photoelectric sensor (LED)



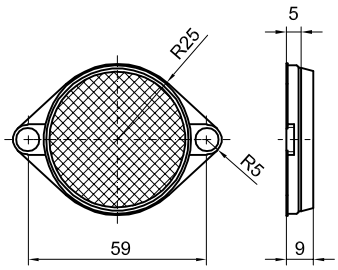
153-00066

Part number / Article number	RD2 / 904-51534
Description	Reflector in housing
Dimensions	Ø 21 x 5 mm³
Mounting	Self-adhesive
Temperature range	-20 … +60 °C
Suitable for	Retroreflective photoelectric sensor (LED)



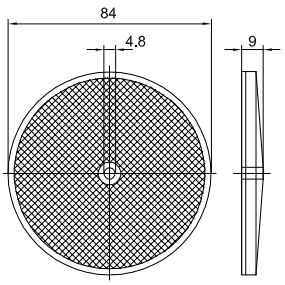
153-00067

Part number / Article number	RD4 / 904-51535
Description	Reflector in housing
Dimensions	Ø 42 x 9.5 mm³
Mounting	Grub screw M5, centred
Temperature range	-20 … +60 °C
Suitable for	Retroreflective photoelectric sensor (LED)



153-00355

Part number / Article number	RD46 / 904-51572
Description	Reflector in housing
Dimensions	Ø 46 x 9 mm³
Mounting	2 mounting holes
Temperature range	-20 … +60 °C
Suitable for	Retroreflective photoelectric sensor (LED)



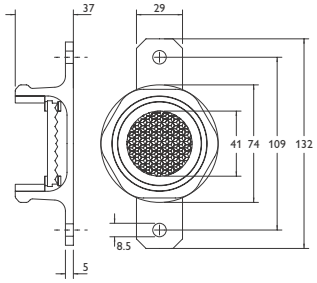
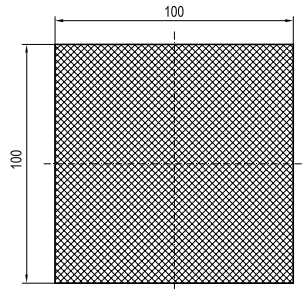
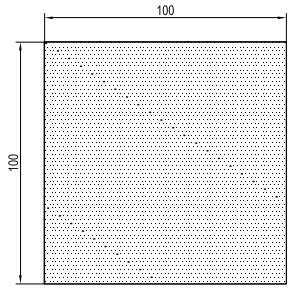
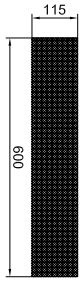
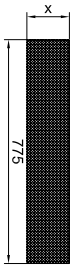
153-00070

Part number / Article number	RD8 / 904-51531
Description	Reflector in housing
Dimensions	Ø 84 x 9 mm³
Mounting	1 mounting hole, centred
Temperature range	-20 … +60 °C
Suitable for	Retroreflective photoelectric sensor (LED)

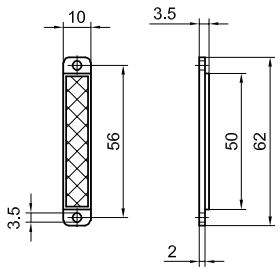
A

Accessories

Reflectors

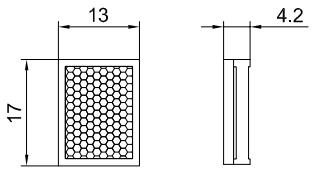
Reflectors for LED Retroreflective photoelectric sensor (Cont.)		
 153-00775	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	R128 / 904-51550 Reflector in housing, with protective glass for high robustness and high temperatures Ø 41 mm active area 2 mounting holes -20 … +300 °C Retroreflective photoelectric sensor (LED)
 153-00071	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	RF 10 / 904-51536 Reflective tape 100 x 100 mm² Self-adhesive -34 … +70 °C Retroreflective photoelectric sensor (LED)
 153-00556	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	RF 10C / 904-51633 Reflective tape for FT 50 C colour sensor 100 x 100 mm² Self-adhesive -40 … +70 °C FT 50 C
 153-01012	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	RF 600x115 / 904-51540 Reflective tape for FMS 200-01 Analogue 600 x 115 mm² Self-adhesive -40 … +70 °C Retroreflective photoelectric sensor (LED)
 153-01015	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	RF 775x … mm / 904-51643 Reflective tape, choice of length, weatherproof 775 x x mm² Self-adhesive -40 … +70°C Retroreflective photoelectric sensor (LED)

Reflectors for laser Retroreflective photoelectric sensor



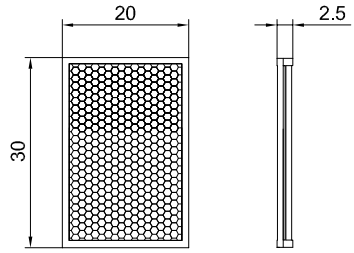
153-00280

Part number / Article number	R1L / 904-51559
Description	Reflector in housing
Dimensions	10 x 62 x 3.5 mm³
Mounting	2 mounting holes
Temperature range	-20 … +60 °C
Suitable for	Retroreflective photoelectric sensor (laser)



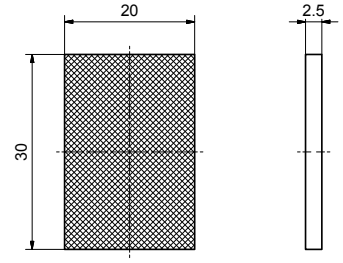
153-00771

Part number / Article number	R2-1LK / 904-51587
Description	Reflector in housing
Dimensions	13 x 17 x 4.2 mm³
Mounting	Self-adhesive
Temperature range	-20 … +60 °C
Suitable for	Retroreflective photoelectric sensor (laser)



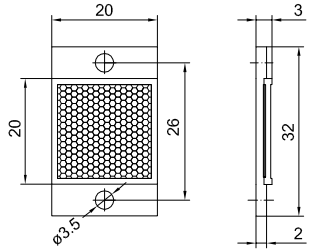
153-00772

Part number / Article number	R3-2LK / 904-51588
Description	Reflector in housing
Dimensions	20 x 30 x 2.5 mm³
Mounting	Self-adhesive
Temperature range	-20 … +60 °C
Suitable for	Retroreflective photoelectric sensor (laser)



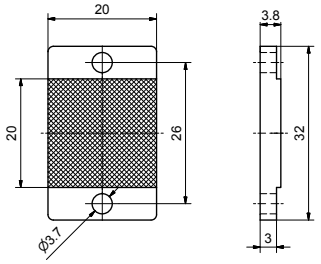
153-01047

Part number / Article number	R3-2LK1 / 904-51596
Description	Reflector in housing with very fine structure
Dimensions	20 x 30 x 2.5 mm³
Mounting	Self-adhesive
Temperature range	-20 … +60 °C
Suitable for	Retroreflective photoelectric sensor (laser)



153-00773

Part number / Article number	R2-2LB / 904-51586
Description	Reflector in housing
Dimensions	20 x 32 x 3 mm³
Mounting	2 mounting holes
Temperature range	-20 … +60 °C
Suitable for	Retroreflective photoelectric sensor (laser)



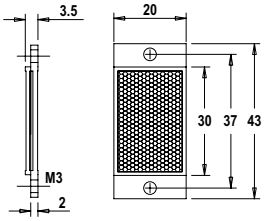
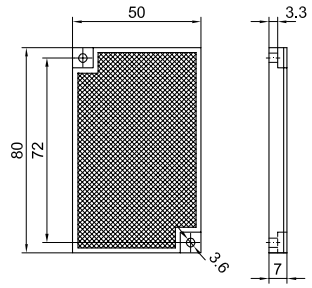
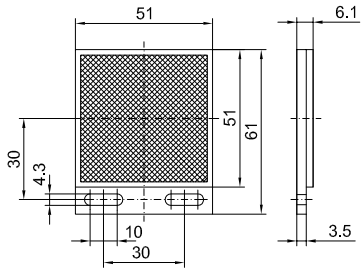
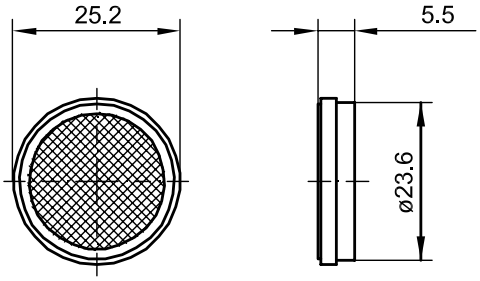
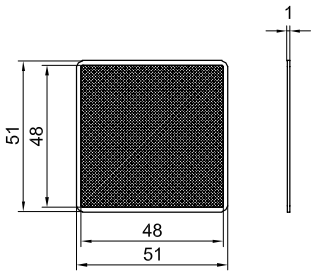
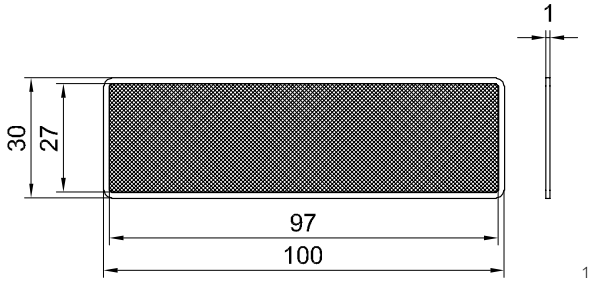
153-001046

Part number / Article number	R2-2LB1 / 904-51595
Description	Reflector in housing,with very fine structure
Dimensions	20 x 32 x 3.8 mm³
Mounting	2 mounting holes
Temperature range	-20 … +60 °C
Suitable for	Retroreflective photoelectric sensor (laser)

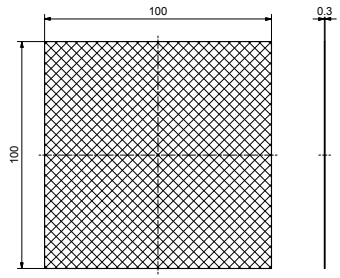
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Accessories

Reflectors

Reflectors for laser Retroreflective photoelectric sensor (Cont.)		
 153-00774	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	R3-2LB / 904-51585 Reflector in housing 20 x 43 x 3.5 mm³ 2 mounting holes -20 … +60 °C Retroreflective photoelectric sensor (laser)
 153-00544	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	R5-8/L / 904-51576 Reflector in housing 50 x 80 x 7 mm³ 2 mounting holes -20 … +60 °C Retroreflective photoelectric sensor (laser)
 153-00242	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	R5L / 904-51543 Reflector in housing 51 x 61 x 6.1 mm³ 2 mounting holes (slots) -20 … +60 °C Retroreflective photoelectric sensor (laser)
 153-00699	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	RD-25 KL / 904-51589 Reflector in housing Ø 25.2 x 5.5 mm³ Self-adhesive -20 … +60 °C Retroreflective photoelectric sensor (laser)
 153-00701	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	RF-50 KL / 904-51590 Reflective tape 51 x 51 mm² Self-adhesive -40 … +70 °C Retroreflective photoelectric sensor (laser)
 153-00950	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	RF-30x100 KL / 904-51592 Reflective tape 100 x 30 mm² Self-adhesive -40 … +70 °C Retroreflective photoelectric sensor (laser)

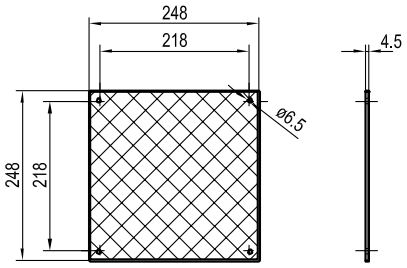
Reflectors for laser Retroreflective photoelectric sensor (Cont.)



153-01125

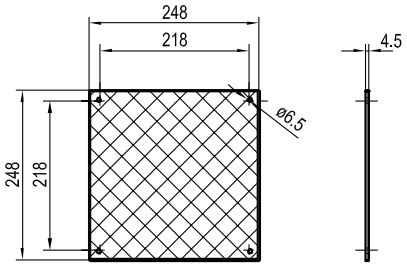
Part number / Article number	RF-100 KL / 904-51644
Description	Reflective tape 100 x 100 mm, to cut to size
Dimensions	100 x 100 mm²
Mounting	Self-adhesive
Temperature range	-40 … +70 °C
Suitable for	Retroreflective photoelectric sensor (laser)

Reflectors for time-of-flight devices



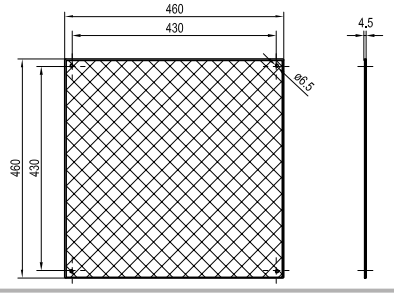
153-00483

Part number / Article number	RL 250 / 904-51562
Description	Reflector for ranges up to 50 m
Dimensions	248 x 248 x 4.5 mm³
Mounting	4 mounting holes
Temperature range	-20 … +60 °C
Suitable for	FR 90, FR 91



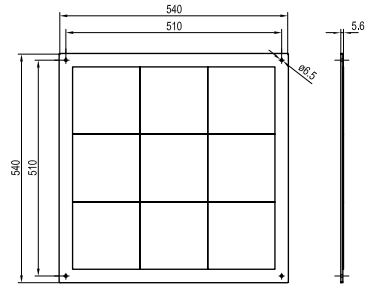
153-00483

Part number / Article number	RL 250/V / 904-51578
Description	Reflector for ranges up to 30 m
Dimensions	248 x 248 x 4.5 mm³
Mounting	4 mounting holes
Temperature range	-20 … +60 °C
Suitable for	FR 92



153-00485

Part number / Article number	RL 460 / 904-51565
Description	Reflector for ranges up to 80 m
Dimensions	460 x 460 x 4.5 m³
Mounting	4 mounting holes
Temperature range	-20 … +60 °C
Suitable for	FR 90, FR 91, FR 92

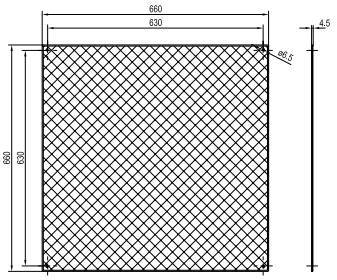


153-00484

Part number / Article number	RL 540 / 904-51571
Description	Reflector in housing for ranges up to 100 m
Dimensions	540 x 540 x 5.6 mm³
Mounting	4 mounting holes
Temperature range	-20 … +60 °C
Suitable for	FR 90, FR 91, FR 92

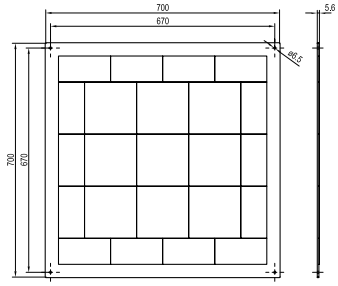
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Reflectors für time-of-flight devices (Cont.)



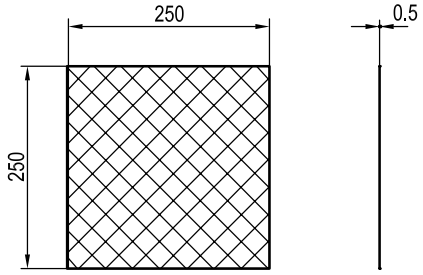
153-00486

Part number / Article number	RL 660 / 904-51564
Description	Reflector for ranges up to 200 m
Dimensions	660 x 660 x 4.5 mm³
Mounting	4 mounting holes
Temperature range	-20 … +60 °C
Suitable for	FR 90, FR 91, FR 92



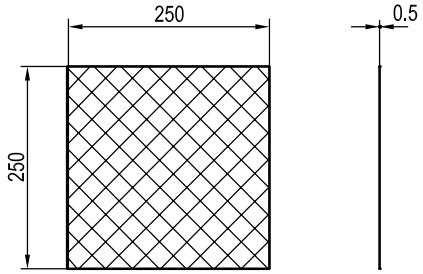
153-00487

Part number / Article number	RL 700 / 904-51570
Description	Reflector in housing for ranges up to 250 m
Dimensions	700 x 700 x 5,6 mm³
Mounting	4 mounting holes
Temperature range	-20 … +60 °C
Suitable for	FR 90, FR 91, FR 92



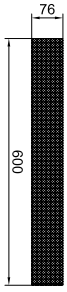
153-00488

Part number / Article number	RF 250 / 599-91009
Description	Reflective tape for ranges up to 50 m
Dimensions	250 x 250 mm²
Mounting	Self-adhesive
Temperature range	-20 … +60 °C
Suitable for	FR 90, FR 91



153-00488

Part number / Article number	RF 250/V / 904-51579
Description	Reflective tape for ranges up to 30 m
Dimensions	250 x 250 mm²
Mounting	Self-adhesive
Temperature range	-20 … +60 °C
Suitable for	FR 92

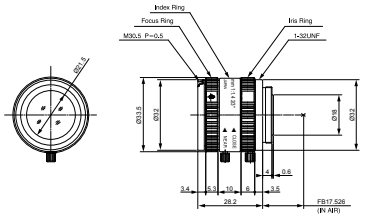
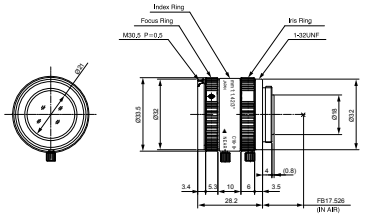
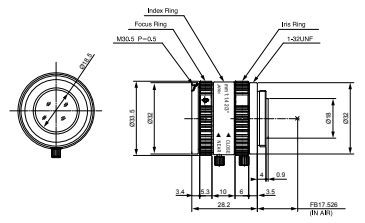
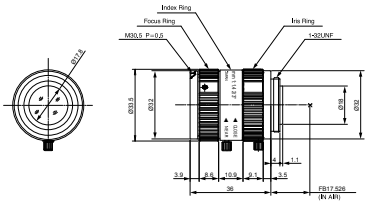
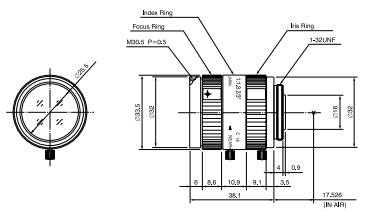


153-01010

Part number / Article number	Reflective tape / 904-51548
Description	Reflective tape
Dimensions	600 x 76 mm²
Mounting	Self-adhesive
Temperature range	-40 … +70 °C
Suitable for	FR 85

Mounting of the reflectors as shown in the dimensional drawing or alignment according to labeling on reflector front.

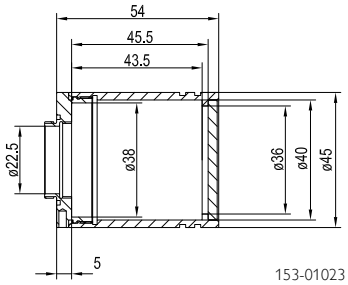
Lenses, C-mount

	 153-01024	Part number / Article number Description Suitable for	LO C 8 / 526-51513 C-mount lens 8 mm focal length Aperture/focus: manual Filter thread: 30.5/0.5 Diameter: 33.5 mm Length: 28.2 Weight: 70 g V10 / V20 C-Mount
	 153-01025	Part number / Article number Description Suitable for	LO C 12 / 526-51514 C-mount lens 12 mm focal length Aperture/focus: manual Filter thread: 30.5/0.5 Diameter: 33.5 mm Length: 28.2 mm Weight: 65 g V10 / V20 C-Mount
	 153-01026	Part number / Article number Description Suitable for	LO C 16 / 526-51515 C-mount lens 16 mm focal length Aperture/focus: manual Filter thread: 30.5/0.5 Diameter: 33.5 mm Length: 28.2 mm Weight: 65 g V10 / V20 C-Mount
	 153-01027	Part number / Article number Description Suitable for	LO C 25 / 526-51516 C-mount lens 25 mm focal length Aperture/focus: manual Filter thread: 30.5/0.5 Diameter: 33.5 mm Length: 36.0 mm Weight: 75 g V10 / V20 C-Mount
	 153-01028	Part number / Article number Description Suitable for	LO C 50 / 526-51113 C-mount lens 50 mm focal length Aperture/focus: manual Filter thread: 30.5/0.5 Diameter: 33.5 mm Length: 38.1 mm Weight: 90 g V10 / V20 C-Mount

A

Protective casings

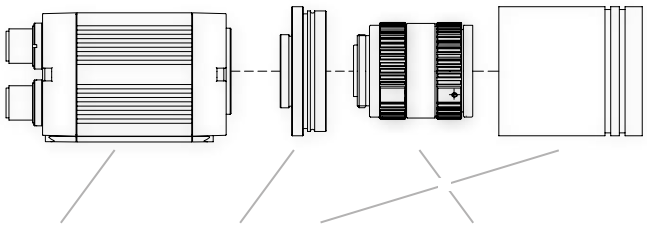




153-01023

Part number / Article number	LPT 45 CML 5 / 527-51132
Description	C-mount IP 65 protective casing Flange 5 mm Maximum lens dimensions: diameter: 38 mm length: 42 mm
Suitable for	V10 / V20 C-Mount





153-01129

Accessories, lenses



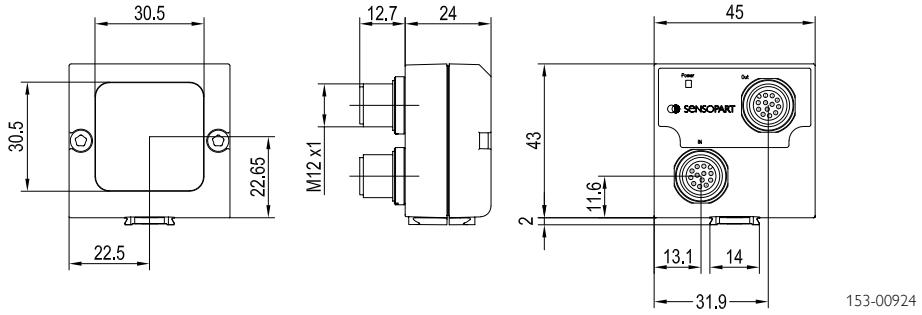


Part number	Article number	Description
ET 0,5	038-12399	Intermediate ring 0.5 mm
ET 1	038-12400	Intermediate ring 1 mm
LR 5	543-11011	Intermediate ring 5 mm
ET 10	038-12402	Intermediate ring 10 mm
ETS	527-51129	Intermediate ring set
VF T M1	533-01010	Infrared filter for C-mount lens

Surface light for V10, V20



Part number	Article number	Description
LF45 W-24-2L12	525-51147	Surface light, V10 / V20, white, 12-pin
LF45 R-24-2L12	525-51148	Surface light, V10 / V20, red, 12-pin
LF45 IR-24-2L12	525-51149	Surface light, V10 / V20, infrared, 12-pin*



* External IR illumination can only be combined with IR Types or C-Mount sensors.
LED area lighting for incidental illumination in IP67 housings. Can be cascaded to illuminate from several directions.
No switching amplifier required.

A

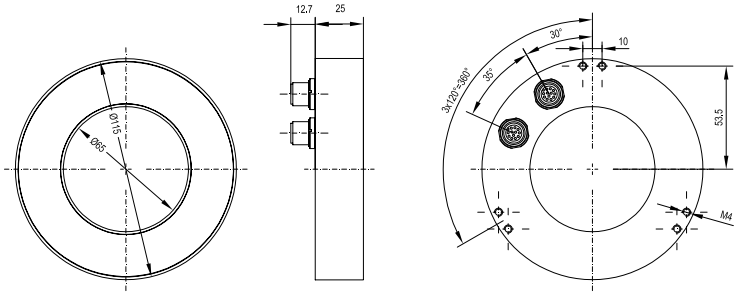
Accessories

Illumination

Ring light for V10, V20



Part number	Article number	Description	Angle bracket
LFR 115 WD-24-2L12	525-51150	Ring light, V10 / V20, white, diffuse, 12-pin	543-11015
LFR 115 RD-24-2L12	525-51151	Ring light, V10 / V20, red, diffuse, 12-pin	543-11015
LFR 115 ID-24-2L12	525-51152	Ring light, V10 / V20, infrared, diffuse, 12-pin*	543-11015
LFR 115 WK-24-2L-12	525-51153	Ring light, V10 / V20, white, clear, 12-pin	543-11015
LFR 115 RK-24-2L-12	525-51154	Ring light, V10 / V20, red, clear, 12-pin	543-11015
LFT 115 IK-24-2L-12	525-51155	Ring light, V10 / V20, infrared, clear, 12-pin	543-11015



153-00926

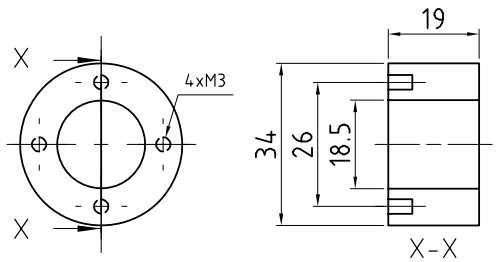
* External IR illumination is only possible for IR types or C-Mount sensors.
LED ring lighting for the incidental illumination of objects in IP67-tight housings. No switching amplifier is required and cascading is possible.

Ring light



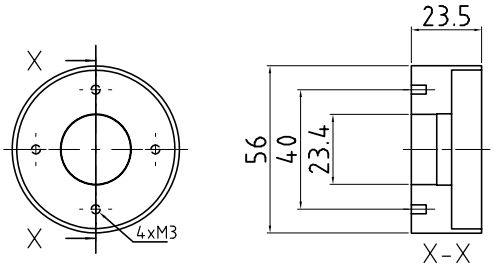
Part number	Article number	Description	Angle bracket	Draw.
LR 32 W-24-KFL5	532-51000	Ring light, 32 mm, white	543-11016	1
LR 56 W-24-KFL5	532-51001	Ring light, 56 mm, white	543-11019	2
LR 70 W-24-KFL5	532-51002	Ring light, 70 mm, white	543-11017	3
LR 32 R-24-KFL5	532-51003	Ring light, 32 mm, red	543-11016	1
LR 56 R-24-KFL5	532-51004	Ring light, 56 mm, red	543-11019	2
LR 70 R-24-KFL5	532-51005	Ring light, 70 mm, red	543-11017	3

1



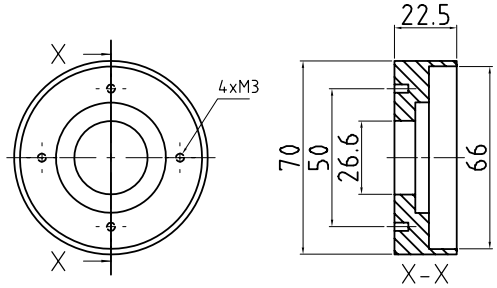
153-00726

2



153-00727

3



153-00731

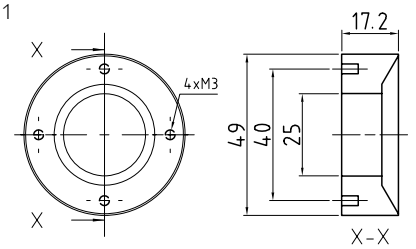
* External IR illumination is only combinable with IR types or C-Mount sensors.
LED ring lighting for the incidental illumination of objects.
LFR 45 xD Types require no switching amplifier, can be cascaded and are in IP67-tight housings.

Ring light, angled



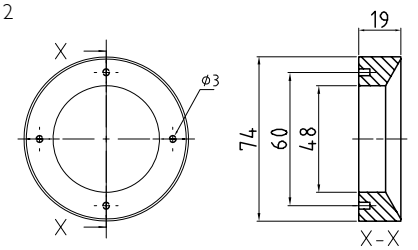
Part number	Article number	Description	Angle bracket	Draw.
LR 50 WW-24-KFL5	532-51006	Ring light, angled, 50 mm, white	543-11017	1
LR 74 WW-24-KFL5	532-51007	Ring light, angled, 74 mm, white	543-11018	2
LR 90 WW-24-KFL5	532-51008	Ring light, angled, 90 mm, white	543-11018	3
LR 132 WW-24-KFL5	532-51009	Ring light, angled, 132 mm, white	543-11015	4
LR 50 RW-24-KFL5	532-51010	Ring light, angled, 50 mm, red	543-11017	1
LR 74 RW-24-KFL5	532-51011	Ring light, angled, 74 mm, red	543-11018	2
LR 90 RW-24-KFL5	532-51012	Ring light, angled, 90 mm, red	543-11018	3
LR 132 RW-24-KFL5	532-51013	Ring light, angled, 132 mm, red	543-11015	4
LR 75 WI-24-KFL5	532-51014	Ring light, indirect, 75 mm, white	543-11018	5
LR 130 WI-24-KFL5	532-51015	Ring light, indirect, 130 mm, white	543-11015	6
LR 75 RI-24-KFL5	532-51016	Ring light, indirect, 75 mm, red	543-11018	5
LR 130 RI-24-KFL5	532-51017	Ring light, indirect, 130 mm, red	543-11015	6

1



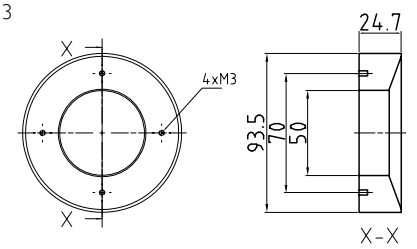
153-00730

2



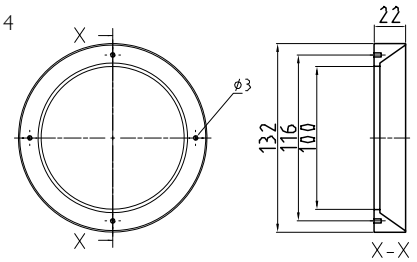
153-00732

3



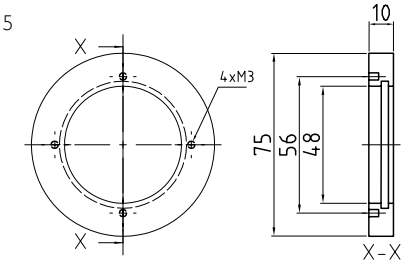
153-00734

4



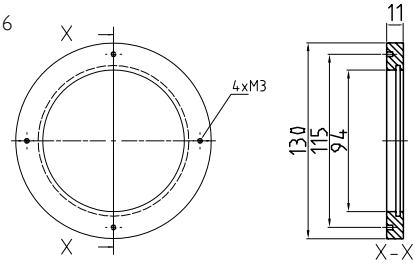
153-00738

5



153-00733

6



153-00737

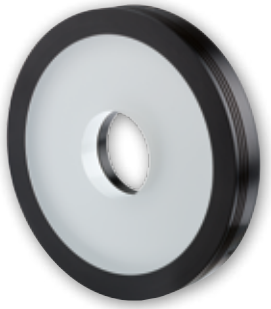
Funnel-shaped LED ring light for dark field illumination.

A

Accessories

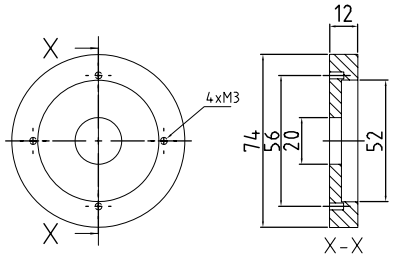
Illumination

Ring light, indirect, diffuse



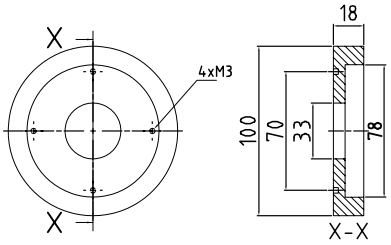
Part number	Article number	Description	Angle bracket	Draw.
LR 70 WID-24-KFL5	532-51030	Ring light, indirect, diffuse, 70 mm, white	543-11019	1
LR 100 WID-24-KFL5	532-51031	Ring light, indirect, diffuse, 100 mm, white	543-11018	2
LR 70 RID-24-KFL5	532-51032	Ring light, indirect, diffuse, 70 mm, red	543-11019	1
LR 100 RID-24-KFL5	532-51033	Ring light, indirect, diffuse, 100 mm, red	543-11018	2
LR 70 WD-24-KFL5	532-51034	Ring light, diffuse, 70 mm, white	543-11019	3
LR 100 WD-24-KFL5	532-51035	Ring light, diffuse, 100 mm, white	543-11015	4
LR 70 RD-24-KFL5	532-51036	Ring light, diffuse, 70 mm, red	543-11019	3
LR 100 RD-24-KFL5	532-51037	Ring light, diffuse, 100 mm, red	543-11015	4

1



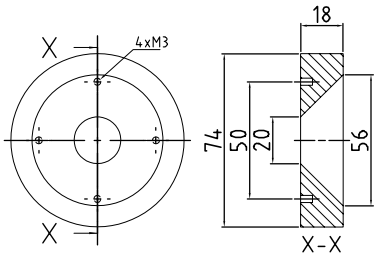
153-00729

2



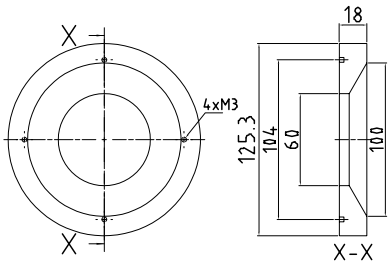
153-00735

3



153-00728

4



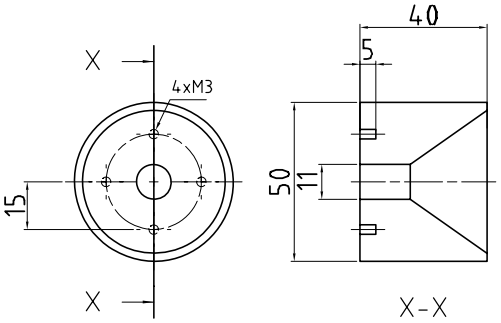
153-00736

LED ring light with LEDs shining surfacely and directly on centre of circle.

Ring light, dome, diffuse



Part number	Article number	Description	Angle bracket
LD 50 WD-24-KFL5	532-51038	Ring light, dome, diffuse, 50 mm, white	543-11016
LD 50 RD-24-KFL5	532-51039	Ring light, dome, diffuse, 50 mm, red	543-11016



153-00704

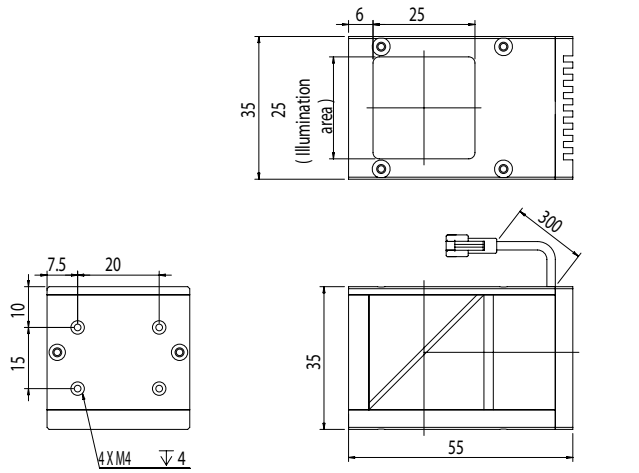
LED ring lighting with funnel-shaped diffuser sheet for strongly reflective objects.

Coaxial illumination



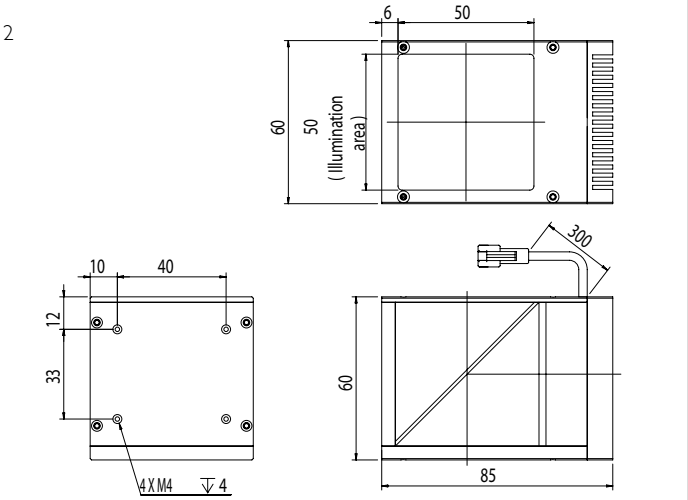
Part number	Article number	Description	Drawing
LK 25 R-24-KFL5	532-51043	Coaxial lighting, 25 mm, red	1
LK 46 R-24-KFL5	532-51044	Coaxial lighting, 46 mm, red	2

1



153-00830

2



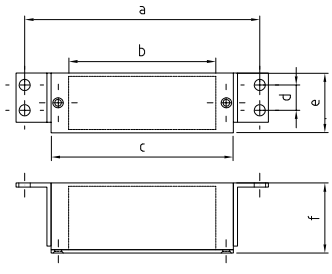
153-00831

Coaxial mirrored LED lighting for homogeneous illumination of reflected objects.

Light strip, diffuse



Part number	Article number	Description	Type
LB 44 WD-24-KFL5	532-51026	Light strip, diffuse, 44 mm, white	1
LB 86 WD-24-KFL5	532-51027	Light strip, diffuse, 86 mm, white	2
LB 180 WD-24-KFL5	532-51049	Light strip, diffuse, 180 mm, white	3
LB 44 RD-24-KFL5	532-51028	Light strip, diffuse, 44 mm, red	1
LB 86 RD-24-KFL5	532-51029	Light strip, diffuse, 86 mm, red	2
LB 180 RD-24-KFL5	532-51052	Light strip, diffuse, 180 mm, red	3



153-00756

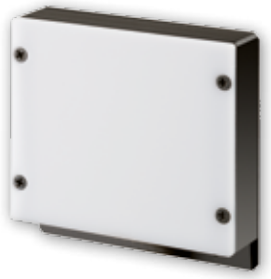
	Type 1	Type 2	Type 2
a	67 mm	109 mm	206.5 mm
b	42 mm	84 mm	181 mm
c	52 mm	95 mm	191 mm
d	7 mm	7 mm	7.2 mm
e	17 mm	17 mm	17.5 mm
f	20 mm	20 mm	20 mm

Bar-shaped light strip with diffuser sheet for indirect illumination.

Accessories

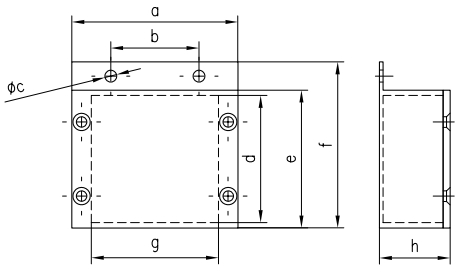
Illumination

Surface light



Part number	Article number	Description	Drawing
LF 36 WD-24-KFL5	532-51018	Surface light, diffuse, 36 mm, white	1
LF 51 WD-24-KFL5	532-51019	Surface light, diffuse, 51 mm, white	2
LF 100 WD-24-KFL5	532-51020	Surface light, diffuse, 100 mm, white	3
LF 200 WD-24-KFL5	532-51024	Surface light, diffuse, 200 mm, white	4
LF 36 RD-24-KFL5	532-51021	Surface light, diffuse, 36 mm, red	1
LF 51 RD-24-KFL5	532-51022	Surface light, diffuse, 51 mm, red	2
LF 100 RD-24-KFL5	532-51023	Surface light, diffuse, 100 mm, red	3
LF 200 RD-24-KFL5	532-51025	Surface light, diffuse, 200 mm, red	4

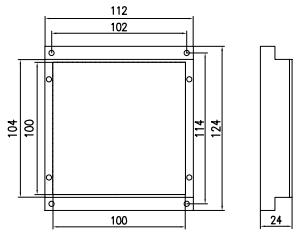
1



a	=	47	mm
b	=	25	mm
c	=	3,4	mm
d	=	36	mm
e	=	40	mm
f	=	47	mm
g	=	36	mm
h	=	15	mm

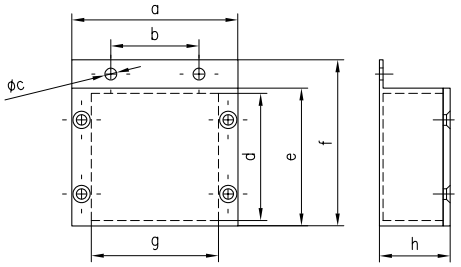
153-00758

3



153-00762

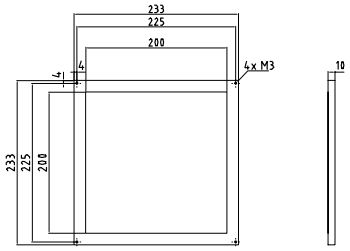
2



a	=	62	mm
b	=	40	mm
c	=	3,4	mm
d	=	50	mm
e	=	54	mm
f	=	62	mm
g	=	50	mm
h	=	15	mm

153-00758

4



153-00757

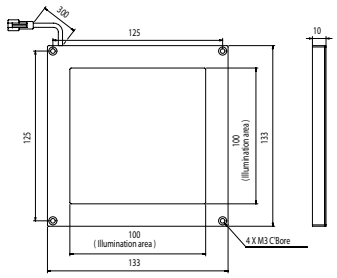
Surface LED background illumination with very bright, regular surface illumination.

Surface light



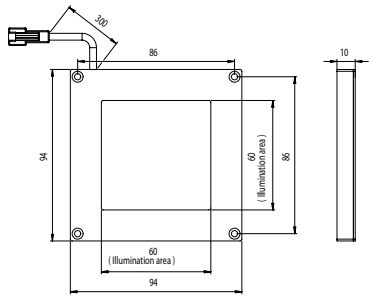
Part number	Article number	Description	Drawing
LF 100 A RD-24-KFL5	532-51040	Surface light, 100 mm, red, diffuse	1
LF 60 A RD-24-KFL5	532-51041	Surface light, 60 mm, red, diffuse	2
LF 100 A WD-24-KFL5-65	532-51042	Surface light, 100 mm, white, diffuse, IP 65	3

1



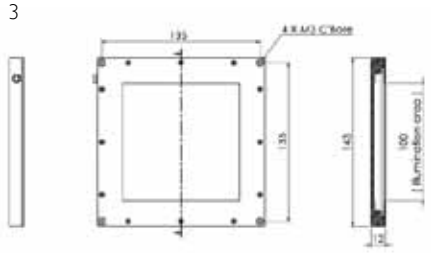
153-00828

2



153-00827

3



153-00829

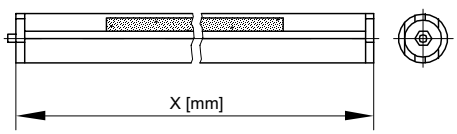
Surface LED background lighting for diffuse illumination.

LZS neon tubes



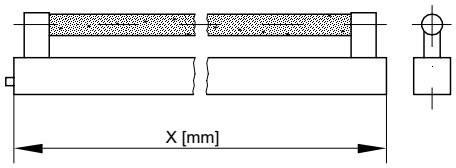
Part number	Article number	Light source	Dimensions (mm)	Power supply	Enclosure rating	Draw.
LZS 08230-50	525-51122	D16x200/D60 X=350	Ø60 x 350	230 V AC	IP 50	1
LZS 13230-50	525-51123	D16x360/D60 X=580	Ø60 x 580	230 V AC	IP 50	1
LZS 18230-67	525-51126	D26x420/D70 X=940	Ø70 x 940	230 V AC	IP 67	1
LZS 18024-54	525-51124	D26x420/45x108 X=635	635 x 45 x 108	24 V DC	IP 54	2
LZS 18230-54	525-51125	D26x420/45x108 X=635	635 x 45 x 108	230 V AC	IP 54	2
LZS 36024-54	525-51127	D26x1000/45x108 X=1245	1245 x 45 x 108	24 V DC	IP 54	2

1



153-00202

2



153-00203

High-frequency fluorescent tubes for extensive illumination.

A

Accessories

Cables



- Cables
- Converters
- Power supply units and switching devices

Straight connectors	90° connectors	90° connectors with LED	Shielded connectors
			

Part number	Article number	Description
M5, 4-pin		
CN4 FG-2m-PUR	902-51793	2 m, straight, PUR
CN4 FG-5m-PUR	902-51791	5 m, straight, PUR
CN4 FW-2m-PUR	902-51794	2 m, 90°, PUR
CN4 FW-5m-PUR	902-51792	5 m, 90°, PUR
M8, 3-pin		
K3-2m-G-PUR	902-50679	2 m, straight, PUR
K3-5m-G-PUR	902-51614	5 m, straight, PUR, suitable for drag chains
K3-10m-G-PUR	902-50694	10 m, straight, PUR, suitable for drag chains
K3-2m-W-PUR	902-50681	2 m, 90°, PUR, suitable for drag chains
K3-5m-W-PUR	902-51615	5 m, 90°, PUR, suitable for drag chains
K3-2m-W-PL-PUR	902-50683	2 m, 90°, PUR, with indicator LED
K3-5m-W-PL-PUR	902-51616	5 m, 90°, PUR, with indicator LED, suitable for drag chains
K3-10m-W-PL-PUR	902-50693	10 m, 90°, PUR, with indicator LED, suitable for drag chains
M8, 4-pin		
K4-2m-G-PUR	902-50801	2 m, straight, PUR, suitable for drag chains
K4-5m-G-PUR	902-51617	5 m, straight, PUR, suitable for drag chains
K4-10m-G-PUR	902-51610	10 m, straight, PUR, suitable for drag chains
K4-2m-W-PUR	902-50803	2 m, 90°, PUR, suitable for drag chains
K4-5m-W-PUR	902-51618	5 m, 90°, PUR, suitable for drag chains
K4-10m-W-PUR	902-51629	10 m, 90°, PUR, suitable for drag chains
K4-2m-W-PL-PUR	902-51642	2 m, 90°, PUR, with indicator LED
K4-5m-W-PL-PUR	902-51643	5 m, 90°, PUR, with indicator LED
CM4 FG-E-5m-PVC	902-50221	5 m, straight, PVC, with hex nut SW 9 stainless steel (IP 69K), suitable for drag chains
CM4 FW-E-5m-PVC	902-50222	5 m, 90°, PVC, with hex nut SW 9 stainless steel (IP 69K), suitable for drag chains

Part number	Article number	Description
M12, 3-pin		
L3-2m-G-PUR	902-50687	2 m, straight, PUR, suitable for drag chains
L3-5m-G-PUR	902-51619	5 m, straight, PUR, suitable for drag chains
L3-2m-W-PUR	902-50689	2 m, 90°, PUR, suitable for drag chains
L3-5m-W-PUR	902-51620	5 m, 90°, PUR, suitable for drag chains
L3-2m-W-PL-PUR	902-50690	2 m, 90°, PUR, with indicator LED, suitable for drag chains
L3-5m-W-PL-PUR	902-51621	5 m, 90°, PUR, with indicator LED, suitable for drag chains
M12, 4-pin		
L4-300mm-G-PUR	902-50811	300 mm, straight, PUR
L4-2m-G-PUR	902-50805	2 m, straight, PUR, suitable for drag chains
L4-5m-G-PUR	902-51612	5 m, straight, PUR, suitable for drag chains
L4-10m-G-PUR	902-51628	10 m, straight, PUR, suitable for drag chains
L4-2m-W-PUR	902-50807	2 m, 90°, PUR, suitable for drag chains
L4-5m-W-PUR	902-51602	5 m, 90°, PUR, suitable for drag chains
L4-2m-W-PL-PUR	902-50808	2 m, 90°, PUR, with indicator LED, suitable for drag chains
L4-5m-W-PL-PUR	902-51603	5 m, 90°, PUR, with indicator LED, suitable for drag chains
L4-10m-W-PL-PUR	902-51604	10 m, 90°, PUR, with indicator LED, suitable for drag chains
L4-15m-W-PL-PUR	902-51607	15 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-10m-G-PVC	902-51651	10 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 (IP 69K), suitable for drag chains
CL4 FW-E-5m-PVC	902-50220	5 m, 90°, PVC, with hex nut SW 14 stainless steel (IP 69K), suitable for drag chains
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, suitable for drag chains
M12, 5-pin		
L5-2m-G-PUR	902-51652	2 m, straight, PUR, suitable for drag chains
L5-5m-G-PUR	902-51624	5 m, straight, PUR, suitable for drag chains
L5-10m-G-PUR	902-51609	10 m, straight, PUR, suitable for drag chains
L5-2m-W-PUR	902-51613	2 m, 90°, PUR, suitable for drag chains
L5-5m-W-PUR	902-51641	5 m, 90°, PUR, suitable for drag chains
M12, 8-pin		
L8FS-2m-G-PUR	902-51671	2 m, straight, PUR, shielded, suitable for drag chains
L8FS-5m-G-PUR	902-51646	5 m, straight, PUR, shielded, suitable for drag chains
L8FS-10m-G-PUR	902-51689	10 m, straight, PUR, shielded, suitable for drag chains
L8FS-2m-W-PUR	902-51687	2 m, 90°, PUR, shielded, suitable for drag chains
L8FS-5m-W-PUR	902-51688	5 m, 90°, PUR, shielded, suitable for drag chains
L8FS-10m-W-PUR	902-51690	10 m, 90°, PUR, shielded, suitable for drag chains
M16, 12-pin		
Q12-3m-G-PVC	902-51656	3 m, straight, PVC
Q12-5m-G-PVC	902-51657	5 m, straight, PVC
Q12-10m-G-PVC	902-51658	10 m, straight, PVC
Q12-20m-G-PVC	902-51663	20 m, straight, PVC
Q12-30m-G-PVC	902-51664	30 m, straight, PVC
Q12-3m-W-PVC	902-51659	3 m, 90°, PVC
Q12-10m-W-PVC	902-51661	10 m, 90°, PVC

Accessories

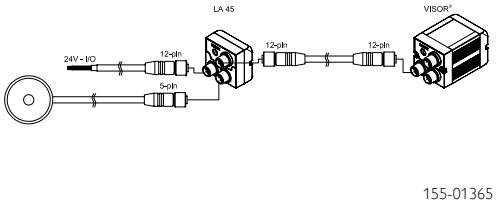
Cables

Part number	Article number	Description
Cables for SmartPlug		
IR-RS232	901-05096	Programmer adapter (MFU)
CUSB-IR-2m	901-05098	Converter, USB to infrared (SmartPlug)
L3M/K3F-0,6 PUR	902-51653	Connection adapter M12 3-pin straight (plug), M8 3-pin straight (socket), suitable for drag chains
L4M/K4F-0,6 PVC	902-51645	Connection adapter M12 4-pin straight (plug), M8 4-pin straight (socket), suitable for drag chains
L4M/K4FW-0,6 PVC	902-51650	Connection adapter M12 4-pin straight (plug), M8 4-pin 90° (socket)
L5F/Q8F-0,5 PUR	606-51686	Connection adapter M12 5-pin straight (socket), M16 8-pin straight (plug), (also for FR 85)
Power supply and I/O cables for V10,V20		
C L12FG-S-2m-PUR	902-51801	Power supply and I/O cable, 2 m, straight, shielded, suitable for drag chains
C L12FG-S-5m-PUR	902-51796	Power supply and I/O cable, 5 m, straight, shielded, suitable for drag chains
C L12FG-S-10m-PUR	902-51797	Power supply and I/O cable, 10 m, straight, shielded, suitable for drag chains
C L12FW-S-2m-PUR	902-51798	Power supply and I/O cable, 2 m, 90°, shielded, suitable for drag chains
C L12FW-S-5m-PUR	902-51799	Power supply and I/O cable, 5 m, 90°, shielded, suitable for drag chains
C L12FW-S-10m-PUR	902-51800	Power supply and I/O cable, 10 m, 90°, shielded, suitable for drag chains
Ethernet cables for V10,V20		
CI L4MG/RJ45G-GS-3m-PUR	902-51754	Ethernet cable, 3 m, M12, straight, 4-pin/RJ45, shielded, suitable for drag chains
CI L4MG/RJ45G-GS-5m-PUR	902-51782	Ethernet cable, 5 m, M12, straight, 4-pin/RJ45, shielded, suitable for drag chains
CI L4MG/RJ45G-GS-10m-PUR	902-51784	Ethernet cable, 10 m, M12, straight, 4-pin/RJ45, shielded, suitable for drag chains
CI L4MW/RJ45G-GS-3m-PUR	902-51786	Ethernet cable, 3 m, M12, 90°, 4-pin/RJ45, shielded, suitable for drag chains
CI L4MW/RJ45G-GS-5m-PUR	902-51788	Ethernet cable, 5 m, M12, 90°, 4-pin/RJ45, shielded, suitable for drag chains
CI L4MW/RJ45G-GS-10m-PUR	902-51790	Ethernet cable, 10 m, M12, 90°, 4-pin/RJ45, shielded, suitable for drag chains
Data cables for V10,V20		
CI L5FG-S-2m-PUR	902-51813	Data cable, 2 m, straight, shielded, suitable for drag chains
CI L5FG-S-5m-PUR	902-51814	Data cable, 5 m, straight, shielded, suitable for drag chains
CI L5FG-S-10m-PUR	902-51815	Data cable, 10 m, straight, shielded, suitable for drag chains
CI L5FW-S-2m-PUR	902-51816	Data cable, 2 m, 90°, shielded, suitable for drag chains
CI L5FW-S-5m-PUR	902-51817	Data cable, 5 m, 90°, shielded, suitable for drag chains
CI L5FW-S-10m-PUR	902-51818	Data cable, 10 m, 90°, shielded, suitable for drag chains
Illumination cables for V10,V20		
CB L12FS/L12FS-0,5m-GG-PUR	902-51806	Illumination cable 2 x M12/12-pin, 0.5 m, straight, shielded, suitable for drag chains
CB L12FS/L12FS-2m-GG-PUR	902-51807	Illumination cable 2 x M12/12-pin, 2 m, straight, shielded, suitable for drag chains
CB L12FS/L12FS-0,5m-WW-PUR	902-51808	Illumination cable 2 x M12/12-pin, 0.5 m, 90°, shielded, suitable for drag chains
CB L12FS/L12FS-2m-WW-PUR	902-51809	Illumination cable 2 x M12/12-pin, 2 m, 90°, shielded, suitable for drag chains
CB L4MG-10m-PUR	902-51756	Illumination cable 1 x M12/4-pin, 10 m, suitable for drag chains for direct connection of devices 532-51000 to 532-51044

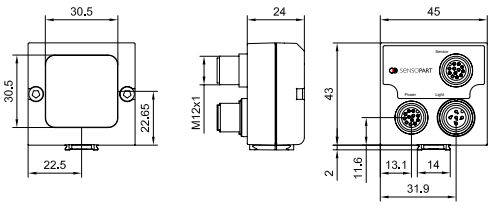
Part number	Article number	Description
Connection adapter, illumination (for 532-51000 to 532-51044)		
LA45V-24-2L12	525-01001	V10 / V20 connection adapter for LED illumination with 5-pin M12 plug

Connection adapter for illumination on V10, V20





155-01365

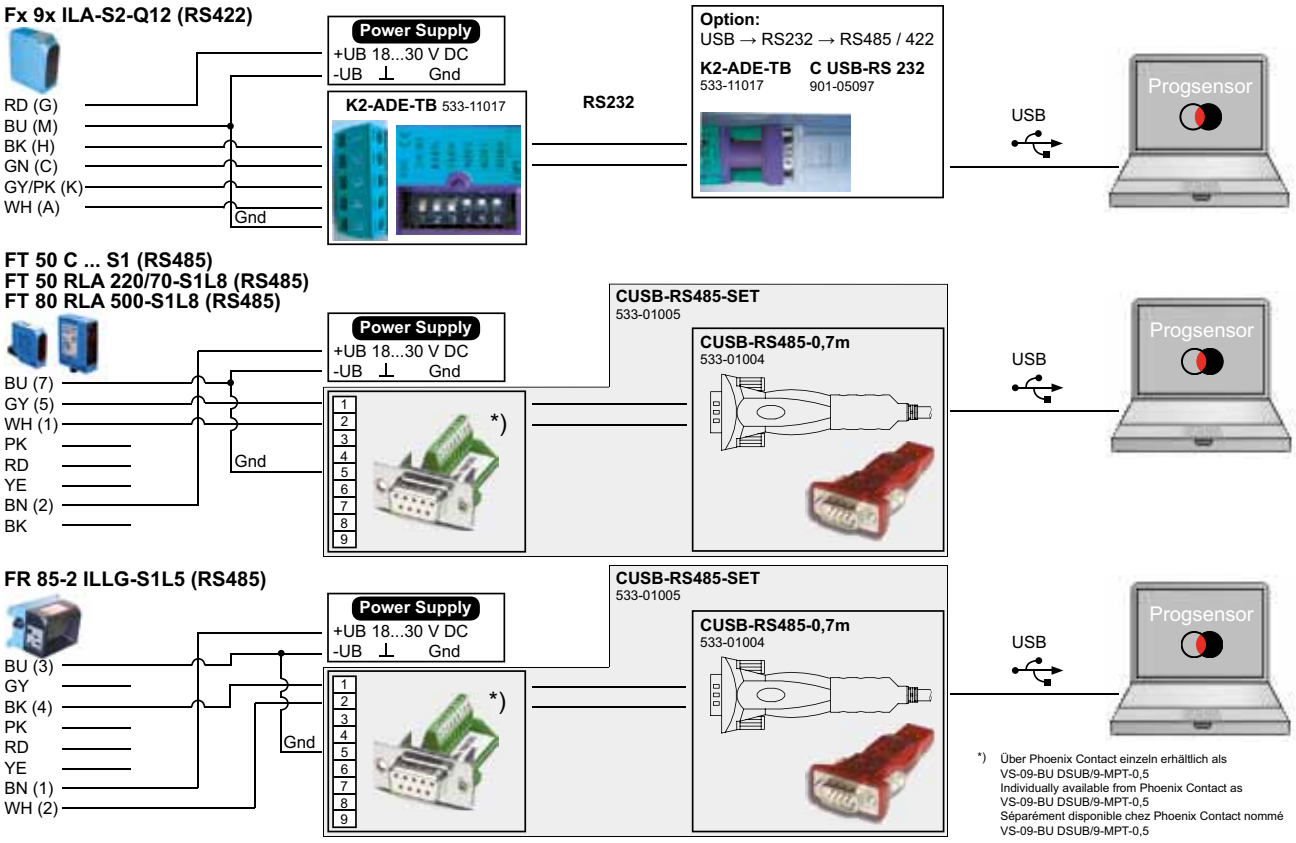


153-00916

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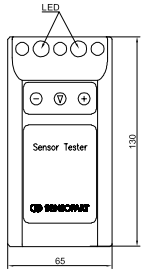
Part number	Article number	Description
Converters and adapter cables		
K2-ADE-TB	533-11017	Converter RS232 ↔ RS485/422
CUSB-RS232-2m	901-05097	Interface converter incl. CD-ROM, cable 2 m, USB ↔ RS232
CUSB-RS485-SET	533-01005	Set: interface converter incl. CD-ROM, cable 0.7 m, USB ↔ RS485 and D-SUB socket, 9-pin, female
CUSB-RS485-0,7m	533-01004	Interface converter incl. CD-ROM, cable 0.7 m, USB ↔ RS485
AS S7/B1 D9F-D9F	902-51735	Anybus Communicator 4, PROFIBUS Interface
AA F90 PROFIBUS	599-91005	Plug adapter for PROFIBUS
CB L12FS/L8MS-0,15m-GG-PUR	902-51810	Power and I/O adapter cable, M12, 8-pin ↔ M12, 12-pin
CI L8MGK/L4MGK-S-0,2m-PVC	902-51773	Ethernet adapter cable, M12, 8-pin ↔ M12, 4-pin
CI L4GFK/L8FGK-S-0,2m-PVC	902-51751	Ethernet adapter cable, M12, 4-pin ↔ M12, 8-pin

Interface Converter (USB / RS232 / RS485 / RS422)



Download software: www.sensopart.com

Power supply units and switching devices



153-00259

Part number / Article number	ST-05 / 997-51467
Description	Sensor tester for PNP and NPN sensors – battery operated, 2 x 9 Volt (supplied) – with acoustic and optical signalling of switching output



Part number / Article number	PA L4M4-TI / 997-51465
Description	Teach-in unit for programming of SmartPlugs and sensors with Teach input – power supply voltage connection via 3-wire cable – M8 and M12 connection plugs



Part number / Article number	Setup Box FR 85-2 ILLX / 533-11016
Description	Setup Box for FR 85 Rail Pilot system. Enables parameterisation of the switching points of FR 85 via PC – Connection of power supply via plug M12, 5-pin – M12, 8-pin – Plug adapter M12, 8-pin to M12, 5-pin for the connection of FR 85 (5-pin) – RS232 interface for connection to PC – Gender Changer – Null modem adapter



Part number / Article number	ST M12-12 / 994-51135
Description	Power supply unit for V10 / V20, M12 connector, 12-pin, Europlug – connection of power supply voltage via Europlug – M12 connector



Part number / Article number	ST M12-12-M / 994-51138
Description	Power supply unit for V10 / V20, M12 connector, 12-pin, Multiplug – connection of power supply voltage via Multiplug – M12 connector



Part number / Article number	ST V10 / 543-11022
Description	Demo and Test Box for all V10 / V20 types. Allows test mode with simulation of inputs (triggers, etc.) and the display of outputs. All I/Os are through-wired, so parallel operation with controller also possible. Connections: – V10 / V20 via 12-pin, plug-in screw terminal – Trigger sensor via 9-pin, plug-in screw terminal and encoder input – PLC via M12 plug, 12-pin – Power supply via 9-pin, plug-in terminal – Power supply via small device plug – Display of switching outputs via LEDs – Operation of inputs via buttons; NPN / PNP selectable

A

SG 12

Power supply unit and switching device for standard rails



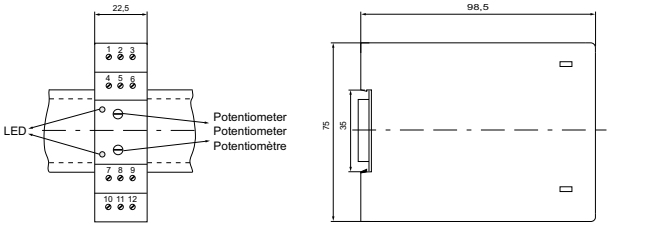
CE

PRODUCT HIGHLIGHTS

- DIN rail mounting
- Switch on/off delay
- Inversion of output

Functions	
LED indicator, yellow	Switching state indicator
Adjustment possibilities	Delay: rise / fall: 50 ms … 30 s Input impulse: ≥ 50 ms

Dimensional drawing



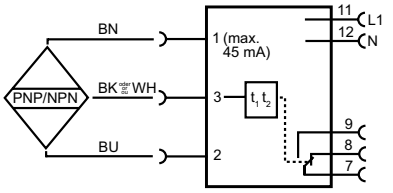
090-12339

Electrical data	
Operating voltage, $+U_B$ (L1 - N)	See Selection Table
No-load current, I_0	16 mA at 230 V AC / 32 mA at 115 V AC
Switching output	Relay contact
Switching function	Change-over contact, potential-free
Switching current	Max. 8 A
Switching voltage	380 V AC / 250 V DC
Switching frequency (ti/tp 1:1)	≤ 10 Hz
Duty cycle	1
Output current, sensor	45 mA
Power supply (V), sensor	24 V ± 10 % DC[1]
Device input	PNP / NPN
Repeatability	≤ 5 %

Mechanical data	
Dimensions	98.5 x 75 x 22.5 mm³
Enclosure rating	IP 40[2]
Material, housing	Makrolon
Type of connection	See Selection Table
Ambient temperature: operation	-30 … +70 °C
Weight	250 g

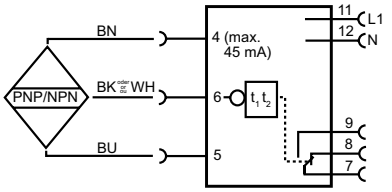
[1] 2 % output ripple [2] With connected IP 40 plug

Connection, non-inverted operation



154-00161

Connection, inverted operation



154-00162

Operating voltage	Type of connection	Part number	Article number
230 V AC (40 … 60 Hz)	Terminals	SG 12 T-00	688-51089
115 V AC (40 … 60 Hz)	Terminals	SG 12 T-02	688-51090

Version: 10/2013. Subject to changes; diagrams similar

IO Box

Expansion box for V10 / V20

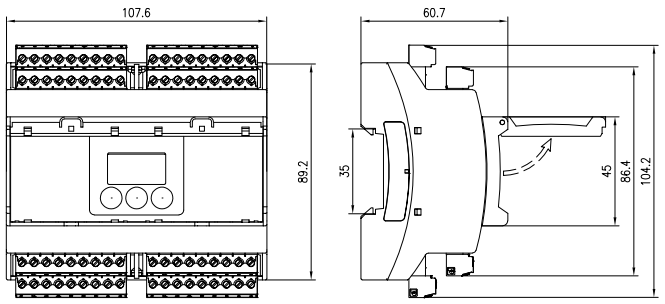


PRODUCT HIGHLIGHTS

- Input/output expansion for V10, V20
- Transcribes sensor's serial data to discrete outputs
- 32 digital switching outputs for the discrete provision of up to 32 individual digital results
- 8 digital switching inputs, e.g. for changing over configurations
- Encoder input, e.g. for ejector control independent of conveyor speed
- Rail mounting
- Display for easy visualisation and operator guidance

Functions	
Programmable time function	Switch-on delay 0 to 7 s, switch-off delay 0 to 1 s, each adjustable in 1 ms increments via control panel.
Programmable counting function	Alternative to time function, 0 to 2000 encoder steps for switch-on delay, 0 to 200 encoder steps for switch-off delay (acc. to prescaler), each adjustable in individual steps via control panel, cache for 512 parts.
Ejector	2x potential-free relay contacts N.O. / N.C. (2 A / 24 V)

Dimensional drawing, IO Box



153-00795

Electrical data	
Operating voltage $+U_B$	20.4 … 26.4 V DC
No-load current, I_0	≤ 250 mA
Switching outputs	32x PNP (50 mA per output), total current max. 1 A
On delay, t_{On}, switching output	≤ 2 ms
Off delay, t_{Off}, switching output	≤ 2 ms
Inputs	8 x
$U_{IN, HIGH}$ control/trigger inputs	> 18 V
$U_{IN,LOW}$ control/trigger inputs	< 3 V
Max. permissible cable length	Power 3 m, others 30 m

Mechanical data	
Dimensions	107.6 x 104.2 x 60.7 mm^3
Enclosure rating	IP 20
Material, housing	Plastic
Connection system	Screw clamp contacts, plug-in
Ambient temperature: operation	5 … +50 °C
Ambient temperature: storage	0 … +50 °C
Vibration and impact resistance	EN 60947-5-2

Part number	Article number
T-AS7T-12ET34PRD	533-01008

Accessories	
Connection cable (data cable)	From Page A-32

A

Glossary

Adjustable focus

This is the area within which the focal position can be set, i.e. the area between minimum and maximum distance between the workpiece and the camera lens.

Ambient light

Apart from the light emitted by the transmitter, light from other sources can hit the receiver. This must not be permitted to lead to spurious switching.

Analogue output

The output of an analogue sensor, whereby the current or voltage signal provides the location information.

Analogue sensors

These provide a distance-proportional current or voltage signal as an output signal. The location of an object within the detection range is converted to a current or voltage value between 4 and 20 mA or 0 and 10 V.

Antivalent

In sensors with an antivalent output, the normally closed (N.C.) and normally open (N.O.) function are simultaneously provided at the corresponding connections. A 4-wire connection cable is required for this.

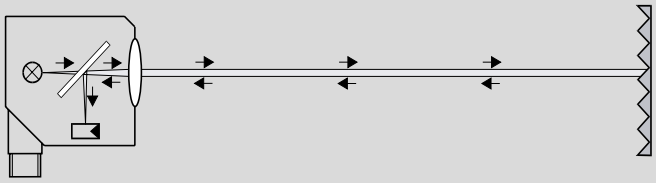
Auto-detect

Auto-detect combines a real PNP and a real NPN switching function in one sensor. On the basis of the load present, the sensor detects whether switching is necessary as a NPN or PNP output. Adaptation of the switching function takes place automatically.

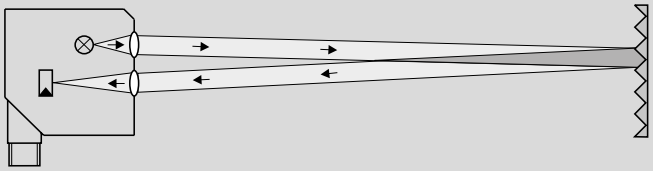
Autocollimation principle

With retroreflective photoelectric sensors one speaks of the autocollimation principle when the light reflected from the reflector travels parallel to itself (i.e. within itself). Unlike the double-lens system, a retroreflective photoelectric sensor using the autocollimation principle has a very homogeneous and narrow optical path. Its switching point is largely independent of the entry direction of the target object.

The autocollimation principle



The double-lens system



Background suppression

Background suppression in photoelectric proximity sensors is a special process for detecting objects with differing surfaces and colours regardless of the background.

Bar codes

Bar codes consist of several bars and spaces that represent optoelectronically legible script. They are illuminated so that a light-sensitive sensor can detect the light beams (wavelengths) of the emitting element. The sensor receives the light reflected from the substrate. The data are thus read automatically and further processed electronically. The most familiar bar codes are 1- and 2-dimensional, whereby 2D codes can contain considerably more information.

Black/white- and grey/white-shift

The black/white-shift defines the difference in switching distance with measurement plates of differing reflectivity (reflectivity: white = 90 %, black = 6 %). The formula for the calculation used by SensoPart is: black/white-shift = [(switch-off point white – switch-on point black) / switch-on point black] x 100 %.

The grey/white-shift defines the difference in switching distance with measurement plates of differing reflectivity (reflectivity: white = 90 %, grey = 18 %). The formula for the calculation used by SensoPart is: grey/white-shift = [(switch-off point white – switch-on point grey) / switch-on point grey] x 100 %.

Blind zone

The area directly in front of the sensor within which no objects can be detected.

CCD

CCDs, Charge-Coupled Devices, are light-sensitive electronic components for transporting electrical charge. A CCD cell passes on its stored electrical charge to the neighbouring cell. The content of the storage cell is passed on to the next cell, as with an analogue shift register.

CMOS

A CMOS, a Complementary Metal Oxide Semiconductor, is an image sensor and light-sensitive component. It converts light falling onto it into a voltage.

Codabar

The Codabar is increasingly being replaced by new codes because of its high error rate. This code is a numerical code and is mainly used in libraries and health care.

Code 39

Code 39 is an alphanumerical, discrete and self-checking bar code and is used where an alphanumerical type of code is required.

Code 93

Code 93 is a continuous code and has a greater density of information than Code 39. The code's character set is identical to that of Code 39 and it is used when a higher information density and reliability is required.

Code 128

This code is based on the 128 representable characters of the ASCII code. Each character consists of 3 bars and 3 spaces of four different widths, with a total width of 11 modules. Apart from its high information density, Code 128 has been able to achieve a wide user community through its ability to represent the complete ASCII code.

Colour

Coloured CCD or CMOS imaging chips provide brightness values for the pixels of each colour channel, generally from 0 to 255. 0 means no light incidence, 255 means maximum light incidence. Coloured pictures are possible.

Colour sensors

These analyse the light reflected from an object according to its spectral composition, and can thus detect coloured objects and differentiate between them.

Correction factor

Refers to inductive sensors and is the reduction in the switching distance for damping materials that deviate from Fe 360 (ISO 630).

Glossary

Cycle time

This is the time required by a vision sensor to carry out the inspection task once.

Dark-switching

The switching output of a photoelectric sensor or a scanner is activated when no light hits the receiver. In this case, the downstream amplifier is activated and connected devices are switched on.

Receiver	Amplifier	Output (PNP)
Unilluminated	Activated	High
Illuminated	Not activated	Low

Datacode

Two-dimensional bar code.

DELTA function

See switching threshold adjustment.

Depth of field

The depth of field is the area in which an object in the object space of an imaging optical system can be sharply focused. Example: in the case of a contrast sensor with a scanning distance of 12 mm (focus) and a depth of field of ± 3 mm the sensor operates reliably in a zone between 9 and 15 mm.

Detector

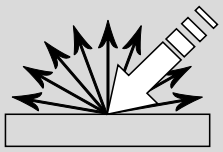
A single inspection task in the VISOR®. Detectors are always part of the user settings for the VISOR® and are stored in a job.

Diffuse (energetic) sensor

A sensor with the transmitter and receiver accommodated in a single housing that can detect light diffusely reflected from the object. Whereby only the intensity of the reflected light is evaluated. Diffuse sensors can therefore only be used for object detection if no background is present or if it is necessary to differentiate between light and dark objects.

Diffuse reflection

Light hitting rough and uneven surfaces, in particular, is reflected in all directions.



Drag & drop

Drag & drop is a technique in graphic user interfaces with which graphic elements are picked up and moved (dragged) with the help of a pointer device and released (dropped) in the desired location.

EAN

EAN stands for European Article Number and is a 13-digit or 8-digit sequence of numbers. This international article number provides information about the article, e.g. the producer and the producing country.

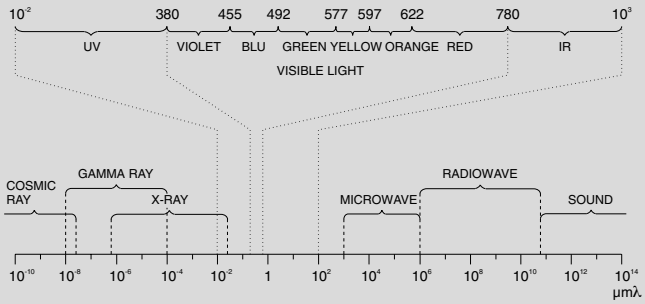
ECC200

ECC200 is also called DataMatrix code and is a two-dimensional code. Compared to the linear bar code, considerably more information can be shown in a smaller space. The size of the code increases proportionately with the content. ECC200 codes can also be printed in a non-square shape.

Electromagnetic radiation spectrum

Only a very small part of the spectrum of all electromagnetic waves is visible to the human eye. The visible range begins at about 380 nm and stops at roughly 780 nm. The colours we perceive can be assigned to individual wavelengths.

Red light and infrared sensors are principally used as optical sensors. Red light offers the advantage that it is visible and thus simplifies the adjustment of sensors. Longer ranges, however, can be achieved with infrared light.



EN 60947-5-2

This is the European standard for optical sensors. It defines the limit values that sensors must maintain, e.g. regarding electromagnetic compatibility (EMC).

Enclosure rating (IP = ingress protection)

Uses a two-digit number to define the tightness of the sensor towards particles and dampness. The first digit stands for mechanical particles such as dust, the second digit stands for moisture particles, e.g. drops of water. The numbers mean differing values according to the following table.

First digit	Protection against contact	Second digit	Protection against water
0	Unprotected	0	Unprotected
1	Protection against foreign bodies > 50 mm	1	Protection against dripping water
2	Protection against foreign bodies > 12 mm	2	Protection against dripping water below 15°
3	Protection against foreign bodies > 2.5 mm	3	Protection against water spray
4	Protection against foreign bodies > 1 mm	4	Protection against water spray
5	Dust protection	5	Protection against water jets
6	Dust-proof	6	Protection against heavy seas
		7	Protection against immersion
		8	Protection against submersion (... m)
		9	High-pressure / steam jet cleaning

IP enclosure ratings, DIN 40 050, Part 9

Glossary

Encoder input

Sensors for determining changes in length (linear) or in angle (rotating) that can detect the path and path direction or angular changes and the direction of rotations are described as encoders or incremental encoders. Such a device can be directly connected to the vision sensor via the encoder input. The vision sensor can delay the output signals in dependence on the position and thus, for example, control an ejector that is not located directly alongside the vision sensor.

Ensured switching distance (operating distance, Sa)

The ensured switching distance takes into account all external influences and sample variances. It is roughly ≤ 80 % of the nominal switching distance. The sensor switches reliably within this range.

Ethernet (LAN)

This widespread producer-neutral technology allows data to be transferred to a Local Area Network (LAN).

EtherNet/IP (EIP)

EIP, also called Ethernet Industrial Protocol, is based on the TCP/IP and UDP/IP transport protocols and is an internationally accepted communication network using the Ethernet. In industry, the EIP thus forms a broad basis for effective data communication.

Exposure time

The illumination duration of, for example, a line sensor. It defines how long the detection line is illuminated. Increasing the exposure time can raise sensitivity (with a simultaneous reduction in switching frequency).

Fibre-optic sensors

The transmitter and receiver are accommodated in a single housing. The light emitted by the transmitter is reflected by the target object and evaluated by the receiver. The advantage is that the transmitted and received light is transported to and from the object directly via a fibre-optic cable – even when space is very limited.

Field of view

The field of view is the area within which objects can be detected.

Focal length

The focal length is the distance from the focus to the lens, also called the focal point. It is measured in millimetres. The greater the focal length of a lens, the smaller the field of view, and the larger and nearer the image appears.

Focus position

This is the location of the focal point in relation to the workpiece surface.

Fork width

The fork width is the distance between the transmitter and receiver of a fork photoelectric sensor.

GS1

The GS1 is a special form of Code 128. It is used in both commerce and industry. The length of the code is variable, but should not exceed the maximum length of 165 mm. A maximum of 48 useful characters can be coded. Because several pieces of data can be coded simultaneously it is also possible to record weight information and the sell-by date on, for example, the bar code of a food pallet.

Hysteresis

The difference between the sensor's switch-on point and switch-off point. It is measured in per cent (related to the switch-on point).

2/5 Industrial

The 2/5 Industrial code is a very simple, self-testing code with a high tolerance. Because of its simplicity it has a low information density, resulting in a relatively high space requirement. It is used, for example, in warehouses and on flight tickets.

2/5 Interleaved

The Interleaved 2 out of 5 code is a numerical, sequential and self-testing code. It is used wherever bar codes are to be attached in compact form. This would be, for example, with difficult surfaces such as outer wrapping made of corrugated cardboard or when the bar code is to be read from a long distance.

Infrared light

Light with wavelengths above that of visible light. The wavelength range of infrared light starts at about 780 nm.

Inspection program

An inspection program is a sequence of instructions in Eyesight.

Jitter (electrical)

Jitter is a measure of the accuracy of the response time. For example: with a max. response time of 20 µs and a jitter of 5 µs, the actual response time is 15 - 20 µs.

Job

Contains all the user settings necessary for operating the VISOR®. These are the basic settings such as resolution, exposure time, interfaces as well as the detectors with their settings.

Laser Protection Class

All devices that contain a laser light source must be assigned to one of the four laser Protection Classes with their corresponding sub-classes (Class 1, 1M, 2, 2M, 3R, 3B and 4). The laser Protection Classes are specified in the DIN EN 60825-1/2001-11 standard.
All current sensors from SensoPart are either in Classes 1 or 2 (not 1M or 2M – see data sheets). The relevant text in the standard is paraphrased below:

Class 1
Lasers that are safe under reasonably predictable operating conditions; whereby the use of optical instruments for the direct observation of the beam is included.
Class 2
Lasers that emit visible radiation at a wavelength between 400 nm to 700 nm; whereby the eyes are usually protected by aversion responses including the eyelid closing reflex. One can expect that this reaction offers appropriate protection under reasonably predictable operating conditions; whereby the use of optical instruments for the direct observation of the beam is included.

Glossary

Light-switching

The switching output of a photoelectric sensor or scanner is activated when light hits the receiver. In this case, the downstream amplifier is activated and connected devices are switched on.

Receiver	Amplifier	Output (PNP)
Unilluminated	Activated	High
Illuminated	Not activated	Low

Limit frequency

The frequency at which the amplitude of an analogue signal has fallen to about 70% (3 dB).

Linearity

A measure of the quality of the characteristic output curve. The sensor's electrical signal is processed and linearised. The characteristic curve thus obtained shows slight deviations from an exactly straight course, defined in per cent as linearity or linearity deviation.

Max. output current

The maximum current with which a load at the switching output can be operated.

Monochrome

Monochrome CCD or CMOS image chips provide a grey value for every pixel. From 0 to 255 with 8 bits. 0 means no light incidence (black), 255 means maximum light incidence (white).

Multi-colour RGB evaluation

During teach-in, contrast sensors with RGB illumination (red, green, blue) select the transmission colour that provides the largest contrast difference between the mark and the background. In operation, the sensor will then only work with this transmission colour.

No-load current

The current consumed by the sensor itself.

NPN output

The NPN output switches a load connected to the positive pole through to the negative pole.

Operating voltage

The voltage range that the sensors need for operation. This is generally 10 … 30 V DC for optical sensors.

PDF 417

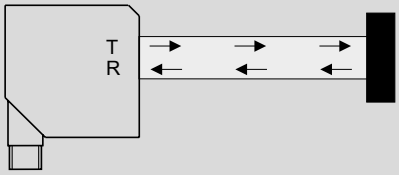
This is a 2D code and is based on stacked bar codes. The characters used are encoded in code words. A code word consists of 17 modules, each made up of 4 bars and 4 spaces.

Pharmacode

This code is the standard bar code for the pharmaceutical industry, e.g. for checking the presence of package inserts. The information is coded in the bars. The code value is calculated by adding up the individual bar values. There are narrow and wide bars. This code offers extremely rapid readability and is not sensitive towards print tolerances.

Photoelectric proximity sensor

A sensor in which the transmitter and receiver are accommodated in a single housing and which detects the diffuse light reflected from the object. Whereby it is not the intensity of the reflected light that is evaluated. Diffuse scanners can therefore only be used for object detection if there is no background or when it is necessary to differentiate between light and dark objects.



Pixel

Also called picture element, it is the smallest image unit in digital projection systems. These are the individual grey or colour values in a digital raster graphic as well as the surface elements of an image sensor for representing a grey or colour value.

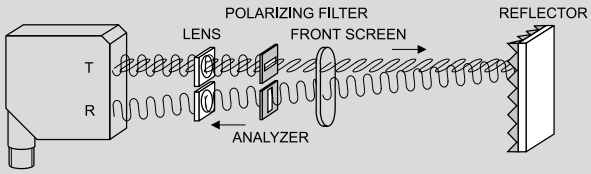
PNP output

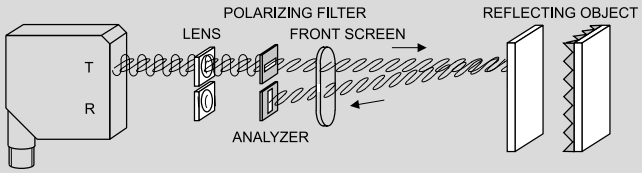
The PNP output switches a load connected to the negative pole through to the positive pole.

Polarisation filters

Polarisation filters are optical filters that can be compared with a grid of lines. Incidental light that oscillates in all directions is filtered and only light that is oscillating parallel to the lattice plane is let through.

Highly reflective objects can be reliably detected by using a polarisation filter in combination with a retroreflective photoelectric sensor and a prismatic reflector.





Polarised light

Light that only oscillates on one plane.

Prismatic reflectors

A prismatic reflector consists of densely packed pyramidical individual reflectors. As a result of its structure it reflects the incidental light back into itself. In addition, the polarisation plane of the light is rotated by 90°.

B

Glossary

Push-pull

With push-pull a complementary pair of transistors (N-channel and P-channel) is used as the output stage. The sensor can therefore be operated as both a PNP and NPN device.

QR code

A quick-response code is a two-dimensional binary code that represents computer-legible text. It appears, for example, in newspapers, and can contain information such as text or Internet addresses.

Range/scanning distance or detection range

The area within which the sensor reliably detects objects.

Red light

In certain applications it can be helpful to change the colour of the light of the vision sensor. Red light generally achieves a better contrast on grey metal surfaces, in particular.

Reference material

A standardised reference material that is used for specifying sensors. A typical reference material would be Kodak paper with varying reflectivity levels (e.g. 90% white, 18% grey, 6% black).

Reflection

When a light beam hits a reflective object it is reflected as a result of the object's surface properties. The structure of the surface influences the type of reflection.

Reflection loss

As a result of the surface structure there is always reflection loss when reflectors are used. The imprecision of the surface is responsible for the level of loss. Highly reflective, polished mirrors have, for example, only low losses. The reflection loss also leads to the defined range being reduced when deflector mirrors are used.

Reflectivity

Reflectivity is the reflection of light by non-transparent surfaces. In the case of proximity sensors, the scanning distance is often defined in relation to the level of surface reflectivity. Black surfaces have a low level of reflectivity. White surfaces have a very high level of reflectivity. As a result of this property, the scanning distance of diffuse scanners is heavily dependent on the surface characteristics and colour of the target object.

Repeatability

This is the measure of the conformity of repeat measurements under the same conditions.

Resolution

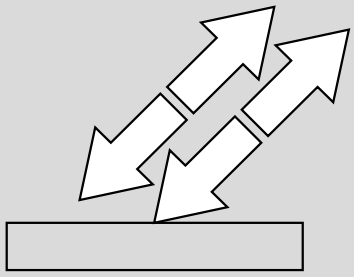
The number of horizontal and vertical picture elements (pixels). The higher the number of pixels, the smaller the details that can be detected within the search area.

Response time

The time the sensor requires to show a detected object at the switching output is the maximum response time.

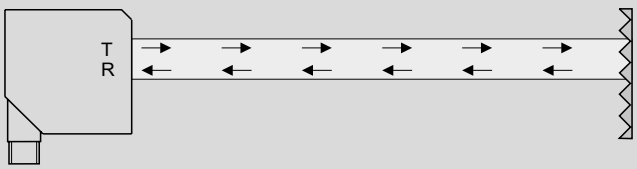
Retroreflection

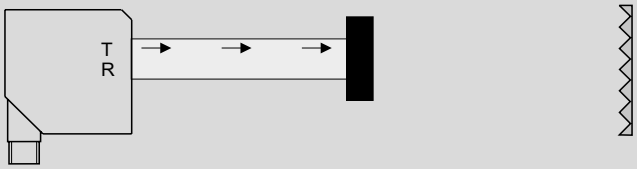
As a result of the special design of the surface of reflectors it is possible to reflect the light beam in the same direction as it hits the reflector. Retroreflective photoelectric sensors can use this special construction of the reflector optimally because the light hitting the reflector is largely reflected back to the sensor.



Retroreflective photoelectric sensor

In a retroreflective photoelectric sensor the transmitter and receiver are accommodated in a single housing. The light emitted by the transmitter hits a reflector and is reflected back. The receiver evaluates the returning light. The advantage lies in the small size of the reflector. It is also easy to install because it is a passive element, i.e. requires no connections.





Reverse-polarity protection

This means that a sensor is protected against transposition of the positive and negative poles of the operating voltage.

Ripple

The maximum permissible fluctuation of the operating voltage for trouble-free operation. It is defined in per cent of the operating voltage.

RS422

The RS422 interface was developed for serial high-speed data transfer over long distances. The serial data are transferred without reference to Ground as a voltage difference between two corresponding cables.

Scanners with background suppression

These evaluate the location of an object and not the light intensity. They can therefore also detect, for example, dark objects against bright backgrounds, because they work (almost) independently of the intensity.

Short-circuit protection

The semiconductor outputs of sensors can be protected from short-circuits by taking special electronic measures. Whereby the electronics in the sensor constantly measures the output current. The output is switched off if it exceeds a certain value. The sensor returns to its normal operating state when normal conditions are restored.

SmartPlug

A multifunctional device for use with sensors, available as a timing element, counter, frequency monitor and inverter. All SmartPlugs work as switching current amplifiers to a maximum output current of 400 mA at a switching frequency of 10 kHz.

Glossary

Standby time / readiness delay

The time the sensor needs to be ready for operation after the operating voltage has been applied.

Switching distance (nominal switching distance, Sn)

The switching distance is the distance between an object and the active surface of a sensor at which a switching process is triggered. The switching distance does not take any external factors, such as temperature, supply voltage or sample variances, into account.

Switching frequency

The maximum frequency with which events can be detected. The reciprocal value of the switching frequency is the minimum time that an object must be in the detection zone in order to be detected.

Switching threshold adjustment (DELTA function)

DELTA – Dynamic Evaluation of Light for Threshold Adaption – describes the automatic adaptation of the switching threshold to changing environmental conditions (e.g. the gradual contamination of a reflector).

Teach-in

A process for setting optical sensors, whereby the sensor is adjusted for the process at the press of a button. The button is pressed when the object is in the detection zone of the sensor (with a time lock of 3 seconds to prevent unintentional adjustment). The sensor shows detection of the object by means of simultaneous blinking of the LEDs. The object is removed after releasing the button, and the button is pressed again for one second in order to store the signal value without the object.

Temperature drift

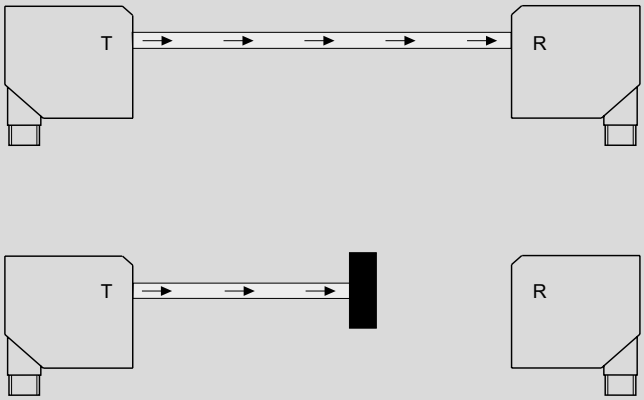
Temperature drift is the change of a physical value in response to a change in the (ambient) temperature.

Test input

Input with which the function of a through-beam photoelectric sensor can be checked. The laying down of a signal at the test input causes the transmitter to switch off, resulting in a change in the switching state of the receiver if the sensor is functioning properly.

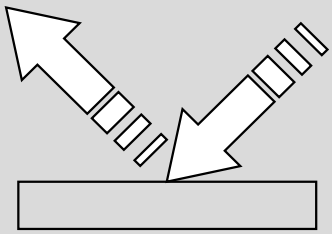
Through-beam photoelectric sensor

Transmitter and receiver are physically separated and each requires its own power supply. Long ranges can be achieved with this system.



Total reflection

Total reflection occurs, for example, with highly reflective mirrors. Whereby the angle of light incidence is equal to the angle of reflection. In optimum cases reflection losses are insignificantly small.

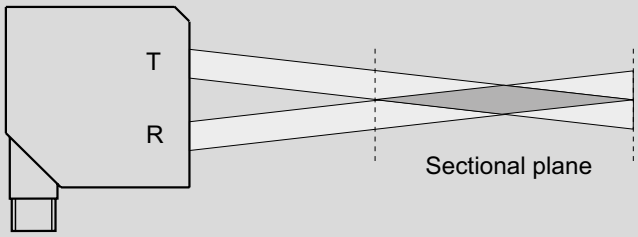


Transmission

The penetration of a medium by radiation (e.g. light through transparent objects).

Triangulation

The light cone of the transmitter and the sensitive area of the receiver form a sectional plane. This is evaluated using triangulation. In the ideal case, only objects in the area of this sectional plane are detected. Objects that lie outside this sectional plane are ignored. Special proximity sensor designs can allow the position of the sectional plane to be changeable.



Trigger input

An input with which the sensor can, for example, be timed. If, for example, the sensor should only detect objects at a particular point in time, a signal is provided to the trigger input within this time period and during the rest of the time the input remains signal-free and the sensor thus function-free.

Types of reflections

Direct reflection
Retroreflection
Diffuse reflection
Total reflection

UPC

UPC, Universal Product Code, is the forerunner of EAN and is still used in the USA.

Vibration and impact resistance

The stresses caused by vibrations or sudden loads to which a sensor may be exposed without function being impaired. The limit values for optical sensors are defined in the EN 60947-5-2 sensor standard.

Vision sensor

A vision sensor is an image-processing system that records pictures, evaluates them and then triggers a reaction. The sensor is optimised for a particular use or field of use. A vision sensor is characterised, above all, by the software interface and operation being designed in such a way that even users with little or no image-processing knowledge can operate it. After commissioning, a vision sensor carries out its inspection task autonomously – without an external PC.

Glossary

Vision systems

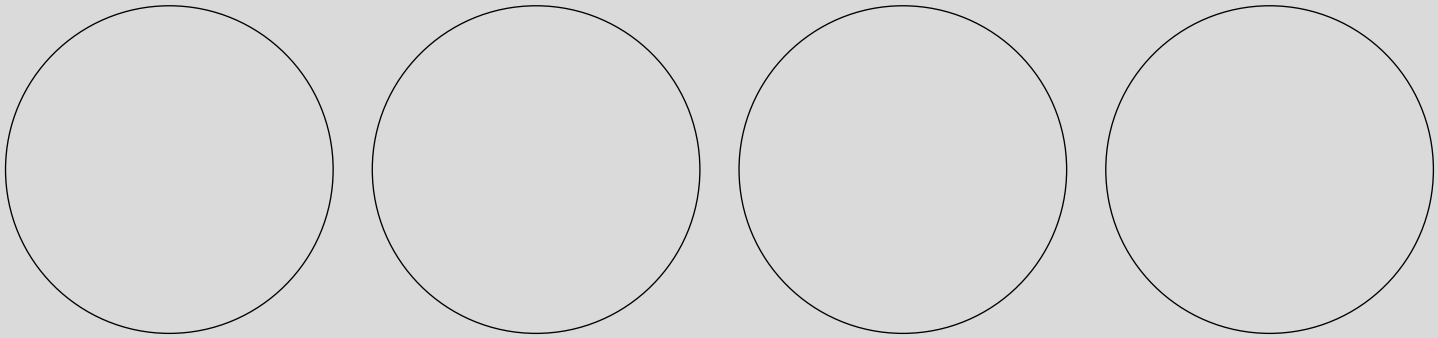
A vision system consists of a camera and software, generally with a larger scope of function than a vision sensor. A vision system is thus considerably more powerful, but far more demanding in terms of operation. After commissioning, a vision system carries out its inspection task autonomously – without an external PC.

White light

White light is used as a light source for colour sensors, contrast sensors, vision sensors and systems because it is a homogeneous spectrum and no mixture of different colours is required.

Window size

The area within which the transmitter and receiver elements of a frame light sensor are located is defined as the window size.



Index

Part number	Article number	Page
18/30 L 0,4/1000-Si	**978-50545**	**479**
18/30 L 0,4/2000-Si	978-50550	479
18/30 L 0,4/250-Si	978-50548	479
18/30 L 0,4/500-Si	978-50549	479
18/30 L 0,5/1000-Si	978-08247	516
18/30 L 0,5/250-Si	978-08218	516
18/30 L 0,5/500-Si	978-08246	516
18/30 L 0,5/750-Si	978-08219	516
18/30 L 1,5/1000-Si	978-08236	516
18/30 L 1,5/1500-Si	978-08570	516
18/30 L 1,5/2000-Si	978-08237	516
18/30 L 1,5/250-Si	978-08234	516
18/30 L 1,5/500-Si	978-08235	516
18/30 L 1,5/750-Si	978-08569	516
18/30 L 1/1000-MSC	978-08208	480
18/30 L 1/1000-PVC	978-08195	480
18/30 L 1/1000-Si	978-08232	480
18/30 L 1/1500-MSC	978-08548	480
18/30 L 1/1500-PVC	978-08542	480
18/30 L 1/1500-Si	978-08568	480
18/30 L 1/2000-MSC	978-08209	480
18/30 L 1/2000-PVC	978-08196	480
18/30 L 1/2000-Si	978-08233	480
18/30 L 1/250-MSC	978-08206	480
18/30 L 1/250-PVC	978-08193	480
18/30 L 1/250-Si	978-08230	480
18/30 L 1/500-MSC	978-08207	480
18/30 L 1/500-PVC	978-08194	480
18/30 L 1/500-Si	978-08231	480
18/30 L 1/750-MSC	978-08547	480
18/30 L 1/750-PVC	978-08541	480
18/30 L 1/750-Si	978-08567	480
18/30 L 2/1000-MSC	978-08212	481
18/30 L 2/1000-PVC	978-08199	481
18/30 L 2/1000-Si	978-08240	481
18/30 L 2/1500-MSC	978-08550	481
18/30 L 2/1500-PVC	978-08544	481
18/30 L 2/1500-Si	978-08572	481
18/30 L 2/2000-MSC	978-08213	481
18/30 L 2/2000-PVC	978-08200	481
18/30 L 2/2000-Si	978-08241	481
18/30 L 2/250-MSC	978-08210	481
18/30 L 2/250-PVC	978-08197	481
18/30 L 2/250-Si	978-08238	481
18/30 L 2/500-MSC	978-08211	481
18/30 L 2/500-PVC	978-08198	481
18/30 L 2/500-Si	978-08239	481
18/30 L 2/750-MSC	978-08549	481
18/30 L 2/750-PVC	978-08543	481
18/30 L 2/750-Si	978-08571	481
18/30 L 3/1000-MSC	978-08216	482
18/30 L 3/1000-PVC	978-08203	482
18/30 L 3/1000-Si	978-08244	482
18/30 L 3/1500-MSC	978-08552	482
18/30 L 3/1500-PVC	978-08546	482
18/30 L 3/1500-Si	978-08574	482

Part number	Article number	Page
18/30 L 3/2000-MSC	978-08217	482
18/30 L 3/2000-PVC	978-08204	482
18/30 L 3/2000-Si	978-08245	482
18/30 L 3/250-MSC	978-08214	482
18/30 L 3/250-PVC	978-08201	482
18/30 L 3/250-Si	978-08242	482
18/30 L 3/500-MSC	978-08215	482
18/30 L 3/500-PVC	978-08202	482
18/30 L 3/500-Si	978-08243	482
18/30 L 3/750-MSC	978-08551	482
18/30 L 3/750-PVC	978-08545	482
18/30 L 3/750-Si	978-08573	482
18/30 LZ 1/1000-MSC	978-06382	489
18/30 LZ 1/1000-MSC	978-06383	489
18/30 LZ 1/1000-Si	978-06384	489
18/30 LZ 1/1000-Si	978-06385	489
18/30 LZ 1/1500-MSC	978-06388	489
18/30 LZ 1/1500-MSC	978-06389	489
18/30 LZ 1/1500-Si	978-06390	489
18/30 LZ 1/1500-Si	978-06391	489
18/30 LZ 1/2000-MSC	978-06394	489
18/30 LZ 1/2000-MSC	978-06395	489
18/30 LZ 1/2000-Si	978-06396	489
18/30 LZ 1/2000-Si	978-06397	489
18/30 LZ 1/250-MSC	978-06364	489
18/30 LZ 1/250-MSC	978-06365	489
18/30 LZ 1/250-Si	978-06366	489
18/30 LZ 1/250-Si	978-06367	489
18/30 LZ 1/500-MSC	978-06370	489
18/30 LZ 1/500-MSC	978-06371	489
18/30 LZ 1/500-Si	978-06372	489
18/30 LZ 1/500-Si	978-06373	489
18/30 LZ 1/750-MSC	978-06376	489
18/30 LZ 1/750-MSC	978-06377	489
18/30 LZ 1/750-Si	978-06378	489
18/30 LZ 1/750-Si	978-06379	489
18/30 LZ 2/1000-MSC	978-06418	491
18/30 LZ 2/1000-MSC	978-06419	491
18/30 LZ 2/1000-PVC	978-06416	491
18/30 LZ 2/1000-PVC	978-06417	491
18/30 LZ 2/1000-Si	978-06420	490
18/30 LZ 2/1000-Si	978-06421	490
18/30 LZ 2/1500-MSC	978-06424	491
18/30 LZ 2/1500-MSC	978-06425	491
18/30 LZ 2/1500-PVC	978-06422	491
18/30 LZ 2/1500-PVC	978-06423	491
18/30 LZ 2/1500-Si	978-06426	490
18/30 LZ 2/1500-Si	978-06427	490
18/30 LZ 2/2000-MSC	978-06430	491
18/30 LZ 2/2000-MSC	978-06431	491
18/30 LZ 2/2000-PVC	978-06428	491
18/30 LZ 2/2000-PVC	978-06429	491
18/30 LZ 2/2000-Si	978-06432	490
18/30 LZ 2/2000-Si	978-06433	490
18/30 LZ 2/250-MSC	978-06400	491
18/30 LZ 2/250-MSC	978-06401	491

Part number	Article number	Page
18/30 LZ 2/250-PVC	978-06398	491
18/30 LZ 2/250-PVC	978-06399	491
18/30 LZ 2/250-Si	978-06402	490
18/30 LZ 2/250-Si	978-06403	490
18/30 LZ 2/500-MSC	978-06406	491
18/30 LZ 2/500-MSC	978-06407	491
18/30 LZ 2/500-PVC	978-06404	491
18/30 LZ 2/500-PVC	978-06405	491
18/30 LZ 2/500-Si	978-06408	490
18/30 LZ 2/500-Si	978-06409	490
18/30 LZ 2/750-MSC	978-06412	491
18/30 LZ 2/750-MSC	978-06413	491
18/30 LZ 2/750-PVC	978-06410	491
18/30 LZ 2/750-PVC	978-06411	491
18/30 LZ 2/750-Si	978-06414	490
18/30 LZ 2/750-Si	978-06415	490
18/30 LZ 3/1000-MSC	978-06454	493
18/30 LZ 3/1000-MSC	978-06455	493
18/30 LZ 3/1000-PVC	978-06452	493
18/30 LZ 3/1000-PVC	978-06453	493
18/30 LZ 3/1000-Si	978-06456	492
18/30 LZ 3/1000-Si	978-06457	492
18/30 LZ 3/1500-MSC	978-06460	493
18/30 LZ 3/1500-MSC	978-06461	493
18/30 LZ 3/1500-PVC	978-06458	493
18/30 LZ 3/1500-PVC	978-06459	493
18/30 LZ 3/1500-Si	978-06462	492
18/30 LZ 3/1500-Si	978-06463	492
18/30 LZ 3/2000-MSC	978-06466	493
18/30 LZ 3/2000-MSC	978-06467	493
18/30 LZ 3/2000-PVC	978-06464	493
18/30 LZ 3/2000-PVC	978-06465	493
18/30 LZ 3/2000-Si	978-06468	492
18/30 LZ 3/2000-Si	978-06469	492
18/30 LZ 3/250-MSC	978-06436	493
18/30 LZ 3/250-MSC	978-06437	493
18/30 LZ 3/250-PVC	978-06434	493
18/30 LZ 3/250-PVC	978-06435	493
18/30 LZ 3/250-Si	978-06438	492
18/30 LZ 3/250-Si	978-06439	492
18/30 LZ 3/500-MSC	978-06442	493
18/30 LZ 3/500-MSC	978-06443	493
18/30 LZ 3/500-PVC	978-06440	493
18/30 LZ 3/500-PVC	978-06441	493
18/30 LZ 3/500-Si	978-06444	492
18/30 LZ 3/500-Si	978-06445	492
18/30 LZ 3/750-MSC	978-06448	493
18/30 LZ 3/750-MSC	978-06449	493
18/30 LZ 3/750-PVC	978-06446	493
18/30 LZ 3/750-PVC	978-06447	493
18/30 LZ 3/750-Si	978-06450	492
18/30 LZ 3/750-Si	978-06451	492
18/30 R 0,4/1000-Si	979-50544	458
18/30 R 0,4/2000Si	979-50553	458
18/30 R 0,4/250-Si	979-50551	458
18/30 R 0,4/500-Si	979-50552	458

Part number	Article number	Page
18/30 R 0,5/1000-Si	979-08098	515
18/30 R 0,5/250-Si	979-08069	515
18/30 R 0,5/500-Si	979-08097	515
18/30 R 0,5/750-Si	979-08070	515
18/30 R 1,5/1000-Si	979-08087	515
18/30 R 1,5/1500-Si	979-08410	515
18/30 R 1,5/2000-Si	979-08088	515
18/30 R 1,5/250-Si	979-08085	515
18/30 R 1,5/500-Si	979-08086	515
18/30 R 1,5/750-Si	979-08409	515
18/30 R 1/1000 PVC	979-08046	459
18/30 R 1/1000-MSC	979-08059	459
18/30 R 1/1000-Si	979-08083	459
18/30 R 1/1500 PVC	979-08382	459
18/30 R 1/1500-MSC	979-08388	459
18/30 R 1/1500-Si	979-08408	459
18/30 R 1/2000 PVC	979-08047	459
18/30 R 1/2000-MSC	979-08060	459
18/30 R 1/2000-Si	979-08084	459
18/30 R 1/250 PVC	979-08044	459
18/30 R 1/250-MSC	979-08057	459
18/30 R 1/250-Si	979-08081	459
18/30 R 1/500 PVC	979-08045	459
18/30 R 1/500-MSC	979-08058	459
18/30 R 1/500-Si	979-08082	459
18/30 R 1/750-MSC	979-08387	459
18/30 R 1/750-PVC	979-08381	459
18/30 R 1/750-Si	979-08407	459
18/30 R 2/1000 PVC	979-08050	460
18/30 R 2/1000-MSC	979-08063	460
18/30 R 2/1000-Si	979-08091	460
18/30 R 2/1500 PVC	979-08384	460
18/30 R 2/1500-MSC	979-08390	460
18/30 R 2/1500-Si	979-08412	460
18/30 R 2/2000 PVC	979-08051	460
18/30 R 2/2000-MSC	979-08064	460
18/30 R 2/2000-Si	979-08092	460
18/30 R 2/250 PVC	979-08048	460
18/30 R 2/250-MSC	979-08061	460
18/30 R 2/250-Si	979-08089	460
18/30 R 2/500 PVC	979-08049	460
18/30 R 2/500-MSC	979-08062	460
18/30 R 2/500-Si	979-08090	460
18/30 R 2/750 PVC	979-08383	460
18/30 R 2/750-MSC	979-08389	460
18/30 R 2/750-Si	979-08411	460
18/30 R 3/1000 PVC	979-08054	461
18/30 R 3/1000-MSC	979-08067	461
18/30 R 3/1000-Si	979-08095	461
18/30 R 3/1500 PVC	979-08386	461
18/30 R 3/1500-MSC	979-08392	461
18/30 R 3/1500-Si	979-08414	461
18/30 R 3/2000 PVC	979-08055	461
18/30 R 3/2000-MSC	979-08068	461
18/30 R 3/2000-Si	979-08096	461
18/30 R 3/250 PVC	979-08052	461

Index

Part number	Article number	Page
18/30 R 3/250-MSC	979-08065	461
18/30 R 3/250-Si	979-08093	461
18/30 R 3/500 PVC	979-08053	461
18/30 R 3/500/Si	979-08094	461
18/30 R 3/500-MSC	979-08066	461
18/30 R 3/750 PVC	979-08385	461
18/30 R 3/750-MSC	979-08391	461
18/30 R 3/750-Si	979-08413	461
18/30 RP 2/1000-Si	975-06586	520
18/30 RP 2/2000-Si	975-06587	520
18/30 RP 2/250-Si	975-06584	520
18/30 RP 2/500-Si	975-06585	520
18/30 RZ 1/1000-MSC	979-06162	471
18/30 RZ 1/1000-MSC	979-06163	471
18/30 RZ 1/1000-Si	979-06164	471
18/30 RZ 1/1000-Si	979-06165	471
18/30 RZ 1/1500-MSC	979-06168	471
18/30 RZ 1/1500-MSC	979-06169	471
18/30 RZ 1/1500-Si	979-06170	471
18/30 RZ 1/1500-Si	979-06171	471
18/30 RZ 1/2000-MSC	979-06174	471
18/30 RZ 1/2000-MSC	979-06175	471
18/30 RZ 1/2000-Si	979-06176	471
18/30 RZ 1/2000-Si	979-06177	471
18/30 RZ 1/250-MSC	979-06144	471
18/30 RZ 1/250-MSC	979-06145	471
18/30 RZ 1/250-Si	979-06146	471
18/30 RZ 1/250-Si	979-06147	471
18/30 RZ 1/500-MSC	979-06150	471
18/30 RZ 1/500-MSC	979-06151	471
18/30 RZ 1/500-Si	979-06152	471
18/30 RZ 1/500-Si	979-06153	471
18/30 RZ 1/750 Si	979-06158	471
18/30 RZ 1/750 Si	979-06159	471
18/30 RZ 1/750-MSC	979-06156	471
18/30 RZ 1/750-MSC	978-06157	471
18/30 RZ 2/1000-MSC	979-06198	473
18/30 RZ 2/1000-MSC	979-06199	473
18/30 RZ 2/1000-PVC	979-06196	473
18/30 RZ 2/1000-PVC	979-06197	473
18/30 RZ 2/1000-Si	979-06200	472
18/30 RZ 2/1000-Si	979-06201	472
18/30 RZ 2/1500-MSC	979-06204	473
18/30 RZ 2/1500-MSC	979-06205	473
18/30 RZ 2/1500-PVC	979-06202	473
18/30 RZ 2/1500-PVC	979-06203	473
18/30 RZ 2/1500-Si	979-06206	472
18/30 RZ 2/1500-Si	979-06207	472
18/30 RZ 2/2000-MSC	979-06210	473
18/30 RZ 2/2000-MSC	979-06211	473
18/30 RZ 2/2000-PVC	979-06208	473
18/30 RZ 2/2000-PVC	979-06209	473
18/30 RZ 2/2000-Si	979-06212	472
18/30 RZ 2/2000-Si	979-06213	472
18/30 RZ 2/250-MSC	979-06180	473
18/30 RZ 2/250-MSC	979-06181	473

Part number	Article number	Page
18/30 RZ 2/250-PVC	979-06178	473
18/30 RZ 2/250-PVC	979-06179	473
18/30 RZ 2/250-Si	979-06182	472
18/30 RZ 2/250-Si	979-06183	472
18/30 RZ 2/500-MSC	979-06186	473
18/30 RZ 2/500-MSC	979-06187	473
18/30 RZ 2/500-PVC	979-06184	473
18/30 RZ 2/500-PVC	979-06185	473
18/30 RZ 2/500-Si	979-06188	472
18/30 RZ 2/500-Si	979-06189	472
18/30 RZ 2/750-MSC	979-06193	473
18/30 RZ 2/750-MSC	979-06192	473
18/30 RZ 2/750-PVC	979-06190	473
18/30 RZ 2/750-PVC	979-06191	473
18/30 RZ 2/750-Si	979-06194	472
18/30 RZ 2/750-Si	979-06195	472
18/30 RZ 3/1000 Si	979-06236	474
18/30 RZ 3/1000 Si	979-06237	474
18/30 RZ 3/1000-MSC	979-06234	475
18/30 RZ 3/1000-MSC	979-06235	475
18/30 RZ 3/1000-PVC	979-06233	475
18/30 RZ 3/1000-PVC	979-06232	475
18/30 RZ 3/1500-MSC	979-06241	475
18/30 RZ 3/1500-MSC	979-06240	475
18/30 RZ 3/1500-PVC	979-06239	475
18/30 RZ 3/1500-PVC	979-06238	475
18/30 RZ 3/1500-Si	979-06242	474
18/30 RZ 3/1500-Si	979-06243	474
18/30 RZ 3/2000-MSC	979-06246	475
18/30 RZ 3/2000-MSC	979-06247	475
18/30 RZ 3/2000-PVC	979-06244	475
18/30 RZ 3/2000-PVC	979-06245	475
18/30 RZ 3/2000-Si	979-06248	474
18/30 RZ 3/2000-Si	979-06249	474
18/30 RZ 3/250 Si	979-06218	474
18/30 RZ 3/250 Si	979-06219	474
18/30 RZ 3/250-MSC	979-06217	475
18/30 RZ 3/250-MSC	979-06216	475
18/30 RZ 3/250-PVC	979-06214	475
18/30 RZ 3/250-PVC	979-06215	475
18/30 RZ 3/500 Si	979-06224	474
18/30 RZ 3/500 Si	979-06225	474
18/30 RZ 3/500-MSC	979-06222	475
18/30 RZ 3/500-MSC	979-06223	475
18/30 RZ 3/500-PVC	979-06220	53
18/30 RZ 3/500-PVC	979-06221	475
18/30 RZ 3/750-MSC	979-06228	475
18/30 RZ 3/750-MSC	979-06229	475
18/30 RZ 3/750-PVC	979-06226	475
18/30 RZ 3/750-PVC	979-06227	475
18/30 RZ 3/750-Si	979-06230	474
18/30 RZ 3/750-Si	979-06231	474
30 L 12/1000-MSC	**978-06799**	**484**
30 L 12/1000-Si	978-06950	484
30 L 12/1500-MSC	978-08556	484
30 L 12/1500-Si	978-08578	484

Part number	Article number	Page
30 L 12/2000-MSC	978-06800	484
30 L 12/2000-Si	978-06951	484
30 L 12/250-MSC	978-06797	484
30 L 12/250-Si	978-06948	484
30 L 12/500-MSC	978-06798	484
30 L 12/500-Si	978-06949	484
30 L 12/750-MSC	978-08555	484
30 L 12/750-Si	978-08577	484
30 L 4/1000-MSC	978-06652	483
30 L 4/1000-Si	978-06934	483
30 L 4/1500-MSC	978-08554	483
30 L 4/1500-Si	978-08576	483
30 L 4/2000-MSC	978-06653	483
30 L 4/2000-Si	978-06935	483
30 L 4/250-MSC	978-06650	483
30 L 4/250-Si	978-06932	483
30 L 4/500-MSC	978-06651	483
30 L 4/500-Si	978-06933	483
30 L 4/750-MSC	978-08553	483
30 L 4/750-Si	978-08575	483
30 LZ 12/1000-MSC	978-06539	495
30 LZ 12/1000-MSC	978-06540	495
30 LZ 12/1000-Si	978-06541	495
30 LZ 12/1000-Si	978-06542	495
30 LZ 12/1500-MSC	978-06543	495
30 LZ 12/1500-MSC	978-06544	495
30 LZ 12/1500-Si	978-06545	495
30 LZ 12/1500-Si	978-06546	495
30 LZ 12/2000-MSC	978-06547	495
30 LZ 12/2000-MSC	978-06548	495
30 LZ 12/2000-Si	978-06549	495
30 LZ 12/2000-Si	978-06550	495
30 LZ 12/250-MSC	978-06527	495
30 LZ 12/250-MSC	978-06528	495
30 LZ 12/250-Si	978-06529	495
30 LZ 12/250-Si	978-06530	495
30 LZ 12/500-MSC	978-06531	495
30 LZ 12/500-MSC	978-06532	495
30 LZ 12/500-Si	978-06533	495
30 LZ 12/500-Si	978-06534	495
30 LZ 12/750-MSC	978-06535	495
30 LZ 12/750-MSC	978-06536	495
30 LZ 12/750-Si	978-06537	495
30 LZ 12/750-Si	978-06538	495
30 LZ 4/1000-MSC	978-06483	494
30 LZ 4/1000-MSC	978-06484	494
30 LZ 4/1000-Si	978-06485	494
30 LZ 4/1000-Si	978-06486	494
30 LZ 4/1500-MSC	978-06487	494
30 LZ 4/1500-MSC	978-06488	494
30 LZ 4/1500-Si	978-06489	494
30 LZ 4/1500-Si	978-06490	494
30 LZ 4/2000-MSC	978-06491	494
30 LZ 4/2000-MSC	978-06492	494
30 LZ 4/2000-Si	978-06493	494
30 LZ 4/2000-Si	978-06494	494

Part number	Article number	Page
30 LZ 4/250-MSC	978-06471	494
30 LZ 4/250-MSC	978-06470	494
30 LZ 4/250-Si	978-06473	494
30 LZ 4/250-Si	978-06472	494
30 LZ 4/500-MSC	978-06474	494
30 LZ 4/500-MSC	978-06475	494
30 LZ 4/500-Si	978-06476	494
30 LZ 4/500-Si	978-06477	494
30 LZ 4/750-MSC	978-06478	494
30 LZ 4/750-MSC	978-06480	494
30 LZ 4/750-Si	978-06482	494
30 LZ 4/750-Si	978-06481	494
30 QL 0,2x10/1000-Si	974-09617	508
30 QL 0,2x10/500-Si	974-09621	508
30 QL 0,2x20/1000-Si	974-09618	509
30 QL 0,2x20/500-Si	974-09622	509
30 QL 0,2x30/1000-Si	974-09619	509
30 QL 0,2x30/500-Si	974-09623	509
30 QL 0,2x40/1000-Si	974-09620	510
30 QL 0,2x40/500-Si	974-09624	510
30 R 12/1000-MSC	979-06648	463
30 R 12/1000-N-02	979-05280	521
30 R 12/1000-Si	979-06942	463
30 R 12/1500-MSC	979-08396	463
30 R 12/1500-N-02	979-05279	521
30 R 12/1500-Si	979-08418	463
30 R 12/2000-MSC	979-06643	463
30 R 12/2000-N-02	979-05278	521
30 R 12/2000-Si	979-06943	463
30 R 12/250-MSC	979-06646	463
30 R 12/250-Si	979-06940	463
30 R 12/500-MSC	979-06647	463
30 R 12/500-N-02	979-05281	521
30 R 12/500-Si	979-06941	463
30 R 12/750-MSC	979-08395	463
30 R 12/750-N-02	979-50546	521
30 R 12/750-Si	979-08417	463
30 R 4/1000-MSC	979-06656	462
30 R 4/1000-Si	979-06926	462
30 R 4/1500-MSC	979-08394	462
30 R 4/1500-Si	979-08416	462
30 R 4/2000-MSC	979-06657	462
30 R 4/2000-Si	979-06927	462
30 R 4/250-MSC	979-06654	462
30 R 4/250-Si	979-06924	462
30 R 4/500-MSC	979-06655	462
30 R 4/500-Si	979-06925	462
30 R 4/750-MSC	979-08393	462
30 R 4/750-Si	979-08415	462
30 RZ 12/1000-MSC	979-06318	477
30 RZ 12/1000-MSC	979-06319	477
30 RZ 12/1000-Si	979-06320	477
30 RZ 12/1000-Si	979-06321	477
30 RZ 12/1500-MSC	979-06323	477
30 RZ 12/1500-MSC	979-06322	477
30 RZ 12/1500-Si	979-06325	477

C

Index

Part number	Article number	Page
30 RZ 12/1500-Si	979-06324	477
30 RZ 12/2000-MSC	979-06326	477
30 RZ 12/2000-MSC	979-06327	477
30 RZ 12/2000-Si	979-06328	477
30 RZ 12/2000-Si	979-06329	477
30 RZ 12/250-MSC	979-06306	477
30 RZ 12/250-MSC	979-06307	477
30 RZ 12/250-Si	979-06308	477
30 RZ 12/250-Si	979-06309	477
30 RZ 12/500-MSC	979-06310	477
30 RZ 12/500-MSC	979-06311	477
30 RZ 12/500-Si	979-06312	477
30 RZ 12/500-Si	979-06313	477
30 RZ 12/750-MSC	979-06314	477
30 RZ 12/750-MSC	979-06315	477
30 RZ 12/750-Si	979-06316	476
30 RZ 12/750-Si	979-06317	476
30 RZ 4/1000-MSC	979-06262	476
30 RZ 4/1000-MSC	979-06263	476
30 RZ 4/1000-Si	979-06264	476
30 RZ 4/1000-Si	979-06265	476
30 RZ 4/1500-MSC	979-06266	476
30 RZ 4/1500-MSC	979-06267	476
30 RZ 4/1500-Si	979-06268	476
30 RZ 4/1500-Si	979-06269	476
30 RZ 4/2000-MSC	979-06270	476
30 RZ 4/2000-MSC	979-06271	476
30 RZ 4/2000-Si	979-06272	476
30 RZ 4/2000-Si	979-06273	476
30 RZ 4/250-MSC	979-06250	476
30 RZ 4/250-MSC	979-06251	476
30 RZ 4/250-Si	979-06252	476
30 RZ 4/250-Si	979-06253	476
30 RZ 4/500-MSC	979-06254	476
30 RZ 4/500-MSC	979-06255	476
30 RZ 4/500-Si	979-06256	476
30 RZ 4/500-Si	979-06257	476
30 RZ 4/750-MSC	979-06258	476
30 RZ 4/750-MSC	979-06259	476
30 RZ 4/750-Si	979-06260	488
30 RZ 4/750-Si	979-06261	488
33 L1/1000-MSC	**978-51657**	**488**
33 L1/2000-MSC	978-51682	488
33 L1/250-MSC	978-51650	528
33 L1/500-MSC	978-51444	528
33 LVL 2,2	722-50775	496
33 LVL 2,2-90 Grad	722-50776	496
33 LZ 1/...-MSC	978-51580	467
33 LZ 1/...-Si	978-51581	467
33 R 1/1000 MSC	979-51448	467
33 R 1/1500 MSC	979-51444	467
33 R 1/2000 MSC	979-51456	467
33 R 1/500 MSC	979-51443	478
33 R 1/500-Si	979-51445	478
33 RZ 1/1500 MSC	979-51459	478
33 RZ 1/2000 MSC	979-51458	478

Part number	Article number	Page
33 RZ 1/500 MSC	979-51457	478
AA F90 Profibus	**599-91005**	**A-36**
AA-RJ45	902-51694	A-36
AS F 90	599-91004	A-9
AS S7/B1 D9F-D9F	902-51735	A-36
C L12FG-S-10m-PUR	**902-51797**	**A-34**
C L12FG-S-2m-PUR	902-51801	A-34
C L12FG-S-5m-PUR	902-51796	A-34
C L12FW-S-10m-PUR	902-51800	A-34
C L12FW-S-2m-PUR	902-51798	A-34
C L12FW-S-5m-PUR	902-51799	A-34
CB L12FS/L12FS-0,5m-GG-PUR	902-51806	A-34
CB L12FS/L12FS-0,5m-WW-PUR	902-51808	A-34
CB L12FS/L12FS-2m-GG-PUR	902-51807	A-34
CB L12FS/L12FS-2m-WW-PUR	902-51809	A-34
CB L12FS/L8MS-0,15m-GG-PUR	902-51810	A-36
CB L4MG-10m-PUR	902-51756	A-34
CI L4GFK/L8FGK-S-0,2m-PVC	902-51751	A-36
CI L4MG/RJ45G-GS-10m-PUR	902-51784	A-34
CI L4MG/RJ45G-GS-3m-PUR	902-51754	A-34
CI L4MG/RJ45G-GS-5m-PUR	902-51782	A-34
CI L4MW/RJ45G-SG-10m-PUR	902-51790	A-34
CI L4MW/RJ45G-SG-3m-PUR	902-51786	A-34
CI L4MW/RJ45G-SG-5m-PUR	902-51788	A-34
CI L5FG-S-10m-PUR	902-51815	A-34
CI L5FG-S-2m-PUR	902-51813	A-34
CI L5FG-S-5m-PUR	902-51814	A-34
CI L5FW-S-10m-PUR	902-51818	A-34
CI L5FW-S-2m-PUR	902-51816	A-34
CI L5FW-S-5m-PUR	902-51817	A-35
CI L8MGK/L4MGK-S-0,2m-PVC	902-51773	A-36
CI RJ45S 1m K	902-51695	A-36
CL4 FG-E-5m-PVC	902-50219	A-33
CL4 FW-E-5m-PVC	902-50220	A-33
CM4 FG-E-5m-PVC	902-50221	A-32
CM4 FW-E-5m-PVC	902-50222	A-32
CN4 FG-2m-PUR	902-51793	A-32
CN4 FG-5m-PUR	902-51791	A-32
CN4 FW-2m-PUR	902-51794	A-32
CN4 FW-5m-PUR	902-51792	A-34
CUSB-IR-2m	901-05098	A-36
CUSB-RS232-2m	901-05097	A-36
CUSB-RS485-0,7m	533-01004	A-36
CUSB-RS485-SET	533-01005	A-24
Cutting/bending tool	724-50799	529
Deflection mirror	**691-51535**	**A-11**
ET 0,5	**038-12399**	**A-24**
ET 1	038-12400	A-24
ET 10	038-12402	A-24
ETS	527-51129	246
FE 10-RL-NS-E4	**602-71001**	**246**
FE 10-RL-NS-K4	602-71003	246
FE 10-RL-NS-KM3	602-71008	246
FE 10-RL-NS-KM4	602-71005	246
FE 10-RL-PS-E4	602-71000	246
FE 10-RL-PS-K4	602-71002	246

Part number	Article number	Page
FE 10-RL-PS-KM3	602-71006	246
FE 10-RL-PS-KM4	602-71004	246
FE 12 RL-NS-L4	580-51405	418
FE 12 RL-PO-L4	580-51403	418
FE 12 RL-PS-L4	580-51402	418
FE 18 RL-NS-L4	580-51399	422
FE 18 RL-PS-L4	580-51400	422
FE 20 R-NSK4	552-21003	346
FE 20 R-NSM4	552-21002	346
FE 20 R-PSK4	552-21001	346
FE 20 R-PSM4	552-21000	346
FE 23 R-NSK4	552-11010	348
FE 23 R-NSM4	552-11009	348
FE 23 R-PSK4	552-11008	348
FE 23 R-PSM4	552-11007	348
FE 25-RF-NS-M4	605-21017	278
FE 25-RF-PS-M4	605-21016	278
FE 25-RL-NS-K4	605-21007	274
FE 25-RL-NS-M4M	605-21015	274
FE 25-RL-PS-K4	605-21004	274
FE 25-RL-PS-M4M	605-21014	274
FE 25-R-NS-K4	605-21003	276
FE 25-R-NS-M4M	605-21013	276
FE 25-R-PS-K4	605-21001	276
FE 25-R-PS-M4M	605-21012	276
FE 50 I-PAK4	573-52003	270
FE 50 I-PAL4	573-52007	270
FE 50 I-PSVK4	573-52005	270
FE 50 I-PSVL4	573-52004	270
FE 55-RL-NS-K4	620-21010	308
FE 55-RL-NS-L4	620-21007	308
FE 55-RL-PS-K4	620-21009	308
FE 55-RL-PS-L4	620-21006	308
FE 55-RM-NS-L4	620-21013	312
FE 55-RM-PS-L4	620-21012	312
FE 55-R-NS-K4	620-21004	310
FE 55-R-NS-L4	620-21001	310
FE 55-R-PS-K4	620-21003	310
FE 55-R-PS-L4	620-21000	310
FE 88-R-NAV-L5	822-21011	382
FE 88-R-PAV-L5	822-21010	382
FE 88-R-RAT-PM	822-21009	384
FG 120 I-PSM3	831-81002	542
FG 40 I-PSM3	831-81000	542
FG 80 I-PSM3	831-81001	542
FGL 10-R-PSM3	830-11001	538
FGL 120-IK-50-NS-M3	832-11029	537
FGL 120-IK-50-NS-M4	832-11031	537
FGL 120-IK-50-PS-M3	832-11028	537
FGL 120-IK-50-PS-M4	832-11030	537
FGL 120-RK-50-NS-M3	832-11013	535
FGL 120-RK-50-NS-M4	832-11015	535
FGL 120-RK-50-PS-M3	832-11012	535
FGL 120-RK-50-PS-M4	832-11014	535
FGL 120-R-PSM3	830-11006	540
FGL 180-R-PSM3	830-11007	540

Part number	Article number	Page
FGL 20-R-PSM3	830-11002	538
FGL 220-R-PSM3	830-11008	540
FGL 30-IK-30-NS-M3	832-11017	536
FGL 30-IK-30-NS-M4	832-11019	536
FGL 30-IK-30-PS-M3	832-11016	536
FGL 30-IK-30-PS-M4	832-11018	536
FGL 30-RK-30-NS-M3	832-11001	534
FGL 30-RK-30-NS-M4	832-11003	534
FGL 30-RK-30-PS-M3	832-11000	534
FGL 30-RK-30-PS-M4	832-11002	534
FGL 30-R-PSM3	830-11003	538
FGL 50-IK-50-NS-M3	832-11021	536
FGL 50-IK-50-NS-M4	832-11023	536
FGL 50-IK-50-PS-M3	832-11020	536
FGL 50-IK-50-PS-M4	832-11022	536
FGL 50-RK-50-NS-M3	832-11005	534
FGL 50-RK-50-NS-M4	832-11007	534
FGL 50-RK-50-PS-M3	832-11004	534
FGL 50-RK-50-PS-M4	832-11006	534
FGL 50-R-PSM3	830-11004	540
FGL 5-R-PSM3	830-11000	538
FGL 80-IK-50-NS-M3	832-11025	537
FGL 80-IK-50-NS-M4	832-11027	537
FGL 80-IK-50-PS-M3	832-11024	537
FGL 80-IK-50-PS-M4	832-11026	537
FGL 80-RK-50-NS-M3	832-11009	535
FGL 80-RK-50-NS-M4	832-11011	535
FGL 80-RK-50-PS-M3	832-11008	535
FGL 80-RK-50-PS-M4	832-11010	535
FGL 80-R-PSM3	830-11005	540
FL 20 R-NSK4	551-71003	436
FL 20 R-NSM4	551-71002	436
FL 20 R-PSK4	551-71001	436
FL 20 R-PSM3	551-71004	436
FL 20 R-PSM4	551-71000	436
FL 70 RA-NSD-K5	567-71007	443
FL 70 RA-PSD-K5	567-71006	443
FL 70 R-NSD-M4	567-71005	443
FL 70 R-NS-K4	567-71003	440
FL 70 R-NS-M4	567-71001	440
FL 70 R-PSD-M4	567-71004	443
FL 70 R-PS-K4	567-71002	440
FL 70 R-PS-M4	567-71000	440
FLE 18	580-51412	426
FLE 18-15	580-51413	426
FLE 18-L4	580-51410	426
FLE 18-L4-15	580-51411	426
FLE 18W	580-51416	424
FLE 18W-15	580-51417	424
FLE 18W-L4	580-51414	424
FLE 18W-L4-15	580-51415	424
FLS 18	580-51407	426
FLS 18-L4	580-51406	426
FLS 18W	580-51407	424
FLS 18W-L4	580-51408	424
FM 04-151	718-51399	398

Index

Part number	Article number	Page
FM 04-153	718-51401	398
FM 04-161	718-51398	398
FM 04-163	718-51400	398
FM 05-151	718-51403	400
FM 05-153	718-51405	400
FM 05-161	718-51402	400
FM 05-163	718-51404	400
FMF 18-34 L4-SP	504-50929	428
FMH 18	518-51504	394
FMH 18-L4	518-51505	394
FMH 18W	518-51506	394
FMH 18W-L4	518-51507	394
FMS 18-34 B	516-50781	408
FMS 18-34 B ONSP	516-50783	408
FMS 18-34 B-L4	516-50781	408
FMS 18-34 U	510-51587	446
FMS 18-34 U-52	510-51603	446
FMS 18-34 U-54	510-51604	446
FMS 18-34 U-60	510-51588	446
FMS 18-34 UL4	510-51589	446
FMS 18-34 UL4-52	510-51602	446
FMS 18-34 UL4-54	510-51605	446
FMS 18-34 UL4-60	510-51590	446
FMS 30-34 B	550-51595	410
FMS 30-34 B-L4	550-51596	410
FMS 30-34 U-52	540-51604	452
FMS 30-34 U-54	540-51605	452
FMS 30-34 UA4	540-51606	452
FMS 30-34 UL4-52	540-51607	452
FMS 30-35 U	544-51323	450
FMS 30-35 UL5	544-51324	450
FMS 30-44 U-56	530-51587	448
FMS 30-44 U-60	530-51588	448
FMS 30-44 UG-56	530-51590	448
FMS 30-44 UG-60	530-51589	448
FMS 30-44 UL4-56	530-51591	448
FMS 30-44 UL4-60	530-51592	448
FMS 30-44 UT-60	530-51596	448
FR 10-RL-NS-E4	603-31001	240
FR 10-RL-NS-K4	603-31003	240
FR 10-RL-NS-KM3	603-31007	240
FR 10-RL-NS-KM4	603-31005	240
FR 10-RL-PS-E4	603-31000	240
FR 10-RL-PS-K4	603-31002	240
FR 10-RL-PS-KM3	603-31006	240
FR 10-RL-PS-KM4	603-31004	240
FR 10-R-NS-K4	603-11004	242
FR 10-R-NS-KM3	603-11006	242
FR 10-R-NS-KM4	603-11005	242
FR 10-R-PS-K4	603-11001	242
FR 10-R-PS-KM3	603-11003	242
FR 10-R-PS-KM4	603-11002	242
FR 12 R-NSK3	703-11003	412
FR 12 R-NSL4	703-11001	412
FR 12 R-PSK3	703-11002	412
FR 12 R-PSL4	703-11000	412

Part number	Article number	Page
FR 18-2 I-NS-K4	741-11025	416
FR 18-2 I-NS-L4	741-11023	416
FR 18-2 I-PS-K4	741-11024	416
FR 18-2 I-PS-L4	741-11022	416
FR 18-2 IW-NS-K4	741-11029	416
FR 18-2 IW-NS-L4	741-11027	416
FR 18-2 IW-PS-K4	741-11028	416
FR 18-2 IW-PS-L4	741-11026	416
FR 18-2 RM-NS-K4	741-11017	414
FR 18-2 RM-NS-L4	741-11015	414
FR 18-2 RM-PS-K4	741-11016	414
FR 18-2 RM-PS-L4	741-11014	414
FR 18-2 RWM-NS-K4	741-11021	414
FR 18-2 RWM-NS-L4	741-11019	414
FR 18-2 RWM-PS-K4	741-11020	414
FR 18-2 RWM-PS-L4	741-11018	414
FR 20 RD-NSK4	553-11007	342
FR 20 RD-NSM4	553-11006	342
FR 20 RD-PSK4	553-11005	342
FR 20 RD-PSM4	553-11004	342
FR 20 RG1-NSK4	553-51009	332
FR 20 RG1-NSM4	553-51008	332
FR 20 RG1-PSK4	553-51007	332
FR 20 RG1-PSM4	553-51006	332
FR 20 RG-NSK4	553-51003	334
FR 20 RG-NSM3	553-51005	334
FR 20 RG-NSM4	553-51002	334
FR 20 RG-PSK4	553-51001	334
FR 20 RG-PSM3	553-51004	334
FR 20 RG-PSM4	553-51000	334
FR 20 RL-NSK4	555-31003	338
FR 20 RL-NSM4	555-31002	338
FR 20 RLO-NSK4	555-31008	336
FR 20 RLO-NSM4	555-31006	336
FR 20 RLO-PSK4	555-31007	336
FR 20 RLO-PSM4	555-31005	336
FR 20 RL-PSK4	555-31001	338
FR 20 RL-PSM3	555-31004	338
FR 20 RL-PSM4	555-31000	338
FR 20 R-NSK4	553-11003	340
FR 20 R-NSM3	553-11010	340
FR 20 R-NSM4	553-11002	340
FR 20 R-PSK4	553-11001	340
FR 20 R-PSM3	553-11009	340
FR 20 R-PSM4	553-11000	340
FR 23 R-NSK4	553-11015	344
FR 23 R-NSM4	553-11014	344
FR 23 R-PSK4	553-11013	344
FR 23 R-PSM4	553-11012	344
FR 25-RF-NS-K4	606-11015	272
FR 25-RF-NS-M4	606-11013	272
FR 25-RF-PS-K4	606-11014	272
FR 25-RF-PS-M4	606-11012	272
FR 25-RGO2-NS-M4	606-11023	264
FR 25-RGO2-PS-M4	606-11022	264
FR 25-RGO-NS-K4	606-11019	262

Part number	Article number	Page
FR 25-RGO-NS-M4	606-11021	262
FR 25-RGO-NS-M4M	606-11017	262
FR 25-RGO-PS-K4	606-11018	262
FR 25-RGO-PS-M4	606-11020	262
FR 25-RGO-PS-M4M	606-11016	262
FR 25-RL-NS-K4	609-21001	266
FR 25-RL-NS-KL4	609-21003	266
FR 25-RL-NS-M4M	609-31002	266
FR 25-RLO1-NS-K4	609-31006	266
FR 25-RLO1-NS-M4M	609-31004	266
FR 25-RLO1-PS-K4	609-31005	266
FR 25-RLO1-PS-M4M	609-31003	266
FR 25-RLO2-NS-K4	609-31010	266
FR 25-RLO2-NS-M4	609-31008	266
FR 25-RLO2-PS-K4	609-31009	266
FR 25-RLO2-PS-M4	609-31007	266
FR 25-RL-PS-K4	609-21004	266
FR 25-RL-PS-KL4	609-21006	266
FR 25-RL-PS-M3M	609-31000	268
FR 25-RL-PS-M4M	609-31001	268
FR 25-R-NS-K4	606-11003	270
FR 25-R-NS-KL4	606-11005	271
FR 25-R-NS-M3M	606-11007	270
FR 25-R-NS-M4	606-11002	270
FR 25-R-NS-M4M	606-11009	270
FR 25-R-PNS-M4M	606-11011	271
FR 25-R-PS-K4	606-11001	270
FR 25-R-PS-KL4	606-11004	271
FR 25-R-PS-M3M	606-11006	270
FR 25-R-PS-M4	606-11000	270
FR 25-R-PS-M4M	606-11008	270
FR 50 RL-NAK4	571-50015	360
FR 50 RL-NAL4	571-50011	360
FR 50 RL-NSVK4	571-50016	360
FR 50 RL-NSVL4	571-50012	360
FR 50 RL-PAK4	571-50013	360
FR 50 RL-PAL4	571-50009	360
FR 50 RL-PSVK4	571-50014	360
FR 50 RL-PSVL4	571-50010	360
FR 50 R-NAK4	571-50001	362
FR 50 R-NAL4	571-50005	362
FR 50 R-NSVK4	571-50003	362
FR 50 R-NSVL4	571-50007	362
FR 50 R-PAK4	571-50000	362
FR 50 R-PAL4	571-50004	362
FR 50 R-POVL4	571-50033	362
FR 50 R-PSVK4	571-50002	362
FR 50 R-PSVL4	571-50006	362
FR 55-RL-NS-K4	621-11010	300
FR 55-RL-NS-L4	621-11007	300
FR 55-RLO1-NS-L4	621-11022	300
FR 55-RLO1-PS-L4	621-11021	300
FR 55-RLO2-NS-L4	621-11024	300
FR 55-RLO2-PS-L4	621-11023	300
FR 55-RL-PS-K4	621-11009	300
FR 55-RL-PS-L4	621-11006	300

Part number	Article number	Page
FR 55-RM-NS-L4	621-11013	304
FR 55-RM-PS-L4	621-11012	304
FR 55-R-NS-K4	621-11004	302
FR 55-R-NS-L4	621-11001	302
FR 55-R-PS-K4	621-11003	302
FR 55-R-PS-L4	621-11000	302
FR 85-2 ILLG-POL5	529-11010	182
FR 85-2 ILLG-S1L5	529-11008	182
FR 85-2 ILLX	533-11016	A-37
FR 88-R-NAV-L5	823-11011	382
FR 88-R-PAV-L5	823-11010	382
FR 88-R-RAT-PM	823-11009	380
FR 90 ILA-S2-Q12	591-91001	174
FR 91 ILA-S2-Q12	591-91002	176
FS 10-RL-E4	601-61000	246
FS 10-RL-K4	601-61002	246
FS 10-RL-KM3	601-61005	246
FS 10-RL-KM4	601-61004	246
FS 12 RL-L4	580-51401	418
FS 18 RL-L4	580-51398	422
FS 20 R-K4	552-11001	346
FS 20 R-M4	552-11000	346
FS 23 R-K4	552-11005	348
FS 23 R-M4	552-11004	348
FS 25-RF-M4	605-11008	278
FS 25-R-K4	605-11001	276
FS 25-RL-K4	605-11002	274
FS 25-RL-M4M	605-11007	274
FS 25-R-M4M	605-11006	276
FS 50 I-K4	573-52002	364
FS 50 I-L4	573-52006	364
FS 55-R-K4	620-11001	310
FS 55-R-L4	620-11000	310
FS 55-RL-K4	620-11003	308
FS 55-RL-L4	620-11002	308
FS 55-RM-L4	620-11004	312
FS 88-R-L5	822-11004	382
FS 88-R-PM	822-11003	384
FS/FE 10-RL-NS-E4	611-51001	244
FS/FE 10-RL-NS-K4	611-51003	244
FS/FE 10-RL-NS-KM3	611-51007	244
FS/FE 10-RL-NS-KM4	611-51005	244
FS/FE 10-RL-PS-E4	611-51000	244
FS/FE 10-RL-PS-K4	611-51002	244
FS/FE 10-RL-PS-KM3	611-51006	244
FS/FE 10-RL-PS-KM4	611-51004	244
FSE 18-2 IM-NS-K4	742-51007	420
FSE 18-2 IM-NS-L4	742-51005	420
FSE 18-2 IM-PS-K4	742-51006	420
FSE 18-2 IM-PS-L4	742-51004	420
FT 10-BF2-NS-K4	600-11029	238
FT 10-BF2-NS-KM3	600-11031	238
FT 10-BF2-NS-KM4	600-11030	238
FT 10-BF2-PS-K4	600-11026	238
FT 10-BF2-PS-KM3	600-11028	238
FT 10-BF2-PS-KM4	600-11027	238

Index

Part number	Article number	Page
FT 10-B-RLF1-NS-E4	600-11101	232
FT 10-B-RLF1-NS-K4	600-11103	232
FT 10-B-RLF1-NS-KM3	600-11143	233
FT 10-B-RLF1-NS-KM4	600-11105	232
FT 10-B-RLF1-PS-E4	600-11100	232
FT 10-B-RLF1-PS-K4	600-11102	232
FT 10-B-RLF1-PS-KM3	600-11142	233
FT 10-B-RLF1-PS-KM4	600-11104	232
FT 10-B-RLF2-NS-E4	600-11107	232
FT 10-B-RLF2-NS-K4	600-11109	232
FT 10-B-RLF2-NS-KM3	600-11145	233
FT 10-B-RLF2-NS-KM4	600-11111	232
FT 10-B-RLF2-PS-E4	600-11106	232
FT 10-B-RLF2-PS-K4	600-11108	232
FT 10-B-RLF2-PS-KM3	600-11144	233
FT 10-B-RLF2-PS-KM4	600-11110	232
FT 10-RF1-NS-K4	600-11011	236
FT 10-RF1-NS-KM3	600-11013	236
FT 10-RF1-NS-KM4	600-11012	236
FT 10-RF1-PS-K4	600-11008	236
FT 10-RF1-PS-KM3	600-11010	236
FT 10-RF1-PS-KM4	600-11009	236
FT 10-RF2-NS-K4	600-11017	236
FT 10-RF2-NS-KM3	600-11019	237
FT 10-RF2-NS-KM4	600-11018	236
FT 10-RF2-PS-K4	600-11014	236
FT 10-RF2-PS-KM3	600-11016	237
FT 10-RF2-PS-KM4	600-11015	236
FT 10-RF3-NS-K4	600-11023	236
FT 10-RF3-NS-KM3	600-11025	237
FT 10-RF3-NS-KM4	600-11024	236
FT 10-RF3-PS-K4	600-11020	236
FT 10-RF3-PS-KM3	600-11022	237
FT 10-RF3-PS-KM4	600-11021	236
FT 10-RH-NS-E4	600-11004	234
FT 10-RH-NS-K4	600-11005	234
FT 10-RH-NS-KM3	600-11007	234
FT 10-RH-NS-KM4	600-11006	234
FT 10-RH-PS-E4	600-11000	234
FT 10-RH-PS-K4	600-11001	234
FT 10-RH-PS-KM3	600-11003	234
FT 10-RH-PS-KM4	600-11002	234
FT 10-RLH-NS-E4	600-11131	228
FT 10-RLH-NS-K4	600-11133	228
FT 10-RLH-NS-KM4	600-11135	228
FT 10-RLH-PS-E4	600-11130	228
FT 10-RLH-PS-K4	600-11132	228
FT 10-RLH-PS-KM3	600-11146	228
FT 10-RLH-PS-KM3	600-11147	228
FT 10-RLH-PS-KM4	600-11134	228
FT 10-RLHR-NS-E4	600-11137	230
FT 10-RLHR-NS-K4	600-11139	230
FT 10-RLHR-NS-KM4	600-11141	230
FT 10-RLHR-PS-E4	600-11136	230
FT 10-RLHR-PS-K4	600-11138	230
FT 10-RLHR-PS-KM3	600-11148	230
FT 10-RLHR-PS-KM3	600-11149	230
FT 10-RLHR-PS-KM4	600-11140	230
FT 12 RF-PSL4	506-11004	396
FT 12 RH-PSL4	506-11000	392
FT 12 R-NSK3	701-21003	402
FT 12 R-NSL4	701-21001	402
FT 12 R-PSK3	701-21002	402
FT 12 R-PSL4	701-21000	402
FT 18-2 IDM-NS-K4	740-21032	404
FT 18-2 IDM-NS-L4	740-21030	404
FT 18-2 IDM-PS-K4	740-21031	404
FT 18-2 IDM-PS-L4	740-21029	404
FT 18-2 ID-NS-K4	740-21043	406
FT 18-2 ID-NS-L4	740-21041	406
FT 18-2 ID-PS-K4	740-21042	406
FT 18-2 ID-PS-L4	740-21040	406
FT 18-2 RM-NS-K4	740-21024	404
FT 18-2 RM-NS-L4	740-21022	404
FT 18-2 RM-PS-K4	740-21023	404
FT 18-2 RM-PS-L4	740-21021	404
FT 18-2 R-NS-K4	740-21035	406
FT 18-2 R-NS-L4	740-21034	406
FT 18-2 R-PS-K4	740-21020	406
FT 18-2 R-PS-L4	740-21033	406
FT 18-2 RWM-NS-K4	740-21028	404
FT 18-2 RWM-NS-L4	740-21026	404
FT 18-2 RWM-PS-K4	740-21027	404
FT 18-2 RWM-PS-L4	740-21025	404
FT 18-2 RW-NS-K4	740-21039	406
FT 18-2 RW-NS-L4	740-21037	406
FT 18-2 RW-PS-K4	740-21038	406
FT 18-2 RW-PS-L4	740-21036	406
FT 20 IH-NSK4	551-11013	322
FT 20 IH-NSM4	551-11012	322
FT 20 IH-PSK4	551-11011	322
FT 20 IH-PSM3	551-11021	322
FT 20 IH-PSM4	551-11010	322
FT 20 RA-60-F-K4	554-11001	150
FT 20 RA-60-F-M4	554-11000	150
FT 20 RH-NSK4	551-11003	320
FT 20 RH-NSM3	551-11005	320
FT 20 RH-NSM4	551-11002	320
FT 20 RH-PSK4	551-11001	320
FT 20 RH-PSM3	551-11004	320
FT 20 RH-PSM4	551-11000	320
FT 20 RLHD-NSK4	551-11025	318
FT 20 RLHD-NSM4	551-11023	318
FT 20 RLHD-PSK4	551-11024	318
FT 20 RLHD-PSM3	551-11026	318
FT 20 RLHD-PSM4	551-11022	318
FT 20 RLH-NSK4	551-11017	316
FT 20 RLH-NSM3	551-11020	316
FT 20 RLH-NSM4	551-11016	316
FT 20 RLH-PSK4	551-11015	316
FT 20 RLH-PSM3	551-11019	316
FT 20 RLH-PSM4	551-11014	316

Version: 10/2013. Subject to changes; diagrams similar

Part number	Article number	Page
FT 20 RL-NSK4	551-21010	326
FT 20 RL-NSM4	551-21009	326
FT 20 RL-PSK4	551-21008	326
FT 20 RL-PSM3	551-21022	326
FT 20 RL-PSM4	551-21007	326
FT 20 R-NSK4	551-21003	328
FT 20 R-NSM3	551-21005	328
FT 20 R-NSM4	551-21002	328
FT 20 R-PSK4	551-21001	328
FT 20 R-PSM3	551-21004	328
FT 20 R-PSM4	551-21000	328
FT 20 WT-NSK4	551-61003	212
FT 20 WT-NSM4	551-61001	212
FT 20 WT-PSK4	551-61002	212
FT 20 WT-PSM4	551-61000	212
FT 23 RF-NSK4	551-21019	324
FT 23 RF-NSM4	551-21018	324
FT 23 RF-PSK4	551-21017	324
FT 23 RF-PSM4	551-21012	324
FT 23 RF-PSM4-X03	551-21024	324
FT 23 R-NSK4	551-21016	330
FT 23 R-NSM4	551-21015	330
FT 23 R-PSK4	551-21014	330
FT 23 R-PSM4	551-21011	330
FT 25 RA-170-NSU-M4M	604-41003	148
FT 25 RA-170-PSU-M4M	604-41002	148
FT 25 RA-60-NSU-M4M	604-41001	148
FT 25 RA-60-PSU-M4M	604-41000	148
FT 25-C1-GS-M4M	607-21020	192
FT 25-C2-GS-M4M	607-21021	192
FT 25-RF1-PS-K4	608-11021	256
FT 25-RF1-PS-M4	608-11020	256
FT 25-RF2-NS-K4	608-11024	256
FT 25-RF2-PS-K4	608-11023	256
FT 25-RF2-PS-M4	608-11022	256
FT 25-RGB1-GS-KL4	607-21010	208
FT 25-RGB1-GS-M4M	607-21011	208
FT 25-RHD-NS-K4	608-11003	254
FT 25-RHD-NS-KL4	608-11011	255
FT 25-RHD-NS-M4	608-11002	254
FT 25-RHD-NS-M4M	608-11017	254
FT 25-RHD-PNS-M4M	608-11019	255
FT 25-RHD-PS-K4	608-11001	254
FT 25-RHD-PS-KL4	608-11010	254
FT 25-RHD-PS-M4	608-11000	254
FT 25-RHD-PS-M4M	608-11016	254
FT 25-RH-NS-K4	608-11007	252
FT 25-RH-NS-KL4	608-11009	252
FT 25-RH-NS-M3M	608-11013	252
FT 25-RH-NS-M4	608-11006	252
FT 25-RH-NS-M4M	608-11015	252
FT 25-RH-PS-K4	608-11005	252
FT 25-RH-PS-KL4	608-11008	252
FT 25-RH-PS-M3M	608-11012	252
FT 25-RH-PS-M4	608-11004	252
FT 25-RH-PS-M4M	608-11014	252

Part number	Article number	Page
FT 25-RLH-NS-K4	609-11001	250
FT 25-RLH-NS-KL4	609-11003	250
FT 25-RLH-NS-M3M	609-11008	250
FT 25-RLH-NS-M4	609-11002	250
FT 25-RLH-NS-M4M	609-11010	250
FT 25-RLH-PS-K4	609-11004	250
FT 25-RLH-PS-KL4	609-11006	250
FT 25-RLH-PS-M3	609-11011	250
FT 25-RLH-PS-M3M	609-11007	250
FT 25-RLH-PS-M4	609-11005	250
FT 25-RLH-PS-M4M	609-11009	250
FT 25-RL-NS-K4	609-21008	208
FT 25-RL-NS-K4	609-21008	258
FT 25-RL-NS-KL4	609-21009	210, 258
FT 25-RL-NS-M4M	609-21014	210, 258
FT 25-RL-PS-K4	609-21010	210, 258
FT 25-RL-PS-KL4	609-21012	210, 258
FT 25-RL-PS-M4M	609-21013	210, 258
FT 25-R-NS-K4	607-21003	260
FT 25-R-NS-KL4	607-21005	260
FT 25-R-NS-M4	607-21002	260
FT 25-R-NS-M4M	607-21007	260
FT 25-R-PS-K4	607-21001	260
FT 25-R-PS-KL4	607-21004	260
FT 25-R-PS-M4	607-21000	260
FT 25-R-PS-M4M	607-21006	260
FT 25-W1-GS-KL4	607-21012	206
FT 25-W1-GS-M4M	607-21013	206
FT 25-W2-GS-KL4	607-21015	206
FT 25-W2-GS-M4	607-21014	206
FT 50 C-1-NS1-L8	575-11010	201
FT 50 C-1-PS1-L8	575-11007	201
FT 50 C-1-PSL5	575-11016	196
FT 50 C-1-PSL8	575-11000	198
FT 50 C-2-NS1-L8	575-11011	201
FT 50 C-2-PS1-L8	575-11008	201
FT 50 C-2-PSL5	575-11017	196
FT 50 C-2-PSL8	575-11003	198
FT 50 C-3-NS1-L8	575-11012	201
FT 50 C-3-PS1-L8	575-11009	201
FT 50 C-3-PSL5	575-11018	196
FT 50 C-3-PSL8	575-11004	198
FT 50 C-UV-1-PSL5	575-11020	216
FT 50 IH-NAK4	572-51037	358
FT 50 IH-NAL4	572-51038	358
FT 50 IH-NSVK4	572-51057	358
FT 50 IH-NSVL4	572-51058	358
FT 50 IH-PAK4	572-51032	358
FT 50 IH-PAL4	572-51029	358
FT 50 IH-PSVK4	572-51033	358
FT 50 IH-PSVL4	572-51031	358
FT 50 RH-NAK4	572-51001	356
FT 50 RH-NAL4	572-51005	356
FT 50 RH-NSVK4	572-51003	356
FT 50 RH-NSVL4	572-51007	356
FT 50 RH-PAK4	572-51000	356

Index

Part number	Article number	Page
FT 50 RH-PAL4	572-51004	356
FT 50 RH-PSVK4	572-51002	356
FT 50 RH-PSVL4	572-51006	356
FT 50 RLA-100-PL5	574-41032	158
FT 50 RLA-100-S1L8	574-41033	160
FT 50 RLA-20-F-K5	574-41004	154
FT 50 RLA-20-F-L4S	574-41005	154
FT 50 RLA-20-S-K5	574-41006	154
FT 50 RLA-20-S-L4S	574-41007	154
FT 50 RLA-220-L8	574-41014	160
FT 50 RLA-220-PL5	574-41029	158
FT 50 RLA-220-S1L8	574-41015	160
FT 50 RLA-40-F-K5	574-41000	156
FT 50 RLA-40-F-L4S	574-41001	156
FT 50 RLA-40-S-K5	574-41002	156
FT 50 RLA-40-S-L4S	574-41003	156
FT 50 RLA-70-L8	574-41018	160
FT 50 RLA-70-PL5	574-41027	158
FT 50 RLA-70-S1L8	574-41019	160
FT 50 RLHD-NAK4	572-51065	354
FT 50 RLHD-NAL4	572-51063	354
FT 50 RLHD-PAK4	572-51064	354
FT 50 RLHD-PAL4	572-51062	354
FT 50 RLHD-PSVL4	572-51051	354
FT 50 RLH-NAK4	572-51015	352
FT 50 RLH-NAL4	572-51011	352
FT 50 RLH-NSVK4	572-51016	352
FT 50 RLH-NSVL4	572-51012	352
FT 50 RLH-PAK4	572-51013	352
FT 50 RLH-PAL4	572-51008	352
FT 50 RLH-PSVK4	572-51014	352
FT 50 RLH-PSVL4	572-51010	352
FT 55 RLAP-4700-PNSI-L5	622-21018	166
FT 55 RLAP-4700-PNSU-L5	622-21021	166
FT 55 RLAP-4900-NSI-L5	622-21017	166
FT 55 RLAP-4900-NSU-L5	622-21020	166
FT 55 RLAP-4900-PSI-L5	622-21016	166
FT 55 RLAP-4900-PSU-L5	622-21019	166
FT 55 RLHP2-2PNS-L5	623-11034	286
FT 55 RLHP2-PNS-L4	623-11031	286
FT 55B-RH-NS-K4	623-11015	288
FT 55B-RH-NS-L4	623-11013	288
FT 55B-RH-PS-K4	623-11014	288
FT 55B-RH-PS-L4	623-11012	288
FT 55-RHM-NS-L4	623-11026	292
FT 55-RHM-PS-L4	623-11025	292
FT 55-RH-NS-K4	623-11004	290
FT 55-RH-NS-L4	623-11001	290
FT 55-RH-PS-K4	623-11003	290
FT 55-RH-PS-L4	623-11000	290
FT 55-RL2H-NS-K4	623-11010	284
FT 55-RL2H-NS-L4	623-11007	284
FT 55-RL2H-PS-K4	623-11009	284
FT 55-RL2H-PS-L4	623-11006	284
FT 55-RL2-NS-K4	622-21010	294
FT 55-RL2-NS-L4	622-21007	294

Part number	Article number	Page
FT 55-RL2-PS-K4	622-21009	294
FT 55-RL2-PS-L4	622-21006	294
FT 55-RLH-NS-K4	623-11022	282
FT 55-RLH-NS-L4	623-11019	282
FT 55-RLH-PS-K4	623-11021	282
FT 55-RLH-PS-L4	623-11018	282
FT 55-RM-NS-L4	622-21013	298
FT 55-RM-PS-L4	622-21012	298
FT 55-R-NS-K4	622-21004	296
FT 55-R-NS-L4	622-21001	296
FT 55-R-PS-K4	622-21003	296
FT 55-R-PS-L4	622-21000	296
FT 80 RLA-500-L8	574-41020	162
FT 80 RLA-500-S1L8	574-41024	162
FT 88-IH-NA-L5	821-11014	372
FT 88-IH-PA-L5	821-11013	372
FT 88-IH-RAT-PM	821-11012	374
FT 88-R-GA-L4	821-21009	376
FT 88-RH-NA-L5	821-11011	368
FT 88-RH-PA-L5	821-11010	368
FT 88-RH-RAT-PM	821-11009	370
FT 90 ILA-S2-Q12	591-91000	168
FT 91 ILA-S2-Q12	591-91003	170
FT 92 ILA-NSL5	591-91008	172
FT 92 ILA-PSL5	591-91005	172
FT 92 ILA-PSL5	591-91006	178
FT 92 IL-NSK3	591-91010	388
FT 92 IL-NSL4	591-91009	388
FT 92 IL-PSK3	591-91011	388
FT 92 IL-PS-KL4	591-91012	388
FT 92 IL-PSL4	591-91007	388
FT 92 IRLA-PSL55	591-91013	172
IDT 6-2B-NS-K3	**697-01041**	**615**
IDT 6-2B-NS-M3	697-01043	615
IDT 6-2B-PS-K3	697-01040	615
IDT 6-2B-PS-M3	697-01042	615
IMT 12-2B-NS-K3	697-01016	624
IMT 12-2B-NS-L4	697-01018	624
IMT 12-2B-PS-K3	697-01017	624
IMT 12-2B-PS-L4	697-01019	624
IMT 12-4B-NS-K3	697-01049	626
IMT 12-4B-NS-L4	697-01051	626
IMT 12-4B-PS-K3	697-01048	626
IMT 12-4B-PS-L4	697-01050	626
IMT 12-4N-NS-K3	697-01020	626
IMT 12-4N-NS-L4	697-01022	626
IMT 12-4N-PS-K3	697-01021	626
IMT 12-4N-PS-L4	697-01023	626
IMT 18-5B-NS-K3	697-01024	632
IMT 18-5B-NS-L4	697-01026	626
IMT 18-5B-PS-K3	697-01025	626
IMT 18-5B-PS-L4	697-01027	626
IMT 18-8B-NS-K3	697-01053	634
IMT 18-8B-NS-L4	697-01055	634
IMT 18-8B-PS-K3	697-01052	634
IMT 18-8B-PS-L4	697-01054	634

Part number	Article number	Page
IMT 18-8N-NS-K3	697-01028	634
IMT 18-8N-NS-L4	697-01030	634
IMT 18-8N-PS-K3	697-01029	634
IMT 18-8N-PS-L4	697-01031	634
IMT 30-10B-NS-K3	697-01032	639
IMT 30-10B-NS-L4	697-01034	639
IMT 30-10B-PS-K3	697-01033	639
IMT 30-10B-PS-L4	697-01035	639
IMT 30-15B-NS-K3	697-01057	640
IMT 30-15B-NS-L4	697-01059	640
IMT 30-15B-PS-K3	697-01056	640
IMT 30-15B-PS-L4	697-01058	640
IMT 30-15N-NS-K3	697-01036	640
IMT 30-15N-NS-L4	697-01038	640
IMT 30-15N-PS-K3	697-01037	640
IMT 30-15N-PS-L4	697-01039	640
IMT 5-0B8-NS-K3	697-01004	612
IMT 5-0B8-NS-M3	697-01006	612
IMT 5-0B8-PS-K3	697-01005	612
IMT 5-0B8-PS-M3	697-01007	612
IMT 8-1B5-NS-K3	697-01008	618
IMT 8-1B5-NS-L4	697-01010	618
IMT 8-1B5-PS-K3	697-01009	618
IMT 8-1B5-PS-L4	697-01011	618
IMT 8-2B-NS-K3	697-01045	620
IMT 8-2B-NS-M3	697-01047	620
IMT 8-2B-PS-K3	697-01044	620
IMT 8-2B-PS-M3	697-01046	620
IMT 8-2N-NS-K3	697-01012	620
IMT 8-2N-NS-L4	697-01014	620
IMT 8-2N-PS-K3	697-01013	620
IMT 8-2N-PS-L4	697-01015	620
IR-RS 232	901-05096	A-34
IS 33-51	996-09391	608
IS 33-52	996-09390	608
IS 34-51	996-09395	608
IS 34-52	996-09397	608
IS 455-01	996-50607	602
IS 455-02	996-50585	602
IS 46-02	996-09401	614
IS 46-11 T	996-50613	614
IS 46-12	996-50590	614
IS 48-01	996-09404	617
IS 48-02	996-09405	617
IS 48-11T	996-50623	617
IS 48-12T	996-50624	617
IS 512-01	996-09420	629
IS 512-02	996-09421	629
IS 512-02 AI	996-51479	645
IS 512-03-S	996-51472	630
IS 512-04-S	996-51458	630
IS 512-41	996-09968	629
IS 512-42	996-09969	629
IS 512-43	996-09970	630
IS 512-44-S	996-51449	630
IS 514-42	996-51193	631

Part number	Article number	Page
IS 518-01	996-09428	636
IS 518-02	996-09429	636
IS 518-02 A	996-09435	646
IS 518-04-S	996-51450	637
IS 518-41	996-09972	636
IS 518-42	996-09973	636
IS 518-43-S	996-50327	637
IS 518-44-S	996-51453	637
IS 530-01	996-09436	642
IS 530-02	996-09437	642
IS 530-03	996-09438	643
IS 530-04-S	996-51452	643
IS 530-41	996-50673	642
IS 530-42	996-09905	642
IS 530-44-S	996-51454	643
IS 56-01	996-09408	616
IS 56-02	996-09409	616
IS 56-11 T	996-50632	616
IS 56-12	996-50586	616
IS 56-41	996-50390	616
IS 56-42	996-09963	616
IS 58-01	996-09412	622
IS 58-02	996-09413	622
IS 58-03-S	996-51465	623
IS 58-04-S	996-51461	623
IS 58-11 T	996-50640	622
IS 58-12 T	996-50587	622
IS 58-13-S	996-51470	623
IS 58-14-S	996-51456	623
IS 58-41	996-09964	622
IS 58-42	996-09965	622
IS 58-43-S	996-51463	623
IS 58-44-S	996-51460	623
IS 588-01	996-50650	603
IS 588-02	996-50589	603
IS 588-02-X	996-51280	603
ISN 44-20	996-09444	609
ISZ 46-01	996-09487	613
ISZ 46-02	996-09488	613
IT 10-4N-NS-K3	697-01071	601
IT 10-4N-PS-K3	697-01070	601
IT 12 BM-PSL4	996-51480	628
IT 12 NBM-PSL4	996-51481	628
IT 12-4B-NS-K3	697-01060	604
IT 12-4B-NS-M3	697-01062	604
IT 12-4B-PS-K3	697-01061	604
IT 12-4B-PS-M3	697-01063	604
IT 12-8N-NS-K3	697-01064	604
IT 12-8N-NS-M3	697-01066	604
IT 12-8N-PS-K3	697-01065	604
IT 12-8N-PS-M3	697-01067	604
IT 18 BM-PSL4	996-51482	638
IT 18 NBM-PSL4	996-51483	638
IT 30 BM-PSL4	996-51484	644
IT 30 NBM-PSL4	996-51485	644
IT 4 BD-PSK3	996-51486	611

Index

Part number	Article number	Page
IT 40 B-ACSL4	810-50004	607
IT 40 BD-ACSL4	810-50005	607
IT 40 BD-NAL4	810-50003	606
IT 40 BD-PAL4	810-50001	606
IT 40 B-NAL4	810-50002	606
IT 40 B-PAL4	810-50000	606
IT 40 NB-ACSL4	810-50008	607
IT 40 NB-NAL4	810-50007	606
IT 40 NB-PAL4	810-50006	606
IT 8-1B5K-NS-K3	697-01069	600
IT 8-1B5K-PS-K3	697-01068	600
K1L-78	**840-11002**	**488**
K1R-101	720-50766	464
K1R-103	720-50769	517
K1R-104	841-21006	519
K1R-35	841-21005	468
K1R-68	951-50001	468
K1RZ-31	841-21003	479
K2-ADE-TB	533-11017	A-36
K2L 0.5 simplex	978-51688	526
K2L 1,0 POF simplex	978-51680	526
K2L-201	721-50771	485
K2L-202	721-50772	485
K2L-203	721-50773	518
K2L-204	721-50774	518
K2L-34	950-50002	497
K2L-7	840-11000	486
K2L-77	840-11001	486
K2Q-12	952-50000	508
K2R 1.0 POF duplex	979-51694	527
K2R-100	720-50770	517
K2R-102	720-50767	464
K2R-25	841-21004	469
K2R-6	841-21000	465
K2R-67	841-21001	465
K3-10m-G-PUR	902-50694	A-32
K3-10m-W-PL-PUR	902-50693	A-32
K3-2m-G-PUR	902-50679	A-32
K3-2m-W-PL-PUR	902-50683	A-32
K3-2m-W-PUR	902-50681	A-32
K3-5m-G-PUR	902-51614	A-32
K3-5m-W-PL-PUR	902-51616	A-32
K3-5m-W-PUR	902-51615	A-32
K4-10m-G-PUR	902-51610	A-32
K4-10m-W-PUR	902-51629	A-32
K4-2m-G-PUR	902-50801	A-32
K4-2m-W-PL-PUR	902-51642	A-32
K4-2m-W-PUR	902-50803	A-32
K4-5m-G-PUR	902-51617	A-32
K4-5m-W-PL-PUR	902-51643	A-32
K4-5m-W-PUR	902-51618	A-32
KD 06 B-NOM3	681-50881	654
KD 06 B-NSM3	681-50880	654
KD 06 B-POM3	681-50879	654
KD 06 B-PSM3	681-50878	654
KD 08 B-NSM3	681-50896	656

Part number	Article number	Page
KD 08 B-POM3	681-50895	656
KD 08 B-PSM3	681-50894	656
KD 12 B-NOL4	681-50917	658
KD 12 B-NSL4	681-50916	658
KD 12 B-POL4	681-50915	658
KD 12 B-PSL4	681-50914	658
KD 18 B-NOL4	681-50929	660
KD 18 B-NSL4	681-50928	660
KD 18 B-POL4	681-50927	660
KD 18 B-PSL4	681-50926	660
KD 30 B-NSOL4	681-50944	662
KD 30 B-PSOL4	681-50942	662
KL 06 NB-NOM3	681-50889	654
KL 06 NB-NSM3	681-50888	654
KL 06 NB-POM3	681-50887	654
KL 06 NB-PSM3	681-50886	654
KL 08 NB-NOM3	681-50905	656
KL 08 NB-NSM3	681-50904	656
KL 08 NB-POM3	681-50903	656
KL 08 NB-PSM3	681-50902	656
KL 12 NB-NOL4	682-50997	658
KL 12 NB-NSL4	682-50996	658
KL 12 NB-POL4	682-50995	658
KL 12 NB-PSL4	682-50994	658
KL 18 NB-NOL4	682-51017	660
KL 18 NB-NSL4	682-51016	660
KL 18 NB-POL4	682-51015	660
KL 18 NB-PSL4	682-51014	660
KL 30 NB-NSOL4	682-51036	662
KL 30 NB-PSOL4	682-51034	662
L3-2m-G-PUR	**902-50687**	**A-33**
L3-2m-W-PL-PUR	902-50690	A-33
L3-2m-W-PUR	902-50689	A-33
L3-5m-G-PUR	902-51619	A-33
L3-5m-W-PL-PUR	902-51621	A-33
L3-5m-W-PUR	902-51620	A-33
L3M/K3F-0,6 PUR	902-51653	A-34
L4 KDG	022-50812	A-33
L4 KDW	022-50813	A-33
L4-10m-G-PUR	902-51628	A-33
L4-10m-W-PL-PUR	902-51604	A-33
L4-15m-W-PL-PUR	902-51607	A-33
L4-2m-G-PUR	902-50805	A-33
L4-2m-W-PL-PUR	902-50808	A-33
L4-2m-W-PUR	902-50807	A-33
L4-300mm-G-PUR	902-50811	A-33
L4-5m-G-PUR	902-51612	A-33
L4-5m-W-PL-PUR	902-51603	A-33
L4-5m-W-PUR	902-51602	A-33
L4F/K4M-0,6 PVC	902-51645	A-34
L4F/L4M-0,48 PUR	902-51670	A-33
L4M/K4FW-0,6 PVC	902-51650	A-34
L4S-10m-G-PVC	902-51651	A-33
L4S-2m-G-PVC	902-51632	A-33
L4S-2m-W-PVC	902-51633	A-33
L4S-5m-G-PVC	902-51634	A-33

Part number	Article number	Page
L4S-5m-W-PVC	902-51635	A-33
L5-10m-G-PUR	902-51609	A-33
L5-2m-G-PUR	902-51652	A-33
L5-2m-W-PUR	902-51613	A-33
L5-5m-G-PUR	902-51624	A-33
L5-5m-W-PUR	902-51641	A-33
L5F/Q8F-0,5 PUR	902-51686	A-34
L8FS-10m-G-PUR	902-51689	A-33
L8FS-10m-W-PUR	902-51690	A-33
L8FS-2m-G-PUR	902-51671	A-33
L8FS-2m-W-PUR	902-51687	A-33
L8FS-5m-G-PUR	902-51646	A-33
L8FS-5m-W-PUR	902-51688	A-33
LA45V-24-2L12	525-01001	A-35
LA45V-24-3L	525-01000	A-35
LB 44 RD-24-KFL5	532-51028	A-29
LB 44 WD-24-KFL5	532-51026	A-29
LB 86 RD-24-KFL5	532-51029	A-29
LB 86 WD-24-KFL5	532-51027	A-29
LD 50 RD-24-KFL5	532-51039	A-28
LD 50 WD-24-KFL5	532-51038	A-28
LF 100 A RD-24-KFL5	532-51040	A-31
LF 100 A WD-24-KFL5-65	532-51042	A-31
LF 100 RD-24-KFL5	532-51023	A-30
LF 100 WD-24-KFL5	532-51020	A-30
LF 200 RD-24-KFL5	532-51025	A-30
LF 200 WD-24-KFL5	532-51024	A-30
LF 36 RD-24-KFL5	532-51021	A-30
LF 36 WD-24-KFL5	532-51018	A-30
LF 51 RD-24-KFL5	532-51022	A-30
LF 51 WD-24-KFL5	532-51019	A-30
LF 60 A RD-24-KFL5	532-51041	A-31
LF45 IR-24-2L12	525-51149	A-25
LF45 R-24-2L12	525-51148	A-25
LF45 W-24-2L12	525-51147	A-25
LFR 115 ID-24-2L12	525-51152	A-26
LFR 115 RD-24-2L12	525-51151	A-26
LFR 115 RK-24-2L-12	525-51154	A-26
LFR 115 WD-24-2L12	525-51150	A-26
LFR 115 WK-24-2L-12	525-51153	A-26
LFR 45 ID	525-51141	A-26
LFR 45 RD	525-51143	A-26
LFR 45 WD	525-51139	A-26
LFT 115 IK-24-2L-12	525-51155	A-26
LK 25 R-24-KFL5	532-51043	A-29
LK 46 R-24-KFL5	532-51044	A-29
LLK1GL10-PE-2m	750-11007	523
LLK1GL5-PE-2m	750-11008	523
LLK1L10x10-PE-2m	750-11010	519
LLK1QRR10x10-PE-2m	750-11003	506
LLK1RD12V6-PE-1m	951-50010	501
LLK1RD20V6-PE-1m	951-50011	501
LLK1RD8V6-PE-1m	951-50009	500
LLK1RKM3-18 PE-2m	750-21005	470
LLK1RKM3-PE-1m	750-21002	469
LLK1RM3-PE-1m	750-21000	466

Part number	Article number	Page
LLK1RVV6-PE-1m	951-50008	502
LLK1VRF17x18-PE-2m	750-11009	522
LLK1VRF5-PE-2m	750-11005	522
LLK1VRR22x15-PE-2m	750-11006	521
LLK2LM3-PE-1m	750-11000	487
LLK2LM4-PE-1m	750-11001	487
LLK2LV6-PE-1m	950-50006	502
LLK2LZ	950-50007	497
LLK2PR2-PE-2m	951-50013	520
LLK2QRR19x25-PE-2m	750-11004	507
LLK2RKM6-PE-1m	750-21003	470
LLK2RM6-PE-1m	750-21001	466
LLK2RZ	951-50012	478
LLK2SLR10-PE-2m	952-50001	507
LMS1,0-S2,2	724-01000	527
LMS1,3-S2,2	724-01001	527
LO C 12	526-51514	A-23
LO C 16	526-51515	A-23
LO C 25	526-51516	A-23
LO C 50	526-51113	A-23
LO C 8	526-51513	A-23
LPT 45 CML 5	527-51132	A-24
LR 100 RD-24-KFL5	532-51037	A-28
LR 100 RID-24-KFL5	532-51033	A-28
LR 100 WD-24-KFL5	532-51035	A-28
LR 100 WID-24-KFL5	532-51031	A-28
LR 130 RI-24-KFL5	532-51017	A-27
LR 130 WI-24-KFL5	532-51015	A-27
LR 132 RW-24-KFL5	532-51013	A-27
LR 132 WW-24-KFL5	532-51009	A-27
LR 32 R-24-KFL5	532-51003	A-26
LR 32 W-24-KFL5	532-51000	A-26
LR 5	543-11011	A-24
LR 50 RW-24-KFL5	532-51010	A-27
LR 50 WW-24-KFL5	532-51006	A-27
LR 56 R-24-KFL5	532-51004	A-26
LR 56 W-24-KFL5	532-51001	A-26
LR 70 R-24-KFL5	532-51005	A-26
LR 70 RD-24-KFL5	532-51036	A-28
LR 70 RID-24-KFL5	532-51032	A-24
LR 70 W-24-KFL5	532-51002	A-26
LR 70 WD-24-KFL5	532-51034	A-24
LR 70 WID-24-KFL5	532-51030	A-24
LR 74 RW-24-KFL5	532-51011	A-27
LR 74 WW-24-KFL5	532-51007	A-27
LR 75 RI-24-KFL5	532-51016	A-27
LR 75 WI-24-KFL5	532-51014	A-27
LR 90 RW-24-KFL5	532-51012	A-27
LR 90 WW-24-KFL5	532-51008	A-27
LS4-60-G-K	022-10773	A-33
LVLF6-M3	722-01003	529
LVLF6-M4	722-01004	529
LZS 08230-50	525-51122	A-31
LZS 13230-50	525-51123	A-31
LZS 18024-54	525-51124	A-31
LZS 18230-54	525-51125	A-31

Index

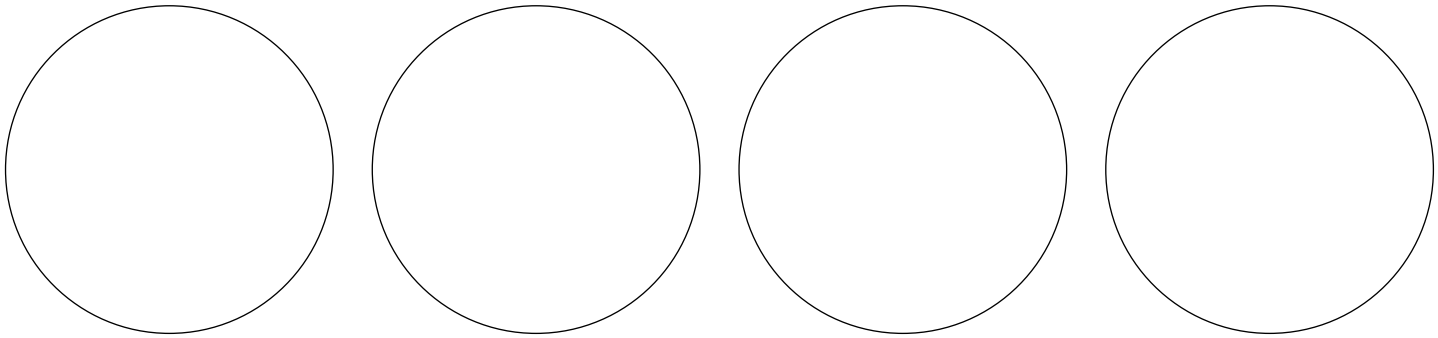
Part number	Article number	Page
LZS 18230-67	525-51126	A-31
LZS 36024-54	525-51127	A-31
MA 12	**041-01305**	**A-10**
MA 18	041-01304	A-10
MA 18 A	042-12825	A-11
MA 30	041-01303	A-11
MA 45	543-11001	A-13
MA 45 L	543-11013	A-13
MA F 55	579-50007	A-7
MA LR-100/112	543-11015	A-15
MA LR-18/112	543-11016	A-14
MA LR-23/112	543-11019	A-14
MA LR-26/112	543-11017	A-14
MA LR-50/112	543-11018	A-15
MB 10	903-05142	A-10
MB 10	903-05142	A-9
MB 12	903-05143	A-10
MB 3,5	903-50313	A-9
MB 4,5	903-50314	A-9
MB 45	543-11002	A-12
MB 6	903-05139	A-9
MB 7	903-05140	A-9
MB 8	903-05141	A-10
MB ST1	661-01002	A-12
MB ST1	661-01002	A-5
MBD F 25	661-01000	A-4
MBD F 25ST	661-01001	A-5
MBD F10	660-01001	A-4
MBD-S94	533-21000	A-8
MC 08	041-01306	A-10
MC 18	042-01528	A-11
MC 30	042-01527	A-11
MC 60	042-12820	A-14
MFC 12 NN4	968-21001	670
MFC 12 PP4	968-21000	670
MFF 12 NN4	968-51001	674
MFF 12 PP4	968-51000	674
MFI 12 NP4	968-21003	668
MFI 12 PN4	968-21002	668
MFT 12 NN4	968-11001	672
MFT 12 NN4 t:..	968-11003	672
MFT 12 PP4	968-11000	672
MFT 12 PP4 t:..	968-11002	672
MFU 12 N4	968-61001	678
MFU 12 P4	968-61000	678
MFW 12 NN4	968-11009	676
MFW 12 NN4 t:..	968-11011	676
MFW 12 PP4	968-11008	676
MFW 12 PP4 t:..	968-11010	676
MG 2A	543-11023	A-13
MG 45	543-11008	A-12
MK 45	543-11000	A-13
MK 45 L	543-11021	A-13
MP 45	543-11003	A-12
MP F 50	579-50003	A-7
MS F 10	660-01000	A-4

Part number	Article number	Page
MS F 20	558-41000	A-4
MS F 20-DIN	558-41001	A-6
MS F 50	579-50000	A-7
MS F 55	579-50010	A-7
MS F 80	820-41000	A-8
MS F 88-1	820-41001	A-8
MS F 88-2	820-41002	A-8
MS F 88-3	820-41003	A-8
MS M5-30	558-41012	A-11
MSP F 20-1	558-41004	A-5
MSP F 20-11	558-41006	A-5
MSP F 20-12	558-41007	A-6
MSP F 20-13	558-41008	A-6
MSP F 20-2	558-41005	A-6
MSP F 20-21	558-41009	A-6
MSP F 20-22	558-41010	A-6
MSP F 20-23	558-41011	A-5
MSP F 50	579-50005	A-7
MSP F 55	579-50011	A-7
MSP F 90	599-91002	A-8
MSP F 90 A	599-91003	A-8
MST 45-20	543-11005	A-12,A-5
MST 45-20	543-11005	A-5, A12
MST 45-30	543-11006	A-12,A-5
MST 45-30	543-11006	A-5, A12
MST 45-40	543-11007	A-12,A-5
MST 45-40	543-11007	A-5, A12
MZ 45	543-11004	A-12
MZ F 25	661-01003	A-15
PA L4M4-TI	**997-51465**	**A-37**
Q12-10m-G-PVC	**902-51658**	**A-33**
Q12-10m-W-PVC	902-51661	A-33
Q12-20m-G-PVC	902-51663	A-33
Q12-30m-G-PVC	902-51664	A-33
Q12-3m-G-PVC	902-51656	A-33
Q12-3m-W-PVC	902-51659	A-33
Q12-5m-G-PVC	902-51657	A-33
R1	**904-51532**	**A-16**
R10	904-51637	A-17
R10/2 (2xR10)	904-51636	A-17
R100 BC	904-51642	A-16
R128	904-51550	A-18
R1L	904-51559	A-19
R2-1LK	904-51587	A-19
R2-2LB	904-51586	A-19
R2-2LB1	904-51595	A-19
R3-2LB	904-51585	A-20
R3-2LK	904-51588	A-19
R3-2LK1	904-51596	A-19
R5	904-51533	A-16
R50 BC	904-51641	A-16
R5-8/L	904-51576	A-20
R5L	904-51543	A-20
R5L	904-51543	A-20
RD2	904-51534	A-17
RD-25 KL	904-51589	A-20

Part number	Article number	Page
RD2-G	904-51567	A-17
RD4	904-51535	A-17
RD46	904-51572	A-17
RD8	904-51531	A-17
Reflective tape	904-51548	A-22
RF 10	904-51536	A-18
RF 10C	904-51633	A-18
RF 250	599-91009	A-22
RF 250/V	904-51579	A-22
RF 600x115	904-51540	A-18
RF 775x … mm	904-51643	A-18
RF-30x100 KL	904-51592	A-20
RF-50 KL	904-51590	A-20
RL 250	904-51562	A-21
RL 250/V	904-51578	A-21
RL 460	904-51565	A-21
RL 540	904-51571	A-21
RL 660	904-51564	A-22
RL 700	904-51570	A-22
SG 12 T-00	688-51089	A-38
SG 12 T-02	688-51090	A-38
ST M12-12	994-51135	A-37
ST M12-12-M	994-51138	A-37
ST V10	543-11022	A-37
ST-05	997-51467	A-37
T-AS7T-12ET34PRD	**533-01008**	**A-39**
T-CS1T-12T34PRD	533-01007	202
UM 18-60/250-CD-HP	**690-51541**	**576**
UM 18-60/250-CD-HP-E	690-51542	576
UMT 30-1300-2PSD-L5	690-51564	583
UMT 30-1300-A-IUD-L5	690-51562	585
UMT 30-1300-PSD-L5	690-51563	583
UMT 30-3400-2PSD-L5	690-51564	587
UMT 30-3400-AE-IUD-L5	690-51566	589
UMT 30-3400-A-IUD-L5	690-51565	589
UMT 30-3400-PSD-L5	690-51563	587
UMT 30-350-2PSD-L5	690-51561	579
UMT 30-350-A-IUD-L5	690-51572	581
UMT 30-350-PSD-L5	690-51560	579
UMT 30-6000-2PSD-L5	690-51571	591
UMT 30-6000-A-IUD-L5	690-51569	593
UMT 30-6000-PSD-L5	690-51570	591
UT 12-370-A-IL4	690-10101	566
UT 12-370-PSL4	690-10100	564
UT 18-270-A-IL4	690-10103	570
UT 18-270-PSL4	690-10102	568
UT 18-750-A-IL4	690-10105	574
UT 18-750-PSL4	690-10104	572
UT 20-150-AIM4	693-11005	554
UT 20-150-AUM4	693-11004	554
UT 20-150-NSM4	693-11001	552
UT 20-150-PSM4	693-11000	552
UT 20-240-AIM4	693-11007	558
UT 20-240-AUM4	693-11006	558
UT 20-240-NSM4	693-11003	556
UT 20-240-PSM4	693-11002	556

Part number	Article number	Page
UT 20-700-AIM4	693-11011	562
UT 20-700-AUM4	693-11010	562
UT 20-700-NSM4	693-11009	560
UT 20-700-PSM4	693-11008	560
UT 20-S150-AIM4	693-11015	550
UT 20-S150-AUM4	693-11014	550
UT 20-S150-NSM4	693-11013	548
UT 20-S150-PSM4	693-11012	548
V10C-CO-A2-C	**535-91076**	**78**
V10C-CO-A2-W12	535-91074	74
V10C-CO-A2-W25	535-91075	76
V10C-CO-A2-W6	535-91073	72
V10C-CO-S2-W12	535-91072	70
V10C-CO-S2-W6	535-91071	68
V10-CR-A1-C	535-91033	140
V10-CR-A1-I25	535-91086	138
V10-CR-A1-R12	535-91026	136
V10-CR-A1-R12D	535-91028	136
V10-CR-A1-R25	535-91085	138
V10-CR-A1-R6	535-91025	134
V10-CR-A1-R6D	535-91027	134
V10-CR-A1-W12	535-91022	136
V10-CR-A1-W12D	535-91024	136
V10-CR-A1-W25	535-91084	138
V10-CR-A1-W6	535-91021	134
V10-CR-A1-W6D	535-91023	134
V10-CR-S1-I12	535-91043	132
V10-CR-S1-I12D	535-91045	132
V10-CR-S1-I6	535-91042	130
V10-CR-S1-I6D	535-91044	130
V10-CR-S1-R12	535-91039	132
V10-CR-S1-R12D	535-91041	132
V10-CR-S1-R6	535-91038	130
V10-CR-S1-R6D	535-91040	130
V10-CR-S1-W12	535-91035	132
V10-CR-S1-W12D	535-91037	132
V10-CR-S1-W6	535-91034	130
V10-CR-S1-W6D	535-91036	130
V10-EYE-A1-C	537-91004	116
V10-EYE-A1-I12	537-91006	114
V10-EYE-A1-I6	537-91005	112
V10-EYE-A1-R12	537-91003	114
V10-EYE-A1-R6	537-91002	112
V10-EYE-A1-W12	537-91001	114
V10-EYE-A1-W6	537-91000	112
V10-OB-A1-C	535-91005	78
V10-OB-A1-I12	535-91007	75
V10-OB-A1-I12D	535-91020	75
V10-OB-A1-I25	535-91018	76
V10-OB-A1-I6	535-91006	73
V10-OB-A1-I6D	535-91019	73
V10-OB-A1-R12	535-91004	74
V10-OB-A1-R12D	535-91017	74
V10-OB-A1-R25	535-91015	76
V10-OB-A1-R6	535-91003	72
V10-OB-A1-R6D	535-91016	72

Part number	Article number	Page
V10-OB-A1-W12	535-91002	74
V10-OB-A1-W12D	535-91014	74
V10-OB-A1-W25	535-91012	76
V10-OB-A1-W6	535-91001	72
V10-OB-A1-W6D	535-91013	72
V10-OB-S1-R12	535-91011	70
V10-OB-S1-R6	535-91010	68
V10-OB-S1-W12	535-91009	70
V10-OB-S1-W6	535-91008	68
V10-SO-A1-I12	535-91054	104
V10-SO-A1-I6	535-91053	102
V10-SO-A1-W12	535-91052	104
V10-SO-A1-W6	535-91051	102
V10-SO-S1-W6	535-91049	100
V20C-CO-A2-C	536-91021	66
V20C-CO-A2-W12	536-91020	64
V20C-EYE-A2-C	537-91015	110
V20C-EYE-A2-W12	537-91014	108
V20-CR-A2-C	536-91000	124
V20-CR-A2-I12	536-91003	122
V20-CR-A2-R12	536-91002	122
V20-CR-A2-U12	536-91019	122
V20-CR-A2-W12	536-91001	122
V20-CR-P2-C	536-91004	128
V20-CR-P2-I12	536-91007	126
V20-CR-P2-R12	536-91006	126
V20-CR-P2-W12	536-91005	126
V20-EYE-A2-C	537-91007	110
V20-EYE-A2-I12	537-91010	108
V20-EYE-A2-R12	537-91009	108
V20-EYE-A2-W12	537-91008	108
V20-OB-A2-C	536-91010	84
V20-OB-A2-I12	536-91013	82
V20-OB-A2-R12	536-91012	82
V20-OB-A2-W12	536-91011	82
VFT M1	533-01010	A-24



Type key

V 10 - OB - A 1 - W 12 D

V = Vision sensor

Resolution
10 = WVGA monochrom
20 = SXGA monochrom
10C = WVGA color
20C = SXGA color

Functionality
OB = Object
CO = Color
CR = Code Reader
SO = Solar
EYE = Eyesight

Performance
S = Standard
A = Advanced
P = Professional

Version

Depth of field (optional)
" "= depth of field = normal
D = depth of field = enhanced

Lens
6 = 6 mm
12 = 12 mm
25 = 25 mm
C = C-mount

Illumination
W = white LEDs
R = red LEDs
I = infrared LEDs
U = UV LEDs

FT 10 - RLH - PS - E4

Functional principle
FT = Photoelectric proximity switch
FR = Retroreflective photoelectric sensor
FE = Through-beam photoelectric sensor, receiver
FS = Through-beam photoelectric sensor, transmitter

Series
F 10

Sensor features
RL = red light laser, teach-in
RLH = red light laser with background suppression, teach-in
RLHR = red light laser with background suppression, teach-in, wide light spot
B-RLF1 = red light, fixed focus with background suppression, 15 mm (basic)
B-RLF2 = red light, fixed focus with background suppression, 30 mm (basic)

Connection
E4 = plug, M5, 4-pin
K4 = cable, 2 m, 4-wire
KM3 = pigtail, 200 mm, M8, 3-pin
KM4 = pigtail, 200 mm, M8, 4-pin

Switching output
PS = PNP, N.O. (default)
NS = NPN, N.O. (default)

FT 25 - RHD - PNS - M4M

Functional principle

FT = Photoelectric proximity sensor
FR = Retroreflective photoelectric sensor
FE = Through-beam photoelectric sensor, receiver
FS = Through-beam photoelectric sensor, transmitter

Series

F 25

Sensor features

C = red/green/blue colour sensor, teach-in
R = red light, teach-in
RA = red light distance sensor, teach-in
RL = red light laser, teach-in
RLO = red light laser, autokollimation principle, teach-in
RH = red light with background suppression, teach-in
RHD = red light with background suppression, teach-in, long scanning distance
RLH = red light laser with background suppression, teach-in
W = white light, teach-in
RGB = red/green/blue, teach-in
RGO = red light, for transparent objects, autocollimation principle, teach-in
RGO2 = red light, autocollimation principle, teach-in
RF1 = red light, fixed focus with background suppression, 60 mm
RF2 = red light, fixed focus with background suppression, 80 mm
RF = fixed setting

Connection

M4 = plastic plug, M8, 4-pin
M3M = metal plug, M8, 3-pin
M4M = metal plug, M8, 4-pin
K4 = cable, 2 m, 4-wire
KL4 = pigtail, 150 mm, M12, 4-pin

Switching output

PS = PNP, N.O. (default)
NS = NPN, N.O. (default)
PNS = auto-detect (PNP / NPN), N.O. (default)
GS = push-pull, N.O. (default)

FT 55 - RH - PS - L4

Functional principle

FT = Photoelectric proximity sensor
FR = Retroreflective photoelectric sensor
FE = Through-beam photoelectric sensor, receiver
FS = Through-beam photoelectric sensor, transmitter

Series

F 55

Sensor features

R = red light, teach-in
RL = red light laser, teach-in
RLO = red light laser, autokollimation principle, teach-in
RL2 = red light laser (Laser Class 2), teach-in
RH = red light with background suppression, potentiometer, long scanning distance
B-RH = red light with background suppression, potentiometer (basic)
RLH = red light laser with background suppression, potentiometer
RL2H = red light laser (Laser Class 2) with background suppression, potentiometer
RHM = red light with background suppression, metal housing, teach-in
RM = red light, metal housing, teach-in

Connection

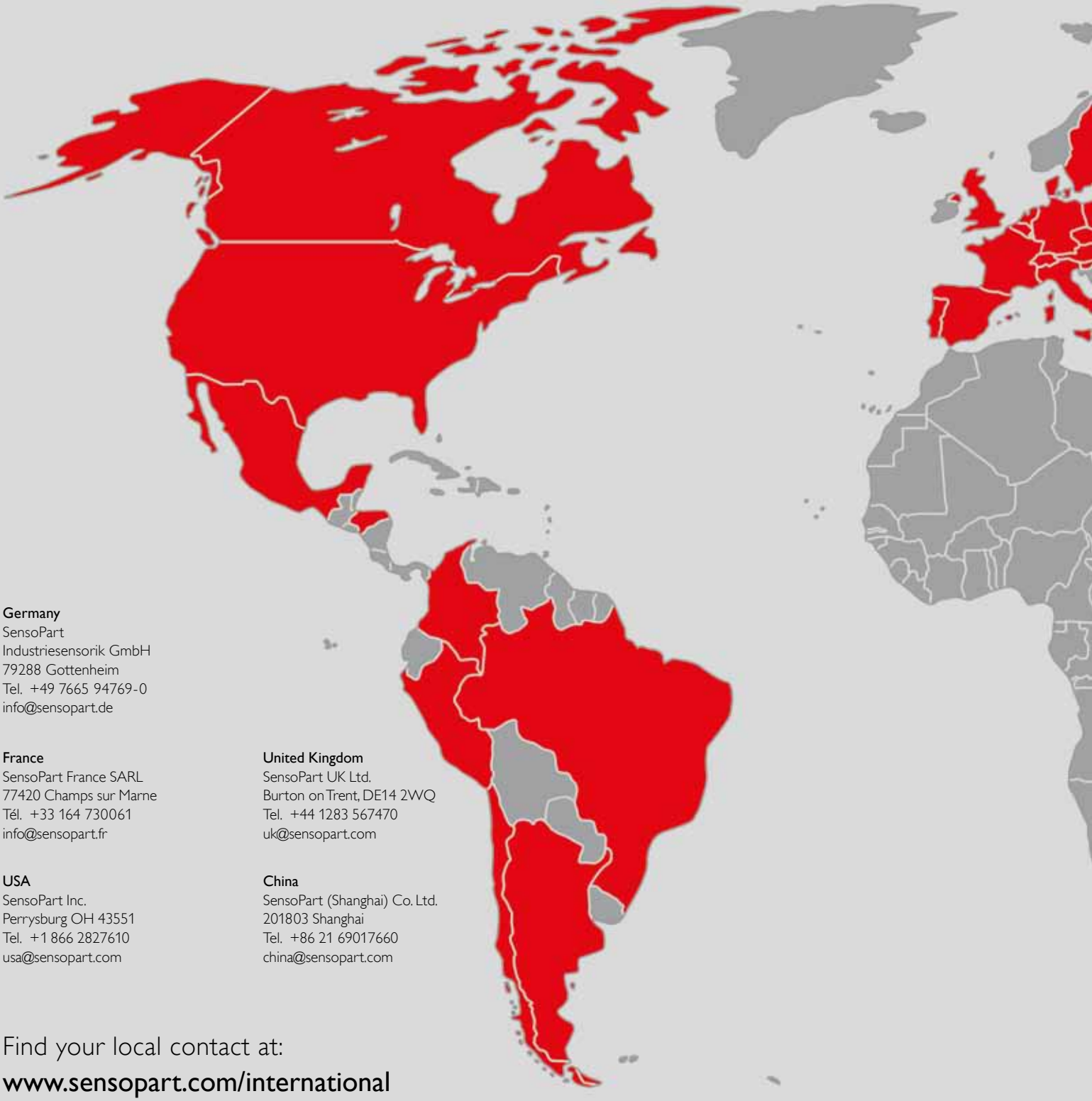
L4 = plug, M12, 4-pin
K4 = cable, 3 m, 4-wire

Switching output

PS = PNP; S = N.O. (default)
NS = NPN; S = N.O. (default)

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Wherever you are, SensoPart is nearby.



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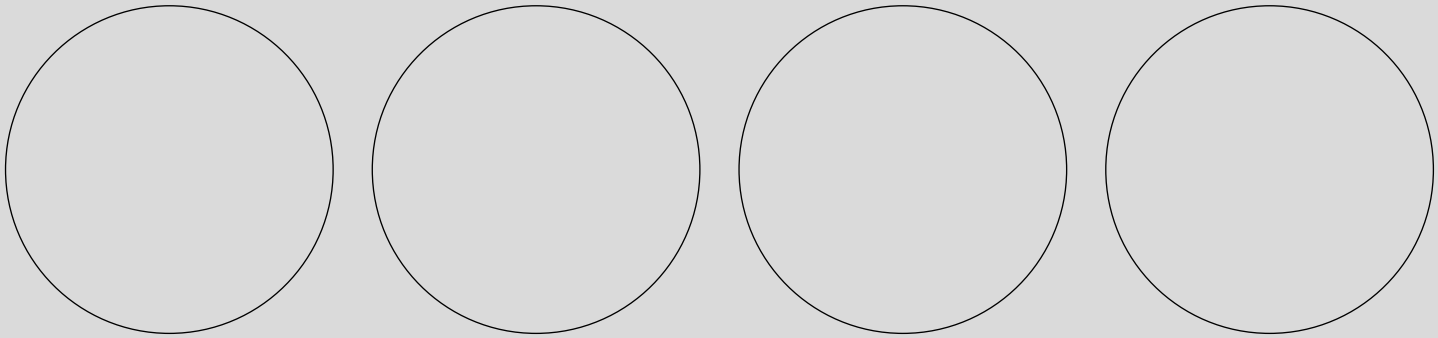
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The "General Conditions for the Supply of Products and Services of the Electrical and Electronics Industry (Green Terms of Delivery)", June 2011 version, issued by the Central Association of the German Electrical and Electronics Industry (ZVEI) apply. They are available for downloading at www.sensopart.com.

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