SENSOPART

The Complete Catalogue

VISOR® and sensors for factory automation

UPDATE

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.*

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New Products

VISOR® object sensor V20 Advanced

from Page 98

Vision sensor with 1.3 megapixel for object detection and classification

- *Real-world engineering units and robot coordinates at a mouse click*
- *Correction of perspective and lens distortion*

VISOR® Vision SensoWeb

from Page 54

Visualisation of images and results via web browser

- *Simple integration into plant visualisation via web browser*
- *Language selectable*
- *Available for all VISOR® vision sensors*

VISOR® Allround Professional

from Page 72

New illumination method (multishot) in combination with VISOR® vision sensors

- *Resolution of minimum height structures, suppression of backgrounds*
- *Reading of embossed or recessed fonts, codes etc.*
- *Recognition of surface defects*

Versatile vision experts – VISOR® vision sensors

Visualisation of images and results via web browser - VISOR® vision sensor SensoWeb

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

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

New illumination method (multishot) – VISOR® Allround Professional

Dancer roll regulation – FT 25-R(L)A

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

Specialist proves to be an all-rounder – F 10 Bluelight

Bluelight sensors

from Page 358

Background proximity senor (BGS) with blue light for difficult object detection

- *First adjustable bluelight BGS sensor on the market - FT 55-BH*
- *Fixed focus variant in a miniature housing with real background suppression from 90 mm*
- *Reliable detection of highly transparent or strongly light-absorbing objects*

FT 25-RLA – sub-mininiature distance sensor

from Page 192

For robotic applications, small part measurement and regulatory tasks thanks to high repeatability

- *Smallest laser triangulation sensor on the market*
- *Operating range (scanning distance) from 20 mm to 100 mm*
- *Simple integration thanks to small housings*
- *Analogue output 1 … 10 V*

FT 25 C – second generation miniature colour sensor

from Page 242

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

- *Reliable detection of taught-in colour*
- *Very small and precise light spot for the detection of the smallest of marks*
- *„Communicating" light spot for simplest setup*

F 55 – time-of-flight sensors

from Page 212

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*
- *IO-Link for user-friendly installation and parameterisation*

made in Germany

Product news		
	Special features	Page
VISOR® Object sensor V20 Advanced	Vision sensor for object detection and classification with 1.3 megapixel	98
VISOR® Vision Sensor SensoWeb	Visualisation of images and results via web browser	54
VISOR® Allround Professional	New illumination method (multishot) in combination with VISOR® vision sensors	72
F 25/55 – Bluelight	Very high detection efficiency for extremely dark objects, transparent objects and large scanning angles	358
FT 25-RLA – miniature distance sensor	Laser distance sensor with high repeatability for robotic applications, small part measurement and many regulatory tasks	192
FT 25 C – second generation miniature colour sensor	Smallest colour sensor with a high switching frequency of ≤10 kHz for rapid applications	242
F 55 – time-of-flight sensors	Compact sensors for distance measurement and object detection at long distances IO-Link	212

Product overview – vision sensors and systems

Features/sensors	VISOR® Allround			VISOR® Object Sensor	
	V10 / V20 Advanced	V10C / V20C Advanced	V20 Professional	V10 Standard	V10 / V20 Advanced
Highlights	Object detection and identification			Object detection and classification	
	–	Colour area	–		
	–	Colour list	–		
	–	Colour value	–		
	Data code	Data code	Data codes		
	Bar code	Bar code	Bar codes		
	Optical character recognition (OCR)	Optical character recognition (OCR)	Optical character recog-nition (OCR)		
	–	–	Multishot		
Functions					
Resolution in pixels V10	736 x 480 Mono	736 x 480 Colour	–	736 x 480 Mono	736 x 480 Mono
Resolution in pixels V20	1280 x 1024 Mono	1280 x 1024 Colour	1280 x 1024 Mono	–	1280 x 1024 Mono
Image rate per second V10 | V20	50 | 40	40 | 20	– | 40	50 | –	50 | 40
Number of jobs | detectors	max. 255 | max. 255	max. 255 | max. 255	max. 255	8 | 32	max. 255 | max. 255
Position tracking	✓	✓	✓	✓	✓
Calibration	✓	✓	✓	–	✓
Contour matching (X-, Y-translation, rotation)	✓	✓	✓	✓	✓
Pattern comparison (X-, Y-translation)	✓	✓	✓	✓	✓
BLOB	✓	✓	✓	–	✓
Calliper	✓	✓	✓	–	✓
Grey threshold	✓	✓	✓	✓	✓
Contrast	✓	✓	✓	✓	✓
Brightness	✓	✓	✓	✓	✓
Freeform tool	✓	✓	✓	Contour only	✓
Interfaces					
Inputs | outputs	2 | 4	2 | 4	2 | 4	2 | 4	2 | 4
Freely definable switching outputs/inputs, PNP or NPN	4	4	4	2	4
Encoder input	✓	✓	✓	–	✓
I/O expansion	✓	✓	✓	–	✓
RS 422 | RS 232	✓ | ✓	✓ | ✓	✓	– | –	✓ | ✓
Ethernet	✓ | ✓	✓ | ✓	✓	✓	✓
EtherNet/IP	✓ | ✓	✓ | ✓	✓	✓	✓
PROFINET	✓ | ✓	✓ | ✓	✓	✓	✓
SensoWeb	✓	✓	✓	✓	✓
Lens					
V10 integrated, 6 mm | 12 mm | 25 mm	✓ | ✓ | ✓	✓ | ✓ | ✓	–	✓ | ✓ | –	✓ | ✓ | ✓
V20 integrated, 12 mm	✓	✓	✓	–	✓
C-mount	✓	✓	✓	–	✓

VISOR® Color		VISOR® Code Reader			VISOR® Solar Sensor	
V10C Standard	V10C / V20C Advanced	V10 Standard	V10 / V20 Advanced	V20 Professional (OCR)	V10 Standard	V10 / V20 Advanced
Improved object detection through additional colour information		Code reading			Positioning and inspecting solar cells	
Colour area	Colour area				Wafer position and breakouts	Wafer position and breakouts
–	Colour list					
–	Colour value				–	Busbar position and number
		Data code	Data code	Data code		
		Bar code	Bar code	Bar code		
		–	–	Optical character recognition (OCR)		
736 x 480 Colour	736 x 480 Colour	736 x 480 Mono	736 x 480 Mono	–	736 x 480 Mono	736 x 480 Mono
–	1280 x 1024 Colour	–	1280 x 1024 Mono/ Colour	1280 x 1024 Mono/ Colour	–	1280 x 1024 Mono
40 | –	40 | 20	50 | –	50 | 40	– | 40	50 | –	50 | 40
8 | 32	max. 255 | max. 255	8 | 2	max. 255 | max. 255	max. 255 | max. 255	8 | 32	max. 255 | max. 255
✓	✓	–	✓	✓	–	✓
–	✓	–	–	–	–	–
✓	✓	–	–	–	–	–
–	✓	–	✓	✓	–	✓
–	✓	–	–	–	–	–
–	✓	–	–	–	–	✓
–	✓	–	✓	✓	✓	✓
✓	✓	–	✓	✓	✓	✓
–	✓	–	✓	✓	✓	✓
–	✓	–	✓	✓	–	✓
2 | 4	2 | 4	2 | 4	2 | 4	2 | 4	2 | 4	2 | 4
2	4	2	4	4	2	4
–	✓	–	✓	✓	–	✓
–	✓	✓	✓	✓	–	✓
– | –	✓ | ✓	✓ | ✓	✓ | ✓	✓ | ✓	– | –	✓ | ✓
✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓
✓	✓	✓	✓	✓	✓	✓
✓ | ✓ | –	✓ | ✓ | ✓	✓ | ✓ | ✓	✓ | ✓ | ✓	–	✓ | – | –	✓ | ✓ | –
–	✓	–	✓	✓	–	✓
–	✓	–	✓	✓	–	✓

Product overview – Eyesight vision systems

Features/system	Eyesight vision systems	
	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 programmes	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, callipers, calculate angle, determine warpage point	
Programme control	Stop watch, control of sequence and loop options, subprogramme, 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	✓	✓

More information from page	146

Overview of commands: Eyesight vision systems

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
- Calliper (hor./vert.)
- Calliper (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

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 mm				
F 25 34 x 20 x 12 mm		FT 25-RLA | **20–100 mm** 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 mm		FT 55-RLAP | **5 m** FR 55-RLAP | **70 m** FT 55-RLAP2 | **5 m** FR 55-RLP | **70 m**		FT 55-RL | **1,200 mm** FT 55-R | **2,000 mm**
F 20 32 x 20 x 12 mm				
F 50 50 x 50 x 17 mm		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-C-UV | **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 mm		FL 70-RA-xD | Proximity switch **310 mm** P/E switch **810 mm**		
F 80 83 x 65 x 25 mm **F 90** 95 x 93 x 42 mm		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		188	236	268

= Display = Potentiometer = Transparent objects/glass = PC = Teach-in
= Bluelight = Laser Lasernorm IEC 60825-1:2014 = IO-Link

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Proximity switches with background suppression (BGS) / with foreground suppression (FGS)	Photoelectric reflex switches	Through-beam photoelectric switches	Fibre-optic sensors	Page
FT 10-RLH | **60 mm** FT 10-B-RLF | **15/30 mm** FT 10-RH | **70 mm** FT 10-RF | **15/30/50 mm** FT 10-BF | **30/50 mm**	FR 10-RL | **2 m** FR 10-R | **1,6 m**	FS/FE 10-RL | **3 m**		276
FT 25-RLH | **120 mm** FT 25-RH | **200 mm** FT 25-RHD | **400 mm** FT 25-RF | **60/80 mm** FT 25-RV (FGS) | **200 mm**	FR 25-RL | **13 m** FR 25-R | **6 m** FR 25-RF | **3 m** FR 25-RGO | **2 m** FR 25-RLO | **4 m**	FS/FE 25-RL | **18 m** FS/FE 25-R | **13 m** FS/FE 25-RF | **4 m**		192 242 296
FT 55-RLH | **800 mm** FT 55-RLH2 | **1.000 mm** FT 55-B-RH | **800 mm** FT 55-RH | **1.200 mm** FT 55-BH | **1.200 mm** FT 55-RLHP2 | **5 m**	FR 55-RL | **12 m** FR 55-R | **12 m** FR 55-RLO | **20 m**	FS/FE 55-RL | **25 m** FS/FE 55-R | **20 m**		210 348
			FL 20-R | Proximity switch **100 mm** P/E switch **1.000 mm**	444
FT 50-RLH | **150 mm** FT 50-RLHD | **300 mm** FT 50-RH | **300 mm** FT 50-IH | **600 mm**	FR 50-RL | **20 m** FR 50-R | **5,5 m**	FS/FE 50-I | **15 m**		200 246 332
FT 12-RH | **60 mm** FT 12-RF | **24 mm** FMH 18 | **120 mm**	FR 12-R | **1,5 m** FR 18-2-R | **3 m** FR 18-2-IR | **3,6 m**	FS/FE 12-RL | **5 m** FS/FE 12-R | **4 m** FS/FE 18-RL | **50 m** FS/FE 18-R | **20 m** FLS/FLE 18-W | **50 m** FSE 18-2-I | **10 m**	FMS 18-U | Proximity switch **160 mm** P/E switch **700 mm** FMS 30-U | Proximity switch **800 mm** P/E switch **4.800 mm** FAV 30 | **500 mm**	400
			FL 70-R | Proximity switch **310 mm** P/E switch **810 mm** FL 70-R-xD | Proximity switch **310 mm** P/E switch **810 mm**	450
FT 92-IL				208 216 228
		FGL-RK /-IK | **30 – 120 mm** FGL 5-IK | **5 mm** FGL | **5 – 220 mm** FG | **40 – 120 x 80 mm²**		544
268	268	268	440	

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	560
UT 12		Via control input	400 mm	PNP, NPN, analogue output	576
UT/UM 18		Via control input	250 mm / 300 mm / 800 mm	Variants with stainless steel housings, PNP, NPN, analogue output	580
UMT 30		Teach-in or display	350 mm / 1300 mm / 3400 mm / 6000 mm	Display, PNP, 2 x PNP or analogue output	590

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	612
IS 33		Cylindrical Ø 3 mm	0.6 mm	PNP, NPN	620
ISN 44-20 IS 34 IT 4		Cylindrical Ø 4 mm	0.8 mm	PNP, NPN, NAMUR, stainless steel housing	621
IMT 5		Cylindrical Ø 5 mm	0.8 mm	PNP, NPN, stainless steel housing	624
ISZ 46 IS 46 / 56 IDT 6		Cylindrical Ø 6,5 mm	1.5 mm / 2 mm / 3 mm	PNP, NPN	625
IS 48 / 58 IMT 8		Cylindrical Ø 8 mm	1.5 mm / 2 mm / 3 mm / 6 mm	PNP, NPN	629
IMT 12 IT 12 IS 512		Cylindrical Ø 12 mm	2 mm / 4 mm / 6 mm / 10 mm	PNP, NPN	636
IS 514		Cylindrical Ø 14 mm	3 mm	PNP, stainless steel housing	643
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	644
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	651
IS 512 / 518		Cylindrical Ø 12 mm / 18 mm analogue	6 mm / 10 mm	Analogue output	641

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Capacitive Sensors

Products		Installation	Adjustment	Switching distance	Page
KD / KL 06		Flush / non-flush	Potentiometer	0.1 … 1.5 / 0.1 … 3 mm	666
KD / KL 08		Flush / non-flush	Potentiometer	0.1 … 1.5 / 0.1 … 3 mm	668
KD / KL 12		Flush / non-flush	Potentiometer	1 … 4 / 1 … 8 mm	670
KD / KL 18		Flush / non-flush	Potentiometer	2 … 8 / 2 … 15 mm	672
KD / KL 30		Flush / non-flush	Potentiometer	1 … 20 / 1 … 30 mm	674

SmartPlug

Products		Special features	Page
MFI (Inverter)		Inverts NPN to PNP or PNP to NPN devices, N.C./N.O. also adjustable	680
MFC (Counter)		Adjustable counter (pulses or intervals) between 1 … 65535	682
MFT (Timer)		Adjustable on-delay or drop-out delay between 1 … 65535 ms	684
MFF (Frequency)		Adjustable frequency monitoring between 15 … 1000 Hz	686
MFW (Wipe Function)		Adjustable wipe function for falling or rising edges; time range 1 … 65535 ms	688
MFU (Universal)		All-in multifunctional switching device programmable via USB	690

Accessories

Products		Description	Page
Mechanical accessories		Brackets for sensors	A-4
		Mountings for VISOR® and illumination	A-14
Optical accessories		Reflectors and reflective tape	A-18
		Lenses and protective casings	A-27
		Illumination	A-27
Electrical accessories		Cables	A-38
		Converters	A-42
		Power supply units, switching devices and Panel Viewer	A-43

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 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. Here the future concepts of **Industry 4.0** are playing an important role for us. Some of them have already been implemented with our products.

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
- **2004** Founding of SensoPart Inc., USA
- **2004** 1st 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

2005 Extension building in Gottenheim

2006 Baden-Württemberg Innovation Prize

2008 "Top 100" Innovation Prize

2009 Freiburg Innovation Prize

2012 Founding of SensoPart China

2014 20 years of SensoPart

2014 Automation Award

2016 Ground-breaking ceremony for the new production and logistics building in Gottenheim

Innovations made in Germany

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

Those entering the SensoPart building 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 of photoelectric sensors with laser proximity sensor with highly precise, adjustable background, in plastic housings (IP 69K) and long scanning distances

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

2015
F 10 Bluelight: Blue LEDs with extra reliable detection with very dark or transparent objects

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

- **Automotive and supplier industries**
- **Machine and plant construction**
- Food and beverages industries
- Pharmaceutical and cosmetics industries
- **Assembly and handling**
- Print industry

Applications

- 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**
- **Robotics**
- Solar industry
- Laboratory automation
- **Plastics industry**

- Product labelling and identification
- Distance measurement
- Automated product tracking (Track & Trace)
- Measurement of parts
- Colour detection

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.

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.

www.sensopart.com/service

- Working out customer-specific solutions
- Product training on site or at SensoPart
- Application support (telephone, online, on site)
- Rapid replacement and repair

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.

SENSOPART

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.

IP 69k

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.

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 or die-cast aluminium) 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.

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, F 25 and F 55 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 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

PROFI NET

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 programme offers a simple and comprehensible design. One need not be an image-processing expert!

Visualisation of images and results via web browser - VISOR® vision sensor SensoWeb

Sectors and applications

The best solution for you

Object detection

from Page 36

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

Position/ orientation detection

from Page 40

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

Measurement

from Page 42

- *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 44

- *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 46

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

Applications for the solar sector

from Page 48

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

Transparent objects

from Page 49

- *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.

Versatile vision experts – VISOR® vision sensors.

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 96

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 96

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 146

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

Baggage distribution
Page 342

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

Pick & Place without programming
Page 96

In order to pick up a component, a robot needs to know the part's exact position, particularly in relation to the robot's own coordinate system. Instead of programming the conversion of sensor coordinates into robot coordinates in the control system, which can be a time-consuming process, this can now be done in the VISOR® configuration software in just a few mouse clicks. This represents a significant boost in efficiency when setting up pick & place applications!

- Simple conversion of pixels into robot coordinates
- Correction for image distortions
- Full automation of calibration process
- Exact part position in robot coordinates

Object detection

Checking presence, inspecting completeness, counting and sorting

Checking the presence of small parts on a vibrating feeder
Page 448

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

Counting parts on a vibrating feeder
Page 540

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 366

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 446

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 298

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 310

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

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 278

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)
- Precise switching behaviour due to small laser light spot (Laser Class 1)

Object front-edge detection
Page 302

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 298

The fine light beam of the **FT 25-RLH laser sensor** permits precise detection of even small objects such as IC pins.

- 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 90** 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 VISOR® vision sensor is available for detailed inspections of dimensional accuracy. It can be calibrated at a mouse click thanks to the **VISOR® calibration plate**, and any image errors or distortions are automatically corrected. For more complex tasks, use the Eyesight vision system with a function library of over 100 functions.

VISOR® calibration plate
Automatic correction of image errors and distortions for a precise positioning, measurement and checking.

Measurement of turned parts on a rotary table
Page 96

Turned parts can be inspected for dimensional accuracy with the **VISOR® vision sensor.**

- Compact hardware, optionnally available with C-Mount lens and protective tube
- Appropriate illumination (surface light) for high process reliability
- Powerful part-finding and tracking
- Caliper function for the reliable measurement of distances
- Calibration in millimeters with distortion correction at a mouse click using the VISOR® calibration plate

Monitoring the sag of carpets
Page 560

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 230

The **FR 90 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 200

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 200

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 246

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 114

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 260

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 266

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)
- 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 158

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.

Mulitshot: Recognition of indentations and bumps on even surfaces
Page 158

With the **multishot function**, four images are captured in sequence, each illuminated from another direction. By combining the four images in one single image, a pseudo height image can be created. This method is particularly suitable for the detection of indentations and bumps on even surfaces, e.g. stamped fonts, codes or surface defects.

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 132

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 illumination necessary
- Measurement of wafers
- Position and orientation of busbars

Checking presence of wafers
Page 276 / Page 198

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)
- 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 sensitivity. SensoPart offers special retroreflective photoelectric sensors **(FR 25-RGO),** ultrasonic sensors (**UT 20, UT 20 Soundpipe, UMT 30** and cylindrical housings) as well as BGS sensors with blue transmission LED **(FT 10-BF2/-BF3, FT 25-BF2, FT 55-BH)** 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 312

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 556

UT 20 Soundpipe ultrasonic sensors in cuboid housings and the **UMT 30 ultrasonic sensor** as well as the **BGS sensors with blue transmission LED** 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® Allround
from Page 66

V20-All-A2-R12
- *All evaluations ("Detectors") of object sensor and code reader united in one device*

>> Page 68

V20C-All-A2-W12
- *All evaluations ("Detectors") of object sensor , colour sensor and code reader united in one device*

>> Page 76

VISOR® Object Sensor
from Page 96

V10-OB-S1-W12
- *Standard version configurable for 8 inspection tasks, up to 32 evaluations can be used for each inspection task*

>> Page 104

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

>> Page 98

VISOR® Color
from Page 114

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

>> Page 122

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

>> Page 116

VISOR® Solar Sensor
from Page 132

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

>> Page 138

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

>> Page 140

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*

Eyesight Vision Systems
from Page 146

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

>> Page 150

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

>> Page 156

VISOR® Code Reader
from Page 158

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 182

V20-CR-P2-R12
- *Professional version with optical character reading (OCR)*
- *Megapixel resolution*

>> Page 168

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® Allround

System description

VISOR® Allround – Object detection in colour plus identification united in one device

The VISOR® Allround is the latest member in the VISOR family and a real multi-talent among vision sensors. In the new allround version, the device unites the functions of the object sensor (i.a. calibration, pattern matching, contour, calliper, BLOB) with the powerful tools of the code reader (bar code, datamatrix and optical character recognition). When feeding parts in correct alignment or positioning components, additional datamatrix codes for example can now also be read. With a resolution of up to 1.3 mega-pixel even the smallest details are reliably detected and evaluated.
In addition to the monochrome version, the VISOR® Allround is also available as a colour version with up to 1.3 megapixel. Thus additional "Detectors" are available for colour evaluation. Even the subtlest nuances in shade can be reliably detected. The relevant object colours, for example, can be taught-in quite simply by push of a button or - thanks to the intuitive colour histogram - set graphically for each channel in the colour space. The authorised colour tolerances can be defined by the user.

Special image filters for image pre-processing can be used, e.g. to highlight edges or to suppress distracting details.

Communication interfaces

In addition to EtherNet/IP and TCP/IP, the VISOR® vision sensors also support the fieldbus standard Profinet IO and thus "understand" the most common communication standards of Industrial Ethernet. Thanks to freely available PLC function blocks for Siemens S7, Codesys and Allen Bradley, the VISOR® can also be easily and flexibly connected to PLC environments.
The new VISOR® Allround is thus one of the most powerful vision sensors in the market.

Product variants: the VISOR® Allround

Features/sensors	V10/V20 Advanced	V10C/V20C Advanced	V20 Professional
Functions			
Resolution V10 in pixels	736 x 480 Mono	736 x 480 Colour	–
Resolution V20 in pixels	1280 x 1024 Mono	1280 x 1024 Colour	1280 x 1024 Mono
Image rate per second V10 | V20	50 | 40	40 | 20	– | 40
Number of jobs | detectors	max. 255 | max. 255	max. 255 | max. 255	max. 255
Mulitshot	–	–	✓
Position tracking	✓	✓	✓
Calibration	✓	✓	✓
Contour (X-,Y-translation, rotation)	✓	✓	✓
Pattern comparison (X-,Y-translation)	✓	✓	✓ ✓
BLOB	✓	✓	✓
Calliper	✓	✓	✓
Grey threshold	✓	✓	✓
Contrast	✓	✓	✓
Brightness	✓	✓	✓
Colour area	–	✓	–
Colour list	–	✓	–
Colour value	–	✓	–
Data code	✓	✓	✓
Bar code	✓	✓	✓
Optical character recognition (OCR)	✓	✓	✓
Freeform Tool	✓	✓	✓
Interfaces			
Inputs | outputs	2 | 4	2 | 4	2 | 4
Freely definable switching outputs/ inputs, PNP or NPN	4	4	4
Encoder input	✓	✓	✓
I/O expansion	✓	✓	✓
RS232 | RS422	✓ | ✓	✓ | ✓	✓
Ethernet/data transmission	✓ | ✓	✓ | ✓	✓
EtherNet/IP	✓ | ✓	✓ | ✓	✓
PROFINET	✓ | ✓	✓ | ✓	✓
SensoWeb	✓	✓	✓
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 **Result window:** Overview of all results.

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

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 ("job") 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 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 „SensoView" with hierarchical user rights (reliably preventing unintentional changes to the configuration) is available for this. "SensoWeb" enables a simple integration into the plant visualisation via web browser. Professional image processing can be this simple and comfortable!

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 x 480	736 x 480
Resolution V20 in pixels	–	1280 x 1024
Image rate per second V10 | V20	50 | –	50 | 40
Number of jobs | detectors	8 | 32	max. 255 | max. 255
Position tracking	Contour only	✓
Calibration	–	✓
Contour (X-, Y-translation, rotation)	✓	✓
Pattern comparison (X-, Y-translation)	✓	✓
BLOB	–	✓
Calliper	–	✓
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	✓	✓
PROFINET	✓	✓
SensoWeb	✓	✓
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 only	✓
Calibration	–	✓
Contour (X-, Y-translation, rotation)	✓	✓
Sample comparison (X-, Y-translation)	–	✓
BLOB	–	✓
Calliper	–	✓
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	✓	✓
PROFINET	✓	✓
SensoWeb	✓	✓
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
- Finds breakouts from depth
- 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, V10	736 x 480	736 x 480
Resolution in pixels, V20	–	1280 x 1024
Image rate per second V10/V20	50 | –	50 | 40
Number of jobs | detectors	8 | 32	255 | 255
Position tracking	–	✓
Pattern comparison (X-, Y-translation)	–	✓
Grey threshold	✓	✓
Contrast	✓	✓
Brightness	✓	✓
Wafer position and breakouts	✓	✓
Busbar position and number	–	✓
Calliper	–	✓
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	✓	✓
PROFINET	✓	✓
SensoWeb	✓	✓
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 differently shaped breakouts

D **Holes:** reject wafers with holes

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

Eyesight vision systems

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 systems offer 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 of function blocks via drag & drop
- 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 systems

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 programmes	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 64	See overview of commands >> Page 64	See overview of commands >> Page 64	See overview of commands >> Page 64
Interfaces	2 | 4	2 | 4	2 | 4	2 | 4
Inputs | outputs	4	4	4	4
Freely definable switching outputs/inputs	✓	✓	✓	✓
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 systems

System description

Overview of commands: Eyesight vision systems

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
- Calliper (hor./vert.)
- Calliper (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 systems

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® Allround

Advanced allround vision sensor for complex inspection tasks.

VISOR® Allround – Object detection in colour plus identification united in one device.
The VISOR® Allround is the latest member in the VISOR family and a real multi-talent among vision sensors. In the new allround version, the device unites the functions of the object sensor (i.a. calibration, pattern matching, contour, calliper, BLOB) with the powerful tools of the code reader (bar code, datamatrix and optical character recognition).

HIGHLIGHTS OF VISOR® ALLROUND

- All evaluations ("Detectors") of object sensor and code reader united in one device
- Highly accurate evaluation via 1.3 megapixel chip
- Real-world engineering units and robot coordinates at a mouse click
- Precise determination of X/Y position, orientation and tracking
- Can be used for all common 2D-Codes (ECC 200-Data-matrix) and common 1D-bar codes
- User-friendly configuration and viewer software with graded user rights and online help

The one with a BLOB:
With the new BLOB detector (Binary Large Object), the VISOR® detects even small differences between objects, counts parts or detects whether a part is face up or face down.

VISOR® Allround – Object detection in colour plus identification united in one device.

The VISOR® Allround is the latest member in the VISOR® family and a real multi-talent among vision sensors. In the new allround version, the device unites the functions of the object sensor (i.a. calibration, pattern matching, contour, calliper, BLOB) with the powerful tools of the code reader (bar code, datamatrix and optical character recognition). When feeding parts in correct alignment or positioning components, additional data matrix codes for example can now also be read. With a resolution of up to 1.3 megapixel even the smallest details are reliably detected and evaluated.

In addition to the monochrome version, the VISOR® Allround is also available as a colour version with up to 1.3 megapixel. Thus additional "Detectors" are available for colour evaluation. Even the subtlest nuances in shade can be reliably detected. The relevant object colours, for example, can be taught-in quite simply by push of a button or - thanks to the intuitive colour histogram - set graphically for each channel in the colour space. The authorised colour tolerances can be defined by the user.

VISOR® Allround – Product Overview					
	Firmware Option	Resolution	Focal Length	Integrated illumination	Page
V20-ALL-A2-xxx	Advanced	1280 x 1024 pixels	12 mm	White, red or infrared	68
V20-ALL-A2-xxx	Advanced	1280 x 1024 pixels	C-mount	None	70
V20-ALL-P2-xxx	Professional	1280 x 1024 pixels	12 mm	White, red or infrared	72
V20-ALL-P2-xxx	Professional	1280 x 1024 pixels	C-mount	None	74
V20C-ALL-A2-xxx	Advanced	1280 x 1024 pixels	12 mm	White	76
V20C-ALL-A2-xxx	Advanced	1280 x 1024 pixels	C-mount	None	78
V10-ALL-A2-xxx	Advanced	736 x 480 pixels	6 mm	White, red or infrared	80
V10-ALL-A2-xxx	Advanced	736 x 480 pixels	12 mm	White, red or infrared	82
V10-ALL-A2-xxx	Advanced	736 x 480 pixels	25 mm	White, red or infrared	84
V10-ALL-A2-xxx	Advanced	736 x 480 pixels	C-mount	None	86
V10C-ALL-A2-xxx	Advanced	736 x 480 pixels	6 mm	White	88
V10C-ALL-A2-xxx	Advanced	736 x 480 pixels	12 mm	White	90
V10C-ALL-A2-xxx	Advanced	736 x 480 pixels	25 mm	White	92
V10C-ALL-A2-xxx	Advanced	736 x 480 pixels	C-mount	None	94

VISOR® V20 Allround

Advanced vision sensor for complex inspection tasks, 12 mm

PRODUCT HIGHLIGHTS

- All evaluations ("Detectors") of object sensor and code reader united in one device
- Highly accurate evaluation via 1.3 mega- pixel chip
- Real-world engineering units and robot coordinates at a mouse click
- Precise determination of X/Y position, orientation and tracking
- Can be used for all common 2D-Codes (ECC 200-Data-matrix) and common 1D-bar codes
- User-friendly configuration and viewer software with graded user rights and online help

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, calliper, BLOB, contrast, brightness, grey level, Data code, Bar code, OCR
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; calliper: distance between edges; BLOB, grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast; bar code: reading 1D bar codes, EAN, UPC, RSS, 2/5 Interleaved, 2/5 Industrial, code 32, code 39, code 93, code 128, GS1, pharm code, codabar; data code: reading 2D codes: ECC200, QR code, PDF 417; OCR
Typical cycle times[2]	Typ. 20 ms pattern comparison Typ. 30 ms contour Typ. 8 ms calliper Typ. 30 ms BLOB Typ. 2 ms brightness Typ. 2 ms contrast Typ. 2 ms grey threshold 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 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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

Version: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Field of view

Depth of field: normal

Illumination	Part number	Article number
White	V20-ALL -A2-W12	536-91032
Red	V20-ALL-A2-R12	536-91033
Infrared	V20-ALL-A2-I12	536-91034

Accessories	
Connection cables	From Page A-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

VISOR® V20 Allround

Advanced vision sensor for complex inspection tasks, C-mount

PRODUCT HIGHLIGHTS

- All evaluations ("Detectors") of object sensor and code reader united in one device
- Highly accurate evaluation via 1.3 mega- pixel chip
- Real-world engineering units and robot coordinates at a mouse click
- Precise position determination: X/Y-position and orientation
- Can be used for all common 2D-Codes (ECC 200-Data-matrix) and common 1D-bar codes
- User-friendly configuration and viewer software with graded user rights and online help

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, calliper, BLOB, contrast, brightness, grey level, Data code, Bar code, OCR
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; calliper: distance between edges; BLOB; grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast; bar code: reading 1D bar codes, EAN, UPC, RSS, 2/5 Interleaved, 2/5 Industrial, code 32, code 39, code 93, code 128, GS1, pharm code, codabar; data code: reading 2D codes: ECC200, QR code, PDF 417; OCR
Typical cycle times[2]	Typ. 20 ms pattern comparison Typ. 30 ms contour Typ. 8 ms calliper Typ. 30 ms BLOB Typ. 2 ms brightness Typ. 2 ms contrast Typ. 2 ms grey threshold 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 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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

Version: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Lens

	LO C 8	LO C 12	LO C 16	LO C 25	LO C 35	LO C 50	LO C 75
Focal length	8 mm	12 mm	16 mm	25 mm	35 mm	50 mm	75 mm
Article number	526-51513	526-51514	526-51515	526-51516	526-51525	526-51113	526-51116

Part number	Article number
V20-ALL-A2-C	536-91035

Accessories	
Connection cables	From Page A-38
Illumination	From Page A-30
Lenses	From Page A-27
Brackets	From Page A-14
Interface accessories	From Page A-42

VISOR® V20 Allround

Advanced vision sensor Professional for complex inspection tasks, 12 mm

PRODUCT HIGHLIGHTS

- All evaluations ("Detectors") of object sensor and code reader united in one device
- Highly accurate evaluation via 1.3 mega- pixel chip
- Real-world engineering units and robot coordinates at a mouse click
- Precise determination of X/Y position, orientation and tracking
- Detection of differences in height in the pseudo height image with multishot technology
- User-friendly configuration and viewer software with graded user rights and online help

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, calliper, BLOB, contrast, brightness, grey level, Data code, Bar code, OCR
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; calliper: distance between edges; BLOB, grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast; bar code: reading 1D bar codes, EAN, UPC, RSS, 2/5 Interleaved, 2/5 Industrial, code 32, code 39, code 93, code 128, GS1, pharm code, codabar; data code: reading 2D codes: ECC200, QR code, PDF 417; OCR
Typical cycle times[2]	Typ. 20 ms pattern comparison Typ. 30 ms contour Typ. 8 ms calliper Typ. 30 ms BLOB Typ. 2 ms brightness Typ. 2 ms contrast Typ. 2 ms grey threshold 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 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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

Version: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Field of view

Depth of field: normal

Illumination Multishot

Illumination	Part number	Article number
White	LM300 WWK-24Q4-2L12	525-51158
Red	LM300 RWK-24Q4-2L12	525-51159
Infrared	LM300 IWK-24Q4-2L12	525-51160

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

Part number	Article number
V20-ALL-P2-W12	536-91040
V20-ALL-P2-R12	536-91041
V20-ALL-P2-I12	536-91042

VISOR® V20 Allround

Advanced vision sensor Professional for complex inspection tasks, C-mount

PRODUCT HIGHLIGHTS

- All evaluations ("Detectors") of object sensor and code reader united in one device
- Highly accurate evaluation via 1.3 mega- pixel chip
- Real-world engineering units and robot coordinates at a mouse click
- Precise position determination: X/Y-position and orientation
- Detection of differences in height in the pseudo height image with multishot technology
- User-friendly configuration and viewer software with graded user rights and online help

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, calliper, BLOB, contrast, brightness, grey level, Data code, Bar code, OCR
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; calliper: distance between edges; BLOB; grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast; bar code: reading 1D bar codes, EAN, UPC, RSS, 2/5 Interleaved, 2/5 Industrial, code 32, code 39, code 93, code 128, GS1, pharm code, codabar; data code: reading 2D codes: ECC200, QR code, PDF 417; OCR
Typical cycle times[2]	Typ. 20 ms pattern comparison Typ. 30 ms contour Typ. 8 ms calliper Typ. 30 ms BLOB Typ. 2 ms brightness Typ. 2 ms contrast Typ. 2 ms grey threshold 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 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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

Version: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Lens

Illumination Multishot

	LO C 8	LO C 12	LO C 16	LO C 25	LO C 35	LO C 50	LO C 75
Focal length	8 mm	12 mm	16 mm	25 mm	35 mm	50 mm	75 mm
Article number	526-51513	526-51514	526-51515	526-51516	526-51525	526-51113	526-51116

Illumination	Part number	Article number
White	LM300 WWK-24Q4-2L12	525-51158
Red	LM300 RWK-24Q4-2L12	525-51159
Infrared	LM300 IWK-24Q4-2L12	525-51160

Accessories	
Connection cables	From Page A-38
Illumination	From Page A-30
Lenses	From Page A-27
Brackets	From Page A-14
Interface accessories	From Page A-42

Part number	Article number
V20-ALL-P2-C	536-91043

VISOR® V20 Allround Color

Advanced vision sensor for complex inspection tasks, 12 mm

PRODUCT HIGHLIGHTS

- All evaluations ("Detectors") of object sensor and code reader united in one device
- Highly accurate evaluation via 1.3 mega- pixel colour chip
- Real-world engineering units and robot coordinates at a mouse click
- Precise position determination: X/Y-position and orientation
- Can be used for all common 2D-Codes (ECC 200-Data-matrix) and common 1D-bar codes
- User-friendly configuration and viewer software with graded user rights and online help

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, calliper, BLOB, contrast, brightness, grey level, data code, bar code, OCR, colour list, colour area, colour value
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; calliper: distance between edges; BLOB, grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast; colour value: output of colour values; colour area: two-dimensional colour inspection with adustable tolerance; colour list: detecting the most similar colours; bar code: reading 1D bar codes, EAN, UPC, RSS, 2/5 Interleaved, 2/5 Industrial, code 32, code 39, code 93, code 128, GS1, pharm code, codabar; data code: reading 2D codes: ECC200, QR code, PDF 417; OCR
Typical cycle times[2]	Typ. 20 ms pattern comparison; typ. 30 ms contour; typ. 8 ms calliper; typ. 30 ms BLOB; 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; 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 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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

Version: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Field of view

Depth of field: normal

Illumination	Part number	Article number
White	V20C-ALL -A2-W12	536-91036

Accessories	
Connection cables	From Page A-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

VISOR® V20 Allround Color

Advanced vision sensor for complex inspection tasks, C-mount

PRODUCT HIGHLIGHTS

- All evaluations ("Detectors") of object sensor and code reader united in one device
- Highly accurate evaluation via 1.3 mega- pixel colour chip
- Real-world engineering units and robot coordinates at a mouse click
- Precise position determination: X/Y-position and orientation
- Can be used for all common 2D-Codes (ECC 200-Data-matrix) and common 1D-bar codes
- User-friendly configuration and viewer software with graded user rights and online help

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, calliper, BLOB, contrast, brightness, grey level, data code, bar code, OCR, colour list, colour area, colour value
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; calliper: distance between edges; BLOB; grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast; colour value: output of colour values; colour area: two-dimensional colour inspection with adustable tolerance; colour list: detecting the most similar colours; bar code: reading 1D bar codes, EAN, UPC, RSS, 2/5 Interleaved, 2/5 Industrial, code 32, code 39, code 93, code 128, GS1, pharm code, codabar; data code: reading 2D codes: ECC200, QR code, PDF 417; OCR
Typical cycle times[2]	Typ. 20 ms pattern comparison; typ. 30 ms contour;typ. 8 ms calliper; typ. 30 ms BLOB; 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; 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 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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

Version: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Lens

	LO C 8	LO C 12	LO C 16	LO C 25	LO C 35	LO C 50	LO C 75
Focal length	8 mm	12 mm	16 mm	25 mm	35 mm	50 mm	75 mm
Article number	526-51513	526-51514	526-51515	526-51516	526-51525	526-51113	526-51116

Part number	Article number
V20C-ALL -A2-C	536-91037

Accessories	
Connection cables	From Page A-38
Illumination	From Page A-30
Lenses	From Page A-27
Brackets	From Page A-14
Interface accessories	From Page A-42

VISOR® V10 Allround

Allround vision sensor for complex inspection tasks, 6 mm

PRODUCT HIGHLIGHTS

- All evaluations ("Detectors") of object sensor and code reader united in one device
- Real-world engineering units and robot coordinates at a mouse click
- Precise position determination: X/Y-position and orientation
- Can be used for all common 2D-Codes (ECC 200-Data-matrix) and common 1D-bar codes
- User-friendly configuration and viewer software with graded user rights and online help

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 mm[2]

Functions	
Number of jobs / detectors	max. 255 / max. 255
Detectors	Contour, pattern comparison, calliper, BLOB, contrast, brightness, grey level, data code, bar code, OCR
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; calliper: distance between edges; BLOB; grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast; bar code: reading 1D bar codes, EAN, UPC, RSS, 2/5 Interleaved, 2/5 Industrial, code 32, code 39, code 93, code 128, GS1, pharm code, codabar; data code: reading 2D codes: ECC200, QR code, PDF 417; OCR
Typical cycle times	Typ. 20 ms pattern comparison Typ. 30 ms contour Typ. 8 ms calliper Typ. 30 ms BLOB Typ. 2 ms brightness Typ. 2 ms contrast Typ. 2 ms grey threshold 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 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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

Version: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Field of view

Depth of field: normal

Illumination	Part number	Article number
White	V10-ALL-A2-W6	535-91092
Red	V10-ALL-A2-R6	535-91095
Infrared	V10-ALL-A2-I6	535-91098

Accessories	
Connection cables	From Page A-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

VISOR® V10 Allround

Allround vision sensor for complex inspection tasks, 12 mm

PRODUCT HIGHLIGHTS

- All evaluations ("Detectors") of object sensor and code reader united in one device
- Real-world engineering units and robot coordinates at a mouse click
- Precise position determination: X/Y-position and orientation
- Can be used for all common 2D-Codes (ECC 200-Data-matrix) and common 1D-bar codes
- User-friendly configuration and viewer software with graded user rights and online help

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, calliper, BLOB, contrast, brightness, grey level, data code, bar code, OCR
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; calliper: distance between edges; BLOB; grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast; bar code: reading 1D bar codes, EAN, UPC, RSS, 2/5 Interleaved, 2/5 Industrial, code 32, code 39, code 93, code 128, GS1, pharm code, codabar; data code: reading 2D codes: ECC200, QR code, PDF 417; OCR
Typical cycle times	Typ. 20 ms pattern comparison Typ. 30 ms contour Typ. 8 ms calliper Typ. 30 ms BLOB Typ. 2 ms brightness Typ. 2 ms contrast Typ. 2 ms grey threshold 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 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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

Version: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Field of view

Depth of field: normal

Illumination	Part number	Article number
White	V10-ALL-A2-W12	535-91093
Red	V10-ALL-A2-R12	535-91096
Infrared	V10-ALL-A2-I12	535-91099

Accessories	
Connection cables	From Page A-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

VISOR® V10 Allround

Allround vision sensor for complex inspection tasks, 25 mm

PRODUCT HIGHLIGHTS

- All evaluations ("Detectors") of object sensor and code reader united in one device
- Real-world engineering units and robot coordinates at a mouse click
- Precise position determination: X/Y-position and orientation
- Can be used for all common 2D-Codes (ECC 200-Data-matrix) and common 1D-bar codes
- User-friendly configuration and viewer software with graded user rights and online help

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, calliper, BLOB, contrast, brightness, grey level, data code, bar code, OCR
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; calliper: distance between edges; BLOB; grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast; bar code: reading 1D bar codes, EAN, UPC, RSS, 2/5 Interleaved, 2/5 Industrial, code 32, code 39, code 93, code 128, GS1, pharm code, codabar; data code: reading 2D codes: ECC200, QR code, PDF 417; OCR
Typical cycle times	Typ. 20 ms pattern comparison Typ. 30 ms contour Typ. 8 ms calliper Typ. 30 ms BLOB Typ. 2 ms brightness Typ. 2 ms contrast Typ. 2 ms grey threshold 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 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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

Version: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Field of view

Depth of field: normal

Illumination	Part number	Article number
White	V10-ALL-A2-W25	535-91094
Red	V10-ALL-A2-R25	535-91097
Infrared	V10-ALL-A2-I25	535-91100

Accessories	
Connection cables	From Page A-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

VISOR® V10 Allround

Allround vision sensor for complex inspection tasks, C-mount

PRODUCT HIGHLIGHTS

- All evaluations ("Detectors") of object sensor and code reader united in one device
- Real-world engineering units and robot coordinates at a mouse click
- Precise position determination: X/Y-position and orientation
- Can be used for all common 2D-Codes (ECC 200-Data-matrix) and common 1D-bar codes
- User-friendly configuration and viewer software with graded user rights and online help

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, calliper, BLOB, contrast, brightness, grey level, data code, bar code, OCR
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; calliper: distance between edges; BLOB; grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast; bar code: reading 1D bar codes, EAN, UPC, RSS, 2/5 Interleaved, 2/5 Industrial, code 32, code 39, code 93, code 128, GS1, pharm code, codabar; data code: reading 2D codes: ECC200, QR code, PDF 417; OCR
Typical cycle times	Typ. 20 ms pattern comparison Typ. 30 ms contour Typ. 8 ms calliper Typ. 30 ms BLOB Typ. 2 ms brightness Typ. 2 ms contrast Typ. 2 ms grey threshold 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 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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

Version: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Lens

	LO C 8	LO C 12	LO C 16	LO C 25	LO C 35	LO C 50	LO C 75
Focal length	8 mm	12 mm	16 mm	25 mm	35 mm	50 mm	75 mm
Article number	526-51513	526-51514	526-51515	526-51516	526-51525	526-51113	526-51116

Part number	Article number
V10-ALL-A2-C	535-91101

Accessories	
Connection cables	From Page A-38
Illumination	From Page A-30
Lenses	From Page A-27
Brackets	From Page A-14
Interface accessories	From Page A-42

VISOR® V10 Allround Color

Allround vision sensor for complex inspection tasks, 6 mm

PRODUCT HIGHLIGHTS

- All evaluations ("Detectors") of object sensor and code reader united in one device
- Real-world engineering units and robot coordinates at a mouse click
- Precise position determination: X/Y-position and orientation
- Can be used for all common 2D-Codes (ECC 200-Data-matrix) and common 1D-bar codes
- User-friendly configuration and viewer software with graded user rights and online help

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 mm[2]

Functions	
Number of jobs / detectors	max. 255 / max. 255
Detectors'	Contour, pattern comparison, calliper, BLOB, contrast, brightness, grey level, data code, bar code, OCR, colour list, colour area, colour value
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; calliper: distance between edges; BLOB; grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast; colour value: output of colour values; colour area: two-dimensional colour inspection with adustable tolerance; colour list: detecting the most similar colours; bar code: reading 1D bar codes, EAN, UPC, RSS, 2/5 Interleaved, 2/5 Industrial, code 32, code 39, code 93, code 128, GS1, pharm code, codabar; data code: reading 2D codes: ECC200, QR code, PDF 417; OCR
Typical cycle times	Typ. 20 ms pattern comparison; typ. 30 ms contour; typ. 8 ms calliper; typ. 30 ms BLOB; 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; 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 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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

Version: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Field of view

Depth of field: normal

Illumination	Part number	Article number
White	V10C-ALL-A2-W6	535-91102

Accessories	
Connection cables	From Page A-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

VISOR® V10 Allround Color

Allround vision sensor for complex inspection tasks, 12 mm

PRODUCT HIGHLIGHTS

- All evaluations ("Detectors") of object sensor and code reader united in one device
- Real-world engineering units and robot coordinates at a mouse click
- Precise position determination: X/Y-position and orientation
- Can be used for all common 2D-Codes (ECC 200-Data-matrix) and common 1D-bar codes
- User-friendly configuration and viewer software with graded user rights and online help

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 mm[2]

Functions	
Number of jobs / detectors	max. 255 / max. 255
Detectors	Contour, pattern comparison, calliper, BLOB, contrast, brightness, grey level-data code, bar code, OCR, colour list, colour area, colour value
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; calliper: distance between edges; BLOB; grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast; colour value: output of colour values; colour area: two-dimensional colour inspection with adustable tolerance; colour list: detecting the most similar colours; bar code: reading 1D bar codes, EAN, UPC, RSS, 2/5 Interleaved, 2/5 Industrial, code 32, code 39, code 93, code 128, GS1, pharm code, codabar; data code: reading 2D codes: ECC200, QR code, PDF 417; OCR
Typical cycle times	Typ. 20 ms pattern comparison; typ. 30 ms contour;typ. 8 ms calliper; typ. 30 ms BLOB; 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; 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 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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

Version: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Field of view

Depth of field: normal

Illumination	Part number	Article number
White	V10C-ALL-A2-W12	535-91103

Accessories	
Connection cables	From Page A-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

VISOR® V10 Allround Color

Allround vision sensor for complex inspection tasks, 25 mm

PRODUCT HIGHLIGHTS

- All evaluations ("Detectors") of object sensor and code reader united in one device
- Real-world engineering units and robot coordinates at a mouse click
- Precise position determination: X/Y-position and orientation
- Can be used for all common 2D-Codes (ECC 200-Data-matrix) and common 1D-bar codes
- User-friendly configuration and viewer software with graded user rights and online help

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, calliper, BLOB, contrast, brightness, grey level, data code, bar code, OCR, colour list, colour area, colour value
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; calliper: distance between edges; BLOB; grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast; colour value: output of colour values; colour area: two-dimensional colour inspection with adustable tolerance; colour list: detecting the most similar colours; bar code: reading 1D bar codes, EAN, UPC, RSS, 2/5 Interleaved, 2/5 Industrial, code 32, code 39, code 93, code 128, GS1, pharm code, codabar; data code: reading 2D codes: ECC200, QR code, PDF 417; OCR
Typical cycle times	Typ. 20 ms pattern comparison; typ. 30 ms contour;typ. 8 ms calliper; typ. 30 ms BLOB; 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; 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 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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

Version: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Field of view

Depth of field: normal

Illumination	Part number	Article number
White	V10C-ALL-A2-W25	535-91104

Accessories	
Connection cables	From Page A-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

VISOR® V10 Allround Color

Allround vision sensor for complex inspection tasks, C-mount

PRODUCT HIGHLIGHTS

- All evaluations ("Detectors") of object sensor and code reader united in one device
- Real-world engineering units and robot coordinates at a mouse click
- Precise position determination: X/Y-position and orientation
- Can be used for all common 2D-Codes (ECC 200-Data-matrix) and common 1D-bar codes
- User-friendly configuration and viewer software with graded user rights and online help

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, calliper, BLOB, contrast, brightness, grey level; data code, bar code, OCR, colour list, colour area, colour value
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; calliper: distance between edges; BLOB; grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast; colour value: output of colour values; colour area: two-dimensional colour inspection with adustable tolerance; colour list: detecting the most similar colours; bar code: reading 1D bar codes, EAN, UPC, RSS, 2/5 Interleaved, 2/5 Industrial, code 32, code 39, code 93, code 128, GS1, pharm code, codabar; data code: reading 2D codes: ECC200, QR code, PDF 417; OCR
Typical cycle times	Typ. 20 ms pattern comparison; typ. 30 ms contour;typ. 8 ms calliper; typ. 30 ms BLOB; 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; 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 kOhm
Encoder input	High > 4 V
Interfaces	Ethernet (LAN), RS422, RS232, EtherNet/IP, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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

Version: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Lens

	LO C 8	LO C 12	LO C 16	LO C 25	LO C 35	LO C 50	LO C 75
Focal length	8 mm	12 mm	16 mm	25 mm	35 mm	50 mm	75 mm
Article number	526-51513	526-51514	526-51515	526-51516	526-51525	526-51113	526-51116

Part number	Article number
V10C-ALL-A2-C	535-91105

Accessories	
Connection cables	From Page A-38
Illumination	From Page A-30
Lenses	From Page A-27
Brackets	From Page A-14
Interface accessories	From Page A-42

VISOR® object sensor for part detection

Detects the right part in the wrong place and vice versa

made in Germany

The one with a BLOB: *With the new BLOB detector (Binary Large Object), the VISOR® detects even small differences between objects, counts parts or detects whether a part is face up or face down.*

Calibration function:
With the VISOR®, positions and distances in the sensor image can now be easily converted into relative world coordinates or absolute robot coordinates. Distortions resulting from diagonal view angles and other image errors are simultaneously corrected. Thus robot applications can be easily solved.

HIGHLIGHTS OF VISOR® OBJECT SENSOR

- User-friendly configuration and viewer software with hierarchical user rights and online help
- Real-world engineering units and robot coordinates at a mouse click
- 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 PROFINET
- 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. The comprehensive calibration functions range from a simple scaling factor via the correction of image and lens distortions at a mouse click through to a point pair list for robot applications.
With its highly precise position and orientation detection, our VISOR® object sensor is one of the best in its class.

Seven detectors plus position detection
A total of seven detectors are available for inspection tasks and evaluations: pattern comparison, contour detection, calliper, BLOB, brightness, grey threshold and contrast detection. Position tracking offers 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	98
V20-OB-A2-xxx	Advanced	1280 x 1024 pixels	C-mount	None	100
V10-OB-S1-xxx	Standard	736 x 480 pixels	6 mm	White, red or infrared LEDs	102
V10-OB-S1-xxx	Standard	736 x 480 pixels	12 mm	White, red or infrared LEDs	104
V10-OB-A1-xxx	Advanced	736 x 480 pixels	6 mm	White, red or infrared LEDs	106
V10-OB-A1-xxx	Advanced	736 x 480 pixels	12 mm	White, red or infrared LEDs	108
V10-OB-A1-xxx	Advanced	736 x 480 pixels	25 mm	White, red or infrared LEDs	110
V10-OB-A1-xxx	Advanced	736 x 480 pixels	C-mount	None	112

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
- Real-world engineering units and robot coordinates at a mouse click
- 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, calliper, BLOB, contrast, brightness, grey level
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; calliper: distance between edges; BLOB, grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast
Typical cycle times[2]	Typ. 20 ms pattern comparison Typ. 30 ms contour Typ. 8 ms calliper Typ. 30 ms BLOB 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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Field of view

Depth of field: normal

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

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
- Real-world engineering units and robot coordinates at a mouse click
- 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, calliper, BLOB, contrast, brightness, grey level
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; calliper: distance between edges; BLOB; grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast
Typical cycle times[2]	Typ. 20 ms pattern comparison Typ. 30 ms contour Typ. 8 ms calliper Typ. 30 ms BLOB 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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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

Version: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Lens

	LO C 8	LO C 12	LO C 16	LO C 25	LO C 35	LO C 50	LO C 75
Focal length	8 mm	12 mm	16 mm	25 mm	35 mm	50 mm	75 mm
Article number	526-51513	526-51514	526-51515	526-51516	526-51525	526-51113	526-51116

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Lenses	From Page A-27
Brackets	From Page A-14
Interface accessories	From Page A-42

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 and tracking
- 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 mm[2]

Functions	
Number of jobs / detectors	8 / 32
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
Interfaces	Ethernet (LAN), EtherNet/IP, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 2 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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

Version: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Field of view

Depth of field: normal

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

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 and tracking
- 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 mm[2]

Functions	
Number of jobs / detectors	8 / 32
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
Interfaces	Ethernet (LAN), EtherNet/IP, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 2 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Field of view

Depth of field: normal

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

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
- Real-world engineering units and robot coordinates at a mouse click
- 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 mm[2]

Functions	
Number of jobs / detectors	max. 255 / max. 255
Detectors	Contour, pattern comparison, calliper, BLOB, contrast, brightness, grey level
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; calliper: distance between edges; BLOB; grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast
Typical cycle times	Typ. 20 ms pattern comparison Typ. 30 ms contour Typ. 8 ms calliper Typ. 30 ms BLOB 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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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

VISOR® vision sensor

Field of view

Depth of field: normal

Depth of field: enhanced

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

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
- Real-world engineering units and robot coordinates at a mouse click
- 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 mm²

Functions	
Number of jobs / detectors	max. 255 / max. 255
Detectors	Contour, pattern comparison, calliper, BLOB, contrast, brightness, grey level
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; calliper: distance between edges; BLOB; grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast
Typical cycle times	Typ. 20 ms pattern comparison Typ. 30 ms contour Typ. 8 ms calliper Typ. 30 ms BLOB 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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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: 07/2016. 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-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

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
- Real-world engineering units and robot coordinates at a mouse click
- 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, calliper, BLOB, contrast, brightness, grey level
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; calliper: distance between edges; BLOB; grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast
Typical cycle times	Typ. 20 ms pattern comparison Typ. 30 ms contour Typ. 8 ms calliper Typ. 30 ms BLOB 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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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

Version: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Field of view

Depth of field: normal

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

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
- Real-world engineering units and robot coordinates at a mouse click
- 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, calliper, BLOB, contrast, brightness, grey level
Properties	Position tracking: X/Y and orientation; pattern comparison / contour: teach-in and detection of patterns and contours; calliper: distance between edges; BLOB; grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast
Typical cycle times	Typ. 20 ms pattern comparison Typ. 30 ms contour Typ. 8 ms calliper Typ. 30 ms BLOB 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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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 35	LO C 50	LO C 75
Focal length	8 mm	12 mm	16 mm	25 mm	35 mm	50 mm	75 mm
Article number	526-51513	526-51514	526-51515	526-51516	526-51525	526-51113	526-51116

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Lenses	From Page A-27
Brackets	From Page A-14
Interface accessories	From Page A-42

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 comprehensive calibration functions range from a simple scaling factor via the correction of image and lens distortions at a mouse click through to a point pair list for robot applications.

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	116
V20C-CO-A2-xx	Advanced	1280 x 1024 pixels	C-mount	None	118
V10C-CO-S2-xx	Standard	736 x 480 pixels	6 mm	White	120
V10C-CO-S2-xx	Standard	736 x 480 pixels	12 mm	White	122
V10C-CO-A2-xx	Advanced	736 x 480 pixels	6 mm	White	124
V10C-CO-A2-xx	Advanced	736 x 480 pixels	12 mm	White	126
V10C-CO-A2-xx	Advanced	736 x 480 pixels	25 mm	White	128
V10C-CO-A2-xx	Advanced	736 x 480 pixels	C-mount	None	130

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
- Real-world engineering units and robot coordinates at a mouse click
- 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, calliper, BLOB, 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; calliper: distance between edges; BLOB; 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. 20 ms pattern comparison; typ. 30 ms contour; Typ. 8 ms calliper; typ. 30 ms BLOB; 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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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

Version: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Field of view

Depth of field: normal

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

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
- Real-world engineering units and robot coordinates at a mouse click
- 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, calliper, BLOB, 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; calliper: distance between edges; BLOB; 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. 20 ms pattern comparison; typ. 30 ms contour; Typ. 8 ms calliper; typ. 30 ms BLOB; 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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Lens

	LO C 8	LO C 12	LO C 16	LO C 25	LO C 35	LO C 50	LO C 75
Focal length	8 mm	12 mm	16 mm	25 mm	35 mm	50 mm	75 mm
Article number	526-51513	526-51514	526-51515	526-51516	526-51525	526-51113	526-51116

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Lenses	From Page A-27
Brackets	From Page A-14
Interface accessories	From Page A-42

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 mm[2]

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. 30 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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 2 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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

Version: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Field of view

Depth of field: normal

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

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 mm[2]

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. 30 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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 2 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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

Version: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Field of view

Depth of field: normal

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

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
- Real-world engineering units and robot coordinates at a mouse click
- 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 mm[2]

Functions	
Number of jobs / detectors	max. 255 / max. 255
Detectors	Contour, pattern comparison, calliper, BLOB, 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; calliper: distance between edges; BLOB; 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. 20 ms pattern comparison; typ. 30 ms contour; Typ. 8 ms calliper; typ. 30 ms BLOB; 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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Field of view

Depth of field: normal

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

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
- Real-world engineering units and robot coordinates at a mouse click
- 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, calliper, BLOB, 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; calliper: distance between edges; BLOB; 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. 20 ms pattern comparison; typ. 30 ms contour; Typ. 8 ms calliper; typ. 30 ms BLOB; 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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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

Version: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Field of view

Depth of field: normal

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

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
- Real-world engineering units and robot coordinates at a mouse click
- 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, calliper, BLOB, 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; calliper: distance between edges; BLOB; 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. 20 ms pattern comparison; typ. 30 ms contour; Typ. 8 ms calliper; typ. 30 ms BLOB; 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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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

VISOR® vision sensor

Field of view

Depth of field: normal

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

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
- Real-world engineering units and robot coordinates at a mouse click
- 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, calliper, BLOB, 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; calliper: distance between edges; BLOB; 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. 20 ms pattern comparison; typ. 30 ms contour; Typ. 8 ms calliper; typ. 30 ms BLOB; 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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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

Version: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Lens

	LO C 8	LO C 12	LO C 16	LO C 25	LO C 35	LO C 50	LO C 75
Focal length	8 mm	12 mm	16 mm	25 mm	35 mm	50 mm	75 mm
Article number	526-51513	526-51514	526-51515	526-51516	526-51525	526-51113	526-51116

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Lenses	From Page A-27
Brackets	From Page A-14
Interface accessories	From Page A-42

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
- Detection of Edge defects
- 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
V20-SO-A2-xxx	Advanced	1280 x 1024 pixels	12 mm	White, red or infrared LEDs	134
V20-SO-A2-xxx	Advanced	1280 x 1024 pixels	C-mount	None	136
V10-SO-S1-xxx	Standard	736 x 480 pixels	6 mm	White LEDs	138
V10-SO-A1-xxx	Advanced	736 x 480 pixels	6 mm	White or infrared LEDs	140
V10-SO-A1-xxx	Advanced	736 x 480 pixels	12 mm	White or infrared LEDs	142
V10-SO-A1-xxx	Advanced	736 x 480 pixels	C-mount	None	144

VISOR® V20 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	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	Wafers, pattern comparison, contrast, brightness, grey level, calliper
Properties	Position tracking; Wafers incl. busbars: localisation of wafers or busbars and examination of wafers; Calliper: distance between edges; Pattern comparison: teach-in and detection of patterns grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast
Typical cycle times[2]	Typ. 100 ms wafer Typ. 8 ms calliper 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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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-SO-A2-W12	536-91028
Red	V20-SO-A2-R12	536-91029
Infrared	V20-SO-A2-I12	536-91030

Version: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Field of view

Depth of field: normal

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

VISOR® V20 Solar sensor

Advanced vision sensor for wafer and cell inspection, C-mount

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	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	Wafers, pattern comparison, contrast, brightness, grey level, calliper
Properties	Position tracking; Wafers incl. busbars: localisation of wafers or busbars and examination of wafers; Calliper: distance between edges; Pattern comparison: teach-in and detection of patterns grey threshold, brightness: evaluation of brightness; contrast: evaluation of contrast
Typical cycle times[2]	Typ. 100 ms wafer Typ. 8 ms calliper 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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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-SO-A2-C	536-91031

Version: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Lens

	LO C 8	LO C 12	LO C 16	LO C 25	LO C 35	LO C 50	LO C 75
Focal length	8 mm	12 mm	16 mm	25 mm	35 mm	50 mm	75 mm
Article number	526-51513	526-51514	526-51515	526-51516	526-51525	526-51113	526-51116

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Lenses	From Page A-27
Brackets	From Page A-14
Interface accessories	From Page A-42

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 mm[2]

Functions	
Number of jobs / detectors	8 / 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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 2 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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

Version: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Field of view

Depth of field: normal

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

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	max. 255 / max. 255
Detectors	Wafers, busbars, pattern comparison, contrast, brightness, grey level, calliper
Properties	Position tracking Wafers incl. busbars: localisation of wafers or busbars and examination of wafers; Calliper: distance between edges; 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. 8 ms calliper 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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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

Version: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Field of view

Depth of field: normal

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

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 mm[2]

Functions	
Number of jobs / detectors	max. 255 / max. 255
Detectors	Wafers, busbars, pattern comparison, contrast, brightness, grey level, calliper
Properties	Position tracking Wafers incl. busbars: localisation of wafers or busbars and examination of wafers; Calliper: distance between edges; 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. 8 ms calliper 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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

VISOR® V10 Solar sensor

Advanced vision sensor for wafer and cell inspection, C-mount

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	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	Wafers, pattern comparison, contrast, brightness, grey level, calliper
Properties	Position tracking; Wafers incl. busbars: localisation of wafers or busbars and examination of wafers; Calliper: distance between edges; 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. 8 ms calliper 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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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-SO-A1-C	535-91050

Version: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Lens

	LO C 8	LO C 12	LO C 16	LO C 25	LO C 35	LO C 50	LO C 75
Focal length	8 mm	12 mm	16 mm	25 mm	35 mm	50 mm	75 mm
Article number	526-51513	526-51514	526-51515	526-51516	526-51525	526-51113	526-51116

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Lenses	From Page A-27
Brackets	From Page A-14
Interface accessories	From Page A-42

Eyesight vision systems – 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.

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

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.

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 systems offer 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	148
V20-EYE-A2-xxx	Monochrome, colour	1280 x 1024 pixels	C-Mount	None	150
V10-EYE-A1-xxx	Monochrome, colour	736 x 480 pixels	6	White, red or infrared LEDs	152
V10-EYE-A1-xxx	Monochrome, colour	736 x 480 pixels	12	White, red or infrared LEDs	154
V10-EYE-A1-xxx	Monochrome, colour	736 x 480 pixels	C-Mount	None	156

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 mm[2]

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

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 mm (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-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

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

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 mm (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: 07/2016. Subject to changes; diagrams similar

V20 vision system

Lens

	LO C 8	LO C 12	LO C 16	LO C 25	LO C 35	LO C 50	LO C 75
Focal length	8 mm	12 mm	16 mm	25 mm	35 mm	50 mm	75 mm
Article number	526-51513	526-51514	526-51515	526-51516	526-51525	526-51113	526-51116

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Lenses	From Page A-27
Brackets	From Page A-14
Interface accessories	From Page A-42

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 mm[2]

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, subprogrammes, script interpreter.
Properties	See overview of commands
Typical cycle times	Dependent on inspection programme

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 mm (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-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

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 mm[2]

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

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 mm (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-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

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

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 mm (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: 07/2016. Subject to changes; diagrams similar

V10 vision system

Lens

	LO C 8	LO C 12	LO C 16	LO C 25	LO C 35	LO C 50	LO C 75
Focal length	8 mm	12 mm	16 mm	25 mm	35 mm	50 mm	75 mm
Article number	526-51513	526-51514	526-51515	526-51516	526-51525	526-51113	526-51116

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Lenses	From Page A-27
Brackets	From Page A-14
Interface accessories	From Page A-42

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 168

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 176

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, PROFINET
- 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, infrared LEDs or UV	162
V20C-CR-A2-xxx	Advanced	1280 x 1024 pixels	12 mm	White LEDs	164
V20-CR-A2-xxx	Advanced	1280 x 1024 pixels	C-mount	None	166
V20-CR-P2-xxx	Professional	1280 x 1024 pixels	12 mm	White, red or infrared LEDs	168
V20C-CR-P2-xxx	Professional	1280 x 1024 pixels	12 mm	White LEDs	170
V20-CR-P2-xxx	Professional	1280 x 1024 pixels	C-mount	None	172
V10-CR-S1-xxx	Standard	736 x 480 pixels	6 mm	White, red or infrared LEDs	174
V10-CR-S1-xxx	Standard	736 x 480 pixels	12 mm	White, red or infrared LEDs	176
V10-CR-S2-xxx	Standard	736 x 480 pixels	25 mm	White, red or infrared LEDs	178
V10-CR-A1-xxx	Advanced	736 x 480 pixels	6 mm	White, red or infrared LEDs	180
V10-CR-A1-xxx	Advanced	736 x 480 pixels	12 mm	White, red or infrared LEDs	182
V10-CR-A2-xxx	Advanced	736 x 480 pixels	25 mm	White, red or infrared LEDs	184
V10-CR-A1-xxx	Advanced	736 x 480 pixels	C-mount	None	186

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 direct 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 | 2	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	✓	✓	✓
PROFINET	✓	✓	✓
SensoWeb	✓	✓	✓
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 (400 nm) 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 32, Code 39, Code 93, Code 128, GS1, Pharmacode, Codabar; data code: reading of 2D codes: ECC200, QR code, PDF 417, ECC200 GS1
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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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 (400 nm)	V20-CR-A2-U12	536-91019

Version: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Field of view

Depth of field: normal

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

VISOR® V20 Code Reader Color

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
- Code reading of colour image
- 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", 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	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 32, Code 39, Code 93, Code 128, GS1, Pharmacode, Codabar; data code: reading of 2D codes: ECC200, QR code, PDF 417, ECC200 GS1
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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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	V20C-CR-A2-W12	536-91026

VISOR® vision sensor

Field of view

Depth of field: normal

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

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 32, Code 39, Code 93, Code 128, GS1, Pharmacode, Codabar; data code: reading of 2D codes: ECC200, QR code, PDF 417, ECC200 GS1
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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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 35	LO C 50	LO C 75
Focal length	8 mm	12 mm	16 mm	25 mm	35 mm	50 mm	75 mm
Article number	526-51513	526-51514	526-51515	526-51516	526-51525	526-51113	526-51116

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Lenses	From Page A-27
Brackets	From Page A-14
Interface accessories	From Page A-42

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 32, Code 39, Code 93, Code 128, GS1, Pharmacode, Codabar; data code: reading of 2D codes: ECC200, QR code, PDF 417; OCR: optical character reading, ECC200 GS1
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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Field of view

Depth of field: normal

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

VISOR® V20 Code Reader Color

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
- Code reading of colour image
- 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", 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	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 32, Code 39, Code 93, Code 128, GS1, Pharma-code, Codabar; data code: reading of 2D codes: ECC200, QR code, PDF 417; ECC200 GS1, OCR: optical character reading; colour area: two-dimen-sional colour inspection with adustable tolerance; colour list: finding the most similar colours
Typical cycle time[2]	Typ. 20 ms pattern comparison; typ. 2 ms bright-ness; typ. 2 ms contrast; typ. 2 ms grey level; typ. 30 ms bar code; typ. 40 ms data code; colour list typ. 15 ms per character OCR; colour value; typ. 30 ms colour area; typ. 2 ms

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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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	V20C-CR-P2-W12	536-91027

Version: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Field of view

Depth of field: normal

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

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 32, Code 39, Code 93, Code 128, GS1, Pharmacode, Codabar; data code: reading of 2D codes: ECC200, QR code, PDF 417; OCR: optical character reading, ECC200 GS1
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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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 35	LO C 50	LO C 75
Focal length	8 mm	12 mm	16 mm	25 mm	35 mm	50 mm	75 mm
Article number	526-51513	526-51514	526-51515	526-51516	526-51525	526-51113	526-51116

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Lenses	From Page A-27
Brackets	From Page A-14
Interface accessories	From Page A-42

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 mm[2]

Functions	
Number of jobs / detectors	8 / 2
Detectors	Bar code / data code
Properties	UPC, RSS, 2/5 Interleaved, 2/5 Industrial, Code 32, Code 39, Code 93, Code 128, GS1, Pharmacode, Codabar; data code: reading of 2D codes, ECC200, QR code, PDF 417, ECC200 GS1
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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 2 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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

VISOR® vision sensor

Field of view

Depth of field: normal

Depth of field: enhanced

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

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 mm[2]

Functions	
Number of jobs / detectors	8 / 2
Detectors	Bar code / data code
Properties	Bar code: reading of 1D bar codes, EAN, UPC, RSS, 2/5 Interleaved, 2/5 Industrial, Code 32, Code 39, Code 93, Code 128, GS1, Pharmacode, Codabar; data code: reading of 2D codes, ECC200, QR code, PDF 417, ECC200 GS1
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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 2 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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: 07/2016. 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-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

VISOR® V10 Code Reader

Standard vision sensor for code reading, 25 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	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	8 / 2
Detectors	Bar code / data code
Properties	Bar code: reading of 1D bar codes, EAN, UPC, RSS, 2/5 Interleaved, 2/5 Industrial, Code 32, Code 39, Code 93, Code 128, GS1, Pharmacode, Codabar; data code: reading of 2D codes, ECC200, QR code, PDF 417, ECC200 GS1
Typical cycle times	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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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-S2-W25	535-91088
Red	Normal	V10-CR-S2-R25	535-91089
Infrared	Normal	V10-CR-S2-I25	535-91090

Version: 07/2016. Subject to changes; diagrams similar

VISOR® vision sensor

Field of view

Depth of field: normal

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

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 32, Code 39, Code 93, Code 128, GS1, Pharmacode, Codabar; data code: reading of 2D codes, ECC200, QR code, PDF 417, ECC200 GS1
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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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: 07/2016. 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-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

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 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 32, Code 39, Code 93, Code 128, GS1, Pharmacode, Codabar; data code: reading of 2D codes: ECC200, QR code, PDF 417, ECC200 GS1
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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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: 07/2016. 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-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

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 32, Code 39, Code 93, Code 128, GS1, Pharmacode, Codabar; data code: reading of 2D codes: ECC200, QR code, PDF 417, ECC200 GS1
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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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-A2-W25	535-91084
Red	Normal	V10-CR-A2-R25	535-91085
Infrared	Normal	V10-CR-A2-I25	535-91086

VISOR® vision sensor

Field of view

Depth of field: normal

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Brackets	From Page A-14
Interface accessories	From Page A-42

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 32, Code 39, Code 93, Code 128, GS1, Pharmacode, Codabar; data code: reading of 2D codes: ECC200, QR code, PDF 417, ECC200 GS1
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, PROFINET, SensoWeb
Inputs/outputs	2 inputs, 4 outputs, 4 selectable inputs/outputs

Mechanical data	
Dimensions	65 x 45 x 45 mm (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 35	LO C 50	LO C 75
Focal length	8 mm	12 mm	16 mm	25 mm	35 mm	50 mm	75 mm
Article number	526-51513	526-51514	526-51515	526-51516	526-51525	526-51113	526-51116

Accessories

Connection cables	From Page A-38
Illumination	From Page A-30
Lenses	From Page A-27
Brackets	From Page A-14
Interface accessories	From Page A-42

Distance sensors

Measurement from 20 mm to 250 m

Optical distance sensors

from Page 192

FT 25

- *Operating range (scanning distance) from 20 mm to 200 mm*
- *Laser- and LED short-range distance sensors using the triangulation principle*
- *Miniature housing for simple integration*
- *Analogue output 1 … 10 V*

from Page 198

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 198

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 210

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 232

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 556

- *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 606

- *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 146

- *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 – optical short-range distance sensors

The compact class for measurement and regulatory tasks

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

TYPICAL FT 25-R(L)A

- Operating range: 20...80 mm / 20...100 mm / 30...200 mm
- Distance sensor with 1 … 10 V analogue output
- Easily integratable ultra-compact ABS housing: 34 x 12 x 20 mm
- High precision and high repeatability – especially for control tasks
- Resolution: from 0.12 mm
- Two adjustable switching points as window mode for 2-point control
- Teach-in operation

In a miniature housing
The FT 25-R(L)A is also suitable for limited installation spaces thanks to its compact dimensions of 34 x 12 x 20 mm.

In addition to its analogue voltage output the small distance sensors also have a switching output and offer the possibility of defining a switching window by means of two switching points. Thanks to their easy operation, these sensors are particularly suitable for simple measurement and regulatory tasks at distances of up to 200 mm. Our laser and LED variants cover a very broad range of applications.

Key applications:

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

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

FT 25-RLA

Miniature laser distance sensor

PRODUCT HIGHLIGHTS

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

Optical data	
Measurement range	20 … 100 mm[1]
Resolution	0.12 mm (12-bit)
Linearity	± 0.25 mm[2]
Repeatability	< 0.25 mm[2, 3]
Type of light	Laser, red, 650 nm
Light spot size	See diagram
Laser class (IEC 60825-1)	1

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Measurement range adjustment	Via Teach-in button
Adjustment possibilities	Analogue measurement range Q_A Invertible analogue characteristic Switching output Q (window mode) N.O. / N.C. and Auto-Detect / NPN / PNP via teach-in button
Default settings	See Table

Electrical data	
Operating voltage, $+U_B$	13 … 30 V DC
No-load current, I_0	≤ 30 mA
Output current, le Q	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Switching output, Q	Auto-Detect (NPN / PNP)[4]
Output function	N.O. / N.C.
Max. capacitive load Q	10 nF
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	3.4 ms
Warm-up time	10 min.
Temperature drift	< 0.1 mm/K

Mechanical data	
Dimensions	34 x 20 x 12 mm
Enclosure rating	IP 67 / IP 69K[5]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C[6]
Ambient temperature: storage	-20 … +80 °C
Weight (metal plug device)	10 g
Resistance to vibrations and impacts	EN 60947-5-2

[1] Reference material: 6…90 % reflectivity [2] Reference material, 18 % reflectivity [3] At 6 σ, at constant ambient conditions, typ. values see diagram [4] Auto-Detect: Automatic selection of PNP or NPN by the sensor, PNP or NPN can be fixed [5] With connected IP 67 / IP 69K plug [6] UL: -20 ... +50 °C

Measurement range	Analogue output	Switching output	Type of connection	Part number	Article number
20 ... 100 mm	1 ... 10 V	Auto-Detect	Metal plug, M8x1, 4-pin	FT 25-RLA-80-PNSU-M4M	604-41010

Version: 07/2016. Subject to changes; diagrams similar

Plug connection

153-00934

Connection, 4-pin

154-00547

Light spot size

155-01394

Scanning properties

155-01966

Repeatability[1] (typ.)

155-01968

[1] At constant ambient conditions

Characteristics

155-01661

155-01681

Default settings

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

Accessories

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

FT 25-RA

Miniature distance sensor

PRODUCT HIGHLIGHTS

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

Optical data		
Measurement range	20 … 80 mm[1]	30 … 200 mm[1]
Resolution	0.12 mm (12-bit)	0.68 mm (12-bit)
Linearity	± 0.4 mm[2]	± 2 mm[2]
Repeatability	< 0.4 mm[2, 3]	< 1 mm[2, 3]
Type of light	LED, red, 632 nm	LED, red, 632 nm
Light spot size	See diagram	See diagram

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Measurement range adjustment	Via Teach-in button
Adjustment possibilities	Analogue measurement range Q_A Invertible analogue characteristic Switching output Q (window mode) N.O./N.C. via teach-in button
Default settings	See Table

Electrical data	
Operating voltage, $+U_B$	13 … 30 V DC
No-load current, I_0	≤ 30 mA
Output current, Ie Q	≤ 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.
Max. capacitive load Q	10 nF
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)

Mechanical data	
Dimensions	34 x 20 x 12 mm
Enclosure rating	IP 67 / IP 69K[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 (metal plug device)	10 g
Resistance to vibrations and impacts	EN 60947-5-2

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

Measurement range	Analogue output	Switching output	Type of connection	Part number	Article number
20 ... 80 mm	1 ... 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

154-00543

Light spot size

155-01663

Scanning properties FT 25-RA-60

155-01666

Scanning properties FT 25-RA-170

155-01667

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-38
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 mm	40 … 60 mm	Analogue output	200
FT 50 RLA-40	50 x 17 x 50 mm	45 … 85 mm	Analogue output	202
FT 50 RLA-70 -100 -220	50 x 17 x 50 mm	30 … 100 mm 70 … 170 mm 80 … 300 mm	Analogue output, switching outputs, simple teach-in of measurement ranges; RS485 interface	204
FT 80 RLA-500	83 x 25 x 65 mm	250 … 750 mm	Analogue output, switching outputs, RS485 interface; M12 8-pin	208

FT 50 RLA 20

Distance sensor

PRODUCT HIGHLIGHTS

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

Optical data		Functions	
Operating range	40 … 60 mm[1]	Indicator LED, green	Operating voltage indicator
Measurement range	20 mm	Indicator LED, red	Contamination indicator
Type of light	Laser, red, 670 nm	Scanning distance adjustment	Fixed setting
Laser Class (IEC 60825-1)	1		
Resolution	40 µm / 7µm (see Selection Table)		
Linearity	< 1 %		
Light spot size	< 1 mm bei 50 mm		
Repeatability	< 0.1 mm / 0.05 mm (see Selection Table)		

Electrical data		Mechanical data	
Operating voltage, $+U_B$	18 … 28 V DC	Dimensions	50 x 50 x 17 mm
No-load current, I_0	≤ 35 mA	Enclosure rating	IP 67[2]
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection, Q	Material, housing	ABS, impact-resistant
		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	Repeatability	Rise time	Fall time	Limit frequency	Type of connection	Part number	Article number
40 µm	< 0.1 mm	3 ms	2 ms	400 Hz	Plug, M12x1, 4-pin	FT 50 RLA-20-F-L4S	574-41005
7 µm	< 0.05 mm	30 ms	20 ms	40 Hz	Plug, M12x1, 4-pin	FT 50 RLA-20-S-L4S	574-41007
40 µm	< 0.1 mm	3 ms	2 ms	400 Hz	Cable, 6 m, 4-wire	FT 50 RLA-20-F-K5	574-41004
7 µm	< 0.05 mm	30 ms	20 ms	40 Hz	Cable, 6 m, 4-wire	FT 50 RLA-20-S-K5	574-41006

Version: 07/2016. Subject to changes; diagrams similar

Plug connection

Cable connection

Connection, 4-pin

Characteristic output curve

Accessories

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

FT 50 RLA 40

Distance sensor

PRODUCT HIGHLIGHTS

- High resolution and small light spot
- Operating range: 45 … 85 mm
- Laser red light (670 nm)
- Small, easily visible light spot
- No adjustments necessary
- Resolution: 0.02 mm / 0.08 mm
- Analogue output: 0 … 10 V
- Device plug rotatable through 270°

Optical data	
Operating range	45 … 85 mm[1]
Measurement range	40 mm
Type of light	Laser, red, 670 nm
Laser Class (IEC 60825-1)	1
Resolution	80 µm / 20 µm (see Selection Table)
Linearity	< 1 %
Light spot size	< 0.8 mm at 65 mm
Repeatability	< 0.2 mm / 0.1 mm (see Selection Table)

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, red	Contamination indicator
Scanning distance adjustment	Fixed setting

Electrical data	
Operating voltage, $+U_B$	18 … 28 V DC
No-load current, I_0	≤ 35 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection, Q
Protection Class	2
Analogue output	0 … 10 V (max. 3 mA)
Limit frequency	400 Hz / 40 Hz (See Selection Table)
Temperature drift	18 µm / K
Rise time (10 to 90 %)	3 ms / 30 ms (See Selection Table)
Fall time (90 to 10 %)	2 ms / 20 ms (See Selection Table)

Mechanical data	
Dimensions	50 x 50 x 17 mm
Enclosure rating	IP 67[2]
Material, housing	ABS, impact-resistant
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	0 … +45 °C
Ambient temperature: storage	-20 … +60 °C
Weight (plug device)	40 g
Weight (cable device)	260 g
Vibration and impact resistance	EN 60947-2

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

Resolution	Repeatability	Rise time	Fall time	Limit frequency	Type of connection	Part number	Article number
80 µm	< 0.2 mm	3 ms	2 ms	400 Hz	Plug, M12x1, 4-pin	FT 50 RLA-40-F-L4S	574-41001
20 µm	< 0.1 mm	30 ms	20 ms	40 Hz	Plug, M12x1, 4-pin	FT 50 RLA-40-S-L4S	574-41003
80 µm	< 0.2 mm	3 ms	2 ms	400 Hz	Cable, 6 m, 4-wire	FT 50 RLA-40-F-K5	574-41000
20 µm	< 0.1 mm	30 ms	20 ms	40 Hz	Cable, 6 m, 4-wire	FT 50 RLA-40-S-K5	574-41002

Plug connection

Cable connection

Connection, 4-pin

Characteristic output curve

Accessories

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

FT 50 RLA 70 / 100 / 220

Distance sensor

PRODUCT HIGHLIGHTS

- Precise distance measurement
- Largely independent of target object reflectivity (highly reflective and glossy objects)
- High long-term stability and low temperature effects
- High resolution
- Very high update rate of analogue output (response time)
- One switching output, one analogue output 4 ... 20 mA
- Simple adjustment via teach-in button

Optical data	
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 (IEC 60825-1)	1
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

Plug connection

153-00716

Type	X (distance, receiver)
FT 50 RLA 70	29.4 mm
FT 50 RLA 100	32.5 mm
FT 50 RLA 220	32.5 mm

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-38
Brackets	From Page A-4

FT 50 RLA 70 / 100 / 220

Distance sensor with RS485 interface

PRODUCT HIGHLIGHTS

- Largely independent of target object reflectivity (highly reflective and glossy objects)
- RS485 interface for parameterisation and measurement value output
- High resolution
- Rapid response time
- 2 switching outputs, 1 analogue output 4 ... 20 mA
- High long-term stability and low temperature effects

Optical data	
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 (IEC 60825-1)	1
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
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	29,4 mm
	FT 50 RLA 100	32,5 mm
	FT 50 RLA 220	32,5 mm

6

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

Characteristic analogue curve

Operating range (default setting)

155-00271

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

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

Installation

155-00270

155-00274

Accessories

Connection cables	From Page A-38
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 (IEC 60825-1)	1
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

Plug connection

Connection, 8-pin

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

155-00157

Accessories

Connection cables	From Page A-38
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 mm
- Version with IO-Link

With a reflector these devices can achieve ranges of up to 250 m (FR 90 ILA).
Ranges of up to 10 m can be achieved with the scanner versions (FT 90 ILA).

Pilot laser
Correct adjustment of the F 90 at long distances is considerably simplified by using the pilot laser. This can be switched off so that no-one is irritated by it during running operation.

Long ranges of up to 250 m are no problem with time-of-flight technology – and ideal in handling and warehousing systems.

F 55 / F 90 / F 91 / F 92 – Product Overview				
	Operating distance	Functional principle	Special features	Page
FT 55-RLAP	0,1 … 5 m	Scanning on object	Compact design, high flexibility	212
FT 55-RLAP2	0.06 … 5 m	Scanning on object	Compact design, IO-Link	214
FT 90 ILA	0.5 … 10 m	Scanning on object	2 switching outputs, RS422 interface, SSI-compatible, switchable red-light pilot laser	216
FT 91 ILA	0.5 … 6 m	Scanning on object	2 switching outputs, RS422 interface, SSI-compatible, switchable red-light pilot laser	218
FT 92 ILA/RLA	0.2 … 6 m	Scanning on object	2 switching outputs, 1 analogue output, switchable red-light pilot laser	220
FR 55-RLAP	0,3 … 70 m	Reflector	1 analogue output 4 ... 20 mA, 2 switching outputs, compact design, high flexibility	222
FR 55-RLP	0,3 … 70 m	Reflector	2 switching outputs, compact design, high flexibility	224
FR 90 ILA	0.5 … 250 m	Reflector	2 switching outputs, RS422 interface, SSI-compatible, switchable red-light pilot laser	226
FR 91 ILA	0.5 … 50 m	Reflector	2 switching outputs, RS422 interface, SSI-compatible, switchable red-light pilot laser	228
FR 92 ILA	0.2 … 30 m	Reflector	2 switching outputs, 1 analogue output, switchable red-light pilot laser	230

FT 55-RLAP

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

PRODUCT HIGHLIGHTS

- For measurement and control tasks with all object surfaces at long scanning distances
- Stable and precise distance measurement even with tilted objects and with bright, highly reflective or shiny backgrounds
- Compact design for an easy integration
- High flexibility thanks to invertible analogue characteristic (Q_A) and window mode (Q)
- Easy installation and operation via external teach-in
- Clearly visible laser light spot (laser class 1) for an easy alignment and full eye safety

Optical data		Functions	
Measurement range	0.1 ... 5 m (see Selection Table)[1]	Indicator LED 2, green	Operating voltage indicator
Resolution	< 5 mm (12-bit)	Indicator LED 2, yellow	Status indicator analogue output
Linearity	± 30 mm[1, 2]	Indicator LED 1 yellow	Switching output indicator
Repeatability	1.2 mm[1, 2, 3]	Measurement range adjustment	Via Teach-in button or control input
Hysteresis	20 mm	Adjustment possibilities	Analogue measurement range Q_A Invertible analogue characteristic Switching output Q (window mode) N.O. / N.C. and Auto-Detect / NPN / PNP via teach-in and control line Button lock via control input
Type of light	Laser, red 655 nm		
Laser class (IEC 60825-1)	1	Default settings	See Selection Table

Electrical data			
Operating voltage $+U_B$	18 … 30 V DC	Response time Q	2 ms
No-load current I	≤ 60 mA	Load	≤ 500 Ohm (4 ... 20 mA) ≥ 4 k Ohm (0 … 10 V)
Output current Ie Q	≤ 100 mA		
Protection circuits	Reverse polarity protection U_B / short-circuit protection (Q)	Analogue output Q_A	4 … 20 mA / 0 … 10 V
		Update rate Q_A	2 ms
Protection class	2	Temperature drift	< 2 mm / K
Power On Delay	< 5 s	Warm-up time	20 min.
Switching output Q	Auto-Detect (PNP/NPN)[4]	Control input IN	$+U_B$ = Teach-in $-U_B$ = Button locked Open = normal operation
Output function	N.O. / N.C.		
Switching frequency f (ti/tp 1:1)	≤ 250 Hz		

Mechanical data			
Dimensions	50 x 50.1 x 23 mm	Ambient temperature: operation	-40 … +60 °C[6, 7]
Enclosure rating	IP 67 & IP 69K[5]	Ambient temperature: storage	-40 … +80 °C
Material, housing	ABS	Weight (plug device)	42 g
Material, front screen	PMMA	Resistance to vibration and impacts	EN 60947-5-2
Type of connection	See Selection Table		

[1] Reference material 90 % reflectivity [2] At 50 Hz [3] For 1 σ, see diagram for further values [4] Auto-Detect: Automatic selection of PNP or NPN by the sensor, PNP or NPN can be fixed
[5] With connected IP 67 / IP 69K plug [6] Up to +50 °C with current output 4 ... 20 mA [7] UL: -20 ... +45 °C

Measurement range[1]	Analogue output	Switching output	Type of connection	Part Number	Article number
0.1… 5 m	4 … 20 mA	Auto-Detect	Plug, M12x1, 5-pin	FT 55-RLAP-5-PNSI-L5	622-21018
0.1 … 5 m	0 … 10 V	Auto-Detect	Plug, M12x1, 5-pin	FT 55-RLAP-5-PNSU-L5	622-21021

Plug connection

Connection, 5-pin, Auto-Detect

Light spot size

Repeatability[1] (50 Hz)

Repeatability[1] (250 Hz[2])

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

Characteristic analogue curve

Reference material	Measurement range
White (90 %)	0.1 … 5 m
Grey (18 %)	0.1 … 5 m
Black (6 %)	0.1 … 3 m

Default setting[3]

Analogue output Q_A (4…20 mA / 0,09 … 10 V)	0.3 … 3 m
Switching output Q (A_1…A_2), N.O., Auto-Detect	0.3 … 3 m

Accessories

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

[3] The specified precision is achieved by teaching the distances

FT 55-RLAP2

Distance sensor with IO-Link measurement value output

PRODUCT HIGHLIGHTS

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

Optical data	
Scanning distance	0 … 5 m (see Selection Table)[1]
Hysteresis	20 mm
Black/white shift (6%/90%)	≤ ± 40 mm
Grey value shift (18%/90%)	≤ ± 40 mm
Type of light	Laser, red 655 nm
Laser class (IEC 60825-1)	1
Resolution	< 5 mm
Linearity	± 30 mm
Repeatability	1.2 mm

Functions	
Indicator LED 2 green	Operating voltage indicator
Indicator LED 1 yellow	Switching output indicator Q
Scanning distance adjustment	Via Teach-in Button and IO-Link
Adjustment possibilities	N.O. / N.C. via Teach-in Button and IO-Link, wide variety of adjustment possibilities for service and process data via IO-Link
Default settings	3 m, N.O.

Electrical data	
Operating voltage $+U_B$	18 … 30 V DC
No-load current I_0	≤ 60 mA
Output current Ie Q	≤ 100 mA
Protection circuits	Reverse polarity protection U_B / short-circuit protection (Q)
Protection class	2
Power On Delay	< 5 s
Switching output Q	1 x Auto-Detect (PNP/NPN)[2]
Output function	N.O. / N.C.
Switching frequency f (ti/tp 1:1) Q	≤ 500 Hz
Response time Q	1 ms
Temperature drift	< 2 mm / K
Warm-up time	20 min.

Mechanical data	
Dimensions	50 x 50.1 x 23 mm
Enclosure rating	IP 67 & IP 69K[3]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection table
Ambient temperature: operation	-40 … +60 °C[4]
Ambient temperature: storage	-40 … +80 °C
Weight (plug device)	42 g
Resistance to vibration and impacts	EN 60947-5-2

IO-Link	
Communication mode	COM 2
Min. cycle time	3 ms
SIO mode	compatible
Process bit length	16 Bit
Specification	1.1

[1] Reference material 90 % reflectivity [2] Auto-Detect: Automatic selection of PNP or NPN by the sensor, PNP or NPN can be fixed [3] With connected IP 67 / IP 69K plug
[4] UL: -20 ... +45 °C

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

Plug connection

Connection, 4-pin, IO-Link

Scanning properties

Light spot size

Repeatability[1] (50 Hz)

Repeatability[1] (250 Hz[2])

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

Reference material	Scanning distance
White (90 %)	0.06 … 5 m
Grey (18 %)	0.06 … 5 m
Black (6 %)	0.06 … 3 m

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

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 (IEC 60825-1)	1 (measurement laser) 1 (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

Light spot geometry

155-01808

Scanning distance

White 90 %	0.5 … 10 m
Grey 10 %	0.5 … 7 m
Black 6 %	0.5 … 3 m

Accessories

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

FT 91 ILA

Distance sensor

PRODUCT HIGHLIGHTS

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

Optical data	
Operating range	0.5 … 6 m[1]
Type of light	Infrared, 905 nm (measurement laser) Laser, red, 650 nm (pilot laser)
Laser Class (IEC 60825-1)	1 (measurement laser) 1 (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: 07/2016. 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

155-01809

Light spot geometry

155-01810

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

FT 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 (IEC 60825-1)	1 (measurement laser) 1 (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

Version: 07/2016. Subject to changes; diagrams similar

Plug connection

153-00346

Connection, 5-pin (PNP)

154-00125

Connection, 5-pin (NPN)

154-00472

Characteristic analogue curve

155-01373

Light spot geometry

155-00141

Scanning distance

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

Accessories

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

FR 55-RLAP

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

PRODUCT HIGHLIGHTS

- Sensor with large range for anticollision and positioning applications
- High flexibility thanks to adjustable analogue characteristic (Q_A)
- 4 distance positions with 2 switching outputs, adjustable via window function
- Q_1/Q_2 switchable to $Q_1/\overline{Q}_1$ as antivalent outputs
- Compact design for an easy integration
- Easy installation and operation via external teach-in
- Clearly visible laser light spot (laser class 1) for a precise alignment and full eye safety
- Laser can be switched off via control line

Optical data		Functions	
Measurement range	0.3 ... 70[1]	Indicator LED 1, green	Operating voltage indicator
Resolution	8 µA	Indicator LED 1, yellow	Switching output indicator
Linearity	± 0.5 %[1, 2]	Indicator LED 2 yellow	Switching output indicator
Repeatability Q	1.5 mm[3]	Measurement range adjustment	Via Teach-in button or control input
Hysteresis	60 mm	Adjustment possibilities	Analogue measurement range Q_A Invertible analogue characteristic Switching output Q (window mode) N.O. / N.C. / antivalent $Q_1/\overline{Q}_1$ and Auto-Detect / NPN / PNP via teach-in and control line Button lock via control input
Type of light	Laser, red 655 nm		
Laser class (IEC 60825-1)	1	Default settings	See Selection Table

Electrical data			
Operating voltage $+U_B$	18 … 30 V DC	Response time Q	10 ms
No-load current I_0	≤ 60 mA	Load	≤ 500 Ohm (4 ... 20 mA)
Output current Ie Q	≤ 100 mA	Analogue output Q_A	4 … 20 mA
Protection circuits	Reverse polarity protection U_B / short-circuit protection (Q)	Update rate Q_A	10 ms
		Temperature drift	< 1 mm / K
Protection class	2	Warm-up time	20 min.
Power On Delay	< 5 s	Control input IN 1 und IN 2	$+U_B$ = Teach-in $-U_B$ = Button locked Open = normal operation
Switching output Q	Auto-Detect (PNP/NPN)[4]		
Output function	N.O. / N.C. / antivalent $Q_1/\overline{Q}_1$		
Switching frequency f (ti/tp 1:1)	≤ 50 Hz	Control input IN 3	$+U_B$ = Laser off $-U_B$ = Laser on offen = Laser on

Mechanical data			
Dimensions	50 x 50.1 x 23 mm	Ambient temperature: operation	-30 … +60 °C[6]
Enclosure rating	IP 67 & IP 69K[5]	Ambient temperature: storage	-40 … +80 °C
Material, housing	ABS	Weight (plug device)	42 g
Material, front screen	PMMA	Resistance to vibration and impacts	EN 60947-5-2
Type of connection	See Selection Table		

[1] Reference material: RF250 reflector [2] Of set measuring range [3] For 1 σ, the set measuring range is < 20 m, for futher values see diagram [4] Auto-Detect: Automatic selection of PNP or NPN by the sensor, PNP or NPN can be fixed [5] With connected IP 67 / IP 69K plug [6] UL: -20 ... +45 °C

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

Plug connection

Connection, 5-pin, Auto-Detect

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

Light spot size

Repeatability Q, Q_A

Characteristic analogue curve

[1] At constant ambient conditions

Default setting	Measurement range
Analogue output Q_A (4…20 mA)	2 … 6 m
Switching output Q (A_1…A_2), N.O., Auto-Detect	2 … 6 m
Switching output Q_2 (A_1…A_2), N.O., Auto-Detect	2 … 6 m

Accessories	
Mounting angle MA F 55 (579-50007)	From Page A-4
Further brackets	From Page A-4
Connection cables (C L8FG-S-2m-PUR / 902-51830)	From Page A-38
Further connection cables	From Page A-38
Reflective foil RF 250 (599-91009)	From Page A-18
Further reflectors	From Page A-18

FR 55-RLP

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

PRODUCT HIGHLIGHTS

- Sensor with large range for anticollision and positioning applications
- 4 distance positions with 2 switching outputs, adjustable via window function
- Q_2 can be switched to Q_1 as antivalent output, e.g. for wire breakage monitoring
- Compact design for an easy integration
- Easy installation and operation via external teach-in
- Clearly visible laser light spot (laser class 1) for a precise alignment and full eye safety

Optical data		Functions	
Measurement range	0.3 ... 70[1]	Indicator LED 1, green	Operating voltage indicator
Repeatability Q	1.5 mm[2]	Indicator LED 1, yellow	Switching output indicator
Hysteresis	60 mm	Indicator LED 2 yellow	Switching output indicator
Type of light	Laser, red 655 nm	Measurement range adjustment	Via Teach-in button or control input
Laser class (IEC 60825-1)	1	Adjustment possibilities	Switching output Q (window mode) N.O. / N.C. / antivalent Q_1/Q_1 and Auto-Detect / NPN / PNP via teach-in and control line Button lock via control input
		Default settings	See Selection Table
Electrical data			
Operating voltage $+U_B$	18 … 30V DC	Response time Q	10 ms
No-load current I_0	≤ 60 mA	Temperature drift	< 1 mm / K
Output current Ie Q	≤ 100 mA	Warm-up time	20 min.
Protection circuits	Reverse polarity protection U_B / short-circuit protection (Q)	Control input IN	$+U_B$ = Teach-in $-U_B$ = Button locked Open = normal operation
Protection class	2		
Power On Delay	< 5 s		
Switching output Q	Auto-Detect (NPN / PNP)[3]		
Output function	N.O. / N.C. / antivalent $Q_1/\overline{Q}_1$		
Switching frequency f (ti/tp 1:1)	≤ 50 Hz		
Mechanical data			
Dimensions	50 x 50.1 x 23 mm	Ambient temperature: operation	-30 … +60 °C[5]
Enclosure rating	IP 67 & IP 69K[4]	Ambient temperature: storage	-40 … +80 °C
Material, housing	ABS	Weight (plug device)	42 g
Material, front screen	PMMA	Resistance to vibration and impacts	EN 60947-5-2
Type of connection	See Selection Table		

[1] RF250 reflector [2] For 1 σ, the set measuring range is < 20 m, for futher values see diagram [3] Auto-Detect: Automatic selection of PNP or NPN by the sensor, PNP or NPN can be fixed
[4] With connected IP 67 / IP 69K plug [5] UL: -20 ... +45 °C

Measurement range[1]	Switching output	Type of connection	Part Number	Article number
0.3… 70 m	2 x Auto-Detect	Plug, M12x1, 5-pin	FR 55-RLP-70-2PNS-L5	621-11027

Plug connection

Connection, 5-pin, Auto-Detect

Light spot size

Repeatability[1] Q_1 / Q_2

Switching output Q_1 / Q_2

[1] At constant ambient conditions

Default setting	Measurement range
Switching output Q_1 (A_1…A_2), N.O., Auto-Detect	2 … 6 m
Switching output Q_2 (A_1…A_2), N.O., Auto-Detect	2 … 6 m

Accessories	
Mounting angle MA F 55 (579-50007)	From Page A-4
Further brackets	From Page A-4
Connection cables	From Page A-38
Reflective foil RF 250 (599-91009)	From Page A-18
Further reflectors	From Page A-18

FR 90 ILA

Reflector distance sensor

PRODUCT HIGHLIGHTS

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

Optical data	
Scanning distance	0.5 … 250 m
Type of light	Infrared, 905 nm (measurement laser) Laser, red, 650 nm (pilot laser)
Laser Class (IEC 60825-1)	1 (measurement laser) 1 (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

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

155-01811

Light spot geometry

155-01807

Accessories

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

FR 91 ILA

Reflector distance sensor

PRODUCT HIGHLIGHTS

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

Optical data	
Scanning distance	0.5 … 50 m
Type of light	Infrared, 905 nm (measurement laser) Laser, red, 650 nm (pilot laser)
Laser Class (IEC 60825-1)	1 (measurement laser) 1 (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: 07/2016. 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

155-01812

Light spot geometry

155-01813

Accessories

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

FR 92 ILA

Reflector distance sensor

PRODUCT HIGHLIGHTS

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

Optical data	
Scanning distance	0.2 … 30 m[1]
Type of light	Infrared, 905 nm (measurement laser) Laser, red, 650 nm (pilot laser)
Laser Class (IEC 60825-1)	1 (measurement laser) 1 (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

Light spot geometry

155-00210

Accessories

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

FR 85 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
- 1 input and 2 PNP outputs
- RS485 interface
- Detection range adjustable externally
- Reliable suppression of foreign objects (girders, pillars)
- ABS housing: 145 x 85 x 80 mm

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

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

FR 85 Rail Pilot – Product Overview			
	Operating range	Special features	Page
FR 85 Rail Pilot	0 … 6 m	RS485 interface or PNP switching outputs	234

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 (IEC 60825-1)	1
Resolution	~ 16 mm
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	Baud rate	Suitable for control	Type of connection	Part number	Article number
RS485	57,6 kB	Lenze / DETO	Plug, M12x1, 5-pin	FR 85-2 ILLG-S1L5	529-11008
RS485	62,5 kB	LJU	Plug, M12x1, 5-pin	FR 85-2 ILLG-S1L5-62,5 kB	529-11014
2 switching points Q (PNP) N.C.	-	-	Plug, M12x1, 5-pin	FR 85-2 ILLG-POL5	529-11010

Version: 07/2016. Subject to changes; diagrams similar

Plug connection

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

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

Detection cone

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

Accessories	
Reflectors	From Page A-18
Connection cables	From Page A-38
Setup Box FR 85-2 ILLX 533-11016	From Page A-38

Colour, contrast and luminescence sensors

A broad spectrum

FT 25-C
RGB colour sensor
from Page 242

- *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 246

- *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 256

- *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 264

- *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 114

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

>> Page 122

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

>> Page 116

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 mm)
- 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	244

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
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked open = normal operation

Mechanical data	
Dimensions	34 x 20 x 12 mm
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

7

Installation

155-01726

Accessories

Connection cables	From Page A-38
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	248
FT 50 C	LED, white	… 32 mm	3 switching outputs	250
FT 50 C	LED, white	… 32 mm	Serial interface	252
IO Box for FT 50 C				254

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
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

Connection, 5-pin

Installation

Accessories

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

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
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-38
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
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

IO-Box T-CS1T-12T34PRD	From Page 254
Connection cables	From Page A-38
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 (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

Version: 07/2016. Subject to changes; diagrams similar

Dimensional drawing, IO Box

Connection IO Box

Accessories

Connection cables	From Page A-38
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 serie), 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 – Product Overview

	Type of light	Scanning distance	Special features	Page
FT 25-W	White LED	12 ± 2,5 mm	Minimal response time	258
FT 25-RGB	Red LED, green LED, blue LED	12 ± 3 mm	Automatic selection of ideal transmission colour, minimal response time	260
FT 25-RL	Laser	250 mm	Long scanning distance	262

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	≤ 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, 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
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked open = normal operation

Mechanical data	
Dimensions	34 x 20 x 12 mm
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 (metal plug device[5])	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 [5] no Ecolab

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-38
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, 633 nm Green LED, 525 nm Blue LED, 460 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 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	≤ 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, 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
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked open = normal operation

Mechanical data	
Dimensions	34 x 20 x 12 mm
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 (metal plug device[5])	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 [5] no Ecolab

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

7

Accessories

Connection cables	From Page A-38
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 (IEC 60825-1)	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)	≤ 4000 Hz
Response time	125 µs
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked open = normal operation

Mechanical data	
Dimensions	34 x 20 x 12 mm
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 (metal plug device[6])	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
[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	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-38
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	266

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
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

Plug connection

153-00826

Connection, 5-pin

154-00262

Installation

155-01167

155-01228

Relative sensitivity*

155-01320

* Reference material: white, 90 % reflectivity

Light spot size

155-01319

Accessories

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

Photoelectric sensors and proximity sensors

Performance and quality made in Germany

F 10 – sub-miniature sensor family

from Page 276

FT 10-RLH
- *The world's smallest adjustable laser photoelectric proximity sensor with background suppression*

>> Page 278

FS/FE 10-RL
- *Very precise front edge detection thanks to high scanning rate and fine laser beam*

>> Page 292

F 25 – the new generation miniature sensor family

from Page 296

FT 25-RLH
- *Extremely accurate small-part detection thanks to tiny laser light spot*
- *Precise background suppression through SensoPart ASIC technology*

>> Page 298

FT 25-RHD
- *Photoelectric proximity sensor with adjustable background suppression*
- *Long scanning distance of 400 mm with miniature housing*

>> Page 302

F 55 – photoelectric sensors and proximity sensors with high-quality housings

from Page 346

FT 55-RLHP2
- *Photoelectric proximity sensor with background suppression*
- *Reliable object detection at long distances up to 5 m*

>> Page 352

FT 55-RL
- *Laser photoelectric proximity sensor*
- *Detection of the slightest contrast differences at a scanning distance of up to 1.2 m*

>> Page 360

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 Auto-detect 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 330

FT 50 RLHD

- *Laser photoelectric proximity sensor with background suppression*
- *Long scanning distance of 300 mm with compact housing and extremely accurate small-part detection*

>> Page 334

F 88 – the photoelectric sensor and proximity sensor family for harsh operating conditions

from Page 374

FT 88-IH

- *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 382

FT 92 – proximity sensors with long ranges

from Page 394

FT 92 IL

- *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 396

Photoelectric sensors and proximity sensors in cylindrical housings

from Page 398

FMH 18

- *Best sensor in cylindrical housing with background suppression*

>> Page 402

FR 18-2 RM

- *Retroreflective photoelectric sensor*
- *Standard M18 sleeve in robust full-metal housing*

>> Page 422

made in Germany

TYPICAL SENSOPART

- SensoPart develops, produces and sells photoelectric proximity 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), 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

By far the best object detection

Our sensors detect almost any object in any surroundings thanks to the distance principle

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.

Your advantages

- Reliable object detection
- High process stability
- An economical solution

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

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.

made in Germany

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	278
FT 10-B-RLF	Laser	Fixed focus	15 mm / 30 mm		280
FT 10-RH	LED	Teach-in	70 mm		282
FT 10-RF	LED	Fixed focus	15 mm / 30 mm / 50 mm		284
FT 10-BF Bluelight	LED, blue	Fixed focus	30 mm / 50 mm	Blue transmission LED for strongly light-absorbing objects	286
Retroreflective photoelectric sensors					
FR 10-RL	Laser	Teach-in	2 m	Long range, precise small-part detection	288
FR 10-R	LED	Teach-in	1.6 m	Long range	290
Through-beam photoelectric sensors					
FS/FE 10-RL	Laser	Teach-in	3 m	Sensor pair, very accurate object positioning	292
FS 10-RL/FE 10-RL	Laser	Teach-in	3 m	Transmitter/receiver, very accurate object positioning	294

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	
Scanning distance	6 … 70 mm[1]
Adjustment range	10 … 70 mm[1]
Type of light	Laser, red, 655 nm
Light spot size (total detection area)	1 x 3 mm[2]
Laser Class (IEC 60825-1)	1

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
Default settings	Max. scanning distance and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
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.
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz
Response time	500 µs
Control input, IN (only 4-pin design)	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions	21.1 x 14.6 x 8 mm
Enclosure rating	IP 67[3]
Material, housing	PUR
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +50 °C[4]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	Ca. 3 g
Weight (cable device)	Ca. 22 g
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 [4] UL: -20 ... +30 °C

Scanning distance	Switching output	Type of connection	Part number	Article number
6 … 70 mm	PNP	Plug, M5x0.5, 4-pin	FT 10-RLH-PS-E4	600-11130
6 … 70 mm	NPN	Plug, M5x0.5, 4-pin	FT 10-RLH-NS-E4	600-11131
6 … 70 mm	PNP	Cable, 2 m, 4-wire	FT 10-RLH-PS-K4	600-11132
6 … 70 mm	NPN	Cable, 2 m, 4-wire	FT 10-RLH-NS-K4	600-11133
6 … 70 mm	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-RLH-PS-KM4	600-11134
6 … 70 mm	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-RLH-NS-KM4	600-11135
6 … 70 mm	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-RLH-PS-KM3	600-11146
6 … 70 mm	NPN	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-RLH-NS-KM3	600-11147
6 … 70 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

Connection, 4-pin	Connection, 3-pin

Reference material	Detection range
White (90 %)	6 … 70 mm
Grey (18 %)	7 … 70 mm
Black (6 %)	7 … 70 mm

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

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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	
Scanning distance	6 … 15 mm[1] 6 … 30 mm[1]
Type of light	Laser, red, 655 nm
Light spot size (total detection area)	1 x 3 mm[2]
Laser Class (IEC 60825-1)	1

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Adjustment possibilities	N.O. / N.C. via control input

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]
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)	≤ 1000 Hz
Response time	500 µs
Control input, IN (only 4-pin design)	$+U_B$ = N.C. $-U_B$ / Open = N.O.

Mechanical data	
Dimensions	21.1 x 14.6 x 8 mm
Enclosure rating	IP 67[3]
Material, housing	PUR
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +50 °C[4]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	Ca. 3 g
Weight (cable device)	Ca. 22 g
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 [4] UL: -20 ... +30 °C

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

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

Including dovetail clamp mounting MBD F 10 for all types

Plug connection

Cable connection

Connection, 4-pin

Connection, 3-pin

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-38
Brackets	From Page A-4

FT 10-RH

Photoelectric proxmity sensor with background suppression

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

Optical data	
Scanning distance	5 … 70 mm[1]
Adjustment range	10 … 70 mm[1]
Used light	LED, red, 650 nm
Light spot size	See diagram
Repeatability	0,45 mm[2, 3]
Hysteresis	≤ 2 mm[2]
Grey/white shift (18%/90%)	≤ 3 mm[2]
Black/white shift (6%/90%)	≤ 4 mm[2]

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Scanning distance adjustment	Via Teach-in button and control input[5]
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[5] Button lock via control input[5]
Default settings	Max. range and N.O.

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[4]
No-load current, I_0	≤ 20 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
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
Enclosure rating	IP 67[6]
Material, housing	PUR
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C[7]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	approx. 3 g
Weight (cable device)	approx. 22 g
Weight (pigtail)	approx. 10 g

[1] Reference material white, 90 % reflectivity [2] At maximum scanning distance [3] In constant environmental conditions [4] Max. 10 % ripple within U_B, ~ 50 Hz / 100 Hz
[5] Only 4-pin design [6] With connected IP 67 plug [7] UL: -20 ... +30 °C

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: 07/2016. 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

Reference material	Detection range
White (90 %)	5 … 70 mm
Grey (18 %)	8 … 70 mm
Black (6 %)	8 … 70 mm

Accessories

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

FT 10-RF

Photoelectric proxmity sensor with background suppression, fixed focus

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	2 … 15 mm[1] 2 … 30 mm[1] 2 … 50 mm[1]
Used light	LED, red, 650 nm
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	≤ 20 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
Enclosure rating	IP 67[4]
Material, housing	PUR
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C[5]
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 [5] UL: -20 ... +30 °C

Scanning distance	Switching output	Type of connection	Part number	Article number
2 … 15 mm[1]	PNP	Cable, 2 m, 4-wire	FT 10-RF1-PS-K4	600-11008
2 … 15 mm[1]	NPN	Cable, 2 m, 4-wire	FT 10-RF1-NS-K4	600-11011
2 … 30 mm[1]	PNP	Cable, 2 m, 4-wire	FT 10-RF2-PS-K4	600-11014
2 … 30 mm[1]	NPN	Cable, 2 m, 4-wire	FT 10-RF2-NS-K4	600-11017
2 … 50 mm[1]	PNP	Cable, 2 m, 4-wire	FT 10-RF3-PS-K4	600-11020
2 … 50 mm[1]	NPN	Cable, 2 m, 4-wire	FT 10-RF3-NS-K4	600-11023
2 … 15 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-RF1-PS-KM4	600-11009
2 … 15 mm[1]	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-RF1-NS-KM4	600-11012
2 … 30 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-RF2-PS-KM4	600-11015
2 … 30 mm[1]	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-RF2-NS-KM4	600-11018
2 … 50 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-RF3-PS-KM4	600-11021
2 … 50 mm[1]	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-RF3-NS-KM4	600-11024
2 … 15 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-RF1-PS-KM3	600-11010
2 … 15 mm[1]	NPN	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-RF1-NS-KM3	600-11013

Scanning distance	Switching output	Type of connection	Part number	Article number
2 … 30 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-RF2-PS-KM3	600-11016
2 … 30 mm[1]	NPN	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-RF2-NS-KM3	600-11019
2 … 50 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-RF3-PS-KM3	600-11022
2 … 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

Connection, 4-pin

Connection, 3-pin

Light spot size

Reference material	Detection range		
	FT 10-RF1	FT 10-RF2	FT 10-RF3
white (90 %)	2 … 15 mm	2 … 30 mm	2 … 50 mm
grey (18 %)	3 … 15 mm	4 … 30 mm	5 … 50 mm
black (6 %)	4 … 15 mm	5 … 30 mm	7 … 50 mm

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

FT 10-BF

Bluelight photoelectric proxmity sensor with background suppression, fixed focus

PRODUCT HIGHLIGHTS

- Sub-miniature sensor with blue transmission LED and precise fixed background suppression
- Reliable switching behaviour with strongly light-absorbing and transparent objects, e.g. solar wafers in every process phase
- 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	2 … 30 mm[1] / 2 … 50 mm[1]	Indicator LED, green	Operating voltage indicator
Optimum scanning distance	15 … 20 mm	Indicator LED, yellow	Switching output indicator
Used light	LED, blue, 450 nm	Adjustment possibilities	N.O. / N.C. via control input[3]
LED risk group (DIN 62471)	2		
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
No-load supply current I_0	≤ 20 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[5]
Power On Delay	< 300 ms	Ambient temperature: storage	-20 … +80 °C
Switching output, Q	PNP/NPN (see Selection Table)	Weight (cable device)	approx. 22 g
Output function	N.O. /N.C.	Weight (pigtail)	approx. 10 g
Switching frequency, f (ti/tp 1:1)	1000 Hz		
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 design [4] With connected IP 67 plug [5] UL: -20 ... +30 °C

Scanning distance	Switching output	Type of connection	Part number	Article number
2 … 30 mm[1]	PNP	Cable, 2 m, 4-wire	FT 10-BF2-PS-K4	600-11026
2 … 30 mm[1]	NPN	Cable, 2 m, 4-wire	FT 10-BF2-NS-K4	600-11029
2 … 30 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-BF2-PS-KM4	600-11027
2 … 30 mm[1]	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-BF2-NS-KM4	600-11030
2 … 30 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-BF2-PS-KM3	600-11028
2 … 30 mm[1]	NPN	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-BF2-NS-KM3	600-11031
2 … 50 mm[1]	PNP	Cable, 2 m, 4-wire	FT 10-BF3-PS-K4	600-11036
2 … 50 mm[1]	NPN	Cable, 2 m, 4-wire	FT 10-BF3-NS-K4	600-11039
2 … 50 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-BF3-PS-KM4	600-11037
2 … 50 mm[1]	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FT 10-BF3-NS-KM4	600-11040
2 … 50 mm[1]	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-BF3-PS-KM3	600-11038
2 … 50 mm[1]	NPN	Pigtail, 200 mm with M8 plug, 3-pin	FT 10-BF3-NS-KM3	600-11041

Including dovetail clamp mounting MBD F 10 for all types

Cable connection

Connection, 4-pin

Connection, 3-pin

Light spot size

Accessories

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

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	
Limit range	0.1 … 4 m[1]
Operating range	0.1 … 3 m[1]
Type of light	Laser, red, 655 nm
Light spot size	See diagram
Laser Class (IEC 60825-1)	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	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	≤ 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)	≤ 1000 Hz
Response time	500 µs
Control input, IN (only 4-pin design)	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions	21.1 x 14.6 x 8 mm
Enclosure rating	IP 67[3]
Material, housing	PUR
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +50 °C[4]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	Ca. 3 g
Weight (cable device)	Ca. 22 g
Weight (pigtail)	Ca. 10 g

[1] Reference material: R5/L reflector [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 plug [4] UL: -20 ... +30 °C

Operating range	Switching output	Type of connection	Part number	Article number
0.1 … 3 m	PNP	Plug, M5x0.5, 4-pin	FR 10-RL-PS-E4	603-31000
0.1 … 3 m	NPN	Plug, M5x0.5, 4-pin	FR 10-RL-NS-E4	603-31001
0.1 … 3 m	PNP	Cable, 2 m, 4-wire	FR 10-RL-PS-K4	603-31002
0.1 … 3 m	NPN	Cable, 2 m, 4-wire	FR 10-RL-NS-K4	603-31003
0.1 … 3 m	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FR 10-RL-PS-KM4	603-31004
0.1 … 3 m	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FR 10-RL-NS-KM4	603-31005
0.1 … 3 m	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FR 10-RL-PS-KM3	603-31006
0.1 … 3 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

Cable connection

Connection, 4-pin

Connection, 3-pin

Light spot size

Reflector / Reflective foil*	Operating range
R5/L	0.1 … 3 m
RF-100 KL*	0.1 … 3 m

Accessories	
Reflectors	From Page A-18
Connection cables	From Page A-38
Brackets	From Page A-4

FR 10-R

Retroreflective photoelectric sensor

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	
Operating range	0.1 … 1.6 m[1]
Used light	LED, red, 650 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[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	≤ 20 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
Enclosure rating	IP 67[4]
Material, housing	PUR
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C[5]
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 [5] UL: -20 ... +30 °C

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

Connection, 4-pin

Connection, 3-pin

Light spot size

Reflector / Reflective foil*	Operating range (min./max. reflector distance)
R5	0.1 … 1.6 m
R1	0.1 … 1 m
R2-2LB1	0,15 … 0,5 m
R3-2LK1	0,15 … 0,5 m
RF-100 KL*	0,15 … 1 m

Accessories	
Reflectors	From Page A-18
Connection cables	From Page A-38
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 … 4 m
Type of light	Laser, red, 655 nm
Light spot size	See diagram
Laser Class (IEC 60825-1)	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
Enclosure rating	IP 67[2]
Material, housing	PUR
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 ... +50 °C[3]
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 [3] UL: -20 ... +30 °C

Operating range	Switching output	Type of connection	Part number	Design	Article number
1 … 4 m	PNP	Plug, M5x0.5, 4-pin	FS/FE 10-RL-PS-E4	Sensor pair (transmitter & receiver)	611-51000
1 … 4 m	NPN	Plug, M5x0.5, 4-pin	FS/FE 10-RL-NS-E4	Sensor pair (transmitter & receiver)	611-51001
1 … 4 m	PNP	Cable, 2 m, 4-wire	FS/FE 10-RL-PS-K4	Sensor pair (transmitter & receiver)	611-51002
1 … 4 m	NPN	Cable, 2 m, 4-wire	FS/FE 10-RL-NS-K4	Sensor pair (transmitter & receiver)	611-51003
1 … 4 m	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FS/FE 10-RL-PS-KM4	Sensor pair (transmitter & receiver)	611-51004
1 … 4 m	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FS/FE 10-RL-NS-KM4	Sensor pair (transmitter & receiver)	611-51005
1 … 4 m	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FS/FE 10-RL-PS-KM3	Sensor pair (transmitter & receiver)	611-51006
1 … 4 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: 07/2016. Subject to changes; diagrams similar

Plug connection

Cable connection

Connection, transmitter, 4-pin

Connection, receiver, 4-pin

Connection, transmitter, 3-pin

Connection, receiver, 3-pin

Light spot size

Accessories

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

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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 … 4 m
Type of light	Laser, red, 655 nm
Light spot size	See diagram
Laser Class (IEC 60825-1)	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
Enclosure rating	IP 67[2]
Material, housing	PUR
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +50 °C[3]
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 [3] UL: -20 ... +30 °C

Operating range	Switching output	Type of connection	Part number	Design	Article number
1 ... 4 m	PNP	Plug, M5x0.5, 4-pin	FE 10-RL-PS-E4	Receiver	602-71000
1 ... 4 m	–	Plug, M5x0.5, 4-pin	FS 10-RL-E4	Transmitter	601-61000
1 ... 4 m	NPN	Plug, M5x0.5, 4-pin	FE 10-RL-NS-E4	Receiver	602-71001
1 ... 4 m	PNP	Cable, 2 m, 4-wire	FE 10-RL-PS-K4	Receiver	602-71002
1 ... 4 m	–	Cable, 2 m, 4-wire	FS 10-RL-K4	Transmitter	601-61002
1 ... 4 m	NPN	Cable, 2 m, 4-wire	FE 10-RL-NS-K4	Receiver	602-71003
1 ... 4 m	PNP	Pigtail, 200 mm with M8 plug, 4-pin	FE 10-RL-PS-KM4	Receiver	602-71004
1 ... 4 m	–	Pigtail, 200 mm with M8 plug, 4-pin	FS 10-RL-KM4	Transmitter	601-61004
1 ... 4 m	NPN	Pigtail, 200 mm with M8 plug, 4-pin	FE 10-RL-NS-KM4	Receiver	602-71005
1 ... 4 m	PNP	Pigtail, 200 mm with M8 plug, 3-pin	FE 10-RL-PS-KM3	Receiver	602-71006
1 ... 4 m	–	Pigtail, 200 mm with M8 plug, 3-pin	FS 10-RL-KM3	Transmitter	601-61005

Operating range	Switching output	Type of connection	Part number	Design	Article number.
1 ... 4 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

Cable connection

Connection, transmitter, 4-pin

Connection, receiver, 4-pin

Connection, transmitter, 3-pin

Connection, receiver, 3-pin

Light spot size

Accessories

Connection cables	From Page A-38
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	298
FT 25-RH	LED	Teach-in	200 mm		300
FT 25-RHD	LED	Teach-in	400 mm	Long scanning distance	302
FT 25-RF1/2	LED	Fixed focus	60 mm / 80 mm		304
Photoelectric proximity sensors with foreground suppression					
FT 25-RV	LED	Teach-in	200 mm	Window function (switching window)	306
Photoelectric proximity sensors					
FT 25-RL	Laser	Teach-in	250 mm	Detection of minimal grey value differences	308
FT 25-R	LED	Teach-in	800 mm		310
Retroreflective photoelectric sensors					
FR 25-RGO	LED	Teach-in	2 m	Autocollimation, detection of transparent objects	312
FR 25-RGO2	LED	Teach-in	2 m	Autocollimation	314
FR 25-RLO	Laser	Teach-in	4 m	Autocollimation, most accurate small-part detection	316
FR 25-RL	Laser	Teach-in	15 m	Most accurate small-part detection	318
FR 25-R	LED	Teach-in	7 m		320
FR 25-RF	LED	Fixed setting	5 m		322
Through-beam photoelectric sensors					
FS/FE 25-RL	Laser	Teach-in	20 m	Most accurate small-part detection	324
FS/FE 25-R	LED	Teach-in	15 m		326
FS/FE 25-RF	LED	Fixed setting	6 m		328

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 (IEC 60825-1)	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
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 ... +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, M8 4-pin	FT 25-RLH-PS-KM4	609-11012
4 … 120 mm	NPN	Pigtail, 150 mm with plug, M8, 4-pin	FT 25-RLH-NS-KM4	609-11013

Scanning distance	Switching output	Type of connection	Part number	Article number
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

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-38
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
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 ... +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, M8, 4-pin	FT 25-RH-PS-KM4	608-11031
1 … 200 mm	NPN	Pigtail, 150 mm with plug, M8, 4-pin	FT 25-RH-NS-KM4	608-11032

Version: 07/2016. Subject to changes; diagrams similar

Scanning distance	Switching output	Type of connection	Part number	Article number
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

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-38
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 (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
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 ... +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	Plug, M8x1, 3-pin	FT 25-RHD-PS-M3M	608-11029
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, M8, 4-pin	FT 25-RHD-PS-KM4	608-11030

Scanning distance	Switching output	Type of connection	Part number	Article number
3 … 400 mm	NPN	Pigtail, 150 mm with plug, M8, 4-pin	FT 25-RHD-NS-KM4	608-11033
3 … 400 mm	PNP	Pigtail, 150 mm with plug, M12, 4-pin	FT 25-RHD-PS-KL4	608-11010
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

8

Connection, 4-pin

154-00312

Connection, 4-pin, Auto-detect

154-00313

Scanning properties

155-01382

Light spot size

155-01381

Reference material	Detection range
White (90 %)	3 … 400 mm
Grey (18 %)	6 … 260 mm
Black (6 %)	12 … 200 mm

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

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	
Scanning distance	1 … 60 mm[1] / 1 … 80 mm[1]
Type of light	LED, red, 632 nm
Light spot size	See diagram
Hysteresis	~ 5%[2]

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Adjustment possibilities	N.O./N.C. via control input

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	< 300ms
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	$+U_B$ = N.C. $-U_B$ / Open = N.O.

Mechanical data	
Dimensions	34 x 20 x 12 mm
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
Vibration and impact resistance	EN 60947-5-2

[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 ... +50 °C [6] No Ecolab

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	Metal plug, M8x1, 4-pin	FT 25-RF1-PS-M4M	608-11037
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-38
Brackets	From Page A-4

FT 25-RV

Photoelectric proximity sensor with foreground suppression

PRODUCT HIGHLIGHTS

- Auto-detect photoelectric proximity sensor with real PNP and real NPN functions
- Precisely adjustable foreground suppression
- Long scanning distance of 200 mm with small and compact housings
- Additional adjustable window function (switching window)
- 2-point teach-in or dynamic teach-in also possible via external control line

Optical data	
Scanning distance	30 … 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 Mode 3: switching window
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
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
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 ... +50 °C [5] No Ecolab

Scanning distance	Switching output	Type of connection	Part number	Article number
30 … 200 mm	PNP	Plug, M8x1, 4-pin	FT 25-RV-PS-M4	604-41006
30 … 200 mm	NPN	Plug, M8x1, 4-pin	FT 25-RV-NS-M4	604-41007
30 … 200 mm	Auto-Detect	Plug, M8x1, 4-pin	FT 25-RV-PNS-M4	604-41005
30 … 200 mm	Auto-Detect	Metal plug, M8x1, 4-pin	FT 25-RV-PNS-M4M	604-41004

Plug connection

Connection, 4-pin, Auto-Detect

Light spot size

Reference material	Detection range
White (90 %)	30 … 200 mm
Grey (18 %)	30 … 200 mm
Black (6 %)	30 … 200 mm

Accessories

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

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 (IEC 60825-1)	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)	≤ 4000 Hz
Response time	125 µs
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked Open = normal operation

Mechanical data	
Dimensions	34 x 20 x 12 mm
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 (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 ... +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, 152 mm with plug, M8, 4-pin	FT 25-RL-PS-KM4	609-21002
1 … 250 mm	NPN	Pigtail, 152 mm with plug, M8, 4-pin	FT 25-RL-NS-KM4	609-21007
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

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-38
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	
Scanning distance	0 … 800 mm[1]
Adjustment range	20 … 800 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
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)	≤ 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
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 ... +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, M8, 4-pin	FT 25-R-PS-KM4	607-21022
0 … 800 mm	NPN	Pigtail, 150 mm with plug, M8, 4-pin	FT 25-R-NS-KM4	607-21023

Scanning distance	Switching output	Type of connection	Part number	Article number
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

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-38
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
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 ... +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
0 … 2 m	PNP	Pigtail, 150 mm with plug, M8, 4-pin	FR 25-RGO-PS-KM4	606-11030
0 … 2 m	NPN	Pigtail, 150 mm with plug, M8, 4-pin	FR 25-RGO-NS-KM4	606-11031
0 … 2 m	PNP	Pigtail, 500 mm with plug, M8, 4-pin	FR 25-RGO-PS-KM4-X04	606-11032

Plug connection

153-00964

Cable connection

153-00963

Connection, 4-pin

154-00312

Light spot size

155-01531

Reflector / Reflective foil*	Operating range (min./max. reflector distance)
R5/L	0.5… 2 m
RF-100 KL*	0 … 2 m
R2-2LB1	0 … 500 mm
R3-2LK1	0 … 500 mm

Accessories

Reflectors	From Page A-18
Connection cables	From Page A-38
Brackets	From Page A-4

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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	
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
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	10 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 ... +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

Connection, 4-pin

Light spot size

Reflector / Reflective foil*	Operating range (min./max. reflector distance)
R5/L	0.5 … 2 m
RF-100 KL*	0 … 2 m
R2-2LB1	0 … 500 mm
R3-2LK1	0 … 500 mm

Accessories

Reflectors	From Page A-18
Connection cables	From Page A-38
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 (IEC 60825-1)	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
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 ... +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
≤ 4 kHz	125 µs	PNP	Pigtail, 150 mm with plug, M8, 4-pin	FR 25-RLO2-PS-KM4	609-31011

Switching frequency, f (ti/tp 1:1)[2]	Response time	Switching output	Type of connection	Part number	Article number
≤ 4 kHz	125 µs	NPN	Pigtail, 150 mm with plug, M8, 4-pin	FR 25-RLO2-NS-KM4	609-31012
≤ 4 kHz	125 µs	PNP	Pigtail, 500 mm with plug, M8, 4-pin	FR 25-RLO2-PS-KM4-X05	609-31013

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 / Reflective foil*	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 / Reflective foil*	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	0.1 … 15 m[1]
Operating range	0.1 … 13 m[1]
Type of light	Laser, red, 650 nm
Light spot size	See diagram
Laser Class (IEC 60825-1)	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)	≤ 4000 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
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 ... +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, M8, 4-pin	FR 25-RL-PS-KM4	609-21016
1 … 13 m	NPN	Pigtail, 150 mm with plug, M8, 4-pin	FR 25-RL-NS-KM4	609-21017
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

Version: 07/2016. Subject to changes; diagrams similar

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-18
Connection cables	From Page A-38
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	0.1 … 7 m[1]
Operating range	0.1 … 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
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 ... +50 °C [6] No Ecolab

Operating range	Switching output	Type of connection	Part number	Article number
0.1 … 6 m	PNP	Plug, M8x1, 4-pin	FR 25-R-PS-M4	606-11000
0.1 … 6 m	NPN	Plug, M8x1, 4-pin	FR 25-R-NS-M4	606-11002
0.1 … 6 m	PNP	Metal plug, M8x1, 3-pin	FR 25-R-PS-M3M	606-11006
0.1 … 6 m	NPN	Metal plug, M8x1, 3-pin	FR 25-R-NS-M3M	606-11007
0.1 … 6 m	PNP	Metal plug, M8x1, 4-pin	FR 25-R-PS-M4M	606-11008
0.1 … 6 m	NPN	Metal plug, M8x1, 4-pin	FR 25-R-NS-M4M	606-11009
0.1 … 6 m	PNP	Cable, 2 m, 4-wire	FR 25-R-PS-K4	606-11001
0.1 … 6 m	NPN	Cable, 2 m, 4-wire	FR 25-R-NS-K4	606-11003

Operating range	Switching output	Type of connection	Part number	Article number
0.1 … 6 m	PNP	Pigtail, 150 mm with plug, M8, 4-pin	FR 25-R-PS-KM4	606-11028
0.1 … 6 m	NPN	Pigtail, 150 mm with plug, M8, 4-pin	FR 25-R-NS-KM4	606-11029
0.1 … 6 m	PNP	Pigtail, 150 mm with plug, M12, 4-pin	FR 25-R-PS-KL4	606-11004
0.1 … 6 m	NPN	Pigtail, 150 mm with plug, M12, 4-pin	FR 25-R-NS-KL4	606-11005
0.1 … 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, 4-pin, 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-18
Connection cables	From Page A-38
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	
Limit range	0.1 … 5 m[1]
Operating range	0.1 … 3 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
Adjustment possibilities	N.O./N.C. via control input

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	$+U_B$ = N.C. $-U_B$ / Open = N.O.

Mechanical data	
Dimensions	34 x 20 x 12 mm
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 (cable device)	40 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 [4] UL: -20 ... +50 °C

Operating range	Switching output	Type of connection	Part number	Article number
0.1 … 3 m	PNP	Plug, M8x1, 3-pin	FR 25-RF-PS-M3	606-11038
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

Cable connection

Connection, 4-pin

Connection, 3-pin

Functional reserves

Light spot size

Reflector	Operating range
R10	0.1 … 3 m
RD8	0.1 … 3 m
R5	0.1 … 3 m

Accessories

Reflectors	From Page A-18
Connection cables	From Page A-38
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 (IEC 60825-1)	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
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 ... +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-38	Brackets	From Page A-4

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
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 ... +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

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-38	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	
Limit range	0 … 6 m
Operating range	0 … 4 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
Adjustment possibilities (receiver)	N.O./N.C. via control input

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)	$+U_B$ = N.C. $-U_B$ / Open = N.O.
Control input, Test (transmitter)	$+U_B$ = Test (transmitter off) $-U_B$ / Open = normal operation

Mechanical data	
Dimensions	34 x 20 x 12 mm
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
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 ... +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-38
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	332
FT 50 RLHD	Laser	Potentiometer	300 mm	Most accurate small-part detection	334
FT 50 RH	LED	Potentiometer	300 mm		336
FT 50 IH	Infrared	Potentiometer	600 mm		338
Photoelectric proximity sensors					
FR 50 RL	Laser	Potentiometer	25 m	Autocollimation	340
FR 50 R	LED	Potentiometer	6 m	Autocollimation	342
Through-beam photoelectric sensor					
FS/FE 50 I	Infrared	Potentiometer	18 m		344

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 (IEC 60825-1)	1
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
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

8

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-38
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	
Scanning distance	50 … 300 mm[1]
Type of light	Laser, red, 650 nm
Light spot size	See table
Laser Class (IEC 60825-1)	1
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
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
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-38
Brackets	From Page A-4

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
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-38
Brackets	From Page A-4

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	
Scanning distance	150 … 600 mm[1]
Type of light	LED, infrared, 880 nm
Light spot size[2]	20 x 20 mm[2]
Hysteresis[3]	< 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[4]
No-load current, I_0	≤ 70 mA[5]
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)	≤ 800 Hz
Response time	625 µs
Connection, BK	N.O.
Connection, WH[6]	N.C.
Contamination output, WH (optional)	N.O. (see Selection Table)

Mechanical data	
Dimensions	50 x 50 x 17 mm
Enclosure rating	IP 67[7]
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 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

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-38
Brackets	From Page A-4

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 (IEC 60825-1)	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
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

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-18
Connection cables	From Page A-38
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
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-18
Connection cables	From Page A-38
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
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

Version: 07/2016. Subject to changes; diagrams similar

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-38
Brackets	From Page A-4

F 55 – New standards in a compact shape

The compact class with long ranges

TYPICAL F 55

- Glass-fibre-reinforced plastic (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 in bright 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.

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	5 ... 800 mm		348
FT 55-RLH2	Laser	Potentiometer	5 ... 1000 mm	Precise small-part detection at long scanning distances	350
FT 55-RLHP2	Laser	Teach-in	0 ... 5000 mm	Very long scanning distances	352
FT 55B-RH	LED	Potentiometer	3 ... 800 mm		354
FT 55-RH	LED	Potentiometer	3 ... 1200 mm		356
FT 55-BH	LED	Potentiometer	3 ... 1200 mm	Bluelight	358
Photoelectric proximity sensors					
FT 55-RL	Laser	Teach-in	5 ... 1200 mm	Detection of slightest grey value differences	360
FT 55-R	LED	Teach-in	5 ... 2000 mm		362
Retroreflective photoelectric sensors					
FR 55-RLO	Laser	Teach-in	0 ... 20 m	Autocollimation, most accurate small-part detection	364
FR 55-RL	Laser	Teach-in	0.3 ... 14 m		366
FR 55-R	LED	Teach-in	0.3 ... 14 m		368
Through-beam photoelectric sensors					
FS/FE 55-RL	Laser	Teach-in	0 ... 30 m		370
FS/FE 55-R	LED	Teach-in	0 ... 25 m		372

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 (IEC 60825-1)	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 50.1 x 23 mm
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
Protection Class	2	Type of connection	See Selection Table
Power On Delay	< 300 ms	Ambient temperature: operation	-20 … +60 °C[4]
Switching output, Q	PNP/NPN (see Selection Table)	Ambient temperature: storage	-20 … +80 °C
Output function	N.O./N.C.	Weight (plug device)	35 g
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Weight (cable device)	125 g
Response time	500 µs	Vibration and impact resistance	EN 60947-5-2
Control input, IN	$+U_B$ = N.C. $-U_B$ / Open = N.O.		

[1] Reference material: white, 90 % reflectivity [2] Max. 10 % ripple, within U_B, ~ 50 Hz / 100 Hz [3] With connected IP 67 / IP 69K plug [4] UL: -20 ... +45 °C

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-38
Brackets	From Page A-4

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FT 55-RLH2

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	
Scanning distance	5 … 1000 mm[1]
Type of light	Laser, red, 655 nm
Light spot size	See diagram
Laser Class (IEC 60825-1)	1

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Scanning distance adjustment	Via potentiometer
Adjustment possibilities	N.O./N.C. via control input
Default settings	S_n = 500 mm (6 %)

Electrical data	
Operating voltage, $+U_B$	12 … 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	$+U_B$ = N.C. $-U_B$ / Open = N.O.

Mechanical data	
Dimensions	50 x 50.1 x 23 mm
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[4]
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 [4] UL: -20 ... +45 °C

Scanning distance	Switching output	Type of connection	Part number	Article number
5 … 1000 mm	PNP	Plug, M12x1, 4-pin	FT 55-RLH2-PS-L4	623-11006
5 … 1000 mm	NPN	Plug, M12x1, 4-pin	FT 55-RLH2-NS-L4	623-11007
5 … 1000 mm	PNP	Cable, 3 m, 4-wire	FT 55-RLH2-PS-K4	623-11009
5 … 1000 mm	NPN	Cable, 3 m, 4-wire	FT 55-RLH2-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-38
Brackets	From Page A-4

FT 55-RLHP2

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

PRODUCT HIGHLIGHTS

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

Optical data	
Scanning distance	0 … 5 m (see Selection Table)[1]
Hysteresis	20 mm
Black/white shift (6%/90%)	≤ ± 40 mm
Grey value shift (18%/90%)	≤ ± 40 mm
Type of light	Laser, red 655 nm
Laser class (IEC 60825-1)	1

Functions	
Indicator LED 2 green	Operating voltage indicator
Indicator LED 2 yellow[2]	Switching output indicator Q2
Indicator LED 1 yellow	Switching output indicator Q resp. Q1
Scanning distance adjustment	Via Teach-in Button and control input
Adjustment possibilities	N.O. / N.C. / antivalent[2] via Teach-in Button and control input Key lock via control input
Default settings	3 m, N.O.

Electrical data	
Operating voltage $+U_B$	18 … 30 V DC
No-load current I_0	≤ 60 mA
Output current Ie Q	≤ 100 mA
Protection circuits	Reverse polarity protection U_B / short-circuit protection (Q)
Protection class	2
Power On Delay	< 5 s
Switching output Q	1 x Auto-Detect (PNP/NPN)[3] 2 x Auto-Detect (PNP/NPN)[3]
Output function	N.O. / N.C. / antivalent[2]
Switching frequency f (ti/tp 1:1) Q	≤ 500 Hz
Response time Q	1 ms
Temperature drift	< 2 mm / K
Warm-up time	20 min.
Control input IN	$+U_B$ = Teach-in $-U_B$ = Button locked Open = normal operation

Mechanical data	
Dimensions	50 x 50.1 x 23 mm
Enclosure rating	IP 67 & IP 69K[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection table
Ambient temperature: operation	-40 … +60 °C[5]
Ambient temperature: storage	-40 … +80 °C
Weight (plug device)	42 g
Resistance to vibration and impacts	EN 60947-5-2

[1] Reference material 90 % reflectivity [2] For variant FT 55-RLHP2-2PNS-L5 [3] Auto-Detect: Automatic selection of PNP or NPN by the sensor, PNP or NPN can be fixed
[4] With connected IP 67 / IP 69K plug [5] UL: -20 ... +45 °C

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

Plug connection[4]

[4] FT 55-RLHP2-PNS-L4 with a teach-in button

Connection, 4-pin, Auto-Detect

Connection, 5-pin, Auto-Detect

Scanning properties

Light spot size

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

Accessories

Connection cables	From Page A-38
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	
Scanning distance	3 … 800 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
Scanning distance adjustment	Via potentiometer
Adjustment possibilities	N.O./N.C. via control input
Default settings	Max. scanning distance (6 %)

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	$+U_B$ = N.C. $-U_B$ / Open = N.O.

Mechanical data	
Dimensions	50 x 50.1 x 23 mm
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[4]
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	35 g
Weight (cable)	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 [4] UL: -20 ... +45 °C

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-38
Brackets	From Page A-4

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	
Scanning distance	3 … 1200 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
Scanning distance adjustment	Via potentiometer
Adjustment possibilities	N.O./N.C. via control input
Default settings	S_n = 500 mm (6 %)

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	$+U_B$ = N.C. $-U_B$ / Open = N.O.

Mechanical data	
Dimensions	50 x 50.1 x 23 mm
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[4]
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 [4] UL: -20 ... +45 °C

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-38
Brackets	From Page A-4

FT 55-BH

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
- Precise scanning distance adjustment by means of potentiometer
- Reliable detection of highly transparent or strongly light-absorbing objects
- Reliable detection even with angles of up to 90°

Optical data	
Scanning distance	3 … 1200 mm[1]
Type of light	LED, blue, 450 nm
Light spot size	See diagram

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator / contamination indicator
Scanning distance adjustment	Via potentiometer
Adjustment possibilities	N.O./N.C. via control input
Default settings	S_n = 500 mm (6 %)

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	$+U_B$ = N.C. $-U_B$ / Open = N.O.

Mechanical data	
Dimensions	50 x 50.1 x 23 mm
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[4]
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 [4] UL: -20 ... +45 °C

Scanning distance	Switching output	Type of connection	Part number	Article number
3 … 1200 mm	PNP	Plug, M12x1, 4-pin	FT 55-BH-PS-L4	623-11036
3 … 1200 mm	NPN	Plug, M12x1, 4-pin	FT 55-BH-NS-L4	623-11037

Plug connection

153-00785

Cable connection

153-00784

Connection, 4-pin

154-00312

Scanning properties

155-02031

Light spot size

155-02032

Reference material	Detection range
White (90 %)	3 … 1200 mm
Grey (18 %)	5 … 750 mm
Black (6 %)	10 … 600 mm

Accessories

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

FT 55-RL

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 (IEC 60825-1)	1
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 50.1 x 23 mm
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[4]
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 [4] UL: -20 ... +45 °C

Scanning distance	Switching output	Type of connection	Part number	Article number
5 … 1200 mm	PNP	Plug, M12x1, 4-pin	FT 55-RL-PS-L4	622-21006
5 … 1200 mm	NPN	Plug, M12x1, 4-pin	FT 55-RL-NS-L4	622-21007
5 … 1200 mm	PNP	Cable, 3 m, 4-wire	FT 55-RL-PS-K4	622-21009
5 … 1200 mm	NPN	Cable, 3 m, 4-wire	FT 55-RL-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-38
Brackets	From Page A-4

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 50.1 x 23 mm
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[4]
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 [4] UL: -20 ... +45 °C

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

Cable connection

Connection, 4-pin

Functional reserves

Light spot size

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-38
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 (IEC 60825-1)	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 50.1 x 23 mm
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[4]
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 [4] UL: -20 ... +45 °C

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

Plug connection

Connection, 4-pin

Lateral object approach

Reference material: R5/L reflector

Functional reserves

Light spot size

Reflector / Reflective foil*	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-38
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 (IEC 60825-1)	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 50.1 x 23 mm
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[4]
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 [4] UL: -20 ... +45 °C

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: 07/2016. 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-18
Connection cables	From Page A-38
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 50.1 x 23 mm
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[4]
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 [4] UL: -20 ... +45 °C

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

Cable connection

Connection, 4-pin

Functional reserves

Light spot size

Reflector / Reflective foil*	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-18
Connection cables	From Page A-38
Brackets	From Page A-4

8

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 (IEC 60825-1)	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 50.1 x 23 mm
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[3]
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 [3] UL: -20 ... +45 °C

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-38	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 50.1 x 23 mm
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[3]
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 [3] UL: -20 ... +45 °C

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

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-38	Brackets	From Page A-4

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	376
FT 88-RH	LED	Potentiometer	700 mm	Relay output	378
FT 88-IH	Infrared	Potentiometer	2 m	PNP, NPN	380
FT 88-IH	Infrared	Potentiometer	2 m	Relay output	382
Photoelectric proximity sensor					
FT 88-R	LED	Potentiometer	2 m	PNP, NPN	384
Retroreflective photoelectric sensors					
FR 88-R	LED	Potentiometer	12 m	PNP, NPN	386
FR 88-R	LED	Potentiometer	12 m	Relay output	388
Through-beam photoelectric sensors					
FS/FE 88-R	LED	Potentiometer	30 m / 65 m	PNP, NPN	390
FS/FE 88-R	LED	Potentiometer	30 m / 65 m	Relay output	392

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
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

Version: 07/2016. Subject to changes; diagrams similar

Plug connection

153-00548

Connection, 5-pin

154-00518

Accessories

Connection cables	From Page A-38
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	
Scanning distance	20 … 700 mm[1]
Type of light	LED, red, 660 nm
Light spot size[2]	Ø 15 mm

Functions	
Indicator LED, yellow	Switching output indicator
Scanning distance adjustment	Via potentiometer
Adjustment possibilities	Time and output function (N.O./N.C.) via operating elements in clamping space
Default setting	Max. scanning distance

Electrical data	
Operating voltage, ~U_B	12 … 240 V AC / DC
Power consumption	≤ 3.5 VA
Output current, Ie	≤ 2 A (≤ 250 V AC/DC)
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
Enclosure rating	IP 67[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-25 … +60 °C
Ambient temperature: storage	-40 … +75 °C
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

Version: 07/2016. Subject to changes; diagrams similar

Plug connection

153-00549

Connection, 8-pin

154-00523

Connection, relay

155-00640

Time functions

155-00641

Accessories

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

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
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-38
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	
Scanning distance	20 … 2000 mm[1]
Type of light	LED, infrared, 880 nm
Light spot size[2]	Ø 70 mm

Functions	
Indicator LED, yellow	Switching output indicator
Scanning distance adjustment	Via potentiometer
Adjustment possibilities	Time and output function (N.O./N.C.) via operating elements in clamping space
Default setting	Max. scanning distance

Electrical data	
Operating voltage, ~U_B	12 … 240 V AC / DC
Power consumption	≤ 3.5 VA
Output current, Ie	≤ 2 A (≤ 250 V AC / DC)
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
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)	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

Version: 07/2016. Subject to changes; diagrams similar

Plug connection

153-00549

Connection, 8-pin

154-00523

Connection, relay

155-00640

Time functions

155-00641

Accessories

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

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	
Scanning distance	50 … 2000 mm[1]
Type of light	LED, red, 660 nm
Light spot size[2]	Ø 50 mm
Hysteresis	< 12 %

Functions	
Indicator LED, yellow	Switching output indicator
Sensitivity adjustment	Via potentiometer
Default setting	Max. scanning distance

Electrical data	
Operating voltage, $+U_B$	10 ... 30 V DC[3]
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/NPN, push-pull, antivalent
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 125 Hz
Response time	4 ms
Connection, BK	N.O.
Connection, WH	N.C.

Mechanical data	
Dimensions	88 x 54.3 x 25.8 mm
Enclosure rating	IP 65[4]
Material, housing	ABS
Material, front screen	PMMA
Type of connection	See Selection Table
Ambient temperature: operation	-25 … +60 °C
Ambient temperature: storage	-40 … +75 °C
Weight (plug device)	70 g
Vibration and impact resistance	EN 60947-5-2

[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

Version: 07/2016. Subject to changes; diagrams similar

Plug connection

153-00597

Connection, 4-pin

154-00517

Accessories

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

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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
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

Version: 07/2016. Subject to changes; diagrams similar

Plug connection

153-00551

Connection, 5-pin

154-00522

Accessories

Reflectors	From Page A-18
Connection cables	From Page A-38
Brackets	From Page A-4

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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
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

Version: 07/2016. Subject to changes; diagrams similar

Plug connection

153-00550

Connection, 5-pin

154-00523

Connection, relay

155-00640

Time functions

155-00641

Accessories

Reflectors	From Page A-18
Connection cables	From Page A-38
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
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-38
Brackets	From Page A-4

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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
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

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-38
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	396

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 (IEC 60825-1)	1
Type of light, pilot laser	Laser, red, 650 nm
Laser Class, pilot laser (IEC 60825-1)	1
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
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	200 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

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

Plug connection

153-00346

Operating / display elements

155-01378

Connection, 4-pin

154-00460

Light spot size

154-00459

Smallest detectable part

155-00207

Reference material	Detection range
White (90 %)	0.2 … 6 m
Grey (18 %)	0.2 … 6 m
Black (6 %)	0.2 … 2.5 m

8

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	400
FMH 18	Red	Potentiometer	40 … 120 mm	M18 housing, very precise detection	402
FT 12 RF	Red	None	24 mm	M12 housing	404
Photoelectric proximity sensors					
FM 04	Infrared	None	0 … 50 mm	Very small housing, M4	406
FM 05	Infrared	None	0 … 50 mm	Very small housing, M5	408
FT 12 R	Red	Potentiometer	1 … 300 mm		410
FT 18-2	Red / infrared	Potentiometer	0 … 800 mm	M18 metal housing	412
FT 18-2	Red / infrared	Potentiometer	0 … 800 mm	M18 plastic housing	414
FMS 18-34 B	Infrared	Potentiometer	5 … 400 mm	M18 housing	416
FMS 30-34 B	Infrared	Potentiometer	5 … 1000 mm	M30 housing, long operating range	418
Retroreflective photoelectric sensors					
FR 12 R	Red	Potentiometer	60 … 1500 mm	M12 housing	420
FR 18-2	Red	Potentiometer	3.0 m	M18 metal housing	422
FR 18-2	Infrared	Potentiometer	3.6 m	M18 plastic housing	424
Through-beam photoelectric sensors					
FS/FE 12 RL	Laser	Control line	0 … 5 m	M12 housing	426
FSE 18-2	Infrared		10 m	M18 housing	428
FS/FE 18 RL	Laser	Control line	0 … 50 m	M18 housing	430
FL 18 W	Laser	Potentiometer	0 … 50 m	M18 housing, adjustable transmission beam size	432
FL 18 WM	Laser	Potentiometer	0 … 5 m	air tube prevents malfunction	434
FL 18	Laser	Potentiometer	0 … 50 m	M18 housing, adjustable transmission beam size	436
Filling level sensor					
FMF 18-34	Infrared	Fixed		M18 housing, detection of liquids	438

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-38
Brackets	From Page A-4

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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	
Scanning distance	40 … 120 mm[1]
Type of light	Red, 660 nm
Light spot size	8 x 10 mm[2]

Functions	
Indicator LED, yellow	Switching state indicator
Scanning distance adjustment	Via 18-step potentiometer

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[3]
No-load current, I_0	≤ 30 mA
Output current, Ie	200 mA
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection
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)	600 Hz
Connection, BK	N.O.
Connection, WH	N.C.

Mechanical data	
Dimensions	See dimensional drawings
Dimensions (angled)	See dimensional drawings
Enclosure rating	IP 67[4]
Material, housing	Brass, nickel-plated
Material, front screen	Glass
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight (plug device)	60 g
Weight (cable device)	160 g

[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-38
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

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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
Protection Class	2	Type of connection	See Selection Table
Switching output, Q	PNP	Ambient temperature: operation	-20 … +60 °C
Output function	N.O.	Ambient temperature: storage	-20 … +80 °C
Switching frequency, f (ti/tp 1:1)	1000 Hz	Weight (plug device)	30 g
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-38
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
154-00163	15400163

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

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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

Connection plug, 3-pin	Connection cable, 3-wire

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

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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		Functions	
Scanning distance	See Selection Table	Indicator LED, green	Operating voltage indicator
Type of light	See Selection Table	Indicator LED, yellow	Switching output indicator
Light spot size	See Selection Table	Sensitivity adjustment	Via potentiometer
		Adjustment possibilities	N.O./N.C. via control input (IN)
		Default settings	Max. scanning distance and N.O.

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC	Dimensions	See dimensional drawings
No-load current, I_0	≤ 30 mA	Enclosure rating	IP 67[1]
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
Switching output, Q	PNP/NPN (see Selection Table)	Ambient temperature: operation	-25 … +55 °C
Output function	N.O./N.C.	Weight (plug device)	23 g[2] / 25 g[3]
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Weight (cable device)	63 g[2] / 65 g[3]
Response time	≤ 1 ms		
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked open = normal operation		

[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

Light spot size	Straight		90° angle	
Scanning distance (mm)	200	400	150	300
Light spot diameter (mm)	Ø 14	Ø 27	Ø 14	Ø 25

Scope of delivery	Accessories	
Sensor	Connection cables	From Page A-38
2 x securing nuts	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		Functions	
Scanning distance	See Selection Table	Indicator LED, green	Operating voltage indicator
Type of light	See Selection Table	Indicator LED, yellow	Switching output indicator
Light spot size	See Selection Table	Sensitivity adjustment	Via potentiometer
		Adjustment possibilities	N.O./N.C. via control input (IN)
		Default settings	Max. scanning distance and N.O.

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC	Dimensions	See dimensional drawings
No-load current, I_0	≤ 30 mA	Enclosure rating	IP 67[1]
Output current, Ie	≤ 100 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection	Material, front screen	PMMA
Switching output, Q	PNP/NPN (see Selection Table)	Type of connection	See Selection Table
Output function	N.O./N.C.	Ambient temperature: operation	-25 … +55 °C
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Weight (plug device)	11 g[2] / 13 g[3]
Response time	≤ 1 ms	Weight (cable device)	55 g[2] / 57g[3]
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked open = normal operation		

[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

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Connection, 4-pin

154-00312

Light spot size	Straight		90° angle	
Scanning distance (mm)	200	400	150	300
Light spot diameter (mm)	Ø 14	Ø 27	Ø 14	Ø 25

Scope of delivery	Accessories	
Sensor	Connection cables	From Page A-38
2 x securing nuts	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	See dimensional drawings
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 (cable 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-38
Brackets	From Page A-4

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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		Functions	
Scanning distance	5 … 1000 mm[1]	Indicator LED, green	Operating voltage indicator
Type of light	Infrared, 880 nm	Indicator LED, yellow	Switching output indicator
Distance hysteresis	≤ 10 % of set scanning distance	Indicator LED, red	Contamination indicator
Aperture angle	50°	Sensitivity adjustment	Via 18-step potentiometer

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]	Dimensions	See dimensional drawings
No-load current, I_0	≤ 40 mA	Enclosure rating	IP 65[3]
Output current, Ie	≤ 200 mA	Material, housing	Brass, nickel-plated
Pull-up resistance	22 kΩ	Type of connection	See Selection Table
Pull-down resistance	22 kΩ	Ambient temperature: operation	-20 … +60 °C
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Ambient temperature: storage	-40 … +80 °C
Protection Class	2	Weight (plug device)	170 g
Power On Delay	≤ 300 ms	Weight (cable device)	280 g
Switching output, Q	PNP/NPN	Vibration and impact resistance	60947-5-2
Output function	N.O.		
Switching frequency, f (ti/tp 1:1)	50 Hz		

[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-38
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

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-38
Brackets	From Page A-4

8

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
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked open = normal operation

Mechanical data	
Dimensions	See dimensional drawings
Enclosure rating	IP 67[2]
Material, housing	Brass, nickel-plated
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

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

Scope of delivery

Sensor
Reflector: 53.4 x 53.4 mm²
2 x securing nuts

Accessories

Reflectors	From Page A-18
Connection cables	From Page A-38
Brackets	From Page A-4

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		Functions	
Operating range	See Selection Table[1]	Indicator LED, yellow	Switching output indicator
Type of light	See Selection Table	Sensitivity adjustment	Via potentiometer
Polarising filter	No	Adjustment possibilities	N.O./N.C. via control input (IN)
		Default settings	Max. scanning distance and N.O.

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC	Dimensions	See dimensional drawings
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	Material, front screen	PMMA
		Type of connection	See Selection Table
Switching output, Q	PNP/NPN (see Selection Table)	Ambient temperature: operation	-25 … +55 °C
Output function	N.O./N.C.	Weight (plug device)	11 g[3] / 13 g[4]
Switching frequency, f (ti/tp 1:1)	≤ 1000 Hz	Weight (cable device)	55 g[3] / 57 g[4]
Response time	≤ 1 ms		
Control input, IN	$+U_B$ = teach-in $-U_B$ = button locked open = normal operation		

[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

Plug connection (straight)

153-00985

Cable connection (straight)

153-00984

Plug connection (angled)

153-00987

Cable connection (angled)

153-00986

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Connection, 4-pin

154-00312

Scope of delivery
Sensor
Reflector: 53.4 x 53.4 mm²
2 x securing nuts

Accessories	
Reflectors	From Page A-18
Connection cables	From Page A-38
Brackets	From Page A-4

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 (IEC 60825-1)	1

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

Version: 07/2016. Subject to changes; diagrams similar

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-38
Brackets	From Page A-4

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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
Control input, IN	$+U_B$ = Test (transmitter off) $-U_B$ / open = normal operation

Mechanical data	
Dimensions	See dimensional drawings
Enclosure rating	IP 67[1]
Material, housing	Brass, nickel-plated
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

Version: 07/2016. Subject to changes; diagrams similar

Plug connection	Cable connection

Connection, 4-pin (transmitter)	Connection, 4-pin (receiver)

Accessories	
Connection cables	From Page A-38
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 (IEC 60825-1)	1

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)	Plug connection (receiver)

Connection, 4-pin (transmitter)	Connection, 4-pin (receiver)

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

8

FLS 18W / FLE 18W

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 (IEC 60825-1)	1

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 (cable 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-38
Brackets	From Page A-4

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

8

FLS 18WM / FLE 18WM

Laser through-beam photoelectric sensor with air tube

PRODUCT HIGHLIGHTS

- Ideal for drill breakage control
- Air tube prevents malfunction
- Easily visible and focusable laser light spot
- Minimum detectable drill 1 mm
- High switching frequency, 6000 Hz

Optical data	
Operating range	< 5 m
Type of light	Laser, red, 650 nm
Laser Class (IEC 60825-1)	1
Max. resolution	0.3 mm

Functions	
Indicator LED, green (receiver FLE)	Operating voltage indicator
Indicator LED, yellow (receiver FLE)	Switching output indicator
Indicator LED, red (receiver FLE)	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 (transmitter FLS)	≤ 10 mA
No-load current, I_0 (receiver FLE)	≤ 15 mA
Output power (transmitter FLS)	< 1 mW
Output current, Ie (receiver FLE)	≤ 200 mA
Voltage drop at signal output (receiver)	≤ 2,4 V
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)
Protection Class	2[2]
Power On Delay	≤ 300 ms
Switching output, Q	PNP, antivalent
Output function	N.O./N.C.
Switching frequency, f (ti/tp 1:1)	≤ 6000 Hz
Response time/drop-out delay (transmitter)	83 µs
Connection BK	N.C.
Connection WH	Contamination output: N. O.

Mechanical data	
Dimensions	See dimensional drawings
Enclosure rating	IP 65[3]
Material, housing	Brass, nickel-plated
Material air tube	Aluminium, black anodized
Type of connection	Plug, M12x1, 4-pin
Connection air tube	Tube, inside Ø-3 mm
Ambient temperature: operation (transmitter FLS)	-10 … +50 °C
Ambient temperature: operation (receiver FLE)	-10 … +60 °C
Ambient temperature: storage	-20 … +80 °C
Weight	approx. 85 g

[1] Max. 10 % ripple, within U_B [2] U_{imp} = 500 V [3] With connected IP 65 plug

Transmitter / receiver	Switching output	Type of connection	Part number	Article number
Receiver	PNP, antivalent	Plug, M12x1, 4-pin	FLE 18WM-L4-X01	580-51440
Transmitter	–	Plug, M12x1, 4-pin	FLS 18WM-L4-X01	580-51439
Receiver	PNP, antivalent	Plug, M12x1, 4-pin	FLE 18WM-L4-X02	580-51447
Transmitter	–	Plug, M12x1, 4-pin	FLS 18WM-L4-X02	580-51446

Version: 07/2016. Subject to changes; diagrams similar

Plug connection (transmitter): FLS 18WM-L4-X01

153-00769

Plug connection, (receiver): FLE 18WM-L4-X01

153-00770

Plug connection (transmitter): FLS 18WM-L4-X02

153-00767

Plug connection, (receiver): FLE 18WM-L4-X02

153-00768

Connection, 4-pin (transmitter)

154-00455

Connection, 4-pin (receiver)

154-00464

Focus key

154-01124

Accessories

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

FLS 18 / FLE 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 (IEC 60825-1)	1

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 (cable 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-38
Brackets	From Page A-4

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

8

FMF 18-34

Filling level sensor

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	See dimensional drawings
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

Version: 07/2016. Subject to changes; diagrams similar

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-38
Brackets	From Page A-4

Fibre-optic sensors and cables

Fibre-optic sensors and fibre-optic cables for a wide range of applications

FL 20

from Page 444

- *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 448

- *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

from Page 454

- *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 464

- *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 508

- *Precise, small light spot for small-part detection*
- *Adjustable scanning distance and light spot size*

Fibre-optic cables – light strips

from Page 514

- *Photoelectric sensor and proximity sensor variants*
- *Variety of light strip widths and ranges*

Fibre-optic cables – special

from Page 522

- *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 534

- *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 serie: 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. 508) 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 mm 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	446

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		Functions	
Scanning distance	Dependant on fibre-optic cable (scanner)[1]	Indicator LED, green	Stability indicator
Operating range	Dependant on fibre-optic cable (cabinet)	Indicator LED, yellow	Light reception indicator
Type of light	LED, red, 660 nm	Sensor adjustment[2]	Via Teach-in button and control input
Distance hysteresis	< 10 % of set scanning distance	Adjustment possibilities	Button lock via control input
		Default setting	N.O.

Functions		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC	Dimensions	32 x 20 x 12 mm
Current consumption without load	≤ 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)	Type of connection	See Selection Table
		Ambient temperature: operation	-20 … +60 °C
Protection Class	2	Ambient temperature: storage	-20 … +80 °C
Switching output, Q	PNP/NPN (see Selection Table)	Weight (plug device)	10 g
Output function	N.O.	Weight (cable device)	40 g
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		

[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

Accessories

Connection cables	From Page A-38
Brackets	From Page A-4
Fibre-optic cables	From Page 514

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	450
FL 70 R-…D	LED, red	Teach-in, display	452
FL 70 RA-…D	LED, red	Teach-in, display, analogue output	452

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
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 A-38
Brackets	From Page A-4
Fibre-optic cables	From Page 514

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./N.C.
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
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

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Accessories

Connection cables	From Page A-38
Brackets	From Page A-4
Fibre-optic cables	From Page 514

FMS 18 / FMS 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

- 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.

FMS 18 / FMS 30 – Product Overview

	Type of light	Special features	Page
FMS 18	LED infrared, red	Extremely robust	456
FMS 30	LED infrared, red	Extremely robust, powerful	458

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	See dimensional drawings
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

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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

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		Functions	
Scanning distance	2 m[1]	Indicator LED, green	Operating voltage indicator
Type of light	Infrared, 880 nm	Indicator LED, yellow	Switching output indicator
Distance hysteresis[1]	≤ 10 % of the set scanning distance	Indicator LED, red	Contamination indicator
Aperture angle	< 18 %	Sensitivity adjustment	Via 18-step potentiometer

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[2]	Dimensions	See dimensional drawings
No-load current, I_0	≤ 40 mA	Enclosure rating	IP 65[3]
Output current, Ie	≤ 200 mA	Material, housing	Brass, nickel-plated
Pull-up resistance	22 kΩ	Type of connection	See Selection Table
Pull-down resistance	22 kΩ	Ambient temperature: operation	-20 … +60 °C
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Ambient temperature: storage	-40 … +80 °C
Protection Class	2	Weight (plug device)	215 g
Power On Delay	≤ 300 ms	Weight (cable device)	315 g
Switching output, Q	PNP	Vibration and impact resistance	EN 60947-5-2
Output function	N.O./N.C.		
Switching frequency, f (ti/tp 1:1)	≤ 100 Hz		

[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

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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, 880 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	See dimensional drawings
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, 880 nm	Plug, M9x0.5, 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

Connection, 4-pin: FMS 30-34 UL4-52

154-00282

Connection, 4-pin

154-00282

Connection, 4-pin: FMS 30-34 UA4

154-00263

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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

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
18/30 R 1/xxxx-Si/MSC/PVC	T	Up to 15 mm	Axial	• Small mounting dimensions • Robust design	FMS 18 / FMS 30
18/30 R 2/xxxx-Si/MSC/PVC	T	Up to 60 mm	Axial	• Robust design	FMS 18 / FMS 30
18/30 R 3/xxxx-Si/MSC/PVC	T	Up to 200 mm	Axial	• Robust design	FMS 18 / FMS 30
30 R 4/xxxx-Si/MSC	T	Up to 400 mm	Axial	• Long range • Robust design	FMS 18 / FMS 30
30 R 12/xxxx-Si/MSC	T	Up to 800 mm	Axial	• Long range • Immune to contamination • Robust design	FMS 18 / FMS 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
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
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
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
30 RZ 4/xxxx-Si/MSC	T	Up to 400 mm	Radial	• For restricted spaces • Long range • Robust design	FMS 18 / FMS 30
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
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
K1RZ-31	T	Up to 30 mm	Radial	• For restricted spaces • Very fine stainless steel tip	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
18/30 L 0,4/xxxx-Si	L	Up to 20 mm	Axial	• Small mounting dimensions • Robust design	FMS 18 / FMS 30
18/30 L 1/xxxx-Si/MSC/PVC	L	Up to 100 mm	Axial	• Small mounting dimensions • Robust design	FMS 18 / FMS 30
18/30 L 2/xxxx-Si/MSC/PVC	L	Up to 400 mm	Axial	• Robust design	FMS 18 / FMS 30
18/30 L 3/xxxx-Si/MSC/PVC	L	Up to 1000 mm	Axial	• Long range • Robust design	FMS 18 / FMS 30
30 L 4/xxxx-Si/MSC	L	Up to 3000 mm	Axial	• Long range • Robust design	FMS 18 / FMS 30
30 L 12/xxxx-Si/MSC	L	Up to 4800 mm	Axial	• Long range • Robust design • Immune to contamination	FMS 18 / FMS 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
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
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
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
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
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

- 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 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

18/30 R 1/…-MSC fibre-optic cable

18/30 R 1/…-PVC fibre-optic cable

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 devices

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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

18/30 R 2/…-MSC fibre-optic cable

18/30 R 2/…-PVC fibre-optic cable

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 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

18/30 R 3/…-MSC fibre-optic cable

18/30 R 3/…-PVC fibre-optic cable

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 devices

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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

30 R 4/…-MSC fibre-optic cable

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 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

30 R 12/…-MSC fibre-optic cable

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 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	–

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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

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

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

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 Stainless steel	–

Part number	Article number
K2R-6	841-21000

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Fibre-optic cables – standard

LLK1RM3-PE-1m fibre-optic cable

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

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

33 R 1/…-MSC fibre-optic cable

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

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

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

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

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

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

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

18/30 RZ 1/…-MSC fibre-optic cable

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 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

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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

18/30 RZ 2/…-MSC fibre-optic cable

18/30 RZ 2/…-PVC fibre-optic cable

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 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

Version: 07/2016. Subject to changes; diagrams similar

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

18/30 RZ 3/…-MSC fibre-optic cable

18/30 RZ 3/…-PVC fibre-optic cable

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 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

30 RZ 4/…-MSC fibre-optic cable

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-30 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 x 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

Version: 07/2016. Subject to changes; diagrams similar

30 RZ 12/…-Si fibre-optic cable

30 RZ 12/…-MSC fibre-optic cable

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-30 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

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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

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

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

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

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 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

18/30 L 1/…-MSC fibre-optic cable

18/30 L 1/…-PVC fibre-optic cable

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 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

18/30 L 2/…-MSC fibre-optic cable

18/30 L 2/…-PVC fibre-optic cable

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 devices

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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

18/30 L 3/…-MSC fibre-optic cable

18/30 L 3/…-PVC fibre-optic cable

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 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

30 L 4/...-MSC fibre-optic cable

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-30 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	–

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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

30 L 12/...-MSC fibre-optic cable

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-30 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

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

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

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 × 1.0 (T) 1 × 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

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 × 1.0 (T) 1 × 1.0 (R) PMMA	Polyamid (PA)	-55 … +85 °C	2	2 m Cutable	M3 Brass, nickel-plated	–

Part number	Article number
K2L-77	840-11001

LLK2LM3-PE-1m fibre-optic cable

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 0.5 (T) 1 x 0.5 (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

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

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

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

18/30 LZ 1/…-MSC fibre-optic cable

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 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

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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

18/30 LZ 2/…-MSC fibre-optic cable

18/30 LZ 2/…-PVC fibre-optic cable

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 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

Version: 07/2016. Subject to changes; diagrams similar

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

18/30 LZ 3/…-MSC fibre-optic cable

18/30 LZ 3/…-PVC fibre-optic cable

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 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

Version: 07/2016. Subject to changes; diagrams similar

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

30 LZ 4/…-MSC fibre-optic cable

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-30 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

30 LZ 12/…-MSC fibre-optic cable

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-30 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

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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

33 LZ 1/…-MSC fibre-optic cable

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

Version: 07/2016. Subject to changes; diagrams similar

LLK2LZ fibre-optic cable

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

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

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 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
LLK1RD8V6 PE-1m	951-50009

LLK1RD12V6 PE-1m fibre-optic cable

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

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

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

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

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

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

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

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

Highlights

- Through-beam photoelectric sensor
- Cross-section converter
- 10 mm light exit
- Robust design with silicone sheath
- -20 … +160 °C
- For FMS/FAV 30 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

Highlights

- Through-beam photoelectric sensor
- Cross-section converter
- 20 mm light exit
- Robust design with silicone sheath
- -20 … +160 °C
- For FMS/FAV 30 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

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30 QL 0,2x30/…-Si fibre-optic cable

Highlights

- Through-beam photoelectric sensor
- Cross-section converter
- 30 mm light exit
- Robust design with silicone sheath
- -20 … +160 °C
- For FMS/FAV 30 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

Highlights

- Through-beam photoelectric sensor
- Cross-section converter
- 40 mm light exit
- Robust design with silicone sheath
- -20 … 160 °C
- For FMS/FAV 30 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

Version: 07/2016. Subject to changes; diagrams similar

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
18/30 R 1,5/xxxx-Si	T	Up to 15 mm	Axial	• Bendable stainless steel tip • For restricted spaces	FMS 18 / FMS 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
18/30 L 1,5/xxxx-Si	L	Up to 100 mm	Axial	• Bendable stainless steel tip • For restricted spaces	FMS 18 / FMS 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
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
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

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 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

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 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

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 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

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 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

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

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

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

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

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

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

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 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

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

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

Highlights

- Photoelectric proximity sensor
- Axial light exit
- High scanning distance/range
- Extremely robust design with stainless steel sheath
- -25 … +250 °C
- For FMS-30 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

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

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

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

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

Fibre-optic cables – Accessories – Product overview	
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Metre goods	536
Adapters	537
Ancillary lenses	538
Cutting tool	539

Fibre-optic cables – accessories

Metre goods

K2L 1,0 POF simplex fibre-optic cable

Highlights

- 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

- 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
		• 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
		• Ancillary lens for plastic fibres (pair) • 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
		• Ancillary lens for fibre-optic cables (single lens) • 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
		• Ancillary lens for fibre-optic cables (single lens) • 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
		• Deflection prism: 90° for plastic fibres (pair) • 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
		• 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 544

- *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*
- *Robust metal plug connection*

FGL-IK – infrared fork sensors

from Page 546

- *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*
- *Robust metal plug connection*

FGL 5-IK – LED fork sensors for the detection of labels and multilayers

from Page 548

- *Specially designed for label dispensers*
- *High speed of 12 kHz for very accurate positioning*
- *Robust metal housing*
- *Easy teach-in during operation*

FGL – LED red light fork sensors with metal housings

from Page 550

- *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 is 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 554

- *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	544
FGL-IK	Infrared	Teach-in	30 / 50 / 80 / 120 mm	Teach-in, dovetail mounting	546
FGL 5-IK	Infrared	Teach-in	5 mm	Teach-in, dovetail mounting	548
FGL	Red light	Potentiometer	5 / 10 / 20 / 30 mm	Metal housings	550
FGL	Red light	Potentiometer	50 / 80 / 120 / 180 / 220 mm	Metal housings	552
Optical windows					
FG	Infrared	Potentiometer	40 x 80 mm / 80 x 80 mm / 120 x 80 mm	Metal housings	554

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.

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
- Robust metal plug connection
- 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	Metal plug, M8x1, 3-pin	20 g	FGL 30-RK-30-PS-M3	832-11000
30 mm	NPN	Metal plug, M8x1, 3-pin	20 g	FGL 30-RK-30-NS-M3	832-11001
30 mm	PNP	Metal plug, M8x1, 4-pin	20 g	FGL 30-RK-30-PS-M4	832-11002
30 mm	NPN	Metal plug, M8x1, 4-pin	20 g	FGL 30-RK-30-NS-M4	832-11003
50 mm	PNP	Metal plug, M8x1, 3-pin	30 g	FGL 50-RK-50-PS-M3	832-11004
50 mm	NPN	Metal plug, M8x1, 3-pin	30 g	FGL 50-RK-50-NS-M3	832-11005
50 mm	PNP	Metal plug, M8x1, 4-pin	30 g	FGL 50-RK-50-PS-M4	832-11006
50 mm	NPN	Metal 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	Metal plug, M8x1, 3-pin	35 g	FGL 80-RK-50-PS-M3	832-11008
80 mm	NPN	Metal plug, M8x1, 3-pin	35 g	FGL 80-RK-50-NS-M3	832-11009
80 mm	PNP	Metal plug, M8x1, 4-pin	35 g	FGL 80-RK-50-PS-M4	832-11010
80 mm	NPN	Metal plug, M8x1, 4-pin	35 g	FGL 80-RK-50-NS-M4	832-11011
120 mm	PNP	Metal plug, M8x1, 3-pin	40 g	FGL 120-RK-50-PS-M3	832-11012
120 mm	NPN	Metal plug, M8x1, 3-pin	40 g	FGL 120-RK-50-NS-M3	832-11013
120 mm	PNP	Metal plug, M8x1, 4-pin	40 g	FGL 120-RK-50-PS-M4	832-11014
120 mm	NPN	Metal plug, M8x1, 4-pin	40 g	FGL 120-RK-50-NS-M4	832-11015

Plug connection

153-00543

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

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-38
Brackets	From Page A-4

FGL… -IK

Infrared fork sensors

PRODUCT HIGHLIGHTS

- Fork widths 30 … 120 mm
- Small part detection from 0.2 mm
- Robust metal plug connection
- 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	Metal plug, M8x1, 3-pin	20 g	FGL 30-IK-30-PS-M3	832-11016
30 mm	NPN	Metal plug, M8x1, 3-pin	20 g	FGL 30-IK-30-NS-M3	832-11017
30 mm	PNP	Metal plug, M8x1, 4-pin	20 g	FGL 30-IK-30-PS-M4	832-11018
30 mm	NPN	Metal plug, M8x1, 4-pin	20 g	FGL 30-IK-30-NS-M4	832-11019
50 mm	PNP	Metal plug, M8x1, 3-pin	30 g	FGL 50-IK-50-PS-M3	832-11020
50 mm	NPN	Metal plug, M8x1, 3-pin	30 g	FGL 50-IK-50-NS-M3	832-11021
50 mm	PNP	Metal plug, M8x1, 4-pin	30 g	FGL 50-IK-50-PS-M4	832-11022
50 mm	NPN	Metal 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	Metal plug, M8x1, 3-pin	35 g	FGL 80-IK-50-PS-M3	832-11024
80 mm	NPN	Metal plug, M8x1, 3-pin	35 g	FGL 80-IK-50-NS-M3	832-11025
80 mm	PNP	Metal plug, M8x1, 4-pin	35 g	FGL 80-IK-50-PS-M4	832-11026
80 mm	NPN	Metal plug, M8x1, 4-pin	35 g	FGL 80-IK-50-NS-M4	832-11027
120 mm	PNP	Metal plug, M8x1, 3-pin	40 g	FGL 120-IK-50-PS-M3	832-11028
120 mm	NPN	Metal plug, M8x1, 3-pin	40 g	FGL 120-IK-50-NS-M3	832-11029
120 mm	PNP	Metal plug, M8x1, 4-pin	40 g	FGL 120-IK-50-PS-M4	832-11030
120 mm	NPN	Metal plug, M8x1, 4-pin	40 g	FGL 120-IK-50-NS-M4	832-11031

Plug connection

153-00697

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

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-38
Brackets	From Page A-4

FGL 5-IK

Fork sensors for the detection of labels and multilayers

PRODUCT HIGHLIGHTS

- Detects even semi-transparent labels on carrier material
- Non-distorting and robust metal housing with cable or M8 plug
- Design with small arm adapted to label dispenser
- Easy adjustment via teach-in button or control line
- Versatile mounting possibilities
- N.O./N.C. switchable
- High positioning accuracy thanks to 12 kHz switching frequency

Optical data	
Fork width	5 mm
Fork depth	50 mm
Type of light	Infrared, 850 nm
Minimum label width	0.5 ... 2 mm[1]
Minimum distance between labels	0.5 ... 2 mm[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: 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	Active on carrier material - reset via control line or teach-in button

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
Switching output, Q	PNP / NPN[3] (see Selection Table)
Output function	N.O. / N.C.
Switching frequency, f (ti/tp 1:1)	12000 Hz
Response time	Max. 40 µs
Control input, ET[2]	$+U_B$ = Teach-in, $-U_B$ = normal operation Open = normal operation

Mechanical data	
Dimensions	64 x 40.4 x 11 mm
Enclosure rating	IP 65[4]
Material, housing	Aluminium, Zinc alloy and PBT (cover)
Material, lens	PC
Type of connection	See Selection Table
Ambient temperature: operation	-20 … +55 °C
Ambient temperature: storage	-20 … +70 °C
Weight	See Selection Table
Vibration and impact resistance	11ms (30 G) 6 shocks per every axis EN 60068-2-27

[1] Max. 10 % ripple, within U_B [2] Voltage peak max. 2 Vpp [3] Pull up/down resistance 33 kOhm [4] With connected IP 67 plug

Fork width	Switching output	Type of connection	Weight	Part number	Article number
5 mm	PNP	Metal plug, M8x1, 4-pin	46 g	FGL 5-IK-50-PS-M4	830-11011
5 mm	NPN	Metal plug, M8x1, 4-pin	46 g	FGL 5-IK-50-NS-M4	830-11013
5 mm	PNP	Cable, 2 m, 4-wire	85 g	FGL 5-IK-50-PS-K4	830-11010
5 mm	NPN	Cable, 2 m, 4-wire	85 g	FGL 5-IK-50-NS-K4	830-11012

Plug connection

153-01165

Cable connection

153-01166

Mounting on dovetail

153-01167

Connection, 4-pin

154-00312

Accessories

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

10

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
		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)	3000 Hz[2] / 1500 Hz[3]		

[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-38

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-38

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	1.0 mm[1, 2] / 1.2 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	≤ 40 mA[1] / ≤ 45 mA[2] / ≤ 60 mA[3]	Enclosure rating	IP 67[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
Protection Class	2	Ambient temperature: operation	-10 … +55 °C
Power On Delay	< 100 ms	Weight	See Selection Table
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 67 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

Version: 07/2016. Subject to changes; diagrams similar

Plug connection, FG 40	Plug connection, FG 80	Plug connection, FG 120

Operating / display elements

Connection, 3-pin

Accessories

Connection cables	From Page A-38

10

Ultrasonic sensors

Reliable on almost all surfaces

UT 20
from Page 560

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 560

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 564

UT 12
from Page 576

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 576

UT/UM 18
from Page 580

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 580

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 UT 20-S measuring levels in microplate wells.

Deflection mirrors are available for deflecting the sound beam when machine space is limited.

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.

UMT 30

from Page 590

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 590

made in Germany

TYPICAL SENSOPART

- Reliable detection of objects with critical surfaces and highly transparent objects
- Available in cubic (32 x 20 x 12 mm) 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	560
UT 12	Via control input	400 mm	PNP, NPN, analogue output	576
UT/UM 18	Via control input	250 mm / 300 mm / 800 mm	Variants with stainless steel housings, PNP, NPN, analogue output	580
UMT 30	Teach-in or display	350 mm / 1300 mm / 3400 mm / 6000 mm	Display, PNP, 2 x PNP or analogue output	590

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		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	Scanning distance adjustment	Via Teach-in button
Resolution	0.20 mm	Teach-in modes	Mode 1: set switching point Mode 2: set Window Mode Mode 3: set two-way / reflex switch
Repeatability	± 0.15 %[1]		
Hysteresis	2 mm		
Temperature drift	0.17 % / °C	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		Mechanical data	
Operating voltage, $+U_B$	20 … 30 V DC[2]	Dimensions	32 x 38.5 x 12 mm
No-load current, I_0	≤ 25 mA	Enclosure rating	IP 67[3]
Output current, Ie	200 mA	Material, housing	ABS
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q)	Material, ultrasonic converter	Polyurethane foam, epoxy resin with glass content
Protection Class	2	Type of connection	(See Selection Table)
Power On Delay	< 300 ms	Ambient temperature, operation	-25 … +70 °C
Switching output, Q	PNP / NPN (see Selection Table)	Ambient temperature, storage	-40 … +85 °C
Output function	N.O. / N.C.	Weight	10 g
Switching frequency, f (ti/tp 1:1)	25 Hz	Vibration and impact resistance	EN 60947-5-2
Response time	24 ms		
Connection, WH	Sync.		

[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

155-00131

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.

Accessories

Connection cables	From Page A-38
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

Plug connection

153-00982

Connection, 4-pin

154-00115

Sound cone

155-01528

Synchronisation / triggering

155-00131

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.

Accessories

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

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

Version: 07/2016. Subject to changes; diagrams similar

Plug connection

153-00391

Connection, 4-pin

154-00116

Sound cone

155-00132

Synchronisation / triggering

155-00131

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.

Accessories

Connection cables	From Page A-38
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
		Vibration and impact resistance	EN 60947-5-2
Response time	30 ms		
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

Connection, 4-pin

Sound cone

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.

Accessories

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

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		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	Scanning distance adjustment	Via Teach-in button
Resolution	0.20 mm	Teach-in modes	Mode 1: set switching point Mode 2: set window operation Mode 3: set two-way / retroflective sensor
Repeatability	± 0.15 %[1]		
Hysteresis	2 mm		
Temperature drift	0.17 % / °C	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		Mechanical data	
Operating voltage, $+U_B$	20 … 30 V DC[2]	Dimensions	32 x 23.1 x 12 mm
No-load current, I_0	≤ 25 mA	Enclosure rating	IP 67[3]
Output current, Ie	200 mA	Material, housing	ABS
Protective circuits	Reverse polarity protection, U_B / short-circuit protection (Q)	Material, ultrasonic converter	Polyurethane foam, epoxy resin with glass content
Protection Class	2	Type of connection	(See Selection Table)
Power On Delay	< 300 ms	Ambient temperature: operation	-25 … +70 °C
Switching output, Q	PNP / NPN (see Selection Table)	Ambient temperature: storage	-40 … +85 °C
Output function	N.O. / N.C.	Weight	10 g
Switching frequency, f (ti/tp 1:1)	25 Hz	Vibration and impact resistance	EN 60947-5-2
Response time	24 ms		
Connection, WH	Sync.		

[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

Version: 07/2016. Subject to changes; diagrams similar

Plug connection

153-00469

Connection, 4-pin

154-00116

Sound cone

155-00286

Synchronisation / triggering

155-00131

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.

Accessories

Connection cables	From Page A-38
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
		Vibration and impact resistance	EN 60947-5-2
Response time	30 ms		
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: 07/2016. Subject to changes; diagrams similar

Plug connection

153-00469

Connection, 4-pin

154-00115

Sound cone

155-00286

Synchronisation / triggering

155-00131

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.

Accessories

Connection cables	From Page A-38
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: 07/2016. Subject to changes; diagrams similar

Plug connection

153-00444

Connection, 4-pin

154-00116

Sound cone

155-00440

Synchronisation / triggering

155-00131

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.

Accessories

Connection cables	From Page A-38
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]	
Limit scanning distance	1000 mm
Operating scanning distance	120 … 700 mm
Ultrasonic frequency	~ 300 kHz
Resolution	0.20 mm
Repeatability	± 0.15 %[2]
Temperature drift	≤ 2 %

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Set characteristic analogue curve	Via Teach-in button
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

Electrical data	
Operating voltage, $+U_B$	20 … 30 V DC[2]
No-load current, I_0	≤ 35 mA
Current output	R_a < 500 Ω
Voltage output	R_a > 500 Ω
Protective circuits	Reverse polarity protection, U_B / short-circuit protection (Q)
Protection Class	2
Power On Delay	< 300 ms
Analogue output	0 … 10 V / 4 … 20 mA (see Selection Table)
Response time	30 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] 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

Version: 07/2016. Subject to changes; diagrams similar

Plug connection

153-00444

Connection, 4-pin

154-00115

Sound cone

155-00440

Synchronisation / triggering

155-00131

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.

Accessories

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

UT 12-370-P

Ultrasonic sensor with switching output

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

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-38
Brackets	From Page A-4

UT 12-370-A

Ultrasonic sensor with analogue output

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

Version: 07/2016. Subject to changes; diagrams similar

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-38
Brackets	From Page A-4

UT 18-270-P

Ultrasonic sensor with switching output

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	35 … 300 mm
Adjustment range	50 … 300 mm
Ultrasonic frequency	~ 390 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 = 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: flat surface 10 mm x 10 mm
Curve 3: round bar, Ø 25 mm

155-00661

Accessories

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

UT 18-270-A

Ultrasonic sensor with analogue output

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	
Operating scanning distance	35 … 300 mm
Adjustment range	50 … 300 mm
Ultrasonic frequency	~ 390 kHz
Resolution	0.40 mm[1]
Temperature drift	± 1.5 %[2]
Repeatability	± 0.5 %[2]

Functions	
Indicator LED, green	Operating voltage indicator
Indicator LED, yellow	Switching output indicator
Indicator LED, red	Fault indicator
Set characteristic analogue curve	Via control input
Adjustment possibilities	Rising / falling slope via control input
Default settings	Evaluation limit 1 = 50 mm Evaluation limit 2 = 300 mm

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC[3]
No-load current, I_0	≤ 20 mA
Current output	R_a < 300 Ω
Protective circuits	Short-circuit protection (Q) / overload protection
Analogue output	4 … 20 mA
Response time	≤ 30 ms
Control input, WH	- U_B = lower evaluation limit + U_B = upper evaluation limit

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] 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: flat surface 10 mm x 10 mm
Curve 3: round bar, Ø 25 mm

155-00661

Accessories

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

UT 18-750-P

Ultrasonic sensor with switching output

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

Version: 07/2016. Subject to changes; diagrams similar

Plug connection

153-00582

Connection, 4-pin

154-00470

Sound cone

155-00662

Curve 1: flat surface 100 mm x 100 mm
Curve 2: round bar, Ø 25 mm

Accessories

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

11

UT 18-750-A

Ultrasonic sensor with analogue output

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

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-38
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-38
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
Accuracy[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

Version: 07/2016. Subject to changes; diagrams similar

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)

154-00322

1 PNP switched output

154-00306

		colour
1	+U_B	brown
3	-U_B	blue
4	Q	black
2	-	white
5	Sync/Com.	grey

Connection, 5-pin (2 x PNP)

154-00323

2 PNP switched outputs

154-00307

		colour
1	+U_B	brown
3	-U_B	blue
4	Q2	black
2	Q1	white
5	Sync/Com.	grey

Sound cone

155-01561

Synchronisation / multiplex

155-01580

Mounting distances below which synchronisation / multiplex should be used.

Accessories

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

11

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]
Accuracy[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

155-01580

Mounting distances below which synchronisation / multiplex should be used.

Accessories

Connection cables	From Page A-38
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
Accuracy[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: 07/2016. 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 switched output

154-00322

154-00306

Connection, 5-pin (2 x PNP)

2 PNP switched outputs

154-00323

154-00307

Sound cone

155-01562

Synchronisation / multiplex

Mounting distances below which synchronisation / multiplex should be used.

155-01580

Accessories

Connection cables	From Page A-38
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]
Accuracy[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	$R_L \leq 100\ \Omega$ 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 $U_B \geq 15V$
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

155-01580

Mounting distances below which synchronisation / multiplex should be used.

Accessories

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

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
Accuracy[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

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 switched output

154-00322

154-00306

Connection, 5-pin (2 x PNP)

2 PNP switched outputs

154-00323

154-00307

Sound cone

155-01563

Synchronisation / multiplex

Mounting distances below which synchronisation / multiplex should be used.

155-01580

Accessories

Connection cables	From Page A-38
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]
Accuracy[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	$R_L \leq 100\ \Omega$ 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 $U_B \geq 15V$
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

Version: 07/2016. Subject to changes; diagrams similar

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

Analogue output

154-00324

154-00308

Sound cone

155-01563

Synchronisation / multiplex

Mounting distances below which synchronisation / multiplex should be used.

155-01580

Accessories

Connection cables	From Page A-38
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
Accuracy[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: 07/2016. 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 switched output

154-00322

154-00306

Connection, 5-pin (2 x PNP)

2 PNP switched outputs

154-00323

154-00307

Sound cone

155-01564

Synchronisation / multiplex

Mounting distances below which synchronisation / multiplex should be used.

155-01580

Accessories

Connection cables	From Page A-38
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]
Accuracy[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]	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

Version: 07/2016. Subject to changes; diagrams similar

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

155-01580

Mounting distances below which synchronisation / multiplex should be used.

Accessories

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

Inductive sensors

The metal detectors

Cubic housings from
from Page 612

- *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 620

- *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	620
	996-09391	IS 33-51	Flush	0.6 mm	NPN / NO	Cable, 3-wire	620
	996-09444	ISN 44-20	Flush	0.8 mm	NAMUR	Cable, 2 m, 2-wire	621
ø 6.5 mm	996-09488	ISZ 46-02	Flush	1.5 mm	PNP / NO	Cable 2 m, 3-wire	625
	996-09487	ISZ 46-01	Flush	1.5 mm	NPN / NO	Cable, 2 m, 3-wire	625
	996-50590	IS 46-12	Flush	1.5 mm	PNP / NO	Plug, M8x1, 3-wire	626
	996-50613	IS 46-11 T	Flush	1.5 mm	NPN / NO	Plug, M8x1, 3-wire	626
	996-09401	IS 46-02	Flush	1.5 mm	PNP / NO	Cable, 2 m, 3-wire	626
	996-50586	IS 56-12	Quasi-flush	3 mm	PNP / NO	Plug, M8x1, 3-pin	628
	996-50632	IS 56-11 T	Quasi-flush	3 mm	NPN / NO	Plug, M8x1, 3-pin	628
	996-09963	IS 56-42	Quasi-flush	3 mm	PNP / NO	Plug, M12x1, 4-pin	628
	996-50390	IS 56-41	Quasi-flush	3 mm	NPN / NO	Plug, M12x1, 4-pin	628
	996-09409	IS 56-02	Quasi-flush	3 mm	PNP / NO	Cable, 2 m, 3-wire	628
	996-09408	IS 56-01	Quasi-flush	3 mm	NPN / NO	Cable, 2 m, 3-wire	628
M4	996-09397	IS 34-52	Flush	0.6 mm	PNP / NO	Cable, 2 m, 3-wire	622
	996-09395	IS 34-51	Flush	0.6 mm	NPN / NO	Cable, 2 m, 3-wire	622
	996-51486	IT 4 BD-PSK3	Flush	1 mm	PNP / NO	Cable, 3-wire	623
M5	697-01004	IMT 5-0B8-NS-K3	Flush	0.8 mm	NPN / NO	Cable 2 m	624
	697-01005	IMT 5-0B8-PS-K3	Flush	0.8 mm	PNP / NO	Cablel 2 m	624
	697-01006	IMT 5-0B8-NS-M3	Flush	0.8 mm	NPN / NO	M8 3-pin	624
	697-01007	IMT 5-0B8-PS-M3	Flush	0.8 mm	PNP / NO	M8 3-pin	624
M8	697-01008	IMT 8-1B5-NS-K3	Flush	1.5 mm	NPN / NO	Cable 2 m	630
	697-01009	IMT 8-1B5-PS-K3	Flush	1.5 mm	PNP / NO	Cable 2 m	630
	697-01010	IMT 8-1B5-NS-L4	Flush	1.5 mm	NPN / NO	M12 3-pin	630
	697-01011	IMT 8-1B5-PS-L4	Flush	1.5 mm	PNP / NO	M12 3-pin	630
	697-01012	IMT 8-2N-NS-K3	Non-flush	2 mm	NPN / NO	Cable 2 m	632
	697-01013	IMT 8-2N-PS-K3	Non-flush	2 mm	PNP / NO	Cable 2 m	632
	697-01014	IMT 8-2N-NS-L4	Non-flush	2 mm	NPN / NO	M12 3-pin	632

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	629
	996-50623	IS 48-11T	Flush	1.5 mm	NPN / NO	Plug, M8x1, 3-pin	629
	996-09405	IS 48-02	Flush	1.5 mm	PNP / NO	Cable, 2 m, 3-wire	629
	996-09404	IS 48-01	Flush	1.5 mm	NPN / NO	Cable, 2 m, 3-wire	629
	996-50587	IS 58-12T	Flush	3 mm	PNP / NO	Plug, M8x1, 3-pin	634
	996-50640	IS 58-11T	Flush	3 mm	NPN / NO	Plug, M8x1, 3-pin	634
	996-09965	IS 58-42	Flush	3 mm	PNP / NO	Plug, M8x1, 4-pin	634
	996-09964	IS 58-41	Flush	3 mm	NPN / NO	Plug, M8x1, 4-pin	634
	996-09413	IS 58-02	Flush	3 mm	PNP / NO	Cable, 2 m, 3-wire	634
	996-09412	IS 58-01	Flush	3 mm	NPN / NO	Cable, 2 m, 3-wire	634
	697-01015	IMT 8-2N-PS-L4	Non-flush	2 mm	PNP / NO	M12 3-pin	632
M12	697-01016	IMT 12-2B-NS-K3	Flush	2 mm	NPN / NO	Cable 2 m	636
	697-01017	IMT 12-2B-PS-K3	Flush	2 mm	PNP / NO	Cable 2 m	636
	697-01018	IMT 12-2B-NS-L4	Flush	2 mm	NPN / NO	M12 3-pin	636
	697-01019	IMT 12-2B-PS-L4	Flush	2 mm	PNP / NO	M12 3-pin	636
	697-01020	IMT 12-4N-NS-K3	Non-flush	4 mm	NPN / NO	Cable 2 m	638
	697-01021	IMT 12-4N-PS-K3	Non-flush	4 mm	PNP / NO	Cable 2 m	638
	697-01022	IMT 12-4N-NS-L4	Non-flush	4 mm	NPN / NO	M12 3-pin	638
	697-01023	IMT 12-4N-PS-L4	Non-flush	4 mm	PNP / NO	M12 3-pin	638
	996-51479	IS 512-02 AI	Quasi-flush	6 mm	Analogue output 0 … 10 V / 4 … 20 mA	Cable, 4-wire	657
M14	996-51193	IS 514-42	Flush	3 mm	PNP / NO	Plug, M12x1, 4-pin	643
M18	697-01024	IMT 18-5B-NS-K3	Flush	5 mm	NPN / NO	Cable 2 m	644
	697-01025	IMT 18-5B-PS-K3	Flush	5 mm	PNP / NO	Cable 2 m	644
	697-01026	IMT 18-5B-NS-L4	Flush	5 mm	NPN / NO	M12 3-pin	644
	697-01027	IMT 18-5B-PS-L4	Flush	5 mm	PNP / NO	M12 3-pin	644
	697-01028	IMT 18-8N-NS-K3	Non-flush	8 mm	NPN / NO	Cable 2 m	646
	697-01029	IMT 18-8N-PS-K3	Non-flush	8 mm	PNP / NO	Cable 2 m	646
	697-01030	IMT 18-8N-NS-L4	Non-flush	8 mm	NPN / NO	M12 3-pin	646
	697-01031	IMT 18-8N-PS-L4	Non-flush	8 mm	PNP / NO	M12 3-pin	646
M18	996-09435	IS 518-02 A	Quasi-flush	10 mm	Analogue output 0 … 10 V / 4 … 20 mA	Cable, 4-wire	658
M30	697-01032	IMT 30-10B-NS-K3	Flush	10 mm	NPN / NO	Cable 2 m	651
	697-01033	IMT 30-10B-PS-K3	Flush	10 mm	PNP / NO	Cable 2 m	651
	697-01034	IMT 30-10B-NS-L4	Flush	10 mm	NPN / NO	M12 3-pin	651
	697-01035	IMT 30-10B-PS-L4	Flush	10 mm	PNP / NO	M12 3-pin	651
	697-01036	IMT 30-15N-NS-K3	Non-flush	15 mm	NPN / NO	Cable 2 m	652
	697-01037	IMT 30-15N-PS-K3	Non-flush	15 mm	PNP / NO	Cable 2 m	652
	697-01038	IMT 30-15N-NS-L4	Non-flush	15 mm	NPN / NO	M12 3-pin	652
	697-01039	IMT 30-15N-PS-L4	Non-flush	15 mm	PNP / NO	M12 3-pin	652

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	627
	697-01041	IDT 6-2B-NS-K3	Flush	2 mm	NPN / NO	Cable 2 m	627
	697-01042	IDT 6-2B-PS-M3	Flush	2 mm	PNP / NO	M8 3-pin	627
	697-01043	IDT 6-2B-NS-M3	Flush	2 mm	NPN / NO	M8 3-pin	627
M8	697-01044	IMT 8-2B-PS-K3	Flush	2 mm	PNP / NO	Cable 2 m	632
	996-51456	IS 58-14-S	Non-flush	6 mm	PNP / NO	Plug, M8x1, 3-pin	635
	996-51470	IS 58-13-S	Non-flush	6 mm	NPN / NO	Plug, M8x1, 3-pin	635
	996-51460	IS 58-44-S	Non-flush	6 mm	PNP / NO	Plug, M8x1, 4-pin	635
	996-51463	IS 58-43-S	Non-flush	6 mm	NPN / NO	Plug, M8x1, 4-pin	635
	996-51461	IS 58-04-S	Non-flush	6 mm	PNP / NO	Cable, 3-wire	635
	996-51465	IS 58-03-S	Non-flush	6 mm	NPN / NO	Cabel, 3-wire	635
	697-01045	IMT 8-2B-NS-K3	Flush	2 mm	NPN / NO	Cable 2 m	632
	697-01046	IMT 8-2B-PS-M3	Flush	2 mm	PNP / NO	M8 3-pin	632
	697-01047	IMT 8-2B-NS-M3	Flush	2 mm	NPN / NO	M8 3-pin	632
M12	996-51480	IT 12 BM-PSL4	Flush	6 mm	PNP / NO	Plug, M12x1, 4-pin	640
	996-51481	IT 12 NBM-PSL4	Non-flush	10 mm	PNP / NO	Plug, M12x1, 4-pin	640
	996-09969	IS 512-42	Quasi-flush	6 mm	PNP / NO	Plug, M12x1, 4-pin	641
	996-09968	IS 512-41	Quasi-flush	6 mm	NPN / NO	Plug, M12x1, 4-pin	641
	996-09421	IS 512-02	Quasi-flush	6 mm	PNP / NO	Cable, 2 m, 3-wire	641

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	641
	996-51449	IS 512-44-S	Non-flush	10 mm	PNP / NO	Plug, M12x1, 4-pin	642
	996-09970	IS 512-43	Non-flush	10 mm	NPN / NO	Plug, M12x1, 4-pin	642
	996-51458	IS 512-04-S	Non-flush	10 mm	PNP / NO	Cable, 2 m, 3-wire	642
	996-51472	IS 512-03-S	Non-flush	10 mm	NPN / NO	Cable, 2 m, 3-wire	642
	697-01048	IMT 12-4B-PS-K3	Flush	4 mm	PNP / NO	Cable 2 m	638
	697-01049	IMT 12-4B-NS-K3	Flush	4 mm	NPN / NO	Cable 2 m	638
	697-01050	IMT 12-4B-PS-L4	Flush	4 mm	PNP / NO	M12 3-pin	638
	697-01051	IMT 12-4B-NS-L4	Flush	4 mm	NPN / NO	M12 3-pin	638
M18	697-01052	IMT 18-8B-PS-K3	Flush	8 mm	PNP / NO	Cable 2 m	646
	697-01053	IMT 18-8B-NS-K3	Flush	8 mm	NPN / NO	Cable 2 m	646
	697-01054	IMT 18-8B-PS-L4	Flush	8 mm	PNP / NO	M12 3-pin	646
	697-01055	IMT 18-8B-NS-L4	Flush	8 mm	NPN / NO	M12 3-pin	646
	996-09973	IS 518-42	Quasi-flush	12 mm	PNP / NO	Plug, M12x1, 4-pin	648
	996-09972	IS 518-41	Quasi-flush	12 mm	NPN / NO	Plug, M12x1, 4-pin	648
	996-09429	IS 518-02	Quasi-flush	12 mm	PNP / NO	Cable, 2 m, 3-wire	648
	996-09428	IS 518-01	Quasi-flush	12 mm	NPN / NO	Cable, 2 m, 3-wire	648
	996-51453	IS 518-44-S	Non-flush	20 mm	PNP / NO	Plug, M12x1, 4-pin	649
	996-50327	IS 518-43-S	Non-flush	20 mm	NPN / NO	Plug, M12x1, 4-pin	649
	996-51450	IS 518-04-S	Non-flush	20 mm	PNP / NO	Cable, 3-wire	649
	996-51482	IT 18 BM-PSL4	Flush	10 mm	PNP / NO	Plug, M12x1, 4-pin	650
	996-51483	IT 18 NBM-PSL4	Non-flush	20 mm	PNP / NO	Plug, M12x1, 4-pin	650
M30	697-01056	IMT 30-15B-PS-K3	Flush	15 mm	PNP / NO	Cable 2 m	652
	697-01057	IMT 30-15B-NS-K3	Flush	15 mm	NPN / NO	Cable 2 m	652
	697-01058	IMT 30-15B-PS-L4	Flush	15 mm	PNP / NO	M12 3-pin	652
	697-01059	IMT 30-15B-NS-L4	Flush	15 mm	NPN / NO	M12 3-pin	652
	996-09905	IS 530-42	Quasi-flush	22 mm	PNP / NO	Plug, M12x1, 4-pin	654
	996-50673	IS 530-41	Quasi-flush	22 mm	NPN / NO	Plug, M12x1, 4-pin	654
	996-09437	IS 530-02	Quasi-flush	22 mm	PNP / NO	Cable, 2 m, 3-wire	654
	996-09436	IS 530-01	Quasi-flush	22 mm	NPN / NO	Cable, 2 m, 3-wire	654
	996-51454	IS 530-44-S	Quasi-flush	22 mm	PNP / NO	Plug, M12x1, 4-pin	655
	996-51452	IS 530-04-S	Quasi-flush	22 mm	PNP / NO	Cable, 2 m, 3-wire	655
	996-09438	IS 530-03	Quasi-flush	22 mm	NPN / NO	Cable, 2 m, 3-wire	655
	996-51484	IT 30 BM-PSL4	Flush	20 mm	PNP / NO	Plug, M12x1, 4-pin	656
	996-51485	IT 30 NBM-PSL4	Non-flush	40 mm	PNP / NO	Plug, M12x1, 4-pin	656

Cubic inductive sensors

Housing size	Part no.	Type code	Installation	Switching distance	Swichting output	Connection type	Page
40 x 26 x 12 mm	697-01060	IT 12-4B-NS-K3	Flush	4 mm	NPN / NO	Cable 2 m	616
	697-01061	IT 12-4B-PS-K3	Flush	4 mm	PNP / NO	Cable 2 m	616
	697-01062	IT 12-4B-NS-M3	Flush	4 mm	NPN / NO	M8 3-pin	616
	697-01063	IT 12-4B-PS-M3	Flush	4 mm	PNP / NO	M8 3-pin	616
	697-01064	IT 12-8N-NS-K3	Non-flush	8 mm	NPN / NO	Cable 2 m	616
	697-01065	IT 12-8N-PS-K3	Non-flush	8 mm	PNP / NO	Cable 2 m	616
	697-01066	IT 12-8N-NS-M3	Non-flush	8 mm	NPN / NO	M8 3-pin	616
	697-01067	IT 12-8N-PS-M3	Non-flush	8 mm	PNP / NO	M8 3-pin	616
16 x 8 x 5 mm	697-01068	IT 8-1B5K-PS-K3	Flush	1.5 mm	PNP / NO	Strand, 0.5 m, 3-wire	612
	697-01069	IT 8-1B5K-NS-K3	Flush	1.5 mm	NPN / NO	Strand, 0.5 m, 3-wire	612
27 x 10 x 7 mm	697-01070	IT10-4N-PS-K3	Non-flush	4 mm	PNP / NO	Cable 2 m	613
	697-01071	IT10-4N-NS-K3	Non-flush	4 mm	NPN / NO	Cable 2 m	613
25 x 5 x 5 mm	996-50585	IS 455-02	Flush	0.8 mm	PNP / NO	Cable, 2 m, 3-wire	614
	996-50607	IS 455-01	Flush	0.8 mm	NPN / NO	Cable, 2 m, 3-wire	614
50 x 8 x 8 mm	996-51280	IS 588-02-X	Quasi-flush	3 mm	PNP / NO	Plug, M8x1, 3-pin	615
40 x 8 x 8 mm	996-50589	IS 588-02	Quasi-flush	3 mm	PNP / NO	Cable, 2 m, 3-wire	615
	996-50650	IS 588-01	Quasi-flush	3 mm	NPN / NO	Cable, 2 m, 3-wire	615
40 x 40 x 55 mm	810-50001	IT 40 BD-PAL 4	Flush	20 mm	PNP, antivalent (N.O/N.C.)	Plug, M12x1, 4-pin	618
	810-50006	IT 40 NB-PAL4	Non-flush	35 mm	PNP, antivalent (N.O/N.C.)	Plug, M12x1, 4-pin	618
	810-50007	IT 40 NB-NAL4	Non-flush	35 mm	PNP, antivalent (N.O/N.C.)	Plug, M12x1, 4-pin	618

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.

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* Metal-free zone

IT 8

Inductive sensor in cubic housing

Strand

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 mm
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)

Connection, 3-wire (NPN)

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

IT 10

Inductive sensor in cubic housing

Cable connection

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
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

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[1] With connected IP 67 plug [2] PNP variants only

Connection, 3-wire (PNP)

Connection, 3-wire (NPN)

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

Cable connection

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
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

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

CE

Plug connection	Cable connection

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 mm
No-load current, I_0	≤ 10 mA	Dimensions (cable device)	8 x 8 x 40 mm
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

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 mm
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

Version: 07/2016. Subject to changes; diagrams similar

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

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IT 40

Inductive sensor in cubic housing, AC/DC

CE

Plug connection

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, $+U_B$	20 … 320 V DC / 20 … 265 V AC
No-load current, I_0	1.5 mA[1]
Output current, Ie	≤ 300 mA
Protective circuits	Induction protection
Power On Delay	100 ms
Switching output, Q	AC / DC (see Selection Table)
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	See Selection Table

Mechanical data	
Dimensions	40 x 55 x 40 mm
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 [2] With connected IP 67 plug [3] Except IT 40 NB-ACSL4 (-25 … +70 °C)

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

Version: 07/2016. Subject to changes; diagrams similar

IS 33

Inductive sensor with stainless steel housing

CE

Cable connection

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

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

[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

CE

Cable connection

153-00998

Sensor data	
Switching distance	1 mm
Hysteresis	1 … 15 %

Functions	
Indicator LED, yellow	Switching output indicator

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
Output current, Ie	≤ 100 mA
Protective circuits	Reverse-polarity protection, U_B
Switching frequency, f (ti/tp 1:1)	≤ 3000 Hz
Switching output, Q	PNP
Output function	N.O.

Mechanical data	
Dimensions	M4 x 22 mm
Mounting	Flush
Enclosure rating	IP 67[1]
Material, housing	Stainless steel, V2A
Type of connection	See Selection Table
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

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)

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

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

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

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)	Ø 6.5 x 29 mm
No-load current, I_0	≤ 10 mA	Dimensions (cable device)	Ø 6.5 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

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

Version: 07/2016. Subject to changes; diagrams similar

IDT 6

Inductive sensor

Plug connection	Cable connection

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

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Connection plug, 3-pin (PNP)	Connection plug, 3-pin (NPN)	Connection cable, 3-wire (PNP)	Connection cable, 3-wire (NPN)

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

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

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

CE

Plug connection	Cable connection

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

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

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
		Material, housing (cable device)	Brass
Switching output, Q	PNP / NPN (see Selection Table)	Material, front surface	LCP
Output function	N.O.	Type of connection	See Selection Table
Switching frequency, f (ti/tp 1:1)	≤ 1500 Hz	Ambient temperature: operation	-25 … +70 °C

[1] With connected IP 67 plug

Connection plug, 3-pin (PNP)[2]	Connection plug, 3-pin (NPN)[2]	Connection cable, 3-wire (PNP)	Connection cable, 3-wire (NPN)

[2] Plug M12x1 3-pin is compatible with M12x1 4- or 5-pin sockets

Switching distance	Switching output	Type of connection	Part number	Article number
1.5 mm	PNP	Plug, M12x1, 3-pin[2]	IMT 8-1B5-PS-L4	697-01011
1.5 mm	NPN	Plug, M12x1, 3-pin[2]	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[6]	IMT 8-2N-PS-L4	697-01015
2 mm	Non-flush	NPN	≤ 1500 Hz	Plug, M12x1, 3-pin[6]	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)	Plug connection (non-flush)
153-00881	153-00865
Cable connection (flush)	**Cable connection (non-flush)**
153-00880	153-00864

Connection plug, 3-pin (PNP)[6]	Connection plug, 3-pin (NPN)[6]
154-00294	154-00293
Connection cable, 3-wire (PNP)	**Connection cable, 3-wire (NPN)**
154-00294	154-00293

[6] Plug M12x1 3-pin is compatible with M12x1 4- or 5-pin sockets

IS 58

Inductive sensor

Plug connection (M8x1)	Plug connection (M12x1)	Cable connection

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

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

Sensor data	
Switching distance	6 mm
Repeatability	≤ 0.3 mm
Reduction factor, Al	0.47
Reduction factor, Cu	0.44
Reduction factor, V2A	0.77

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	≤ 200 mA
Voltage drop, U_D	≤ 2 V at 200 mA
Protective circuits	Short-circuit protection (Q) / overload protection
Power On Delay	50 ms
Switching output, Q	PNP / NPN (see Selection Table)
Output function	N.O.
Switching frequency, f (ti/tp 1:1)	≤ 500 Hz

Mechanical data	
Dimensions	See Selection Table
Enclosure rating	IP 67[2]
Mounting	Non-flush
Material, housing	Brass, chrome-plated
Material, front surface	PBTP
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 plug, 3-pin	Connection plug, 4-pin	Connection cable, 3-wire

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

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)[2]	Connection plug, 3-pin (NPN)[2]	Connection cable, 3-wire (PNP)	Connection cable, 3-wire (NPN)

[2] Plug M12x1 3-pin is compatible with M12x1 4- or 5-pin sockets

Switching distance	Switching output	Type of connection	Part number	Article number
2 mm	PNP	Plug, M12x1, 3-pin[2]	IMT 12-2B-PS-L4	697-01019
2 mm	NPN	Plug, M12x1, 3-pin[2]	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

Version: 07/2016. Subject to changes; diagrams similar

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[6]	IMT 12-4B-PS-L4	697-01050
4 mm	Flush	NPN	≤ 800 Hz	Plug, M12x1, 3-pin[6]	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[6]	IMT 12-4N-PS-L4	697-01023
4 mm	Non-flush	NPN	≤ 1200 Hz	Plug, M12x1, 3-pin[6]	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)[6]	**Connection plug, 3-pin (NPN)[6]**
154-00294	154-00293
Connection cable, 3-wire (PNP)	**Connection cable, 3-wire (NPN)**
154-00294	154-00293

[6] Plug M12x1 3-pin is compatible with M12x1 4- or 5-pin sockets

IT 12

Inductive sensor with expanded switching distance

Plug connection (flush)	Plug connection (non-flush)	Cable connection (flush)

Sensor data		Functions	
Switching distance[1]	6 mm	Indicator LED, yellow	Switching output indicator
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		

Electrical data		Mechanical data	
Operating voltage, $+U_B$	10 … 30 V DC[6]	Dimensions	M12 x 60 mm
No-load current, I_0	≤ 10 mA	Mounting	Flush / non-flush (see Selection Table)
Operating current, I_L	≤ 200 mA	Enclosure rating	IP 69K & IP 68[7]
Voltage drop, U_D	≤ 2 V at 200 mA	Material, housing	Stainless steel,V2A
Protective circuits	Reverse-polarity protection, U_B / short-circuit protection (Q) / induction protection	Material, front surface	Stainless steel,V2A
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)	See Selection Table	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

Connectionplug, 4-pin	Connection cable, 3-wire

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
6mm	Flush	PNP	≤ 600 Hz	Cable, 2 m, 3-wire	IT 12 BM-PSK3	996-51487

Version: 07/2016. Subject to changes; diagrams similar

IS 512

Inductive sensor with expanded switching distance

CE

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

CE

Plug connection	Cable connection

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)
		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)	≤ 400 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

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

SENSOPART

Inductive sensor, high-pressure immunity with stainless steel housing

CE

Plug connection

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

Response curve

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

Sensor data		Functions	
Switching distance	5 mm	Indicator LED, yellow	Switching output indicator
Ensured switching distance	0 … 4.05 mm		
Reduction factor, Al	0.30		
Reduction factor, Cu	0.30		
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	≤ 20 mA	Dimensions (cable device)	M18 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)	≤ 800 Hz		

[1] With connected IP 67 plug

Connection plug, 3-pin (PNP)[2]	Connection plug, 3-pin (NPN)[2]	Connection cable, 3-wire (PNP)	Connection cable, 3-wire (NPN)

[2] Plug M12x1 3-pin is compatible with M12x1 4- or 5-pin sockets

Switching distance	Switching output	Type of connection	Part number	Article number
5 mm	PNP	Plug, M12x1, 3-pin[2]	IMT 18-5B-PS-L4	697-01027
5 mm	NPN	Plug, M12x1, 3-pin[2]	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	
Switching distance	8 mm
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

Functions	
Indicator LED, yellow	Switching output indicator

Electrical data	
Operating voltage, $+U_B$	10 … 30 V DC
No-load current, I_0	≤ 15 mA[1] / ≤ 18 mA[2]
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)	≤ 500 Hz

Mechanical data	
Dimensions (plug device)	M18 x 65 mm
Dimensions (cable device)	M18 x 50 mm
Mounting	Flush / non-flush (see Selection Table)
Enclosure rating	IP 67[3]
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] 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[4]	IMT 18-8B-PS-L4	697-01054
8 mm	Flush	NPN	Plug, M12x1, 3-pin[4]	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[4]	IMT 18-8N-PS-L4	697-01031
8 mm	Non-flush	NPN	Plug, M12x1, 3-pin[4]	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)	Plug connection (non-flush)
153-00885	153-00873
Cable connection (flush)	**Cable connection (non-flush)**
153-00884	153-00872

Connection plug, 3-pin (PNP)[4]	Connection plug, 3-pin (NPN)[4]
154-00294	154-00293
Connection cable, 3-wire (PNP)	**Connection cable, 3-wire (NPN)**
154-00294	154-00293

[4] Plug M12x1 3-pin is compatible with M12x1 4- or 5-pin sockets

IS 518

Inductive sensor with expanded switching distance

CE

Plug connection	Cable connection

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

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

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

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Connection plug, 4-pin	Connection cable, 3-wire

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

CE

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

Version: 07/2016. Subject to changes; diagrams similar

IMT 30-10

Inductive sensor

Plug connection	Cable connection

Sensor data	
Switching distance	10 mm
Ensured switching distance	0 … 8.1 mm
Reduction factor, Al	0.30
Reduction factor, Cu	0.30
Reduction factor, V2A	0.80

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)	≤ 200 Hz

Mechanical data	
Dimensions (plug device)	M30 x 65 mm
Dimensions (cable device)	M30 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

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Connection plug, 3-pin (PNP)[2]	Connection plug, 3-pin (NPN)[2]	Connection cable, 3-wire (PNP)	Connection cable, 3-wire (NPN)

[2] Plug M12x1 3-pin is compatible with M12x1 4- or 5-pin sockets

Switching distance	Switching output	Type of connection	Part number	Article number
10 mm	PNP	Plug, M12x1, 3-pin[2]	IMT 30-10B-PS-L4	697-01035
10 mm	NPN	Plug, M12x1, 3-pin[2]	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[5]	IMT 30-15B-PS-L4	697-01058
15 mm	Flush	NPN	Plug, M12x1, 3-pin[5]	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[5]	IMT 30-15N-PS-L4	697-01039
15 mm	Non-flush	NPN	Plug, M12x1, 3-pin[5]	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)	Plug connection (non-flush)
153-00887	153-00877
Cable connection (flush)	**Cable connection (non-flush)**
153-00886	153-00876
Connection plug, 3-pin (PNP)[5]	**Connection plug, 3-pin (NPN)[5]**
154-00294	154-00293
Connection cable, 3-wire (PNP)	**Connection cable, 3-wire (NPN)**
154-00294	154-00293

[5] Plug M12x1 3-pin is compatible with M12x1 4- or 5-pin sockets

IS 530

Inductive sensor with expanded switching distance

CE

Plug connection	Cable connection

Sensor data		Functions	
Switching distance	22 mm	Indicator LED, yellow	Operating voltage indicator
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		

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)	≤ 200 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

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

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
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)	≤ 100 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
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

CE

Plug connection (flush)	Plug connection (non-flush)

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

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

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

Characteristic output curve

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

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

Characteristic output curve

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 666

- *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 668

- *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 670

- *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 672

- *Increased switching distance 1 … 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 674

- *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		666
KD / KL 08	Flush / non-flush	Potentiometer	0.1 … 1.5 / 0.1 … 3 mm		668
KD / KL 12	Flush / non-flush	Potentiometer	1 … 4 / 1 … 8 mm		670
KD / KL 18	Flush / non-flush	Potentiometer	1 … 8 / 2 … 15 mm	Longer switching distance	672
KD / KL 30	Flush / non-flush	Potentiometer	1 … 20 / 1 … 30 mm	Longer switching distance	674

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 (ε_{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 (ε_{water} = 80!)

Installation / Mutual interference

Flush version

Non-flush version

A: Sensing face
d: Diameter
Sn: Operating distance

The IEC 60947-5-2 standard stipulates the mentionned above values as minimum distances. They refer to the mounting of frequently used cylindrical housings.
If several capacitive proximity switches of the same type are mounted close together, certain minimum distances between the units should also be observed.

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 672

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 668

The capacitive sensor (e.g. KL 08) detects the level of a reservoir for liquid refrigerant.

Level measuring
Page 670

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	
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	Ø 6.5 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 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

Version: 07/2016. Subject to changes; diagrams similar

Plug connection (flush)

153-00516

Plug connection (non-flush)

153-00517

Connection, 3-pin

154-00459

Accessories

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

13

KD/KL 12

Capacitive sensor

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-38
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)	1 … 8 mm
Switching distance (non-flush)	2 … 15 mm
Hysteresis	15 %[1]
Repeatability	2 %[1]
Temperature drift	20 % / °C[1] [-5 … +55 °C]
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, $+U_B$ (flush)	10 … 30 V DC
Operating voltage, $+U_B$ (non-flush)	10 … 35 V DC
No-load current, I_0 (flush)	≤ 18 mA
No-load current, I_0 (non-flush)	≤ 10 mA
Output current, Ie (flush)	≤ 100 mA
Output current, Ie (non-flush)	≤ 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 (flush)	-25 … +85 °C
Ambient temperature: operation (non-flush)	-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 … 8 mm	Flush	PNP (N.O.)	Plug, M12x1, 4-pin	KD 18 B-PSL4	681-50990
1 … 8 mm	Flush	PNP (N.C.)	Plug, M12x1, 4-pin	KD 18 B-POL4	681-50991
1 … 8 mm	Flush	NPN (N.O.)	Plug, M12x1, 4-pin	KD 18 B-NSL4	681-50992
1 … 8 mm	Flush	NPN (N.C.)	Plug, M12x1, 4-pin	KD 18 B-NOL4	681-50993
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

Version: 07/2016. Subject to changes; diagrams similar

Plug connection (flush)

153-00522

Plug connection (non-flush)

153-00523

Connection, 4-pin

154-00460

Accessories

Connection cables	From Page A-38
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: 07/2016. Subject to changes; diagrams similar

Plug connection (flush)

Plug connection (non-flush)

Connection, 4-pin

Accessories

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

13

SmartPlug

Plug-in intelligence

MFI Inverter
from Page 680

- *Inverts NPN to PNP or PNP to NPN devices, and N.C./N.O. also adjustable*

MFC Counter
from Page 682

- *Adjustable counter (pulses or intervals) between 1 … 65535 ms*
- *Count parts*
- *Parts from results*
- *Flip-flop*

MFT Timer
from Page 684

- *Adjustable on-delay or drop-out delay between 1 … 65535 ms*

MFF Frequency
from Page 686

- *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 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 programmes 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 688

- *Adjustable wipe function for falling or rising edges; time calculation 1 … 65535 ms*
- *Signal expansion*
- *Filter*

MFU Universal
from Page 690

- *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	680
MFC (Counter)	Adjustable counter (pulses or intervals) between 1 … 65535	682
MFT (Timer)	Adjustable on-delay or drop-out delay between 1 … 65535 ms	684
MFF (Frequency)	Adjustable frequency monitoring between 15 … 1000 Hz	686
MFW (Wipe Function)	Adjustable wipe function for falling or rising edges; time range 1 … 65535 ms	688
MFU (Universal)	All-in multifunctional switching device programmable via USB	690

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

Version: 07/2016. Subject to changes; diagrams similar

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	
Operating voltage, $+U_B$	10 … 30 V DC[1]
Power consumption	≤ 10 mA
Input resistance	> 10 kOhm
Input frequency	≤ 1 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	Part number	Article number
PNP	MFC 12 PP4	968-21000
NPN	MFC 12 NN4	968-21001

Version: 07/2016. 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

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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	
Operating voltage, $+U_B$	10 … 30 V DC[1]
Power consumption	≤ 10 mA
Input resistance	> 10 kOhm
Input frequency	≤ 1 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	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

Version: 07/2016. Subject to changes; diagrams similar

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

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

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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	
Operating voltage, $+U_B$	10 … 30 V DC[1]
Power consumption	≤ 10 mA
Input resistance	> 10 kOhm
Input frequency	≤ 8 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	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-38

Accessories

Meeting all needs

Mechanical accessories from Page A-4

- *Brackets for sensors*
- *Brackets for VISOR® and illumination*

Optical accessories from Page A-18

- *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-38

- *Cables*
- *Converters*
- *Power supply units, switching devices and Panel Viewer*

Flexible: *MG 3A Mounting angle with 2 axes and drilled hole for mounting rod.*

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

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A

Accessories

Brackets

- Brackets

Brackets for F 10 series

	153-00899	Part number / Article number Description Suitable for	MBD F 10 / 660-01001 Dovetail clamp mounting, adjustable ± 10° Material: PBT F 10
	153-00907	Part number / Article number Description Suitable for	MS F 10 / 660-01000 Mounting bracket with screws 1x mounting plate M3 1x mounting plate ø 3.1 mm Material: stainless steel V2A F 10

Brackets for F 25, F 20, UT 20, FL 20 series

	153-00945 153-00946	Part number / Article number Description Suitable for	MBD F 25 / 661-01000 Dovetail clamp mounting, adjustable ± 15°, with screws Material: anodised aluminium F 25
	153-00241	Part number / Article number Description Suitable for	MS F 20 / 558-41000 Mounting bracket with screws 1x retaining strip Material: nickel-plated steel F 20 F 25 UT 20 FL 20

Brackets for F 25, F 20, UT 20, FL 20 series (Cont.)

153-01155
153-01156

Part number / Article number	MBD F 25ST2 / 661-01005
Description	Clamping bracket for Ø 12 mm mounting rod and 10 x 10 mm square profile, with M4 screw and M3 nut Material: die-cast zinc
Suitable for	F 25

153-01155
153-01163

Part number / Article number	Set: MBD F 25STP / 661-01004
Description	Clamping bracket for Ø 12 mm mounting rod and 10 x 10 mm square profile, with protective casing, M4 screw, M4 thumbscrew, M4 nut, 2x M3 screw Material: die-cast zinc Casing Material: stainless steel V2A
Suitable for	F 25

153-01164

Part number / Article number	MB ST2 / 661-01007
Description	Mounting component for Ø 12 mm mounting rod and 10 x 10 mm square profile, and F 55 and fork sensors (FGL), with M4 screw Material: die-cast zinc
Suitable for	F 55, FGL, MST 45-20, MST 45-30, MST 45-40

153-01017

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

153-00296

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

153-00908

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	MSP F 20-2 / 558-41005
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

153-00973

Part number / Article number	MSP F 20-13 / 558-41008
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

153-00972

Part number / Article number	MSP F 20-12 / 558-41007
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

153-00974

Part number / Article number	MSP F 20-21 / 558-41009
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

153-00975

Part number / Article number	MSP F 20-22 / 558-41010
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

153-00291

Part number / Article number	MS F 20-DIN / 558-41001
Description	DIN rail mounting with screws Material: nickel-plated steel
Suitable for	FL 20

Brackets for F 20, F 25, UT 20, FL 20 series (Cont.)

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

Brackets for F 50, F 55, F 80, F 88, FGL series

153-01164

Part number / Article number	MB ST2 / 661-01007
Description	Mounting component for Ø 12 mm mounting rod and 10 x 10 mm square profile, and F 55 and fork sensors (FGL), with M4 screw Material: die-cast zinc
Suitable for	F 55, FGL, MST 45-20, MST 45-30, MST 45-40

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 F 80

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

A

Accessories

Brackets

Brackets for F 50, F 55, F 80, F 88, FGL series (Cont.)

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: stainless steel V2A
Suitable for	F 55

153-00542

Part number / Article number	MBD-S94 / 533-21000
Description	Dovetail double clamp mounting Material: metal
Suitable for	F 55 FGL F 88

153-00561

Part number / Article number	MS F 88-1 / 820-41001
Description	Angle bracket Material: stainless steel
Suitable for	F 80 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 80 F 88

153-00563

Bestellbezeichnung / Artikel-Nr.	MS F 88-3 / 820-41003
Beschreibung	Halterung für Montagestange mit Gelenk für Feinjustage, mit Schrauben Material: Metall
Passend für	F 80 F 88

Brackets for F 50, F 55, F 80, F 88, FGL series (Cont.)

153-01164

Part number / Article number	MB ST2 / 661-01007
Description	Mounting component for Ø 12 mm mounting rod and 10 x 10 mm square profile, and F 55 and fork sensors (FGL), with M4 screw Material: die-cast zinc
Suitable for	F 55, FGL, MST 45-20, MST 45-30, MST 45-40

Brackets for F 90, F 91, F 92 series

153-01164

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

153-00470

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 F 90

155-00212

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

A

Accessories

Brackets

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

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

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

Brackets for fibre-optic cables and round housings (Cont.)

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

Part number / Article number	MC 08 / 041-01306
Description	Mounting angle for round housings Material: aluminium
Suitable for	Round M8 housings

Part number / Article number	MA 12 / 041-01305
Description	Mounting angle for round housings Material: aluminium
Suitable for	Round M12 housings

Part number / Article number	MA 18 / 041-01304
Description	Mounting angle for round housings Material: aluminium
Suitable for	Round M18 housings

Part number / Article number	MA 30 / 041-01303
Description	Mounting angle for round housings Material: aluminium
Suitable for	Round M30 housings

A

Accessories

Brackets

Brackets for fibre-optic cables and round housings (Cont.)			
		Part number / Article number Description Suitable for	MC 18 / 042-01528 Retaining clip for round housings Material: plastic Round M18 housings
		Part number / Article number Description Suitable for	MC 30 / 042-01527 Retaining clip for round housings Material: plastic Round M30 housings
		Part number / Article number Description Suitable for	MA 18 A / 042-12825 Universal mounting angle for round housings, fine-adjustable with adjusting screws Material: galvanised steel Round M12 and M18 housings
		Part number / Article number Description Suitable for	MS M5-30 / 558-41012 Universal bracket for round housings Material: connecting rod, metal / mounting elements, plastic Round M5, M8, M12, M14, M18 and M30 housings
		Part number / Article number Description Suitable for	Deflection mirror / 691-51535 Deflection mirror for ultrasonic sensors Material: stainless steel UMT 30-350 UMT 30-1300

Accessories

Brackets

Brackets 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

Brackets 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

Part number / Article number	MG 3A / 543-11024
Description	Mounting angle with 2 axes and drilled hole for mounting rod Material: anodised aluminium
Suitable for	V10 / V20

A

Accessories

Brackets

Brackets for V10, V20 (Cont.)

Brackets for illumination

	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
	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

Brackets for illumination (Cont.)

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

Brackets for light strips, High Power, LBxxx

Part number / Article number	MG LB L / 543-11025
Description	Mounting clamp light strip long Material: nickel-plated steel
Suitable for	Light strips High Power, LBxxx

Part number / Article number	MG LB LL / 543-11026
Description	Mounting angle light strip long, lite Material: anodised aluminium
Suitable for	Light strips High Power, LBxxx

A

Accessories

Reflectors

- Reflectors
- Lenses / Protective casings
- Illumination

Reflectors for Retroreflective photoelectric sensor

	153-01197	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	RD 10L / 904-51653 Reflector in housing Ø 10 x 5.6 mm Grub screw M3, centred -20 … +60 °C Retroreflective photoelectric sensor (laser)
	153-01198	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	RD 10LK / 904-51654 Reflector in housing Ø 10 x 3.7 mm Self-adhesive -20 … +60 °C Retroreflective photoelectric sensor (laser)
	153-01199	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	RD 15 / 904-51655 Reflector in housing Ø 15 x 6.4 mm Grub screw M3, centred -20 … +60 °C Retroreflective photoelectric sensor (LED)
	153-01200	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	RD 15K / 904-51656 Reflector in housing Ø 15 x 4.5 mm Self-adhesive -20 … +60 °C Retroreflective photoelectric sensor (LED)

Version: 07/2016. Subject to changes; diagrams similar

Reflectors for Retroreflective photoelectric sensor (Cont.)

	153-01201	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	RD 15L / 904-51657 Reflector in housing Ø 15 x 6.4 mm Grub screw M3, centred -20 … +60 °C Retroreflective photoelectric sensor (laser)
	153-01202	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	RD 15LK / 904-51658 Reflector in housing Ø 15 x 3.7 mm Self-adhesive -20 … +60 °C Retroreflective photoelectric sensor (laser)
	153-01014	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	RD2-G / 904-51567 Reflector in housing Ø 19 x 5.6 mm Grub screw M3, centred -20 … +60 °C Retroreflective photoelectric sensor (LED)
	153-00066	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	RD2 / 904-51534 Reflector in housing Ø 21 x 5 mm Self-adhesive -20 … +60 °C Retroreflective photoelectric sensor (LED)
	153-01203	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	RD 25L / 904-51659 Reflector in housing Ø 25 x 7.5 mm Grub screw M4, centred -20 … +60 °C Retroreflective photoelectric sensor (laser)
	153-01204	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	RD 25LK / 904-51660 Reflector in housing Ø 25 x 5.5 mm Self-adhesive -20 … +60 °C Retroreflective photoelectric sensor (laser)

A

Accessories

Reflectors

Reflectors for Retroreflective photoelectric sensor (Cont.)			
	153-01205	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	RD 35 / 904-51661 Reflector in housing Ø 35 x 10.2 mm Grub screw M5, centred -20 … +60 °C Retroreflective photoelectric sensor (LED)
	153-01206	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	RD 35K / 904-51662 Reflector in housing Ø 35 x 7.4 mm Self-adhesive -20 … +60 °C Retroreflective photoelectric sensor (LED)
	153-01207	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	RD 35L / 904-51663 Reflector in housing Ø 35 x 8.6 mm Grub screw M5, centred -20 … +60 °C Retroreflective photoelectric sensor (laser)
	153-01208	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	RD 35LK / 904-51664 Reflector in housing Ø 35 x 5.7 mm Self-adhesive -20 … +60 °C Retroreflective photoelectric sensor (laser)
	153-00067	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	RD4 / 904-51535 Reflector in housing Ø 42 x 9.5 mm Grub screw M5, centred -20 … +60 °C Retroreflective photoelectric sensor (LED)
	153-00355	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	RD46 / 904-51572 Reflector in housing Ø 46 x 9 mm 2 mounting holes -20 … +60 °C Retroreflective photoelectric sensor (LED)

Reflectors for Retroreflective photoelectric sensor (Cont.)

153-00070

Part number / Article number	RD8 / 904-51531
Description	Reflector in housing
Dimensions	Ø 84 x 9 mm
Mounting	1 mounting hole, centred
Temperature range	-20 … +60 °C
Suitable for	Retroreflective photoelectric sensor (LED)

153-00280

Part number / Article number	R1L / 904-51559
Description	Reflector in housing
Dimensions	10 x 62 x 3.5 mm
Mounting	2 mounting holes
Temperature range	-20 … +60 °C
Suitable for	Retroreflective photoelectric sensor (laser)

153-00068

Part number / Article number	R1 / 904-51532
Description	Reflector in housing
Dimensions	19 x 73 x 8 mm
Mounting	2 mounting holes M3
Temperature range	-20 … +60 °C
Suitable for	Retroreflective photoelectric sensor (LED)

153-00772

Part number / Article number	R3-2LK / 904-51588
Description	Reflector in housing
Dimensions	20 x 30 x 2.5 mm
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 mm
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 mm
Mounting	2 mounting holes
Temperature range	-20 … +60 °C
Suitable for	Retroreflective photoelectric sensor (laser)

A

Accessories

Reflectors

Reflectors for Retroreflective photoelectric sensor (Cont.)

153-01210

Part number / Article number	R3-2LBC / 904-51666
Description	Reflector, chemically resistant for critical cleaning processes
Dimensions	20 x 32 x 3 mm
Mounting	2 mounting holes
Temperature range	-20 … +60 °C
Suitable for	Retroreflective photoelectric sensor (laser)

153-01046

Part number / Article number	R2-2LB1 / 904-51595
Description	Reflector in housing,with very fine structure
Dimensions	20 x 32 x 3.8 mm
Mounting	2 mounting holes
Temperature range	-20 … +60 °C
Suitable for	Retroreflective photoelectric sensor (laser)

153-01196

Part number / Article number	R4-6LB / 904-51652
Description	Reflector in housing
Dimensions	40 x 60 x 6.1 mm
Mounting	2 mounting holes
Temperature range	-20 … +60 °C
Suitable for	Retroreflective photoelectric sensor (laser)

153-01195

Part number / Article number	R4-6B / 904-51651
Description	Reflector in housing
Dimensions	40 x 60 x 7.5 mm
Mounting	2 mounting holes
Temperature range	-20 … +60 °C
Suitable for	Retroreflective photoelectric sensor (LED)

153-01209

Part number / Article number	R4-6BC / 904-51665
Description	Reflector, chemically resistant for critical cleaning processes
Dimensions	40 x 60 x 7.5 mm
Mounting	2 mounting holes
Temperature range	-20 … +60 °C
Suitable for	Retroreflective photoelectric sensor (LED)

153-01194

Part number / Article number	R5-7B / 904-51650
Description	Reflector in housing
Dimensions	50 x 70 x 6.8 mm
Mounting	2 mounting holes
Temperature range	-20 … +60 °C
Suitable for	Retroreflective photoelectric sensor (LED)

Reflectors for Retroreflective photoelectric sensor (Cont.)

	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 mm 2 mounting holes -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 foil 51 x 51 mm Self-adhesive -40 … +70 °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 mm 2 mounting holes (slots) -20 … +60 °C Retroreflective photoelectric sensor (laser)
	153-00069	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	R5 / 904-51533 Reflector in housing 51 x 61 x 8 mm 2 mounting holes -20 … +60 °C Retroreflective photoelectric sensor (LED)
	153-00816	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	R50 BC / 904-51641 Reflector, chemically resistant for critical cleaning processes 51 x 69 x 8.1 mm 6 mounting holes -20 … +140 °C Retroreflective photoelectric sensor (LED) ECOLAB
	153-00557	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	R10 / 904-51637 R10 / 2 (2 x R10) / 904-51636 Reflector in housing 100 x 100 x 9 mm 2 mounting holes -40 … +70 °C Retroreflective photoelectric sensor (LED) FR 85

A

Accessories

Reflectors

Reflectors for Retroreflective photoelectric sensor (Cont.)			
	153-00817	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	R100 BC / 904-51642 Reflector, chemically resistant for critical cleaning processes 100 x 100 x 9.2 mm 2 mounting holes -20 … +140 °C Retroreflective photoelectric sensor (LED) ECOLAB®
	153-00950	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	RF-30x100 KL / 904-51592 Reflective foil 100 x 30 mm Self-adhesive -40 … +70 °C Retroreflective photoelectric sensor (laser)
	153-00071	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	RF 10 / 904-51536 Reflective foil 100 x 100 mm 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 foil for FT 50 C colour sensor 100 x 100 mm Self-adhesive -40 … +70 °C FT 50 C
	153-01125	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	RF-100 KL / 904-51644 Reflective foil 100 x 100 mm, to cut to size 100 x 100 mm Self-adhesive -40 … +70 °C Retroreflective photoelectric sensor (laser)

Reflectors for Retroreflective photoelectric sensor (Cont.)

153-01015

Part number / Article number	RF 775x 100 mm / 904-51643
Description	RF 775x 200 mm / 904-51645
	RF 775x 300 mm / 904-51646
	RF 775x 400 mm / 904-51647
	RF 775x 500 mm / 904-51648
	Reflective foil, weatherproof
Dimensions	775 x ... mm
Mounting	Self-adhesive
Temperature range	-40 … +70°C
Suitable for	Retroreflective photoelectric sensor (LED)

Reflectors für time-of-flight devices (Cont.)

153-00483

Part number / Article number	RL 250 / 904-51562
Description	Reflector for ranges up to 50 m / 70 m
Dimensions	248 x 248 x 4.5 mm
Mounting	4 mounting holes
Temperature range	-20 … +60 °C
Suitable for	FR 55, 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 mm
Mounting	4 mounting holes
Temperature range	-20 … +60 °C
Suitable for	FR 92

153-00488

Part number / Article number	RF 250 / 599-91009
Description	Reflective foil for ranges up to 50 m / 70 m
Dimensions	250 x 250 mm
Mounting	Self-adhesive
Temperature range	-20 … +60 °C
Suitable for	FR 55, FR 90, FR 91

153-00488

Part number / Article number	RF 250/V / 904-51579
Description	Reflective foil for ranges up to 30 m
Dimensions	250 x 250 mm
Mounting	Self-adhesive
Temperature range	-20 … +60 °C
Suitable for	FR 92

A

Accessories

Reflectors

Reflectors für time-of-flight devices (Cont.)			
	153-00485	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	RL 460 / 904-51565 Reflector for ranges up to 80 m 460 x 460 x 4.5 m 4 mounting holes -20 … +60 °C FR 90, FR 91, FR 92
	153-00484	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	RL 540 / 904-51571 Reflector in housing for ranges up to 200 m 540 x 540 x 5.6 mm 4 mounting holes -20 … +60 °C FR 90, FR 91, FR 92
	153-00486	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	RL 660 / 904-51564 Reflector for ranges up to 80 m 660 x 660 x 4.5 mm 4 mounting holes -20 … +60 °C FR 90, FR 91, FR 92
	153-00487	Part number / Article number Description Dimensions Mounting Temperature range Suitable for	RL 700 / 904-51570 Reflector in housing for ranges up to 250 m 700 x 700 x 5,6 mm 4 mounting holes -20 … +60 °C FR 90, FR 91, FR 92

Mounting of the reflectors as shown in the dimensional drawing or alignment according to labeling on reflector front

Lenses, C-mount

		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 Max. length: 33.5 mm Weight: 70 g V10 / V20 C-Mount
		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 Max. length: 33.5 mm Weight: 65 g V10 / V20 C-Mount
		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 Max. length: 33.5 mm Weight: 65 g V10 / V20 C-Mount
		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 Max. length: 44.9 mm Weight: 75 g V10 / V20 C-Mount
		Part number / Article number Description Suitable for	LO C 35 / 526-51525 C-mount lens 35 mm focal length Aperture/focus: manual Filter thread: 30.5/0.5 Diameter: 33.5 mm Max. length: 47.5 mm Weight: 87 g V10 / V20 C-Mount
		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 Max. length: 47.2 mm Weight: 90 g V10 / V20 C-Mount

A

Accessories

Lenses

Lenses, C-mount (Cont.)

Part number / Article number	LO C 75 / 526-51116
Description	C-mount lens 75 mm focal length Aperture/focus: manual Filter thread: 30.5/0.5 Diameter: 35.0 mm Max. length: 73.6 mm Weight: 113 g
Suitable for	V10 / V20 C-Mount

Accessories, lenses

Part number	Article number	Description
LR 5	543-11011	Intermediate ring 5 mm
ETS	527-51129	Intermediate ring set: 1 x 0.5 mm 2 x 1 mm 1 x 5 mm 1 x 10 mm

Part number	Article number	Description
LOF-BP-R635-30,5x0,5	533-01015	Red filter for C-mount lens, Bandpass 610 - 660 nm
LOF-LP-IR850-30,5x0,5	533-01010	Infrared filter for C-mount lens, Transmission > 825 nm
LOF-PF-30,5 x 0,5	526-51531	Polarisation filter for C-mount lens

Protective casing and polarizer glasses

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

Part number / Article number	LPT 45 CML 5L / 527-51134
Description	C-mount IP 65 protective casing Flange 5 mm Maximum lens dimensions: diameter: 38 mm length: 60 mm
Suitable for	V10 / V20 C-Mount

V10,V20	C-mount IP 65 protective casing LPT 45 CML 5 / 527-51132	C-mount lenses
		LO C 8 / 526-51513
		LO C 12 / 526-51514
		LO C 16 / 526-51515
		LO C 25 / 526-51516
		LO C 35 / 526-51525
		LO C 50 / 526-51113
	LPT 45 CML 5L / 527-51134	LO C 75 / 526-51116

Protective casing and polarizer glasses (Cont.)			
		Part number / Article number Description Suitable for	LPT W50 / 527-51135 Spark protection V10/ V20 Material: anodised aluminium incl. front screen, glass V10 / V20
		Part number / Article number Description Suitable for	LPT S5 / 527-51136 Replacement front screen, set of 5 pcs for LPT W50 Material: glass LPT W50
		Part number / Article number Description Suitable for	LPF S1 / 527-51139 Polarizer glass for welding spark protection (100% coverage) Material: coated glass V10 / V20
		Part number / Article number Description Suitable for	LPF S2 / 527-51140 Polarizer glass for welding spark protection (50% coverage, switchable) Material: coated glass V10 / V20

A

Accessories

Illumination

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.

Multishot

Part number	Article number	Description
LM300 WWK-24Q4-2L12	525-51158	Illumination Mulitshot, 4 x LF 45 white, including MG3A for VISOR, mounting, apre-assembled on retaining ring and pre-wired with 3 special cables, beam angle 60°, changeable to 30 °
LM300 RWK-24Q4-2L12	525-51159	Illumination Mulitshot, 4 x LF 45 red, including MG3A for VISOR, mounting, apre-assembled on retaining ring and pre-wired with 3 special cables, beam angle 60°, changeable to 30 °
LM300 IWK-24Q4-2L12	525-51160	Illumination Mulitshot, 4 x LF 45 infrared, including MG3A for VISOR, mounting, apre-assembled on retaining ring and pre-wired with 3 special cables, beam angle 60°, changeable to 30 °

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-24-2L12	525-51153	Ring light, V10 / V20, white, clear, 12-pin	543-11015
LFR 115 RK-24-2L12	525-51154	Ring light, V10 / V20, red, clear, 12-pin	543-11015
LFR 115 IK-24-2L12	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

LED ring lighting for the incidental illumination of objects.
Requires connection adapter for LED illumination LA45V-24-2L12.

A

Accessories

Illumination

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

Funnel-shaped LED ring light for dark field illumination.
Requires connection adapter for LED illumination LA45V-24-2L12.

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

1

153-00729

2

153-00735

Ring light, indirect, diffuse

Part number	Article number	Description	Angle bracket	Draw.
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

3

153-00728

4

153-00736

LED ring light with LEDs shining surfacely and directly on centre of circle.
Requires connection adapter for LED illumination LA45V-24-2L12.

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.
Requires connection adapter for LED illumination LA45V-24-2L12.

A

Accessories

Illumination

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

2

Coaxial mirrored LED lighting for homogeneous illumination of reflected objects.
Requires connection adapter for LED illumination LA45V-24-2L12.

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

	Type 1	Type 2	Type 3
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.
Requires connection adapter for LED illumination LA45V-24-2L12.

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.
Requires connection adapter for LED illumination LA45V-24-2L12.

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

A

Surface LED background lighting for diffuse illumination.
Requires connection adapter for LED illumination LA45V-24-2L12.

Accessories

Illumination

Light strips, High Power, LBxxx			
Part number	Article number	Description	Type
LB 250 WK 24 A15 3L5	532-51056	Light strip, 250 mm, white, clear glass, 24V DC, 15°, 3 x M12, 5-pin	1
LB 375 WK 24 A15 3L5	532-51057	Light strip, 375 mm, white, clear glass, 24V DC, 15°, 3 x M12, 5-pin	2
LB 625 WK 24 A15 3L5	532-51058	Light strip, 625 mm, white, clear glass, 24V DC, 15°, 3 x M12, 5-pin	3
LB 1000 WK 24 A15 3L5	532-51059	Light strip, 1000 mm, white, clear glass, 24V DC, 15°, 3 x M12, 5-pin	4
LB 250 WK 24 A35 3L5	532-51060	Light strip, 250 mm, white, clear glass, 24V DC, 35°, 3 x M12, 5-pin	1
LB 375 WK 24 A35 3L5	532-51061	Light strip, 375 mm, white, clear glass, 24V DC, 35°, 3 x M12, 5-pin	2
LB 625 WK 24 A35 3L5	532-51062	Light strip, 625 mm, white, clear glass, 24V DC, 35°, 3 x M12, 5-pin	3
LB 1000 WK 24 A35 3L5	532-51063	Light strip, 1000 mm, white, clear glass, 24V DC, 35°, 3 x M12, 5-pin	4
LB 250 RK 24 A15 3L5	532-51064	Light strip, 250 mm, red, clear glass, 24V DC, 15°, 3 x M12, 5-pin	1
LB 375 RK 24 A15 3L5	532-51065	Light strip, 375 mm, red, clear glass, 24V DC, 15°, 3 x M12, 5-pin	2
LB 625 RK 24 A15 3L5	532-51066	Light strip, 625 mm, red, clear glass, 24V DC, 15°, 3 x M12, 5-pin	3
LB 1000 RK 24 A15 3L5	532-51067	Light strip, 1000 mm, red, clear glass, 24V DC, 15°, 3 x M12, 5-pin	4
LB 250 RK 24 A35 3L5	532-51068	Light strip, 250 mm, red, clear glass, 24V DC, 35°, 3 x M12, 5-pin	1
LB 375 RK 24 A35 3L5	532-51069	Light strip, 375 mm, red, clear glass, 24V DC, 35°, 3 x M12, 5-pin	2
LB 625 RK 24 A35 3L5	532-51070	Light strip, 625 mm, red, clear glass, 24V DC, 35°, 3 x M12, 5-pin	3
LB 1000 RK 24 A35 3L5	532-51071	Light strip, 1000 mm, red, clear glass, 24V DC, 35°, 3 x M12, 5-pin	4
LB 250 IRK 24 A15 3L5	532-51055	Light strip, 250 mm, infrared, clear glass, 24V DC, 15°, 3 x M12, 5-pin	1
LB 375 IRK 24 A15 3L5	532-51072	Light strip, 375 mm, infrared, clear glass, 24V DC, 15°, 3 x M12, 5-pin	2
LB 625 IRK 24 A15 3L5	532-51073	Light strip, 625 mm, infrared, clear glass, 24V DC, 15°, 3 x M12, 5-pin	3
LB 1000 IRK 24 A15 3L5	532-51074	Light strip, 1000 mm, infrared, clear glass, 24V DC, 15°, 3 x M12, 5-pin	4
LB 250 IRK 24 A35 3L5	532-51075	Light strip, 250 mm, infrared, clear glass, 24V DC, 35°, 3 x M12, 5-pin	1
LB 375 IRK 24 A35 3L5	532-51076	Light strip, 375 mm, infrared, clear glass, 24V DC, 35°, 3 x M12, 5-pin	2
LB 625 IRK 24 A35 3L5	532-51077	Light strip, 625 mm, infrared, clear glass, 24V DC, 35°, 3 x M12, 5-pin	3
LB 1000 IRK 24 A35 3L5	532-51078	Light strip, 1000 mm, infrared, clear glass, 24V DC, 35°, 3 x M12, 5-pin	4

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

Light strips, High Power, LBxxx

Type	Overall length	Lighting area
1 / LB 250	283	251
2 / LB 375	408	376
3 / LB 625	658	626
4 / LB 1000	1033	1001

Mounting

155-01926

LB250 / LB375 = 2x M4 Nuts LB625 / LB1000 = 3x M4 Nuts

Wiring

male

154-00539

female

154-00540

155-01927

Nuts M4 supplied Screw M4 not supplied

154-00532

Connection illumination - sensor

155-01906

Dauerbetrieb /continuous operation / fonctionnement continu: Strobe = 24V DC

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 / connection cable FR 85, M12 (angled, a-coded) to M12 (straight, a-coded), 0.48 m, suitable for drag chains
L4F/L4M-b-coded-0,48 PUR	902-51739	Connection cable FR 85, M12 (angled, a-coded) to M12 (straigth, b-coded), 0.48 m, suitable for drag chains
L4F/L4M-b-coded-0,53 PUR	902-51825	Connection cable FR 85, M12 (angled, a-coded) to M12 (straigth, b-coded), 0.53 m, suitable for drag chains
L4F/L4M-b-coded-0,48-X02 PUR	902-51823	Connection cable FR 85, M12 (angled, a-coded) to M12 (straigth, b-coded), PINs 2 & 4 interchanged, 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
C L8FG-S-2m-PUR	902-51830	2 m straight, PUR, shielded, colour assignment in acc. to DIN 60947-5-2, suitable for drag chains
C L8FG-S-5m-PUR	902-51831	5 m straight, PUR, shielded, colour assignment in acc. to DIN 60947-5-2, suitable for drag chains
C L8FG-S-10m-PUR	902-51832	10 m straight, PUR, shielded, colour assignment in acc. to DIN 60947-5-2, suitable for drag chains

Accessories

Cables

Part number	Article number	Description
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
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, M12, straight, 12-pin, shielded, suitable for drag chains
C L12FG-S-5m-PUR	902-51796	Power supply and I/O cable, 5 m, M12, straight, 12-pin, shielded, suitable for drag chains
C L12FG-S-10m-PUR	902-51797	Power supply and I/O cable, 10 m, M12, straight, 12-pin, shielded, suitable for drag chains
C L12FG-S-20m-PUR	902-51805	Power - I/O, cable, 20 m, M12, straight, 12-pin, shielded, suitable for drag chains
C L12FG-S-30m-PUR	902-51845	Power - I/O, cable, 30 m, M12, straight, 12-pin, shielded, suitable for drag chains
C L12FW-S-2m-PUR	902-51798	Power supply and I/O cable, 2 m, M12, 90°, 12-pin, shielded, suitable for drag chains
C L12FW-S-5m-PUR	902-51799	Power supply and I/O cable, 5 m, M12, 90°, 12-pin, shielded, suitable for drag chains
C L12FW-S-10m-PUR	902-51800	Power supply and I/O cable, 10 m, M12, 90°, 12-pin, shielded, suitable for drag chains
C L12FW-S-20m-PUR	902-51821	Power - I/O, cable, 20 m, M12, 90°, 12-pin, shielded, suitable for drag chains
C L12FW-S-30m-PUR	902-51846	Power - I/O, cable, 30 m, M12, 90°, 12-pin, 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 L4MG/RJ45G-GS-20m-PUR	902-51820	Ethernet, cable, 20m, M12, straight connector, 4-pin/RJ45 shielded
CI L4MG/RJ45G-GS-30m-PUR	902-51843	Ethernet, cable, 30m, M12, straight connector, 4-pin/RJ45 shielded
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
CI L4MW/RJ45G-GS-20m-PUR	902-51822	Ethernet, cable, 20m, M12, angled connector, 4-pin/RJ45 shielded
CI L4MW/RJ45G-GS-30m-PUR	902-51844	Ethernet, cable, 30m, M12, angled connector, 4-pin/RJ45 shielded
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

Part number	Article number	Description
Illumination cables for V10/V20		
CB L12FS/L12FS-0,35m-GG-PUR	902-51841	Illumination cable 2 x M12/12-pin, 0.35 m, straight, shielded, suitable for drag chains
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-10m-GG-PUR	902-51854	Illumination cable 2 x M12/12-pin, 10 m, straight, shielded, suitable for drag chains
CB L12FS/L12FS-0,35m-WW-PUR	902-51842	Illumination cable 2 x M12/12-pin, 0.35 m, 90°, 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 532-51052
Connection adapter, illumination		
LA45V-24-2L12	525-01001	V10 / V20 connection adapter for LED illumination with 5-pin M12 plug

Connection adapter for illumination on V10, V20

A

Accessories

Converters

Part number	Article number	Description
Converters and adapter cables		
K2-ADE-TB	533-11017	Converter RS232 ↔ RS485/422, in combination with CUSB-RS232-2m (901-05097) for PC connection of F 90/91 sensors, parameterisation via „ProgSensor“ software
CUSB-RS232-2m	901-05097	Interface converter incl. CD-ROM, cable 2 m, USB ↔ RS232, in combination with K2-ADE-TB (533-11017) for PC connection of F 90/91 sensors, parameterisation via „ProgSensor“ software
CUSB-RS485-SET	533-01005	Set: interface converter incl. CD-ROM, cable 0.7 m, USB ↔ RS485 and D-SUB socket, 9-pin, socket, for PC connection of F 50/80 sensors, parameterisation via „ProgSensor“ software
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

Interface Converter (USB / RS232 / RS485 / RS422)

Download software: www.sensopart.com

Power supply units and switching devices		
	Part number / Article number Description	ST-05 / 997-51467 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 Description	PA L4M4-TI / 997-51465 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 Description	Setup Box FR 85-2 ILLX / 533-11016 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 Description	ST M12-12 / 994-51135 Power supply unit for V10 / V20, M12 connector, 12-pin, Europlug – connection of power supply voltage via Europlug – M12 connector
	Part number / Article number Description	ST M12-12-M / 994-51138 Power supply unit for V10 / V20, M12 connector, 12-pin, Multiplug – connection of power supply voltage via Multiplug – M12 connector
	Part number / Article number Description	ST V10 / 543-11022 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

SG 12

Power supply unit and switching device for standard rails

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

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 mm[3]
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

Connection, inverted operation

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: 07/2016. 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

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
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-38

A

PV-AW1010.4TX

Display and configuration device for SensoPart vision sensors

CE

PRODUCT HIGHLIGHTS

- Display and configuration device for SensoPart vision sensors and systems
- Suitable for installation in switching cabinet doors and operating panels
- Completely preconfigured

Functions	
Display of results	10.4" screen diagonal
Configuration of VISOR and Eyesight	Touch-sensitive screen panel
Ready to use	Operating system Windows 10 and current SensoPart software pre-installed

Dimensional drawing

Electrical data	
Operating voltage, $+U_B$	12 V DC, power supply unit 230V included, alternatively supply via screw-fastened DC input
CPU	Intel Celeron J1900, Quadcore
Interfaces	2x USB 2.0, 2x USB 3.0, 2xRJ-45, 2x Com-Port (RS232)
Memory	min. 4GB RAM, 60 GB SSD

Mechanical data	
Dimensions	25.5 x 20.2 x 5 cm
Installation dimensions	24.2 x 19.2 x 3.15
Ambient temperature: operation	0 ... +50°C
Ambient temperature: storage	0 ... +60°C
Attachment	VESA-100 bracket for mounting
Weight	2000 g

Part number	Article number	Description
PV-AW1010.4TX_EN	533-01028	Panel Viewer 10.4" (EN), Win10, Touch, XGA
MP PPC 10.4	533-01013	Mounting kit Panel Viewer 10.4"

Accessories	
Connection cable (Ethernet cable)	From Page A-38

Mounting PV-AW1010.4TX_EN - MP PPC10.4	Bracket for PV-AW1010.4TX_EN

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.

Calibration

The function „Calibration" transforms the image coordinates (pixel) into world coordinates (e.g. millimeter). When activated all position and distance data is calculated in the selected unit.

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.

Glossary

Correction factor

Refers to inductive sensors and is the reduction in the switching distance for damping materials that deviate from Fe 360 (ISO 630).

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.

ECC200 GS1

ECC200 GS1 is a special form of the ECC200 data matrix code; main field of application are data matrix codes on pharmaceutical packages.

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

B

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 programme

An inspection programme is a sequence of instructions in Eyesight.

IO-Link

IO-Link is the first standardised IO technology worldwide (IEC 61131-9) for the communication with sensors and actuators. The point-to-point communication is established via an unscreened cable connection. IO-Link is no fieldbus but the further development of a tried-and-tested connection technology.

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.

Multishot

With the multishot function, four images are captured one after the other, each illuminated from another direction. By combining the four images in one single image, a pseudo height image can be created. This method is particularly suitable for the detection of indentations and bumps on even surfaces, e.g. stamped fonts, codes or surface defects.

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.

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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
ALL = Allround
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
R = Red light, Teach-in
RL = Red light laser, teach-in
RH = Red light with background suppression, teach-in
RLH = Red light laser with background suppression, teach-in
RF1 = Red light, with background suppression 15 mm
RF2 = Red light, with background suppression 30 mm
RF3 = Red light, with background suppression 50 mm
BF2 = Bluelight, with background suppression 30 mm
BF3 = Bluelight, with background suppression 50 mm
B-RLF1 = Red light laser, fixed focus with background suppression, 15 mm
B-RLF2 = Red light laser, fixed focus with background suppression, 30 mm

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; S = N.O. (default)
NS = NPN; S = N.O. (default)

FT 25 - RA - 60 - PSU - 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

R = Red light, teach-in
RL = Red light laser, 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
RV = Red light with foreground suppression, Teach-in
W = White light, contrast, teach-in
RGB = Red/green/blue, contrast, teach-in
RGO = Red light, for transparent objects, autocollimation principle, teach-in
RGO2 = Red light, autocollimation principle, teach-in
RLO = Red light laser, autokollimation principle, teach-in
RF1 = Red light, fixed focus with background suppression, 60 mm
RF2 = Red light, fixed focus with background suppression, 80 mm
RF = Red light, fixed setting
RLA = Red light laser, teach-in, distance
RA = Red light, teach-in, distance
C1 = Red/green/blue, colour, 10 kHz, Teach-in
C2 = Red/green/blue, colour, 2.5 kHz, Teach-in

Measuring range (only distance sensors)

60 = Measuring range 20 ... 80 mm
80 = Measuring range 20 ... 100 mm
170 = Measuring range 30 ... 200 mm

Switching output

PS = PNP; S = N.O. (default)
NS = NPN; S = N.O. (default)
PNS = Auto-Detect (PNP / NPN); S = N.O. (default)
GS = Push-Pull; S = N.O. (default)

Analogue output (only distance sensors)

U = Voltage output 1 … 10 V

Connection

M3 = Plastic plug, M8, 3-pin
M4 = Plastic plug, M8, 4-pin
M3M = Metal plug, M8, 3-pin
M4M = Metal plug, M8, 4-pin
K4 = Cable, 2 m, 4-wire
KM4 = Pigtail, 150 mm, M8, 4-pin
KL4 = Pigtail, 150 mm, M12, 4-pin

FT 55 - RLAP - 5 - PNSI - L5

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, autocollimation principle, teach-in
RL2 = Red light laser (laser class 2), teach-in
RH = Red light with background suppression, potentiometer, long scanning distance
BH = Bluelight with background suppression, potentiometer, long scanning distance
B-RH = Red light with background suppression, potentiometer
RLH = Red light laser with background suppression, potentiometer
RL2H = Red light laser (laser class 2) with background suppression, potentiometer
RLHP2 = Red light laser with background suppression, teach-in, time-of-flight technology
RLP = Red light laser, teach-in, time-of-flight technology
RLAP = Red light laser, teach-in, distance, time-of-flight technology
RLAP2 = Red light laser, distance, time-of-flight technology

Measuring range (only distance sensors)

5 = Max. measuring distance 5 m
70 = Max. measuring distance 70 m

Switching output

PS = PNP; S = N.O. (default)
NS = NPN; S = N.O. (default)
PNS = Auto-Detect (PNP / NPN); S = N.O. (default)
L = IO-Link

Analogue output (only distance sensors)

U = Voltage output 0 … 10 V
I = Current output 4 … 20 mA

Connection

L4 = plug, M12, 4-pin
K4 = cable, 3 m, 4-wire
L5 = plug, M12, 4-pin

Active worldwide.

Wherever you are, SensoPart is nearby.

Germany
SensoPart
Industriesensorik GmbH
79288 Gottenheim
Tel. +49 7665 94769-0
info@sensopart.de

France
SensoPart France SARL
77420 Champs sur Marne
Tél. +33 164 730061
info@sensopart.fr

United Kingdom
SensoPart UK Limited
Pera Business Park, Nottingham Road,
Melton Mowbray, Leicestershire, LE13 0PB
Tel. +44 1664 561539
uk@sensopart.com

USA
SensoPart Inc.
Perrysburg OH 43551
Tel. +1 866 2827610
usa@sensopart.com

China
SensoPart (Shanghai) Co. Ltd.
201803 Shanghai
Tel. +86 21 69017660
china@sensopart.cn

Find your local contact at:
www.sensopart.com/international

SENSOPART INTERNATIONAL

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All product images and illustrations are schematic representations and may deviate from individual products.

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SENSOPART

Germany
SensoPart
Industriesensorik GmbH
79288 Gottenheim
Tel. +49 7665 94769-0
info@sensopart.de

France
SensoPart France SARL
77420 Champs sur Marne
Tel. +33 164 730061
info@sensopart.fr

United Kingdom
SensoPart UK Limited
Pera Business Park, Nottingham Road,
Melton Mowbray, Leicestershire, LE13 0PB
Tel. +44 1664 561539
uk@sensopart.com

USA
SensoPart Inc.
Perrysburg OH 43551
Tel. +1 866 2827610
usa@sensopart.com

China
SensoPart (Shanghai) Co. Ltd.
201803 Shanghai
Tel. +86 21 69017660
china@sensopart.com

Find your local contact at: www.sensopart.com/international

www.sensopart.com

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