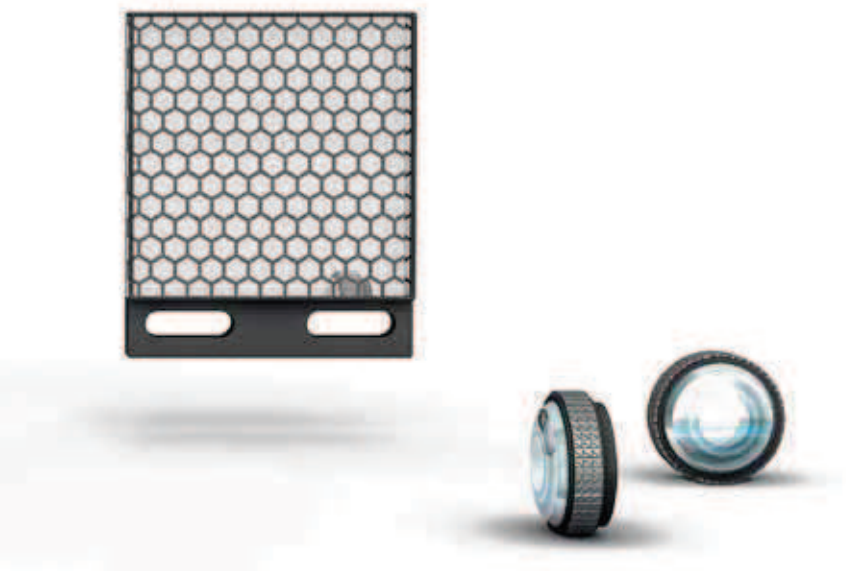
Photoelectric Sensors

Special accessories for photoelectric sensors

Complete optical accessories – from mounting brackets, reflectors, lenses and holding systems etc. for standard applications and applications under more difficult ambient conditions.

Special Accessories for Photoelectric Sensors
Contents

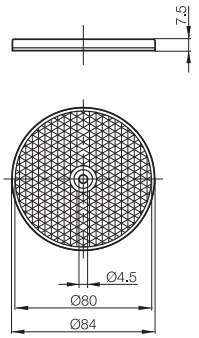
Basic information and definitions can be found on **page 884.**

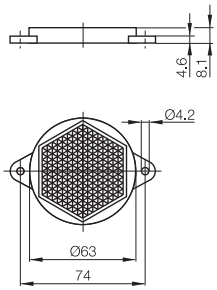


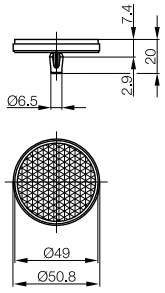
Round reflectors

Reflectors are assigned to the accessories that we mark in gray.

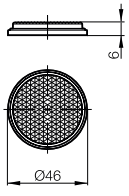
Size	Reflector Ø 84 mm	Reflector Ø 62 mm	Reflector Ø 51 mm
Fasteners	M4 screw	Two M4 screws	Rivet with mounting tabs
Ordering code	**BAM00UK**	**BAM0126**	**BAM00UP**
Part number	BOS R-1	BOS R-10	BOS R-14
Material	PMMA/ABS	PMMA/ABS	PC
Triple size	4 mm	4 mm	4 mm
Mounting accessories	BOS 21-AD-1		
Special features			More chemical resistant
Temperature range	–20...+60 °C	–20...+60 °C	0...+100 °C

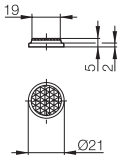


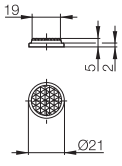




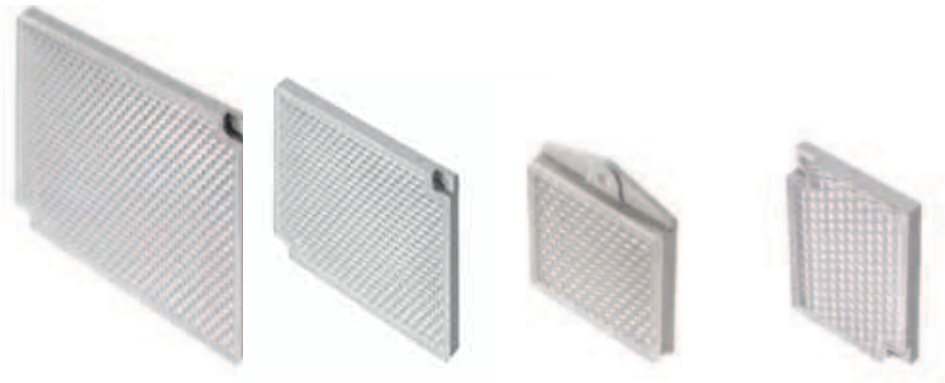
Size	Reflector Ø 46 mm	Reflector Ø 21 mm	Reflector Ø 21 mm
Fasteners	Glue	Glue	Glue
Ordering code	**BAM00UW**	**BAM00W4**	**BAM00UR**
Part number	BOS R-2	BOS R-3	BOS R-15
Material	PMMA/ABS	PMMA/ABS	PC
Triple size	2.5 mm	2 mm	2 mm
Special features			More chemical resistant
Temperature range	–20...+60 °C	–20...+60 °C	–20...+99°C



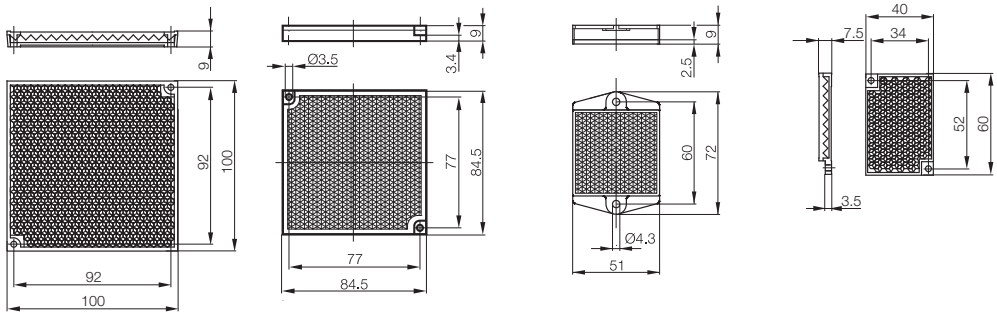




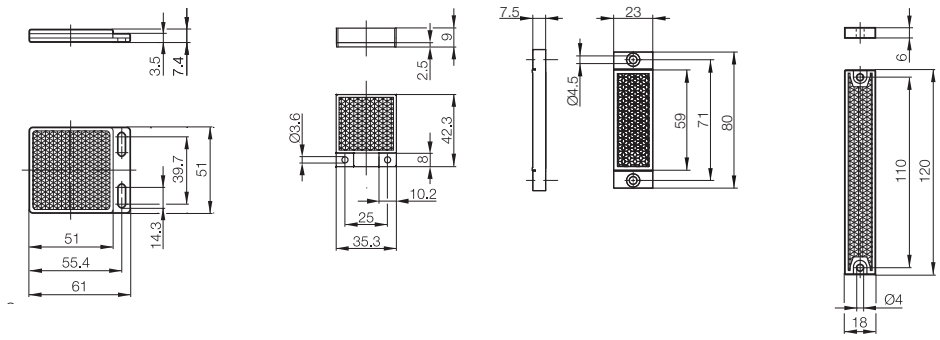
Block-shaped reflectors



Size	Reflector 100×100 mm	Reflector 84×84 mm	Reflector 51×72 mm	Reflector 60×40 mm
Fasteners	Two M3 screws	Two M3 screws	Two M4 screws	Two M3 screws
Ordering code	**BAM01JN**	**BAM00UL**	**BAM00UZ**	**BAM01JP**
Part number	BOS R-47	BOS R-11	BOS R-25	BOS R-46
Material	PMMA/ABS	PMMA/ABS	PMMA	PMMA/ABS
Triple size	4 mm	4 mm	4 mm	4 mm
Temperature range	–20...+60 °C	–20...+60 °C	0...+50 °C	–20...+60 °C



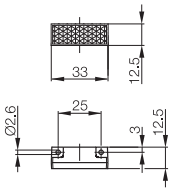
Size	Reflector 51×61 mm	Reflector 35×42 mm	Reflector 23×80 mm	Reflector 18×120 mm
Fasteners	Two M4 screws	Two M3 screws	Two M4 screws	Two M4 screws
Ordering code	**BAM00WL**	**BAM00W0**	**BAM01LA**	**BAM00WA**
Part number	BOS R-9	BOS R-26	BOS R-48	BOS R-5
Material	PMMA/ABS	PMMA	PMMA/ABS	PMMA/ABS
Triple size	4 mm	4 mm	4 mm	4 mm
Mounting accessories		BOS 5-HW-5		
Temperature range	–20...+60 °C	0...+50 °C	–20...+60 °C	–20...+60 °C

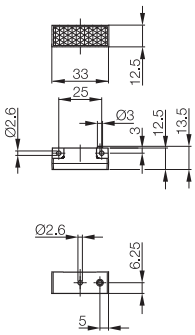


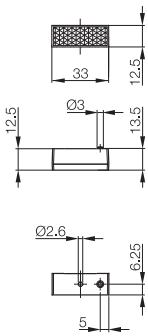
Block-shaped reflectors

Reflectors are assigned to the accessories that we mark in gray.

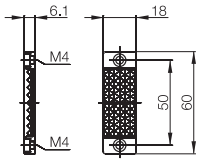
Size	Reflector 33×12 mm	Reflector 33×12 mm	Reflector 33×12 mm
Fasteners	Side screws	Rear and side screws	Rear screws
Ordering code	**BAM00W3**	**BAM00W1**	**BAM00W2**
Part number	BOS R-29	BOS R-27	BOS R-28
Material	PMMA	PMMA	PMMA
Triple size	2.3 mm	2.3 mm	2.3 mm
Mounting accessories	BOS 5-HW-1/2	BOS 5-HW-1/2	
Temperature range	0...+50 °C	0...+50 °C	0...+50 °C

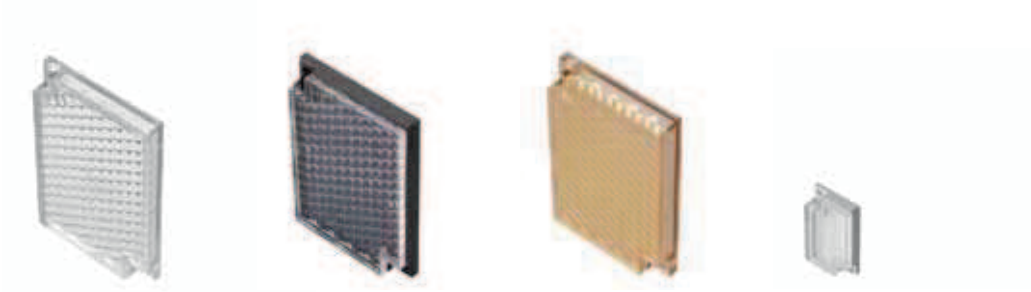




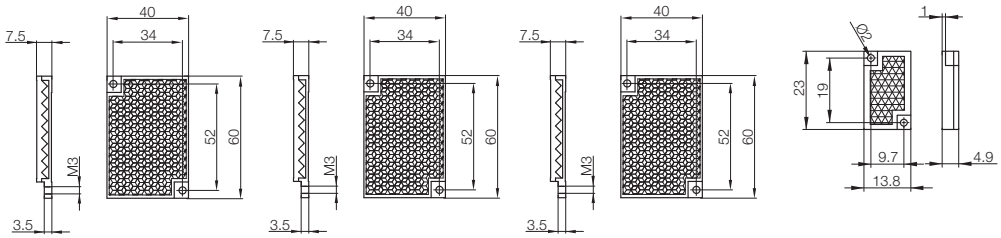


Size	Reflector 18×60 mm		
Fasteners	Two M4 screws		
Ordering code	**BAM00W7**		
Part number	BOS R-33		
Material	PMMA/ABS		
Triple size	4 mm		
Mounting accessories			
Temperature range	–20...+60 °C		

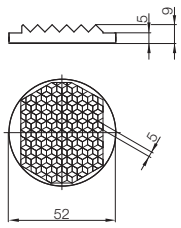




Size	**Reflector 60×40 mm**	**Reflector 60×40 mm**	**Reflector 60×40 mm**	**Reflector 14×23 mm**
Fasteners	Two M3 screws	Two M3 screws	Two M3 screws	Two M1.5 screws
Ordering code	**BAM00W8**	**BAM01CM**	**BAM01HE**	**BAM01NH**
Part number	BOS R-34	BOS R-36	BOS R-44	BOS R-49
Material	Hot thermoplastic	PMMA/ABS	Solidchem	Hot thermoplastic
Triple size	4 mm	4 mm	4 mm	0.9 mm
Special features	Heat-resistant	Anti-fogging	Chemical-resistant	Heat-resistant; For laser applications
Temperature range	–20...+150°C	–20...+60 °C	–20...+140°C	–20...+110°C



Size	**Reflector Ø 52 mm**
Fasteners	Clamps
Ordering code	**BAM01H6**
Part number	BOS R-31
Material	Borosilicate
Triple size	4 mm
Special features	Glass reflector
Temperature range	–20...+500°C

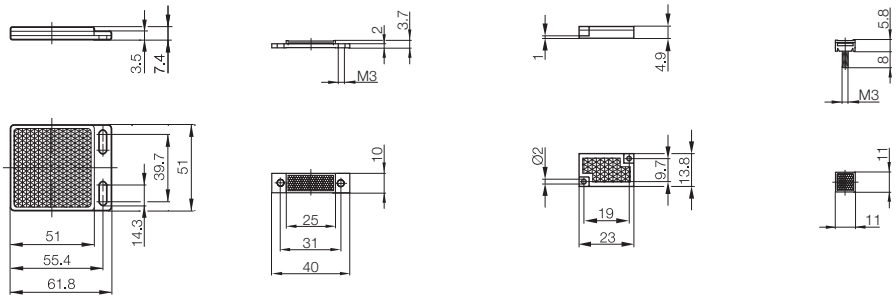


Special Accessories for Photoelectric Sensors
Reflectors for laser retroreflective sensors

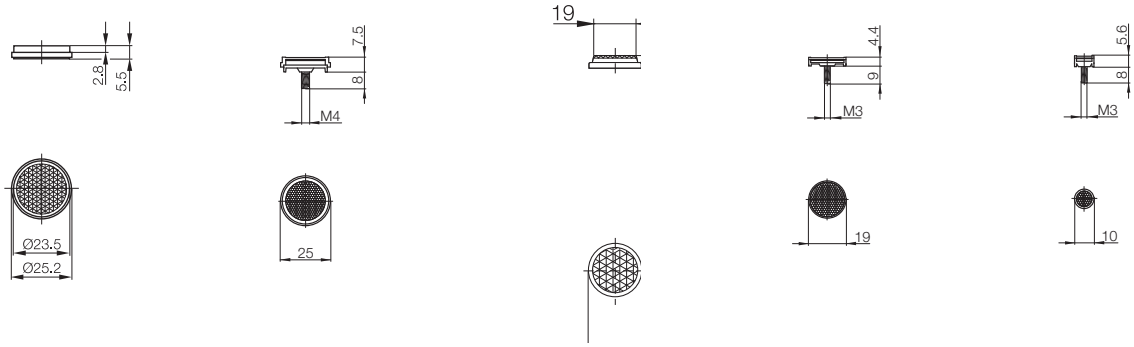
Reflectors are assigned to the accessories that we mark in gray.




Size	Reflector 51×62 mm	Reflector 40×10 mm	Reflector 14×23 mm	Reflector 11×11 mm	
Fasteners	Two M4 screws	Two M3 screws	Two M1.5 screws	M3 screw	
Ordering code	**BAM00UY**	**BAM01H9**	**BAM00UM**	**BAM01H8**	
Part number	BOS R-22	BOS R-41	BOS R-12	BOS R-39	
Material	PMMA/ABS	PMMA/ABS	PMMA/ABS	PMMA/ABS	
Triple size	1.2 mm	1.2 mm	0.9 mm	0.9 mm	
Mounting accessories	BOS 5-HW-6				
Special features			For laser retroreflective sensors		
Temperature range	–20...+60 °C		–20...+60 °C	–20...+60 °C	



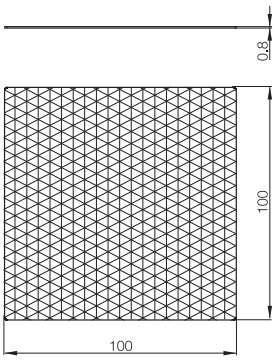
	Reflector Ø 25 mm	Reflector Ø 25 mm	Reflector Ø 21 mm	Reflector Ø 19 mm	Reflector Ø 10 mm
	Glue	M4 screw	Glue	M3 screw	M3 screw
	BAM00UN	**BAM01HC**	**BAM00UT**	**BAM01HA**	**BAM01H7**
	BOS R-13	BOS R-43	BOS R-16	BOS R-42	BOS R-38
	PMMA/ABS	PMMA/ABS	PMMA/ABS	PMMA/ABS	PMMA/ABS
	1.2 mm	1.2 mm	1.2 mm	0.9 mm	0.9 mm
			For laser retroreflective sensors		
	–20...+60 °C	–20...+60 °C	–20...+60 °C	–20...+60 °C	–20...+60 °C

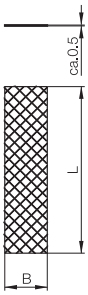


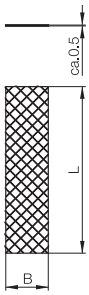
Reflective foils

Reflectors are assigned to the accessories that we mark in gray.

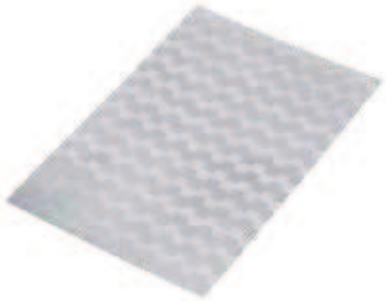
Size		Reflective foils (standard)	Reflective foils (standard)	Reflective foils (standard) (not for polarized light)	
Fasteners		Self-adhesive	Self-adhesive	Self-adhesive	
100 ×	**Ordering code**	**BAM01JM**			
100 mm	Part number	BOS R-50			
50 mm ×	**Ordering code**			**BAM00WC**	
25 cm	Part number			BOS R-6-0,25	
50 mm ×	**Ordering code**			**BAM00WE**	
45 m	Part number			BOS R-6-45	
50 mm ×	**Ordering code**		**BAM00WF**		
25 cm	Part number		BOS R-7-0,25		
50 mm ×	**Ordering code**		**BAM00WH**		
22 m	Part number		BOS R-7-22		
50 mm ×	**Ordering code**		**BAM00WJ**		
25 cm	Part number		BOS R-8-0,25		
25 mm ×	**Ordering code**		**BAM00WK**		
22 m	Part number		BOS R-8-22		
Material		PMMA	PMMA	PMMA	
Special features				Not for polarized light	
Temperature range		–20...+60 °C	–20...+60 °C	–20...+60 °C	



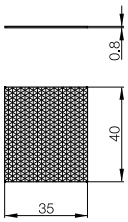


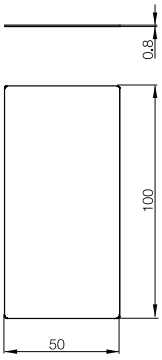


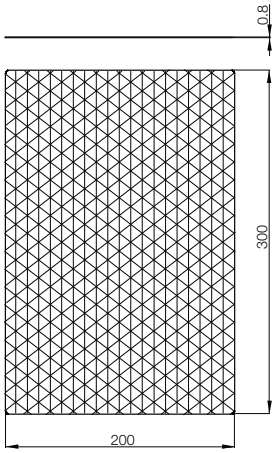
Reflective foils



	Reflective tape 40×35 mm	Reflective tape 100×50 mm	Reflective tape 300×200 mm
	Self-adhesive	Self-adhesive	Self-adhesive
	BAM00W5	**BAM01CF**	**BAM01HF**
	BOS R-30 (standard)	BOS R-40	BOS R-45
	PMMA	PMMA	PMMA
		Special for laser sensors	Standard and laser sensors for large surfaces
	–20...+60 °C	–20...+60 °C	–20...+60 °C



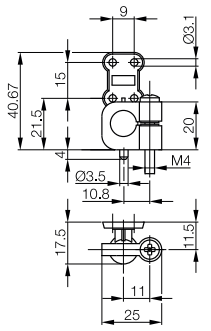


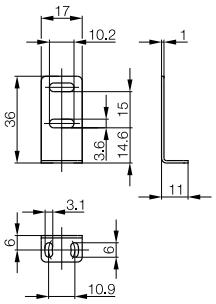


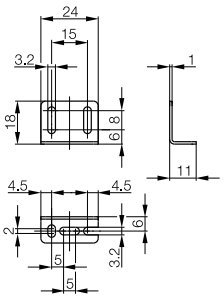
Mounting brackets

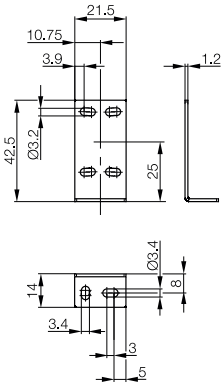
Reflectors are assigned to the accessories that we mark in gray.

Description	Mounting bracket	Mounting bracket	Mounting bracket	Mounting bracket
Use	For BOS 2K	For BOS 2K	For BOS 2K	For BOS 5K
Ordering code	**BAM00T4**	**BAM00T6**	**BAM00T5**	**BAM00U5**
Part number	BOS 2-HW-1	BOS 2-HW-2	BOS 2-HW-3	BOS 5-HW-1

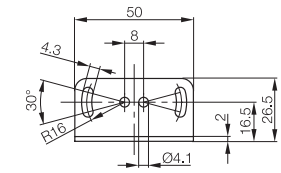


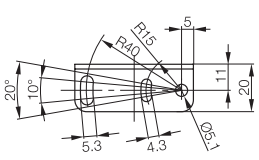


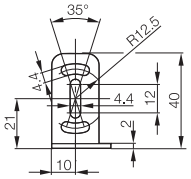


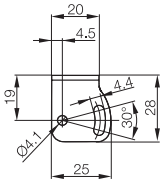


Description	Mounting bracket	Mounting bracket
Use	For BOS 21K	For BOS 21K
Ordering code	**BAM00T9**	**BAM00TA**
Part number	BOS 21-HW-1	BOS 21-HW-2



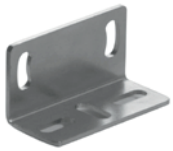




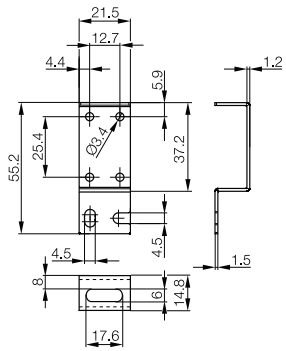


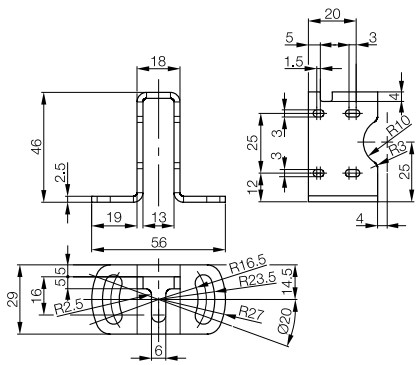
Mounting bracket
For BOS 5K
BAM00U6
BOS 5-HW-2

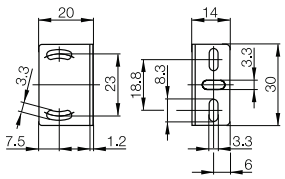
Mounting bracket
For BOS 5K
BAM00U7
BOS 5-HW-3



Mounting bracket
For BOS 6K and BOS 21M
BAM00UH
BOS 6-HW-1



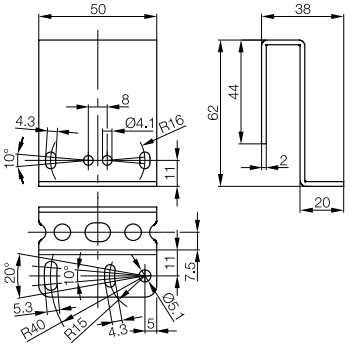


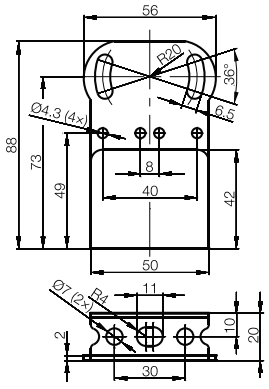


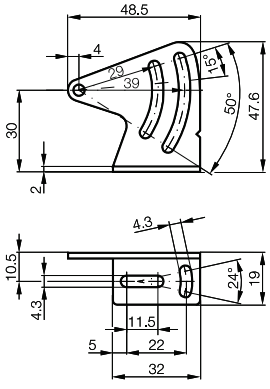
Mounting bracket
For BOS 21K
BAM00TC
BOS 21-HW-3

Mounting bracket
For BOS 21K
BAM00TE
BOS 21-HW-4

Mounting bracket
For BOS 25K, BOS 26K, BOS 21M
BAM00TK
BOS 26-HW-1



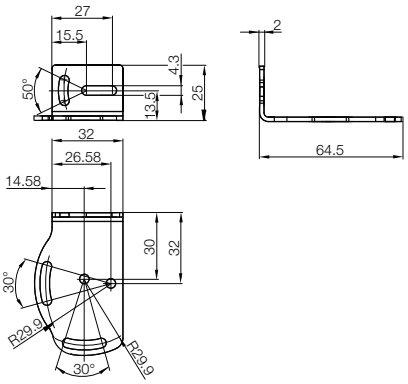


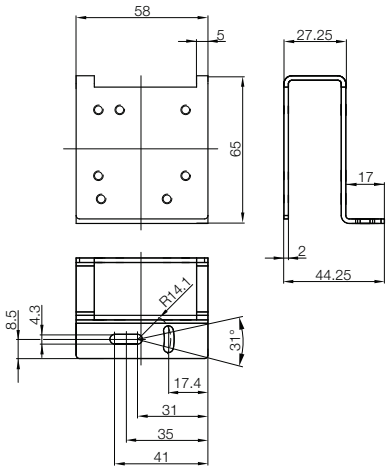


Mounting brackets

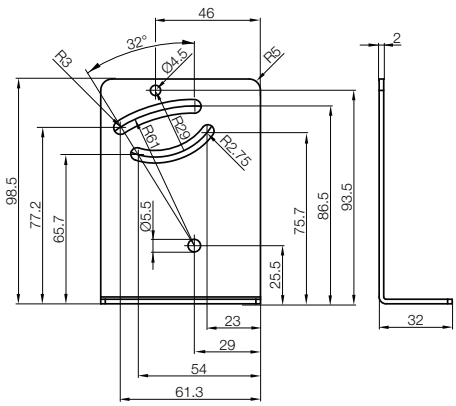
Reflectors are assigned to the accessories that we mark in gray.

Description	**Mounting bracket**	**Mounting bracket**
Use	For BOS 23K	For BOS 23
Ordering code	**BAM01FK**	**BAM01FM**
Part number	BAM MB-X0-006-B05-4	BAM MB-X0-007-B05-4
Material	Stainless steel	Stainless steel



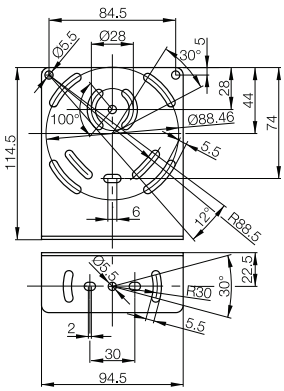


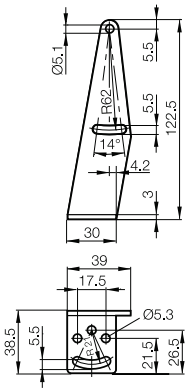
Description	**Mounting bracket**
Use	For BOS 50K/23K
Ordering code	**BAM01E8**
Part number	BAM MB-X0-005-B04-4
Material	Stainless steel

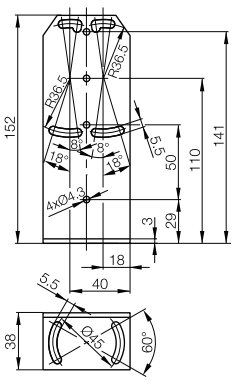


Mounting bracket

Description	Mounting bracket	Mounting bracket	Mounting bracket
Use	For BOS 63M, BOD 63M	For BOS 65K	For BOD 66M
Ordering code	**BAM00P6**	**BAM0125**	**BAM00P9**
Part number	BOS 63-HW-1	BOS 65-HW-1	BOD 66-HW-1
Material	Stainless steel	Stainless steel	Stainless steel



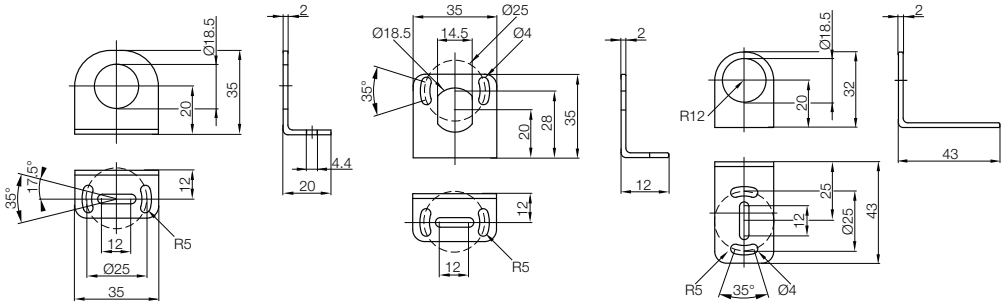




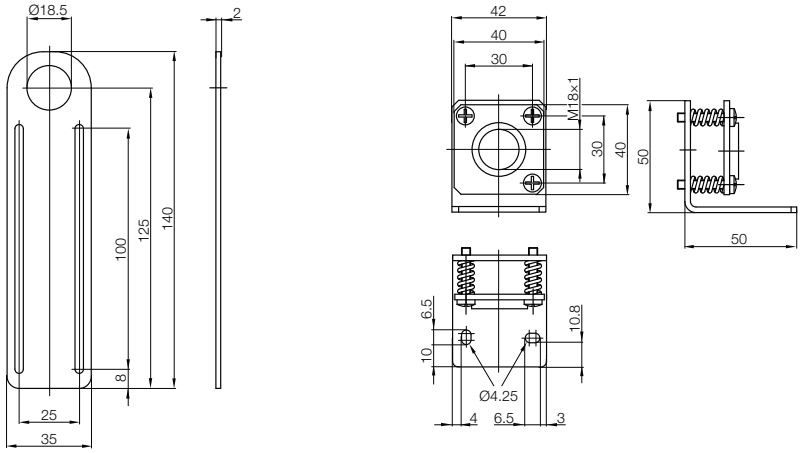
Special Accessories for Photoelectric Sensors
Mounting brackets

Reflectors are assigned to the accessories that we mark in gray.

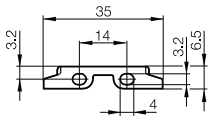
Description	Mounting bracket	Mounting bracket	Mounting bracket
Use	For BOS 18	For BOS 18F/BOS 18KW	For BOS 18
Ordering code	**BAM00RY**	**BAM00RZ**	**BAM00T0**
Part number	BOS 18,0-HW-1	BOS 18,0-HW-2	BOS 18,0-HW-3

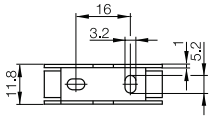


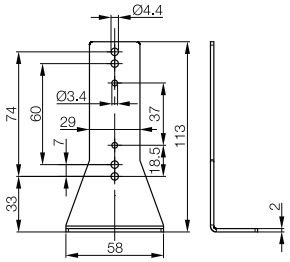
Description	Mounting bracket	Mounting bracket
Use	For BOS 18	For BOS 18 laser sensors
Ordering code	**BAM00T1**	**BAM00T2**
Part number	BOS 18,0-HW-4	BOS 18,0-HW-6

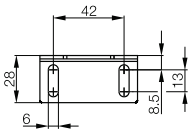


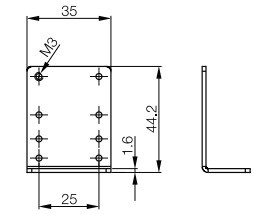
Description	Mounting bracket	Mounting bracket	Mounting bracket
Use	For BOS 74K	For BOS R-10 and BOS R-25	For BOS R-26 reflectors
Ordering code	**BAM00UJ**	**BAM00U8**	**BAM00U9**
Part number	BOS 74-HW-1	BOS 5-HW-4	BOS 5-HW-5

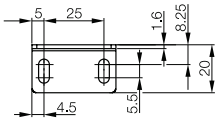




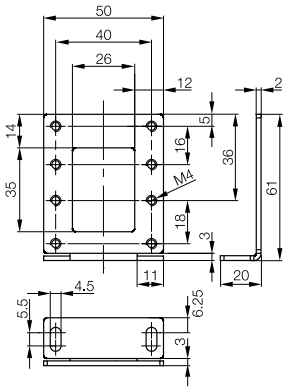








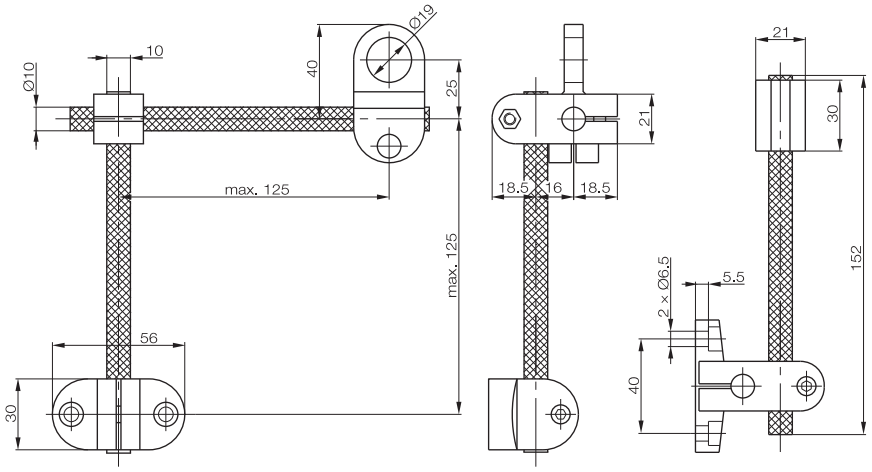
Description	Mounting bracket
Use	For BOS R-9 and BOS R-22
Ordering code	**BAM00UA**
Part number	BOS 5-HW-6



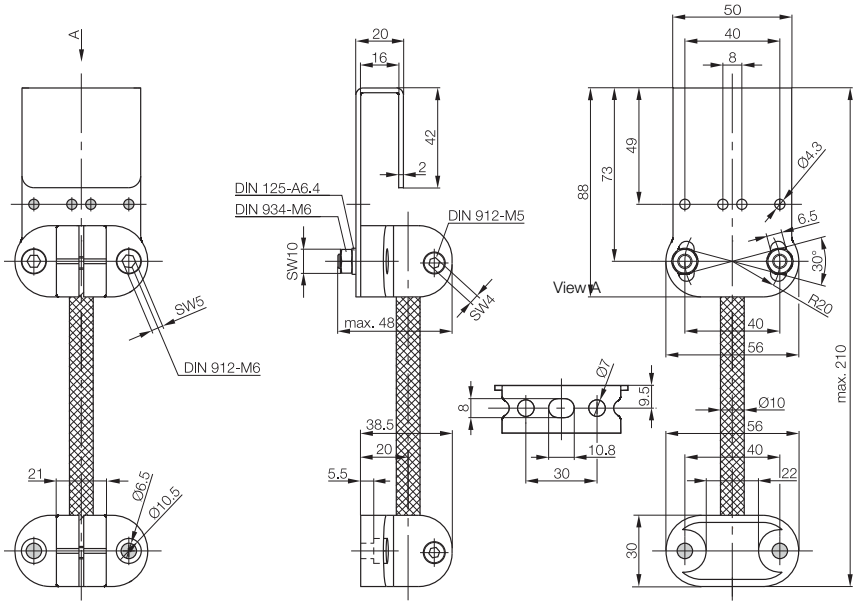
Mounting rods are knurled all the way around.
This prevents any position change.

Holding systems are assigned to the accessories that we mark in gray.

Description	**Holding system**
Use	For flexible mounting; for all cylindrical sensors with M18 outside thread and 8×8 sensors. May be combined with other Balluff accessories.
Ordering code	**BAM00R8**
Part number	BOS 18-HS-1



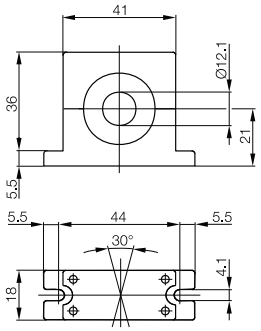
Description	**Holding system**
Use	For sensors in series BOS 21M. May be combined with other Balluff accessories.
Ordering code	**BAM00T8**
Part number	BOS 21-HS-1

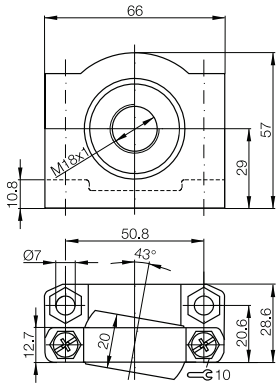


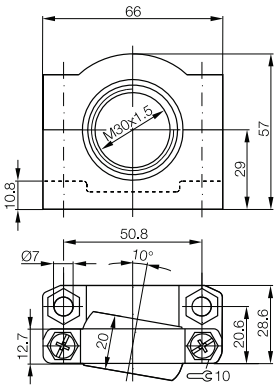
Special Accessories for Photoelectric Sensors
Mounting cuff, clamping blocks, clamping holder, adapter plate

Mounting cuffs, clamping blocks, clamping holder, adapter plate and apertures are assigned to the accessories that we have marked in gray.

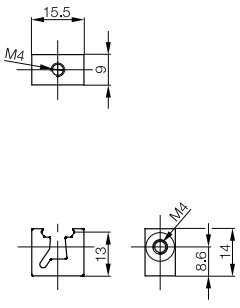
Description	Mounting cuff	Mounting clamp with ball joint	Mounting clamp with ball joint
Use	For cylindrical sensors with M12 outside thread	For cylindrical sensors with M18 outside thread	For cylindrical sensors with M30 outside thread
Ordering code	**BAM01KM**	**BAM00T3**	**BAM00TN**
Part number	BOS 12,0-KB-1	BOS 18,0-KB-1	BOS 30,0-KB-1

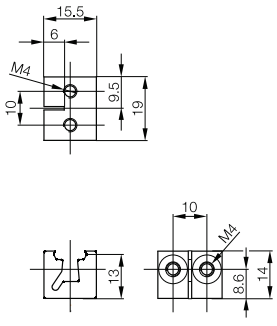


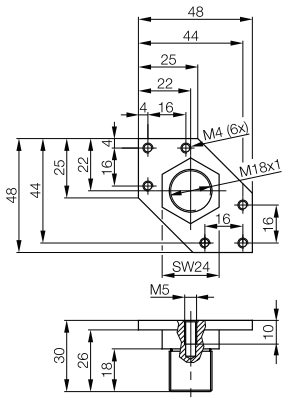




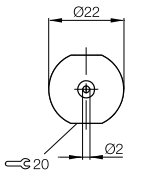
Description	Clamping holder	Clamping holder	Adapter plate
Use	Sensors with dovetail for BOS 21M	Sensors with dovetail for BOS 21M	For BOS 21M, BOS 25K, BOS 26K and BOS R-1
Ordering code	**BAM00TF**	**BAM00TH**	**BAM00T7**
Part number	BOS 21-KH-1	BOS 21-KH-2	BOS 21-AD-1

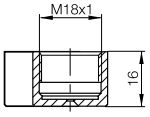


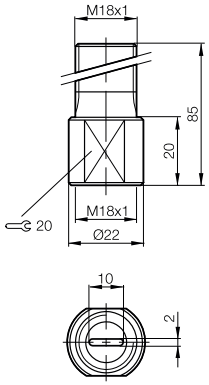


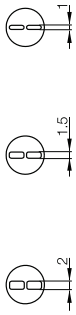


Description	Round aperture			Double slit aperture			Slit aperture		
Use	For BLE/BLS 18			For BLE/BLS 18			For BLE/BLS 12M		
Ordering code	**BAM00R6**			**BAM00R7**			**BAM00PW**		
Part number	BOS 18-BL-1			BOS 18-BL-2			BOS 12-BL-1		
	Aperture on emitter	**Aperture on receiver**	**Range**	**Aperture on emitter**	**Aperture on receiver**	**Range**	**Slit width**	**Range**	**Object size**
	○		8 mm	▯	▯	3 mm	1 mm	0.5 mm	> 1 mm
		○	8 mm	⬭	▯	2 mm	1.5 mm	1 mm	> 1.5 mm
	○	○	2 mm	▯	⬭	2 mm	2 mm	2 mm	> 2 mm









The round and slit apertures restrict the beam diameter. This allows you to detect small parts over a large range. The emitter and receiver must be exactly aligned with each other.

Advantages:
- Small parts detection, i.e. 1 mm drill, aperture on emitter only
- Through-beams may be mounted close to one another
- Highly reflective parts directly next to the light path do not interfere.

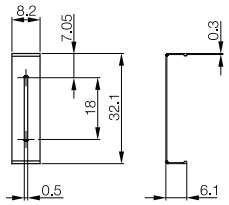
Apertures

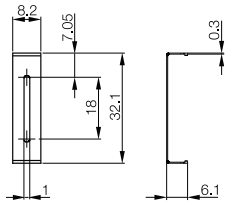
Reflectors are assigned to the accessories that we mark in gray.

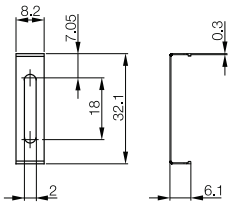


Description	Vertical slit aperture	Vertical slit aperture	Vertical slit aperture
Use	For BOS 5K through-beam sensors	For BOS 5K through-beam sensors	For BOS 5K through-beam sensors
Ordering code	**BAM00TU**	**BAM00TW**	**BAM00TY**
Part number	BOS 5-BL-1	BOS 5-BL-2	BOS 5-BL-3
Aperture size	0.5 mm, vertical	1 mm, vertical	2 mm, vertical
Range*	1.0 (2.5 m)	1.5 (3.5 m)	3.5 (6 m)
Min. object*	0.5 (7 mm)	1.0 (7 mm)	2.0 (7 mm)
Packaging unit	2 pcs.	2 pcs.	2 pcs.

*Values in brackets apply to slit apertures on one side

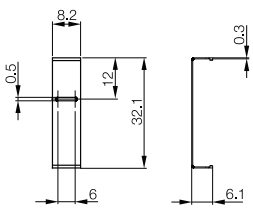


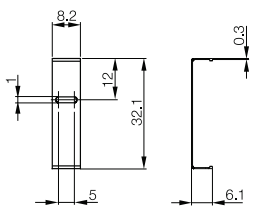


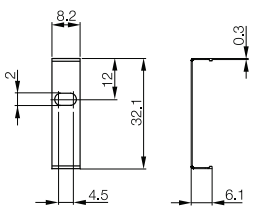




Description	Horizontal slit aperture	Horizontal slit aperture	Horizontal slit aperture
Use	For BOS 5K through-beam sensors	For BOS 5K through-beam sensors	For BOS 5K through-beam sensors
Ordering code	**BAM00TZ**	**BAM00U0**	**BAM00U1**
Part number	BOS 5-BL-4	BOS 5-BL-5	BOS 5-BL-6
Aperture size	0.5 mm horizontal	1 mm horizontal	2 mm horizontal
Range	0.7 (2 m)	1.5 (3 m)	3.0 (5.5 m)
Min. object	0.4 (7 mm)	0.7 (7 mm)	1.5 (7 mm)
Packaging unit	2 pcs.	2 pcs.	2 pcs.

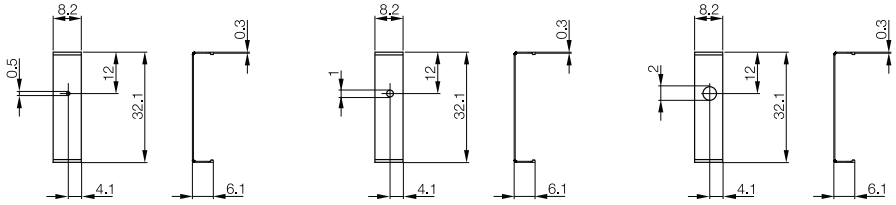








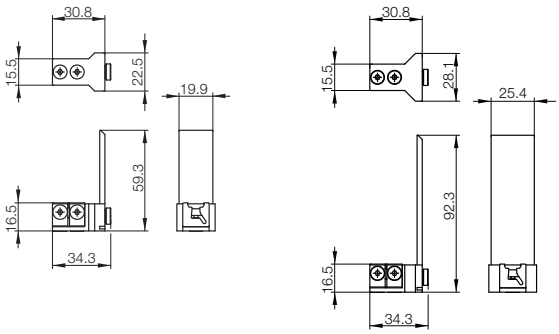
Description	Round aperture	Round aperture	Round aperture
Use	For BOS 5K through-beam sensors	For BOS 5K through-beam sensors	For BOS 5K through-beam sensors
Ordering code	**BAM00U2**	**BAM00U3**	**BAM00U4**
Part number	BOS 5-BL-7	BOS 5-BL-8	BOS 5-BL-9
Aperture size	0.5 mm Ø	1 mm Ø	2 mm Ø
Range	0.08 (0.8 m)	0.3 (1.5 m)	1.2 (2.5 m)
Min. object	0.3 (5 mm)	0.6 (5 mm)	1.5 (7 mm)
Packaging unit	2 pcs.	2 pcs.	2 pcs.




Sensor not included in the standard scope of delivery!


Sensor not included in the standard scope of delivery!

Description	Weld protection	Weld protection	
Use	For BOS 23K	For BOS 50K	
Ordering code	**BAM01L8**	**BAM01U6**	
Part number	BAM PC-XO-006-23K-1	BAM PC-XO-006-50K-1	

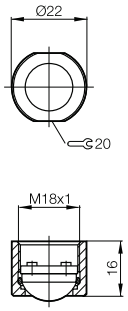


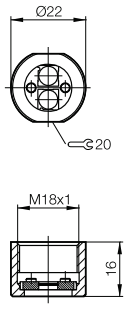
Special Accessories for Photoelectric Sensors
Planoconvex lens, polarizing filter, air tube

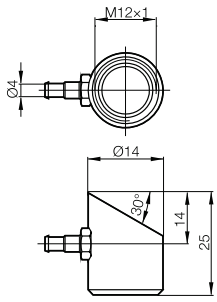
Planoconvex lens, polarizing filter, air tube, lenses and intermediate ring are assigned to the accessories that we mark gray.

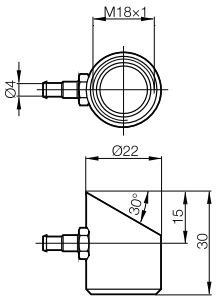



Description	**Planoconvex lens**	**Polarizing filter**	**Air shield**	**Air shield**
Use	For all BOS 18 diffuse sensors for background suppression and small parts detection	Only for BOS 18M-...-1RD...	For BOS 12 and tube with 4 mm inner diameter	For BOS 18 and tube with 4 mm inner diameter
Focal length/focus				
Ordering code	**BAM00RF**	**BAM00RE**	**BAM00PY**	**BAM00R9**
Part number	BOS 18-PK-1	BOS 18-PF-1	BOS 12-LT-1	BOS 18-LT-1
Material	Housing: PA6 Planoconvex lens: glass	Housing: PA6 Polarization filter: IR polarization		









Benefits
- Sensing distance adjustable 0...40 mm
- Low switching point shift, e.g. for different colors or surface properties
- Background suppression facilitates detection of objects on reflective background
- Small parts detection down to 0.05 mm through focusing planoconvex lens with a working range of approx. 0...13 mm

Polarizing filters are used for reliably sensing highly reflective objects. They prevent faulty switching.

Reflecting or shiny parts will then not cause faulty switching. The polarizing filters guarantee that only the light reflected back by the reflector is detected. They reduce the sensing range by 50%.

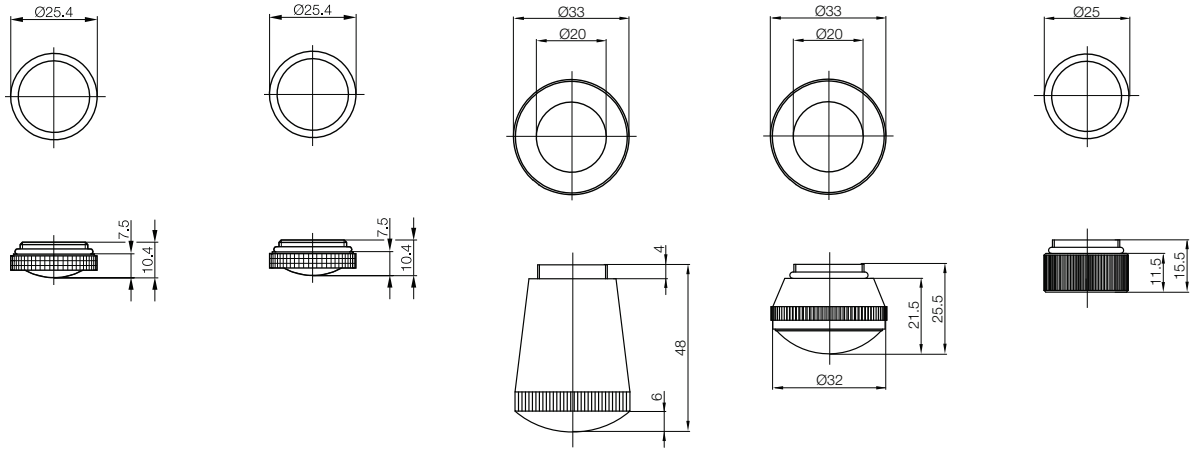
The air tube with a compressed air source prevents premature contamination of the optics.

The air tube with a compressed air source prevents premature contamination of the optics.





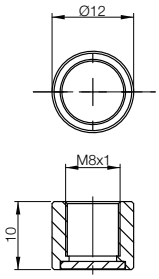
	Lens	**Lens**	**Lens**	**Lens**	**Intermediate ring**
	For BKT 67 for increasing the sensing distance (light spot 2×7 mm)	For BKT 67 standard lenses (light spot 1.5×4 mm)	For BKT 67 for increasing the sensing distance (light spot 2×8 mm)	For BKT 67 for increasing the sensing distance (light spot 2.5×11 mm)	Intermediate ring with lens for increased resolution for BKT 67 in combination with M-PK-2. It is screwed in between the sensor and the 9 mm lens.
	18 mm	9 mm	28 mm	50 mm	
	BAM0120	**BAM0121**	**BAM0122**	**BAM00P3**	**BAM00P2**
	BKT M-PK-1	BKT M-PK-2	BKT M-PK-3	BKT M-PK-5	BKT M-PK-4
	Lens: glass Version: aluminum	Lens: glass Version: aluminum	Lens: glass Version: aluminum	Lens: glass Version: aluminum	Lens: glass Version: aluminum

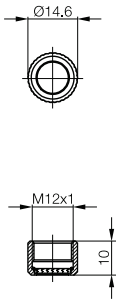


Neutral density filters

Neutral filter and protective nuts are assigned to the accessories that we mark in gray.

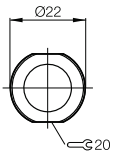
Description	**Cover nut**	**Cover nut**	
Use	For BOS 08	For BOS 12	
Transmission			
Ordering code	**BAM01Y5**	**BAM01Y6**	
Part number	BAM PC-X0-005-08M-4	BOS PC-XO-005-12M-4	

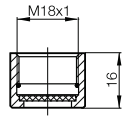




The protective end cap (cap nut) is made with tempered glass and can be used with all M12 photoelectric sensors.
The protective glass is used to protect the optics from mechanical or thermal damage, such as weld splatter.

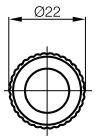
Cover nut	
For BOS 18	
BAM00RL	
BOS 18-SM-1	

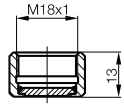




The protective end cap is made with tempered glass and can be used with all M18 photoelectric sensors.
The protective glass is used to protect the optics from mechanical or thermal damage, such as weld splatter.

Cover nut	
For BOS 18 with flat front surface	
BAM01NC	
BAM PC-XO-005-18M-4	



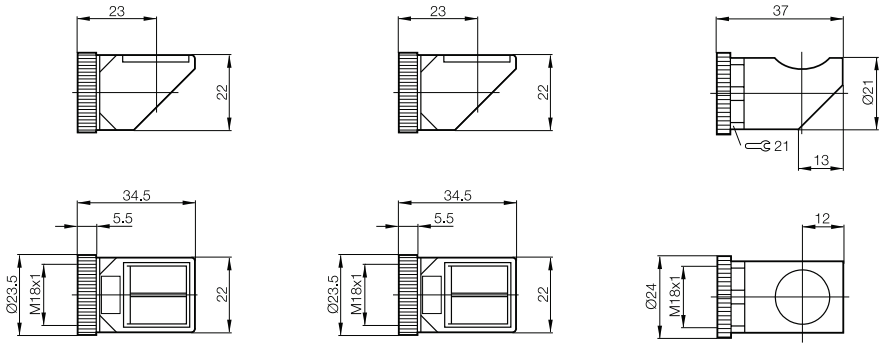


The protective cap can be used in combination with all BOS 18M and BOS 18K sensors. It protects the sensor optics from external effects, such as welding splatter.
For increased protection, the BOS 18-SM-2 is made of metal, providing even better protection for the sensor optics. The heat-protecting glass closes off flush with the front surface of the cover nut. This prevents dust deposits from forming, which can impact the range.
A ring between the sensor and protective glass makes sure the system is sealed.

Deflection heads

Deflection heads and angled mirrors are assigned to the accessories that we mark in gray.

Description	90° deflection head	90° deflection head	90° deflection head
Use	For diffuse, retroreflective and through-beam sensors BOS 18 (except laser)	For diffuse, retroreflective and through-beam sensors BOS 18 (except laser)	For diffuse, retroreflective and through-beam sensors BOS 18
Ordering code	**BAM00RP**	**BAM00RT**	**BAM00RR**
Part number	BOS 18-UK-1	BOS 18-UK-2	BOS 18-UK-10

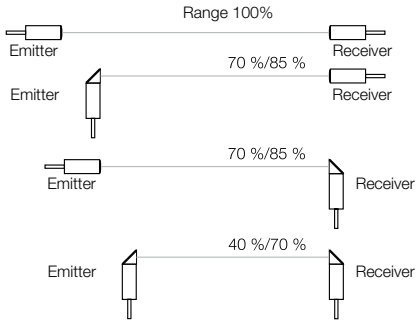


	BOS 18-UK-1	BOS 18-UK-2	BOS 18-UK-10
Diffuse sensor			
BOS 18...-XA-...100 mm	RF = 45 %		RF = 50 %
BOS 18...-XB-...200 mm	RF = 25 %		RF = 50 %
BOS 18...-PB-...200 mm	RF = 25 %		RF = 50 %
BOS 18...-XD-...400 mm		RF = 25 %	RF = 30 %
BOS 18...-PD-...400 mm		RF = 25 %	RF = 30 %
Retroreflective sensor			
BOS 18...-RB-...2 m		RF = 20 %	RF = 20 %
BOS 18...-RD-...4 m		RF = 20 %	RF = 20 %
Through-beam sensor			
BLE 18...-P-...16 m		RF = 15 %	RF = 30 %
BLS 18...-XX-...16 m		RF = 15 %	RF = 30 %

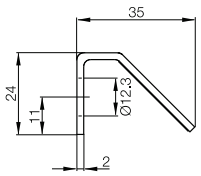
Deflection heads, suitable combinations

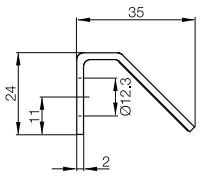
All BOS 18 photoelectric sensors can be equipped with a 90° deflection head.

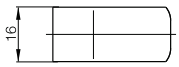
The table shows the appropriate deflection head for each switch type and indicates the corresponding reduction factor (RF) to apply to the range. With a through-beam sensor, the emitter and the receiver can be equipped with a 90° deflection head. Each deflection head reduces the range by approx. 15% ... 50%.

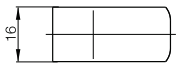


	Angled mirror For diffuse and through-beam sensors BOS 12	**Angled mirror** For laser through-beam sensors BOS 12		
	BAM00R0 BOS 12-WS-1	**BAM00R1** BOS 12-WS-2		







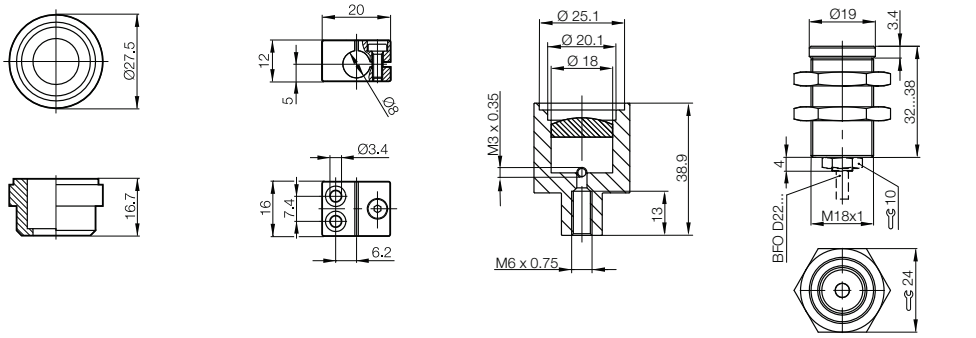


When using the angled mirror, the sensing range is reduced by 30% for the M12 diffuse and M12 through-beam sensors. Not suitable for retroreflective sensors.

Adapter, holder, cutting tool, adapter lens, deflection head, focus lens and metal helical tube are assigned to the accessories that we mark in gray.

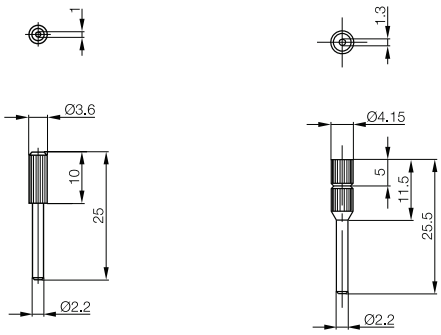



Description	**Adapter**	**Holder**	**Lens (Long Range)**	**Optics (adjustable)**
Use	For BFO 18V glass fiber optics for connecting to BOS 30M	For glass fiber optics and sensors with a corresponding diameter	screwed to fiber optics BFO00C4, 400 mm true-color sensor	screwed to fiber optics BFO00C4, 200 mm true-color sensor
Ordering code	**BAM00NM**	**BAM00PO**	**BAM01PA**	**BAM01U2**
Part number	BFO 30-A1	BFO 08,0-KB-1	BAM LS-FO-001-M6-L	BAM LS-FO-002-F
Packaging unit	1 pc.	1 pc.	1 pc.	1 pc.



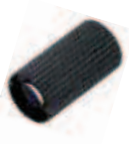


Description	**Adapter**	**Adapter**	**Cutting tool**
Use	For plastic fiber optics Ø 1 mm for connecting to fiber optic base units	For plastic fiber optics Ø 1.3 mm for connecting to fiber optic base units	For trimming plastic fiber optics Ø 1 mm or Ø 2.2 mm
Ordering code	**BAM0003**	**BAM00P1**	**BAM000E**
Part number	BFO D10-LA-DC-10	BFO D13-LA-EC-10	BFO CT
Packaging unit	2 pcs.	2 pcs.	1 pc.

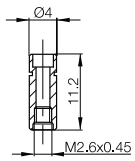


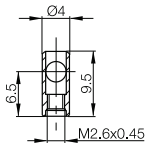
Special Accessories for Photoelectric Sensors
Adapter lens, deflection head, focus lens, metal helical tube, optical fiber

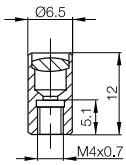


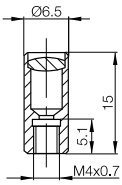



Description	**Adapter lens**	**90° deflection head**	**Focus lens**	**Focus lens**
Use	For through-beam optical fibers M2.6×0.45	For through-beam optical fibers M2.6×0.45	For coaxial diffuse sensor optical fibers M4×0.7	For coaxial diffuse sensor optical fibers M4×0.7
Ordering code	**BAM00NN**	**BAM00NP**	**BAM00NR**	**BAM00NT**
Part number	BFO 02-PK-1	BFO 02-UK-1	BFO 04-FL-1	BFO 04-FL-2
Sensing distance/range with corresponding fiber optics	×10	×0.7	19 mm±2 mm	7 mm±2 mm
Packaging unit	2 pcs.	2 pcs.	1 pc.	1 pc.



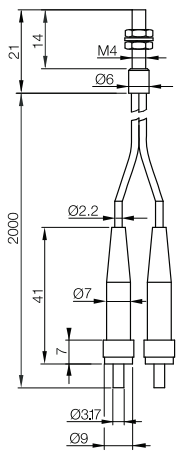


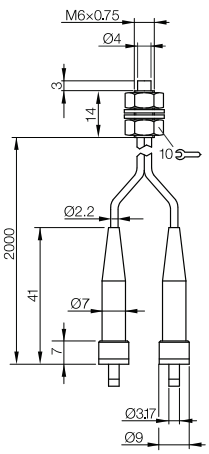


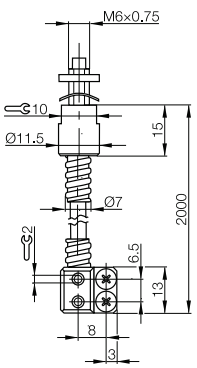


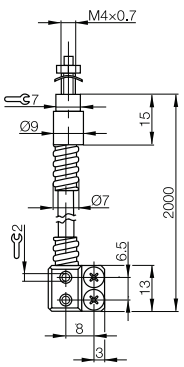



Description	**Optical fiber M4 with SMA connector**	**Optical fiber M6 with SMA connector**	**Metal corrugated tube (stainless steel)**	**Metal corrugated tube (stainless steel)**
Use	For BFS000L True color sensor	For BFS000L True color sensor	For fiber optics M6×0.75	For fiber optics M4×0.7
Ordering code	**BFO00C9**	**BFO00C4**	**BAM00NY**	**BAM00NU**
Part number	BFO D22-XB-UB-EAK-15-SA1-02	BFO D22-XB-LB-EAK-15-SA1-02	BFO 06-FS-1	BFO 04-FS-1
Sensing distance/range with corresponding fiber optics	80 mm	80 mm		
Packaging unit	1 pc.	1 pc.	1 pc.	1 pc.

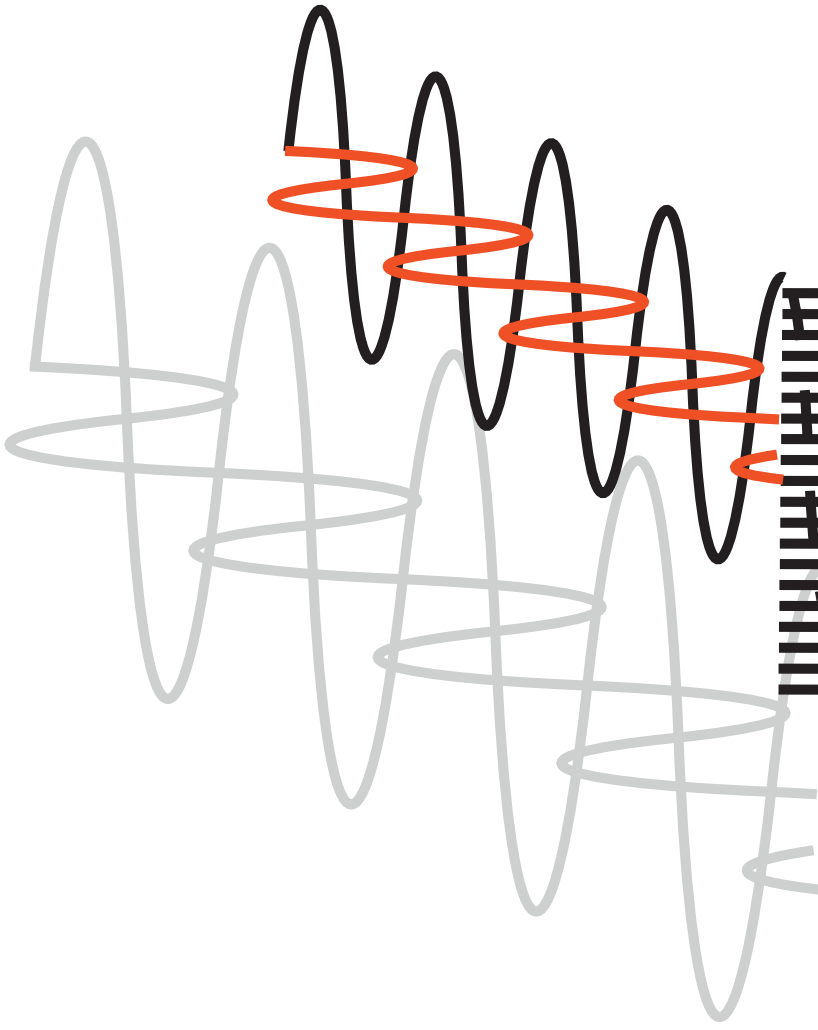




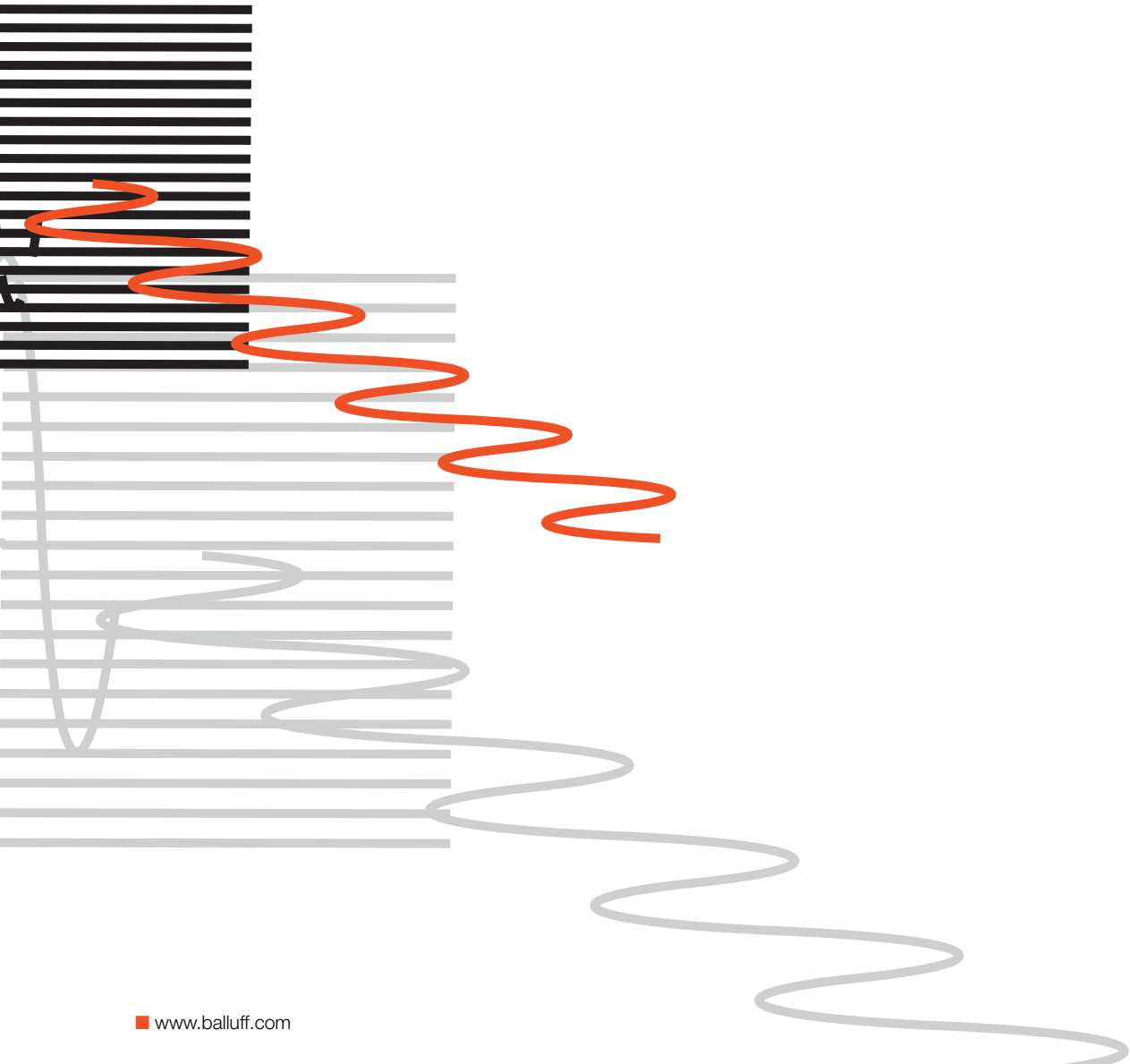




Basic Information and Definitions



Contents



Cable properties

Cable types

PUR cable, PUR insulated

No. of wires × conductor cross-section	Outside diameter typical
2×0.08 mm²	3...4 mm
2×0.14 mm²	3...4.1 mm
2×0.34 mm²	4...5.5 mm
3×0.06 mm²	2...2.5 mm
3×0.09 mm²	2.5...3 mm
3×0.14 mm²	2.5...3.5 mm
3×0.25 mm²	3.5...4.5 mm
3×0.34 mm²	4...5.5 mm
3×0.75 mm²	6.5...7 mm
4×0.14 mm²	3...4 mm
4×0.25 mm²	4...5.5 mm
8×0.25 mm²	6...8 mm

PVC cable, PVC insulated

No. of wires × conductor cross-section	Outside diameter typical
2×0.14 mm²	2.5...3.5 mm
2×0.34 mm²	4.5...5.5 mm
3×0.14 mm²	2.7...4.5 mm
3×0.25 mm²	4...5 mm
3×0.34 mm²	4.5...5.5 mm
4×0.25 mm²	4.5...5.5 mm

Smallest bending radius

tensioned	untensioned	drag chain and roll deflection
4×D	3×D	4×D...7.5×D only with "SP" wire

Special cable

The SP- cable is a irradiated cross-linked PUR- cable that has good resistance to weld splatter. A special connection cable is used for sensors that need to be used at higher ambient temperatures.

Tightening torques

The permitted tightening torque is indicated in the data sheets or on the sensor packaging.

Quality and the environment

Quality management system as per DIN EN ISO 9001:2008

Balluff companies	
Balluff GmbH	Germany
Balluff SIE Sensorik GmbH	Germany
Balluff Controles Elétricos Ltda.	Brazil
Balluff Sensors (Chengdu) Co., Ltd.	China
Balluff Ltd.	Great Britain
Balluff Automation S.R.L.	Italy
Balluff Canada Inc.	Canada
Balluff de México S.A. de C.V.	Mexico
Balluff GmbH	Austria
Balluff Sp. z o.o.	Poland
Balluff Hy-Tech AG	Switzerland
Balluff Sensortechnik AG	Switzerland
Balluff S.L.	Spain
Balluff CZ, s.r.o	Czech Republic
Balluff Elektronika Kft.	Hungary
Balluff Inc.	USA

Reg.Nr.: 19279-03

Environmental management system as per DIN EN ISO 14001:2009

Balluff companies	
Balluff GmbH	Germany
Balluff Sensors (Chengdu) Co., Ltd.	China
Balluff Elektronika KFT	Hungary

Testing laboratory

The Balluff testing laboratory operates in accordance with ISO/IEC 17025 and is accredited by DAkks for testing electromagnetic compatibility (EMC).

DAkkS Deutsche Akkreditierungsstelle D-PL-12017-01-01

Balluff products comply with EU directives

Products that require labeling are subject to a conformity evaluation process according to the EU directive and the product is labeled with the CE marking.
Balluff products fall under the following EU directive:

2004/108/EC	EMC directive
2006/95/EC	Low Voltage Directive valid for products with supply voltage ≥ 75 V DC/≥ 50 V AC
94/9/EC	ATEX-directive valid for products with Ex-label

Product approvals

Product approvals are awarded by domestic and international institutions. Their symbols affirm that our products meet the specifications of these institutions.

"US Safety System" and "Canadian Standards Association" under the auspices of Underwriters Laboratories Inc. (cUL).

CCC-Code by the Chinese CQC.

Standards

Sensors	Low-voltage switchgear and controlgear	EN 60947-5-2/IEC 60947-5-2
	NAMUR-sensors	EN 60947-5-6/IEC 60947-5-6
Protection class	II ⧈	EN 60947-5-2/IEC 60947-5-2
Degree of protection	IP 60...67	EN 60529/IEC 60529
	IP 68 per BWN Pr. 20	Balluff factory standard (BWN): Temperature storage 48 h at 60 °C, 8 temperature cycles according to EN 60068-2-14/IEC 60068-2-14 between the benchmark temperatures according to the data sheet, 1 h storage in water, insulation inspection, 24 h storage in water, insulation test, 8 temperature cycles according to EN 60068-2-14 IEC 60068-2-14 between the benchmark temperatures according to the data sheet, 7 days storage in water, insulation test.
	P 68 according to BWN Pr. 27	Balluff Factory Standard (BWN): Testing products for use in the foods industry.
	IP 69K	DIN 40050 part 9: Protection against entry of water under high pressure- or steam jet cleaning.
EMC (Electromagnetic Compatibility)	Emissions, RF noise voltage and RF noise radiation from electrical equipment	EN 55011
	Interference immunity against discharging static electricity (ESD)	EN 61000-4-2/IEC 61000-4-2
	Radio frequency immunity against high-frequency electromagnetic fields (RFI)	EN 61000-4-3/IEC 61000-4-3
	Immunity to fast transients (bursts)	EN 61000-4-4/IEC 61000-4-4
	Interference immunity against conducted interference, induced by high-frequency fields	EN 61000-4-6/IEC 61000-4-6
	Immunity to voltage dips and voltage interruptions	EN 61000-4-11/IEC 61000-4-11
	Surge-voltage stability	EN 60947-5-2/IEC 60947-5-2
Environmental simulation	Vibration, sinusoidal	EN 60068-2-6/IEC 60068-2-6
	Shock	EN 60068-2-27/IEC 60068-2-27
	Continuous shock	EN 60068-2-29/IEC 60068-2-29
EX area	Electrical equipment for explosive atmospheres, general requirements.	EN 50014
	Succeeded by: Electrical equipment for gas explosive atmospheres, general requirements.	EN 60079-0
	Electrical apparatus for explosive areas – intrinsic safety "i".	EN 50020

For conformity, see product marking.

Mounting torques

The following torques are to be followed so that the sensors are not mechanically destroyed during installation, as long as no other information is indicated on the data sheet or the sensor packaging.

Size	Material	Tightening torque
M5×0.5	Stainless steel	3 Nm
M8 × 1	Stainless steel	15 Nm
M12×1	Stainless steel	40 Nm
M18×1	PBT	1 Nm
M18×1	Stainless steel	60 Nm
M30×1.5	PBT	3 Nm
M30×1.5	Stainless steel	90 Nm

Housing tolerances for unthreaded cylindrical sensors

Diameter	Tolerance
Ø 3 mm	–0.1
Ø 4 mm	–0.1
Ø 6.5 mm	–0.15
Ø 8 mm	–0.15

Degree of protection

The degrees of protection are given according to IEC 60529. Code letters IP (International Protection) designate protection for electrical equipment against shock hazard, ingress of solid foreign bodies and water.

IP 69K
Protection against ingress of water at high pressure and steam cleaning per DIN 40050 Part 9.

First digit:
2 Protection against penetration of solid bodies larger than 12 mm, shielding from fingers and objects
4 Protection against penetration of solid bodies larger than 1 mm, shielding from tools and wires
5 Protection against damaging dust deposits, complete contact protection
6 Protection against penetration of dust, complete contact protection

Second digit:
0 No special protection
4 Protection against water, which is sprayed from all directions against the equipment
5 Protection against a stream of water from a nozzle which hits the equipment from all directions
7 Protection against water, if the equipment (housing) is temporarily submerged
8 Protection against water when submerged for some time

Materials

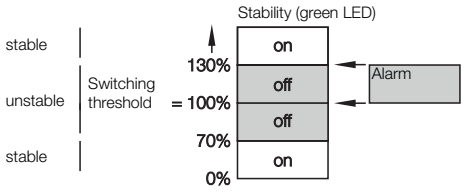
Material	Use and characteristics
Plastics	
ABS Acrylonitrile-Butadiene-Styrene	Impact-resistant, stiff, limited chemical resistance. Some types flame-retardant. Used for housings.
AES/CP Acrylonitrile-Ethylene-Propylene-Styrene	Impact-resistant, stiff, limited chemical resistance. Used for housings.
EP Epoxy resin	Duromer, molded plastic material, highest mechanical strength and temperature resistance. Very good dimensional stability. Cannot be melted.
Epoxy resin - hollow glass spheres	Hollow glass spheres can be treated with epoxy resins. They are used for manufacturing converters with low thickness and high pressure rating.
Tetrafluorethylene-perfluorpropylene	High temperature resistance up to 180 °C, insulation material for cable.
LCP Liquid Crystalline Polymer	High mechanical strength and temperature resistance. Very good chemical resistance. Inherently non-flammable.
PA Polyamide	High impact resistance, good chemical resistance.
PA 6, PA 66, PA mod., PA 12 Polyamide	Good mechanical strength. Temperature resistance. PA 12 approved for food industry applications.
PA transp. Transparent polyamide	Transparent, hard, inflexible. Good chemical resistance.
PBT Polybutylene terephtalate	High mechanical strength and temperature resistance. Some types flame-retardant. Good chemical resistance. Good oil resistance.
PC Polycarbonate	Clear, hard, elastic and impact resistant. Good temperature resistance. Limited chemical resistance.
PEEK Polyetheretherketone	Thermoplastic. Very high strength and temperature resistance. Good chemical resistance. Can be sterilized, good resistance to ionizing radiation.
PEI Polyetherimide	High mechanical strength and good temperature resistance. Good chemical resistance even with many solvents. Transparent with amber-yellow inherent color (not pigmented).
PET Polyethylene terephtalate	High resistance to breakage, good dimensional stability. Frequently used in the food industry.
PMMA Polymethylmethacrylate	Clear, transparent, hard, scratch-resistant, UV-resistant, mainly for optical applications.
POM Polyoxymethylene	High impact resistance, good mechanical strength. Good chemical resistance.

Mechanical properties

Material	Use and characteristics
Plastics	
PP Polypropylene	Very good electrical properties. Impact resistant, tough, mechanically resilient. Very low water uptake. Good to very good chemical resistance.
PPE Polyphenylene ether	Tough, inflexible, high mechanical strength over a wide temperature range. Good chemical resistance. Good hot water resistance.
PSU Polysulfone	High temperature resistance, high impact resistance, good chemical resistance, FDA approved (food grade).
PTFE Polytetrafluoroethylene	Best temperature and chemical resistance, FDA approved (food grade).
PUR Polyurethane	Elastic, abrasion-resistant, impact-resistant. Good resistance to oils, greases, solvents (used for gaskets and cable jackets).
PVC Polyvinyl chloride	Good mechanical strength and chemical resistance (cable).
PVDF Polyvinylidene fluoride	Thermoplastic. High mechanical strength and temperature resistance. Good chemical resistance (similar to PTFE).
Metal	
Wrought aluminum alloy	Standard-aluminum for machined cutting. Can be anodized. Used for housings and mounting components.
CuZn Brass	Standard-housing material with surface protection.
Stainless steel	Excellent corrosion resistance and strength. **Quality 1.4034, 1.4104:** Standard-material; **quality 1.4305, 1.4301:** Standard-material for the food industry; **quality 1.4401, 1.4404, 1.4571:** With increased requirements on chemical resistance at elevated temperatures for the food industry.
GD-Al die-cast aluminum-	Low specific gravity. Good strength and resistance. Some types can be anodized.
GD-Zn die-cast zinc-	Good resistance and strength. Usually with protective surface coating.
Other	
Glass	Good chemical resistance and strength. Used primarily in optical applications (lenses, cover lenses).
Ceramic	Very good strength and chemical resistance. Electrically insulating. Excellent temperature resistance.

Alarm output

The alarm output at the receiver (PNP open collector – 30 mA) triggers a warning signal in the case of functional interruptions, which can be caused by contamination or mechanical de-adjustment. The alarm output is activated if the received signal lies in the alarm range for a defined amount of time.



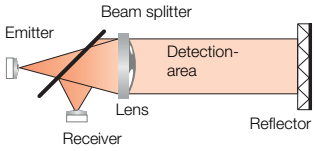
For series BOS 18M Teach-in and BOS 65K, the entire product family, including diffuse and retroreflective sensors, is equipped with an alarm output.

Turn-off delay

The turn-off delay is the time which the sensor requires for actuation when the target object leaves the sensing zone, at a transmission efficiency factor of 0.5.

Autocollimation

Emitter and receiver use a common lens. The emitter light passes through the beam splitter and the lens to the reflector. The reflector bounces the emitter light back to the lens. This gives retroreflective sensors that work with autocollimation a small, round beam profile. Additional benefits: no dead zone for scanning and for the reflector, better small parts detection, and the switching characteristic is independent of the approach direction.



Distance sensors with analog output

A sensor with an analog output does not switch at a particular target distance. Its analog output emits a distance-dependent output signal. The output voltage corresponds to the object location within the sensing range. These systems operate on the same principle as sensors with background suppression.
They generate a linear output signal within a certain range (measuring range).

Dark switching
according to DIN 44030

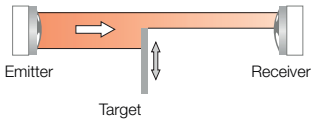
Light receiver	Amplifier	Consumer
non-illuminated	conducting	switched on
illuminated	not fully modulated	switched off

Turn-on delay

The switching delay is the time which the sensor requires for actuation when the target object leaves the sensing zone, at a transmission efficiency factor of 2.

Through-beam sensor

Through-beam sensors consist of separate emitter- and receiver units which have to be aligned opposite each other at the two sides of the detection range. A target interrupts the light beam and causes the receiver to switch, regardless of the surface characteristics. In unfavorable conditions (e.g. dust, moisture, oil), you achieve the best results with through-beam sensors. Ranges of up to 50 m can be achieved.



Color sensing

Sensors for color recognition detect objects based on their color. The sensor is calibrated so that it recognizes objects having a certain color. Then, different colored objects do not generate a switching signal.

Fiber optics

Optical conductors are made of glass or plastic with a diameter of as little as 50 µm and bunched in bundles of several hundred individual fibers to form so-called fiber optics. The fiber ends are ground and polished to meet the quality criteria of the optical industry.
The individual fibers are coated with a very thin layer of lubricant. This reduces friction against the outer jacket and between the fibers, so that broken fibers are prevented even when the cable is continuously flexed. The transmission properties are guaranteed through this over a long span of time.
The ends of the bundles are potted with the connection sleeve and the jacket. Balluff fiber optics thus have an IP 67 rating (IP 65 for metal jacket). Moisture and aggressive media cannot hurt either the fibers or the slide coating, so the optical properties remain unaffected.
This design distributes axial pull forces evenly over all the fibers, and protects the individual fibers from excessive pull loads.

Polyurethane jacket
- Temperature T = +85 °C
- Excellent chemical resistance
- Flexible
- No embrittlement from oils and cooling emulsions.

Corrugated metal tube, silicon jacketed
- Temperature T = +150 °C
- Highly flexible
- Crush-resistant
- Can be sterilized.

Metal jacket
- Temperature T = +150 °C
- Resistant to hot swarf
- Flexible
- Crush-resistant

Focusing

In order to achieve a smaller light spot, the light beam of the emitter is focused through lenses. Through the focusing and the light spot caused by it, the switch is better suited to recognize small parts and details. Focusing is often used with retroreflective sensors with background suppression, as well as with retroflective sensors.

Ambient light

The ambient light is the portion of light that is received by the receiver, but does not originate at the associated emitter.

Fork sensor

Fork sensors are through-beam designs in which the emitter and receiver are arranged across from each other in a U-shaped housing. Through the housing type, alignment and electrical connection are simplified. Different ranges are available by selecting different housing configurations. Fork openings of 5...220 mm are possible in various increments. The built-in potentiometer and apertures allow you to adjust the fork sensors easily for detecting parts down to a diameter of 60 µm.

Gray value shift

Gray value shift is the switching distance difference when calibrating using different object reflectivities. The sensor is calibrated for a distance using a Kodak-gray card with 90 % reflection. With the Kodak-gray card with 18 % reflection, the distance achieved with it is measured. The difference between these two switchpoints in % is referred to as the gray value shift. The smaller the gray value shift, the more color-independently the sensor operates.

Light switching
according to DIN 44030

Light receiver	Amplifier	Consumer
Illuminated	Fully modulated	Switched on
Non-illuminated	Not fully modulated	switched off

Background suppression (BGA)

Through the background suppression, objects within a set switching distance are detected, without being impeded by the reflective background, and nearly independent of color and surface of the object (object reflection).
Background suppression is achieved by cutting the beam from the emitter to the receiver. To do so, it divides the visible field into an active area and the background. In addition, by dividing the receiver into at least two adjacent areas (e. g. by using a dual diode or a PSD- element) and by means of a geometric arrangement (triangulation), the actual position of the object within the sensing range can be determined. Through this, the object and the background can be distinguished accurately. Diffuse sensors with background suppression are characterized by low gray value shift and hysteresis.

Hysteresis

The hysteresis is the distance between the switchpoints for a target approaching and then receding from a photoelectric switch.

Kodak gray card

The standard target photoelectric sensors are referred to as the Kodak-gray card. This is a cardboard sheet whose surface has a defined degree of reflectivity. The side with 90 % reflection determines the range of diffuse sensors, with 18 % reflection to determine the gray value shift.

Correction factors
(for diffuse sensors)

For objects with varying reflection characteristics, the range can be determined by using the correction factors shown. See the adjacent table.

Correction factor	Object, surface
1	Paper, white, matte 200 g/m²
1.2...1.6	Metal, shiny
1.2...1.8	Aluminum, black anodized
1	Styrofoam, white
0.6	Cotton fabric, white
0.5	PVC, gray
0.4	Wood, rough
0.3	Cardboard, black, shiny
0.1	Cardboard, black, matte

Short-circuit protected

The output leads can be connected to the wrong potential without destroying the sensor. Together with their polarity reversal protection, these sensors are completely protected against miswiring.

Lasers, laser class

The purpose of laser protection classes is to protect persons from laser radiation by specifying limit values. Based on this, the lasers used are classified according to a scale reflecting the degree of hazard. The calculations and associated limit values relevant for the classification are described in the standard EN 60825-1:2001-11. The grouping is based on a combination of output power and wavelength, taking into account emission duration, number of pulses and angle extension.

Balluff sensors work in the following laser protection classes:
Class 1: Not dangerous, no protective measures.
Class 2: Low output, lid-closing reflex sufficient for protection. With devices of protection class 2, the eye closes on its own due to the lid closing reflex before it has been open to the beam for too long. Laser warning signs on the device and possibly also on the machine in which a laser is being used are sufficient. Additional protective measures are not required. When using devices of protection classes 1 and 2, no laser safety officer is necessary in the company.

Light as a sensor medium

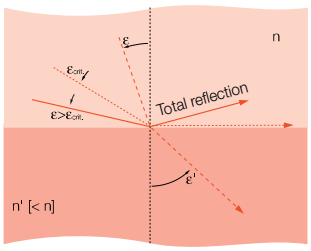
Light is used as a sensor medium in many areas of technology and daily life. Used in controllers- and regulation equipment as a sensor medium. Generally a change in the light intensity in an optical beam (between emitter and receiver) caused by a target object is evaluated. Depending on the properties of this object and the characteristics of the optical beam, the light beam is either interrupted or reflected, or even scattered.
Predominantly clocked infrared light-LEDs are used as emitters, and phototransistors are used as receivers. The output signal is for the most part independent of the ambient light conditions, since visible light can be easily filtered out.
With critical detection procedures, diffuse sensors and -beams can be used with red light-LEDs, because the light beam and the detection point can be measured visually and can be adjusted more easily. For the various usage conditions, Balluff offers three sensor variants: diffuse sensors, retroreflective light sensors, and one-way photoelectric sensors.

Light refraction

Light beams experience a change in direction (interruption) at the border between two optical media with different optical **thicknesses** (e.g. glass/air). The degree of interruption depends on the quotients of the optical **thicknesses** of both media and on the angle of incidence ε to the optical axis.

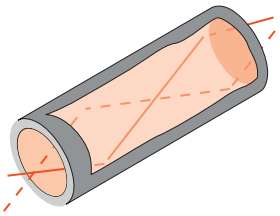
$$\sin \varepsilon' = \frac{n}{n'} \sin \varepsilon$$

If a light beam travels from a dense medium, **n**, into a thinner one, **n'**, its course there will show a greater angle ε'. However, above εcrit. (boundary angle at which the broken beam runs parallel to the boundary layer), it again enters the medium with the thickness **n**; this means that a total reflection is pending.



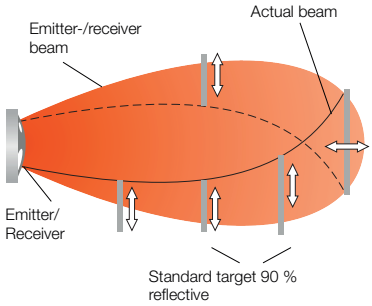
Light transmission by total reflection

Without the total reflection at boundary layers described above, fiber optics of today's quality would not be feasible. They consist of a cylindrical, light-conducting core and a surrounding thin-wall jacket. The optical density **n** of the core is greater than that of the jacket. A light beam is always completely reflected at the junction between core and jacket, and can therefore never leave the core in a radial direction. Theoretically, the light is not weakened by these reflections; however, contamination and small defects both in the core material as well as the boundary layer do cause losses (attenuation) and effectively limit the fiber optic length over which reliable information can be transmitted.



Photoelectric sensor

With diffuse types, the emitter and receiver are integrated into a single housing. The alignment to a detection object is largely uncritical. A target object (e. g. a standard target which is 90 % reflective) bounces a part of the light from its surface back to the receiver. If the standard target reaches the response curve (see image), the output signal changes. The sensing distance depends on the size, shape, color and properties of the reflective object surface. Using a Kodak-gray card with 90 % reflectivity (like white paper), distances of up to 2 m can be obtained.



Permitted humidity

The permitted humidity is 35 to 85 % (not condensed).

Luminescence

To locate invisible marks on objects, so-called luminescent materials (contained in special chalks, inks, paints etc.) are used which can only be made visible under ultraviolet (UV) light. The fluorescent materials convert the invisible UV light (short wavelength, here 380 nm) into visible light (between blue 450 nm and dark red 780 nm). This effect is called photoluminescence. The visible light can then be detected as usual by the receiver component of the sensor.

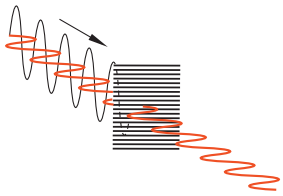
Polarizing filters

When do you need them?

A part of the emitter light in retroreflective systems is reflected directly back to the receiver from target objects with shiny surfaces, e. g. stainless steel, aluminum or tinplate. Simple Retroreflective light sensors can therefore not reliably distinguish reflected light from the object and reflected light. Erroneous readings therefore cannot be ruled out. For this reason, Balluff retroreflective light sensors are alternatively equipped with **polarizing filters,** 0which, together with a **Balluff reflector**, an **optically activated prismatic mirror**, form a selective barrier against the reflected light from the object, but still allow the reflector light to occur.

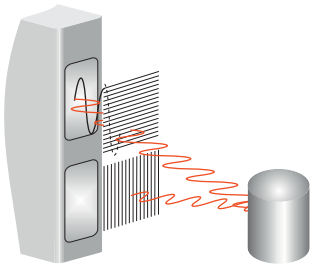
How do they work?

Light consists of a wide variety of individual beams, which all sinusoidally oscillate on their dispersal axes. Their oscillation levels, however, are independent of one another and can take on any angle position desired (see image).
If they meet a polarizing filter (fine line grid), then only the beams oscillating parallel to the grid level are let through, and the vertically oscillating ones are entirely deleted. Of all the other oscillation planes, only the portion which consists of parallel components is allowed to pass.



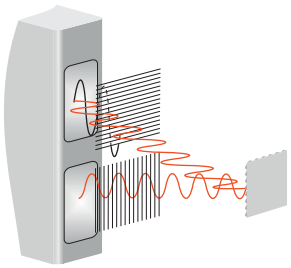
To suppress mirror reflections

Behind the filter, the light only oscillates parallel to the polarization plane. For this light, an additional 90° rotated polarizing filter becomes an impassable barrier.
With a 90° rotated polarizing filter in front of both the emitter- and receiver of a retroreflective system, you can therefore prevent the reflected light of a reflecting target object from falsely triggering the signal of the photo-receiver.



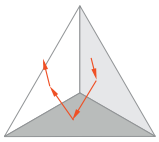
For reliable detection of reflective target objects

On the other hand, the light reflected from the triple mirror, with its polarization plane rotated by 90° as described above, is allowed to pass unhindered by this filter.
The receiver of a retroreflective system is thereby fully shielded even when a reflecting target object enters the beam, so that the object is still reliably detected.



Reflectors
(optically active triple mirrors)

The two-dimensional principle of retroreflection described above can be carried over to a spatial system with three mirrors which are oriented at right angles to each other (one corner of a cube standing on its point). A light beam entering this system is totally reflected by all three surfaces and exits parallel to the incident beam.
Triple mirrors are called **optically active**, because they also turn the polarization level of the reflected light beam by 90°.
This property first enables a secure recognition of reflective detection objects, together with a **polarization filter** with retroreflective light sensors.

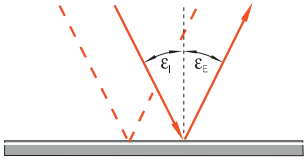


Each six triple mirrors are to be arranged into a hexagon and arranged in a honeycomb next to each other. Their orientation with respect to the light beam is then totally unproblematic. These are generally made of plastics with high optical density, injected as sheets or pressed into flexible tape.

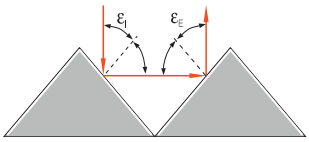
Reflection

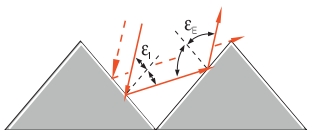
What is it?
Light beams extend to a straight line in free space. Upon striking an object, they are reflected. Depending on the surface composition of the object, one of three types of reflection occurs: total reflection, retroreflection, and diffuse reflection.

The total reflection reaches a highly reflective (mirroring) surface. The angle of incidence is thereby the same as the angle of reflection ($\varepsilon_I = \varepsilon_E$). The reflection losses are in the ideal case negligible.

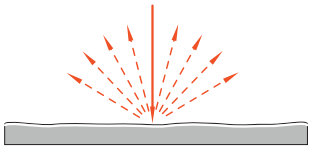


The retroreflection is caused by two mirrors aligned vertically to each other. A light beam is again projected back through double reflection in the same direction. The angle of incidence can thus be altered in a relatively wide range.



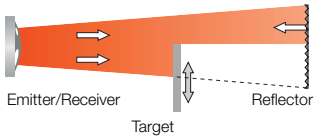


Diffuse reflection occurs on an uneven and rough surface. It can be illustrated through a wide variety of poorly reflective and differently aligned miniature mirrors. Incidental light is widely "scattered" from such a surface. The reflection losses are higher the darker and more matte finished the surface is. Diffuse sensors, for example, detect diffuse reflecting light from target objects.



Retroreflective sensor

With retroreflective light sensors, the emitter and the receiver are in a single housing. A reflector on the opposite side of the beam bounces the emitter's light back to the receiver.
A target object interrupts the reflected light beam and causes a change in the output signal. With reflective interfaces, it is advisable that the light reflected from the object is to be blanked out with a polarizing filter in front of the receiver optics, in order to prevent possible error signals.



Switching distance s

The switching distance is the distance between the standard target and the "sensing surface" of the light sensor for causing a signal change (per EN 60947-5-2).

Rated switching distance s_n

The rated switching distance is a switching distance- characteristic, which does not take into account manufacturing tolerances, sample differences, operating temperatures, supply voltages, etc.

Real switching distance s_r

The actual switching distance is the switching distance at measured voltage U_e, taking into account the manufacturing tolerances at an ambient temperature of (T = +23 °C ±0.5).

Usable switching distance s_u

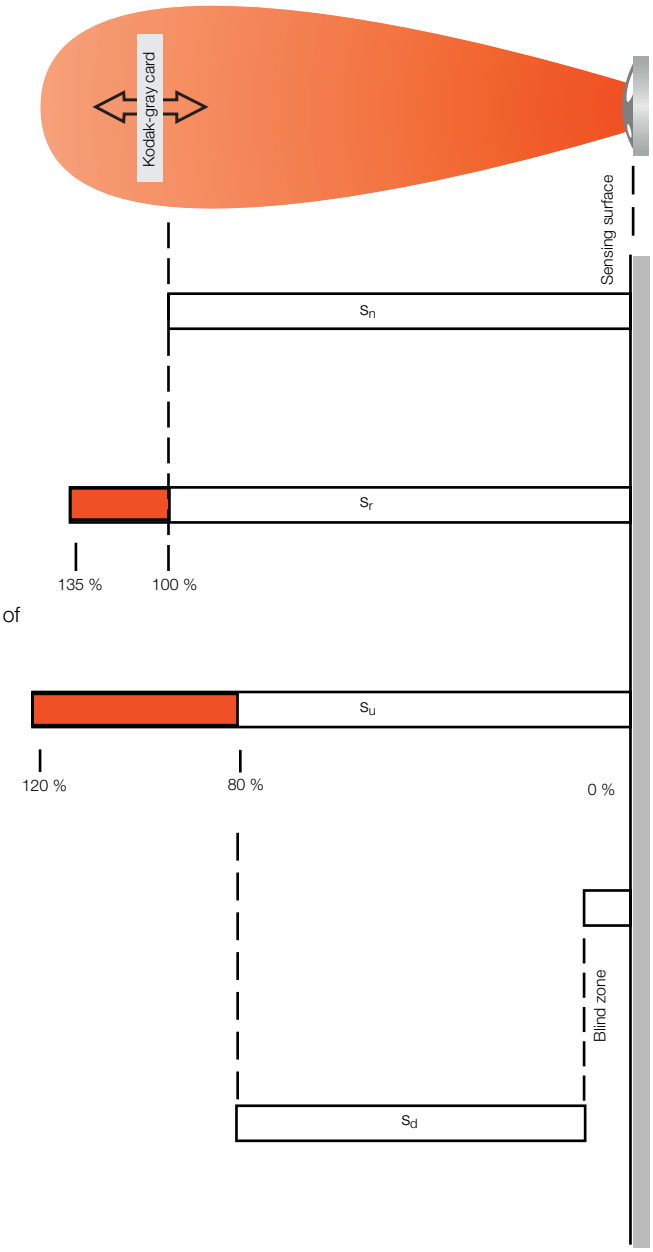
The usable switching distance is the permitted switching distance within fixed voltage- and temperature limits ($0.80\ s_n \leq s_u \leq 1.20\ s_n$).

Blind zone

The blind zone is the range between the sensing surface and the minimum switching distance in which a detection object cannot be detected.

Detection range s_d

The detection range is the area in which the switching distance of a photoelectric sensor to the standard target can be set.



Emitter light

Photoelectric sensors use mainly the following transmission components:

- **Red light LED:** visible light, well-suited as an orientation aid and for sensor adjustment.
- **Infrared LED (IR):** Invisible beam with high energy.
- **Red light laser:** Visible light, optimal for detecting small parts and high ranges due to the physical properties of the laser.

Teach-in

Sensor settings are no longer carried out with potentiometers or slide switches with Teach-in-sensors. Everything is controlled by pressing a button. The microcontroller integrated in Teach-in-sensors enables the complete control of the setting process by buttons. Through defined setting steps, there is the advantage that the sensor cannot be set in an unreliable range. The microcontroller also assumes control of the contamination indicator and the contamination output.
A wide variety of Balluff Teach-in-switches have remote control; the setting process via Teach-in can also be triggered externally via cable.

Technical data, general

	Photoelectric sensor					Background suppression			Retroreflective sensor			Through-beam sensor			
Rated switching distance s_n	100 mm	200 mm	400 mm	1 m	2 m	120 mm	250 mm	1.1 m	2 m	4 m	8 m	5 m	8 m	16 m	50 m
Actual switching distance (in % of s_n)	125	125	125	135	150	135	135	135	150	150	150	150	150	150	150
Switching hysteresis (in %)	≤ 20	≤ 20	≤ 25	≤ 15	≤ 15	≤ 1	≤ 1	≤ 1	≤ 10	≤ 10	≤ 10	≤ 15	≤ 15	≤ 15	≤ 15
Ø the response beam at s_n/2 typical (mm)	20	25	150	300	300	6	10	25	50	100	150				
Ø of the active area (mm)												8	12	12	20

Temperature drift

The temperature drift is the switching point shift at temperature changes in % of s_r.

Test input

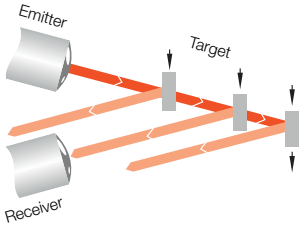
The test input of the emitter interrupts its light impulses and, through that, enables the function check of emitter and receiver. If Test+ is used, then Test– has to be at 0 V, and if Test– is used, then Test+ has to be placed at 10...30 V. The receiver-output has to switch every time if there is a voltage of 10...30 V DC (Test+) or 0 V DC (Test–) at the test input. Contamination or maladjustment of the optical axis causes the emitter signal to reach the receiver only weakly, if at all. Therefore, the output will not switch, even though the test input is activated. The test function corresponds to a remote monitoring of the photoelectric sensor and enables a preventive system control.

Transmission

The transmission is a measure for the light transmission ability of a medium. It is defined as the ratio of: – passed to – entering light (in %). Diffuse transmission is the term which is used when the light is partially or completely diffused.

Triangulation

With a triangulation, the emitter- and the receiver beam are cut by a photoelectric sensor at a pointed angle. A target object will **only be detected in the range** where the beams overlap.The emitter light which is reflected or diffused from objects outside this limited zone cannot be registered by the photo-receiver.
With the triangulation, relatively small changes in distance can be recognized (e.g. slots, offsets on shafts). Color and shape of the object have very little effect on the registration.



Ambient temperature

The ambient temperature is the temperature range in which the function of the photoelectric switch is guaranteed. Balluff Standard: $-15\ °C \leq T_a \leq +55\ °C$

Polarity reversal protection

The power supply connections can be reversed without destroying the sensor. In combination with the short-circuit protection, there is protection against total reversal.

Contamination (influence on the response range)

Contamination reduces the specified response range of sensors and fiber optics compared to clean air, because the dirt- and dust particles

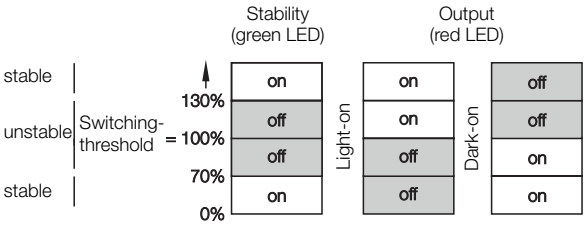
- deposit on the lenses and impair their light transmission,
- and absorb and scatter light in the beam path.

An oil-free source of compressed air can be used to prevent the effects of dirt and contamination due to impure air.

Contamination indicator

The contamination indicator (green) lights in the safe zone if the input energy exceeds the threshold energy by at least 30 %.
The threshold energy, at which a signal change affects the output, is defined at 100 %.
From this, the safe zone results

- if the input signal exceeds at least **130 %** of the threshold energy
- if the input signal exceeds at least **70 %** of the threshold energy.



Degree of contamination

Pure air	Ideal conditions
Trace contamination	Relatively clean air in indoor rooms
Slight contamination	Workshop- and storage rooms
Moderate contamination	Dirty and dusty environments; switching distance is reduced to $s = 0.5\ s_u$
High contamination	Heavy precipitation, whirled-up particles and swarf: Functional failure of the photoelectric sensor is possible.
Highest contamination	Coal dust precipitating on the lens. Photoelectric sensor function may fail.

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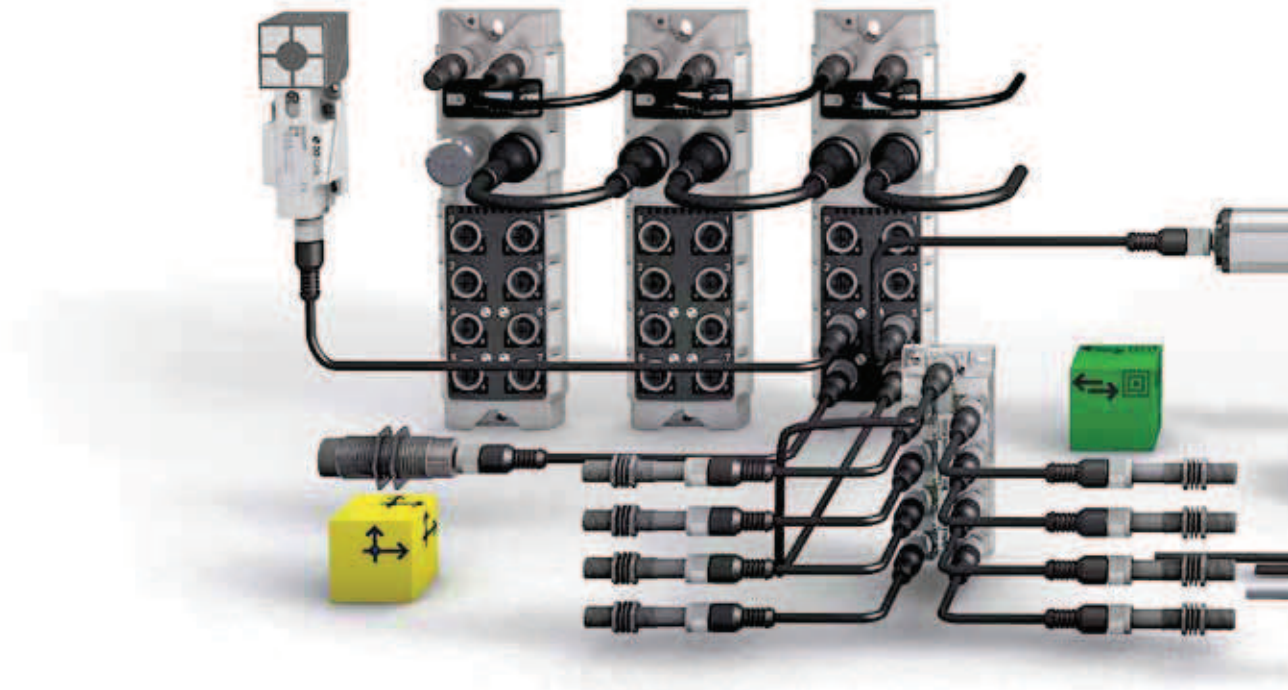

Selection
Integration
Instruction
Application
Industrial identification
Project support
Vision sensors
IO-Link
Industrial networking and connectivity
Product
System components
Decision help

Tec

We offer ...
- Decision help for the correct product selection
- Complex product and application support
- Integration support
- Customer-specific product and commissioning training
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- Assumption of time-consuming project work

We support you during the project implementation, commissioning and integration
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- Would you like to identify, control, monitor and optimize objects?
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- Industrial networking and connectivity for wiring and networking
- IO-Link – network technology for reliable data transfer and greater efficiency
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According to your specifications. In the best quality.

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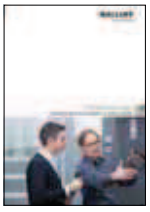
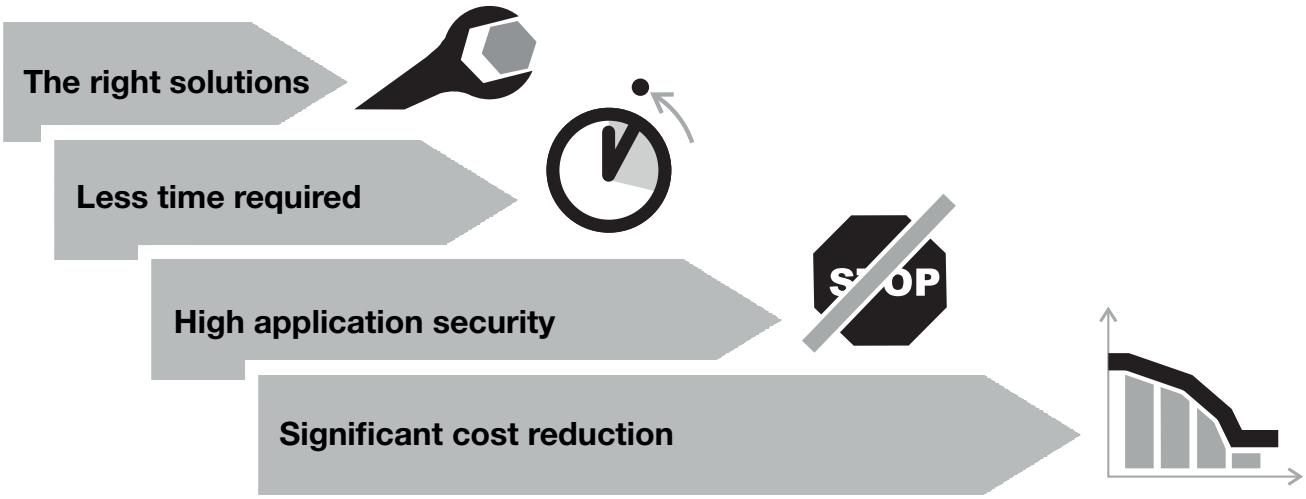
This creates greater planning security and provides faster commissioning and an earlier start of production. This leads to higher productivity and more cost-effectiveness. And this relieves you of additional stress in your everyday work, giving you more time to focus on your core business.

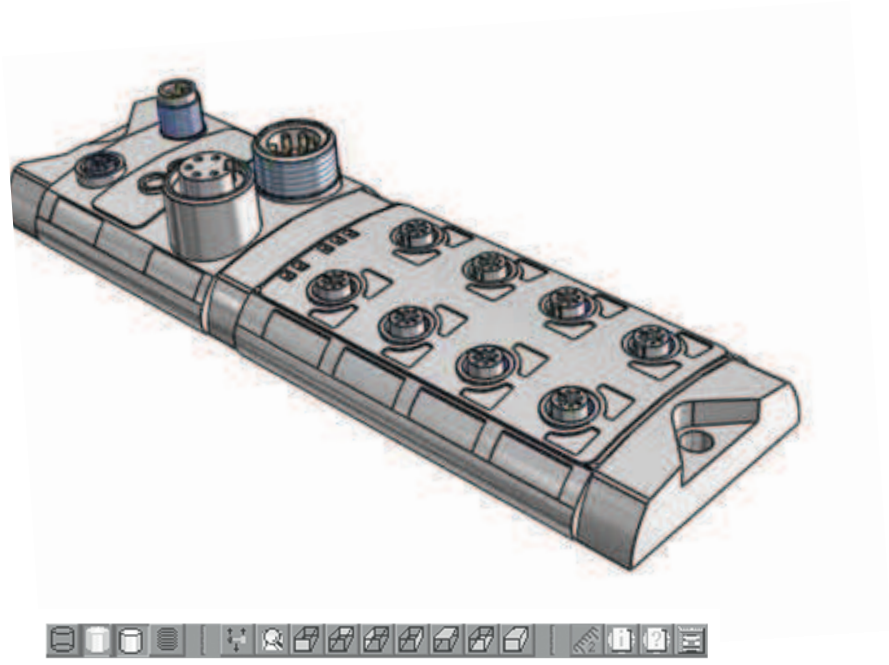


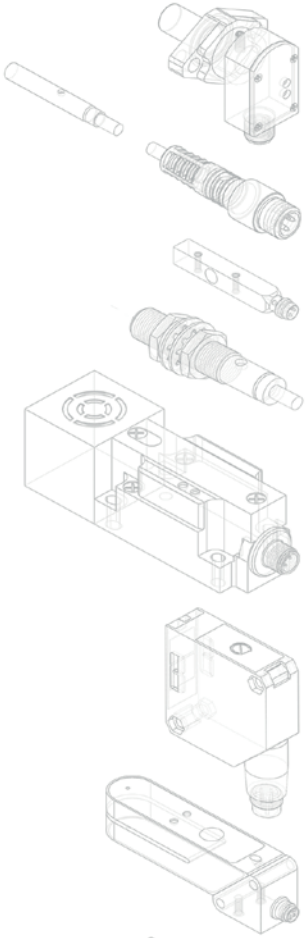
You can find more information in our Services brochure or send us an e-mail: tsm.de@balluff.com



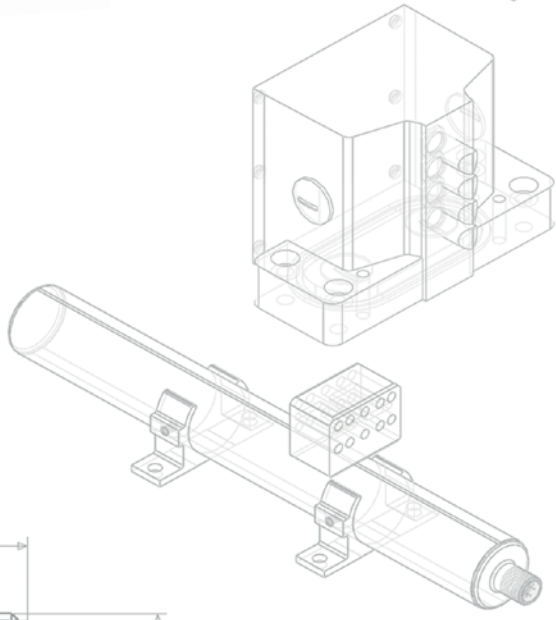
Application advice through our TecSupport: Discuss your technical requirements. And take advantage of our expertise.	Real-world examples: ■ Selection of the correct identification procedure for an assembly line ■ IO-Link concept as a cost-effective alternative to conventional wiring ■ System consulting for radio frequency identification (RFID): identification of large steel pipes in adverse environments ■ Recognizing multiple containers on a pallet in goods receiving
Commissioning: Order expert knowledge. And benefit from a quick start of production.	Real-world examples: ■ Setting up an optical checkpoint with the BVS vision sensor ■ Consulting and support during the programming of BIS RFID systems ■ Installation and commissioning of a color detection application with the BFS color sensor
Fully customized products: Order individual versions according to your requirements: from preassembly to engineering services. And take advantage of the optimum.	Real-world examples: ■ Extending the housing of a BHS high-pressure resistant inductive sensor ■ Extra threads for the housing cover of a micropulse transducer BTL ■ Customer-specific holder for an RFID data carrier ■ Adaptation of the characteristics for analog sensors BAW
Workshops: make use of well-founded manufacturer knowledge. And benefit from application security.	■ **Professional sensor use:** Select operating principles, install sensors professionally and ensure the reliable operation of your application. ■ **Linear position sensing:** This is how you measure precisely and wear-free. ■ **RFID:** The right data at the right time at the right place. ■ **Vision sensor:** Using an image processing sensor, ensure manufacturing quality in three steps. ■ **Vision sensor identification:** Reliably identify data matrix codes with an image-processing sensor. ■ **Industrial networking with IO-Link:** Manage signals intelligently and cost-effectively.

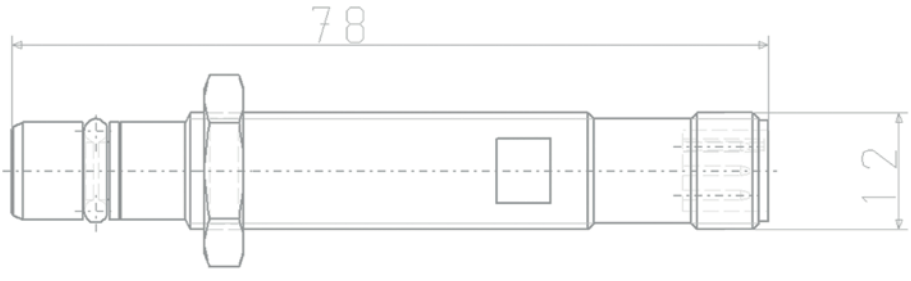
Balluff Products in 3D





- All catalog products are available: inductive sensors, photoelectric sensors, sensors for pneumatic cylinders, micropulse transducers, industrial RFID systems, vision sensors BVS, mechanical single and multiple position switches, industrial networking and connectivity, and so on.
- sizephics reduced to the essentials for optimized performance

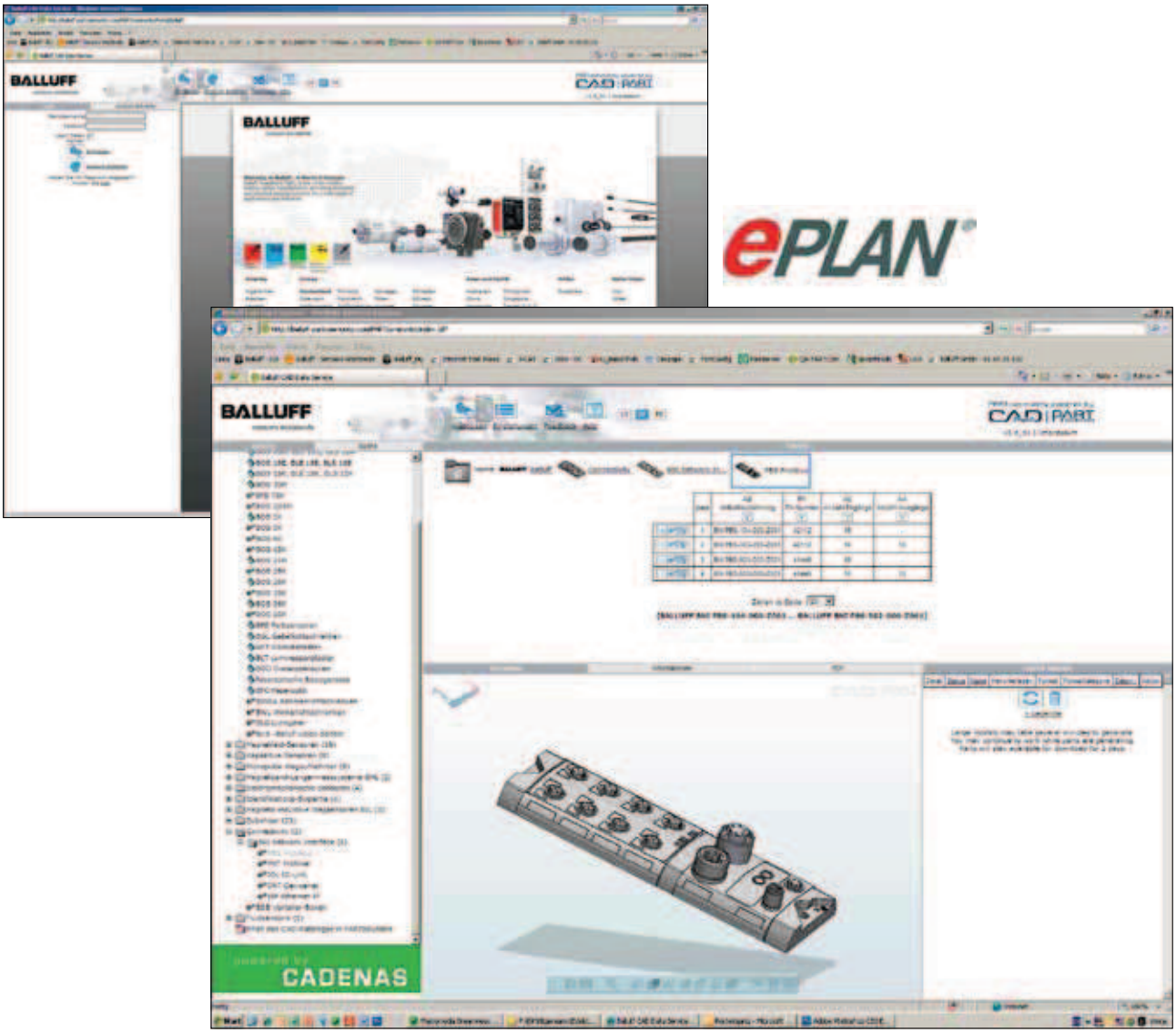




CAD formats on the Cadenas PARTserver

Retrieving Product Information Online

Various CAD and electronic diagram formats available



The benefits to you

- Faster and more efficient designing
- Free availability of all Balluff catalog products
- All common CAD formats
- Convenient preview in 3D
- Configurable products

And here is how it works

- Go to the 3D data at **www.balluff.com**
- You are redirected to the Cadenas PARTserver
- Select a sensor and perform an optional check via 3D preview
- Add it to the shopping cart
- Once you have entered your details, the CAD files of your choice are sent to you by e-mail

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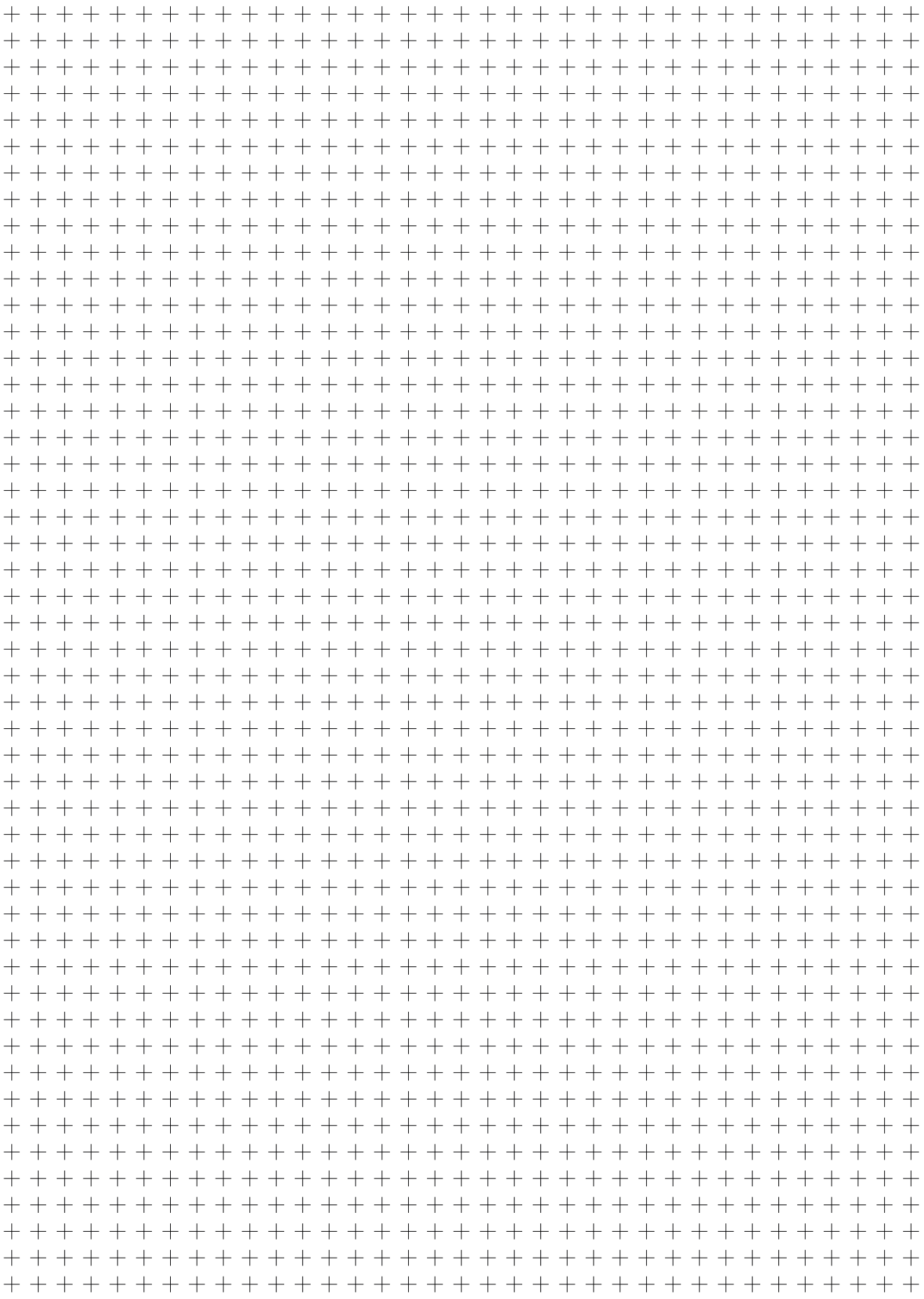

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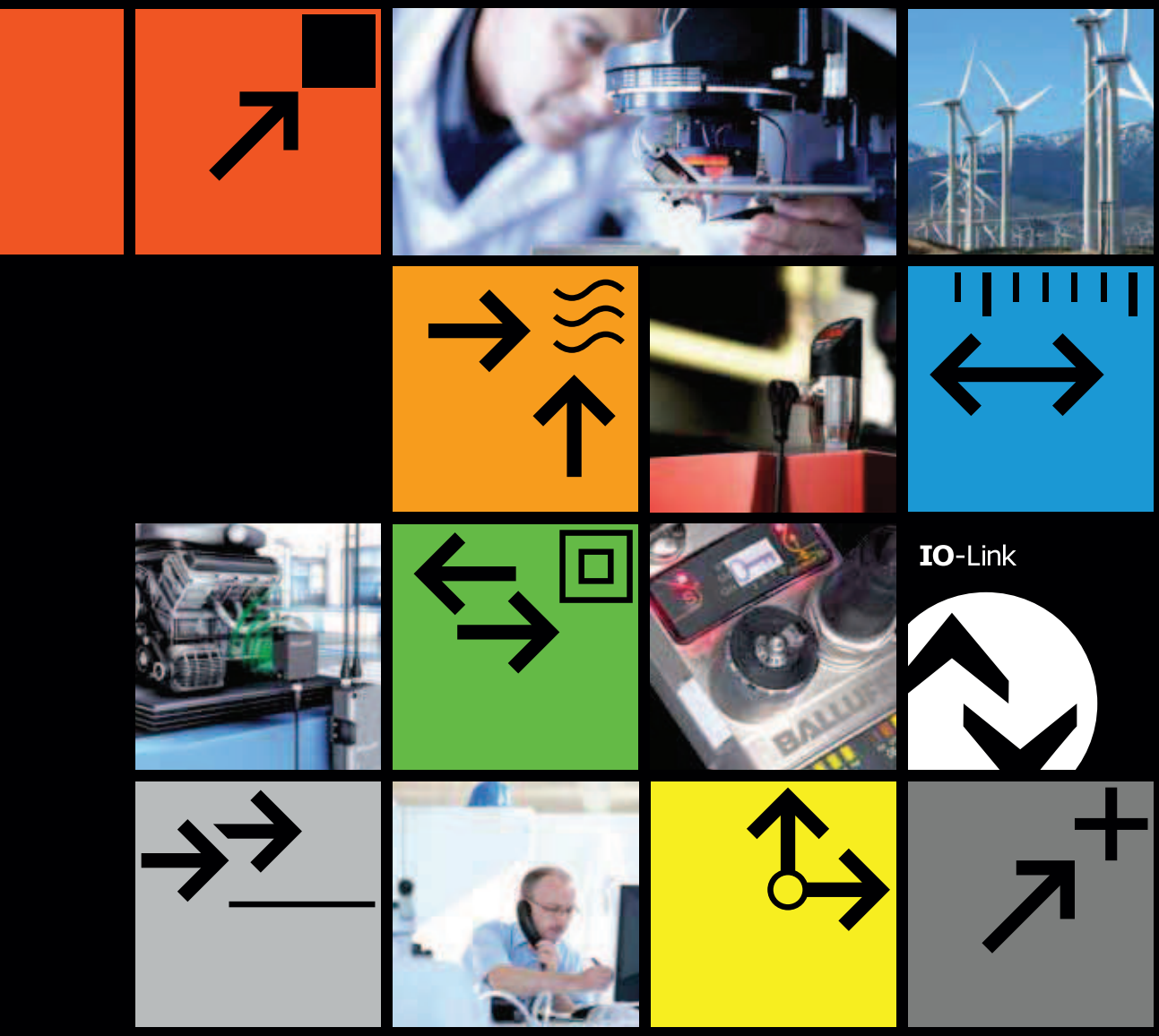

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