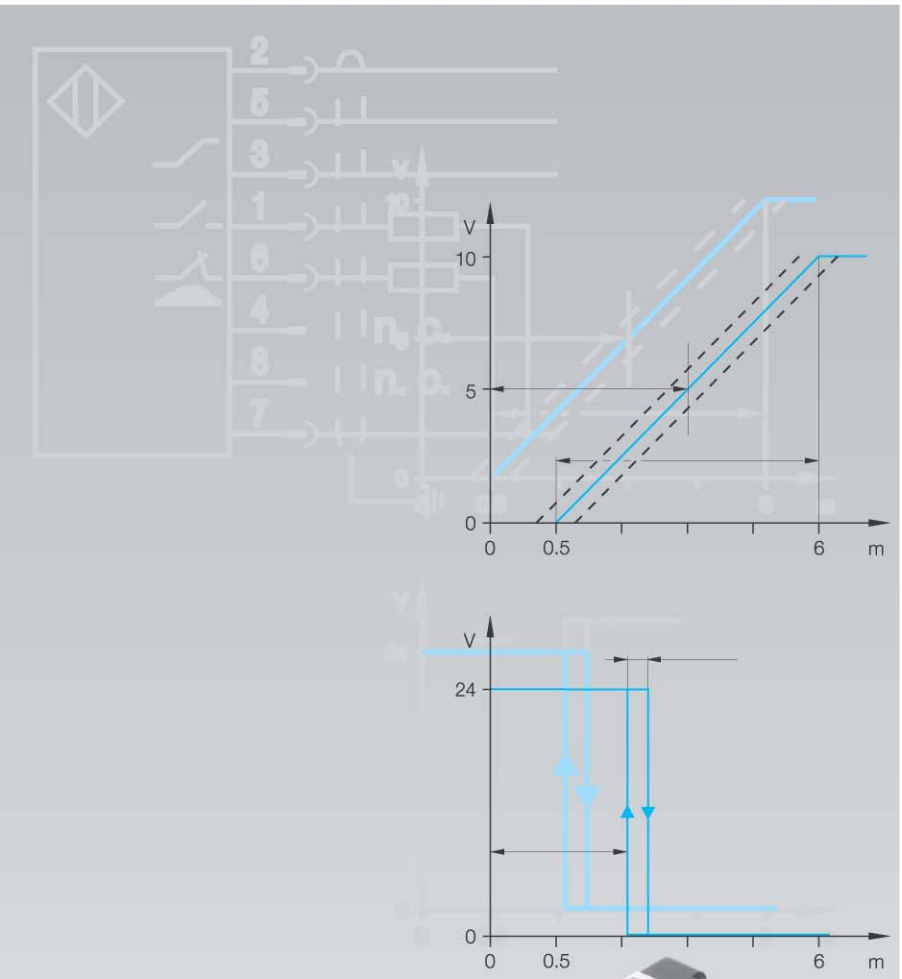
Photoelectric Distance Sensors



Balluff photoelectric distance sensors provide an output signal proportional to the object distance, virtually independent of reflectivity, color or material of the object. Specifically designed for various requirements in positioning tasks or material flow control, photoelectric distance sensors offer you a variety of application possibilities

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Wire colors
designation
per DIN IEC 60757

BN	brown
BK	black
BU	blue
OG	orange
WH	white
RD	red
GY	gray

Analog output

A sensor with an analog output does not switch at a particular target distance. These devices have an analog output with a distance-dependent output signal. The output voltage is proportional to the object point in the sensing area. These systems operate on the same principle as sensors with background suppression. They generate a linear output signal within a certain range (measuring range)

Focusing

To achieve a smaller light spot, the light beam from the emitter is focused using lenses. Focusing and the resulting light spot allow the switch to better detect small parts and details. Focusing is often used with retroreflective sensors, as well as with diffuse sensors, and in conjunction with background suppression.

Ambient light ...

... is the portion of light which is picked up by the receiver, but does not originate from the emitter.

Gray scale shift

Gray scale 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. A Kodak gray card having 18 % reflection is used and the resulting distance measured. The difference between these two switchpoints in % is referred to as the gray scale shift. The smaller the gray scale shift the less color-dependent the sensor will be.

Background suppression
(background suppression)

Background suppression allows objects within a certain switching distance to be detected without being affected by a reflecting background and virtually independent of object reflectivity (color or surface texture). Background suppression is realized by allowing the beam cones of the emitter and receiver to intersect. This results in a division of the field of view 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. These two design features allow the object to be reliably distinguished from the background. Diffuse sensors with background suppression are characterized by low gray scale shift and hysteresis.

Hysteresis H ...

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

Kodak gray card

The “standard target” for photoelectric sensors is the Kodak gray card. This is a cardboard sheet whose surface has a defined degree of reflectivity. The side with 90 % reflection is used for determining the range of diffuse sensors, and the side with 18 % for determining the gray scale shift.

Short circuit protection

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.

Laser, laser class

The purpose of laser 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 for the classification are described in 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.

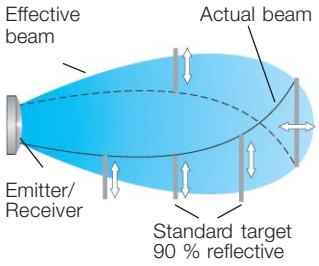
Balluff sensors operate in the following laser classes:

Class 1: harmless, no protective measures necessary
Class 2: low power, eyelid reflex is sufficient protection.

Appropriate warning labels must be affixed to the device and in some cases to the machine in which the laser is used. No other mechanical or optical protection measures are required. When using devices from Class 1 and 2, no person responsible for laser protection needs to be present.

Diffuse

With diffuse types, the emitter and receiver are integrated into a single housing. Orientation to the target is not critical.
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. Once the standard target enters the effective beam (see illustration), a change in the output switching state occurs.
The sensing distance depends upon size, shape, color and surface characteristics of the reflecting target object.
Using a Kodak gray card with 90 % reflectivity (like white paper), distances of up to 2 m can be obtained.



Max. **humidity ...**

... is 35...85 % (non-condensing).

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Reflection
What is it?

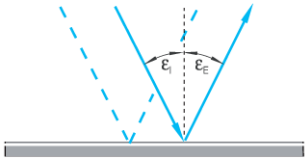
Light beams extend to a straight line in free space. Upon striking an object, they are reflected.

Depending on the surface composition of the object, one of three types of reflection occurs: total reflection, retroreflection, and diffuse reflection.

Total reflection ...

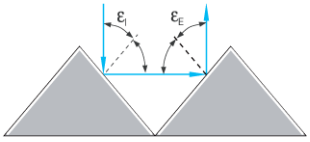
... occurs with a very shiny (reflecting) surface. The angle of incidence of a light beam is thereby the same as the angle of reflection ($\varepsilon_I = \varepsilon_E$).

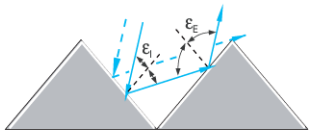
The reflection losses are in the ideal case negligible.



Retroreflection ...

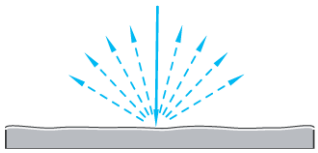
... is caused by two mirrors at vertical angles to each other. The double reflection causes a light beam to be bounced back in the same direction.
The angle of incidence can thus be altered in a relatively wide range.





Diffuse reflection ...

... occurs with an uneven and rough surface. It can be demonstrated with a variety of poorly-reflecting 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.



Emitter light

Optical sensors generally use the following emitter components:

Red light-LED
Visible light, good as an alignment aid and for sensor adjustment.

Red light laser
Visible light whose physical properties make it ideal for small parts detection and long ranges.

Teach-in

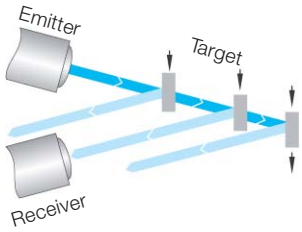
Sensor settings on teach-in sensors do not have to be made using a potentiometer or slide switches; everything is controlled with the push of a button. The microcontroller integrated into teach-in sensors allows the entire setup sequence to be controlled by pressing the button. The use of defined calibration steps also means that the sensor cannot be calibrated for an unreliable zone. The microcontroller also assumes control of the contamination indicator and the contamination output.
A variety of Balluff teach-in sensors also provide the option of remote operation, whereby the teach-in calibration process is initiated “externally” through a cable line.

Temperature drift ...

... is the switchpoint shift with changing temperature in % of s_r.

In **triangulation ...**

... the light cones of a through-beam system intersect each other at a narrow angle. A target object will **only be registered in the area** where the cones overlap.
The emitter light which is reflected or diffused from objects outside this limited zone cannot be registered by the photo-receiver.
With this triangulation method, relatively small distance changes (e.g. grooves, shaft recesses) are identified. Color and shape of the object have very little effect on the registration.



Light time-of-flight

Light time-of-flight is the time the light needs to transverse a particular distance. Since the speed of light is finite and is the same everywhere, the travel time is equal to a distance which the light traverses during this time.

Ambient operating temperature ...

... is the temperature range within which reliable operation of the photoelectric switch is guaranteed. Balluff standard:
$-15\ °C \leq T_a \leq +55\ °C$

Polarity reversal protection

The supply voltage leads can be reversed without destroying the sensor.

In combination with the short circuit protection, these sensors are completely protected against miswiring.

Contamination ...
(influence on the sensing range)

... reduces the indicated sensing range of sensors and fiber optics as compared with „pure air“, because the dirt and dust particles:

- accumulate on the lenses and impair their light transparency,
- 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 scale

Pure air	Ideal conditions
Trace contamination	Relatively clean air in indoor rooms
Slight contamination	Tool and storage rooms
Moderate contamination	Dusty and vaporous environment Switching distance reduced by a factor of $s = 0.5\ s_u$
High contamination	Heavy precipitations, swirling flakes and chips Photoelectric sensor function may fail
Highest contamination	Coal dust precipitating on the lens Photoelectric sensor function may fail

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Optical distance sensors are used when distances of objects need to be measured or monitored or their precise position determined.

Distance measurement is based on the principles of triangulation or speed of light measurement.

PSD elements or CCD arrays are used for the receiving elements, with the emitter consisting of a red light or laser light source.

Analog current and voltage values, serial interfaces and digital outputs are available to the user.

Applications

- Control tasks (grinding machines)
- Sensing
- Object positioning
- Level detection

Type	Working range	Reso-lution	Light type		Analog Output			Output			U_B			Connection				Page
			Red light	Laser light	0...10 V	1...10 V	4...20 mA	Interface RS485	Switching output	Error output	10...30 V DC	15...30 V DC	18...30 V DC	M8 connector, 4-pin	M12 connector, 5-pin	M12 connector, 8-pin	Cable	
Distance sensor																		
BOD 6K-RA01-S75-C	20...80 mm		■		■				■			■		■				60
BOD 6K-RA01-C-02	20...80 mm		■		■				■			■					■	60
BOD 18KF-RA01-S4-C	50...100 mm	1 mm	■		■						■					■		62
BOD 18KF-RA01-C-02	50...100 mm	1 mm	■		■						■						■	62
BOD 26K-LA01-S4-C	45...85 mm	80 µm		■	■								■			■		64
BOD 26K-LA01-C-06	45...85 mm	80 µm		■	■								■				■	64
BOD 26K-LA02-S4-C	45...85 mm	20 µm		■	■								■			■		64
BOD 26K-LA02-C-06	45...85 mm	20 µm		■	■								■				■	64
BOD 26K-LB04-S115-C	30...100 mm	70 µm		■			■		■				■			■		66
BOD 26K-LBR04-S115-C	30...100 mm	70 µm		■			■	■	■				■			■		66
BOD 26K-LB05-S115-C	80...300 mm	220 µm		■			■		■				■			■		68
BOD 26K-LBR05-S115-C	80...300 mm	220 µm		■			■	■	■				■			■		68
BOD 26K-LB06-S92-C	30...100 mm	70 µm		■			■		■				■		■			70
BOD 26K-LB07-S92-C	80...300 mm	220 µm		■			■		■				■		■			70
BOD 63M-LA02-S115	200...2000 mm	1 mm		■	■				■	■		■				■		72
BOD 63M-LB02-S115	200...2000 mm	1 mm		■			■		■	■		■				■		72
BOD 63M-LA04-S115	200...6000 mm	1 mm		■	■				■	■		■				■		74
BOD 63M-LB04-S115	200...6000 mm	1 mm		■			■		■	■		■				■		74
BOD 66M-RA01-S92-C	100...600 mm	0.5 mm	■			■			■				■			■		76
BOD 66M-RB01-S92-C	100...600 mm	0.5 mm	■				■		■				■			■		76
BOD 66M-LA04-S92-C	200...2000 mm	5 mm		■		■			■				■			■		78
BOD 66M-LB04-S92-C	200...2000 mm	5 mm		■			■		■				■			■		78

BOD

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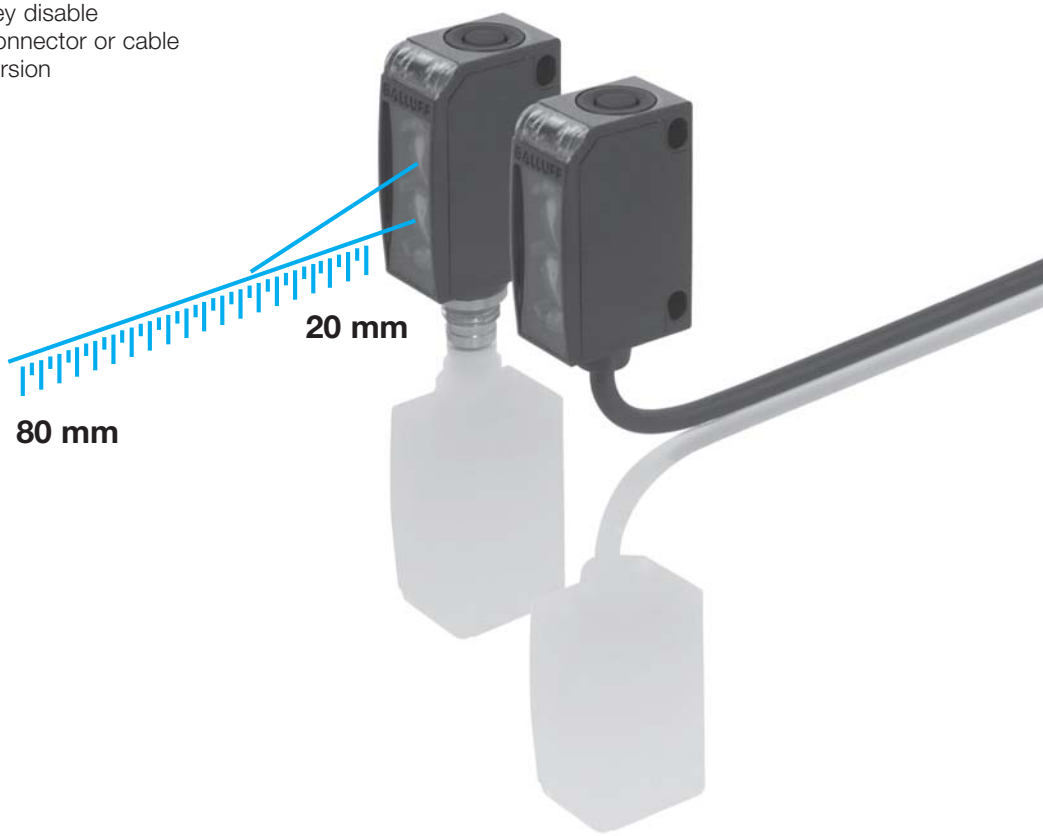
The **BOD 6K** provides a distance-proportional analog output signal with falling voltage over a fixed measuring range of 20 to 80 mm.

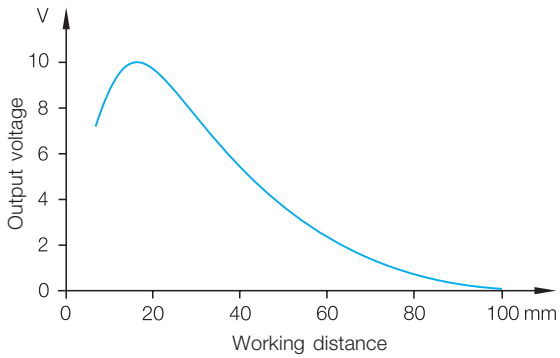
With an output, adjustable using teach-in, the sensor can also be used as a diffuse type with background suppression.

Features

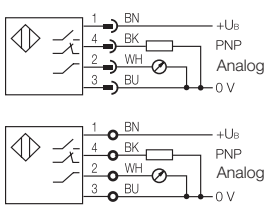
- Fixed measuring range between 20...80 mm
- Analog output 0...10 V
- Adjustable background suppression
- Output PNP, NO/NC
- Teach-in
- Key disable
- Connector or cable version



Analog output BOD 6K-RA01



Wiring diagram

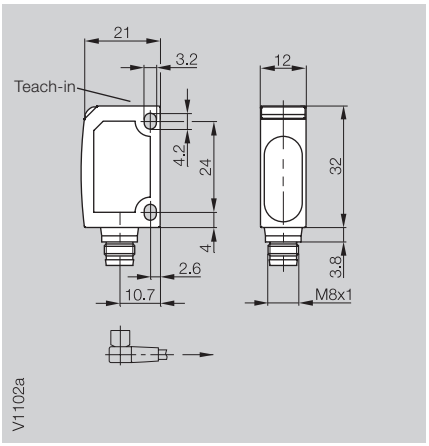


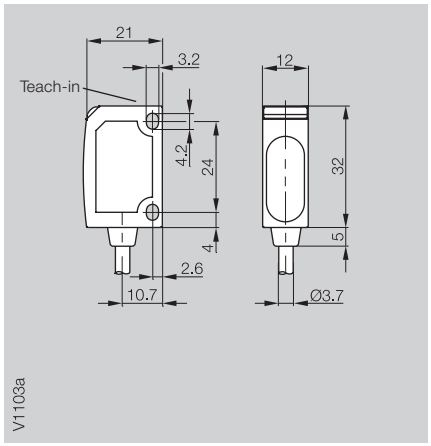
Recommended accessories
please order separately

Mounting bracket
BOS 6-HW-1

Connector
Straight BKS-S 74
Right-angle BKS-S 75

Series	BOD 6K	BOD 6K
Working range	**20...80 mm**	**20...80 mm**
Measuring range	**60 mm**	**60 mm**





Ordering code	BOD 6K-RA01-S75-C	BOD 6K-RA01-C-02
Electrical data		
Supply voltage U_B	15...30 V DC	15...30 V DC
Ripple	≤ 15 % of U_B	≤ 15 % of U_B
No-load supply current I_0 max.	≤ 30 mA at 24 V DC	≤ 30 mA at 24 V DC
Analog output	0...10 V (max. 3 mA)	0...10 V (max. 3 mA)
Cutoff frequency	200 Hz	200 Hz
Switching output	PNP-Transistor	PNP-Transistor
Switching type	NO/NC (selectable)	NO/NC (selectable)
Output current	100 mA	100 mA
Voltage drop U_d at I_e	≤ 2.4 V	≤ 2.4 V
Settings	Teach-in	Teach-in
Optical data		
Emitter, light type	LED, red light	LED, red light
Wavelength	660 nm	660 nm
Light spot diameter	5×5 mm at 60 mm	5×5 mm at 60 mm
Time data		
On-/off-delay	0.5 ms	0.5 ms
Switching frequency f	1 kHz	1 kHz
Indicators		
Power-on indicator	LED green	LED green
Output function indicator	LED yellow	LED yellow
Mechanical data		
Dimensions	21×32×12 mm	21×32×12 mm
Connection	M8 connector, 4-pin	2 m cable, PVC
No. of wires × cross-section		4×0.14 mm²
Housing material	ABS	ABS
Optical surface	PMMA	PMMA
Weight	40 g	120 g
Ambient data		
Degree of protection per IEC 60529	IP 67	IP 67
Polarity reversal protected	yes	yes
Short circuit protected	yes	yes
Ambient temperature range T_a	–20...+60 °C	–20...+60 °C
Ambient light rejection	5 kLux	5 kLux

Measurement values referenced to Kodak gray card 90% Reflexion, 100×100 mm.

Connector orientation

BOD

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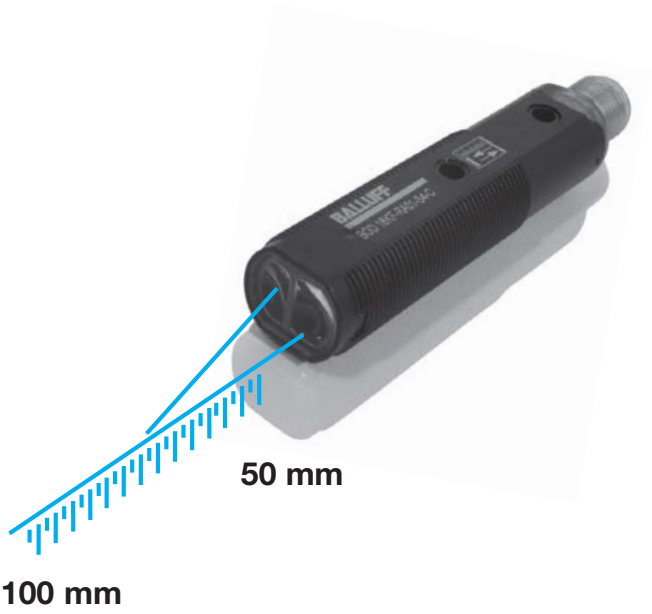
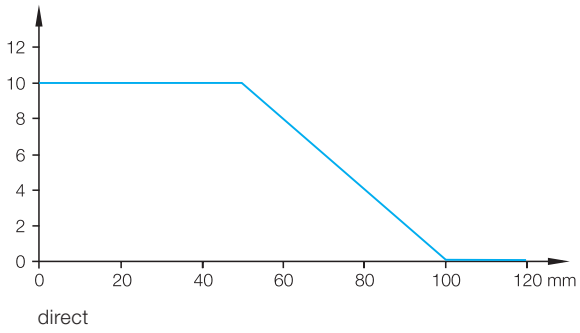
The **BOD 18KF** provides an analog signal proportional to the distance of the object. At the same time the distance is visualized by the light intensity of the yellow LED.
The red LED turns on when the target is outside the measuring range.

Features

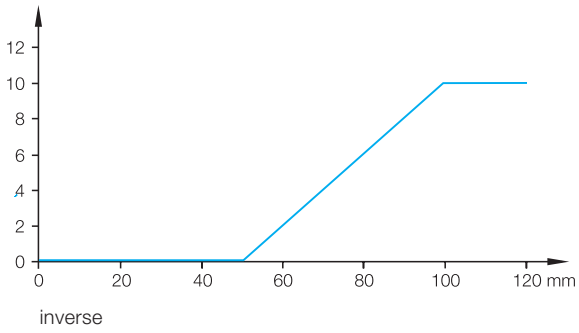
- Fixed measuring range between 50...100 mm
- Analog output 0...10 V
- Output curve can be rising or falling (direct/inverse)
- Resolution 1 mm
- Connector or cable version



Analog output

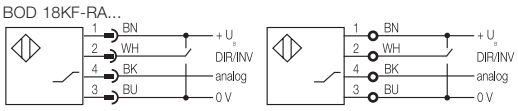


direct

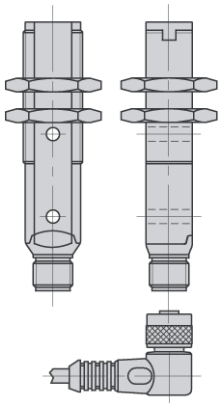


inverse

Wiring diagrams



Connector orientation



Recommended accessories

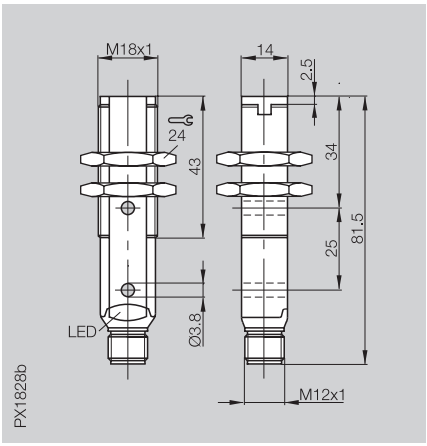
please order separately

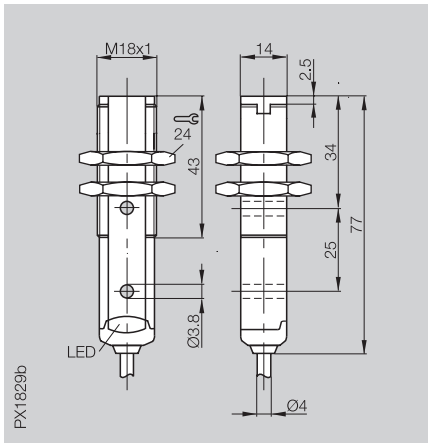
Mounting clamp
BOS 18,0-KB-1

Mounting bracket
BES 18-HW-1

Connector
Straight BKS-_ 19
Right-angle BKS-_ 20

Series	BOD 18KF	BOD 18KF
Working range	**50...100 mm**	**50...100 mm**
Measuring range	**50 mm**	**50 mm**





Ordering code	BOD 18KF-RA01-S4-C	BOD 18KF-RA01-C-02
Electrical data		
Supply voltage U_B	10...30 V DC	10...30 V DC
Ripple	≤ 2 V	≤ 2 V
No-load supply current I_0 max.	≤ 30 mA	≤ 30 mA
Analog output	0...10 V	0...10 V
Output curve	Rising/falling	Rising/falling
Settings	fixed	fixed
Optical data		
Emitter, light type	LED, red light	LED, red light
Wavelength	630 nm	630 nm
Light spot diameter	approx. 8 mm at 100 mm	approx. 8 mm at 100 mm
Resolution	1 mm/200 mV	1 mm/200 mV
Time data		
Limit frequency f	150 Hz	150 Hz
Indicators		
Output function*	LED yellow	LED yellow
Measuring range**	LED red	LED red
Mechanical data		
Dimensions	M18×81.5 mm	M18×77 mm
Connection	M12 connector, 4-pin	2 m cable, PVC
No. of wires × cross-section		4×0.14 mm²
Housing material	PBT	PBT
Lens material	PMMA	PMMA
Weight	25 g	75 g
Ambient data		
Degree of protection per IEC 60529	IP 67	IP 67
Polarity reversal protected	yes	yes
Short circuit protected	yes	yes
Ambient light rejection	EN 60947-5-2	EN 60947-5-2
Ambient temperature range T_a	–25...+55 °C	–25...+55 °C

Measurement values referenced to Kodak gray card 90% Reflexion, 100×100 mm.

*Proportional to output
**Turns on when object is outside the measuring range

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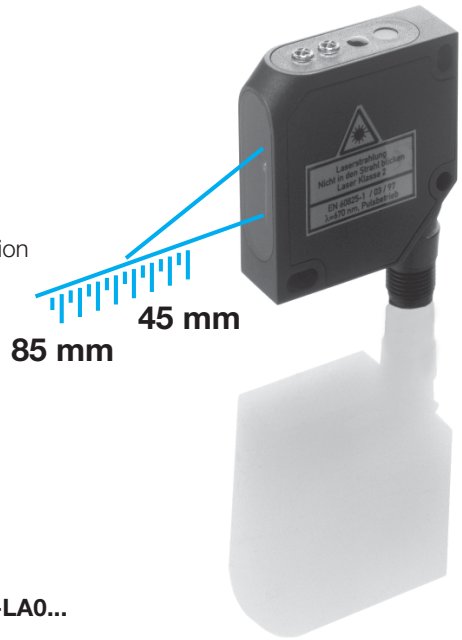
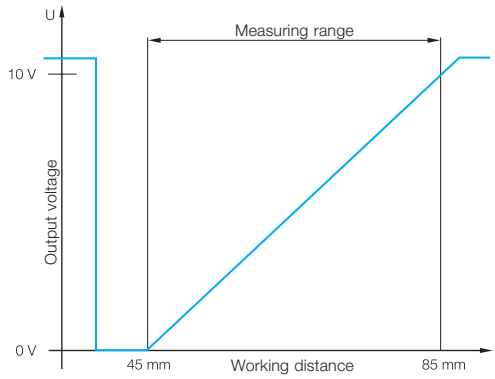
Series	
Working range	
Measuring range	

Features

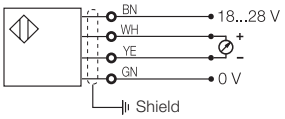
- Fixed measuring range between 45...85 mm
- Analog output 0...10 V
- Resolution 20 µm or 80 µm
- Connector or cable version

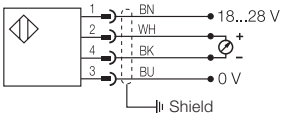


Analog output BOD 26K-LA0...



Wiring diagrams





Ordering code	
Electrical data	
Supply voltage U_B	
Ripple	
No-load supply current I_0 max.	
Analog output	
Settings	
Optical data	
Emitter, light type	
Wavelength	
Laser class	
Light spot diameter	
Temperature drift	
Resolution	
Linearity	
Time data	
Cutoff frequency	
Rise time (from 10 % to 90 %)	
Fall-off time (from 90 % to 10 %)	
Indicators	
Power-on indicator	
Contamination indicator	
Mechanical data	
Dimensions	
Connection	
No. of wires × cross-section	
Housing material	
Optical surface	
Weight	
Ambient data	
Degree of protection per IEC 60529	
Polarity reversal protected	
Short circuit protected	
Ambient light rejection	
Ambient temperature range T_a	

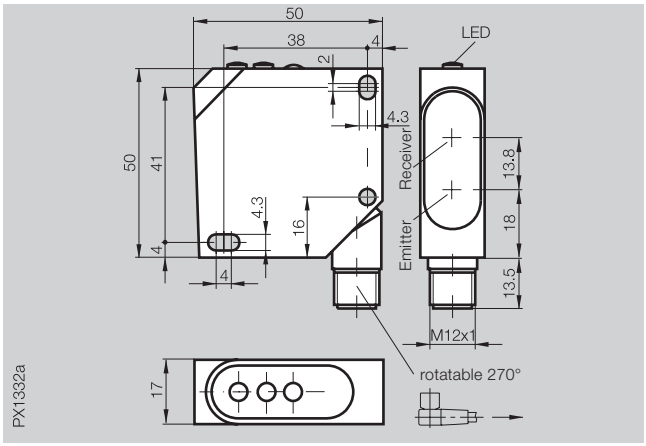
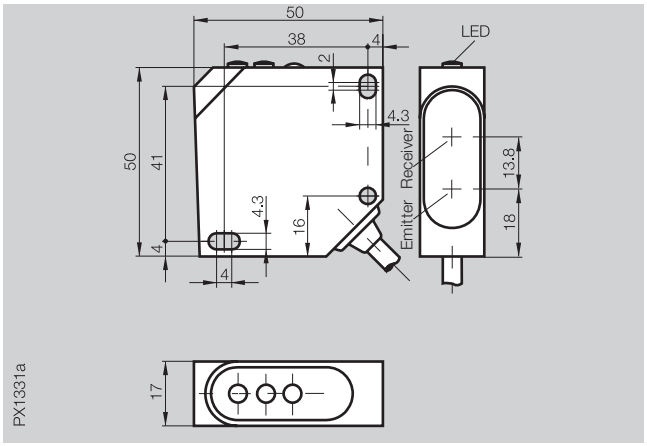
Measured values referenced to Kodak gray card 90 % Reflexion.

Connector orientation

Recommended accessories
please order separately

Mounting bracket
BOS 26-HW-1

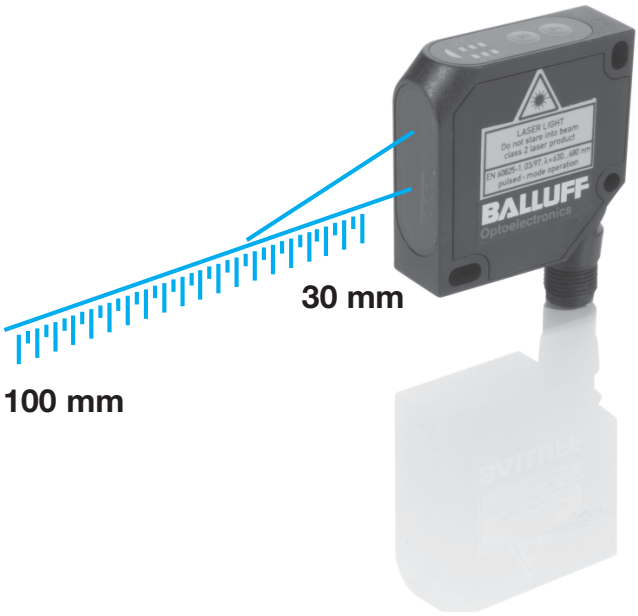
Connector
BKS-S 19-14-PU-05

	BOD 26K **45...85 mm** **40 mm**		BOD 26K **45...85 mm** **40 mm**	
				
	BOD 26K-LA01-S4-C	BOD 26K-LA02-S4-C	BOD 26K-LA01-C-06	BOD 26K-LA02-C-06
	18...28 V DC	18...28 V DC	18...28 V DC	18...28 V DC
	10 %	10 %	10 %	10 %
	≤ 35 mA	≤ 35 mA	≤ 35 mA	≤ 35 mA
	0...10 V (max. 3 mA)	0...10 V (max. 3 mA)	0...10 V (max. 3 mA)	0...10 V (max. 3 mA)
	fixed	fixed	fixed	fixed
	Laser, red light	Laser, red light	Laser, red light	Laser, red light
	670 nm	670 nm	670 nm	670 nm
	2	2	2	2
	≤ 0.8 mm at 65 mm	≤ 0.8 mm at 65 mm	≤ 0.8 mm at 65 mm	≤ 0.8 mm at 65 mm
	18 µm/°C	18 µm/°C	18 µm/°C	18 µm/°C
	80 µm	**20 µm**	**80 µm**	**20 µm**
	≤ 1 %	≤ 1 %	≤ 1 %	≤ 1 %
	400 Hz	**40 Hz**	**400 Hz**	**40 Hz**
	3 ms	30 ms	3 ms	30 ms
	2 ms	20 ms	2 ms	20 ms
	LED green	LED green	LED green	LED green
	LED red	LED red	LED red	LED red
	50×50×17 mm	50×50×17 mm	50×50×17 mm	50×50×17 mm
	M12 connector, 4-pin	M12 connector, 4-pin	6 m cable, PVC	6 m cable, PVC
			4×0.25 mm²	4×0.25 mm²
	Impact-resistant ABS	Impact-resistant ABS	Impact-resistant ABS	Impact-resistant ABS
	PMMA	PMMA	PMMA	PMMA
	40 g	40 g	600 g	600 g
	IP 67	IP 67	IP 67	IP 67
	yes	yes	yes	yes
	yes	yes	yes	yes
	EN 60947-5-2	EN 60947-5-2	EN 60947-5-2	EN 60947-5-2
	0...+45 °C	0...+45 °C	0...+45 °C	0...+45 °C

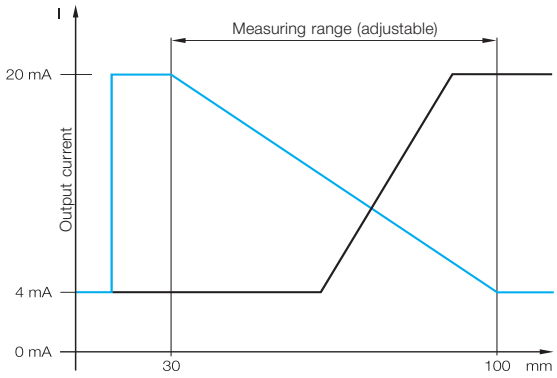
BOD
Connectors, holders ... starting page 81

Features

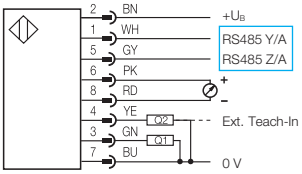
- Adjustable measuring range between 30...100 mm
- Analog output 4...20 mA adjustable: rising or falling
- Option with RS485-Interface (for Master-slave mode) and for visualization on a PC (additional software required)
- 2 switching outputs with adjustable switch points
- Teach-in
- Adjustable averaging
- Numerous additional functions



Analog output BOD 26K-LB(R)04...

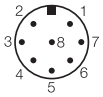


Wiring diagram



only type
BOD 26K-LB**R**...

Connector diagram



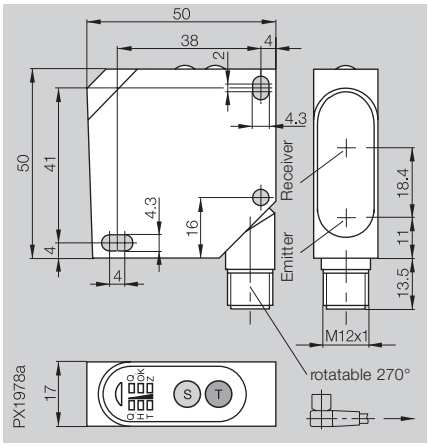
Recommended accessories

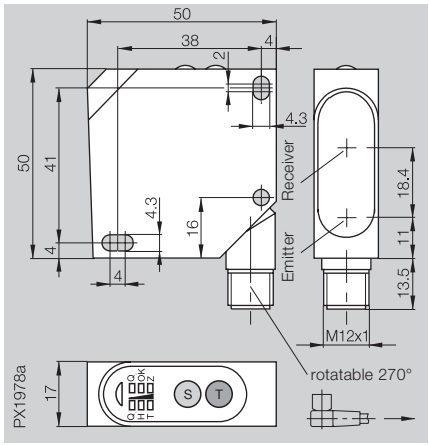
please order separately

Mounting bracket
BOS 26-HW-1

Connector
Straight, 5 m
BKS-S139-PU-05
Right-angle, 5 m
BKS-S138-PU-05

Series	BOD 26K	BOD 26K
Working range	**30...100 mm**	**30...100 mm**
Measuring range	**adjustable max. 70 mm**	**adjustable max. 70 mm**





Ordering code	BOD 26K-LB04-S115-C	BOD 26K-LBR04-S115-C
Electrical data		
Supply voltage U_B	18...30 V DC	18...30 V DC
Ripple	10 %	10 %
No-load supply current I_0 max.	≤ 40 mA	≤ 40 mA
Analog output	4...20 mA	4...20 mA
Interface		**RS485**
Switching output	2× PNP-Transistor	2× PNP-Transistor
Output current	100 mA	100 mA
Switching type	NO/NC	NO/NC
Settings	Teach-in	Teach-in
Additional functions		Master-slave mode
Optical data		
Emitter, light type	Laser, red light	Laser, red light
Wavelength	650 nm	650 nm
Laser class	2	2
Light spot diameter	3.25 mm at 100 mm	3.25 mm at 100 mm
Resolution	≤ 70 µm	≤ 70 µm
Linearity	≤ 175 µm	≤ 175 µm
Time data		
Switching frequency f	1 kHz	1 kHz
Time functions	50 ms pulse extension	50 ms pulse extension
Indicators		
Power-on indicator	LED green	LED green
Output function indicator	LED yellow	LED yellow
Mechanical data		
Dimensions	50×50×17 mm	50×50×17 mm
Connection	M12 connector, 8-pin	M12 connector, 8-pin
Housing material	Impact-resistant ABS	Impact-resistant ABS
Optical surface	PMMA	PMMA
Weight	43 g	43 g
Ambient data		
Degree of protection per IEC 60529	IP 67	IP 67
Polarity reversal protected	yes	yes
Short circuit protected	yes	yes
Ambient light rejection	EN 60947-5-2	EN 60947-5-2
Ambient temperature range T_a	–10...+60 °C	–10...+60 °C

Measured values referenced to Kodak gray card 90 % Reflexion.

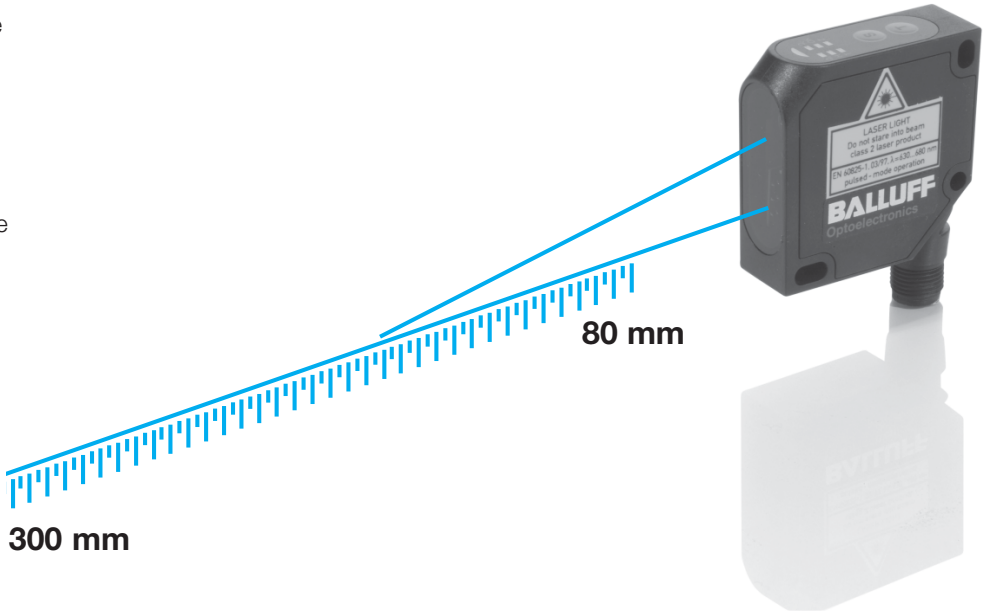
Connector orientation

BOD

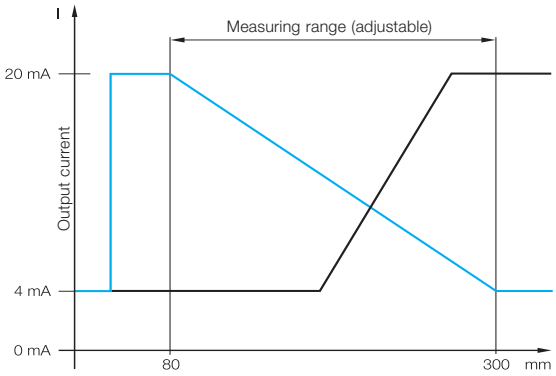
Connectors, holders ... starting page 81

Features

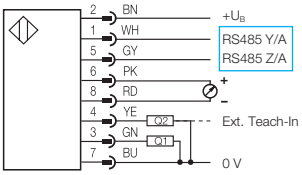
- Measuring range adjustable between 80...300 mm
- Analog output 4...20 mA adjustable: rising or falling
- Option with RS485-Interface (for Master-slave mode) and for visualization on a PC (additional software required)
- 2 switching outputs with adjustable switch points
- Teach-in
- Adjustable averaging
- Numerous additional functions



Analog output BOD 26K-LB(R)05...

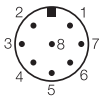


Wiring diagram



only type
BOD 26K-LB**R**...

Connector diagram



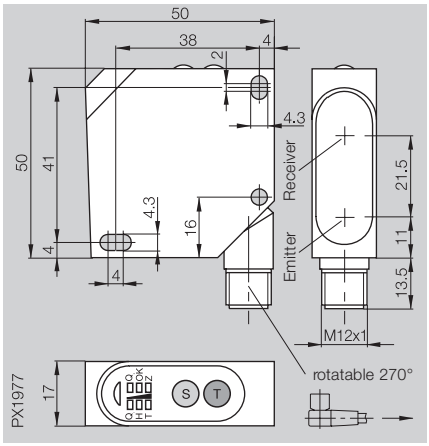
Recommended accessories

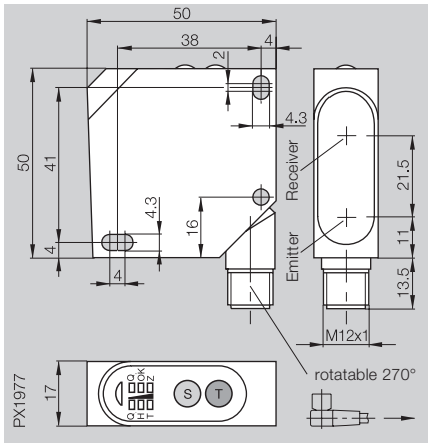
please order separately

Mounting bracket
BOS 26-HW-1

Connector
Straight, 5 m
BKS-S139-PU-05
Right-angle, 5 m
BKS-S138-PU-05

Series	BOD 26K	BOD 26K
Working range	**80...300 mm**	**80...300 mm**
Measuring range	**adjustable max. 220 mm**	**adjustable max. 220 mm**





Ordering code	BOD 26K-LB05-S115-C	BOD 26K-LBR05-S115-C
Electrical data		
Supply voltage U_B	18...30 V DC	18...30 V DC
Ripple	10 %	10 %
No-load supply current I_0 max.	≤ 40 mA	≤ 40 mA
Analog output	4...20 mA	4...20 mA
Interface		**RS485**
Switching output	2× PNP-Transistor	2× PNP-Transistor
Output current	100 mA	100 mA
Switching type	NO/NC	NO/NC
Settings	Teach-in	Teach-in
Additional functions		Master-slave mode
Optical data		
Emitter, light type	Laser, red light	Laser, red light
Wavelength	650 nm	650 nm
Laser class	2	2
Light spot diameter	4.5 mm at 300 mm	4.5 mm at 300 mm
Resolution	≤ 220 µm	≤ 220 µm
Linearity	≤ 550 µm	≤ 550 µm
Time data		
Switching frequency f	1 kHz	1 kHz
Time functions	50 ms pulse extension	50 ms pulse extension
Indicators		
Power-on indicator	LED green	LED green
Output function indicator	LED yellow	LED yellow
Mechanical data		
Dimensions	50×50×17 mm	50×50×17 mm
Connection	M12 connector, 8-pin	M12 connector, 8-pin
Housing material	Impact-resistant ABS	Impact-resistant ABS
Optical surface	PMMA	PMMA
Weight	43 g	43 g
Ambient data		
Degree of protection per IEC 60529	IP 67	IP 67
Polarity reversal protected	yes	yes
Short circuit protected	yes	yes
Ambient light rejection	EN 60947-5-2	EN 60947-5-2
Ambient temperature range T_a	–10...+60 °C	–10...+60 °C

Measured values referenced to Kodak gray card 90 % Reflexion.

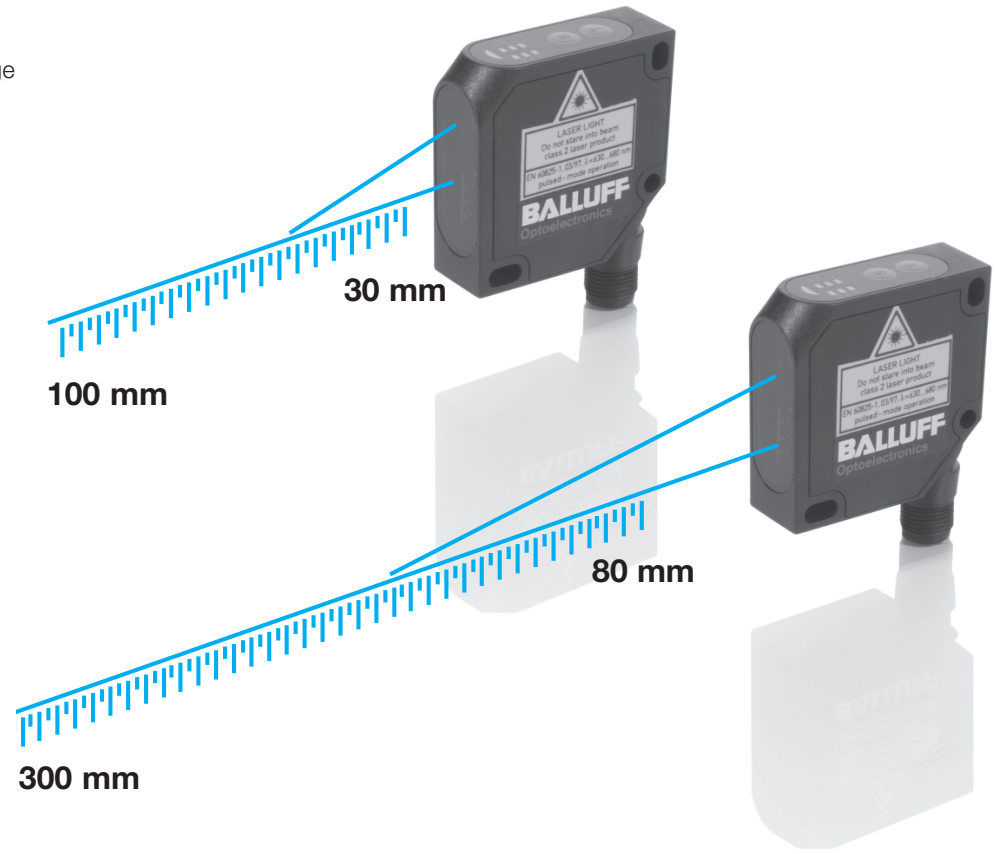
Connector orientation

BOD

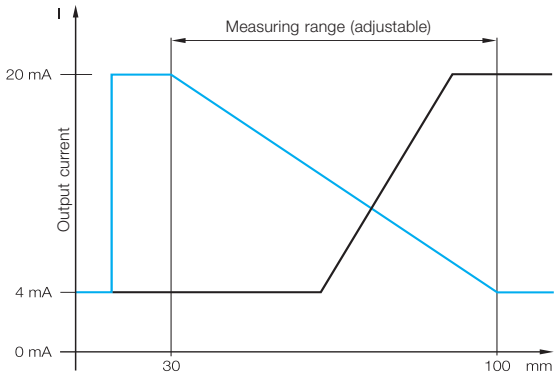
Connectors, holders ... starting page 81

Features

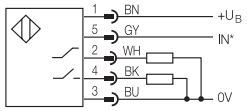
- Adjustable measuring range
- Analog output 4...20 mA adjustable: rising or falling
- 1 switching output with adjustable switch points
- Teach-in
- Laser beam can be turned off



Analog output BOD 26K-LB06...



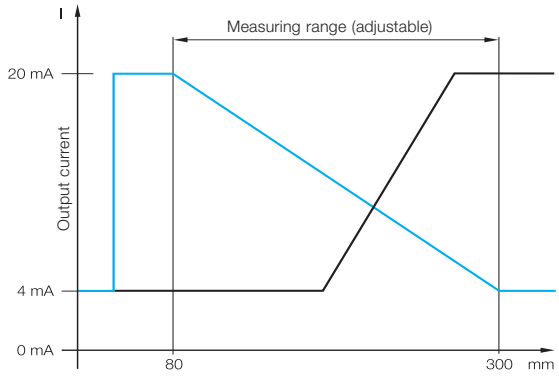
Wiring diagram



*Laser shut-off (+UB)
Key disable (0V)

Connector diagram

Analog output BOD 26K-LB07...

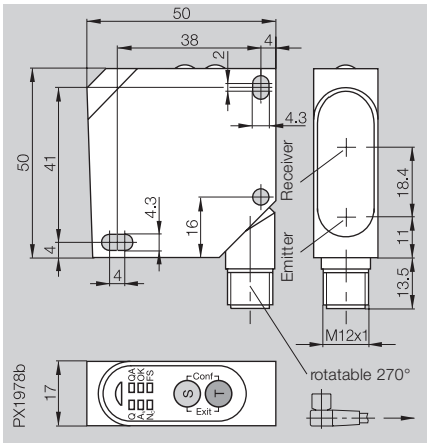


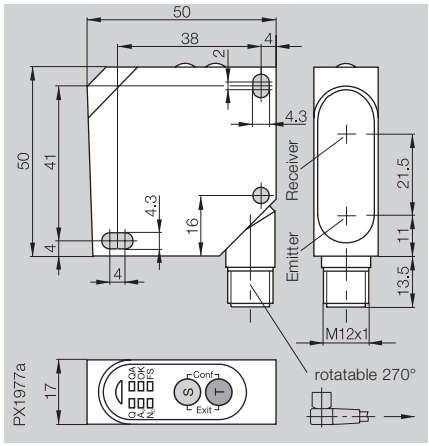
Recommended accessories
please order separately

Mounting bracket
BOS 26-HW-1

Connector
Straight BKS-S137-17-PU-05
Right-angle BKS-S134-17

Series	BOD 26K	BOD 26K
Working range	**30...100 mm**	**80...300 mm**
Measuring range	**adjustable max. 70 mm**	**adjustable max. 220 mm**





Ordering code	BOD 26K-LB06-S92-C	BOD 26K-LB07-S92-C
Electrical data		
Supply voltage U_B	18...30 V DC	18...30 V DC
Ripple	10 %	10 %
No-load supply current I_0 max.	≤ 40 mA	≤ 40 mA
Analog output	4...20 mA	4...20 mA
Switching output	1× PNP-Transistor	1× PNP-Transistor
Output current	100 mA	100 mA
Switching type	NO/NC	NO/NC
Settings	Teach-in	Teach-in
Optical data		
Emitter, light type	Laser, red light	Laser, red light
Wavelength	650 nm	650 nm
Laser class	2	2
Light spot diameter	3.25 mm at 100 mm	4.5 mm at 300 mm
Resolution	≤ 70 µm	≤ 220 µm
Linearity	≤ 175 µm	≤ 550 µm
Time data		
Switching frequency f	1 kHz	1 kHz
Time functions	50 ms pulse extension	50 ms pulse extension
Indicators		
Power-on indicator	LED green	LED green
Output function indicator	LED yellow	LED yellow
Mechanical data		
Dimensions	50×50×17 mm	50×50×17 mm
Connection	M12 connector, 5-pin	M12 connector, 5-pin
Housing material	Impact-resistant ABS	Impact-resistant ABS
Optical surface	PMMA	PMMA
Weight	43 g	43 g
Ambient data		
Degree of protection per IEC 60529	IP 67	IP 67
Polarity reversal protected	yes	yes
Short circuit protected	yes	yes
Ambient light rejection	EN 60947-5-2	EN 60947-5-2
Ambient temperature range T_a	–10...+60 °C	–10...+60 °C

Measured values referenced to Kodak gray card 90 % Reflexion.

Connector orientation

BOD

Connectors, holders ... starting page 81

The **BOD 63M** in its tough metal housing has a working range of 200...2000/6000 mm. It features adjustable background fade-out and an analog output of 0...10 V or 4...20 mA.

Speed of light measurement enables longer ranges than triangulation-based or energetic diffuse sensors.

The switching outputs are set using a multi-turn potentiometer.

This innovative sensor technology is used in applications where traditional methods meet either technological or economical limits. Such applications include detecting small objects at great distances and operating in difficult conditions. e.g. if sensing must be performed “externally” in process with high temperatures or in robotic cells.

Features

- Small laser spot for detecting small objects over large distances
- Virtually independent of the reflective properties of the target object within a particular sensing range
- Background suppression (HGA) over the entire working range
- Analog, binary and alarm output
- Laser beam can be turned off

Applications

- Exact detection tasks over long distances (e.g. due to design limitations or heat at the target location)
- Detecting objects with changing colors, shiny surfaces or unfavorable angle to the light beam
- Flexible solutions for position sensing, level detection and monitoring, distance and height measurement, quality assurance applications

Laser class
(see page 55)

The emitter meets Laser Class 2 per EN 60825-1:2001-11. This means no additional safety measures are necessary.

Install the device so that the laser warning label is easily visible.

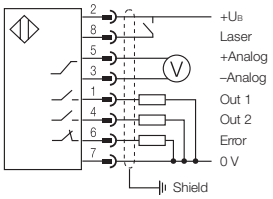
Recommended accessories
please order separately

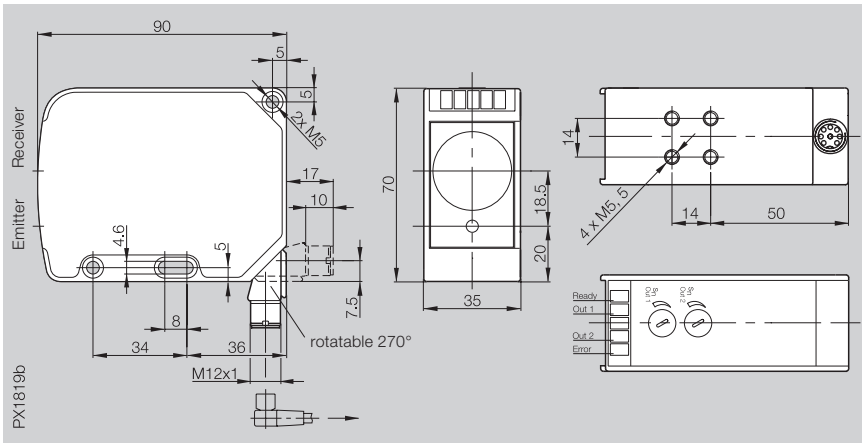
Connector
Straight, 5 m
BKS-S139-PU-05
Right-angle, 5 m
BKS-S138-PU-05

Mounting bracket
BOD 63-HW-1

These sensors are also available as IO-Link types.
Please request our separate IO-Link brochure!

Series	BOD 63M	BOD 63M
Working range	**200...2000 mm**	**200...2000 mm**
Measuring range	**1800 mm**	**1800 mm**



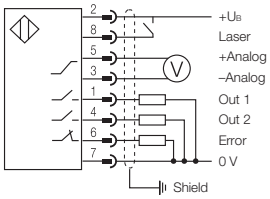


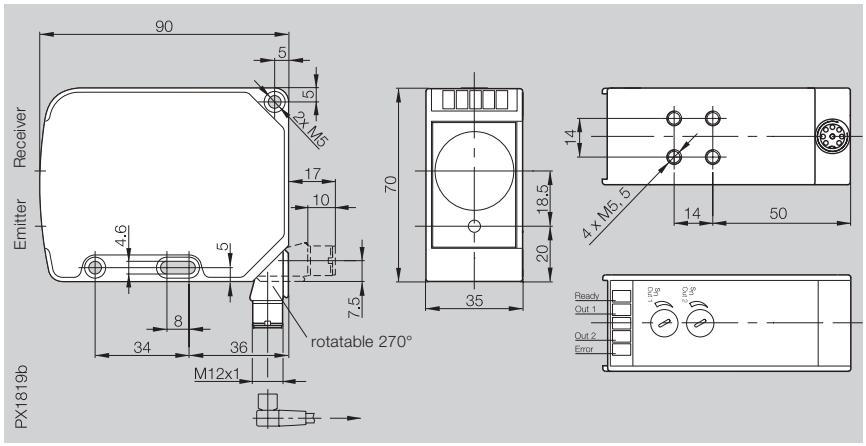
Ordering code		BOD 63M-LA02-S115	BOD 63M-LB02-S115
Electrical data			
Supply voltage U_B		15...30 V DC	15...30 V DC
No-load current I_0 max. at U_e 24 V DC		≤ 75 mA	≤ 75 mA
Analog output		**0...10 V**	**4...20 mA**
Switching outputs		2× PNP normally open	2× PNP normally open
Error output		PNP normally closed	PNP normally closed
Output current	Switching output	200 mA	200 mA
	Error output	200 mA	200 mA
Voltage drop U_d at I_e		≤ 2 V	≤ 2 V
Settings		4-turn potentiometer	4-turn potentiometer
Optical data			
Emitter, light type		Laser, red light	Laser, red light
Wavelength		660 nm	660 nm
Laser class		2 per EN 60825	2 per EN 60825
Light spot diameter		10 mm	10 mm
Resolution		≤ 1 mm	≤ 1 mm
Gray value shift		≤ 2 %	≤ 2 %
Repeat accuracy per BWN		≤ ±3 mm	≤ ±3 mm
Temperature drift		≤ 0.6 mm/°C	≤ 0.6 mm/°C
Linearity		≤ ±2%	≤ ±2%
Switching hysteresis		≤ 10 mm	≤ 10 mm
Time data			
Ready delay		≤ 20 ms	≤ 20 ms
Response time		≤ 2 ms	≤ 2 ms
Switching frequency f		≥ 250 Hz	≥ 250 Hz
Indicators			
Supply voltage		LED green	LED green
Switching output		2× LED yellow	2× LED yellow
Stability indicator		LED red	LED red
Mechanical data			
Dimensions		90×70×35 mm	90×70×35 mm
Connection		M12 connector, 8-pin	M12 connector, 8-pin
Housing material		Anodized Al	Anodized Al
Optical surface		Glass	Glass
Weight incl. holder		260 g	260 g
Ambient data			
Degree of protection per IEC 60529		IP 67	IP 67
Polarity reversal protected		yes	yes
Short circuit protected		yes	yes
Ambient temperature range T_a		–10...+60 °C	–10...+60 °C
Ambient light rejection		≤ 10 kLux	≤ 10 kLux

Connector orientation

BOD
Connectors, holders ... starting page 81

Series	BOD 63M	BOD 63M
Working range	**200...6000 mm**	**200...6000 mm**
Measuring range	**5800 mm**	**5800 mm**

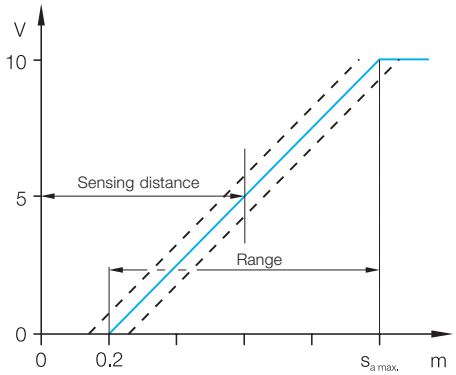


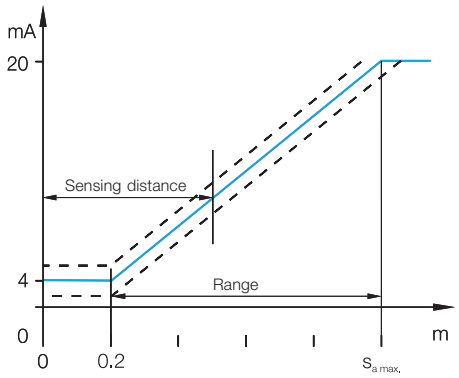


Ordering code		BOD 63M-LA04-S115	BOD 63M-LB04-S115
Electrical data			
Supply voltage U_B		15...30 V DC	15...30 V DC
No-load current I_0 max. at U_e 24 V DC		≤ 75 mA	≤ 75 mA
Analog output		**0...10 V**	**4...20 mA**
Switching outputs		2× PNP normally open	2× PNP normally open
Error output		PNP normally closed	PNP normally closed
Output current	Switching output	200 mA	200 mA
	Error output	200 mA	200 mA
Voltage drop U_d at I_e		≤ 2 V	≤ 2 V
Settings		4-turn potentiometer	4-turn potentiometer
Optical data			
Emitter, light type		Laser, red light	Laser, red light
Wavelength		660 nm	660 nm
Laser class		2 per EN 60825	2 per EN 60825
Light spot diameter		10 mm	10 mm
Resolution		≤ 1 mm	≤ 1 mm
Gray value shift		≤ 1.5 %	≤ 1.5 %
Repeat accuracy per BWN		≤ ±4 mm	≤ ±4 mm
Temperature drift		≤ 1.5 mm/°C	≤ 1.5 mm/°C
Linearity		≤ ±1%	≤ ±1%
Switching hysteresis		≤ 15 mm	≤ 15 mm
Time data			
Ready delay		≤ 20 ms	≤ 20 ms
Response time		≤ 2 ms	≤ 2 ms
Switching frequency f		≥ 250 Hz	≥ 250 Hz
Indicators			
Supply voltage		LED green	LED green
Switching output		2× LED yellow	2× LED yellow
Stability indicator		LED red	LED red
Mechanical data			
Dimensions		90×70×35 mm	90×70×35 mm
Connection		M12 connector, 8-pin	M12 connector, 8-pin
Housing material		Anodized Al	Anodized Al
Optical surface		Glass	Glass
Weight incl. holder		260 g	260 g
Ambient data			
Degree of protection per IEC 60529		IP 67	IP 67
Polarity reversal protected		yes	yes
Short circuit protected		yes	yes
Ambient temperature range T_a		–10...+60 °C	–10...+60 °C
Ambient light rejection		≤ 10 kLux	≤ 10 kLux

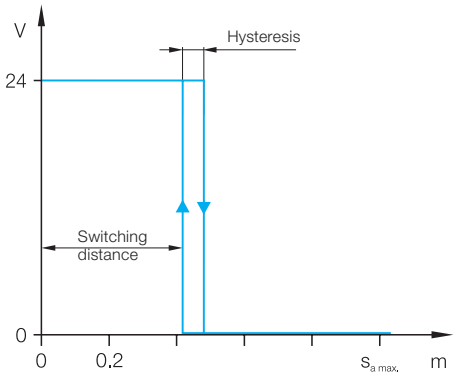
Connector orientation

Analog output

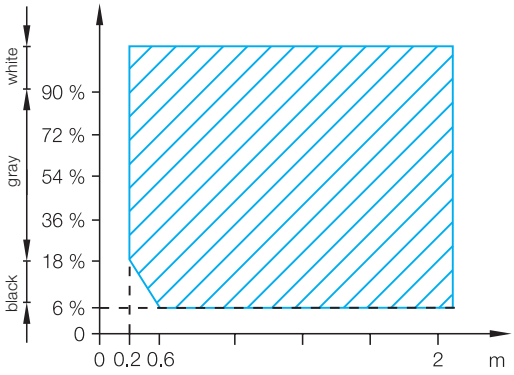




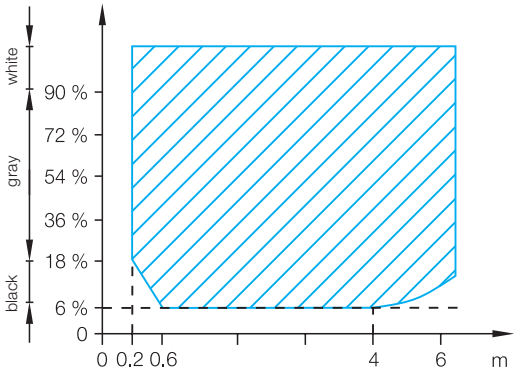
Switching output



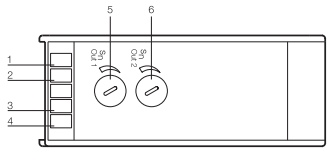
Measuring range BOD 63M-LA/LB02... depending on object reflection



Measuring range BOD 63M-LA/LB04... depending on object reflection

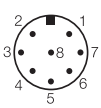


Indicators and operating elements



1 Power (green)
2 Switching output Out 1 (yellow)
3 Switching output Out 2 (yellow)
4 Stability indicator (red)
5 Potentiometer Out 1, 4 turns
6 Potentiometer Out 2, 4 turns

Connector diagram



Pin outs	Cable color	
1	white	Out 1
2	brown	$+U_B$
3	green	–Analog output
4	yellow	Out 2
5	gray	+Analog output
6	pink	Stability indicator
7	blue	0 V
8	red	Laser shut-off
Knurled ring	Braided shield	Shield

BOD
Connectors, holders ... starting page 81

Distance measurements with high resolution are achieved using triangulation and modern CCD technology.

The **BOD 66M-R_01** with analog voltage or current output and an additional switching output can measure or monitor distance and, at the same time, operate as a diffuse type with background suppression for object detection.

The BOD 66M-R_01 uses red light over a measuring range of 100...600 mm at a resolution of 0.5 mm.

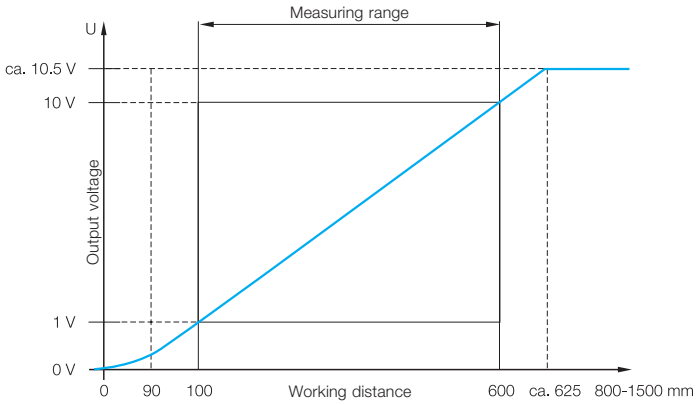
Features

- Extremely color- and ambient light insensitive
- Working range 100...600 mm
- Resolution 0.5 mm
- Analog output with voltage (1...10 V) or current (4...20 mA)
- PNP output teachable
- Tough metal housing
- Scratch-resistant glass optics

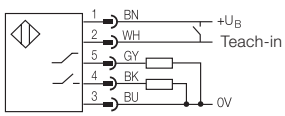
Applications

- Level monitoring
- Positioning tasks
- Winding diameter measurement
- Profile measurement
- Sag control

Analog output BOD 66M-R...



Wiring diagram



Connector diagram

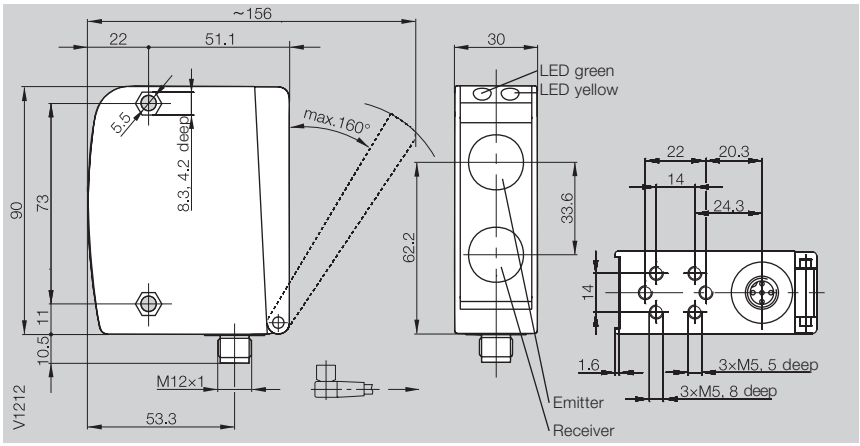
Recommended accessories

please order separately

Mounting bracket
BOD 66-HW-1

Connector
Straight BKS-S137-17-PU-05
Right-angle BKS-S134-17

Series	BOD 66M	BOD 66M
Working range	**100...600 mm**	**100...600 mm**
Measuring range	**500 mm**	**500 mm**



Ordering code	BOD 66M-RA01-S92-C	BOD 66M-RB01-S92-C
Electrical data		
Supply voltage U_B	18...30 V DC	18...30 V DC
Ripple	≤ 15 % of U_B	≤ 15 % of U_B
No-load supply current I_0 max.	≤ 150 mA	≤ 150 mA
Analog output	**1...10 V**	**4...20 mA**
Switching output	PNP normally open	PNP normally open
Output current	250 mA	250 mA
Voltage drop U_d at I_e	≤ 2 V	≤ 2 V
Settings	Teach-in	Teach-in
Optical data		
Emitter, light type	LED, red light	LED, red light
Wavelength	660 nm	660 nm
Light spot diameter	approx. 10 mm	approx. 10 mm
Resolution	≤ 0.5 mm	≤ 0.5 mm
Gray value shift (90 %/6 %)	≤ 1 %	≤ 1 %
Repeat accuracy	± 0.5 %	± 0.5 %
Temperature drift	0.2 mm/°C	0.2 mm/°C
Absolute measuring accuracy**	±2 % (of the measured distance)	±2 % (of the measured distance)
Time data		
On-/off-delay	≤ 100 ms	≤ 100 ms
Ready delay	≤ 300 ms	≤ 300 ms
Switching frequency f	20...100 Hz*	20...100 Hz*
Indicators		
Power-on indicator	LED green	LED green
Output function indicator	LED yellow	LED yellow
Mechanical data		
Dimensions	73×90×30 mm	73×90×30 mm
Connection	M12 connector, 5-pin	M12 connector, 5-pin
Housing material	Anodized Al	Anodized Al
Optical surface	Glass	Glass
Weight	250 g	250 g
Ambient data		
Degree of protection per IEC 60529	IP 65	IP 65
Polarity reversal protected	yes	yes
Short circuit protected	yes	yes
Ambient temperature range T_a	–20...+50 °C	–20...+50 °C
Ambient light rejection	≤ 5 kLux	≤ 5 kLux

*depending on object reflectivity
**Target ≥ 50×50 mm²

Connector orientation

BOD

Connectors, holders ... starting page 81

The **BOD 66M-L_04** features an analog as well as an additional switching output.
It measures object position over a range of 200...2000 mm. The switching output (with background fade-out) can also be set in the same range using a tech-in procedure. Forward-looking laser and CCD technology ensure accuracy and reliability.

Features

- Laser class 2
- Small light spot over the entire range
- CCD array for high color independence and ambient light rejection
- Analog current or voltage output over 200...2000 mm
- PNP output, teach-in
- Tough metal housing
- Scratch-resistant glass optics

Applications

- Background suppression up to 2 m
- Analog measurement up to 2 m of distance
- Positioning tasks

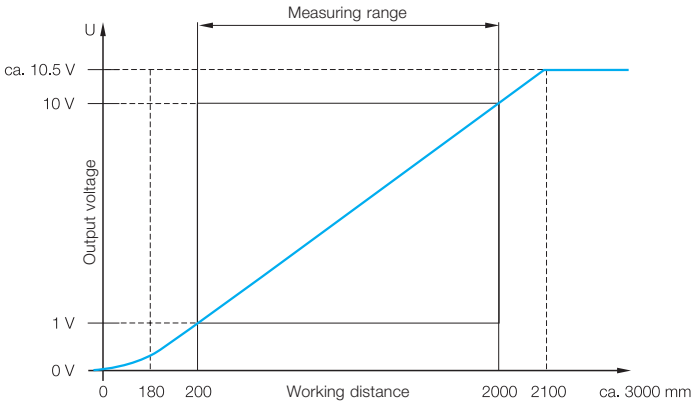
Laser class

(see page 55)

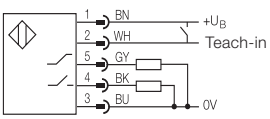
The emitter meets Laser Class 2 per EN 60825-1:2001-11. This means no additional safety measures are necessary.

Install the device so that the laser warning label is easily visible.

Analog output BOD 66M-L...



Wiring diagram



Connector diagram

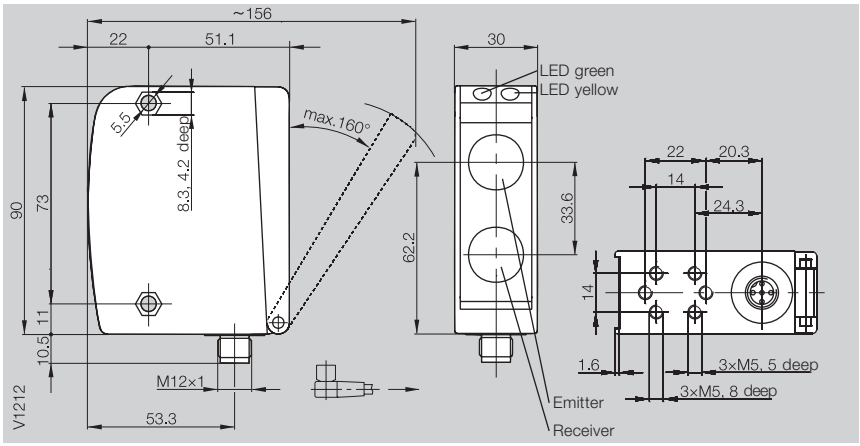
Recommended accessories

please order separately

Mounting bracket
BOD 66-HW-1

Connector
Straight BKS-S137-17-PU-05
Right-angle BKS-S134-17

Series	BOD 66M	BOD 66M
Working range	**200...2000 mm**	**200...2000 mm**
Measuring range	**1800 mm**	**1800 mm**



Ordering code	BOD 66M-LA04-S92-C	BOD 66M-LB04-S92-C
Electrical data		
Supply voltage U_B	18...30 V DC	18...30 V DC
Ripple	≤ 15 % of U_B	≤ 15 % of U_B
No-load supply current I_0 max.	≤ 150 mA	≤ 150 mA
Analog output	**1...10 V**	**4...20 mA**
Switching output	PNP normally open	PNP normally open
Output current	250 mA	250 mA
Voltage drop U_d at I_e	≤ 2 V	≤ 2 V
Settings	Teach-in	Teach-in
Optical data		
Emitter, light type	Laser, red light	Laser, red light
Wavelength	660 nm	660 nm
Laser class	2	2
Light spot diameter	3 × 12 mm² at 2 m	3 × 12 mm² at 2 m
Resolution	≤ 5 mm	≤ 5 mm
Gray value shift (90 %/6 %)	≤ 1 %	≤ 1 %
Repeat accuracy	± 0.5 %	± 0.5 %
Temperature drift	0.6 mm/°C	0.6 mm/°C
Absolute measuring accuracy**	±2 % (of the measured distance)	±2 % (of the measured distance)
Time data		
On-/off-delay	≤ 100 ms	≤ 100 ms
Ready delay	≤ 300 ms	≤ 300 ms
Switching frequency f	10...100 Hz*	10...100 Hz*
Indicators		
Power-on indicator	LED green	LED green
Output function indicator	LED yellow	LED yellow
Mechanical data		
Dimensions	73×90×30 mm	73×90×30 mm
Connection	M12 connector, 5-pin	M12 connector, 5-pin
Housing material	Anodized Al	Anodized Al
Optical surface	Glass	Glass
Weight	250 g	250 g
Ambient data		
Degree of protection per IEC 60529	IP 65	IP 65
Polarity reversal protected	yes	yes
Short circuit protected	yes	yes
Ambient temperature range T_a	–20...+50 °C	–20...+50 °C
Ambient light rejection	≤ 5 kLux	≤ 5 kLux

*depending on object reflectivity
**Target ≥ 50×50 mm²

Connector orientation

BOD

Connectors, holders ... starting page 81