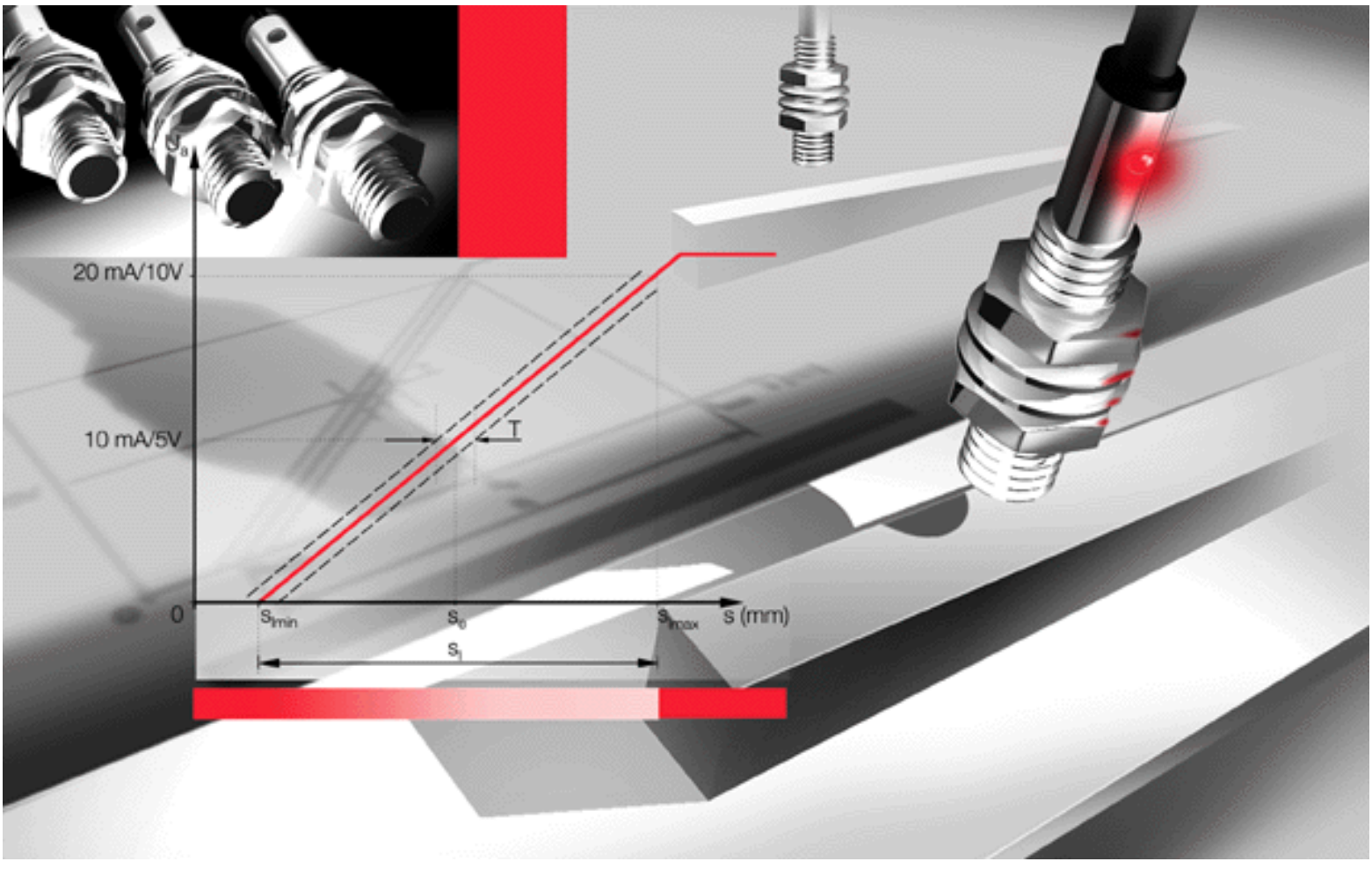
BALLUFF

Analog Sensors

Linear sensing of short travel



Analog sensors ...

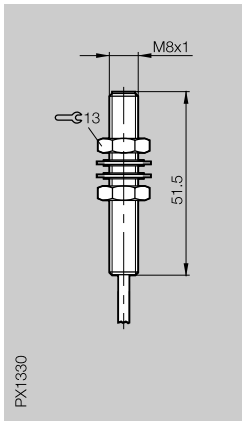
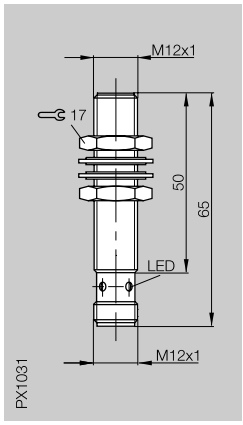
... have a linear voltage or current output signal which changes in proportion to target distance from the damping surface.–
The curve is linear over the entire working range s_l.

Some of the numerous applications in measuring and controlling include:

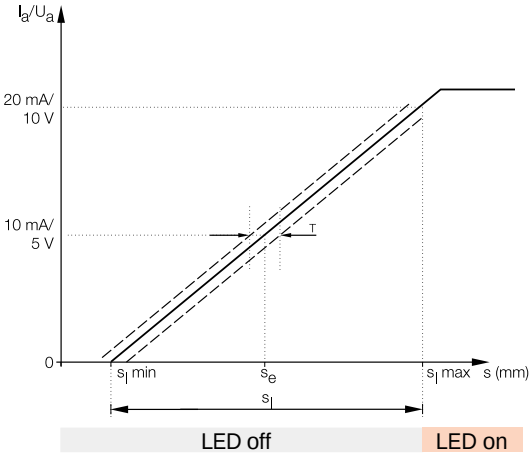
- Distance measurement
- Thickness measurement
- Run-off measurement
- Detection of surface waves
- Counting
- Positioning
- Position monitoring
- Selection of parts of various sizes and materials

Advantages of the new analog sensor family:

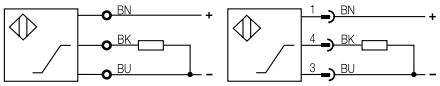
- Working range = linear range
- High repeat accuracy
- Low temperature drift
- Both connector and cable versions available
- Short and long housings

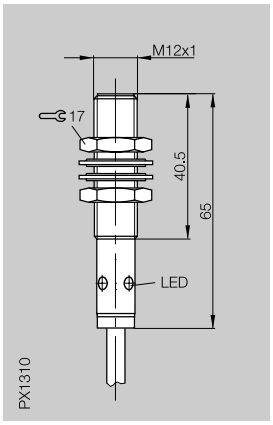
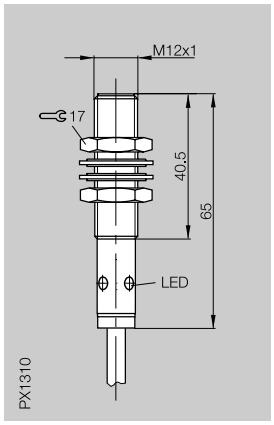
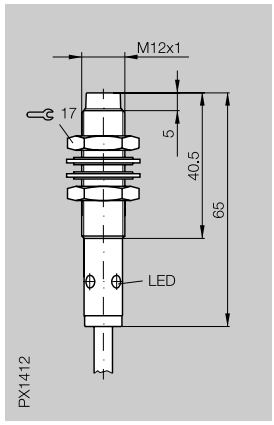
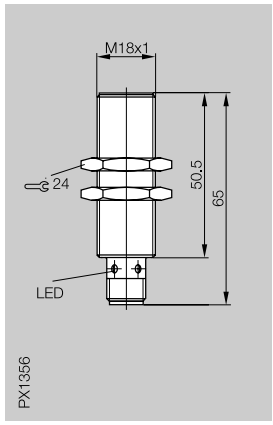
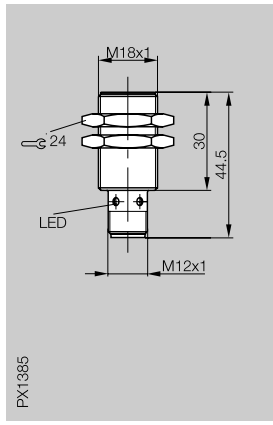
Housing size	**M8×1**	**M12×1**
Mounting	flush	flush
Output signal	**voltage 0...10 V**	**voltage 0...10 V**
Linear range s_l	0.5...1.5 mm	0.5...2 mm
		
Ordering code	BAW M08EI-UAD15B-BP03	BAW M12MI-UAC20B-S04G
Rated operational voltage U_e	24 V DC	24 V DC
Supply voltage U_B	15...30 V DC	15...30 V DC
Ripple	≤ 15 % of U_e	≤ 15 % of U_e
Rated insulation voltage U_i	250 V AC	250 V AC
Rated sensing distance s_e	1 mm	1.25 mm
Max. working point shift T at s_e	±0.1 mm	±0.125 mm
Load resistance R_l	≥ 2 KΩ	≥ 2 KΩ
No-load supply current I_0 at U_e	≤ 8 mA	≤ 10 mA
Protected against polarity reversal	yes	yes
Short circuit/overload protected	yes	yes
Ambient temperature range T_a	–10...+70 °C	–10...+70 °C
Temperature drift at s	≤ 5 % of U_a max.	≤ 5 % of U_a max.
Time delay before availability t_v	≤ 1 ms	≤ 1 ms
Max. non-linearity at s_l	±3 % of U_a max.	±3 % of U_a max.
Adjustment display (end of linear range)	no	yes
Degree of protection per IEC 529	IP 67	IP 67
Insulation class	⧈	⧈
Housing material	stainless steel	CuZn nickel plated
Material of sensing face	PBTP	PA 12
Connection	3 m PUR-cable	connector M12
No. of wires × conductor cross section	3 × 0.14 mm²	
Recommended connector		BKS-S 19/BKS-S 20

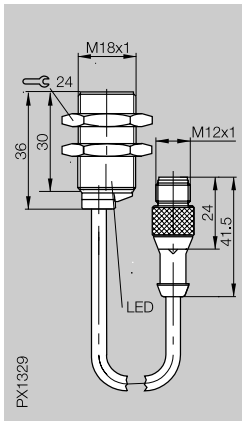
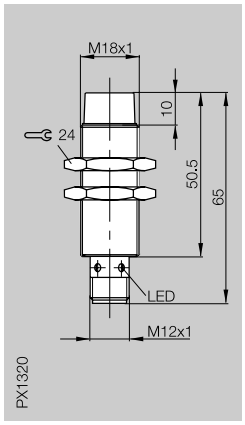
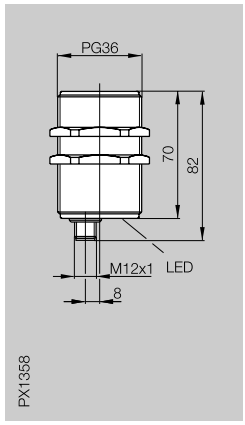
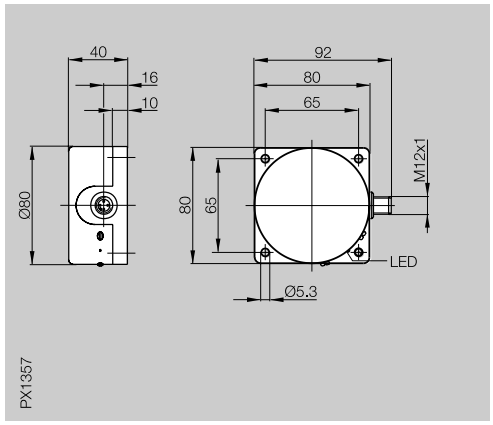
Approach Characteristics Curve



Wiring diagrams



	M12×1	**M12×1**	**M12×1**	**M18×1**	**M18×1**
	flush	flush	non flush	flush	flush
	voltage 0...10 V	**current 0...20 mA**	**voltage 0...10 V**	**voltage 0...10 V**	**voltage 0...10 V**
	0.5...2 mm	0.5...2 mm	1...4 mm	1...5 mm	1...5 mm
					
	BAW M12MG2-UAC20B-BP05	BAW M12MG2-IAC20B-BP05	BAW M12MF2-UAC40F-BP05	BAW M18MI-UAC50B-S04G	BAW M18ME-UAC50B-S04G
	24 V DC	24 V DC	24 V DC	24 V DC	24 V DC
	15...30 V DC	10...30 V DC	15...30 V DC	15...30 V DC	15...30 V DC
	≤ 15 % of U_e	≤ 15 % of U_e	≤ 15 % of U_e	≤ 15 % of U_e	≤ 15 % of U_e
	250 V AC	250 V AC	250 V AC	250 V AC	75 V DC
	1.25 mm	1.25 mm	2,5 mm	3 mm	3 mm
	±0.125 mm	±0.125 mm	±0.25 mm	±0.3 mm	±0.3 mm
	≥ 2 KΩ	≤ 0.5 KΩ	≥ 2 KΩ	≥ 2 KΩ	≥ 2 KΩ
	≤ 10 mA	≤ 10 mA	≤ 10 mA	≤ 10 mA	≤ 10 mA
	yes	yes	yes	yes	yes
	yes	yes	yes	yes	yes
	–10...+70 °C	–10...+70 °C	–10...+70 °C	–10...+70 °C	–10...+70 °C
	≤ 5 % of U_a max.	≤ 5 % of I_a max.	≤ 5 % of U_a max.	≤ 5 % of U_a max.	≤ 5 % of U_a max.
	≤ 1 ms	≤ 1 ms	≤ 1 ms	≤ 1 ms	≤ 1 ms
	±3 % of U_a max.	±3 % of I_a max	±3 % of U_a max.	±3 % of U_a max.	±3 % of U_a max.
	yes	yes	yes	yes	yes
	IP 67	IP 67	IP 67	IP 67	IP 67
	⧈	⧈	⧈	⧈	
	CuZn nickel plated	CuZn nickel plated	CuZn nickel plated	CuZn nickel plated	CuZn nickel plated
	PA 12	PA 12	PBTP	PBTP	PBTP
	5 m PUR-cable	5 m PUR-cable	5 m PUR-cable	connector M12	connector M12
	3 × 0.34 mm²	3 × 0.34 mm²	3 × 0.34 mm²		
				BKS-S 19/BKS-S 20	BKS-S 19/BKS-S 20

M18×1	**M18×1**	**PG 36**	**80×80×40**
flush	non flush	flush	non flush
voltage 0...10 V	**voltage 0...10 V**	**voltage 0...10 V**	**voltage 0...10 V**
1...5 mm	2...8 mm	0...20 mm	0...50 mm
			
BAW M18ME-UAC50B-BP_ -GS04	BAW M18MG-UAC80F-S04G	BAW MKZ-471.19-S4	BAW MKK-050.19-S4
24 V DC	24 V DC	24 V DC	24 V DC
15...30 V DC	15...30 V DC	U_e ±20 %	U_e ±20 %
≤ 15 % of U_e	≤ 15 % of U_e	≤ 15 % of U_e	≤ 15 % of U_e
75 V DC	250 V AC	250 V AC	250 V AC
3 mm	5 mm	10 mm	25 mm
±0.3 mm	±0.5 mm	±0.1 mm	±1 mm
≥ 2 KΩ	≥ 2 KΩ	≥ 10 KΩ	≥ 10 KΩ
≤ 10 mA	≤ 10 mA	≤ 12 mA	≤ 12 mA
yes	yes	yes	yes
yes	yes	yes	yes
–10...+70 °C	–10...+70 °C	–10...+70 °C	–10...+70 °C
≤ 5 % of U_a max.	≤ 5 % of U_a max.	≤ 5 %	≤ 7 %
≤ 1 ms	≤ 1 ms	1 s	1 s
±3 % of U_a max.	±3 % of U_a max.	≤ 1 %	≤ 2 %
yes	yes	no	no
IP 67	IP 67	IP 67	IP 67
	⧈		
CuZn nickel plated	CuZn nickel plated	CuZn nickel plated	PBTP
PBTP	PBTP	PBTP	PBTP
cable with connector	connector M12	connector M12	connector M12
BKS-S 19/BKS-S 20	BKS-S 19/BKS-S 20	BKS-S 19/BKS-S 20	BKS-S 19/BKS-S 20

Please add the cable lenght to the ordering code!
00.2 = 0.2 m PUR-cable
01.5 = 1.5 m PUR-cable

Analog Sensors

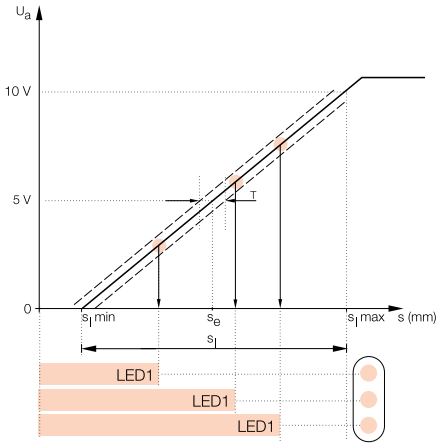
Analog sensor with integrated switching outputs

Inductive analog sensors output a signal which is proportional to the target distance.
Many applications also call for a switching signal at certain points along the travel distance. These discrete signals are used to indicate when a particular position of the target, generally the moving member of a machine, has been reached.
In the past this required the use of an additional, external analog switching device. This separate component has now been eliminated. Balluff has developed an analog sensor with three integrated switching thresholds. These thresholds are programmable and are available as a switching signal on their own dedicated lines.
All this is packaged in a standard M18 housing 76 mm in length.
The 3 switching outputs are programmed using a "teach-in" procedure, whereby the sensor is positioned at the desired switching distance from the object.
By connecting the control line with + the switch is "taught", i.e. now knows to switch an output whenever this internal signal level is reached.
An LED for each output indicates the switching state of that output.
In addition an analog signal from 0 to 10 V is output.
The linearity of this signal is <±3 %, with a sensing range of 1...5 mm.
The sensor may be flush mounted in steel.

Two in one – Sensor and analog switching unit

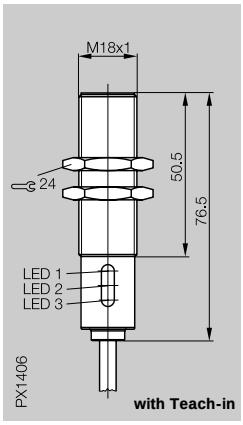
Instead of mounting two devices, only the sensor itself is necessary. Since programming is remote, the switching outputs can be set even if the sensor is mounted in an inaccessible location.

Approach Characteristics Curve



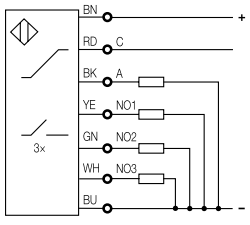
With sensors having the "Teach-in" function the switching distance can be freely programmed within the working range. This can be done either using the BES 516-4 programmer or directly on the control line of the sensor.

Housing size	**M18×1**
Mounting	flush
Output signal	**voltage 0...10 V**
Linear range s_r	1...5 mm

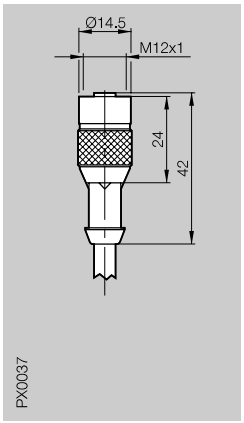
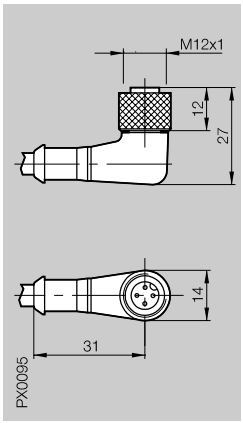


Ordering code	BAW M18MI2-UAC50B-BP05-002
Rated operational voltage U_e	24 V DC
Supply voltage U_B	15...30 V DC
Ripple	≤ 15 % of U_e
Rated insulation voltage U_i	75 V DC
Rated sensing distance s_e	3 mm
Max. working point shift T at s_e	±0.3 mm
Load resistance R_l for analog output	≥ 2 KΩ
No-load supply current I_0 at U_e	≤ 20 mA
Protected against polarity reversal	yes
Short circuit/overload protected	yes
Ambient temperature range T_a	–10...+70 °C
Temperature drift at s_r	≤ 5 % of U_a max.
Time delay before availability t_v	≤ 5 ms
Max. non-linearity at s_r	±3 % of U_a max.
Degree of protection per IEC 529	IP 67
Housing material	CuZn nickel plated
Material of sensing face	PBTP
Connection	5 m PUR-cable
No. of wires × conductor cross section	7 × 0.25 mm²
LED display for each output	yes
Teach-in function	yes
Hysteresis	≤ 0.3 mm
Repeat accuracy R	≤ 0.1 mm
Effective operating current I_e for one switching output	20 mA
Voltage drop U_d at I_e	≤ 1.5 V

Wiring diagram

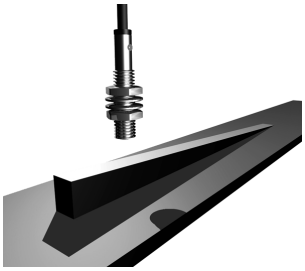


For easy programming: BES 516-4

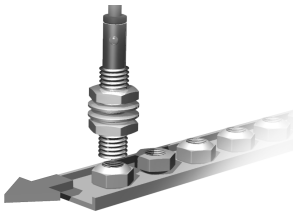
Connectors	**BKS-S 19**	**BKS-S 20**
Type	straight	right angle
For use with	S 4 connector switch	S 4 connector switch
			
without LED	BKS-S 19-1-_ _	BKS-S 20-1-_ _
Supply voltage U_B	10...30 V DC	10...30 V DC
Cable	molded-in PUR	molded-in PUR
Lead cross-section/gauge	3 × 0.34 mm²/AWG 22	3 × 0.34 mm²/AWG 22
Degree of protection per	IP 68 and BWN Pr. 20	IP 68 and BWN Pr. 20
Ambient temperature range T_a	–25...+ 90 °C	–25...+ 90 °C

Please add the cable lenght to the ordering code!
PU-03, PU-05 = PUR, 3 m or 5 m length

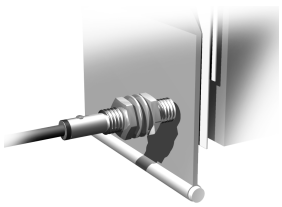
Interesting applications for analog sensors



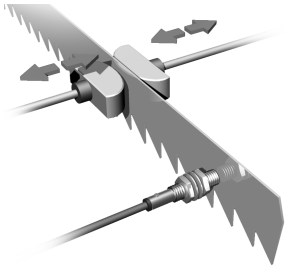
With a sensing distance of 5 or 10 mm, length measurements are normally out of reach. But if the angled surface is detected, distances of 50 mm and more can be measured. Note however that in this configuration linearity and repeatability will be degraded.



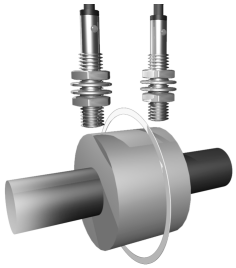
Nuts are checked for correct location (assembly robots).



2 inserted sheets of paper provides double the deflection of the spring steel band.



Measuring deflection, for example of a saw blade. The slant of the saw blade is detected by the sensor and the blade guide mechanism accordingly adjusted. Blade regulation within a range of 0.2 to 0.5 mm.



Detecting large linear motion on machines using economical analog sensors. Detecting a defined center position of a sliding machine part and rotation. A controller processes both sensor signals.

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