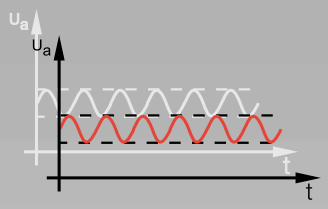
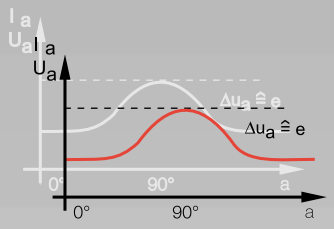
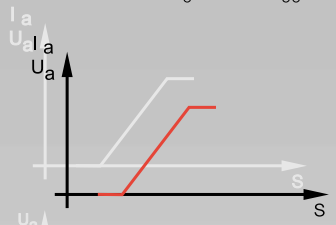
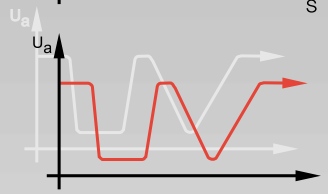
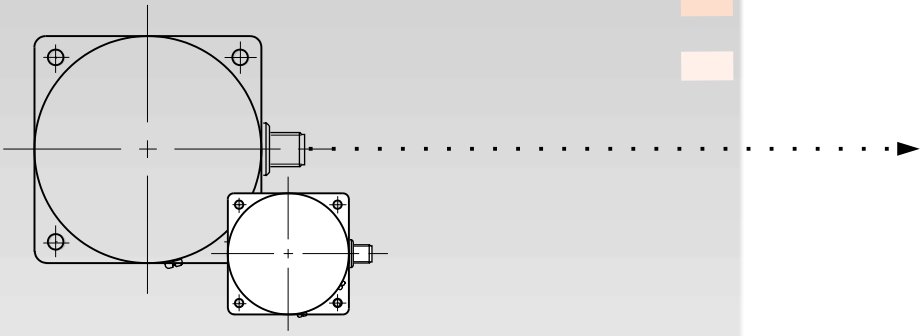


## Analog Sensors BAW

... 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 $s_l$.





### Application examples

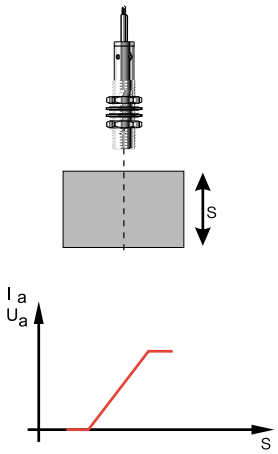
Some of the numerous applications in measuring and controlling include:

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

### Features

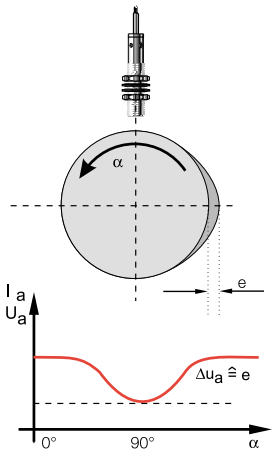
- Distance-proportional analog signal
- Housing sizes M8...80×80
- Sensing ranges 1...50 mm
- Non-contact, absolute operating principle
- High repeat accuracy
- Low temperature drift
- LED for setup aid
- Compact, sealed, rugged and reliable

### Axial approach



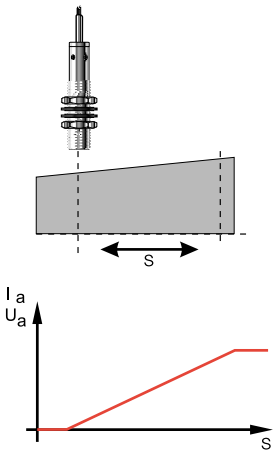

Distance changes in the sensor axis result in proportionally changing output signals.

### Sensing a rotating object



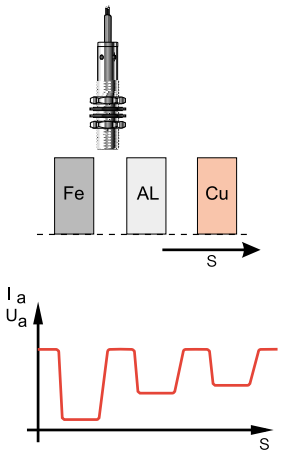

Eccentric cams, lobes or imbalances result in a periodic change of the output signal.

### Lateral approach



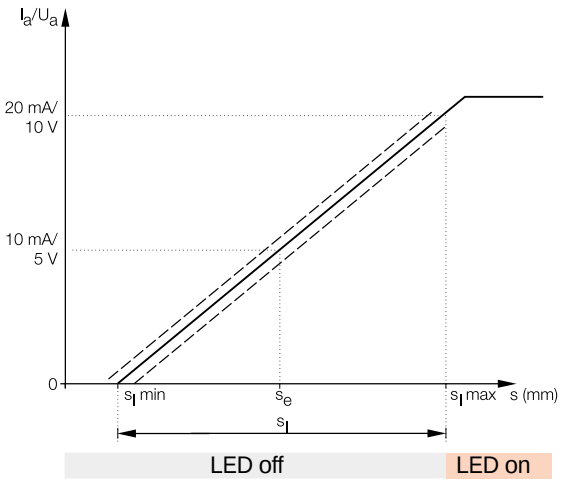

Detecting larger travel by sensing an inclined surface.

### Sensing various materials

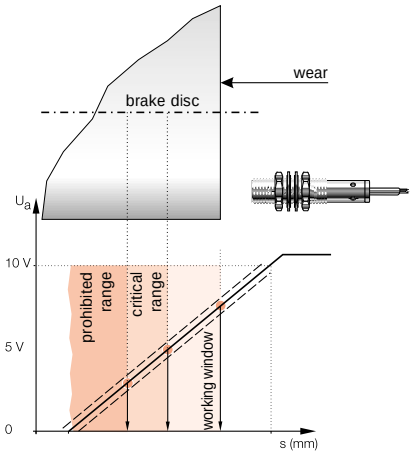



With the distance constant, the output signal will change only of the object material changes.

### Approach curve

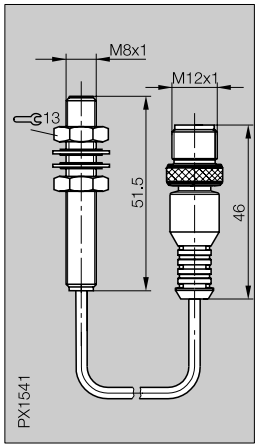


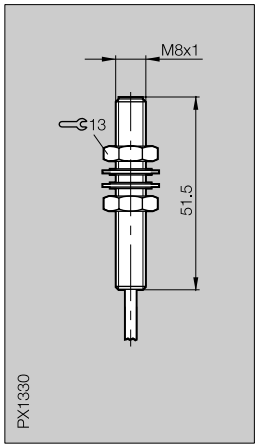

### Processing programmable switchpoints



| | | | |
|---|---|---|---|
| Housing size | **M8×1** | **M8×1** | |
| Mounting | flush | flush | |
| Output signal | **voltage 0...10 V** | **voltage 0...10 V** | |
| Linear range $s_l$ | 0.5...1.5 mm | 0.5...1.5 mm | |

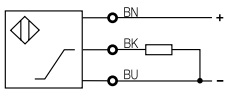
CE

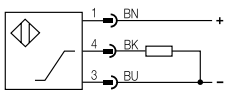



| Ordering code | BAW M08EI-UAD15B-BP____-GS04 | BAW M08EI-UAD15B- | |
|---|---|---|---|
| Rated operational voltage $U_e$ | 24 V DC | 24 V DC | |
| Supply voltage $U_B$ | 15...30 V DC | 15...30 V DC | |
| Ripple | ≤ 15 % of $U_e$ | ≤ 15 % of $U_e$ | |
| Rated insulation voltage $U_i$ | 250 V AC | 250 V AC | |
| Rated sensing distance $s_e$ | 1 mm | 1 mm | |
| Load resistance $R_l$ | ≥ 2 kΩ | ≥ 2 kΩ | |
| No-load supply current $I_0$ at $U_e$ | ≤ 8 mA | ≤ 8 mA | |
| Protected against polarity reversal | yes | yes | |
| Short circuit protected | yes | yes | |
| Ambient temperature range $T_a$ | –10...+70 °C | –10...+70 °C | |
| Temperature drift at $s_l$ | ≤ 5 % of $U_a$ max. | ≤ 5 % of $U_a$ max. | |
| Max. non-linearity at $s_l$ | ±3 % of $U_a$ max. | ±3 % of $U_a$ max. | |
| Adjustment indication (end of linear range) | no | no | |
| Degree of protection per IEC 60529 | IP 67 | IP 67 | |
| Insulation class | ⧈ | ⧈ | |
| Housing material | stainless steel | stainless steel | |
| Material of sensing face | PBT | PBT | |
| Connection | cable with connector | cable | |
| No. of wires × conductor cross section | | 3 × 0.14 mm² | |
| Approval | cULus | cULus | |
| Recommended connector | BKS-B 19 | | |

**Wiring diagrams**



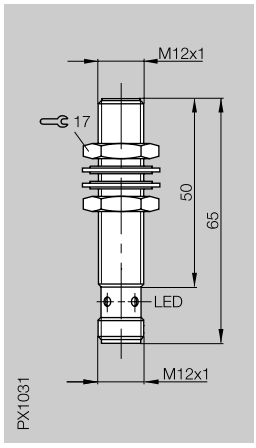
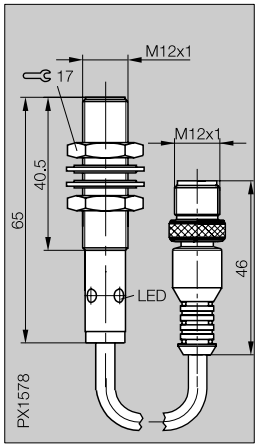
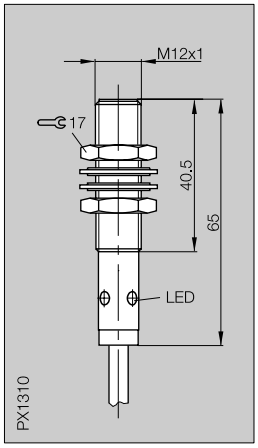
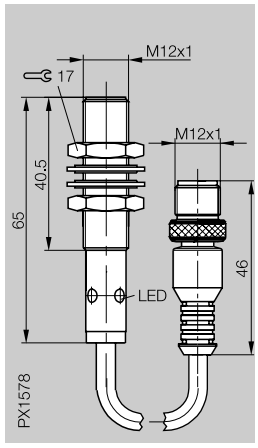




Please add the cable length to the ordering code for sensors with **cable!**
BP03, BP05 = PUR, length 3 m or 5 m

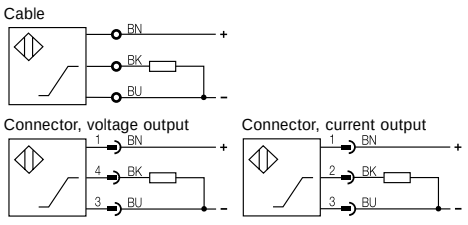
Please add the cable length to the ordering code for sensors with **cable and connector!**
00,2, 00,5 = PUR, length 0.2 or 0.5 m

1.7

6
Connectors, clamps ... page 6.2 ...

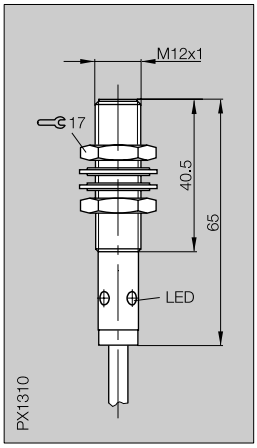
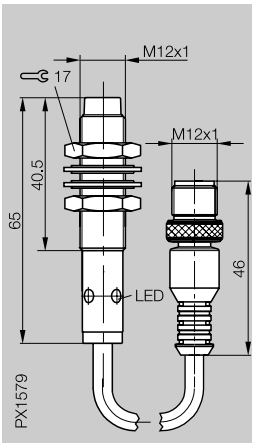
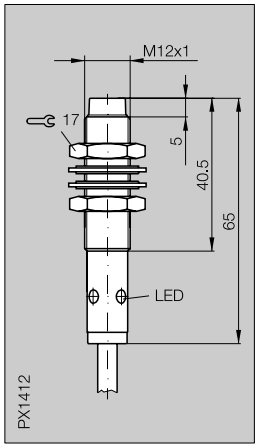
| | | | | |
|---|---|---|---|---|
| Housing size | **M12×1** | **M12×1** | **M12×1** | **M12×1** |
| Mounting | flush | flush | flush | flush |
| Output signal | **voltage 0...10 V** | **voltage 0...10 V** | **voltage 0...10 V** | **current 0...20 mA** |
| Linear range $s_l$ | 0.5...2 mm | 0.5...2 mm | 0.5...2 mm | 0.5...2 mm |
| |  |  |  |  |
| Ordering code | BAW M12MI-UAC20B-S04G | BAW M12MG2-UAC20B-BP____-GS04 | BAW M12MG2-UAC20B- | BAW M12MG2-IAC20B-BP____-GS04 |
| Rated operational voltage $U_e$ | 24 V DC | 24 V DC | 24 V DC | 24 V DC |
| Supply voltage $U_B$ | 15...30 V DC | 15...30 V DC | 15...30 V DC | 10...30 V DC |
| Ripple | ≤ 15 % of $U_e$ | ≤ 15 % of $U_e$ | ≤ 15 % of $U_e$ | ≤ 15 % of $U_e$ |
| Rated insulation voltage $U_i$ | 250 V AC | 250 V AC | 250 V AC | 250 V AC |
| Rated sensing distance $s_e$ | 1.25 mm | 1.25 mm | 1.25 mm | 1.25 mm |
| Load resistance $R_l$ | ≥ 2 kΩ | ≥ 2 kΩ | ≥ 2 kΩ | ≤ 0.5 kΩ |
| No-load supply current $I_0$ at $U_e$ | ≤ 10 mA | ≤ 10 mA | ≤ 10 mA | ≤ 10 mA |
| Protected against polarity reversal | yes | yes | yes | yes |
| Short circuit protected | yes | yes | yes | yes |
| Ambient temperature range $T_a$ | –10...+70 °C | –10...+70 °C | –10...+70 °C | –10...+75 °C |
| Temperature drift at $s_l$ | ≤ 5 % of $U_a$ max. | ≤ 5 % of $U_a$ max. | ≤ 5 % of $U_a$ max. | ≤ 5 % of $I_a$ max. |
| Max. non-linearity at $s_l$ | ±3 % of $U_a$ max. | ±3 % of $U_a$ max. | ±3 % of of $U_a$ max. | ±3 % of $I_a$ max. |
| Adjustment indication (end of linear range) | yes | yes | yes | yes |
| Degree of protection per IEC 60529 | IP 67 | IP 67 | IP 67 | IP 67 |
| Insulation class | ⧈ | ⧈ | ⧈ | ⧈ |
| Housing material | CuZn nickel plated | CuZn nickel plated | CuZn nickel plated | CuZn nickel plated |
| Material of sensing face | PA 12 | PA 12 | PA 12 | PA 12 |
| Connection | connector | cable with connector | cable | cable with connector |
| No. of wires × conductor cross section | | | 3 × 0.34 mm² | |
| Approval | cULus | cULus | cULus | cULus |
| Recommended connector | BKS-B 19/BKS-B 20 | BKS-B 19 | | BKS-B 19 |

### Wiring diagrams



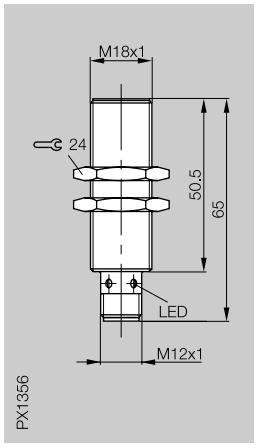
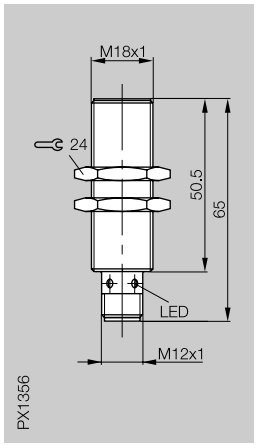
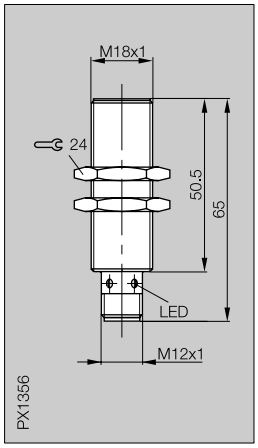
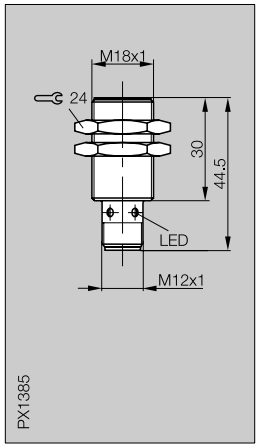

Please add the cable length to the ordering code for sensors with **cable!**
BP03, BP05 = PUR, length 3 m or 5 m

Please add the cable length to the ordering code for sensors with **cable and connector!**
00,2, 00,5 = PUR, length 0.2 or 0.5 m

| | | | | | | |
|---|---|---|---|---|---|---|
| | **M12×1** | **M12×1** | **M12×1** | | | |
| | flush | non-flush | non-flush | | | |
| | **current 0...20 mA** | **voltage 0...10 V** | **voltage 0...10 V** | | | |
| | 0.5...2 mm | 1...4 mm | 1...4 mm | | | |
| |  |  |  | | | |
| | BAW M12MG2-IAC20B- | BAW M12MF2-UAC40F-BP____-GS04 | BAW M12MF2-UAC40F- | | | |
| | 24 V DC | 24 V DC | 24 V DC | | | |
| | 10...30 V DC | 15...30 V DC | 15...30 V DC | | | |
| | ≤ 15 % of $U_e$ | ≤ 15 % of $U_e$ | ≤ 15 % of $U_e$ | | | |
| | 250 V AC | 250 V AC | 250 V AC | | | |
| | 1.25 mm | 2.5 mm | 2.5 mm | | | |
| | ≤ 0.5 kΩ | ≥ 2 kΩ | ≥ 2 kΩ | | | |
| | ≤ 10 mA | ≤ 10 mA | ≤ 10 mA | | | |
| | yes | yes | yes | | | |
| | yes | yes | yes | | | |
| | –10...+70 °C | –10...+70 °C | –10...+70 °C | | | |
| | ≤ 5 % of $I_a$ max. | ≤ 5 % of $U_a$ max. | ≤ 5 % of $U_a$ max. | | | |
| | ±3 % of $I_a$ max. | ±3 % of $U_a$ max. | ±3 % of $U_a$ max. | | | |
| | yes | yes | yes | | | |
| | IP 67 | IP 67 | IP 67 | | | |
| | ⊡ | ⊡ | ⊡ | | | |
| | CuZn nickel plated | CuZn nickel plated | CuZn nickel plated | | | |
| | PA 12 | PBT | PBT | | | |
| | cable | cable with connector | cable | | | |
| | 3 × 0.34 mm² | | 3 × 0.34 mm² | | | |
| | cULus | cULus | cULus | | | |
| | | BKS-B 19 | | | | |

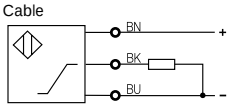


6
Connectors, clamps ...
page 6.2 ...

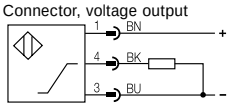
| | | | | |
|---|---|---|---|---|
| Housing size | **M18×1** | **M18×1** | **M18×1** | **M18×1** |
| Mounting | flush | flush | flush | flush |
| Output signal | **voltage 0...10 V** | **current 0...20 mA** | **current 4...20 mA** | **voltage 0...10 V** |
| Linear range $s_l$ | 1...5 mm | 1...5 mm | 1...5 mm | 1...5 mm |
| |  |  |  |  |
| Ordering code | BAW M18MI-UAC50B-S04G | BAW M18MI-IAC50B-S04G | BAW M18MI-ICC50B-S04G | BAW M18ME-UAC50B-S04G |
| Rated operational voltage $U_e$ | 24 V DC | 24 V DC | 24 V DC | 24 V DC |
| Supply voltage $U_B$ | 15...30 V DC | 10...30 V DC | 10...30 V DC | 15...30 V DC |
| Ripple | ≤ 15 % of $U_e$ | ≤ 15 % of $U_e$ | ≤ 15 % of $U_e$ | ≤ 15 % of $U_e$ |
| Rated insulation voltage $U_i$ | 250 V AC | 250 V AC | 250 V AC | 75 V DC |
| Rated sensing distance $s_e$ | 3 mm | 3 mm | 3 mm | 3 mm |
| Load resistance $R_l$ | ≥ 2 kΩ | ≤ 0.5 kΩ | ≤ 0.5 kΩ | ≥ 2 kΩ |
| No-load supply current $I_0$ at $U_e$ | ≤ 10 mA | ≤ 10 mA | ≤ 10 mA | ≤ 10 mA |
| Protected against polarity reversal | yes | yes | yes | yes |
| Short circuit protected | yes | yes | yes | yes |
| Ambient temperature range $T_a$ | –10...+70 °C | –10...+70 °C | –10...+70 °C | –10...+70 °C |
| Temperature drift at $s_l$ | ≤ 5 % of $U_a$ max. | ≤ 5 % of $I_a$ max. | ≤ 5 % of $I_a$ max. | ≤ 5 % of $U_a$ max. |
| Max. non-linearity at $s_l$ | ±3 % of $U_a$ max. | ±3 % of $I_a$ max. | ±3 % of $I_a$ max. | ±3 % of $U_a$ max. |
| Adjustment indication (end of linear range) | yes | yes | yes | yes |
| Degree of protection per IEC 60529 | IP 67 | IP 67 | IP 67 | IP 67 |
| Insulation class | ⧈ | ⧈ | ⧈ | |
| Housing material | CuZn nickel plated | CuZn nickel plated | CuZn nickel plated | CuZn nickel plated |
| Material of sensing face | PBT | PBT | PBT | PBT |
| Connection | connector | connector | connector | connector |
| No. of wires × conductor cross section | | | | |
| Approval | cULus | cULus | cULus | cULus |
| Recommended connector | BKS-B 19/BKS-B 20 | BKS-B 19/BKS-B 20 | BKS-B 19/BKS-B 20 | BKS-B 19/BKS-B 20 |

## Wiring diagrams

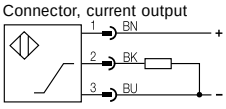
Cable




Connector, voltage output

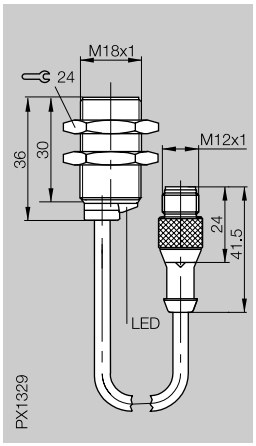
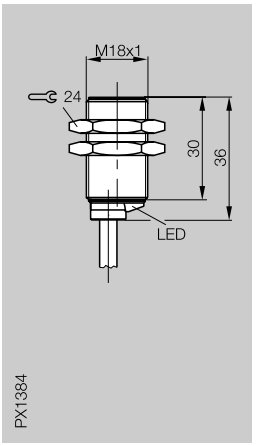
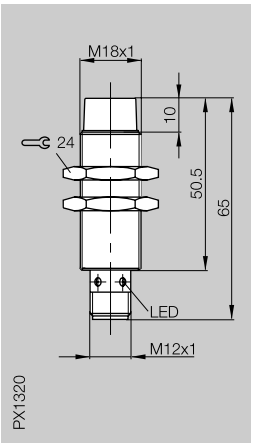
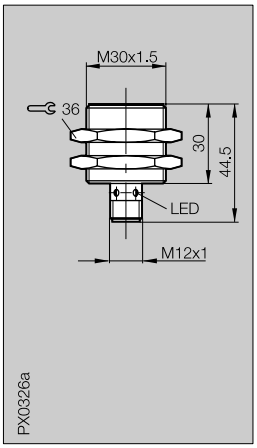



Connector, current output




Please add the cable length to the ordering code for sensors with **cable!**
BP03, BP05 = PUR, length 3 m or 5 m

Please add the cable length to the ordering code for sensors with **cable and connector!**
00,2, 00,5 = PUR, length 0.2 or 0.5 m

| | M18×1 | M18×1 | M18×1 | | M30×1 |
|---|---|---|---|---|---|
| | flush | flush | non-flush | | flush |
| | **voltage 0...10 V** | **voltage 0...10 V** | **voltage 0...10 V** | | **voltage 0...10 V** |
| | 1...5 mm | 1...5 mm | 2...8 mm | | 2...10 mm |
| |  |  |  | |  |
| | BAW M18ME-UAC50B-BP____-GS04 | BAW M18ME-UAC50B- | BAW M18MG-UAC80F-S04G | | BAW M30ME-UAC10B-S04G |
| | 24 V DC | 24 V DC | 24 V DC | | 24 V DC |
| | 15...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 $U_e$ |
| | 75 V DC | 75 V DC | 250 V AC | | 250 V AC |
| | 3 mm | 3 mm | 5 mm | | 6 mm |
| | ≥ 2 kΩ | ≥ 2 kΩ | ≥ 2 kΩ | | 2 kΩ |
| | ≤ 10 mA | ≤ 10 mA | ≤ 10 mA | | ≤ 10 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 % of $U_a$ max. | | ≤ 5 % of $U_a$ max. |
| | ±3 % of $U_a$ max. | ±3 % of $U_a$ max. | ±3 % of $U_a$ max. | | ±3 % of $U_a$ max. |
| | yes | yes | yes | | yes |
| | | | | | |
| | IP 67 | IP 67 | IP 67 | | IP 67 |
| | | | ⊡ | | ⊡ |
| | CuZn nickel plated | CuZn nickel plated | CuZn nickel plated | | CuZn nickel plated |
| | PBT | PBT | PBT | | PBT |
| | cable with connector | cable | connector | | connector |
| | | 3 × 0.34 mm² | | | |
| | cULus | cULus | cULus | | cULus |
| | BKS-B 19 | | BKS-B 19/BKS-B 20 | | BKS-B 19/BKS-B 20 |



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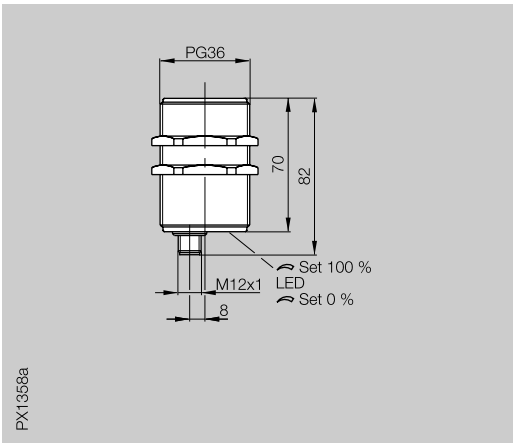
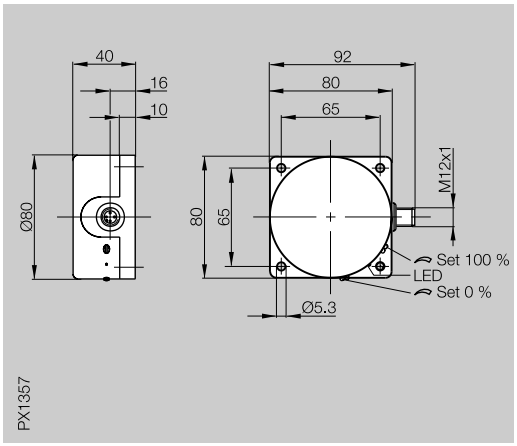
Connectors, clamps ...
page 6.2 ...

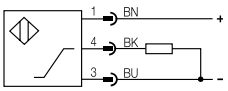
| | | |
|---|---|---|
| Housing size | **PG 36** | **80×80×40** |
| Mounting | flush | non-flush |
| Output signal | **voltage 0...10 V** | **voltage 0...10 V** |
| Linear range $s_l$ | 0...20 mm | 0...50 mm |




| | | |
|---|---|---|
| Ordering code | BAW MKZ-471.19-S4 | BAW MKK-050.19-S4 |
| Rated operational voltage $U_e$ | 24 V DC | 24 V DC |
| Supply voltage $U_B$ | $U_e$ ±20 % | $U_e$ ±20 % |
| Ripple | ≤ 15 % of $U_e$ | ≤ 15 % of $U_e$ |
| Rated insulation voltage $U_i$ | 75 V DC | 75 V DC |
| Rated sensing distance $s_e$ | 10 mm | 25 mm |
| Load resistance $R_l$ | ≥ 10 kΩ | ≥ 10 kΩ |
| No-load supply current $I_0$ at $U_e$ | ≤ 12 mA | ≤ 12 mA |
| Protected against polarity reversal | yes | yes |
| Short circuit protected | yes | yes |
| Ambient temperature range $T_a$ | –10...+70 °C | –10...+70 °C |
| Temperature drift at $s_l$ | ≤ 5 % of $U_a$ max. | ≤ 7 % of $U_a$ max. |
| Max. non-linearity at $s_l$ | ≤ 1 % of $U_a$ max. | ≤ 2 % of $U_a$ max. |
| Adjustment indication (end of linear range) | no | no |
| Degree of protection per IEC 60529 | IP 67 | IP 67 |
| Housing material | CuZn nickel plated | PBT |
| Material of sensing face | PBT | PBT |
| Connection | connector | connector |
| Recommended connector | BKS-B 19/BKS-B 20 | BKS-B 19/BKS-B 20 |

**Wiring diagram**




Standard version of BAW MKZ/MKK with rising output curve! These sensors are also available with falling output curve. Please indicate separately when ordering.

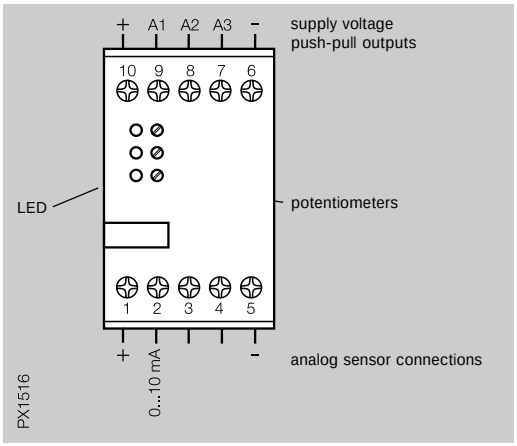
**Analog Set Point Controller**
for analog current and voltage signals

**The analog set point controller ...**

... is powered with 24 V (6; 10). It provides the supply voltage for Balluff analog sensors (1; 5) and is switched directly by their current outputs. Based on these signals, three switch-points (A1...A3) are output through separate push-pull final stages (PNP/NPN). The switchpoints are individually set using the front-mounted potentio-meters. The corresponding switching state is displayed using LED's. The effective direction (rising/falling) can be configured using wire jumpers inside the controller.

Terminal (4) has a voltage output proportional to the current, which can be used for other external analog switching devices (to provide additional switchpoints, for example).

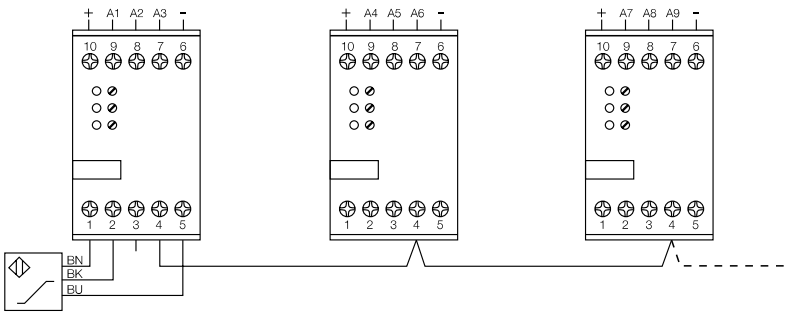
The signal inputs are protected against polarity reversal and the push-pull stages against short circuit (fuse protected internally).




| Ordering code | BES 516-611-A-1 |
|---|---|
| Supply voltage $U_B$ | 24 V DC |
| Ripple | ≤ 10 % |
| Input circuit | |
| Current input terminal 2/terminal 3 | 0...10 mA/0...20 mA |
| Input resistance | 308 Ω/154 Ω |
| Voltage input terminal 4 | 0...10 V |
| Input resistance | 13 kΩ |
| Range of adjustment | 3...100 % |
| Hysteresis (with respect to the pre-set value) | 3 % |
| Output circuit | |
| Voltage drop PNP transistor | ≤ 3.5 V |
| Voltage drop NPN transistor | ≤ 2.5 V |
| Operational current per push-pull stage | ≤ 200 mA |
| Housing material | PC (fiberglass reinforced) |
| Housing dimensions b × l × h | 74 × 45 × 120 mm |
| Connection | screw terminals |
| Max. cross section for connection | up to 2.5 mm² |
| Mounting | snap-on rail mount |
| Ambient temperature range $T_a$ | 0...+50 °C |
| Degree of protection per IEC 60529 | terminals IP 20, housing IP 40 |

**Parallel arrangement of set point controllers**

Expansion for additional switchpoints



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Connectors, clamps ... page 6.2 ...

### Analog sensor with integrated switching outputs

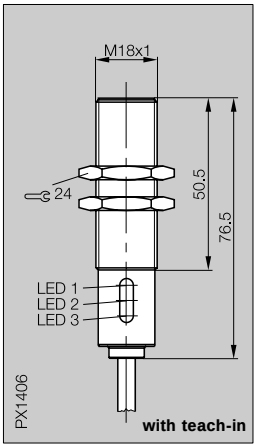
Inductive analog sensors output a signal which is proportional to the target distance.
Many applications also call for a switching signal at certain points along the travel distance. These discrete signals are used to indicate when a particular position of the target, generally the moving member of a 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 set point controller

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.

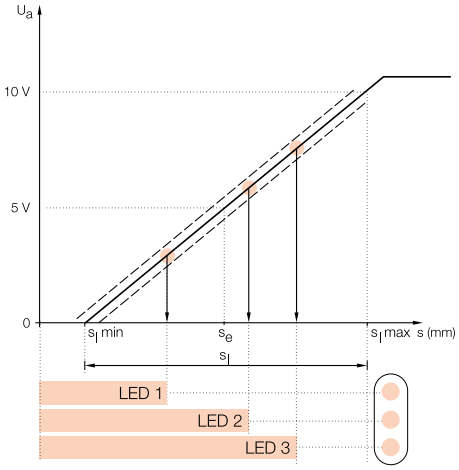
| | |
|---|---|
| Housing size | **M18×1** |
| Mounting | flush |
| Output signal | **voltage 0...10 V** |
| Linear range $s_l$ | 1...5 mm |




| | |
|---|---|
| Ordering code | BAW M18MI2-UAC50B-____-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 $U_i$ | 250 V AC |
| Rated sensing distance $s_e$ | 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 protected | yes |
| Ambient temperature range $T_a$ | –10...+70 °C |
| Temperature drift at $s_l$ | ≤ 5 % of $U_a$ max. |
| Max. non-linearity at $s_l$ | ±3 % of $U_a$ max. |
| Degree of protection per IEC 60529 | IP 67 |
| Insulation class | ⧈ |
| Housing material | CuZn nickel plated |
| Material of sensing face | PBT |
| Connection | cable |
| No. of wires × conductor cross section | 7 × 0.25 mm² |
| Approval | cULus |
| LED indication for each output | yes |
| Teach-in function | yes |
| Hysteresis | ≤ 0.3 mm |
| Repeat accuracy R | ≤ 0.1 mm |
| Rated operational current $I_e$ for one switching output | 20 mA |
| Voltage drop $U_d$ at $I_e$ | ≤ 1.5 V |

Please add the cable length to the ordering code for sensors with **cable!**
BP03, BP05 = PUR, length 3 m or 5 m

### Approach 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 (starting page **6.2** ...) or directly on the control line of the sensor.

### Wiring diagram