

BALLUFF

Control of Clamping Force with BAW ... in Plastic Injection Molding Machines



Tie-bar elongation in plastic injection molding machines

is a side-effect that can have useful implications.

Tie-bar elongation is proportional to the clamping force in mechanical toggle clamping systems. Depending on the machine size and clamping force, during ordinary operation the actual extension can be up to 2 mm (0.08"). This relatively large mechanical movement leads to an interesting application for Balluff BAW analog inductive displacement sensors. A high-resolution analog device for measuring small displacements of metal targets, the Balluff BAW can detect the extension of the tie-bar in-process, providing continuous measurement of the clamping force without the need for expensive instrumentation.

The Balluff BAW detects the elongation of the tie bar when placed in front of the tie-bar surface at the side of the stationary platen. With an operating range of up to 5 mm it provides the change of the

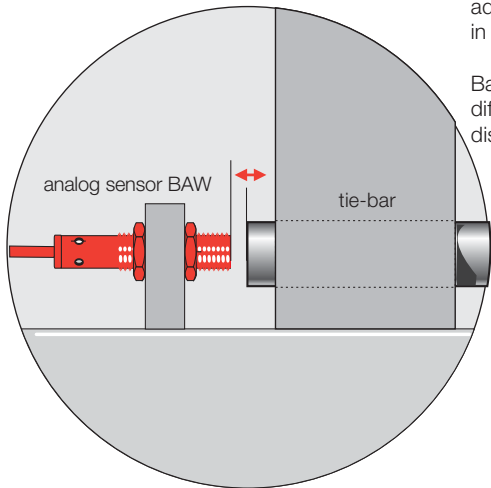
length with a repeatability of $\pm 10 \mu\text{m}$ (0,0004"), which is sufficient in most cases and gives a great cost-performance ratio. Since there is no need to modify the tie-bars, installation is simple and universal for all diameters.

The application helps to prevent tie-bar overload, machine wear and protects the expensive molds from severe damage. Besides possible damages, worn out bushings and supports of the platens will result in loss of accuracy if the machine is operated permanently with overload.

The performance of the machine and the quality of the molded products will be improved by continuous control of the clamping force. While increased mechanical stress is a result of too high force, nonfilled cavities and flash appears when the force is less than calculated.

Using Balluff BAW to control this important machine parameter represents a significant lower cost solution compared to the traditional strain gauge technology which is used for adjustment and quality control in the maintenance process.

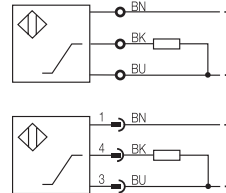
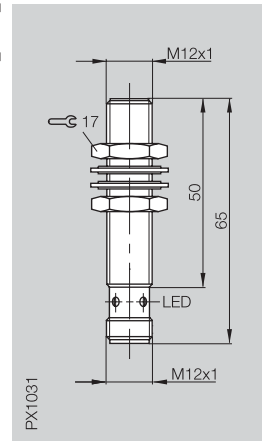
Balluff BAW are available in different sizes and sensing distances:



Analog position sensors

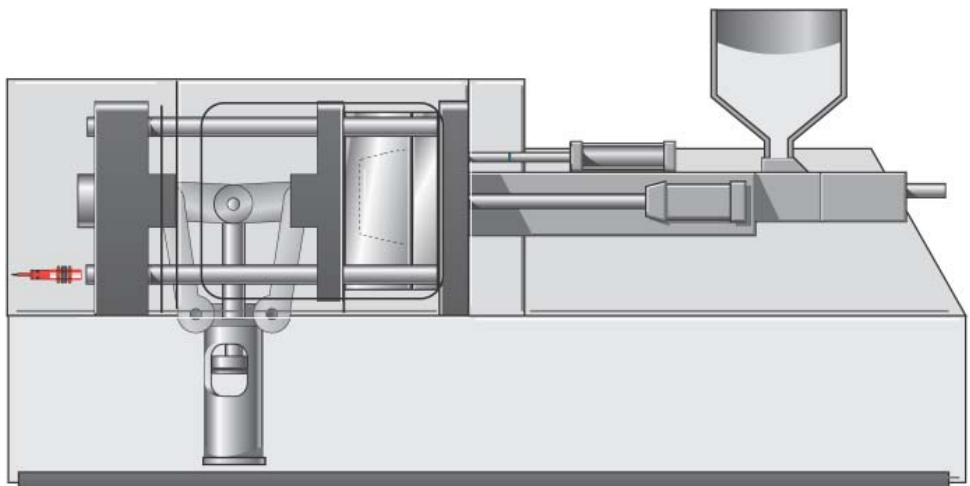
Even the strongest shaft will stretch as a result of hydraulic forces. Analog sensors BAW can detect and signal this change in length with a signal that is proportional to the length change and the clamping force of the monitored tie-bars.

Housing size	M12x1
Mounting	flush
Output signal	voltage 0...10 V
Linear range s_l	0.5...2 mm

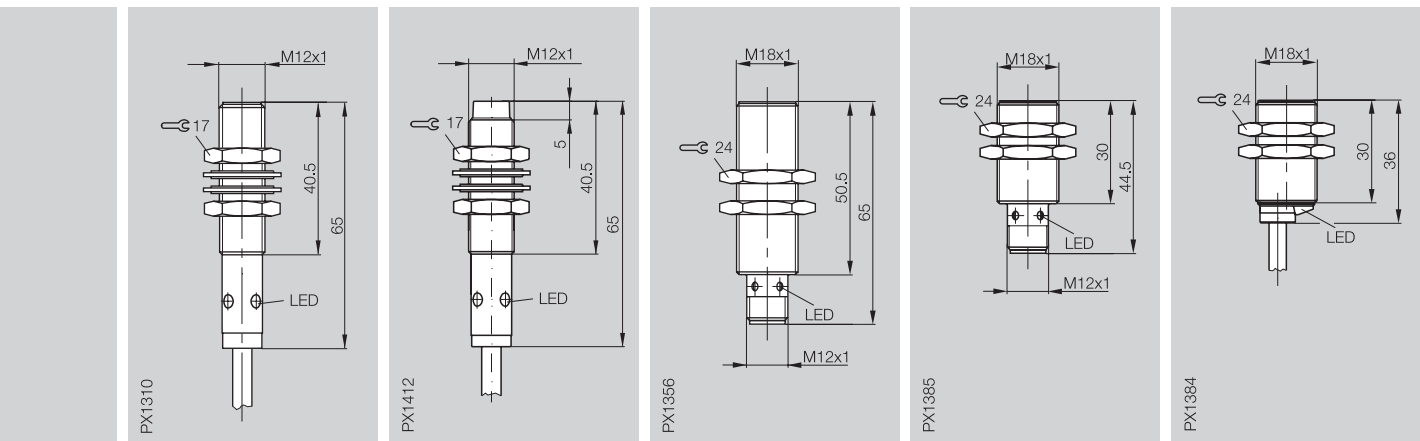


Ordering code	BAW M12MI-UAC20B-S04G
Rated operational voltage U_e	24 V DC
Supply voltage U_B	15...30 V DC
Ripple	$\leq 15\%$ of U_e
Rated insulation voltage U_i	250 V AC
Rated sensing distance s_e	1.25 mm
Load resistance R_L	$\geq 2 \text{ k}\Omega$
No-load supply current I_0 at U_e	$\leq 10 \text{ mA}$
Protected against polarity reversal	yes
Short circuit protected	yes
Ambient temperature range T_a	$-10...+70 \text{ }^\circ\text{C}$
Temperature drift at s_l	$\leq 5\%$ of U_a max.
Max. non-linearity at s_l	$\pm 3\%$ of U_a max.
Adjustment indication (end of linear range)	yes
Degree of protection per IEC 60529	IP 67
Insulation class	\square
Housing material	CuZn nickel plated
Material of sensing face	PA 12
Connection	connector
No. of wires x conductor cross section	
Approval	cULus
Recommended connector	BKS-B 19/BKS-B 20

Please add the cable material and length to the ordering code for sensors with **cable!**
PUR, length 3 m = BP03



M12x1 flush voltage 0...10 V 0.5...2 mm	M12x1 non-flush voltage 0...10 V 1...4 mm	M18x1 flush voltage 0...10 V 1...5 mm	M18x1 flush voltage 0...10 V 1...5 mm	M18x1 flush voltage 0...10 V 1...5 mm
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BAW M12MG2-UAC20B-	BAW M12MF2-UAC40F-	BAW M18MI-UAC50B-S04G	BAW M18ME-UAC50B-S04G	BAW M18ME-UAC50B-
24 V DC	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...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	75 V DC	75 V DC
1.25 mm	2.5 mm	3 mm	3 mm	3 mm
≥ 2 kΩ	≥ 2 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 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.	±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	PBT	PBT	PBT	PBT
cable	cable	connector	connector	cable
3x0.34 mm ²	3x0.34 mm ²			3x0.34 mm ²
cULus	cULus	cULus	cULus	cULus
		BKS-B 19/BKS-B 20	BKS-B 19/BKS-B 20	



For more sensors see main catalog "The Sensor Line" on CD-ROM or online!

Connector Type	BKS-B 19 straight	BKS-B 20 angle
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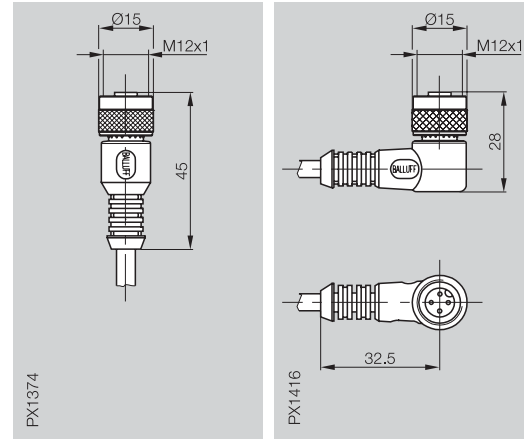
Application examples

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...80x80
- 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



No LED	BKS-B 19-1-__	BKS-B 20-1-__
Supply voltage U_B	10...30 V DC	10...30 V DC
Cable	molded-on PVC/PUR	molded-on PVC/PUR
No. of wires x conductor cross section	3x0.34 mm ² /4x0.25 mm ²	3x0.34 mm ² /4x0.25 mm ²
Degree of protection per IEC 60529	IP 67	IP 67
Ambient temperature range T_a	-25...+ 85 °C	-25...+ 85 °C

Please add the cable material and length to the ordering code!
PUR, length 3 m = PU-03

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.

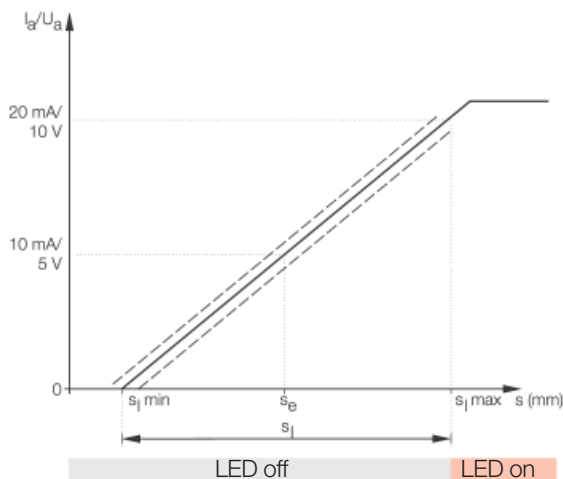
Lateral approach

Detecting larger travel by sensing an inclined surface.

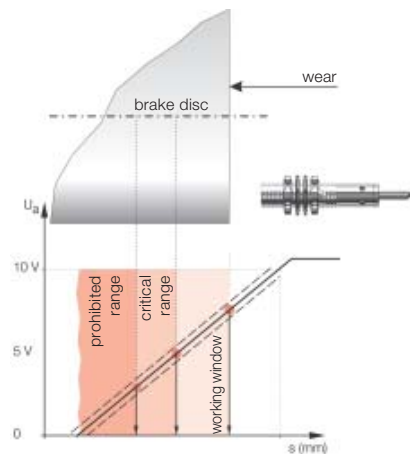
Sensing various materials

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

Approach curve



Processing programmable switchpoints



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