

# Magneto-inductive

BIL magneto-inductive position sensors are compact distance sensors for detecting positions up to 160 mm.

The magneto-inductive analog position sensor measures without contact and absolutely, using a passive magnetic position marker.

44	Principles, definitions
47	SMARTSENS Micro-BIL BIL ED0
48	SMARTSENS BIL BIL AMD0
49	SMARTSENS BIL BIL EMD0, BIL ED0
50	Accessories
51	Analog switching amplifiers

**BIL**



Connectors, holders ... starting page 81



# SMARTSENS

<b>Position sensors with analog output</b>	... are sensors which generate a continually varying output signal which depends on the distance between	its sensing face and the location of the magnet relative to the sensor (BIL).
<b>Working range <math>s_a</math></b>	... is the usable travel for position sensing.	
<b>Effective distance <math>s_e</math></b>	... is the point in the center of the linear range $s_l$ used as	a reference point for other specifications.
<b>Linear range <math>s_l</math></b>	... corresponds to the working range in which the distance	sensor is characterized by a defined linearity.
<b>Non-linearity</b>	... indicates the maximum deviation of the output curve from a reference straight line.	This value applies to the linear range.
<b>Measuring speed</b>	... indicates the ability to detect the position (for a BIL) of a linear moving object.	The direction of movement of the object is assumed to be parallel to its sensing face.
<b>Response time</b>	... is the time which a sensor requires in order to reliably and steadily change the output signal. The specified time, which was determined at maximum measuring	speed, includes both the electrical response time of the sensor and the time for the mechanical change in the damping state.
<b>Slope</b>	... is a measure of the sensitivity of the sensor with respect to a distance change. This physical	relationship can be calculated for position sensors as follows:
	Slope S [V/mm] = $\frac{U_a \max - U_a \min}{s_a \max - s_a \min}$	
	resp.	
	Slope S [mA/mm] = $\frac{I_a \max - I_a \min}{s_a \max - s_a \min}$	
<b>Temperature drift</b>	... is the shift which a point experiences on the actual output curve at various temperatures.	The temperature drift is described by the temperature coefficient.
<b>Temperature coefficient TK</b>	... describes the deviation of the sensor output signal under the effect of a temperature change, and	thus represents a quality criterion for the sensor also.
<b>Tolerance T</b>	... is a variable which defines the manufacturing tolerance band of the output curve,	thereby determining the maximum sample deviation.

### Repeat accuracy R

... is the value of the output signal changes under specified conditions, expressed in a percentage of the upper distance. The measurement must be taken in the lower, upper and center area of the linear range. It corresponds to

the repeat accuracy R of proximity switches and is determined under the same standardized conditions (EN 60947-5-2). Distance sensors with analog output achieve the value R defined in the standard of  $\leq 5\%$ .

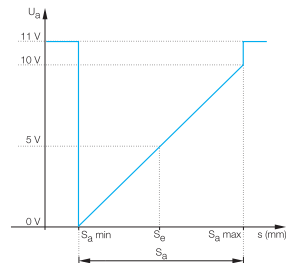
### Repeat accuracy $R_{BWN}$

... describes the precision which an analog sensor achieves when approaching the same point multiple times. The value specified on

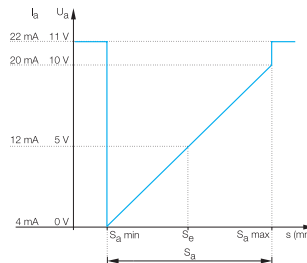
the basis of the Balluff Factory Standard (BWN Pr. 44) describes the maximum deviation from this measuring point.

### Output curves

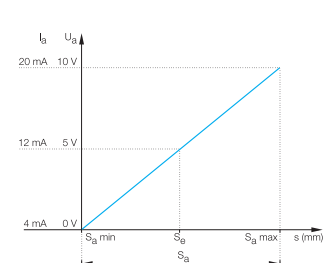
BIL AMD0...



BIL EMD0...



BIL ED0...



### Installation notes

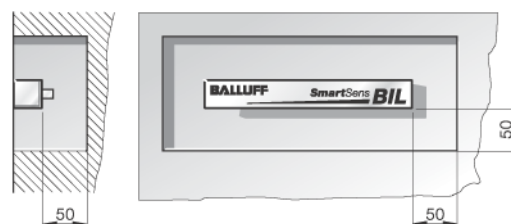
Non-magnetizable materials such as alloys, austenitic steels, plastics, etc. are recommended for mounting. This applies both to the mounting of the sensor as well as the magnet.

Magnetizable materials may affect the geometry and

strength of the effective market magnet field.

Magnetic fields near the BIL can affect the output signal depending on their location and strength. This also applies to magnets used with neighboring BIL sensors.

### Recommended minimum spacing from magnetizable materials or additional BIL sensors



Units in mm

BIL



Connectors, holders ... starting page 81

**BIL – Precision in compact form**

**BIL**



Balluff magneto-inductive position sensors detect positions up to 160 mm away. The BIL analog position sensors measure **without contact and absolutely using a passive magnet marker.** The compact design means these sensors can be easily integrated into the application even when mounting space is extremely tight.

**BIL features**

- Wear-free, as the position is detected without contact
- Shock and vibration resistant
- Absolute output signal: Voltage or current (cable break monitoring possible)
- Housing cross-section 15x15 mm
- Simple to install

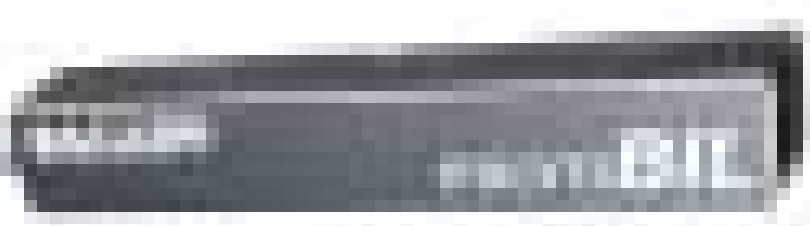
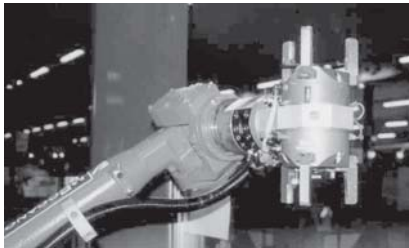
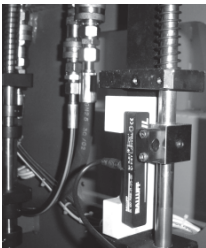
**Micro-BIL**



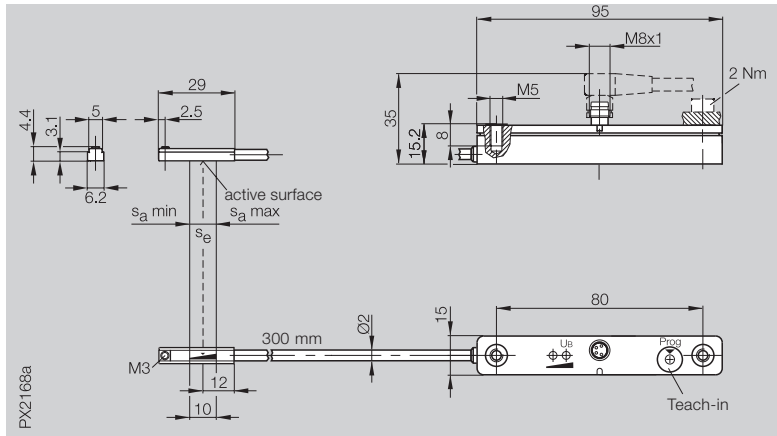
The Micro-BIL detects the absolute position on pneumatic miniature grippers or compact cylinders having integrated permanent magnets; the sensor element can be easily installed in the T-slot. The analog output signal allows you to individually and flexibly detect end-of-travel and intermediate positions on gripper jaws or pistons.

**Features of the Micro-BIL**

- Wear-free, as the position is detected without contact
- Shock and vibration resistant
- Absolute output signal: Voltage or current (cable break monitoring possible)
- Measuring range and magnetic field strength adjustable
- Easy to install in the T-slot gripper jaws or pistons.

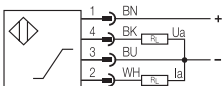


Output signal $U_a$	<b>Voltage 0...10 V or Current 4...20 mA</b>
Output signal $I_a$	
Working range $s_a$	
Linear range $s_l$	



Ordering code	BIL ED0-B010P-02/30-S75
Supply voltage $U_B$	for voltage output $U_a$ : $U_B = 15...30$ V DC, for current output $I_a$ : $U_B = 10...30$ V DC
Field strength, axial $H_n$	10 kA/m typical
-3dB width of the axial field distribution, typical (axial field strength typical - parallel to sensing face)	2.5 mm
Ripple	$\leq 10\%$ of $U_e$
Rated insulation voltage $U_i$	75 V DC
Effective distance $s_e$	5 mm
Load resistance $R_L$	for voltage output $U_a$ : $R_L \geq 2$ k $\Omega$ , for current output $I_a$ : $R_L \leq 500$ $\Omega$
No-load current $I_0$ at $U_e$	$\leq 30$ mA
Polarity reversal protected	yes
Short circuit protected	yes
Ambient temperature range $T_a$	-10...+70 °C
Repeat accuracy $R_{BWN}$	$\leq \pm 30$ $\mu$ m
Non-linearity	$\leq \pm 0.3$ mm
Temperature coefficient TK	typical +4 $\mu$ m/K min. +2 $\mu$ m/K max. +10 $\mu$ m/K
Power-on indicator	yes
Programming indicator	yes
Degree of protection per IEC 60529	IP 67
Housing material	PA fiberglass reinforced
Connection	Connectors
Approval	cULus
Recommended connector	BKS-S 74/BKS-S 75

### Wiring diagram



Connect either the voltage or current output.

A button is provided for adjustment to varying magnetic field strengths. The technical data refer to reference measurements. Different

grippers/cylinders having differing magnetic fields may affect the technical data.



Original mounting brackets and screws are recommended for attaching the Micro-BIL. Please order accessories separately. See page 50!



BIL



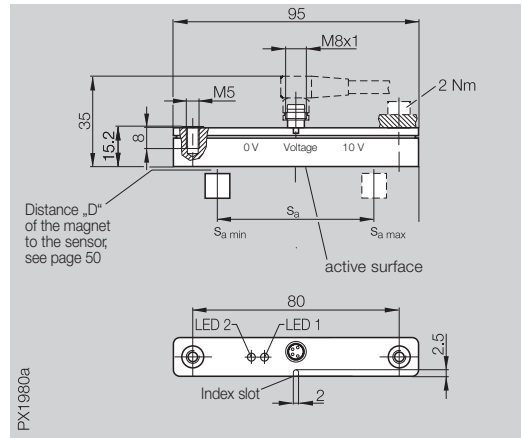
Connectors, holders ... starting page 81

# Out-of-range function

Output signal  $U_a$   
 Output signal  $I_a$   
 Working range  $s_a$   
 Linear range  $s_l$

**Voltage 0...10 V, out-of-range 11 V**

0...60 mm  
 5...55 mm



Ordering code

**BIL AMD0-T060A-01-S75**

Supply voltage  $U_B$

15...30 V DC

Ripple

$\leq 10\%$  of  $U_B$

Rated insulation voltage  $U_i$

75 V DC

Effective distance  $s_e$

30 mm

Load resistance  $R_L$

$\geq 2$  k $\Omega$

No-load current  $I_0$  at  $U_B$

$\leq 30$  mA

Polarity reversal protected

yes

Short circuit protected

yes

Ambient temperature range  $T_a$

-10...+75 °C

Repeat accuracy  $R_{BWN}$

$\leq \pm 60$   $\mu$ m

Linearity

$\leq \pm 1$  mm

Limit frequency (-3 dB)

1500 Hz

Measuring speed

$\leq 5$  m/s

Temperature coefficient TK typical

+5  $\mu$ m/K

in the optimal range min.

-20  $\mu$ m/K

from +10...+50 °C max.

+30  $\mu$ m/K

Power-on indicator

yes

Out-of-range indicator

yes

Degree of protection per IEC 60529

IP 67

Housing material

PA mod.

Connection

Connectors

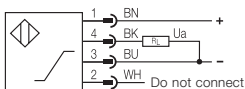
Approval

cULus

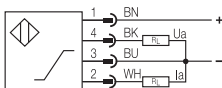
Recommended connector

BKS-S 74/BKS-S 75

BIL AMD0...



BIL EMD0.../BIL EDO...



Connect either the voltage or current output.

## Out-of-range function

Magnet within working range:

- Output voltage 0...10 V or output current 4...20 mA
- LED not on

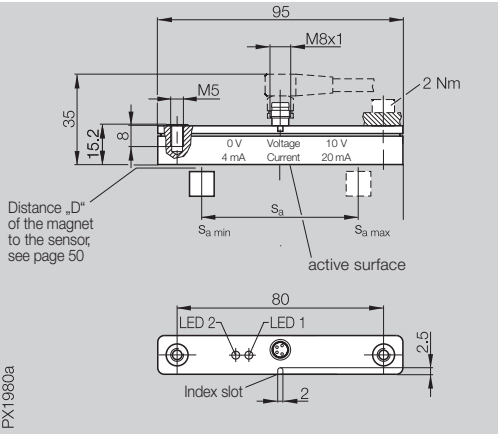
Magnet outside the working range:

- Output voltage approx. 11 V or output current approx. 22 mA
- LED on



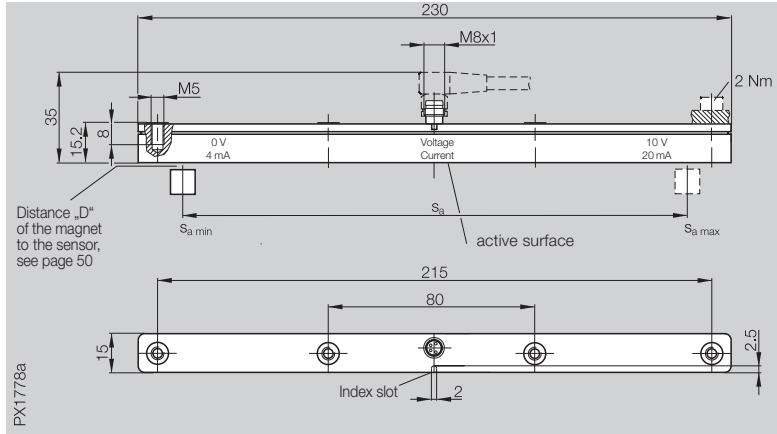
**Voltage 0...10 V, out-of-range 11 V or  
 Current 4...20 mA, out-of-range 22 mA**

0...60 mm  
 5...55 mm



**Voltage 0...10 V or  
 Current 4...20 mA**

0...160 mm  
 0...160 mm



BIL EMD0-T060A-01-S75

BIL ED0-T160A-01-S75

for voltage output  $U_a$ :  $U_B = 15...30$  V DC,  
 for current output  $I_a$ :  $U_B = 10...30$  V DC

$\leq 10\%$  of  $U_e$   
 75 V DC  
 30 mm

for voltage output  $U_a$ :  $R_L = \geq 2$  k $\Omega$ ,  
 for current output  $I_a$ :  $R_L = \leq 500$   $\Omega$   
 $\leq 30$  mA

yes  
 yes  
 -10...+75 °C  
 $\leq \pm 60$   $\mu$ m  
 $\leq \pm 1$  mm  
 1500 Hz  
 $\leq 5$  m/s  
 +5  $\mu$ m/K  
 -20  $\mu$ m/K  
 +30  $\mu$ m/K

yes  
 yes  
 IP 67  
 PA mod.

Connectors  
 cULus

BKS-S 74/BKS-S 75

for voltage output  $U_a$ :  $U_B = 15...30$  V DC,  
 for current output  $I_a$ :  $U_B = 10...30$  V DC

$\leq 10\%$  of  $U_e$   
 75 V DC  
 80 mm

for voltage output  $U_a$ :  $R_L = \geq 2$  k $\Omega$ ,  
 for current output  $I_a$ :  $R_L = \leq 500$   $\Omega$   
 $\leq 25$  mA

yes  
 yes  
 -10...+75 °C  
 $\leq \pm 500$   $\mu$ m  
 $\leq \pm 2.4$  m  
 300 Hz  
 $\leq 5$  m/s  
 -40  $\mu$ m/K  
 +120  $\mu$ m/K  
 -200  $\mu$ m/K

no  
 no  
 IP 67  
 PA mod.

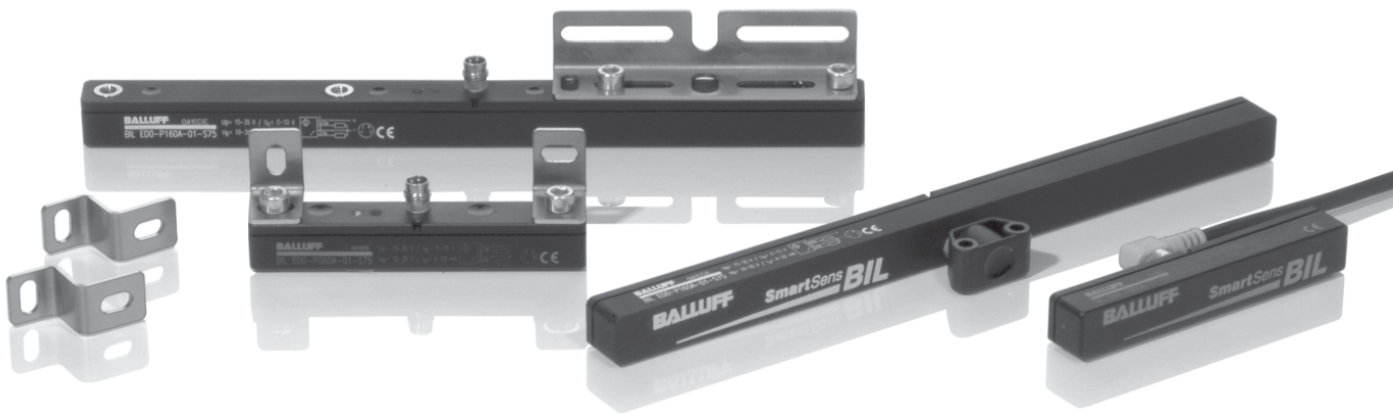
Connectors  
 cULus

BKS-S 74/BKS-S 75

BIL



Connectors,  
 holders ...  
 starting  
 page 81

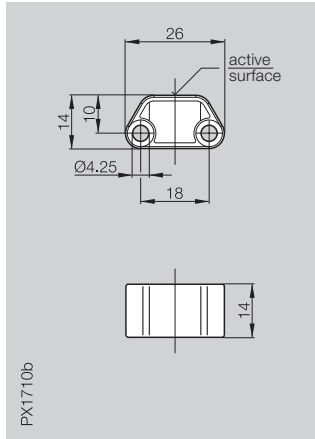
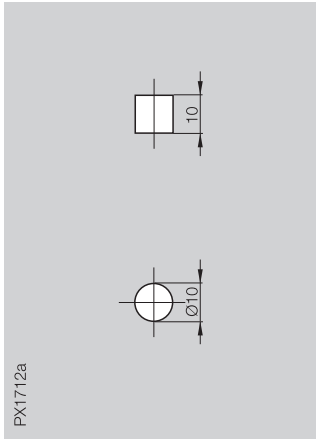


Original mounting brackets  
 and screws are recommended  
 for attaching the BIL.  
 Please order accessories  
 separately see page 50!

www.balluff.com

# Magneto-inductive Position Sensors Accessories

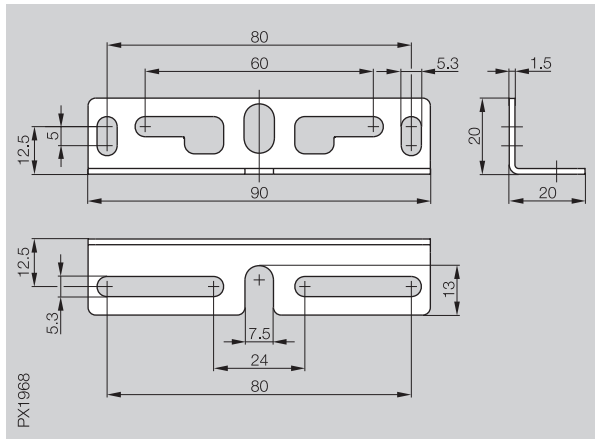
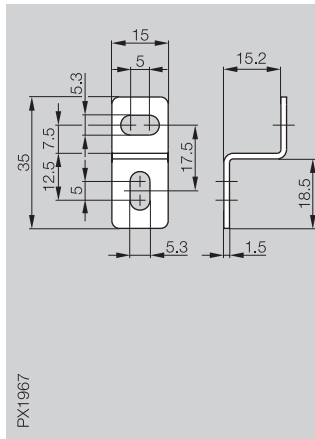
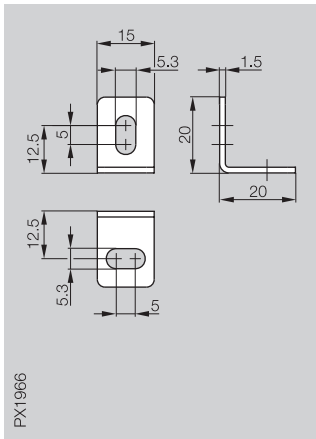
Description	<b>Magnet</b>	<b>Magnet</b>	
Housing size	Ø 10×10 mm	26×14×14 mm	
Material	Hard ferrite	PA fiberglass reinforced	
Distance "D"	2 mm	1 mm	



Ordering code	BIL 000-MH-A	BIL 001-MH-A	
---------------	--------------	--------------	--

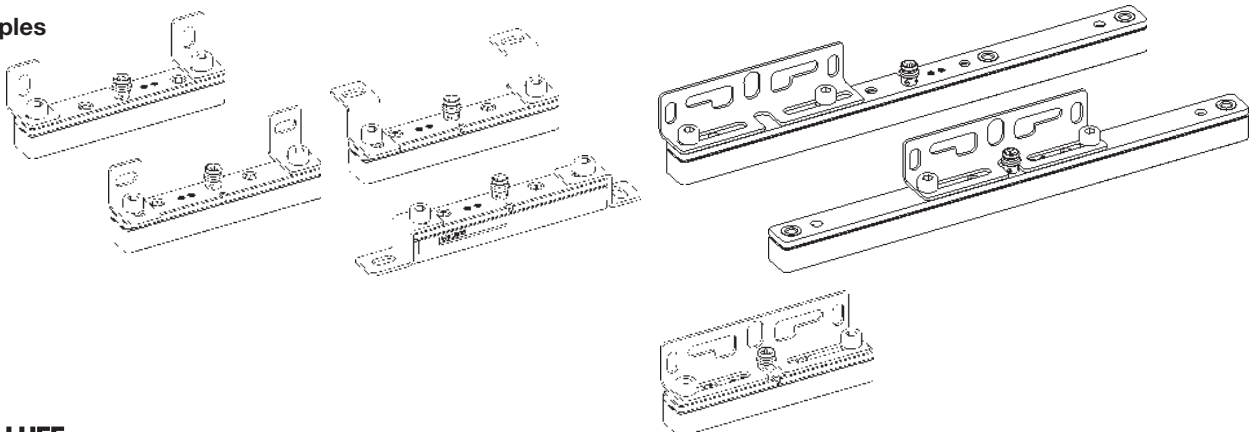


Description	<b>Mounting bracket</b>	<b>Mounting bracket</b>	<b>Mounting bracket</b>
Material	Stainless steel	Stainless steel	Stainless steel



Ordering code	BIL 01-HW-1	BIL 01-HW-2	BIL 01-HW-3
---------------	-------------	-------------	-------------

## Mounting examples





#### Analog switching amplifiers

are available in tubular housing form for direct installation near the sensor, or for installation in a control cabinet.



#### Analog Switching Amplifiers BES 516-615-PS/NS-1-PU-05

Analog output and PNP or NPN normally open for connecting an analog sensor with M12 connector. For technical data see page 85.

#### Analog switching amplifier BES 516-611-A-1

for analog current and voltage signals. For technical data see page 86.



#### Tester/Programmer BES 516-4

see page 89

BIL



Connectors,  
holders ...  
starting  
page 81