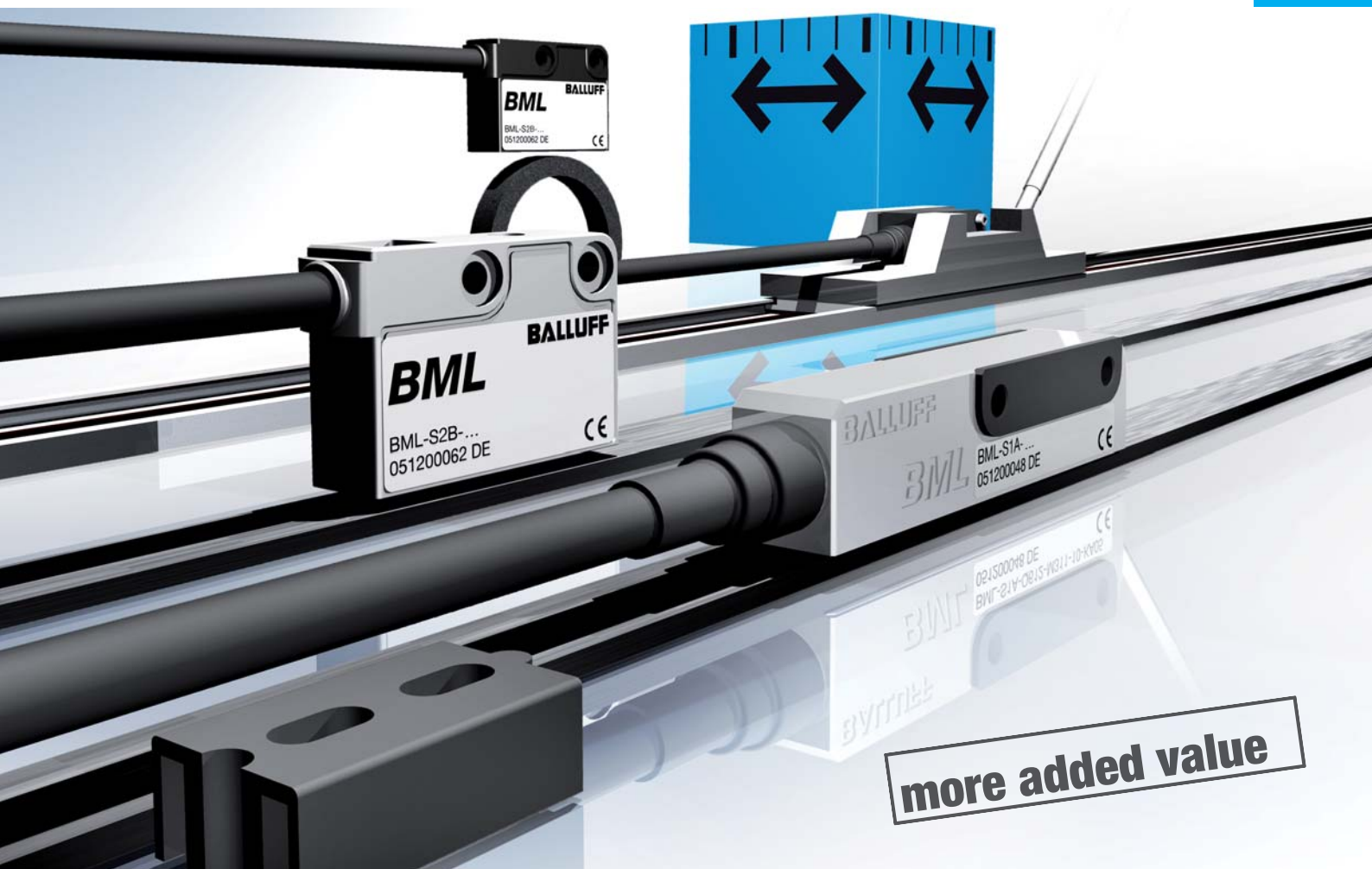
BALLUFF

sensors worldwide

BML Magnetic Linear Encoder Systems

Non-contact and high-resolution



Magnetic Linear Encoder Systems
Non-contact and high-resolution

With over 50 years of sensor experience, Balluff is a leading global sensor specialist that has developed well-engineered distance measurement technology and its own line of connectivity products for every area of factory automation. Balluff is based in Germany and has a tight international network of 54 representatives and subsidiaries.

Balluff stands for comprehensive systems from a single source, continuous innovation, the most modern technology, highest quality and greatest reliability and prides itself on distinctive customer orientation, custom-tailored solutions, fast worldwide service and outstanding application assistance.

Whether electronic and mechanical sensors, rotary and linear transducers, identification systems or optimized connection technology for high-performance automation, Balluff masters not only the entire technological variety with all of the different operating principles, but Balluff technology fulfills regional quality standards and is suitable for use worldwide. Wherever you are in the world, Balluff technology is never far away. You won't have to look far for you nearest Balluff expert.

Balluff products increase performance, quality and productivity around the world every day. They satisfy prerequisites for meeting demands for greater performance and cost reductions on the global market. Even in the most demanding areas. No matter how stringent your requirements may be, Balluff delivers state-of-the-art solutions.

Fully exploit the potential of high quality with sophisticated distance measurement technology for greater efficiency

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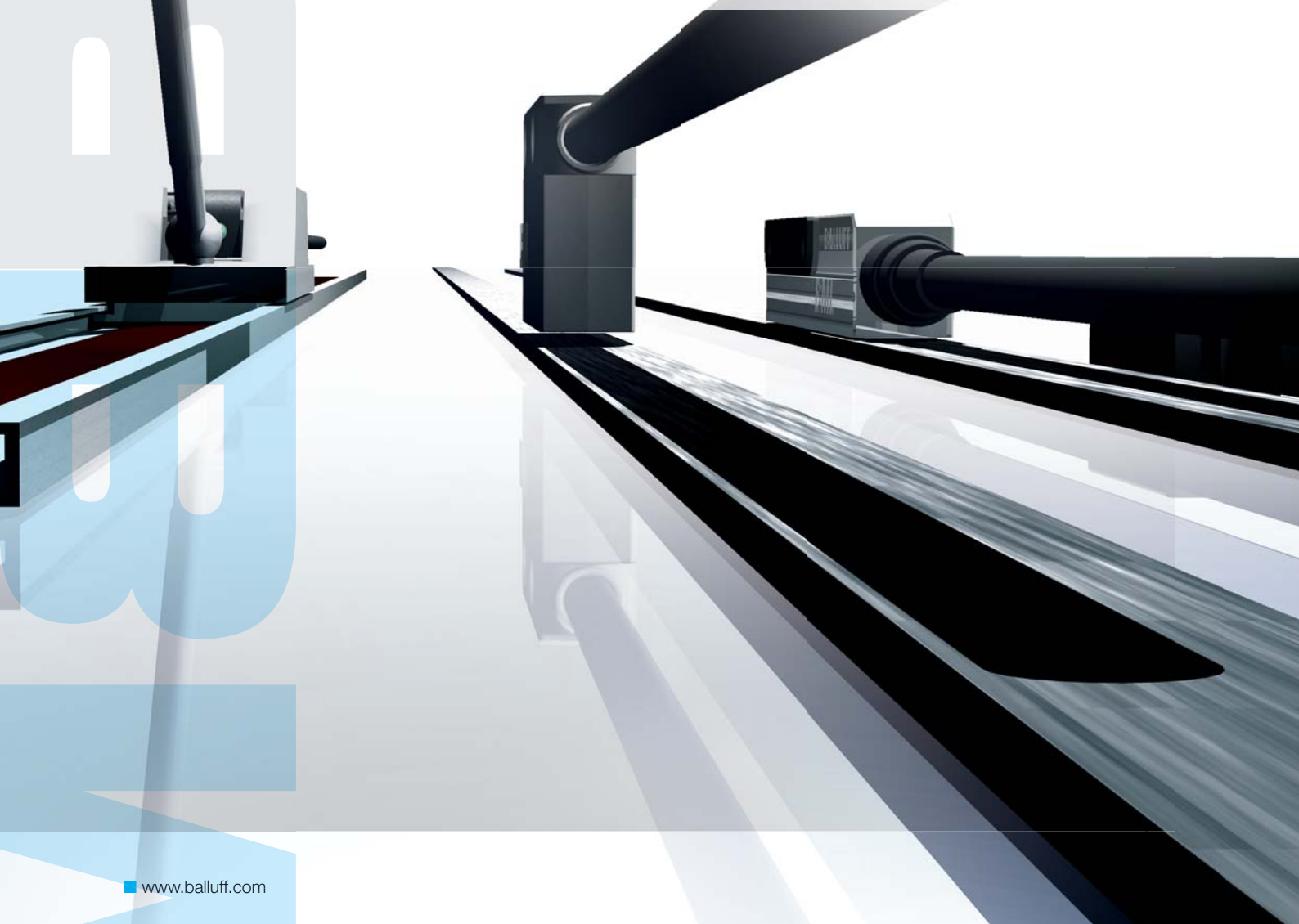
more added value

– Full-range assortment for greater flexibility
– Parameter selection for perfect adaptation
– High precision positioning for improved productivity

Magnetic Linear Encoder Systems



Magnetic Linear Encoder Systems

Overview

Linear position sensing

BML Magnetic linear encoder systems – High precision and extended lengths

BML 48000 mm

BTL Micropulse transducers/BIW Inductive linear position sensors – Extremely robust and reliable

BTL/BIW 7500 mm

BOD Photoelectric distance sensors – Independent of material and color

BOD 6000 mm

BIL Magneto-inductive position sensors – Compact and absolute

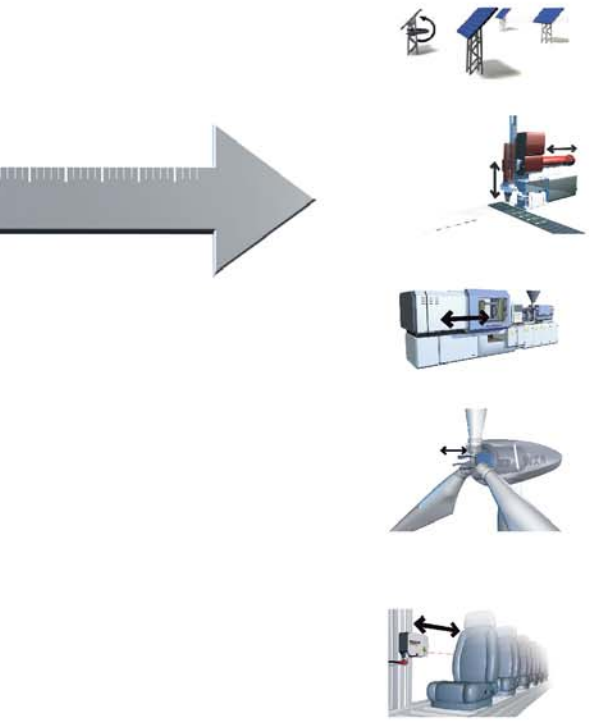
BIL 160 mm

BAW Inductive distance sensors – For short strokes

BAW 20 mm

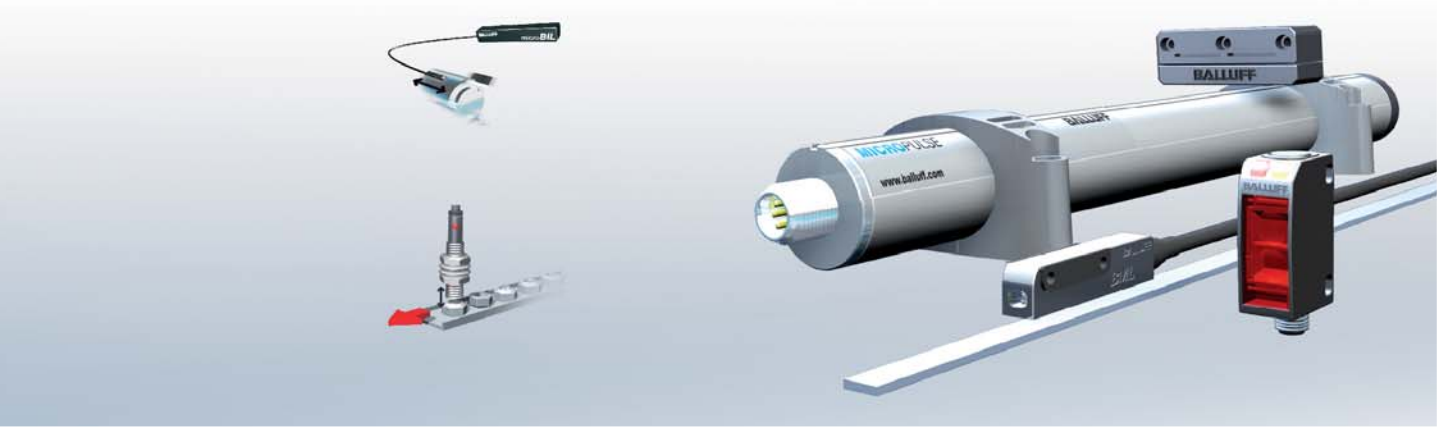
more added value

- Full-range assortment for greater flexibility
- Greater efficiency with optimized solutions
- Superior distance measurement technology for increased productivity



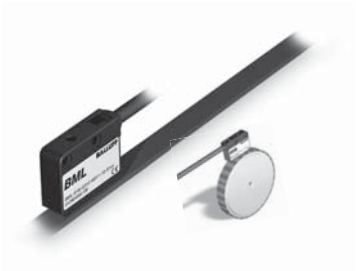
Balluff distance measurement – the right solution for you

Balluff distance measurement offers efficient individual solutions that are adapted to your specific requirements. Different working principles are available for distances from 1 to 48000 mm and resolutions from 1 to 100 µm. From position detection to distance measurement. Fully exploit the benefits available. Choose the option that's right for you and increase your added value with superior Balluff distance measurement technology. Robust industrial Balluff distance measurement technology is accurate, reliable, non-contact, wear-free and brings out the best from your machines.

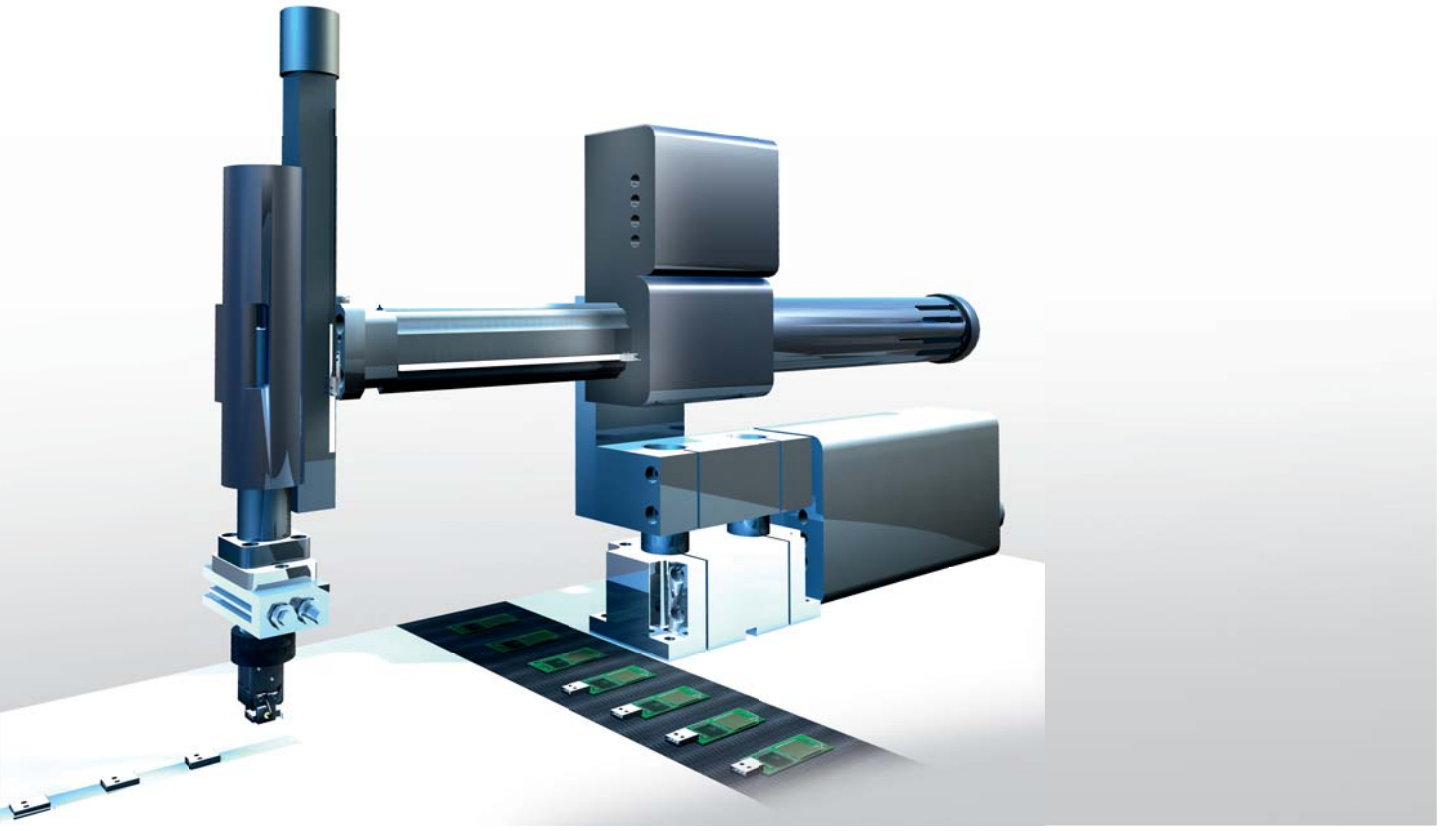


BML Magnetic Linear Encoder Systems	BML-S1A_-Q... digital	BML-S1A_-A... analog sin/cos, 1 V_{pp}	BML-S1F_-Q... digital	BML-S1F_-A... analog sin/cos, 1 V_{pp}	
Resolution	1...10 µm		1...10 µm		
System accuracy	±10 µm	±10 µm	±10 µm	±10 µm	
Distance to tape	0.1...0.35 mm	0.1...0.35 mm	0.1...0.35 mm	0.1...0.35 mm	
Digital output signal RS422 (TTL)	■		■		
Digital output signal HTL (as operating voltage 10...30 V)					
Analog output signal cos (1 V_{pp})		■		■	
Linear tape up to 48 m	■	■	■	■	
Rotary tape (magnetic ring) Ø 30...300 mm	■	■	■	■	
From page	18	18	20	20	

BML Magnetic linear encoder systems
... high precision and extended lengths



	BML-S2B0-Q... digital	BML-S2E0-Q... digital	BML-S1C0-Q... digital	
	5...50 µm	5...50 µm	100...2000 µm	
	±50 µm	±100 µm	±100 µm	
	0.1...2 mm	0.1...2 mm	0.1...2 mm	
	■	■		
	■	■	■	
	■	■	■	
	■	■	■	
	28	28	30	



Distance Measurement

Overview
Micropulse transducers
Inductive linear position system

Series	Profile P	Profile PF	Profile A1	Profile BIW	Rod B, A, Z, Y	Rod Compact	
Internal fitting version e.g. in hydraulic cylinders					■	■	
External fitting version e.g. on machine frames	■	■	■	■			
Filling level sensor e.g. device filling systems							
Special approvals							
Encoders	free/captive	free/captive	free	captive push rod	free or float	free or float	
Interfaces							
Analog voltage 0...10 V, 10...0 V, –10 V...+10 V	■	■	■	■	■	■	
Analog current 4...20 mA, 0...20 mA	■	■		■	■	■	
SSI	■				■	■	
SSI-SYNC	■				■	■	
CANopen	■				■	■	
DeviceNet	■						
PROFIBUS-DP	■				■		
Start/Stop pulse interface	■		■		■		
VARAN			■				

BTL Micropulse transducers
BIW Inductive linear position system
... extremely robust and reliable

	Rod Pro Compact	Rod AR	Compact rod DEX B/J	Rod DEX C	Rod NEX	Rod PEX	Rod T	Rod SF
	■	■	■	■	■	■		
		Vehicle approval	Potentially explosive operation	Potentially explosive operation	Potentially explosive operation	Potentially explosive operation		Certified for foodstuffs
		KBA, e1	Flameproof "d" zone 0, zone 1, ATEX, KOSHA, GOST	Flameproof "d", zone 0, zone 1, ATEX, CENELEC, FM, CSA	protection type "n" zone 2	Dust protection zone 22	Increased safety 2 or 3-way redundant	Conforms with FDA, 3A, ECOLAB, EHEDG
	free or float	free or float	free or float	free or float	free or float	free or float	free or float	float
	■	■	■	■	■		■	■
	■	■	■	■	■		■	■
	■		■	■				
			■	■				
	■			■				
				■				
	■	■	■	■	■	■	■	

MICROPULSE®

Refer to our catalog
BTL/BIW Micropulse transducers
or visit our website at
www.balluff.com

SMART*SENS*

SMART*SENS*

SMART*SENS*

BIL Magneto-inductive position sensors		**Micro-BIL**	**BIL 60**	**BIL 160**
Working range		0...10 mm	0...60 mm	0...160 mm
Resolution			±0.15 mm	±0.4 mm
Linearity		±0.3 mm	±1 mm	±2.4 mm
Repeat accuracy		±30 µm	±60 µm	±0.5 mm
Housing size		28×6.2×4.4 mm	95×15.2×15.2 mm	230×15.2×15.2 mm
Output	0...10 V	■	■	■
	4...20 mA	■	■	■
Special features		Mounted in T-slot		

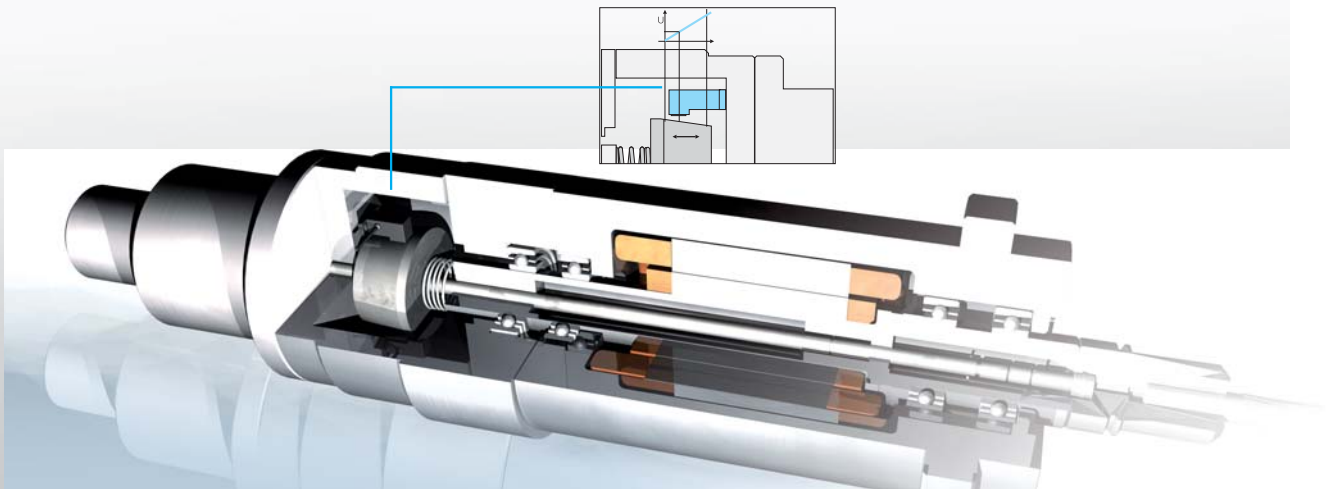
BIL Magneto-inductive position sensors
... compact and absolute

Refer to our Linear Position Sensing catalog for more information on BIL magneto-inductive position sensors and BAW inductive distance sensors or visit our website at www.balluff.com

BAW Inductive distance sensors		BAW Ø 6.5 mm	BAW M12	BAW M18	BAW R03	BAW PG 36	BAW 80×80 mm
Linear range	flush	0.5...2 mm	0.5...2 mm	1...5 mm	1...4 mm	0...20 mm	
	not flush		1...4 mm	2...16 mm			0...50 mm
Housing size		Ø 6.5 mm	M12×1	M12×1	10×30×6 mm	PG 36	80×80 mm
Output	0...10 V	■	■	■	■	■	■
	0...20 mA		■	■			
	4...20 mA		■	■			
Connection	Connector	■	■	■	■	■	■
	Cable	■	■	■	■		
Special features				Teachable switching output			

BAW Inductive distance sensors

... for short strokes



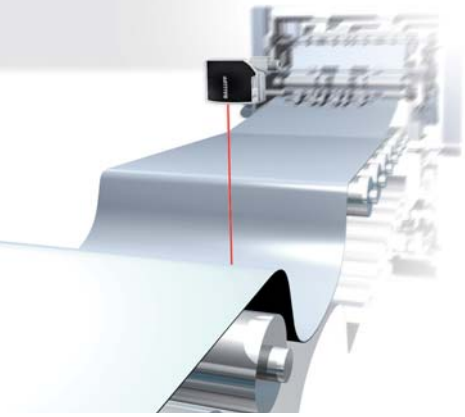




BOD Photoelectric distance sensors		BOD 6K	BOD 18K	BOD 26K	BOD 63M	BOD 66M
Distance sensor measuring range		20...80 mm	50...100 mm	45...85 mm 30...100 mm 80...300 mm	200...2000 mm 200...6000 mm	100...600 mm 200...2000 mm
Diffuse sensor measuring range with background suppression		20...80 mm		30...100 mm 80...300 mm	200...2000 mm 200...6000 mm	100...600 mm 200...2000 mm
Housing size		20×32 mm	M18×1	50×50 mm	90×70 mm	73×90 mm
Output	0...10 V	■	■	■	■	■
	4...20 mA			■	■	■
Connection	Connector	■	■	■	■	■
	Cable	■	■	■	■	■
Special features		Teachable switching output		Teachable switching output, adjustable measuring range	Teachable switching output	Teachable switching output

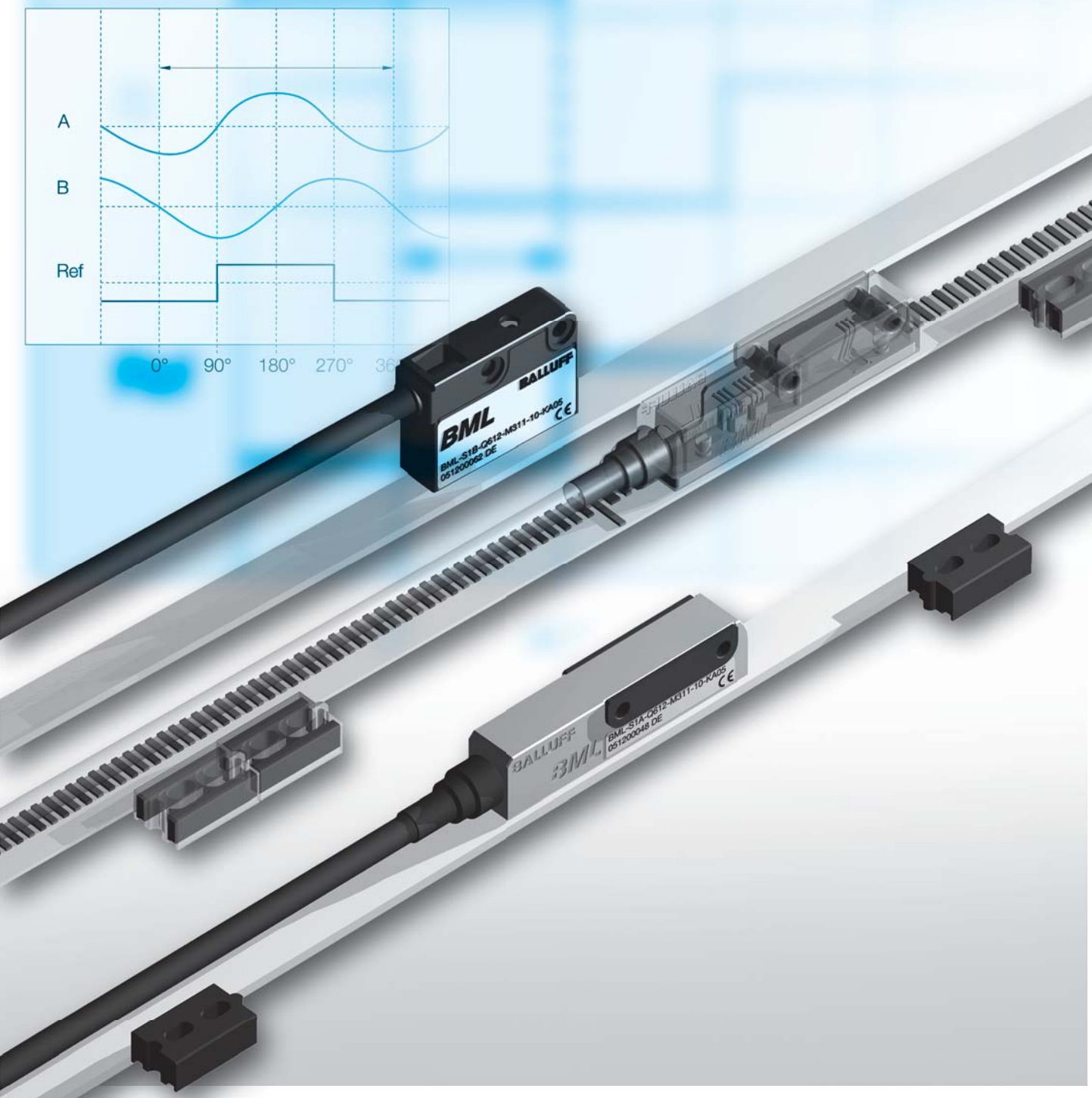
BOD Photoelectric distance sensors

... independent of material and color



Refer to our catalog Linear Position Sensing for more information on BOD photoelectric distance sensors or visit our website at www.balluff.com

Contents



The high-precision incremental BML Magnetic Linear Encoder System consists of a sensing head and a magnetically encoded tape. The sensing head glides over the tape, which is magnetized with alternating polarity, with a gap of up to 2 mm. The period changes on the sensor output are available as standard square wave or sinusoidal signals. Counting or processing of the signals is accomplished using standard incremental or sinus signal counter inputs on the processing electronics.

Magnetic linear encoder systems are highly accurate and realtime-capable

Displacement sensors with a magnetically encoded tape form a highly precise, fast-response and very rugged measuring system. Resolution is down to 1 µm. Accuracy degrees of 10 µm can be achieved. The permissible traverse speed is up to 20 m/s. The measured position value is made available in fractions of a microsecond. The controller receives the position signal in realtime.

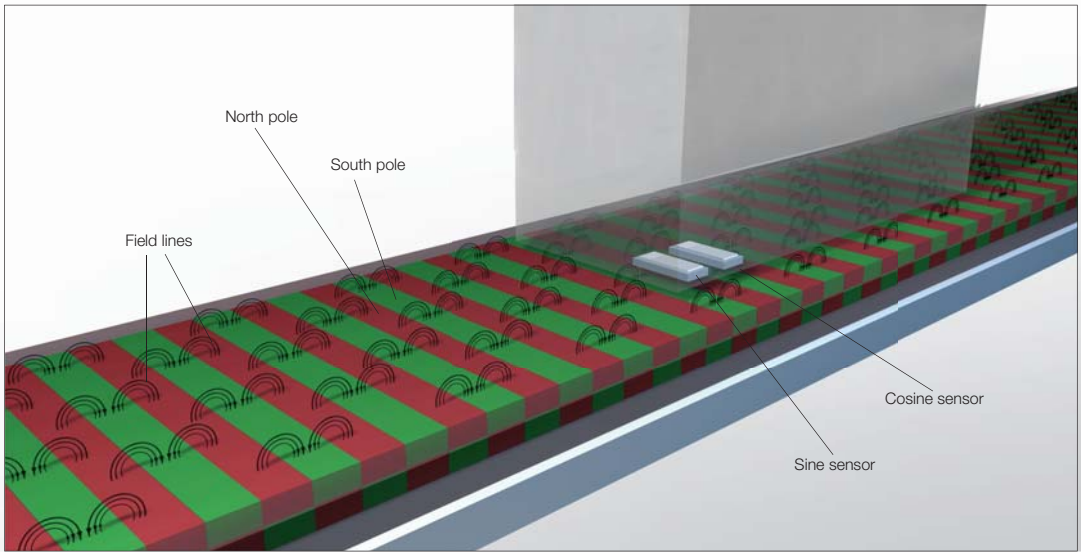
The controller receives the position signal in realtime.

In spite of the high accuracy and realtime capability, distances (gaps) of up to 2 mm (approx. 30 % of the pole width) above the magnetic tape are permitted. Since the system works on the principle of magnetism, unlike optical systems it is highly immune to contamination from oils, dust etc. These properties make it ideal for use in harsh, dusty industrial environments such as found in the wood industry.

System features

- Non-contact operating principle
- Resolution down to 1 µm
- System accuracy to ±10 µm
- Digital square wave signals RS422 or 10...30 V
- Sinusoidal analog signals 1 V_{pp}
- Distance between sensor and tape up to 2 mm
- Reference and limit switch function
- Cable or connector version

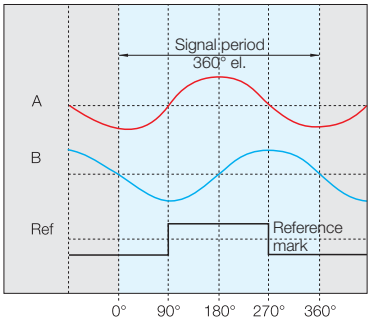
Operating principles of BML magnetic linear encoder system



Output signals

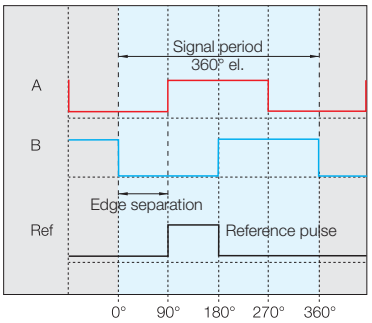
Sinusoidal analog signals 1 V_{pp}

- Sinusoidal voltage signals with inversion
- Signal period 360°, electrical = 1000 µm
- Terminating resistor ≥ 120 ohms (integrated in the processor unit)

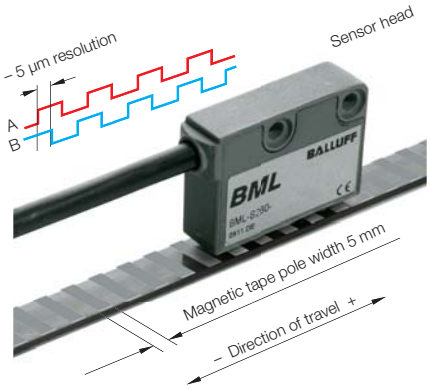


Digital square wave signals RS422

- Square wave signals RS422 to DIN 66259 90° phase shifted
- Edge separation A/B corresponds to the resolution of the sensing head
- Differential signal (BML-S1A...)
- Terminating resistor ≥ 120 ohms (integrated in the processor unit)



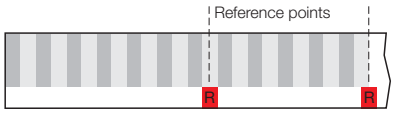
BML sensor head with integrated interpolator



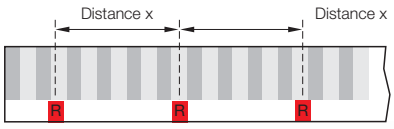
Reference points

The **pole-periodic** magnetic tape has alternating magnetic south and north poles but no integrated reference point. The reference point function is implemented by means of a reference switch.

For magnetic tapes with one or two reference points, the reference points can be integrated at any position if required. To determine the exact position, the reference move must cover the entire length of the tape up to the reference point.

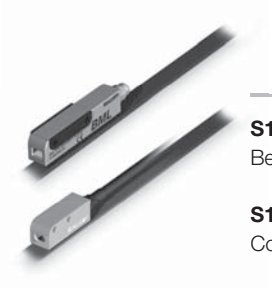


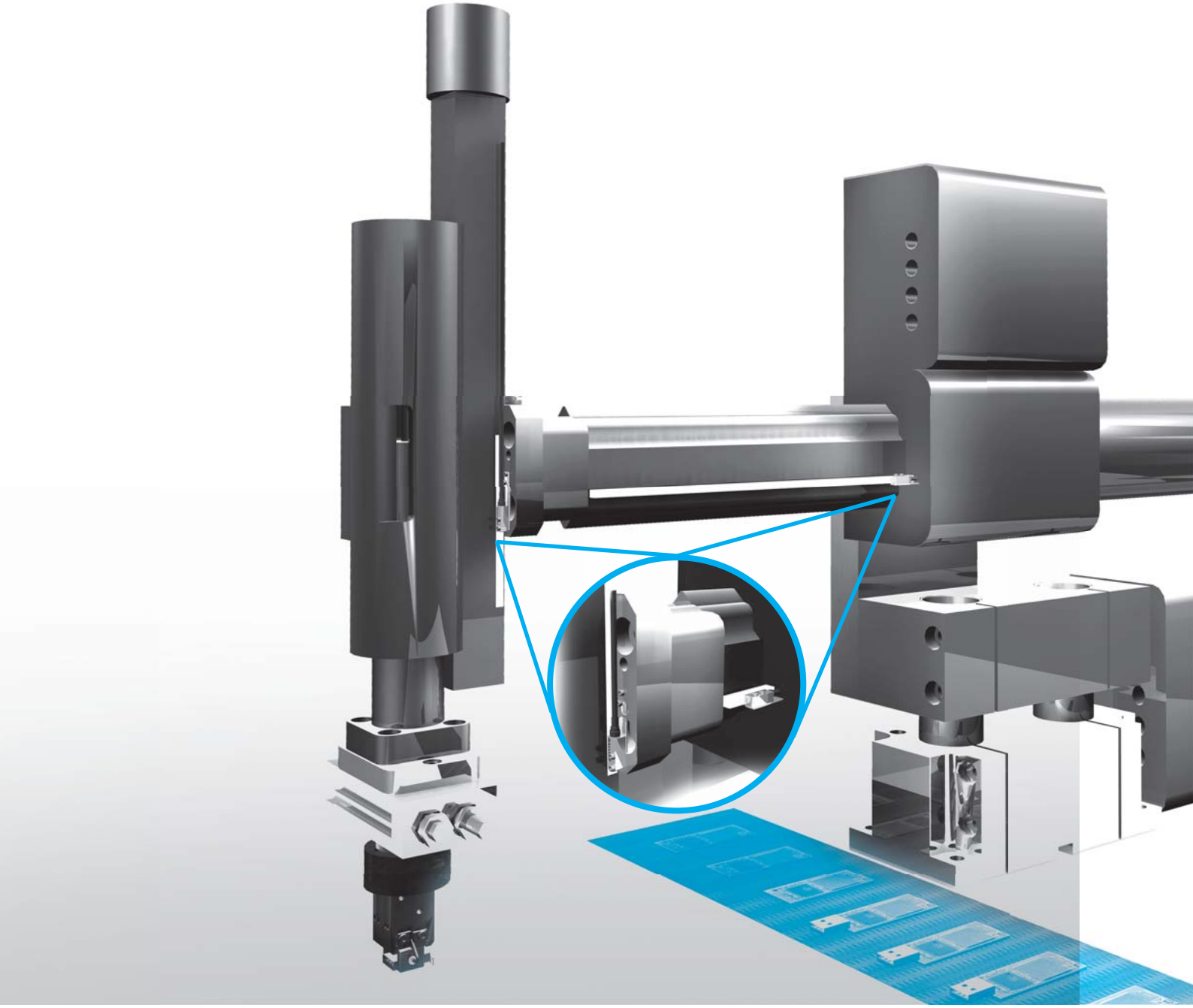
For magnetic tapes with **fixed-periodic reference points** the reference points are integrated across the entire length of the tape at certain constant intervals, such as every 10 cm. To determine the exact position, the reference move must cover the entire length of the tape up to the external reference switch.



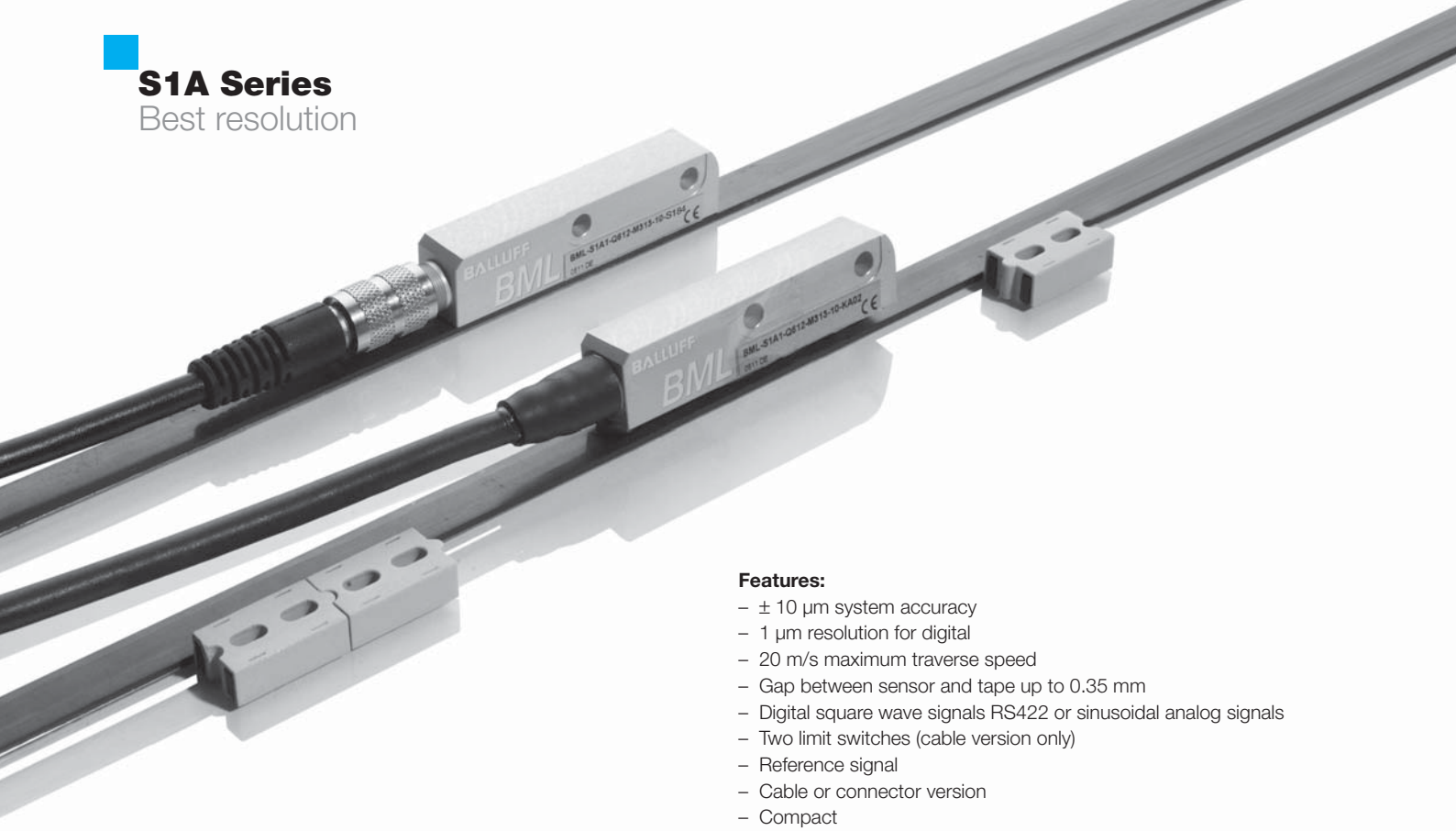
S1A/S1F Series
Contents

The BML magnetic linear encoder system installed in a robust metal housing offers two high-resolution systems in combination with S1A/S1F sensor heads. Both series also detect reference points on the tape. The S1A series can also detect limit switches and provides additional switching functions as a result.
The S1F series has an extremely compact design and is therefore easy to integrate in systems with restricted installation space.





S1A Series
Best resolution



Features:
- ± 10 µm system accuracy
- 1 µm resolution for digital
- 20 m/s maximum traverse speed
- Gap between sensor and tape up to 0.35 mm
- Digital square wave signals RS422 or sinusoidal analog signals
- Two limit switches (cable version only)
- Reference signal
- Cable or connector version
- Compact
- Rugged metal housing
- Easy installation using mounting thread or through-hole
- Insulator for installing the sensor where EMC conditions are extreme

Selecting a suitable BML system: see selection guide on page 44.

Ordering example: sensor head

BML-S1A_-A62Z-M3_ _-90-_ _ _ _ (with analog output signal)
BML-S1A_-Q61_-M3_ _-_0-_ _ _ _ (with digital square wave signal RS422)

Attachment	Resolution	Reference signal	Limit switch	min. edge separation	Connection type
1 Through-hole Ø 4.3 mm	D 1 µm	0 None	0 No limit switch	D 0.12 µs	S184 Connector
2 M3 thread	E 2 µm	1 Single or fixed-periodic	3 Two limit switches only with cable connection	E 0.29 µs	KA02 PUR cable 2 m
	F 5 µm	2 Pole-periodic only with digital version ...-Q61_-...		F 0.48 µs	KA05 PUR cable 5 m
	G 10 µm			G 1 µs	KA10 PUR cable 10 m
				H 2 µs	KA15 PUR cable 15 m
				K 4 µs	KA20 PUR cable 20 m
				L 8 µs	
				N 16 µs	
				P 24 µs	

Other sensor connectors (e.g. SUB-D) are available on request.

Preferred models:
BML-S1A1-A62Z-M310-90-S184 (BML0002):
Analog output sin/cos, with reference signal, plug-in connection

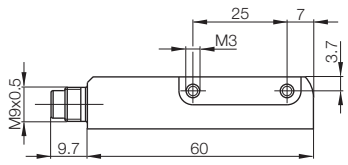
BML-S1A1-Q61D-M320-F0-S184 (BML0005):
Digital signal RS422, with pole-periodic reference signal, plug-in connection, resolution 1 µm, edge separation 0.48 µs, max. traverse speed 1 m/s

For detailed technical description and installation instructions, see user's guide at www.balluff.com

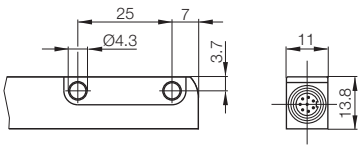
Series	**BML-S1A_-Q...**	**BML-S1A_-A...**
Output signal	Digital square wave signals RS422	Sinusoidal analog signals sin/cos
Resolution	1 µm, 2 µm, 5 µm or 10 µm	processing-dependent
Part number	BML-S1A_-Q61_-M3 _ _-_0-_ _ _ _	BML-S1A_-A62Z-M3 _ _-90-_ _ _ _
Output voltage (A/B/Z)	RS422 to DIN 66259	1 V_{pp}
Overall system accuracy	±10 µm	±10 µm
Operating voltage	5 V ±5 %	5 V ±5 %
Current draw at 5 V operating voltage	< 50 mA + current draw of the controller (depending on internal resistance)	< 50 mA + current draw of the controller (depending on internal resistance)
Max. read distance sensor/tape	0.35 mm	0.35 mm
Traverse speed max.	20 m/s	20 m/s
Operating temperature, cable style	–20...+80 °C	–20...+80 °C
Operating temperature, connector style	–20...+70 °C	–20...+70 °C
Recommended processing temperature for tape	0...+40 °C	0...+40 °C
Housing material	GD-Zn	GD-Zn
Degree of protection	IP 67	IP 67

All specifications in conjunction with tape BML-...-I34... (see page 22).

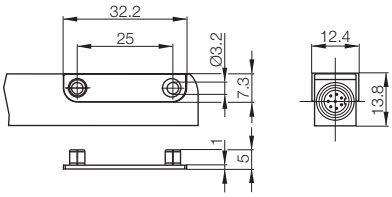
BML-S1A**2**-...-S184 with M3 thread



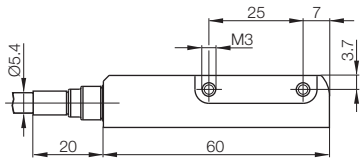
BML-S1A**1**-...-S184 with through-hole Ø 4.3 mm



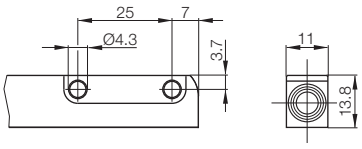
Insulator BML-Z0004 for BML-S1A**1**-...



BML-S1A**2**-...-KA..with M3 thread



BML-S1A**1**-...-KA..with through-hole Ø 4.3 mm



S1F Series
Compact and high-resolution

Features:
- ±10 µm system accuracy
- 1 µm resolution for digital
- Hysteresis-free
- 20 m/s maximum traverse speed
- Gap between sensor and tape up to 0.35 mm
- Digital square wave signals RS422 or sinusoidal analog signals
- Reference signal
- Cable connection
- Compact
- Rugged metal housing
- Easy installation using mounting thread
- Mounted parallel or perpendicular to tape

Selecting a suitable BML system: see selection guide on page 44.

Ordering example: sensor head

BML-S1F_-A62Z-M3_ -90-_ _ _ _ (with analog output signal)
BML-S1F_-Q61_-M3_0-_0-_ _ _ _ (with digital square wave signal RS422)

Approach direction	Resolution	Reference signal	min. edge separation	Connection type
1 Length-ways	D 1 µm	0 None	D 0.12 µs	KA02 PUR cable 2 m
2 Cross-ways	E 2 µm	1 Single or fixed-periodic	E 0.29 µs	KA05 PUR cable 5 m
	F 5 µm	2 Pole-periodic only with digital version ...-Q61_-...	F 0.48 µs	KA10 PUR cable 10 m
	G 10 µm		G 1 µs	KA15 PUR cable 15 m
			H 2 µs	KA20 PUR cable 20 m
			K 4 µs	
			L 8 µs	
			N 16 µs	
			P 24 µs	

Sensor connectors (e.g. SUB-D) are available on request.

Preferred models:
BML-S1F1-A62Z-M310-90-KA02 (BML0019):
Installed parallel to tape, analog output sin/cos, with reference signal, 2 m cable

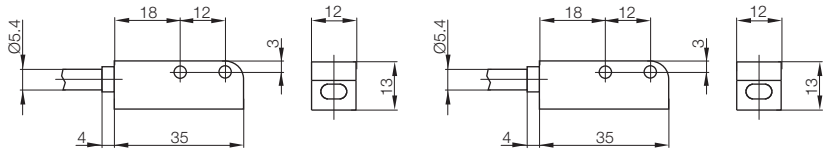
BML-S1F2-A62Z-M310-90-KA05 (BML0001):
Installed perpendicular to tape, analog output sin/cos, with reference signal, 5 m cable

BML-S1F1-Q61D-M310-F0-KA05 (BML001A):
Installed parallel to tape, digital signal RS422, with reference signal, 5 m cable, resolution 1 µm, edge separation 0.48 µs, max. traverse speed 1 m/s

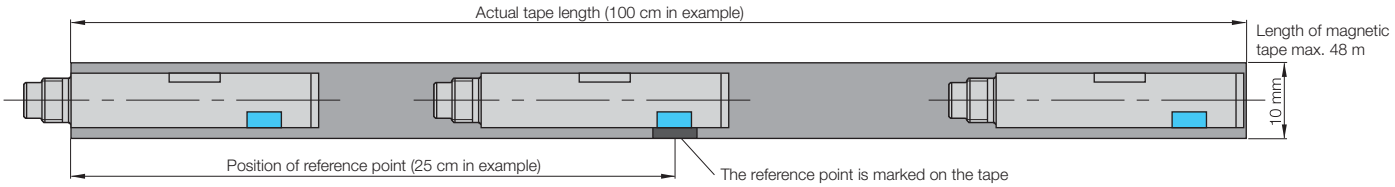
For detailed technical description and installation instructions,
see user's guide at www.balluff.com

Series	**BML-S1F_-Q...**	**BML-S1F_-A...**
Output signal	Digital square wave signals RS422	Sinusoidal analog signals sin/cos
Resolution	1 µm, 2 µm, 5 µm or 10 µm	processing-dependent
Part number	BML-S1F_-Q61_-M3_ _-_0-_ _	BML-S1F_-A62Z-M3_ _-90-_ _
Output voltage (A/B/Z)	RS422 to DIN 66259	1 V_{pp}
Overall system accuracy	±10 µm	±10 µm
Operating voltage	5 V ±5 %	5 V ±5 %
Current draw at 5 V operating voltage	< 50 mA + current draw of the controller (depending on internal resistance)	< 50 mA + current draw of the controller (depending on internal resistance)
Max. read distance sensor/tape	0.35 mm	0.35 mm
Traverse speed max.	20 m/s	20 m/s
Operating temperature	–20...+80 °C	–20...+80 °C
Recommended processing temperature for tape	0...+40 °C	0...+40 °C
Housing material	Al	Al
Degree of protection	IP 67	IP 67

All specifications in conjunction with tape BML-...-I34... (see page 22).



Position of single reference point using example of BML-M02-I34-A3-M0100-R0025/0000



Typical position of reference points in sensor head

Pre-assembled magnetic tape

BML-M_ _-I3_-A_-M_ _ _ _-_ _ _ _ _

Housing	Accuracy class	Cover strip	Length in cm	Reference point type*	Reference point positions
02 1.55 mm thick, with adhesive foil	4 8 µm, overall accuracy ±10 µm	3 With cover strip (thickness 0.15 mm)	Ordered length	R No reference point or 1 to 2 reference points or pole-periodic reference point	0000 None or pole-periodic
03 1.35 mm thick, without adhesive foil	5 18 µm, overall accuracy ±20 µm	0 Without cover strip		C Fix-periodic reference point	xxxx/yyyy Position of max. 2 reference points
					0006/yyyy Type **C** only: 0002, 0005, 0010, 0020 or 0050 (one point at 6 cm, all others at yyyy cm)

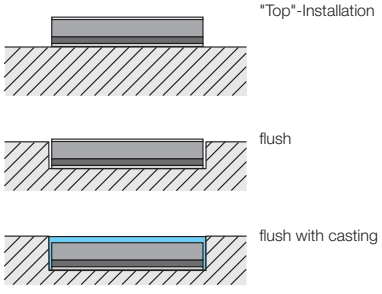
*fixed-periodic reference point only for BML-M02-I34-...

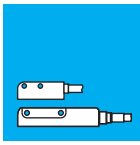
Ordering example: magnetic tape by the roll

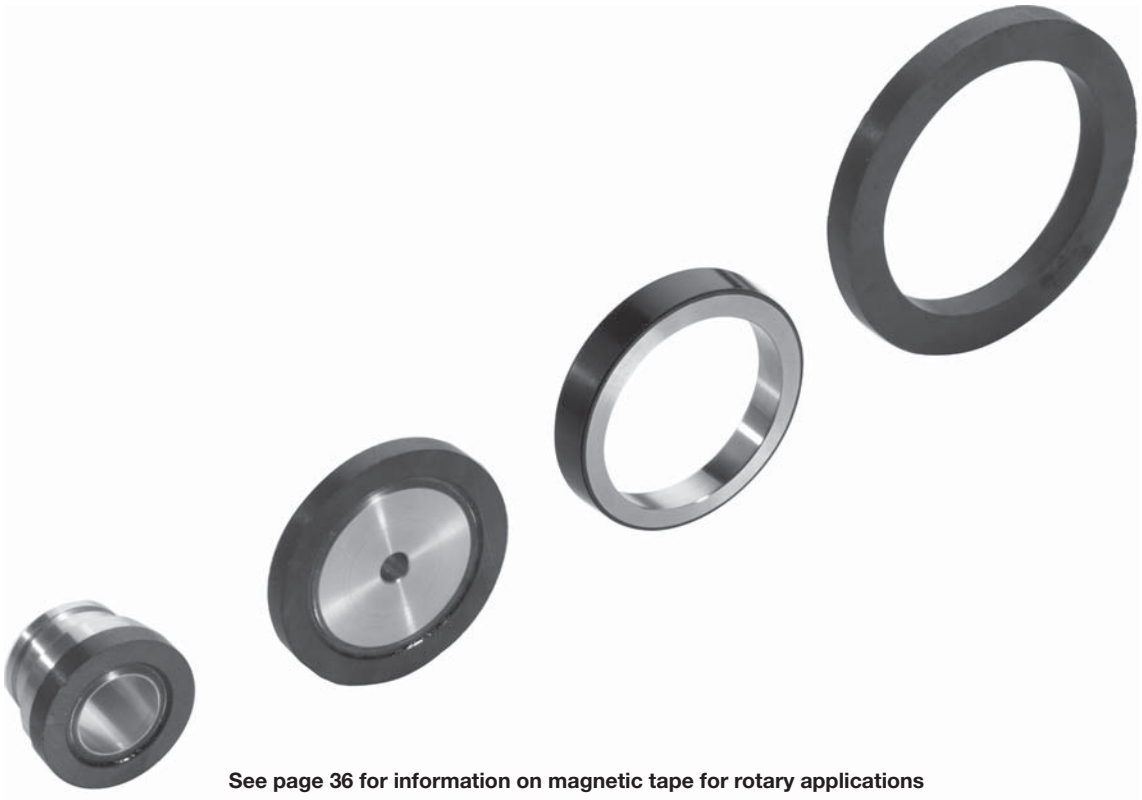
BML-M02-I3_-A0-T_ _ _ _-R0000

Accuracy class	Length
4 8 µm, overall accuracy ±10 µm	0500 5 m
5 18 µm, overall accuracy ±20 µm	1000 10 m
	2400 24 m
	4800 48 m

Magnetic tape mounting options
(also in magnetizable material)

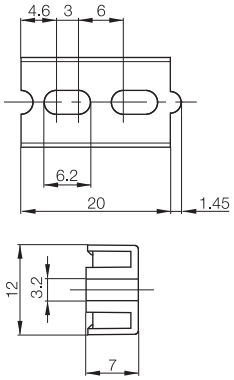


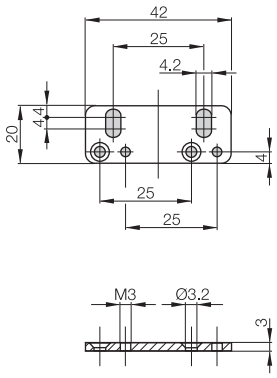


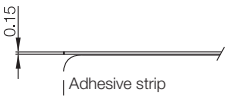


See page 36 for information on magnetic tape for rotary applications

Accessories	Limit switch magnet	Adapter plate	Cover strip by the roll
Ordering code	**BAM0138**	**BAM011W**	
Part number	BML-Z0002	BML-Z0005	BML-A013-T_ _ _ _
	for S1A...	for S1A...	

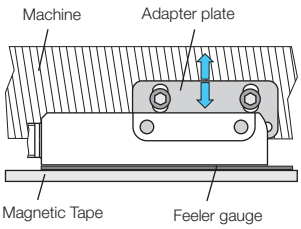






The adapter plate allows you to set the vertical distance from the tape. It can be attached on the left or right of the sensor head.

Installation example



You may cover the magnetic tape with a stainless steel cover strip to protect it from damage caused by chips or chemicals. Note that the permissible air gap between the sensor head and tape is reduced by the thickness of the cover strip with adhesive film (0.15 mm).

Delivery variations:
Cover strip and magnetic tape can be ordered together in matching lengths (see order code for tape).

Cover strip by the roll can be ordered in 4 defined lengths.

Ordering example:

BML-A013-T_ _ _ _

Length

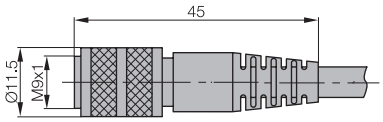
0500	5 m
1000	10 m
2400	24 m
4800	48 m

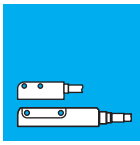
For detailed technical description and installation instructions, see user's guide at www.balluff.com

Version	8-pin, female straight
Part number	BKS-S184-PU-_ _
Housing and cable material	PUR
Contacts	Bronze
Contact surface	Gold
Cable diameter	5.5 mm
No. of wires x cross-section	8×0.14 mm²
Cable type	(4×(2×Lif.PP.F)) +V.C.V.M-PUR/0.14/5.3)
Degree of protection per IEC 60529	IP 67 (when connected)
for shielding	Brass
Min. bending radius	dynamic 15×D, static 7.5×D
Temperature range	–25...+70 °C
View of female coupling side	

PIN	Color
1	WH
2	BN
3	GN
4	YE
5	GY
6	PK
7	BU
8	RD

Please indicate cable length in order code!
Possible cable lengths 2, 5, , 10 or 15 m





S2B/S2E/S1C Series
Contents

The BML magnetic linear encoder system offers three variations for adapting your system to any measurement task in combination with S2B/S2E/S1C sensor heads.
An appropriate resolution and degree of accuracy can be selected in line with the application and reference points can also be integrated. All three systems have a compact design and the same dimensions throughout the series, making them extremely flexible to integrate.

S2B/S2E Series
Best resolution and fast

Features:
- 5 µm resolution
- 20 m/s maximum traverse speed
- Distance between sensor and tape up to 2 mm
- Digital square wave signals RS422 or output voltage 10...30 V
- Two freely positionable limit switches
- Reference signal
- Cable connection
- LED indicator for reference signal

Selecting a suitable BML system: see selection guide on page 44.

Ordering example: sensor head

BML-S2E0-Q_ _ _-M4_ _-_0-_ _ _ _
BML-S2B0-Q_ _ _-M4_ _-_0-_ _ _ _

Operating voltage	Output voltage	Resolution	Reference signal	Limit switch	min. edge separation	Connection type
5 10...30 V	1 Digital square wave signal RS422	F 5 µm	0 None	0 No limit switch	D 0.12 µs	KA02 PUR cable 2 m
6 5 V	3 Same as operating voltage (for 10...30 V only)	G 10 µm	1 Single or fixed-periodic	3 Two limit switches	E 0.29 µs	KA05 PUR cable 5 m
		H 25 µm	2 Pole-periodic		F 0.48 µs	KA10 PUR cable 10 m
		K 50 µm			G 1 µs	KA15 PUR cable 15 m
					H 2 µs	KA20 PUR cable 20 m
					K 4 µs	
					L 8 µs	
					N 16 µs	
					P 24 µs	

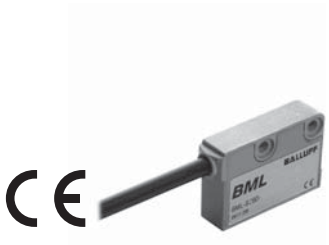
Sensor connectors (e.g. SUB-D or M12 connectors) are available on request.

Preferred models:
BML-S2B0-Q53F-M410-D0-KA05 (BML0211)
Digital signal, 10..30 V, with reference signal, 5 m cable, resolution 5 µm, edge separation 0.12 µs, max. traverse speed 20 m/s

BML S2E0-Q53G-M410-P0-KA05 (BML00JC)
Digital signal, 10..30 V, with reference signal, 5 m cable, resolution 10 µm, edge separation 24 µs, max. traverse speed 26 cm/s

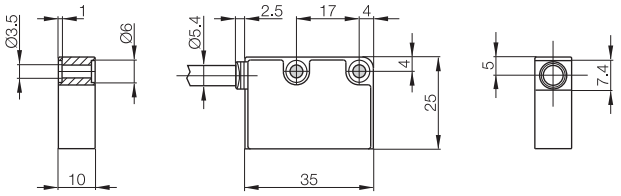
BML S2E0-Q61F-M410-G0-KA05 (BML001E)
Digital signal, 5 V, with reference signal, 5 m cable, resolution 5 µm, edge separation 1 µs, max. traverse speed 3.25 m/s

For detailed technical description and installation instructions,
see user's guide at www.balluff.com

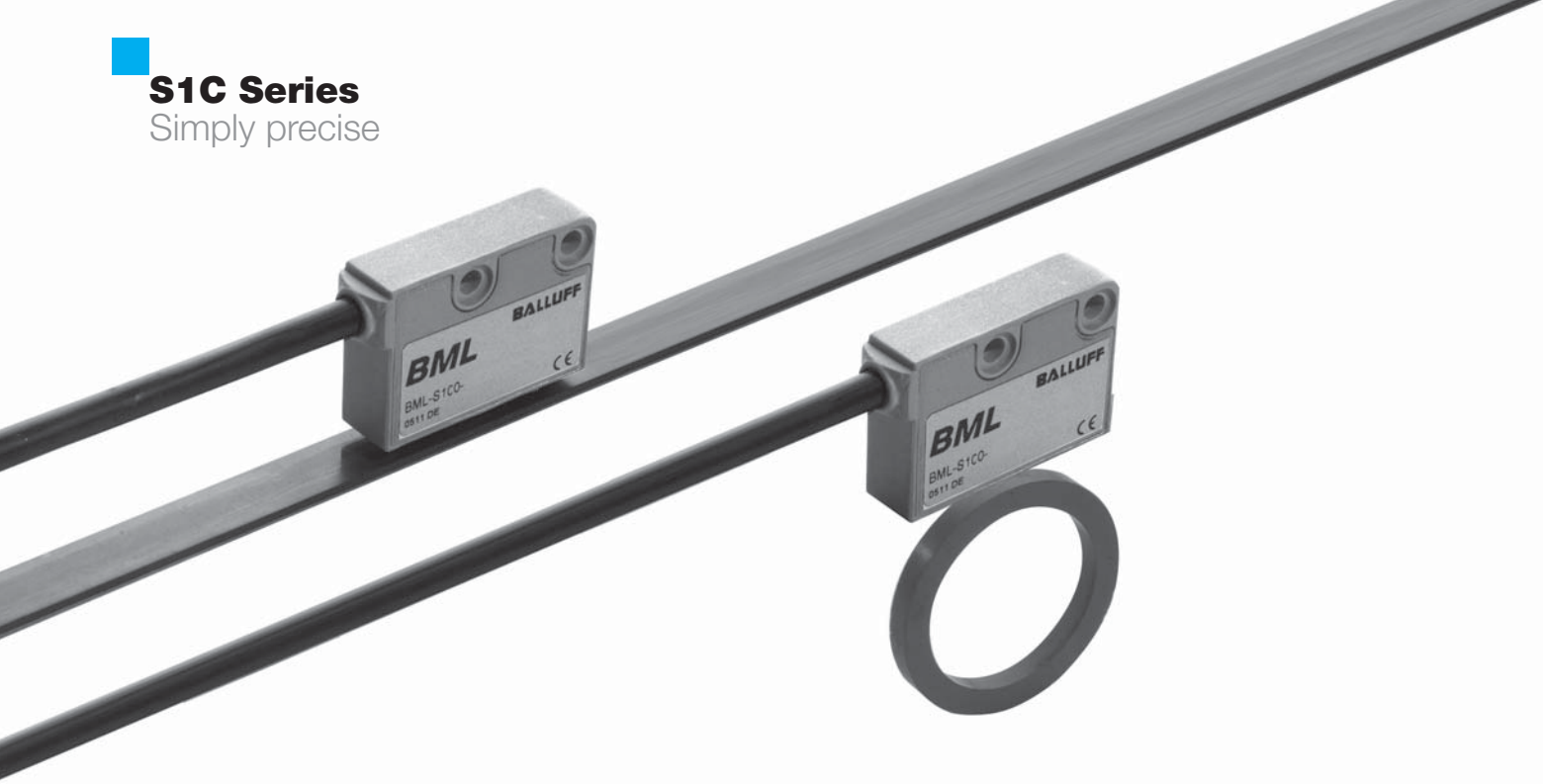


Series	**BML-S2B0-...**	**BML-S2E0-...**
Output signal	Digital square wave signals	Digital square wave signals
Resolution	5 µm, 10 µm, 25 µm or 50 µm	5 µm, 10 µm, 25 µm or 50 µm
Part number	BML-S2B0-Q_ _ _-M4_ _-_0-_ _ _ _	BML-S2E0-Q_ _ _-M4_ _-_0-_ _ _ _
Output voltage (A/B/Z)	RS422 to DIN 66259 or same as operating voltage 10...30 V (without A–, B–, Z–)	RS422 to DIN 66259 or same as operating voltage 10...30 V (without A–, B–, Z–)
Overall system accuracy	±50 µm	±100 µm
Operating voltage	10...30 V or 5 V ±5 %	10...30 V or 5 V ±5 %
Current draw at 5 V operating voltage	< 50 mA + current draw of the controller (depending on internal resistance)	< 50 mA + current draw of the controller (depending on internal resistance)
Current draw at 10...30 V operating voltage	< 40 mA + current draw of the controller (depending on internal resistance)	< 40 mA + current draw of the controller (depending on internal resistance)
Max. read distance sensor/tape	2 mm	2 mm
Traverse speed max.	20 m/s	20 m/s
Operating temperature	–20...+80 °C	–20...+80 °C
Recommended processing temperature for tape	0...+40 °C	0...+40 °C
Housing material	PBT	PBT
Degree of protection	IP 67	IP 67

All specifications in conjunction with tape BML-...-I45-... (BML-S2B0...) or BML-...-I46-... (BML-S2E0...) with read distance of 1 mm (see page 32).



S1C Series
Simply precise



Features:
- ±100 µm system accuracy
  with distance to tape of 0.1...2 mm
- High repeat accuracy ±1 increment
- 0.1 mm resolution
- 10 m/s maximum traverse speed
- Distance between sensor and tape up to 2 mm
- Digital square wave signals, output voltage 10...30 V (HTL)
- Cable connection
- 10...30 V DC output voltage

Selecting a suitable BML system: see selection guide on page 44.

Ordering example: sensor head

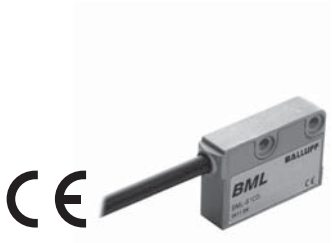
BML-S1C0-Q53_-M400-_0-KA_ _

Resolution		min. edge separation		Connection type	
L	0.1 mm	M	10 µs	KA02	PUR cable 2 m
M	0.2 mm	R	100 µs	KA05	PUR cable 5 m
N	0.5 mm			KA10	PUR cable 10 m
P	1.0 mm			KA15	PUR cable 15 m
R	2.0 mm			KA20	PUR cable 20 m

Sensor connectors (e.g. SUB-D or M12 connectors) are available on request.

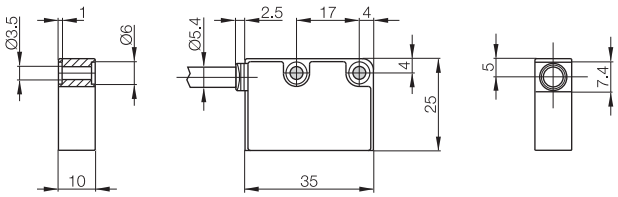
Preferred model:
BML S1C0-Q53L-M400-M0-KA05 (BML003U)
Digital signal, 10..30 V, 5 m cable, resolution 0.1 mm, edge separation 10 µs, max. traverse speed 8 m/s

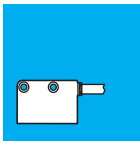
For detailed technical description and installation instructions,
see user's guide at www.balluff.com



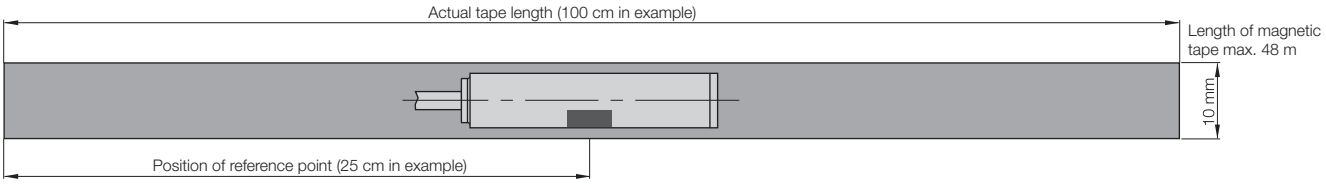
Series	**BML-S1C0-...**
Output signal	Digital square wave signals
Resolution	0,1 mm, 0,2 mm, 0,5 mm, 1 mm or 2 mm
Part number	BML-S1C0-Q53_-M400-_0-KA_ _
Output voltage (A/B)	Same as operating voltage 10...30 V (without A–, B–)
Overall system accuracy	±100 µm
Operating voltage	10...30 V
Current draw at 10...30 V operating voltage	< 40 mA + current draw of the controller (depending on internal resistance)
Max. read distance sensor/tape	2 mm
Traverse speed max.	10 m/s
Operating temperature	–20...+80 °C
Recommended processing temperature for tape	0...+40 °C
Housing material	PBT
Degree of protection	IP 67

All specifications in conjunction with tape BML-...-I46-... with read distance of 1 mm (see page 32).

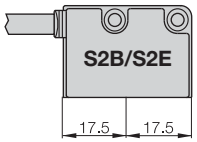




Position of single reference point using example of BML-M02-I45-A0-M0100-R0025/0000



Typical position of reference points in sensor head



Ordering example:

BML-M_ _-I4_-A_-M_ _ _ _-R_ _ _ _

Housing	Accuracy class	Cover strip	Length in cm	Reference point type*	Reference point positions
02 1.55 mm thick, with adhesive foil	5 18 µm, overall accuracy ±50 µm	3 With cover strip	Ordered length	R No reference point or 1 to 2 reference points or pole-periodic reference point	0000 None or pole-periodic
03 1.35 mm thick, without adhesive foil	6 50 µm, overall accuracy ±100 µm (S2E... and S1C... only)	0 Without cover strip		C fixed-periodic reference point	xxxx/yyyy Position of max. 2 reference points only type C: 0006/yyyy 0005, 0010, (one point at 6 cm, all others at yyyy cm)
04 1.15 mm thick, inverse, without adhesive strip, available in accuracy class 6					

* For BML-S1C, only R0000 (no reference point) / fixed-periodic reference point only for type BML-M02-I45-...

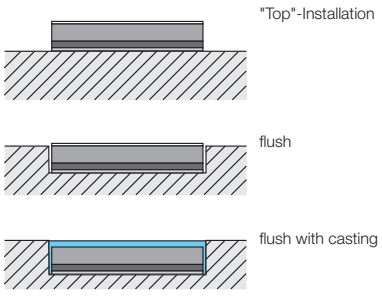
Ordering example: Magnetic tape by the roll

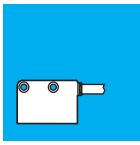
BML-M02-I4_-A0-T_ _ _ _-R0000

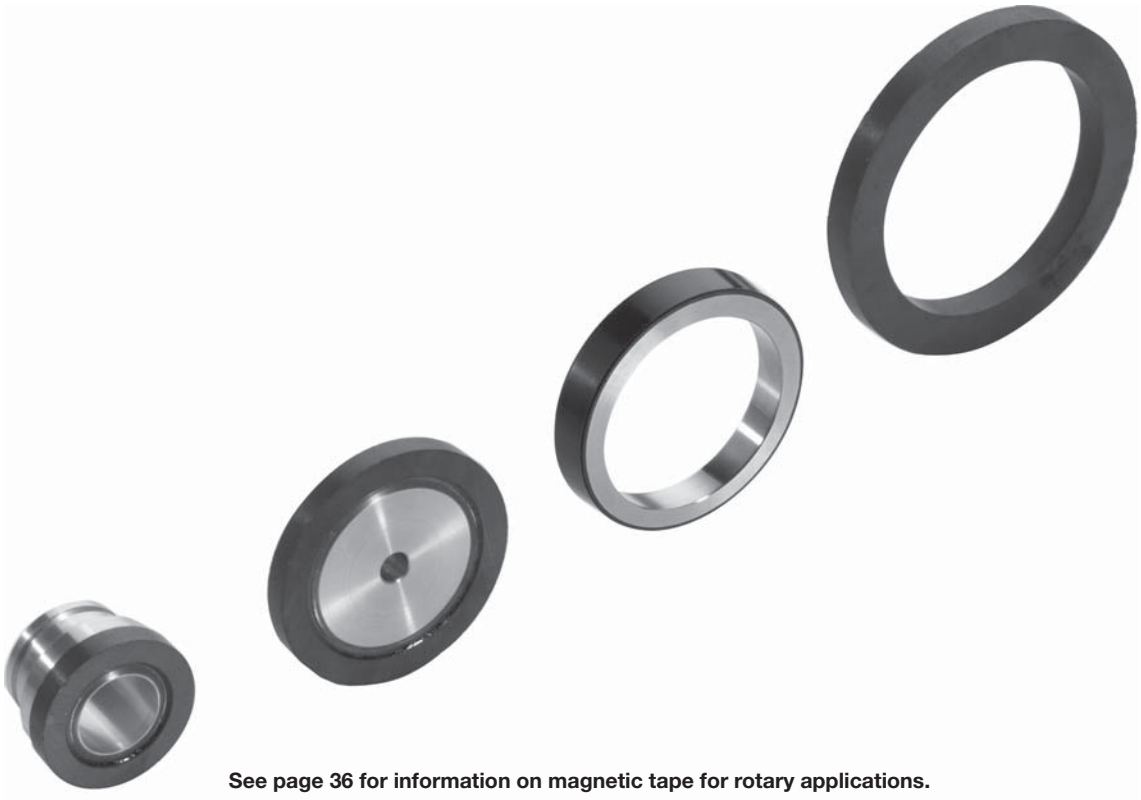
Accuracy class	Length
5 18 µm, overall accuracy ±50 µm	0500 5 m
6 50 µm, overall accuracy ±100 µm	1000 10 m
	2400 24 m
	4800 48 m

Better accuracy classes are available on request.

Installation possibilities for magnetic tape
(also in magnetizable material)







See page 36 for information on magnetic tape for rotary applications.

Accessories
Contents

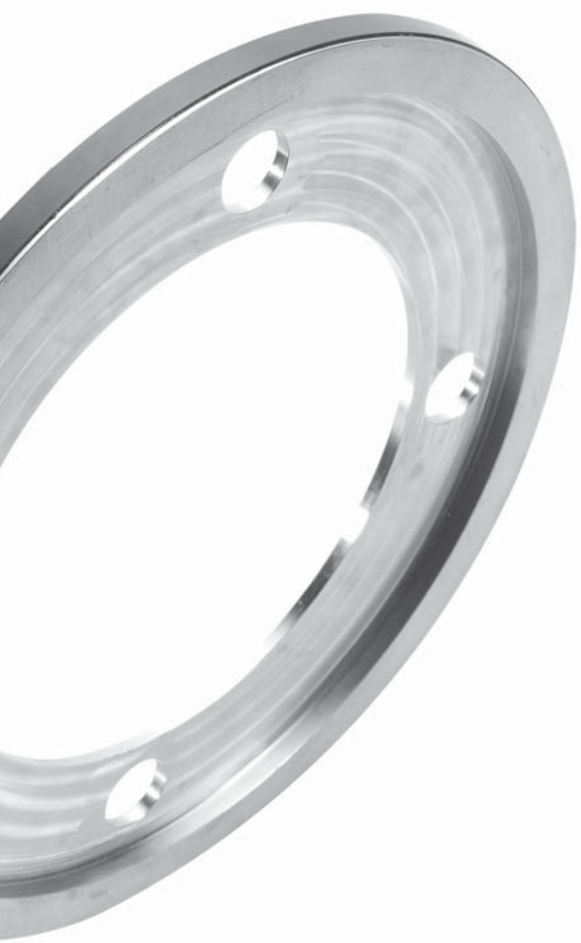
Counters and displays are available for all series to integrate the sensor systems perfectly in your application.
The range of sensor guides gives you the option of integrating robust, high-precision measurement systems in applications where machines are not able to provide adequate guidance.

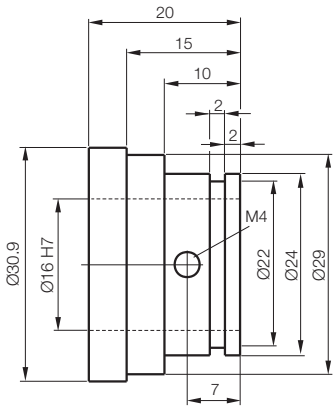
Accessories
Magnet rings

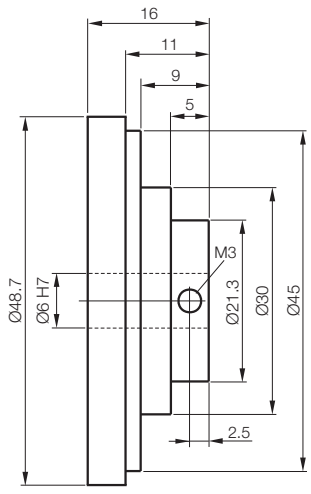
Special solutions for a range of applications
Magnetic rings are suitable for all types of application where the monitoring of rotary movements is required. Due to the high resolution, synchronous run monitoring is just as easy to implement as precision angle positioning.
Balluff offers a range of standard rotary tapes that are suitable for most types of application. Due to the wide variety of different machine applications, special dimensions and magnetic configurations are available on request.

Even linear tapes have been used successfully in rotary applications. For example, the magnetic tape can be attached to the shaft of a solar panel unit to monitor whether the panel is aligned perfectly with the sun. Balluff also offers prefabricated magnetic tapes with holes for convenient, simplified installation.

Series	Sensor range B/C/E	Sensor range B/C/E	
Ordering code	**BML002T**	**BML002R**	
Part number	BML-M22-I40-A0-M031/016-R0	BML-M21-I40-A0-M048/006-R0	
With hub	■	■	
Material	Hard ferrite/aluminum	Hard ferrite/aluminum	



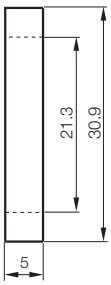


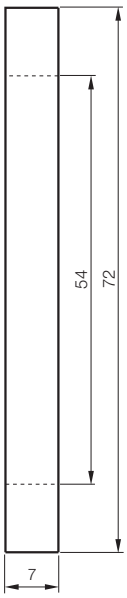


Special solutions for even greater performance.
Do not hesitate to contact us.

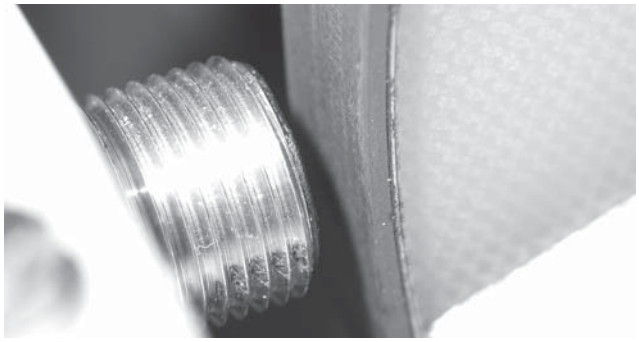
Magnet rings
Counter displays
Sensor guide
Technical selection guide

	Sensor range B/C/E	Sensor range B/C/E	Sensor range B/C/E
	BML002L	**BML002M**	**BML002N**
	BML-M20-I40-A0- M031/021-R0	BML-M20-I40-A0- M048/037-R0	BML-M20-I40-A0- M072/054-R0
	Hard ferrite	Hard ferrite	Hard ferrite

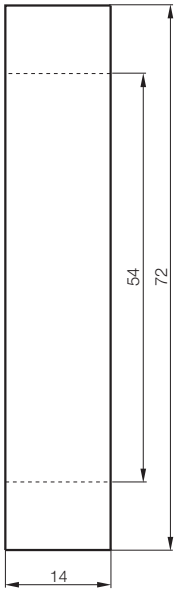


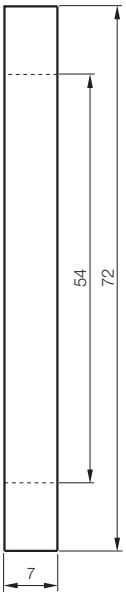


Speed monitoring in rotary applications: so much easier.
Designed for the B/C/E range of sensors, the magnetic rings and tapes shown here allow you to measure speed, even in combination with switching magnetic field sensors from the BMF series. The sensor BMF 12M-PS-D-2-S4 with standard M12 thread is suitable for a wide range of applications and can be installed as close as 2 mm from the magnet. A pulse signal that represents the rotary speed is issued at the switching output. The sensor can detect frequencies up to 7 kHz and measure speeds of up to 20000 rpm, depending on the selected tape.

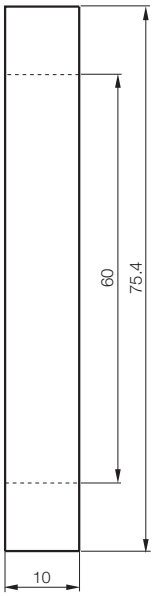


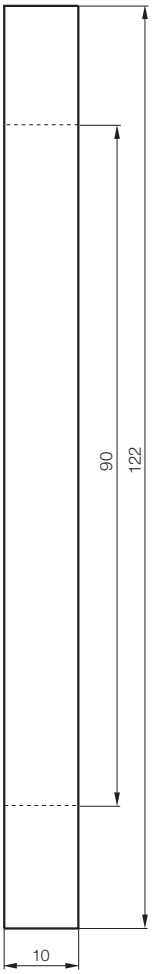
Series	Sensor range B/C/E	Sensor range A/F	
Ordering code	**BML002P**	**BML002K**	
Part number	BML-M20-I40-A0- M072/054-R1	BML-M20-I30-A0- M072/054-R0	
With reference mark	■		
Material	Hard ferrite	Hard ferrite	





	Sensor range A/F	Sensor range A/F	
	BML01KM	**BML01EW**	
	BML-M31-I30-A0-M075/060-R0	BML-M30-I30-A0-M122/090-R0	
	Elastomer on steel ring with fit H7	Elastomer on steel ring with fit H7	





Ordering example:

BDD 610-R3Q3-0-_ _-N-00

Options

51 2 digital inputs
53 2 digital outputs

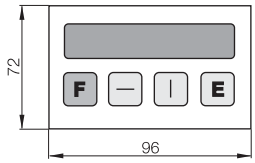
BDD 611-R3Q4-0-52-N-00

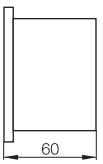
BDD 6_2-R3Q4-0-52-N-00

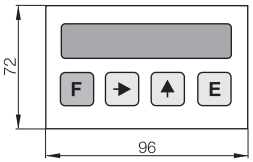
Number of axes

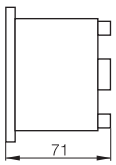
2 2 axes
3 3 axes

Series	**BDD 610**	**BDD 611**	**BDD 622/BDD 632**
Interface	Single-axis counter for BML series B/C/E	Single-axis counter for all BML-Sxx...	Single-axis counter for all BML-Sxx...
Part number	BDD 610-R3Q3-0-_ _-N-00	BDD 611-R3Q4-0-52-N-00	BDD 6_2-R3Q4-0-52-N-00
Functions	– Set value – Power down memory – Factor calculation – Reverse count direction – Up to 3 decimal places – Assignable key functions – Reset and set logic – In- and outputs logic – Security code	– Set value – Power down memory – Factor calculation – Edge evaluation – Reverse count direction – Up to 3 decimal places – Assignable key functions – Reset and set logic – Absolute and incremental – Offset logic – Saw blade correction – In- and outputs logic – Security code – Reference pulse	– Set value – Power down memory – Factor calculation – Edge evaluation – Reverse count direction – Up to 3 decimal places – Assignable key functions – Reset and set logic – Absolute and incremental – Offset logic – Saw blade correction – In- and outputs logic – Security code – Reference pulse
Features	– 1×6 decade LED display – Digit height 14 mm – Incremental measuring system with tracks A, B – max. 25 kHz – Operating voltage 24 V DC – 2 digital inputs – 2 digital outputs	– 1×6 decade LED display – Digit height 14 mm – Incremental measuring system with A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ or A, B, Z – max. input frequency: Signal A or B: 1 MHz – Min. edge separation for 4-way processing: 250 ns – Operating voltage 24 V DC – 4 digital inputs – 2 digital outputs (BDD 611-R3Q4-0-52-N-00)	– 2×6/3×6 decade LED display – Digit height 14 mm – Incremental measuring system with A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ – Min. edge separation for 4-way processing: 250 ns – Operating voltage 24 V DC – 4 digital inputs – 2 digital outputs (BDD 622-R3Q4-0-52-N-00)
Version	for BML series B/C/E-Q53..., min. edge separation Code M, N, P, R	for BML with operating voltage 5 V/10...30 V, output voltage RS422/HTL, min. edge separation Code E, F, G, H, K, L, M, N, P, R	for BML with operating voltage 5 V/10...30 V, output voltage RS422/HTL, min. edge separation Code E, F, G, H, K, L, M, N, P, R

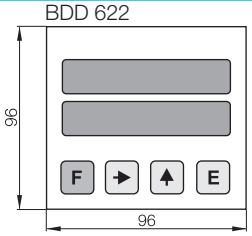




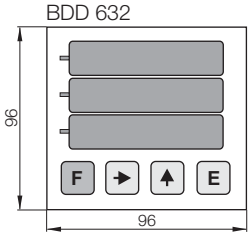


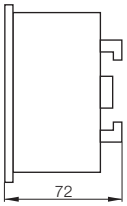


BDD 622



BDD 632





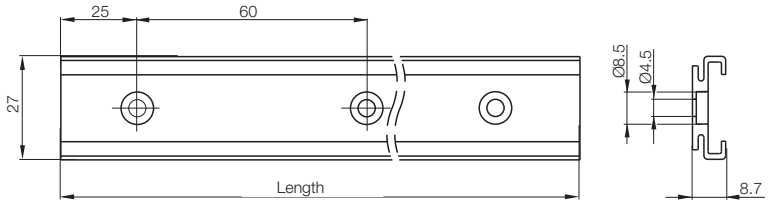
Please order separately:

Accessories	Power supply 115V/230 V	Power supply 115V/230 V
Ordering code	**BAE0001**	**BAE00EN**
Part number	BAE PS-XA-1W-24-007-0010	BAE PS-XA-1W-24-038-601

The sensor guide always consists of an aluminum rail that retains the magnetic tape and a carriage with runners that guides the sensor head accurately. A standard control arm is used for the mechanical connection.

The benefits:
Perfect adaptation to your individual application:
- Individual lengths available
- Direct screws or mounting elements for simple attachment
- Rails can be mounted side by side and elements disassembled
- Connection of drag chains possible
- Flat design, minimal space requirements
- Low costs
- Lubrication of runners unnecessary, no maintenance costs as a result
- Minimum stock holding times because concept is universal, even compatible with different sensor heads
- Mounting aid for easy installation of the magnetic tape

Sensor guide	Guide rail for slide carriage	
Ordering code		
Part number	BML-R01-M_ _ _	
Features	– Anodized aluminum – Mounting holes available – Alternative mounting using lateral groove and brackets – Side by side installation using mounting brackets – Maintenance-free dry operation – Free of lubricants – Suitable for all linear tapes	
Version	for retaining slide carriages BML-C01 or BML-C02	

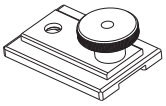


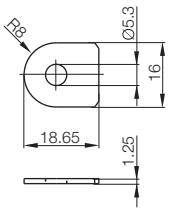
Ordering example: aluminum rail

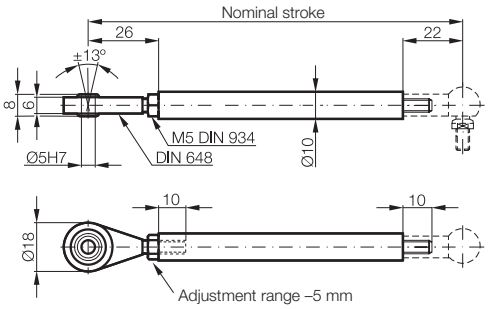
BML-R01-M_ _ _

Length in cm, max. 300

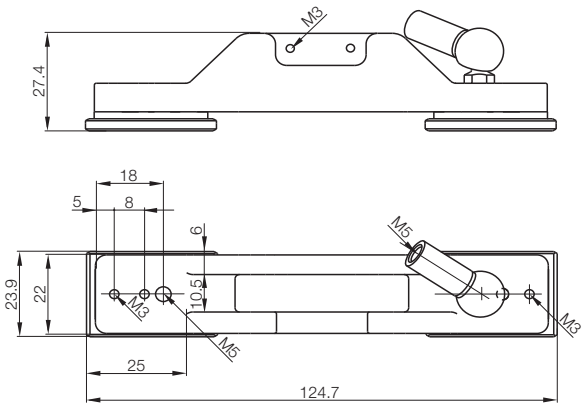
Accessories	Mounting guide	Brackets (2 pieces)	Control arm
Ordering code	**BAM01L9**	**BAM01JL**	
Part number	BML-Z0010	BML-Z0008	BTL2-GS10-_ _ _ _-A
Version	for mounting the magnetic tape with maximum precision	for side mounting of the rail as well as on transition points	for connecting the slide carriage to the machine

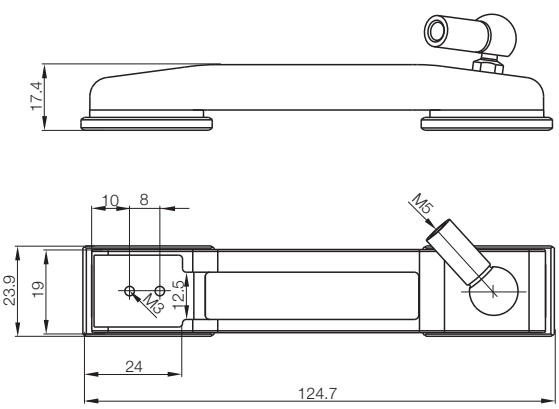






	Slide carriage	Slide carriage
	for sensors BML-S2B, BML-S2E, BML-S1C	for sensors BML-S1F
	BML01FR	**BML01FJ**
	BML-C01	BML-C02
	– Aluminum – Fully assembled with runners and connection for control arm – Connection for drag chains available – Maintenance-free dry operation – Free of lubricants	– Aluminum – Fully assembled with runners and connection for control arm – Connection for drag chains available – Maintenance-free dry operation – Free of lubricants
	for retaining sensors BML-S2B, BML-S1C or BML-S2E	for retaining sensor BML-S1F





The BML system allows precision adaptation to the relevant application. Balluff offers a technical selection guide that provides valuable assistance.

Selecting a suitable controller

Each sensor with a digital output signal has a characteristic minimum edge separation gap that the higher level controller must reliably detect. We therefore recommend selecting a controller with a counting frequency that is higher than the theoretically calculated counting frequency.

Please use the following formula to select a suitable controller:

$$\text{Counting frequency of controller} \geq \frac{1}{\text{min. edge separation}}$$

Example: If the sensor has a minimum edge separation gap of 1µs, then a controller capable of detecting a frequency of at least 1 MHz must be selected based on the above formula.

Maximum traverse speed, resolution and edge separation

The following tables show the relationship between the selected resolution of the sensor head, the minimum edge separation and the potential traverse speed:

Sensors from the S1A/S1F series: system accuracy up to 10 µm

min. edge separation		V_{max} in accordance with edge separation and resolution Mechanical resolution **D** 1 µm	**E** 2 µm	**F** 5 µm	**G** 10 µm
D	0.12 µs	5 m/s	10 m/s	20 m/s	20 m/s
E	0.29 µs	2 m/s	4 m/s	10 m/s	10 m/s
F	0.48 µs	1 m/s	2 m/s	5.41 m/s	5.41 m/s
G	1 µs	0.65 m/s	1.3 m/s	2.95 m/s	2.95 m/s
H	2 µs	0.3 m/s	0.6 m/s	1.54 m/s	1.54 m/s
K	4 µs	0.15 m/s	0.3 m/s	0.79 m/s	0.79 m/s
L	8 µs	0.075 m/s	0.15 m/s	0.34 m/s	0.34 m/s
N	16 µs	0.039 m/s	0.079 m/s	0.19 m/s	0.19 m/s
P	24 µs	0.026 m/s	0.052 m/s	0.13 m/s	0.13 m/s

Table 1: Selection guide for maximum traverse speed of S1A/S1F series.

Sensors from the S2B/S2E series: system accuracy up to 50 µm

min. edge separation		V_{max} in accordance with edge separation and resolution Mechanical resolution **F** 5 µm	**G** 10 µm	**H** 25 µm	**K** 50 µm
D	0.12 µs	20 m/s	20 m/s	20 m/s	20 m/s
E	0.29 µs	10 m/s	20 m/s	20 m/s	20 m/s
F	0.48 µs	5 m/s	10 m/s	20 m/s	20 m/s
G	1 µs	3.25 m/s	6.5 m/s	14.75 m/s	14.75 m/s
H	2 µs	1.5 m/s	3 m/s	7.7 m/s	7.7 m/s
K	4 µs	0.75 m/s	1.5 m/s	3.95 m/s	3.95 m/s
L	8 µs	0.375 m/s	0.75 m/s	1.7 m/s	1.7 m/s
N	16 µs	0.195 m/s	0.395 m/s	0.95 m/s	0.95 m/s
P	24 µs	0.13 m/s	0.26 m/s	0.65 m/s	0.65 m/s

Table 2: Selection guide for maximum traverse speed of S2B/S2E series.

Sensors from the S2B/S2E series: system accuracy up to 100 µm

min. edge separation		V_{max} in accordance with edge separation and resolution Mechanical resolution **L** 100 µm	**M** 200 µm	**N** 500 µm	**P** 1000 µm	**R** 2000 µm
M	10 µs	8 m/s	10 m/s	10 m/s	10 m/s	10 m/s
R	100 µs	0.9 m/s	1.8 m/s	4.2 m/s	8.8 m/s	10 m/s

Table 3: Selection guide for maximum traverse speed of S1C series.

Rotary applications
The BML system allows precision adaptation of rotary tapes to the relevant application.
Balluff offers a technical selection guide for rotary systems that provides valuable assistance.

Determining the pulses per rotation
The number of required pulses per rotation varies depending on the application. which determines the resolution of the sensor head and the diameter of the magnetic ring.

Sensors from S1A/S1F series

	Pulses/revolution with 4-way evaluation		
	∅ External magnetic ring		
Sensor head resolution	**72 mm**	**75 mm**	**122 mm**
D = 1 µm	228000	238000	384000
E = 2 µm	114000	119000	192000
F = 5 µm	45600	47600	76800
G = 10 µm	22800	23800	38400

Table 4: Selection guide for magnetic rings from the S1A/S1F series

Sensors from S2B/S2E series

	Pulses/revolution with 4-way evaluation		
	∅ External magnetic ring		
Sensor head resolution	**31 mm**	**49 mm**	**72 mm**
F = 5 µm	20000	32000	46000
G = 10 µm	10000	16000	23000
H = 25 µm	4000	6400	9200
K = 50 µm	2000	3200	4600

Table 5: Selection guide for magnetic rings from the S2B/S2E series

Sensors from S1C series

	Pulses/revolution with 4-way evaluation		
	∅ External magnetic ring		
Sensor head resolution	**31 mm**	**49 mm**	**72 mm**
L = 100 µm	1000	1600	2300
M = 200 µm	500	800	1150
N = 500 µm	200	320	460
P = 1000 µm	100	160	230
R = 2000 µm	50	80	115

Table 6: Selection guide for magnetic rings from the S1C series

Maximum speed
The BML system enables the detection of rotary movements. The speed and the diameter of the magnetic ring determine the speed of the ring on the sensor head.
The maximum traverse speed that the sensor can detect influences the selection of the resolution and edge separation of the sensor head. A maximum speed is then calculated using the following formula:

$$\text{Max. speed (rpm)} = \frac{60 \times \text{max. traverse speed (m/s)}}{\pi \times \text{magnetic ring diameter (m)}}$$

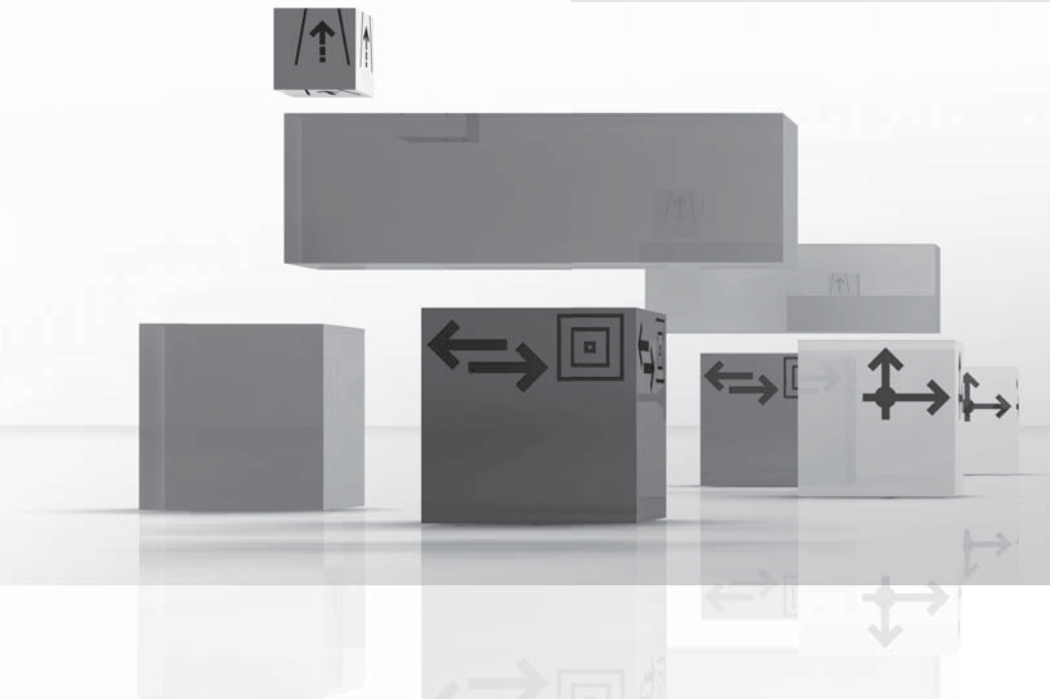
Refer to tables 1 to 3 for information on the maximum traverse speed. When selecting a maximum speed for the application, we recommend using a value 10 % lower than this value.

Example:
You are using a BML-S2B sensor with a resolution of 5 µm (F) and a minimum edge separation of 1µs (G). For this sensor, a maximum traverse speed of 3.25 m/s is calculated using Table 2.
If the magnetic ring diameter is 48 mm = 0.048 m, a speed of 1293 rpm can be achieved using the formula. With consideration for the reduced value, the speed should not exceed 1164 rpm.

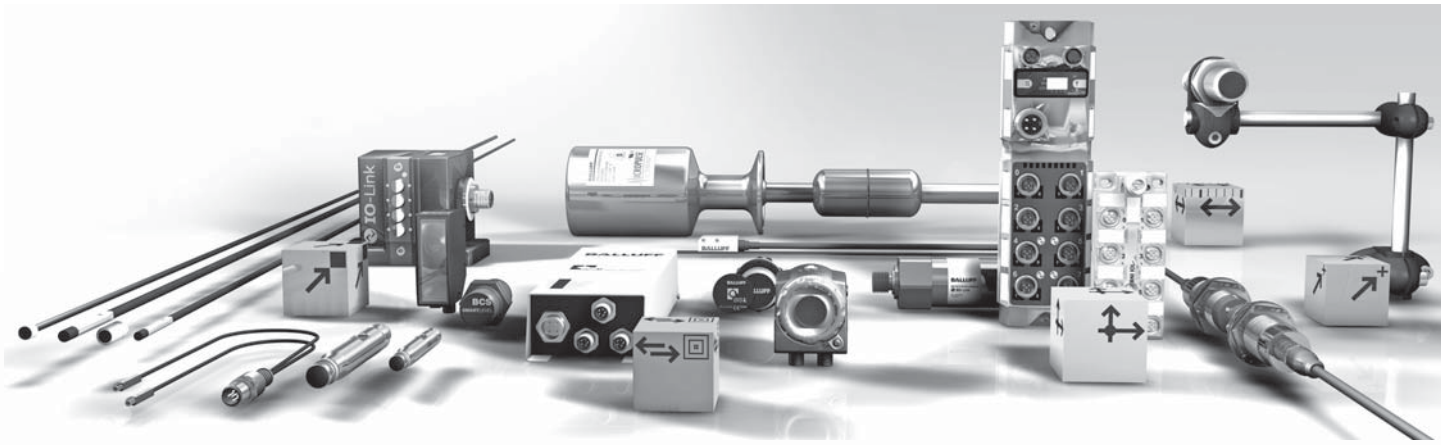
Part number	Ordering code	Page
BDD 610-R3Q3-0-_ _-N-00		41
BDD 611-R_Q4-0-_ _-N-00		41
BDD 6_2-R_Q4-0-_ _-N-00		41
BKS-S184-PU-_ _		25
BML-A013-T_ _ _ _		24
BML-C01	**BML01FR**	43
BML-C02	**BML01FJ**	43
BML-M02-I34-A3-M0100-R0025/0000		22
BML-M02-I45-A0-M0100-R0025/0000		32
BML-M20-I40-A0-M031/021-R0	**BML002L**	37
BML-M20-I40-A0-M048/037-R0	**BML002M**	37
BML-M20-I40-A0-M072/054-R0	**BML002N**	37
BML-M20-I40-A0-M072/054-R1	**BML0028**	38
BML-M20-I30-A0-M072/054-R0	**BML002K**	38
BML-M21-I40-A0-M048/006-R0	**BML002R**	36
BML-M22-I40-A0-M031/016-R0	**BML002T**	36
BML-M30-I30-A0-M122/090-R0	**BML01EW**	39
BML-M31-I30-A0-M075/060-R0	**BML01KM**	39
BML-R01-M_ _ _		42
BML-S1A1-A62Z-M310-90-S184	**BML0002**	18
BML-S1A1-Q61D-M320-F0-S184	**BML0005**	18
BML-S1A_-A62Z-M3 _ _-90-_ _ _ _		19
BML-S1A_-Q61_-M3_ _-_0-_ _ _ _		19
BML-S1C0-Q53L-M400-M0-KA05	**BML003U**	30
BML-S1C0-Q53_-M400-_0-KA_ _		31
BML-S1F1-A62Z-M310-90-KA02	**BML0019**	20
BML-S1F1-Q61D-M310-F0-KA05	**BML001A**	20
BML-S1F2-A62Z-M310-90-KA05	**BML0001**	20
BML-S1F_-A62Z-M3_ _-20-_ _		21
BML-S1F_-Q61_-M3_ _-_0-_ _		21
BML-S2B0-Q53F-M410-D0-KA05	**BML0211**	28
BML-S2B0-Q_ _ _-M4_ _-_0-_ _ _ _		29
BML-S2E0-Q53G-M410-P0-KA05	**BML00JC**	28
BML-S2E0-Q61F-M410-G0-KA05	**BML001E**	28
BML-S2E0-Q_ _ _-M4_ _-_0-_ _ _ _		29
BML-Z0002	**BAM0138**	24
BML-Z0005	**BAM011W**	24
BML-Z0010	**BAM01L9**	43
BML-Z0008	**BAM01JL**	43
BTL2-GS10-_ _ _ _-A		43

Object Detection
- BES Inductive sensors
- BMF Sensors for pneumatic cylinders
- BMF Magnetic field sensors
- BCS Capacitive sensors
- BUS Ultrasonic sensors
- BSP Pressure sensors
- BOS Photoelectric sensors
- BFB Fiber optic devices
- BGL Through-beam fork sensors
- BOWA Dynamic optical windows
- BLG Light grids
- BKT Contrast sensors
- BLT Luminescence sensors
- BFS Color sensors
- BNS Mechanical single and multiple position switches
- BNS Inductive single and multiple position switches

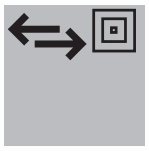
Take advantage of the broad performance spectrum from Balluff. And profit from maximum precision, even in difficult areas.
Balluff stands for comprehensive systems from a single source, continuous innovation, the most modern technology, highest quality and greatest reliability and prides itself on distinctive customer orientation, custom-tailored solutions, fast worldwide service and outstanding application assistance. In short: for reliable, expert partnership.



Intelligent Sensor Solutions
The whole product range for your needs



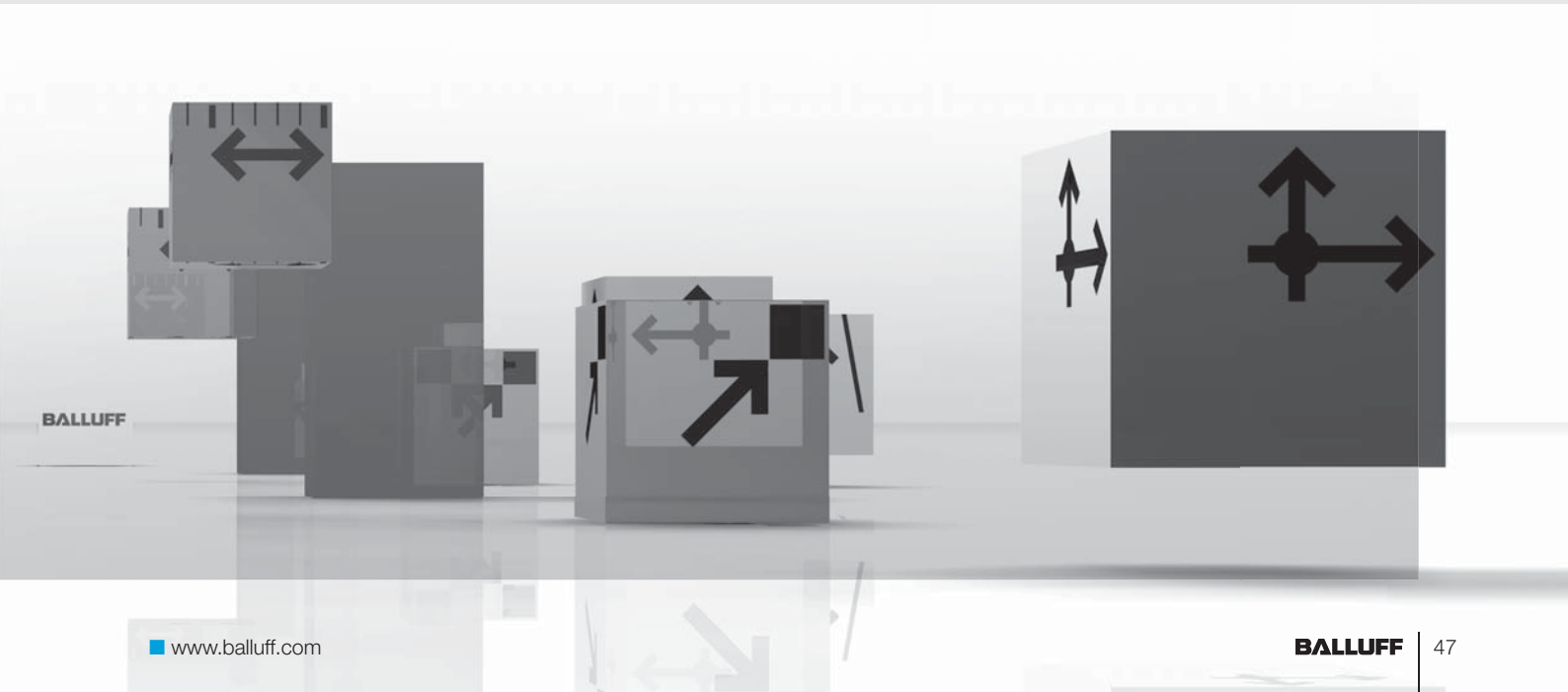
Linear Position Sensing
- BTL Micropulse transducers
- BML Magnetic linear encoder system
- BDG Incremental encoders
- BRG Absolute encoders
- BIW Inductive linear position sensors
- BAW Inductive distance sensors
- BIL Magneto-inductive position sensors
- BOD Photoelectric distance sensors
- BUS Ultrasonic sensors



Industrial Identification
- BIS Industrial RFID systems
- BVS Vision sensors

Industrial Networking and Connectivity
- BCC Connectors and connection cables
- BPI Passive splitter boxes
- BNI Active splitter boxes
- IO-Link
- BIC Inductive couplers
- Bus systems
- Wireless
- Electrical devices

Mechanical Accessories
- Holders and fastening systems
- BMS Mounting system



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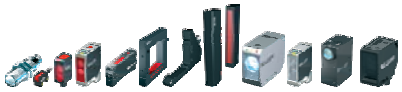
Object Detection

Sensor Product Line
Inductive sensors BES DC 3-/4-wire
Inductive sensors BES DC 2-wire
Inductive sensors BES AC/DC
Inductive sensors BES with special properties
Sensors for pneumatic cylinders BMF
Magnetic field sensors BMF
Capacitive sensors BCS
Ultrasonic sensors BUS
Pressure sensors BSP



Photoelectric Product Line
Diffuse energetic BOS with fore- and background suppression
Retro-reflective sensors BOS
Through-beam sensors BOS (emitter/receiver)
Fiber optic devices BFB
Through-beam fork sensors BGL
Dynamic optical windows BOWA
Light grids BLG
Contrast sensors BKT
Luminescence sensors BLT
Color sensors BFS
Photoelectric distance sensors BOD

Mechanical Product Line
Mechanical multiple and single position switches
Mechanical multiple and single position switches to DIN EN 60204-1/VDE 0113
Mechanical multiple and single position switches with forced opening
Mechanical multiple and single position switches with quick-change plunger unit
Inductive multiple and single position switches
Inductive multiple and single position switches with extended switching distance
Mechanical wireless position switches
Mixed assembly multiple position switches

Linear Position Sensing

Linear Position Sensing Product Line
Micropulse® transducer BTL Profile series
Micropulse® transducer BTL AT series
Micropulse® transducer BTL Rod series
Micropulse® transducer BTL Compact Rod series
Micropulse® processors, BUS interfaces
Magnetic linear encoder system BML
Incremental and absolute encoders BDG/BRG
Inductive linear position sensor BIW
Inductive distance sensors BAW
Magneto-inductive position sensors BIL
Photoelectric distance sensors BOD
Ultrasonic sensors BUS

Industrial Identification

Industrial Identification
Industrial RFID systems BIS C
Industrial RFID Systems BIS L
Industrial RFID systems BIS M
Industrial RFID systems BIS S
Vision sensor BVS

Industrial Networking and Connectivity

Industrial Networking and Connectivity
Connectors and cables BCC
Passive splitter boxes BPI
Active splitter boxes BNI
IO-Link
Remote inductive transmission systems
Inductive couplers BIC
Bus systems
Wireless
Electrical devices

Mechanical Accessories

Mechanical Accessories
Holders and fastening systems
Mounting system BMS

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Object Detection

Linear Position Sensing

Industrial Identification

Industrial Networking and Connectivity

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