BALLUFF

Magnetic Linear Encoder Systems BML

... non-contacting and high-resolution

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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 are a highly precise, fast-response and very rugged measuring system. Resolution is up to 1 µm. In addition, accuracy classes of 10...20 µm are achieved. The permissible traverse speed is up to 10 m/s. The measured position value is made available in fractions of microseconds. The controller receives the position signal in realtime.

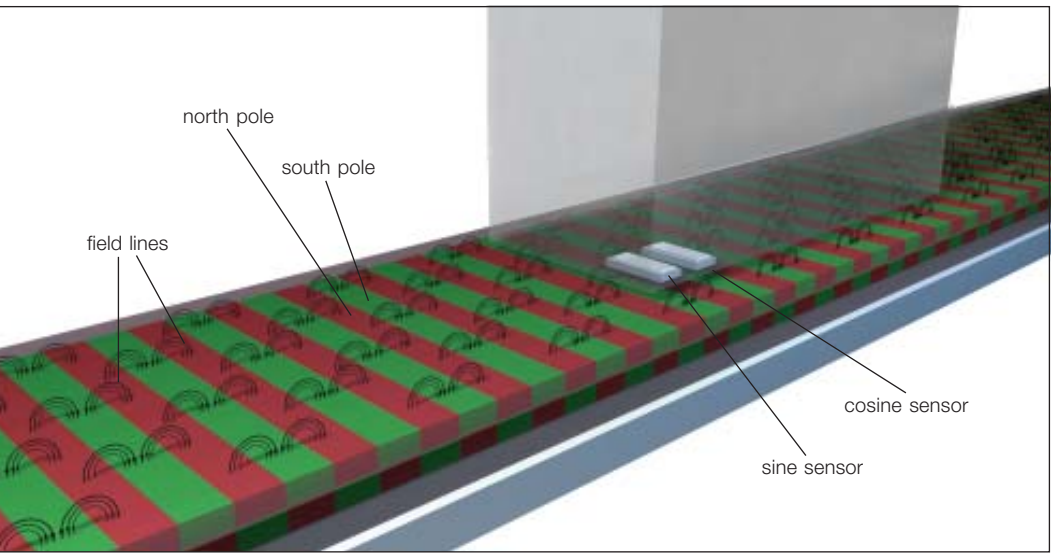
Non-contacting and highly rugged for harsh applications

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

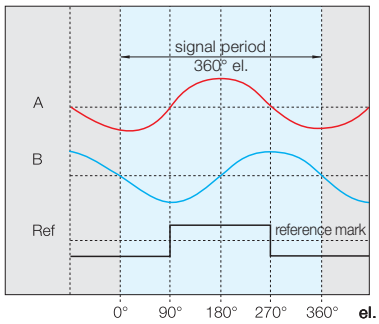
- Non-contact operating principle
- Resolution to 1 µm
- System accuracy to ±10 µm
- Digital square wave signals RS422 or 10...30 V
- Sinusoidal analog signals 1 V_{ss}
- Gap between sensor and tape up to 2 mm
- Reference and limit switch function
- Cable or connector version

Operating principle of Magnetic Linear Encoder System BML



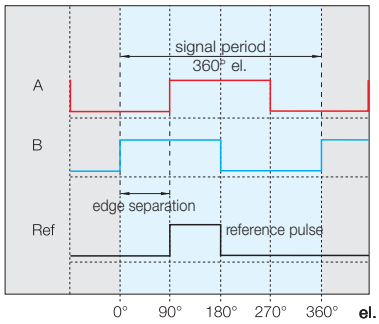
Output signals

Sinusoidal analog signals 1 V_{ss}



- Sinusoidal voltage signals with inversion
- Signal period 360° electrical = 1000 µm
- Termination resistance 120 Ohm

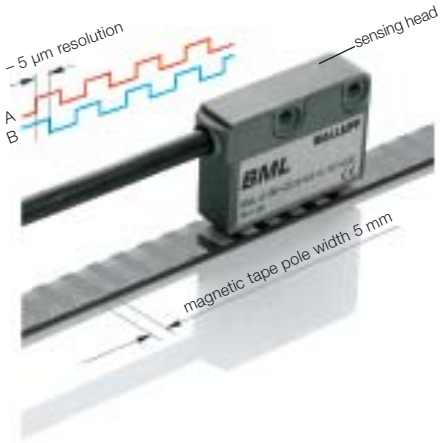
Digital square wave signals RS422



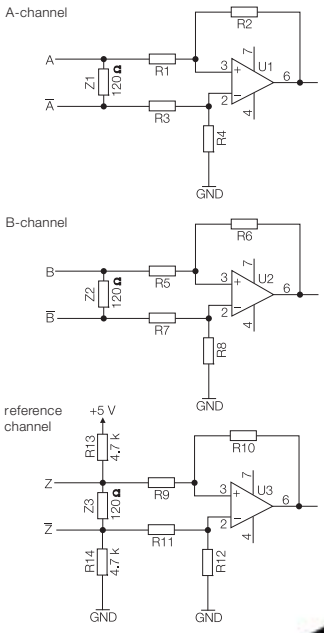
- Square wave signals RS422 to DIN 66259 90° phase shifted
- Edge separation A/B corresponds to resolution of sensing head
- Differential signal (BML-S1A...)
- Termination resistance 120 Ohm

BML sensor head with integrated interpolator

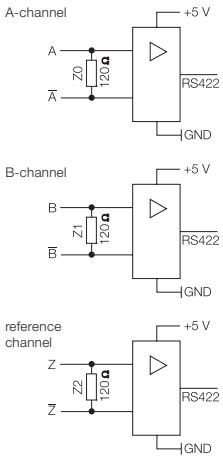
Example: BML-S1B... 5 µm resolution

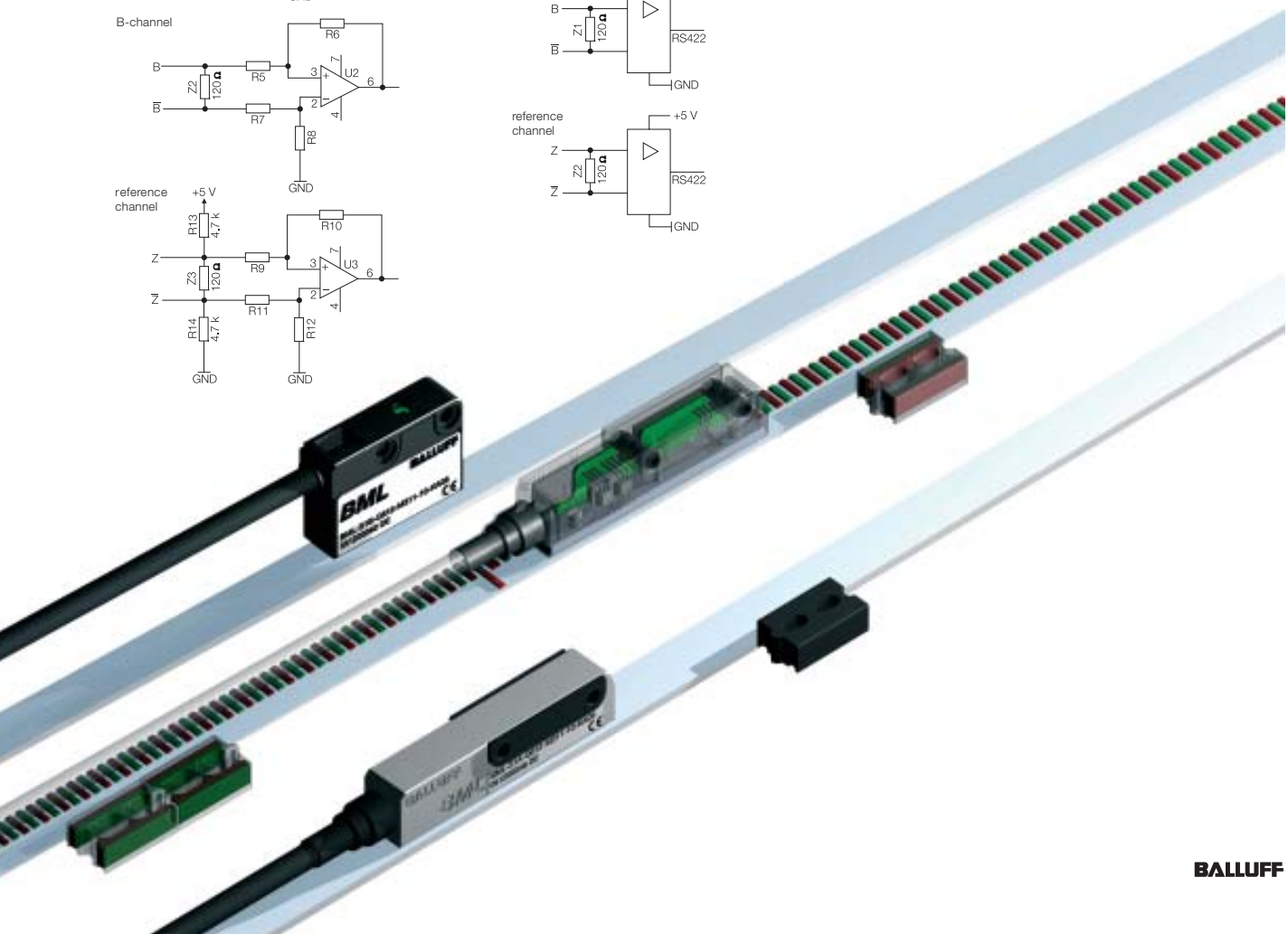


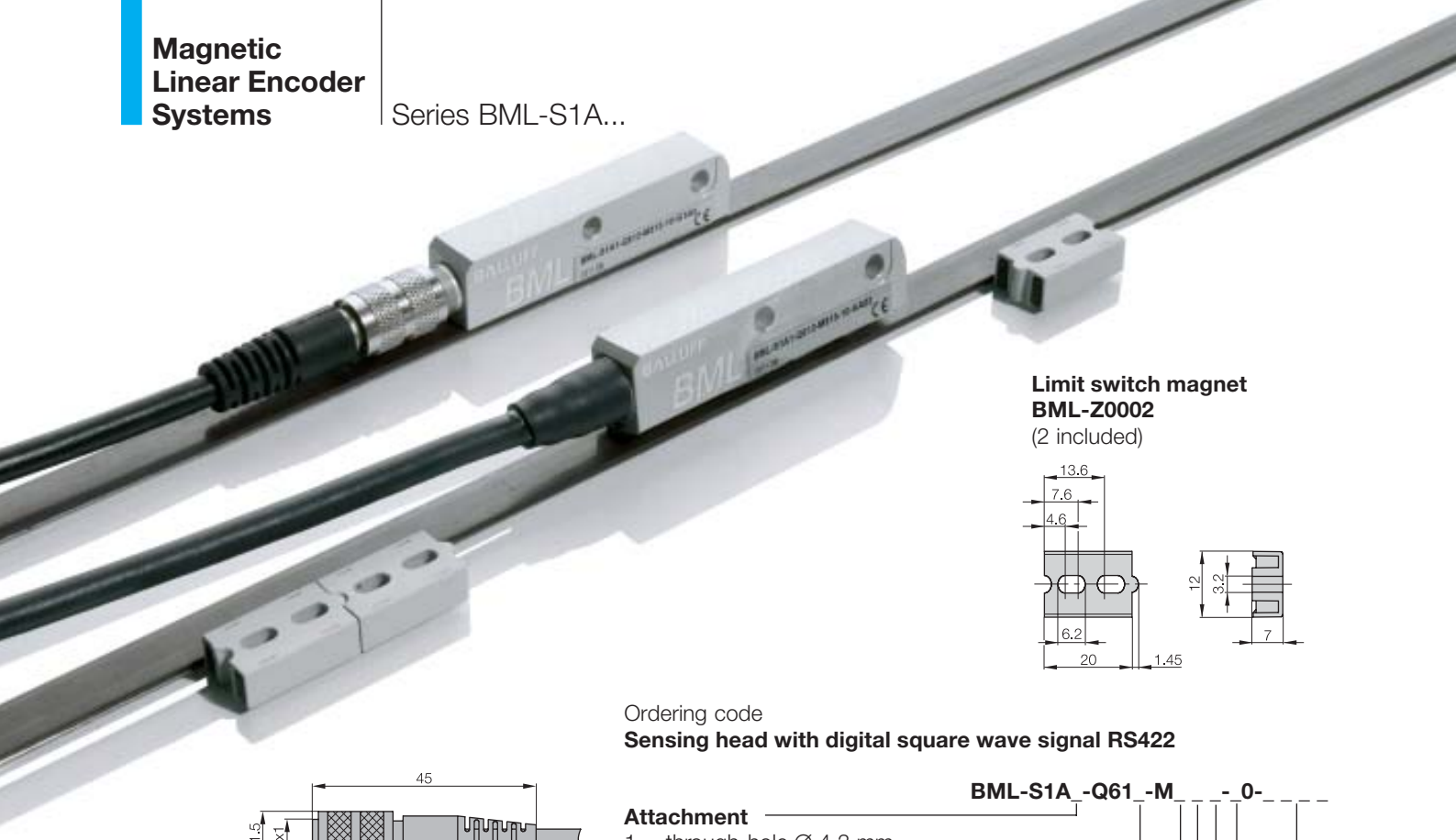
Processing electronics



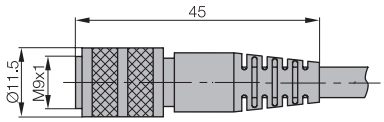
Processing electronics







Limit switch magnet BML-Z0002
(2 included)



Connector BKS-S184-PU-_ _

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

Version	8-pin, straight female
Housing and cable material	PUR
Contact	CuSn
Contact surface	Au
Cable diameter	5.5 mm
No. of conductors x cross-section	8×0.14 mm²
Cable type	(4×(2×Lif.PP.Fl) +V.C.V.M-PUR/0,14/5,3)
Enclosure rating per IEC 60529	IP 67 (when threaded together)
Knurled nut	CuZn
Least bending radius	dynamic 15×D, static 7.5×D
Temperature range	–25...+70 °C

Please append cable length to ordering code! Possible cable lengths 2, 5, 10 or 15 m

Features

- ±10 µm system accuracy
- 1 µm resolution for digital
- 10 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 freely positionable 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

Ordering code
Sensing head with digital square wave signal RS422

BML-S1A_-Q61_-M_ _ _-_0-_ _ _ _

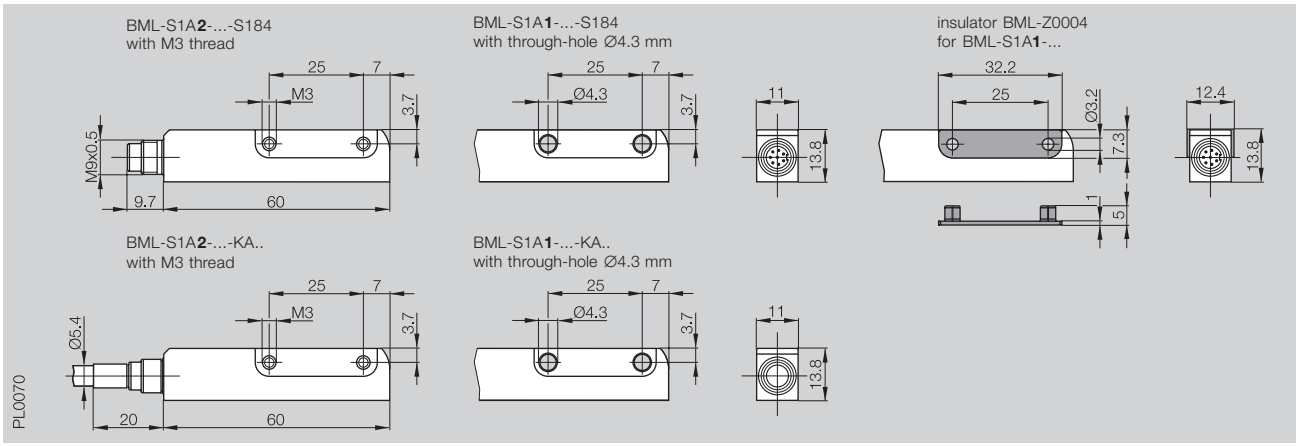
Attachment
1 = through-hole Ø 4.3 mm
2 = M3 thread
Resolution (edge separation A/B)
D = 1 µm
E = 2 µm
F = 5 µm
G = 10 µm
Pole width
3 = 1 mm
Reference signal
0 = none
1 = individual
2 = periodic
Limit switches
0 = no limit switch
3 = two limit switches (cable version only)
Traverse speed max.
1 = 1 m/s
2 = 10 m/s
Connection type
S184 = connector
KA05 = PUR cable 5 m (example)
possible cable lengths 2, 5, 10, 15 or 20 m

Ordering code
Sensing head with sinusoidal analog output sin/cos, 1 V_{ss}

BML-S1A_-A62Z-M_ _ _-90-_ _ _ _

Attachment
1 = through-hole Ø 4.3 mm
2 = M3 thread
Pole width
3 = 1 mm
Reference signal
0 = none
1 = individual
Limit switches
0 = no limit switch
3 = two limit switches (cable version only)
Connection type
S184 = connector
KA05 = PUR cable 5 m (example)
possible cable lengths 2, 5, 10, 15 or 20 m

Series	**BML-S1A_-Q...**	**BML-S1A_-A...**
Interface	incremental	incremental
Output signal	**digital square wave signals RS422**	**sinusoidal analog signals sin/cos**
Resolution	1 µm, 2 µm, 5 µm or 10 µm	depending on processing



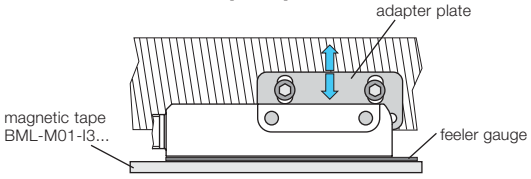
Ordering code	BML-S1A_-**Q**_ _ _-M_ _ _-_0-_ _ _ _	BML-S1A_-**A**_ _ _-M_ _ _-_0-_ _ _ _
Output voltage (A/B/Z)	RS422 to DIN 66259	1 V_{ss}
Output voltage of limit switch, U_{max} = 28 V, I_{max} = 25 mA	GND-switching NC (cable break monitoring)	GND-switching NC (cable break monitoring)
Hysteresis depending on working distance	1...5 µm	1...5 µm
Temperature coefficient (steel)	ca. 10.5×10^{-6}/K	ca. 10.5×10^{-6}/K
Max. non-linearity (Lin1) of the processing electronics, unidirectional	±2 µm	min. ±2 µm (depending on processing electronics)
Max. non-linearity of the magnetic tape (Lin2), unidirectional, measuring length max. 24 m	±8 µm or ±18 µm	±8 µm or ±18 µm
Overall system accuracy (Lin1 + Lin2)	±10 µm or ±20 µm	±10 µm or ±20 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)
Permissible distance between sensor and tape	0...0.35 mm	0...0.35 mm
Traverse speed max.	1 m/s or 10 m/s	> 10 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
Cable type	LIf12YFCF11Y 6×2×0.08 mm²	LIf12YFCF11Y 6×2×0.08 mm²
Reference signal	none, individual or periodic	none or individual
Degree of protection	IP 67	IP 67

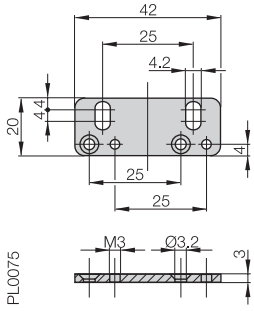
Pin configuration	Pin	Color connector style	Color cable style		
Output signals	1	WH	WH	A	A (sin)
	2	BN	BN	$\overline{A}$	$\overline{A}$ (–sin)
	3	GN	GN	B	B (cos)
	4	YE	YE	$\overline{B}$	$\overline{B}$ (–cos)
	5	GY	GY	Z	Z
	6	PK	PK	$\overline{Z}$	$\overline{Z}$
Operating voltage	7	BU	BU	0 V	0 V
	8	RD	RD	5 V	5 V
			BK	0 V sense	0 V sense
			VT	5 V sense	5 V sense
			GYPK	limit switch front	limit switch front
			RDBU	limit switch rear	limit switch rear

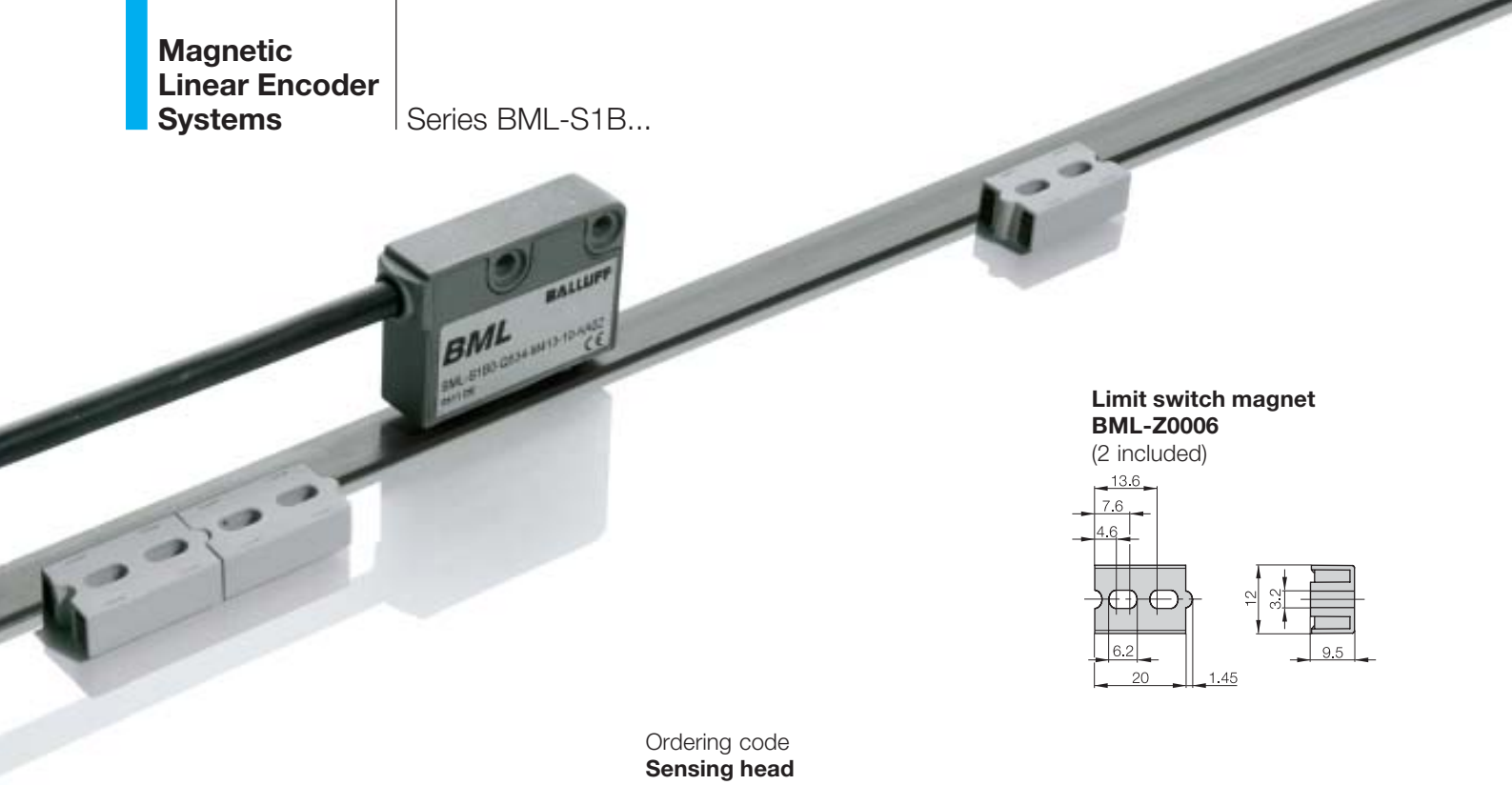
Shield connected to housing

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

Installation example with BML-Z005 adapter plate







Limit switch magnet
BML-Z0006
(2 included)

Features

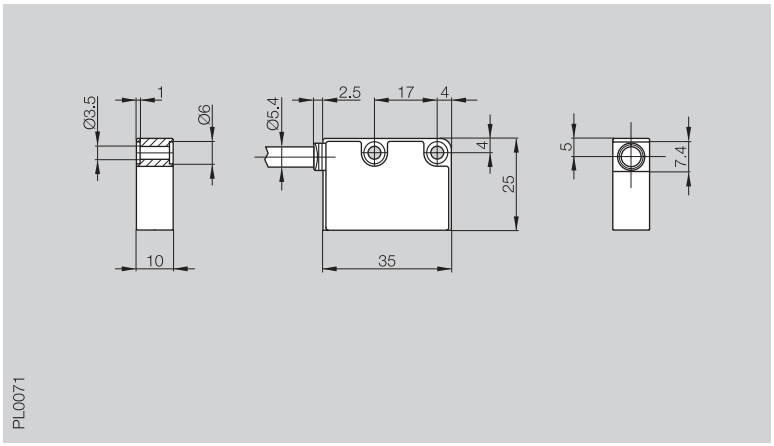
- ±50 µm system accuracy at 0.1...1 mm distance from tape
- ±60 µm system accuracy at 1...2 mm distance from tape
- 5 µm resolution
- 10 m/s maximum traverse speed
- Gap between sensor and tape up to 2 mm
- Digital square wave signals RS422 or output voltage 10...30 V
- Two freely positionable limit switches
- Reference signal
- Cable connection

Ordering code
Sensing head

BML-S1B0-_ _ _ _-M_ _ _-_0-_ _ _ _

Output signal
Q = incremental (digital)
Operating voltage
5 = 10...30 V
6 = 5 V
Output voltage
1 = digital square wave signal RS422
3 = level same as operating voltage (only for 10...30 V)
Resolution (edge separation A/B)
F = 5 µm
G = 10 µm
H = 25 µm
K = 50 µm
Pole width
4 = 5 mm
Reference signal
0 = none
1 = individual
2 = periodic
Limit switches
0 = no limit switch
3 = two limit switches
Traverse speed max.
1 = 1 m/s
2 = 10 m/s
Connection type
KA05 = PUR cable 5 m (example)
possible cable lengths 2, 5, 10, 15 or 20 m

Series	**BML-S1B0-...**
Interface	incremental
Output signal	**digital square wave signals**
Resolution	5 µm, 10 µm, 25 µm or 50 µm



Ordering code	BML-S1B0-_ _ _ _-M_ _ _-_0-_ _ _ _
Output voltage (A/B/Z)	RS422 to DIN 66259 or same as supply voltage 10...30 V (without $\overline{A}/\overline{B}/\overline{Z}$)
Output voltage of limit switch, U_{max} = 28 V, I_{max} = 25 mA	GND-switching NC (cable break monitoring)
Hysteresis depending on working distance	3...7 µm
Temperature coefficient (steel)	ca. 10.5×10^{-6}/K
Max. non-linearity (Lin1) of the processing electronics, unidirectional	at 0.1...1 mm distance from tape ±30 µm at 1...2 mm distance from tape ±40 µm
Max. non-linearity of the magnetic tape (Lin2), unidirectional, measuring length max. 24 m	±18 µm
Overall system accuracy (Lin1 + Lin2)	±50 µm or ±60 µm
Operating voltage	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)
Current draw at 10...30 V operating voltage	< 40 mA + current draw of the controller (depending on internal resistance)
Permissible distance between sensor and tape	0...2 mm
Traverse speed max.	1 m/s or 10 m/s
Operating temperature	–20...+80 °C
Recommended processing temperature for tape	0...+40 °C
Housing material	PBT
Cable type	LIf12YFCF11Y 6×2×0.08 mm²
Reference signal	none, individual or periodic
Degree of protection	IP 67

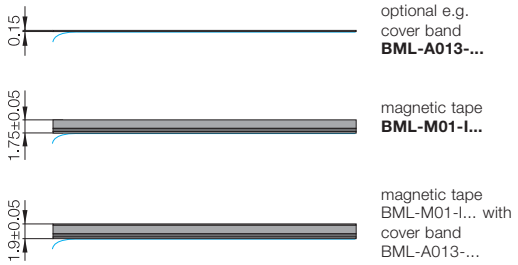
Pin configuration	Pin	Color	
Output signals	1	WH	A
	2	BN	$\overline{A}$ (not connected for BML-S1B0-Q53...)
	3	GN	B
	4	YE	$\overline{B}$ (not connected for BML-S1B0-Q53...)
	5	GY	Z
	6	PK	$\overline{Z}$ (not connected for BML-S1B0-Q53...)
Operating voltage	7	BU	0 V
	8	RD	10...30 V or 5 V
		BK	0 V sense
		VT	10...30 V or 5 V sense
		GYPK	limit switch front
		RDBU	limit switch rear

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

Magnetic tape

The highly rugged, flexible plastic magnetic tape is applied to a steel support band. A special industrial adhesive film is attached to the underside of the steel carrier band. A stainless steel cover band is optionally available for additional protection.

Construction of the magnetic tape system



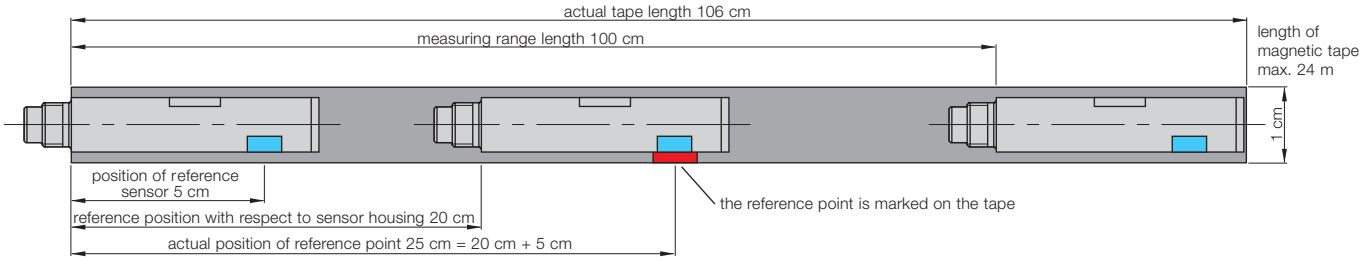
Ordering code
Pre-assembled magnetic tape

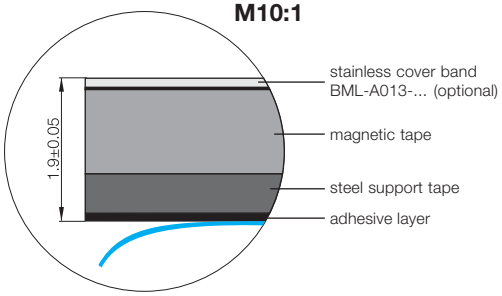
BML-M_ _-_ _ _-A_-M_ _ _ _-R_ _ _ _

Construction
01 = linear, incremental 10 mm wide
Type
I = incremental
Pole width
3 = 1 mm (for BML-S1A...)
4 = 5 mm (for BML-S1B...)
Accuracy class
4 = 8 µm overall accuracy ±10 µm (only BML-S1A...)
5 = 18 µm overall accuracy ±20 µm
Cover Band
3 = with cover band
0 = without cover band
Length in cm
Order length = effective measuring length + 6 cm
e.g. 100 cm effective measuring length + 6 cm = 106 cm order length
Reference point position
0000 = none or periodic (same as pole width)
0020 = position of reference point, e.g. at 20 cm effective measuring length

Position of reference point using example of BML-M01-I34-A3-M0106-R0020

Length in cm: 0106, reference point position in cm: 0020





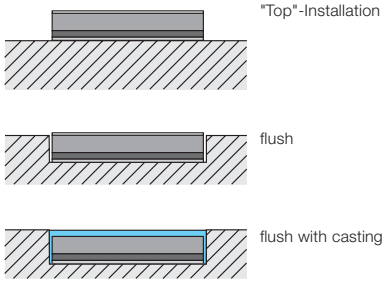
Ordering code
Magnetic tape by the roll

BML-M01-I_ _-A0-T_ _ _ _-R0000

Pole width
3 = 1 mm (for BML-S1A...)
4 = 5 mm (for BML-S1B...)
Accuracy class
4 = 8 µm overall accuracy ±10 µm (only BML-S1A...)
5 = 18 µm overall accuracy ±20 µm
Length
0500 = 5 m
1000 = 10 m
2400 = 24 m

Magnetic tape mounting options

(also in magnetizable material)



Ordering code
Cover band by the roll

BML-A013-T_ _ _ _

Length
0500 = 5 m
1000 = 10 m
2400 = 24 m

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