

Precise positioning in very fast-moving applications

# MAGNETIC ENCODERS



Balluff's magnetic encoders were developed for precise positioning and speed detection in very dynamic applications. The highly-precise, fast-response encoders are optionally equipped with magnetic linear or rotational measuring elements. They are appropriate for linear as well as rotational applications, and incremental or absolute position detection.

Their rugged design makes them ideal in extreme ambient conditions. They also ensure increased uptime of your machines and equipment.

#### Features

- Contact-free and therefore wear-free
- Incremental or absolute interfaces
- High resolution to 1  $\mu\text{m}$
- Measurement lengths to 48 m
- Flexible installation and handling
- Long operational life, since very rugged

**Preferred models**

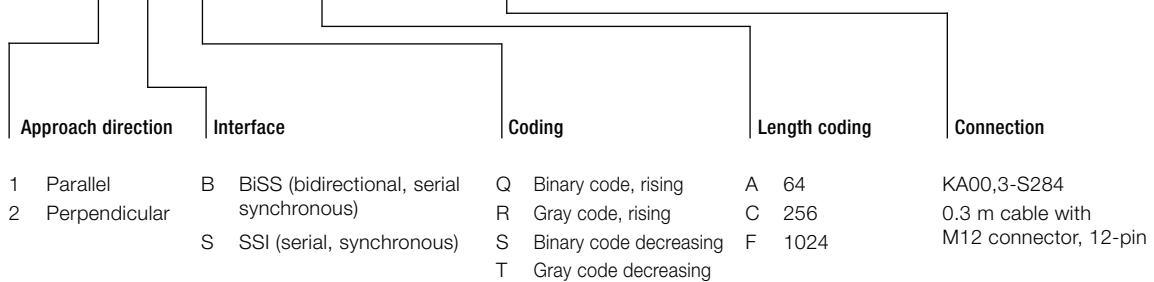
- BML-S1H1-S6QC-M3CA-D0-KA00,3-S284 (BML0393)  
Approach direction longitudinal to tape, SSI interface, binary code increasing, 256 length coding, pigtail 0.3 m with M12 plug
- BML-S1H2-S6QC-M3CA-D0-KA00,3-S284 (BML0394)  
Approach direction transverse to tape, SSI interface, binary code increasing, 256 length coding, pigtail 0.3 m with M12 plug

Absolute interface
Data format
Incremental interface
Resolution
Repeat accuracy
Overall system accuracy
Operating voltage
Current consumption
Max. read distance sensor/tape
Max. measuring length
Pole division incremental track
Traverse speed max.
Degree of protection
Approval/Conformity
Operating temperature
Housing material
Productview

For all specifications in conjunction with magnetic tape see page 62

**Ordering example:**

**BML-S1H - 6 - C-M3 - A-D0-KA00.3-S284**



**BML-S1H**

BML-S1H\_-6\_C-M3\_A-D0-KA00,3-S284

SSI or BiSS-C

16-bit (BML-S1H...-M3AA-...), 18-bit (BML-S1H...-M3CA-...) or 20-bit (BML-S1H...-M3FA-...)

Analog signals Sin/Cos 1 Vpp

~0.98  $\mu\text{m}$  $\pm 1$  increment $\pm 7 \mu\text{m}$ 5 V  $\pm 5\%$ 

&lt; 50 mA at 5 V operating voltage

0.35 mm

64 mm (...-M3AA-...), 256 mm (...-M3CA-...) or 1024 mm (...-M3FA-...)

1 mm

5 m/s (absolute)

IP67

CE, cURus, EAC

-20...+80 °C

Aluminum, stainless steel

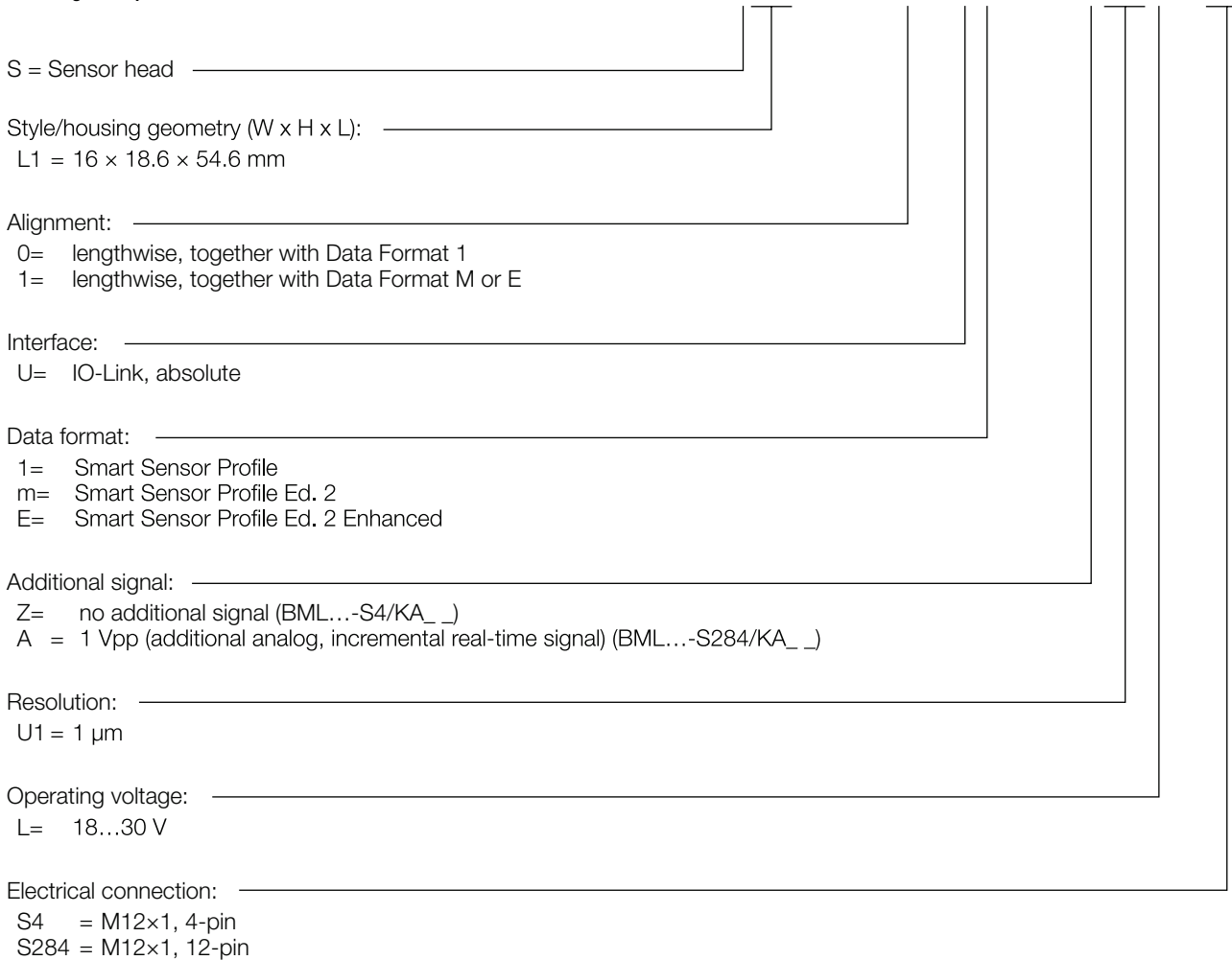
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	<b>BML0903</b> BML SL1-ALZ1-UMZZ-ZU1L-S4	
Dimension	16 x 18.6 x 54 mm	
Interface	IO-Link 1.1	
Measuring range	8190 mm	
Connection	M12x1-Male, 4-pin	
Connection	Connector, M12x1-Male, 4-pin	
Resolution	1 µm	
Housing material	Die-cast zinc, nickel plated, Chrome-plated	
Operating voltage $U_b$	18...30 VDC	
Approval/Conformity	cURus, CE, EAC, WEEE	
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**Ordering example:**

**BML SL1 - ALZ0 - U1ZZ - ZU1L - S4**





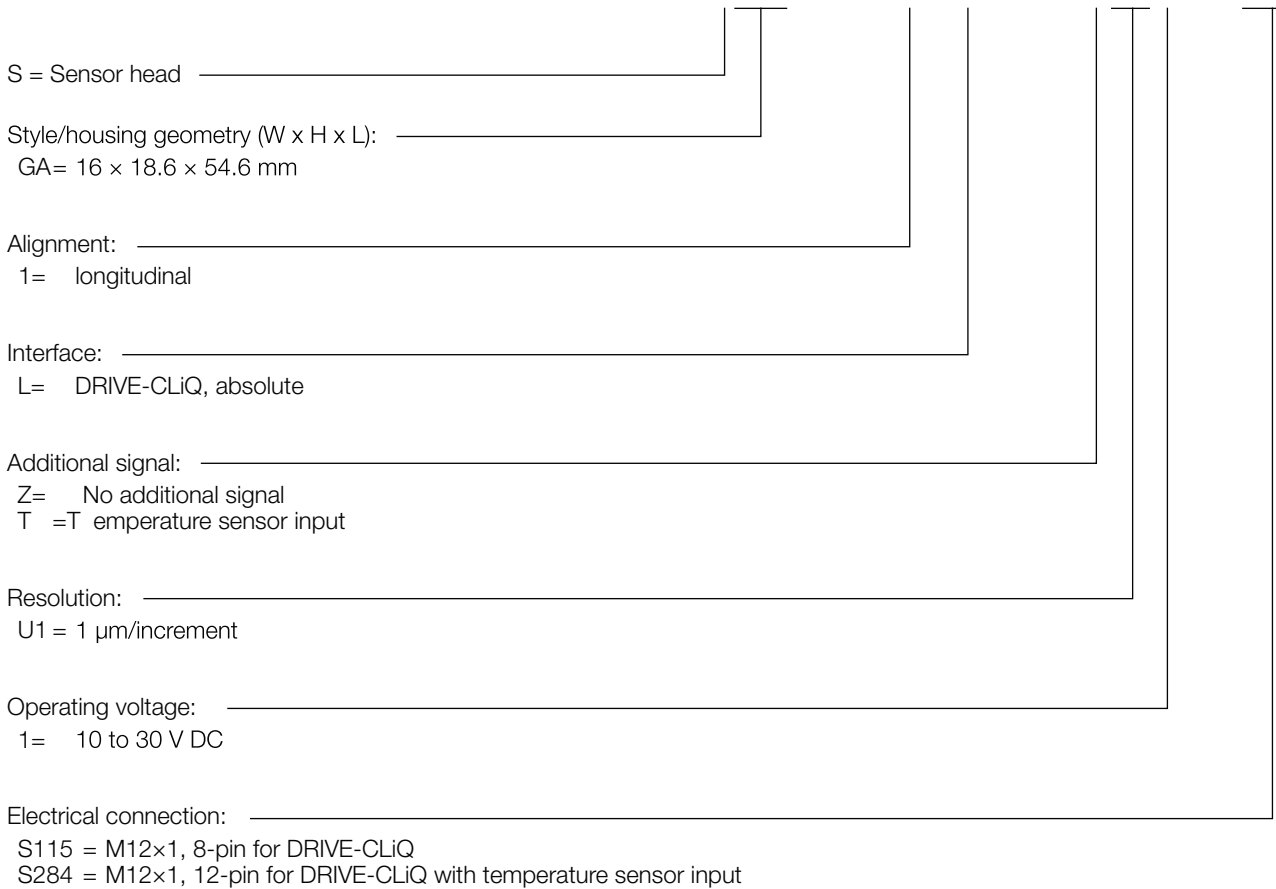
	<b>BML0905</b> BML SL1-ALZ1-UMZZ-AU1L-KA05	<b>BML0901</b> BML SL1-ALZ1-UMZZ-AU1L-S284	<b>BML0904</b> BML SL1-ALZ1-UEZZ-ZU1L-S4
	16 x 18.6 x 54 mm	16 x 18.6 x 54 mm	16 x 18.6 x 54 mm
	IO-Link 1.1	IO-Link 1.1	IO-Link 1.1
	8190 mm	8190 mm	8190 mm
		M12x1-Male, 12-pin	M12x1-Male, 4-pin
	Cable, 5 m, PUR	Connector, M12x1-Male, 12-pin	Connector, M12x1-Male, 4-pin
	1 µm	1 µm	1 µm
	Die-cast zinc, nickel plated, Chrome-plated	Die-cast zinc, nickel plated, Chrome-plated	Die-cast zinc, nickel plated, Chrome-plated
	18...30 VDC	18...30 VDC	18...30 VDC
	cURus, CE, EAC, WEEE	cURus, CE, EAC, WEEE	cURus, CE, EAC, WEEE
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	<b>BML085L</b> BML SGA-AEZ1-LZZZ-ZU11-S115	
Dimension	16 x 18.6 x 54 mm	
Interface	DRIVE-CLiQ	
Measuring range	48 m	
Connection	M12x1-Male, 8-pin	
Connection	Connector, M12x1-Male, 8-pin	
Resolution	1 µm	
Housing material	Die-cast zinc, nickel plated, Chrome-plated	
Operating voltage $U_b$	10...30 VDC	
Approval/Conformity	cURus, CE, EAC, WEEE	
Productview	Page 66	

**Ordering example:**

**BML SGA - AEZ1 - LZZZ - ZU11 - S115**





<b>BML08MH</b> BML SGA-AEZ1-LZZZ-TU11-S284
16 x 18.6 x 54 mm
DRIVE-CLiQ
48 m
M12x1-Male, 12-pin
Connector, M12x1-Male, 12-pin
1 µm
Die-cast zinc, nickel plated, Chrome-plated
10...30 VDC
cURus, CE, EAC, WEEE
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**Preferred models**

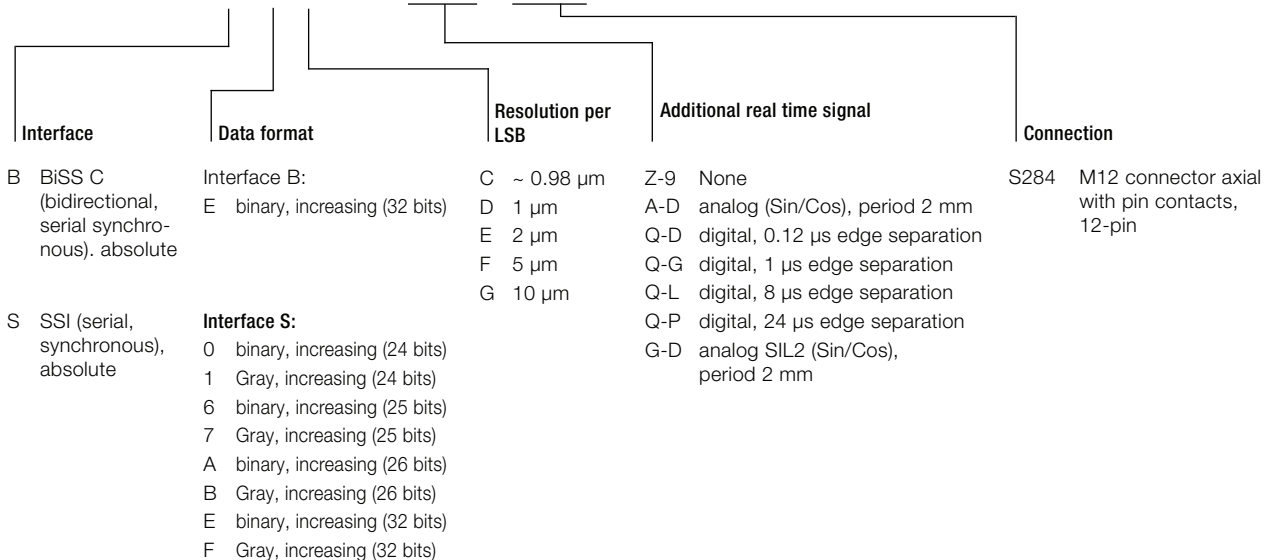
- BML-S1G0-S7ED-M5EA-D0-S284 (BML041H)  
SSI interface, 1 µm resolution, additional real time signal Sin/Cos, M12 connector, 12-pin
- BML-S1G0-B7ED-M5EZ-90-S284 (BML042T)  
BiSS-C interface, 1 µm resolution, no real time signal, M12 connector, 12-pin

Absolute interface
Data format
Incremental interface
Resolution
Repeat accuracy
Overall system accuracy
Operating voltage
Current consumption
Max. read distance sensor/tape
Max. measuring length
Pole division incremental track
Traverse speed max.
Degree of protection
Approval/Conformity
Operating temperature
Housing material
Productview

For all specifications in conjunction with magnetic tape see page 62

**Ordering example:**

**BML - S1G0 - 7 - M5E - 0 - S284**





**BML-S1G0**  
BML-S1G0-7\_\_-M5E\_-0-S284

SSI or BiSS-C

24, 25, 26 or 32 bit

Digital square wave signals RS 422 A, /A, B, /B, Z, /Z, analog signals Sin/Cos 1 Vpp, or safety-related analog signals Sin/Cos 1 Vpp (SIL2)

~0.98, 1, 2, 5 or 10 µm

±1 increment

±20 µm

5 V ±5 % and 10...28 V DC

70 mA at 24 V DC operating voltage

0.8 mm

48 m

2 mm

10 m/s

IP 67

CE, cURus, EAC

-20...+70 °C

Die-case zinc, stainless steel

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**Features**

- 1 µm resolution (digital)
- ±10 µm system accuracy permits high gain factors
- High repeat accuracy ±1 increment
- Reference signal
- Smallest form factor
- Rugged metal housing
- Mounted parallel or perpendicular to tape
- Pole separation 1 mm

**Preferred models**

- BML-S1F1-A62Z-M310-90-KA05 (BML02J1):  
Installation parallel to tape, analog output Sin/Cos, with reference signal, 5 m cable
- BML-S1F1-Q61D-M310-F0-KA05 (BML001A):  
Installation parallel to tape, analog output Sin/Cos, with reference signal, 5 m cable, resolution 1 µm, edge separation 0.48 µs, traverse speed up to 1 m/s

Incremental interface
Resolution
Repeat accuracy
Overall system accuracy
Operating voltage
Current consumption
Max. read distance sensor/tape
Pole division incremental track
Traverse speed max.
Degree of protection
Approval/Conformity
Operating temperature
Housing material
Productview

For all specifications in conjunction with magnetic tape see page 62

**Ordering example:**

**BML-S1F\_-A62Z-M3\_0-90\_-\_-\_-\_-** (with analog output signal Sin/Cos)

**BML-S1F\_-Q61\_-M3\_0-0\_-\_-\_-\_-** (with digital square wave signal RS422)

Approach direction	Resolution	Reference signal	Min. edge separation*	Connection
1 Parallel	D 1 µm	0 None	D 0.12 µs	KA02 PUR cable 2 m
2 Perpendicular	E 2 µm	1 Individually or fixed-periodic	E 0.29 µs	KA05 PUR cable 5 m
	F 5 µm		F 0.48 µs	KA10 PUR cable 10 m
	G 10 µm		G 1 µs	KA20 PUR cable 20 m
			H 2 µs	
			K 4 µs	
	L 8 µs	2 pole-periodic, digital version only ...-Q61_-...		
			N 16 µs	
			P 24 µs	



**BML-S1F**

BML-S1F-A62Z-M3\_0-90-  
BML-S1F-Q61-M3\_0-0-

Digital square wave signals RS422 A, /A, B, /B, Z, /Z, sinusoidal analog signals Sin/Cos 1 Vpp

1 µm, 2 µm, 5 µm or 10 µm

±1 increment

±10 µm

5 V ±5%

< 50 mA at 5 V operating voltage

0.35 mm

1 mm

20 m/s

IP67

CE, cURus, EAC

-20...+80 °C

Aluminum, stainless steel

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**Preferred models**

- BML SF2-I201-AZZZ-ZZZ5-KA05 (BML07RR)  
Output signal analog Sin/Cos 1 Vpp
- BML SF2-I201-QZ11-ZU25-KA05 (BML0870)  
Output signal digital A/B/Z TTL
- BML SF2-I211-AZZZ-ZZZ5-KA05 (BML07RT)  
Output signal analog Sin/Cos 1 Vpp with reference signal
- BML SF2-I211-QZ11-ZU25-KA05 (BML085N)  
Output signal digital A/B/Z TTL with reference signal

Incremental interface
Resolution
Repeat accuracy
Overall system accuracy
Operating voltage
Current consumption
Max. read distance sensor/tape
Pole division incremental track
Traverse speed max.
Degree of protection
Approval/Conformity
Operating temperature
Housing material
Productview

For all specifications in conjunction with magnetic tape see page 62

**Ordering example:**

**BML SF2-I2 - - A Z Z Z - Z Z Z 5 - - - - -** (with analog output signal Sin/Cos)  
**BML SF2-I2 - - Q Z - - Z - 5 - - - - -** (with digital square wave signal RS422)

Reference signal	Approach direction	Minimum edge separation	Resolution	Connection
0 no signal	1 Parallel	11 0.11 μs	U1 1 μs	KA02 PUR cable 2 m
1 Single signal (or fixed-periodic)	2 Perpendicular	26 0.6 μs	U2 2 μs	KA05 PUR cable 5 m
		42 0.42 μs	UD 10 μs	KA10 PUR cable 10 m
2 Pole-periodic signal		94 0.94 μs	UZ 20 μs	KA20 PUR cable 20 m
		N1 1.8 μs		
		J3 3.5 μs		
		A7 7 μs		
		B4 14 μs		
		C1 21 μs		



**BML SF2**

BML SF2-I2--A-ZZZ-ZZZ5-  
BML SF2-I2--QZ--Z\_5-

Digital square wave signals RS422 A, /A, B, /B, Z, /Z, sinusoidal analog signals Sin/Cos 1 Vpp

1, 2, 10 or 20 µm

±1 increment

up to ±12 µm (depending on the mechanical installation)

5 V ±5%

< 50 mA at 5 V operating voltage

1.8 mm

1 mm

20 m/s

IP67

CE, cURus, EAC

-20...+80 °C

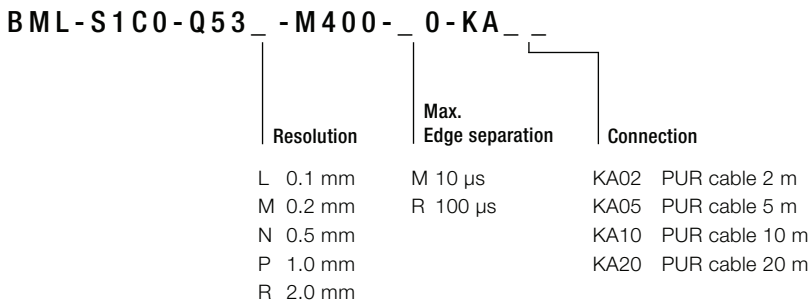
Aluminum, stainless steel

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**Preferred type**

BML S1C0-Q53L-M400-M0-KA05 (BML0034)  
 Digital signal, 10...30 V, 5 m cable, resolution 0.1 mm, edge separation 10 µs, traverse speed up to 8 m/s

**Ordering example:**



Incremental interface
Resolution
Repeat accuracy
Overall system accuracy
Operating voltage
Current consumption
Max. read distance sensor/tape
Traverse speed max.
Pole division, incremental track
Degree of protection
Approval/Conformity
Operating temperature
Housing material
Productview

For all specifications in conjunction with magnetic tape see page 62

**Ordering example:**

**BML - S2C0 - - - - M6 - - 0 - - - -**

**Interface/supply voltage/output signal**  
 Q51 digital square-wave signals, 10...30 V DC, differential voltage signal (RS422)  
 Q53 digital square-wave signals, 10...30 V DC, level same as operating voltage HTL  
 Q61 digital square-wave signals, 5 V DC, differential voltage signal (RS422)

**Resolution (edge separation A/B)**  
 G 10 µm    K 50 µm    L 100 µm  
 N 500 µm    T 2500 µm

**Reference signal**  
 0 no signal  
 2 pole-periodic signal

**Error signal**  
 0 no error signal  
 4 Error signal (not for BML-...-KF...)

**Min. edge separation /max. travel speed**  
 K 10 µm    L 8 µm    M 10 µm  
 N 16 µm    P 24 µm    R 100 µm  
 S 1 ms    T 2 ms

**Connection**  
 KA05 5 m cable, PUR, 12-conductor, cable lengths 2, 5, 10, 20 m  
 KF05 5 m cable, PUR, 8-conductor, possible cable lengths 2, 5, 10, 20 m  
 KA00,3-S284 0.3 m cable with M12 connector, 12-pin



<b>BML-S1C0</b> BML-S1C0-Q53_-M400-_0-KA__	<b>BML-S2C0</b> BML-S2C0-_____-M6__-0-____
Digital square wave signals HTL A, B	Digital square wave signals RS422 A, /A, B, /B, Z, /Z or HTL A, B, Z
5 µm, 10 µm, 25 µm or 50 µm	10 µm, 50 µm, 100 µm, 500 µm, 2500 µm
±1 increment	±1 increment
±100 µm	±400 µm
10...30 V	10...30 V or 5 V ±5%
< 40 mA at 24 V operating voltage	< 80 mA at 24 V operating voltage
2 mm	1...5 mm (without cover strip)
10 m/s	10 m/s
5 mm	10 mm
IP67	IP67
CE, cURus, EAC	CE, cURus, EAC
-20...+80 °C	-20...+80 °C
PBT	PBT
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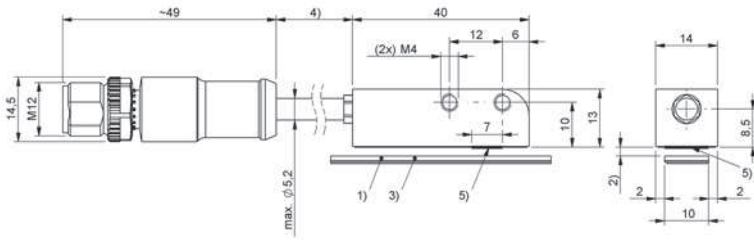




Model	Magnetic Tape	Magnetic Tape	Magnetic Tape	
Suitable for sensor heads	BML-S1H	BML-S1G	BML SL1	
Type code	BML-M02-A33-A3-M0009-A BML-M02-A33-A3-M0028-C BML-M02-A33-A3-M0102-F	BML-M02-A55-A3-M_ _ _ -E	BML TSC-ALCZ-1_ZZ-M_ _ _ _	
Total length	91 mm, 283 mm, 1024 mm	up to 48 m	up to 8.19 m	
Measuring length	64 mm, 256 mm, 997 mm	up to 48 m	up to 8.19 m	
Accuracy class	5 µm	18 µm	40 µm	
Reference points	not relevant	not relevant	not relevant	
Magnetic tape material	Rubber ferrite	Rubber ferrite	Rubber ferrite	
Cover strip and tape carrier material	Stainless steel	Stainless steel	Stainless steel	
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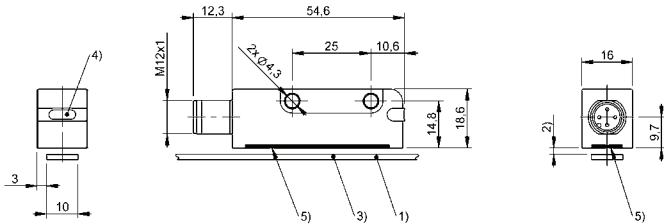


Magnetic Tape	Magnetic Tape	Magnetic Tape	Magnetic Tape
BML-S1F	BML SF2	BML-S2B BML-S2E BML-S1C	BML-S2C
BML-M02-I3_-A_-M_ _ _ _ -R0000	BML TSC-I2_-1_ZZ-M_____	BML-M02-I4_-A_-M_____ -R0000	BML-M07-I68-A_-M_ _ _ _ -R0000
up to 48 m	up to 48 m	up to 48 m	up to 48 m
up to 48 m	up to 48 m	up to 48 m	up to 48 m
8 µm, 18 µm	8 µm, 18 µm	18 µm, 50 µm	250 µm
with/without	with/without	with/without	without
Rubber ferrite	Rubber ferrite	Rubber ferrite	Rubber ferrite
Stainless steel	Stainless steel	Stainless steel	Stainless steel
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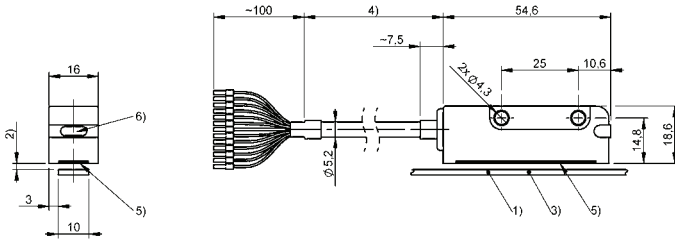
1) Not included in scope of delivery, 2) Distance to tape, 3) Tape, 4) Cable length, 5) Active measuring surface

**BML-S1H...**



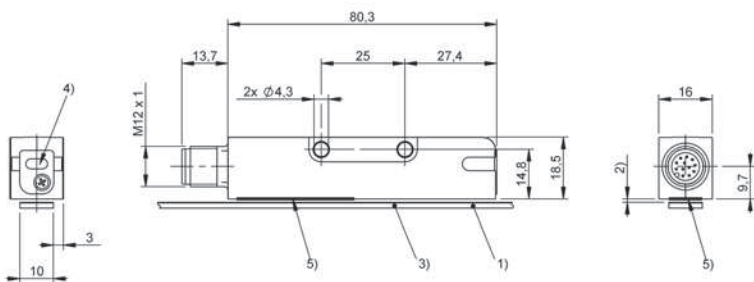
1) Not included in scope of delivery, 2) Distance to tape, 3) Tape, 4) Cable length, 5) Active measuring surface  
6) LED function indicator

**BML SL1-ALZ1-..., BML06HE, BML06HC**



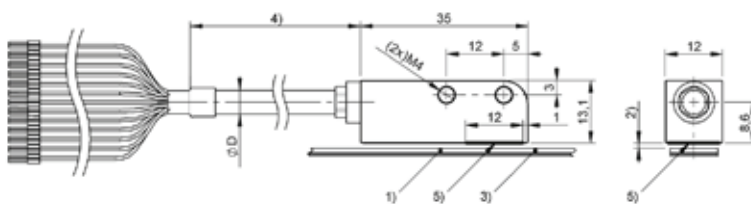
1) Not included in scope of delivery, 2) Distance to tape, 3) Tape, 4) Cable length, 5) Active measuring surface  
6) LED function indicator

**BML0905**



1) Not included in scope of delivery, 2) Distance to tape, 3) Tape, 4) Insulator, 5) Active measuring surface  
6) LED function indicator

**BML-S1G0...**



1) Not included in scope of delivery, 2) Distance to tape, 3) Tape, 4) Cable length

**BML-S1F...**