

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 μm
- Measurement lengths to 48 m
- Flexible installation and handling
- Long operational life, since very rugged

Preferred models

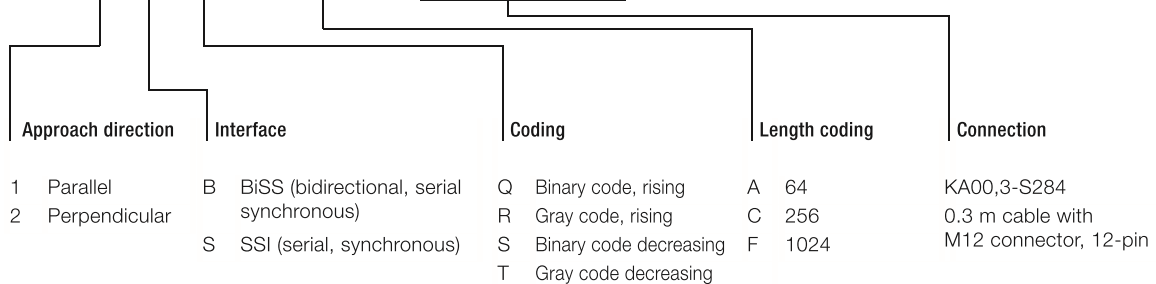
- BML-S1H1-S6QC-M3CA-D0-KA00,3-S284 (BML0393)
Approach direction longitudinal to tape, SSI interface, binary code increasing, 256 length coding, pigtail 0.3 m with M12 plug
- BML-S1H2-S6QC-M3CA-D0-KA00,3-S284 (BML0394)
Approach direction transverse to tape, SSI interface, binary code increasing, 256 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-S1H1-6C-M3A-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 µm

±1 increment

±7 µm

5 V ±5%

< 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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Features

- Simplest connection via IO-Link or best control suitability using SSI or BiSS-C
- Distance detection with maximum accuracy up to 8 m
- Extensive parameterization functions as well as diagnostic and status information via IO-Link provides great flexibility
- Simple to install, reliable operation with a generous read distance of up to 1.3 mm
- Optional analog measurement output for control applications

	BML SL1 BML SL1-ALZ0-U1ZZ- U1L-_____ BML SL1-ALZ1-__ZZ- BA-_____	
Absolute interface	SSI or BiSS-C	
Data format	24 bits	
Incremental interface	Analog Sin/Cos 1 Vpp	
Resolution	~0.98 µm	
Repeat accuracy	±1 increment	
Overall system accuracy	±15...100 µm (depending on the mechanical installation)	
Current consumption	<70 mA at 24 V operating voltage	
Max. measuring length	8.19 m	
Max. read distance sensor/tape	1.3 mm	
Traverse speed max.	10 m/s	
Operating voltage	10...30 V or 5 V ±5%	
Degree of protection	IP67	
Approval/Conformity	CE, cURus, EAC	
Operating temperature	-20...+70 °C	
Housing material	Die-case zinc, stainless steel	
Productview	Page 64	

For all specifications in conjunction with magnetic tape see page 62

Ordering example:

BML SL1-ALZ0-U 1 ZZ - U1L- _____
BML SL1-ALZ1- _____ ZZ- BA - _____

Interface

U = IO-Link B = BiSS-C S = SSI

Data format

- 1 Smart Sensor Profile (IO-Link)
- 0 24-bit, binary, increasing (SSI, BiSS-C)
- 2 24-bit, binary, decreasing (SSI, BiSS-C)

Additional signal

- Z No additional signal
- A 1 Vpp (additional analog, incremental real-time signal)

Resolution

- U1 1 µm
- BA 1000/1024 µm (~0.98µm)

Operating voltage

- L 18...30 V (IO-Link)
- 5 5 V (SSI, BiSS-C)
- 1 10...30 V (SSI, BiSS-C)

Electrical Connection

- S4 M12 × 1, 4-pin for IO-Link
- S284 M12 × 12-pin for IO-Link and analog additional signal or SSI, BiSS-C
- KA__ PUR, 12-conductor (6 × 2 × 0.08 mm²) for IO-Link and analog additional signal or SSI, BiSS-C



	BML06HE BML SL1-ALZ0-U1ZZ-ZU1L-S4	BML06HC BML SL1-ALZ0-U1ZZ-AU1L-S284	BML06FU BML SL1-ALZ0-U1ZZ-AU1L-KA05
	IO-Link 1.1	IO-Link 1.1	IO-Link 1.1
	32 bits	32 bits	32 bits
		Analog Sin/Cos 1 Vpp	Analog Sin/Cos 1 Vpp
	1 µm	1 µm	1 µm
	±1 increment	±1 increment	±1 increment
	±15...100 µm (depending on the mechanical installation)	±15...100 µm (depending on the mechanical installation)	±15...100 µm (depending on the mechanical installation)
	<70 mA at 24 V operating voltage	<70 mA at 24 V operating voltage	<70 mA at 24 V operating voltage
	8.19 m	8.19 m	8.19 m
	1.3 mm	1.3 mm	1.3 mm
	10 m/s	10 m/s	10 m/s
	18...30 V DC	18...30 V DC	18...30 V DC
	IP67	IP67	IP67
	CE, cURus, EAC	CE, cURus, EAC	CE, cURus, EAC
	-10 ... +70 °C	-10 ... +70 °C	-10 ... +70 °C
	Die-case zinc, stainless steel	Die-case zinc, stainless steel	Die-case zinc, stainless steel
	Page 64	Page 64	Page 64

Preferred models

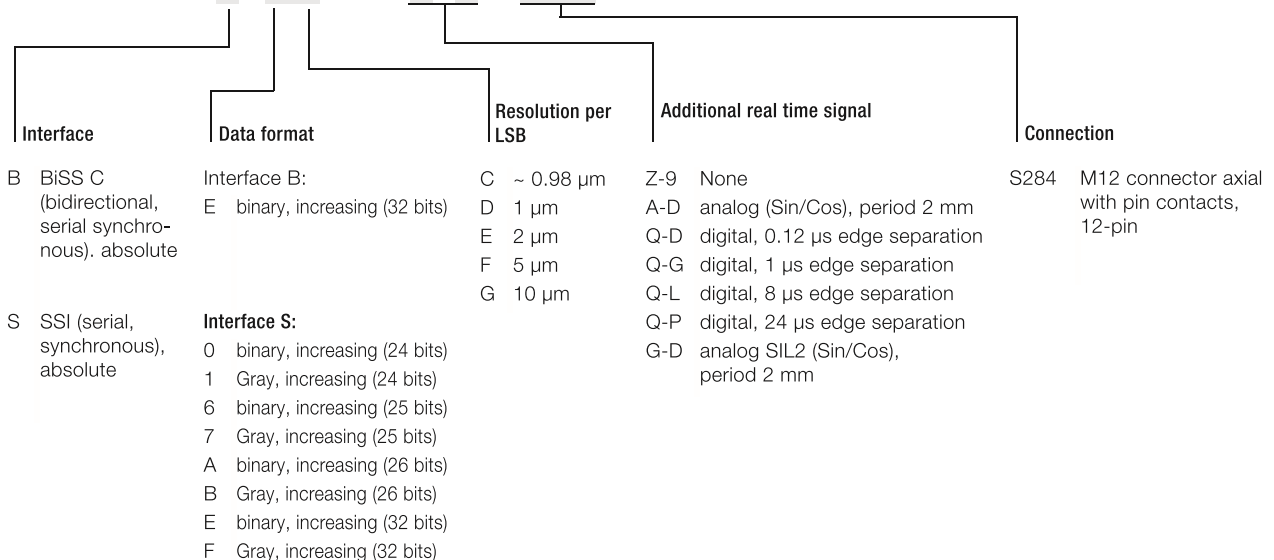
- BML-S1G0-S7ED-M5EA-D0-S284 (BML041H)
SSI interface, 1 µm resolution, additional real time signal Sin/Cos, M12 connector, 12-pin
- BML-S1G0-B7ED-M5EZ-90-S284 (BML042T)
BiSS-C interface, 1 µm resolution, no real time signal, M12 connector, 12-pin

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		2 pole-periodic, digital version only ...-Q61_-...	G 1 µs	KA20 PUR cable 20 m
				H 2 µs	
				K 4 µs	
			L 8 µs		
			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-ZZ-ZZ5-
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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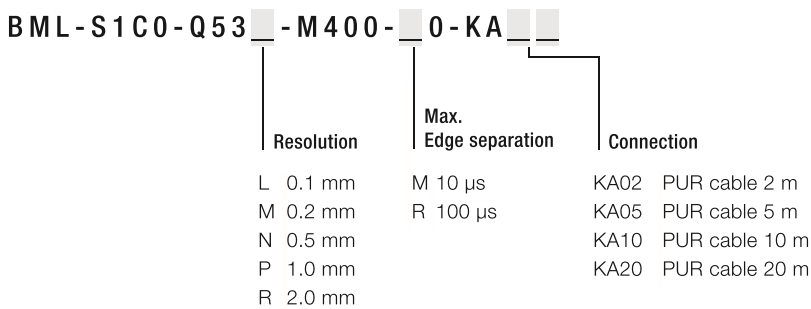


BML-S2B0	BML-S2E0
BML-S2B0-Q___-M4__-0-____	BML-S2E0-Q___-M4__-0-____
Digital square wave signals RS422 A, /A, B, /B, Z, /Z or HTL A, B, Z	Digital square wave signals RS422 A, /A, B, /B, Z, /Z or HTL A, B, Z
5 µm, 10 µm, 25 µm or 50 µm	5 µm, 10 µm, 25 µm or 50 µm
±1 increment	±1 increment
±50 µm	±100 µm
10...30 V or 5 V ±5%	10...30 V or 5 V ±5%
< 40 mA at 24 V operating voltage	< 40 mA at 24 V operating voltage
2 mm	2 mm
5 mm	5 mm
20 m/s	20 m/s
IP67	IP67
CE, cURus, EAC	CE, cURus, EAC
-20...+80 °C	-20...+80 °C
PBT	PBT
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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

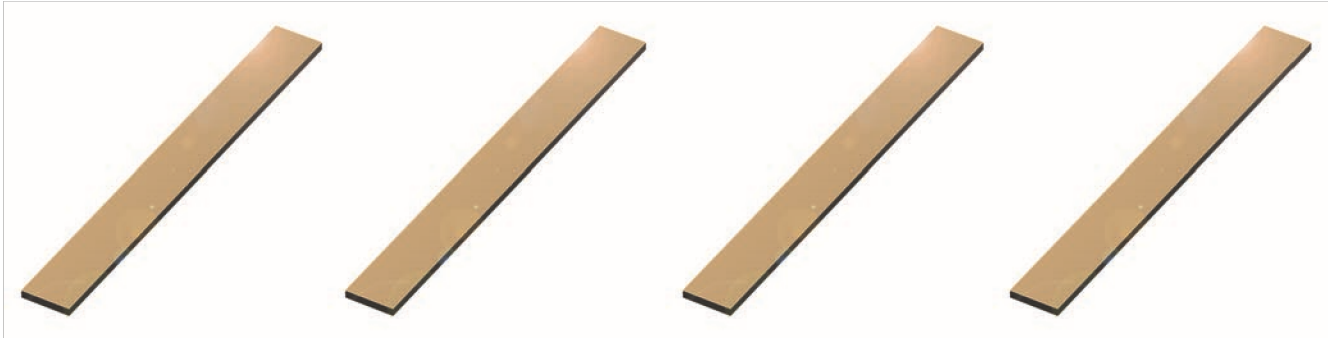
KA05 5 m cable, PUR, 12-conductor, cable lengths 2, 5, 10, 20 m
 KF05 5 m cable, PUR, 8-conductor, possible cable lengths 2, 5, 10, 20 m
 KA00,3-S284 0.3 m cable with M12 connector, 12-pin



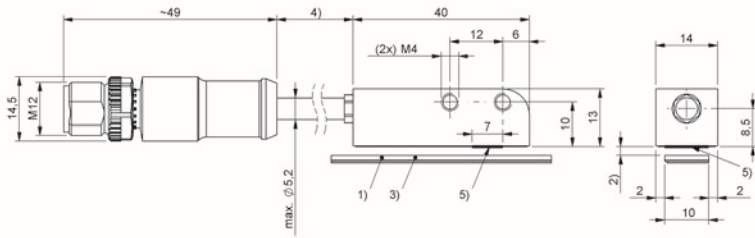
BML-S1C0 BML-S1C0-Q53_-M400-_0-KA__	BML-S2C0 BML-S2C0-_____-M6__-0-____
Digital square wave signals HTL A, B	Digital square wave signals RS422 A, /A, B, /B, Z, /Z or HTL A, B, Z
5 µm, 10 µm, 25 µm or 50 µm	10 µm, 50 µm, 100 µm, 500 µm, 2500 µm
±1 increment	±1 increment
±100 µm	±400 µm
10...30 V	10...30 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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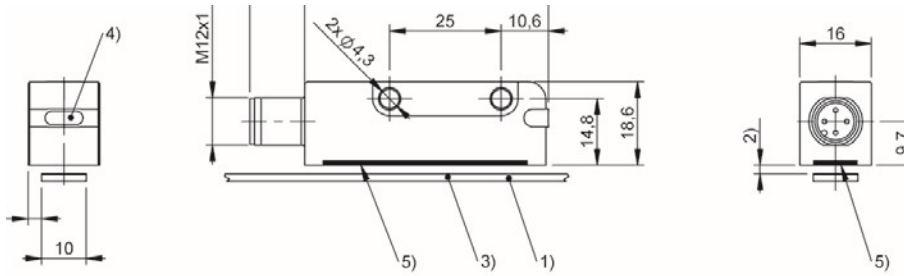


Magnetic Tape	Magnetic Tape	Magnetic Tape	Magnetic Tape
BML-S1F	BML SF2	BML-S2B BML-S2E BML-S1C	BML-S2C
BML-M02-I3_-A_-M_ _ _ _ -R0000	BML TSC-I2_-1_ZZ-M_ _ _ _	BML-M02-I4_-A_-M_ _ _ _ -R0000	BML-M07-I68-A_-M_ _ _ _ -R0000
up to 48 m	up to 48 m	up to 48 m	up to 48 m
up to 48 m	up to 48 m	up to 48 m	up 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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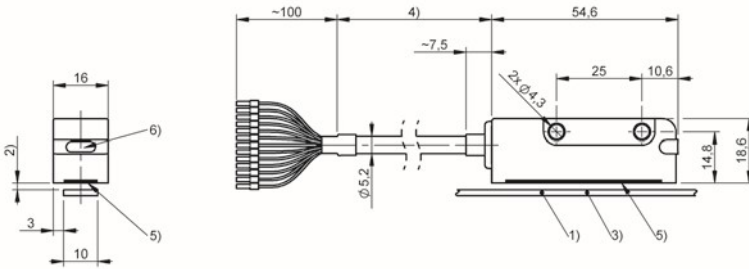
1) Not included in scope of delivery, 2) Distance to tape, 3) Tape, 4) Cable length, 5) Active measuring surface

BML-S1H...



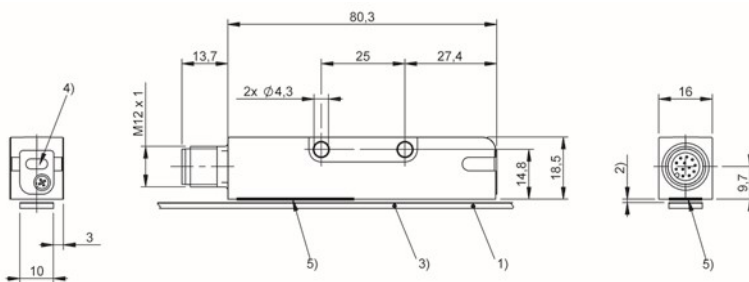
1) Not included in scope of delivery, 2) Distance to tape, 3) Tape, 4) LED function indicator, 5) Active measuring surface

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



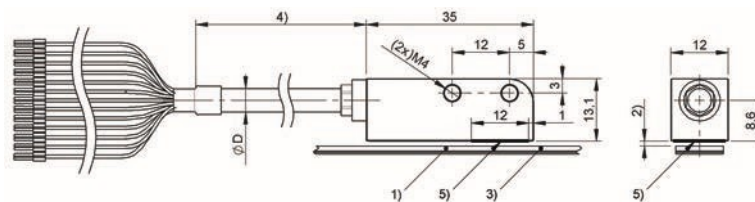
1) Not included in scope of delivery, 2) Distance to tape, 3) Tape, 4) Cable length, 5) Active measuring surface
6) LED function indicator

BML06FU



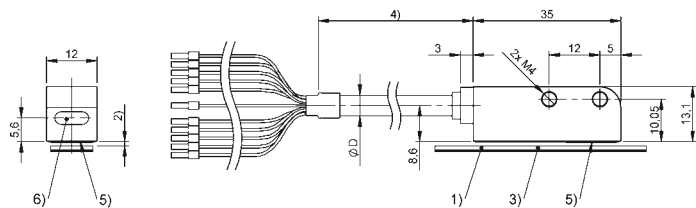
1) Not included in scope of delivery, 2) Distance to tape, 3) Tape, 4) Insulator, 5) Active measuring surface
6) LED function indicator

BML-S1G0...



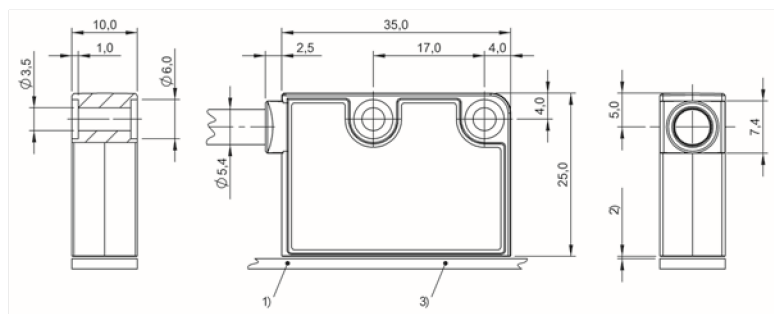
1) Not included in scope of delivery, 2) Distance to tape, 3) Tape, 4) Cable length

BML-S1F...



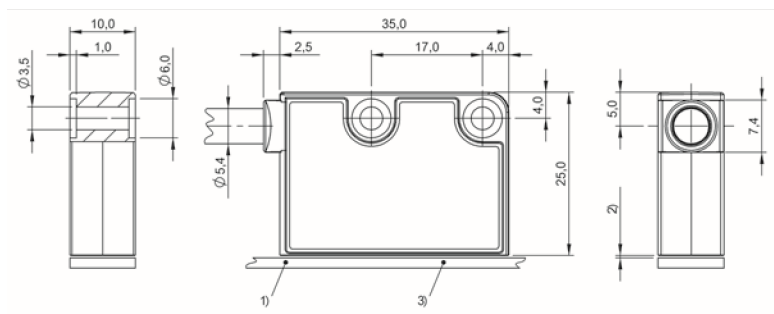
1) Not included in scope of delivery, 2) Distance to tape, 3) Tape, 4) Cable length, 5) Active measuring surface, 6) LED function indicator

BML SF2..



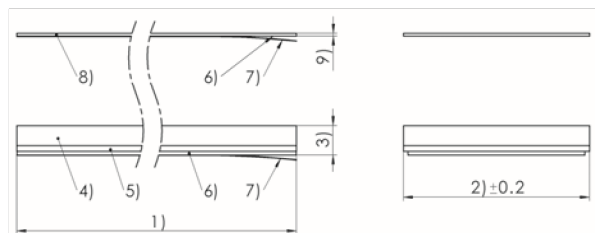
1) not included in scope of delivery, 2) Distance to tape, 3) Tape

BML-S2B0..., BML-S2E0...



1) Not included in scope of delivery, 2) Distance to tape, 3) tape

BML-S1C0-..., BML-S2C0-...



1) Nominal length/order length, 2) Width, 3) Height of tape, 4) Magnetic layer, 5) Carrier tape, 6) Adhesive layer, 7) Protective film for removing, 8) Cover tape, 9) Height of cover tape

MAGNETIC TAPE

BML-S1H, BML-S1G, BML-SL1, BML-S1F, BML SF2, BML-S2B, BML-S2E, BML-S2C, BML-S1C