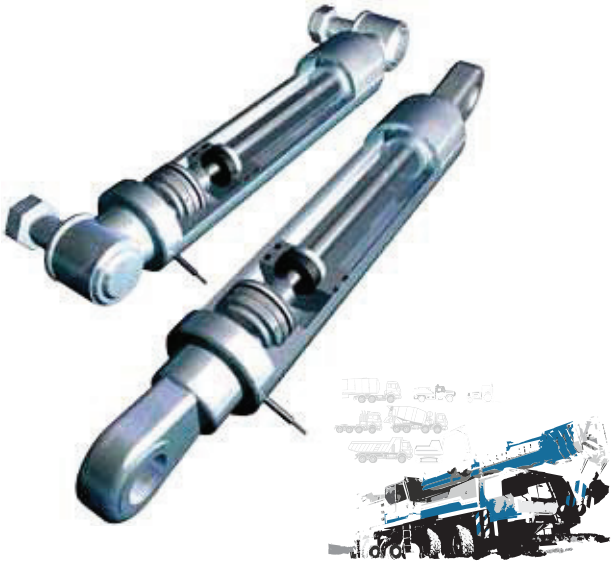
Position detection in mobile hydraulics
Sensors are being used increasingly to extend the useful life and improve safety in mobile equipment.
The new Micropulse AR Transducer senses the piston position in mobile hydraulic cylinders. The sensor operates according to the proven Balluff magnetostrictive measuring principle. The compact size of the sensor makes it ideal for use in slender joint bearings and spherical eye end cylinders or large bore cylinders. The electronic processor unit integrated in the sensor has been designed to meet the strict EMC Directives for industrial lift trucks, agricultural and forestry equipment and earthmoving machinery.

Compatibility testing according to EMC Directives
ISO 14982 Agricultural and Forestry Machinery
ISO 13766 Earthmoving Machinery
ISO 7637-1/2/3 Road Vehicles
EN 12895 Industrial Trucks
EN 50121-3-2 Railway Applications
ISO 11452-5 Electromagnetic HF field, 200 V/m

e1 type approval
The e1 type approval is granted by the German Federal Motor Transport Authority (Kraftfahrt-Bundesamt, or KBA). It confirms that special motor vehicle standards have been maintained. The devices may be mounted on vehicles which travel on public roads. The standards describe EMC conditions under which the devices must operate interference-free. e1 approved Micropulse Transducers are indicated by "-SA265-" in the part number.

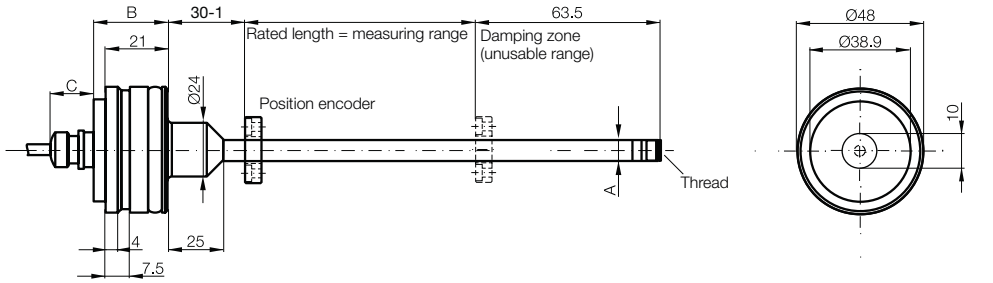
Series	**Rod AR BTL6**
Shock load	100 g/6 ms as per EN 60068-2-27
Continuous shock	50 g/2 ms
Vibration	12 g, 10...2000 Hz as per EN 60068-2-6
Polarity reversal protected	yes
Dielectric strength	500 V DC (GND to housing)
Degree of protection as per IEC 60529	IP 67
Housing material	Stainless steel protective tube 1.4571, stainless steel flange 1.4404
Pressure rating	
with 10.2 mm protective tube E2	350 bar installed in hydraulic cylinder
with 8 mm protective tube E28	250 bar installed in hydraulic cylinder
Connection	Cable connection or stranded wire
EMC testing	
Radio interference emission	EN 55016-2-3 (industrial and residential area)
Static electricity (ESD)	EN 61000-4-2 Severity level 3
Electromagnetic fields (RFI)	EN 61000-4-3 Severity level 3
Electrical fast transient bursts (BURST)	EN 61000-4-4 Severity level 3
Surge voltage	EN 61000-4-5 Severity level 2
Conducted interference	EN 61000-4-6 Severity level 3
Magnetic fields	EN 61000-4-8 Severity level 4
Standard nominal strokes [mm] with 8 mm outer tube (style E28), the max. rated length is 1016 mm	0050...2000 mm in 1-mm increments

CE
e1



Design E2/E28
BTL6-…-E2/E28-_ _ _ _-KA

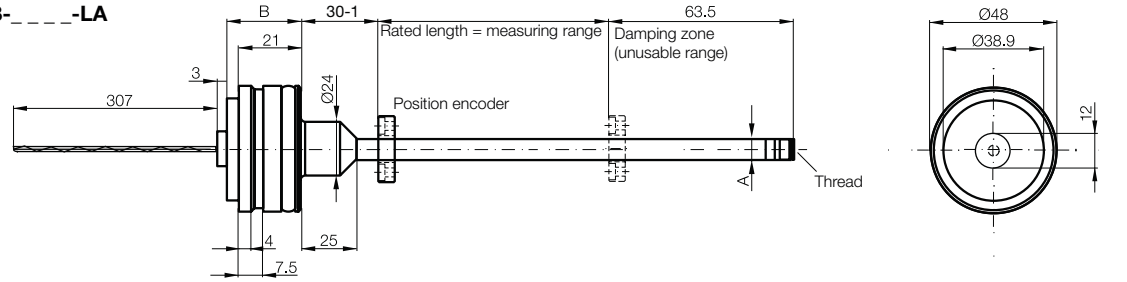
Cable outlet
axial centric



	B	C
BTL6-A/B/E	25.2	13
BTL6-P	25.2	17
	A	**G**
E2	10.2	Thread M4×4/6 deep
E28	8	without thread

Design E2/E28
BTL6-…-E2/E28-_ _ _ _-LA

Cable outlet
axial with
stranded wire



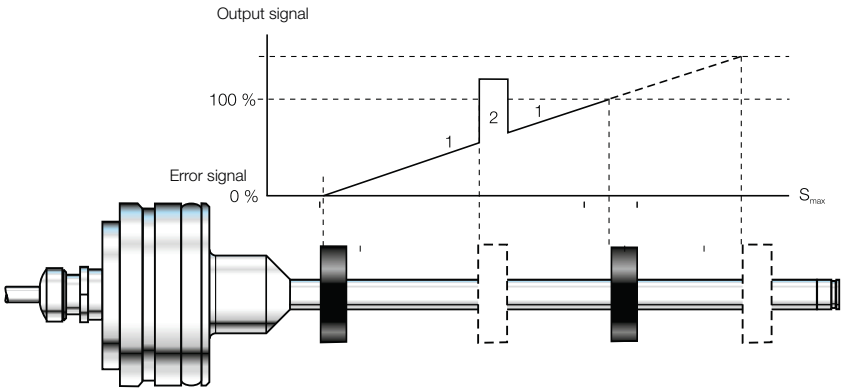
	B	
BTL6-A/B/E	25.7	
BTL6-P	25.7	
	A	**G**
E2	10.2	Thread M4×4/6 deep
E28	8	without thread

Caution!
Before design, installation and startup please familiarize yourself with the user's guide to be found at www.balluff.com.

Rod AR BTL6
Analog interface

The position encoder's position is determined from the runtime of an ultrasonic wave, triggered by magnetostriction.
It is output as an analog value and has a rising characteristic. This is done with high precision and reproducibility within the measuring range designated as the rated length. If there is no position encoder within the measuring range, an error signal is output. There is a damping zone at the rod end. This zone may be traversed, but is not useful for metrology purposes. The electrical connection between the transducer, the controller and the power supply is established using a cable or stranded wire.

Position encoder position
- Within the measuring range (1)
- Position encoder not available (2)



Output signal with rising characteristic

Series		
Output signal		
Transducer interface		
Customer device interface		
Part number		
Output voltage		
Output current		
Load current		
Max. residual ripple		
Load resistance		
System resolution		
Hysteresis		
Repeat accuracy		
Measurement rate		
Max. linearity deviation		
Temperature coef-ficient	Voltage output	
	Current output	
Supply voltage		
Current consumption		
Polarity reversal protected		
Overvoltage protection		
Dielectric strength		
Operating temperature		
Storage temperature		

Ordering example:

BTL6-_500-M_ _ _ _-_ _ _-_ _ _ _ _

Output signal

A	0...10 V
B	0...5 V
E	4...20 mA

Standard nominal strokes [mm]

0050...2000 mm in 1-mm increments

Design

E2	Protective tube Ø 10.2 mm
E28	Protective tube Ø 8 mm, max. rated length 1016 mm

Connection

Axial output

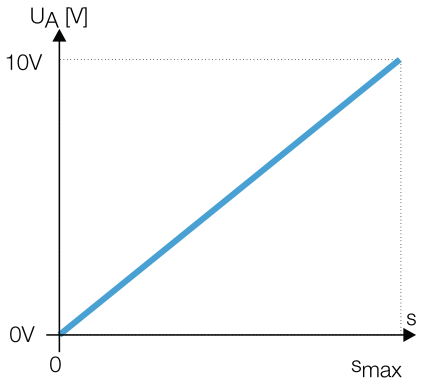
KA02	PUR cable 2 m
KA05	PUR cable 5 m
KA10	PUR cable 10 m
KA15	PUR cable 15 m
KA20	PUR cable 20 m

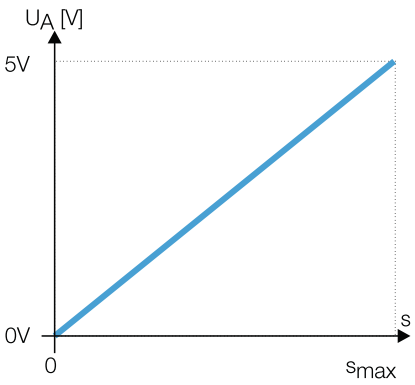
Axial output

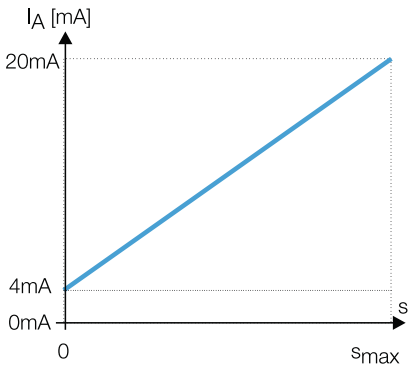
LA00,3	PUR stranded wire, 0.3 m

„Pigtail“ connector systems „ZA“
See page 265.

	Rod AR BTL6	**Rod AR BTL6**	**Rod AR BTL6**
	Analog	Analog	Analog
	A	**B**	**E**
	Analog	Analog	Analog
	BTL6-**A**500-M_ _ _ _-_ _ _-_ _ _ _	BTL6-**B**500-M_ _ _ _-_ _ _-_ _ _ _	BTL6-**E**500-M_ _ _ _-_ _ _-_ _ _ _
	0...10 V	0...5 V	
			4...20 mA
	Max. 2 mA	Max. 2 mA	
	≤ 5 mV	≤ 2 mV	
			≤ 500 Ω
	±1.5 mV	±1.5 mV	±7 µA
	≤ 5 µm	≤ 4 µm	
	System resolution/min. 2 µm	System resolution/min. 2 µm	System resolution/min. 2 µm
	$f_{STANDARD}$ = 1 kHz	$f_{STANDARD}$ = 1 kHz	$f_{STANDARD}$ = 1 kHz
	±200 µm to 500 mm rated length	±200 µm to 500 mm rated length	±200 µm to 500 mm rated length
	typ. ±0.02% ≥ 500 rated length	typ. ±0.02% ≥ 500 rated length	typ. ±0.02% ≥ 500 rated length
	[150 µV/°C + (5 ppm/°C × P × U/L)] × ΔT	[150 µV/°C + (5 ppm/°C × P × U/L)] × ΔT	[150 µV/°C + (5 ppm/°C × P × U/L)] × ΔT
	[0.6 µA/°C + (10 ppm/°C × P × I/L)] × ΔT	[0.6 µA/°C + (10 ppm/°C × P × I/L)] × ΔT	[0.6 µA/°C + (10 ppm/°C × P × I/L)] × ΔT
	10...30 V DC	10...30 V DC	10...30 V DC
	typ. ≤ 60 mA	typ. ≤ 60 mA	typ. ≤ 60 mA
	yes	yes	yes
	yes	yes	yes
	500 V DC (GND to housing)	500 V DC (GND to housing)	500 V DC (GND to housing)
	–40...+85 °C	–40...+85 °C	–40...+85 °C
	–40...+100 °C	–40...+100 °C	–40...+100 °C







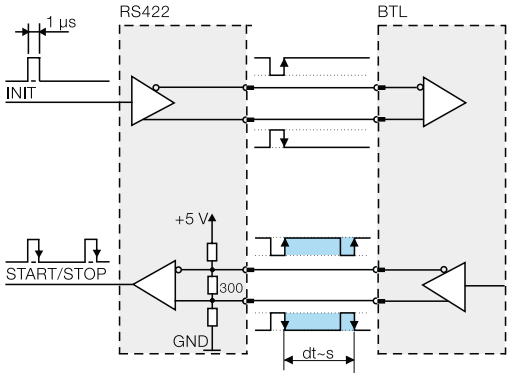
Please enter code for output signal, rated length, design and connection in the part numbers.

Scope of delivery
- Transducer
- Quick start instructions

Please order separately:
Position encoders, see page 218
Floats, see page 216

P510 interface

The 510 interface is compatible with BTA processor units as well as with controllers and modules from various manufacturers including Siemens, B & R, Bosch, Phoenix Contact, Mitsubishi, Sigmatek, Parker, Esitron, WAGO and others.
Reliable signal transmission, even with cable lengths of up to 500 m between the BTA processor unit and the transducer. This is guaranteed by the especially interference-free RS485/differential drivers and receivers. Interference signals are effectively suppressed.



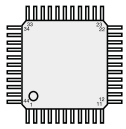
Block diagram of P interface

Universal P510 for rising and falling edge evaluation

As a consequence of different control philosophies, Digital Pulse Interfaces are available in two different types depending on the controller.
The difference lies in how the edges are processed. The falling edges are processed in the P interface and the rising edges in the M interface. To reduce the number of different models to a minimum, the P510 interface was created as a universal pulse interface which combines both functions. The reference point for the propagation time measurement is the "start pulse".

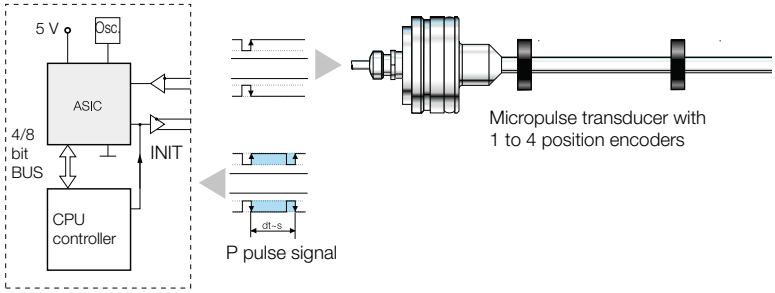
Extremely precise digitizing chip for P510 pulse interface

Companies developing their own electronic control and processor unit can create a highly accurate P interface cost-effectively and with minimum effort using the Balluff digitizing chip. The digitizing chip was developed as a high-resolution, configurable ASIC for Micropulse transducers with P pulse interface.


Digitizing chip 44QFP

Benefits

- High position resolution: the actual 1 µm resolution of the BTL position measurement system is supported completely by the 133 ps resolution of the chip (at low clock frequency 2 or 20 MHz).
- Position data from 4 position encoders can be processed simultaneously
- 4/8-bit processor interface

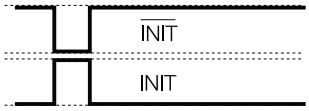


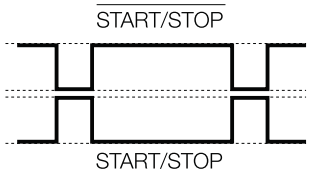
Controller or electronic processor unit

ASIC INFO: +49 7158 173-370

Series	**Rod AR BTL6**
Transducer interface	Pulse **P510**
Customer device interface	Pulse **P510**
Part number	BTL6-**P**510-M_ _ _ _-_ _ _- _ _ _ _ _
System resolution	processing-dependent
Repeat accuracy	≤ 10 µm
Reproducibility	≤ 20 µm
Resolution	≤ 10 µm
Linearity deviation	±200 µm up to 500 mm rated length typ. ±0.02%, max. ±0.04% 500...1500 mm rated length
Supply voltage	10...30 V DC
Current consumption	≤ 60 mA (at 1kHz)
Operating temperature	–40...+85 °C
Storage temperature	–40...+100 °C

The rising and falling edges can be evaluated.





Please enter code for rated length, design and connection in the part number.

Scope of delivery
- Transducer
- Quick start instructions

Please order separately:
Position encoders, see page 218
Floats, see page 216

Ordering example:

BTL6-P510-M_ _ _ _-_ _ _-_ _ _ _ _

Standard nominal strokes [mm]
0050...1524 mm
in 1-mm increments

Design
E2 Protective tube Ø 10.2 mm
E28 Protective tube Ø 8 mm,
Max. rated length 1016 mm

Connection
Axial output
KA02 PUR cable 2 m
KA05 PUR cable 5 m
KA10 PUR cable 10 m
KA15 PUR cable 15 m
KA20 PUR cable 20 m

Axial output
LA00,3 PUR stranded wire, 0.3 m

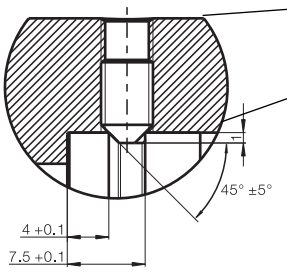
„Pigtail“ connector systems „ZA“
See page 265

Installation notices

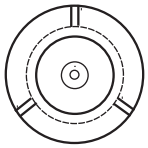
Series AR Micropulse Transducers BTL are designed for integration in hydraulic cylinders. The transducer is supported mechanically on the housing. Three M5 set screws at an angle of 120 °C hold the transducer, which fits into a Ø 48 H8 fitting bore.
Sealing is accomplished using the supplied O-ring and support ring. The position encoder integrated in the piston marks the actual position of the piston without making contact.

The metal surrounding of the cylinder eliminates the need for a cable shield with the BTL AR...**LA**, cable outlet stranded wire version is installed in the cylinder. The stranded wire version cannot be used without additional EMC protection (shield).

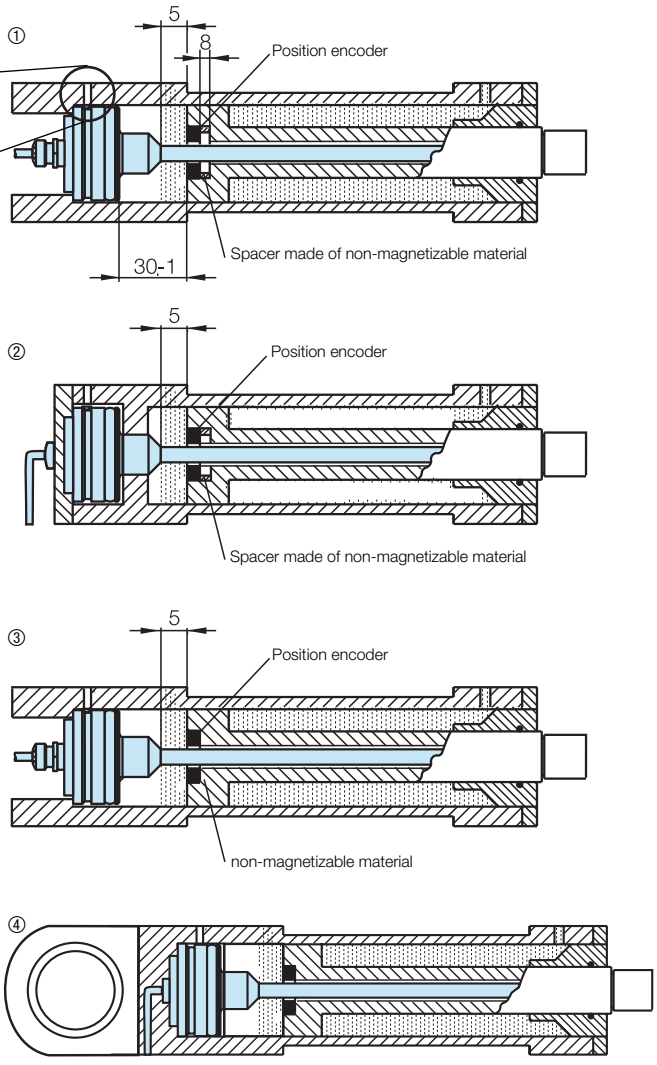
Set screw
DIN 914 M5×8



Fixing the transducer using three M5 set screws at an angle of 120 °C



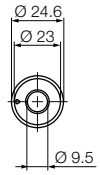
Installation examples

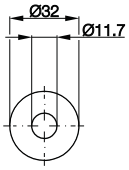


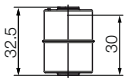
Caution!
Before design, installation and startup please familiarize yourself with the user's guide to be found at www.balluff.com.

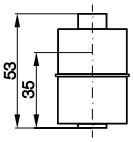
① Installation on the piston, in magnetic piston material
② Installation from rear, in magnetizable piston material
③ Installation on the piston
④ Installation on piston in a cylinder with articulated lug

Description	**Float**	**Float**
for Series	Rod BTL (8 mm)	Rod BTL
Ordering code	**BAM01ZE**	**BAM024J**
Part number	BTL-S-2510-2Z	BTL2-S-3212-4Z
Material	Stainless steel 1.4404	Stainless steel 1.4404
Weight	approx. 9 g	Approx. 20 g
Operating temperature/Storage temperature range	–20...+130 °C	–20...+120 °C
Immersion depth in water	approx. 30 mm	approx. 35 mm
Pressure rating (static)	60 bar	24 bar

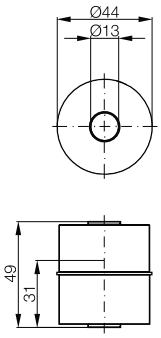


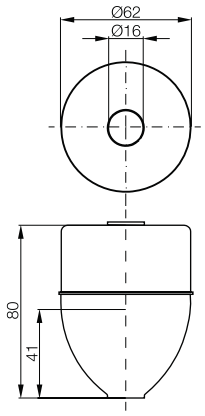


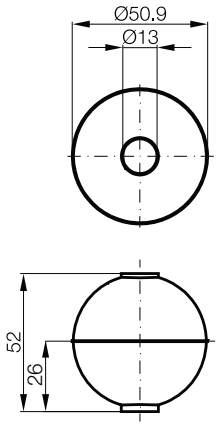




	Float	**Float**	**Float**
	Rod BTL	Rod BTL	Rod BTL
	BAM0146	**BAM014C**	**BAM0149**
	BTL2-S-4414-4Z	BTL2-S-6216-8P	BTL2-S-5113-4K
	Stainless steel 1.4404	Stainless steel 1.4404	Stainless steel 1.4404
	Approx. 34 g	Approx. 69 g	Approx. 35 g
	–20...+120 °C	–20...+120 °C	–20...+120 °C
	approx. 31 mm	approx. 41 mm	approx. 26 mm
	20 bar	15 bar	40 bar

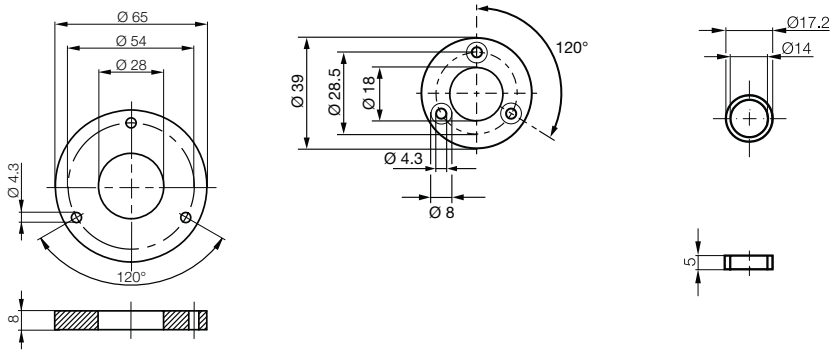




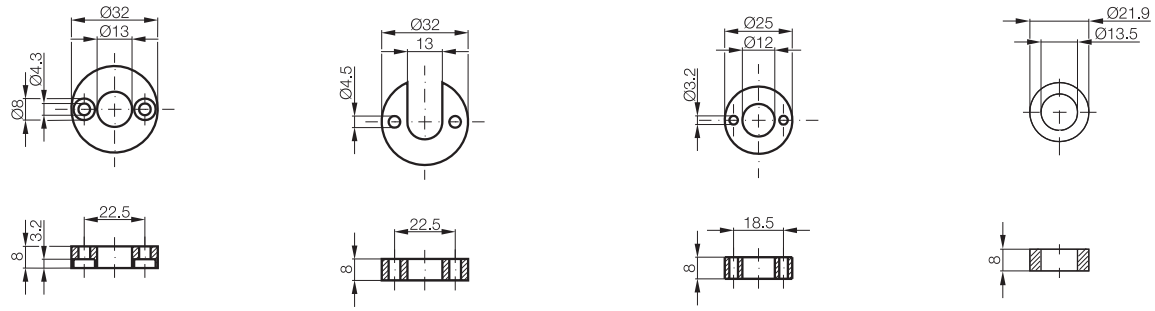


Caution!
Before design, installation and startup please familiarize yourself with the user's guide to be found at www.balluff.com.

Description	**Position encoder**	**Position encoder**	**Position encoder**	
for Series	Rod BTL	Rod BTL	Rod BTL	
Ordering code	**BAM01CE**	**BAM013Y**	**BAM013H**	
Part number	BTL-P-1018-3R	BTL-P-1028-15R	BTL-P-0814-GR-PAF	
Material	Al	Al	Ferrite bound in PA	
Weight		approx. 68 g	approx. 1.5 g	
Position encoder travel speed	any	any	any	
Operating temperature/ Storage temperature	–40...+100 °C	–40...+100 °C	–40...+100 °C	
Ordering code				
Part number PA 60 fiberglass reinforced				
Material				
Weight				
Position encoder travel speed				
Operating temperature/Storage temperature				



	Position encoder	Position encoder	Position encoder	Position encoder
	Rod BTL	Rod BTL	Rod BTL	Rod BTL
	BAM013L	**BAM013P**	**BAM013J**	**BAM013R**
	BTL-P-1013-4R	BTL-P-1013-4S	BTL-P-1012-4R	BTL-P-1014-2R
	Aluminum	Aluminum	Aluminum	Aluminum
	approx. 12 g	approx. 12 g	approx. 12 g	approx. 10 g
	any	any	any	any
	–40...+100 °C	–40...+100 °C	–40...+100 °C	–40...+100 °C
	BAM013M		**BAM013K**	
	BTL-P-1013-4R-PA		BTL-P-1012-4R-PA	
	PA 60 fiberglass reinforced		PA 60 fiberglass reinforced	
	approx. 10 g		approx. 10 g	
	any		any	
	–40...+100 °C		–40...+100 °C	



M18×1.5 fastening nut
Order designation:
BTL-A-FK01-E-M18×1.5
Ordering code: **BAM0118**

3/4"-16-UNF fastening nut
Order designation:
BTL-A-FK01-E-3/4"-16 UNF
Ordering code: **BAM0117**

Caution!
Before design, installation and startup please familiarize yourself with the user's guide to be found at www.balluff.com.