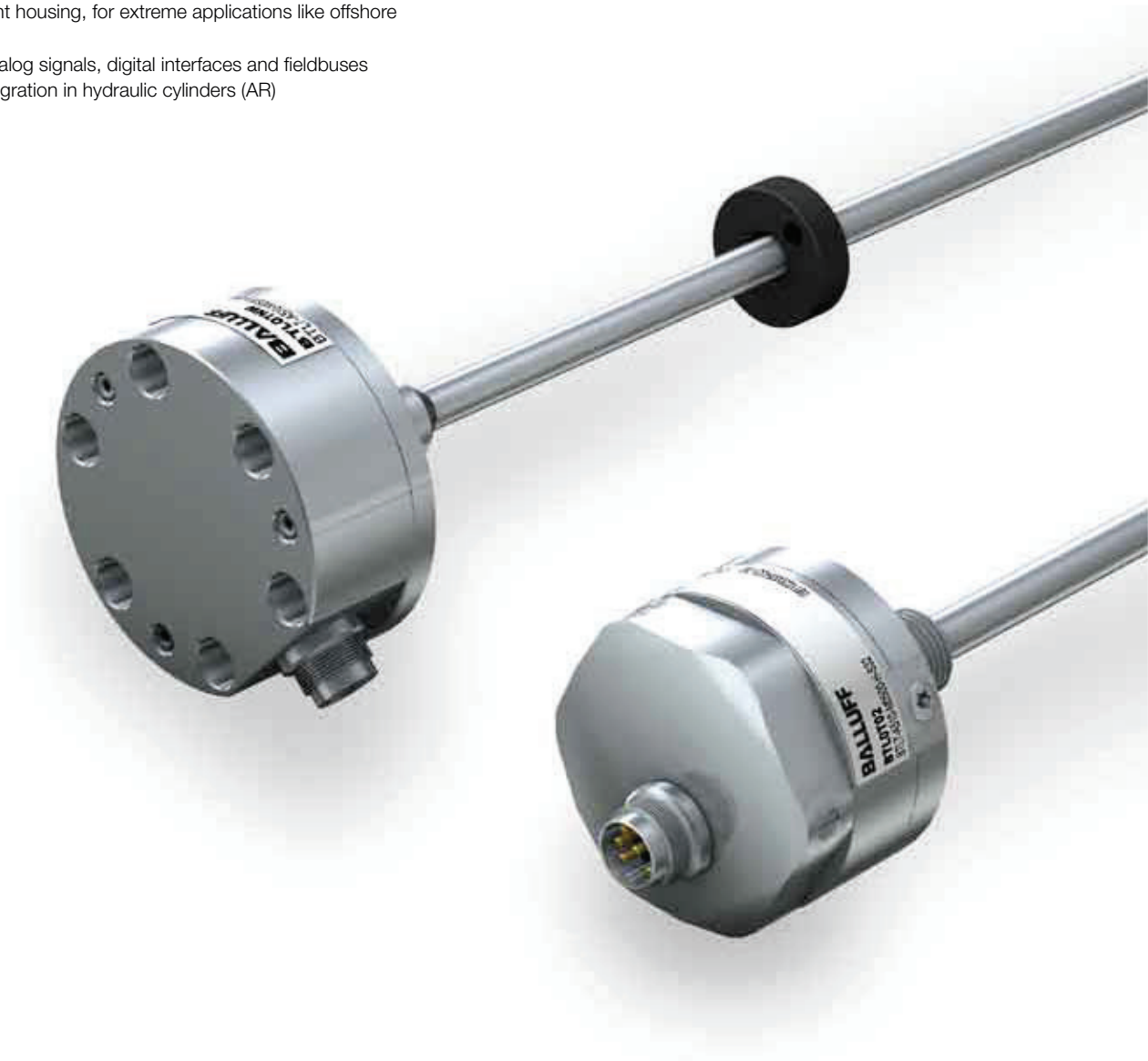
Micropulse Transducers

Rod Compact and Rod AR

- Compact housing with only 34 mm in length saves valuable space in and around the cylinder.
- Stainless steel housing with connecting flange and robust 6-screw fastening (K) – no additional protective housing is needed
- Simple characteristic settings
- shock and vibration-resistant with IP 67/68 degree of protection
- Pressure-resistant housing, for extreme applications like offshore or under water
- Available with analog signals, digital interfaces and fieldbuses
- for complete integration in hydraulic cylinders (AR)



Contents

MICROPULSE®

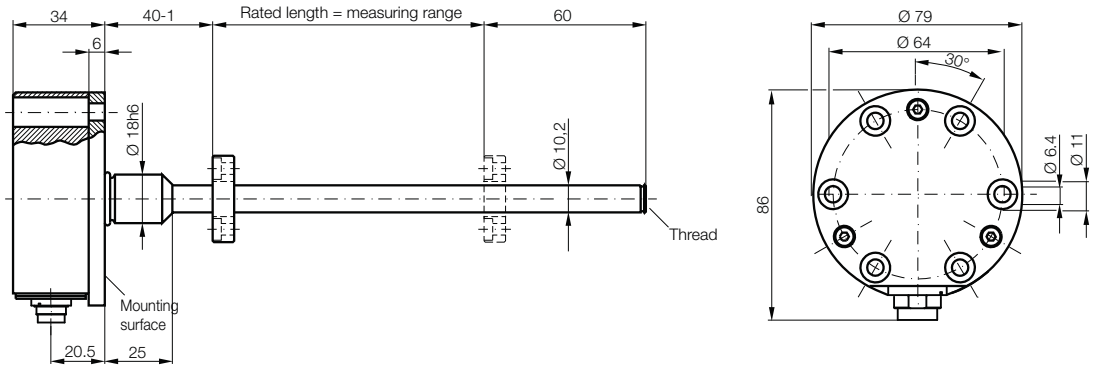
Pressure-resistant to 600 bar, high reproducibility, contact-less, robust

The Micropulse Transducer BTL is a robust position measuring system for measuring ranges between 25 and 7620 mm under extreme ambient conditions. The actual measurement section is protected inside a high-pressure resistant stainless steel tube. The system is ideal for use in hydraulic cylinders for position feedback or as a level monitor with aggressive media in the food and chemical industries.

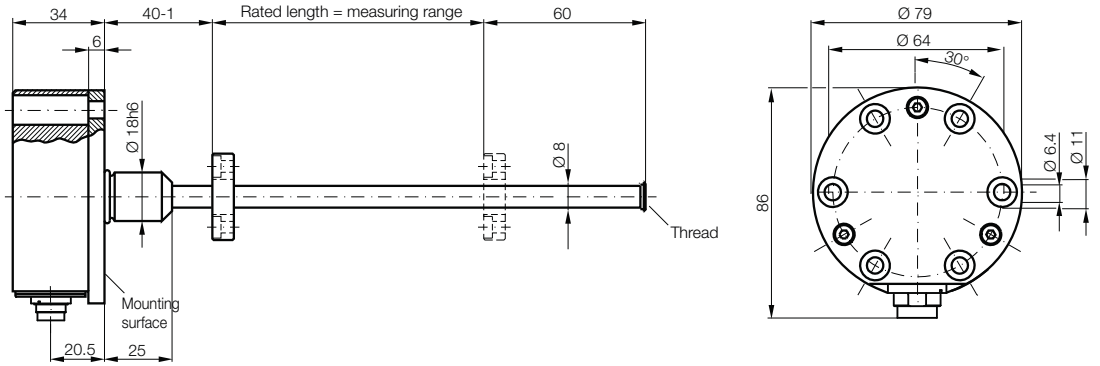
Series	**Rod Compact K BTL7**
Shock load	150 g/6 ms as per EN 60068-2-27
Vibration	20 g, 10...2000 Hz per EN 60068-2-6
Polarity reversal protected	to 36 V
Overvoltage protection	to 36 V
Dielectric strength	500 V AC (GND to housing)
Degree of protection as per IEC 60529	IP 68 with cable outlet, IP 67 with screwed-on plug connector BKS-S...
Housing material	Anodized aluminum/1.4571 stainless steel protective tube, 1.3952 stainless steel cast flange
Fastener	Design K, 18h6 with 6 cylinder head screws
Pressure rating	
with 10.2 mm protective tube	600 bar with installation in hydraulic cylinder
with 8 mm protective tube	250 bar installed in hydraulic cylinder
Connection	Plug connector or cable connection
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 induced by high-frequency fields	EN 61000-4-6 Severity level 3
Magnetic fields	EN 61000-4-8 Severity level 4
Standard nominal strokes [mm] with an 8 mm protective tube, the max. rated length is 1016 mm	0025...7620 mm in 1-mm increments

General data

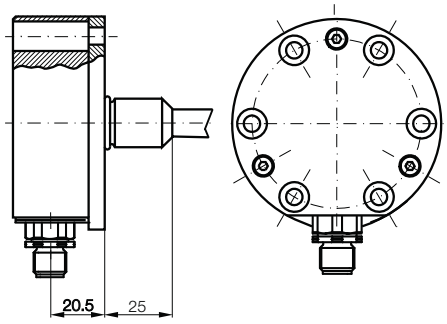
Design K,
BTL7-...-K-SR32



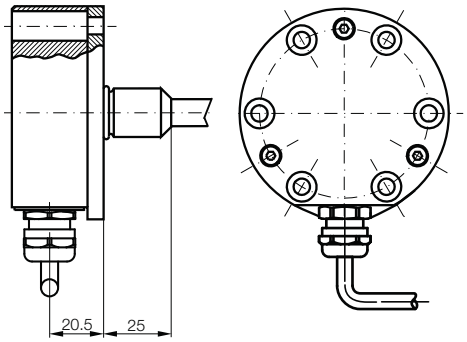
Design K8,
BTL7-...-K8-SR32



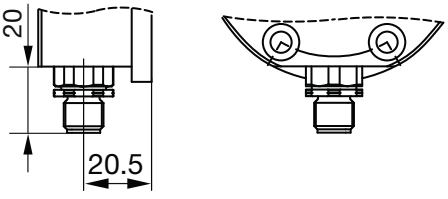
Design K,
BTL7-...-K-SR115



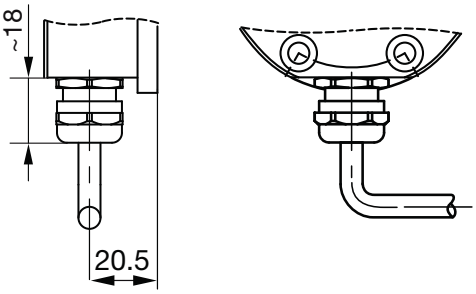
Design K, BTL7-...-K-K _ _, radial cable outlet



BTL7-...-K-SR115



BTL7...-K-K _ _



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

Rod Compact BTL7 H/W
General data

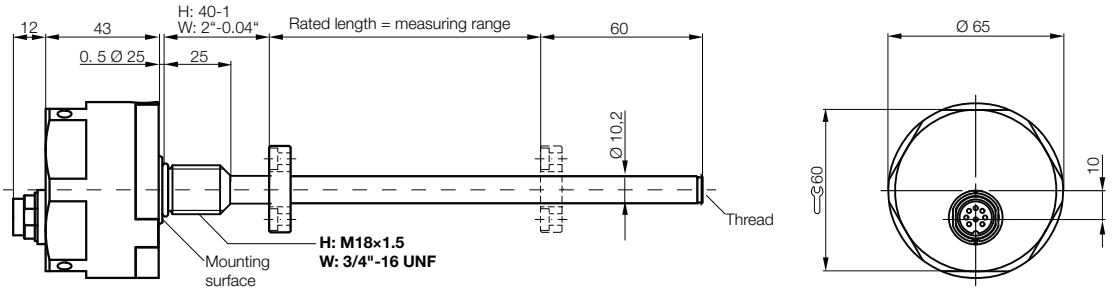
Pressure-resistant to 600 bar, high reproducibility, contact-less, robust
The Micropulse Transducer BTL is a robust position measuring system for measuring ranges between 25 and 7620 mm under extreme ambient conditions. The actual measurement section is protected inside a high-pressure resistant stainless steel tube. The system is ideal for use in hydraulic cylinders for position feedback or as a level monitor with aggressive media in the food and chemical industries.

Series	**Rod Compact BTL7 H/W**
Shock load	150 g/6 ms as per EN 60068-2-27
Vibration	20 g, 10...2000 Hz per EN 60068-2-6
Polarity reversal protected	to 36 V
Overvoltage protection	to 36 V
Dielectric strength	500 V AC (GND to housing)
Degree of protection as per IEC 60529	IP 68 with cable outlet, IP 67 with screwed-on plug connector BKS-S...
Housing material	Anodized aluminum/1.4571 stainless steel protective tube, 1.3952 stainless steel cast flange
Fastener	Design H M18×1.5 thread Design W 3/4"-16 UNF
Pressure rating	
with 10.2 mm protective tube	600 bar with installation in hydraulic cylinder
with 8 mm protective tube	250 bar installed in hydraulic cylinder
Connection	Plug connector or cable connection
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 induced by high-frequency fields	EN 61000-4-6 Severity level 3
Magnetic fields	EN 61000-4-8 Severity level 4
Standard nominal strokes [mm] with an 8 mm protective tube, the max. rated length is 1016 mm	0025...7620 mm in 1-mm increments

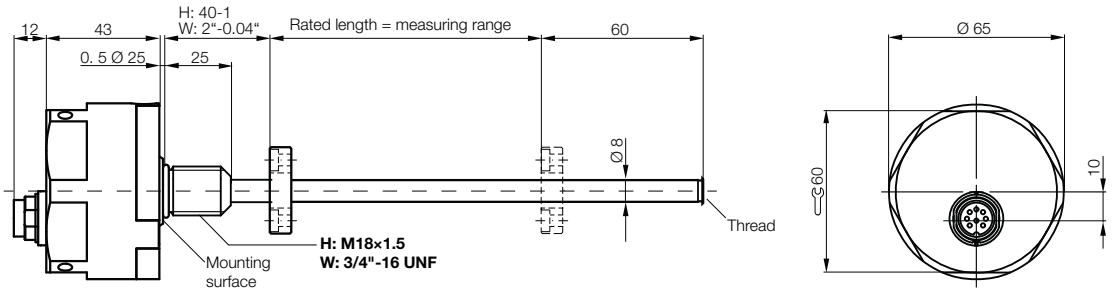
Caution!
Before design, installation and startup please familiarize yourself with the user's guide to be found at www.balluff.com.

Rod Compact BTL7 H/W
General data

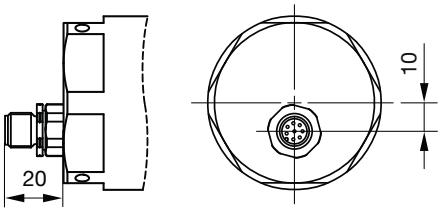
**Design H/W,
BTL7-...-H/W-S32**



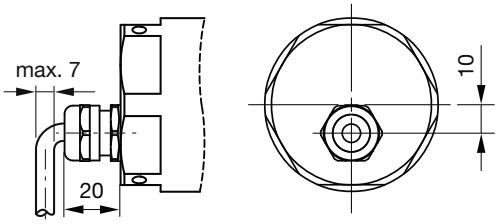
**Design H/W,
BTL7-...-H8/W8-
S32,**



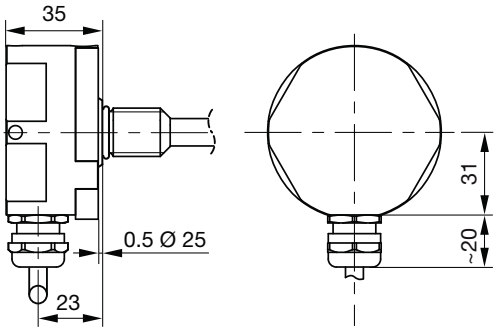
**Design H/W,
BTL7-...-H/W-S115**



**Design H/W,
BTL7-...-H/W-KA**



**Design H/W,
BTL7-...-H/W-K**



Measurement rate to 4 kHz

Features of Micropulse BTL7-A/C/E/G...H, K, W
- Non-contact detection of piston position
- Insensitive to contamination to IP 68
- Shock and vibration resistant 150 g/20 g
- Absolute output signal
- Measurement lengths 25 to 7620 mm in-mm increments
- Flexibly adjustable measuring range through button programming
- High measurement rate up to 4 kHz
- Temperature range –40...+85°C

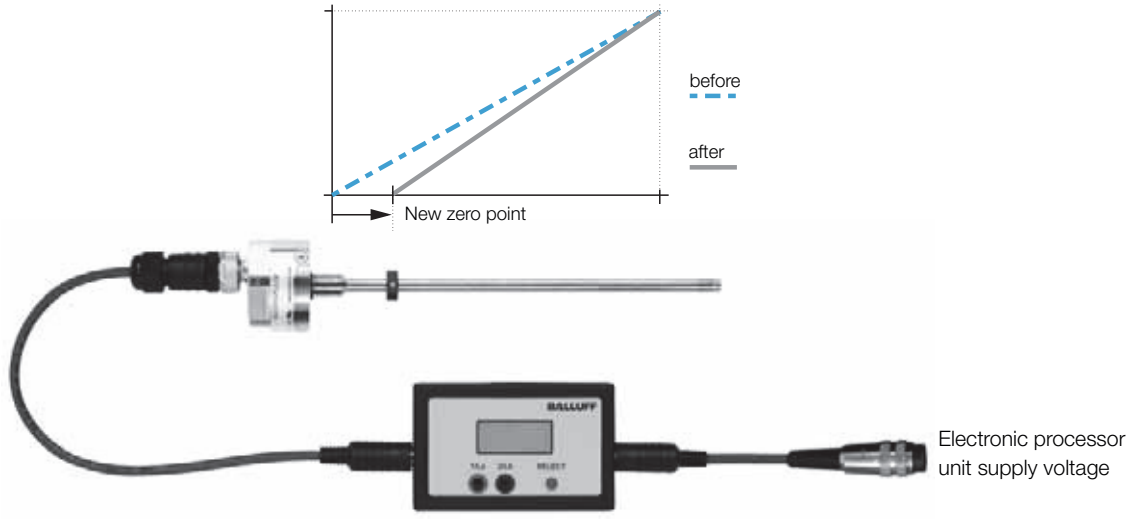
Micropulse transducer BTL7 Compact with calibration box BTL-A-CB02
With the Calibration Box BTL-A-CB02, the characteristic of the position measuring system can be easily and quickly adapted to the requirements of the hydraulic cylinder and the application. With simple plug & play, without PC, laptop or extensive software downloads, the measuring range as well as the slope of the output characteristic are set. The setting option saves storage and setup costs, since one Micropulse BTL7 Compact can fulfill different requirements that, in the past, required several systems.

Series	
Output signal	
Transducer interface	
Customer device interface	
Part number	
Output voltage	
Output current	
Load current	
Load resistance	
System resolution	
Repeat accuracy	
Measurement rate, length-dependent	
Max. linearity deviation	
Temperature coefficient	
Supply voltage	
Current consumption at 24 V DC	
Polarity reversal protected	
Overvoltage protection	
Dielectric strength	
Operating temperature	

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

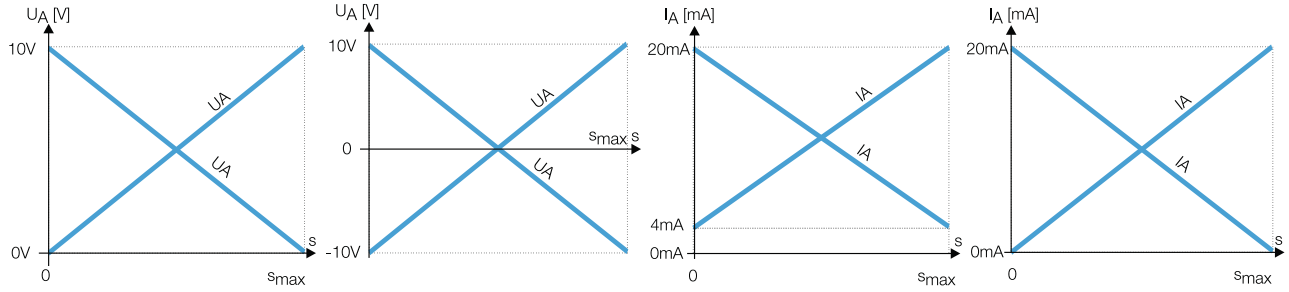
Scope of delivery
- Transducer
- Quick start instructions
- Stainless steel fastening screws "600 bar"

Please order separately:
Calibration box, see page 190
Position encoders, see page 216



Set the output characteristic with the calibration box.
Zero and end points, measuring range, rising and falling characteristic

Rod Compact BTL7	Rod Compact BTL7	Rod Compact BTL7	Rod Compact BTL7
Analog	Analog	Analog	Analog
A	**G**	**E**	**C**
Analog	Analog	Analog	Analog
BTL7-**A**510-M_ _ _ _-_-_ _ _ _	BTL7-**G**510-M_ _ _ _-_-_ _ _ _	BTL7-**E**5_0-M_ _ _ _-_-_ _ _ _	BTL7-**C**5_0-M_ _ _ _-_-_ _ _ _
0...10 V and 10...0 V	–10...10 V and 10...–10 V		
		4...20 mA or 20...4 mA	0...20 mA or 20...0 mA
Max. 5 mA	Max. 5 mA		
		≤ 500 Ω	≤ 500 Ω
≤ 0.33 mV	≤ 0.33 mV	≤ 0.66 µA	≤ 0.66 µA
System resolution/min. 2 µm	System resolution/min. 2 µm	System resolution/min. 2 µm	System resolution/min. 2 µm
Max. 4 kHz	Max. 4 kHz	Max. 4 kHz	Max. 4 kHz
±50 µm to ≤ 500 mm rated length	±50 µm to ≤ 500 mm rated length	±50 µm to ≤ 500 mm rated length	±50 µm to ≤ 500 mm rated length
±0.01% FS < 5500 mm rated length	±0.01% FS < 5500 mm rated length	±0.01% FS < 5500 mm rated length	±0.01% FS < 5500 mm rated length
±0.02% FS > 5500 mm rated length	±0.02% FS > 5500 mm rated length	±0.02% FS > 5500 mm rated length	±0.02% FS > 5500 mm rated length
≤ 30 ppm/K	≤ 30 ppm/K	≤ 30 ppm/K	≤ 30 ppm/K
10...30 V DC	10...30 V DC	10...30 V DC	10...30 V DC
≤ 150 mA	≤ 150 mA	≤ 150 mA	≤ 150 mA
to 36 V	to 36 V	to 36 V	to 36 V
to 36 V	to 36 V	to 36 V	to 36 V
500 V AC (GND to housing)	500 V AC (GND to housing)	500 V AC (GND to housing)	500 V AC (GND to housing)
–40...+85 °C	–40...+85 °C	–40...+85 °C	–40...+85 °C



Ordering example:

BTL7-_5_0-M_ _ _ _-_ _-_ _ _ _

Output signal

A	0...10 V and 10...0 V
G	-10...10 V and 10...–10 V
E	4...20 mA or 20...4 mA
C	0...20 mA or 20...0 mA

Characteristic

1	rising and falling (at A and G)
0	Rising (for C and E)
7	Falling (for C and E)

Standard nominal strokes [mm]

0025...7620
in 1-mm increments

Design

K	10.2 mm protective tube
K8	8 mm protective tube
H	10.2 mm protective tube
H8	8 mm protective tube
W	10.2 mm protective tube
W8	8 mm protective tube

Connection

K-radial design

K02	PUR cable 2 m
K05	PUR cable 5 m
K10	PUR cable 10 m
K15	PUR cable 15 m
SR32	Connectors
SR115	Connectors

H/W radial design

K02	PUR cable 2 m
K05	PUR cable 5 m
K10	PUR cable 10 m
K15	PUR cable 15 m

H/W design, axial

KA02	PUR cable 2 m
KA05	PUR cable 5 m
KA10	PUR cable 10 m
KA15	PUR cable 15 m
S32	Connectors
S115	Connectors

Calibration box with cable set	
Part number	**Cable set**
BTL7-A-CB02	Cable connection
BTL7-A-CB02-S115	Plug connector S115
BTL7-A-CB02-S32	Connector S32

Micropulse transducer BTL7 Rod Compact with calibration box BTL-A-CB02

Electronic processor unit
Supply voltage

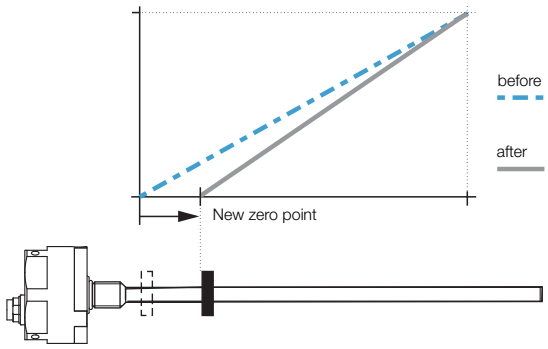
Set the output characteristic with the calibration box.
Zero and end point, measuring range, rising or falling characteristic.

Teach-in
The factory-set zero and end points are replaced by new zero and end points. The zero and end points can be set independently of each other, and the characteristic slope changes.

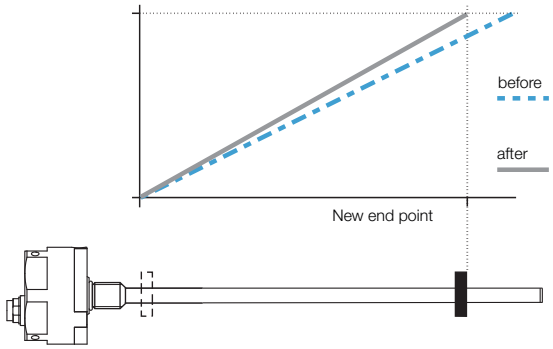
Inverting (only with BTL7-C/E)
The characteristic of the current output can be inverted by activating the programming inputs. For example, the rising characteristic of the output becomes a falling characteristic.
The voltage outputs are not inverted.

Adjusting
Setting and adjusting the characteristic with stopped position encoder. The factory-set zero and end points can be replaced by a new start and end points, and the associated output values can be adjusted. The start and end values can be adjusted as desired to the limits.
Adjustment is possible from serial number 120615000xxxxx xx.

Reset
Restoring the transducer to its factory default settings.



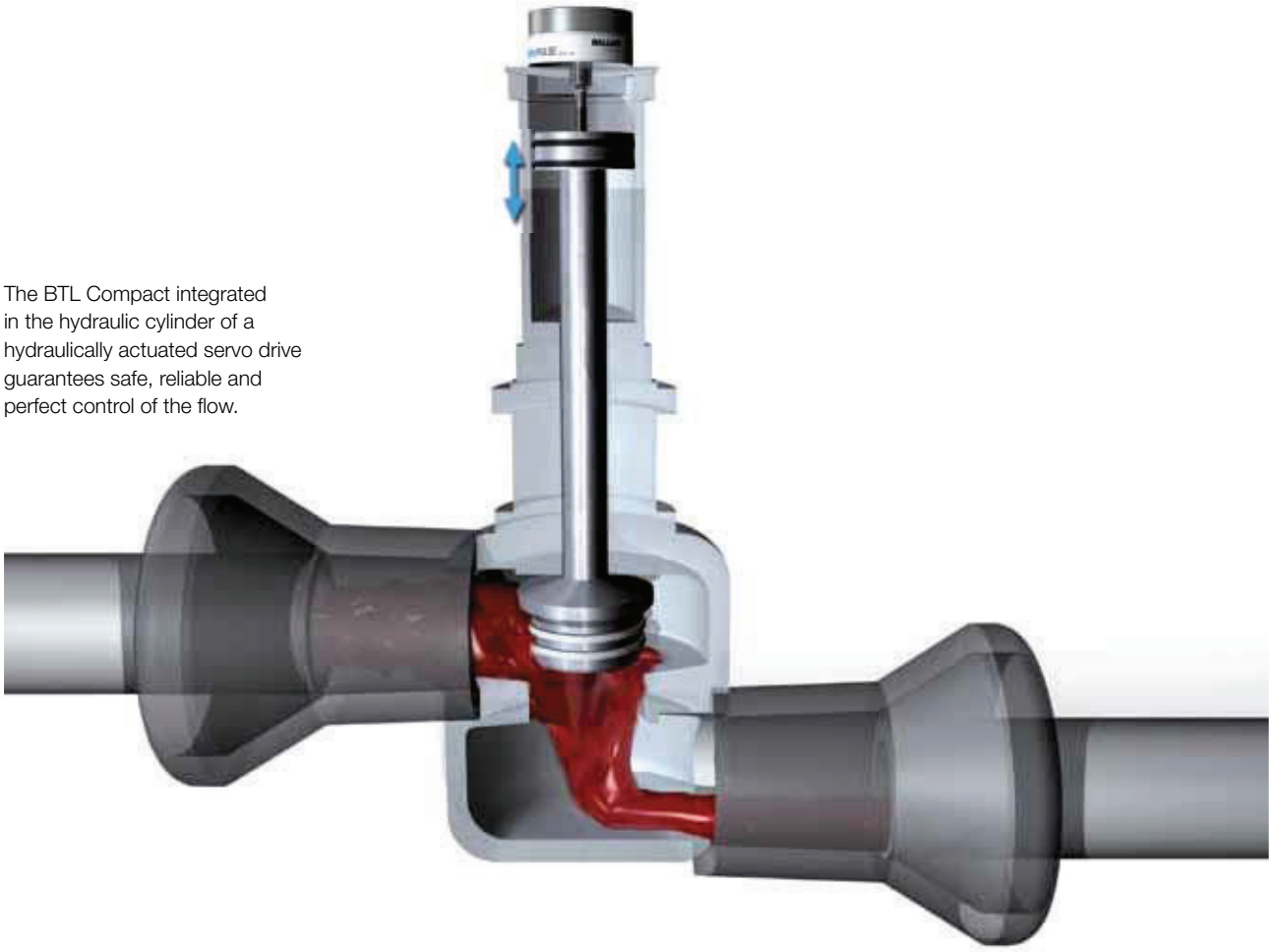
Read in new zero point



Read in new end point

BTL Compact – the standard in power plant and process engineering

Balluff, as the first manufacturer of magnetostrictive position measurement systems, presented the BTL Compact, with a length of only 34 mm, as an innovation as early as the 1995 Hanover trade fair. The target applications were hydraulically actuated valve drives in power plant and process engineering. In the meantime, thousands of BTL Compacts all over the world reliably measure the current position of valves and guarantee safe, dependable and perfect control. Balluff is once again achieving new benchmarks with the new generation, the Micropulse BTL7 Compact. The position measurement system, which is 100% backward-compatible with the existing BTL5 generation, impresses with its improvement in many types of performance data and a large number of extensions in application and function.

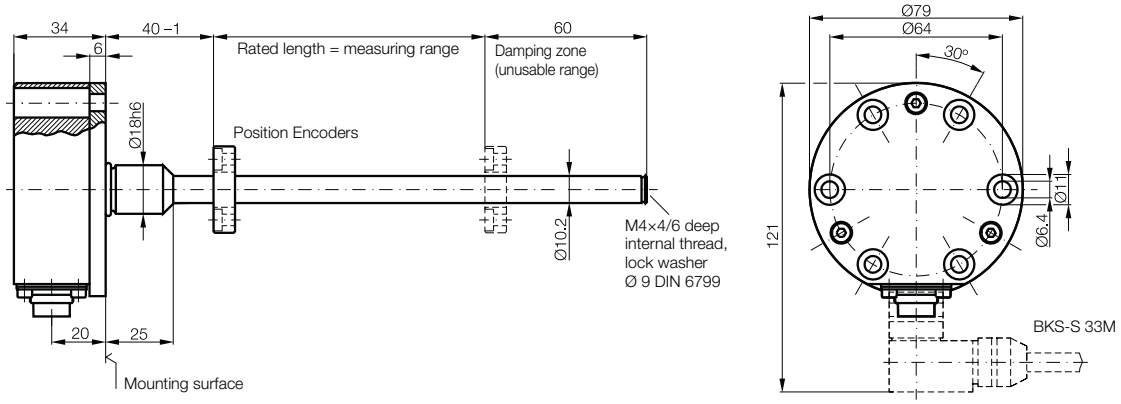


The BTL Compact integrated in the hydraulic cylinder of a hydraulically actuated servo drive guarantees safe, reliable and perfect control of the flow.

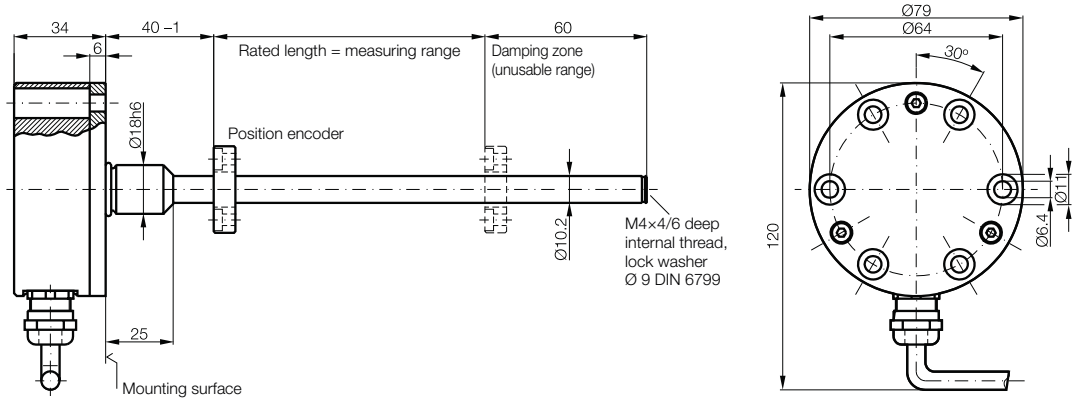
Pressure-resistant to 600 bar, high reproducibility, contactless, robust
The Micropulse Transducer BTL is a robust position measurement system for measuring ranges between 25 and 5500 mm as well as for use under extreme ambient conditions. The actual measurement section is protected inside a high-pressure resistant stainless steel tube. The system is ideal for use in hydraulic cylinders for position feedback or as a level monitor with aggressive media in the food and chemical industries.

Series	**Rod Compact K BTL5**
Shock load	100 g/6 ms in accordance with EN 60068-2-27 and 100 g/2 ms in accordance with EN 60068-2-29
Vibration	12 g, 10...2000 Hz as per EN 60068-2-6
Polarity reversal protected	yes
Overvoltage protection	TransZorb protection diodes
Dielectric strength	500 V DC (GND to housing)
Degree of protection as per IEC 60529	IP 67 (with IP-67 connector BKS-S... attached); IP 68 (5 bar with cable)
Housing material	Stainless steel 1.4305
Flange and tube material	Tube stainless steel 1.4571, flange 1.4571 or 1.4429 or 1.4404
Housing attachment	Design K, 18h6 with 6 cylinder head screws
Connection	Plug connector or cable connection
Plug connector suggestion see page 188/212	BKS-S 32M/BKS-S 32M-C/BKS-S 33M
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
Conducted interference induced by high-frequency fields	EN 61000-4-6 Severity level 3
Standard nominal strokes [mm]	0025...5500 mm in 1-mm increments, depending on the interface

Design K, BTL5-...-M_ _ _ _-K-SR32



Design K, BTL5-...-M_ _ _ _-K-K_ _



Caution!
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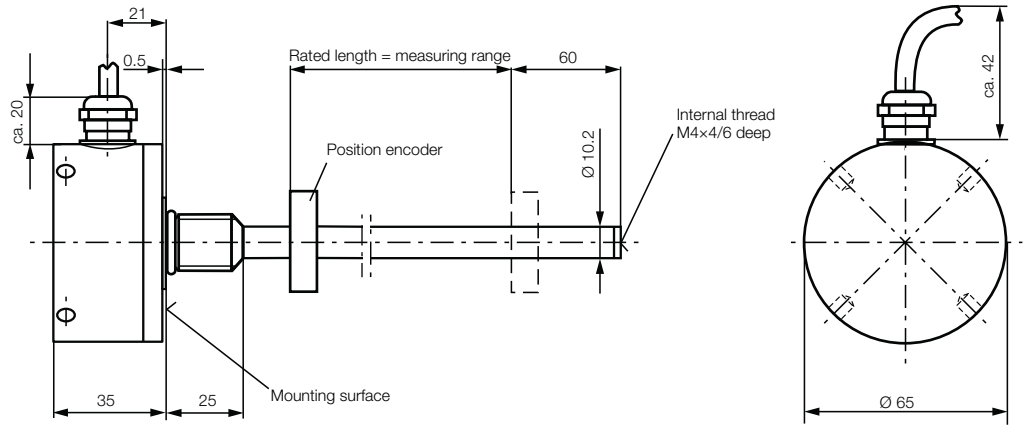
Pressure-resistant to 600 bar, high reproducibility, contactless, robust
The Micropulse Transducer BTL is a robust position measurement system for measuring ranges between 25 and 5500 mm as well as for use under extreme ambient conditions. The actual measurement section is protected inside a high-pressure resistant stainless steel tube. The system is ideal for use in hydraulic cylinders for position feedback or as a level monitor with aggressive media in the food and chemical industries.

Series	**BTL5 Rod Compact H**
Shock load	100 g/6 ms in accordance with EN 60068-2-27 and 100 g/2 ms in accordance with EN 60068-2-29
Vibration	12 g, 10...2000 Hz as per EN 60068-2-6
Polarity reversal protected	yes
Overvoltage protection	TransZorb protection diodes
Dielectric strength	500 V DC (GND to housing)
Degree of protection as per IEC 60529	IP 67 (with IP-67 connector BKS-S... attached); IP 68 (5 bar with cable)
Housing material	Stainless steel 1.4305
Flange and tube material	Tube stainless steel 1.4571, flange 1.4571 or 1.4429 or 1.4404
Housing attachment	Design H thread M18×1.5, design W 3/4"-16 UNF
Connection	Plug connector or cable connection
Plug connector suggestion see page 188/212	BKS-S 32M/BKS-S 32M-C/BKS-S 33M
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
Conducted interference induced by high-frequency fields	EN 61000-4-6 Severity level 3
Standard nominal strokes [mm]	0025...5500 mm in 1-mm increments

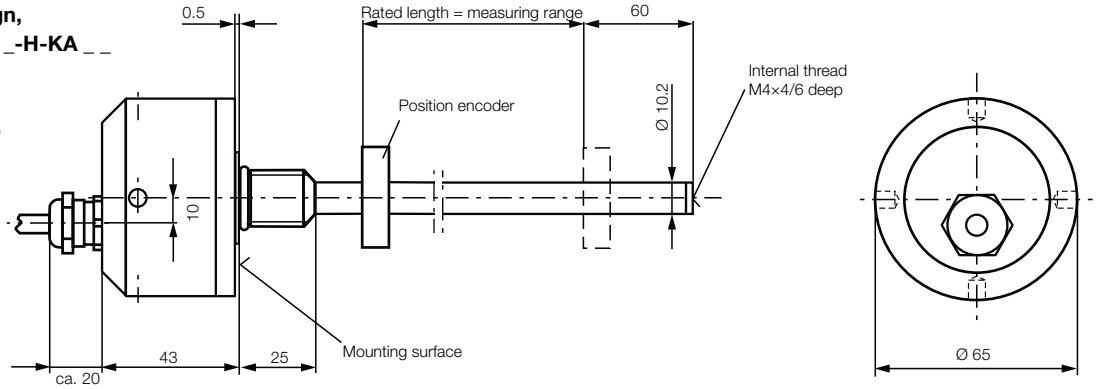
Hardware design,
BTL5-...-M_ _ _ _-H-K_ _

Mounting
thread M18×1.5
Radial cable outlet



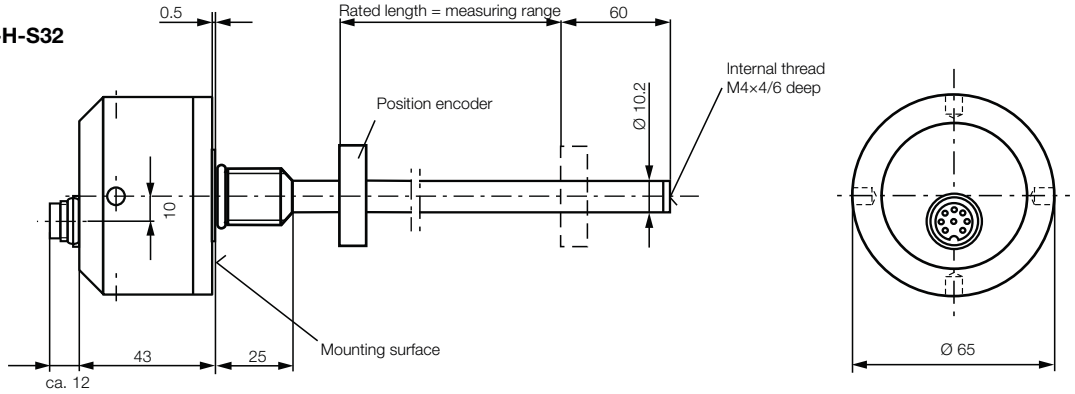
Hardware design,
BTL5-...-M_ _ _ _-H-KA _ _

Mounting
thread M18×1.5
Cable outlet
axial



Design H/W,
BTL5-...-M_ _ _ _-H-S32

Mounting
thread M18×1.5
Plug connector
axial



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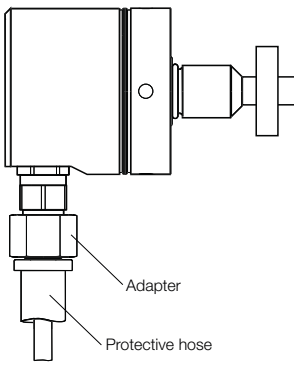
The outdoor system IP 69K, 40 bar

Micropulse ProCompact with cable protection system
Extreme ambient conditions, in which high reliability and accuracy are required, are typical application areas for Micropulse ProCompact transducers. The non-contact working principle of the systems ensures a complete absence of wear and nearly endless service life. The high-precision output signal is used as an absolute signal for the controller in a wide range of different interfaces.

Areas of application
- Locks and floodgates
- Water power plants
- Large, hydraulically powered valves
- Positioning the reflection channels for thermosolar power plants
- Dredger
- Railway track
- Logging machines
- Hydroelectric power plants
- Construction machinery
- Combine harvesters

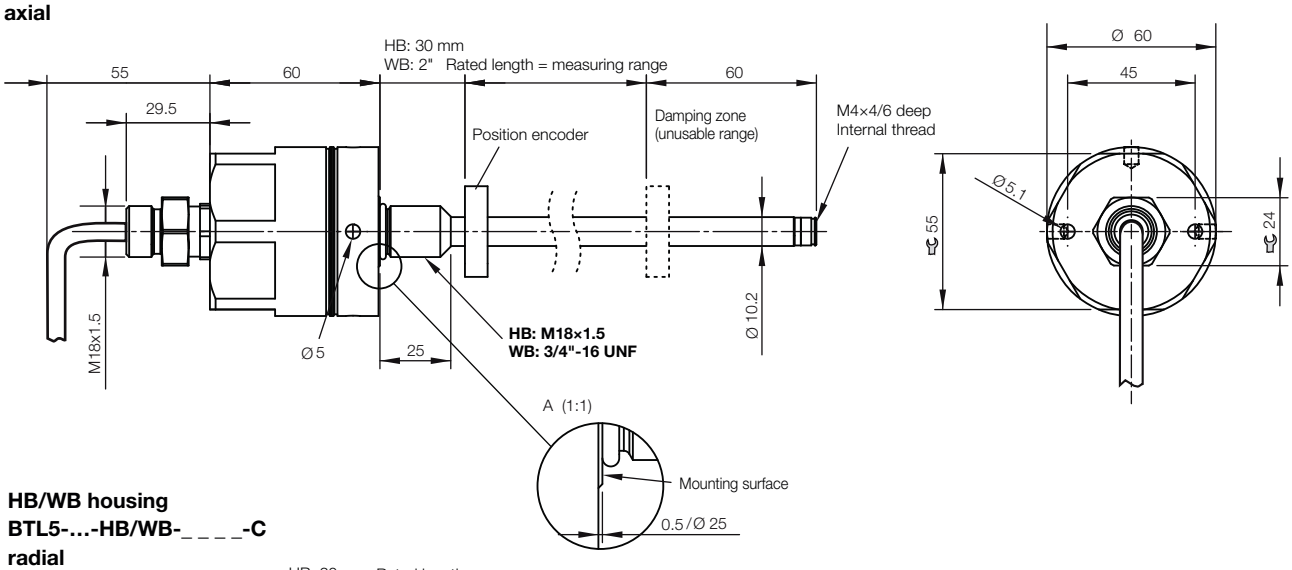


Accessories for the cable protection system

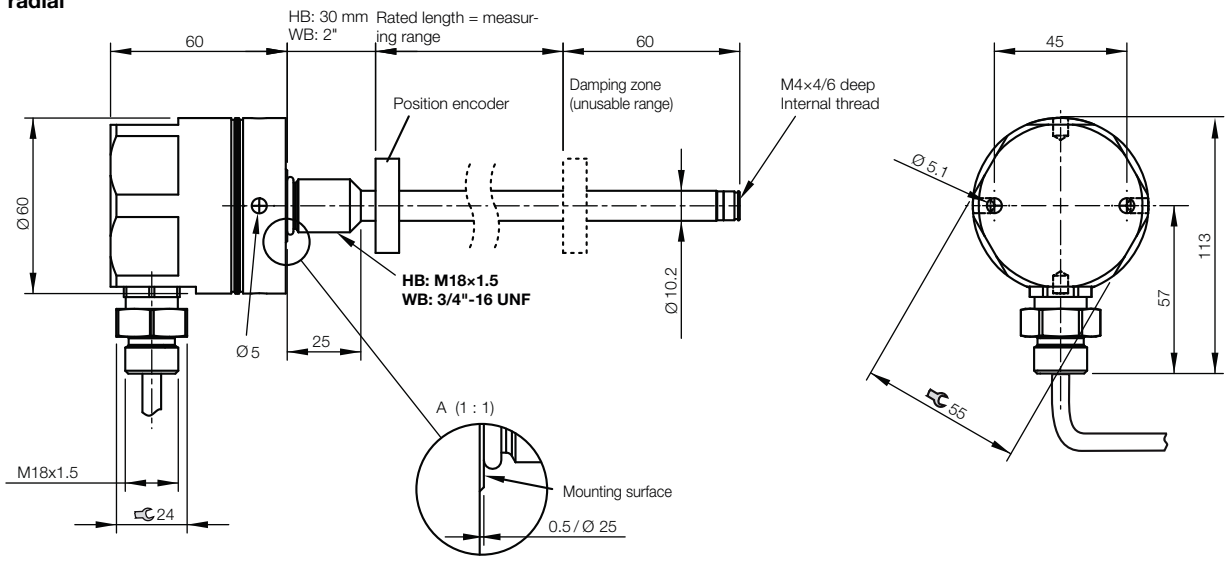
Series	**Adapter**
Ordering code	**BAM01JW**
Part number	BAM AD-XA-007-M18×1.5/D12-2
Housing material	Brass (not saltwater-resistant)
Ordering code	**BAM01JY**
Part number	BAM AD-XA-007-M18×1.5/D12-4
Housing material	Stainless steel V2A (conditionally saltwater-resistant)
Series	**Protective hose**
Part number	BAM PT-XA-001-095-0-_ _ _
Tube length	02, 05, 10, 15, 20, 30, 50 and 100 m
Degree of protection	IP 68 (40 bar) IP 69K (in installed and screwed-on state)
Housing material	PUR (resistant to seawater, weld spatter and UV radiation)
Outer diameter	16 mm
Inside diameter	9.5 mm
Temperature range	–40...+95 °C
Bending radius min. (static)	51 mm

Series	**Rod ProCompact HB/WB BTL5**
Shock load	100 g/6 ms in accordance with EN 60068-2-27 and 100 g/2 ms in accordance with EN 60068-2-29
Vibration	12 g, 10...2000 Hz as per EN 60068-2-6
Polarity reversal protected	yes
Overvoltage protection	TransZorb protection diodes
Dielectric strength	500 V DC (GND to housing)
Degree of protection as per IEC 60529	IP 68 (5 bar with cable); IP 69K, 40 bar (with cable protection system)
Housing material	Stainless steel 1.4404
Flange and tube material	Stainless steel tube 1.4571, flange 1.4404
Housing attachment	Flange with thread
Connection	Cable connection
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
Conducted interference induced by high-frequency fields	EN 61000-4-6 Severity level 3
Standard nominal strokes [mm]	0025...5500 mm in 1-mm increments

HB/WB housing
BTL5-...-HB/WB-_ _ _ _-C
axial



HB/WB housing
BTL5-...-HB/WB-_ _ _ _-C
radial



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

The outdoor system IP 69K, 40 bar

Micropulse ProCompact with cable protection system
Extreme ambient conditions, in which high reliability and accuracy are required, are typical application areas for Micropulse ProCompact transducers. The non-contact working principle of the systems ensures a complete absence of wear and nearly endless service life. The high-precision output signal is used as an absolute signal for the controller in a wide range of different interfaces.

Areas of application
- Locks and floodgates
- Water power plants
- Large, hydraulically powered valves
- Positioning the reflection channels for thermosolar power plants
- Dredger
- Railway track
- Logging machines
- Hydroelectric power plants
- Construction machinery
- Combine harvesters

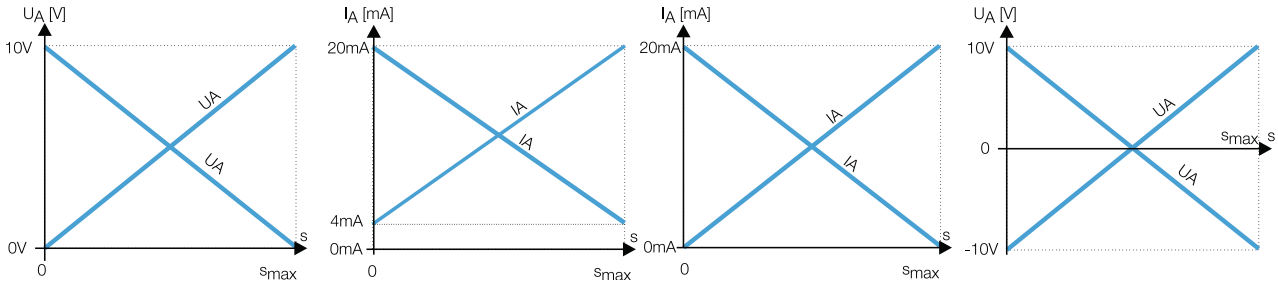
Series		
Output signal		
Transducer interface		
Customer device interface		
Part number		
Output voltage		
Output current		
Load current		
Max. residual ripple		
Load resistance		
System resolution		
Hysteresis		
Repeat accuracy		
Measurement rate		
Max. linearity deviation		
Temperature coefficient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

Please enter code for output signal, 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
Fastening nut, see page 219
Plug connectors, see page 252

	Rod Compact BTL5	**Rod Compact BTL5**	**Rod Compact BTL5**	**Rod Compact BTL5**
	Analog	Analog	Analog	Analog
	A	**E**	**C**	**G**
	Analog	Analog	Analog	Analog
	BTL5-**A11**-M_ _ _ _-HB/WB-_ _ _ _	BTL5-**E1**-M_ _ _ _-HB/WB-_ _ _ _	BTL5-**C1**-M_ _ _ _-HB/WB-_ _ _ _	BTL5-**G11**-M_ _ _ _-HB/WB-_ _ _ _
	0...10 V and 10...0 V			–10...10 V and 10...–10 V
		4...20 mA or 20...4 mA	0...20 mA or 20...0 mA	
	Max. 5 mA			Max. 5 mA
	≤ 5 mV			≤ 5 mV
		≤ 500 Ω	≤ 500 Ω	
	≤ 0.1 mV	≤ 0.2 µA	≤ 0.2 µA	≤ 0.1 mV
	≤ 4 µm	≤ 4 µm	≤ 4 µm	≤ 4 µm
	System resolution/min. 2 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	$f_{STANDARD}$ = 1 kHz
	±100 up to 500 mm rated length	±100 up to 500 mm rated length	±100 up to 500 mm rated length	±100 up to 500 mm rated length
	±0.02% 500... max. rated length	±0.02% 500... max. rated length	±0.02% 500... max. rated length	±0.02% 500... max. rated length
	[150 µV/°C + (5 ppm/°C x P xU/L)] x ΔT			[150 µV/°C + (5 ppm/°C x P xU/L)] x ΔT
		[0.6 µA/°C + (10 ppm/°C x P xI/L)] x ΔT	[0.6 µA/°C + (10 ppm/°C x P xI/L)] x ΔT	
	20...28 V DC	20...28 V DC	20...28 V DC	20...28 V DC
	≤ 150 mA	≤ 150 mA	≤ 150 mA	≤ 150 mA
	yes	yes	yes	yes
	TransZorb protection diodes	TransZorb protection diodes	TransZorb protection diodes	TransZorb protection diodes
	500 V DC (GND to housing)	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...+85 °C
	–40...+100 °C	–40...+100 °C	–40...+100 °C	–40...+100 °C



Ordering example:

B T L 5 - E 1 _ - M _ _ _ _ - _ _ - _ _ _ _ - C

Characteristic

1 rising and falling (at A and G)
0 Rising
7 falling (for C and E)

Standard Rated length [mm]

0025...5500 in 1-mm increments

Design

HB
WB

Connection

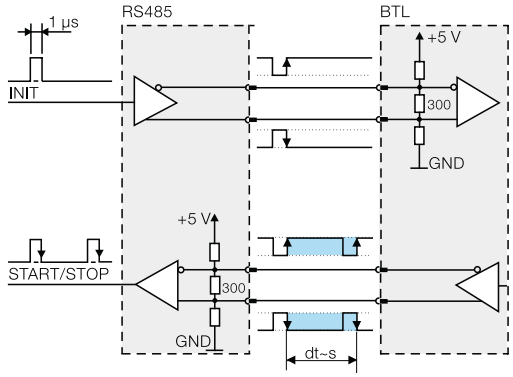
Radial output
F05 5 m Teflon cable
Axial output
FA05 5 m Teflon cable

Compact and cost-effective

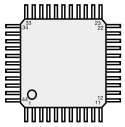
P Interface
The P interface is compatible with BTA processor units as well as with controllers and modules from various manufacturers including Siemens, B & R, Phoenix Contact, Mitsubishi, Sigmatek, Parker, Esitron, WAGO and others.
Reliable signal transmission, even with cable lengths of up to 500 m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

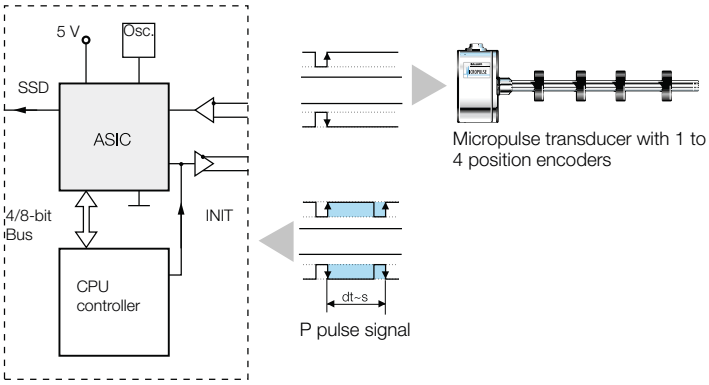
Highly precise digitizing of the P pulse signal
Companies developing their own electronic control and processor unit can create a highly accurate P interface cost-effectively and with minimum effort using the Balluff digitizing chip. The digitizing chip was developed as a high-resolution, configurable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

Benefits
- Position resolution 1 µm!
- The 1 µm resolution of the Micropulse position measurement system is achieved by the high resolution of the digitizing chip (133 ps) (clock frequency 2 or 20 MHz).
- Position data from 4 position encoders can be processed simultaneously
- 4/8-bit processor interface



Block diagram of P interface


Digitizing chip 44QFP



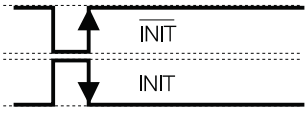
Micropulse transducer with 1 to 4 position encoders

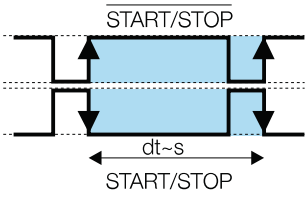
P pulse signal

Controller or electronic processor unit

ASIC INFO:
+49 7158 173-370

Series	**Rod Compact BTL5**
Transducer interface	Pulse **P**
Customer device interface	Pulse **P**
Part number	BTL5-**P**1-M_ _ _ _-_-_ _ _ _
System resolution	processing-dependent
Repeat accuracy	2 µm or ±1 digit depending on electronic processor unit
Resolution	≤ 2 µm
Hysteresis	≤ 4 µm
Measurement rate	$f_{STANDARD}$ = 1 kHz = ≤ 1400 mm
Max. linearity deviation	±100 µm up to 500 mm rated length ±0.02% 500...5500 mm rated length
Temperature coefficient of overall system	(6 µm + 5 ppm × L)/°C
Supply voltage	20...28 V DC
Current consumption	≤ 100 mA
Operating temperature	–40...+85 °C
Storage temperature	–40...+100 °C





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
Fastening nut, see page 219 (for Stab Compact H)
Plug connectors, see page 252

Ordering example:

B T L 5 - P 1 - M _ _ _ _ - _ - _ _ _ _

Standard Rated length [mm]
0025...5500
in 1-mm increments

Design
K
H
W

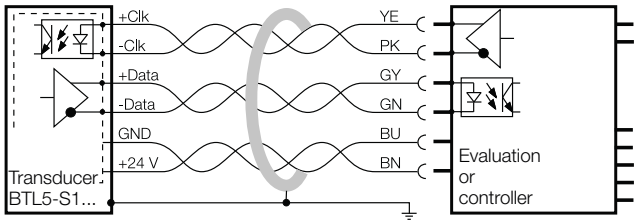
Connection

Radial output
K02 PUR cable 2 m
K05 PUR cable 5 m
K10 PUR cable 10 m
K15 PUR cable 15 m
SR32 Connectors

Radial output
K02 PUR cable 2 m
K05 PUR cable 5 m
K10 PUR cable 10 m
K15 PUR cable 15 m

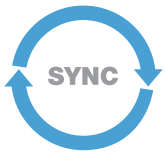
Axial output
KA02 PUR cable 2 m
KA05 PUR cable 5 m
KA10 PUR cable 10 m
KA15 PUR cable 15 m
S32 Connectors

Standard SSI interface
The synchronous serial data transmission is used by controllers from various manufacturers, such as Siemens, Bosch Rexroth, WAGO, B & R, Parker, Esitron, PEP and others and the Balluff BDD-AM 10-1-SSD and BDD-CC 08-1-SSD display and control units.
Reliable signal transmission, even with cable lengths of up to 400 m between controller and BTL transducer. This is guaranteed by the especially interference-free RS485/422 differential drivers and receivers. Any interference signals are effectively suppressed.



BTL5-S1... with evaluation/controller, connection example

Synchronized BTL5-S1_ _B-M_ _ _ _-_ -_ _ _ _ SSI Interface
Micropulse Transducers with synchronized SSI interface are well suited for dynamic control applications. Data acquisition in the transducer is synchronized using the external clock of the controller, allowing an optimum speed calculation to be performed in the regulator/controller.
Prerequisite for this synchronous method of transducer operation is time stability of the clock signal.
The **maximum scan rate f_A**, at which a new current value is generated for each scan, can be derived from the table:



Rated length range			Scan rate
< Rated length	≤	100 mm	1500 Hz
100 mm < Rated length	≤	1000 mm	1000 Hz
1000 mm < Rated length	≤	1400 mm	666 Hz
1400 mm < Rated length	≤	2600 mm	500 Hz
2600 mm < Rated length	≤	4000 mm	333 Hz

The clock frequency depends on the cable length.

Cable length		Clock frequency
<	25 m	1000 kHz
<	50 m	500 kHz
<	100 m	400 kHz
<	200 m	200 kHz
<	400 m	100 kHz

Ordering example:

B T L 5 - S 1 _ _ - M _ _ _ _ - _ - _ _ _ _ - C for asynchronous operation
B T L 5 - S 1 _ _ B - M _ _ _ _ - _ - _ _ _ _ - C for synchronous operation

Coding
0 Binary code rising (24-bit)
1 Gray code rising (24-bit)
6 Binary code rising (25-bit)
7 Gray code rising (25-bit)

System resolution
1 1 µm
2 5 µm
3 10 µm
4 20 µm
5 40 µm
6 100 µm
7 2 µm

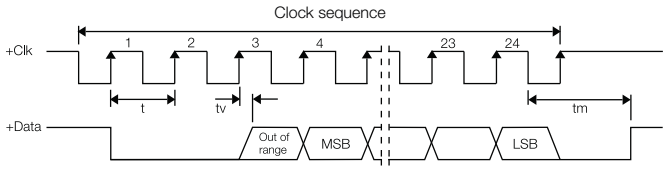
Standard Rated length [mm]
0025...4000 mm in 1-mm increments

Design
HB
WB

Connection
Radial output
F05 5 m Teflon cable
Axial output
FA05 5 m Teflon cable

Rod Compact
SSI Interface

Series	**Rod Compact BTL5**
Output signal	Synchronous-serial
Transducer interface	S
Customer device interface	Synchronous-serial
Part number	BTL5-S1_ _-M_ _ _ _-_-_ _ _ _
Part number synchronization	BTL5-S1_ _B-M_ _ _ _-_-_ _ _ _
System resolution depending on model (LSB)	1, 2, 5, 10, 20, 40 or 100 µm
Repeat accuracy	±1 digit
Hysteresis	≤ 1 digit
Measurement rate	$f_{STANDARD}$ = 1 kHz
Max. linearity deviation.	±30 µm at ≤ 10 µm resolution or ≤ ±2 LSB
Temperature coefficient of overall system	(6 µm +5 ppm × L)/°C
Supply voltage	20...28 V DC
Current consumption	≤ 80 mA
Operating temperature	–40...+85 °C
Storage temperature	–40...+100 °C



Please enter code for coding, system resolution, 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
Fastening nut, see page 219
Plug connectors, see page 252

Ordering example:

BTL5-S1_ _ -M_ _ _ _-_-_ _ _ _ for asynchronous operation
BTL5-S1_ _B-M_ _ _ _-_-_ _ _ _ for synchronous operation

Coding

0	Binary code rising (24-bit)
1	Gray code, rising (24-bit)
6	Binary code rising (25-bit)
7	Gray code, rising (25-bit)

System resolution

1	1 µm
2	5 µm
3	10 µm
4	20 µm
5	40 µm
6	100 µm
7	2 µm

Standard nominal strokes [mm]

0025...4000 mm in 1-mm increments

Design

K	Radial output
H	Radial output
W	Radial output

Connection

K02	PUR cable 2 m
K05	PUR cable 5 m
K10	PUR cable 10 m
K15	PUR cable 15 m
SR32	Connectors

Axial output

KA02	PUR cable 2 m
KA05	PUR cable 5 m
KA10	PUR cable 10 m
KA15	PUR cable 15 m
S32	Connectors

CANopen interface
Based on CAN (ISO/IEC 7498 and DIN ISO 11898), CANopen provides a Layer-7 implementation for industrial CAN networks. The serial data protocol of the CAN specification is defined according to the producer-consumer principle as opposed to most other fieldbus protocols. This eliminates target addressing of the process data. Each bus node decides for itself how the received data is processed. The CANopen interface of the Micropulse transducer is compatible with CANopen according to CiA Standard DS301 Rev. 3.0 as well as with CAL and Layer 2 CAN networks.

EDS
CANopen offers a high level of flexibility in configuring functionality and data exchange. Using a standard data sheet in the form of an EDS file, it is easy to link the Micropulse transducers to any CANopen system.

Process Data Object (PDO)
Micropulse transducers send their position information optionally in one, two or four PDOs with 8 bytes of data each. The contents of the PDOs are freely configurable. The following information can be sent:
- Current encoder position with resolution in 5 µm increments
- Current speed of the position encoder, with resolution selectable in 0.1mm/s increments
- the current status of four freely programmable cams per position encoder

Synchronization Object (SYNC)
SYNC serves as a network-wide trigger for synchronizing all network nodes. When the SYNC object is received, all Micropulse transducers connected to the bus store their current position and velocity information and then send it sequentially to the controller. This assures time-synchronous acquisition of the measured values.

FMM
The sensor can be operated as a 4-magnet type, whereby the sensor itself recognizes how many magnets are currently active.
So if only two magnets are positioned in the measuring range, a valid value is output for the first two positions and a defined error value for positions 3 and 4.

Emergency Object
The emergency object is sent with the highest priority. This is used, for example, for error messages when cam states change.

Service Data Object (SDO)
Service data objects transmit the parameters for the configuration to the transducer. The transducer may be configured on the bus by the controller or offline with a bus analyzer/CANopen tool. The configuration is stored in the transducer's non-volatile memory.

CiA 199911-301v30/11-009

Use of multiple position encoders
The minimum distance between the position encoders must be 65 mm.

Ordering example:

BTL5-H1_ _-M_ _ _ _-_ _-_ _ _ _-C

Software configuration
1 1 × position and 1 × velocity
2 2 × position and 2 × velocity
3 4 × position

Baud rate
0 1 Mbaud
1 800 kbaud
2 500 kbaud
3 250 kbaud
4 125 kbaud
5 100 kbaud
6 50 kbaud
7 20 kbaud
8 10 kbaud

Standard nominal strokes [mm]
0025...4000 mm in 1-mm increments

Design
HB
WB

Connection
Radial output
K05 PUR cable 5 m

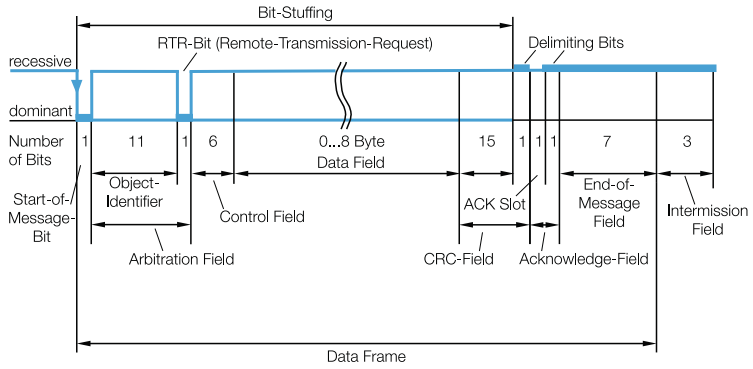
Axial output
KA05 PUR cable 5 m

Series		**Rod Compact BTL5**						
Output signal		CANopen						
Transducer interface		H						
Customer device interface		CANopen						
Part number		BTL5-**H**1_ _-M_ _ _ _-_-_ _ _ _						
CANopen Version		Floating						
Repeat accuracy		±1 digit						
System resolution, configurable	Position	5 µm increments						
	Velocity	0.1 mm/s increments						
Hysteresis		≤ 1 digit						
Measurement rate		$f_{STANDARD}$ = 1 kHz						
Max. linearity deviation		±30 µm at 5 µm resolution						
Temperature coefficient of overall system		(6 µm + 5 ppm × L)/°C						
Supply voltage		20...28 V DC						
Current consumption		≤ 100 mA						
Operating temperature		–40...+85 °C						
Storage temperature		–40...+100 °C						
Cable length [m] per CiA DS301		< 25	< 50	< 100	< 250	< 500	< 1000	< 1250	< 2500
Baud rate [kbaud] per CiA DS301		1000	800	500	250	125	100	50	20/10

Please enter code for software configuration, baud rate, rated length and design in the part number. Cable on request.

Scope of delivery
- Transducer
- Quick start instructions

Please order separately:
Position encoders, see page 218
Floats, see page 216
Fastening nut, see page 219
Plug connectors, see page 252



Using the CANopen interface and a cable up to 2500 m in length, the signal is sent at a length-dependent baud rate to the controller. The high interference immunity of the connection is achieved using differential drivers and by the data monitoring scheme implemented in the data protocol.

Ordering example:

B T L 5 - H 1 _ _ - M _ _ _ _ - _ - _ _ _ _

Software configuration
- 1 1 × position and 1 × velocity
- 2 2 × position and 2 × velocity
- 3 4 × position

Baud rate
- 0 1 Mbaud
- 1 800 kbaud
- 2 500 kbaud
- 3 250 kbaud
- 4 125 kbaud
- 5 100 kbaud
- 6 50 kbaud
- 7 20 kbaud
- 8 10 kbaud

Standard nominal strokes [mm]
0025...4000 mm in 1-mm increments

Design
- K
- H
- W
- HC

Connection

Radial output
- K02 PUR cable 2 m
- K05 PUR cable 5 m
- SR92 Connectors

Radial output
- K02 PUR cable 2 m
- K05 PUR cable 5 m

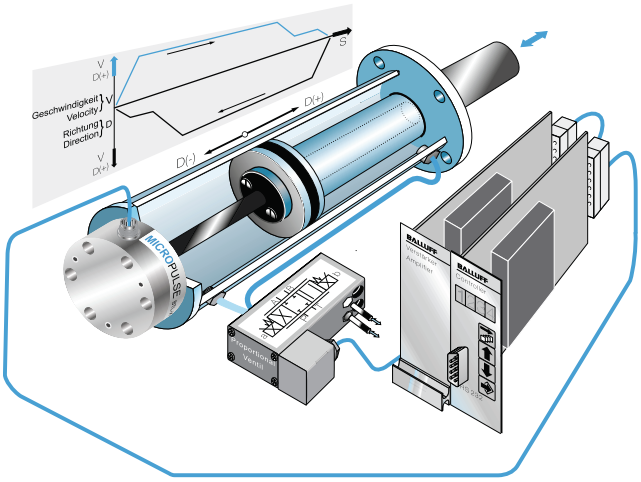
Axial output
- KA02 PUR cable 2 m
- KA05 PUR cable 5 m
- S92 Connectors

Installation notices

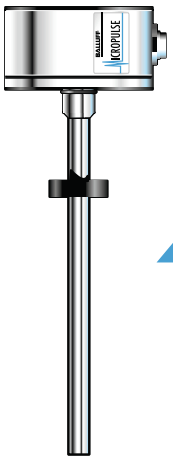
SSI-SYNC – better control behavior and higher dynamics

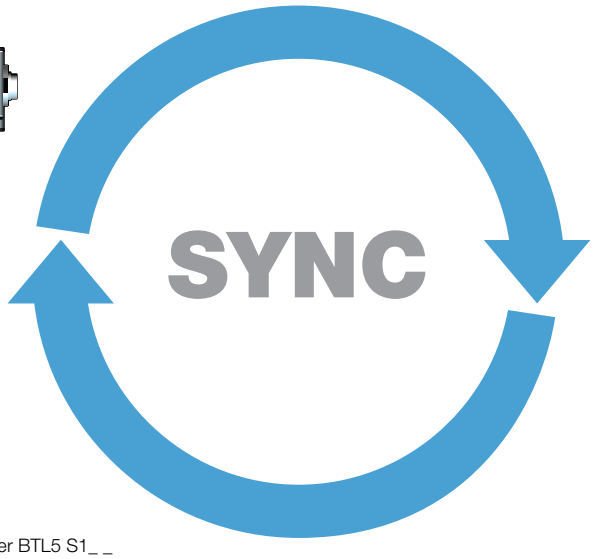
The absolute position information from the Micropulse transducer is transmitted synchronously to the axis control card. This synchronous data acquisition permits a precise calculation of the speed and acceleration.

The feedback of these status sizes (speed and acceleration) allows the damping and natural frequency of a hydraulic system to be increased. These measures permit greater loop gain and with it, better control behavior and higher dynamics.

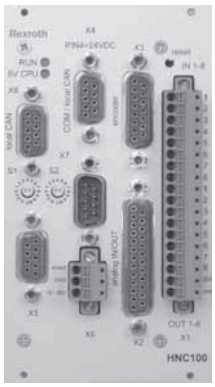


Application with hydraulic cylinder in a control loop

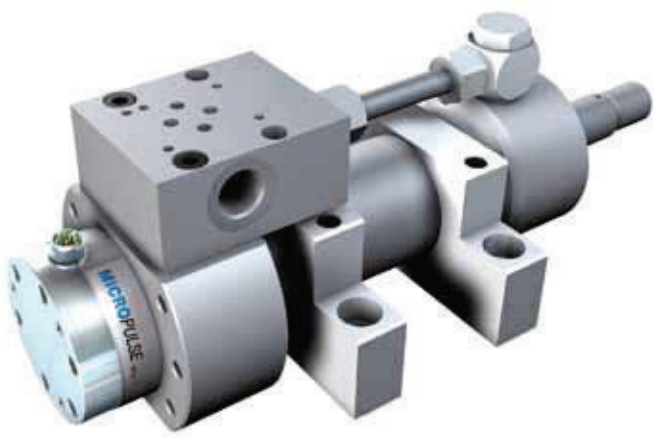




Micropulse Transducer BTL5 S1_ _



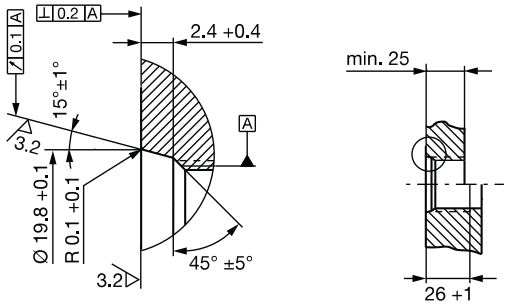
Control card with SSI interface for connecting Micropulse Transducers



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

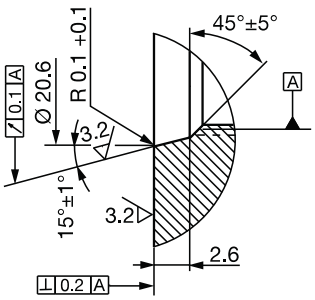
Installation of BTL Rod Compact H

The Micropulse Transducer BTL has an M18×1.5 mounting thread. We recommend that the mounting is made of non-magnetizable material.
If magnetizable materials are used, then the measures shown below have to be taken. Sealing is at the flange mounting surface using the supplied 15.4×2.1 O-ring with M18×1.5 thread.

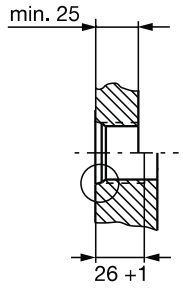


Installation of BTL Rod Compact W

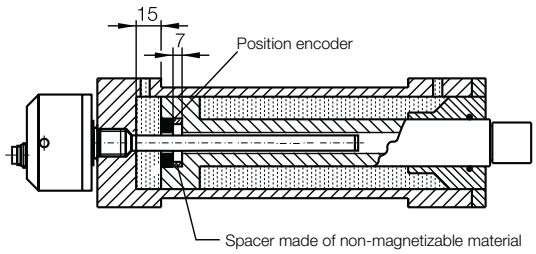
The Micropulse transducer BTL has a mounting thread M18×1.5. We recommend that the mounting is made of non-magnetizable material.
If magnetizable materials are used, then the measures shown below have to be taken. Sealing is at the flange mounting surface using the supplied 15.4×2.1 O-ring with M18×1.5 thread.

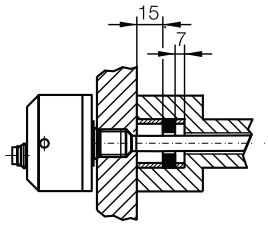


Countersink for O-ring



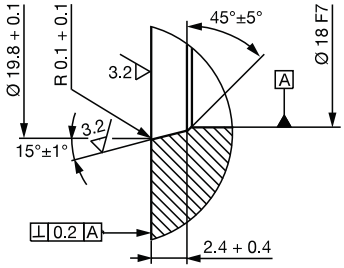
Tapped hole
3/4" 16 UNF thread

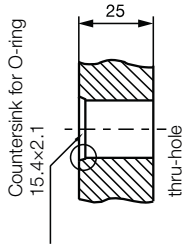


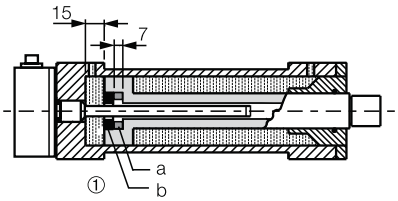


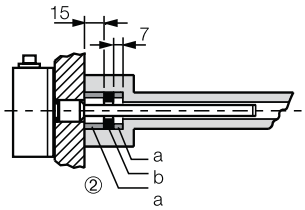
Installation BTL Rod Compact K

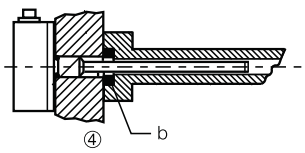
The Micropulse Transducer BTL has 6 mounting holes for cylinder head screws (ISO 4762 M6×18 A2-70).
We recommend that the holder is made of non-magnetizable material. If magnetizable materials are used, the measures described above have to be taken. Sealing is at the flange mounting surface using the supplied 15.4×2.1 mm O-ring.











①-② with magnetizable material
④ with non-magnetizable material
A Spacer made of non-magnetizable material
B Position encoder