

Micropulse Transducers



Micropulse Transducers

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Magnetostrictive position measurement systems are firmly entrenched in plant engineering and automation technology. Areas of use in which high reliability and precision are in demand are typical application areas for magnetostrictive Micropulse Transducers. Integrated or compact versions with measuring lengths of 25 to 7,600 mm allow the position measurement systems to be used universally.

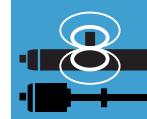
Non-contact, precise and absolute measuring are the critical features that have brought linear magnetostrictive encoders into widespread industrial use. The contactless and thus wear-free working method helps to prevent expensive service calls and the hassle of down-times. The operating principle allows it to be installed in hermetically sealed housings. The current position information is transferred via magnetic fields contactlessly through the housing wall to the internal sensor element. In principle, the simultaneous measurement of multiple positions with one measurement system is possible. Without inconvenient, high-effort and error-prone seal designs, magnetostrictive position measurement systems achieve a degree of protection of IP 67 to IP 69K. The high resistance with regard to shocks and vibration stresses extend the industrial fields of application greatly into heavy machinery and system design. The measurement and position values, which are available as absolute values immediately after switching on the system, are required in many applications. Because the reference runs are omitted, machine availability is increased substantially.

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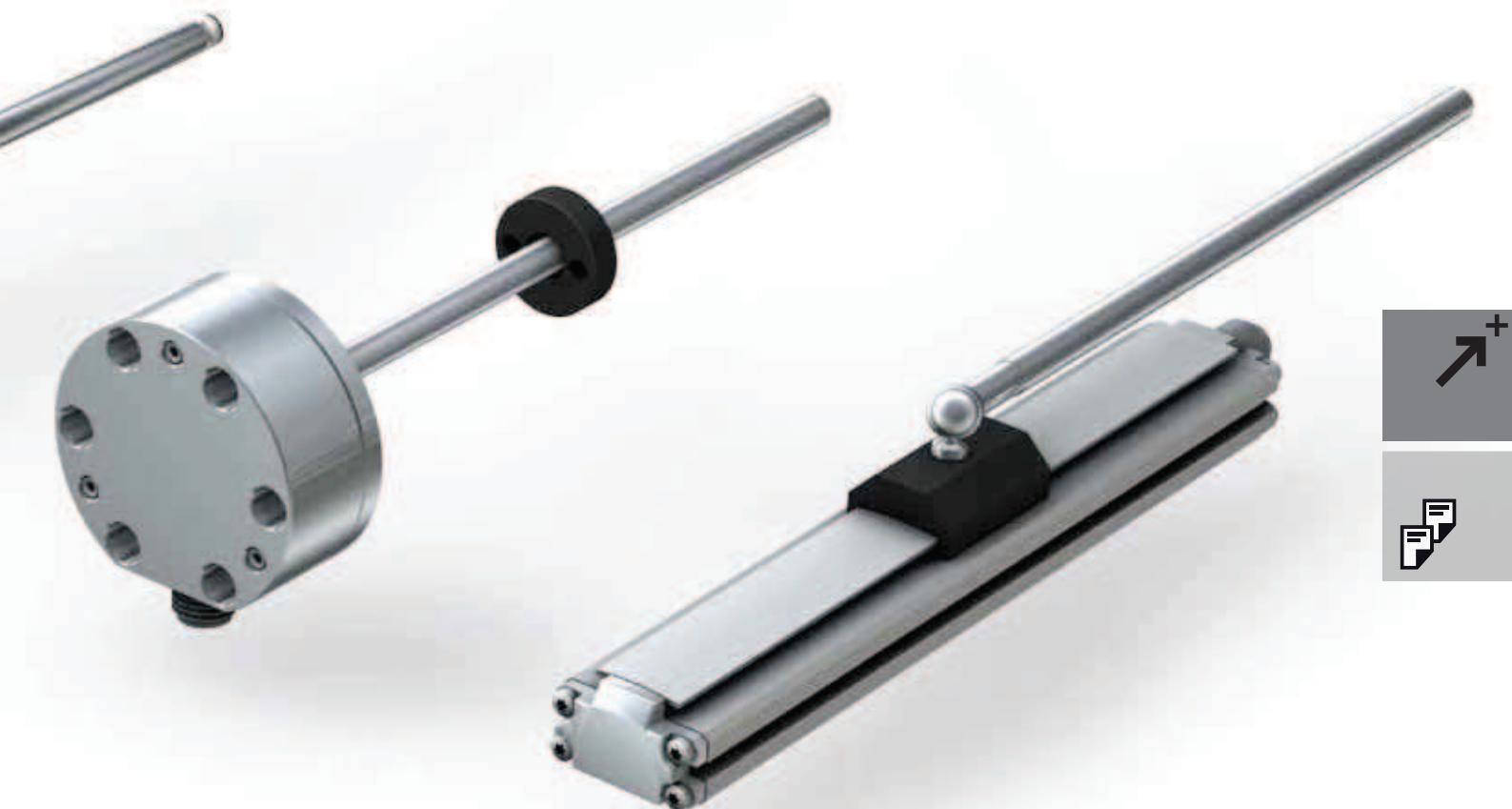
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MICRO PULSE[®]



Micropulse Transducers

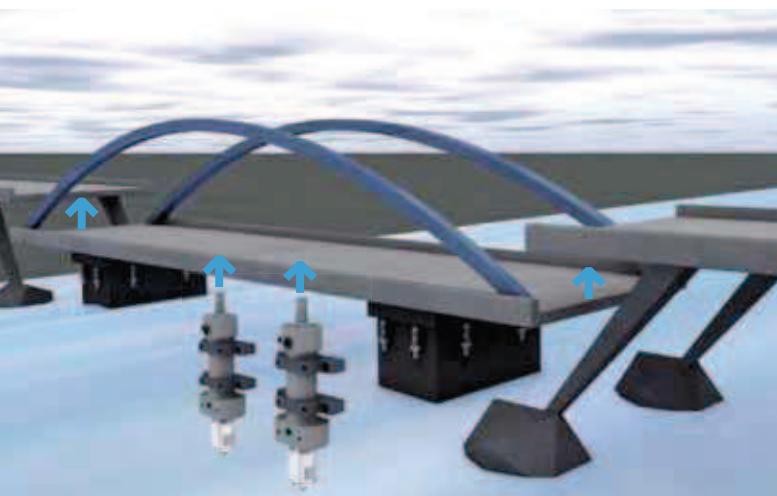
Applications

Areas of use in which high reliability and precision are in demand are typical application areas for Micropulse Transducers.

As integrated or compact versions with measuring lengths of 25 to 7,500 mm, Micropulse position measurement systems can be used universally.

The non-contact working principle of the systems guarantees complete freedom from wear and a virtually endless service life. The high-precision output signal is used as an absolute signal for the controller in a wide range of different interfaces.

As a position measurement system for actual value recording, integrated in the pressure area of hydraulic cylinders, Micropulse Transducers are used in the most varied areas.



Heavy-duty cylinders raise the bridge to the planned road level after they are "floated" into position.

Areas of application

- Pitch adjustment on wind generators
- Positioning reflection channels of thermosolar power plants
- Large, hydraulically powered valves
- Casting and rolling mills
- Lift controls
- Flight simulators
- Foundries
- Logging machines
- Automation engineering
- Hydroelectric power plants
- Locks and floodgates
- Construction machinery
- Combine harvesters

Structural design and calculations

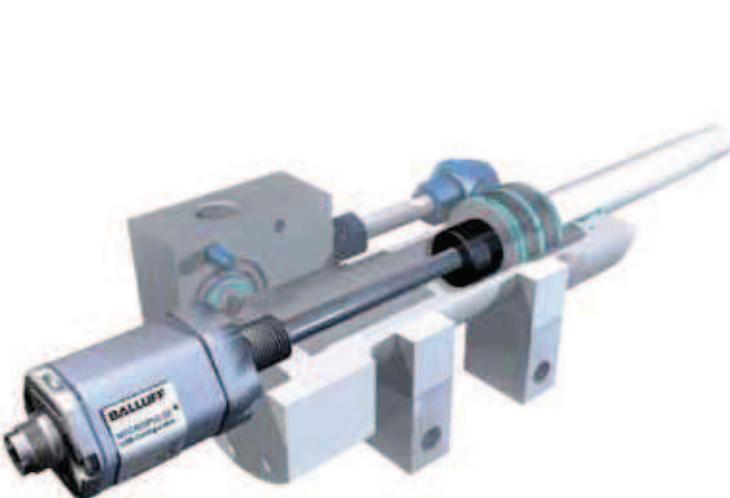
- Active support of walls
- Bridge positioning and lifting technology
- Leveling structures
- Off-shore sector
- Tunnel construction

Industrial applications

- Pumps and compressors
- Elevator and lifting technology
- Forging presses
- High-pressure hydraulics



Large valve with controlled actuating drive



Industry: hydraulic cylinder



Mobile hydraulics

Micropulse Transducers Applications



Wind power plant



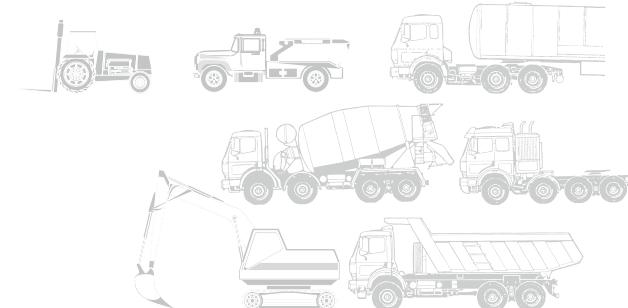
Solar-thermal parabolic trough power plant



Sawmill machinery



Hydraulic riveting system



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Solar-thermal parabolic trough power plant

Micropulse Transducers Applications

Precision, freedom from wear, ease of installation, a high degree of protection and a low price are of high priority for automating a wide variety of machine types.

Micropulse transducers in a profile housing entirely fulfill automation technology requirements.

Areas of application

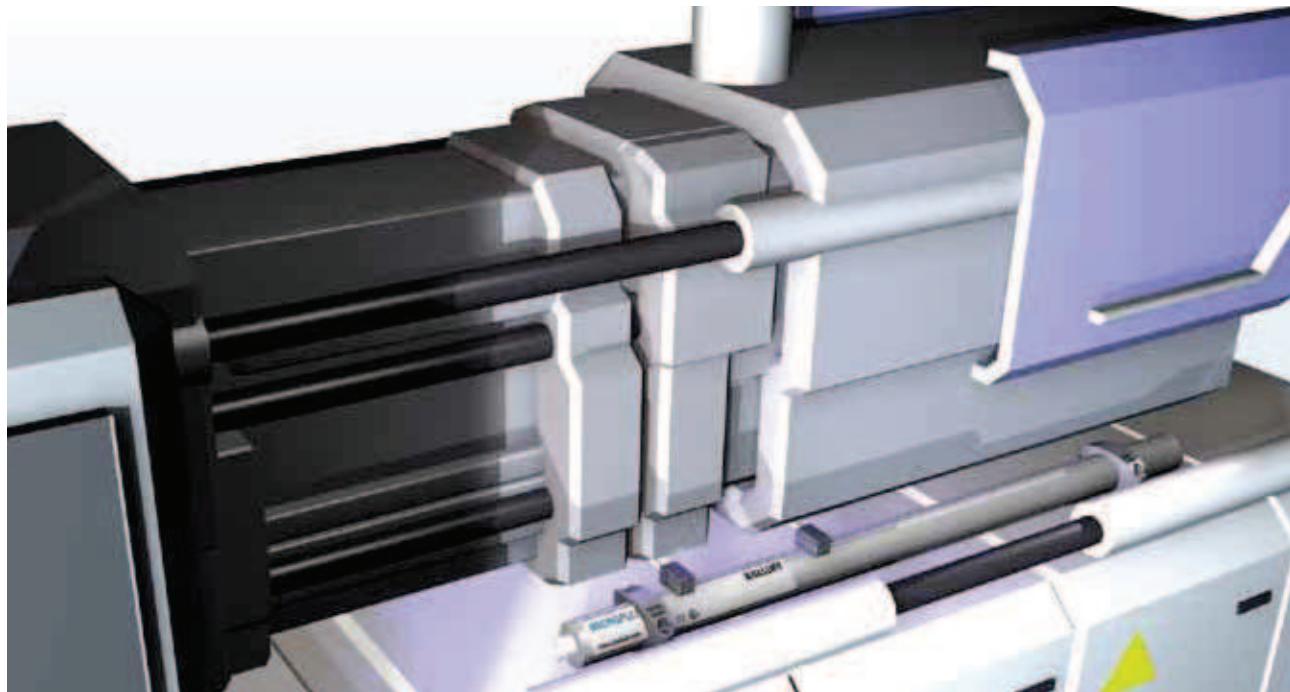
- Injection molding
- Pressing
- Handling systems
- Portal robots
- Woodworking machinery
- Packaging machinery
- Conveyor technology
- Straightening machinery
- Surgical tables
- Concrete block making machinery



Film slitting machinery



Injection molding machinery



Injection molding machinery

Micropulse Transducers Applications



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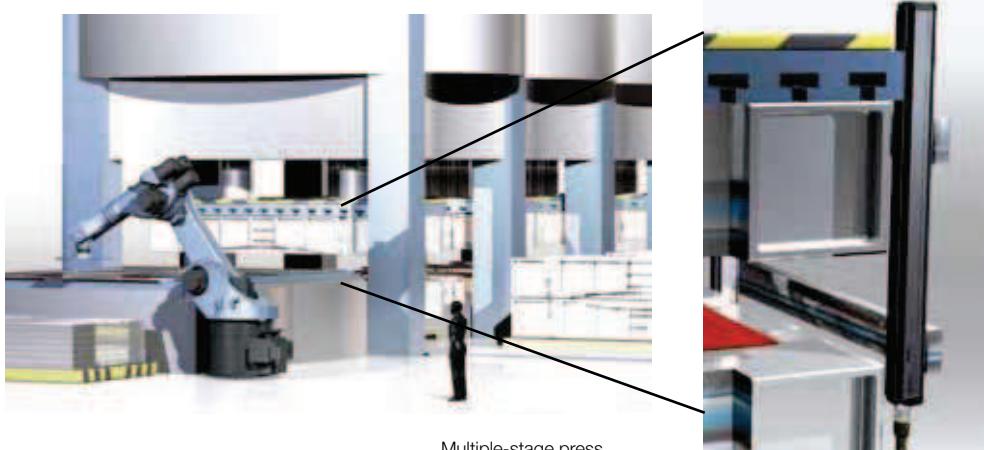
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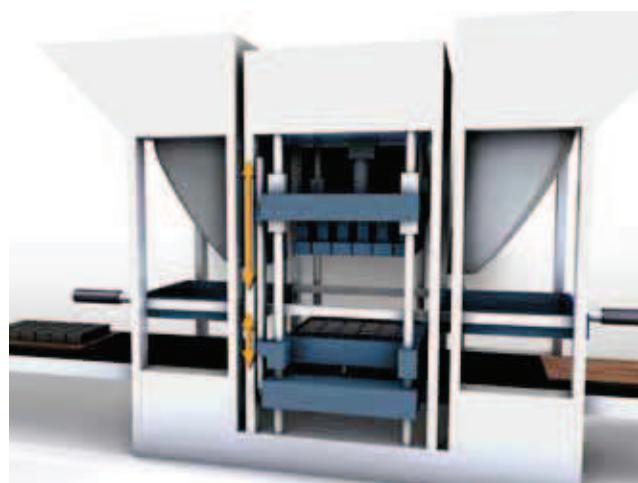
Multiple-stage press



Automation engineering



Laundry press



Micropulse⁺ position measurement systems guarantee high cost-effectiveness and quality in the manufacture of concrete blocks. In a concrete block machine, the Micropulse⁺ position measurement system simultaneously and reliably measures the axis position of load and molding stroke movement.



Level monitoring

The non-contact magnetostrictive working principle is also ideal for special position measurement tasks.

Areas of application

- Process technology
- Filling of foodstuffs
- Level monitoring in milk tanks
- Filling units
- Perfume manufacturing
- Pharmaceuticals
- Producing alcohol

Micropulse Transducers

Function principle

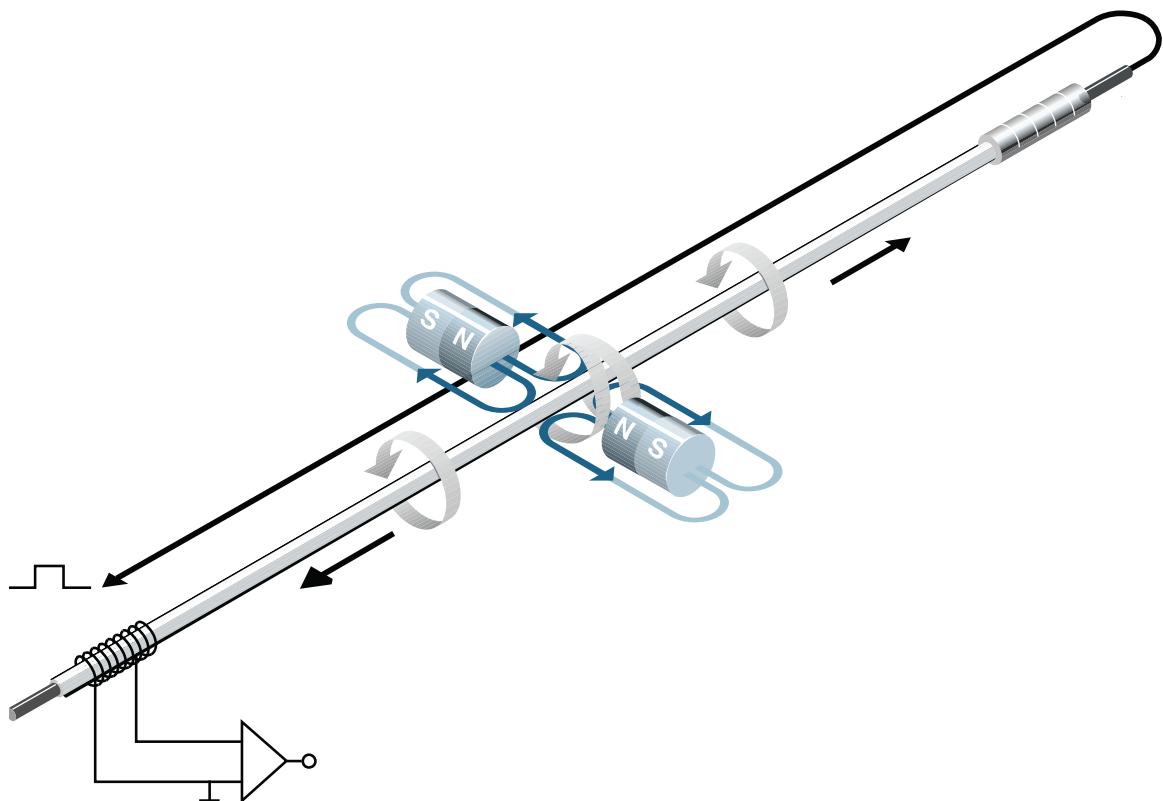
Function principle

The measuring element, the waveguide, consists of a special nickel-iron alloy with 0.7 mm outer and 0.5 mm inner diameter. A copper conductor is threaded through this tube. A short current pulse triggers the measurement process. This current generates a circular magnetic field which, due to soft magnetic properties of the waveguide, is integrated into it. A permanent magnet at the point of measurement is used as the marker element, whose lines of field run at right angles to the pulsed magnetic field and are integrated in the waveguide.

In the area of the waveguide, where both magnetic fields are superimposed, there is an elastic deformation in the micro range of the structure due to magnetostriction, which generates a mechanical wave that spreads on both sides.

The propagation velocity of this wave in the waveguide is 2,830 m/s, and is almost completely insensitive to environmental effects such as temperature, shock and contamination.

The wave running to the end of the waveguide is damped out, while the wave running to the signal converter generates an electrical signal by reversing the magnetostrictive effect. The time the wave takes to travel from its point of origin to the signal converter is directly proportional to the distance between the permanent magnet and the signal converter. A time measurement then allows this distance to be calculated with extreme accuracy.

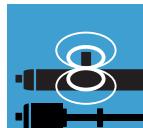


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Micropulse Transducers Designs

Rod housings

Rod housings are mainly used in hydraulic drive applications. When installed in the pressure section of the hydraulic cylinder, the displacement sensor requires the same pressure rating as the actual hydraulic cylinder. In practice, the sensor must be able to withstand pressures up to 1000 bar. The electronics are integrated in an aluminum or stainless steel housing and the waveguide in a pressure-resistant tube made from nonmagnetic stainless steel that is sealed off at the front end with a welded plug. An O-ring seal in the flange at the opposite end seals off the high-pressure section. An encoder ring with magnets slides over the tube or rod with internal waveguide to mark the position prior to detection.



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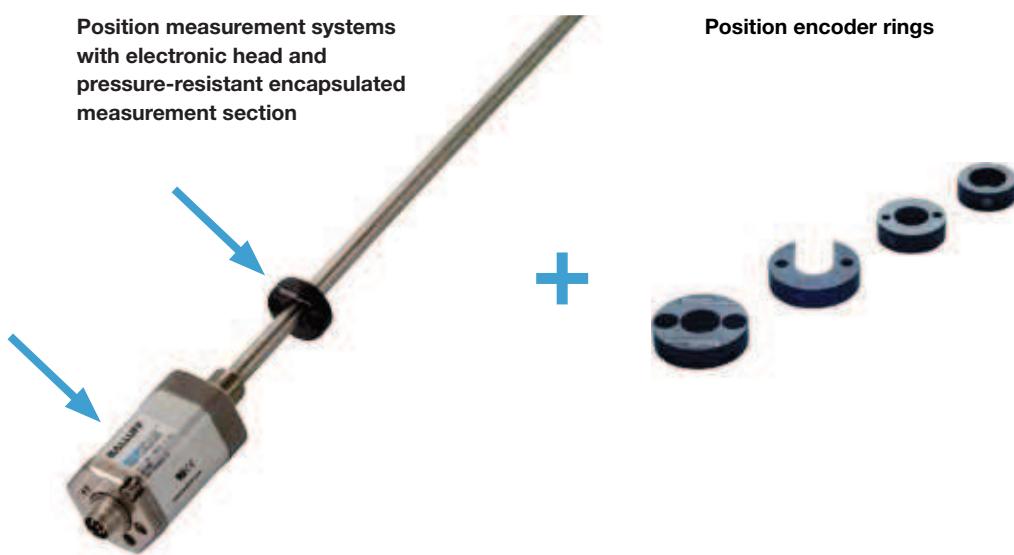
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Rod system components

A position measurement system consists of the actual transducer, the position encoder and wiring for the electronic processor unit.



A prerequisite for flawless function is the use of original Balluff position encoders.

Micropulse Transducers Designs

Profile housings

The electronics and the measurement section are housed in an aluminum profile. The aluminum housing is hermetically sealed according to degree of protection IP 67. The magnets on the encoder act on the waveguide through the wall of the aluminum profile. The position encoder exists as a captive and a floating variant. Floating position encoders are secured directly on the moving machine part and move with the part above and along the profile at a certain distance. The advantage is that guide precision is not an issue with this type of sensor. The sensors tolerate an offset to the side and at the height of up to a few millimeters. If even these generous tolerances cannot be adhered to, captive encoders are ideal. With captive encoders, the profile housing of the displacement sensor acts as a sliding rail along which the position encoder travels. In this case, a joint rod with spherical heads compensates for even highly unparallel movements.



Profile system components

A position measurement system consists of the actual transducer, the position encoder and wiring for the electronic processor unit.

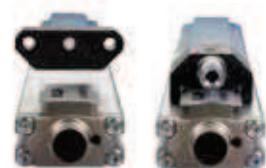
Position measurement system with integrated measurement section and electronics



Position encoder



Floating and captive encoders



Maximum distance of
15 mm between the position measurement system and the floating position encoder

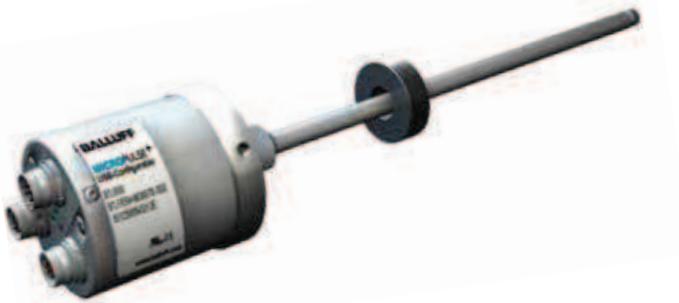
Micropulse Transducers Designs

Explosion-proof versions

Many applications require the use of displacement sensors in potentially explosive areas. Flameproof magnetostrictive Micropulse Transducers are available in a wide range of designs for use in zones 0 and 1.

Safety through redundancy

Magnetostrictive displacement sensors are ideal for applications requiring a high degree of safety or availability. They often have a double- or triple-redundant design in order to ensure mutual monitoring or provide a reserve channel when required. A displacement sensor with a 3-times redundant design incorporates 3 adjacent measurement sections offset by 120°C and housed in a collective protective tube along which a position encoder moves, in much the same way as standard designs. The magnets on the encoder act on all three measurement sections simultaneously. The evaluation of the 3 positions is done by 3 independent and completely disconnected electronics, which, however, may be stored in the same housing. Application examples include ship propulsion drives, power stations and train inclination technology.



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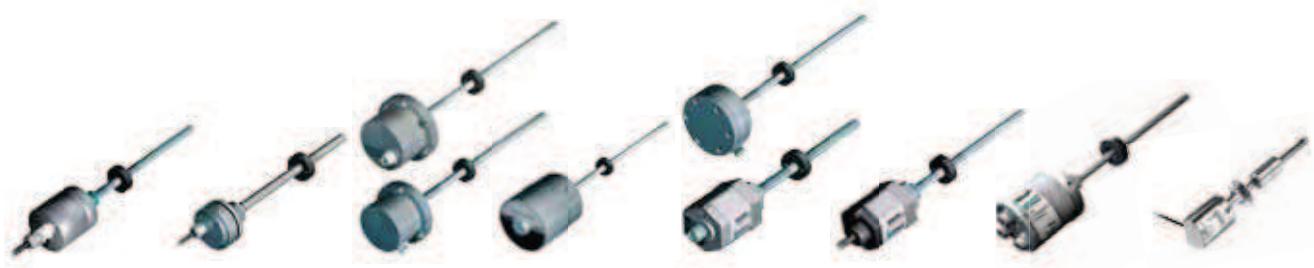
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Series	Profile style	Profile style	Profile AT	Profile BIW	Rod	Rod Compact
Design	P	PF	A1	P1	B, A, Z, Y	H, K, W
Installation version e.g. in hydraulic cylinders					■	■
External fitting version e.g. on machine frames	■	■	■	■		
Filling level sensor e.g. device filling systems						
Special approvals						
Position encoder	Floating/ captive	Floating/ captive	Floating	Captive push rod	Free or floating	Free or floating
Multi-position encoder	■		■		■	
Interfaces						
Analog voltage 0...10 V, 10...0 V, -10 V...+10 V	■	■	■	■	■	■
Analog current 4...20 mA, 0...20 mA	■	■		■	■	■
SSI	■				■	■
SSI-SYNC	■				■	■
CANopen	■				■	■
DeviceNet	■					
Profibus DP	■				■	
Start/stop pulse interface	■		■		■	
VARAN			■			
EtherCAT	■		■		■	
IO-Link		■				
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Micropulse Transducers

Product overview



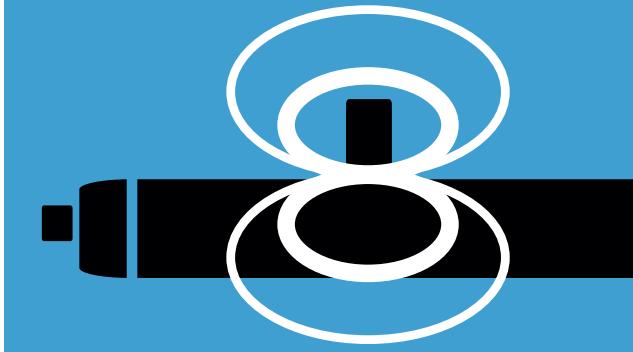
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HB/WB	E2/E28	B/J	C	K, B, Z	B, Z	T	SF
	Vehicle approval	Potentially explosive operation	Potentially explosive operation	Potentially explosive operation	Potentially explosive operation		Certified for foodstuffs
	KBA, e1	Flameproof "d" zone 0, zone 1, ATEX, KOSHA, GOST, IECEx	Flameproof "d", zone 0, Zone 1, ATEX, CENELEC, FM, CSA, IECEx	Ignition protection type "n" zone 2	Dust protection zone 22	Increased safety 2 or 3 times redundant	Conforms with FDA, 3A, ECOLAB, EHEDG
Free or floating	Free or floating	Free or floating	Free or floating	Free or floating	Free or floating	Free or floating	Floating
182	182	220	220	220	220	220	242

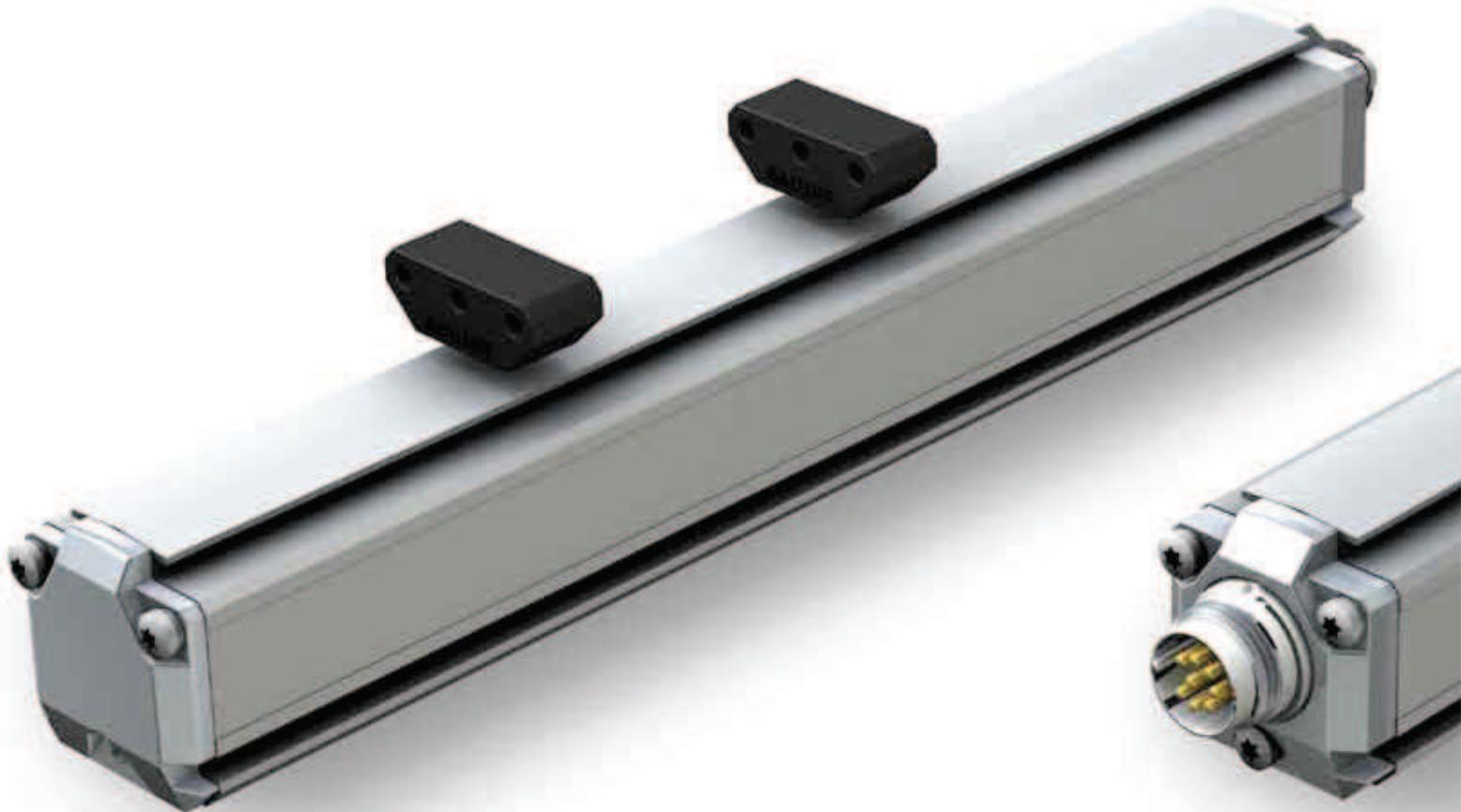
MICROPULSE®



Micropulse Transducers

Profile P

- The universal standard series
- Measuring lengths up to 7,620 mm
- Multiple paths – one system, which measures position in many paths
- Programmable output signals – measuring range, inverting, configuring, documenting
- Floating and captive encoders
- Up to 15 mm distance between position encoder and system – truly contactless!
- Measures position and speed
- Differential and synchronized measurement
- Available with analog signals, digital interfaces and fieldbuses



P BTL7 MICROPULSE⁺

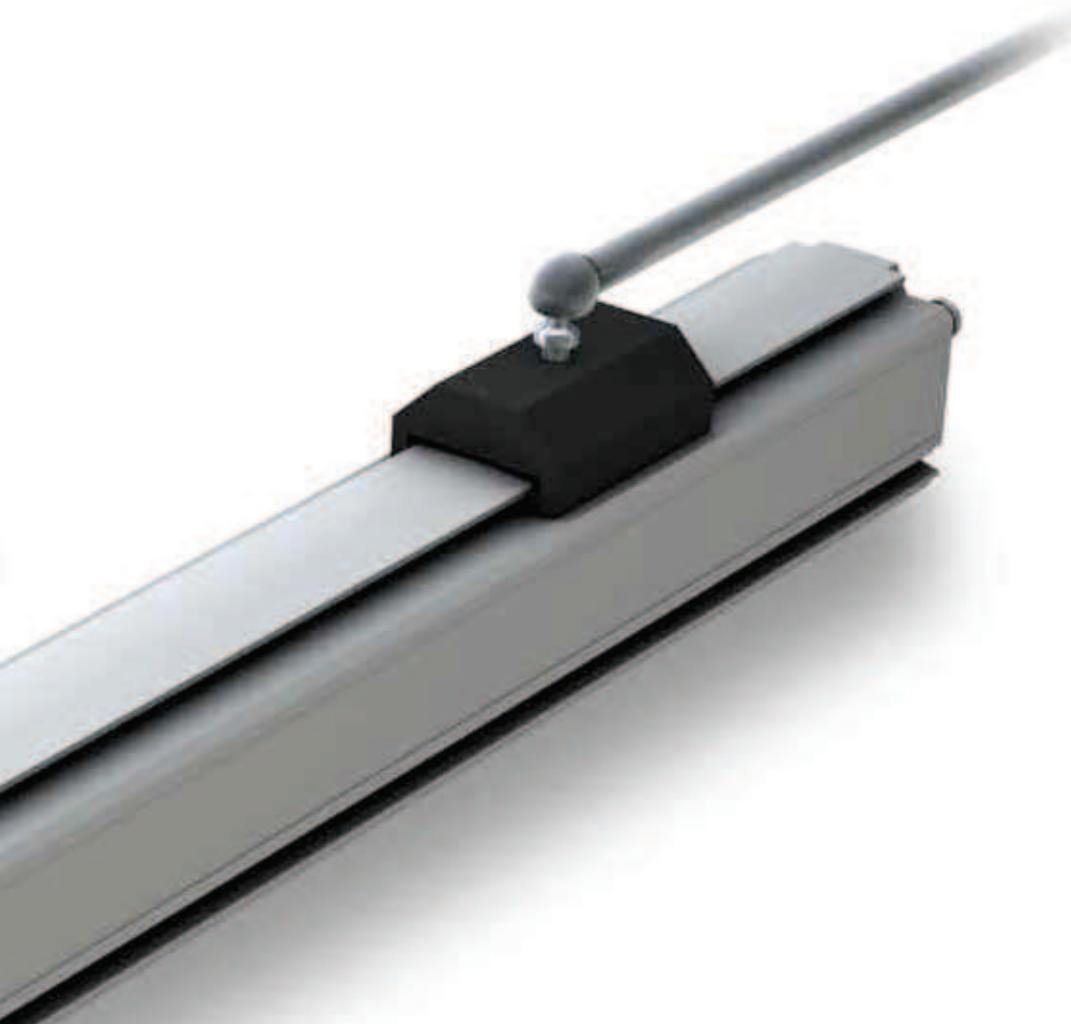
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CANopen Interface	108
DeviceNet Interface	110
Profibus DP Interface	112
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Captive Position Encoders, Joint Rod	116



MICROPULSE[®]



Series	Profile P BTL7
Shock load	150 g/6 ms as per EN 60068-2-27
Continuous shock	150 g/2 ms as per IEC 60068-2-29
Vibration	20 g, 10...2000 Hz per EN 60068-2-6
Polarity reversal protected	to 36 V
Overshoot 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
Housing attachment	Mounting clamps
Connection	Connectors/cables
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]	0050...7620 mm in 5-mm increments

- Non-contact detection of the measuring position
- IP 67, insensitive to contamination
- Wear-free
- Insensitive to shock and vibration
- Absolute output signal
- Measurement length up to 7,620 mm
- Two measurement paths per system
- Error and status LED

Scope of delivery

- Transducer (select your interface from page 94)
- Quick start instructions
- Mounting clamps with insulating sleeves and screws

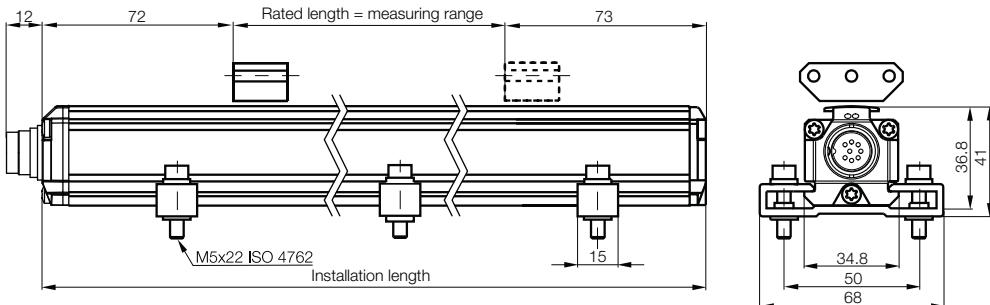


Please order separately:
USB communication box, page 96
Position encoders, see page 114
Plug connectors, page 252



Profile P BTL7 Micropulse⁺ General data

Transducer with floating position encoder and S32 connection



Micropulse
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Profile P BTL7
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Analog Interface
Programming
EtherCAT

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General Data
Analog Interface
Digital Pulse Interface
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DeviceNet Interface
Profibus DP Interface

Floating Position
Encoders
Captive Position
Encoders

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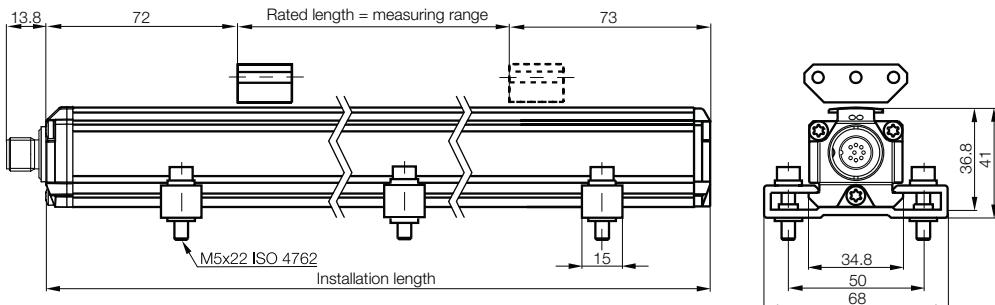
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Sensor SF

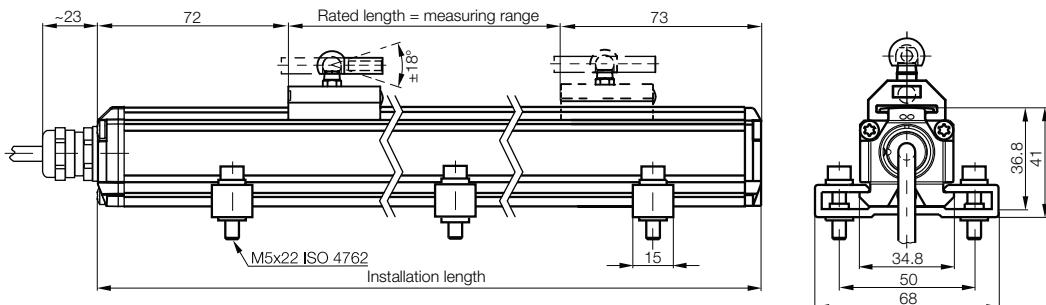
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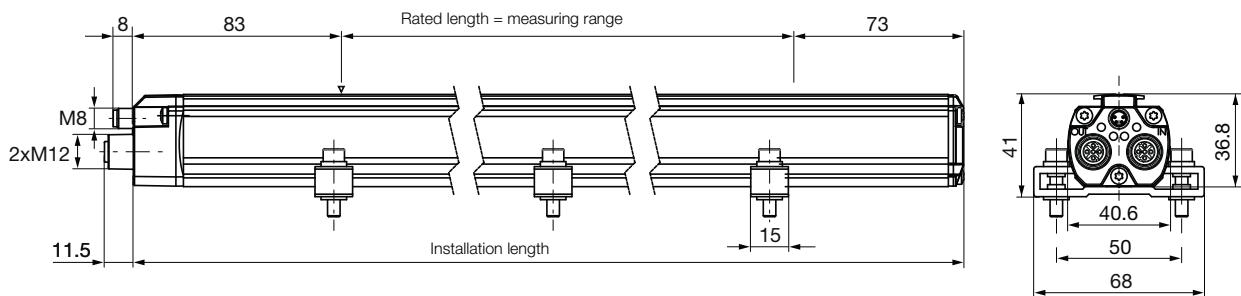
Transducer with floating position encoder and S115 connection



Transducer with captive encoder and KA cable outlet



Transducer with EtherCAT connection C003



Micropulse⁺ USB-Configurable BTL7-A/E501

- Simple configuration and adjustment of the start and end point via the USB interface, quick startup
- Configurable dual output functions, position and speed
- Increased operating reliability with status LEDs for indicating the operating status and for diagnostics

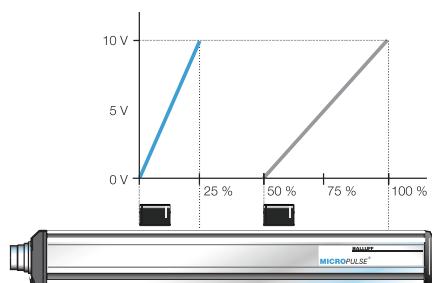
Position and velocity

Two outputs can be assigned any position value and velocity signal using the USB interface.



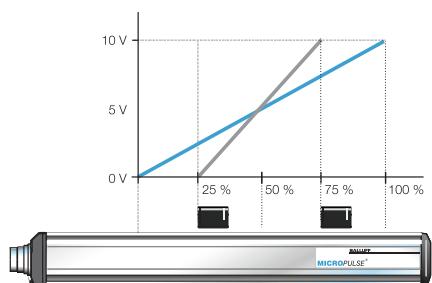
Series	
Output signal	
Transducer interface	
Position signal interface, customer device	
Part number	
Output signal factory setting	
Output signal can be adjusted via configurable USB	
Load current	
Load resistance	
System resolution	
Current consumption at 24 V DC	
Hysteresis	
Repeat accuracy	
Measurement rate, length-dependent	
Max. linearity deviation	
Temperature coefficient	
Supply voltage	
Polarity reversal protected	
Oversupply protection	
Dielectric strength	
Operating temperature	

Operating mode: Double position encoder



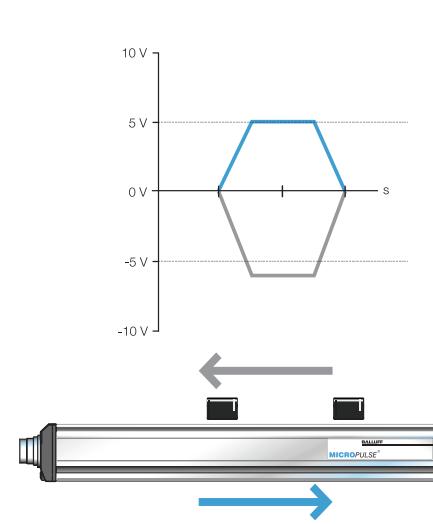
2 encoders, 2 movements, 2 output signals

Operating mode: Differential



Differential signal between
2 encoders, position and difference possible.

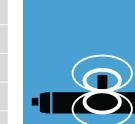
Operating mode: Speed



Velocity output

Profile P BTL7 Micropulse⁺ Analog interface

Profile P BTL7	Profile P BTL7
Analog	Analog
A	E
Analog	Analog
BTL7- A501 -M- <u> </u> -P- <u> </u>	BTL7- E501 -M- <u> </u> -P- <u> </u>
0...10 V and 10...0 V	4...20 mA and 20...4 mA
-10...10 V and 10...-10 V	0...20 mA and 20...0 mA
Max. 5 mA	$\leq 500 \Omega$
$\leq 0.33 \text{ mV}$	$\leq 0.66 \mu\text{A}$
$\leq 150 \text{ mA}$	$\leq 180 \text{ mA}$
$\leq 10 \mu\text{m}$	$\leq 5 \mu\text{m}$
System resolution/min. 2 μm	System resolution/min. 2 μm
Max. 4 kHz	Max. 4 kHz
$\pm 50 \mu\text{m}$ to $\leq 500 \text{ mm}$ rated length	$\pm 50 \mu\text{m}$ to $\leq 500 \text{ mm}$ rated length
$\pm 0.01\%$ FS > 500... $\leq 5500 \text{ mm}$ rated length	$\pm 0.01\%$ FS > 500... $\leq 5500 \text{ mm}$ rated length
$\pm 0.02\%$ FS > 5500 mm rated length	$\pm 0.02\%$ FS > 5500 mm rated length
$\leq 30 \text{ ppm/K}$	$\leq 30 \text{ ppm/K}$
10...30 V DC	10...30 V DC
to 36 V	to 36 V
to 36 V	to 36 V
500 V AC (GND to housing)	500 V AC (GND to housing)
-40...+85 °C	-40...+85 °C



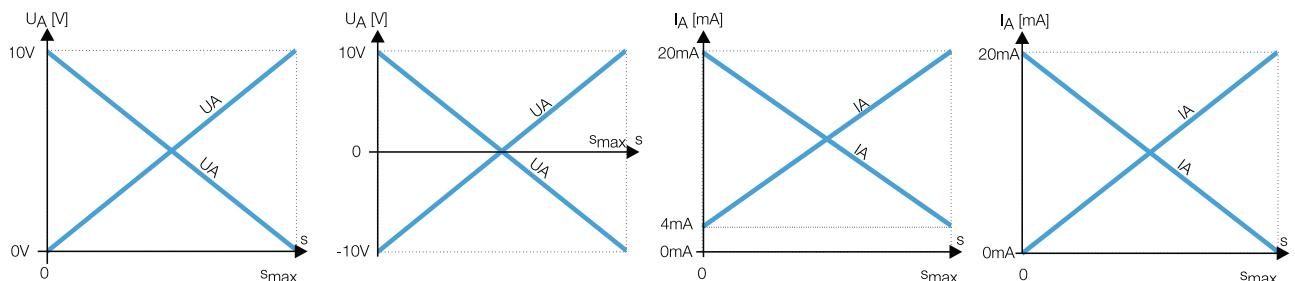
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**Analog
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Programming
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Interface
Digital Pulse
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SSI Interface
CANopen
Interface
DeviceNet
Interface
Profinet
DP
Interface
Floating Position
Encoders
Captive Position
Encoders

Profile PF
Profile AT
Profile BIW

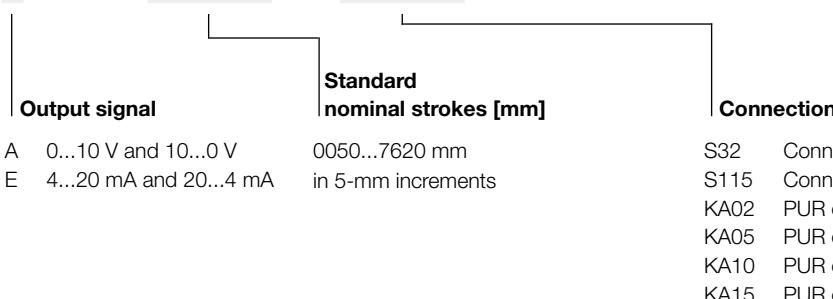
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Please enter code for output signal, rated length and connection in the part number.

Ordering example:

B T L 7 - 5 0 1 - M - P - -



USB configuration

System requirements

- Standard PC
- Operating system: Windows 2000/XP/Vista/7
- Screen resolution at least 1024 x 768 pixels
- 10 MB available hard disk space
- Install Java Runtime Environment (JRE) Version 1.4.2 or higher
<http://java.com/getjava>
- USB port

Start, end value setting and configuration via USB

The Micropulse Configuration Tool software allows the quick and easy configuration of Balluff transducers of type BTL7-A/E501... on a PC.

The most important features are:

- Online display of the current position of the encoder
- Graphic support for setting the functions and characteristics
- Display of information about the connected transducer
- Selectable number formats and units for display
- Reset to factory settings possible
- Demo mode without having a transducer connected

Connecting the USB communication box

For transducers BTL7-A/E501-M...-P-S32 and ...-S115, the communication box can be switched between the transducer and the controller. The communication box is connected to the PC using a USB cable.

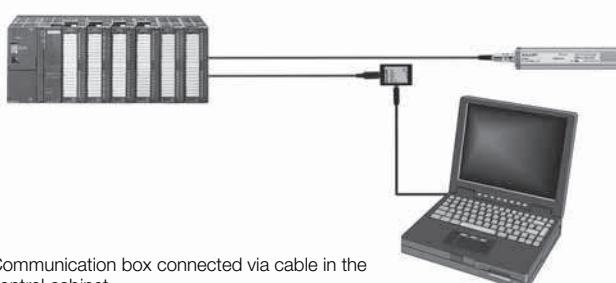
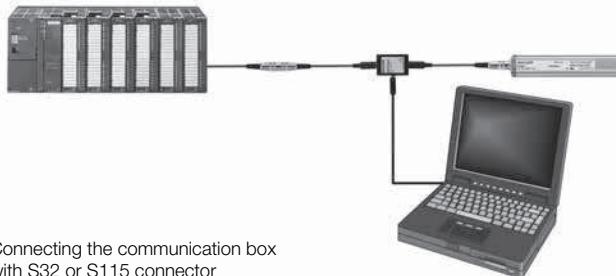
USB communication box

Part number	with cable sets
BTL7-A-CB01-USB-S32	S32 connector
BTL7-A-CB01-USB-S115	S115 connector
BTL7-A-CB01-USB-KA	Cable connection

Scope of delivery

- USB communication box
- Cable set
- Quick start instructions

The PC software and corresponding manual are available on the Internet at www.balluff.com/downloads-btl7



Caution!

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

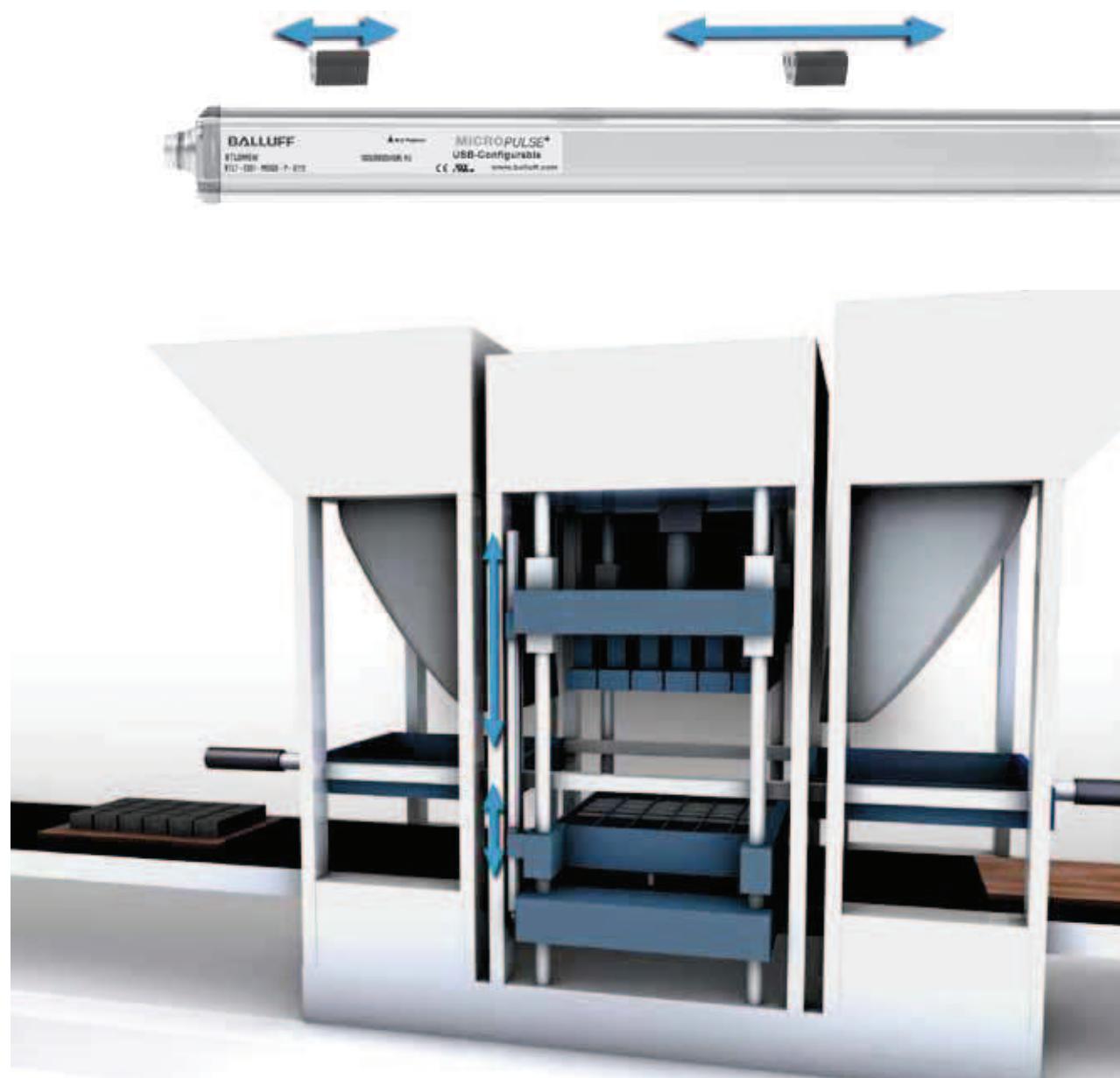
Profile P BTL7 Micropulse⁺ Application

Micropulse⁺ position measurement systems in a profile housing are non-contact, absolute measurement systems for accurately measuring one or more measurement paths. They feature a robust design including the high IP 67 degree of protection, ease of installation, and a wear-free measuring principle with high accuracy. The current axis positions are marked by the position encoder magnets through the wall of the aluminum profile. The position measurement systems tolerate a lateral offset as well as a vertical offset of up to 15 mm.

Features

- Non-contact detection of the measuring position
- IP 67, insensitive to contamination
- Insensitive to shock and vibration
- Absolute output signal
- Measuring lengths up to 7,620 mm
- Two measurement paths per system
- Error and status LED
- Quick commissioning through USB configuration

Micropulse⁺ position measurement systems guarantee high cost-effectiveness and quality in the manufacture of concrete blocks. In a concrete block machine, the Micropulse⁺ position measurement system simultaneously and reliably measures the axis position of load and molding stroke movement.



Micropulse
Transducers

Profile P BTL7
General
Data
Analog
Interface
Programming
EtherCAT

Profile P BTL5
General
Data
Analog
Interface
Digital Pulse
Interface
SSI Interface
CANopen
Interface
DeviceNet
Interface
Profinet
Profinet DP
interface

Floating Position
Encoders
Captive Position
Encoders

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact
and Rod AR

Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

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EtherCAT

EtherCAT is an Ethernet-based fieldbus initiated by Beckhoff. The open protocol is suitable for hard and soft realtime requirements in automation technology.

The focal points in the development of EtherCAT are extremely short cycle times ($\leq 100 \mu\text{s}$), low jitter for exact synchronization ($\leq 1 \mu\text{s}$) and low hardware costs.

Modular device profile: absolute linear encoder

The BTL-V50E... corresponds to the profile for absolute linear encoders and is configured as a modular device. The transducer represents a virtual module carrier, which has 16 slots for the position encoder. Various virtual modules can be plugged into each slot. These specify which data are assigned to the respective position encoder.

Synchronous operating mode

EtherCAT devices implement a high-precision time in hardware, more precisely, in the EtherCAT Slave Controller. These distributed clocks lend the EtherCAT synchronization mechanism its name, "Distributed Clocks" (DC).

Cams/switching points

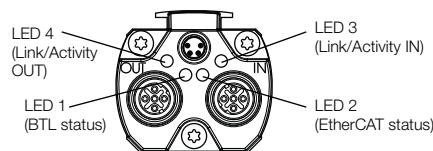
The BTL7-V50E... can also be used as a cam switch. For this purpose there are four cams (Cam) available per position encoder (Magnet).

Advantages, features

- Multiposition detection – simultaneously detect 16 positions
- Easy evaluation – 4 cams or switching points per position
- Highly dynamic, because synchronous – synchronous operating mode through DC (Distributed Clocks)
- Flexibly installable – completely transferable system
- Reliability in the BUS – LED EtherCAT diagnostics
- Reliability in the measurement system – LED Micropulse system diagnostics

LED 1	Micropulse BTL7 diagnostics
Green	Normal function The position encoder is within the limits.
Red	Error No position encoder, or position encoder is outside the limits.
LED 2 – 4	EtherCAT – Bus diagnostics

Series			
Output signal			
Transducer interface			
Position signal interface, customer device			
Part number			
EtherCAT interface			
Repeat accuracy			
System resolution, configurable	Position		
	Velocity		
Hysteresis			
Measurement rate			
Max. linearity deviation			
Temperature coefficient of overall system			
Supply voltage			
Current consumption			
Operating temperature			
Storage temperature			
ESI file			
Max. cable length			



Profile P BTL7 Micropulse⁺ EtherCAT interface

Profile P BTL7

EtherCAT

V50E

EtherCAT

BTL7-V50E-M_ _ _ -P-C003

Floating

$\leq 5 \mu\text{m}$, (typically $\pm 2.5 \mu\text{m}$)

1 μm

0.1 mm/s increments configurable

$\leq \pm 10 \mu\text{m}$

$f_{\text{STANDARD}} = 1 \text{ kHz}$

$\leq 5500 \pm 30 \mu\text{m}$, $> 5500 \pm 0.002 \% \text{ FS}$

$\leq 18 \text{ ppm/K}$ (at 500 mm)

10...30 V DC

$\leq 120 \text{ mA}$

-40...+85 °C

-40...+100 °C

www.balluff.com

< 100 m



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Data

Analog
Interface

Digital Pulse
Interface

SSI Interface

CANopen
Interface

DeviceNet
Interface

Profinet
Interface

Profinet
DP
Interface

Floating Position
Encoders
Captive Position
Encoders

Profile PF

Profile AT

Profile BIW

Rod

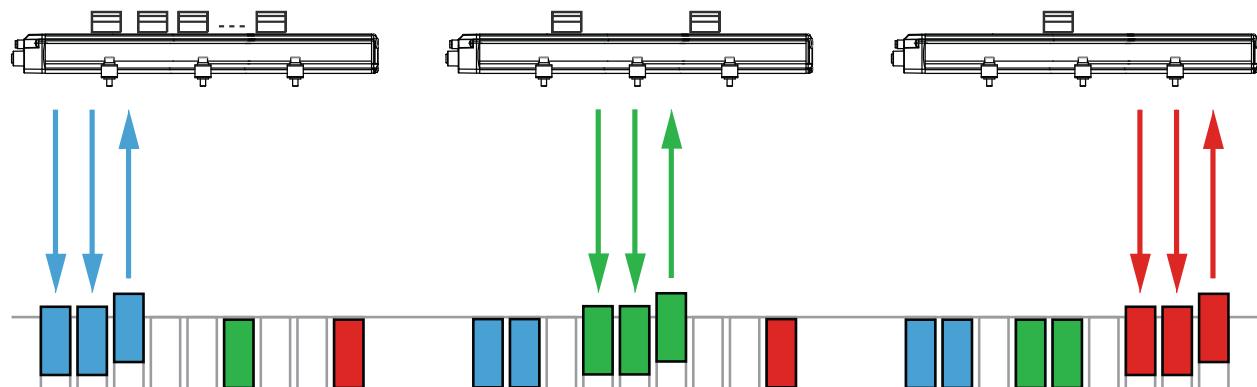
Rod Compact
and Rod AR

Rod EX,
T Redundant
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Function principle of the EtherCAT data transmission

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

Ordering example:

B T L 7 - V 5 0 E - M _ _ _ - P - _ _ _

**Ethernet
Interface type**

E EtherCAT

**Standard
Rated length [mm]**

0050...7620 mm in 5-mm increments

Connection

C003 4-pin

1x M8 connector + 2x M12 connector

D-coded

The structural design, high degree of protection and easy installation of Balluff Micropulse transducers housed in a profile make them an excellent alternative to linear transducers, such as potentiometers, glass rulers and LVDTs. The measurement section is protected inside an extruded aluminum profile.

A passive encoder with no power supply marks the measuring point on the measuring path without making contact. Measuring ranges between 50 and 5,000 mm are possible.

- Non-contact detection of the measuring position
- IP 67, insensitive to contamination
- Wear-free
- Insensitive to shock and vibration
- Absolute output signal
- Max. resolution of 0.001 mm (depending on the electronic processor unit)
- Direct signal evaluation or in conjunction with processor units for all control and closed-loop systems

Series	Profile P BTL5
Shock load	100 g/6 ms as per EN 60068-2-27
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 (GND to housing)
Degree of protection as per IEC 60529	IP 67 (with IP-67 connector BKS-S... attached)
Housing material	Anodized aluminum
Housing attachment	Compression clamps
Connection	Connectors/cables
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)	IEC 61000-4-4 Severity level 4
Conducted interference induced by high-frequency fields	EN 61000-4-6 Severity level 3
Standard nominal strokes [mm]	0050...5500 mm in 5-mm increments, depending on the interface

Scope of delivery

- Transducer (select your interface from page 102)
- Quick start instructions
- Mounting clamps with insulating sleeves and screws

Please order separately:

- Position encoders, see page 114
- Plug connectors, see page 252

Caution!

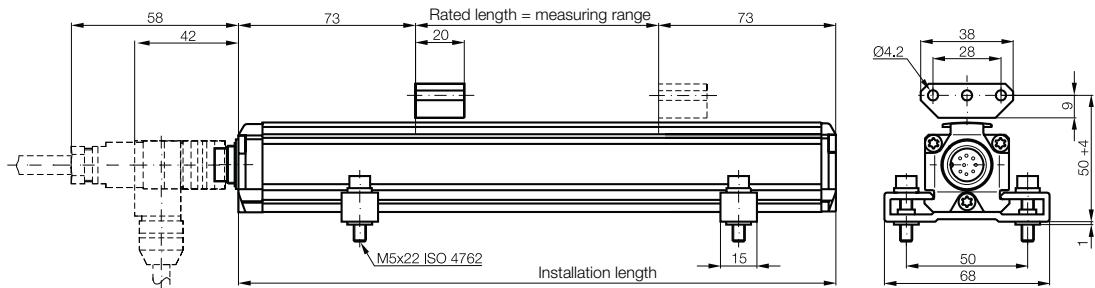
Before design, installation and startup please familiarize yourself with the user's guide to be found at www.balluff.com.



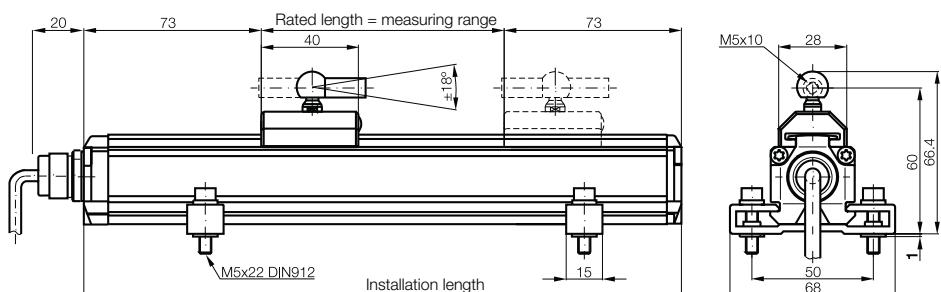
Profile P BTL5

General data

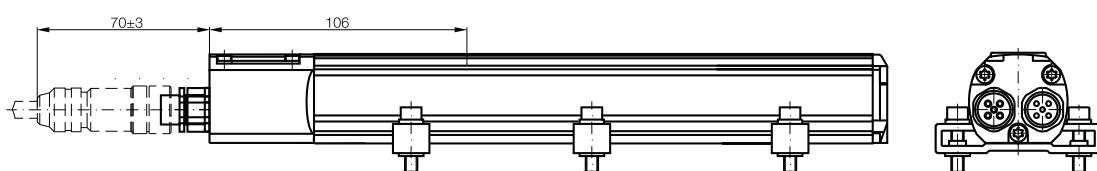
Transducers with floating position encoder and connection S32 with connector BKS-S 32M/BKS-S 32M-C/BKS-S 33M for transducers with analog interface, digital pulse interface and SSI interface, page 252



Transducers with captive encoders and cable outlet for transducers with analog interface, Digital Pulse Interface and SSI Interface, from page 252



CANopen connection S94 with connector BKS-S94-00 and BKS-S92-00 for transducers with CANopen interface, page 254

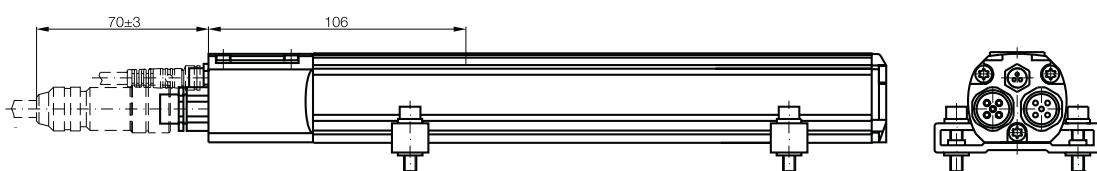


CANopen connection S92 with connector BKS-S92-00 for transducers with CANopen interface, page 254



DeviceNet connection S93 with connector BKS-S92-00, BKS-S93-00 and BKS-S 48-15-CP-___, page 254

Profibus DP connection S103 with plug connector BCC0715 and BCC0714, page 257 and BKS-S48-15-CP-___, page 254



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SSI Interface
CANopen
Interface
DeviceNet
Interface
Profibus DP
Interface

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Encoders
Captive Position
Encoders

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact
and Rod AR

Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

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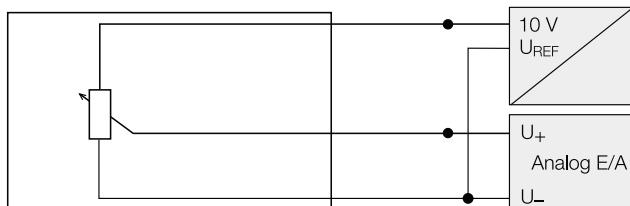
Profile P BTL5

Analog interface

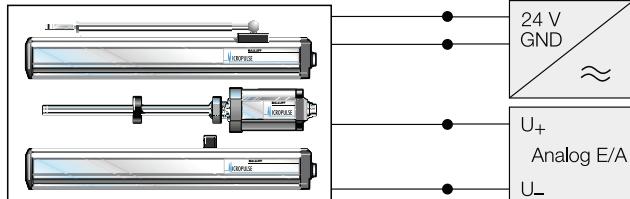
The analog outputs of the profile series are floating with respect to the input voltage. The isolation is galvanic using DC/DC converters. BTL transducers with analog outputs are available in the variants 0...10 V, 4...20 mA, 0...20 mA and -10...10V, with a rising and falling characteristic.

Series	
Output signal	
Transducer interface	
Customer device interface	
Part number	
Output	
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	
Oversupply protection	
Dielectric strength	
Operating temperature	
Storage temperature	

Micropulse transducers – a non-contact alternative to contacting transducers



Connection scheme potentiometer, block diagram



Micropulse Transducer connections, block diagram

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

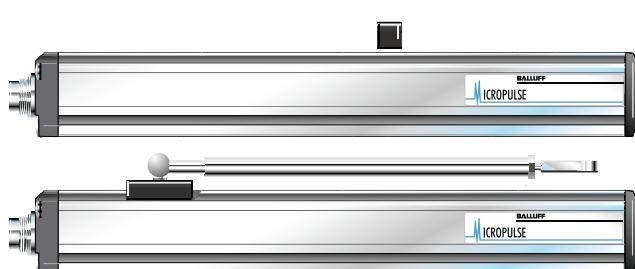
Scope of delivery

- Transducer
- Mounting clamps with insulating sleeves and screws
- Quick start instructions

Please order separately:

Position encoders, see page 114

Plug connectors, see page 252



Profile P BTL5

Analog interface

Profile P BTL5	Profile P BTL5	Profile P BTL5	Profile P BTL5
Analog	Analog	Analog	Analog
A	E	C	G
Analog	Analog	Analog	Analog
BTL5- A11 -M- -P- - - 	BTL5- E1 -M- -P- - - 	BTL5- C1 -M- -P- - - 	BTL5- G11 -M- -P- - -
Floating	Floating	Floating	Floating
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
≤ 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 μm up to 500 mm rated length	±100 μm up to 500 mm rated length	±100 μm up to 500 mm rated length	±100 μm 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 × 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	[150 μV/°C + (5 ppm/°C × P × U/L)] × 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



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**Analog
Interface**
Digital Pulse
Interface
SSI Interface
CANopen
Interface
DeviceNet
Interface
Profinet DP
Interface

Floating Position
Encoders
Captive Position
Encoders

Profile PF

Profile AT

Profile BIW

Rod

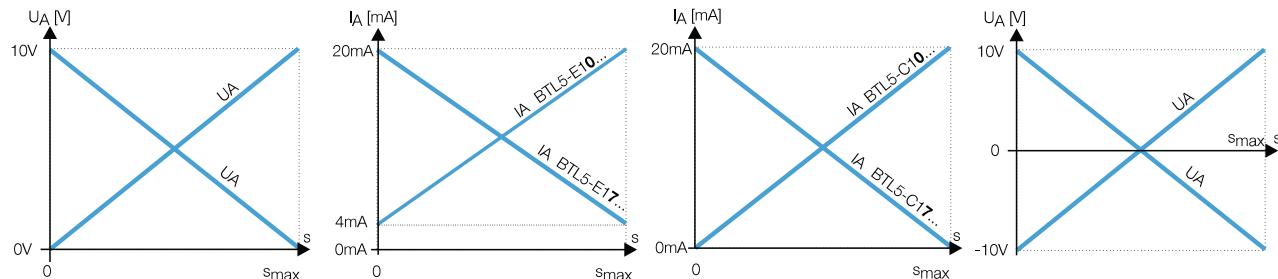
Rod Compact
and Rod AR

Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

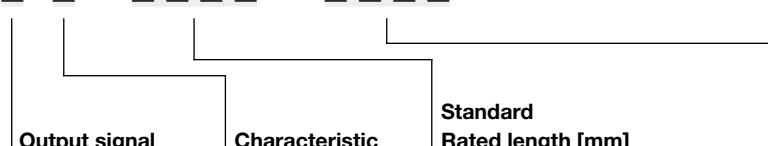
Accessories

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Ordering example:

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



A 0...10 V and 10...0 V	1 rising and falling (with A and G)	0050...4500 mm in 5-mm increments	S32 Connectors
E 4...20 mA or 20...4 mA	0 rising (at C and E)		KA02 PUR cable 2 m
C 0...20 mA or 20...0 mA	7 falling (for C and E)		KA05 PUR cable 5 m
G -10...10 V and 10...-10 V			KA10 PUR cable 10 m
			KA15 PUR cable 15 m

P Interface

The P interface is compatible with BTA/BTM processor units as well as with controllers and modules from various manufacturers, including Siemens, B & R, Phoenix Contact, Mitsubishi, Sigmatek, Esitron, WAGO and others.

Reliable signal transmission, even over cable lengths up to 500 m, between processor unit BTA and transducer BTL is guaranteed by the particularly interference-free RS485 differential drivers and receivers. Interference signals are effectively suppressed.

M Interface

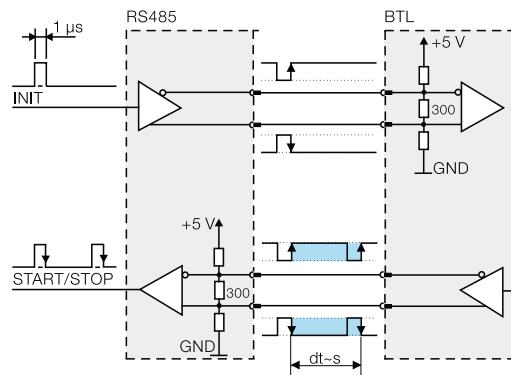
The I and M interfaces are control-specific interface variations.

Highly precise digitizing of the P pulse signal

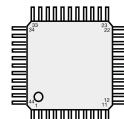
Companies developing their own electronic control and electronic processor unit can create a highly accurate P pulse interface cost-effectively and with minimum effort using the Balluff digitizing chip. The digitizing chip was developed as a high-resolution, configurable ASIC for Micropulse transducers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

Benefits

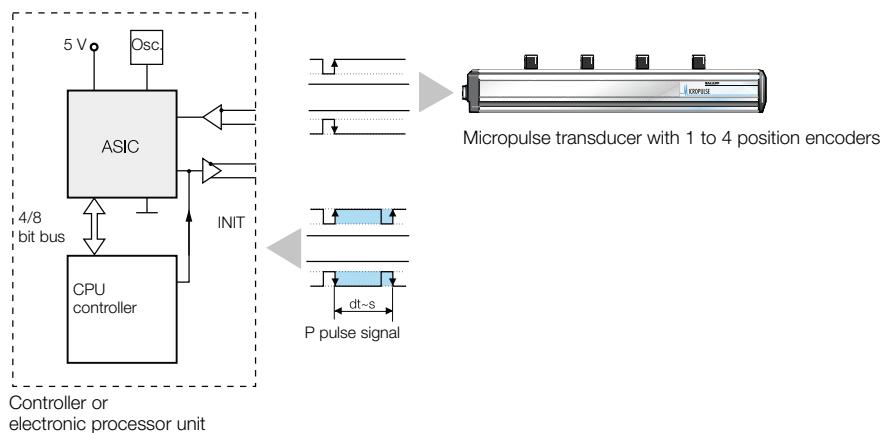
- Position resolution 1 μ m!
- The 1 μ m resolution of the Micropulse position measuring system is achieved by the high resolution of the digitizing chip (133 pS) (clock frequency 2 or 20 MHz).
- Position data from 4 position encoders can be processed simultaneously
- 4/8-bit processor interface



Block diagram of P interface



Digitizing chip 44QFP



Controller or
electronic processor unit



ASIC INFO:
+49 7158 173-370

Profile P BTL5

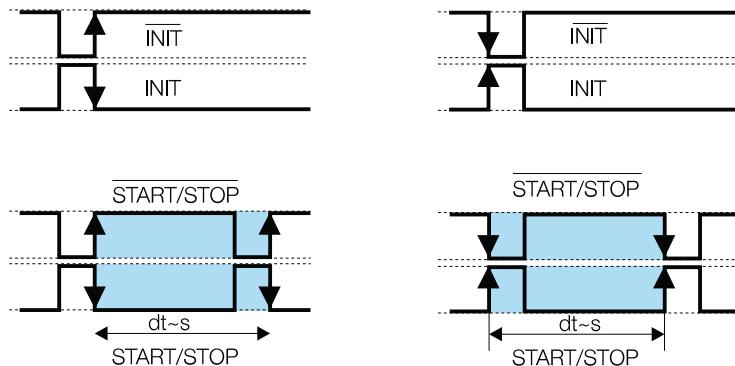
Digital Pulse Interface

Series	Profile P BTL5	Profile P BTL5
Transducer interface	Pulse P	Pulse M
Customer device interface	Pulse P	Pulse M
Part number	BTL5-P1-M_____ -P-----	BTL5-M1-M_____ -P-----
System resolution	processing-dependent	processing-dependent
Repeat accuracy	2 µm or ± 1 digit depending on electronic processor unit	2 µm or ± 1 digit depending on electronic processor unit
Resolution	≤ 2 µm	≤ 2 µm
Hysteresis	≤ 4 µm	≤ 4 µm
Measurement rate	3 kHz to 500 Hz depending on rated length	3 kHz to 500 Hz depending on rated length
Max. linearity deviation	± 100 µm up to 500 mm rated length $\pm 0.02\%$ 500...5000 mm rated length	± 100 µm up to 500 mm rated length $\pm 0.02\%$ 500...5000 mm rated length
Temperature coefficient of overall system	(6 µm + 5 ppm \times L)/°C	(6 µm + 5 ppm \times L)/°C
Supply voltage	20...28 V DC	20...28 V DC
Current consumption	≤ 90 mA	≤ 90 mA
Operating temperature	-40...+85 °C	-40...+85 °C
Storage temperature	-40...+100 °C	-40...+100 °C



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Captive Position
Encoders

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Profile BIW

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Rod Compact
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Please enter the code for the rated length in the part number.

Ordering example:

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

**Standard
nominal strokes [mm]**

0050...5500 mm
in 5-mm increments

Connection

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

Scope of delivery

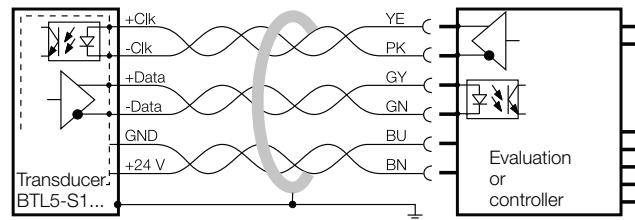
- Transducer
- Mounting clamps with insulating sleeves and screws
- Quick start instructions

Please order separately:

- Position encoders, see page 114
- Plug connectors, see page 252

Standard SSI interface

Synchronous serial data transmission works with controllers from various manufacturers, including Siemens, Bosch Rexroth, WAGO, B & R, Esitron, PEP and others, as well as for the Balluff BDD-AM 10-1-SSD and BDD-CC 08-1-SSD displays/control units. Reliable signal transmission, even with cable lengths of up to 400 m between controller and BTL transducer, is assured by interference-free RS485/422 differential drivers and receivers. Any interference signals are effectively suppressed.



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

Synchronized SSI interface BTL5-S1_-B-M_-P_-

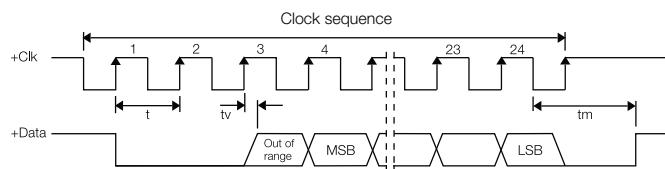
Micropulse Transducers with synchronized SSI interface are well suited for dynamic control applications. Data acquisition in the transducer is synchronized using the external clock of the controller, allowing an optimum speed calculation to be performed in the regulator/controller. Prerequisite for this 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 to the right:

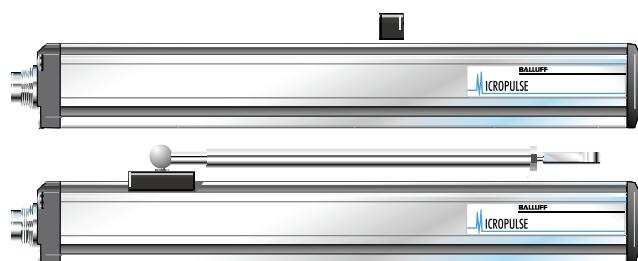
Rated length range	Scan rate
< Rated length	\leq 100 mm : 1500 Hz
100 mm < Rated length	\leq 1000 mm : 1000 Hz
1000 mm < Rated length	\leq 1400 mm : 666 Hz
1400 mm < Rated length	\leq 2600 mm : 500 Hz
2600 mm < Rated length	\leq 4000 mm : 333 Hz

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



Super-fast 2.5 kHz sampling rate



Profile P BTL5

SSI interface



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Interface
Profibus DP
Interface

Floating Position
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Captive Position
Encoders

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Rod Compact
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Series	Profile P BTL5
Output signal	Synchronous-serial
Transducer interface	S
Customer device interface	synchronous serial (SSI)
Part number	BTL5- S1 __-M__-P__
Part number synchronization	BTL5- S1 _B-M__-P__
System resolution depending on model (LSB)	1, 2, 5, 10, 20, 40 or 100 μ m
Repeat accuracy	$\pm 5 \mu$ m
Hysteresis	$\leq 4 \mu$ m or ≤ 1 digit
Measurement rate	$f_{STANDARD} = 2$ kHz
Max. linearity deviation	$\pm 30 \mu$ m at $\leq 10 \mu$ m resolution or $\leq \pm 2$ LSB at $> 10 \mu$ m resolution
Temperature coefficient of overall system	(6 μ m + 5 ppm \times L)/ $^{\circ}$ C
Supply voltage	20...28 V DC
Current consumption	≤ 80 mA
Operating temperature	-40...+85 $^{\circ}$ C
Storage temperature	-40...+100 $^{\circ}$ C

Please enter code for coding, system resolution and rated length in the part number.

Scope of delivery

- Transducer
- Mounting clamps with insulating sleeves and screws
- Quick start instructions

Please order separately:

- Position encoders, see page 114
- Plug connectors, see page 252

Ordering example:

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

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

Coding	System resolution	Standard Rated length [mm]	Connection
0 Binary code rising (24-bit)	1 1 μ m 2 5 μ m	0100...4000 mm in 5-mm increments	S32 Connectors
1 Gray code rising (24-bit)	3 10 μ m 4 20 μ m		KA02 PUR cable 2 m
6 Binary code rising (25-bit)	5 40 μ m 6 100 μ m		KA05 PUR cable 5 m
7 Gray code rising (25-bit)	7 2 μ m		KA10 PUR cable 10 m
			KA15 PUR cable 15 m

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 conforming with CiA Standard DS301 Rev. 3.0, and with CAL and Layer 2 CAN networks.

EDS

CANopen offers a high level of flexibility in configuration 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.

LED

Display of the CANopen status in accordance with DS303-3

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

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

Service Data Object (SDO)

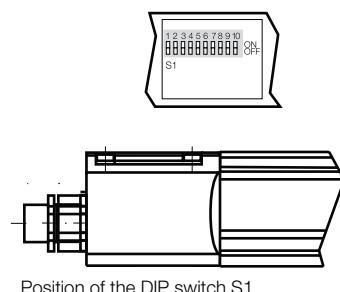
Service Data Objects transmit the configuration parameters to the transducer. The transducer may be configured on the bus by the controller or offline with a bus analyzer/CANopen tool. The configuration is stored in the transducer's non-volatile memory.



CiA 199911-301v30/11-009

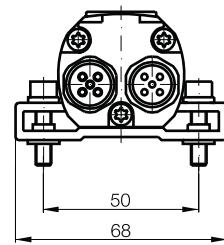
Use of multiple position encoders

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



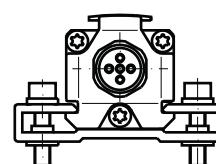
Position of the DIP switch S1,
only on BTL5-H1_ _ _ -P-S94

BTL5-H1_ _ _ -M_ _ _ -P-S94



Node ID can be set by DIP switch.

BTL5-H1_ _ _ -M_ _ _ -P-S92

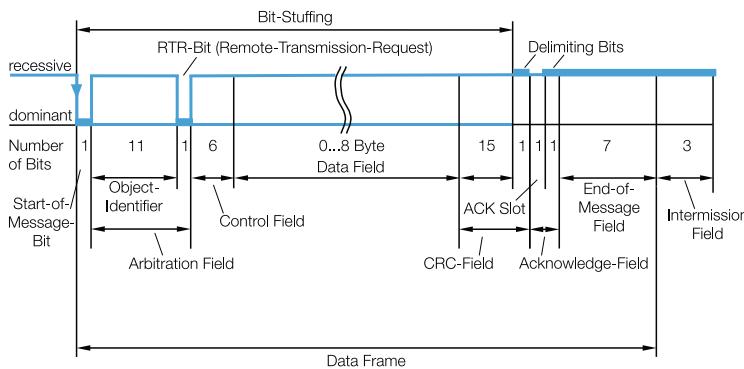


Profile P BTL5

CANopen interface

Series	Profile P BTL5								
Output signal	CANopen								
Transducer interface	H								
Customer device interface	CANopen								
Part number	BTL5- H1 __-M__-__-P-S92								
Part number	BTL5- H1 __-M__-__-P-S94								
CANopen version	DS301, DS406								
Repeat accuracy	±1 digit								
System resolution	Position	Configurable in increments of 5 µm							
Configurable	Velocity	0.1 mm/s increments configurable							
Hysteresis	≤ 1 digit								
Sampling 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								
Position encoder travel speed	any								
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	

Using the CANopen interface and cable lengths up to 2500 m, 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.



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

Scope of delivery

- Transducer
- Mounting clamps with insulating sleeves and screws
- Quick start instructions

Please order separately:

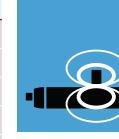
- Position encoders, see page 114
- Plug connectors, see page 252

Ordering example:

B T L 5 - H 1 _ _ - M _ _ _ - P - S 9 2

B T L 5 - H 1 _ _ - M _ _ _ - P - S 9 4

Software configuration	Baud rate	Standard Rated length [mm]
1 1 x Position and 1 x Velocity	0 1 Mbaud	0050...4000
2 2 x Position and 2 x Velocity	1 800 kbaud	in 5-mm increments
	2 500 kbaud	
	3 250 kbaud	
	4 125 kbaud	
	5 100 kbaud	
	6 50 kbaud	
	7 20 kbaud	
	8 10 kbaud	



Micropulse Transducers

Profile P BTL7
General Data
Analog Interface
Programming
EtherCAT

Profile P BTL5
General Data
Analog Interface
Digital Pulse Interface
SSI Interface
CANopen Interface
DeviceNet Interface
Profibus DP Interface

Floating Position Encoders
Captive Position Encoders

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact and Rod AR

Rod EX, T Redundant and CD

Filling Level Sensor SF

Accessories

Basic Information and Definitions

Profile P BTL5

DeviceNet interface

DeviceNet

DeviceNet is a manufacturer-independent open fieldbus standard used in automation technology for connecting programmable logic controllers (PLCs) to intelligent devices such as sensors, pushbuttons, I/O modules, basic user interfaces and drives via a single cable. DeviceNet is an application protocol (OSI layer 7) based on the Controller Area Network (CAN) principle. It offers high reliability for demanding applications with a high number of IO modules. The transmission speed is between 125 kbit/s and 500 kbit/s depending on type and length of the cable.

EDS

DeviceNet offers configuration of 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 DeviceNet system.

DeviceNet features

- Linear topology
- Low-cost wiring with two-wire cable
- Fast response times
- High data integrity due to CRC checking
- Hamming distance of 6
- Floating data transmission (RS485)
- 125 Kb/s at cable length < 500 m
- 250 Kb/s at cable length < 250 m
- 500 Kb/s at cable length < 100 m
- Protocol limits number of nodes to 64

Position Sensor Object

The DeviceNet interface of the Micropulse Transducer is compatible with the CIP Common Specification Object Library "Position Sensor Object" of the ODVA.

The Micropulse Transducers transmit their measured values to an instance of the position sensor object as a 32-bit value.

The following information can be sent:

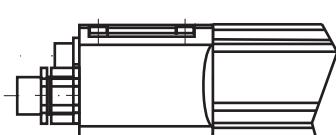
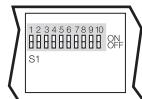
- Current encoder position with resolution in 5 μ m increments
- Current encoder speed in increments of 0.1 mm/s
- Current status of the four freely programmable cams

Synchronization

Measurement can be triggered by the master I/O bit Strobe Command Message. On receiving this bit, the respective Micropulse Transducer saves its current position and velocity information and sends it back to the controller.

FMM

The sensor can be operated as a 1...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.



Device address can be set by DIP switch

Use of multiple position encoders

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

Profile P BTL5 DeviceNet interface

Series		Profile P BTL5
Output signal		DeviceNet
Transducer interface		D
Customer device interface		DeviceNet
Part number plug version S103		BTL5- D1 __-M__-__-P-S93
Profibus version		Encoder profile
Profibus interface		Floating
Repeat accuracy		±1 digit
System resolution	Position	Configurable in increments of 5 µm
Configurable	Velocity	0.1 mm/s increments configurable
Hysteresis		≤ 1 digit
Sampling rate		$f_{STANDARD} = 1 \text{ kHz}$
Max. linearity deviation		±30 µm at 5 µm resolution
Temperature coefficient of overall system		(6 µm + 5 ppm × L)/°C
Position encoder travel speed		any
Supply voltage		20...28 V DC
Current consumption		≤ 100 mA
Operating temperature		-40...+85 °C
Storage temperature		-40...+100 °C
Address assignment		Mechanical switches or DeviceNet
Cable length [m]	100	250
Baud rate [Kbps]	500	250
		500
		100



Micropulse
Transducers

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Profile P BTL5

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Digital Pulse
Interface
SSI Interface
CANopen
Interface
**DeviceNet
Interface**
Profibus DP
Interface

Floating Position
Encoders
Captive Position
Encoders

Profile PF

Profile AT

Profile BIW

Rod

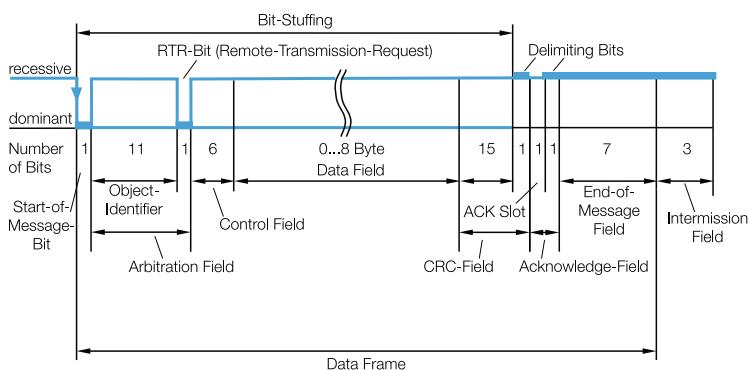
Rod Compact
and Rod AR

Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

Accessories

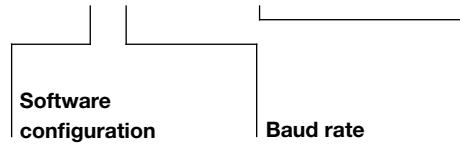
Basic
Information and
Definitions



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

Ordering example:

B T L 5 - D 1 __ - M __ - __ - P - S 9 3



Software configuration	Baud rate	Standard nominal strokes [mm]
1 Magnet FMM	2 500 kbaud	0050...4000 in 5-mm increments
	3 250 kbaud	
	4 125 kbaud	

Please order separately:
Position encoders, see page 114
Plug connectors, see page 252

As the market leading standard for serial data transmission for process automation, Profibus DP is the ideal choice for implementing automation tasks with cycle times of > 5 ms.

Data transmission

A Profibus telegram can contain up to 244 bytes of user data per telegram and node. The position measurement system BTL5-T uses max. 32 bytes (max. 4 position values and max. 4 speed values) for process data transmission. Up to 126 active stations (addresses 0 to 125) can be connected to Profibus DP. User data cannot be sent with node address 126. This address is used as the default address for bus nodes that have to be configured by a Class 2 master (for setting the device address if there are no mechanical switches available). Each Profibus node has the same priority. Prioritizing individual stations is not intended, but can be done by the master since the bus transmission only makes up a fraction of the process cycle anyway. At a transfer rate of 12 Mbaud, the transmission time for an average data telegram is in the 100 µs range.

GSD (device master data)

The length of the data exchangeable with a slave is defined in the Device Master Data file (GSD) and is checked by the slave with the configuration telegram and confirmed for correctness.

In modular systems, various configurations are defined in the GSD file. These can be selected freely by the users so that they can configure their system according to the function they want. The BTL5-T is a modular device with the possibility of selecting the number of magnets (position values).

Process data

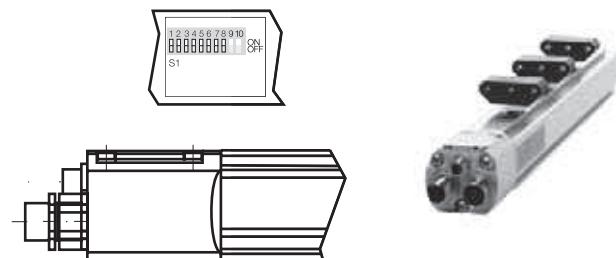
Under Profibus DP, the default is for process data to be sent from the master to slaves acyclically and for the slave data to then be queried. To ensure synchronization of multiple devices, the master may use the SYNC and FREEZE services.

DP/V1 and DP/V2 isochronous mode

Isochronous mode enables quick and deterministic data exchange by means of clock synchronicity on the bus system. A cyclical, equidistant clock signal is sent by the master to all bus nodes. This signal allows master and slaves to be synchronized irrespective of application – with an accuracy < 1 µs.

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.



Device address can
be set by DIP switch

Use of multiple position encoders

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

Profile P BTL5

Profibus DP interface

Series		Profile P BTL5				
Output signal		Profibus DP				
Transducer interface		T				
Customer device interface		Profibus DP				
Part number plug version S103		BTL5- T1 _0-M_ _ _ -P-S103				
Profibus version		DPV1/DPV2 EN 50170, encoder profile				
Profibus interface		Floating				
Repeat accuracy		±1 digit				
System resolution	Position	Configurable in increments of 5 µm				
Configurable	Velocity	0.1 mm/s increments configurable				
Hysteresis		≤ 1 digit				
Sampling 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				
Position encoder travel speed		any				
Supply voltage		20...28 V DC				
Current consumption		≤ 120 mA				
Operating temperature		−40...+85 °C				
Storage temperature		−40...+100 °C				
GSD file		BTL504B2.GSD				
Address assignment		Mechanical switches or Class 2 master				
Cable length [m]		< 100	< 200	< 400	< 1000	< 1200
Baud rate [Kbps]		12000	1500	900	187.5	93.7/19.2/9.6



Micropulse
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Digital Pulse
Interface
SSI Interface
CANopen
Interface
DeviceNet
Interface
**Profibus DP
Interface**

Floating Position
Encoders
Captive Position
Encoders

Profile PF

Profile AT

Profile BIW

Rod

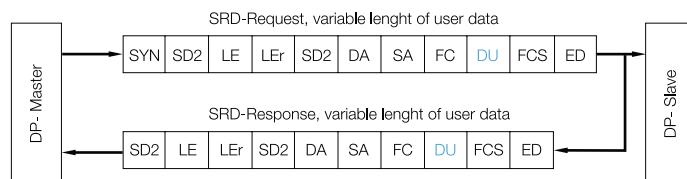
Rod Compact
and Rod AR

Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

Accessories

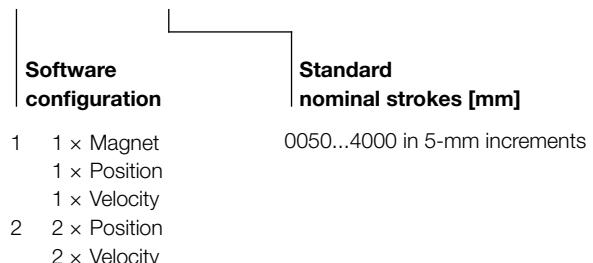
Basic
Information and
Definitions



Please enter code for software configuration and rated length in the part number.

Ordering example:

B T L 5 - T 1 _ 0 - M _ _ _ - P - S 1 0 3



Please order separately:

Position encoders, see page 114
Plug connectors, see page 252

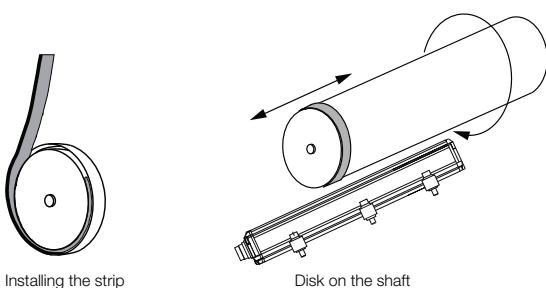
Balluff encoders are available in captive or floating designs. Maximum resolution and reproducibility are achieved using transducers with captive encoders.

The position encoder BTL5-P-4500-1 is an electromagnet and requires an operating voltage of 24V, which can be turned on and off for selective activation. This allows multiplex operation with multiple encoders on a single transducer, since only one encoder is active at a time.

Description for Series
Version
Ordering code
Part number
Housing material
Weight
Position encoder travel speed
Supply voltage
Current consumption
Operating temperature/Storage temperature range
Scope of delivery
Accessories
(please order separately)

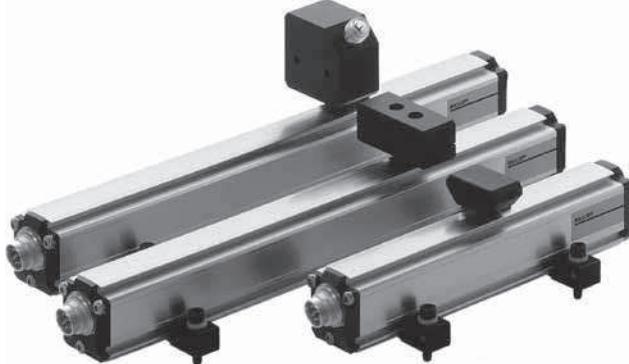
Magnetic tape position encoder for detecting the position of a rotating shaft

For rotating machine parts adjusted in the direction of travel, a rotating position encoder can be set up with the magnetic tape. Example: Installation in a groove of a nonmagnetic ring or a round disk for querying the position of a rotating shaft with Micropulse transducers.



Installing the strip

Disk on the shaft



Caution!

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

Length		Number of mounting clamp pairs
	to 250 mm	1
251	to 750 mm	2
751	to 1250 mm	3
1251	to 1750 mm	4
1751	to 2250 mm	5
2251	to 2750 mm	6
2751	to 3250 mm	7
	more than 3251 mm	8

Mounting clamps with insulating sleeves and screws included in the scope of delivery of the transducer.

1 pair of replacement mounting clamps and screws.
No.: 110404



Profile P

Floating position encoders

Position encoder	Position encoder	Position encoder	Magnetic tape position encoder
Profile P BTL Floating BAM014M BTL5-P-3800-2	Profile P BTL Floating BAM014T BTL5-P-5500-2	Profile P BTL Floating BAM014P BTL5-P-4500-1	Profile P BTL Floating BAM013E BTL-A-TM01-M1000
Plastic approx. 12 g any	Plastic approx. 40 g any	Plastic approx. 90 g any 24 V DC 100 mA	Plastic approx. 50 g any
-40...+85 °C Position encoder 2 fastening screws DIN 84 M4x35-A2 with washers and nuts	-40...+85 °C Position encoder	-40...+60 °C Position encoder	-40...+85 °C Magnetic tape
		Connector, straight* BCC M415-0000-1A-014-PS0434-... Connector, angle* BCC M425-0000-1A-014-PS0434-...	Cover strip (optional) BML-A013-T0200



Micropulse
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Profile P BTL5

General
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Interface
Digital Pulse
Interface
SSI Interface
CANopen
Interface
DeviceNet
Interface
Profinet
DP
Interface

Floating Position
Encoders
Captive Position
Encoders

Profile PF

Profile AT

Profile BIW

Rod

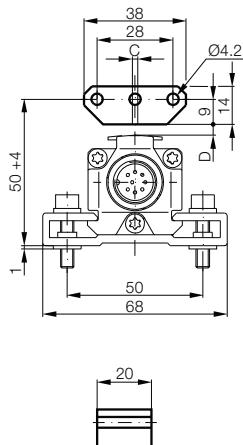
Rod Compact
and Rod AR

Rod EX,
T Redundant
and CD

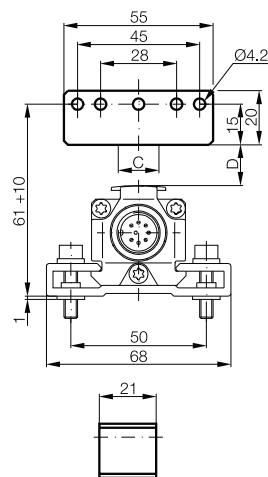
Filling Level
Sensor SF

Accessories

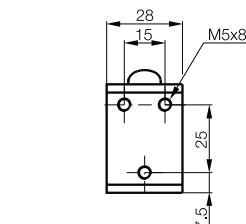
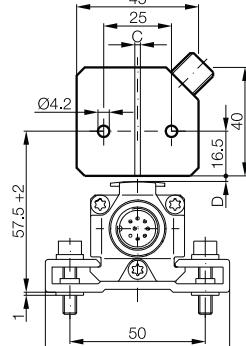
Basic
Information and
Definitions



Lateral offset:
C = ± 2 mm
Distance of position encoder:
D = 0.1...4 mm

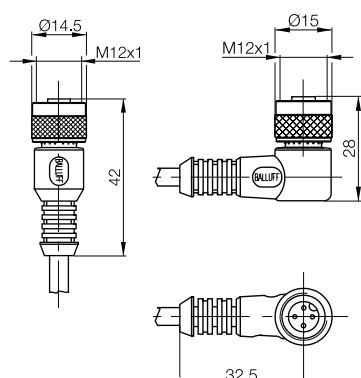


Lateral offset:
C = ± 15 mm
Distance of position encoder:
D = 5...15 mm

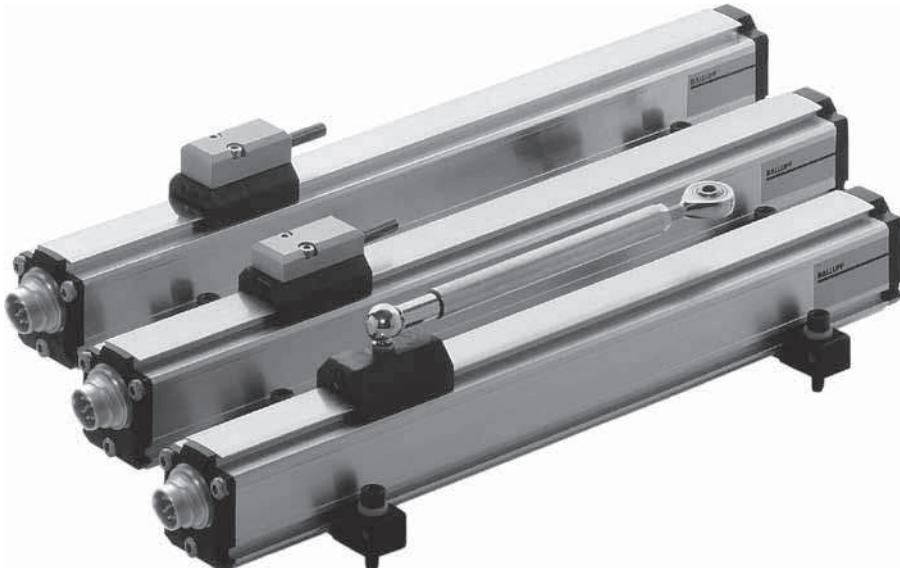
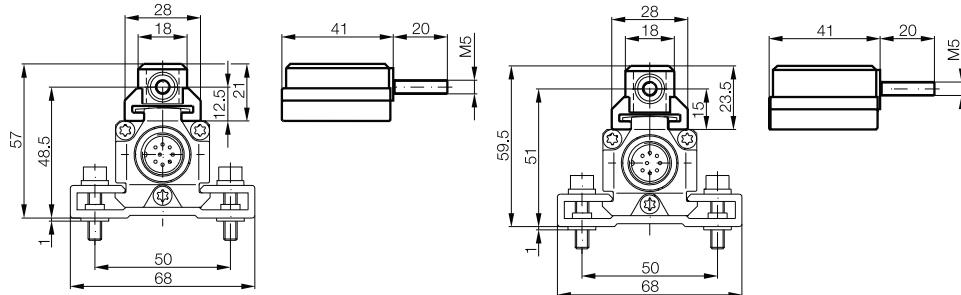


Lateral offset:
C = ± 2 mm
Distance of position encoder:
D = 0.1...2 mm

* Please include the cable length
code in the part number.
020 = 2 m, 050 = 5 m, 100 = 10 m



Description for Series	Position encoder	Position encoder
Version	Profile P BTL	Profile P BTL
Ordering code	Captive BAM014K	Captive BAM014L
Part number	BTL5-M-2814-1S	BTL5-N-2814-1S
Material	Housing	Anodized aluminum
	Sliding surface	Plastic
Weight	Approx. 32 g	Approx. 35 g
Position encoder travel speed	any	any
Operating temperature/Storage temperature range	-40...+85 °C	-40...+85 °C



Caution!

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

Length	Number of mounting clamp pairs
to 250 mm	1
251 to 750 mm	2
751 to 1250 mm	3
1251 to 1750 mm	4
1751 to 2250 mm	5
2251 to 2750 mm	6
2751 to 3250 mm	7
more than 3251 mm	8

Mounting clamps with insulating sleeves and screws included in the scope of delivery of the transducer.

1 pair of replacement mounting clamps and screws.
No.: 229157
Part number:
BAM MC-TL-025-P-1

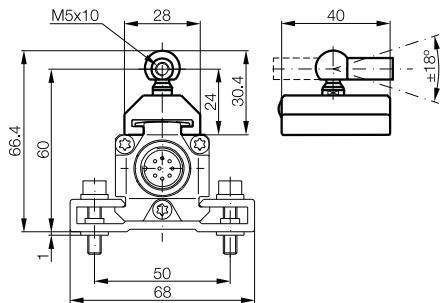


Profile P BTL

Captive position encoders

Position encoder

Profile P BTL
Captive
BAM014H
BTL5-F-2814-1S
Anodized aluminum
Plastic
approx. 28 g
any
-40...+85 °C



Description

for Series

Version

Part number

Material

Weight

Joint rod

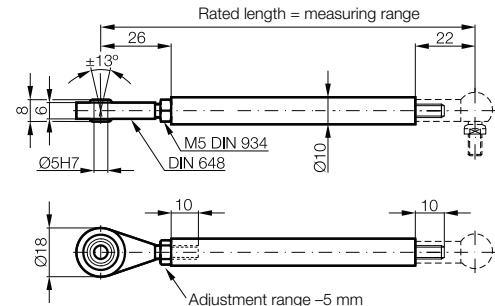
Profile P

Captive

BTL2-GS10-__-A

Aluminum

approx. 150 g/m



Micropulse
Transducers

Profile P BTL7
General
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CANopen
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DeviceNet
Interface
Profinet
Interface

Floating Position
Encoders
Captive Position
Encoders

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact
and Rod AR

Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

Accessories

Basic
Information and
Definitions

Please enter the code for the
rated length in the part number.

Ordering example:

B T L 2 - G S 1 0 - __ - __ - A

Standard nominal strokes [mm]

0075	0100	0125
0150	0200	0250
0350	0400	0450
0500	0600	0800
1000	1500	2000



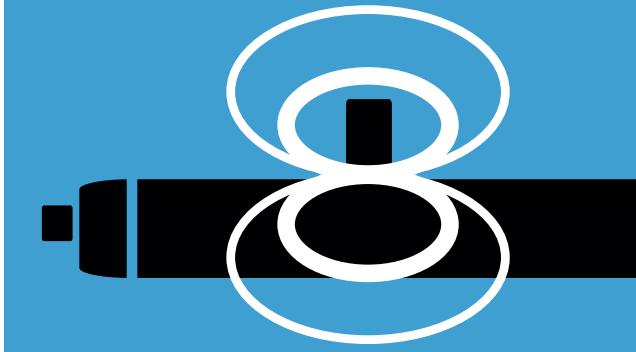
Swivel eye

Material number 714619



When using captured encoders with ball joint and control arm,
transverse forces do not impinge on the transducer system.

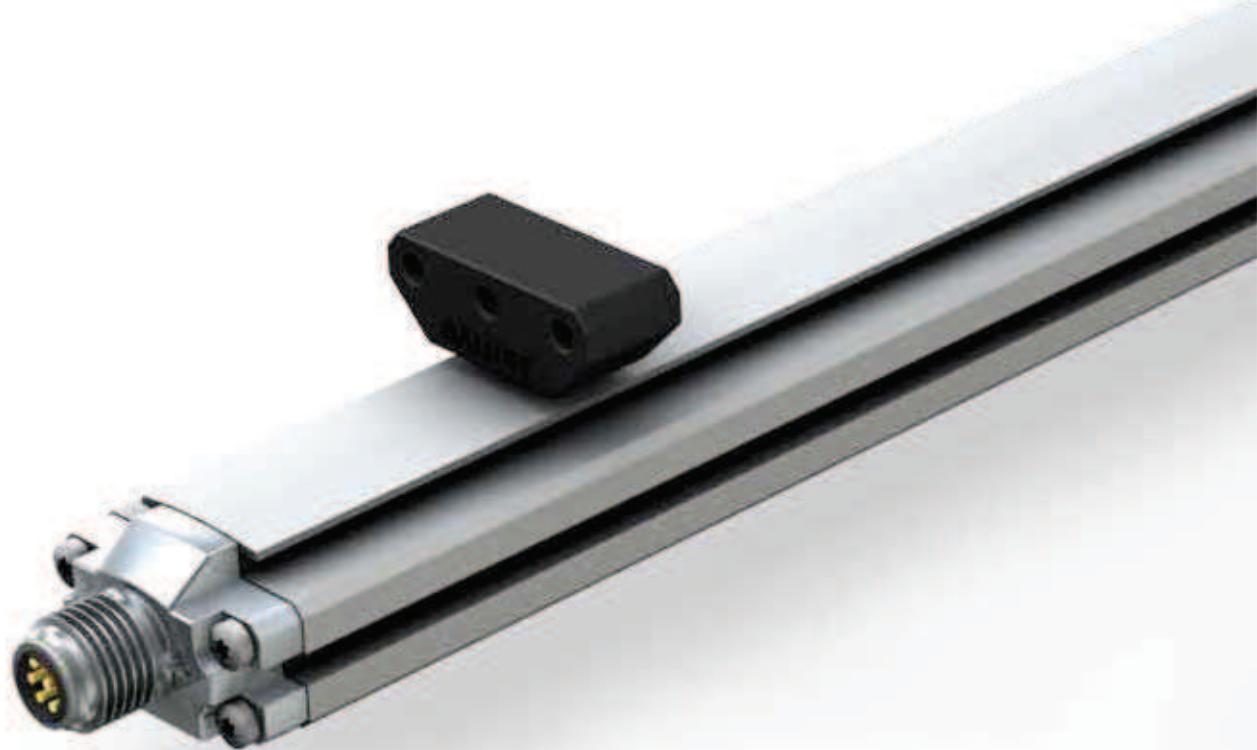




Micropulse Transducers

Profile PF

- Flat design, fits in every niche
- Easy to install
- Characteristic curve setting with LED support for quick commissioning
- High degree of protection, IP 67 standard
- Up to 15 mm distance between position encoder and system – truly contactless!
- Floating and captive ball joint arm position encoders
- Available with the entire series of analog signals

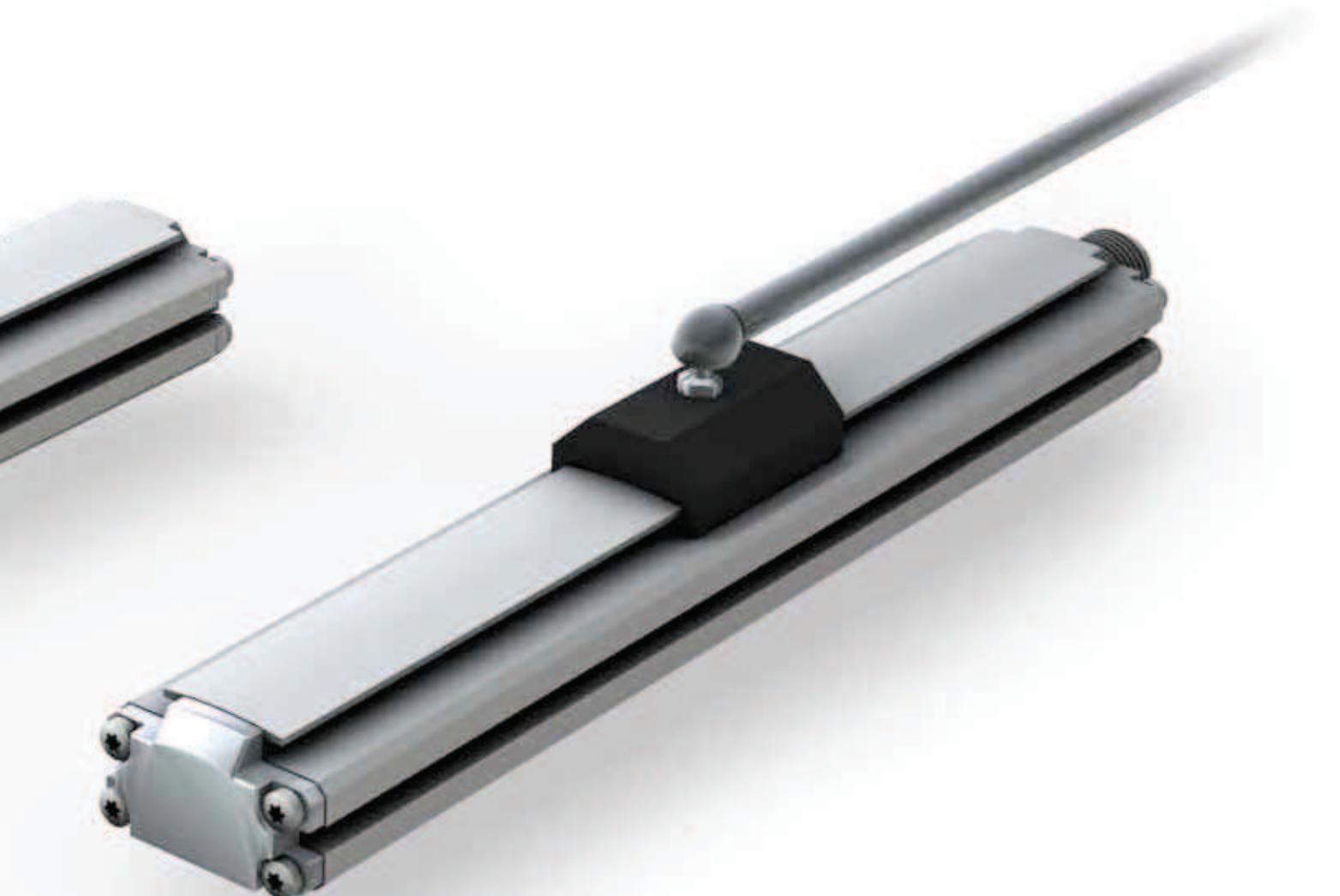


PF

General Data	120
Analog Interface	122
IO Link V1.1	124
Floating Position Encoders	126
Captive Position Encoders	128



MICRO PULSE[®]



The structural design, high degree of protection and simple installation of Balluff Micropulse transducers in a profiled housing makes them an excellent alternative to linear transducers, e.g. potentiometers, glass rulers and LVDTs. The measurement section is protected inside an extruded aluminum profile. A passive encoder with no power supply marks the measuring point on the measuring path without making contact. Measuring ranges between 50 and 4572 mm are possible.

- Non-contact detection of the measuring position
- IP 67, insensitive to contamination
- Wear-free
- Insensitive to shock and vibration
- Absolute output signal
- Max. resolution of 0.005 mm (depending on the electronic processor unit)
- Direct signal evaluation or in conjunction with processor units for all control and closed-loop systems



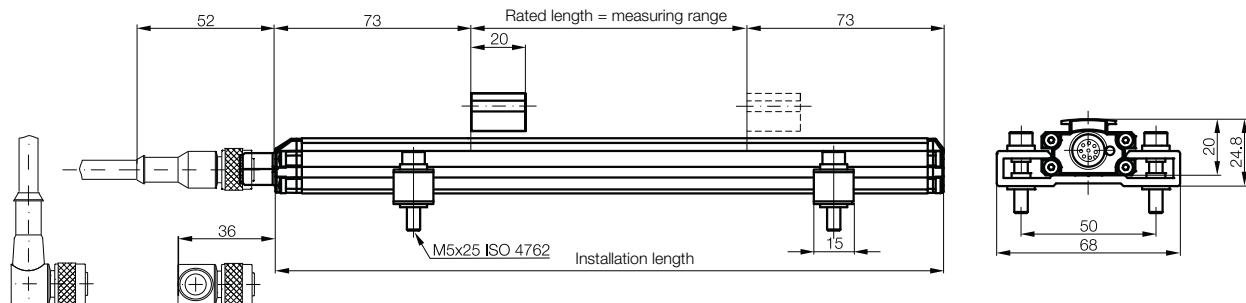
Caution!

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

Profile PF General data

Series	Profile PF BTL6
Shock load	50 g/6 ms as per IEC 60068-2-27
Vibration	12 g, 10...2000 Hz as per EN 60068-2-6
Polarity reversal protected	Yes (up to 36 V)
Overvoltage protection	to 36 V
Dielectric strength	500 VDC (GND to housing)
Degree of protection as per IEC 60529	IP 67 (with IP-67 connector BKS-S... attached)
Housing material	Anodized aluminum
Housing attachment	Compression clamps
Connection	Connectors
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]	0050...4572 in 5-mm increments

Transducers with floating position encoder and connection S115 with BKS-S115/BKS-S116 connector



Scope of delivery

- Transducer (select your interface from page 122)
- Quick start instructions
- Mounting clamps with insulating sleeves and screws

Please order separately:

Position encoders, see page 126

Plug connectors, see page 260



Micropulse
Transducers

Profile P

Profile PF

General
Data

Analog
Interface

IO-Link V1.1

Floating Position
Encoders

Captive Position
Encoders

Profile AT

Profile BIW

Rod

Rod Compact
and Rod AR

Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

Accessories

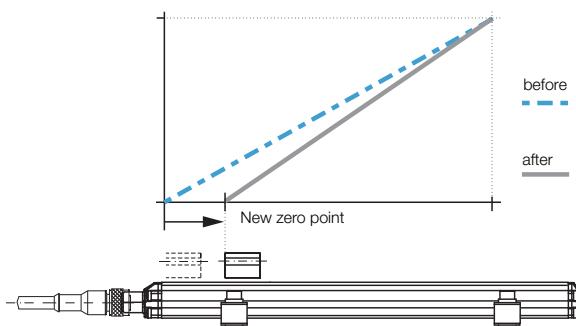
Basic
Information and
Definitions

Output and measuring range setting

The measuring range and the output signal can be adapted to the relevant application requirements via programming inputs. In teach-in mode with inversion or reset function.

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.



Read in new zero point

Inverting (only with BTL-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.

Reset

Restoring the transducer to its factory default settings.

Calibration box with cable set

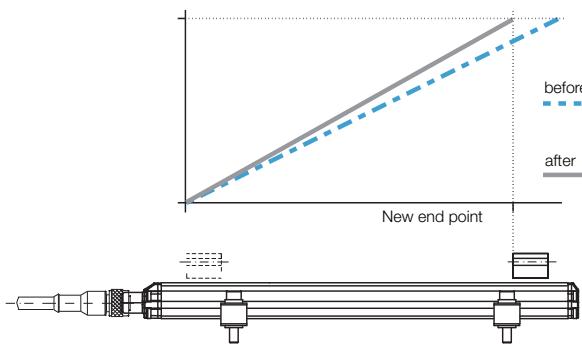
Part number	Cable set
BTL7-A-CB02	Cable connection
BTL7-A-CB02-S115	Plug connector S115
BTL7-A-CB02-S32	Connector S32

**Micropulse Transducer BTL6 profile PF with
Calibration Box BTL7-A-CB02**



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

Series
Output signal
Transducer interface
Customer device interface
Part number
Output voltage
Output current
Load current
Max. residual ripple
Load resistance (recommended)
System resolution
Measurement rate
Max. linearity deviation
Temperature coefficient
Supply voltage
Current consumption
Operating temperature
Storage temperature



Read in new end point

Profile PF Analog interface

Profile PF BTL6	Profile PF BTL6	Profile PF BTL6	Profile PF BTL6
Analog	Analog	Analog	Analog
A	E	C	G
Analog	Analog	Analog	Analog
BTL6- A 500-M_ _ _ -PF-S115	BTL6- E 500-M_ _ _ -PF-S115	BTL6- C 500-M_ _ _ -PF-S115	BTL6- G 500-M_ _ _ -PF-S115
0...10 V	4...20 mA	0.1...20 mA	-10...10 V
Max. 5 mA			Max. 5 mA
$\leq 5 \text{ mV}$			$\leq 5 \text{ mV}$
	$\leq 500 \Omega$ (500 Ω)	$\leq 500 \Omega$ (500 Ω)	
$\leq 0.35 \text{ mV}$	$\leq 0.7 \mu\text{A}$	$\leq 0.7 \mu\text{A}$	$\leq 0.35 \text{ mV}$
$f_{\max} = 2 \text{ kHz}$			
$\pm 200 \mu\text{m}$ up to 500 mm rated length	$\pm 200 \mu\text{m}$ up to 500 mm rated length	$\pm 200 \mu\text{m}$ up to 500 mm rated length	$\pm 200 \mu\text{m}$ up to 500 mm rated length
$\pm 0.04\%$ 500... max. rated length			
30 ppm at 500 mm			
10...30 V DC	10...30 V DC	10...30 V DC	10...30 V DC
$\leq 150 \text{ mA}$			
-25...+70 °C	-25...+70 °C	-25...+70 °C	-25...+70 °C
-40...+100 °C	-40...+100 °C	-40...+100 °C	-40...+100 °C



Micropulse
Transducers

Profile P

Profile PF
General
Data
Analog
Interface

IO-Link V1.1
Floating Position
Encoders

Captive Position
Encoders

Profile AT

Profile BIW

Rod

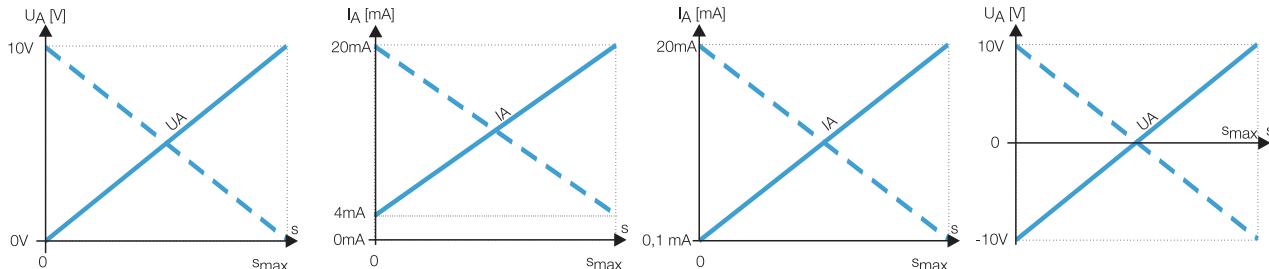
Rod Compact
and Rod AR

Rod EX,
T Redundant
and CD

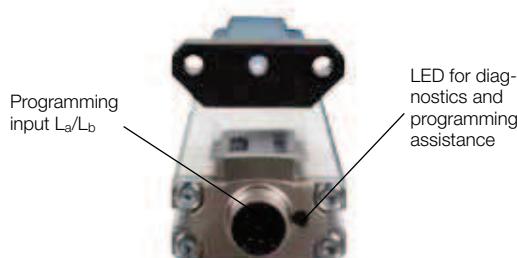
Filling Level
Sensor SF

Accessories

Basic
Information and
Definitions



Output signal can be inverted via programming inputs



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

Scope of delivery

- Transducer
- Mounting clamps with insulating sleeves and screws
- Quick start instructions

Please order separately:

- Position encoders, see page 126
- Plug connectors, see page 252

Ordering example:

B T L 6 - _ 5 0 0 - M _ _ _ - P F - S 1 1 5

Output signal	Standard nominal strokes [mm]
A 0...10 V	0050...4572 in 5-mm increments
E 4...20 mA	
C 0.1...20 mA	
G -10...10 V	

Contactless position measurement technology with IO-Link

Micropulse PF IO-Link is an absolute and non-contact position measurement system that continuously provides measured values in μm on a 1 ms cycle. These measured values are directly transferred digitally via IO-Link.

IO-Link is a point-to-point connection within any number of networks. An IO-Link system consists of an IO-Link device such as a sensor or actuator, an IO-Link master and wiring. The IO-Link master is either an integrated/modular IP20 module for central operation in the control cabinet or as a remote I/O module in IP 65/67 degree of protection for tough applications directly in the field. Master modules are available with all current field bus protocols. The Micropulse PF IO-Link device is coupled to the master via a maximum 20 m long standard sensor/actuator line. The Micropulse PF IO-Link works at COM3 communication speed (230 kBaud), which can achieve a process data cycle of 1 ms with a 1.1 master. Data transmission between the master and the device utilizes three-conductor physics well-known in the world of standard sensor/actuators. A standard UART protocol is used. The exact nature of the data packets defines the IO-Link protocol. Via IO-Link, the user interface can be mapped based on an IODD (IO Device Description) in the engineering system. Due to the continuous flow of information, all data is centrally and consistently saved, so that a configuration is possible and reproducible at any time.

- Simple configuration, time-saving installation and startup
- OTF, automatic configuration in running operation (on the fly)
- Continuous monitoring and diagnostics
- High transfer rate, quick process data cycle
- Cost-effective wiring with standard M12 cable plug connector
- Simple control integration via standard IO-Link modules
- For use in rough industrial environments, with IP-67 IO-Link master modules from Balluff
- Process data 32 bit signed integer
- Output resolution 1 μm /digit
- Diagnostics + error value recognition

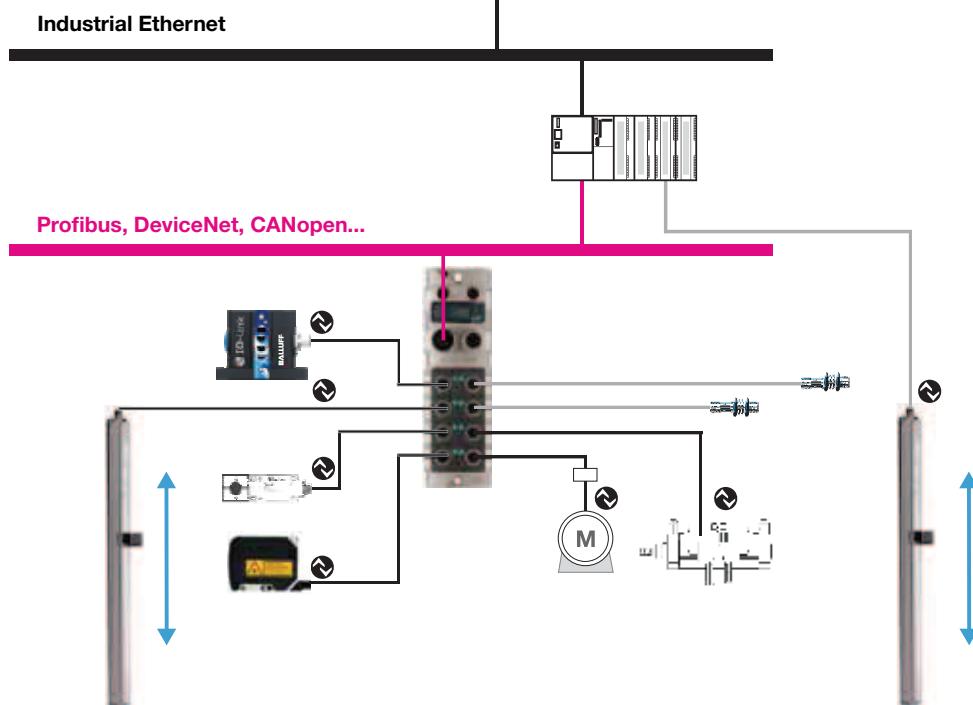
Additional information

About IO-Link: www.io-link.com

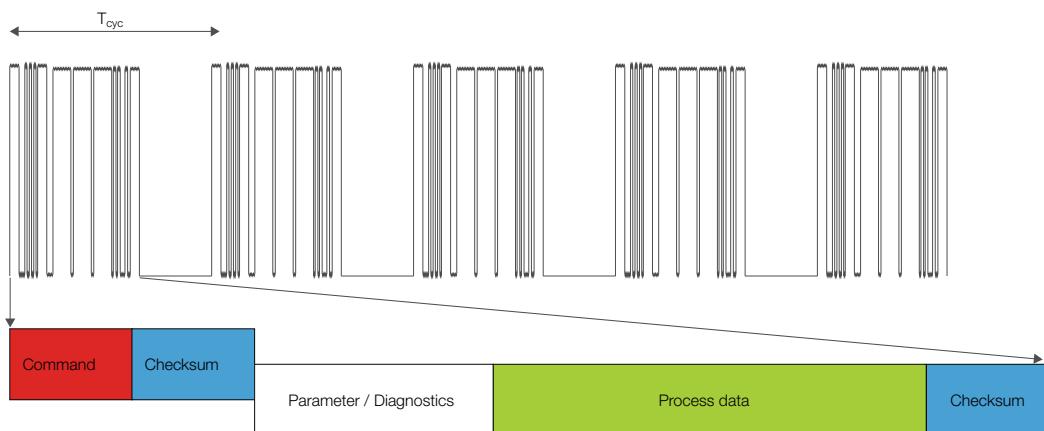
You can find the compact IO-Link product line in the **Industrial Networking and Connectivity** catalog.



IO-Link



Series	Profile PF BTL6
Output signal	IO-Link V1.1
Transducer interface	U110
Part number	BTL6-U110-M_ _ _ -PF-S4
System resolution	5 µm
Repeat accuracy	≤ 30 µm
Measurement rate	f _{STANDARD} = 1 kHz (< 1300 mm)
Linearity deviation	≤ ±200 µm up to 500 mm rated length
Supply voltage	±0.04 %
Current consumption	18...30 V DC
Polarity reversal protected	≤ 150 mA
Operating temperature	yes
Storage temperature	-25...+70 °C
Mode	-40...+100 °C
Transmission rate	COM 3
Process data cycle	230.4 kbaud
Process data	1 ms
Parameters	Position value in µm
Diagnostics	Measuring range, zero point
	Position encoder in the measuring range, below, above, no magnet



Please enter the code for the rated length in the part number.

Ordering example:

B T L 6 - U 1 1 0 - M _ _ _ - P F - S 4

**Standard
nominal strokes [mm]**

0050...4572 mm in 5-mm increments

Please order separately:

Position encoders, see page 126

See separate catalog for plug connectors:

Industrial networking and connectivity



Micropulse
Transducers

Profile P

Profile PF

General
Data

Analog
Interface

IO-Link V1.1

Floating Position
Encoders

Captive Position
Encoders

Profile AT

Profile BIW

Rod

Rod Compact
and Rod AR

Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

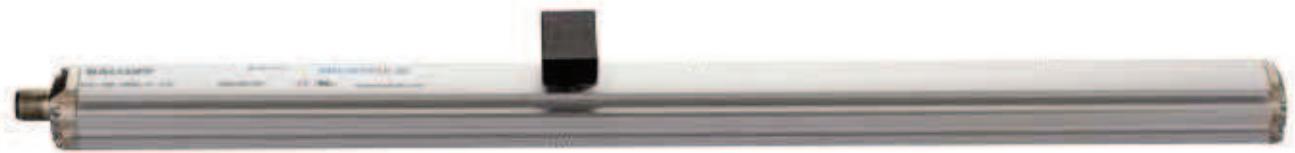
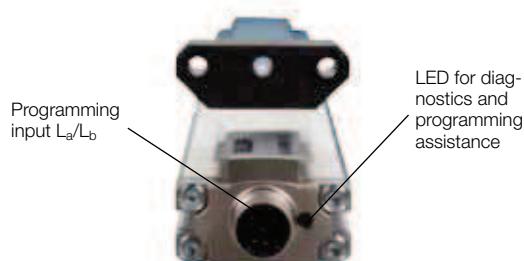
Accessories

Basic
Information and
Definitions

Balluff encoders are available in captive or floating designs. Maximum resolution and reproducibility are achieved using transducers with captive encoders.

The position encoder BTL5-P-4500-1 is an electromagnet and requires an operating voltage of 24V, which can be turned on and off for selective activation. This allows multiplex operation with multiple encoders on a single transducer, since only one encoder is active at a time.

Description for Series
Version
Ordering code
Part number
Housing material
Weight
Position encoder travel speed
Supply voltage
Current consumption
Operating temperature/Storage temperature range
Scope of delivery
Accessories (please order separately)



Caution!

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

Length		Number of mounting clamp pairs
	to	250 mm
251	to	750 mm
751	to	1250 mm
1251	to	1750 mm
1751	to	2250 mm
2251	to	2750 mm
2751	to	3250 mm
3251	to	3750 mm
3751	to	4250 mm
	more than	4251 mm

Mounting clamps with insulating sleeves and screws included in the scope of delivery of the transducer.

Replacement:
BTL6-A-MF07-A-PF/M5 1 pair of
brackets and screws,
ordering code: **BAM01N3**



Profile PF

Floating position encoders

Position encoder	Position encoder	Position encoder
Profile PF BTL	Profile PF BTL	Profile PF BTL
Floating	Floating	Floating
BAM014M	BAM014T	BAM014P
BTL5-P-3800-2	BTL5-P-5500-2	BTL5-P-4500-1
Plastic	Plastic	Plastic
approx. 12 g	approx. 40 g	Approx. 90 g
any	any	any
-40...+85 °C	-40...+85 °C	-40...+60 °C
Position encoder	Position encoder	Position encoder
2 fastening screws DIN 84 M4x35-A2 with washers and nuts		
		Connector, straight*
		BCC M415-0000-1A-014-PS0434-...
		Connector, angle*
		BCC M425-0000-1A-014-PS0434-...



Micropulse
Transducers

Profile P

Profile PF

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Analog
Interface
IO-Link V1.1

**Floating Position
Encoders**

Captive Position
Encoders

Profile AT

Profile BIW

Rod

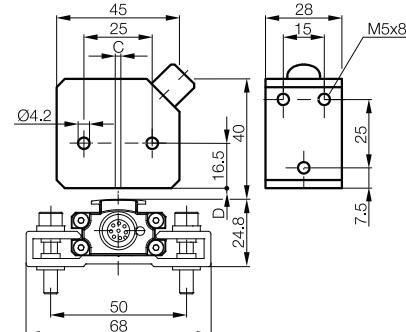
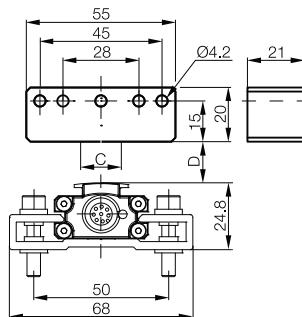
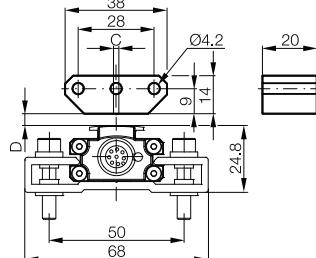
Rod Compact
and Rod AR

Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

Accessories

Basic
Information and
Definitions

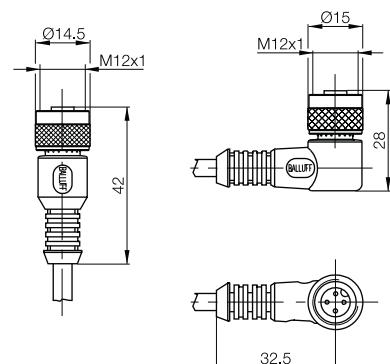


Lateral offset:
C = ± 2 mm
Distance of position encoder:
D = 0.1...4 mm

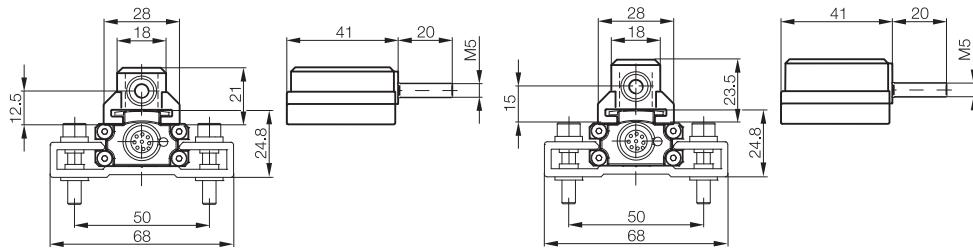
Lateral offset:
C = ± 15 mm
Distance of position encoder:
D = 5...15 mm

Lateral offset:
C = ± 2 mm
Distance of position encoder:
D = 0.1...2 mm

* Please include the cable length code
in the part number.
020 = 2 m, 050 = 5 m, 100 = 10 m



Description for Series	Position encoder	Position encoder
Version	Profile PF BTL	Profile PF BTL
Ordering code	Captive BAM014K	Captive BAM014L
Part number	BTL5-M-2814-1S	BTL5-N-2814-1S
Material	Housing	Anodized aluminum
	Sliding surface	Plastic
Weight	Approx. 32 g	Approx. 35 g
Position encoder travel speed	any	any
Operating temperature/Storage temperature range	-40...+85 °C	-40...+85 °C



Caution!

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

Length			Number of mounting clamp pairs
	to	250 mm	1
251	to	750 mm	2
751	to	1250 mm	3
1251	to	1750 mm	4
1751	to	2250 mm	5
2251	to	2750 mm	6
2751	to	3250 mm	7
3251	to	3750 mm	8
3751	to	4250 mm	9
	more than	4251 mm	10

Mounting clamps with insulating sleeves and screws included in the scope of delivery of the transducer.

Replacement:
BTL6-A-MF07-A-PF/M5 1 pair of brackets and screws, ordering code: **BAM01N3**



Profile PF

Captive position encoders

Position encoder	Position encoder	Joint rod
Profile PF BTL	Profile PF BTL	Profile PF BTL
Captive	Captive	Captive
BAM014H	BAM01FC	
BTL5-F-2814-1S	BTL5-T-2814-1S	BTL2-GS10-_____A
Anodized aluminum	Anodized aluminum	Aluminum
Plastic	Plastic	
approx. 28 g	approx. 28 g	approx. 150 g/mg
any	any	
-40...+85 °C	-40...+85 °C	



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Floating Position
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**Captive Position
Encoders**

Profile AT

Profile BIW

Rod

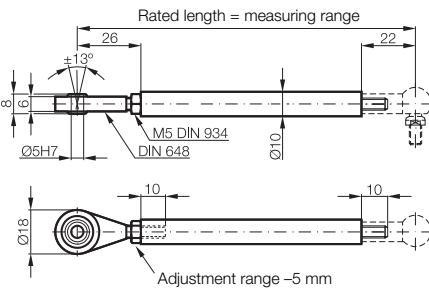
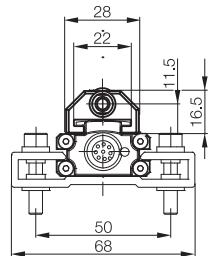
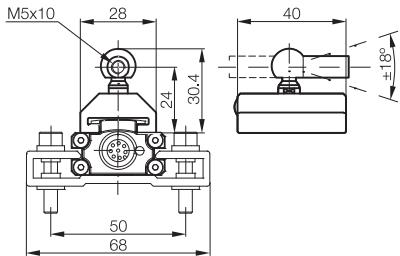
Rod Compact
and Rod AR

Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

Accessories

Basic
Information and
Definitions



Please enter the code for the rated length
in the part number.

Ordering example:

B T L 2 - G S 1 0 - _____ - A



Standard nominal strokes [mm]

0075	0100	0125
0150	0200	0250
0350	0400	0450
0500	0600	0800
1000	1500	2000

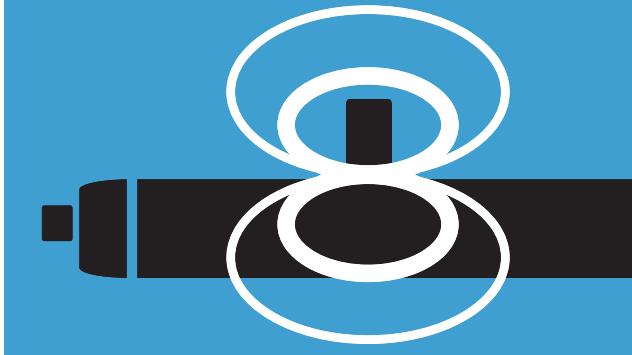
When using captured encoders with
ball joint and control arm, transverse
forces do not impinge on the transducer
system.

Swivel eye

Material number 714619



When using captured encoders with
ball joint and control arm, transverse
forces do not impinge on the transducer
system.



Micropulse Transducers

Profile AT

- In a robust 30-mm pipe housing for universal fastening
- The cost-effective, contactless position measuring solution
- Multiple paths – one system, which measures position in many paths
- With analog output signal and Real-Time Ethernet



AT

General Data	132
Analog Interface	134
Operating Modes	136
Digital Pulse Interface	138
Ethernet interface	140
Accessories	142



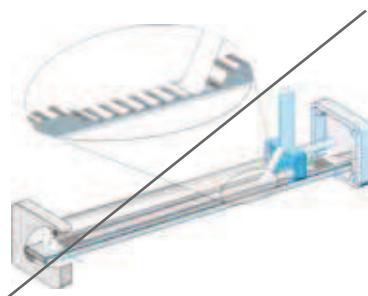
MICRO PULSE[®]



Micropulse transducers – a contactless alternative to contacting transducers

The structural design, high degree of protection and simple installation of non-contact Balluff Micropulse AT transducers in a profiled housing makes them an excellent alternative to contacting potentiometers. The measurement section is protected inside an extruded aluminum profile.

A passive encoder with no power supply marks the measuring point on the measuring path without making contact. Measuring ranges between 50 and 1,500 mm are possible.



- Non-contact detection of the measuring position
- IP 67, insensitive to contamination
- Wear-free
- Insensitive to shock and vibration
- Absolute output signal
- Direct signal evaluation or in conjunction with processor units for all control and closed-loop systems



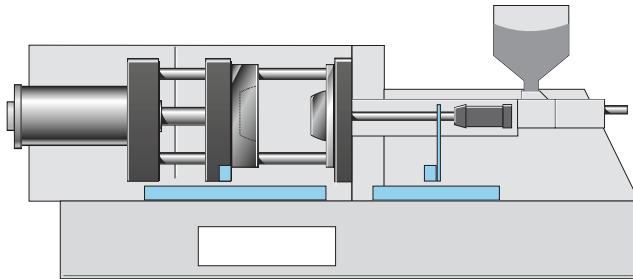
This product is
certified according to
File No. E227256.

From optional to standard

Micropulse transducers have long been standard in the plastics machinery industry on high-precision machines and offered on standard machines as a non-contact option for potentiometric systems. The only thing that has stood in the way of more widespread use has been the comparatively high price.

The Micropulse AT has been designed in cooperation with development engineers from the plastics machinery industry and represents a system that is competitively priced and meets all the technical demands of the industry.

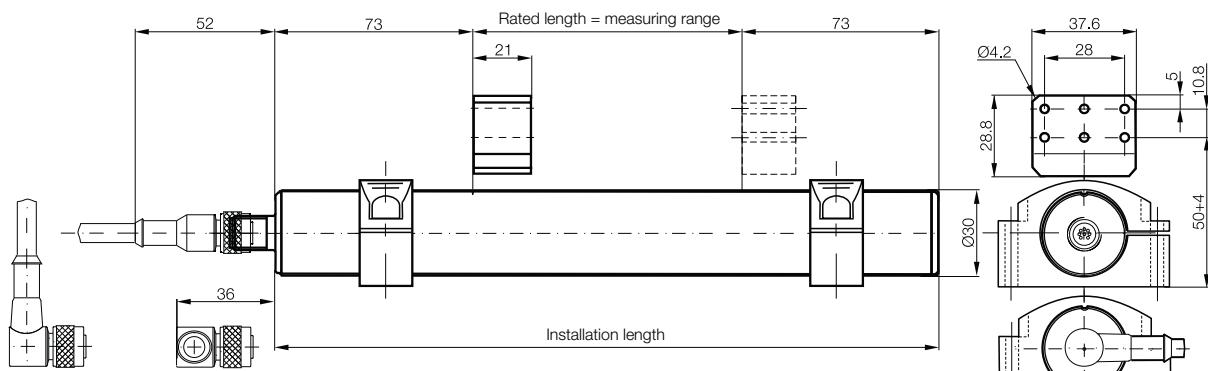
With the Micropulse AT position feedback system, now even standard machines can feature the benefit of minimum downtime provided by non-contact transducer systems.



Profile AT General data

Series	Profile A1 BTL6
Part number	BTL6-__-M__-A1-S115
Part number	BTL6-A301-M__-A1-S115
Shock load	50 g/6 ms as per IEC 60068-2-27
Vibration	12 g, 10...2000 Hz as per EN 60068-2-6
Polarity reversal protected	yes
Oversupply protection	yes
Degree of protection as per IEC 60529	IP 67 (with IP-67 connector BKS-S... attached)
Housing material	Anodized aluminum
Housing attachment	Mounting clamps
Connection	Connector M12, 8-pin standard
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	EN 61000-4-6 Severity level 3
induced by high-frequency fields	EN 61000-4-8 Severity level 4

Transducers with floating position encoder and connection S115 with plug connector BKS-S115/BKS-S116 for transducer with analog interface, Digital Pulse Interface and VARAN Bus interface on page 134



Caution!

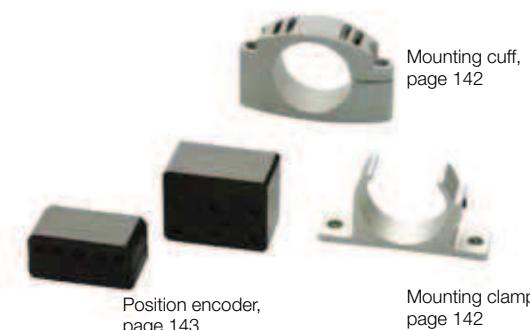
Before design, installation and startup please familiarize yourself with the user's guide to be found at www.balluff.com.

Scope of delivery

- Transducer (select your interface from page 134)
- Quick start instructions

Please order separately:

- Position encoders, see page 143
- Mounting clamps/cuff, see page 142
- Plug connectors, see page 252



Mounting cuff,
page 142

Mounting clamps,
page 142



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Transducers

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Profile BIW

Rod

Rod Compact
and Rod AR

Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

Accessories

Basic
Information and
Definitions

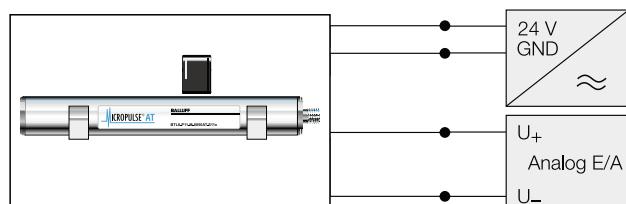
Profile AT

Analog interface

The analog outputs of the standard series BTL6-A110 are non-floating. BTL6 transducers exist in the variants 0...10 V and -10...10 V with rising and falling characteristics. The version -10...10 V generally has floating output signals.



Connection scheme potentiometer, block diagram



Micropulse Transducer connections, block diagram

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

Preferred models

BTL6-A110-M_ _ _ -A1-S115

are available from stock in the rated lengths highlighted in blue.

Scope of delivery

- Transducer
- Quick start instructions

Please order separately:

Position encoders, see page 143

Mounting clamps/cuff, see page 142

Plug connectors, see page 252

Ordering example:

BTL6- _ _ 10 - M_ _ _ - A1 - S115



Output signal	Characteristic
A 0...10 V	1 Non-floating*
10...0 V	3 Floating

Output signal	Characteristic
G -10...10 V	1 Non-floating*
-10...10 V	3 Floating

Standard nominal strokes [mm]

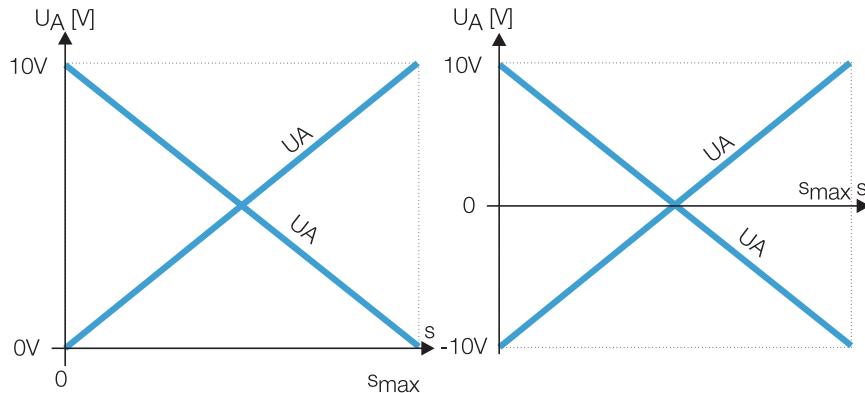
0100	0130	0150	0160	0175	0200	0225
0250	0275	0300	0325	0350	0360	0375
0400	0425	0450	0475	0500	0550	0600
0650	0700	0750	0800	0850	0900	0950
1000	1100	1200	1250	1300	1400	1500

in 25-mm increments on request

*only for BTL6-A110-M_ _ _ -A1-S115

Profile AT Analog interface

Series	Profile A1 BTL6	Profile A1 BTL6
Output signal	Analog	Analog
Transducer interface	A	G
Customer device interface	Analog	Analog
Part number	BT6-A110-M_ _ _ -A1-S115	BT6-G310-M_ _ _ -A1-S115
Output voltage	0...10 V and 10...0 V	-10...10 V and 10...-10 V
Load current	Max. 5 mA	Max. 5 mA
Max. residual ripple	$\leq 5 \text{ mV}$	$\leq 5 \text{ mV}$
System resolution	$\leq 10 \text{ \mu m}$	$\leq 10 \text{ \mu m}$
Repeat accuracy	$\leq 10 \text{ \mu m}$	$\leq 10 \text{ \mu m}$
Reproducibility	$\leq 20 \text{ \mu m}$	$\leq 20 \text{ \mu m}$
Measurement rate	$f_{\text{STANDARD}} = 1 \text{ kHz}$	$f_{\text{STANDARD}} = 1 \text{ kHz}$
Linearity deviation	$\leq \pm 200 \text{ \mu m}$ up to 500 mm rated length typ. $\pm 0.02\%$, max. $\pm 0.04\%$ 500...1500 mm rated length	$\leq \pm 200 \text{ \mu m}$ up to 500 mm rated length typ. $\pm 0.02\%$, max. $\pm 0.04\%$ 500...1500 mm rated length
Supply voltage	20...28 V DC	20...28 V DC
Current consumption	$\leq 70 \text{ mA}$	$\leq 70 \text{ mA}$
Polarity reversal protected	yes	yes
Operating temperature	0...+70 °C	0...+70 °C
Storage temperature	-40...+100 °C	-40...+100 °C



Micropulse
Transducers

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Profile AT

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Accessories

Profile BIW

Rod

Rod Compact
and Rod AR

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Filling Level
Sensor SF

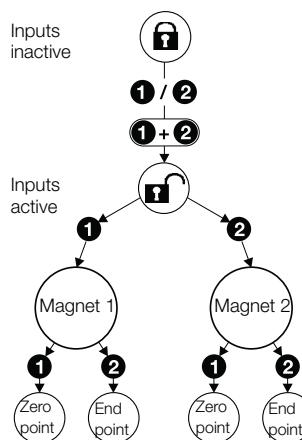
Accessories

Basic
Information and
Definitions



BTL6-A301-... Two become one

Two moving members on a machine often travel in the same direction. Each axis normally requires a separate feedback sensor. With the Micropulse AT, it is now possible to detect two movements at the same time using just one sensor with two analog outputs. The position of the respective zero and end points can be set individually using programming inputs. The two measuring ranges can be adjacent, can partially overlap, and can be programmed for a rising or falling characteristic. The transducer can be operated using one or two encoders. If one encoder leaves the measuring range or if only one is present, the position is indicated on Output 1. Output 2 then indicates an error value.



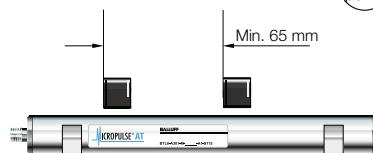
Teach-in

The zero and end points set at the factory are to be replaced by the new zero and end points. First, the encoder must be brought to the new zero point and then to the new end position, and the respective values stored by pressing the button.

Example: Programming steps for setting the measuring range

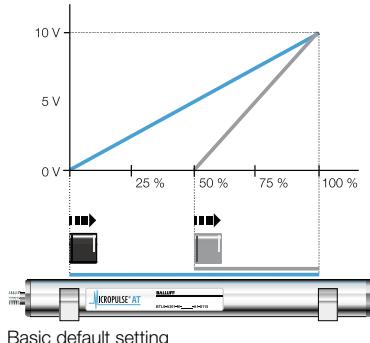
Mode selection

The standard function is the separate measurement of two positions. The programming inputs are used to switch the mode.

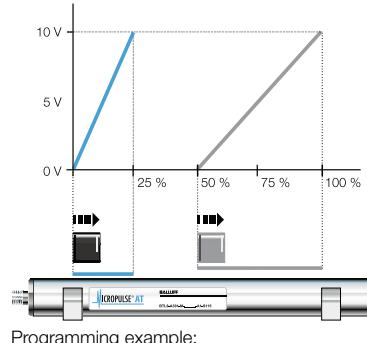


The separation between two encoders should not generally be less than 65 mm.

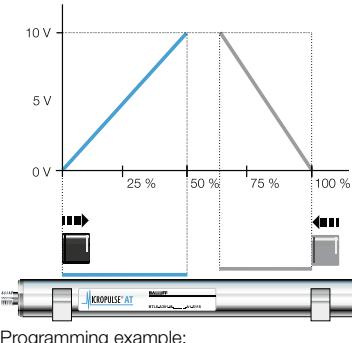
Mode 1: Single measurement of 2 positions (single measurement default setting 100%/50%)



Basic default setting

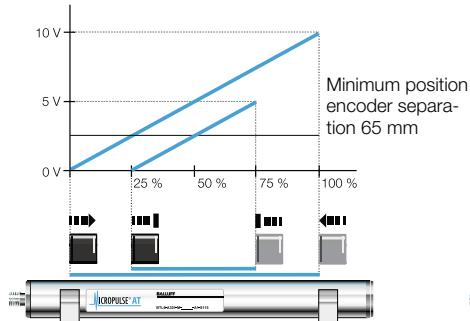


Programming example:
Output 1: 25% rated length, signal rising
Output 2: 50% rated length, signal rising

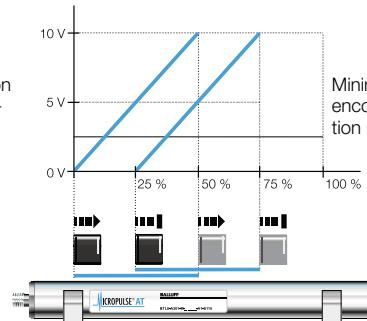


Programming example:
Output 1: 50% rated length, signal rising
Output 2: 37.5% rated length, signal falling

Mode 2: Differential measurement between 2 position encoders

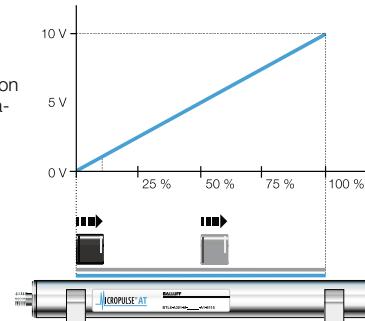


Default setting: Differential measurement
Output 1: Standard displacement signal (not shown)
Output 2: Differential signal 100% rated length = 10 V
Programming example:
Differential displacement 50% rated length = 5 V differential signal



Programming example: Differential displacement 50% rated length = 10 V differential signal

Mode 3: Single measurement (both encoders 0...100%)



Profile AT

Operating modes

Features of Micropulse BTL6-A

- 100% setting range of the analog signals
- Error signal value, no position encoder in the measuring range, transducer in setting mode
- LED display for programming support
- Separate teach-in of all zero and end points
- Freely selectable single position or differential measurement

Measure two motions with one system

- One transducer measures two movements simultaneously.
- Substantial cost reduction, because installation costs are halved.
- Two analog outputs 0...10 V

Series	Profile A1 BTL6
Output signal	Analog
Transducer interface	A
Customer device interface	Analog
Part number	BTL6-A301-M_ _ _ -A1-S115
Output	Floating
Output voltage	0...10 V programmable
Load current	Max. 5 mA
Max. residual ripple	$\leq 5 \text{ mV}$
System resolution	$\leq 10 \mu\text{m}$
Repeat accuracy	$\leq 10 \mu\text{m}$
Reproducibility	$\leq 20 \mu\text{m}$
Measurement rate	$f_{\text{STANDARD}} = 1 \text{ kHz} (< 850 \text{ mm})$
Linearity deviation	$\leq \pm 200 \mu\text{m}$ up to 500 mm rated length typ. $\pm 0.02\%$, max. $\pm 0.04\%$ 500...1500 mm rated length
Supply voltage	18...30 V DC
Current consumption	$\leq 100 \text{ mA}$
Polarity reversal protected	yes
Operating temperature	0...+70 °C
Storage temperature	-40...+100 °C



Micropulse
Transducers

Profile P

Profile PF

Profile AT

General
Data

Analog
Interface

Operating
Modes

Digital Pulse
Interface

Ethernet
Interface

Accessories

Profile BIW

Rod

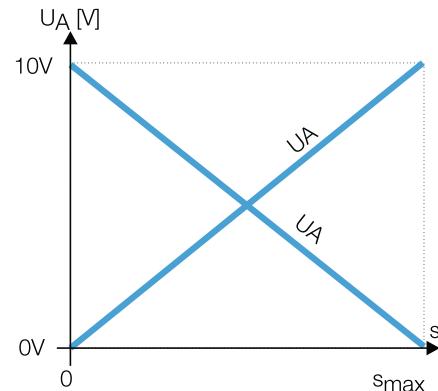
Rod Compact
and Rod AR

Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

Accessories

Basic
Information and
Definitions



Please enter the code for the rated length in the part number.

Ordering example:

B T L 6 - A 3 0 1 - M _ _ _ - A 1 - S 1 1 5

Characteristic

Electrically separated
2 analog outputs
Individual or differential
measurement, rising,
falling, zero and end point
programmable

Standard Rated length [mm]

0160 0175 0200 0225 0250 0275 0300
0325 0350 0360 0375 0400 0425 0450
0475 0500 0550 0600 0650 0700 0750
0800 0850 0900 0950 1000 1100 1200
1250 1300 1400 1500
in 25-mm increments on request

Standard rated length (mm):
0050, 0100, 0130, 0150 for single magnet only

Preferred models interface A301

BTL6-A301-M_ _ _ -A1-S115
are available from stock in the rated lengths highlighted in blue.

Scope of delivery

- Transducer
- Quick start instructions

Please order separately:

Position encoders, see page 143

Mounting clamps/cuff, see page 142

P110 interface

The P110 interface works with Balluff BTA processor units and controllers and modules from various manufacturers, e.g. Siemens, B & R, Bosch, Phoenix Contact, Mitsubishi, Sigmatek, Esitron, WAGO and others.

Reliable signal transmission, even over cable lengths up to 500 m, between the BTA processor unit and the transducer is guaranteed by the particularly interference-free RS485 differential drivers and receivers. Interference signals are effectively suppressed.

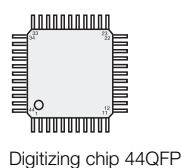
P110 replaces P1 and M1

Based on differing philosophies, two controller-specific interfaces have been established for the digital pulse interface versions. 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 P110 interface was created as a universal pulse interface which combines both functions. The reference point for the propagation time measurement is the start pulse.

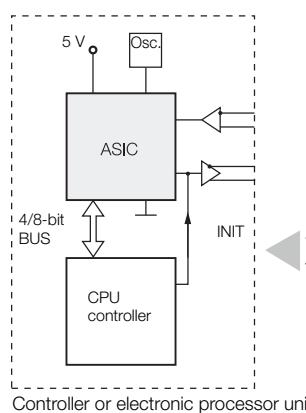


Extremely precise digitizing chip for P110 pulse interface

Companies developing their own electronic control and processor units 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



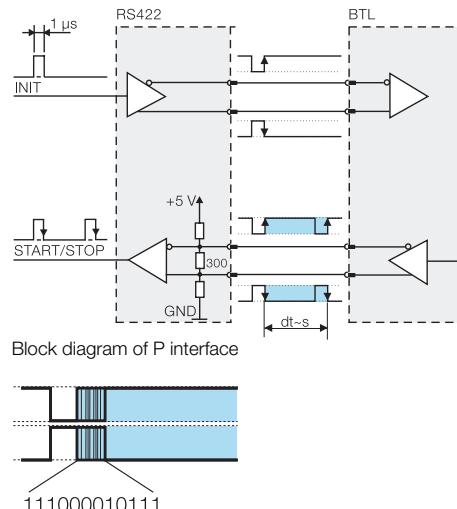
Controller or electronic processor unit

P111 interface – Cost savings using DPI/IP for start-up and installation

DPI/IP is a protocol for direct data exchange between a controller and transducer. The signal lines are used to send additional information such as manufacturer, measuring length and waveguide gradient. This allows start-up or replacement of a transducer without having to make manual changes to the controller parameters.

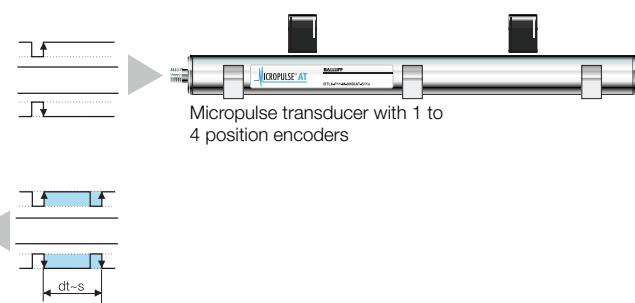
Features

- Bi-directional communication
- Position measurement system controller using Init and start/stop signals
- Integrated diagnostic functions
- Plug and Play
- Automatic configuration – shorter downtimes
- Transmission of sensor type, measuring length, specific parameters
- Measuring length up to 3250 mm



Benefits

- High position resolution: the actual 1 µm resolution of the BTL position measurement system is given comprehensive support 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



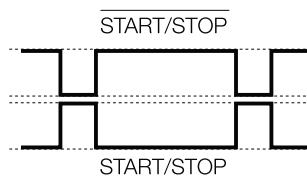
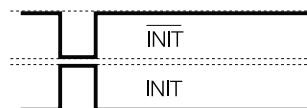
ASIC INFO:
+49 7158 173-370

Profile AT

Digital Pulse Interface

Series	Profile A1 BTL6
Transducer interface	Pulse P11_
Customer device interface	Pulse P11_
Part number	BTL6-P11_ -M_ _ _ -A1-S115
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	20...28 V DC
Current consumption	≤ 60 mA (at 1 kHz)
Operating temperature	0...+70 °C
Storage temperature	-40...+100 °C

The rising and falling edges can be evaluated.



Please enter code for data protocol and rated length in the part number.

Preferred models interface P11_. BTL6-P11_ -M_ _ _ -A1-S115 are available from stock in the rated lengths highlighted in blue.

Scope of delivery

- Transducer
- Quick start instructions

Please order separately:

- Position encoders, see page 143
- Mounting clamps/cuff, see page 142
- Plug connectors, see page 252

Ordering example:

B T L 6 - P 1 1 _ - M _ _ _ - A 1 - S 1 1 5

Data protocol

- 0 without DPI/IP* (standard)
- 1 with DPI/IP

Standard
Rated length [mm]

0050	0075	0100	0130	0150	0160	0175
0200	0225	0250	0300	0350	0360	0400
0450	0500	0550	0600	0650	0700	0750
0800	0850	0900	0950	1000	1100	1200
1250	1300	1400	1500	1700	2000	2100
2500	2800	3000	3250			

in 25-mm increments on request

*The version without DPI/IP is only available up to a rated length of 1,500.



Micropulse
Transducers

Profile P

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Profile AT
General
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Operating Modes
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and Rod AR

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T Redundant
and CD

Filling Level
Sensor SF

Accessories

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Micropulse position measurement system
BTL6-V11_Profile AT with real-time Industrial Ethernet

Precision measurement of the travel path of primary and secondary axes!

Micropulse position measurement systems in a profile housing are non-contact, absolute measurement systems for accurately measuring one or more measurement paths. The position measuring systems are characterized by a stable structure, high degree of protection, simple installation and wear-free measuring principle with a high degree of accuracy. One significant advantage is an economical single plug solution, which in terms of system costs incurred for materials and installation, scores well compared to expensive three-plug models.

Up to four axes with one position measurement system

Up to four passive position encoders with no power supply "mark" the measuring positions on the measuring path without making contact, with measuring ranges from 50 to 4000 mm. The particular attraction of this is that as a result of the system, up to four different paths can be measured simultaneously with one transducer. The position measurement systems tolerate a lateral offset as well as a vertical offset of up to 15 mm.

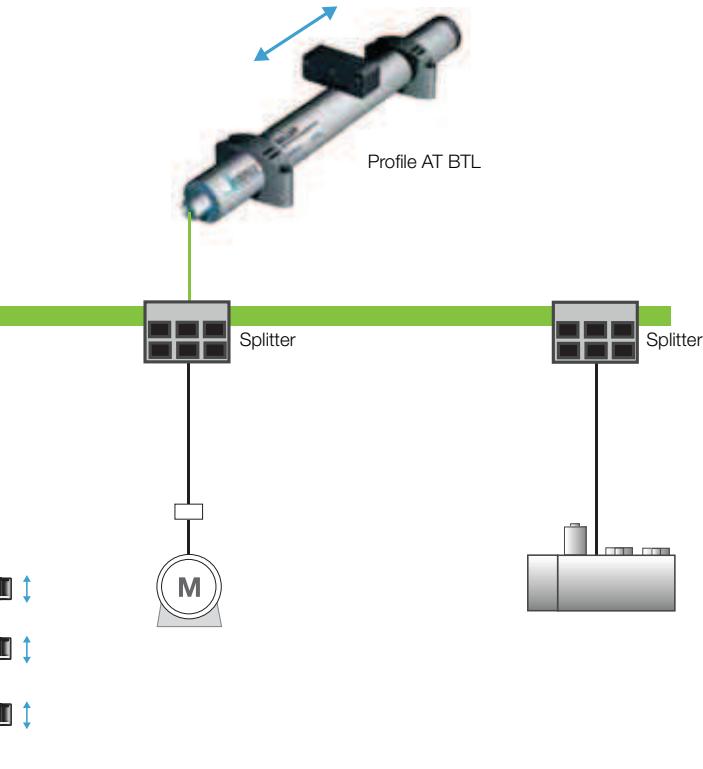
Features

- Non-contact detection of the measuring position
- IP 67, insensitive to contamination
- Insensitive to shock and vibration
- Absolute output signal
- Measuring lengths up to 4012 mm
- Up to 4 measurement paths per system
- Fast, simple mounting
- Single-plug solution – lower system costs.
- Secure data transmission

Additional information

For VARAN, see www.varan-bus.net
or for EtherCAT, see www.ethercat.org

EtherCAT®



MICRO PULSE®

Profile AT

Ethernet interface

Series	Profile A1 BTL6	Profile A1 BTL6
Output signal	VARAN	EtherCAT
Transducer interface	V11V	V11E
Customer device interface	VARAN	EtherCAT
Part number	BTL6- V11V-M ____-A1-S115	BTL6- V11E-M ____-A1-S115
System resolution	≤ 15 µm	≤ 15 µm
Repeat accuracy	≤ 20 µm	≤ 30 µm
Reproducibility	≤ 30 µm	≤ 30 µm
Measurement rate	$f_{STANDARD} = 1 \text{ kHz} (< 850 \text{ mm})$	$f_{STANDARD} = 1 \text{ kHz} (< 850 \text{ mm})$
Linearity deviation	≤ ±200 µm up to 500 mm rated length ±0.04% 500...1500 mm rated length	≤ ±200 µm up to 500 mm rated length ±0.04% 500...1500 mm rated length
Supply voltage	20...28 V DC	20...28 V DC
Current consumption	≤ 75 mA	≤ 100 mA
Polarity reversal protected	yes	yes
Operating temperature	0...+70 °C	0...+70 °C
Storage temperature	-40...+100 °C	-40...+100 °C



Micropulse
Transducers

Profile P

Profile PF

Profile AT
General
Data
Analog
Interface
Operating Modes
Digital Pulse
Interface
**Ethernet
Interface**
Accessories

Profile BIW

Rod

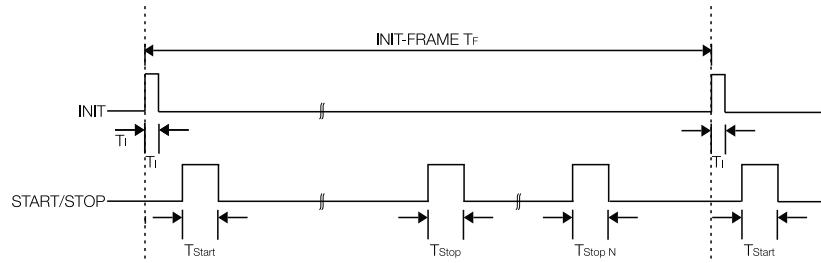
Rod Compact
and Rod AR

Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

Accessories

Basic
Information and
Definitions



Please enter the code for the rated length
in the part number.

Ordering example:

B T L 6 - V 1 1 **- M** **- A 1 - S 1 1 5**

Interface
V VARAN
E EtherCAT

Standard
nominal strokes [mm]

0160 0175 0200 0225 0250 0275 0300
0325 0350 0360 0375 0400 0425 0450
0475 0500 0550 0600 0650 0700 0750
0800 0850 0900 0950 1000 1100 1200
1250 1300 1400 1500 ... 4012
in 25-mm increments on request

Scope of delivery

- Transducer
- Quick start instructions

Please order separately:

- Position encoders, see page 143
- Mounting clamps/cuff, see page 142
- Plug connectors, see page 252

Profile AT

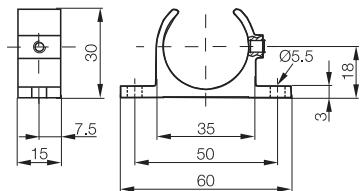
Accessories

The position encoder BTL6-A-3800-2 can be operated at a distance of 4...8 mm from the profile surface.

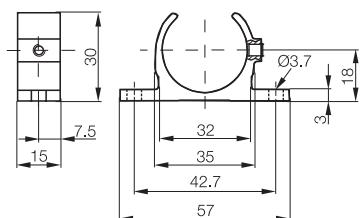
In conjunction with mounting clamp BTL6-A-MF01-A-50 and mounting cuff BTL6-A-MF03-K-50, the mechanical installation is compatible with series BTL5-...-P-S32 with encoder BTL5-P-3800-2 or BTL5-P-5500-2.

As a result, large measurement lengths or transducers with a bus connection, for example, can be implemented optionally without requiring mechanical modifications.

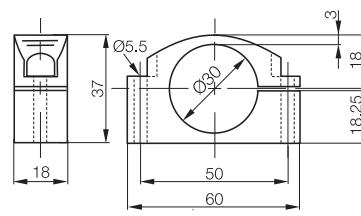
Mounting clamps/cuff



Mounting clamp
Ordering code: **BTL6-A-MF01-A-50**
Includes: 1 clamp
Material: Anodized aluminum



Mounting clamp
Ordering code: **BTL6-A-MF01-A-43**
Includes: 1 clamp
Material: Anodized aluminum



Mounting cuff
Ordering code: **BTL6-A-MF03-A-50**
Includes: 1 cuff
Material: Polyamide

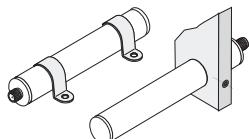
When extreme shock and vibration loads are present, we recommend spacing mounting clamps every 250 mm.

Length		Number of mounting clamp pairs
251	to 250 mm	1
751	to 750 mm	2
1251	to 1250 mm	3
1251	to 1750 mm	4
1751	to 2250 mm	5
2251	to 2750 mm	6
2751	to 3250 mm	7
more than	3251 mm	8

Caution!

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

Application-specific mounting options



For connector accessories, see page 252

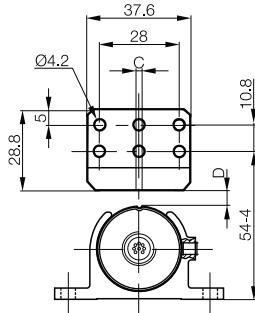


Profile AT Accessories

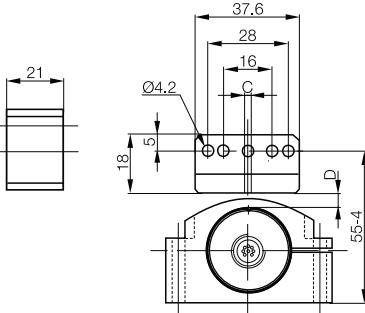
Description for Series	Position encoder	Position encoder
	Profile A1 BTL	Profile A1 BTL
Ordering code	BAM014W	BAM014Z
Part number	BTL6-A-3800-2	BTL6-A-3801-2
Housing material	Plastic	Plastic
Weight	Approx. 30 g	Approx. 25 g
Position encoder travel speed	any	any
Operating temperature/Storage temperature range	-40...+85 °C	-40...+85 °C
Scope of delivery	Position encoder	Position encoder



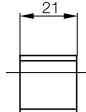
Micropulse
Transducers



Lateral offset: C = ± 5 mm
Distance of position encoder:
D = 4...8 mm



Lateral offset: C = ± 5 mm
Distance of position encoder:
D = 4...8 mm



Profile P



Profile PF



Profile AT
General
Data
Analog
Interface
Operating Modes
Digital Pulse
Interface
Ethernet
Interface
Accessories

Profile BIW

Rod

Rod Compact
and Rod AR

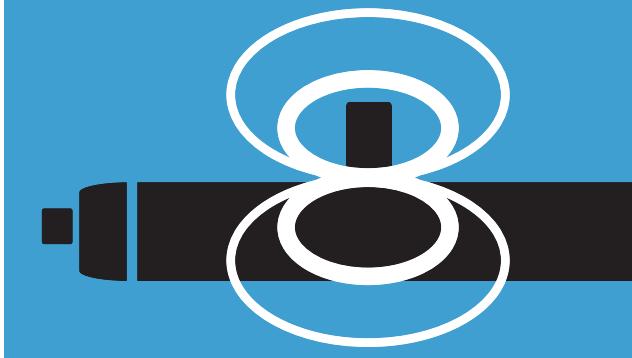
Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

Accessories

Basic
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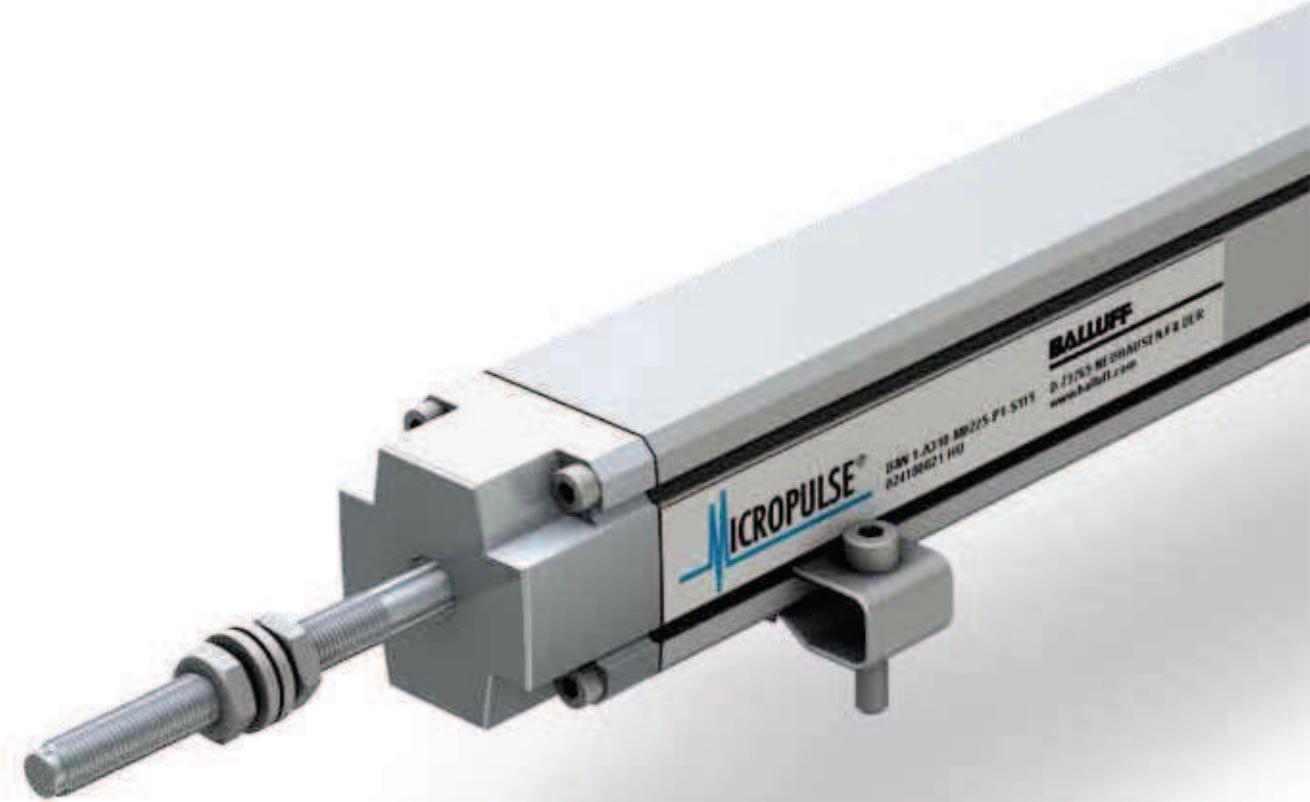




Micropulse Transducers

Profile BIW

- The contactless potentiometer in the compact push rod design
- With high measurement rate for quick movements
- The characteristic of the analog output can be inverted via a programming input

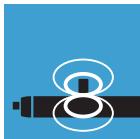


BIW

General Data
Analog Interface

146
148

MICRO PULSE[®]



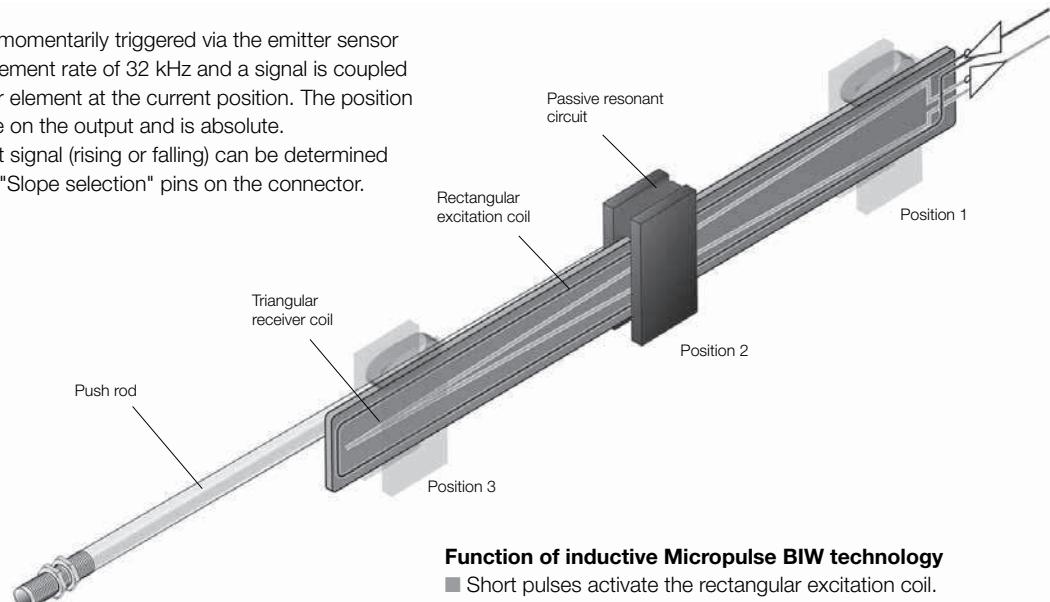
The inductive transducer BIW is based on a new, patented operating principle which detects the actual position without making contact.

The transducer BIW contains a transmitter/receiver sensor element and a resonant circuit, all protected by an extruded aluminum housing.

The resonant circuit is attached to a connecting rod, which is secured on the part of the machine whose position needs to be determined.

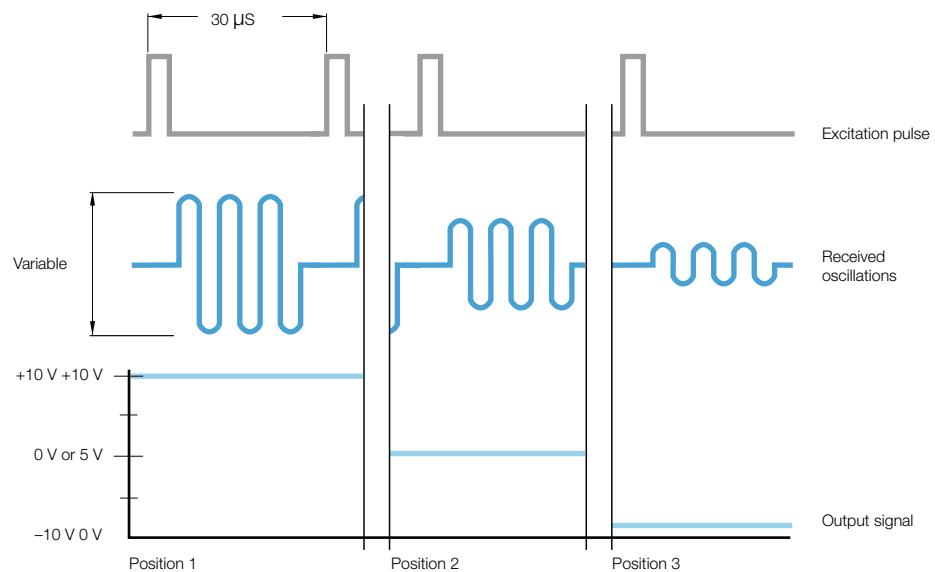
The resonant circuit is momentarily triggered via the emitter sensor element with a measurement rate of 32 kHz and a signal is coupled into the receiver sensor element at the current position. The position is immediately available on the output and is absolute.

The slope of the output signal (rising or falling) can be determined through the use of the "Slope selection" pins on the connector.



Function of inductive Micropulse BIW technology

- Short pulses activate the rectangular excitation coil.
- The excitation coil sets the passive resonant circuit of the position encoder in motion.
- The resonant circuit on the position encoder transmits the frequency inductively to the triangular receiver coil without making contact.
- The amplitude level varies according to the position of the position encoder resonant circuit. Comparable to the amplitude level, the electronics integrated in the Micropulse BIW issue a standard analog voltage or current signal.



Profile BIW

General data

Series	Profile P1 BIW
Shock load	100 g/2 ms
Vibration	12 g, 10...2000 Hz
Dielectric strength	500 V (GND to housing)
Degree of protection as per IEC 60529	IP 54
Housing material	Anodized aluminum
Fastener	Mounting clamps
Connection	Connector M12, 8-pin standard
Standard nominal strokes [mm]	0075, 0100, 0130, 0150, 0175, 0225, 0260, 0300, 0360, 0375, 0400, 0450, 0500, 0600, 0650, 0750



Micropulse
Transducers

Profile P

Profile PF

Profile AT

Profile BIW
General Data
Analog Interface

Rod

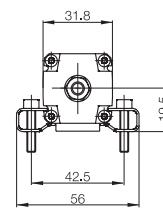
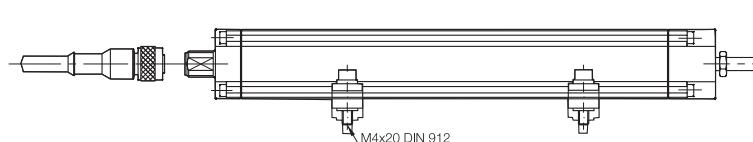
Rod Compact
and Rod AR

Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

Accessories

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Definitions



Housing length	A = rated length + 100 mm
Mechanical zero point	B0 = 0 + 2 mm
Electrical zero point	B0 + 5 mm
Electrical stroke = mechanical stroke	B = rated length + 10 mm
Recommend clamp distance	
Rated length \leq 300 mm	C = rated length - 20 mm
Rated length 300 mm to \leq 600 mm	C = rated length - 15 mm
Rated length > 600 mm	C = rated length - 10 mm

Calculation example

BIW1-...-M0100-P1-S115

Rated length 100

A = 200

B = 110

C = 80



Scope of delivery

- Transducer
- Quick start instructions
- 2 mounting clamps BIW-A-MF01-M-43

Please order separately:
Plug connectors, see page 260

Caution!

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

Properties of the transducer BIW

- High resolution and reproducibility
- Resistant to shock, vibration and noise fields
- Absolute rising or falling analog output signal
- Captive sensor element
- Sampling rate 32 kHz
- Floating
- Non-contact measuring principle

Series
Output signal
Transducer interface
Customer device interface
Part number
Output voltage U_{out}
Output current I_A
Max. current load per output
System resolution
Repeat accuracy
Measurement rate
Max. linearity deviation
Supply voltage
No-load current consumption
Operating temperature
Storage temperature
Shock load
Vibration
Dielectric strength
Degree of protection as per IEC 60529
Housing material
Fastener
Connection
Housing length A
Mechanical stroke B



Profile P1 BIW

Analog interface

Profile P1 BIW	Profile P1 BIW	Profile P1 BIW	Profile P1 BIW
Analog	Analog	Analog	Analog
A	E	C	G
Analog	Analog	Analog	Analog
BIW1- A 310-M_ _ _ -P1-S115	BIW1- E 310-M_ _ _ -P1-S115	BIW1- C 310-M_ _ _ -P1-S115	BIW1- G 310-M_ _ _ -P1-S115
0...10 V	4...20 mA	0...20 mA	-10...10 V
6 mA	5 µm	5 µm	6 mA
5 µm	10 µm	10 µm	5 µm
10 µm	typ. 32 kHz	typ. 32 kHz	10 µm
typ. 32 kHz	≤ 0.02%	≤ 0.02%	typ. 32 kHz
≤ 0.02%	18...30 V DC	18...30 V DC	≤ 0.02%
18...30 V DC	≤ 80 mA	≤ 80 mA	18...30 V DC
≤ 80 mA	-20...+85 °C	-20...+85 °C	≤ 80 mA
-20...+85 °C	-40...+100 °C	-40...+100 °C	-20...+85 °C
-40...+100 °C	100 g/2 ms	100 g/2 ms	-40...+100 °C
100 g/2 ms	12 g, 10...2000 Hz	12 g, 10...2000 Hz	100 g/2 ms
12 g, 10...2000 Hz	500 V (GND to housing)	500 V (GND to housing)	12 g, 10...2000 Hz
500 V (GND to housing)	IP 54	IP 54	500 V (GND to housing)
IP 54	Anodized aluminum	Anodized aluminum	IP 54
Anodized aluminum	Mounting clamps	Mounting clamps	Anodized aluminum
Mounting clamps	Connector M12,	Connector M12,	Mounting clamps
Connector M12,	8-pin standard	8-pin standard	Connector M12,
8-pin standard	Rated length + 100 mm	Rated length + 100 mm	8-pin standard
Rated length + 100 mm	Rated length + 10 mm	Rated length + 10 mm	Rated length + 100 mm
Rated length + 10 mm			



Micropulse
Transducers

Profile P

Profile PF

Profile AT

Profile BIW
General
Data

Analog
Interface

Rod

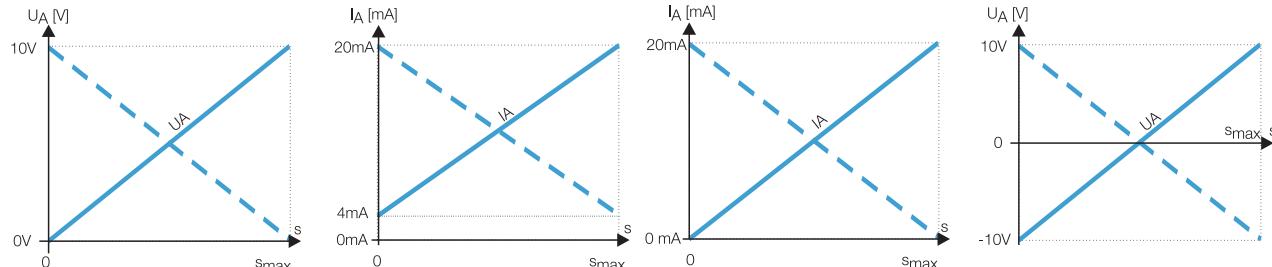
Rod Compact
and Rod AR

Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

Accessories

Basic
Information and
Definitions



— Output signal can be inverted via programming inputs

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

Scope of delivery

- Transducer
- Quick start instructions
- 2 mounting clamps BIW-A-MF02-M

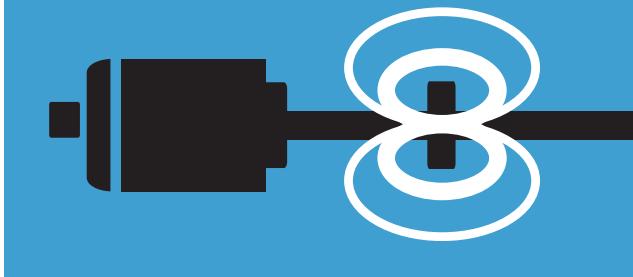
Please order separately:
Plug connectors, see page 252



Ordering example:

BIW1- _ 310 - M _ _ _ - P1 - S115

Output signal	Standard Rated length [mm]
A 0...+10 V	0075 0100 0130 0150
G -10...+10 V	0175 0225 0260 0300
E 4...20 mA	0360 0375 0400 0450
C 0...20 mA	0500 0600 0650 0750



Micropulse Transducers

Rod

Rod housings are mainly used in hydraulic drive applications. When installed in the pressure section of the hydraulic cylinder, the displacement sensor requires the same pressure rating as the actual hydraulic cylinder. In practice, the sensor must be able to withstand pressures up to 1000 bar. The electronics are integrated in an aluminum or stainless steel housing and the waveguide in a pressure-resistant tube made from nonmagnetic stainless steel that is sealed off at the front end with a welded plug. An O-ring in the flange at the opposite end seals off the high-pressure section. An encoder ring with magnets slides over the tube or rod with internal waveguide to mark the position prior to detection.



BTL7 MICRO PULSE +

General Data	152
Analog Interface	154
Programming	158
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Programming	164
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BTL5/BTL6

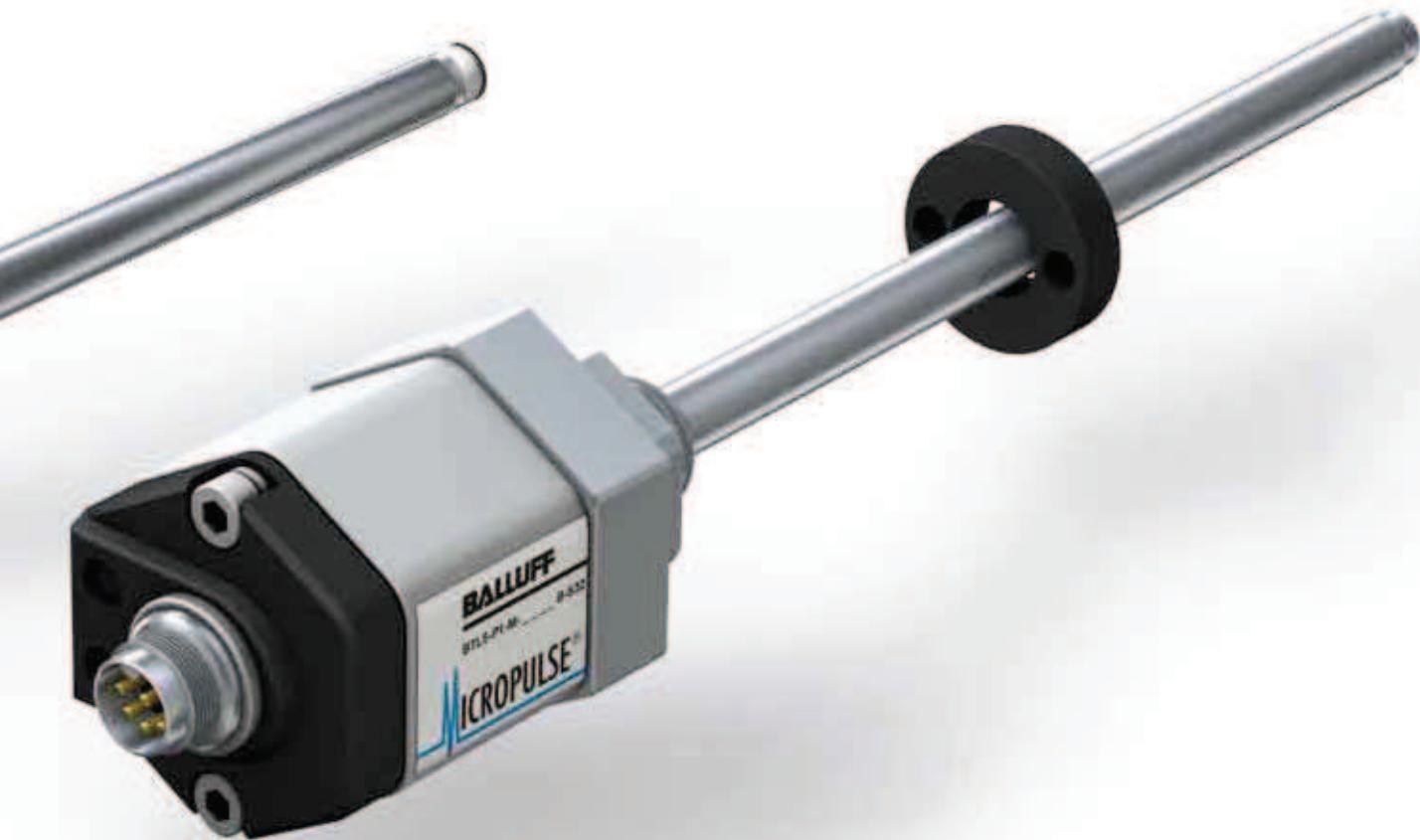
General Data	168
CANopen Interface	170
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MICRO PULSE[®]

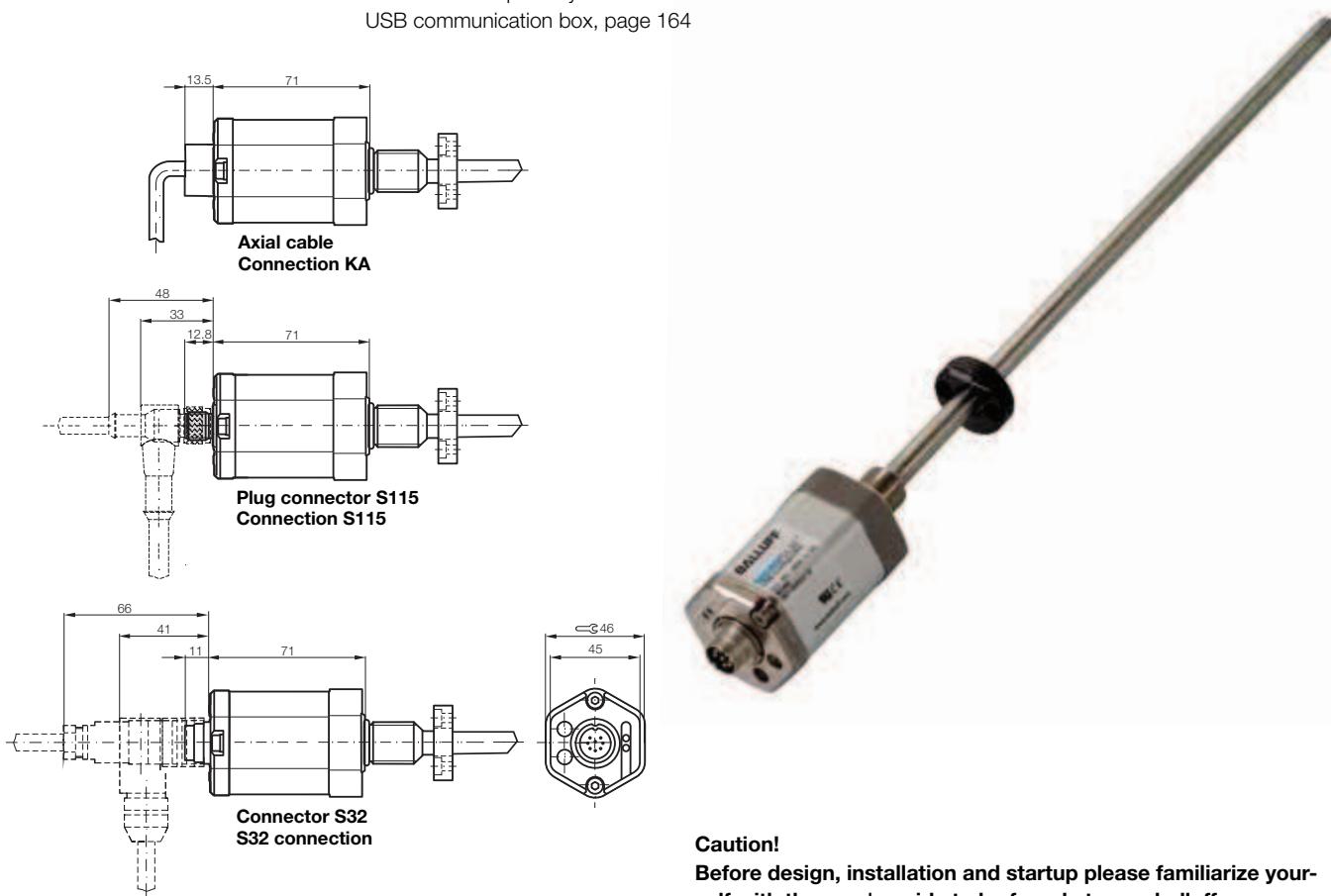


**Pressure-resistant to 600 bar,
high reproducibility, contact-
less, robust**

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 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	yes
Oversupply protection	TransZorb protection diodes
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	Style B thread M18x1.5, style Z 3/4"-16 UNF
Pressure rating	600 bar with installation in hydraulic cylinder 250 bar installed in hydraulic cylinder
with 10.2 mm protective tube	
with 8 mm protective tube	
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)	IEC 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]	0025...7620 mm in 1-mm increments
with an 8 mm protective tube, the max. rated length is 1016 mm	

Please order separately:
USB communication box, page 164



Caution!

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

Rod BTL7

General data

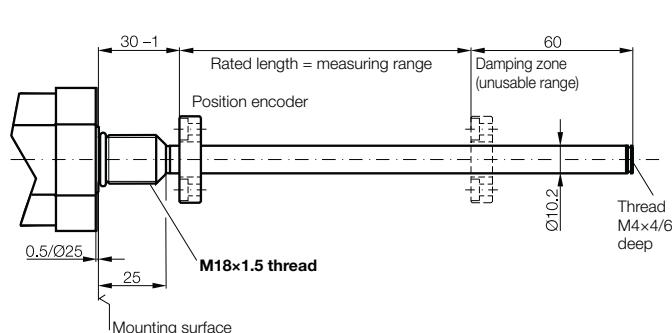
Style B

(standard design)

BTL7 -B-

Metric

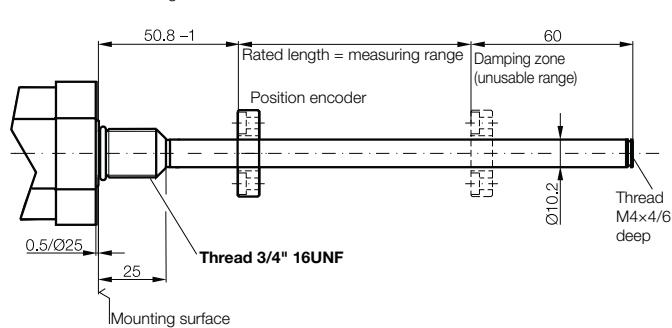
mounting thread M18x1.5



Style Z

BTL7 -Z-

3/4" UNF mounting thread



Style B8

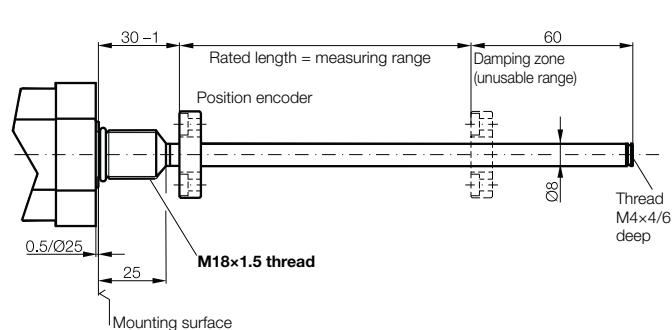
BTL7 -B8-

Metric mounting thread

M18x1.5

8 mm protective tube

Max. 1016 mm rated length



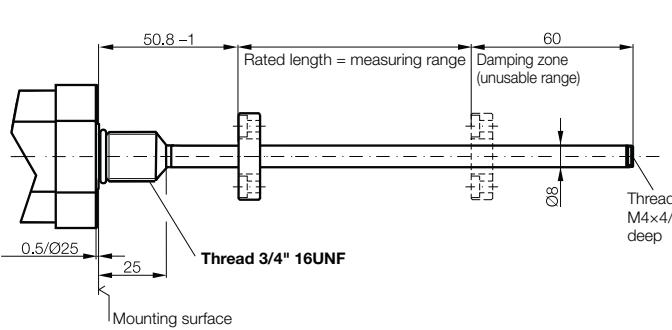
Style Z8

BTL7 -Z8-

3/4" UNF mounting thread

8 mm protective tube

Max. 1016 mm rated length



Style A

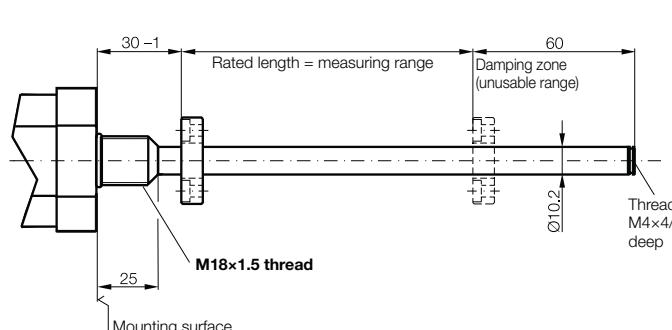
BTL7 -A-

Metric mounting thread

M18x1.5

Flange without

0.5/Ø 25 mm mounting surface



Micropulse
Transducers

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Profile AT

Profile BIW

Rod BTL7

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and Rod AR

Rod EX,

T Redundant

and CD

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Features of Micropulse BTL7-A/C/E/G...B, Z, A

- Status LEDs for indicating operating status and diagnostics
- Extended application range due to high degree of protection IP 68 (cable version)
- Electronics head can be replaced in the event of service
- Compact housing, saves space
- Error signal, no position encoder within measuring range

Flexible measuring range

The start and end point of the measuring range can be adapted to the application. The points are set using the included calibration device directly on the unit or remotely, see page 158.

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, 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
- Calibration device
- Quick start instructions

Please order separately:

- Calibration box, see page 164
- Position encoders, see page 218
- Floats, see page 216
- Fastening nut, see page 219
- Plug connectors, see page 252

Rod BTL7 Analog interface

Rod BTL7	Rod BTL7	Rod BTL7	Rod BTL7
Analog	Analog	Analog	Analog
A	G	E	C
Analog	Analog	Analog	Analog
BTL7- A110-M	BTL7- G110-M	BTL7- E1_0-M	BTL7- C1_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	$\leq 500 \Omega$	$\leq 500 \Omega$
$\leq 5 \text{ mV}_{\text{pp}}$	$\leq 5 \text{ mV}_{\text{pp}}$	$\leq 0.66 \mu\text{A}$	$\leq 0.66 \mu\text{A}$
$\leq 0.33 \text{ mV}$	$\leq 0.33 \text{ mV}$	$\leq 5 \mu\text{m}$	$\leq 5 \mu\text{m}$
$\leq 5 \mu\text{m}$	$\leq 5 \mu\text{m}$	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	$\pm 50 \mu\text{m}$ to $\leq 500 \text{ mm}$ rated length	$\pm 50 \mu\text{m}$ to $\leq 500 \text{ mm}$ rated length
$\pm 50 \mu\text{m}$ to $\leq 500 \text{ mm}$ rated length	$\pm 50 \mu\text{m}$ to $\leq 500 \text{ mm}$ rated length	$\pm 0.01\%$ 501...5500 mm rated length	$\pm 0.01\%$ 501...5500 mm rated length
$\pm 0.01\%$ 501...5500 mm rated length	$\pm 0.01\%$ 501...5500 mm rated length	$\pm 0.02\%$ FS > 5500 mm rated length	$\pm 0.02\%$ FS > 5500 mm rated length
$\pm 0.02\%$ FS > 5500 mm rated length	$\pm 0.02\%$ FS > 5500 mm rated length	$\pm 30 \text{ ppm/K}$	$\pm 30 \text{ ppm/K}$
$\leq 30 \text{ ppm/K}$	$\leq 30 \text{ ppm/K}$	20...28 V DC	20...28 V DC
20...28 V DC	20...28 V DC	$\leq 150 \text{ mA}$	$\leq 150 \text{ mA}$
$\leq 150 \text{ mA}$	$\leq 150 \text{ mA}$	yes	yes
yes	yes	yes	yes
yes	yes	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		



Micropulse
Transducers

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Rod BTL7

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Interface

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Interface

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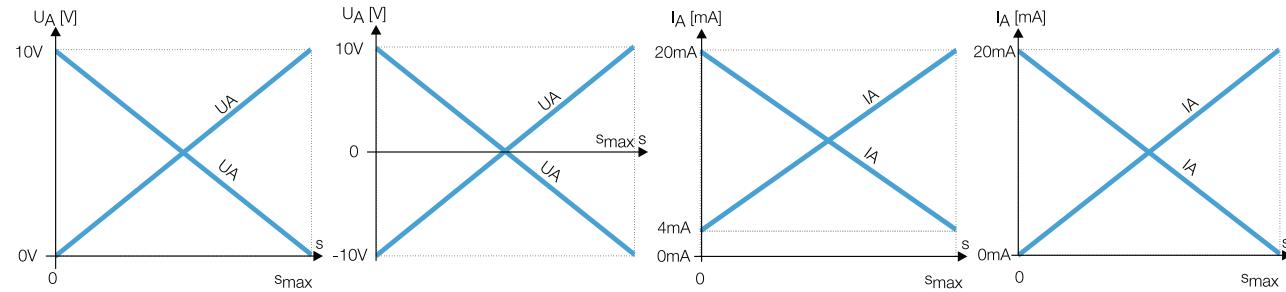
Sensor SF

Accessories

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Ordering example:

B T L 7 - **0 - M**

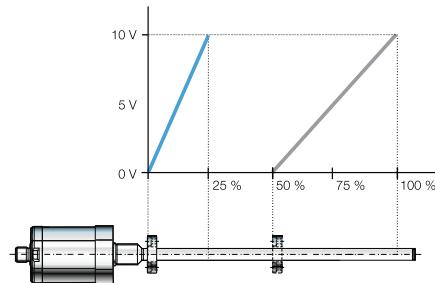
Output signal	Operating voltage	Characteristic	Standard Rated length [mm]	Design	Connection
A 0...10 V and 10...0 V	1 24 V 5 10-30 V	1 rising and falling (with A and G)	0025...7620 in 1-mm increments	B Standard M18x1.5 For additional designs, see page 153	S32 Connectors S115 Connectors
G -10...10 V and 10...-10 V		0 rising (at C and E)			KA02 PUR cable 2 m
E 4...20 mA or 20...4 mA		7 falling (for C and E)			KA05 PUR cable 5 m
C 0...20 mA or 20...0 mA					KA10 PUR cable 10 m

Position and velocity

Two outputs can be assigned any position value and velocity signal using the USB interface.

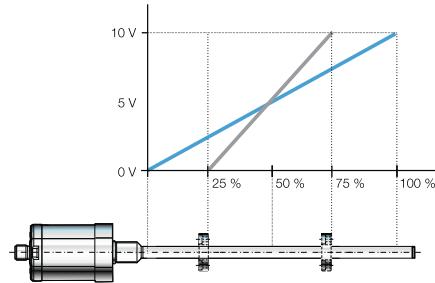
Mode examples:

Double position encoder



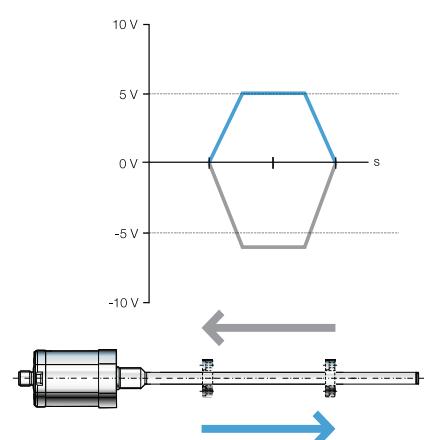
2 encoders, 2 movements, 2 output signals

Differential



Differential signal between 2 position encoders, position and difference possible

Velocity



Velocity output

Series
Output signal
Transducer interface
Position signal interface, customer device
Part number
Output signal factory setting
Output signal can be adjusted via configurable USB
Load current
Max. residual ripple
Load resistance
System resolution
Current consumption at 24 V DC
Hysteresis
Repeat accuracy
Measurement rate, length-dependent
Max. linearity deviation

Temperature coefficient
Supply voltage
Polarity reversal protected
Overvoltage protection
Dielectric strength
Operating temperature

Micropulse⁺ USB configurable BTL7-A/E501

- Simple configuration and adjustment of the start and end point via the USB interface, quick startup
- "Easy Setup" for manual adjustment on-site
- Configurable dual output functions, position and speed
- Increased operating reliability with status LEDs for indicating the operating status and diagnostic information
- Extended application range due to high degree of protection IP 68 (cable version)
- The electronics head can be replaced in the event of service
- Compact housing
- Error signals, no position encoder within measuring range

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

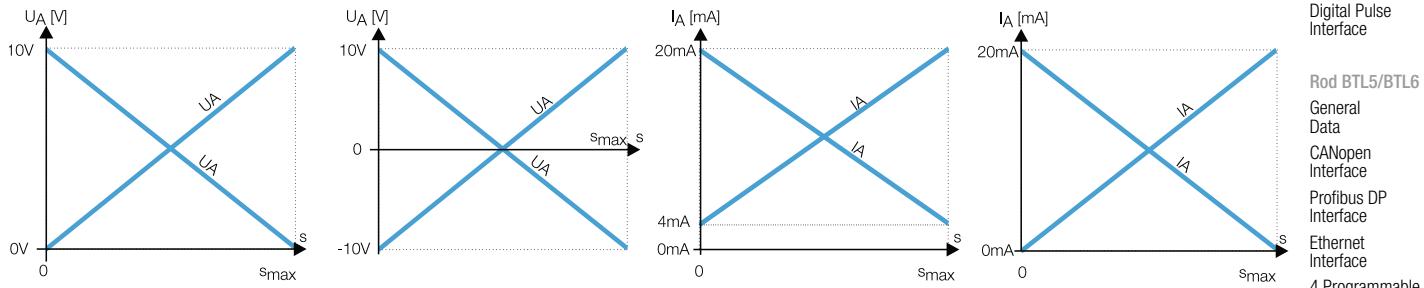
Scope of delivery

- Transducer
- Calibration device
- Quick start instructions

Please order separately:

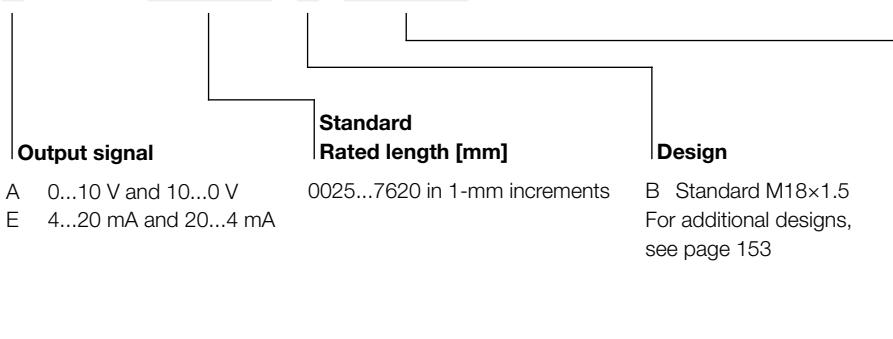
- USB communication box, see page 159
- Position encoders, see page 218
- Floats, see page 216
- Fastening nut, see page 219
- Plug connectors, see page 252

Rod BTL7	Rod BTL7
Analog	Analog
A	E
Analog	Analog
BTL7- A501-M	BTL7- E501-M
0...10 V and 10...0 V	4...20 mA and 20...4 mA
-10...10 V and 10...-10 V	0...20 mA and 20...0 mA
Max. 5 mA	$\leq 500 \Omega$
$\leq 5 \text{ mV}_{\text{pp}}$	$\leq 0.66 \mu\text{A}$
$\leq 0.33 \text{ mV}$	$\leq 180 \text{ mA}$
$\leq 150 \text{ mA}$	$\leq 5 \mu\text{m}$
$\leq 5 \mu\text{m}$	System resolution/min. 2 μm
System resolution/min. 2 μm	Max. 4 kHz
Max. 4 kHz	$\pm 50 \mu\text{m}$ to $\leq 500 \text{ mm}$ rated length
$\pm 50 \mu\text{m}$ to $\leq 500 \text{ mm}$ rated length	$\pm 0.01\%$ FS > 500...5500 mm rated length
$\pm 0.01\%$ FS > 500...5500 mm rated length	$\pm 0.02\%$ FS > 5500 mm rated length
$\pm 0.02\%$ FS > 5500 mm rated length	$\leq 30 \text{ ppm/K}$
$\leq 30 \text{ ppm/K}$	10...30 V DC
10...30 V DC	yes
yes	yes
yes	500 V AC (GND to housing)
500 V AC (GND to housing)	-40...+85 °C
-40...+85 °C	-40...+85 °C



Ordering example:

BTL7- 501-M - -



Micropulse Transducers

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Profile PF

Profile AT

Profile BIW

Rod BTL7

General Data
Analog Interface

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Digital Pulse Interface

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Profinet DP Interface
Ethernet Interface
4 Programmable Switching Points

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Basic Information and Definitions

Setting options for the start and end point

	BTL7 Standard	BTL7-A/E501... Micropulse ⁺ USB configurable
1. Calibration device	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Teach-in	<input checked="" type="checkbox"/>	
Adjusting	<input checked="" type="checkbox"/>	
Online setting	<input checked="" type="checkbox"/>	
Easy Setup		<input checked="" type="checkbox"/>
2. Remote setup, calibration box	<input checked="" type="checkbox"/>	
3. USB configuration		<input checked="" type="checkbox"/>

1. Calibration device

100% start and end point calibration

The start and end points of the analog signal can be set to the optimal position at the touch of a button. Depending on the application, "teach-in" or "adjust" mode is used, selectable by pressing a button combination. Two-color LED indicators assist the procedure.

Easy Setup

For BTL7-A/E501 Micropulse⁺ only. Simple programming mode for adjusting the start and end point of the transducer to the current application in just a few steps. The position encoder is brought into the new position. Confirm by pressing a button. The "Adjust" function allows the new value to be fine-tuned for a stationary encoder. No error value is output during the setup procedure.

Adjusting

Here you can adjust to a new start and end value. This may be required when you cannot physically move the encoder to the start and/or end point. Move the encoder to the new start and end position, and adjust the displayed value by pressing the button until the desired output values are reached.

Online setting

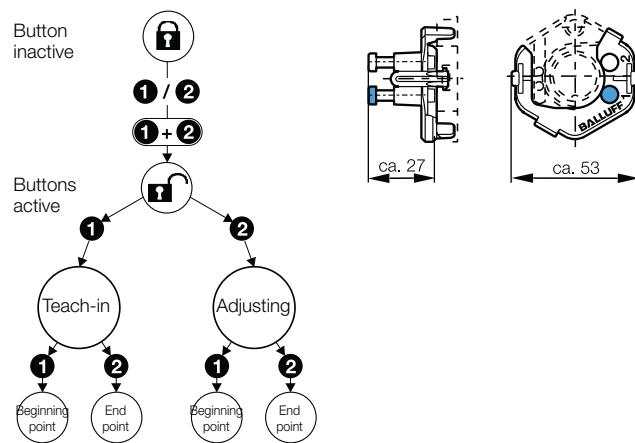
This programming function allows you to set the start and end point while in run mode, such as in a closed loop configuration. No error value is output during the setup procedure. The calibration range is limited to $\pm 25\%$.

Teach-in

The beginning and end points set at the factory are to be replaced by the new beginning and end points.

In addition, the position encoder must first be brought into the new beginning position and then into the new end position, and the respective values stored by pressing the button.

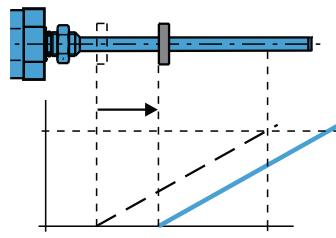
Set start and end points using the BTL7-A/EH01 calibration device, included in the scope of delivery.



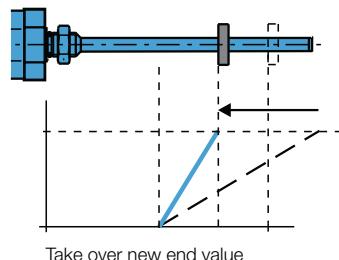
Procedure for teach-in, rising signal

before 
after 

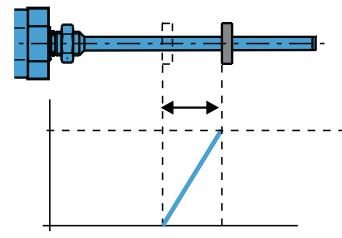
1. Move the position encoder into the new zero position.



2. Move the position encoder into the new end position.



3. Newly set measurement path



Rod BTL7 Programming

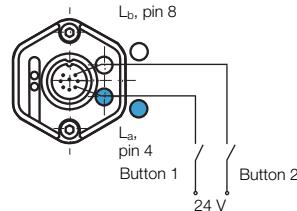
2. Remote setup

Setting the start and end points using programming inputs

If the transducer is located in an inaccessible place or a hazardous area, the start and end point can be adjusted remotely. Teach-in, adjustment and online setting are identical to programming with the calibration device. Button 1, blue, corresponds to programming input L_a and button 2, gray, to input L_b .

Remote setting of the start and end points using calibration box

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 can fulfill different requirements that, in the past, required several systems.



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Transducers

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Rod BTL7

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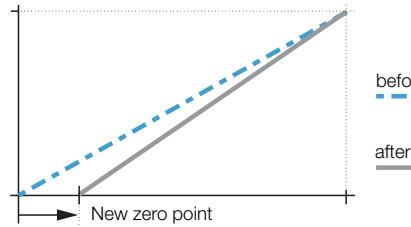
Sensor SF

Accessories

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Definitions



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

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

3. USB configuration

Start, end value setting and configuration via USB

The Micropulse Configuration Tool software allows the quick and easy configuration of Balluff transducers of type BTL7-A/E501... on a PC.

The most important features are:

- Online display of the current position of the encoder
- Graphical support for setting the functions and characteristics
- Display of information about the connected transducer
- Selectable number formats and units for display
- Reset to factory settings possible
- Calibration device can be disabled
- Demo mode without having a transducer connected

Connecting the USB communication box

For model BTL7-A/E501-M...-S32/S115 transducers, the communication box can be switched between the transducer and the controller. The communication box is connected to the PC using a USB cable.

USB communication box

Part number	with cable sets
BTL7-A-CB01-USB-S32	Connector S32
BTL7-A-CB01-USB-S115	Plug connector S115
BTL7-A-CB01-USB-KA	Cable connection

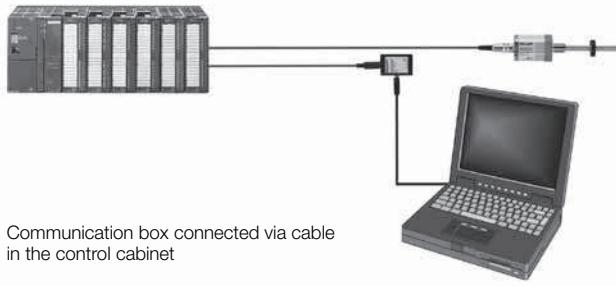
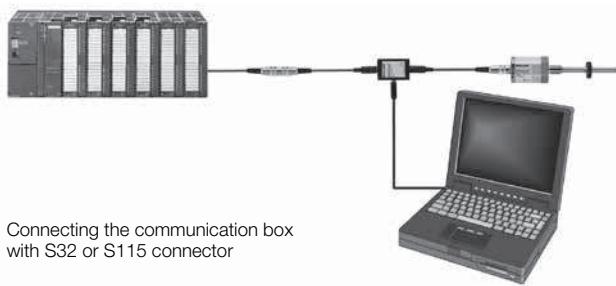
Scope of delivery

- USB communication box
- Cable set
- Quick start instructions

The PC software and the corresponding manual are available on the Internet at www.balluff.com/downloads-btl7

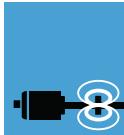
System requirements

- Standard PC
- Operating system: Windows 2000/XP/Vista/7
- Screen resolution at least 1024 x 768 pixels
- 10 MB available hard disk space
- Install Java Runtime Environment (JRE) Version 1.4.2 or higher
<http://java.com/getjava>
- USB port



Caution!

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



Micropulse
Transducers

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Profile PF

Profile AT

Profile BIW

Rod BTL7

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SSI interface Micropulse standard for asynchronous operation

BTL7-S5...-M---B---

The synchronous serial data transmission is suitable for controllers from different manufacturers.

Reliable signal transmission, even with cable lengths of up to 400 m between the controller and the BTL transducer, is assured by interference-free RS485/422 differential drivers and receivers. Any interference signals are effectively suppressed.

SSI interface Micropulse Plus for asynchronous operation

BTL7-S510-M---B---

Functions, interface parameters and measuring range can be set via an integrated USB interface.

SSI interface Micropulse Standard for synchronous operation

BTL7-S5...-B-M---B---

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** , with which a new, current value is available on each sampling, can be approximated from the table to the right. An exact diagram can be found in the current user's guide.

SSI interface Micropulse Plus for synchronous operation

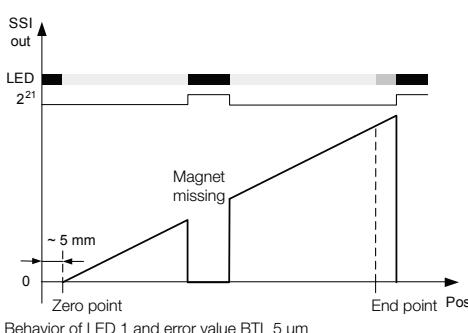
BTL7-S510B-M---B---

Via an integrated USB interface, functions,

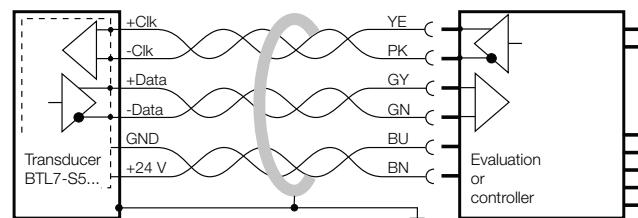
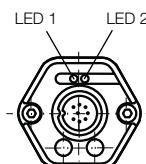
Functions, interface parameters and measuring range can be set via an integrated USB interface.

The clock frequency depends on the cable length.

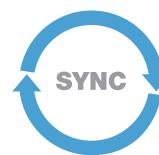
Behavior of LED 1 and the error value over the entire range



LED indicator



BTL7-S5... with evaluation/controller, connection example



Rated length range		Scan rate
25 mm	< Rated length	\leq 150 mm : 4050 Hz
150 mm	< Rated length	\leq 300 mm : 3250 Hz
300 mm	< Rated length	\leq 500 mm : 2200 Hz
500 mm	< Rated length	\leq 1000 mm : 1200 Hz
1000 mm	< Rated length	\leq 2000 mm : 650 Hz
2000 mm	< Rated length	\leq 7620 mm : 170 Hz

Cable length	Clock frequency
< 20 m	< 1000 kHz
< 50 m	< 600 kHz
< 100 m	< 330 kHz
< 200 m	< 180 kHz
< 400 m	< 90 kHz

LED 1	
Green	Normal function The position encoder is within the limits
Red	Error No position encoder, or position encoder is outside the limits

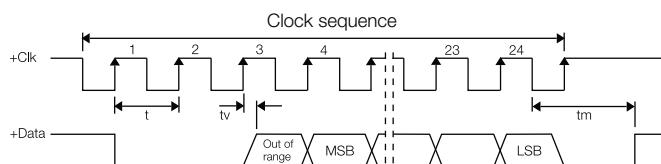
LED 2	
Green	Synchronous operation Internal measurement is synchronous with SSI query
Off	Asynchronous operation Internal measurement is asynchronous with SSI query
Flashing green	Programming mode Only with BTL7-S510(B)...

Series	Rod BTL7
Output signal	Synchronous-serial
Transducer interface	S
Customer device interface	Synchronous-serial
Part number - Standard asynchronous	BTL7-S5_ _ _ _ _
Part number - Plus asynchronous	BTL7-S510-M_ _ _ _ _
Part number - Standard synchronous	BTL7-S5_ B -M_ _ _ _ _
Part number - Plus synchronous	BTL7-S510 B -M_ _ _ _ _
System resolution depending on model (LSB)	1, 2, 5, 10, 20, 40, 50 or 100 µm
Repeat accuracy	≤ 11 µm, typical ± 2 µm
Hysteresis	≤ 7 µm
Max. linearity deviation	± 30 µm with 5 and 10 µm resolution or ≤ ± 2 LSB
Temperature coefficient, typical	≤ 15 ppm/K
Supply voltage, stabilized	10...30 V DC
Current consumption	≤ 120 mA
Operating temperature	-40...+85 °C
Storage temperature	-40...+100 °C

Scope of delivery

- Transducer
- Quick start instructions

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


Order example BTL7-S standard:

BTL7-S5_ _ _ _ _ - M_ _ _ _ _ for asynchronous operation

BTL7-S5_ _ **B-M_ _ _ _ _** for synchronous operation

Coding	System resolution	Standard rated length [mm]	Design	Connection
0 Binary code rising (24-bit)	1 1 µm	0025...7620 mm	B Standard M18x1.5	S32 Connectors
1 Gray code rising (24-bit)	2 5 µm	in 1 mm increments	For additional designs, see page 153	S115 Connectors
6 Binary code rising (25-bit)	3 10 µm			KA02 PUR cable 2 m
7 Gray code rising (25-bit)	4 20 µm			KA05 PUR cable 5 m
A Binary code rising (26-bit)	5 40 µm			KA10 PUR cable 10 m
B Gray code rising (26-bit)	6 100 µm			KA15 PUR cable 15 m
	7 2 µm			
	8 50 µm			

Order example BTL7-S Plus:

BTL7-S510_ _ - M_ _ _ _ _ for asynchronous operation

BTL7-S510B**-M_ _ _ _ _** for synchronous operation

Standard rated length [mm]	Design	Connection
0025...7620 mm in 1-mm increments on request	B Standard M18x1.5 For additional designs, see page 153	S32 Connectors S115 Connectors KA02 PUR cable 2 m KA05 PUR cable 5 m KA10 PUR cable 10 m KA15 PUR cable 15 m


 Micropulse
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Rod BTL7

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SSI Interface
Digital Pulse
Interface

Rod BTL5/BTL6

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Interface
Profinet DP
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Ethernet
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Micropulse Plus BTL7-S510_-... with USB interface

Configuration via USB

The BTL7-S510_-... transducers can be configured quickly and easily on a PC.

The most important features are:

- Online display of the current position of the encoder
- Graphical support for setting the functions and characteristics
- Display of information via the connected transducer (model, serial number, firmware version, nominal length, SSI output signal)
- Selectable number formats and units for display
- Reset to factory settings possible
- Demo mode without having a transducer connected

Configuration options of the position measuring system

BTL7-S510_-...

- Number of position encoder 1 or 2
- Position
- Velocity

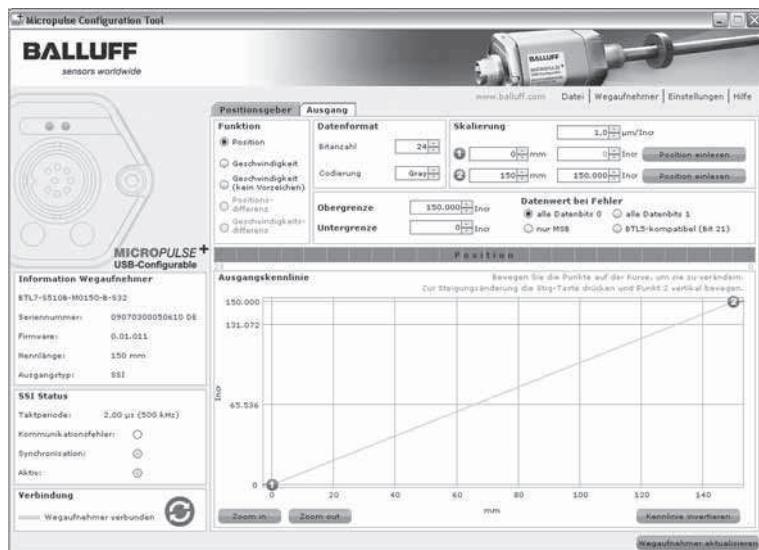
Differential position

- Speed difference

System requirements

- Standard PC
- Operating system: Windows 2000/XP/Vista/7
- Screen resolution at least 1024 x 768 pixels
- 10 MB available hard disk space
- Install Java Runtime Environment (JRE) Version 1.4.2 or higher
<http://java.com/getjava>
- USB port

The PC software and the corresponding manual are available on the Internet at www.balluff.com/downloads-btl7



Rod BTL7 Programming

Connecting the USB communication box

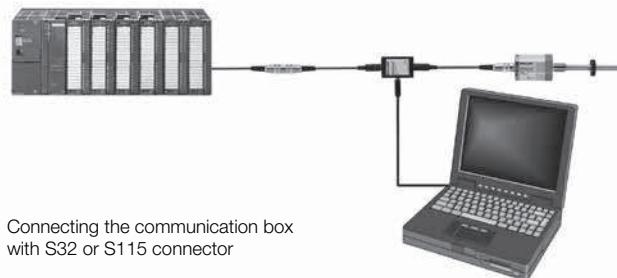
With the BTL7-S510-M... transducers, the communication box can be connected between the transducer and controller. The communication box is connected to the PC using a USB cable.

USB communication box with cable set

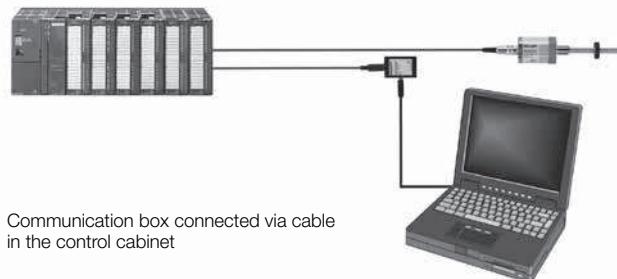
Part number	Cable set
BTL7-A-CB01-USB-S32	Connector S32
BTL7-A-CB01-USB-S115	Plug connector S115
BTL7-A-CB01-USB-KA	Cable connection

Scope of delivery

- USB communication box
- Cable set
- Quick start instructions



Connecting the communication box with S32 or S115 connector



Communication box connected via cable in the control cabinet

Caution!

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

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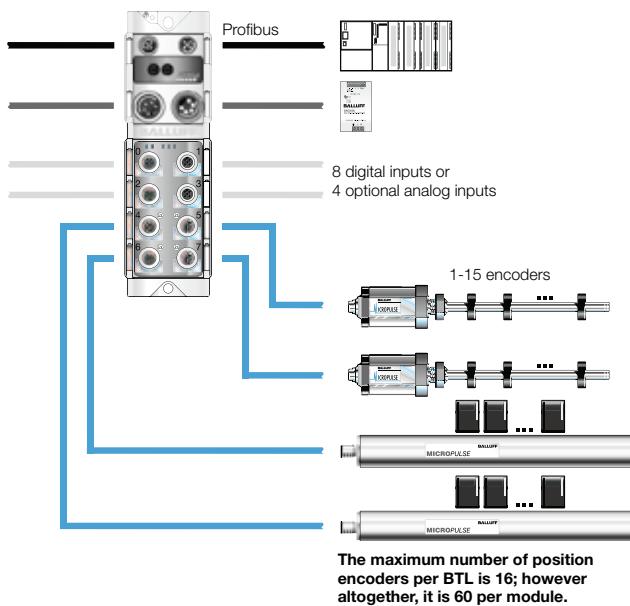
Accessories

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Profibus BNI modules are an elegant, cost-effective solution from Balluff.

The modules have a robust metal housing that was designed for use in harsh industrial environments and is capable of withstanding powerful mechanical loads. The modules have four independent ports for Micropulse Transducers BTL with P511. A maximum of 16 encoders can be used per BTL port. The maximum rated length here is 7500 mm. Depending on the version, four additional ports with digital or analog sensors can be assigned. You can achieve maximum functionality and cost efficiency for fieldbus integration by combining Micropulse Transducers BTL with Profibus modules P111.

For more information, see page 268

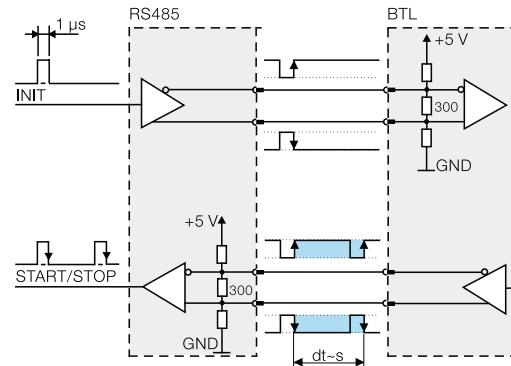


P511 interface – Cost savings using DPI/IP for start-up and installation

DPI/IP is a protocol for direct data exchange between a controller and transducer. The signal lines are used to send additional information such as manufacturer, measuring length and waveguide gradient. This allows start-up or replacement of a transducer without having to make manual changes to the controller parameters.

Features

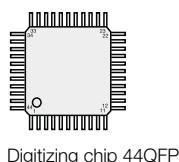
- Bi-directional communication
- Position measurement system controller using Init and start/stop signals
- Integrated diagnostic functions
- Plug and Play
- Automatic configuration – shorter downtimes
- Transmission of sensor type, measuring length, specific parameters
- Measurement length up to 7,620 mm



Block diagram of P interface

Highly accurate digitalizations of the P511 pulse signal

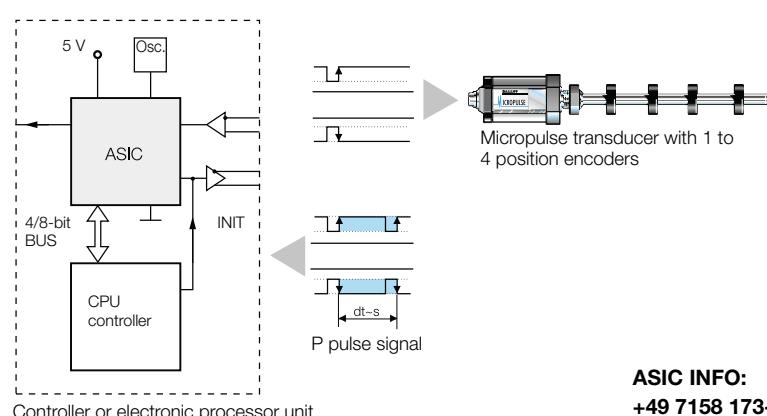
Companies developing their own electronic control and processor units can create a highly accurate P interface cost-effectively and with minimum effort using the Balluff digitizing chip. The digitizing chip was developed as a high-resolution, configurable ASIC for Micropulse transducers with P pulse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



Digitizing chip 44QFP

Benefits

- High position resolution: the actual 1 μ m resolution of the BTL position measurement system is supported 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

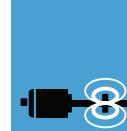


ASIC INFO:
+49 7158 173-370

Rod BTL7

Digital Pulse Interface

Series	Rod BTL7
Transducer interface	Pulse P511
Customer device interface	Pulse P511
Part number	BTL7-P511-M_____
System resolution	processing-dependent
Repeat accuracy	typ. $\pm 2.5 \mu\text{m}$
Hysteresis	$\leq \pm 7 \mu\text{m}$
Linearity deviation	$\pm 50 \mu\text{m}$ up to 500 mm rated length typ. $\pm 0.01\%$ 501...5500 mm rated length typ. $\pm 0.02\%$ 5500...7620 mm rated length
Ultrasonic speed (standardized)	2850 m/s
Gradient (standardized)	8.9122807 $\mu\text{s/inch}$
Supply voltage	10...30 V
Current consumption at 24 V	120 mA
Operating temperature	-40...+85 °C
Storage temperature	-40...+100 °C



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Rod BTL7

General

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Interface

Programming

SSI Interface

Digital Pulse

Interface

Rod BTL5/BTL6

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CANopen

Interface

Profinet

DP

Interface

Ethernet

Interface

4 Programmable

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and Rod AR

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T Redundant

and CD

Filling Level

Sensor SF

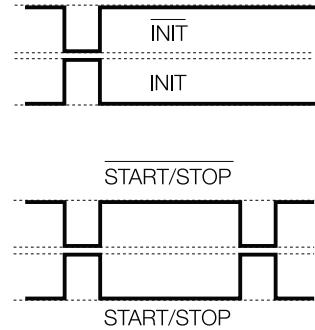
Accessories

Basic

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Definitions

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
- Fastening nut, see page 219
- Plug connectors, see page 252

Ordering example:

B T L 7 - P 5 1 1 - M _____ - - - - -



0025...7620 mm
in 1-mm increments

B Standard M18x1.5
For additional designs,
see page 153

B	S32	Connectors
S	S115	Connectors
A	KA02	PUR cable 2 m
A	KA05	PUR cable 5 m
K	KA10	PUR cable 10 m
A	KA15	PUR cable 15 m

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

The Micropulse Transducer BTL is a robust position feedback 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.

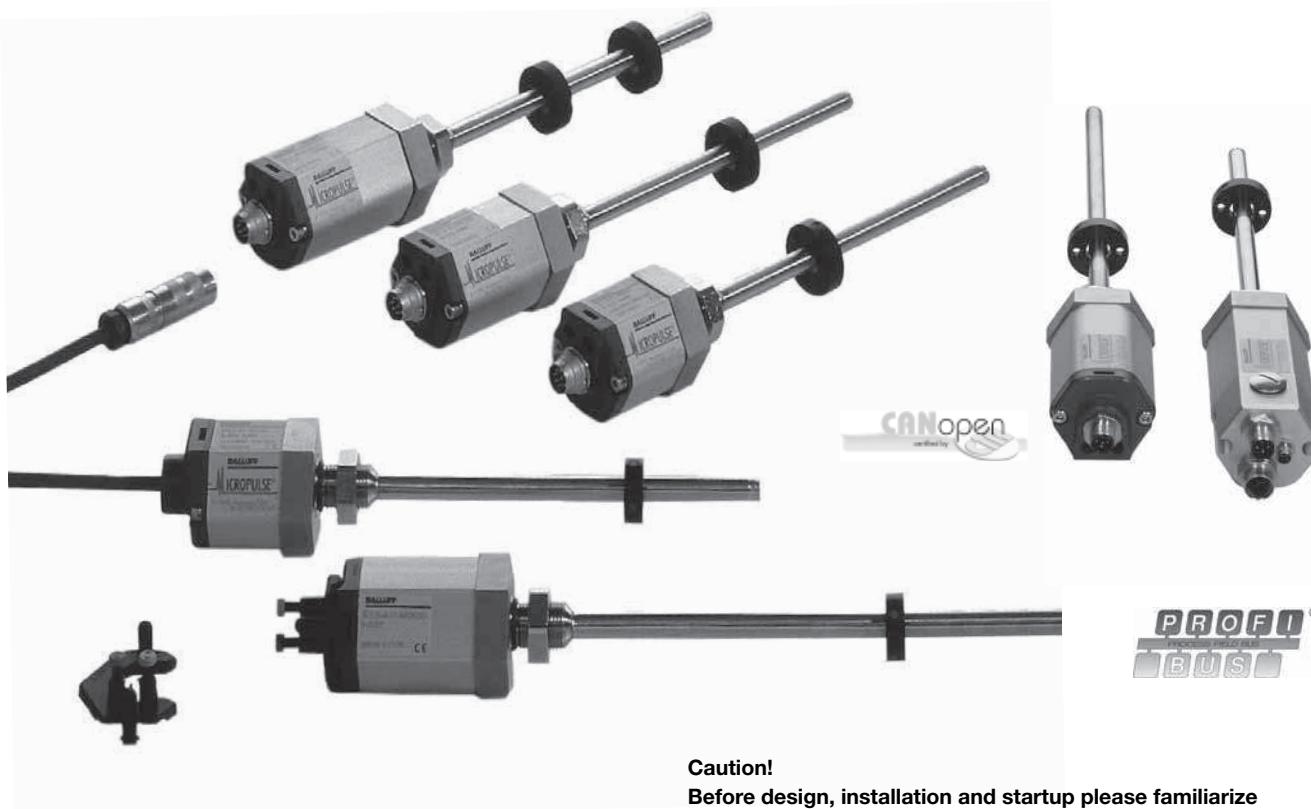
Series	Rod BTL5
Shock load	100 g/6 ms as per EN 60068-2-27
Vibration	12 g, 10...2000 Hz as per EN 60068-2-6
Polarity reversal protected	yes
Oversupply protection	TransZorb protection diodes
Dielectric strength	500 V DC (GND to housing)
Degree of protection as per IEC 60529	IP 67 (with IP-67 connector BKS-S... attached)
Housing material	Anodized aluminum/1.4571 stainless steel protective tube, 1.3952 stainless steel cast flange
Housing attachment	Style B thread M18x1.5, style Z 3/4"-16 UNF
Pressure rating	600 bar with installation in hydraulic cylinder 250 bar installed in hydraulic cylinder
with 10.2 mm protective tube	
with 8 mm protective tube	
Connection	Connectors/cables
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
with an 8 mm protective tube, the max. rated length is 1016 mm	

Scope of delivery

- Transducer (select your interface from page 170)
- 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



Caution!

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

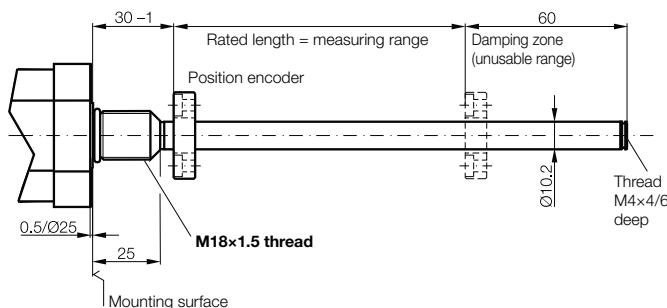
Rod BTL5

General data

Style B
(standard design)

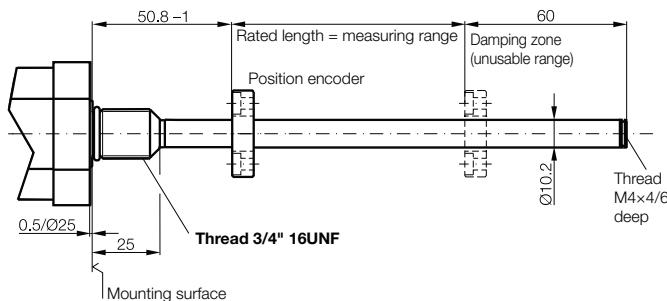
BTL5- -B-

Metric
mounting thread M18x1.5



Style Z
BTL5- -Z-

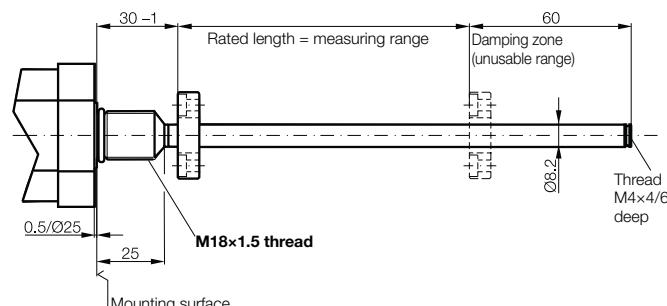
3/4" UNF mounting thread



Micropulse
Transducers

Style B8
BTL5- -B8-

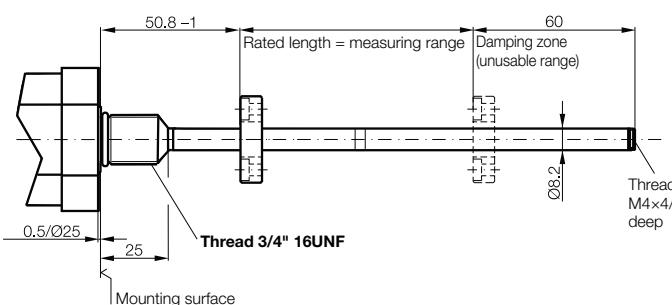
Metric mounting thread
M18x1.5
8 mm protective tube
Max. 1016 mm rated length



Rod BTL7
General
Data
Analog
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Programming
SSI Interface
Digital Pulse
Interface

Style Z8
BTL5- -Z8-

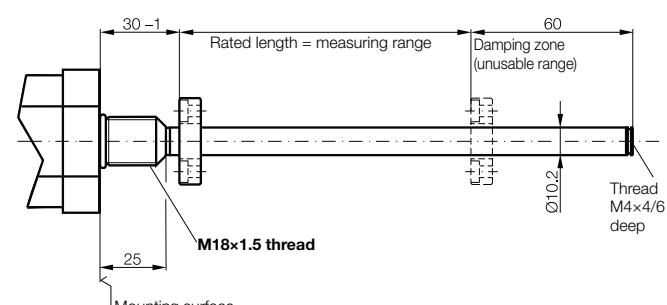
3/4" UNF mounting thread
8 mm protective tube
Max. 1016 mm rated length



Rod BTL5/BTL6
General
Data
CANopen
Interface
Profinet DP
Interface
Ethernet
Interface
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Style A
BTL5- -A-

Metric mounting thread
M18x1.5
Flange without
0.5/Ø 25 mm mounting surface



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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 conforming with CiA Standard DS301 Rev. 3.0, and 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)

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.

LED

Display of the CANopen status in accordance with DS303-3

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

This 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/CAN open tool. The configuration is stored in the transducer's non-volatile memory.



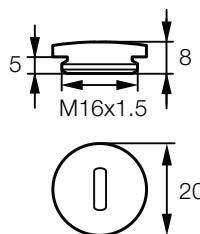
CiA 199911-301v30/11-009

Use of multiple position encoders

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

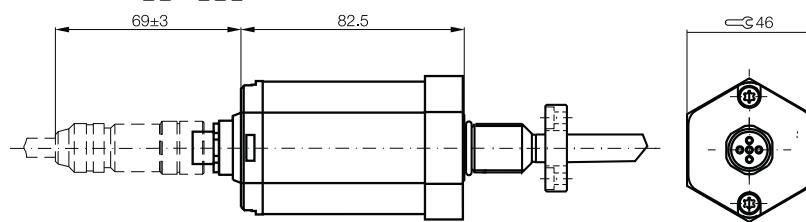
Inside temperature monitoring

A built-in temperature sensor enables monitoring of the inside temperature in the electronic head. The temperature can be queried via the bus protocol.

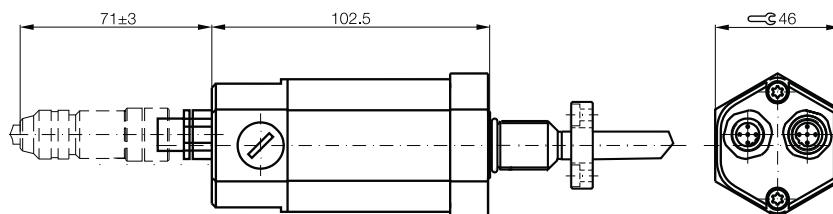


Transparent cover BKS 16-CS-00
Ordering code: BAM0116

BTL5-H1_-M_- -B-S92



BTL5-H1_-M_- -B-S94



Node ID can be set by DIP switch

Rod BTL5 CANopen interface

BTL5 rod	
Series	CANopen
Output signal	CANopen
Transducer interface	H
Customer device interface	CANopen
Part number	BTL5-H1_ _-M_ _-_S92
Part number	BTL5-H1_ _-M_ _-_S94
Repeat accuracy	±1 digit
System resolution	Position 5 µm increments
Configurable	Velocity 0.1 mm/s increments
Hysteresis	≤ 1 digit
Measurement rate	$f_{STANDARD} = 1 \text{ kHz}$
Max. linearity deviation	±30 µm at 5 µm resolution
Temperature coefficient of overall system	(6 µm + 5 ppm \times 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



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Profile BIW

Rod BTL7

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Rod BTL5/BTL6

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Profibus DP
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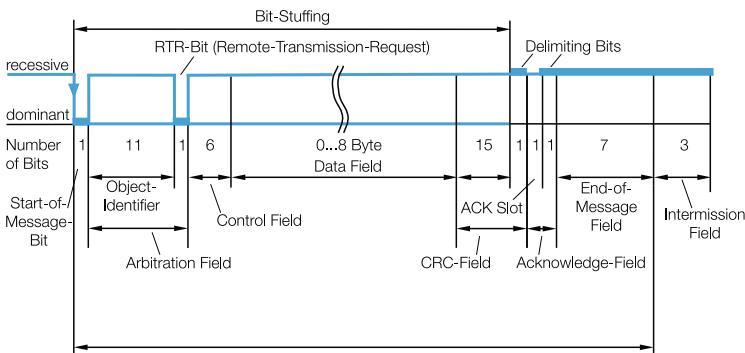
Rod Compact
and Rod AR

Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

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Please enter code for software configuration, baud rate and rated length 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:

BTL5-H1_ _-M_ _-_S92
BTL5-H1_ _-M_ _-_S94

Software configuration	Baud rate	Standard Rated length [mm]	Design
1 1 x position and 1 x velocity	0 1 Mbaud 1 800 kbaud	0025...4000 mm in 1-mm increments	B Standard M18x1.5 For additional designs, see page 169
2 2 x position and 2 x velocity	2 500 kbaud 3 250 kbaud		
3 4 x position	4 125 kbaud 5 100 kbaud 6 50 kbaud 7 20 kbaud 8 10 kbaud		

Connecting analog sensors

BTL5-H1A/C/E _ -M _ _ _ -A/B/Y/Z(8)-C001 allows the use of analog pressure or temperature sensors in parallel with the transducer. In this manner, the measured values of the analog sensors are transferred very easily in the CAN protocol. Analog inputs are detected in series, not simultaneously. The second channel is converted while the first channel is being read and vice versa.

The analog process signal from the BTL is converted into digital form because the analog values from the BTL are only processed in digital form. The overall conversion time consists of the time the converter takes to perform the conversion plus additional processing time in the microcontroller (μ C).

The analog values are displayed in the form of a fixed-point number in the 2's complement. The prefix of the analog value is always in bit 15.

- "0" for +
- "1" for -

Use of one to four position encoders

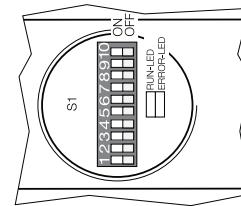
The number of encoders can be preset to 1-4 via CANopen. The transducer is preset to operate with an encoder on delivery. The minimum distance between the position encoders must be 65 mm.

Setting the node ID

For the node ID, values between 0...63 can be preset using DIP switches S1.1...S1.6.

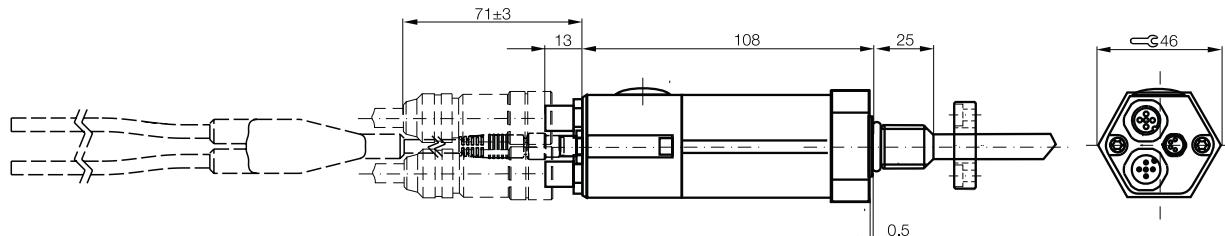


CIA 199911-301v30/11-009

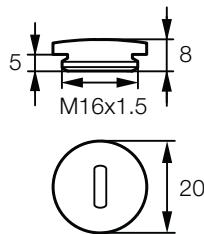


BTL5-H1_ _ _ -M _ _ _ -C001

Top view of DIP switch S1



Node ID can be set by DIP switch



Transparent cover **BKS 16-CS-00**
Ordering code: **BAM0116**

Rod BTL5 CANopen interface

Series		Rod BTL5							
Output signal		CANopen							
Transducer interface		H							
Customer device interface		CANopen							
Part number		BTL5- H1 ---							
CANopen version		Floating							
Repeat accuracy		±1 digit							
System resolution	Position	5 µm increments							
Configurable	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 input configuration, baud rate and rated length in the part number. Cable on request.

Scope of delivery

- Transducer
- Quick start instructions

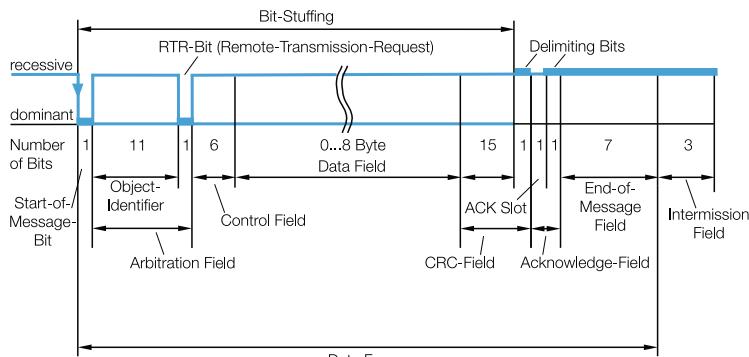
Please order separately:

- Position encoders, see page 218
- Floats, see page 216
- Fastening nut, see page 219
- Plug connectors, see page 252

Ordering example:

BTL5-H1  **-M**  **-C001**

Input configuration	Baud rate	Standard Rated length [mm]	Design
A 3-wire voltage, 0...+10 V, 12-bit, Max. 2 inputs	0 1 Mbaud 1 800 kbaud 2 500 kbaud	0025...4000 mm in 1-mm increments	B Standard M18×1.5 For additional designs, see page 169
C 3-wire current, 0...20 mA, 12-bit, Max. 2 inputs	3 250 kbaud 4 125 kbaud 5 100 kbaud		
E 2-wire current, 4...20 mA, 12-bit, Max. 2 inputs	6 50 kbaud 7 20 kbaud 8 10 kbaud		



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.



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Rod BTL7

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Programming
SSI Interface
Digital Pulse Interface

Rod BTL5/BTL6

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CANopen Interface
Profibus DP Interface
Ethernet Interface
4 Programmable Switching Points

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Filling Level Sensor SF

Accessories

Basic Information and Definitions

As the market leading standard for serial data transmission for process automation, Profibus DP is the ideal choice for implementing automation tasks with cycle times of > 5 ms.

Data transmission

A Profibus telegram can contain up to 244 bytes of user data per telegram and node. The BTL5-T uses max. 32 bytes (max. 4 position values and max. 4 speed values) for process data transmission. Up to 126 active stations (Addresses 0 to 125) can be connected to Profibus DP. User data cannot be sent with node address 126. This address is used as the default address for bus nodes that have to be configured by a Class 2 master (for setting the device address if there are no mechanical switches available). Each Profibus node has the same priority. Prioritizing individual nodes is not intended, but can be done by the master since the bus transmission only makes up a fraction of the process cycle anyway. At a transfer rate of 12 Mbaud, the transmission time for an average data telegram is in the 100 μ s range.

GSD (device master data)

The length of the data exchangeable with a slave is defined in the Device Master Data file (GSD) and is checked by the slave with the configuration telegram and confirmed for correctness. In modular systems, various configurations are defined in the GSD file. Depending on the desired functionality, one of these configurations can be selected by the user. The BTL5-T is a modular device with the option of selecting the number of magnets (position values).

Process data

Under Profibus DP, the default is for process data to be sent from the master to slaves acyclically and for the slave data to then be queried. To ensure synchronization of multiple devices, the master may use the SYNC and FREEZE services.

DP/V1 and DP/V2 isochronous mode

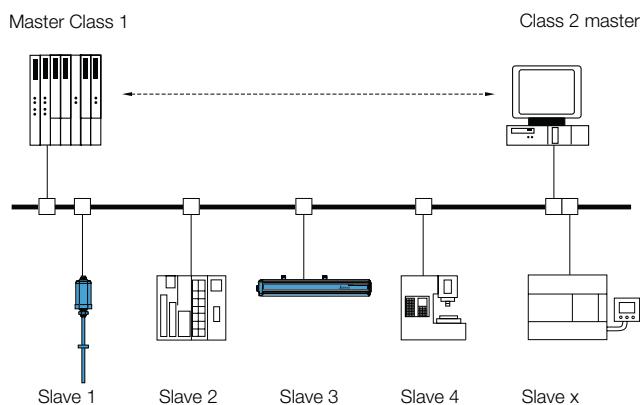
Isochronous mode enables quick and deterministic data exchange by means of clock synchronicity on the bus system. A cyclical, equidistant clock signal is sent by the master to all bus nodes. This signal allows master and slaves to be synchronized irrespective of application – with an accuracy < 1 μ s.

FMM

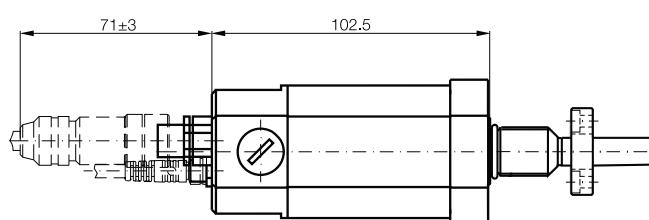
The sensor can be operated as a 4-magnet type, whereby the sensor itself recognizes how many magnets are currently active. So if only two magnets are positioned in the measuring range, a valid value is output for the first two positions and a defined error value for positions 3 and 4.

Inside temperature monitoring

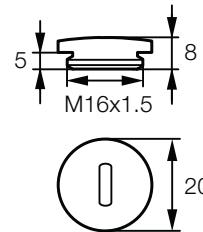
A built-in temperature sensor enables monitoring of the inside temperature in the electronic head. The temperature can be queried via the bus protocol.



Device address can be set by DIP switch



The address can be set by the DIP switch.

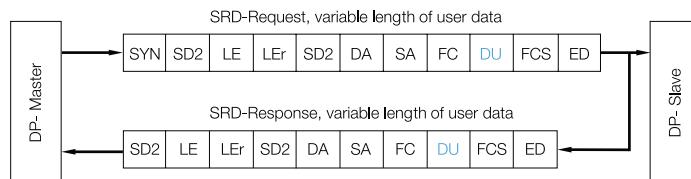


Transparent cover **BKS 16-CS-00**
Ordering code: **BAM0116**

Rod BTL5 Profibus DP interface

Series		Rod BTL5				
Output signal		Profibus DP				
Transducer interface		T				
Customer device interface		Profibus DP				
Part number plug version S103		BTL5-T1_0-M_ _ _ -S103				
Profibus version		EN 50170, encoder profile				
Profibus interface		Floating				
Repeat accuracy		±1 digit				
System resolution	Position	Configurable in increments of 5 µm				
Configurable	Velocity	0.1 mm/s increments configurable				
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				
Position encoder travel speed		any				
Supply voltage		20...28 V DC				
Current consumption		≤ 120 mA				
Operating temperature		-40...+85 °C				
Storage temperature		-40...+100 °C				
GSD file		BTL504B2.GSD				
Address assignment		Mechanical switches and Class 2 master				
Cable length [m]		< 100	< 200	< 400	< 1000	< 1200
Baud rate [Kbps]		12000	1500	900	187.5	93.7/19.2/9.6

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



Scope of delivery

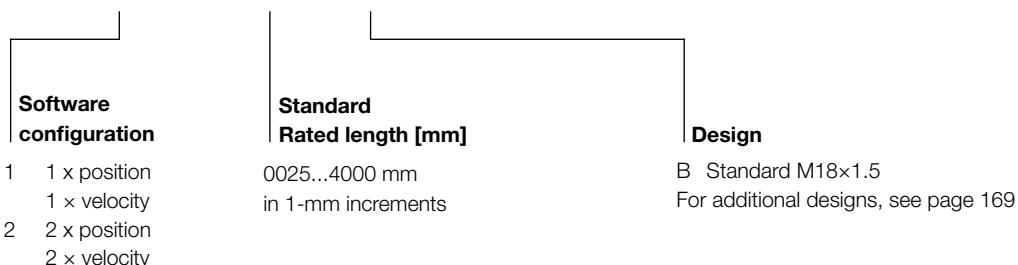
- Transducer
- Quick start instructions

Please order separately:

- Position encoders, see page 218
- Floats, see page 216
- Fastening nut, see page 219
- Plug connectors, see page 252

Ordering example:

B T L 5 - T 1 _ 0 - M _ _ _ _ - _ - S 1 0 3



Feedback system for hydraulically controlled axes

Micropulse position measurement systems with a rod design integrated in the pressure section of the hydraulic cylinder measure the current piston position directly. Optimal control quality of the hydraulic axis is achieved through dynamic, reproducible high-precision measurements. The extremely quick and secure real-time data transmission of the industrial Ethernet and the precise dynamic measurement of the piston position of the Micropulse BTL makes the system ideal for use in advanced applications with regulated axes.

Reduction in material and installation costs

The Micropulse position measurement system's single-plug solution lowers total system costs enormously. And every plug connection spared also means that a significant source of errors is eliminated.

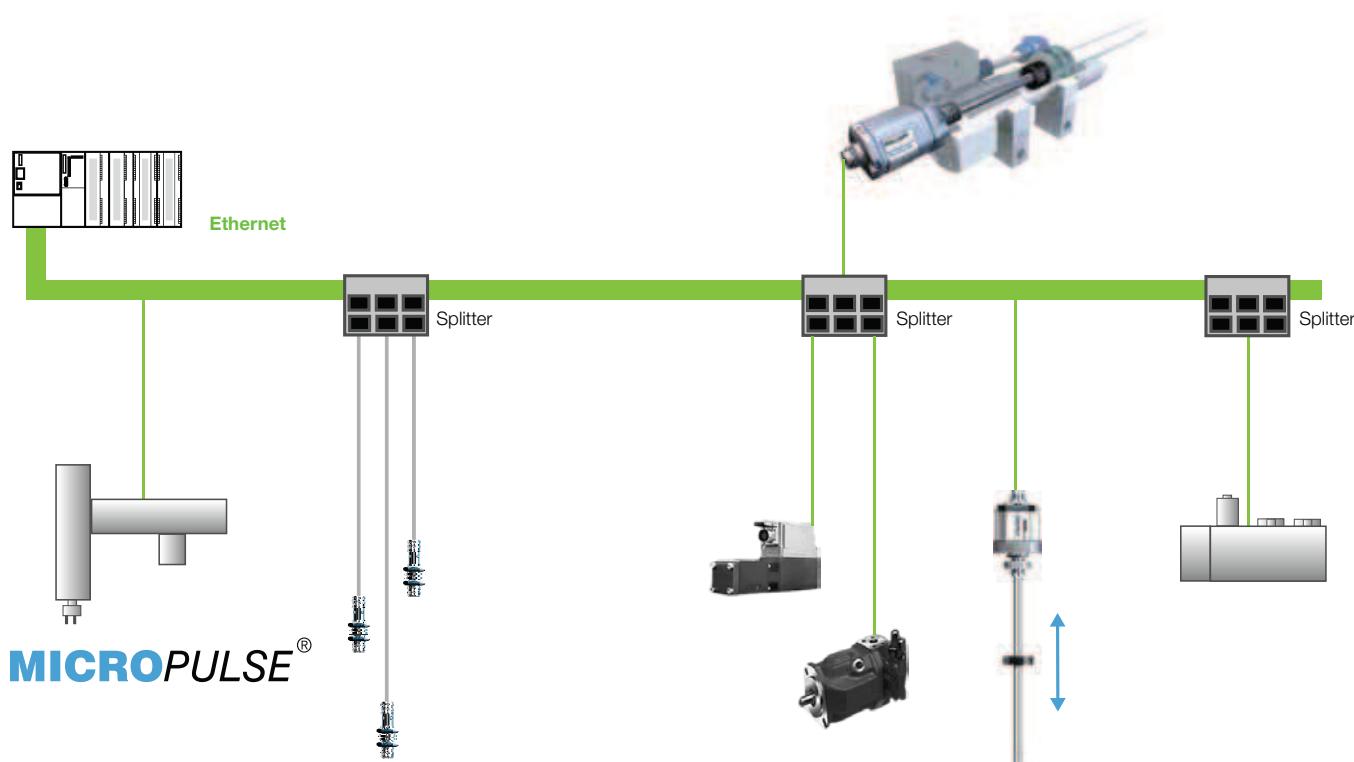
Features

- Non-contact detection of the measuring position
- Pressure-resistant up to 600 bar (1000 bar) for direct integration in the pressure area
- IP 67, insensitive to contamination
- Insensitive to shock and vibration
- Absolute output signal
- Measurement length up to 4012 mm
- Fast, simple mounting
- Single-plug solution – lower system costs

Additional information

For VARAN, see www.varan-bus.net
or for EtherCAT, see www.ethercat.org

EtherCAT®



Rod BTL6

Ethernet interface

Series	Rod BTL6	Rod BTL6
Output signal	VARAN	EtherCAT
Transducer interface	V11V	V11E
Customer device interface	VARAN	EtherCAT
Part number	BTL6-V11V-M_ _ _ -B-S115	BTL-V11E-M_ _ _ -B-S115
System resolution	$\leq 15 \mu\text{m}$	$\leq 10 \mu\text{m}$
Repeat accuracy	$\leq 20 \mu\text{m}$	$\leq 30 \mu\text{m}$
Measurement rate	$f_{\text{STANDARD}} = 1 \text{ kHz} (< 850 \text{ mm})$	$f_{\text{STANDARD}} = 1 \text{ kHz} (< 850 \text{ mm})$
Linearity deviation	$\leq \pm 200 \mu\text{m}$ up to 500 mm rated length $\pm 0.04 \%$ 500...1500 mm rated length	$\leq \pm 200 \mu\text{m}$ up to 500 mm rated length $\pm 0.04 \%$ 500...1500 mm rated length
Supply voltage	20...28 V DC	20...28 V DC
Current consumption	$\leq 75 \text{ mA}$	$\leq 100 \text{ mA}$
Polarity reversal protected	yes	yes
Operating temperature	0...+70 °C	0...+70 °C
Storage temperature	-40...+100 °C	-40...+100 °C



Micropulse
Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod BTL7
General
Data
Analog
Interface
Programming
SSI Interface
Digital Pulse
Interface

Rod BTL5/BTL6
General
Data

CANopen
Interface

Profinet DP
Interface

Ethernet
Interface

4 Programmable
Switching Points

Installation
Notices

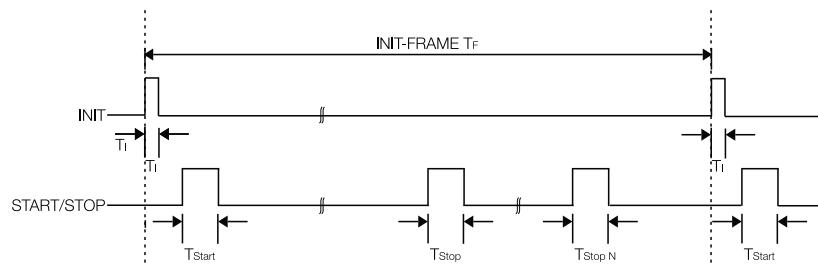
Rod Compact
and Rod AR

Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

Accessories

Basic
Information and
Definitions



Please enter the code for the rated length in the part number.

Scope of delivery

- Transducer
- Quick start instructions

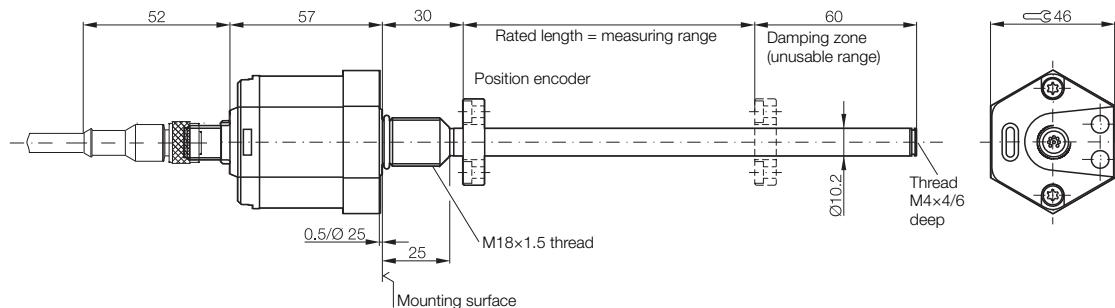
Please order separately:

- Position encoders, see page 218
- Floats, see page 216
- Fastening nut, see page 219
- Plug connectors, see page 252

Ordering example:

B T L 6 - V 1 1 _ - M _ _ _ - _ - S 1 1 5

Interface	Standard Rated length [mm]	Design
V VARAN	0025...4012 mm in 1-mm increments	B Standard M18x1.5 For additional designs, see page 169
E EtherCAT		

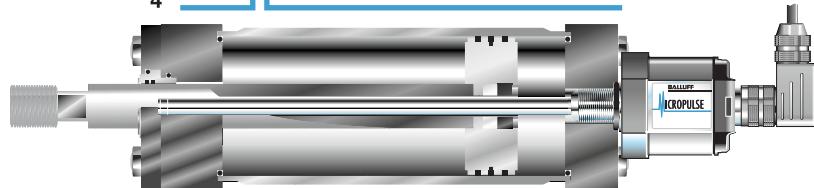
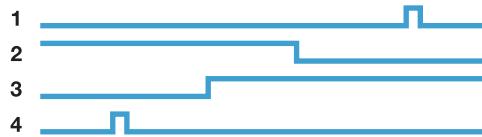
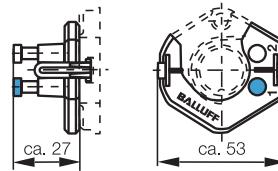


Single position measurement between the piston limits on a standard cylinder series

Benefits

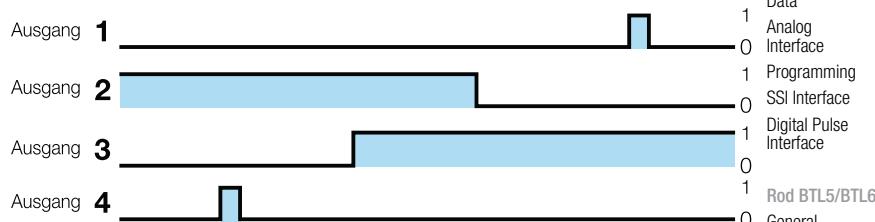
- No special design of piston or piston rod necessary
- No permanent magnet required between the piston seals
- Easy to program
- No time-consuming adjustment
- High resolution and reproducibility
- Switching points freely programmable using calibration device or programming inputs

BTL5-A-EH01 calibration device for programming the outputs



Rod BTL5

Series	Rod BTL5
Transducer interface	F
Customer device interface	digital
Part number	BTL5-F1_0-M_--S115
Output signals	4 switching outputs
Max. current load per output	100 mA
Max. current load for 4 outputs	200 mA
Repeat accuracy	±0.1 mm
Measurement rate	f _{STANDARD} = 1 kHz = ≤ 1400 mm
Supply voltage	24 V DC ±20%
Current consumption without load	≤ 100 mA
Operating temperature	-40...+85 °C
Storage temperature	-40...+100 °C
Shock load	100 g/6 ms as per EN 60068-2-27
Vibration	12 g, 10...2000 Hz as per EN 60068-2-6
Dielectric strength	500 V DC (GND to housing)
Degree of protection as per IEC 60529	IP 67 (with IP-67 connector BKS-S... attached)
Housing material	Anodized aluminum/1.4571 stainless steel protective tube, 1.3952 stainless steel cast flange
Fastener	Thread M18×1.5, 3/4"-16 UNF on request
Pressure rating	600 bar with installation in hydraulic cylinder
Connection	Connectors



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

Scope of delivery

- Transducer
- Quick start instructions
- Calibration device

Please order separately:

Position encoders, see page 218

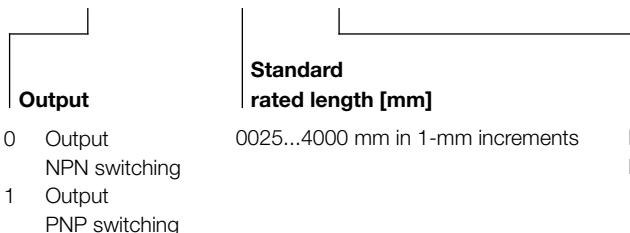
Floats, see page 216

Fastening nut, see page 219

Plug connectors, see page 252

Ordering example:

BTL5-F1 **0-M** - **-S115**



B Standard M18×1.5
For additional designs, see page 169



Installation Notices

Rod Compact and Rod AR

Rod EX,
T Redundant
and CP

Filling Level Sensor SF

Accessories

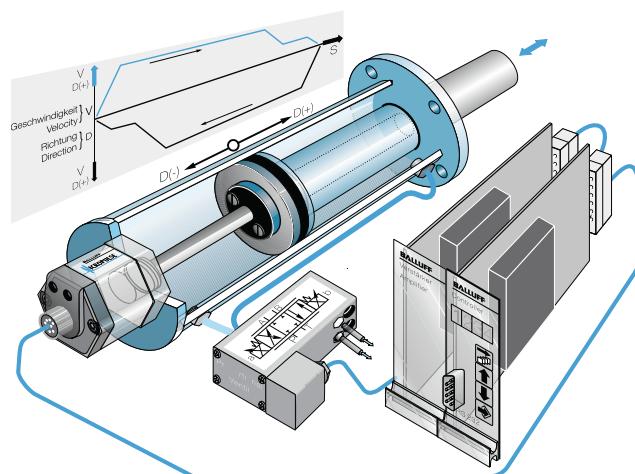
Information and Definitions

Rod BTL5 **Installation notices**

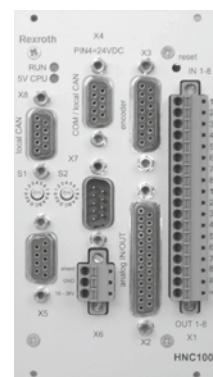
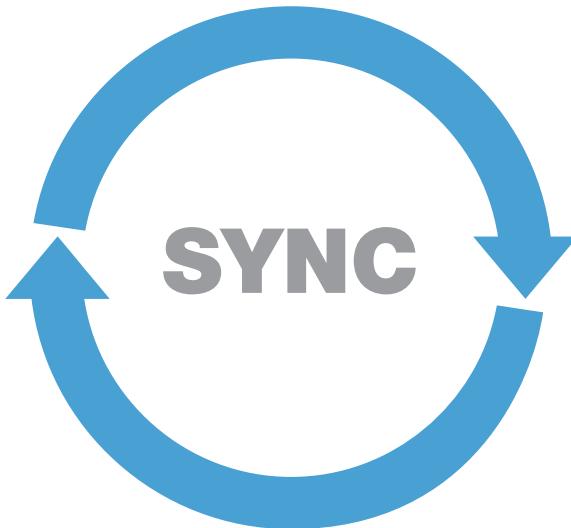
SSI-SYNC – better control behavior and higher dynamics

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.

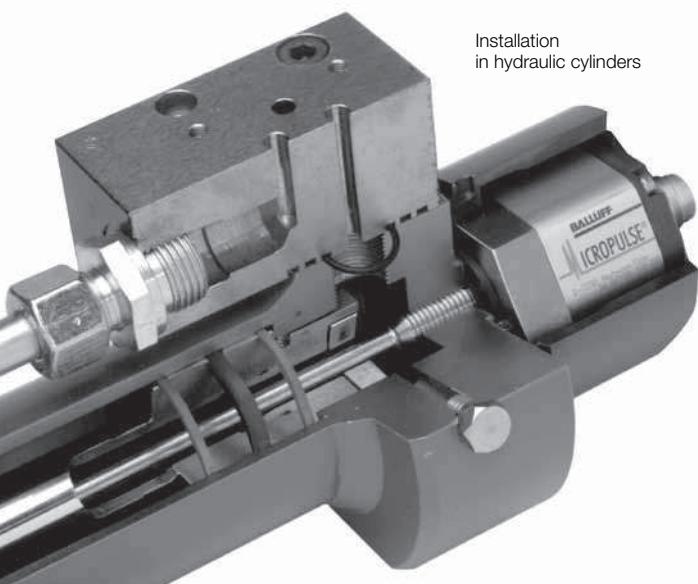
The feedback of these status sizes (speed and acceleration) allows the damping and natural frequency of a hydraulic system to be increased. These measures permit greater loop gain and with it, better control behavior and higher dynamics.



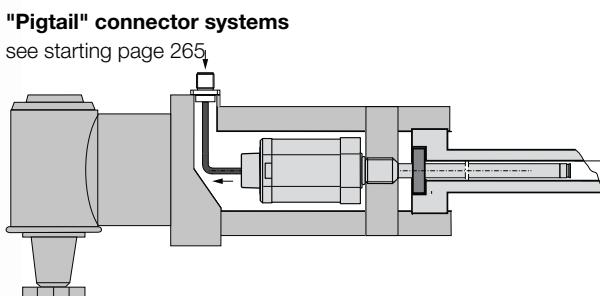
Application with hydraulic cylinder in a control loop



Control card with SSI
interface for connecting
Micropulse transducers



Installation in hydraulic cylinders



"Pigtail" connector systems

see starting page 2

Caution!

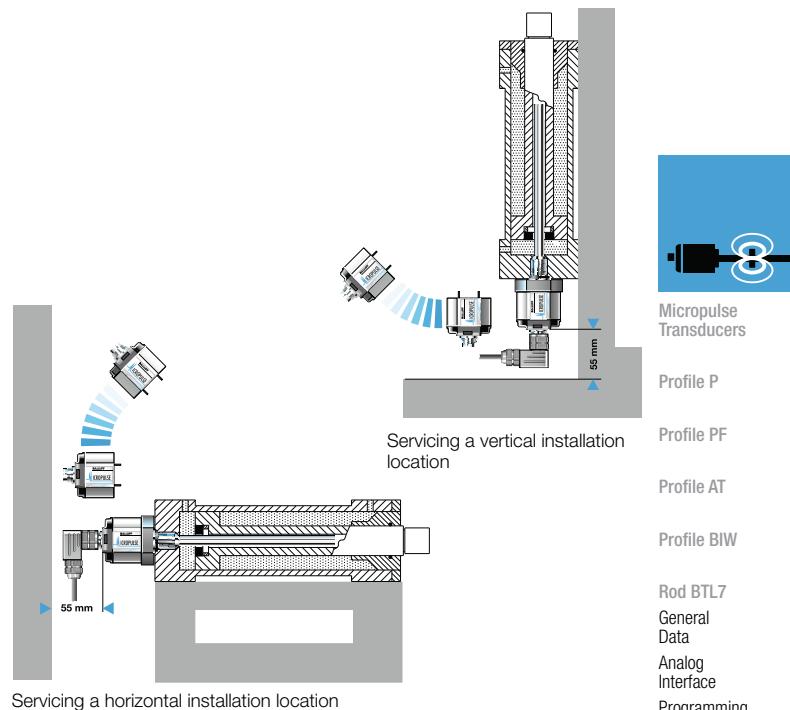
Caution:
Before design, installation and startup please familiarize yourself with the user's guide to be found at www.balluff.com.

Rod BTL5

Installation notices

Service without great assembly effort

Transducers are often installed in hydraulic cylinders at locations that are difficult to access. In the event of service, a complete replacement of the electronics with waveguide is often a difficult and expensive proposition. Should a problem occur in the electronics of the Micropulse Transducer, the electronics head can be easily and quickly exchanged for a new one. The fluid circuit is also not closed in the event of service, as no drainage is necessary.

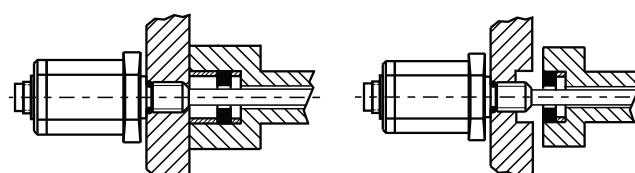
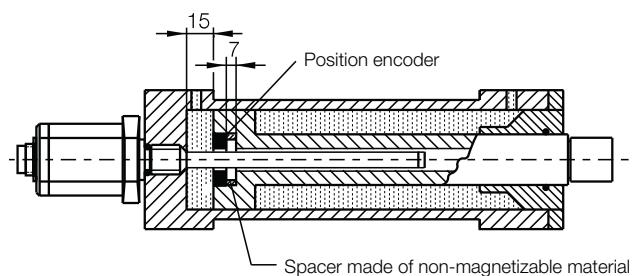
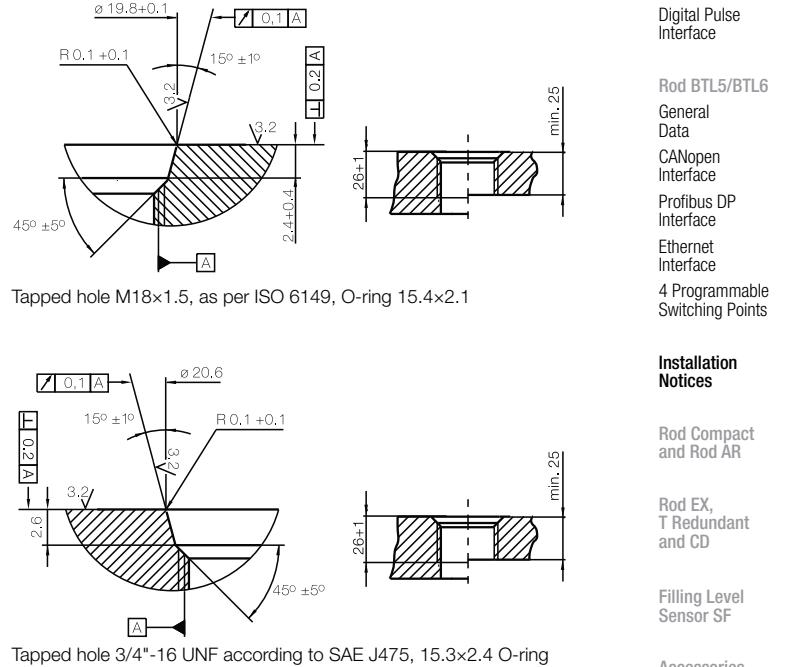


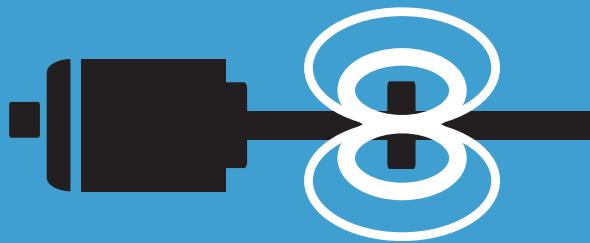
Installation

The Micropulse transducer BTL has a mounting thread M18x1.5. 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 done at the flange mounting surface, for example, in the B design, with a M18x1.5 thread with an included 15.4x2.1 O-ring.

Tapped hole

The transducer comes with an M18x1.5 (according to ISO) or a 3/4"-16 UNF (according to SAE) thread to secure it. Depending on the version, the hole must be tapped before installation.

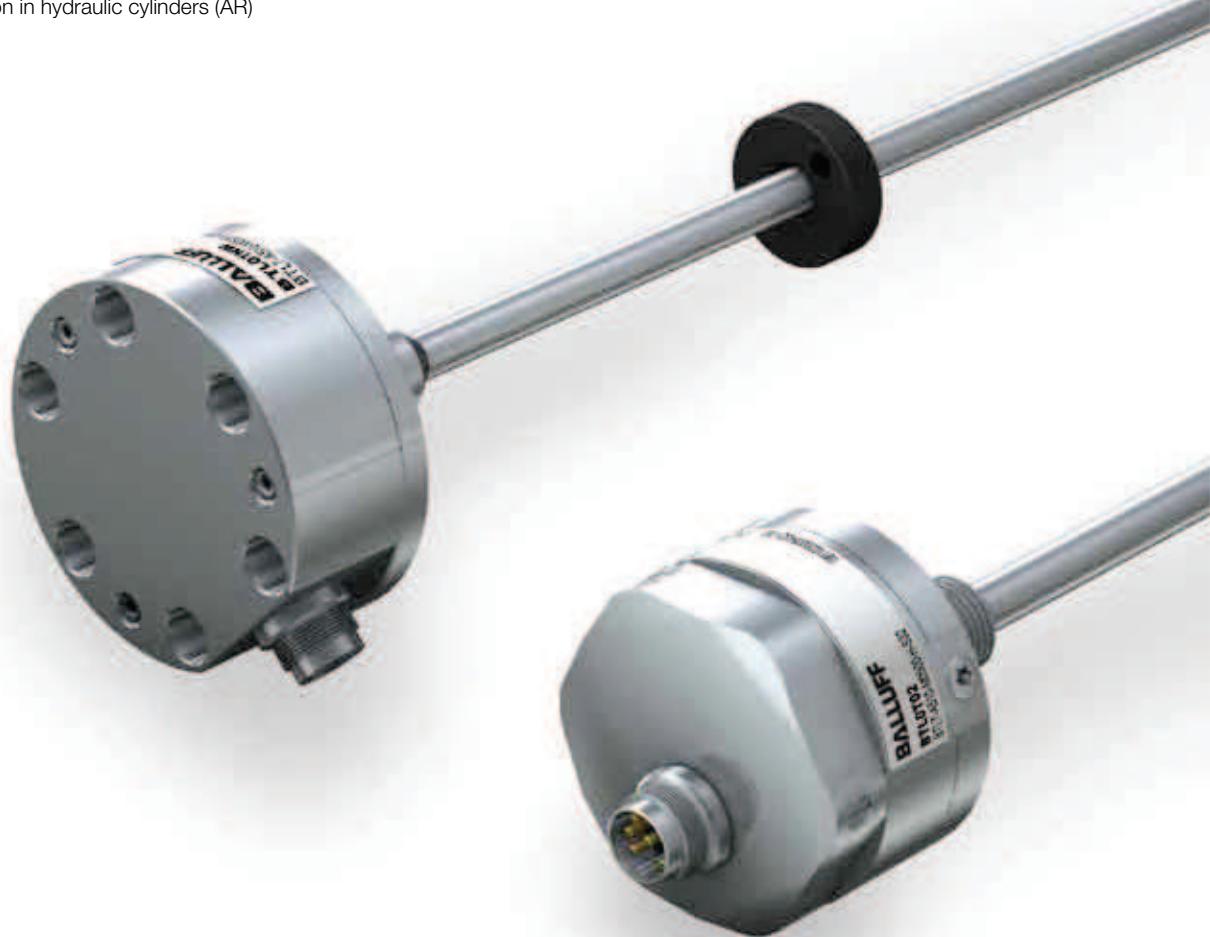




Micropulse Transducers

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)

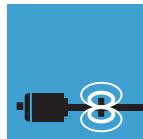




Rod Compact and Rod AR Contents

Rod Compact

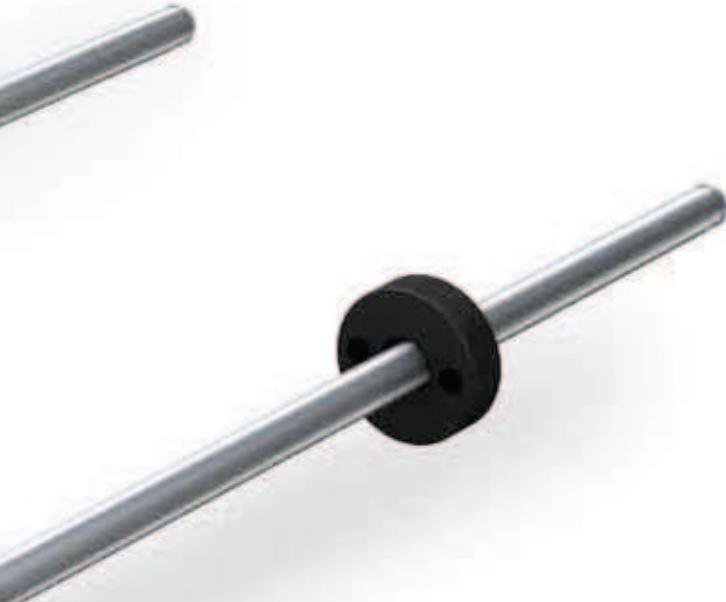
K BTL7, General Data	184
H/W BTL7, General Data	186
BTL7, General Data	188
K BTL5, General Data	192
H/W BTL5, General Data	194
HB/WB BTL5, General Data	196
Analog Interface	198
Digital Pulse Interface	200
SSI Interface	202
CANopen Interface	204
Installation Notices	206



Rod AR BTL6

General Data	208
Analog Interface	210
Digital Pulse Interface	212
Installation Notices	214
Floats	216
Position Encoders	218

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.

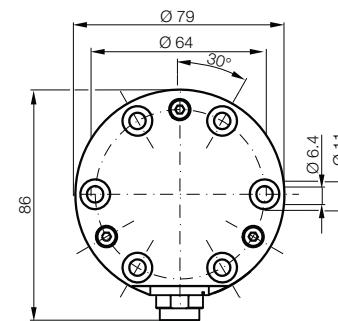
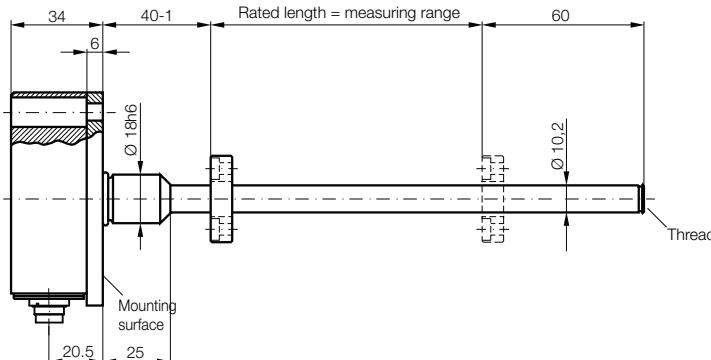
Series	Rod Compact K BTL7
Shock load	150 g/6 ms as per EN 60068-2-27
Vibration	20 g, 10...2000 Hz per EN 60068-2-6
Polarity reversal protected	to 36 V
Oversupply protection	to 36 V
Dielectric strength	500 V AC (GND to housing)
Degree of protection as per IEC 60529	IP 68 with cable outlet, IP 67 with 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



Rod Compact K BTL7

General data

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



Profile P

Profile PF

Profile AT

Profile BIW

Rod
Rod Compact
K BTL7

H/W BTL7
BTL7
K BTL5

H/W BTL5
HB/WB BTL5

Analog
Interface

Digital Pulse
Interface

SSI Interface

CANopen
Interface

Installation
Notices

Rod AR BTL6
General
Data

Analog
Interface
Digital Pulse
Interface
Installation
Notices

Floats
Position Encoders

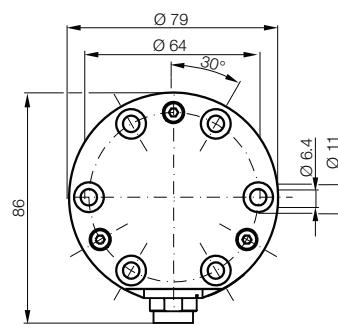
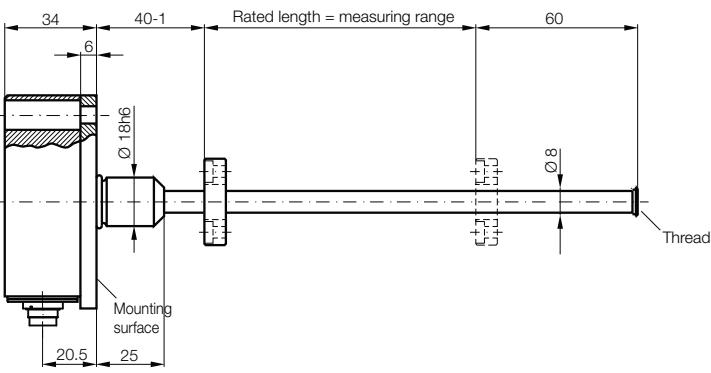
Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

Accessories

Basic
Information and
Definitions

**Design K,
BTL7-...-K8-SR32**



Micropulse
Transducers

Profile P

Profile AT

Profile BIW

Rod
Rod Compact
K BTL7

H/W BTL7
BTL7
K BTL5

H/W BTL5
HB/WB BTL5

Analog
Interface

Digital Pulse
Interface

SSI Interface

CANopen
Interface

Installation
Notices

Rod AR BTL6
General
Data

Analog
Interface
Digital Pulse
Interface
Installation
Notices

Floats
Position Encoders

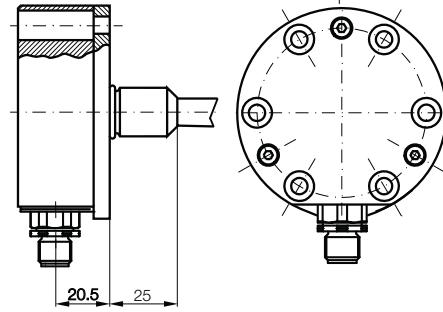
Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

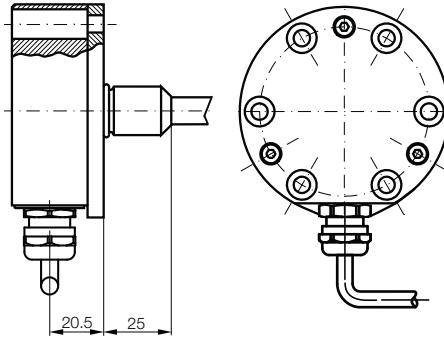
Accessories

Basic
Information and
Definitions

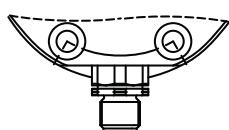
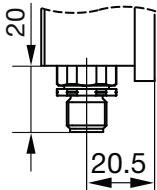
**Design K,
BTL7-...-K-SR115**



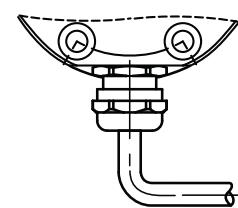
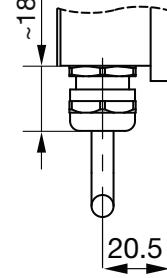
Design K, BTL7-...-K-K __, radial cable outlet



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
Oversupply 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 M18x1.5 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



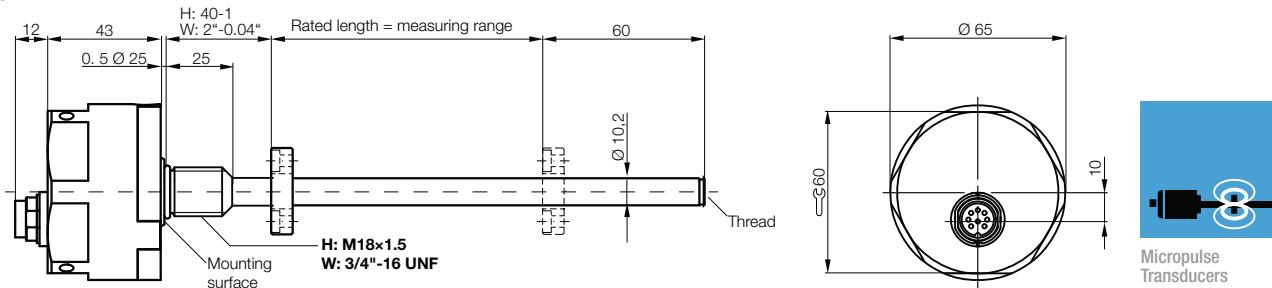
Caution!

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

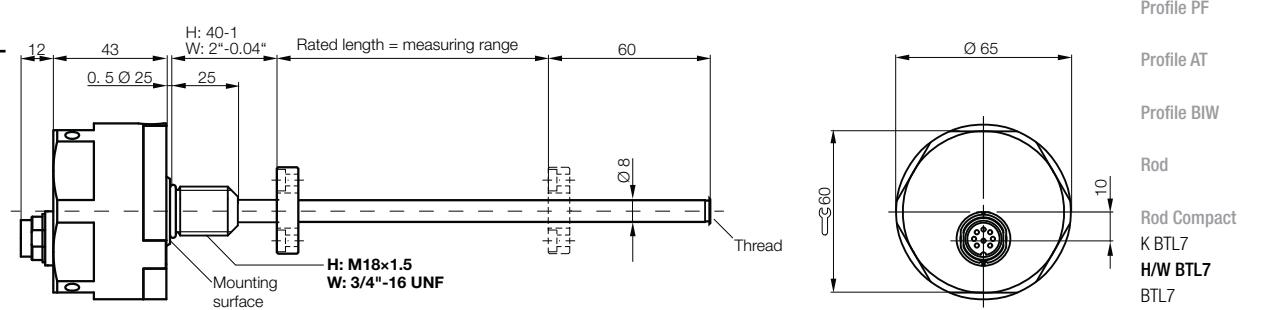
"Long" up to 7620 mm

Rod Compact BTL7 H/W General data

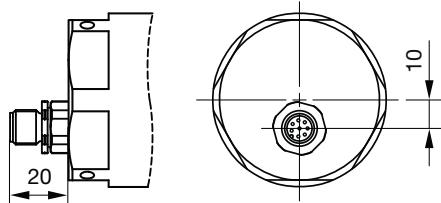
Design H/W, BTL7-...-H/W-S32



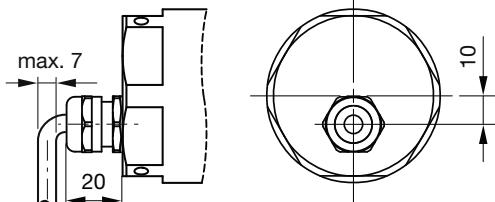
Design H/W, BTL7-...-H8/W8-S32,



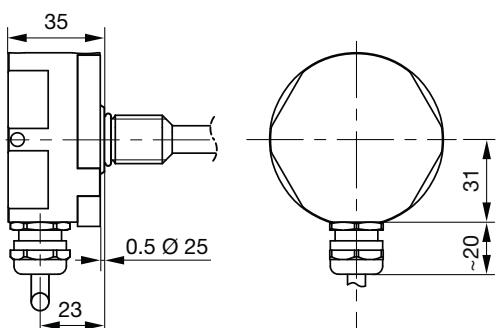
Design H/W, BTL7-...-H/W-S115



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



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



Micropulse
Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact

K BTL7

BTL7

K BTL5

H/W BTL5

HB/WB BTL5

Analog
Interface

Digital Pulse
Interface

SSI Interface

CANopen

Interface

Installation
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Rod AR BTL6

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Interface

Installation
Notices

Floats
Position Encoders

Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

Accessories

Basic
Information and
Definitions

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 $-40\dots+85^\circ\text{C}$

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	
Oversupply protection	
Dielectric strength	
Operating temperature	

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

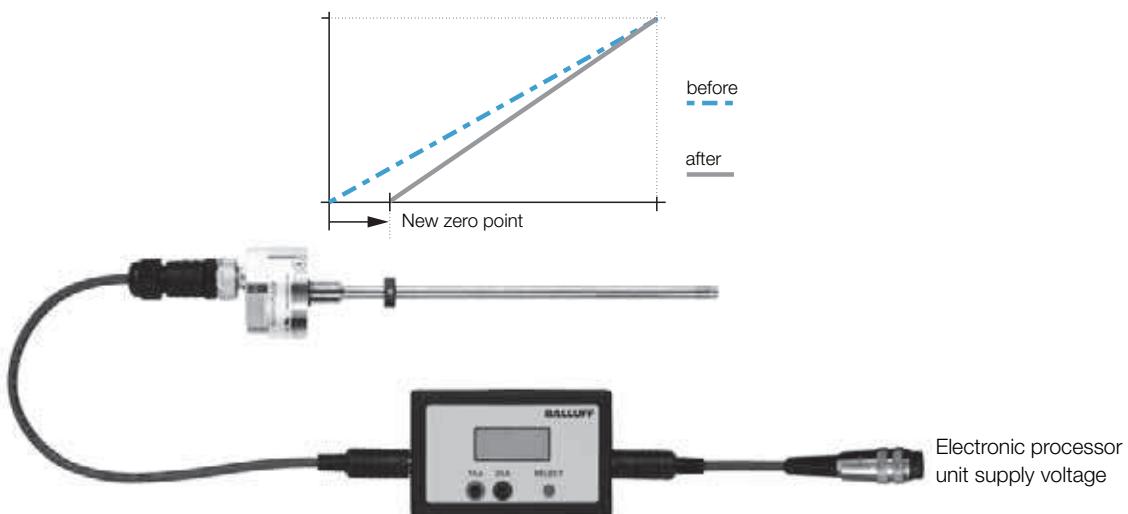
Scope of delivery

- 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

General data

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-A510-M_	BTL7-G510-M_	BTL7-E5_0-M_	BTL7-C5_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	$\leq 500 \Omega$	$\leq 500 \Omega$
$\leq 0.33 \text{ mV}$	$\leq 0.33 \text{ mV}$	$\leq 0.66 \mu\text{A}$	$\leq 0.66 \mu\text{A}$
System resolution/min. 2 μm			
Max. 4 kHz	Max. 4 kHz	Max. 4 kHz	Max. 4 kHz
$\pm 50 \mu\text{m}$ to $\leq 500 \text{ mm}$ rated length	$\pm 50 \mu\text{m}$ to $\leq 500 \text{ mm}$ rated length	$\pm 50 \mu\text{m}$ to $\leq 500 \text{ mm}$ rated length	$\pm 50 \mu\text{m}$ to $\leq 500 \text{ mm}$ rated length
$\pm 0.01\%$ FS < 5500 mm rated length	$\pm 0.01\%$ FS < 5500 mm rated length	$\pm 0.01\%$ FS < 5500 mm rated length	$\pm 0.01\%$ FS < 5500 mm rated length
$\pm 0.02\%$ FS > 5500 mm rated length	$\pm 0.02\%$ FS > 5500 mm rated length	$\pm 0.02\%$ FS > 5500 mm rated length	$\pm 0.02\%$ FS > 5500 mm rated length
$\leq 30 \text{ ppm/K}$			
10...30 V DC	10...30 V DC	10...30 V DC	10...30 V DC
$\leq 150 \text{ mA}$			
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)			
-40...+85 °C	-40...+85 °C	-40...+85 °C	-40...+85 °C



Micropulse Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact K BTL7 H/W BTL7

BTL7 K BTL5 H/W BTL5 HB/WB BTL5

Analog Interface

Digital Pulse Interface

SSI Interface

CANopen Interface

Installation Notices

Rod AR BTL6

General Data

Analog Interface

Digital Pulse Interface

Installation Notices

Float

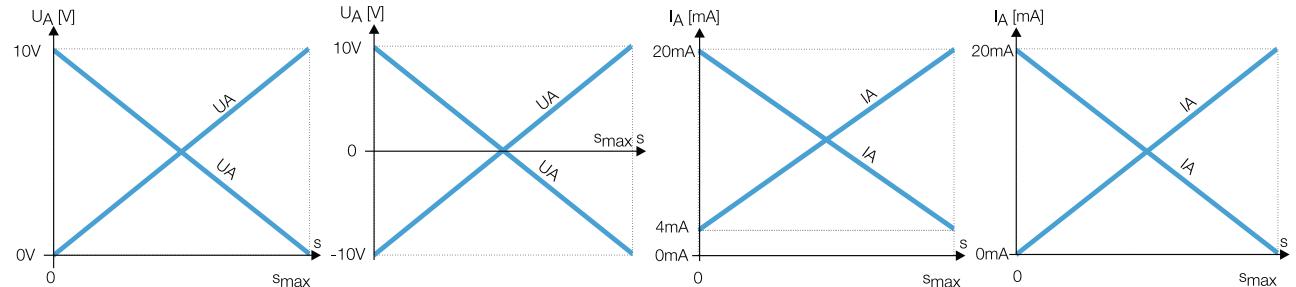
Position Encoders

Rod EX, T Redundant and CD

Filling Level Sensor SF

Accessories

Basic Information and Definitions



Ordering example:

B T L 7 - **5 0 - M** **- - -**

Output signal	Characteristic	Standard nominal strokes [mm]	Design	Connection
A 0...10 V and 10...0 V (at A and G)	1 rising and falling	0025...7620 in 1-mm increments	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	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
G -10...10 V and 10...-10 V	0 Rising (for C and E)			
E 4...20 mA or 20...4 mA	7 Falling (for C and E)			
C 0...20 mA or 20...0 mA				

H/W radial design
K02 PUR cable 2 m
K05 PUR cable 5 m
K10 PUR cable 10 m
K15 PUR cable 15 m

Accessories

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



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

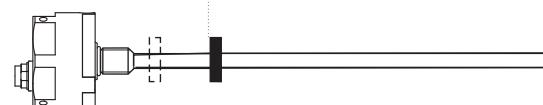
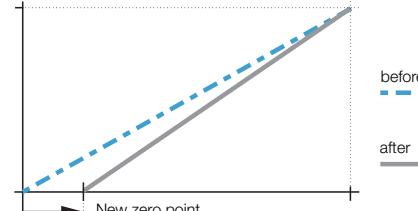
Teach-in

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.

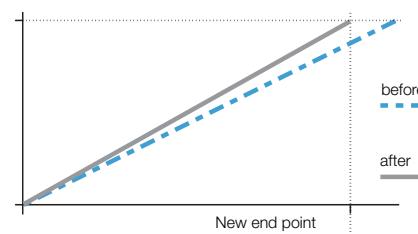
Inverting (only with BTL7-C/E)

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.



Read in new zero point



Read in new end point

Reset

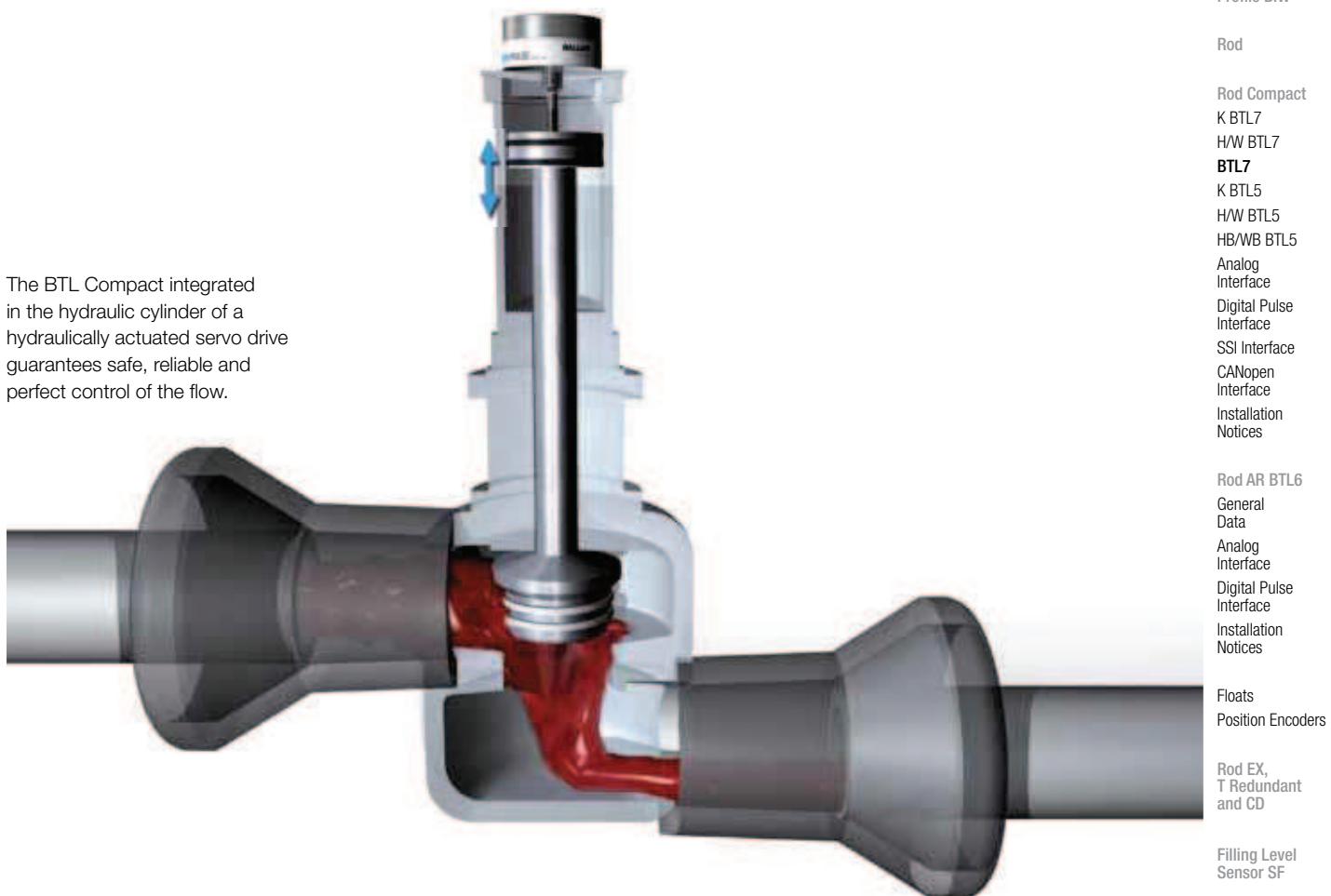
Restoring the transducer to its factory default settings.

Rod Compact BTL7 Application

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.



Micropulse
Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact

K BTL7

H/W BTL7

BTL7

K BTL5

H/W BTL5

HB/WB BTL5

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Interface

Digital Pulse
Interface

SSI Interface

CANopen
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T Redundant
and CD

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Sensor SF

Accessories

Basic
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Definitions

**Pressure-resistant to 600 bar,
high reproducibility, contact-
less, 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.

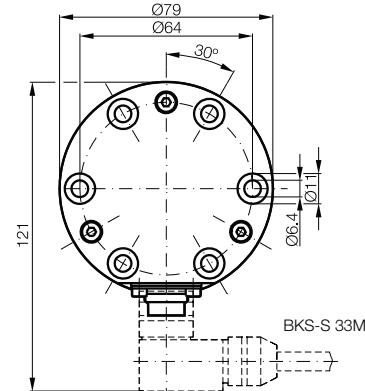
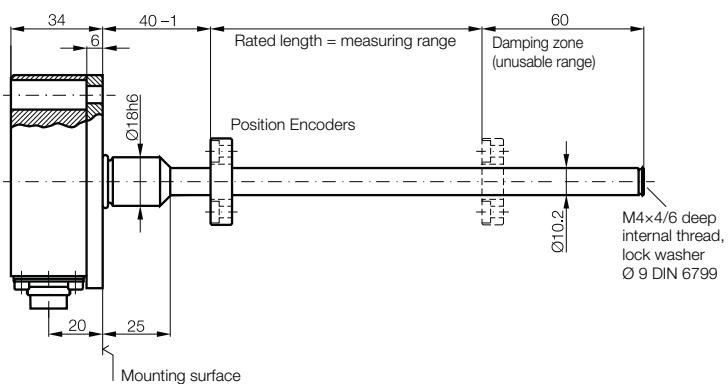
Series	Rod Compact K BTL5
Shock load	100 g/6 ms in accordance with EN 60068-2-27 and 100 g/2 ms in accordance with EN 60068-2-29
Vibration	12 g, 10...2000 Hz as per EN 60068-2-6
Polarity reversal protected	yes
Oversupply protection	TransZorb protection diodes
Dielectric strength	500 V DC (GND to housing)
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



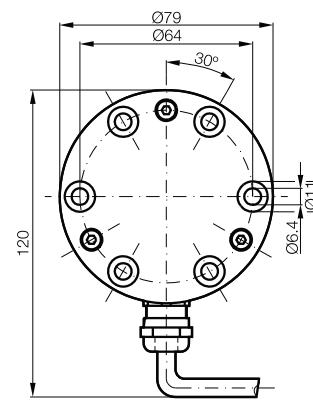
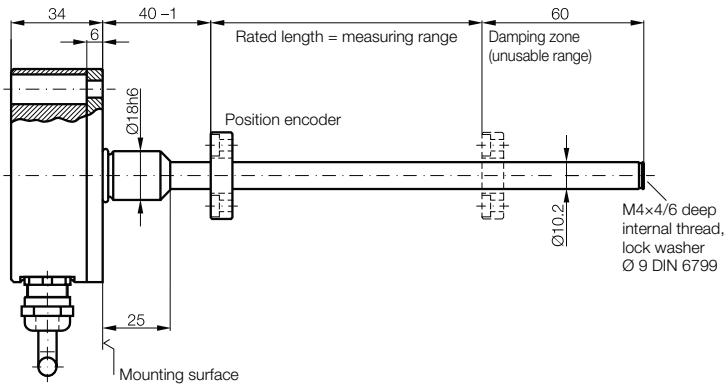
Rod Compact K BTL5

General data

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



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



Caution!

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



Micropulse
Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact
K BTL7
H/W BTL7
BTL7
K BTL5
H/W BTL5
HB/WB BTL5
Analog
Interface
Digital Pulse
Interface
SSI Interface
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Interface
Installation
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T Redundant
and CD

Filling Level
Sensor SF

Accessories

Basic
Information and
Definitions

**Pressure-resistant to 600 bar,
high reproducibility, contact-
less, 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
Oversupply 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 M18x1.5, 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

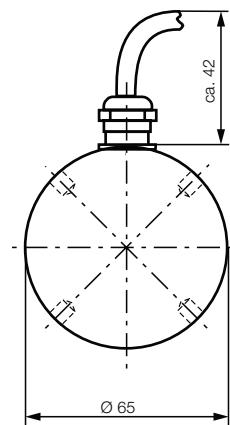
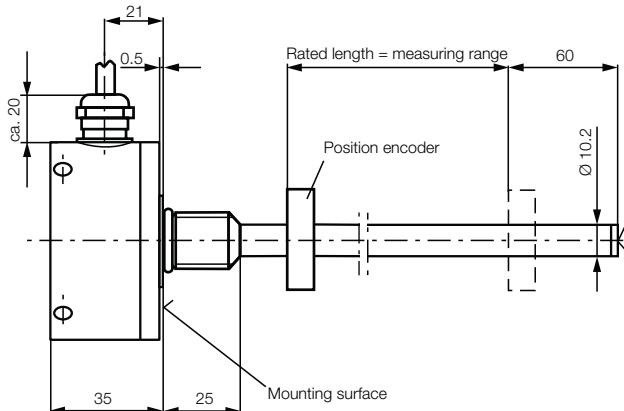


Rod Compact H/W BTL5

General data

**Hardware design,
BTL5-...-M-...-H-K**

**Mounting
thread M18x1.5
Radial cable outlet**



Micropulse
Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact
K BTL7
H/W BTL7
BTL7
K BTL5
H/W BTL5
HB/WB BTL5
Analog
Interface
Digital Pulse
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SSI Interface
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Floats

Position Encoders

Rod EX,
T Redundant
and CD

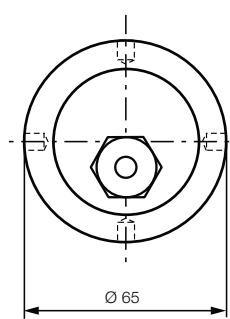
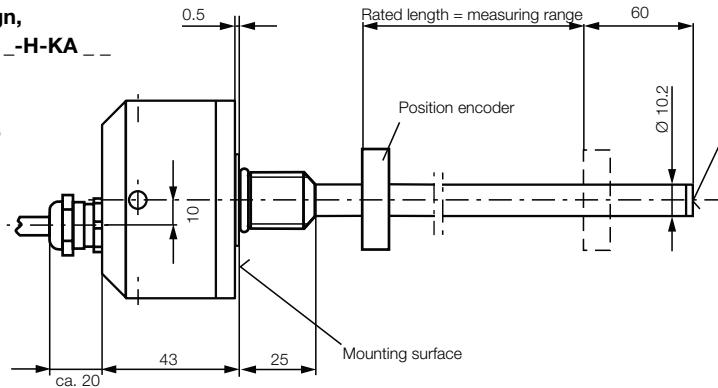
Filling Level
Sensor SF

Accessories

Basic
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Definitions

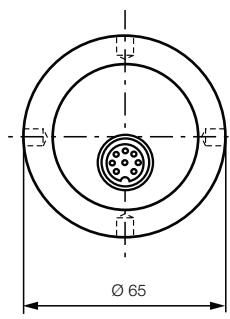
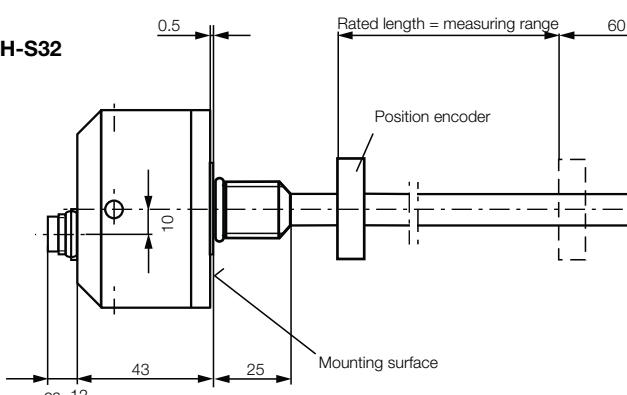
**Hardware design,
BTL5-...-M-...-H-KA**

**Mounting
thread M18x1.5
Cable outlet
axial**



**Design H/W,
BTL5-...-M-...-H-S32**

**Mounting
thread M18x1.5
Plug connector
axial**



Caution!

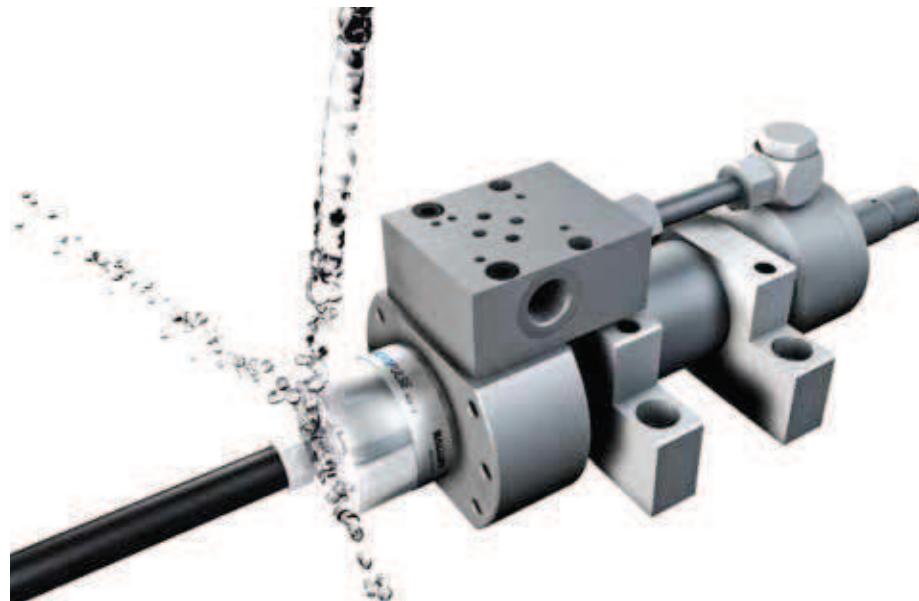
Before design, installation and startup please familiarize
yourself with the user's guide to be found at www.balluff.com.

Micropulse ProCompact with cable protection system

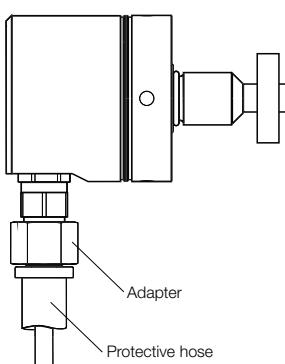
Extreme ambient conditions, in which high reliability and accuracy are required, are typical application areas for Micropulse ProCompact transducers. The non-contact working principle of the systems ensures a complete absence of wear and nearly endless service life. The high-precision output signal is 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-M18x1.5/D12-2
Housing material	Brass (not saltwater-resistant)
Ordering code	BAM01JY
Part number	BAM AD-XA-007-M18x1.5/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

Rod ProCompact HB/WB BTL5

General data

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



Micropulse
Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact

K BTL7

H/W BTL7

BTL7

K BTL5

H/W BTL5

HB/WB BTL5

Analog Interface
Digital Pulse Interface
SSI Interface
CANopen Interface
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Rod AR BTL6

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Digital Pulse Interface

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Float

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T Redundant and CD

Filling Level Sensor SF

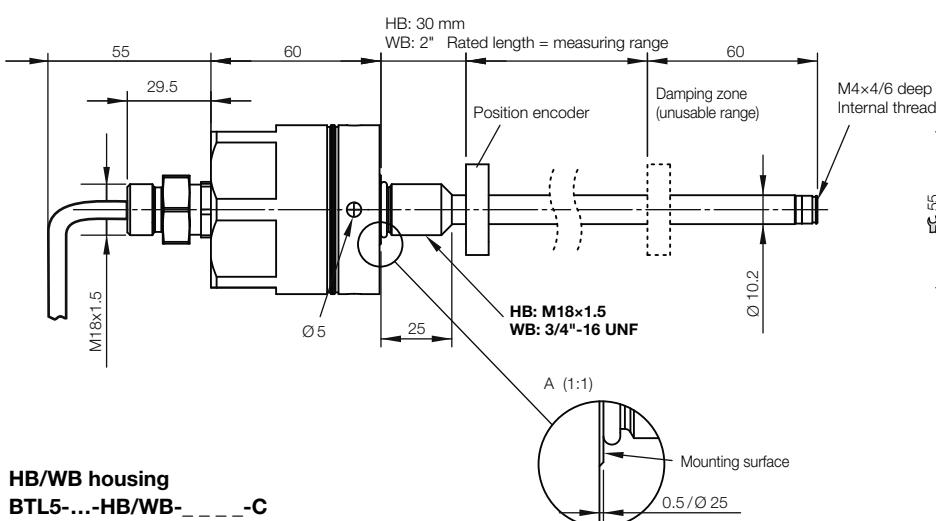
Accessories

Basic Information and Definitions

HB/WB housing

BTL5-....-HB/WB-....-C

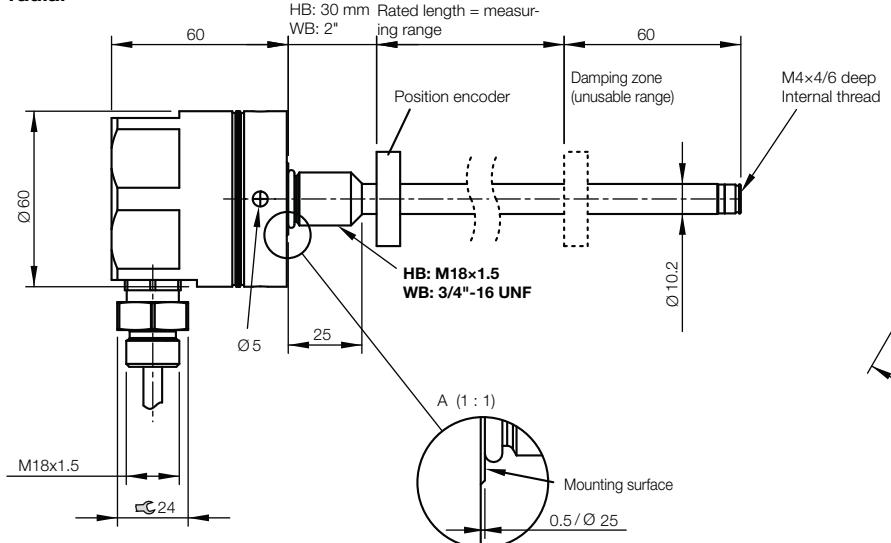
axial



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.

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	
Oversupply 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 Analog interface

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- <u> </u> -HB/WB- <u> </u>	BTL5- E1 -M- <u> </u> -HB/WB- <u> </u>	BTL5- C1 -M- <u> </u> -HB/WB- <u> </u>	BTL5- G11 -M- <u> </u> -HB/WB- <u> </u>
0...10 V and 10...0 V	4...20 mA or 20...4 mA	0...20 mA or 20...0 mA	-10...10 V and 10...-10 V
Max. 5 mA			Max. 5 mA
$\leq 5 \text{ mV}$	$\leq 500 \Omega$	$\leq 500 \Omega$	$\leq 5 \text{ mV}$
$\leq 0.1 \text{ mV}$	$\leq 0.2 \mu\text{A}$	$\leq 0.2 \mu\text{A}$	$\leq 0.1 \text{ mV}$
$\leq 4 \mu\text{m}$	$\leq 4 \mu\text{m}$	$\leq 4 \mu\text{m}$	$\leq 4 \mu\text{m}$
System resolution/min. 2 μm	System resolution/min. 2 μm	System resolution/min. 2 μm	System resolution/min. 2 μm
$f_{\text{STANDARD}} = 1 \text{ kHz}$	$f_{\text{STANDARD}} = 1 \text{ kHz}$	$f_{\text{STANDARD}} = 1 \text{ kHz}$	$f_{\text{STANDARD}} = 1 \text{ kHz}$
± 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
$\pm 0.02\%$ 500... max. rated length	$\pm 0.02\%$ 500... max. rated length	$\pm 0.02\%$ 500... max. rated length	$\pm 0.02\%$ 500... max. rated length
$[150 \mu\text{V}/\text{C} + (5 \text{ ppm}/\text{C} \times P \times U/L)] \times \Delta T$	$[0.6 \mu\text{A}/\text{C} + (10 \text{ ppm}/\text{C} \times P \times l/L)] \times \Delta T$	$[0.6 \mu\text{A}/\text{C} + (10 \text{ ppm}/\text{C} \times P \times l/L)] \times \Delta T$	$[150 \mu\text{V}/\text{C} + (5 \text{ ppm}/\text{C} \times P \times U/L)] \times \Delta T$
20...28 V DC	20...28 V DC	20...28 V DC	20...28 V DC
$\leq 150 \text{ mA}$	$\leq 150 \text{ mA}$	$\leq 150 \text{ mA}$	$\leq 150 \text{ mA}$
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



Micropulse
Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact

K BTL7

H/W BTL7

BTL7

K BTL5

H/W BTL5

HB/WB BTL5

Analog Interface

Digital Pulse Interface

SSI Interface

CANopen Interface

Installation Notices

Rod AR BTL6

General Data

Analog Interface

Digital Pulse Interface

Installation Notices

Floats

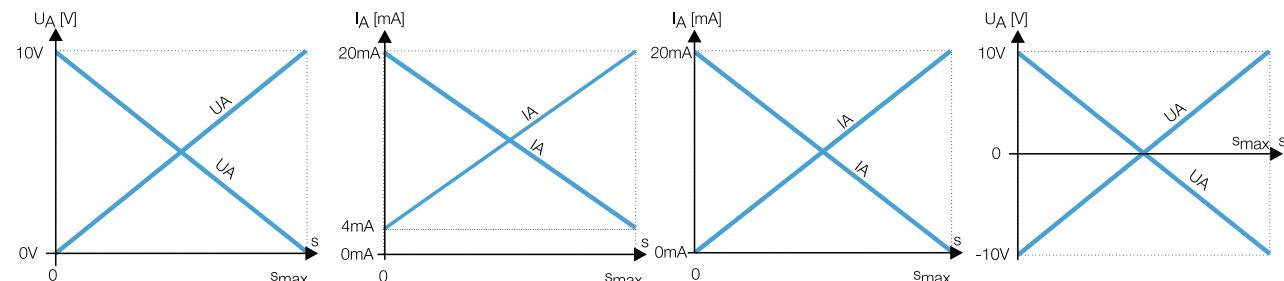
Position Encoders

Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

Accessories

Basic
Information and
Definitions



Ordering example:

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

Characteristic	Standard Rated length [mm]	Design	Connection
1 rising and falling (at A and G)	0025...5500 in 1-mm increments	HB WB	Radial output F05 5 m Teflon cable
0 Rising			Axial output FA05 5 m Teflon cable
7 falling (for C and E)			

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.

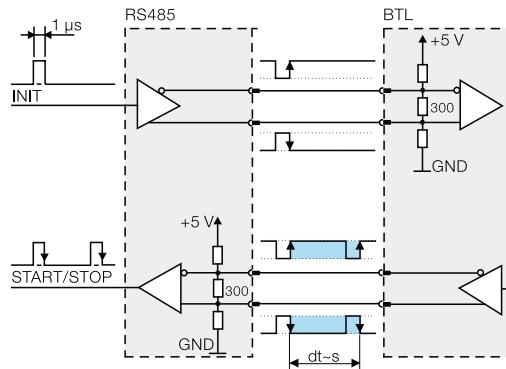
Reliable signal transmission, even with cable lengths of up to 500 m between the BTA processor unit and the BTL transducer. This is guaranteed by the especially interference-free RS485 differential drivers and receivers. Interference signals are effectively suppressed.

Highly precise digitizing of the P pulse signal

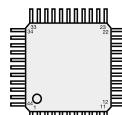
Companies developing their own electronic control and processor unit can create a highly accurate P interface cost-effectively and with minimum effort using the Balluff digitizing chip. The digitizing chip was developed as a high-resolution, configurable ASIC for Micro-pulse Transducers with P pulse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

Benefits

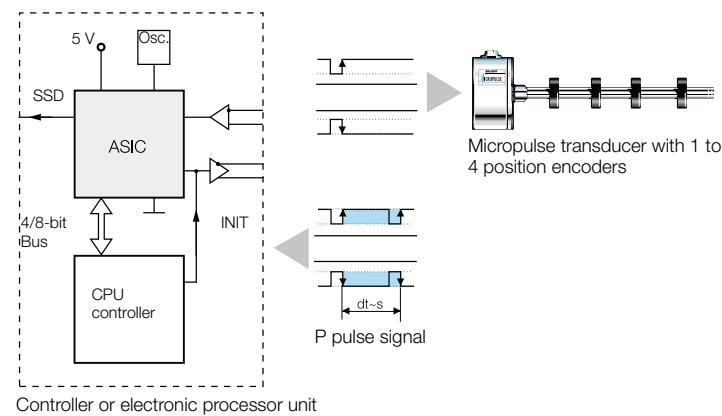
- Position resolution 1 μ m!
- The 1 μ m resolution of the Micropulse position measurement system is achieved by the high resolution of the digitizing chip (133 ps) (clock frequency 2 or 20 MHz).
- Position data from 4 position encoders can be processed simultaneously
- 4/8-bit processor interface



Block diagram of P interface



Digitizing chip 44QFP

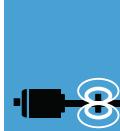


Controller or electronic processor unit

ASIC INFO:
+49 7158 173-370

Rod Compact Digital Pulse Interface

Series	Rod Compact BTL5
Transducer interface	Pulse P
Customer device interface	Pulse P
Part number	BTL5-P1-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 $\pm 0.02\%$ 500...5500 mm rated length
Temperature coefficient of overall system	$(6$ µm $+ 5$ ppm $\times L)/^{\circ}C$
Supply voltage	20...28 V DC
Current consumption	≤ 100 mA
Operating temperature	-40...+85 °C
Storage temperature	-40...+100 °C



Micropulse
Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact

K BTL7

H/W BTL7

BTL7

K BTL5

H/W BTL5

HB/WB BTL5

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Interface

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Rod AR BTL6

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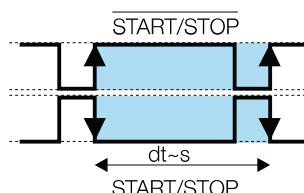
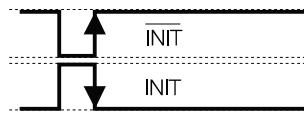
Position Encoders

Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

Accessories

Basic
Information and
Definitions



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

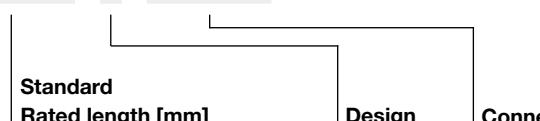
Floats, see page 216

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

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

H

Radial output

K02 PUR cable 2 m

K05 PUR cable 5 m

K10 PUR cable 10 m

K15 PUR cable 15 m

W

Axial output

KA02 PUR cable 2 m

KA05 PUR cable 5 m

KA10 PUR cable 10 m

KA15 PUR cable 15 m

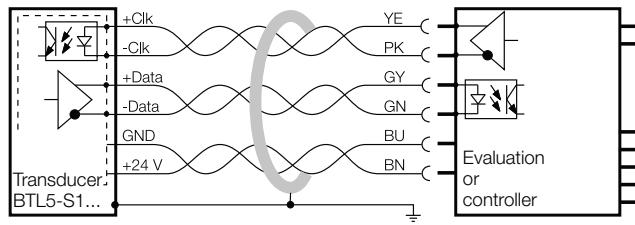
S32 Connectors

Rod Compact SSI interface

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 \leq 100 mm	1500 Hz
100 mm < Rated length \leq 1000 mm	1000 Hz
1000 mm < Rated length \leq 1400 mm	666 Hz
1400 mm < Rated length \leq 2600 mm	500 Hz
2600 mm < Rated length \leq 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

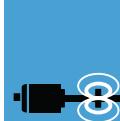
B T L 5 - S 1 [] B - M [] - [] - [] - C for synchronous operation

Coding	System resolution	Standard Rated length [mm]	Design	Connection
0 Binary code rising (24-bit)	1 1 µm	0025...4000 mm in 1-mm increments	HB	Radial output F05 5 m Teflon cable
1 Gray code rising (24-bit)	2 5 µm		WB	Axial output FA05 5 m Teflon cable
6 Binary code rising (25-bit)	3 10 µm			
7 Gray code rising (25-bit)	4 20 µm			
	5 40 µm			
	6 100 µm			
	7 2 µm			

Compact and synchronous

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	$f_{\text{STANDARD}} = 1$ kHz
Max. linearity deviation.	$\pm 30 \mu\text{m}$ at $\leq 10 \mu\text{m}$ resolution or $\leq \pm 2$ LSB
Temperature coefficient of overall system	(6 μm + 5 ppm $\times L$)/ $^{\circ}\text{C}$
Supply voltage	20...28 V DC
Current consumption	≤ 80 mA
Operating temperature	-40...+85 $^{\circ}\text{C}$
Storage temperature	-40...+100 $^{\circ}\text{C}$



Micropulse
Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact

K BTL7

H/W BTL7

BTL7

K BTL5

H/W BTL5

HB/WB BTL5

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Interface

Digital Pulse
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SSI Interface

CANopen
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Rod AR BTL6

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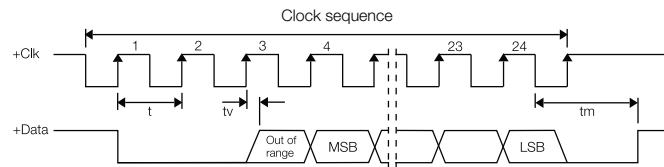
Position Encoders

Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

Accessories

Basic
Information and
Definitions



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

Scope of delivery

- Transducer
- Quick start instructions

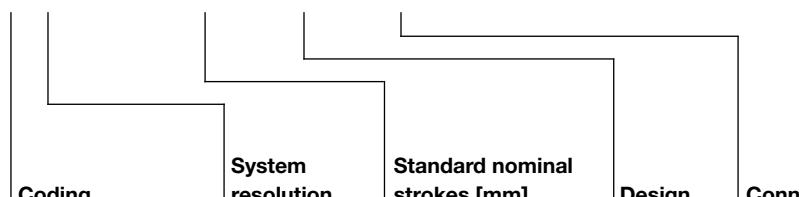
Please order separately:

- Position encoders, see page 218
- Floats, see page 216
- Fastening nut, see page 219
- Plug connectors, see page 252

Ordering example:

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

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



Coding	System resolution	Standard nominal strokes [mm]	Design	Connection
0 Binary code rising (24-bit)	1 1 μm 2 5 μm	0025...4000 mm in 1-mm increments	K	Radial output K02 PUR cable 2 m K05 PUR cable 5 m K10 PUR cable 10 m K15 PUR cable 15 m SR32 Connectors
1 Gray code, rising (24-bit)	3 10 μm 4 20 μm			
6 Binary code rising (25-bit)	5 40 μm 6 100 μm			
7 Gray code, rising (25-bit)	7 2 μm		H	Radial output K02 PUR cable 2 m K05 PUR cable 5 m K10 PUR cable 10 m K15 PUR cable 15 m

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

Rod Compact CANopen interface

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:

B T L 5 - H 1 [] - M [] - [] - [] - [] - C

Software configuration	Baud rate	Standard nominal strokes [mm]	Design	Connection
1 1 x position and 1 x velocity	0 1 Mbaud	0025...4000 mm in 1-mm increments	HB	Radial output
2 2 x position and 2 x velocity	1 800 kbaud		WB	K05 PUR cable 5 m
3 4 x position	2 500 kbaud			Axial output
	3 250 kbaud			KA05 PUR cable 5 m
	4 125 kbaud			
	5 100 kbaud			
	6 50 kbaud			
	7 20 kbaud			
	8 10 kbaud			

Rod Compact CANopen Interface

Series	Rod Compact BTL5																
Output signal	CANopen																
Transducer interface	H																
Customer device interface	CANopen																
Part number	BTL5-H1_ _ -M_ _ - - - -																
CANopen Version	Floating																
Repeat accuracy	± 1 digit																
System resolution, configurable	Position	5 μ m increments															
	Velocity	0.1 mm/s increments															
Hysteresis	≤ 1 digit																
Measurement rate	$f_{STANDARD} = 1$ kHz																
Max. linearity deviation	± 30 μ m at 5 μ m resolution																
Temperature coefficient of overall system	$(6 \mu\text{m} + 5 \text{ ppm} \times L)/^\circ\text{C}$																
Supply voltage	20...28 V DC																
Current consumption	≤ 100 mA																
Operating temperature	-40...+85 $^\circ\text{C}$																
Storage temperature	-40...+100 $^\circ\text{C}$																
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									



Micropulse
Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact

K BTL7

H/W BTL7

BTL7

K BTL5

H/W BTL5

HB/WB BTL5

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T Redundant
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Sensor SF

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

Scope of delivery

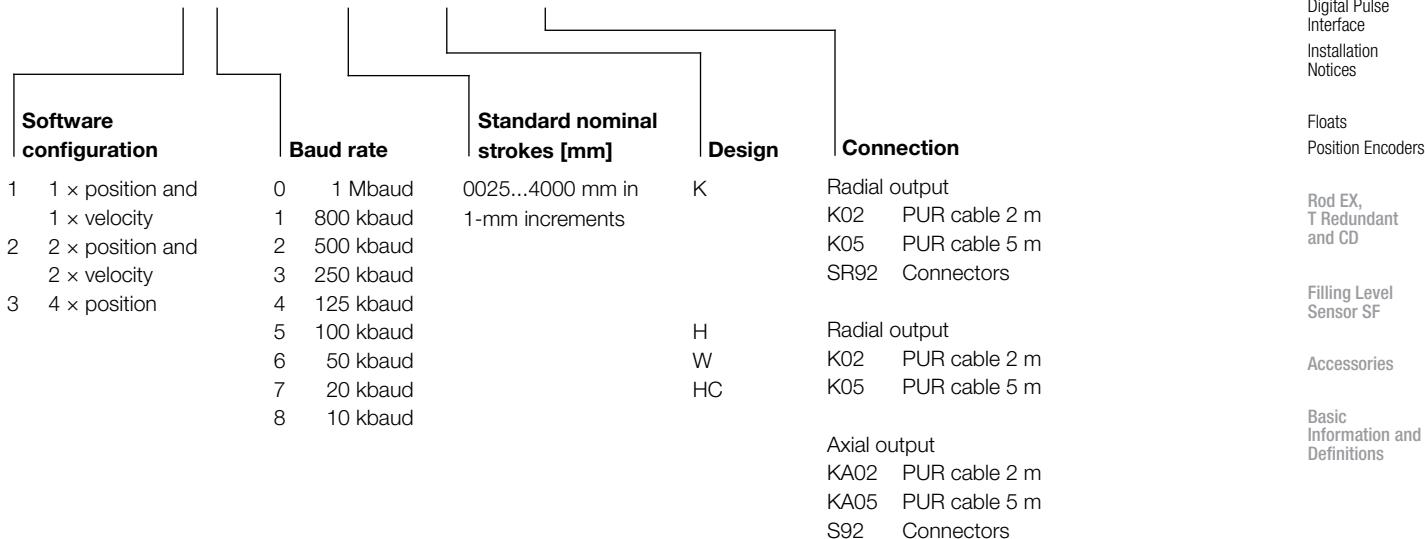
- Transducer
- Quick start instructions

Please order separately:

- Position encoders, see page 218
- Floats, see page 216
- Fastening nut, see page 219
- Plug connectors, see page 252

Ordering example:

BTL5 - H1_ _ - M_ _ - - - -



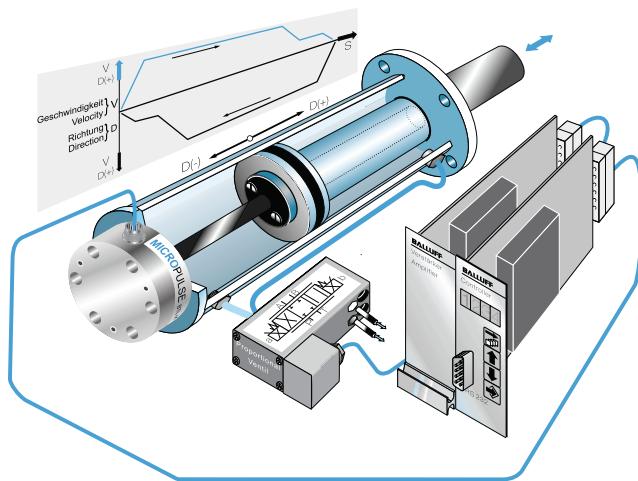
Rod Compact H/K/W BTL5/7

Installation notices

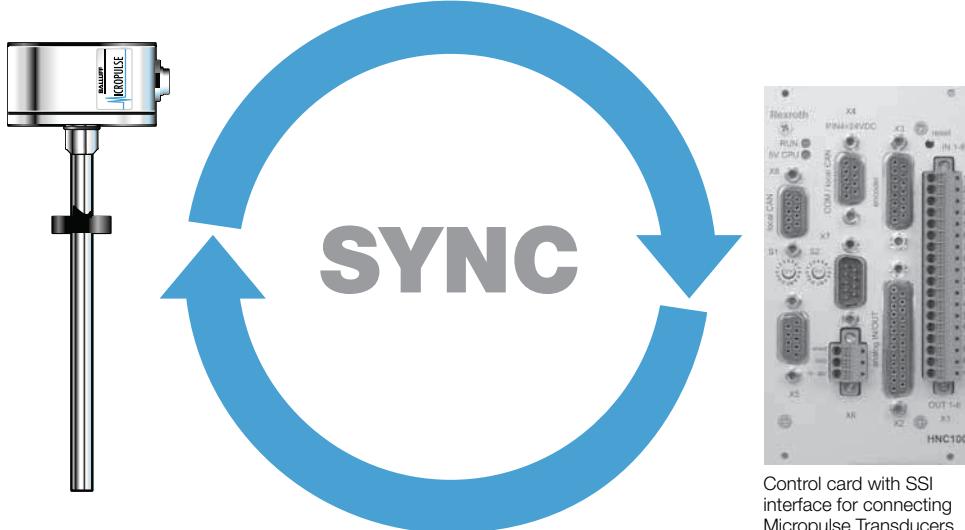
SSI-SYNC – better control behavior and higher dynamics

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.

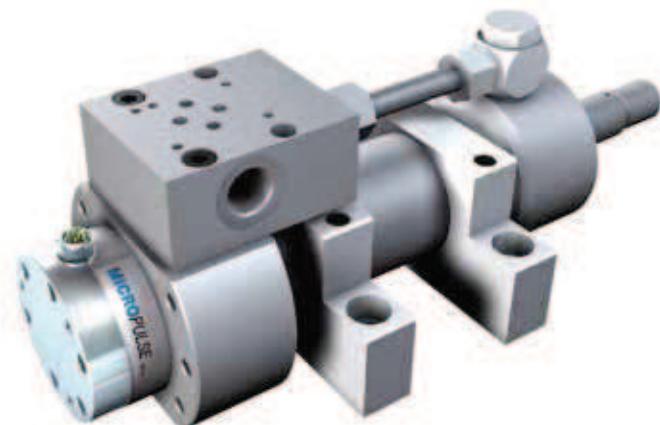


Application with hydraulic cylinder in a control loop



Micropulse Transducer BTL5 S1_

Control card with SSI interface for connecting Micropulse Transducers



Caution!

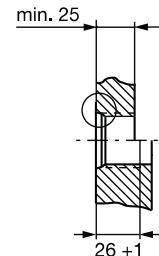
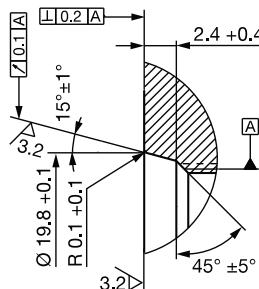
Before design, installation and startup please familiarize yourself with the user's guide to be found at www.balluff.com.

Rod Compact H/KW BTL5/7 **Installation notices**

Installation of BTL Rod Compact H

The Micropulse Transducer BTL has an M18x1.5 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 $M18 \times 1.5$ thread.

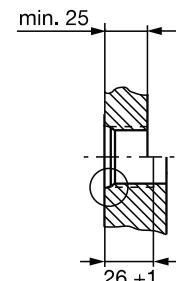
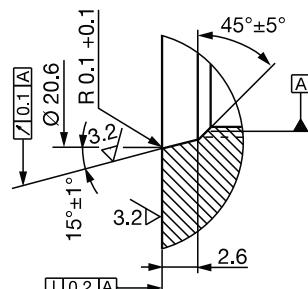


Micropulse Transducers

Installation of BTL Rod Compact W

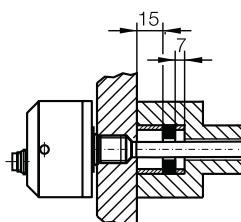
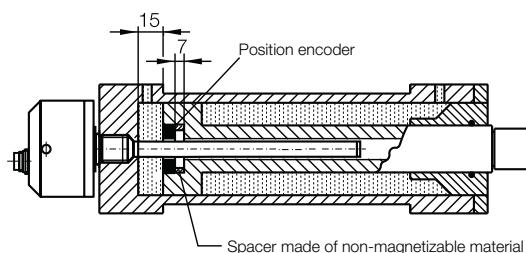
The Micropulse transducer BTL has a mounting thread M18x1.5. We recommend that the mounting is made of non-magnetizable material.

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 $M18 \times 1.5$ thread.



Countersink for O-ring

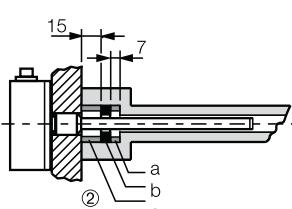
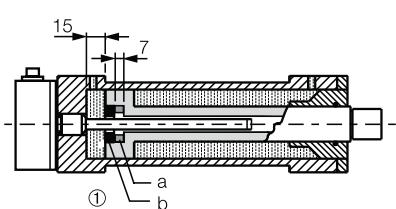
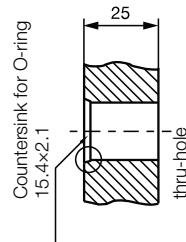
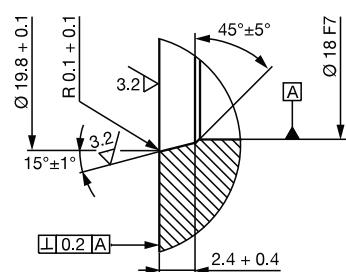
Tapped hole
3/4" 16 UNE thread



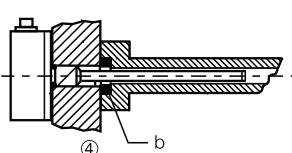
Installation BTL Rod Compact K

The Micropulse Transducer BTL has 6 mounting holes for cylinder head screws (ISO 4762 M6x18 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 15.4x2.1 mm O-ring.



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



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

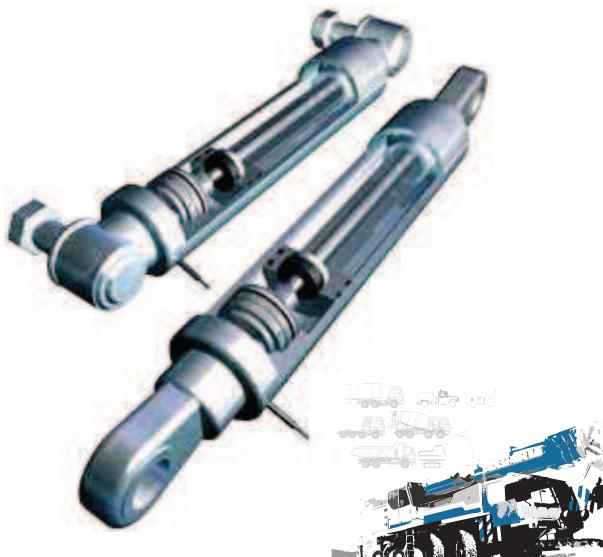
ISO 14982 Agricultural and Forestry Machinery
ISO 13766 Earthmoving Machinery
ISO 7637-1/2/3 Road Vehicles
EN 12895 Industrial Trucks
EN 50121-3-2 Railway Applications
ISO 11452-5 Electromagnetic HF field, 200 V/m

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]	0050...2000 mm in 1-mm increments
with 8 mm outer tube (style E28), the max. rated length is 1016 mm	

CE
e1



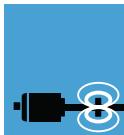
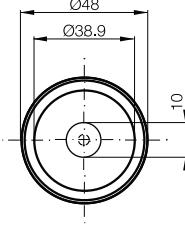
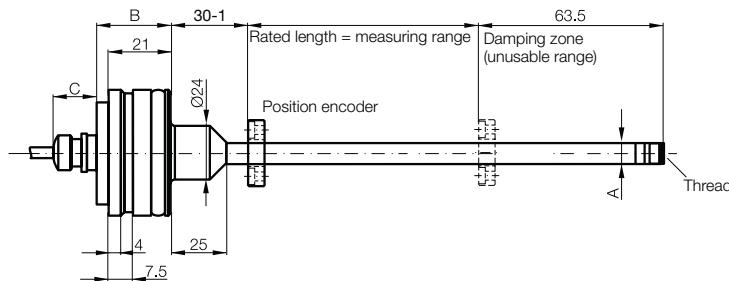
Rod AR BTL6

General data

Design E2/E28

BTL6-...-E2/E28-...-KA

Cable outlet
axial centric



Micropulse
Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact

K BTL7

H/W BTL7

BTL7

K BTL5

H/W BTL5

HB/WB BTL5

Analog Interface

Digital Pulse Interface

SSI Interface

CANopen Interface

Installation Notices

Rod AR BTL6
General Data

Analog Interface

Digital Pulse Interface

Installation Notices

Float
Position Encoders

Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

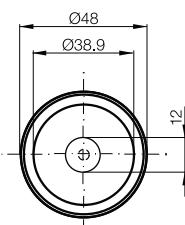
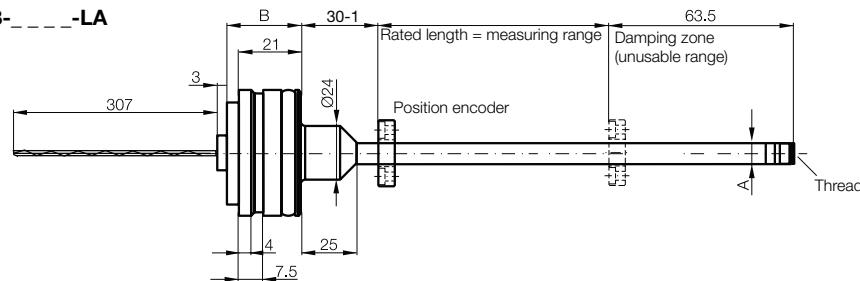
Accessories

Basic
Information and
Definitions

Design E2/E28

BTL6-...-E2/E28-...-LA

Cable outlet
axial with
stranded wire



Rod AR BTL6
General Data

Analog Interface

Digital Pulse Interface

Installation Notices

Caution!

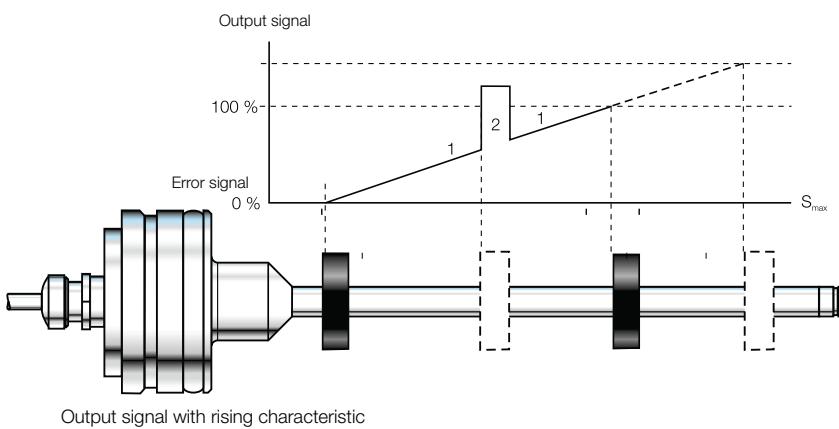
Before design, installation and startup please familiarize yourself with the user's guide to be found at www.balluff.com.

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 coefficient	Voltage output
Supply voltage	Current output
Current consumption	
Polarity reversal protected	
Overvoltage protection	
Dielectric strength	
Operating temperature	
Storage temperature	

Ordering example:

B T L 6 - 5 0 0 - M - - - - -

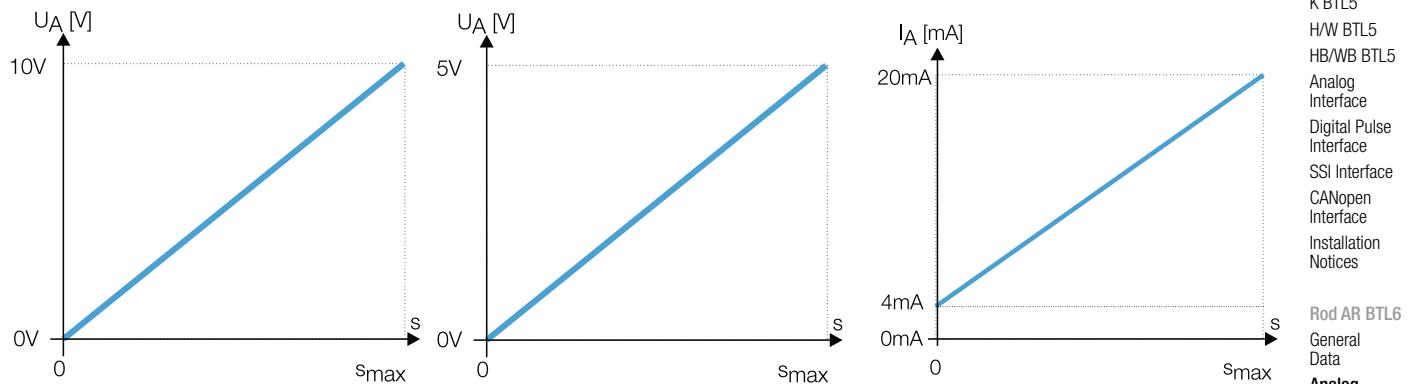
Output signal	Standard nominal strokes [mm]	Design	Connection
A 0...10 V	0050...2000 mm in 1-mm increments	E2 Protective tube Ø 10.2 mm	Axial output KA02 PUR cable 2 m
B 0...5 V		E28 Protective tube Ø 8 mm, max. rated length 1016 mm	KA05 PUR cable 5 m KA10 PUR cable 10 m KA15 PUR cable 15 m KA20 PUR cable 20 m
E 4...20 mA			Axial output LA00,3 PUR stranded wire, 0.3 m

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

Rod AR BTL6

Analog interface

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	$\leq 500 \Omega$
$\leq 5 \text{ mV}$	$\leq 2 \text{ mV}$	$\pm 7 \mu\text{A}$
$\pm 1.5 \text{ mV}$	$\pm 1.5 \text{ mV}$	System resolution/min. 2 μm
$\leq 5 \mu\text{m}$	$\leq 4 \mu\text{m}$	$f_{\text{STANDARD}} = 1 \text{ kHz}$
System resolution/min. 2 μm	System resolution/min. 2 μm	$\pm 200 \mu\text{m}$ to 500 mm rated length
$f_{\text{STANDARD}} = 1 \text{ kHz}$	$f_{\text{STANDARD}} = 1 \text{ kHz}$	typ. $\pm 0.02\% \geq 500$ rated length
$\pm 200 \mu\text{m}$ to 500 mm rated length	$\pm 200 \mu\text{m}$ to 500 mm rated length	$[150 \mu\text{V}/^{\circ}\text{C} + (5 \text{ ppm}/^{\circ}\text{C} \times P \times U/L)] \times \Delta T$
typ. $\pm 0.02\% \geq 500$ rated length	typ. $\pm 0.02\% \geq 500$ rated length	$[0.6 \mu\text{A}/^{\circ}\text{C} + (10 \text{ ppm}/^{\circ}\text{C} \times P \times I/L)] \times \Delta T$
$[150 \mu\text{V}/^{\circ}\text{C} + (5 \text{ ppm}/^{\circ}\text{C} \times P \times U/L)] \times \Delta T$	$[0.6 \mu\text{A}/^{\circ}\text{C} + (10 \text{ ppm}/^{\circ}\text{C} \times P \times I/L)] \times \Delta T$	$10...30 \text{ V DC}$
$[0.6 \mu\text{A}/^{\circ}\text{C} + (10 \text{ ppm}/^{\circ}\text{C} \times P \times I/L)] \times \Delta T$	$10...30 \text{ V DC}$	typ. $\leq 60 \text{ mA}$
$10...30 \text{ V DC}$	typ. $\leq 60 \text{ mA}$	yes
typ. $\leq 60 \text{ mA}$	yes	yes
yes	yes	yes
yes	yes	500 V DC (GND to housing)
500 V DC (GND to housing)	500 V DC (GND to housing)	500 V DC (GND to housing)
$-40...+85 \text{ }^{\circ}\text{C}$	$-40...+85 \text{ }^{\circ}\text{C}$	$-40...+85 \text{ }^{\circ}\text{C}$
$-40...+100 \text{ }^{\circ}\text{C}$	$-40...+100 \text{ }^{\circ}\text{C}$	$-40...+100 \text{ }^{\circ}\text{C}$



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



Micropulse
Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact
K BTL7
H/W BTL7
BTL7

K BTL5
H/W BTL5
HB/WB BTL5

Analog Interface

Digital Pulse Interface

SSI Interface

CANopen Interface

Installation Notices
Rod AR BTL6
General Data

Analog Interface

Digital Pulse Interface

Installation Notices

Floats

Position Encoders

Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

Accessories

Basic
Information and
Definitions

Rod AR BTL6

Digital Pulse Interface

P510 interface

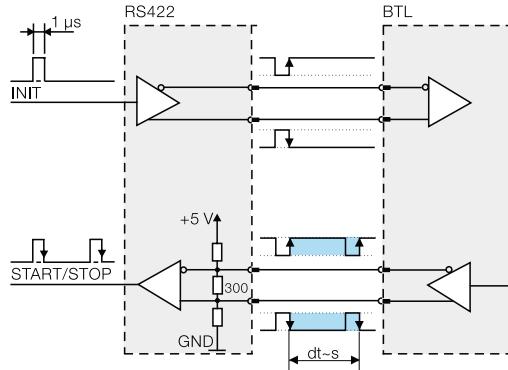
The 510 interface is compatible with BTA processor units as well as with controllers and modules from various manufacturers including Siemens, B & R, Bosch, Phoenix Contact, Mitsubishi, Sigmatek, Parker, Esitron, WAGO and others.

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.

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.

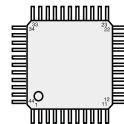
The difference lies in how the edges are processed. The falling edges are processed in the P interface and the rising edges in the M interface. To reduce the number of different models to a minimum, the P510 interface was created as a universal pulse interface which combines both functions. The reference point for the propagation time measurement is the "start pulse".



Block diagram of P interface

Extremely precise digitizing chip for P510 pulse interface

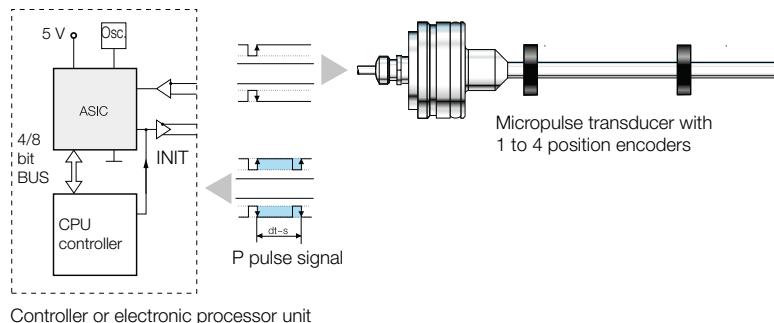
Companies developing their own electronic control and processor unit can create a highly accurate P interface cost-effectively and with minimum effort using the Balluff digitizing chip. The digitizing chip was developed as a high-resolution, configurable ASIC for Micro-pulse transducers with P pulse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

Rod AR BTL6

Digital Pulse Interface

Series	Rod AR BTL6
Transducer interface	Pulse P510
Customer device interface	Pulse P510
Part number	BTL6-P510-M
System resolution	processing-dependent
Repeat accuracy	$\leq 10 \mu\text{m}$
Reproducibility	$\leq 20 \mu\text{m}$
Resolution	$\leq 10 \mu\text{m}$
Linearity deviation	$\pm 200 \mu\text{m}$ up to 500 mm rated length typ. $\pm 0.02\%$, max. $\pm 0.04\%$ 500...1500 mm rated length
Supply voltage	10...30 V DC
Current consumption	$\leq 60 \text{ mA}$ (at 1 kHz)
Operating temperature	-40...+85 °C
Storage temperature	-40...+100 °C



Micropulse
Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact

K BTL7

H/W BTL7

BTL7

K BTL5

H/W BTL5

HB/WB BTL5

Analog
Interface

Digital Pulse
Interface

SSI Interface

CANopen
Interface

Installation
Notices

Rod AR BTL6

General
Data

Analog
Interface

**Digital Pulse
Interface**

Installation
Notices

Floats
Position Encoders

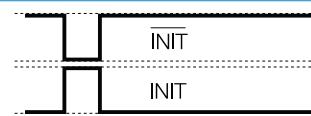
Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

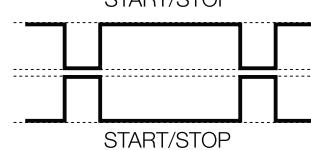
Accessories

Basic
Information and
Definitions

The rising and falling edges can be
evaluated.



START/STOP



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

Scope of delivery

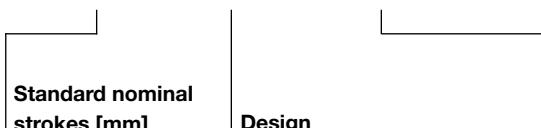
- Transducer
- Quick start instructions

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

Rod AR BTL6

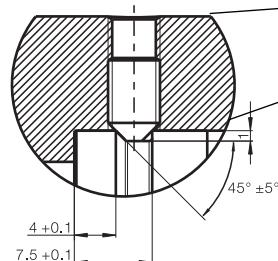
Installation notices

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.

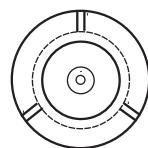
Sealing is accomplished using the supplied O-ring and support ring. The position encoder integrated in the piston marks the actual position of the piston without making contact.

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).

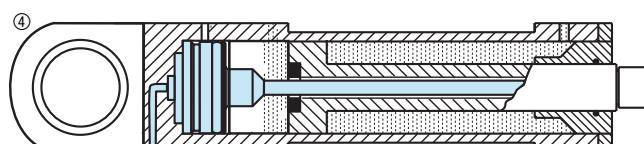
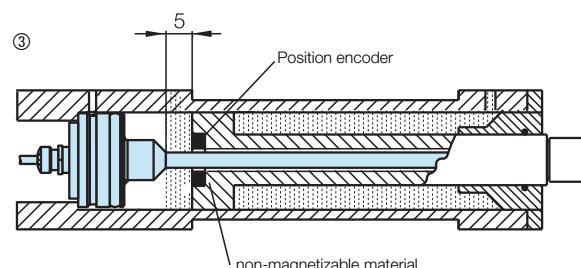
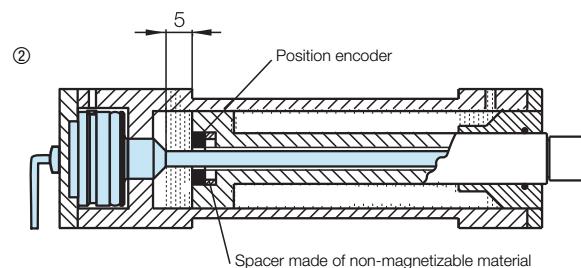
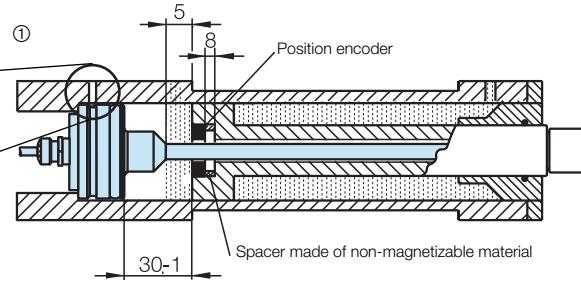
Set screw
DIN 914 M5x8



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.

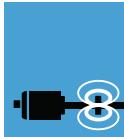
① Installation on the piston, in magnetic piston material

② Installation from rear, in magnetizable piston material

③ Installation on the piston

④ Installation on piston in a cylinder with articulated lug





Micropulse
Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact
K BTL7
H/W BTL7
BTL7
K BTL5
H/W BTL5
HB/WB BTL5
Analog
Interface
Digital Pulse
Interface
SSI Interface
CANopen
Interface
Installation
Notices

Rod AR BTL6
General
Data
Analog
Interface
Digital Pulse
Interface
**Installation
Notices**

Floats
Position Encoders

Rod EX,
T Redundant
and CD

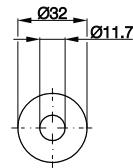
Filling Level
Sensor SF

Accessories

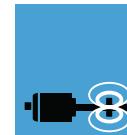
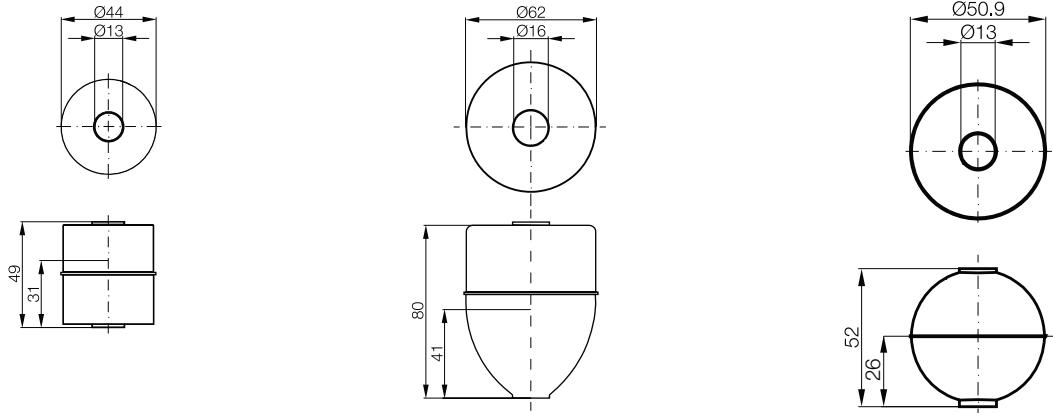
Basic
Information and
Definitions

Rod Float

Description for Series	Float Rod BTL (8 mm)	Float Rod BTL
Ordering code	BAM01ZE	BAM024J
Part number	BTLS-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


 Micropulse
Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact

K BTL7

H/W BTL7

BTL7

K BTL5

H/W BTL5

HB/WB BTL5

Analog

Interface

Digital Pulse

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SSI Interface

CANopen

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Rod AR BTL6

Floats

Position Encoders

Rod EX,

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and CD

Filling Level

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Accessories

Basic

Information and

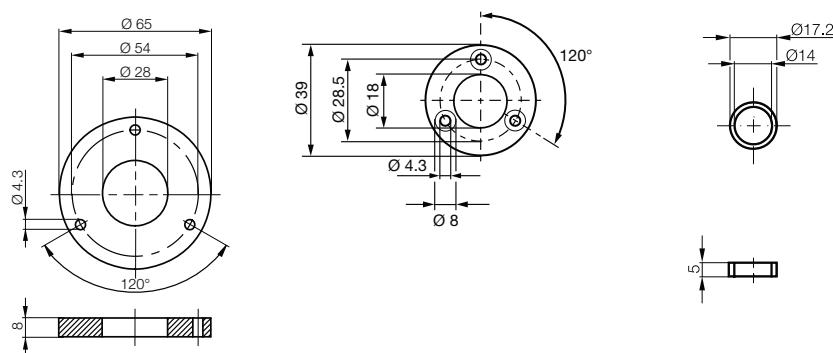
Definitions

Caution!

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

Rod Position encoder

Description for Series	Position encoder	Position encoder	Position encoder
Ordering code	Rod BTL BAM01CE	Rod BTL BAM013Y	Rod BTL 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			



Rod Position encoder

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	



Micropulse
Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact

K BTL7

H/W BTL7

BTL7

K BTL5

H/W BTL5

HB/WB BTL5

Analog
Interface

Digital Pulse
Interface

SSI Interface

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Interface

Installation
Notices

Rod AR BTL6

General
Data

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Interface

Installation
Notices

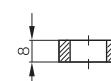
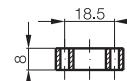
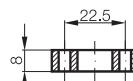
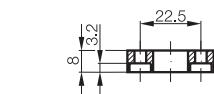
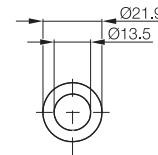
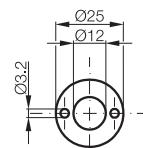
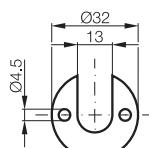
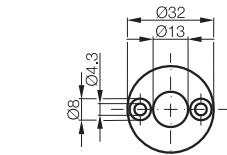
Floats
Position
Encoders

Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

Accessories

Basic
Information and
Definitions



M18x1.5 fastening nut

Order designation:

BTL-A-FK01-E-M18x1.5

Ordering code: **BAM0118**

3/4"-16-UNF fastening nut

Order designation:

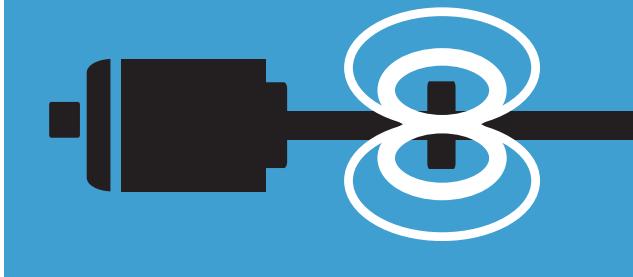
BTL-A-FK01-E-3/4"-16 UNF

Ordering code: **BAM0117**



Caution!

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



Micropulse Transducers

Rod EX

- For use in a potentially explosive environment
- With IECEx, ATEX, FM, and many other international approvals
- Different solutions in accordance with the requirements
- With a slim, robust stainless steel design
- Can also be used as a filling level sensor

Rod T Redundant

- 2 or 3 times redundant design for increased security
- Universally programmable via USB – set measuring range, invert signal, configure system, document and transmit configuration
- Mount with M18x1.5 or UNF 3/4" thread or via adapter with connecting flange and 6 cheese head screws

Rod CD

- Pressure-resistant up to 1000 bar – the sensor for high-pressure hydraulic units
- Mounting thread M22x1.5 with 12.7 mm pressure pipe
- Measuring lengths up to 2000 mm in millimeter increments
- Shock- and vibration-resistant with high degree of protection, for robust use
- Available with analog signals, digital interfaces, fieldbuses, and Real-Time Ethernet





Rod EX, T, CD Contents

**Rod EX**

Filling Level Sensor in Zone 0/1	222
Transducer in Zone 1	223
Rod DEX, General Data	224
Rod J-DEXC, General Data	227
Rod PEX, General Data	230
Rod NEX, General Data	231
Floats and Encoders	232

**Rod T Redundant**

General Data	234
Programming	238
Position Encoders	239

Rod CD

General Data	240
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MICRO PULSE®

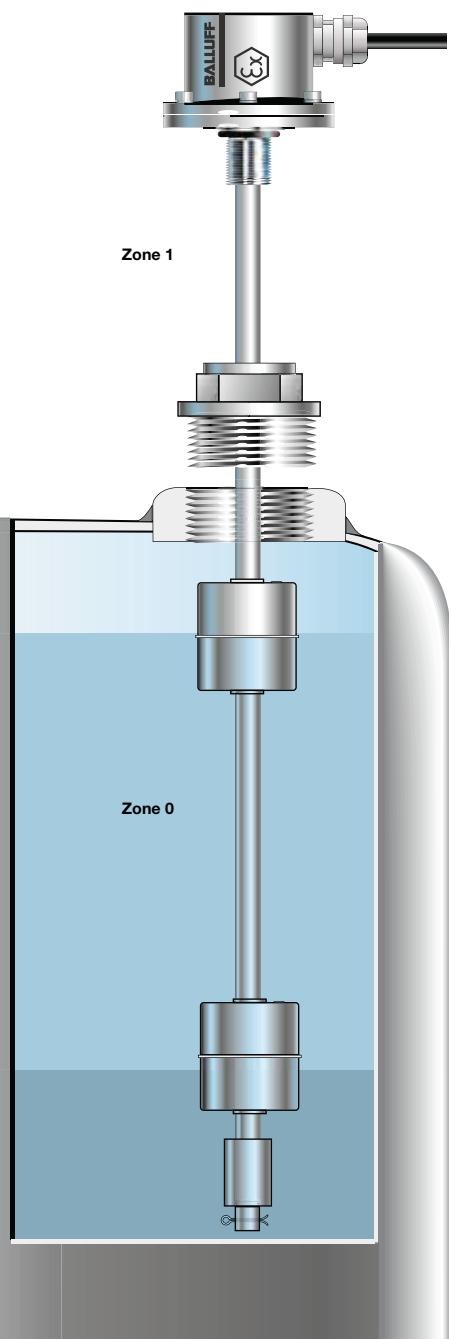


BTL5-1-M...-B-DEXA-__

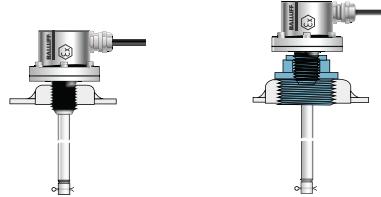
Rod version "DEXA" is the safe and reliable approach for filling level applications in Zone 0. A cotter pin prevents the float from getting lost. Floats, see page 232.

Applications

- Filling stations
- Tank systems
- Refineries
- Chemical industry
- Pharmaceuticals



Installation examples



Caution!

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



BTL5-1-M...-B-DEXB-__

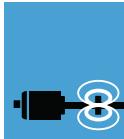
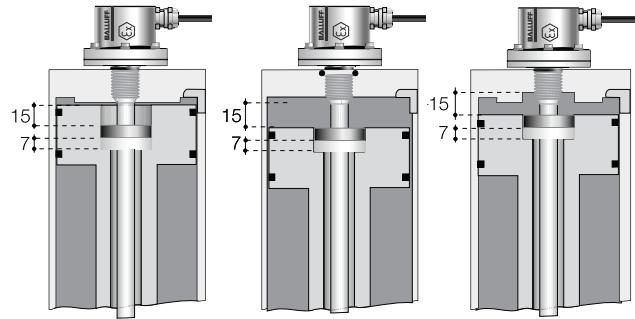
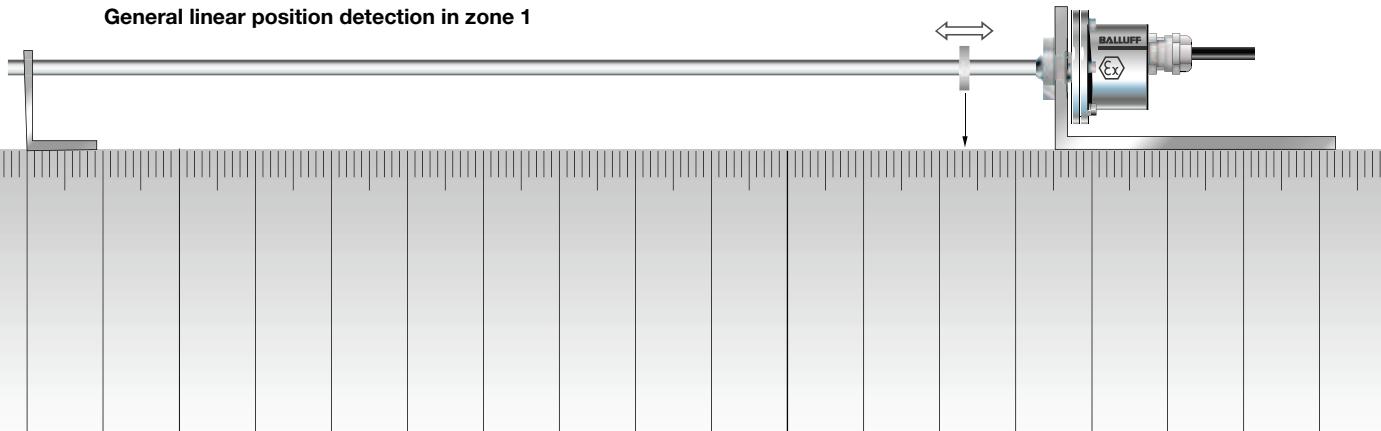
The BTL can be used to sense the position of a hydraulic piston directly without making contact, even up to pressures of 600 bar. The BTL is threaded into the head of the cylinder. The measurement section enters a hole drilled deep into the piston.

Applications

- Actual value monitoring in hydraulic cylinders
- Valve adjustment in power plants
- Filling units
- Positioning spray guns



General linear position detection in zone 1



Micropulse
Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact and Rod AR

Rod EX

Filling Level
Sensor
in Zone 0/1

Transducer
in Zone 1

Rod DEX

Rod J-DEXC

Rod PEX

Rod NEX

Floats

and

Encoders

Rod T

Redundant
General
Data

Programming
Position Encoders

Rod CD

General
Data

Filling Level
Sensor SF

Accessories

Basic
Information and
Definitions

**Pressure-resistant up to 600 bar, high reproducibility,
contactless, robust**

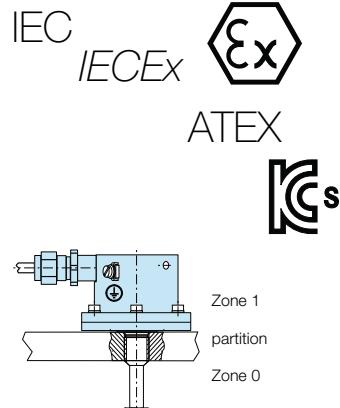
The Micropulse transducer BTL is a robust position feedback system for measuring ranges between 25 and 4000 mm as well as use under extreme ambient conditions.

Ex protection type "d" – flameproof encapsulation

Transducers designated **Ex d IIB + H₂ T6 Ga/Gb** meet the requirements for electrical equipment in potentially explosive areas. When in use you must follow applicable safety regulations, such as:

- Explosion protection guidelines (EX-RL)
- Constructing electrical equipment in potentially explosive atmospheres (EN 60079-14)
- Ignition protection type "d", flameproof encapsulation (EN 60079-1)

Transducers from category II 1/2 G designated Ex d IIB+H₂ T6 meet the requirements for electrical equipment in areas containing potentially explosive gases. Requirements for areas containing flammable dust are also fulfilled in accordance with category II 3D designated Ex tD IP 67 T85°C, A zone 22.



Series	Rod DEX BTL5
Part number	BTL5-__M__-__-DEX-__
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 in accordance with EN 60068-2-6
Operating temperature	-40...+60 °C
Polarity reversal protected	yes
Oversupply protection	TransZorb protection diodes
Dielectric strength	500 V DC (GND to housing)
Degree of protection as per IEC 60529	IP 67
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	Model B thread M18x1.5, model Z 3/4" 16 UNF, model K fit 18h6 with 6 cheese-head screws
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	IEC 61000-4-4 Severity level 4
Conducted interference induced by high-frequency fields	EN 61000-4-6 Severity level 3

Please enter code for output signal, interface, coding, rated length, model, rod end, and connection in the part number.

Scope of delivery

- Transducer
- User's Guide

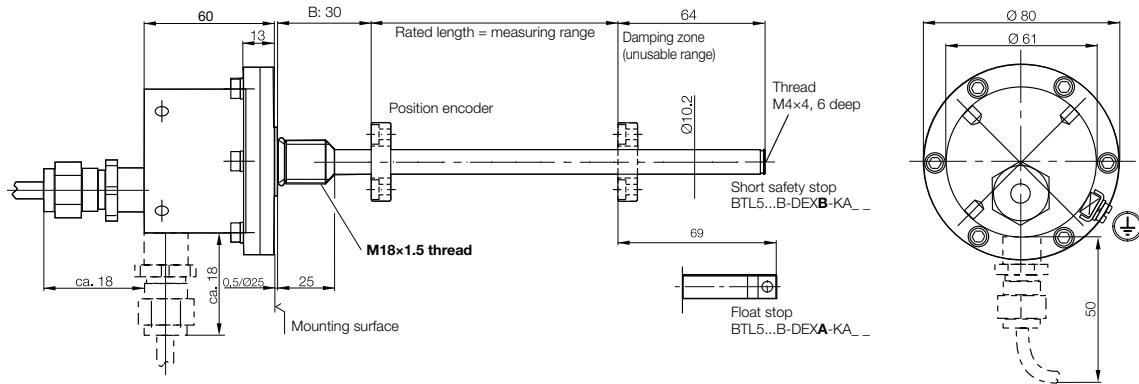
Please order separately:

Position encoders, see page 232

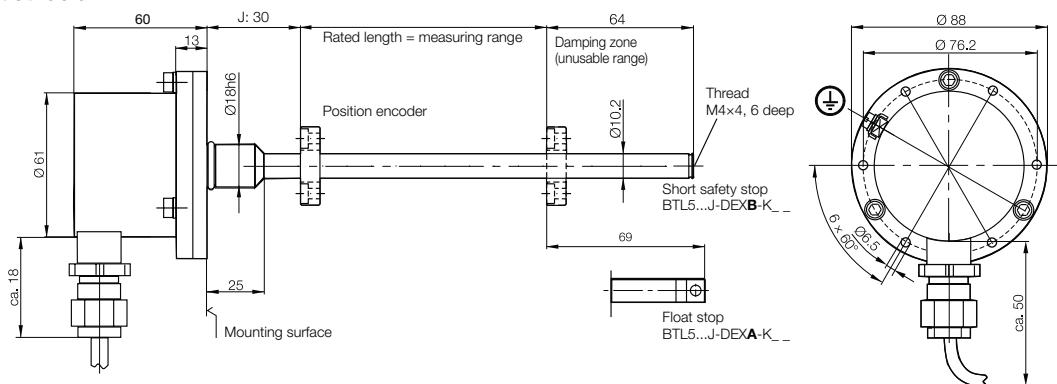
Floats, see page 232

Housing B, metric mounting thread

Cable outlet axial, radial

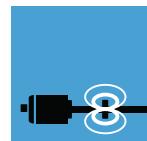


**Model J, flange Ø 18 mm, pitch circle Ø 76.2 mm,
Cable outlet radial**



Caution!

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



**Micropulse
Transducers**

Profile P

Profile PF

Profile AT

Profile BIW

Rod

**Rod Compact
and Rod AR**

Rod EX

**Filling Level
Sensor
in Zone 0/1**

**Transducer
in Zone 1**

Rod DEX

Rod J-DEXC

Rod PEX

Rod NEX

**Floats
and
Encoders**

Rod T

**Redundant
General
Data**

**Programming
Position Encoders**

Rod CD

**General
Data**

**Filling Level
Sensor SF**

Accessories

**Basic
Information and
Definitions**

Rod DEX

General data

Analog interface no zero- or end-point setting possible; see technical data on page 198

Ordering example:

B T L 5 - [] - M [] - [] - D E X [] - []

Output signal	Standard nominal strokes [mm]	Design	Rod end	Connection
A11 0...10 V and 10...0 V Rising and falling	0025...4000 mm in 1-mm increments	B J Z	A B	Float stop Short safety stop
E10 4...20 mA, rising				KA02 PUR cable 2 m
E17 20...4 mA, falling				KA05 PUR cable 5 m
C10 0...20 mA, rising				KA10 PUR cable 10 m
C17 20...0 mA, falling				KA15 PUR cable 15 m
G11 -10...10 V and 10...-10 V rising and falling				Radial output K02 PUR cable 2 m K05 PUR cable 5 m K10 PUR cable 10 m K15 PUR cable 15 m

Digital pulse interface, see technical data on page 200

Ordering example:

B T L 5 - [] 1 - M [] - [] - D E X [] - []

Interface	Standard nominal strokes [mm]	Design	Rod end	Connection
P Pulse interface P	see above analog interface DEX	B J Z	A B	Float stop Short safety stop
				see above analog interface DEX

SSI interface, see technical data on page 202

Ordering example:

B T L 5 - S 1 [] - M [] - [] - D E X [] - [] for asynchronous operation

B T L 5 - S 1 [] B - M [] - [] - D E X [] - [] for synchronous operation

Coding	System resolution	Standard rated length [mm]	Design	Rod end	Connection
0 Binary code rising (24-bit)	1 1 µm	see above	B	A	See above, analog interface DEX
1 Gray code rising (24-bit)	2 5 µm	analog interface DEX	J	Float stop	
6 Binary code rising (25-bit)	3 10 µm		Z		
7 Gray code rising (25-bit)	4 20 µm			B	Short safety stop
	5 40 µm				

Flameproof enclosure

Rod J-DEXC-TA12 General data

The Micropulse transducer J-DEXC has been specially developed for use in potentially explosive atmospheres. The important demands of the oil and gas industry for high reliability and ease of servicing are combined in the J-DEXC system. J-DEXC comprises a robust flameproof Ex housing and an electronics module that is easily accessible and exchanged for servicing. Spare electronics modules can be ordered from Balluff Service department.

Fields of application

- Hydraulically or pneumatically actuated valves
- Clutch travel monitoring for compressors
- Level monitoring
- Level control
- Actual value sensing in hydraulic cylinders in Ex areas



Micropulse
Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact
and Rod AR

Rod EX

Filling Level
Sensor
in Zone 0/1
Transducer
in Zone 1

Rod DEX

Rod J-DEXC

Rod PEX

Rod NEX

Floats
and
Encoders

Rod T
Redundant
General
Data
Programming
Position Encoders

Rod CD
General
Data

Filling Level
Sensor SF

Accessories

Basic
Information and
Definitions

Series	Rod J-DEXC-TA12	Micropulse Transducers
Part number	BTL5-__-M-__-J-DEXC-TA12	Profile P
Shock load	100 g/6 ms in accordance with EN 60068-2-27	Profile PF
Vibration	12 g, 10...2000 Hz as per EN 60068-2-6	Profile AT
Operating temperature	-20...+80°C for T5	Profile BIW
Storage temperature	-40...+100 °C outside of Ex zone	Rod
Degree of protection	IP 68	Rod Compact and Rod AR
Housing material	Stainless steel AISI 304, optional: AISI 316L, Nitronics 60	Rod EX
Protective tube	Stainless steel 1.4571	Filling Level Sensor in Zone 0/1
Pressure rating	600 bar max.	Transducer in Zone 1
Connection	Screw terminals	Rod DEX
Cable entry	Ex cable gland BTL-A-AD09-M-00EX or Ex installation pipe system	Rod J-DEXC
EMC testing		Rod PEX
Radio interference emission	EN 55016-2-3 (industrial and residential area)	Rod NEX
Static electricity (ESD)	EN 61000-4-2 Severity level 3	Floats and Encoders
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	

Please enter the code for the output signal, interface, coding, system solution, software configuration, baud rate, rated length, and connection in the part number.

Scope of delivery

- Transducer
- User's Guide



Please order separately:
Position encoders,
see page 232
Floats, see page 232



Class I, Division 1, Groups A, B, C, and D
Class II, Division 1, Groups E, F, and G; Class III
T6 Ta=65°C, T5 Ta=80°C Type 4X/6P; IP 68
Class I, Zone 1 AEx d IIC T6 Ta=65°C, T5 Ta=80°C
Class I, Zone 1 Ex d IIC T6 Ta=65°C, T5 Ta=80°C
11-2411253X

SIRA 11ATEX1104X
IECEx SIR 11.0048X



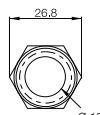
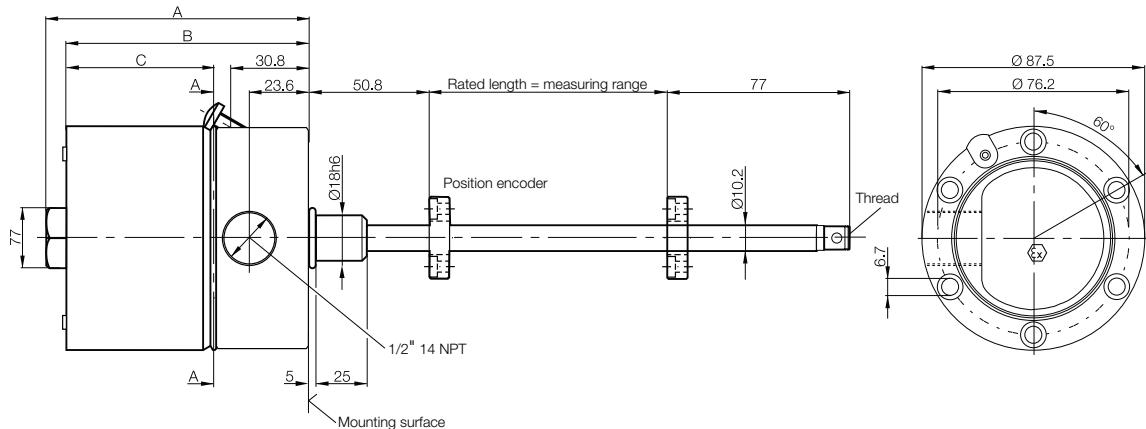
CE II 1/2GD
Ex d IIC T6/T5 Ga/Gb Ta +65°C (T6) +80°C (T5)
Ex t IIIC T85/T100°C Da IP 68 Ta +65°C (T85) +80°C (T100)

CE 0518

Rod J-DEXC-TA12

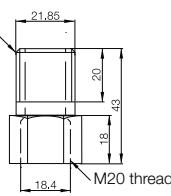
General data

Model J-DEXC, flange Ø 18 mm, pitch circle Ø 76.2 mm



1/2" NPT thread

Cable gland
1/2" - 14 NPT to
M20 metric
BTL-A-AD09-M-00EX



Interface	A (mm)	B (mm)	C (mm)
Analog A, E, C	104.12	96.12	59.5
Digital SSI			
Profibus DP, CANopen	135.62	127.62	91

Analog interface, see technical data on page 154/155

Ordering example:

B T L 5 - _ _ _ - M _ _ _ - J - D E X C - T A 1 2

Output signal	Standard nominal strokes [mm]	Connection
A51 0...10 V and 10...0 V Rising and falling	0025...4000 mm in 1-mm increments	TA12 Internal thread 1/2" 14 NPT
E50 4...20 mA, rising		
E57 20...4 mA, falling		
C50 0...20 mA, rising		
C57 20...0 mA, falling		
G51 -10...10 V and 10...-10 V rising and falling		

Programming tool for zero point and end point **BTL5-A-EH03**

Rod J-DEXC-TA12

General data

SSI interface, see technical data on page 162/163

Ordering example:

B T L 5 - S 1 [] - M [] - J - D E X C - T A 1 2 for asynchronous operation

B T L 5 - S 1 [] - B - M [] - J - D E X C - T A 1 2 for synchronous operation

Coding	System resolution	Standard rated length [mm]	Connection
0 Binary code rising (24-bit)	1 1 µm	Analog interface J-DEXC	TA12 Internal thread 1/2" 14 NPT
1 Gray code rising (24-bit)	2 5 µm		Micropulse Transducers
6 Binary code rising (25-bit)	3 10 µm		Profile P
7 Gray code rising (25-bit)	4 20 µm		Profile PF
	5 40 µm		Profile AT
			Profile BIW
			Rod
			Rod Compact and Rod AR
			Rod EX
			Filling Level Sensor in Zone 0/1
			Transducer in Zone 1
			Rod DEX
			Rod J-DEXC
			Rod PEX
			Rod NEX
			Floats and Encoders
			Rod T
			Redundant General Data
			Programming Position Encoders
			Rod CD
			General Data
			Filling Level Sensor SF
			Accessories
			Basic Information and Definitions

CANopen interface, see technical data on page 170/171

Ordering example:

B T L 5 - H 1 [] - M [] - J - D E X C - T A 1 2

Software configuration	Baud rate	Standard rated length [mm]	Connection
1 1 x position and 1 x velocity	0 1 Mbaud	Analog interface J-DEXC	TA12 Internal thread 1/2" 14 NPT
	1 800 kbaud		
2 2 x position and 2 x velocity	2 500 kbaud		
	3 250 kbaud		
	4 125 kbaud		
	5 100 kbaud		
	6 50 kbaud		
	7 20 kbaud		
	8 10 kbaud		

Profibus DP interface, see technical data on page 172/173

Ordering example:

B T L 5 - T 1 [] 0 - M [] - J - D E X C - T A 1 2

Software configuration	Standard rated length [mm]	Connection
1 1 x position and 1 x velocity	Analog interface J-DEXC	TA12 Internal thread 1/2" 14 NPT
2 2 x position and 2 x velocity		

Caution!

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

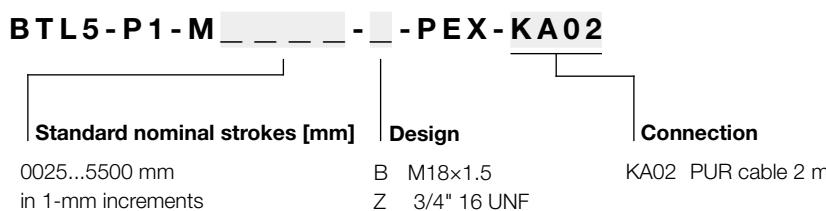
Dust protection zone 22

Devices in these categories are intended for use in areas where swirling dust is not expected to create an explosive atmosphere. The probability is extremely small. Even if it were to occur, it would be only for a short time.

A manufacturer's declaration confirms that transducers designated **II 3 D T 90°C X** meet the requirements for electrical equipment for use in areas with combustible dust.



Digital pulse interface, for technical data refer to the user's guide
Ordering example:



Caution!

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

Ignition protection type "n" for zone 2

Rod NEX General data

Ignition protection type "n" designated "EEx n"

Devices in this category are intended for use in areas where an explosive atmosphere is not expected. The probability is extremely small. Even if it were to occur, it would be only for a short time. A manufacturer's declaration confirms that the indicated product meets the requirements for electrical equipment in potentially explosive areas.

This designation combines multiple methods of ignition protection.

Model K, analog interface, see page 198

Ordering example:

B T L 5 - - M - K - N E X -

Output signal	Standard nominal strokes [mm]	Connection
A11 0...10 V and 10...0 V	0025...4500 mm in 1-mm increments	SR32 with connector plug
E10 4...20 mA, rising		K05 PUR cable 5 m
E17 20...4 mA, falling		
C10 0...20 mA, rising		
C17 20...0 mA, falling		

Rod series, analog interface, see page 154/155

Ordering example:

B T L 7 - - M - - N E X -

Output signal	Standard nominal strokes [mm]	Design	Connection
A510 0...10 V and 10...0 V	0025...2000 mm in 1-mm increments	B M18x1.5	S32 with connector plug
E500 4...20 mA, rising		Z 3/4" 16 UNF	KA05 PUR cable 5 m
E570 20...4 mA, falling		CD M22x1.5 high-pressure resistant	
C500 0...20 mA, rising			
C570 20...0 mA, falling			

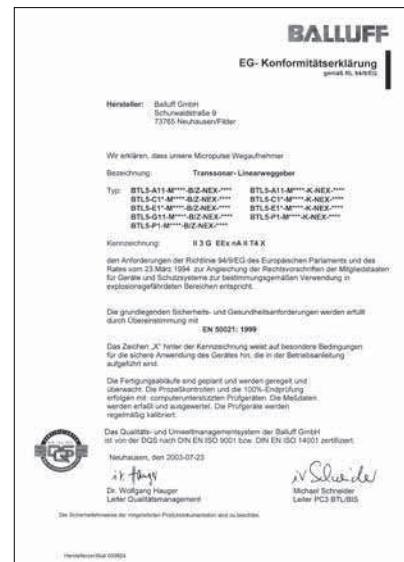
Please enter code for output signal, rated length, design and connection in the part number.

Please order separately:

Position encoders, see page 233

Floats, see page 232

Plug connectors, see page 252



Micropulse
Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact
and Rod AR

Rod EX

Filling Level
Sensor

in Zone 0/1

Transducer

in Zone 1

Rod DEX

Rod J-DEX

Rod PEX

Rod NEX

Floats

and

Encoders

Rod T
Redundant
General
Data
Programming
Position Encoders

Rod CD
General
Data

Filling Level
Sensor SF

Accessories

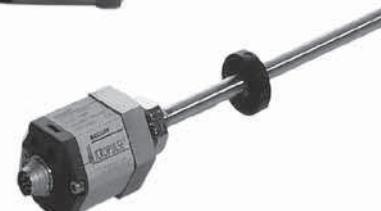
Basic
Information and
Definitions

Stainless steel



Connection

S32 with connector plug
KA05 PUR cable 5 m



Floats (Zone 0)

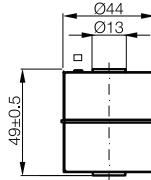
BTL2-S-4414-4Z-Ex

Ordering code: **BAM0147**

Cylindrical float, zone 0 permitted up to density $\rho \geq 0.7 \text{ g/cm}^3$

Orientation:

Raised dimple on upper side of float



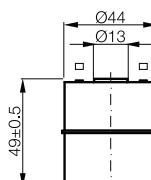
BTL2-S-4414-4Z01-Ex

Ordering code: **BAM0148**

Cylindrical float, zone 0, density of float $\rho = 0.85 \text{ g/cm}^3$ for separation layer measurement

Orientation:

2 raised dimples on upper side of float



Interface

A second float can be added to measure the position of the interface between two liquids, such as oil and condensed water.

Suitable: BTL2-S-4414-4Z01-Ex.

BTL2-A-DH01-E-32-Ex

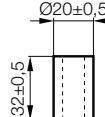
Spacer sleeve for the float:

BTL2-S-4414-4Z-Ex

BTL2-S-4414-4Z01-Ex

BTL2-S-5113-4K-Ex

The sleeve is included.



Caution!

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

Rod EX

Floats and encoders

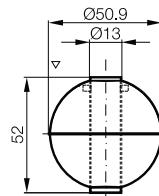
BTL2-S-5113-4K-Ex

Ordering code: **BAM014A**

Ball float, zone 0 permitted up to density $\rho \geq 0.7 \text{ g/cm}^3$

Orientation:

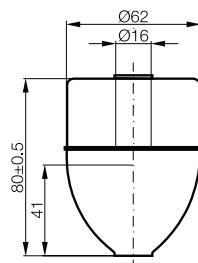
Raised dimple on upper side of float



BTL2-S-6216-8P-Ex

Ordering code: **BAM014E**

Parabolic float, permitted up to $\rho \geq 0.6 \text{ g/cm}^3$



Float type

Immersion depths given $\rho = 1 \text{ g/cm}^3(\text{H}_2\text{O})$

Immersion depths given $\rho = 0.7 \text{ g/cm}^3$

Profile BIW

BTL2-S-6216-8P-Ex

$s_s \sim 41 \text{ mm}$

$s_s \sim 57 \text{ mm}$

Rod

BTL2-S-5113-4K-Ex

$s_s \sim 26 \text{ mm}$

$s_s \sim 40 \text{ mm}$

Rod Compact

BTL2-S-4414-4Z-Ex

$s_s \sim 30 \text{ mm}$

$s_s \sim 39 \text{ mm}$

and Rod AR

BTL2-S-4414-4Z01-Ex

$s_s \sim 45 \text{ mm}$

submerges

For technical data, see standard series on page 216.

Rod EX

Filling Level

Sensor

in Zone 0/1

Transducer

in Zone 1

Rod DEX

Rod J-DEXC

Rod PEX

Rod NEX

Floats

and

Encoders

Position encoder (zone 1) for installation in hydraulic cylinder

See page 218

Rod T

Redundant

General

Data

Programming

Position Encoders

Rod CD

General

Data

Filling Level

Sensor SF

Accessories

Basic

Information and

Definitions



Rod Redundant

General data

Series	Rod Redundant BTL7
Shock load	100 g/6 ms in accordance with EN 60068-2-27
Vibration	12 g, 10...2000 Hz as per EN 60068-2-6
Polarity reversal protected	to 36 V
Oversupply protection	to 36 V
Dielectric strength	500 V AC (GND to housing)
Degree of protection as per IEC 60529	IP 67
Housing material	Aluminum anodized/protective tube stainless 1.4571, flange stainless 1.4571
Fastener	Model TB thread M18x1.5, Model TZ thread 3/4" 16 UNF Model TK, 18h6 with 6 cheese head screws, Model TT thread M30x1.5
Pressure rating with 10.2 mm protective tube	600 bars if installed in a hydraulic cylinder up to 2000 mm in rated length 300 bar for rated length > 2000 mm
Pressure rating with 21 mm protective tube	250 bars if installed in hydraulic cylinder up to 2000 mm rated length
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]	25...7620 mm in 1-mm increments



"Long" up to 7620 mm

Rod Redundant General data

Pressure-resistant up to 600 bar, high reproducibility, redundant, contactless

Redundant Micropulse Transducers BTL7: the robust position measurement system for use in safety-related valves and hydraulic cylinders for measuring ranges between 25 and 7620 mm.

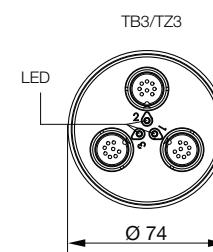
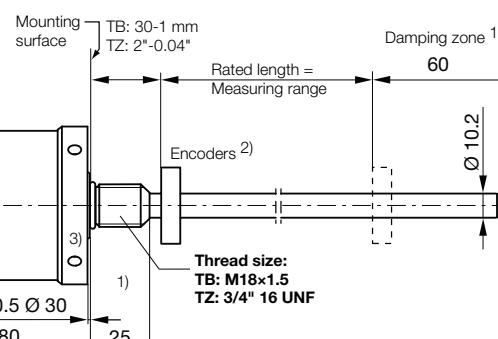
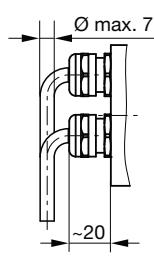
Up to three independent position measurement systems in the same housing enable failsafe linear measurement of, for example, safety valves or the combined monitoring of position and adjustment speed.

Design TB

Metric mounting thread M18x1.5
Protective tube Ø10.2 mm

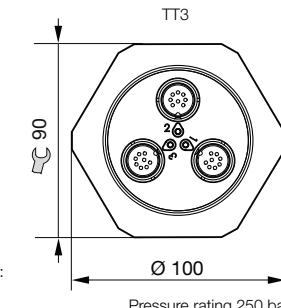
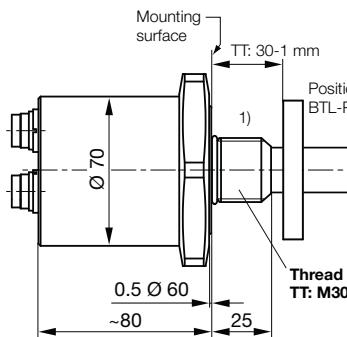
Design TZ

English mounting thread 3/4" UNF
Protective tube Ø10.2 mm



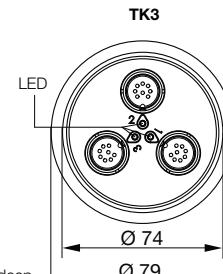
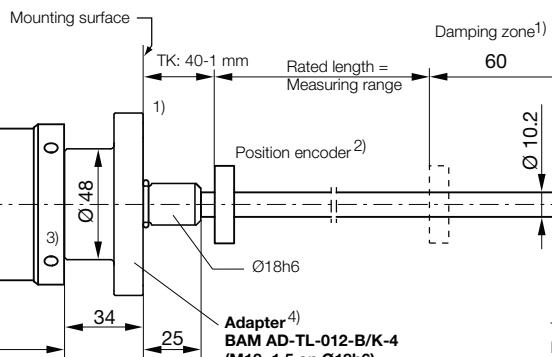
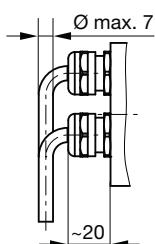
Design TT

Metric mounting thread M30x1.5
Protective tube Ø21 mm



Design TK

Flange Ø18 mm
Pitch circle Ø64 mm
Protective tube Ø10.2 mm



Caution!

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

Pressure rating 250 bar

- 1) Non-usable area
- 2) Not included in the scope of delivery
- 3) Ø 6.1 for hook wrench Ø 74
- 4) Included in the scope of delivery

Micropulse Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact and Rod AR

Rod EX

Filling Level Sensor in Zone 0/1

Transducer in Zone 1

Rod DEX

Rod J-DEX

Rod PEX

Rod NEX

Floats and Encoders

Rod T Redundant General Data

Programming Position Encoders

Rod CD General Data

Filling Level Sensor SF

Accessories

Basic Information and Definitions

Properties of Micropulse BTL7-A/C/E/G to TB/TZ/TK/TT

- 2 or 3 times redundant
- Non-contact detection of piston position
- IP 67, insensitive to contamination
- Shock and vibration resistant 100 g/12 g
- Absolute output signal
- Measurement lengths 25 to 7620 mm in 1-mm increments
- Flexibly configurable measuring range via computer programming
- Status LED to indicate the operating state
- Temperature range -40...+85°C

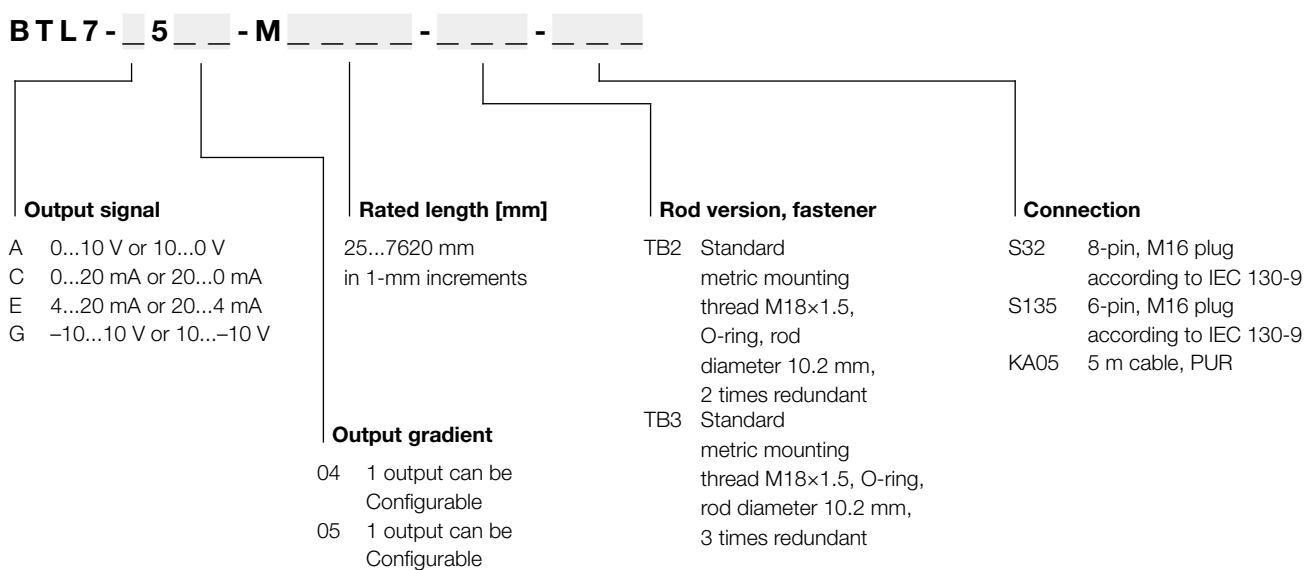
Flexible measuring range

The start and end point of the measuring range can be adapted to the application. The output signal for the position indicator or the travel signal can be set just as conveniently.

Once configured, settings can easily be copied redundantly to the remaining measuring channels of the RTI 7

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 (per unit)
Polarity reversal protected
Overvoltage protection
Dielectric strength
Operating temperature

Ordering example:



For additional designs, see page 235

Rod Redundant General data

Rod Redundant BTL7	Rod Redundant BTL7	Rod Redundant BTL7	Rod Redundant BTL7
Analog	Analog	Analog	Analog
A	G	E	C
Analog	Analog	Analog	Analog
BTL7- A5 _-M_-_-_-_-	BTL7- G5 _-M_-_-_-_-	BTL5- E5 _-M_-_-_-_-	BTL7- C5 _-M_-_-_-_-
0...10 V	-10...10 V	4...20 mA	0...20 mA
Max. 5 mA	Max. 5 mA	$\leq 500 \Omega$	$\leq 500 \Omega$
$\leq 0.33 \text{ mV}$	$\leq 0.33 \text{ mV}$	$\leq 0.66 \mu\text{A}$	$\leq 0.66 \mu\text{A}$
System resolution/min. 2 μm			
Max. 500 Hz	Max. 500 Hz	Max. 500 Hz	Max. 500 Hz
$\pm 200 \mu\text{m}$ to $\leq 500 \text{ mm}$ rated length	$\pm 200 \mu\text{m}$ to $\leq 500 \text{ mm}$ rated length	$\pm 200 \mu\text{m}$ to $\leq 500 \text{ mm}$ rated length	$\pm 200 \mu\text{m}$ to $\leq 500 \text{ mm}$ rated length
$\pm 0.04\%$ FS > 500 mm rated length	$\pm 0.04\%$ FS > 500 mm rated length	$\pm 0.04\%$ FS > 500 mm rated length	$\pm 0.04\%$ FS > 500 mm rated length
$\leq 40 \text{ ppm/K}$	$\leq 40 \text{ ppm/K}$	$\leq 20 \text{ ppm/K}$	$\leq 20 \text{ ppm/K}$
10...30 V DC	10...30 V DC	10...30 V DC	10...30 V DC
$\leq 150 \text{ mA}$			
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)			
-40...+85 °C	-40...+85 °C	-40...+85 °C	-40...+85 °C



Micropulse
Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact
and Rod AR

Rod EX

Filling Level
Sensor in Zone 0/1

Transducer in Zone 1

Rod DEX

Rod J-DEX

Rod PEX

Rod NEX

Floats
and
Encoders

Rod T
Redundant

General
Data

Programming
Position Encoders

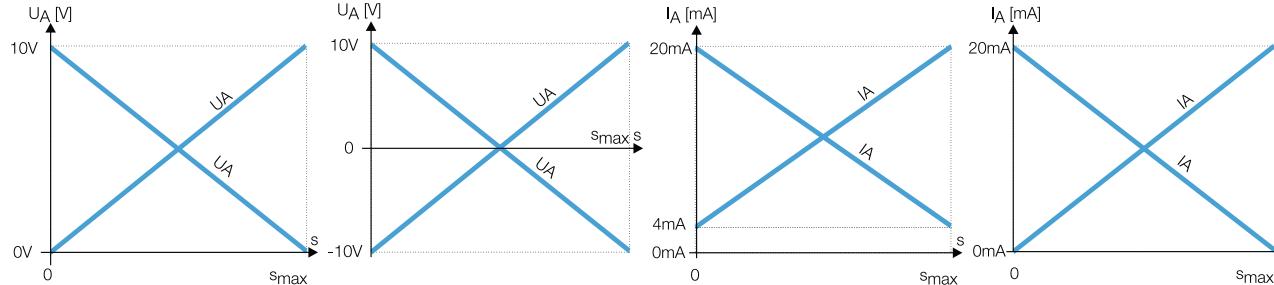
Rod CD

General
Data

Filling Level
Sensor SF

Accessories

Basic
Information and
Definitions



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

Scope of delivery

- Transducer
- Quick start instructions
- Fastening screws, stainless steel, "600 bar" (only design TK)
- Adapter flange (only design TK)

Please order separately:

Calibration box, see page 190

Position encoders, see page 239

Rod Redundant Programming

System requirements

- Standard PC
- Operating system: Windows 2000/XP/Vista/7
- Screen resolution at least 1024 x 768 pixels
- 10 MB available hard disk space
- Install Java Runtime Environment (JRE) Version 1.4.2 or higher
<http://java.com/getjava>
- USB port

USB configuration

Start, end value setting and configuration via USB

The software called Micropulse Configuration Tool enables Balluff transducers of type BTL7-A/E50... to be quickly and easily configured on a computer.

The most important features are:

- Online display of the current position of the encoder
- Graphic support for setting the functions and characteristics
- Display of information about the connected transducer
- Selectable number formats and units for display
- Reset to factory settings possible
- Demo mode without having a transducer connected

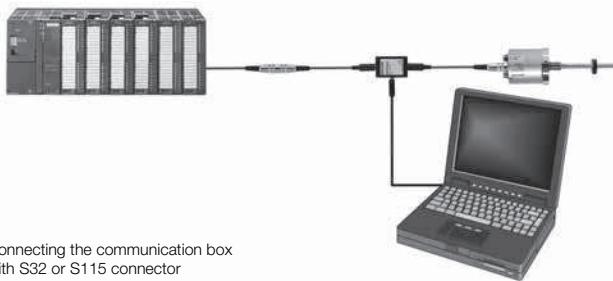
Connecting the USB communication box

With the BTL7-A/504/505-S32 transducers, the communication box can be connected between the transducer and controller. The communication box is connected to the PC using a USB cable.

USB communication box with cable set

Part number	Cable set
BTL7-A-CB01-USB-S32	Connector S32
BTL7-A-CB01-USB-KA	Cable connection

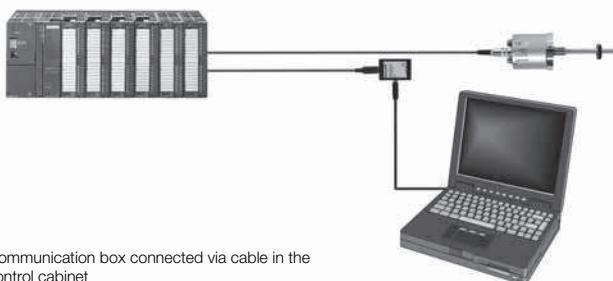
Description for Series	
Ordering code	
Part number	
Material	
Weight	
Position encoder travel speed	
Operating temperature/Storage temperature range	
Ordering code PA 60 fiberglass reinforced	
Part number PA 60 fiberglass reinforced	
Material	
Weight	
Position encoder travel speed	
Operating temperature/Storage temperature range	



Connecting the communication box with S32 or S115 connector

Scope of delivery

- USB communication box
- Cable set
- Quick start instructions



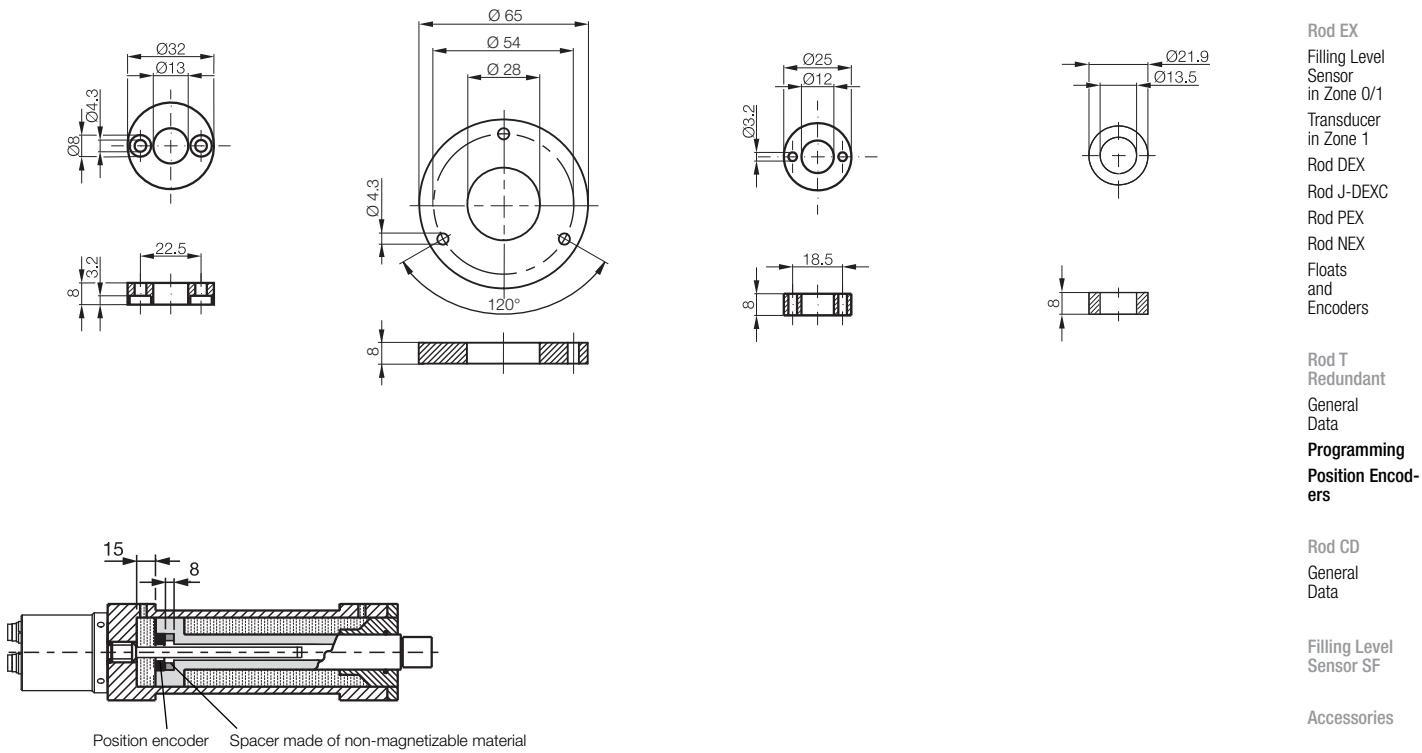
Communication box connected via cable in the control cabinet

The PC software and the corresponding manual are available on the Internet at www.balluff.com/downloads-btl7

Rod Redundant Position encoders



Position encoder	Position encoder	Position encoder	Position encoder
Rod BTL	Rod BTL	Rod BTL	Rod BTL
BAM013L	BAM013Y	BAM013J	BAM013R
BTL-P-1013-4R	BTL-P-1028-15R	BTL-P-1012-4R	BTL-P-1014-2R
Aluminum	Aluminum	Aluminum	Aluminum
approx. 12 g	approx. 68 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	

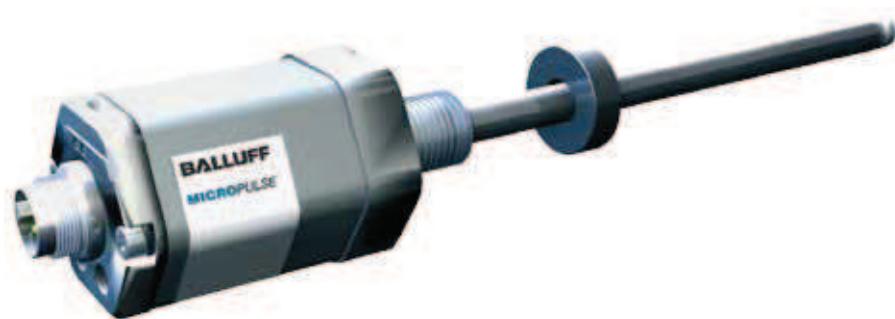


Caution!
Before design, installation and startup please familiarize yourself with the user's guide to be found at www.balluff.com.

Micropulse CD transducers ensure that extreme loads are moved steadily and with precision. They are based on the established magnetostrictive position measurement technology. The absolute, contact-free principle is suitable for the reliable, high-precision and dynamic measurement of piston positions on hydraulic cylinders. The special flange and protective pipe design as well as the extremely robust stainless steel material make the Micropulse CD transducers ideal for installation as a feedback system in high-pressure and heavy-duty cylinders.

Features

- For pressures up to 1000 bar
- Measuring lengths 25...2000 mm
- Resolution down to 1 μ m
- Degree of protection IP 67/68
- Temperature range -40...+85 °C
- Ex area zone 2; non-incendive "nA"
- Plug or cable variants
- Multi-magnet technology

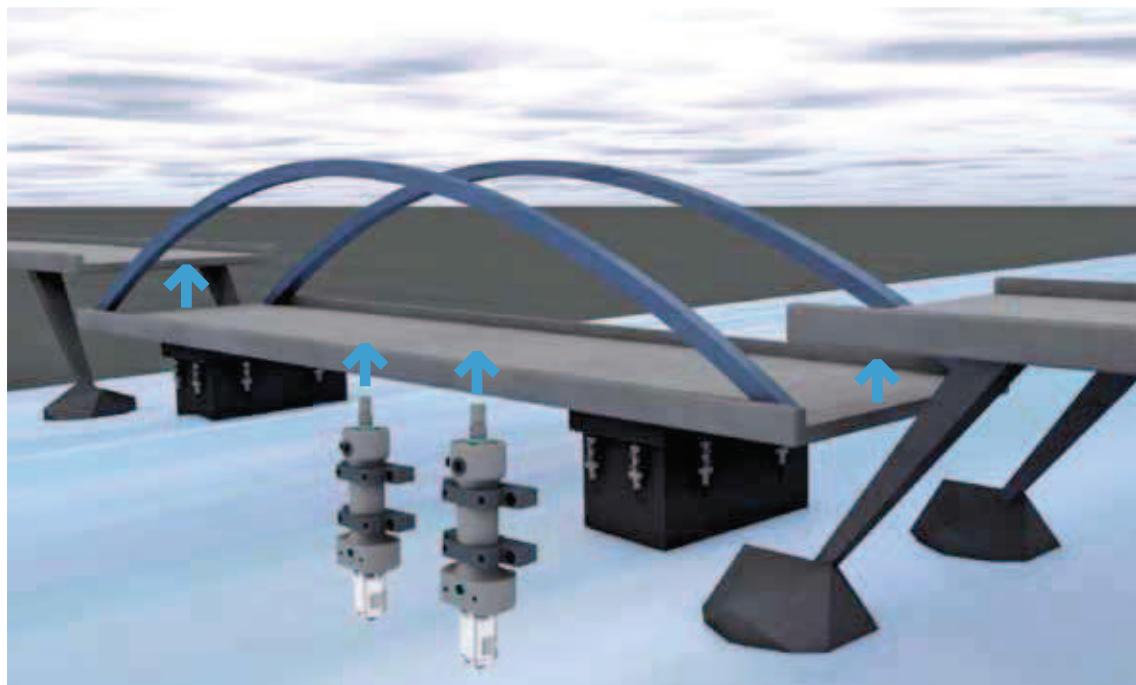


Structural design and calculations

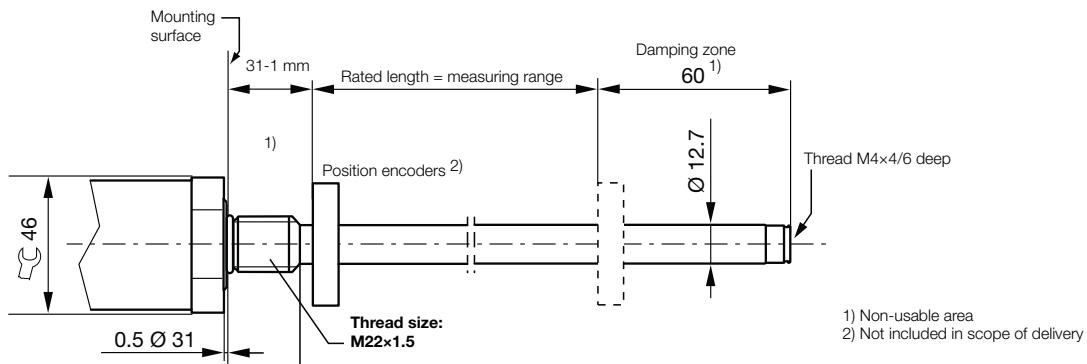
- Active support of walls
- Bridge positioning and lifting technology
- Leveling structures
- Off-shore sector
- Tunnel construction

Industrial applications

- Pumps and compressors
- Elevator and lifting technology
- Forging presses
- High-pressure hydraulics



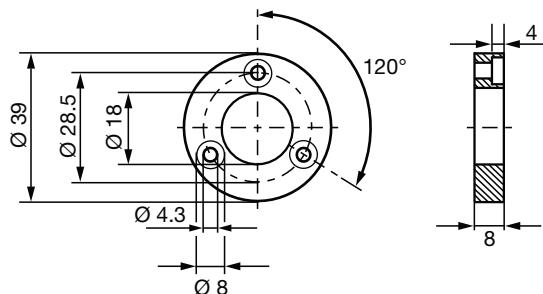
Heavy-duty cylinders raise the bridge to the planned road level after they are "floated" into position.



BTL-P-1018-3R

Weight:
Housing:

Approx. 19 g
Anodized aluminum



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:

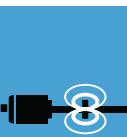
- Calibration box, see page 190
- Position encoders, see page 239

Ordering example:

B T L 5 / 7 - - M - C D - -

Output signal	Rated length [mm]	NEX	Connection
A Analog 0...10 V	0025...2000 mm in 1-mm increments	Optional: EX zone 2	S32 Terminal plug
G Analog -10...10 V	NEX		KA05 PUR cable 5 m
C Analog 0...20 mA	0025...0500 mm in 1-mm increments		
E Analog 4...20 mA			
P digital pulse			
S digital SSI			

Analog interface, see page 154; SSI interface, see page 162;
Digital Pulse Interface, see page 166; NEX, see page 231



Micropulse
Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact
and Rod AR

Rod EX

Filling Level
Sensor
in Zone 0/1

Transducer
in Zone 1

Rod DEX

Rod J-DEXC

Rod PEX

Rod NEX

Floats
and
Encoders

Rod T

Redundant
General
Data
Programming
Position Encoders

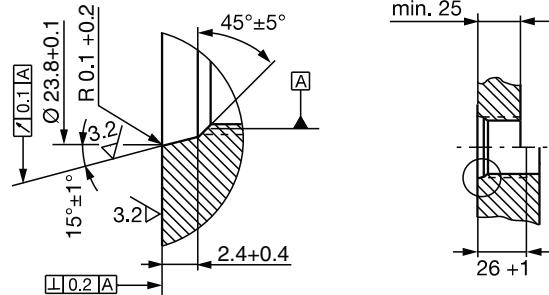
Rod CD
General
Data

Filling Level
Sensor SF

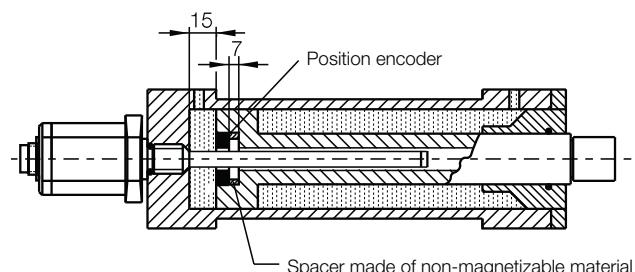
Accessories

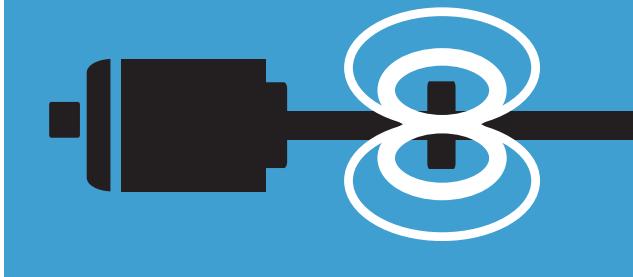
Basic
Information and
Definitions

Tapped hole M22x1.5 acc. to ISO 6149, O-ring 19.3x2.2



The transducer has a mounting thread M22x1.5 (according to ISO). Depending on the version, the hole must be tapped before installation.





Micropulse Transducers

Filling Level Sensor SF

- Highly accurate filling level sensor
- Compensation for inaccuracies due to foam build-up
- With international approvals, such as 3-A Sanitary Standard, FDA and ECOLAB
- In stainless steel housing with Tri-Clamp fastener
- Safe for sterilization (SIP) and cleaning (CIP)



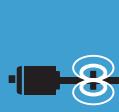


Filling Level Sensor SF Contents

Filling Level Sensor SF

General Data	244
Analog Interface	246
Floats and Accessories	248

MICRO PULSE[®]



Maximum precision for food hygiene – internationally certified

The filling level sensor BTL-SF ensures continuously precise measurement in applications that have extreme hygiene requirements. Made from corrosion-free stainless steel with excellent surface quality and rounded edges, the sensor meets the highest international hygiene standards and fulfills all of the food industry's strict requirements. Take advantage of the best quality directly from the manufacturer.

Other benefits

- Neutral for all liquids
- Compensates for foam, thus delivering reliable filling level values
- Adjustment-free installation
- Easy to clean in installed state (CIP – clean in place)
- For process temperatures up to 130 °C (SIP – sterilization in place)
- Standardized interfaces for flexible installation
- Internationally certified quality for global marketing and sales of your system
- Rising and falling signal available



In the USA, 3-A Sanitary Standards Inc. formulates and monitors hygiene guidelines for devices used in the manufacture and packaging of milk and foodstuffs. Our products with this designation are 3-A authorized.



The FDA (Food and Drug Administration) oversees the U.S. food and drug industries and certifies devices, materials as well as systems in these industries. A product designation of this kind makes your system eligible for FDA approval.



The ECOLAB marking stands for resistance to aggressive cleaning agents. Devices with ECOLAB markings fulfill their standards.



Filling Level Sensor SF General data

IP69K
A
3
74-06



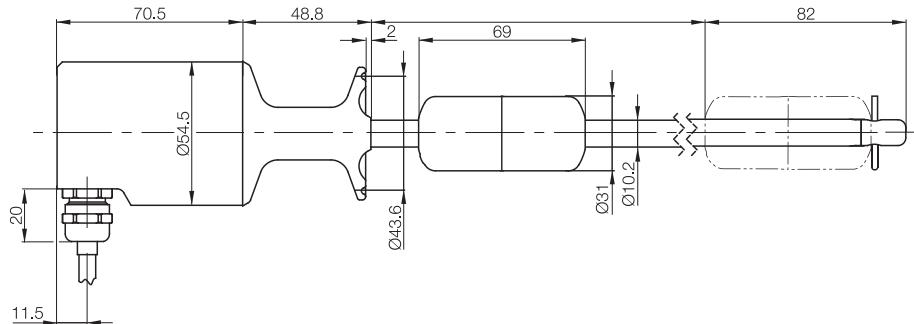
Series	Rod SF BTL5	Micropulse Transducers
Polarity reversal protected	yes	
Overvoltage protection	36 V	
Dielectric strength	500 V DC (GND to housing)	
Degree of protection as per IEC 60529	IP 67/IP 69K (flange and tube)	
Housing material	Stainless steel 1.4404	Profile P
Flange and tube material	1.4404	Profile PF
Connection	Cable connection	Profile AT
Fastener	1.5" Tri-Clamp as per SSI 3A standard 74-06	Profile BIW
Pressure rating	300 bar (depending on float)	Rod
EMC testing		Rod Compact and Rod AR
Radio interference emission	EN 55016-2-3 (industrial and residential area)	Rod EX, T Redundant and CD
Static electricity (ESD)	EN 61000-4-2/EN 61000-4-2 Severity level 3	
Electromagnetic fields (RFI)	EN 61000-4-3/EN 61000-4-3 Severity level 3	
Electrical fast transient bursts	EN 61000-4-4/EN 61000-4-4 Severity level 3	
Conducted interference induced by high-frequency fields	EN 61000-4-6/EN 61000-4-6 Severity level 3	
Surge voltage	IEC 61000-4-5/EN 61000-4-5 Severity level 2	Filling Level Sensor SF
Magnetic fields	IEC 61000-4-8/EN 61000-4-8 Severity level 4	General Data
Standard rated length (mm)	50...2500 in 1-mm increments	Analog Interface
		Floats and Accessories
		Accessories
		Basic Information and Definitions

Scope of delivery

- Transducer
- Quick start instructions

Please order separately:

- Tri-Clamp, see page 248
- Floats, see page 248
- Seal, see page 248
- Weld nipple, see page 248



Caution!

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

Filling Level Sensor SF

Analog interface

The industry-standard filling level sensor works with tried-and-tested Micropulse technology, absolute and contact-free magnetostriuctive measurement, which has been associated with top reliability for years. In addition, it has analog interfaces and, due to this common standard signal, can be used in process automation.

Analog signal

A signal that can assume any value between a minimum and maximum continuously (almost) without increments is called an analog signal.

The output signal for the filling level sensor BTL-SF is analog and directly proportional to the position of the float on the sensor tube.

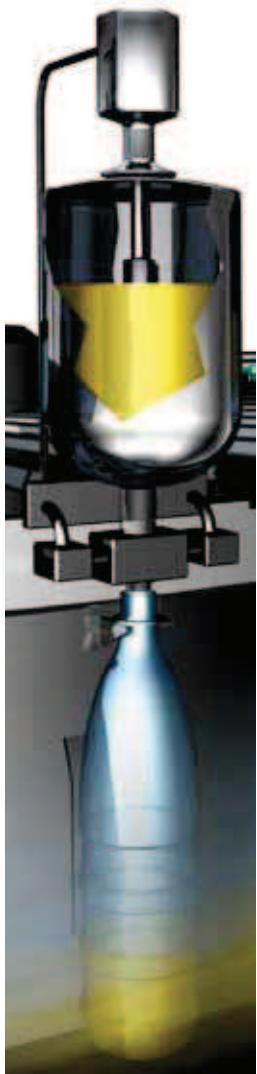
Features

- Economically priced system solution
- Can be used from each controller
- Cable break monitoring using 4...20 mA signal
- Current signal, interference-free signal transmission
- High resolution and reproducibility
- Rising and falling signal available

Variants

- Current (4...20 mA or 0...20 mA)
- Voltage (0...10 V or 10...0 V)

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	
Supply voltage	
Current consumption	
Polarity reversal protected	
Overvoltage protection	
Dielectric strength	
Operating temperature	
Process temperature (130 °C over one hour)	



Scope of delivery

- Transducer
- Quick start instructions

Please order separately:

- Tri-Clamp, see page 248
- Floats, see page 248
- Seal, see page 248
- Weld nipple, see page 248

Teflon cable – LIF5Y-FC-5Y (7×0.25 mm²):

- Temperature-resistant up to 200°C
- Good resistance to chemicals and oil

Filling Level Sensor SF Analog interface

Rod SF BTL5	Rod SF BTL5	Rod SF BTL5
Analog	Analog	Analog
A	E	C
Analog	Analog	Analog
BTL5- A11 -M- -SF- 	BTL5- E1 -M- -SF- 	BTL5- C1 -M- -SF-
0...10 V and 10...0 V	4...20 mA or 20...4 mA	0...20 mA or 20...0 mA
Max. 5 mA		
$\leq 5 \text{ mV}$		
$\leq 0.1 \text{ mV}$	$\leq 500 \Omega (500 \Omega)$	$\leq 500 \Omega (500 \Omega)$
$\leq 4 \mu\text{m}$	$\leq 0.2 \mu\text{A}$	$\leq 0.2 \mu\text{A}$
System resolution/min. 2 μm	System resolution/min. 2 μm	System resolution/min. 2 μm
$f_{\text{STANDARD}} = 500 \text{ Hz}$	$f_{\text{STANDARD}} = 500 \text{ Hz}$	$f_{\text{STANDARD}} = 500 \text{ Hz}$
$\pm 100 \mu\text{m}$ up to 500 mm rated length	$\pm 100 \mu\text{m}$ up to 500 mm rated length	$\pm 100 \mu\text{m}$ up to 500 mm rated length
$\pm 0.02\%$ 500... max. rated length	$\pm 0.02\%$ 500... max. rated length	$\pm 0.02\%$ 500... max. rated length
$\leq 40 \text{ ppm/K}$ for rated length 500 mm, float at center of measuring range	$\leq 40 \text{ ppm/K}$ for rated length 500 mm, float at center of measuring range	$\leq 40 \text{ ppm/K}$ for rated length 500 mm, float at center of measuring range
20...28 V DC	20...28 V DC	20...28 V DC
$\leq 150 \text{ mA}$	$\leq 150 \text{ mA}$	$\leq 150 \text{ mA}$
yes	yes	yes
36 V	36 V	36 V
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
-20...+130 °C	-20...+130 °C	-20...+130 °C



Micropulse
Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact
and Rod AR

Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

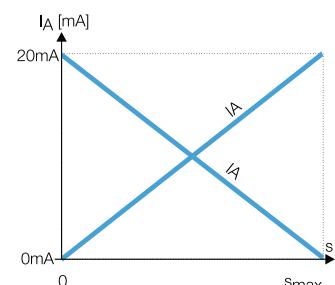
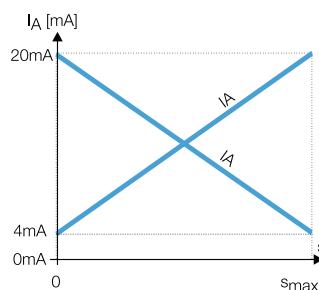
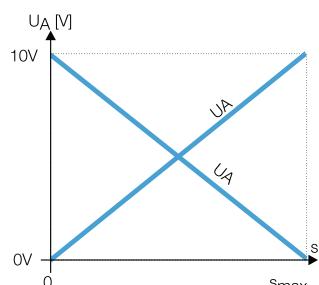
General
Data

Analog
Interface

Floats and Accesso-
ries

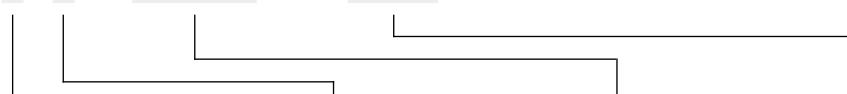
Accessories

Basic
Information and
Definitions



Ordering example:

B T L 5 - 1 - M - SF - -



Output signal

- A Analog 0...10 V
- C Analog 0...20 mA
- E Analog 4...20 mA

Characteristic curves

- 1 Rising and falling for A
- 0 Rising (for C and E)
- 7 Falling (for C and E)

Standard rated length [mm]

50...2500 mm
in 1-mm increments

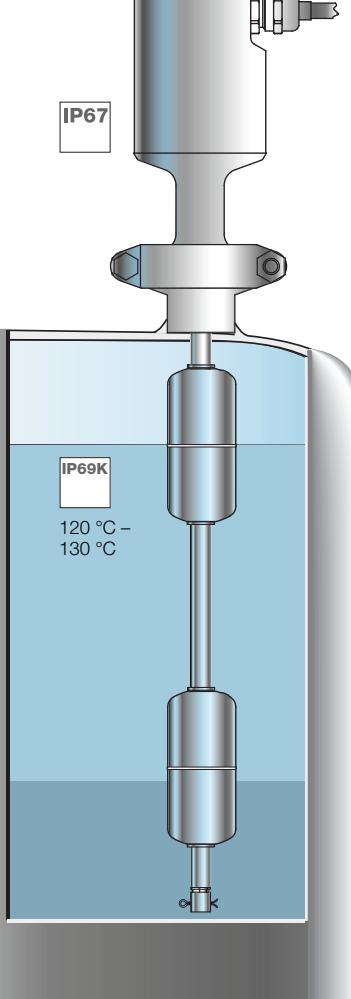
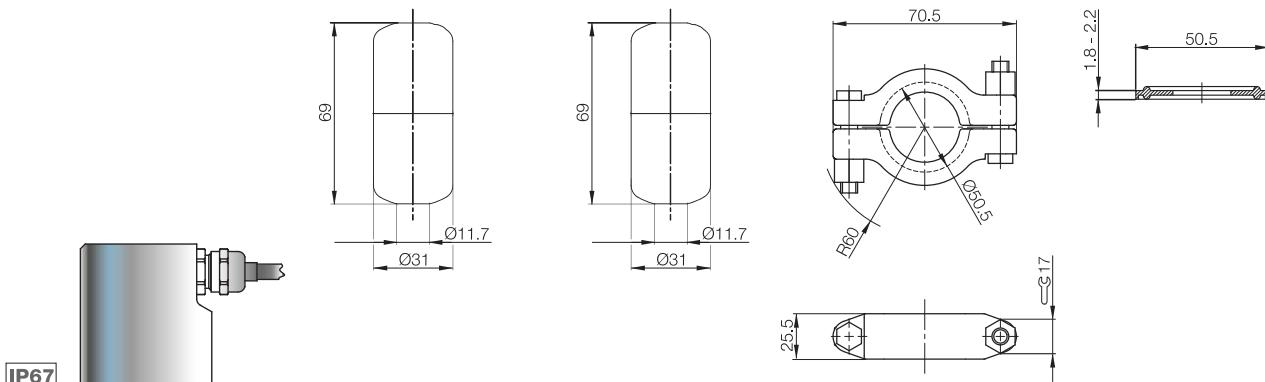
- F-radial design
- F02 2 m Teflon cable
- F05 5 m Teflon cable
- F10 10 m Teflon cable
- F15 15 m Teflon cable
- F20 20 m Teflon cable

Filling Level Sensor SF

Floats and accessories



Designation for Series	Float	Float	Tri-Clamp (DIN 32676)	O-ring
	Rod SF BTL	Rod SF BTL	Rod SF BTL	Rod SF BTL
Ordering code	BAM01KA	BAM01A2	BAM01A5	BAM01A4
Part number	BTL-S-3112-4Z-SA10	BTL-S-3112-4Z	BAM MC-XA-006-D38,1-5	BAM SE-XA-002-D38,1-S
Material	Stainless steel 1.4404	Stainless steel 1.4404	USA ASTM 316 (1.4401)	Platinum catalyzed silicone
Weight	Approx. 30 g	Approx. 30 g		
Operating temperature/ Storage temperature range	-20...+130 °C	-20...+130 °C		
Immersion depth in water	approx. 54 mm	approx. 31 mm		
Pressure rating (static)	25 bar	4 bar		

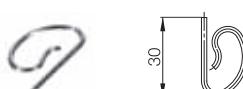


Process temperature:
maximum permissible temperature of
the rod under the flange (with media
contact).
Certain production processes require
sterilization at
120...130°C for 0.5...1 hour, for
instance.

"Junction float" on request.

Included in scope of delivery for float

- Float
- Instructions
- Cotter pin (spring pin 2x30)



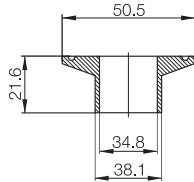
Caution!

Approvals only issued through use of these components.
Before design, installation and startup please familiarize yourself with the user's guide to be found at www.balluff.com.

Filling Level Sensor SF Application



Weld nipple
Rod SF BTL
BAM01A3
BAM-AD-XA-003-D38,1-5
Part no. W. 1.4435 BN2 (Fe ≤ 0.5%) as per EB 10088



- Continuously precise measurement in μ area delivers excellent filling results
- 100% stainless steel ensures top hygiene standards and long service life
- International certificates ensure maximum quality

Maximum precision for food hygiene – internationally certified

The filling level sensor BTL-SF ensures continuously precise measurement in applications that have extreme hygiene requirements. Made from corrosion-free stainless steel with excellent surface quality and rounded edges, the sensor meets the highest international hygiene standards and fulfills all of the food industry's strict requirements. Take advantage of the best quality directly from the manufacturer.

Other benefits

- Neutral for all liquids
- Compensates for foam to deliver reliable filling level values
- Adjustment-free installation
- Easy to clean in installed state (CIP – clean in place)
- For process temperatures up to 130 °C (SIP – sterilization in place)
- Standardized interfaces ensure flexible installation
- Internationally certified quality ensures global marketing and sales of your system
- Rising and falling signal available



Micropulse
Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact
and Rod AR

Rod EX,
T Redundant
and CD

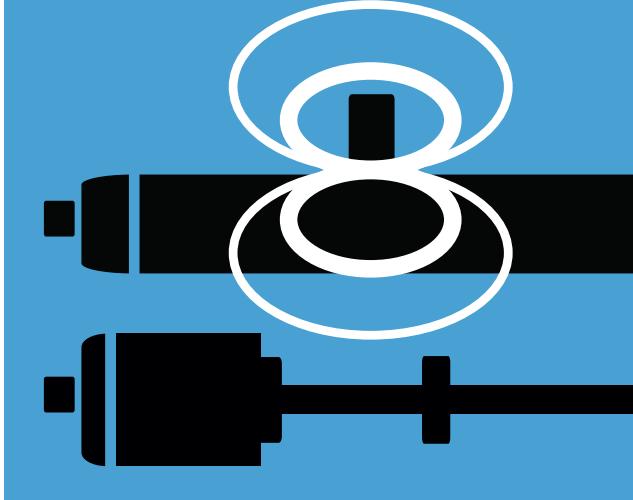
Filling Level
Sensor SF
General
Data
Analog
Interface

Floats and Ac-
cessories

Accessories

Basic
Information and
Definitions





Micropulse Transducers

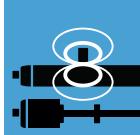




Accessories Contents

Accessories

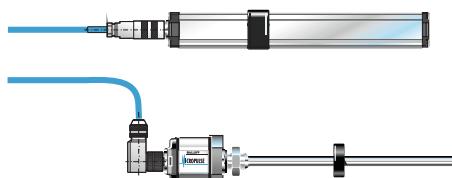
Connectors	252
"Pigtail" Connector System	264
Processor Units	266
Profibus Modules P111	270
BUS Interface Modules	272
Digital Display, CAM Controller	273



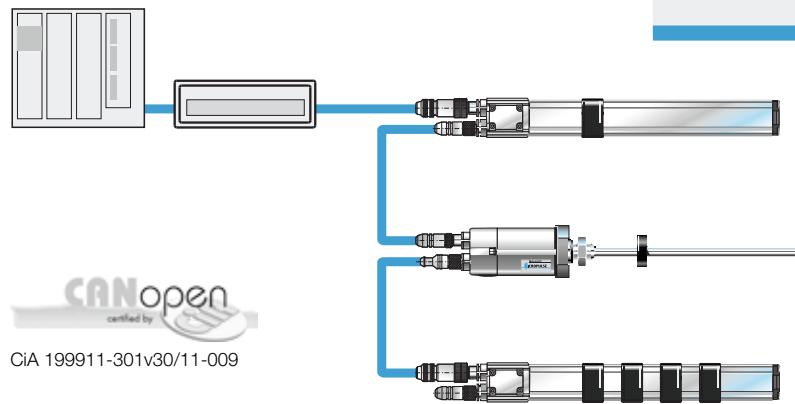
MICRO PULSE®



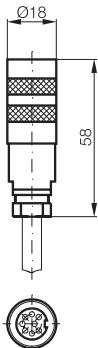
**Connector for analog,
pulse and SSI interfaces**



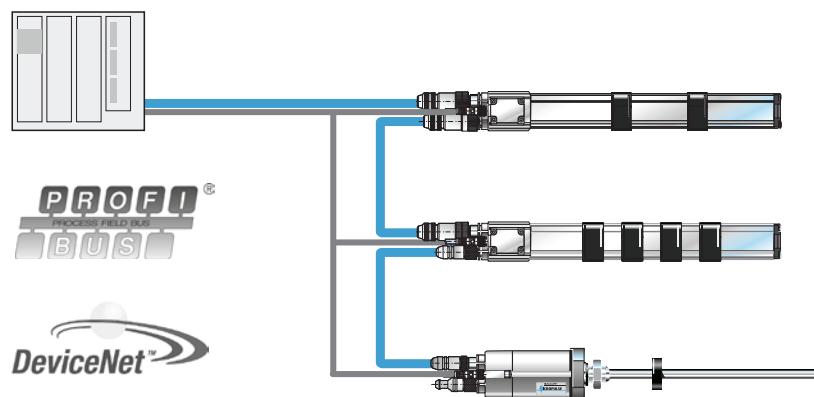
**Connectors
for CANopen interfaces**



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



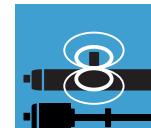
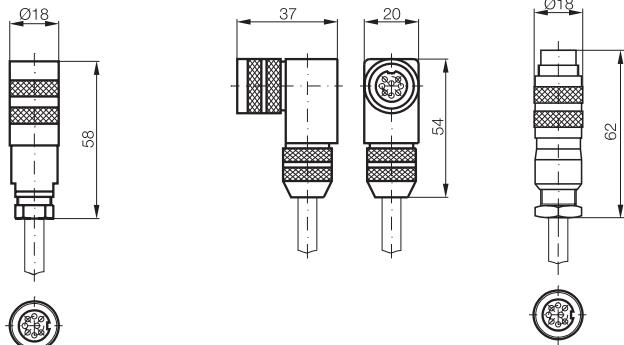
**Connectors for Profibus DP and De-
viceNet interfaces**



Accessories

Connectors for analog, pulse and SSI interfaces

BKS-S 32M-C	BKS-S 33M	BKS-S 78M	BKS-S232	BKS-S233																																																																																										
BTL_...-S 32 crimped contacts Straight, female BKS-S 32M-C-00	BTL_...-S 32 soldered contacts Angled, female BKS-S 33M-__	BTL_...-S 32 soldered contacts Straight, male BKS-S 78M-00	BTL_...-S32 Straight, female BKS-S232-PU-__	BTL_...-S32 Angled, female BKS-S233-PU-__																																																																																										
max. 0.5 mm ²	max. 0.75 mm ²	max. 0.75 mm ²																																																																																												
Nickel-plated CuZn CuZn 0.8 µm Au PG 9 6...8 mm Lif2Y-FC-11Y- 0 8x0.25 mm ²	Nickel plated ZnAlCu1 CuZn 0.8 µm Au PG 9 6...8 mm Lif2Y-FC-11Y- 0 8x0.25 mm ²	Nickel-plated CuZn CuZn 0.8 µm Au PG 9 6...8 mm	PUR	PUR																																																																																										
IP 67 (when screwed into place)	IP 67 (when screwed into place)	IP 67 (when screwed into place)	IP 67 (when screwed into place)	IP 67 (when screwed into place)																																																																																										
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Filling Level Sensor SF

Accessories
Connectors
"Pigtail" Connector System
Evaluation Units
Profinet Modules P111
BUS Interface Modules
Digital Display CAM Controller

Basic Information and Definitions



Please include the cable length with the part number.

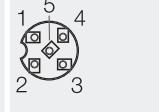
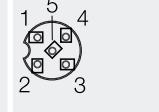
Code 00 for user-assembly

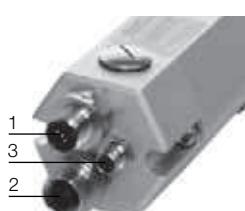
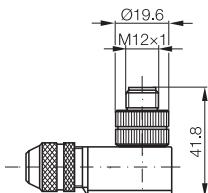
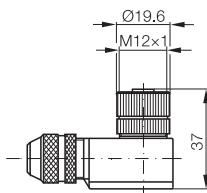
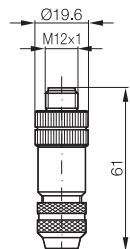
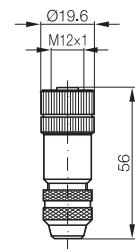
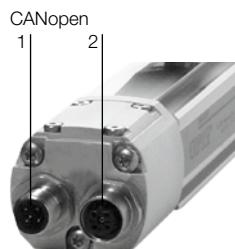
(please use shielded cable).

Code 05, 10, 15, 20, 25, 30 m for finished cable assembly.

Accessories

Connectors for CANopen and DeviceNet interfaces

Connectors for Series	BKS-S92-00 BTL_H__-S92/S93/S94 Screw terminals	BKS-S94-00 BTL_H__-S92/S93/S94 Screw terminals	BKS-S93-00 BTL_H__-S92/S93/S94 Screw terminals	BKS-S95-00 BTL_H__-S92/S93/S94 Screw terminals																																																
Design	5-pin, female	5-pin, male	5-pin, female	5-pin, male																																																
Part number	BKS-S92-00	BKS-S94-00	BKS-S93-00	BKS-S95-00																																																
Screw terminal	max. 0.75 mm ²	max. 0.75 mm ²	max. 0.75 mm ²	max. 0.75 mm ²																																																
Housing material	Nickel-plated CuZn	Nickel-plated CuZn	Nickel-plated CuZn	Nickel-plated CuZn																																																
Contact	CuZn	CuZn	CuZn	CuZn																																																
Contact surface	0.8 µm Au	0.8 µm Au	0.8 µm Au	0.8 µm Au																																																
Cable strain relief	PG 9	PG 9	PG 9	PG 9																																																
Cable diameter	6...8 mm	6...8 mm	6...8 mm	6...8 mm																																																
Number of conductors x conductor cross-section																																																				
Degree of protection as per IEC 60529	IP 67 (when screwed into place)	IP 67 (when screwed into place)	IP 67 (when screwed into place)	IP 67 (when screwed into place)																																																
Knurled nut																																																				
Finish																																																				
O-ring																																																				
Resistor																																																				
Coding	A	A	A	A																																																
Slot on transducer	1	2	1	2																																																
View of female coupling side	 <table border="1"><tr><th>PIN</th><th>Signal</th></tr><tr><td>1</td><td>CAN_GND</td></tr><tr><td>2</td><td>+24 V</td></tr><tr><td>3</td><td>GND (0 V)</td></tr><tr><td>4</td><td>CAN_HIGH</td></tr><tr><td>5</td><td>CAN_LOW</td></tr></table>	PIN	Signal	1	CAN_GND	2	+24 V	3	GND (0 V)	4	CAN_HIGH	5	CAN_LOW	 <table border="1"><tr><th>PIN</th><th>Signal</th></tr><tr><td>1</td><td>CAN_GND</td></tr><tr><td>2</td><td>+24 V</td></tr><tr><td>3</td><td>GND (0 V)</td></tr><tr><td>4</td><td>CAN_HIGH</td></tr><tr><td>5</td><td>CAN_LOW</td></tr></table>	PIN	Signal	1	CAN_GND	2	+24 V	3	GND (0 V)	4	CAN_HIGH	5	CAN_LOW	 <table border="1"><tr><th>PIN</th><th>Signal</th></tr><tr><td>1</td><td>CAN_GND</td></tr><tr><td>2</td><td>+24 V</td></tr><tr><td>3</td><td>GND (0 V)</td></tr><tr><td>4</td><td>CAN_HIGH</td></tr><tr><td>5</td><td>CAN_LOW</td></tr></table>	PIN	Signal	1	CAN_GND	2	+24 V	3	GND (0 V)	4	CAN_HIGH	5	CAN_LOW	 <table border="1"><tr><th>PIN</th><th>Signal</th></tr><tr><td>1</td><td>CAN_GND</td></tr><tr><td>2</td><td>+24 V</td></tr><tr><td>3</td><td>GND (0 V)</td></tr><tr><td>4</td><td>CAN_HIGH</td></tr><tr><td>5</td><td>CAN_LOW</td></tr></table>	PIN	Signal	1	CAN_GND	2	+24 V	3	GND (0 V)	4	CAN_HIGH	5	CAN_LOW
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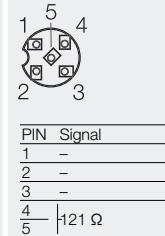


Slot 3

Power supply for DeviceNet:
BKS-S48-15-CP-... page 259

Accessories
Connectors for CANopen and DeviceNet interfaces

BKS-S92-TA1 BTL-H____-S92	BKS-S137-19-PC-... BTL-H____-S92/S93/S94	BKS-S151-19-PC-... BTL-H____-S92/S93/S94	BKS-S94-R01 BTL-H____-S92/S93/S94	BKS-S92-16/GS92-... BTL-H____-S92/S93/S94
T-splitter, 2 x female, 1 x male	5-pin, female	5-pin, male	Terminating resistor, male	Male/female extension
BKS-S92-TA1	BKS-S137-19-PC-...	BKS-S151-19-PC-...	BKS-S94-R01	BKS-S92-16/GS92-...
PA	PUR	PUR	TPU	PUR
CuZn	CuZn	CuZn	CuZn	CuZn
NI	0.8 µm Au	0.8 µm Au	0.8 µm Au	0.8 µm Au
	5x0.25 mm ²	5x0.25 mm ²		5x0.34 mm ²
IP 67	IP 67	IP 67	IP 68	IP 67
CuZn	CuZn	CuZn	CuZn	CuZn
2.5 µm Ni	2.5 µm Ni	2.5 µm Ni	2.5 µm Ni	2.5 µm Ni
HBR	Viton	Viton	Viton	Viton
			121 Ω	
A	A	A	A	A
1*	1	2	2	1/2



*Only for
BTL5-H1...-M-P/B-S92

Please include the
cable length with the part
number!

02 = Length of 2 m
05 = Length of 5 m
10 = Length of 10 m

Please include the
cable length with the part
number!

02 = Length of 2 m
05 = Length of 5 m
10 = Length of 10 m

Please include the
cable length with the part
number.

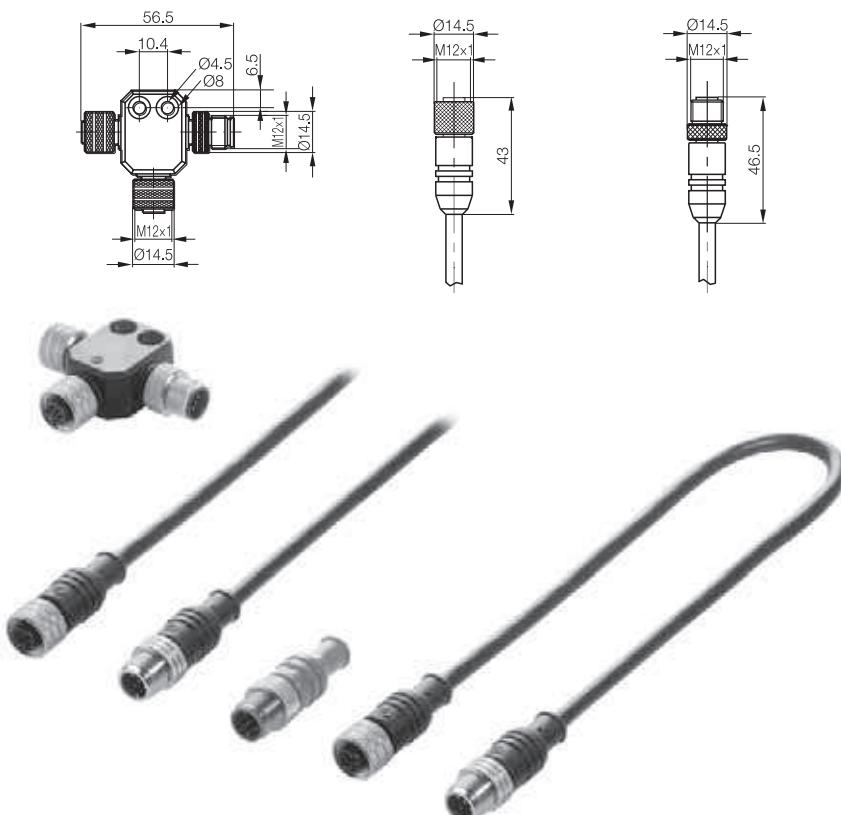
02 = Length of 2 m
05 = Length of 5 m
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Accessories
Connectors

"Pigtail" Connec-
tor System
Evaluation
Units

Profinet
Modules P111
BUS Interface
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CAM Controller

Basic
Information and
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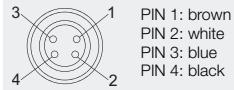
Please order the
clear view cover
separately.

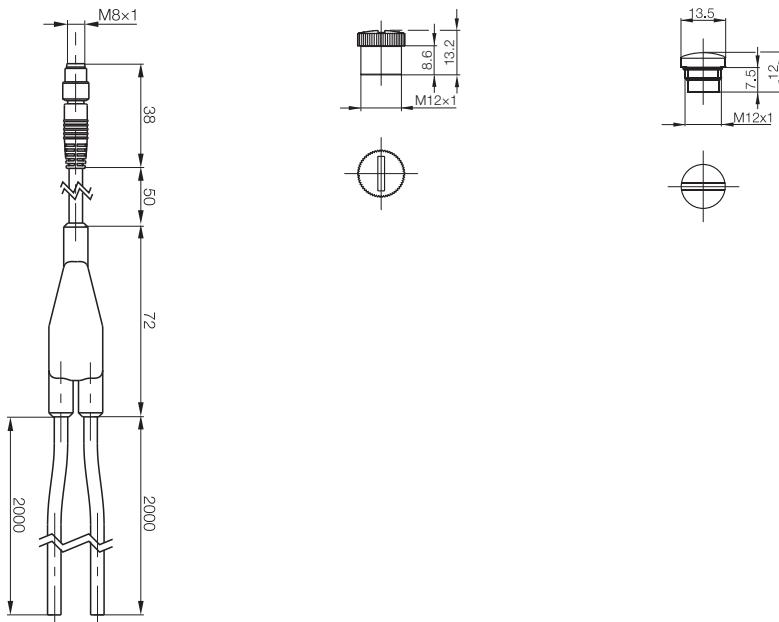
Order designation:
BTL5-A-CP01-K



Accessories

M8 Y-connectors for CANopen

Connectors	1xM8 straight/2x3-wire		
Designation	Y-connector	M12 locking screw	M12 locking screw
Design	Male		
Use	Splitter boxes	IP 65 screw plug for unused ports	for connector type M12x1
Ordering code	BCC08JZ	BAM01C2	BAM0114
Part number	BKS-S 75-TB4-05-PU-00,05/02/02	BAM CS-XA-002-M12-A	BKS-12-CS-01
Supply voltage U_s	10...30 V DC		
Number of conductors \times conductor cross-section	4x0.34 mm ²		
Connection	Molded-in		
Degree of protection as per IEC 60529	IP 67		
Ambient temperature T_a	-25...+85 °C	-20...+80 °C	
Housing material	PUR	Plastic	Brass
View of female/male side	 PIN 1: brown PIN 2: white PIN 3: blue PIN 4: black		



Accessories

Connectors for Profibus DP



Connectors	M12	M12	M12	M12
Design	B-coded 5-pin	B-coded 5-pin	B-coded 5-pin	B-coded 5-pin
Use	Male	Male	Female	Female
Ordering code	BCC0714	BCC0716	BCC0715	BCC0717
Part number	BCC M475-0000-2B-000-01X575-000	BCC M485-0000-2B-000-01X575-000	BCC M475-0000-1B-000-01X575-000	BCC M485-0000-1B-000-01X575-000
Supply voltage U_S	10...30 V DC	10...30 V DC	10...30 V DC	10...30 V DC
Number of conductors \times conductor cross-section	5x max. 0.75 mm ²			
Cable diameter	6...8 mm	6...8 mm	6...8 mm	6...8 mm
Connection	Screw terminal	Screw terminal	Screw terminal	Screw terminal
Degree of protection as per IEC 60529	IP 67 (when screwed into place)			
Ambient temperature T_a	-25...+85 °C	-25...+85 °C	-25...+85 °C	-25...+85 °C
Housing material	CuZn	CuZn	CuZn	CuZn
Shielded design	yes*	yes*	yes*	yes*
Coding	B	B	B	B
Slot on transducer	2	2	1	1
View of female/male side				

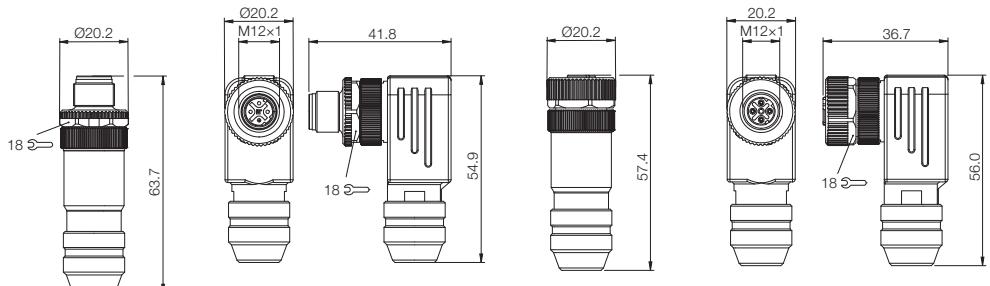
*Knurled ring used
Knurled nut

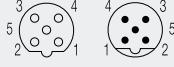
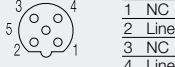
Previously BKS-S 105-00
00,3 = Length of 0.3 m
02 = Length of 2 m
05 = Length of 5 m
10 = Length of 10 m

Previously BKS-S 106-00
00,3 = Length of 0.3 m
02 = Length of 2 m
05 = Length of 5 m
10 = Length of 10 m

Previously BKS-S 103-00
00,3 = Length of 0.3 m
02 = Length of 2 m
05 = Length of 5 m
10 = Length of 10 m

Previously BKS-S 104-00
00,3 = Length of 0.3 m
02 = Length of 2 m
05 = Length of 5 m
10 = Length of 10 m

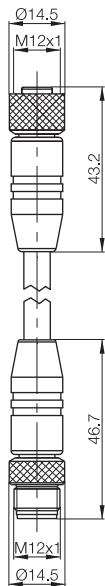


Connector diagram and wiring	 <table border="1"> <tr><td>1</td><td>NC</td></tr> <tr><td>2</td><td>Line A green</td></tr> <tr><td>3</td><td>NC</td></tr> <tr><td>4</td><td>Line B red</td></tr> <tr><td>5</td><td>NC</td></tr> </table>	1	NC	2	Line A green	3	NC	4	Line B red	5	NC	 <table border="1"> <tr><td>1</td><td>NC</td></tr> <tr><td>2</td><td>Line A green</td></tr> <tr><td>3</td><td>NC</td></tr> <tr><td>4</td><td>Line B red</td></tr> <tr><td>5</td><td>NC</td></tr> </table>	1	NC	2	Line A green	3	NC	4	Line B red	5	NC
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3	NC																					
4	Line B red																					
5	NC																					
1	NC																					
2	Line A green																					
3	NC																					
4	Line B red																					
5	NC																					
Configuration																						
Design																						
Use	Female/male	Female																				
Supply voltage U_S	300 V	300 V																				
Cable material	PUR	PUR																				
Color	Violet	Violet																				
Number of conductors \times conductor cross-section	2 \times 0.38 mm ²	2 \times 0.38 mm ²																				
Degree of protection as per IEC 60529	IP 67	IP 67																				
Ambient temperature T_a	-25...+80 °C	-25...+80 °C																				
Housing material	PUR	PUR																				
Knurled nut	Nickel-plated CuZn	Nickel-plated CuZn																				
Coding	B	B																				
Slot on transducer	1/2	1																				

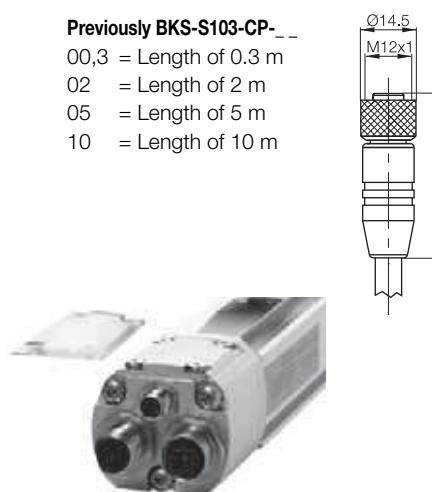
	Ordering code		
	Part number		
Cable length	Ordering code	BCC0A12	
0.6 m	Part number	BCC M415-M412-3B-329-PS72N1-006	
Cable length	Ordering code	BCC0A13	
1 m	Part number	BCC M415-M412-3B-329-PS72N1-010	
Cable length	Ordering code	BCC0A14	BCC070Y
2 m	Part number	BCC M415-M412-3B-329-PS72N1-020	BCC M415-0000-1B-031-PS72N1-020
Cable length	Ordering code	BCC0A15	BCC070Z
5 m	Part number	BCC M415-M412-3B-329-PS72N1-050	BCC M415-0000-1B-031-PS72N1-050
Cable length	Ordering code	BCC0A16	BCC0710
10 m	Part number	BCC M415-M412-3B-329-PS72N1-100	BCC M415-0000-1B-031-PS72N1-100
Cable length	Ordering code	BCC0A17	BCC0A0K
15 m	Part number	BCC M415-M412-3B-329-PS72N1-150	BCC M415-0000-1B-031-PS72N1-150
Cable length	Ordering code	BCC0A18	BCC0A0L
20 m	Part number	BCC M415-M412-3B-329-PS72N1-200	BCC M415-0000-1B-031-PS72N1-200



Previously BKS-S103/GS103-CP-__
 00,3 = Length of 0.3 m
 02 = Length of 2 m
 05 = Length of 5 m
 10 = Length of 10 m



Previously BKS-S103-CP-__
 00,3 = Length of 0.3 m
 02 = Length of 2 m
 05 = Length of 5 m
 10 = Length of 10 m

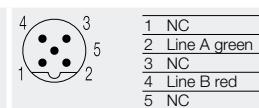


Please order the clear view cover separately!
 Order designation: BTL5-A-CP01-K



Accessories

Connector for M12. 5-pin, B-coded for Profibus DP



Male	M12 terminating resistor	M8 power supply cord
300 V	5-pin, B-coded	
PUR	Male	Female
Violet	10...30 V DC	
2x0.38 mm ²		PUR
IP 67	IP 67	Black
-25...+80 °C	-40...+85 °C	2x0.25 mm ²
PUR	Plastic	IP 67
Nickel-plated CuZn		PUR
B	B	
2	2	3



Micropulse
Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact
and Rod AR

Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

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Connectors

"Pigtail" Connec-
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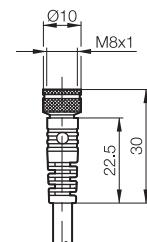
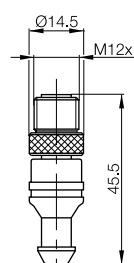
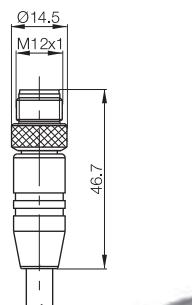
Basic
Information and
Definitions



BCC0A0Y	BCC0718
BCC M412-0000-2B-031-PS72N1-020	BCC M415-0000-2B-R01
BCC0A0Z	
BCC M412-0000-2B-031-PS72N1-050	

BCC0069
BKS-S 48-15-CP-02
BCC006A
BKS-S 48-15-CP-05
BCC006C
BKS-S 48-15-CP-10
BCC006E
BKS-S 48-15-CP-20
BCC006F
BKS-S 48-15-CP-30

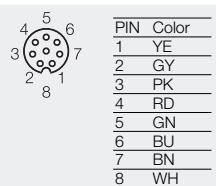
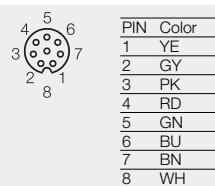
Previously BKS-S105-CP-__
00,3 = Length of 0.3 m
02 = Length of 2 m
05 = Length of 5 m
10 = Length of 10 m



Accessories

M12 female straight and right-angle connectors, 8-pin, customized assembly

Connector diagram and wiring

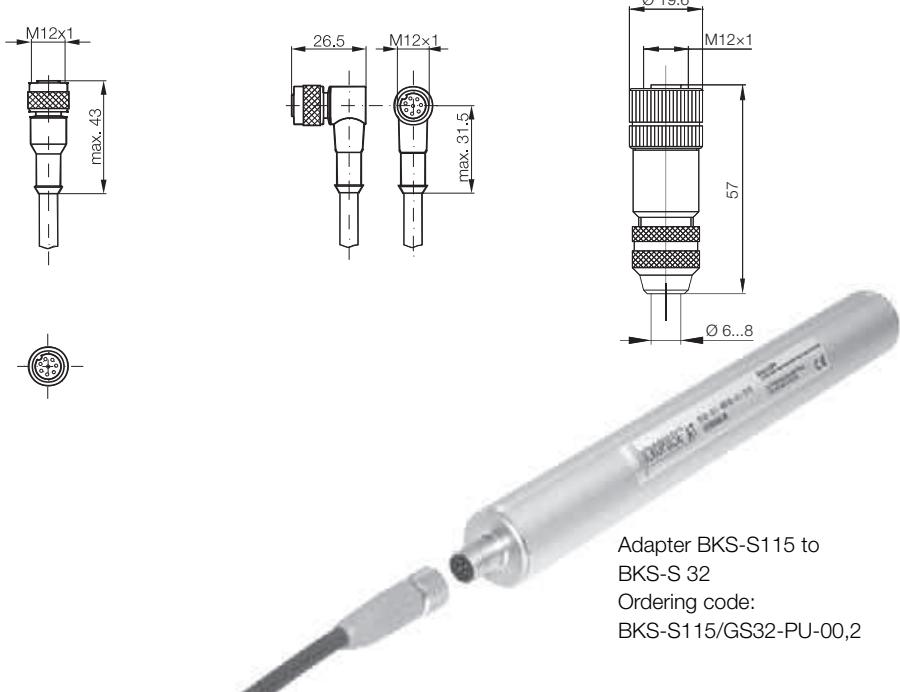


for Series	BTL_....-S115
Design	8-pin, straight, female
Ambient temperature T_a	
Housing material	PUR
Degree of protection as per IEC 60529	IP 67 (when screwed into place)
Cable material	PUR
Number of conductors \times conductor cross-section	8 \times 0.25 mm ²
Cable diameter D	6.6 \pm 0.2 mm
Min. bending radius	dynamic 5 \times D, static 2 \times D
Coding	
Slot on transducer	

for Series	BTL_....-S115
Design	8-pin, angled, female
Ambient temperature T_a	
Housing material	PUR
Degree of protection as per IEC 60529	IP 67 (when screwed into place)
Cable material	PUR
Number of conductors \times conductor cross-section	8 \times 0.25 mm ²
Cable diameter D	6.6 \pm 0.2 mm
Min. bending radius	dynamic 5 \times D, static 2 \times D
Coding	
Slot on transducer	

for Series	BTL_....-S115
Design	8-pin, female
Ambient temperature T_a	
Housing material	Nickel-plated CuZn
Degree of protection as per IEC 60529	IP 67 (when screwed into place)
Cable material	
Number of conductors \times conductor cross-section	max. 0.75 mm ²
Cable diameter D	6...8 mm
Min. bending radius	
Coding	
Slot on transducer	

Ordering code	Part number	BCC00YA	
		BKS-S115-00	
Cable length	Ordering code	BCC00YE	BCC00YU
2 m	Part number	BKS-S115-PU-02	BKS-S116-PU-02
Cable length	Ordering code	BCC00YF	BCC00YW
5 m	Part number	BKS-S115-PU-05	BKS-S116-PU-05
Cable length	Ordering code	BCC00YH	BCC00YY
10 m	Part number	BKS-S115-PU-10	BKS-S116-PU-10
Cable length	Ordering code	BCC00YJ	BCC00YZ
15 m	Part number	BKS-S115-PU-15	BKS-S116-PU-15
Cable length	Ordering code	BCC00YK	BCC00ZO
20 m	Part number	BKS-S115-PU-20	BKS-S116-PU-20
Cable length	Ordering code	BCC00YL	BCC00Z1
25 m	Part number	BKS-S115-PU-25	BKS-S116-PU-25
Cable length	Ordering code	BCC00YM	BCC00Z2
50 m	Part number	BKS-S115-PU-50	BKS-S116-PU-50



Accessories

M12 female straight and angled connector, 8-pin, user-configurable for VARAN and EtherCAT



Micropulse
Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact
and Rod AR

Rod EX,
T Redundant
and CD

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M12 female, straight, 8-pin

-25...+85 °C

CuZn

IP 67 (when screwed into place)

8×0.14...0.25 mm²

4...8 mm

M12 female, angled, 8-pin

-25...+85 °C

CuZn

IP 67 (when screwed into place)

8×0.14...0.25 mm²

4...8 mm

M12/M18 Y-plug splitter

-25...+85 °C

TPU

IP 67 (when screwed into place)

I = A, III = D

C

BCC04MC

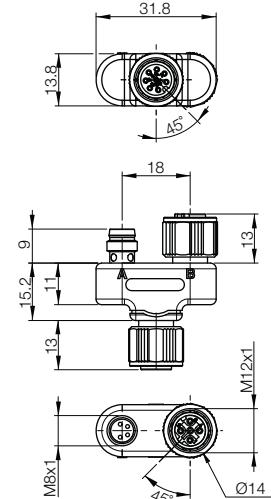
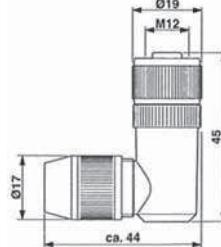
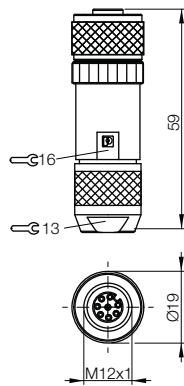
BCC M478-0000-1A-000-43X834-000

BCC050F

BCC M488-0000-1A-000-43X834-000

BCC0CK4

BCC_M418-M314-M415-V0038-000



Accessories

M8 connector, female, 4-pin, fabricated and for EtherCAT



Connector diagram and wiring



Configuration	M8 connector, straight, molded, fabricated	M8 connector, angled, molded, fabricated
Design	4-pin	4-pin
Use	Female	Female
Supply voltage U_S	30 V AC/DC	30 V AC/DC
Cable material	PUR	PUR
Color	Black	Black
Number of conductors \times conductor cross-section	4 \times 0.34 mm ²	4 \times 0.34 mm ²
Degree of protection as per IEC 60529	IP 67	IP 67
Ambient temperature T_a	-25...+80 °C	-25...+80 °C

	Ordering code	
	Part number	
Cable length 2 m	BCC02N5	BCC02NH
	Part number	BCC M314-0000-10-014-PS0434-020
Cable length 5 m	BCC02N6	BCC02NJ
	Part number	BCC M314-0000-10-014-PS0434-050
Cable length 10 m	BCC02N7	BCC02NK
	Part number	BCC M314-0000-10-014-PS0434-100
Cable length 15 m	BCC02N8	
	Part number	
Cable length 20 m	BCC02N9	
	Part number	



Accessories

M12 connector, M12 connection cable 4-pin, for EtherCAT



M12 connector, straight	M12 connector, angled	M12 connection cable, straight/straight	M12 connection cable, straight/RJ45 straight
4-pin, D-coded	4-pin, D-coded	4-pin, D-coded	4-pin, D-coded
Male	Male	Male/male	Male/male
60 V AC/DC	60 V AC/DC	60 V AC/DC	60 V AC/DC
		PUR	PUR
		Green	Green
4x0.75 mm ²	4x0.75 mm ²	4x22 AWG	4x22 AWG
IP 67	IP 67	IP 68	IP 68/IP 20
-25...+85 °C	-25...+85 °C	-20...+60 °C	-20...+60 °C



Micropulse Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact and Rod AR

Rod EX, T Redundant and CD

Filling Level Sensor SF

Accessories

Connectors

"Pigtail" Connector System

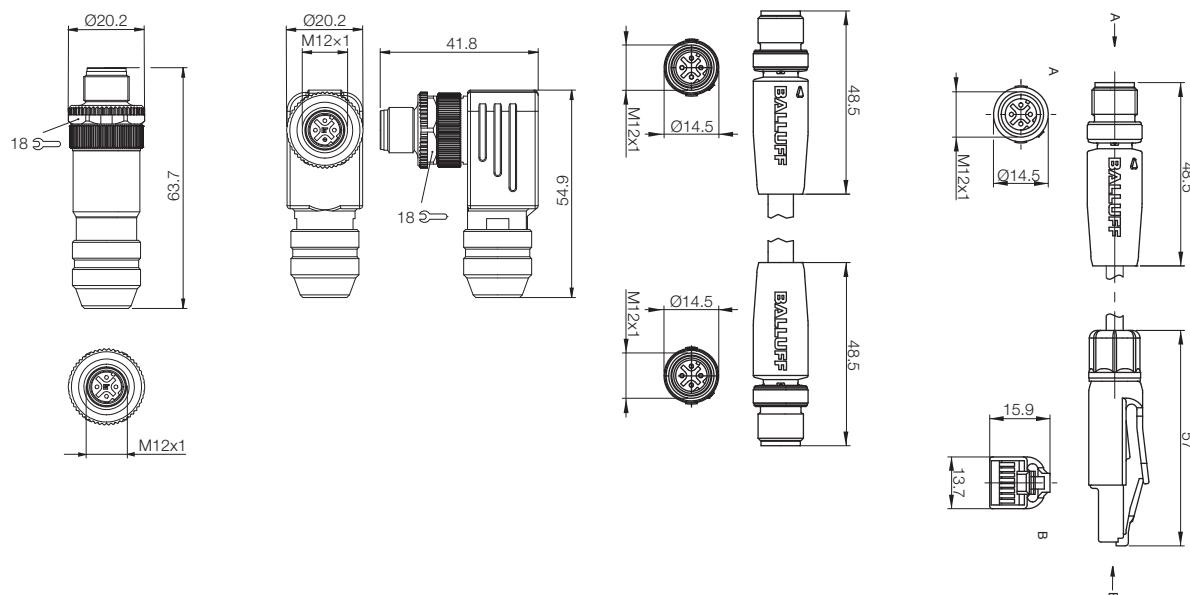
Evaluation Units

Profibus Modules P111

BUS Interface Modules

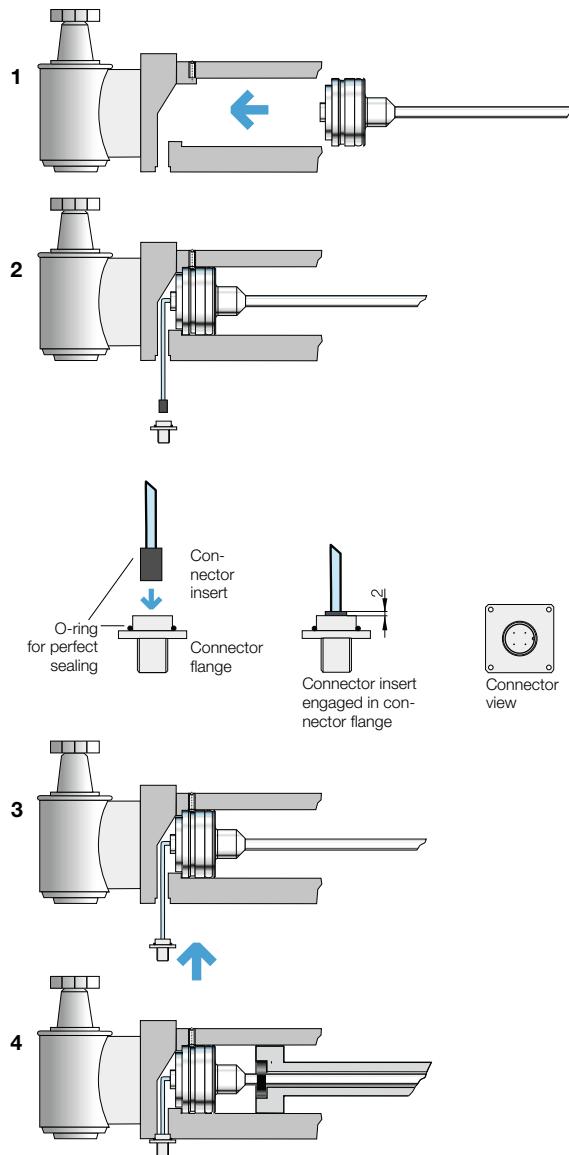
Digital Display CAM Controller

Basic Information and Definitions



A simple "click" and the IP67 plug-in connector is ready

Push the position measurement system Micropulse AR into the hydraulic cylinder. Insert the connector insert into the connector flange (1), let it click (2), secure the connector flange (3), and the IP-67 connector (4) is ready.



Series

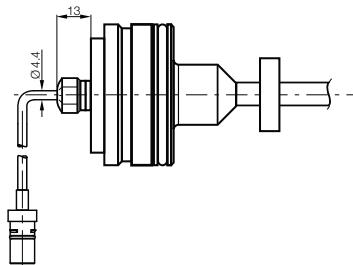
...KA 00,20-ZA0	PUR cable 0.2 m	Connector system for transducers with cable outlet
...KA 00,30-ZA0	PUR cable 0.3 m	Connector system for transducers with cable outlet
...LA 00,07-ZA0	Stranded wire 0.07 m	Connector system for transducers with stranded wire output
...LA 00,15-ZA0	Stranded wire 0.15 m	Connector system for transducers with stranded wire output
...LA 00,20-ZA0	Stranded wire 0.20 m	Connector system for transducers with stranded wire output
...LA 00,30-ZA0	Stranded wire 0.30 m	Connector system for transducers with stranded wire output

Pin	-ZA0N	-ZA0R
1		10...30 V
2	not assigned ¹⁾	Output signal
3		GND ²⁾
4	Output signal	not assigned ¹⁾
		Pin assignment (top view of the plug), 4-pin round plug M12

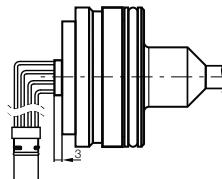
¹⁾ Unassigned wires can be connected with GND by the controller, but not with the shielding.

²⁾ Reference potential for supply voltage and EMC GND.

Connector system with cable outlet -KA-



Connector system with stranded wire output -LA-



Accessories

"Pigtail" connector system, 8-pin

ZA10 and ZA15 for BTL6 rod design H, K, W, A, Z, Y

Series ZA10

Housing: Nickel-plated brass

BTL_..._KA00,20-ZA10, PUR cable 0.2 m

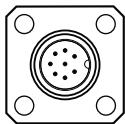
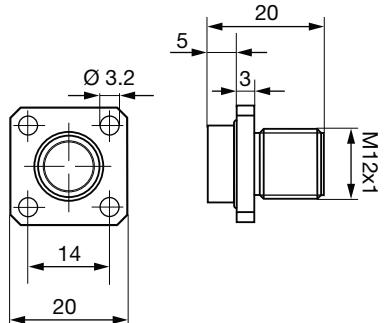
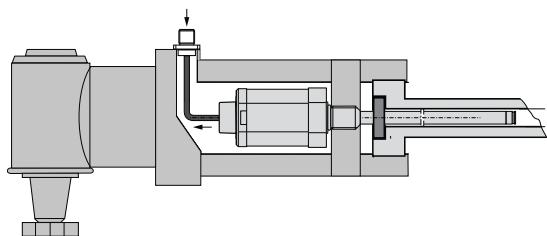
BTL_..._KA00,30-ZA10, PUR cable 0.3 m

Series ZA15

Housing: Stainless steel 1.4404

BTL_..._KA00,20-ZA15, PUR cable 0.2 m

BTL_..._KA00,30-ZA15, PUR cable 0.3 m



Pin assignment S115 Standard,
see detailed user's guide.

Mating connector

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Micropulse
Transducers

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Rod

Rod Compact and Rod AR

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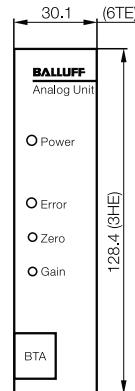
Accessories

Analog processor units

Features

- The processor units are configured in a Eurocard format for use in 19" racks and card holders / top-hat rail fitting.
- The measured values are updated at a frequency of max. 2 kHz, so that the current position can be captured with negligible lag even at high speeds.
- High resolution (down to 0.01 mm) provided by microcontroller-controlled digitizing
- Data format can be switched between binary, BCD or gray (only BTM-H) in parallel
- SSI data format (only BTM-H)
- Interference-free data transmission between processor unit and transducer provided by RS485/422 differential drivers, with cable lengths up to 500 m
- Error output immediately reports a cable break, defect or missing position encoder.

Series	BTA-A	
Output signal	Displacement signal	Analog
	Velocity	Analog
Input interface (transducer)	P	
Part number	BTA-A1_-_-_-	
Features	Resolution 0.1 mV/0.2 μ A, LED function indicator, Zero point adjustment 15%, Span adjust 15%, Velocity output, Error output (relay)	
Transducer rated length	50...5500 mm	
Design	Edge connector, 32-pin, DIN 41612 F, 19" plug-in card	
Supply voltage	20...28 V DC	
Current consumption	130 mA at 24 V DC	
Operating temperature	0...60 °C	
Update time for standard	1 kHz	
Interface	Analog voltage	
Output signals	Displacement signals	0...10 V and 10...0 V
	Velocity	\pm 10 V at \pm 2.5 m/s
Accessories (please order separately)	Card holder 48-pin Form F/627164	

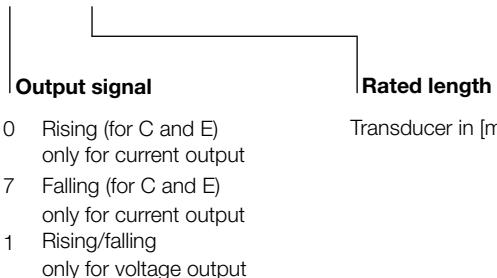


Micropulse analog processor unit

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

Ordering example:

B T A - A 1 - - -



Micropulse digital processor unit

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

Accessories

Analog and digital processor units

BTA-C	BTA-E	BTA-G
Analog	Analog	Analog
Analog	Analog	Analog
P	P	P
BTA-C1_-_-_-_-	BTA-E1_-_-_-_-	BTA-G1_-_-_-_-
Resolution 0.1 mV/0.2 μ A, LED function indicator, Zero point adjustment 15%, Span adjust 15%, Velocity output, Error output (relay) 50...5500 mm	Resolution 0.1 mV/0.2 μ A, LED function indicator, Zero point adjustment 15%, Span adjust 15%, Velocity output, Error output (relay) 50...5500 mm	Resolution 0.1 mV/0.2 μ A, LED function indicator, Zero point adjustment 15%, Span adjustment 15%, Velocity output, Error output (relay) 50...5500 mm
Edge connector, 32-pin, DIN 41612 F, 19" plug-in card 20...28 V DC	Edge connector, 32-pin, DIN 41612 F, 19" plug-in card 20...28 V DC	Edge connector, 32-pin, DIN 41612 F, 19" plug-in card 20...28 V DC
130 mA at 24 V DC	130 mA at 24 V DC	130 mA at 24 V DC
0...60 °C	0...60 °C	0...60 °C
1 kHz	1 kHz	1 kHz
Analog voltage, current	Analog voltage, current	Analog voltage
0...10 V and 10...0 V, 0...20 mA	0...10 V and 10...0 V, 4...20 mA	-10...+10 V and +10...-10 V
±10 V at ±2.5 m/s	±10 V at ±2.5 m/s	±10 V at ±2.5 m/s
Card holder 48-pin Form F/627164	Card holder 48-pin Form F/627164	Card holder 48-pin Form F/627164



Micropulse
Transducers



Profile P



Profile PF



Profile AT



Profile BIW



Rod



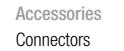
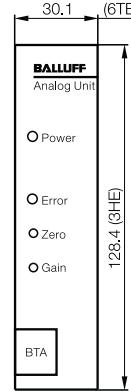
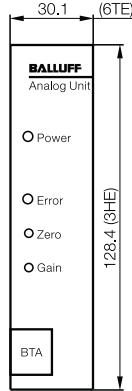
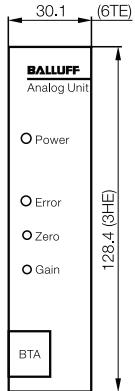
Rod Compact
and Rod AR



Rod EX,
T Redundant
and CD



Filling Level
Sensor SF



Accessories
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"Pigtail" Connec-
tor System



Evaluation
Units



Profibus
Modules P111



BUS Interface
Modules



Digital Display
CAM Controller



Basic
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Definitions



Accessories

Analog and digital processor units

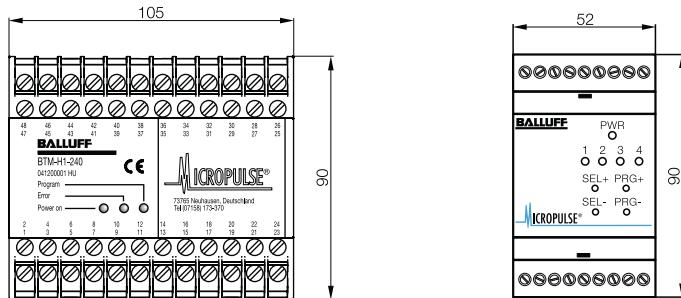
Series	BTM-H1	BTM-1
Output signal	Displacement signal Velocity	digital
Input interface (transducer)	P	Analog
Part number	BTM-H1-_____	Analog
Features	Resolution of 0.01 mm, 0.025 mm, 0.1 mm, 1 mm, BCD, binary, Gray code, zero point adjustment, direction signal, DATA READY, min./max. programming, ENABLE, DATA HOLD, bus-compatible, Error output. Replaces processor units: BTA-D, BTA-H, BTA-P	16-bit resolution Up to 4 encoders on a single transducer can be processed individually. Analog velocity output. 100% programmable measuring range, error output
Transducer rated length	50...5500 mm	25...4000 mm
Design	Plastic housing for mounting on standard top-hat rail EN 50022-35	Plastic housing for mounting on standard top-hat rail EN 50022-35
Supply voltage	20...28 V DC	20...28 V DC
Current consumption	Max. 500 mA	Max. 300 mA
Operating temperature	0...60 °C	0...70 °C
Update time for standard	2 kHz	2 kHz
Interface	Digital 22-bit parallel BCD, binary, Gray code, 24-bit synchronous serial (SSI) Gray code	Analog, voltage or current see ordering code
Output signals	Displacement signals Velocity	Analog, voltage or current see ordering code Analog ±10 V programmed to 1000 mm/s, adjustable over a range of 50 mm/s...10 m/s
Accessories (please order separately)		

Micropulse digital processor unit

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

Micropulse analog module

Please enter code for output signal and version in the part number.



Ordering examples:

B T M - H 1 - _____



- 240 Source driver (PNP with short circuit protection 10...30 V) and 24-bit synchronous serial data transmission (SSI)
- 340 Tri-state TTL output and 24-bit synchronous serial-data transmission (SSI)

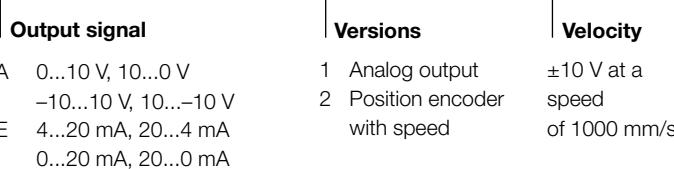
B T M - 1 - _____



- A 0...10 V, 10...0 V
-10...10 V, 10...-10 V
- E 4...20 mA, 20...4 mA
0...20 mA, 20...0 mA

- 101 1 analog output, 1 position encoder
- 102 2 analog outputs, 2 position encoders
- 103 3 analog outputs, 3 position encoders
- 104 4 analog outputs, 4 position encoders

B T M - 1 - 1 0 2 - V M 1 0 0 0

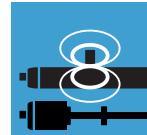


- A 0...10 V, 10...0 V
-10...10 V, 10...-10 V
- E 4...20 mA, 20...4 mA
0...20 mA, 20...0 mA

- 1 Analog output ±10 V at a speed
- 2 Position encoder with speed of 1000 mm/s

Accessories

Profibus modules P111 for BTL



Micropulse Transducers

Profile P

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Profile AT

Profile BIW

Rod

Rod Compact and Rod AR

Rod EX, T Redundant and CD

Filling Level Sensor SF

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Profibus Modules P111

BUS Interface Modules

Digital Display CAM Controller

Basic Information and Definitions

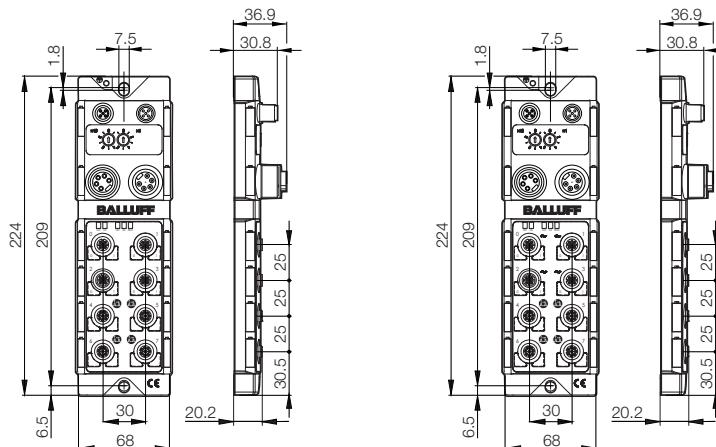


Fieldbus	Profibus	Profibus
Design	4x P111 or M1	4x P111 or M1
Ordering code	BNI001A	BNI002H
Part number	BNI-PBS-551-000-Z001	BNI-PBS-552-000-Z001
Supply voltage Us	18...30 V DC	18...30 V DC
Function indicator	BUS RUN	BUS RUN
Fault function indicator	Red LED	
Power-on indicator	V _A , V _S , undervoltage	V _A , V _S , undervoltage
Connection: Fieldbus	M12, B-coded	M12, B-coded
Supply voltage connection	7/8", 5-pin, female and male	7/8", 5-pin, female and male
Connection: I/O ports	M12, A-coded, 5-pin, female	M12, A-coded, 5-pin, female
Connection: P111 port	M12, A-coded, 8-pin, female	M12, A-coded, 8-pin, female
No. of I/O ports	8	8
No. of digital inputs	8	
No. of analog inputs		4
Outputs	0	0
No. of P111 inputs	4	4
Max. load current for sensors/channel	1 A	1 A
Port status indicator (signal status)	Yellow LED	Yellow LED
Port diagnostic indicator (overload)	Red LED	Red LED
Total current U _{Sensor}	9 A	9 A
Degree of protection as per IEC 60529	IP 67 (when screwed into place)	IP 67 (when screwed into place)
Operating temperature T _a	0...+55 °C	0...+55 °C
Weight	Approx. 735 g	Approx. 735 g
Fastener	2 mounting holes	2 mounting holes
Dimensions (LxWxH)	224x68x36.9	224x68x36.9
Housing material	Nickel-plated GD-Zn, matt finish	Nickel-plated GD-Zn, matt finish

Profibus modules P111 are an elegant, cost-effective solution from Balluff.

The modules have a robust metal housing that was designed for use in harsh industrial environments and is capable of withstanding powerful mechanical loads. The module is fitted with four independent ports for Micropulse transducers BTL with a P111 or M1 pulse interface. A maximum of 16 encoders can be used per BTL port. The maximum rated length is 7500 mm. Four additional ports can be configured with digital or analog sensors, depending on the version.

You can achieve maximum functionality and cost efficiency for fieldbus integration by combining Micropulse transducers BTL with Profibus modules P111.



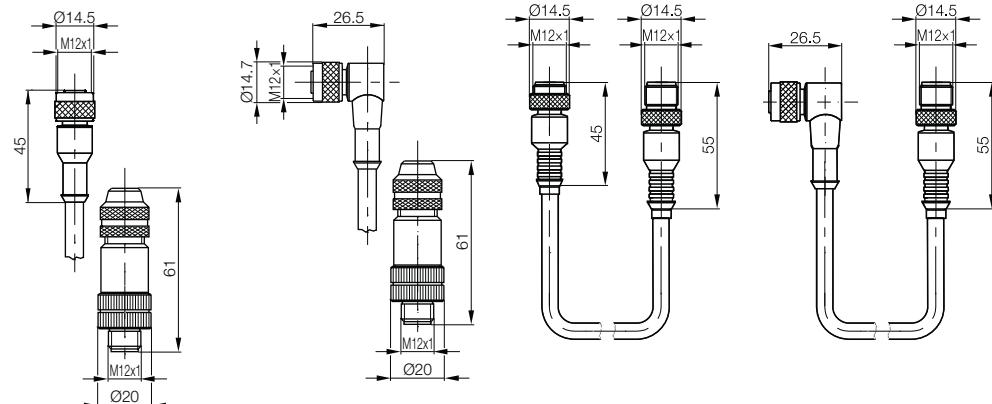
All modules include four screw plugs and a label set.

Accessories

Profibus modules P111 for BTL

Design	8-pin, female	8-pin, female	8-pin, pin, female	8-pin, pin, female
Use	8-pin, pin for Profibus modules BNI-PBS 0-3 BTL	8-pin, pin for Profibus modules BNI-PBS 0-3 BTL	for Profibus modules BNI-PBS 0-3 BTL	for Profibus modules BNI-PBS 0-3 BTL
Part number	BIS Z-501-PU1-_/_E	BIS Z-502-PU1-_/_E	BIS Z-501-PU1-_/_M	BIS Z-502-PU1-_/_M
Male	M12	M12	M12	M12
Cable diameter	6.9 mm	6.9 mm	6.9 mm	6.9 mm
Degree of protection* as per IEC 60529	IP 67 when attached	IP 67 when attached	IP 67	IP 67
Number of conductors x conductor cross-section	8x0.25 mm ²	8x0.25 mm ²	8x0.25 mm ²	8x0.25 mm ²
Ambient temperature	-40...+85 °C	-40...+85 °C	-40...+85 °C	-40...+85 °C
Plug in	BKS-S117-00	BKS-S117-00		
M12 pin scope of delivery				
Cable	One end molded-in, other end pigtailed	One end molded-in, other end pigtailed	Both ends molded-on	Both ends molded-on

* When plugged in



Please include the cable length with the part number:

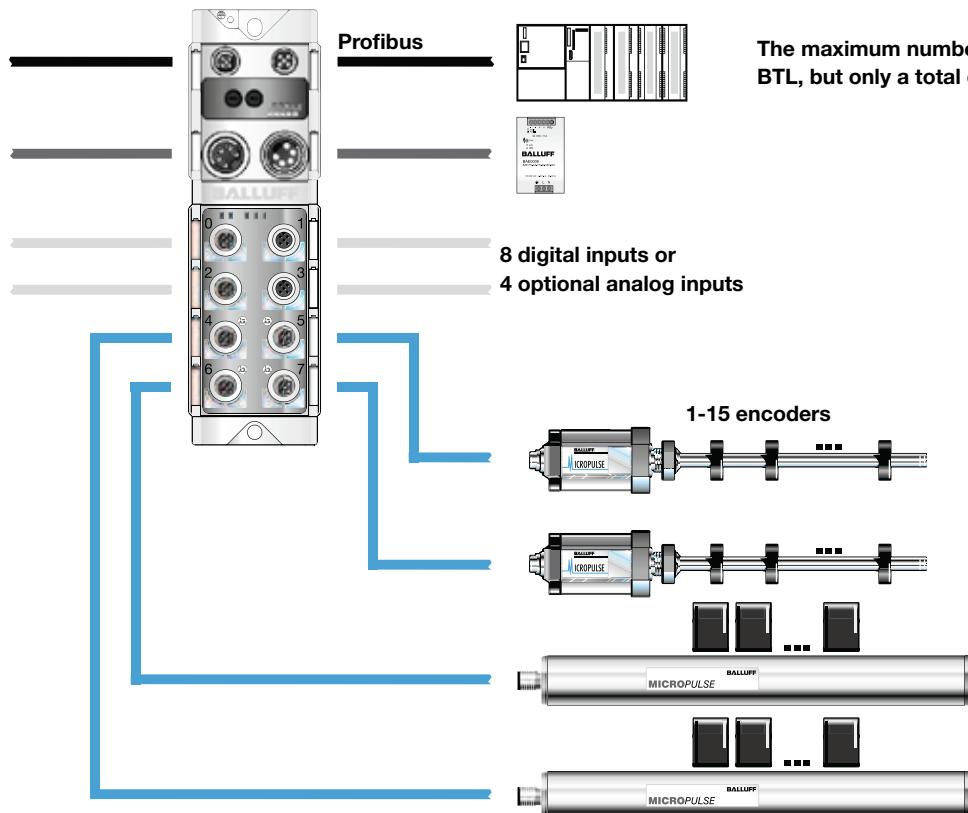
05 = Length 5 m
 10 = Length 10 m
 20 = Length 20 m
 25 = Length 25 m
 50 = Length 50 m

Please include the cable length with the part number:

00,5 = Length 0.5 m
 01 = Length 1 m
 02 = Length 2 m
 05 = Length 5 m

Accessories

Profibus modules P111 for BTL



The maximum number of encoders is 16 per BTL, but only a total of 60 per module



Micropulse
Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact
and Rod AR

Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

Accessories
Connectors

"Pigtail" Connec-
tor System

Evaluation
Units

Profibus
Modules P111

BUS Interface
Modules

Digital Display
CAM Controller

Basic
Information and
Definitions



BUS interface modules WAGO/Phoenix Contact

WAGO Digital Pulse Interface 750-635 for BTL5-P1-__ or BTL6-P1__-

The digital pulse interface was developed for connecting Micropulse transducers (BTL5-P1-...). The RS422 interface ensures quick and interference-free signal transmission with a resolution down to 1 µm. The absolute position of the Micropulse transducer is sent to the higher-level controller as a 24-bit value.

The controller can perform a zero point shift and configure the number of encoders.

The bus terminal with a digital pulse interface can be operated by all bus drivers of the WAGO-I/O-SYSTEM 750, except the Economy variants.

Interfaces

- Inter-Bus
- Profibus DP
- CANopen
- DeviceNet
- Ethernet TCP/IP
- Modulbus
- CC-Link

Resolution: 1 µm Number of magnets configurable (1...4)

Further technical details and orders from:

WAGO
Kontakttechnik GmbH
Hansastraße 27
32423 Minden, Germany
Phone +49 571 887-0
Fax +49 571 887 169
E-mail: info@wago.com
www.wago.com

Phoenix Contact IMPULSE-IN terminal for BTL5-P1-__ or BTL6-P1__-

The IB IL IMPULSE-IN is a terminal from the Inline product family by Phoenix Contact and is used for evaluating Micropulse transducers with a pulse interface.

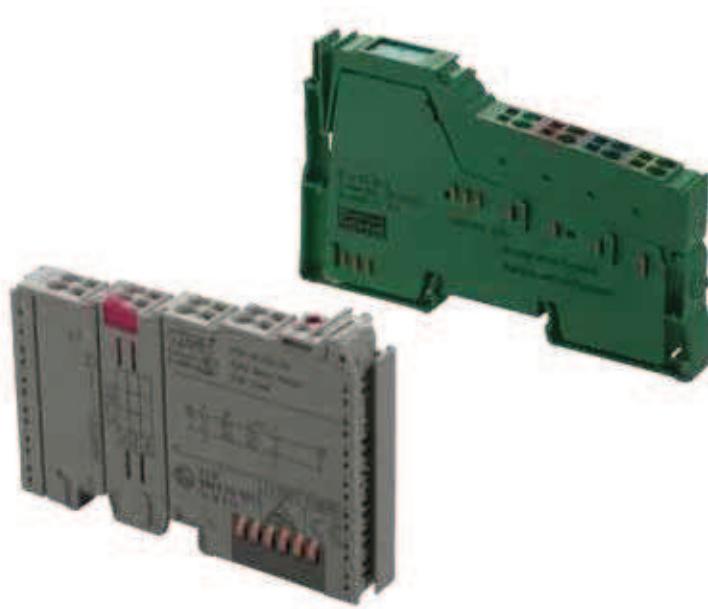
The IMPULSE-IN terminal enables particularly cost-effective solutions because it senses the positions using a low-cost pulse interface. In addition, the pulse interface has the advantage of real time capability, making it especially suitable for applications with position or bearing control.

Interfaces

- Inter-Bus
- Profibus DP
- CANopen
- DeviceNet
- Ethernet

Further technical details and orders from:

Phoenix Contact
GmbH & Co. KG
Flachsmarktstrasse 8
32823 Blomberg, Germany
Phone +49 5235 300
Fax +49 5235 341200
E-mail: info@phoenixcontact.com
www.phoenixcontact.com



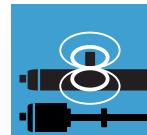
Accessories

Digital display, CAM controller

Series	BDD-UM 3023	BDD-AM 10-1-P	BDD-AM 10-1-SSD	BDD-CC 08-1-P	BDD-CC 08-1-SSD
	Digital display for analog input signals Current / voltage	Digital display for BTL5-P with P Interface	Digital display for BTL5-S with SSD interface	CAM controller for BTL5-P with P Interface	CAM controller for BTL5-S with SSD interface
Part number	BDD-UM 3023	BDD-AM 10-1-P	BDD-AM 10-1-SSD	BDD-CC 08-1-P	BDD-CC 08-1-SSD

Features

- 4-digit display with leading sign
- LED display, 14 mm-high, red 7-segment digits
- Programmable decimal point
- 12-bit AC/DC converter
- Measurement range selection
- Voltage input of 0...10 V
- Current input of 0/4...20 mA
- Scalable display range
- 7 1/2-digit display with leading sign
- LED display, 14 mm-high, red 7-segment digits
- Scalable measured values
- Variable decimal point setting
- Adjustable zero point
- Supply voltage 10...32 V
- 2 programmable relay outputs, each as limit switch/comparator
- Cam
- 2-point controller
- 1 configurable input
- External zeroing
- Retention of the display value
- Insulated DIN housing for mounting in front panel (clamp included in the scope of delivery)
- 8 programmable outputs
- 8 directional switching points possible
- LED display, six 14-mm high red 7-segment digits
- Switching points can be monitored using LEDs on the front panel
- 300 switching points can be distributed over up to 15 programs
- Adjustable top dead center/zero point shift
- Dynamic dead time compensation for each individual switching point
- Multiple BDD-CC 08 units can be wired in parallel
- Integrated transducer supply voltage 300 mA, 24 V
- Insulated DIN housing for mounting in front panel (clamp included in the scope of delivery)



Micropulse
Transducers

Profile P

Profile PF

Profile AT

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Rod

Rod Compact
and Rod AR

Rod EX,
T Redundant
and CD

Filling Level
Sensor SF



Accessories
Connectors
"Pigtail" Connector System

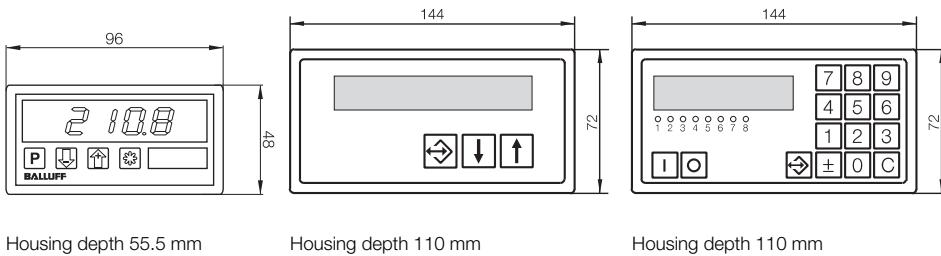
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Profibus
Module P111

**BUS Interface
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Definitions



Housing depth 55.5 mm

Housing depth 110 mm

Housing depth 110 mm





Systems and Service



Industrial Networking and Connectivity



Industrial Identification



Object Detection



Linear Position Sensing and Measurement



Condition Monitoring and Fluid Sensors



Accessories

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