

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 downtimes. 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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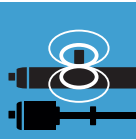
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MICROPULSE®



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.

Areas of application

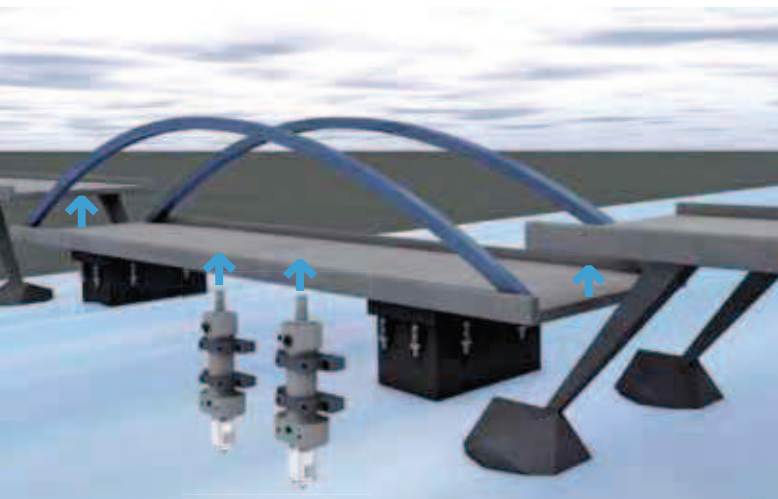
- Pitch adjustment on wind generators
- Positioning reflection channels of thermosolar power plants
- Large, hydraulically powered valves
- Casting and rolling mills
- Lift controls
- Flight simulators
- Foundries
- Logging machines
- Automation engineering
- Hydroelectric power plants
- Locks and floodgates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

Structural design and calculations

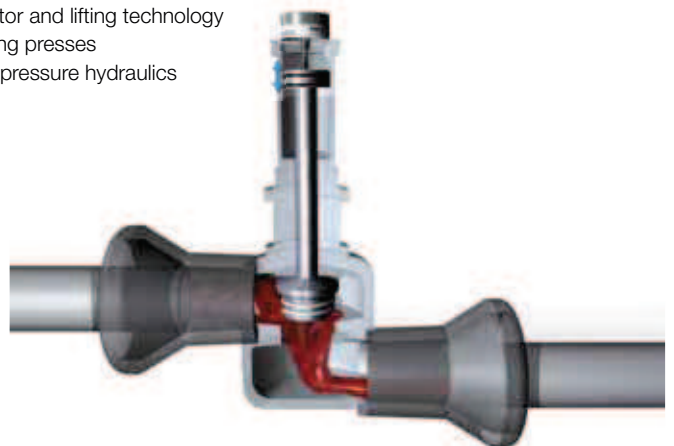
- Active support of walls
- Bridge positioning and lifting technology
- Leveling structures
- Off-shore sector
- Tunnel construction

Industrial applications

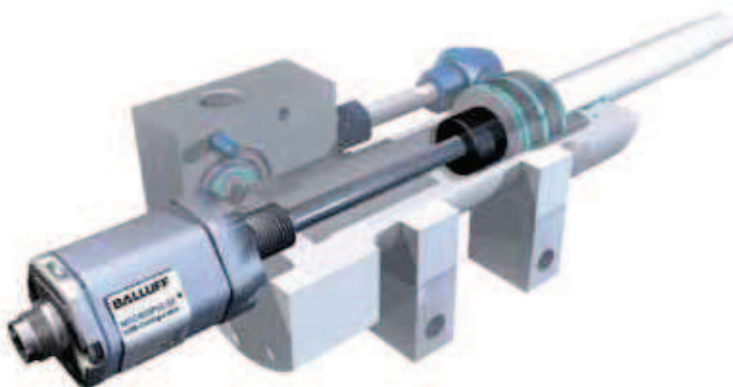
- Pumps and compressors
- Elevator and lifting technology
- Forging presses
- High-pressure hydraulics



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



Large valve with controlled actuating drive

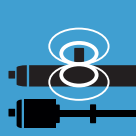


Industry: hydraulic cylinder



Mobile hydraulics

Micropulse Transducers Applications



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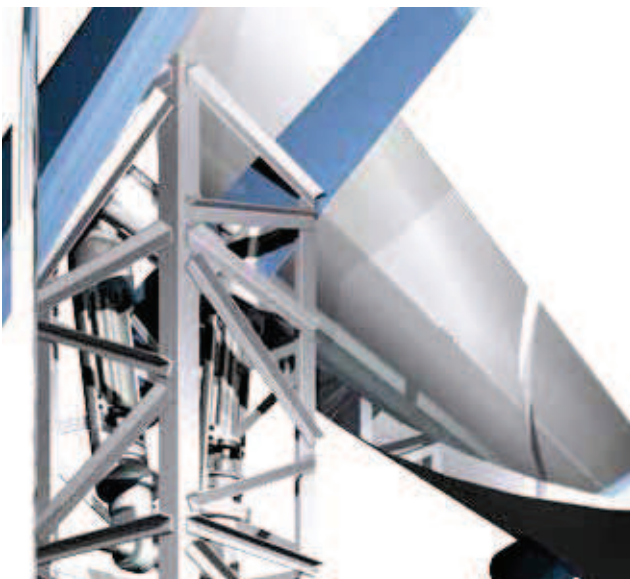
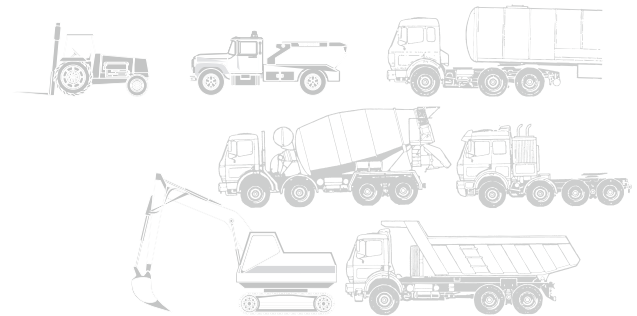
Wind power plant



Sawmill machinery



Hydraulic riveting system



Solar-thermal parabolic trough power plant



Solar-thermal parabolic trough power plant

Micropulse Transducers

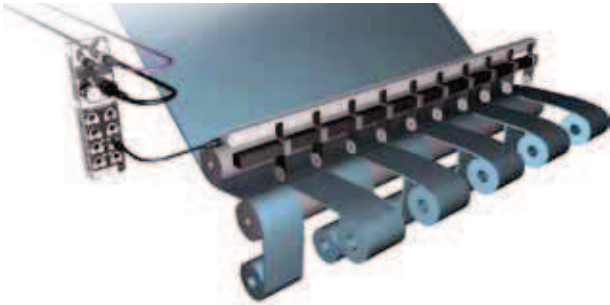
Applications

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

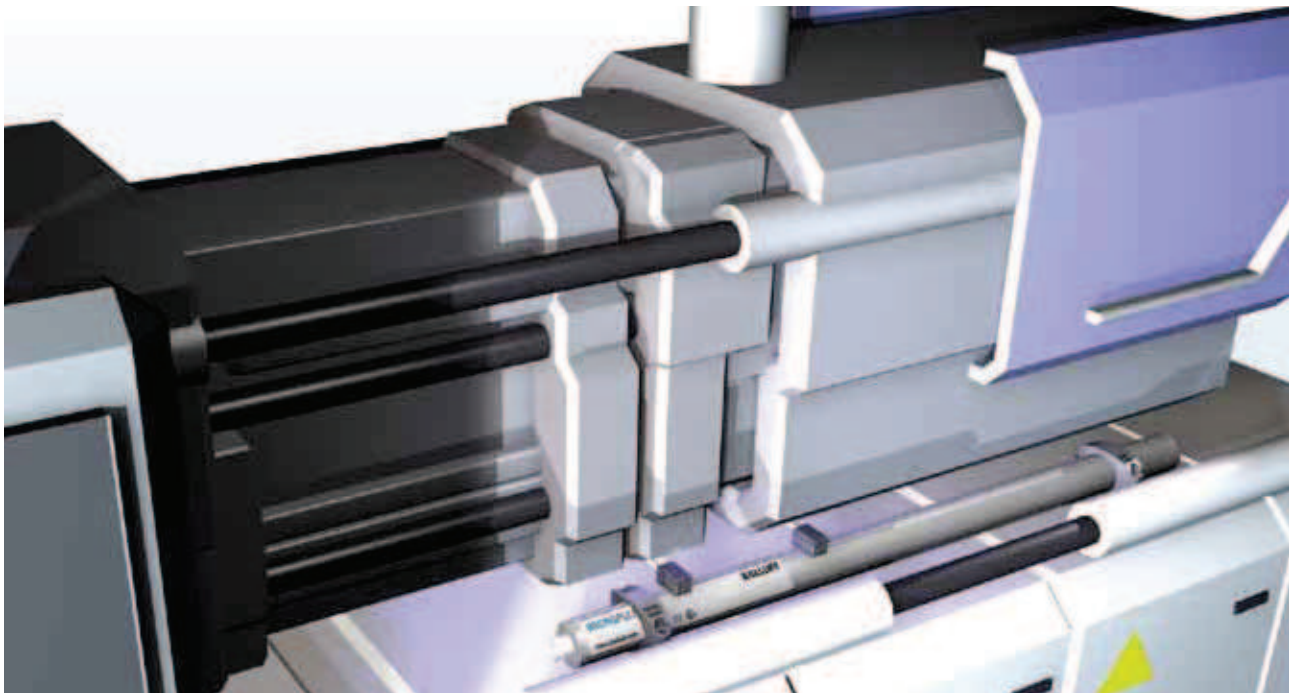
- Injection molding
- Pressing
- Handling systems
- Portal robots
- Woodworking machinery
- Packaging machinery
- Conveyor technology
- Straightening machinery
- Surgical tables
- Concrete block making machinery



Film slitting machinery



Injection molding machinery

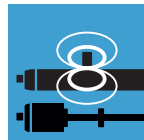


Injection molding machinery

Micropulse Transducers Applications



Multiple-stage press



Micropulse Transducers

Applications

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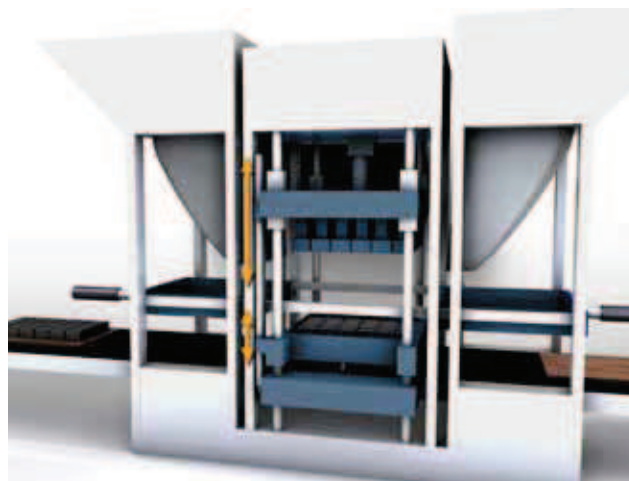
Basic Information and Definitions



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

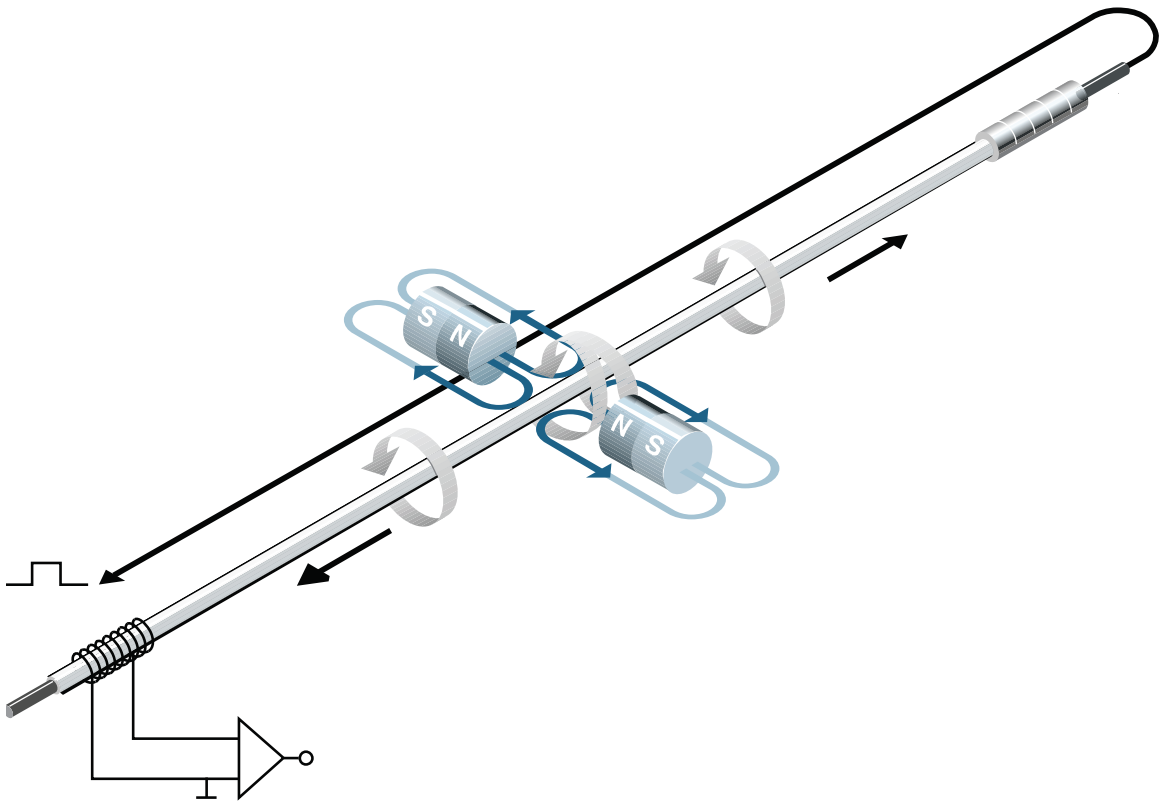
Function principle

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.

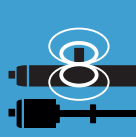


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Micropulse Transducers Designs

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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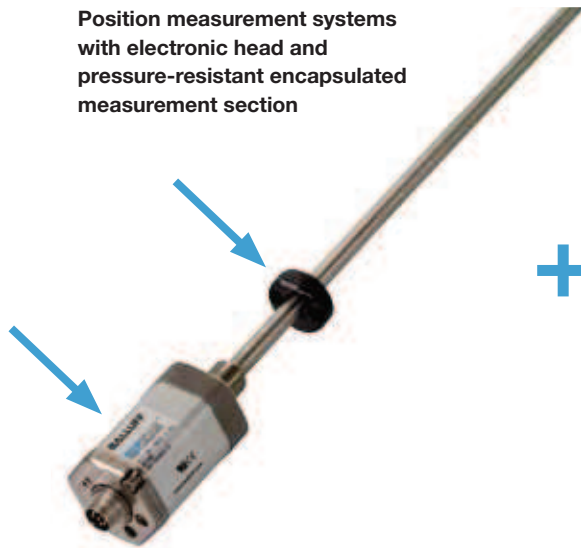
Accessories

Basic Information and Definitions

Rod system components

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

Position measurement systems with electronic head and pressure-resistant encapsulated measurement section



Position encoder rings



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

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.

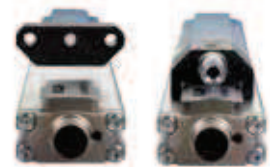
Position measurement system with integrated measurement section and electronics



Position encoder



Floating and captive encoders



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

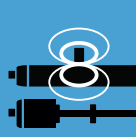
Micropulse Transducers Designs

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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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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Product overview



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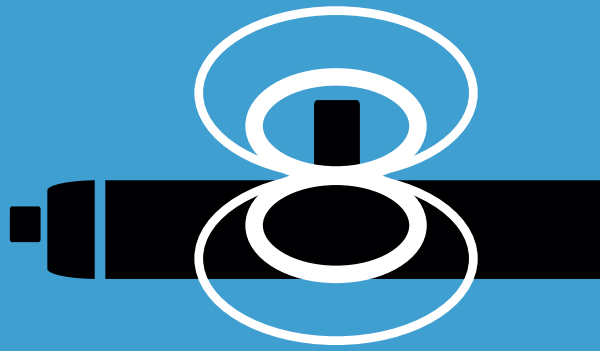
Filling Level Sensor SF

Accessories

Basic Information and Definitions

	Rod Pro Compact	Rod AR	Rod DEX	Rod J-DEX TA12	Rod NEX	Rod PEX	Rod Redundant	Filling Level Sensor
	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

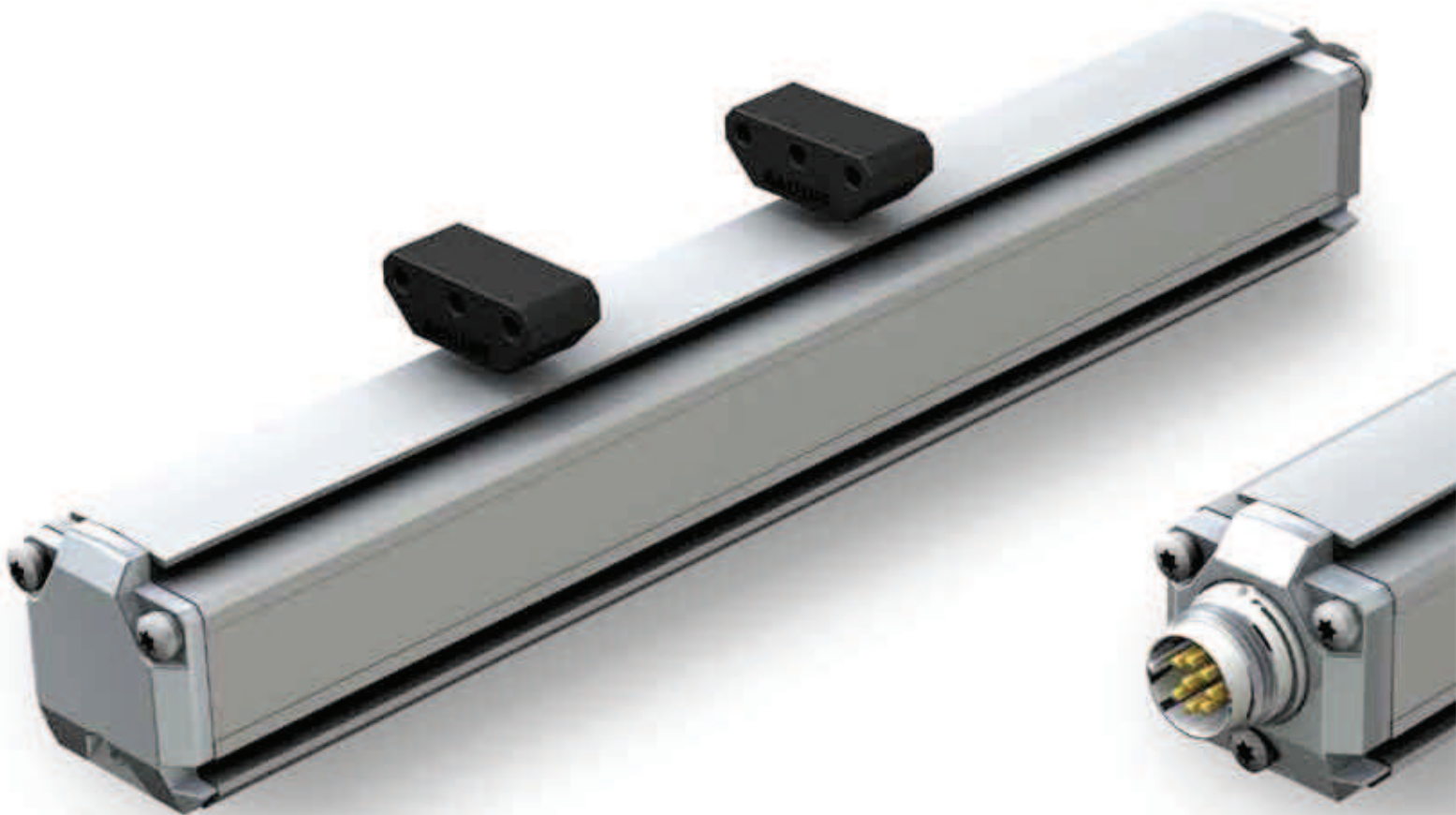
MICROPULSE®



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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P BTL5

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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
Overvoltage protection	to 36 V
Dielectric strength	500 V AC (GND to housing)
Degree of protection as per IEC 60529	IP 68 with cable outlet, IP 67 with screwed-on plug connector BKS-S...
Housing material	Anodized aluminum
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



Caution!

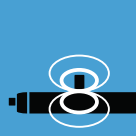
Before design, installation and startup please familiarize yourself with the user's guide to be found at www.balluff.com.

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



Profile P BTL7 Micropulse⁺

General data



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

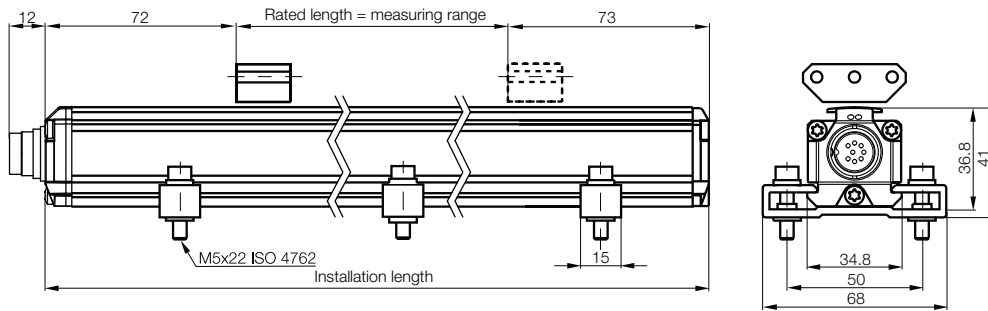
Rod EX, T Redundant and CD

Filling Level Sensor SF

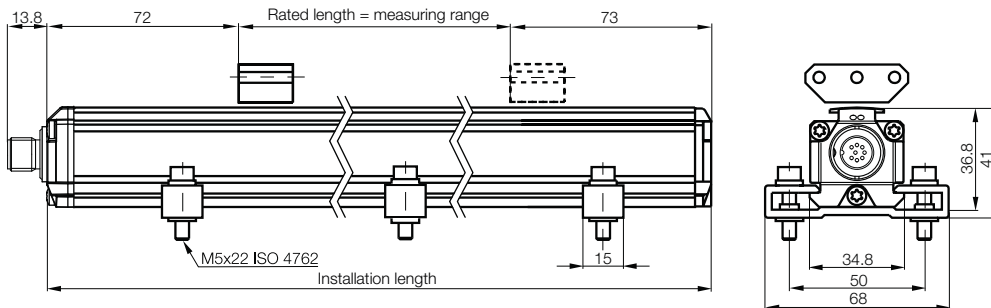
Accessories

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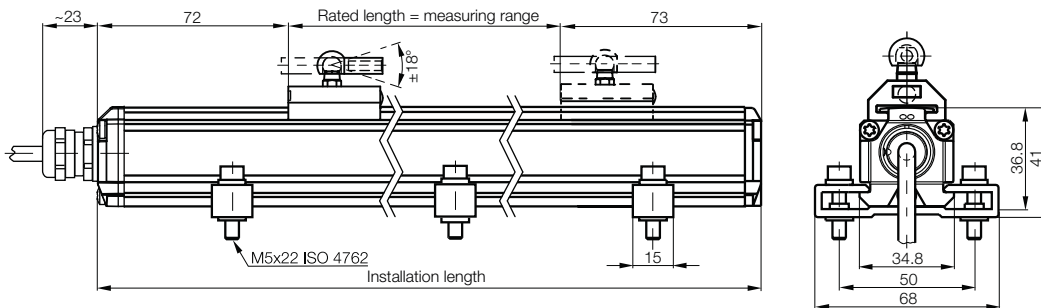
Transducer with floating position encoder and S32 connection



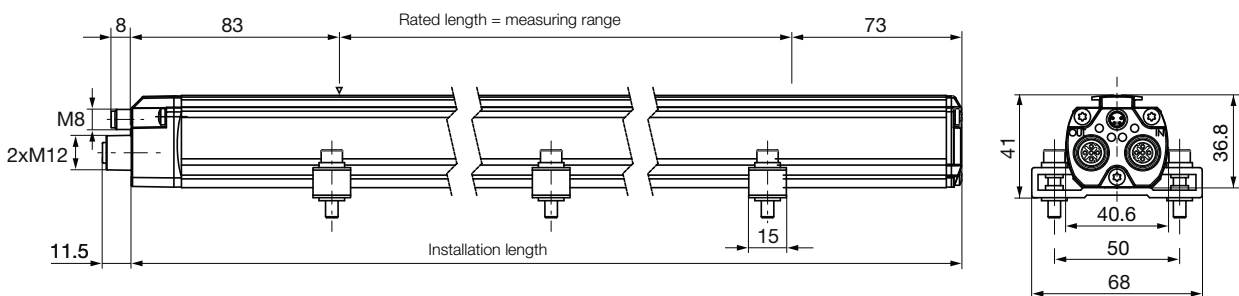
Transducer with floating position encoder and S115 connection



Transducer with captive encoder and KA cable outlet



Transducer with EtherCAT connection C003



Profile P BTL7 Micropulse⁺ Analog interface

"Long" up to 7620 mm

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

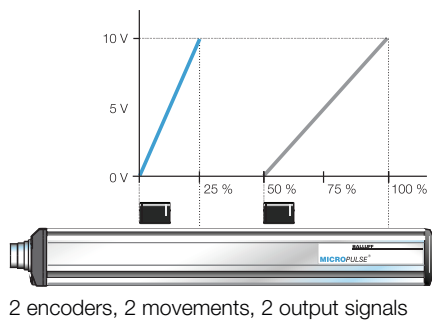
Position and velocity

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

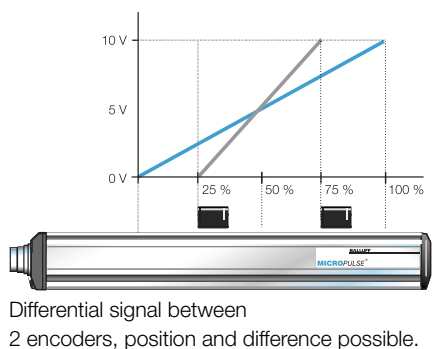


Series	
Output signal	
Transducer interface	
Position signal interface, customer device	
Part number	
Output signal factory setting	
Output signal can be adjusted via configurable USB	
Load current	
Load resistance	
System resolution	
Current consumption at 24 V DC	
Hysteresis	
Repeat accuracy	
Measurement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

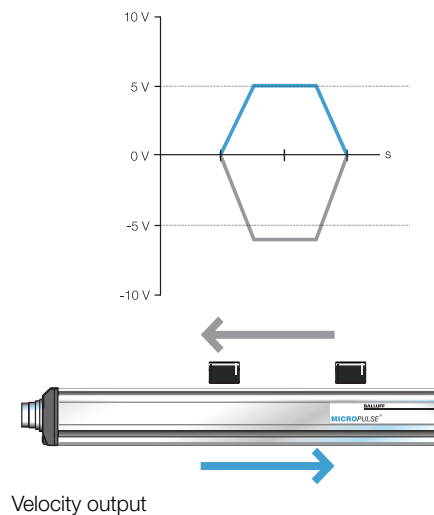
Operating mode: Double position encoder



Operating mode: Differential



Operating mode: Speed



Profile P BTL7 Micropulse⁺ Analog interface

Profile P BTL7	Profile P BTL7
Analog	Analog
A	E
Analog	Analog
BTL7- A501 -M____-P-____	BTL7- E501 -M____-P-____
0...10 V and 10...0 V -10...10 V and 10...-10 V Max. 5 mA	4...20 mA and 20...4 mA 0...20 mA and 20...0 mA
≤ 0.33 mV ≤ 150 mA ≤ 10 μm System resolution/min. 2 μm Max. 4 kHz ±50 μm to ≤ 500 mm rated length ±0.01% FS > 500...≤ 5500 mm rated length ±0.02% FS > 5500 mm rated length ≤ 30 ppm/K 10...30 V DC to 36 V to 36 V 500 V AC (GND to housing) -40...+85 °C	≤ 500 Ω ≤ 0.66 μA ≤ 180 mA ≤ 5 μm System resolution/min. 2 μm Max. 4 kHz ±50 μm to ≤ 500 mm rated length ±0.01% FS > 500...≤ 5500 mm rated length ±0.02% FS > 5500 mm rated length ≤ 30 ppm/K 10...30 V DC to 36 V to 36 V 500 V AC (GND to housing) -40...+85 °C



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

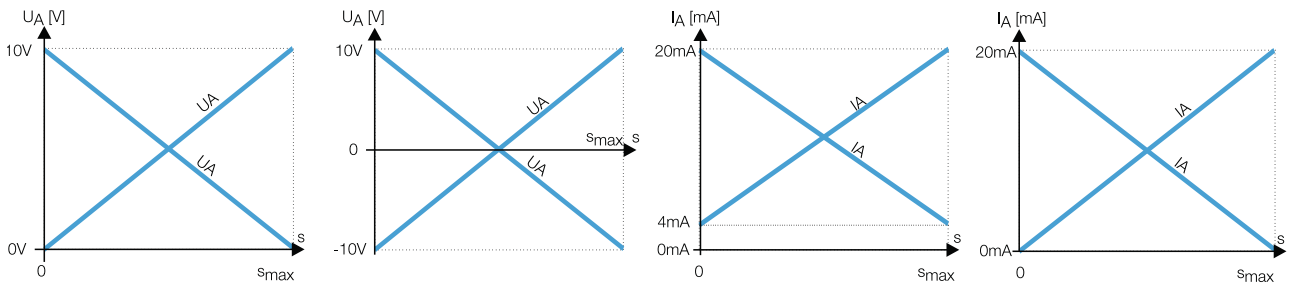
Rod Compact and Rod AR

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Accessories

Basic Information and Definitions



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

Ordering example:

BTL7 - 501 - M - P -

Output signal

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

Standard nominal strokes [mm]

- 0050...7620 mm
- in 5-mm increments

Connection

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

USB configuration

System requirements

- Standard PC
- Operating system: Windows 2000/XP/Vista/7
- Screen resolution at least 1024 × 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

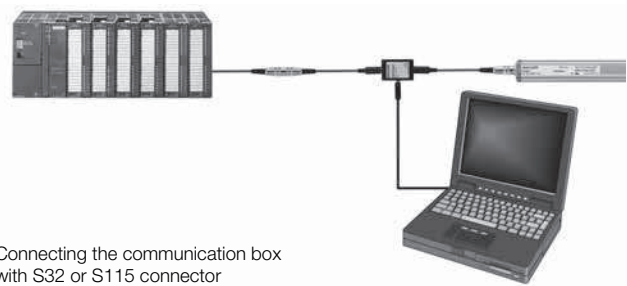
For transducers BTL7-A/E501-M...-P-S32 and ...-S115, the communication box can be switched between the transducer and the controller. The communication box is connected to the PC using a USB cable.

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

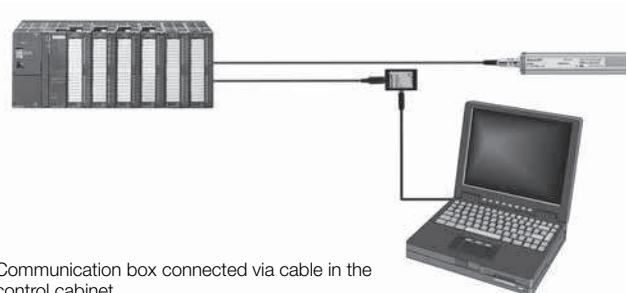
Scope of delivery

- USB communication box
- Cable set
- Quick start instructions

The PC software and corresponding manual are available on the Internet at www.balluff.com/downloads-bt17



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.

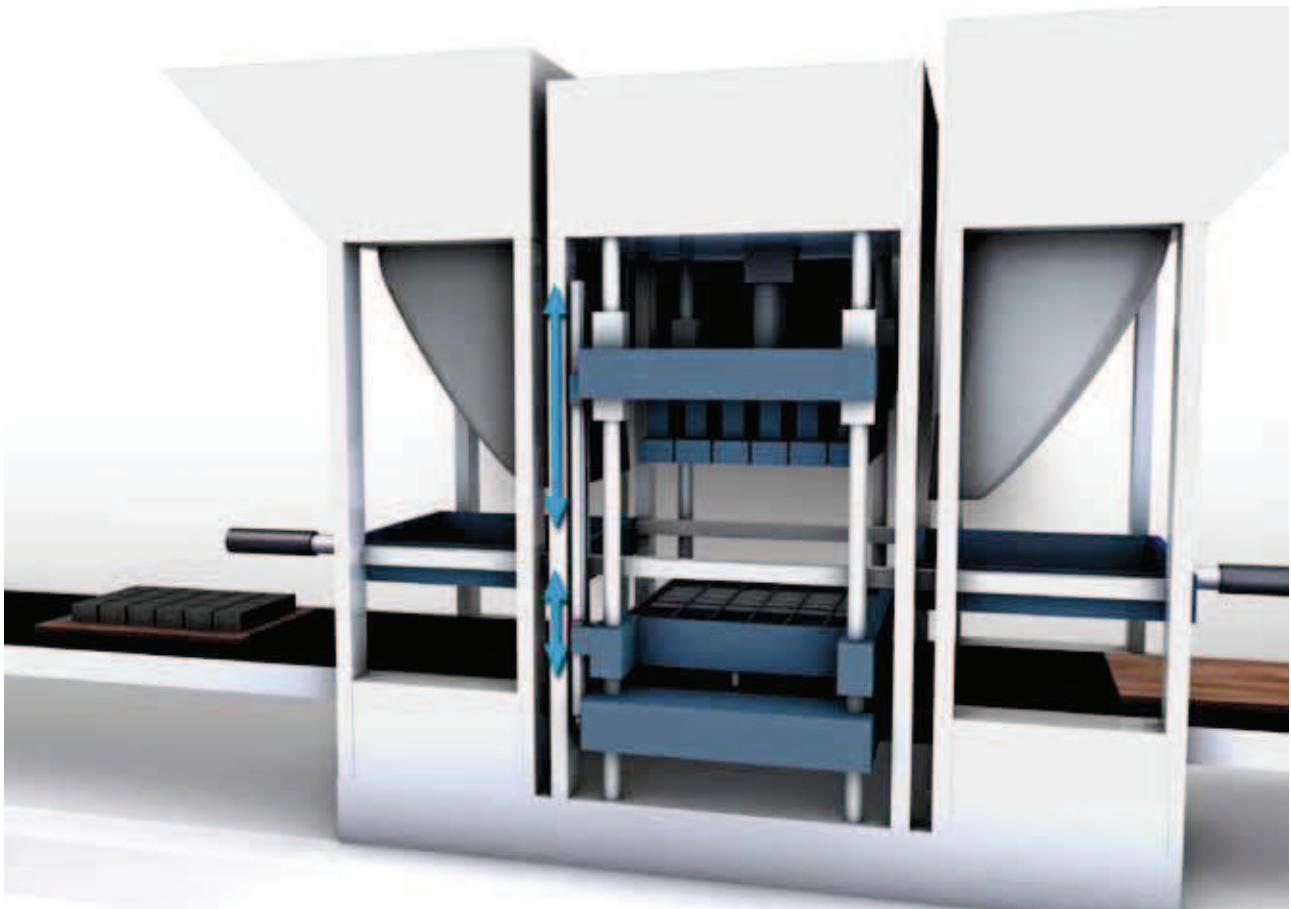
Profile P BTL7 Micropulse⁺ Application

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
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

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

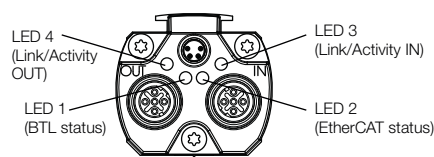
The BTL7-V50E-... can also be used as a cam switch. For this purpose there are four cams (Cam) available per position encoder (Magnet).

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

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	

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



Profile P BTL7 Micropulse+ EtherCAT interface



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

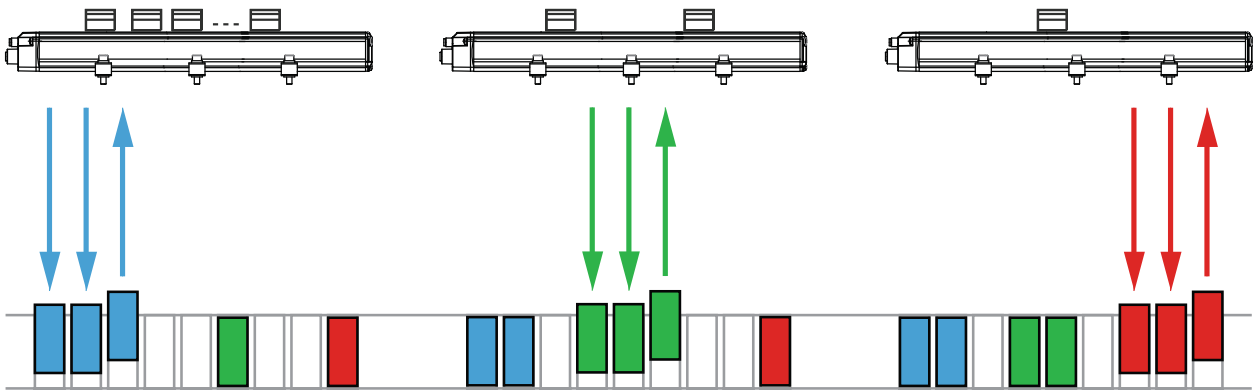
Rod EX, T Redundant and CD

Filling Level Sensor SF

Accessories

Basic Information and Definitions

Profile P BTL7	
EtherCAT	
V50E	
EtherCAT	
BTL7-V50E-M_ _ _ _ -P-C003	
Floating	
≤ 5 μm, (typically ±2.5 μm)	
1 μm	
0.1 mm/s increments configurable	
≤ ±10 μm	
f _{STANDARD} = 1 kHz	
≤ 5500 ±30 μm, > 5500 ±0.002 % FS	
≤ 18 ppm/K (at 500 mm)	
10...30 V DC	
≤ 120 mA	
-40...+85 °C	
-40...+100 °C	
www.balluff.com	
< 100 m	

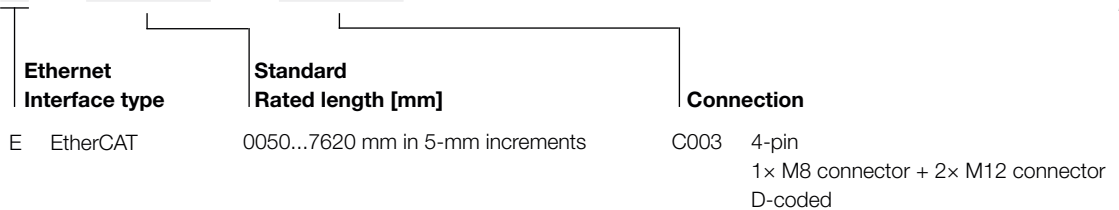


Function principle of the EtherCAT data transmission

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

Ordering example:

BTL7-V50E-M_ _ _ _ -P- _ _ _ _



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

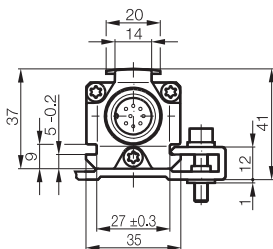
Scope of delivery

- 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!

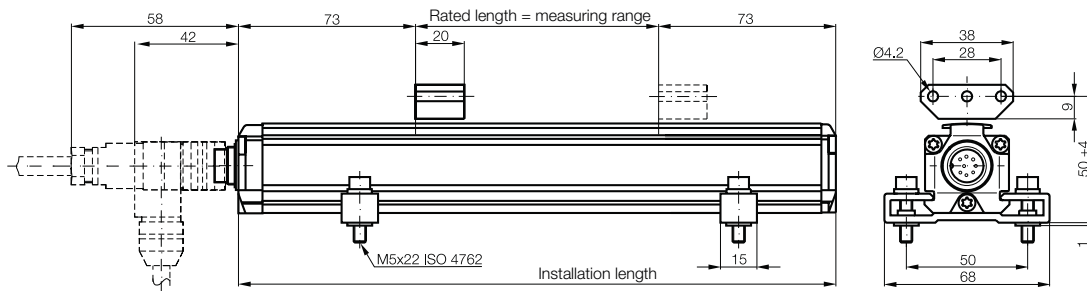
Before design, installation and startup please familiarize yourself with the user's guide to be found at www.balluff.com.



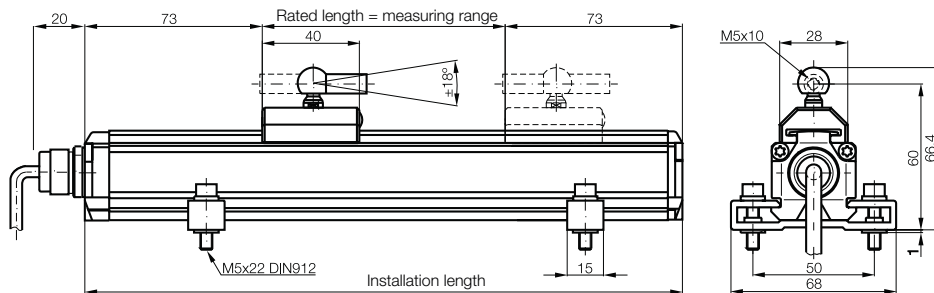
Profile P BTL5

General data

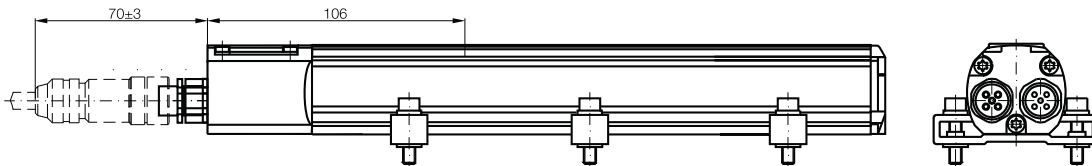
Transducers with floating position encoder and connection S32 with connector BKS-S 32M/BKS-S 32M-C/BKS-S 33M for transducers with analog interface, digital pulse interface and SSI interface, page 252



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



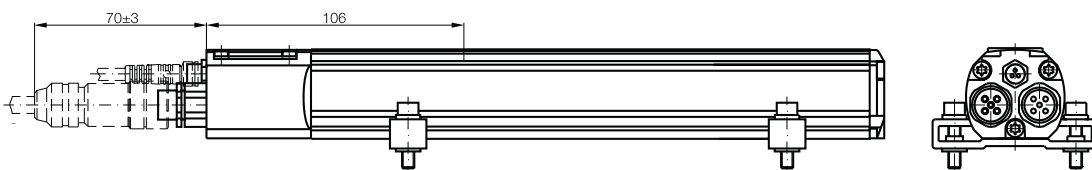
CANopen connection S94 with connector BKS-S94-00 and BKS-S92-00 for transducers with CANopen interface, page 254



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



Micropulse Transducers

Profile P BTL7
 General Data
 Analog Interface
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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

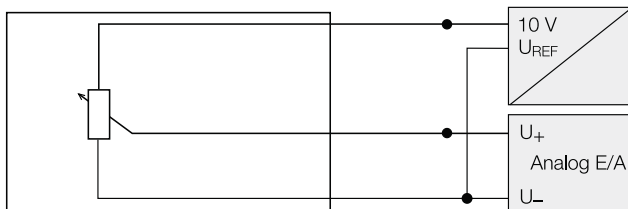
Basic Information and Definitions

Profile P BTL5

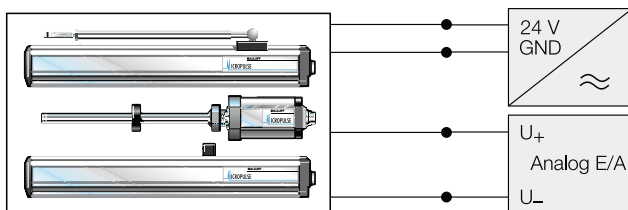
Analog interface

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.

Micropulse transducers – a non-contact alternative to contacting transducers



Connection scheme potentiometer, block diagram



Micropulse Transducer connections, block diagram

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	
Overvoltage protection	
Dielectric strength	
Operating temperature	
Storage temperature	

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

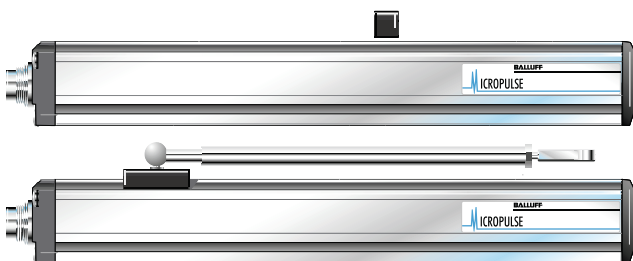
Scope of delivery

- 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- A 11-M_ _-P- _ _ _ _	BTL5- E 1_ -M_ _-P- _ _ _ _	BTL5- C 1_ -M_ _-P- _ _ _ _	BTL5- G 11-M_ _-P- _ _ _ _
Floating	Floating	Floating	Floating
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
≤ 5 mV			≤ 5 mV
≤ 0.1 mV	≤ 500 Ω	≤ 500 Ω	≤ 0.1 mV
≤ 4 μm	≤ 0.2 μA	≤ 0.2 μA	≤ 4 μm
System resolution/min. 2 μm	≤ 4 μm	≤ 4 μm	System resolution/min. 2 μm
f _{STANDARD} = 1 kHz	System resolution/min. 2 μm	System resolution/min. 2 μm	f _{STANDARD} = 1 kHz
±100 μm up to 500 mm rated length	f _{STANDARD} = 1 kHz	f _{STANDARD} = 1 kHz	±100 μm up to 500 mm rated length
±0.02% 500... max. rated length	±100 μm up to 500 mm rated length	±100 μm up to 500 mm rated length	±0.02% 500... max. rated length
[150 μV/°C + (5 ppm/°C × P × U/L)] × ΔT	±0.02% 500... max. rated length	±0.02% 500... max. rated length	[150 μV/°C + (5 ppm/°C × P × U/L)] × ΔT
20...28 V DC	[0.6 μA/°C + (10 ppm/°C × P × U/L)] × ΔT	[0.6 μA/°C + (10 ppm/°C × P × U/L)] × ΔT	20...28 V DC
≤ 150 mA	20...28 V DC	20...28 V DC	≤ 150 mA
yes	≤ 150 mA	≤ 150 mA	yes
TransZorb protection diodes	yes	yes	TransZorb protection diodes
500 V DC (GND to housing)	TransZorb protection diodes	TransZorb protection diodes	500 V DC (GND to housing)
-40...+85 °C	500 V DC (GND to housing)	500 V DC (GND to housing)	-40...+85 °C
-40...+100 °C	-40...+85 °C	-40...+85 °C	-40...+100 °C
	-40...+100 °C	-40...+100 °C	



Micropulse Transducers

Profile P BTL7

General Data

Analog Interface

Programming

EtherCAT

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

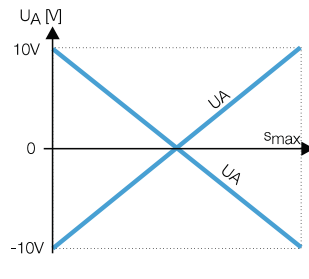
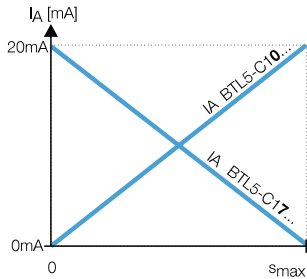
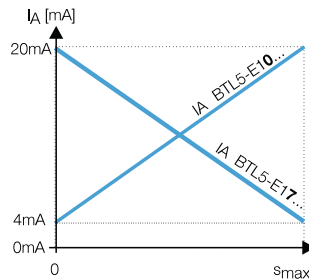
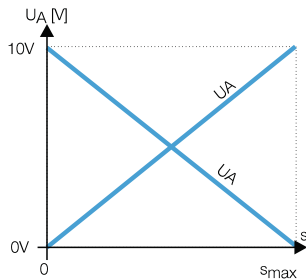
Rod Compact and Rod AR

Rod EX, T Redundant and CD

Filling Level Sensor SF

Accessories

Basic Information and Definitions



Ordering example:

BTL5 - 1 - M - P -

Output signal	Characteristic	Standard Rated length [mm]	Connection
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 KA02 PUR cable 2 m KA05 PUR cable 5 m KA10 PUR cable 10 m KA15 PUR cable 15 m
E 4...20 mA or 20...4 mA	0 rising (at C and E)		
C 0...20 mA or 20...0 mA	7 falling (for C and E)		
G -10...10 V and 10...-10 V			

P Interface

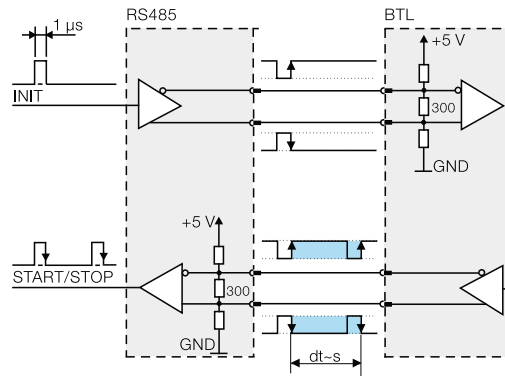
The P interface is compatible with BTA/BTM processor units as well as with controllers and modules from various manufacturers, including Siemens, B & R, Phoenix Contact, Mitsubishi, Sigmatek, Esitron, WAGO and others.

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.

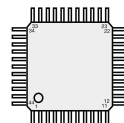


Block diagram of P interface

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.

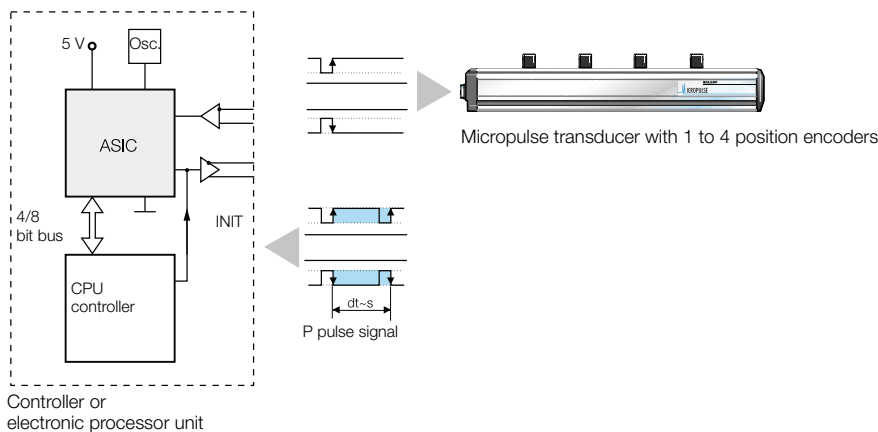
The digitizing chip was developed as a high-resolution, configurable ASIC for Micropulse transducers with P pulse interface.



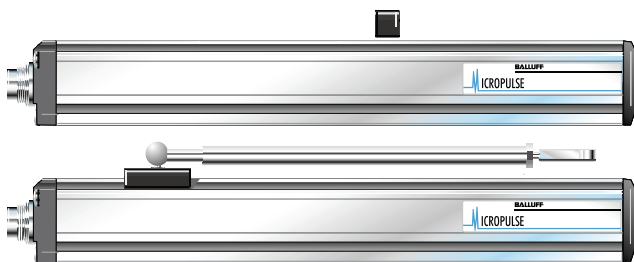
Digitizing chip 44QFP

Benefits

- Position resolution 1 μm!
- The 1 μm 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



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- P 1-M____-P-____	BTL5- M 1-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 ±0.02% 500...5000 mm rated length	±100 µm up to 500 mm rated length ±0.02% 500...5000 mm rated length
Temperature coefficient of overall system	(6 µm + 5 ppm × L)/°C	(6 µm + 5 ppm × 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



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

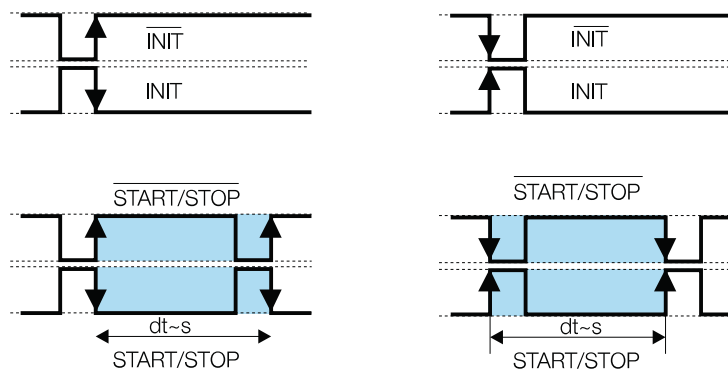
Rod Compact and Rod AR

Rod EX, T Redundant and CD

Filling Level Sensor SF

Accessories

Basic Information and Definitions



Please enter the code for the 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:

BTL5 - P 1 - M _____ **- P -** _____

Standard nominal strokes [mm]

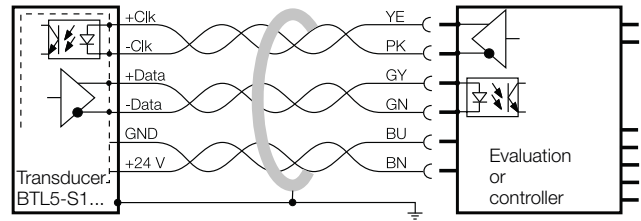
0050...5500 mm
in 5-mm increments

Connection

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

Standard SSI interface

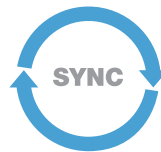
Synchronous serial data transmission works with controllers from various manufacturers, including Siemens, Bosch Rexroth, WAGO, B & R, Esitron, PEP and others, as well as for the Balluff BDD-AM 10-1-SSD and BDD-CC 08-1-SSD displays/control units. Reliable signal transmission, even with cable lengths 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-_____

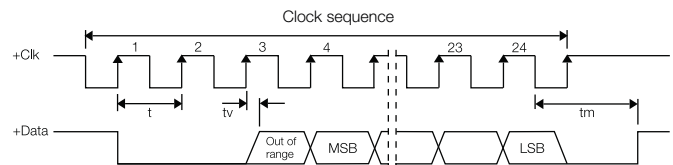
Micropulse Transducers with synchronized SSI interface are well suited for dynamic control applications. Data acquisition in the transducer is synchronized using the external clock of the controller, allowing an optimum speed calculation to be performed in the regulator/controller. Prerequisite for this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



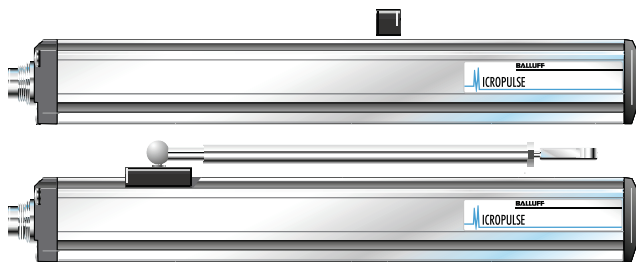
Rated length range	Scan rate
< Rated length ≤ 100 mm	: 1500 Hz
100 mm < Rated length ≤ 1000 mm	: 1000 Hz
1000 mm < Rated length ≤ 1400 mm	: 666 Hz
1400 mm < Rated length ≤ 2600 mm	: 500 Hz
2600 mm < Rated length ≤ 4000 mm	: 333 Hz

The clock frequency depends on the cable length.

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



Super-fast 2.5 kHz sampling rate



Profile P BTL5

SSI interface

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 µm
Repeat accuracy	±5 µm
Hysteresis	≤ 4 µm or ≤ 1 digit
Measurement rate	f _{STANDARD} = 2 kHz
Max. linearity deviation	±30 µm at ≤ 10 µm resolution or ≤ ±2 LSB at > 10 µm resolution
Temperature coefficient of overall system	(6 µm + 5 ppm × L)/°C
Supply voltage	20...28 V DC
Current consumption	≤ 80 mA
Operating temperature	-40...+85 °C
Storage temperature	-40...+100 °C



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

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:

BTL5-S1 [] [] **-M** [] [] [] **-P-** [] [] [] **for asynchronous operation**

BTL5-S1 [] [] **-B-M** [] [] [] **-P-** [] [] [] **for synchronous operation**

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

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)

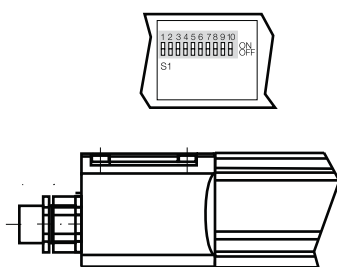
Service Data Objects transmit the configuration parameters to the transducer. The transducer may be configured on the bus by the controller or offline with a bus analyzer/CANopen tool. The configuration is stored in the transducer's non-volatile memory.



CiA 199911-301v30/11-009

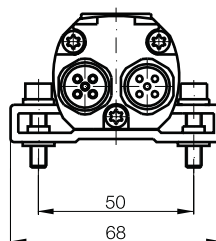
Use of multiple position encoders

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



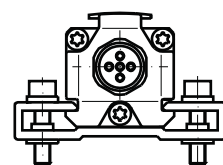
Position of the DIP switch S1, only on BTL5-H1...-P-S94

BTL5-H1...-M...-P-S94



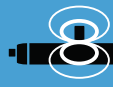
Node ID can be set by DIP switch.

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



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

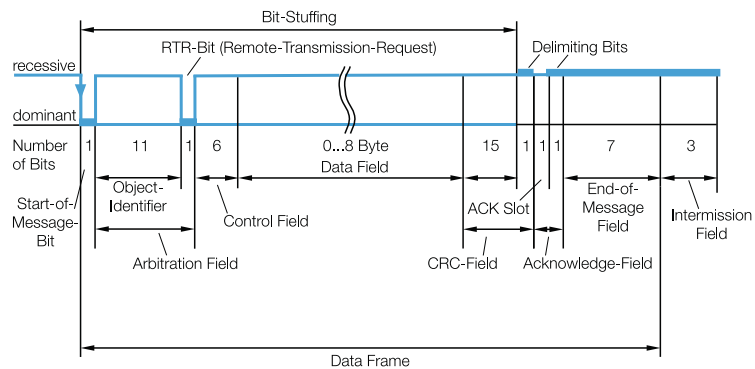
Rod EX, T Redundant and CD

Filling Level Sensor SF

Accessories

Basic Information and Definitions

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:

BTL5-H1 **-M** **-P-S92**

BTL5-H1 **-M** **-P-S94**

Software configuration		Baud rate		Standard Rated length [mm]
1	1 × Position and 1 × Velocity	0	1 Mbaud	0050...4000
2	2 × Position and 2 × 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	

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:

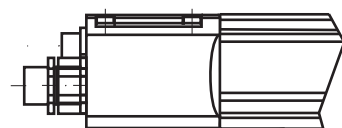
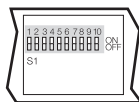
- Current encoder position with resolution in 5 μm increments
- Current encoder speed in increments of 0.1 mm/s
- Current status of the four freely programmable cams

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.



Position of the DIP switch S1



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 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	500
Baud rate [Kbps]	500	250	100



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

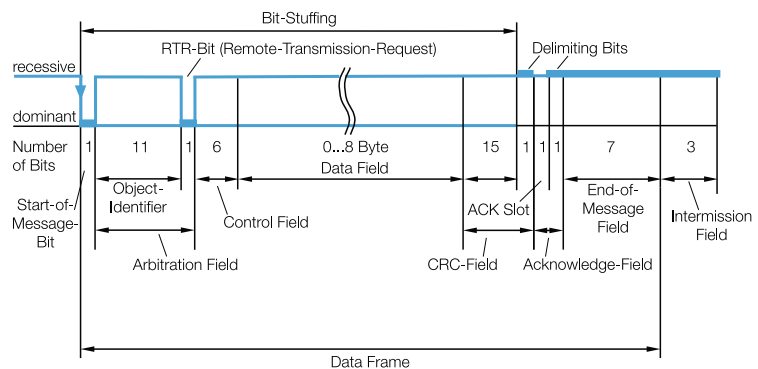
Rod Compact and Rod AR

Rod EX, T Redundant and CD

Filling Level Sensor SF

Accessories

Basic Information and Definitions



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

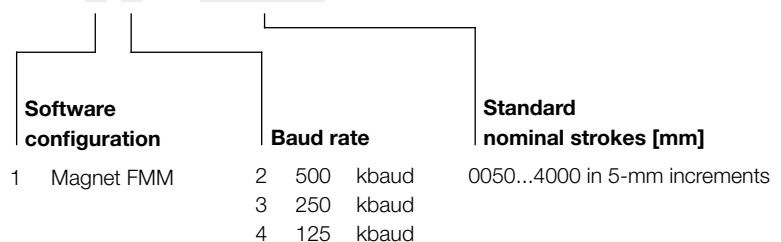
Scope of delivery

- 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:

BTL5-D1__-M____-P-S93



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

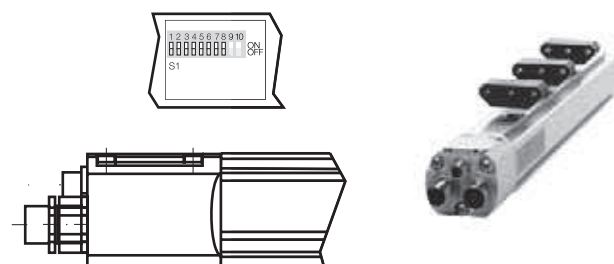
Under Profibus DP, the default is for process data to be sent from the master to slaves acyclically and for the slave data to then be queried. To ensure synchronization of multiple devices, the master may use the SYNC and FREEZE services.

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.



Position of the DIP switch S1

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 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

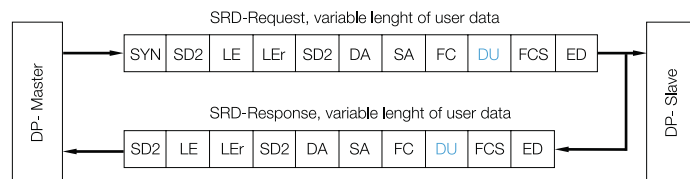
Rod Compact and Rod AR

Rod EX, T Redundant and CD

Filling Level Sensor SF

Accessories

Basic Information and Definitions



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

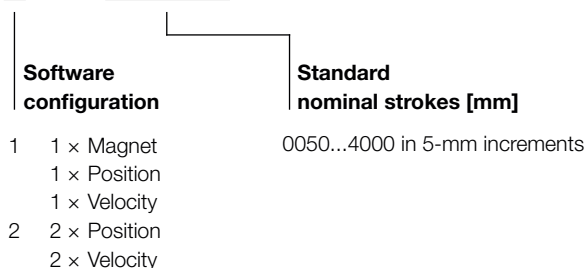
Scope of delivery

- 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:

BTL5-T1 0 - **M** --- - **P-S103**



Profile P Floating position encoders

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

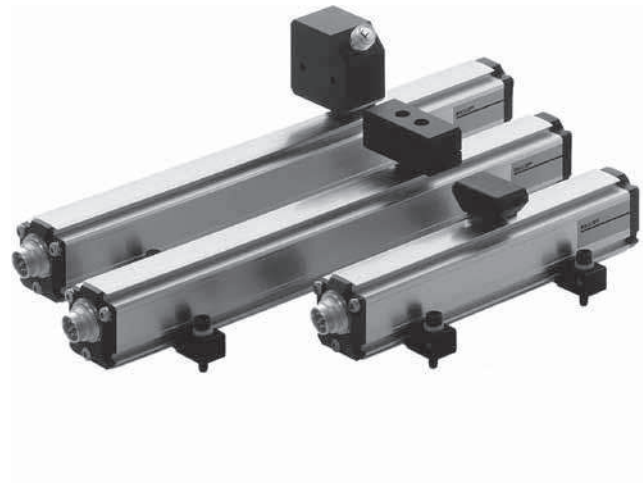
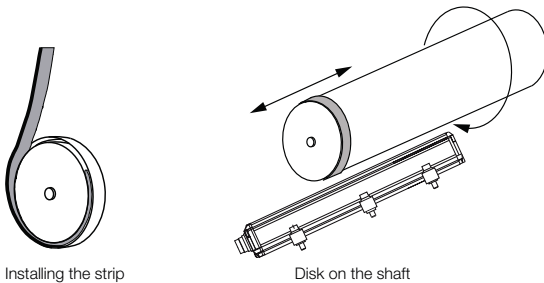
The position encoder BTL5-P-4500-1 is an electromagnet and requires an operating voltage of 24V, which can be turned on and off for selective activation. This allows multiplex operation with multiple encoders on a single transducer, since only one encoder is active at a time.

Non-contact! Distance up to 15 mm

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.



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	Profile P BTL Floating	Profile P BTL Floating	Profile P BTL Floating
BAM014M	BAM014T	BAM014P	BAM013E
BTL5-P-3800-2	BTL5-P-5500-2	BTL5-P-4500-1	BTL-A-TM01-M1000
Plastic approx. 12 g any	Plastic approx. 40 g any	Plastic approx. 90 g any	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 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

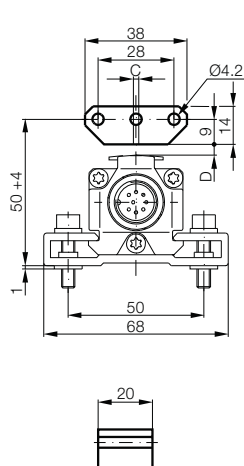
Rod Compact and Rod AR

Rod EX, T Redundant and CD

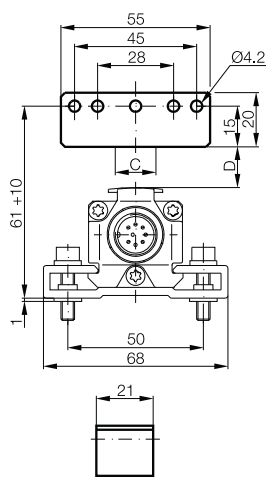
Filling Level Sensor SF

Accessories

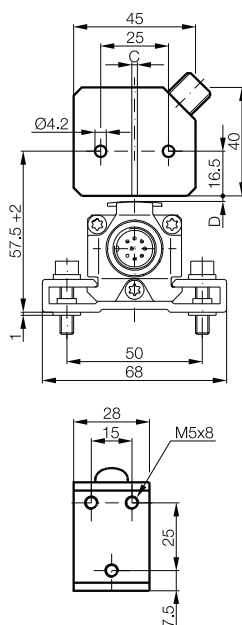
Basic Information and Definitions



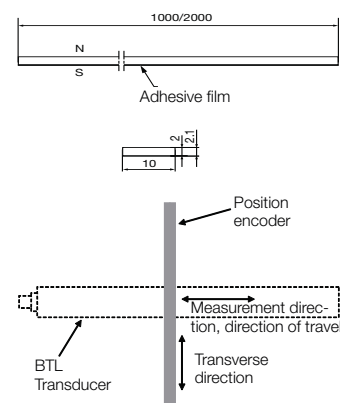
Lateral offset:
C = ±2 mm
Distance of position encoder:
D = 0.1...4 mm



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

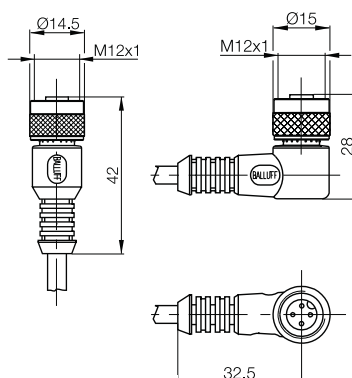


Lateral offset:
C = ±2 mm
Distance of position encoder:
D = 0.1...2 mm

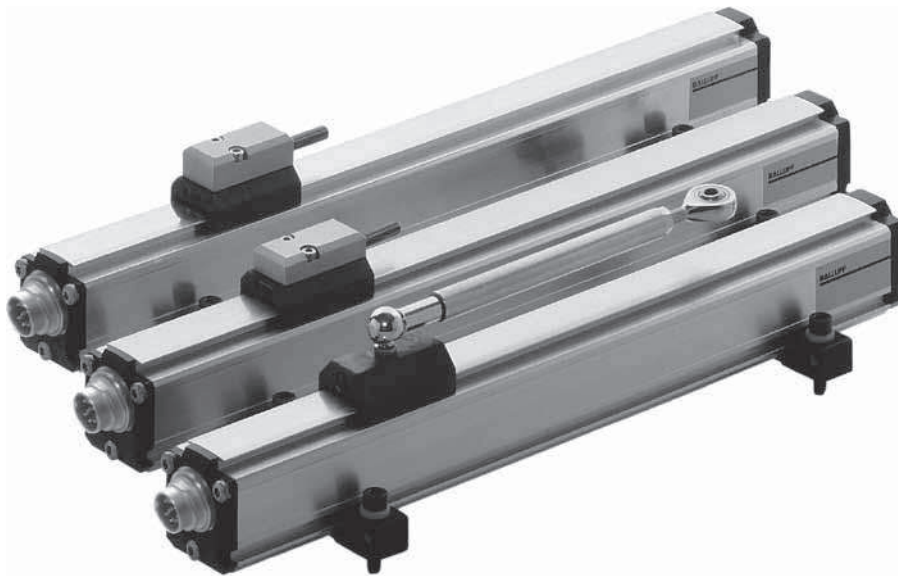
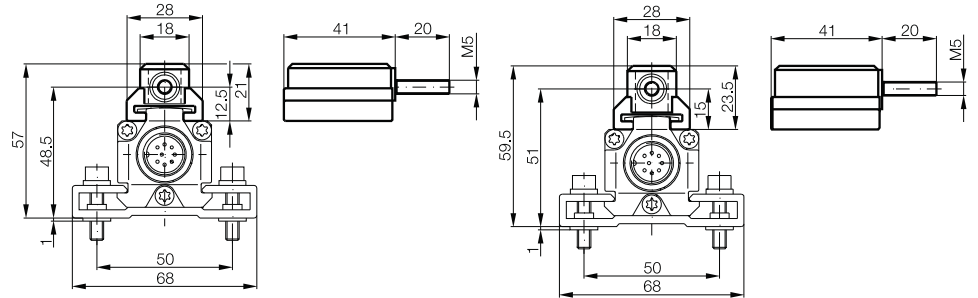


Offset in transverse direction:
C = Magnetic tape length
Distance of magnetic tape:
D = 0...4 mm

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



Description		Position encoder	Position encoder
for Series		Profile P BTL	Profile P BTL
Version		Captive	Captive
Ordering code		BAM014K	BAM014L
Part number		BTL5-M-2814-1S	BTL5-N-2814-1S
Material	Housing	Anodized aluminum	Anodized aluminum
	Sliding surface	Plastic	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

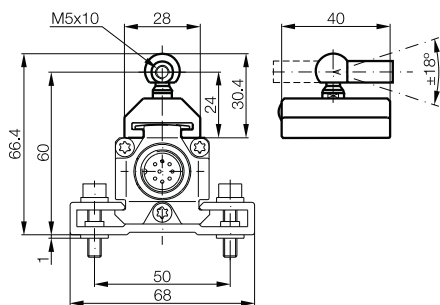
Mounting clamps with insulating sleeves and screws included in the scope of delivery of the transducer.

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

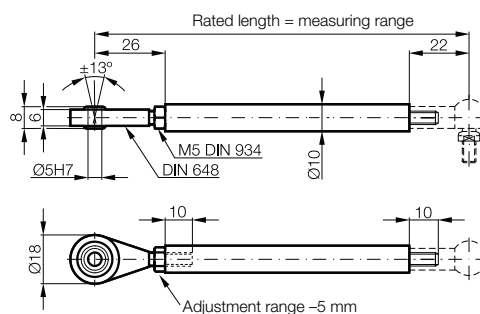


Profile P BTL Captive position encoders

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



Description	Joint rod
for Series	Profile P
Version	Captive
Part number	BTL2-GS10-____-A
Material	Aluminum
Weight	approx. 150 g/m



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

Ordering example:

BTL2-GS10-____-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 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

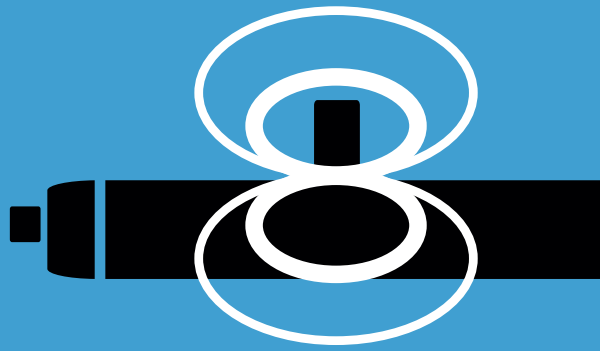
Rod Compact and Rod AR

Rod EX, T Redundant and CD

Filling Level Sensor SF

Accessories

Basic Information and Definitions



Micropulse Transducers

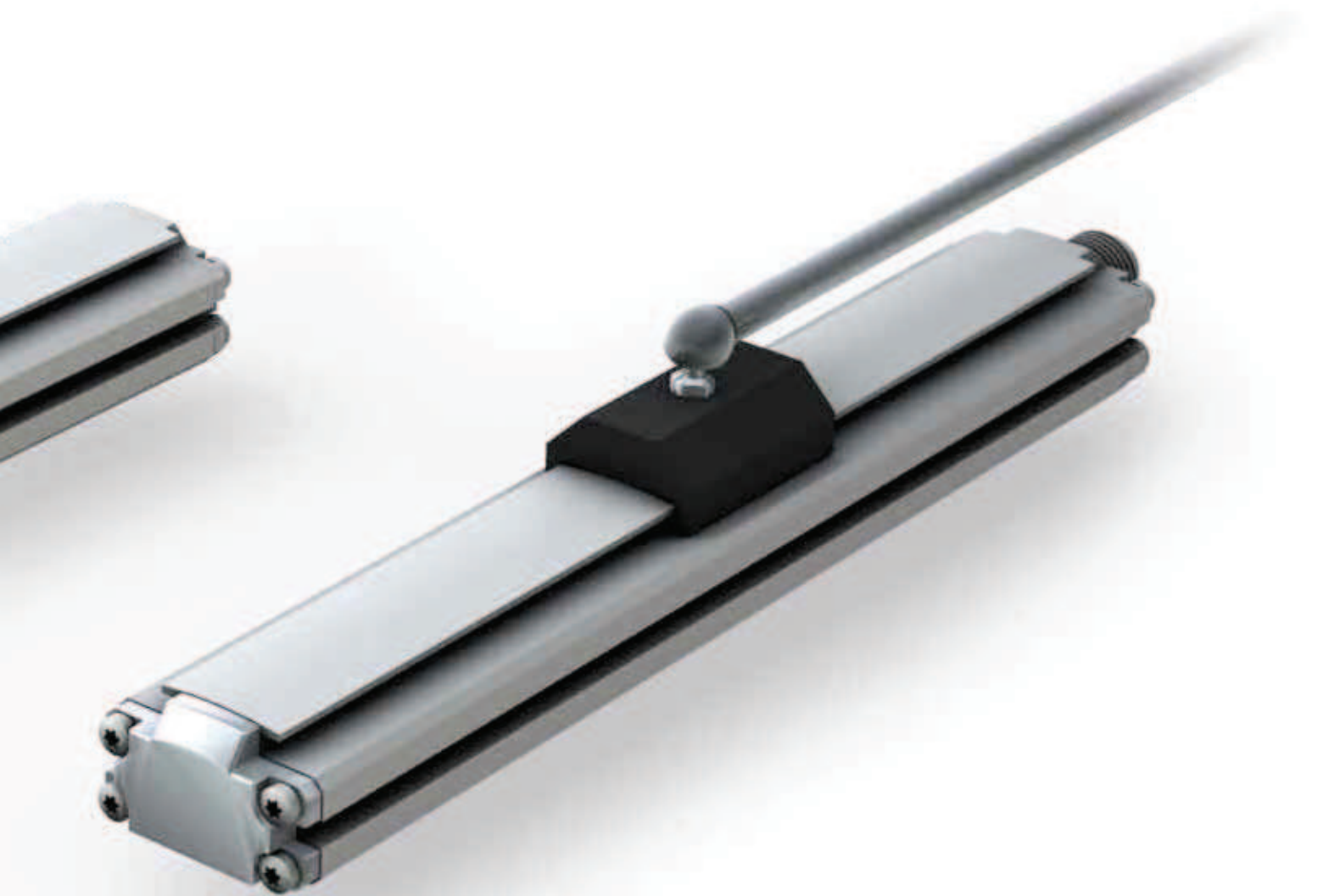
Profile PF

- 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

MICROPULSE[®]



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)
Overtoltage 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



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

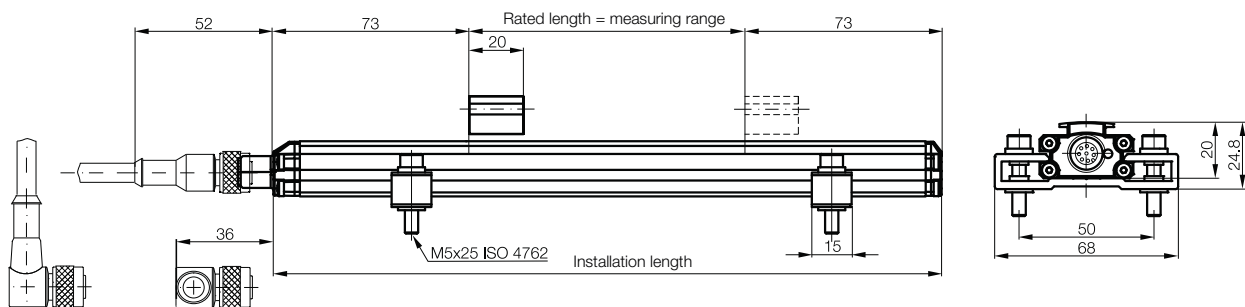
Rod EX, T Redundant and CD

Filling Level Sensor SF

Accessories

Basic Information and Definitions

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

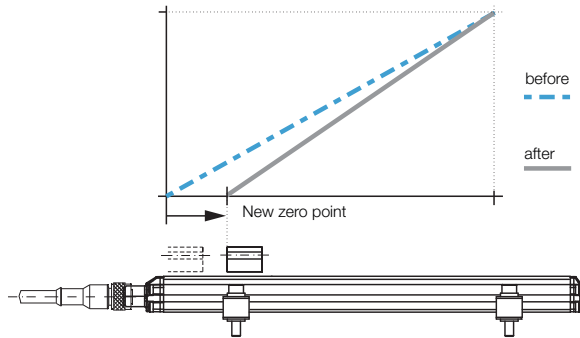
Plug connectors, see page 260

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

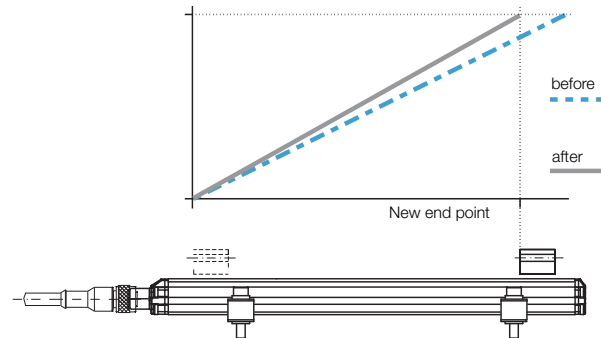
Micropulse Transducer BTL6 profile PF with Calibration Box BTL7-A-CB02



Electronic processor unit
Supply voltage

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
≤ 5 mV			≤ 5 mV
≤ 0.35 mV	≤ 500 Ω (500 Ω)	≤ 500 Ω (500 Ω)	≤ 0.35 mV
f _{max} = 2 kHz	≤ 0.7 μA	≤ 0.7 μA	f _{max} = 2 kHz
±200 μm up to 500 mm rated length	f _{max} = 2 kHz	f _{max} = 2 kHz	±200 μm up to 500 mm rated length
±0.04% 500... max. rated length	±200 μm up to 500 mm rated length	±200 μm up to 500 mm rated length	±0.04% 500... max. rated length
30 ppm at 500 mm	±0.04% 500... max. rated length	±0.04% 500... max. rated length	30 ppm at 500 mm
10...30 V DC	30 ppm at 500 mm	30 ppm at 500 mm	10...30 V DC
≤ 150 mA	10...30 V DC	10...30 V DC	≤ 150 mA
-25...+70 °C	≤ 150 mA	≤ 150 mA	-25...+70 °C
-40...+100 °C	-25...+70 °C	-25...+70 °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

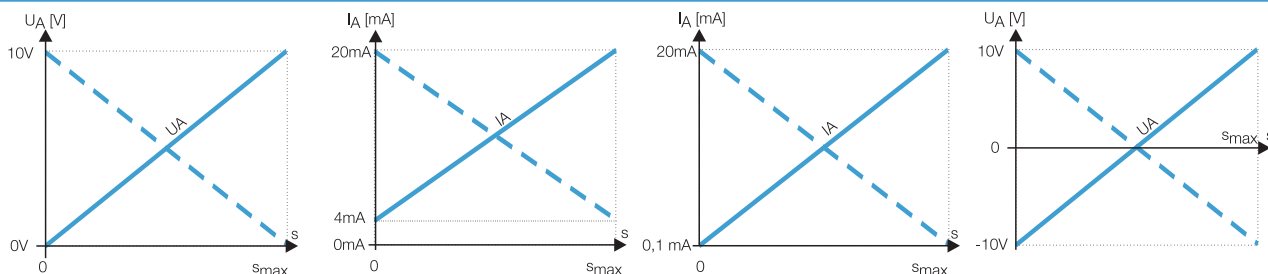
Rod Compact and Rod AR

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:

BTL6- 500-M - PF-S115

Output signal

- A 0...10 V
- E 4...20 mA
- C 0.1...20 mA
- G -10...10 V

Standard nominal strokes [mm]

0050...4572 in 5-mm increments

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.

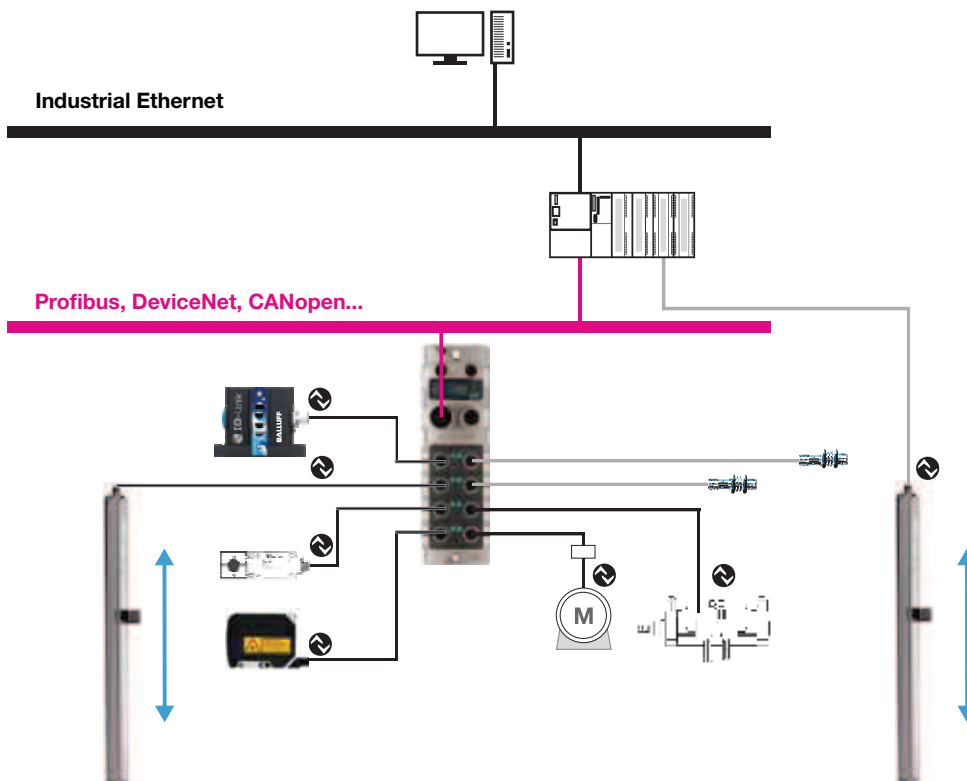
IO-Link is a point-to-point connection within any number of networks. An IO-Link system consists of an IO-Link device such as a sensor or actuator, an IO-Link master and wiring. The IO-Link master is either an integrated/modular IP20 module for central operation in the control cabinet or as a remote 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 IO-DD (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 $\mu\text{m}/\text{digit}$
- Diagnostics + error value recognition

Additional information

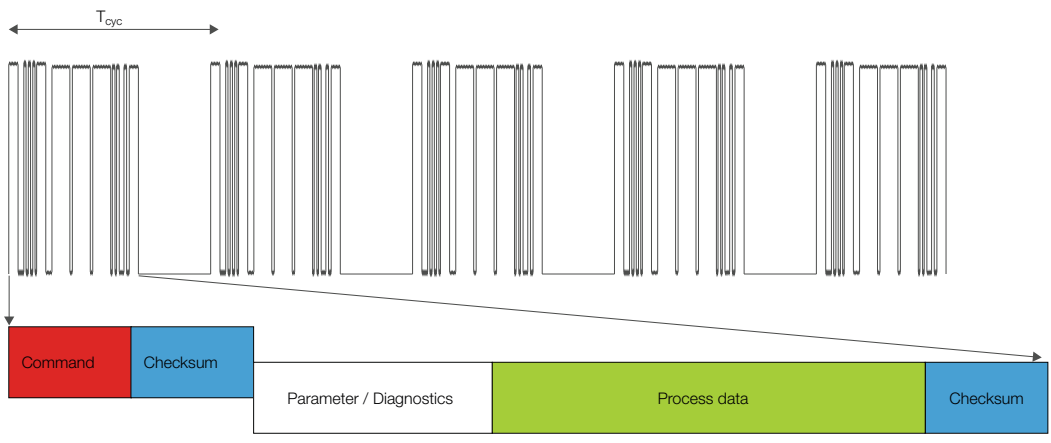
About IO-Link: www.io-link.com

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



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 ±0.04 %
Supply voltage	18...30 V DC
Current consumption	≤ 150 mA
Polarity reversal protected	yes
Operating temperature	-25...+70 °C
Storage temperature	-40...+100 °C
Mode	COM 3
Transmission rate	230.4 kbaud
Process data cycle	1 ms
Process data	Position value in µm
Parameters	Measuring range, zero point
Diagnostics	Position encoder in the measuring range, below, above, no magnet

- 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



Please enter the code for the 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
See separate catalog for plug connectors:

Industrial networking and connectivity

Ordering example:

BTL6-U110-M **-PF-S4**

Standard nominal strokes [mm]

0050...4572 mm in 5-mm increments

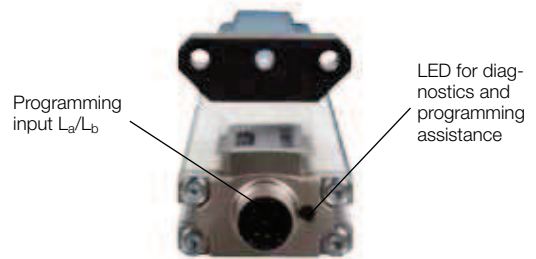
Profile PF Floating position encoders

non-contact Distance up to 15 mm

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	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

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
		24 V DC
		100 mA
-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
General Data

Analog Interface

IO-Link V1.1

Floating Position Encoders

Captive Position Encoders

Profile AT

Profile BIW

Rod

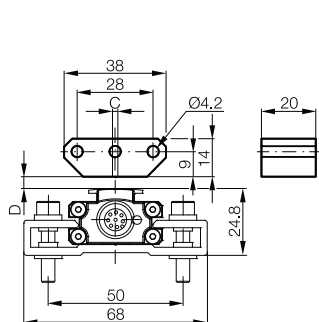
Rod Compact and Rod AR

Rod EX, T Redundant and CD

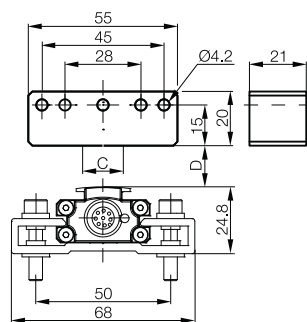
Filling Level Sensor SF

Accessories

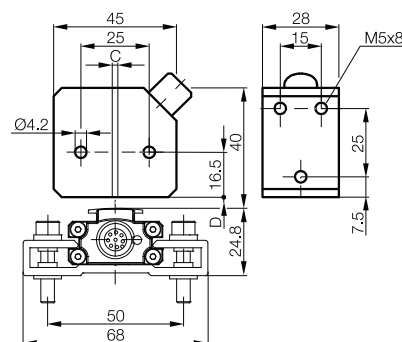
Basic Information and Definitions



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



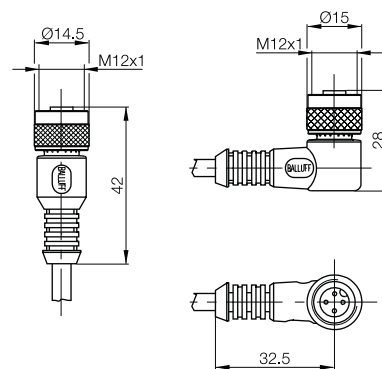
Lateral offset:
C = ±15 mm
Distance of position encoder:
D = 5...15 mm



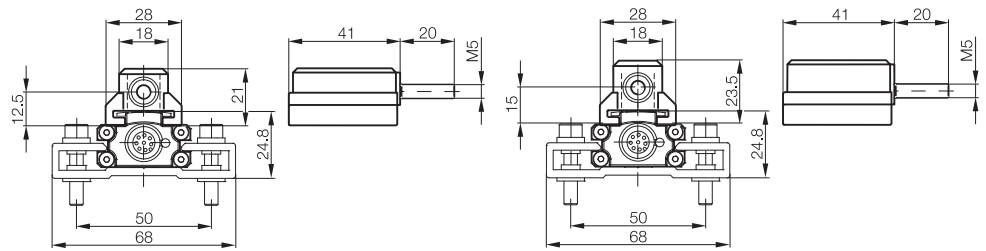
Lateral offset:
C = ±2 mm
Distance of position encoder:
D = 0.1...2 mm



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



Description		Position encoder	Position encoder
for Series		Profile PF BTL	Profile PF BTL
Version		Captive	Captive
Ordering code		BAM014K	BAM014L
Part number		BTL5-M-2814-1S	BTL5-N-2814-1S
Material	Housing	Anodized aluminum	Anodized aluminum
	Sliding surface	Plastic	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



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

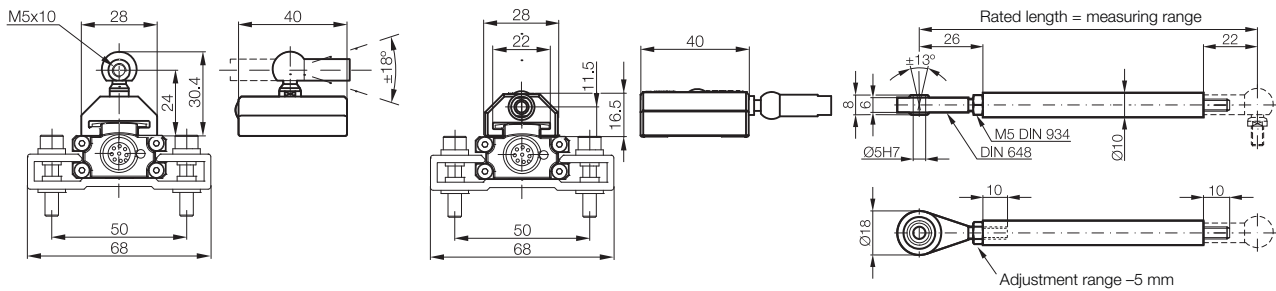
Rod EX, T Redundant and CD

Filling Level Sensor SF

Accessories

Basic Information and Definitions

Position encoder	Position encoder	Joint rod
Profile PF BTL Captive	Profile PF BTL Captive	Profile PF BTL 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	



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

Ordering example:

BTL2-GS10-_____-A

Standard nominal strokes [mm]

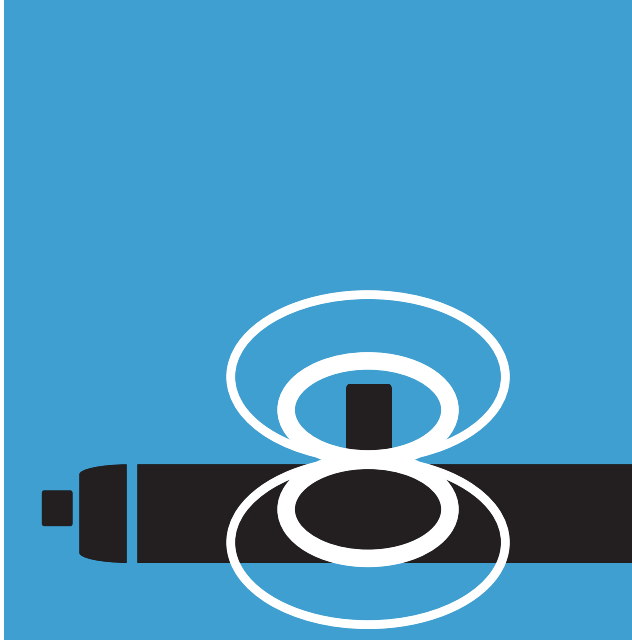
0075	0100	0125
0150	0200	0250
0350	0400	0450
0500	0600	0800
1000	1500	2000



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

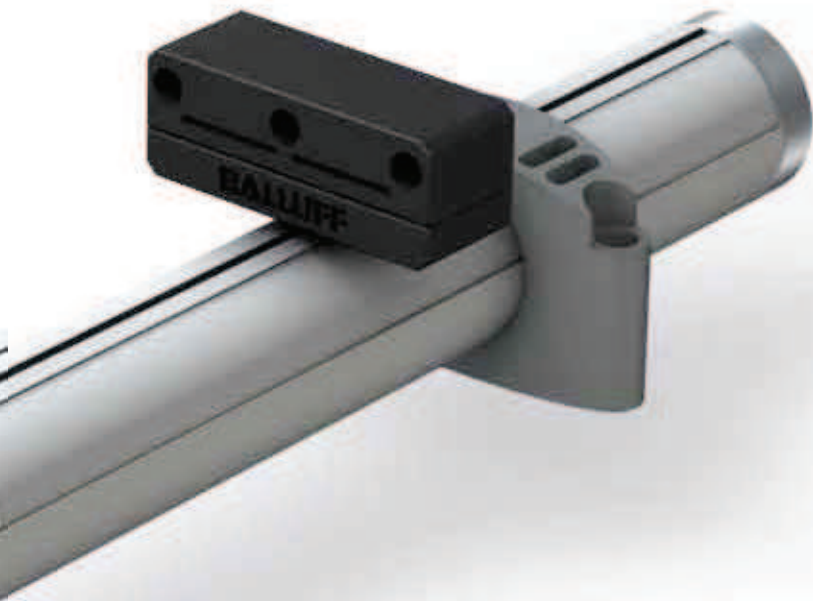
Profile AT

- 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

MICROPULSE[®]

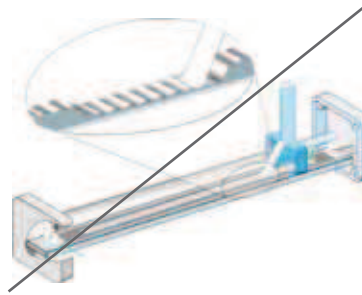


Micropulse transducers – a contactless alternative to contacting transducers

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



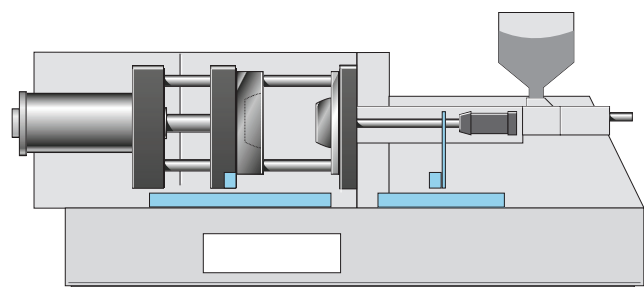

This product is
certified according to
File No. E227256.

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- A 301-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
Overvoltage 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



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

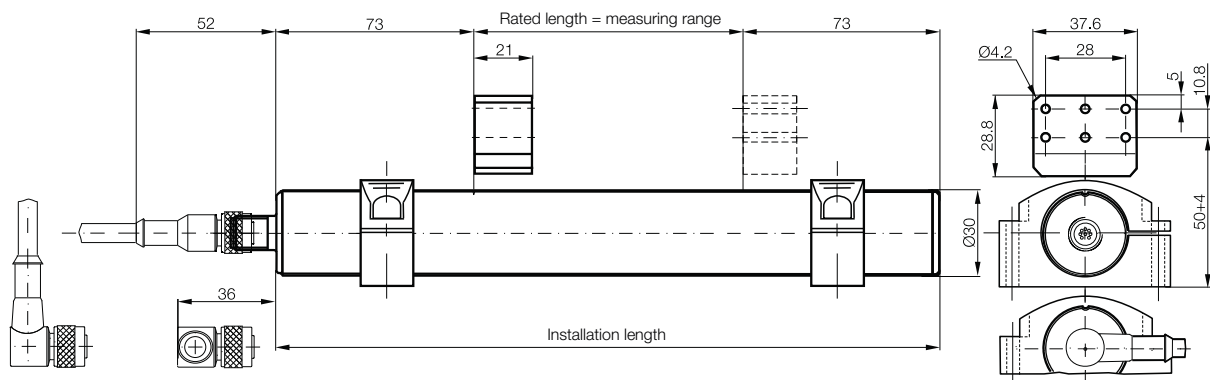
Rod EX, T Redundant and CD

Filling Level Sensor SF

Accessories

Basic Information and Definitions

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!

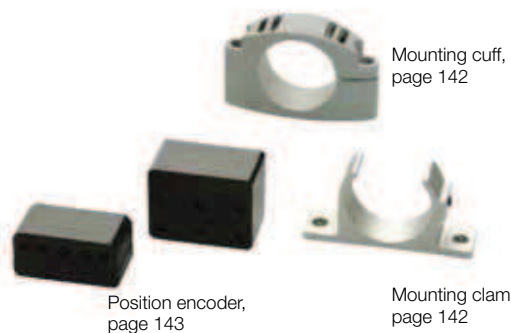
Before design, installation and startup please familiarize yourself with the user's guide to be found at www.balluff.com.

Scope of delivery

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

Please order separately:

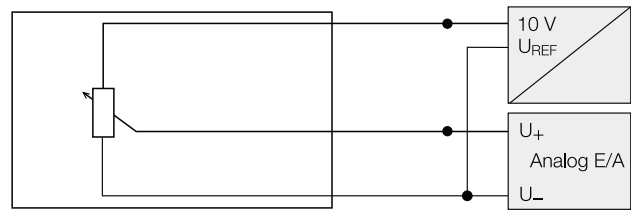
- Position encoders, see page 143
- Mounting cuffs/clamp, see page 142
- Plug connectors, see page 252



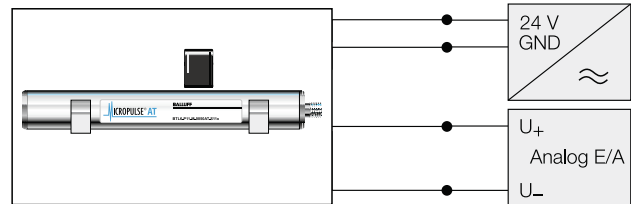
Profile AT

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	Standard nominal strokes [mm]							
A	0...10 V 10...0 V	1 Non-floating* 3 Floating	0100	0130	0150	0160	0175	0200	0225	
G	-10...10 V -10...10 V		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	BTL6-A110-M____-A1-S115	BTL6-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	≤ 5 mV	≤ 5 mV
System resolution	≤ 10 μm	≤ 10 μm
Repeat accuracy	≤ 10 μm	≤ 10 μm
Reproducibility	≤ 20 μm	≤ 20 μm
Measurement rate	$f_{\text{STANDARD}} = 1 \text{ kHz}$	$f_{\text{STANDARD}} = 1 \text{ kHz}$
Linearity deviation	≤ ±200 μm up to 500 mm rated length typ. ±0.02%, max. ±0.04%	≤ ±200 μm up to 500 mm rated length typ. ±0.02%, max. ±0.04%
Supply voltage	20...28 V DC	20...28 V DC
Current consumption	≤ 70 mA	≤ 70 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

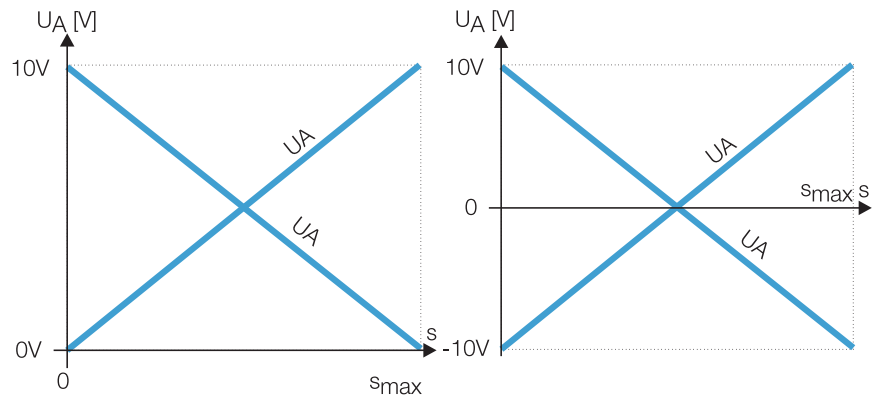
Rod Compact and Rod AR

Rod EX, T Redundant and CD

Filling Level Sensor SF

Accessories

Basic Information and Definitions

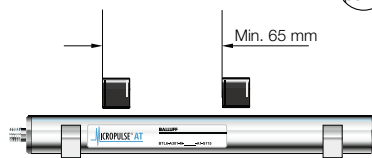


BTL6-A301-... Two become one

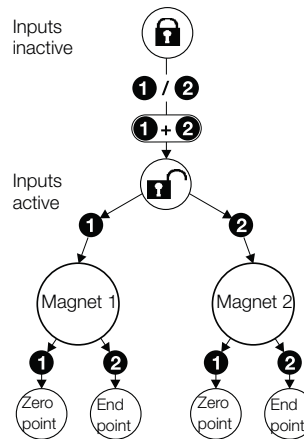
Two moving members on a machine often travel in the same direction. Each axis normally requires a separate feedback sensor. With the Micropulse AT, it is now possible to detect two movements at the same time using just one sensor with two analog outputs. The position of the respective zero and end points 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.

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.

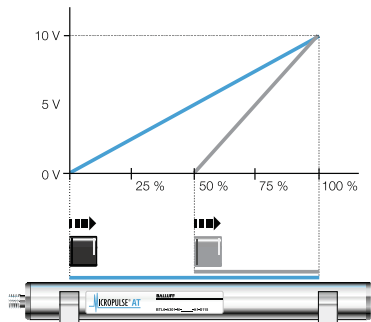


Teach-in

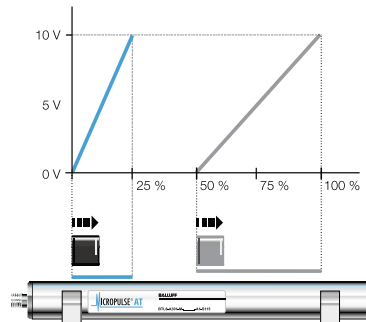
The zero and end points set at the factory are to be replaced by the new zero and end points. First, the encoder must be brought to the new zero point and then to the new end position, and the respective values stored by pressing the button.

Example: Programming steps for setting the measuring range

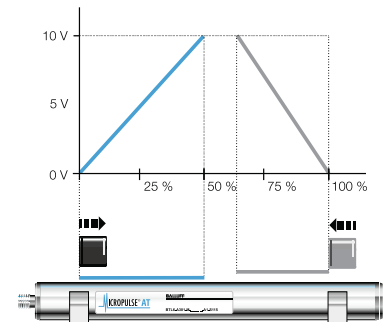
Mode 1: Single measurement of 2 positions (single measurement default setting 100%/50%)



Basic default setting

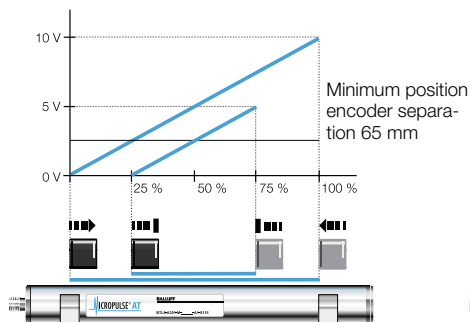


Programming example:
Output 1: 25% rated length, signal rising
Output 2: 50% rated length, signal rising

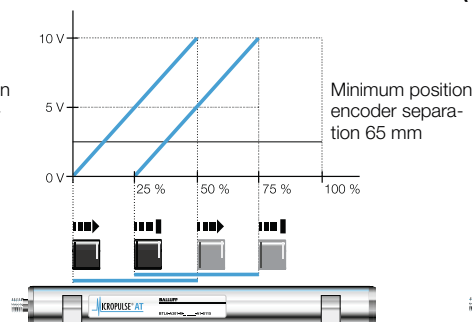


Programming example:
Output 1: 50% rated length, signal rising
Output 2: 37.5% rated length, signal falling

Mode 2: Differential measurement between 2 position encoders

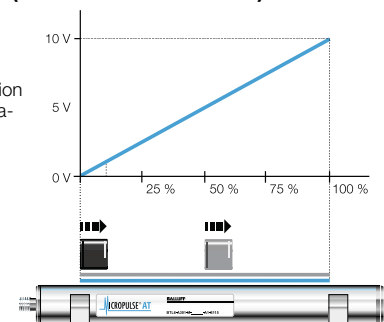


Default setting: Differential measurement
Output 1: Standard displacement signal (not shown)
Output 2: Differential signal 100% rated length = 10 V
Programming example:
Differential displacement 50% rated length = 5 V differential signal



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

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



Profile AT

Operating modes

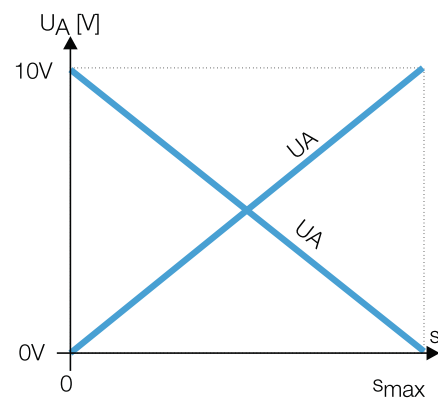
Features of Micropulse BTL6-A

- 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- A 301-M_ _ _ _ -A1-S115
Output	Floating
Output voltage	0...10 V programmable
Load current	Max. 5 mA
Max. residual ripple	≤ 5 mV
System resolution	≤ 10 μm
Repeat accuracy	≤ 10 μm
Reproducibility	≤ 20 μm
Measurement rate	f _{STANDARD} = 1 kHz (< 850 mm)
Linearity deviation	≤ ±200 μm up to 500 mm rated length typ. ±0.02%, max. ±0.04% 500...1500 mm rated length
Supply voltage	18...30 V DC
Current consumption	≤ 100 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.

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

Ordering example:

BTL6 - A301 - M _ _ _ _ - A1 - S115

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

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.

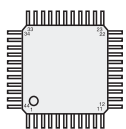
P110 replaces P1 and M1

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.

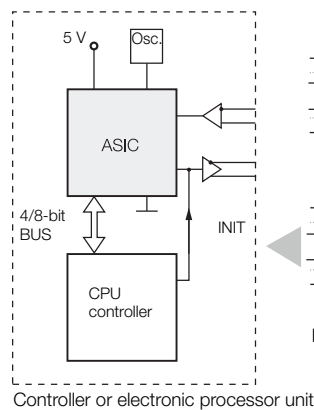


Extremely precise digitizing chip for P110 pulse interface

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



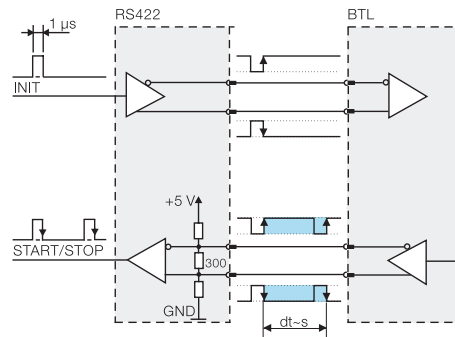
Controller or electronic processor unit

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

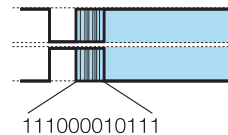
DPI/IP is a protocol for direct data exchange between a controller and transducer. The signal lines are used to send additional information such as manufacturer, measuring length and waveguide gradient. This allows start-up or replacement of a transducer without having to make manual changes to the controller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

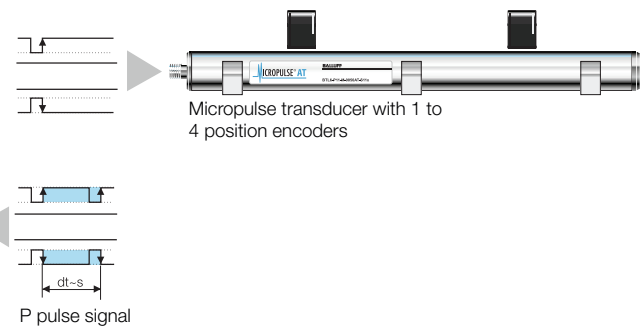


Block diagram of P interface



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



Micropulse transducer with 1 to 4 position encoders

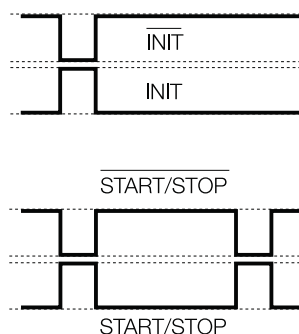
ASIC INFO:
+49 7158 173-370

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:

BTL6 - P 11 _ - M _ _ _ _ - A 1 - S 115

Data protocol	Standard Rated length [mm]
0 without DPI/IP* (standard)	0050 0075 0100 0130 0150 0160 0175 0200 0225 0250 0300 0350 0360 0400
1 with DPI/IP	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

Profile PF

Profile AT

General Data

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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

**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

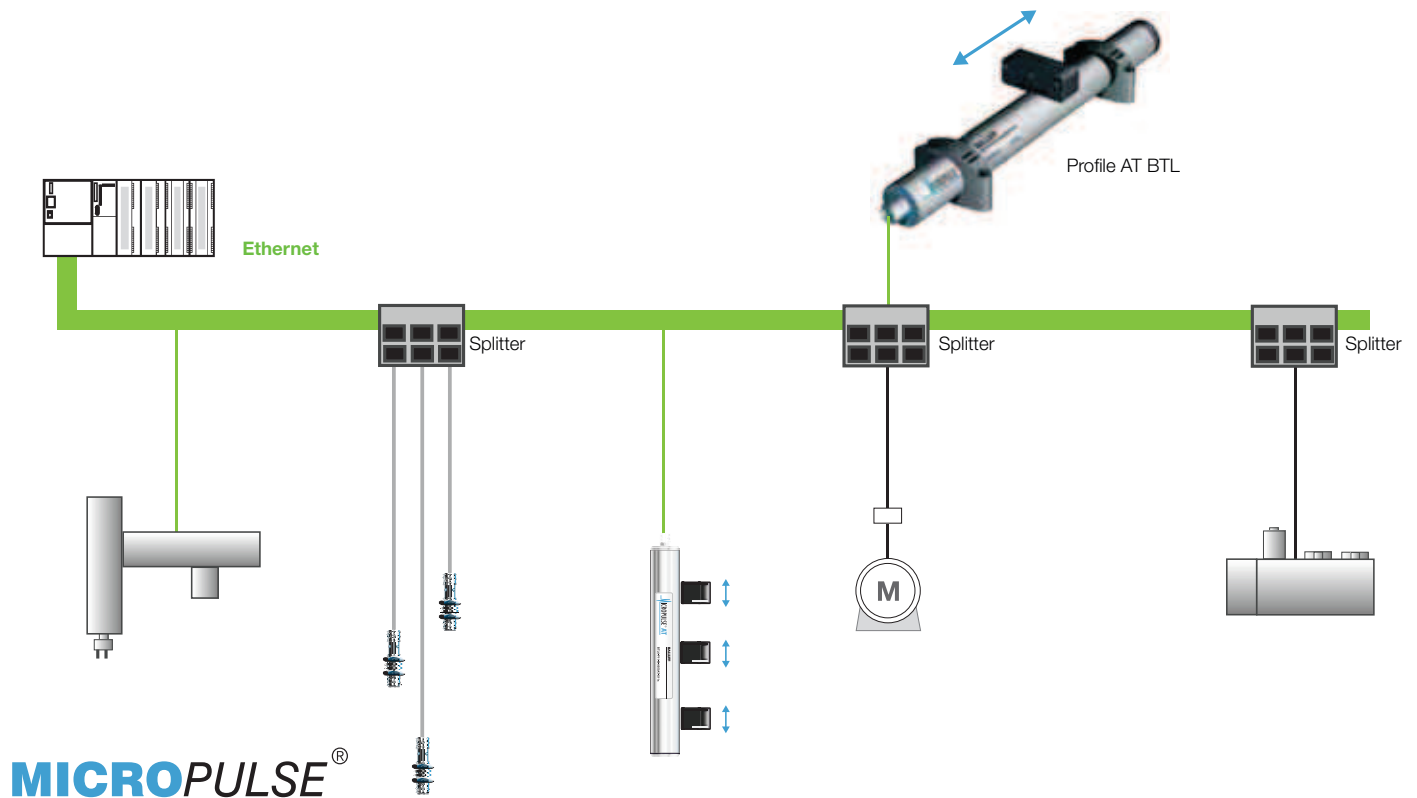
Up to four passive position encoders with no power supply "mark" the measuring positions on the measuring path without making contact, with measuring ranges from 50 to 4000 mm. The particular attraction of this is that as a result of the system, up to four different paths can be measured simultaneously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

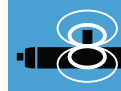
For VARAN, see www.varan-bus.net
or for EtherCAT, see www.ethercat.org



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	$f_{\text{STANDARD}} = 1 \text{ kHz} (< 850 \text{ mm})$	$f_{\text{STANDARD}} = 1 \text{ kHz} (< 850 \text{ mm})$
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

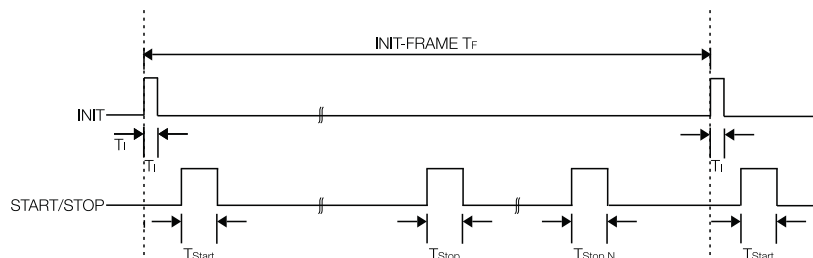
Rod Compact and Rod AR

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.

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-V11 - M - - - - A1-S115

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

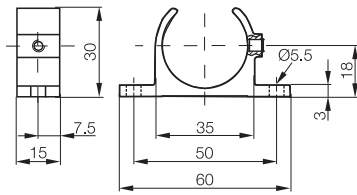
Profile AT Accessories

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

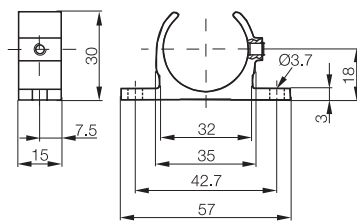
In conjunction with mounting clamp BTL6-A-MF01-A-50 and mounting cuff BTL6-A-MF03-K-50, the mechanical installation is compatible with series BTL5-...-P-S32 with encoder BTL5-P-3800-2 or BTL5-P-5500-2.

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

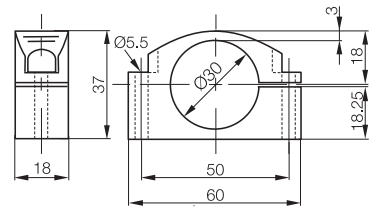
Mounting clamps/cuff



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

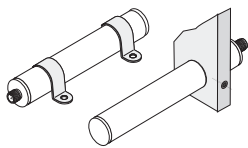
When extreme shock and vibration loads are present, we recommend spacing mounting clamps every 250 mm.

Length	Number of mounting clamp pairs
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

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

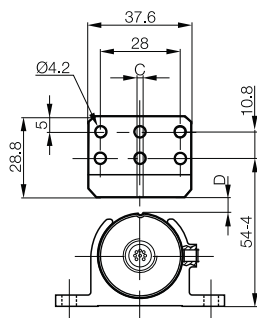


For connector accessories, see page 252

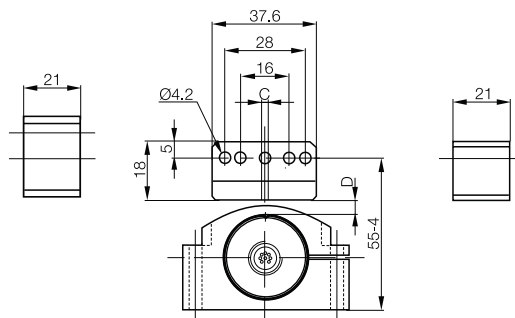


Profile AT Accessories

Description for Series	Position encoder Profile A1 BTL	Position encoder 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



Lateral offset: $C = \pm 5$ mm
Distance of position encoder:
 $D = 4...8$ mm



Lateral offset: $C = \pm 5$ mm
Distance of position encoder:
 $D = 4...8$ mm



Micropulse Transducers

Profile P

Profile PF

Profile AT

General Data

Analog Interface

Operating Modes

Digital Pulse Interface

Ethernet Interface

Accessories

Profile BIW

Rod

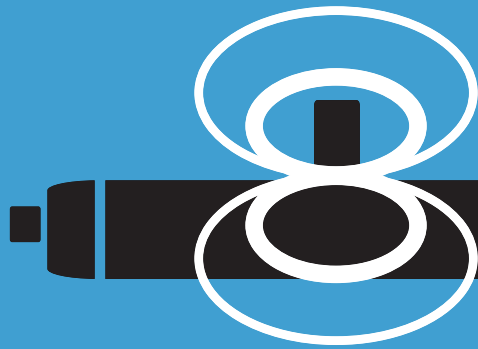
Rod Compact and Rod AR

Rod EX, T Redundant and CD

Filling Level Sensor SF

Accessories

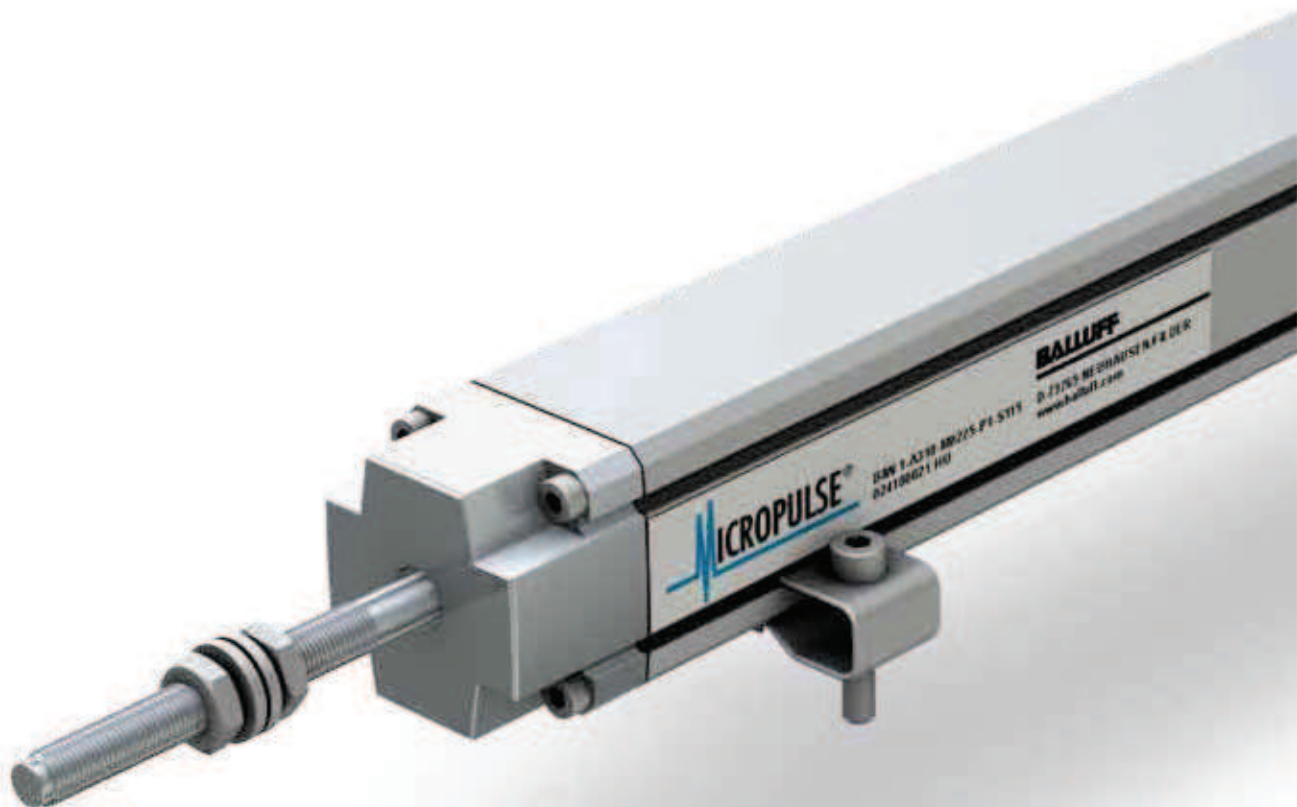
Basic Information and Definitions



Micropulse Transducers

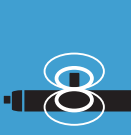
Profile BIW

- 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	146
Analog Interface	148

MICROPULSE[®]



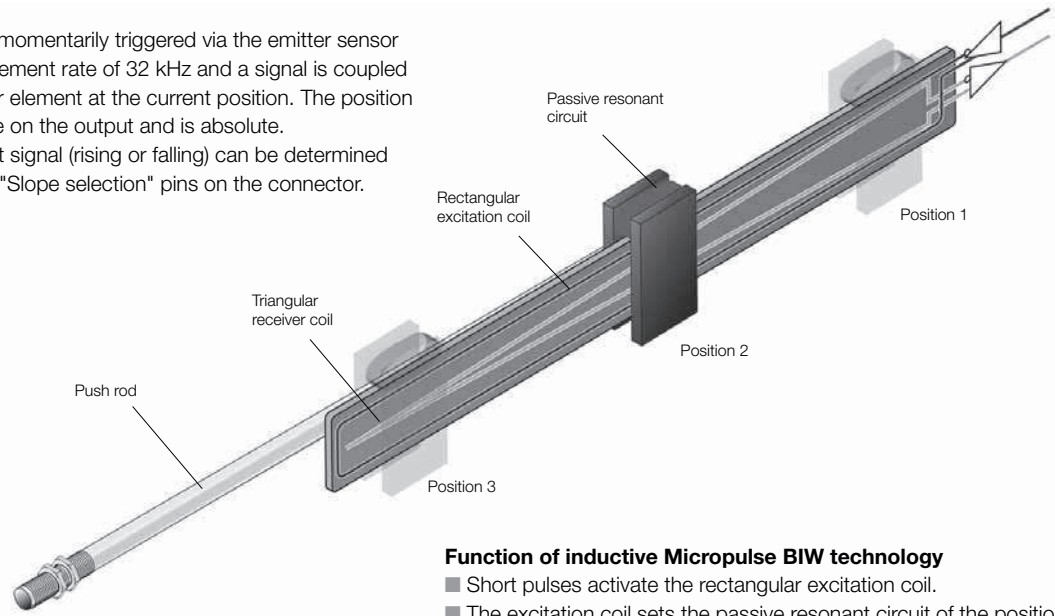
The inductive transducer BIW is based on a new, patented operating principle which detects the actual position without making contact.

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.

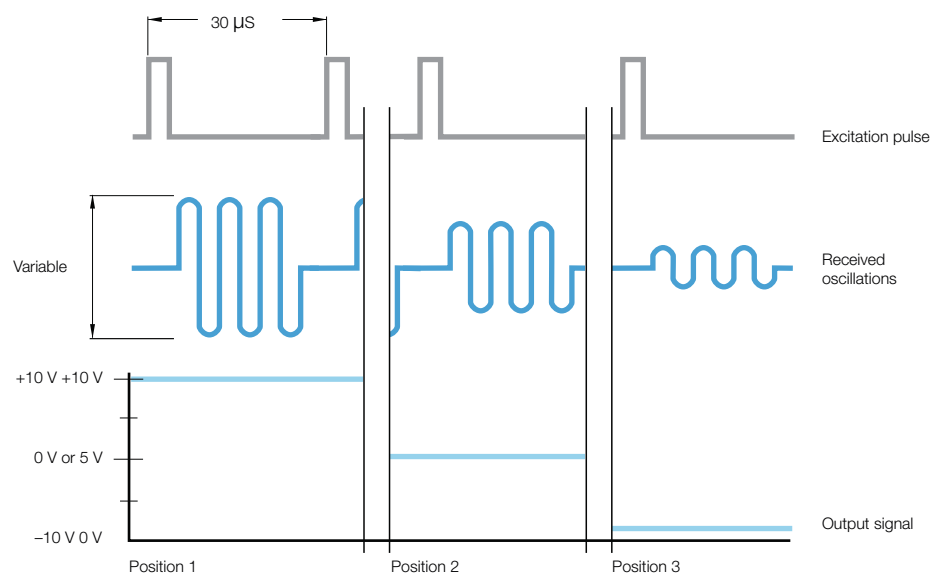
The resonant circuit is momentarily triggered via the emitter sensor element with a measurement rate of 32 kHz and a signal is coupled into the receiver sensor element at the current position. The position is immediately available on the output and is absolute.

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

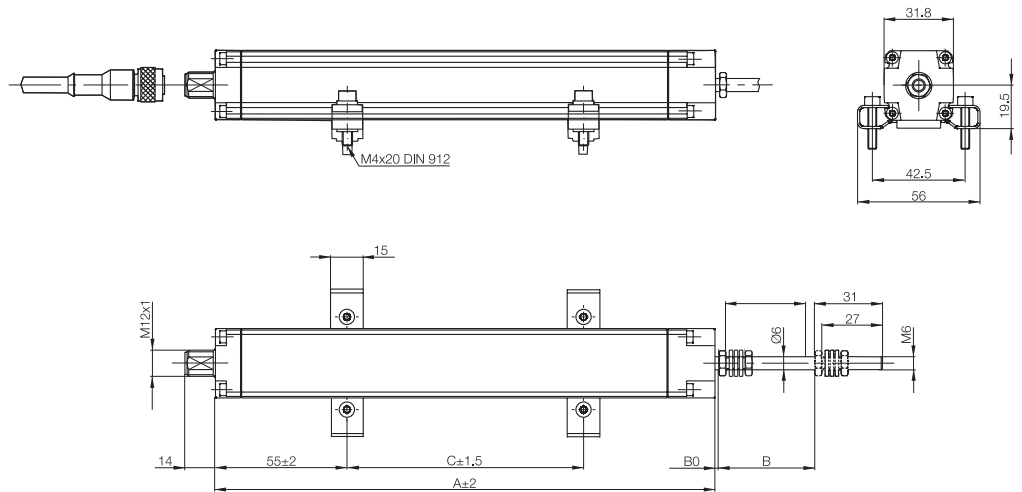
Rod Compact and Rod AR

Rod EX, T Redundant and CD

Filling Level Sensor SF

Accessories

Basic Information and 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 ≤ 300 mm	C = rated length – 20 mm
Rated length 300 mm to ≤ 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.

Profile P1 BIW
Analog interface

Sampling rate 32 kHz

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			Rated length + 10 mm



Micropulse Transducers

Profile P

Profile PF

Profile AT

Profile BIW

General Data

Analog Interface

Rod

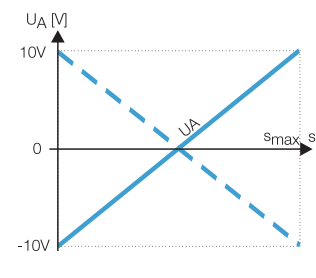
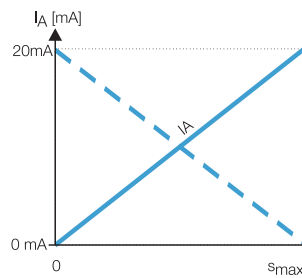
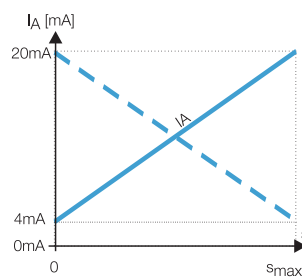
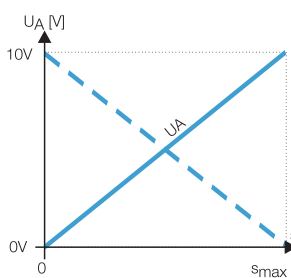
Rod Compact and Rod AR

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

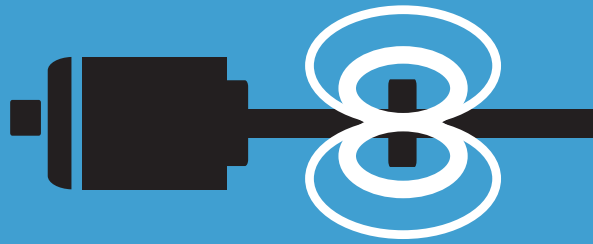
Please order separately:
Plug connectors, see page 252



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



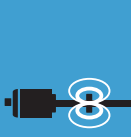
Micropulse Transducers

Rod

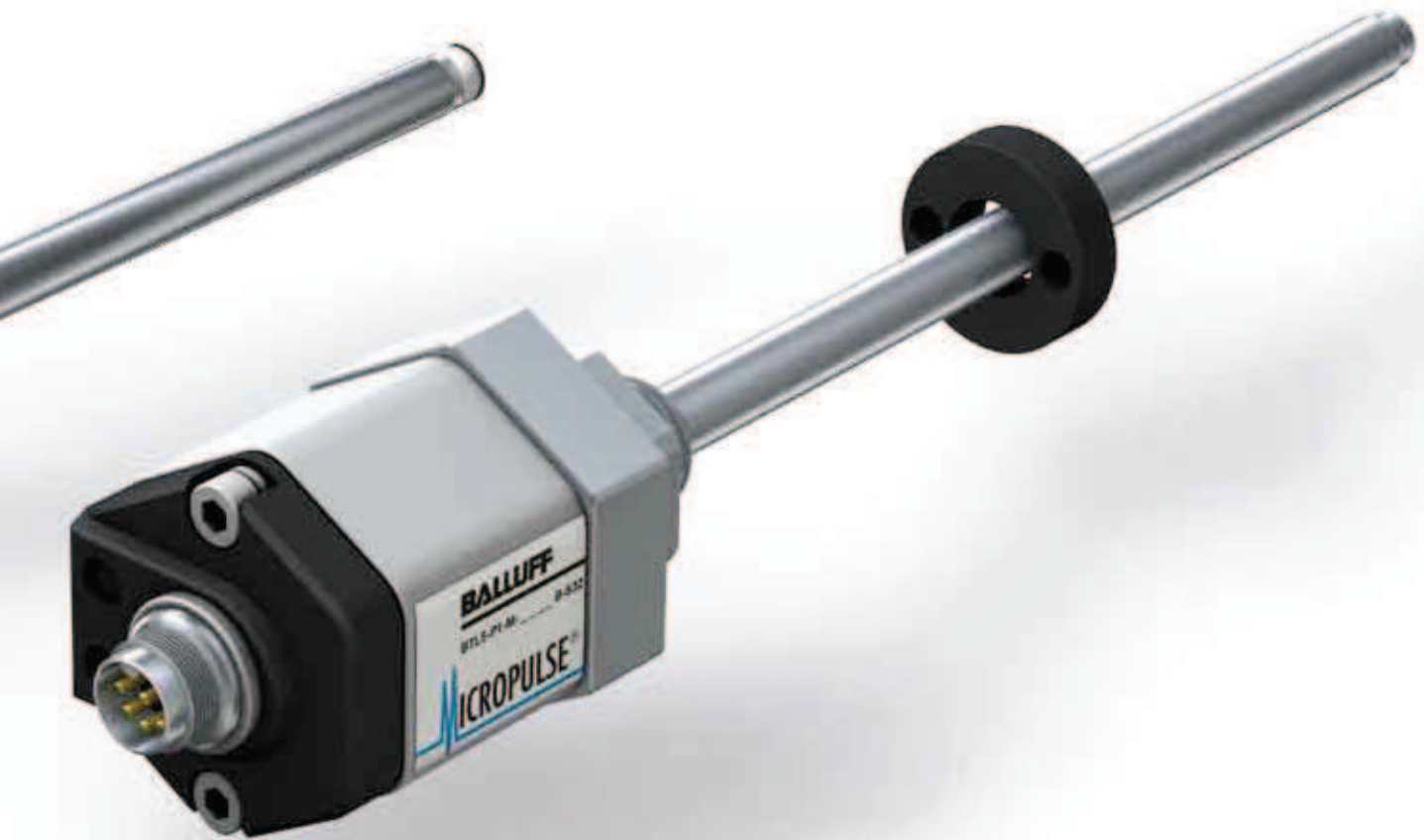
Rod housings are mainly used in hydraulic drive applications. When installed in the pressure section of the hydraulic cylinder, the displacement sensor requires the same pressure rating as the actual hydraulic cylinder. In practice, the sensor must be able to withstand pressures up to 1000 bar. The electronics 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 MICROPULSE⁺	
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SSI Interface	162
Programming	164
Digital Pulse Interface	166
BTL5/BTL6	
General Data	168
CANopen Interface	170
Profibus DP Interface	174
Ethernet Interface	176
4 Programmable Switching Points	178
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MICROPULSE[®]

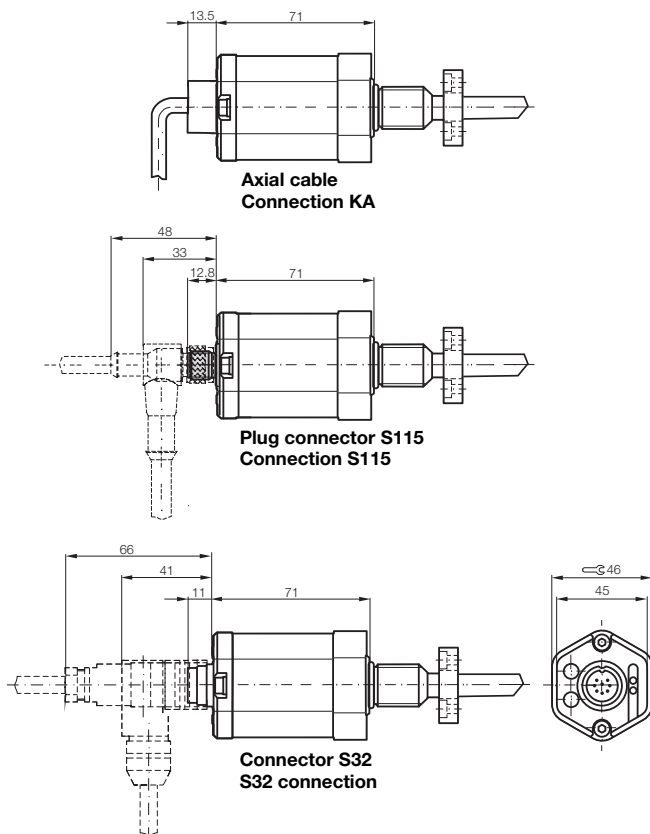


Pressure-resistant to 600 bar, high reproducibility, contactless, robust

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
Overvoltage 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	
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)	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] with an 8 mm protective tube, the max. rated length is 1016 mm	0025...7620 mm in 1-mm increments

Please order separately:
USB communication box, page 164



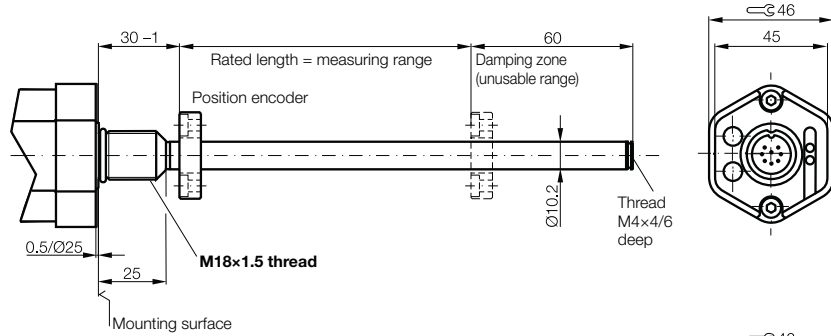
Caution!
Before design, installation and startup please familiarize yourself with the user's guide to be found at www.balluff.com.

Rod BTL7

General data

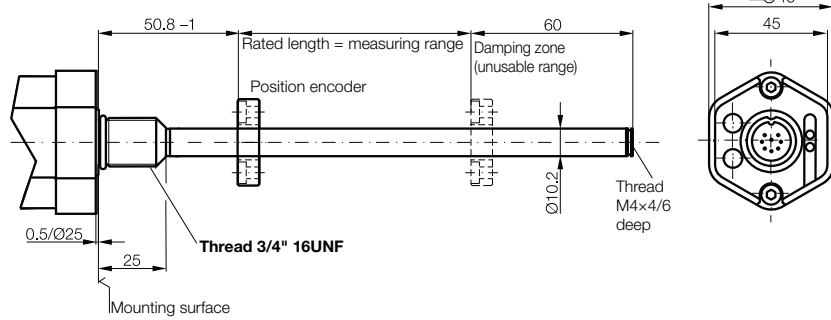
Style B
(standard design)
BTL7 -B-

Metric mounting thread M18x1.5



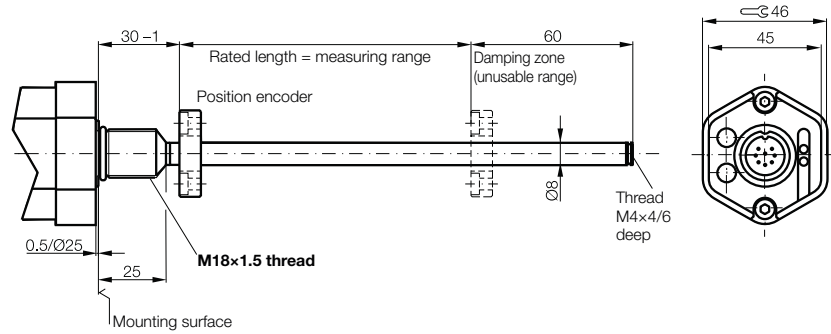
Style Z
BTL7 -Z-

3/4" UNF mounting thread



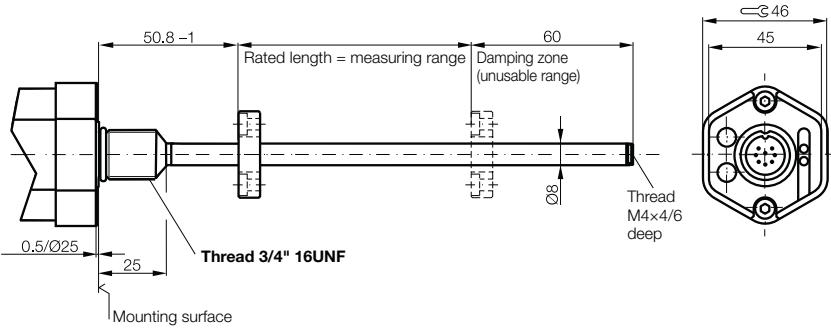
Style B8
BTL7 -B8-

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



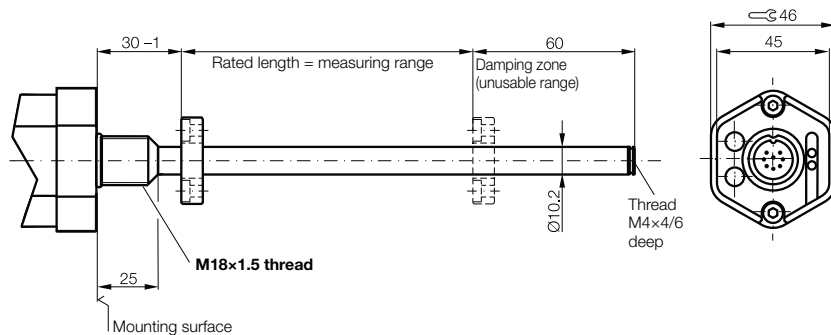
Style Z8
BTL7 -Z8-

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

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

Profibus 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

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

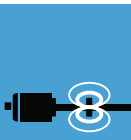
Please order separately:

- 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		
≤ 5 mV _{pp}	≤ 5 mV _{pp}		
≤ 0.33 mV	≤ 0.33 mV	≤ 500 Ω	≤ 500 Ω
≤ 5 μm	≤ 5 μm	≤ 0.66 μA	≤ 0.66 μA
System resolution/min. 2 μm	System resolution/min. 2 μm	≤ 5 μm	≤ 5 μm
Max. 4 kHz	Max. 4 kHz	System resolution/min. 2 μm	System resolution/min. 2 μm
±50 μm to ≤ 500 mm rated length	±50 μm to ≤ 500 mm rated length	Max. 4 kHz	Max. 4 kHz
±0.01% 501...5500 mm rated length	±0.01% 501...5500 mm rated length	±50 μm to ≤ 500 mm rated length	±50 μm to ≤ 500 mm rated length
±0.02% FS > 5500 mm rated length	±0.02% FS > 5500 mm rated length	±0.01% 501...5500 mm rated length	±0.01% 501...5500 mm rated length
≤ 30 ppm/K	≤ 30 ppm/K	±0.02% FS > 5500 mm rated length	±0.02% FS > 5500 mm rated length
20...28 V DC	20...28 V DC	≤ 30 ppm/K	≤ 30 ppm/K
≤ 150 mA	≤ 150 mA	20...28 V DC	20...28 V DC
yes	yes	≤ 150 mA	≤ 150 mA
yes	yes	yes	yes
500 V AC (GND to housing)	500 V AC (GND to housing)	yes	yes
-40...+85 °C	-40...+85 °C	500 V AC (GND to housing)	500 V AC (GND to housing)
		-40...+85 °C	-40...+85 °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

Profibus DP Interface

Ethernet Interface

4 Programmable Switching Points

Installation Notices

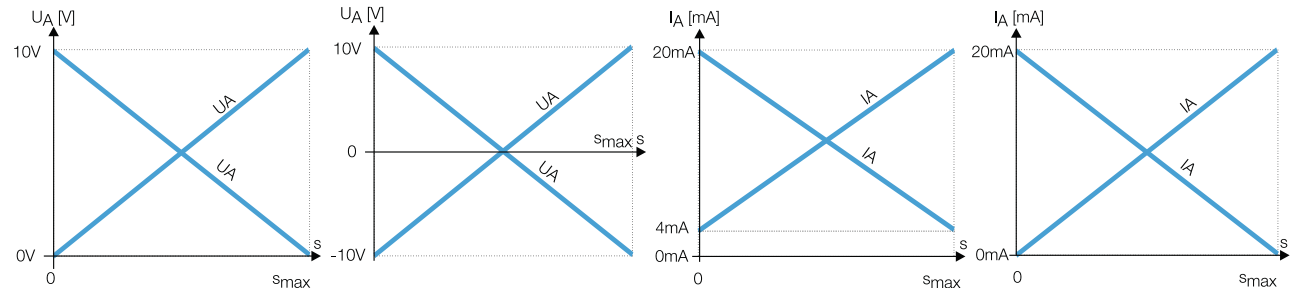
Rod Compact and Rod AR

Rod EX, T Redundant and CD

Filling Level Sensor SF

Accessories

Basic Information and Definitions



Ordering example:

BTL7 - **0 - M**

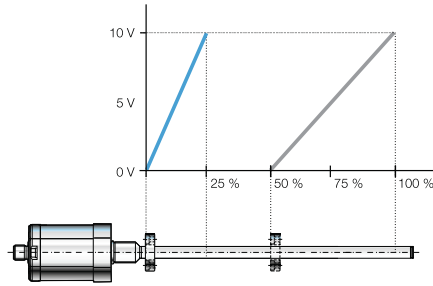
	Output signal	Operating voltage	Characteristic	Standard Rated length [mm]	Design	Connection
A	0...10 V and 10...0 V	1 24 V 5 10-30 V	1 rising and falling (with A and G)	0025...7620 in 1-mm increments	B Standard M18×1.5 For additional designs, see page 153	S32 Connectors S115 Connectors KA02 PUR cable 2 m KA05 PUR cable 5 m KA10 PUR cable 10 m KA15 PUR cable 15 m
G	-10...10 V and 10...-10 V		0 rising (at 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					

Position and velocity

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

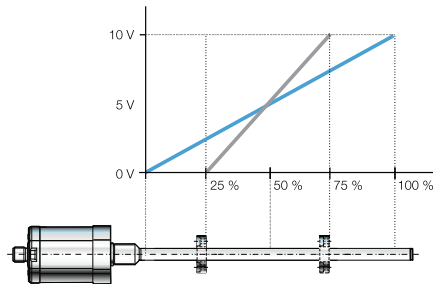
Mode examples:

Double position encoder



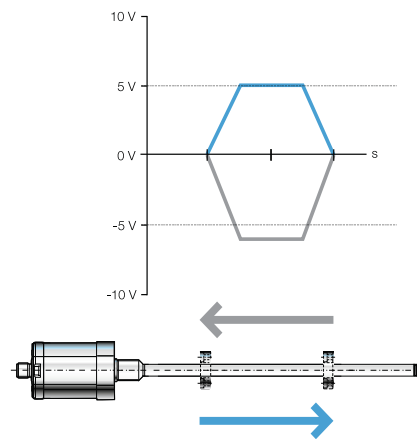
2 encoders, 2 movements, 2 output signals

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

Profibus DP Interface

Ethernet Interface

4 Programmable Switching Points

Installation Notices

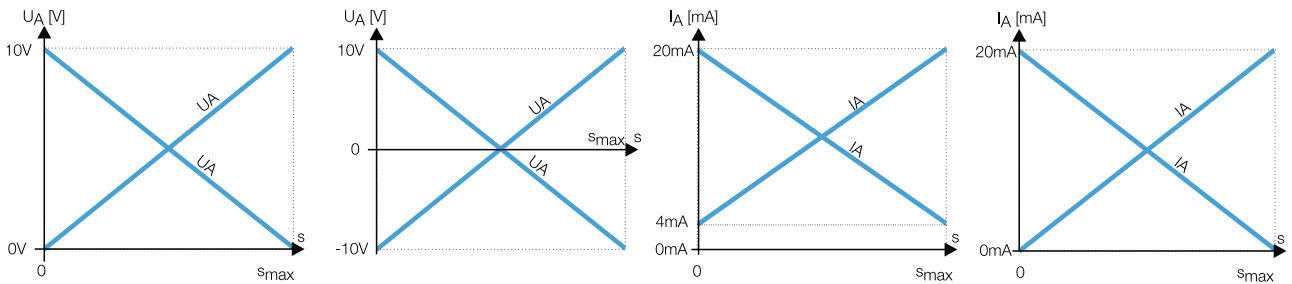
Rod Compact and Rod AR

Rod EX, T Redundant and CD

Filling Level Sensor SF

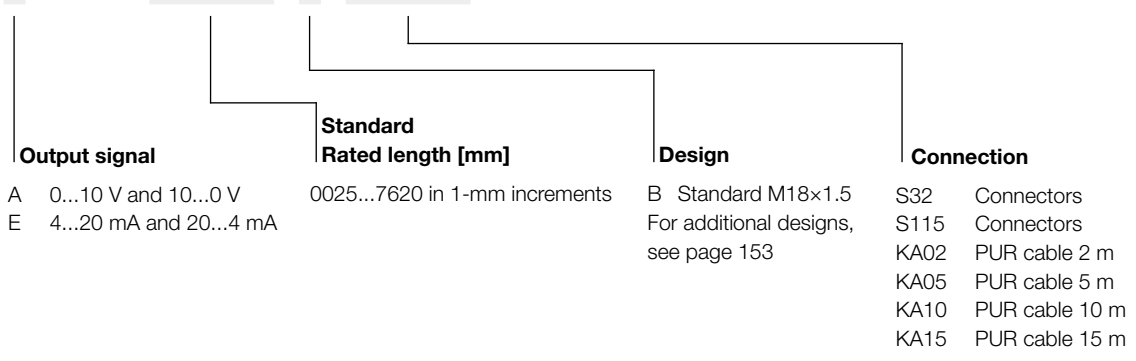
Accessories

Basic Information and Definitions



Ordering example:

BTL7 - 501 - M -----



Setting options for the start and end point

	BTL7 Standard	BTL7-A/E501... Micropulse ⁺ USB configurable
1. Calibration device	■	■
Teach-in	■	
Adjusting	■	
Online setting	■	
Easy Setup		■
2. Remote setup, calibration box	■	
3. USB configuration		■

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

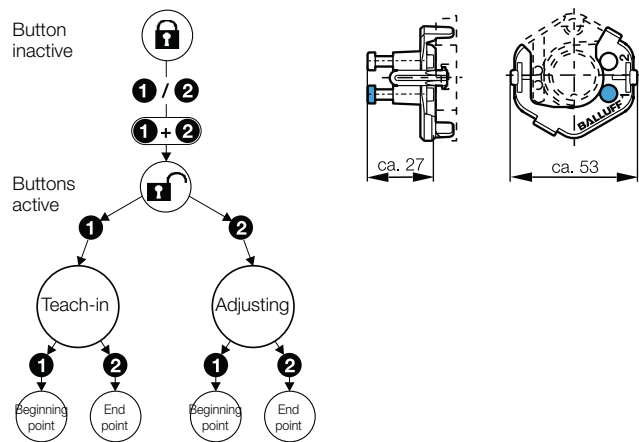
This programming function allows you to set the start and end point while in run mode, such as in a closed loop configuration. No error value is output during the setup procedure. The calibration range is limited to ±25%.

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.

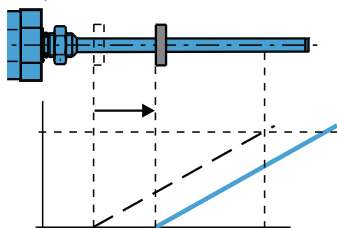
Set start and end points using the BTL7-A/EH01 calibration device, included in the scope of delivery.



Procedure for teach-in, rising signal

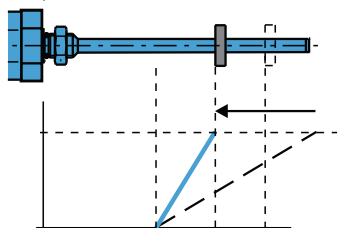


1. Move the position encoder into the new zero position.



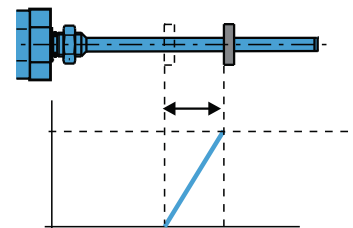
Take over new zero value

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



Take over new end value

3. Newly set measurement path

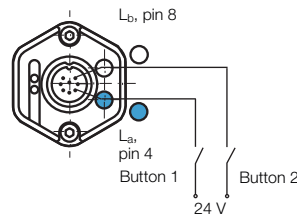


Selecting the calibration procedure BTL7 Standard

2. Remote setup

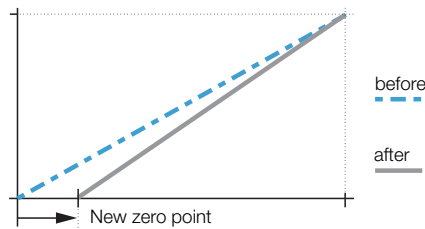
Setting the start and end points using programming inputs

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.



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



Micropulse Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod BTL7

General Data

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Programming

SSI Interface

Digital Pulse Interface

Rod BTL5/BTL6

General Data

CANopen Interface

Profibus DP Interface

Ethernet Interface

4 Programmable Switching Points

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Rod Compact and Rod AR

Rod EX, T Redundant and CD

Filling Level Sensor SF

Accessories

Basic Information and Definitions

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

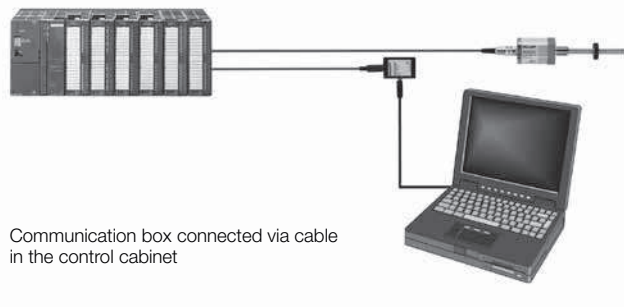
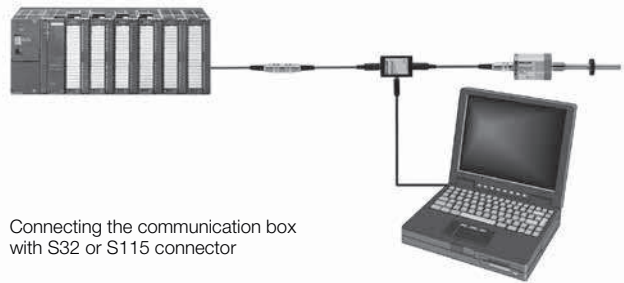
Scope of delivery

- 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

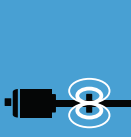
System requirements

- Standard PC
- Operating system: Windows 2000/XP/Vista/7
- Screen resolution at least 1024 × 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

Profile P

Profile PF

Profile AT

Profile BIW

Rod BTL7

General
Data

Analog
Interface

Programming

SSI Interface

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Interface

Rod BTL5/BTL6

General
Data

CANopen
Interface

Profibus DP
Interface

Ethernet
Interface

4 Programmable
Switching Points

Installation
Notices

Rod Compact
and Rod AR

Rod EX,
T Redundant
and CD

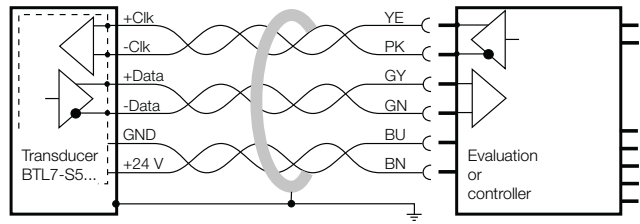
Filling Level
Sensor SF

Accessories

Basic
Information and
Definitions

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.



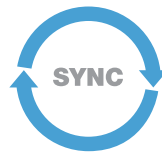
BTL7-S5... with evaluation/controller, connection example

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.



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

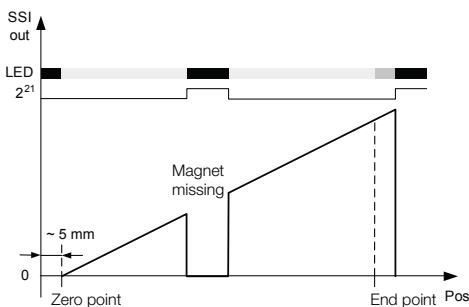
SSI interface Micropulse Plus for synchronous operation
BTL7-S510B-M_-B-

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

The clock frequency depends on the cable length.

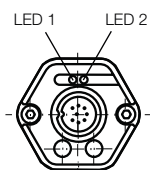
Cable length	Clock frequency
< 20 m	< 1000 kHz
< 50 m	< 600 kHz
< 100 m	< 330 kHz
< 200 m	< 180 kHz
< 400 m	< 90 kHz

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



Behavior of LED 1 and error value BTL 5 µm

LED indicator



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)-...

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

System requirements

- Standard PC
- Operating system: Windows 2000/XP/Vista/7
- Screen resolution at least 1024 × 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

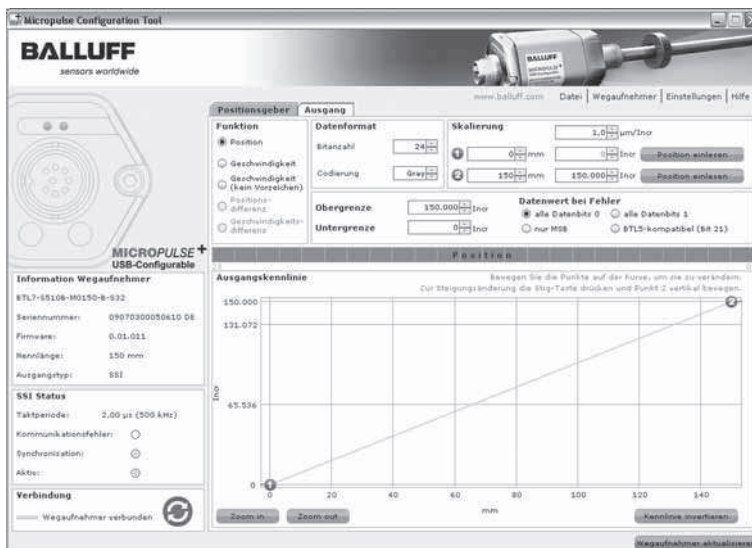
Configuration options of the position measuring system BTL7-S510_-...

- Number of position encoder 1 or 2
- Position
- Velocity
- **Differential position**
- Speed difference

Interface configuration

- Start/end point
- Rising/falling signal
- Error value
- Data format
- Code
- Resolution

The PC software and the corresponding manual are available on the Internet at www.balluff.com/downloads-bt17



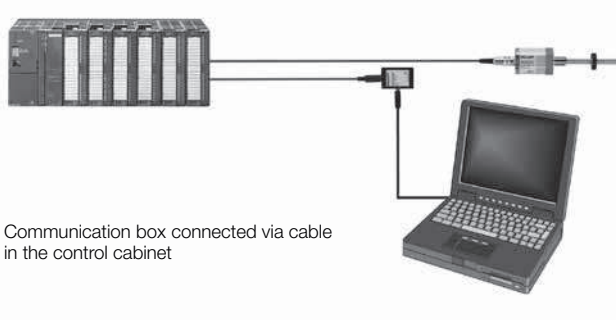
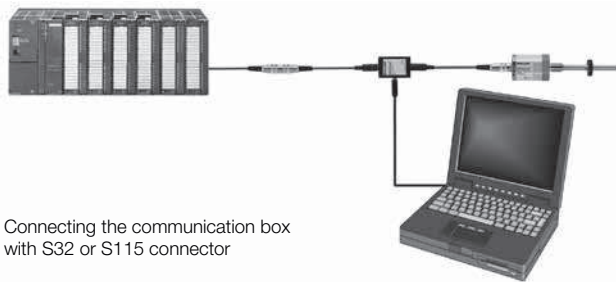
Connecting the USB communication box

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

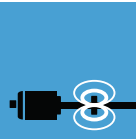
Scope of delivery

- USB communication box
- Cable set
- Quick start instructions



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 BTL7

General

Data

Analog

Interface

Programming

SSI Interface

Digital Pulse

Interface

Rod BTL5/BTL6

General

Data

CANopen

Interface

Profibus 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

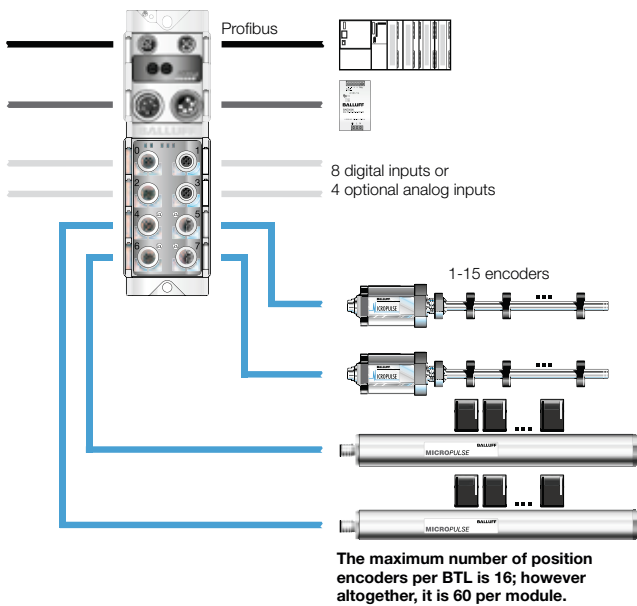
Information and

Definitions

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

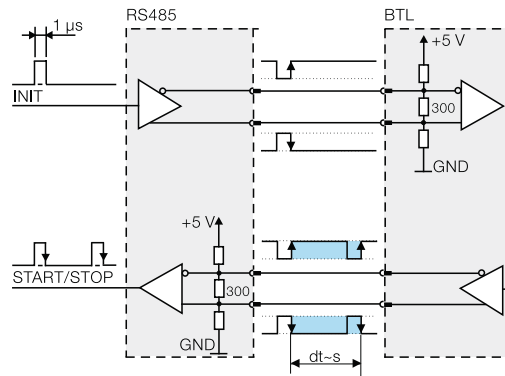


P511 interface – Cost savings using DPI/IP for start-up and installation

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

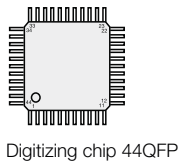
- Bi-directional communication
- Position measurement system controller using Init and start/stop signals
- Integrated diagnostic functions
- Plug and Play
- Automatic configuration – shorter downtimes
- Transmission of sensor type, measuring length, specific parameters
- Measurement length up to 7,620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



Block diagram of P interface

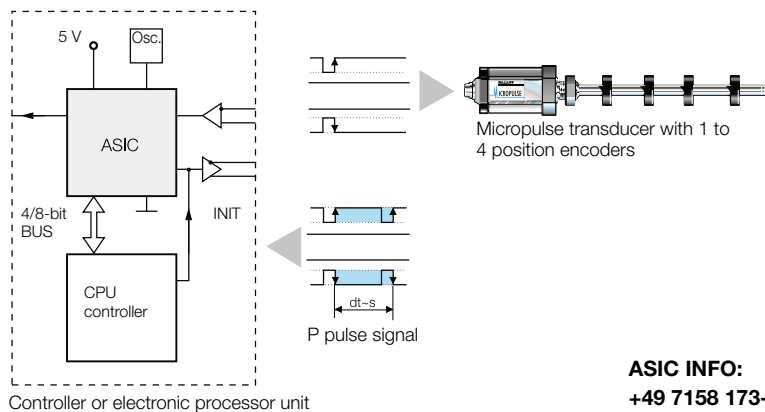
Highly accurate digitalizations of the P511 pulse signal

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.



Benefits

- High position resolution: the actual 1 μm 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



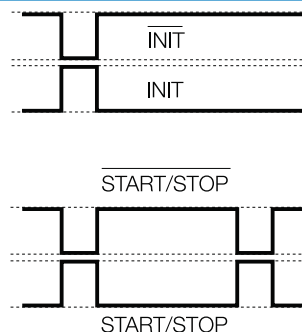
ASIC INFO:
+49 7158 173-370

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 $\mu\text{s}/\text{inch}$
Supply voltage	10...30 V
Current consumption at 24 V	120 mA
Operating temperature	$-40...+85 \text{ }^\circ\text{C}$
Storage temperature	$-40...+100 \text{ }^\circ\text{C}$

The rising and falling edges can be evaluated.



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

Scope of delivery

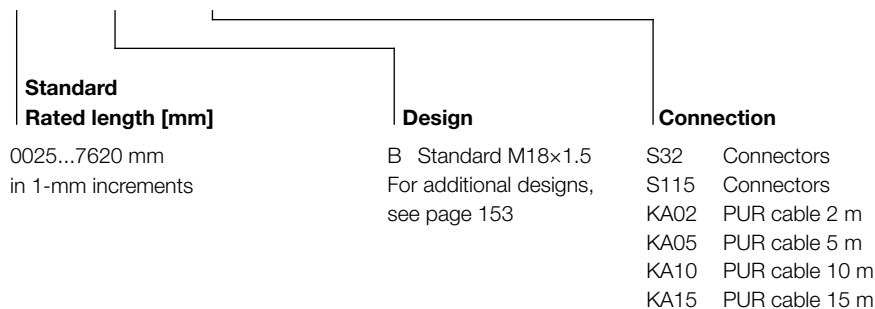
- Transducer
- Quick start instructions

Please order separately:

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

Ordering example:

BTL7 - P 5 1 1 - M _ _ _ _ - - _ _ _ _



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

Profibus 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

Pressure-resistant to 600 bar, high reproducibility, contactless, 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.

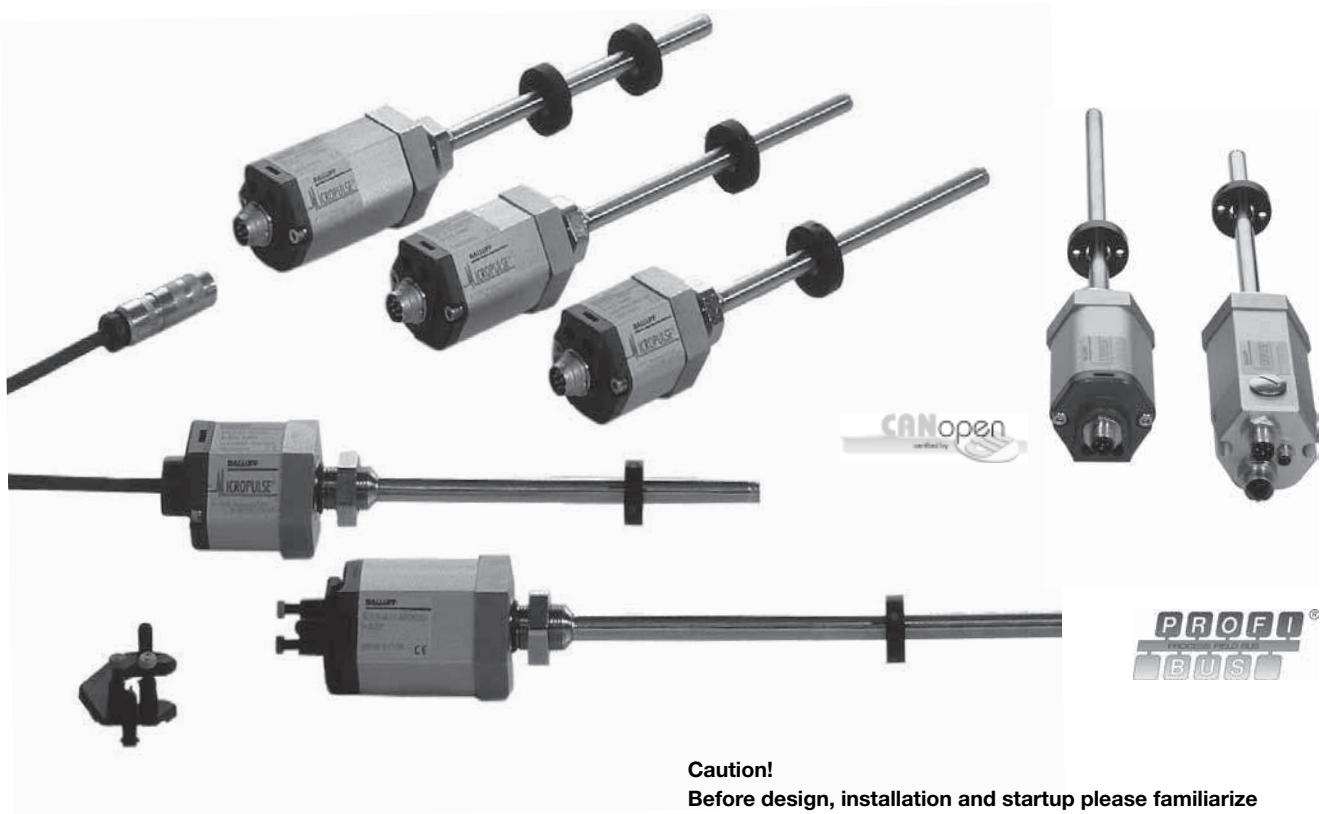
The actual measurement section is protected inside a high-pressure resistant stainless steel tube.

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
Overvoltage protection	TransZorb protection diodes
Dielectric strength	500 V DC (GND to housing)
Degree of protection as per IEC 60529	IP 67 (with IP-67 connector BKS-S... attached)
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	
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	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] with an 8 mm protective tube, the max. rated length is 1016 mm	0025...5500 mm in 1-mm increments, depending on the interface

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



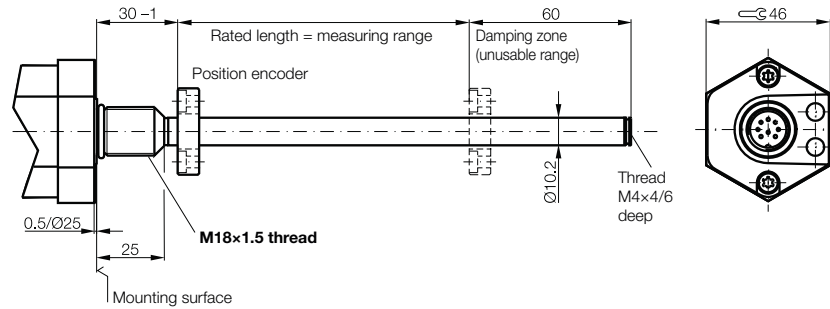
Caution!
 Before design, installation and startup please familiarize yourself with the user's guide to be found at www.balluff.com.

Rod BTL5

General data

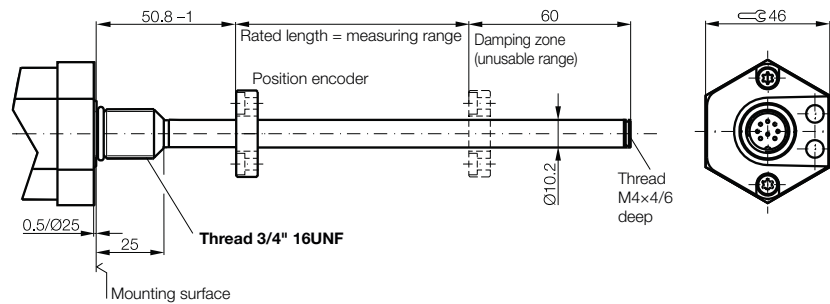
Style B
(standard design)
BTL5-____-B-____

Metric
mounting thread M18x1.5



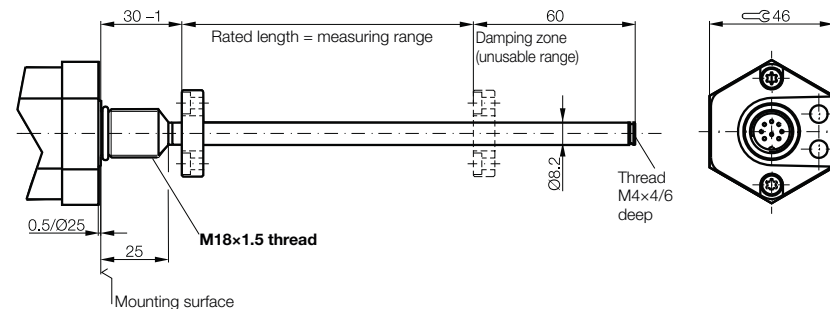
Style Z
BTL5-____-Z-____

3/4" UNF mounting thread



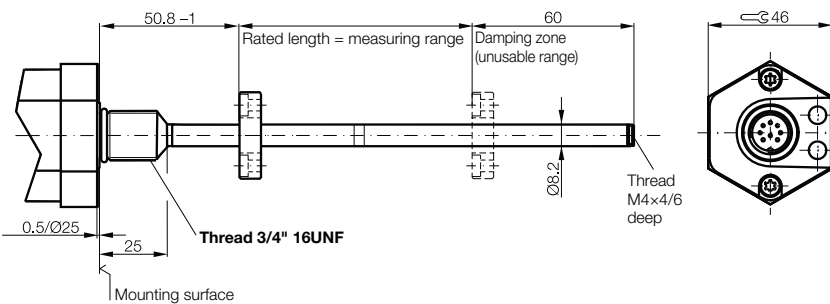
Style B8
BTL5-____-B8-____

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



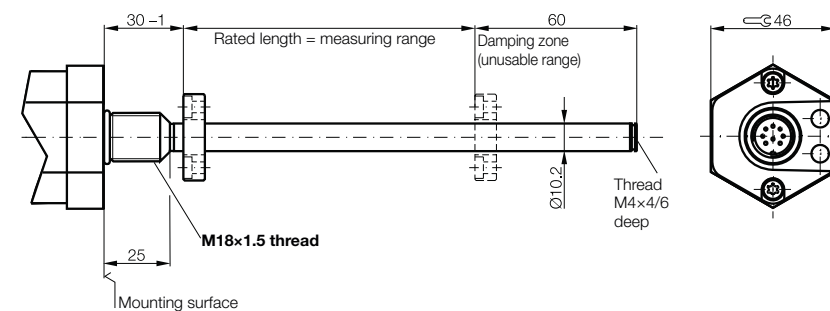
Style Z8
BTL5-____-Z8-____

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



Style A
BTL5-____-A-____

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



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

Profibus 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

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.



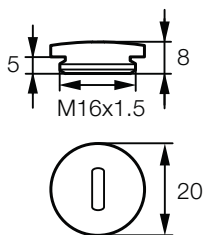
CiA 199911-301v30/11-009

Use of multiple position encoders

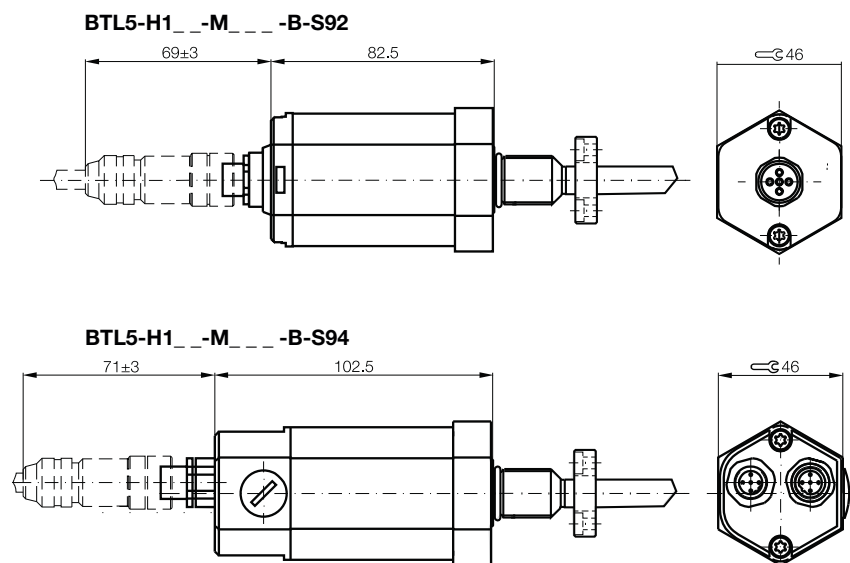
The minimum distance between the position encoders must be 65 mm.

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**



Node ID can be set by DIP switch

Rod BTL5

CANopen interface

Series	BTL5 rod								
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 kHz								
Max. linearity deviation	±30 µm at 5 µm resolution								
Temperature coefficient of overall system	(6 µm + 5 ppm × L)/°C								
Supply voltage	20...28 V DC								
Current consumption	≤ 100 mA								
Operating temperature	-40...+85 °C								
Storage temperature	-40...+100 °C								
Cable length [m] per CiA DS301	< 25	< 50	< 100	< 250	< 500	< 1000	< 1250	< 2500	
Baud rate [kbaud] per CiA DS301	1000	800	500	250	125	100	50	20/10	

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

Scope of delivery

- Transducer
- Quick start instructions

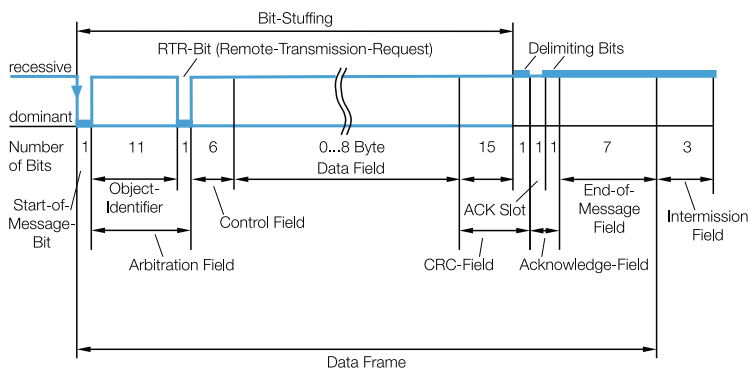
Please order separately:
 Position encoders, see page 218
 Floats, see page 216
 Fastening nut, see page 219
 Plug connectors, see page 252

Ordering example:

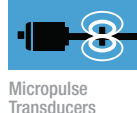
BTL5-H1 - **M** - - **S92**

BTL5-H1 - **M** - - **S94**

Software configuration	Baud rate	Standard Rated length [mm]	Design
1 1 × position and 1 × velocity	0 1 Mbaud	0025...4000 mm in 1-mm increments	B Standard M18×1.5 For additional designs, see page 169
2 2 × position and 2 × velocity	1 800 kbaud		
3 4 × position	2 500 kbaud		
	3 250 kbaud		
	4 125 kbaud		
	5 100 kbaud		
	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.



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

Profibus 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

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

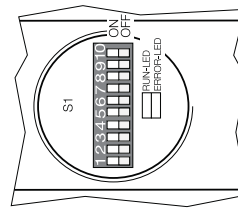
The number of encoders can be preset to 1-4 via CANopen. The transducer is preset to operate with an encoder on delivery. The minimum distance between the position encoders must be 65 mm.

Setting the node ID

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

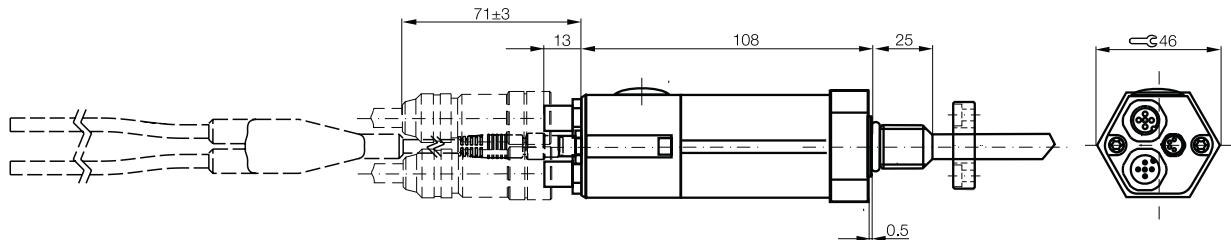


CiA 199911-301v30/11-009

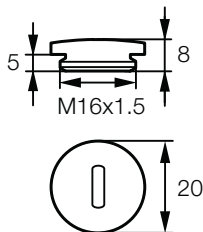


Top view of DIP switch S1

BTL5-H1_-M____-C001



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 _ _ -M _ _ _ _ - _ _ _ _								
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

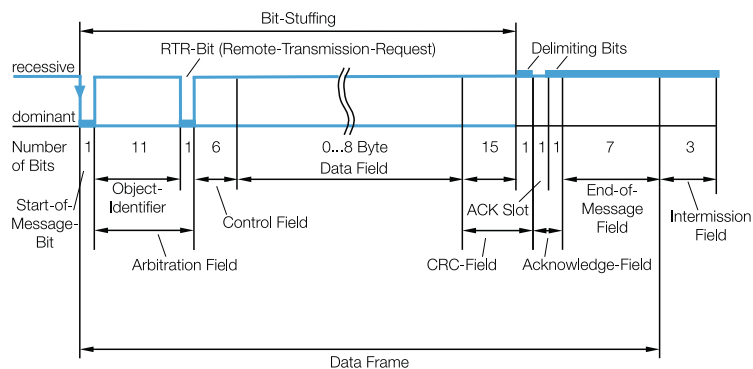
- Transducer
- Quick start instructions

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.



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

Profibus 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

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 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. 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

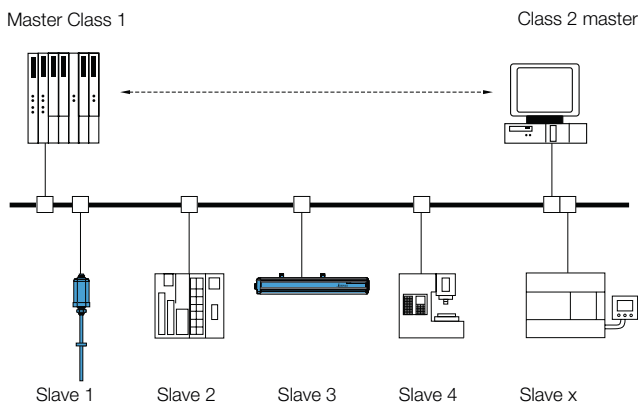
Isochronous mode enables quick and deterministic data exchange by means of clock synchronicity on the bus system. A cyclical, equidistant clock signal is sent by the master to all bus nodes. This signal allows master and slaves to be synchronized irrespective of application – with an accuracy < 1 µs.

FMM

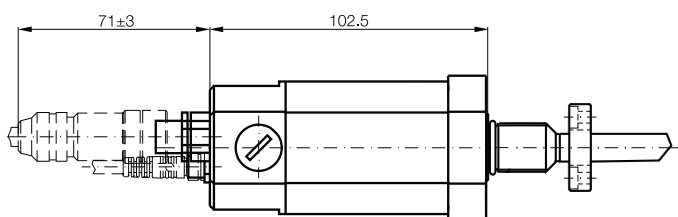
The sensor can be operated as a 4-magnet type, whereby the sensor itself recognizes how many magnets are currently active. So if only two magnets are positioned in the measuring range, a valid value is output for the first two positions and a defined error value for positions 3 and 4.

Inside temperature monitoring

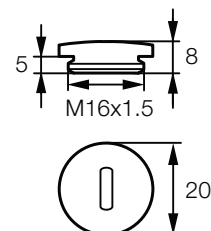
A built-in temperature sensor enables monitoring of the inside temperature in the electronic head. The temperature can be queried via the bus protocol.



Device address can be set by DIP switch



The address can be set by the DIP switch.

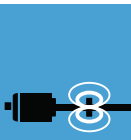


Transparent cover **BKS 16-CS-00**
Ordering code: **BAM0116**

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



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

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

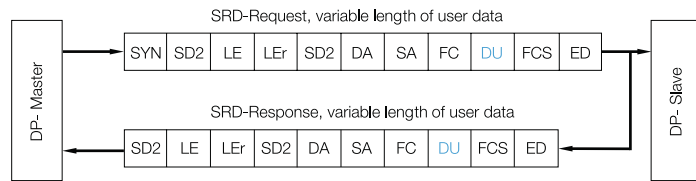
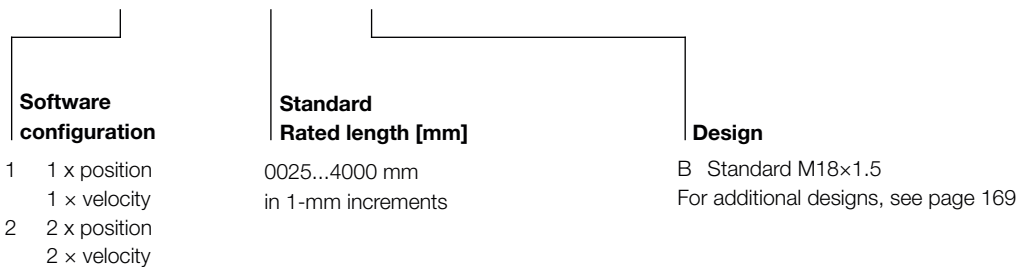
Scope of delivery

- 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:

BTL5-T1_0-M_ _ _ _ - _ -S103



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.

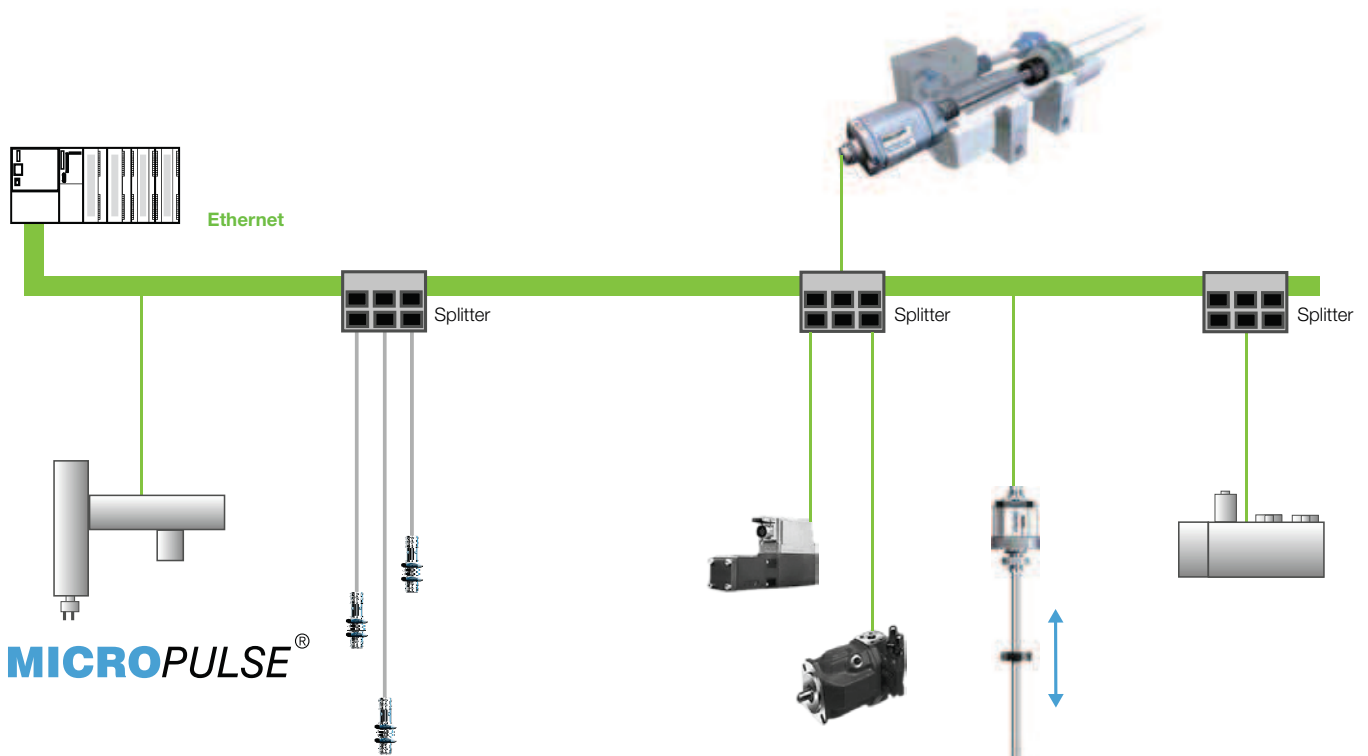
Features

- 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	≤ 15 μm	≤ 10 μm
Repeat accuracy	≤ 20 μm	≤ 30 μm
Measurement rate	$f_{\text{STANDARD}} = 1 \text{ kHz} (< 850 \text{ mm})$	$f_{\text{STANDARD}} = 1 \text{ kHz} (< 850 \text{ mm})$
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

Profile BIW

Rod BTL7

General Data

Analog Interface

Programming

SSI Interface

Digital Pulse Interface

Rod BTL5/BTL6

General Data

General Data

CANopen Interface

Profibus DP Interface

Ethernet Interface

4 Programmable Switching Points

Installation Notices

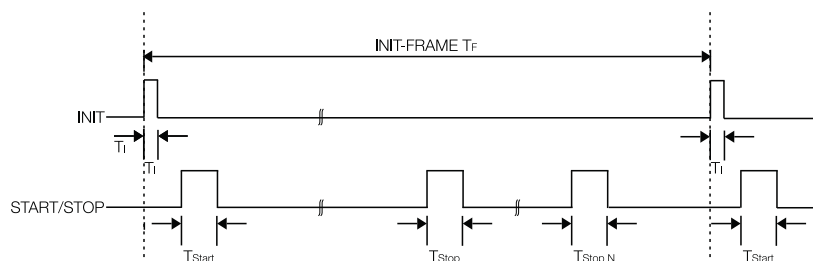
Rod Compact and Rod AR

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.

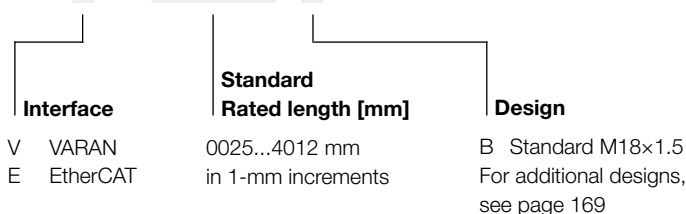
Scope of delivery

- 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

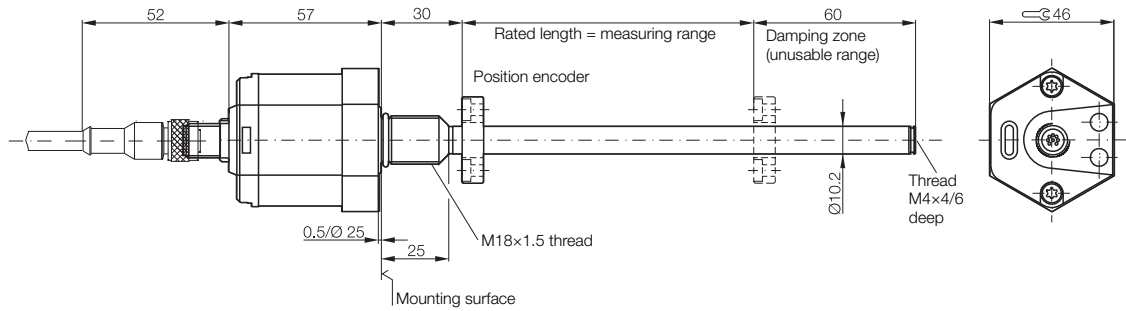
Ordering example:

BTL6-V11 - M - - S115



Rod BTL5
4 programmable switching points

simple switching

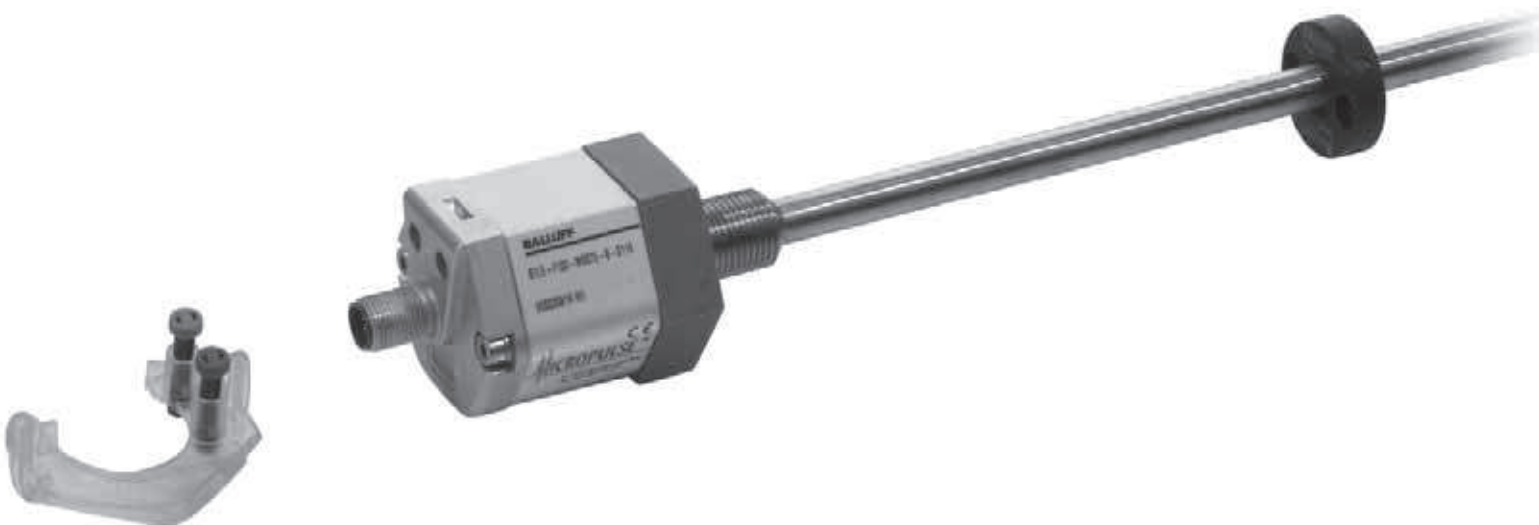
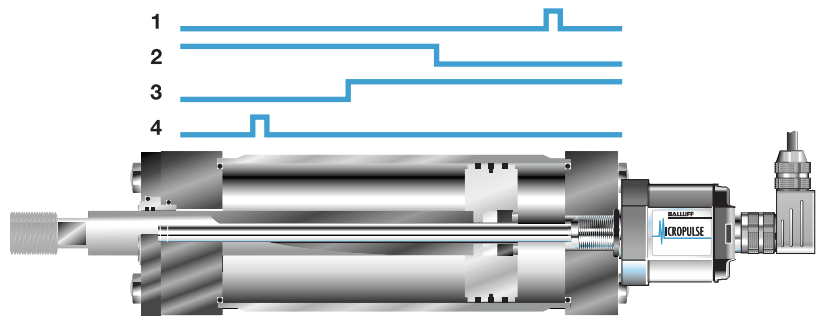
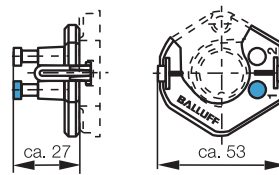


Single position measurement between the piston limits on a standard cylinder series

BTL5-A-EH01 calibration device for programming the outputs

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



Rod BTL5

4 programmable switching points

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



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

Profibus DP Interface

Ethernet Interface

4 Programmable Switching Points

Installation Notices

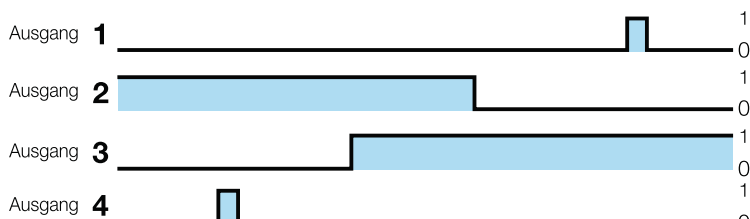
Rod Compact and Rod AR

Rod EX, T Redundant and CD

Filling Level Sensor SF

Accessories

Basic Information and Definitions



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

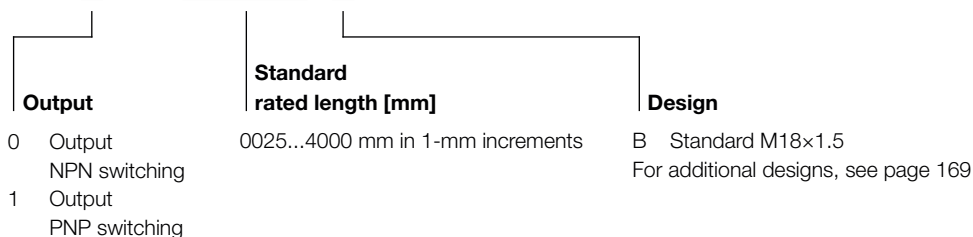
Scope of delivery

- 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



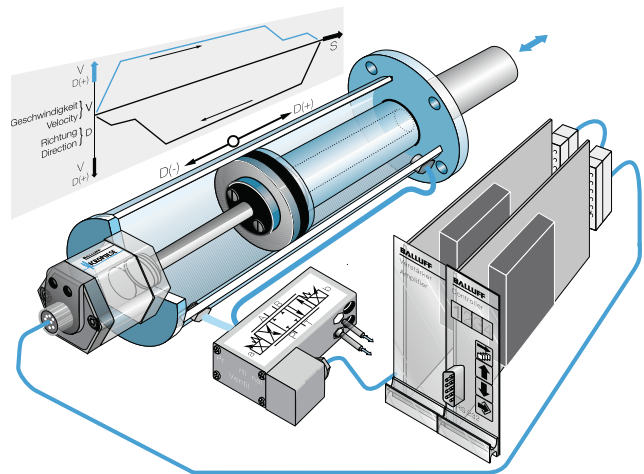
Rod BTL5

Installation notices

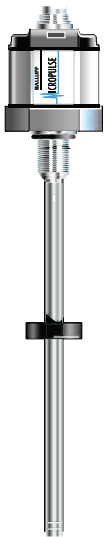
SSI-SYNC – better control behavior and higher dynamics

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.

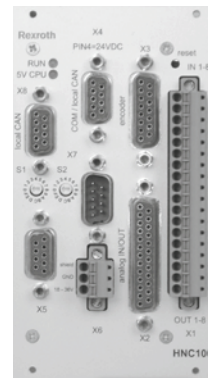
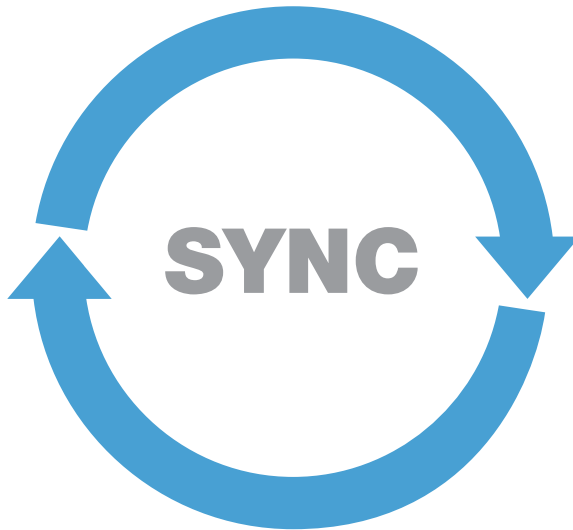
The feedback of these status sizes (speed and acceleration) allows the damping and natural frequency of a hydraulic system to be increased. These measures permit greater loop gain and with it, better control behavior and higher dynamics.



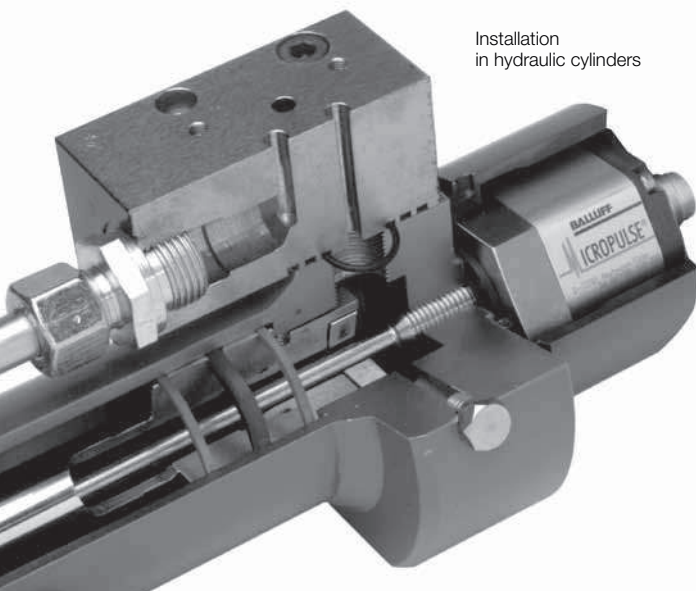
Application with hydraulic cylinder in a control loop



BTL7 Micropulse Transducer S1_ _



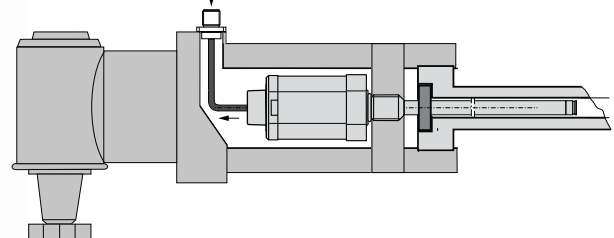
Control card with SSI interface for connecting Micropulse transducers



Installation in hydraulic cylinders

"Pigtail" connector systems

see starting page 265



Caution!

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

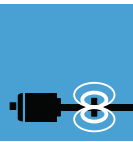
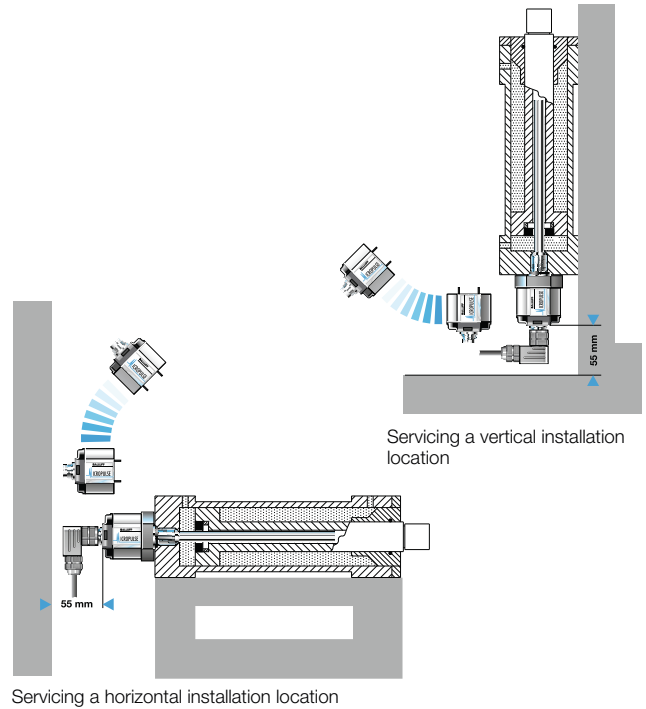
Rod BTL5

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.



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

Profibus 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

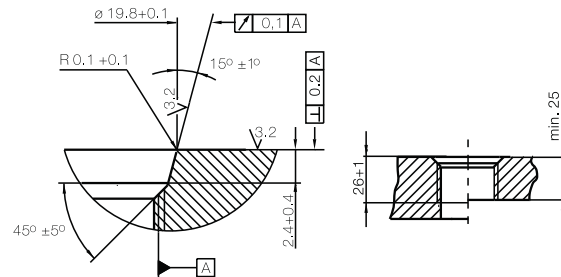
Basic Information and Definitions

Installation

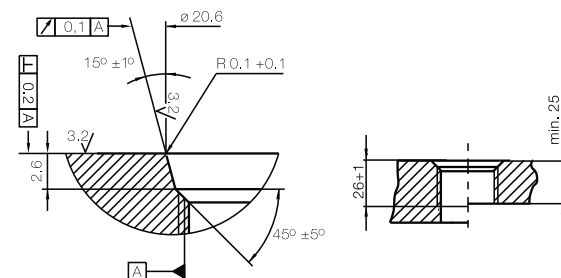
The Micropulse transducer BTL has a mounting thread M18×1.5. We recommend that the mounting is made of non-magnetizable material. If magnetizable materials are used, then the measures shown below have to be taken. Sealing is done at the flange mounting surface, for example, in the B design, with a M18×1.5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

Tapped hole

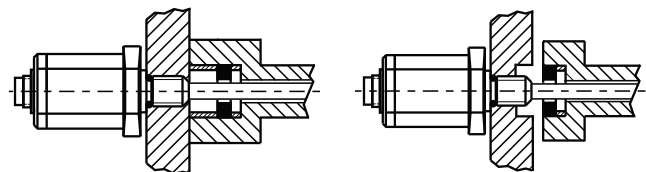
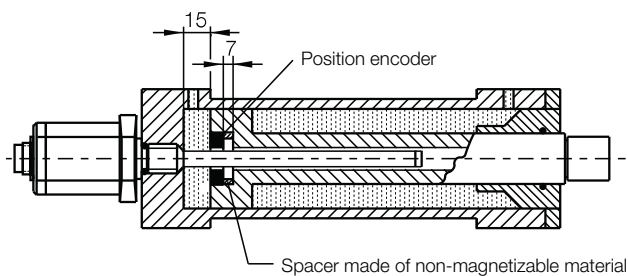
The transducer comes with an M18×1.5 (according to ISO) or a 3/4"-16 UNF (according to SAE) thread to secure it. Depending on the version, the hole must be tapped before installation.

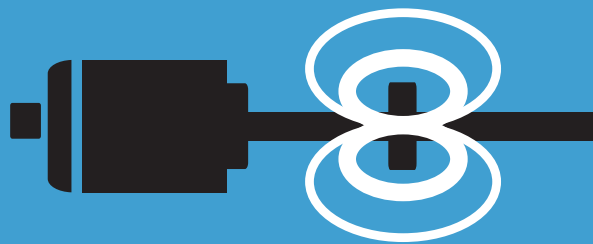


Tapped hole M18×1.5, as per ISO 6149, O-ring 15.4×2.1



Tapped hole 3/4"-16 UNF according to SAE J475, 15.3×2.4 O-ring

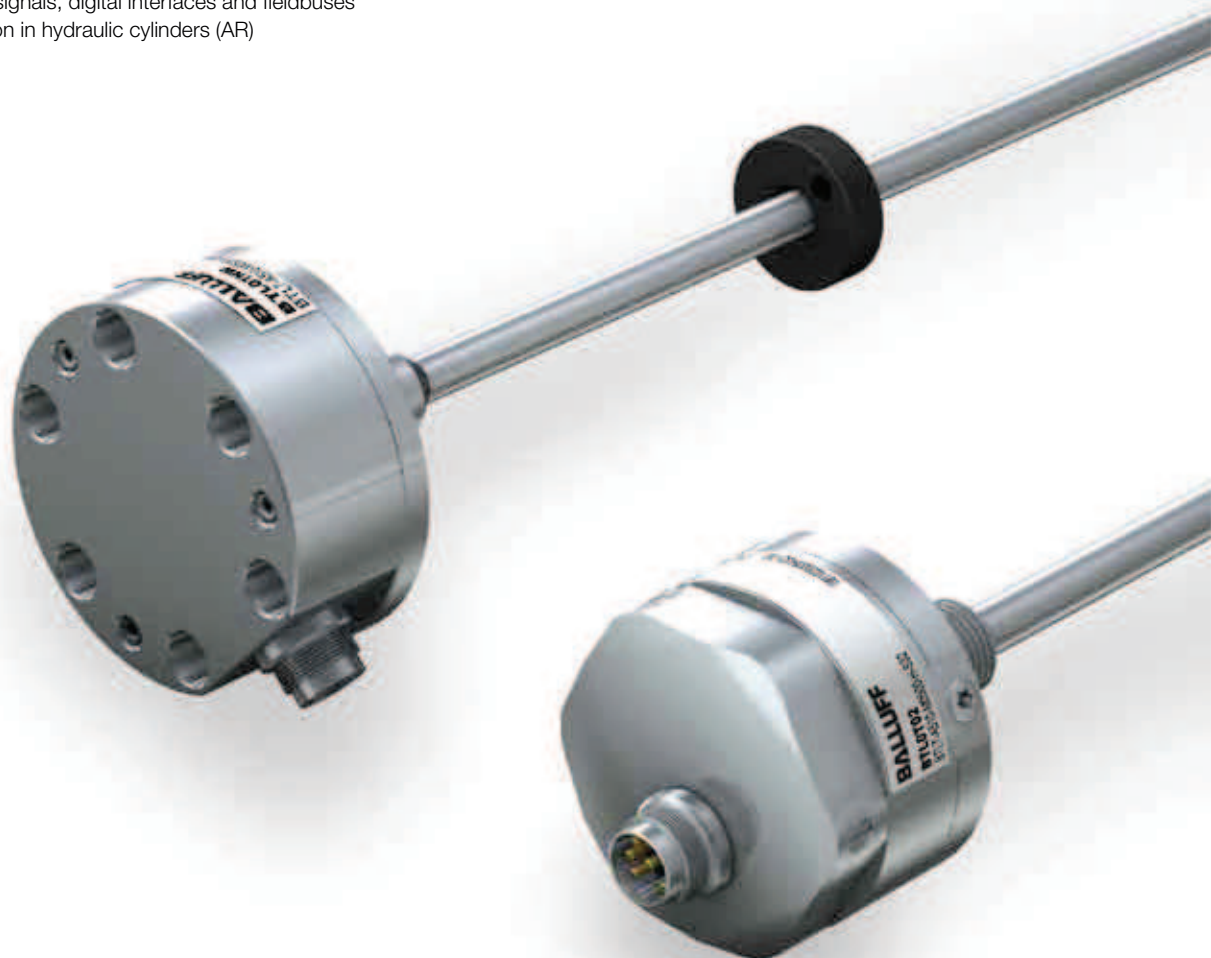




Micropulse Transducers

Rod Compact and Rod AR

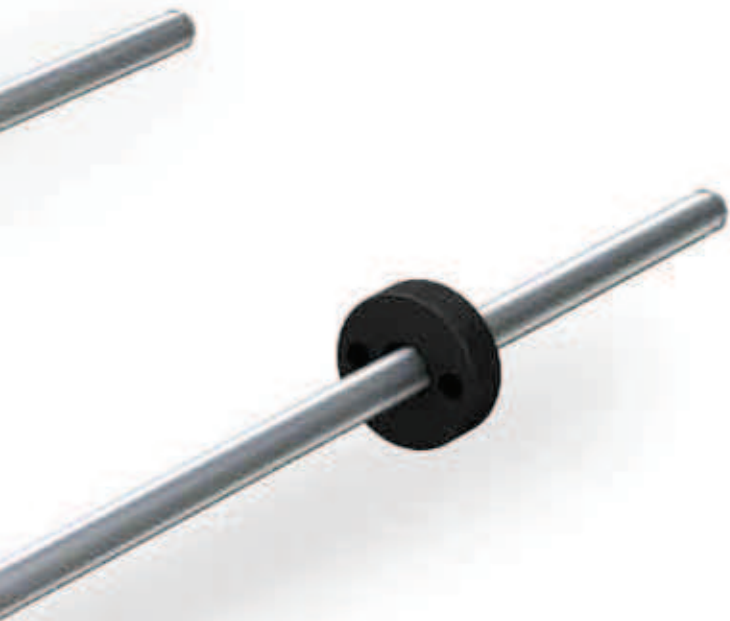
- Compact housing with only 34 mm in length saves valuable space in and around the cylinder.
- Stainless steel housing with connecting flange and robust 6-screw fastening (K) – no additional protective housing is needed
- Simple characteristic settings
- shock and vibration-resistant with IP 67/68 degree 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
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SSI Interface	202
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Rod AR BTL6	
General Data	208
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Installation Notices	214
Floats	216
Position Encoders	218

MICROPULSE[®]



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

The Micropulse Transducer BTL is a robust position measuring system for measuring ranges between 25 and 7620 mm under extreme ambient conditions.

The actual measurement section is protected inside a high-pressure resistant stainless steel tube. The system is ideal for use in hydraulic cylinders for position feedback or as a level monitor with aggressive media in the food and chemical industries.

Series	Rod Compact K BTL7
Shock load	150 g/6 ms as per EN 60068-2-27
Vibration	20 g, 10...2000 Hz per EN 60068-2-6
Polarity reversal protected	to 36 V
Overvoltage protection	to 36 V
Dielectric strength	500 V AC (GND to housing)
Degree of protection as per IEC 60529	IP 68 with cable outlet, IP 67 with screwed-on plug connector BKS-S...
Housing material	Anodized aluminum/1.4571 stainless steel protective tube, 1.3952 stainless steel cast flange
Fastener	Design K, 18h6 with 6 cylinder head screws
Pressure rating	
with 10.2 mm protective tube	600 bar with installation in hydraulic cylinder
with 8 mm protective tube	250 bar installed in hydraulic cylinder
Connection	Plug connector or cable connection
EMC testing	
Radio interference emission	EN 55016-2-3 (industrial and residential area)
Static electricity (ESD)	EN 61000-4-2 Severity level 3
Electromagnetic fields (RFI)	EN 61000-4-3 Severity level 3
Electrical fast transient bursts (BURST)	EN 61000-4-4 Severity level 3
Surge voltage	EN 61000-4-5 Severity level 2
Conducted interference induced by high-frequency fields	EN 61000-4-6 Severity level 3
Magnetic fields	EN 61000-4-8 Severity level 4
Standard nominal strokes [mm] with an 8 mm protective tube, the max. rated length is 1016 mm	0025...7620 mm in 1-mm increments

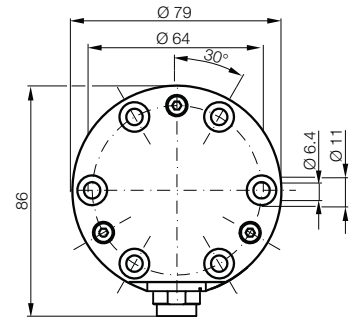
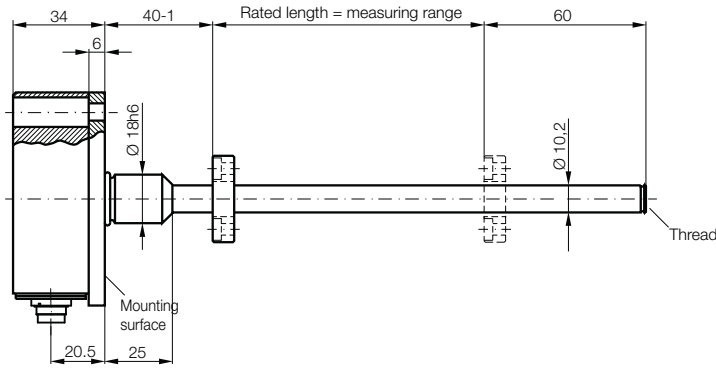


Stainless steel

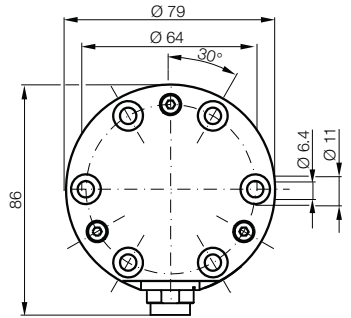
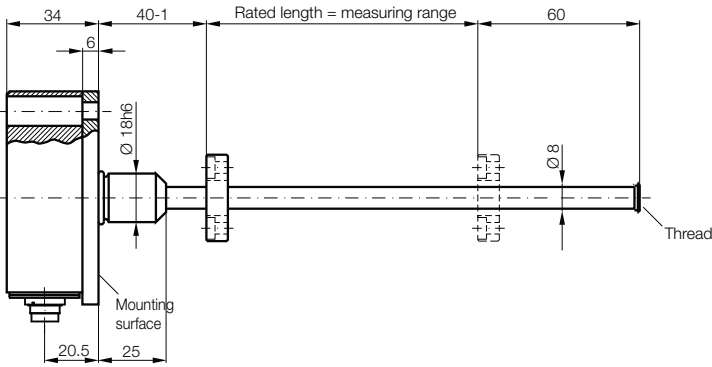
Rod Compact K BTL7

General data

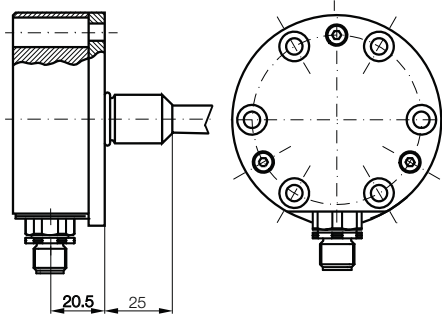
**Design K,
BTL7-...-K-SR32**



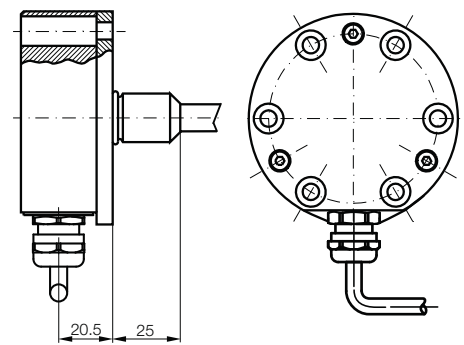
**Design K8,
BTL7-...-K8-SR32**



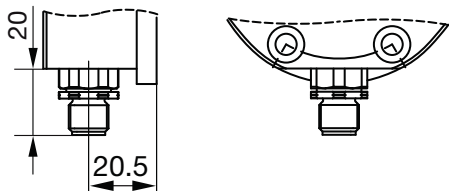
**Design K,
BTL7-...-K-SR115**



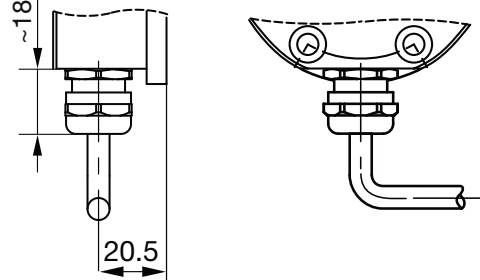
Design K, BTL7-...-K-K __, radial cable outlet



BTL7-...-K-SR115



BTL7-...-K-K __



Caution!

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



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 Compact BTL7 H/W

General data

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

The Micropulse Transducer BTL is a robust position measuring system for measuring ranges between 25 and 7620 mm under extreme ambient conditions.

The actual measurement section is protected inside a high-pressure resistant stainless steel tube. The system is ideal for use in hydraulic cylinders for position feedback or as a level monitor with aggressive media in the food and chemical industries.

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



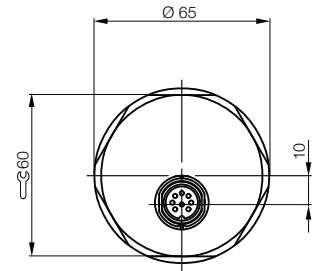
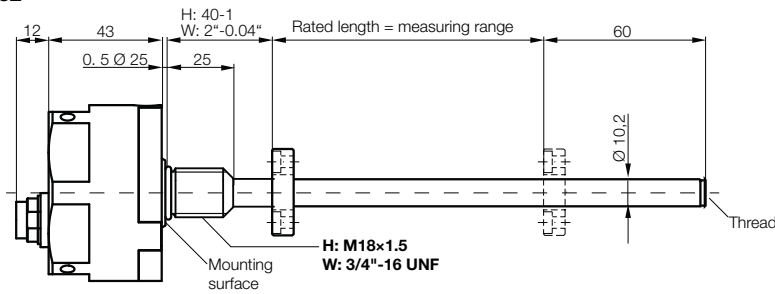
Caution!

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

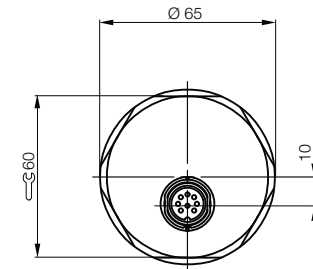
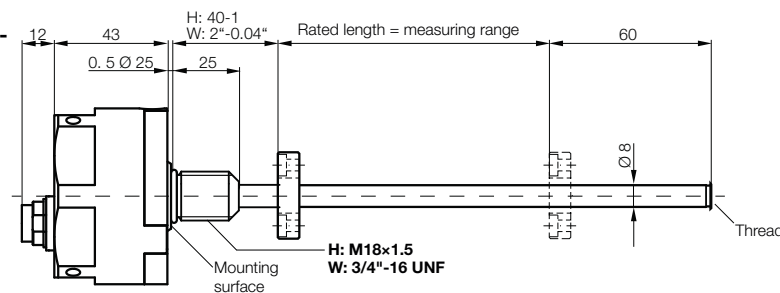
"Long" up to 7620 mm

Rod Compact BTL7 H/W General data

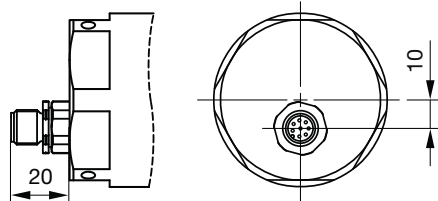
Design H/W, BTL7-...-H/W-S32



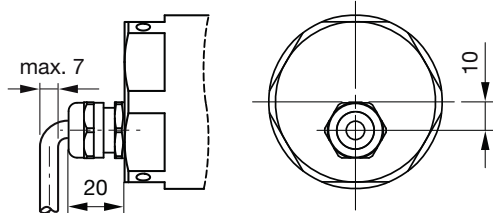
Design H/W, BTL7-...-H8/W8-S32,



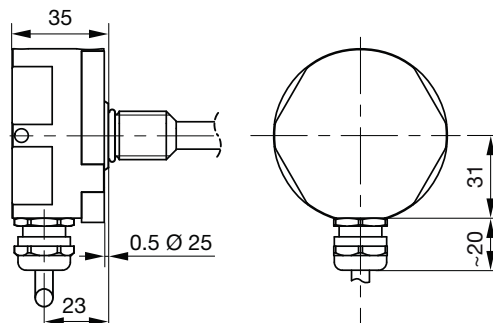
Design H/W, BTL7-...-H/W-S115



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

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

Features of Micropulse BTL7-A/C/E/G...H, K, W

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

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

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

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

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

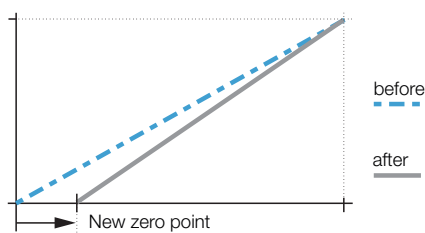
Scope of delivery

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

Please order separately:

Calibration box, see page 190

Position encoders, see page 216



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

Rod Compact BTL7

General data

Rod Compact BTL7	Rod Compact BTL7	Rod Compact BTL7	Rod Compact BTL7
Analogue	Analogue	Analogue	Analogue
A	G	E	C
Analogue	Analogue	Analogue	Analogue
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		
≤ 0.33 mV	≤ 0.33 mV	$\leq 500 \Omega$	$\leq 500 \Omega$
$\leq 0.66 \mu\text{A}$	$\leq 0.66 \mu\text{A}$	$\leq 50 \mu\text{m}$ to ≤ 500 mm rated length	$\leq 50 \mu\text{m}$ to ≤ 500 mm rated length
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
$\pm 0.01\%$ 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
≤ 30 ppm/K	≤ 30 ppm/K	≤ 30 ppm/K	≤ 30 ppm/K
10...30 V DC	10...30 V DC	10...30 V DC	10...30 V DC
≤ 150 mA	≤ 150 mA	≤ 150 mA	≤ 150 mA
to 36 V	to 36 V	to 36 V	to 36 V
to 36 V	to 36 V	to 36 V	to 36 V
500 V AC (GND to housing)	500 V AC (GND to housing)	500 V AC (GND to housing)	500 V AC (GND to housing)
-40...+85 °C	-40...+85 °C	-40...+85 °C	-40...+85 °C



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

Analogue Interface

Digital Pulse Interface

SSI Interface

CANopen Interface

Installation Notices

Installation Notices

Installation Notices

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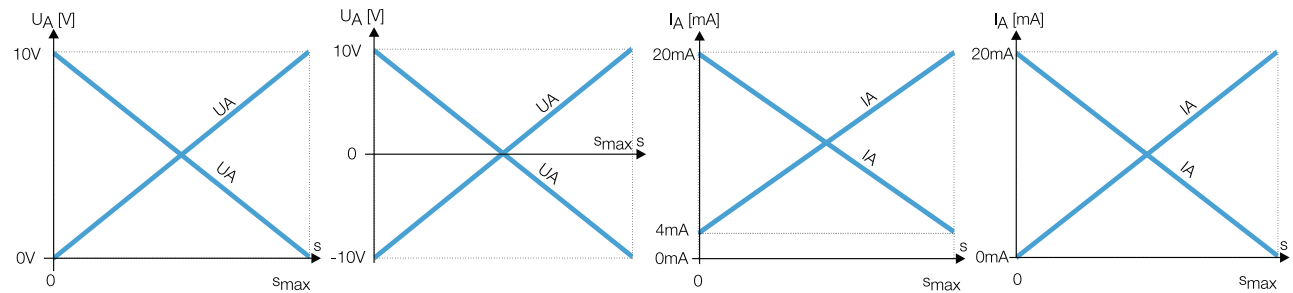
Installation Notices

Installation Notices

Installation Notices

Installation Notices

Installation Notices



Ordering example:

BTL7 - 5 0 - M

Output signal	Characteristic	Standard nominal strokes [mm]	Design	Connection
A 0...10 V and 10...0 V	1 rising and falling (at A and G)	0025...7620 in 1-mm increments	K 10.2 mm protective tube	K-radial design
G -10...10 V and 10...-10 V	0 Rising (for C and E)		K8 8 mm protective tube	K02 PUR cable 2 m
E 4...20 mA or 20...4 mA	7 Falling (for C and E)		H 10.2 mm protective tube	K05 PUR cable 5 m
C 0...20 mA or 20...0 mA			H8 8 mm protective tube	K10 PUR cable 10 m
			W 10.2 mm protective tube	K15 PUR cable 15 m
			W8 8 mm protective tube	SR32 Connectors
				SR115 Connectors
				H/W radial design
				K02 PUR cable 2 m
				K05 PUR cable 5 m
				K10 PUR cable 10 m
				K15 PUR cable 15 m
				H/W design, axial
				KA02 PUR cable 2 m
				KA05 PUR cable 5 m
				KA10 PUR cable 10 m
				KA15 PUR cable 15 m
				S32 Connectors
				S115 Connectors

Rod AR BTL6

General Data

Analogue Interface

Digital Pulse Interface

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Installation Notices

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)

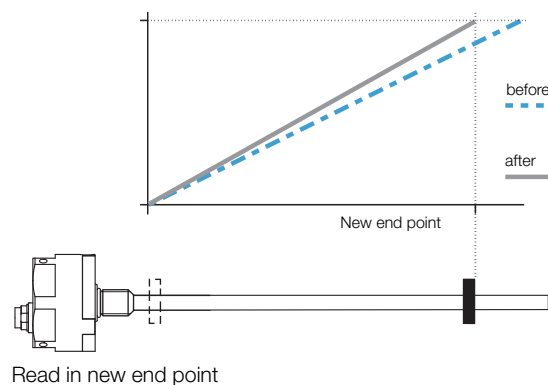
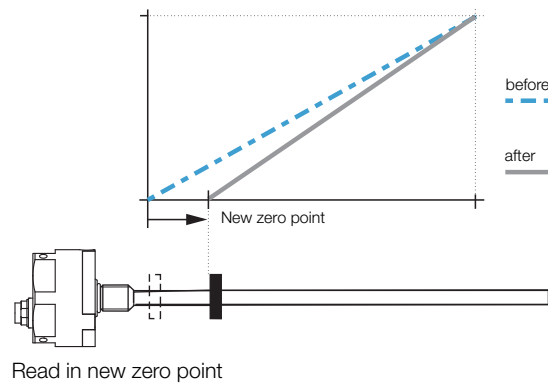
The characteristic of the current output can be inverted by activating the programming inputs. For example, the rising characteristic of the output becomes a falling characteristic. The voltage outputs are not inverted.

Adjusting

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

Reset

Restoring the transducer to its factory default settings.

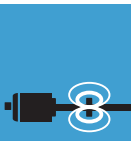
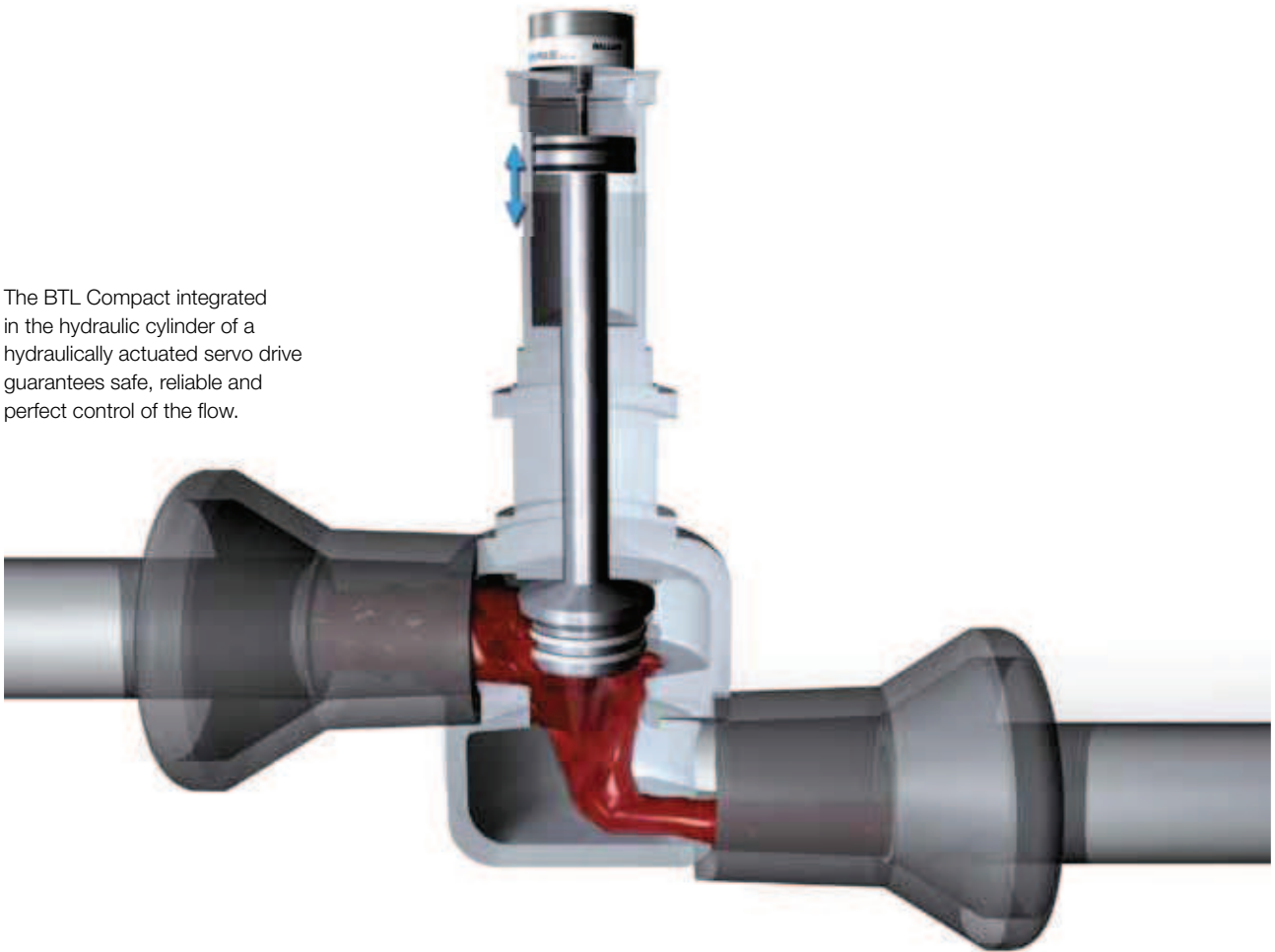


Rod Compact BTL7 Application

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

Analog Interface

Digital Pulse Interface

SSI Interface

CANopen Interface

Installation Notices

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Installation Notices

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

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

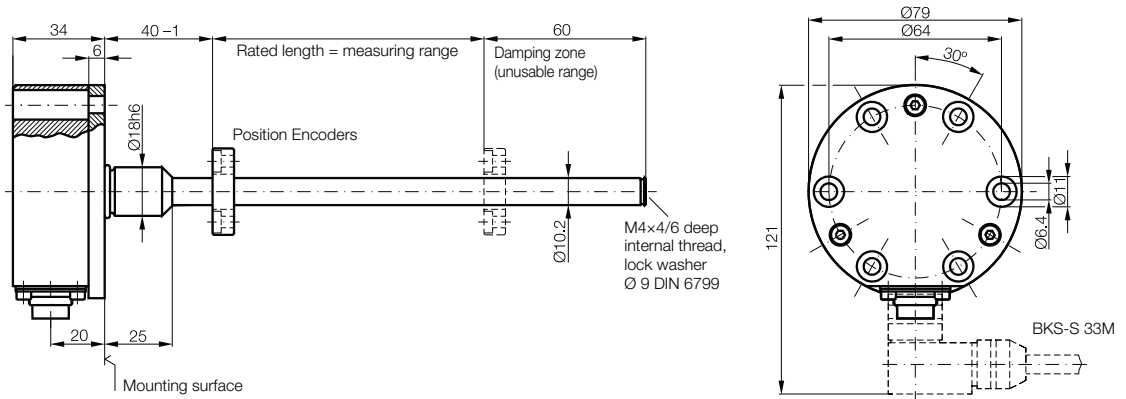
Series	Rod Compact K BTL5
Shock load	100 g/6 ms in accordance with EN 60068-2-27 and 100 g/2 ms in accordance with EN 60068-2-29
Vibration	12 g, 10...2000 Hz as per EN 60068-2-6
Polarity reversal protected	yes
Overvoltage protection	TransZorb protection diodes
Dielectric strength	500 V DC (GND to housing)
Degree of protection as per IEC 60529	IP 67 (with IP-67 connector BKS-S... attached); IP 68 (5 bar with cable)
Housing material	Stainless steel 1.4305
Flange and tube material	Tube stainless steel 1.4571, flange 1.4571 or 1.4429 or 1.4404
Housing attachment	Design K, 18h6 with 6 cylinder head screws
Connection	Plug connector or cable connection
Plug connector suggestion see page 188/212	BKS-S 32M/BKS-S 32M-C/BKS-S 33M
EMC testing	
Radio interference emission	EN 55016-2-3 (industrial and residential area)
Static electricity (ESD)	EN 61000-4-2 Severity level 3
Electromagnetic fields (RFI)	EN 61000-4-3 Severity level 3
Electrical fast transient bursts (BURST)	EN 61000-4-4 Severity level 3
Conducted interference induced by high-frequency fields	EN 61000-4-6 Severity level 3
Standard nominal strokes [mm]	0025...5500 mm in 1-mm increments, depending on the interface



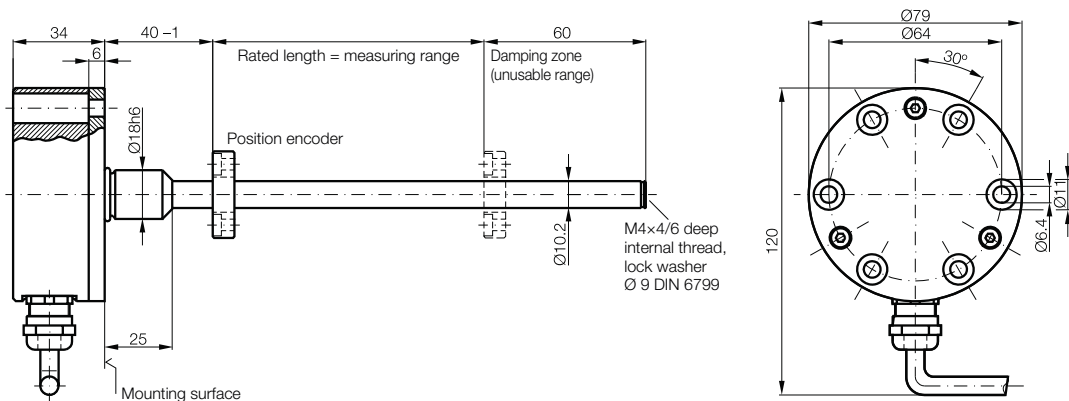
Rod Compact K BTL5

General data

Design K, BTL5-...-M-...-K-SR32

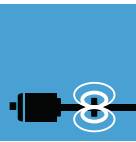


Design K, BTL5-...-M-...-K-K_



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

CANopen Interface

Installation Notices

Rod AR BTL6

General Data

Analog Interface

Digital Pulse Interface

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Floats

Position Encoders

Rod EX,

T Redundant and CD

Filling Level Sensor SF

Accessories

Basic Information and Definitions

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

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

Series	BTL5 Rod Compact H
Shock load	100 g/6 ms in accordance with EN 60068-2-27 and 100 g/2 ms in accordance with EN 60068-2-29
Vibration	12 g, 10...2000 Hz as per EN 60068-2-6
Polarity reversal protected	yes
Overvoltage protection	TransZorb protection diodes
Dielectric strength	500 V DC (GND to housing)
Degree of protection as per IEC 60529	IP 67 (with IP-67 connector BKS-S... attached); IP 68 (5 bar with cable)
Housing material	Stainless steel 1.4305
Flange and tube material	Tube stainless steel 1.4571, flange 1.4571 or 1.4429 or 1.4404
Housing attachment	Design H thread M18×1.5, design W 3/4"-16 UNF
Connection	Plug connector or cable connection
Plug connector suggestion see page 188/212	BKS-S 32M/BKS-S 32M-C/BKS-S 33M
EMC testing	
Radio interference emission	EN 55016-2-3 (industrial and residential area)
Static electricity (ESD)	EN 61000-4-2 Severity level 3
Electromagnetic fields (RFI)	EN 61000-4-3 Severity level 3
Electrical fast transient bursts (BURST)	EN 61000-4-4 Severity level 3
Conducted interference induced by high-frequency fields	EN 61000-4-6 Severity level 3
Standard nominal strokes [mm]	0025...5500 mm in 1-mm increments

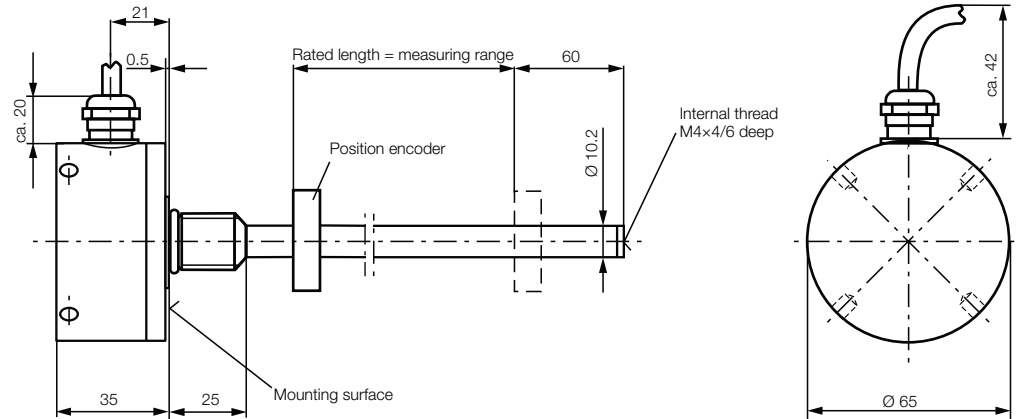


Rod Compact H/W BTL5

General data

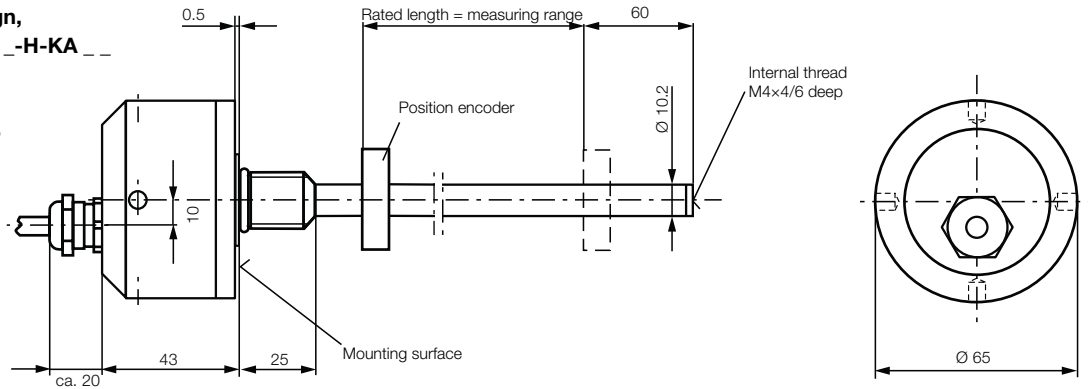
Hardware design,
BTL5-...-M...-H-K

Mounting
thread M18x1.5
Radial cable outlet



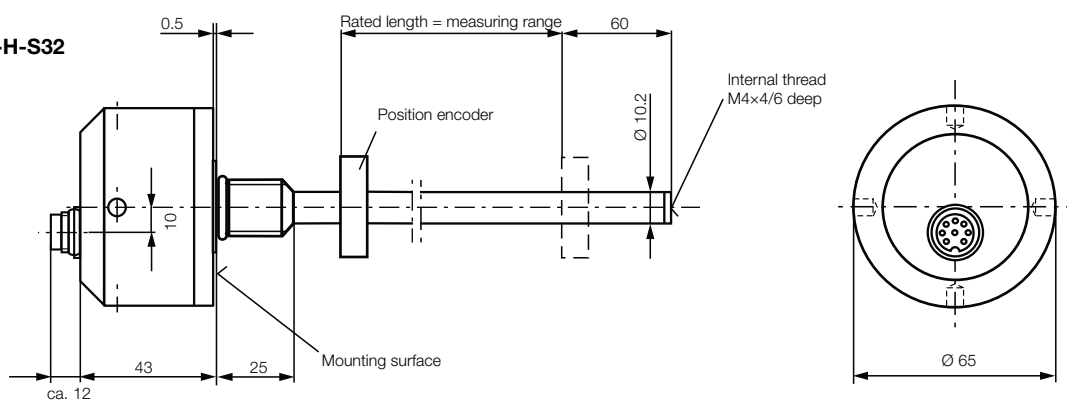
Hardware design,
BTL5-...-M...-H-KA

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
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

General

Data

Analog

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Position Encoders

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T Redundant

and CD

Filling Level

Sensor SF

Accessories

Basic

Information and

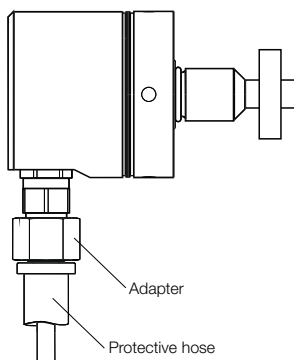
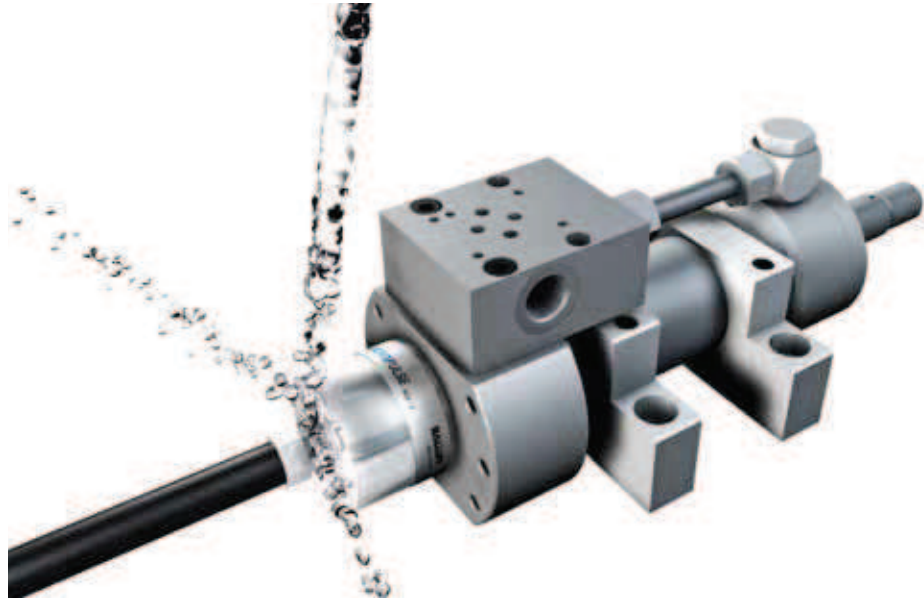
Definitions

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

Installation Notices

Rod AR BTL6

General Data

Analog Interface

Digital Pulse Interface

Installation Notices

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Float

Position Encoders

Rod EX, T Redundant and CD

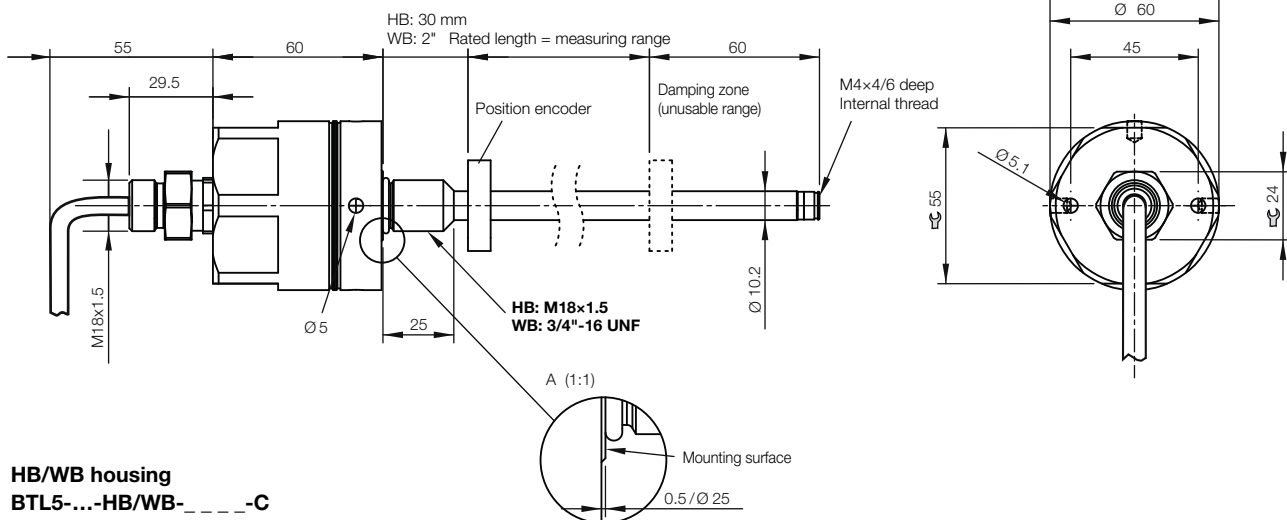
Filling Level Sensor SF

Accessories

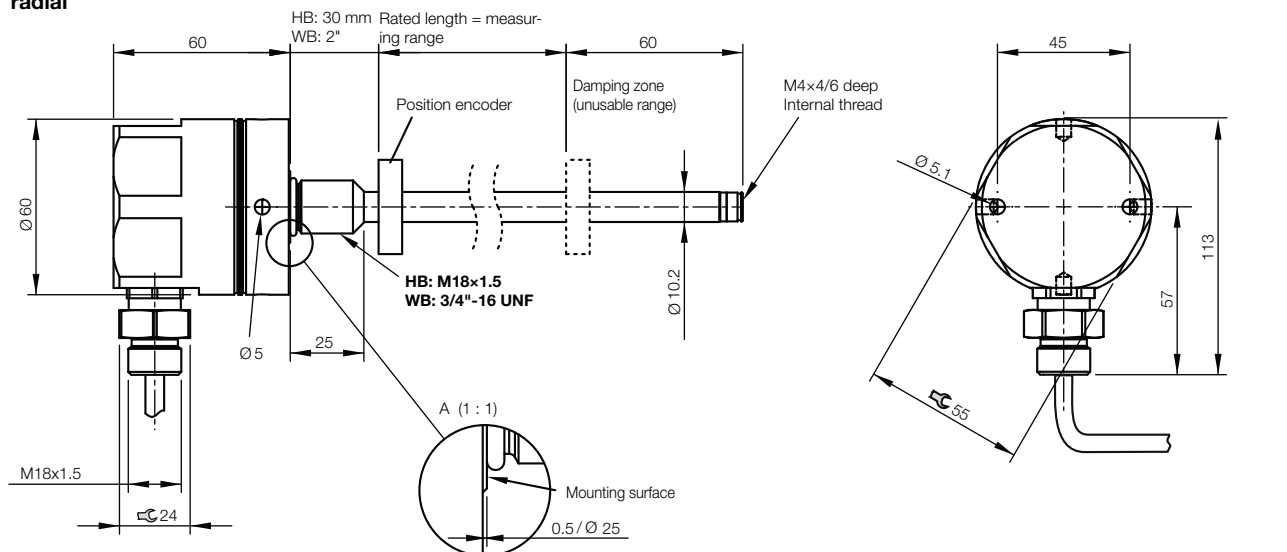
Basic Information and Definitions

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	
Overvoltage protection	
Dielectric strength	
Operating temperature	
Storage temperature	

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

Scope of delivery

- Transducer
- Quick start instructions

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

P Interface

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

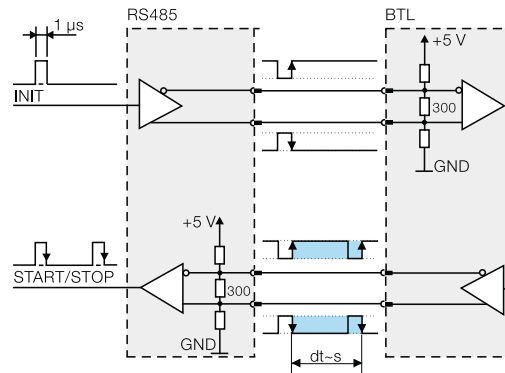
Reliable signal transmission, even with cable lengths of up to 500 m between the BTA processor unit and the BTL transducer. This is guaranteed by the especially interference-free RS485 differential drivers and receivers. Interference signals are effectively suppressed.

Highly precise digitizing of the P pulse signal

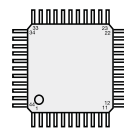
Companies developing their own electronic control and processor unit can create a highly accurate P interface cost-effectively and with minimum effort using the Balluff digitizing chip. The digitizing chip was developed as a high-resolution, configurable ASIC for Micropulse Transducers with P pulse interface.

Benefits

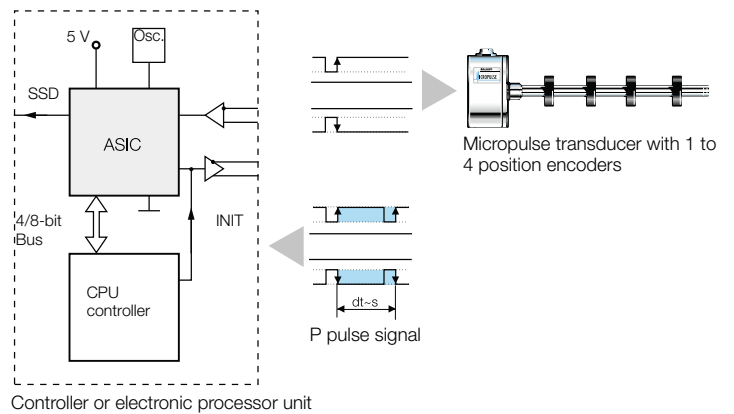
- Position resolution 1 µm!
- The 1 µm resolution of the Micropulse position measurement system is achieved by the high resolution of the digitizing chip (133 ps) (clock frequency 2 or 20 MHz).
- Position data from 4 position encoders can be processed simultaneously
- 4/8-bit processor interface



Block diagram of P interface



Digitizing chip 44QFP



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	$f_{\text{STANDARD}} = 1 \text{ kHz} = \leq 1400 \text{ mm}$
Max. linearity deviation	±100 µm up to 500 mm rated length ±0.02% 500...5500 mm rated length
Temperature coefficient of overall system	(6 µm + 5 ppm × L)/°C
Supply voltage	20...28 V DC
Current consumption	≤ 100 mA
Operating temperature	-40...+85 °C
Storage temperature	-40...+100 °C

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

Scope of delivery

- Transducer
- Quick start instructions

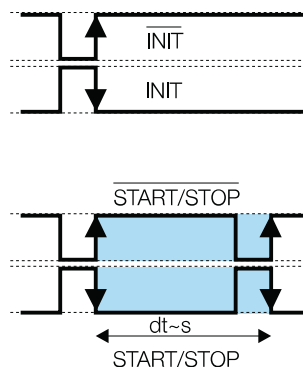
Please order separately:

- Position encoders, see page 218
- Floats, see page 216
- Fastening nut, see page 219 (for Stab Compact H)
- Plug connectors, see page 252

Ordering example:

BTL5-P1-M - - - - -

Standard Rated length [mm]	Design	Connection
0025...5500 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
	H W	Radial output K02 PUR cable 2 m K05 PUR cable 5 m K10 PUR cable 10 m K15 PUR cable 15 m
		Axial output KA02 PUR cable 2 m KA05 PUR cable 5 m KA10 PUR cable 10 m KA15 PUR cable 15 m S32 Connectors



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

Installation Notices

Rod AR BTL6

General Data

Data

Analog Interface

Interface

Digital Pulse Interface

Interface

Installation Notices

Installation Notices

Floats

Position Encoders

Rod EX, T Redundant and CD

and CD

Filling Level Sensor SF

SF

Accessories

Basic Information and Definitions

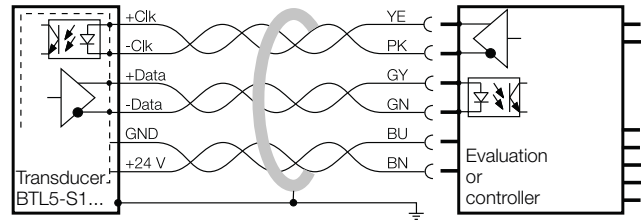
Definitions

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.



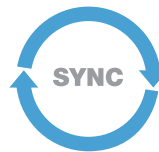
BTL5-S1... with evaluation/controller, connection example

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

The clock frequency depends on the cable length.

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

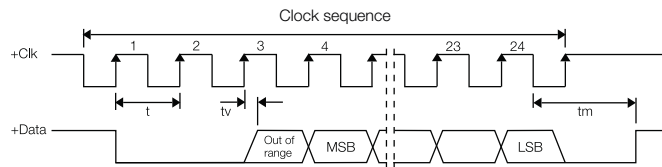
Ordering example:

BTL5-S1 [] [] - **M** [] [] [] [] [] [] - **C** for asynchronous operation

BTL5-S1 [] [] **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
1 Gray code rising (24-bit)	2 5 μm		WB	F05 5 m Teflon cable
6 Binary code rising (25-bit)	3 10 μm			Axial output
7 Gray code rising (25-bit)	4 20 μm			FA05 5 m Teflon cable
	5 40 μm			
	6 100 μm			
	7 2 μm			

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



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

Scope of delivery

- Transducer
- Quick start instructions

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

Ordering example:

BTL5-S1 _ _ - **M** _ _ _ _ - _ _ _ _ _ **for asynchronous operation**

BTL5-S1 _ _ - **B-M** _ _ _ _ - _ _ _ _ _ **for synchronous operation**

Coding	System resolution	Standard nominal strokes [mm]	Design	Connection
0 Binary code rising (24-bit)	1 1 µm	0025...4000 mm in	K	Radial output
1 Gray code, rising (24-bit)	2 5 µm	1-mm increments		K02 PUR cable 2 m
6 Binary code rising (25-bit)	3 10 µm		H W	K05 PUR cable 5 m
7 Gray code, rising (25-bit)	4 20 µm			K10 PUR cable 10 m
	5 40 µm			K15 PUR cable 15 m
	6 100 µm			SR32 Connectors
	7 2 µm			Radial output
				K02 PUR cable 2 m
				K05 PUR cable 5 m
				K10 PUR cable 10 m
				K15 PUR cable 15 m
				Axial output
				KA02 PUR cable 2 m
				KA05 PUR cable 5 m
				KA10 PUR cable 10 m
				KA15 PUR cable 15 m
				S32 Connectors

- 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

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 × position and 1 × velocity	0 1 Mbaud	0025...4000 mm in 1-mm increments	HB	Radial output K05 PUR cable 5 m
2	2 × position and 2 × velocity	1 800 kbaud		WB	
3	4 × position	2 500 kbaud			Axial output KA05 PUR cable 5 m
		3 250 kbaud			
		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, Position configurable	5 µm increments								
Velocity	0.1 mm/s increments								
Hysteresis	≤ 1 digit								
Measurement rate	f _{STANDARD} = 1 kHz								
Max. linearity deviation	±30 µm at 5 µm resolution								
Temperature coefficient of overall system	(6 µm + 5 ppm × L)/°C								
Supply voltage	20...28 V DC								
Current consumption	≤ 100 mA								
Operating temperature	-40...+85 °C								
Storage temperature	-40...+100 °C								
Cable length [m] per CiA DS301	< 25	< 50	< 100	< 250	< 500	< 1000	< 1250	< 2500	
Baud rate [kbaud] per CiA DS301	1000	800	500	250	125	100	50	20/10	



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

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

Scope of delivery

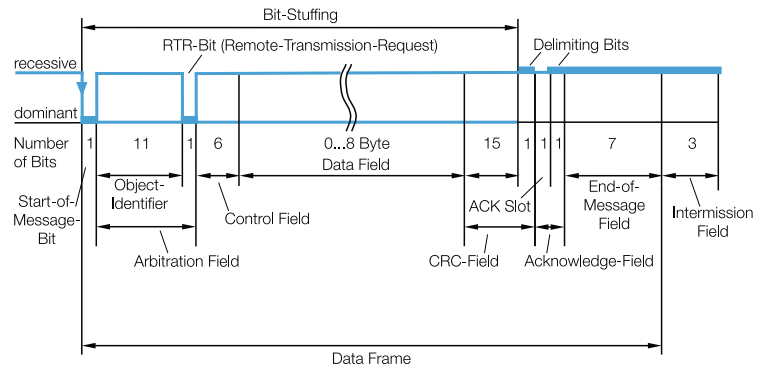
- Transducer
- Quick start instructions

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 - H 1 - **M** - - - - -

Software configuration	Baud rate	Standard nominal strokes [mm]	Design	Connection
1 1 × position and 1 × velocity	0 1 Mbaud	0025...4000 mm in 1-mm increments	K	Radial output K02 PUR cable 2 m K05 PUR cable 5 m SR92 Connectors
2 2 × position and 2 × velocity	2 500 kbaud			
3 4 × position	3 250 kbaud			
	4 125 kbaud			
	5 100 kbaud		H	Radial output
	6 50 kbaud		W	K02 PUR cable 2 m
	7 20 kbaud		HC	K05 PUR cable 5 m
	8 10 kbaud			
				Axial output KA02 PUR cable 2 m KA05 PUR cable 5 m S92 Connectors



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.

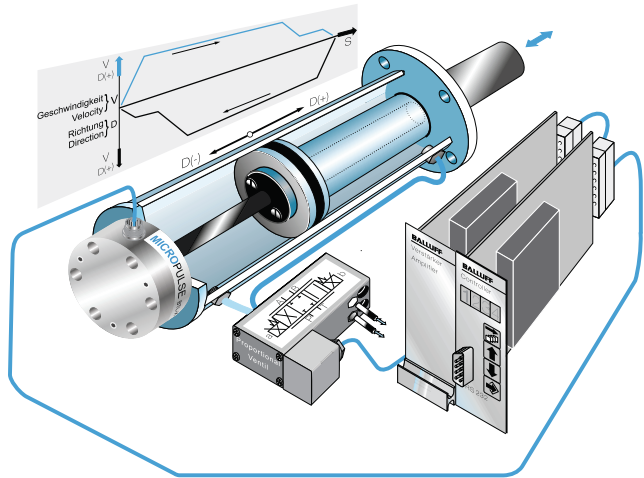
Rod Compact H/K/W BTL5/7

Installation notices

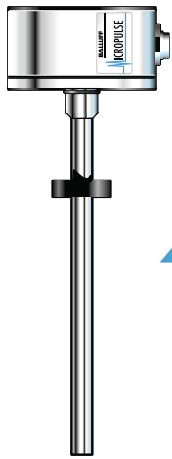
SSI-SYNC – better control behavior and higher dynamics

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.

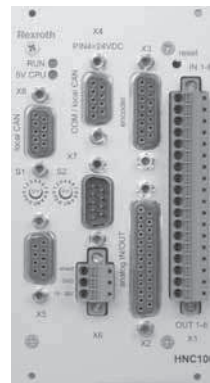
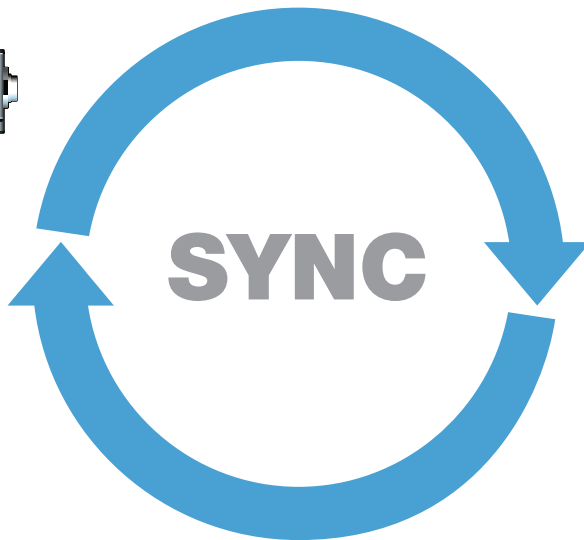
The feedback of these status sizes (speed and acceleration) allows the damping and natural frequency of a hydraulic system to be increased. These measures permit greater loop gain and with it, better control behavior and higher dynamics.



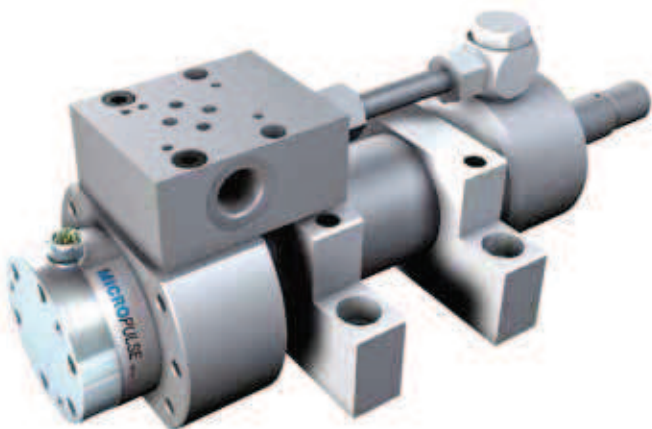
Application with hydraulic cylinder in a control loop



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.

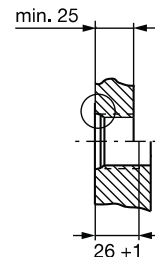
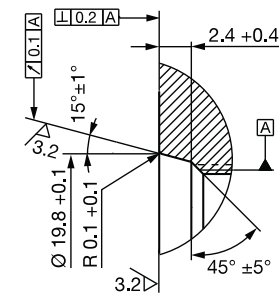
Rod Compact H/K/W BTL5/7

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.

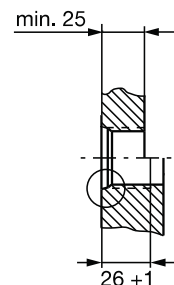
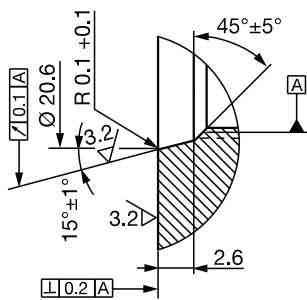
If magnetizable materials are used, then the measures shown below have to be taken. Sealing is at the flange mounting surface using the supplied 15.4x2.1 O-ring with M18x1.5 thread.



Installation of BTL Rod Compact W

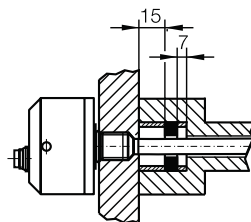
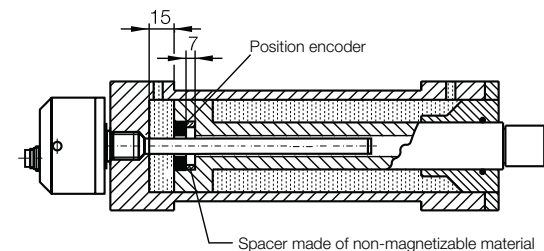
The Micropulse transducer BTL has a mounting thread M18x1.5. We recommend that the mounting is made of non-magnetizable material.

If magnetizable materials are used, then the measures shown below have to be taken. Sealing is at the flange mounting surface using the supplied 15.4x2.1 O-ring with M18x1.5 thread.



Countersink for O-ring

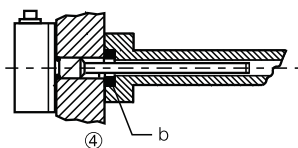
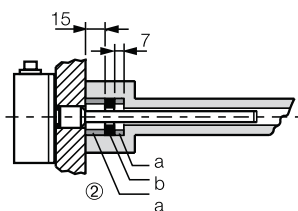
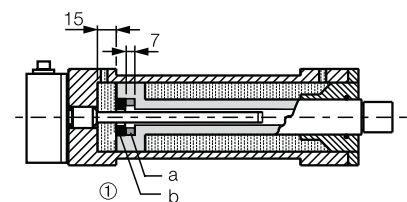
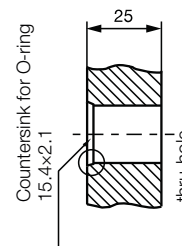
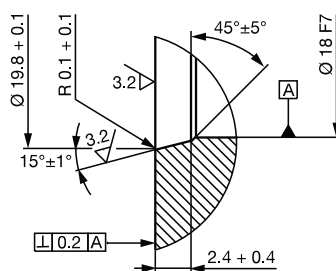
Tapped hole
3/4" 16 UNF thread



Installation BTL Rod Compact K

The Micropulse Transducer BTL has 6 mounting holes for cylinder head screws (ISO 4762 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] with 8 mm outer tube (style E28), the max. rated length is 1016 mm	0050...2000 mm in 1-mm increments

CE
e1

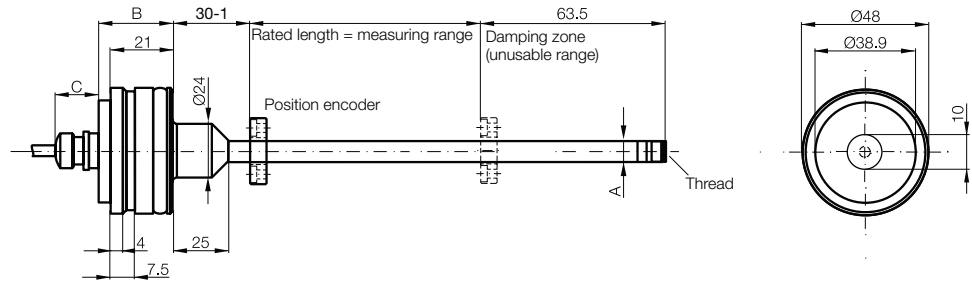


Rod AR BTL6

General data

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

Cable outlet
axial centric



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

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

Installation
Notices

Installation
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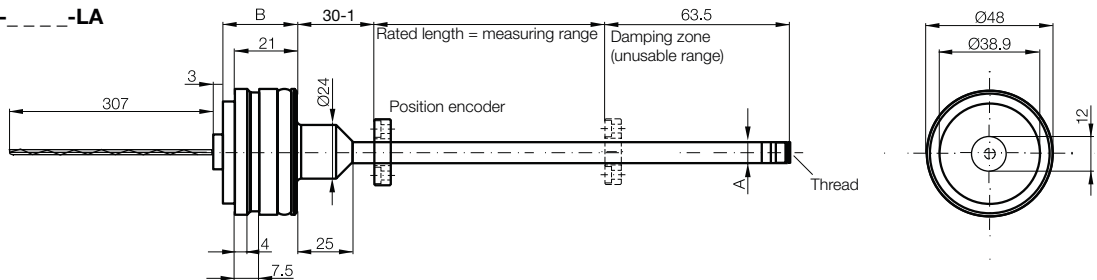
Installation
Notices

Installation
Notices

Installation
Notices

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

Cable outlet
axial with
stranded wire



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

Rod AR BTL6

General
Data

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Caution!

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

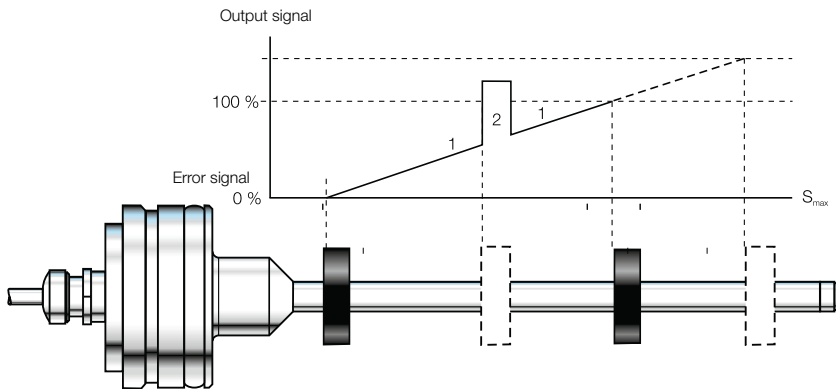
Rod AR BTL6

Analog interface

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

Position encoder position

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



Output signal with rising characteristic

Ordering example:

BTL6 - 500 - M - - - - -

Output signal

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

Standard nominal strokes [mm]

0050...2000 mm
in 1-mm increments

Design

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

Connection

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

Axial output
LA00,3 PUR stranded wire, 0.3 m

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



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

Rod AR BTL6

Analog interface

Rod AR BTL6	Rod AR BTL6	Rod AR BTL6
Analogue	Analogue	Analogue
A	B	E
Analogue	Analogue	Analogue
BTL6-A500-M_ _ _ _ _	BTL6-B500-M_ _ _ _ _	BTL6-E500-M_ _ _ _ _
0...10 V	0...5 V	4...20 mA
Max. 2 mA	Max. 2 mA	
≤ 5 mV	≤ 2 mV	
±1.5 mV	±1.5 mV	≤ 500 Ω
≤ 5 μm	≤ 4 μm	±7 μA
System resolution/min. 2 μm	System resolution/min. 2 μm	System resolution/min. 2 μm
f _{STANDARD} = 1 kHz	f _{STANDARD} = 1 kHz	f _{STANDARD} = 1 kHz
±200 μm to 500 mm rated length	±200 μm to 500 mm rated length	±200 μm to 500 mm rated length
typ. ±0.02% ≥ 500 rated length	typ. ±0.02% ≥ 500 rated length	typ. ±0.02% ≥ 500 rated length
[150 μV/°C + (5 ppm/°C × P × U/L)] × ΔT	[150 μV/°C + (5 ppm/°C × P × U/L)] × ΔT	[150 μV/°C + (5 ppm/°C × P × U/L)] × ΔT
[0.6 μA/°C + (10 ppm/°C × P × I/L)] × ΔT	[0.6 μA/°C + (10 ppm/°C × P × I/L)] × ΔT	[0.6 μA/°C + (10 ppm/°C × P × I/L)] × ΔT
10...30 V DC	10...30 V DC	10...30 V DC
typ. ≤ 60 mA	typ. ≤ 60 mA	typ. ≤ 60 mA
yes	yes	yes
yes	yes	yes
500 V DC (GND to housing)	500 V DC (GND to housing)	500 V DC (GND to housing)
-40...+85 °C	-40...+85 °C	-40...+85 °C
-40...+100 °C	-40...+100 °C	-40...+100 °C



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

Analogue Interface

Digital Pulse Interface

SSI Interface

CANopen Interface

Installation Notices

Installation Notices

Installation Notices

Installation Notices

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Installation Notices

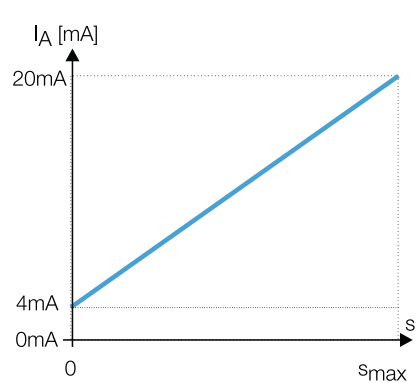
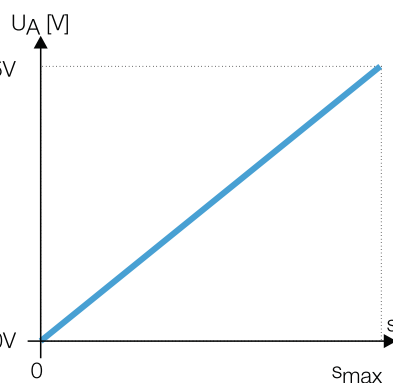
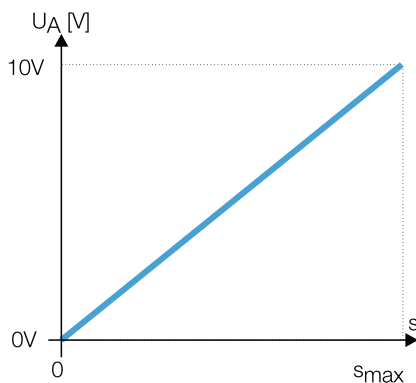
Installation Notices

Installation Notices

Installation Notices

Installation Notices

Installation Notices



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

Floats

Position Encoders

Rod EX,
T Redundant
and CD

Filling Level
Sensor SF

Accessories

Basic
Information and
Definitions

Rod AR BTL6

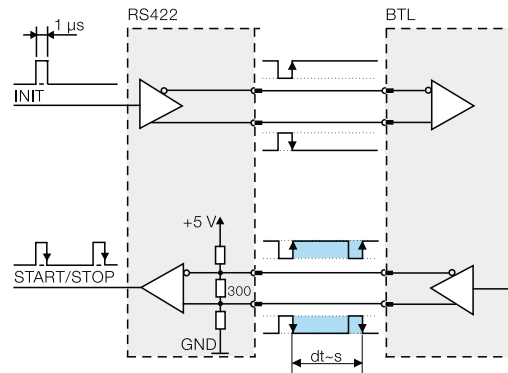
Digital Pulse Interface

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

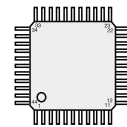
As a consequence of different control philosophies, Digital Pulse Interfaces are available in two different types depending on the controller. The difference lies in how the edges are processed. The falling edges are processed in the P interface and the rising edges in the M interface. To reduce the 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

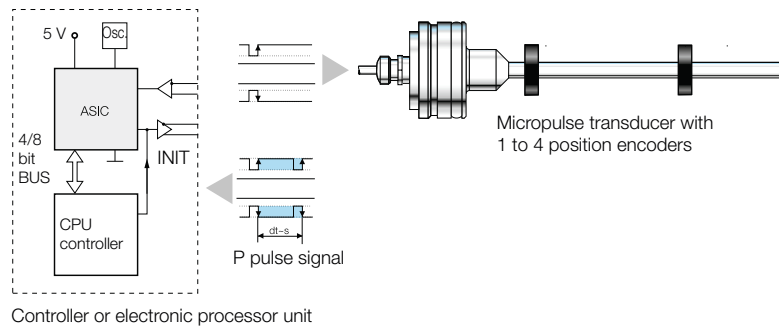
Companies developing their own electronic control and processor unit can create a highly accurate P interface cost-effectively and with minimum effort using the Balluff digitizing chip. The digitizing chip was developed as a high-resolution, configurable ASIC for Micro-pulse transducers with P pulse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



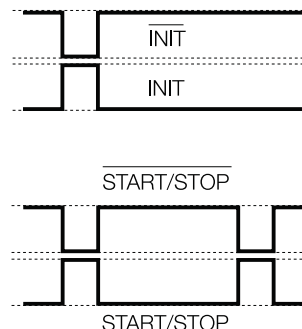
ASIC INFO: +49 7158 173-370

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	≤ 10 µm
Reproducibility	≤ 20 µm
Resolution	≤ 10 µm
Linearity deviation	±200 µm up to 500 mm rated length typ. ±0.02%, max. ±0.04% 500...1500 mm rated length
Supply voltage	10...30 V DC
Current consumption	≤ 60 mA (at 1kHz)
Operating temperature	-40...+85 °C
Storage temperature	-40...+100 °C

The rising and falling edges can be evaluated.



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

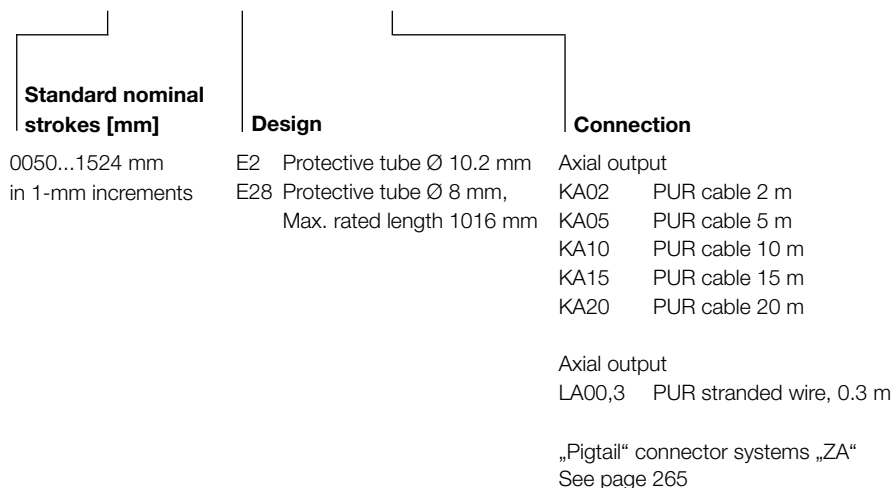
Scope of delivery

- Transducer
- Quick start instructions

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

Ordering example:

BTL6 - P 5 1 0 - M _ _ _ _ - _ _ _ - _ _ _ _



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

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Installation Notices

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Position Encoders

Rod EX, T Redundant and CD

Filling Level Sensor SF

Accessories

Basic Information and Definitions

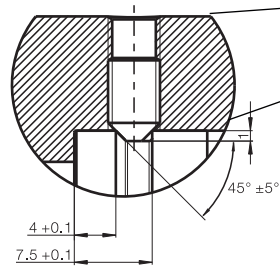
Rod AR BTL6

Installation notices

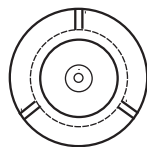
Series AR Micropulse Transducers BTL are designed for integration in hydraulic cylinders. The transducer is supported mechanically on the housing. Three M5 set screws at an angle of 120 °C hold the transducer, which fits into a $\varnothing 48$ H8 fitting bore. Sealing is accomplished using the supplied 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).

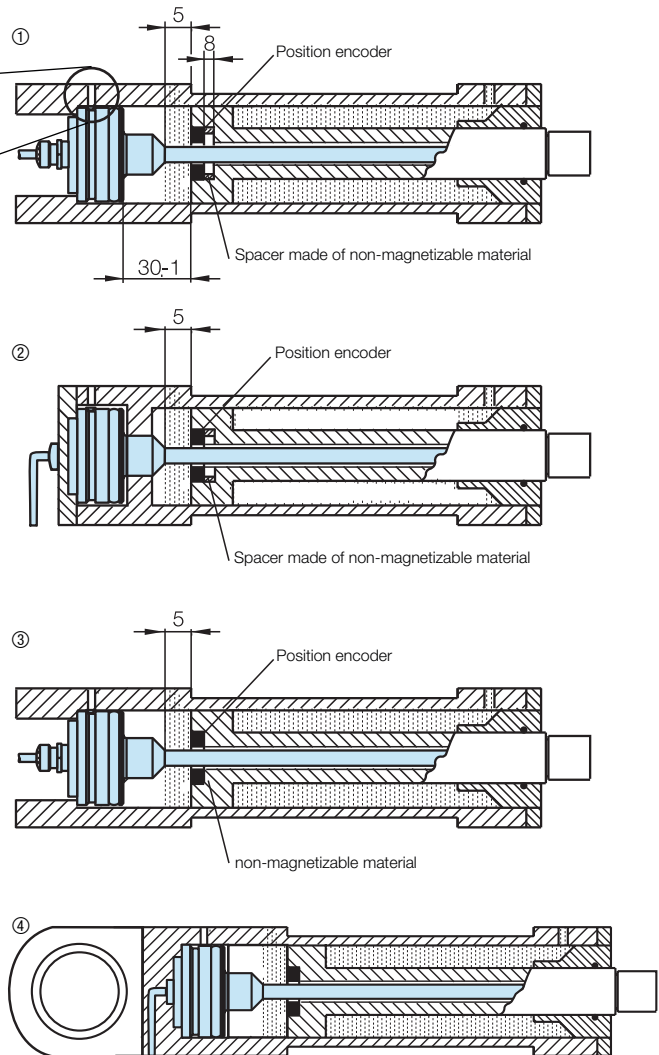
Set screw DIN 914 M5x8



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



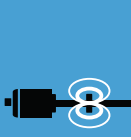
Installation examples



- 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

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

CANopen

Interface

Installation

Notices

Rod AR BTL6

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Position Encoders

Rod EX,

T Redundant

and CD

Filling Level

Sensor SF

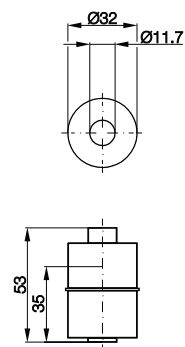
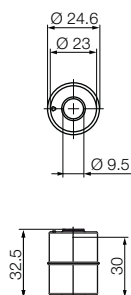
Accessories

Basic

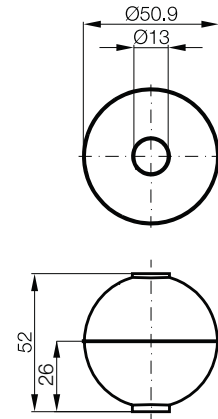
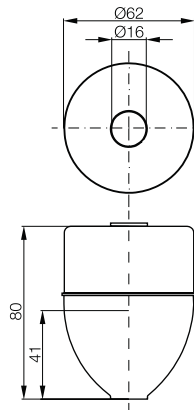
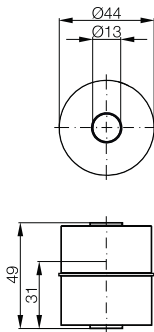
Information and

Definitions

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



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



Caution!
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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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Position Encoders

Rod EX, T Redundant and CD

Filling Level Sensor SF

Accessories

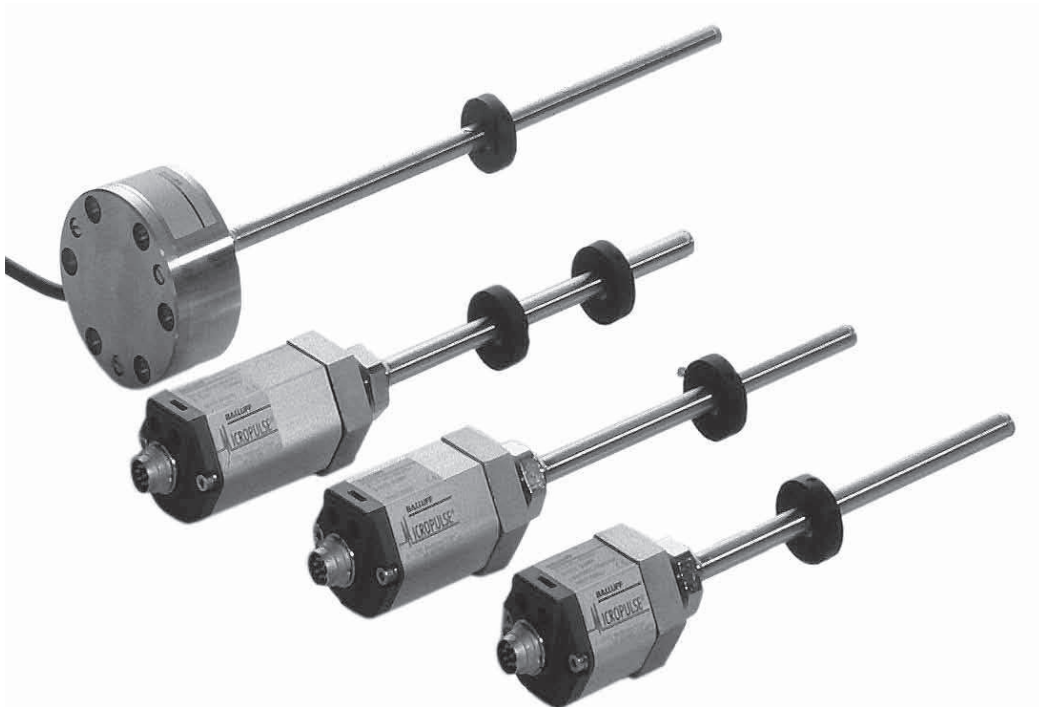
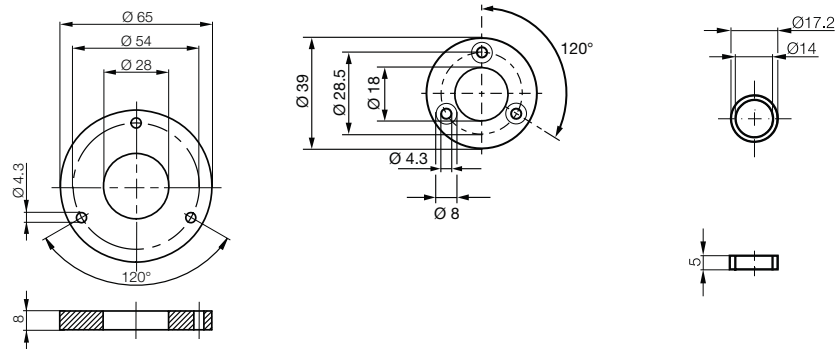
Accessories

Basic Information and Definitions

Basic Information and Definitions

Rod Position encoder

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



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



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

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Installation Notices

Floats

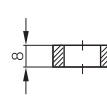
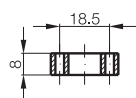
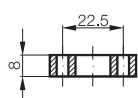
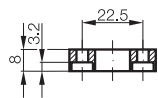
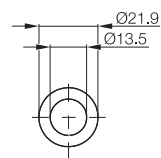
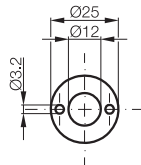
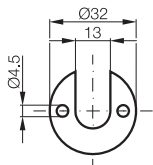
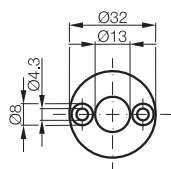
Position Encoders

Rod EX, T Redundant and CD

Filling Level Sensor SF

Accessories

Basic Information and Definitions

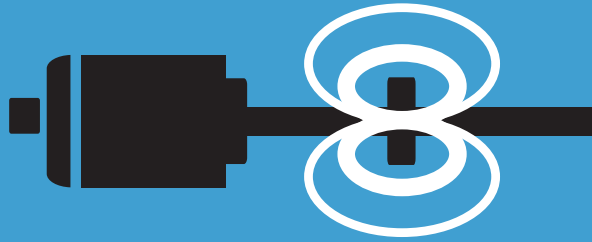


M18x1.5 fastening nut
Order designation:
BTL-A-FK01-E-M18x1.5
Ordering code: **BAM0118**

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 M18×1.5 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 M22×1.5 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

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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MICROPULSE[®]

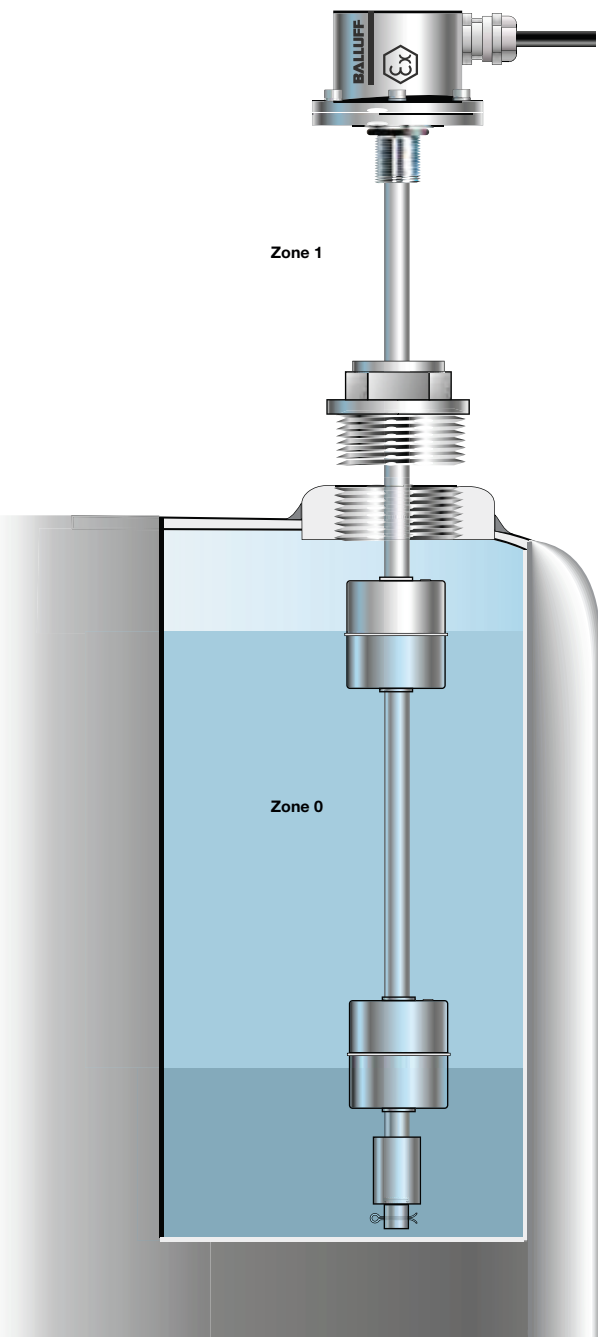


BTL5-1-M...-B-DEXA-...

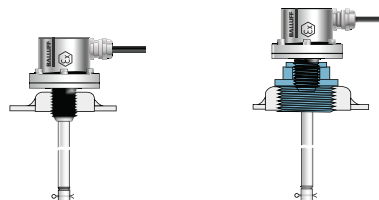
Rod version "DEXA" is the safe and reliable approach for filling level applications in Zone 0. A cotter pin prevents the float from getting lost. Floats, see page 232.

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.

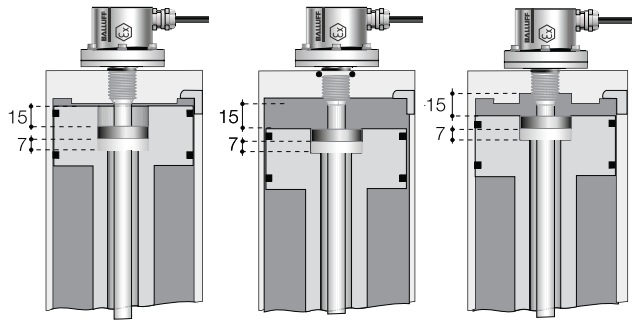


BTL5_1-M...-B-DEXB...

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.

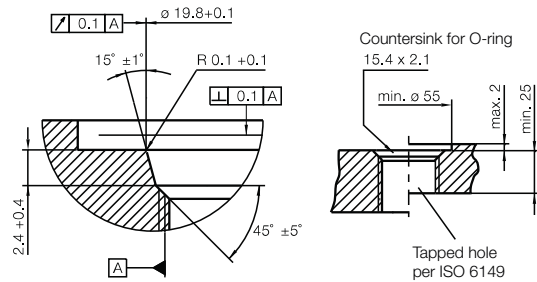
Applications

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

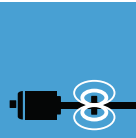
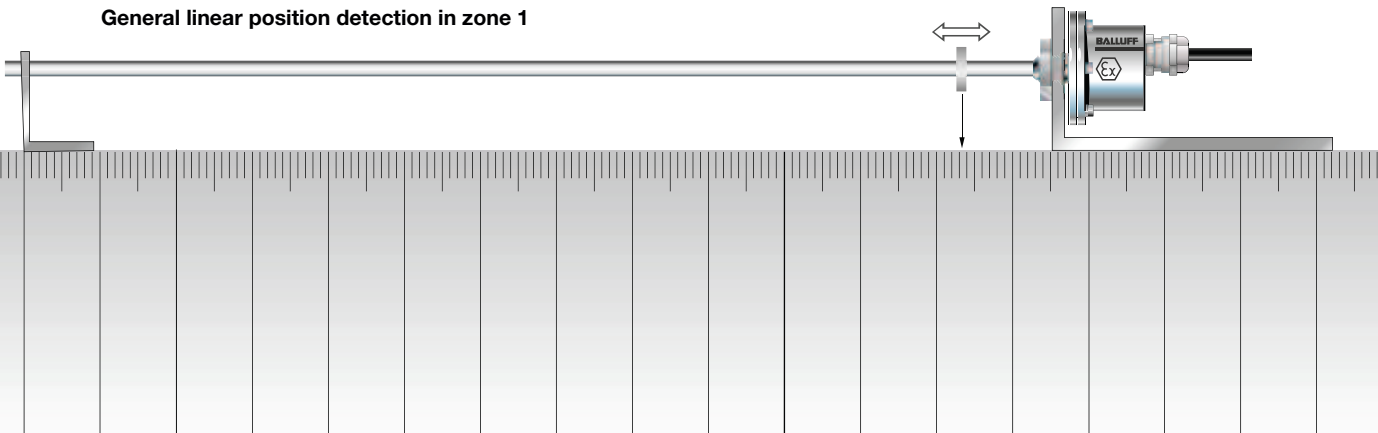


Installation

The Micropulse transducer BTL has a M18x1.5 mounting thread. We recommend that the mounting 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 O-ring 15.4x2.1 with M18x1.5 thread.



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

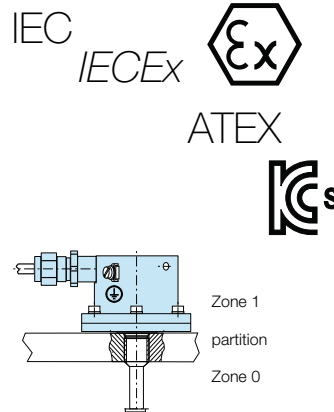
The Micropulse transducer BTL is a robust position feedback system for measuring ranges between 25 and 4000 mm as well as use under extreme ambient conditions.

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
Overvoltage 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

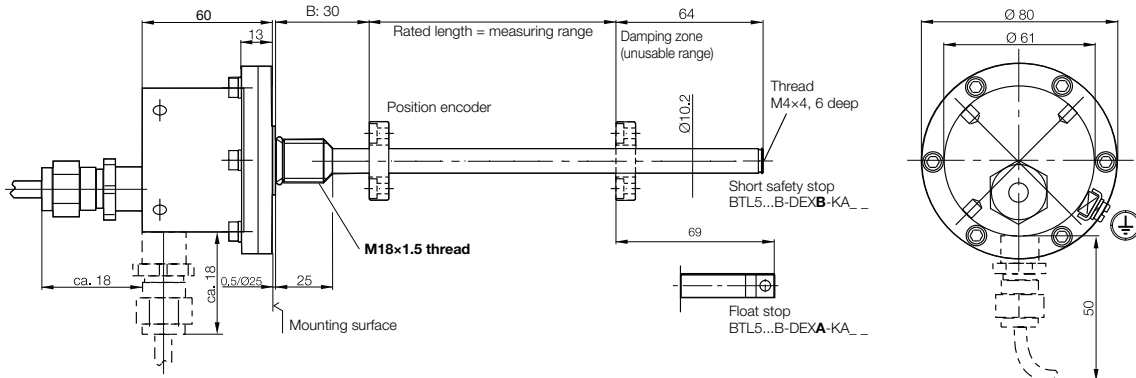
Please enter code for output signal, interface, coding, rated length, model, rod end, and connection in the part number.

Scope of delivery

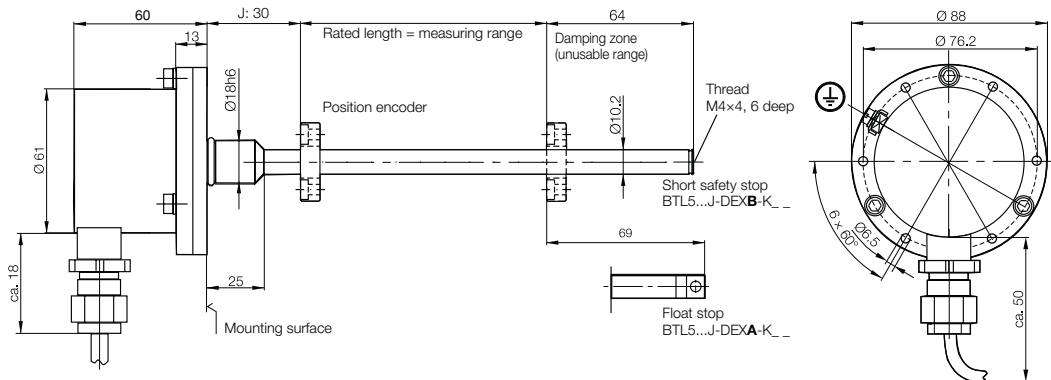
- Transducer
- User's Guide

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

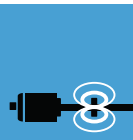
Housing B, metric mounting thread
Cable outlet axial, radial



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

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

Ordering example:

BTL5 - [] - M [] - [] - DEX [] - []

	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	A Float stop	Axial cable outlet only for model B, Z
E10	4...20 mA, rising		J		KA02 PUR cable 2 m
E17	20...4 mA, falling		Z	B Short safety stop	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:

BTL5 - [] 1 - M [] - [] - DEX [] - []

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

SSI interface, see technical data on page 202

Ordering example:

BTL5 - S1 [] [] - M [] - [] - DEX [] - [] for asynchronous operation

BTL5 - S1 [] [] B - M [] - [] - DEX [] - [] 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 Float stop	See above, analog interface DEX
1	Gray code rising (24-bit)	2 5 µm	analog interface DEX	J		
6	Binary code rising (25-bit)	3 10 µm		Z		
7	Gray code rising (25-bit)	4 20 µm 5 40 µm			B Short safety stop	

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

Series	Rod J-DEXC-TA12	
Part number	BTL5-_-M-_-J-DEXC-TA12	
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	
Operating temperature	-20...+80°C for T5	
Storage temperature	-40...+100 °C outside of Ex zone	
Degree of protection	IP 68	
Housing material	Stainless steel AISI 304, optional: AISI 316L, Nitronics 60	
Protective tube	Stainless steel 1.4571	
Pressure rating	600 bar max.	
Connection	Screw terminals	
Cable entry	Ex cable gland BTL-A-AD09-M-00EX or Ex installation pipe system	
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	

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

SIRA 11ATEX1104X
IECEX SIR 11.0048X



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



CE 0518



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

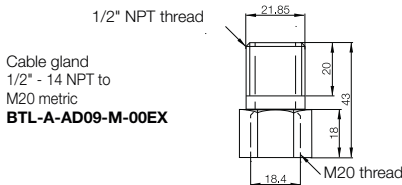
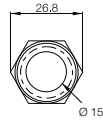
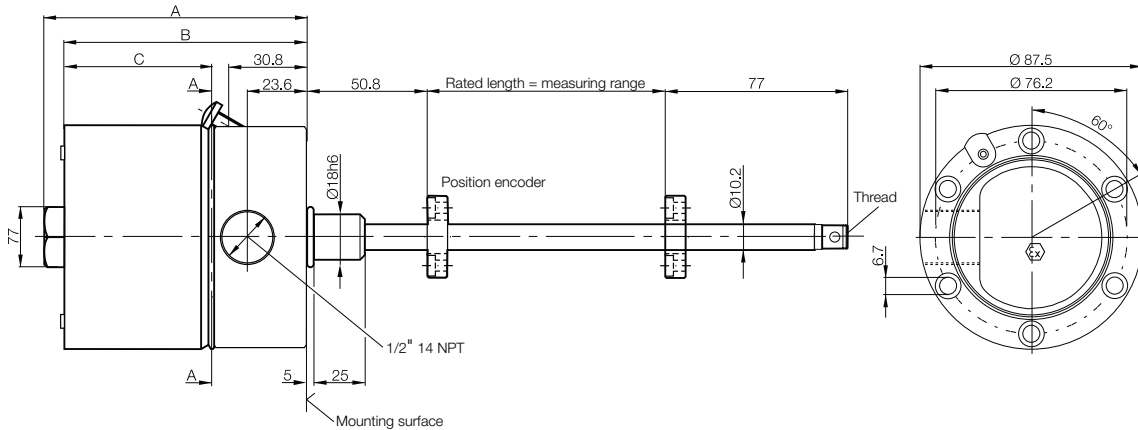
Accessories

Basic Information and Definitions

Rod J-DEXC-TA12

General data

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



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:

BTL5- _____ - M _____ - J-DEXC-TA12

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:

BTL5-S1 **-M** **-J-DEXC-TA12** for asynchronous operation

BTL5-S1 **-B-M** **-J-DEXC-TA12** 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		
6 Binary code rising (25-bit)	3 10 µm		
7 Gray code rising (25-bit)	4 20 µm		
	5 40 µm		

CANopen interface, see technical data on page 170/171

Ordering example:

BTL5-H1 **-M** **-J-DEXC-TA12**

Software configuration	Baud rate	Standard rated length [mm]	Connection
1 1 × position and 1 × velocity	0 1 Mbaud	Analog interface J-DEXC	TA12 Internal thread 1/2" 14 NPT
	1 800 kbaud		
2 2 × position and 2 × 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

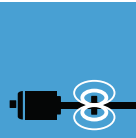
Ordering example:

BTL5-T1 **0-M** **-J-DEXC-TA12**

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

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

Ignition protection type "n" for zone 2

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:

BTL5 - [] - M [] - K - NEX - []

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 K05 PUR cable 5 m
E10 4...20 mA, rising		
E17 20...4 mA, falling		
C10 0...20 mA, rising		
C17 20...0 mA, falling		

Rod series, analog interface, see page 154/155

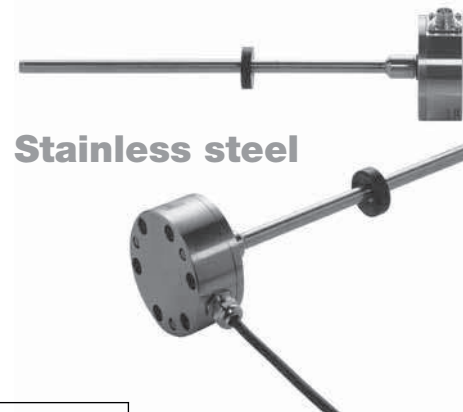
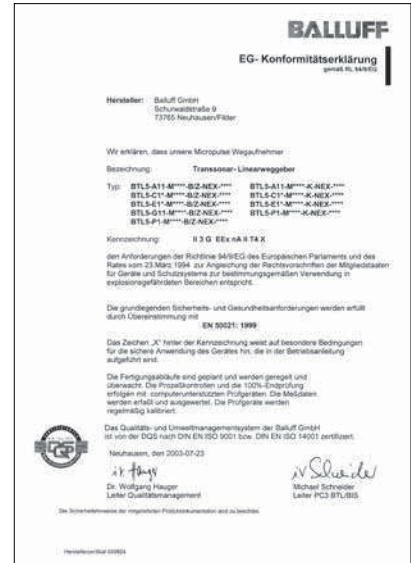
Ordering example:

BTL7 - [] - M [] - [] - NEX - []

Output signal	Standard nominal strokes [mm]	Design	Connection
A510 0...10 V and 10...0 V	0025...2000 mm in 1-mm increments	B M18×1.5 Z 3/4" 16 UNF CD M22×1.5 high-pressure resistant	S32 with connector plug KA05 PUR cable 5 m
E500 4...20 mA, rising			
E570 20...4 mA, falling			
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-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

Floats (Zone 0)

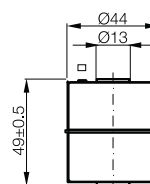
BTL2-S-4414-4Z-Ex

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



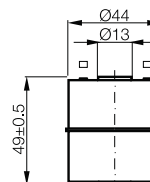
BTL2-S-4414-4Z01-Ex

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

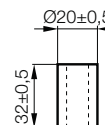
Spacer sleeve for the float:

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.

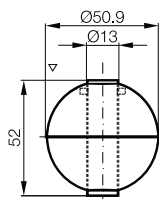
BTL2-S-5113-4K-Ex

Ordering code: **BAM014A**

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

Orientation:

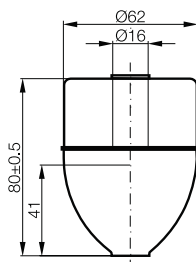
Raised dimple on upper side of float



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 $\rho = 0.7 \text{ g/cm}^3$
BTL2-S-6216-8P-Ex	$s_s \sim 41 \text{ mm}$	$s_s \sim 57 \text{ mm}$
BTL2-S-5113-4K-Ex	$s_s \sim 26 \text{ mm}$	$s_s \sim 40 \text{ mm}$
BTL2-S-4414-4Z-Ex	$s_s \sim 30 \text{ mm}$	$s_s \sim 39 \text{ mm}$
BTL2-S-4414-4Z01-Ex	$s_s \sim 45 \text{ mm}$	submerges

For technical data, see standard series on page 216.

Position encoder (zone 1) for installation in hydraulic cylinder

See page 218

Processor units, digital displays

See page 266



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 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
Overvoltage 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 M18×1.5, Model TZ thread 3/4" 16 UNF Model TK, 18h6 with 6 cheese head screws, Model TT thread M30×1.5
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" 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.

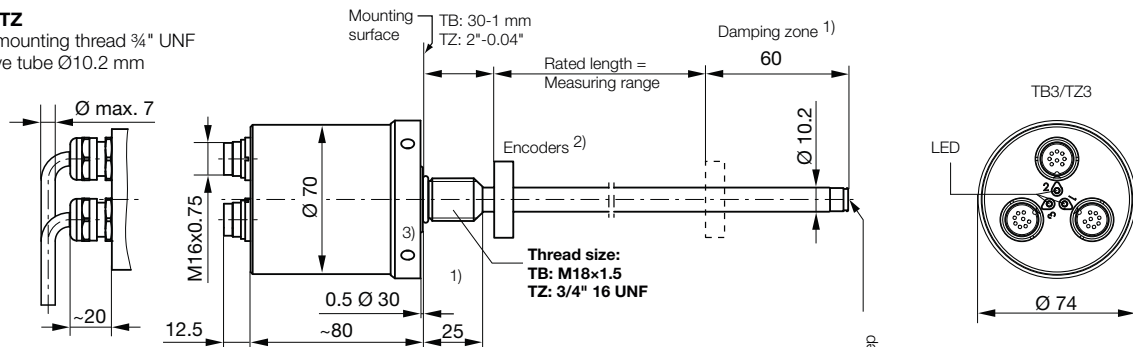
Up to three independent position measurement systems in the same housing enable failsafe linear measurement of, for example, safety valves or the combined monitoring of position and adjustment speed.

Design TB

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

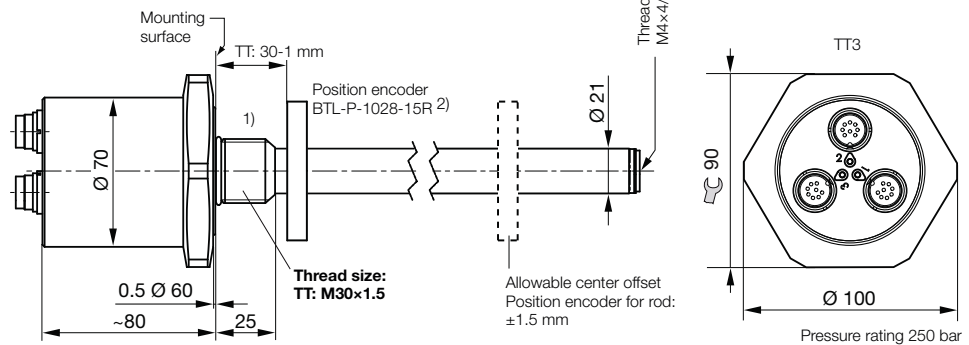
Design TZ

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



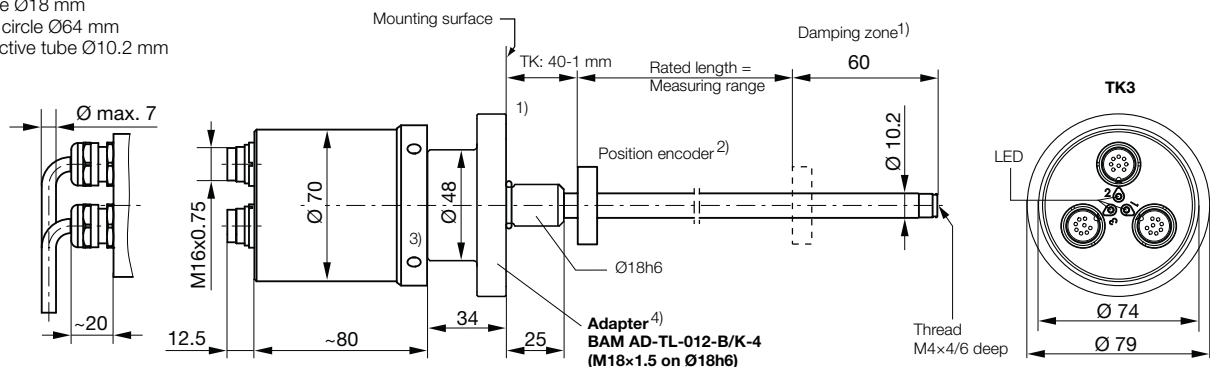
Design TT

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-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

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

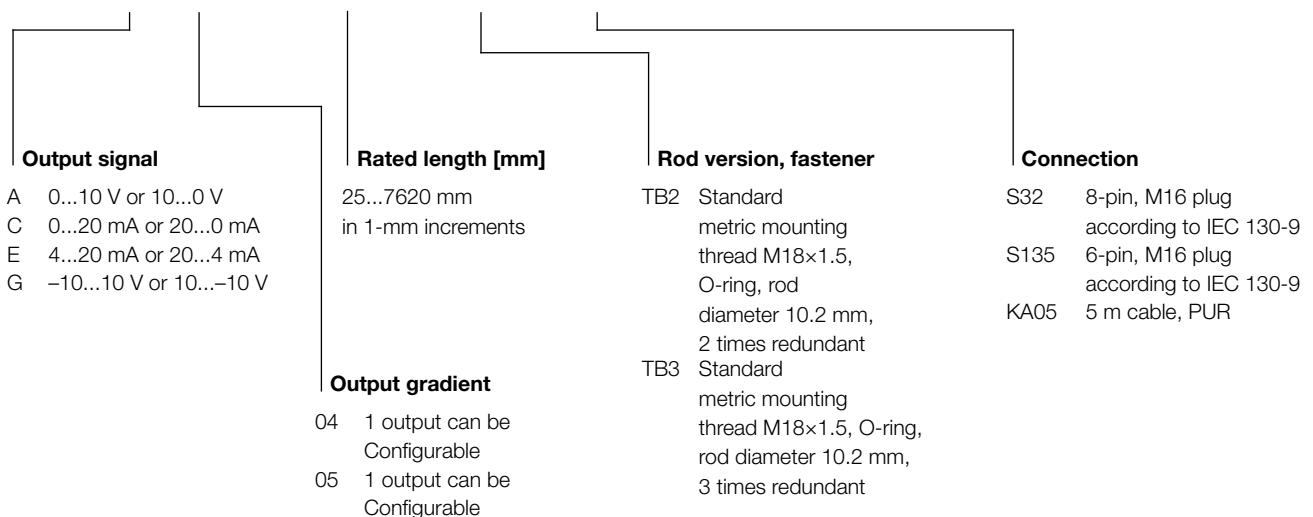
Flexible measuring range

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 speed can be set just as conveniently. Once configured, settings can easily be copied redundantly to the remaining measuring channels of the BTL 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:

BTL7 - 5 - M - - - - -



For additional designs, see page 235

Rod Redundant Programming

System requirements

- Standard PC
- Operating system: Windows 2000/XP/Vista/7
- Screen resolution at least 1024 × 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

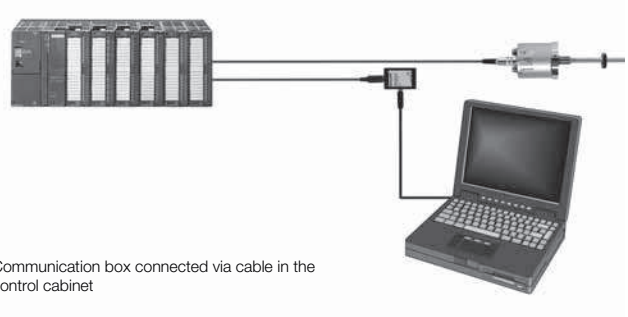
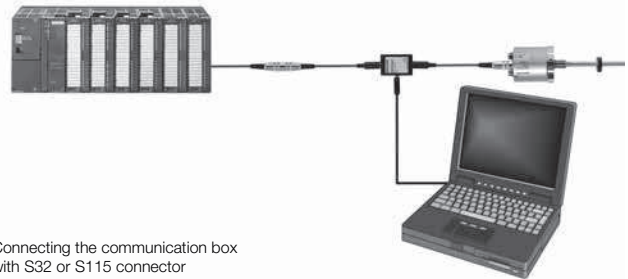
With the BTL7-A/504/505-S32 transducers, the communication box can be connected between the transducer and controller. The communication box is connected to the PC using a USB cable.

USB communication box with cable set	
Part number	Cable set
BTL7-A-CB01-USB-S32	Connector S32
BTL7-A-CB01-USB-KA	Cable connection

Scope of delivery

- USB communication box
- Cable set
- Quick start instructions

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	










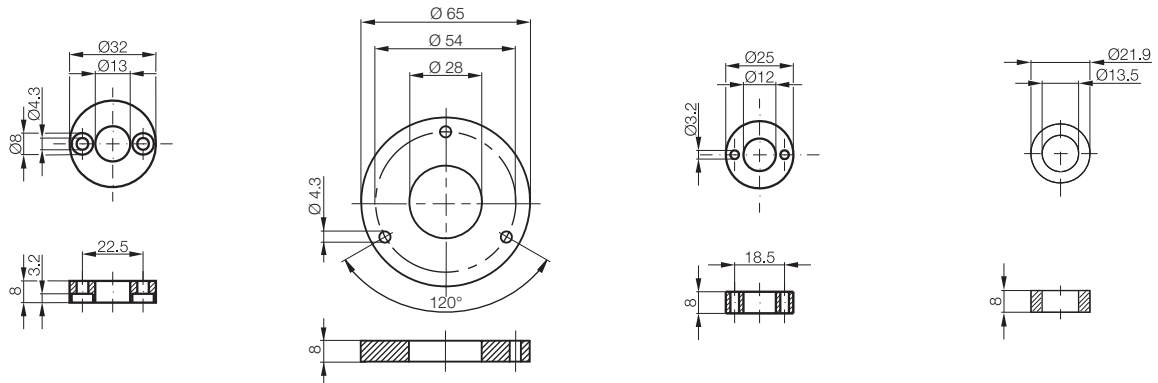
The PC software and the corresponding manual are available on the Internet at www.balluff.com/downloads-btl7

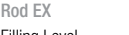
Rod Redundant Position encoders



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	

-  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

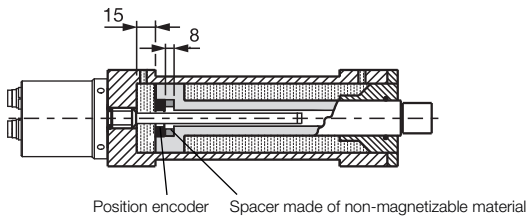
Programming Position Encoders

-  Rod CD
-  General Data

-  Filling Level Sensor SF

-  Accessories

-  Basic Information and Definitions

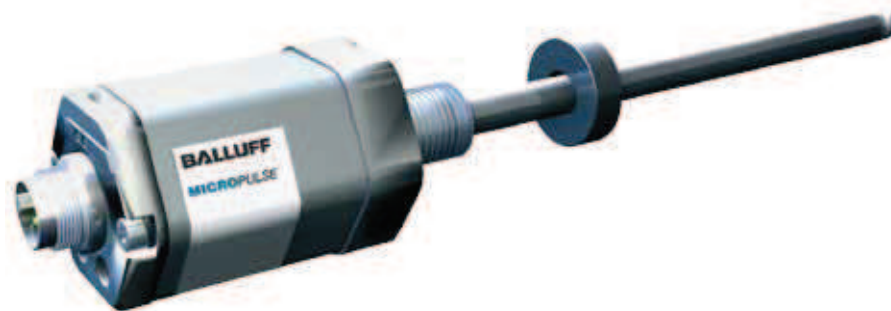


Caution!
Before design, installation and startup please familiarize yourself with the user's guide to be found at www.balluff.com.

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 μm
- Degree of protection IP 67/68
- Temperature range $-40...+85\text{ }^{\circ}\text{C}$
- Ex area zone 2; non-incendive "nA"
- Plug or cable variants
- Multi-magnet technology

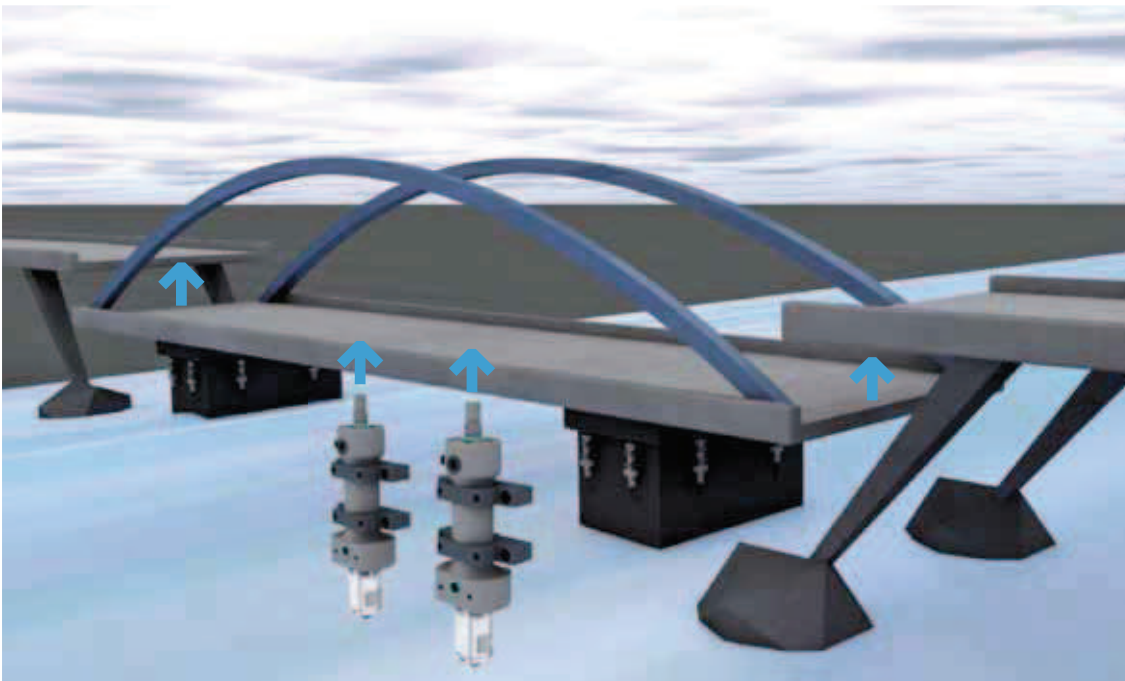


Structural design and calculations

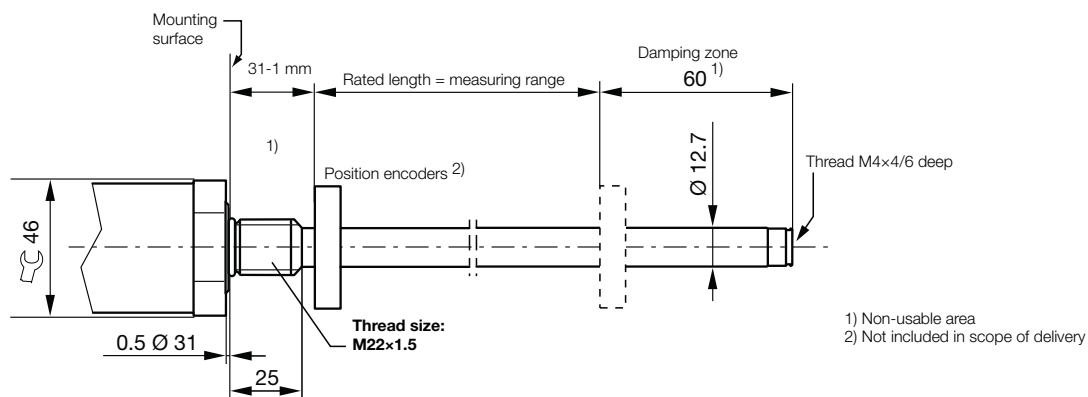
- Active support of walls
- Bridge positioning and lifting technology
- Leveling structures
- Off-shore sector
- Tunnel construction

Industrial applications

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

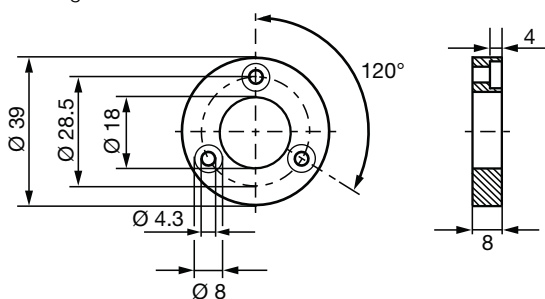


Heavy-duty cylinders raise the bridge to the planned road level after they are "floated" into position.

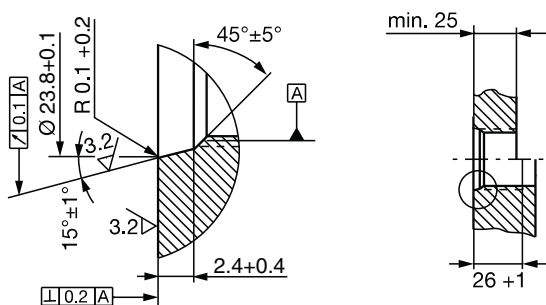


BTL-P-1018-3R

Weight: Approx. 19 g
Housing: Anodized aluminum



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



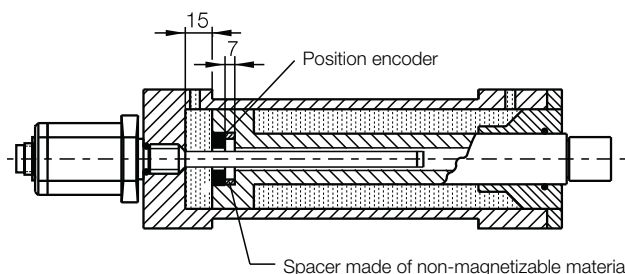
The transducer has a mounting thread M22x1.5 (according to ISO). Depending on the version, the hole must be tapped before installation.

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:

BTL5/7 - [] - M [] - CD - [] - []

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

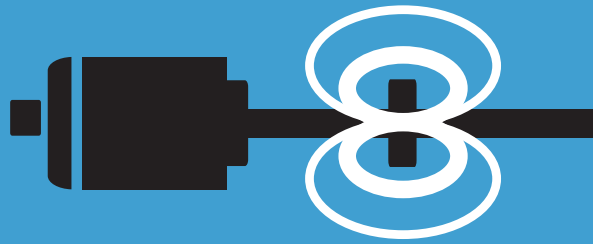
Rod CD

General Data

Filling Level Sensor SF

Accessories

Basic Information and Definitions



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)





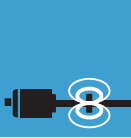
Filling Level Sensor SF

Contents

Filling Level Sensor SF

General Data	244
Analog Interface	246
Floats and Accessories	248

MICROPULSE[®]



Filling Level Sensor SF

General data

100% stainless steel

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



Series	Rod SF BTL5
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
Flange and tube material	1.4404
Connection	Cable connection
Fastener	1.5" Tri-Clamp as per SSI 3A standard 74-06
Pressure rating	300 bar (depending on float)
EMC testing	
Radio interference emission	EN 55016-2-3 (industrial and residential area)
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
Magnetic fields	IEC 61000-4-8/EN 61000-4-8 Severity level 4
Standard rated length (mm)	50...2500 in 1-mm increments



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 Accessories

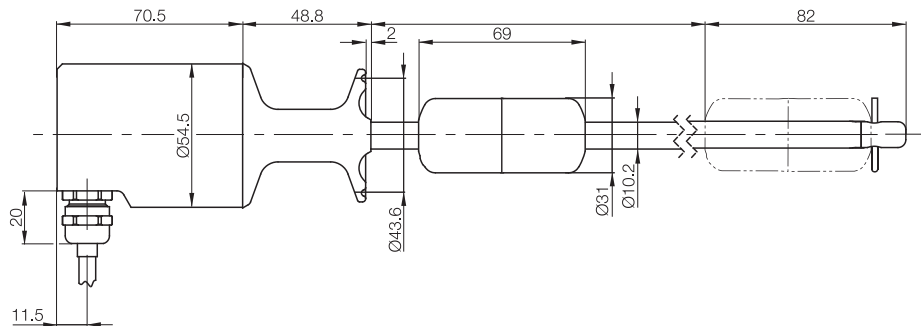
Accessories

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 magnetostrictive 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
Analogue	Analogue	Analogue
A	E	C
Analogue	Analogue	Analogue
BTL5- A 11-M-____-SF-____	BTL5- E 1_-M-____-SF-____	BTL5- C 1_-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 ≤ 5 mV		
≤ 0.1 mV ≤ 4 μm	≤ 500 Ω (500 Ω) ≤ 0.2 μA ≤ 4 μm	≤ 500 Ω (500 Ω) ≤ 0.2 μA ≤ 4 μm
System resolution/min. 2 μm f _{STANDARD} = 500 Hz ±100 μm up to 500 mm rated length ±0.02% 500... max. rated length	System resolution/min. 2 μm f _{STANDARD} = 500 Hz ±100 μm up to 500 mm rated length ±0.02% 500... max. rated length	System resolution/min. 2 μm f _{STANDARD} = 500 Hz ±100 μm up to 500 mm rated length ±0.02% 500... max. rated length
≤ 40 ppm/K for rated length 500 mm, float at center of measuring range	≤ 40 ppm/K for rated length 500 mm, float at center of measuring range	≤ 40 ppm/K for rated length 500 mm, float at center of measuring range
20...28 V DC ≤ 150 mA	20...28 V DC ≤ 150 mA	20...28 V DC ≤ 150 mA
yes 36 V	yes 36 V	yes 36 V
500 V DC (GND to housing)	500 V DC (GND to housing)	500 V DC (GND to housing)
-40...+85 °C -20...+130 °C	-40...+85 °C -20...+130 °C	-40...+85 °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

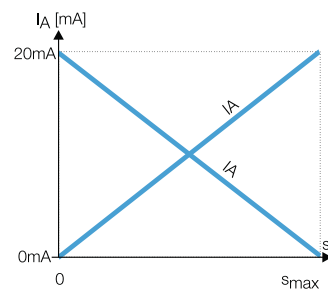
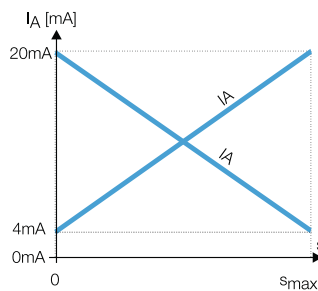
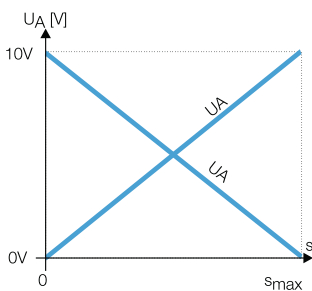
General Data

Analog Interface

Floats and Accessories

Accessories

Basic Information and Definitions



Ordering example:

BTL5 - 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

Radial connection

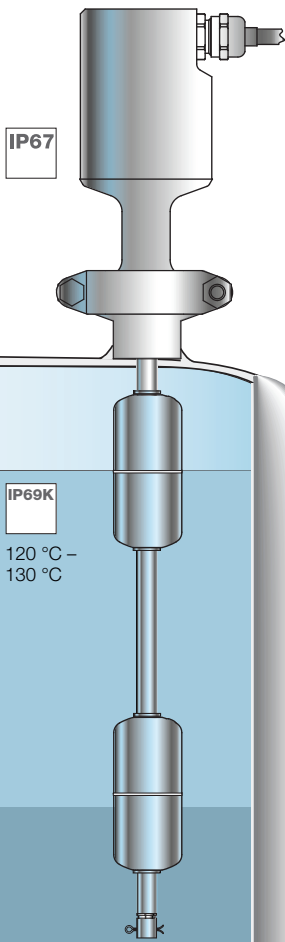
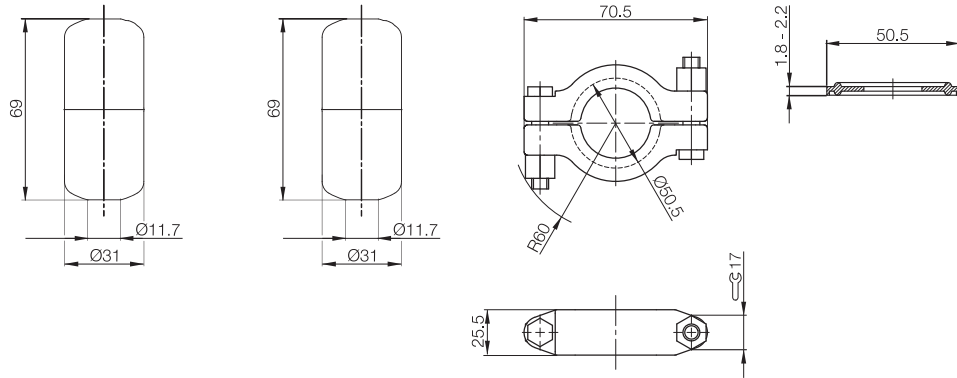
- F-radial design
- F02 2 m Teflon cable
- F05 5 m Teflon cable
- F10 10 m Teflon cable
- F15 15 m Teflon cable
- F20 20 m Teflon cable

Filling Level Sensor SF

Floats and accessories



Designation for Series	Float Rod SF BTL	Float Rod SF BTL	Tri-Clamp (DIN 32676) Rod SF BTL	O-ring 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		

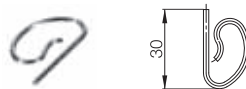


Process temperature:
maximum permissible temperature of
the rod under the flange (with media
contact).
Certain production processes require
sterilization at
120...130°C for 0.5...1 hour, for
instance.

"Junction float" on request.

Included in scope of delivery for float

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



Caution!

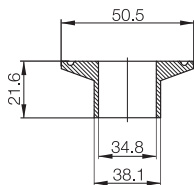
Approvals only issued through use of these components.
Before design, installation and startup please familiarize your-
self with the user's guide to be found at www.balluff.com.

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

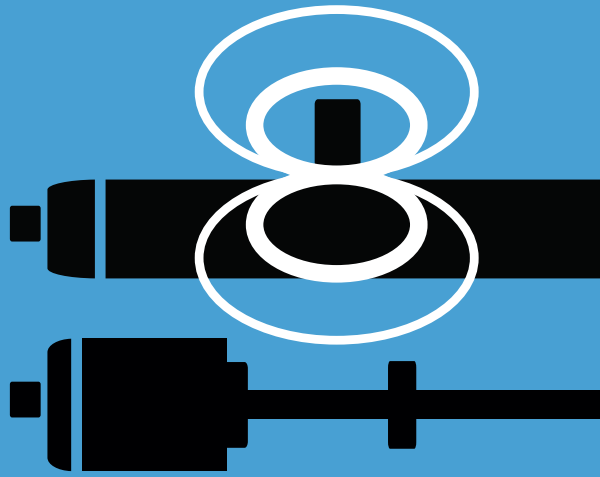
Analog Interface

Floats and Accessories

Accessories

Basic Information and Definitions





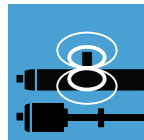
Micropulse Transducers



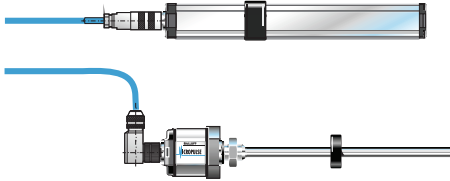
Accessories Contents

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

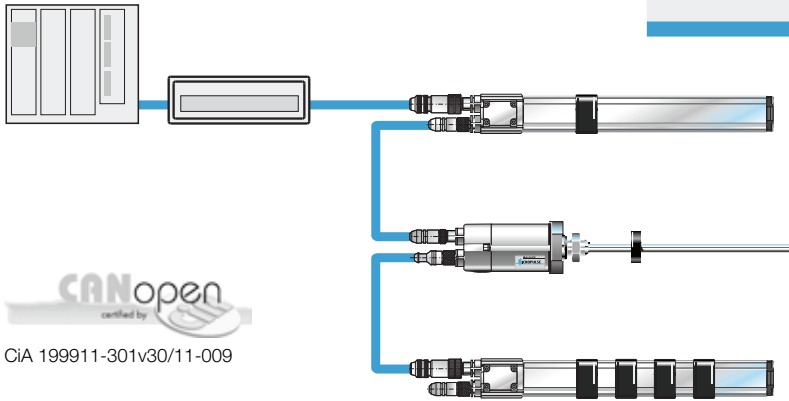
MICROPULSE®



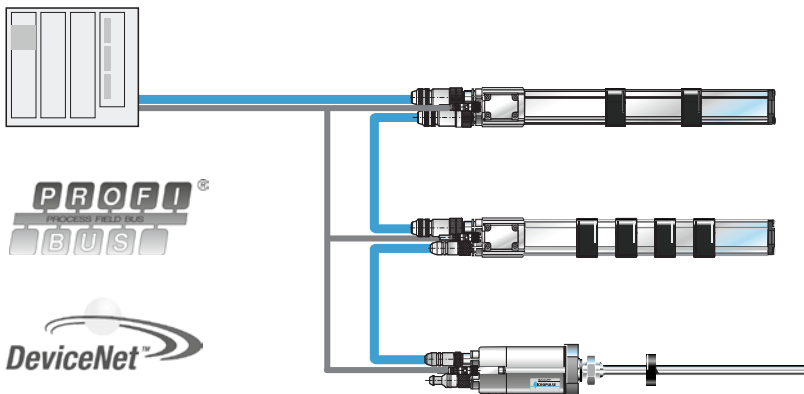
Connector for analog, pulse and SSI interfaces




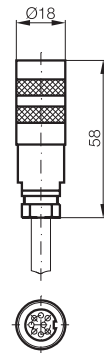
Connectors for CANopen interfaces



Connectors for Profibus DP and DeviceNet interfaces








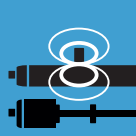
Connectors for Series	BKS-S 32M BTL_...-S 32																		
Design	soldered contacts Straight, female																		
Part number	BKS-S 32M-__																		
Crimped contacts																			
Solder connection	max. 0.75 mm ²																		
Housing material	Nickel-plated CuZn																		
Contact	CuZn																		
Contact surface	0.8 µm Au																		
Cable strain relief	PG 9																		
Cable diameter	6...8 mm																		
Cable	Lif2Y-FC-11Y- 0																		
Number of conductors x conductor cross-section	8x0.25 mm ²																		
Degree of protection as per IEC 60529	IP 67 (when screwed into place)																		
View of female solder side	 <table border="1"> <thead> <tr> <th>PIN</th> <th>Color</th> </tr> </thead> <tbody> <tr><td>1</td><td>YE</td></tr> <tr><td>2</td><td>GY</td></tr> <tr><td>3</td><td>PK</td></tr> <tr><td>4</td><td>RD</td></tr> <tr><td>5</td><td>GN</td></tr> <tr><td>6</td><td>BU</td></tr> <tr><td>7</td><td>BN</td></tr> <tr><td>8</td><td>WH</td></tr> </tbody> </table>	PIN	Color	1	YE	2	GY	3	PK	4	RD	5	GN	6	BU	7	BN	8	WH
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8	WH																		



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	BTL_...-S 32 soldered contacts Angled, female	BTL_...-S 32 soldered contacts Straight, male	BTL_...-S32 Straight, female	BTL_...-S32 Angled, female																																																																																										
BKS-S 32M-C-00	BKS-S 33M-__	BKS-S 78M-00	BKS-S232-PU-__	BKS-S233-PU-__																																																																																										
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Nickel-plated CuZn	max. 0.75 mm ²	max. 0.75 mm ²																																																																																												
CuZn	Nickel plated ZnAlCu1	Nickel-plated CuZn	PUR	PUR																																																																																										
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PG 9	0.8 µm Au	0.8 µm Au	0.8 µm Au	0.8 µm Au																																																																																										
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Lif2Y-FC-11Y- 0	6...8 mm	6...8 mm																																																																																												
8x0.25 mm ²	Lif2Y-FC-11Y- 0		LifgY+LifgY, FC-11Y	LifgY+LifgY, FC-11Y																																																																																										
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5	GN																																																																																													
6	BU																																																																																													
7	BN																																																																																													
8	WH																																																																																													
PIN	Color																																																																																													
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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

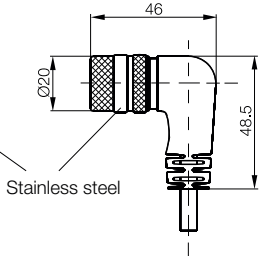
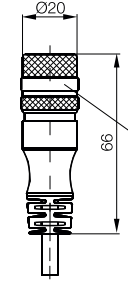
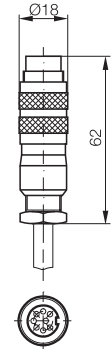
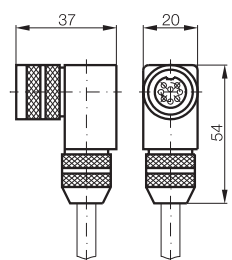
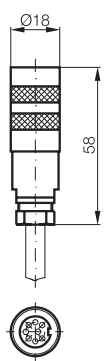
Profibus Modules P111

BUS Interface Modules



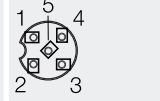

Digital Display

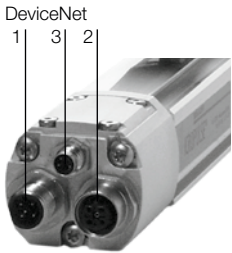
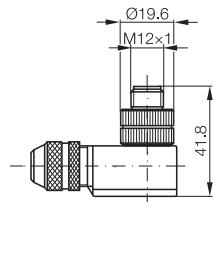
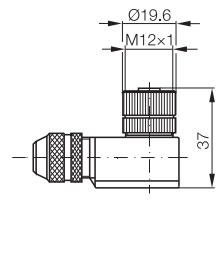
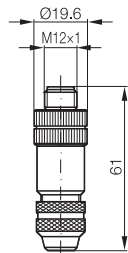
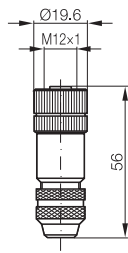
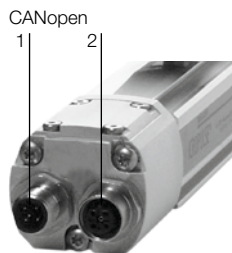
CAM Controller

Basic Information and Definitions



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.


Connectors for Series	BKS-S92-00	BKS-S94-00	BKS-S93-00	BKS-S95-00																																																
Design	BTL_-H___-S92/S93/S94 Screw terminals	BTL_-H___-S92/S93/S94 Screw terminals	BTL_-H___-S92/S93/S94 Screw terminals	BTL_-H___-S92/S93/S94 Screw terminals																																																
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"> <thead> <tr> <th>PIN</th> <th>Signal</th> </tr> </thead> <tbody> <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> </tbody> </table>	PIN	Signal	1	CAN_GND	2	+24 V	3	GND (0 V)	4	CAN_HIGH	5	CAN_LOW	 <table border="1"> <thead> <tr> <th>PIN</th> <th>Signal</th> </tr> </thead> <tbody> <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> </tbody> </table>	PIN	Signal	1	CAN_GND	2	+24 V	3	GND (0 V)	4	CAN_HIGH	5	CAN_LOW	 <table border="1"> <thead> <tr> <th>PIN</th> <th>Signal</th> </tr> </thead> <tbody> <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> </tbody> </table>	PIN	Signal	1	CAN_GND	2	+24 V	3	GND (0 V)	4	CAN_HIGH	5	CAN_LOW	 <table border="1"> <thead> <tr> <th>PIN</th> <th>Signal</th> </tr> </thead> <tbody> <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> </tbody> </table>	PIN	Signal	1	CAN_GND	2	+24 V	3	GND (0 V)	4	CAN_HIGH	5	CAN_LOW
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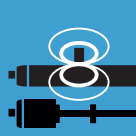


Slot 3
Power supply for DeviceNet:
BKS-S48-15-CP... page 259

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 BKS-S92-TA1	5-pin, female BKS-S137-19-PC-...	5-pin, male BKS-S151-19-PC-...	Terminating resistor, male BKS-S94-R01	Male/female extension BKS-S92-16/GS92-_-_												
PA CuZn Ni	PUR CuZn 0.8 µm Au	PUR CuZn 0.8 µm Au	TPU CuZn 0.8 µm Au	PUR CuZn 0.8 µm Au												
	5x0.25 mm ²	5x0.25 mm ²		5x0.34 mm ²												
IP 67 CuZn 2.5 µm Ni HBR	IP 67 CuZn 2.5 µm Ni Viton	IP 67 CuZn 2.5 µm Ni Viton	IP 68 CuZn 2.5 µm Ni Viton 121 Ω	IP 67 CuZn 2.5 µm Ni Viton												
A 1*	A 1	A 2	A 2	A 1/2												
			 <table border="1"> <thead> <tr> <th>PIN</th> <th>Signal</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>-</td> </tr> <tr> <td>2</td> <td>-</td> </tr> <tr> <td>3</td> <td>-</td> </tr> <tr> <td>4</td> <td>121 Ω</td> </tr> <tr> <td>5</td> <td>-</td> </tr> </tbody> </table>	PIN	Signal	1	-	2	-	3	-	4	121 Ω	5	-	
PIN	Signal															
1	-															
2	-															
3	-															
4	121 Ω															
5	-															



Micropulse Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod

Rod Compact and Rod AR

Rod EX, T Redundant and 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

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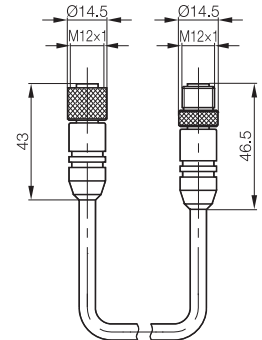
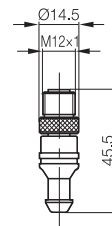
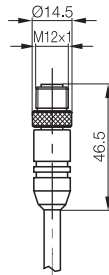
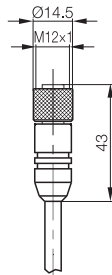
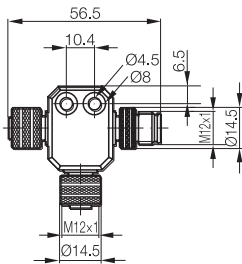
Basic Information and Definitions

*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
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Please include the cable length with the part number.
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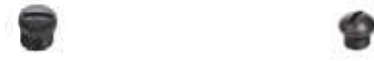
Please order the clear view cover separately.

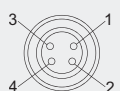
Order designation: BTL5-A-CP01-K

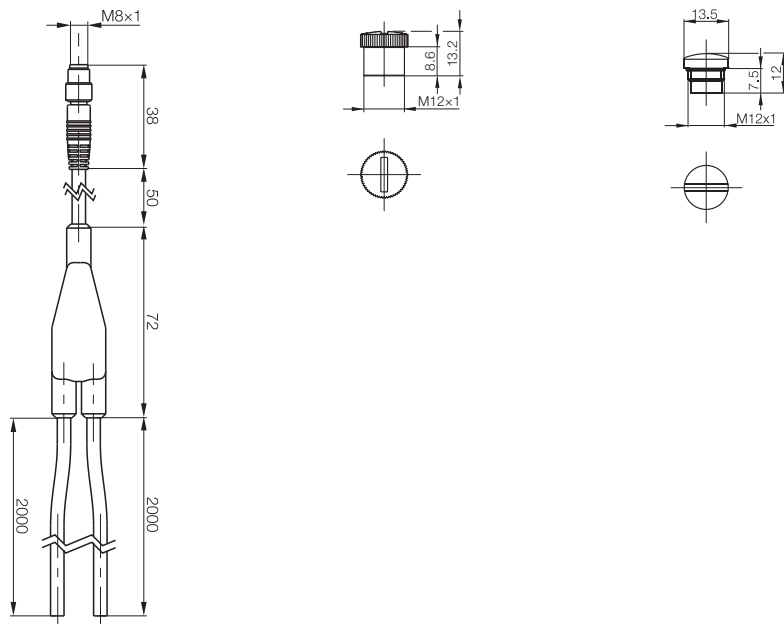


Accessories

M8 Y-connectors for CANopen



Connectors	1×M8 straight/2×3-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 M12×1
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 × conductor cross-section	4×0.34 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	 <p>PIN 1: brown PIN 2: white PIN 3: blue PIN 4: black</p>		

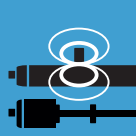


Accessories

Connectors for Profibus DP



Connectors	M12	M12	M12	M12
Design	B-coded	B-coded	B-coded	B-coded
	5-pin	5-pin	5-pin	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 × conductor cross-section	5x max. 0.75 mm ²	5x max. 0.75 mm ²	5x max. 0.75 mm ²	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)	IP 67 (when screwed into place)	IP 67 (when screwed into place)	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				



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

*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

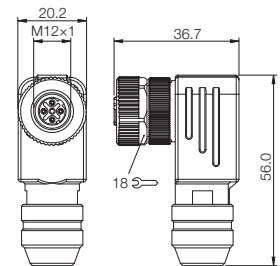
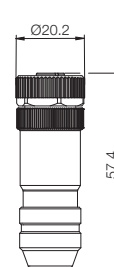
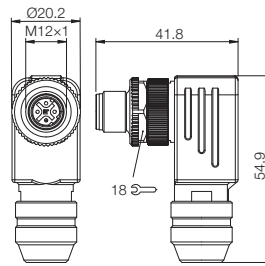
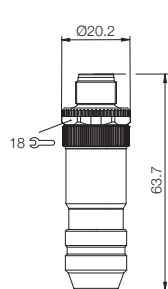
00,3 = Length of 0.3 m
02 = Length of 2 m
05 = Length of 5 m
10 = Length of 10 m

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



Profibus DP



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

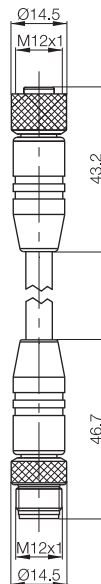
Connector diagram and wiring		
Configuration		
Design		
Use	Female/male	Female
Supply voltage U_s	300 V	300 V
Cable material	PUR	PUR
Color	Violet	Violet
Number of conductors × conductor cross-section	2×0.38 mm ²	2×0.38 mm ²
Degree of protection as per IEC 60529	IP 67	IP 67
Ambient temperature T_a	-25...+80 °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



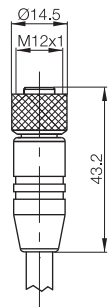
Previously BKS-S103/GS103-CP-__

- 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

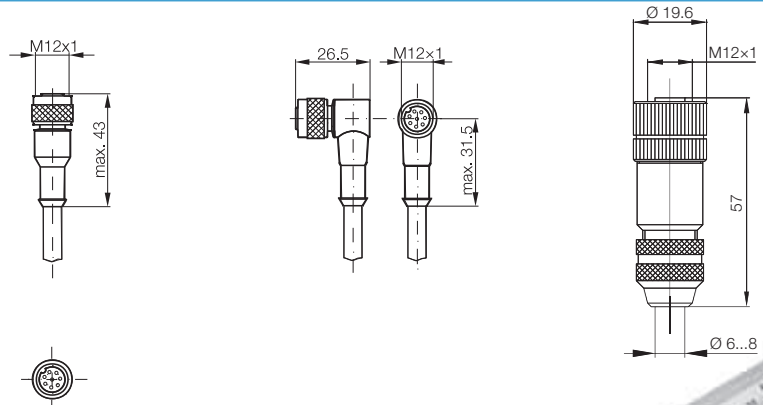


Accessories

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

Connector diagram and wiring	 PIN Color 1 YE 2 GY 3 PK 4 RD 5 GN 6 BU 7 BN 8 WH	 PIN Color 1 YE 2 GY 3 PK 4 RD 5 GN 6 BU 7 BN 8 WH	 PIN Color 1 YE 2 GY 3 PK 4 RD 5 GN 6 BU 7 BN 8 WH
for Series	BTL_...-S115	BTL_...-S115	BTL_...-S115
Design	8-pin, straight, female	8-pin, angled, female	8-pin, female
Ambient temperature T _a			
Housing material	PUR	PUR	Nickel-plated CuZn
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)
Cable material	PUR	PUR	
Number of conductors × conductor cross-section	8×0.25 mm ²	8×0.25 mm ²	max. 0.75 mm ²
Cable diameter D	6.6 ±0.2 mm	6.6 ±0.2 mm	6...8 mm
Min. bending radius	dynamic 5× D, static 2× D	dynamic 5× D, static 2× D	
Coding			
Slot on transducer			

	Ordering code			BCC00YA
	Part number			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	BCC00Z0	
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	



Adapter BKS-S115 to BKS-S 32
Ordering code:
BKS-S115/GS32-PU-00,2

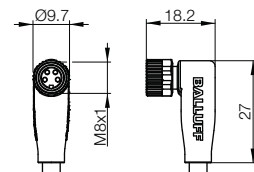
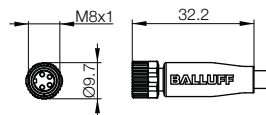
Accessories

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 x conductor cross-section	4x0.34 mm ²	4x0.34 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	Ordering code	BCC02N5	BCC02NH
	Part number	BCC M314-0000-10-014-PS0434-020	BCC M324-0000-10-014-PS0434-020
Cable length 5 m	Ordering code	BCC02N6	BCC02NJ
	Part number	BCC M314-0000-10-014-PS0434-050	BCC M324-0000-10-014-PS0434-050
Cable length 10 m	Ordering code	BCC02N7	BCC02NK
	Part number	BCC M314-0000-10-014-PS0434-100	BCC M324-0000-10-014-PS0434-100
Cable length 15 m	Ordering code		
	Part number		
Cable length 20 m	Ordering code		
	Part number		

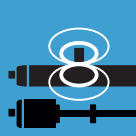
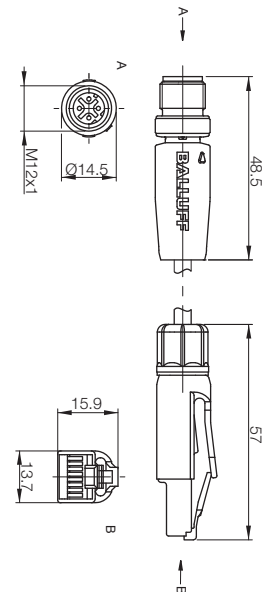
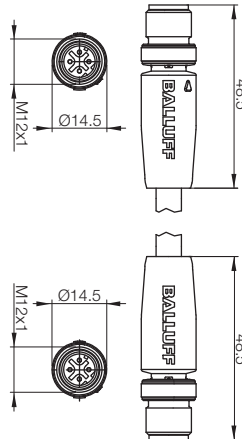
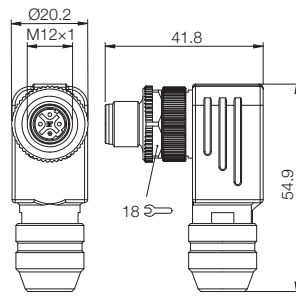
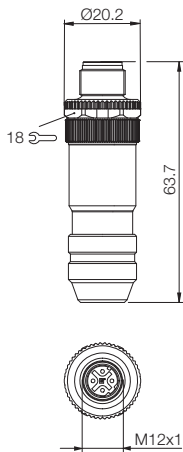


Accessories

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
	BCC03WZ	BCC03Y0		
	BCC M474-0000-2D-000-51X475-000	BCC M484-0000-2D-000-51X475-000		
			BCC04K1	BCC04K7
			BCC M414-M414-6D-331-PS54T2-020	BCC M414-E834-8G-668-PS54T2-020
			BCC04K2	BCC04K8
			BCC M414-M414-6D-331-PS54T2-050	BCC M414-E834-8G-668-PS54T2-050
			BCC04K3	BCC04K9
			BCC M414-M414-6D-331-PS54T2-100	BCC M414-E834-8G-668-PS54T2-100
				BCC04ZJ
				BCC M414-E834-8G-668-PS54T2-150
			BCC04K4	BCC04KA
			BCC M414-M414-6D-331-PS54T2-200	BCC M414-E834-8G-668-PS54T2-200



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Profile PF

Profile AT

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Rod

Rod Compact and Rod AR

Rod EX, T Redundant and CD

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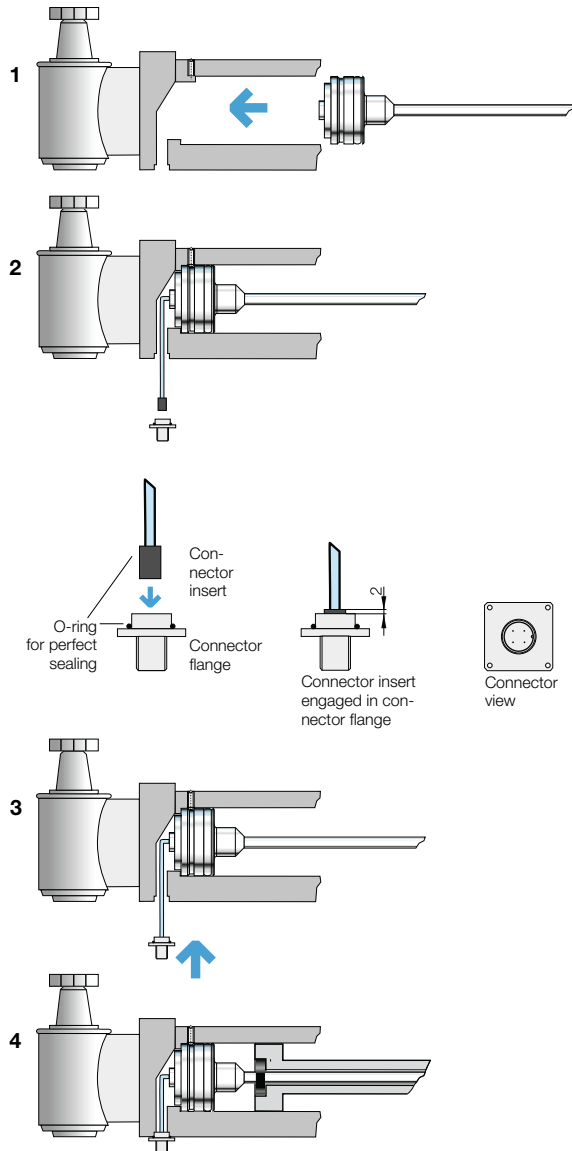
Basic Information and Definitions

Basic Information and Definitions

**"Pigtail" connector system, 4-pin
ZA0N and ZA0B for BTL6-...E2/E28...**

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.

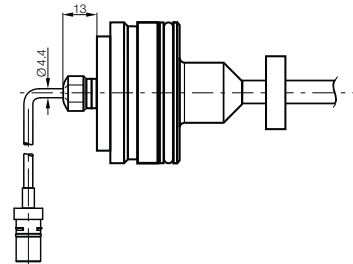


Series		
...KA 00,20-ZA0_	PUR cable 0.2 m	Connector system for transducers with cable outlet
...KA 00,30-ZA0_	PUR cable 0.3 m	Connector system for transducers with cable outlet
...LA 00,07-ZA0_	Stranded wire 0.07 m	Connector system for transducers with stranded wire output
...LA 00,15-ZA0_	Stranded wire 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

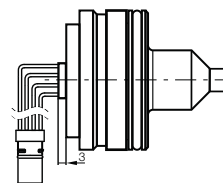
Pin	-ZA0N	-ZA0R
1		10...30 V
2	not assigned ¹⁾	Output signal
3		GND ²⁾
4	Output signal	not assigned ¹⁾
		Pin assignment (top view of the plug), 4-pin round plug M12

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

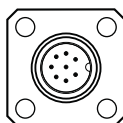
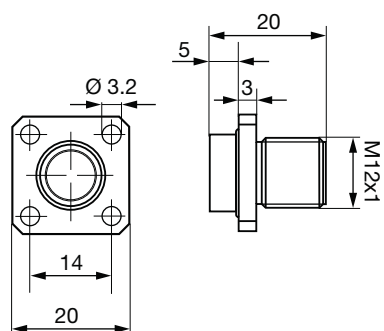
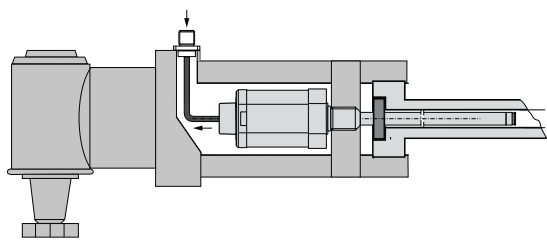
BTL_...-...-KA00,30-ZA10, PUR cable 0.3 m

Series ZA15

Housing: Stainless steel 1.4404

BTL_...-...-KA00,20-ZA15, PUR cable 0.2 m

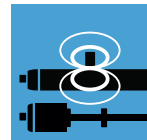
BTL_...-...-KA00,30-ZA15, PUR cable 0.3 m



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

Mating connector

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Micropulse
Transducers

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Profile BIW

Rod

Rod Compact
and Rod AR

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T Redundant
and CD

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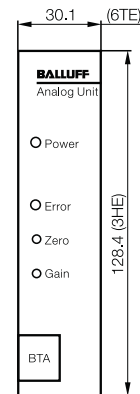


Analog processor units

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 µA, 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	±10 V at ±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.

Micropulse digital processor unit

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

Ordering example:

BTA - A 1 -

Output signal

- 0 Rising (for C and E) only for current output
- 7 Falling (for C and E) only for current output
- 1 Rising/falling only for voltage output

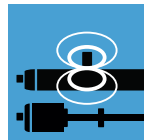
Rated length

Transducer in [mm]

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



Micropulse Transducers

Profile P

Profile PF

Profile AT

Profile BIW

Rod

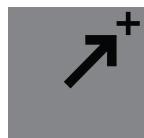
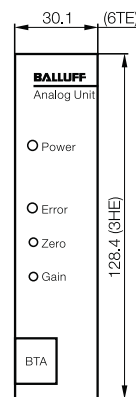
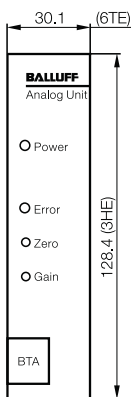
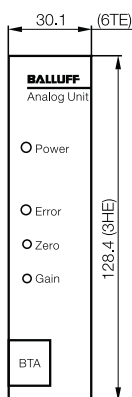
Rod Compact and Rod AR

Rod EX, T Redundant and CD

Filling Level Sensor SF

Accessories
Connectors
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BUS Interface Modules
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Analog and digital processor units

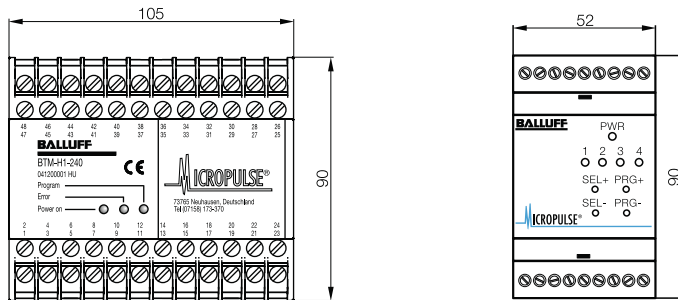
Series	BTM-H1	BTM-1
Output signal	digital	Analog
Displacement signal		Analog
Velocity		
Input interface (transducer)	P	P
Part number	BTM-H1-_-_-_-	BTM-1-_-_-_-
Features	Resolution of 0.01 mm, 0.025 mm, 0.1 mm, 1 mm, BCD, binary, Gray code, zero point adjustment, direction signal, DATA READY, min./max. 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	Digital TTL 5 V DC (BTM-H1-340) PNP source driver, 24 V DC (BTM-H1-240)	Analog, voltage or current see ordering code
Displacement signals		Analog ±10 V programmed to 1000 mm/s, adjustable over a range of 50 mm/s...10 m/s
Velocity		
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:

BTM-H1-_-_-_-

Output driver

- 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)

BTM-1-_-_-_-

Output signal

- 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

Versions

- 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

BTM-1-102-VM1000

Output signal

- 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

Versions

- 1 Analog output
- 2 Position encoder with speed

Velocity

- ±10 V at a speed of 1000 mm/s

Accessories

Profibus modules P111 for BTL

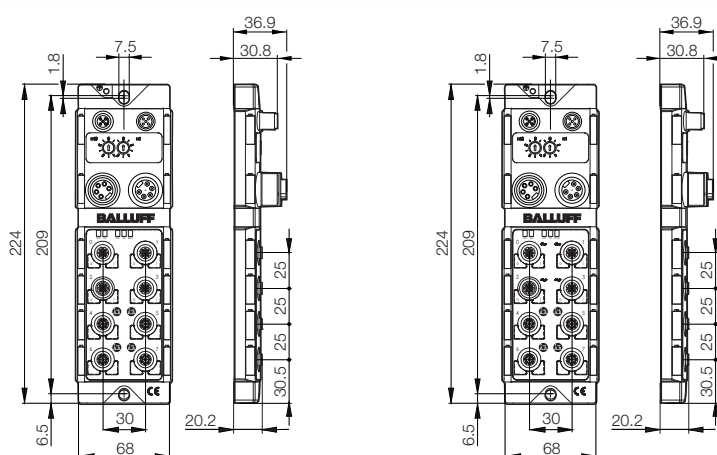


Fieldbus Design	Profibus 4x P111 or M1	Profibus 4x P111 or M1	
Ordering code	BNI001A	BNI002H	
Part number	BNI-PBS-551-000-Z001	BNI-PBS-552-000-Z001	
Supply voltage U_S	18...30 V DC	18...30 V DC	
Function indicator	BUS RUN	BUS RUN	
Fault function indicator	Red LED		
Power-on indicator	V_A , V_S , undervoltage	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.



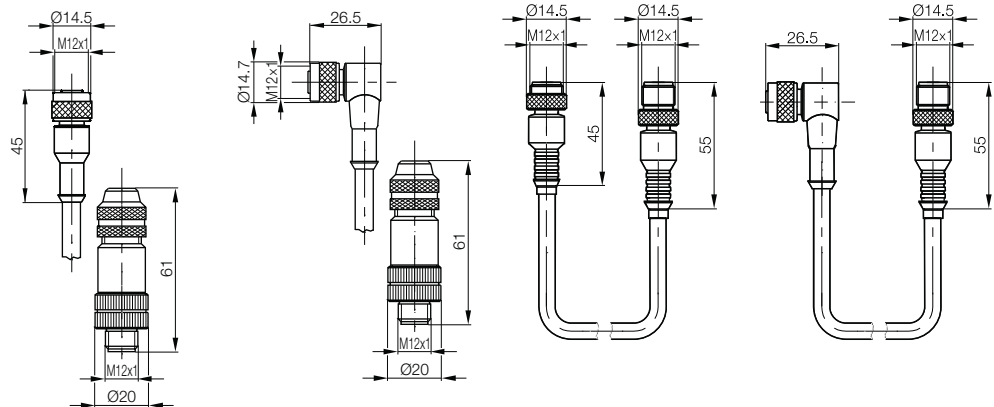
- Micropulse Transducers
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Profibus modules P111 for BTL

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 × conductor cross-section	8×0.25 mm ²	8×0.25 mm ²	8×0.25 mm ²	8×0.25 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:

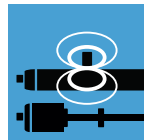
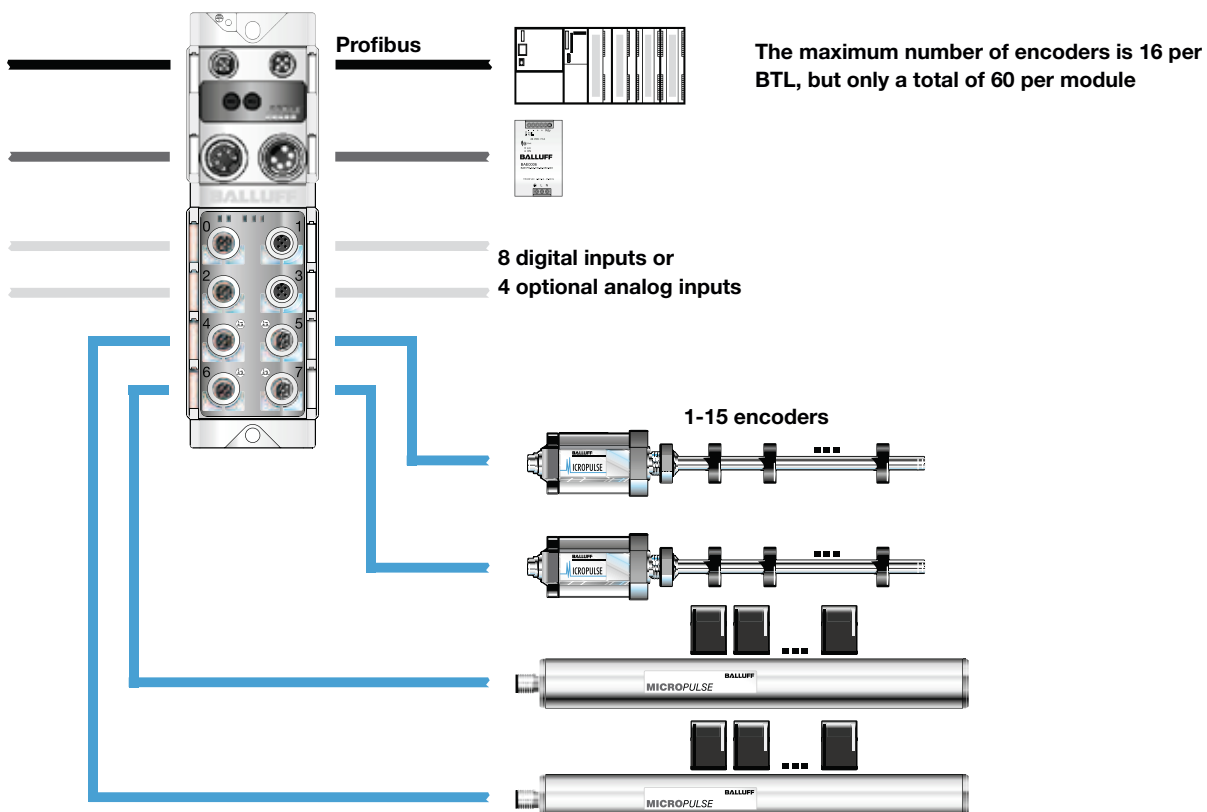
05 = Length 5 m
 10 = Length 10 m
 20 = Length 20 m
 25 = Length 25 m
 50 = Length 50 m

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



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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 μ m. 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 μ m 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.

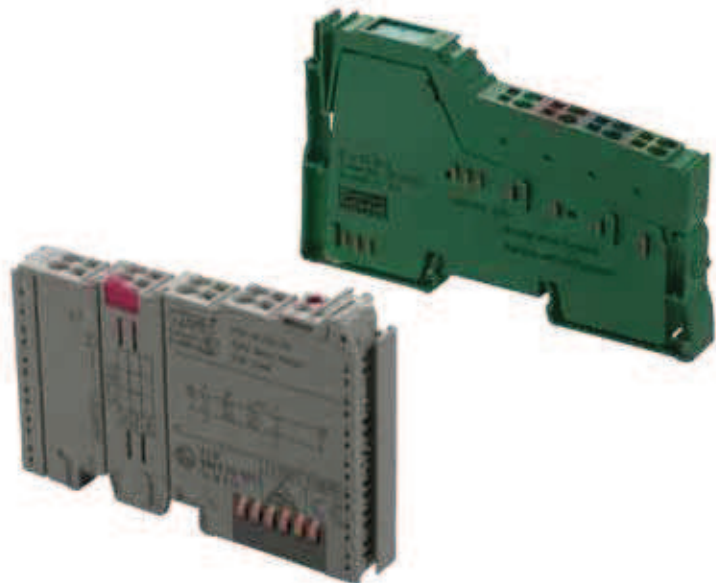
The IMPULSE-IN terminal enables particularly cost-effective solutions because it senses the positions using a low-cost pulse interface. In addition, the pulse interface has the advantage of real time capability, making it especially suitable for applications with position or bearing control.

Interfaces

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

Further technical details and orders from:

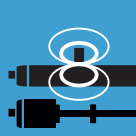
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Accessories

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	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	<ul style="list-style-type: none"> ■ 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 	<ul style="list-style-type: none"> ■ 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) 	<ul style="list-style-type: none"> ■ 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) 		



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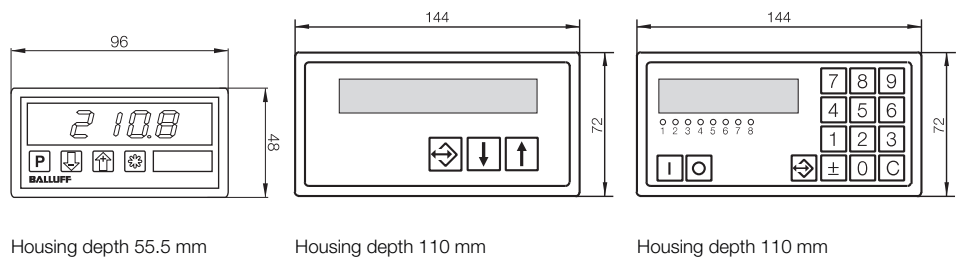
"Pigtail" Connector System

Evaluation Units

Profibus Module P111

BUS Interface Modules

Digital Display CAM Controller

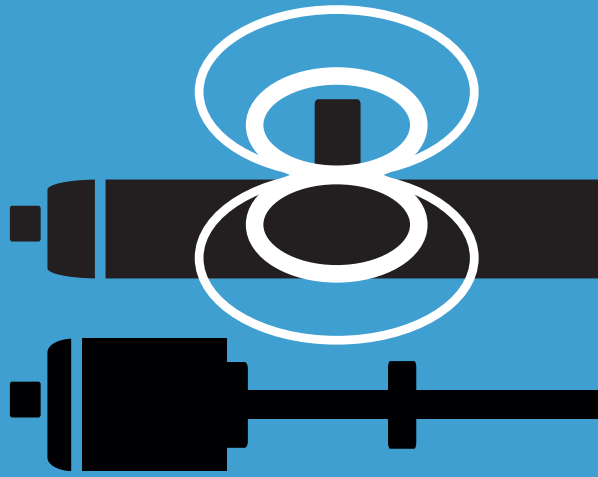


Housing depth 55.5 mm

Housing depth 110 mm

Housing depth 110 mm





Micropulse Transducers



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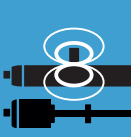
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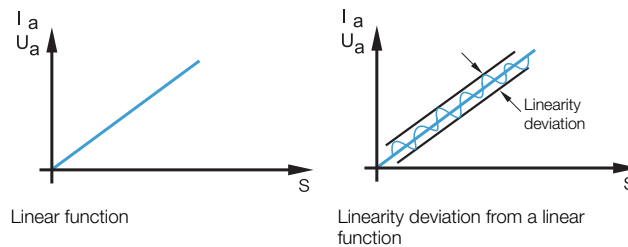
Output signal, characteristic curve, resolution, sensitivity

The characteristic curve describes the relationship between the output signal and the input signal. The slope of the curve represents the sensitivity of the device.

The sensitivity (resolution) is the quotient of the input signal change and the change in the output signal. On Micropulse transducers, the input signal change is the change in the position of the encoder and the output signal change is the change in the electrical output signal.

Linearity

A measuring device has a linear characteristic curve and a constant sensitivity when the relationship between the input and output variable is represented by a straight line (linear function). Linear scales are assumed for the X and Y-axes. A characteristic curve is not linear if it is not a straight line.

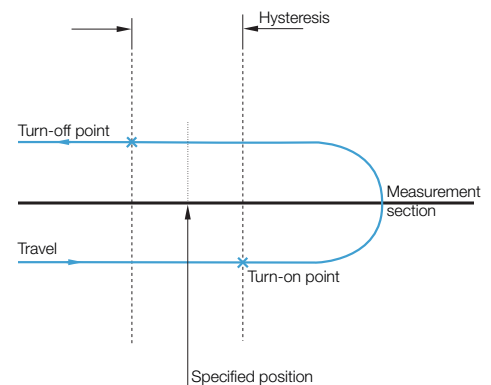


Linearity deviation

A linearity deviation is the maximum deviation from a straight line that connects the zero point of a measuring range with the end point (full scale). There is a linear relationship between the position or path to be measured and the output signal for a voltage, current or digitized output information. The linearity characteristic curve of magnetostrictive transducers does not change during the life of the system. The curve, however, can be corrected.

Hysteresis

Hysteresis is the signal difference resulting when arriving at a certain position, traveling beyond it and then returning to this position from the other direction.



Reproducibility

Reproducibility is moving to a certain position from different directions. Reproducibility is the sum of the hysteresis and the resolution.

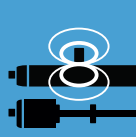
Repeat accuracy

Repeat accuracy is the value resulting when moving to the same position from the same direction under unchanging ambient conditions.



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SYNC mode

The absolute positioning information of the position measurement system is determined and transmitted synchronously to the read cycle of the electronic processor unit, e.g. an axis controller or a regulating controller.

Incremental

After the system is switched on, the measured value currently available is not defined. A reference run to a defined point, a reference point, is necessary in order to obtain a position value. The position value is calculated by adding or subtracting individual, equal increments from the reference point.

Absolute

The measured value for the current position is available immediately after the system is switched on. Each position, e.g. a measurement section, is assigned an absolute, coded digital signal or an analog value. A reference run is not required.

Temperature coefficient, formula

The temperature coefficient is the relative change of a physical variable with changing temperature. The temperature dependency of variable y can be approximated at least for a limited temperature range by using temperature coefficient α with linear relationship $y = y_0 (1 + \alpha \times \Delta T)$.



Temperature coefficient

The temperature coefficient indicates the relative change in length as temperature changes. This means that temperature factors change the measured value by the indicated amount.

Zero point

The zero point is the position with the lowest output value along the measuring range. The zero point can be set by the user for some transducer models. The zero point must lie within the measuring range.

Measurement rate

The measurement rate is the frequency at which the output position information is updated. It can be the same as the number of measurements per second. A high measurement rate for rapidly changing positions is important if a process is time-critical.

Rated length

The rated length is the usable area, i.e. the available path/length measurement range (also see the characteristic curve). The rated length is always shorter than the overall length of the transducer.

Damping zone

The damping zone is the area in which the second (undesired) magnetostrictive wave is damped. This area is always outside of the measuring range. Depending on the transducer model, either an erroneous output signal or an error signal will be output if the encoder is allowed to travel into this zone, which must not be considered valid information.



Intrinsically safe "i" Coding "Ex i"

A circuit is intrinsically safe if it does not permit a spark or thermal effect that could ignite an explosive atmosphere as defined by Group IIA, IIB or IIC, whereby the test conditions prescribed in the standard must be applied. The test conditions take into account normal operation and certain fault conditions.

The implementation of intrinsically safe circuits results in certain restrictions pertaining to the selection of components for electrical and electronic circuits.

In addition, the permissible load on the components as compared with normal industrial applications must be reduced:

- for the voltage in terms of electrical stability, and
- for the current in terms of heating



Flameproof encapsulation "d" Coding "Ex d"

Parts that could ignite a potentially explosive atmosphere must be housed in an enclosure:

- that can withstand the pressure resulting from the explosion of an explosive mixture inside the housing, and
- that prevents the internal explosion from igniting the potentially explosive atmosphere surrounding the housing.

Non-incendive "n" Coding "Ex n"

Devices in this category are intended for use in areas where an explosive atmosphere is not expected. Even if the atmosphere were to become explosive, in all probability it would be infrequent and only for a short period of time.

A manufacturer's declaration confirms that the product satisfies requirements for the use of electrical equipment in potentially explosive areas according to EN 60079-15.

This designation combines multiple methods of ignition protection.

e1 type approval

e1 type approval is granted by the German Federal Motor Transport Authority (KBA) and confirms that special motor vehicle standards have been maintained.

The devices may be mounted on vehicles that travel on public roads. The standards describe EMC conditions under which the devices must operate without failure. e1 approved Micropulse transducers are indicated by "-SA265-" in the part number.



FDA

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.



Basic Information and Definitions Designs

Filling level sensor

The magnetostrictive working principle is also ideal for the continuous high-precision measurement of fluid filling levels. The measuring section and electronic processor unit are enclosed inside a housing made from stainless steel. Stainless steel floats with permanent integrated magnets mark the current filling level in the tank or vessel. The design of the sensors meets international hygiene standards.



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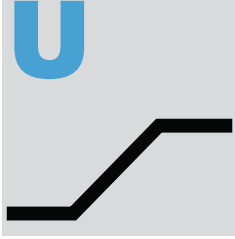
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MICROPULSE®



Analog voltage output

The output voltage is directly proportional to the position of the encoder along the measurement section.

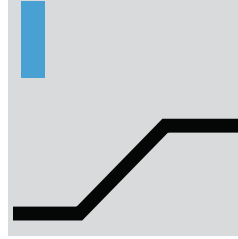
The most important parameter for analog outputs is the refresh rate and residual ripple of the output signal.

Many transducers on the market attain the specified values for output ripple only by means of low-pass filtering. This always carries with it an undesirable time delay of the output signal.

Micropulse transducers attain the specified signal quality without low-pass filters, instead using a fundamentally improved circuit design. This means fast output signals with low levels of ripple and noise in the output voltage.

Micropulse transducers with voltage output have 2 outputs, one rising characteristic and one falling.

Versions can be provided with 0...10 V (10...0 V) and -10...10 V (10...-10 V).



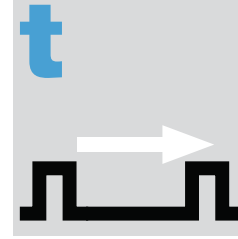
Analog current output

The output current is directly proportional to the position of the encoder along the measurement section.

Analog current interfaces 0...20 mA and 4...20 mA are standard in numerous applications and in many industries. Current interfaces are significantly less sensitive to induced noise voltage than analog voltage interfaces. A 500 Ω resistor can be used to easily convert the 0...20 mA signal into a 0...10 V voltage.

The 4...20 mA interface provides a simple form of cable break monitoring, since a current of 4 mA has to flow even at the measuring range zero point.

Micropulse transducers with current output are available with rising or falling characteristic.



Pulse interface

The time between a query and reply signal is directly proportional to the position of the encoder along the measurement section.

These pulses are transmitted using RS485/422 differential drivers, guaranteeing interference-free signal transmission over cable lengths of up to 500 m.

The great advantage of these interfaces is the noise-immune signal transmission with a simple and economical interface. Interfaces with tristate outputs allow multiplexing of several Micropulse transducers.

Appropriate control cards are available.

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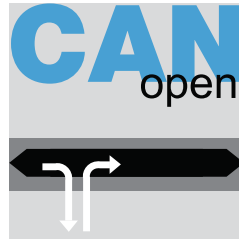
Interfaces



Synchronous serial interface (SSI)

The position of the encoder along the measurement section is sent to the controller serially in a data word.

Micropulse transducers with an SSI interface can be connected directly to controllers or to axis control cards with an SSI interface. The transmission of data from the sensor to the controller is synchronized by the controller's clock. Transducers with 16, 24 or 25-bit data words are available depending on the required resolution. The $\pm 30 \mu\text{m}$ maximum linearity deviation of the SSI Micropulse transducer over the entire length, the max. 5 kHz update frequency and a resolution of $1 \mu\text{m}$ make SSI Micropulse transducers an ideal feedback sensor – even in the most demanding positioning and control applications.



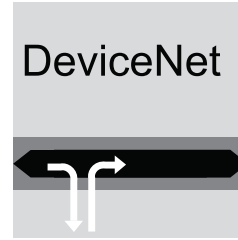
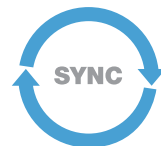
CANopen

The position of the encoder along the measurement section is sent over the CAN bus to the controller in what are known as **Process Data Objects** or PDOs.

Micropulse transducers work with standard CANopen protocols as per CiA DS 301 and with the standard device profile as per DS406. CANopen offers greater flexibility because of the large number of configuration options for the transducer.

For example, the resolution is programmable for 5, 10, 20 or $100 \mu\text{m}$ – depending on your application. Alternatively you can select whether both position and velocity information is to be sent to your controller by your Micropulse sensor. Cyclically or on-demand.

Up to 4 so-called software cams can be defined in the active measuring range. Each status change to one of these cams is transmitted to the controller using high-priority emergency messages.

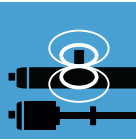


DeviceNet

DeviceNet is a fieldbus network that permits communication between basic sensors/actuators as well as programmable logic controllers.

Micropulse transducers transmit the absolute position and the velocity to the controller in the form of a 4-byte value with a maximum cycle time of 1 ms.

The communication parameters and the objects available to the Micropulse transducer can be configured using the electronic device data sheet (EDS file).



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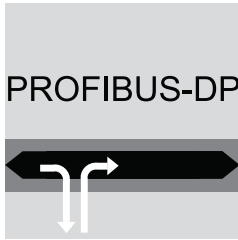
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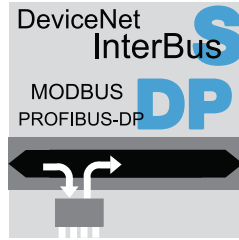
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Profibus DP

The **P**rocess **D**ata **U**nit sends position and velocity information for the transducer to the controller via the Profibus DP. Micropulse transducers operate according to EN 50170 and support the Profibus DP encoder profile and multi-magnet operation. Micropulse transducers can be parameterized using the GSD file. The position resolution can be adjusted at 5 μm increments and the velocity resolution at 0.1 mm/s increments. A zero point and working ranges can be configured individually for each encoder.



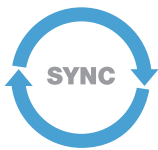
WAGO/Phoenix Contact BUS interface modules

One flexible way of connecting Micropulse transducers to various bus systems is to use interface modules available from WAGO and Phoenix Contact. These provide the option of transmitting the positioning information from several transducers through a single bus driver to the higher-level controller within a single bus cycle. The resolution and zero point of the transducers with the pulse interface can be programmed using the respective bus driver. For further technical data and ordering bus interface modules, contact WAGO and Phoenix Contact.



VARAN bus

VARAN is an open, real-time Ethernet bus system. Micropulse AT VARAN position measurement systems detect the movements of highly dynamic axes in complex applications. The real-time Ethernet system is extremely economical, easy to implement and simple to program. VARAN networks in combination with controllers, such as from Sigmatek, are widespread on the market. VARAN is fully integrated in hardware and designed according to IEEE 802.3 for standard Ethernet physics. The simple design guarantees extremely rapid cycle times while achieving maximum data security and reducing implementation costs.





IO-Link

IO-Link is a point-to-point connection within any network. 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 (230kB), which can achieve a process data cycle of 1 ms with a 1.1 master.

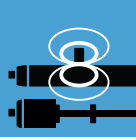
Data transmission between the master and the device utilizes three-conductor physics well-known in the world of standard sensor/actuators. A standard UART protocol is used. The exact nature of the data packets defines the IO-Link protocol. Via IO-Link, the user interface can be mapped based on an IODD (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. More information about IO-Link: www.io-link.com.

EtherCAT

Micropulse position measurement systems with an EtherCAT interface are the ideal nodes in an EtherCAT network when dealing with controlling and positioning with precision down to the micrometer.

Multi-position capable up to 16 axes, path and speed, monitored working ranges with diagnostics – these characteristics are used in automation and drive technology.

EtherCAT is an Ethernet-based bus system. The protocol is disclosed as the IEC61188 type 12 (EtherCAT) IEC standard and is suitable for hard and soft real time requirements. The structure of the standard Ethernet frame sent by the master is structured according to IEEE 802.3. EtherCAT slave devices take the data intended for them while the telegram goes through the device. Likewise, input data is inserted into the telegram as it goes through the device. This results in short cycle times that can be significantly below 100 μ s, making them ideal for application areas in drive and automation technology. EtherCAT offers extensive diagnostic options with precise and quick error detection.



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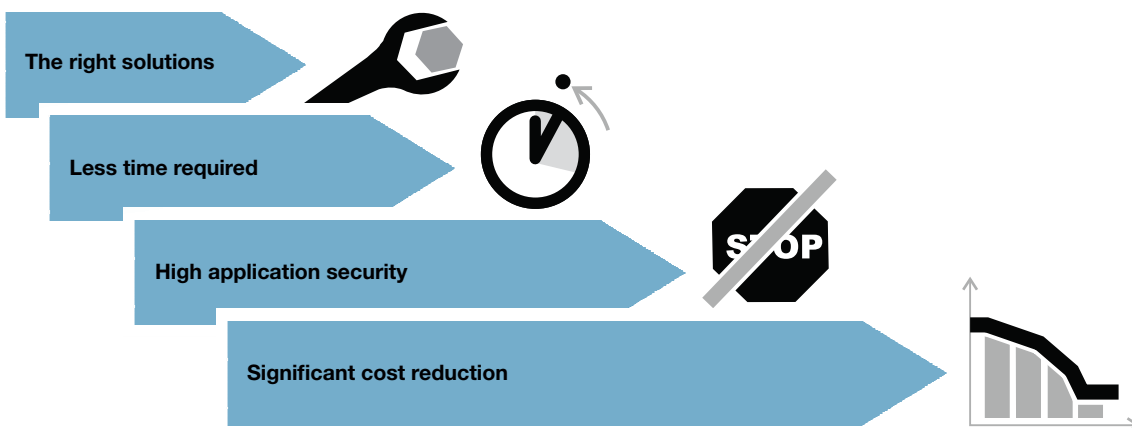
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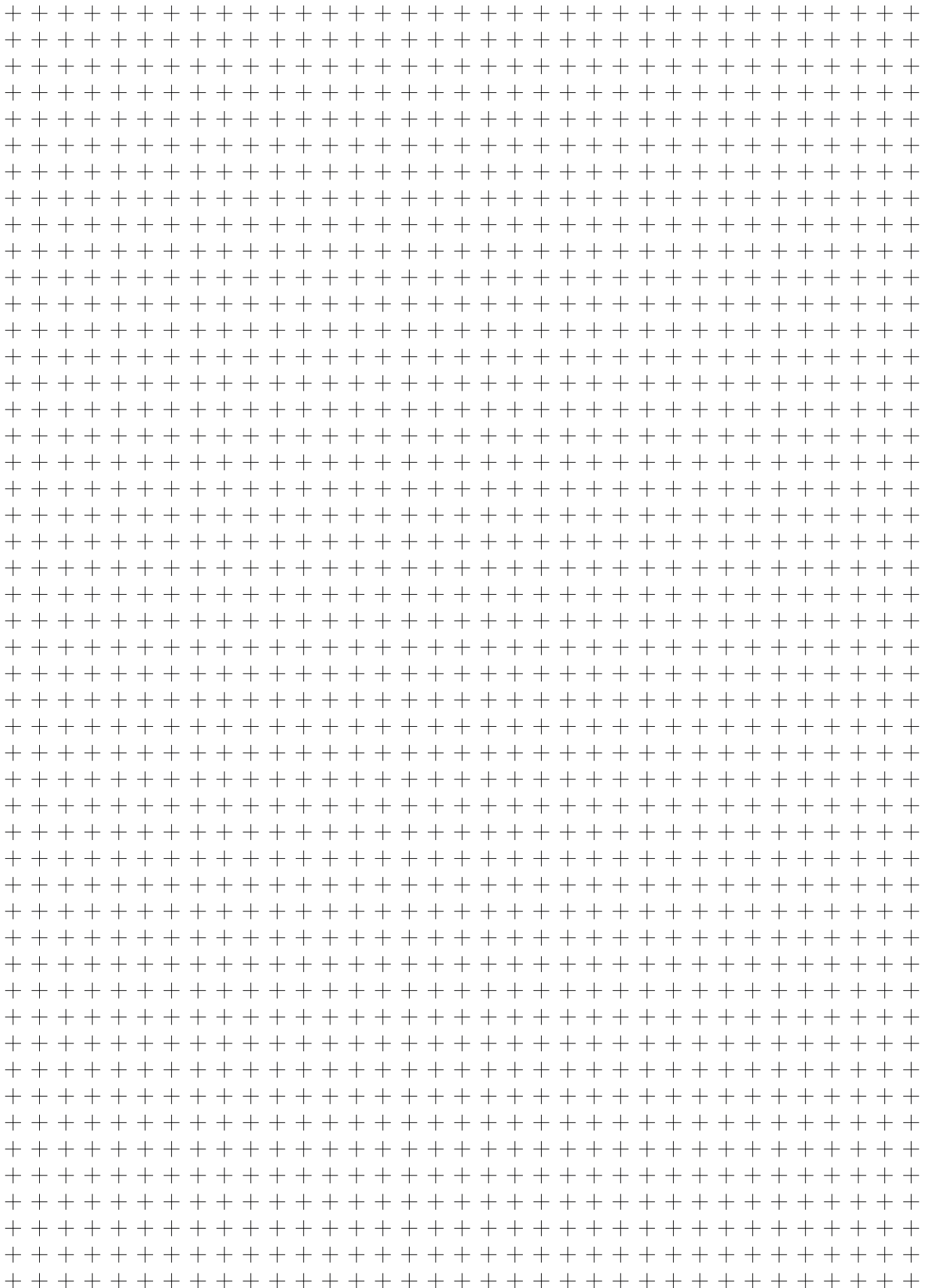
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<p>Application advice through our TecSupport Individualized expertise for your technical requirements</p>	<p>Real-world examples:</p> <ul style="list-style-type: none"> ■ Selection of the correct identification procedure for an assembly line ■ IO-Link concept as a cost-effective alternative to conventional wiring ■ System consulting for radio frequency identification (RFID): identification of large steel pipes in adverse environments ■ Recognizing multiple containers on a pallet in goods receiving
<p>Commissioning Order expert knowledge. And benefit from a quick start of production.</p>	<p>Real-world examples:</p> <ul style="list-style-type: none"> ■ Setting up an optical checkpoint with the vision sensor BVS ■ Consulting and support during the programming of RFID systems BIS ■ Installation and commissioning of a color detection application with the BFS color sensor
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<p>Training Make use of well-founded manufacturer knowledge. And benefit from application security.</p>	<ul style="list-style-type: none"> ■ Professional sensor use: Select operating principles, install sensors professionally and ensure the reliable operation of your application. ■ Position and distance measurement: This is how you make precise and wear-free measurements. ■ RFID: The right data at the right time at the right place. ■ Vision sensor: Using an image processing sensor, ensure manufacturing quality in three steps. ■ Vision sensor identification: Reliably identify data matrix codes with an image-processing sensor. ■ Industrial networking with IO-Link: Manage signals intelligently and cost-effectively.





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